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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
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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 55 mm 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

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

Kilogram to Pound

1 kg = 2.2046 lb

	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

1 kgf · m = 7.233 lbf · 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

1 kgf / cm² = 14.2233 lbf / 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

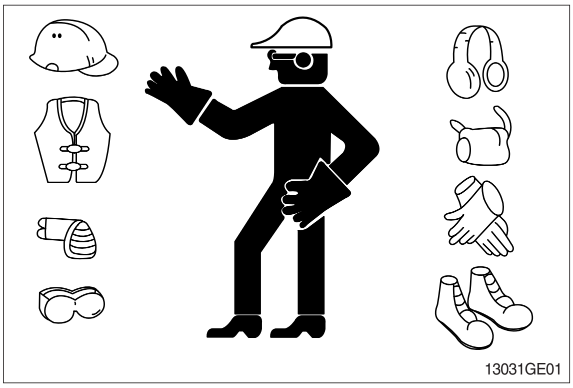
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

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

WEAR PROTECTIVE CLOTHING

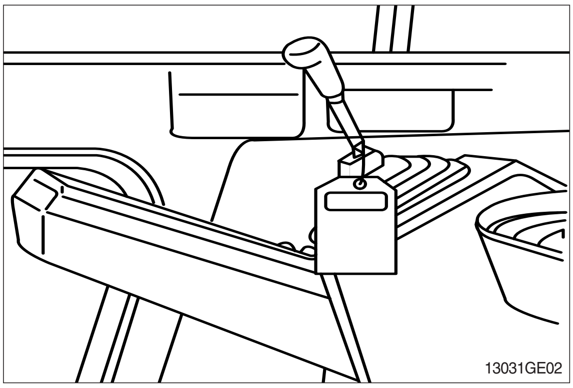
Wear close fitting clothing and safety equipment appropriate to the job.



13031GE01

WARN OTHERS OF SERVICE WORK

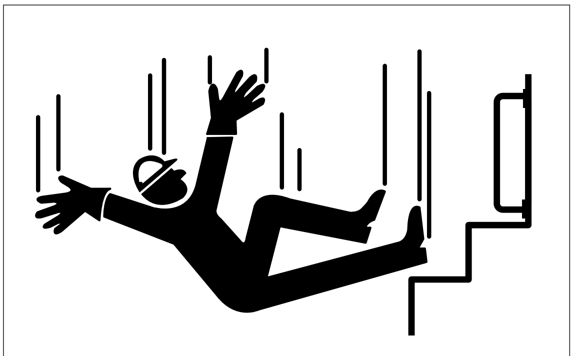
Unexpected machine movement can cause serious injury.
Before performing any work on the excavator, attach a 「**Do Not Operate**」 tag on the right side control lever.



13031GE02

USE HANDHOLDS AND STEPS

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



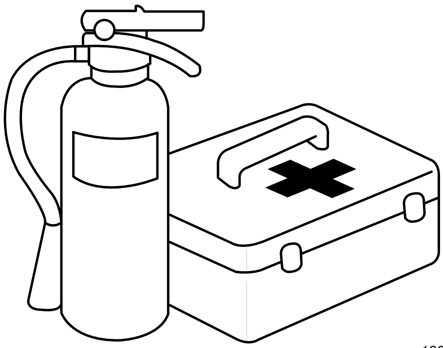
13031GE03

PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

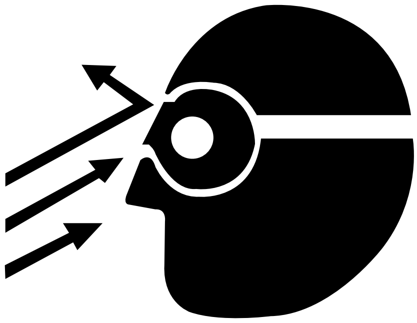
Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



13031GE04

PROTECT AGAINST FLYING DEBRIS

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



13031GE05

PROTECT AGAINST NOISE

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

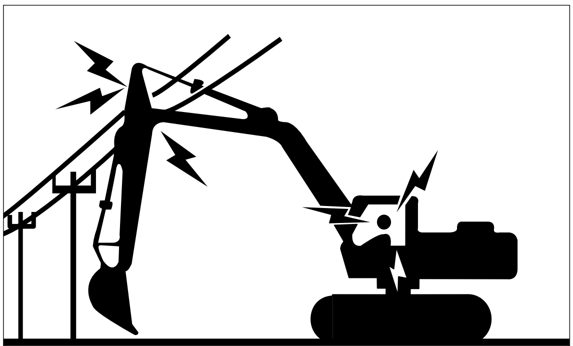
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

13031GE06

AVOID POWER LINES

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

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

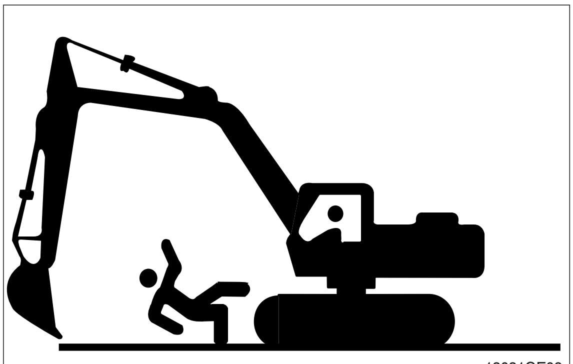


13031GE07

KEEP RIDERS OFF EXCAVATOR

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

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



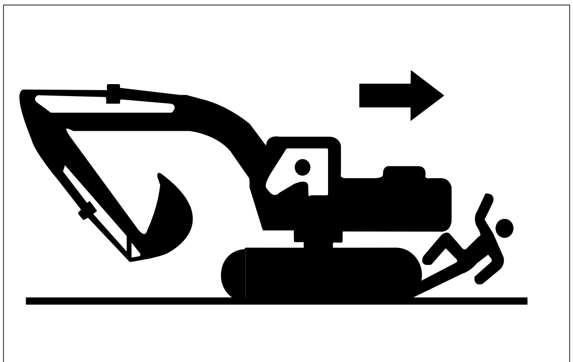
13031GE08

MOVE AND OPERATE MACHINE SAFELY

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

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

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



13031GE09

OPERATE ONLY FORM OPERATOR'S SEAT

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

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

13031GE26

PARK MACHINE SAFELY

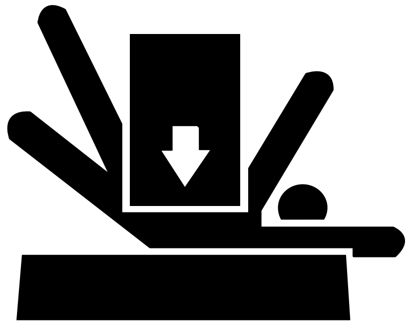
Before working on the machine:

· Park machine on a level surface.
· Lower bucket to the ground.
· Turn auto idle switch off.
· Run engine at low idle speed without load for 5 minutes.
· Turn key switch to OFF to stop engine. Remove key from switch.
· Place safety lever to locked position.
· Allow engine to cool.

SUPPORT MACHINE PROPERLY

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

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

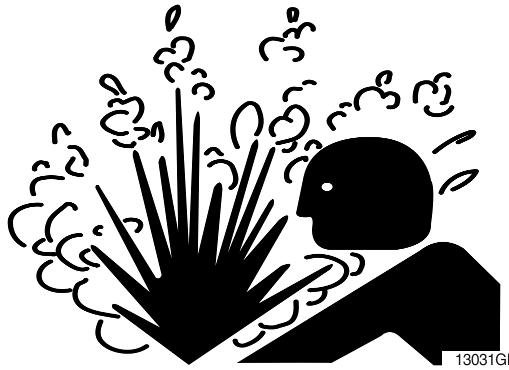


13031GE10

SERVICE COOLING SYSTEM SAFELY

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

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



13031GE11

HANDLE FLUIDS SAFELY-AVOID FIRES

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

13031GE12

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

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

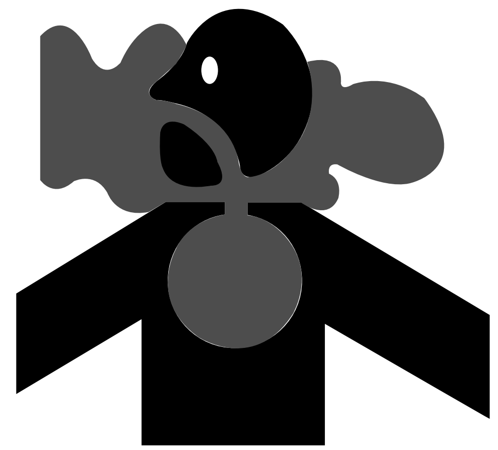
Do not store oily rags; They can ignite and burn spontaneously.

13031GE13

BEWARE OF EXHAUST FUMES

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

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



13031GE14

REMOVE PAINT BEFORE WELDING OR HEATING

Avoid potentially toxic fumes and dust.

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

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

Remove paint before welding or heating:

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

ILLUMINATE WORK AREA SAFELY

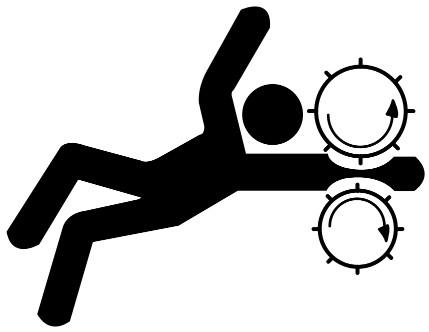
Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

13031GE15

SERVICE MACHINE SAFELY

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

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

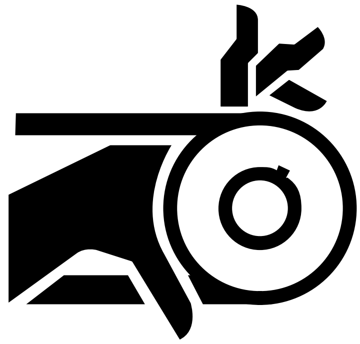


13031GE16

STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

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



13031GE17

AVOID HIGH PRESSURE FLUIDS

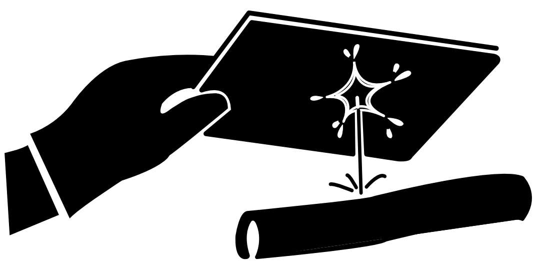
Escaping fluid under pressure can penetrate the skin causing serious injury.

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

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

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

13031GE18



13031GE19

AVOID HEATING NEAR PRESSURIZED FLUID LINES

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

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


13031GE20

PREVENT BATTERY EXPLOSIONS

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

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

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


13031GE21

PREVENT ACID BURNS

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

Avoid the hazard by:

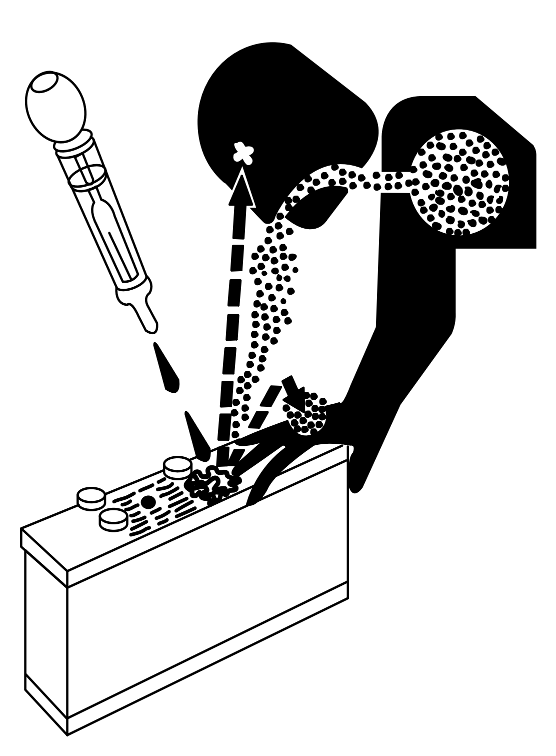
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling of dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

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

If acid is swallowed:

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



13031GE22

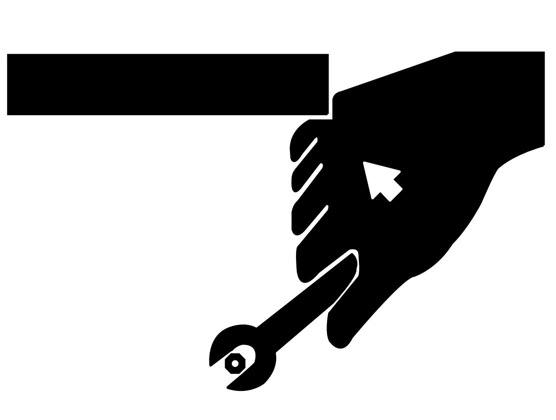
USE TOOLS PROPERLY

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

Use power tools only to loosen threaded tools and fasteners.

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

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



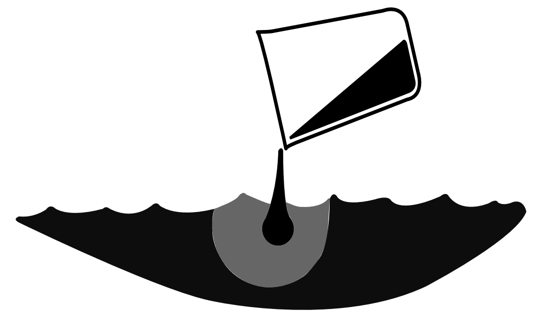
13031GE23

DISPOSE OF FLUIDS PROPERLY

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

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

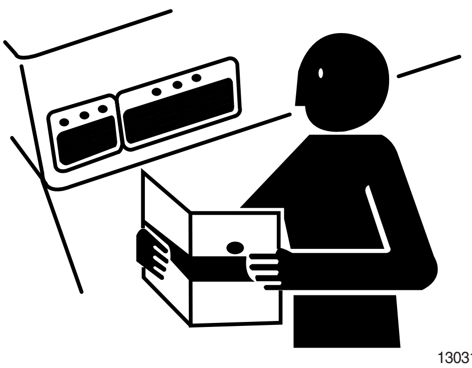
DO NOT pour oil into the ground, down a drain, or into a stream, pond, or lake. Observe relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters, batteries, and other harmful waste.



13031GE24

REPLACE SAFETY LABELS

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

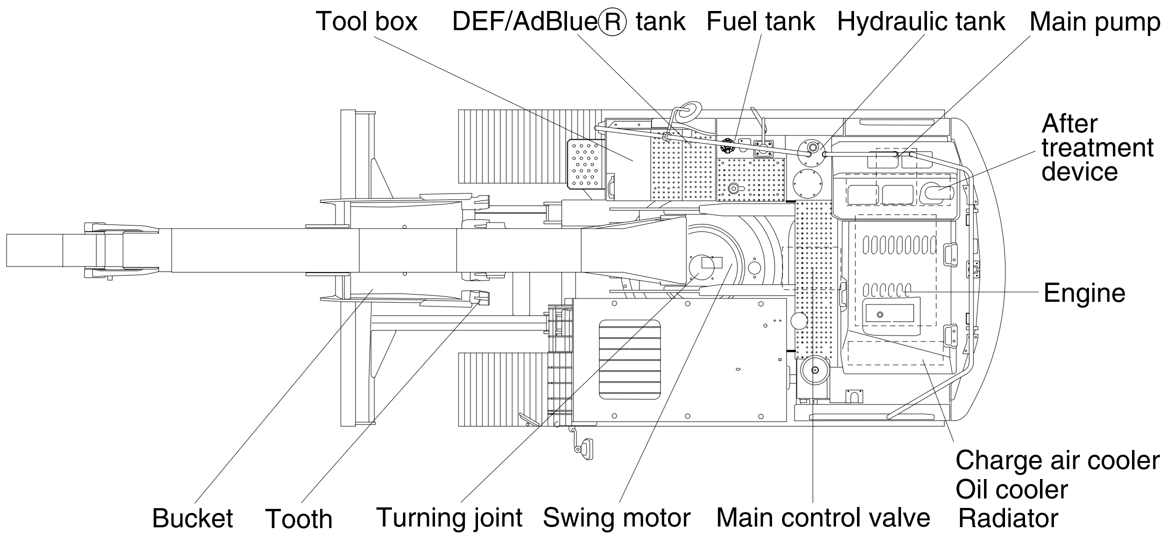


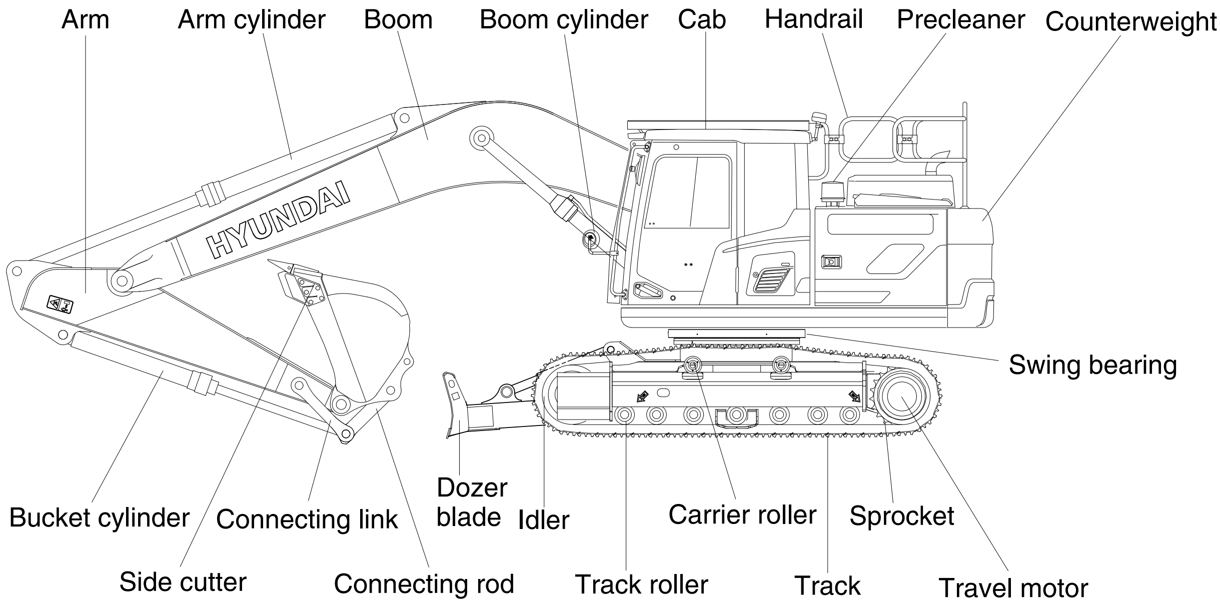
13031GE25

LIVE WITH SAFETY

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

1. MAJOR COMPONENT

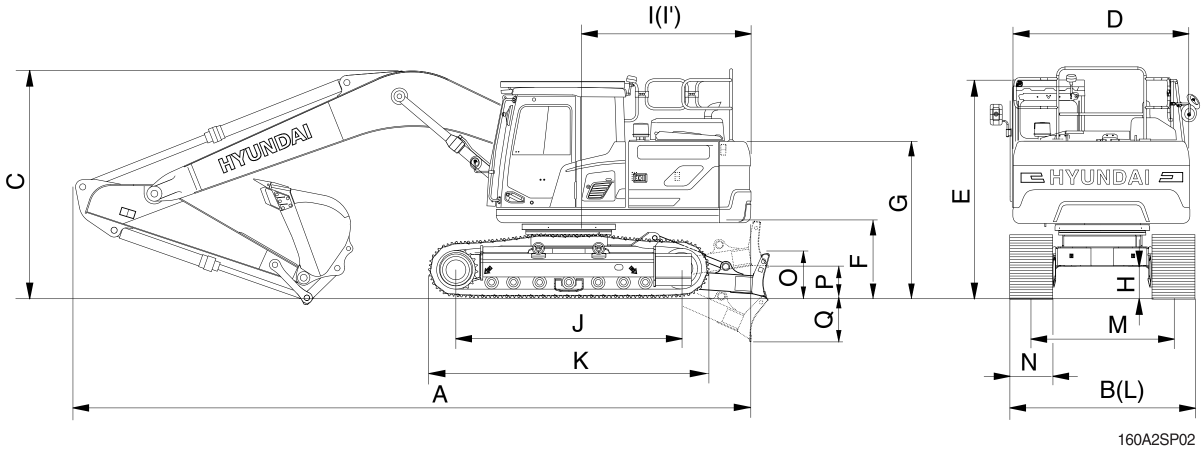




160A2SP01

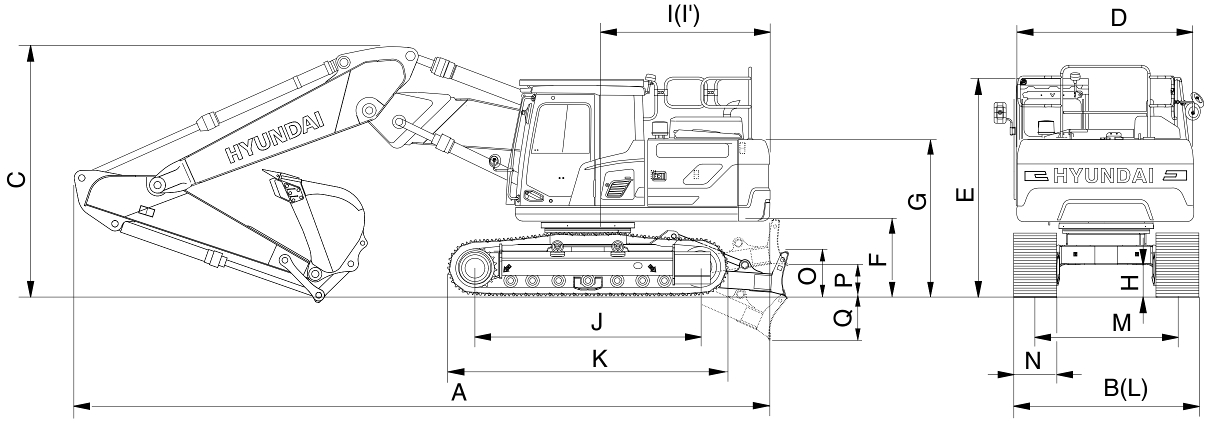
2. SPECIFICATIONS

1) HX160A L, MONO BOOM



Description		Unit		Specification		
		m (ft-in)	Boom	5.1 (16' 9")		
			Arm	2.2 (7' 3")	2.6 (8' 6")	3.1 (10' 2")
		mm (in)	Shoe	600 (24)		
Operating weight		kg (lb)		17645 (38900)	17695 (39010)	17720 (39070)
Overall length	A	mm (ft-in)		8650 (28' 5")	8660 (28' 5")	8670 (28' 5")
Overall width	B			2590 (8' 6")	2590 (8' 6")	2590 (8' 6")
Overall width with add footboard	B'			2590 (8' 6")	2590 (8' 6")	2590 (8' 6")
Overall height of boom	C			3030 (9' 11")	3040 (10' 0")	3195 (10' 6")
Overall width of upper structure	D			2475 (8' 1")	2475 (8' 1")	2475 (8' 1")
Overall height of cab	E			2980 (9' 9")	2980 (9' 9")	2980 (9' 9")
Ground clearance of counterweight	F			1060 (3' 6")	1060 (3' 6")	1060 (3' 6")
Overall height of engine hood	G			2535 (8' 4")	2535 (8' 4")	2535 (8' 4")
Overall height of handrail	G'			3250 (10' 8")	3250 (10' 8")	3250 (10' 8")
Minimum ground clearance	H			460 (1' 6")	460 (1' 6")	460 (1' 6")
Rear-end distance	I			2490 (8' 2")	2490 (8' 2")	2490 (8' 2")
Rear-end swing radius	I'			2490 (8' 2")	2490 (8' 2")	2490 (8' 2")
Distance between tumblers	J			3170 (10' 5")	3170 (10' 5")	3170 (10' 5")
Undercarriage length (without grouser)	K			3910 (12' 10")	3910 (12' 10")	3910 (12' 10")
Undercarriage length (with grouser)	K'			3960 (13' 0")	3960 (13' 0")	3960 (13' 0")
Undercarriage width	L			2590 (8' 6")	2590 (8' 6")	2590 (8' 6")
Undercarriage width with add footboard	L'			2590 (8' 6")	2590 (8' 6")	2590 (8' 6")
Track gauge	M			1990 (6' 6")	1990 (6' 6")	1990 (6' 6")
Track shoe width, standard	N			600 (2' 0")	600 (2' 0")	600 (2' 0")
Height of blade	O			640 (2' 1")	640 (2' 1")	640 (2' 1")
Ground clearance of blade up	P			615 (2' 0")	615 (2' 0")	615 (2' 0")
Depth of blade down	Q			670 (2' 2")	670 (2' 2")	670 (2' 2")
Track shoe link quantity		EA		49	49	49
Travel speed (low/high)		km/hr (mph)		3.1 / 5.4 (1.9/3.4)	3.1 / 5.4 (1.9/3.4)	3.1 / 5.4 (1.9/3.4)
Swing speed		rpm		10.3	10.3	10.3
Gradeability		Degree (%)		35 (70)	35 (70)	35 (70)
Ground pressure		kgf/cm² (psi)		0.43 (6.10)	0.43 (6.12)	0.43 (6.12)
Max traction force		kg (lb)		16700 (36820)	16700 (36820)	16700 (36820)

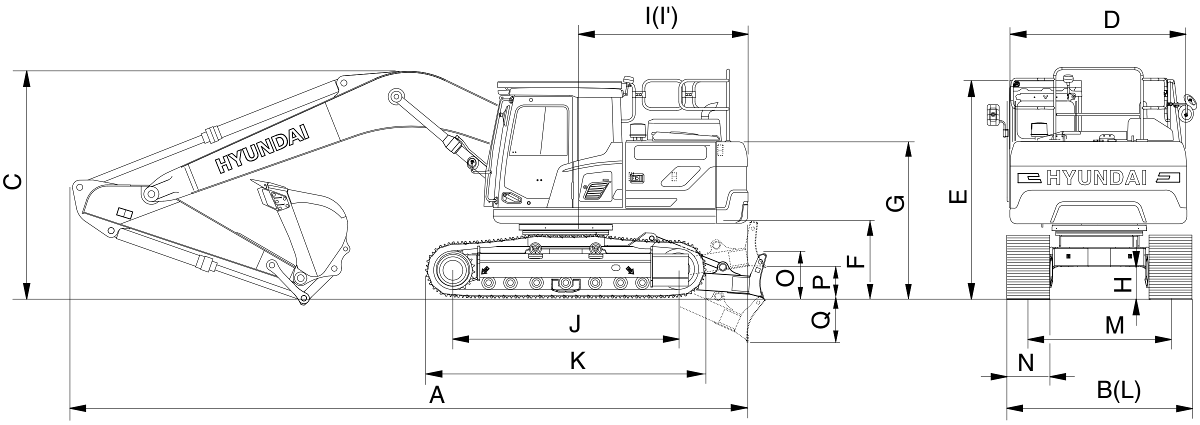
2) HX160A L, 2-PIECE BOOM



160A2SP03

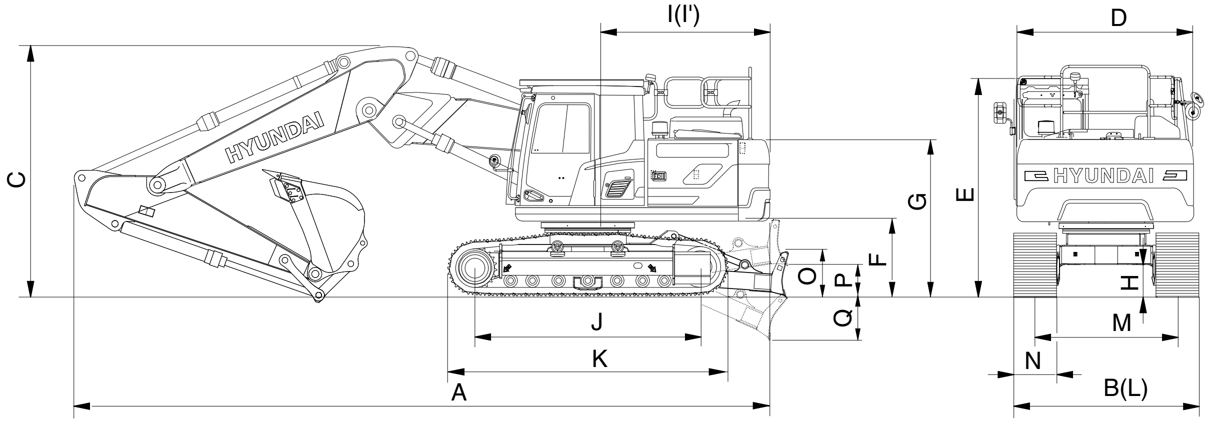
Description		Unit		Specification	
		m (ft-in)	Boom	5.1 (16' 9")	
			Arm	2.2 (7' 3")	2.6 (8' 6")
		mm (in)	Shoe	600 (24)	
Operating weight		kg (lb)		18810 (41470)	18865 (41590)
Overall length	A	mm (ft-in)		8575 (28' 2")	8585 (28' 2")
Overall width	B			2590 (8' 6")	2590 (8' 6")
Overall width with add footboard	B'			2590 (8' 6")	2590 (8' 6")
Overall height of boom	C			3060 (10' 0")	3035 (9' 11")
Overall width of upper structure	D			2475 (8' 1")	2475 (8' 1")
Overall height of cab	E			2980 (9' 9")	2980 (9' 9")
Ground clearance of counterweight	F			1060 (3' 6")	1060 (3' 6")
Overall height of engine hood	G			2535 (8' 4")	2535 (8' 4")
Overall height of handrail	G'			3250 (10' 8")	3250 (10' 8")
Minimum ground clearance	H			460 (1' 6")	460 (1' 6")
Rear-end distance	I			2490 (8' 2")	2490 (8' 2")
Rear-end swing radius	I'			2490 (8' 2")	2490 (8' 2")
Distance between tumblers	J			3170 (10' 5")	3170 (10' 5")
Undercarriage length (without grouser)	K			3910 (12' 10")	3910 (12' 10")
Undercarriage length (with grouser)	K'			3960 (13' 0")	3960 (13' 0")
Undercarriage width	L			2590 (8' 6")	2590 (8' 6")
Undercarriage width with add footboard	L'			2590 (8' 6")	2590 (8' 6")
Track gauge	M			1990 (6' 6")	1990 (6' 6")
Track shoe width, standard	N			600 (2' 0")	600 (2' 0")
Height of blade	O			640 (2' 1")	640 (2' 1")
Ground clearance of blade up	P			615 (2' 0")	615 (2' 0")
Depth of blade down	Q			670 (2' 2")	670 (2' 2")
Track shoe link quantity		EA		49	49
Travel speed (low/high)		km/hr (mph)		3.1 / 5.4 (1.9/3.4)	3.1 / 5.4 (1.9/3.4)
Swing speed		rpm		10.3	10.3
Gradeability		Degree (%)		35 (70)	35 (70)
Ground pressure		kgf/cm² (psi)		0.46 (6.50)	0.46 (6.52)
Max traction force		kg (lb)		16700 (36820)	16700 (36820)

3) HX180A L, MONO BOOM



Description		Unit		Specification		
		m (ft-in)	Boom	5.1 (16' 9")		
			Arm	2.2 (7' 3")	2.6 (8' 6")	3.1 (10' 2")
		mm (in)	Shoe	700 (28)		
Operating weight		kg (lb)		18610 (41030)	18665 (41150)	18690 (41200)
Overall length	A	mm (ft-in)		8650 (28' 5")	8660 (28' 5")	8670 (28' 5")
Overall width	B			2950 (9' 8")	2950 (9' 8")	2950 (9' 8")
Overall width with add footboard	B'			2950 (9' 8")	2950 (9' 8")	2950 (9' 8")
Overall height of boom	C			3030 (9' 11")	3040 (10' 0")	3195 (10' 6")
Overall width of upper structure	D			2475 (8' 1")	2475 (8' 1")	2475 (8' 1")
Overall height of cab	E			2980 (9' 9")	2980 (9' 9")	2980 (9' 9")
Ground clearance of counterweight	F			1060 (3' 6")	1060 (3' 6")	1060 (3' 6")
Overall height of engine hood	G			2535 (8' 4")	2535 (8' 4")	2535 (8' 4")
Overall height of handrail	G'			3250 (10' 8")	3250 (10' 8")	3250 (10' 8")
Minimum ground clearance	H			460 (1' 6")	460 (1' 6")	460 (1' 6")
Rear-end distance	I			2490 (8' 2")	2490 (8' 2")	2490 (8' 2")
Rear-end swing radius	I'			2490 (8' 2")	2490 (8' 2")	2490 (8' 2")
Distance between tumblers	J			3360 (11' 0")	3360 (11' 0")	3360 (11' 0")
Undercarriage length (without grouser)	K			4100 (13' 5")	4100 (13' 5")	4100 (13' 5")
Undercarriage length (with grouser)	K'			4150 (13' 7")	4150 (13' 7")	4150 (13' 7")
Undercarriage width	L			2950 (9' 8")	2950 (9' 8")	2950 (9' 8")
Undercarriage width with add footboard	L'			2950 (9' 8")	2950 (9' 8")	2950 (9' 8")
Track gauge	M			2250 (7' 5")	2250 (7' 5")	2250 (7' 5")
Track shoe width, standard	N			700 (2' 4")	700 (2' 4")	700 (2' 4")
Height of blade	O			640 (2' 1")	640 (2' 1")	640 (2' 1")
Ground clearance of blade up	P			615 (2' 0")	615 (2' 0")	615 (2' 0")
Depth of blade down	Q			670 (2' 2")	670 (2' 2")	670 (2' 2")
Track shoe link quantity		EA		51	51	51
Travel speed (low/high)		km/hr (mph)		3.1 / 5.4 (1.9/3.4)	3.1 / 5.4 (1.9/3.4)	3.1 / 5.4 (1.9/3.4)
Swing speed		rpm		10.3	10.3	10.3
Gradeability		Degree (%)		35 (70)	35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.37 (5.22)	0.37 (5.24)	0.37 (5.25)
Max traction force		kg (lb)		16700 (36820)	16700 (36820)	16700 (36820)

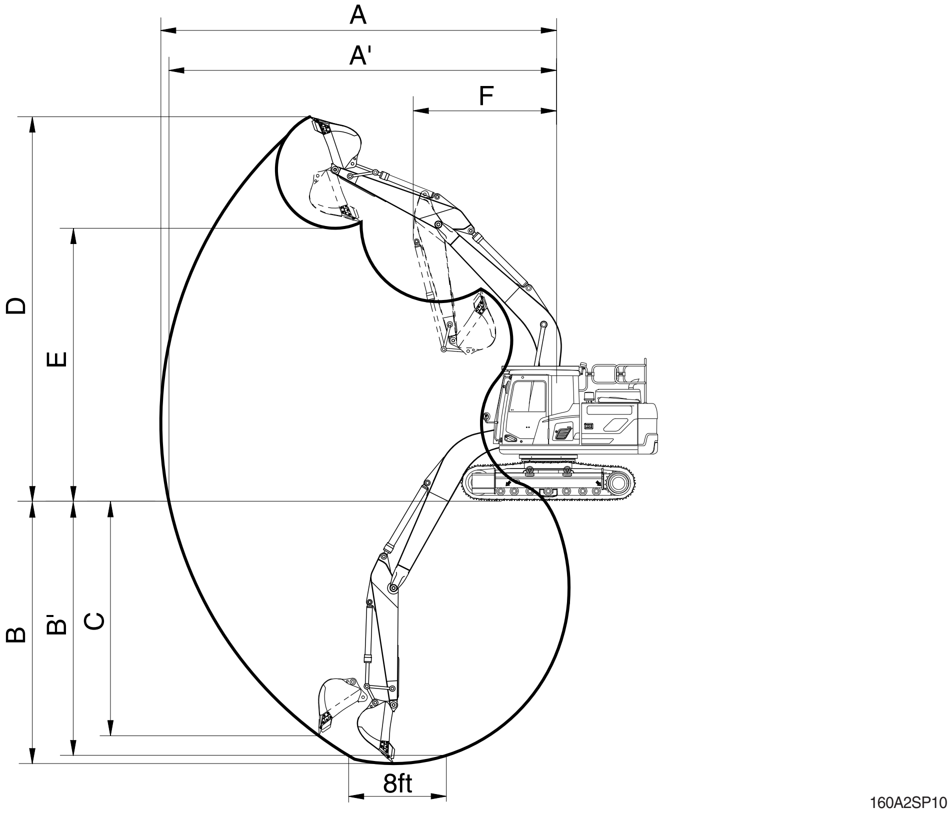
4) HX180A L, 2-PIECE BOOM



Description		Unit		Specification	
		m (ft-in)	Boom	5.1 (16' 9")	
			Arm	2.2 (7' 3")	2.6 (8' 6")
		mm (in)	Shoe	700 (28)	
Operating weight		kg (lb)		19480 (42950)	19535 (43070)
Overall length	A	mm (ft-in)		8575 (28' 2")	8585 (28' 2")
Overall width	B			2950 (9' 8")	2950 (9' 8")
Overall width with add footboard	B'			2950 (9' 8")	2950 (9' 8")
Overall height of boom	C			3060 (10' 0")	3035 (9' 11")
Overall width of upper structure	D			2475 (8' 1")	2475 (8' 1")
Overall height of cab	E			2980 (9' 9")	2980 (9' 9")
Ground clearance of counterweight	F			1060 (3' 6")	1060 (3' 6")
Overall height of engine hood	G			2535 (8' 4")	2535 (8' 4")
Overall height of handrail	G'			3250 (10' 8")	3250 (10' 8")
Minimum ground clearance	H			460 (1' 6")	460 (1' 6")
Rear-end distance	I			2490 (8' 2")	2490 (8' 2")
Rear-end swing radius	I'			2490 (8' 2")	2490 (8' 2")
Distance between tumblers	J			3360 (11' 0")	3360 (11' 0")
Undercarriage length (without grouser)	K			4100 (13' 5")	4100 (13' 5")
Undercarriage length (with grouser)	K'			4150 (13' 7")	4150 (13' 7")
Undercarriage width	L			2950 (9' 8")	2950 (9' 8")
Undercarriage width with add footboard	L'			2950 (9' 8")	2950 (9' 8")
Track gauge	M			2250 (7' 5")	2250 (7' 5")
Track shoe width, standard	N			700 (2' 4")	700 (2' 4")
Height of blade	O			640 (2' 1")	640 (2' 1")
Ground clearance of blade up	P			615 (2' 0")	615 (2' 0")
Depth of blade down	Q			670 (2' 2")	670 (2' 2")
Track shoe link quantity		EA		51	51
Travel speed (low/high)		km/hr (mph)		3.1 / 5.4 (1.9/3.4)	3.1 / 5.4 (1.9/3.4)
Swing speed		rpm		10.3	10.3
Gradeability		Degree (%)		35 (70)	35 (70)
Ground pressure		kgf/cm² (psi)		0.38 (5.47)	0.39 (5.48)
Max traction force		kg (lb)		16700 (36820)	16700 (36820)

3. WORKING RANGE AND DIGGING FORCE

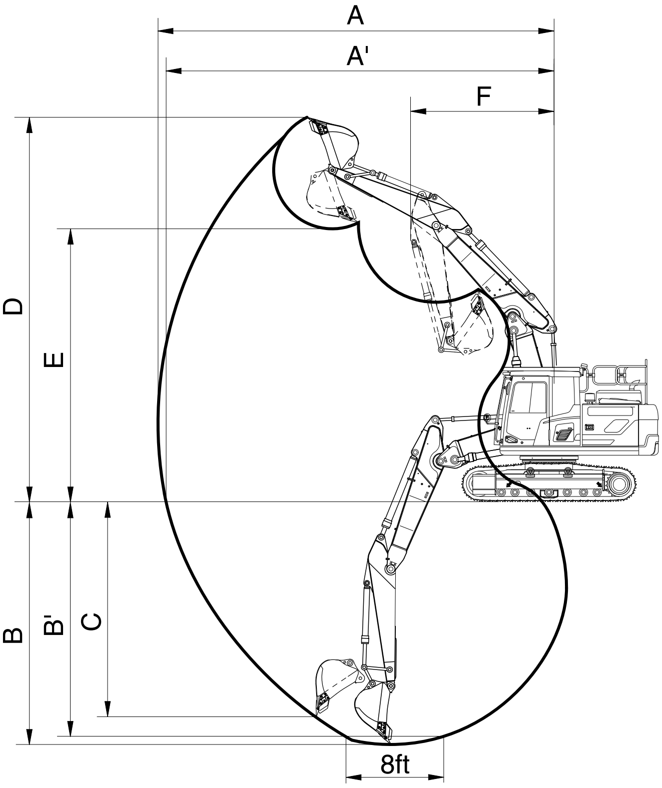
1) HX160A L, MONO BOOM



Description	m (ft-in)	Boom	5.1 (16' 9")		
		Arm	2.2 (7' 3")	2.6 (8' 6")	3.1 (10' 2")
Max digging reach	mm (ft-in)	A	9020 (29' 7")	8690 (28' 6")	9450 (31' 0")
Max digging reach on ground		A'	8860 (29' 1")	8530 (28' 0")	9300 (30' 6")
Max digging depth		B	6030 (19' 9")	5630 (18' 6")	6530 (21' 5")
Max digging depth (8 ft level)		B'	5825 (19' 1")	5410 (17' 9")	6340 (20' 10")
Max vertical wall digging depth		C	3600 (11' 10")	3410 (11' 2")	3845 (12' 7")
Max digging height		D	8750 (28' 8")	8670 (28' 5")	8880 (29' 2")
Max dumping height		E	6250 (20' 6")	6140 (20' 2")	6410 (21' 0")
Min swing radius		F	3170 (10' 5")	3180 (10' 5")	3160 (10' 4")
Bucket digging force	kN	SAE	107.9 [117.2]	107.7 [117]	107.9 [117.2]
	kgf		11004 [11950]	10987 [11930]	11006 [11950]
	lbf		24259 [26345]	24222 [26301]	24264 [26345]
	kN	ISO	126.4 [137.3]	126.2 [137.1]	126.5 [137.3]
	kgf		12892 [14000]	12872 [13980]	12894 [14000]
	lbf		28421 [30865]	28379 [30821]	28427 [30865]
Arm digging force	kN	SAE	77.3 [83.8]	87.2 [94.6]	69 [74.9]
	kgf		7878.9 [8550]	8888.7 [9650]	7035 [7640]
	lbf		17370 [18850]	19596 [21275]	15510 [16843]
	kN	ISO	80.8 [87.7]	91.6 [99.4]	71.7 [77.9]
	kgf		8236.5 [8940]	9339.4 [10140]	7313.9 [7940]
	lbf		18158 [19709]	20590 [22355]	16124 [17505]

[ ] : Power boost

2) HX160A L, 2-PIECE BOOM

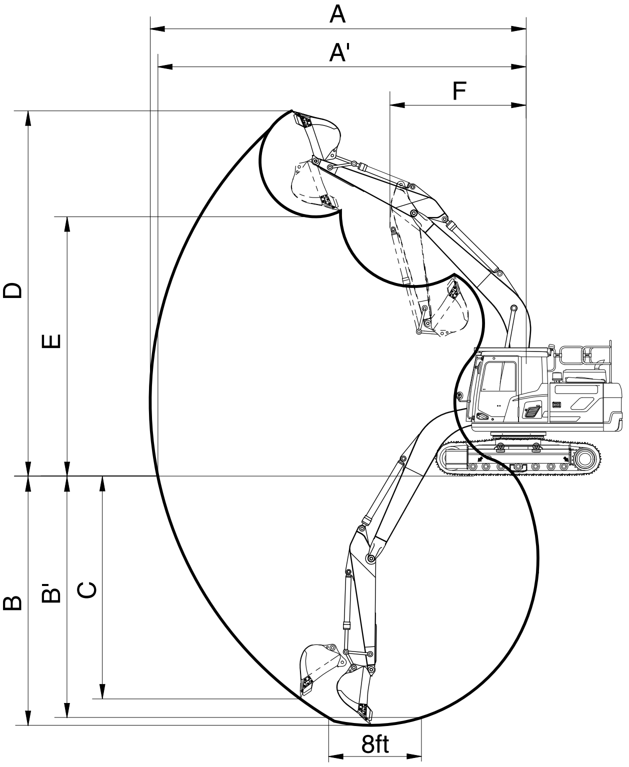


160A2SP11

Description	m (ft-in)	Boom	5.1 (16' 9")	
		Arm	2.2 (7' 3")	2.6 (8' 6")
Max digging reach	mm (ft-in)	A	8760 (28' 9")	9110 (29' 11")
Max digging reach on ground		A'	8600 (28' 3")	8955 (29' 5")
Max digging depth		B	5690 (18' 8")	5305 (17' 5")
Max digging depth (8 ft level)		B'	5590 (18' 4")	5200 (17' 1")
Max vertical wall digging depth		C	3790 (12' 5")	3520 (11' 7")
Max digging height		D	9380 (30' 9")	9560 (31' 4")
Max dumping height		E	6720 (22' 1")	6920 (22' 8")
Min swing radius		F	3090 (10' 2")	2970 (9' 9")
Bucket digging force	kN	SAE	107.9 [117.2]	107.7 [117]
	kgf		11004 [11950]	10987 [11930]
	lbf		24259 [26345]	24222 [26301]
	kN	ISO	126.4 [137.3]	126.2 [137.1]
	kgf		12892 [14000]	12872 [13980]
	lbf		28421 [30865]	28379 [30821]
Arm digging force	kN	SAE	77.3 [83.8]	87.2 [94.6]
	kgf		7878.9 [8550]	8888.7 [9650]
	lbf		17370 [18850]	19596 [21275]
	kN	ISO	80.8 [87.7]	91.6 [99.4]
	kgf		8236.5 [8940]	9339.4 [10140]
	lbf		18158 [19709]	20590 [22355]

[ ] : Power boost

3) HX180A L, MONO BOOM

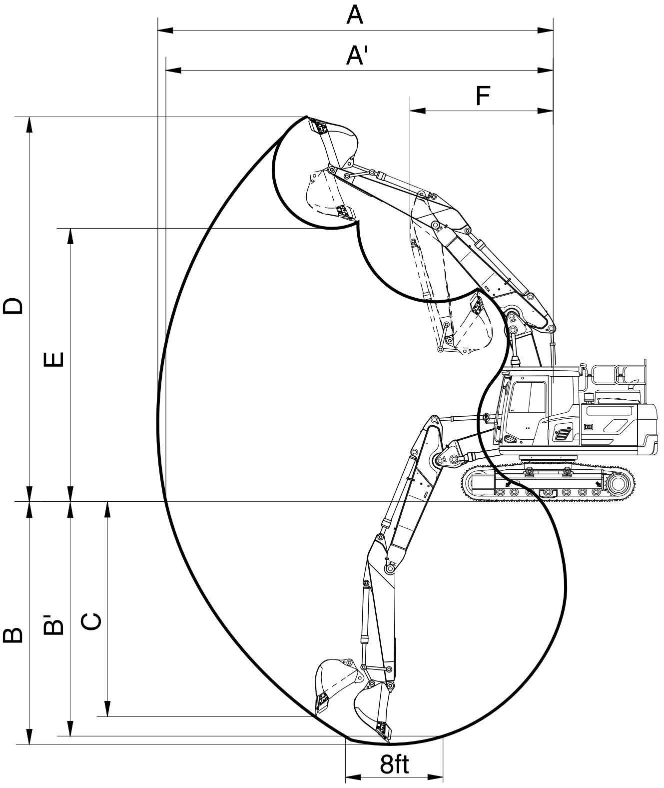


160A2SP10

Description	m (ft-in)	Boom	5.1 (16' 9")		
		Arm	2.2 (7' 3")	2.6 (8' 6")	3.1 (10' 2")
Max digging reach	mm (ft-in)	A	9020 (29' 7")	8690 (28' 6")	9450 (31' 0")
Max digging reach on ground		A'	8860 (29' 1")	8530 (28' 0")	9300 (30' 6")
Max digging depth		B	6030 (19' 9")	5630 (18' 6")	6530 (21' 5")
Max digging depth (8 ft level)		B'	5825 (19' 1")	5410 (17' 9")	6340 (20' 10")
Max vertical wall digging depth		C	3600 (11' 10")	3410 (11' 2")	3845 (12' 7")
Max digging height		D	8750 (28' 8")	8670 (28' 5")	8880 (29' 2")
Max dumping height		E	6250 (20' 6")	6140 (20' 2")	6410 (21' 0")
Min swing radius		F	3170 (10' 5")	3180 (10' 5")	3160 (10' 4")
Bucket digging force	kN	SAE	107.9 [117.2]	107.7 [117]	107.9 [117.2]
	kgf		11004 [11950]	10987 [11930]	11006 [11950]
	lbf		24259 [26345]	24222 [26301]	24264 [26345]
	kN	ISO	126.4 [137.3]	126.2 [137.1]	126.5 [137.3]
	kgf		12892 [14000]	12872 [13980]	12894 [14000]
	lbf		28421 [30865]	28379 [30821]	28427 [30865]
Arm digging force	kN	SAE	77.3 [83.8]	87.2 [94.6]	69 [74.9]
	kgf		7878.9 [8550]	8888.7 [9650]	7035 [7640]
	lbf		17370 [18850]	19596 [21275]	15510 [16843]
	kN	ISO	80.8 [87.7]	91.6 [99.4]	71.7 [77.9]
	kgf		8236.5 [8940]	9339.4 [10140]	7313.9 [7940]
	lbf		18158 [19709]	20590 [22355]	16124 [17505]

[ ] : Power boost

4) HX180A L, 2-PIECE BOOM



160A2SP11

Description	m (ft-in)	Boom	5.1 (16' 9")	
		Arm	2.2 (7' 3")	2.6 (8' 6")
Max digging reach	mm (ft-in)	A	8760 (28' 9")	9110 (29' 11")
Max digging reach on ground		A'	8600 (28' 3")	8955 (29' 5")
Max digging depth		B	5690 (18' 8")	5305 (17' 5")
Max digging depth (8 ft level)		B'	5590 (18' 4")	5200 (17' 1")
Max vertical wall digging depth		C	3790 (12' 5")	3520 (11' 7")
Max digging height		D	9380 (30' 9")	9560 (31' 4")
Max dumping height		E	6720 (22' 1")	6920 (22' 8")
Min swing radius		F	3090 (10' 2")	2970 (9' 9")
Bucket digging force	kN	SAE	107.9 [117.2]	107.7 [117]
	kgf		11004 [11950]	10987 [11930]
	lbf		24259 [26345]	24222 [26301]
	kN	ISO	126.4 [137.3]	126.2 [137.1]
	kgf		12892 [14000]	12872 [13980]
	lbf		28421 [30865]	28379 [30821]
Arm digging force	kN	SAE	77.3 [83.8]	87.2 [94.6]
	kgf		7878.9 [8550]	8888.7 [9650]
	lbf		17370 [18850]	19596 [21275]
	kN	ISO	80.8 [87.7]	91.6 [99.4]
	kgf		8236.5 [8940]	9339.4 [10140]
	lbf		18158 [19709]	20590 [22355]

[ ] : Power boost

4. WEIGHT

1) HX160A L

Item	Qty	HX160A L		HX160A LD	
	EA	kg	lb	kg	lb
Upperstructure assembly					
· Main frame weld assembly	1	1,413	3,115	1,413	3,115
· Engine assembly	1	383	844	383	844
· Aftertreatment assy	1	64	141	64	141
· Main pump assembly	1	89	196	89	196
· Main control valve assembly	1	140	309	140	309
· Swing motor assembly	1	261	575	261	575
· Hydraulic oil tank WA	1	136	300	136	300
· Fuel tank WA	1	147	324	147	324
· Counterweight	1	2,600	5,732	2,600	5,732
· Cab assembly	1	495	1,090	495	1,090
Lower chassis assembly					
· Track frame weld assembly	1	2,002	4,414	2,230	4,916
· Dozer blade assembly	1	-	-	652	1,437
· Swing bearing	1	260	573	260	573
· Travel motor assembly	2	600	1,323	600	1,323
· Turning joint	1	56	123	63	139
· Sprocket	2	49	109	49	109
· Track recoil spring	2	132	291	132	291
· Idler	2	151	332	151	332
· Upper roller	4	21	45	21	45
· Lower roller	14	40	88	40	88
· Track Guard	2	41	90	41	90
· Track-chain assembly (500 mm, 49 link)	2	1,061	2,338	1,061	2,338
· Track-chain assembly (600 mm, 49 link)	2	1,181	2,605	1,181	2,605
· Track-chain assembly (700 mm, 49 link)	2	1,305	2,877	1,305	2,877
Front attachment assembly					
· 5.1 m mono boom assembly	1	1,041	2,295	1,041	2,295
· 5.1 m 2-piece boom assembly	1	1,293	2,851	1,293	2,851
· 2.60 m arm assembly	1	550	1,213	550	1,213
· 2.20 m arm assembly	1	497	1,096	497	1,096
· 3.10 m arm assembly	1	578	1,274	578	1,274
· 2.60 m arm assembly (w/o reinforce)	1	543	1,197	543	1,197
· 3.10 m arm assembly (w/o reinforce)	1	570	1,257	570	1,257
· 0.88 m^3 bucket assembly	1	662	1,459	662	1,459
· 0.96 m^3 bucket assembly	1	726	1,601	726	1,601
· 0.73 m^3 bucket assembly	1	617	1,361	617	1,361
· 0.85 m^3 bucket assembly	1	669	1,476	669	1,476
· Boom cylinder assembly	2	280	617	280	617
· Arm cylinder assembly	1	172	379	172	379
· Bucket cylinder assembly	1	121	267	121	267
· 2-piece boom cylinder assembly	1	215	474	215	474
· Dozer cylinder assembly	2	-	-	132	291
· Bucket control linkage total	1	158	348	158	348

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

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

2) HX180A L

Item	Qty	HX180A L		HX180A LD	
	EA	kg	lb	kg	lb
Upperstructure assembly					
· Main frame weld assembly	1	1,413	3,115	1,413	3,115
· Engine assembly	1	383	844	383	844
· Aftertreatment assy	1	64	141	64	141
· Main pump assembly	1	89	196	89	196
· Main control valve assembly	1	140	309	140	309
· Swing motor assembly	1	261	575	61	134
· Hydraulic oil tank WA	1	136	300	136	300
· Fuel tank WA	1	147	324	147	324
· Counterweight	1	2,900	6,393	2,900	6,393
· Cab assembly	1	495	1,090	495	1,090
Lower chassis assembly					
· Track frame weld assembly	1	2,164	4,771	2,381	5,249
· Dozer blade assembly	1	0	0	700	1,543
· Swing bearing	1	260	573	260	573
· Travel motor assembly	2	600	1,323	600	1,323
· Turning joint	1	56	123	63	139
· Sprocket	2	49	109	49	109
· Track recoil spring	2	132	291	132	291
· Idler	2	152	332	152	332
· Upper roller	4	21	45	21	45
· Lower roller	14	48	105	48	105
· Track Guard	2	41	90	41	90
· Track-chain assembly (500 mm, 51 link)	2	1,109	2,445	1,109	2,445
· Track-chain assembly (600 mm, 51 link)	2	1,239	2,731	1,239	2,731
· Track-chain assembly (700 mm, 51 link)	2	1,371	3,022	1,371	3,022
· Track-chain assembly (800 mm, 51 link)	2	1,500	3,306	1,500	3,306
Front attachment assembly					
· 5.1 m mono boom assembly	1	1,041	2,295	1,041	2,295
· 5.1 m[2] piece boom assembly	1	1,293	2,851	1,293	2,851
· 2.60 m arm assembly	1	550	1,213	550	1,213
· 2.20 m arm assembly	1	497	1,096	497	1,096
· 3.10 m arm assembly	1	578	1,274	578	1,274
· 2.60 m arm assembly (w/o reinforce)	1	543	1,197	543	1,197
· 3.10 m arm assembly (w/o reinforce)	1	570	1,257	570	1,257
· 0.88 m^3 bucket assembly	1	662	1,459	662	1,459
· 0.96 m^3 bucket assembly	1	726	1,601	726	1,601
· 0.73 m^3 bucket assembly	1	617	1,361	617	1,361
· 0.85 m^3 bucket assembly	1	669	1,476	669	1,476
· Boom cylinder assembly	2	280	617	280	617
· Arm cylinder assembly	1	172	379	172	379
· Bucket cylinder assembly	1	121	267	121	267
· 2-piece boom cylinder assembly	1	215	474	215	474
· Dozer cylinder assembly	2	-	-	132	291
· Bucket control linkage total	1	158	348	158	348

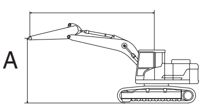
※ This information is different with operating and transportation weight because it is not including harness, pipe, oil, fuel so on.

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

5. LIFTING CAPACITIES

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2200	2600	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)		Capacity		Reach
												m (ft)
6.0 m	kg									*3850	3340	5.86
(19.7 ft)	lb									*8490	7360	(19.2)
4.5 m	kg					*5320	5000	*4750	3200	*3630	2630	6.74
(14.8 ft)	lb					*11730	11020	*10470	7050	*8000	5800	(22.1)
3.0 m	kg					*6540	4670	4990	3070	*3650	2310	7.20
(9.8 ft)	lb					*14420	10300	11000	6770	*8050	5090	(23.6)
1.5 m	kg					7500	4360	4840	2940	3600	2200	7.33
(4.9 ft)	lb					16530	9610	10670	6480	7940	4850	(24.0)
0.0 m	kg					7310	4200	4730	2840	3700	2250	7.13
(0.0 ft)	lb					16120	9260	10430	6260	8160	4960	(23.4)
-1.5 m	kg			*9400	7730	7270	4170	4710	2820	4150	2510	6.58
(-4.9 ft)	lb			*20720	17040	16030	9190	10380	6220	9150	5530	(21.6)
-3.0 m	kg			*9400	7900	*6720	4250			*4980	3200	5.58
(-9.8 ft)	lb			*20720	17420	*14820	9370			*10980	7050	(18.3)

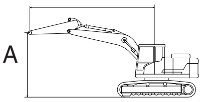
Note 1. Lifting capacity are based on ISO 10567.
2. Lifting capacity of the HX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates load limited 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 with your local HD Hyundai Construction Equipment dealer regarding the lifting capacities for specific work tools and attachments.

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

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2600	2600	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											*3410	*3410	4.85
(24.6 ft)	lb											*7520	*7520	(15.9)
6.0 m	kg							*3840	3280			*2970	*2970	6.27
(19.7 ft)	lb							*8470	7230			*6550	*6550	(20.6)
4.5 m	kg					*4870	*4870	*4430	3230			*2850	2430	7.10
(14.8 ft)	lb					*10740	*10740	*9770	7120			*6280	5360	(23.3)
3.0 m	kg			*9370	8720	*6120	4740	*4940	3090	*3110	2170	*2880	2150	7.54
(9.8 ft)	lb			*20660	19220	*13490	10450	*10890	6810	*6860	4780	*6350	4740	(24.7)
1.5 m	kg					*7380	4390	4840	2940	3470	2120	*3060	2050	7.66
(4.9 ft)	lb					*16270	9680	10670	6480	7650	4670	*6750	4520	(25.1)
0.0 m	kg			*5290	*5290	7300	4190	4720	2820			*3420	2080	7.47
(0.0 ft)	lb			*11660	*11660	16090	9240	10410	6220			*7540	4590	(24.5)
-1.5 m	kg	*5090	*5090	*9190	7630	7230	4120	4670	2780			3800	2290	6.95
(-4.9 ft)	lb	*11220	*11220	*20260	16820	15940	9080	10300	6130			8380	5050	(22.8)
-3.0 m	kg	*9360	*9360	*10170	7770	*7120	4180	4740	2840			4720	2830	6.01
(-9.8 ft)	lb	*20640	*20640	*22420	17130	*15700	9220	10450	6260			10410	6240	(19.7)
-4.5 m	kg			*6860	*6860							*4560	*4560	4.39
(-14.8 ft)	lb			*15120	*15120							*10050	*10050	(14.4)

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

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

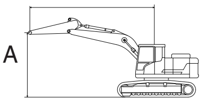
⚠ Failure to comply to the rated load can cause serious injury, death, or property damage. Make adjustments to the rated load as necessary for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	3100	2600	600	-	-	-	-	-

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

B

A



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											*2710	*2710	5.51
(24.6 ft)	lb											*5970	*5970	(18.1)
6.0 m	kg							*3700	3330			*2430	*2430	6.79
(19.7 ft)	lb							*8160	7340			*5360	*5360	(22.3)
4.5 m	kg							*4020	3260	*2570	2230	*2340	2190	7.56
(14.8 ft)	lb							*8860	7190	*5670	4920	*5160	4830	(24.8)
3.0 m	kg			*7930	*7930	*5540	4810	*4580	3110	3540	2170	*2380	1950	7.97
(9.8 ft)	lb			*17480	*17480	*12210	10600	*10100	6860	7800	4780	*5250	4300	(26.2)
1.5 m	kg			*6760	*6760	*6920	4430	4850	2930	3450	2100	*2530	1860	8.09
(4.9 ft)	lb			*14900	*14900	*15260	9770	10690	6460	7610	4630	*5580	4100	(26.5)
0.0 m	kg			*6160	*6160	7280	4160	4690	2790	3380	2030	*2820	1880	7.91
(0.0 ft)	lb			*13580	*13580	16050	9170	10340	6150	7450	4480	*6220	4140	(25.9)
-1.5 m	kg	*4790	*4790	*8770	7480	7150	4050	4610	2720			*3360	2040	7.42
(-4.9 ft)	lb	*10560	*10560	*19330	16490	15760	8930	10160	6000			*7410	4500	(24.3)
-3.0 m	kg	*8080	*8080	*10910	7580	7170	4070	4630	2740			4090	2440	6.55
(-9.8 ft)	lb	*17810	*17810	*24050	16710	15810	8970	10210	6040			9020	5380	(21.5)
-4.5 m	kg			*8260	7850	*5640	4230					*4650	3560	5.11
(-14.8 ft)	lb			*18210	17310	*12430	9330					*10250	7850	(16.8)

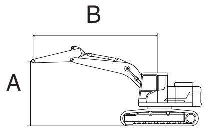
Note 1. Lifting capacity are based on ISO 10567.
2. Lifting capacity of the HX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates load limited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

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

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

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2200	3250	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)		Capacity		Reach
												m (ft)
6.0 m	kg									*3850	3690	5.86
(19.7 ft)	lb									*8490	8140	(19.2)
4.5 m	kg					*5320	*5320	*4750	3530	*3630	2920	6.74
(14.8 ft)	lb					*11730	*11730	*10470	7780	*8000	6440	(22.1)
3.0 m	kg					*6540	5160	*5200	3410	*3650	2580	7.20
(9.8 ft)	lb					*14420	11380	*11460	7520	*8050	5690	(23.6)
1.5 m	kg					*7690	4840	5270	3270	*3850	2470	7.33
(4.9 ft)	lb					*16950	10670	11620	7210	*8490	5450	(24.0)
0.0 m	kg					7960	4680	5160	3180	4050	2530	7.13
(0.0 ft)	lb					17550	10320	11380	7010	8930	5580	(23.4)
-1.5 m	kg			*9400	8590	*7910	4650	5140	3160	4530	2810	6.58
(-4.9 ft)	lb			*20720	18940	*17440	10250	11330	6970	9990	6190	(21.6)
-3.0 m	kg			*9400	8760	*6720	4740			*4980	3570	5.58
(-9.8 ft)	lb			*20720	19310	*14820	10450			*10980	7870	(18.3)

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.

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Lifting capacities will vary with different work tools, ground conditions and attachments.
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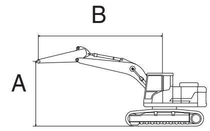
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2600	3250	600	-	-	-	-	-

· : 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											*3410	*3410	4.85
(24.6 ft)	lb											*7520	*7520	(15.9)
6.0 m	kg							*3840	3610			*2970	*2970	6.27
(19.7 ft)	lb							*8470	7960			*6550	*6550	(20.6)
4.5 m	kg					*4870	*4870	*4430	3560			*2850	2700	7.10
(14.8 ft)	lb					*10740	*10740	*9770	7850			*6280	5950	(23.3)
3.0 m	kg			*9370	*9370	*6120	5220	*4940	3430	*3110	2430	*2880	2410	7.54
(9.8 ft)	lb			*20660	*20660	*13490	11510	*10890	7560	*6860	5360	*6350	5310	(24.7)
1.5 m	kg					*7380	4880	5280	3270	3790	2370	*3060	2300	7.66
(4.9 ft)	lb					*16270	10760	11640	7210	8360	5220	*6750	5070	(25.1)
0.0 m	kg			*5290	*5290	7960	4670	5150	3160			*3420	2340	7.47
(0.0 ft)	lb			*11660	*11660	17550	10300	11350	6970			*7540	5160	(24.5)
-1.5 m	kg	*5090	*5090	*9190	8490	7880	4600	5100	3110			*4130	2570	6.95
(-4.9 ft)	lb	*11220	*11220	*20260	18720	17370	10140	11240	6860			*9110	5670	(22.8)
-3.0 m	kg	*9360	*9360	*10170	8630	*7120	4660	*4910	3180			*4890	3170	6.01
(-9.8 ft)	lb	*20640	*20640	*22420	19030	*15700	10270	*10820	7010			*10780	6990	(19.7)
-4.5 m	kg			*6860	*6860							*4560	*4560	4.39
(-14.8 ft)	lb			*15120	*15120							*10050	*10050	(14.4)

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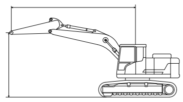
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	3100	3250	600	-	-	-	-	-



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

Lift-point height (A)		Lift-point radius (B) 1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 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)
7.5 m	kg											*2710	*2710	5.51
(24.6 ft)	lb											*5970	*5970	(18.1)
6.0 m	kg							*3700	3670			*2430	*2430	6.79
(19.7 ft)	lb							*8160	8090			*5360	*5360	(22.3)
4.5 m	kg							*4020	3600	*2570	2480	*2340	*2340	7.56
(14.8 ft)	lb							*8860	7940	*5670	5470	*5160	*5160	(24.8)
3.0 m	kg			*7930	*7930	*5540	5300	*4580	3440	*3790	2430	*2380	2190	7.97
(9.8 ft)	lb			*17480	*17480	*12210	11680	*10100	7580	*8360	5360	*5250	4830	(26.2)
1.5 m	kg			*6760	*6760	*6920	4910	*5230	3270	3770	2350	*2530	2090	8.09
(4.9 ft)	lb			*14900	*14900	*15260	10820	*11530	7210	8310	5180	*5580	4610	(26.5)
0.0 m	kg			*6160	*6160	*7830	4650	5120	3130	3700	2290	*2820	2120	7.91
(0.0 ft)	lb			*13580	*13580	*17260	10250	11290	6900	8160	5050	*6220	4670	(25.9)
-1.5 m	kg	*4790	*4790	*8770	8340	7810	4530	5040	3050			*3360	2300	7.42
(-4.9 ft)	lb	*10560	*10560	*19330	18390	17220	9990	11110	6720			*7410	5070	(24.3)
-3.0 m	kg	*8080	*8080	*10910	8440	*7450	4550	5060	3070			4480	2750	6.55
(-9.8 ft)	lb	*17810	*17810	*24050	18610	*16420	10030	11160	6770			9880	6060	(21.5)
-4.5 m	kg			*8260	*8260	*5640	4710					*4650	3970	5.11
(-14.8 ft)	lb			*18210	*18210	*12430	10380					*10250	8750	(16.8)

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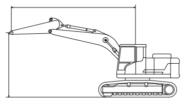
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A L	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5097	2200	3250	600	-	-	-	-	-

· : 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									*4850	*4850	4.43
(24.6 ft)	lb									*10690	*10690	(14.5)
6.0 m	kg			*4510	*4510					*3970	3580	5.95
(19.7 ft)	lb			*9940	*9940					*8750	7890	(19.5)
4.5 m	kg			*5110	*5110	*4560	3530			*3670	2840	6.82
(14.8 ft)	lb			*11270	*11270	*10050	7780			*8090	6260	(22.4)
3.0 m	kg			*6280	5140	*5010	3390			*3620	2520	7.28
(9.8 ft)	lb			*13850	11330	*11050	7470			*7980	5560	(23.9)
1.5 m	kg			*7440	4810	5280	3250			*3750	2410	7.40
(4.9 ft)	lb			*16400	10600	11640	7170			*8270	5310	(24.3)
0.0 m	kg			7980	4640	5170	3150			4000	2470	7.20
(0.0 ft)	lb			17590	10230	11400	6940			8820	5450	(23.6)
-1.5 m	kg	*8360	*8360	*7890	4620	5160	3130			4470	2760	6.66
(-4.9 ft)	lb	*18430	*18430	*17390	10190	11380	6900			9850	6080	(21.9)

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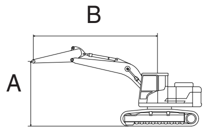
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A L	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5097	2600	3250	600	-	-	-	-	-

· : 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			*4310	*4310					*3570	*3570	5.00
(24.6 ft)	lb			*9500	*9500					*7870	*7870	(16.4)
6.0 m	kg					*4130	3610			*3050	*3050	6.39
(19.7 ft)	lb					*9110	7960			*6720	*6720	(21.0)
4.5 m	kg			*4680	*4680	*4250	3560			*2870	2620	7.20
(14.8 ft)	lb			*10320	*10320	*9370	7850			*6330	5780	(23.6)
3.0 m	kg			*5870	5210	*4750	3410	*3660	2410	*2850	2340	7.63
(9.8 ft)	lb			*12940	11490	*10470	7520	*8070	5310	*6280	5160	(25.0)
1.5 m	kg			*7130	4850	5290	3250	3800	2350	*2970	2240	7.75
(4.9 ft)	lb			*15720	10690	11660	7170	8380	5180	*6550	4940	(25.4)
0.0 m	kg			*7880	4630	5160	3130	3750	2310	*3250	2280	7.56
(0.0 ft)	lb			*17370	10210	11380	6900	8270	5090	*7170	5030	(24.8)
-1.5 m	kg	*8290	*8290	7900	4570	5110	3090			*3800	2510	7.05
(-4.9 ft)	lb	*18280	*18280	17420	10080	11270	6810			*8380	5530	(23.1)
-3.0 m	kg			*7200	4640							
(-9.8 ft)	lb			*15870	10230							

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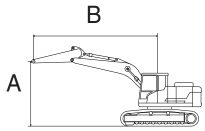
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2200	2600	600	-	Down	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m	kg									*3850	3530	5.86
(19.7 ft)	lb									*8490	7780	(19.2)
4.5 m	kg					*5320	5270	*4750	3380	*3630	2790	6.74
(14.8 ft)	lb					*11730	11620	*10470	7450	*8000	6150	(22.1)
3.0 m	kg					*6540	4940	*5200	3260	*3650	2460	7.20
(9.8 ft)	lb					*14420	10890	*11460	7190	*8050	5420	(23.6)
1.5 m	kg					*7690	4630	*5710	3120	*3850	2350	7.33
(4.9 ft)	lb					*16950	10210	*12590	6880	*8490	5180	(24.0)
0.0 m	kg					*8180	4460	*5980	3030	*4310	2400	7.13
(0.0 ft)	lb					*18030	9830	*13180	6680	*9500	5290	(23.4)
-1.5 m	kg			*9400	8200	*7910	4430	*5770	3010	*5030	2680	6.58
(-4.9 ft)	lb			*20720	18080	*17440	9770	*12720	6640	*11090	5910	(21.6)
-3.0 m	kg			*9400	8370	*6720	4520			*4980	3400	5.58
(-9.8 ft)	lb			*20720	18450	*14820	9960			*10980	7500	(18.3)

Note 1. Lifting capacity are based on ISO 10567.
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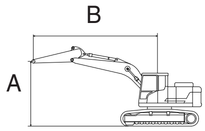
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2200	2600	600	-	Up	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m	kg									*3850	3530	5.86
(19.7 ft)	lb									*8490	7780	(19.2)
4.5 m	kg					*5320	5270	*4750	3380	*3630	2790	6.74
(14.8 ft)	lb					*11730	11620	*10470	7450	*8000	6150	(22.1)
3.0 m	kg					*6540	4940	4950	3260	*3650	2460	7.20
(9.8 ft)	lb					*14420	10890	10910	7190	*8050	5420	(23.6)
1.5 m	kg					7430	4630	4790	3120	3570	2350	7.33
(4.9 ft)	lb					16380	10210	10560	6880	7870	5180	(24.0)
0.0 m	kg					7240	4460	4690	3030	3670	2400	7.13
(0.0 ft)	lb					15960	9830	10340	6680	8090	5290	(23.4)
-1.5 m	kg			*9400	8200	7200	4430	4670	3010	4110	2680	6.58
(-4.9 ft)	lb			*20720	18080	15870	9770	10300	6640	9060	5910	(21.6)
-3.0 m	kg			*9400	8370	*6720	4520			*4980	3400	5.58
(-9.8 ft)	lb			*20720	18450	*14820	9960			*10980	7500	(18.3)

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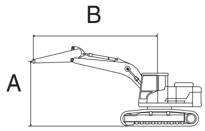
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2600	2600	600	-	Down	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m	kg											*3410	*3410	4.85
(24.6 ft)	lb											*7520	*7520	(15.9)
6.0 m	kg							*3840	3460			*2970	*2970	6.27
(19.7 ft)	lb							*8470	7630			*6550	*6550	(20.6)
4.5 m	kg					*4870	*4870	*4430	3410			*2850	2580	7.10
(14.8 ft)	lb					*10740	*10740	*9770	7520			*6280	5690	(23.3)
3.0 m	kg			*9370	9190	*6120	5000	*4940	3280	*3110	2310	*2880	2290	7.54
(9.8 ft)	lb			*20660	20260	*13490	11020	*10890	7230	*6860	5090	*6350	5050	(24.7)
1.5 m	kg					*7380	4660	*5520	3120	*4040	2260	*3060	2190	7.66
(4.9 ft)	lb					*16270	10270	*12170	6880	*8910	4980	*6750	4830	(25.1)
0.0 m	kg			*5290	*5290	*8070	4450	*5900	3010			*3420	2230	7.47
(0.0 ft)	lb			*11660	*11660	*17790	9810	*13010	6640			*7540	4920	(24.5)
-1.5 m	kg	*5090	*5090	*9190	8100	*8010	4390	*5850	2960			*4130	2450	6.95
(-4.9 ft)	lb	*11220	*11220	*20260	17860	*17660	9680	*12900	6530			*9110	5400	(22.8)
-3.0 m	kg	*9360	*9360	*10170	8240	*7120	4440	*4910	3030			*4890	3020	6.01
(-9.8 ft)	lb	*20640	*20640	*22420	18170	*15700	9790	*10820	6680			*10780	6660	(19.7)
-4.5 m	kg			*6860	*6860							*4560	*4560	4.39
(-14.8 ft)	lb			*15120	*15120							*10050	*10050	(14.4)

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.

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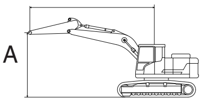
⚠ Failure to comply to the rated load can cause serious injury, death, or property damage. Make adjustments to the rated load as necessary for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2600	2600	600	-	Up	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m	kg											*3410	*3410	4.85
(24.6 ft)	lb											*7520	*7520	(15.9)
6.0 m	kg							*3840	3460			*2970	*2970	6.27
(19.7 ft)	lb							*8470	7630			*6550	*6550	(20.6)
4.5 m	kg					*4870	*4870	*4430	3410			*2850	2580	7.10
(14.8 ft)	lb					*10740	*10740	*9770	7520			*6280	5690	(23.3)
3.0 m	kg			*9370	9190	*6120	5000	*4940	3280	*3110	2310	*2880	2290	7.54
(9.8 ft)	lb			*20660	20260	*13490	11020	*10890	7230	*6860	5090	*6350	5050	(24.7)
1.5 m	kg					*7380	4660	4800	3120	3430	2260	*3060	2190	7.66
(4.9 ft)	lb					*16270	10270	10580	6880	7560	4980	*6750	4830	(25.1)
0.0 m	kg			*5290	*5290	7230	4450	4670	3010			3410	2230	7.47
(0.0 ft)	lb			*11660	*11660	15940	9810	10300	6640			7520	4920	(24.5)
-1.5 m	kg	*5090	*5090	*9190	8100	7160	4390	4620	2960			3760	2450	6.95
(-4.9 ft)	lb	*11220	*11220	*20260	17860	15790	9680	10190	6530			8290	5400	(22.8)
-3.0 m	kg	*9360	*9360	*10170	8240	*7120	4440	4690	3030			4680	3020	6.01
(-9.8 ft)	lb	*20640	*20640	*22420	18170	*15700	9790	10340	6680			10320	6660	(19.7)
-4.5 m	kg			*6860	*6860							*4560	*4560	4.39
(-14.8 ft)	lb			*15120	*15120							*10050	*10050	(14.4)

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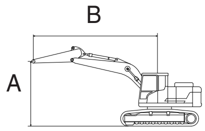
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	3100	2600	600	-	Down	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m	kg											*2710	*2710	5.51
(24.6 ft)	lb											*5970	*5970	(18.1)
6.0 m	kg							*3700	3520			*2430	*2430	6.79
(19.7 ft)	lb							*8160	7760			*5360	*5360	(22.3)
4.5 m	kg							*4020	3450	*2570	2370	*2340	2330	7.56
(14.8 ft)	lb							*8860	7610	*5670	5220	*5160	5140	(24.8)
3.0 m	kg			*7930	*7930	*5540	5080	*4580	3290	*3790	2320	*2380	2090	7.97
(9.8 ft)	lb			*17480	*17480	*12210	11200	*10100	7250	*8360	5110	*5250	4610	(26.2)
1.5 m	kg			*6760	*6760	*6920	4690	*5230	3120	*4390	2240	*2530	1990	8.09
(4.9 ft)	lb			*14900	*14900	*15260	10340	*11530	6880	*9680	4940	*5580	4390	(26.5)
0.0 m	kg			*6160	*6160	*7830	4430	*5730	2980	*4580	2170	*2820	2010	7.91
(0.0 ft)	lb			*13580	*13580	*17260	9770	*12630	6570	*10100	4780	*6220	4430	(25.9)
-1.5 m	kg	*4790	*4790	*8770	7960	*8030	4320	*5860	2900			*3360	2180	7.42
(-4.9 ft)	lb	*10560	*10560	*19330	17550	*17700	9520	*12920	6390			*7410	4810	(24.3)
-3.0 m	kg	*8080	*8080	*10910	8060	*7450	4330	*5360	2920			*4510	2610	6.55
(-9.8 ft)	lb	*17810	*17810	*24050	17770	*16420	9550	*11820	6440			*9940	5750	(21.5)
-4.5 m	kg			*8260	*8260	*5640	4490					*4650	3790	5.11
(-14.8 ft)	lb			*18210	*18210	*12430	9900					*10250	8360	(16.8)

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	3100	2600	600	-	Up	-	-	-

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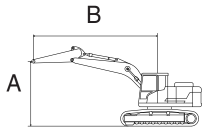

Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m	kg											*2710	*2710	5.51
(24.6 ft)	lb											*5970	*5970	(18.1)
6.0 m	kg							*3700	3520			*2430	*2430	6.79
(19.7 ft)	lb							*8160	7760			*5360	*5360	(22.3)
4.5 m	kg							*4020	3450	*2570	2370	*2340	2330	7.56
(14.8 ft)	lb							*8860	7610	*5670	5220	*5160	5140	(24.8)
3.0 m	kg			*7930	*7930	*5540	5080	*4580	3290	3500	2320	*2380	2090	7.97
(9.8 ft)	lb			*17480	*17480	*12210	11200	*10100	7250	7720	5110	*5250	4610	(26.2)
1.5 m	kg			*6760	*6760	*6920	4690	4800	3120	3420	2240	*2530	1990	8.09
(4.9 ft)	lb			*14900	*14900	*15260	10340	10580	6880	7540	4940	*5580	4390	(26.5)
0.0 m	kg			*6160	*6160	7220	4430	4640	2980	3350	2170	*2820	2010	7.91
(0.0 ft)	lb			*13580	*13580	15920	9770	10230	6570	7390	4780	*6220	4430	(25.9)
-1.5 m	kg	*4790	*4790	*8770	7960	7090	4320	4560	2900			*3360	2180	7.42
(-4.9 ft)	lb	*10560	*10560	*19330	17550	15630	9520	10050	6390			*7410	4810	(24.3)
-3.0 m	kg	*8080	*8080	*10910	8060	7110	4330	4580	2920			4050	2610	6.55
(-9.8 ft)	lb	*17810	*17810	*24050	17770	15670	9550	10100	6440			8930	5750	(21.5)
-4.5 m	kg			*8260	*8260	*5640	4490					*4650	3790	5.11
(-14.8 ft)	lb			*18210	*18210	*12430	9900					*10250	8360	(16.8)

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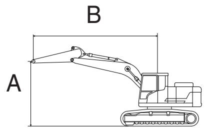
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2200	3250	600	-	Down	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m	kg									*3850	*3850	5.86
(19.7 ft)	lb									*8490	*8490	(19.2)
4.5 m	kg					*5320	*5320	*4750	3720	*3630	3080	6.74
(14.8 ft)	lb					*11730	*11730	*10470	8200	*8000	6790	(22.1)
3.0 m	kg					*6540	5420	*5200	3600	*3650	2730	7.20
(9.8 ft)	lb					*14420	11950	*11460	7940	*8050	6020	(23.6)
1.5 m	kg					*7690	5110	*5710	3460	*3850	2610	7.33
(4.9 ft)	lb					*16950	11270	*12590	7630	*8490	5750	(24.0)
0.0 m	kg					*8180	4950	*5980	3360	*4310	2680	7.13
(0.0 ft)	lb					*18030	10910	*13180	7410	*9500	5910	(23.4)
-1.5 m	kg			*9400	9060	*7910	4920	*5770	3340	*5030	2980	6.58
(-4.9 ft)	lb			*20720	19970	*17440	10850	*12720	7360	*11090	6570	(21.6)
-3.0 m	kg			*9400	9230	*6720	5000			*4980	3770	5.58
(-9.8 ft)	lb			*20720	20350	*14820	11020			*10980	8310	(18.3)

Note 1. Lifting capacity are based on ISO 10567.

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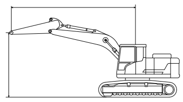
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2200	3250	600	-	Up	-	-	-

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

B

A



Lift-point height (A)		Lift-point radius (B) 1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		At max. reach Capacity		Reach
		Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	m (ft)
6.0 m	kg									*3850	*3850	5.86
(19.7 ft)	lb									*8490	*8490	(19.2)
4.5 m	kg					*5320	*5320	*4750	3720	*3630	3080	6.74
(14.8 ft)	lb					*11730	*11730	*10470	8200	*8000	6790	(22.1)
3.0 m	kg					*6540	5420	*5200	3600	*3650	2730	7.20
(9.8 ft)	lb					*14420	11950	*11460	7940	*8050	6020	(23.6)
1.5 m	kg					*7690	5110	5230	3460	*3850	2610	7.33
(4.9 ft)	lb					*16950	11270	11530	7630	*8490	5750	(24.0)
0.0 m	kg					7890	4950	5120	3360	4010	2680	7.13
(0.0 ft)	lb					17390	10910	11290	7410	8840	5910	(23.4)
-1.5 m	kg			*9400	9060	7860	4920	5100	3340	4490	2980	6.58
(-4.9 ft)	lb			*20720	19970	17330	10850	11240	7360	9900	6570	(21.6)
-3.0 m	kg			*9400	9230	*6720	5000			*4980	3770	5.58
(-9.8 ft)	lb			*20720	20350	*14820	11020			*10980	8310	(18.3)

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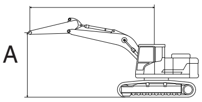
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2600	3250	600	-	Down	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m	kg											*3410	*3410	4.85
(24.6 ft)	lb											*7520	*7520	(15.9)
6.0 m	kg							*3840	3800			*2970	*2970	6.27
(19.7 ft)	lb							*8470	8380			*6550	*6550	(20.6)
4.5 m	kg					*4870	*4870	*4430	3750			*2850	*2850	7.10
(14.8 ft)	lb					*10740	*10740	*9770	8270			*6280	*6280	(23.3)
3.0 m	kg			*9370	*9370	*6120	5490	*4940	3610	*3110	2570	*2880	2550	7.54
(9.8 ft)	lb			*20660	*20660	*13490	12100	*10890	7960	*6860	5670	*6350	5620	(24.7)
1.5 m	kg					*7380	5140	*5520	3460	*4040	2510	*3060	2440	7.66
(4.9 ft)	lb					*16270	11330	*12170	7630	*8910	5530	*6750	5380	(25.1)
0.0 m	kg			*5290	*5290	*8070	4940	*5900	3340			*3420	2490	7.47
(0.0 ft)	lb			*11660	*11660	*17790	10890	*13010	7360			*7540	5490	(24.5)
-1.5 m	kg	*5090	*5090	*9190	8960	*8010	4870	*5850	3300			*4130	2730	6.95
(-4.9 ft)	lb	*11220	*11220	*20260	19750	*17660	10740	*12900	7280			*9110	6020	(22.8)
-3.0 m	kg	*9360	*9360	*10170	9100	*7120	4930	*4910	3360			*4890	3350	6.01
(-9.8 ft)	lb	*20640	*20640	*22420	20060	*15700	10870	*10820	7410			*10780	7390	(19.7)
-4.5 m	kg			*6860	*6860							*4560	*4560	4.39
(-14.8 ft)	lb			*15120	*15120							*10050	*10050	(14.4)

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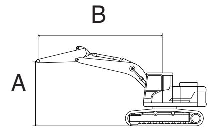
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2600	3250	600	-	Up	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m	kg											*3410	*3410	4.85
(24.6 ft)	lb											*7520	*7520	(15.9)
6.0 m	kg							*3840	3800			*2970	*2970	6.27
(19.7 ft)	lb							*8470	8380			*6550	*6550	(20.6)
4.5 m	kg					*4870	*4870	*4430	3750			*2850	*2850	7.10
(14.8 ft)	lb					*10740	*10740	*9770	8270			*6280	*6280	(23.3)
3.0 m	kg			*9370	*9370	*6120	5490	*4940	3610	*3110	2570	*2880	2550	7.54
(9.8 ft)	lb			*20660	*20660	*13490	12100	*10890	7960	*6860	5670	*6350	5620	(24.7)
1.5 m	kg					*7380	5140	5230	3460	3760	2510	*3060	2440	7.66
(4.9 ft)	lb					*16270	11330	11530	7630	8290	5530	*6750	5380	(25.1)
0.0 m	kg			*5290	*5290	7890	4940	5100	3340			*3420	2490	7.47
(0.0 ft)	lb			*11660	*11660	17390	10890	11240	7360			*7540	5490	(24.5)
-1.5 m	kg	*5090	*5090	*9190	8960	7810	4870	5050	3300			4120	2730	6.95
(-4.9 ft)	lb	*11220	*11220	*20260	19750	17220	10740	11130	7280			9080	6020	(22.8)
-3.0 m	kg	*9360	*9360	*10170	9100	*7120	4930	*4910	3360			*4890	3350	6.01
(-9.8 ft)	lb	*20640	*20640	*22420	20060	*15700	10870	*10820	7410			*10780	7390	(19.7)
-4.5 m	kg			*6860	*6860							*4560	*4560	4.39
(-14.8 ft)	lb			*15120	*15120							*10050	*10050	(14.4)

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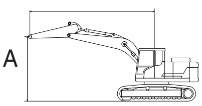
⚠ Failure to comply to the rated load can cause serious injury, death, or property damage. Make adjustments to the rated load as necessary for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	3100	3250	600	-	Down	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m	kg											*2710	*2710	5.51
(24.6 ft)	lb											*5970	*5970	(18.1)
6.0 m	kg							*3700	*3700			*2430	*2430	6.79
(19.7 ft)	lb							*8160	*8160			*5360	*5360	(22.3)
4.5 m	kg							*4020	3780	*2570	*2570	*2340	*2340	7.56
(14.8 ft)	lb							*8860	8330	*5670	*5670	*5160	*5160	(24.8)
3.0 m	kg			*7930	*7930	*5540	*5540	*4580	3630	*3790	2570	*2380	2330	7.97
(9.8 ft)	lb			*17480	*17480	*12210	*12210	*10100	8000	*8360	5670	*5250	5140	(26.2)
1.5 m	kg			*6760	*6760	*6920	5180	*5230	3450	*4390	2490	*2530	2220	8.09
(4.9 ft)	lb			*14900	*14900	*15260	11420	*11530	7610	*9680	5490	*5580	4890	(26.5)
0.0 m	kg			*6160	*6160	*7830	4910	*5730	3310	*4580	2430	*2820	2260	7.91
(0.0 ft)	lb			*13580	*13580	*17260	10820	*12630	7300	*10100	5360	*6220	4980	(25.9)
-1.5 m	kg	*4790	*4790	*8770	*8770	*8030	4800	*5860	3240			*3360	2440	7.42
(-4.9 ft)	lb	*10560	*10560	*19330	*19330	*17700	10580	*12920	7140			*7410	5380	(24.3)
-3.0 m	kg	*8080	*8080	*10910	8920	*7450	4820	*5360	3260			*4510	2910	6.55
(-9.8 ft)	lb	*17810	*17810	*24050	19670	*16420	10630	*11820	7190			*9940	6420	(21.5)
-4.5 m	kg			*8260	*8260	*5640	4980					*4650	4200	5.11
(-14.8 ft)	lb			*18210	*18210	*12430	10980					*10250	9260	(16.8)

Note 1. Lifting capacity are based on ISO 10567.
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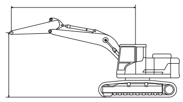
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	3100	3250	600	-	Up	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m	kg											*2710	*2710	5.51
(24.6 ft)	lb											*5970	*5970	(18.1)
6.0 m	kg							*3700	*3700			*2430	*2430	6.79
(19.7 ft)	lb							*8160	*8160			*5360	*5360	(22.3)
4.5 m	kg							*4020	3780	*2570	*2570	*2340	*2340	7.56
(14.8 ft)	lb							*8860	8330	*5670	*5670	*5160	*5160	(24.8)
3.0 m	kg			*7930	*7930	*5540	*5540	*4580	3630	*3790	2570	*2380	2330	7.97
(9.8 ft)	lb			*17480	*17480	*12210	*12210	*10100	8000	*8360	5670	*5250	5140	(26.2)
1.5 m	kg			*6760	*6760	*6920	5180	*5230	3450	3740	2490	*2530	2220	8.09
(4.9 ft)	lb			*14900	*14900	*15260	11420	*11530	7610	8250	5490	*5580	4890	(26.5)
0.0 m	kg			*6160	*6160	*7830	4910	5080	3310	3670	2430	*2820	2260	7.91
(0.0 ft)	lb			*13580	*13580	*17260	10820	11200	7300	8090	5360	*6220	4980	(25.9)
-1.5 m	kg	*4790	*4790	*8770	*8770	7740	4800	5000	3240			*3360	2440	7.42
(-4.9 ft)	lb	*10560	*10560	*19330	*19330	17060	10580	11020	7140			*7410	5380	(24.3)
-3.0 m	kg	*8080	*8080	*10910	8920	*7450	4820	5020	3260			4440	2910	6.55
(-9.8 ft)	lb	*17810	*17810	*24050	19670	*16420	10630	11070	7190			9790	6420	(21.5)
-4.5 m	kg			*8260	*8260	*5640	4980					*4650	4200	5.11
(-14.8 ft)	lb			*18210	*18210	*12430	10980					*10250	9260	(16.8)

Note 1. Lifting capacity are based on ISO 10567.
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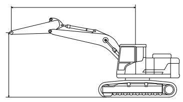
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A LD	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5097	2200	3250	600	-	Down	-	-	-

· : 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									*4850	*4850	4.43
(24.6 ft)	lb									*10690	*10690	(14.5)
6.0 m	kg			*4510	*4510					*3970	3760	5.95
(19.7 ft)	lb			*9940	*9940					*8750	8290	(19.5)
4.5 m	kg			*5110	*5110	*4560	3710			*3670	3000	6.82
(14.8 ft)	lb			*11270	*11270	*10050	8180			*8090	6610	(22.4)
3.0 m	kg			*6280	5410	*5010	3580			*3620	2670	7.28
(9.8 ft)	lb			*13850	11930	*11050	7890			*7980	5890	(23.9)
1.5 m	kg			*7440	5080	*5530	3430			*3750	2550	7.40
(4.9 ft)	lb			*16400	11200	*12190	7560			*8270	5620	(24.3)
0.0 m	kg			*8020	4910	*5870	3330			*4090	2620	7.20
(0.0 ft)	lb			*17680	10820	*12940	7340			*9020	5780	(23.6)
-1.5 m	kg	*8360	*8360	*7890	4880	*5760	3320			*4780	2920	6.66
(-4.9 ft)	lb	*18430	*18430	*17390	10760	*12700	7320			*10540	6440	(21.9)

Note 1. Lifting capacity are based on ISO 10567.
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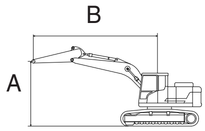
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A LD	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5097	2200	3250	600	-	Up	-	-	-

· : 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									*4850	*4850	4.43
(24.6 ft)	lb									*10690	*10690	(14.5)
6.0 m	kg			*4510	*4510					*3970	3760	5.95
(19.7 ft)	lb			*9940	*9940					*8750	8290	(19.5)
4.5 m	kg			*5110	*5110	*4560	3710			*3670	3000	6.82
(14.8 ft)	lb			*11270	*11270	*10050	8180			*8090	6610	(22.4)
3.0 m	kg			*6280	5410	*5010	3580			*3620	2670	7.28
(9.8 ft)	lb			*13850	11930	*11050	7890			*7980	5890	(23.9)
1.5 m	kg			*7440	5080	5240	3430			*3750	2550	7.40
(4.9 ft)	lb			*16400	11200	11550	7560			*8270	5620	(24.3)
0.0 m	kg			7910	4910	5130	3330			3970	2620	7.20
(0.0 ft)	lb			17440	10820	11310	7340			8750	5780	(23.6)
-1.5 m	kg	*8360	*8360	7880	4880	5110	3320			4440	2920	6.66
(-4.9 ft)	lb	*18430	*18430	17370	10760	11270	7320			9790	6440	(21.9)

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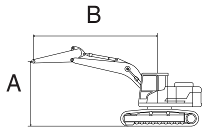
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A LD	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5097	2600	3250	600	-	Down	-	-	-

· : 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			*4310	*4310					*3570	*3570	5.00
(24.6 ft)	lb			*9500	*9500					*7870	*7870	(16.4)
6.0 m	kg					*4130	3800			*3050	*3050	6.39
(19.7 ft)	lb					*9110	8380			*6720	*6720	(21.0)
4.5 m	kg			*4680	*4680	*4250	3750			*2870	2770	7.20
(14.8 ft)	lb			*10320	*10320	*9370	8270			*6330	6110	(23.6)
3.0 m	kg			*5870	5480	*4750	3600	*3660	2550	*2850	2480	7.63
(9.8 ft)	lb			*12940	12080	*10470	7940	*8070	5620	*6280	5470	(25.0)
1.5 m	kg			*7130	5110	*5330	3430	*4480	2490	*2970	2370	7.75
(4.9 ft)	lb			*15720	11270	*11750	7560	*9880	5490	*6550	5220	(25.4)
0.0 m	kg			*7880	4900	*5760	3320	*3840	2450	*3250	2420	7.56
(0.0 ft)	lb			*17370	10800	*12700	7320	*8470	5400	*7170	5340	(24.8)
-1.5 m	kg	*8290	*8290	*7950	4830	*5810	3270			*3800	2670	7.05
(-4.9 ft)	lb	*18280	*18280	*17530	10650	*12810	7210			*8380	5890	(23.1)
-3.0 m	kg			*7200	4900							
(-9.8 ft)	lb			*15870	10800							

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX160A LD	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5097	2600	3250	600	-	Up	-	-	-

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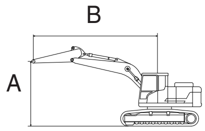

Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m	kg			*4310	*4310					*3570	*3570	5.00
(24.6 ft)	lb			*9500	*9500					*7870	*7870	(16.4)
6.0 m	kg					*4130	3800			*3050	*3050	6.39
(19.7 ft)	lb					*9110	8380			*6720	*6720	(21.0)
4.5 m	kg			*4680	*4680	*4250	3750			*2870	2770	7.20
(14.8 ft)	lb			*10320	*10320	*9370	8270			*6330	6110	(23.6)
3.0 m	kg			*5870	5480	*4750	3600	*3660	2550	*2850	2480	7.63
(9.8 ft)	lb			*12940	12080	*10470	7940	*8070	5620	*6280	5470	(25.0)
1.5 m	kg			*7130	5110	5250	3430	3760	2490	*2970	2370	7.75
(4.9 ft)	lb			*15720	11270	11570	7560	8290	5490	*6550	5220	(25.4)
0.0 m	kg			*7880	4900	5110	3320	3720	2450	*3250	2420	7.56
(0.0 ft)	lb			*17370	10800	11270	7320	8200	5400	*7170	5340	(24.8)
-1.5 m	kg	*8290	*8290	7830	4830	5070	3270			*3800	2670	7.05
(-4.9 ft)	lb	*18280	*18280	17260	10650	11180	7210			*8380	5890	(23.1)
-3.0 m	kg			*7200	4900							
(-9.8 ft)	lb			*15870	10800							

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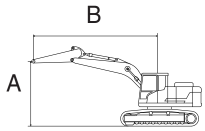
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2200	2900	600	-	-	-	-	-

· : 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)		Capacity		Reach
												m (ft)
6.0 m	kg									*3850	*3850	5.86
(19.7 ft)	lb									*8490	*8490	(19.2)
4.5 m	kg					*5320	*5320	*4750	3880	*3630	3210	6.74
(14.8 ft)	lb					*11730	*11730	*10470	8550	*8000	7080	(22.1)
3.0 m	kg					*6540	5720	*5200	3750	*3650	2840	7.20
(9.8 ft)	lb					*14420	12610	*11460	8270	*8050	6260	(23.6)
1.5 m	kg					*7690	5400	5530	3610	*3850	2720	7.33
(4.9 ft)	lb					*16950	11900	12190	7960	*8490	6000	(24.0)
0.0 m	kg					*8180	5230	5420	3510	4230	2780	7.13
(0.0 ft)	lb					*18030	11530	11950	7740	9330	6130	(23.4)
-1.5 m	kg			*9400	*9400	*7910	5200	5390	3490	4740	3100	6.58
(-4.9 ft)	lb			*20720	*20720	*17440	11460	11880	7690	10450	6830	(21.6)
-3.0 m	kg			*9400	*9400	*6720	5290			*4980	3940	5.58
(-9.8 ft)	lb			*20720	*20720	*14820	11660			*10980	8690	(18.3)

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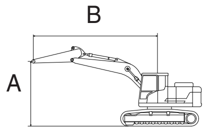
⚠ Failure to comply to the rated load can cause serious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2600	2900	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											*3410	*3410	4.85
(24.6 ft)	lb											*7520	*7520	(15.9)
6.0 m	kg							*3840	*3840			*2970	*2970	6.27
(19.7 ft)	lb							*8470	*8470			*6550	*6550	(20.6)
4.5 m	kg					*4870	*4870	*4430	3910			*2850	*2850	7.10
(14.8 ft)	lb					*10740	*10740	*9770	8620			*6280	*6280	(23.3)
3.0 m	kg			*9370	*9370	*6120	5790	*4940	3770	*3110	2670	*2880	2650	7.54
(9.8 ft)	lb			*20660	*20660	*13490	12760	*10890	8310	*6860	5890	*6350	5840	(24.7)
1.5 m	kg					*7380	5430	*5520	3610	3960	2610	*3060	2530	7.66
(4.9 ft)	lb					*16270	11970	*12170	7960	8730	5750	*6750	5580	(25.1)
0.0 m	kg			*5290	*5290	*8070	5220	5400	3490			*3420	2580	7.47
(0.0 ft)	lb			*11660	*11660	*17790	11510	11900	7690			*7540	5690	(24.5)
-1.5 m	kg	*5090	*5090	*9190	*9190	*8010	5150	5350	3450			*4130	2840	6.95
(-4.9 ft)	lb	*11220	*11220	*20260	*20260	*17660	11350	11790	7610			*9110	6260	(22.8)
-3.0 m	kg	*9360	*9360	*10170	9930	*7120	5210	*4910	3510			*4890	3500	6.01
(-9.8 ft)	lb	*20640	*20640	*22420	21890	*15700	11490	*10820	7740			*10780	7720	(19.7)
-4.5 m	kg			*6860	*6860							*4560	*4560	4.39
(-14.8 ft)	lb			*15120	*15120							*10050	*10050	(14.4)

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2600	2900	600	-	-	-	-	-

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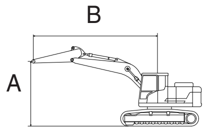

Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
		Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	m (ft)
7.5 m	kg											*2710	*2710	5.51
(24.6 ft)	lb											*5970	*5970	(18.1)
6.0 m	kg							*3700	*3700			*2430	*2430	6.79
(19.7 ft)	lb							*8160	*8160			*5360	*5360	(22.3)
4.5 m	kg							*4020	3950	*2570	*2570	*2340	*2340	7.56
(14.8 ft)	lb							*8860	8710	*5670	*5670	*5160	*5160	(24.8)
3.0 m	kg			*7930	*7930	*5540	*5540	*4580	3790	*3790	2670	*2380	*2380	7.97
(9.8 ft)	lb			*17480	*17480	*12210	*12210	*10100	8360	*8360	5890	*5250	*5250	(26.2)
1.5 m	kg			*6760	*6760	*6920	5470	*5230	3610	3940	2590	*2530	2310	8.09
(4.9 ft)	lb			*14900	*14900	*15260	12060	*11530	7960	8690	5710	*5580	5090	(26.5)
0.0 m	kg			*6160	*6160	*7830	5200	5380	3460	3870	2530	*2820	2340	7.91
(0.0 ft)	lb			*13580	*13580	*17260	11460	11860	7630	8530	5580	*6220	5160	(25.9)
-1.5 m	kg	*4790	*4790	*8770	*8770	*8030	5080	5290	3390			*3360	2540	7.42
(-4.9 ft)	lb	*10560	*10560	*19330	*19330	*17700	11200	11660	7470			*7410	5600	(24.3)
-3.0 m	kg	*8080	*8080	*10910	9730	*7450	5100	5310	3410			*4510	3040	6.55
(-9.8 ft)	lb	*17810	*17810	*24050	21450	*16420	11240	11710	7520			*9940	6700	(21.5)
-4.5 m	kg			*8260	*8260	*5640	5260					*4650	4410	5.11
(-14.8 ft)	lb			*18210	*18210	*12430	11600					*10250	9720	(16.8)

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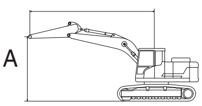
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2200	3250	600	-	-	-	-	-

· : 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)		Capacity		Reach
												m (ft)
6.0 m (19.7 ft)	kg lb									*3850 *8490	*3850 *8490	5.86 (19.2)
4.5 m (14.8 ft)	kg lb					*5320 *11730	*5320 *11730	*4750 *10470	4070 8970	*3630 *8000	3370 7430	6.74 (22.1)
3.0 m (9.8 ft)	kg lb					*6540 *14420	6010 13250	*5200 *11460	3950 8710	*3650 *8050	2990 6590	7.20 (23.6)
1.5 m (4.9 ft)	kg lb					*7690 *16950	5680 12520	*5710 *12590	3800 8380	*3850 *8490	2870 6330	7.33 (24.0)
0.0 m (0.0 ft)	kg lb					*8180 *18030	5510 12150	5660 12480	3710 8180	*4310 *9500	2940 6480	7.13 (23.4)
-1.5 m (-4.9 ft)	kg lb			*9400 *20720	*9400 *20720	*7910 *17440	5480 12080	5640 12430	3680 8110	4950 10910	3270 7210	6.58 (21.6)
-3.0 m (-9.8 ft)	kg lb			*9400 *20720	*9400 *20720	*6720 *14820	5570 12280			*4980 *10980	4160 9170	5.58 (18.3)

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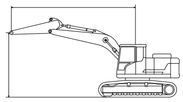
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
		Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
HX180A L	MONO BOOM	5100	2600	3250	600	-	-	-	-	-

· : 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
		Over-front	Over-side or 360 degree	Over-front	Over-side or 360 degree	Over-front	Over-side or 360 degree	Over-front	Over-side or 360 degree	Over-front	Over-side or 360 degree	Over-front	Over-side or 360 degree	m (ft)
7.5 m	kg											*3410	*3410	4.85
(24.6 ft)	lb											*7520	*7520	(15.9)
6.0 m	kg							*3840	*3840			*2970	*2970	6.27
(19.7 ft)	lb							*8470	*8470			*6550	*6550	(20.6)
4.5 m	kg					*4870	*4870	*4430	4100			*2850	*2850	7.10
(14.8 ft)	lb					*10740	*10740	*9770	9040			*6280	*6280	(23.3)
3.0 m	kg			*9370	*9370	*6120	6070	*4940	3960	*3110	2820	*2880	2790	7.54
(9.8 ft)	lb			*20660	*20660	*13490	13380	*10890	8730	*6860	6220	*6350	6150	(24.7)
1.5 m	kg					*7380	5720	*5520	3800	*4040	2760	*3060	2680	7.66
(4.9 ft)	lb					*16270	12610	*12170	8380	*8910	6080	*6750	5910	(25.1)
0.0 m	kg			*5290	*5290	*8070	5500	5640	3690			*3420	2730	7.47
(0.0 ft)	lb			*11660	*11660	*17790	12130	12430	8140			*7540	6020	(24.5)
-1.5 m	kg	*5090	*5090	*9190	*9190	*8010	5430	5590	3640			*4130	3000	6.95
(-4.9 ft)	lb	*11220	*11220	*20260	*20260	*17660	11970	12320	8020			*9110	6610	(22.8)
-3.0 m	kg	*9360	*9360	*10170	*10170	*7120	5490	*4910	3710			*4890	3700	6.01
(-9.8 ft)	lb	*20640	*20640	*22420	*22420	*15700	12100	*10820	8180			*10780	8160	(19.7)
-4.5 m	kg			*6860	*6860							*4560	*4560	4.39
(-14.8 ft)	lb			*15120	*15120							*10050	*10050	(14.4)

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	3100	3250	600	-	-	-	-	-

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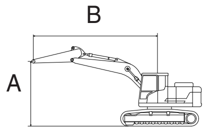

Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m	kg											*2710	*2710	5.51
(24.6 ft)	lb											*5970	*5970	(18.1)
6.0 m	kg							*3700	*3700			*2430	*2430	6.79
(19.7 ft)	lb							*8160	*8160			*5360	*5360	(22.3)
4.5 m	kg							*4020	*4020	*2570	*2570	*2340	*2340	7.56
(14.8 ft)	lb							*8860	*8860	*5670	*5670	*5160	*5160	(24.8)
3.0 m	kg			*7930	*7930	*5540	*5540	*4580	3980	*3790	2820	*2380	*2380	7.97
(9.8 ft)	lb			*17480	*17480	*12210	*12210	*10100	8770	*8360	6220	*5250	*5250	(26.2)
1.5 m	kg			*6760	*6760	*6920	5750	*5230	3800	4120	2740	*2530	2440	8.09
(4.9 ft)	lb			*14900	*14900	*15260	12680	*11530	8380	9080	6040	*5580	5380	(26.5)
0.0 m	kg			*6160	*6160	*7830	5480	5620	3660	4050	2670	*2820	2480	7.91
(0.0 ft)	lb			*13580	*13580	*17260	12080	12390	8070	8930	5890	*6220	5470	(25.9)
-1.5 m	kg	*4790	*4790	*8770	*8770	*8030	5360	5540	3580			*3360	2690	7.42
(-4.9 ft)	lb	*10560	*10560	*19330	*19330	*17700	11820	12210	7890			*7410	5930	(24.3)
-3.0 m	kg	*8080	*8080	*10910	10250	*7450	5380	*5360	3600			*4510	3210	6.55
(-9.8 ft)	lb	*17810	*17810	*24050	22600	*16420	11860	*11820	7940			*9940	7080	(21.5)
-4.5 m	kg			*8260	*8260	*5640	5550					*4650	*4650	5.11
(-14.8 ft)	lb			*18210	*18210	*12430	12240					*10250	*10250	(16.8)

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A L	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5097	2200	3250	600	-	-	-	-	-

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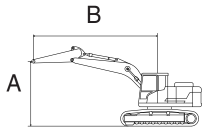

Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m	kg									*4850	*4850	4.43
(24.6 ft)	lb									*10690	*10690	(14.5)
6.0 m	kg			*4510	*4510					*3970	*3970	5.95
(19.7 ft)	lb			*9940	*9940					*8750	*8750	(19.5)
4.5 m	kg			*5110	*5110	*4560	4070			*3670	3300	6.82
(14.8 ft)	lb			*11270	*11270	*10050	8970			*8090	7280	(22.4)
3.0 m	kg			*6280	6010	*5010	3940			*3620	2930	7.28
(9.8 ft)	lb			*13850	13250	*11050	8690			*7980	6460	(23.9)
1.5 m	kg			*7440	5660	*5530	3790			*3750	2810	7.40
(4.9 ft)	lb			*16400	12480	*12190	8360			*8270	6190	(24.3)
0.0 m	kg			*8020	5480	5680	3690			*4090	2890	7.20
(0.0 ft)	lb			*17680	12080	12520	8140			*9020	6370	(23.6)
-1.5 m	kg	*8360	*8360	*7890	5460	5660	3670			*4780	3220	6.66
(-4.9 ft)	lb	*18430	*18430	*17390	12040	12480	8090			*10540	7100	(21.9)

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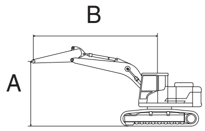
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A L	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5097	2600	3250	600	-	-	-	-	-

· : 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			*4310	*4310					*3570	*3570	5.00
(24.6 ft)	lb			*9500	*9500					*7870	*7870	(16.4)
6.0 m	kg					*4130	*4130			*3050	*3050	6.39
(19.7 ft)	lb					*9110	*9110			*6720	*6720	(21.0)
4.5 m	kg			*4680	*4680	*4250	4110			*2870	*2870	7.20
(14.8 ft)	lb			*10320	*10320	*9370	9060			*6330	*6330	(23.6)
3.0 m	kg			*5870	*5870	*4750	3960	*3660	2810	*2850	2720	7.63
(9.8 ft)	lb			*12940	*12940	*10470	8730	*8070	6190	*6280	6000	(25.0)
1.5 m	kg			*7130	5700	*5330	3790	4150	2750	*2970	2610	7.75
(4.9 ft)	lb			*15720	12570	*11750	8360	9150	6060	*6550	5750	(25.4)
0.0 m	kg			*7880	5470	5660	3670	*3840	2700	*3250	2670	7.56
(0.0 ft)	lb			*17370	12060	12480	8090	*8470	5950	*7170	5890	(24.8)
-1.5 m	kg	*8290	*8290	*7950	5410	5610	3620			*3800	2940	7.05
(-4.9 ft)	lb	*18280	*18280	*17530	11930	12370	7980			*8380	6480	(23.1)
-3.0 m	kg			*7200	5480							
(-9.8 ft)	lb			*15870	12080							

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

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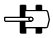
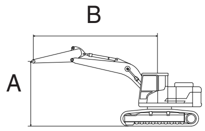
⚠ Failure to comply to the rated load can cause serious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2200	2900	600	-	Down	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m	kg									*3850	*3850	5.86
(19.7 ft)	lb									*8490	*8490	(19.2)
4.5 m	kg					*5320	*5320	*4750	4090	*3630	3390	6.74
(14.8 ft)	lb					*11730	*11730	*10470	9020	*8000	7470	(22.1)
3.0 m	kg					*6540	6030	*5200	3960	*3650	3010	7.20
(9.8 ft)	lb					*14420	13290	*11460	8730	*8050	6640	(23.6)
1.5 m	kg					*7690	5700	*5710	3820	*3850	2880	7.33
(4.9 ft)	lb					*16950	12570	*12590	8420	*8490	6350	(24.0)
0.0 m	kg					*8180	5530	*5980	3720	*4310	2950	7.13
(0.0 ft)	lb					*18030	12190	*13180	8200	*9500	6500	(23.4)
-1.5 m	kg			*9400	*9400	*7910	5500	*5770	3700	*5030	3290	6.58
(-4.9 ft)	lb			*20720	*20720	*17440	12130	*12720	8160	*11090	7250	(21.6)
-3.0 m	kg			*9400	*9400	*6720	5590			*4980	4170	5.58
(-9.8 ft)	lb			*20720	*20720	*14820	12320			*10980	9190	(18.3)

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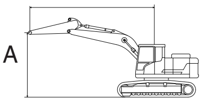
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2200	2900	600	-	Up	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m	kg									*3850	*3850	5.86
(19.7 ft)	lb									*8490	*8490	(19.2)
4.5 m	kg					*5320	*5320	*4750	4090	*3630	3390	6.74
(14.8 ft)	lb					*11730	*11730	*10470	9020	*8000	7470	(22.1)
3.0 m	kg					*6540	6030	*5200	3960	*3650	3010	7.20
(9.8 ft)	lb					*14420	13290	*11460	8730	*8050	6640	(23.6)
1.5 m	kg					*7690	5700	5470	3820	*3850	2880	7.33
(4.9 ft)	lb					*16950	12570	12060	8420	*8490	6350	(24.0)
0.0 m	kg					*8180	5530	5370	3720	4190	2950	7.13
(0.0 ft)	lb					*18030	12190	11840	8200	9240	6500	(23.4)
-1.5 m	kg			*9400	*9400	*7910	5500	5340	3700	4690	3290	6.58
(-4.9 ft)	lb			*20720	*20720	*17440	12130	11770	8160	10340	7250	(21.6)
-3.0 m	kg			*9400	*9400	*6720	5590			*4980	4170	5.58
(-9.8 ft)	lb			*20720	*20720	*14820	12320			*10980	9190	(18.3)

Note 1. Lifting capacity are based on ISO 10567.
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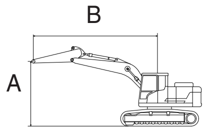
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2600	2900	600	-	Down	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m	kg											*3410	*3410	4.85
(24.6 ft)	lb											*7520	*7520	(15.9)
6.0 m	kg							*3840	*3840			*2970	*2970	6.27
(19.7 ft)	lb							*8470	*8470			*6550	*6550	(20.6)
4.5 m	kg					*4870	*4870	*4430	4120			*2850	*2850	7.10
(14.8 ft)	lb					*10740	*10740	*9770	9080			*6280	*6280	(23.3)
3.0 m	kg			*9370	*9370	*6120	6100	*4940	3980	*3110	2830	*2880	2810	7.54
(9.8 ft)	lb			*20660	*20660	*13490	13450	*10890	8770	*6860	6240	*6350	6190	(24.7)
1.5 m	kg					*7380	5740	*5520	3820	*4040	2770	*3060	2690	7.66
(4.9 ft)	lb					*16270	12650	*12170	8420	*8910	6110	*6750	5930	(25.1)
0.0 m	kg			*5290	*5290	*8070	5520	*5900	3700			*3420	2740	7.47
(0.0 ft)	lb			*11660	*11660	*17790	12170	*13010	8160			*7540	6040	(24.5)
-1.5 m	kg	*5090	*5090	*9190	*9190	*8010	5460	*5850	3660			*4130	3020	6.95
(-4.9 ft)	lb	*11220	*11220	*20260	*20260	*17660	12040	*12900	8070			*9110	6660	(22.8)
-3.0 m	kg	*9360	*9360	*10170	*10170	*7120	5510	*4910	3720			*4890	3710	6.01
(-9.8 ft)	lb	*20640	*20640	*22420	*22420	*15700	12150	*10820	8200			*10780	8180	(19.7)
-4.5 m	kg			*6860	*6860							*4560	*4560	4.39
(-14.8 ft)	lb			*15120	*15120							*10050	*10050	(14.4)

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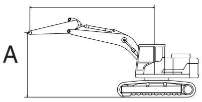
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2600	2900	600	-	Up	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m	kg											*3410	*3410	4.85
(24.6 ft)	lb											*7520	*7520	(15.9)
6.0 m	kg							*3840	*3840			*2970	*2970	6.27
(19.7 ft)	lb							*8470	*8470			*6550	*6550	(20.6)
4.5 m	kg					*4870	*4870	*4430	4120			*2850	*2850	7.10
(14.8 ft)	lb					*10740	*10740	*9770	9080			*6280	*6280	(23.3)
3.0 m	kg			*9370	*9370	*6120	6100	*4940	3980	*3110	2830	*2880	2810	7.54
(9.8 ft)	lb			*20660	*20660	*13490	13450	*10890	8770	*6860	6240	*6350	6190	(24.7)
1.5 m	kg					*7380	5740	5480	3820	3920	2770	*3060	2690	7.66
(4.9 ft)	lb					*16270	12650	12080	8420	8640	6110	*6750	5930	(25.1)
0.0 m	kg			*5290	*5290	*8070	5520	5350	3700			*3420	2740	7.47
(0.0 ft)	lb			*11660	*11660	*17790	12170	11790	8160			*7540	6040	(24.5)
-1.5 m	kg	*5090	*5090	*9190	*9190	*8010	5460	5300	3660			*4130	3020	6.95
(-4.9 ft)	lb	*11220	*11220	*20260	*20260	*17660	12040	11680	8070			*9110	6660	(22.8)
-3.0 m	kg	*9360	*9360	*10170	*10170	*7120	5510	*4910	3720			*4890	3710	6.01
(-9.8 ft)	lb	*20640	*20640	*22420	*22420	*15700	12150	*10820	8200			*10780	8180	(19.7)
-4.5 m	kg			*6860	*6860							*4560	*4560	4.39
(-14.8 ft)	lb			*15120	*15120							*10050	*10050	(14.4)

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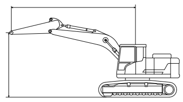
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	3100	2900	600	-	Down	-	-	-

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

B

A 

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 (24.6 ft)	kg											*2710	*2710	5.51
	lb											*5970	*5970	(18.1)
6.0 m (19.7 ft)	kg							*3700	*3700			*2430	*2430	6.79
	lb							*8160	*8160			*5360	*5360	(22.3)
4.5 m (14.8 ft)	kg							*4020	*4020	*2570	*2570	*2340	*2340	7.56
	lb							*8860	*8860	*5670	*5670	*5160	*5160	(24.8)
3.0 m (9.8 ft)	kg			*7930	*7930	*5540	*5540	*4580	4000	*3790	2830	*2380	*2380	7.97
	lb			*17480	*17480	*12210	*12210	*10100	8820	*8360	6240	*5250	*5250	(26.2)
1.5 m (4.9 ft)	kg			*6760	*6760	*6920	5780	*5230	3820	*4390	2750	*2530	2460	8.09
	lb			*14900	*14900	*15260	12740	*11530	8420	*9680	6060	*5580	5420	(26.5)
0.0 m (0.0 ft)	kg			*6160	*6160	*7830	5500	*5730	3670	*4580	2690	*2820	2490	7.91
	lb			*13580	*13580	*17260	12130	*12630	8090	*10100	5930	*6220	5490	(25.9)
-1.5 m (-4.9 ft)	kg	*4790	*4790	*8770	*8770	*8030	5390	*5860	3600			*3360	2700	7.42
	lb	*10560	*10560	*19330	*19330	*17700	11880	*12920	7940			*7410	5950	(24.3)
-3.0 m (-9.8 ft)	kg	*8080	*8080	*10910	10290	*7450	5400	*5360	3620			*4510	3230	6.55
	lb	*17810	*17810	*24050	22690	*16420	11900	*11820	7980			*9940	7120	(21.5)
-4.5 m (-14.8 ft)	kg			*8260	*8260	*5640	5570					*4650	*4650	5.11
	lb			*18210	*18210	*12430	12280					*10250	*10250	(16.8)

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
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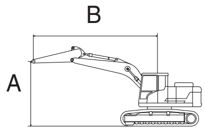

Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m	kg											*2710	*2710	5.51
(24.6 ft)	lb											*5970	*5970	(18.1)
6.0 m	kg							*3700	*3700			*2430	*2430	6.79
(19.7 ft)	lb							*8160	*8160			*5360	*5360	(22.3)
4.5 m	kg							*4020	*4020	*2570	*2570	*2340	*2340	7.56
(14.8 ft)	lb							*8860	*8860	*5670	*5670	*5160	*5160	(24.8)
3.0 m	kg			*7930	*7930	*5540	*5540	*4580	4000	*3790	2830	*2380	*2380	7.97
(9.8 ft)	lb			*17480	*17480	*12210	*12210	*10100	8820	*8360	6240	*5250	*5250	(26.2)
1.5 m	kg			*6760	*6760	*6920	5780	*5230	3820	3900	2750	*2530	2460	8.09
(4.9 ft)	lb			*14900	*14900	*15260	12740	*11530	8420	8600	6060	*5580	5420	(26.5)
0.0 m	kg			*6160	*6160	*7830	5500	5320	3670	3830	2690	*2820	2490	7.91
(0.0 ft)	lb			*13580	*13580	*17260	12130	11730	8090	8440	5930	*6220	5490	(25.9)
-1.5 m	kg	*4790	*4790	*8770	*8770	*8030	5390	5240	3600			*3360	2700	7.42
(-4.9 ft)	lb	*10560	*10560	*19330	*19330	*17700	11880	11550	7940			*7410	5950	(24.3)
-3.0 m	kg	*8080	*8080	*10910	10290	*7450	5400	5260	3620			*4510	3230	6.55
(-9.8 ft)	lb	*17810	*17810	*24050	22690	*16420	11900	11600	7980			*9940	7120	(21.5)
-4.5 m	kg			*8260	*8260	*5640	5570					*4650	*4650	5.11
(-14.8 ft)	lb			*18210	*18210	*12430	12280					*10250	*10250	(16.8)

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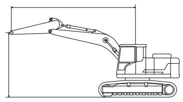
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2200	3250	600	-	Down	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m (19.7 ft)	kg									*3850	*3850	5.86
	lb									*8490	*8490	(19.2)
4.5 m (14.8 ft)	kg					*5320	*5320	*4750	4280	*3630	3560	6.74
	lb					*11730	*11730	*10470	9440	*8000	7850	(22.1)
3.0 m (9.8 ft)	kg					*6540	6310	*5200	4150	*3650	3160	7.20
	lb					*14420	13910	*11460	9150	*8050	6970	(23.6)
1.5 m (4.9 ft)	kg					*7690	5990	*5710	4010	*3850	3030	7.33
	lb					*16950	13210	*12590	8840	*8490	6680	(24.0)
0.0 m (0.0 ft)	kg					*8180	5810	*5980	3910	*4310	3110	7.13
	lb					*18030	12810	*13180	8620	*9500	6860	(23.4)
-1.5 m (-4.9 ft)	kg			*9400	*9400	*7910	5780	*5770	3890	*5030	3460	6.58
	lb			*20720	*20720	*17440	12740	*12720	8580	*11090	7630	(21.6)
-3.0 m (-9.8 ft)	kg			*9400	*9400	*6720	5870			*4980	4390	5.58
	lb			*20720	*20720	*14820	12940			*10980	9680	(18.3)

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.

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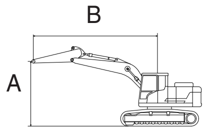
⚠ Failure to comply to the rated load can cause serious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2200	3250	600	-	Up	-	-	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		Capacity		Reach
												m (ft)
6.0 m	kg									*3850	*3850	5.86
(19.7 ft)	lb									*8490	*8490	(19.2)
4.5 m	kg					*5320	*5320	*4750	4280	*3630	3560	6.74
(14.8 ft)	lb					*11730	*11730	*10470	9440	*8000	7850	(22.1)
3.0 m	kg					*6540	6310	*5200	4150	*3650	3160	7.20
(9.8 ft)	lb					*14420	13910	*11460	9150	*8050	6970	(23.6)
1.5 m	kg					*7690	5990	*5710	4010	*3850	3030	7.33
(4.9 ft)	lb					*16950	13210	*12590	8840	*8490	6680	(24.0)
0.0 m	kg					*8180	5810	5610	3910	*4310	3110	7.13
(0.0 ft)	lb					*18030	12810	12370	8620	*9500	6860	(23.4)
-1.5 m	kg			*9400	*9400	*7910	5780	5590	3890	4910	3460	6.58
(-4.9 ft)	lb			*20720	*20720	*17440	12740	12320	8580	10820	7630	(21.6)
-3.0 m	kg			*9400	*9400	*6720	5870			*4980	4390	5.58
(-9.8 ft)	lb			*20720	*20720	*14820	12940			*10980	9680	(18.3)

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.

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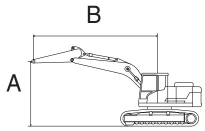
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2600	3250	600	-	Down	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m	kg											*3410	*3410	4.85
(24.6 ft)	lb											*7520	*7520	(15.9)
6.0 m	kg							*3840	*3840			*2970	*2970	6.27
(19.7 ft)	lb							*8470	*8470			*6550	*6550	(20.6)
4.5 m	kg					*4870	*4870	*4430	4310			*2850	*2850	7.10
(14.8 ft)	lb					*10740	*10740	*9770	9500			*6280	*6280	(23.3)
3.0 m	kg			*9370	*9370	*6120	*6120	*4940	4170	*3110	2980	*2880	*2880	7.54
(9.8 ft)	lb			*20660	*20660	*13490	*13490	*10890	9190	*6860	6570	*6350	*6350	(24.7)
1.5 m	kg					*7380	6020	*5520	4010	*4040	2920	*3060	2830	7.66
(4.9 ft)	lb					*16270	13270	*12170	8840	*8910	6440	*6750	6240	(25.1)
0.0 m	kg			*5290	*5290	*8070	5800	*5900	3900			*3420	2890	7.47
(0.0 ft)	lb			*11660	*11660	*17790	12790	*13010	8600			*7540	6370	(24.5)
-1.5 m	kg	*5090	*5090	*9190	*9190	*8010	5740	*5850	3850			*4130	3180	6.95
(-4.9 ft)	lb	*11220	*11220	*20260	*20260	*17660	12650	*12900	8490			*9110	7010	(22.8)
-3.0 m	kg	*9360	*9360	*10170	*10170	*7120	5790	*4910	3920			*4890	3900	6.01
(-9.8 ft)	lb	*20640	*20640	*22420	*22420	*15700	12760	*10820	8640			*10780	8600	(19.7)
-4.5 m	kg			*6860	*6860							*4560	*4560	4.39
(-14.8 ft)	lb			*15120	*15120							*10050	*10050	(14.4)

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

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	2600	3250	600	-	Up	-	-	-

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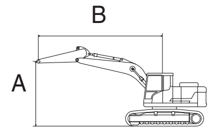

Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m	kg											*3410	*3410	4.85
(24.6 ft)	lb											*7520	*7520	(15.9)
6.0 m	kg							*3840	*3840			*2970	*2970	6.27
(19.7 ft)	lb							*8470	*8470			*6550	*6550	(20.6)
4.5 m	kg					*4870	*4870	*4430	4310			*2850	*2850	7.10
(14.8 ft)	lb					*10740	*10740	*9770	9500			*6280	*6280	(23.3)
3.0 m	kg			*9370	*9370	*6120	*6120	*4940	4170	*3110	2980	*2880	*2880	7.54
(9.8 ft)	lb			*20660	*20660	*13490	*13490	*10890	9190	*6860	6570	*6350	*6350	(24.7)
1.5 m	kg					*7380	6020	*5520	4010	*4040	2920	*3060	2830	7.66
(4.9 ft)	lb					*16270	13270	*12170	8840	*8910	6440	*6750	6240	(25.1)
0.0 m	kg			*5290	*5290	*8070	5800	5590	3900			*3420	2890	7.47
(0.0 ft)	lb			*11660	*11660	*17790	12790	12320	8600			*7540	6370	(24.5)
-1.5 m	kg	*5090	*5090	*9190	*9190	*8010	5740	5540	3850			*4130	3180	6.95
(-4.9 ft)	lb	*11220	*11220	*20260	*20260	*17660	12650	12210	8490			*9110	7010	(22.8)
-3.0 m	kg	*9360	*9360	*10170	*10170	*7120	5790	*4910	3920			*4890	3900	6.01
(-9.8 ft)	lb	*20640	*20640	*22420	*22420	*15700	12760	*10820	8640			*10780	8600	(19.7)
-4.5 m	kg			*6860	*6860							*4560	*4560	4.39
(-14.8 ft)	lb			*15120	*15120							*10050	*10050	(14.4)

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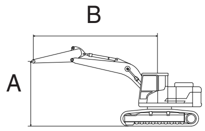
⚠ Failure to comply to the rated load can cause serious injury, death, or property damage. Make adjustments to the rated load as necessary for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	3100	3250	600	-	Down	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m	kg											*2710	*2710	5.51
(24.6 ft)	lb											*5970	*5970	(18.1)
6.0 m	kg							*3700	*3700			*2430	*2430	6.79
(19.7 ft)	lb							*8160	*8160			*5360	*5360	(22.3)
4.5 m	kg							*4020	*4020	*2570	*2570	*2340	*2340	7.56
(14.8 ft)	lb							*8860	*8860	*5670	*5670	*5160	*5160	(24.8)
3.0 m	kg			*7930	*7930	*5540	*5540	*4580	4190	*3790	2980	*2380	*2380	7.97
(9.8 ft)	lb			*17480	*17480	*12210	*12210	*10100	9240	*8360	6570	*5250	*5250	(26.2)
1.5 m	kg			*6760	*6760	*6920	6060	*5230	4010	*4390	2900	*2530	*2530	8.09
(4.9 ft)	lb			*14900	*14900	*15260	13360	*11530	8840	*9680	6390	*5580	*5580	(26.5)
0.0 m	kg			*6160	*6160	*7830	5780	*5730	3870	*4580	2830	*2820	2630	7.91
(0.0 ft)	lb			*13580	*13580	*17260	12740	*12630	8530	*10100	6240	*6220	5800	(25.9)
-1.5 m	kg	*4790	*4790	*8770	*8770	*8030	5670	*5860	3790			*3360	2850	7.42
(-4.9 ft)	lb	*10560	*10560	*19330	*19330	*17700	12500	*12920	8360			*7410	6280	(24.3)
-3.0 m	kg	*8080	*8080	*10910	10810	*7450	5680	*5360	3810			*4510	3400	6.55
(-9.8 ft)	lb	*17810	*17810	*24050	23830	*16420	12520	*11820	8400			*9940	7500	(21.5)
-4.5 m	kg			*8260	*8260	*5640	*5640					*4650	*4650	5.11
(-14.8 ft)	lb			*18210	*18210	*12430	*12430					*10250	*10250	(16.8)

Note 1. Lifting capacity are based on ISO 10567.

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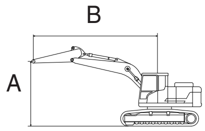
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A LD	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5100	3100	3250	600	-	Up	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m (24.6 ft)	kg											*2710	*2710	5.51
	lb											*5970	*5970	(18.1)
6.0 m (19.7 ft)	kg							*3700	*3700			*2430	*2430	6.79
	lb							*8160	*8160			*5360	*5360	(22.3)
4.5 m (14.8 ft)	kg							*4020	*4020	*2570	*2570	*2340	*2340	7.56
	lb							*8860	*8860	*5670	*5670	*5160	*5160	(24.8)
3.0 m (9.8 ft)	kg			*7930	*7930	*5540	*5540	*4580	4190	*3790	2980	*2380	*2380	7.97
	lb			*17480	*17480	*12210	*12210	*10100	9240	*8360	6570	*5250	*5250	(26.2)
1.5 m (4.9 ft)	kg			*6760	*6760	*6920	6060	*5230	4010	4080	2900	*2530	*2530	8.09
	lb			*14900	*14900	*15260	13360	*11530	8840	8990	6390	*5580	*5580	(26.5)
0.0 m (0.0 ft)	kg			*6160	*6160	*7830	5780	5570	3870	4010	2830	*2820	2630	7.91
	lb			*13580	*13580	*17260	12740	12280	8530	8840	6240	*6220	5800	(25.9)
-1.5 m (-4.9 ft)	kg	*4790	*4790	*8770	*8770	*8030	5670	5480	3790			*3360	2850	7.42
	lb	*10560	*10560	*19330	*19330	*17700	12500	12080	8360			*7410	6280	(24.3)
-3.0 m (-9.8 ft)	kg	*8080	*8080	*10910	10810	*7450	5680	*5360	3810			*4510	3400	6.55
	lb	*17810	*17810	*24050	23830	*16420	12520	*11820	8400			*9940	7500	(21.5)
-4.5 m (-14.8 ft)	kg			*8260	*8260	*5640	*5640					*4650	*4650	5.11
	lb			*18210	*18210	*12430	*12430					*10250	*10250	(16.8)

Note 1. Lifting capacity are based on ISO 10567.
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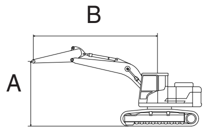
⚠ Failure to comply to the rated load can cause serious injury, death, or property damage. Make adjustments to the rated load as necessary for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A LD	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5097	2200	3250	600	-	Down	-	-	-

· : 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)		At max. reach Capacity		Reach
												m (ft)
7.5 m	kg									*4850	*4850	4.43
(24.6 ft)	lb									*10690	*10690	(14.5)
6.0 m	kg			*4510	*4510					*3970	*3970	5.95
(19.7 ft)	lb			*9940	*9940					*8750	*8750	(19.5)
4.5 m	kg			*5110	*5110	*4560	4280			*3670	3470	6.82
(14.8 ft)	lb			*11270	*11270	*10050	9440			*8090	7650	(22.4)
3.0 m	kg			*6280	*6280	*5010	4150			*3620	3100	7.28
(9.8 ft)	lb			*13850	*13850	*11050	9150			*7980	6830	(23.9)
1.5 m	kg			*7440	5960	*5530	4000			*3750	2970	7.40
(4.9 ft)	lb			*16400	13140	*12190	8820			*8270	6550	(24.3)
0.0 m	kg			*8020	5790	*5870	3890			*4090	3050	7.20
(0.0 ft)	lb			*17680	12760	*12940	8580			*9020	6720	(23.6)
-1.5 m	kg	*8360	*8360	*7890	5760	*5760	3880			*4780	3400	6.66
(-4.9 ft)	lb	*18430	*18430	*17390	12700	*12700	8550			*10540	7500	(21.9)

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3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates load limited by hydraulic capacity.

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

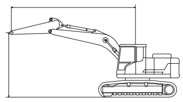
⚠ Failure to comply to the rated load can cause serious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A LD	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5097	2200	3250	600	-	Up	-	-	-

· : 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									*4850	*4850	4.43
(24.6 ft)	lb									*10690	*10690	(14.5)
6.0 m	kg			*4510	*4510					*3970	*3970	5.95
(19.7 ft)	lb			*9940	*9940					*8750	*8750	(19.5)
4.5 m	kg			*5110	*5110	*4560	4280			*3670	3470	6.82
(14.8 ft)	lb			*11270	*11270	*10050	9440			*8090	7650	(22.4)
3.0 m	kg			*6280	*6280	*5010	4150			*3620	3100	7.28
(9.8 ft)	lb			*13850	*13850	*11050	9150			*7980	6830	(23.9)
1.5 m	kg			*7440	5960	*5530	4000			*3750	2970	7.40
(4.9 ft)	lb			*16400	13140	*12190	8820			*8270	6550	(24.3)
0.0 m	kg			*8020	5790	5620	3890			*4090	3050	7.20
(0.0 ft)	lb			*17680	12760	12390	8580			*9020	6720	(23.6)
-1.5 m	kg	*8360	*8360	*7890	5760	5610	3880			*4780	3400	6.66
(-4.9 ft)	lb	*18430	*18430	*17390	12700	12370	8550			*10540	7500	(21.9)

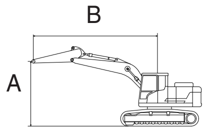
Note 1. Lifting capacity are based on ISO 10567.
2. Lifting capacity of the HX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates load limited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

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

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

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A LD	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5097	2600	3250	600	-	Down	-	-	-

· : 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			*4310	*4310					*3570	*3570	5.00
(24.6 ft)	lb			*9500	*9500					*7870	*7870	(16.4)
6.0 m	kg					*4130	*4130			*3050	*3050	6.39
(19.7 ft)	lb					*9110	*9110			*6720	*6720	(21.0)
4.5 m	kg			*4680	*4680	*4250	*4250			*2870	*2870	7.20
(14.8 ft)	lb			*10320	*10320	*9370	*9370			*6330	*6330	(23.6)
3.0 m	kg			*5870	*5870	*4750	4170	*3660	2970	*2850	*2850	7.63
(9.8 ft)	lb			*12940	*12940	*10470	9190	*8070	6550	*6280	*6280	(25.0)
1.5 m	kg			*7130	6000	*5330	4000	*4480	2900	*2970	2770	7.75
(4.9 ft)	lb			*15720	13230	*11750	8820	*9880	6390	*6550	6110	(25.4)
0.0 m	kg			*7880	5780	*5760	3880	*3840	2860	*3250	2830	7.56
(0.0 ft)	lb			*17370	12740	*12700	8550	*8470	6310	*7170	6240	(24.8)
-1.5 m	kg	*8290	*8290	*7950	5710	*5810	3830			*3800	3110	7.05
(-4.9 ft)	lb	*18280	*18280	*17530	12590	*12810	8440			*8380	6860	(23.1)
-3.0 m	kg			*7200	5780							
(-9.8 ft)	lb			*15870	12740							

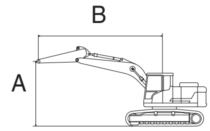
Note 1. Lifting capacity are based on ISO 10567.
2. Lifting capacity of the HX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates load limited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

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

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

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX180A LD	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5097	2600	3250	600	-	Up	-	-	-

· : 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			*4310	*4310					*3570	*3570	5.00
(24.6 ft)	lb			*9500	*9500					*7870	*7870	(16.4)
6.0 m	kg					*4130	*4130			*3050	*3050	6.39
(19.7 ft)	lb					*9110	*9110			*6720	*6720	(21.0)
4.5 m	kg			*4680	*4680	*4250	*4250			*2870	*2870	7.20
(14.8 ft)	lb			*10320	*10320	*9370	*9370			*6330	*6330	(23.6)
3.0 m	kg			*5870	*5870	*4750	4170	*3660	2970	*2850	*2850	7.63
(9.8 ft)	lb			*12940	*12940	*10470	9190	*8070	6550	*6280	*6280	(25.0)
1.5 m	kg			*7130	6000	*5330	4000	4110	2900	*2970	2770	7.75
(4.9 ft)	lb			*15720	13230	*11750	8820	9060	6390	*6550	6110	(25.4)
0.0 m	kg			*7880	5780	5610	3880	*3840	2860	*3250	2830	7.56
(0.0 ft)	lb			*17370	12740	12370	8550	*8470	6310	*7170	6240	(24.8)
-1.5 m	kg	*8290	*8290	*7950	5710	5560	3830			*3800	3110	7.05
(-4.9 ft)	lb	*18280	*18280	*17530	12590	12260	8440			*8380	6860	(23.1)
-3.0 m	kg			*7200	5780							
(-9.8 ft)	lb			*15870	12740							

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

6. BUCKET SELECTION GUIDE

1) HX160A L/LD (1/2)

General bucket

Type	Counterweight					2600 kg			3250 kg	
	Capacity		Width	Weight	Tooth	MONO			2-PIECE	
	SAE Heaped	CECE heaped	Without side cutter			5.1 m (16' 9") Boom				
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.2 m (7' 3") Arm	2.6 m (8' 6") Arm	3.1 m (10' 2") Arm	2.2 m (7' 3") Arm	2.6 m (8' 6") Arm
General bucket	0.73 (0.95)	0.67 (0.88)	914 (36.0")	617 (1360)	5	●	◐	◐	●	●
	0.85 (1.11)	0.76 (0.99)	1067 (42.0")	669 (1470)	5	◐	■	X	◐	◐
	0.88 (1.15)	0.77 (1.01)	1200 (47.2")	662 (1460)	6	◐	■	X	◐	◐
	0.96 (1.26)	0.84 (1.10)	1350 (53.1")	726 (1600)	6	X	X	X	X	X

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

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

HX160A L/LD (2/2)

General bucket

Type	Counterweight					3250 kg				
	Capacity		Width	Weight	Tooth	MONO			2-PIECE	
	SAE Heaped	CECE heaped	Without side cutter			5.1 m (16' 9") Boom				
	m³ (yd³)	m³ (yd³)	mm (in)	kg (lb)	EA	2.2 m (7' 3") Arm	2.6 m (8' 6") Arm	3.1 m (10' 2") Arm	2.2 m (7' 3") Arm	2.6 m (8' 6") Arm
General bucket	0.73 (0.95)	0.67 (0.88)	914 (36.0")	617 (1360)	5	●	●	◐	●	●
	0.85 (1.11)	0.76 (0.99)	1067 (42.0")	669 (1470)	5	◐	◐	X	◐	◐
	0.88 (1.15)	0.77 (1.01)	1200 (47.2")	662 (1460)	5	◐	◐	X	◐	◐
	0.96 (1.26)	0.84 (1.10)	1350 (53.1")	726 (1600)	6	■	■	X	■	■

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◐	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 with your local HD Hyundai Construction Equipment dealer for information on selecting the correct boom−arm−bucket combination.

2) HX180A L/LD (1/2)

General bucket

Type	Counterweight					2900 kg			3250 kg	
	Capacity		Width	Weight	Tooth	MONO			2-PIECE	
	SAE Heaped	CECE heaped	Without side cutter			5.1 m (16' 9") Boom				
	m³ (yd³)	m³ (yd³)	mm (in)	kg (lb)	EA	2.2 m (7' 3") Arm	2.6 m (8' 6") Arm	3.1 m (10' 2") Arm	2.2 m (7' 3") Arm	2.6 m (8' 6") Arm
General bucket	0.73 (0.95)	0.67 (0.88)	914 (36.0")	617 (1360)	5	●	●	●	●	●
	0.85 (1.11)	0.76 (0.99)	1067 (42.0")	669 (1470)	5	●	●	◐	●	●
	0.88 (1.15)	0.77 (1.01)	1200 (47.2")	662 (1460)	5	●	●	◐	●	●
	0.96 (1.26)	0.84 (1.10)	1350 (53.1")	726 (1600)	6	◐	◐	■	●	◐

●	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 with your local HD Hyundai Construction Equipment dealer for information on selecting the correct boom–arm–bucket combination.

HX180A L/LD (2/2)

General bucket

Type	Counterweight					3250 kg				
	Capacity		Width	Weight	Tooth	MONO			2-PIECE	
	SAE Heaped	CECE heaped	Without side cutter			5.1 m (16' 9") Boom				
	m³ (yd³)	m³ (yd³)	mm (in)	kg (lb)	EA	2.2 m (7' 3") Arm	2.6 m (8' 6") Arm	3.1 m (10' 2") Arm	2.2 m (7' 3") Arm	2.6 m (8' 6") Arm
General bucket	0.73 (0.95)	0.67 (0.88)	914 (36.0")	617 (1360)	5	●	●	●	●	●
	0.85 (1.11)	0.76 (0.99)	1067 (42.0")	669 (1470)	5	●	●	◐	●	●
	0.88 (1.15)	0.77 (1.01)	1200 (47.2")	662 (1460)	5	●	●	◐	●	●
	0.96 (1.26)	0.84 (1.10)	1350 (53.1")	726 (1600)	6	●	◐	◐	●	◐

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▲	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 with your local HD Hyundai Construction Equipment dealer for information on selecting the correct boom–arm–bucket combination.

7. UNDERCARRIAGE

1) TYPES OF SHOES

Model	Description	Unit		Triple grouser							
	width	mm	(in)	500	(20")	600	(24")	700	(28")	800	(32)
HX160A L	Operating weight	kg	(lb)	17455	38480	17965	39010	17945	39560	-	-
	Ground pressure	kgf/cm^2	(psi)	0.51	7.24	0.51	7.24	0.37	5.32	-	-
	Overall width	mm		2490	(8' 2")	2590	(8' 6")	2690	(8' 10")	-	-
	Link quantity	EA		49		49		49		-	
HX160A LD	Operating weight	kg	(lb)	18540	40870	18775	41390	19050	42000	-	-
	Ground pressure	kgf/cm^2	(psi)	0.54	7.69	0.46	6.49	0.40	5.64	-	-
	Overall width	mm		2490	(8' 2")	2590	(8' 6")	2690	(8' 10")	-	-
	Link quantity	EA		49		49		49		-	
HX180A L	Operating weight	kg	(lb)	18140	39990	18400	40570	18665	41150	18920	41710
	Ground pressure	kgf/cm^2	(psi)	0.50	7.13	0.42	6.03	0.37	5.24	0.33	4.65
	Overall width	mm		2750	(9' 0")	2850	(9' 4")	2950	(9' 8")	3050	(10' 0")
	Link quantity	EA		51		51		51		51	
HX180A LD	Operating weight	kg	(lb)	19235	42410	19505	43000	19780	43610	19985	44060
	Ground pressure	kgf/cm^2	(psi)	0.53	7.56	0.45	6.39	0.39	5.55	0.35	4.91
	Overall width	mm		2750	(9' 0")	2850	(9' 4")	2950	(9' 8")	3050	(10' 0")
	Link quantity	EA		51		51		51		51	

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

Model	Track shoe	Specification	Category
HX160A L	500 mm triple grouser	Standard	A
	600 mm triple grouser	Option	B
	700 mm triple grouser	Option	C
HX180A L	500 mm triple grouser	Standard	A
	600 mm triple grouser	Option	B
	700 mm triple grouser	Option	C
	800 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 / B4.5
Type	4-cycle, turbocharged, charge air cooled, electronic controlled diesel engine
Cooling method	Water cooled
Number of cylinders and arrangement	4 cylinders, in-line
Firing order	1-3-4-2
Combustion chamber type	Direct injection type
Cylinder bore × stroke	107 × 124 mm (4.21" × 4.88")
Displacement	4.5 ℓ (275 cu in)
Compression ratio	17.2 : 1
Gross power	155 Hp (115 kW) at 2200 rpm
Net power	152 Hp (113 kW) at 2200 rpm
Max. power	155 Hp (115 kW) at 2200 rpm
Peak Torque	712 N·m (525 lbf·ft) at 1200 rpm
Engine oil quantity	11 ℓ (2.9 U.S. gal)
Wet weight	383 kg (844 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 × 80 cc/rev
Maximum pressure	350 kgf/cm^2 (4980 psi)
Maximum pressure (power boost)	380 kgf/cm^2 (5400 psi)
Rated oil flow	2 × 160 ℓ/min (42.3 U.S. gpm / 35.2 U.K. gpm)
Rated speed	2000 rpm

3) GEAR PUMP

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	15 cc/rev
Maximum pressure	40 kgf/cm^2 (570 psi)
Rated oil flow	29 ℓ/min (7.7 U.S. gpm/6.4 U.K. gpm)

4) MAIN CONTROL VALVE

Item		Specification
Type		11 spools
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		Fixed displacement axial piston motor
Capacity		142.8 cc/rev
Relief pressure		285 kgf/cm^2 (4060 psi)
Braking system		Automatic, spring applied hydraulic released
Braking torque		1183 kgf · m (8557 lbf · ft) over
Brake release pressure	Cracking	22.3 kgf/cm^2 (317 psi)
	Full stroke	36.6 kgf/cm^2 (521 psi)
Reduction gear type		2 - stage planetary

6) TRAVEL MOTOR

Item	Specification
Type	Variable displacement axial piston motor
Capacity	147.1/83.6 cc/rev
Relief pressure	350 kgf/cm^2 (4980 psi)
Braking system	Automatic, spring applied hydraulic released
Braking torque	2868 kgf·m (20708 lbf·ft)
Brake release pressure	11.1~14.9 kgf/cm^2 (158~212 psi)
Reduction gear type	2-stage planetary

7) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Stroke	Ø115 × 1090 mm
	Cushion	Extend only
Arm cylinder	Bore dia × Stroke	Ø120 × 1355 mm
	Cushion	Extend and retract
Arm cylinder (2-piece boom)	Bore dia × Stroke	Ø160×650 mm
	Cushion	Extend and retract
Adjust cylinder (2-piece boom)	Bore dia × Stroke	Ø110×995 mm
	Cushion	Extend only
Bucket cylinder	Bore dia × Stroke	Ø110 × 995 mm
	Cushion	Extend only
Bucket cylinder (long reach)	Bore dia × Stroke	Ø110 × 320 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	11 (2.9)	★SAE 0W-40 SAE 5W-40 SAE 15W-40
DEF/ AdBlue® tank	Mixture of urea and deionized water	35 (9.2)	ISO 22241, High-purity urea + deionized water (32.5:67.5)
Swing drive	Gear oil	6.2 (1.6)	★SAE 75W-90
Final drive	Gear oil	6.0x2 (1.6x2)	SAE 80W-90
Hydraulic tank	Hydraulic oil	Tank 125 (33.0) System 225 (67.4)	★ISO VG 15 ISO VG 32 ISO VG 46, HBHO VG 46★3 ISO VG 68
Fuel tank	Diesel fuel★1	290 (76.6)	★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	23 (6.1)	Ethylene glycol base permanent type (50 : 50) ★Ethylene glycol base permanent type (60 : 40)

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

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

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

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

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

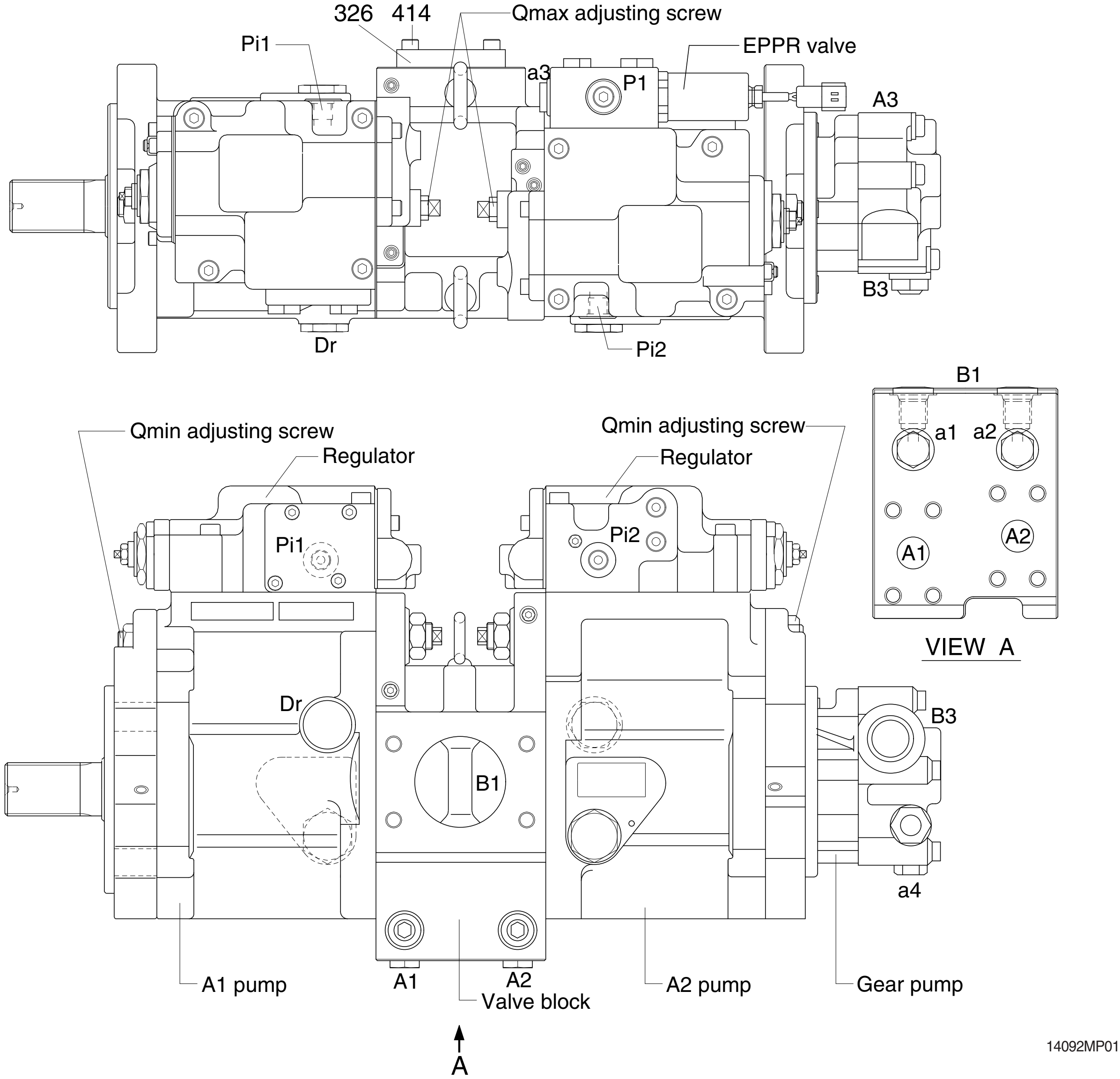
※ For HD Hyundai Construction Equipment genuine lubricating oils and grease for use in regions with extremely low temperatures, please contact your local HD Hyundai Construction Equipment dealer.

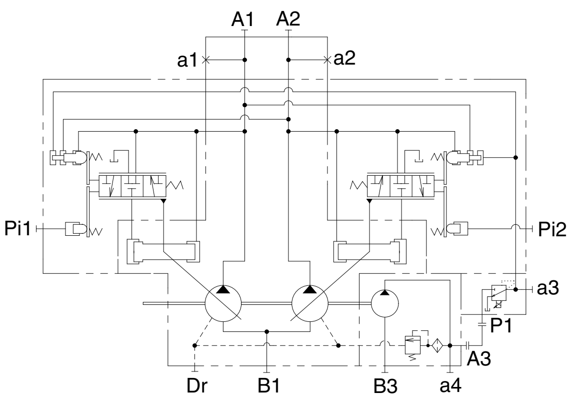
SECTION 2 STRUCTURE AND FUNCTION

GROUP 1 PUMP DEVICE

1. STRUCTURE

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



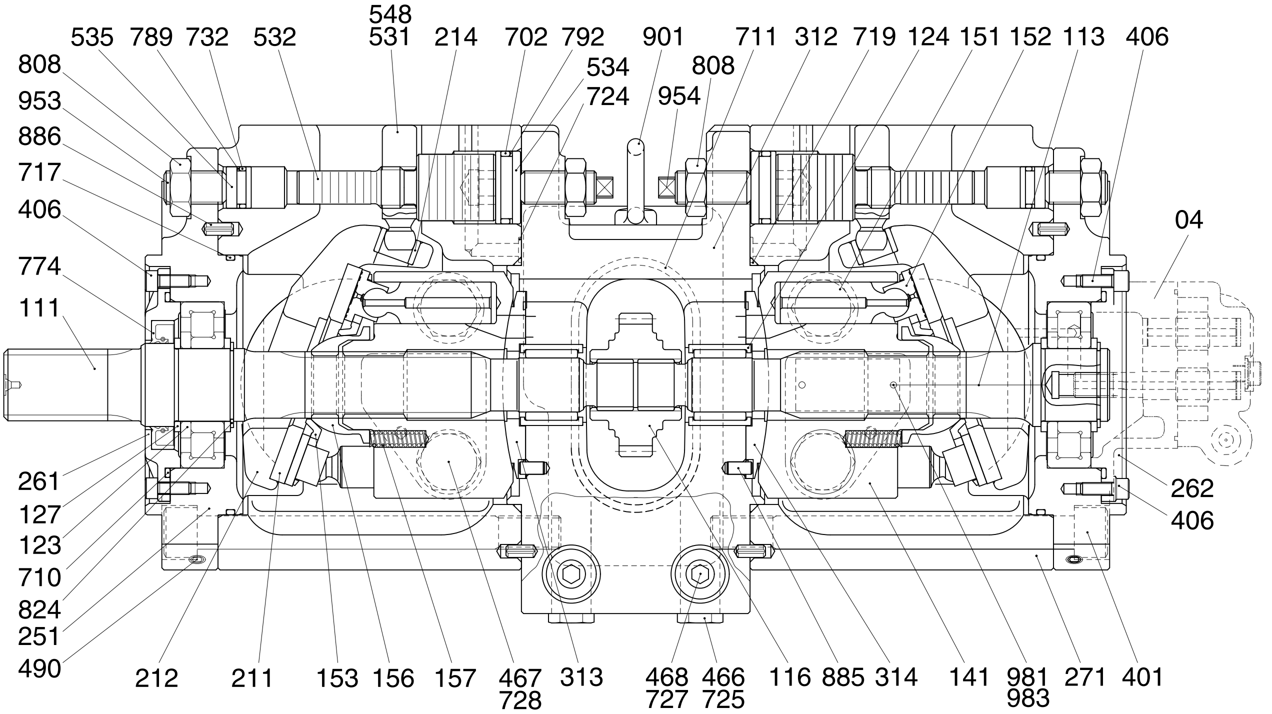


Hydraulic circuit

Port	Port name	Port size
A1, A2	Delivery port	SAE6000 psi 3/4"
B1	Suction port	SAE2500 psi 2 1/2"
Dr	Drain port	PF 1/2 - 19
Pi1, Pi2	Pilot port	PF 1/4 - 15
P1	EPPR port	PF 1/4 - 15
a1, a2, a3	Gauge port	PF 1/4 - 15
a4	Gauge port	PF 1/4-14
A3	Gear pump delivery port	PF 1/2 - 19
B3	Gear pump suction port	PF 3/4 - 20.5

1) MAIN PUMP (1/2)

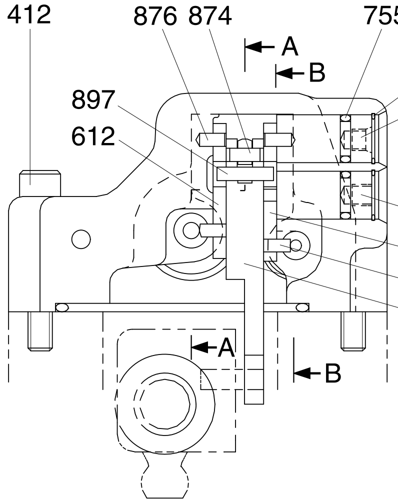
The main pump consists of two piston pumps (front & rear) and valve block.

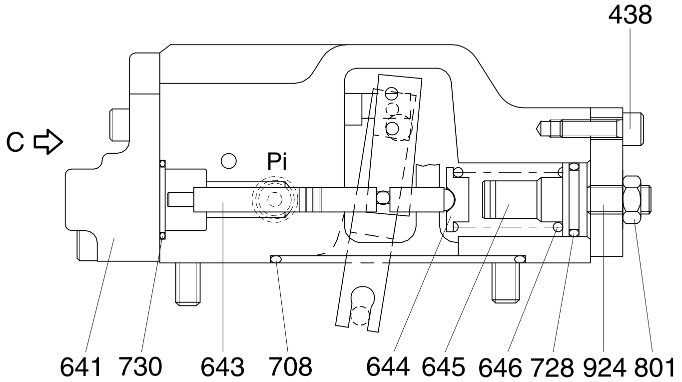


14092MP02

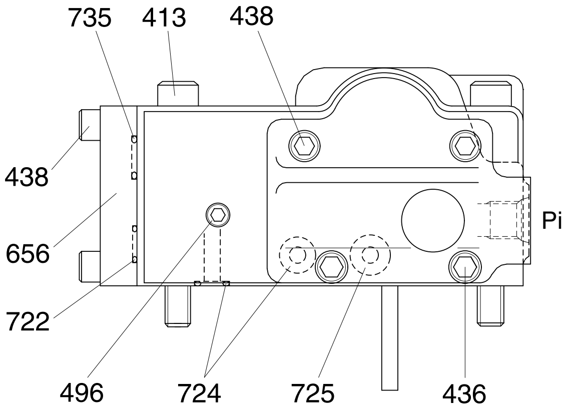
04	Gear pump	312	Valve block	717	O-ring
111	Drive shaft (F)	313	Valve plate (R)	719	O-ring
113	Drive shaft (R)	314	Valve plate (L)	724	O-ring
116	1st Gear	326	Cover	725	O-ring
123	Roller bearing	401	Hexagon socket bolt	727	O-ring
124	Needle bearing	406	Hexagon socket bolt	728	O-ring
127	Bearing spacer	414	Hexagon socket bolt	732	O-ring
141	Cylinder block	466	Plug	774	Oil seal
151	Piston	467	plug	789	Back up ring
152	Shoe	468	Plug	792	Back up ring
153	Set plate	490	Plug	808	Hexagon head nut
156	Bushing	531	Tilting pin	824	Snap ring
157	Cylinder spring	532	Servo piston	885	Pin
211	Shoe plate	534	Stopper (L)	886	Spring pin
212	Swash plate	535	Stopper (S)	901	Eye bolt
214	Bushing	548	Pin	953	Set screw
251	Support	702	O-ring	954	Set screw
261	Seal cover (F)	710	O-ring	981	Plate
271	Pump casing	711	O-ring	983	Pin

2) REGULATOR (1/2)

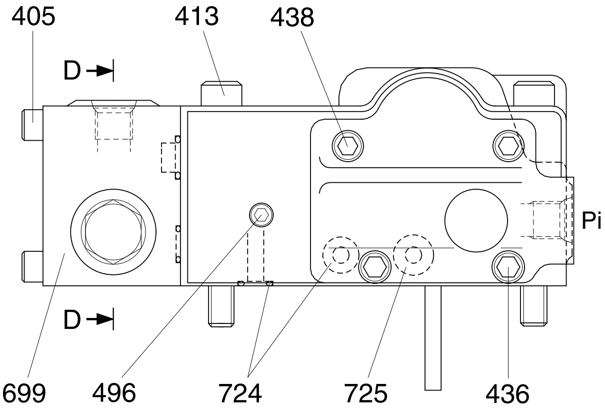




SECTION B-B

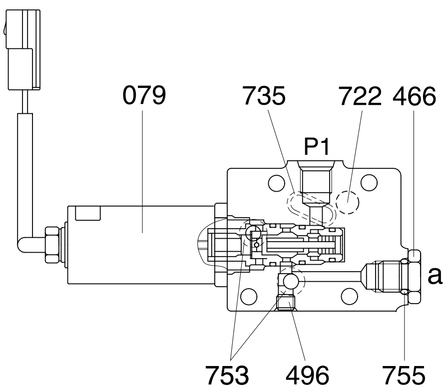


VIEW C (FRONT)

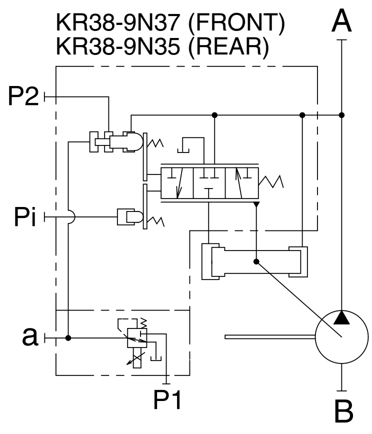


VIEW C (REAR)

16092MP04

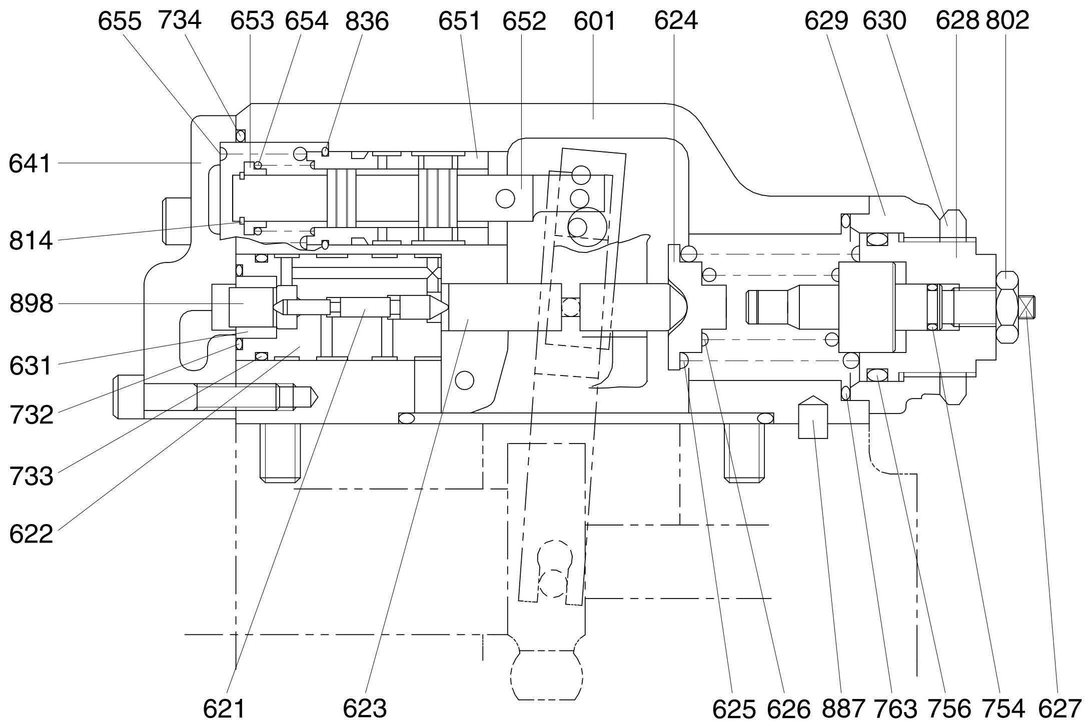


SECTION D-D(REAR)



Port	Port name	Port size
A	Delivery port	SAE6000 psi 3/4"
B	Suction port	SAE2500 psi 2 1/2"
Pi	Pilot port	PF 1/4-15

REGULATOR (2/2)

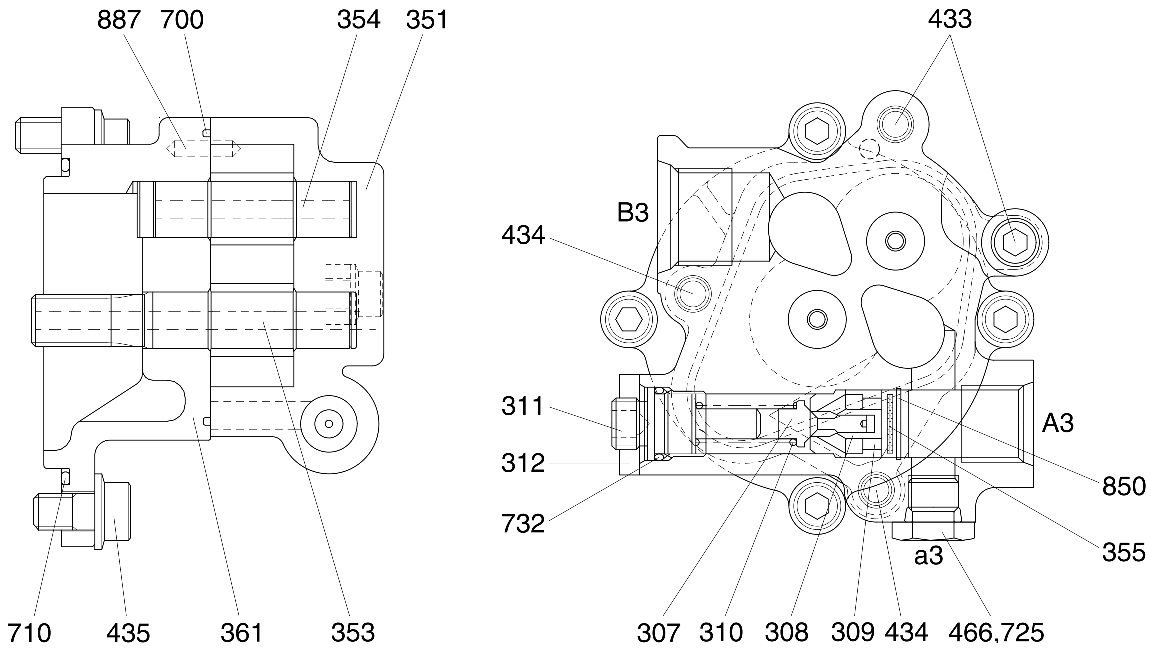


SECTION A-A

14W92MP05

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

3) GEAR PUMP



14092MP06

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

2. FUNCTION

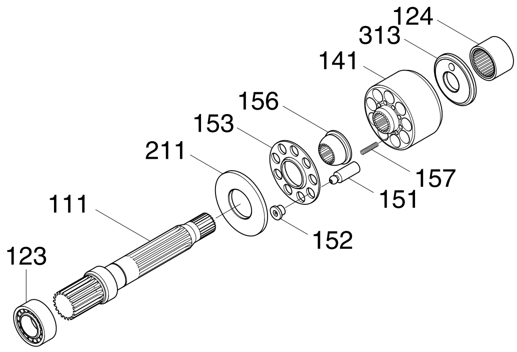
1) MAIN PUMP

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

(1) Rotary group

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

The shoe is caulked to the piston to from a spherical coupling. It has a pocket to relieve thrust force generated by loading pressure and the take hydraulic balance so that it slides lightly over the shoe plate (211). The sub group composed by a piston and a shoe is pressed against the shoe plate by the action of the cylinder spring via a retainer and a spherical bush. Similarly, the cylinder block is pressed against valve plate (313) by the action of the cylinder spring.



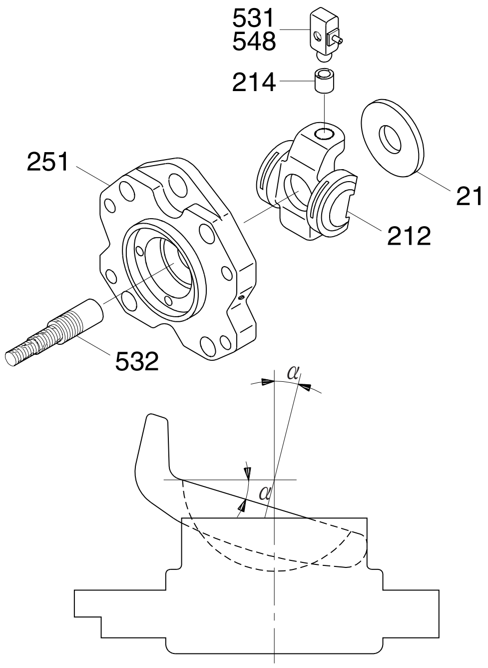
21092MP06

(2) Swash plate group

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

The swash plate is a cylindrical part formed on the opposite side of the sliding surface of the shoe and is supported by the swash support.

If the servo piston moves to the right and left as hydraulic force controlled by the regulator is admitted to hydraulic chamber located on both sides of the servo piston, the swash plate slides over the swash plate support via the spherical part of the tilting pin to change the tilting angle (α)



2507A2MP14

(3) Valve block group

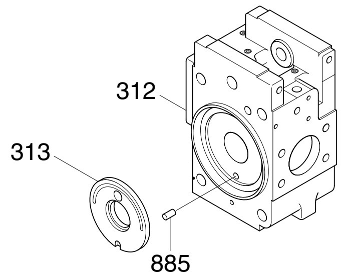
The valve block group consists of valve block (312), valve plate (313) and valve plate pin(885).

The valve plate having two melon-shaped ports is fixed to the valve block and feeds and collects oil to and from the cylinder block.

The oil changed over by the valve plate is connected to an external pipeline by way of the valve block.

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

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



21092MP07

2) REGULATOR

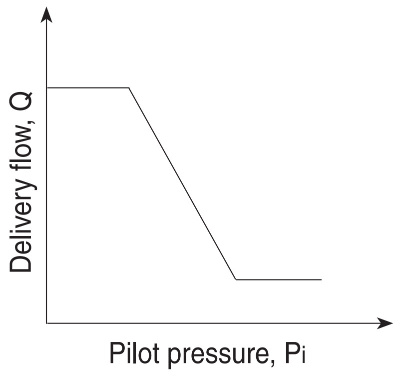
Regulator consists of the negative flow control, total horse power control and power shift control function.

(1) Negative flow control

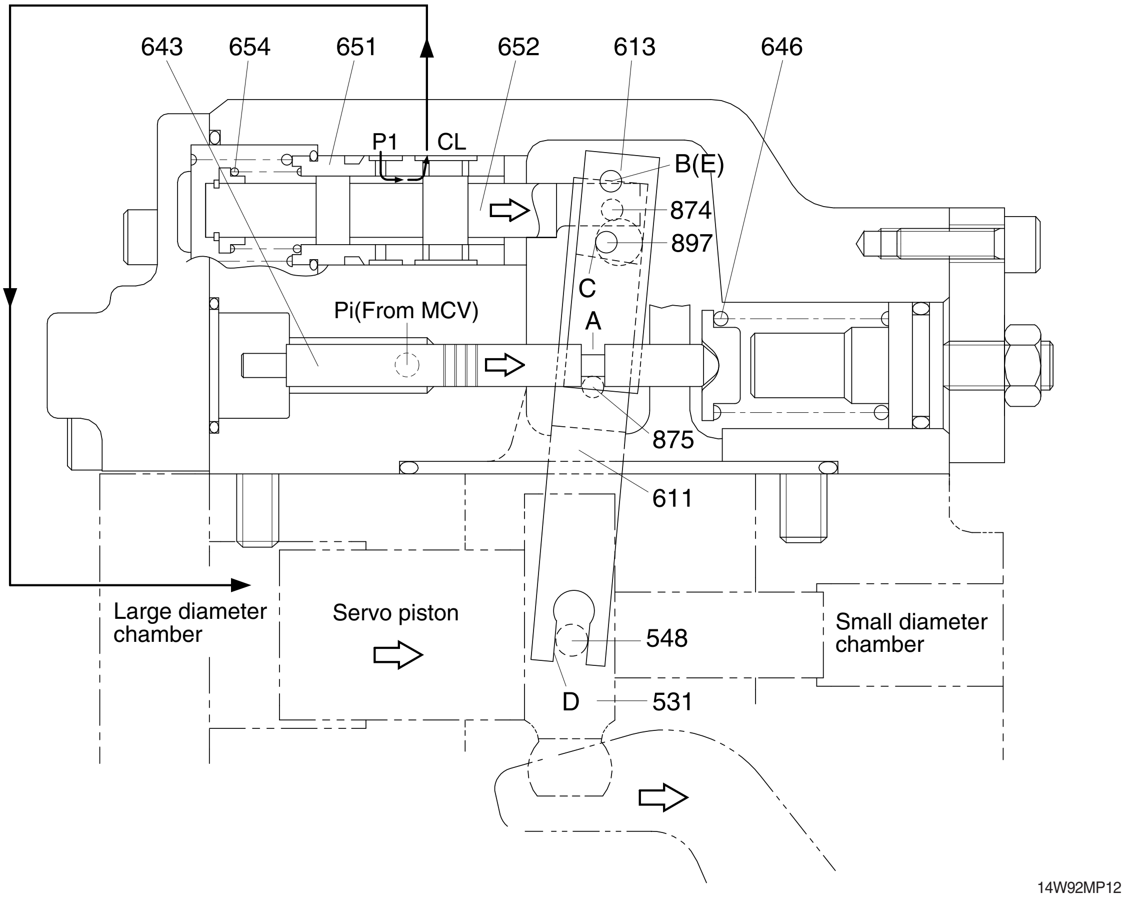
By changing the pilot pressure Pi, the pump tilting angle (delivery flow) is regulated arbitrarily, as shown in the figure.

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

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



① Flow reducing function



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

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

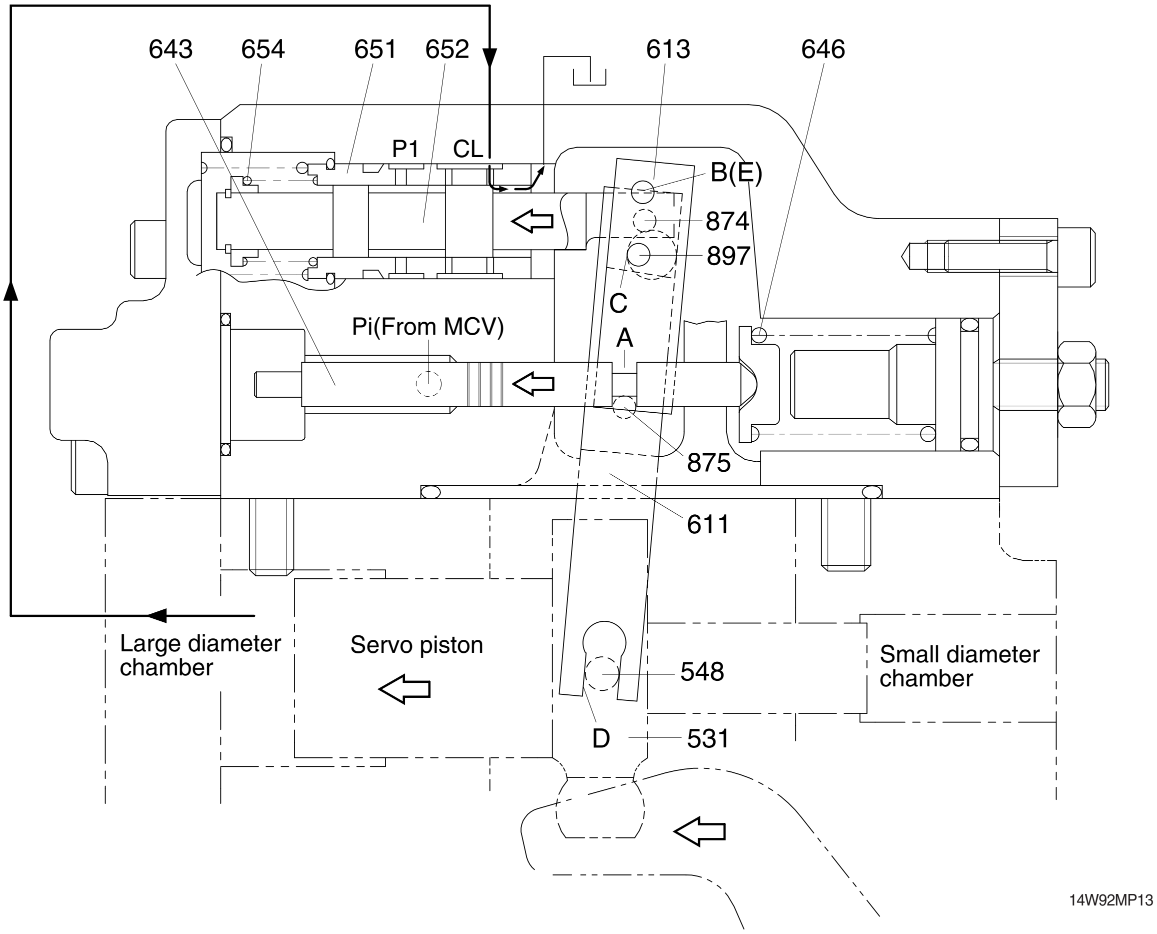
Since the feedback lever is connected with the spool (652) via the pin (874), the spool moves to the right.

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

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

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

② Flow increasing function



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

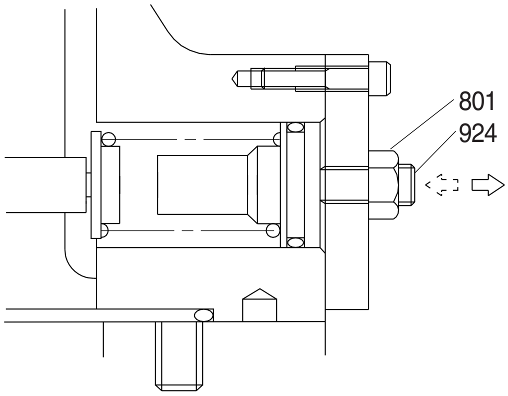
As the servo piston moves, point D also moves to the left, the feedback lever rotates around the fulcrum of point C, and the spool moves to the right till the opening between the spool and sleeve is closed.

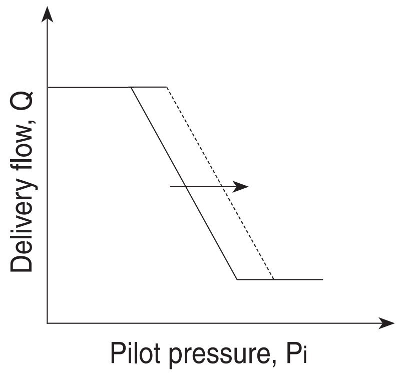
③ Adjustment of flow control characteristic

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

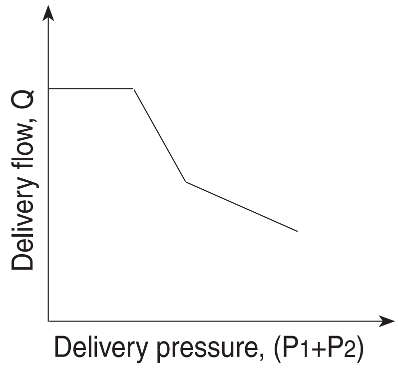
※ Adjusting value

Speed	Adjustment of flow control characteristic		
	Tightening amount of adjusting screw (924)	Flow control starting pressure change amount	Flow change amount
(min -1)	(Turn)	(kgf/cm2)	(ℓ /min)
2000	+1/4	+1.5	+9.5





(2) Total horsepower control

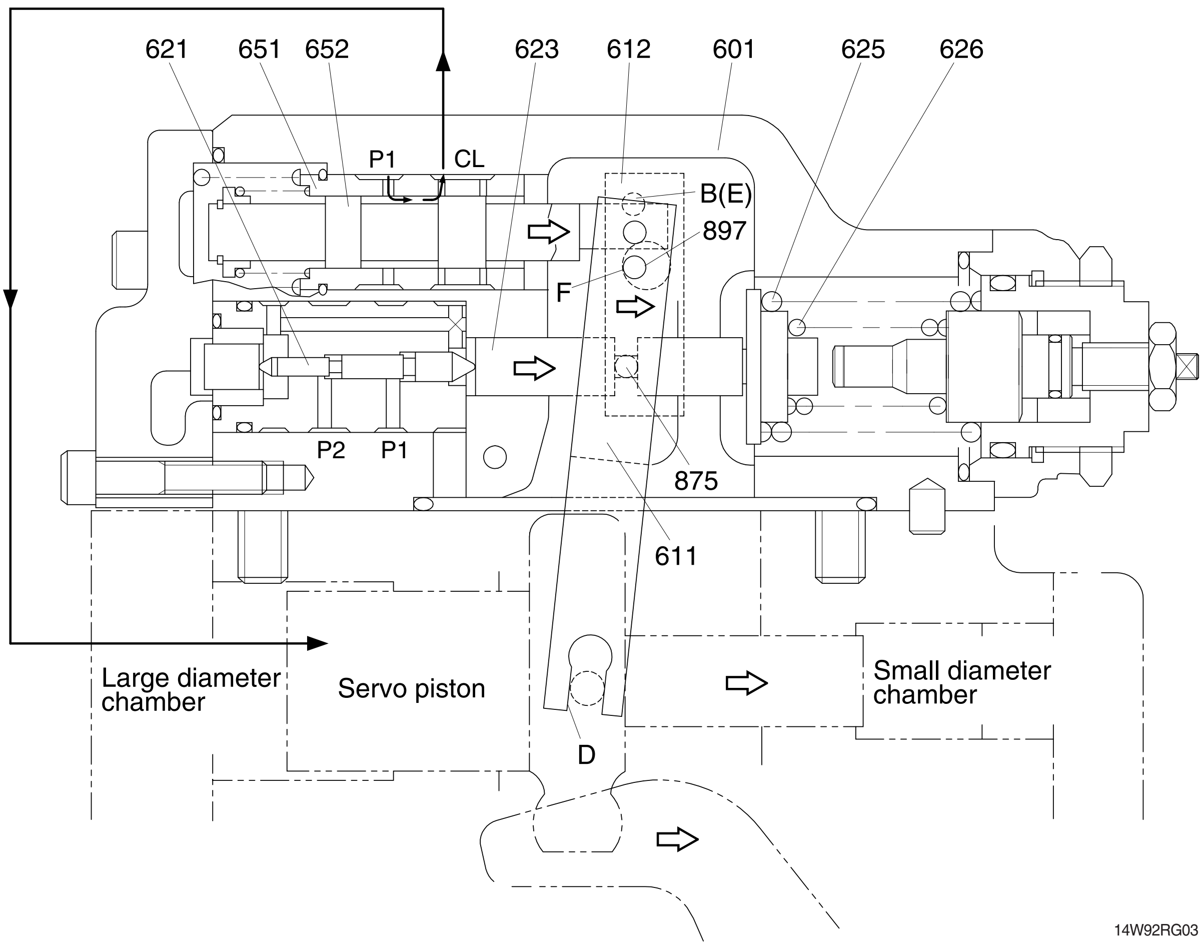


The regulator decreases the pump tilting angle (delivery flow) automatically to limit the input torque within a certain value with a rise in the delivery pressure P1 of the self pump and the delivery pressure P2 of the companion pump.
(The input horsepower is constant when the speed is constant.)
Since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

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

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

① Overload preventive function

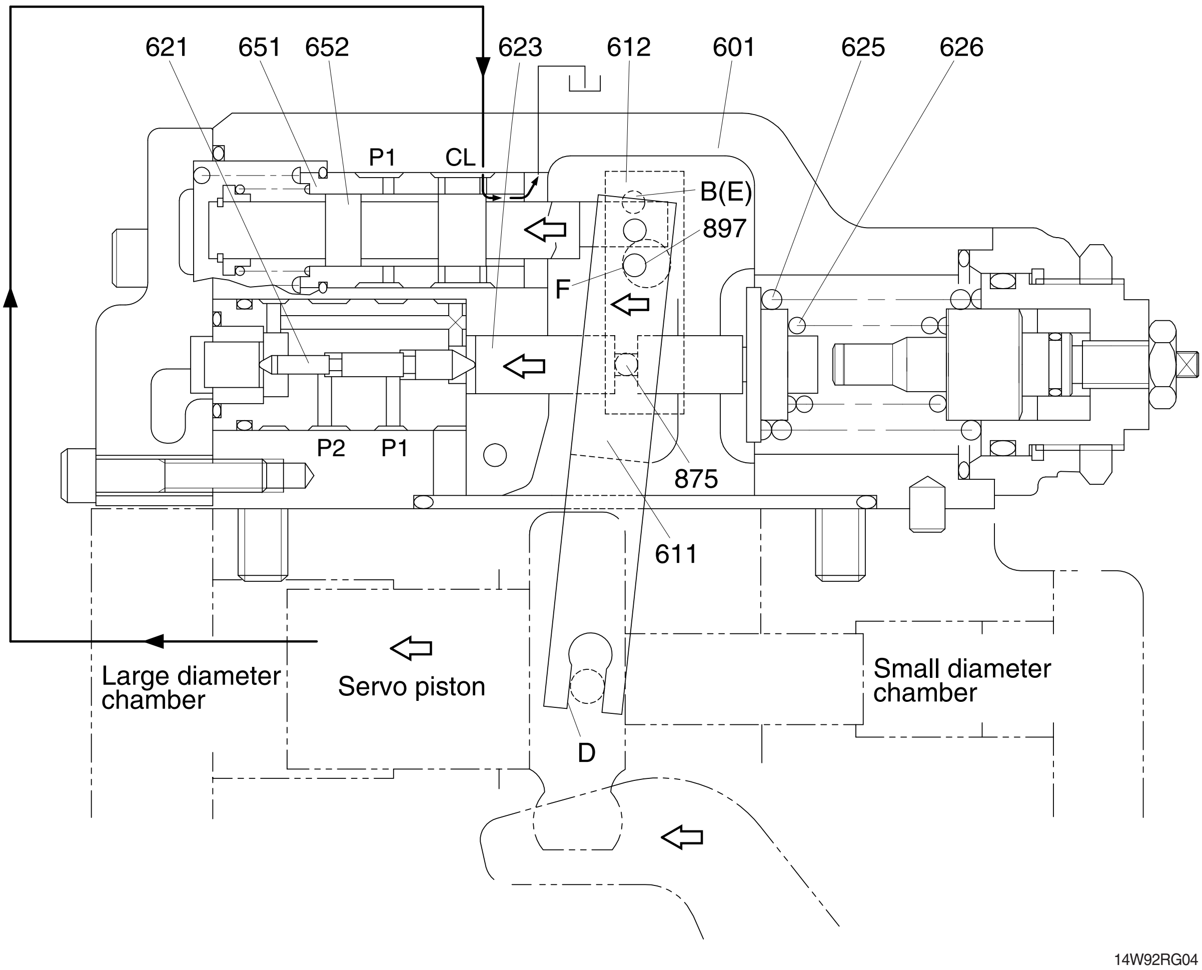


When the self pump delivery pressure P1 or the companion pump delivery pressure P2 rises, it acts on the stepped part of the compensating piston (621). It presses the compensating rod (623) to the right till the force of the outer spring (625) and inner spring (626) balances with the hydraulic force. The movement of the compensating rod is transmitted to lever 1 (612) via pin (875).

Lever 1 rotates around the pin (875) (E) fixed to the casing (601).

Since the large hole section (F) of lever 1 contains a protruding pin (897) fixed to the feedback lever (611), the feedback lever rotates around the fulcrum of point D as lever 1 rotates, and then the spool (652) is shifted to the right. As the spool moves, the delivery pressure P1 is admitted to the large diameter section of the servo piston via port CL, causes the servo piston move to the right, reduces the pump delivery, flow rate, and prevents the prime mover from being overloaded. The movement of the servo piston is transmitted to the feedback lever via point D. Then the feedback lever rotates around the fulcrum of point F and the spool is shifted to the left. The spool moves till the opening between the spool (652) and sleeve (651) is closed.

② Flow reset function



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

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

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

③ Low tilting angle (low flow) command preferential function

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

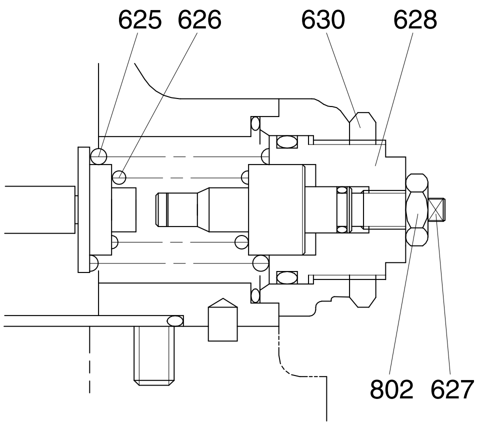
④ Adjustment of input horsepower

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

a. Adjustment of outer spring

Adjust it by loosening the hexagon nut (630) and by tightening (or loosening) the adjusting screw C (628).

Tightening the screw shifts the control chart to the right and increases the input horsepower as shown in the figure. Since turning the adjusting screw C (628) by N turns changes the setting of the inner spring (626), return the adjusting stem C (627) by N×A turns at first. (A=1.85)



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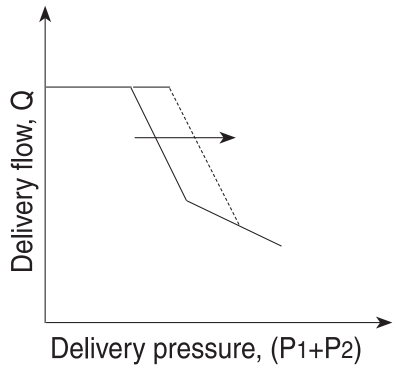
※ Adjusting value

Speed	Adjustment of input horsepower		
	Tightening amount of adjusting screw (C) (628)	Compensa-ting control starting pressure change amount	Input torque change amount
(min -1)	(Turn)	(kgf/cm2)	(kgf · m)
2000	+1/4	+17.7	+3.5



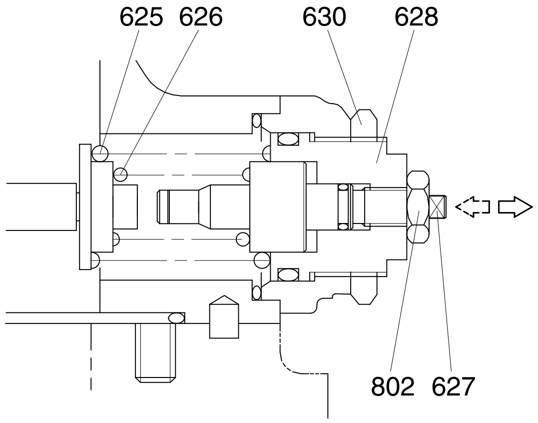
b. **Adjustment of inner spring**

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

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

※ **Adjusting value**

Speed	Adjustment of input horsepower		
	Tightening amount of adjusting stem (C) (627)	Flow change amount	Input torque change amount
(min^{-1})	(Turn)	(ℓ/min)	(kgf · m)
2000	+1/4	+8.4	+3.8



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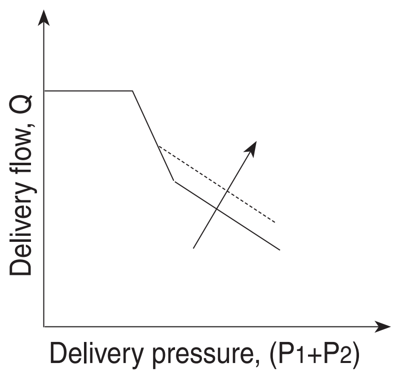
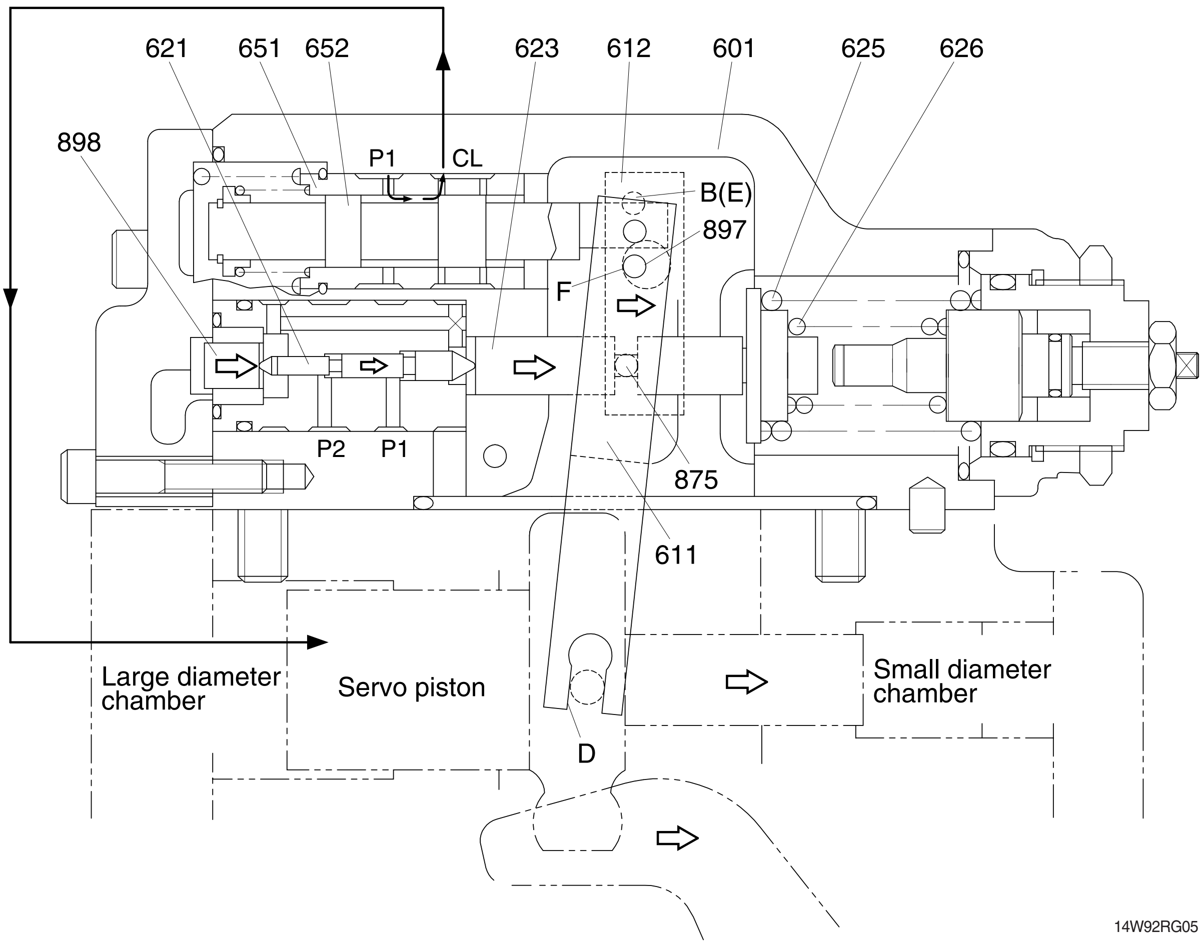


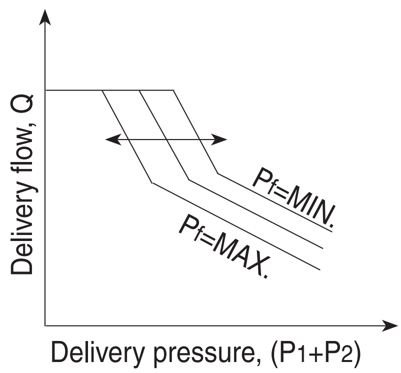
(3) Power shift control



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

Only one proportional pressure reducing valve is provided.

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



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

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

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

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

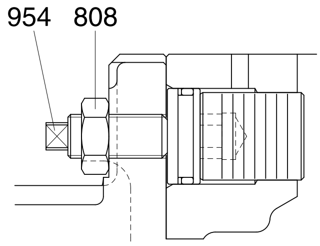
(4) Adjustment of maximum and minimum flows

① Adjustment of maximum flow

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

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

Speed	Adjustment of max flow	
	Tightening amount of adjusting screw (954)	Flow change amount
(min $^{-1}$)	(Turn)	(ℓ /min)
2000	+1/4	-3.2



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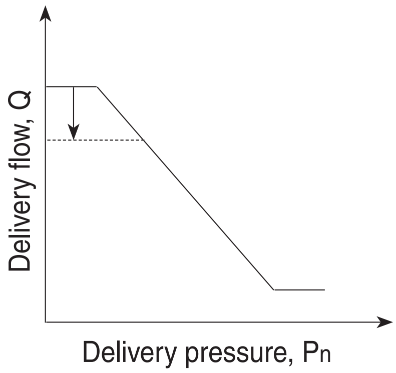
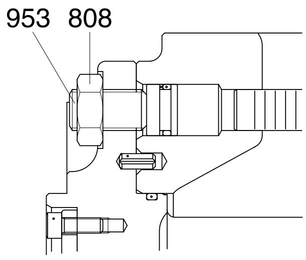


② Adjustment of minimum flow

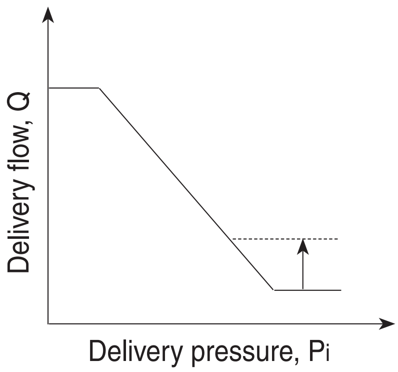
Adjust it by loosening the hexagon nut (808) and by tightening (or loosening) the hexagonal socket head set screw (953). Similarly to the adjustment of the maximum flow, other characteristics are not changed.

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

Speed	Adjustment of min flow	
	Tightening amount of adjusting screw (953)	Flow change amount
(min $^{-1}$)	(Turn)	(ℓ /min)
2000	+1/4	+3.2

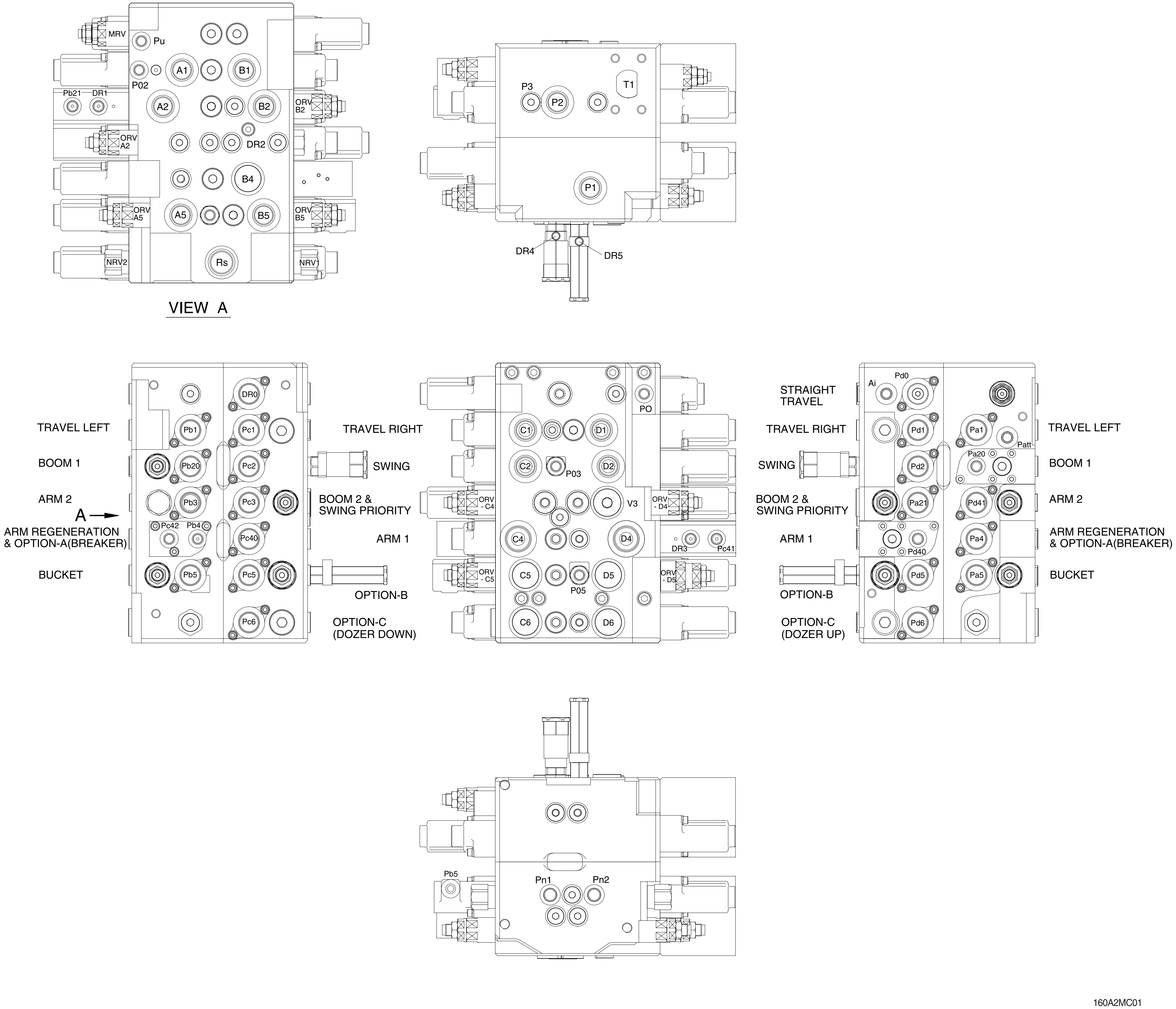


14W92MP24



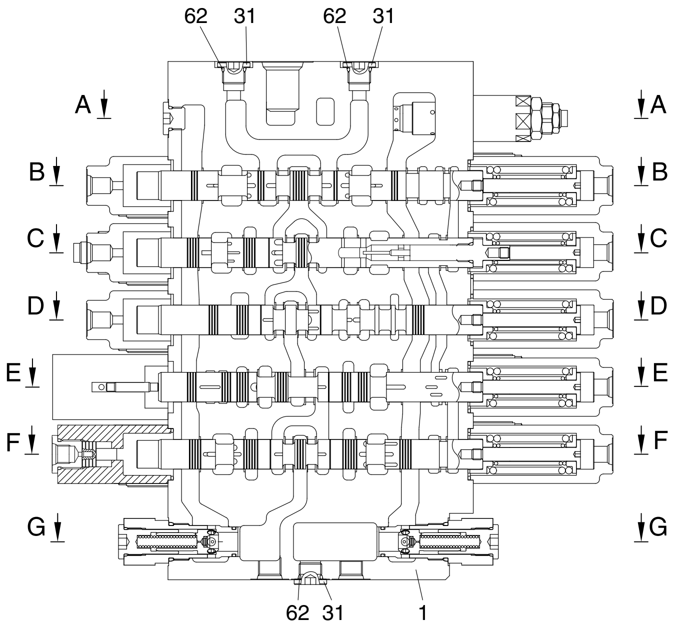
GROUP 2 MAIN CONTROL VALVE

1. STRUCTURE



Mark	Port name	Port size	Tightening torque
Pd0	Straight travel pilot port	PF 1/4	3.5~3.9 kgf · m (25.3~28.2 lbf · ft)
Pa1	Travel left pilot port (BW)		
Pb1	Travel left pilot port (FW)		
Pc1	Travel right pilot port (FW)		
Pd1	Travel right pilot port (BW)		
Pa20	Boom up pilot port		
Pa21	Boom up confluence pilot port		
Pb20	Boom down pilot port		
Pb21	Lock valve pilot port (boom)		
Pc2	Swing pilot port (RH)		
Pd2	Swing pilot port (LH)		
Pb3	Arm in confluence pilot port		
Pc3	Swing priority pilot port		
Pa4	Option A pilot port (breaker)		
Pb4	Arm in regeneration cut port		
Pc40	Arm in pilot port		
Pc41	Lock valve pilot port (arm)		
Pc42	Arm in regen-cut signal selector port		
Pd40	Arm out pilot port		
Pd41	Arm out confluence pilot port		
Pa5	Bucket in pilot port		
Pb5	Bucket out pilot port		
Pc5	Option B pilot port		
Pd5	Option B pilot port		
Pc6	Option C pilot port (dozer blade down)		
Pd6	Option C pilot port (dozer blade up)		
P0	Pilot pressure port		
Pu	Main relief pressure up pilot port		
Ai	Auto idle signal port		
Patt	Auto idle signal-attachment		
P02	Pilot signal port		
P03	Boom priority pilot port		
P04	Boom parallel orifice pilot port		
P05	Breaker summation pilot port		
DR0	Drain port (travel straight)		
DR1	Drain port (boom holding valve)		
DR2	Drain port (boom 2 & swing priority)		
DR3	Drain port (arm holding valve)		
Pn1	Negative control signal port (P1 port side)	PF 3/8	7~8 kgf · m (50.6~57.8 lbf · ft)
Pn2	Negative control signal port (P2 port side)		
P3	Quick clamp port		
A1	Travel motor left side port (BW)	PF 3/4	15~18 kgf · m (109~130 lbf · ft)
B1	Travel motor left side port (FW)		
C1	Travel motor right side port (FW)		
D1	Travel motor right side port (BW)		
B2	Boom rod side port		
C2	Swing motor port (RH)		
D2	Swing motor port (LH)		
B4	Option A port (breaker)		
A5	Bucket head side port		
B5	Bucket rod side port		
C5	Option B port		
D5	Option B port		
C6	Option C pilot port (dozer down port)		
D6	Option C pilot port (dozer up port)		
P1	Pump port (P1 side)		
P2	Pump port (P2 side)		
A2	Boom head side port	PF 1	20~25 kgf · m (115~180 lbf · ft)
C4	Arm head side port		
D4	Arm rod side port		
DR4	Drain port (swing logic valve)	PF 1/8	1.5~1.9 kgf · m (10.8~13.7 lbf · ft)
DR5	Drain port (flow summation)		
T1	Return port	SAE 3000, 1 1/2 (M12×1.75)	8.5~11.5 kgf · m (61.5~83.1 lbf · ft)

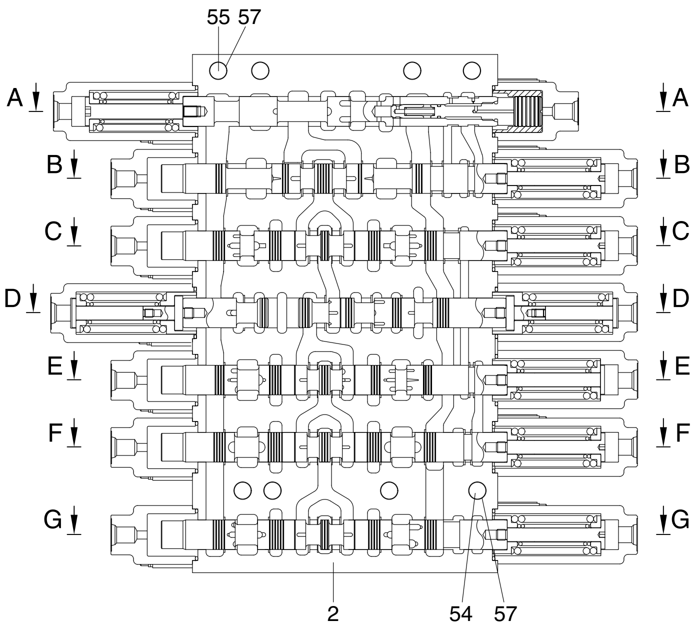
1) P1 SPOOL SECTION



1	Housing P1
31	Plug
62	O-ring

160A2MC10

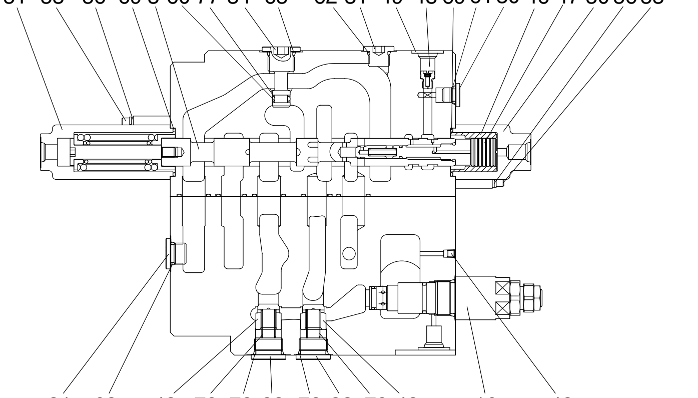
2) P2 SPOOL SECTION



2	Housing P2
54	Socket bolt
55	Socket bolt
57	Spring washer

160A2MC11

3) STRAIGHT TRAVEL AND SUPPLY

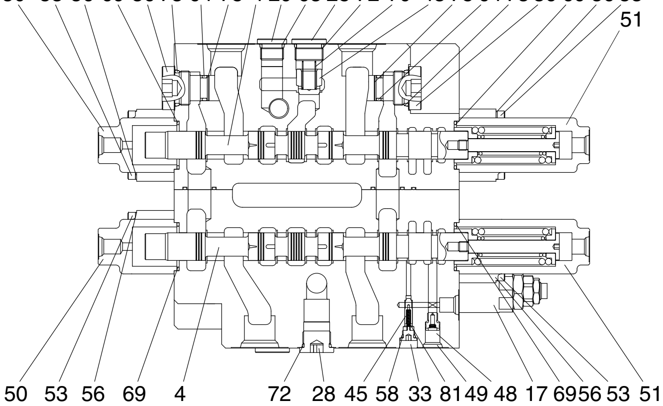


A-A (STRAIGHT TRAVEL & SUPPLY)

160A2MC12

3 Straight travel spool
16 Main relief valve
28 Plug
30 Plug
31 Plug
34 Parallel plug
42 Plug
43 Load check poppet
45 Signal poppet
46 Travel straight sleeve
47 Travel straight piston
48 Orifice signal
49 Coin type filter
50 Pilot cap
51 Pilot cap
53 Socket bolt
56 Washer
58 O-ring
60 O-ring
61 O-ring
62 O-ring
65 O-ring
69 O-ring
72 O-ring
77 Back-up ring
79 Back-up ring

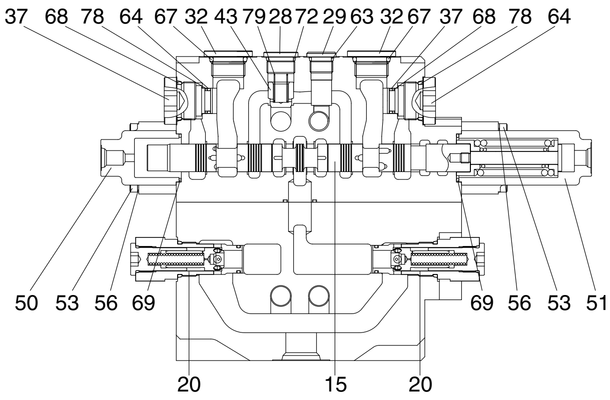
4) TRAVEL RIGHT AND LEFT SECTION



160A2MC13

4 Travel spool (LH, RH)
17 Overload relief valve
28 Plug
29 Plug
33 Plug
36 Relief cat plug
43 Load check poppet
45 Signal poppet
48 Orifice signal
49 Coin type filter
50 Pilot cap
51 Pilot cap
53 Socket bolt
56 Washer
58 O-ring
63 O-ring
64 O-ring
69 O-ring
72 O-ring
76 Back-up ring
78 Back-up ring
79 Load check valve
81 Poppet signal spring

5) OPTION C AND NEGATIVE CONTROL SECTION

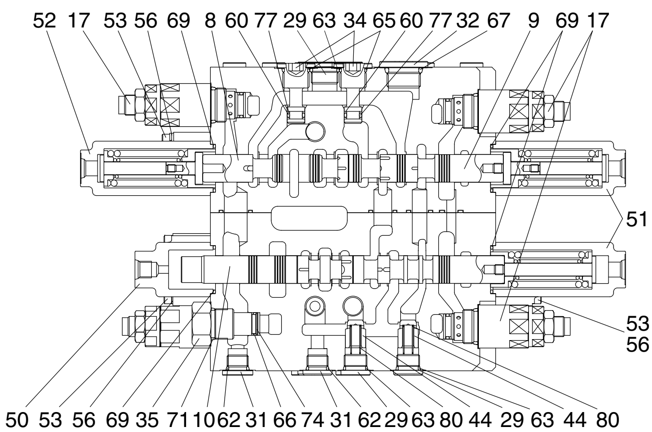


G-G (OPTION-C & NEGATIVE CONTROL)

160A2MC14

28 Plug
29 Plug
32 Plug
37 Relief cat plug
43 Load check poppet
50 Pilot cap
51 Pilot cap
53 Socket bolt
56 Washer
63 O-ring
64 O-ring
67 O-ring
68 O-ring
69 O-ring
72 O-ring
78 Back-up ring
79 Load check spring

6) SWING PRIORITY, BOOM 2 AND ARM 2 SECTION

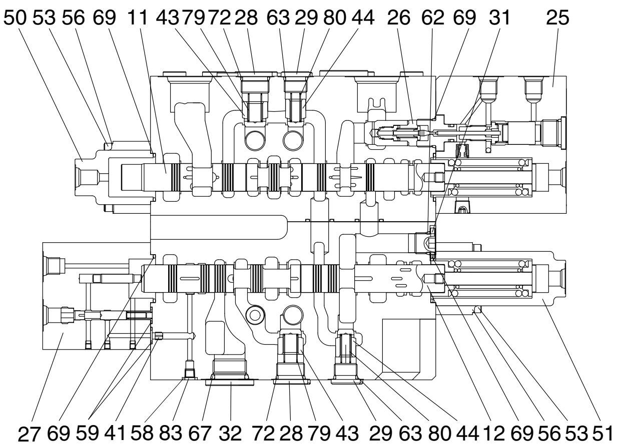


D-D (SWING PRIORITY & BOOM 2 & ARM 2)

160A2MC15

8 Swing priority spool
9 Boom 2 spool
10 Arm 2 spool
17 Overload relief valve
29 Plug
31 Plug
32 Plug
34 Parallel plug
35 Relief cat plug
44 Load check poppet
50 Pilot cap
51 Pilot cap
52 Pilot cap
53 Socket bolt
56 Washer
60 O-ring
62 O-ring
63 O-ring
65 O-ring
66 O-ring
67 O-ring
69 O-ring
71 O-ring
74 Back-up ring
77 Back-up ring
80 Load check spring

7) ARM 1 AND ARM REGENERATION/BREAKER SECTION

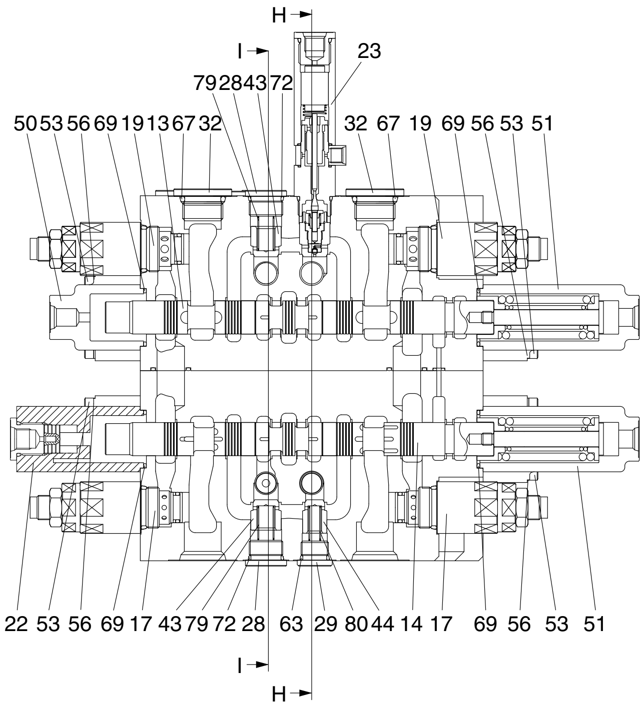


E-E (ARM 1 & ARM REGENERATION /BREAKER)

160A2MC16

11 Arm 1 spool
12 Arm regeneration spool
25 Holding valve kit A2
26 Holding valve kit B
27 Regeneration block
28 Plug
29 Plug
31 Plug
32 Plug
41 Option plug
43 Load check poppet
44 Load check poppet
50 Pilot cap
51 Pilot cap
53 Socket bolt
56 Washer
58 O-ring
59 O-ring
62 O-ring
63 O-ring
67 O-ring
69 O-ring
72 O-ring
79 Load check spring
80 Load check spring
83 Plug

8) OPTIOM B AND BUCKET SECTION

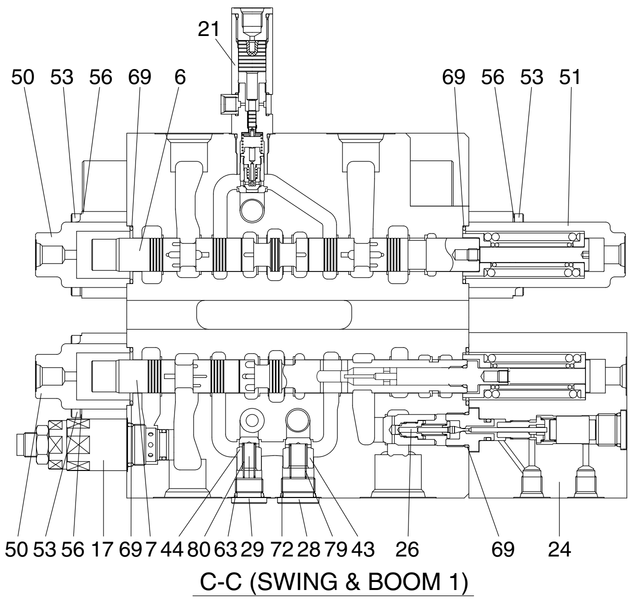


F-F (OPTION-B & BUCKET)

160A2MC17

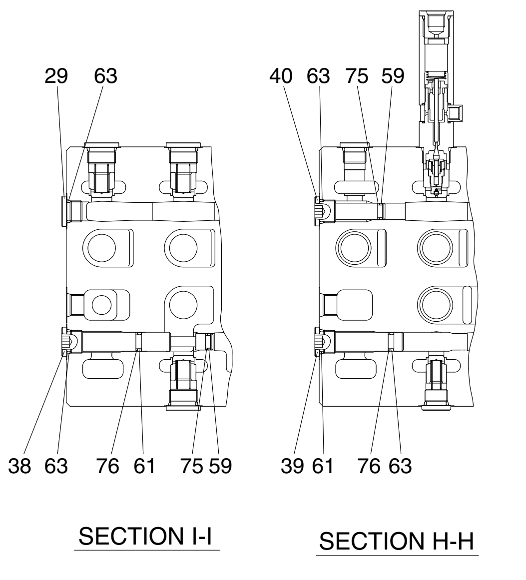
13 Option B spool
14 Bucket spool
17 Overload relief valve
19 Overload relief valve
22 Bucket stroke limiter
23 Option on-off valve
28 Plug
29 Plug
32 Plug
43 Load check valve
44 Load check valve
50 Pilot cap
51 Pilot cap
53 Socket bolt
56 Washer
63 O-ring
67 O-ring
69 O-ring
72 O-ring
79 Load check spring
80 Load check spring

9) SWING AND BOOM 1 SECTION



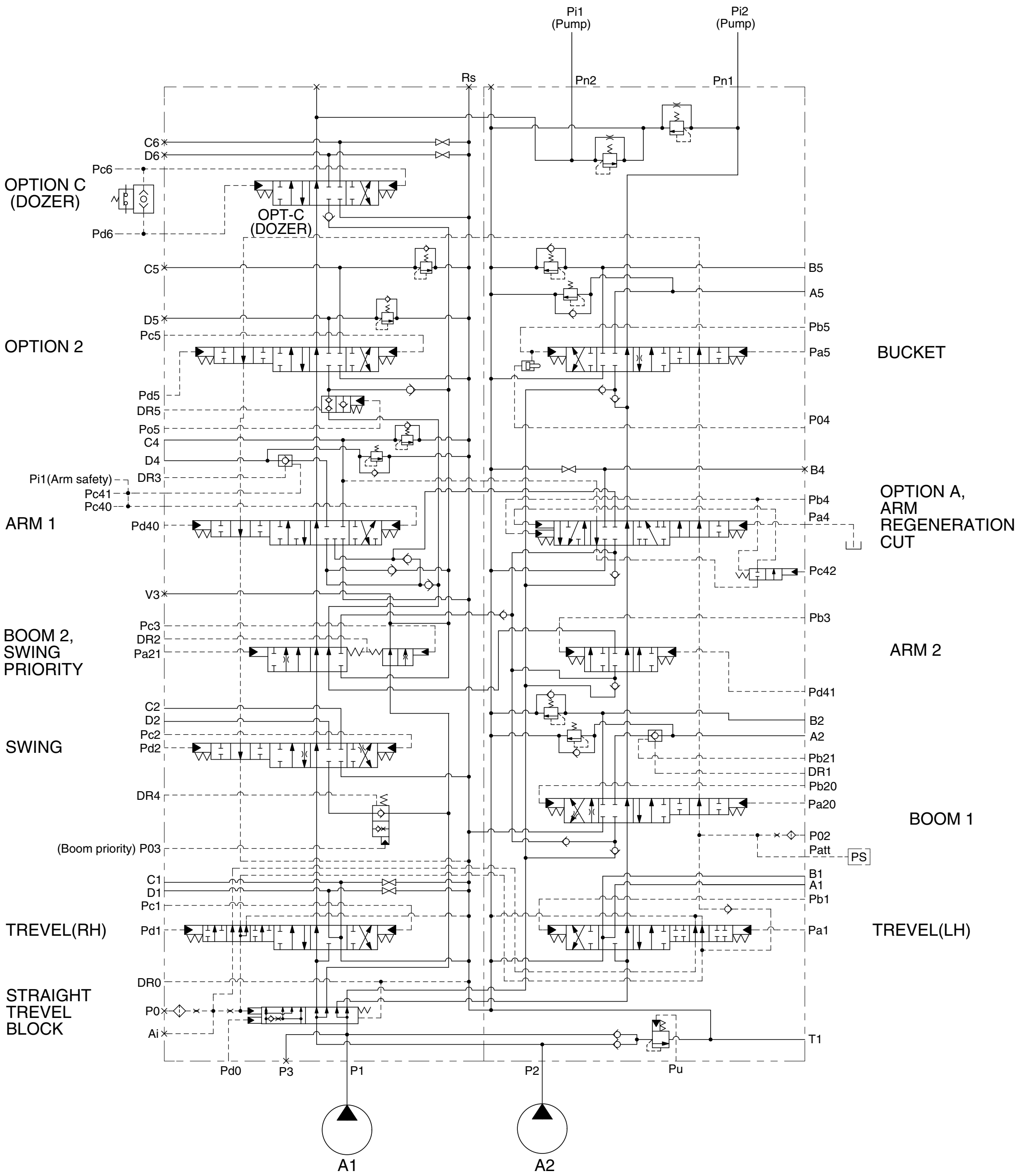
6	Swing spool
7	Boom 1 spool
17	Overload relief valve
21	Swing logic valve
24	Holding valve kit A1
26	Holding valve kit B
28	Plug
29	Plug
43	Load check valve
44	Load check valve
50	Pilot cap
51	Pilot cap
53	Socket valve
56	Washer
63	O-ring
69	O-ring
72	O-ring
79	Load check spring
80	Load check spring

10) BYPASS CUT SECTION



29	Plug
38	Bucket plug
39	Bucket parallel plug
40	Option plug
59	O-ring
61	O-ring
63	O-ring
75	Back-up ring
76	Back-up ring

2. HYDRAULIC CIRCUIT



160A2MC20

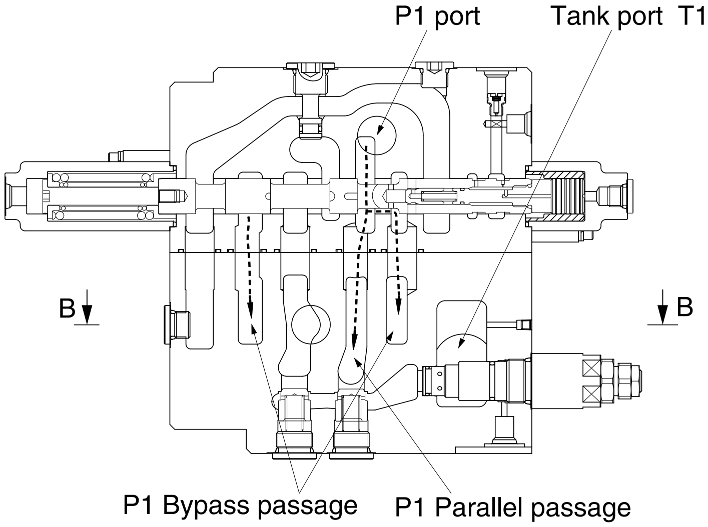
3. FUNCTION

1) CONTROL IN NEUTRAL

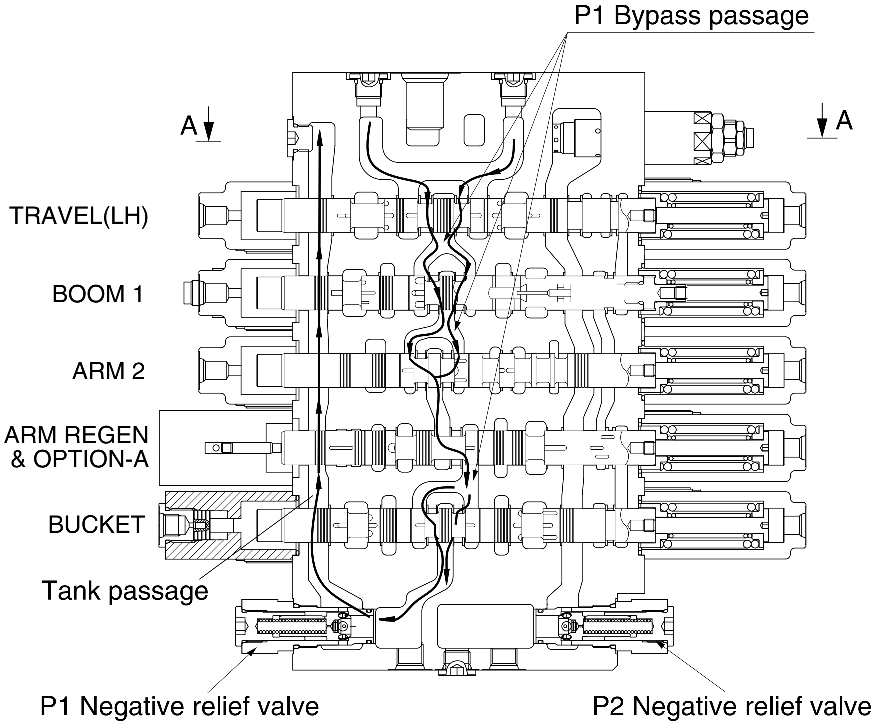
(1) P1 SIDE

The hydraulic fluid from pump A2 flows into the main control valve through the inlet port "P1", pass the straight travel spool into the P1 bypass passage and P1parallel passage.

The hydraulic fluid from the pump A2 is directed to the tank through the bypass passage of spools : travel left, boom 1, arm 2, arm regeneration & option A and bucket, the negative relief valve of P1, tank passage, and the tank port "T1"



SECTION A-A



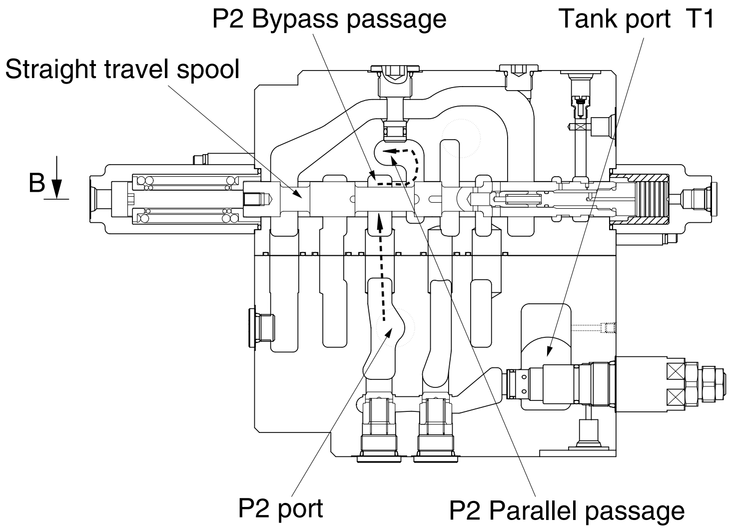
SECTION B-B

160A2MC21

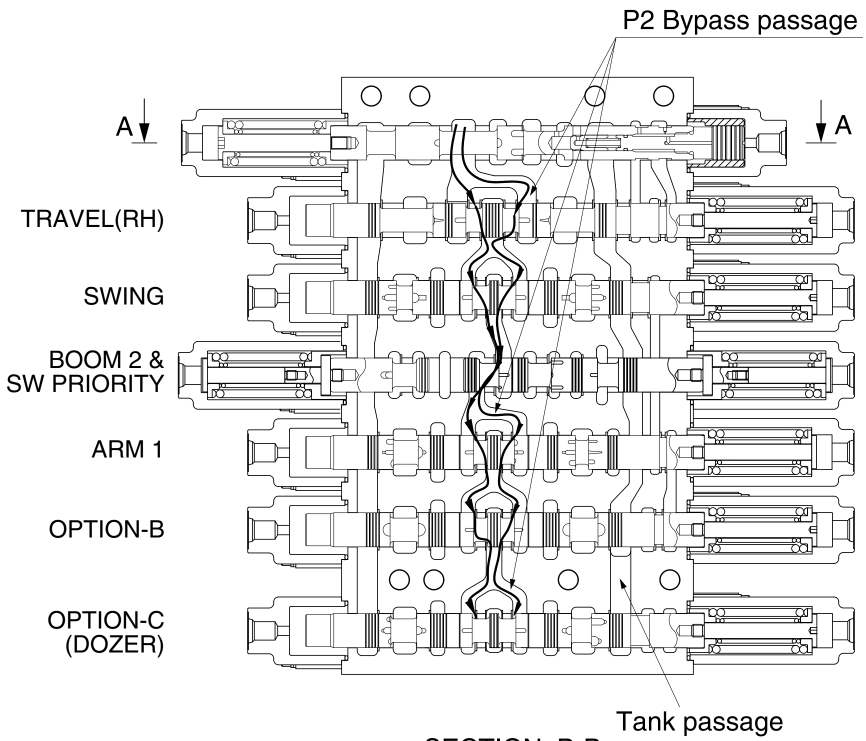
(2) P2 SIDE

The hydraulic fluid from pump A1 flows into the main control valve through the inlet port "P2", into the P2 bypass passage and P2 parallel passage.

The hydraulic fluid from the pump A1 is directed to the tank through the bypass passage of spools : travel right, swing, boom 2 & swing priority, arm 1, option "B" and option "C" (dozer), the negative relief valve of P2, tank passage and the tank port "T1".



SECTION A-A

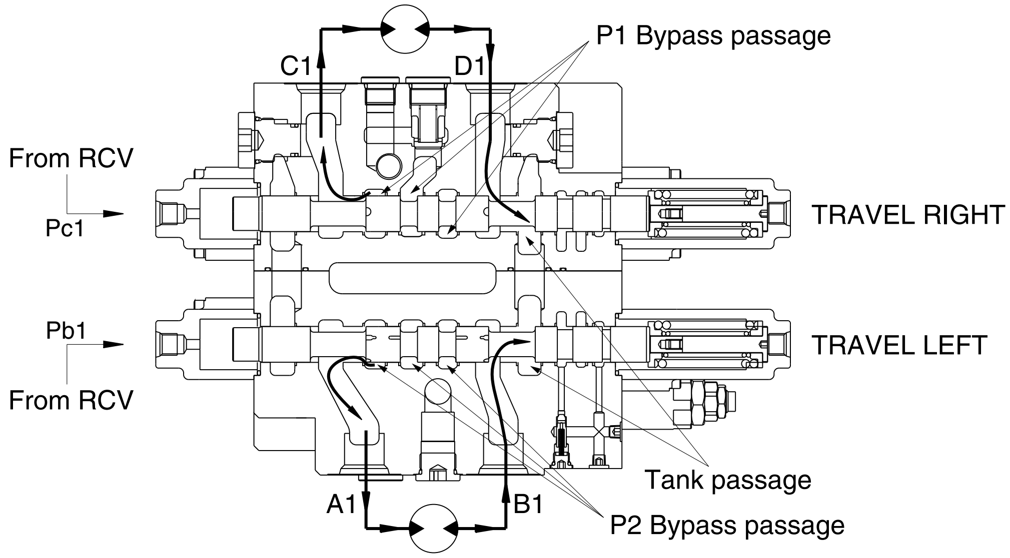


SECTION B-B

160A2MC22

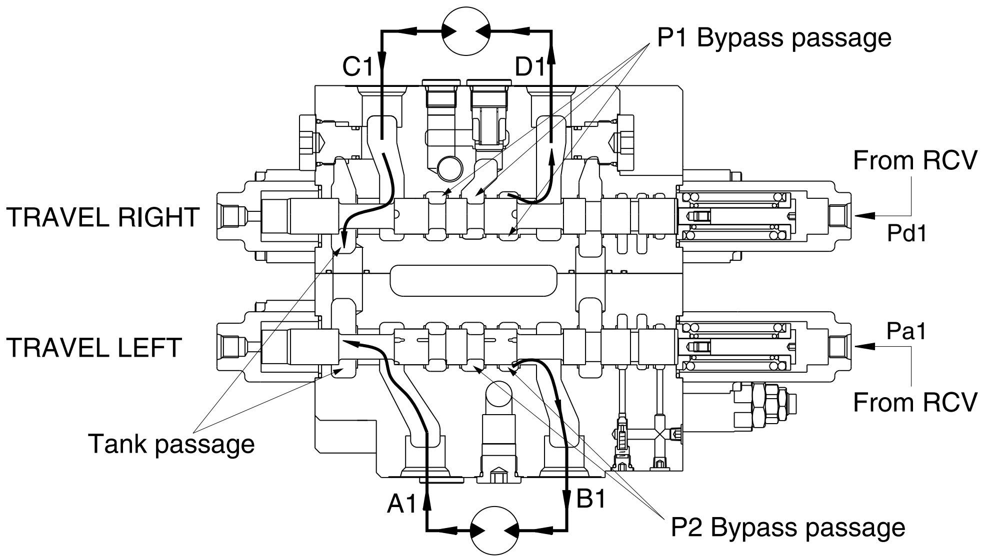
2) TRAVEL OPERATION

(1) TRAVEL FORWARD OPERATION



14092MC18

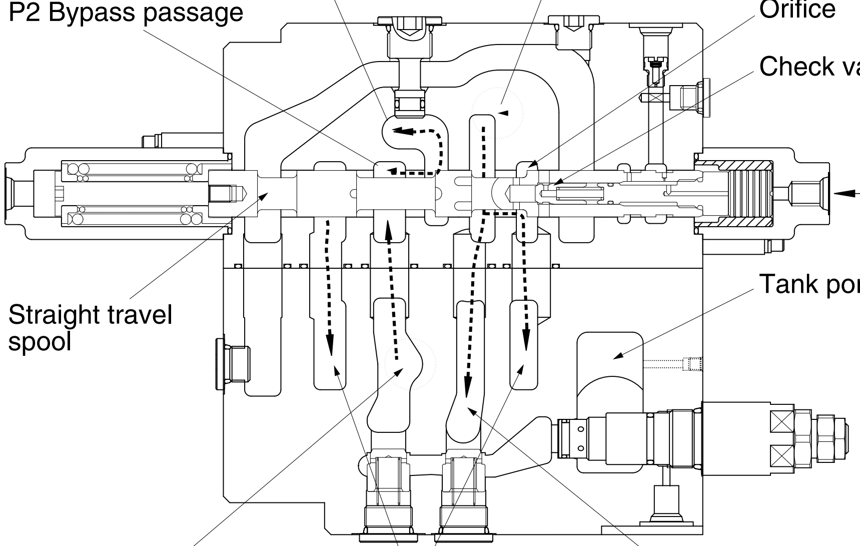
(2) TRAVEL BACKWARD OPERATION



14092MC17

During the travel forward operation, the hydraulic fluid of the pump A2 is supplied to the travel left motor and the hydraulic fluid of the pump A1 is supplied to the other travel right motor.
The pilot pressure from the pilot control valve is supplied to the spring side of pilot port (pb1, pc1).
And it shifts travel right and left spools in the left direction against springs. Hydraulic fluid from the pump A1 flow into the travel right spool through the bypass passage and hydraulic fluid from the pump A2 flow into the travel left spool through the bypass passage.
Then they are directed to the each travel motor through port A1 and C1. As a result, the travel motors turn and hydraulic fluid returns to the tank passage through the travel spools.
In case of the reverse operation, the operation is similar.

(3) TRAVEL STRAIGHT FUNCTION



160A2MC23

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

① **During travel only :**

The hydraulic fluid of the pump A1 is supplied to the travel right motor and the pump A2 is supplied to the travel left motor.

Thus, the machine keep travel straight.

② **The other actuator operation during straight travel operation :**

When the other actuator spool (s) is selected under straight travel operation, the straight travel spool is moved by pilot pressure from the travel straight EPPR valve.

The hydraulic fluid from pump A2 is supplied actuator through P2 and P1 parallel pass and travel motors through orifice at side of straight travel spool.

The hydraulic oil fluid from pump A1 is supplied to travel motors (left/right).

Therefore, the other actuator operation with straight travel operation, hydraulic oil fluid from pump A2 is mainly supplied to actuator, and the hydraulic oil fluid form pump A1 is mainly supplied to travel motors (left/right).

Then the machine keeps straight travel.

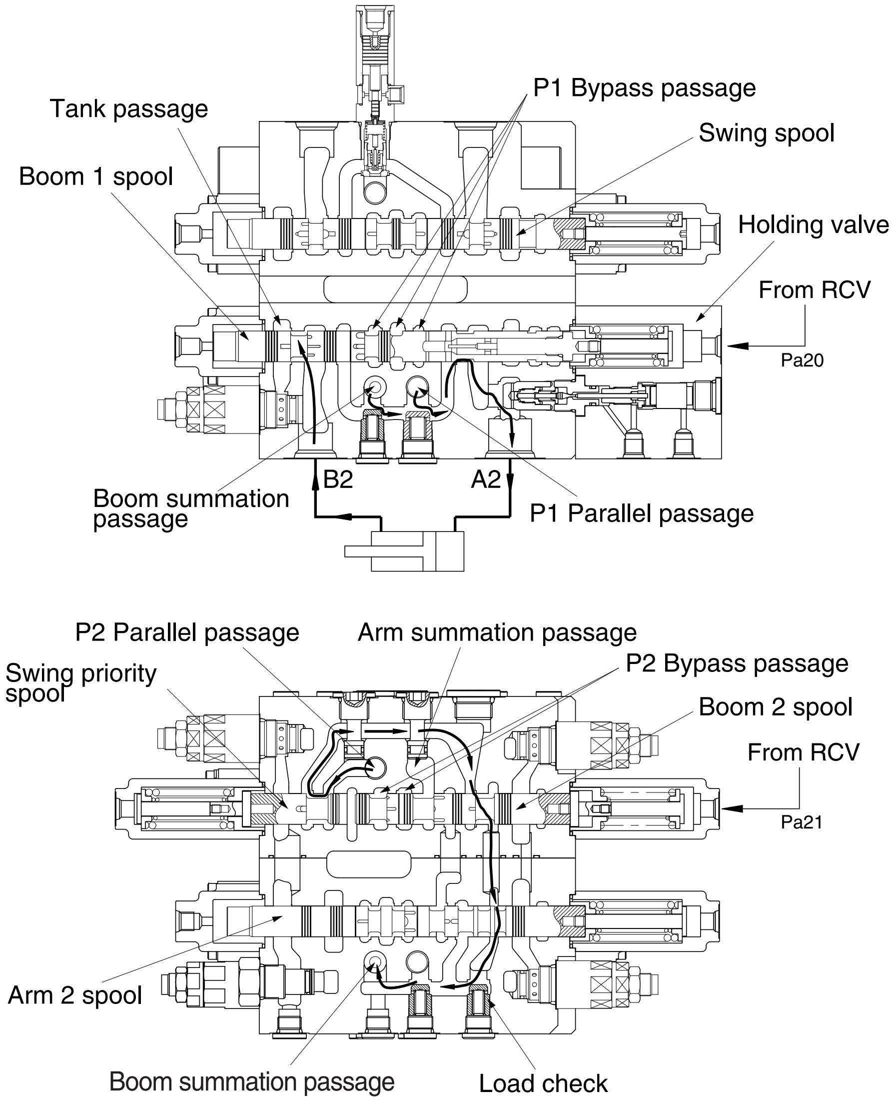
3) BOOM OPERATION

(1) BOOM UP OPERATION

During boom up operation, the pilot secondary pressure from RCV is supplied to the port Pa20 of the spring side and shifts the boom 1 spool in the left direction. The bypass passage is shut off by the movement of the boom 1 spool and the hydraulic oil fluid from pump A2 is entered P1 parallel passage and then passes through the load check, bridge passage and boom holding valve then flows into the port A2. Following this it flows into the head side of the boom cylinder. (In this case, the boom holding valve is free flow condition)

At the same time, the pilot pressure from RCV is supplied to the port Pa21 of the spring side of boom 2 and shifts the boom 2 spool. The bypass passage is shut off by the movement of the boom 2 spool and the hydraulic oil fluid from pump A1 entered boom summation passage via the P2 parallel passage, the land of the swing priority spool, notch of the boom 2 spool, arm 2 spool and the check. The flows combine in passage and are directed to port A2 and head side of boom cylinder.

At the same time, the flow from rod side of the boom cylinder return to the boom 1 spool through the port B2. Thereafter it is directed to the hydraulic oil tank through the tank passage.



160A2MC24

(2) BOOM DOWN OPERATION

During the boom lowing operation, the pilot pressure from RCV is supplied to the port Pb20 of the spring opposite side and shifts the boom 1 spool in the right direction.

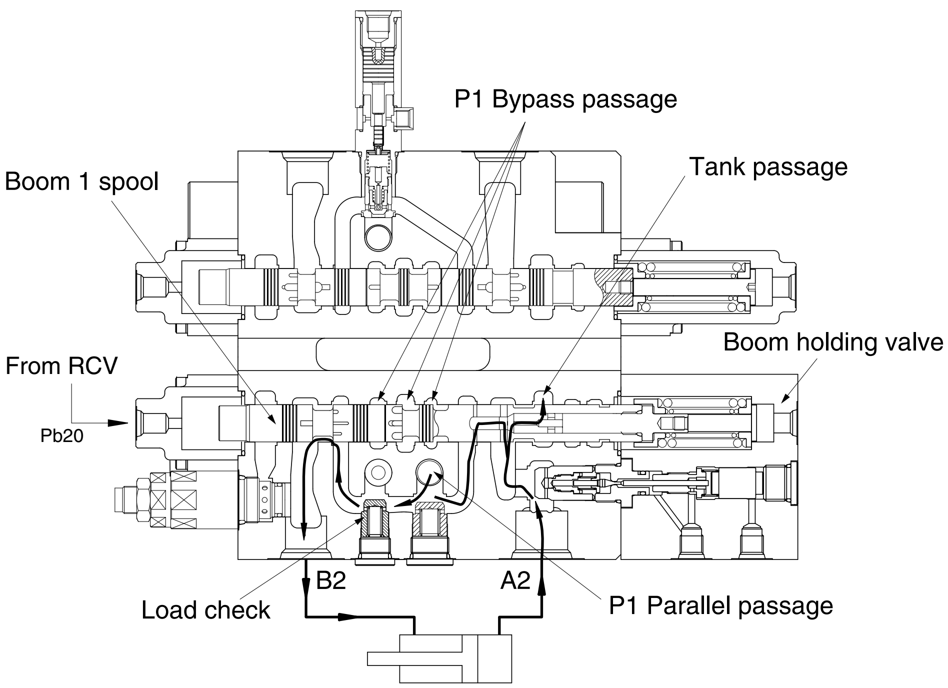
The bypass passage is shut off by the movement of the boom 1 spool and the hydraulic fluid from the pump A2 enters the parallel passage and is directed to the port B2 through the load check. Following this, it flows into the rod side of the boom cylinder.

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

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

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

During the boom lowering operation, the fluid from A1 pump is not summation.

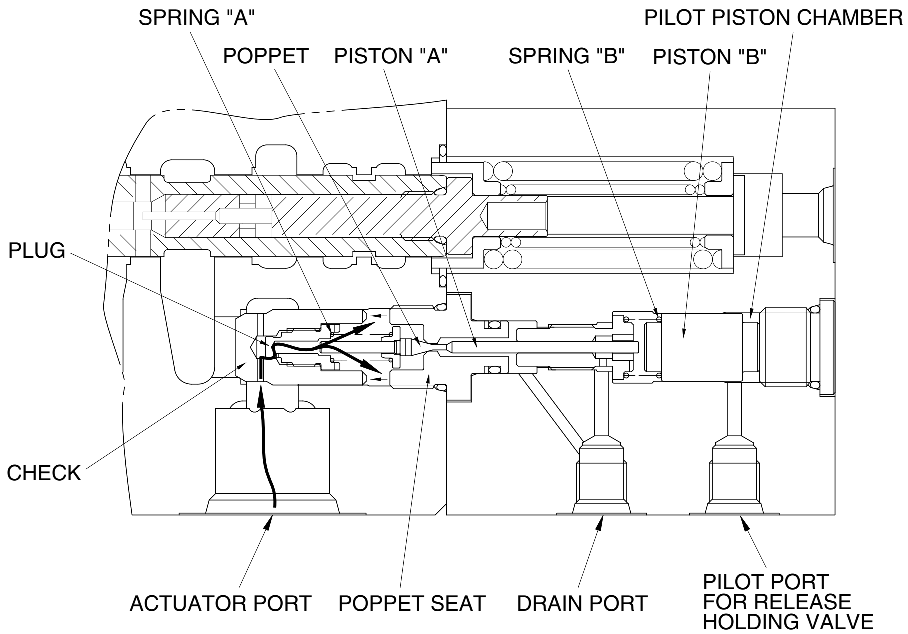


160A2MC25

4) HOLDING VALVE OPERATION

(1) HOLDING OPERATION

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



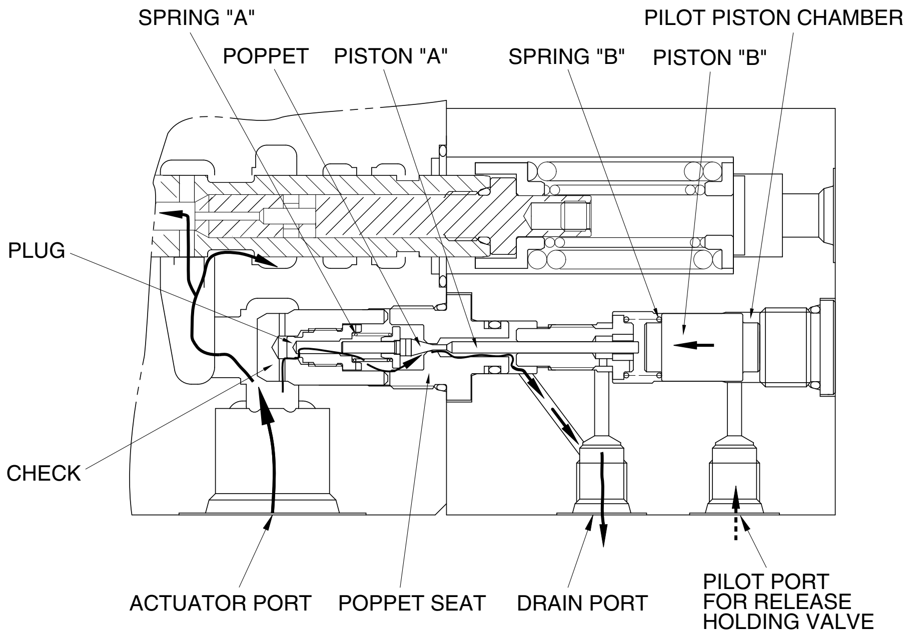
160A2MC26

(2) RELEASE HOLDING OPERATION

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

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

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

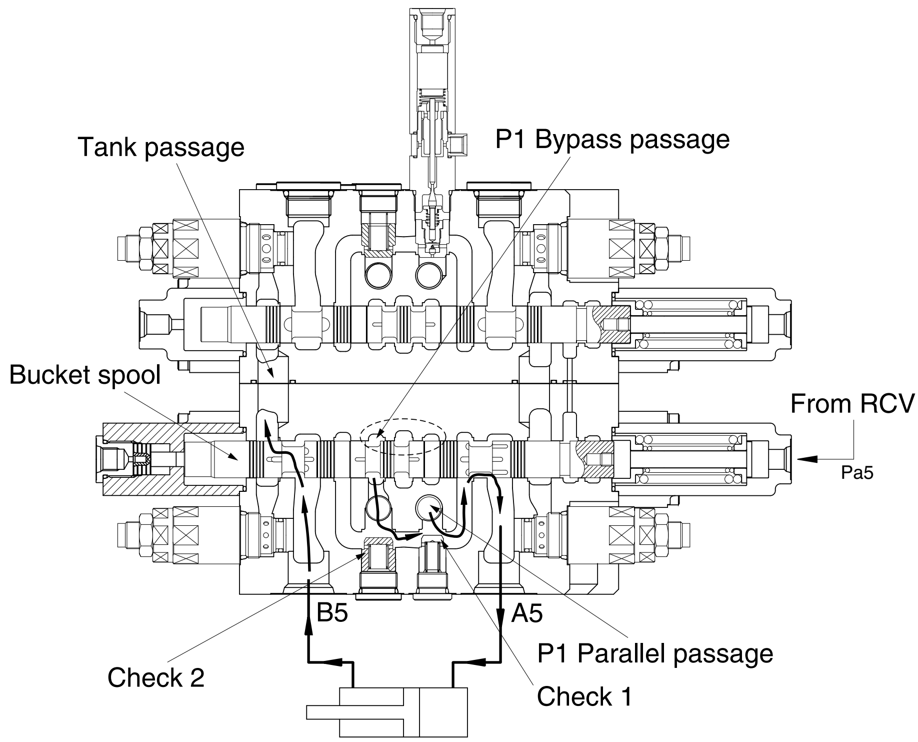


160A2MC27

5) BUCKET OPERATION

(1) BUCKET IN OPERATION

During the bucket in operation, the pilot secondary pressure from RCV is supplied to port Pa5 of the spring side and shifts the bucket spool in the left direction.
The bypass passage is shut off by the movement of the bucket spool and the hydraulic fluid from pump A2 entered P1 parallel passage and is directed to the port A5 through the check 1.
At the same time, the hydraulic fluid from P1 bypass passage is directed to the port A5 through the check 2.
Following this it flows into the head side of the bucket cylinder.
The return flow from the rod side of the bucket cylinder returns to the bucket spool through the port B5. Thereafter it is directed to the hydraulic oil tank through the tank passage.



160F2MC34

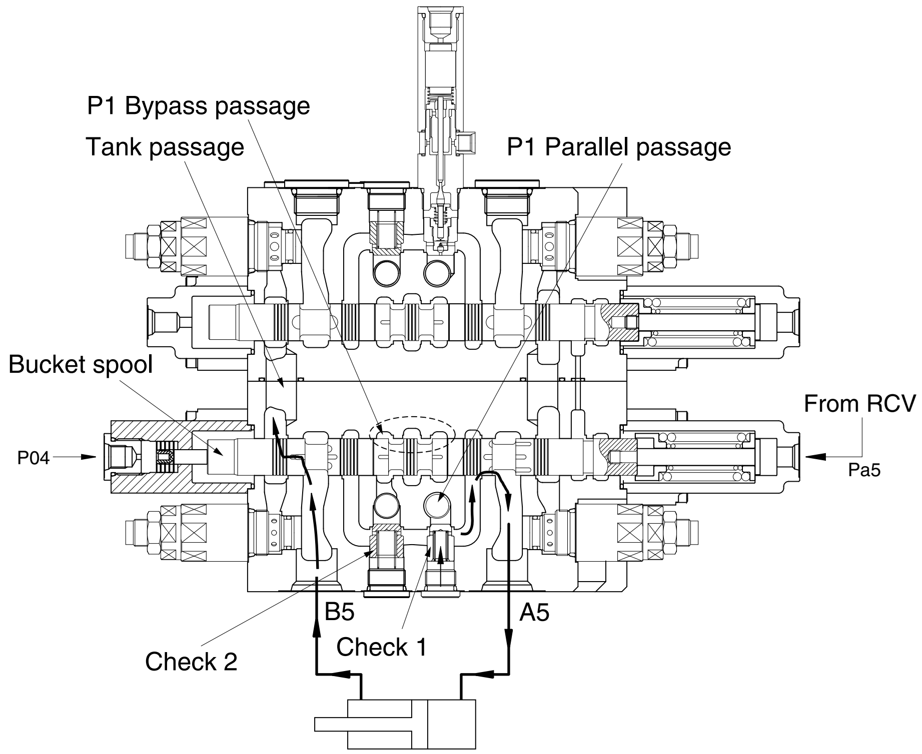
(2) BUCKET OUT OPERATION

During the bucket out operation, the pilot secondary pressure from RCV is supplied to port Pb5 of the spring opposite side and shifts the bucket spool in the right direction.

The bypass passage is shut off by the movement of the bucket spool and the hydraulic fluid from pump A2 entered P1 parallel passage and is directed to the port B5 through the check 1.

At the same time, the hydraulic fluid from P1 bypass passage is directed to the port B5 through the check 2.

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



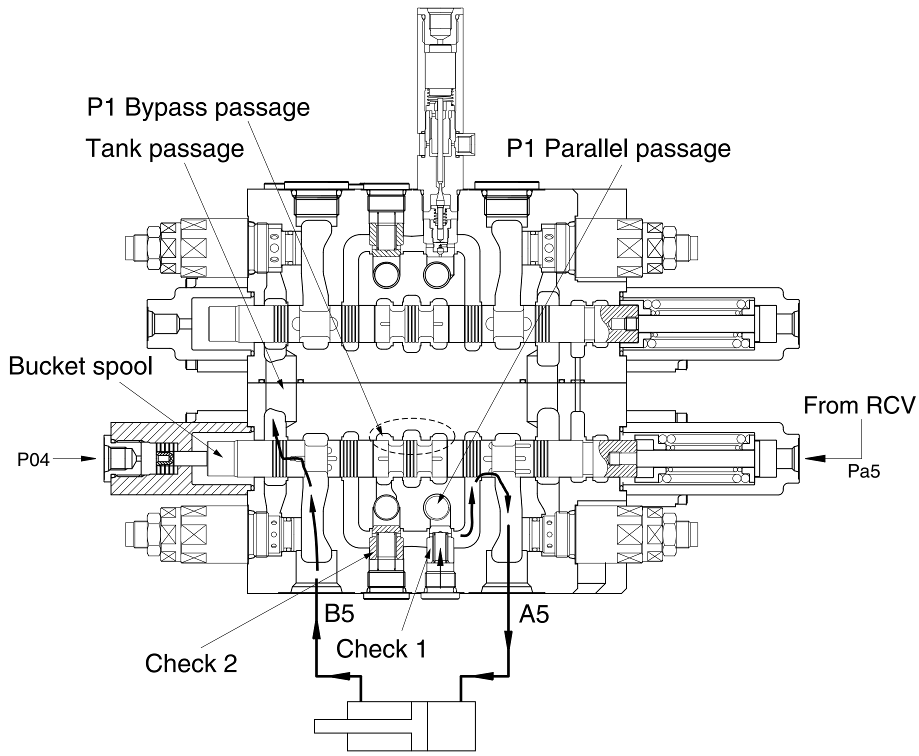
160F2MC35

(3) BUCKET IN OPERATION WITH BOOM UP OPERATION

When combined operation, mostly same as previous page.

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

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



160F2MC29

6) SWING OPERATION

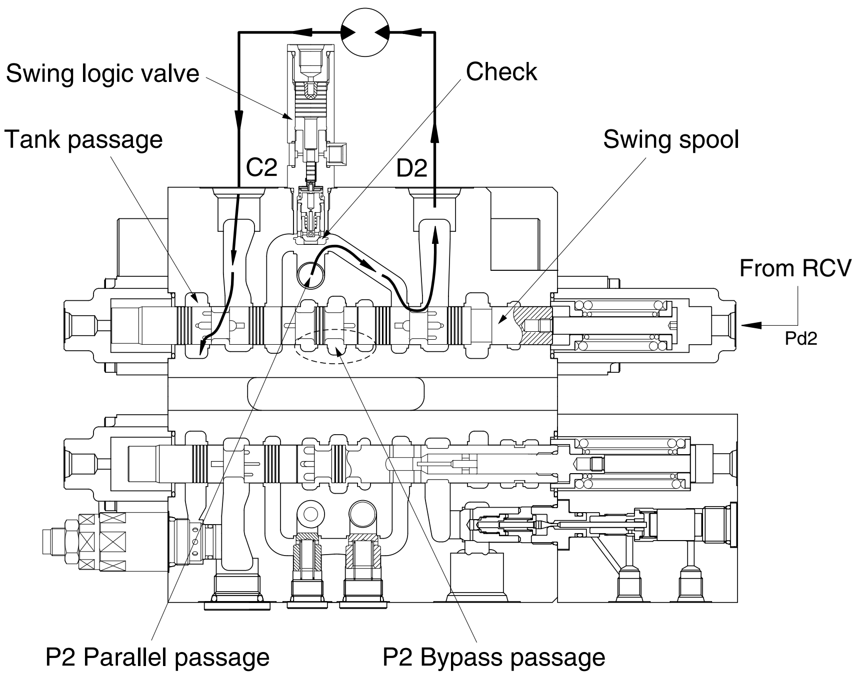
(1) SWING LEFT & RIGHT OPERATION

During the swing left operation, the pilot secondary pressure from the RCV is supplied to the port Pd2 of the spring side and shift the swing spool in left direction. The bypass passage is shut off by the movement of the swing spool and the hydraulic fluid from pump A1 flows into swing spool through the P2 parallel passage. Then it is directed to swing motor through the port D2.

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

In case of swing right operation, the operation is similar to swing left operation but the pilot secondary pressure from the RCV is supplied to the port Pc2 of the spring opposite side.

Accordingly, the hydraulic fluid from pump A1 flows into swing motor through the port C2 and returns to the hydraulic oil tank through the port D2 and the tank passage.

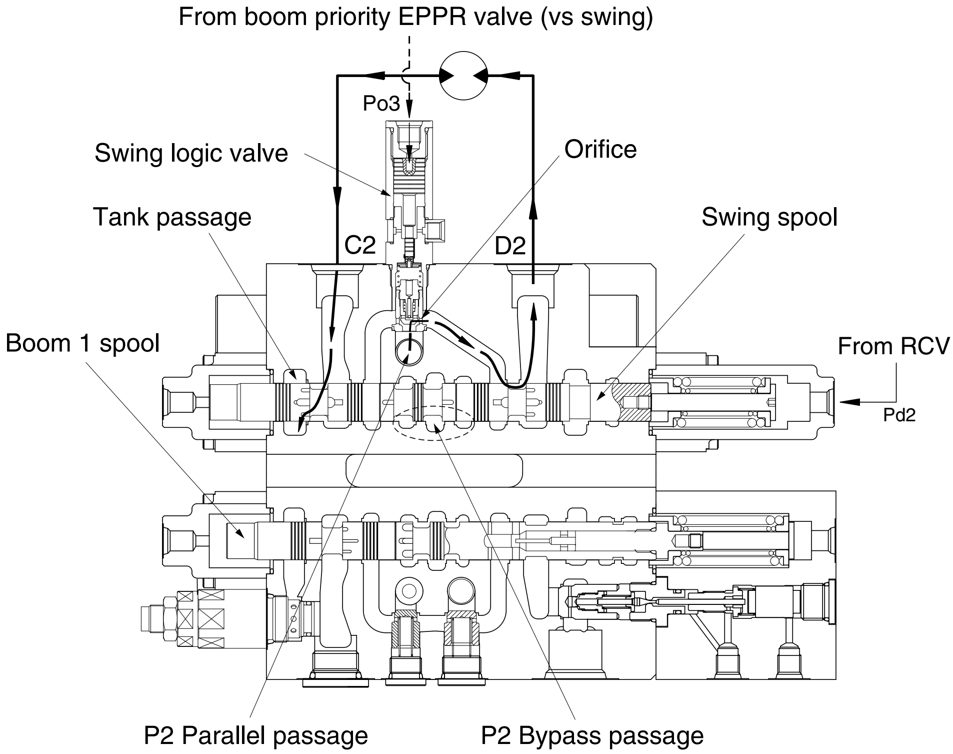


160A2MC28

(2) SWING LEFT OPERATION WITH BOOM OPERATION

When combined operation, mostly same as previous page but the fluid from P2 bypass passage is empty.

So only the fluid from parallel passage is supplied to the swing motor. Also, parallel passage is installed the orifice of swing logic valve for supplying the fluid from pump A1 to the boom operation prior to the swing operation. In case of the swing right operation with boom operation, operation is similar.



160A2MC29

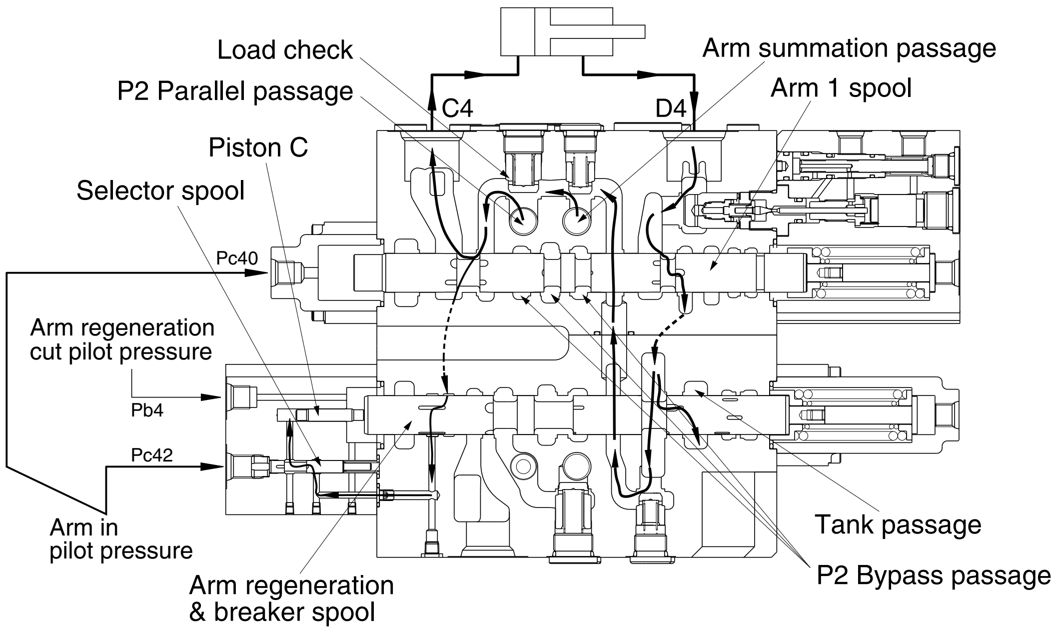
7) ARM OPERATION

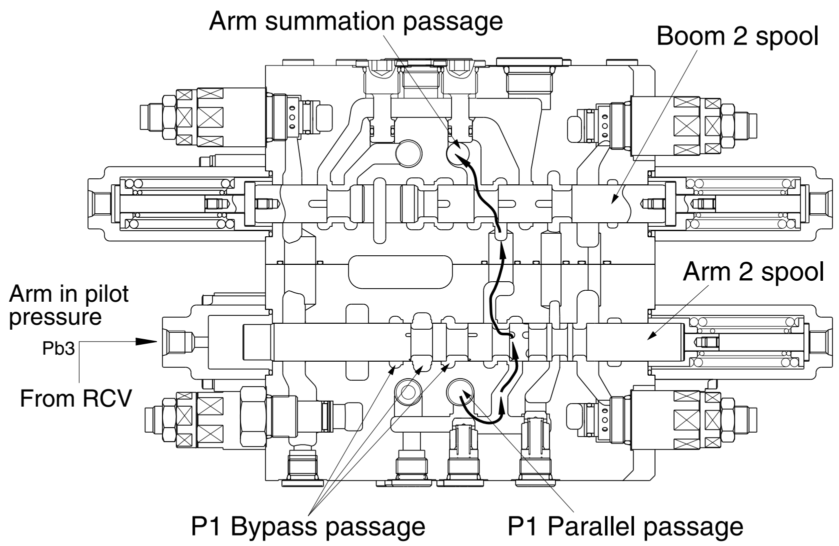
(1) ARM IN OPERATION

During arm in operation, the pilot secondary pressure from the RCV is supplied to the port Pc40 of spring opposite side and shifts arm 1 spool in the right direction.

The bypass passage is shut off by the movement of the arm 1 spool and the hydraulic oil from the pump A1 flows into the arm cylinder head side through P2 parallel passage, the load check valve, bridge passage and the port C4.

At same time, the pilot secondary pressure from the RCV is supplied to the port Pb3 of spring opposite side and shifts arm 2 spool in the right direction. The bypass passage is shut off by the movement of the arm 2 spool and the hydraulic fluid from the pump A2 flows into the arm summation passage through P1 parallel passage, the check valve, the arm 2 spool and the boom 2 spool. Then it entered the arm cylinder head side with hydraulic fluid from arm 1 spool.





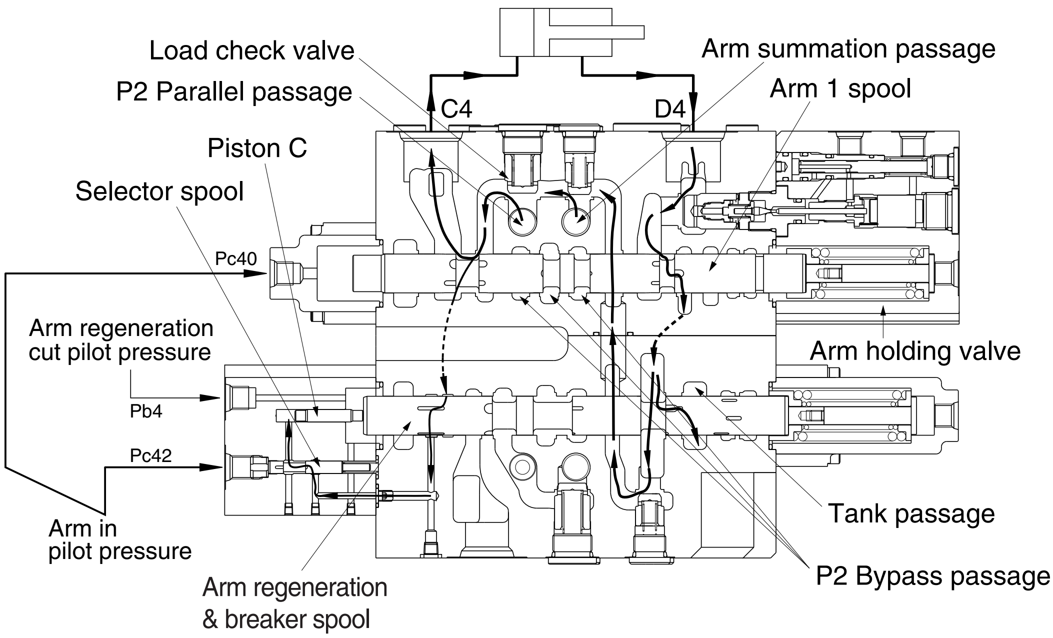
160A2MC30

ARM REGENERATION

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

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

Furthermore, the arm regeneration cut pressure is supplied to the port Pb4 of spring opposite side and arm regeneration spool is move into the right direction fully. The flow from the arm cylinder rod is returned to the hydraulic oil tank and regeneration function is not activated. (The return fluid is maximum condition)



1609A2MC22

(2) ARM OUT OPERATION

During arm out operation, the pilot secondary pressure from RCV is supplied to the port Pd40 of spring side and shifts arm 1 spool in the left direction.

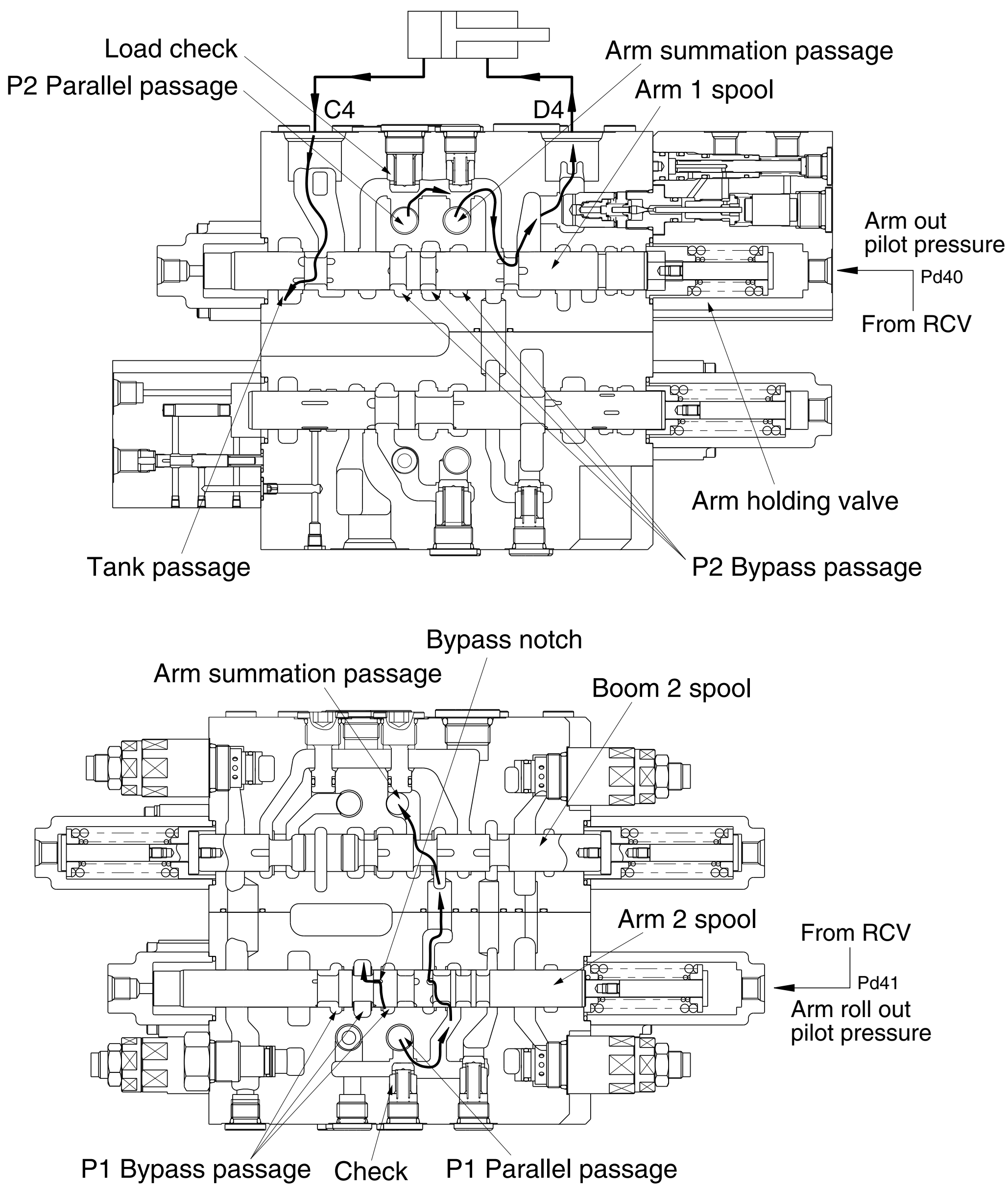
The bypass passage is shut off by the movement of the arm 1 spool and the hydraulic fluid from pump A1 flows into arm 1 spool through the P2 parallel passage. Then it enters into the arm cylinder rod side through the load check, bridge passage, arm holding valve and the port D4.

Also, the pilot secondary pressure from RCV is supplied to the port Pd41 of spring side and shifts arm 2 spool in the left direction.

The bypass passage is shut off by the movement of the arm 2 spool and some of the hydraulic fluid from pump A2 bypassed through bypass notch. The rest of hydraulic fluid from pump A2 flows into the arm summation passage through P1 parallel passage, the check valve, arm 2 spool and boom 2 spool.

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

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

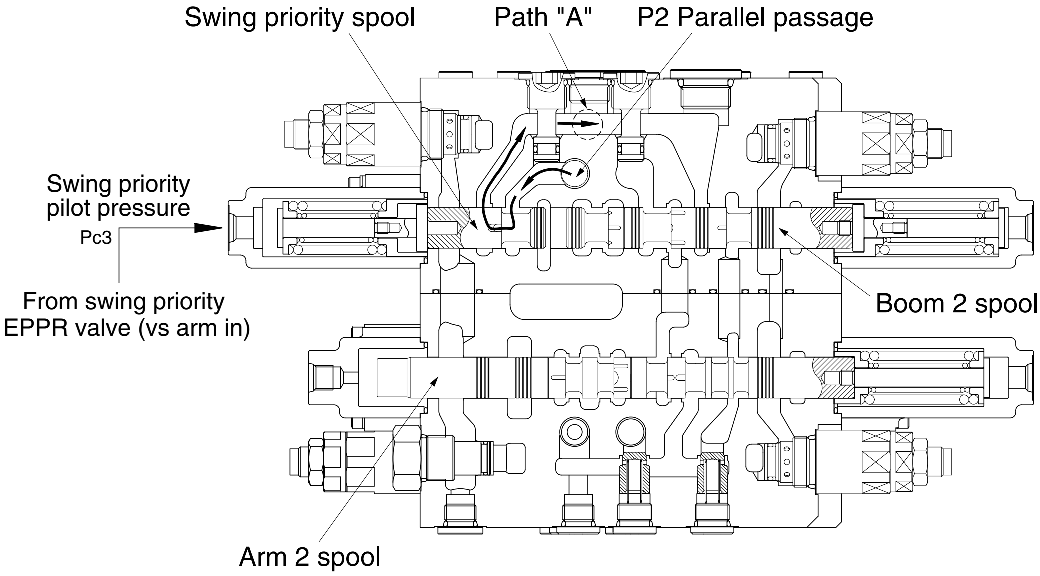


160A2MC31

8) SWING PRIORITY FUNCTION (VS ARM IN)

When the swing and arm in functions are operated simultaneously, the pilot secondary pressure from swing priority EPPR valve is supplied to the port Pc3 of the spring side of the swing priority spool and shift swing priority spool in the right direction.

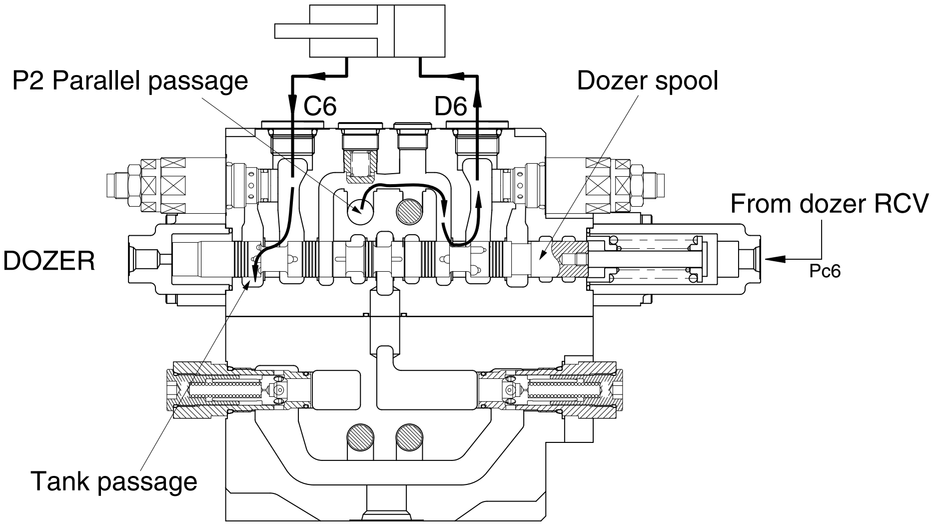
Then, the fluid from pump A1 flows to swing side more then the boom 2, arm 1, option B and dozer spools to make the swing operation most preferential.



160A2MC32

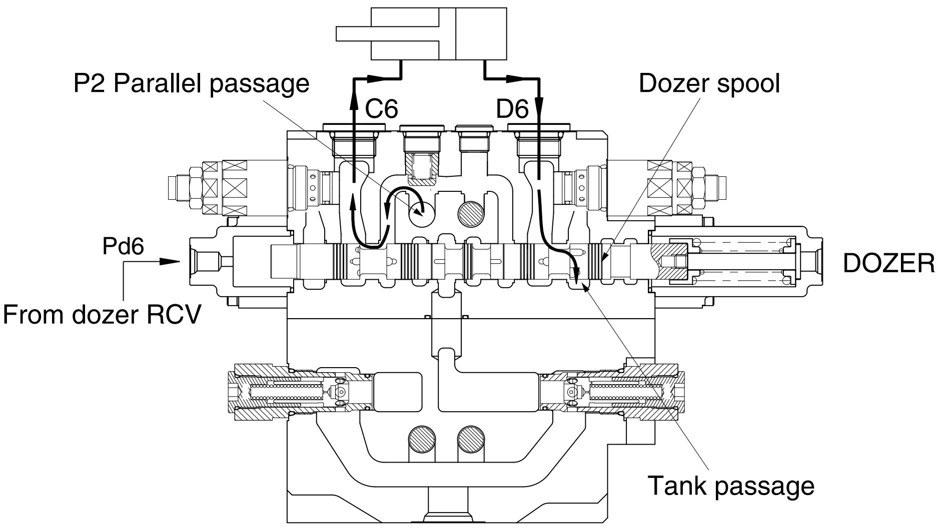
9) DOZER OPERATION

(1) Dozer down operation



160A2MC33

(2) Dozer up operation



160A2MC34

During the dozer down operation, the pilot pressure from the dozer control valve is supplied into the port Pc6 of the spring side and it shifts the dozer spool in the left direction.
The hydraulic fluid from the pump A1 enters the parallel passage and is direction to the head side of the dozer cylinder through port D6.
The return flow from the rod side of the dozer cylinder returns to the dozer spool through C6 port. Thereafter it is directed to the hydraulic tank through tank passage.
In case of the dozer up operation, operation is similar.

10) NEGATIVE RELIEF VALVE OPERATION

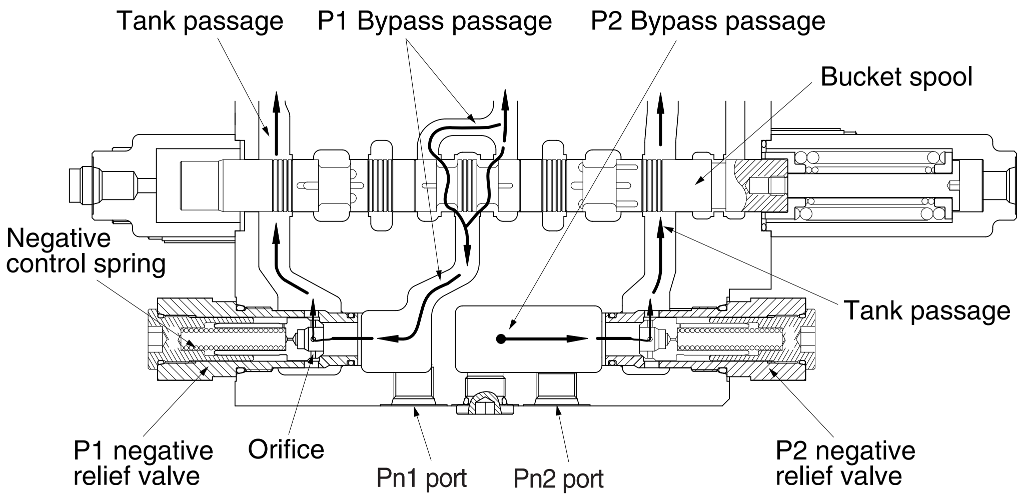
When no function is being actuated on P1 side, the hydraulic fluid from the pump A2, flows into the tank passage through the P1 bypass passage and orifice. The restriction caused by this orifice thereby pressurizes. This pressure is transferred as the negative control signal pressure Pn1 to the pump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

It controls the pump regulator so as to minimize the discharge of the pump A2.

The bypass passage is shut off when the shifting of one or more spools and the flow through bypass passage became zero. The pressure of negative control signal becomes zero and the discharge of the pump A2 becomes maximum.

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

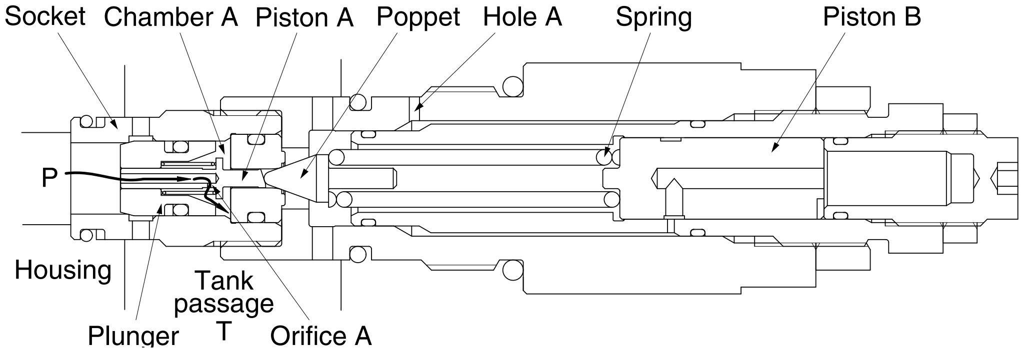
For the pump A1 the same negative control principle.



14W92MC28

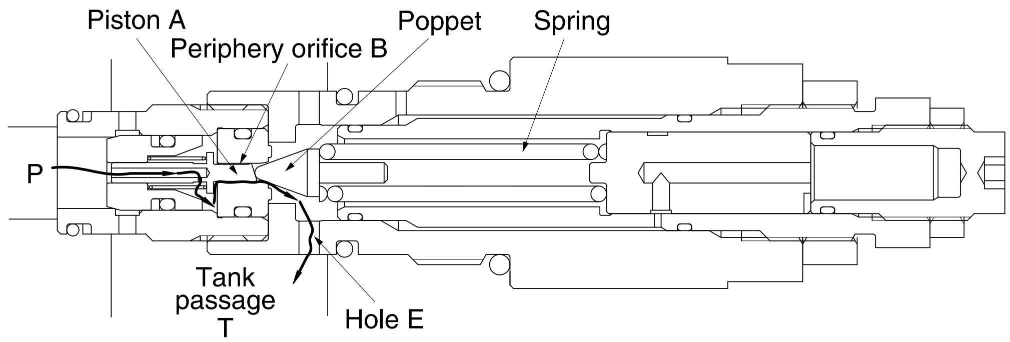
11) OPERATION OF MAIN RELIEF VALVE

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



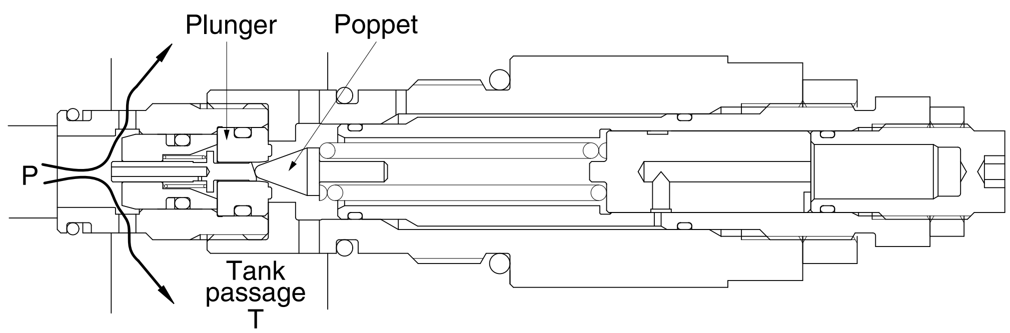
14W92MC36

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



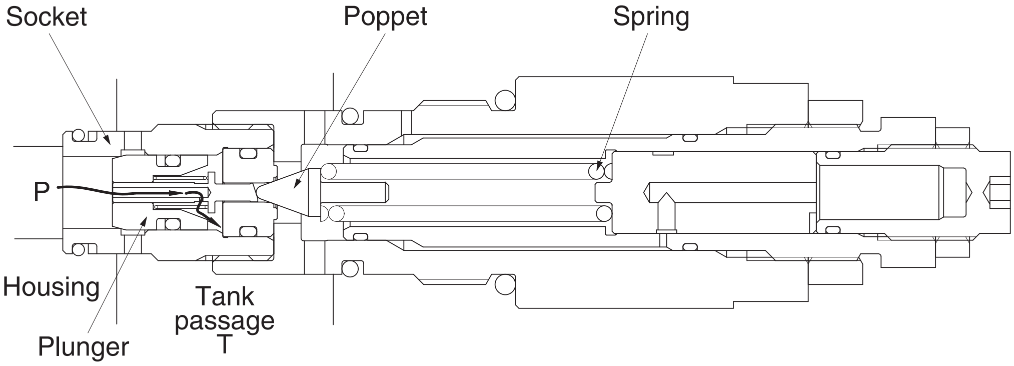
14W92MC37

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



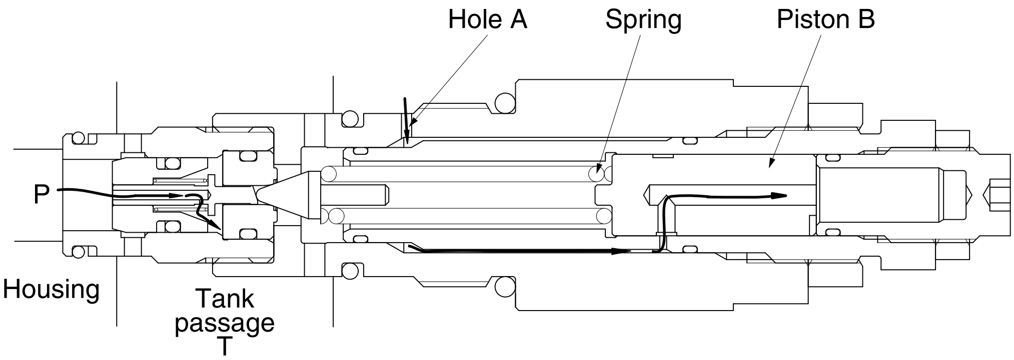
14W92MC38

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



14W92MC39

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

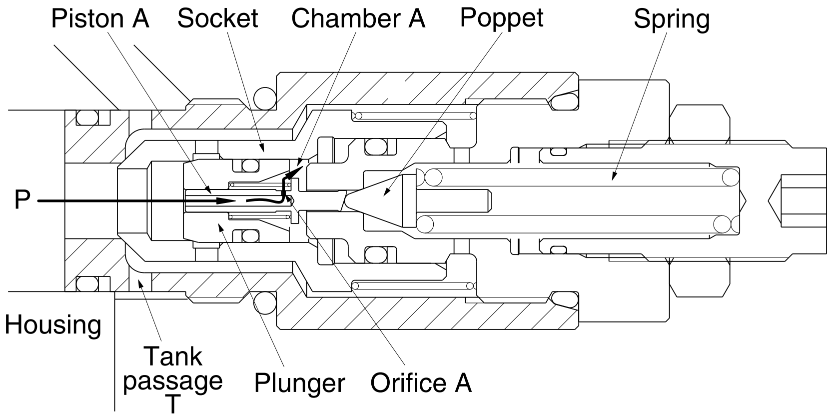


14W92MC40

12) OPERATION OF OVERLOAD RELIEF VALVE

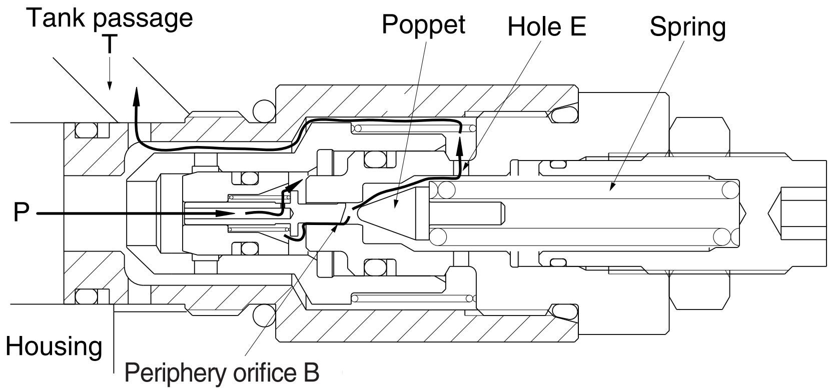
FUNCTION AS RELIEF VALVE

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



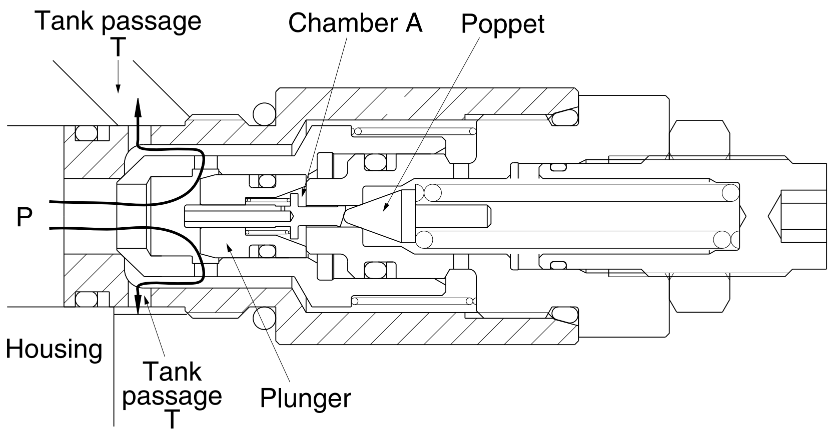
14W92MC41

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



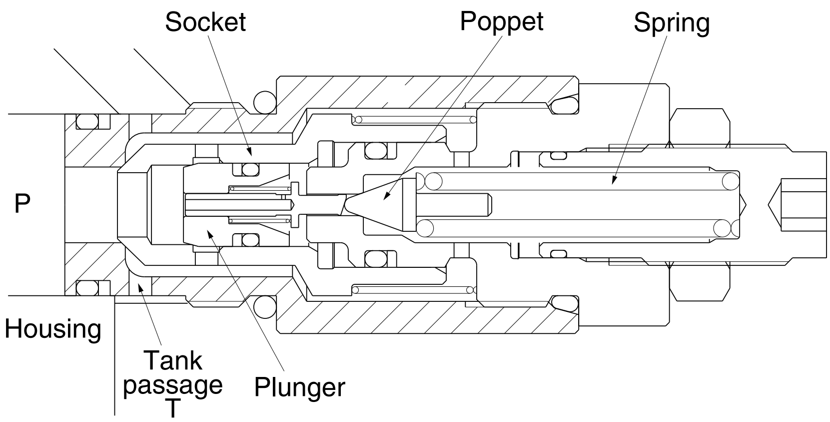
14W92MC42

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



14W92MC43

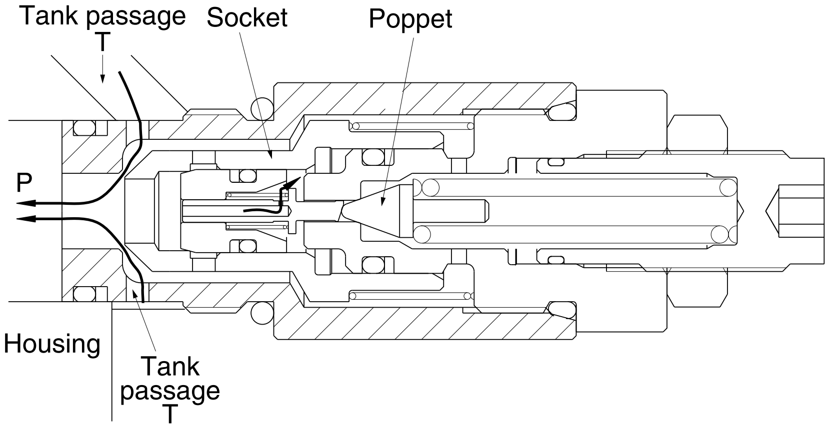
(4) The pressure at port P becomes lower than set pressure of the spring, the poppet is seated by spring force. Then the pressure at port P becomes equal to set pressure of the spring and the plunger is seated to the socket.



14W92MC44

MAKE-UP FUNCTION

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



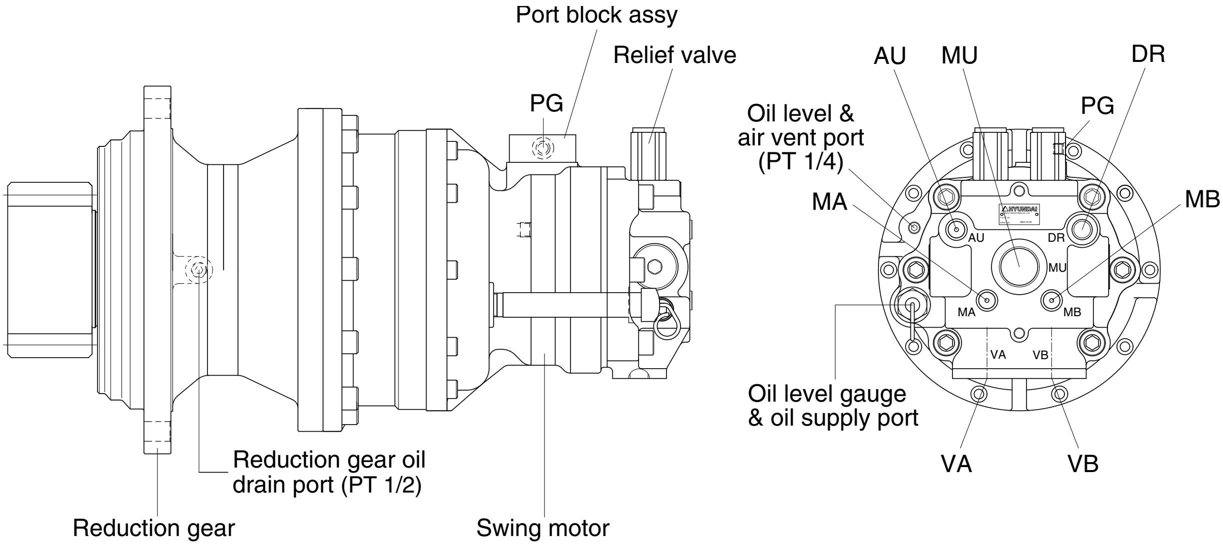
14W92MC45

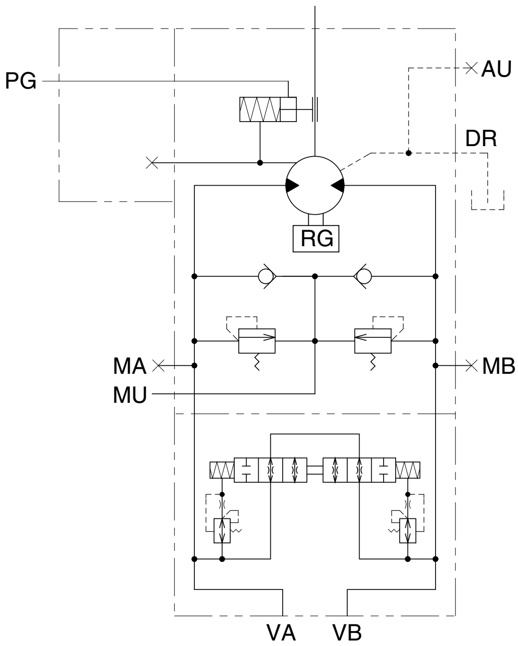
GROUP 3 SWING DEVICE

1. STRUCTURE

Swing device consists swing motor and swing reduction gear.

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



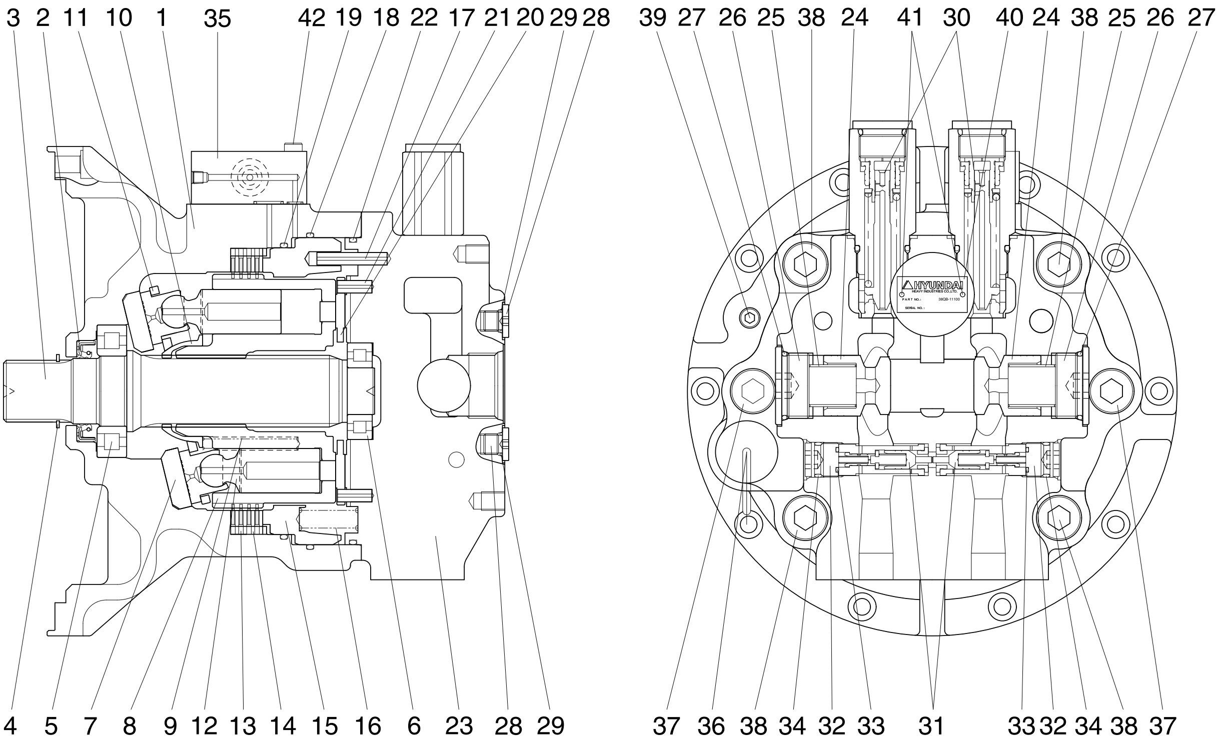


Hydraulic circuit

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

160A2SM01

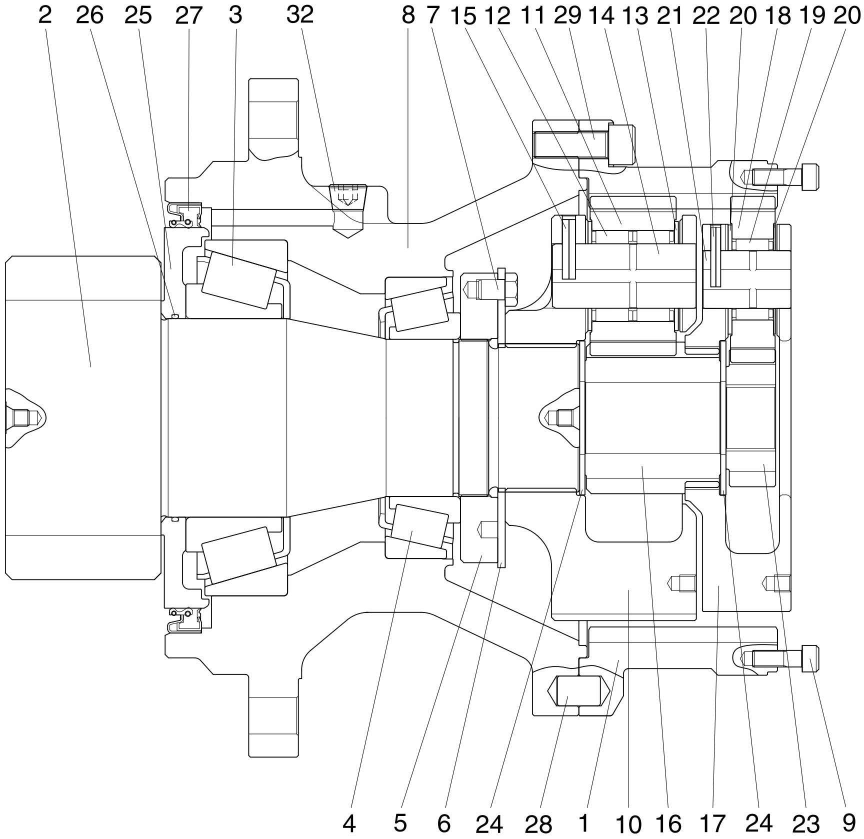
1) SWING MOTOR



160A2SM02

1	Casing	15	Parking piston	29	O-ring
2	Oil seal	16	Brake spring	30	Relief valve assy
3	Shaft	17	Spring pin	31	Anti-rotation 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 assy
9	Spring	23	Valve casing	37	Socket bolt
10	Ball guide	24	Check valve	38	Socket bolt
11	Retainer plate	25	Spring	39	Plug
12	Piston assy	26	Plug	40	Name plate
13	Friction plate	27	O-ring	41	Rivet
14	Separate plate	28	Plug	42	Hex socket bolt

2) REDUCTION GEAR



160A2SM03

1	Ring gear	11	Planetary gear 2	21	Carrier pin 1
2	Drive shaft	12	Needle bearing 2	22	Spring pin 1
3	Taper roller bearing	13	Thrust washer 2	23	Sun gear 1
4	Taper roller bearing	14	Carrier pin 2	24	Thrust plate
5	Ring nut	15	Spring pin 2	25	Sleeve
6	Lock plate	16	Sun gear 2	26	O-ring
7	Hexagon bolt	17	Carrier 1	27	Oil seal
8	Casing	18	Planetary gear 1	28	Parallel pin
9	Socket bolt	19	Needle bearing 1	29	Socket bolt
10	Carrier 2	20	Thrust washer 1	32	Plug

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 (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).

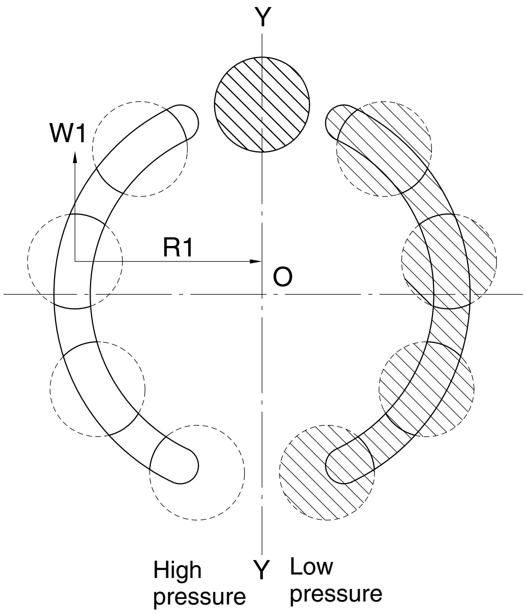
The high hydraulic can generate the force, F1=P×A (P : supplied pressure, A : water pressure area), like following pictures, working on a piston.

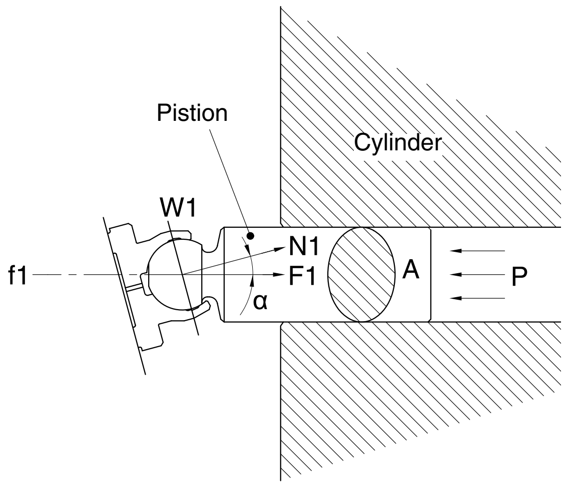
This force, F1, is divided as N1 thrust partial pressure and W1 radial partial pressure, in case of the plate of a tilt angle, α.

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.





235ZF8TM05

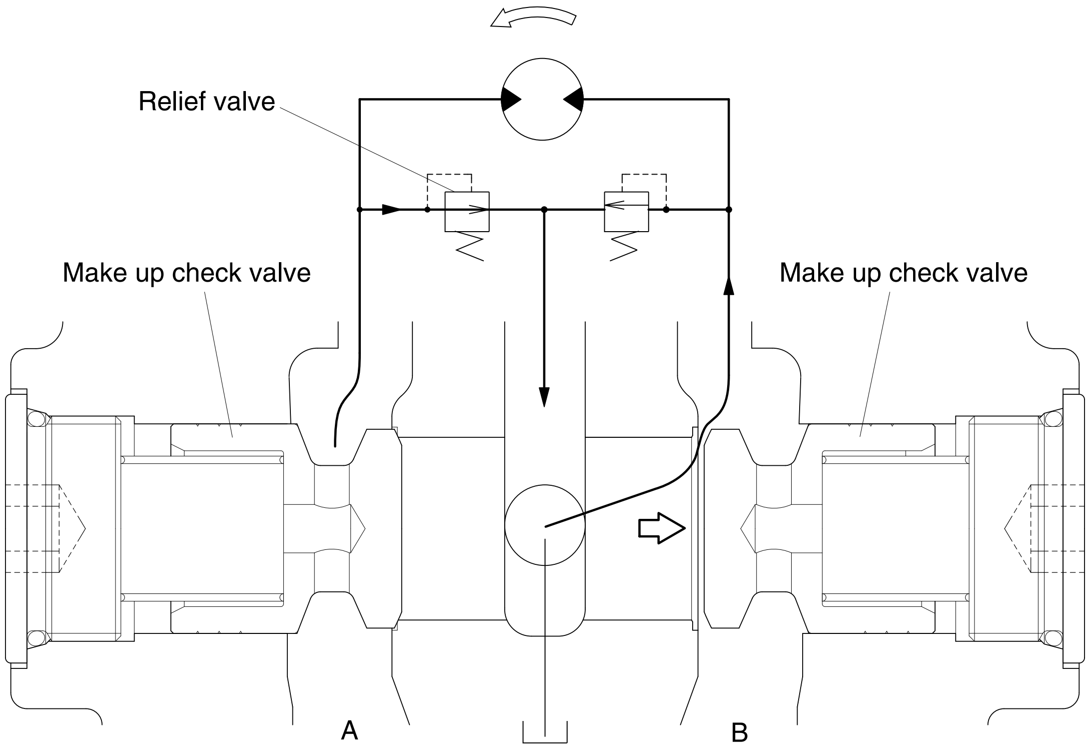
2) MAKE UP VALVE

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.

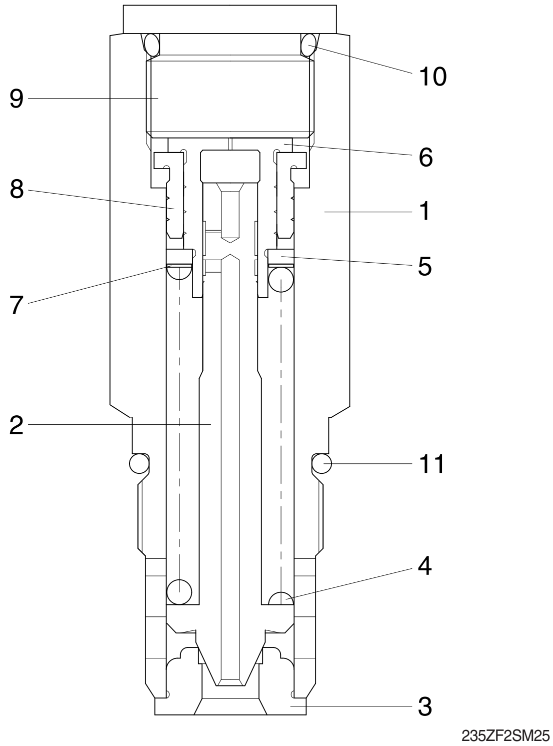
Pressurized oil into the port B, the motor rotate counterclockwise.

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.



235ZF2SM04

3) RELIEF VALVE



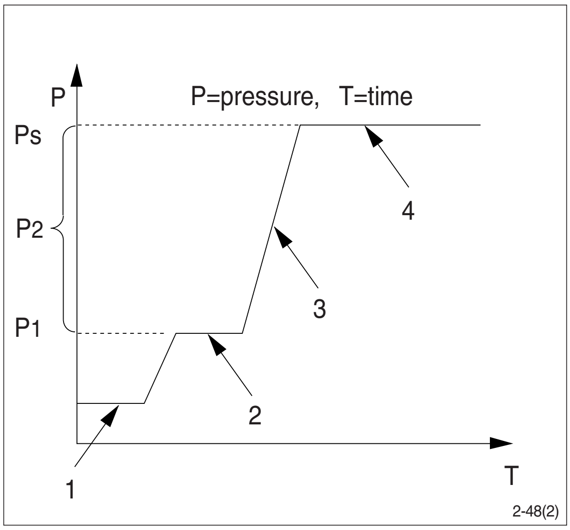
1	Sleeve
2	Poppet
3	Poppet seat
4	Spring
5	Spring seat
6	Shim
7	Piston
8	Stopper
9	Plug
10	O-ring
11	O-ring

(1) Construction of relief valve

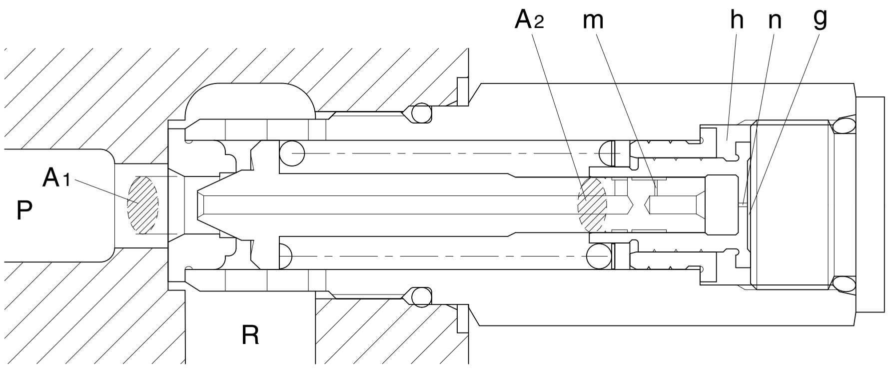
The valve casing contains two cartridge type relief valves that stop the regular and reverse rotations of the hydraulic motor. The relief valves relieve high pressure at start or at stop of swing motion and can control the relief pressure in two steps, high and low, in order to insure smooth operation.

(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.

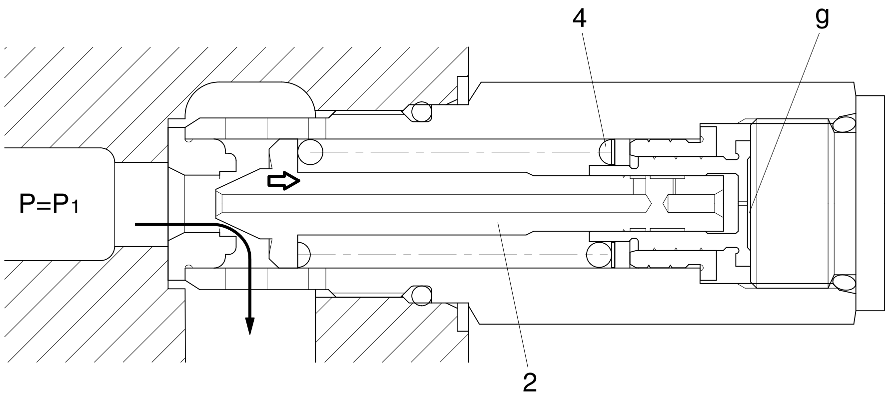


235ZF2SM26

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.

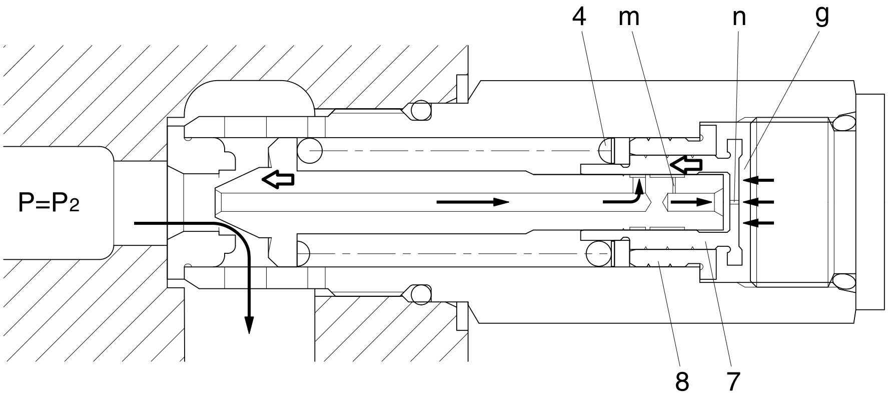
$P_1 \times A_1 = Fsp + Pg \times A_2$

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



235ZF2SM27

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).

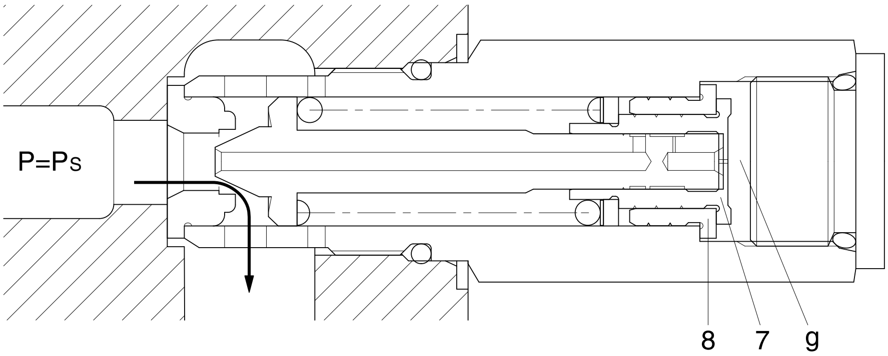


235ZF2SM28

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).

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

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



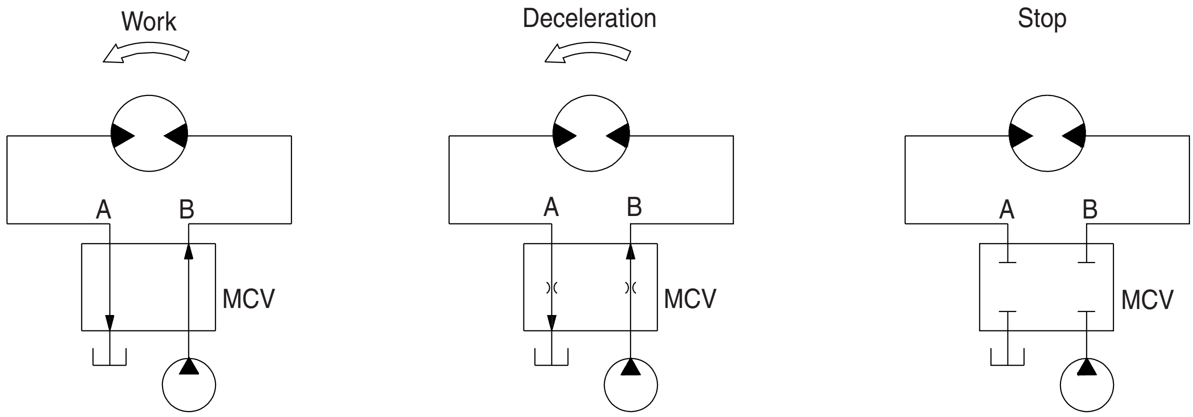
235ZF2SM29

4) BRAKE SYSTEM

(1) Control valve swing brake system

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

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



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

2-48(1)

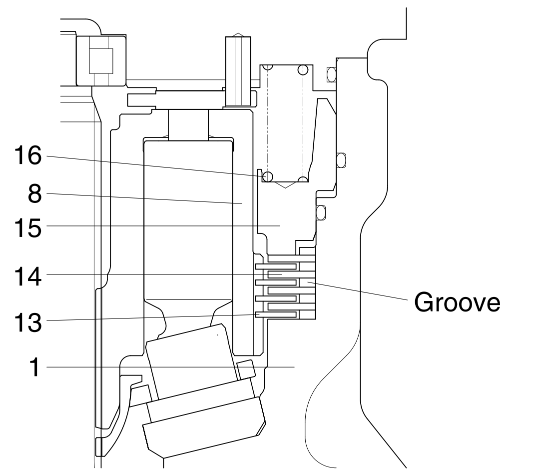
(2) Mechanical swing parking brake system

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

① **Brake assembly**

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

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



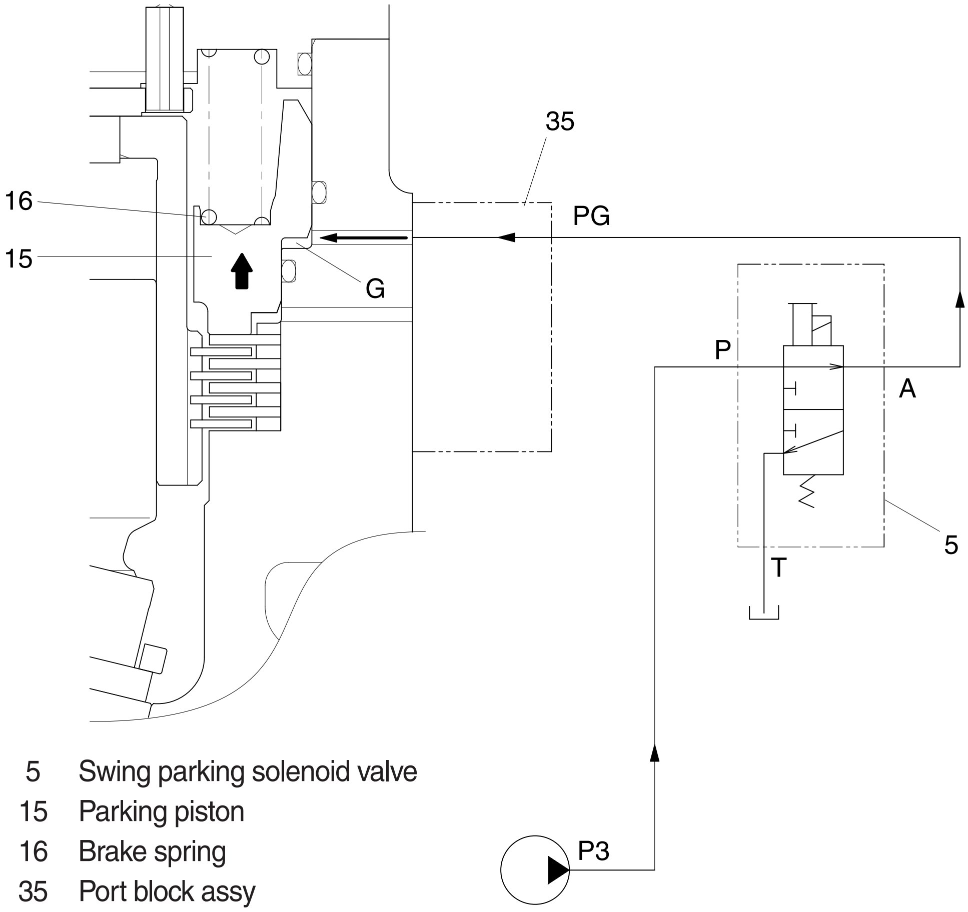
235ZF2SM35

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 brake 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
35 Port block assy

160A2SM10

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.

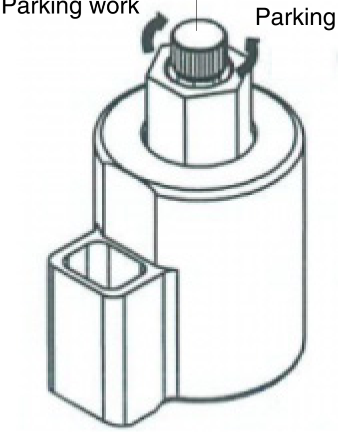
※ Manual override solenoid valve

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.

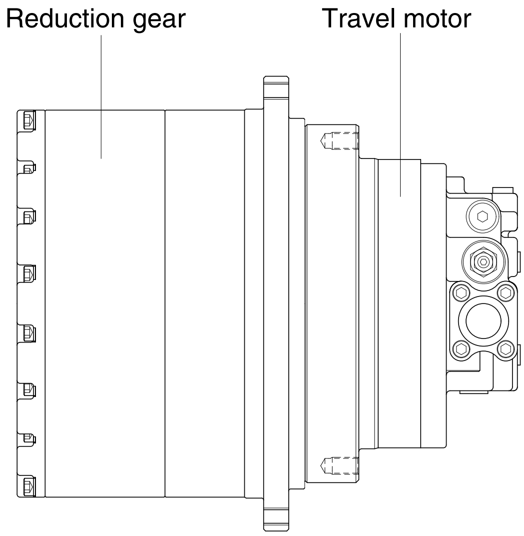


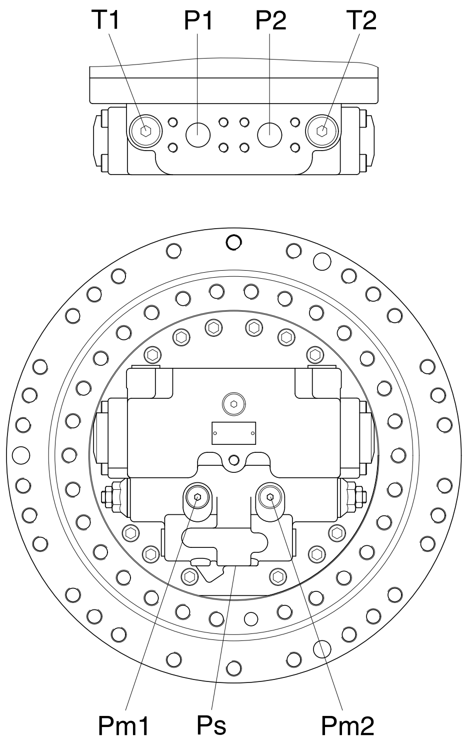
GROUP 4 TRAVEL DEVICE

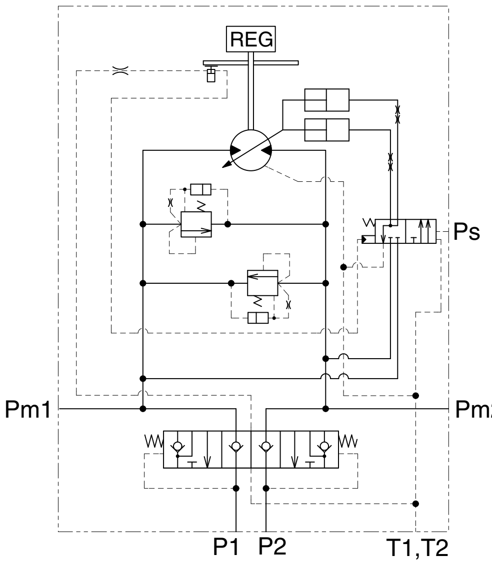
1. STRUCTURE

A Hydraulic motor includes followings.

- · Part of rotary generating turning force
- · Part of a valve of relief
- · Part of Brake
- · Part of a valve of counterbalance
- · Part of flowing changeover
- · Part of auto changeover





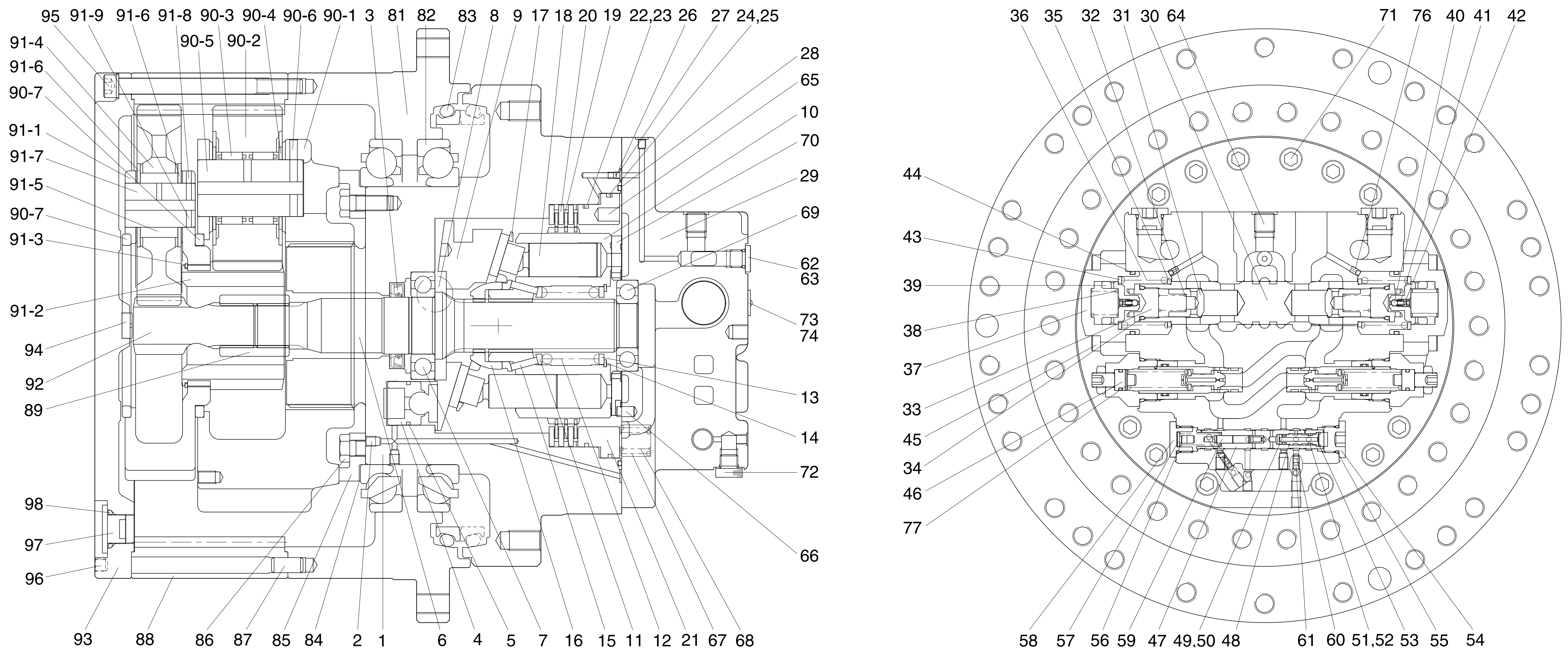


Hydraulic circuit

Port	Port name	Port size
P_1, P_2	Main port	SAE 4694 psi 1"
Pm_1, Pm_2	Gauge port	PF 1/4
T_1, T_2	Drain port	PF 1/2
Ps	2 speed control port	PF 1/4

160F2TM01

1) STRUCTURE



16092TM02

1	Shaft casing	20	Separate plate	39	Spool	58	Plug	77	Shim	91-1	Carrier No.1
2	Plug	21	Parking piston	40	Steel ball	59	Spool	81	Housing	91-2	Sun-gear No.2
3	Oil seal	22	O-ring	41	Spring	60	Orifice	82	Main bearing	91-3	Retaining ring
4	Swash piston	23	Back up ring	42	Plug	61	Orifice	83	Floating seal	91-4	Planetary gear No.1
5	Piston ring	24	O-ring	43	Spring seat	62	Plug	84	Shim	91-5	Needle bearing No.1
6	Shaft	25	Back up ring	44	O-ring	63	O-ring	85	Retainer	91-6	Thrust washer
7	Bearing	26	Orifice	45	Wrench bolt	64	Plug	86	Hex head bolt	91-7	Pin No.1
8	Steel ball	27	O-ring	46	Relief valve assy	65	Pin	87	Parallel pin	91-8	Spring pin
9	Swash plate	28	O-ring	47	Spool	66	Pin	88	Ring gear	91-9	Spring pin
10	Cylinder block	29	Rear cover	48	Guide	67	Spring	89	Coupling	92	Sun gear No.1
11	Spring seat	30	Spool	49	O-ring	68	Spring	90	Carrier assy No.2	93	Cover
12	Spring	31	Check	50	Back up ring	69	Bearing	90-1	Carrier No.2	94	Pad
13	End plate	32	Spring	51	O-ring	70	Valve plate	90-2	Planetary gear No.2	95	Hex socket head bolt
14	Snap ring	33	Plug	52	Back up ring	71	Wrench bolt	90-3	Needle bearing No.2	96	Hex socket Screw
15	Pin	34	O-ring	53	Snap ring	72	Plug	90-4	Thrust washer	97	Hydraulic plug
16	Ball guide	35	Spring seat	54	plug	73	Name plate	90-5	Pin No.2	98	O-ring
17	Set plate	36	Spring	55	O-ring	74	Rivet	90-6	Spring pin	99	Name plate
18	Piston assy	37	Cover	56	Spring	75	Seal kit	90-7	Thrust ring		
19	Friction plate	38	Spring	57	Spring seat	76	Orifice	91	Carrier assy No.1		

2. PRINCIPLE OF DRIVING

2.1 Generating the turning force

The high hydraulic supplied from a hydraulic pump flows into a cylinder block (10) through rear cover (29) of motor, and valve plate (70).

The high hydraulic is built as flowing on one side of Y-Y line connected by the upper and lower sides of piston assy (18).

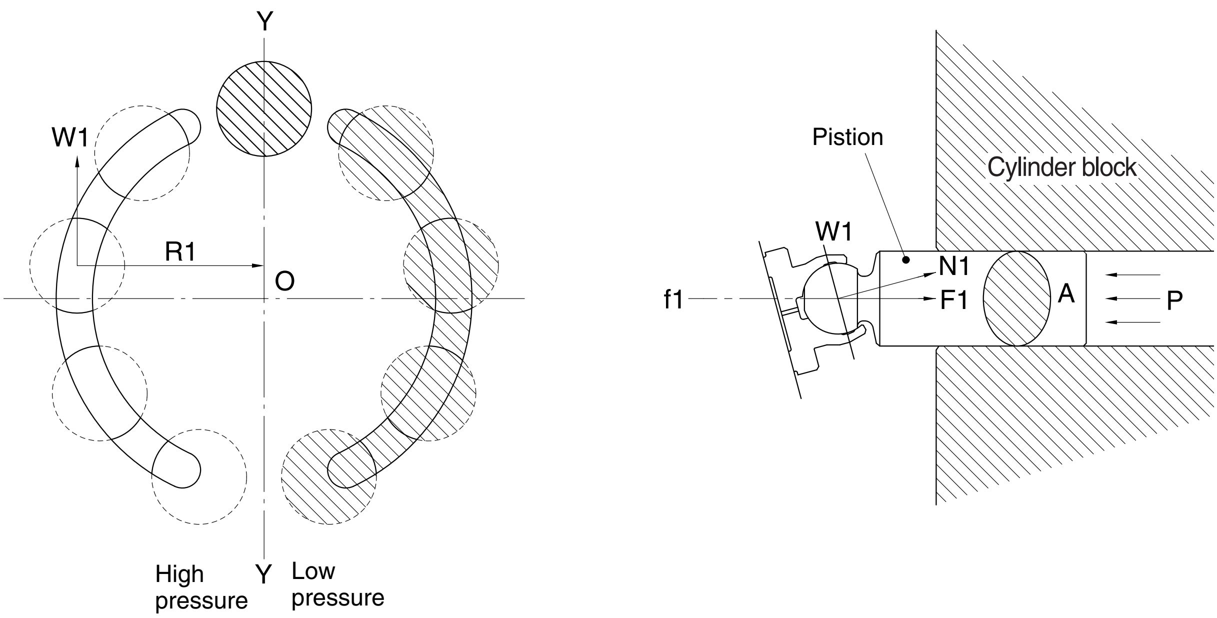
The high hydraulic can generate the force, F1 = P$\times$A (P : supplied pressure, A : water pressure area), like following pictures, working on a piston.

This force, F1, is divided as N1 thrust partial pressure and W1 radial partial pressure, in case of the plate (09) of a tilt angle, α.

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

The sum of torque (ΣW1$\times$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 block (10) through a piston; because a cylinder block is combined with a turning axis and spline, a turning axis rotates and a turning force is sent.



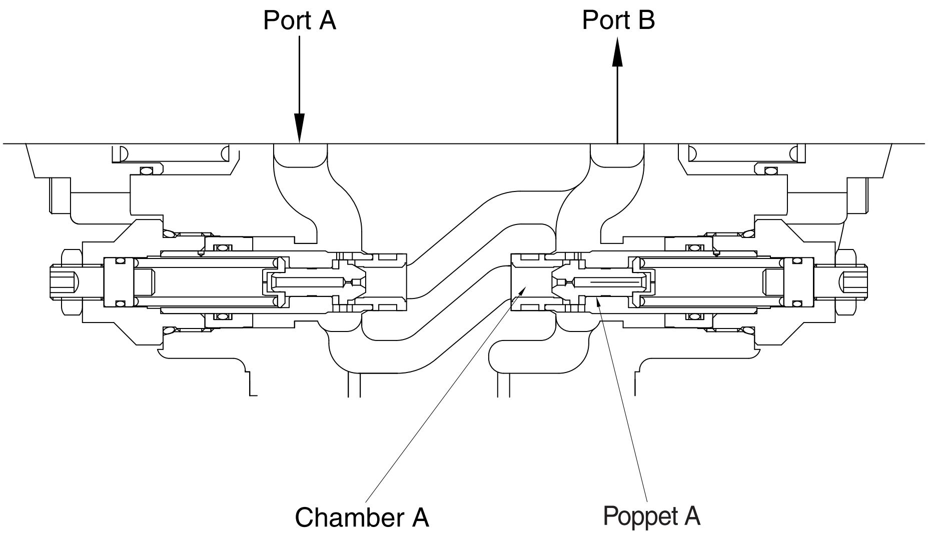
21078TM05

2.2 Working of relief valve

Relief valve carries on two functions of followings.

1) It standardizes a pressure in case of driving a hydraulic motor ; bypasses and extra oil in a motor inlet related to acceleration of an inertia to an outlet.

2) In case of an inertia stopped, it forces an equipment stopped, according to generating the pressure of a brake on the projected side.
Room A is always connected with port A of a motor. If the pressure of port is increased, press poppet A. And if it is higher than the setting pressure of a spring, the oil of an hydraulic flows from room A to port B, because poppet A is detached from the contact surface of seat A.



21078TM06A

2.3 Working of negative brake

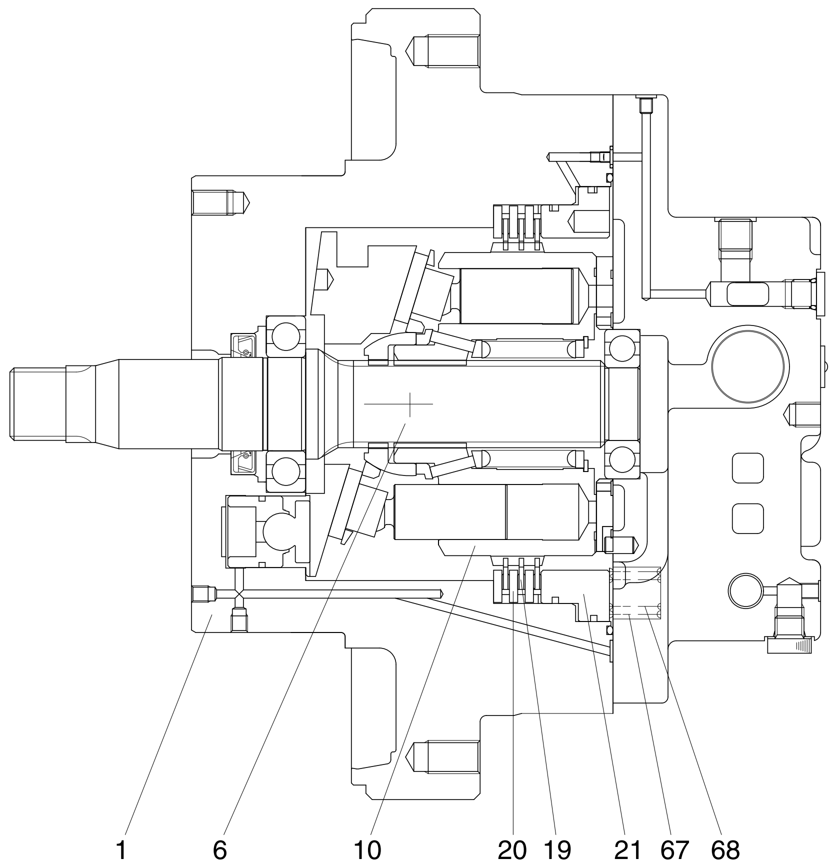
When the operating pressure is supplied to the brake piston (21) through the spool (simultaneous peripheral operation online) built in the shaft casing (1), the negative brake is released.

When the pressure does not work, the brake always runs.

The force of a brake is generated by the frictional force among a separate plate (20) fixed by shaft casing, parking piston (21) and a frictional plate (19) connected through spline outside a cylinder block (10).

When a pressure does not work on the part of piston, brake spring presses brake piston; oil in a brake room flows into the drain of a motor through an orifice; in that time, brake piston compresses a frictional plate and a detached plate in the middle of shaft casing (1) and brake piston (21) according to the force that presses 10 pieces of brake springs (67, 68); finally, it makes a frictional force.

This frictional force helps the brake fixing a turning shaft (6) connected by a cylinder and spline operated.

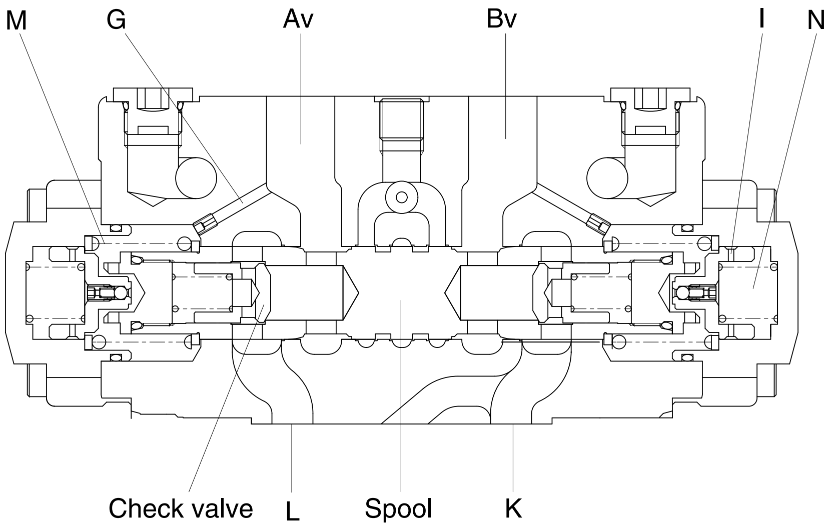


21092TM07

2.4 Counterbalance valve

Av port is connected to a hydraulic pump; Bv port is connected to a tank.

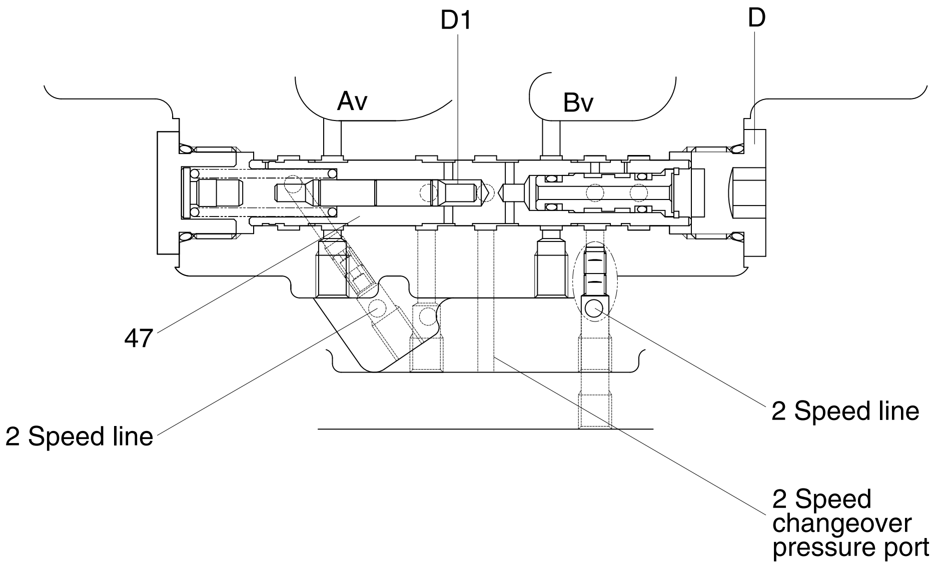
An oil supplied from a hydraulic pump presses check valve and flows into L port. It makes a hydraulic motor circulated. The oil pressure out of a pump is increased and transferred to spring room M through the path G because negative brake is working on. When the pressure of room M exceeds the force of spring that keeps spool at its neutral position, the spool begins to move the right side.
An oil in room N is sent to room M by orifice I and discharged from G line to a tank.
Then the spool moves to the right and the oil flows from K to Bv.



21078TM08

2.5 Working description of automatic switch (at normal speed)

Due to no pressure on pilot now, spool (47) is not working.



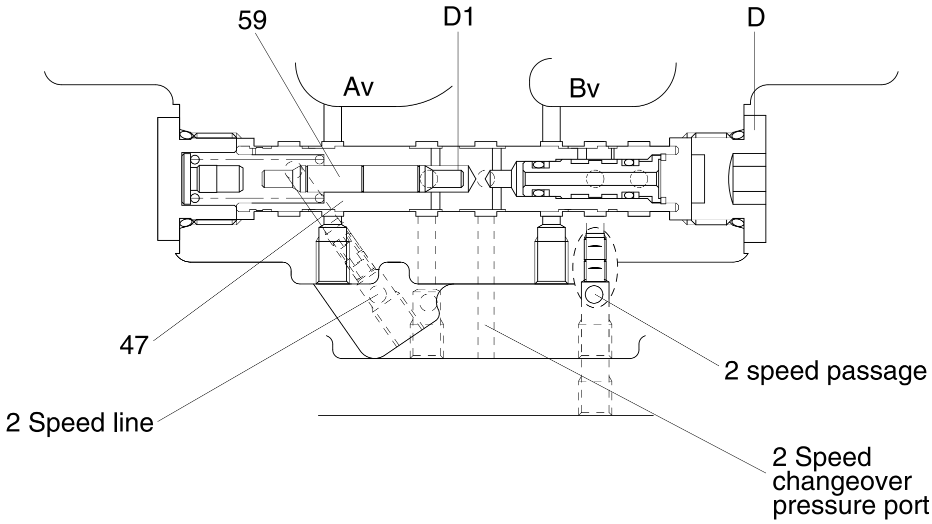
(Normal speed)

21078TM09

2.6 Working description of automatic switch (at high speed)

At normal speed, once the hydraulic oil which is through the inner path of spool (47) flows into high speed switching pressure port (the pressure of external pilot : Pi = 35 kgf/cm^2) spool (47) moves from right to left.

At high speed, turning pressure of motor (D1) is over 250 kgf/cm^2, when the power forcing to spool (59) (pressure, P1) is stronger than spool (47) and spool (59) is pushed out, after then spool (47) moves from left to right. So it is switched.



(High speed)

21078TM10

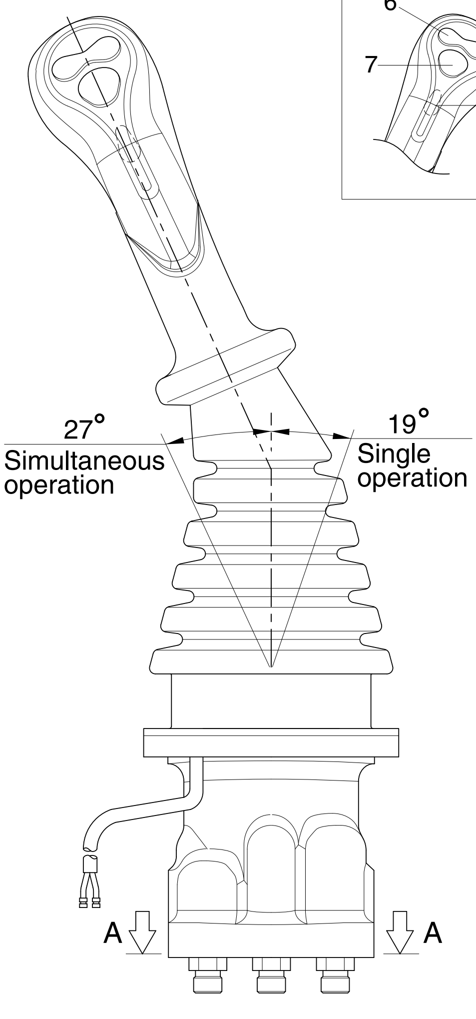
GROUP 5 RCV LEVER

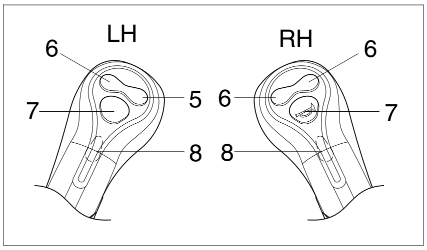
1. STRUCTURE

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

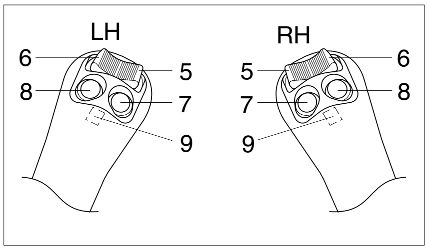
※ **Refer to the parts manual for the types of the RCV lever.**

1) TYPE M1, M10





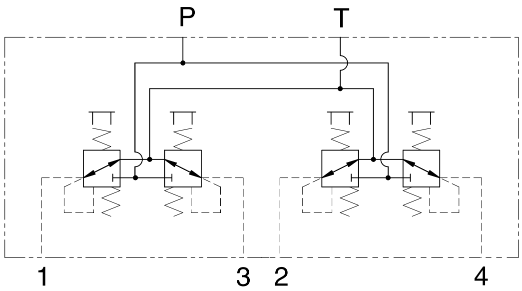
TYPE M1



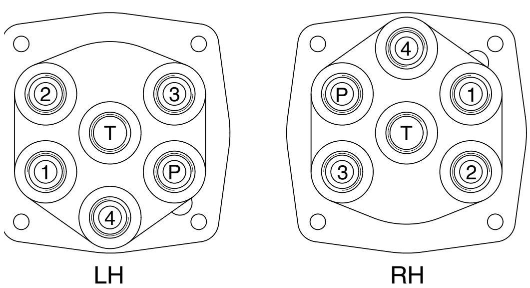
TYPE M10

Switches

Type	No.	LH	RH
M1	5	Null	Null
	6	Null	Null
	7	One touch decel	Horn
	8	Power boost	Breaker
M10	5	CW rotation	2-way open
	6	CCW rotation	2-way close
	7	One touch decel	Null
	8	Null	Horn
	9	Power boost	Breaker



Hydraulic circuit



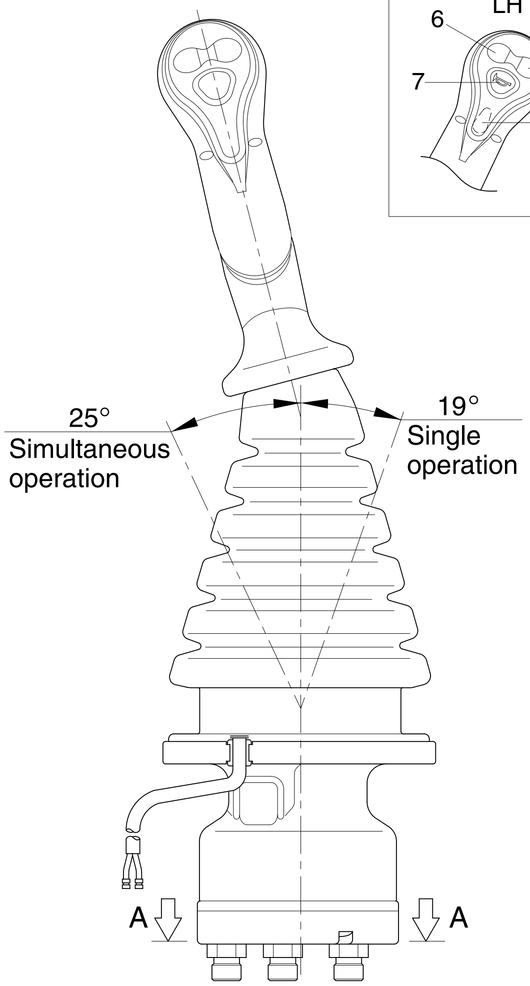
VIEW A-A

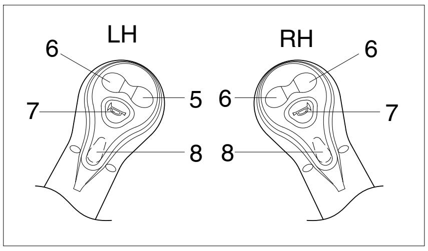
Pilot ports

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

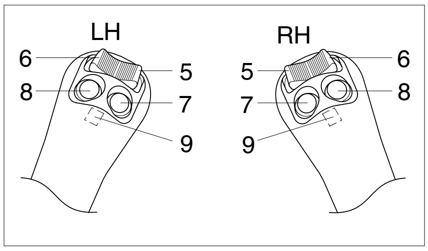
160A2RL01

2) TYPE M11, M12





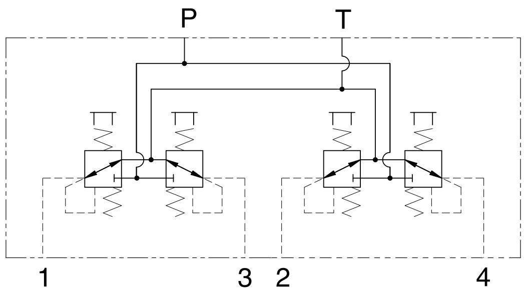
TYPE M12



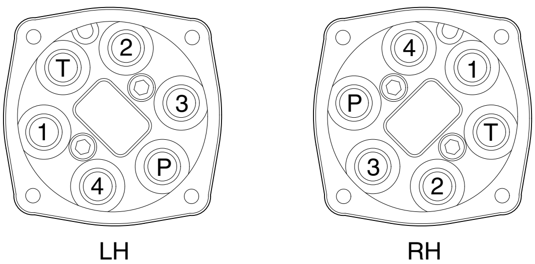
TYPE M11

Switches

Type	No.	LH	RH
M12	5	Null	Null
	6	Null	Null
	7	One touch decel	Horn
	8	Power boost	Breaker
M11	5	CW rotation	2-way open
	6	CCW rotation	2-way close
	7	One touch decel	Null
	8	Null	Horn
	9	Power boost	Breaker



Hydraulic circuit



VIEW A-A

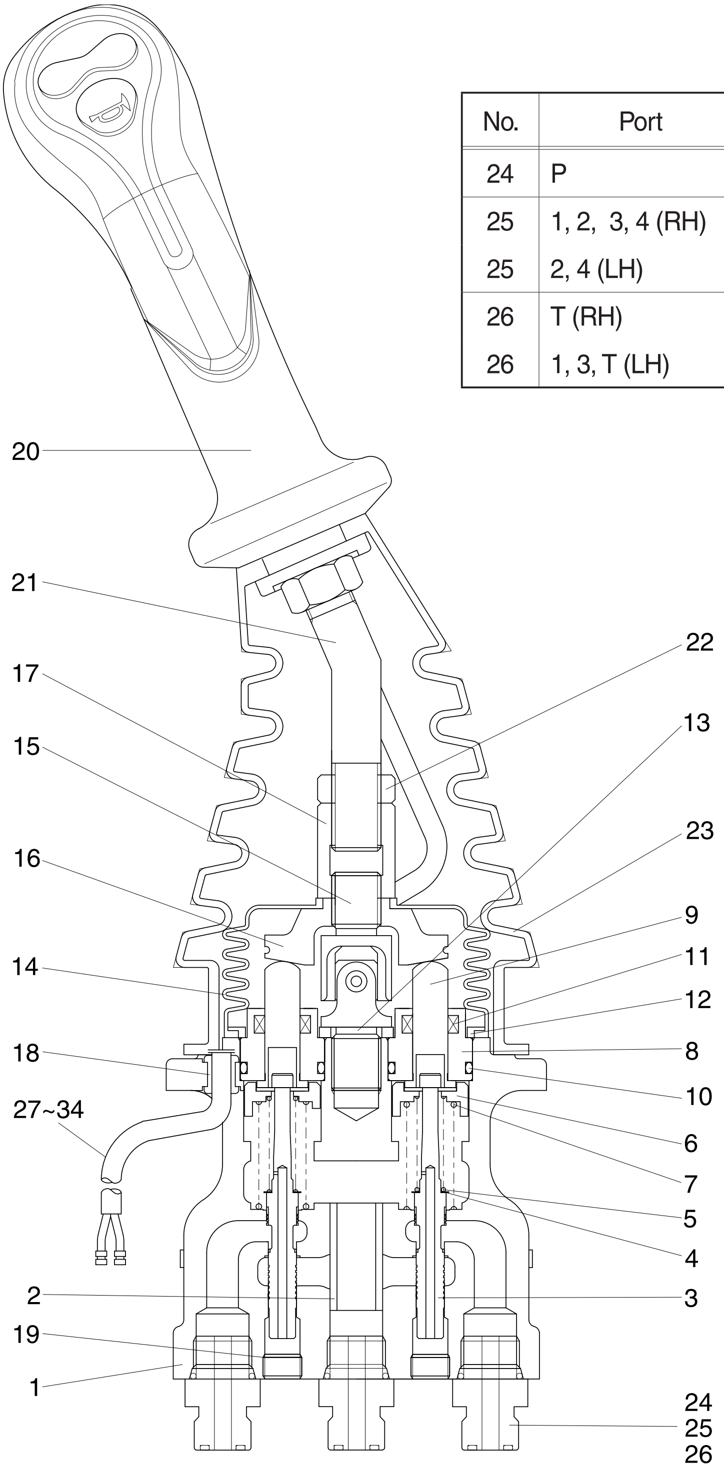
Pilot ports

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

160A2RL05

3) CROSS SECTION

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



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

210S2RL06

Item numbers are based on the type M1.

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

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

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

2. FUNCTIONS

1) FUNDAMENTAL FUNCTIONS

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

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

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

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

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

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

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

2) FUNCTIONS OF MAJOR SECTIONS

Item numbers are based on the type M1.

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

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

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

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

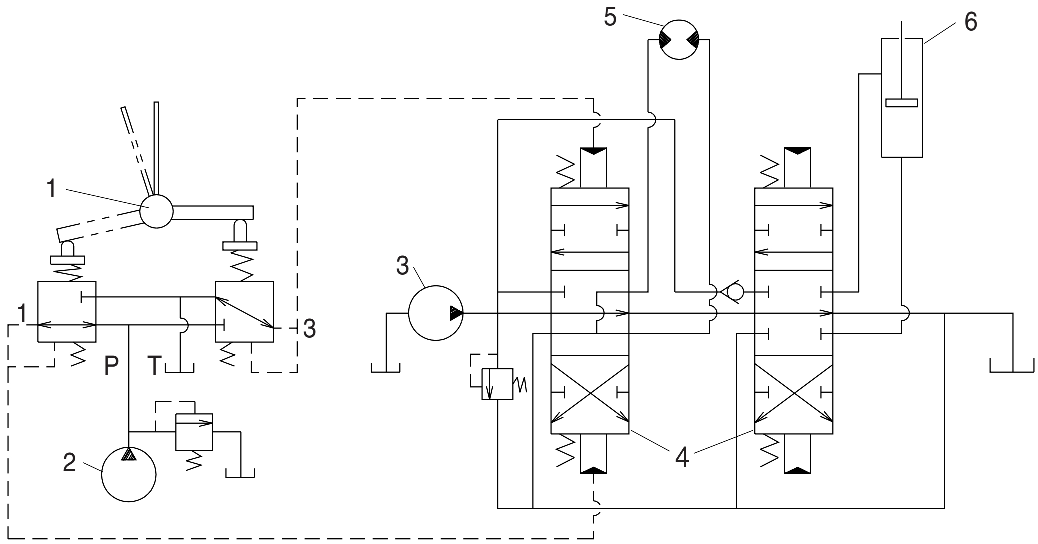
The spring (7) works on the case (1) and spring seat (6) and tries to return the push rod (9) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

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

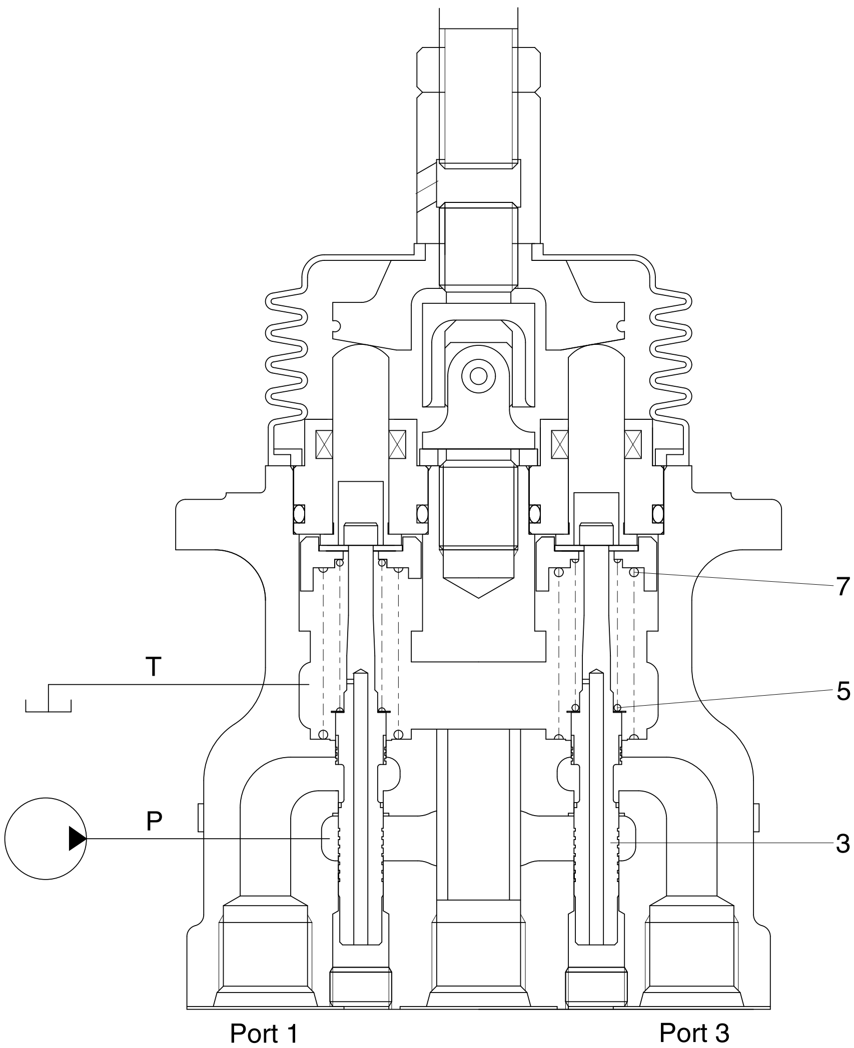
The diagram shown below is the typical application example of the pilot valve.



2-70

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

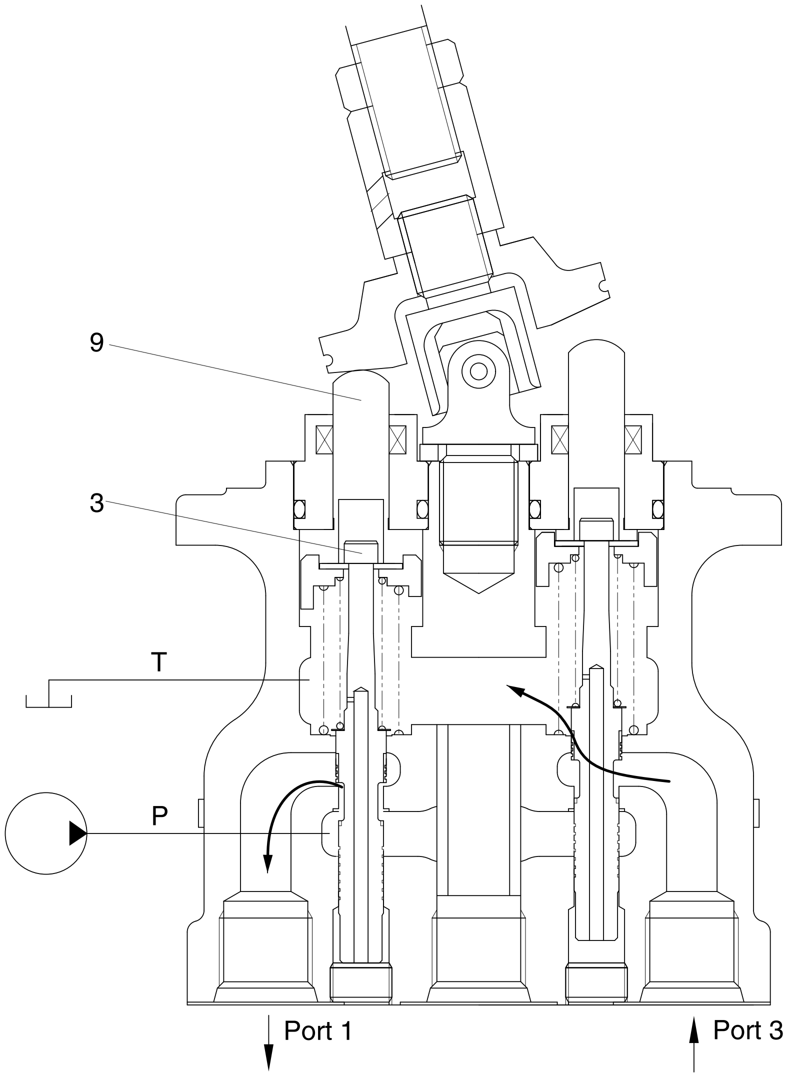
(1) Case where handle is in neutral position



300L2RL03

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

(2) Case where handle is tilted



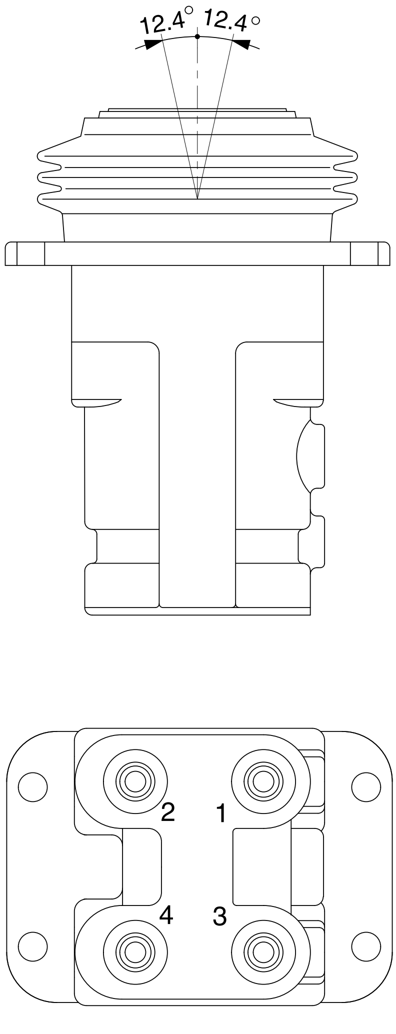
300L2RL04

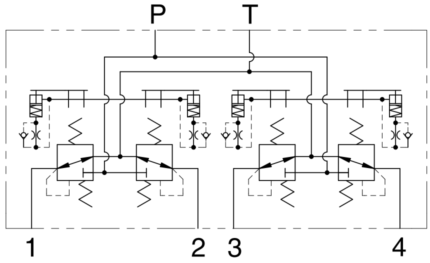
When the push rod (9) is stroked, the spool (3) moves downwards.
Then port P is connected with port (1) and the oil supplied from the pilot pump flows through port (1) to generate the pressure.
When the pressure at port (1) increases to the value corresponding to the spring force set by tilting the handle,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

GROUP 6 RCV PEDAL

1. STRUCTURE

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





Hydraulic circuit

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

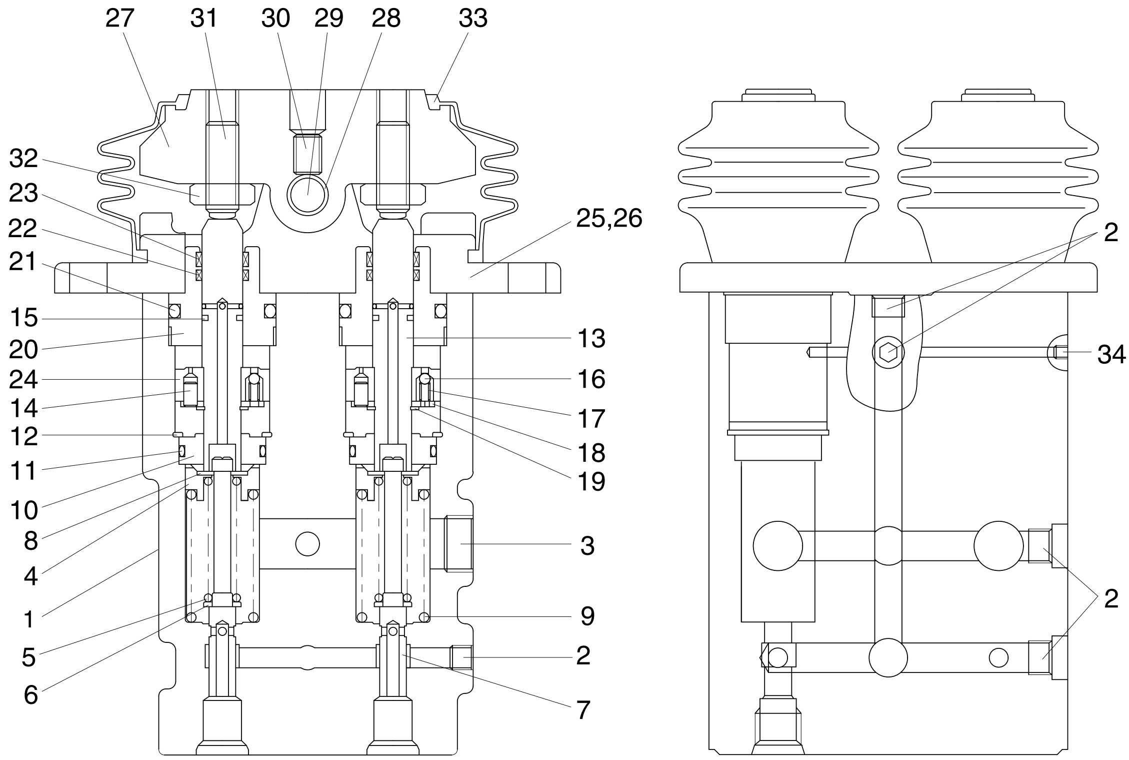
480A2RP01

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 kit (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.



480A2RP02

1	Body	13	Push rod	25	Cover
2	Plug	14	Spring pin	26	Socket 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 kit	19	Snap ring	31	Set screw
8	Stopper	20	Plug	32	Hex nut
9	Spring	21	O-ring	33	Bellows
10	Rod guide	22	Oil seal	34	Expand
11	O-ring	23	Dust seal	36	Cap
12	Snap ring	24	Piston		

2. FUNCTION

1) FUNDAMENTAL FUNCTIONS

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

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

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

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

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

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

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

2) FUNCTIONS OF MAJOR SECTIONS

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

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

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

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

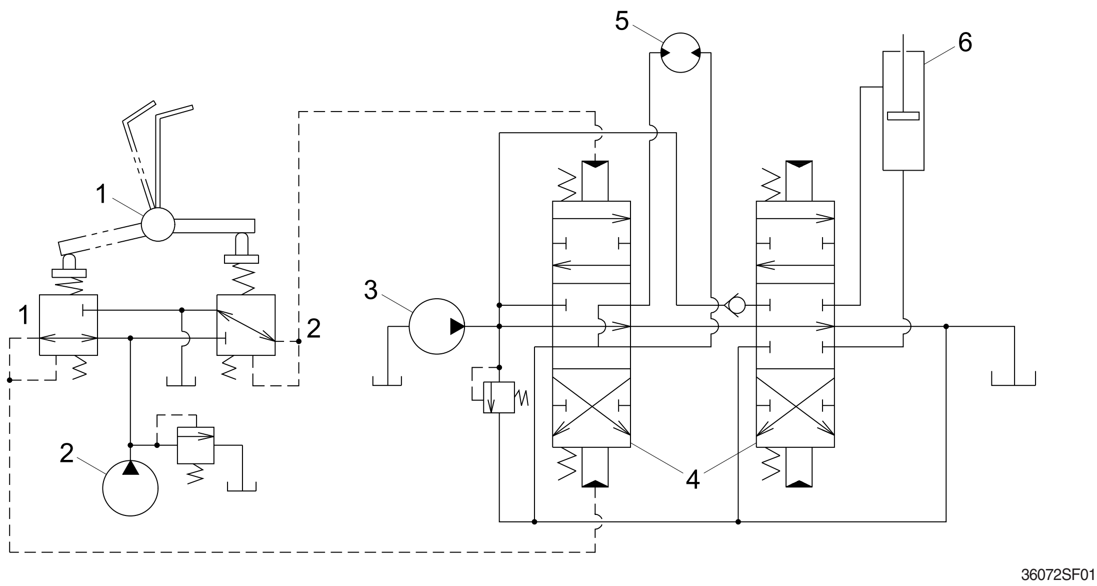
The spring (9) works on the body (1) and spring seat (6) and tries to return the push rod (13) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

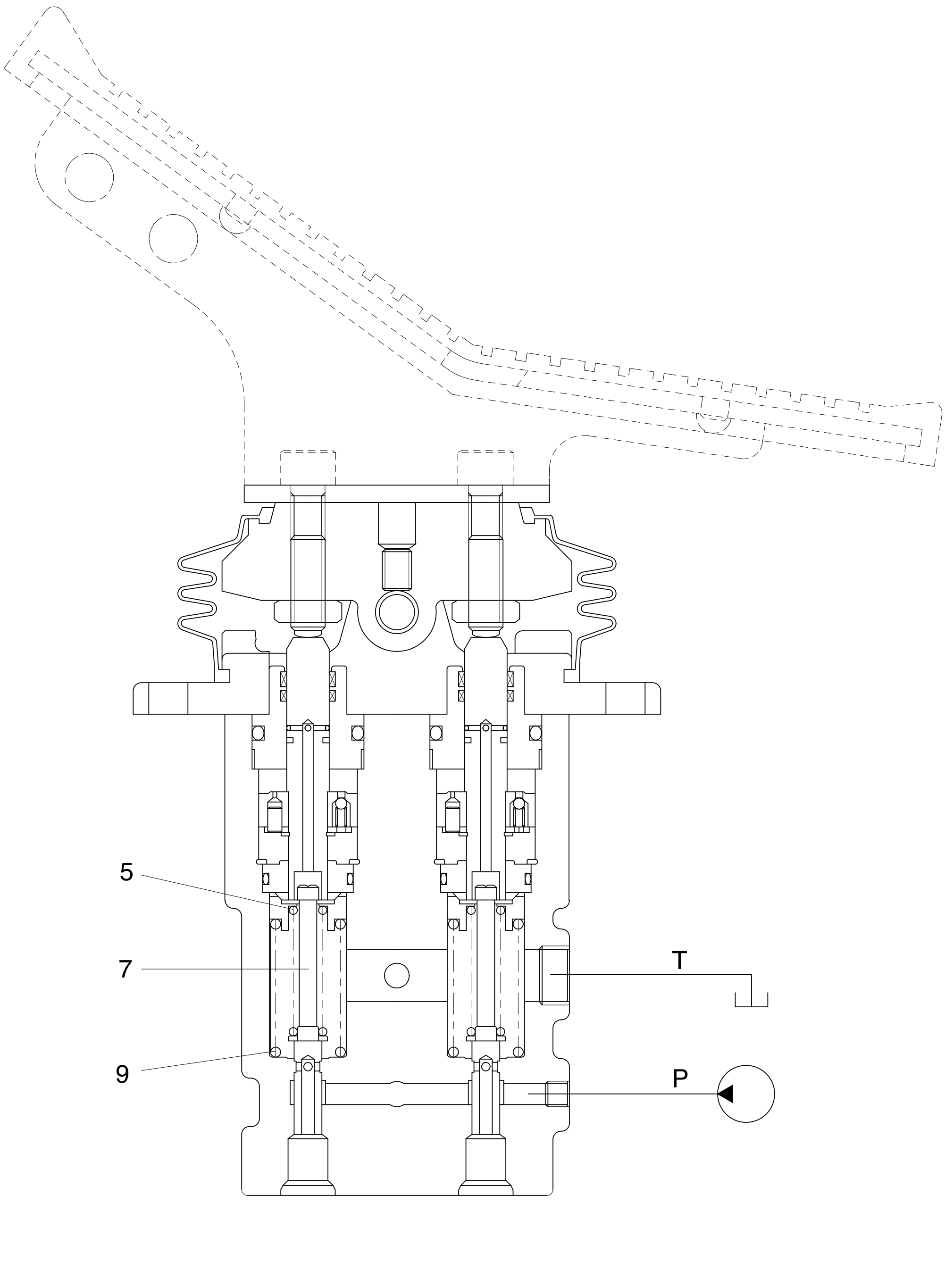
The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below and the attached operation explanation drawing.

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



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

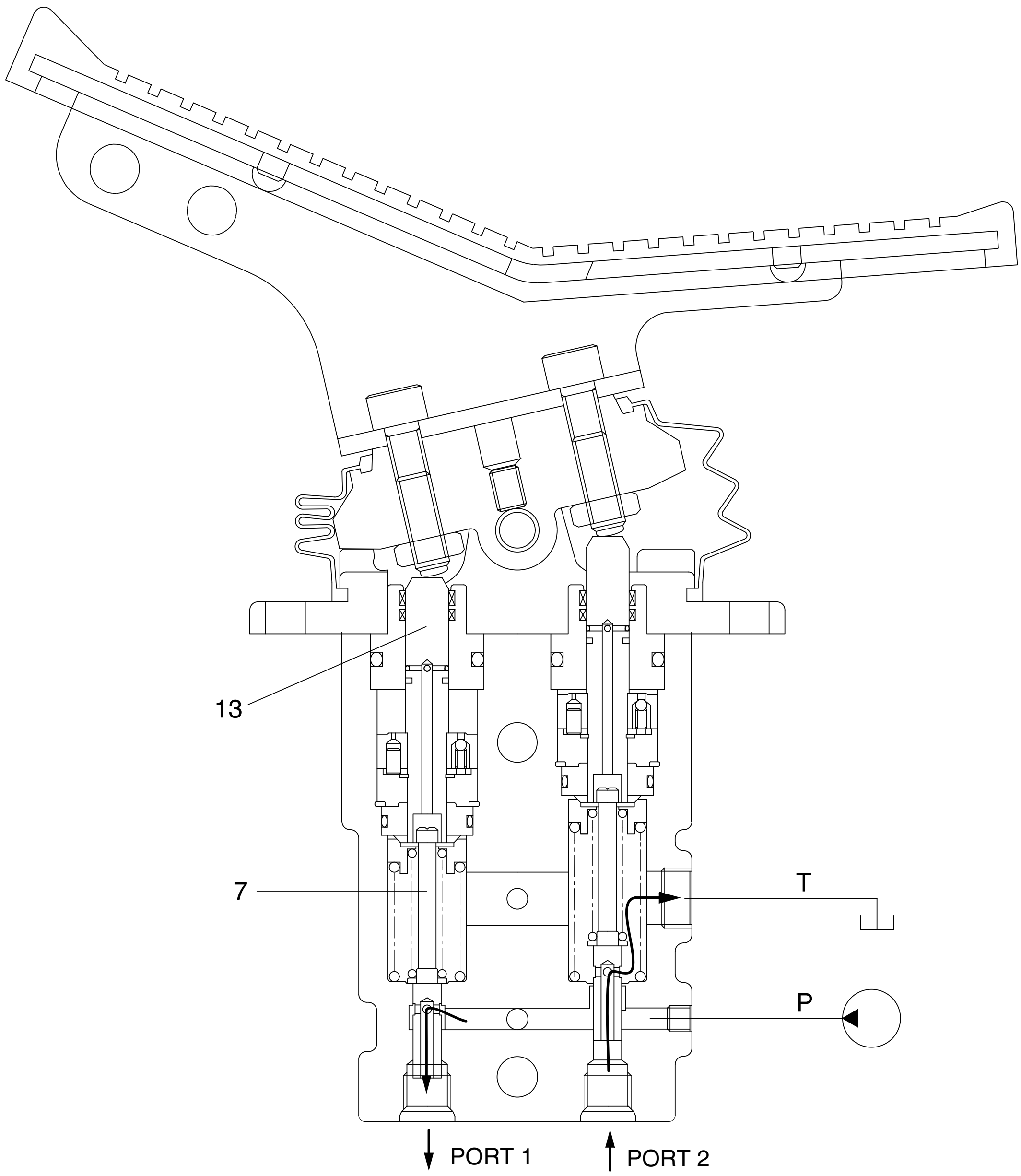
(1) Case where pedal is in neutral position



130ZF2RP03

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

(2) Case where pedal is tilted



220F2RP04

When the push rod (13) is stroked, the spool kit (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.

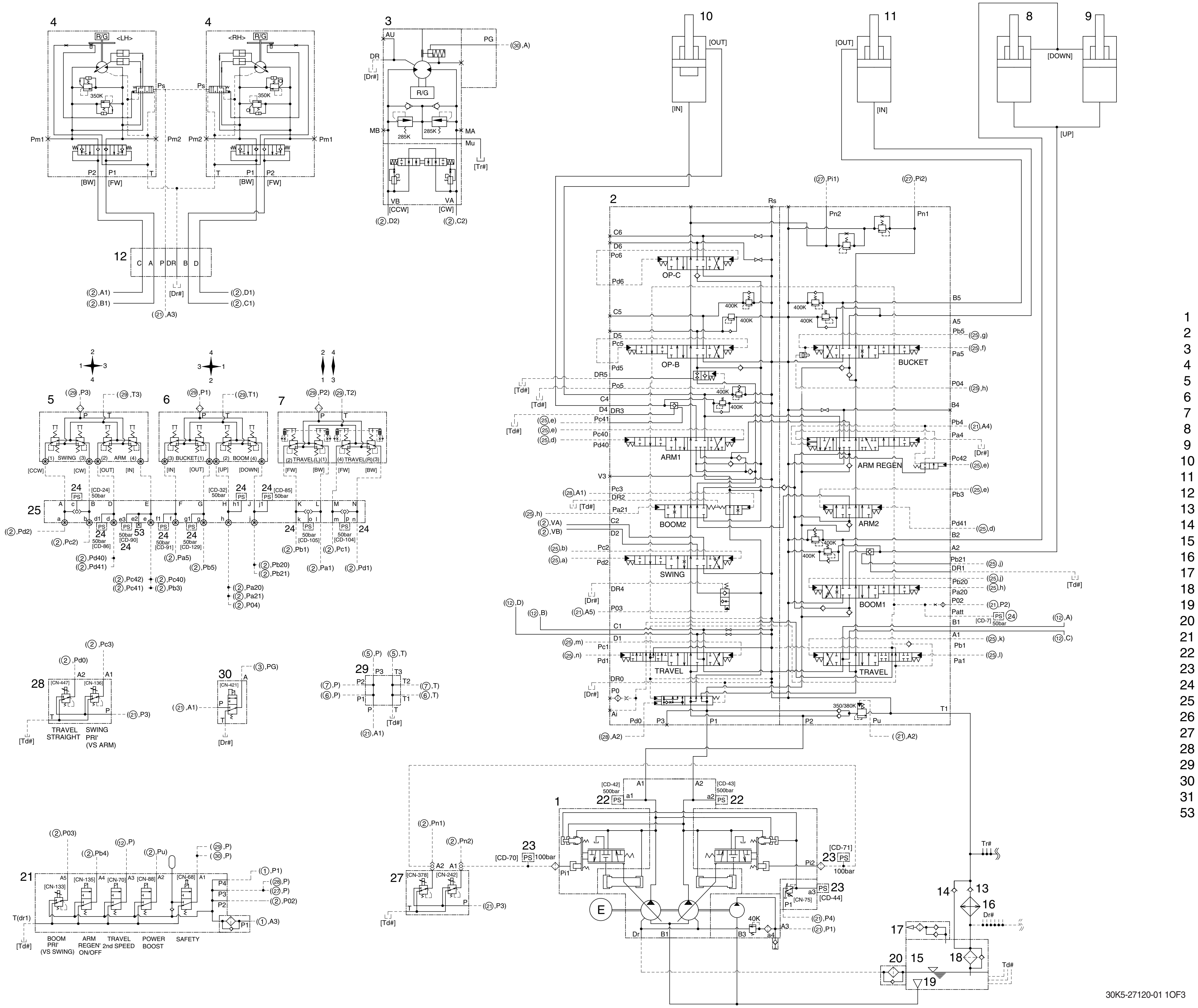
In this manner the secondary pressure is kept at the constant value.

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

1. HYDRAULIC CIRCUIT (1/3)



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

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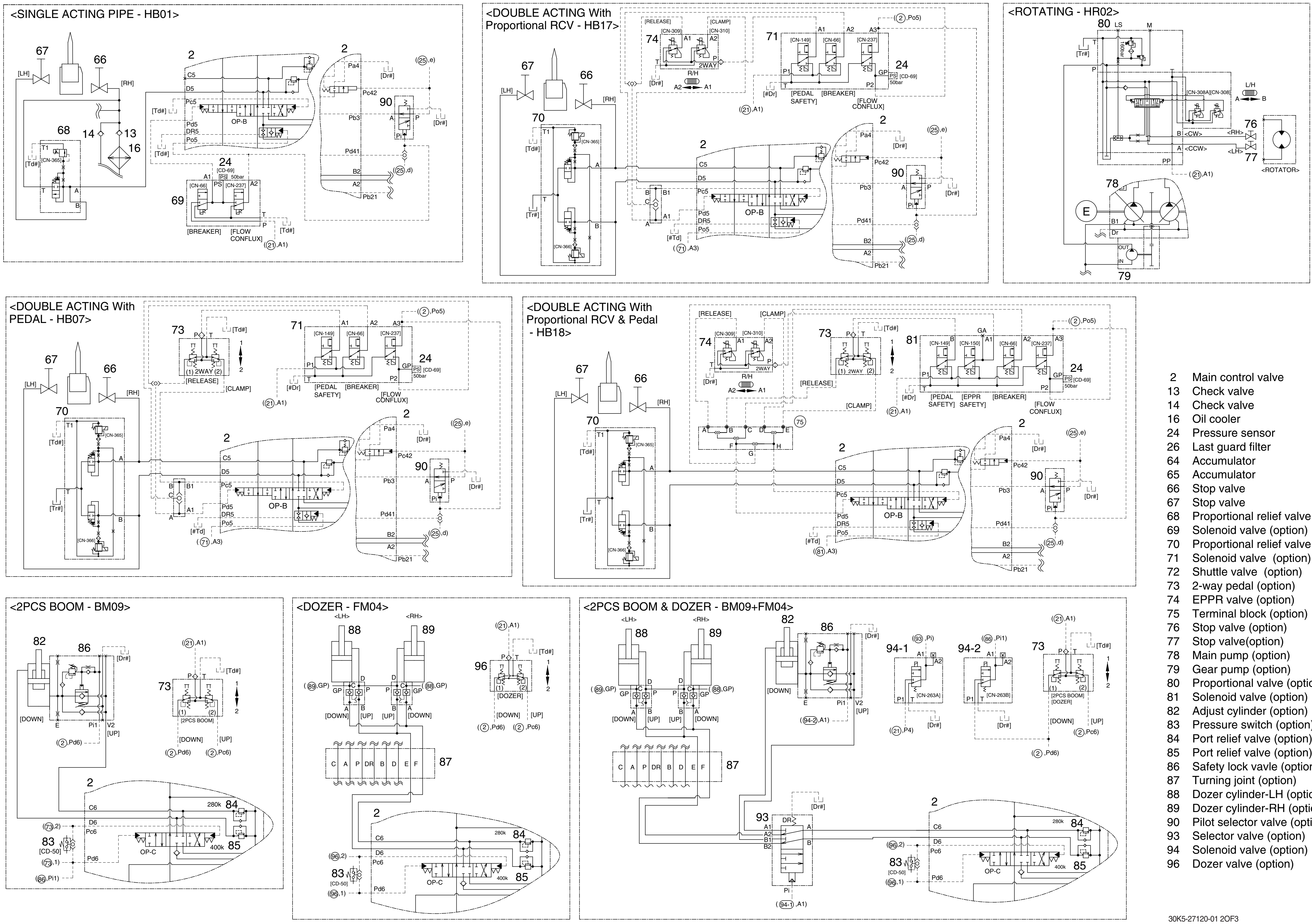
2. HYDRAULIC CIRCUIT (2/3)



2 Main control valve
13 Check valve
14 Check valve
16 Oil cooler
24 Pressure sensor
26 Last guard filter
64 Accumulator
65 Accumulator
66 Stop valve
67 Stop valve
68 Proportional relief valve (option)
69 Solenoid valve (option)
70 Proportional relief valve (option)
71 Solenoid valve (option)
72 Shuttle valve (option)
73 2-way pedal (option)
74 EPPR valve (option)
75 Terminal block (option)
76 Stop valve (option)
77 Stop valve(option)
78 Main pump (option)
79 Gear pump (option)
80 Proportional valve (option)
81 Solenoid valve (option)
82 Adjust cylinder (option)
83 Pressure switch (option)
84 Port relief valve (option)
85 Port relief valve (option)
86 Safety lock vavle (option)
87 Turning joint (option)
88 Dozer cylinder-LH (option)
89 Dozer cylinder-RH (option)
90 Pilot selector valve (option)
93 Selector valve (option)
94 Solenoid valve (option)
96 Dozer valve (option)

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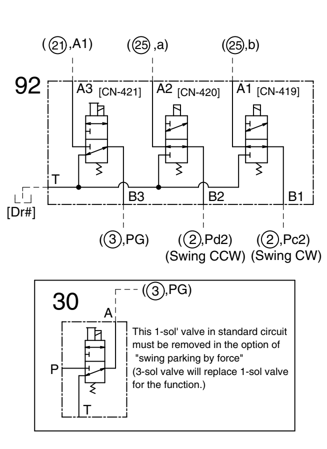
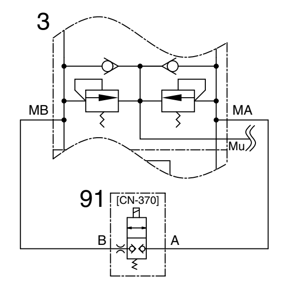
3. HYDRAULIC CIRCUIT (3/3)

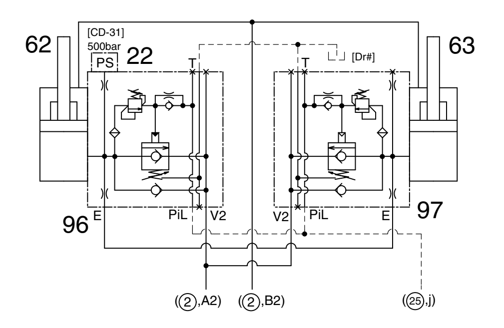
<SWING LOCK - LO01>



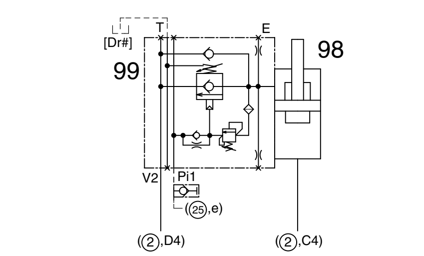
<FINE SWING CONTROL - IS01>



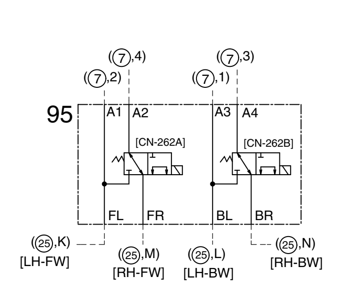
<BOOM SAFETY LOCK - BS01>



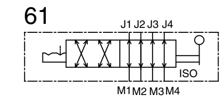
<ARM SAFETY LOCK - AS01>



<ONE PEDAL T/STRAIGHT - IT01>

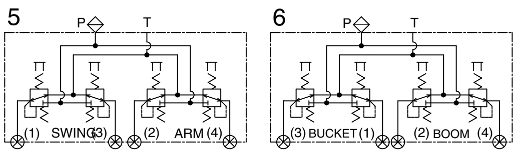


<PATTERN CHANGE- PV01>



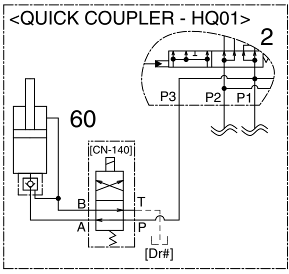
FROM		TO	
ITEM	PORT	ITEM	PORT
5	2	61	J1
	4		J3
6	2		J4
	4		J2
61	M1	25	D
	M2		J
	M3		E
	M4		H

<RCV LEVER(LH/RH) OPTION>



PART NO.				OPTION CODE	REMARKS	
LH		RH			PRODUCER	MODULATION
5	31K4-21012	6	31K4-21022	ERR00, EJA01	EATON	X
	31K4-21133		31K4-21143	ERR01, EJA01	EATON (DAEHYUN)	RH/LH
	31K6-21410		31K6-21420	ERR00, EJA21	KPM (DAEHYUN)	X
	31K6-21430		31K6-21440	ERR01, EJA21	KPM (DAEHYUN)	RH/LH

<QUICK COUPLER - HQ01>



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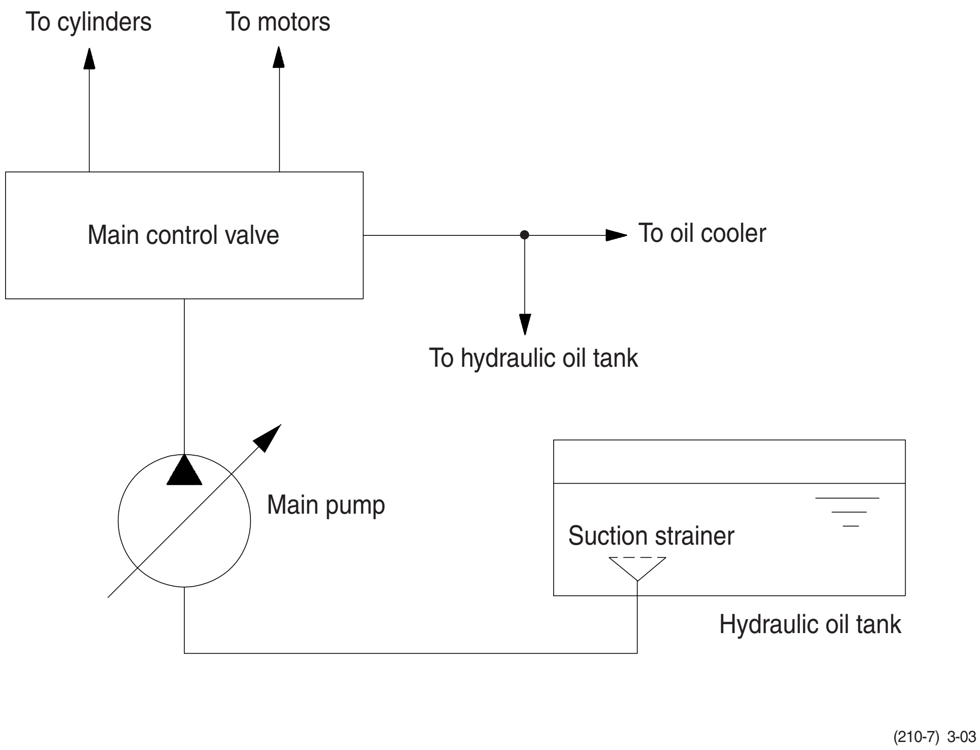
2	Main control valve	31	Screw coupling	92	3-solenoid valve
3	Swing motor	60	Solenoid valve	95	Solenoid valve
5	RCV lever-LH	61	Pattern change valve	96	Boom safety lock valve-LH
6	RCV lever-RH	62	Boom cylinder-safety, LH	97	Boom safety lock valve-RH
22	Pressure sensor	63	Boom cylinder-safety, RH	98	Arm cylinder safety valve
30	Solenoid valve	91	3-solenoid valve	99	Arm safety lock valve

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

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.

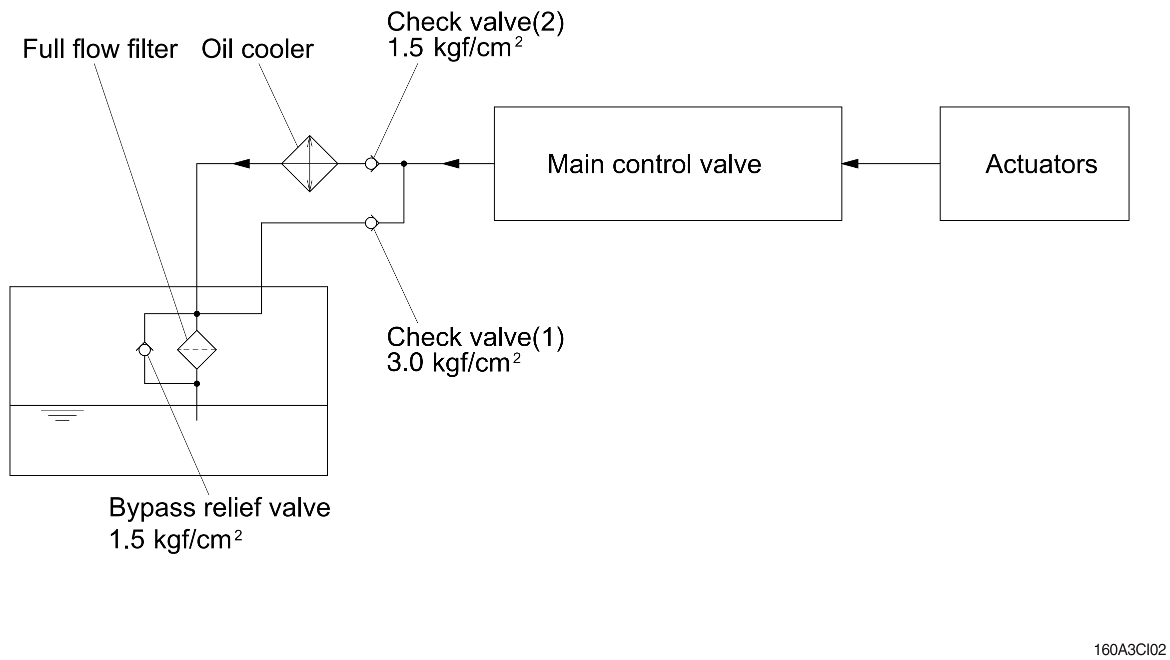
1. SUCTION AND DELIVERY CIRCUIT



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



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).

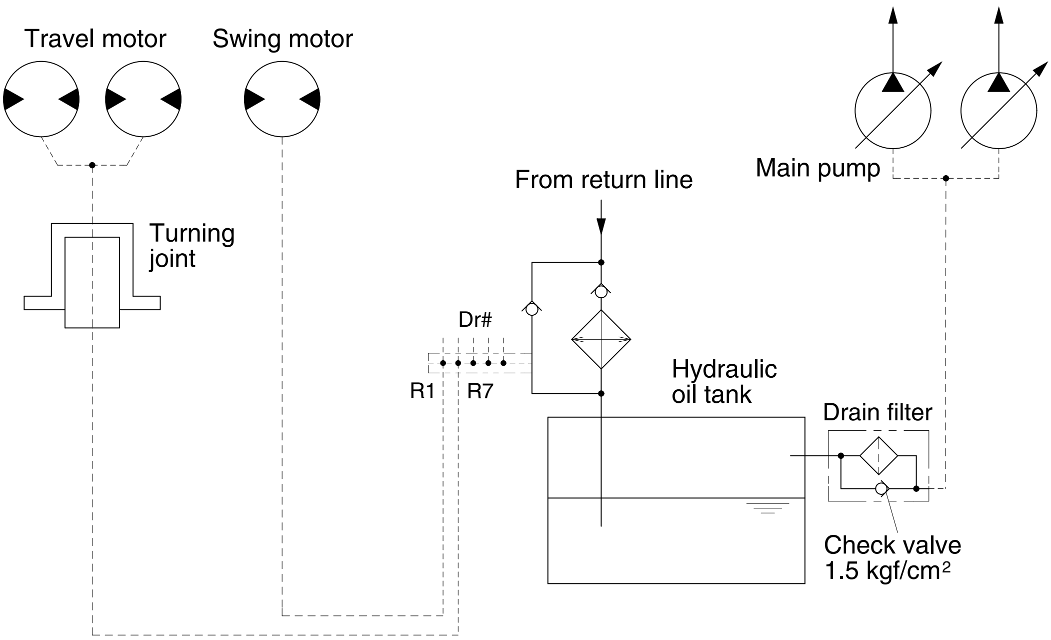
The full-flow filter and bypass relief valve are provided in the hydraulic tank.

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



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

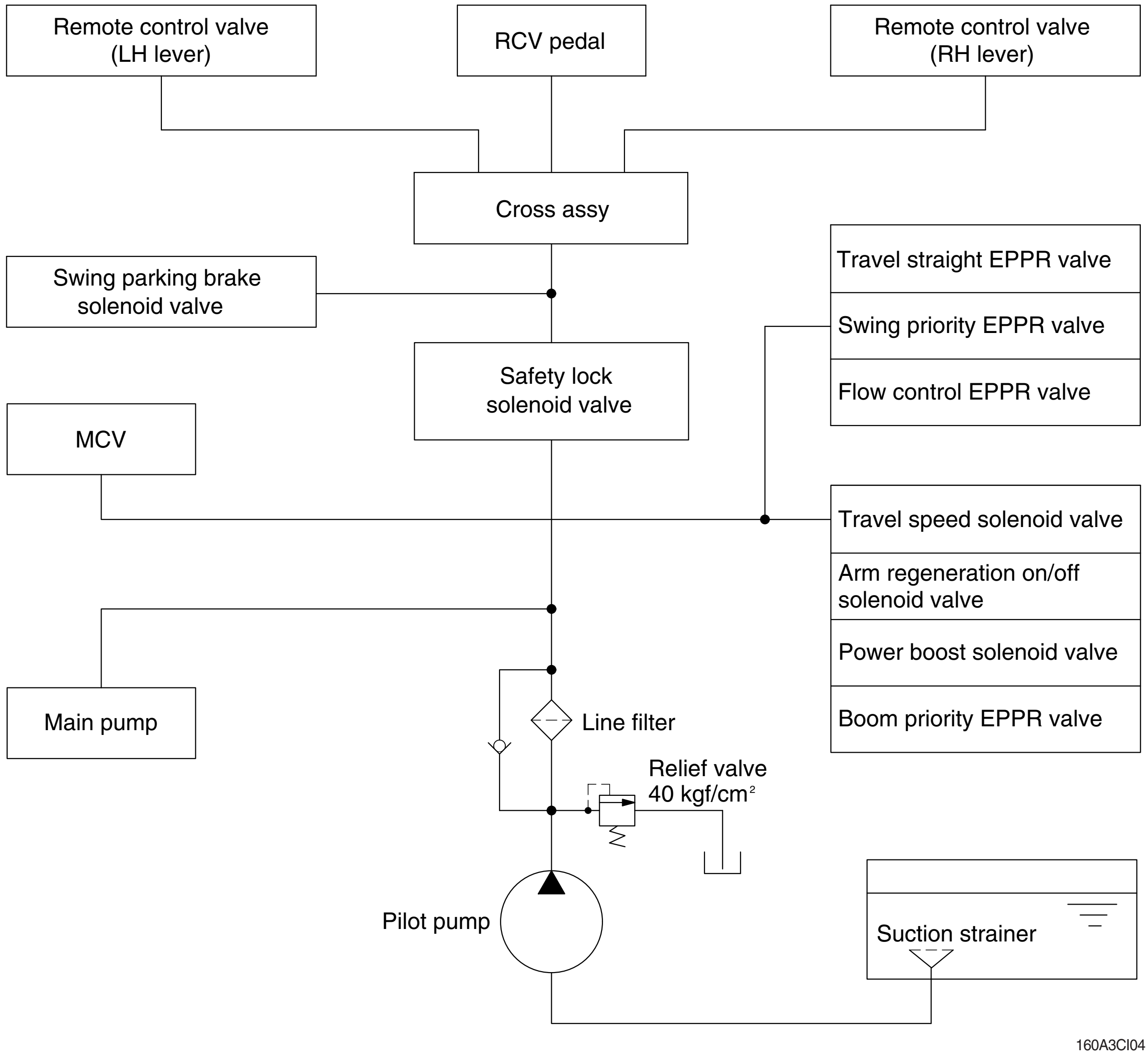
1) TRAVEL MOTOR DRAIN CIRCUIT
Oil leaked from the right and left travel motors comes out of the drain ports provided in the respective motor casing and join with each other. These oils pass through the turning joint and return to the hydraulic tank after being filtered by the return filter.

2) SWING MOTOR DRAIN CIRCUIT
Oil leaked from the swing motor returns to the hydraulic tank passing through the return filter.

3) MAIN PUMP DRAIN CIRCUIT
Oil leaked from main pump returns to the hydraulic tank passing through the drain filter.

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

GROUP 3 PILOT CIRCUIT



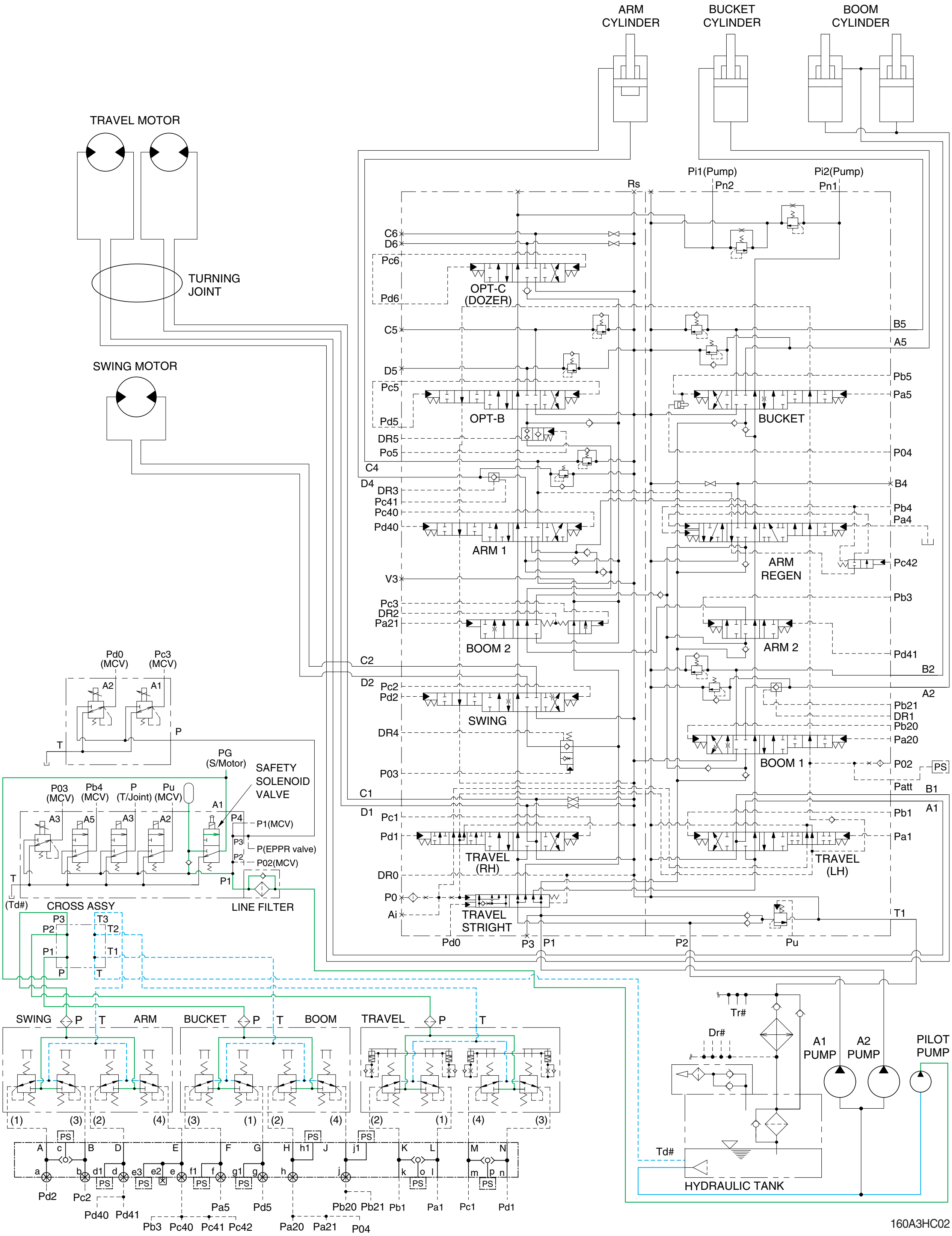
The pilot circuit consists of suction circuit, delivery circuit and return circuit.

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 and swing parking solenoid valve through safety lock solenoid valve and line filter. Also, it flows to the EPPR valve, solenoid valve assemblies, swing parking solenoid valve, main control valve and main pump.

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

1. SUCTION, DELIVERY AND RETURN CIRCUIT



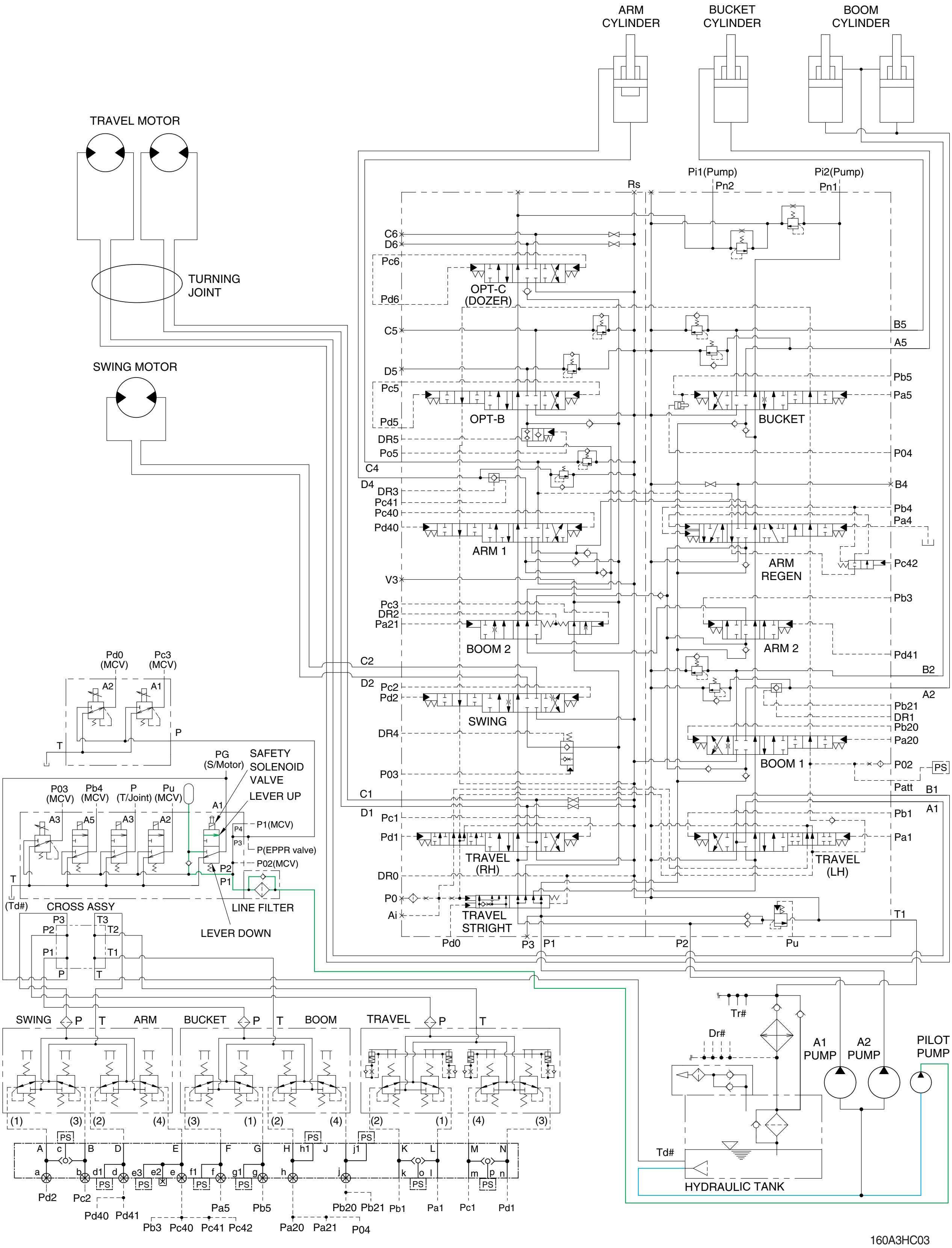
The pilot pump receive oil from the hydraulic tank. The discharged oil from the pilot pump flows to the safety solenoid valve through the line filter. The oil is filtered by the line filter. The pilot relief valve is provided in the pilot pump for limiting the pilot circuit pressure.

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

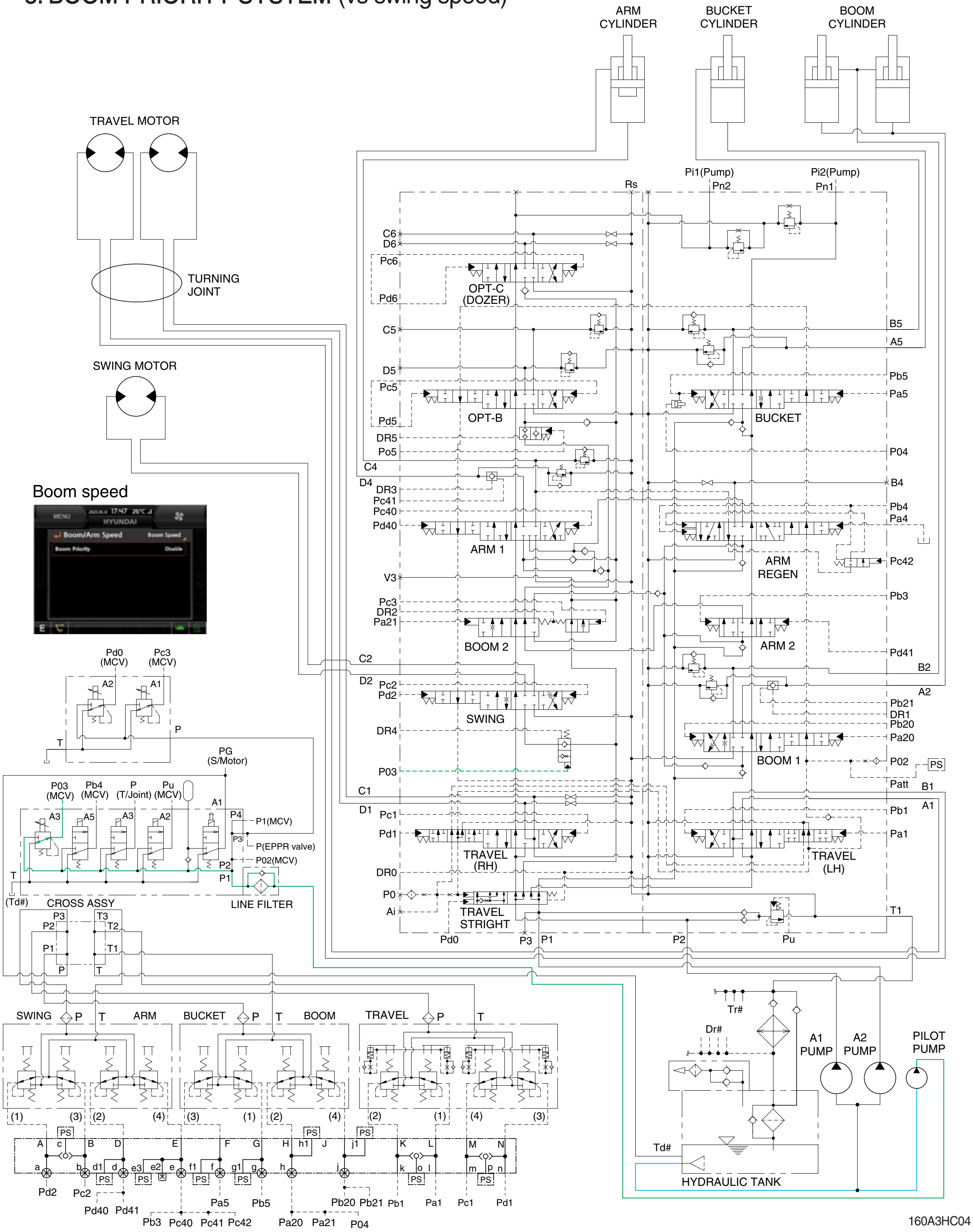


When the lever of the safety solenoid valve is moved upward, oil flows into the remote control valve through the line filter, safety solenoid valve and cross assy.

When the lever of the safety solenoid valve is moved upward, 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)



160A3HC04

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

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

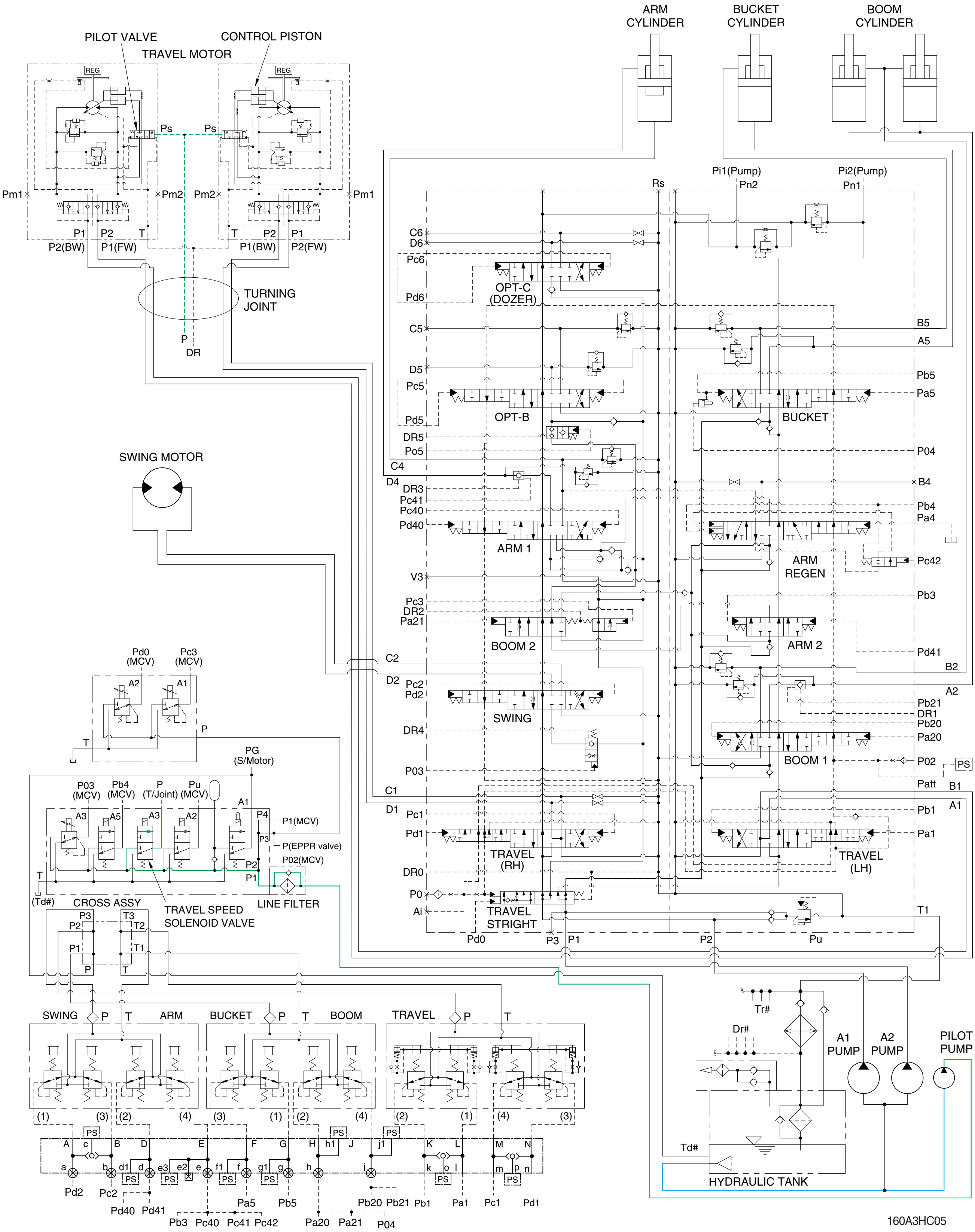
The pilot oil from pilot pump flow into P03 port in main control valve through boom priority EPPR valve. P03 oil pressure moves swing reducing spool to lower position and oil flow rate to the swing motor decreased.

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

The boom up speed can be adjusted by the cluster. Refer to page 3-23 of the operator's manual.

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

4. TRAVEL SPEED CONTROL SYSTEM

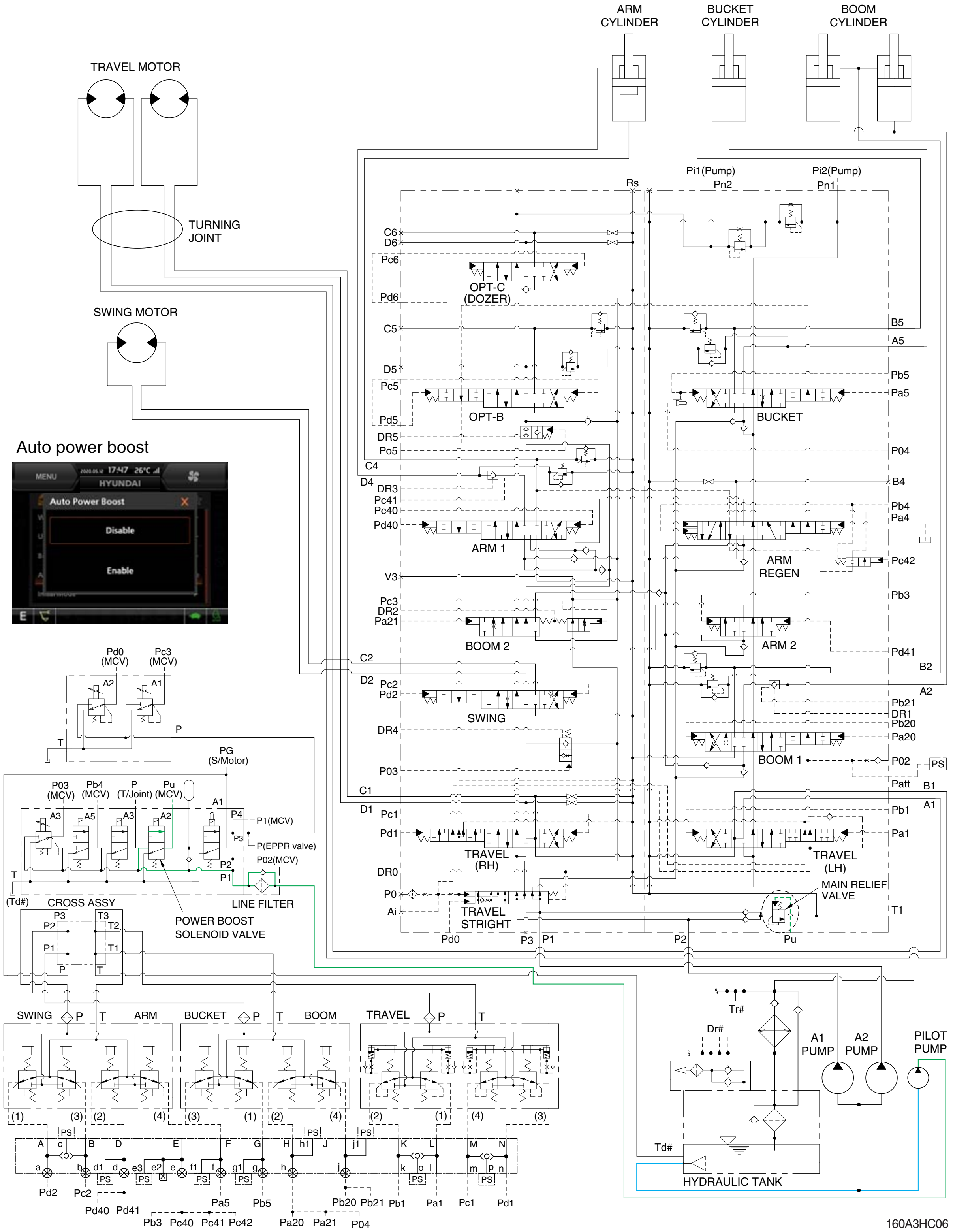


When the travel speed solenoid valve was placed in the Hi position, the pressure oil from pilot pump through line filter flows to port **Ps** of travel speed change over valve, and the control piston is pushed left (LH) and right (RH), thus minimizing the displacement.

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

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

5. MAIN RELIEF PRESSURE CHANGE SYSTEM



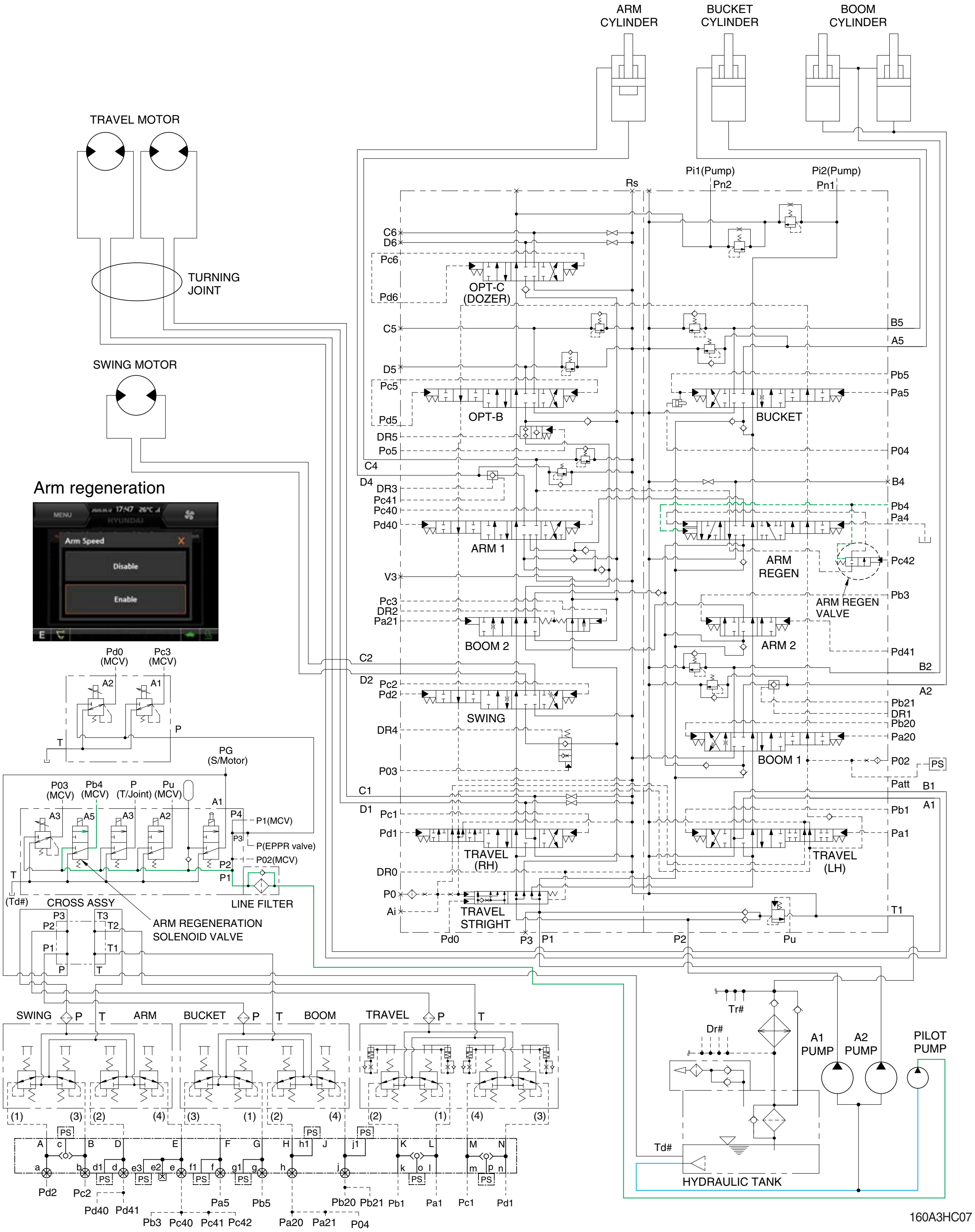
When the power boost switch on the left control lever is pushed ON, the power boost solenoid valve is actuated, the discharged oil from the pilot pump flows into **Pu** port of the main relief valve of main control valve; then the setting pressure of the main relief valve is raised from 350 kgf/cm² (4980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

And even when pressed 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.

6. ARM REGENERATION CUT SYSTEM



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

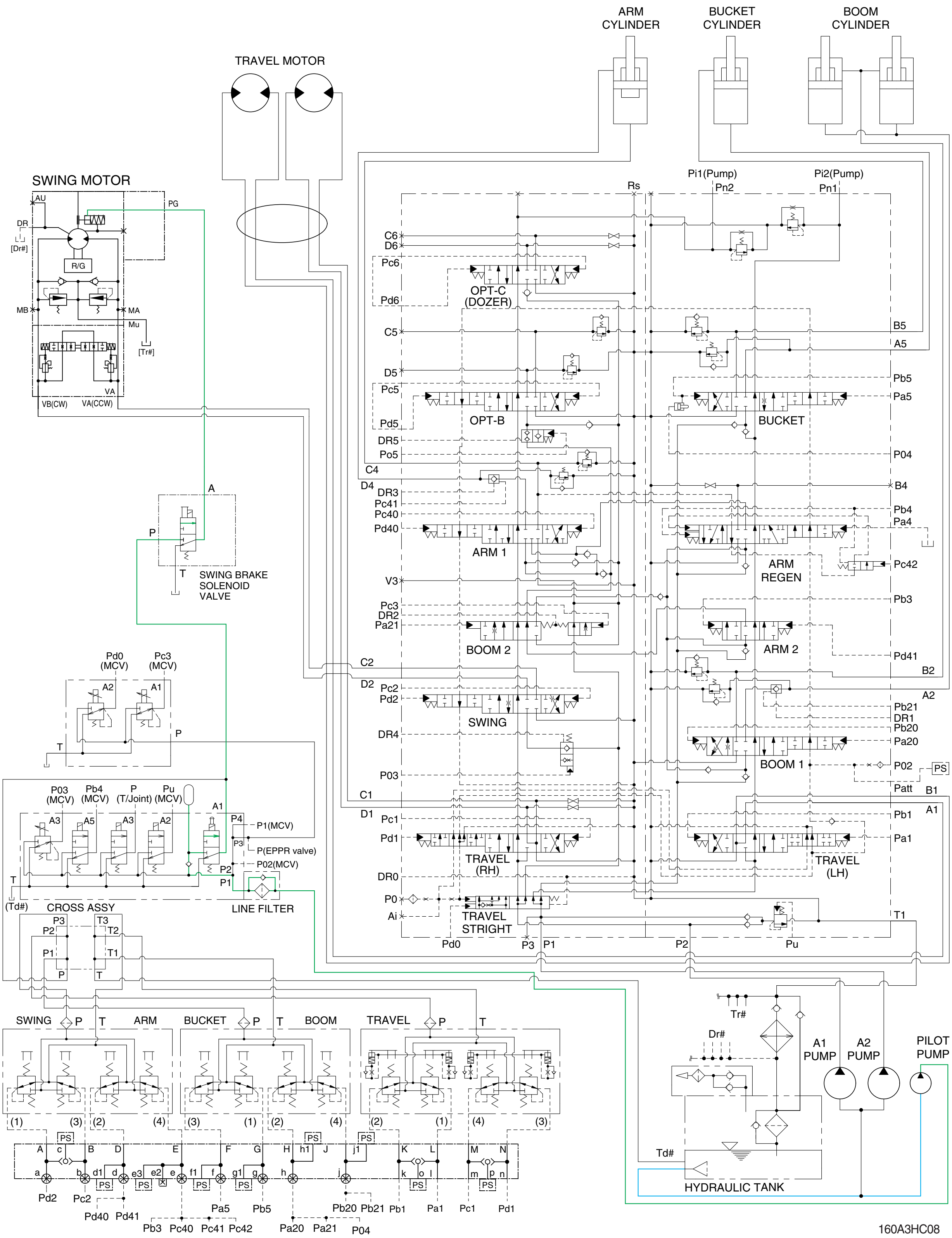
Then, the oil from arm regeneration passage returns to tank and the arm regeneration function is deactivated.

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 2-36 for the arm regeneration function.

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

7. SWING PARKING BRAKE RELEASE



160A3HC08

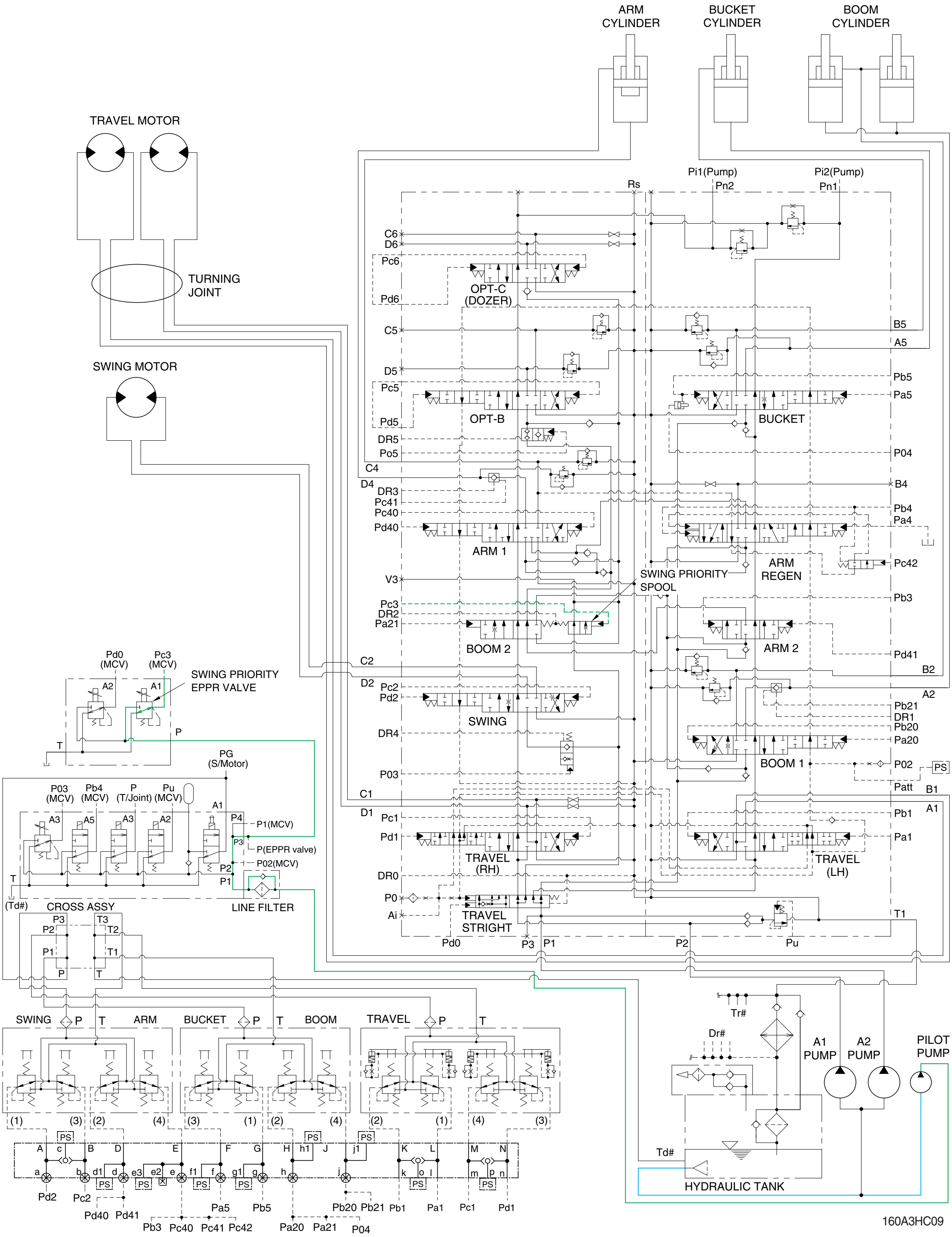
When any of the swing, arm in, boom up or travel is tilted, the swing brake solenoid valve is shifted to the downward by the MCU that senses the pilot pressure of the swing control lever.

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

When the RCV control lever is set in the neutral position, the swing brake solenoid valve is shifted to the upward, oil in the swing motor disc cylinder is drained through the the swing brake solenoid valve, thus the brake is applied. For details, refer to page 2-60.

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

8. SWING PRIORITY SYSTEM



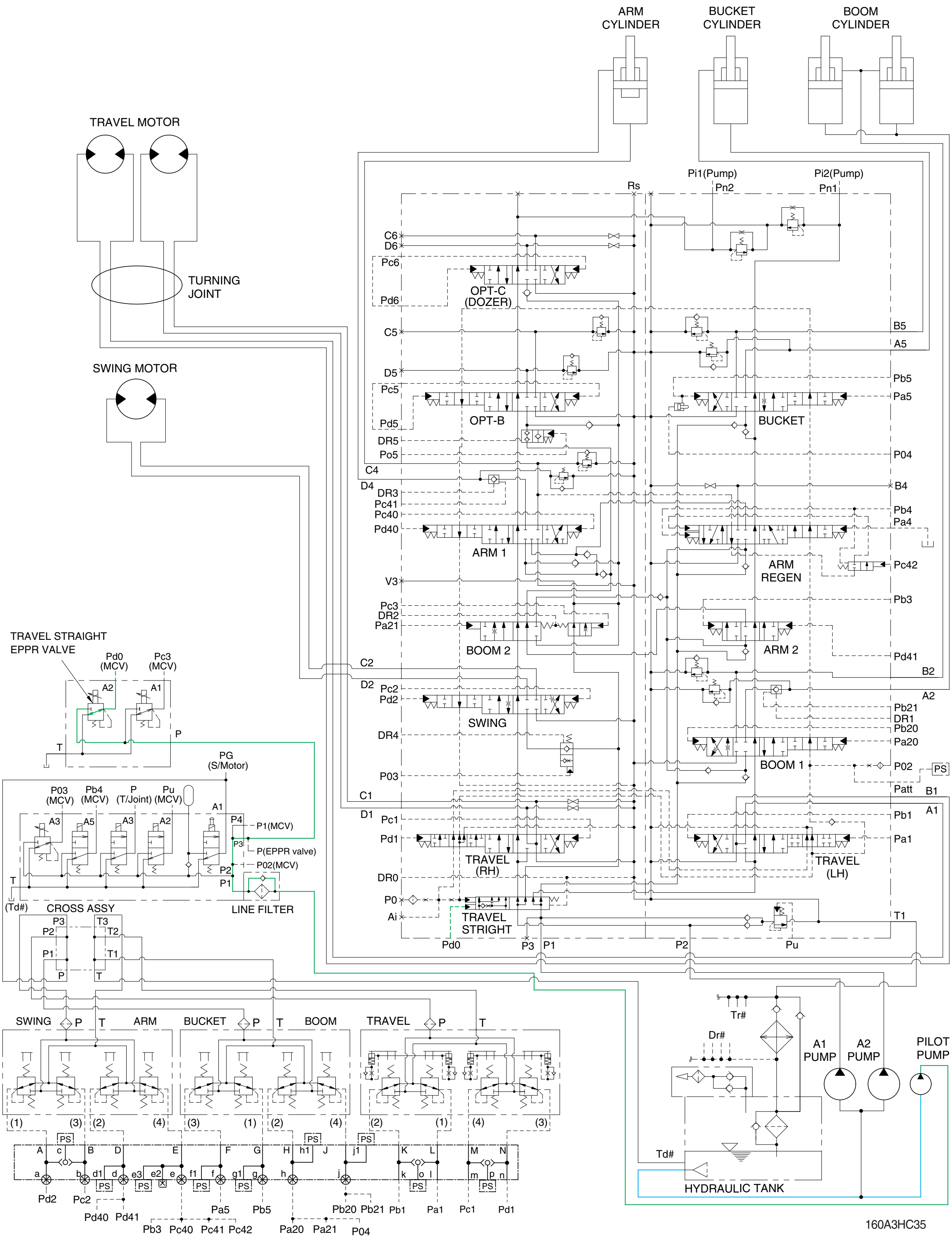
When carrying out the combined operation of swing and arm in of the left control valve, the swing speed can be lowered than operating speed of arm.

When the swing control lever is tilted, the swing priority EPPR valve is energized by the MCU that senses the swing pilot pressure and Pc3 pressure from the swing priority EPPR valve 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 2-42.

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

9. TRAVEL STRAIGHT SYSTEM



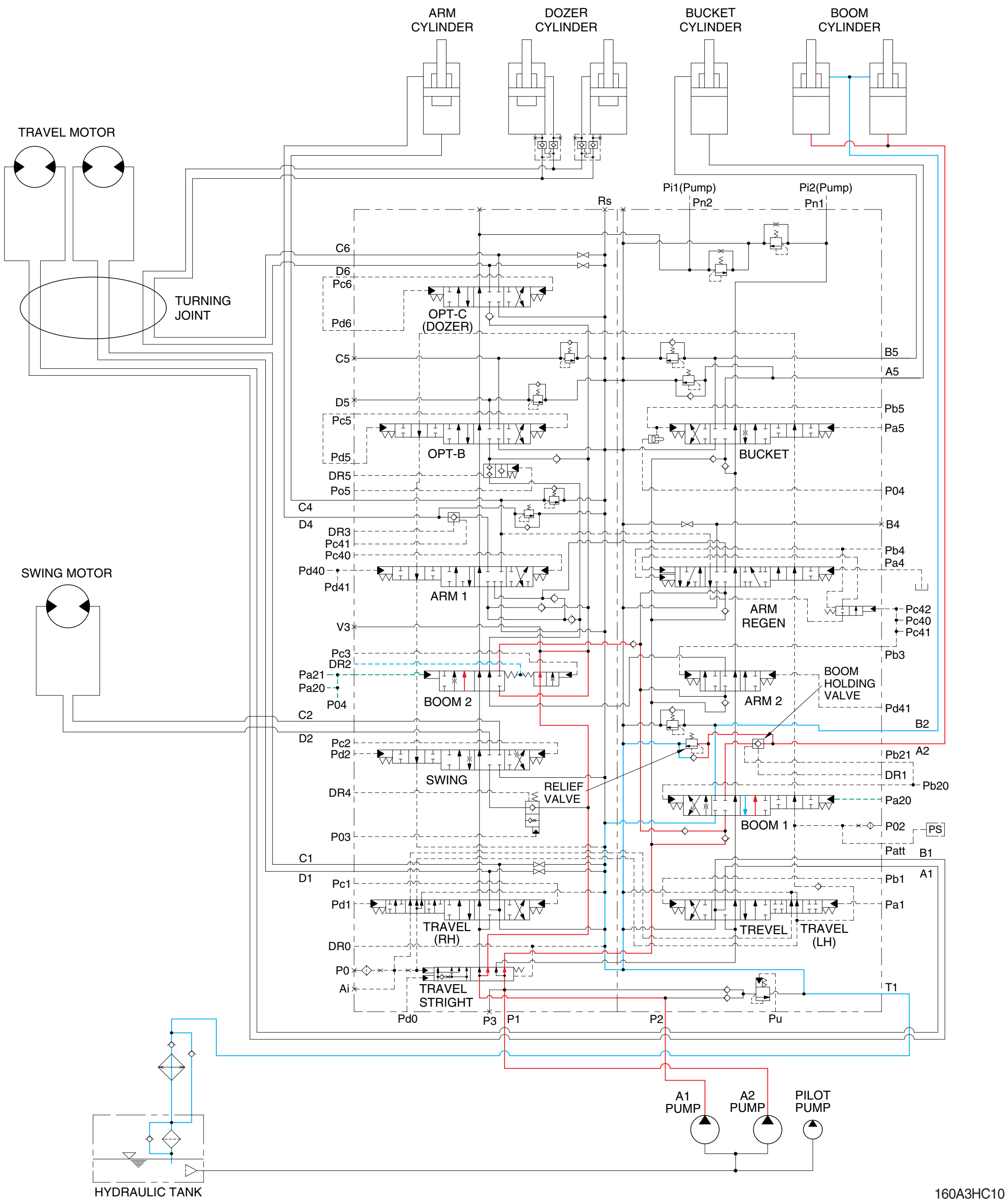
When the travel and other function (boom, arm, bucket, swing, option B or option C) are operated, the travel straight EPPR valve is energized by the MCU that senses the pilot pressure of the travel and other functions and Pd0 pressure from the travel straight EPPR valve changes the travel straight spool.

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. For details, refer to page 2-29.

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

GROUP 4 SINGLE OPERATION

1. BOOM UP OPERATION



160A3HC10

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 (Pa20, Pa21) 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.

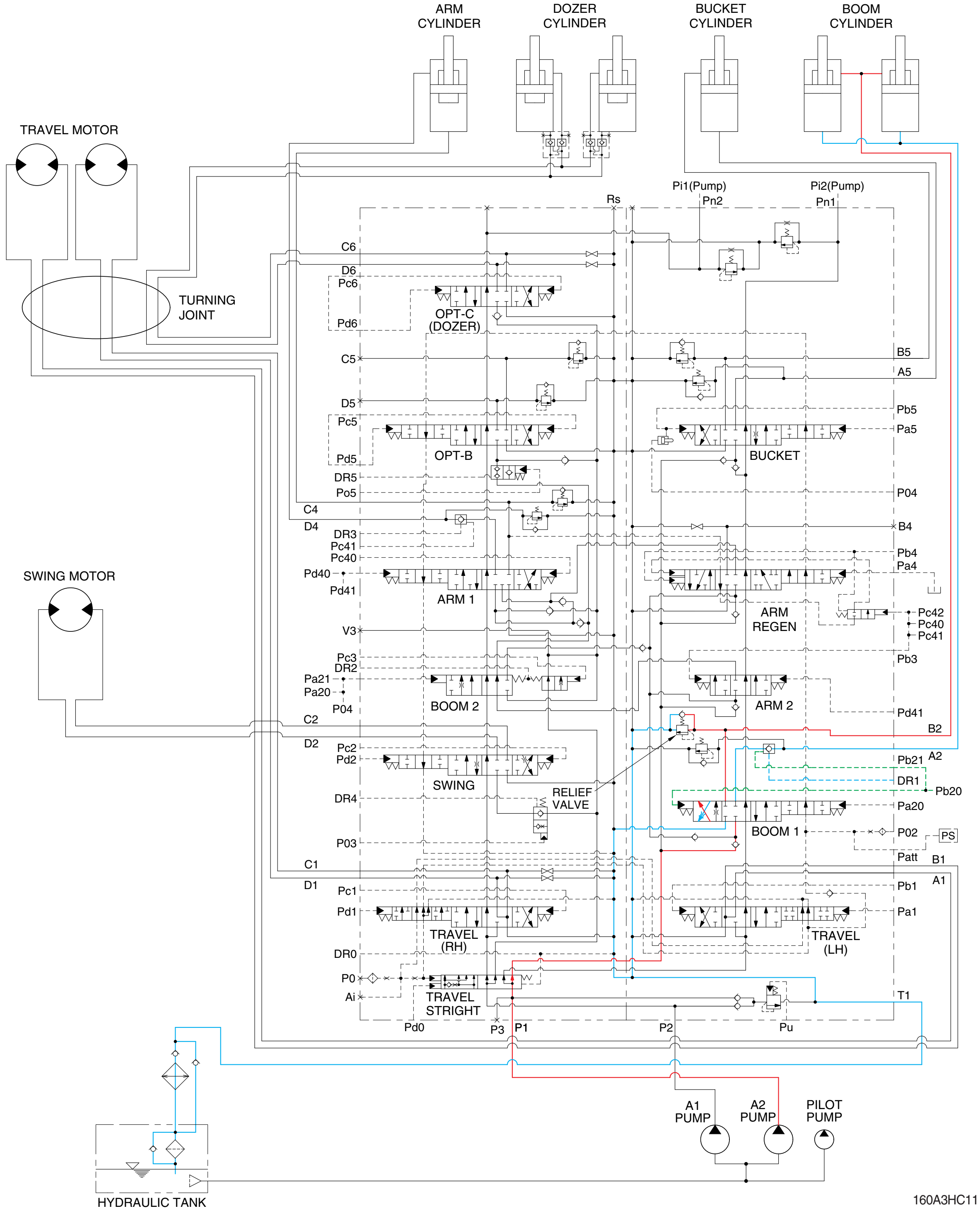
The excessive pressure in the boom cylinder head side is prevented by relief valve.

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 cylinders.

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

2. BOOM DOWN OPERATION



When the right control lever is pushed forward, the boom 1 spool in the main control valve is moved to the down position by the pilot oil pressure (Pb20) from the remote control valve.

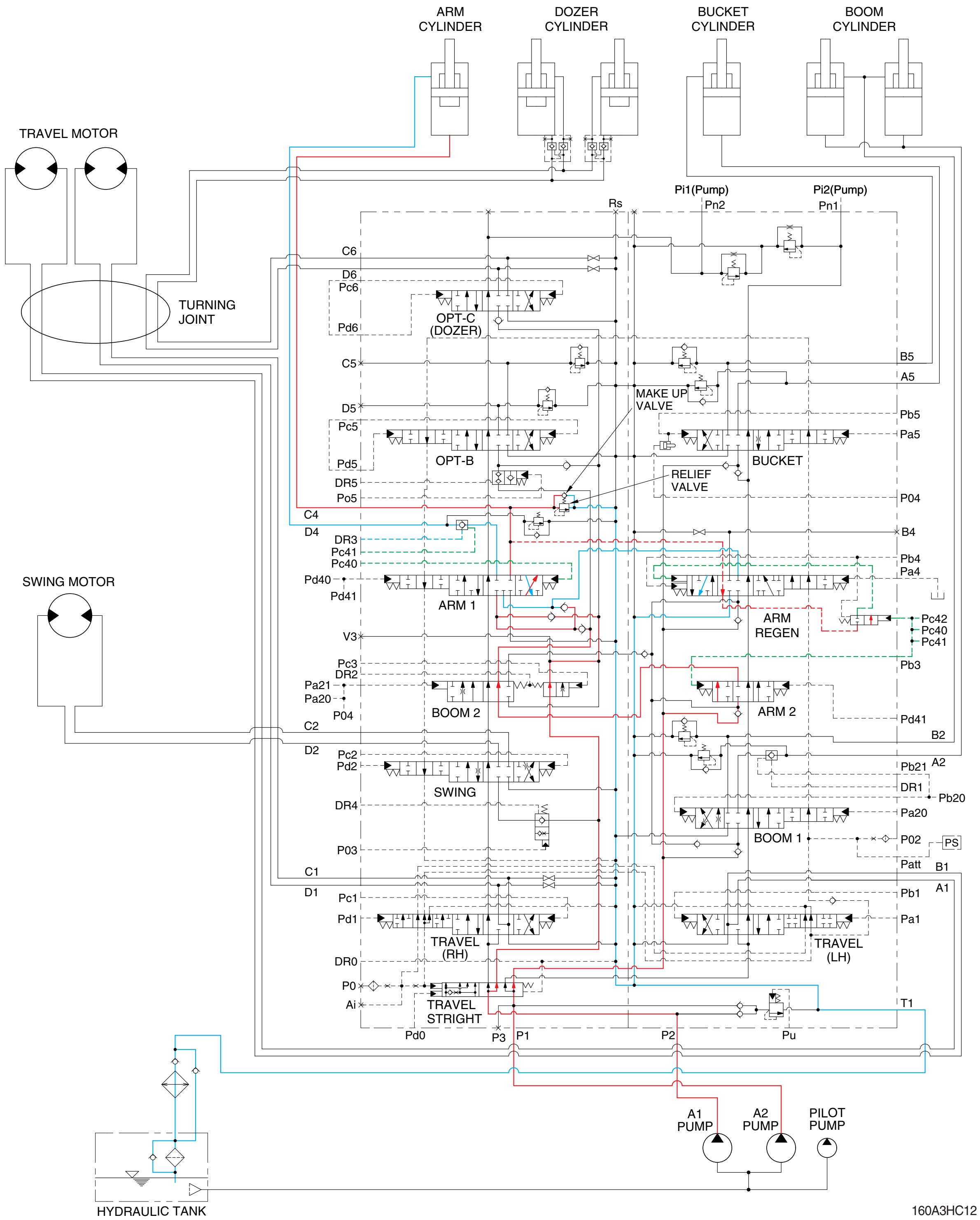
The oil from the A2 pump flows into the main control valve and then goes to the small chamber of boom cylinders. At the same time, the oil from the large chamber of boom cylinders returns to the hydraulic tank through the boom 1 spool in the main control valve.

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

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

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

3. ARM IN OPERATION



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 (Pc40, Pb3) 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.

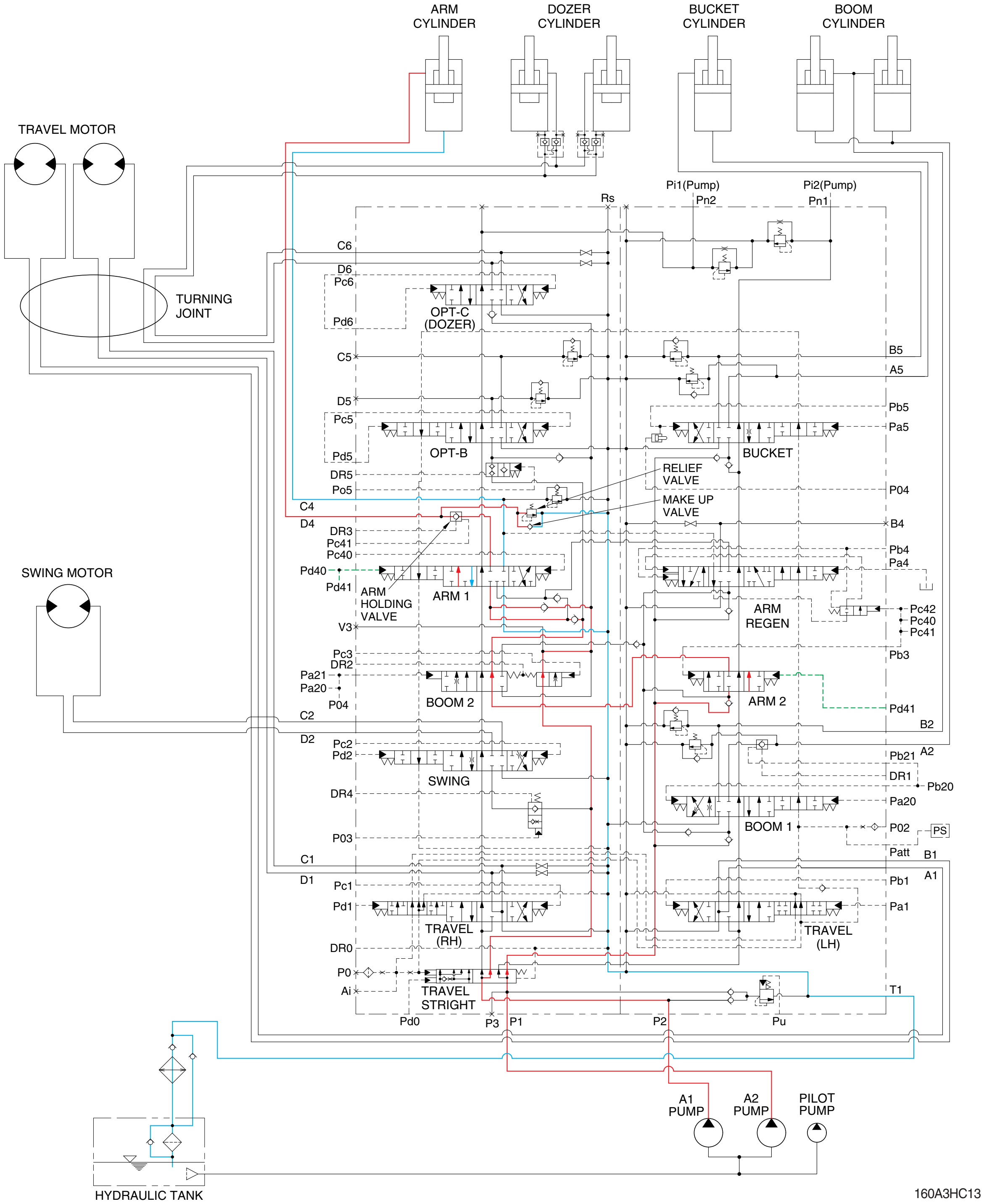
At the same time, the oil from small chamber of arm cylinder returns to the hydraulic oil tank through the arm 1 spool in the main control valve. When this happens, the arm rolls in.

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



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 (Pd40, Pd41) from the remote control valve.

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

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

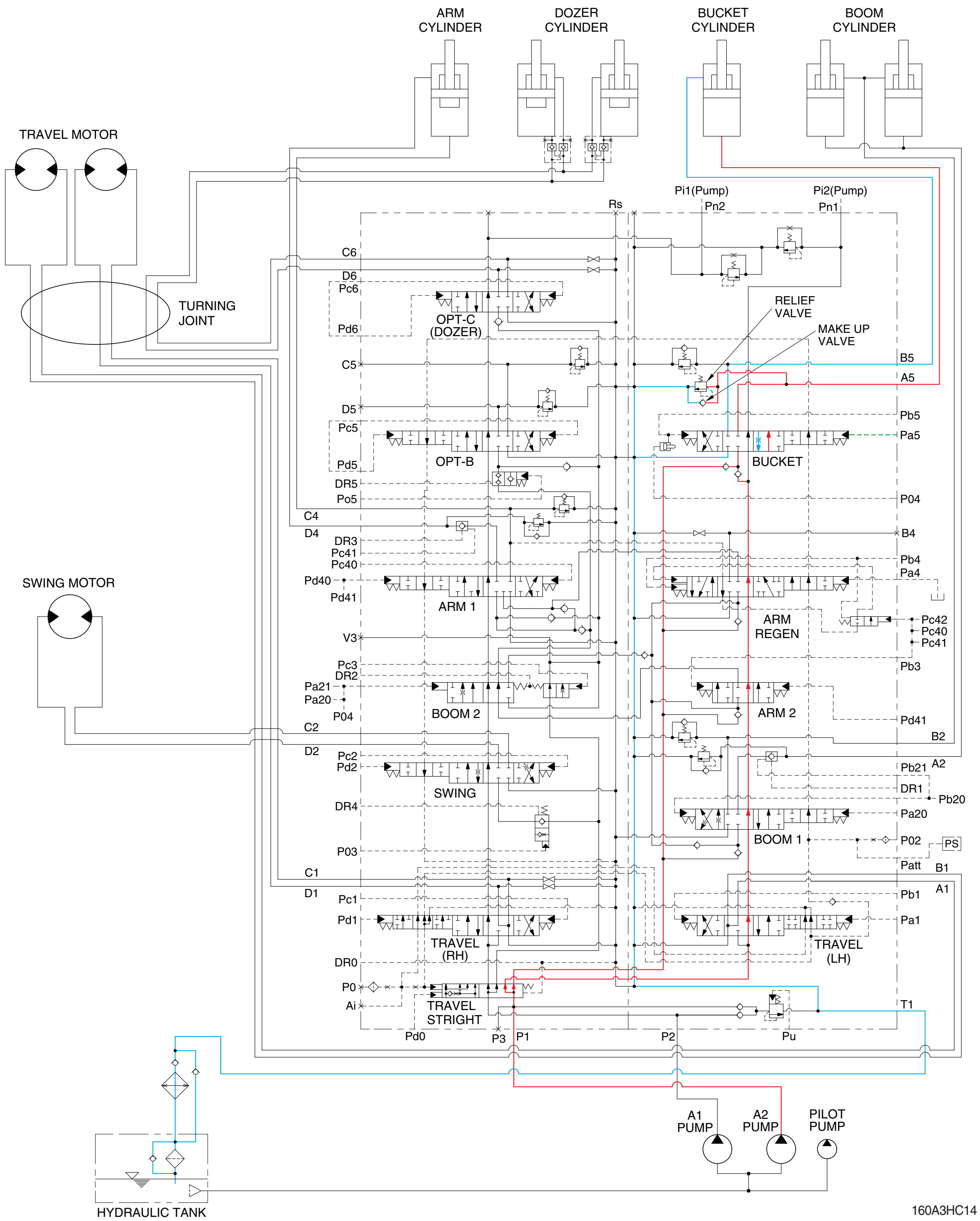
The excessive pressure in the arm cylinder rod side is prevented by relief valve.

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

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

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

5. BUCKET IN OPERATION



When the right control lever is pulled left, the bucket spool in the main control valve is moved to the roll in position by the pilot oil pressure (Pa5) from the remote control valve.

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

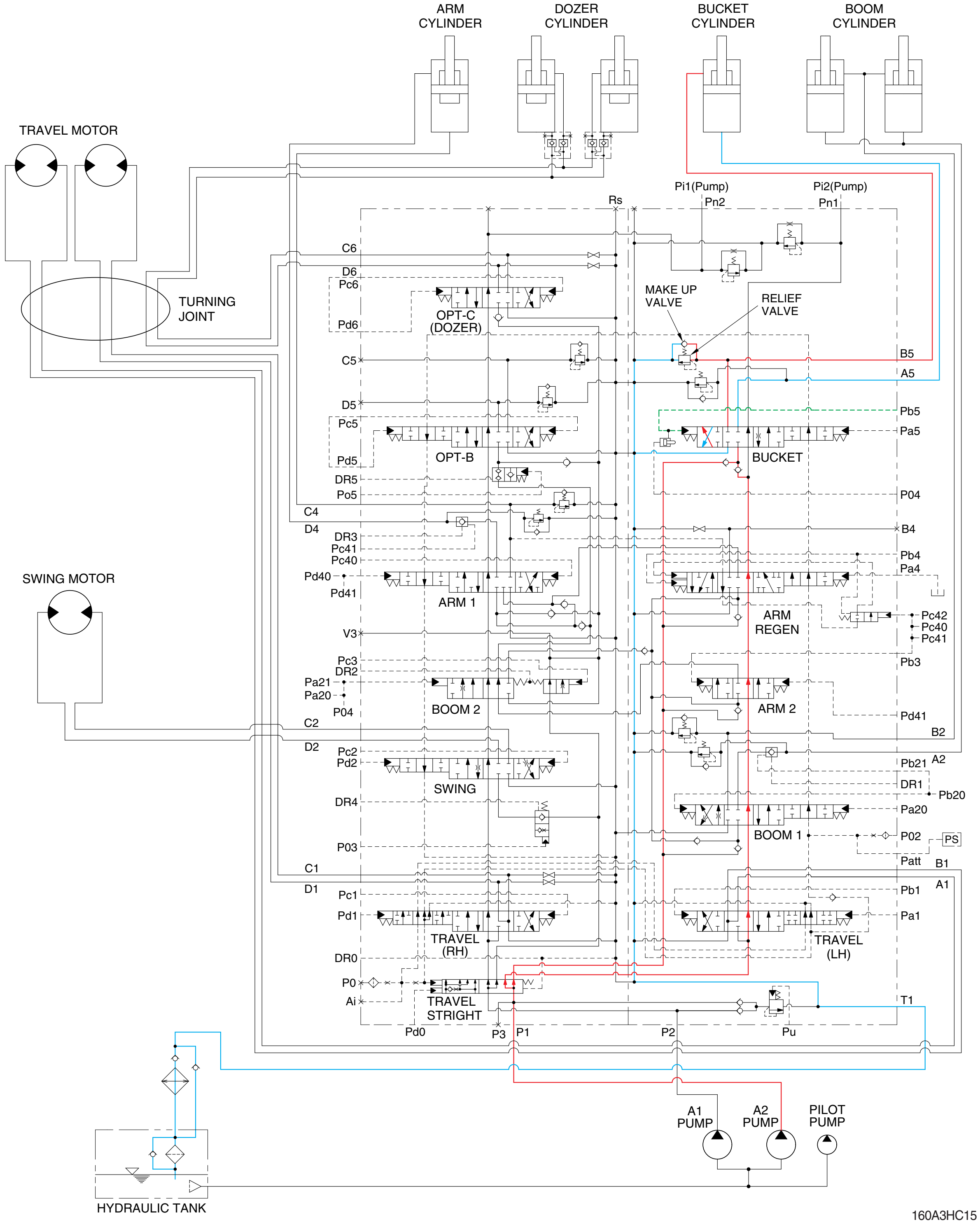
At the same time, the oil from the small chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls in.

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

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

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

6. BUCKET OUT OPERATION



When the right control lever is pushed right, the bucket spool in the main control valve is moved to the roll out position by the pilot oil pressure (Pb5) from the remote control valve.

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

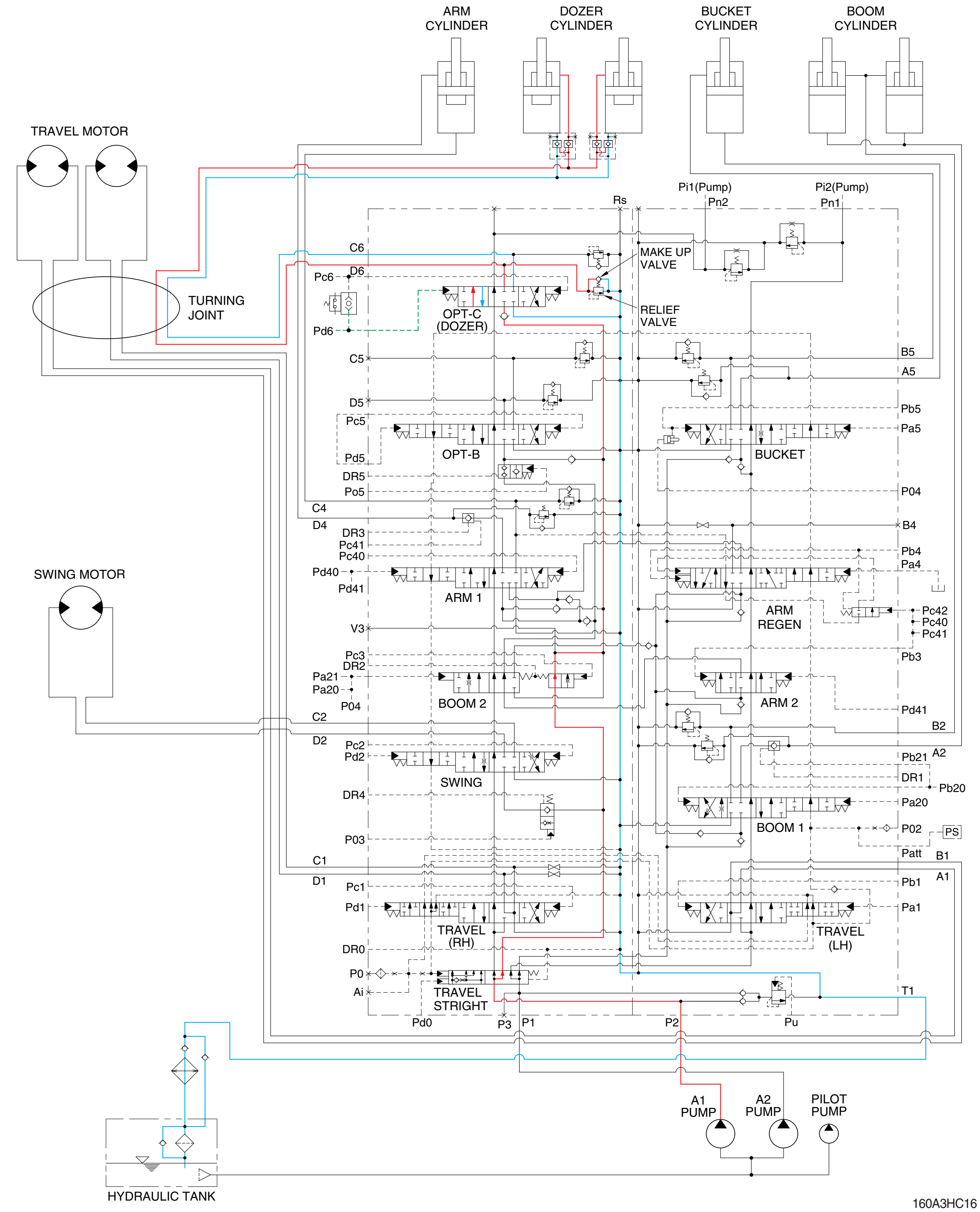
At the same time, the oil from the large chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls out.

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

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

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

7. DOZER UP OPERATION



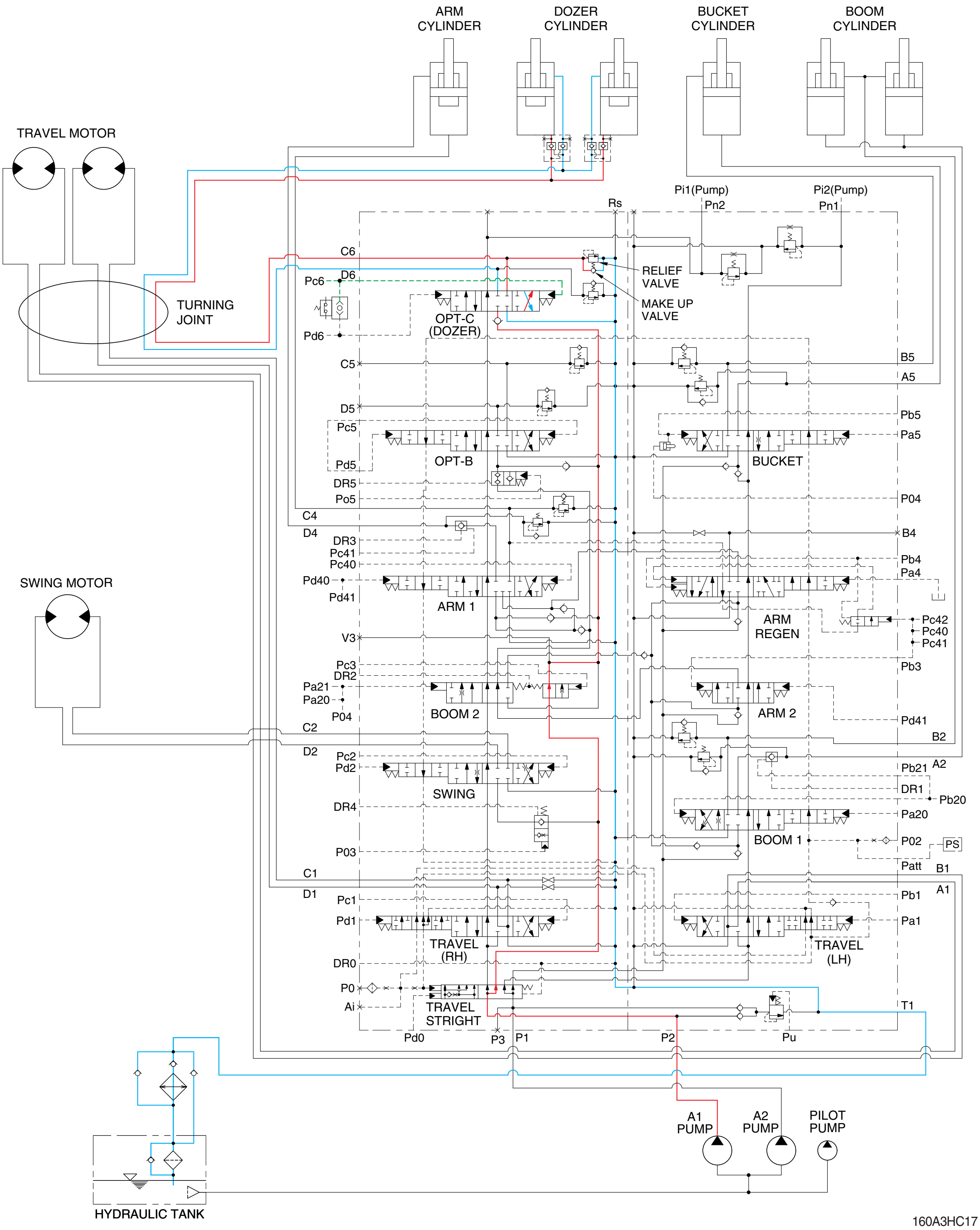
When the dozer control lever is pulled back, the dozer spool in the main control valve is moved to the dozer up position by the pilot oil pressure (Pd6) from the remote control valve.

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

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

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

8. DOZER DOWN OPERATION



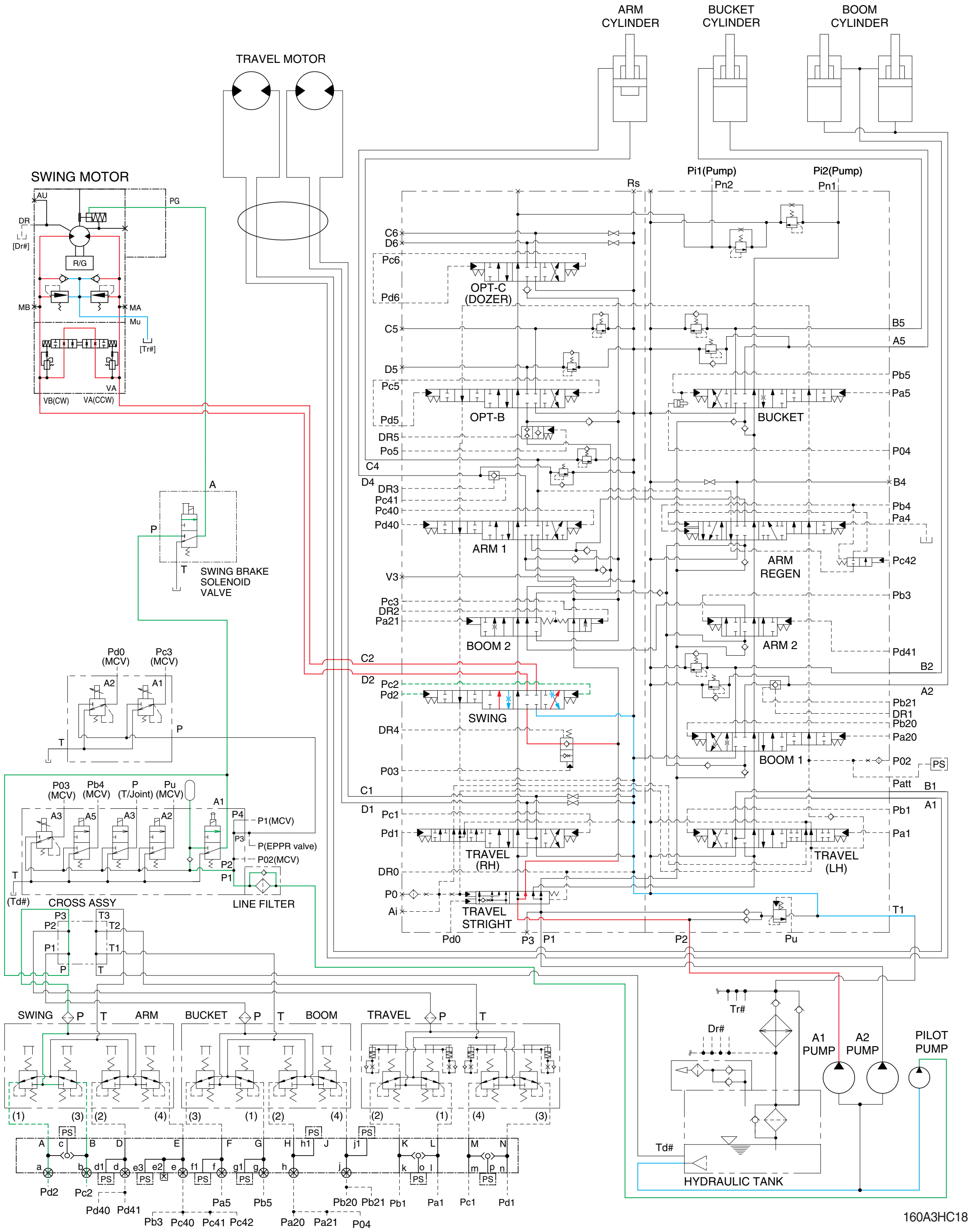
When the dozer control lever is pushed forward, the dozer spool in the main control valve is moved to the dozer down position by the pilot oil pressure (Pc6) from the remote control valve.

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

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

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

9. SWING OPERATION



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 (Pc2, Pd2) from the remote control valve.

Also the swing operation preference function is operated by the pilot pressure **Pc3** (refer to page 3-15).

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.

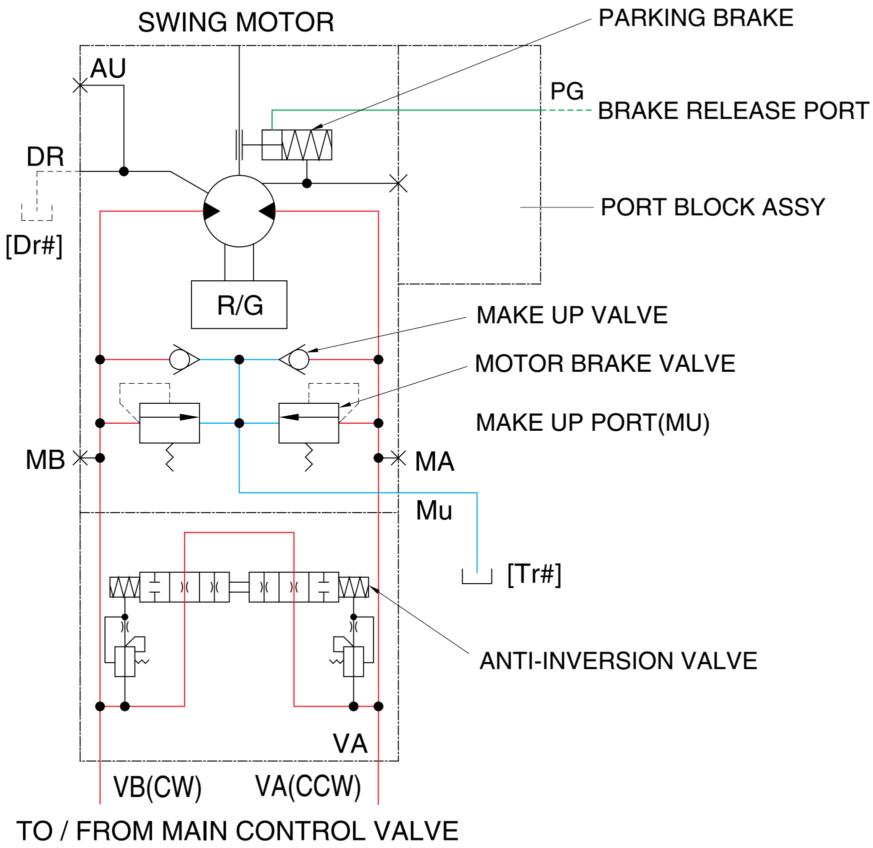
When this happens, the upper structure swings to the left or right.

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



160A3HC18A

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 285 kgf/cm^2 (4060 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 is not operated.

PARKING BRAKE "OFF" OPERATION

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

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

PARKING BRAKE "ON" OPERATION

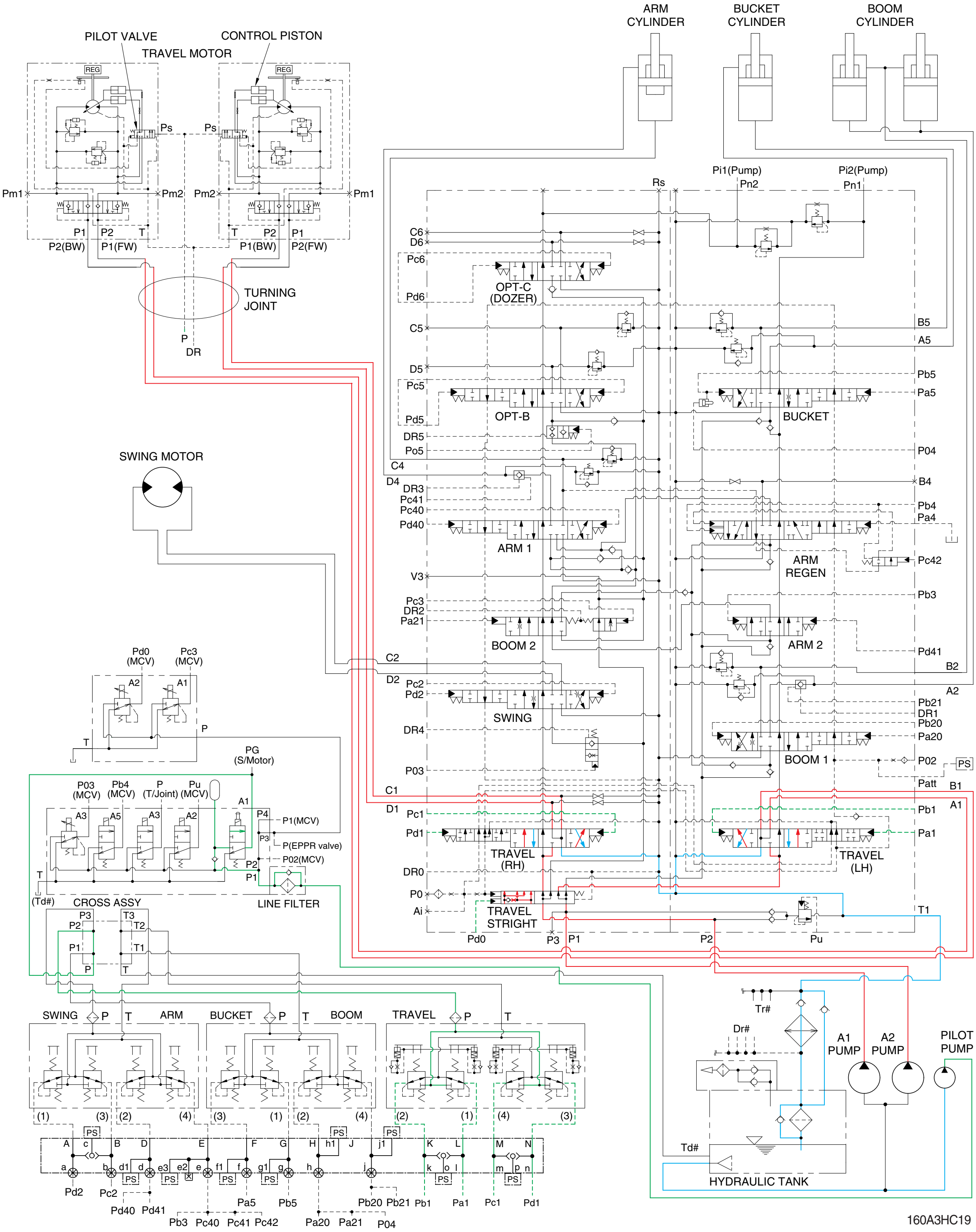
When the swing control lever is set in the neutral position, the swing brake solenoid valve is de-energized, oil in the swing parking brake chamber is drained through the the swing brake solenoid valve, thus the brake is applied by spring force.

4) ANTI-INVERSION VALVE

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

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

10. TRAVEL FORWARD AND REVERSE OPERATION



When the travel levers are pushed forward or reverse position, the travel spools in the main control valve are moved to the forward or reverse travel position by the pilot oil pressure (Pa1, Pb1, Pc1, Pd1) from the remote control valve.

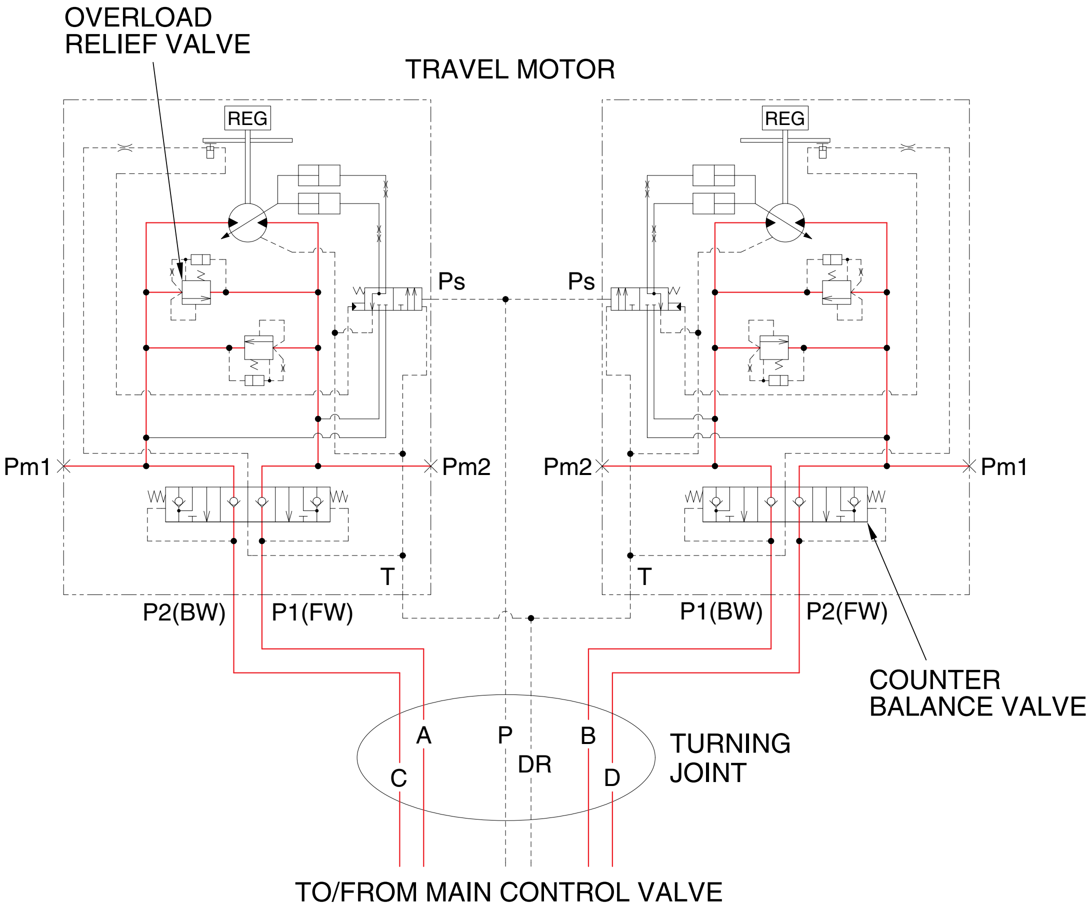
The travel straight spool is shifted to the right and the left and right travel oil supply passage are connected, and equivalent amount of oil flows into the left and right travel motors through the turning joint. This keeps the straight travel. Refer to the page 3-16.

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



160A3HC19A

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

1) COUNTER BALANCE VALVE

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

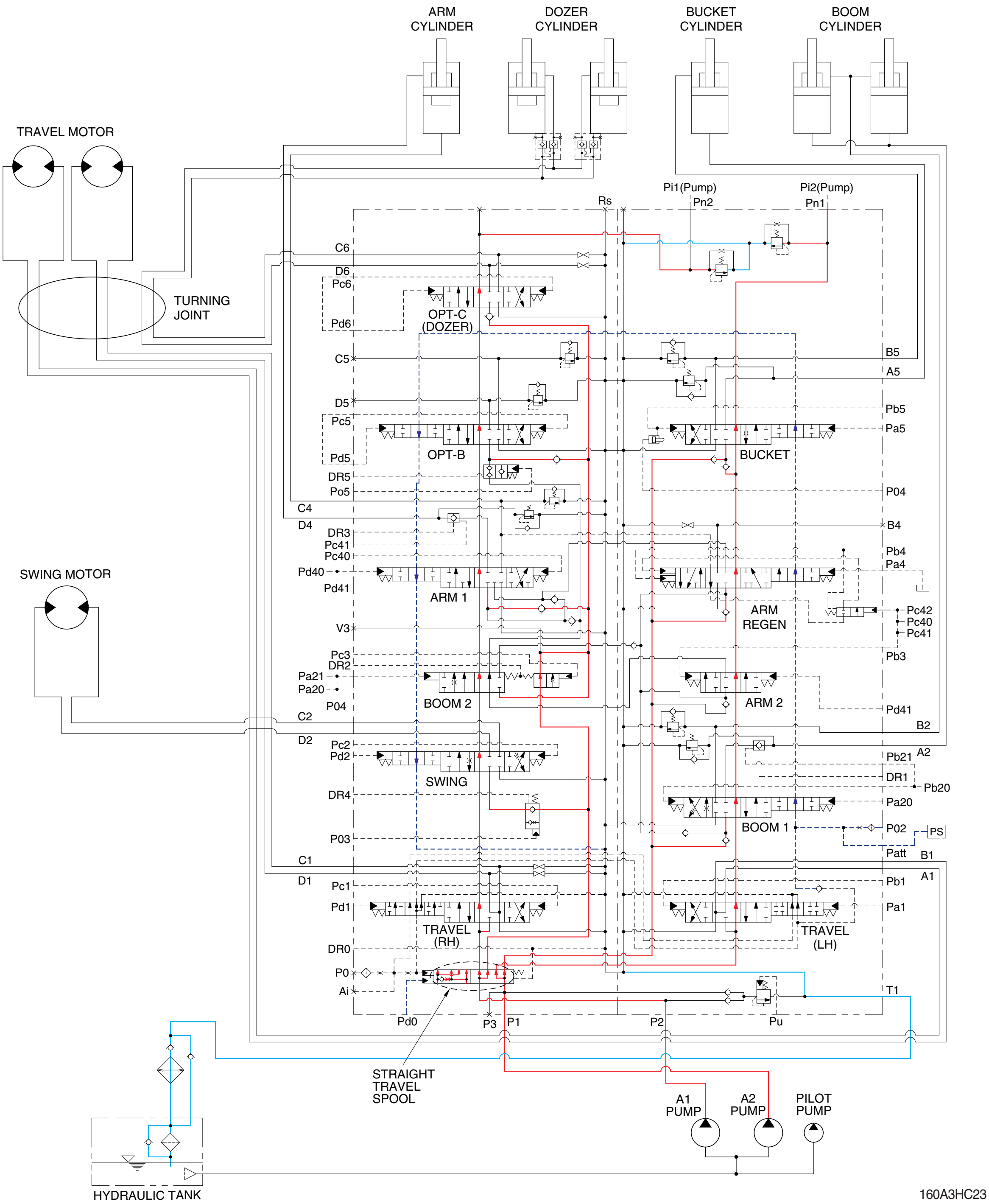
2) OVERLOAD RELIEF VALVE

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

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

GROUP 5 COMBINED OPERATION

1. OUTLINE



160A3HC23

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.

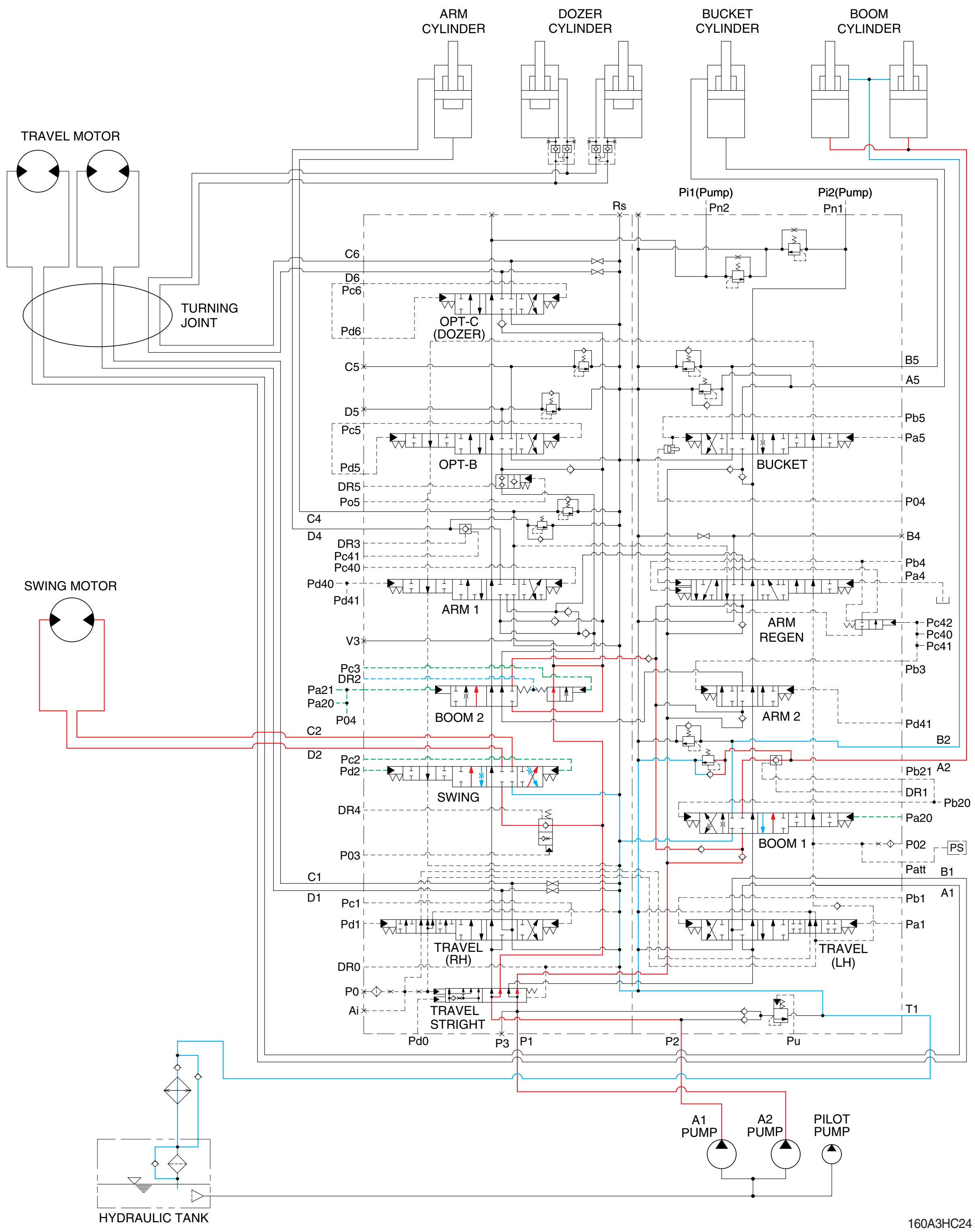
STRAIGHT TRAVEL SPOOL

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

Refer to the page 3-16 for details.

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

2. COMBINED SWING AND BOOM UP OPERATION



When the swing and boom up functions are operated simultaneously, the swing spool and boom spools in the main control valve are moved to the functional position by the pilot oil pressure (Pc2, Pd2, Pa20, Pa21) from the remote control valve.

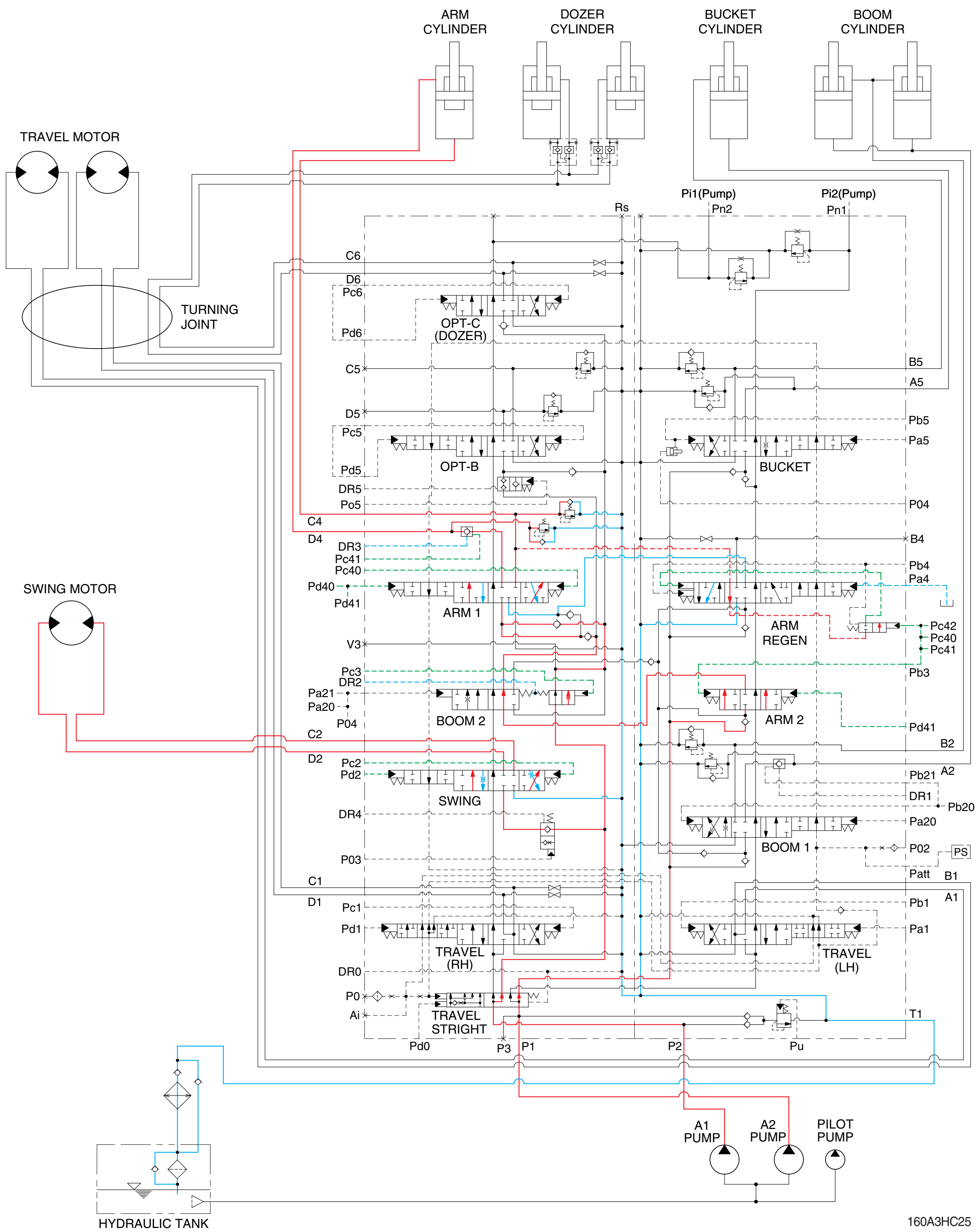
The oil from the A1 pump flows into the swing motor through swing spool and the boom cylinders through boom 2 spool.

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



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 (Pc2, Pd2, Pc40, Pb3, Pd40, Pd41) from the remote control valve.

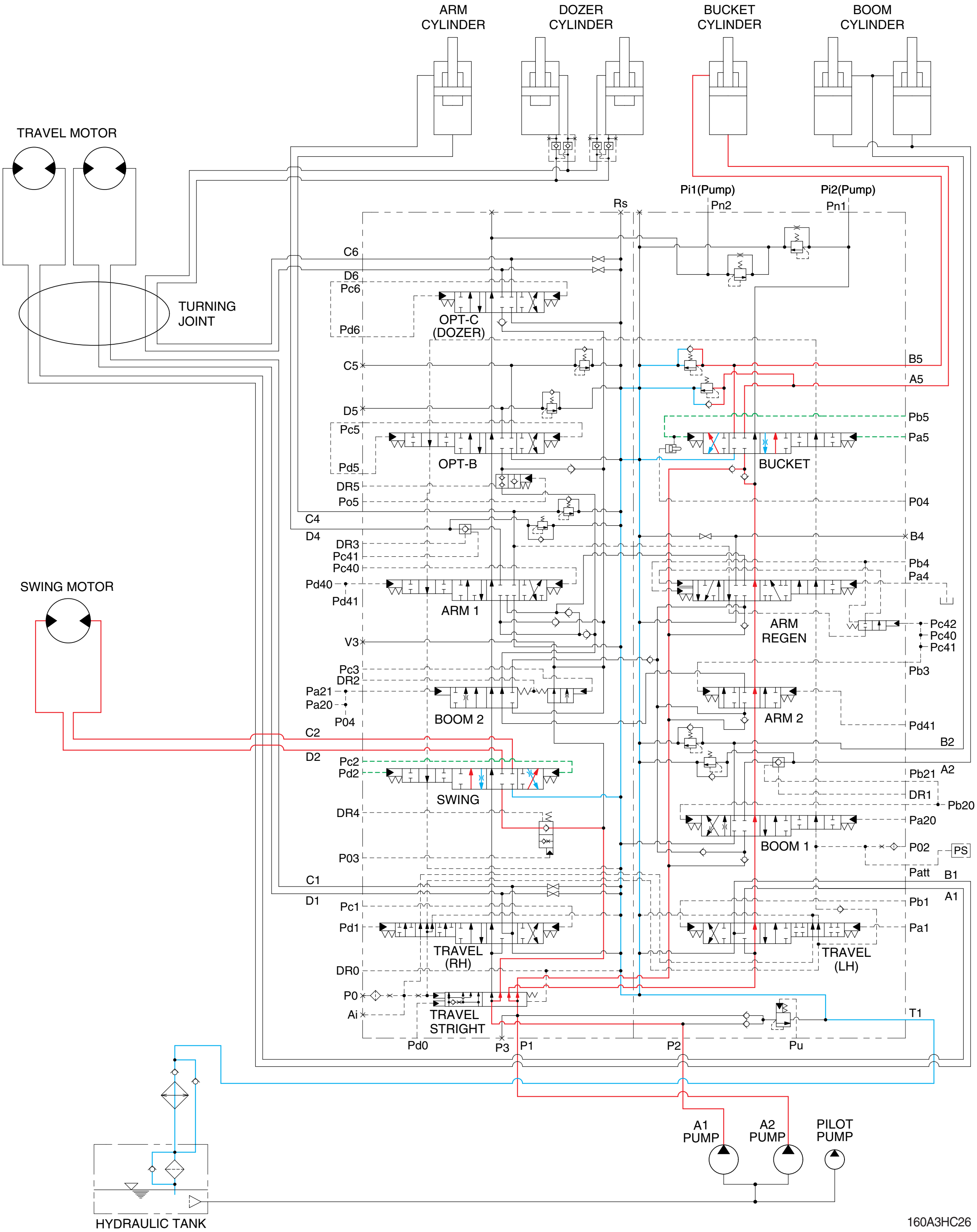
The oil from the A1 pump flows into the swing motor through swing spool and the arm cylinder through arm 1 spool.

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 3-15 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



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 (Pc2, Pd2, Pa5, Pb5) from the remote control valve.

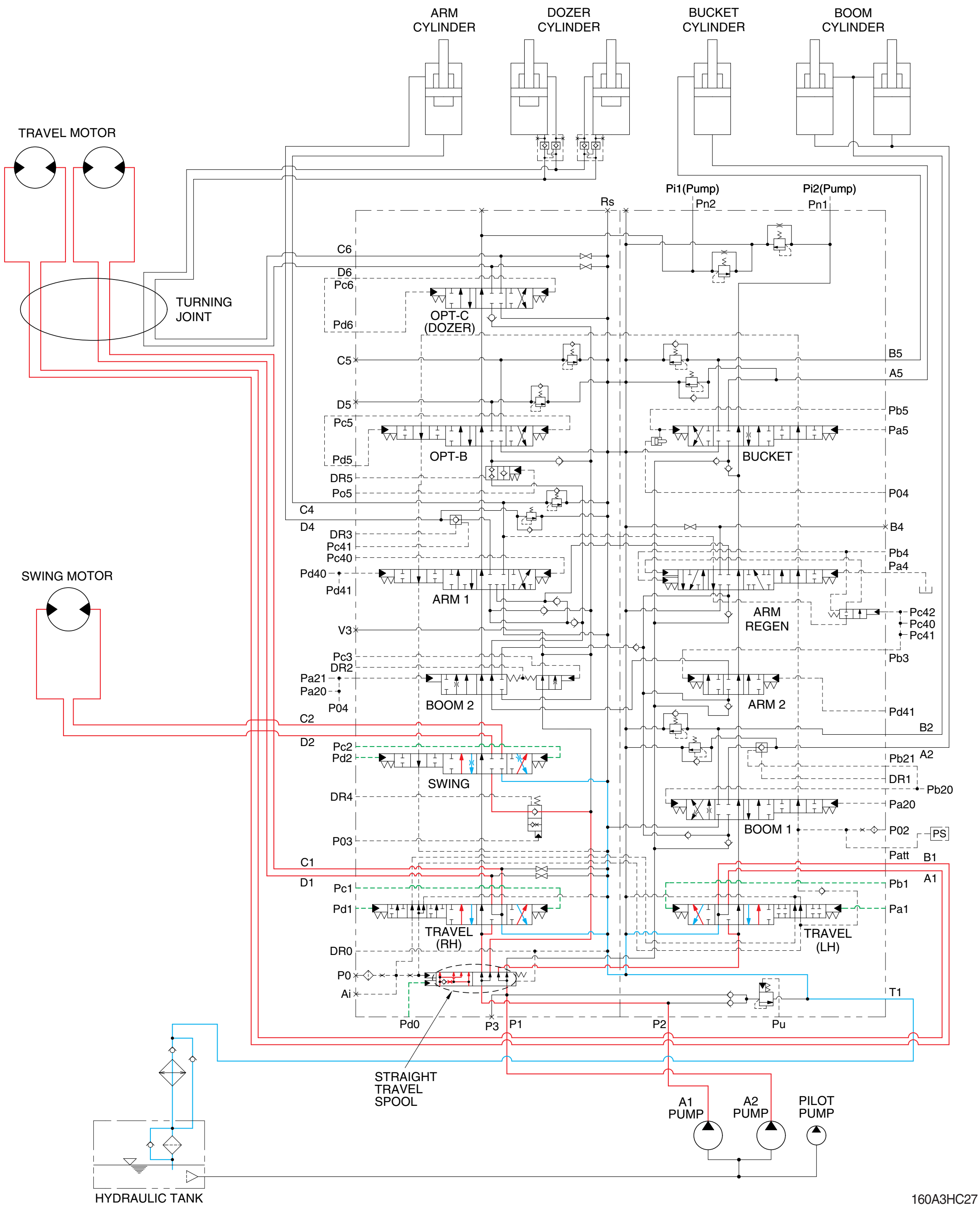
The oil from the A1 pump flows into the swing motor through the swing spool in the left control valve.

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



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 (Pc2, Pd2, Pa1, Pb1, Pc1, Pd1) from the remote control valve and straight travel spool is pushed to the right by the pilot oil pressure of the travel straight EPPR valve.

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.

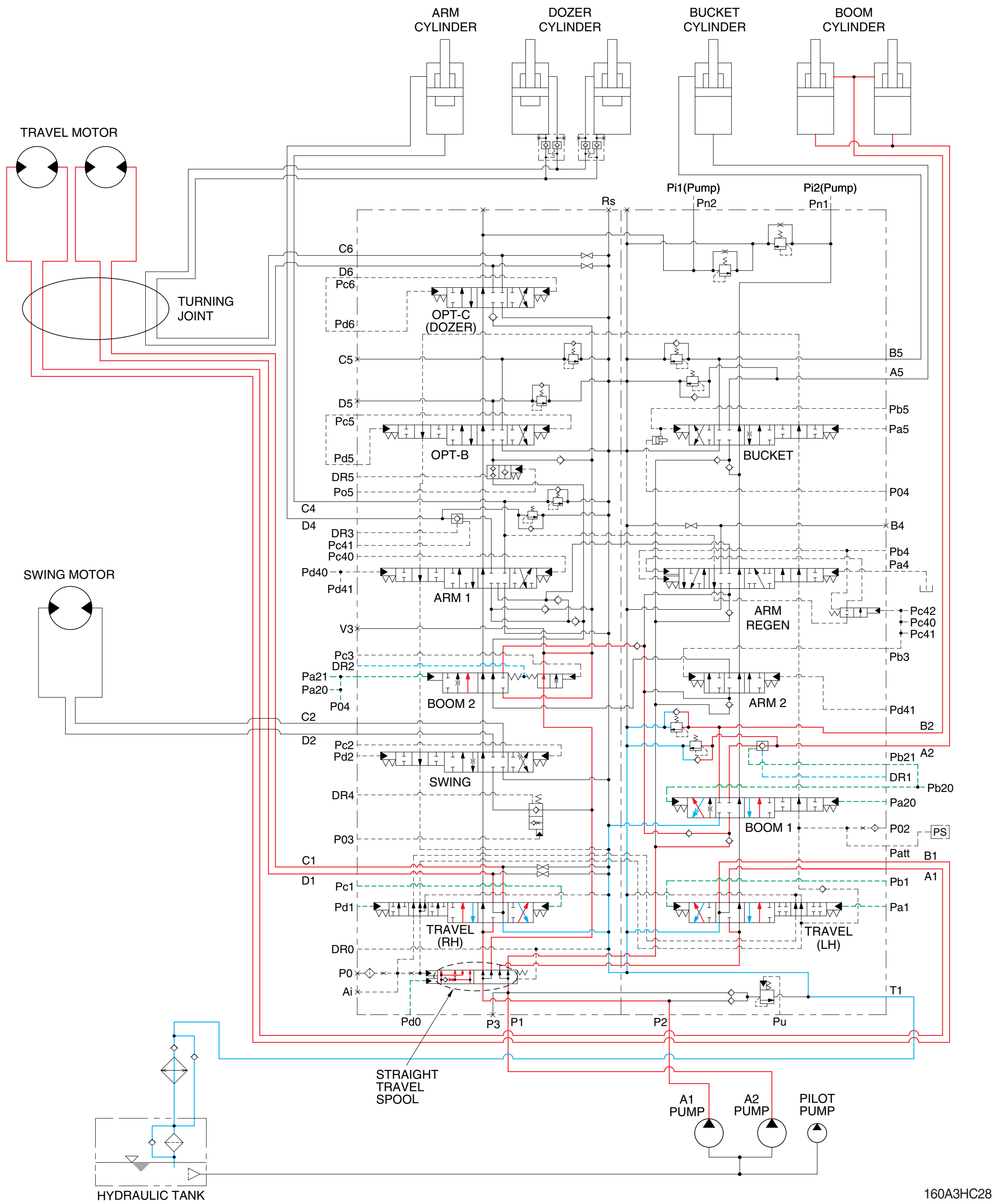
The oil from the A2 pump flows into the swing motor through the straight travel spool.

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

The upper structure swings and the machine travels straight.

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

6. COMBINED BOOM AND TRAVEL OPERATION



When the boom and travel functions are operated simultaneously, the boom spools and travel spools in the main control valve are moved to the functional position by the pilot oil pressure (Pa20, Pa21, Pb20, Pc2, Pd2, Pa1, Pb1, Pc1, Pd1) from the remote control valve and the straight travel spool is pushed to the right by the oil pressure of the travel straight EPPR valve.

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

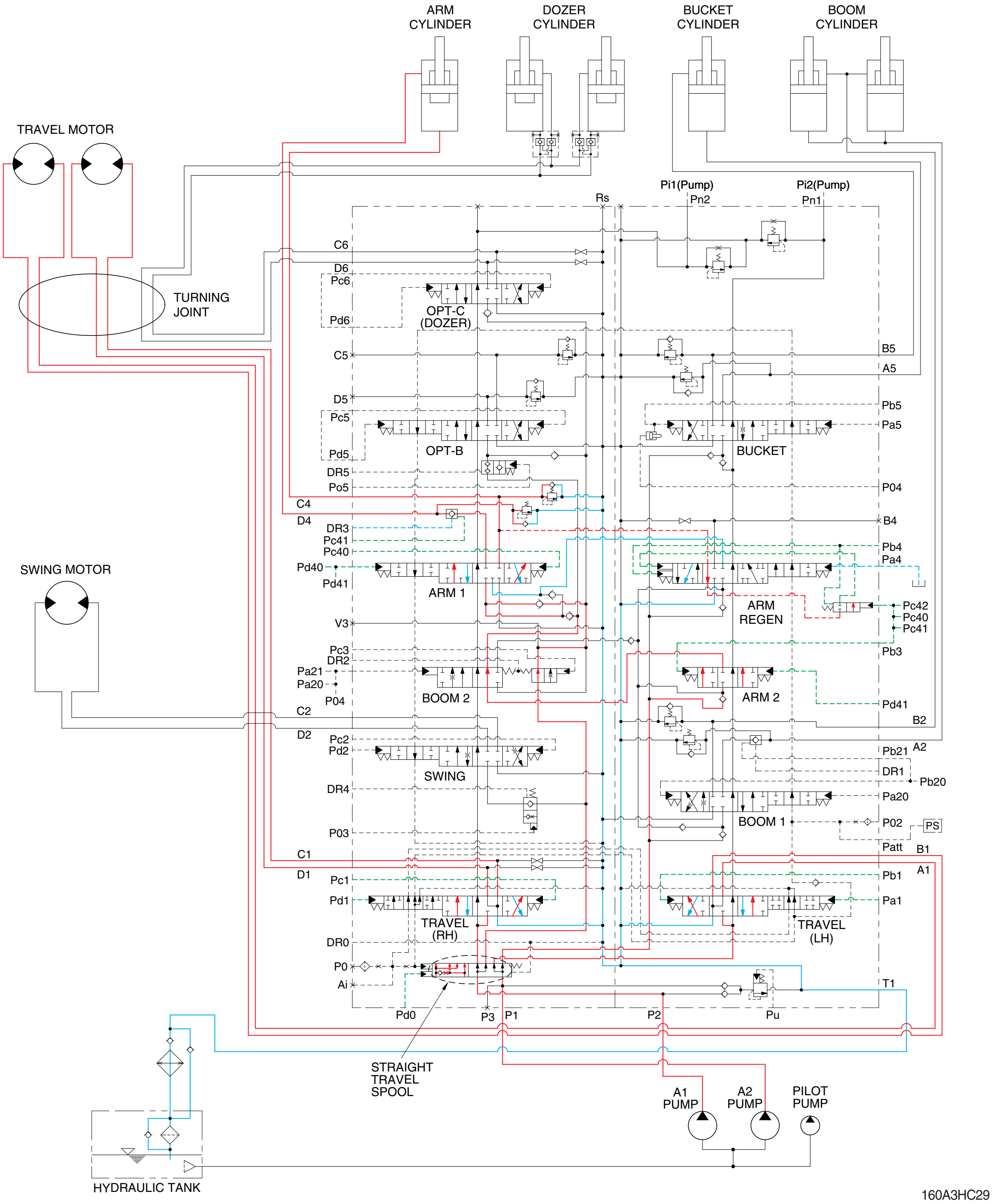
The oil from the A2 pump flows into the boom cylinders through the boom 2 spool and boom 1 spool via the parallel and confluence oil passage in case boom up operation.

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

The boom is operated and the machine travels straight.

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

7. COMBINED ARM AND TRAVEL OPERATION



When the arm and travel functions are operated simultaneously, the arm spools and travel spools in the main control valve are moved to the functional position by the pilot oil pressure (Pc40, Pb3, Pd40, Pd41, Pa1, Pb1, Pc1, Pd1) from the remote control valve and the straight travel spool is pushed to the right by the oil pressure of the travel straight EPPR valve.

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

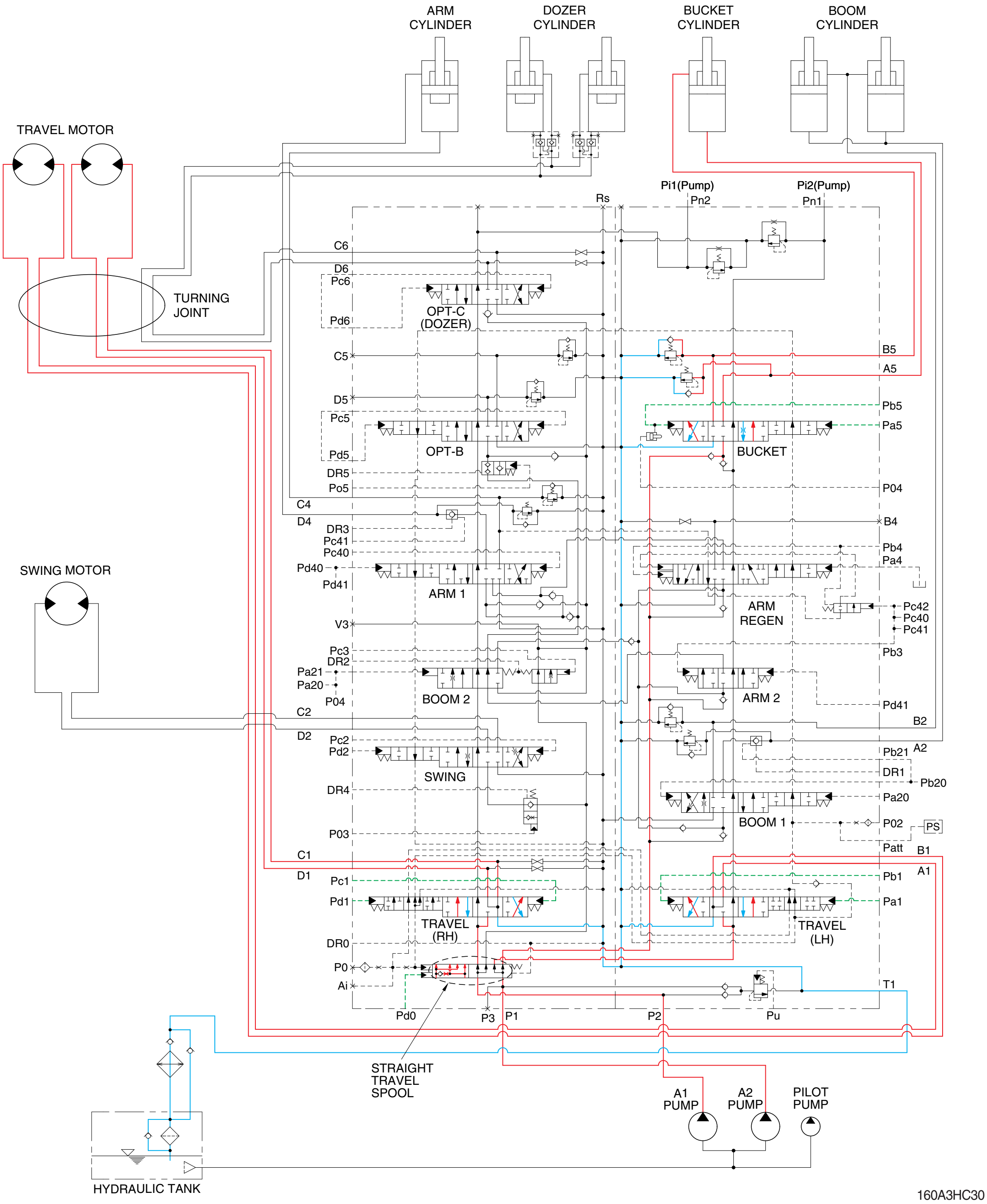
The oil from the A2 pump flows into the arm cylinders through the arm 1 spool and arm 2 spool via the parallel and confluence oil passage.

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

The arm is operated and the machine travels straight.

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

8. COMBINED BUCKET AND TRAVEL OPERATION



160A3HC30

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 (Pa5, Pb5, Pa1, Pb1, Pc1, Pd1) from the remote control valve, and the straight travel spool is pushed to the right by the oil pressure of the travel straight EPPR valve. The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool of the control valve.

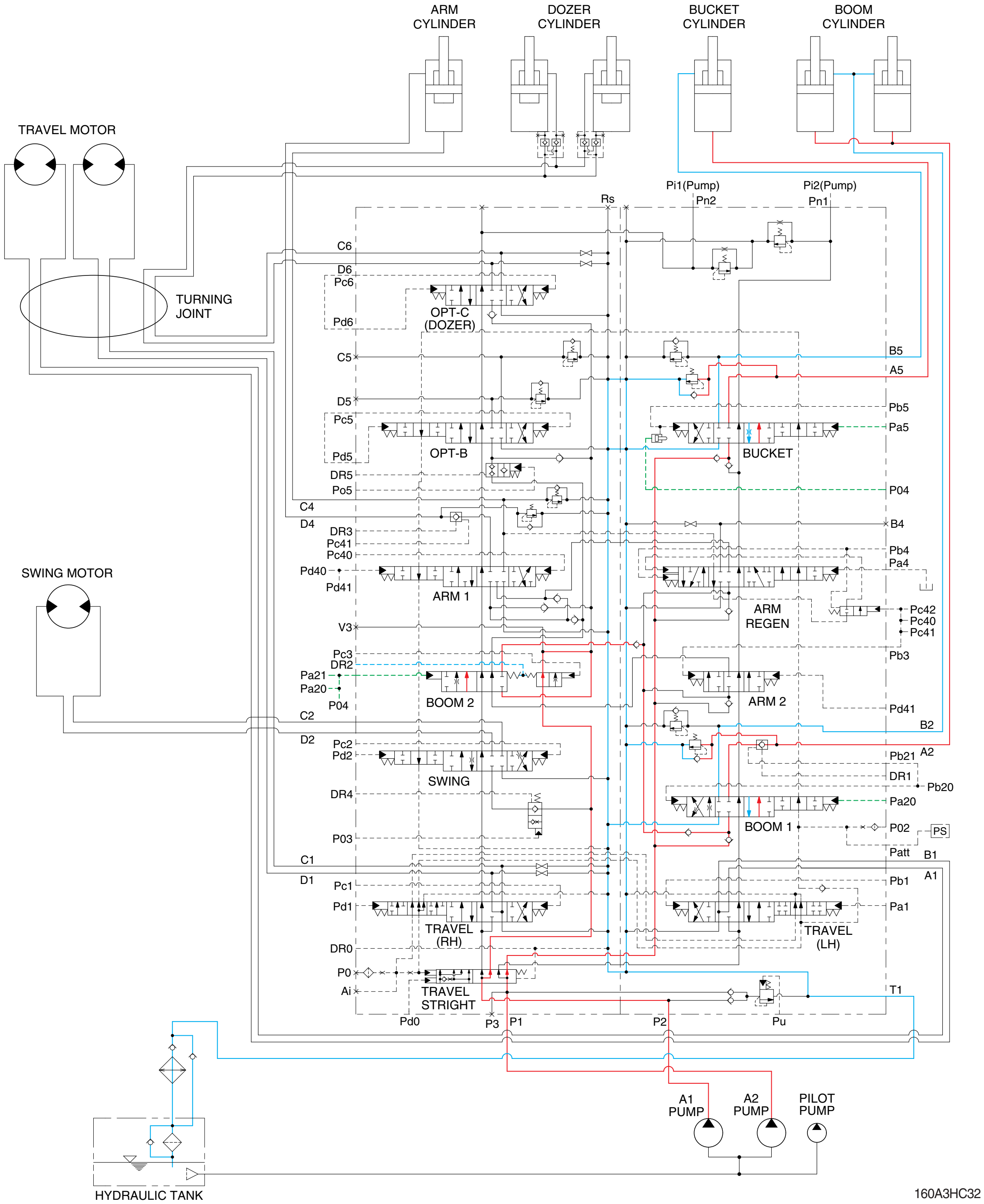
The oil from the A2 pump flows into the bucket cylinder through the bucket spool via the confluence oil passage.

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

The bucket is operated and the machine travels straight.

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

9. COMBINED BOOM UP AND BUCKET IN OPERATION



When the boom up and bucket functions are operated simultaneously, each spool in the main control valve is moved to the functional position by the pilot oil pressure (Pa20, Pa21, Pa5) from the remote control valve.

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

Also, when the boom up and bucket in functions are operated simultaneously, the boom up operation preference function is operated by the pilot pressure **P04** and then the the bucket spool transfers in the half stroke not full stroke (refer to page 2-36). Therefore, the most of pressurized oil flows into boom 1 spool than the bucket spool to make the boom up operation more preferential.

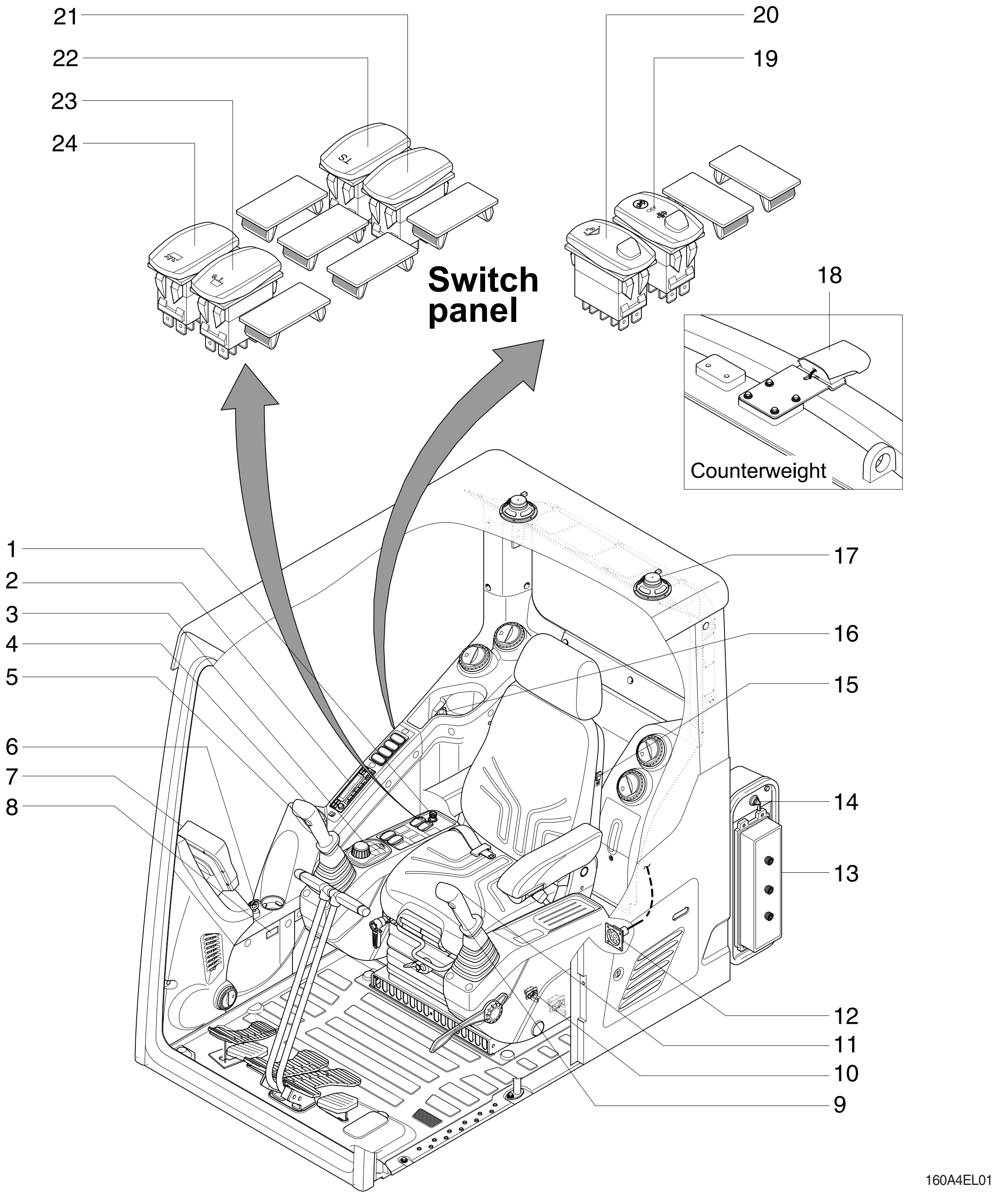
The boom and bucket are operated.

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

SECTION 4 ELECTRICAL SYSTEM

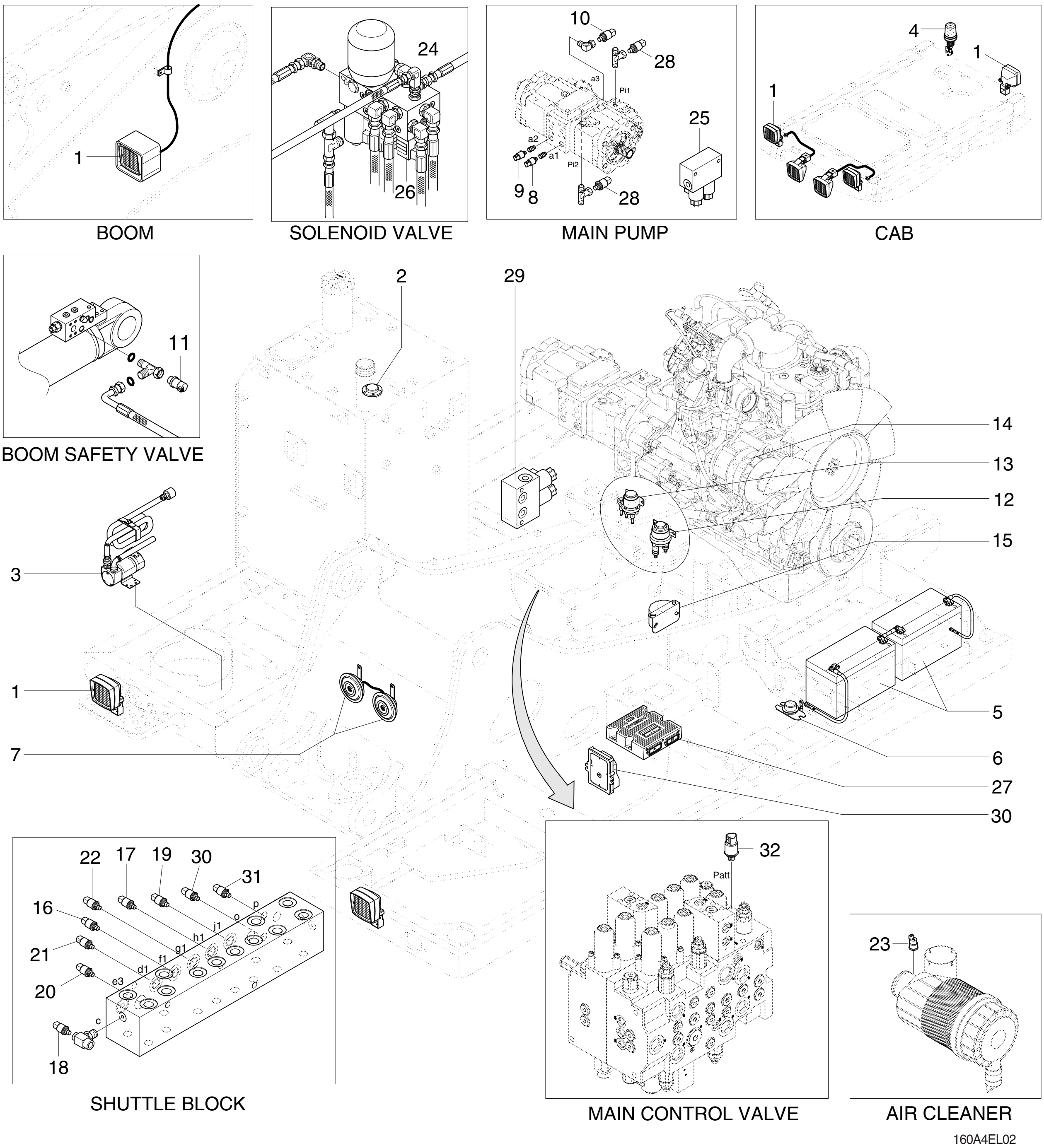
GROUP 1 COMPONENT LOCATION

1. LOCATION 1



1	Cigar lighter	10	Emergency engine stop switch	19	Exhaust system cleaning switch
2	Radio & USB player	11	One touch decel switch	20	Quick clamp switch (opt)
3	Haptic controller	12	RS232 & J1939 service socket	21	Option attachment switch (opt)
4	Horn switch	13	Fuse & relay box	22	Travel straight switch (opt)
5	Breaker operation switch	14	Master switch	23	Swing lock switch (opt)
6	Starting switch	15	Seat heater switch	24	Free/fine swing switch (opt)
7	Cluster	16	Power socket	25	Rear view camera
8	Service meter	17	Speaker		
9	Power max switch	18	Camera		

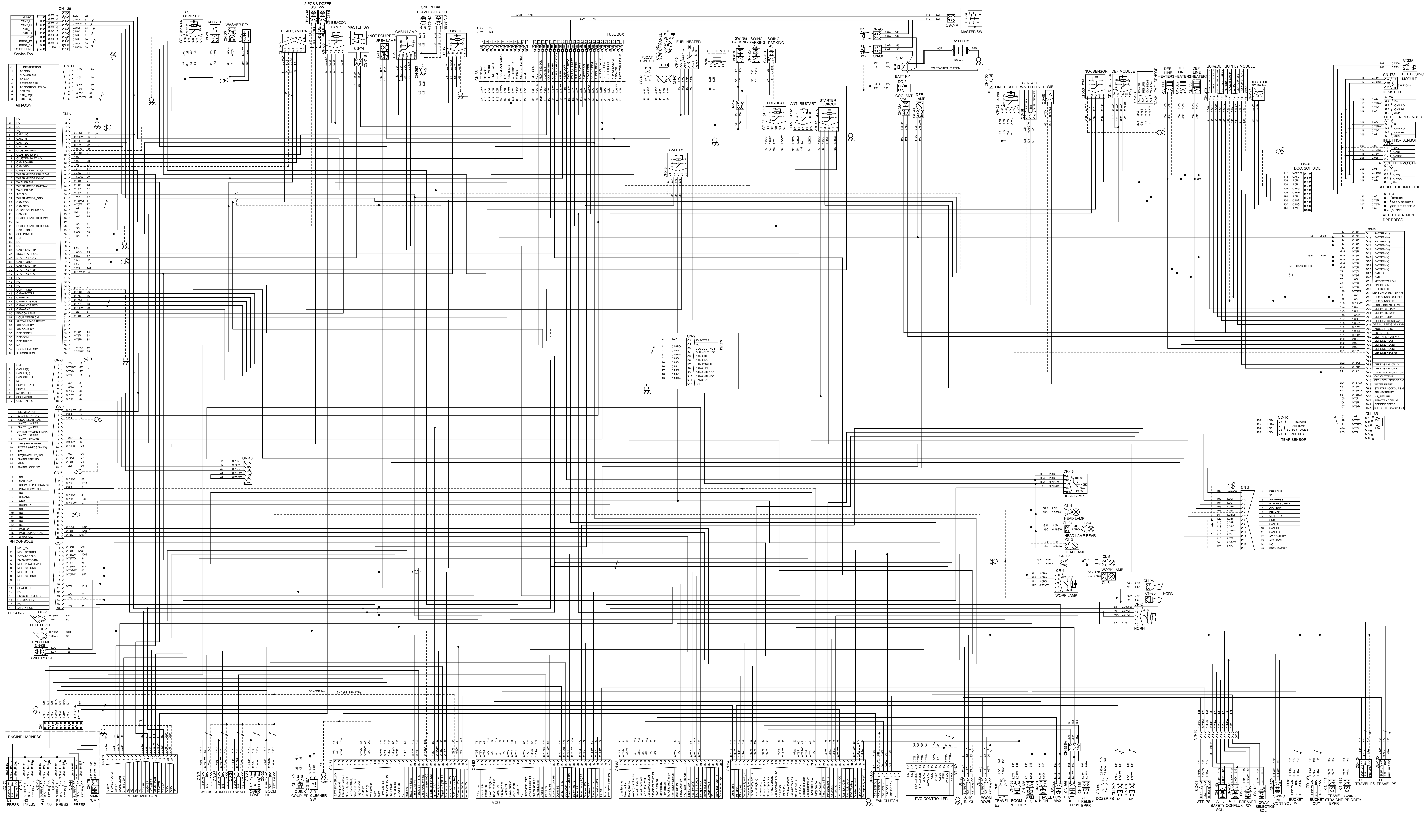
2. LOCATION 2



1	Lamp	12	Start relay	23	Air cleaner sensor
2	Fuel sender	13	Heater relay	24	Solenoid valve
3	Fuel filler pump	14	Alternator	25	Pump EPPR valve
4	Beacon lamp	15	Travel alarm buzzer	26	Boom priority EPPR valve
5	Battery	16	Bucket in pressure sensor	27	MCU
6	Battery relay	17	Boom up pressure sensor	28	Nega-control pressure sensor
7	Horn	18	Swing pressure sensor	29	EPPR valve (travel straight & swing priority)
8	P1 pressure sensor	19	Boom down pressure sensor	30	LH Travel pressure sensor
9	P2 pressure sensor	20	Arm in pressure sensor	31	RH Travel pressure sensor
10	EPPR pressure sensor	21	Arm out pressure sensor	32	Attach pressure sensor
11	Overload pressure sensor	22	Bucket out pressure sensor		

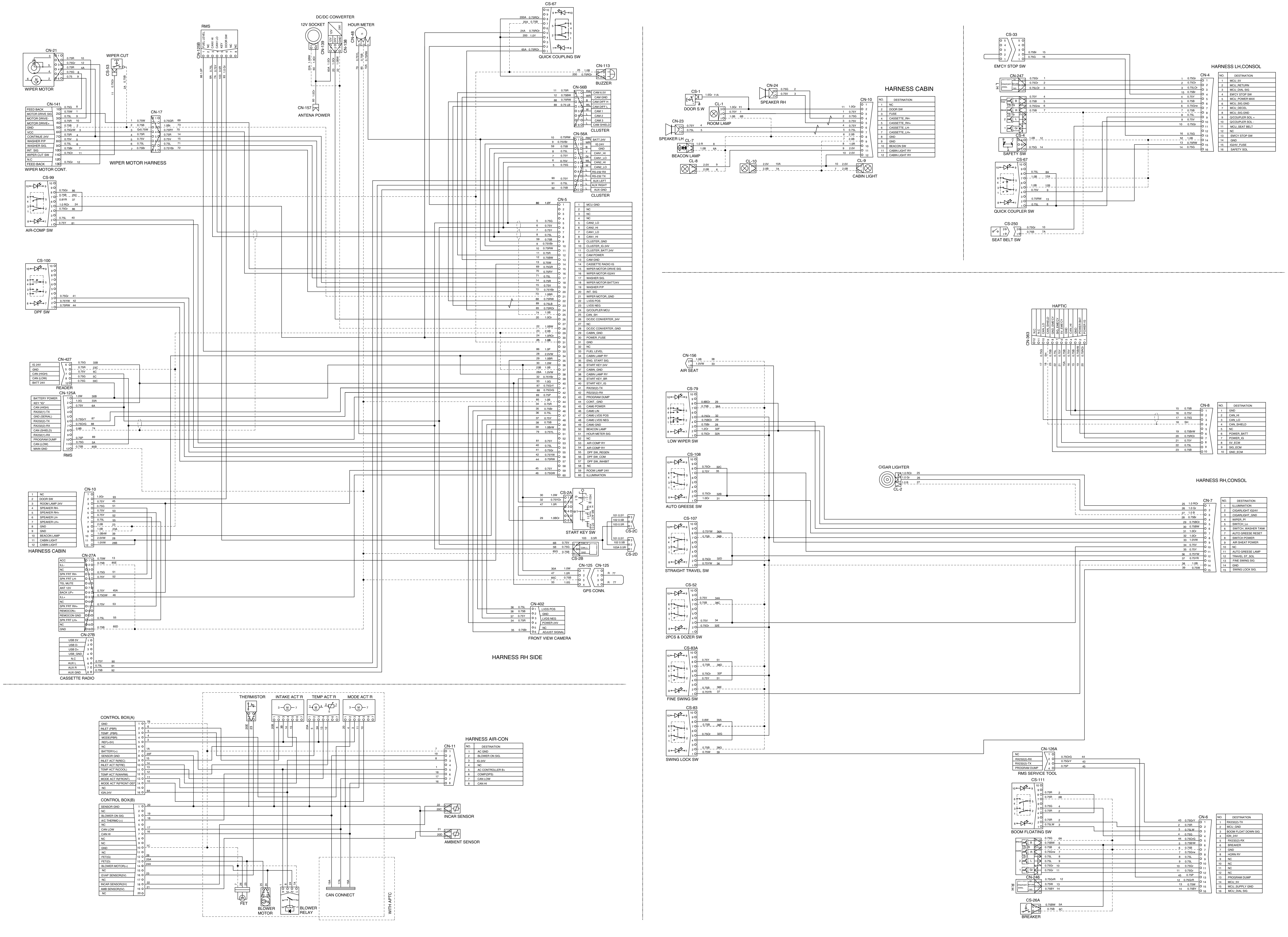
GROUP 2 ELECTRICAL CIRCUIT

· ELECTRICAL CIRCUIT (1/3)

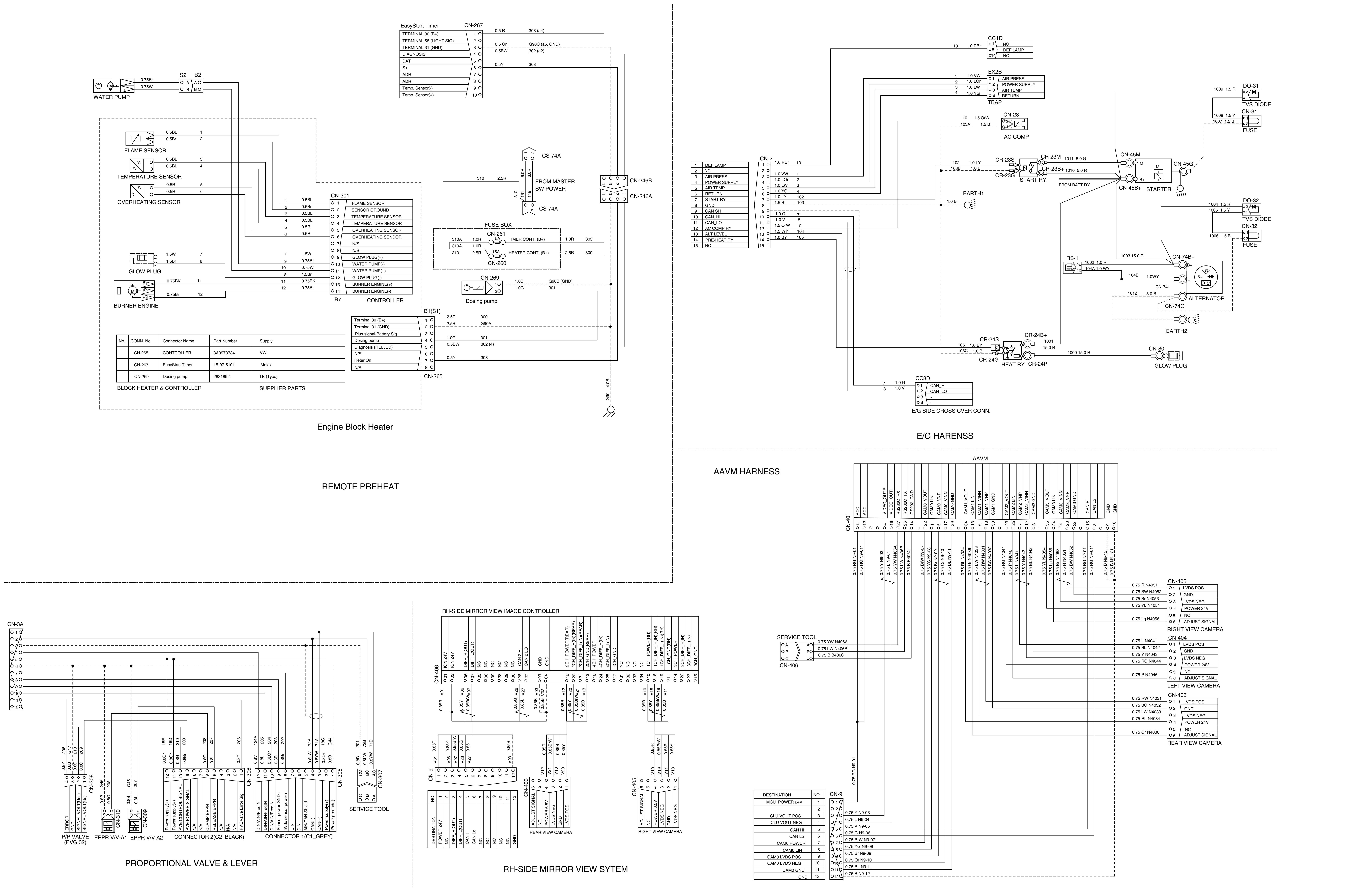


20K4-65521-00

· ELECTRICAL CIRCUIT (2/3)



20K4-65540-00



20K4-65531-00

MEMORANDUM

1. POWER CIRCUIT

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-] → Circuit breaker [CN-60] → Master switch [CS-74A]
- → Fuse box [No.1] → MCU [CN-54 (18)]
- → Fuse box [No.2] → NOx sensor [CR-50 (3)]
- → Fuse box [No.3] → DEF module [CR-5 (30, 86)]
- Fuse box [No.4] → Line heater [CR-53 (30, 86)]
- → Fuse box [No.5]
  - → I/conn [CN-3 (1, 6, 11)] → Engine ECM [CN-93 (1, 25, 26, 27, 28)]
  - → DEF/AdBlue® purging lamp [CL-40 (1)]
- → Fuse box [No.6] → I/conn [CN-5 (59)]
  - → I/conn [CN-10 (3)] → Room lamp [CL-1 (2)]
    - → Door switch [CS-1]
  - → Radio & USB player [CN-27A (8)]
- → Fuse box [No.7] → MCU [CN-51 (1)]
- → Fuse box [No.8]
  - → 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.9] → I/conn [CN-11 (5)]
  - → AC & Heater control box A (7)
  - → Blower relay (4)
- → Fuse box [No.10] → I/conn [CN - 5 (18)] → I/conn [CN -17 (5)]
  - → Wiper motor controller [CN-141 (7)]
  - → Wiper motor [CN-21 (4)]
- → Fuse box [No.11] → I/conn [CN - 5 (11)]
  - → Cluster [CN -56A (1)]
  - → Hour meter [CN-48 (1)]

※ I/conn : Intermediate connector

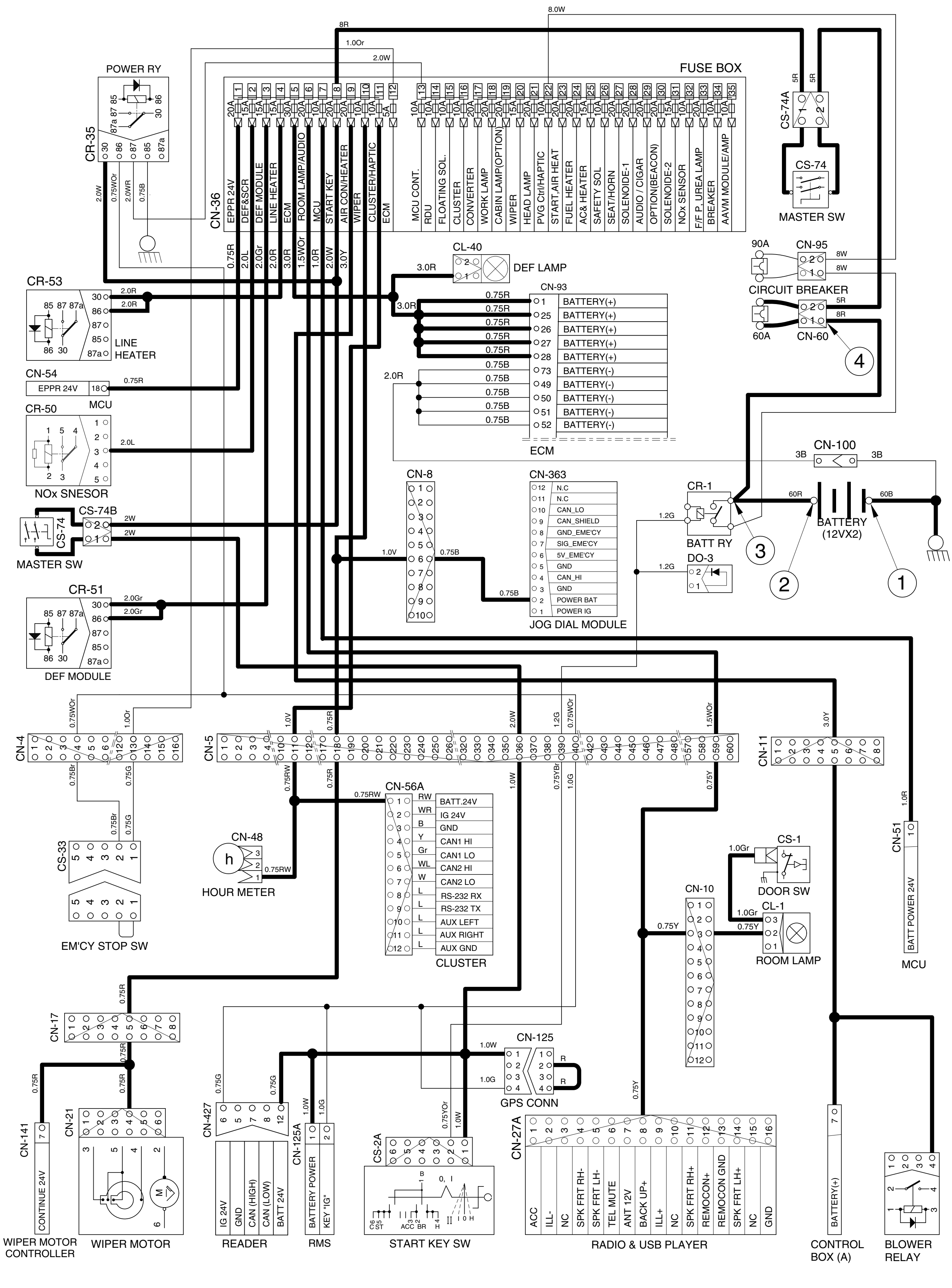
2) CHECK POINT

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

※ GND : Ground

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

POWER CIRCUIT



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

2. STARTING CIRCUIT

1) OPERATING FLOW

Battery (+) terminal → Battery relay [CR-1] → Circuit breaker [CN-60] → Master switch [CS-74A] → Fuse box [No.8] → Master switch [CS-74B] → I/conn [CN-5 (36)] → Start switch [CS-2A (1)]

(1) When start key switch is in ON position

→ Start switch ON [CS-2A (2)] → I/conn [CN-5 (39)]
  → Battery relay [CR-1] → Battery relay operating (all power is supplied with the electric component)
  → 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)]
→ 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 [No.13]
  → I/conn [CN-427 (6)]
  → RMS [CN-125A (2)]

(2) When start key switch is in START position

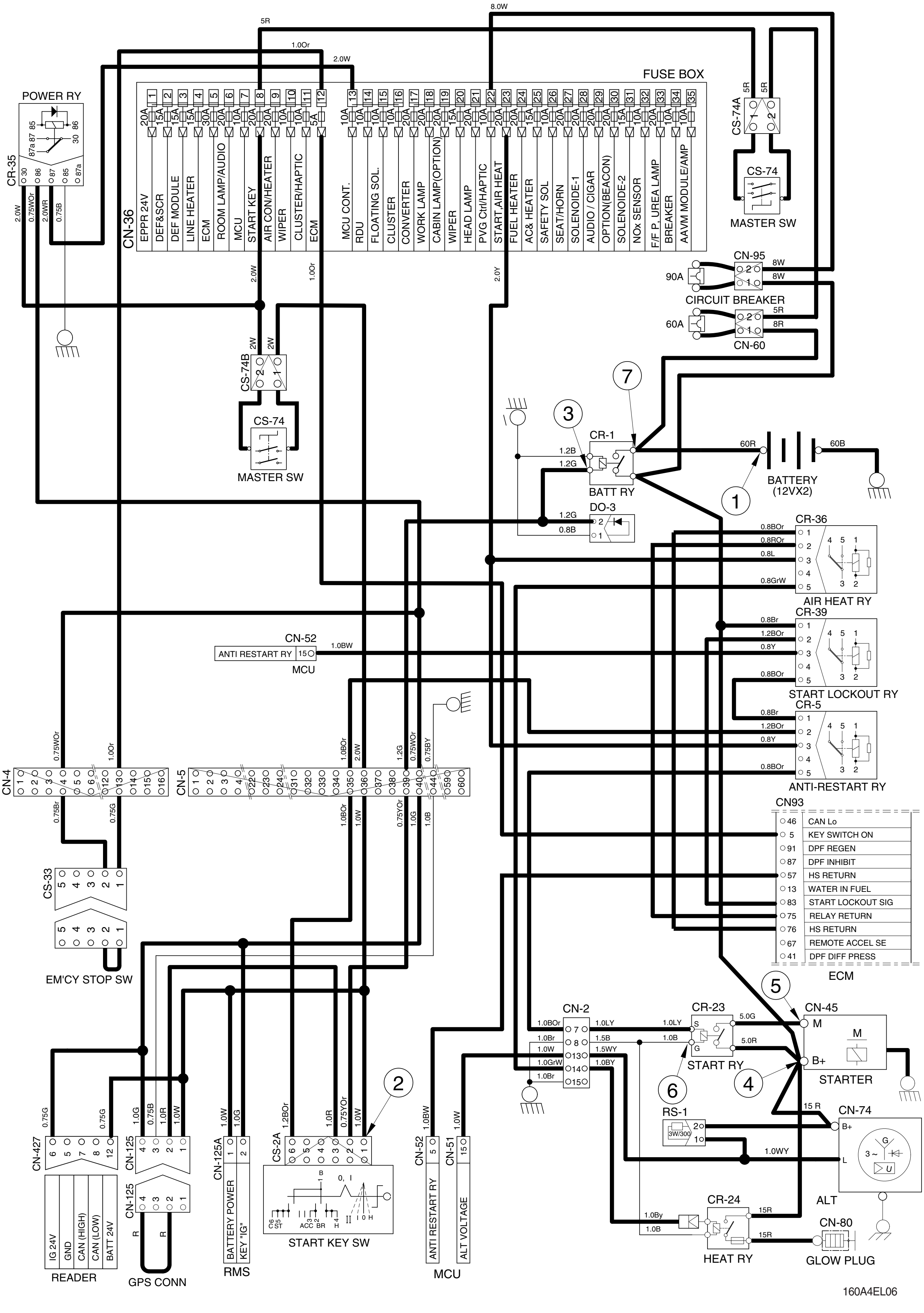
Start switch START [CS-2A (6)] → I/conn [CN-5 (35)] → Anti-restart relay [CR-5 (2)→(5)] → I/conn [CN-2 (7)] → Start relay [CR-23 (5)] → Starter motor operating

2) CHECK POINT

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

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

STARTING CIRCUIT



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

3. CHARGING CIRCUIT

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

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

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

1) OPERATING FLOW

(1) Warning flow

Alternator [CN-74 (L)] → I/conn [CN-2 (13)] → MCU alternator level [CN-51 (15)]
→ Cluster charging warning lamp (Via CAN interface)

(2) Charging flow

Alternator "B^+" terminal → Starter motor [CN-45 (B+)]
→ Battery relay (M8) → Battery (+) terminal
→ Circuit breaker [CN-60] → Master switch [CS-74A]
→ Fuse box [No.1~11]
→ Circuit breaker [CN-95] → Fuse box [No.17~35]

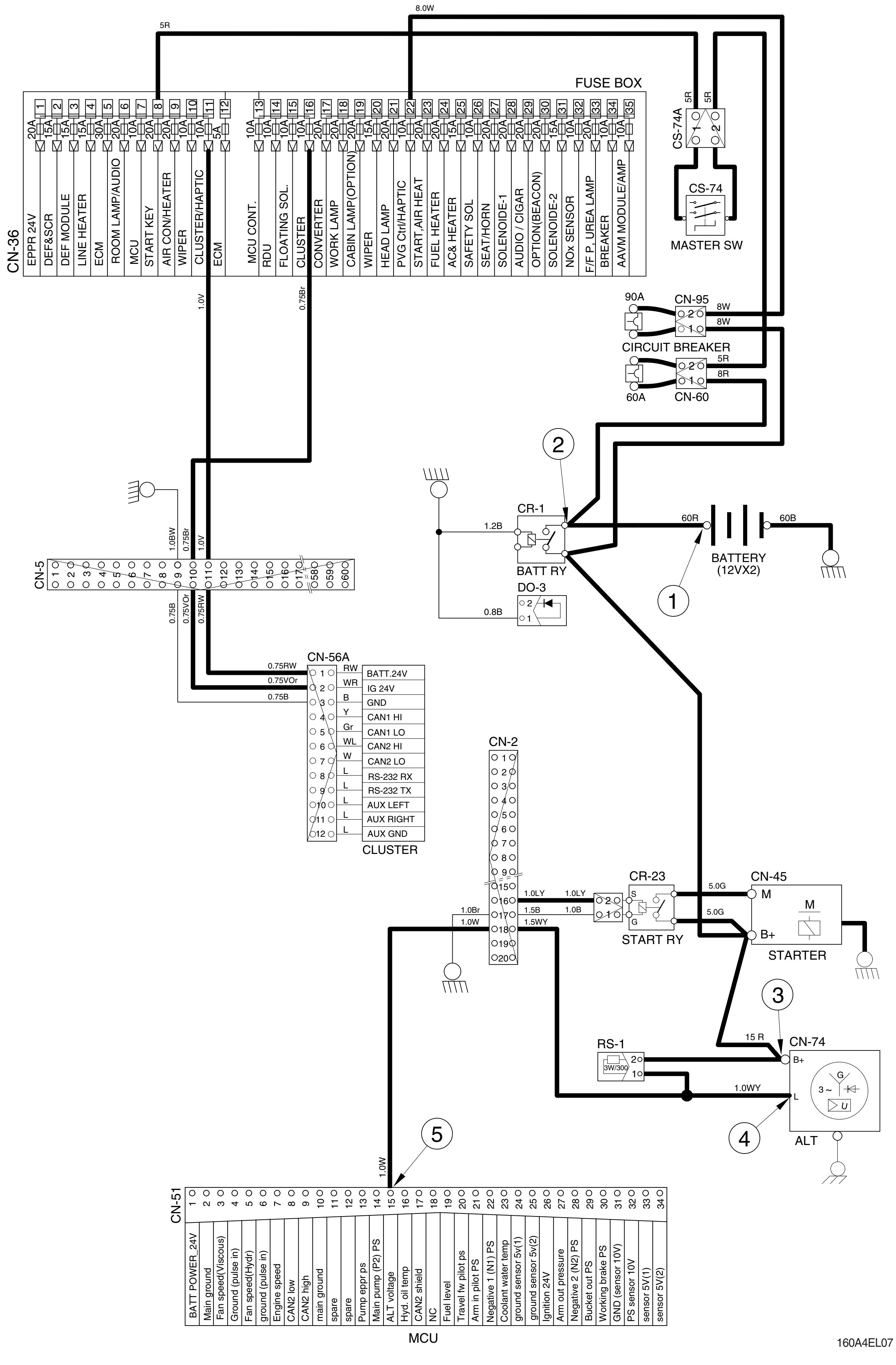
2) CHECK POINT

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

※ GND : Ground

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

CHARGING CIRCUIT



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

4. HEAD AND WORK LIGHT CIRCUIT

1) OPERATING FLOW

Fuse box (No.21) → Head light relay [CR-13 (30, 86)]
Fuse box (No.18) → 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 (2), CL-4 (2), CL-24 (2)]
→ I/conn [CN-7 (1)] → Cigar lighter [CL-2]
→ I/conn [CN-5 (60)] → Radio & USB player illumination ON [CN-27A (9)]

(2) Work light switch ON

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

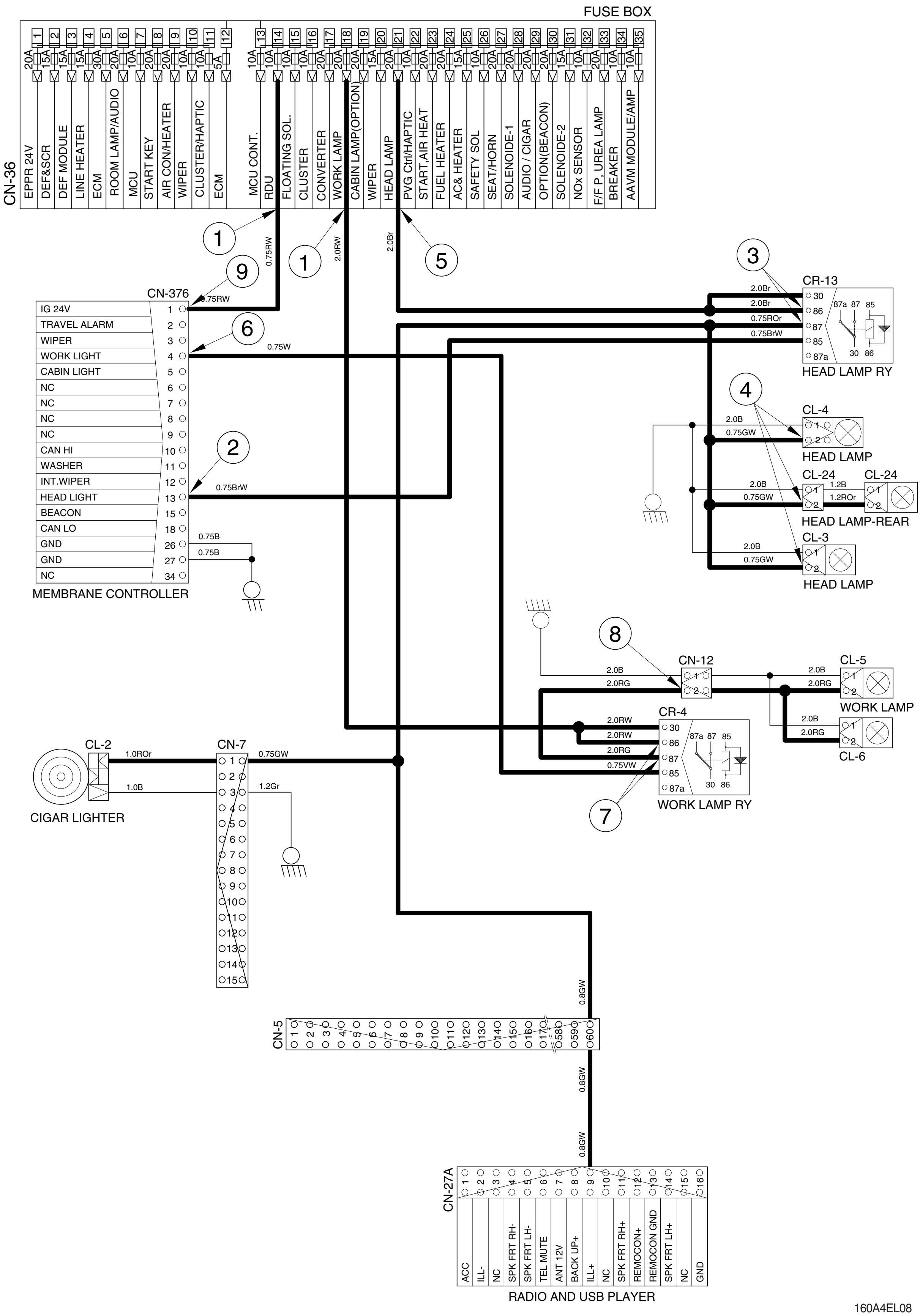
2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box) ② - GND (head light switch power output) ③ - GND (head light relay) ④ - GND (head light) ⑤ - GND (fuse box) ⑥ - GND (work light switch power output) ⑦ - GND (work light relay) ⑧ - GND (work light) ⑨ - GND (switch power input)	20~25V

※ GND : Ground

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

HEAD AND WORK LIGHT CIRCUIT



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

5. BEACON LAMP AND CAB LIGHT CIRCUIT

1) OPERATING FLOW

Fuse box (No.30) → Beacon lamp relay [CR-85 (2, 3)]
Fuse box (No.19) → 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)]

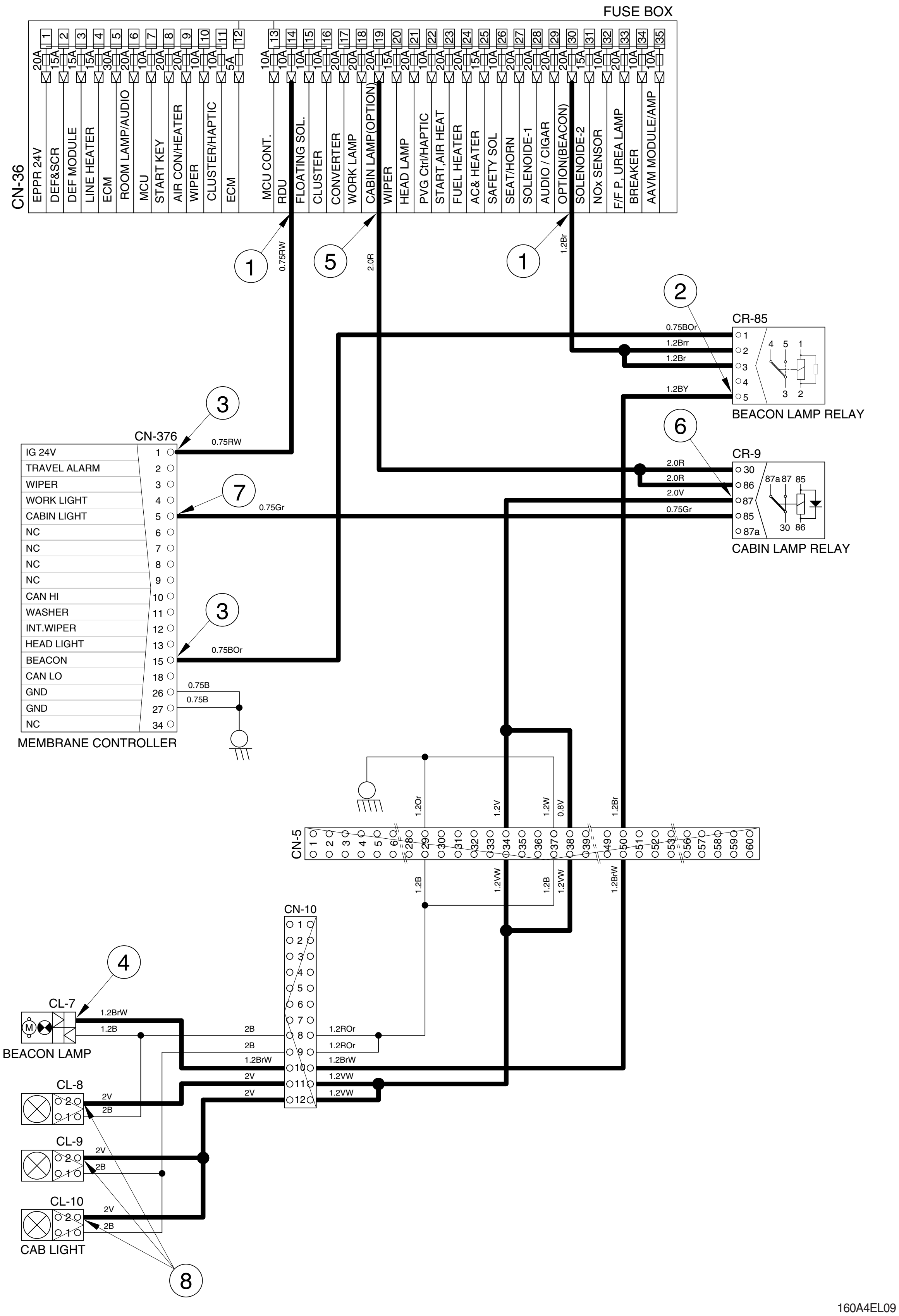
2) CHECK POINT

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



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

6. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

(1) Key switch ON

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

Fuse box (No.10) → 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)]
└→ 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

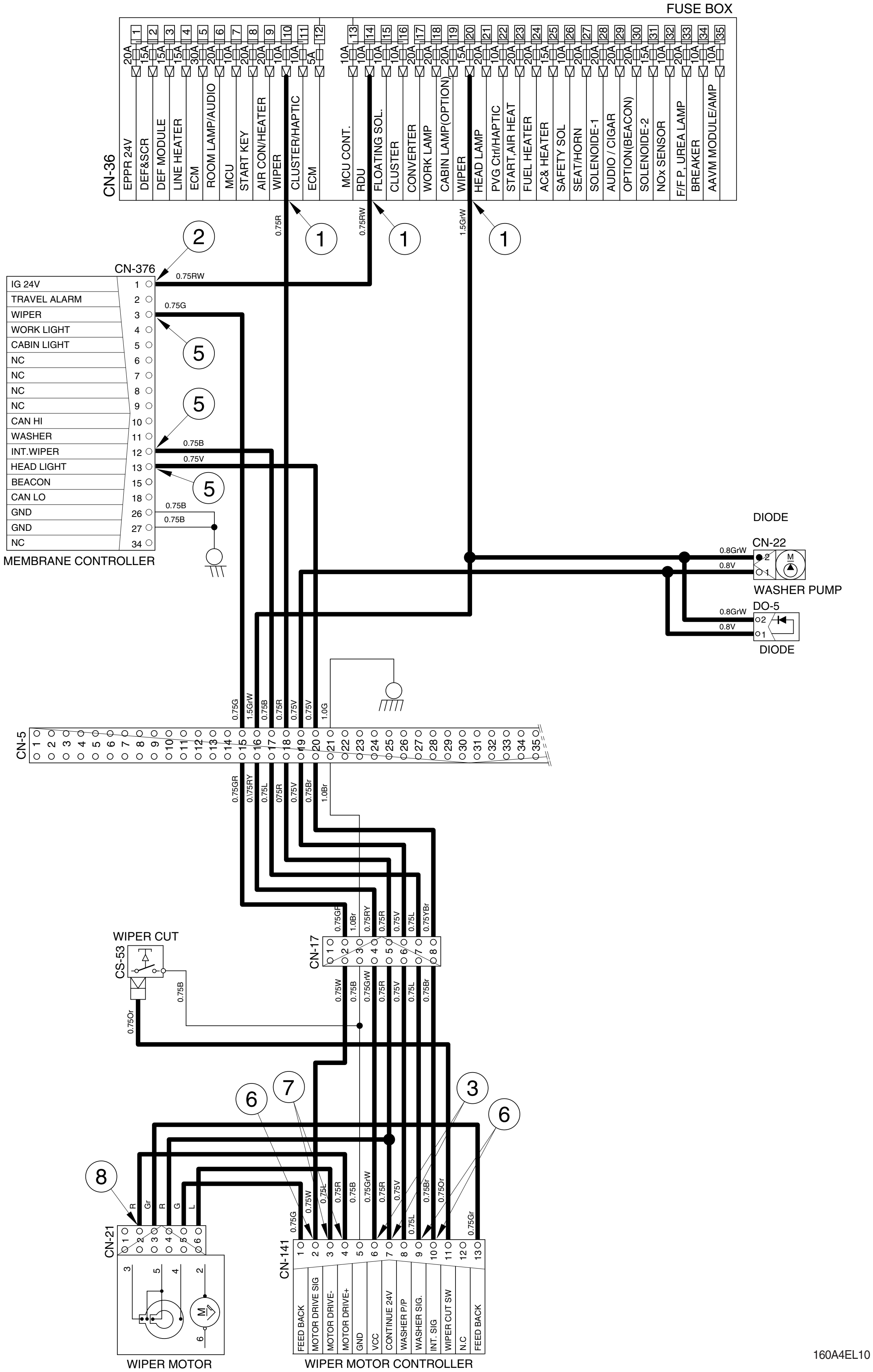
2) CHECK POINT

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

※ GND : Ground

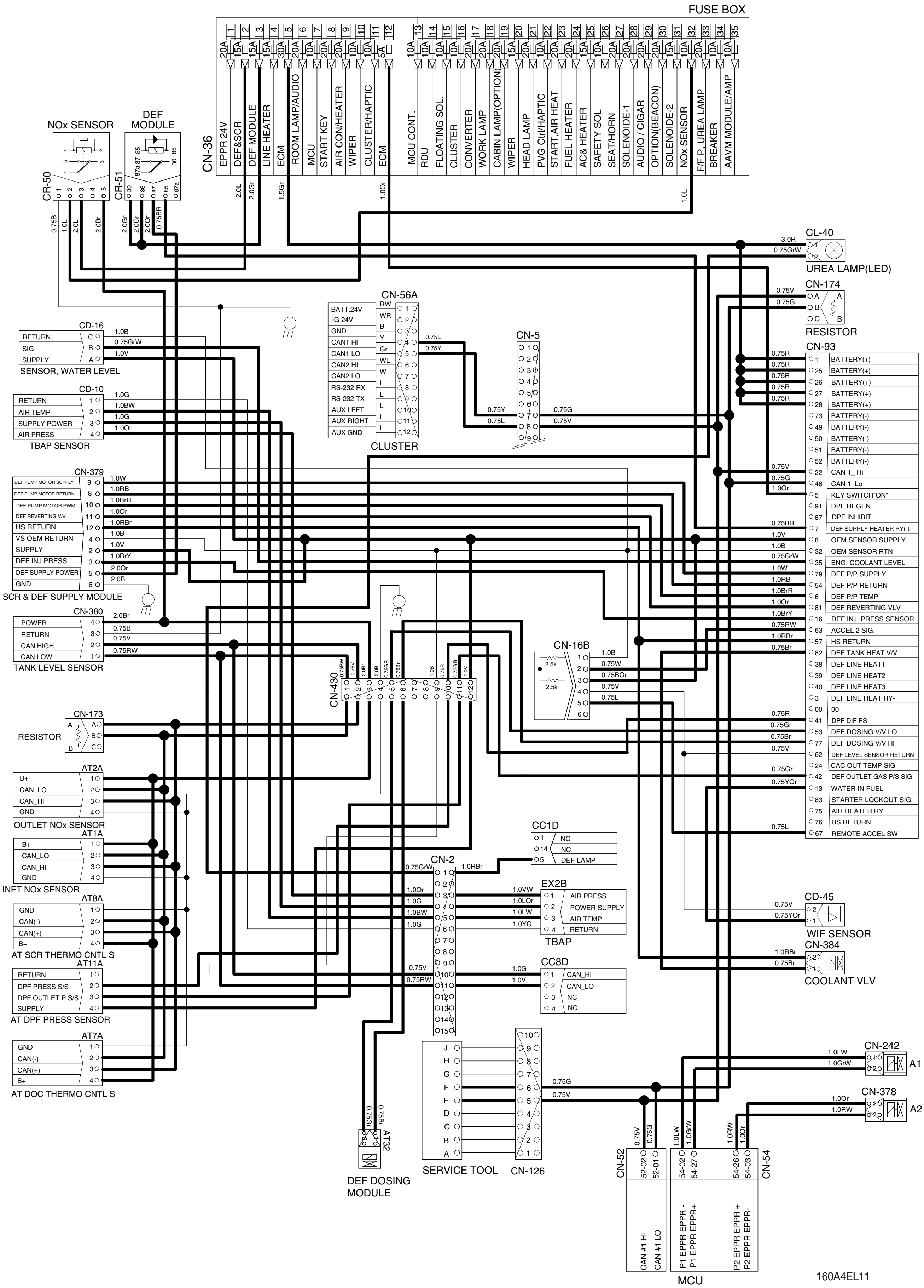
※ The circuit diagram may differ from the equipment, so please check before a repair.

WIPER AND WASHER CIRCUIT



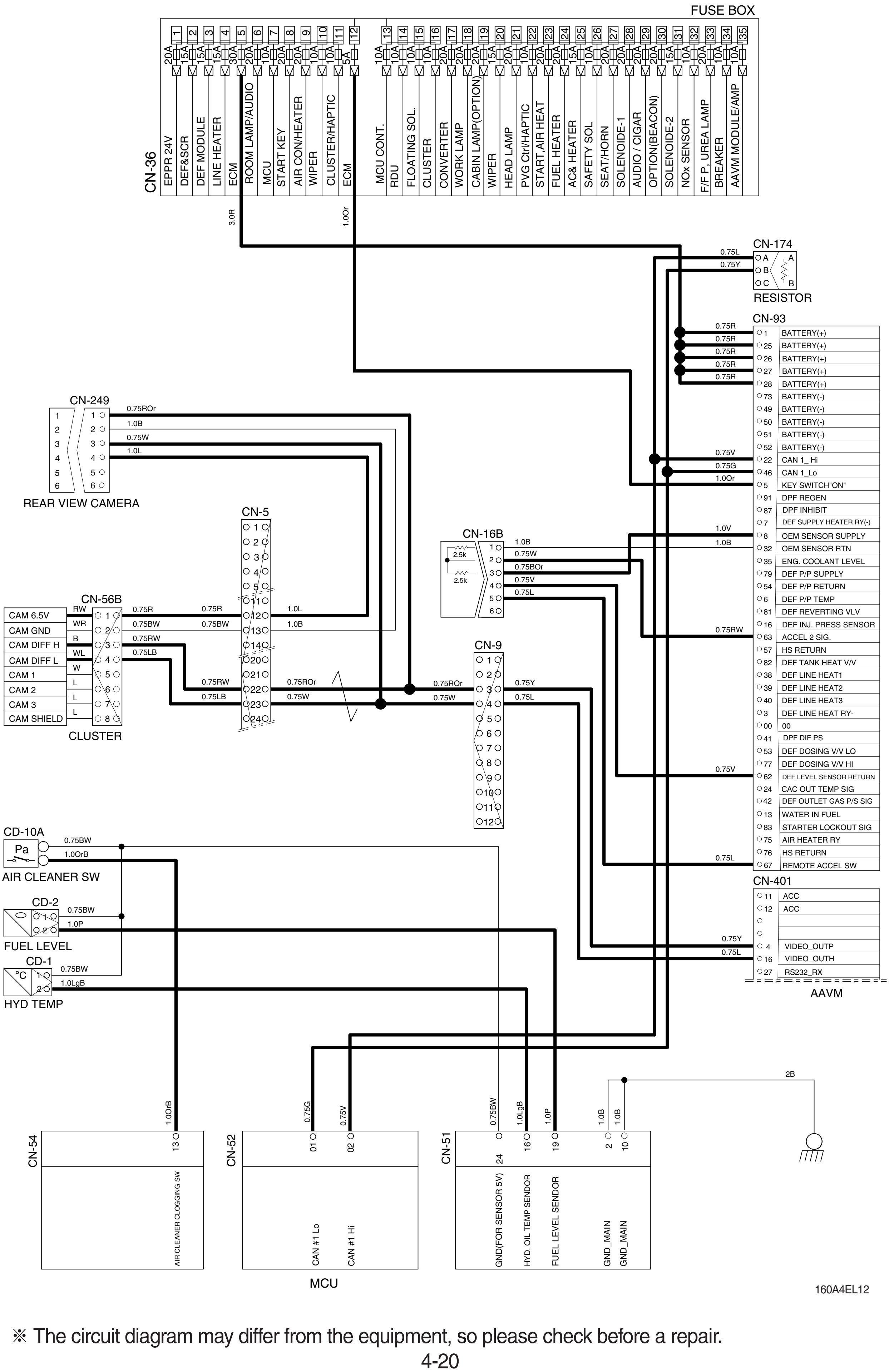
※ The circuit diagram may differ from the equipment, so please check before a repair.

CONTROLLER CIRCUIT



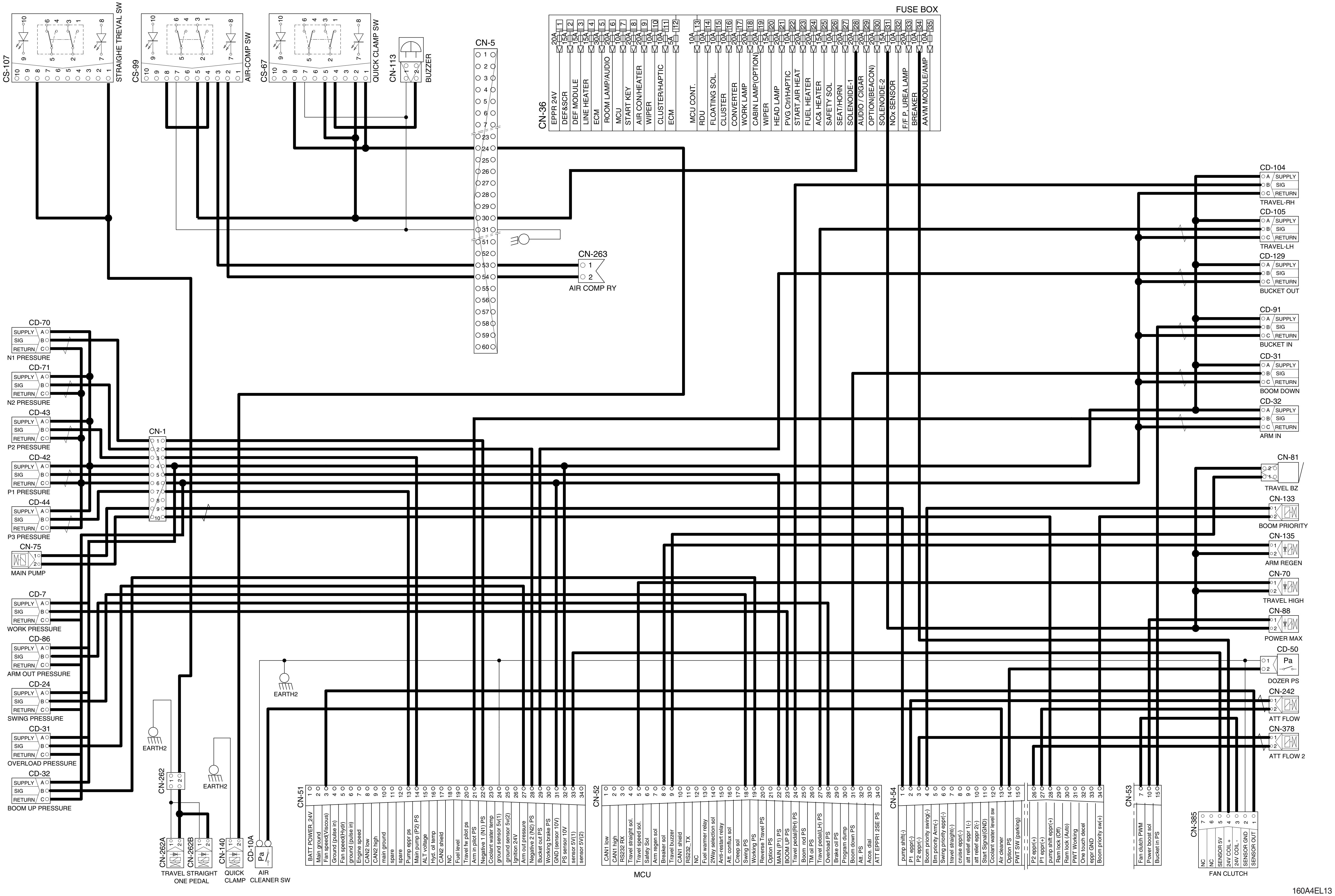
※ The circuit diagram may differ from the equipment, so please check before a repair.

MONITORING CIRCUIT



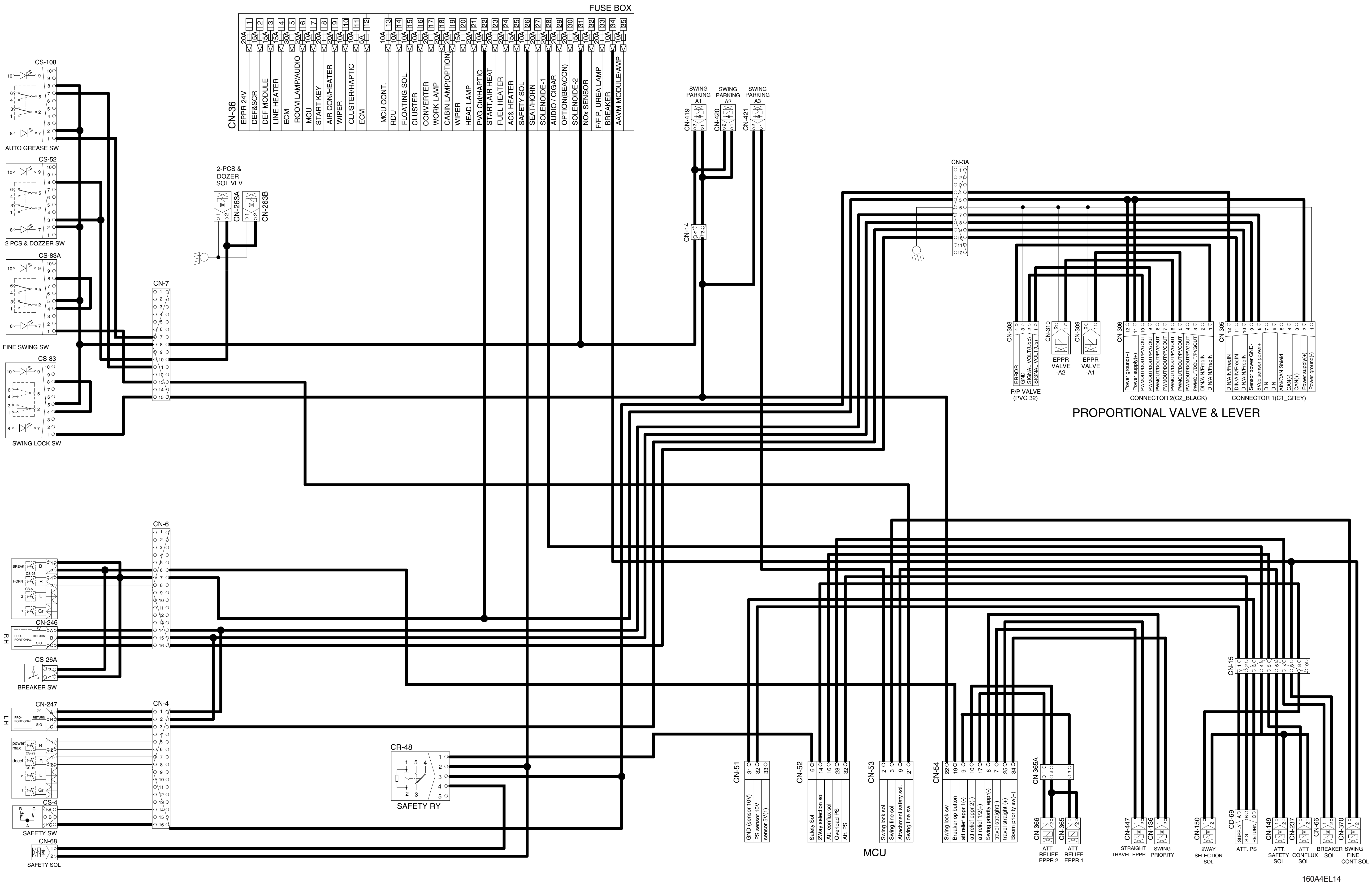
※ The circuit diagram may differ from the equipment, so please check before a repair.

ELECTRIC CIRCUIT FOR HYDRAULIC (1/2)



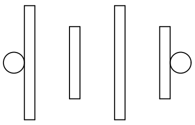
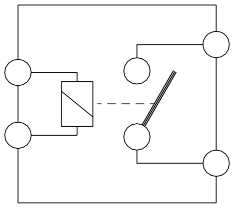
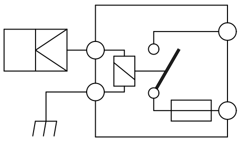
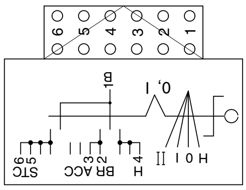
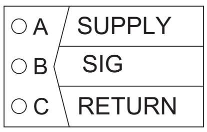
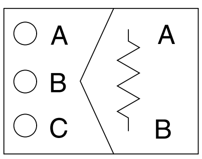
※ The circuit diagram may differ from the equipment, so please check before a repair.

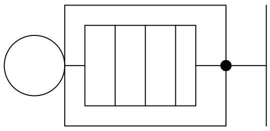
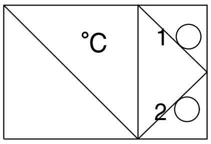
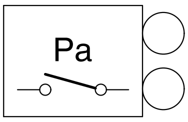
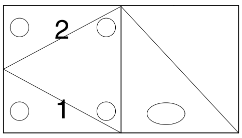
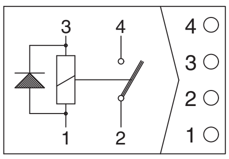
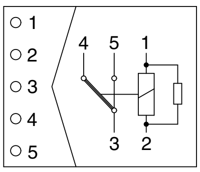
ELECTRIC CIRCUIT FOR HYDRAULIC (2/2)

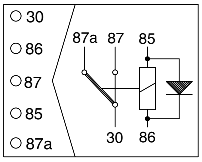
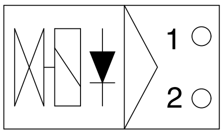
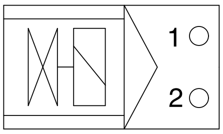
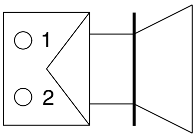
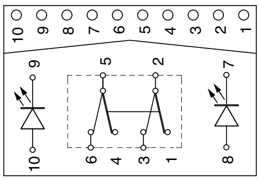
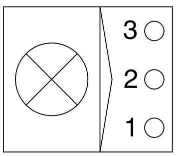


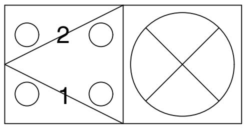
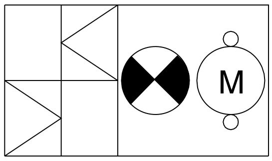
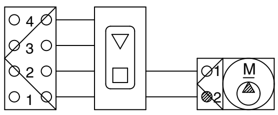
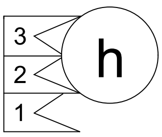
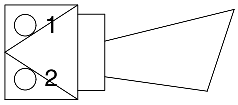
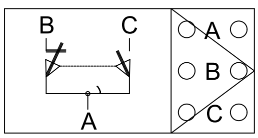
※ The circuit diagram may differ from the equipment, so please check before a repair.

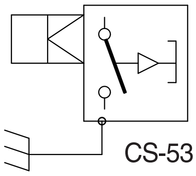
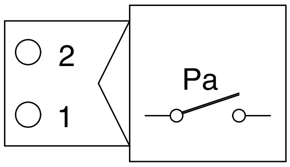
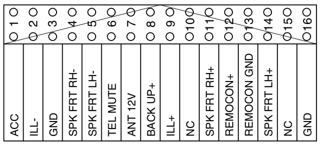
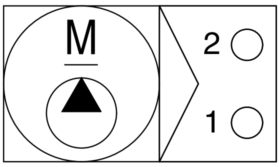
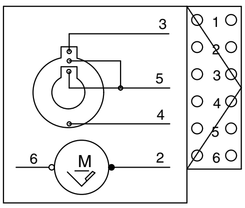
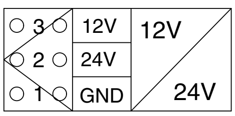
GROUP 3 ELECTRICAL COMPONENT SPECIFICATION

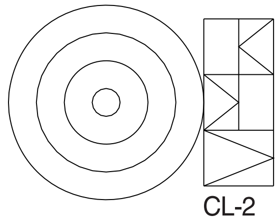
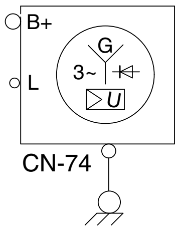
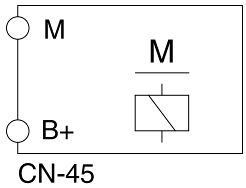
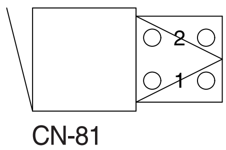
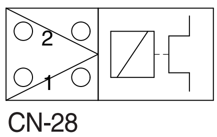
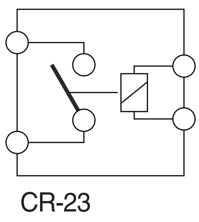
Part name	Symbol	Specifications	Check
Battery		12V×100Ah (2EA)	※ Check specific gravity 1.280 over : Over charged 1.280 ~ 1.250 : Normal 1.250 below : Recharging
Battery relay	 CR-1	Rated load : 24V 100A (continuity) 1000A (30seconds)	※ Check coil resistance(M4 to M4) Normal : About 50Ω ※ Check contact Normal : ∞Ω
Hearter 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-7 CD-16 CD-24 CD-31 CD-32 CD-42 CD-43 CD-44 CD-69 CD-70 CD-71 CD-85 CD-86 CD-87 CD-90 CD-91 CD-104 CD-105 CD-129	8~30V	※ Check contact Normal : 0.1Ω
Resistor	 CN-173 CN-174	3W	※ Check resistance A-B : 120Ω

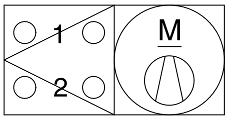
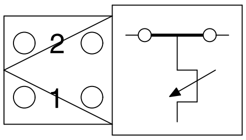
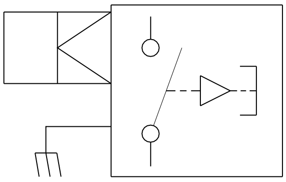
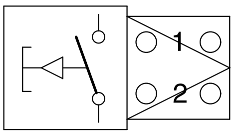
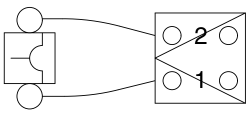
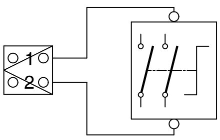
Part name	Symbol	Specifications	Check
Glow plug	 CN-80	24V 200A	※ Check resistance 0.25~0.12Ω
Temperature sensor (hydraulic)	 CD-1	-	※ Check resistance 50˚C : 804Ω 80˚C : 310Ω 100˚C : 180Ω
Air cleaner pressure switch	 CD-10A	N.O TYPE	※ Check contact High level : ∞Ω Low level : 0Ω
Fuel level sender	 CD-2	-	※ 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-85	24V 16A	※ Check resistance Normal : About 160 Ω (for terminal 1-2) 0Ω (for terminal 3-4) ∞Ω (for terminal 3-5)

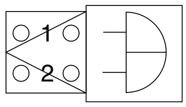
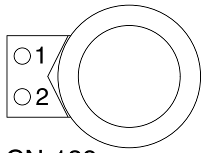
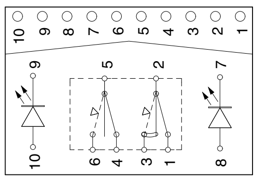
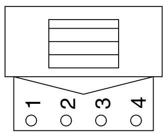
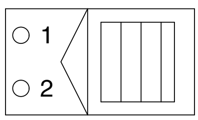
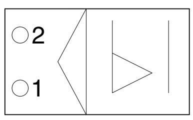
Part name	Symbol	Specifications	Check
Relay	 CR-4 CR-7 CR-9 CR-13 CR-35 CR-46 CR-51 CR-52	24V 16A	※ Check resistance Normal : About 160 Ω (for terminal 85-86) 0Ω (for terminal 30-87a) ∞Ω (for terminal 30-87)
Solenoid valve	 CN-66 CN-68 CN-70 CN-88 CN-135 CN-140 CN-149 CN-150 CN-237 CN-262A CN-262B CN-263A CN-263B CN-369 CN-370 CN-419 CN-420 CN-421	24V 1A	※ Check resistance Normal : 15~25Ω (for terminal 1-2)
EPPR valve	 CN-75 CN-133 CN-136 CN-242 CN-309 CN-310 CN-365 CN-366 CN-378 CN-447	700mA	※ Check resistance Normal : 15~25Ω (for terminal 1-2)
Speaker	 CN-23(LH) CN-24(RH)	20W	※ Check resistance Normal : A fewΩ
Switch (locking type)	 CS-52 CS-67 CS-83 CS-83A CS-99 CS-107 CS-108 CS-111	24V 1.5A	※ Check contact Normal ON : 0 Ω (for terminal 2-3, 5-6) ∞Ω (for terminal 2-1, 5-4) OFF : ∞Ω (for terminal 2-3, 5-6) 0 Ω (for terminal 2-1, 5-4)
Room lamp	 CL-1	24V 10W	※ Check disconnection Normal : 1.0Ω ON : 0Ω (For terminal 1-2) ∞Ω (For terminal 1-3) OFF : ∞Ω (For terminal 1-2) 0Ω (For terminal 1-3)

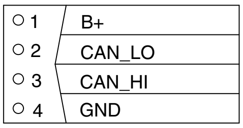
Part name	Symbol	Specifications	Check
Head lamp, Work lamp, Cab lamp	 CL-3 CL-4 CL-5 CL-6 CL-8 CL-9 CL-10 CL-24	24V 65W (H3 Type)	※ Check disconnection Normal : 1.2Ω
Beacon lamp	 CL-7	21V 70W (H1 Type)	※ Check disconnection Normal : A fewΩ
Fuel filler pump	 CN-61	24V 10A 35 ℓ /min	※ Check resistance 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)

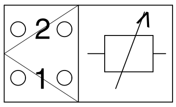
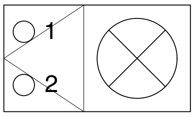
Part name	Symbol	Specifications	Check
Wiper cut switch		24V (N.O TYPE)	※ Check contact Normal : 0Ω (one pin to ground)
Receiver dryer	 CN-29	24V 2.5A	※ Check contact Normal : ∞Ω
Radio & USB player	 CN-27A	24V 2A	※ Check voltage 20~25V (for terminal 1-3, 3-8)
Washer pump	 CN-22	24V 3.8A	※ Check contact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

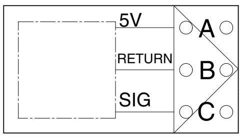
Part name	Symbol	Specifications	Check
Cigar lighter		24V 5A 1.4W	※ Check coil resistance Normal : About 1MΩ ※ Check contact Normal : ∞Ω Operating time : 5~15sec
Alternator		24V 95A	※ Check contact Normal : 0Ω (for terminal B^+-L) Normal : 24~27.5V
Starter		24V 4.8kW	※ Check contact Normal : 0.1Ω
Travel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

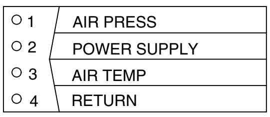
Part name	Symbol	Specifications	Check
Blower motor		24V 9.5A	※ Check resistance Normal : 2.5Ω (for terminal 1-2)
Thermistor (switch)		1˚C OFF 4˚C ON	※ Check resistance Normal : 0Ω (for terminal 1-2), the atmosphere temp : Over 4˚C
Door switch	 CS-1	24V 2W	※ Check resistance Normal : About 5MΩ
Switch (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	6-36V	※ Check disconnection Normal : 0.1Ω

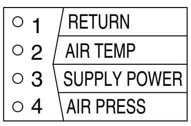
Part name	Symbol	Specifications	Check
Quick clamp buzzer	 CN-113	24V 200mA 107±4dB	-
Socket	 CN-139	12V 10A	-
Switch	 CS-70 CS-100	24V 8A	※ Check contact Normal ON : 0Ω (for terminal 2-3, 5-6) ∞Ω (for terminal 2-1, 5-4) OFF : ∞Ω (for terminal 2-3, 5-6) 0Ω (for terminal 2-1, 5-4)
Fuel heater	 CN-96	-	-
DEF/AdBlue® line heater	 CN-381 CN-382 CN-383	-	-
WIF sensor	 CD-45	-	-

<table>
<tr><th>Part name</th><th>Symbol</th><th>Specifications</th><th>Check</th></tr>
<tr><td>NOx sensor</td><td>

AT1A AT2A</td><td>-</td><td>-</td></tr>
<tr><td>Temperature sensor (A/C)</td><td>
</td><td>-</td><td>-</td></tr>
<tr><td>DEF/AdBlue® lamp (LED)</td><td>

CL-40</td><td>-</td><td>-</td></tr>
<tr><td>Proportional valve sensor</td><td>

CN-246 CN-247</td><td>-</td><td>-</td></tr>
<tr><td>TBAP</td><td>

EX2B</td><td>-</td><td>-</td></tr>
<tr><td>Pressure temp sensor</td><td>

CD-10</td><td>-</td><td>-</td></tr>
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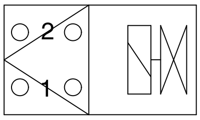
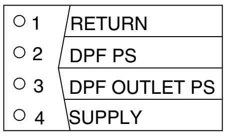
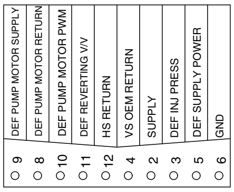
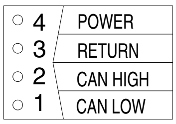
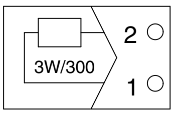
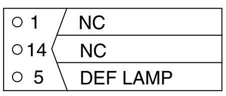
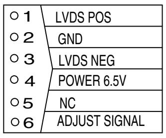
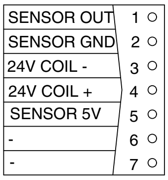
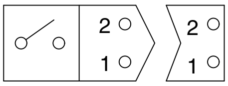
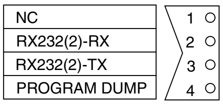
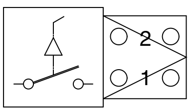
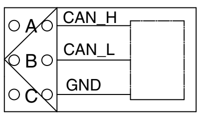
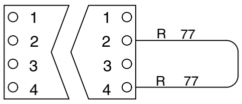
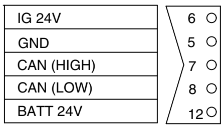
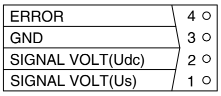
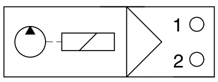
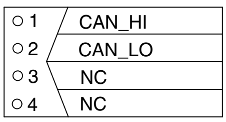
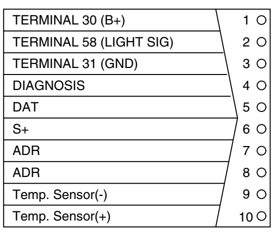
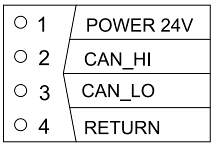
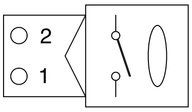
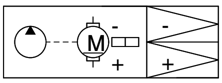
Part name	Symbol	Specifications	Check
Coolant valve	 CN-384 AT32A	-	
DPF pressure sensor	 AT11A	-	
SCR and DEF supply module	 CN-379	-	
Tank level sensor	 CN-380	-	
Resistor	 RS-1	3W	※ Check resistance Normal : 300Ω
DEF lamp connector	 CC1D	-	

Part name	Symbol	Specifications	Check
Camera (rear, side)	 CN-402 CN-403 CN-404 CN-405	-	
Fan clutch	 CN-385	-	
Seat belt sw	 CS-250	-	
RMS service tool	 CN-126A	-	
Breaker switch	 CS-26A	-	
Start button	 CS-2B	-	

Part name	Symbol	Specifications	Check
GPS connector	 CN-125	-	
Reader	 CN-427	-	
Proportional valve	 CN-308	-	
Dosing pump	 CN-269	-	
Engine side cross over connector	 CC8D	-	
Easystart timer	 CN-267	-	

Part name	Symbol	Specifications	Check
Exhaust gas temp sensor	 AT9A	-	
Float switch	 CS-61	-	
Water pump		-	

GROUP 4 CONNECTORS

1. CONNECTOR DESTINATION

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-1	TYCO	10	I/conn (Frame harness-Engine harness)	174655-2	174657-2
CN-2	AMP	15	I/conn (Frame harness-Engine harness)	2-85262-1	368301-1
CN-3	TYCO	12	I/conn (Frame harness-Pro vlv harness)	174661-2	368537-1
CN-4	AMP	16	I/conn (Console harness LH-Frame harness)	368047-1	368050-1
CN-5	DEUTSCH	60	I/conn (Side harness RH-Frame harness)	DRB16-60SAE-L018	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-14	DEUTSCH	2	I/conn (Frame harness-S/f & parking harness)	DT06-2S-EP06	DT04-2S-E005
CN-15	AMP	10	I/conn (Frame harness-Breaker sol)	174655-2	174657-2
CN-16	AMP	6	Emergency engine start & speed control	S816-006002	S816-106002
CN-16B	AMP	6	Emergency engine start & speed control	S816-006002	-
CN-17	AMP	8	I/conn (Side harness RH-Wiper harness)	S816-008002	S816-108002
CN-20	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-21	AMP	6	Wiper motor	S810-006202	-
CN-22	KET	2	Washer tank	MG640605	-
CN-23	KET	2	Speaker-LH	MG610070	-
CN-24	KET	2	Speaker-RH	MG610070	-
CN-25	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	2	Aircon compressor	MG610320	-
CN-29	KET	2	Receiver dryer	MG640795	-
CN-31	-	-	Fuse 1	21WD-44450	-
CN-32	-	-	Fuse 2	21WD-44450	-
CN-36	-	-	Fuse & relay box	21Q7-10910	-
CN-45B+	RING-TERM	-	Starter motor B^+	S820-410001	-
CN-45M	RING-TERM	-	Starter motor M	ST710246-2	-
CN-48	KET	1	Hour meter	2-520193-2	-
CN-51	TE	34	MCU	2-1473285-3	-
CN-52	TE	34	MCU	4-1437290-1	-
CN-53	TE	26	MCU	1473416-1	-
CN-54	TE	34	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
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-74B+	RING-TERM	1	Alternator "B+" terminal	S820-408001	-
CN-74L	RING-TERM	1	Alternator "L" terminal	S820-105000	-
CN-74G	RING-TERM	1	Alternator "G" terminal	S820-306001	-
CN-75	AMP	1	Pump EPPR solenoid	S816-002002	-
CN-80	RING-TERM	-	Glow plug	S820-406001	-
CN-81	DEUTSCH	2	Travel buzzer solenoid	DT06-2S-EP06	DT04-2P-E005
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	I/conn (Frame harness - Fuel warmer harness)	15300027	2-967402-2
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	174655-2	S816-110002
CN-126A	DEUTSCH	4	RMS Service tool	DT06-4S	DT06-4P
CN-133	DEUTSCH	2	Boom priority solenoid (A5)	DT06-2S-EP06	-
CN-135	DEUTSCH	2	Arm regeneration solenoid (A4)	DT06-2S-EP06	-
CN-136	DEUTSCH	2	Swing priority solenoid (A1)	DT06-2S-EP06	-
CN-138	FASTEN	3	DC/DC Converter	S810-003202	-
CN-139	FASTEN	2	12V socket	172434-2	-
CN-140	DEUTSCH	2	Quick clamp solenoid	DT06-2S-EP06	DT04-2P-E005
CN-141	AMP	13	Wiper motor controller	172498-1	-
CN-149	DEUTSCH	2	Pedal safety (B)	DT06-2S-EP06	-
CN-150	DEUTSCH	2	Satety EPPR (A1)	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-242	DEUTSCH	2	P1 EPPR solenoid (A1)	DT06-2S-EP06	-

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-timer	DT06-4S-EP06	-
CN-246B	DEUTSCH	4	Preheater harness-timer	-	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-260	MTA	2	Preheater harness-fuse 15A	03 01305	-
CN-261	MTA	2	Preheater harness-fuse 5A	03 01305	-
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-263A	DEUTSCH	2	2 PCS & dozer solenoid	DT06-2S-EP06	DT04-2P-E005
CN-263B	DEUTSCH	2	2 PCS & dozer solenoid	DT06-2S-EP06	DT04-2P-E005
CN-265	FCI	8	Controller	22.1000.30.10	-
CN-267	MOLEX	10	Easy start timer	15-97-5101	-
CN-269	TE	2	Dosing pump	963040-3	-
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-308	DEUTSCH	4	Proportional-valve	DT06-4S-EP06	DT04-4P
CN-308A	DEUTSCH	4	Proportional-valve	DT06-4S-EP06	DT04-4P
CN-309	DEUTSCH	2	Proportional-EPPR valve-A2	DT06-2S-EP06	-
CN-310	DEUTSCH	2	Proportional-EPPR valve-A1	DT06-2S-EP06	-
CN-363	AMP	12	Jog dial module	174045-2	-
CN-365	DEUTSCH	2	Attach EPPR valve-LH	DT06-2S-EP06	-
CN-365A	DEUTSCH	3	Attach relief exit	DT06-3S-EP06	DT04-3P-E005
CN-366	DEUTSCH	2	Attach EPPR valve-RH	DT06-2S-EP06	-
CN-370	DEUTSCH	2	Swing fine control solenoid	DT06-2S-EP06	DT04-2P-E005
CN-376	AMP	34	Membrane controller	4-1437290-1	-
CN-378	DEUTSCH	2	P2 EPPR solenoid (A2)	DT06-2S-EP06	-
CN-379	-	12	SCR Supply module	F16-001	-
CN-380	DEUTSCH	2	DEF tank level sensor	DT06-4S-EP06	-
CN-381	DEUTSCH	2	DEF line heater 1	DT06-2S-EP06	-
CN-382	DEUTSCH	2	DEF line heater 2	DT06-2S-EP06	-
CN-383	DEUTSCH	2	DEF line heater 3	DT06-2S-EP06	-
CN-384	DEUTSCH	2	Coolant valve	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-E005

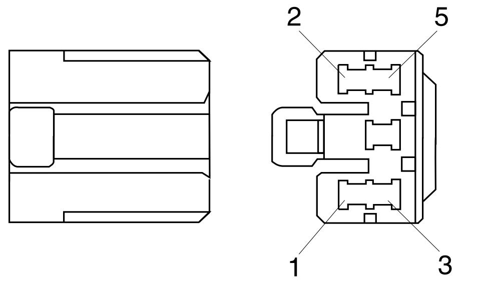
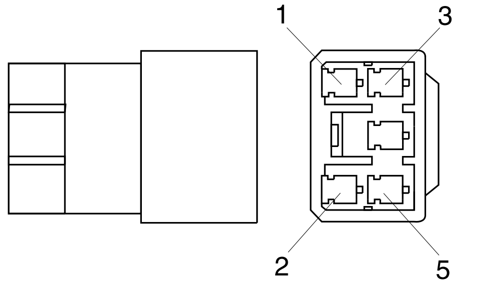
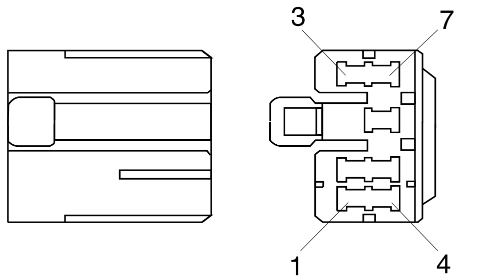
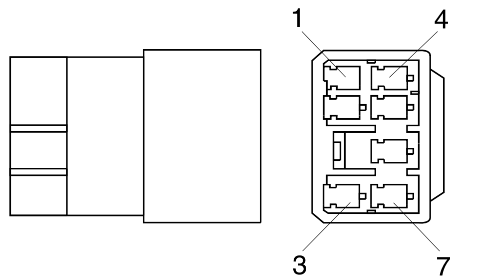
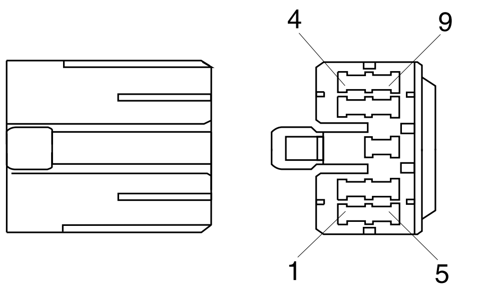
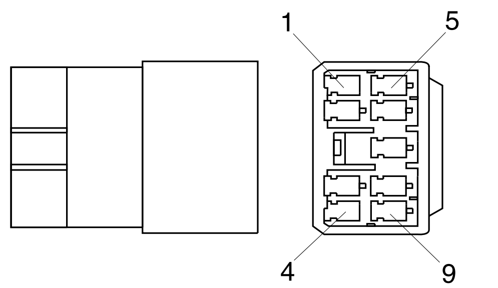
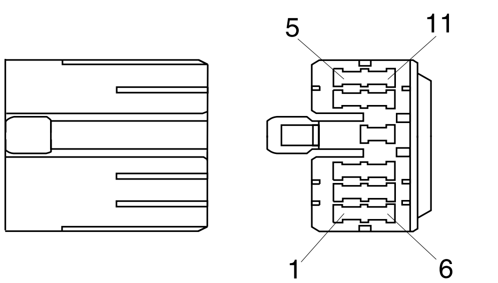
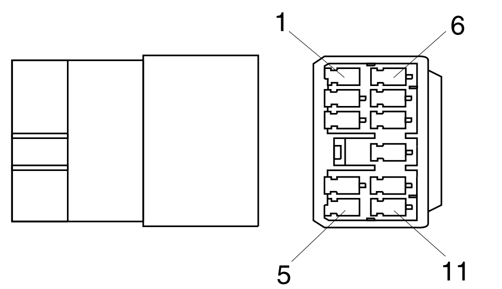
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-404	DEUTSCH	6	LH view camera	DT06-6S-EP06	DT04-6P-E005
CN-405	DEUTSCH	6	RH view camera	DT06-6S-EP06	DT04-6P-E005
CN-406	DEUTSCH	4	Service tool	DT06-4S-EP05	DT04-4P-E005
CN-419	DEUTSCH	2	Swing parking-A1	DT06-2S-EP06	-
CN-420	DEUTSCH	2	Swing parking-A2	DT06-2S-EP06	-
CN-421	DEUTSCH	2	Swing parking-A3	DT06-2S-EP06	-
CN-427	MOLEX	12	Reader-RMS	5557-12R	5559-12P
CN-430	AMP	10	I/conn (Frame harness - DEF harness)	174655-2	174657-2
CN-447	DEUTSCH	2	Travel straight (A2)	DT06-2S-EP06	-
AT1A	TYCO	4	DOC NOx sensor (inlet)	2-1418390-1	-
AT2A	TYCO	4	SCR NOx sensor (outlet)	1-1418390-1	-
AT7A	TYCO	4	DOC thermister	4-1418390-1	-
AT8A	TYCO	4	SCR thermister	2-1418390-1	-
AT10A	DEUTSCH	10	Ureatank level sensor	DT06-4S-EP06	-
AT11A	FRAMATOME	4	DEF dif pressure sensor	F715600	-
AT32A	TYCO	2	DEF dosing valve	1-928405-522	-
CCID	DELPHI	14	Cross over connector	-	13533441
CC8D	DELPHI	4	Engine sensor	DT06-4S-CE04	-
EX2B	FCI	4	TBAP	-	54200419
· 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-23B+	RING TERM	-	Start relay B+	ST710384-2	-
CR-23G	RING TERM	-	Start relay G	ST710289-2	-
CR-23M	RING TERM	-	Start relay M	ST710384-2	-
CR-23S	RING TERM	-	Start relay S	ST710289-2	-
CR-24B+	RING TERM	-	Preheat relay B+	S820-406001	-
CR-24P	RING TERM	-	Preheat relay	S820-406001	-
CR-24S	-	1	Preheat relay	S822-014001	-
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	-	-

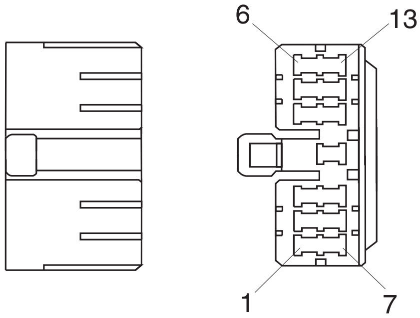
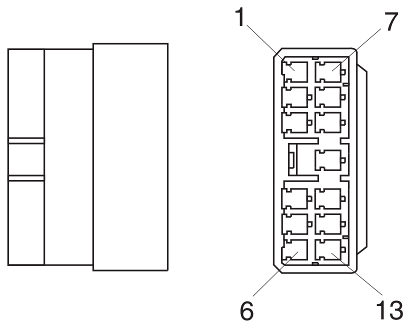
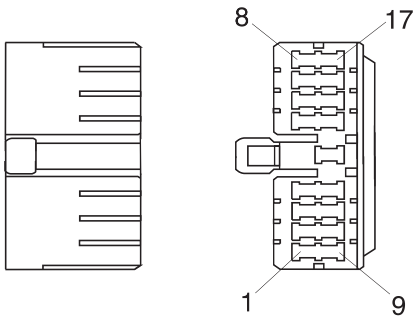
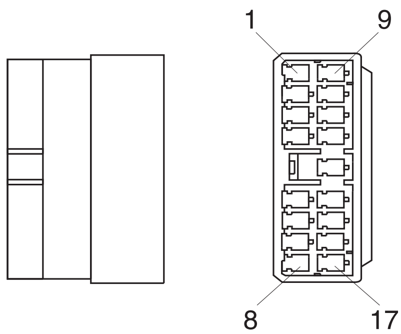
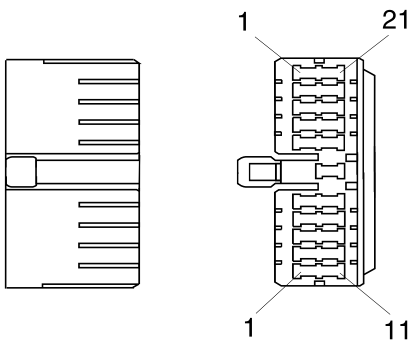
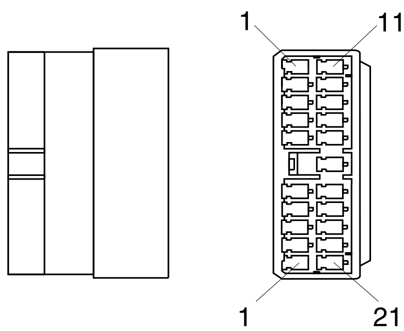
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CR-50	-	5	NOx sensor relay	-	-
CR-51	-	5	DEF module relay	-	-
CR-52	-	5	Line heater relay	-	-
CR-85	-	5	Beacon lamp relay	-	-
· Switch					
CS-1	SHUR	1	Door switch	S822-014002	S822-114002
CS-2A	WP	6	Start switch	S814-006100	-
CS-2B	DEUTSCH	3	Start button	DT06-3S-EP06	DT04-3P-E005
CS-2C	KET	3	BKCU	MG651032	-
CS-2D	KET	3	Button key	-	MG641035
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	-
CS-67	CARLING	10	Quick clamp 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	AMP	2	Master switch	S813-030201	S813-130201
CS-74A	KET	2	From master SW power	MG610557-5	MG620558-5
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	Exhaust system cleaning switch	VC2-01	-
CS-107	CARLING	10	Travel straight switch	VC2-01	-
CS-108	CARLING	10	Auto grease switch	VC2-01	-
CS-111	CARLING	10	Boom floating switch	VC2-01	-
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-3	DEUTSCH	2	Head lamp-LH	DT06-2S-EP06	-
CL-4	DEUTSCH	2	Head lamp-RH	DT06-2S-EP06	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CL-5	DEUTSCH	2	Work lamp-LH	DT06-2S-EP06	-
CL-6	DEUTSCH	2	Work lamp-RH	DT06-2S-EP06	-
CL-7	DEUTSCH	2	Beacon lamp	DT06-2S-EP06	DT04-2P
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-7	DEUTSCH	3	Work pilot pressure sw	DT06-3S-EP06	-
CD-10	SUMITOMO	4	Pre temperature sensor	6908-0144	-
CD-10A	AMP	2	Air cleaner switch	85202-1	-
CD-16	DELPHi	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-42	DEUTSCH	3	A1 pump delivery pressure sw	DT06-3S-EP06	-
CD-43	DEUTSCH	3	A2 pump delivery pressure sw	DT06-3S-EP06	-
CD-44	DEUTSCH	3	A3 pump delivery pressure sw	DT06-3S-EP06	-
CD-45	DEUTSCH	2	WIF sensor	DT06-2S-EP06	-
CD-50	KET	3	Dozer pilot pressure sw	MG640795	-
CD-69	DEUTSCH	3	Attach pressure sensor	DT06-3S-EP06	-
CD-70	DEUTSCH	3	N1 pressure sensor	DT06-3S-EP06	-
CD-71	DEUTSCH	3	N2 pressure sensor	DT06-3S-EP06	-
CD-85	DEUTSCH	3	Boom down pilot pressure sw	DT06-3S-EP06	-
CD-86	DEUTSCH	3	Arm out pilot pressure sw	DT06-3S-EP06	-
CD-90	DEUTSCH	3	Arm in pilot pressure sw	DT06-3S-EP06	-
CD-91	DEUTSCH	3	Bucket 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-129	DEUTSCH	3	Bucket out pilot pressure sw	DT06-3S-EP06	-

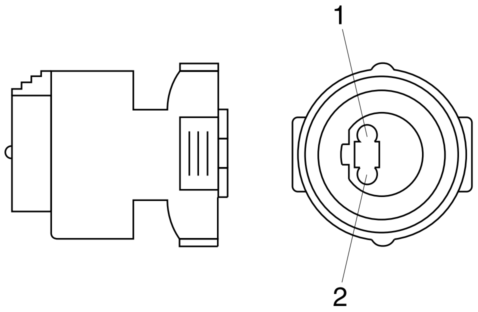
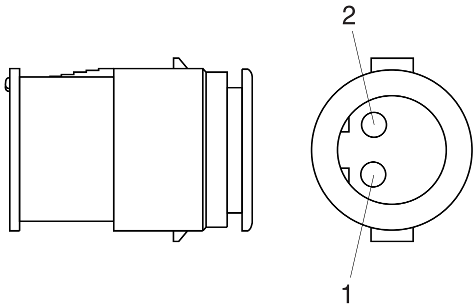
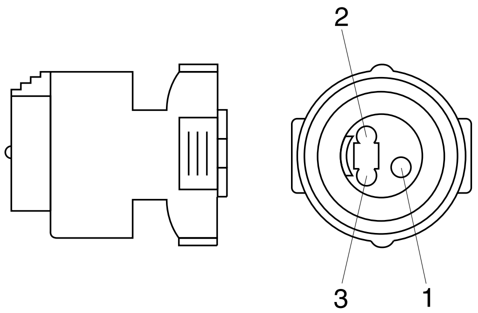
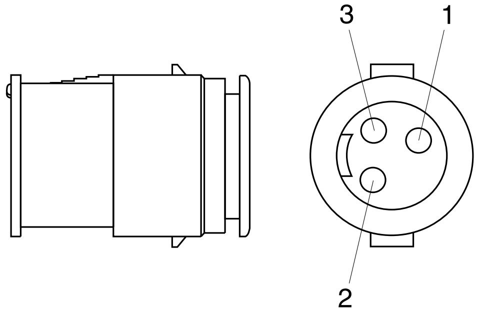
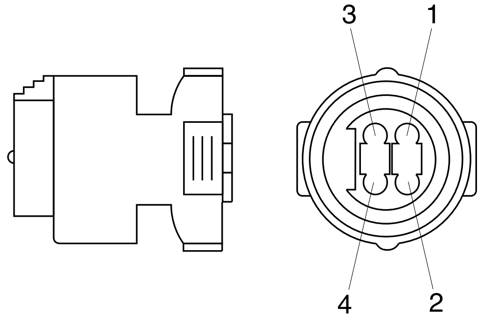
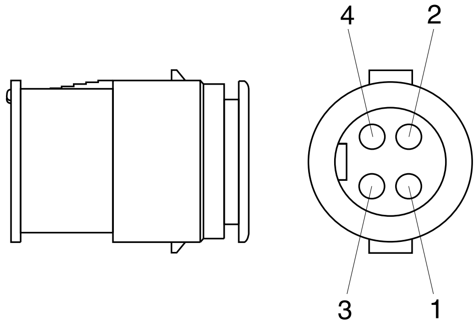
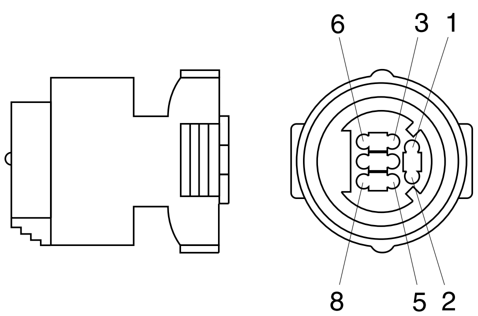
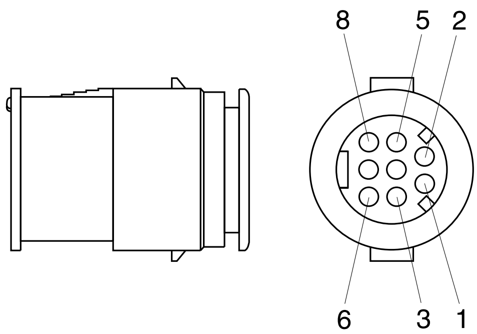
2. CONNECTION TABLE FOR CONNECTORS

1) PA TYPE CONNECTOR

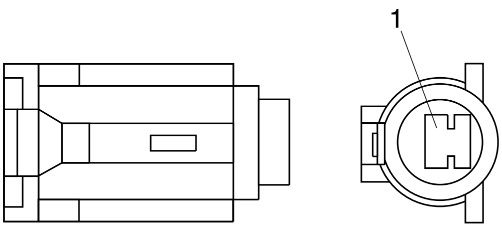
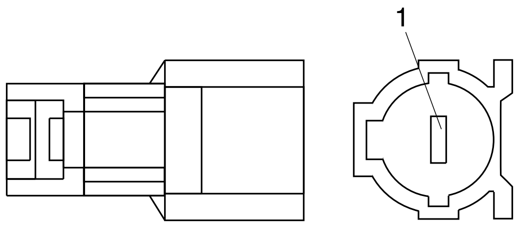
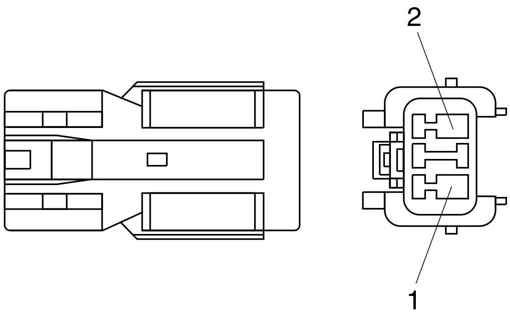
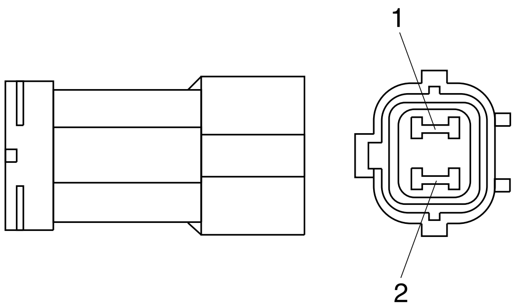
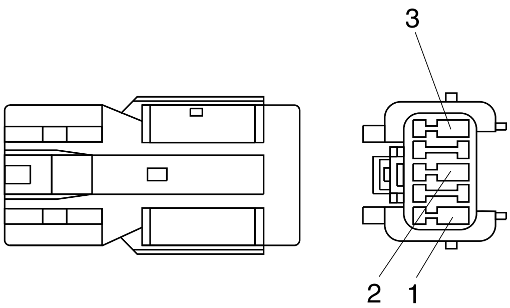
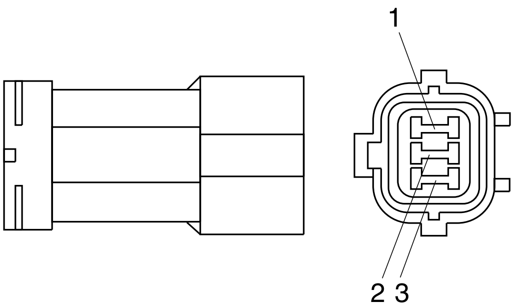
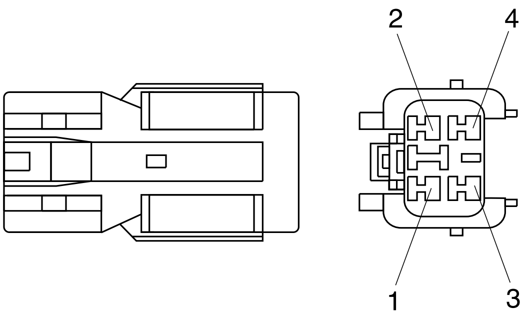
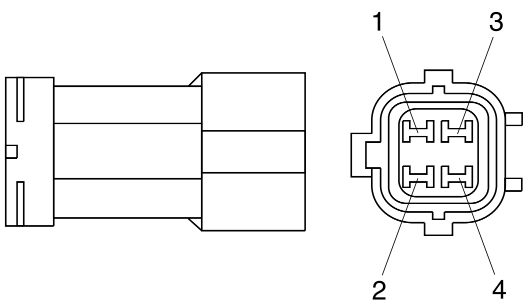
No. of pin	Receptacle connector (female)	Plug connector (male)
5	 S811-005002	 S811-105002
7	 S811-007002	 S811-107002
9	 S811-009002	 3S811-109002
11	 S811-011002	 S811-111002

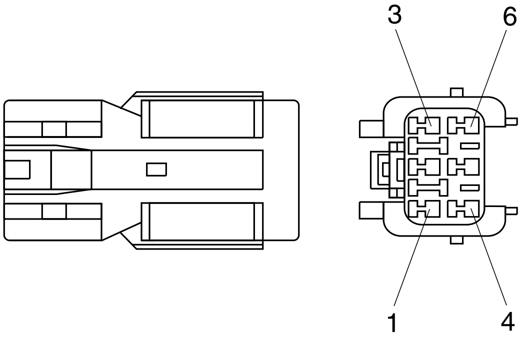
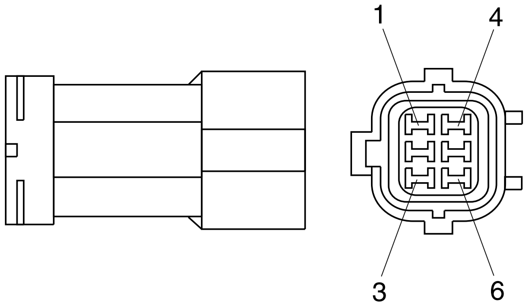
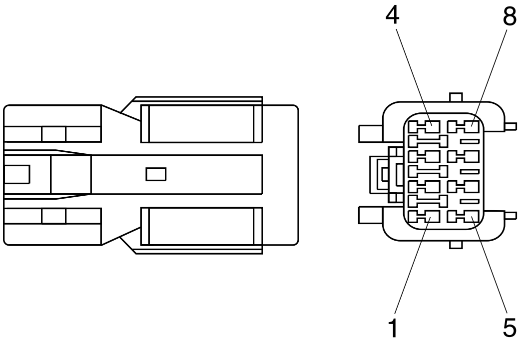
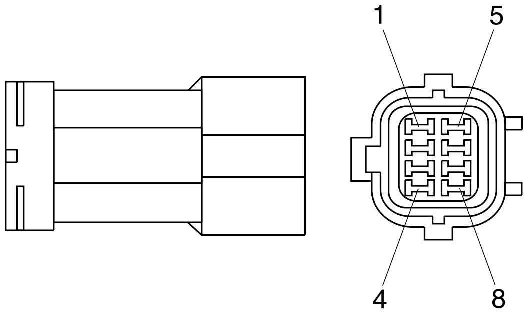
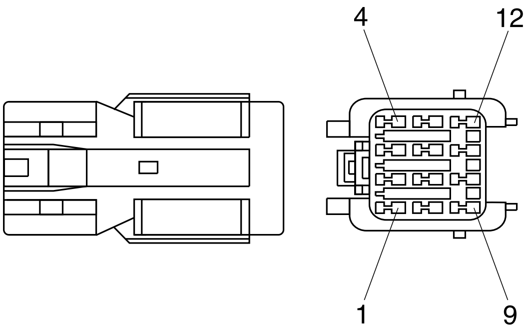
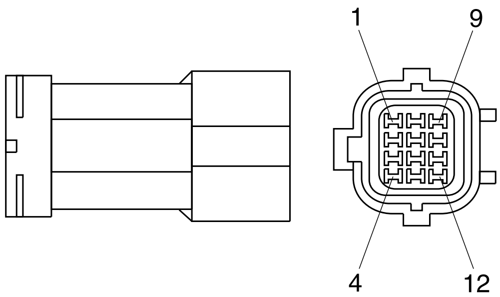
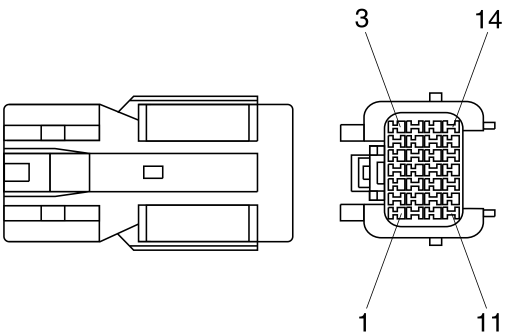
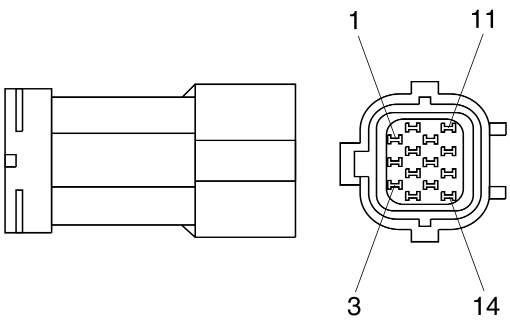
No. of pin	Receptacle connector (female)	Plug connector (male)
13	 S811-013002	 S811-113002
17	 S811-017002	 S811-117002
21	 S811-021002	 S811-121002

2) J TYPE CONNECTOR

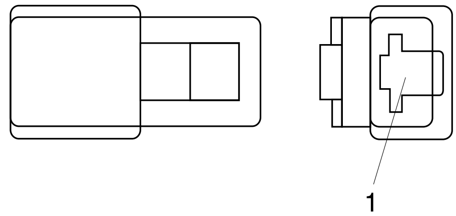
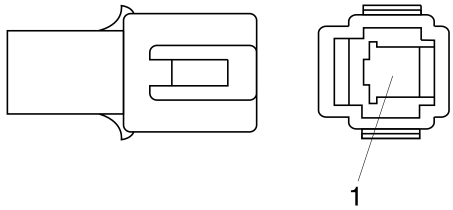
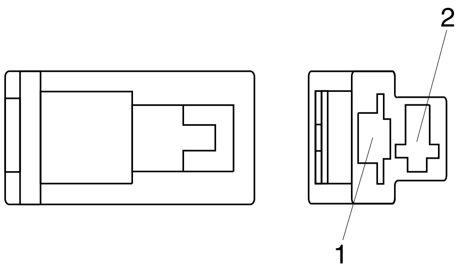
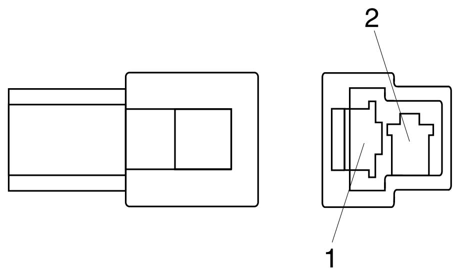
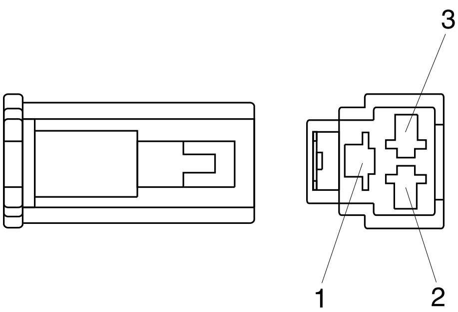
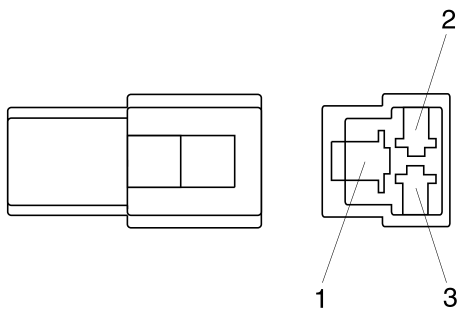
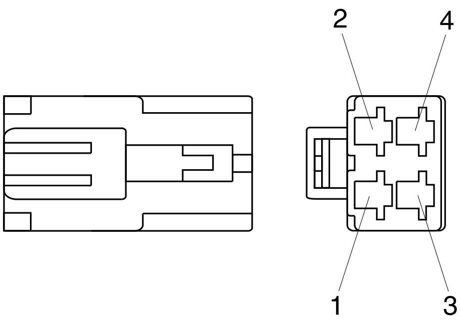
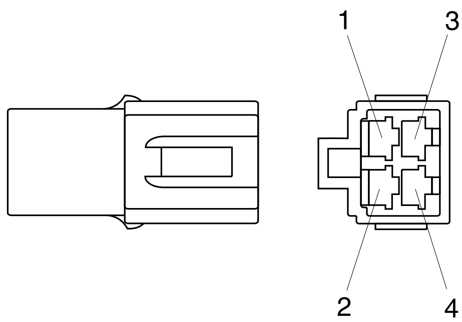
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 S816-002001	 S816-102001
3	 S816-003001	 S816-103001
4	 S816-004001	 S816-104001
8	 S816-008001	 S816-108001

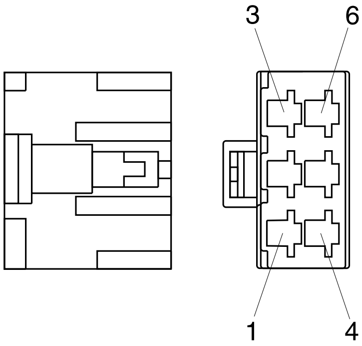
3) SWP TYPE CONNECTOR

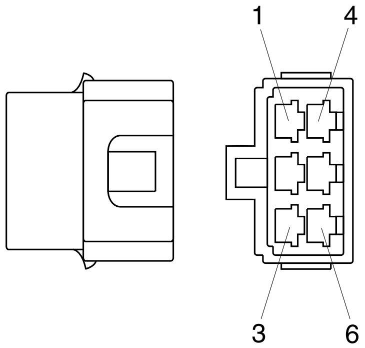
No. of pin	Receptacle connector (female)	Plug connector (male)
1	 S814-001000	 S814-101000
2	 S814-002000	 S814-102000
3	 S814-003000	 S814-103000
4	 S814-004000	 S814-104000

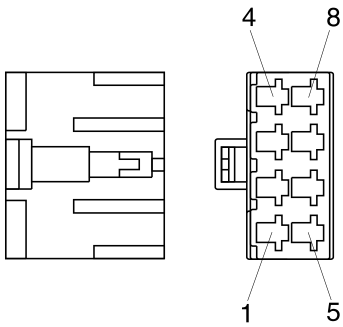
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S814-006000	 S814-106000
8	 S814-008000	 S814-108000
12	 S814-012000	 S814-112000
14	 S814-014000	 S814-114000

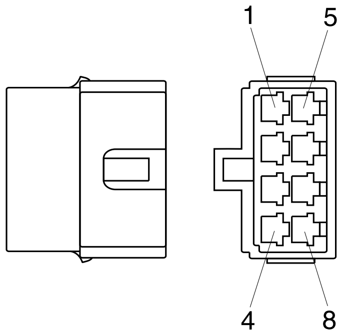
4) CN TYPE CONNECTOR

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

<table>
<tr><th>No. of pin</th><th>Receptacle connector (female)</th><th>Plug connector (male)</th></tr>
<tr><td>6</td><td>

S810-006202</td><td>

S810-106202</td></tr>
<tr><td>8</td><td>

S810-008202</td><td>

S810-108202</td></tr>
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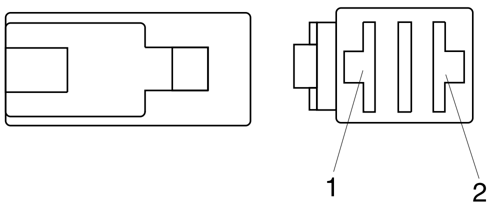
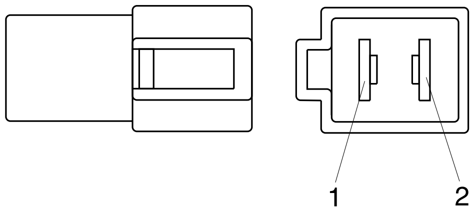
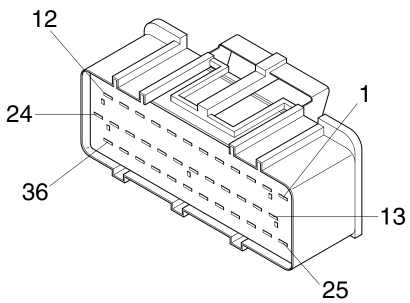
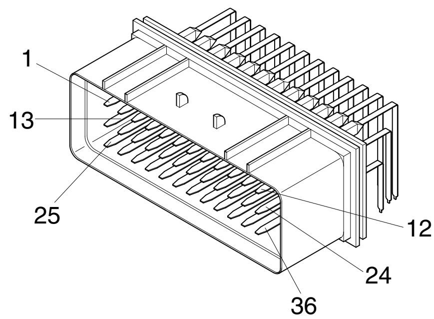
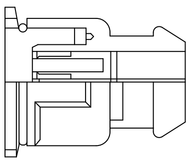
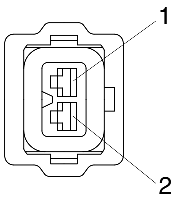
5) 375 FASTEN TYPE CONNECTOR

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

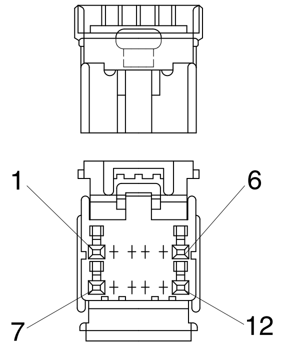
6) AMP ECONOSEAL CONNECTOR

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

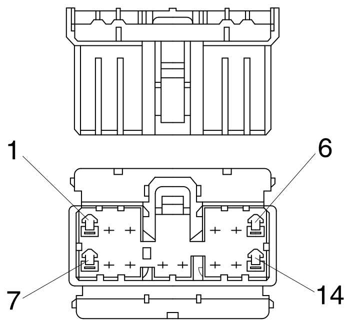
7) AMP TIMER CONNECTOR

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

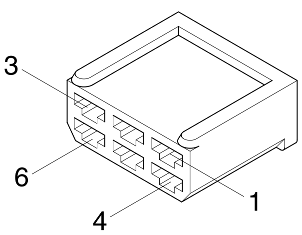
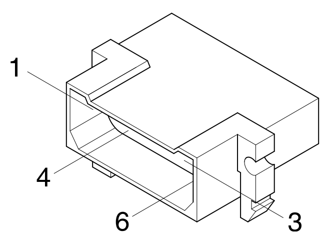
8) AMP 040 MULTILOCK CONNECTOR

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

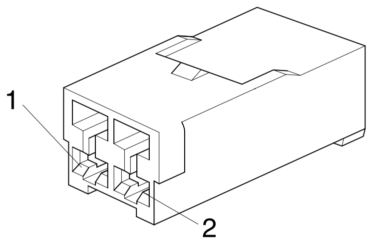
9) AMP 070 MULTILOCK CONNECTOR

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

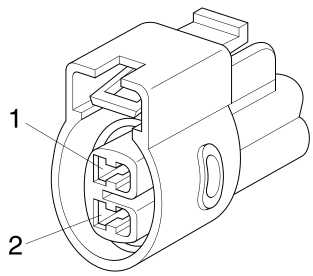
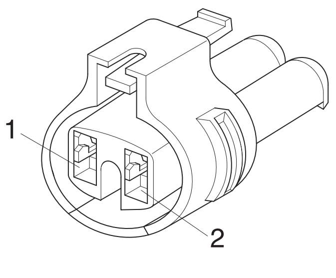
10) AMP FASTIN - FASTON CONNECTOR

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

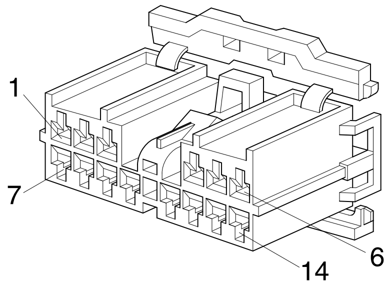
11) KET 090 CONNECTOR

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

12) KET 090 WP CONNECTORS

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

13) KET SDL CONNECTOR

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

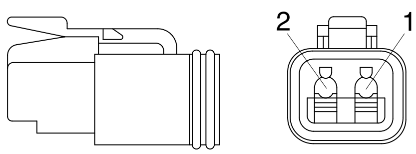
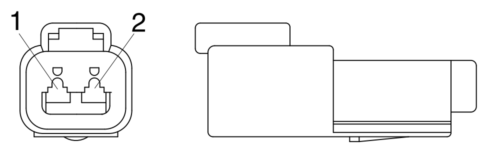
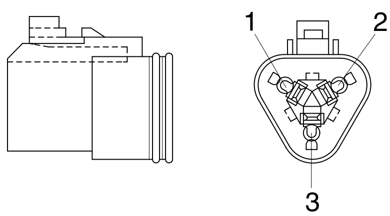
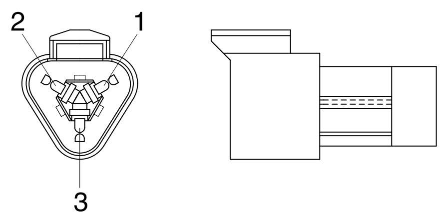
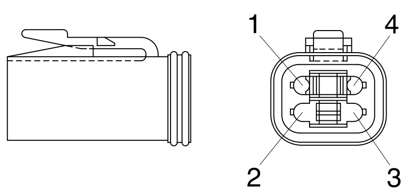
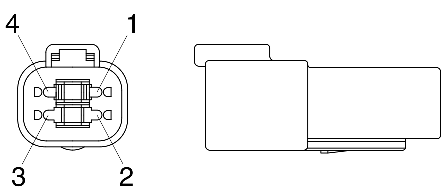
14) DEUTSCH DT CONNECTORS

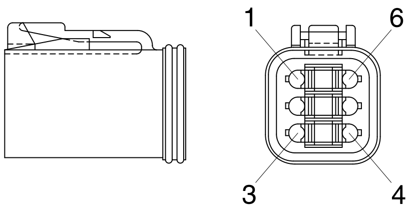
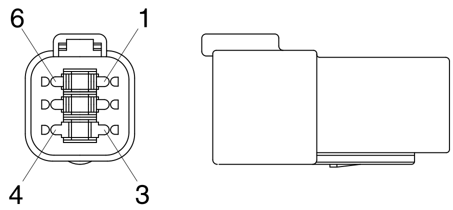
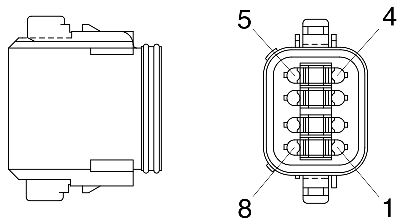
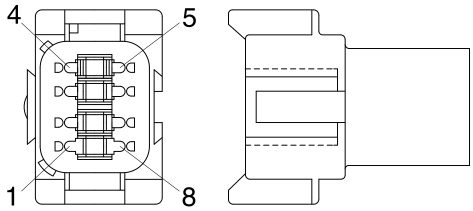
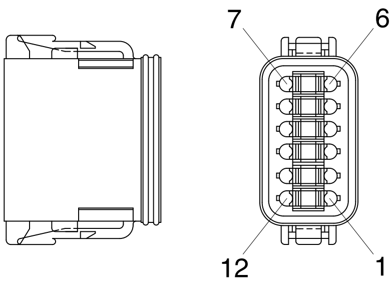
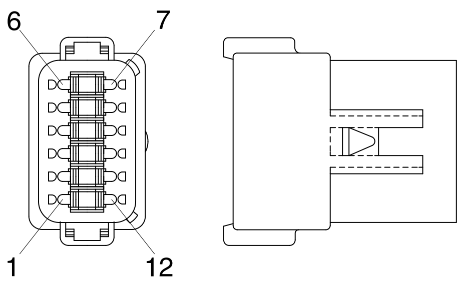
DT 06 - 3S - ★★★★

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

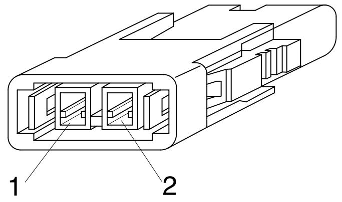
※ Modification

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

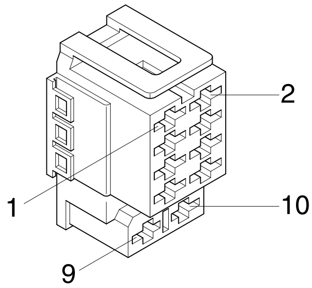
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 DT06-2S	 DT04-2P
3	 DT06-3S	 DT04-3P
4	 DT06-4S	 DT04-4P

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

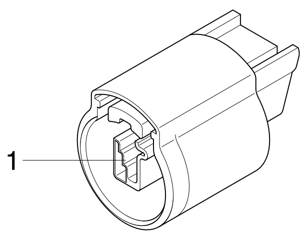
15) MOLEX 2CKTS CONNECTOR

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

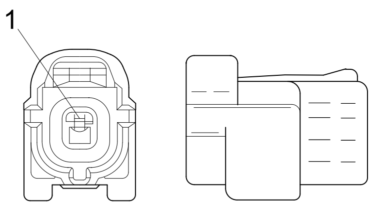
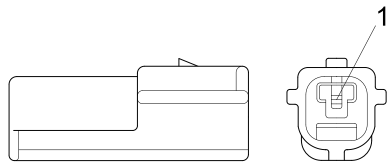
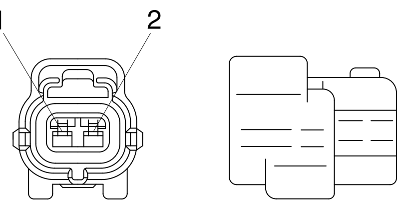
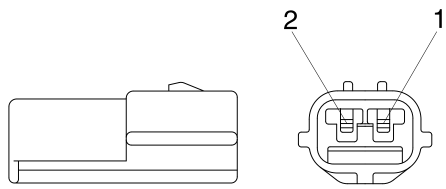
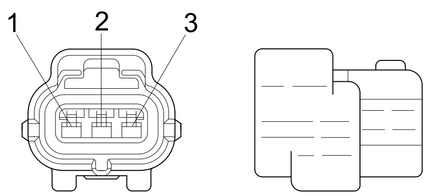
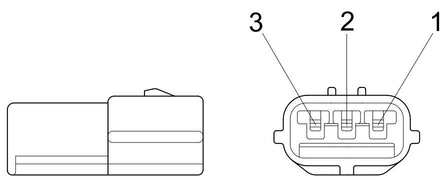
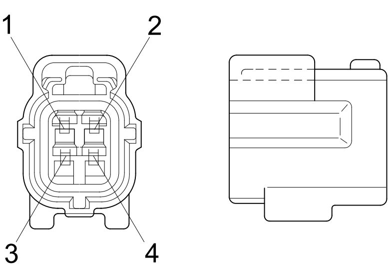
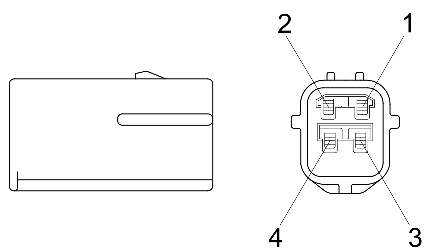
16) ITT SWF CONNECTOR

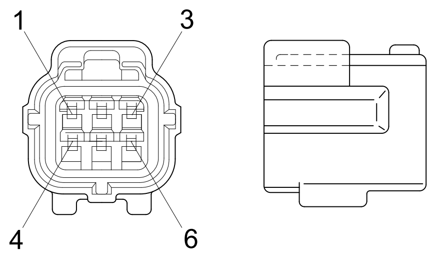
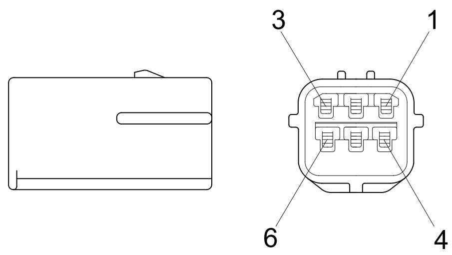
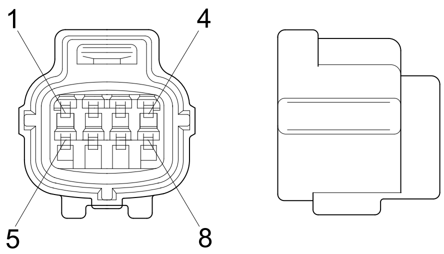
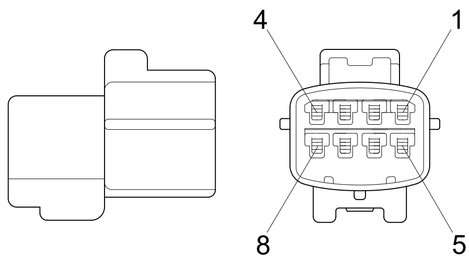
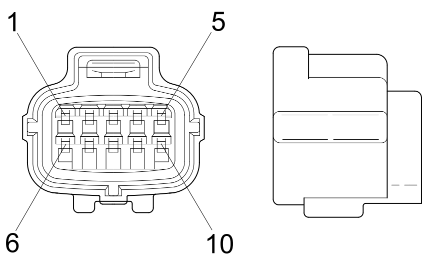
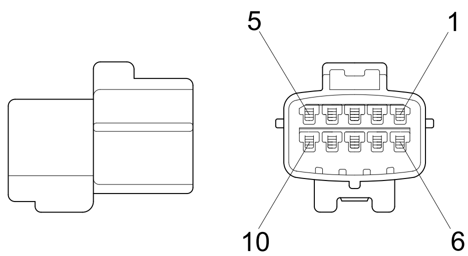
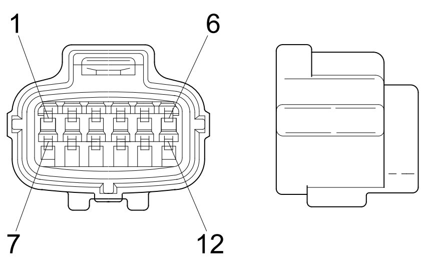
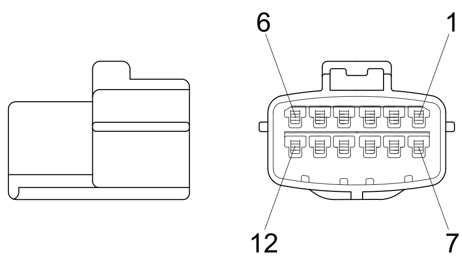
No. of pin	Receptacle connector (female)	Plug connector (male)
10	 SWF593757	

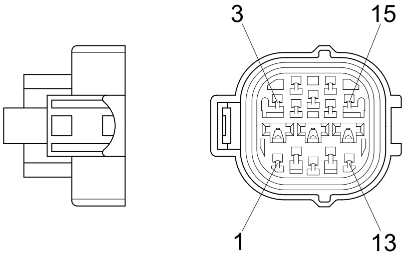
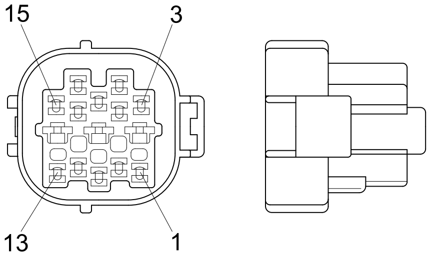
17) MWP NMWP CONNECTOR

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

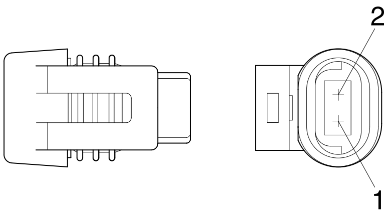
18) ECONOSEAL J TYPE CONNECTORS

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

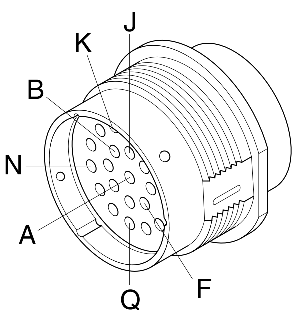
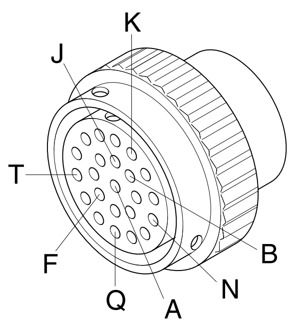
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S816-006002	 S816-106002
8	 S816-008002	 S816-108002
10	 S816-010002	 S816-110002
12	 S816-012002	 S816-112002

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

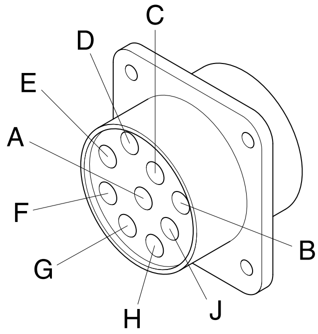
19) METRI-PACK TYPE CONNECTOR

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

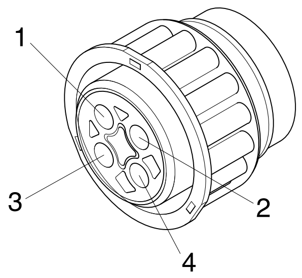
20) DEUTSCH HD30 CONNECTOR

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

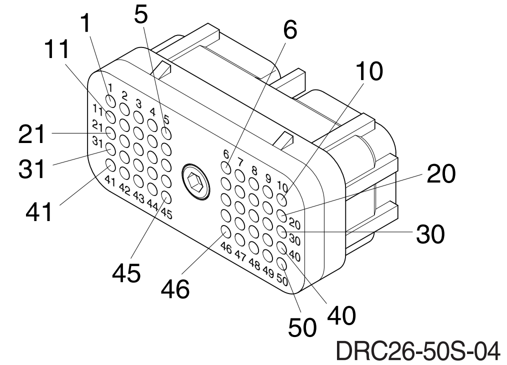
21) DEUTSCH SERVICE TOOL CONNECTOR

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

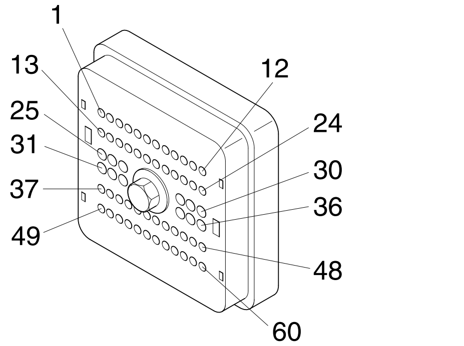
22) AMP FUEL WARMER CONNECTOR

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

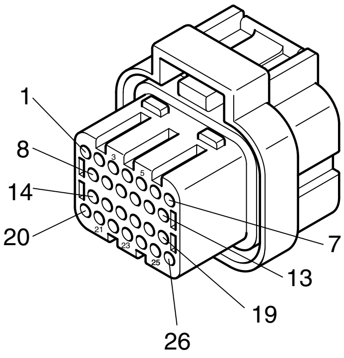
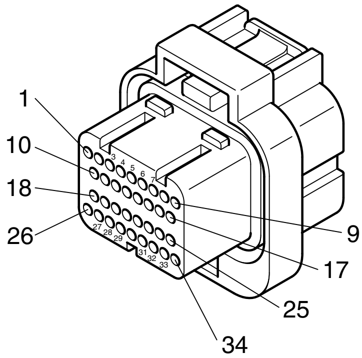
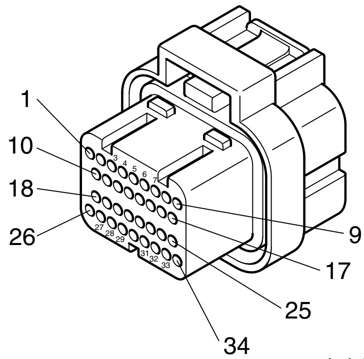
23) DEUTSCH ENGINE ECM CONNECTOR

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

24) DEUTSCH INTERMEDIATE CONNECTOR

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

25) TE MCU CONNECTOR

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

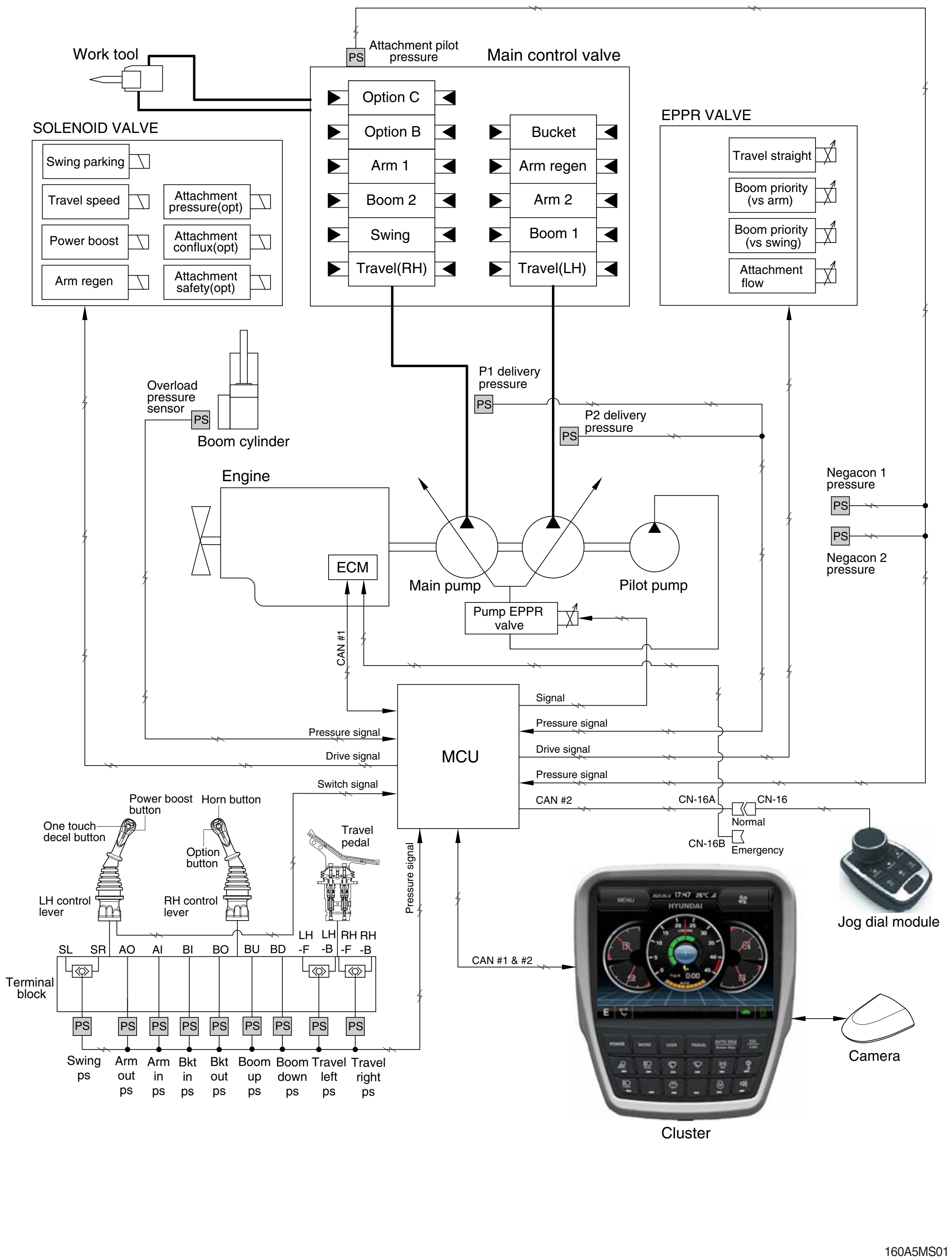
SECTION 5 MECHATRONICS SYSTEM

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.

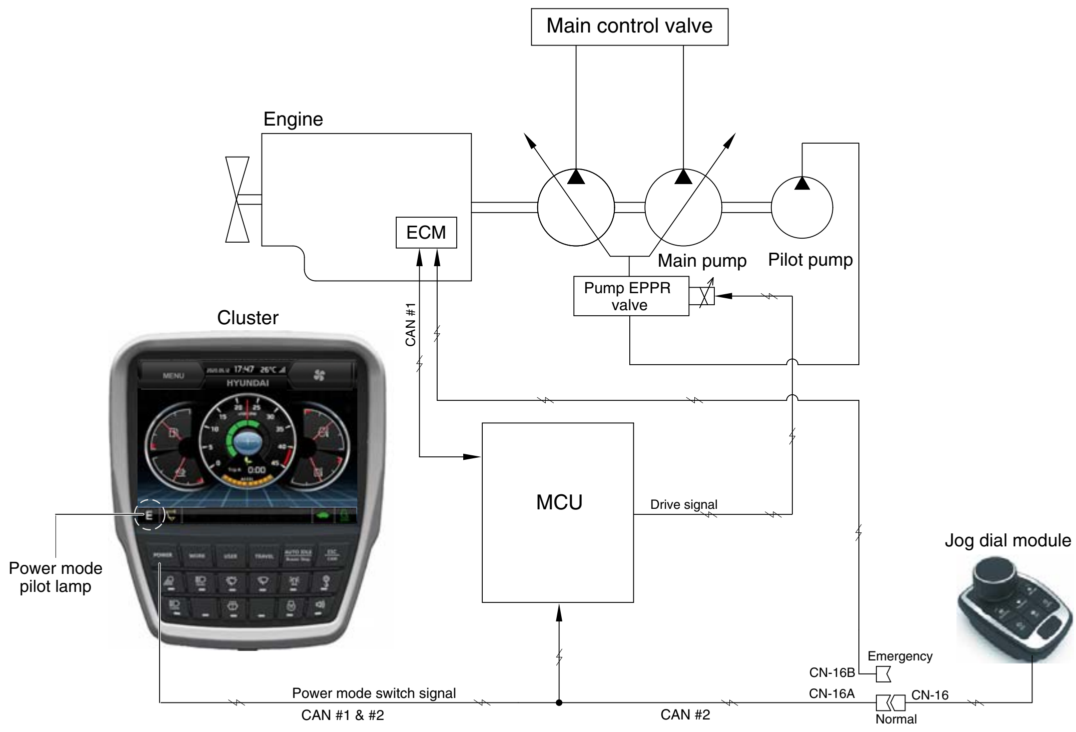
- ADVANCED CAPO SYSTEM
  - Mode selection system
    - Power mode selection (P, S, E)
    - Work mode selection
    - User mode system (U)
  - Auto deceleration system
  - Power boost system
  - Travel speed control system
  - Automatic warming up system
  - Engine overheat prevention system
  - Variable power control system
  - Attachment flow control system
  - 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



GROUP 2 MODE SELECTION SYSTEM

1. POWER MODE SELECTION SYSTEM



160A5MS02

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

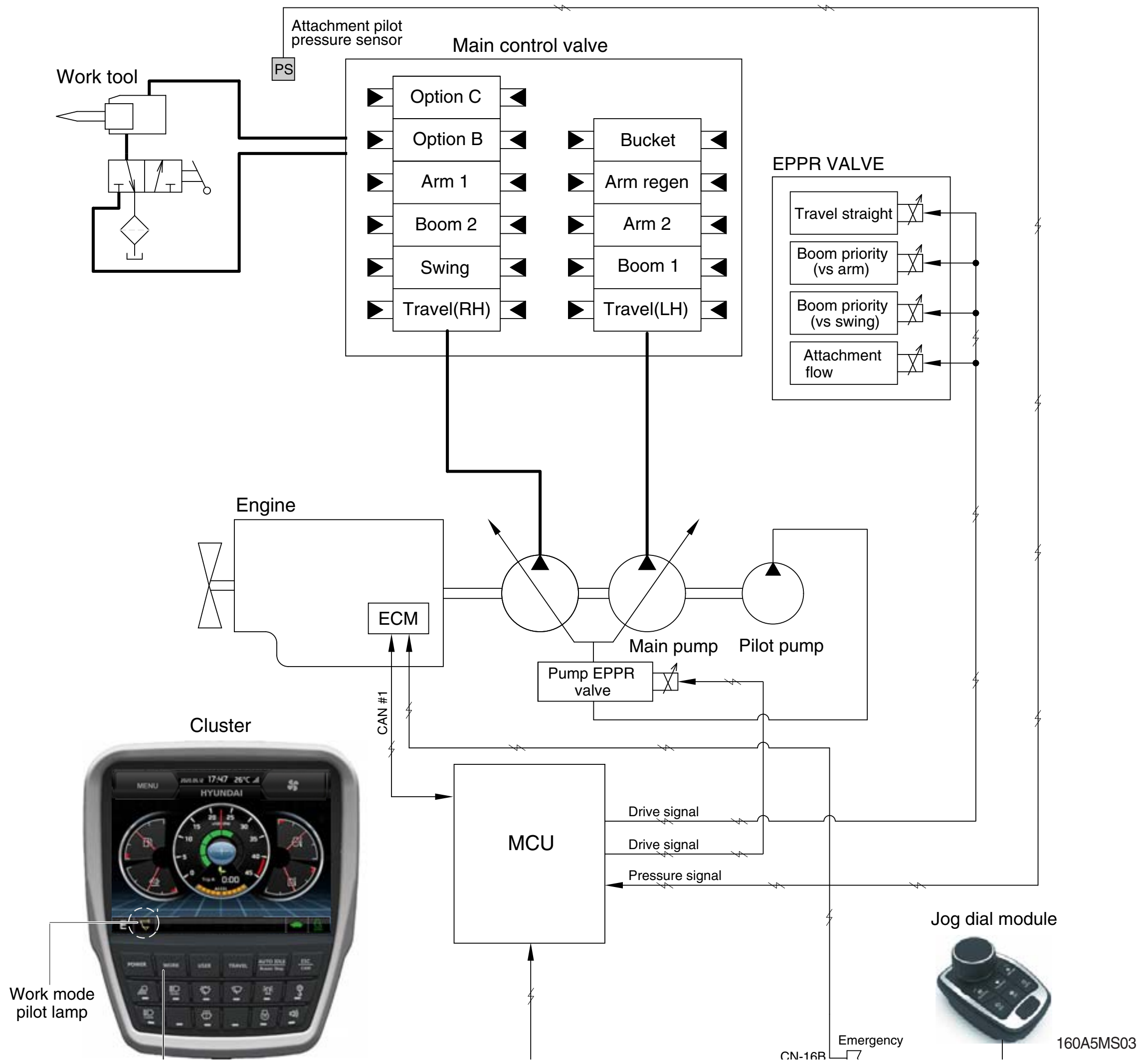
The combination of 3 power modes (P, S, E) and acceleration mode (10 set) of jog dial module makes it possible to use the engine and pump power more effectively corresponding to the work conditions from a heavy and great power requesting work to a light and precise work.

Power mode	Application	Engine rpm				Power shift by EPPR valve (kgf/cm^2)			
		Standard		Option		Standard		Option	
		Unload	Load	Unload	Load	Current (mA)	Pressure (kgf/cm^2)	Current (mA)	Pressure (kgf/cm^2)
P	Heavy duty power	1950	2050	2050	2050	12	5	12	5
S	Standard power	1850	1950	1950	1950	15	8	15	8
E	Economy operation	1750	1850	1850	1850	17	10	17	10
AUTO DECEL	Engine deceleration	1100±100	-	1100±100	-	38	38	38	38
One touch decel	Engine quick deceleration	1000±100	-	1000±100	-	38	38	38	38
KEY START	Key switch start position	1000±100	-	1000±100	-	38	38	38	38

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

2. WORK MODE SELECTION SYSTEM

Work mode consists of the general operation (bucket) and the optional attachment (breaker, crusher).



1) GENERAL WORK MODE (bucket)

This mode is used to general digging work.

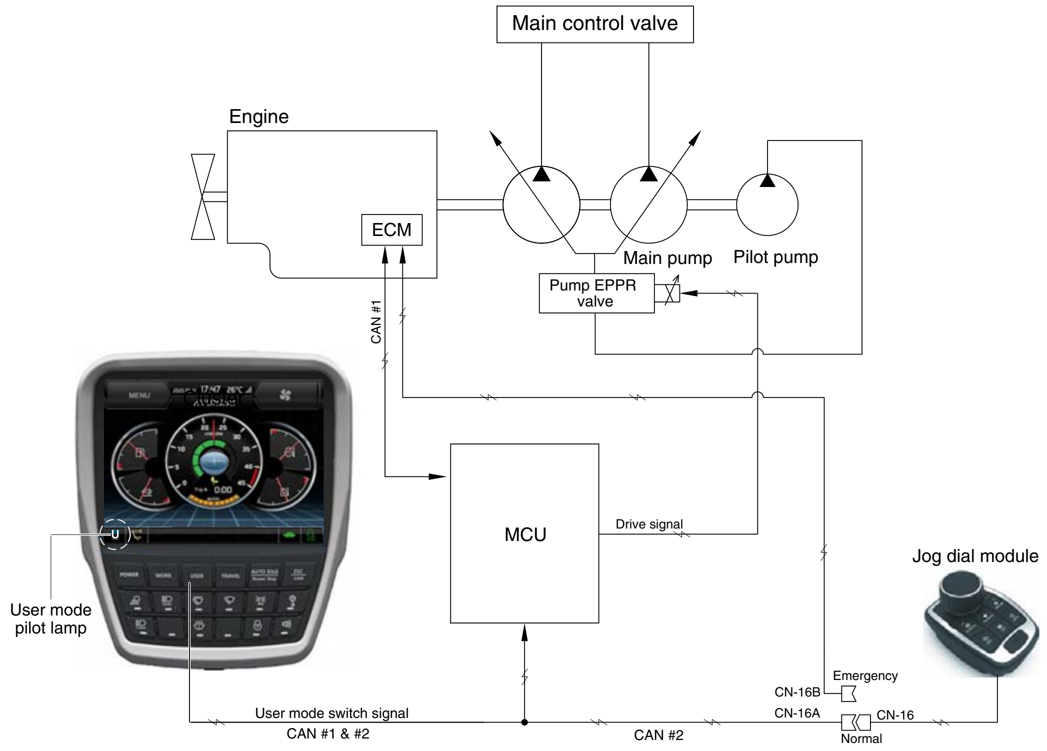
2) ATT WORK MODE (breaker, crusher)

It controls the pump flow and system pressure according to the operation of breaker or crusher.

Description	General mode	Work tool	
	Bucket	Breaker	Crusher
Attachment safety solenoid	OFF	-	ON
Attachment conflux solenoid	OFF	ON/OFF	ON/OFF
Attachment flow EPPR current	100 mA	100~700 mA	100~700 mA
Breaker solenoid★	OFF	ON	-

★ When breaker operating button is pushed.

3. USER MODE SELECTION SYSTEM



160A5MS04

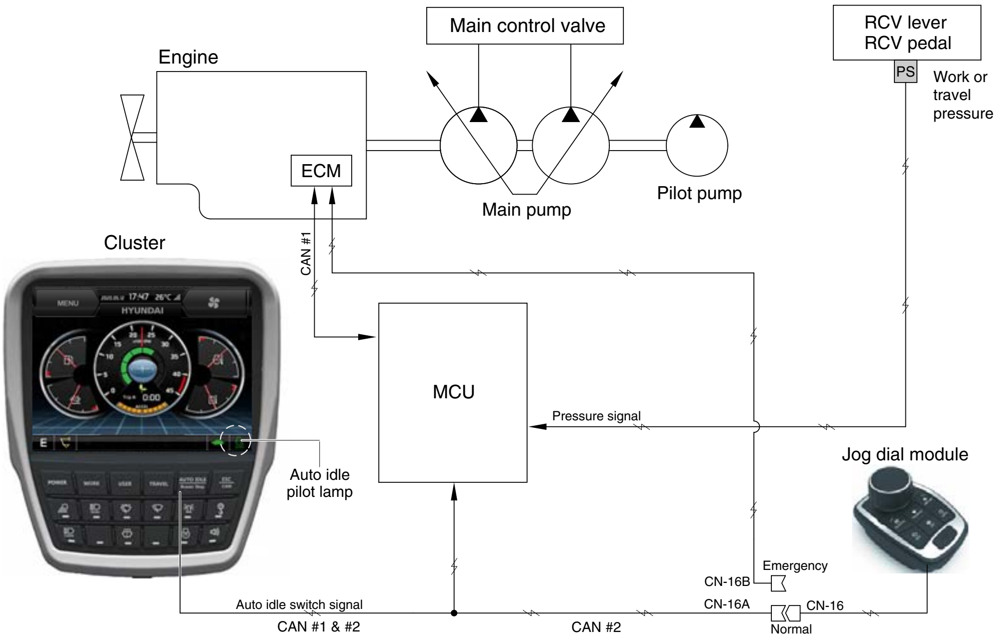
1) High idle rpm, auto idle rpm and EPPR pressure can be adjusted and memorized in the U-mode.

2) LCD segment vs parameter setting

Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift pressure (bar)
1	1300	750	0
2	1400	800	3
3	1500	850	6
4	1600	900	9
5	1700	950	12
6	1800	1000	16
7	1850	1050	20
8	1900	1100 (auto decel)	26
9	1950	1150	32
10	2000	1200	38

※ Refer to page 5-90.

GROUP 3 AUTOMATIC DECELERATION SYSTEM

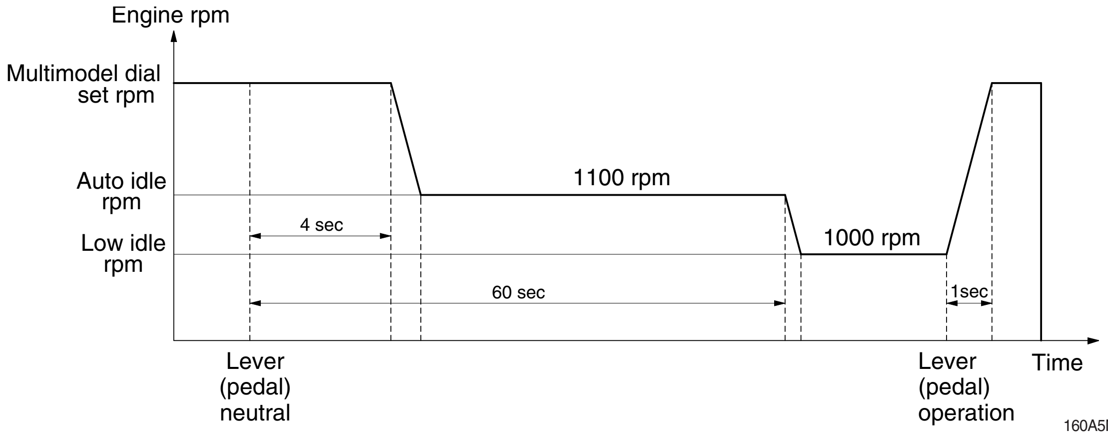


210A5MS05

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.



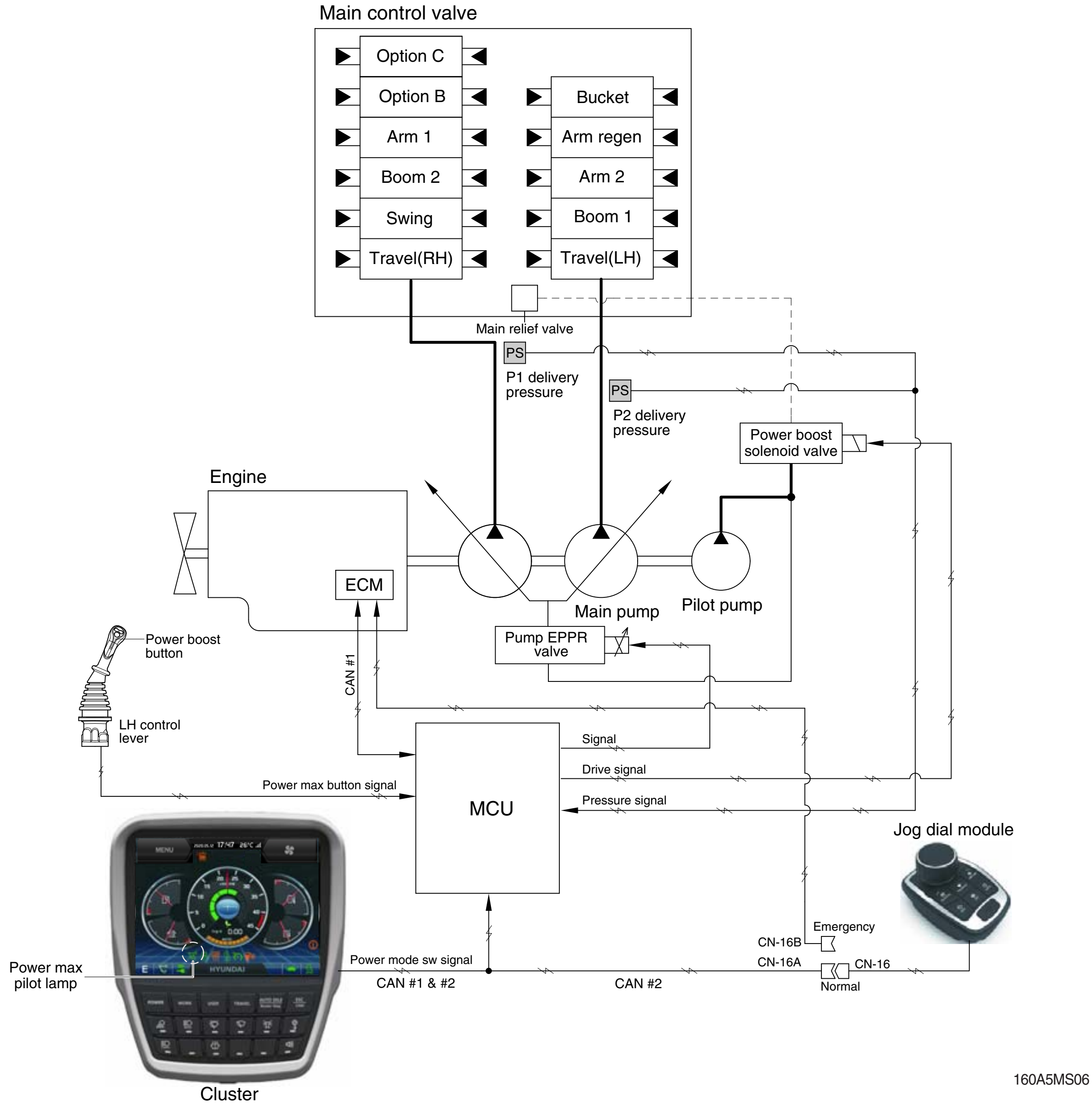
160A5MS105

2. WHEN AUTO IDLE PILOT LAMP OFF

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

※ Auto idle function can be activated when multimodal dial position is over 4.

GROUP 4 POWER BOOST SYSTEM



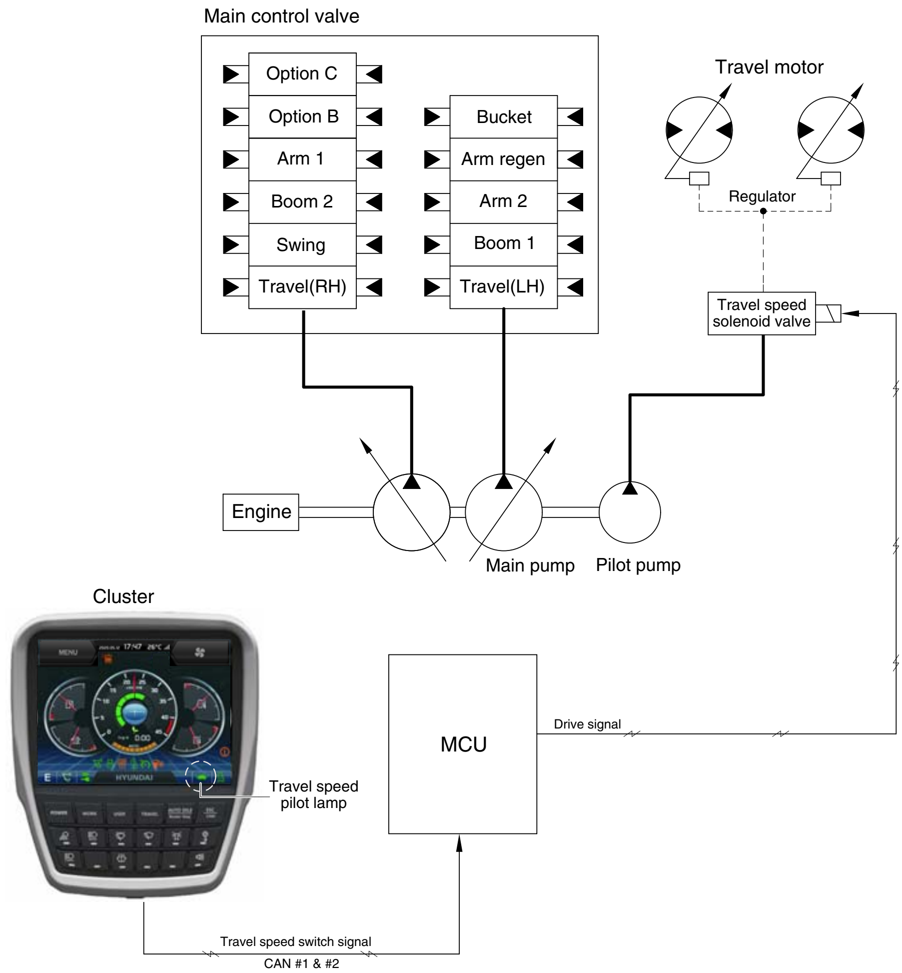
· When the power boost switch on the left control lever knob is pushed ON, the power mode is set P mode and maximum digging power is increased by 10 %.

· When the power boost function is activated, the power boost solenoid valve pilot pressure raises the set pressure of the main relief valve to increase the digging power.

Description	Condition	Function
Activated	Power boost switch : ON Multimodal dial : over 8	- Power mode : P - Multimodal dial power : 9 - Power boost solenoid : ON - Power boost pilot lmap : ON - Operating time : max 8 seconds
Canceled	Power boost switch : OFF	- Pre-set power mode - Power boost solenoid : OFF - Power boost pilot lamp : OFF

※ When the auto power boost is set to Enable and power mode is set to P mode on the cluster, the digging power is automatically increased as working conditions by the MCU. It is operated max 8 seconds.

GROUP 5 TRAVEL SPEED CONTROL SYSTEM



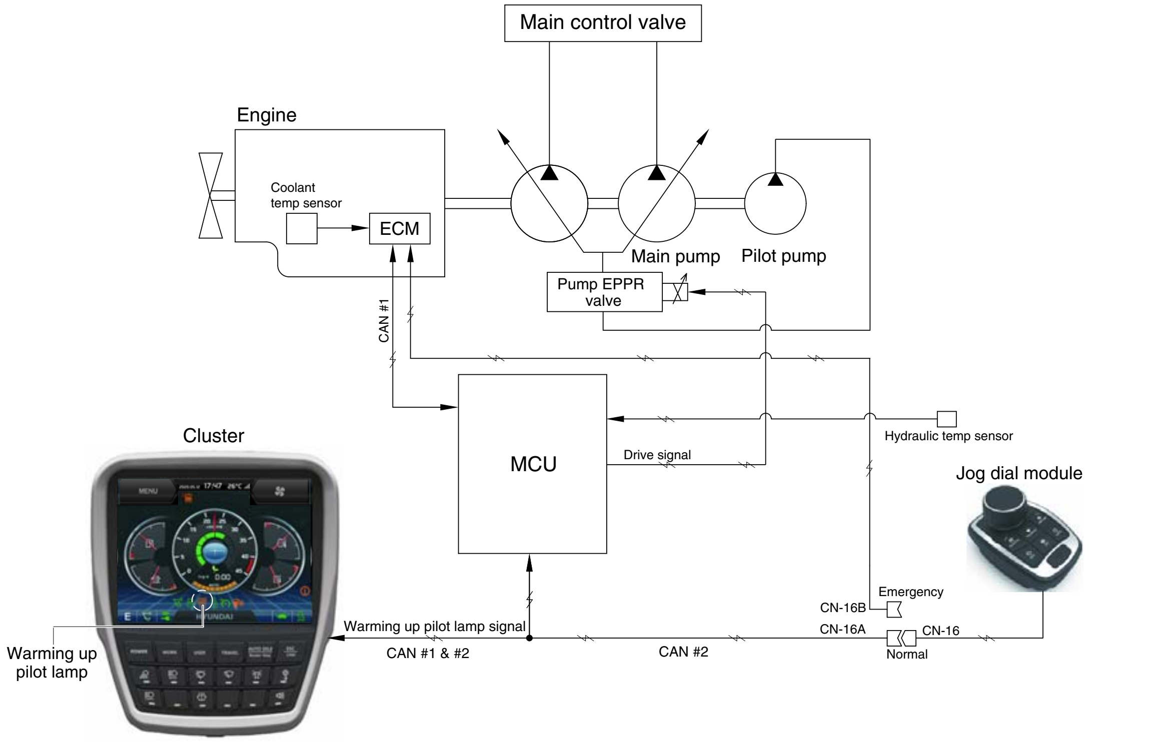
160A5MS07

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



160A5MS08

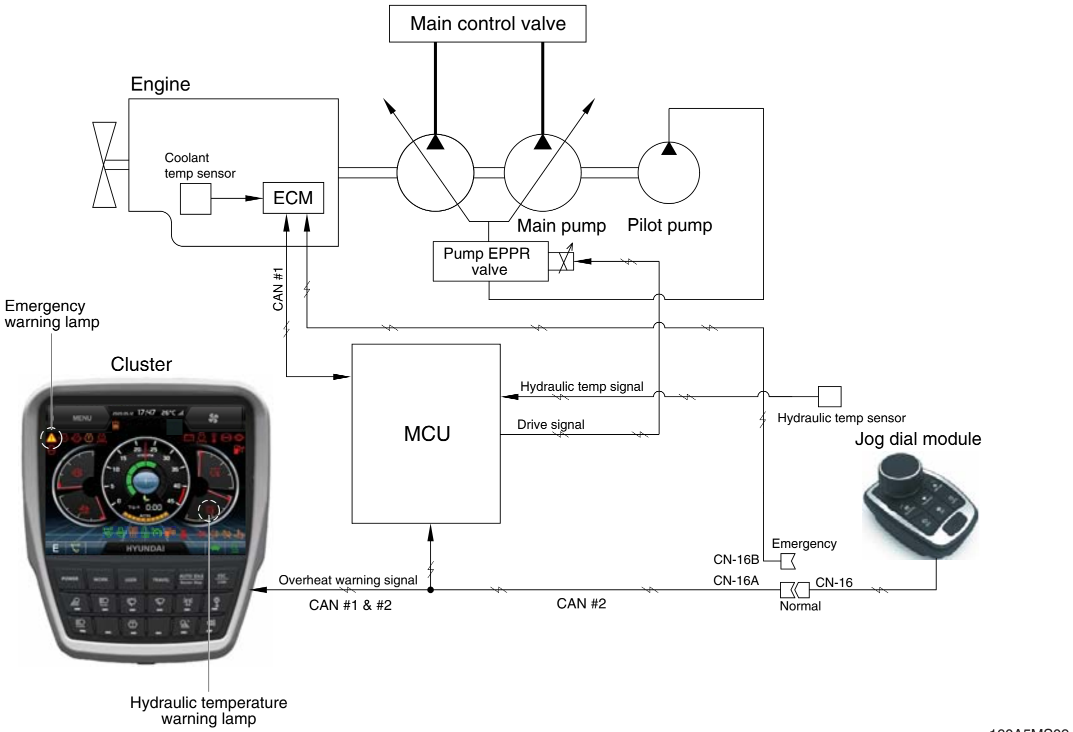
1. The MCU receives the engine coolant temperature from the ECM, and if the coolant temperature is below 30˚C, it increases the engine speed from key start rpm to 1200 rpm. At this time the mode does not change. If the coolant temperature sensor has fault, the hydraulic oil temperature signal is substituted.

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



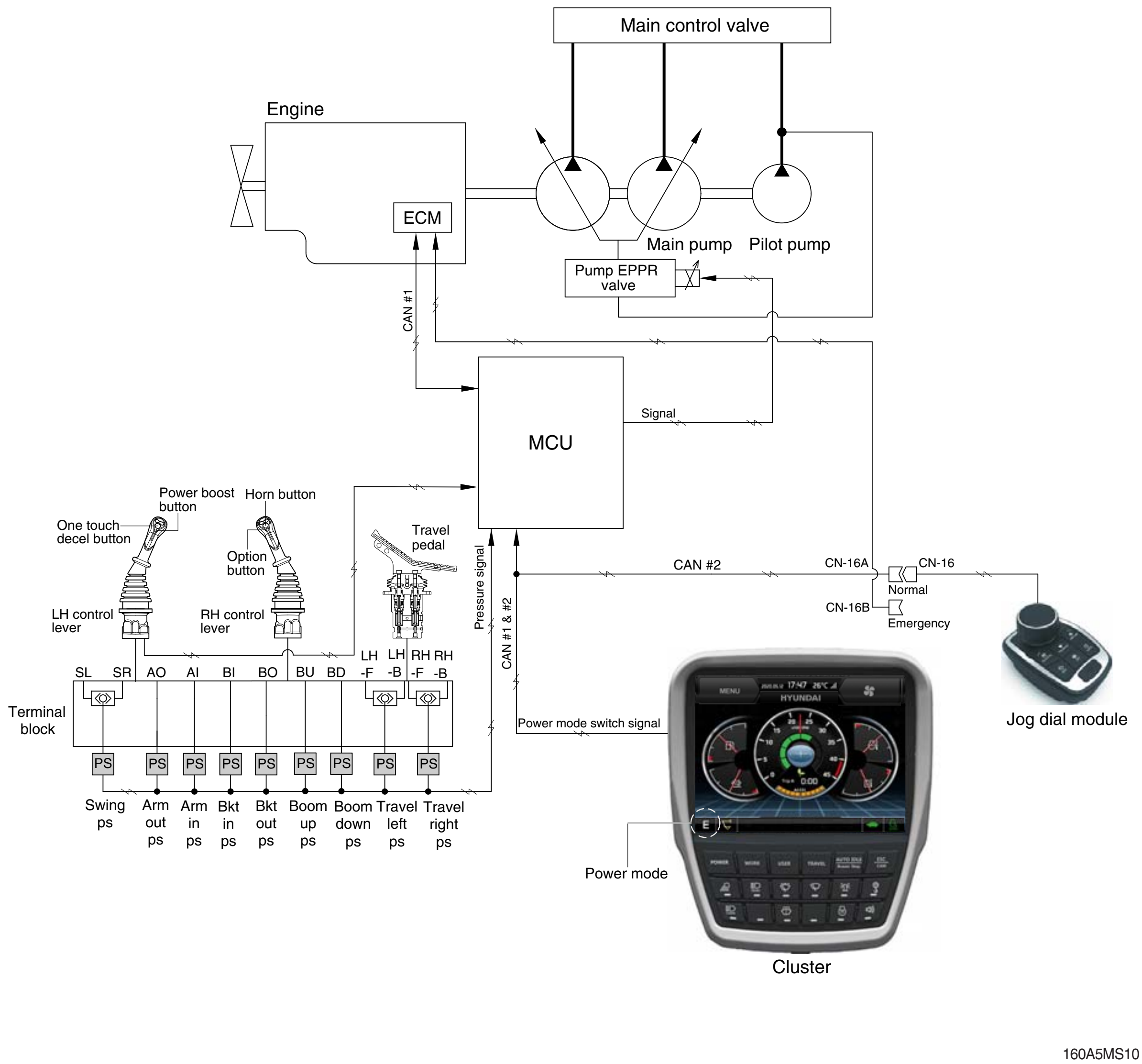
160A5MS09

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

GROUP 8 VARIABLE POWER CONTROL SYSTEM

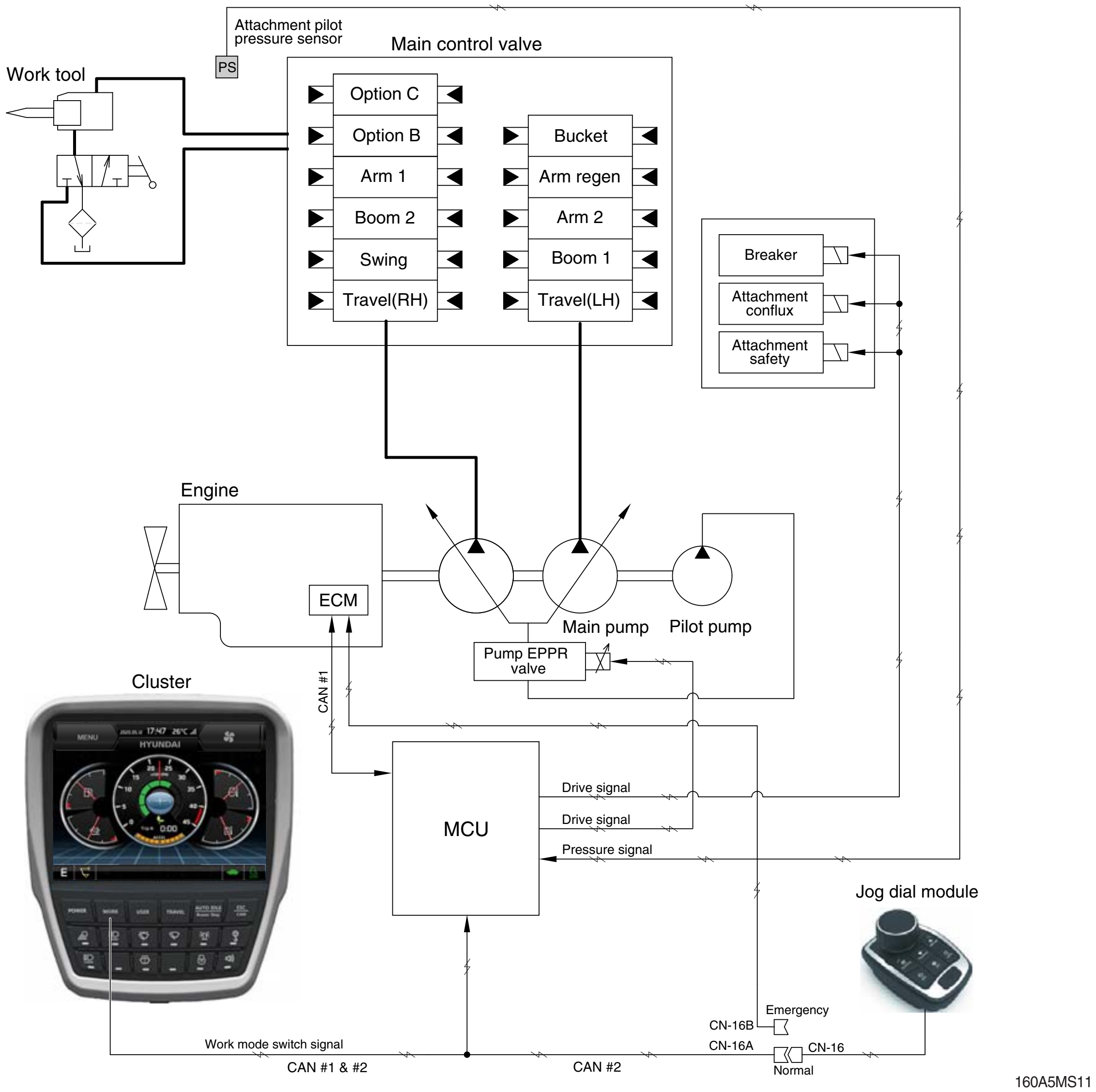


· The variable power control system controls the engine and pump mutual power according to RCV lever stroke and pump load.
It makes fuel saving and smooth control at precise work.

Description	Working condition
Power mode	P, S, E
Work mode	General (bucket)
Pressure sensor	Normal

※ The variable power control function can be activated when the power mode is set to all power mode.

GROUP 9 ATTACHMENT FLOW CONTROL SYSTEM



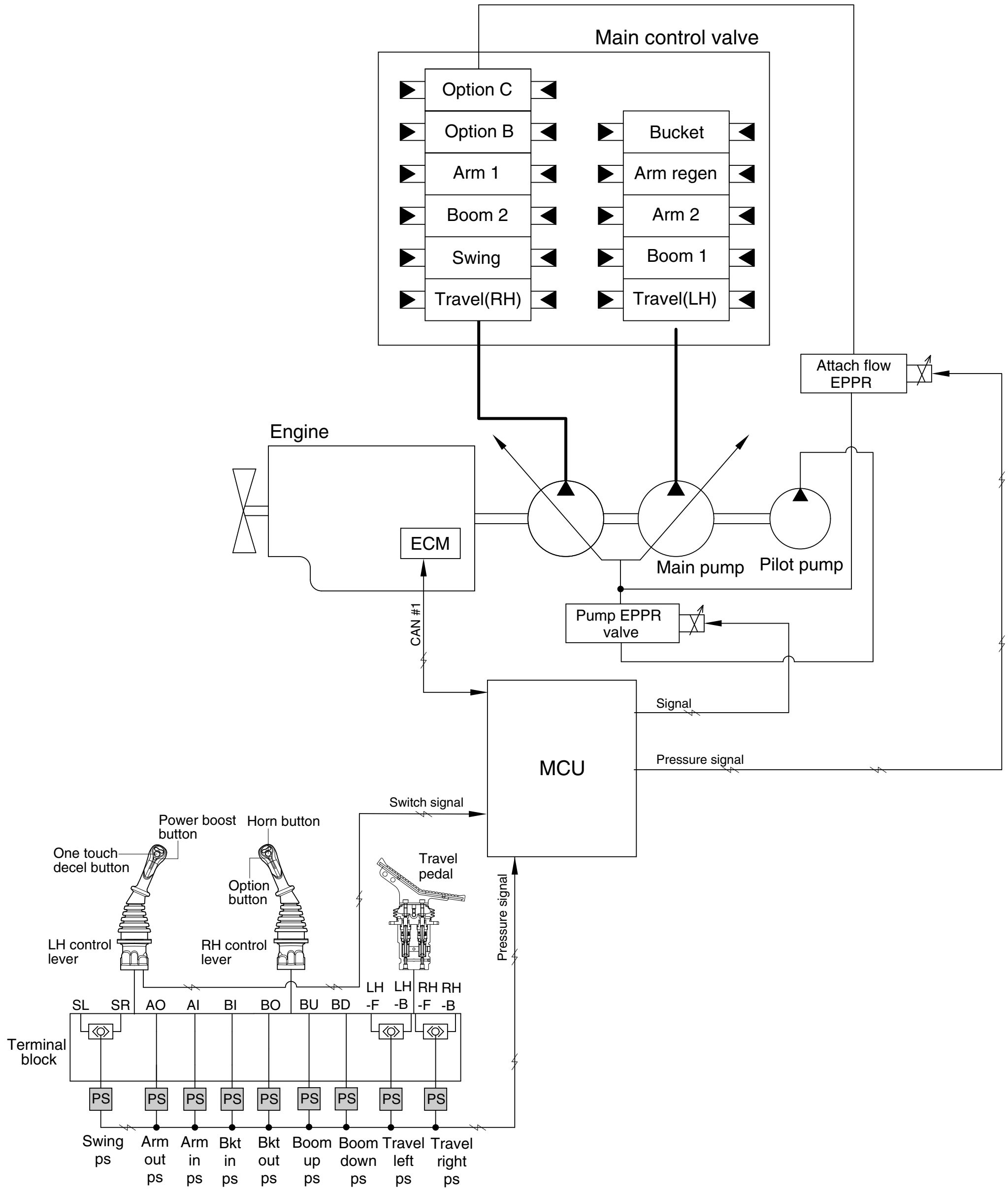
· The system is used to control the pump delivery flow according to set of the work tool on the cluster by the attachment flow EPPR valve.

Description	Work tool	
	Breaker	Crusher
Flow level	100 ~ 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 INTELLIGENT POWER CONTROL SYSTEM



160A5MS18

1. When the requirement of pump flow rate is low, IPC mode controls pump flow rate to improve fuel efficiency. The function works only in Balance or Efficiency mode.

Condition	Function
Arm in with boom up	Limitation of pump flow rate : Activated
Boom down with other actuator	
Starting point when swing operation	
Reduction for fuel when idle condition	
None of upper condition	Limitation of pump flow rate : Canceled

1) ARM IN WITH BOOM UP

A fuel efficiency is improved by maximizing arm regeneration by reducing pump flow rate during boom up and arm in combination operation.

2) BOOM DOWN WITH OTHER ACTUATOR

The flow for boom-down is replaced with regeneration-flow as much as possible, and fuel consumption is reduced by reducing the flow rate of the pump.

3) STARTING POINT WHEN SWING OPERATION

A technology reduces the amount of flow that is wasted to the swing relief due to the inertia at the beginning of the swing start.

4) REDUCTION FOR FUEL WHEN IDLE CONDITION

A technology reduces energy loss due to unnecessary pump volume increase in idle state before the machine operation.

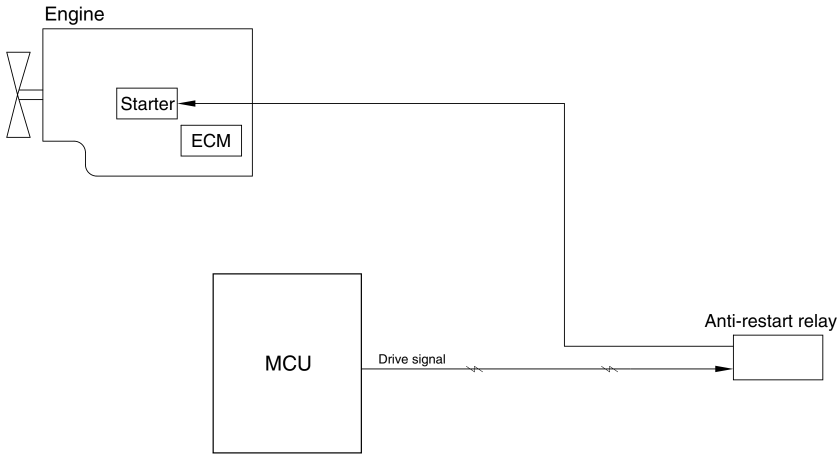
2. IPC MODE SELECTION

The levels of flow rate limit depends on at IPC mode.

300A3CD52A

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 11 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.

GROUP 12 SELF-DIAGNOSTIC SYSTEM

1. OUTLINE

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

2. MONITORING

1) Active fault

300A3CD65A

300A3CD66A

300A3CD67A

· The active faults of the MCU, engine ECM, FATC and AAVM (option) can be checked by this menu.

2) Logged fault

300A3CD68A

300A3CD69A

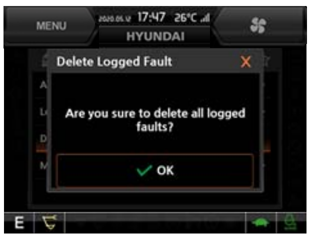
300A3CD70A

· The logged faults of the MCU, engine ECM, FATC and AAVM (option) can be checked by this menu.

3) Delete logged fault

300A3CD71A

300A3CD72A



300A3CD73A

· The logged faults of the MCU, engine ECM, FATC and AAVM (option) 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 (#24) Checking Open/Short</td></tr>
<tr><td rowspan="4">105</td><td>0</td><td>10 seconds continuous, Working Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V≤ Working Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Working Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Working Press. display failure
2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure
(Checking list)
1. CD-7 (#B) – CN-52 (#19) Checking Open/Short
2. CD-7 (#A) – CN-51 (#32) Checking Open/Short
3. CD-7 (#C) – CN-51 (#31) Checking Open/Short</td></tr>
<tr><td rowspan="4">108</td><td>0</td><td>10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V</td><td></td><td>●</td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V ≤ Travel Oil Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Travel Oil Press. display failure
2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure
(Checking list)
1. CD-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

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
128	0	(when you had conditions mounting pressure sensor) 10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	(when you had conditions mounting pressure sensor) 10 seconds continuous, 0.3V≤ Boom Down Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	(when you had conditions mounting pressure sensor) 10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Boom Down Pilot Press. display failure 2. Control Function – Boom floating operation failure (Checking list) 1. CD-85 (#B) – CN-52 (#31) Checking Open/Short 2. CD-85 (#A) – CN-51 (#32) Checking Open/Short 3. CD-85 (#C) – CN-51 (#31) Checking Open/Short				
129	0	10 seconds continuous, Arm In Pilot Press. Sensor Measurement Voltage > 4.8V	●		
	1	10 seconds continuous, 0.3V≤ Arm In Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Arm In Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Arm In Pilot Press. display failure 2. Control Function – IPC operation failure (Checking list) 1. CD-90 (#B) – CN-51 (#21) Checking Open/Short 2. CD-90 (#A) – CN-51 (#32) Checking Open/Short 3. CD-90 (#C) – CN-51 (#31) Checking Open/Short				
133	0	10 seconds continuous, Arm Out Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Arm Out Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Arm Out Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Arm Out 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				

※ 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

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">140</td><td>5</td><td>(Detection)
(When Pump 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</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Pump regulator EPPR drive current > 1.0A
(Cancellation)
3 seconds continuous, Pump regulator EPPR drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Pump horse power setting specification difference
(Fuel efficiency/speed specification failure)
(Checking list)
1. CN-70 (#1)-CN-54 (#1) Checking Open/Short
2. CN-70 (#2)-CN-54 (#28) Checking Open/Short</td></tr>
<tr><td rowspan="3">141</td><td>5</td><td>(Model Parameter) mounting Boom Priority EPPR
(Detection)
(When Boom Priority EPPR Current is more than 10 mA)
10 seconds continuous, Boom Priority EPPR drive current < 0 mA
(Cancellation)
(When Boom Priority EPPR Current is more than 10 mA)
3 seconds continuous, Boom Priority EPPR drive current ≥ 10 mA</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Boom Priority EPPR drive current > 1.0 A
(Cancellation)
3 seconds continuous, Boom Priority EPPR drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Boom first control operation failure
(Checking list)
1. CN-133 (#1)-CN-54 (#4) Checking Open/Short
2. CN-133 (#2)-CN-54 (#34) 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
143 (N.A)	5	(Detection) (When Travel EPPR Current is more than 10 mA) 10 seconds continuous, Travel EPPR drive current = 0 mA (Cancellation) (When Travel EPPR Current is more than 100 mA) 3 seconds continuous, Travel EPPR drive current ≥ 10 mA			●
	6	(Detection) 10 seconds continuous, Travel EPPR drive current > 1.0 A (Cancellation) 3 seconds continuous, Travel EPPR drive current ≤ 1.0 A			●
	(Results / Symptoms) 1. Control Function – cruise control operation failure (Checking list) 1. CN-246 (#2) – CN-54 (#39) Checking Open/Short 2. CN-246 (#1) – CN-51 (#40) Checking Open/Short				
145	5	(Model Parameter) mounting Remote Cooling Fan EPPR (Detection) (When Remote Cooling Fan EPPR Current is more than 10 mA) 10 seconds continuous, Remote Cooling Fan EPPR drive current = 0 mA (Cancellation) (When Remote Cooling Fan EPPR Current is more than 10 mA) 3 seconds continuous, Remote Cooling Fan EPPR drive current ≥ 10 mA	●		
	6	(Detection) 10 seconds continuous, Remote Cooling Fan EPPR drive current > 1.0 A (Cancellation) 3 seconds continuous, Remote Cooling Fan EPPR drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Remote fan control operation failure (Checking list) 1. CN-385 (#3) – CN-53 (#07) Checking Open/Short 2. CN-385 (#1) – CN-51 (#03) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
164 (N.A)	4	(Detection) (When Working Cutoff Relay is Off) 10 seconds continuous, Working Cutoff Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Working Cutoff Relay is Off) 3 seconds continuous, Working Cutoff Relay drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Working Cutoff Relay is On) 10 seconds continuous, Working Cutoff Relay drive current > 6.5 A (Cancellation) (When Working Cutoff Relay is On) 3 seconds continuous, Working Cutoff Relay drive current ≤ 6.5 A			●
	(Results / Symptoms) 1. Control Function – (Wheel Excavator) In driving mode, attachment hydraulic pilot pressure cut off failure (Checking list) 1. CR-47 (#85) – CN-54 (#9) Checking Open/Short 2. CR-47 (#30, #86) – Fuse box (#28) Checking Open/Short				
166	4	(Detection) (When Power Max Solenoid is Off) 10 seconds continuous, Power Max Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Power Max Solenoid is Off) 3 seconds continuous, Power Max Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Power Max Solenoid is On) 5 seconds continuous, Power Max Solenoid drive current > 4.5 A (Cancellation) (When Power Max Solenoid is On) 3 seconds continuous, Power Max Solenoid drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – Voltage increase operation failure (Checking list) 1. CN-88 (#1) – CN-53 (#10) Checking Open/Short 2. CN-88 (#2) – Fuse box (#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">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 (#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="3">169</td><td>4</td><td>Monitor – Selecting attachment(breaker / crusher)
(Detection)
(When Attachment Conflux Solenoid is Off)
10 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Attachment Conflux Solenoid is Off)
3 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Attachment Conflux Solenoid is On)
10 seconds continuous, Attachment Conflux Solenoid drive Current > 6.5 A
(Cancellation)
(When Attachment Conflux Solenoid is On)
3 seconds continuous, Attachment Conflux Solenoid drive Current ≤ 6.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / symptoms)
1. Control Function – Option attachment flow control – Joining operation failure
(Eco breaker mode, crusher mode)
(Checking list)
1. CN-237 (#1) – CN-52 (#16) Checking Open/Short
2. CN-237 (#2) – Fuse box (#28) Checking Open/Short</td></tr>
<tr><td rowspan="3">170</td><td>4</td><td>(Model Parameter) mounting Arm Regenerating Solenoid
(Detection)
(When Arm Regeneration Solenoid is Off)
10 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Arm Regeneration Solenoid is Off)
3 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Arm Regeneration Solenoid is On)
10 seconds continuous, Arm Regeneration Solenoid drive current > 4.5 A
(Cancellation)
(When Arm Regeneration Solenoid is On)
3 seconds continuous, Arm Regeneration Solenoid drive current ≤ 4.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / symptoms)
1. Control Function – Arm regeneration operation failure
(Checking list)
1. CN-135 (#1) – CN-52 (#7) Checking Open/Short
2. CN-135 (#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

<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 (#9) Checking Open/Short
2. CN-149 (#2) – Fuse box (#28) 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 (#8) Checking Open/Short
2. CN-66 (#2) – Fuse box (#34) 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-242 (#2) – CN-54 (#27) Checking Open/Short 2. CN-242 (#1) – CN-54 (#02) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
189	5	(Detection) (When Pump P2 regulator EPPR current is equal or more than 300 mA) 10 seconds continuous, Pump P2 regulator EPPR drive current < 100 mA (Cancellation) (When Pump P2 regulator EPPR current is equal or more than 300 mA) 3 seconds continuous, Pump P2 regulator EPPR drive current ≥ 100 mA	●		
	6	(Detection) 10 seconds continuous, Attachment Flow EPPR 2 drive current > 1.0 A (Cancellation) 3 seconds continuous, Attachment Flow EPPR 2 drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control operation failure (Checking list) 1. CN-378 (#2) – CN-54 (#26) Checking Open/Short 2. CN-378 (#1) – CN-54 (#03) Checking Open/Short				
196 (N.A)	0	HW145 10 seconds continuous, Attachment flow control EPPR 1 press. Sensor Measurement Voltage > 5.2V			
	1	HW145 10 seconds continuous, 0.3V≤ Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.8V			
	4	HW145 10 seconds continuous, Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.3V			
	(Results / Symptoms) 1. Control Function – Driving second pump joining function operation failure (Checking list) 1. CD-93 (#B) – CN-52 (#34) Checking Open/Short 2. CD-93 (#A) – CN-51 (#32) Checking Open/Short 3. CD-93 (#C) – CN-51 (#31) Checking Open/Short				
200	0	10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Pump EPPR Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Pump EPPR Press. display failure 2. Control Function – Pump input horse power control failure, Overload at compensation control operation failure (Fuel efficiency/speed performance failure) (Checking list) 1. CD-44 (#B) – CN-51 (#13) Checking Open/Short 2. CD-44 (#A) – CN-51 (#32) Checking Open/Short 3. CD-44 (#C) – CN-51 (#31) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General   C : Crawler Type   W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
205 (N.A)	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 (N.A)	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
(N.A)</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 (#9) 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
222	5	Monitor – Selecting attachment(crusher) (Detection) (When ATT Relief Setting EPPR 2 Current is equal or more than 10 mA) 10 seconds continuous, ATT Relief Setting EPPR 2 drive current = 0 mA (Cancellation) (When ATT Relief Setting EPPR 2 Current is equal or more than 10 mA) 3 seconds continuous, ATT Relief Setting EPPR 2 drive current ≥ 10mA	●		
	6	(Detection) 10 seconds continuous, ATT Relief Setting EPPR 2 drive current > 1.0 A (Cancellation) 3 seconds continuous, ATT Relief Setting EPPR 2 drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control – P2 relief pressure setting failure (Checking list) 1. CN-366 (#2) – CN-54 (#17) Checking Open/Short 2. CN-366 (#1) – CN-54 (#10) Checking Open/Short				
301	3	10 seconds continuous, Fuel Level Measurement Voltage > 3.8V	●		
	4	10 seconds continuous, Fuel Level Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Fuel remaining display failure (Checking list) 1. CD-2 (#2) – CN-51 (#19) Checking Open/Short 2. CD-2 (#1) – CN-51 (#25) Checking Open/Short				
325	4	(Model Parameter) mounting Fuel Warmer Relay (Detection) (When Fuel Warmer Relay is Off) 10 seconds continuous, Fuel Warmer Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Fuel Warmer Relay is Off) 3 seconds continuous, Fuel Warmer Relay drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Fuel Warmer Relay is On) 10 seconds continuous, Fuel Warmer Relay drive current > 4.5 A (Cancellation) (When Fuel Warmer Relay is On) 3 seconds continuous, Fuel Warmer Relay drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – Fuel warmer operation failure (Checking list) 1. CR-46 (#85) – CN-52 (#13) Checking Open/Short 2. CR-46 (##30, #86) – Fuse box (#24) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
501 (N.A)	0	10 seconds continuous, Transmission Oil Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V≤ Transmission Oil Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Transmission Oil Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Transmission Oil Press. display failure, Transmission Oil low pressure warning failure (Checking list) 1. CD-5 (#B) – CN-52 (#26) Checking Open/Short 2. CD-5 (#A) – CN-51 (#32) Checking Open/Short 3. CD-5 (#C) – CN-51 (#31) Checking Open/Short				
503 (N.A)	0	10 seconds continuous, Brake Oil Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V≤ Brake Oil Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Brake Oil Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Brake Oil Press. display failure, Brake Oil low pressure warning failure (Checking list) 1. CD-3 (#B) – CN-52 (#29) Checking Open/Short 2. CD-3 (#A) – CN-51 (#32) Checking Open/Short 3. CD-3 (#C) – CN-51 (#31) Checking Open/Short				
505 (N.A)	0	10 seconds continuous, Working Brake Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V≤ Working Brake Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Working Brake Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Working Brake Oil Press. display failure, Working Brake Oil low pressure warning failure (Checking list) 1. CD-38 (#B) – CN-51 (#30) Checking Open/Short 2. CD-38 (#A) – CN-51 (#32) Checking Open/Short 3. CD-38 (#C) – CN-51 (#31) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">514
(N.A)</td><td>4</td><td>(Detection)
(When Parking Relay is Off)
10 seconds continuous, Parking Relay drive unit
Measurement Voltage ≤ 3.0V
(Cancellation)
(When Parking Relay is Off)
3 seconds continuous, Parking Relay drive unit
Measurement Voltage > 3.0V</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(Detection)
(When Parking Relay is On)
10 seconds continuous, Parking Relay drive current > 6.5 A
(Cancellation)
(When Parking Relay is On)
3 seconds continuous, Parking Relay drive current ≤ 6.5 A</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Parking Relay operation failure
(Checking list)
1. CR-66 (#1) – CN-53 (#11) Checking Open/Short
2. CR-66 (#2) – Fuse box (#30) Checking Open/Short</td></tr>
<tr><td rowspan="3">517
(N.A)</td><td>4</td><td>(Detection)
(When Traveling Cutoff Relay is Off)
10 seconds continuous, Traveling Cutoff Relay drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Traveling Cutoff Relay is Off)
3 seconds continuous, Traveling Cutoff Relay drive unit Measurement Voltage > 3.0V</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(Detection)
(When Traveling Cutoff Relay is On)
10 seconds continuous, Traveling Cutoff Relay drive current > 6.5 A
(Cancellation)
(When Traveling Cutoff Relay is On)
3 seconds continuous, Traveling Cutoff Relay drive current ≤ 6.5 A</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Traveling Cutoff Relay operation failure
(Checking list)
1. CR-47 (#85) – CN-53 (#04) Checking Open/Short
2. CR-47 (#86) – Fuse box (#28) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

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 HCESPN	DTC FMI	Diagnostic Criteria	Application G	Application C	Application 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-74A (#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-74A (#1) – CN-51 (#15) Checking Open/Short			

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
714 (N.A)	3	(Model Parameter) Mounting Acc. Dial 10 seconds continuous, Acc. Dial Measurement Voltage > 5.2V	●		
	4	(Model Parameter) Mounting Acc. Dial 10 seconds continuous, Acc. Dial Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Acc. Dial Voltage display failure 2. Control Function – Engine rpm control failure (Checking list) 1. CN-7 (#15) – CN-52 (#33) Checking Open/Short				
722	4	(Detection) (When Travel Alarm (Buzzer) Sound is Off) 10 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Travel Alarm (Buzzer) Sound Relay is Off) 3 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Travel Alarm (Buzzer) Sound is On) 10 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive current > 4.5 A (Cancellation) (When Travel Alarm (Buzzer) Sound is On) 3 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – Driving alarm operation failure (Checking list) 1. CN-81 (#1) – CN-52 (#9) Checking Open/Short 2. CN-81 (#2) – Fuse box (#31) Checking Open/Short				
831	2	(When mounting the A/C Controller) 60 seconds continuous, A/C Controller Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – A/C Controller operation failure (Checking list) 1. CN-11 (#8) – CN-51 (#9) Checking Open/Short 2. CN-11 (#7) – CN-51 (#8) Checking Open/Short				
840	2	60 seconds continuous, Cluster Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – Cluster operation failure (Checking list) 1. CN-56A (#5) – CN-52 (#1) Checking Open/Short 2. CN-56A (#4) – CN-52 (#2) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
841	2	10 seconds continuous, ECM Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – ECM operation failure (Checking list) 1. CN-93 (#22) – CN-52 (#2) Checking Open/Short 2. CN-93 (#46) – CN-52 (#1) Checking Open/Short				
848	2	(When mounting the Jog Dial Module) 60 seconds continuous, Jog Dial Module Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – Jog Dial Module operation failure (Checking list) 1. CN-363 (#4) – CN-51 (#9) Checking Open/Short 2. CN-363 (#10) – CN-51 (#8) Checking Open/Short				
850	2	(When mounting the RMCU) 60 seconds continuous, RMCU communication Data Error	●		
	(Resuluts / Symptoms) 1. Control Function – RMCU operation failure (Checking list) 1. CN-125A (#3) – CN-51 (#9) Checking Open/Short 2. CN-125A (#11) – CN-51 (#8) Checking Open/Short				
866	2	(When mounting the AAVM) 60 seconds continuous, AAVM communication Data Error	●		
	(Results / Symptoms) 1. Control Function – AAVM operation failure (Checking list) 1. CN-9 (#5) – CN-51 (#9) Checking Open/Short 2. CN-9 (#6) – CN-51 (#8) Checking Open/Short				
867	2	60 seconds continuous, RDU communication Data Error	●		
	(Results / Symptoms) 1. Control Function – RDU operation failure (Checking list) 1. CN-376 (#10) – CN-51 (#9) Checking Open/Short 2. CN-376 (#18) – CN-51 (#8) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
868	2	60 seconds continuous, Switch Controller communication Data Error	●		
	(Results / Symptoms) 1. Control Function – Switch Controller operation failure (Checking list) 1. CN-56A (#7) – CN-51 (#8) Checking Open/Short 2. CN-56A (#6) – CN-51 (#9) Checking Open/Short				
869	2	(When mounting the BKCU) 60 seconds continuous, BKCU communication Data Error	●		
	(Results / Symptoms) 1. Control Function – BKCU operation failure (Checking list) 1. CS-2B (#A) – CN-51 (#9) Checking Open/Short 2. CS-2B (#B) – CN-51 (#8) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

4. ENGINE FAULT CODE

Fault code J1939 SPN J1939 FMI	Item	Description
111 629 12	Engine control module critical internal failure	Bad intelligent device or component
122 102 3	Intake manifold 1 pressure sensor circuit	Voltage above normal, or shorted to high source
123 102 4	Intake manifold 1 pressure sensor circuit	Voltage below normal, or shorted to low source
124 102 16	Intake manifold 1 pressure	Data valid but above normal operating range - moderately severe level
125 102 18	Intake manifold 1 pressure	Data valid but below normal operating range - moderately severe level
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

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
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
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

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
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
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
324 653 5	Injector solenoid driver cylinder 3 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
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
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

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
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
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
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

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
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
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

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
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
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

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
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
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
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
2311 633 31	Electronic fuel injection control valve circuit	Condition exists
2321 190 2	Engine crankshaft speed/position	Data erratic, intermittent or incorrect
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
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

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
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
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
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
2976 3361 2	Aftertreatment 1 diesel exhaust fluid dosing unit temperature	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

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
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
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
3254 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

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
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
3375 5397 31	Aftertreatment diesel particulate filter regeneration too frequent	Condition exists
3376 5319 31	Aftertreatment diesel particulate filter incomplete regeneration	Condition exists
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
3545 3226 31	Aftertreatment 1 outlet NOx sensor	Abnormal rate of change
3547 4096 31	Aftertreatment diesel exhaust fluid tank empty	Condition exists

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
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
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
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
3577 4376 3	Aftertreatment diesel exhaust fluid return valve	Voltage above normal, or shorted to high source
3578 4376 4	Aftertreatment diesel exhaust fluid return valve	Voltage above normal, or shorted to low source
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

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
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
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

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
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
4156 5746 4	Aftertreatment 1 diesel exhaust fluid dosing unit heater relay	Voltage below normal, or shorted to low source
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
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
4168 5745 3	Aftertreatment 1 diesel exhaust fluid dosing unit heater	Voltage above normal, or shorted to high source
4169 5745 4	Aftertreatment 1 diesel exhaust fluid dosing unit heater	Voltage below normal, or shorted to low source
4249 4337 10	Aftertreatment 1 diesel exhaust fluid dosing temperature	Abnormal rate of change
4251 5798 10	Aftertreatment 1 diesel exhaust fluid dosing unit heater temperature	Abnormal rate of change

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
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
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
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

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
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
4863 5245 31	Aftertreatment diesel exhaust fluid tank low level indicator	-
4953 3353 3	Alternator 1 status	Voltage above normal, or shorted to high source
4954 3353 4	Alternator 1 status	Voltage below normal, or shorted to low source
5248 1623 13	Tachograph output shaft speed	Out of calibration
5272 649 4	Engine exhaust back pressure regulator control circuit	Voltage below normal, or shorted to low source
5273 649 5	Engine exhaust back pressure regulator control circuit	Current below normal or open circuit
5274 5625 2	Engine exhaust back pressure regulator position	Data erratic, intermittent or incorrect
5275 5625 3	Engine exhaust back pressure regulator 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
5276 5625 4	Engine exhaust back pressure regulator position sensor circuit	Voltage above normal, or shorted to low source
5292 520809 31	Excessive time since last engine air shutoff maintenance test	Condition exists
5383 3720 15	Aftertreatment 1 diesel particulate filter ash load percent	Data valid but above normal operating range - least severe level
5576 107 15	Engine air filter differential pressure	Data valid but above normal operating range - least severe level
5632 6918 31	SCR system cleaning inhibited due to inhibit switch	Condition exists
5652 1209 15	Exhaust pressure 1	Data valid but above normal operating range - least severe level
5653 6881 9	SCR operator inducement override switch	Abnormal update rate
5654 6881 13	SCR operator inducement override switch	Out of calibration
5655 4364 31	Aftertreatment 1 scr conversion efficiency	Condition exists
5689 3226 11	Aftertreatment 1 outlet nox sensor	Root cause not known
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
5868 4339 7	Aftertreatment 1 scr feedback control status	Mechanical system not responding or out of adjustment
5935 4334 7	Aftertreatment 1 diesel exhaust fluid pressure	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
5936 4334 15	Aftertreatment 1 diesel exhaust fluid pressure	Data valid but above normal operating range - least severe level
5938 3750 14	Aftertreatment 1 diesel particulate filter conditions not met for active regeneration	Special instructions
5939 520968 9	Machine constrained operation	Abnormal update rate. No communication or an Invalid data transfer rate has been detected on the J1939 data link between the ECM and the machine
5941 520968 19	Machine constrained operation	Received network data in error. The received J1939 datalink message was not valid.
6256 168 15	Battery 1 voltage	Data valid but below normal operating range - moderately severe level
6257 168 17	Battery 1 voltage	Data valid but below normal operating range - moderately severe level
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

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
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
6511 6655 3	Maintain ECM power lamp	Voltage above normal, or shorted to high source
6512 6655 4	Maintain ECM power lamp	Voltage below normal, or shorted to low source
6513 5745 17	Aftertreatment 1 diesel exhaust fluid dosing unit heater	Data valid but below normal operating range
6522 111 3	Coolant level sensor 1 circuit	Voltage above normal, or shorted to high source
6523 111 4	Coolant level sensor 1 circuit	Voltage below normal, or shorted to low source
6526 1761 13	Aftertreatment 1 diesel exhaust fluid tank level sensor	Out of calibration
6527 4376 7	Aftertreatment diesel exhaust fluid return valve	Mechanical system not responding or out of adjust
6529 5746 3	Aftertreatment 1 diesel exhaust fluid dosing unit heater relay	Voltage above normal, or shorted to high source
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

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
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
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

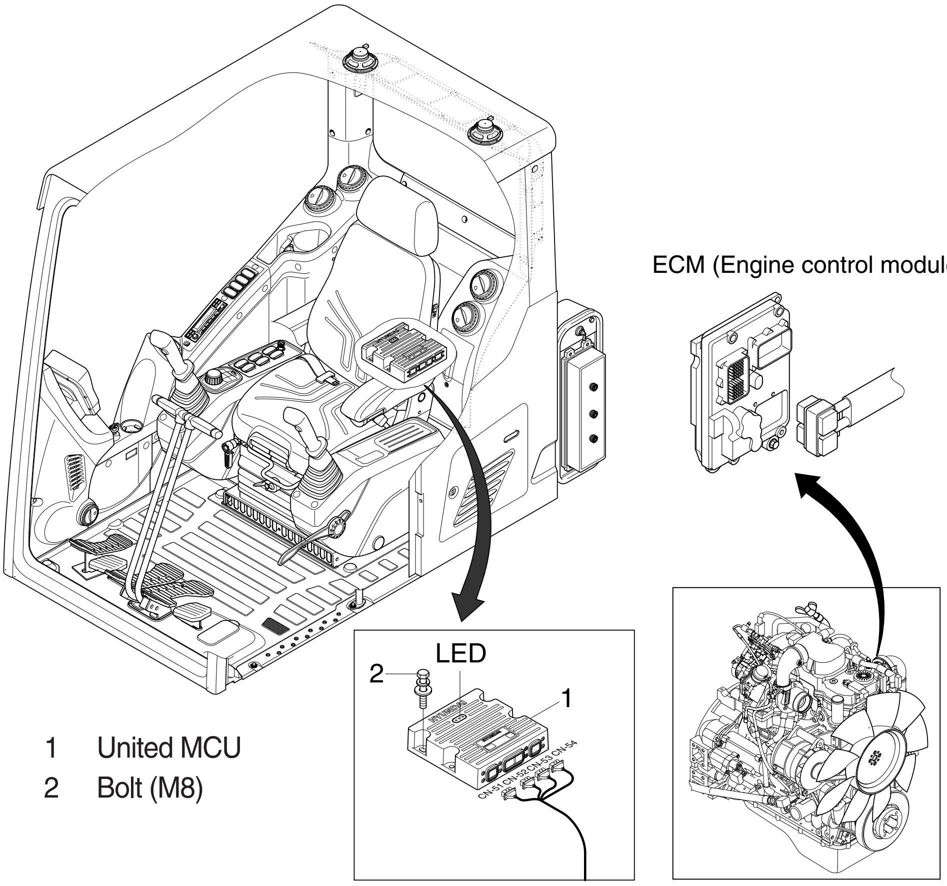
※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
6654 5626 7	Engine exhaust back pressure regulator	Mechanical system not responding or out of adjustment
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
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 13 ENGINE CONTROL SYSTEM

1. UNITED MCU AND ENGINE ECM



160A5MS13

2. UNITED MCU ASSEMBLY

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

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

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

G : green, R : red, Y : yellow

GROUP 14 EPPR VALVE

1. PUMP EPPR VALVE

1) COMPOSITION

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

(1) Electro magnet valve

Receive electric current from MCU and move the spool proportionally according to the specific amount of electric current value.

(2) Spool valve

Is the two way direction control valve for pilot pressure to reduce main pump flow.
When the electro magnet valve is activated, pilot pressure enters into flow regulator of main pump.

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

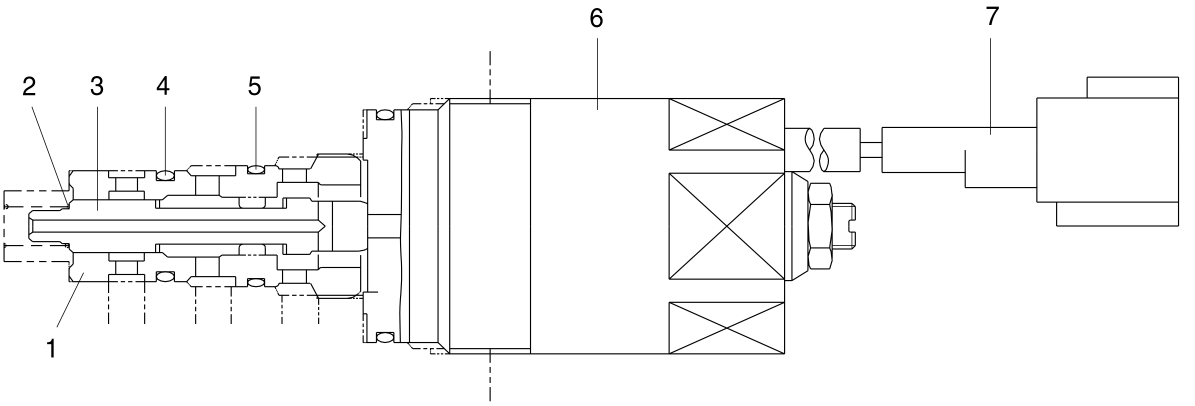
Enter the password 300A3CD106A

300A3CD107A

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

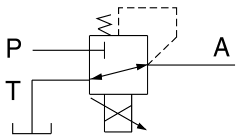
3) OPERATING PRINCIPLE (pump EPPR valve)

(1) Structure



5-22(1)

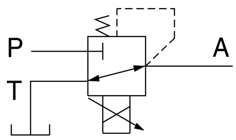
1	Sleeve	4	O-ring	6	Solenoid valve
2	Spring	5	O-ring	7	Connector
3	Spool				

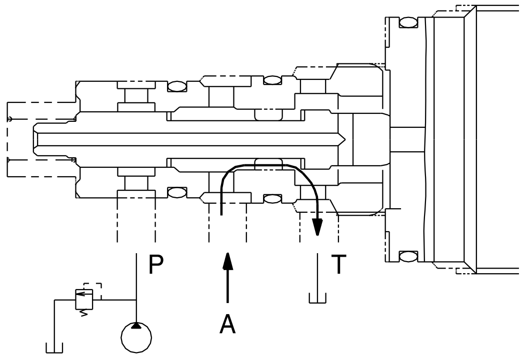


P Pilot oil supply line (pilot pressure)
T Return to tank
A Secondary pressure to flow regulator at main pump

(2) Neutral

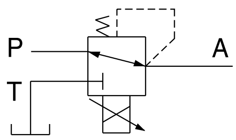
Pressure line is blocked and A oil returns to tank.

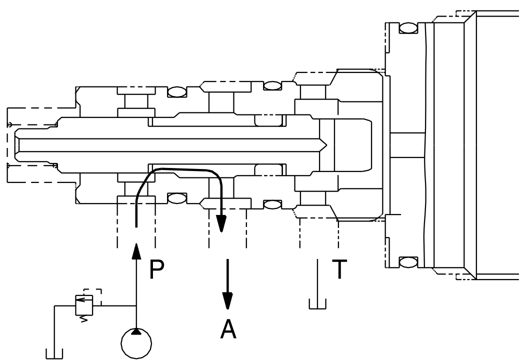




(3) Operating

Secondary pressure enters into A.





5-22(2)

4) EPPR VALVE CHECK PROCEDURE

(1) Check electric current value at EPPR valve

① Disconnect connector CN-75 from EPPR valve.

② Insert the adapter to CN-75 and install multimeter as figure.

③ Start engine.

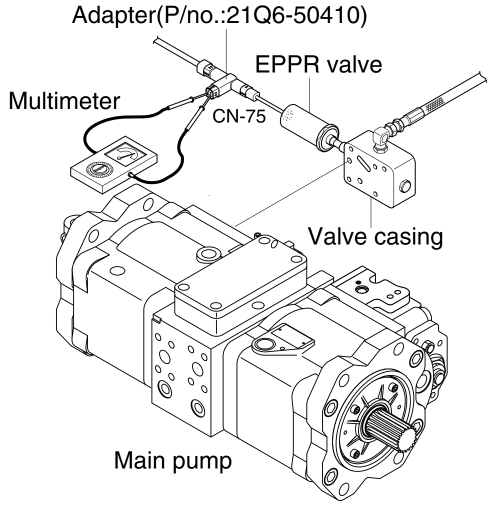
④ Set S-mode and cancel auto decel mode.

⑤ Position the multimodal dial at 10.

⑥ If rpm display show approx 1850±50 rpm check electric current at bucket circuit relief position.

⑦ Check electric current at bucket circuit relief position.

Spec : 100~700 mA



160A5MS21

(2) Check pressure at EPPR valve

① Start engine.

② Set S-mode and cancel auto decel mode.

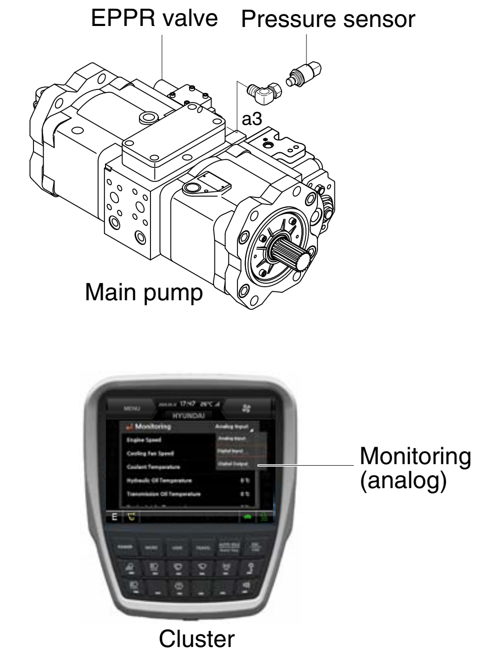
③ Position the multimodal dial at 10.

④ Slowly operate control lever of bucket functions at full stroke over relief and measure the EPPR valve pressure by the the monitoring menu of the cluster.

⑤ If pressure is not correct, adjust it.

⑥ After adjust, test the machine.

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



160A5MS22

2. BOOM PRIORITY EPPR VALVE

1) COMPOSITION

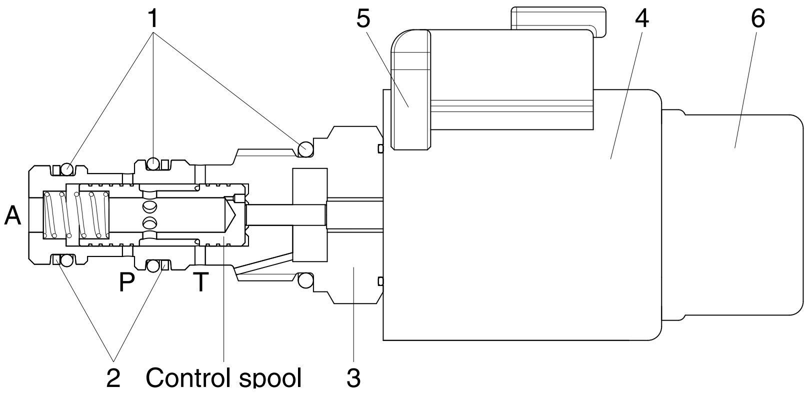
The boom priority EPPR valve is built in a manifold and mainly consisting of valve body and coil. This EPPR valve installed under the solenoid valve.

2) CONTROL

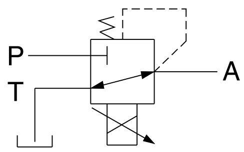
The boom priority EPPR valve has to be controlled by a specific electronic amplifier card, which is supplying the coil with a current 580 mA at 30Ω and 24 V.

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.

4) EPPR VALVE CHECK PROCEDURE

(1) Check electric current value at EPPR valve

① Disconnect connector CN-133 from EPPR valve.

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

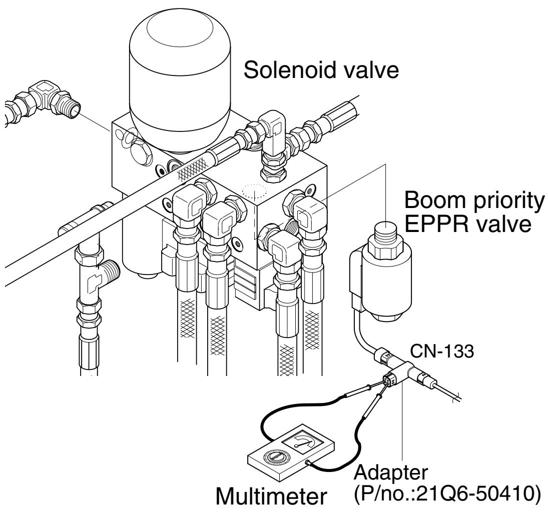
③ Start engine.

④ Set S-mode and cancel auto decel mode.

⑤ If rpm display approx 1850±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)



160A5MS15

(2) Check pressure at EPPR valve

① Remove hose from A5 port and connect pressure gauge as figure.
  · Gauge capacity : 0 to 50 kgf/cm2 (0 to 725 psi)

② Start engine.

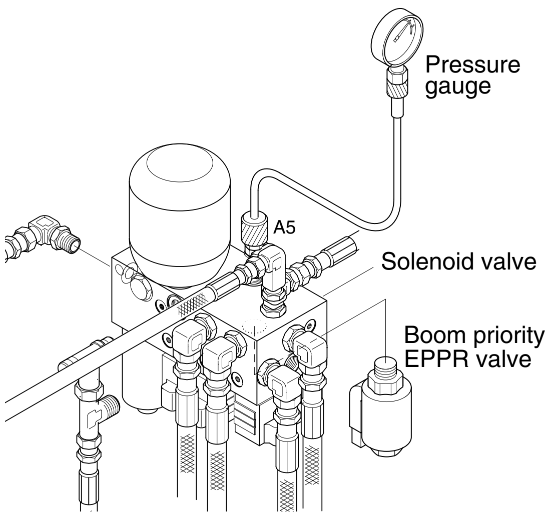
③ Set S-mode and cancel auto decel mode.

④ If rpm display approx 1850±50 rpm check pressure (In case of combined boom up and swing operation).

⑤ If pressure is not correct, adjust it.

⑥ After adjust, test the machine.

Spec : 12~37 kgf/cm2 (170~530 psi)
(combined boom up and swing operation)



160A5MS16

GROUP 15 MONITORING SYSTEM

1. OUTLINE

Monitoring system consists of the monitor part and switch part.

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

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

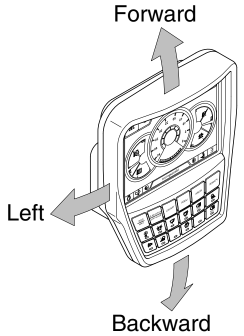
2. CLUSTER

1) MONITOR PANEL

160A5CD20

※ 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 5-73 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 1200 rpm.

※ Others same as above.

③ When abnormal condition

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

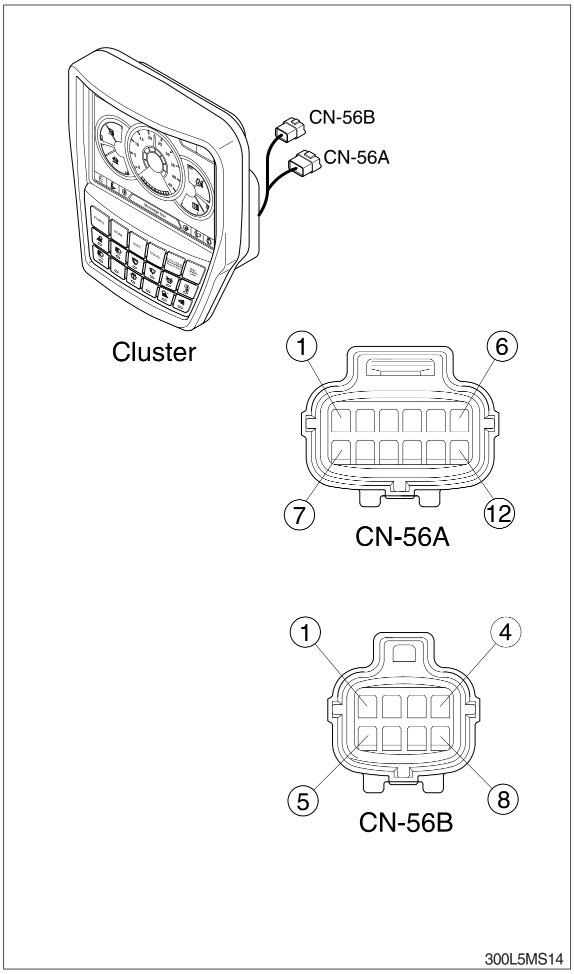
b. If BUZZER STOP switch is pressed, buzzer sound is canceled but the lamp warning lights up until normal condition.

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

3) CLUSTER CONNECTOR

(1) CN-56A

No.	Name	Signal
1	Battery 24V	20~32V
2	Power IG (24V)	20~32V
3	GND	-
4	CAN 1 (H)	0~5V
5	CAN 1 (L)	0~5V
6	CAN 2 (H)	0~5V
7	CAN 2 (L)	20~32V
8	NC	-
9	NC	-
10	Aux left	0~5V
11	Aux right	0~5V
12	Aux GND	-



(2) CN-56B

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

NTSC : National Television System Committee

4) GAUGE

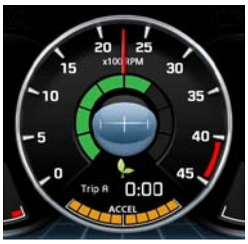
(1) Operation screen

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

300A3CD21A

1	RPM / Speed gauge	5	DEF/AdBlue® level gauge
2	Engine coolant temperature gauge	6	Tripmeter display
3	Hydraulic oil temperature gauge	7	Eco guage
4	Fuel level gauge	8	Accel dial gauge

(2) RPM / Speed gauge



300A3CD22

① This displays the engine speed.

(3) Engine coolant temperature gauge

290F3CD53

① This gauge indicates the temperature of coolant.

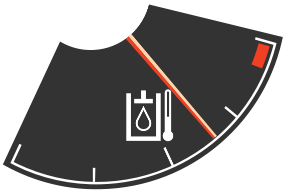
· White range : 40-107˚C (104-225˚F)

· Red range : Above 107˚C (225˚F)

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

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

(4) Hydraulic oil temperature gauge



290F3CD54

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

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

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

(5) Fuel level gauge

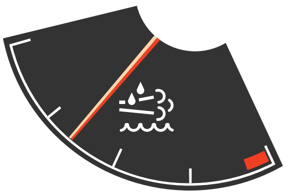
290F3CD55

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

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

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

(6) DEF/AdBlue® Level gauge



290F3CD57

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

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

③ Do not overfull DEF/AdBlue®.

※ Refer to page 5-78.

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

(7) Tripmeter display

290F3CD56

① This displays the engine the tripmeter.

※ Refer to page 5-103 for details.

(8) Eco gauge

290F3CD58

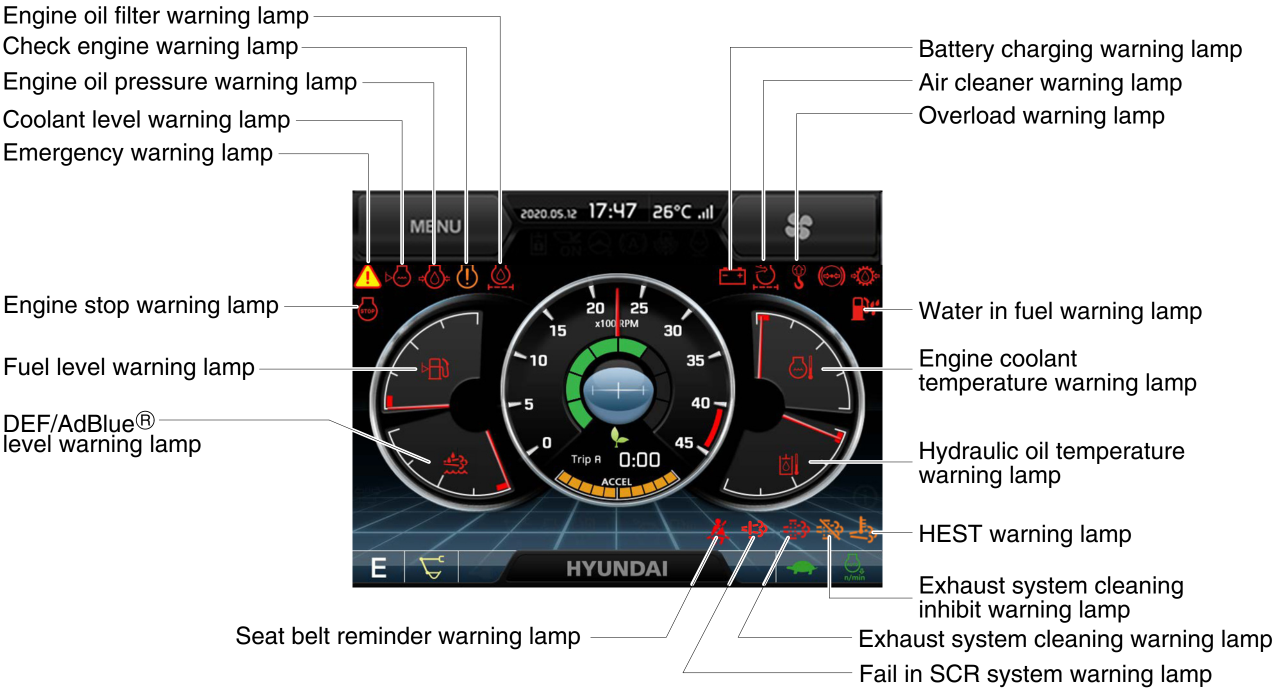
① This gauge indicates the fuel consumption rate and machine load status so that the operators can operate the machine efficient in regards to fuel consumption.
② Fuel consumption rate or machine load is higher if the number of segments are increased.
③ The color of Eco gauge indicates operation status.
· White : Idle operation
· Green : Economy operation
· Yellow : Non-economy operation at a medium level.
· Red : Non-economy operation at a high level.

(9) Accel dial gauge

290F3CD59

① This gauge indicates the level of accel dial.

5) WARNING LAMPS



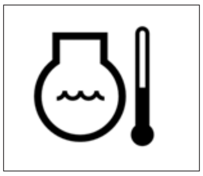
300A3CD23B

※ 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, 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, lights up 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 5-78 for details.**
  	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position, lights up and the buzzer stops after 2 seconds elapses.
	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position, blinks and the buzzer stops after 2 seconds elapses.
	Warning lamp pops up on the center of the LCD and the buzzer sounds	· Cluster displays this pop-up when it has communication error with MCU. · If communication with MCU become normal state, it will disappear automatically.
 	Warning lamp pops up on the center of the LCD and the buzzer sounds	※ **Refer to page 5-74 for details.**
	Warning lamp lights up and the buzzer sounds	※ **Refer to page 5-78 for details.**

※ Refer to page 5-86 for the buzzer stop switch  and operator's manual page 3-66 for the jog dial module.

(1) Engine coolant temperature warning lamp



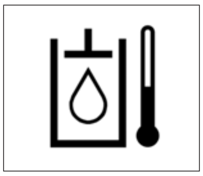
290F3CD61

① Engine coolant temperature warning is indicated in 2 steps.
- 103˚C over : The lamp pops up and the buzzer sounds.
- 107˚C over : The lamp pops up and the buzzer sounds.

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

③ Check the cooling system when the lamps keep blinking.

(2) Hydraulic oil temperature warning lamp



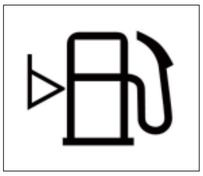
290F3CD62

① Hydraulic oil temperature warning is indicated in 2 steps.
- 100˚C over : The lamp pops up and the buzzer sounds.
- 105˚C over : The lamp pops up and the buzzer sounds.

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

③ Check the hydraulic oil level and hydraulic cooling system.

(3) Fuel level warning lamp



290F3CD63

① This warning lamp pops up and the buzzer sounds when the fuel level is below 37 ℓ (9.8 U.S. gal).

② Fill the fuel immediately after the lamp blinks.

(4) Emergency warning lamp

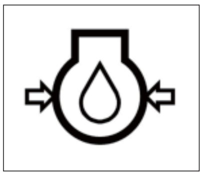
290F3CD64

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

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

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

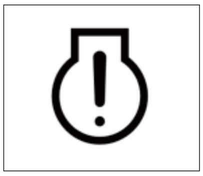
(5) Engine oil pressure warning lamp



290F3CD65

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

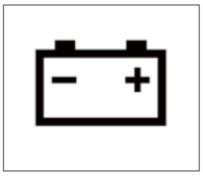
(6) Check engine warning lamp



290F3CD66

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

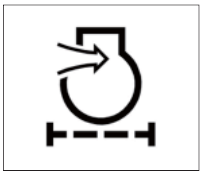
(7) Battery charging warning lamp



290F3CD67

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

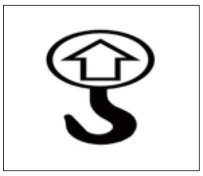
(8) Air cleaner warning lamp



290F3CD68

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

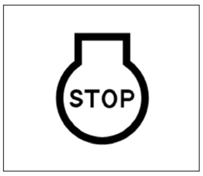
(9) Overload warning lamp (opt)



290F3CD69

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

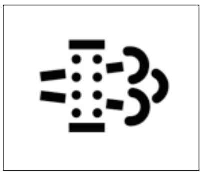
(10) Engine stop warning lamp



290F3CD252

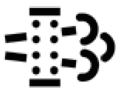
① This warning lamp pops up and the buzzer sounds after 30 minutes of run time elapses, when the DEF/AdBlue® tank has reached it's minimum level. Stop engine immediately and check actual DEF/AdBlue® level.
② Fill the DEF/AdBlue® immediately.
※ Refer to page 3-11.
③ This lamp pops up and the buzzer sounds when the maual (stationary) exhuast system cleaning is not performed.
※ Refer to page 3-9.
※ Please contact your HD Hyundai Construction Equipment service center or local dealer.
※ "Engine shutdown" cluster message pops up when the exhaust gas temperature reaches above 800℃.

(11) Exhaust system cleaning warning lamp

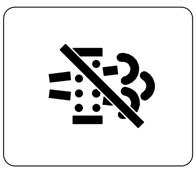


290F3CD70

① This warning lamp lights up or blinks when exhaust system cleaning is needed as seen in the table below.

Warning lamp			Description
Exhaust 	Check engine 	Stop engine 	
Off	Off	Off	· Automatic exhaust system cleaning
Blink	Off	Off	· The status of a manual (stationary) exhaust system cleaning when the exhaust system cleaning switch has been activated. ※ Refer to page 5-77.
On	On	Off	· The aftertreatment exhaust system needs to be cleaned immediately. · Engine power will be reduced automatically if action is not taken. ※ The exhaust system cleaning can be accomplished by: - Changing to a more challenging duty cycle. - Performing a manual (stationary) exhaust system cleaning.
On	On	On	· These lamps will be ON when a manual (stationary) exhaust system cleaning is not performed. · Stop the engine immediately. · Please contact your HD Hyundai Construction Equipment service center or local dealer.

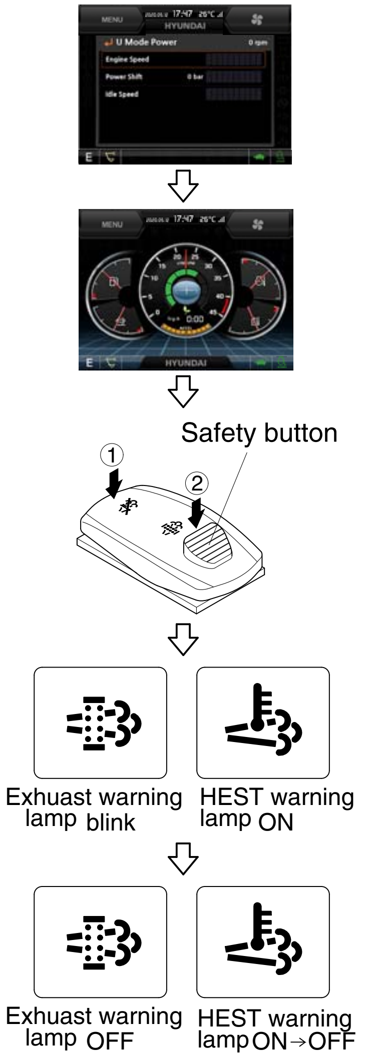
(12) Exhaust system cleaning inhibit warning lamp



2609A3CD20

① This warning lamp indicates the exhaust system cleaning switch is pushed to the inhibit position, therefore automatic and manual exhaust system cleaning can not occur.
※ Refer to operator's manual page 3-43 for the exhaust system cleaning switch.

※ Manual exhaust system cleaning



220A3CD73B

※ Manual exhaust system cleaning must be operated in a fireproof area.

※ To stop a manual exhaust system cleaning before it has completed, set to the exhaust system cleaning switch to the inhibit position or turn OFF the engine.

① Stop and park the machine.

② Pull the safety button and push the switch to position ② to initiate the manual exhaust system cleaning.

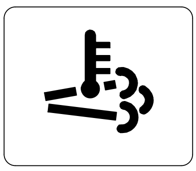
※ Refer to the page operator's manual 3-43 for the exhaust system cleaning switch operation.

※ The engine speed may increase to 950~1050 rpm and exhaust system cleaning begins and it will take approximately 20~30 minutes.

③ The exhaust system cleaning warning lamp will blink and HEST warning lamp will light up during the exhaust system cleaning operation.

④ The exhaust system cleaning and/or HEST warning lamp light will go off when the exhaust system cleaning is completed.

(13) HEST (High exhaust system temperature) warning lamp


2609A3CD21

① This warning lamp indicates, when illuminated, that exhaust temperatures are high due to exhaust system cleaning.

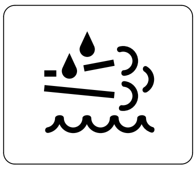
② The lamp will also illuminate during a manual exhaust system cleaning.

③ When this lamp is illuminated, be sure the exhaust pipe outlet is not directed at any surface or material that can melt, burn, or explode.

⚠ When this lamp is illuminated, the exhaust gas temperature could reach 800˚C [1500˚F], which is hot enough to ignite or melt common materials, and to burn people.

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

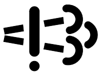
(14) DEF/AdBlue® level warning lamp



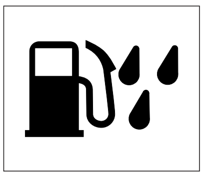
290F3CD257

① This warning lamp when ON or blinking, indicates that the DEF/AdBlue® level is low as per the table below.

※ **It is recommended that the DEF/AdBlue® tank be filled completely full of the DEF/AdBlue® in order to correct any fault conditions.**

Warning lamp				Description
Fail in SCR system 	DEF/AdBlue® level 	Check engine 	Stop engine 	
On	On	Off	Off	· The DEF/AdBlue® level has fallen below the initial warning level (10%).
On	On	On	Off	· The DEF/AdBlue® level has fallen below the initial derate level (2.5%). · The engine power will be limited automatically.
On	Blink	On	On	· This happens when 30 minutes has elapsed with empty conditions (0%) of the DEF/AdBlue® tank. · The engine will enter the final derate level which may include low idle lock or engine shutdown with restart limitations. · In order to remove the final derate, the DEF/AdBlue® tank must be filled to above 10% gauge reading.

(15) Water in fuel warning lamp



300A3CD24A

① This warning lamp lights up and the buzzer sounds when the water separator is full of water or malfunctioning.

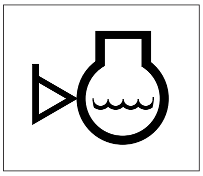
※ **When this lamp lights up, stop the machine and drain water from the separator.**

(16) Seat belt reminder warning lamp

300A3CD25

① When operator does not fasten the operator's seat belt, the seat belt reminder warning lamp pops up and the buzzer sounds.
② Fasten the seat belt.

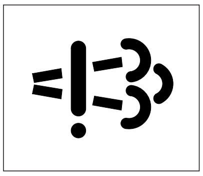
(17) Coolant level warning lamp



760F3CD58

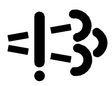
① This warning lamp indicates lack of coolant.
② Check and refill coolant.

(18) Fail in SCR system warning lamp



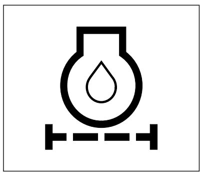
300A3CD15

① This warning lamp indicates there are faults related to SCR system.
② The lamp lights up when each of the below warnings is happening.
a. Low DEF/AdBlue® level
b. Poor quality of DEF/AdBlue®
c. Tempering or malfunction in the aftertreatment system
③ Once the lamp lights up, the engine will derate soon.
※ **Please contact your HD Hyundai Construction Equipment service center or local dealer.**

Warning lamp		Torque reduction
	Time	
On	Fault detected	-
On	After 2 h 30 min	· Torque is reduced to 75% of the highest torque.
Blink	After 3 h 45 min	· Torque is reduced to 50% of the highest torque.
Blink rapidly	After 4 hours	· Torque is reduced to 0% (low idling) of the hightest torque within 2~10 min.

※ If a new fault ocuurs within 40 hours of operation since the first fault, the warning lamp will light up. After 3 hours of operation, the warning lamp will blink rapidly and torque will be reduced to 0% (low idling) within 2~10 minutes.
※ Once the fault has been remedied and the engine control unit has received an indication that it is working, torque returns to the normal level.

(19) Engine oil filter warning lamp



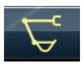
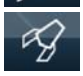
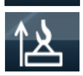
300A3CD306

① This warning lamp pops up and the buzzer sounds when the engine oil filter is clogged.
② Check, clean or replace filter.

6) PILOT LAMPS

300A3CD26A

(1) Mode pilot lamps

No	Mode	Pilot lamp	Selected mode
1	Power mode	P S E	Heavy duty power work mode Standard power mode Economy power mode
2	User mode	U	User preferable power mode
3	Work tool mode	     	General operation - IPC speed mode General operation - IPC balance mode General operation - IPC efficiency mode Breaker operation mode Crusher operation mode Lifting mode
4	Travel mode	 	Low speed traveling High speed traveling
5	Auto idle mode		Auto idle

(2) Power max pilot lamp

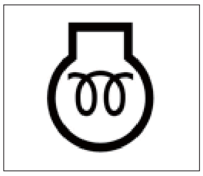
300A3CD32

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

② The power max function operates for a max period of 8 seconds.

※ Refer to the operator's manual page 3-45 for power max function.

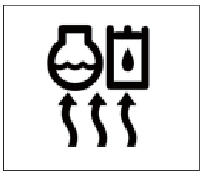
(3) Preheat pilot lamp



290F3CD79

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

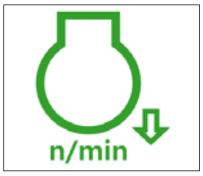
(4) Warming up pilot lamp



290F3CD80

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

(5) Decel pilot lamp

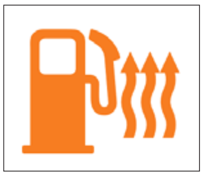


300A3CD33

① Operating one touch decel switch on the RCV lever makes the lamp light up.
② Also, the lamp will light up and engine speed will be reduced automatically to save fuel when all levers and pedals are in the neutral position, and the auto idle function is selected.
③ If it follows the case below, decel goes off in the idle state.
- Auto idle button off
- Working/Travel
- One touch decel button off
- Safety knob unlock

※ Refer to the operator's manual page 3-45.

(6) Fuel warmer pilot lamp



300A3CD34

① This lamp lights up when the coolant temperature is below 10℃ (50°F) or the hydraulic oil temperature is 20℃ (68°F).
② The automatic fuel warming is cancelled when the engine coolant temperature is above 60℃ (140°F), and the hydraulic oil temperature is above 45℃ (113°F) since the start switch was ON position.

(7) Maintenance pilot lamp

300A3CD35

① This lamp lights up when consumable parts are in need of replacement. It means that the change or replacement interval of parts is 30 hours from the required change interval.
② Check the message in maintenance information of main menu. Also, this lamp lights up for 3 minutes when the start switch is switched to the ON position.

※ Refer to page 5-96.

(8) **RMCU signal strength pilot lamp** (mobile only)

220A3CD200

① This lamp indicates RMCU signal strength as below.

: Searching

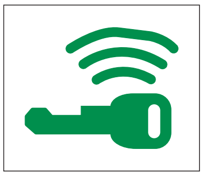
: Bad

: Normal

: Good

: Excellent

(9) **Smart key pilot lamp** (opt)



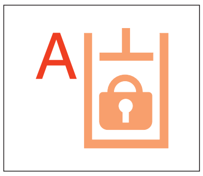
300A3CD36A

① This lamp lights up when the engine is started by the start button.

② This lamp is red when the a authentication fails, it will be green when it authentication is successful.

※ Refer to the page 5-97.

(10) **Auto safety lock pilot lamp**



300A3CD37A

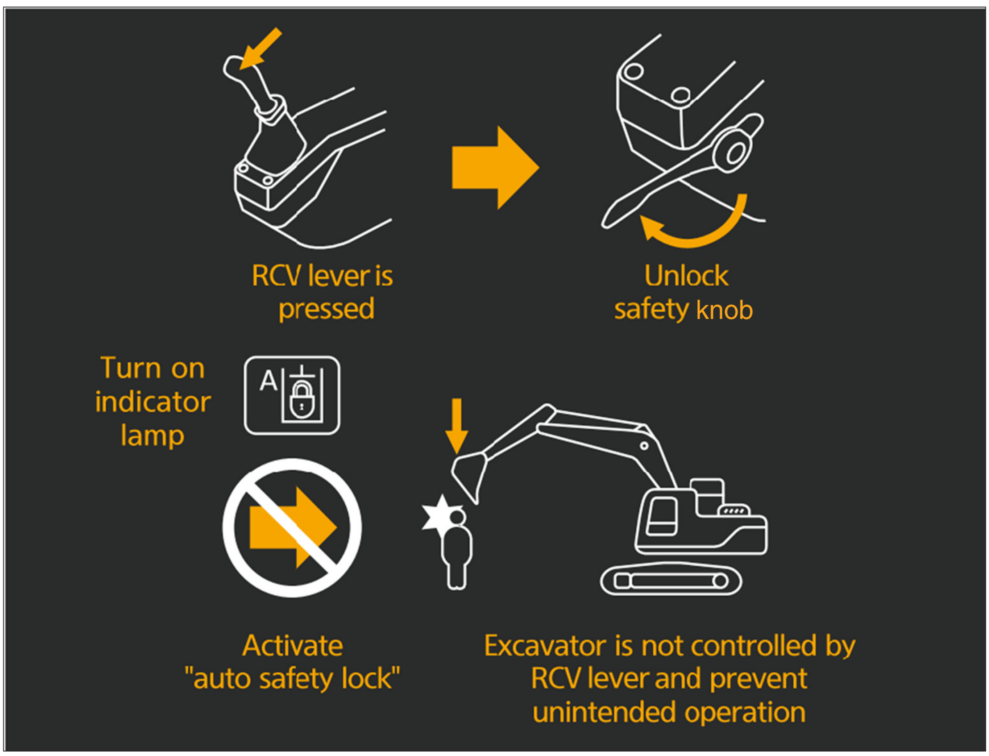
① Auto safety lock system prevents unintended operation of the machine in order to improve safety.

② Engine will only start if safety knob is locked.

③ If operator unlocks safety knob when RCV lever is pressed, machine is not controlled by RCV lever.

⚠ **If operator unlocks safety knob while any control/function is being operated, the machine will move violently. This could cause serious injury, death or damage to property.**

④ The function is released only by turning the safety knob to the UNLOCK position and the LOCK position again.



300A3CD38A

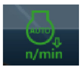
(11) Auto engine shutdown pilot lamp

220A3CD202A

① This lamp lights up when the auto engine shutdown is activated.

※ Refer to page 5-92.

(12) Engine rpm state

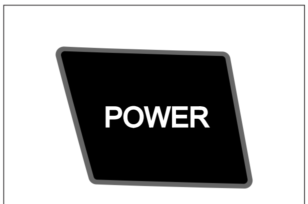
Function	Safety Knob	Auto Idle Mode	One Touch Decel	RPM State
				
State 1	Unlock	OFF	OFF	High rpm
State 2	Unlock	OFF	ON	Low rpm
State 3	Unlock	ON	OFF	Auto Idle rpm
State 4	Lock	ON	OFF	Low rpm
State 5	Lock	OFF	ON	Low rpm
State 6	Unlock	ON	ON	Low rpm
State 7	Lock → Unlock	ON	ON	Low → High → Low rpm (few seconds later)
State 8	Lock	ON	OFF	Low rpm
State 9	Lock	ON	ON	Low rpm

7) SWITCHES

300A3CD39A

※ When some of the switches are selected, the pilot lamps are displayed on the LCD. Refer to page 5-81 for details.

(1) Power mode switch



290F3CD76

① This switch is to select the machine power mode and when pressed, the power mode pilot lamp will be displayed on the section of the monitor.

- · P : Heavy duty power work.
- · S : Standard power work.
- · E : Economy power work.

② The pilot lamp changes E → S → P → E in this order.

(2) Work mode switch

290F3CD88

① This switch is to select the machine work mode, which shifts from general operation mode to optional attachment operation mode.

- · : General operation mode
- · : Breaker operation mode (if equipped)
- · : Crusher operation mode (if equipped)
- · : Lifting mode
- · Not installed : Breaker or crusher is not installed.

※ **Refer to the operator's manual page 2-7 for details.**

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.

300A3CD168

(3) User mode switch

290F3CD89

① This switch is used to select the user mode.
② Refer to page 5-90 for another set of the user mode.

(4) Travel speed switch

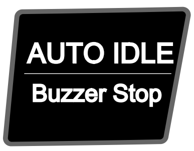
290F3CD91

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 while machine is moving. Machine stability may be adversely affected.

⚠ Serious injury or death can result from sudden changes in machine stability.

(5) Auto idle/ buzzer stop switch



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 5-103 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 lights up when this switch is pressed.

(8) Head light switch

290F3CD94

① This switch is used to operate the head light.
② The pilot lamp lights up when this switch is pressed.

(9) Intermittent wiper switch

290F3CD95

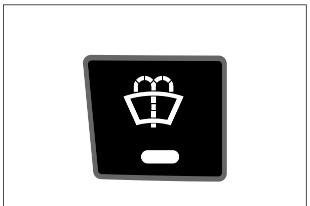
① When this switch is pressed, wipers operate intermittently.
② The pilot lamp lights up when this switch is pressed.

(10) Wiper switch

290F3CD96

① This switch is used to operate the wiper.
② Note that the wiper will self-park when switched off.
③ The pilot lamp lights up when this switch is pressed.
△ **If the wiper does not operate with the switch in ON position, turn the switch OFF immediately. Check the cause. If the switch remains ON, motor failure can result.**

(11) Washer switch



290F3CD100

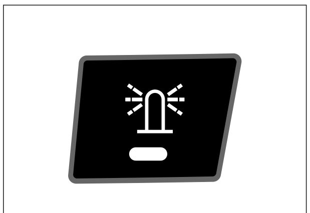
① Washer fluid is sprayed and the wiper is operated only when this switch is pressed.
② The pilot lamp lights up when this switch is pressed.

(12) Cab light switch

290F3CD99

① This switch turns on the cab light.
② The pilot lamp lights up when this switch is pressed.

(13) Beacon switch (opt)



290F3CD97

① This switch activates the rotary light on the cab.
② The pilot lamp lights up when this switch is pressed.

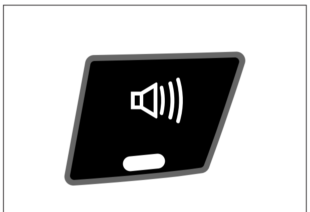
(14) Overload switch (opt)

290F3CD98

① When this switch is activated, buzzer makes sound and overload warning lamp lights up in the event that the machine is or becomes in an overloaded situation.
② When the switch is inactivated, buzzer stops and warning lamp goes off.

⚠ **Overloading the machine could impact the machines stability which could result in tipover hazard. A tipover hazard could result in serious injury or death. Always activate the overload warning device before you handle or lift objects.**

(15) Travel alarm switch



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 page 5-105.

(17) Main menu quick touch switch

290F3CD217

① This switch is to activate the main menu in the cluster.
※ Refer to page 5-89.

8) MAIN MENU

※ You can select or set the menu by the jog dial module or touch screen.
On the operation screen, tap MENU to access the main menu screen.
On the sub menu screen, you can tap the menu bar to access functions or applications.

· Operation screen

300A3CD40A

※ Please refer to the jog dial module, operator's manual page 3-66 for selection and change of menu and input value.

(1) Structure

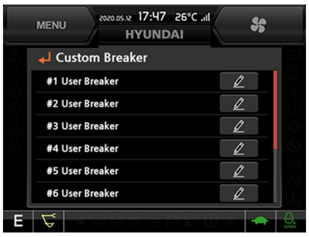
No	Main menu	Sub menu	Description
1	 Mode 290F3CD103	Work tool U mode power Boom/Arm speed Auto power boost IPC mode Auto engine shutdown Initial mode Emergency mode	Breaker, Crusher, Not installed User mode only Boom speed, Arm speed Enable, Disable Speed mode, Balance mode, Efficiency mode One time, Always, Disable Key on initial mode / initial work mode, Accel initial mode / step Switch function
2	 Monitoring 290F3CD104	Active fault Logged fault Delete logged fault Monitoring	MCU, Engine ECM, FATC, AAVM (option) MCU, Engine ECM, FATC, AAVM (option) All logged fault delete, Initialization canceled Machine information, Switch status, Output status,
3	 Management 290F3CD105	Fuel rate information Maintenance information Machine security Machine information Contact Service menu Clinometer Update	General record, Hourly, Daily, Mode record Replacement, Change interval oils and filters ESL mode setting, Password change Model, MCU, Monitor, jog dial module, switch controller, RMCU, Relay drive unit, FATC, AAVM (option) A/S phone number, A/S phone number change Power shift, Operating hour, Breaker mode pump acting, EPPR current level, Overload pressure, Optional piping pressure removal, Fine swing Clinometer setting Cluster, ETC device
4	 Display 290F3CD106	Display item Clock Brightness Unit setup Language selection Screen type	Engine speed, Tripmeter A, Tripmeter B, Tripmeter C Clock Manual, Auto Temperature, Pressure, Flow, Distance, Date format Korean, English, ETC A type, B type
5	 Utilities 290F3CD107	Tripmeter Camera Auto idle time setting	3 kinds (A, B, C) Camera setting, Auto mode (travel) Time setting

(2) Mode setup

① Work tool (Machine Serial No. : -#0289)

300A3CD41A

A



300A3CD42A

B

300A3CD43A

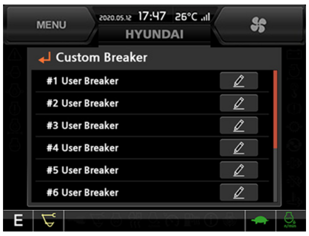
· Select installed optional attachment
- A : It can set the user's attachment.
  It is available in setting #1~#10.
- B : Max flow - Set the maximum flow for the attachment.
  Relief pressure - Set the relief pressure.

(2) Mode setup

① Work tool (Machine Serial No. : #0290-)

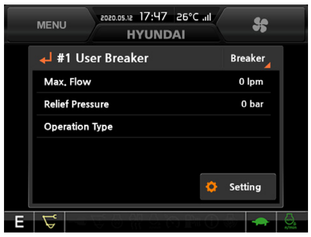
300A3CD41A

A



300A3CD42A

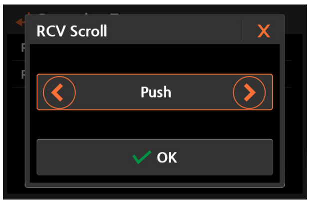
B



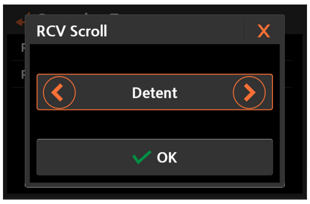
3003CD43B

300A3CD651

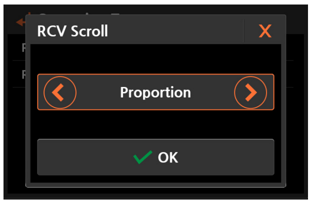
· Select installed optional attachment
 - A : It can set the user's attachment.
   It is available in setting #1~#10.
 - B : Max flow - Set the maximum flow for the attachment.
   Relief pressure - Set the relief pressure.
   Operation type - Set the operation type for attachment.



140WA3CD654A



140WA3CD653A

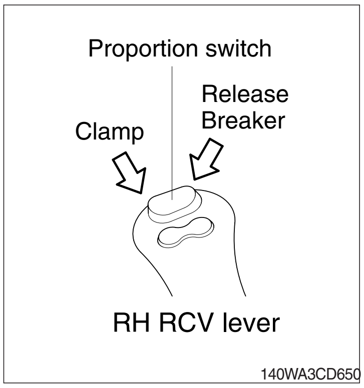


140WA3CD652A

■ Operation type

Operation type is used to set the operation of the proportion switch on the RCV lever if equipped proportional function.

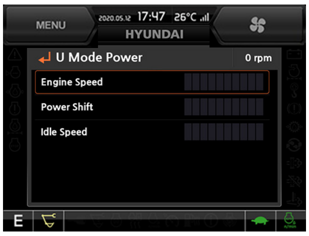
- Push : Switch actuation will be deactivated when the proportion switch is released.
- Detent : Switch actuation will remain even if the proportion switch is released. To deactivate, move the switch in the same direction again or to the opposite direction.
- Proportion : Switch actuation is proportional to the movement of the proportion switch.



140WA3CD650

② U mode power

300A3CD44A



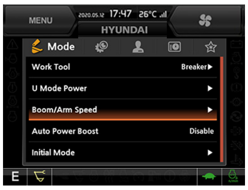
300A3CD45B

Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1300	750	0
2	1400	800	3
3	1500	850	6
4	1600	900	9
5	1700	950	12
6	1800	1000	16
7	1900	1050	20
8	2000	1100 (auto decel)	26
9	2100	1150	32
10	2200	1200	38

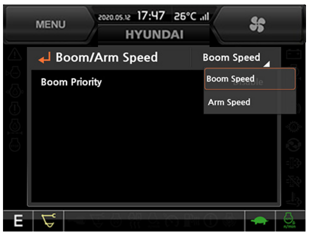
※One touch decel & low idle : 1000 rpm

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

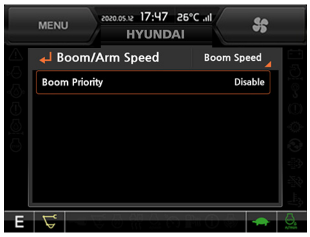
③ Boom/Arm speed



300A3CD46A



300A3CD47A

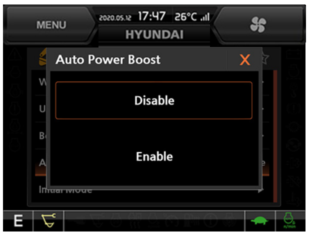


300A3CD48A

- Boom speed
  It adjusts the ratio of relative speed in the boom up and swing combination operation.
  - Boom priority enable is mainly used in work environments that require high boom up work at a short swing angle of about 45 degrees.
  - Boom priority disable is recommended for use in work environments that require high swing speed and acceleration, some slow boom up, and more than 45 degrees.
- Arm speed
  This provides ON and OFF of the regeneration function of the arm in operation.
  - Enable means that regeneration is ON, and an energy can be used efficiently through automatic regeneration according to the load.
  - Disable means that regeneration is always OFF, and it can be effective for heavy digging work.

④ Auto power boost

300A3CD49A

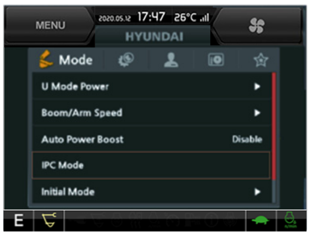


300A3CD50A

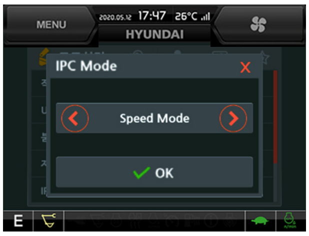
· The power boost function can be activated or cancelled.
  - Enable : The digging power is automatically increased as working conditions by the MCU. It is operated max 8 seconds.
  - Disable : Not operated.

※ The auto power boost function is activated in P mode. It does not work in S mode and E mode.

⑤ IPC mode



300A3CD51A



300A3CD52A

300A3CD53A

300A3CD54A

300A3CD55A

300A3CD56A

300A3CD57A

· The operator can improve fuel consumption and working speed through IPC mode.
· IPC mode is working by using inertial energy in specific case.
· The IPC mode can be selected by this menu.
  - Speed mode / Balance mode / Efficiency mode
· The effect of IPC mode is different at power mode. The fuel efficiency is about 5% in P mode and about 3% in E mode based on Balance mode against Speed mode.
· The manufacturer recommends using the balance mode in IPC mode.

※ The effect is the result of the standard operation. Depending on the operator's working conditions and machine options, the results could be different.

※ Please update the cluster programs if this mode is not displayed in the mode setup menu. Refer to page 5-99.

⑥ Automatic engine shutdown

300A3CD58A

300A3CD59A

300A3CD60A

- The automatic engine shutdown function can be set by this menu.
  - One time
  - Always
  - Disable
  - Wait time setting : Max 40 minutes, min 2 minutes

⑦ Initial mode

300A3CD61A

300A3CD62B

- Key on initial mode
  - Selected the power mode is activated when the engine is started.
- Key on initial work mode
  - Not installed
  - Last setting
  - Work mode
- Accel initial mode
  - Last setting value
  - User setting value
- Accel initial step
  - 0~9 step

⑧ Emergency mode

300A3CD63A

300A3CD64A

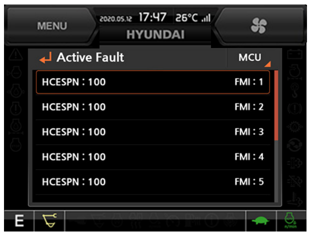
- This mode can be used when the switches are abnormal on the cluster.
- The cluster switches can be selected by touching each icon.

(3) Monitoring

① Active fault

300A3CD65A

300A3CD66A

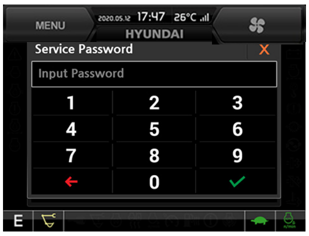


300A3CD67A

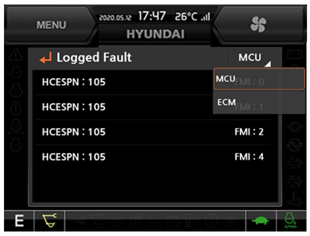
· The active faults of the MCU, ECM, FATC, AAVM (option) can be checked by this menu.

② Logged fault

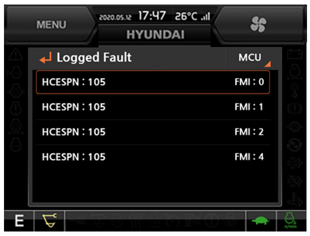
300A3CD68A



300A3CD72A



300A3CD69A

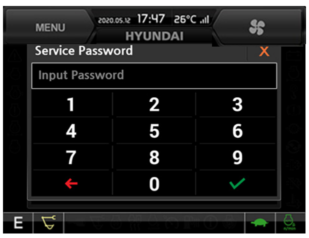


300A3CD70A

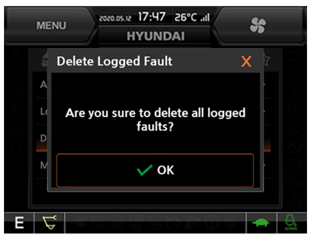
· The logged faults of the MCU, ECM, FATC, AAVM (option) can be checked by this menu.

③ Delete logged fault

300A3CD71A



300A3CD72A

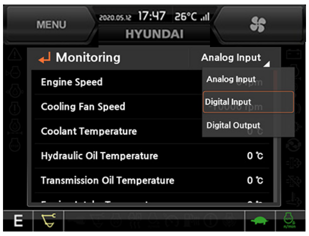


300A3CD73A

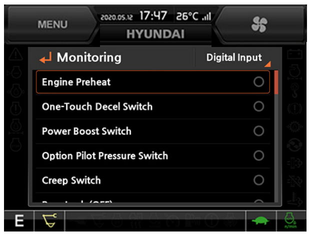
· The logged faults of the MCU, ECM, FATC, AAVM (option) can be deleted by this menu.

④ Monitoring

300A3CD74A



300A3CD75A



300A3CD76A

· The machine status such as the engine rpm, oil temperature, voltage and pressure etc. can be checked by this menu (Analog input).

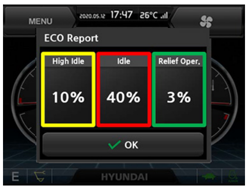
· The switch status or output status can be confirmed by this menu (Digital input & Digital output).

· The activated switch or output pilot lamps ● will light up.

(4) Management

① ECO report

This reports the machine's inefficient operation status in order to improve operator's improper working habit.



300A3CD77A

High idle

300A3CD78A

· Shows a breakdown of high idle, idle and relief operation when monitor is on.

· Gives a daily usage breakdown record for a 7 day period and an overall accumulated record from the first operation.

Idle

300A3CD79A

Relief operation

300A3CD80A

② Fuel rate information

300A3CD81A

300A3CD82A

· General record (A)
- Average fuel rate (left) (from "Reset" to now)
  Fuel consumption divided by engine run time (service meter time).
- A days fuel used (right)
  Fuel consumption from 24:00 (or "Reset" time) to now (MCU real time).

A

300A3CD83A

· Hourly record (B)
- Hourly fuel rates for past 12 hours (service meter time).
- No record during key-off time.
- One step shift to the right for every one hour.
- Automatic deletion of data from 12 hours and earlier.
- "Reset" deletes all hourly records.

B

300A3CD84A

· Daily record (C)
- Daily fuel consumption for past seven days (MCU real time).
- No record during key-off time.
- One step shift to the right at 24:00 for every day.
- Automatically deletes data from 7 days and earlier.
- All daily records deletion by "Reset".

C

300A3CD85A

· Mode record (D)
- Average fuel rate for each power mode/accel dial (at least 7) from "Reset" till present.
- No record during idle.
- All records can be deleted by "Reset".

D

300A3CD86A

③ Maintenance information

300A3CD87A

300A3CD88A

300A3CD89A

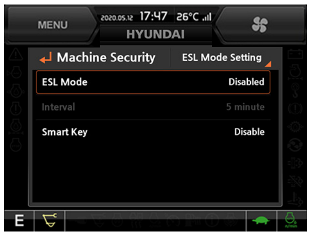
· Alarm lamp (●) is ON when oil or filter needs to be changed or replaced.
· Replacement : The elapsed time will be reset to zero (0).
· Change interval : The change intervals can be changed in hour increments of 50.

※ Refer to section, Maintenance chart for further information of maintenance interval.

④ Machine security

300A3CD90A

300A3CD91A



300A3CD92A

· ESL mode setting

- ESL : Engine Starting Limit
- ESL mode is desingned to be a theft deterrent or will prevent the unauthorized operation of the machine.
- When you Enable the ESL mode, the password will be required when the starting switch is turned to the on position.
- Machine security

  Disable : ESL function is disabled and password is not required to start engine.

  Enable (always) : The password is required whenever the operator starts engine.
- Interval : The password is required when the operator starts engine first. But the operator can restart the engine within the interval time without inputting the password. The interval time can be set to a maximum 4 hours.

  ※Default password : 00000＋☑

  ※Password length : (5~10 digits)＋☑
- Smart key (option) : Refer to next page.

300A3CD93A

300A3CD94A

· Password change

- The password is 5~10 digits.

300A3CD95A

300A3CD96A

300A3CD91A

Enter the current password

300A3CD98A

Enter the new password again

300A3CD99A

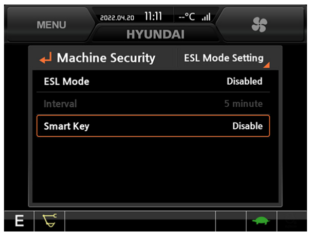
Enter the new password

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

- Smart key

300A3CD90A

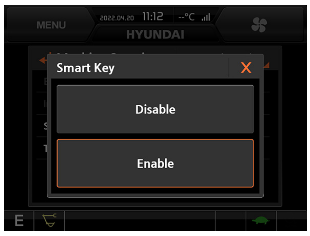
300A3CD91A



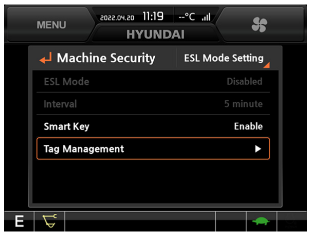
300A3CD001

- · 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.

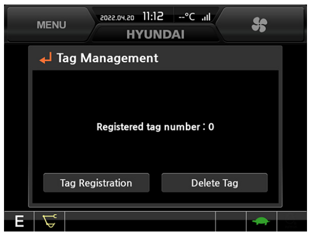
- Tag management
  - · When registering a tag : Only the tag you want to register must be in the cabin.
  - · When deleting a tag : All registered tags are deleted.



300A3CD002

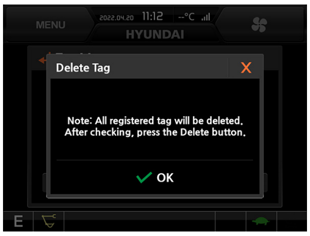


300A3CD003



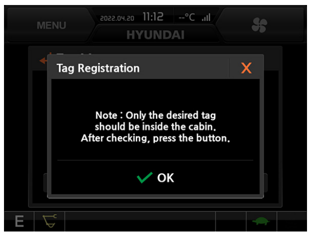
300A3CD004

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

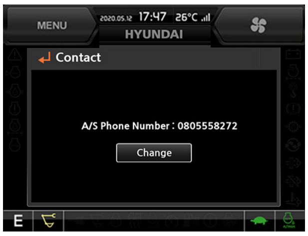
300A3CD100A

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



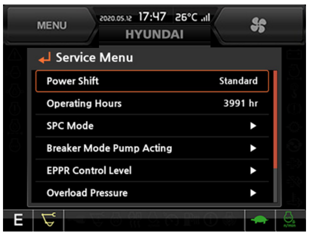
300A3CD103A

300A3CD104A

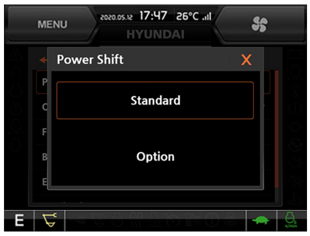
Enter the new A/S phone number

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)

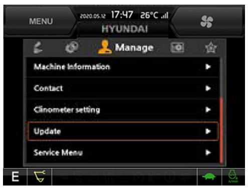
⑧ Clinometer

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)

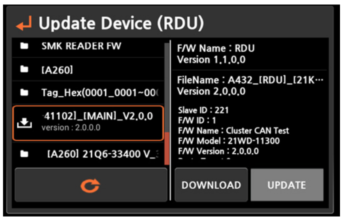


300A3CD110A

300A3CD111A

300A3CD112A

300A3CD114A



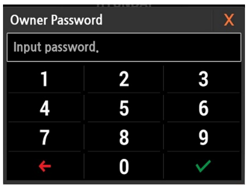
380F3CD06

· 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



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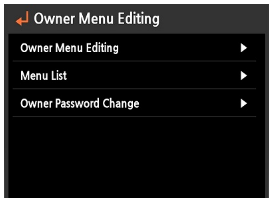

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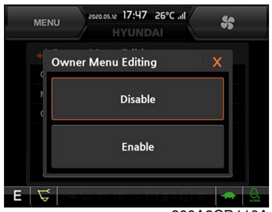


300A3CD116A

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.

(5) Display

① Display item

300A3CD119A

300A3CD120A

300A3CD121A

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

② Clock

300A3CD122A

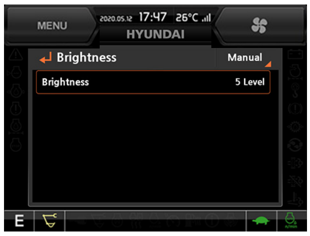
300A3CD123A

· The first row of boxes indicate Year/Month/Day.
· The second row shows the current time. (0:00~23:59)

③ Brightness

300A3CD124A

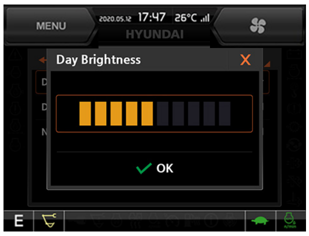
300A3CD125A



300A3CD126A

300A3CD127A

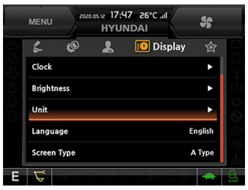
300A3CD128A



300A3CD129A

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

④ Unit



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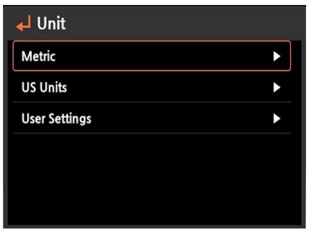
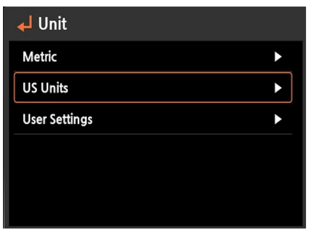


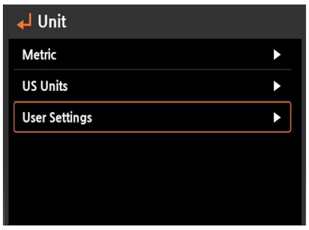
300A3CD130B

300A3CD130C



300A3CD130D

300A3CD130E



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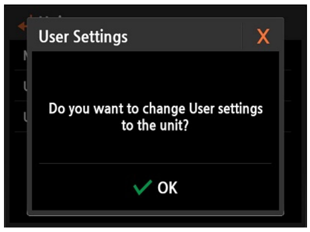
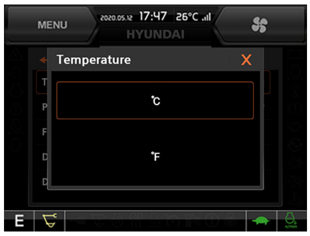


300A3CD130G

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

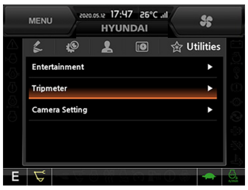
300A3CD133A

300A3CD134A

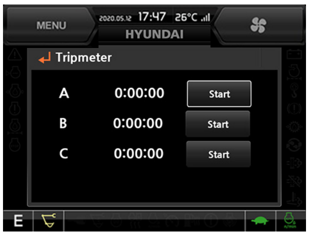
· User can select preferable language and all displays are changed to the selected language.

(6) Utilities

① Tripmeter



300A3CD143A

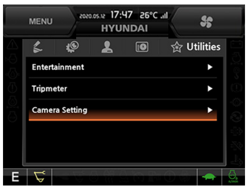


300A3CD144A

· A maximum of 3 types of tripmeters can be used at the same time.
· Each tripmeter can be turned on by choosing "Start". It can be turned off by choosing "Stop".
· If the tripmeter icon is activated in the operation screen, it can be controlled directly in this screen.

② Camera setting

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



300A3CD145A

300A3CD146B

300A3CD147A

· Auto Mode (Travel) : Enable
The cluster will automatically show camera view while machine is traveling.
· In the operation screen, rear camera screen shows up when ESC/CAM switch is pushed.

300A3CD97A

290F3CD221

③ Auto idle time setting

300A3CD166

300A3CD167

· The auto idle time is can be set by this menu.
· Time : 3~30 seconds

④ AAVM (Advanced Around View Monitoring, option)

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

300A3CD149A

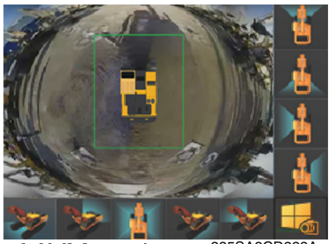
- Escape switch

· Activates AAVM mode from the beginning if AAVM is installed.

· While in the AAVM mode, select the ESC switch to return to the home screen.

300A3CD97A

Home screen

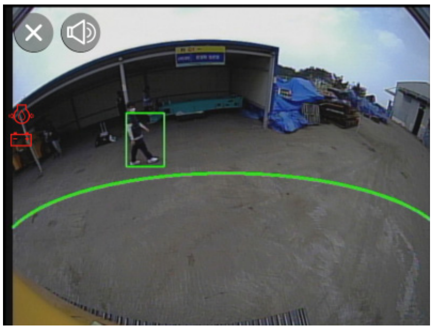


AAVM mode 235SA3CD222A

- Buzzer stop switch

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

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



220A3CD246

· When a worker/pedestrian reaches the green line, which is an external danger area equipped on the cluster, warning buzzer sounds and it displays a green 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.

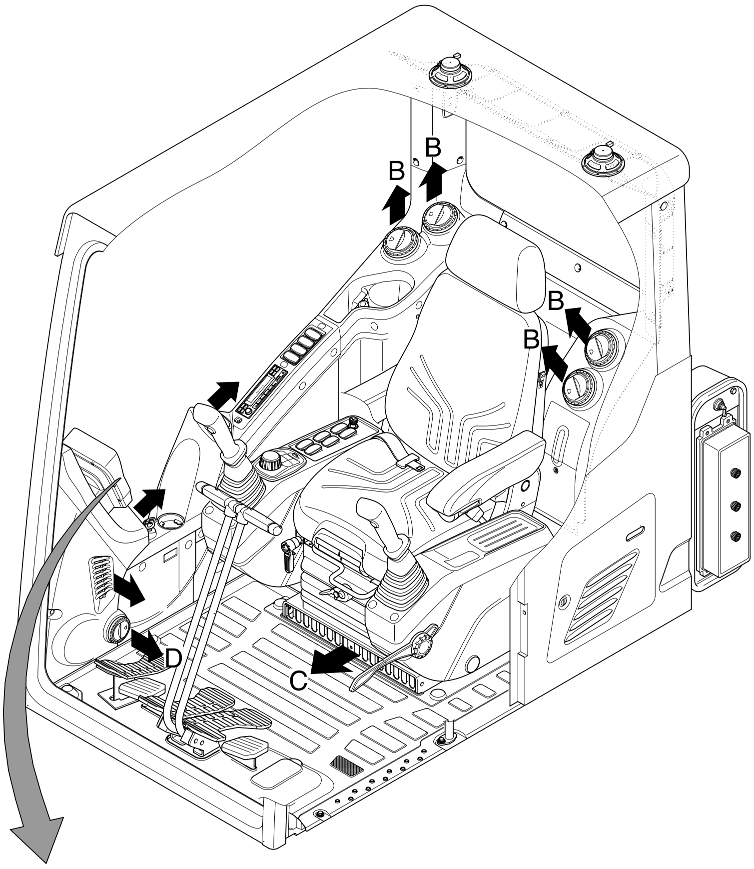
⚠ Failure to comply may result in serious injury or death.

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

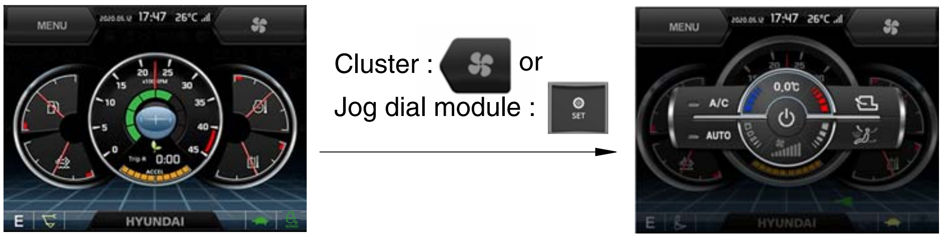
9) AIR CONDITIONER AND HEATER

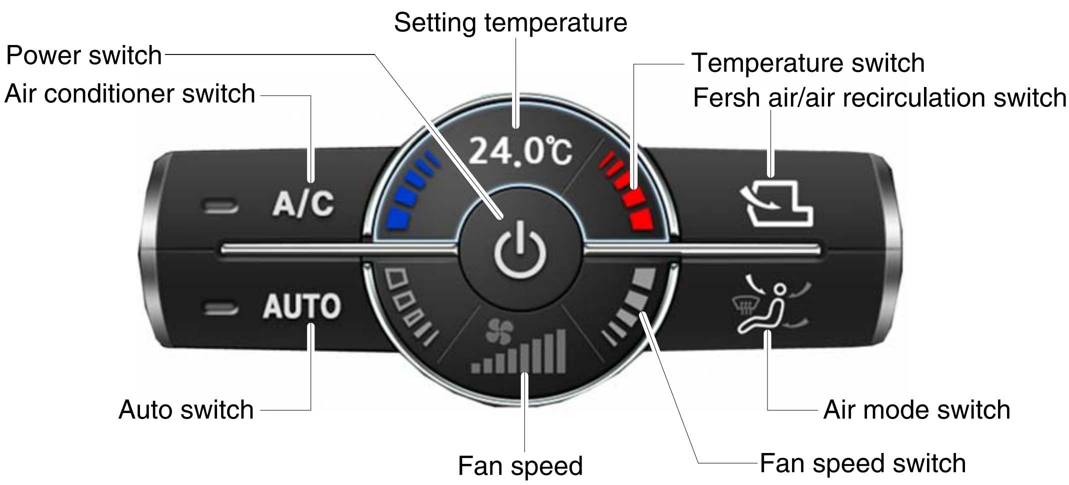
Full auto air conditioner and heater system automatically keeps the optimum condition in accordance with operator's temperature configuration sensing ambient and cabin inside temperature.

· Location of air flow ducts



Cluster LCD





160A3CD21

※ Jog dial module : Refer to page operator's manual 3-66.

(1) Power switch


290F3CD251

① This switch turns the system ON and OFF.
Just before powering OFF, set values are stored.
② Default setting values

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

(2) Air conditioner switch

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

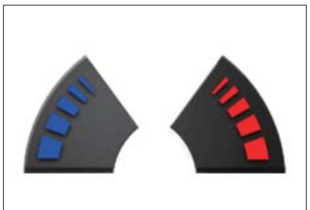
① Auto air conditioner and heater system automatically keeps the optimum condition in accordance with operator's temperature configuration sensing ambient and cabin inside temperature.

(4) Setting temperature

290F3CD224

① Displays the temperature setting.

(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 per the following table.

Temperature	Compressor	Fan speed	In/outlet	Mode
Max cool	ON	Hi (8 step)	Recirculation	Face
Max warm	OFF	Hi (7 step)	Fresh	Def/Foot

④ Temperature unit can be changed between celsius (˚C) and fahrenheit (˚F)
a. Default status (˚C)
b. The temperature unit can be changed (℃ ↔ ˚F) by pressing temperature switchs (Up/Down) simultaneously for more than 5 seconds.

(6) Fan speed switch


290F3CD226

① Fan speed is controlled automatically by set temperature.
② This switch controls fan speed manually.
- There are 8 up/down steps to control fan speed.
- The maximum step or the minimum step beeps 5 times.

(7) Fan speed


290F3CD227

① Steps 1 through 8 to display the amount of air being circulated.

(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 periods of time.

※ Check condition of an outer filter and an inner filter periodically to maintain good efficiency of the system.

(9) Air mode switch


290F3CD229

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

Mode switch		Face	Face/Rear	Face/Rear/Foot	Foot	Def/Foot
Outlet	A	●	●	●		
	B		●	●		
	C			●	●	●
	D					●

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

(10) Self Diagnosis Function

① Diagnostic methods : Diagnostic information window, select
② Diagnostic indication (Displays fault)

Fault code	Description	Fail safe function
F01	Ambient temperature sensor open	20˚C alternate value control
F02	Ambient temperature sensor short	
F03	Cab inside temperature sensor open	25˚C alternate value control
F04	Cab inside temperature sensor short	
F05	Evaporate temperature sensor open	0˚C alternate value control
F06	Evaporate temperature sensor short	
F07	Null	-
F08	Null	-
F09	Mode 1 actuator open/short	The alternate value is face
F10	Mode 1 actuator drive circuit malfunction	If not, the alternate value is Def/Foot
F11	Intake actuator open/short	The alternate value is air recirculation
F12	Intake actuator drive circuit malfunction	The alternate fresh air
F13	Temperature actuator open/short	If opening amount is 0 %, the alternate value is 0 %
F14	Temperature actuator drive circuit malfunction	If not, the alternate value is 100 %
F15	Null	-
F16	Null	-

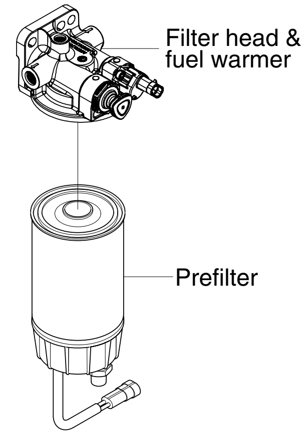
GROUP 16 FUEL WARMER SYSTEM

1. SPECIFICATION

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

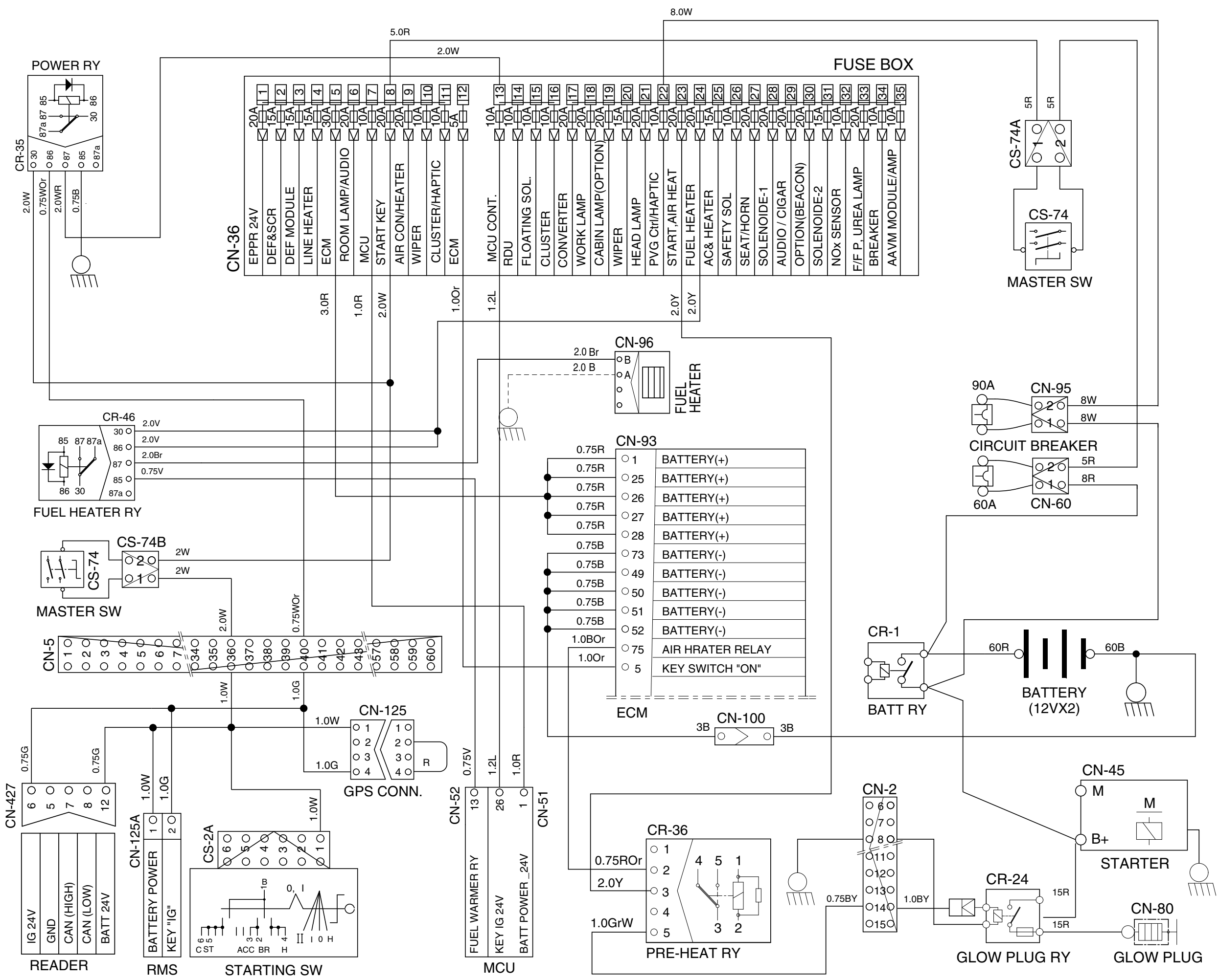
2. OPERATION

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.



160A5MS25

3. ELECTRIC CIRCUIT



160A5MS26

GROUP 17 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.

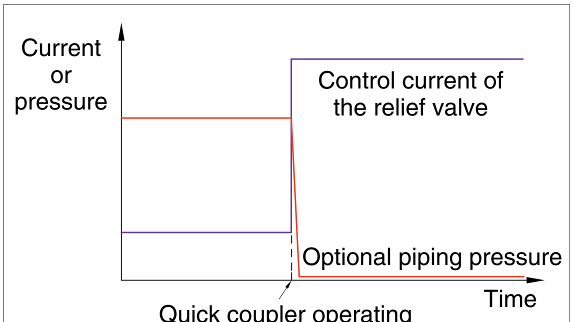
※ Oil quick function

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.

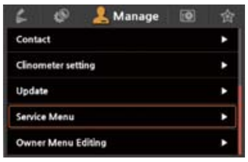
2. OPERATING PRINCIPLE

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.

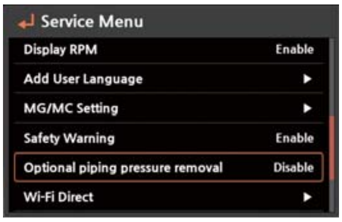


220A5MS100

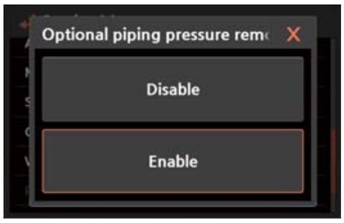
3. SETTING METHOD



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

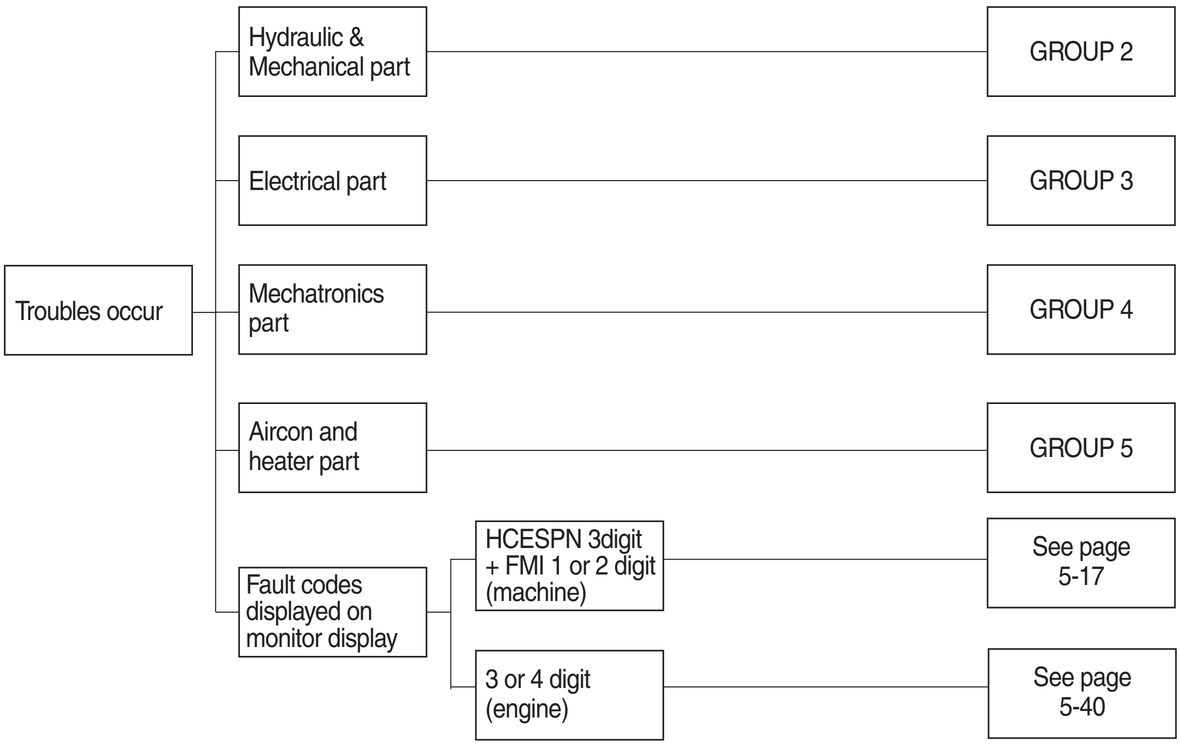
GROUP 1 BEFORE TROUBLESHOOTING

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.**

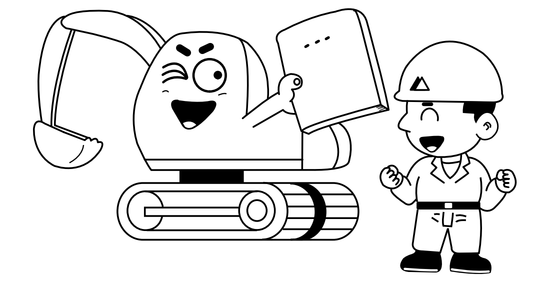


2. DIAGNOSING PROCEDURE

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.

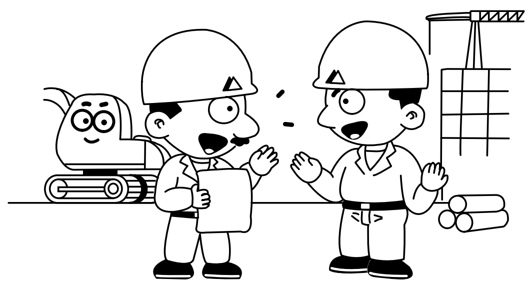


13031SH02

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.

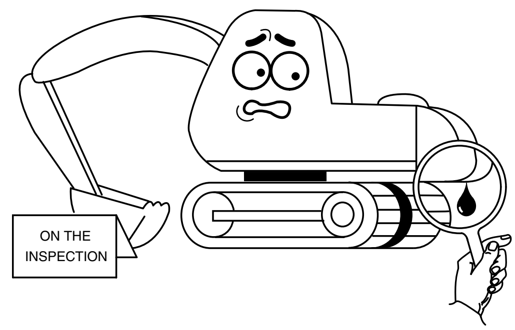


13031SH03

STEP 3. Inspect the machine

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

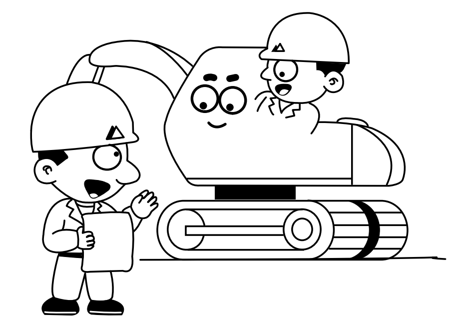
And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.



(210-7) 6-2(3)

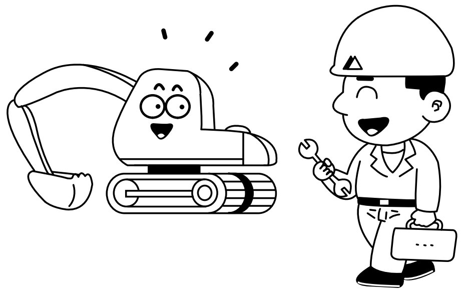
STEP 4. Inspect the trouble actually on the machine

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

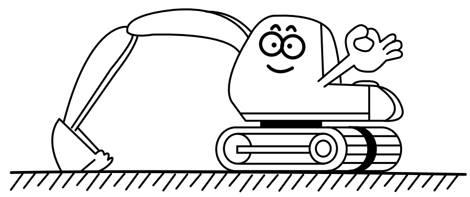
According to where the trouble parts are located, hydraulic & mechanical system part or electrical system part or mechatronics system part, perform troubleshooting the machine refer to the each system part's troubleshooting process diagram.


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.

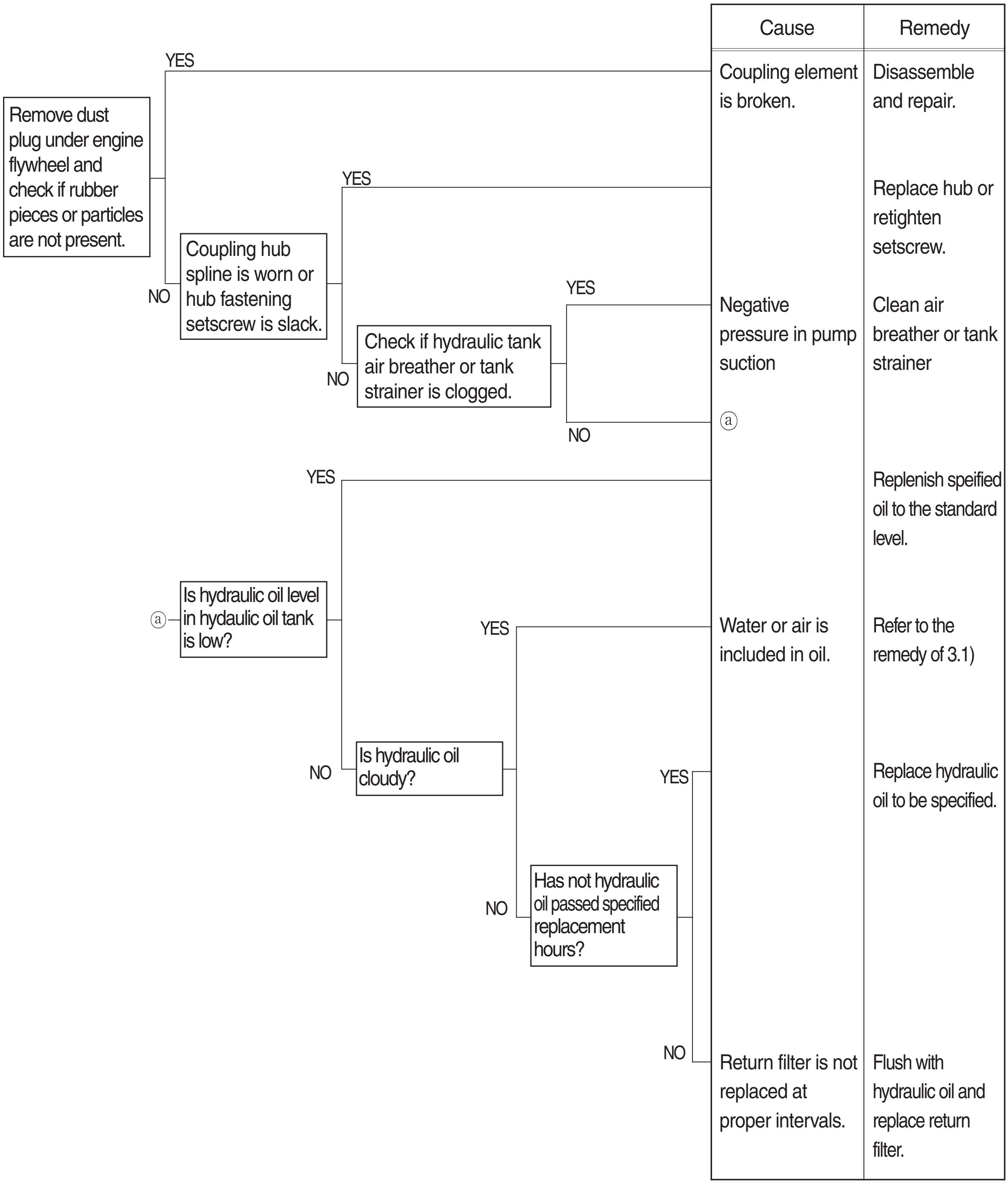
Analog 1 Analog 2 210A6HS01

(2) Specification

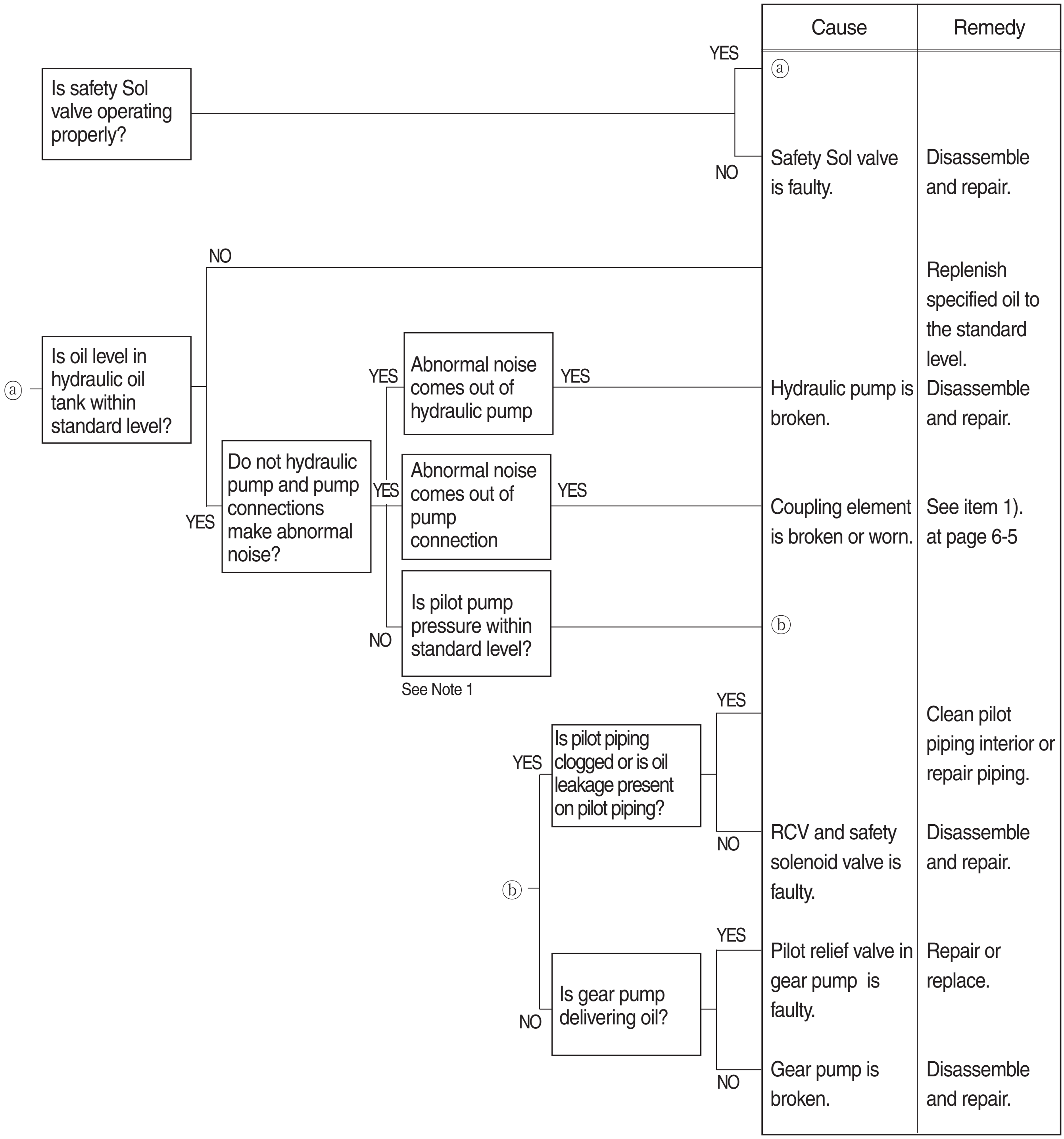
No.	Description	Specification
Note 1	Work pilot pressure	40^{+2}_{0} bar
Note 2	Swing pilot pressure	0~40 bar
Note 3	Boom up pilot pressure	0~40 bar
Note 4	Arm/bucket pilot pressure	0~40 bar
Note 5	Pump 1 regulator pressure	0~50 bar
Note 6	Pump 2 regulator pressure	0~50 bar
Note 7	Pump 1 pressure	350 bar

2. DRIVE SYSTEM

1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION

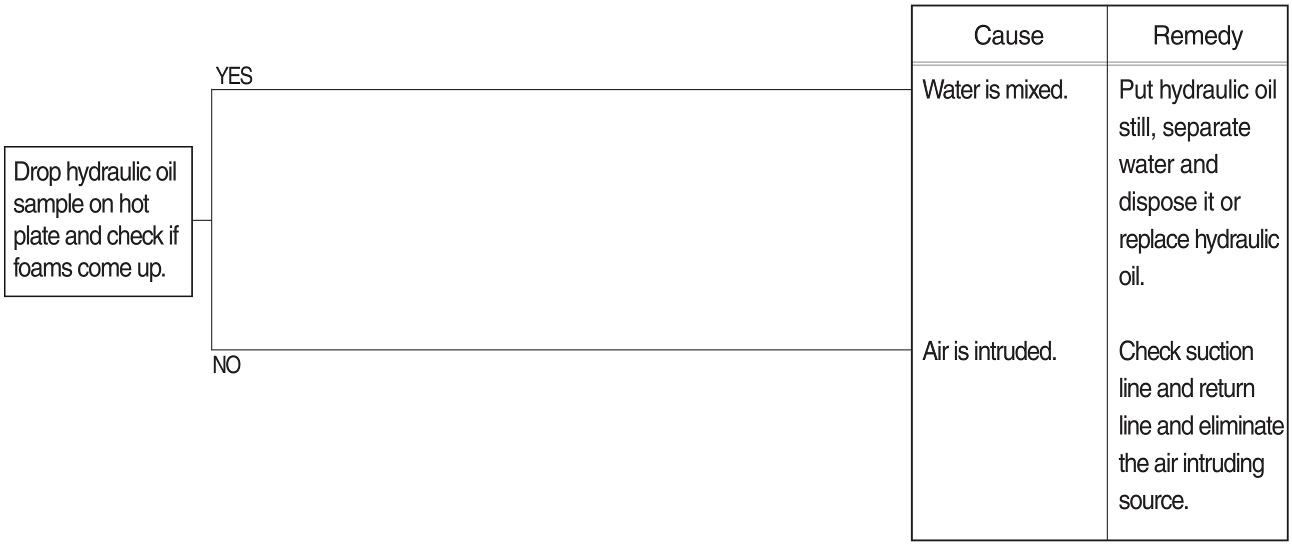


2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL

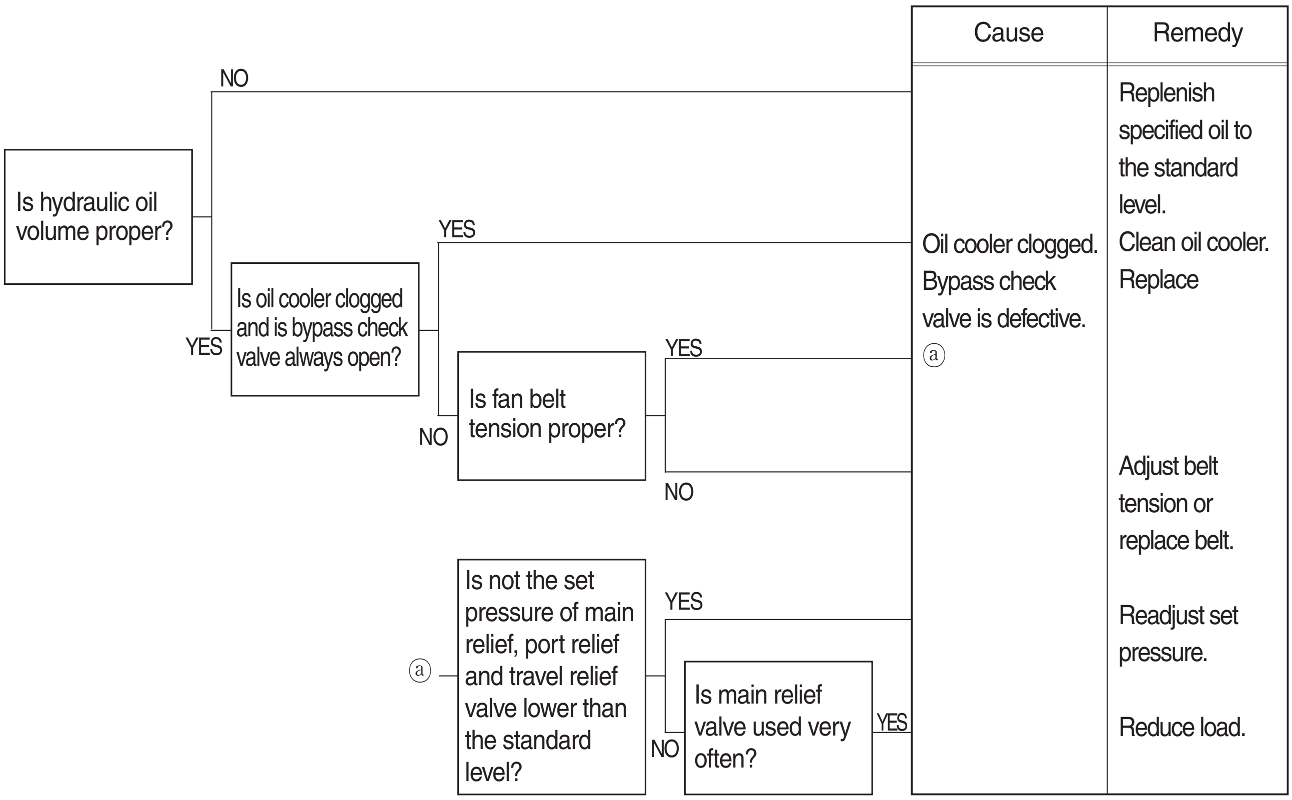


3. HYDRAULIC SYSTEM

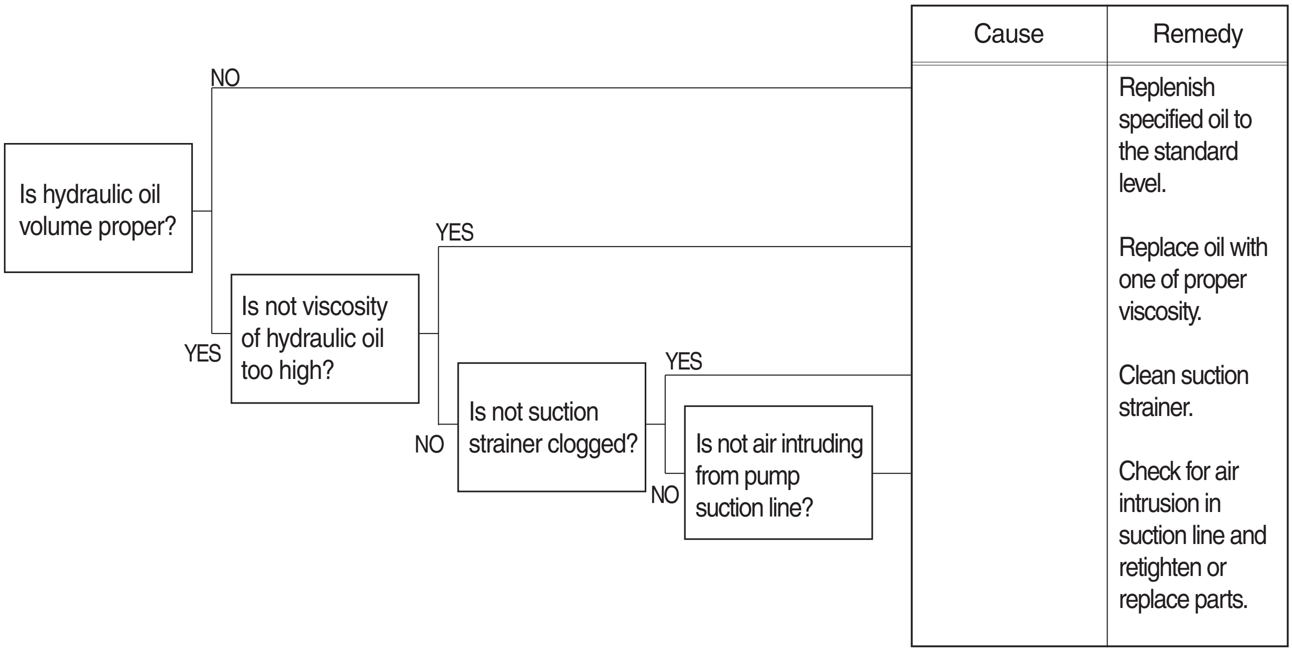
1) HYDRAULIC OIL IS CLOUDY



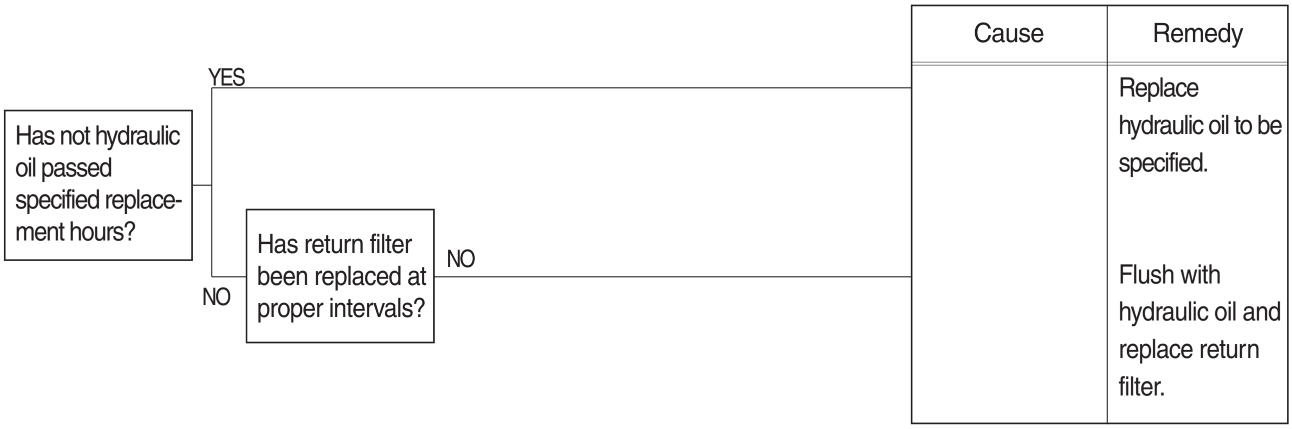
2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY



3) CAVITATION OCCURS WITH PUMP

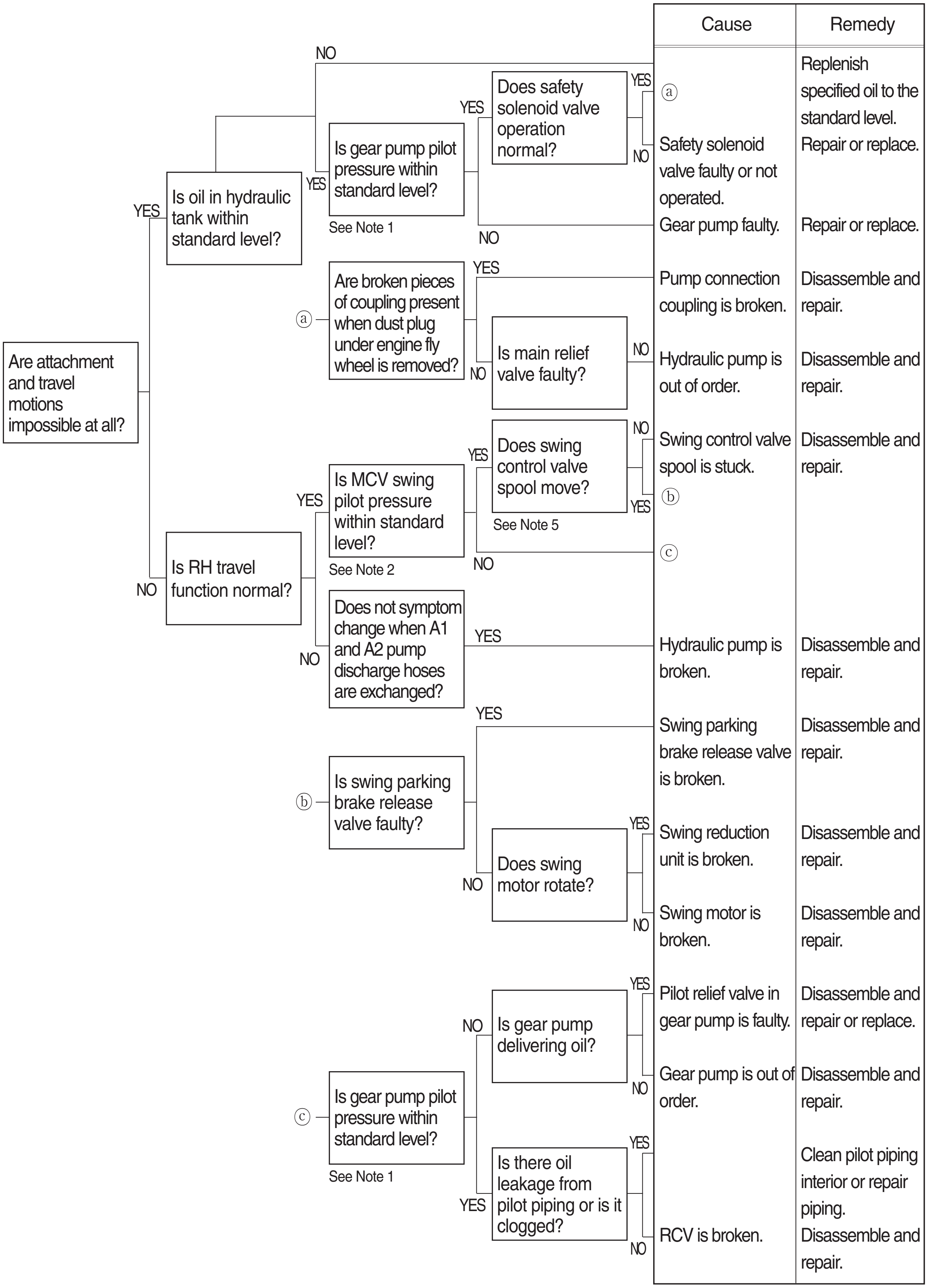


4) HYDRAULIC OIL IS CONTAMINATED

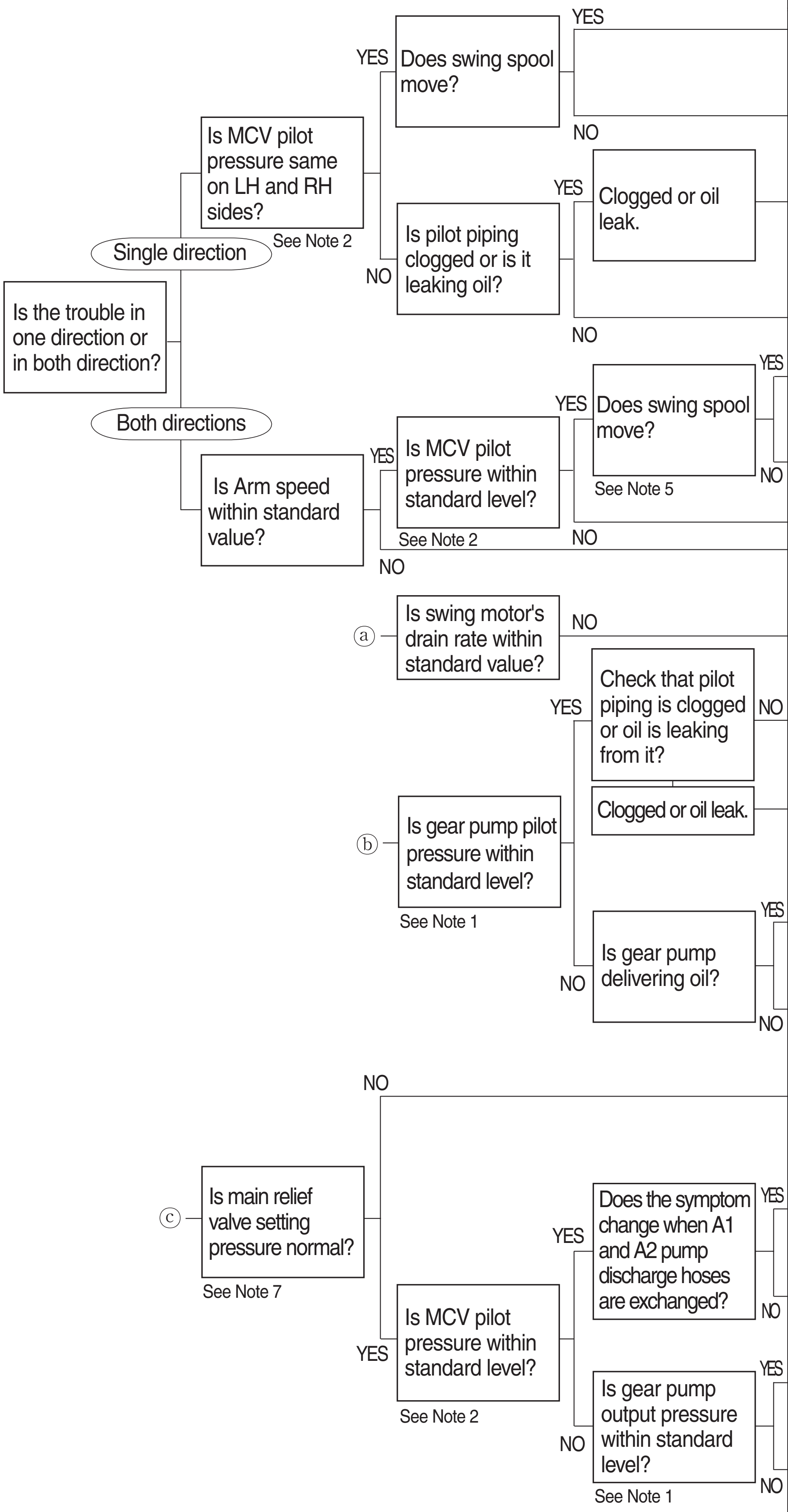


4. SWING SYSTEM

1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE

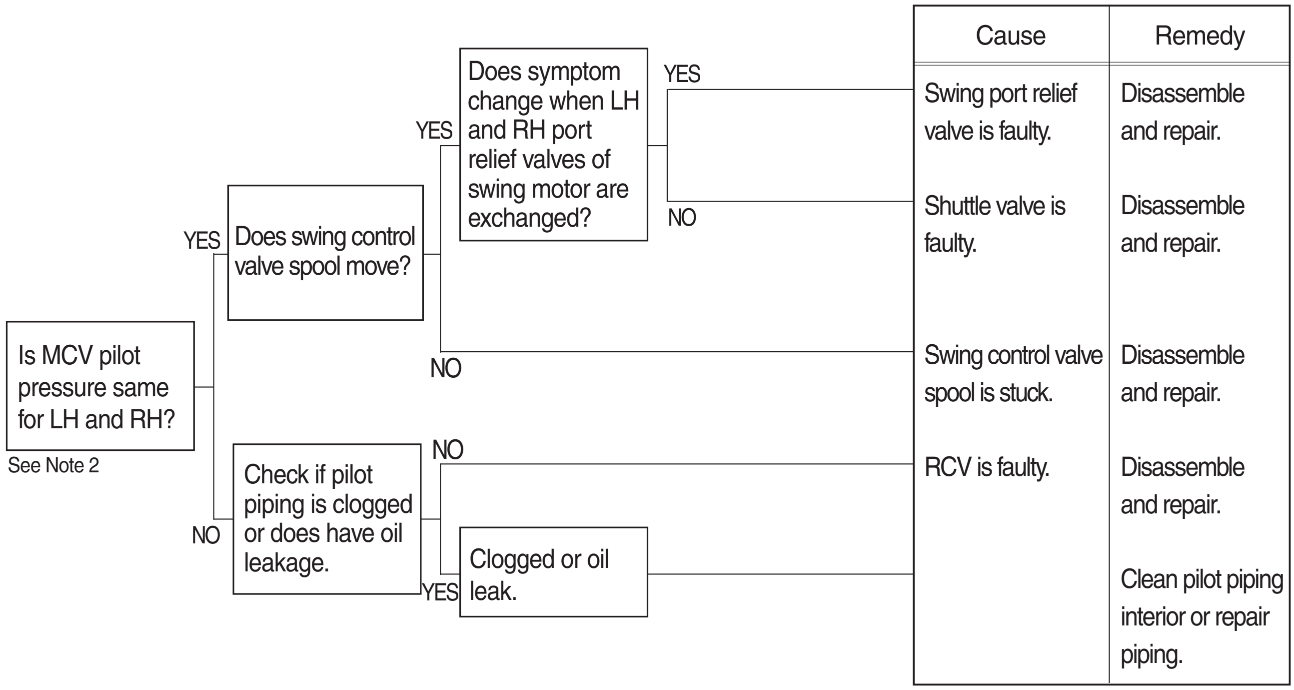


2) SWING SPEED IS LOW

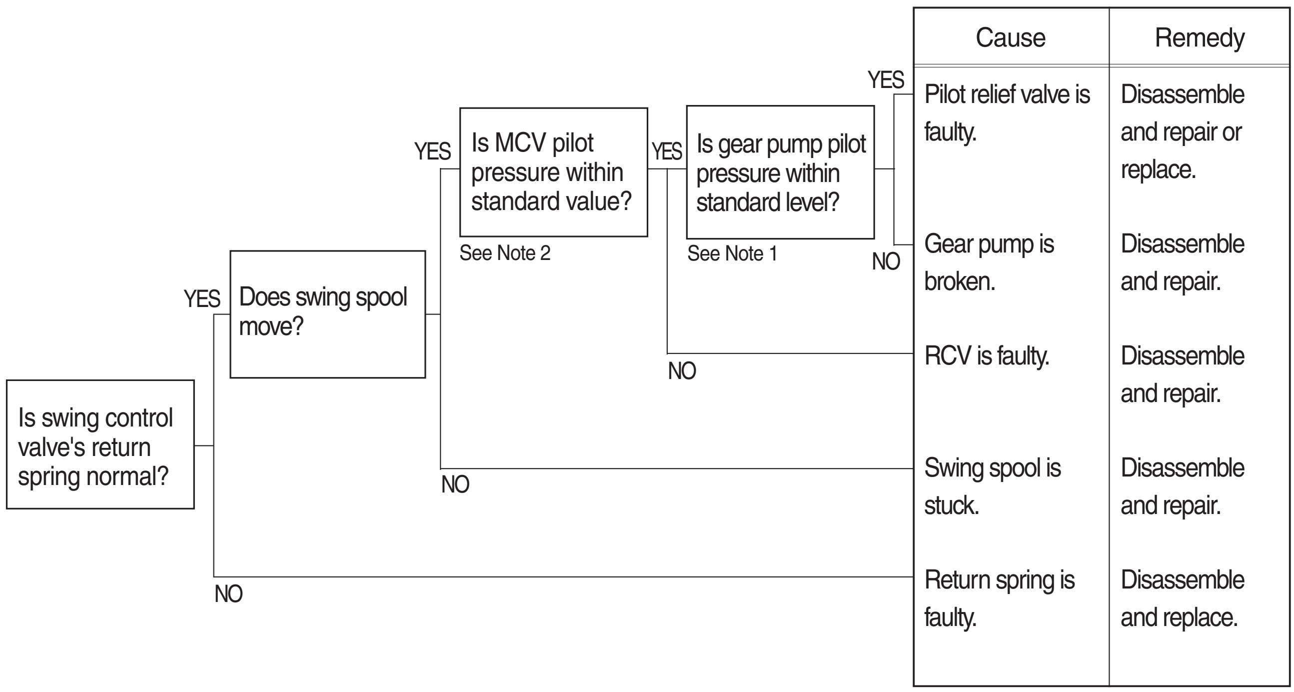


Cause	Remedy
Swing port relief valve is faulty.	Disassemble and repair or replace.
Swing control valve spool is stuck.	Disassemble and repair.
	Clean pilot piping interior or repair piping.
RCV or shuttle valve is faulty.	Disassemble and repair.
Swing spool is stuck.	Disassemble and repair.
Swing motor is broken.	Disassemble and repair.
RCV or shuttle valve is faulty.	Disassemble and repair.
	Clean pilot piping interior or repair piping.
Pilot relief valve in gear pump is defective.	Disassemble and repair or replace.
Gear pump is broken.	Disassemble and repair.
Main relief valve faulty.	Main relief valve pressure resetting or repair.
Hydraulic pump is broken.	Disassemble and repair.
Shuttle valve is faulty.	Repair or replace.
Pilot relief valve is faulty.	Repair or replace.
Gear pump is faulty.	Repair or replace.

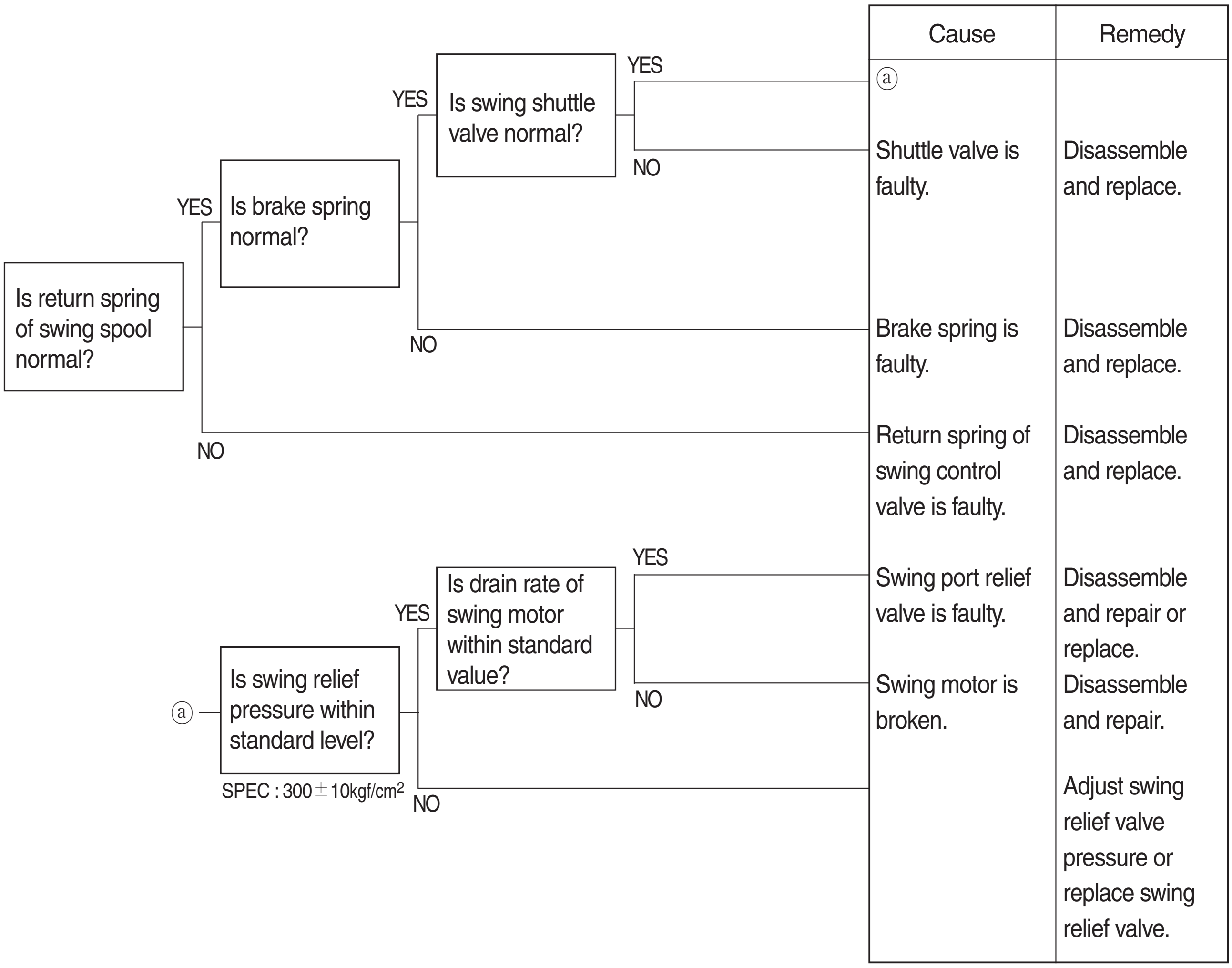
3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



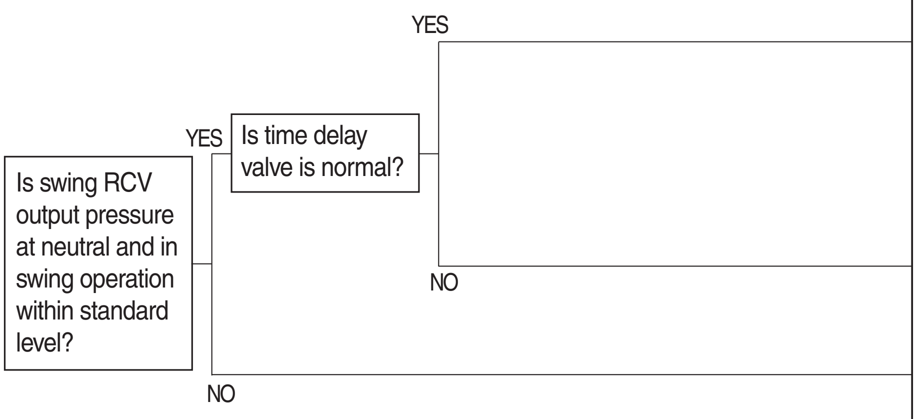
4) MACHINE SWINGS BUT DOES NOT STOP



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

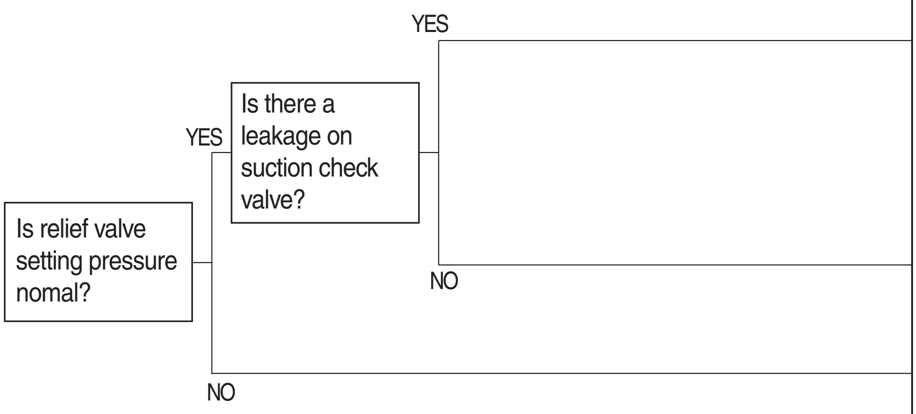


6) LARGE SHOCK OCCURS WHEN STOP SWINGING



Cause	Remedy
Swing motor is broken.	Disassemble and repair.
Time delay valve is faulty.	Disassemble and repair or replace.
Malfunction of swing RCV	Disassemble and repair.

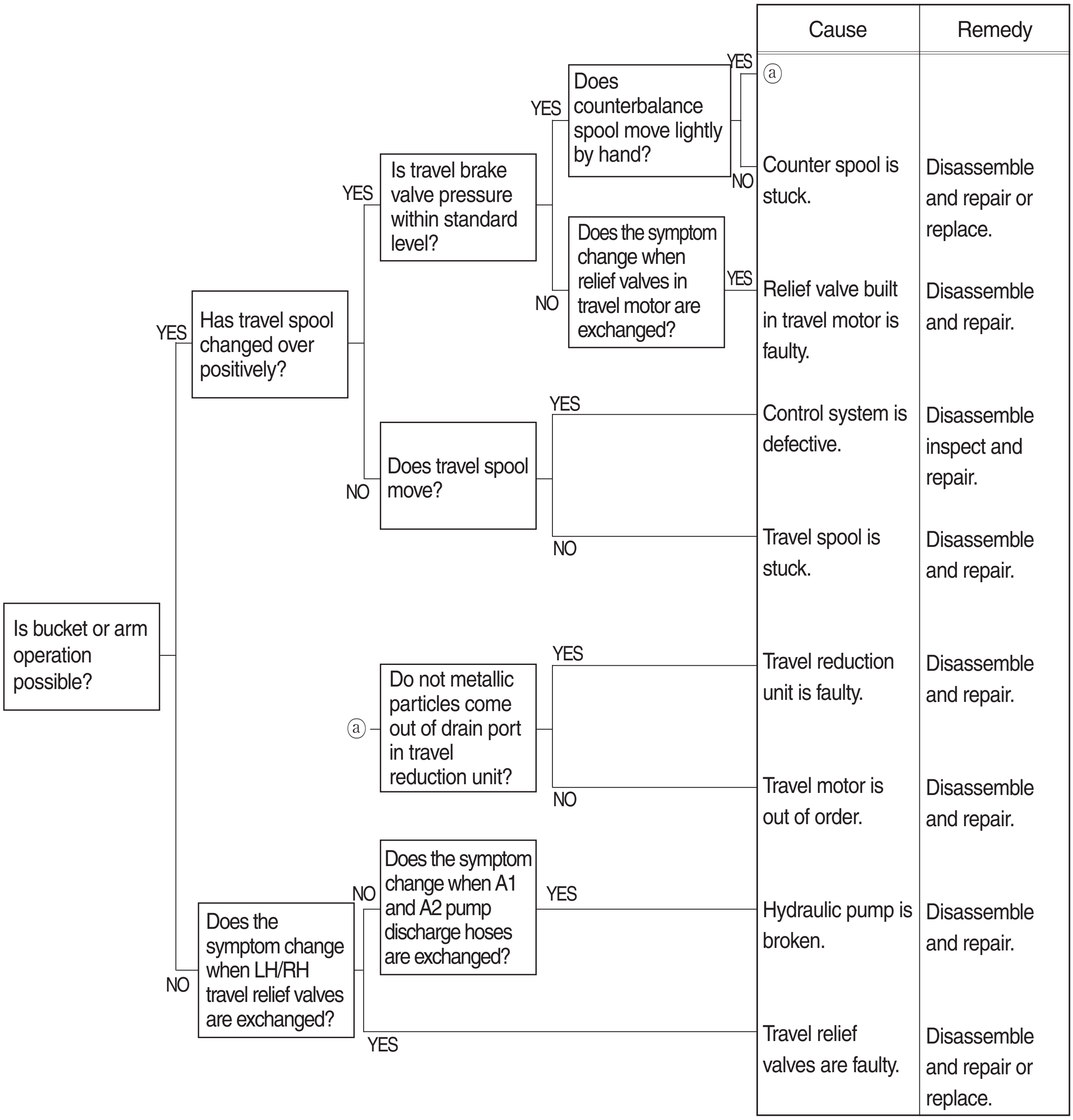
7) LARGE SOUND OCCURS WHEN STOP SWINGING



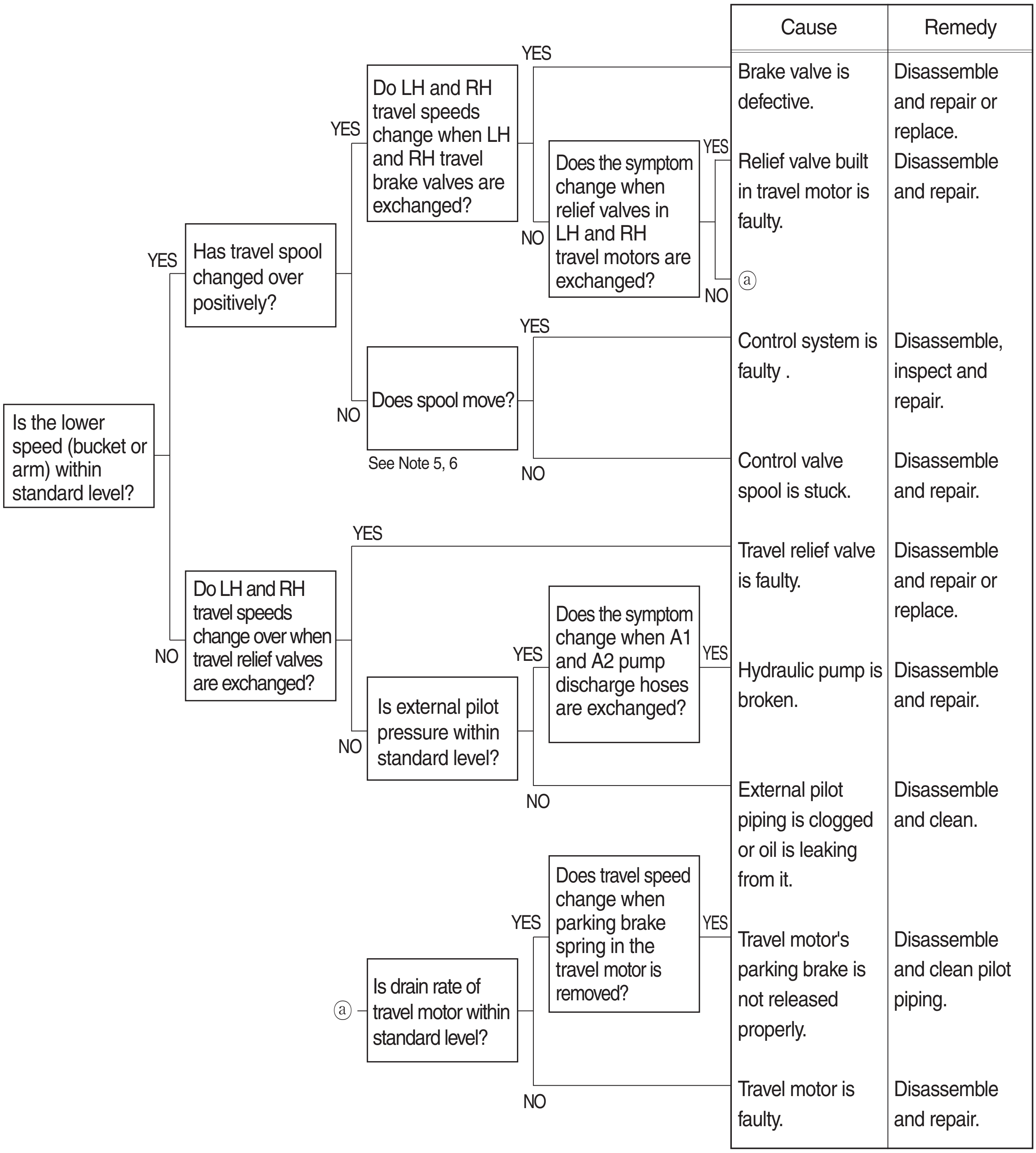
Cause	Remedy
Seal of suction valve is faulty.	Disassemble and repair.
Internal defect of swing motor.	Disassemble and repair.
Malfunction of relief valve.	Adjust swing relief valve pressure or replace swing relief valve.

5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION AT ALL ON ONE SIDE

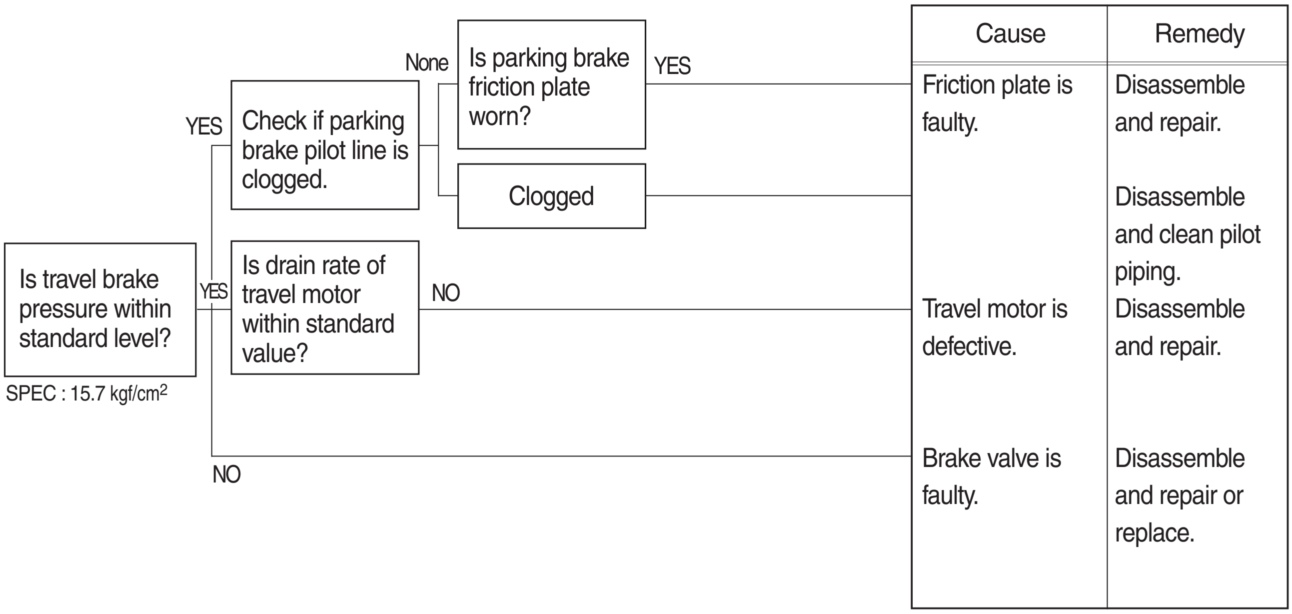


2) SPEED ON ONE SIDE FALLS AND THE MACHINE CURVES

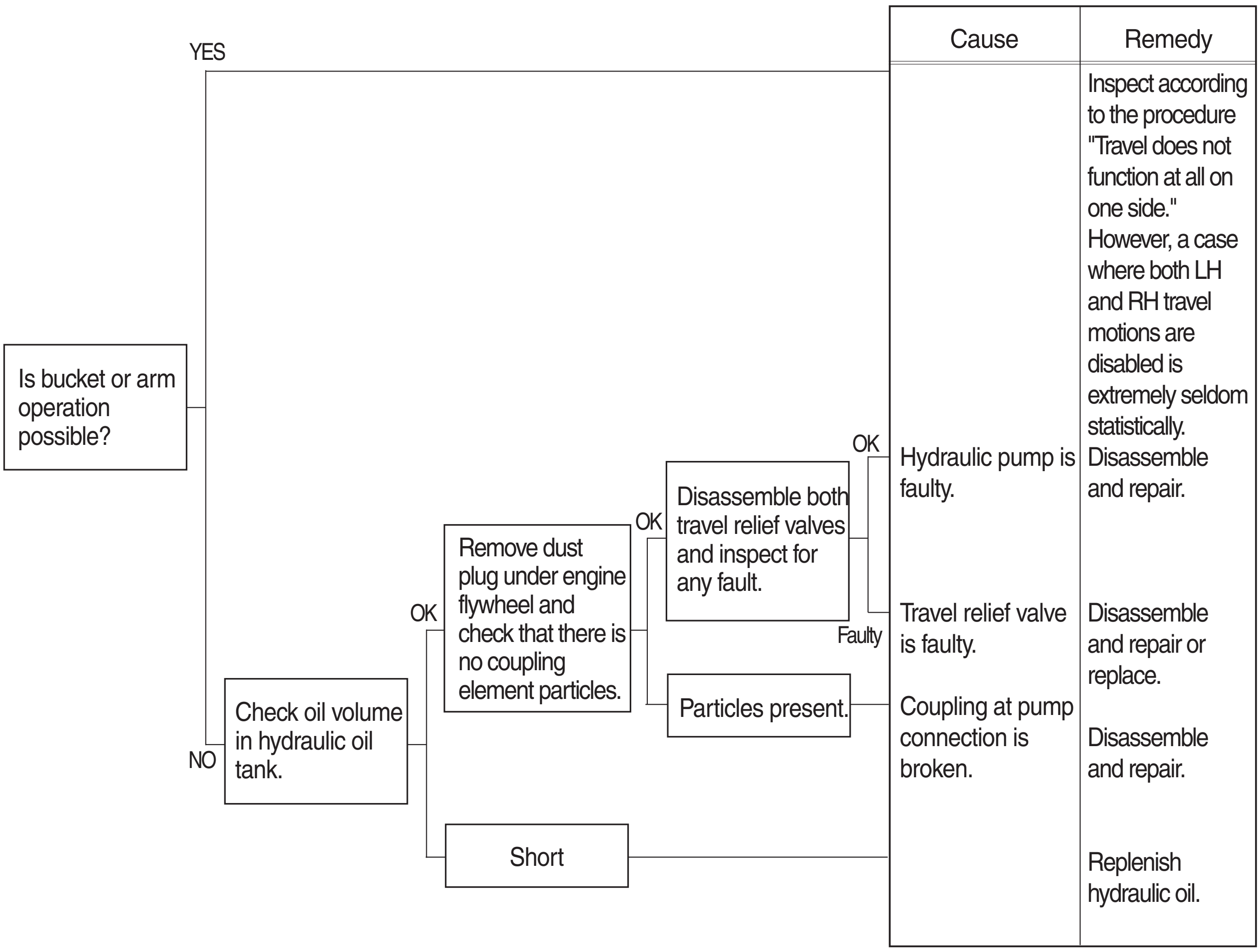


3) MACHINE DOES NOT STOP ON A SLOPE

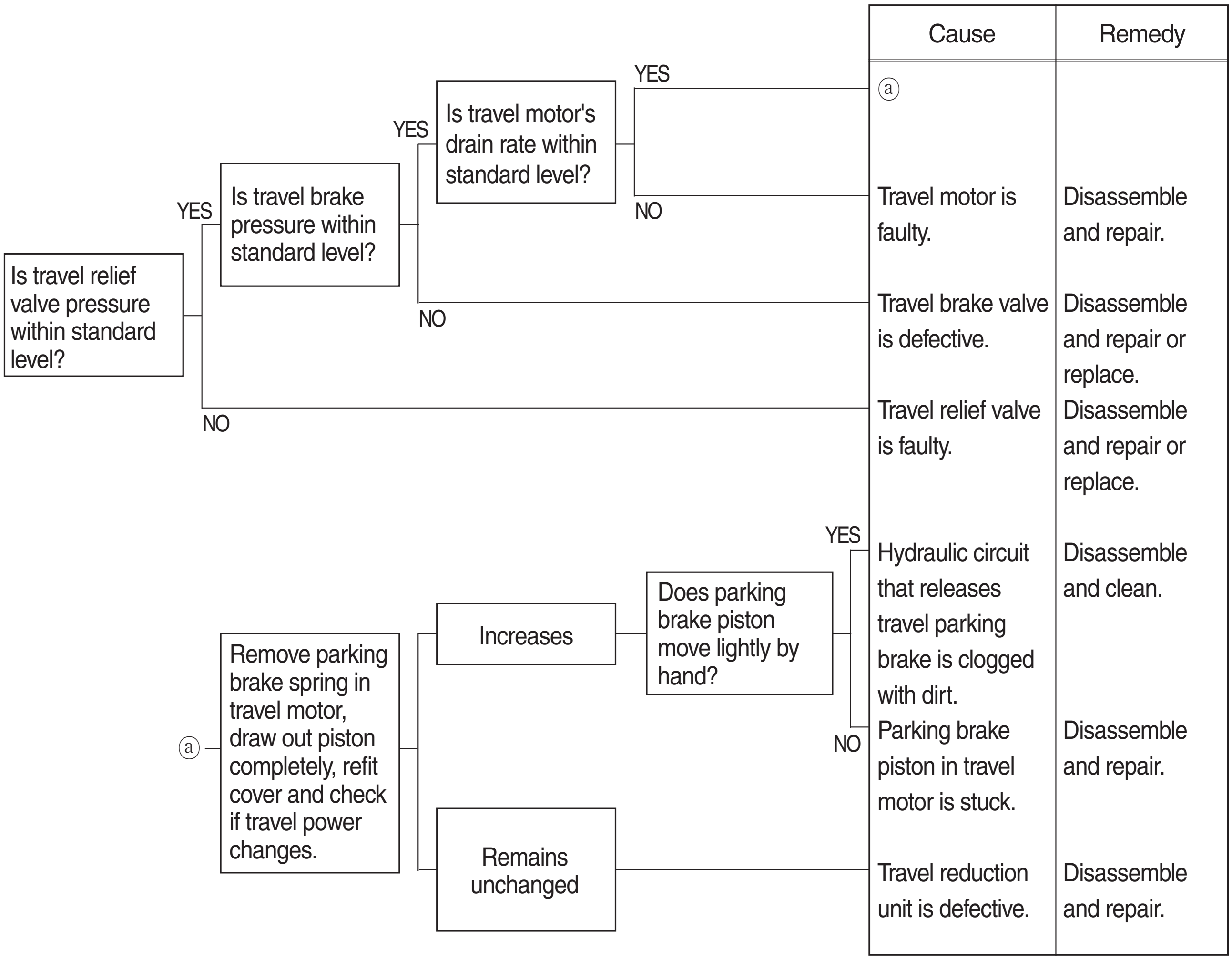
Machine is pulled forward as sprocket rotates during digging operation.



4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE

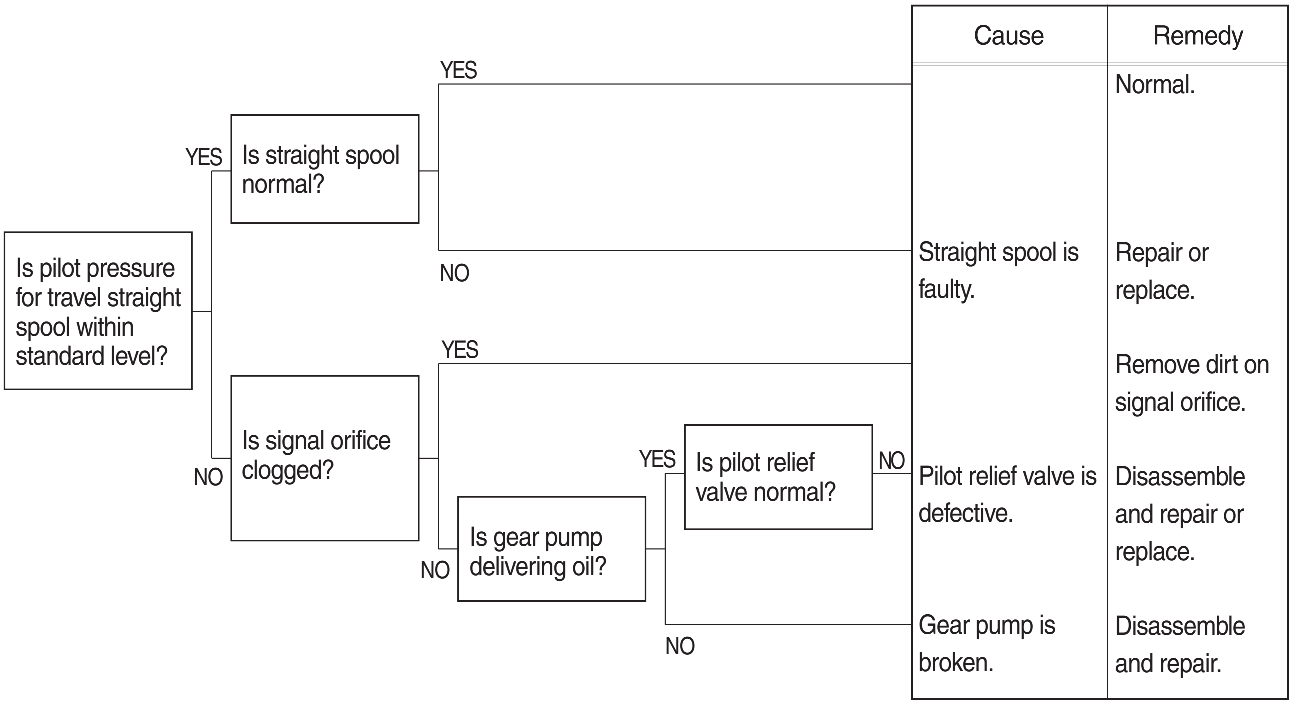


5) TRAVEL ACTION IS POWERLESS (travel only)



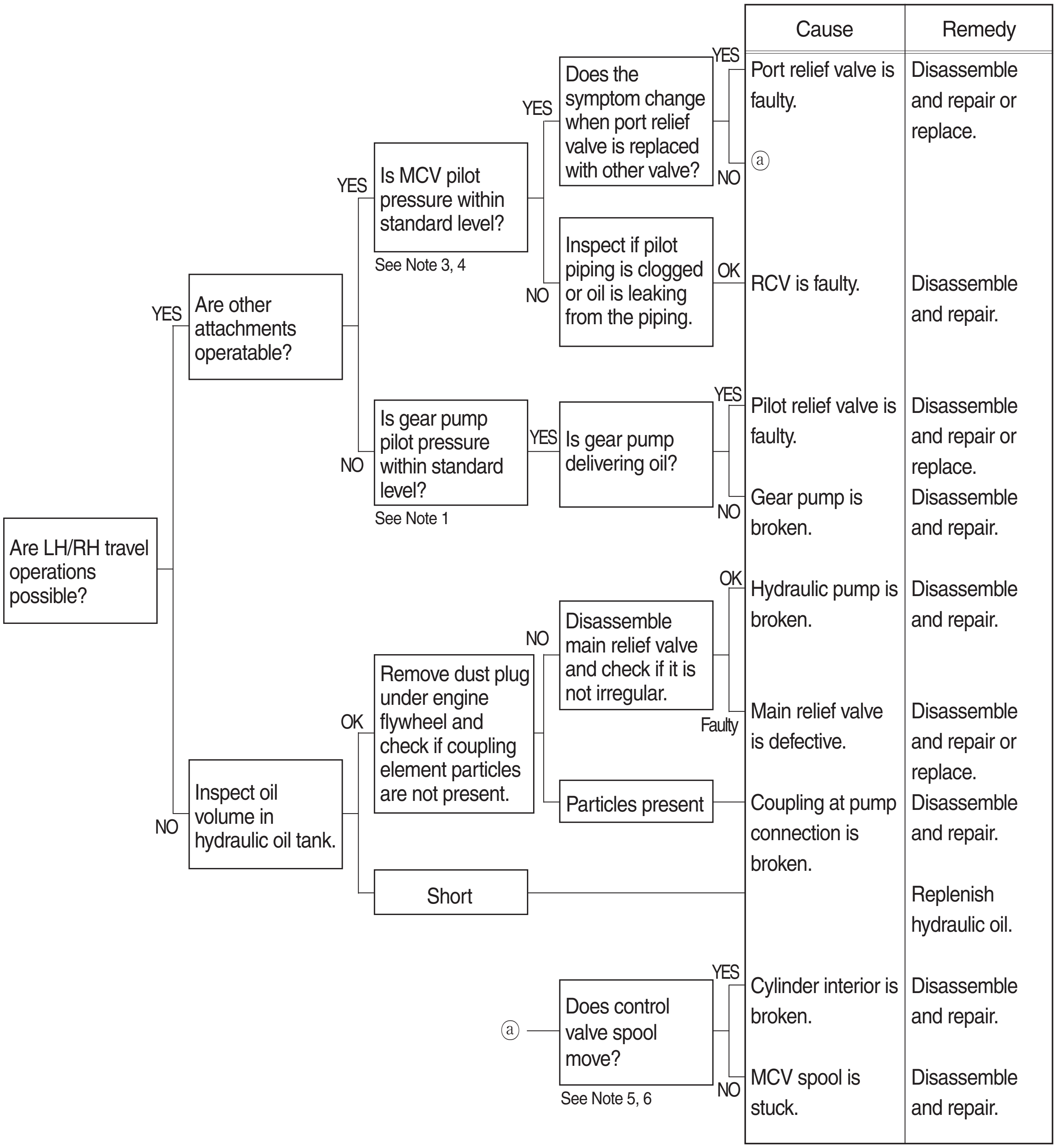
6) MACHINE RUNS RECKLESSLY ON A SLOPE

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

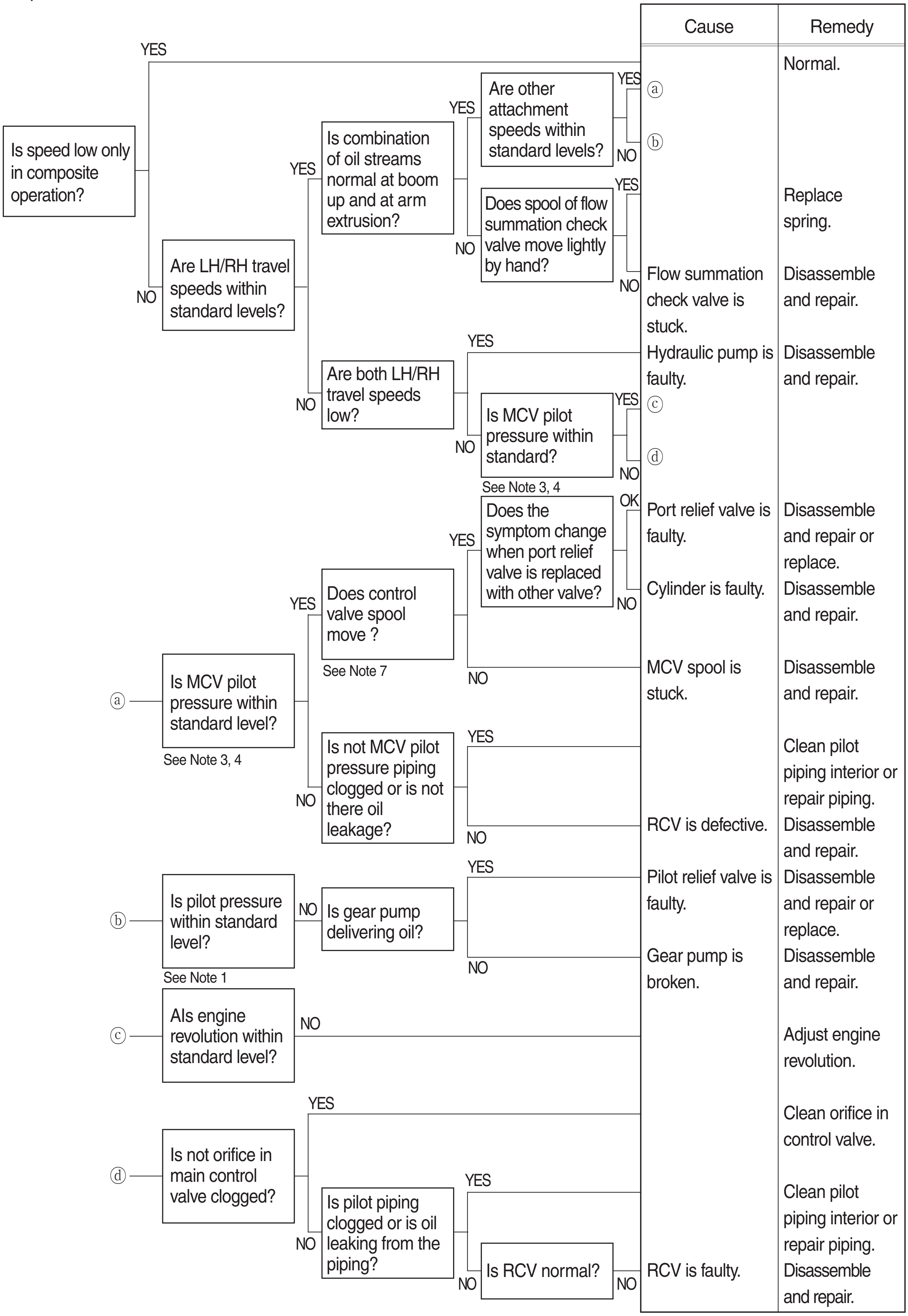


6. ATTACHMENT SYSTEM

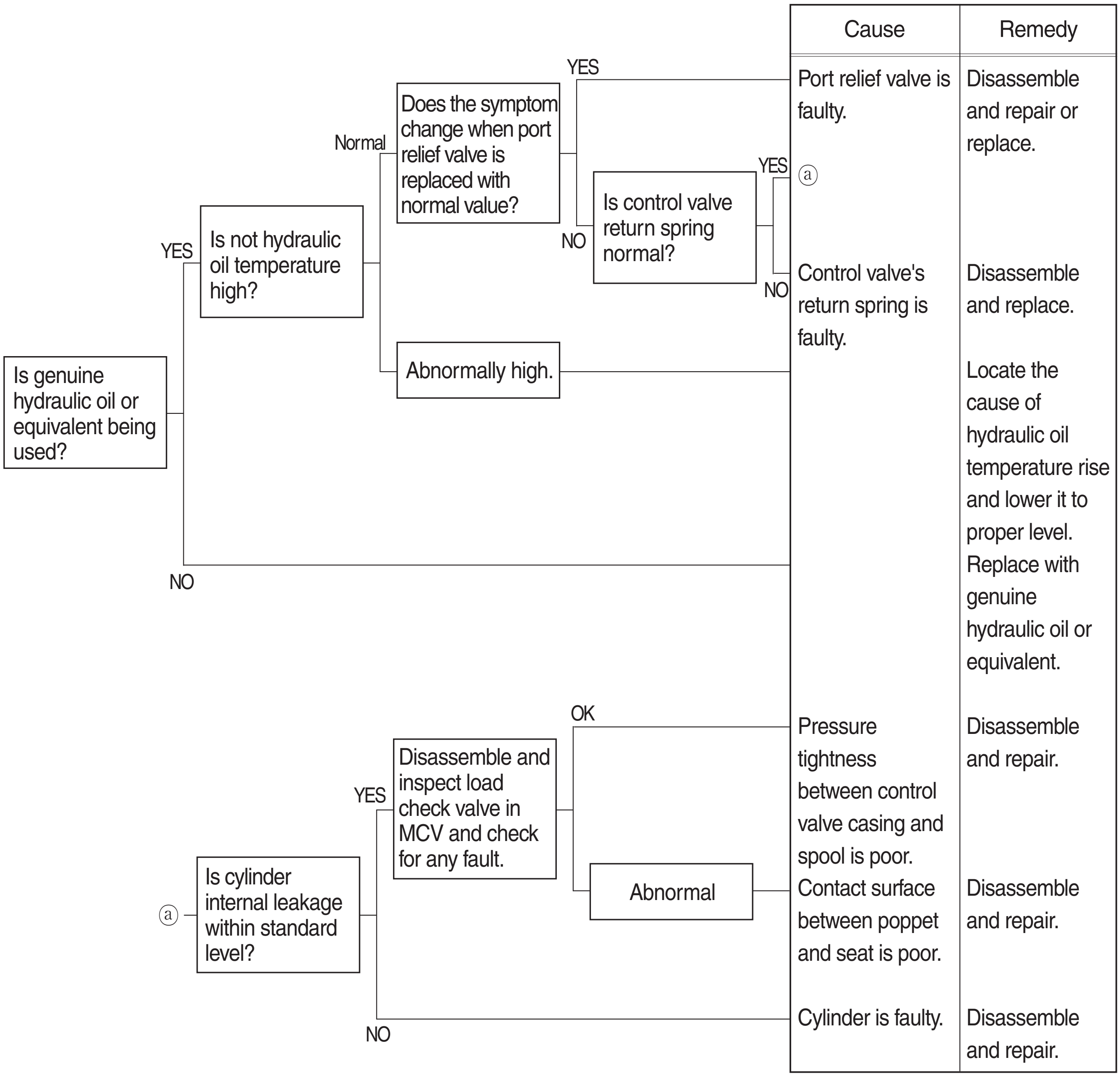
1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



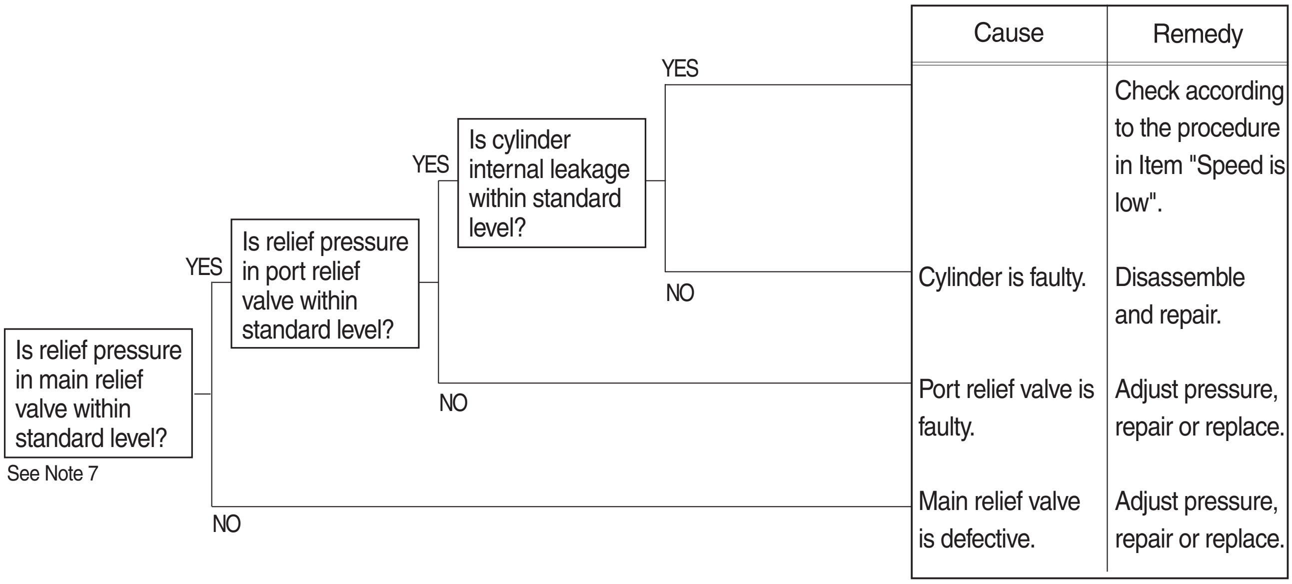
2) BOOM, ARM OR BUCKET SPEED IS LOW



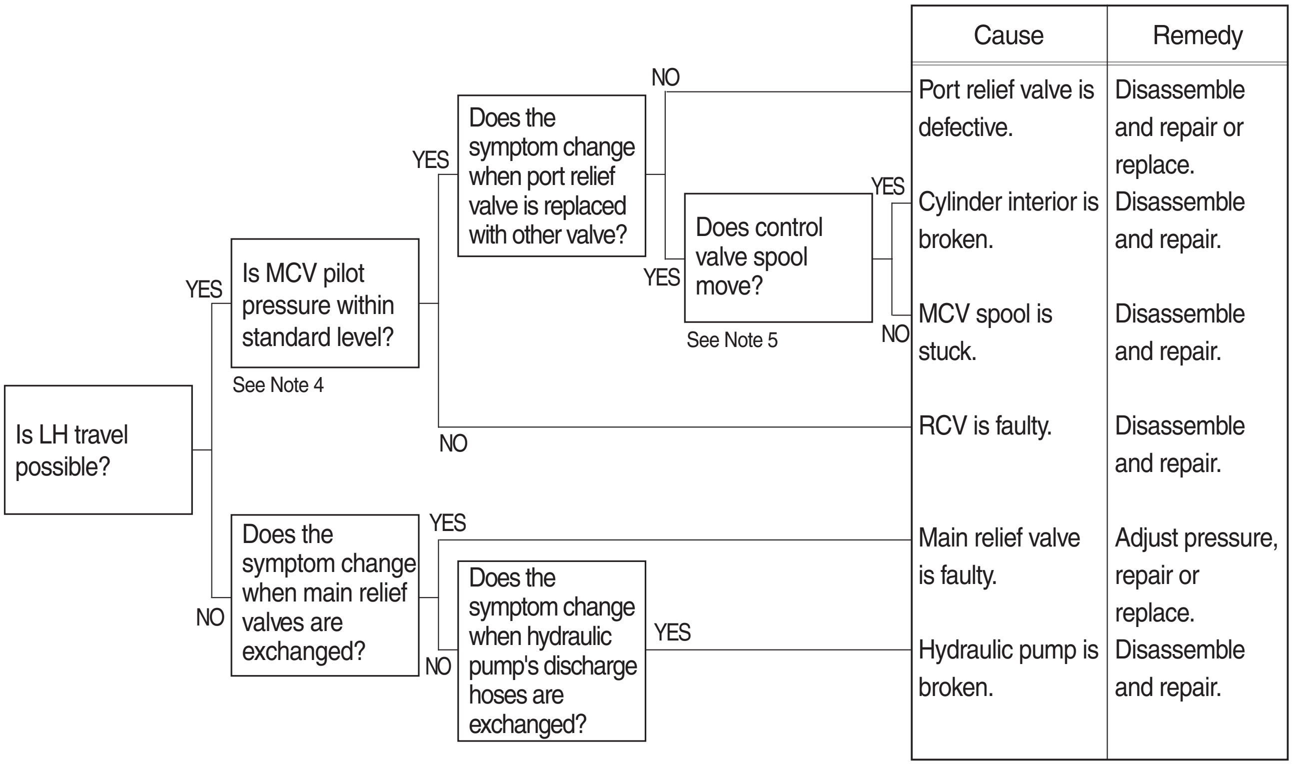
3) BOOM, ARM OR BUCKET CYLINDER EXTENDS OR CONTRACTS ITSELF AND ATTACHMENT FALLS



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.

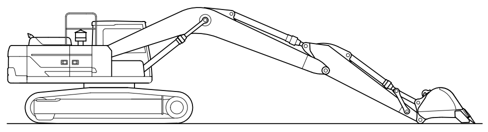
7) TIME LAG OF MACHINE WORKING IS LARGE.

Is overload relief valve for each spool working properly?

	Cause	Remedy
YES		Refer to 2)
NO	Overload relief valve is faulty.	Disassemble and repair.

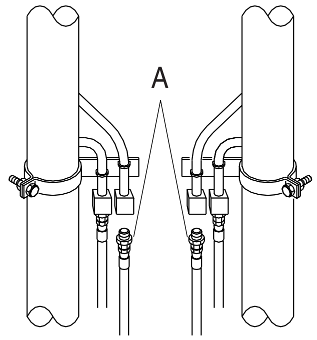
※ HOW TO CHECK INTERNAL BOOM CYLINDER LEAKAGE

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



300L6TS01

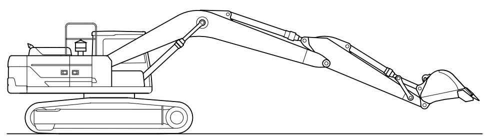
2. Disconnect hose (A) from rod side of boom cylinder and drain oil from cylinders and hose. (put cups on piping and hose ends)



(210-7) 6-20(2)

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

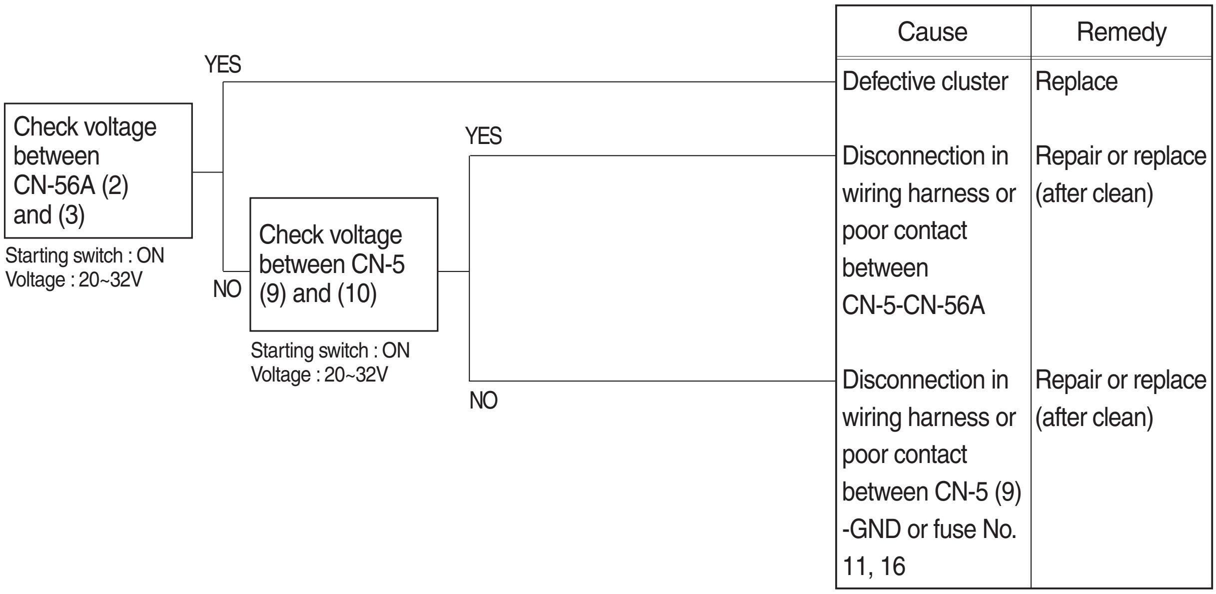
   If oil leaks from piping side and boom cylinder rod is retracted there is an internal leak in the cylinder.
   If no oil leaks from piping side and boom cylinder rod is retracted, there is an internal leak in the control valve.



300L6TS02

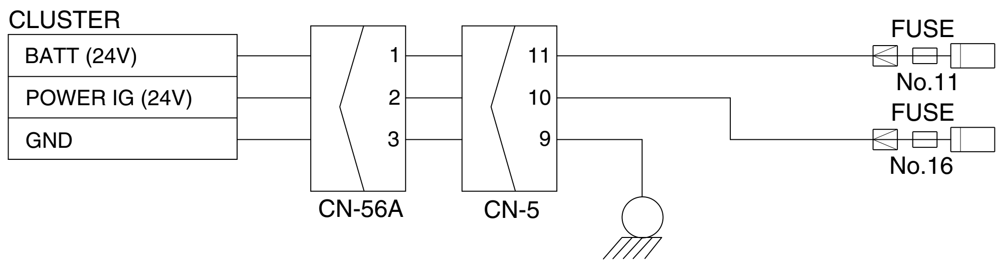
1. WHEN STARTING SWITCH IS TURNED ON, CLUSTER DISPLAY DOES NOT APPEAR

· 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. 11, 16.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Check voltage

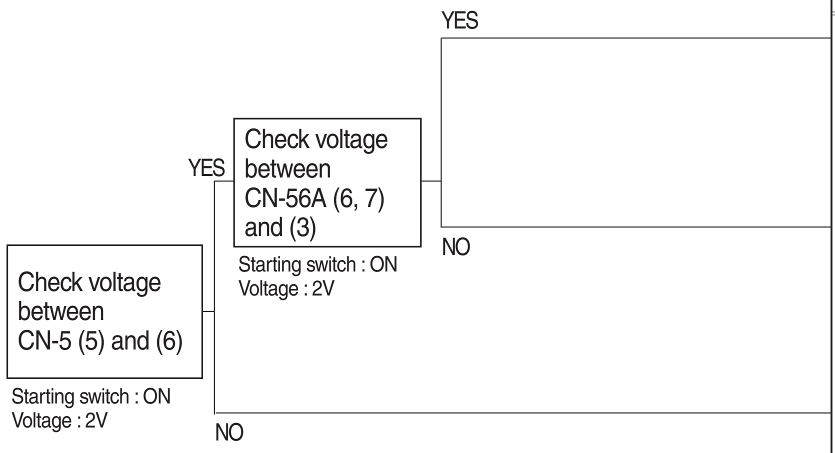
YES	20~32V
NO	0V



160A6ES01

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

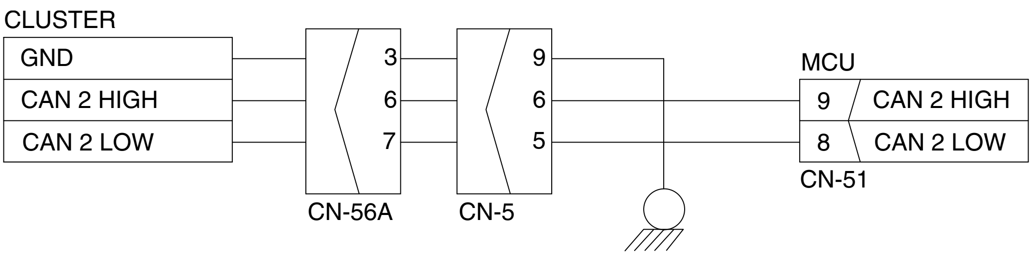
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective cluster	Replace
Disconnection in wiring harness or poor contact between CN-56A (6, 7)-CN-5 (5, 6)	Repair or replace (after clean)
Defective united MCU Disconnection in wiring harness or poor contact between CN-5 (5, 6)- CN-51 (8, 9)	Replace Repair or replace (after clean)

Check voltage

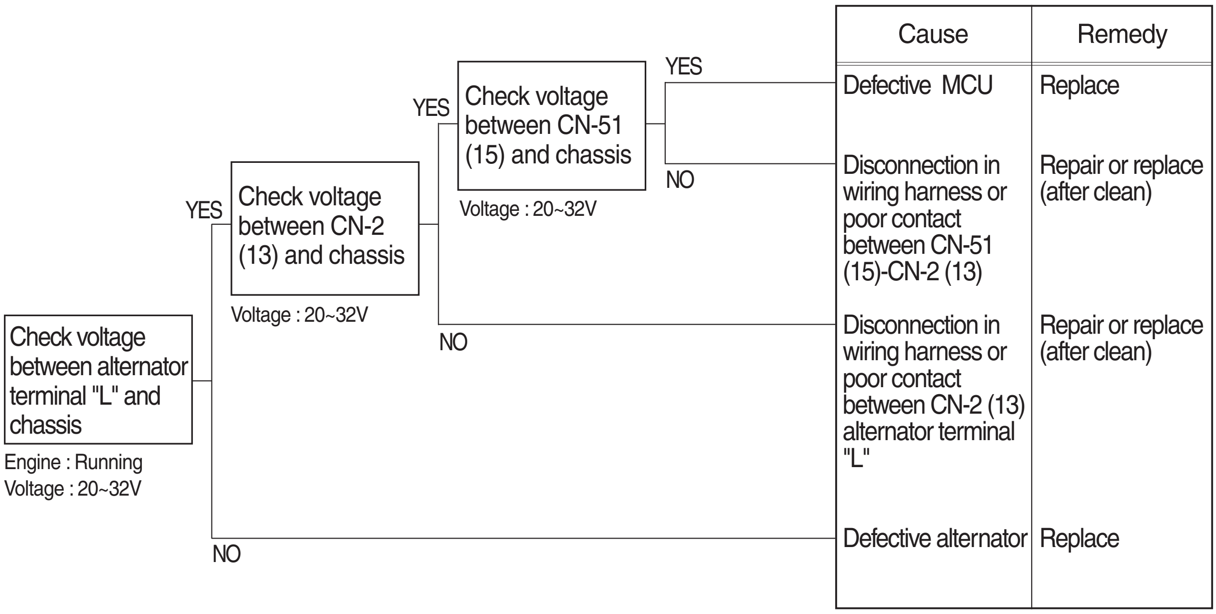
YES	2V
NO	0V



160A6ES02

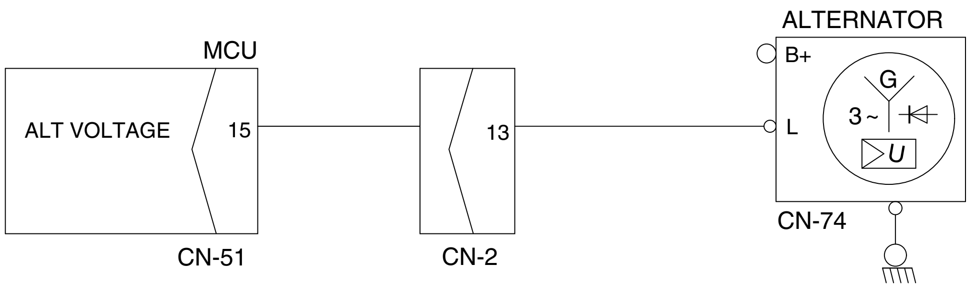
3. BATTERY CHARGING WARNING LAMP LIGHTS UP (Starting switch : ON)

· 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

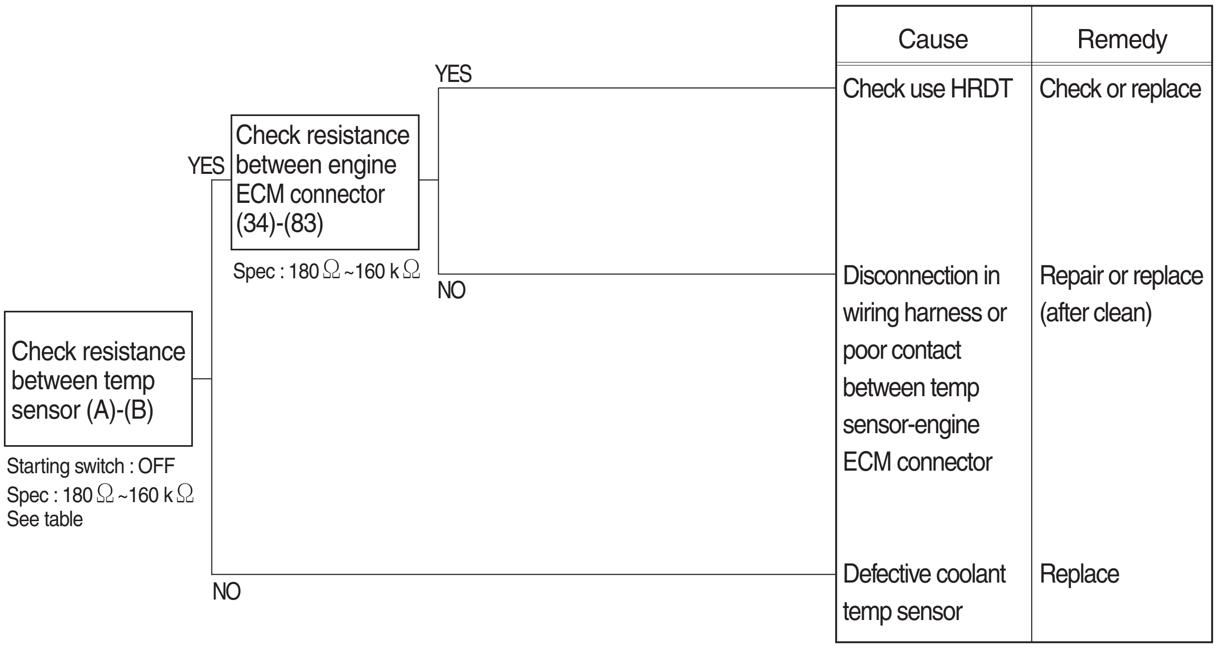
YES	20~32V
NO	0V



160A6ES03

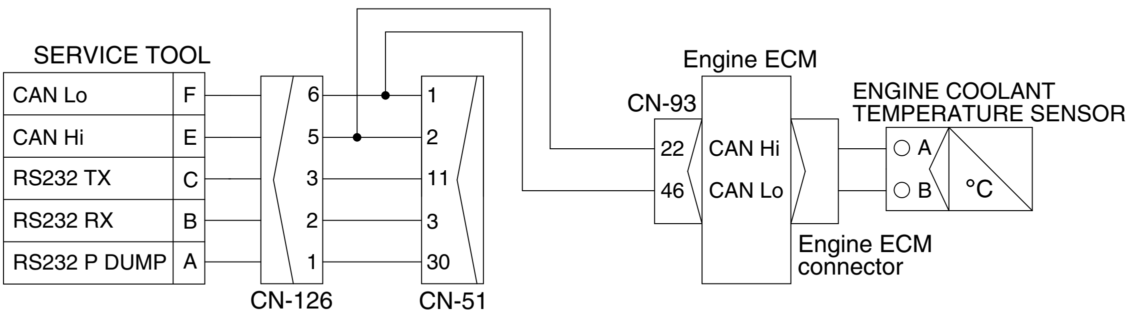
4. WHEN COOLANT OVERHEAT WARNING LAMP LIGHTS UP (engine is started)

· 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

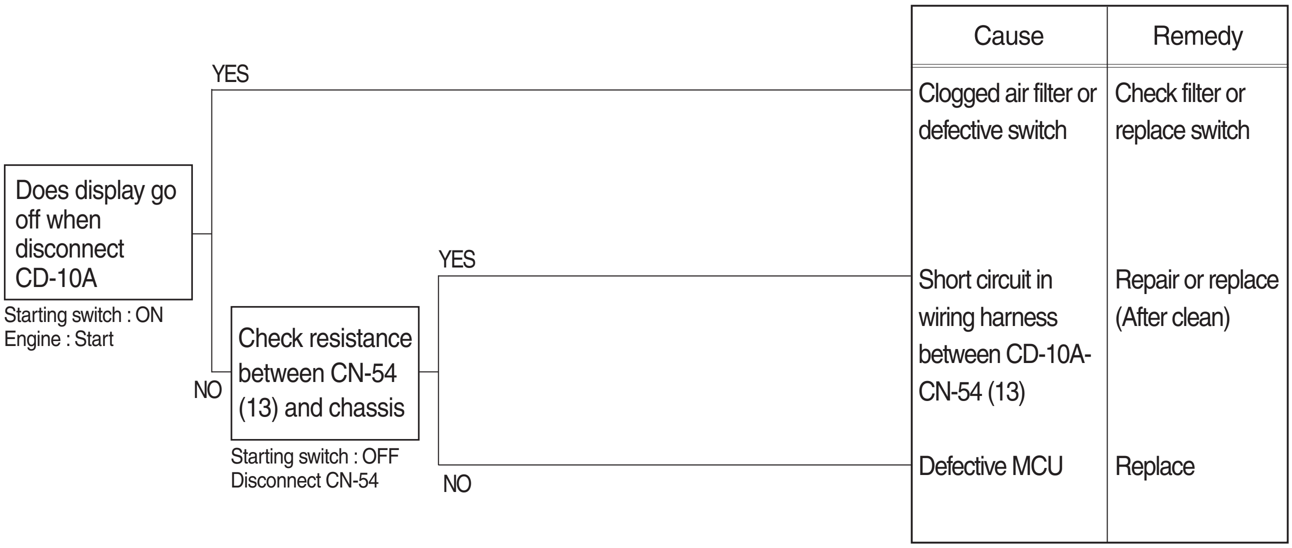
Temperature (˚C)	0	25	50	80	95
Resistance (kΩ)	30~37	9.3~10.7	3.2~3.8	1.0~1.3	0.7~0.8



160A6ES04

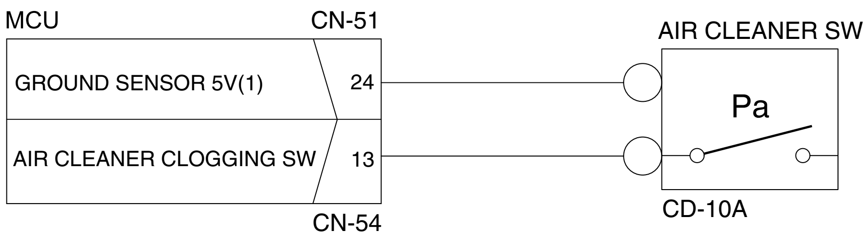
5. WHEN AIR CLEANER WARNING LAMP LIGHTS UP (engine is started)

· 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

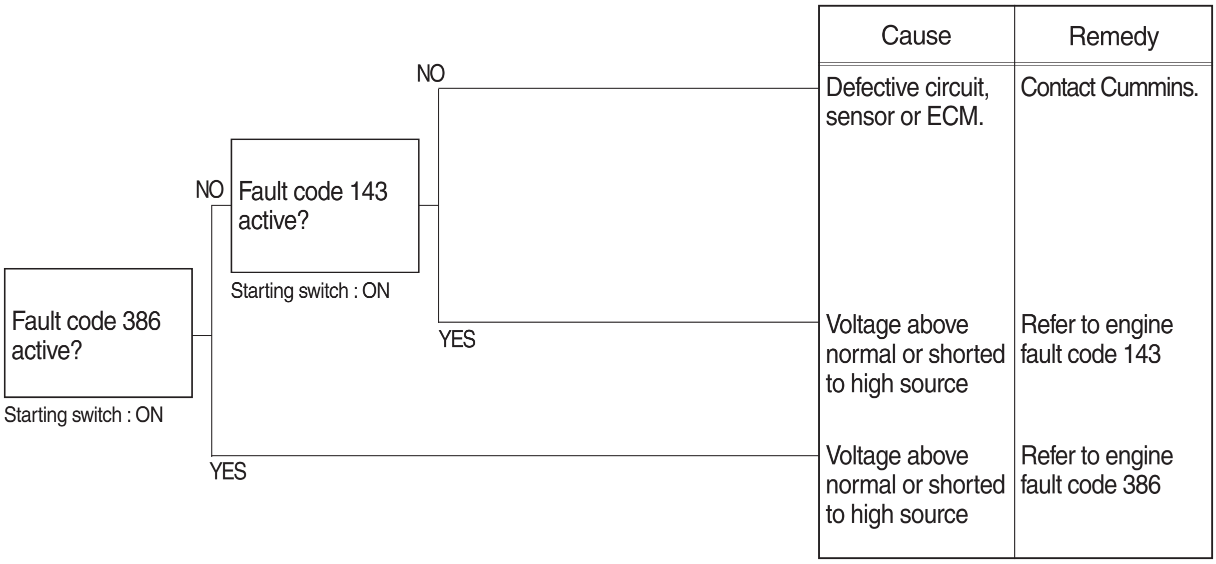
YES	MAX 1Ω
NO	MIN 1MΩ

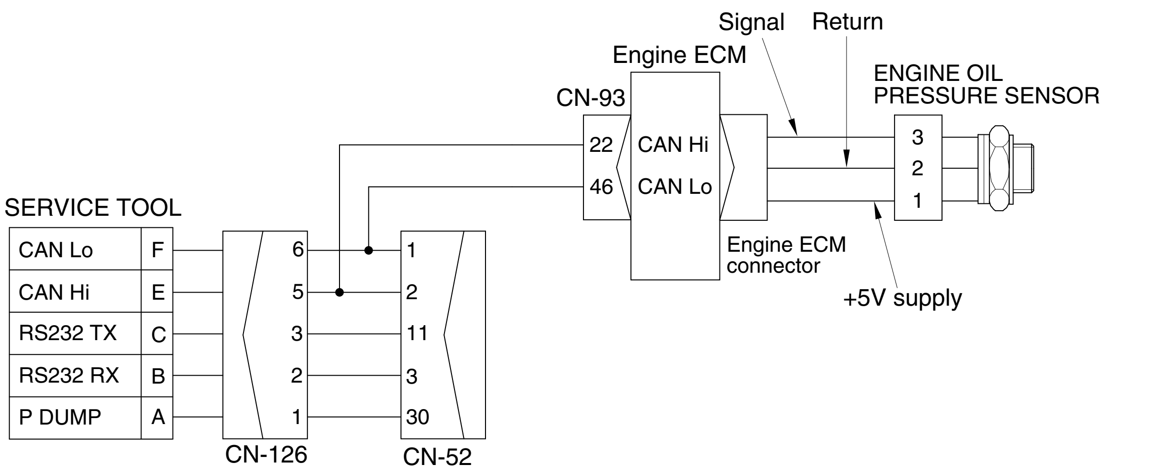


160A6ES06

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.

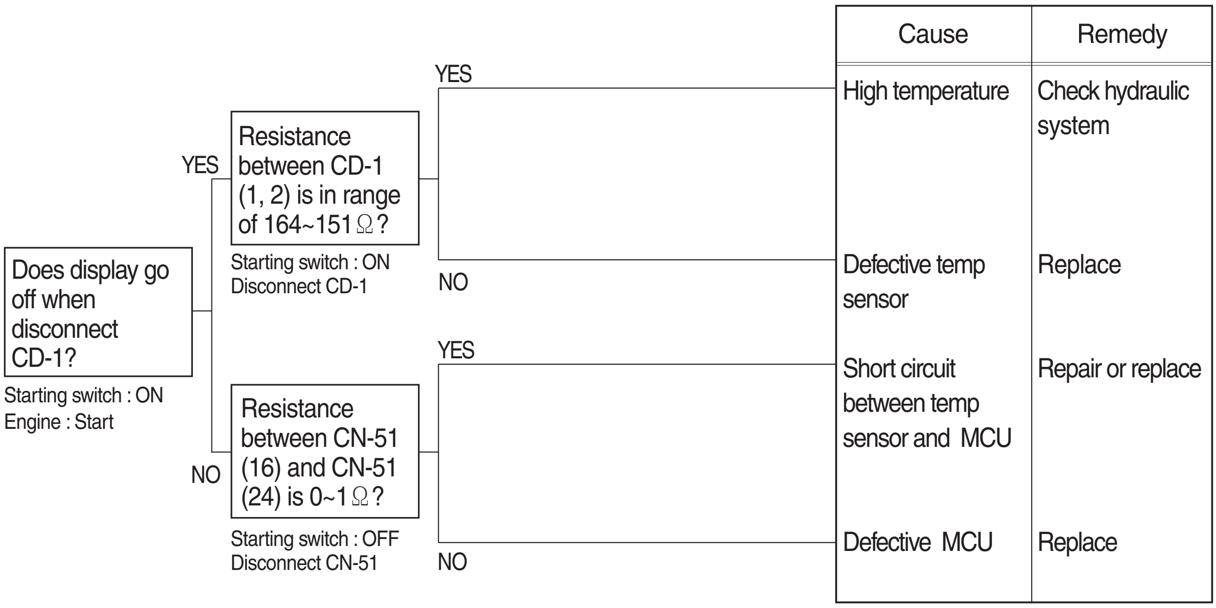


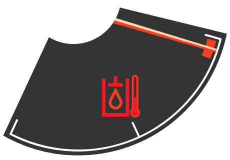


160A6ES07

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

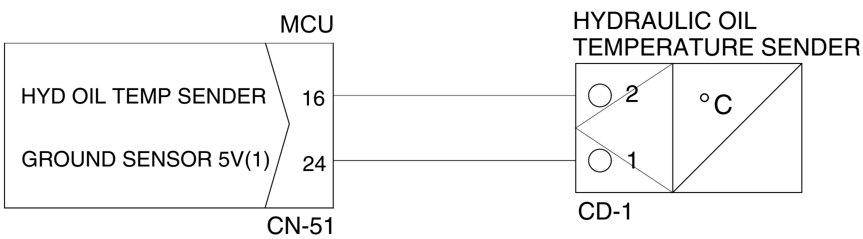
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

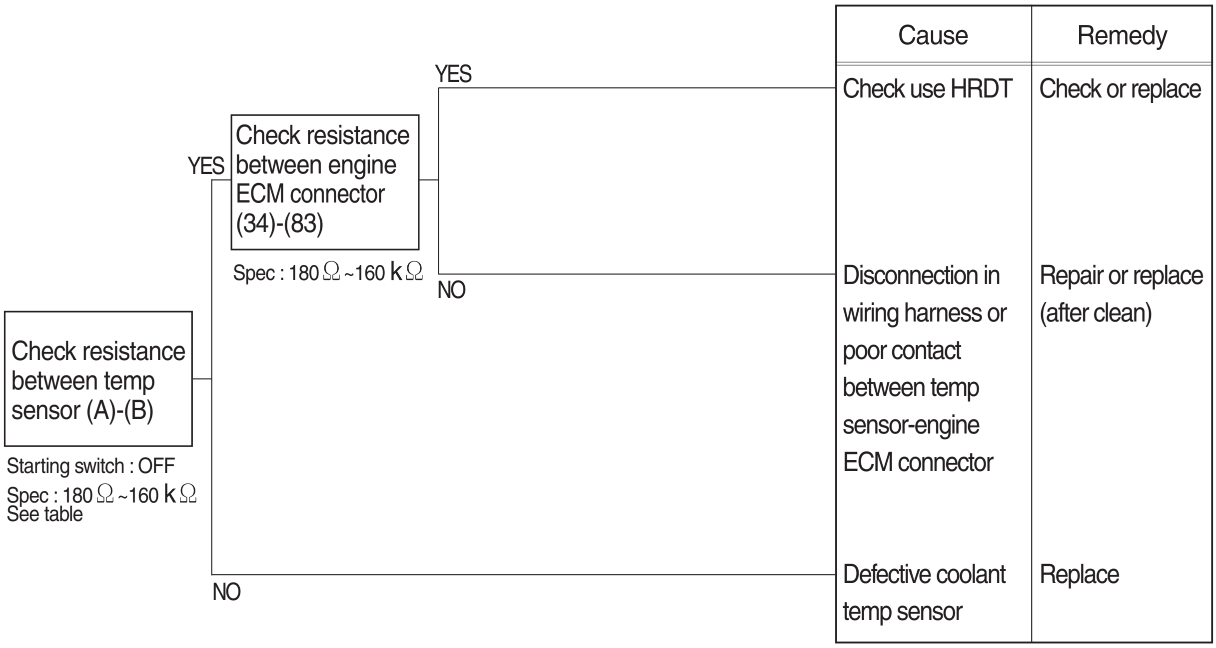
Temperature (˚C)	~ -30	~ -10	~ 0	~ 40	~ 70	~ 80	~ 90	~ 100	105~
Resistance (kΩ)	22.22 ~31.78	8.16 ~10.74	5.18 ~ 6.6	1.06 ~1.28	0.39 ~0.476	0.322 ~0.298	0.243 ~0.219	0.185 ~0.167	0.164 ~0.151



160A6ES08

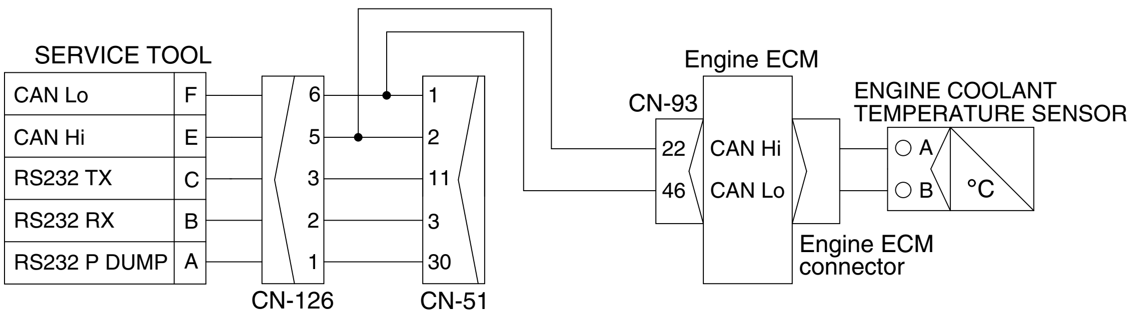
8. WHEN COOLANT TEMPERATURE GAUGE DOES NOT OPERATE

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



Check Table

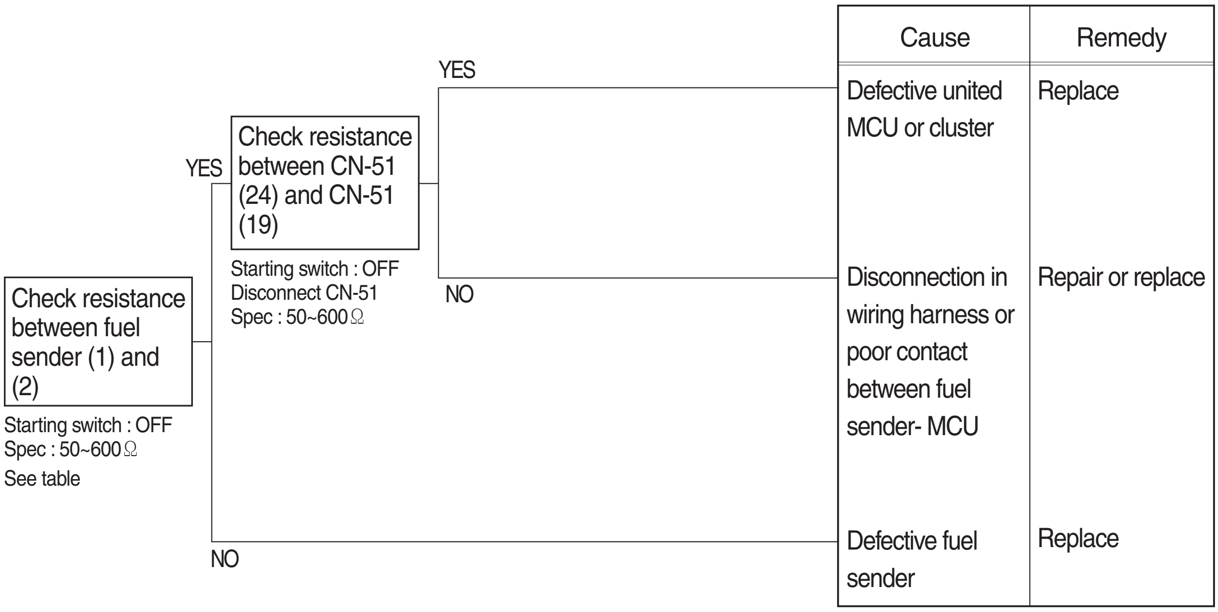
Temperature (˚C)	0	25	50	80	95
Resistance (kΩ)	30~37	9.3~10.7	3.2~3.8	1.0~1.3	0.7~0.8

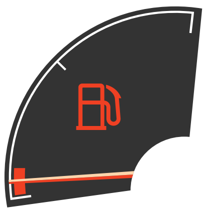


160A6ES04

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

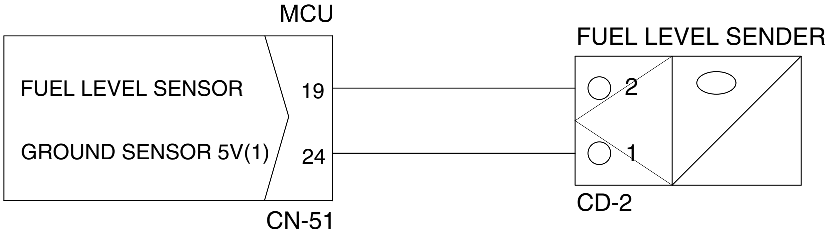
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

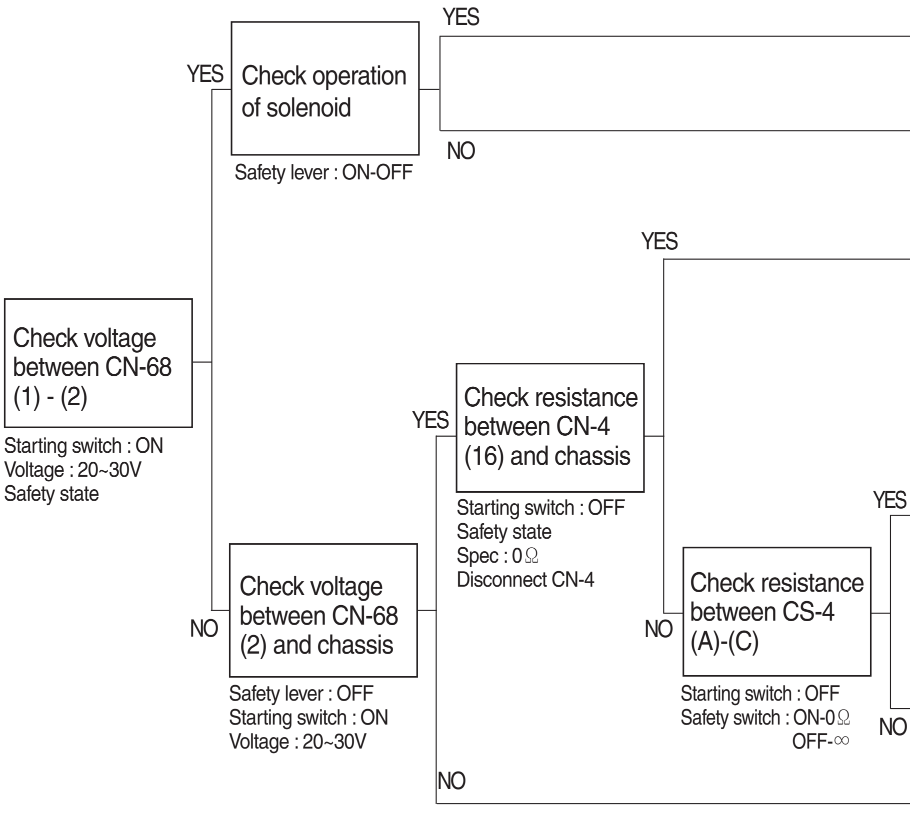
Range	Resistance (Ω)	Range	Resistance (Ω)
Full	50	5/12	400
11/12	100	4/12	450
10/12	150	3/12	500
9/12	200	2/12	550
8/12	250	1/12	600
7/12	300	Empty warning	700
6/12	350	-	-



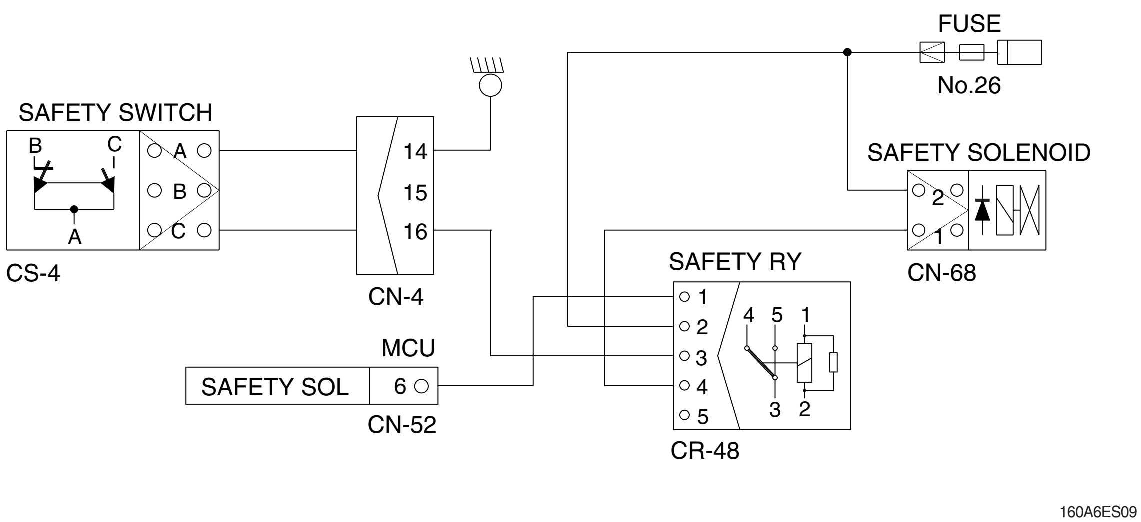
160A6ES10

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.



Cause	Remedy
Hydraulic system malfunction	Check hydraulic system
Defective solenoid	Replace
Disconnect in wiring harness or poor contact between CN-4-CN-68 or defective safety relay	Repair or replace (after clean)
Disconnect in wiring harness or poor contact between CN-4-CS-4	Repair or replace (after clean)
Defective safety switch	Replace
Disconnection in wiring harness between CN-68 (2)-fuse No. 26	Repair or replace



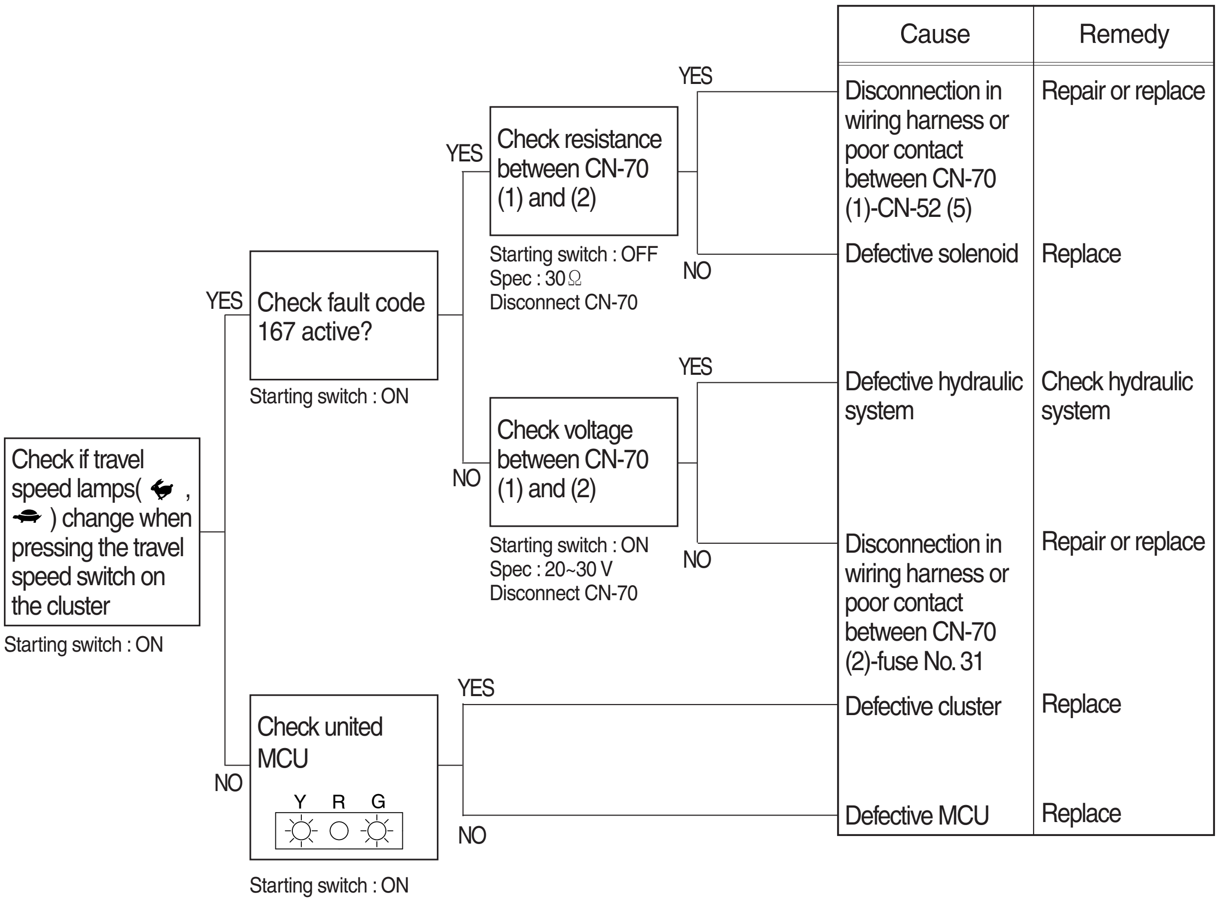
160A6ES09

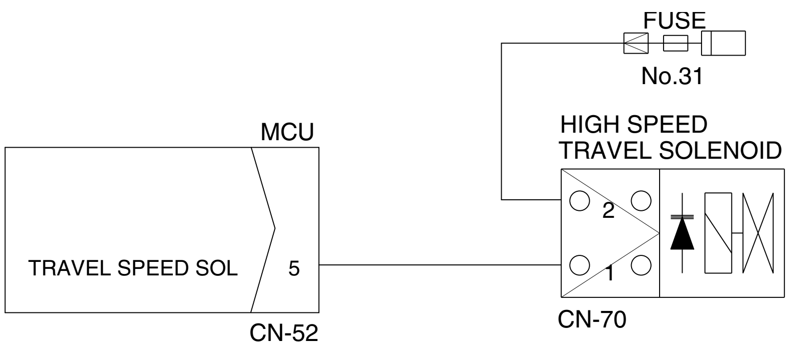
11. WHEN TRAVEL SPEED 1, 2 DOES NOT OPERATE (HCESPN 167, FMI 4 or 6)

· 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.

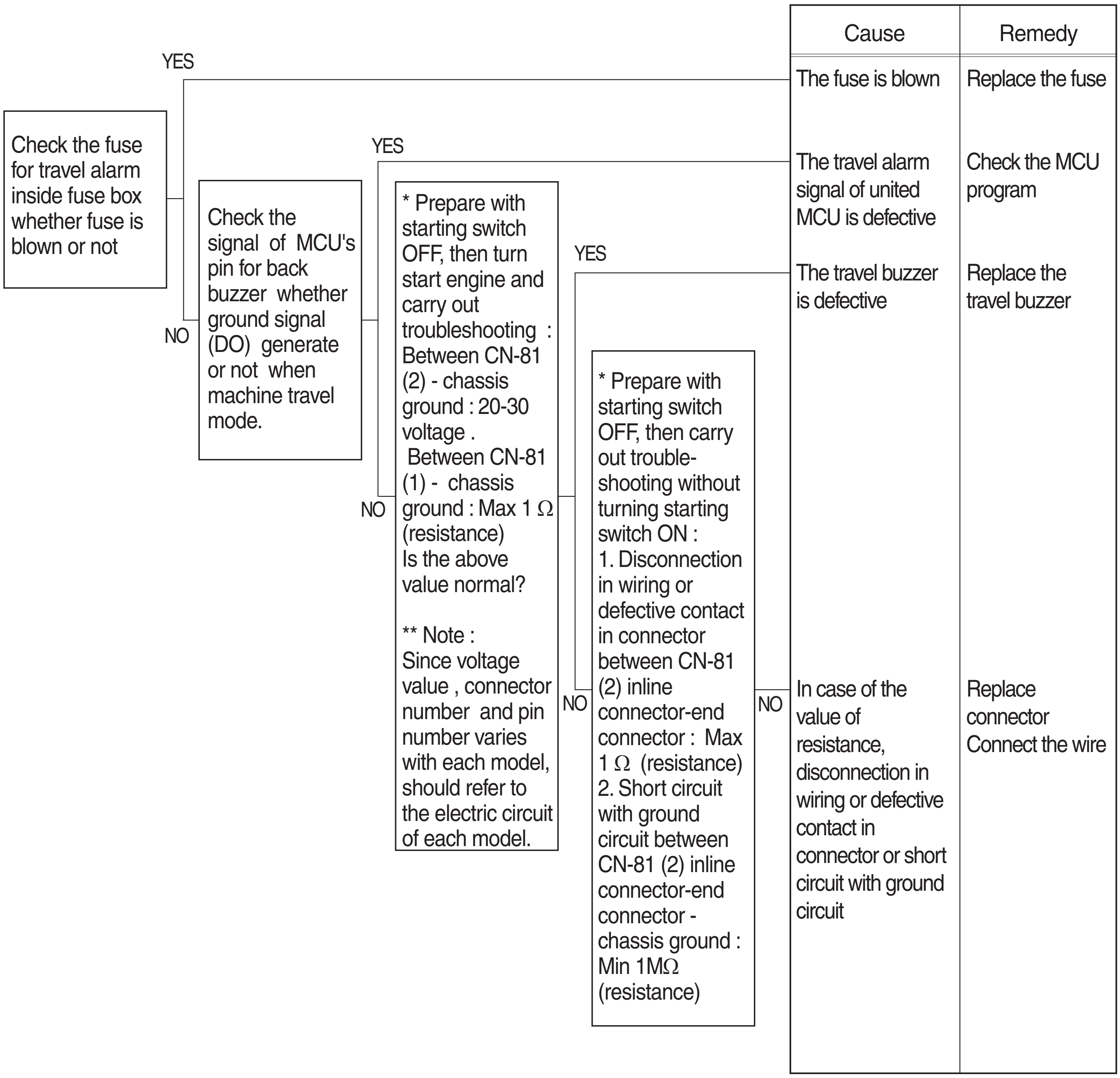
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

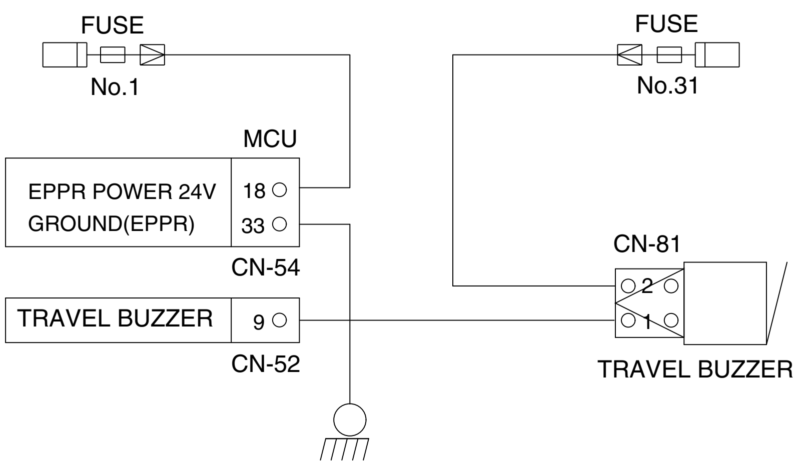




160A6ES11

12. TRAVEL ALARM DOES NOT SOUND OR DOES NOT STOP SOUNDING





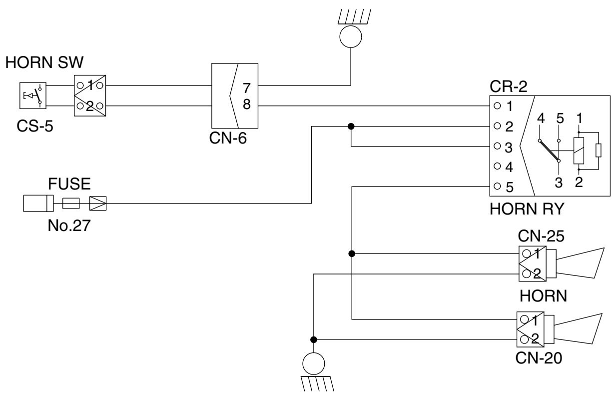
160A6ES15

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

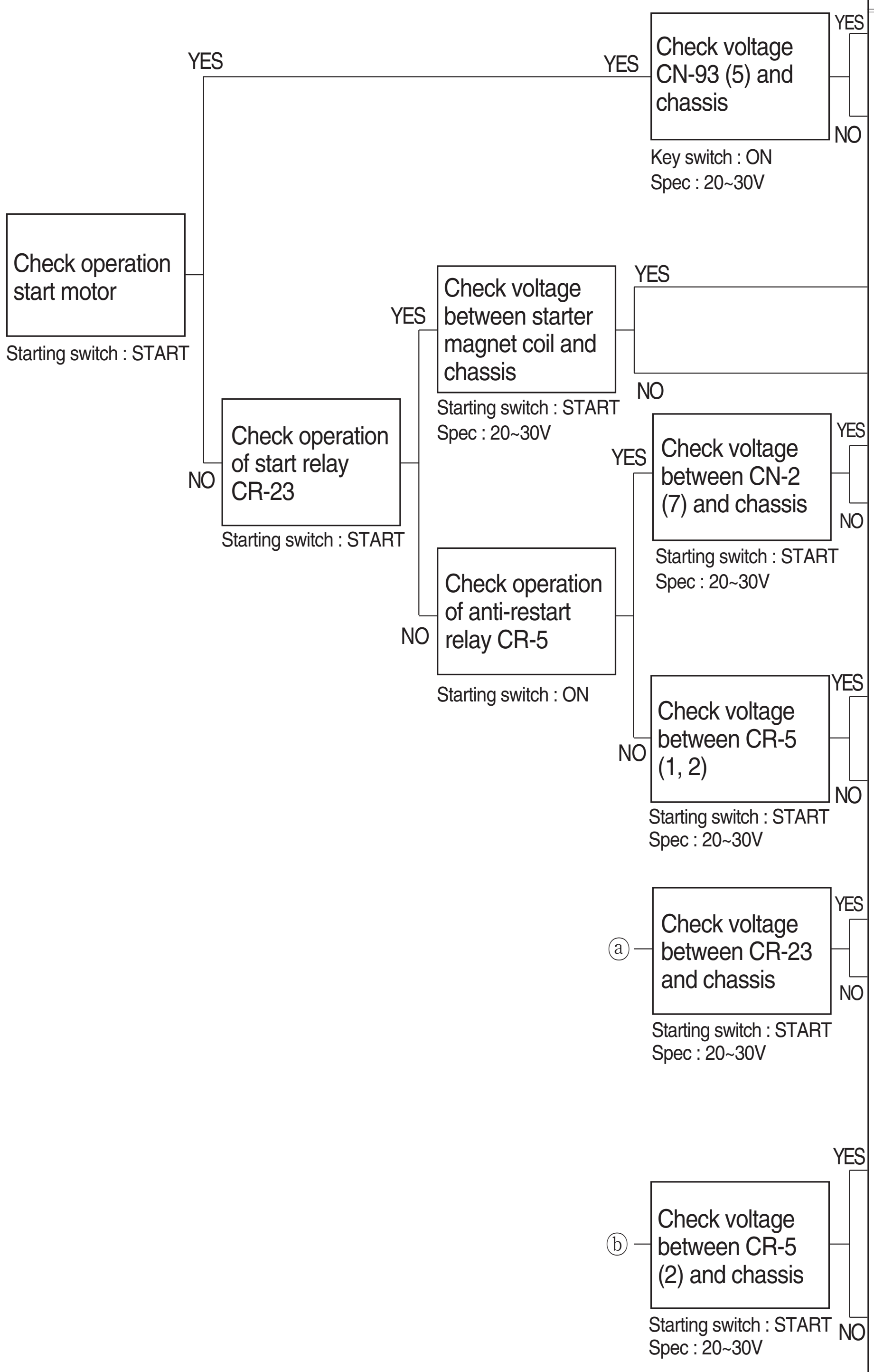
Cause	Remedy
The fuse is blown	Replace the fuse
The relay is broken	Replace the relay
The horn is defective	Replace the horn
In case of the value of resistance, disconnection in wiring or defective contact in connector or short circuit with ground circuit	Replace connector. Connect the wire



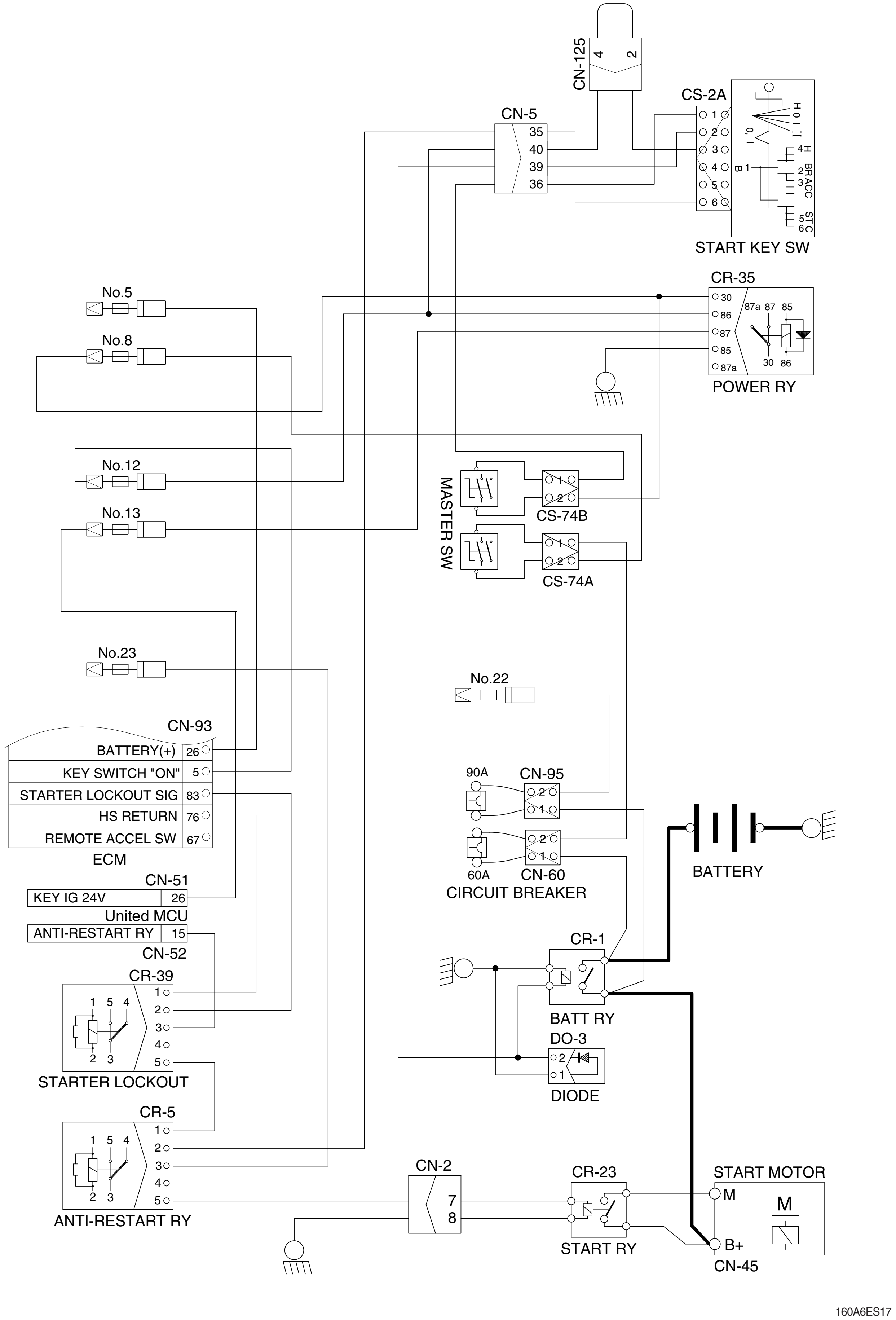
160A6ES16

14. WHEN ENGINE DOES NOT START ([battery symbol] 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. 5, 8, 12, 13, 23.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

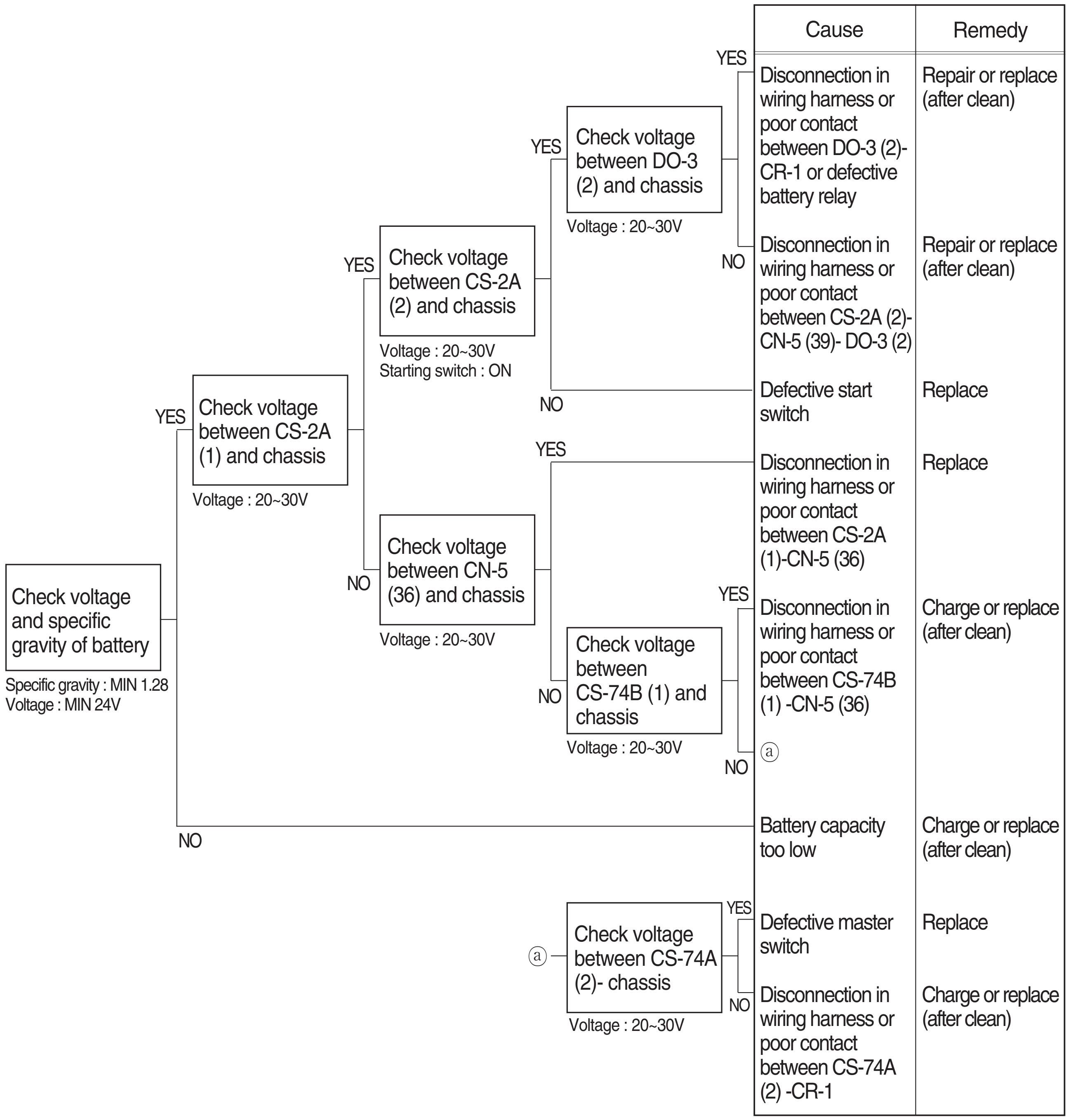


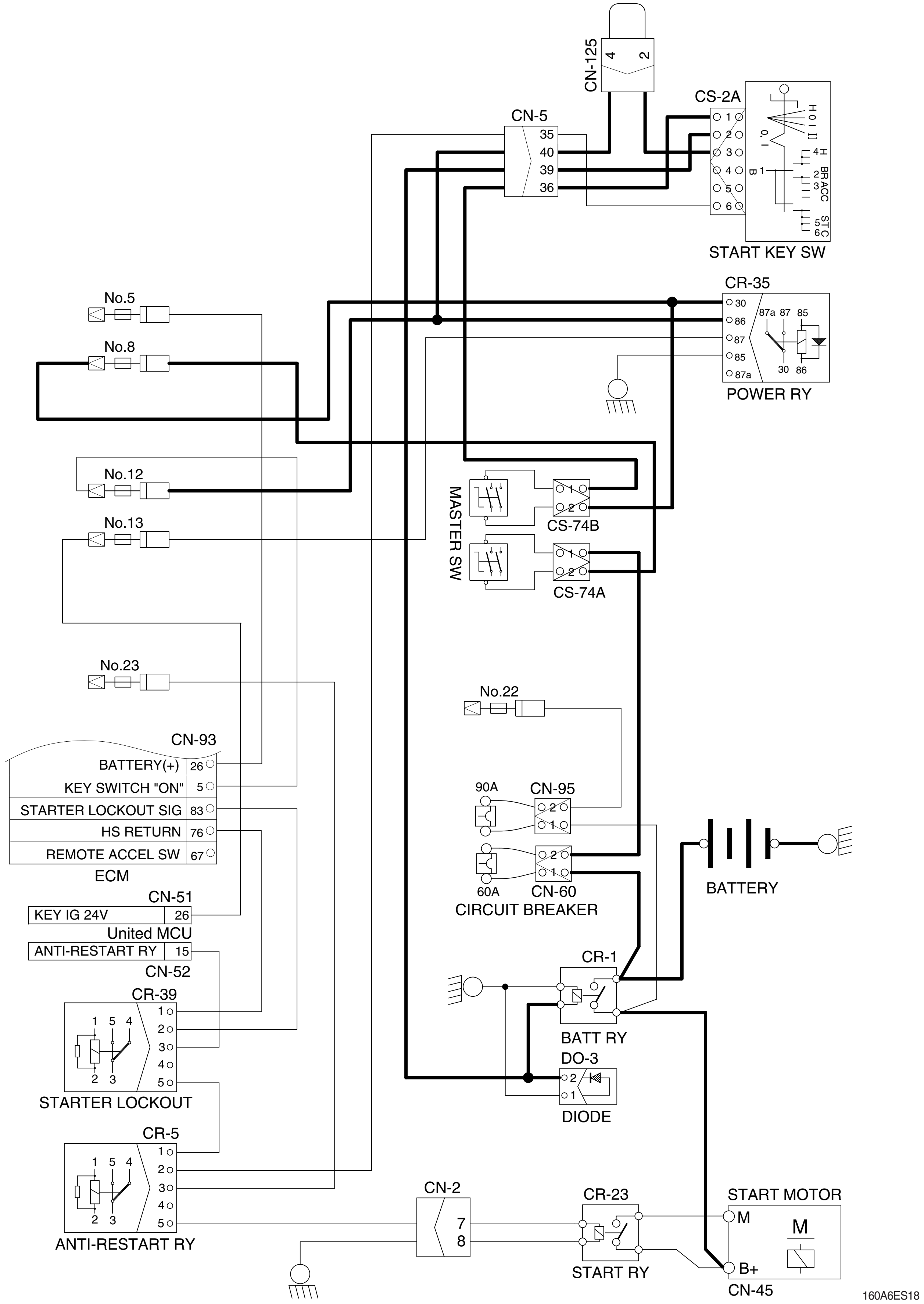
Cause	Remedy
Defective ECM or battery	Replace
Disconnection in wiring harness or poor contact between CR-35 (86) -CN-93 (5)	Repair or replace
Defective magnet of start motor	Replace
Defective start relay	Replace
ⓐ	
Disconnection in wiring harness or poor contact between CN-2 (7) -CR-5 (5)	Repair or replace
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



15. WHEN STARTING SWITCH ON DOES NOT OPERATE

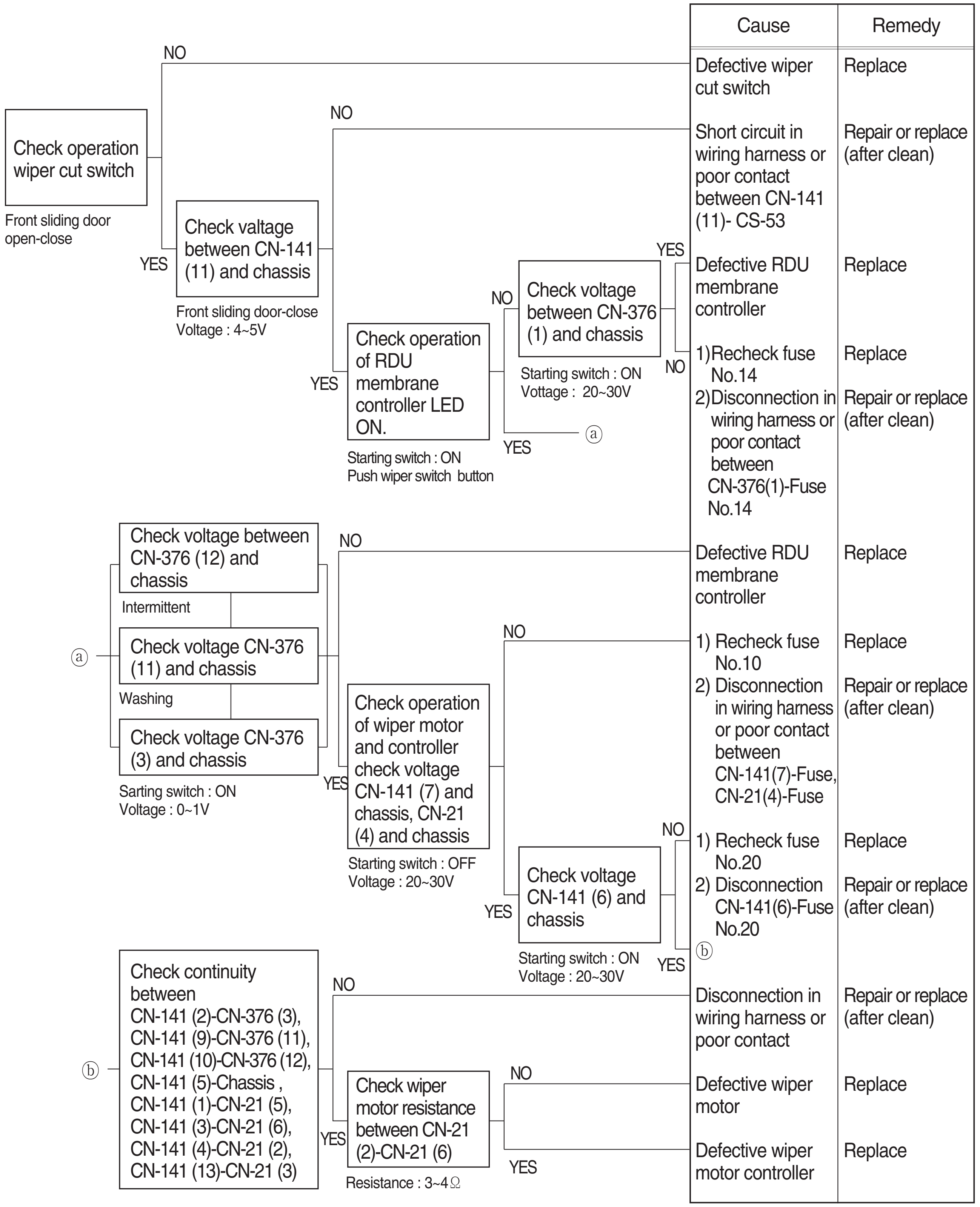
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted, master switch ON and check open circuit of circuit breaker (CN-60).
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

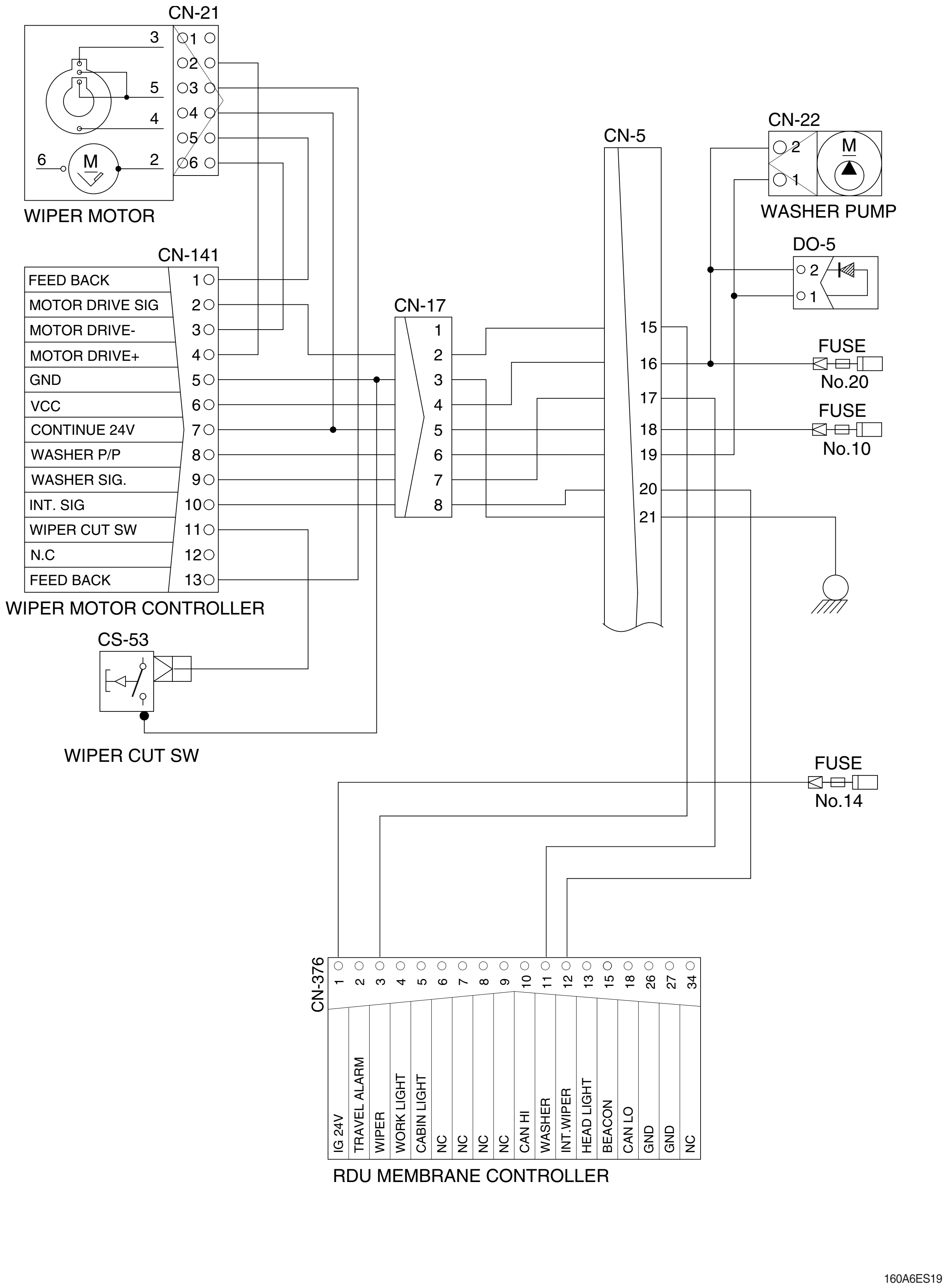




16. WHEN STARTING SWITCH IS TURNED ON, WIPER MOTOR DOES NOT OPERATE

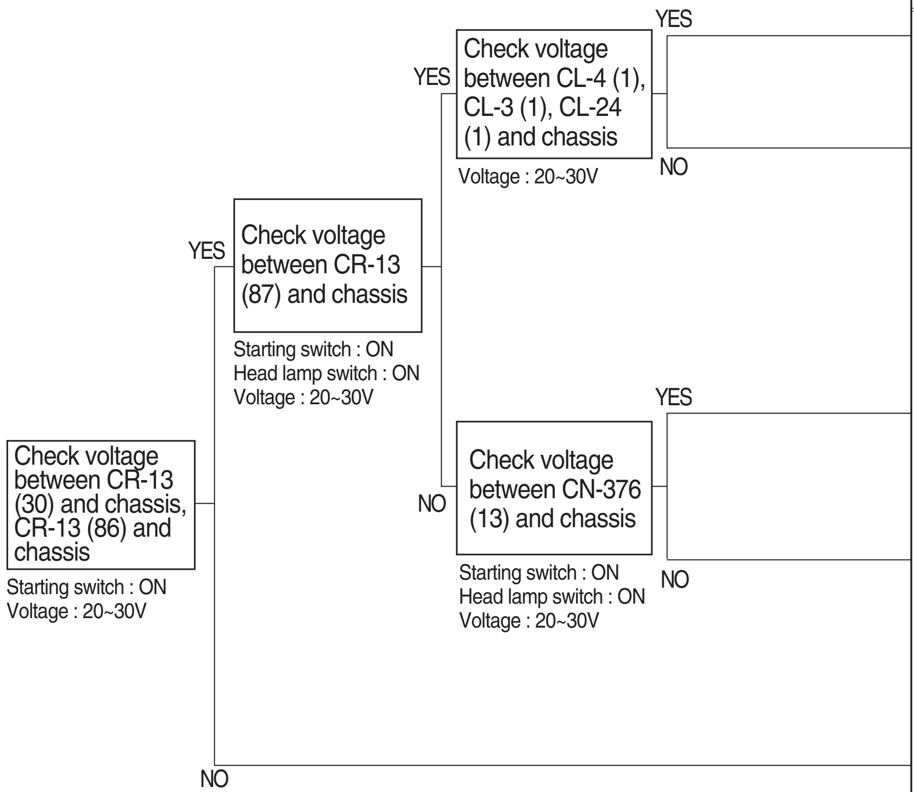
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and the fuse No. 10, 14 and 20 is not blown out.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



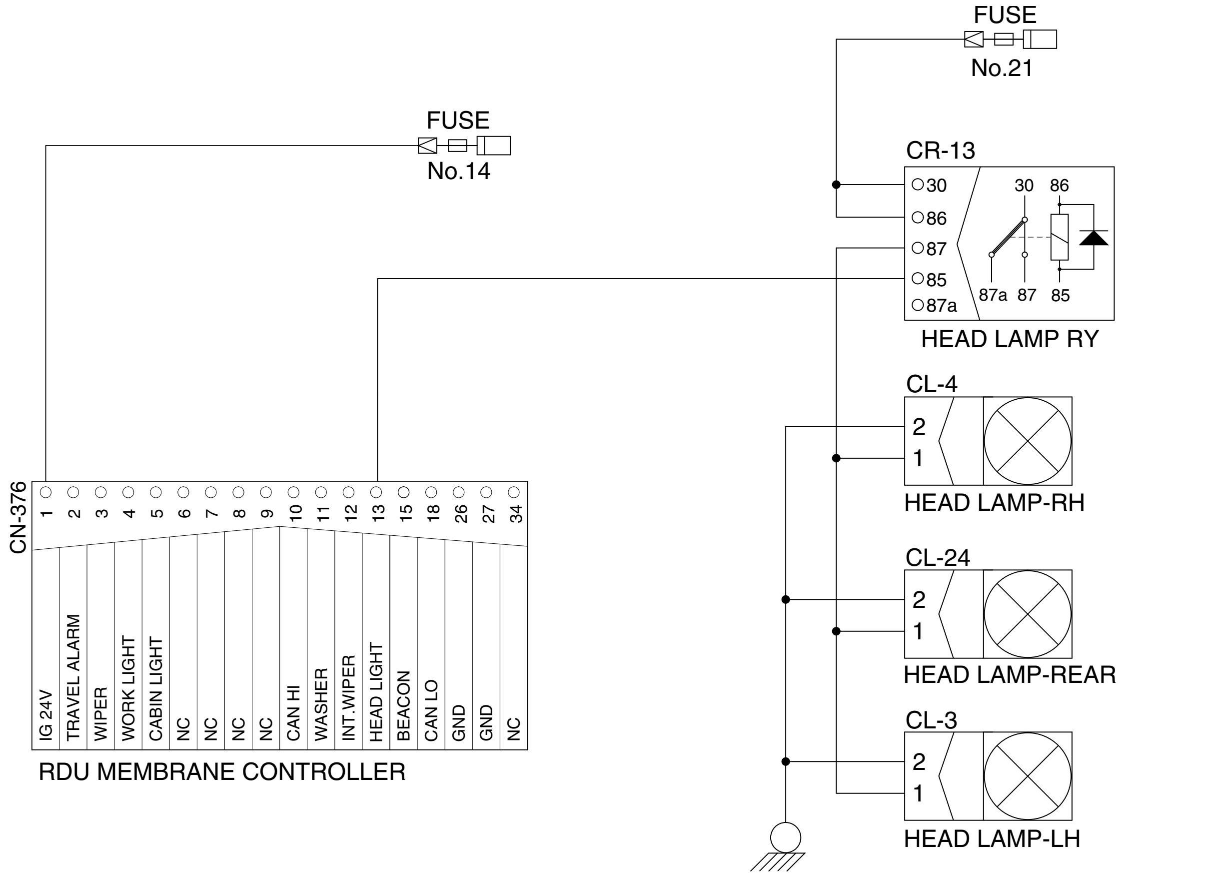


17. WHEN STARTING SWITCH IS TURNED ON, HEAD LAMP DOES NOT LIGHTS UP

· 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.



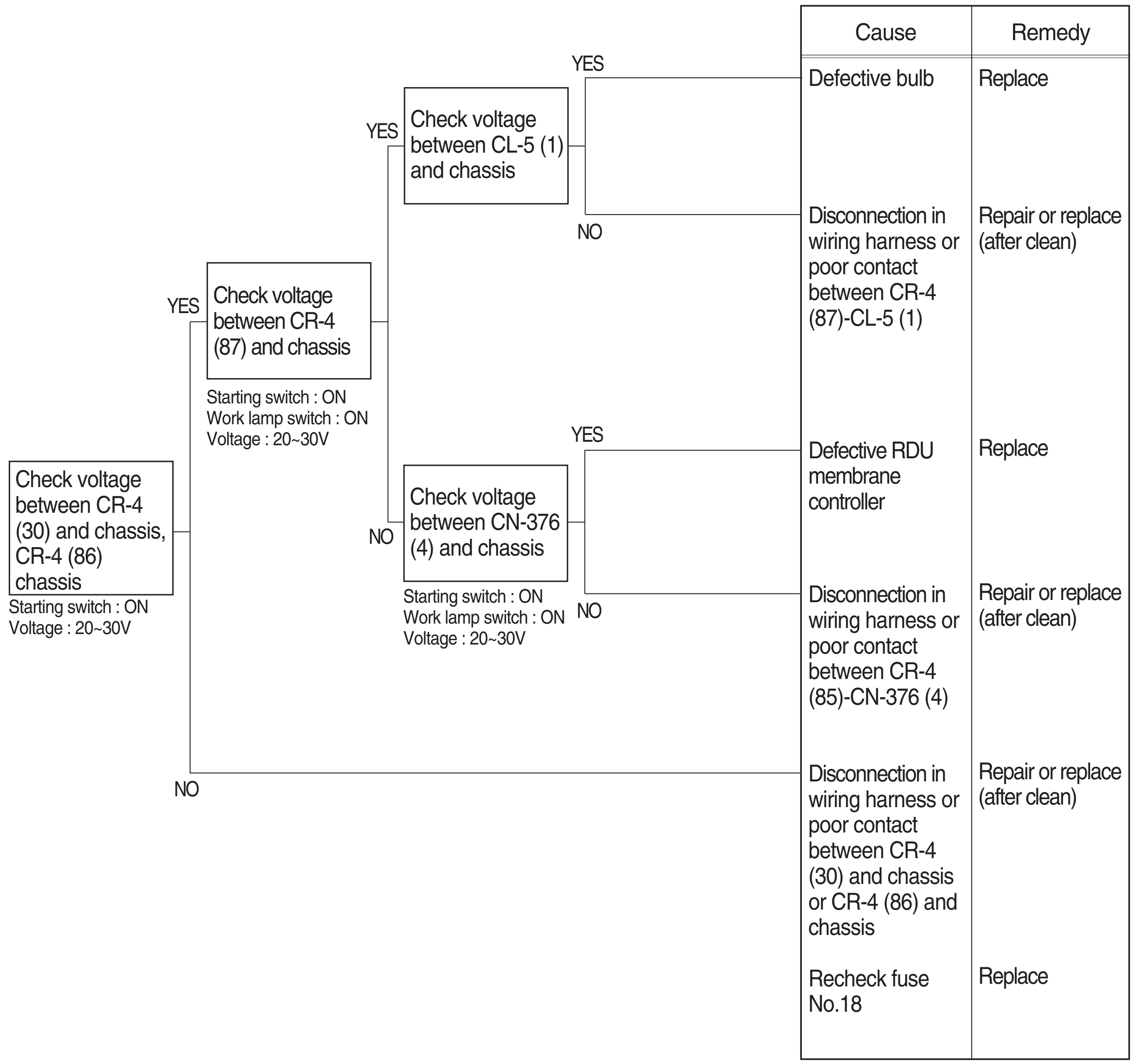
Cause	Remedy
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CR-13 (87)-CL-4 (1), CR-13 (87)-CL-3 (1) or CR-13 (87)-CL-24 (1)	Repair or replace (after clean)
Defective RDU membrane controller	Replace
Disconnection in wiring harness or poor contact between CN-376 (13)-CR-13 (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

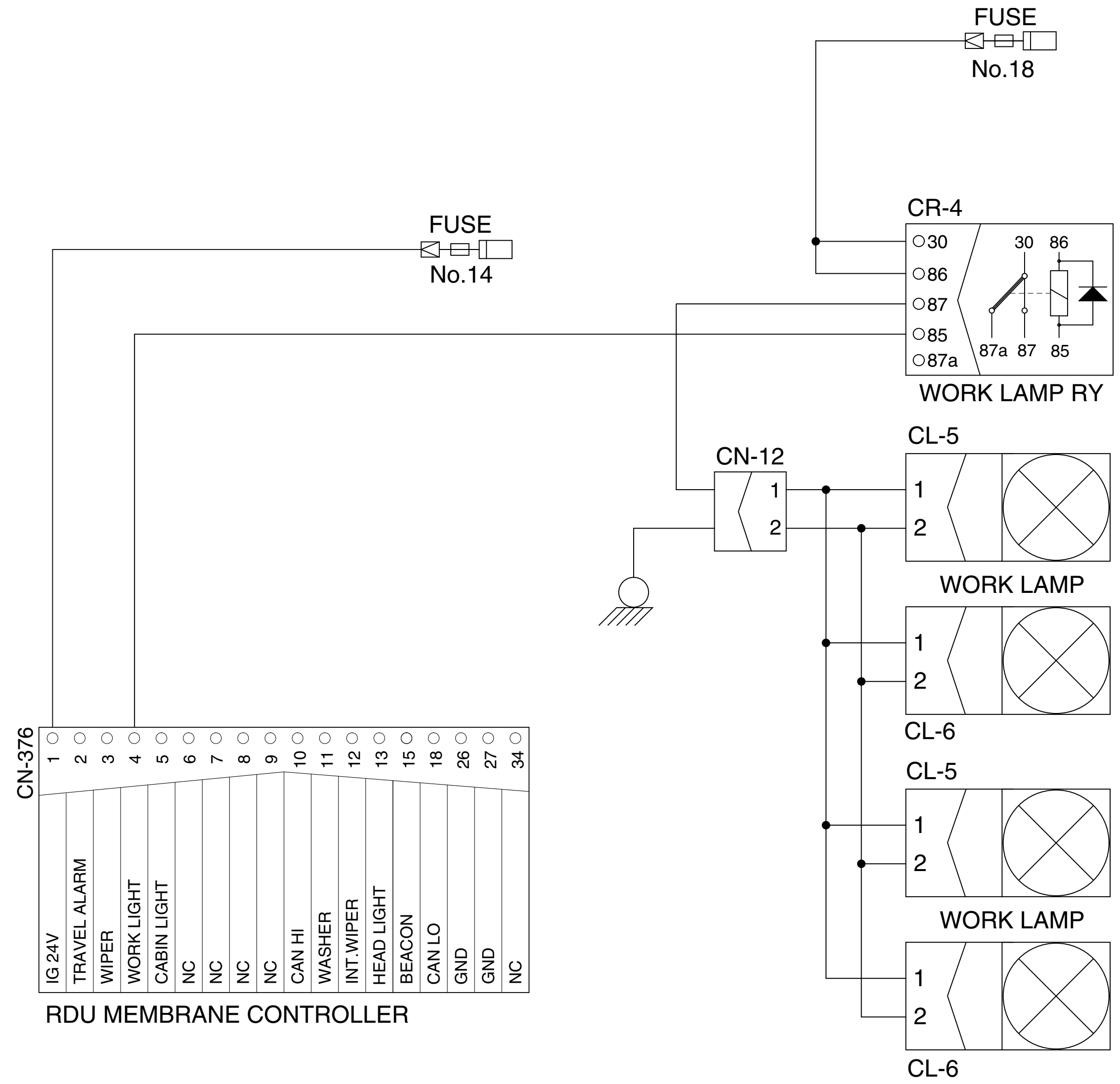


160A6ES20

18. 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 & 18.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





160A6ES21

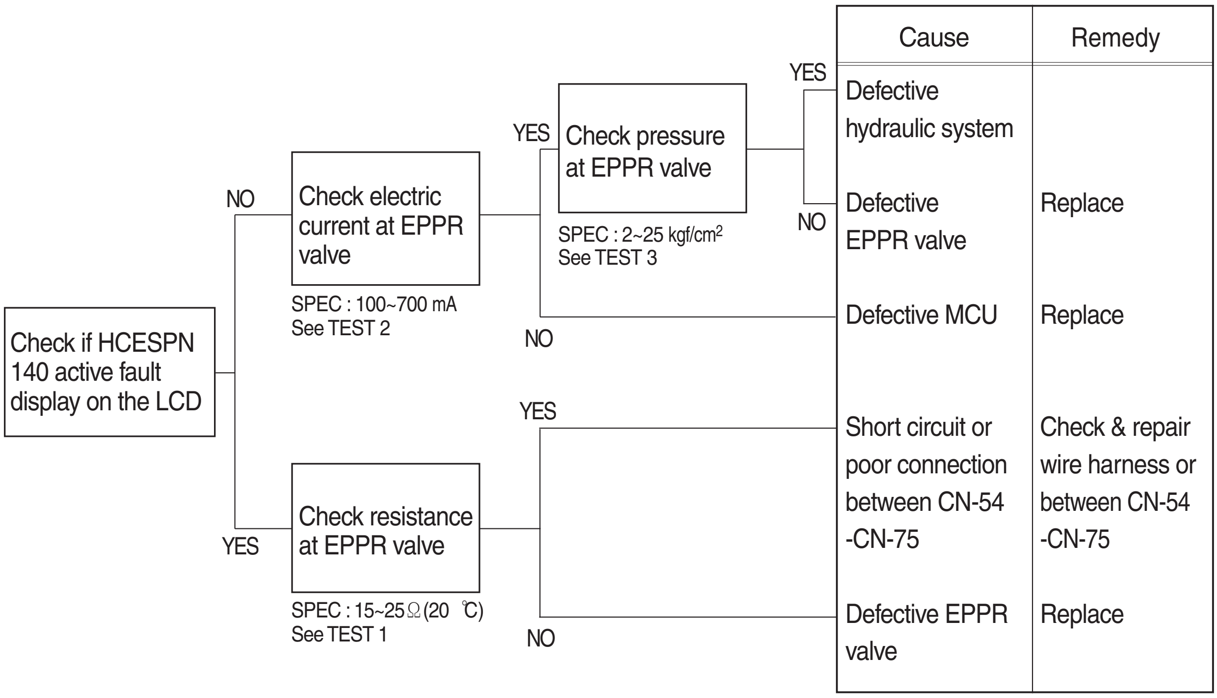
1. ALL ACTUATORS SPEED ARE SLOW

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

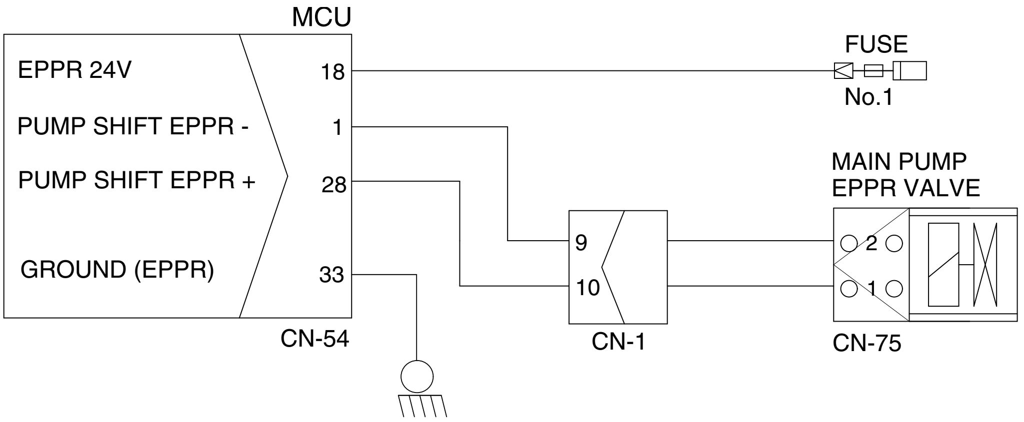
※ Spec : P-mode 1950 ± 50 rpm S -mode 1850 ± 50 rpm E-mode 1750 ± 50 rpm

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

1) INSPECTION PROCEDURE



Wiring diagram



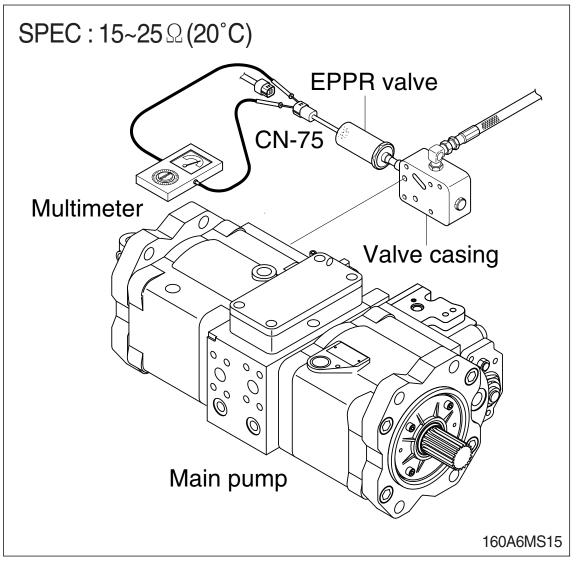
2) TEST PROCEDURE

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

① Starting switch OFF.

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

③ Check resistance between 2 lines as figure.



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

① Disconnect connector CN-75 from EPPR valve.

② Insert the adapter to CN-75 and install multimeter as figure.

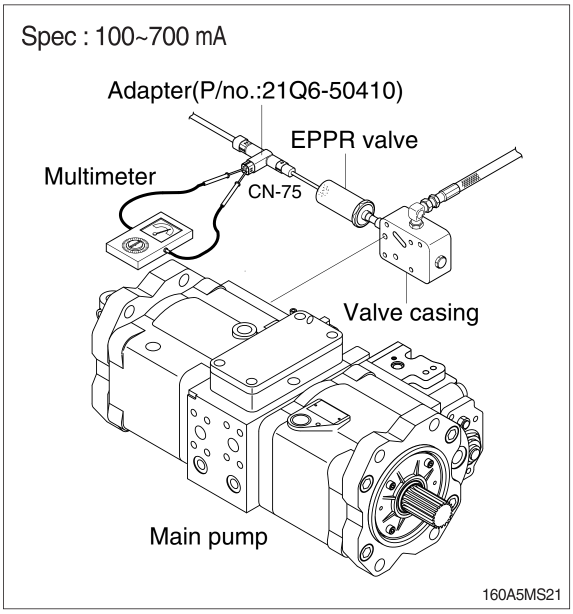
③ Start engine.

④ Set S-mode and cancel auto decel mode.

⑤ Position the multimodal dial at 10.

⑥ If tachometer show approx 1850±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 Start engine.

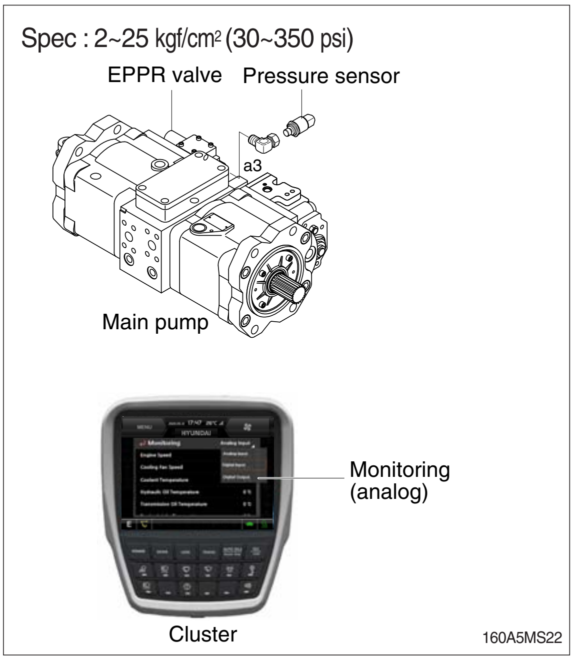
② Set S-mode and cancel auto decel mode.

③ Position the multimodal dial at 10.

④ Slowly operate control lever of bucket functions at full stroke over relief and measure the EPPR valve pressure by the the monitoring menu of the cluster.

⑤ If pressure is not correct, adjust it.

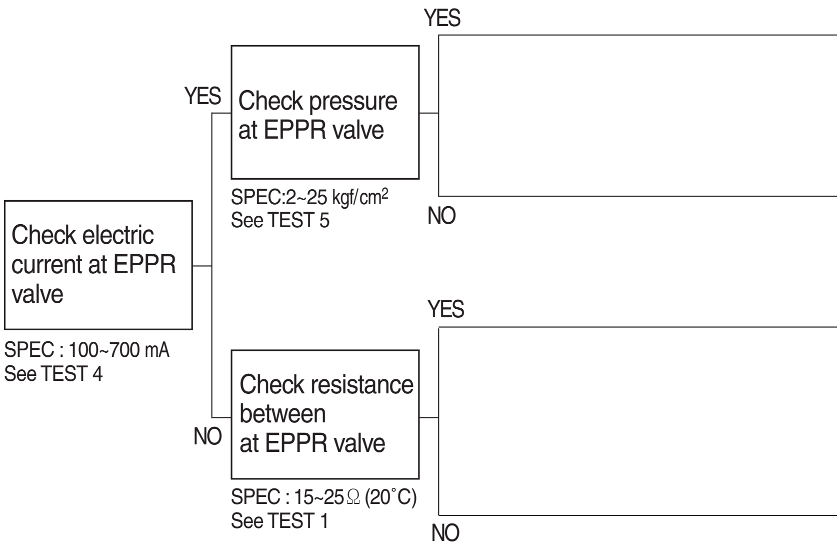
⑥ After adjust, test the machine.



2. ENGINE STALL

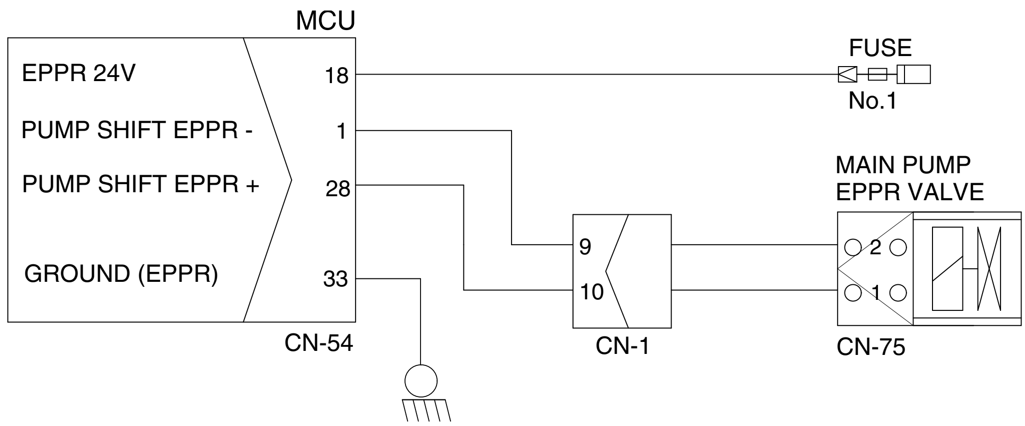
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Not enough engine power	Check engine fault Contact cummins
Defective EPPR valve	Replace
Short circuit or poor connection between CN-54-CN-342 (or 343)	Check and repair wire harness
Defective EPPR valve	Replace

Wiring diagram



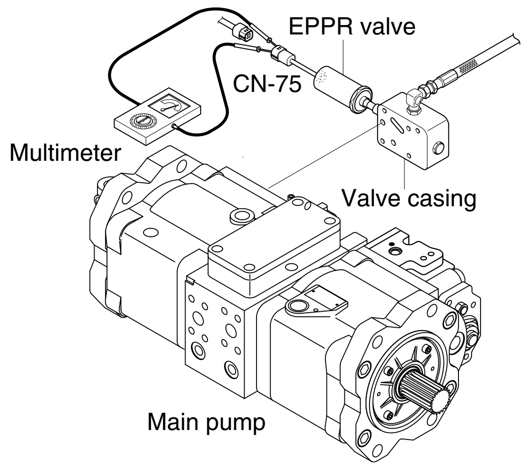
160A6MS01

2) TEST PROCEDURE

(1) Test 4 : Check electric current at EPPR valve.

① Disconnect connector CN-75 from EPPR valve.
② Insert the adapter to CN-75 and install multimeter as figure.
③ Start engine.
④ Set S-mode and cancel auto decel mode.
⑤ Position the multimodal dial at 10.
⑥ If rpm show approx 1850±50 rpm disconnect one wire harness from EPPR valve.
Check electric current at bucket circuit
⑦ relief position.

Spec : 100~700 mA

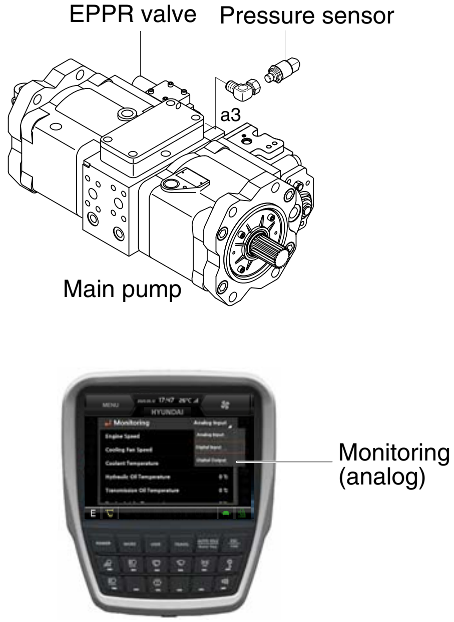


160A6MS15

(2) Test 5 : Check pressure at EPPR valve.

① Start engine.
② Set S-mode and cancel auto decel mode.
③ Position the multimodal dial at 10.
④ Slowly operate control lever of bucket functions at full stroke over relief and measure the EPPR valve pressure by the the monitoring menu of the cluster.
⑤ If pressure is not correct, adjust it.
⑥ After adjust, test the machine.

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

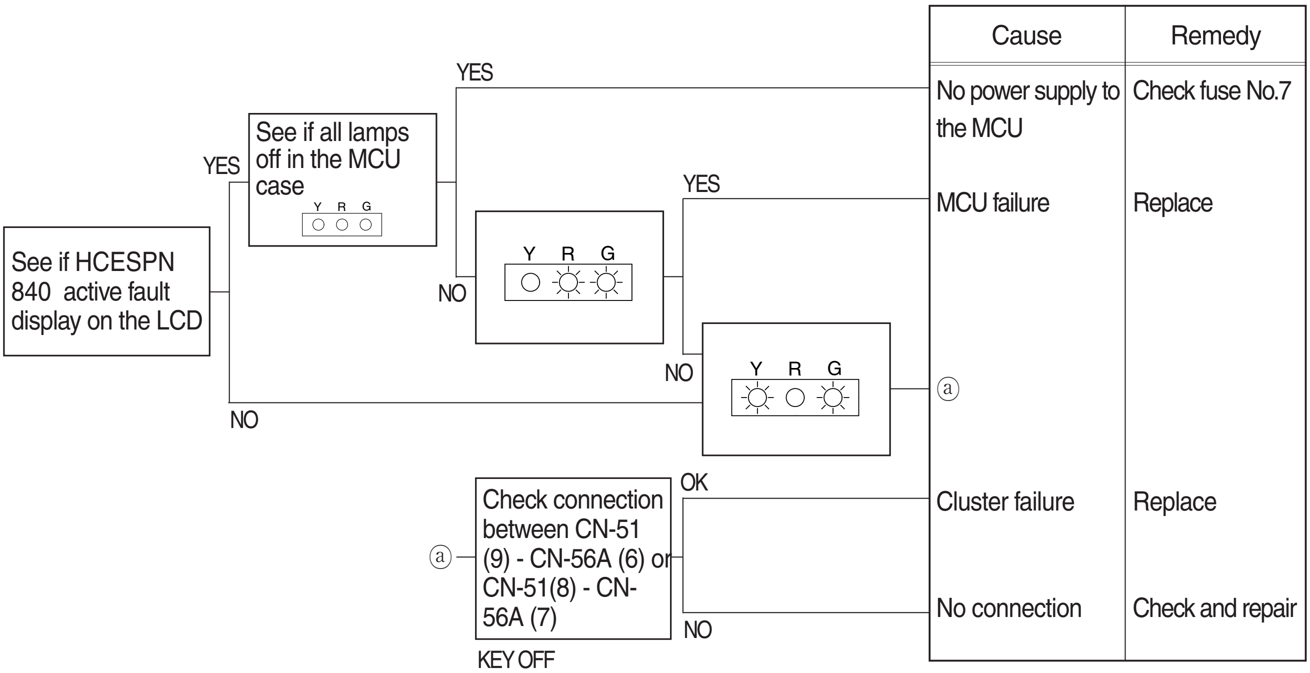


160A5MS22

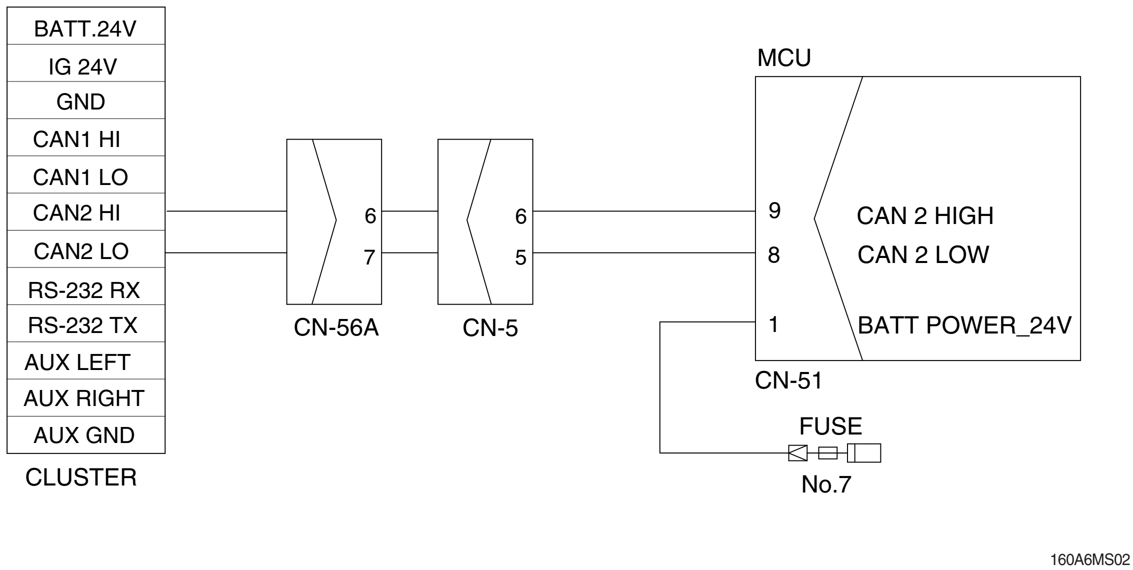
3. MALFUNCTION OF CLUSTER OR MODE SELECTION SYSTEM

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

1) INSPECTION PROCEDURE



Wiring diagram

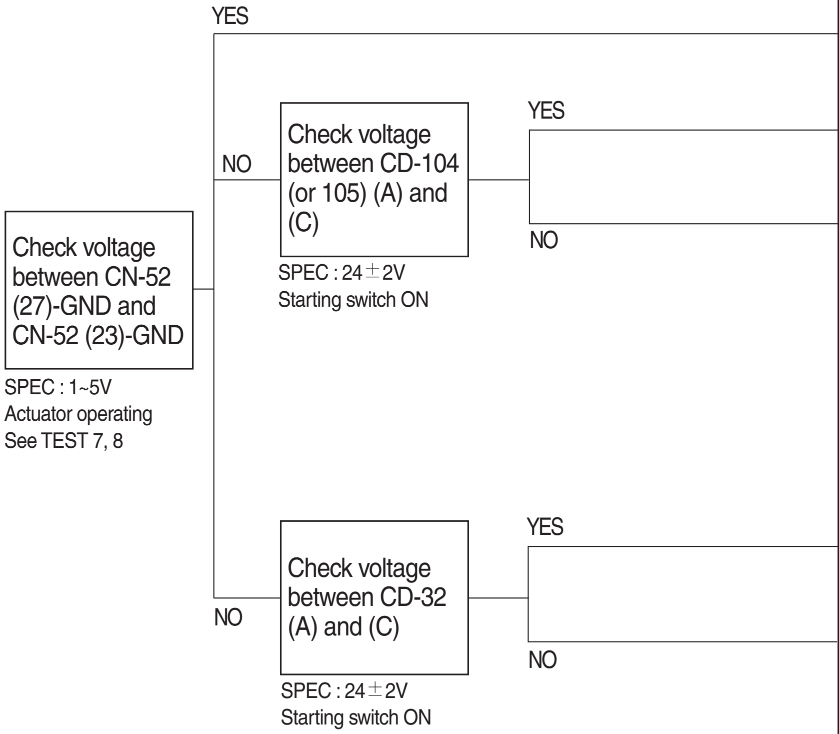


4. AUTO DECEL SYSTEM DOES NOT WORK

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

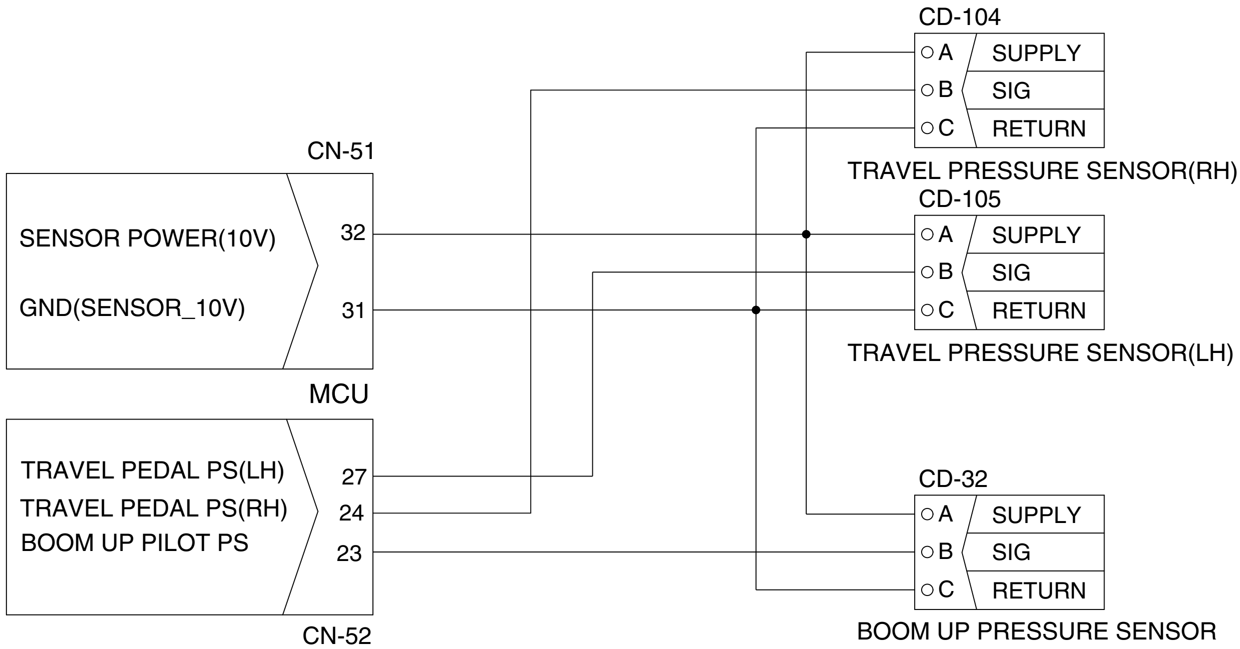
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Defective travel pressure 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



160A6MS03

2) TEST PROCEDURE

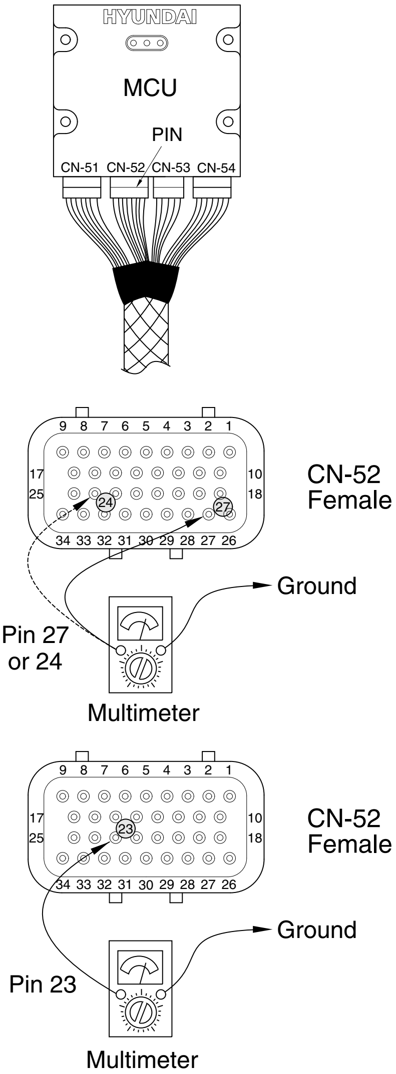
(1) Test 7 : Check voltage at CN-52 (24 or 27) and ground.

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



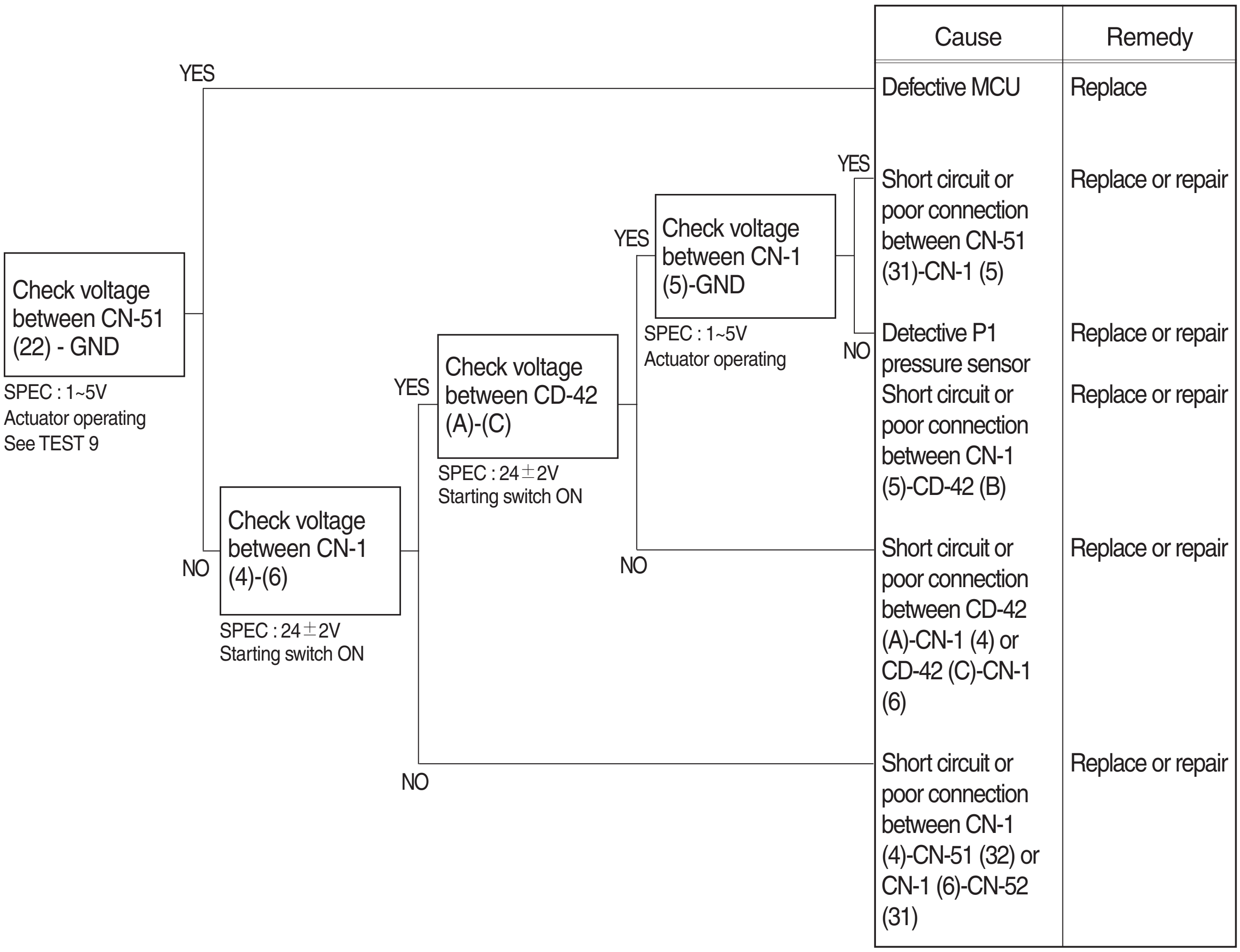
235A6MS104

5. MALFUNCTION OF PUMP 1 PRESSURE SENSOR

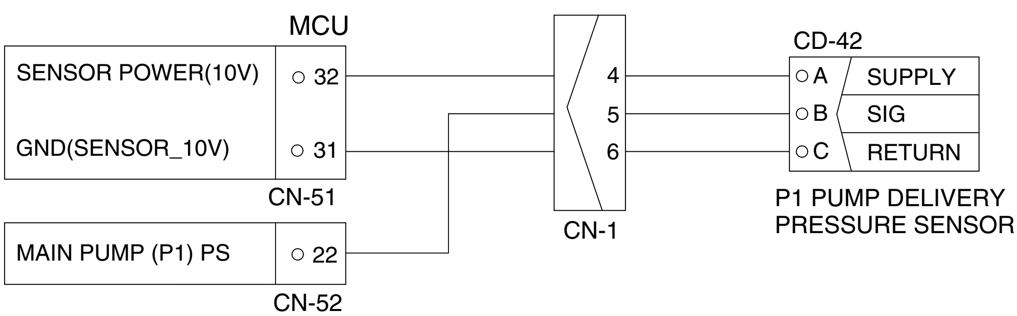
· Fault code : HCESPN 120, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



160A6MS05

2) TEST PROCEDURE

(1) Test 9 : Check voltage at CN-52 (22) and ground.

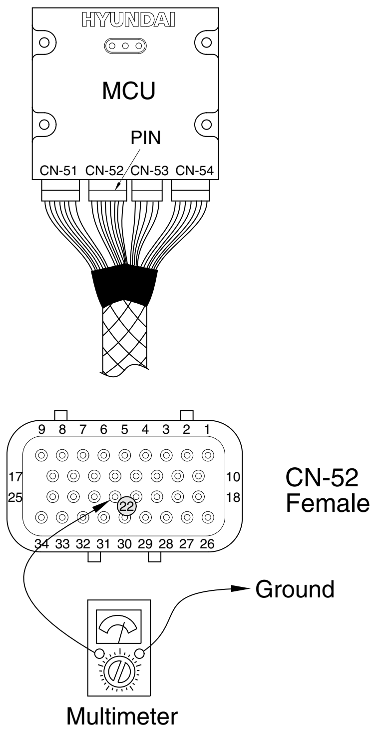
① Prepare 1 piece of thin sharp pin, steel or copper.

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



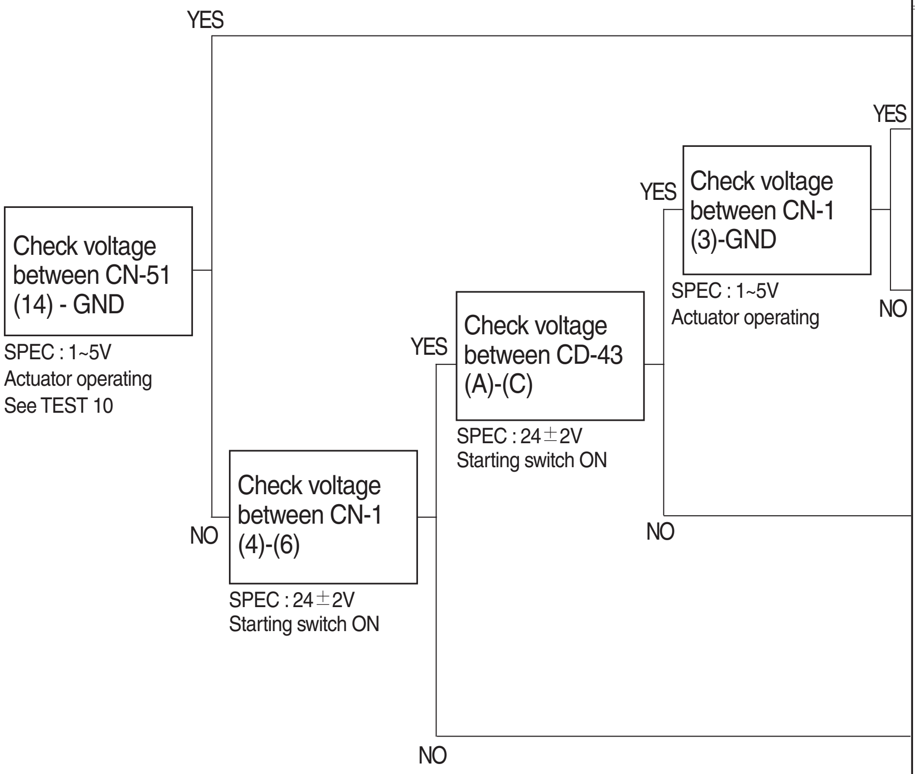
220A6MS106

6. MALFUNCTION OF PUMP 2 PRESSURE SENSOR

· Fault code : HCESPN 121, FMI 0~4

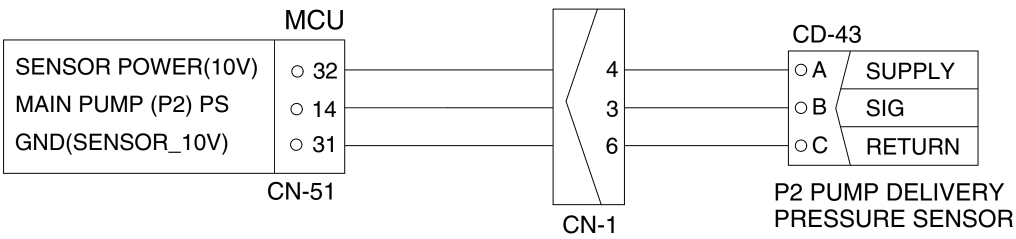
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective 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



160A6MS07

2) TEST PROCEDURE

(1) Test 10 : Check voltage at CN-51 (14) and ground.

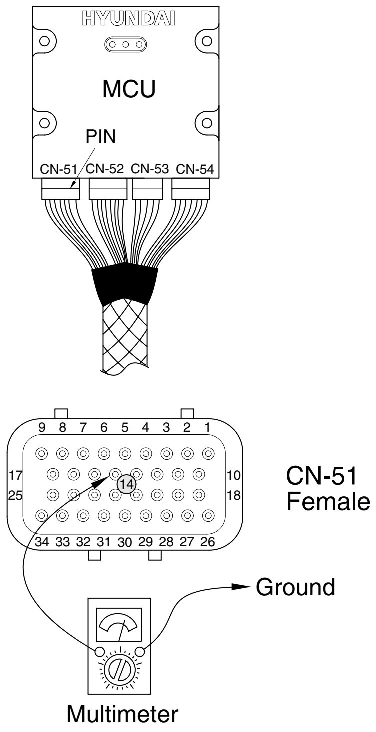
① Prepare 1 piece of thin sharp pin, steel or copper.

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



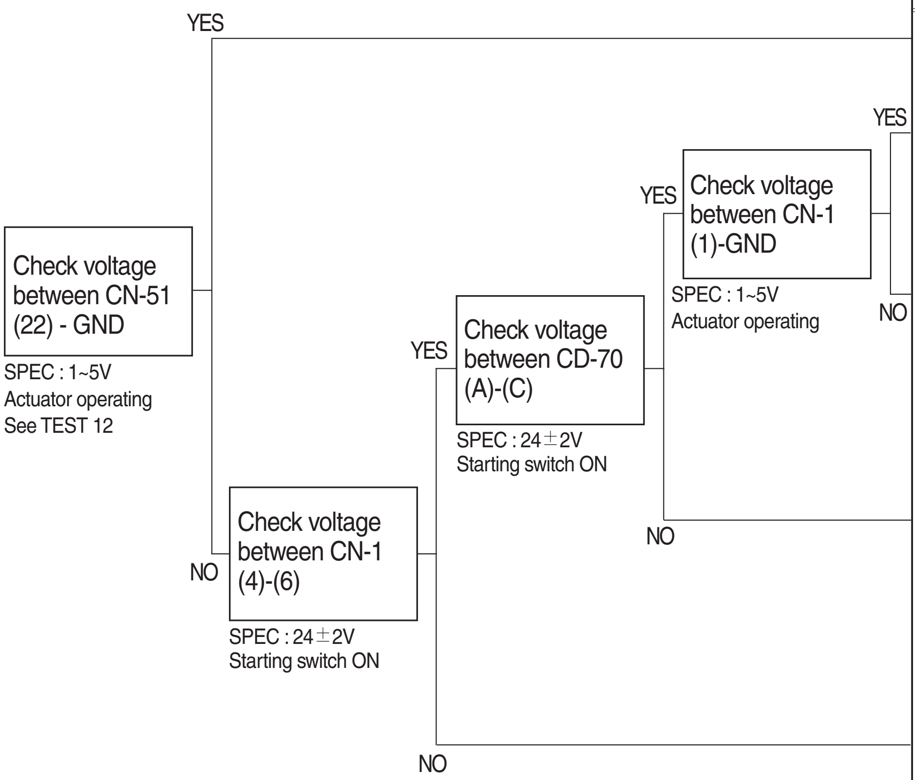
220A6MS108

7. MALFUNCTION OF NEGATIVE 1 PRESSURE SENSOR

· Fault code : HCESPN 123, FMI 0~4

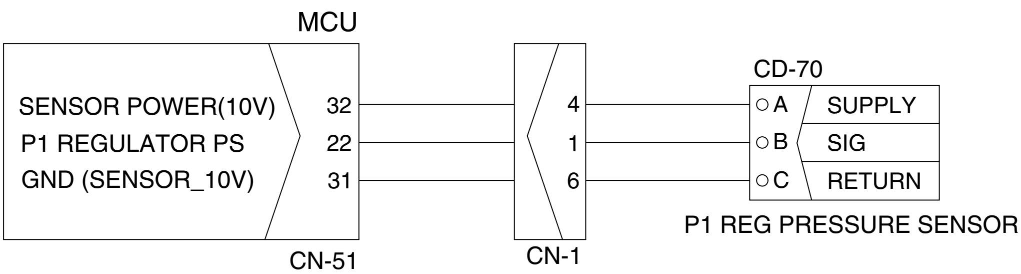
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective 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



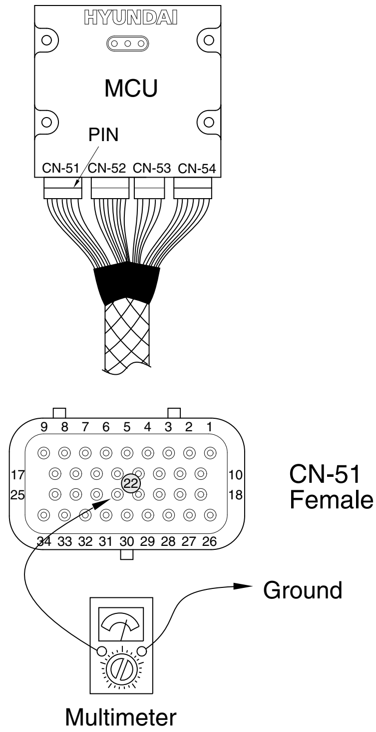
160A6MS11

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



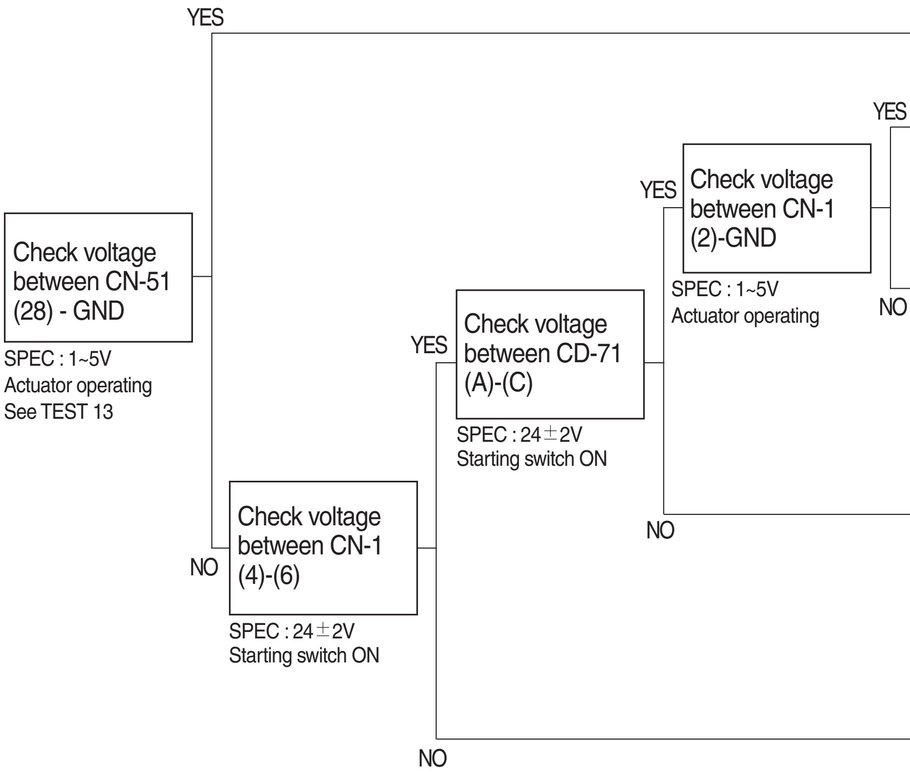
140L6MS112

8. MALFUNCTION OF NEGATIVE 2 PRESSURE SENSOR

· Fault code : HCESPN 124, FMI 0~4

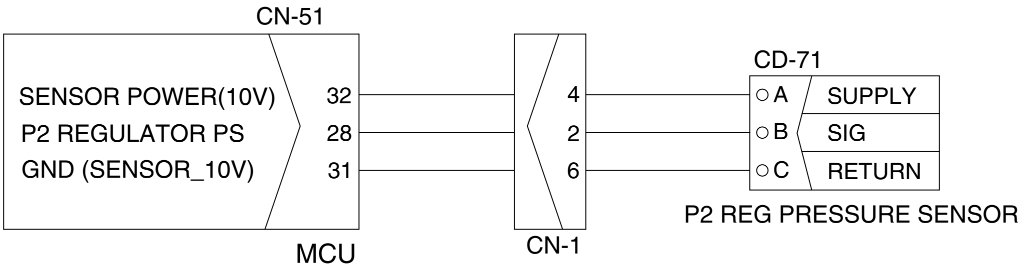
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective 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



160A6MS13

2) TEST PROCEDURE

(1) Test 13 : Check voltage at CN-51 (28) and ground.

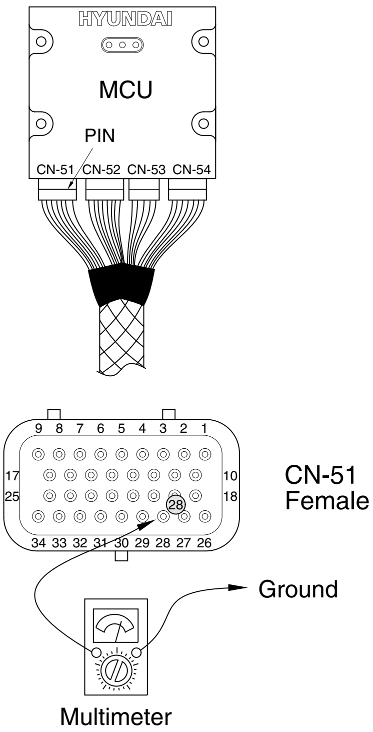
① Prepare 1 piece of thin sharp pin, steel or copper.

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



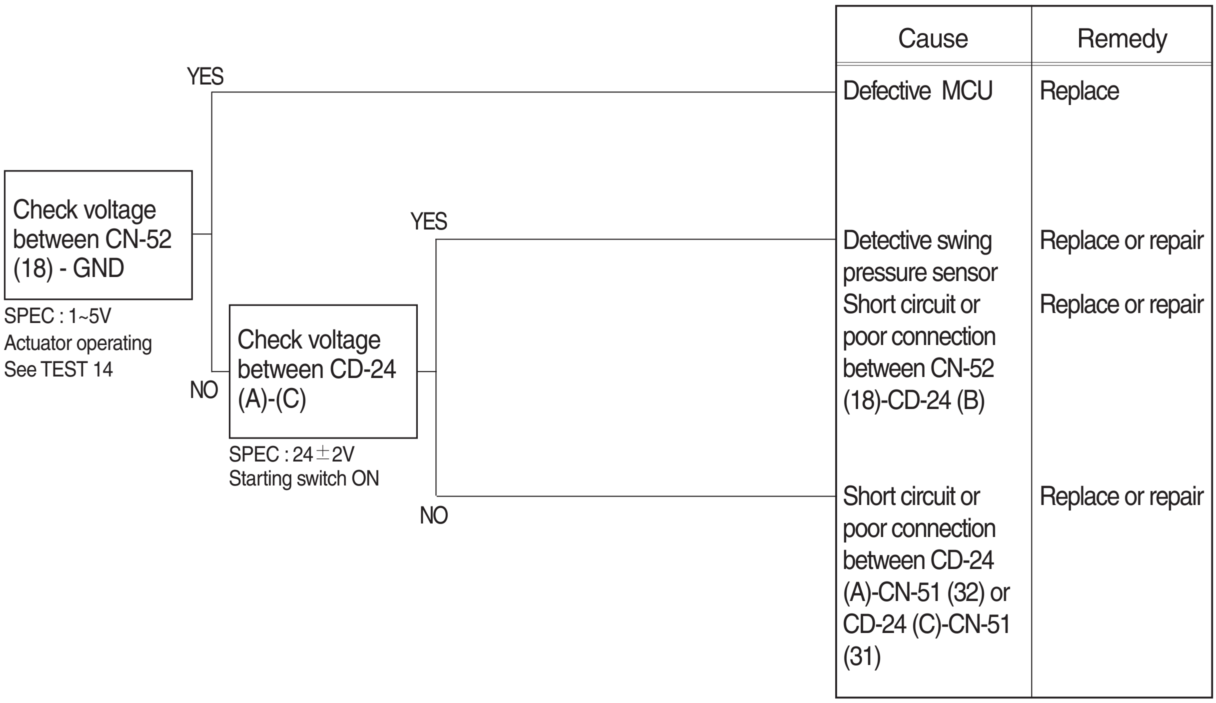
140L6MS114

9. MALFUNCTION OF SWING PRESSURE SENSOR

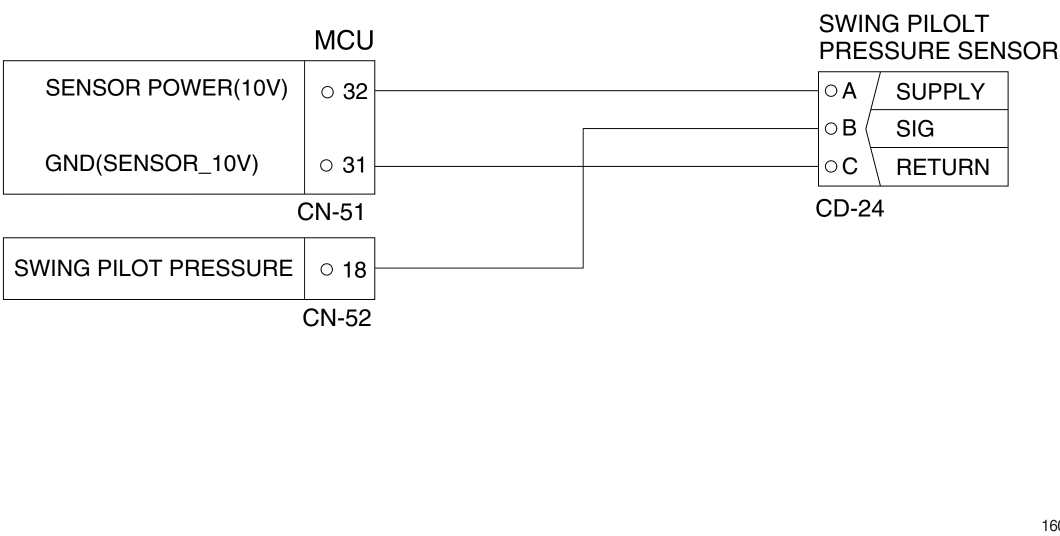
· Fault code : HCESPN 135, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



2) TEST PROCEDURE

(1) Test 14 : Check voltage at CN-52 (18) and ground.

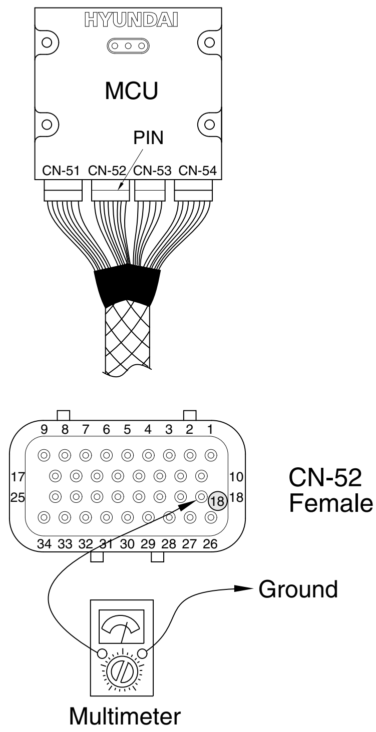
① Prepare 1 piece of thin sharp pin, steel or copper.

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



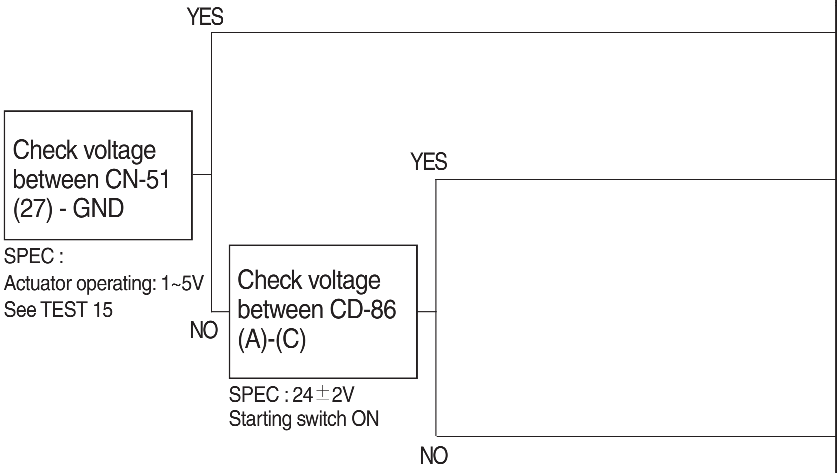
220A6MS116

10. MALFUNCTION OF ARM OUT PRESSURE SENSOR

· Fault code : HCESPN 133, FMI 0~4

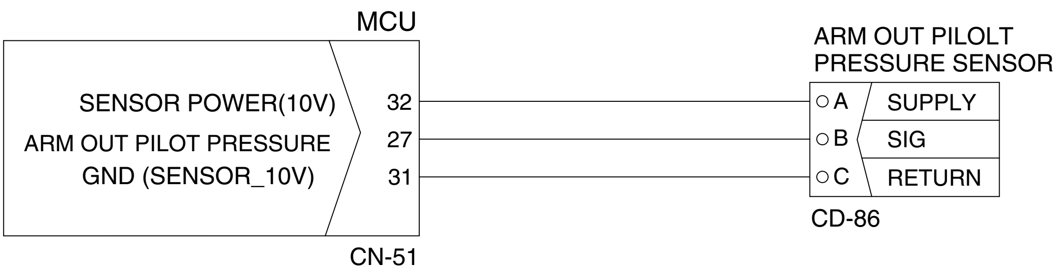
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective 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



160A6MS17

2) TEST PROCEDURE

(1) Test 15 : Check voltage at CN-51 (27) and ground.

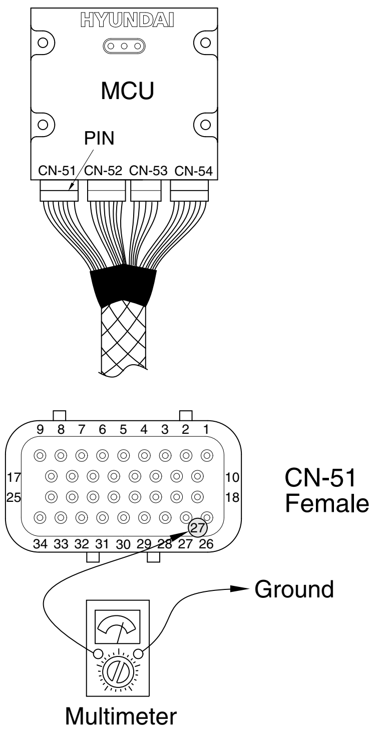
① Prepare 1 piece of thin sharp pin, steel or copper.

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



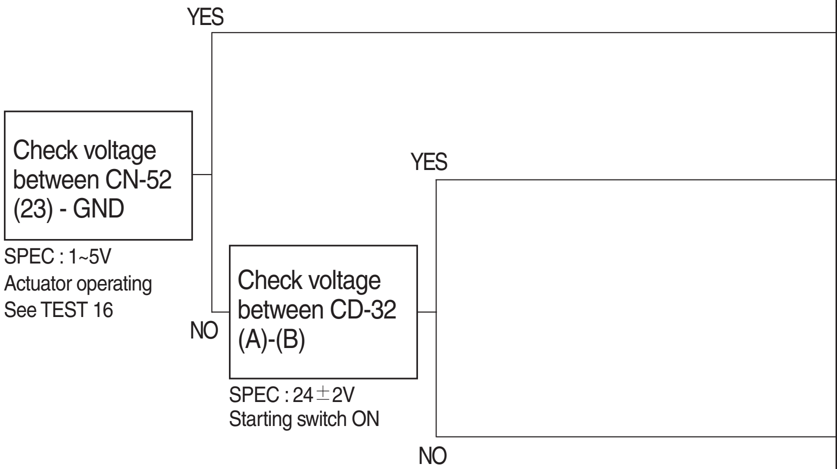
220A6MS118

11. MALFUNCTION OF BOOM UP PRESSURE SENSOR

· Fault code : HCESPN 127, FMI 0~4

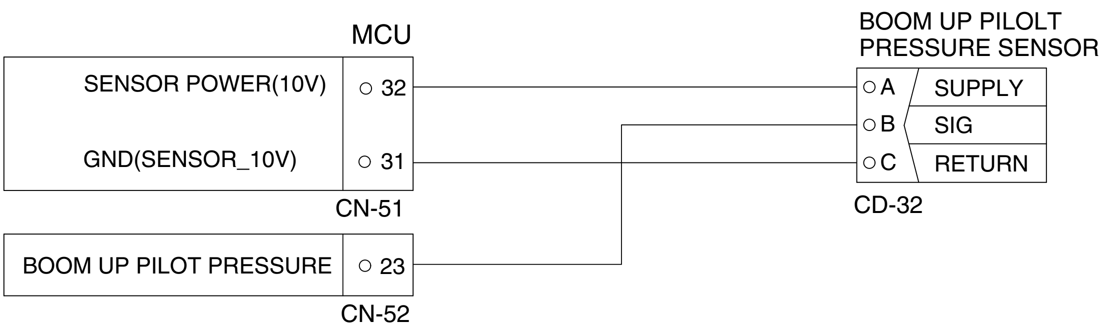
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective 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



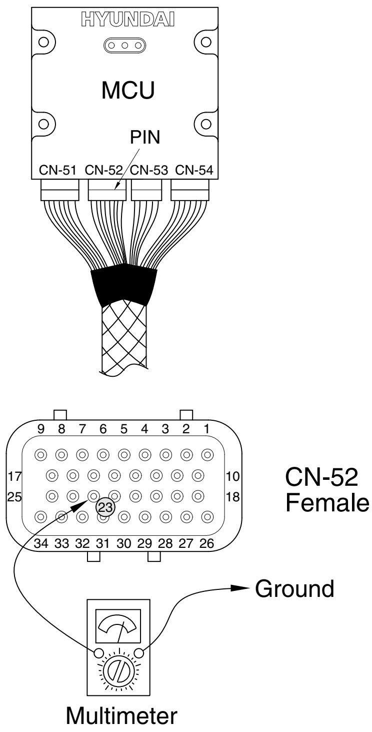
160A6MS19

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



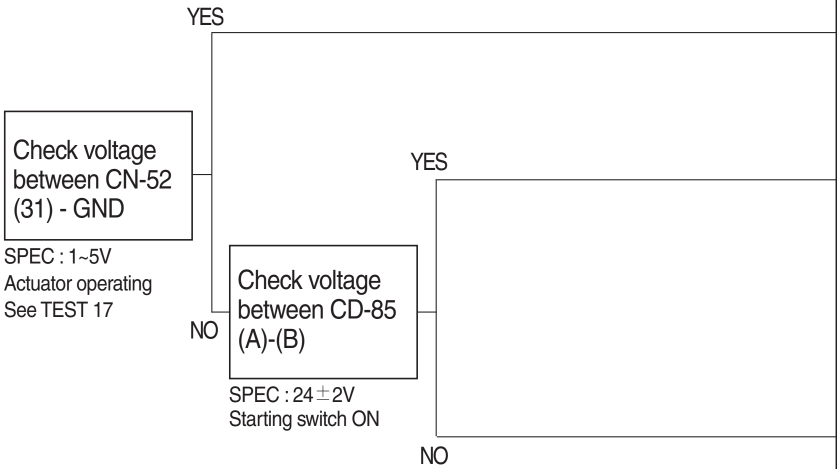
220A6MS120

12. MALFUNCTION OF BOOM DOWN PRESSURE SENSOR

· Fault code : HCESPN 128, FMI 0~4

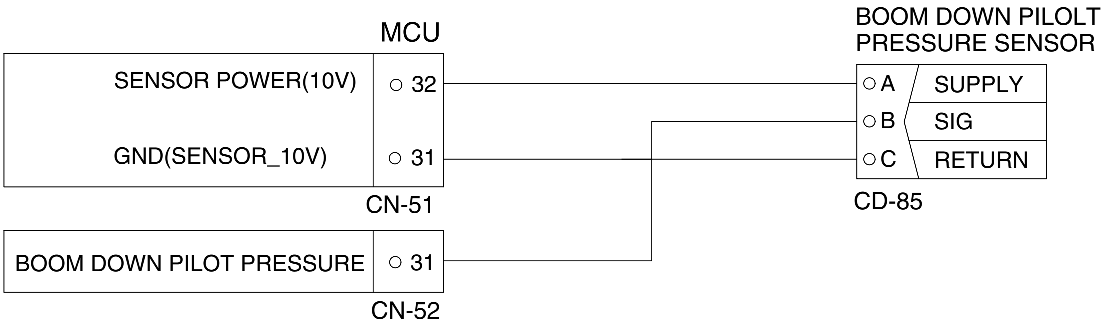
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective 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



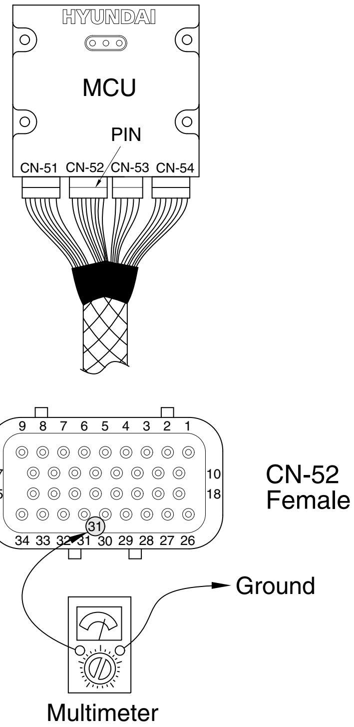
160A6MS21

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



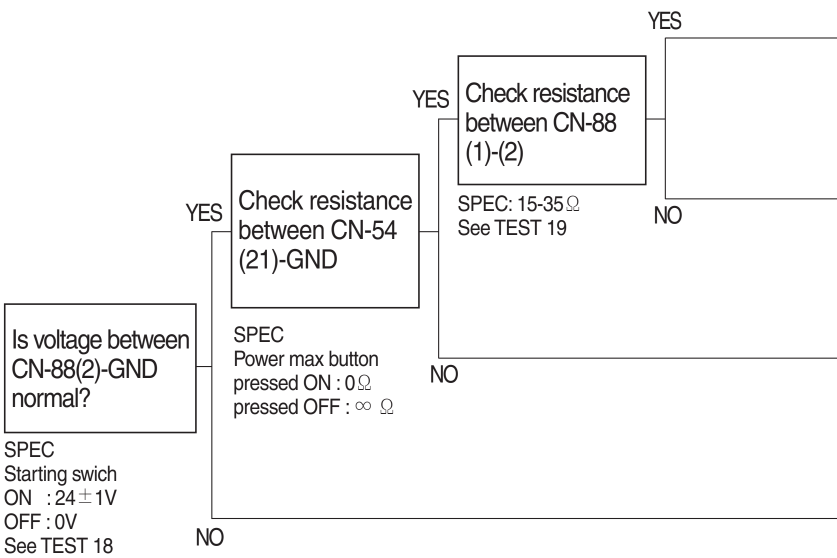
220A6MS122

13. MALFUNCTION OF POWER MAX

· Fault code : HCESPN 166, FMI 4 or 6

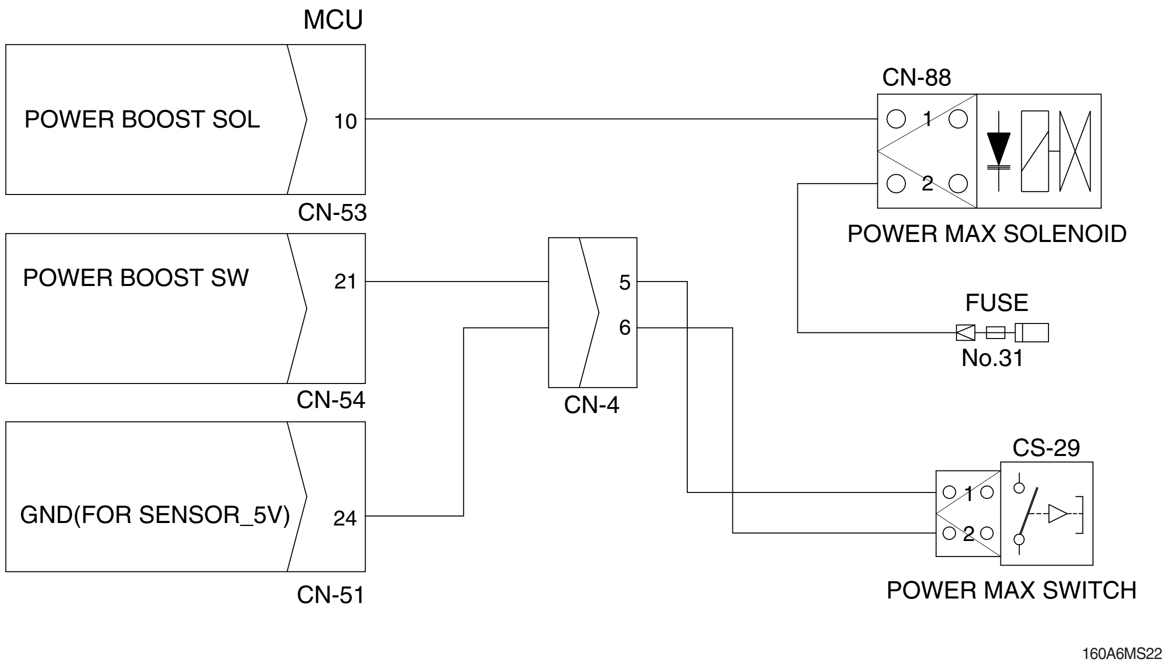
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Short circuit or poor connection between CN-88 (1)-CN-53 (10)	Repair or replace
Defective power max. solenoid valve Check hydraulic system	Repair or replace
Short circuit or poor connection between CN-54 (21)-CS-29 (1)	Repair or replace
Short circuit or poor connection between CN-88 (2)- Fuse No. 31	Repair or replace

Wiring diagram

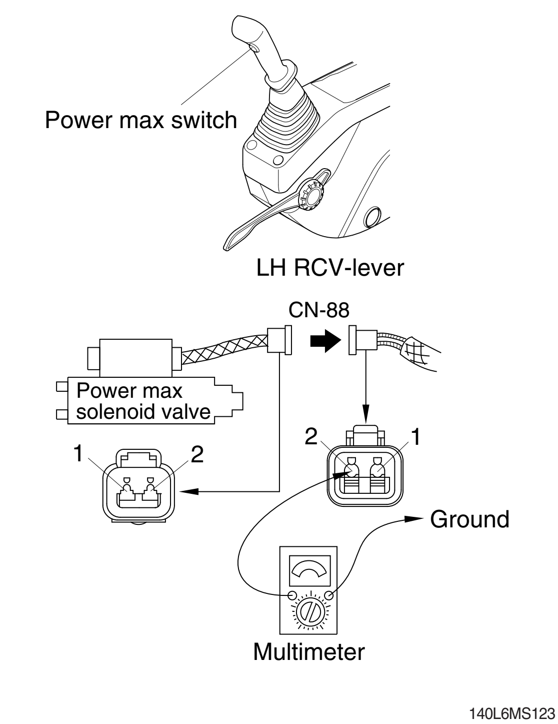


2) TEST PROCEDURE

(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.

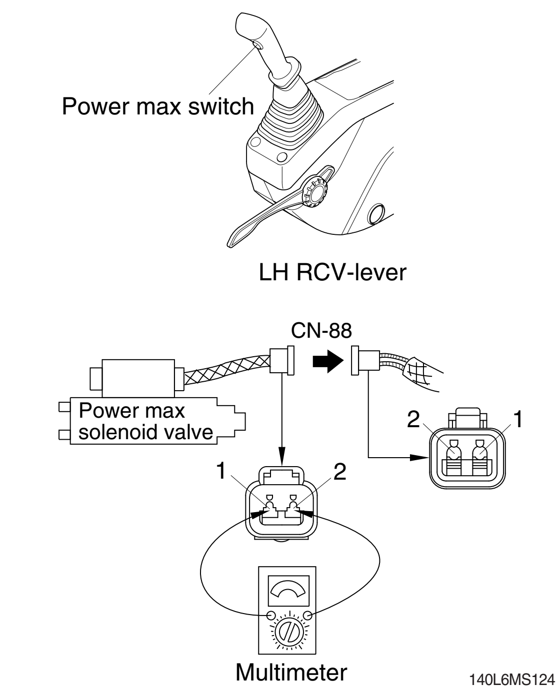
SPEC : Starting switch ON : 24±1V
Starting switch OFF : 0V



(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.

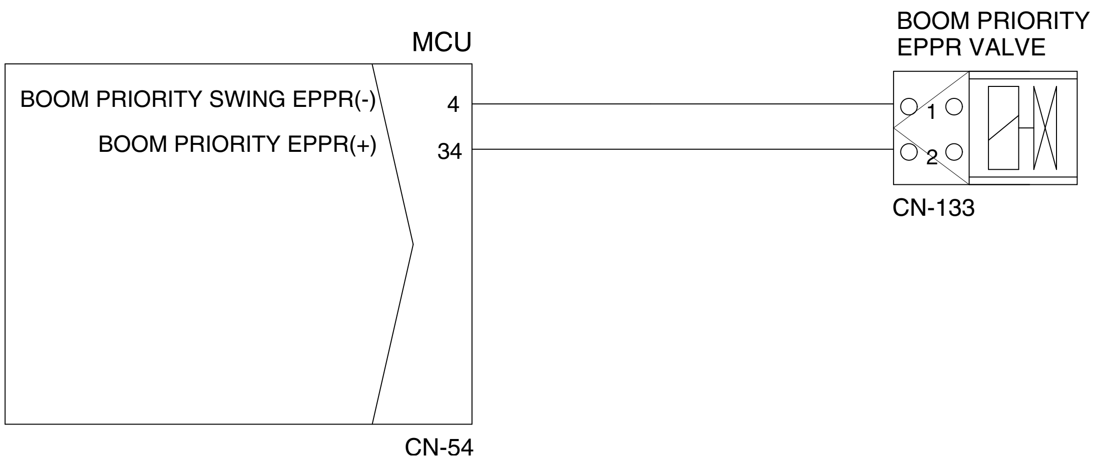
1) INSPECTION PROCEDURE

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

SPEC : 20~30V
Starting switch ON

	Cause	Remedy
YES	Short circuit or poor connection between CN-54 (4)-CN-133 (1) or CN-54 (34)-CN-133 (2)	Repair or replace
NO	Defective EPPR valve	Repair or replace

Wiring diagram



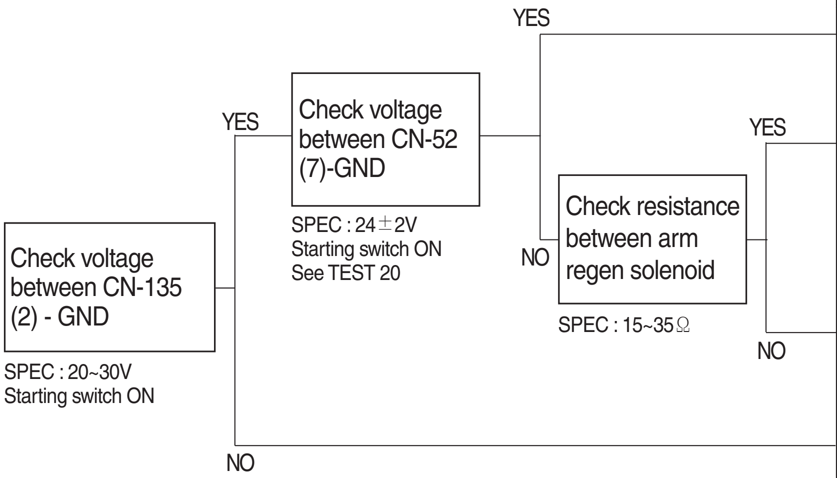
160A6MS23

15. MALFUNCTION OF ARM REGENERATION SOLENOID

· Fault code : HCESPN 170, FMI 4 or 6

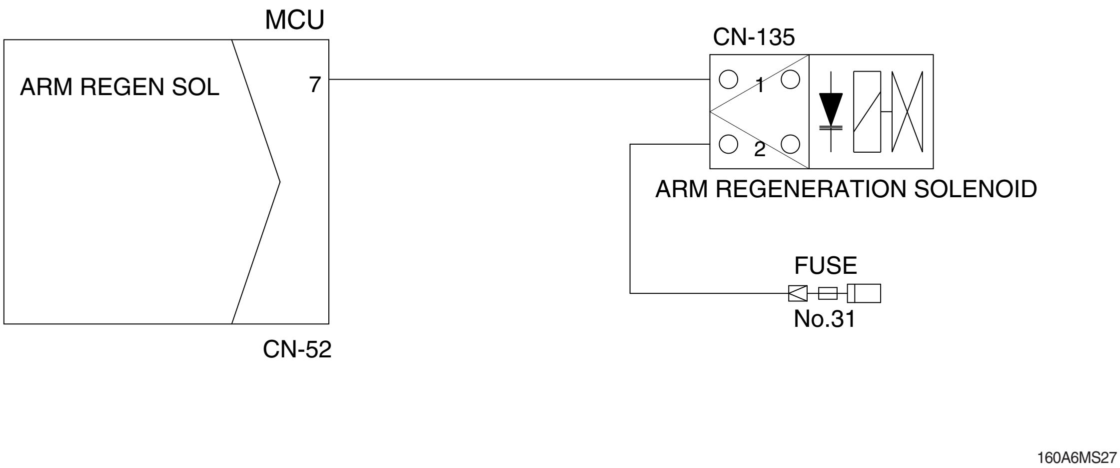
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Short circuit or poor connection between CN-52 (7)-CN-135 (1)	Replace or repair
Defective solenoid valve	Replace
Open circuit between CN-135 (2)-Fuse No. 31	Replace or repair

Wiring diagram



2) TEST PROCEDURE

(1) Test 20 : Check voltage at CN-52 (7) and ground.

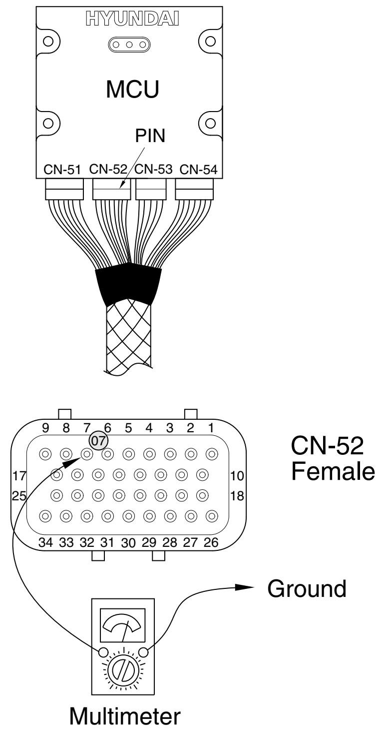
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (7) of CN-52.

③ Starting switch ON.

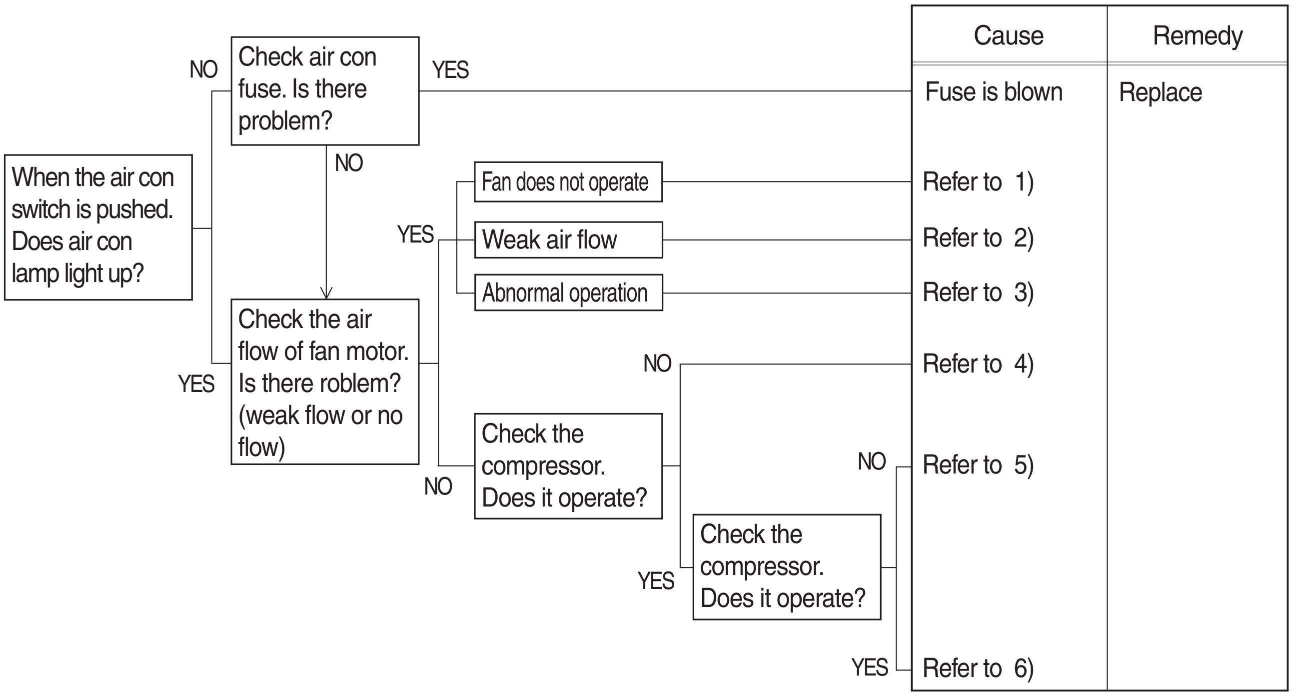
④ Check voltage as figure.

SPEC : Key ON : 24±2 V



140L6MS128

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

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.

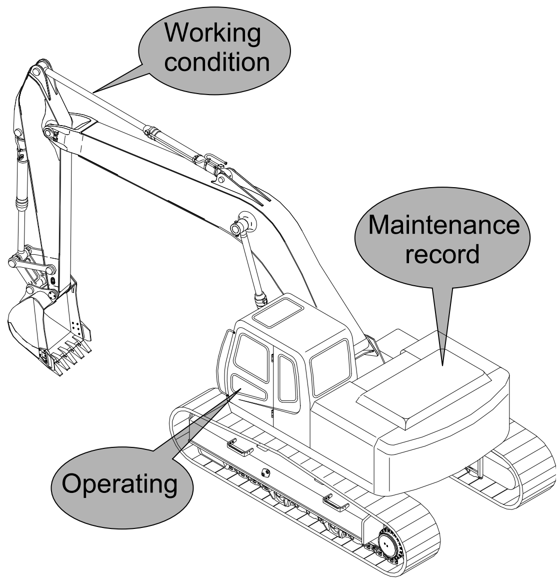
2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

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.

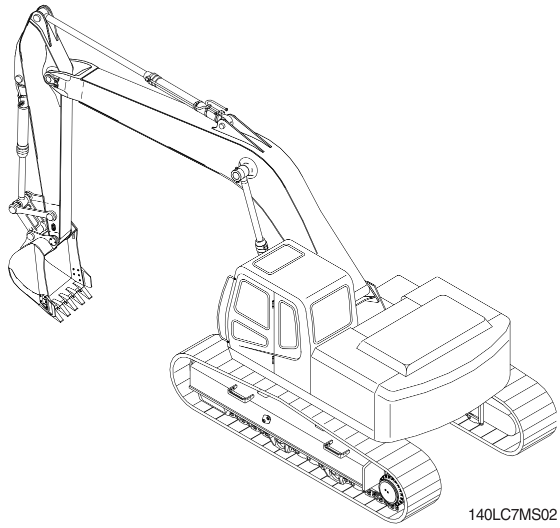


140LC7MS01

2. TERMINOLOGY

1) STANDARD

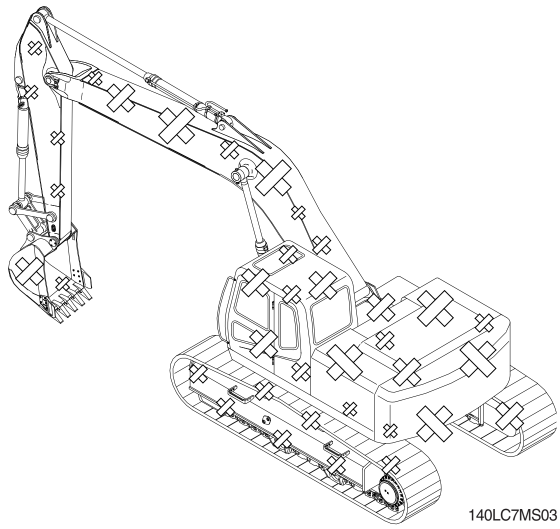
Specifications applied to the brand-new machine, components and parts.



140LC7MS02

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.



140LC7MS03

3. OPERATION FOR PERFORMANCE TESTS

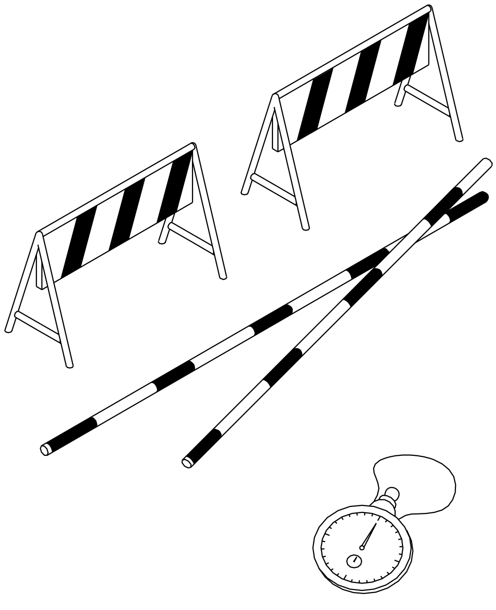
1) Observe the following rules in order to carry out performance tests accurately and safely.

(1) The machine
Repair any defects and damage found, such as oil or water leaks, loose bolts, cracks and so on, before starting to test.

(2) Test area
① Select a hard, flat surface.
② Secure enough space to allow the machine to run straight more than 20m, and to make a full swing with the front attachment extended.
③ If required, rope off the test area and provide signboards to keep unauthorized personnel away.

(3) Precautions
① Before starting to test, agree upon the signals to be employed for communication among coworkers. Once the test is started, be sure to communicate with each other using these signals, and to follow them without fail.
② Operate the machine carefully and always give first priority to safety.
③ While testing, always take care to avoid accidents due to landslides or contact with high voltage power lines. Always confirm that there is sufficient space for full swings.
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

(4) Make precise measurements
① Accurately calibrate test instruments in advance to obtain correct data.
② Carry out tests under the exact test conditions prescribed for each test item.
③ Repeat the same test and confirm that the test data obtained can be procured repeatedly.
Use mean values of measurements if necessary.



(290-7TIER) 7-3

2) ENGINE SPEED

(1) Measure the engine speed at each power mode

※ The engine speed at each power mode must meet standard RPM; if not, all other operational performance data will be unreliable. It is essential to perform this test first.

(2) Preparation

① Warm up the machine, until the engine coolant temperature reaches 50˚C or more, and the hydraulic oil is 50±5˚C.

② Set the multimodal dial at 10 (Max) position.

③ Measure the engine RPM.

(3) Measurement

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

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

③ Select the P-mode.

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

⑤ Measure and record the auto deceleration speed.

(4) Evaluation

The measured speeds should meet the following specifications.

Unit : rpm

Model	Engine speed	Standard	Remarks
HX160A L HX180A L	Start idle	1000±100	
	P mode	1950±50	
	S mode	1850±50	
	E mode	1750±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.

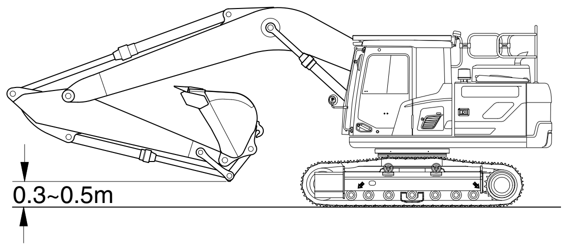
(2) Preparation

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.



160A7MS02

(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.

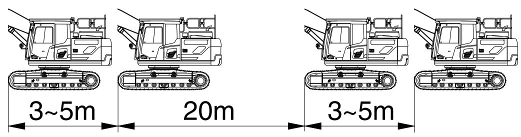
· Power mode switch : P mode

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.



160A7MS03

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds / 20 ㎙

Model	Travel speed	Standard	Maximum allowable	Remarks
HX160A L HX180A L	1 Speed	22.9±2.0	28.6	
	2 Speed	13.4±1.0	16.6	

4) TRACK REVOLUTION SPEED

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

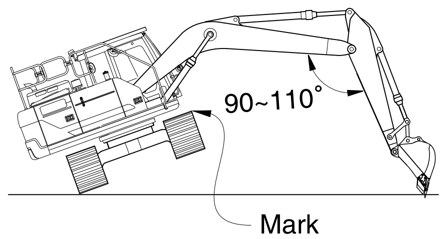
(2) Preparation

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.



160A7MS04

(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
HX160A L HX180A L	1 Speed	28.9±2.0	35.5
	2 Speed	16.7±2.0	21.5

5) TRAVEL DEVIATION

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

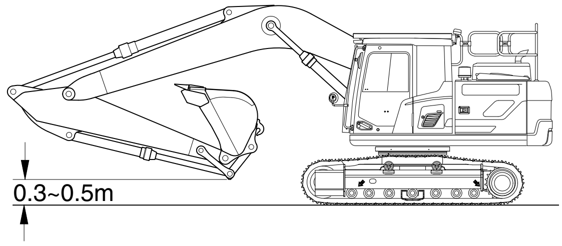
(2) Preparation

① Adjust the tension of both tracks to be equal.

② Provide a flat, solid test yard 20 m in length, with extra length of 3 to 5 m on both ends for machine acceleration and deceleration.

③ Hold the bucket 0.3 to 0.5 m above the ground with the arm and bucket rolled in.

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



160A7MS02

(3) Measurement

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

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

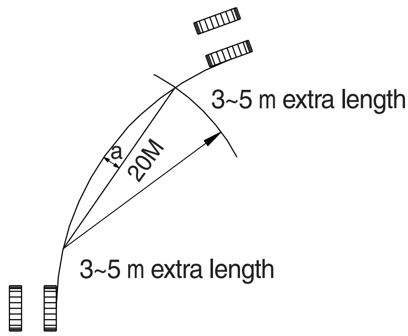
· Power mode switch : P mode

③ Start traveling the machine in the acceleration zone with the travel levers at full stroke.

④ Measure the distance between a straight 20 m line and the track made by the machine. (dimension a)

⑤ After measuring the tracking in forward travel, turn the upperstructure 180 °and measure that in reverse travel.

⑥ Repeat steps ④ and ⑤ three times and calculate the average values.



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(4) Evaluation

Mistrack should be within the following specifications.

Unit : mm / 20 m

Model	Standard	Maximum allowable	Remarks
HX160A L HX180A L	200 below	240	

6) SWING SPEED

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

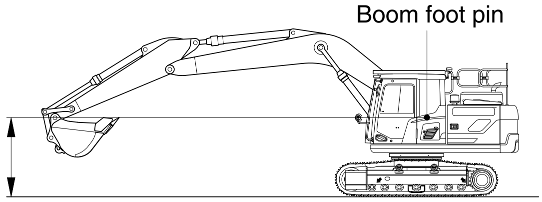
(2) Preparation

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.



160A7MS05

(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

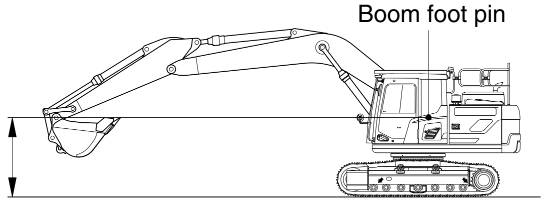
The time required for 3 swings should meet the following specifications.

Unit : Seconds / 3 revolutions

Model	Power mode switch	Standard	Maximum allowable
HX160A L HX180A L	P mode	17.7±1.5	22

7) SWING FUNCTION DRIFT CHECK

(1) Measure the swing drift on the bearing outer circumference when stopping after a 360 °full speed swing.



160A7MS05

(2) Preparation

① Check the lubrication of the swing gear and swing bearing.

② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.

③ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. The bucket must be empty.

④ Make two chalk marks: one on the swing bearing and one directly below it on the track frame.

⑤ Swing the upperstructure 360˚.

⑥ Keep the hydraulic oil temperature at 50±5˚C.

(3) Measurement

① Conduct this test in the M mode.

② Select the following switch positions.

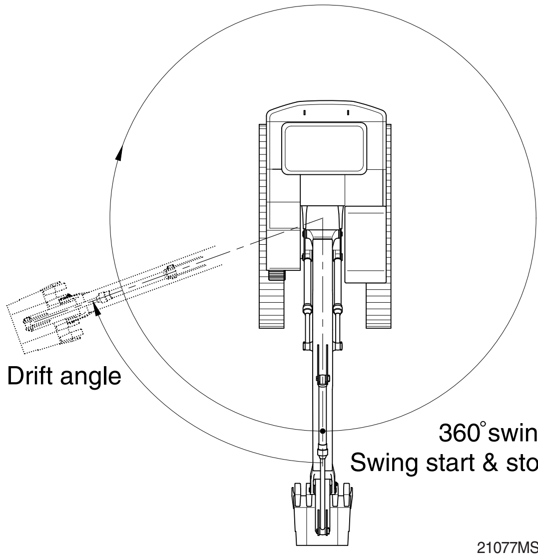
· Power mode switch : P mode

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

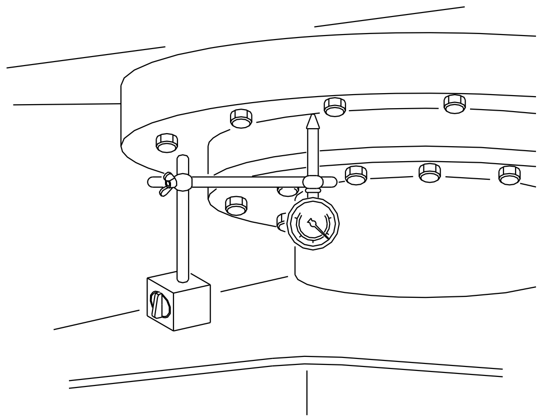
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Power mode switch	Standard	Maximum allowable	Remarks
HX160A L HX180A L	P mode	90 below	157.5	

8) SWING BEARING PLAY

(1) Measure the swing bearing play using a dial gauge to check the wear of bearing races and balls.



(210-7) 7-10(1)

(2) Preparation

① Check swing bearing mounting cap screws for loosening.

② Check the lubrication of the swing bearing. Confirm that bearing rotation is smooth and without noise.

③ Install a dial gauge on the track frame as shown, using a magnetic base.

④ Position the upperstructure so that the boom aligns with the tracks facing towards the front idlers.

⑤ Position the dial gauge so that its needle point comes into contact with the bottom face of the bearing outer race.

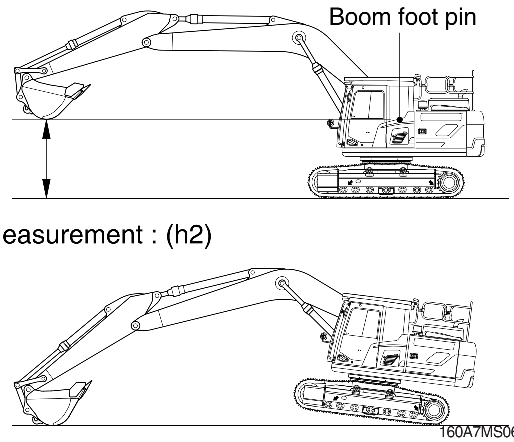
⑥ Bucket should be empty.

(3) Measurement

① With the arm rolled out and bucket rolled in, hold the bottom face of the bucket to the same height of the boom foot pin. Record the dial gauge reading (h1).

② Lower the bucket to the ground and use it to raise the front idler 50㎝. Record the dial gauge reading (h2).

③ Calculate bearing play (H) from this data (h1 and h2) as follows. H=h2-h1



160A7MS06

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Standard	Maximum allowable	Remarks
HX160A L HX180A L	0.5 ~ 1.5	3.0	

9) HYDRAULIC CYLINDER CYCLE TIME

(1) Measure the cycle time of the boom, standard arm, and standard bucket cylinders.

(2) Preparation

① To measure the cycle time of the boom cylinders:
With the arm rolled out and the empty bucket rolled out, lower the bucket to the ground, as shown.

② To measure the cycle time of the arm cylinder.
With the empty bucket rolled in, position the arm so that it is vertical to the ground. Lower the boom until the bucket is 0.5 m above the ground.

③ To measure the cycle time of the bucket cylinder.
The empty bucket should be positioned at midstroke between roll-in and roll-out, so that the sideplate edges are vertical to the ground.

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

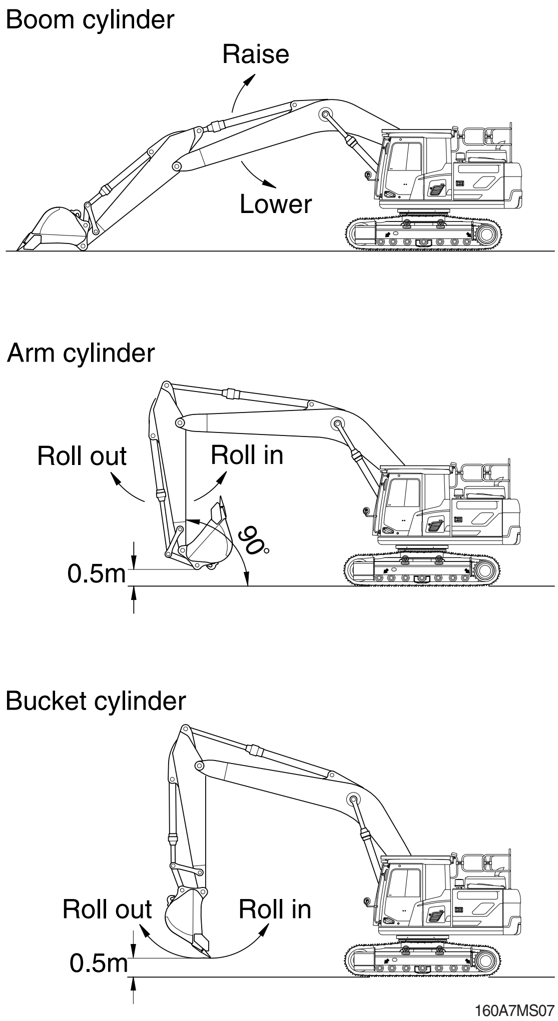
(3) Measurement

① Select the following switch positions.

· Power mode switch : P mode

② To measure cylinder cycle times.

- Boom cylinders.
Measure the time it takes to raise the boom, and the time it takes to lower the boom. To do so, position the boom at one stroke end then move the control lever to the other stroke end as quickly as possible.
- Arm cylinder.
Measure the time it takes to roll in the arm, and the time it takes to roll out the arm. To do so, position the bucket at one stroke end, then move the control lever to the other stroke end as quickly as possible.



160A7MS07

- 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
HX160A L HX180A L	Boom raise		3.6±0.4	4.4	
	Boom lower		2.4±0.4	3.1	
	Arm in	Regen ON	2.6±0.4	3.3	
		Regen OFF	3.0±0.4	3.8	
	Arm out		3.1±0.3	3.8	
	Bucket in		4.0±0.4	4.8	
	Bucket out		2.8±0.4	3.5	

10) DIG FUNCTION DRIFT CHECK

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

(2) Preparation

① Load bucket fully. Instead of loading the bucket, weight(W) of the following specification can be used.

· $W=M^3 \times 1.5$

Where :

M^3 = Bucket heaped capacity (m^3)

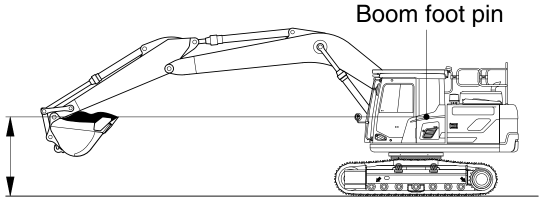
1.5 = Soil specific gravity

② Position the arm cylinder with the rod 20 to 30 mm extended from the fully retracted position.

③ Position the bucket cylinder with the rod 20 to 30 mm retracted from the fully extended position.

④ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin.

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



160A7MS08

(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
HX160A L HX180A 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
HX160A L HX180A L	Boom lever	1.9 or below	2.5	
	Arm lever	1.9 or below	2.5	
	Bucket lever	1.9 or below	2.5	
	Swing lever	1.9 or below	2.5	
	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.

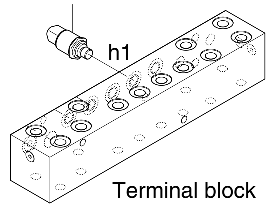
(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Kind of lever	Standard	Maximum allowable	Remarks
HX160A L HX180A L	Boom lever	90±10	115	
	Arm lever	90±10	115	
	Bucket lever	90±10	115	
	Swing lever	90±10	115	
	Travel lever	142±10	178	

13) PILOT PRIMARY PRESSURE



(1) Preparation

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

(2) Measurement

① Select the following switch positions.

- Power mode switch : P mode
- Auto decel switch : OFF

② 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.

Cluster

160A7MS12

(3) Evaluation

The average measured pressure should meet the following specifications:

Unit : kgf / cm²

Model	Engine speed	Standard	Allowable limits	Remarks
HX160A L HX180A L	P mode	39^{+2}_{0}	-	

14) FOR TRAVEL SPEED SELECTING PRESSURE:

(1) Preparation

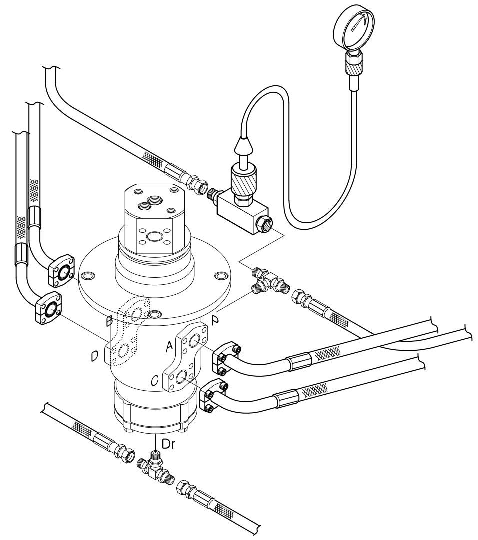
① Stop the engine.

② Loosen the cap and relieve the pressure in the tank by pushing the top of the air breather.

③ To measure the speed selecting pressure: Install a connector and pressure gauge assembly to turning joint P port as shown.

④ Start the engine and check for on leakage from the adapter.

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



21077MS13

(2) Measurement

① Select the following switch positions.
Travel mode switch : 1 speed
2 speed
· Mode selector : P mode

② Measure the travel speed selecting pressure in the Hi or Lo mode.

③ Repeat step ② three times and calculate the average values.

(3) Evaluation

The average measured pressure should be within the following specifications.

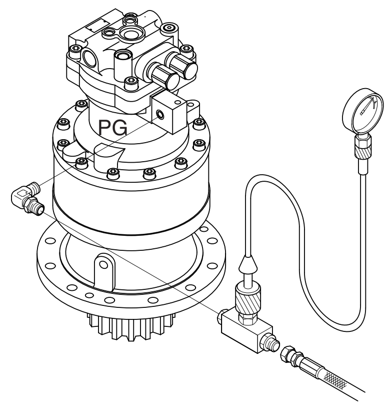
Unit : kgf / cm^2

Model	Travel speed mode	Standard	Maximum allowable	Remarks
HX160A L HX180A L	1 Speed	0	-	
	2 Speed	40±5	-	

15) SWING PARKING BRAKE RELEASING PILOT PRESSURE

(1) Preparation

① Stop the engine.
② Loosen the cap and relieve the pressure in the tank by pushing the top of the air breather.
③ The pressure release L wrench to bleed air.
④ Install a connector and pressure gauge assembly to swing motor 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.



160A7MS14

(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.
③ Repeat step ② three times and calculate the average values.

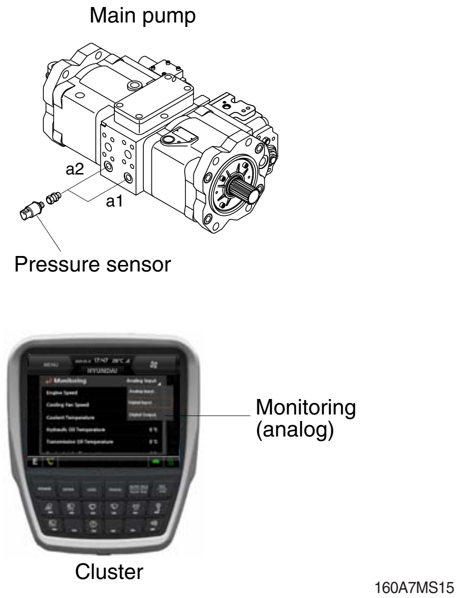
(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm^2

Model	Description	Standard	Allowable limits	Remarks
HX160A L HX180A L	Brake disengaged	40^{+5}_{-5}	Over 20.9	
	Brake applied	0	-	

16) MAIN PUMP DELIVERY PRESSURE



(1) Preparation

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

(2) Measurement

① Select the following switch positions.

· Power mode switch : P mode

② Measure the main pump delivery pressure in the P mode (high idle).

(3) Evaluation

The average measured pressure should meet the following specifications.

Unit : kgf / cm^2

Model	Engine speed	Standard	Allowable limits	Remarks
HX160A L HX180A L	High idle	32±5	-	

17) SYSTEM PRESSURE REGULATOR RELIEF SETTING

(1) Preparation

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

(2) Measurement

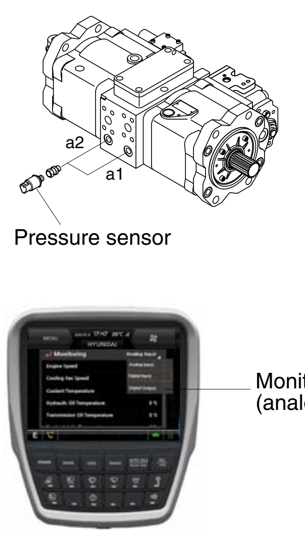
① Select the following switch positions.

· Power mode switch : P mode

② Slowly operate each control lever of boom, arm and bucket functions at full stroke over relief and measure the pressure.

③ In the swing function, place bucket against an immovable object and measure the relief pressure.

④ In the travel function, lock undercarriage with an immovable object and measure the relief pressure.



160A7MS15

(3) Evaluation

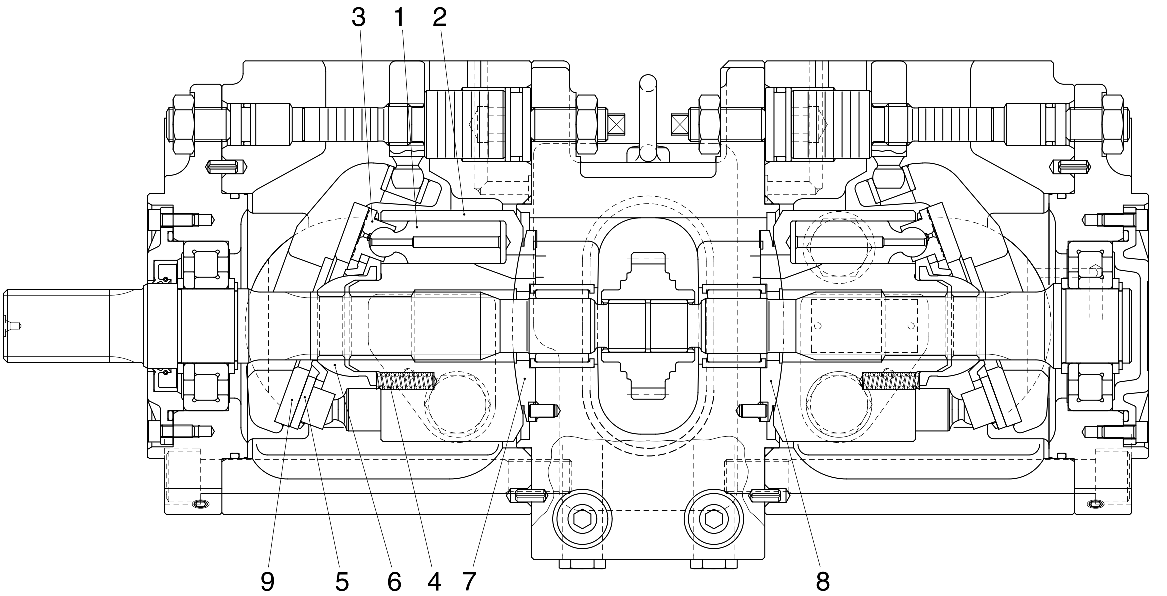
The average measured pressure should be within the following specifications.

Unit : kgf / cm^2

Model	Function to be tested	Standard	Port relief setting at 20 lpm
HX160A L HX180A L	Boom, Arm, Bucket	350 (380)±10	400±10
	Travel	350±10	-
	Swing	285±10	-

(　) : Power boost

1. MAIN PUMP



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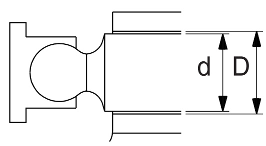
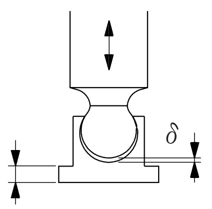
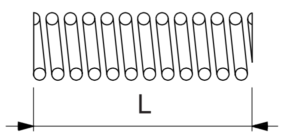
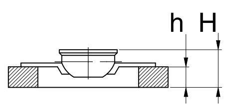
Part name & inspection item		Standard dimension	Recommended replacement value	Counter measures
Clearance between piston (1) & cylinder bore (2) (D-d)		0.028	0.056	Replace piston or cylinder.
Play between piston (1) & shoe caulking section (3) (δ)		0-0.1	0.3	Replace assembly of piston & shoe.
Thickness of shoe (t)		3.9	3.7	
Free height of cylinder spring(4) (L)		31.3	30.5	Replace cylinder spring.
Combined height of set plate(5)(H) & spherical bushing(6)(h) (H-h)		19.0	18.3	Replace retainer or set plate.
Surface roughness for valve plate (Sliding face)(7,8), swash plate (shoe plate area) (9), & cylinder (2) (Sliding face)	Surface roughness necessary to be corrected	3z		Lapping
	Standard surface roughness (Corrected value)	0.4z or lower		

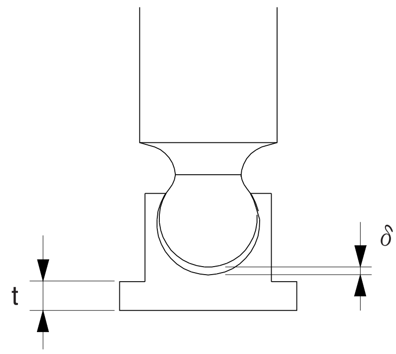
2. MAIN CONTROL VALVE

Part name	Inspection item	Criteria & measure
Casing	· Existence of scratch, rusting or corrosion.	· In case of damage in following section, replace part. - Sliding sections of casing fore and spool, especially land sections applied with holded pressure. - Seal pocket section where spool is inserted. - Seal section of port where O-ring contacts. - Seal section of each relief valve for main, travel, and port. - Other damages that may damage normal functions.
Spool	· Existence of scratch, gnawing, rusting or corrosion. · O-ring seal sections at both ends. · Insert spool in casing hole, rotate and reciprocate it.	· Replacement when its outside sliding section has scratch (especially on seals-contacting section). · Replacement when its sliding section has scratch. · Correction or replacement when O-ring is damaged or when spool does not move smoothly.
Poppet	· Damage of poppet or spring · Insert poppet into casing and function it.	· Correction or replacement when sealing is incomplete. · Normal when it can function lightly without being caught.
Around spring	· Rusting, corrosion, deformation or breaking of spring, spring seat, plug or cover.	· Replacement for significant damage.
Around seal for spool	· External oil leakage. · Rusting, corrosion or deformation of seal plate.	· Correction or replacement. · Correction or replacement.
Main relief valve, port relief valve & negative control relief valve	· External rusting or damage. · Contacting face of valve seat. · Contacting face of poppet. · Abnormal spring. · O-rings, back up rings and seals.	· Replacement. · Replacement when damaged. · Replacement when damaged. · Replacement. · 100% replacement in general.

3. SWING DEVICE

1) WEARING PARTS

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



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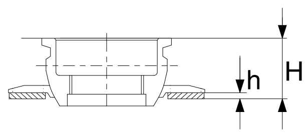

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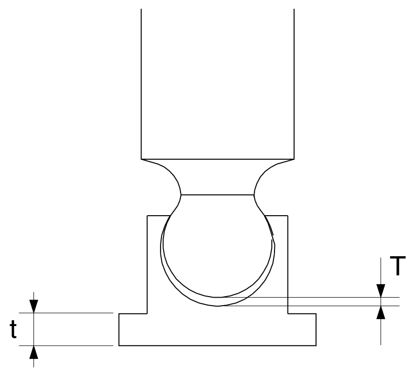
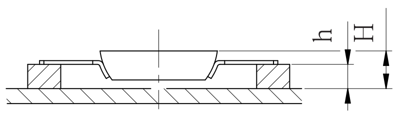
2) SLIDING PARTS

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

4. TRAVEL MOTOR

Inspection item	Standard dimension	Recommended replacement value	Counter measures
Clearance between piston and cylinder block bore	0.025	0.050	Replace piston or cylinder block
Play between piston and shoe caulking section (T)	0	0.3	Replace assembly of piston and shoe
Thickness of shoe (t)	4.5	4.3	Replace assembly of piston and shoe
Combined height of set plate and ball guide (H)	7.3	7.0	Replace set of set plate and ball guide
Thickness of friction plate	3.0	2.6	Replace

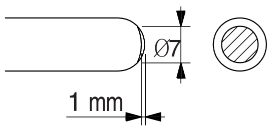




2) SLIDING PARTS

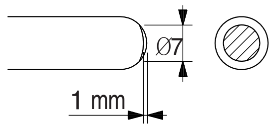
Part name	Standard roughness	Remark
Shoe	0.8S	-
Shoe plate	0.8S	-
Cylinder	0.8S	-
Valve plate	0.8S	-

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 1mm.	
Play at operating section	The pin, shaft, and joint of the operating section are to be replaced when their plays become more than 2 mm due to wears or so on.	When a play is due to looseness of a tightened section, adjust it.
Operation stability	When abnormal noises, hunting, primary pressure drop, etc. are generated during operation, and these cannot be remedied, referring to section 6 troubleshooting, replace the related parts.	

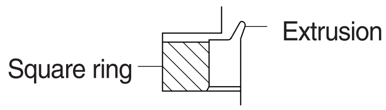
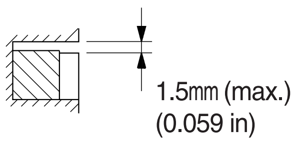
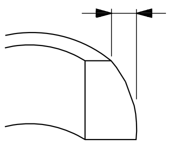
Notes 1. It is desirable to replace seal materials, such as O-rings, every disassembling. However, they may be reused, after being confirmed to be free of damage.

6. RCV PEDAL

Maintenance check item	Criteria	Remark
Leakage	The valve is to be replaced when the leakage effect to the system. For example, the primary pressure drop.	Conditions : Primary pressure : 40 kgf/cm^2 Oil viscosity : 23 cSt
Spool	This is to be replaced when the sliding surface has worn more than 10 μm, compared with the non-sliding surface.	The leakage at the left condition is estimated to be nearly equal to the above leakage.
Push rod	 This is to be replaced when the top end has worn more than 1 mm.	
Play at operating section	The pin, shaft, and joint of the operating section are to be replaced when their plays become more than 2 mm due to wears or so on.	When a play is due to looseness of a tightened section, adjust it.
Operation stability	When abnormal noises, hunting, primary pressure drop, etc. are generated during operation, and these cannot be remedied, referring to section 6. Troubleshooting, replace the related parts.	

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

7. TURNING JOINT

Part name		Maintenance standards	Remedy
Body, Stem	Sliding surface with sealing sections.	Plating worn or peeled due to seizure or contamination.	Replace
	Sliding surface between body and stem other than sealing section.	· Worn abnormality or damaged more than 0.1 mm (0.0039 in) in depth due to seizure contamination.	Replace
		· Damaged more than 0.1 mm (0.0039 in) in depth.	Smooth with oilstone.
	Sliding surface with thrust plate.	· Worn more than 0.5 mm (0.02 in) or abnormality.	Replace
		· Worn less than 0.5 mm (0.02 in).	Smooth
		· Damage due to seizure or contamination remediable within wear limit (0.5 mm) (0.02 in).	Smooth
Cover	Sliding surface with thrust plate.	· Worn more than 0.5 mm (0.02 in) or abnormality.	Replace
		· Worn less than 0.5 mm (0.02 in).	Smooth
		· Damage due to seizure or contamination remediable within wear limit (0.5 mm) (0.02 in).	Replace
Seal set	-	· Extruded excessively from seal groove square ring. 	Replace
	-	· Slipper ring 1.5 mm (0.059 in) narrower than seal groove, or narrower than back ring. 	Replace
	-	· Worn more than 0.5 mm (0.02 in) ~ 1.5 mm (MAX.) (0.059 in) 	Replace

8. CYLINDER

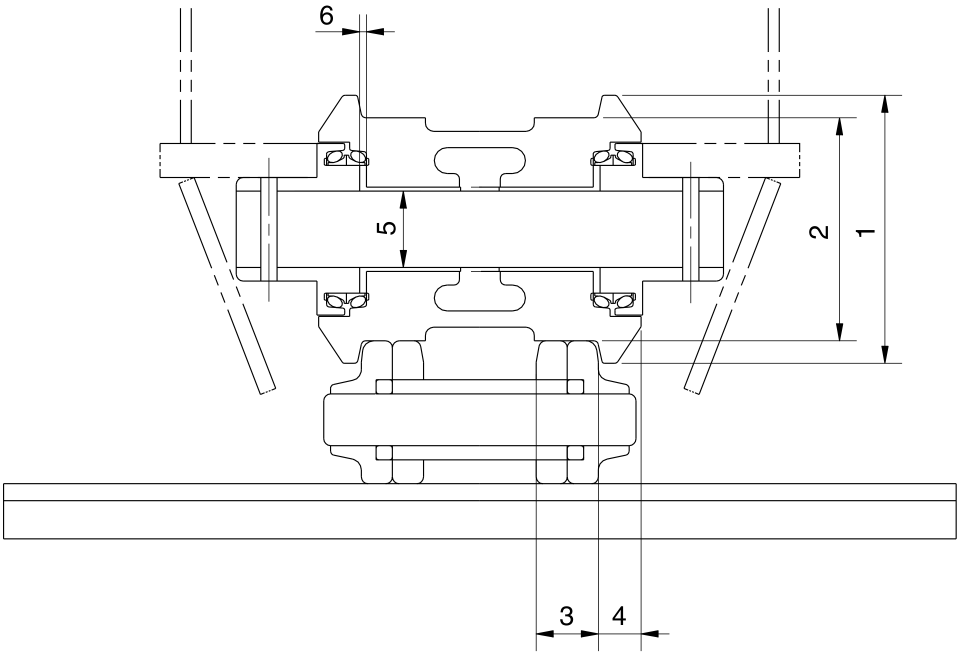
Part name	Inspecting section	Inspection item	Remedy
Piston rod	· Neck of rod pin	· Presence of crack	· Replace
	· Weld on rod hub	· Presence of crack	· Replace
	· Stepped part to which piston is attached.	· Presence of crack	· Replace
	· Threads	· Presence of crack	· Recondition or replace
	· Plated surface	· Plating is not worn off to base metal.	· Replace or replate
		· Rust is not present on plating.	· Replace or replate
		· Scratches are not present.	· Recondition, replate or replace
	· Rod	· Wear of O.D.	· Recondition, replate or replace
	· Bushing at mounting part	· Wear of I.D.	· Replace
Cylinder tube	· Weld on bottom	· Presence of crack	· Replace
	· Weld on head	· Presence of crack	· Replace
	· Weld on hub	· Presence of crack	· Replace
	· Tube interior	· Presence of faults	· Replace if oil leak is seen
	· Bushing at mounting part	· Wear on inner surface	· Replace
Gland	· Bushing	· Flaw on inner surface	· Replace if flaw is deeper than coating

GROUP 3 TRACK AND WORK EQUIPMENT

1. TRACK

1) LOWER ROLLER

(1) HX160A L

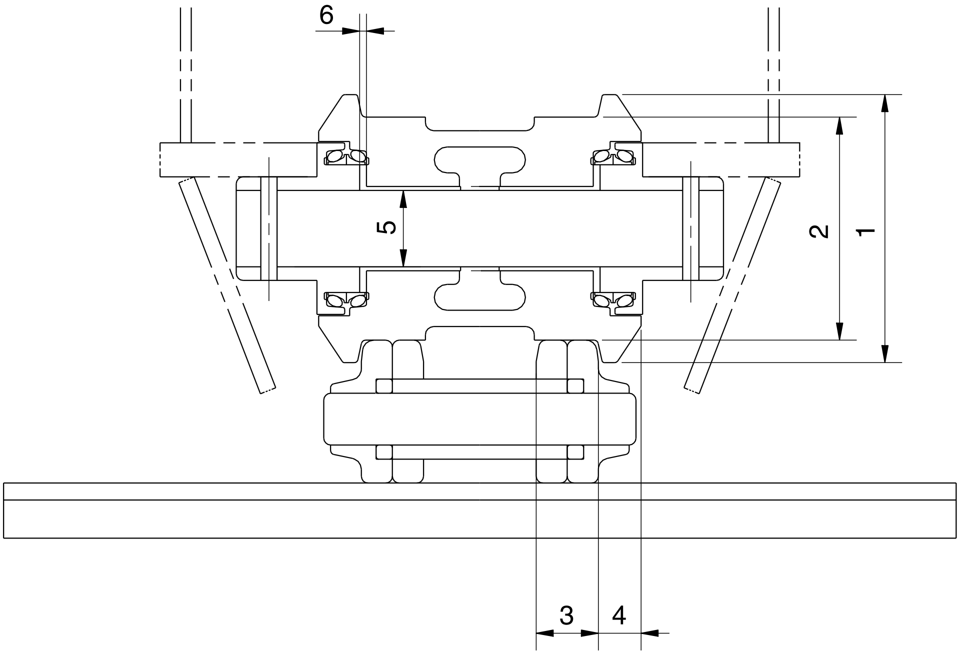


21037MS01

Unit : mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="4">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outside diameter of flange</td><td colspan="2">Standard size</td><td colspan="2">Repair limit</td><td rowspan="5">Rebuild or replace</td></tr>
<tr><td colspan="2">Ø185</td><td colspan="2">-</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="2">Ø150</td><td colspan="2">Ø138</td></tr>
<tr><td>3</td><td>Width of tread</td><td colspan="2">45</td><td colspan="2">39</td></tr>
<tr><td>4</td><td>Width of flange</td><td colspan="2">29</td><td colspan="2">-</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Clearance between shaft and bushing</td><td colspan="2">Standard size & tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="3">Replace bushing</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>Ø65 $^{0}_{-0.03}$</td><td>Ø65 $^{+0.17}_{+0.30}$</td><td>0.17~0.33</td><td>2.0</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Side clearance of roller (both side)</td><td colspan="2">Standard clearance</td><td colspan="2">Clearance limit</td><td rowspan="2">Replace</td></tr>
<tr><td colspan="2">0.23~1.32</td><td colspan="2">2.0</td></tr>
</table>

(2) HX180A L

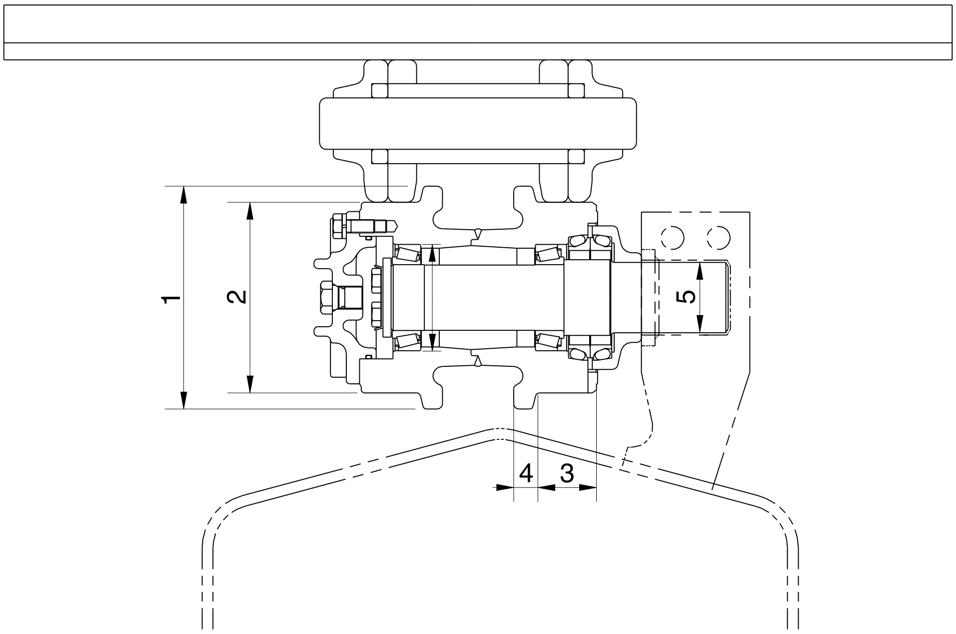


21037MS01

Unit : ㎜

<table>
<tr><th>No.</th><th>Check item</th><th colspan="4">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outside diameter of flange</td><td colspan="2">Standard size</td><td colspan="2">Repair limit</td><td rowspan="5">Rebuild or replace</td></tr>
<tr><td colspan="2">Ø185</td><td colspan="2">–</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="2">Ø160</td><td colspan="2">Ø148</td></tr>
<tr><td>3</td><td>Width of tread</td><td colspan="2">43.5</td><td colspan="2">37.5</td></tr>
<tr><td>4</td><td>Width of flange</td><td colspan="2">20.5</td><td colspan="2">-</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Clearance between shaft and bushing</td><td colspan="2">Standard size & tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="3">Replace bushing</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>Ø70 $^{0}_{-0.03}$</td><td>Ø70 $^{+0.168}_{+0.304}$</td><td>0.168~0.334</td><td>2.0</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Side clearance of roller (both side)</td><td colspan="2">Standard clearance</td><td colspan="2">Clearance limit</td><td rowspan="2">Replace</td></tr>
<tr><td colspan="2">0.26~1.22</td><td colspan="2">2.0</td></tr>
</table>

2) UPPER ROLLER

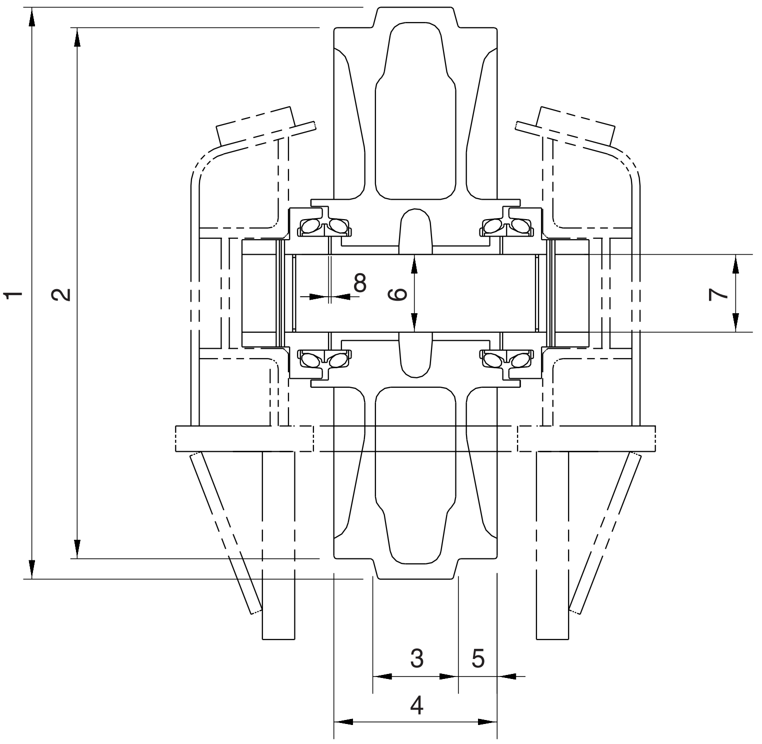


16077MSS02

Unit : mm

No.	Check item	Criteria				Remedy
1	Outside diameter of flange	Standard size		Repair limit		Rebuild or replace
		Ø169		Ø155		
2	Outside diameter of tread	Ø144		Ø134		
3	Width of tread	45.7		40.7		
4	Width of flange	17		-		
5	Clearance between shaft and bushing	Standard size & Tolerance		Standard clearance	Clearance limit	Replace bushing
		Shaft	Hole			
		Ø55 - 0.05 - 0.1	Ø55 +0.3 +0.1	0.15 to 0.40	1.2	

3) IDLER

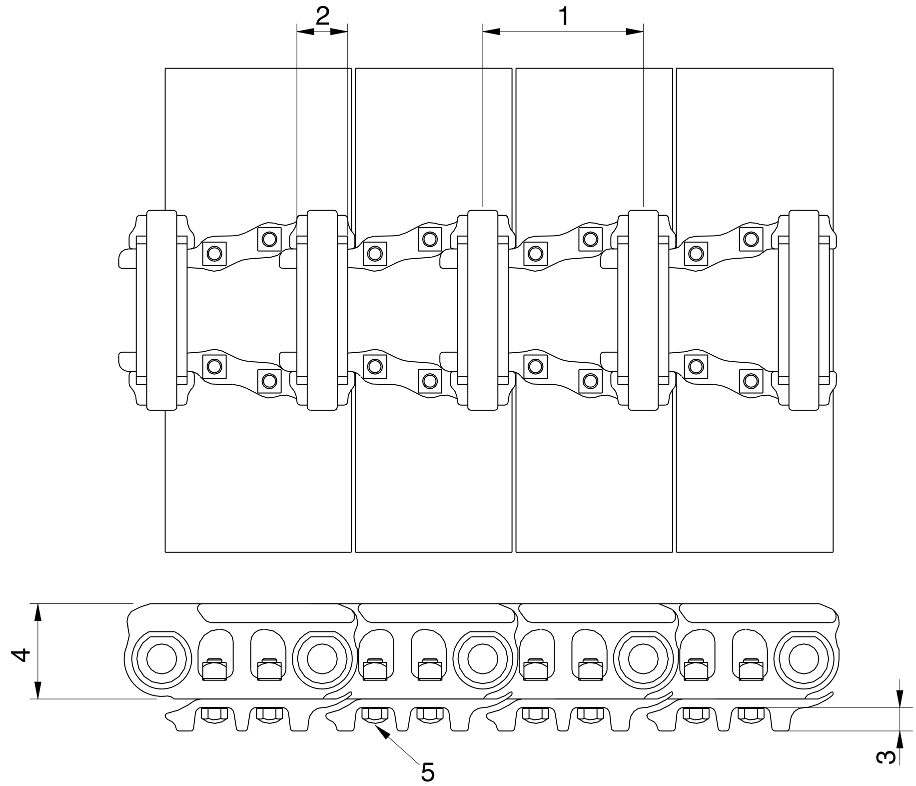


21037MS03

Unit : mm

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		43		
6	Clearance between shaft and bushing	Standard size & Tolerance		Standard clearance	Clearance limit	Replace bushing
		Shaft	Hole			
		Ø75 0 -0.03	Ø75 +1.195 +0.379	0.195~0.409	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
		0.40~1.2		2.0		

4) TRACK

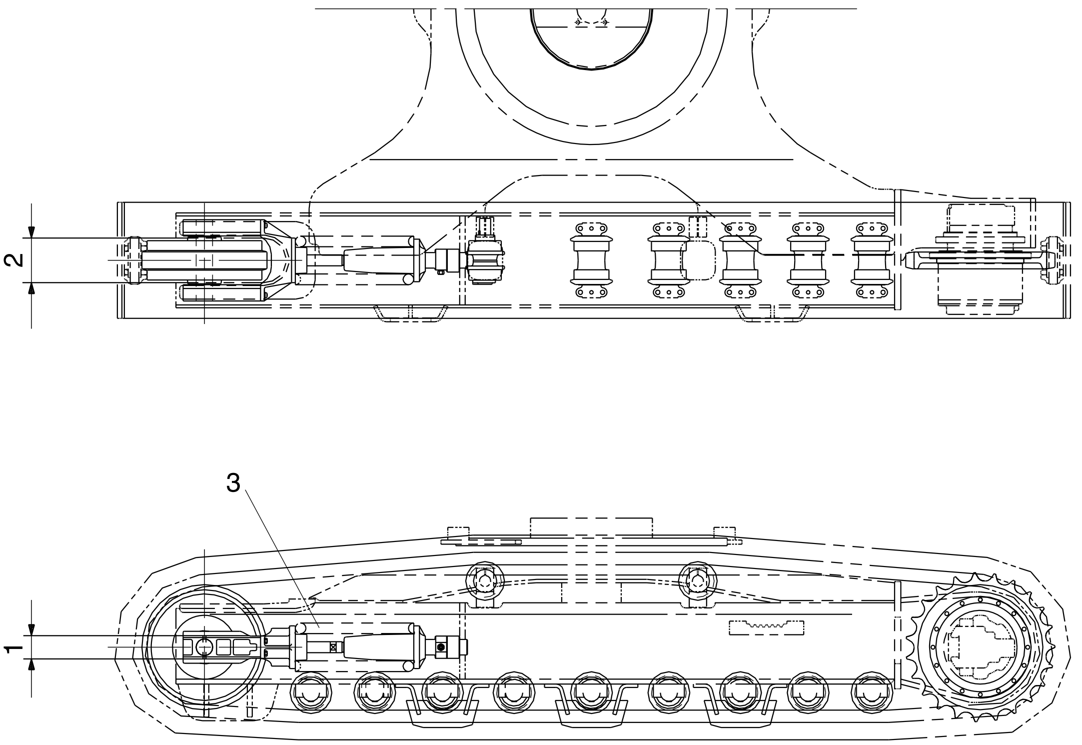


32077MS04

Unit : ㎜

No.	Check item	Criteria		Remedy
1	Link pitch	Standard size	Repair limit	Turn or replace
		171.45	178.95	
2	Outside diameter of bushing	Ø54	Ø46	Rebuild or replace
3	Height of grouser	25	16	
4	Height of link	101.6	93.6	
5	Tightening torque	Initial tightening torque : 40±4 kgf · m		Retighten

5) TRACK FRAME AND RECOIL SPRING

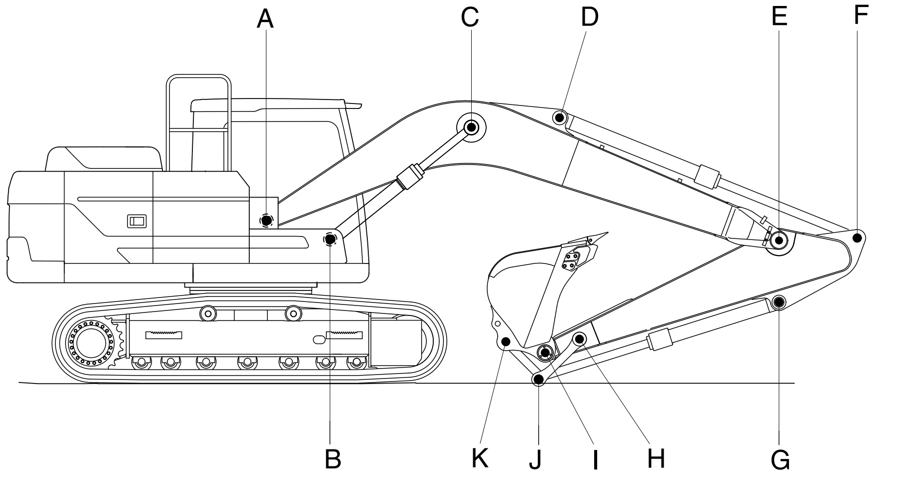


21037MS05

Unit : ㎜

<table>
<tr><th>No.</th><th>Check item</th><th colspan="8">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Vertical width of idler guide</td><td colspan="2"></td><td colspan="2">Standard size</td><td colspan="2">Tolerance</td><td colspan="2">Repair limit</td><td rowspan="5">Rebuild or replace</td></tr>
<tr><td colspan="2">Track frame</td><td colspan="2">113</td><td colspan="2">+2
0</td><td colspan="2">117</td></tr>
<tr><td colspan="2">Idler support</td><td colspan="2">110</td><td colspan="2">±0.3</td><td colspan="2">106</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Horizontal width of idler guide</td><td colspan="2">Track frame</td><td colspan="2">272</td><td colspan="2">+2
0</td><td colspan="2">276</td></tr>
<tr><td colspan="2">Idler support</td><td colspan="2">270</td><td colspan="2">±0.5</td><td colspan="2">267</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Recoil spring</td><td colspan="5">Standard size</td><td colspan="3">Repair limit</td><td rowspan="3">Replace</td></tr>
<tr><td>Free length</td><td colspan="2">Installation length</td><td colspan="2">Installation load</td><td colspan="2">Free length</td><td>Installation load</td></tr>
<tr><td>Ø225×525</td><td colspan="2">420</td><td colspan="2">11,908kg</td><td colspan="2">-</td><td>9,526kg</td></tr>
</table>

2. WORK EQUIPMENT



160F7MS01

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	75	74	73.5	75.5	76	Replace
B	Boom Cylinder Head	70	69	68.5	70.5	71	〃
C	Boom Cylinder Rod	75	74	73.5	75.5	76	〃
D	Arm Cylinder Head	70	69	68.5	70.5	71	〃
E	Boom Front	75	74	73.5	75.5	76	〃
F	Arm Cylinder Rod	70	69	68.5	70.5	71	〃
G	Bucket Cylinder Head	70	69	68.5	70.5	71	〃
H	Arm Link	70	69	68.5	70.5	71	〃
I	Bucket and Arm Link	70	69	68.5	70.5	71	〃
J	Bucket Cylinder Rod	70	69	68.5	70.5	71	〃
K	Bucket Link	70	69	68.5	70.5	71	〃

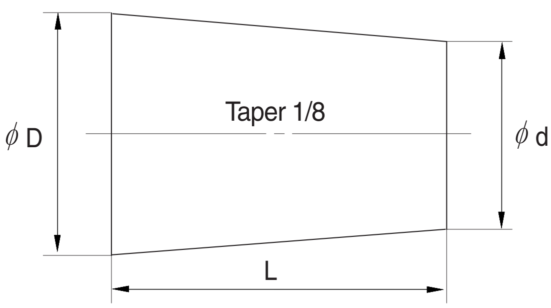
SECTION 8 DISASSEMBLY AND ASSEMBLY

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

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

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



2. INSTALL WORK

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

2) Install the hoses without twisting or interference.

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

4) Bend the cotter pin or lock plate securely.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

※ If the hydraulic cylinder has been replaced, carry out this procedure before assembling the rod to the work equipment. Carry out the same operation on machines that have been in storage for a long time after completion of repairs.

3. COMPLETING WORK

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

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

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

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

GROUP 2 TIGHTENING TORQUE

1. MAJOR COMPONENTS

No.	Descriptions		Bolt size	Torque	
				kgf · m	lbf · ft
1	Engine	Engine mounting bolt (engine-bracket, FR)	M12 × 1.75	11.5 ± 1.0	83.2 ± 7.2
2		Engine mounting bolt (engine-bracket, RR)	M12 × 1.75	11.5 ± 1.0	83.2 ± 7.2
3		Engine mounting bolt (bracket-frame, FR)	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
4		Engine mounting bolt (bracket-frame, RR)	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
5		Radiator mounting bolt	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
6		Coupling mounting socket bolt	M16 × 2.0	22.0 ± 1.0	159 ±7.2
7		Fuel tank mounting bolt	M10 × 1.5	6.5 ± 0.7	47.0 ± 5.1
8	Hydraulic system	Main pump mounting socket bolt	M16 × 2.0	29.7 ± 1.5	215 ± 10.9
9		Main control valve mounting bolt	M12 × 1.75	12.2 ± 1.3	88.2 ± 9.4
10		Fuel tank mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
11		Hydraulic oil tank mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
12		Turning joint mounting bolt, nut	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
13	Power train system	Swing motor mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
14		Swing bearing upper part mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 49.9
15		Swing bearing lower part mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 49.9
16		Travel motor mounting bolt	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
17		Sprocket mounting bolt	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
18	Under carriage	Upper roller mounting bolt, nut	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
19		Lower roller mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 49.9
20		Track tension cylinder mounting bolt	M16 × 2.0	21.9 ± 3.3	158 ± 23.9
21		Track shoe mounting bolt, nut	5/8 - 18UNF	42.0 ± 4.0	304 ± 28.9
22		Track guard mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 49.9
23	Others	Counterweight mounting bolt	M30 × 3.5	199 ± 30	1439 ± 217
24		Cab mounting bolt	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
25		Operator's seat mounting bolt	M 8 × 1.25	4.05 ± 0.8	29.3 ± 5.8
26		Under cover mounting bolt	M12 × 1.75	12.8 ± 3.0	92.6 ± 21

※ 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.

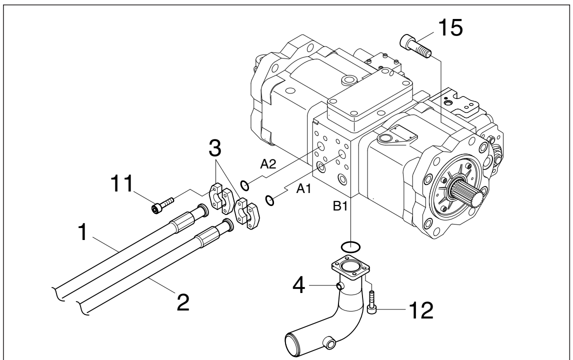
⚠ **Escaping fluid under pressure can penetrate the skin causing serious injury.**

13031GE18

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

· Hydraulic tank quantity : 125 ℓ (33.0 U.S. gal)

(5) Remove socket bolts (11) and disconnect hoses (1, 2).



160A8MP01

(6) Disconnect pilot line hoses (5, 6, 7, 8, 9, 10).

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

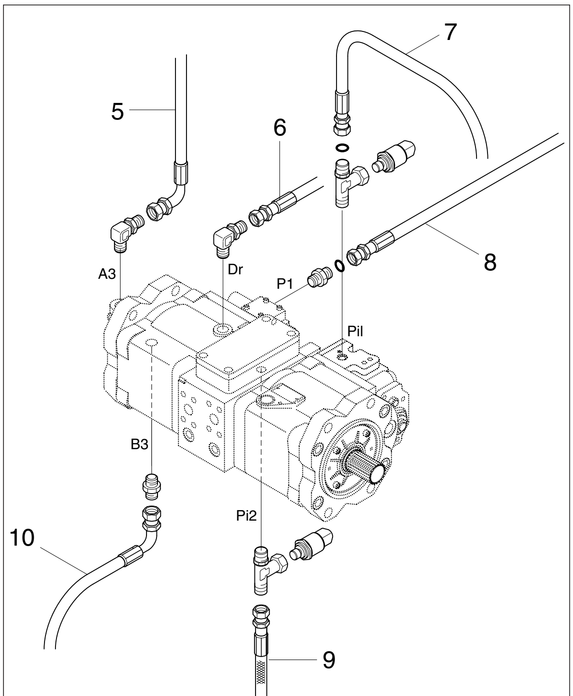
※ When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(8) Sling the pump assembly and remove the pump mounting bolts (15).

· Weight : 89 kg (200 lb)

· Tightening torque : 29.7 ± 1.5 kgf·m (215 ± 10.9 lbf·ft)

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



160A8MP02

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.

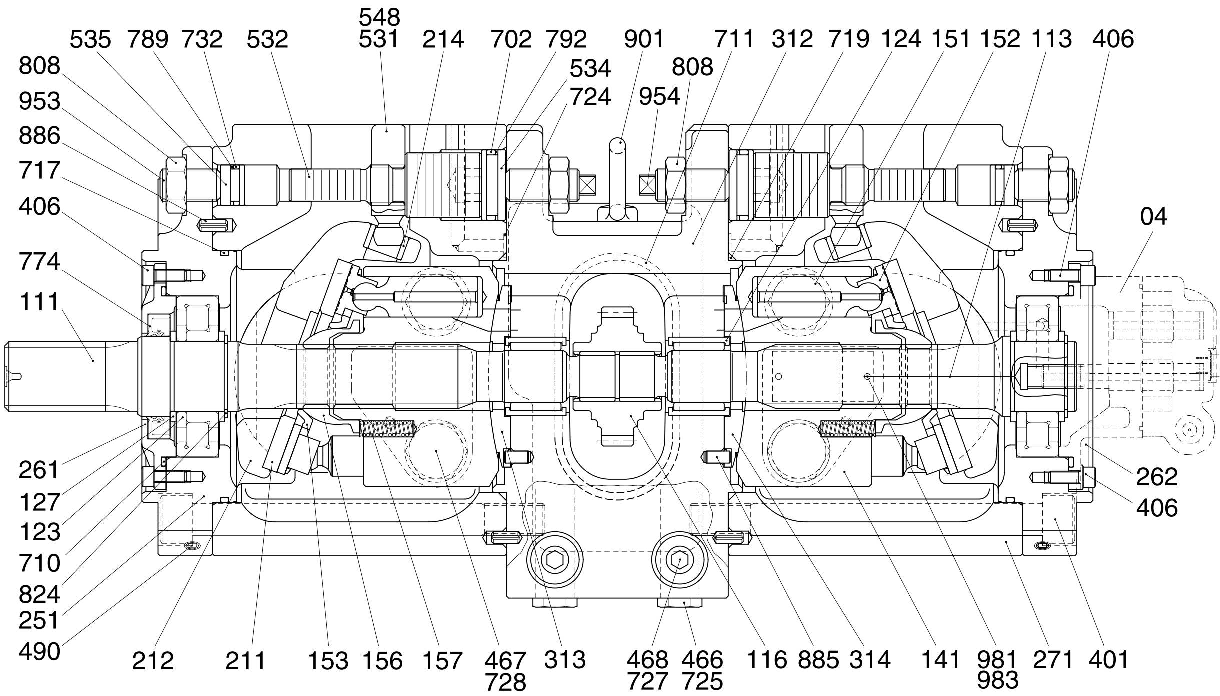
(6) Bleed the air from the hydraulic pump.
- ① Remove the air vent plug (2 EA).
- ② Tighten plug lightly.
- ③ Start the engine, run at low idling, and check oil come out from plug.
- ④ Tighten plug.

(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



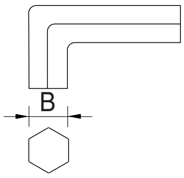
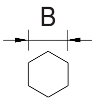
14092MP02

04	Gear pump	312	Valve block	717	O-ring
111	Drive shaft (F)	313	Valve plate (R)	719	O-ring
113	Drive shaft (R)	314	Valve plate (L)	724	O-ring
116	1st Gear	326	Cover	725	O-ring
123	Roller bearing	401	Hexagon socket bolt	727	O-ring
124	Needle bearing	406	Hexagon socket bolt	728	O-ring
127	Bearing spacer	414	Hexagon socket bolt	732	O-ring
141	Cylinder block	466	Plug	774	Oil seal
151	Piston	467	plug	789	Back up ring
152	Shoe	468	Plug	792	Back up ring
153	Set plate	490	Plug	808	Hexagon head nut
156	Bushing	531	Tilting pin	824	Snap ring
157	Cylinder spring	532	Servo piston	885	Pin
211	Shoe plate	534	Stopper (L)	886	Spring pin
212	Swash plate	535	Stopper (S)	901	Eye bolt
214	Bushing	548	Pin	953	Set screw
251	Support	702	O-ring	954	Set screw
261	Seal cover (F)	710	O-ring	981	Plate
271	Pump casing	711	O-ring	983	Pin

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the follow list.

<table>
<tr><th colspan="2">Tool name & size</th><th colspan="4">Part name</th></tr>
<tr><td>Name</td><td>B</td><td>Hexagon socket head bolt</td><td>PT plug (PT thread)</td><td>PO plug (PF thread)</td><td>Hexagon socket head setscrew</td></tr>
<tr><td rowspan="5">Allen wrench

</td><td>4</td><td>M 5</td><td>BP-1/16</td><td>-</td><td>M 8</td></tr>
<tr><td>5</td><td>M 6</td><td>BP-1/8</td><td>-</td><td>M10</td></tr>
<tr><td>6</td><td>M 8</td><td>BP-1/4</td><td>PO-1/4</td><td>M12, M14</td></tr>
<tr><td>8</td><td>M10</td><td>BP-3/8</td><td>PO-3/8</td><td>M16, M18</td></tr>
<tr><td>17</td><td>M20, M22</td><td>BP-1</td><td>PO-1, 1 1/4, 1 1/2</td><td>-</td></tr>
<tr><td rowspan="6">Double ring spanner, socket wrench, double (single) open end spanner

</td><td>-</td><td colspan="2">Hexagon bolt</td><td>Hexagon nut</td><td>VP plug (PF thread)</td></tr>
<tr><td>19</td><td colspan="2">M12</td><td>M12</td><td>VP-1/4</td></tr>
<tr><td>24</td><td colspan="2">M16</td><td>M16</td><td>-</td></tr>
<tr><td>27</td><td colspan="2">M18</td><td>M18</td><td>VP-1/2</td></tr>
<tr><td>30</td><td colspan="2">M20</td><td>M20</td><td>-</td></tr>
<tr><td>36</td><td colspan="2">-</td><td>-</td><td>VP-3/4</td></tr>
<tr><td colspan="2">Adjustable angle wrench</td><td colspan="4">Medium size, 1 set</td></tr>
<tr><td colspan="2">Screw driver</td><td colspan="4">Minus type screw driver, Medium size, 2 sets</td></tr>
<tr><td colspan="2">Hammer</td><td colspan="4">Plastic hammer, 1 set</td></tr>
<tr><td colspan="2">Pliers</td><td colspan="4">For snap ring, TSR-160</td></tr>
<tr><td colspan="2">Steel bar</td><td colspan="4">Steel bar of key material approx. 10×8×200</td></tr>
<tr><td colspan="2">Torque wrench</td><td colspan="4">Capable of tightening with the specified torques</td></tr>
</table>

(2) Tightening torque

Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt (material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.0	116	0.47	12
	M16	24.0	174	0.55	14
	M18	34.0	246	0.55	14
	M20	44.0	318	0.67	17
PT Plug (material : S45C) ※Wind a seal tape 1 1/2 to 2 turns round the plug	PT1/16	0.7	5.1	0.16	4
	PT 1/8	1.05	7.59	0.20	5
	PT 1/4	1.75	12.7	0.24	6
	PT 3/8	3.5	25.3	0.31	8
	PT 1/2	5.0	36.2	0.39	10
PF Plug (material : S45C)	PF 1/4	3.0	21.7	0.24	6
	PF 1/2	10.0	72.3	0.39	10
	PF 3/4	15.0	109	0.55	14
	PF 1	19.0	137	0.67	17
	PF 1 1/4	27.0	195	0.67	17
	PF 1 1/2	28.0	203	0.67	17

3) DISASSEMBLY

(1) Select place suitable to disassembling.

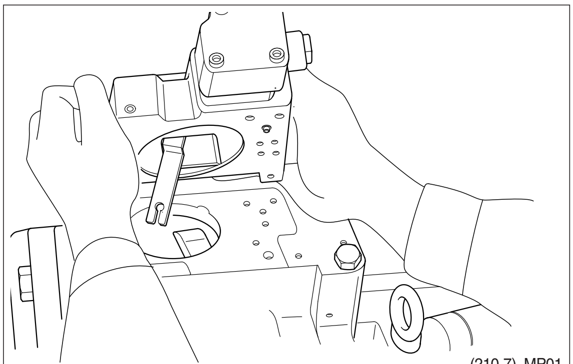
※ Select clean place.

※ Spread rubber sheet, cloth or so on on overhaul workbench top to prevent parts from being damaged.

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

(3) Remove drain port plug (468) and let oil out of pump casing (front and rear pump).

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



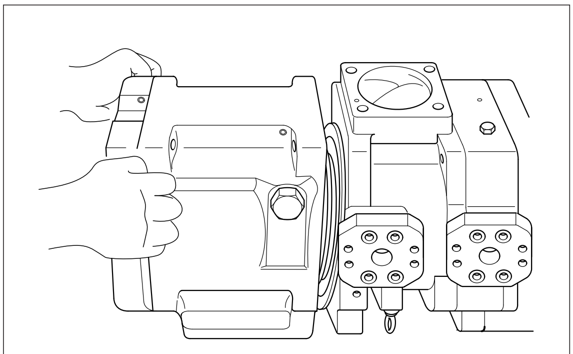
(210-7) MP01

(5) Loosen hexagon socket head bolts (401) which tighten swash plate support (251), pump casing (271) and valve block (312).

※ If gear pump and so on are fitted to rear face of pump, remove them before starting this work.

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

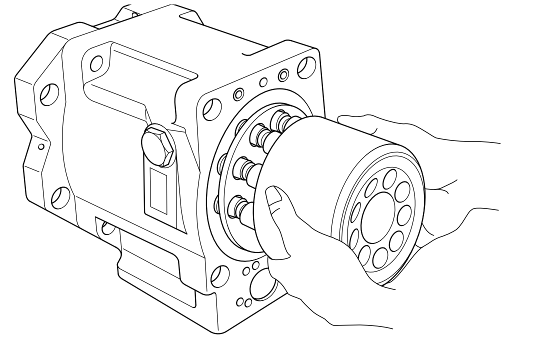
※ Before bringing this surface down, spread rubber sheet on workbench without fail to prevent this surface from being damaged.



(210-7) MP02

(7) Pull cylinder block (141) out of pump casing (271) straightly over drive shaft (111). Pull out also pistons (151), set plate (153), spherical bush (156) and cylinder springs (157) simultaneously.

※ Take care not to damage sliding surfaces of cylinder, spherical bushing, shoes, swash plate, etc.

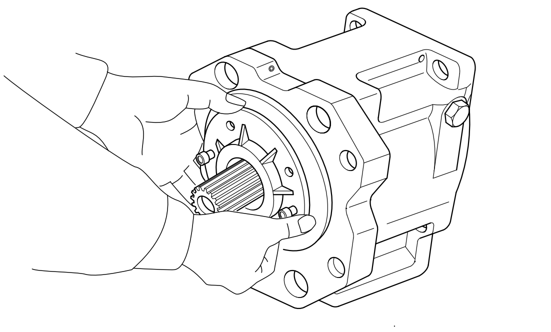


(210-7) MP03

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

※ Fit bolt into pulling out tapped hole of seal cover (F), and cover can be removed easily.

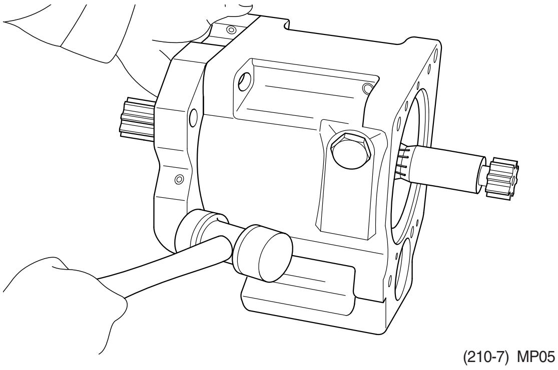
※ Since oil seal is fitted on seal cover (F), take care not to damage it in removing cover.



(210-7) MP04

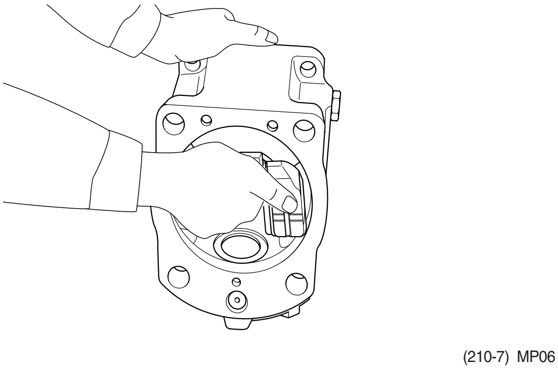
(9) Remove hexagon socket head bolts (408) and then seal cover (R, 262).
In case fitting a gear pump, first, remove gear pump.

(10) Tapping lightly fitting flange section of swash plate support (251) on its pump casing side, separate swash plate support from pump casing.



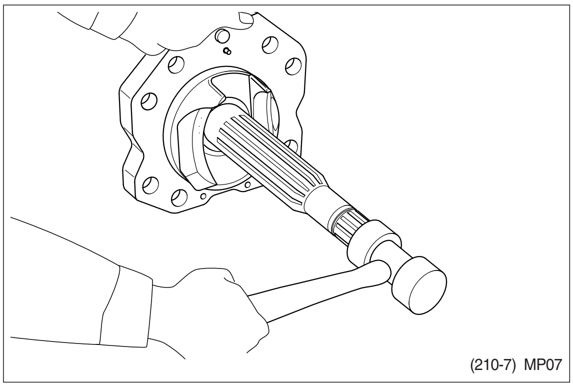
(210-7) MP05

(11) Remove shoe plate (211) and swash plate (212) from pump casing (271).



(210-7) MP06

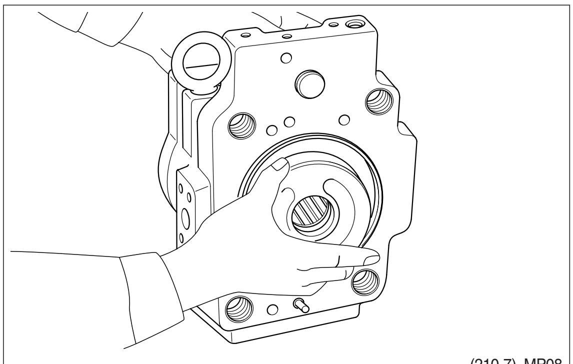
(12) Tapping lightly shaft ends of drive shafts (111, 113) with plastic hammer, take out drive shafts from swash plate supports.



(210-7) MP07

(13) Remove valve plates (313, 314) from valve block (312).

※ These may be removed in work (6).



(210-7) MP08

(14) If necessary, remove stopper (L, 534), stopper (S, 535), servo piston (532) and tilting pin (531) from pump casing (271), and needle bearing (124) and splined coupling (114) from valve block (312).

※ In removing tilting pin, use a protector to prevent pin head from being damaged.

※ Since loctite is applied to fitting areas of tilting pin and servo piston, take care not to damage servo piston.

※ Do not remove needle bearing as far as possible, except when it is considered to be out of its life span.

※ Do not loosen hexagon nuts of valve block and swash plate support.
If loosened, flow setting will be changed.

4) ASSEMBLY

(1) For reassembling reverse the disassembling procedures, paying attention to the following items.

① Do not fail to repair the parts damaged during disassembling, and prepare replacement parts in advance.

② Clean each part fully with cleaning oil and dry it with compressed air.

③ Do not fail to apply clean working oil to sliding sections, bearings, etc. before assembling them.

④ In principle, replace seal parts, such as O-rings, oil seals, etc.

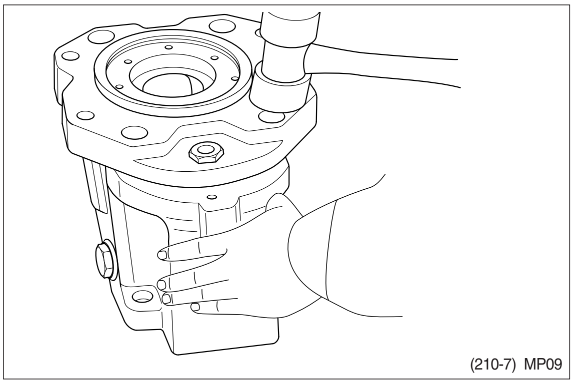
⑤ For fitting bolts, plug, etc., prepare a torque wrench or so on, and tighten them with torques shown in page 8-10.

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

(2) Fit swash plate support (251) to pump casing (271), tapping the former lightly with a hammer.

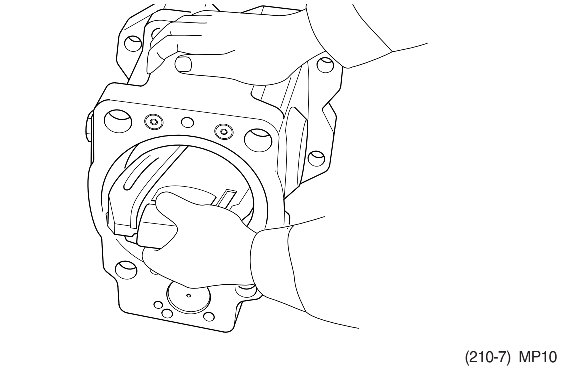
※ After servo piston, tilting pin, stopper (L) and stopper (S) are removed, fit them soon to pump casing in advance for reassembling.

※ In tightening servo piston and tilting pin, use a protector to prevent tilting pin head and feedback pin from being damaged. In addition, apply loctite (Medium strength) to their threaded sections.



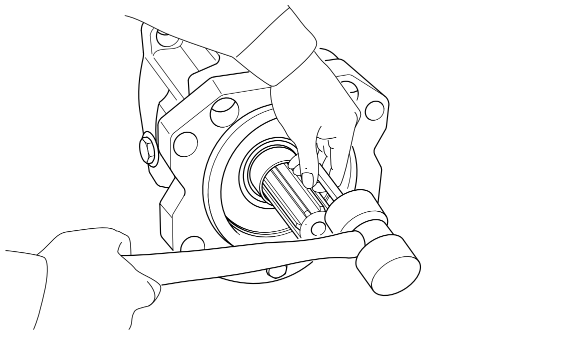
(210-7) MP09

(3) Place pump casing with its regulator fitting surface down, fit tilting bush of swash plate to tilting pin (531) and fit swash plate (212) to swash plate support (251) correctly.
※ Confirm with fingers of both hands that swash plate can be removed smoothly.
※ Apply grease to sliding sections of swash plate and swash plate support, and drive shaft can be fitted easily.



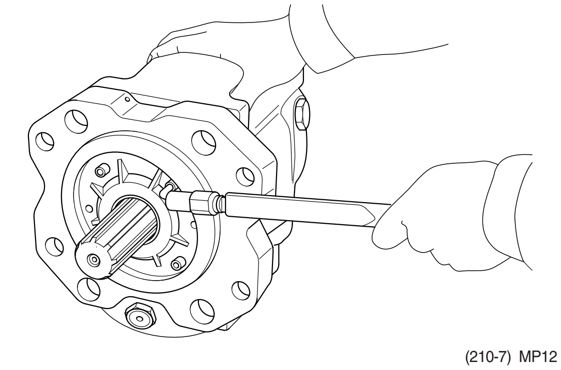
(210-7) MP10

(4) To swash plate support (251), fit drive shaft (111) set with bearing (123), bearing spacer (127) and snap ring (824).
※ Do not tap drive shaft with hammer or so on.
※ Assemble them into support, tapping outer race of bearing lightly with plastic hammer.
Fit them fully, using steel bar or so on.



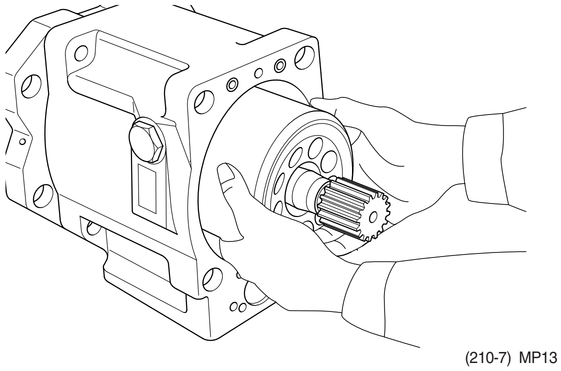
(210-7) MP11

(5) Assemble seal cover (F, 261) to pump casing (271) and fix it with hexagon socket head bolts (406).
※ Apply grease lightly to oil seal in seal cover (F).
※ Assemble oil seal, taking full care not to damage it.
※ For tandem type pump, fit rear cover (263) and seal cover (262) similarly.



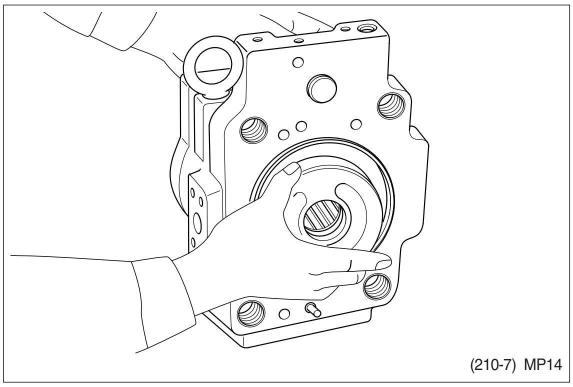
(210-7) MP12

(6) Assemble piston cylinder subassembly 〔cylinder block (141), piston subassembly (151, 152), set plate (153), spherical bush (156), spacer (158) and cylinder spring (157)〕.
Fit spline phases of retainer and cylinder.
Then, insert piston cylinder subassembly into pump casing.

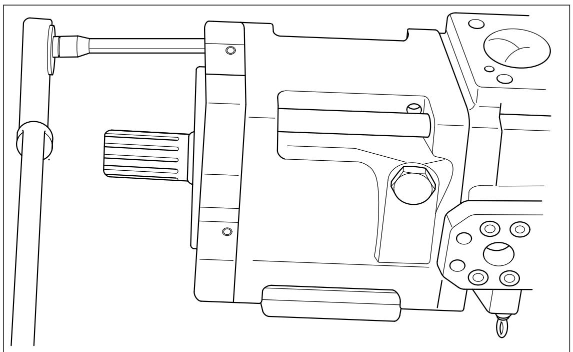


(210-7) MP13

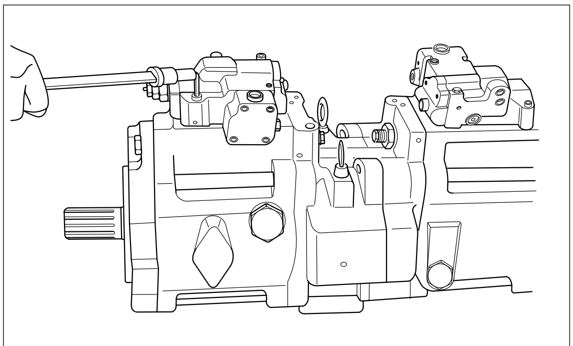
(7) Fit valve plate (313) to valve block (312), entering pin into pin hole.
※ Take care not to mistake suction / delivery directions of valve plate.


(210-7) MP14

(8) Fit valve block (312) to pump casing (271) and tighten hexagon socket head bolts (401).
※ At first assemble this at rear pump side, and this work will be easy.
※ Take care not to mistake direction of valve block.
※ Clockwise rotation (viewed from input shaft side) - Fit block with regulator up and with delivery flange left, viewed from front side.
※ Counter clockwise rotation (viewed from input shaft side) - Fit block with delivery flange right, viewed from front side.


(210-7) MP16

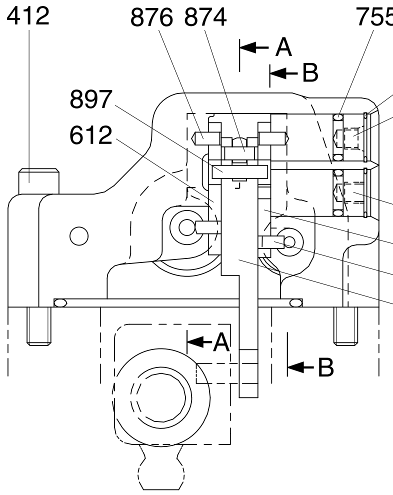
(9) Putting feedback pin of tilting pin into feedback lever of regulator, fit regulator and tighten hexagon socket head bolts (412, 413).
※ Take care not to mistake regulator of front pump for that of rear pump.

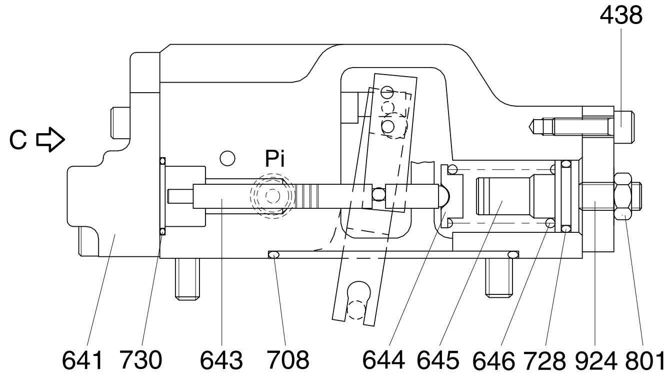

(210-7) MP17

(10) Fit drain port plug (468).
This is the end of reassembling procedures.

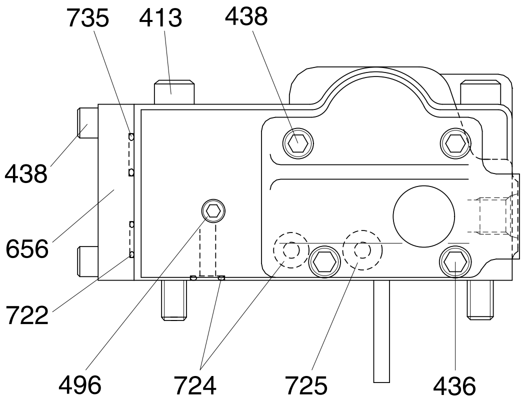
3. REGULATOR

1) STRUCTURE (1/2)

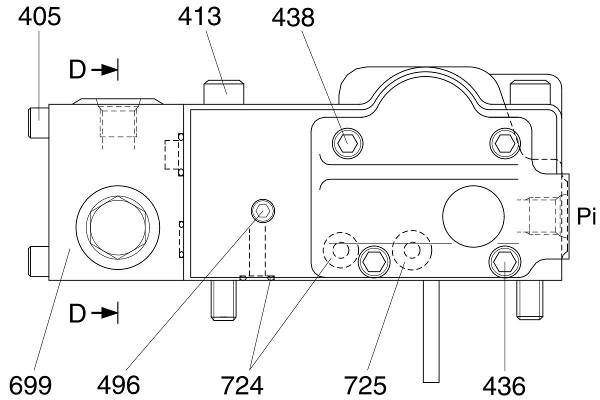




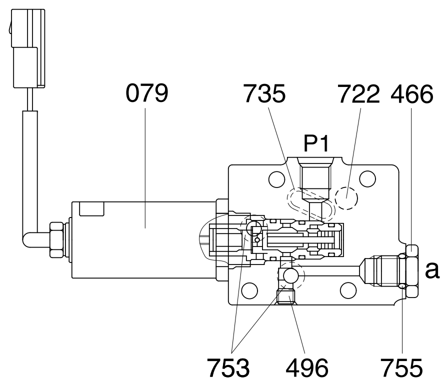
SECTION B-B



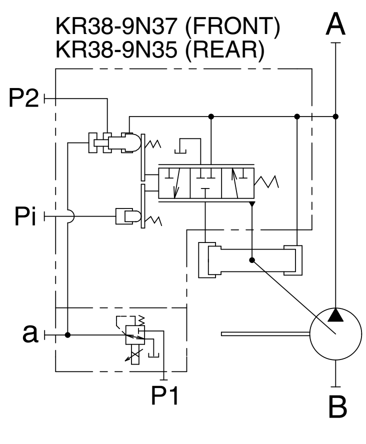
VIEW C (FRONT)



VIEW C (REAR)

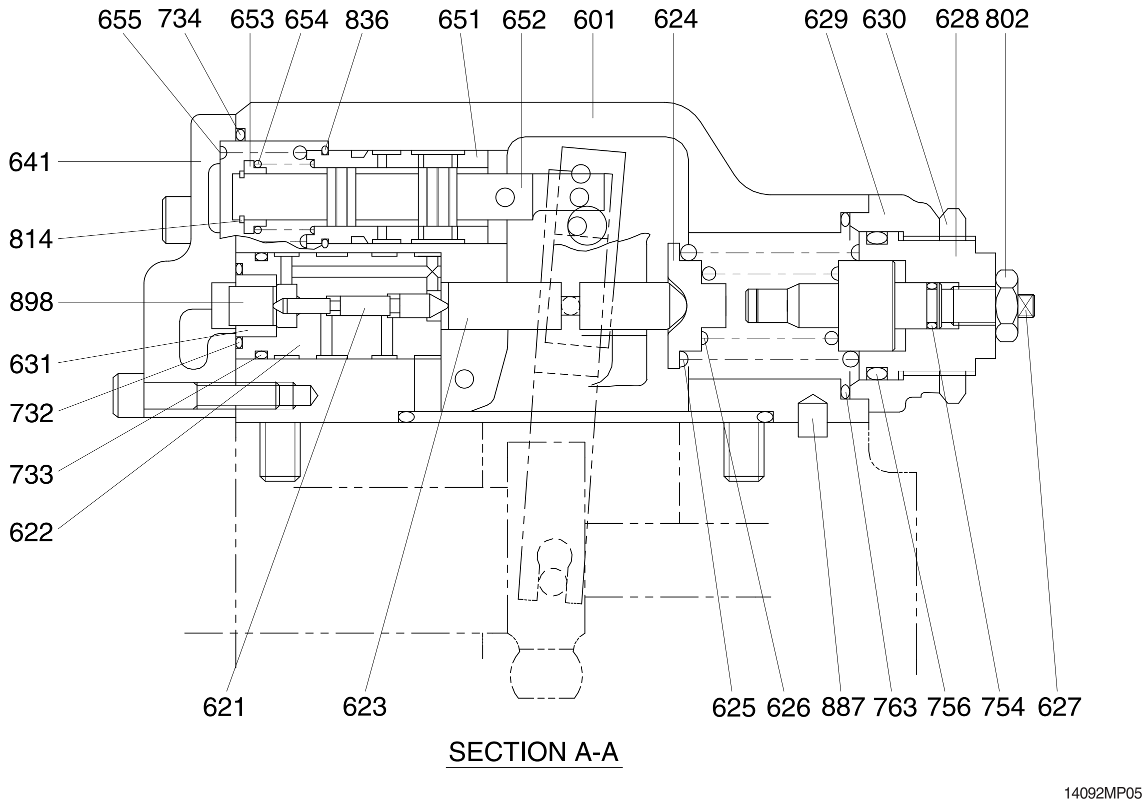


SECTION D-D(REAR)



16092MP04

REGULATOR (2/2)



079	EPPR valve assembly	629	Cover (C)	733	O-ring
405	Hexagon socket screw (R)	630	Lock nut	734	O-ring
412	Hexagon socket screw	631	Sleeve, Pf	735	O-ring
413	Hexagon socket screw	641	Pilot cover	753	O-ring (R)
436	Hexagon socket screw	643	Pilot piston	754	O-ring
438	Hexagon socket screw	644	Spring seat (Q)	755	O-ring
466	Plug (R)	645	Adjust stem (Q)	756	O-ring
496	Plug	646	Pilot spring	763	O-ring
601	Casing	651	Sleeve	801	Nut
611	Feed back lever	652	Spool	802	Nut
612	Lever (1)	653	Spring seat	814	Snap ring
613	Lever (2)	654	Return spring	836	Snap ring
614	Fulcrum plug	655	Set spring	858	Snap ring
615	Adjust plug	656	Block cover (F)	874	Pin
621	Compensator piston	699	Valve casing (R)	875	Pin
622	Piston case	708	O-ring	876	Pin
623	Compensator rod	722	O-ring	887	Pin
624	Spring seat (C)	724	O-ring	897	Pin
625	Outer spring	725	O-ring	898	Pin
626	Inner spring	728	O-ring	924	Set screw
627	Adjust stem (C)	730	O-ring		
628	Adjust screw (C)	732	O-ring		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the follow list.

<table>
<tr><th colspan="2">Tool name & size</th><th colspan="12">Part name</th></tr>
<tr><td>Name</td><td>B</td><td colspan="3">Hexagon socket head bolt</td><td colspan="3">PT plug (PT thread)</td><td colspan="3">PO plug (PF thread)</td><td colspan="3">Hexagon socket head setscrew</td></tr>
<tr><td rowspan="3">Allen wrench</td><td>4</td><td colspan="3">M5</td><td colspan="3">BP-1/16</td><td colspan="3">-</td><td colspan="3">M 8</td></tr>
<tr><td>5</td><td colspan="3">M6</td><td colspan="3">BP-1/8</td><td colspan="3">-</td><td colspan="3">M10</td></tr>
<tr><td>6</td><td colspan="3">M8</td><td colspan="3">BP-1/4</td><td colspan="3">PO-1/4</td><td colspan="3">M12, M14</td></tr>
<tr><td rowspan="2">Double ring spanner, socket wrench, double (single) open end spanner</td><td>-</td><td colspan="4">Hexagon head bolt</td><td colspan="4">Hexagon nut</td><td colspan="4">VP plug (PF thread)</td></tr>
<tr><td>6</td><td colspan="4">M 8</td><td colspan="4">M 8</td><td colspan="4">-</td></tr>
<tr><td colspan="2">Adjustable angle wrench</td><td colspan="12">Small size, Max 36 mm</td></tr>
<tr><td colspan="2">Screw driver</td><td colspan="12">Minus type screw driver, Medium size, 2 sets</td></tr>
<tr><td colspan="2">Hammer</td><td colspan="12">Plastic hammer, 1 set</td></tr>
<tr><td colspan="2">Pliers</td><td colspan="12">For snap ring, TSR-160</td></tr>
<tr><td colspan="2">Steel bar</td><td colspan="12">4×100 mm</td></tr>
<tr><td colspan="2">Torque wrench</td><td colspan="12">Capable of tightening with the specified torques</td></tr>
<tr><td colspan="2">Pincers</td><td colspan="12">-</td></tr>
<tr><td colspan="2">Bolt</td><td colspan="12">M4, Length : 50 mm</td></tr>
</table>

(2) Tightening torque

Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt (material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.0	116	0.47	12
	M16	24.0	174	0.55	14
	M18	34.0	246	0.55	14
	M20	44.0	318	0.67	17
PT Plug (material : S45C) ※Wind a seal tape 1 1/2 to 2 turns round the plug	PT1/16	0.7	5.1	0.16	4
	PT 1/8	1.05	7.59	0.20	5
	PT 1/4	1.75	12.7	0.24	6
	PT 3/8	3.5	25.3	0.31	8
	PT 1/2	5.0	36.2	0.39	10
PF Plug (material : S35C)	PF 1/4	3.0	21.7	0.24	6
	PF 1/2	10.0	72.3	0.39	10
	PF 3/4	15.0	109	0.55	14
	PF 1	19.0	137	0.67	17
	PF 1 1/4	27.0	195	0.67	17
	PF 1 1/2	28.0	203	0.67	17

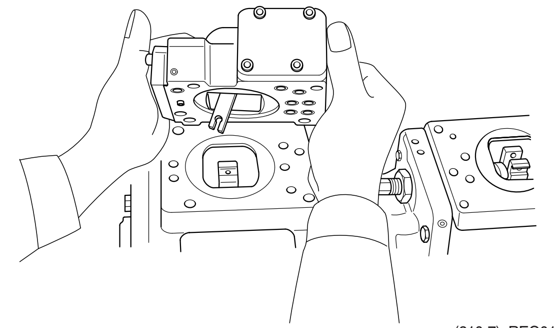
3) DISASSEMBLY

Since the regulator consists of small precision finished parts, disassembly and assembly are rather complicated.
For this reason, replacement of a regulator assembly is recommended, unless there is a special reason, but in case disassembly is necessary for an unavoidable reason, read through this manual to the end before starting disassembly.

(1) Choose a place for disassembly.
※ Choose a clean place.
※ Spread rubber sheet, cloth, or so on on top of work-bench to prevent parts from being damaged.

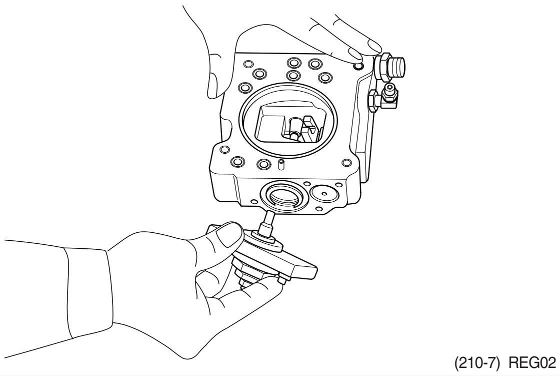
(2) Remove dust, rust, etc. from surfaces of regulator with clean oil.

(3) Remove hexagon socket head screw (412, 413) and remove regulator main body from pump main body.
※ Take care not to lose O-ring.



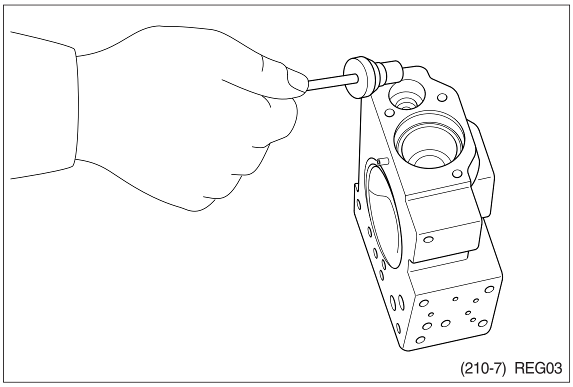
(210-7) REG01

(4) Remove hexagon socket head screw (438) and remove cover (C, 629)
※ Cover (C) is fitted with adjusting screw (C, 628), adjusting ring (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).
※ Do not loosen these screws and nuts.
If they are loosened, adjusted pressure-flow setting will vary.

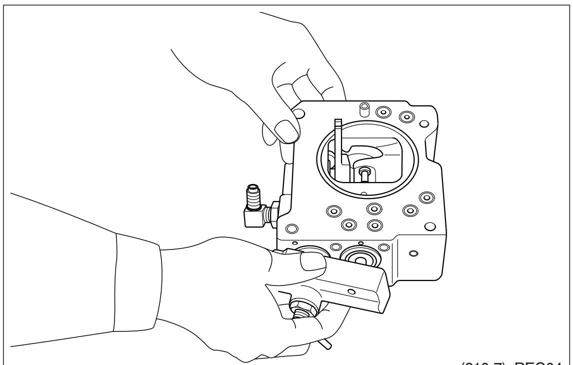


(210-7) REG02

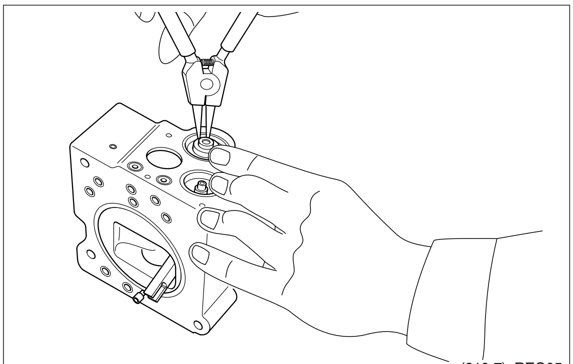
(5) After removing cover (C, 629) subassembly, take out outer spring (625), inner spring (626) and spring seat (C, 624) from compensating section.
Then draw out adjusting ring (Q, 645), pilot spring (646) and spring seat (644) from pilot section.
※ Adjusting ring (Q, 645) can easily be drawn out with M4 bolt.


(210-7) REG03

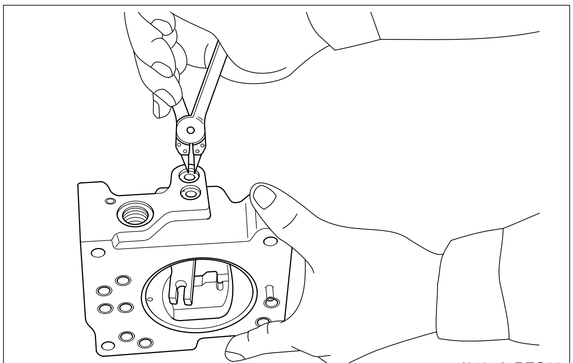
(6) Remove hexagon socket head screws (436, 438) and remove pilot cover (641).
After removing pilot cover, take out set spring (655) from pilot section.

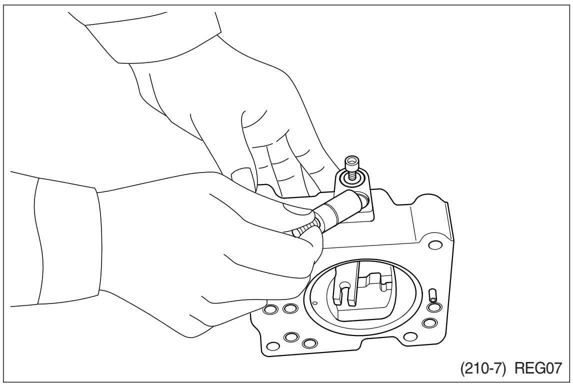

(210-7) REG04

(7) Remove snap ring (814) and take out spring seat (653), return spring (654) and sleeve (651).
※ Sleeve (651) is fitted with snap ring (836).
※ When removing snap ring (814), return spring (654) may pop out.
Take care not to lose it.


(210-7) REG05

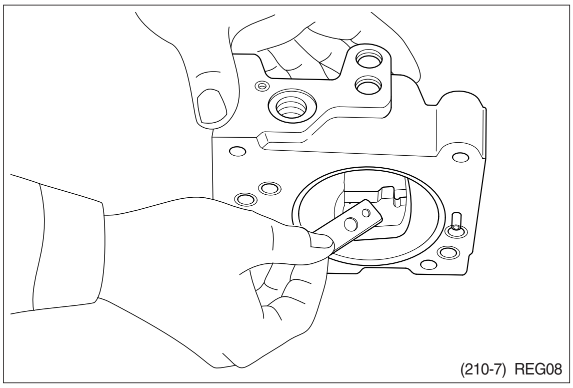
(8) Remove locking ring (858) and take out fulcrum plug (614) and adjusting plug (615).
※ Fulcrum plug (614) and adjusting plug (615) can easily be taken out with M6 bolt.


(210-7) REG06


(210-7) REG07

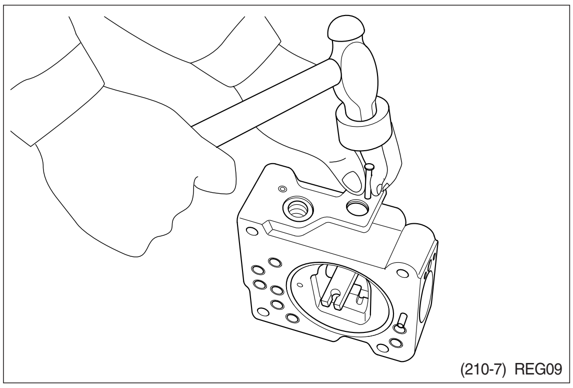
(9) Remove lever (2, 613). Do not draw out pin (875).

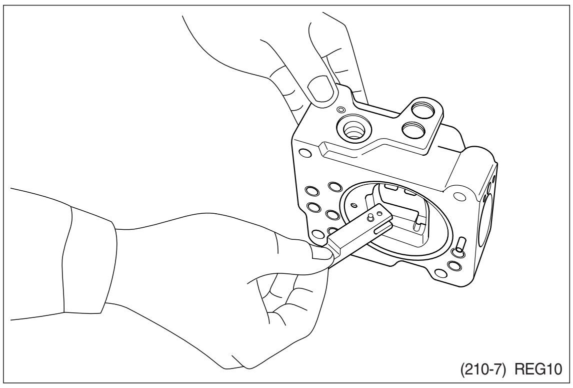
※ Work will be promoted by using pincers or so on.


(210-7) REG08

(10) Draw out pin (874) and remove feedback lever (611).

Push out pin (874, 4 mm in dia.) from above with slender steel bar so that it may not interfere with lever (1, 612).


(210-7) REG09


(210-7) REG10

(11) Remove lever (1, 612). Do not draw out pin (875).

(12) Draw out pilot piston (643) and spool (652).

(13) Draw out piston case (622), compensating piston (621) and compensating rod (623).

※ Piston case (622) can be taken out by pushing compensating rod (623) at opposite side of piston case.

This completes disassembly.

4) ASSEMBLY

(1) For assembly, reverse disassembly procedures, but pay attention to the following items.

① Always repair parts that were scored at disassembly.

② Get replacement parts ready beforehand. Mixing of foreign matter will cause malfunction.
Therefore, wash parts well with cleaning oil, let them dry with jet air and handle them in clean place.

③ Always tighten bolts, plugs, etc. to their specified torques.

④ Do not fail to coat sliding surfaces with clean hydraulic oil before assembly.

⑤ Replace seals such as O-ring with new ones as a rule.

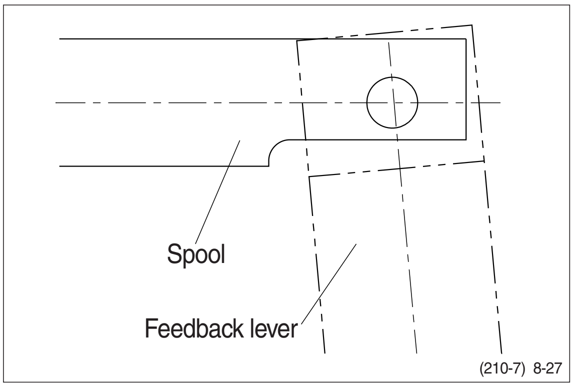
(2) Put compensating rod (623) into compensating hole of casing (601).

(3) Put pin force-fitted in lever (1, 612) into groove of compensating rod and fit lever (1) to pin force-fitted in casing.

(4) Fit spool (652) and sleeve (651) into hole in spool of casing.

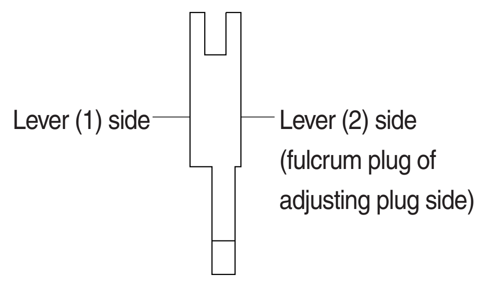
※ Confirm that spool and sleeve slide smoothly in casing without binding.

※ Pay attention to orientation of spool.



(210-7) 8-27

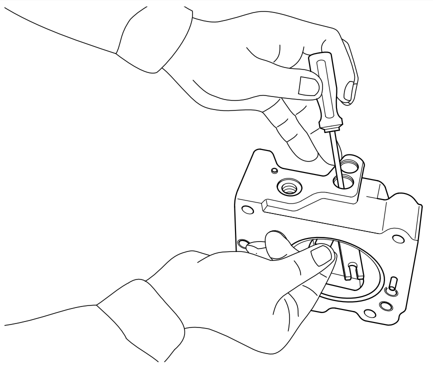
(5) Fit feedback lever (611), matching its pin hole with pin hole in spool.
Then insert pin (874).
※ Insert pin in feedback lever a little to ease operation.
※ Take care not to mistake direction of feedback lever.



(210-7) 8-28

(6) Put pilot piston (643) into pilot hole of casing.
※ Confirm that pilot piston slides smoothly without binding.

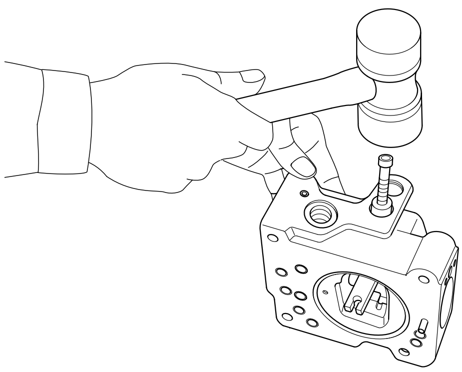
(7) Put pin force-fitted in lever (2, 613) into groove of pilot piston.
Then fix lever (2).



(210-7) REG11

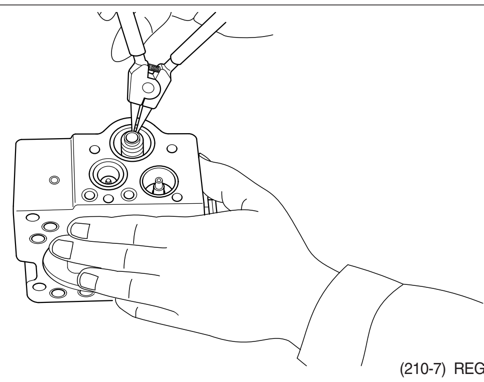
(8) Fit fulcrum plug (614) so that pin force-fitted in fulcrum plug (614) can be put into pin hole of lever (2).
Then fix locking ring (858).

(9) Insert adjusting plug (615) and fit locking ring.
※ Take care not to mistake inserting holes for fulcrum plug and adjusting plug.
At this point in time move feedback lever to confirm that it has no large play and is free from binding.



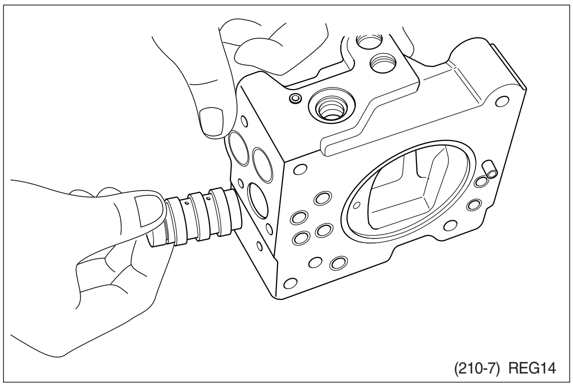
(210-7) REG12

(10) Fit return spring (654) and spring seat (653) into spool hole and attach snap ring (814).



(210-7) REG13

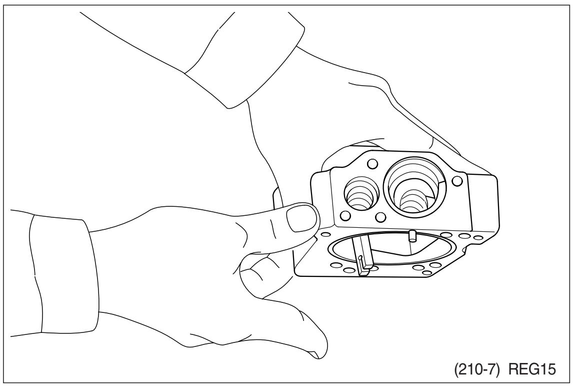
(11) Fit set spring (655) to spool hole and put compensating piston (621) and piston case (622) into compensating hole.
Fit pilot cover (641) and tighten it with hexagonal socket head screws (436, 438).



(210-7) REG14

(12) Put spring seat (644), pilot spring (646) and adjusting ring (Q, 645) into pilot hole.
Then fix spring seat (624), inner spring (626) and outer spring (625) into compensating hole.

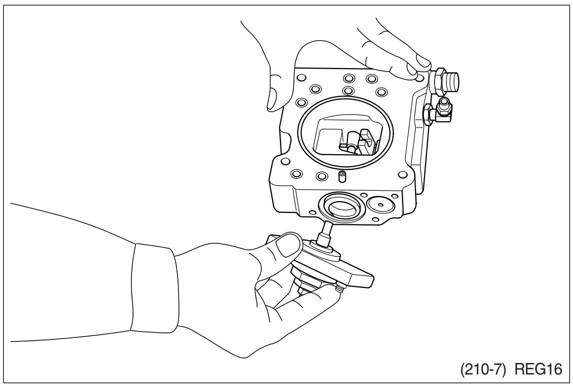
※ When fitting spring seat, take care not to mistake direction of spring seat.



(210-7) REG15

(13) Install cover (C, 629) fitted with adjusting screws (628), adjusting ring (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).
Then tighten them with hexagonal socket head screws (438).

This completes assembly.



(210-7) REG16

GROUP 4 MAIN CONTROL VALVE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

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

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

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

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(4) Remove the wirings for the pressure sensor and so on.

(5) Remove bolts and disconnect pipe.

(6) Disconnect pilot line hoses.

(7) Disconnect pilot piping.

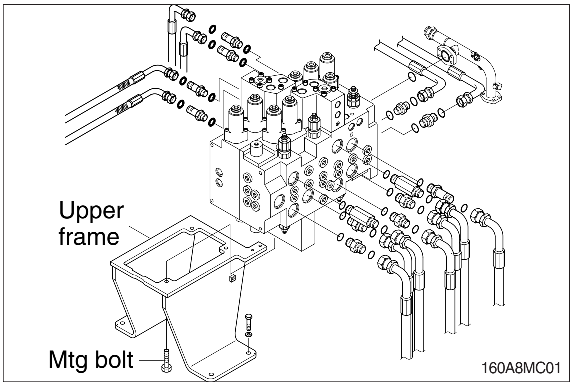
(8) Sling the control valve assembly and remove the control valve mounting bolt and bracket.

· Weight : 140 kg (310 lb)

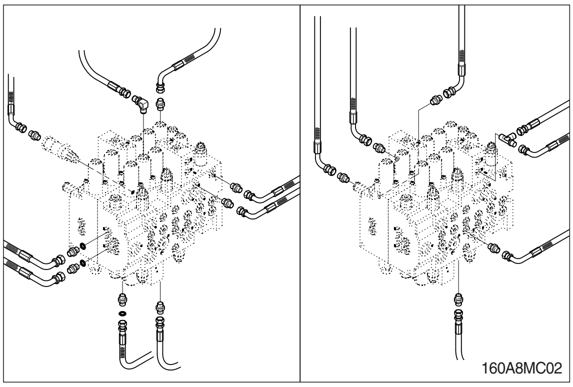
· Tightening torque : 12.2 ± 1.3 kgf·m (88.2 ± 9.4 lbf·ft)

(9) Remove the control valve assembly. When removing the control valve assembly, check that all the piping have been disconnected.

13031GE18



160A8MC01



160A8MC02

2) INSTALL

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

(2) Bleed the air from below items.

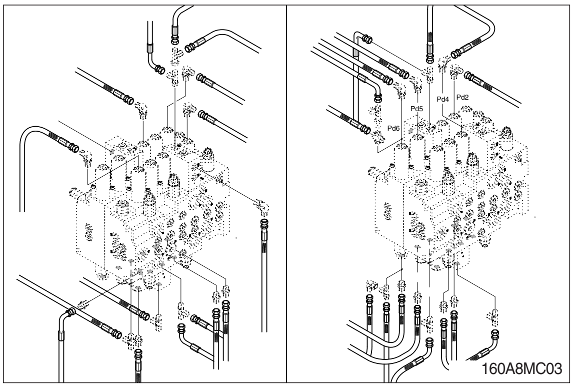
① Cylinder (boom, arm, bucket)

② Swing motor

③ Travel motor

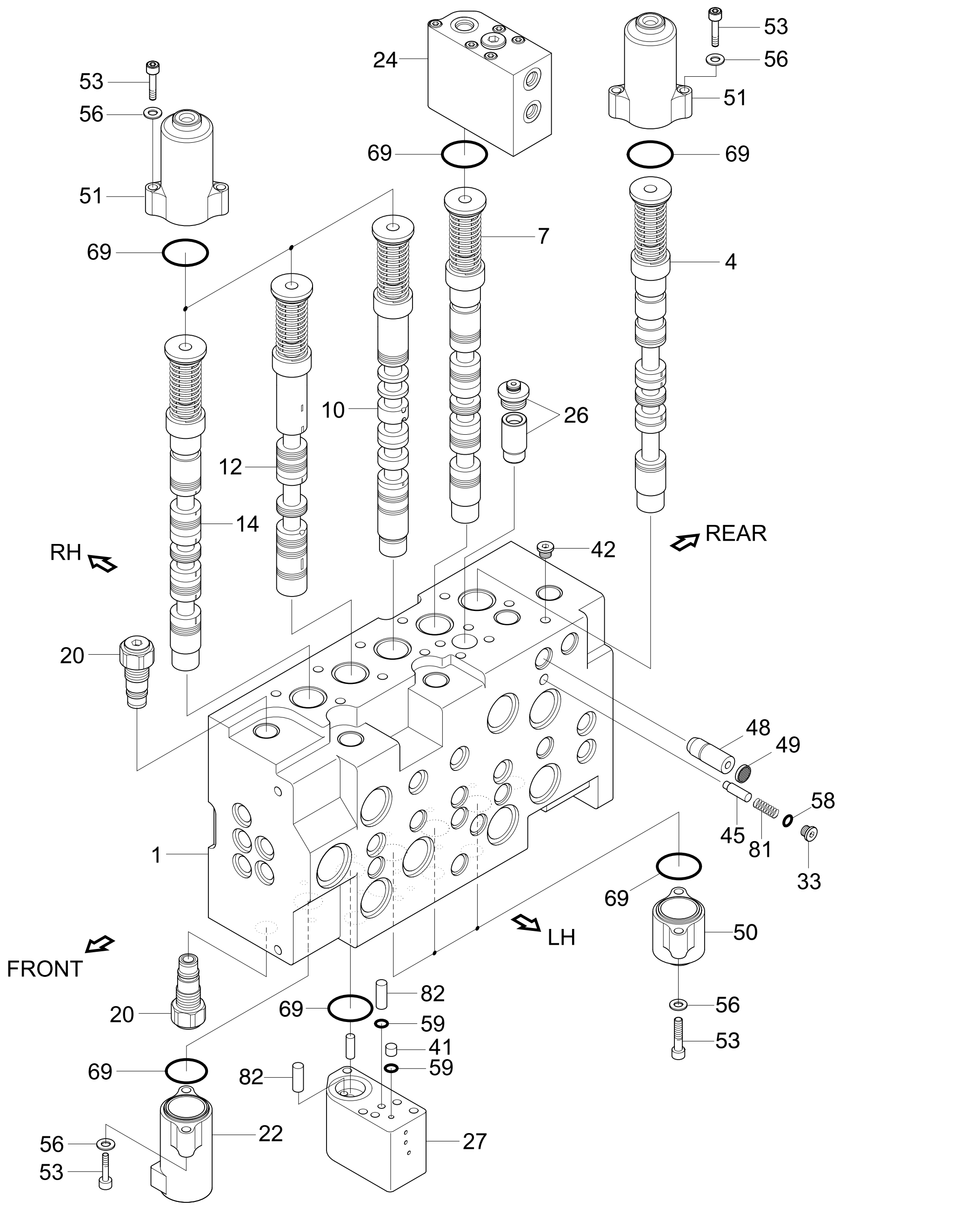
※ See each item removal and install.

(3) Confirm the hydraulic oil level and recheck the hydraulic oil leak or not.



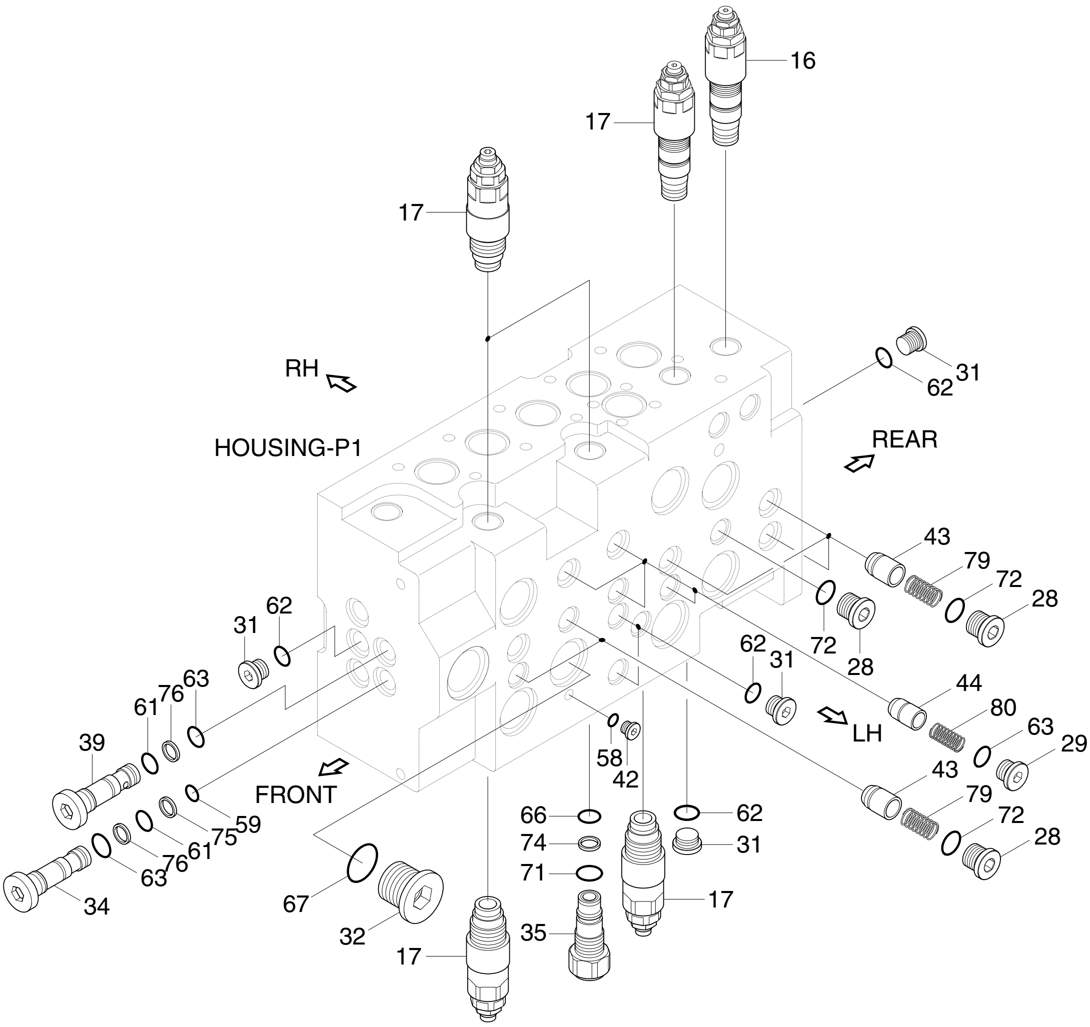
160A8MC03

2. STRUCTURE (1/4)



1	Housing P1	26	Lock valve kit B	51	Pilot B1 cap
4	Travel (LH) spool assy	27	Regeneration block	53	Socket bolt
7	Boom 1 spool assy	33	Plug	56	Plain washer
10	Arm 2 spool assy	41	Orifice	58	O-ring
12	Arm regen spool assy	42	Plug	59	O-ring
14	Bucket spool assy	45	Poppet	69	O-ring
20	Nega con relief valve	48	Orifice	81	Spring
22	Bucket stroke limiter	49	Coin type filter	82	Pin
24	Holding valve kit A1	50	Pilot A cap		

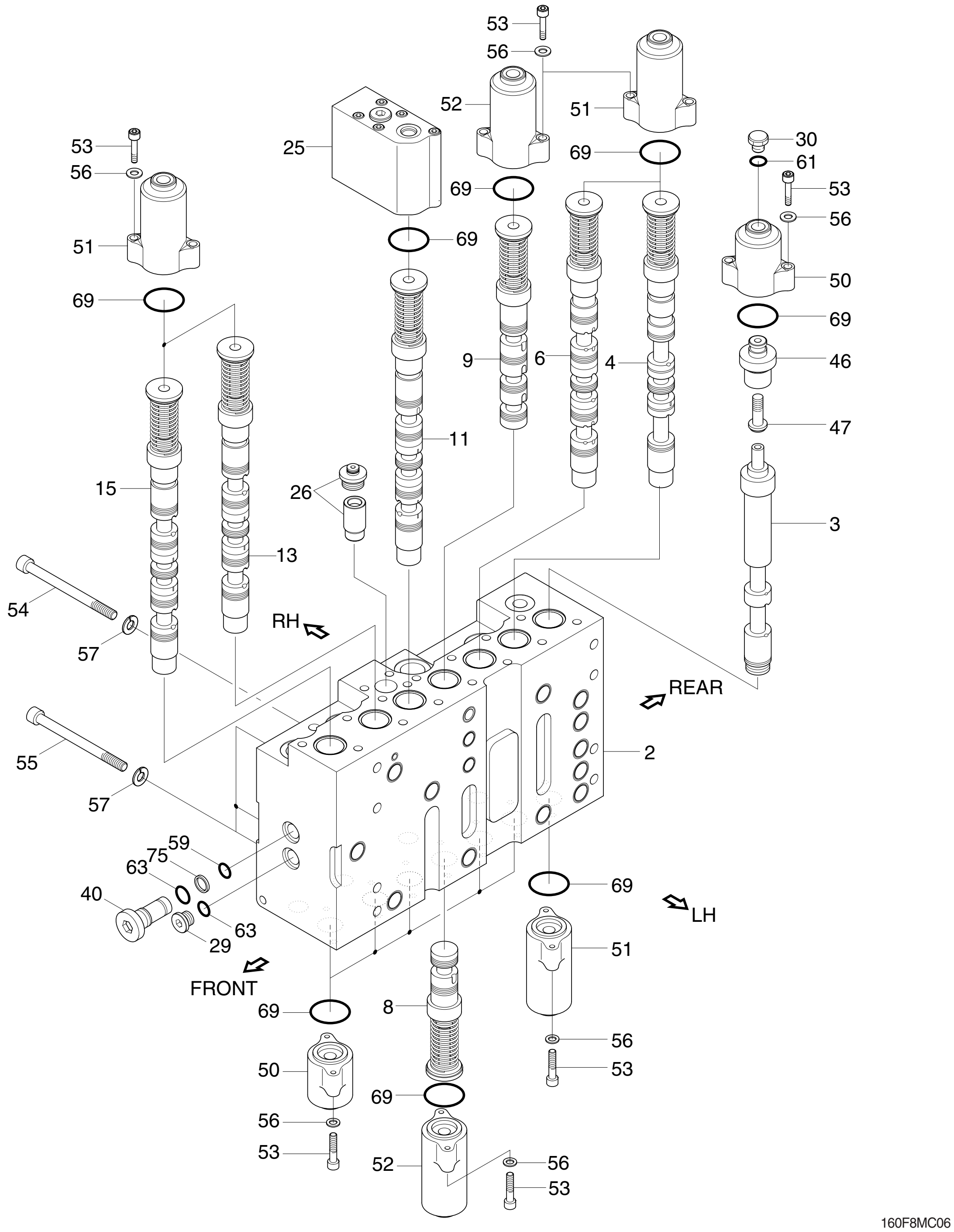
STRUCTURE (2/4)



160A8MC05

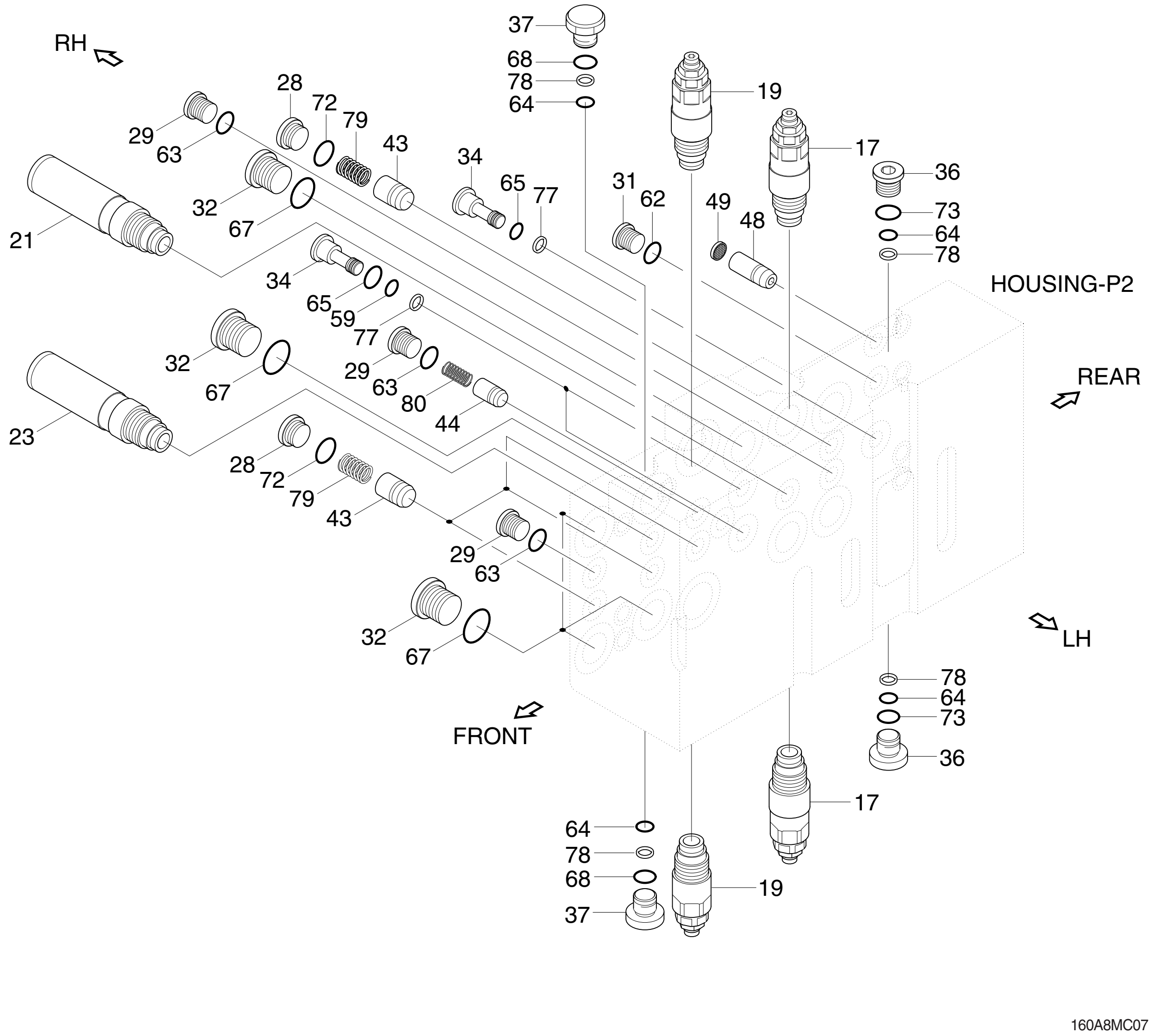
16	Main relief valve	42	Plug	67	O-ring
17	Overload relief valve	43	Poppet 1	71	O-ring
28	Plug	44	Poppet 2	72	O-ring
29	Plug	58	O-ring	74	Back up ring
31	Plug	59	O-ring	75	Back up ring
32	Plug	61	O-ring	76	Back up ring
34	Plug	62	O-ring	79	Spring
35	Plug	63	O-ring	80	Spring
39	Plug	66	O-ring		

STRUCTURE (3/4)



2	Housing P2	26	Lock valve kit B	54	Socket bolt
3	Travel straight spool assy	29	Plug	55	Socket bolt
4	Travel (RH) spool assy	30	Plug	56	Plain washer
6	Swing spool assy	40	Plug	57	Spring washer
8	Swing priority spool assy	46	Sleeve	59	O-ring
9	Boom 2 spool assy	47	Piston	61	O-ring
11	Arm 1 spool assy	50	Pilot A cap	63	O-ring
13	Option B spool assy	51	Pilot B1 cap	69	O-ring
15	Option C spool assy	52	Pilot B2 cap	75	Back up ring
25	Holding valve kit A2	53	Socket bolt		

STRUCTURE (4/4)



17	Overload relief valve	37	Plug	67	O-ring
19	Overload relief valve	43	Poppet 1	68	O-ring
21	Swing logic valve	44	Poppet 2	72	O-ring
23	ON/OFF valve-option	48	Orifice	73	O-ring
28	Plug	49	Coin type filter	77	Back up ring
29	Plug	59	O-ring	78	Back up ring
31	Plug	62	O-ring	79	Spring
32	Plug	63	O-ring	80	Spring
34	Plug	64	O-ring		
36	Plug	65	O-ring		

3. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

(1) All hydraulic components are manufactured to a high precision. Consequently, before disassembling and assembling them, it is essential to select an especially clean place.

(2) In handling a control valve, pay full attention to prevent dust, sand, etc. from entering into it.

(3) When a control valve is to be remove from the machine, apply caps and masking seals to all ports. Before disassembling the valve, recheck that these caps and masking seals are fitted completely, and then clean the outside of the assembly. Use a proper bench for working. Spread paper or a rubber mat on the bench, and disassemble the valve on it.

(4) Support the body section carefully when carrying or transferring the control valve. Do not lift by the exposed spool, end cover section etc.

(5) After disassembling and assembling of the component it is desired to carry out various tests (for the relief characteristics, leakage, flow resistance, etc.), but hydraulic test equipment is necessary for these tests. Therefore, even when its disassembling can be carried out technically, do not disassemble such components that cannot be tested, adjusted, and so on. Additionally one should always prepare clean cleaning oil, hydraulic oil, grease, etc. beforehand.

2) TOOLS

Before disassembling the control valve, prepare the following tools beforehand.

Name of tool	Quantity	Size (mm)
Vice mounted on bench (soft jaws)	1 unit	
Hexagon wrench	Each 1 piece	5, 6, 10, 12 and 14
Socket wrench	Each 1 piece	27 and 32
Spanner	Each 1 piece	32 (main relief valve, overload relief valve, negative relief valve) 26 (holding valve)

3) DISASSEMBLY

(1) Disassembly of spools without holding valve (travel right, travel left)

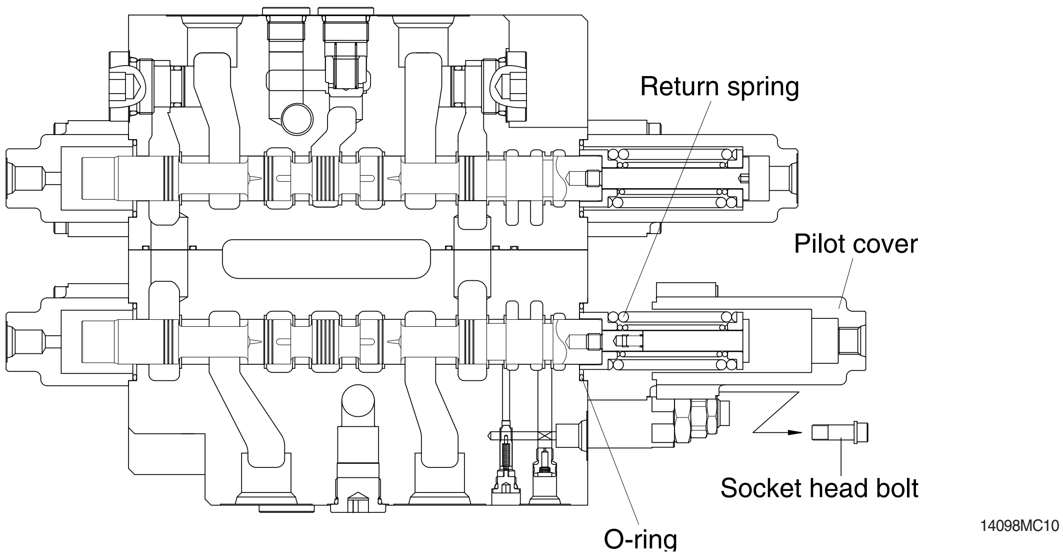
① Loosen hexagon socket head bolts with washer.
(hexagon wrench : 5 mm)

② Remove the pilot cover.

※ Pay attention not to lose the O-ring under the pilot cover.

③ Remove the spool assembly from the body by hand slightly.

※ When extracting each spool from its body, pay attention not to damage the body.
※ When extracting each spool assembly, it must be extracted from spring side only.
※ When any abnormal parts are found, replace it with completely new spool assembly.
※ When disassembled, tag the components for identification so that they can be reassembled correctly.



(2) **Disassembly of spools with holding valve** (boom 1, arm 1 spool)

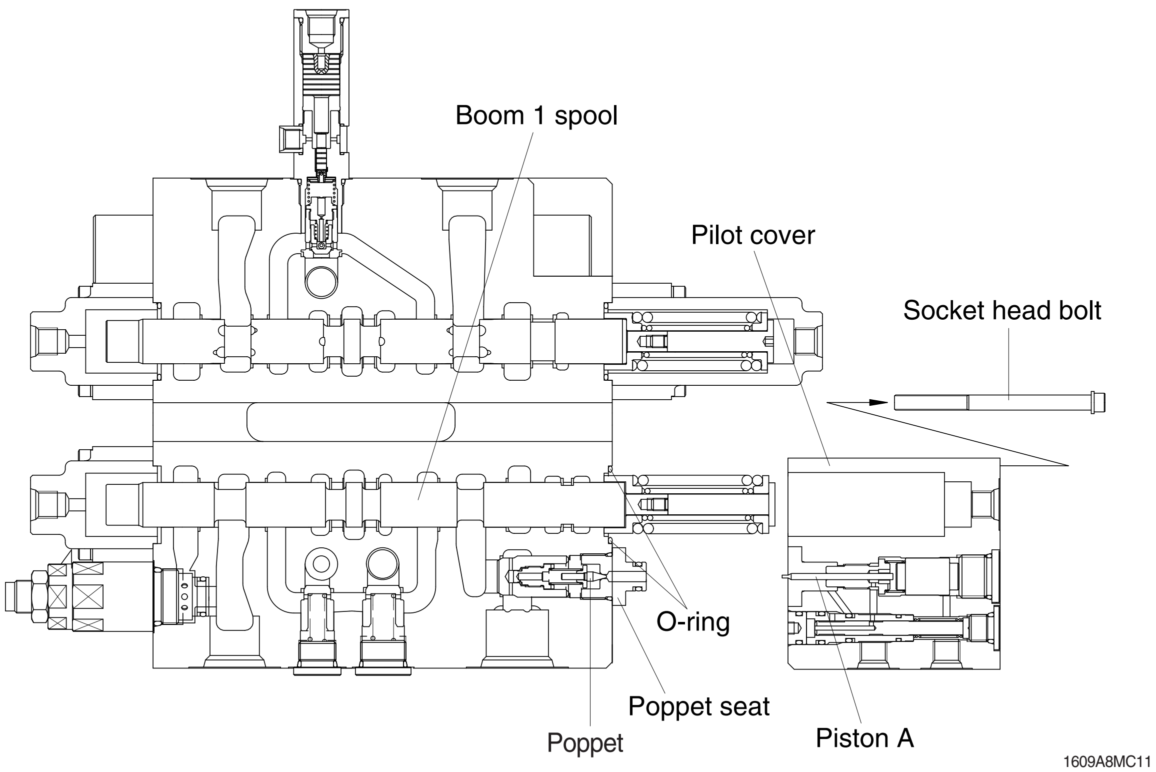
① Loosen hexagon socket head bolts with washer.
(hexagon wrench : 5 mm)

② Remove the pilot cover with internal parts.

※ Pay attention not to lose the O-ring and the poppet under the pilot cover.
※ Pay attention not to damage the "piston A" under pilot cover.

③ Remove the spool assembly from the body by hand slightly.

※ When extracting each spool from its body, pay attention not to damage the body.
※ When extracting each spool assembly, it must be extracted from spring side only.
※ When any abnormal parts are found, replace it with completely new spool assembly.
※ When disassembled, tag the components for identification so that they can be reassembled correctly.



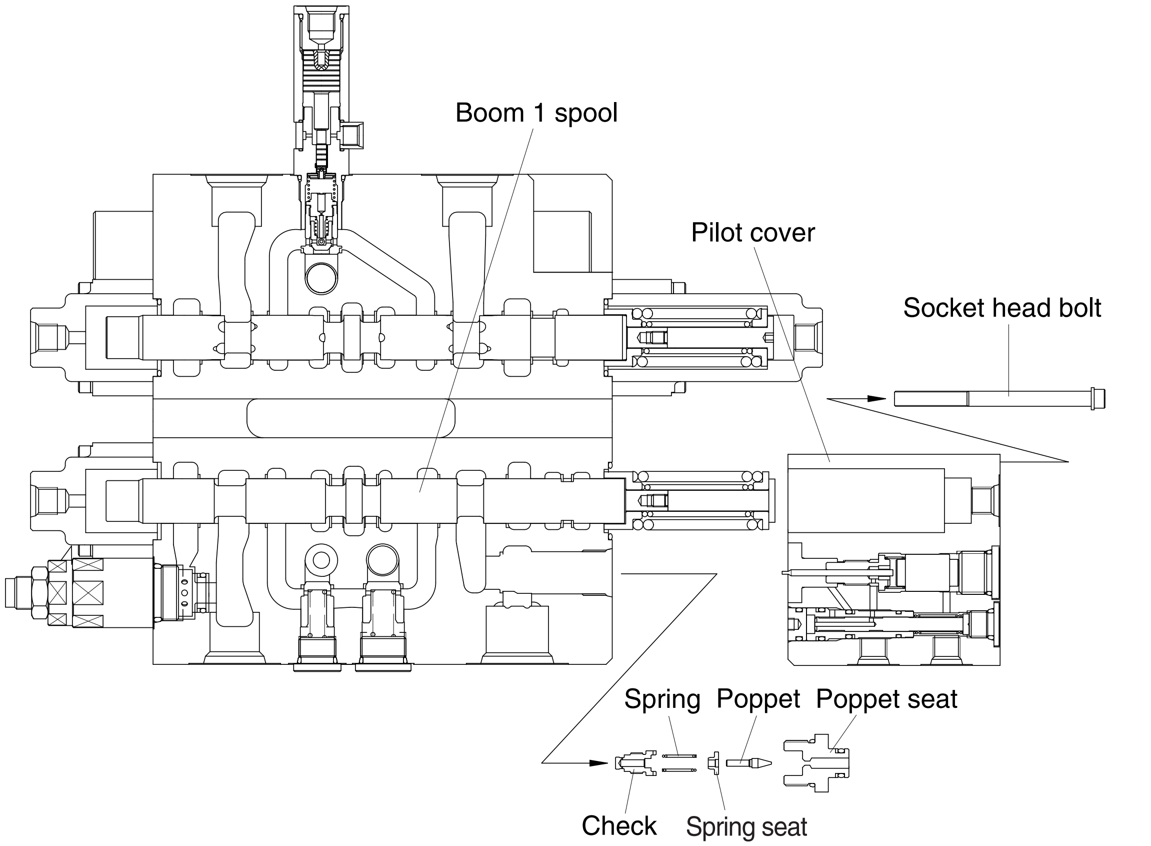
(3) Disassembly of the holding valve

① Remove the pilot cover with the holding valve as described on previous page.

※ Do not disassembled internal parts of the pilot cover.

② Loosen the poppet seat and remove the poppet, spring seat, spring and check.
(spanner : 26 ㎜)

※ Pay attention not to lose the poppet.
※ Do not disassembled internal parts of the check.



(4) Disassembly of the load check valve and the negative relief valve

① The load check valve

a. Fix the body to suitable work bench.

※ Pay attention not to damage the body.

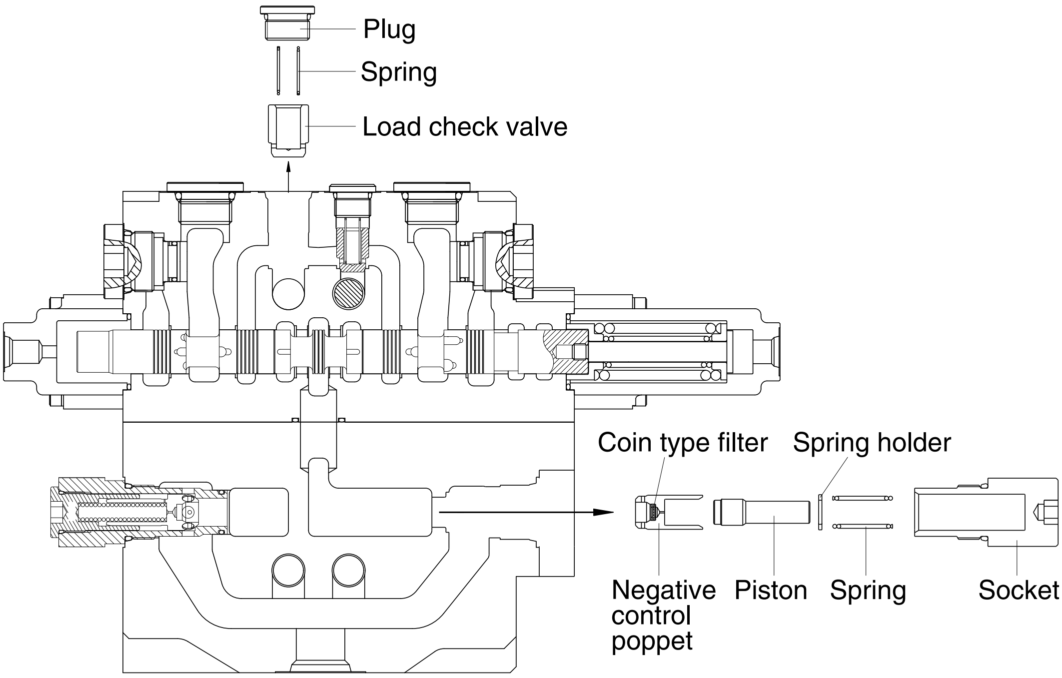
b. Loosen the plug (hexagon wrench : 10 ㎜).

c. Remove the spring and the load check valve with pincers or magnet.

② The negative relief valve

a. Loosen the socket (spanner : 32 ㎜).

b. Remove the spring, spring holder, piston and negative control poppet.



14W98MC13

(5) Disassembly of the main and overload relief valve

① Fix the body to suitable work bench.

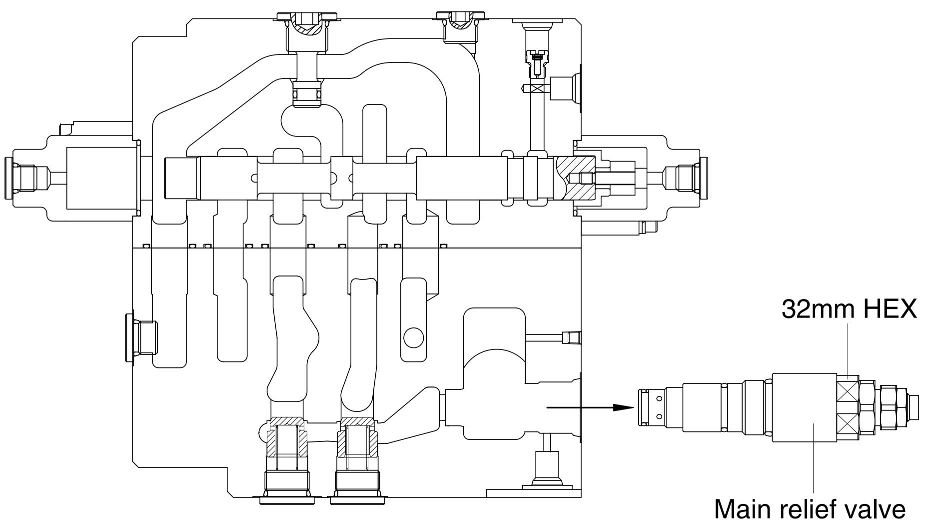
② Remove the main relief valve.
(spanner : 32 ㎜)

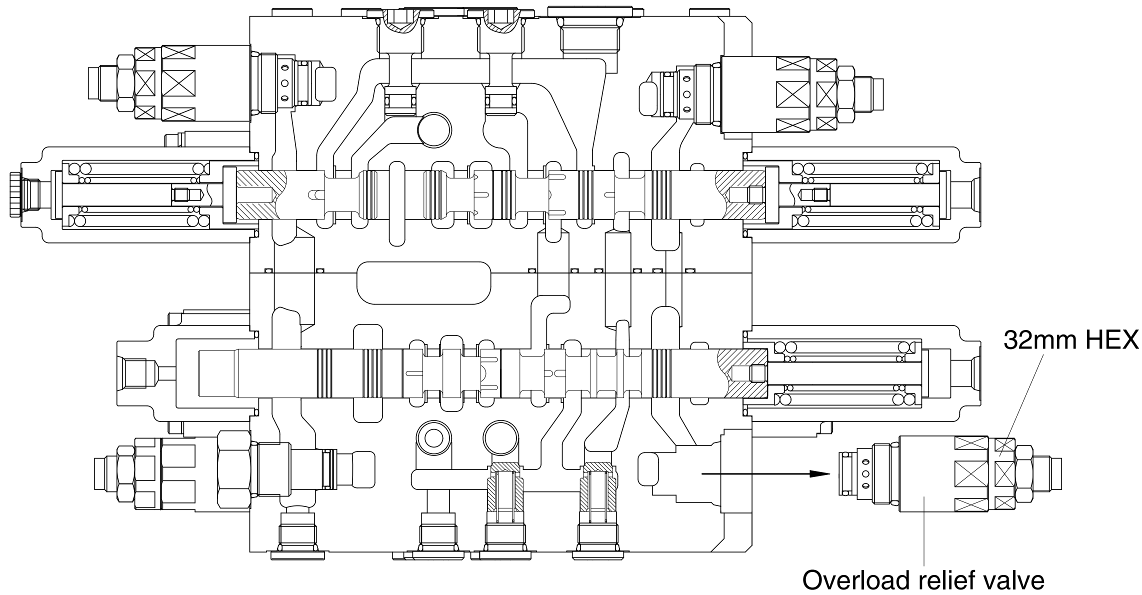
③ Remove the overload relief valve.
(spanner : 32 ㎜)

※ When disassembled, tag the relief valve for identification so that they can be reassembled correctly.

※ Pay attention not to damage seat face.

※ When any abnormal parts are found, replace it with completely new relief valve assembly.





1609A8MC14

(6) Inspection after disassembly

Clean all disassembled parts with clean mineral oil fully, and dry them with compressed air. Then, place them on clean papers or cloths for inspection.

① Control valve

a. Check whole surfaces of all parts for burrs, scratches, notches and other defects.
b. Confirm that seal groove faces of body and block are smooth and free of dust, dent, rust etc.
c. Correct dents and damages and check seat faces within the body, if any, by lapping.
※ Pay careful attention not to leave any lapping agent within the body.
d. Confirm that all sliding and fitting parts can be moved manually and that all grooves and path's are free foreign matter.
e. If any spring is broken or deformed, replace it with new one.
f. When a relief valve does not function properly, repair it, following it's the prescribed disassembly and assembly procedures.
g. Replace all seals and O-rings with new ones.

② Relief valve

a. Confirm that all seat faces at ends of all poppets and seats are free of defects and show uniform and consistent contact faces.
b. Confirm manually that main poppet and seat can slide lightly and smoothly.
c. Confirm that outside face of main poppet and inside face of seat are free from scratches and so on.
d. Confirm that springs are free from breakage, deformation, and wear.
e. Confirm that orifices of main poppet and seat section are not clogged with foreign matter.
f. Replace all O-rings with new ones.
g. When any light damage is found in above inspections, correct it by lapping.
h. When any abnormal part is found, replace it with a completely new relief valve assembly.

4) ASSEMBLY

(1) General precaution

① In this assembly section, explanation only is shown.
For further understanding, please refer to the figures shown in the previous structure & disassembly section.
② Pay close attention to keeping all seals free from handling damage and inspect carefully for damage before using them.
③ Apply clean grease or hydraulic oil to the seal so as to ensure it is fully lubricated before assembly. Do not stretch seals so much as to deform them permanently.
④ In fitting O-rings, pay close attention not to roll them into their final position in addition, a twisted
⑤ O-ring cannot easily untwist itself naturally and could thereby cause inadequate sealing and thereby both internal and external oil leakage.
⑥ Tighten fitting bolts for all sections with a torque wrench adjusted to the respective tightening torque.
⑦ Do not reuse removed O-rings and seals.

(2) Load check valve

① Assemble the load check valve and spring.
② Put O-rings on to plug.
③ Tighten plug to the specified torque.
· Hexagon wrench : 10 mm
· Tightening torque : 6~7 kgf · m (43.4~50.6 lbf · ft)

(3) Negative control relief valve

① Assemble the nega-con poppet, piston, spring holder and spring together into body.
② Put O-ring on to plug and tighten the latter to its specified torque.
· Hexagon wrench : 12 mm
· Tightening torque : 8~9 kgf · m (57.8~65.1 lbf · ft)

(4) Main relief, overload relief valves

Install main relief valve, overload relief valve into the body and tighten to the specified torque.

Component	Tools	Tightening torque	
		kgf · m	lbf · ft
Main relief valve	Spanner 32 mm	8~9	57.8~65.1
Overload relief valve	Spanner 32 mm	8~9	57.8~65.1

(5) Main spools

① Carefully insert the previously assembled spool assemblies into their respective bores within of body.
※ Fit spool assemblies into body carefully and slowly. Do not under any circumstances push them forcibly in.

(6) Pilot covers

① Fit spool covers to the non-spring assembly end of the spool, and tighten the hexagonal socket head bolts to the specified torque.

· Hexagon wrench : 5 mm

· Tightening torque : 1.0~1.1 kgf · m (7.2~7.9 lbf · ft)

※ Confirm that O-rings have been fitted.

② Fit spring covers to the spring end for the spools, and tighten hexagon socket head bolts to the specified torque.

· Hexagon wrench : 5 mm

· Tightening torque : 1.0~1.1 kgf·m (7.2~7.9 lbf·ft)

※ Confirm that O-rings have been fitted.

(7) Holding valves

① Assemble the check, spring seat and poppet together into body.

② Tighten the poppet seat to the specified torque.

· Spanner : 26 mm

· Tightening torque : 6~7 kgf · m (43.4~50.6 lbf · ft)

③ Fit the "piston A" under pilot cover with internal parts into hole on the poppet seat.

④ Tighten hexagon socket head bolt to specified torque.

· Hexagon wrench : 5 mm

· Tightening torque : 1.0~1.1 kgf · m (7.2~7.9 lbf · ft)

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

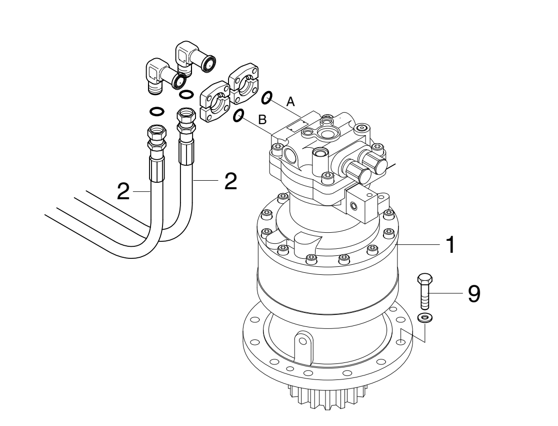
(4) Disconnect hose assembly (2).

(5) Disconnect pilot line hoses (3, 4, 5, 6).

(6) Sling the swing motor assembly (1) and remove the swing motor mounting socket bolts (9).

· Motor device weight : 261 kg (575 lb)

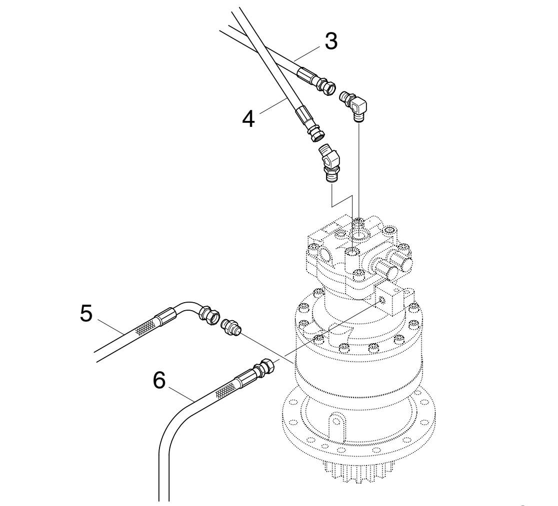
· Tightening torque : 57.9 ± 8.7 kgf·m (419 ± 62.9 lbf·ft)



160A8SM21

(7) Remove the swing motor assembly.

※ When removing the swing motor assembly, check that all the piping have been disconnected.



160A8SM22

2) INSTALL

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

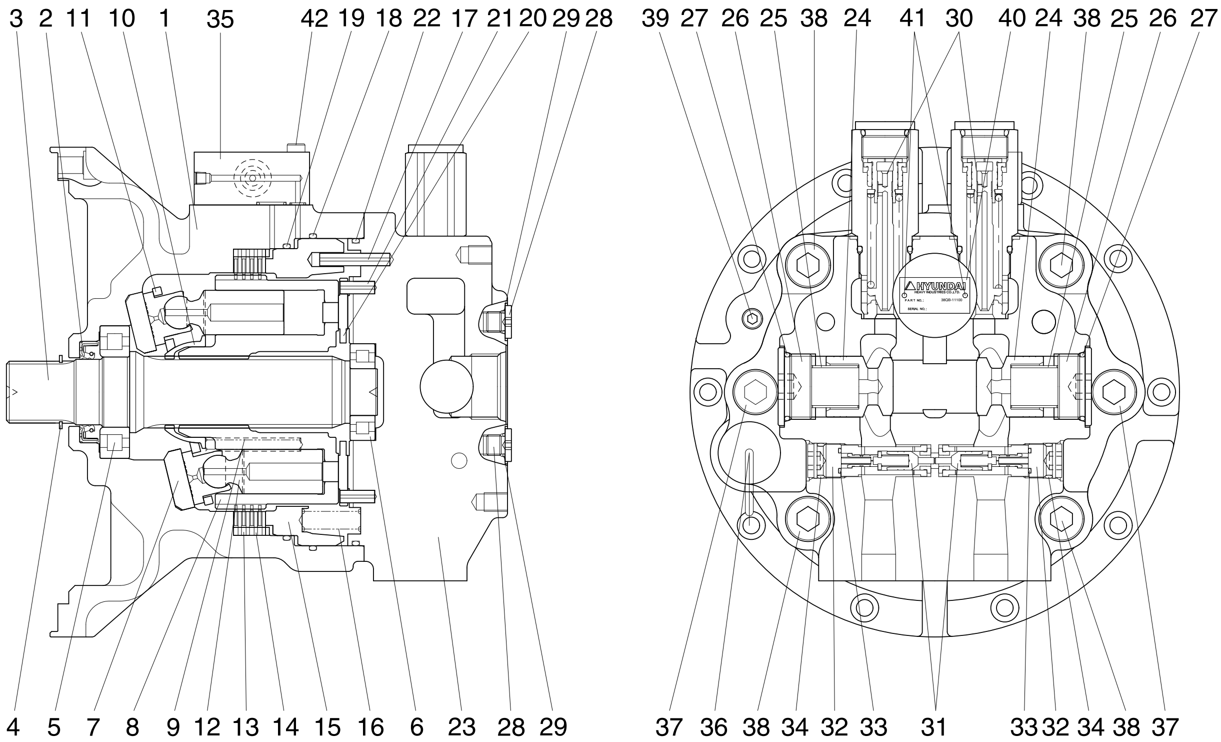
(2) Bleed the air from the swing motor.

① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling and check oil come out from plug.
⑤ Tighten plug fully.

(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



160A2SM02

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

2) DISASSEMBLY

(1) Disassemble drive shaft

① Unloosing socket bolt (port block assy, 42) and disassemble port block assy assy (35) from casing (1).

2209A8SM51

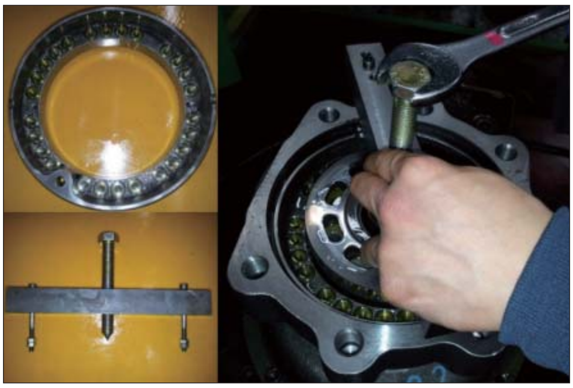
② Disassemble level gauge assy (36) from casing (1).

2209A8SM52

③ Hang valve casing (23) on hoist, unloose socket bolt (37, 38) and disassemble from casing (1).

2209A8SM53

④ Disassemble spring (16) and using a jig, disassemble parking piston (15) from casing (1).



2209A8SM54

⑤ Disassemble respectively cylinder block sub (8), friction plate (13), separate plate (14) from casing (1).

2209A8SM55

⑥ Disassemble swash plate (7) from casing (1).

2209A8SM56

⑦ Using a plier jig, disassemble snap ring (4) from casing (1).

2209A8SM57

⑧ Disassemble shaft assy (3), oil seal (2) and O-ring (18, 22) from casing (1).

2209A8SM58

(2) Disassemble cylinder block sub

① Disassemble piston assy (12) from cylinder block (8).

2209A8SM59

② Disassemble ball guide (10) and spring (cylinder block, 9) from cylinder block (8).

· Ball guide × 1EA
· Spring × 9EA

2209A8SM60

(3) Disassemble valve casing sub

① Disassemble spring pin (17, 21), valve plate (20), O-ring (22) from valve casing (23).

2209A8SM61

② Using a torque wrench, disassemble relief valve (30) from valve casing (23).

2209A8SM62

③ Using a torque wrench, disassemble plug (32) from valve casing (23) and disassemble O-ring (33, 34) and anti-rotation 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

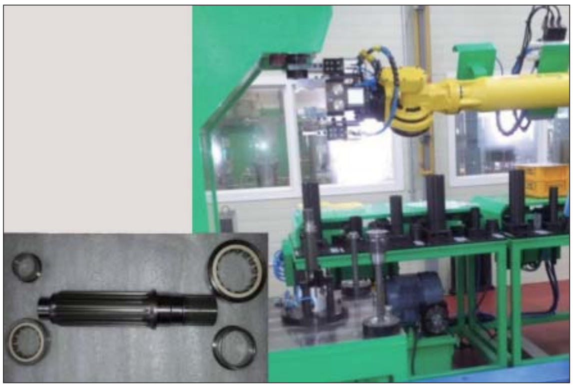
3) ASSEMBLING

(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

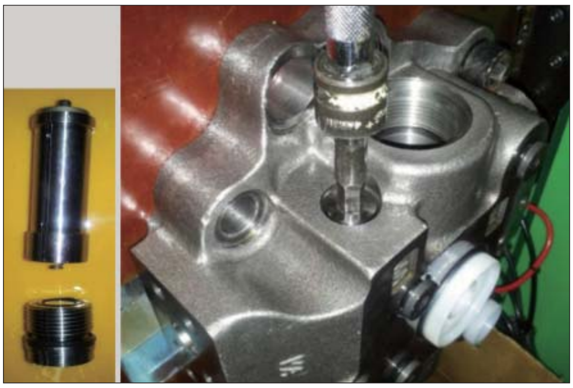
① Assemble make up check valve sub

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.
- Anti-rotation 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

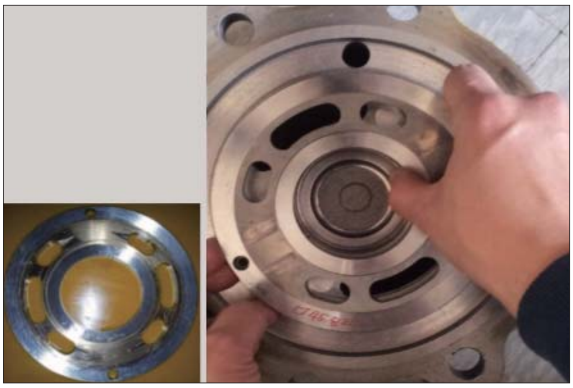
④ Assemble plug (28) and O-ring (27) into valve casing (23).
- Plug (28)×3EA
- O-ring (27)×3EA

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 time 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

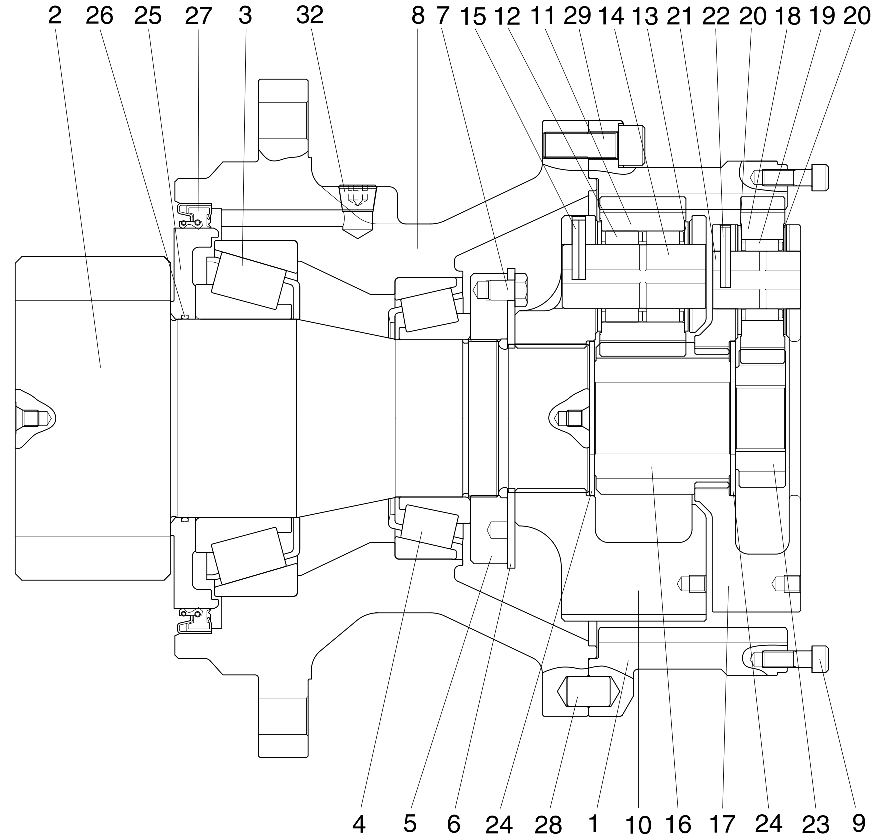
⑭ Mount test bench

Mounting motor a test bench, test the availability of each part.

2209A8SM91

3. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE



160A2SM03

1	Ring gear	11	Planetary gear 2	21	Carrier pin 1
2	Drive shaft	12	Needle bearing 2	22	Spring pin 1
3	Taper roller bearing	13	Thrust washer 2	23	Sun gear 1
4	Taper roller bearing	14	Carrier pin 2	24	Thrust plate
5	Ring nut	15	Spring pin 2	25	Sleeve
6	Lock plate	16	Sun gear 2	26	O-ring
7	Hexagon bolt	17	Carrier 1	27	Oil seal
8	Casing	18	Planetary gear 1	28	Parallel pin
9	Socket bolt	19	Needle bearing 1	29	Socket bolt
10	Carrier 2	20	Thrust washer 1	32	Plug

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

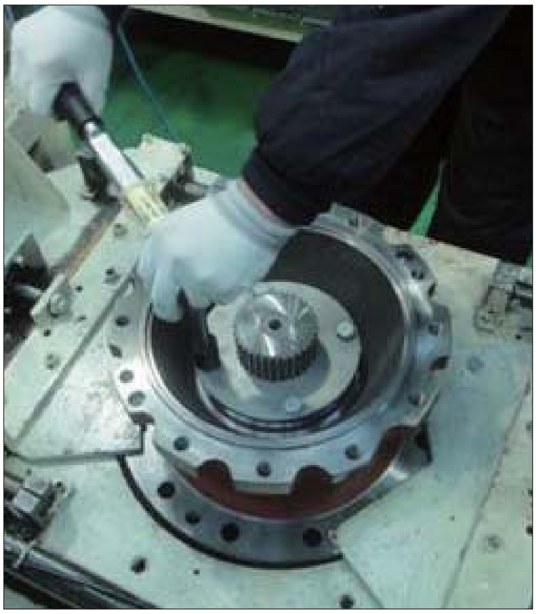
After unscrewing every socket bolt (M16), remove ring gear from casing.

※ Because of liquid gaskets between ring gear and casing, put sharp punch between ring gear and casing and tapping it to remove them.

2209A8SM06

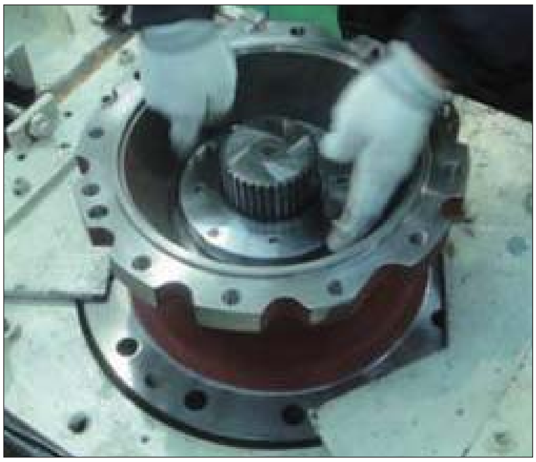
④ Removing drive shaft sub assy

a. Unscrew every hex head bolt (M12) to remove lock plate.



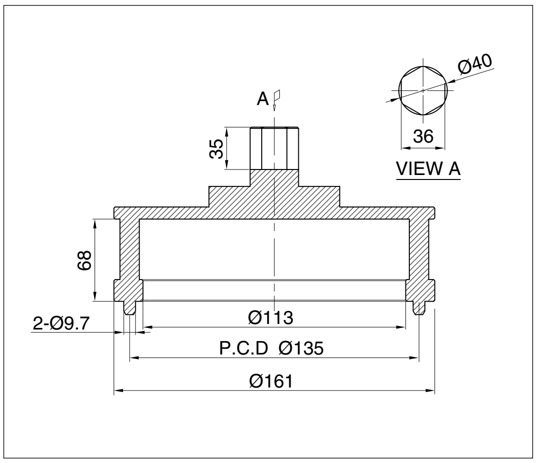
2209A8SM07

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 disassemble 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.

2209A8SM12

(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.

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.

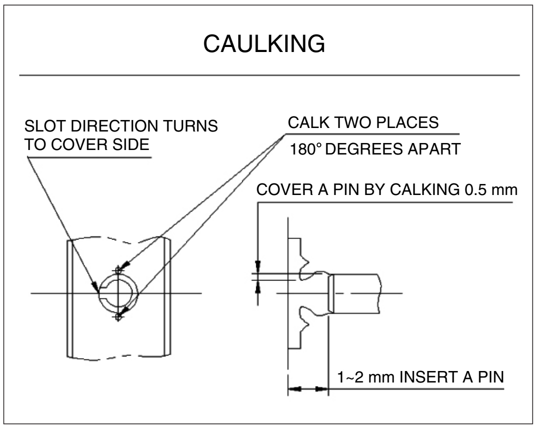
2209A8SM14

(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

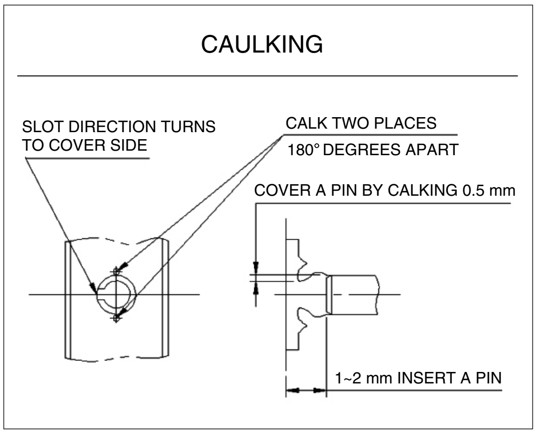
(3) Align No.2 spring pin hole and No.2 carrier spring pin hole, put No.2 spring pin into the holes.
Make No.2 spring pin cutting line face to No.2 planetary gear.

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

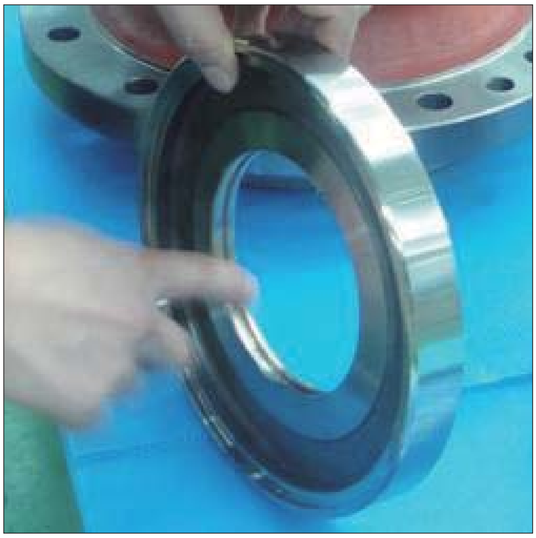
(1) Prepare drive shaft pinion gear vertical with ground.

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

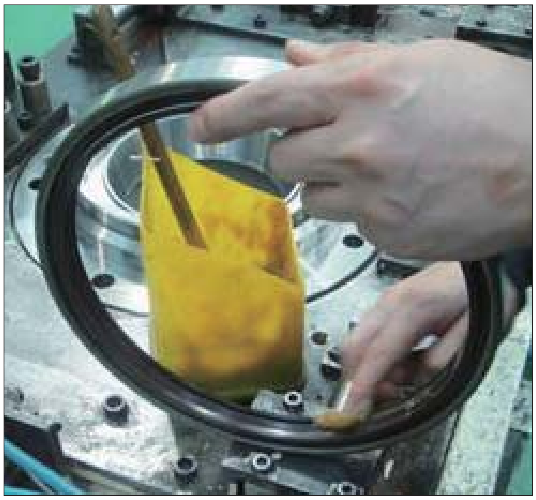
2209A8SM26

(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.

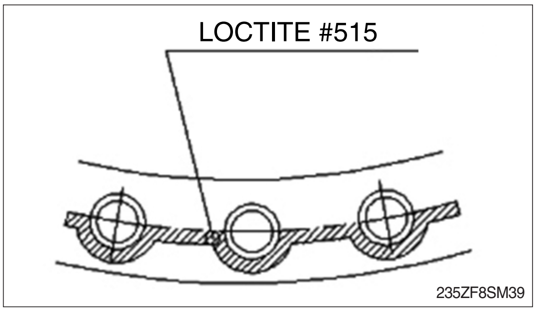
2209A8SM37

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.

(4) Remove the track shoe assembly.
For details, see **removal of track shoe assembly.**

(5) Remove the cover.

(6) Remove the hose.

※ Fit blind plugs to the disconnected hoses.

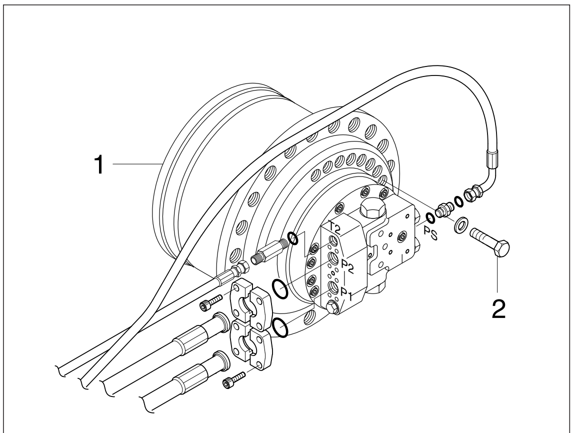
(7) Remove the bolts and the sprocket.

(8) Sling travel device assembly (1).

(9) Remove the mounting bolts (2), then remove the travel device assembly.

· Weight : 300 kg (660 lb)

· Tightening torque : 29.7 ± 3.0 kgf·m
(215 ± 21.7 lbf·ft)



16098TM01

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.

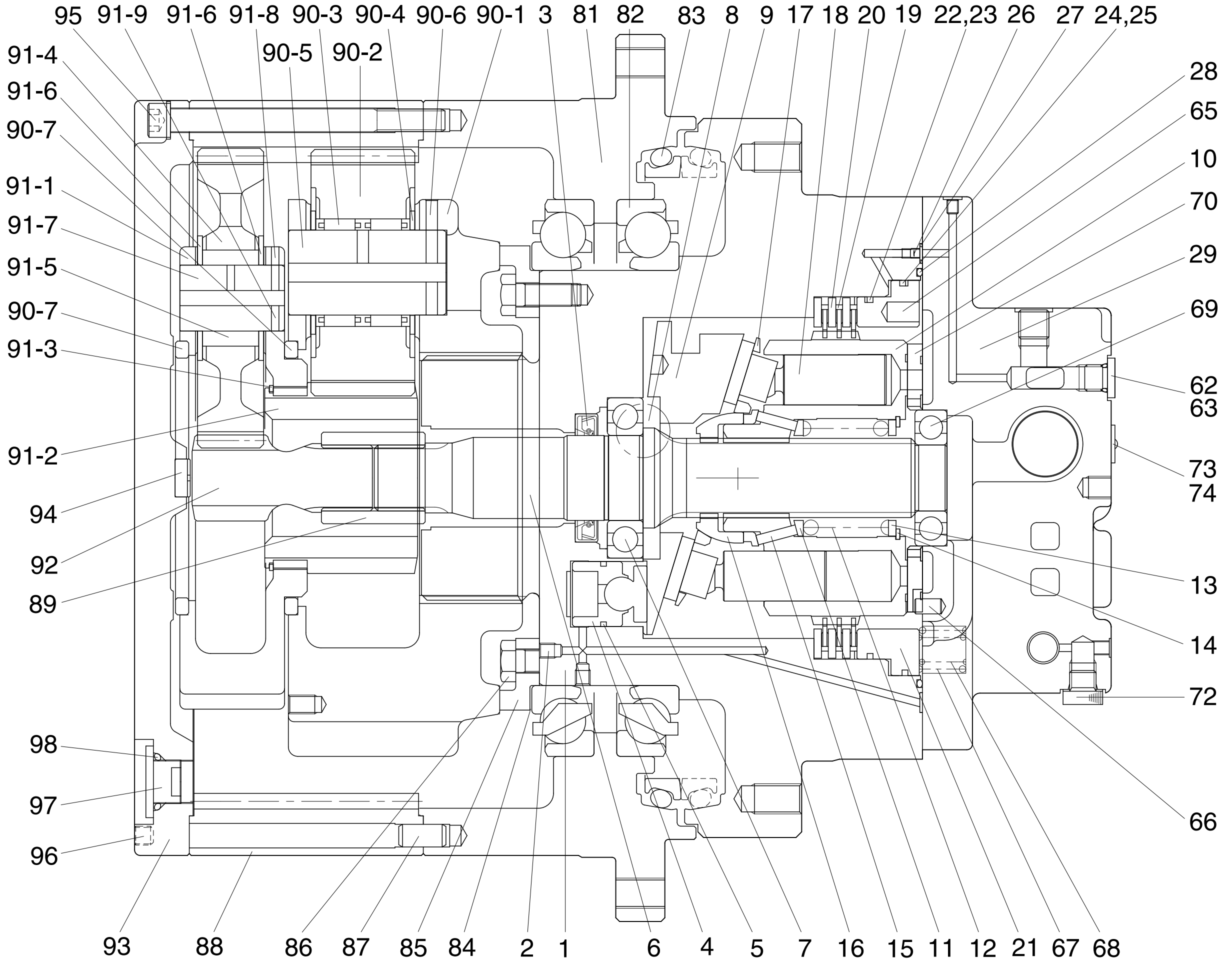
④ Start the engine, run at low idling, and check oil come out from plug.

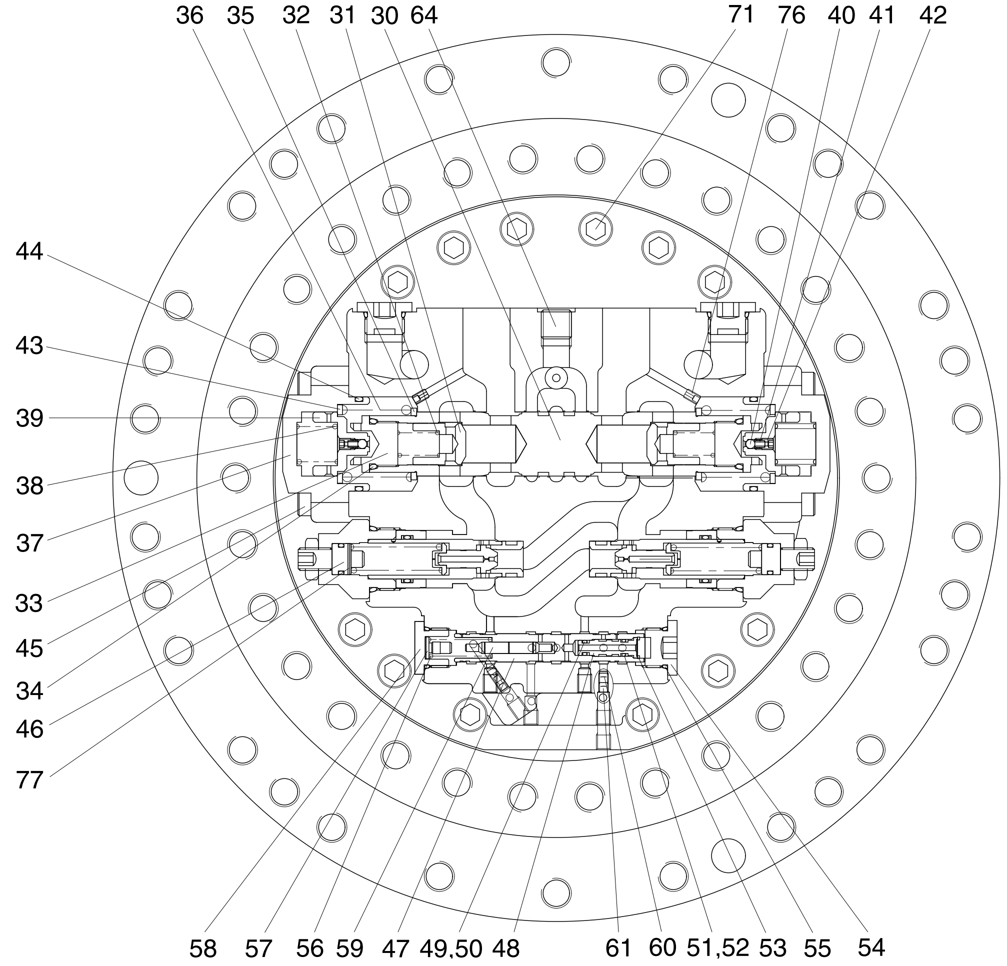
⑤ Tighten plug fully.

(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. TRAVEL MOTOR

1) STRUCTURE



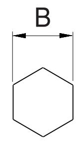


16092TM02

1 Shaft casing
2 Plug
3 Oil seal
4 Swash piston
5 Piston ring
6 Shaft
7 Bearing
8 Steel ball
9 Swash plate
10 Cylinder block
11 Spring seat
12 Spring
13 End plate
14 Snap ring
15 Pin
16 Ball guide
17 Set plate
18 Piston assy
19 Friction plate
20 Separate plate
21 Parking piston
22 O-ring
23 Back up ring
24 O-ring
25 Back up ring
26 Orifice
27 O-ring
28 O-ring
29 Rear cover
30 Spool
31 Check
32 Spring
33 Plug
34 O-ring
35 Spring seat
36 Spring
37 Cover
38 Spring
39 Spool
40 Steel ball
41 Spring
42 Plug
43 Spring seat
44 O-ring
45 Wrench bolt
46 Relief valve assy
47 Spool
48 Guide
49 O-ring
50 Back up ring
51 O-ring
52 Back up ring
53 Snap ring
54 plug
55 O-ring
56 Spring
57 Spring seat
58 Plug
59 Spool
60 Orifice
61 Orifice
62 Plug
63 O-ring
64 Plug
65 Pin
66 Pin
67 Spring
68 Spring
69 Bearing
70 Valve plate
71 Wrench bolt
72 Plug
73 Name plate
74 Rivet
75 Seal kit
76 Orifice
77 Shim
81 Housing
82 Main bearing
83 Floating seal
84 Shim
85 Retainer
86 Hex head bolt
87 Parallel pin
88 Ring gear
89 Coupling
90 Carrier assy No.2
90-1 Carrier No.2
90-2 Planetary gear No.2
90-3 Needle bearing No.2
90-4 Thrust washer
90-5 Pin No.2
90-6 Spring pin
90-7 Thrust ring
91 Carrier assy No.1
91-1 Carrier No.1
91-2 Sun-gear No.2
91-3 Retaining ring
91-4 Planetary gear No.1
91-5 Needle bearing No.1
91-6 Thrust washer
91-7 Pin No.1
91-8 Spring pin
91-9 Spring pin
92 Sun gear No.1
93 Cover
94 Pad
95 Hex socket head bolt
96 Hex socket Screw
97 Hydraulic plug
98 O-ring
99 Name plate

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name		Remark	
Allen wrench		2, 5, 4, 6, 10	
Socket for socket wrench, spanner	Socket	8, 14, 24, 27	
Torque wrench		Capable of tightening with the specified torques	
Pliers		-	
Plastic and iron hammer		Wooden hammer allowed. Normal 1 or so	
Monkey wrench		-	
Oil seal inserting jig		-	
Bearing pliers		-	
Seal tape		-	
Eye bolt		M10, M12, M14	
Press (0.5 ton)		-	
Oil stone		-	
Bearing assembling jig		-	

(2) Tightening torque

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Plug	2	NPT 1/16	1±0.1	7.2±0.7
Orifice	26	M5	0.7±0.1	5±0.7
Wrench bolt	45	M12×40	10±1.0	72±7.0
Relief valve	46	HEX 27	18±1.0	130±7.0
Plug	54	PF 1/2	8.5±1.0	61±7.0
Plug	58	HEX 24	5±1.0	36±7.0
Plug	62	PF 1/4	5±1.0	36±7.0
Wrench bolt	71	M12×35	10±1.0	72±7.0
Hex head bolt	-	M12×25	11±1.5	79±10
Hex socket head bolt	-	M12×155	11±1.5	79±10
Hex socket head plug	-	PF 3/4	19±1	137±7.0

3. OUTLINE OF DISASSEMBLING

1) GENERAL SUGGESTIONS

(1) Select a clean place for dismantling.
Spread a rubber plate on a working table in order to prohibit the damage of parts.

(2) Clean a deceleration equipment and a motor part, washing out dirt and unnecessary substances.

(3) Without any damage of O-ring, oil seal, the adhered surface of other seals, a gear, a pin, the adhered surface of other bearings, and the surface of moisturized copper, treat each parts.

(4) Numbers written in the parenthesis, ( ), next to the name of a part represent the part numbers of a cross-sectional view annexed with a drawing.

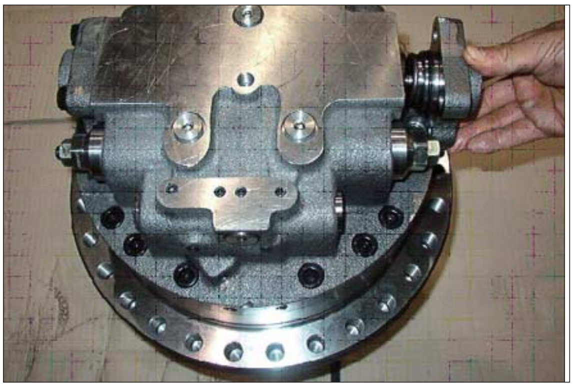
(5) The side of a pipe in a motor can be written as a rear side; the side of out-put as a front side.

(6) Using and combining a liquid gasket, both sides must be dried completely before spraying a liquid gasket.

(7) In case of bonding volts, combine a standard torque by torque wrench after spraying loctite 262 on the tab parts. (It can be dealt as assembling NPTF screws and an acceleration equipment.)

3.1 DISASSEMBLING

1) Unloosing wrench bolt and disassemble cover (37).
※ Wrench bolt = M12×40L-8 EA
(purchasing goods)

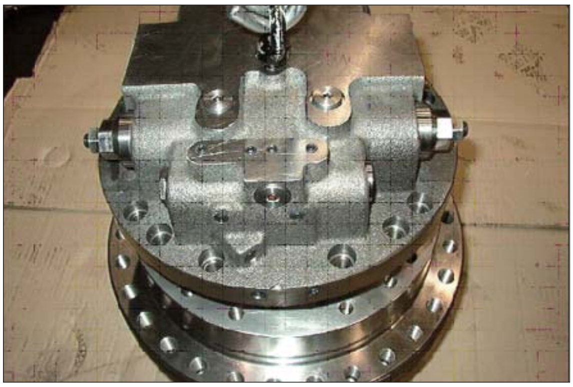


21078TM21

2) Disassemble parts related to counterbalance valve.

21078TM22

3) Unloosing wrench bolt (M12×35L, 16 EA) and disassemble rear cover assembly from motor assembly.



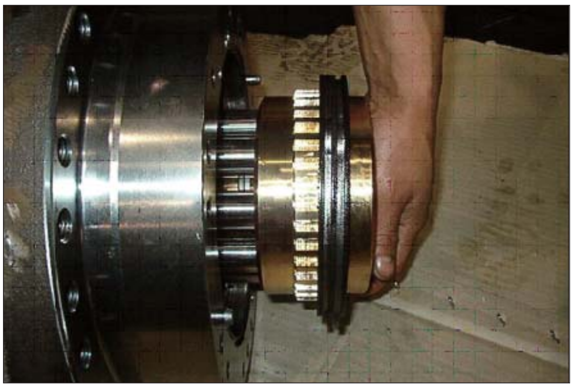
21078TM23

21078TM24

4) Dismantle packing piston (21) using compressed air.

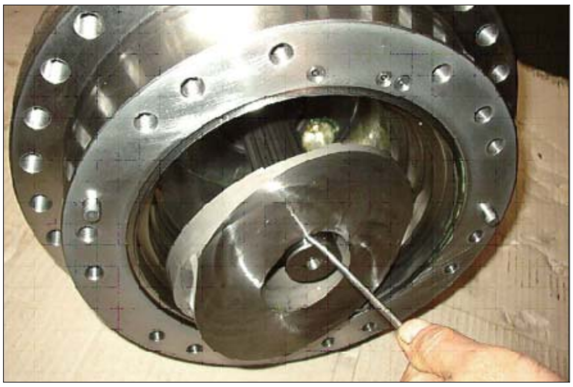
21078TM25

5) Disassembly rotary kit from motor assembly (cylinder block assembly, piston assembly, ball guide, set plate, friction plate, steel plate...)



21078TM26

6) Using a jig, disassemble swash plate (9) from shaft casing.



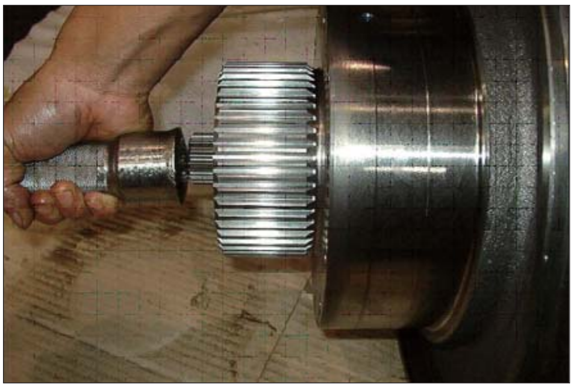
21078TM27

7) Using compressed air, disassemble piston swash (4) piston ring (5), respectively.

21078TM28

21078TM29

8) Using a hammer, disassemble shaft (6) from shaft casing (1).



21078TM30

■ Disassemble cylinder sub.

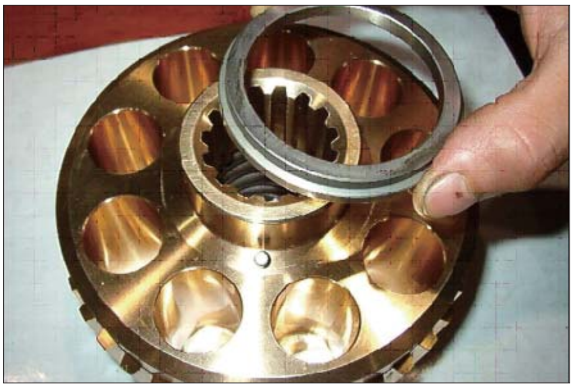
9) Disassemble cylinder block assembly, piston assembly (9) and seat plate (M).

21078TM31

21078TM32

10) Disassemble ball guide (16), ring and pin (15) from cylinder block, respectively.

21078TM33



21078TM34

21078TM35

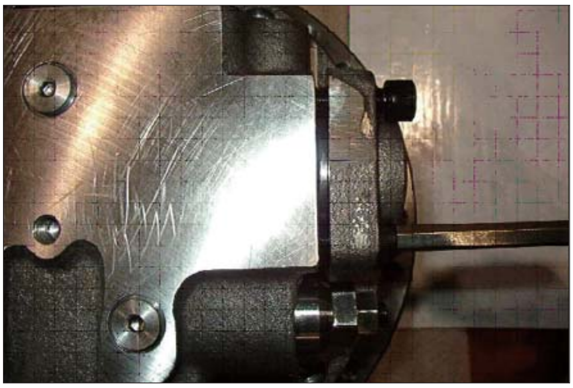
11) Pushing spring (12) by an assembling jig, disassemble snap ring (14), spring seat (13), spring (12) and spring seat (11), respectively.

21078TM36

21078TM37

■ Disassemble valve casing sub.

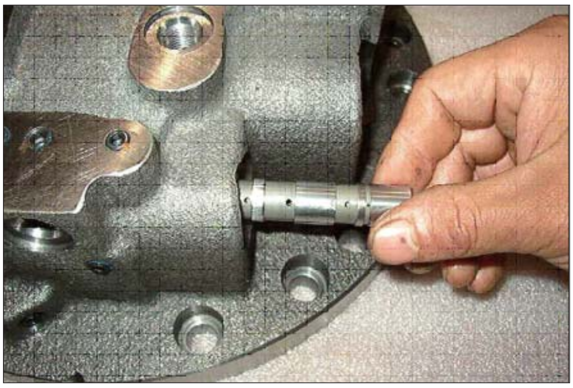
12) Using an hexagon wrench, unloosing wrench bolt (45) and disassemble cover (37), spring (38), spool (39), spring seat (43), spring (36) and spring seat (35), respectively.
(same balance on both sides)



21078TM38

21078TM39

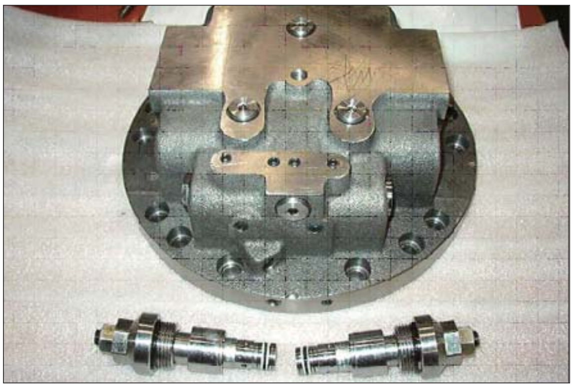
13) Disassemble spool (59), spool (47), O-ring (51), guide (48) and snap ring (53) on rear cover, respectively.



21078TM40

21078TM41

14) Using a torque wrench, disassemble relief valve assembly (46) on rear cover.



21078TM42

4. OUTLINE FOR ASSEMBLING

1) GENERAL SUGGESTIONS

(1) After washing each parts cleanly, dry it with compressed air.
Provided that you do not wash friction plate with treated oil.

(2) In bonding each part, fasten bond torque.

(3) When using a hammer, do not forget to use a plastic hammer.

4.1 ASSEMBLING

■ **Assemble the sub of turning axis**

1) Using a jig, assemble oil seal (3) into shaft casing (1)


21078TM43

2) Have a bearing (8) thermal reacted into shaft (6).


21078TM44


21078TM45

21078TM46

3) Using a jig, assemble shaft assembly into shaft casing (1).

21078TM47

4) After spreading grease on steel ball (8) assemble into shaft casing (1).

21078TM48

5) Assemble swash piston assembly (4, 5) into shaft casing (1).

21078TM49

6) Assemble swash plate (9) into shaft casing (1).

21078TM50

■ Assemble cylinder block sub.

7) Assemble spring seat (13), spring (12), spring seat (11) into cylinder block (10) respectively, pushing spring (12) using by a jig, assemble snap ring (14) with a snap ring (14).

21078TM51

21078TM52

8) Assemble ring, pin (15) on cylinder block (10) ball guide (16) respectively.

21078TM53

21078TM54

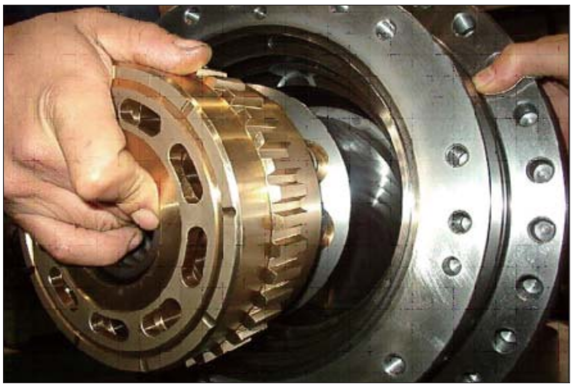
21078TM55

9) Assemble cylinder block assembly, piston assembly (9), seat plate (17).

21078TM56

21078TM57

10) Assemble cylinder block assembly (9) into shaft casing (1).



21078TM58

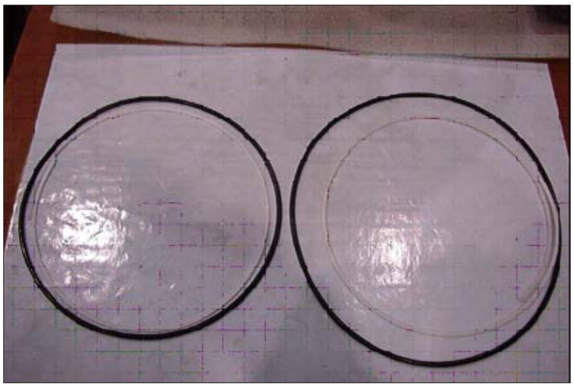
11) Assemble friction plate (19) and plate (20) into shaft casing (1) respectively, prepare 6 set.

21078TM59

21078TM59-1

12) Assemble O-ring (22, 23) into packing piston (21).

21078TM60



21078TM60-1

13) After spreading grease on packing piston (21) bond wrench bolt and assemble shaft casing (1).

21078TM61

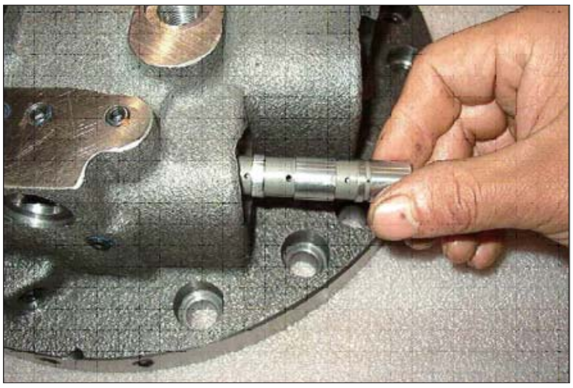
■ Assemble rear cover sub.

14) Using a jig, assemble bearing (69) into rear cover (29).

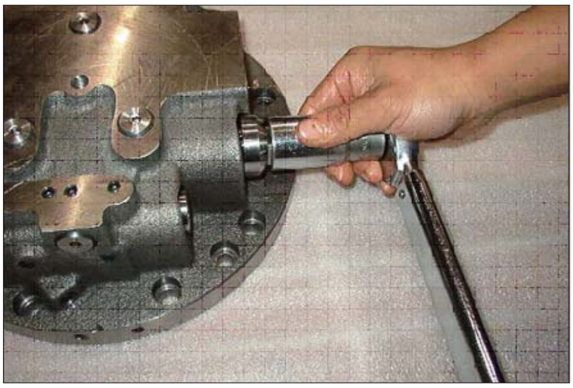
21078TM62

15) After assembling spool (59), spool (47), O-ring (51), guide (48) and snap ring (53) respectively into rear cover (29).
Using torque wrench, assemble it.

21078TM63

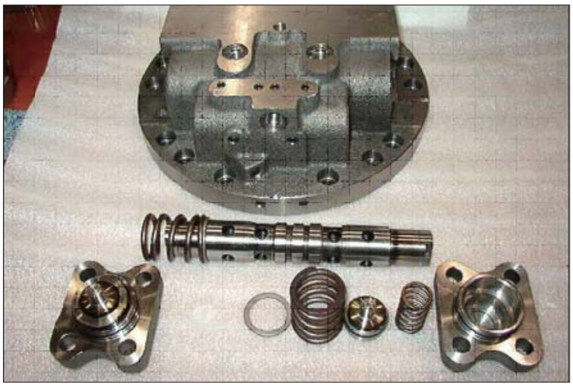


21078TM64

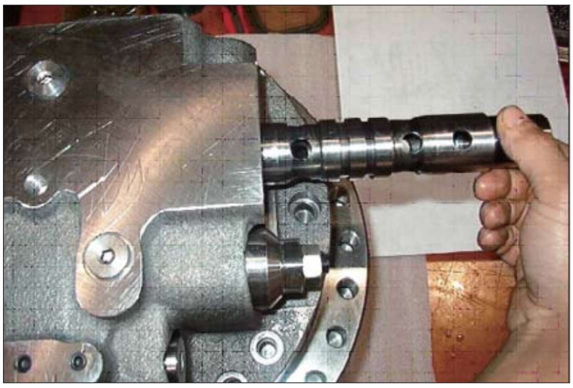


21078TM65

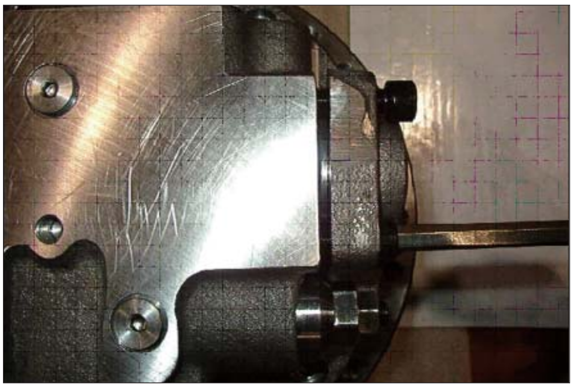
16) Assemble spring seat (35), spring (36), spring seat (43), spool (39), spring (38), cover (37) respectively and assemble wrench bolt (45).
(same balance on both sides)



21078TM66



21078TM67



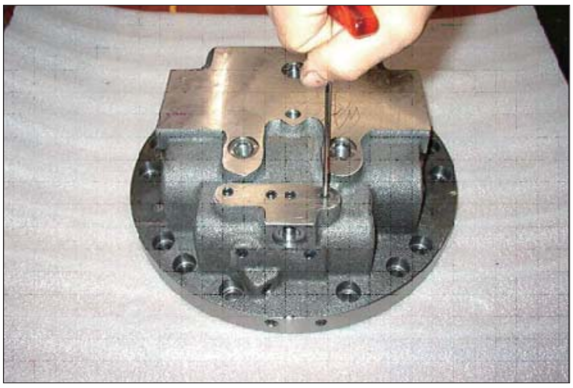
21078TM67-1

17) Assemble plug (2).

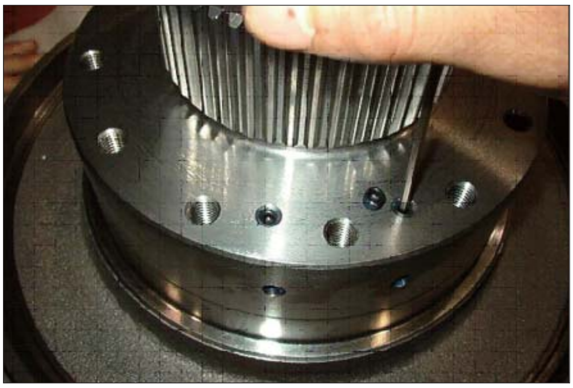
※ Plug (NPT1/16) - 11 EA

21078TM68

21078TM69



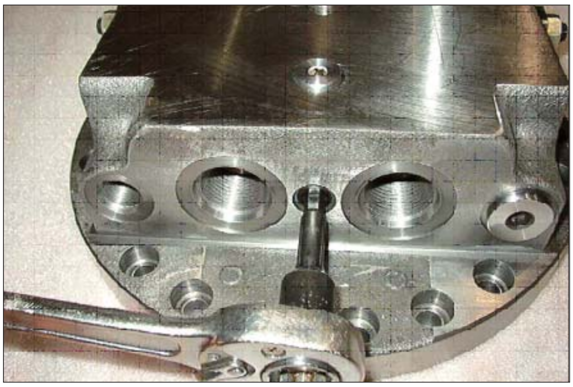
21078TM70



21078TM71

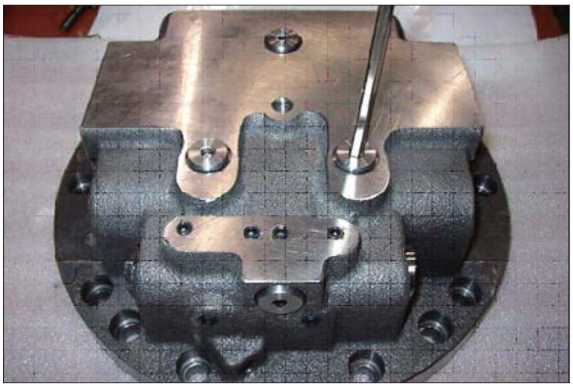
18) Assemble plug (64).

※ Plug (PT3/8) - 11 EA

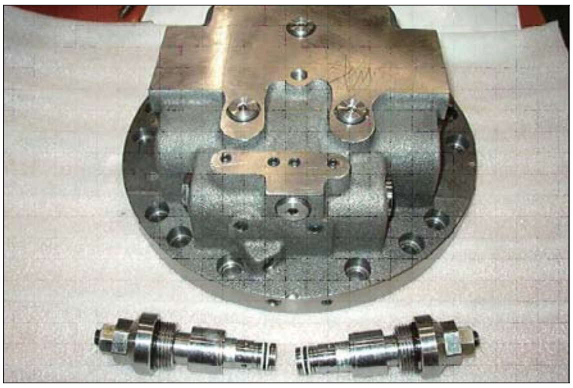


21078TM72

19) Assemble plug (62, 63) into rear cover (29) and assemble relief valve assembly.



21078TM73



21078TM74

20) Put spring (67, 68) together into rear cover (29), prepare 6 set.

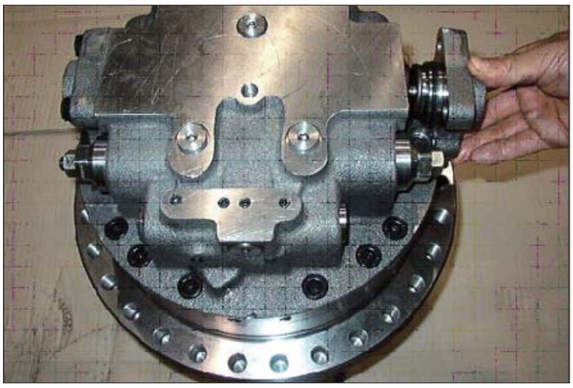
21078TM75

21078TM76

21) Assemble valve plate (70) into rear cover (29).

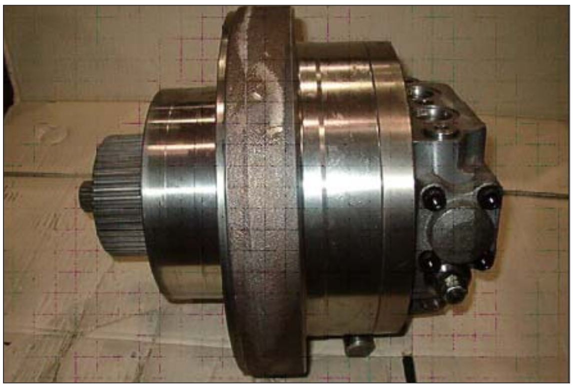
21078TM77

22) After assembling shaft casing (1) and rear cover (29).
Assemble spool assembly (30), spring (38), spool (39), cover (37) after then complete assembly with wrench bolt (45).



21078TM78

23) Finish assembly.



21078TM79

5.1 DISASSEMBLING REDUCTION UNIT

1) Preparation for disassembling

(1) The reduction units removed from excavator are usually covered with mud. Wash outside of propelling unit and dry it.

(2) Locate reducer in order for drain port to be at the lowest level loosen taper screw plug of drain port, and drain oil from reduction gear.

※ While oil is still hot, inside of the unit may be pressurized.

⚠ Take care of the hot oil gushing out of the unit when loosening the plug.

(3) Mark for mating

Put marks on each mating parts when disassembling so as to reassemble correctly as before.

21078TM80

2) Setting reduction unit (or whole propelling unit) on work stand for disassembling

(1) Remove M12 hexagon socket head bolts (95) at 3 places from cover (93) almost equally apart each other, and then install M12×155L eye bolts.

Lift up the unit using them and place it on work stand with cover upward.

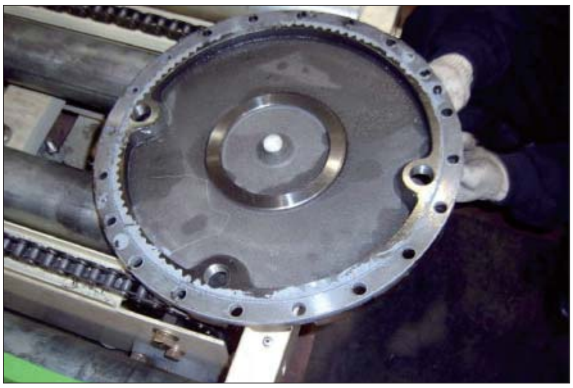
⚠ Take great care not to pinch your hand between parts while disassembling nor let fall parts on your foot while lifting them.

21078TM81

3) Removing cover

(1) Remove the rest of M12 hexagon socket head bolts (95) that securing gear and housing. Loosen all the socket bolts and then, disassemble cover.

(2) As the cover (93) is adhered to ring gear (88), disassemble ring gear (88) and cover (93) vy lightly hammering slantwise upward using sharpen punch inserted between the cover and ring gear.



21078TM82

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.

21078TM83

(2) Remove No.1 sun gear

※ Be sure to maintain it vertical with the ground when disassembling No.1 sun gear.

21078TM84

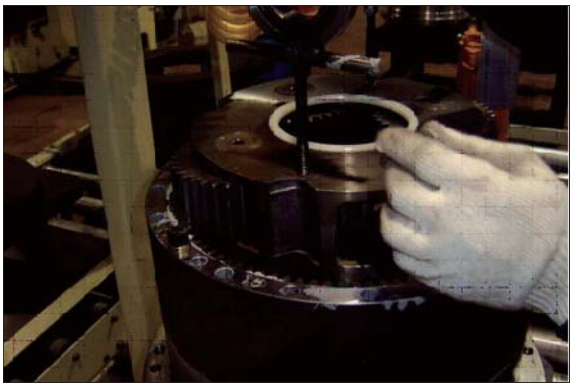
5) Removing No.2 carrier sub assembly

(1) Screw three M10 eye-bolt in No.2 carrier and lift up and remove No.2 carrier assy.

21078TM85

(2) Remove No.2 sun gear

※ Be sure to maintain it vertical with the ground when disassembling No.2 sun gear.



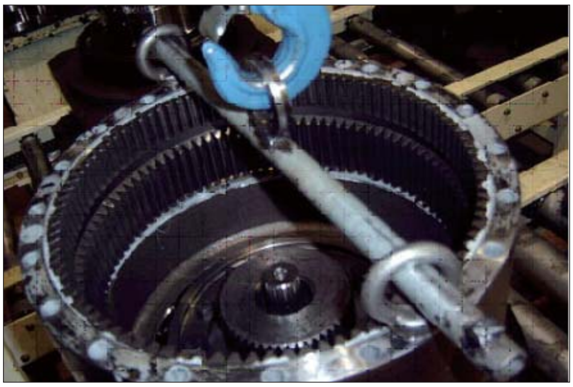
21078TM86

6) Removing ring gear

(1) As the ring gear (88) is adhered to housing (81), disassemble ring gear (88) and housing (81) by lightly hammering slantwise upward using sharpen punch inserted between the ring gear and housing.

※ Carefully disassembling ring gear not to make scratch on it.

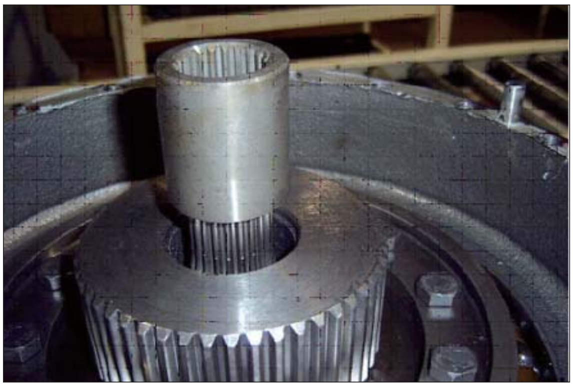
(2) Screw M14 eye-bolt in ring gear and lift up and remove it.



21078TM87

7) Removing coupling

(1) Remove coupling.

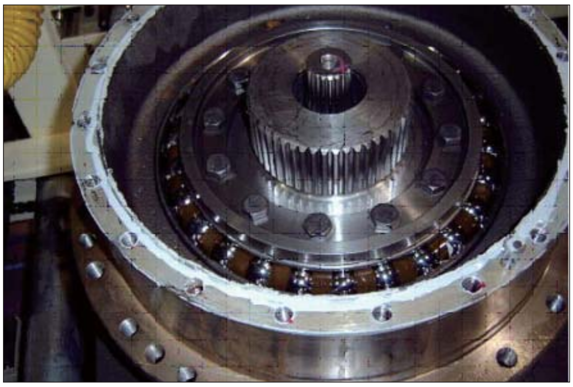


21078TM88

8) Removing retainer & shim

(1) Remove M12 hexagon socket head bolts that secure retainer and motor.

(2) Remove retainer & shim.



21078TM89

9) Removing housing sub assembly

(1) Screw M12 eye bolt in housing and lift up housing assembly including angular bearing and floating seal.

21078TM90

10) Removing floating seal

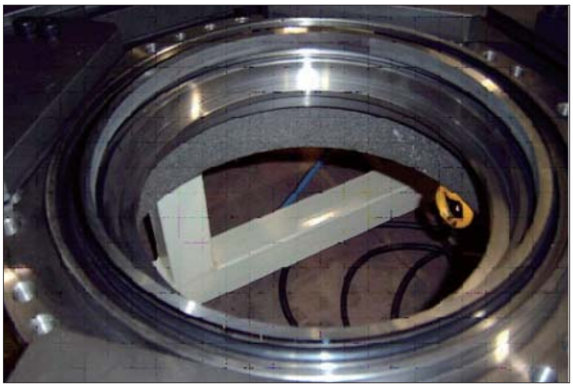
(1) Lift up a piece of floating seal of motor side.

21078TM91

11) Disassembling housing assembly

(1) After turning housing, lift up a piece of floating seal from housing and then remove it.

※ Don't disassemble angular bearing.



21078TM92

12) Disassembling No.1 carrier

(1) Remove thrust ring (90-7) from carrier.

(2) Knock spring pin (91-8) fully into No.1 pin (91-7).

(3) Remove planetary, thrust washer, No.1 pin, bearing from carrier.

21078TM93

21078TM94

21078TM95

13) Disassembling No.2 carrier

(1) Disassemble No.2 carriers, using the same method for No.1 carrier assembly.

21078TM96

21078TM97

6.1 ASSEMBLY REDUCTION GEAR

■ General notes

Clean every part by kerosene and dry them by air blow.
Surfaces to be applied by locktite must be decreased by solvent.
Check every part for any abnormals.
Each hexagon socket head bolt should be used with locktite No. 262 applied on its threads.
Apply gear oil slightly on each part before assembling.
Take great care not to pinch your hand between parts or tools while assembling nor let fall parts on your foot while lifting them.

Inspection before reassembling

Thrust washer

· Check if there are seizure, abnormal wear or uneven wear.
· Check if wear is over the allowable limit.

Gears

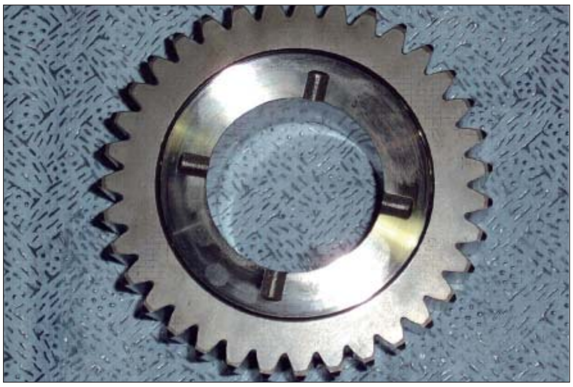
· Check if there are pitting or seizure on the tooth surface.
· Check if there are cracks on the root of tooth by die check.

Bearings

· Rotate by hand to see if there are something unusual such as noise or uneven rotation.

Floating seal

· Check flaw or score on sliding surfaces or O-ring.

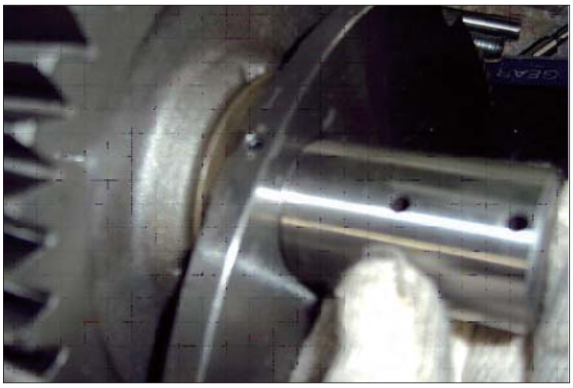


21078TM98

1) Assembling No.1 carrier

(1) Put No.1 carrier (91-1) on a flat place.

(2) Install No.1 needle bearing (91-5) into No.1 planetary gear (91-4), put 2 EA of No.1 thrust washer (91-6) on both sides of bearing, and then, install it into carrier.



21078TM99

(3) Install No.1 pin (91-5) into No.1 carrier where the holes for No.1 pin (91-5) are to be in line with those of No.1 carrier, and then, install spring pins into the holes.

21078TM100

(4) Caulk carrier holes as shown on the picture.

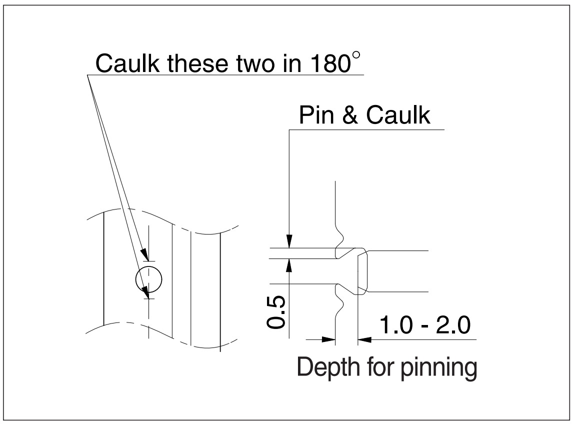
(5) Assembly thrust ring (90-7) into carrier.

21078TM101

2) Assembling No.2 carrier

(1) Put No.2 carrier (90-1) on a flat place.

(2) Install No.2 needle bearing (90-3) into No.2 planetary gear (90-2), put 2 EA of No.2 thrust washer (90-4) on both sides of bearing, and then, install it into carrier.



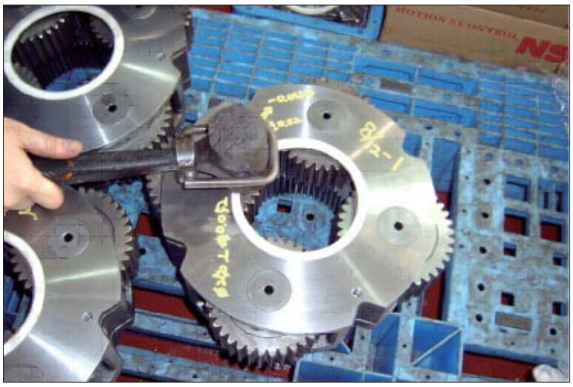
21078TM102

(3) Install No.2 pin (90-5) into No.2 carrier where the holes for No.2 pin (90-5) are to be in line with those of No.2 carrier, and then, install spring pins into the holes.

21078TM103

(4) Caulk carrier holes as shown on the picture.

(5) Assembly thrust ring (90-7) into carrier.



21078TM104

3) Assembling floating seal (83) and main bearing (82)

(1) Assemble floating seal into motor by use of pressing jig. Grease the contact parts for floating seal which is assembled into motor.

(2) Heat bearing at 60~70˚C and then, put into the motor side.

21078TM105

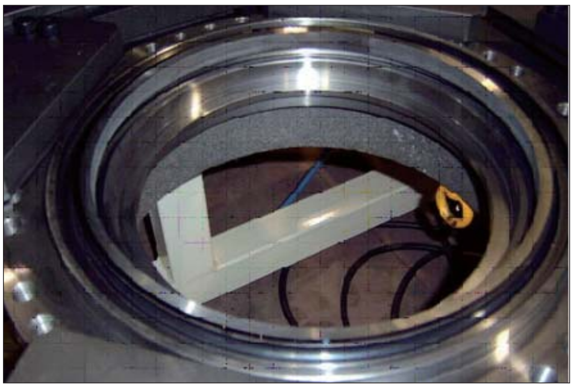
※ Be sure to maintain it vertical with the ground when assembling bearing and floating seal.

21078TM106

4) 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.

※ Be sure to maintain it vertical with the ground when assembling floating seal.



21078TM705

5) Installing housing assembly

(1) Install 2 EA of M12 eye-bolt into housing assembly.

(2) Assemble housing into motor by use of hoist and eye-bolt.

※ Be sure to tighten eye-bolt deep enough.

21078TM108

6) Installing main bearing (82)

(1) Heat main bearing at 60~70 ℃ and then, install.

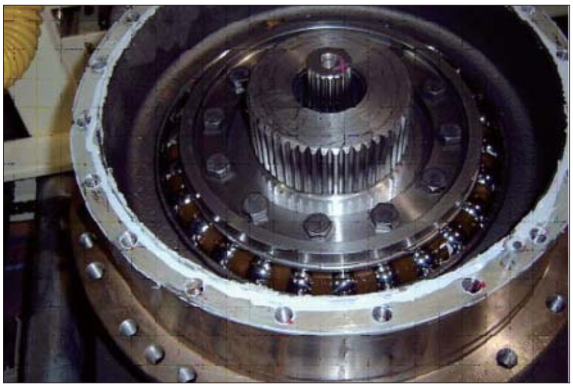
※ Be sure to maintain it vertical with the ground when assembling bearing.

21078TM109

7) Installing retainer (85) and shim (84)

(1) Measure clearance between main bearing and retainer by use of jig to decide the thickness of shim and select an appropriate shim, and then, assemble retainer.

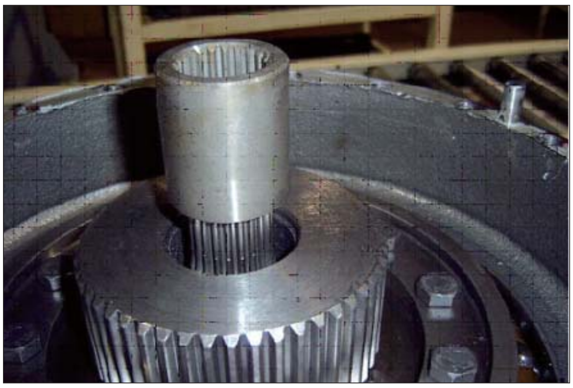
(2) Apply locktite (#262) on M12 hexagon head bolt, and then, bolt.



21078TM110

8) Installing coupling

(1) Install coupling on spline of the motor.



21078TM111

9) Installing ring gear

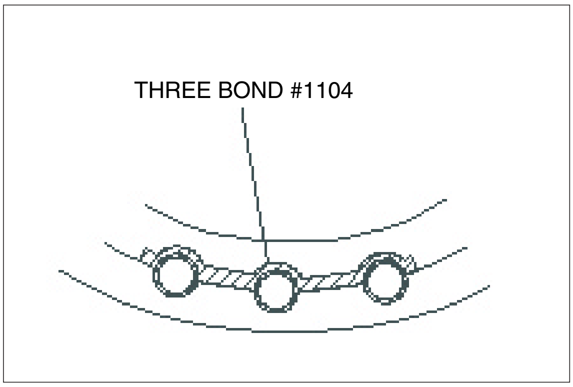
(1) Apply three bone #1104 (loctite #515) on housing for ring gear without gap.

(2) Insert lock pin into housing hole.

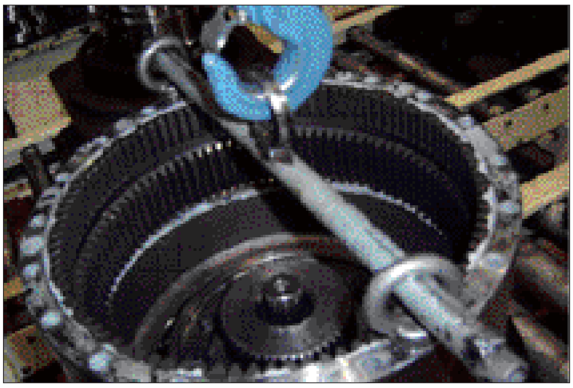
(3) Install M14 eye-bolt on the tap of ring gear.

(4) Lift ring gear and then, assemble into housing in order for hole of ring gear and parallel pin of housing to be in line.

(5) Temporarily secure 4EA of M12 hexagon socket bolt and shim with cover thickness having appropriate torque.



160A8TM112



21078TM113

10) Installing 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.

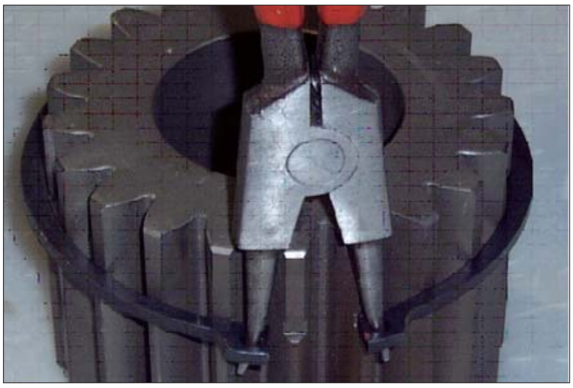
21078TM114

11) Installing No.2 sun gear (91-2)

(1) Install No.2 sun gear on the spline of No.2 carrier and No.2 planetary gear, matching teeth of them.

21078TM115

(2) Install No.2 sun gear on the spline of No.2 carrier and No.2 planetary gear, matching teeth of them.



21078TM116

12) Installing No.1 carrier sub assembly

(1) Install M10 eye-bolt on No.2 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.

21078TM117

13) Installing No.1 sun gear (92)

(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.

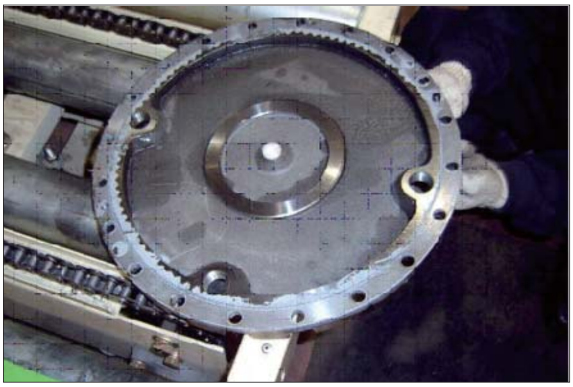
21078TM118

14) Installing cover (93)

(1) Beat pad (94) with plastic hammer, and press it into the center of cover.

(2) Apply three bond #1104, loctite (#515) on the ring gear for cover without gap.

(3) Put cover on ring gear, apply loctite (#262) on M12 hexagon socket head bolt, and then, bolt.



21078TM119

(4) Fill gear oil (5.8 liter) into drain port.

(5) Apply gear oil on PF3/4 hydraulic plug (97) and then, bolt.

21078TM120

GROUP 7 RCV LEVER

1. REMOVAL AND INSTALL

1) REMOVAL

13031GE18

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

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

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

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

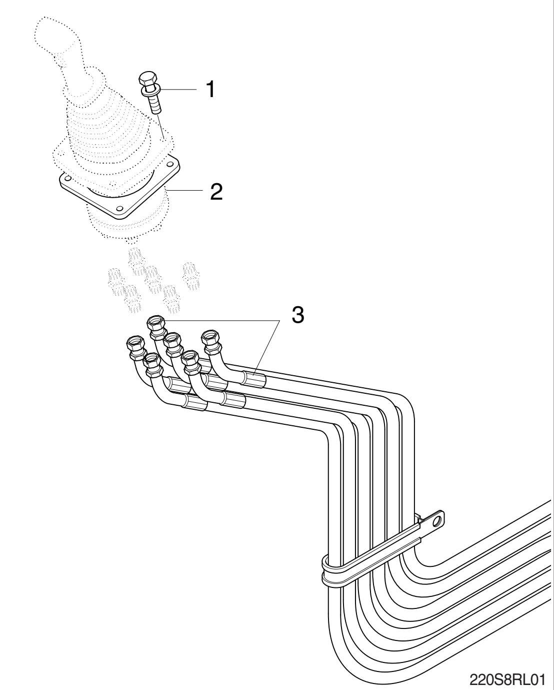
(4) Loosen the socket bolt (1).
Tightening torque : 1.05 ± 0.2 kgf · m
(7.6 ± 1.45 lbf · ft)

(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.



220S8RL01

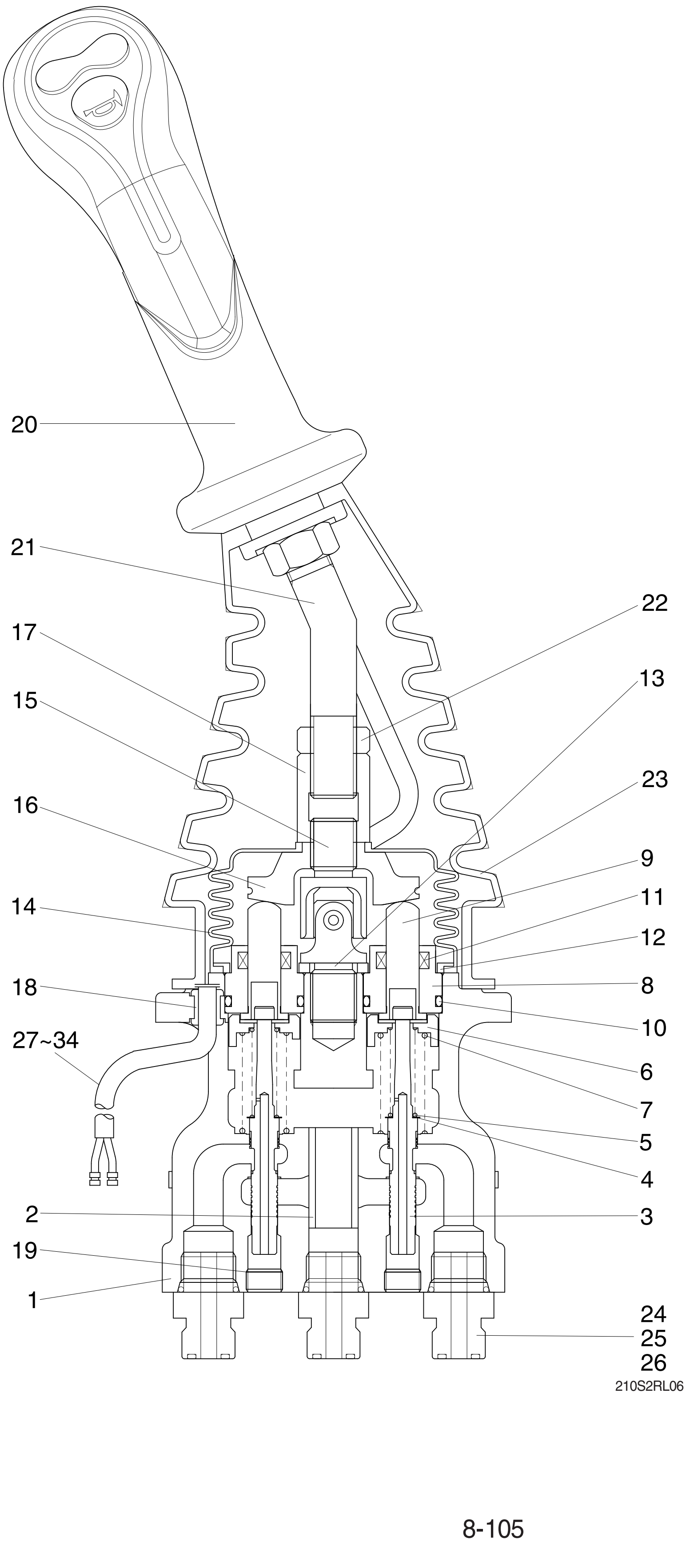
2) INSTALL

(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

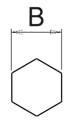
1) STRUCTURE



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	Spacer
13	Spacer
14	Boot
15	Joint assembly
16	Swash plate
17	Adjusting nut
18	Bushing
19	Plug
20	Handle assembly
21	Handle bar
22	Nut
23	Boot
24	Last guard filter
25	Connector
26	Connector
27	Connector pin
28	Connector pin
29	Connector pin
30	Connector pin
32	Connector
34	Connector

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

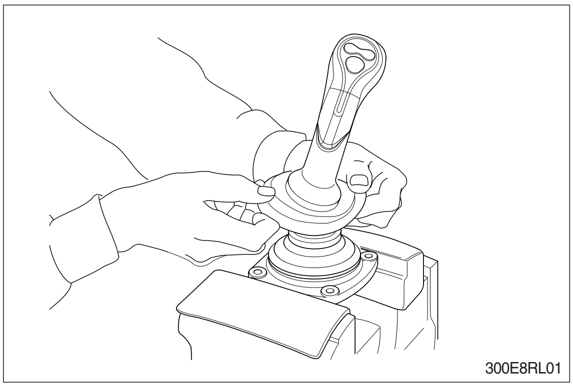
※ Procedures are based on the type M1.

(1) Clean pilot valve with kerosene.

※ Put blind plugs into all ports

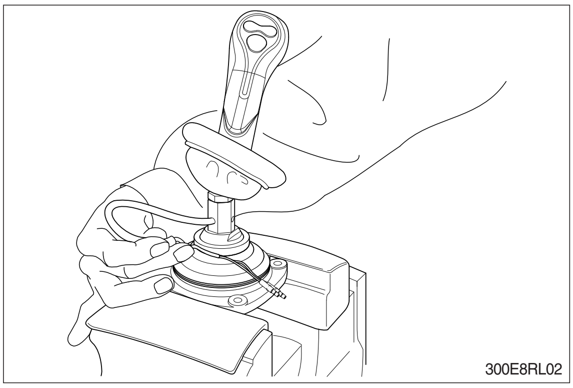
(2) Fix pilot valve in a vise with copper (or lead) sheets.

(3) Remove end of boot (23) from case (1) and take it out upwards.



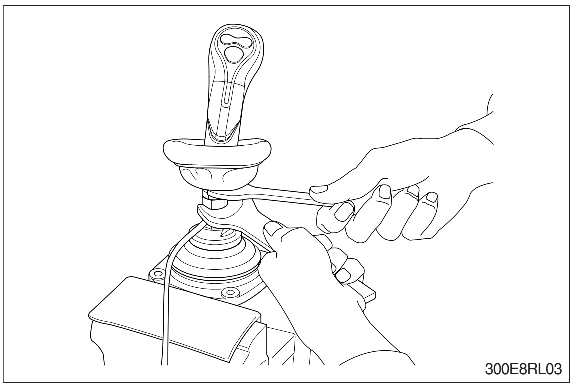
300E8RL01

※ For valve with switch, remove cord also through hole of casing.



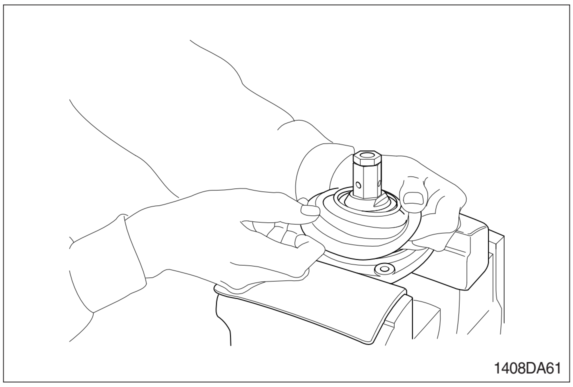
300E8RL02

(4) Loosen lock nut (22) and adjusting nut (17) with spanners on them respectively, and take out handle section as one body.



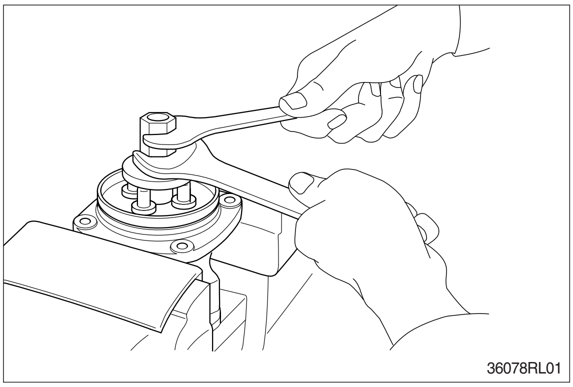
300E8RL03

(5) Remove the boot (14).

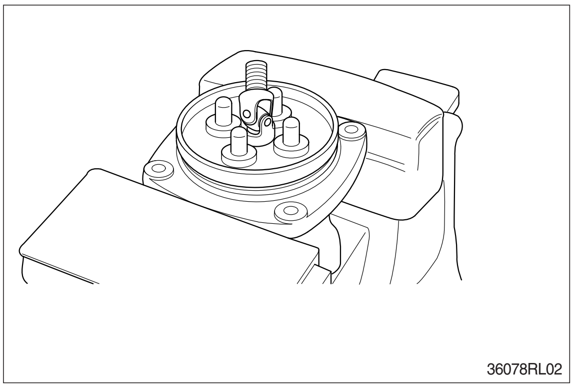


1408DA61

(6) Loosen adjusting nut (17) and swash plate (16) with spanners on them respectively, and remove them.



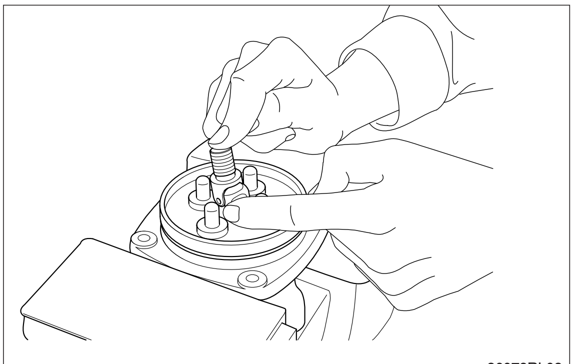
36078RL01



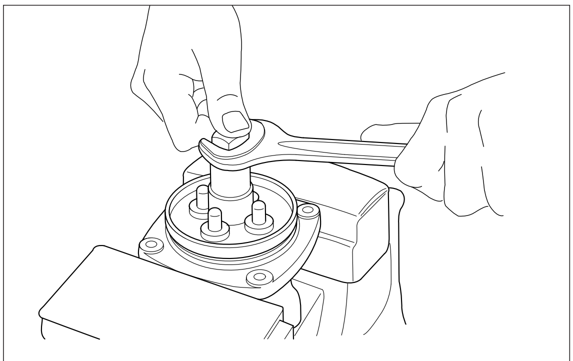
36078RL02

(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.

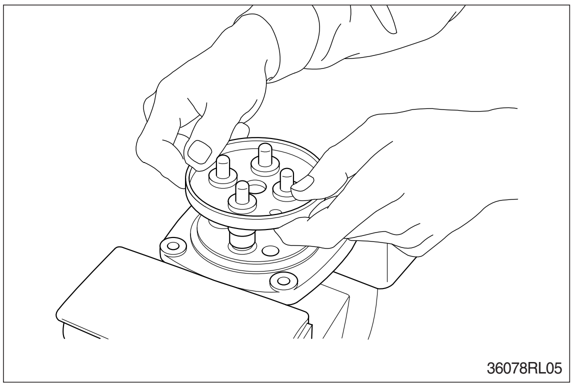


36078RL03



36078RL04

(8) Remove plate (12).

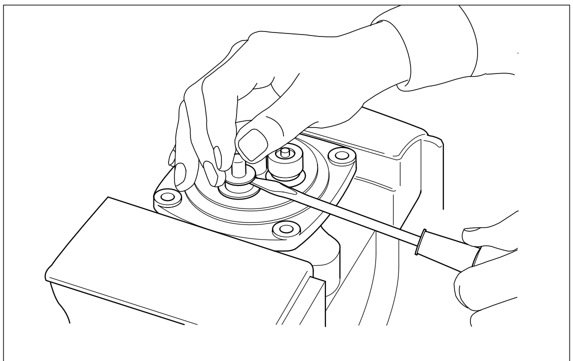


36078RL05

(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.

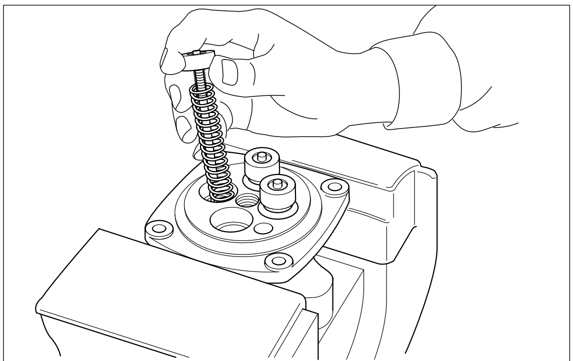
※ During taking out, plug may jump up due to return spring (7) force.
Pay attention to this.



36078RL06

(10) Remove reducing valve subassembly and return spring (7) out of casing.

※ Record relative position of reducing valve subassembly and return springs.



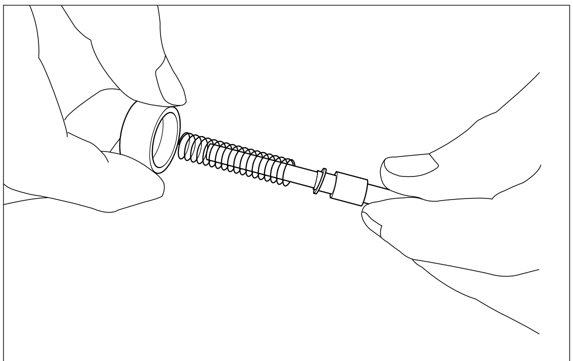
36078RL07

(11) Separate spool (3), spring seat (6), spring (5) and shim (4) individually.

※ Pay attention not to damage spool surface.

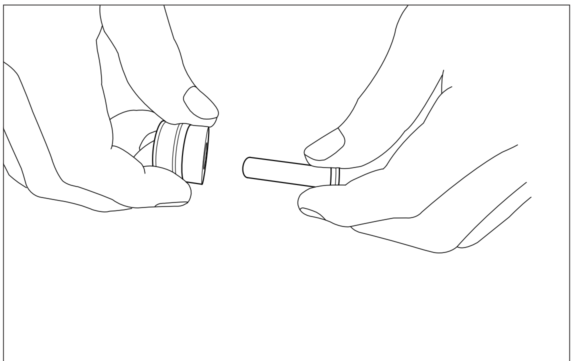
※ Record original position of spring seat (6).

※ Until being assembled, they should be handled as one subassembly group.



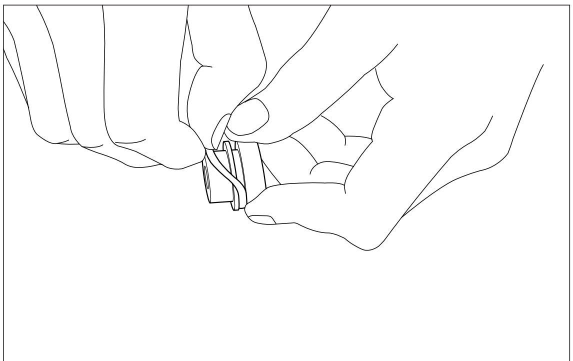
36078RL10

(12) Take push rod (9) out of plug (8).

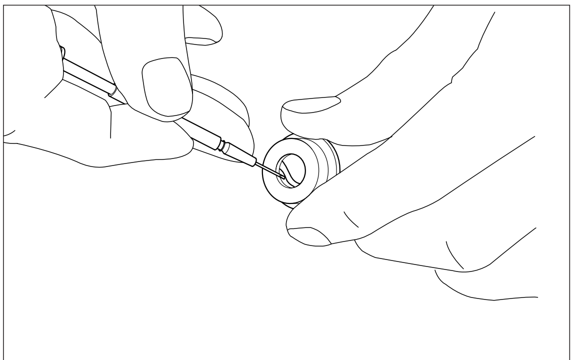


36078RL11

(13) Remove O-ring (10) and seal (11) from plug (8).
Use small minus screwdriver or so on to remove this seal.

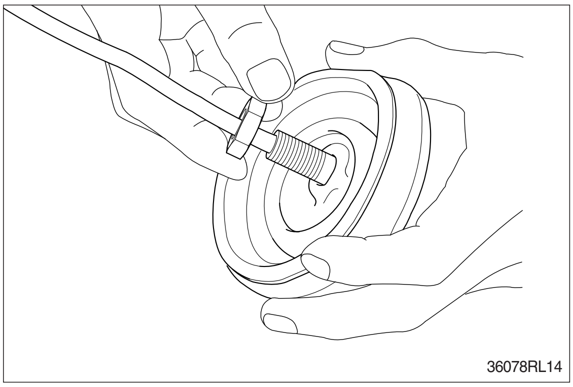


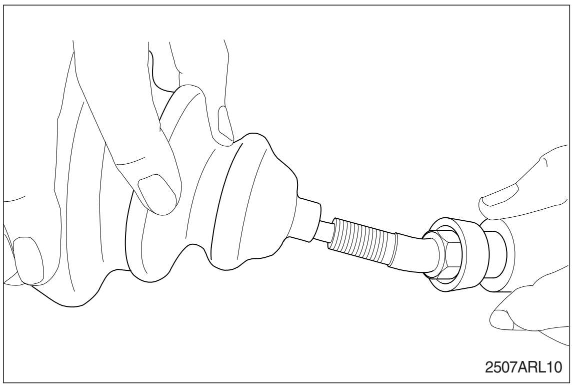
36078RL12



36078RL13

(14) Remove lock nut (22) and then boot (23).





(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.

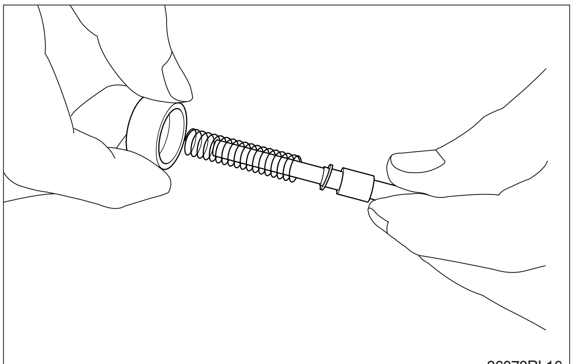
(16) **Rust prevention of parts**

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.

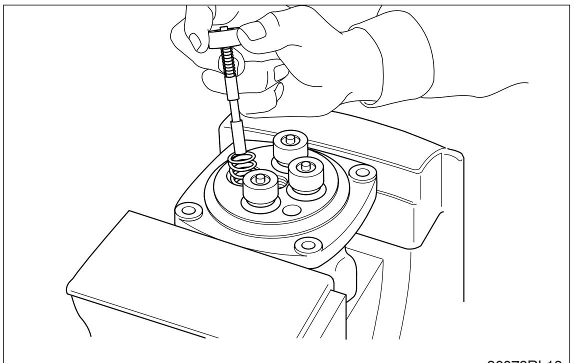
4) ASSEMBLY

(1) Put shim (4), springs (5) and spring seat (6) onto spool (3) in this order.

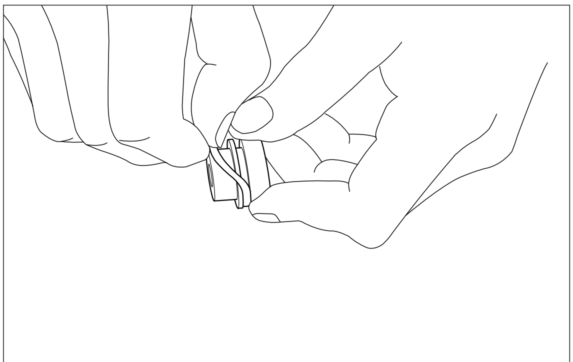

36078RL16

(2) Assemble spring (7) into casing (1). Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.

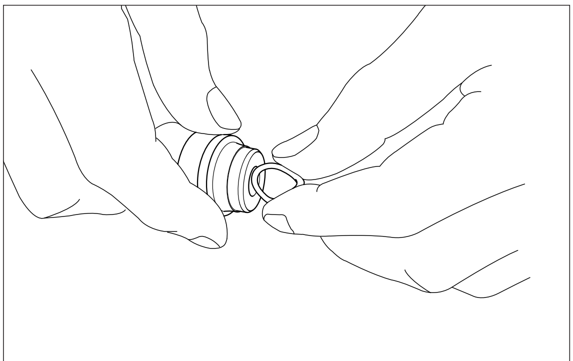

36078RL18

(3) Assemble O-ring (10) onto plug (8).

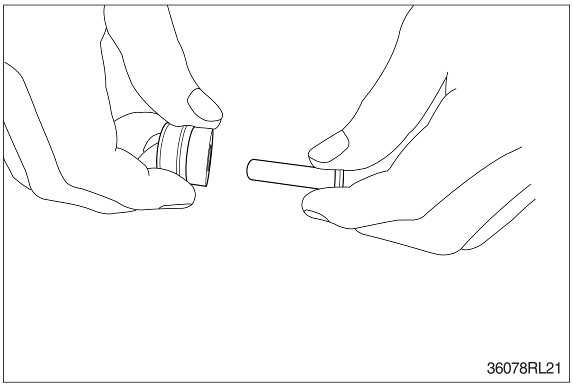

36078RL19

(4) Assemble seal (11) to plug (8).

※ Assemble seal in such lip direction as shown below.

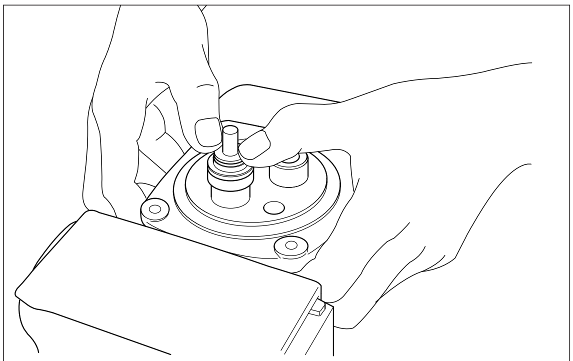

36078RL20

(5) Assemble push rod (9) to plug (8).
※ Apply working oil on push-rod surface.



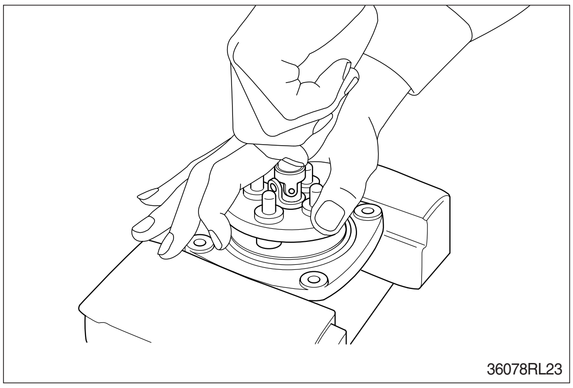
36078RL21

(6) Assemble plug subassembly to casing.
※ When return spring is weak in force, subassembly stops due to resistance of O-ring.



36078RL22

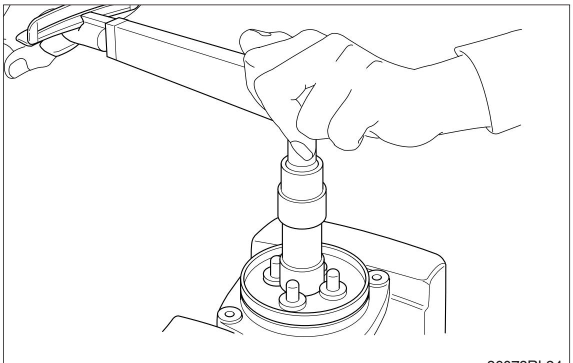
(7) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (12), and tighten joint (15) temporarily.



36078RL23

(8) Fit plate (12).

(9) Tighten joint (15) with the specified torque to casing, utilizing jig.

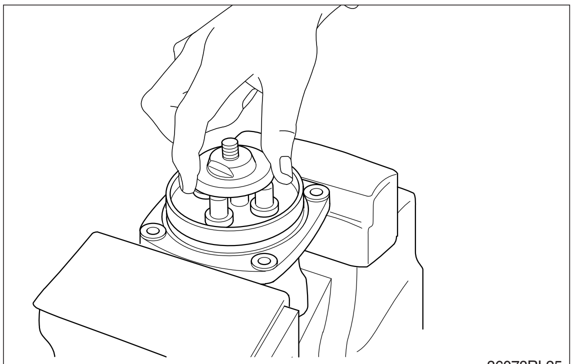


36078RL24

(10) Assemble swash plate (16) to joint (15).

※ Screw it to position that it contacts with 4 push rods evenly.

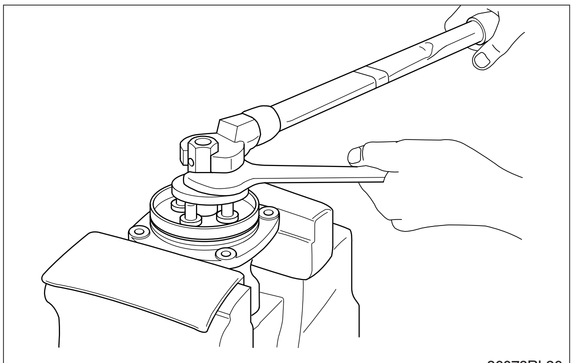
※ Do not screw it over.



36078RL25

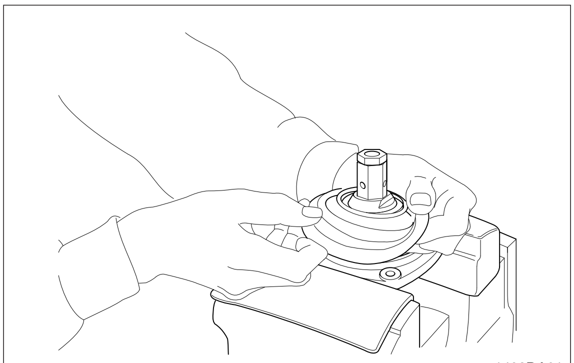
(11) Assemble adjusting nut (17), apply spanner to width across flat of plate (16) to fix it, and tighten adjusting nut to the specified torque.

※ During tightening, do not change position of disk.



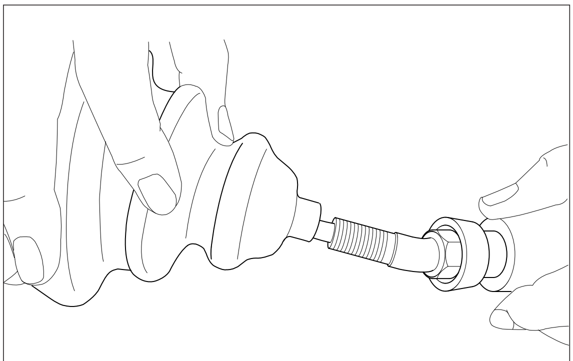
36078RL26

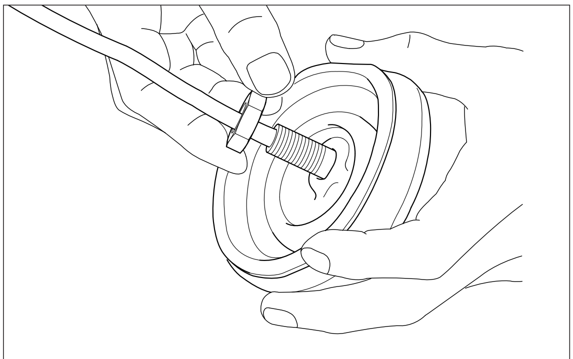
(12) Fit boot (14) to plate.



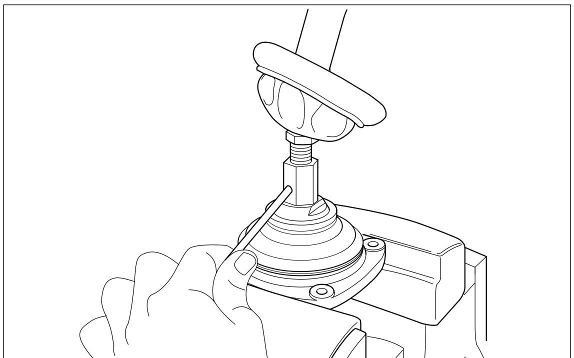
1408DA61

(13) Fit boot (23) and lock nut (22), and handle subassembly is assembled completely.


2507ARL10

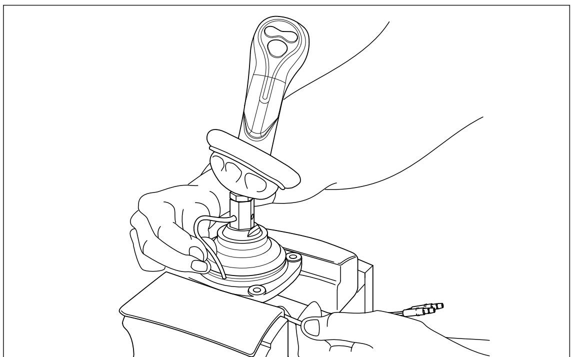

36078RL27

(14) Pull out cord and tube through adjusting nut hole provided in direction 60 ° to 120 ° from casing hole.

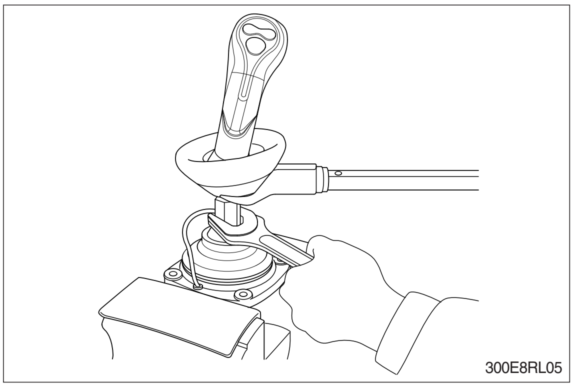

1408DA66

(15) Assemble bushing (18) to plate and pass cord and tube through it.

※ Provide margin necessary to operation.

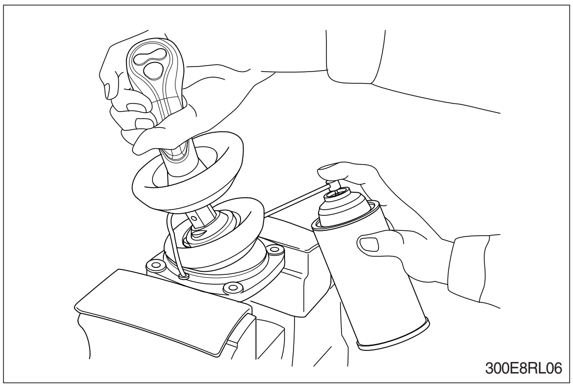

300E8RL04

(16) Determine handle direction, tighten lock nut (22) to specified torque to fix handle.



300E8RL05

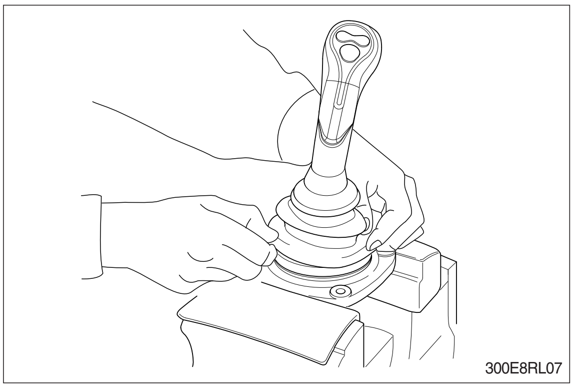
(17) Apply grease to rotating section of joint and contacting faces of disk and push rod.



300E8RL06

(18) Assemble lower end of bellows to casing.

(19) Inject volatile rust-preventives through all ports and then put blind plugs in ports.



300E8RL07

GROUP 8 TURNING JOINT

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(4) Disconnect all hoses.

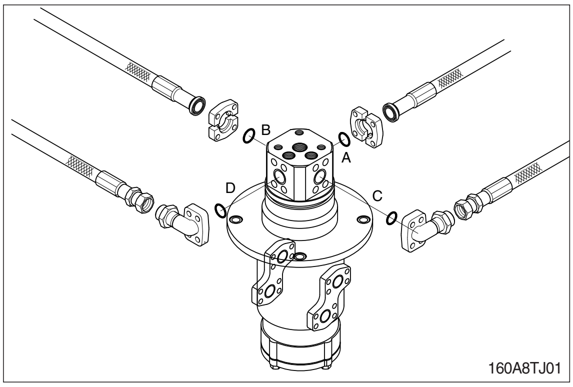
(5) Sling the turning joint assembly (1) and remove the mounting bolt (2).

· HX160/180A L : 56 kg (123 lb)
· HX160/180A LD : 63 kg (139 lb)
· Tightening torque : 12.8±3.0 kgf · m (92.6±21.7 lbf · ft)

(6) Remove the turning joint assembly.

※ When removing the turning joint, check that all the hoses have been disconnected.


13031GE18



160A8TJ01

2) INSTALL

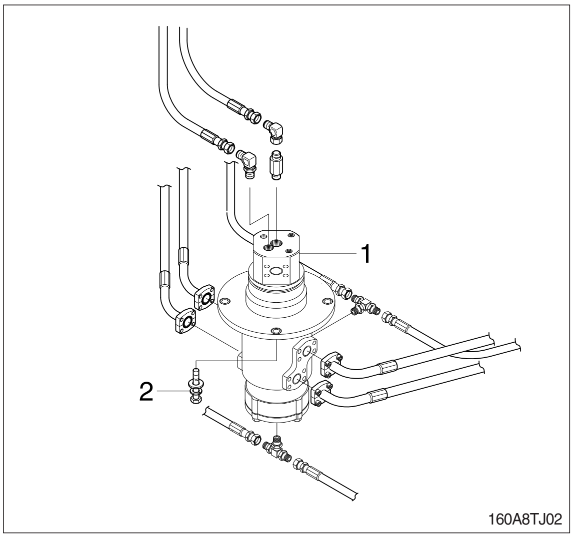
(1) Carry out installation in the reverse order to removal.

※ Take care of turning joint direction.

※ Assemble hoses to their original

※ positions.

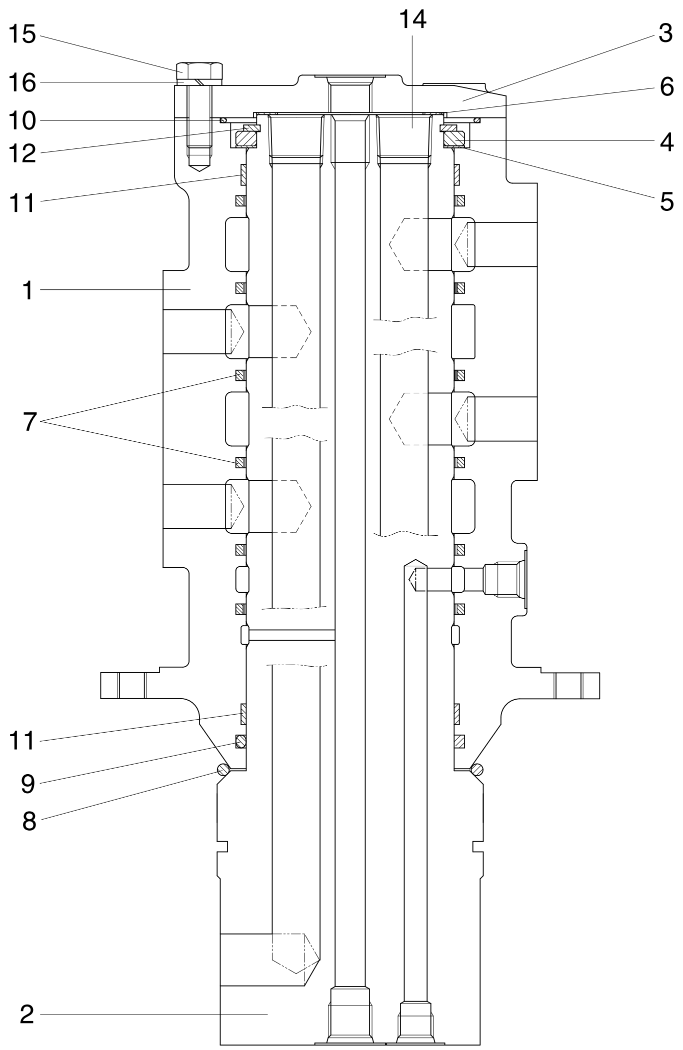
Confirm the hydraulic oil level and check the hydraulic oil leak or not.



160A8TJ02

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



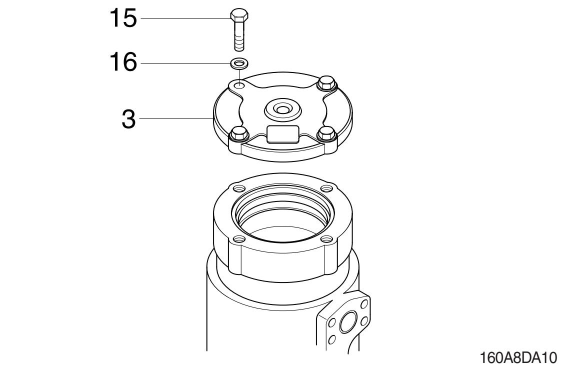
160A8TJ03

1	Hub	7	Slipper seal	13	Plug
2	Shaft	8	O-ring	14	Plug
3	Cover	9	O-ring	15	Hexagon bolt
4	Spacer	10	O-ring	16	Spring washer
5	Shim	11	Wear ring		
6	Shim	12	Retainer ring		

2) DISASSEMBLY

※ Before the disassembly, clean the turning joint.

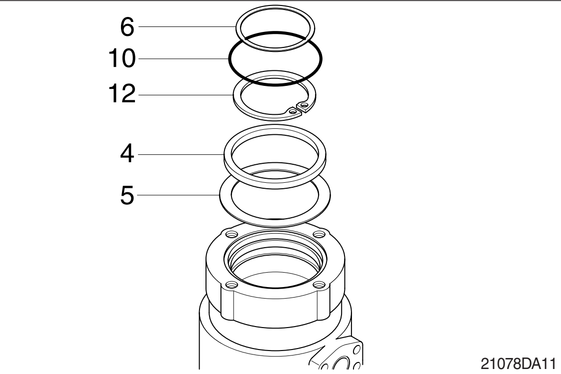
(1) Remove bolts (15), washer (16) and cove r (3).



160A8DA10

(2) Remove shim (6) and O-ring (10).

(3) Remove retainer ring (12), spacer (4) and shim (5).

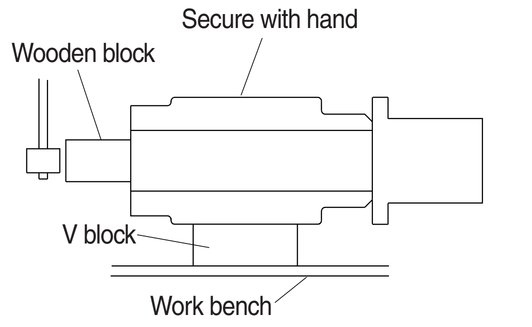


21078DA11

(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.

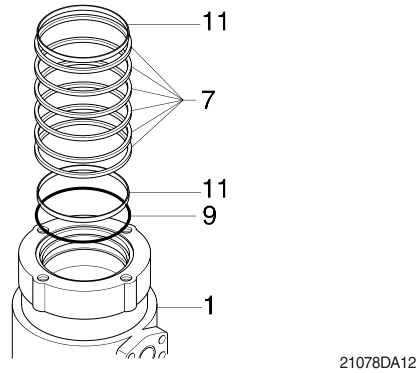
※ Take care not to damage the shaft (2) when remove hub (1) or rest it sideway.

※ Put a fitting mark on hub (1) and shaft (2).



8-14(3) (360-7)

(5) Remove six slipper seals (7) and O-ring (9), two wear ring (11) from hub (1).



21078DA12

3) ASSEMBLY

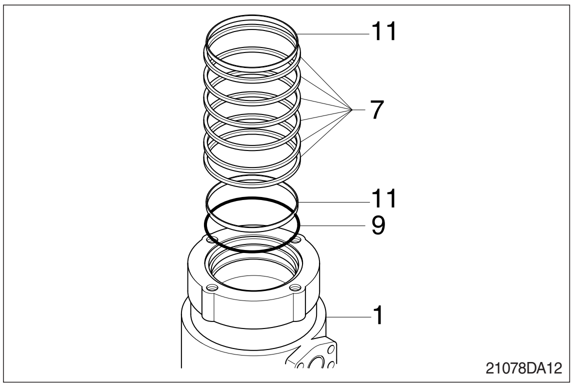
※ Clean all parts.

※ As a general rule, replace oil seals and O-ring.

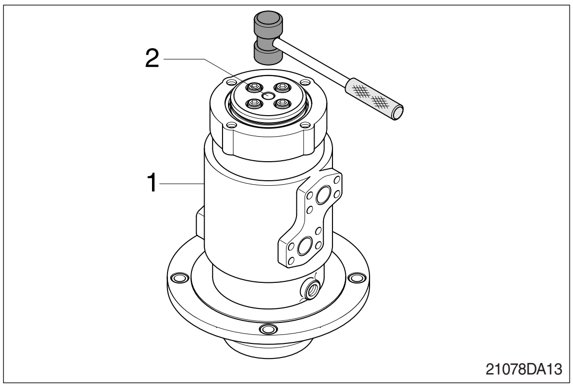
※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(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).



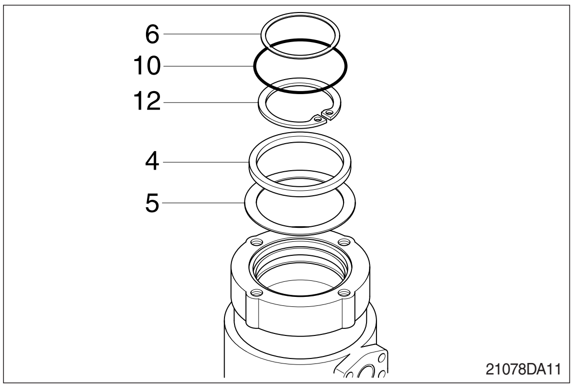
(3) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.



(4) Fit shim (5), spacer (4) and retainer ring (12) to shaft (2).

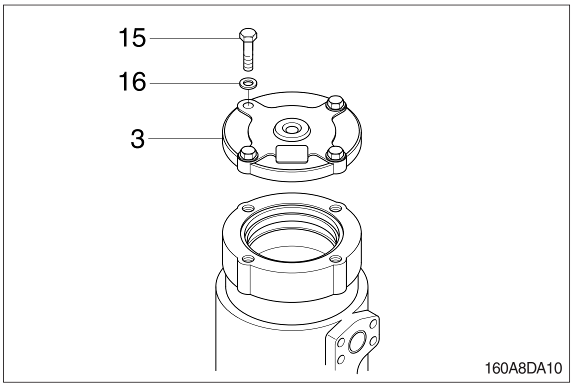
(5) Fit O-ring (10) to hub (1).

(6) Fit shim (6) to shaft (2).



(7) Install cover (3) to body (1) and tighten bolts (15).

· 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.

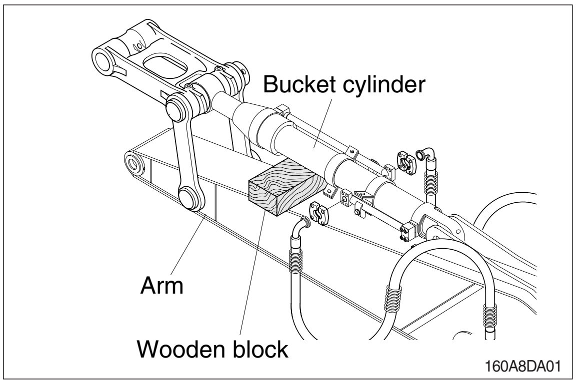
※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ **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.


13031GE18

① Set block between bucket cylinder and arm.

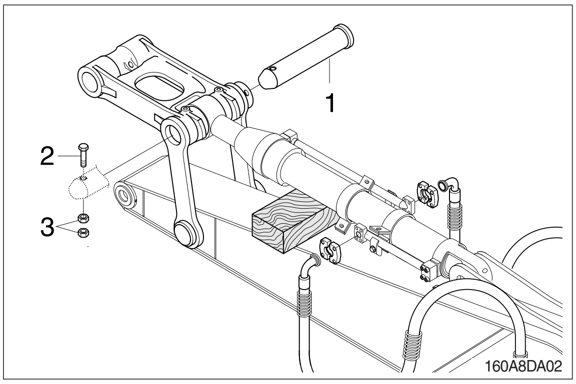


160A8DA01

② Remove bolt (2), nut (3) and pull out pin (1).

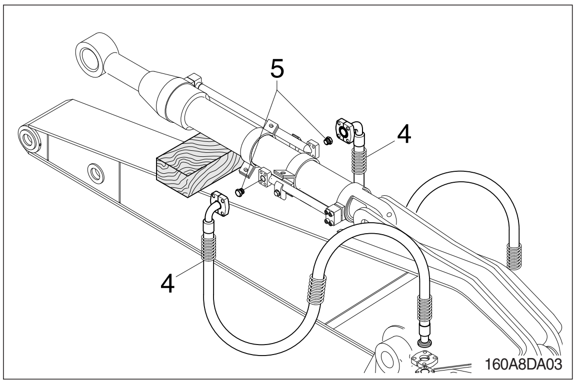
※ Tie the rod with wire to prevent it from coming out.

· Tightening torque (2) : 29.7±4.5 kgf · m (215±32.5 lbf · ft)



160A8DA02

③ Disconnect bucket cylinder hoses (4), grease line hose (7) and put plugs (5) on cylinder pipe.



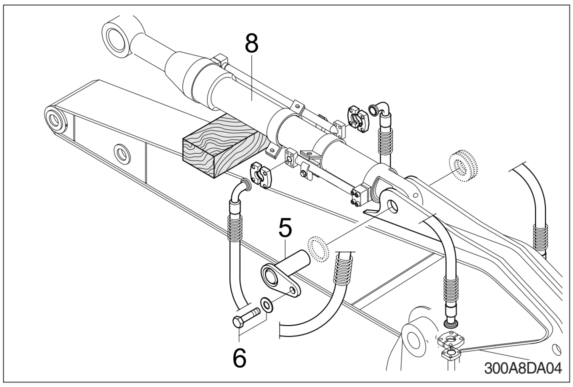
160A8DA03

④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).

⑤ Remove bucket cylinder assembly (8).

· Weight : 121 ㎏ (267 ℔)

· Tightening torque (6) : 29.7 ± 4.5 kgf · m (215 ± 32.5 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.

※ Bleed the air from the bucket cylinder.

※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

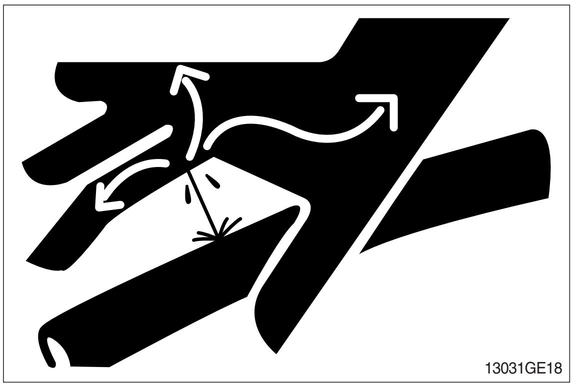
2) ARM CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

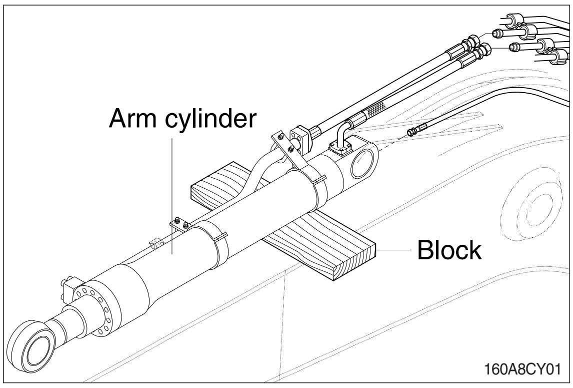
※ Loosen the breather slowly to release the pressure inside the hydraulic tank.



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

※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between arm cylinder and boom.

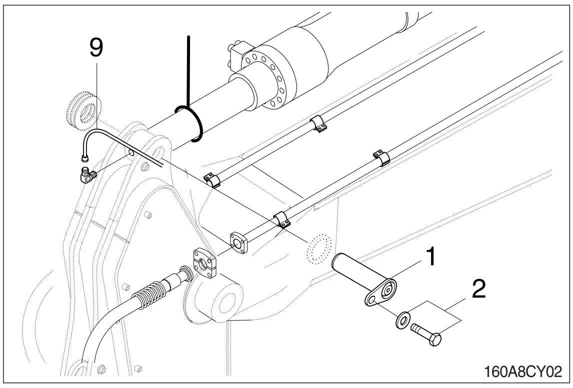


② Disconnect grease line hose (9).

③ Remove bolt (2) and pull out pin (1).

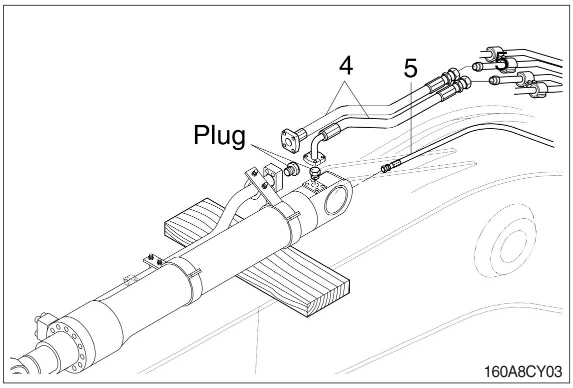
※ Tie the rod with wire to prevent it from coming out.

· Tightening torque (2) : 29.7 ± 4.5 kgf · m (215 ± 32.5 lbf · ft)



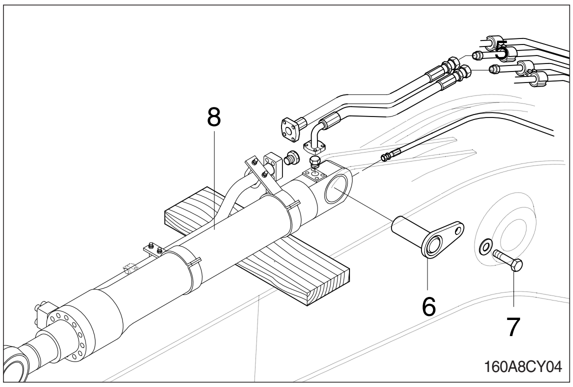
④ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

⑤ Disconnect greasing pipings (5).



⑥ Sling arm cylinder assembly(8) and remove bolt (7) then pull out pin (6).
 · Tightening torque (7) : 29.7 ± 4.5 kgf · m (215 ± 32.5 lbf · ft)

⑦ Remove arm cylinder assembly (8).
 · Weight : 172 kg (379 lb)



(2) Install

① Carry out installation in the reverse order to removal.

▲ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

※ Bleed the air from the arm cylinder.

※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

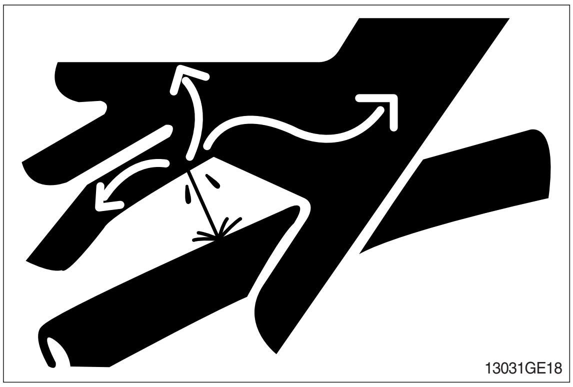
3) BOOM CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

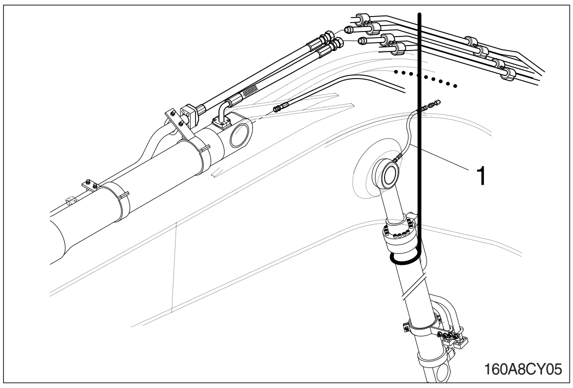


▲ **Escaping fluid under pressure can penetrate the skin causing serious injury.**

※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Disconnect greasing hoses (1).

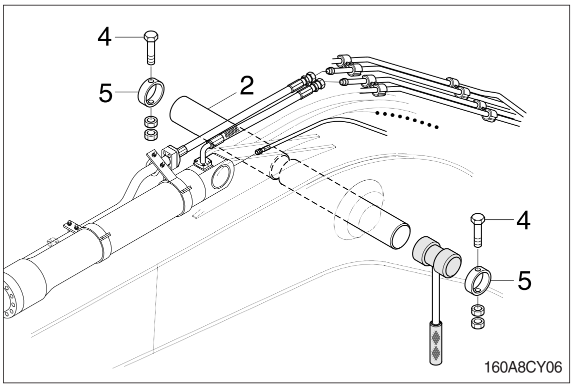
② Sling boom cylinder assembly.



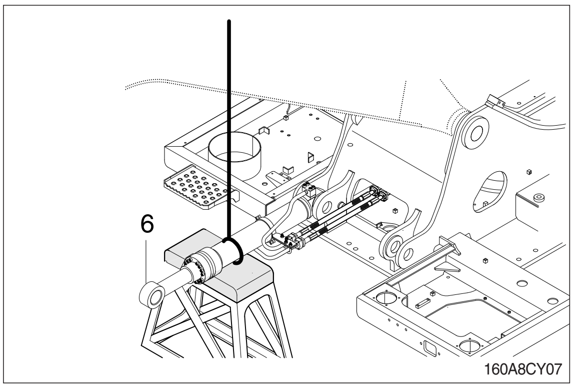
③ Remove bolt (4), stopper (5) and pull out pin (2).

※ Tie the rod with wire to prevent it from coming out.

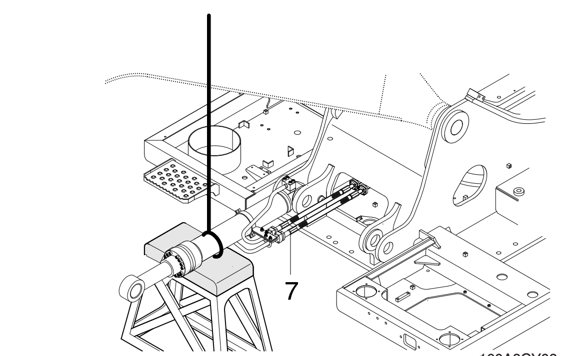
· Tightening torque (4) : 29.7 ± 4.5 kgf · m (215 ± 32.5 lbf · ft)



④ Lower the boom cylinder assembly (6) on a stand.



⑤ Disconnect boom cylinder hoses (7) and put plugs on cylinder pipe.



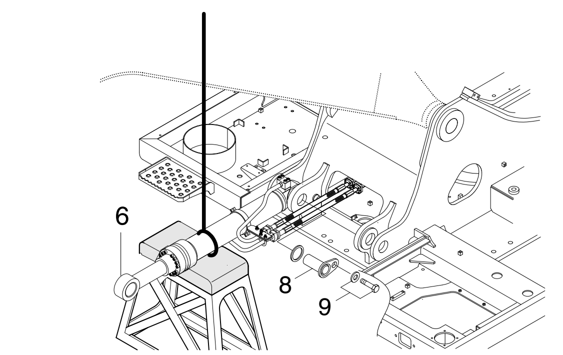
160A8CY08

⑥ Remove bolt (9) and pull out pin (8).

· Tightening torque (9) : 29.7 ± 4.5 kgf · m (215 ± 32.5 lbf · ft)

⑦ Remove boom cylinder assembly (6).

· Weight : 131 kg (290 lb)



160A8CY09

(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

※ Bleed the air from the boom cylinder.

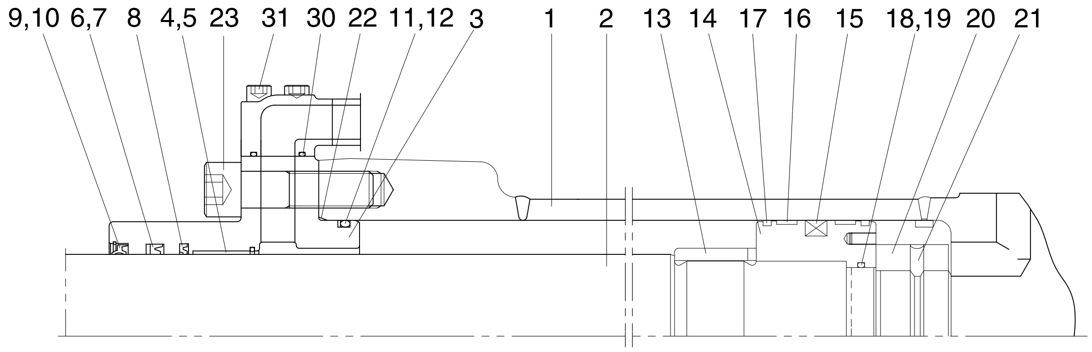
※ Conformed the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

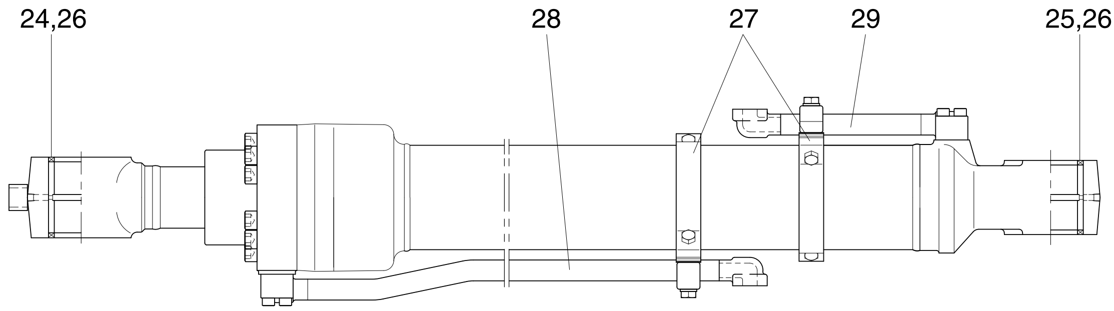
1) STRUCTURE

(1) Bucket cylinder

① Standard (CHANGZHOU)



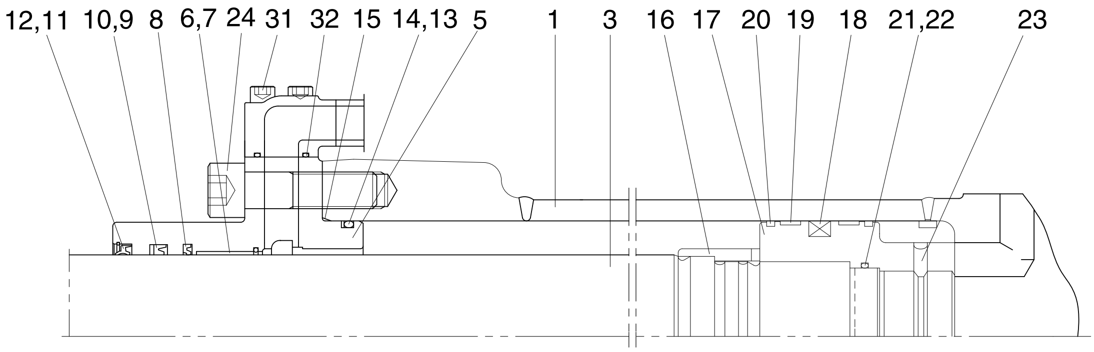
Internal detail



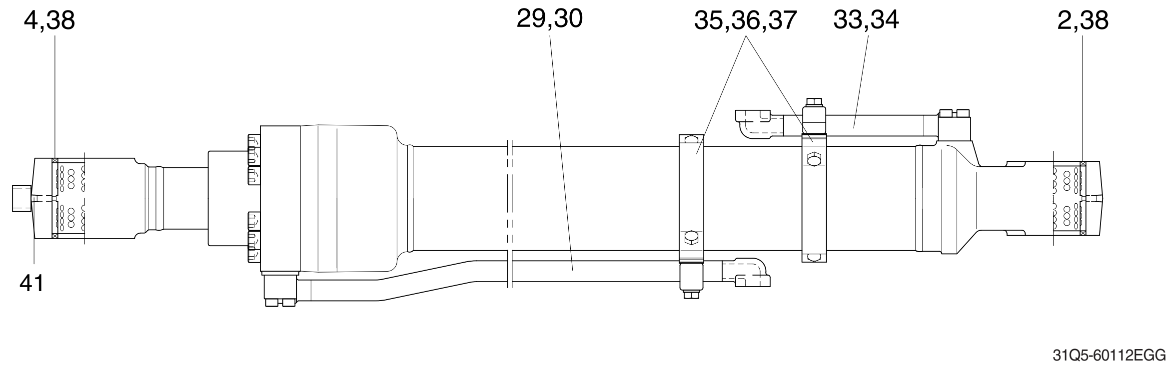
31Q6-60111CGG

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	Band assembly
6	Rod seal	17	Dust ring	28	Pipe assembly-R
7	Back up ring	18	O-ring	29	Pipe assembly-B
8	Buffer ring	19	Back up ring	30	O-ring
9	Dust wiper	20	Lock nut	31	Hexagon socket head bolt
10	Snap ring	21	Hexagon socket set screw		
11	O-ring	22	O-ring		

Standard (DY POWER)



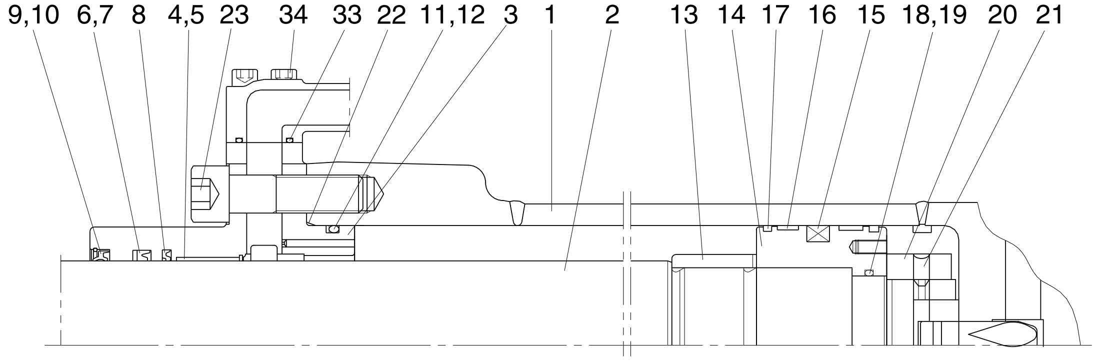
Internal detail



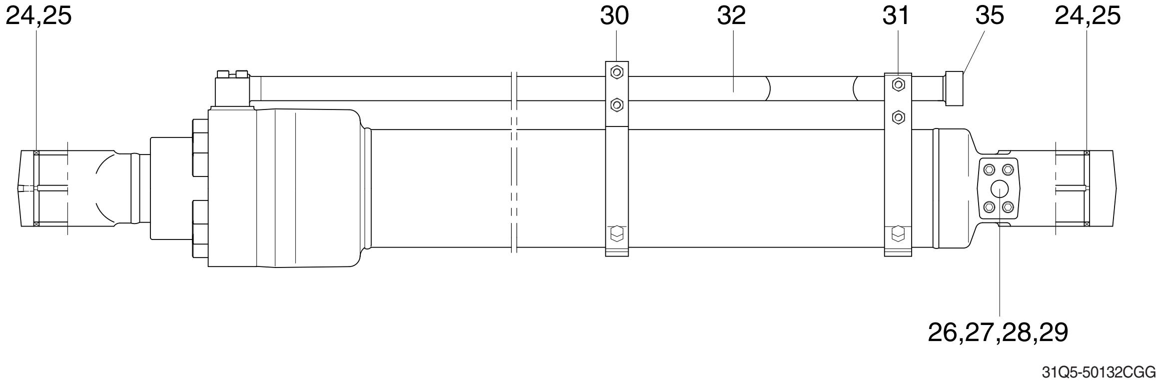
1	Tube assembly	14	Back up ring	27	Hexagon bolt
2	Pin bushing	15	O-ring	28	Spring washer
3	Rod assembly	16	Cushion ring	29	Pipe assy
4	Pin bushing	17	Piston	30	O-ring
5	Rod cover	18	Piston seal	31	Hexagon socket bolt
6	Rod bushing	19	Wear ring	32	Spring washer
7	Retaining ring	20	Dust ring	33	Pipe assy
8	Buffer seal	21	O-ring	34	O-ring
9	U-packing	22	Back up ring	35	Clamp
10	Back up ring	23	Set screw	36	Spring washer
11	Dust wiper	24	Hexagon socket bolt	37	Hexagon nut
12	Retaining ring	25	Pipe band assy	38	Pin wiper
13	O-ring	26	Pipe band		

(2) Arm cylinder

① Standard (CHANGZHOU)

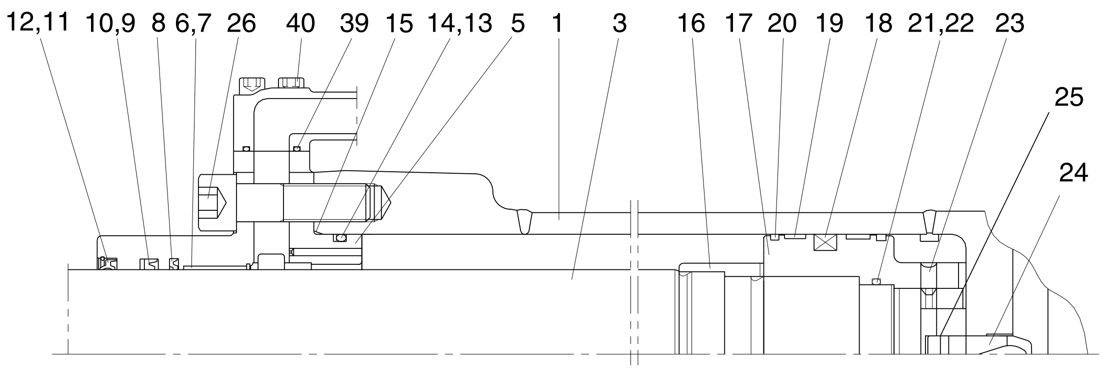


Internal detail

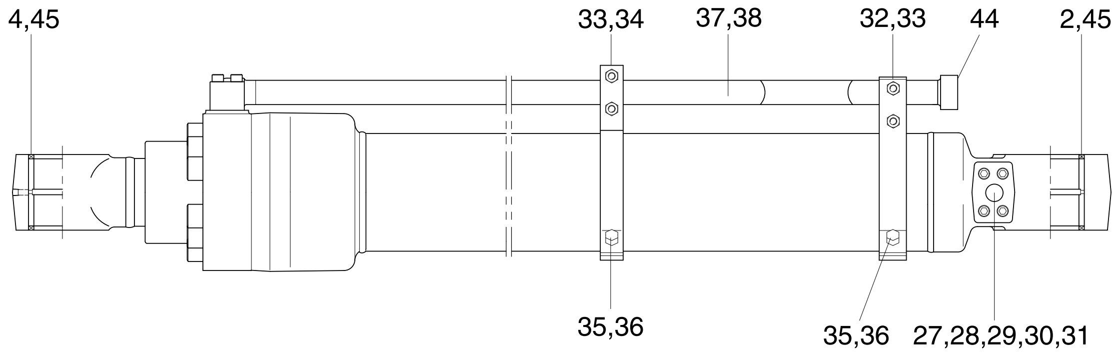


1	Tube assembly	13	Cushion ring	25	Dust seal
2	Rod assembly	14	Piston	26	Check valve
3	Gland	15	Piston seal	27	Coil spring
4	DD2 bushing	16	Wear ring	28	O-ring
5	Snap ring	17	Dust ring	29	Plug
6	Rod seal	18	O-ring	30	Band assembly-R
7	Back up ring	19	Back up ring	31	Band assembly-B
8	Buffer ring	20	Lock nut	32	Pipe assembly-R
9	Dust wiper	21	Hexagon socket set screw	33	O-ring
10	Snap ring	22	O-ring	34	Hexagon socket head bolt
11	O-ring	23	Hexagon socket head bolt	35	O-ring
12	Back up ring	24	Dimple bushing		

Standard (DY POWER)

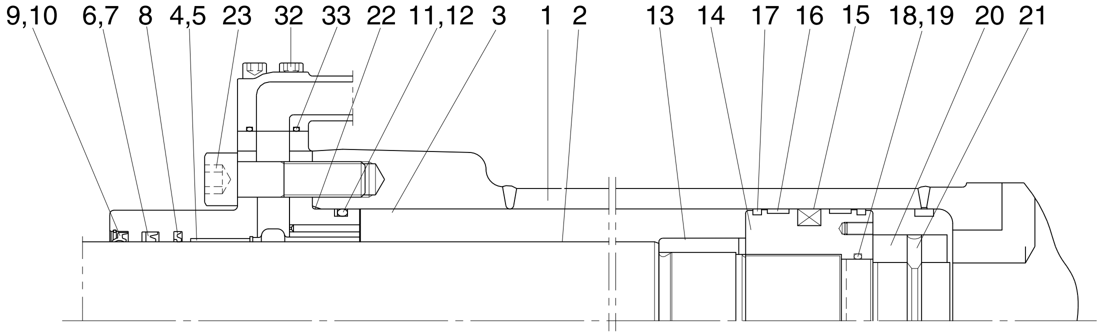


Internal detail

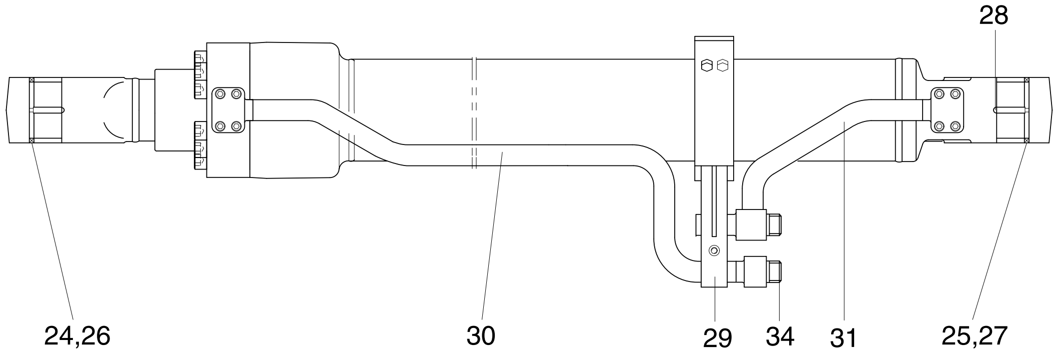


1	Tube assembly	16	Cushion ring	31	Plug
2	Pin bushing	17	Piston	32	Pipe band assy
3	Rod assembly	18	Piston seal	33	Pipe band
4	Pin bushing	19	Wear ring	34	Pipe band assy
5	Cover	20	Dust ring	35	Spring washer
6	Rod bushing	21	O-ring	36	Hexagon bolt
7	Retaining ring	22	Back up ring	37	Pipe assy
8	Buffer seal	23	Set screw	38	O-ring
9	U-packing	24	Cushion plunger	39	Spring washer
10	Back up ring	25	Stop ring	40	Hexagon socket bolt
11	Dust wiper	26	Hexagon socket bolt	41	U-bolt
12	Retaining ring	27	Check	42	Spring washer
13	O-ring	28	Spring	43	Hexagon nut
14	Back up ring	29	Bracket	44	O-ring
15	O-ring	30	O-ring	45	Pin washer

(3) Boom cylinder (CHANGZHOU)



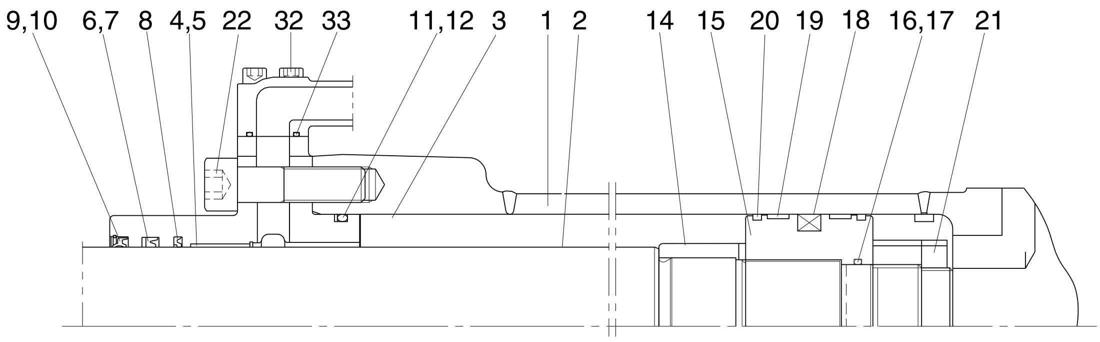
Internal detail



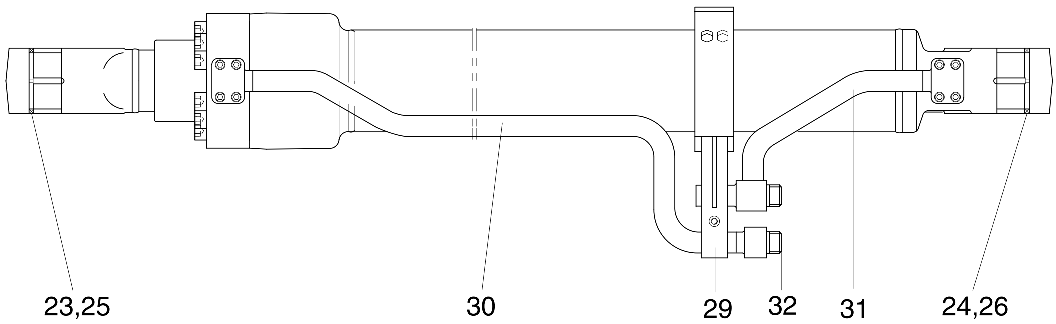
31K5-50111C

1	Tube assembly	13	Cushion ring	25	Dimple bushing
2	Rod assembly	14	Piston	26	Dust seal
3	Gland	15	Piston seal	27	Dust seal
4	DD2 bushing	16	Wear ring	28	Plug
5	Snap ring	17	Dust ring	29	Band assembly
6	Rod seal	18	O-ring	30	Pipe assembly-R
7	Back up ring	19	Back up ring	31	Pipe assembly-B
8	Buffer ring	20	Lock nut	32	O-ring
9	Dust wiper	21	Hexagon socket set screw	33	Hexagon socket head bolt
10	Snap ring	22	O-ring	34	O-ring
11	O-ring	23	Hexagon socket head bolt		
12	Back up ring	24	Dimple bushing		

Boom cylinder (CHANGZHOU TYPE 2)



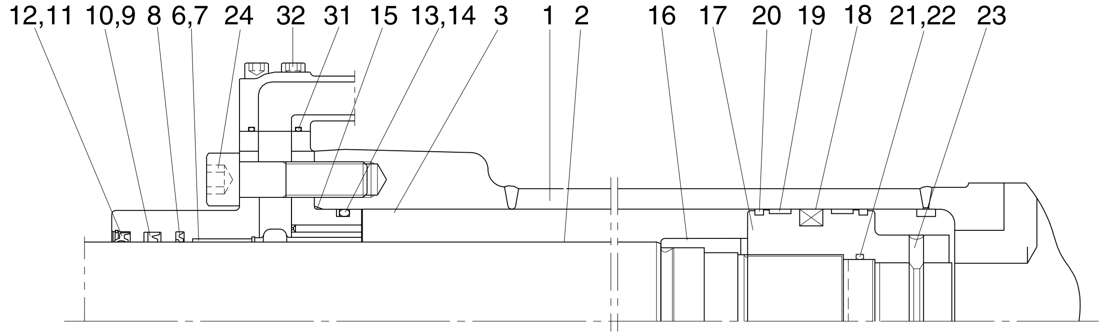
Internal detail



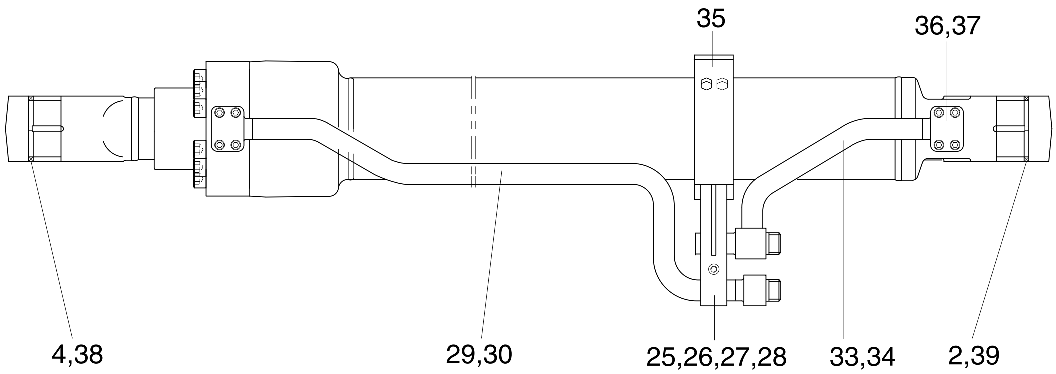
31K5-50911C

1	Tube assembly	12	Back up ring	23	Dimple bushing
2	Rod assembly	13	Back up ring	24	Dimple bushing
3	Gland	14	Cushion ring	25	Dust seal
4	DU bushing	15	Piston	26	Dust seal
5	Snap ring	16	O-ring	27	Band assembly
6	Rod seal	17	Back up ring	28	Pipe assembly-R
7	Back up ring	18	Piston seal	29	Pipe assembly-B
8	Buffer ring	19	Wear ring	30	O-ring
9	Dust wiper	20	Dust ring	31	Hexagon socket head bolt
10	Snap ring	21	Lock nut	32	O-ring
11	O-ring	22	Hexagon socket set screw		

Boom cylinder (DY POWER)



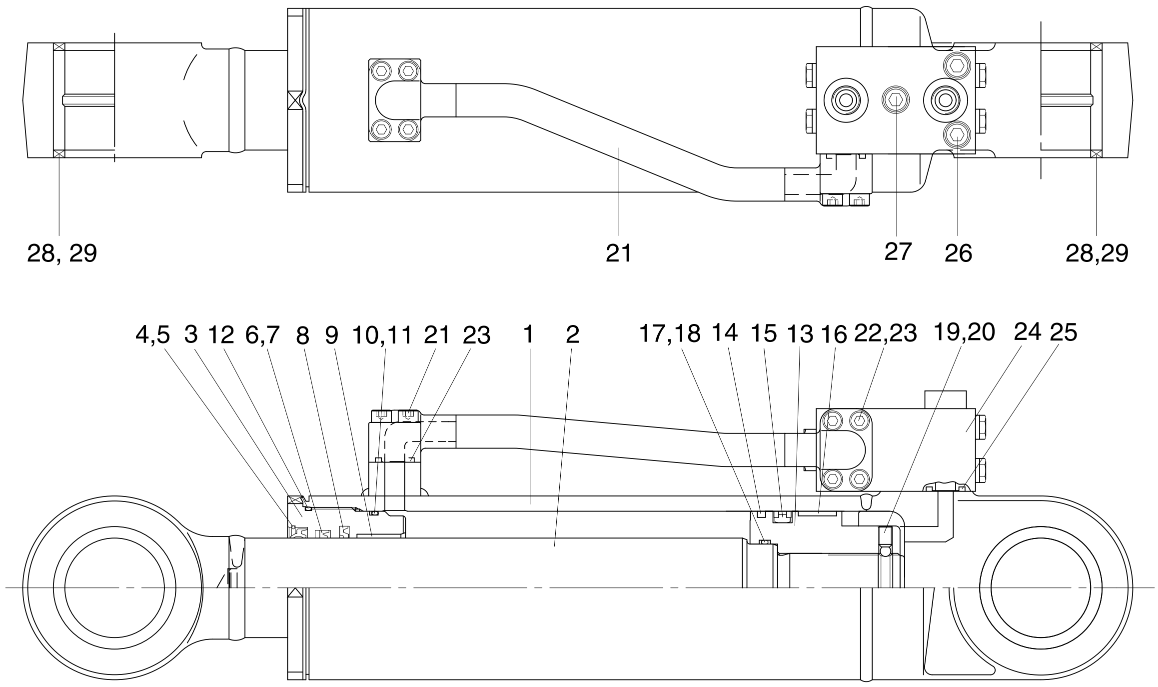
Internal detail



31K5-50111E

1	Tube assembly	15	O-ring	29	Pipe assy
2	Dimple bushing	16	Cushion ring	30	O-ring
3	Rod assembly	17	Piston	31	Spring washer
4	Dimple bushing	18	Piston seal	32	Hexagon socket bolt
5	Rod cover	19	Wear ring	33	Pipe assy
6	Rod bushing	20	Dust ring	34	O-ring
7	Retaining ring	21	O-ring	35	Clamp
8	Buffer seal	22	Back up ring	36	Spring washer
9	U-packing	23	Set screw	37	Hexagon nut
10	Back up ring	24	Hexagon socket bolt	38	Pin wiper
11	Dust wiper	25	Pipe band assy	39	Pin wiper
12	Retaining ring	26	Pipe band	40	O-ring
13	O-ring	27	Spring washer	43	Plug
14	Back up ring	28	Hexagon nit		

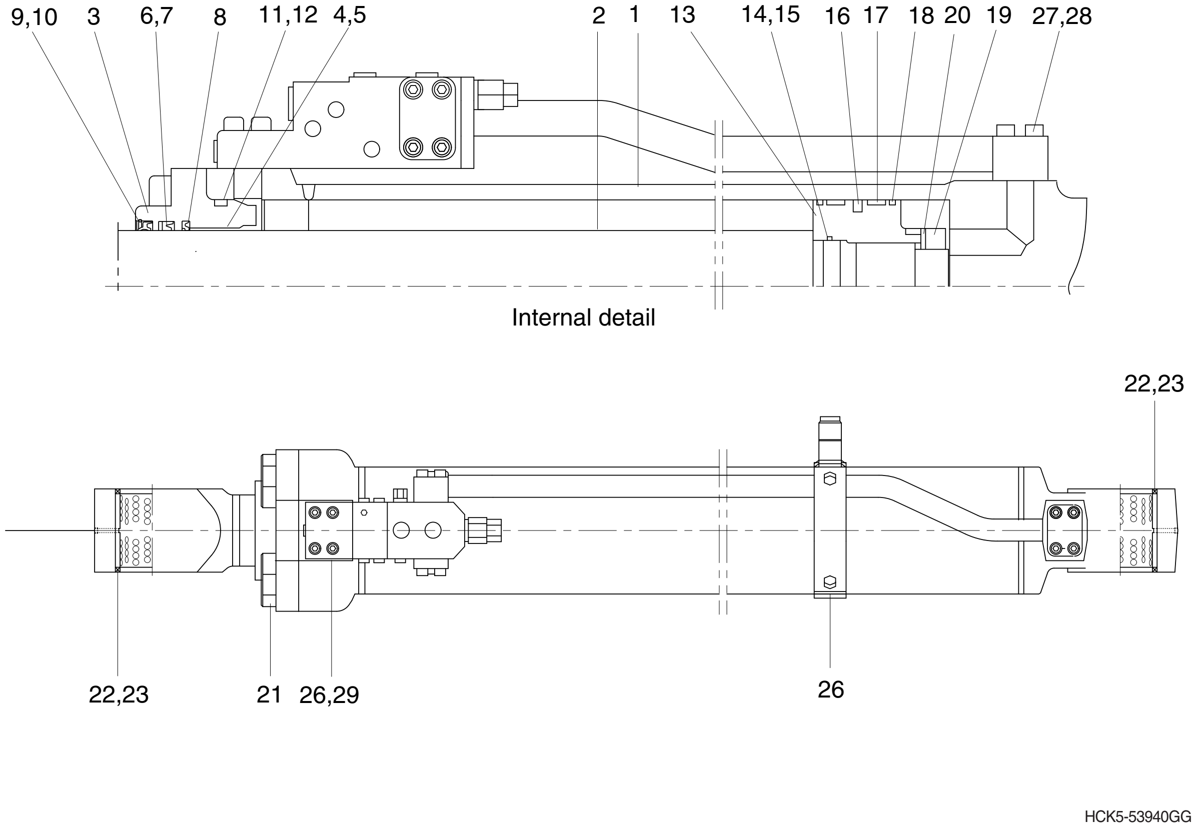
(4) Dozer cylinder (SHPAC)



31Q5-70011-00

1	Tube assembly	11	Retaining ring	21	Pipe assy
2	Rod assembly	12	O-ring	22	Hexagon socket head bolt
3	Gland	13	Piston	23	O-ring
4	Dust wiper	14	Dust ring	24	Pilot check valve
5	Retaining ring	15	Piston seal	25	O-ring
6	Rod seal	16	Wear ring	26	Hexagon socket head bolt
7	Back up ring	17	O-ring	27	Hexagon socket head bolt
8	Buffer ring	18	Retaining ring	28	Pin bushing
9	Dry bearing	19	Steel ball	29	Dust seal
10	O-ring	20	Set screw		

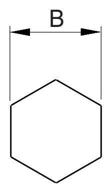
(5) Adjustment cylinder (CHANGZHOU)



1	Tube assembly	11	O-ring	21	Hexagon socket head bolt
2	Rod assembly	12	Retaining ring	22	Dimple bushing
3	Gland	13	Piston	23	Dust seal
4	DU bushing	14	O-ring	24	Band assy
5	Snap ring	15	Back up ring	25	Pipe assy
6	Rod seal	16	Piston seal	26	Safety lock valve
7	Back up ring	17	Wear ring	27	O-ring
8	Buffer ring	18	Dust ring	28	Hexagon socket head bolt
9	Dust wiper	19	Lock nut	29	Hexagon socket head bolt
10	Snap ring	20	Lock washer		

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	Torque lbf · ft
Socket head bolt	Bucket cylinder	23★1★3	M14	15.0±2.0	108±14.5
		24★1★4	M14	19.0±1.0	137±7.2
		31★3	M10	5.4±0.5	39.1±3.6
		31★4	M10	5.75±0.25	41.6±1.8
	Boom cylinder	23★1★3	M16	23.0±2.0	166±14.5
		24★1★4	M16	30±2.0	231±14.5
		22★6	M18	32.0±3.0	231±21.7
		32★3	M10	5.75±0.25	41.6±1.8
		31★6	M10	5.4±0.5	39.1±3.6
	Arm cylinder	23★1★3	M16	23±2.0	166±14.5
		26★1★4	M16	30±2.0	217±14.5
		28★1★5	M18	38.0±3.8	275±27.5
		34★3	M10	5.4±0.5	39.1±3.6
		40★4	M10	5.75±0.25	41.6±1.8
		33★5	M12	11.3±1.1	81.7±8.0
	Adjustment cylinder	21★1★3	M22	63.0±6.0	456±43.4
		27★3	M10	5.4±0.5	39.1±3.6
	Dozer cylinder	25★7	M8	2.7±0.3	19.5±2.2

★1 : Apply loctite #243 on the thread of bolt.
★3 : CHANGZHOU
★4 : DY POWER
★5 : 2-piece boom
★6 : CHANGZHOU TYPE 2
★7 : SHPAC

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Lock nut	Bucket cylinder	20★3	-	100±10.0	723±72.3
	Boom cylinder	20★3 21★6	- -	100±10.0 100±10.0	723±72.3 723±72.3
	Arm cylinder	20★3	-	100±10.0	723±72.3
	Adjustment cylinder	19★3	M80	100±10.0	723±72.3
Piston	Bucket cylinder	14★3 17★4	- M65	150±15.0 130±13.0	1085±108 940±94.0
	Boom cylinder	14★3 16★4 15★6	- M70 -	150±15.0 190±19.0 150±15.0	1085±108 1374±137 1085±108
	Arm cylinder	14★3 17★4	- M75	150±15.0 190±19.0	1085±108 1374±137
	Adjustment cylinder	13★3	-	150±15.0	1085±108
	Dozer cylinder	13★7	M68	170±17.0	1230±123
Set screw	Bucket cylinder	21★3 23★4	M8 M12	2.7±0.3 5.25±0.25	19.5±2.2 38.0±1.8
	Boom cylinder	21★3 23★4	M8 M12	2.7±0.3 5.0	19.5±2.2 36.2
	Arm cylinder	21★3 23★4	M8 M12	2.7±0.3 5.0	19.5±2.2 36.2
Gland	Dozer cylinder	3★7	M115	92±9.0	665±65.1

★1 : Apply loctite #243 on the thread of bolt.
★3 : CHANGZHOU
★4 : DY POWER
★5 : 2-piece boom
★6 : CHANGZHOU TYPE 2
★7 : SHPAC

3) DISASSEMBLY

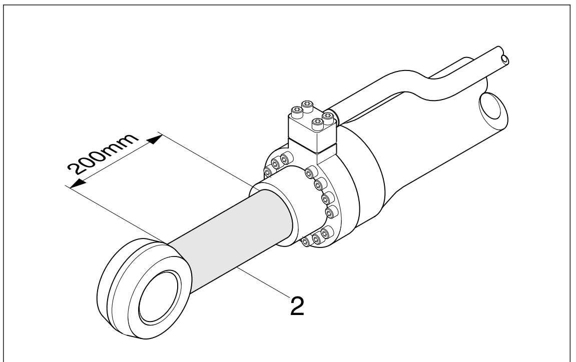
(1) Remove cylinder head and piston rod

※ 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.

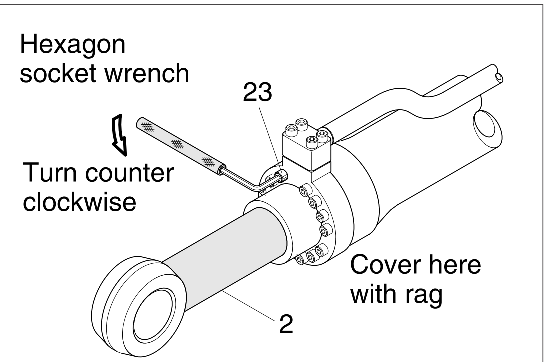
② Pull out rod assembly (2) about 200 mm (7.1 in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



21078DA30

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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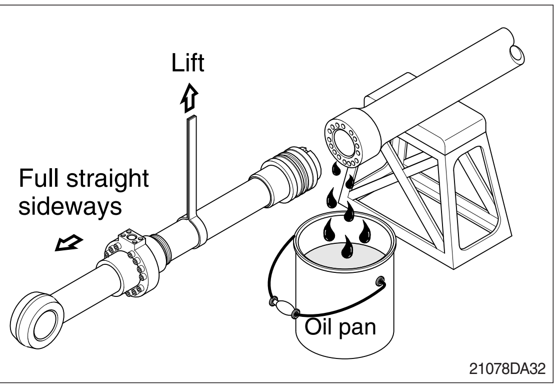
④ Draw out cylinder head and rod assembly together from tube assembly

※ (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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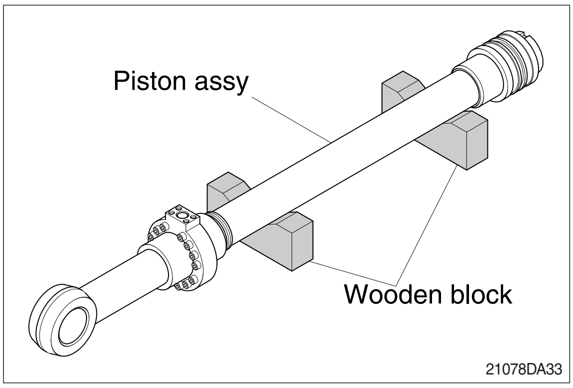
Note that the plated surface of rod assembly (2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

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

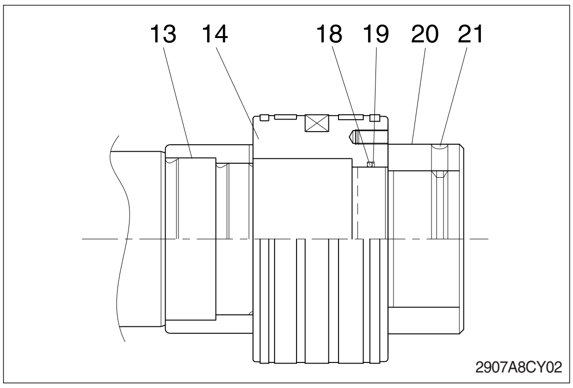
① Remove set screw (21).

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).

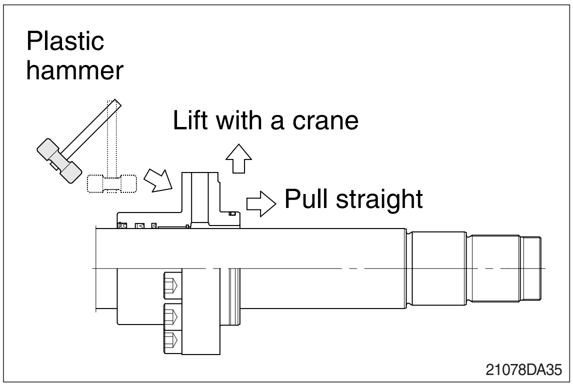


⑤ Remove the cylinder head assembly from rod assembly (2).

※ If it is too heavy to move, move it by striking the flanged part of cylinder head with a plastic hammer.

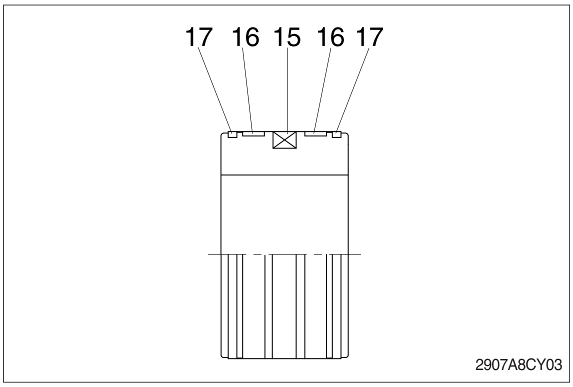
※ Pull it straight with cylinder head assembly lifted with a crane.

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).



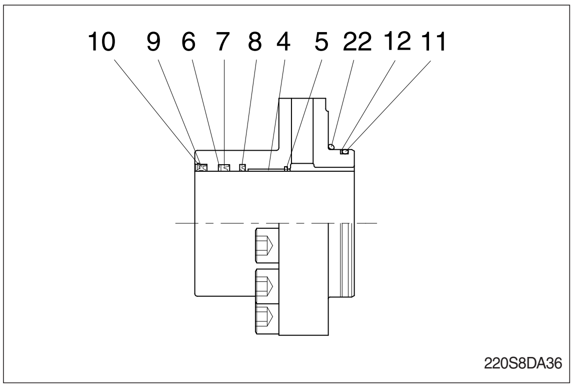
(3) Disassemble the piston assembly

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).

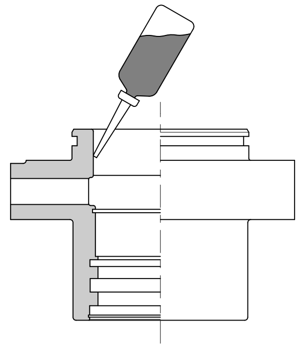


4) ASSEMBLY

(1) Assemble cylinder head assembly

※ Check for scratches or rough surfaces if found smooth with an oil stone.

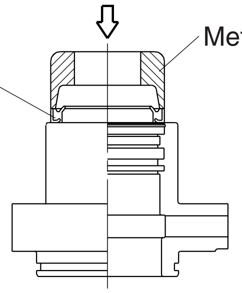
① Coat the inner face of gland (3) with hydraulic oil.



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.

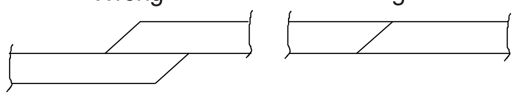


8-157(2)

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.

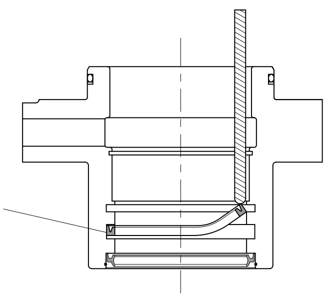
※ Insert the backup ring until one side of it is inserted into groove.



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.

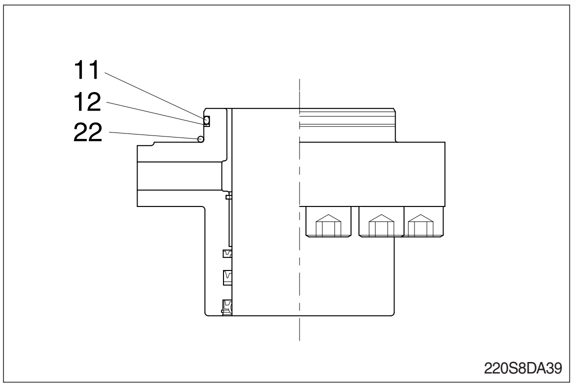


21078DA38

⑤ Fit back up ring (12) to gland (3).

※ Put the backup ring in the warm water of 30~50˚C.

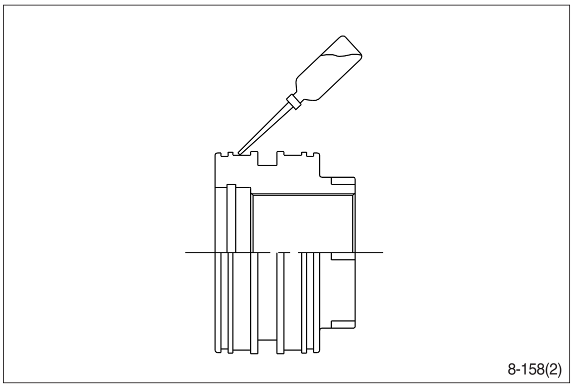
⑥ Fit O-ring (11) and O-ring (22) to gland (3).



(2) Assemble piston assembly

※ Check for scratches or rough surfaces. If found smooth with an oil stone.

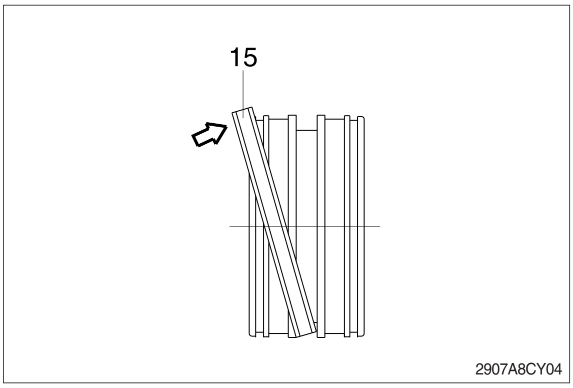
① Coat the outer face of piston (14) with hydraulic oil.



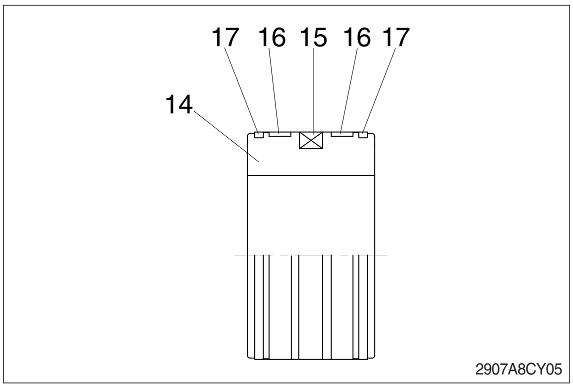
② Fit piston seal (15) to piston.

※ 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.

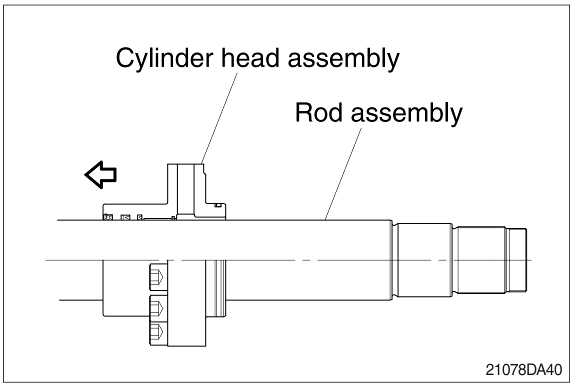


③ Fit wear ring (16) and dust ring (17) to piston (14).

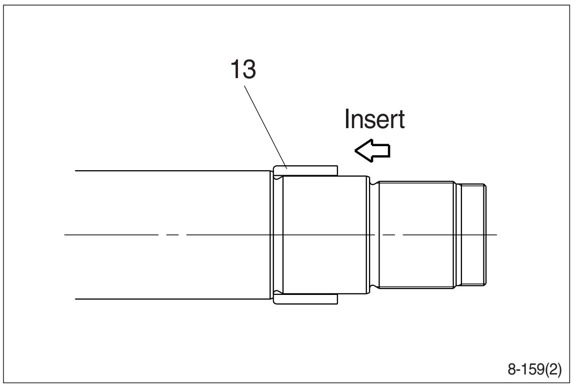


(3) Install piston and cylinder head

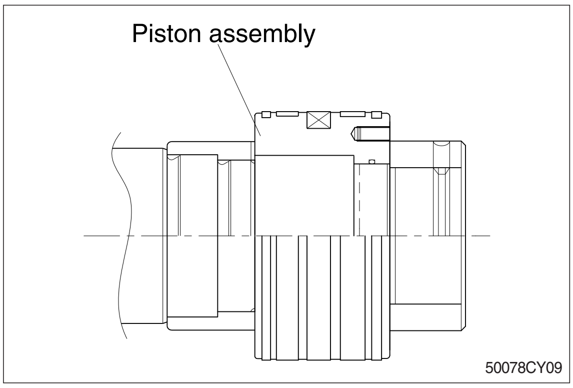
① Fix the rod assembly to the work bench.
② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and cylinder head.
③ Insert cylinder head assembly to rod assembly.



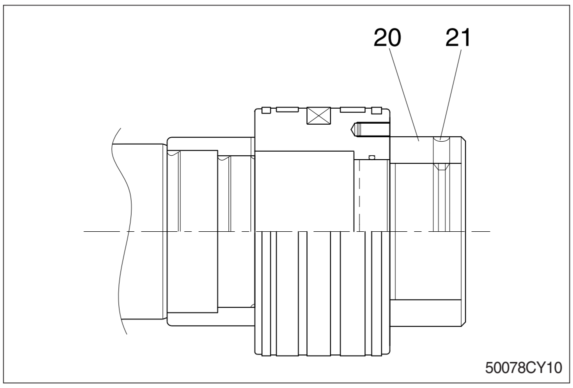
④ Insert cushion ring (13) to rod assembly.
※ Note that cushion ring (13) has a direction in which it should be fitted.



⑤ Fit piston assembly to rod assembly.
· Tightening torque : 150±15.0 kgf · m (1085±108 lbf · ft)
※ Refer to page 8-138.



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 : 2.7±0.3 kgf·m (19.5±2.2 lbf·ft)
※ Refer to page 8-138.



(4) Overall assemble

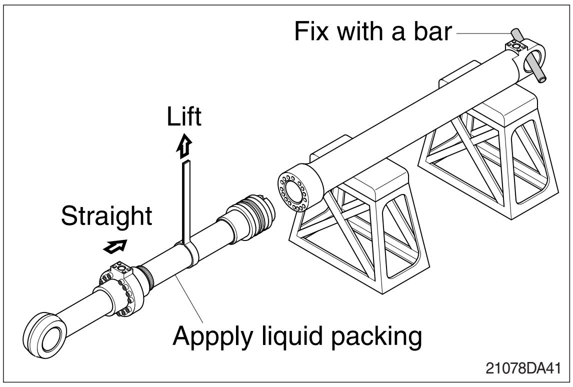
① Place a V-block on a rigid work bench. Mount the tube assembly (1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

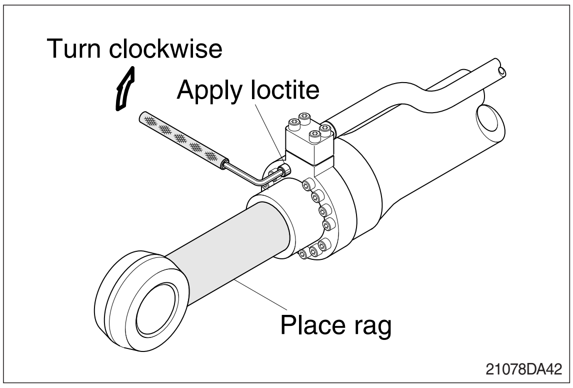
② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.

※ 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

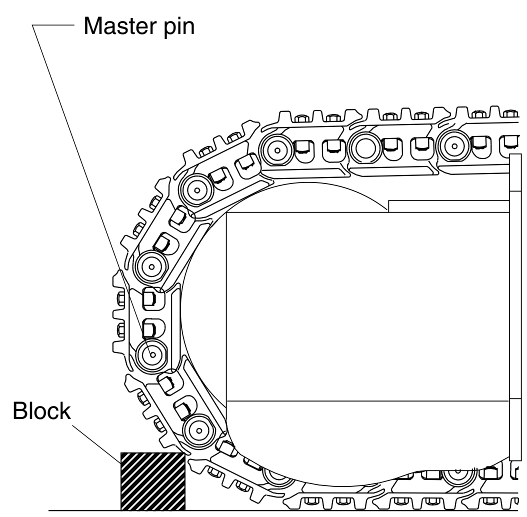
1) REMOVAL

(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.



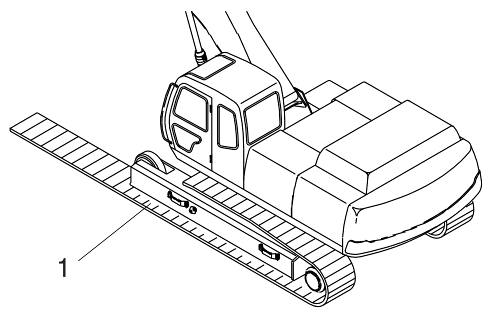
220S8UC01

(3) Push out master pin by using a suitable tool.

(4) Move the machine slowly in reverse, and lay out track link assembly (1).

※ Jack up the machine and put wooden block under the machine.

※ Don't get close to the sprocket side as the track shoe plate may fall down on your feet.

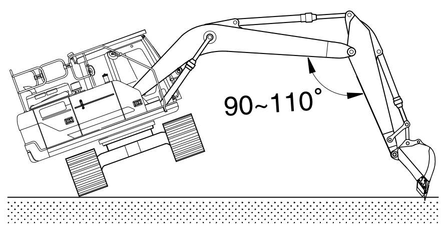


8-161(2)

2) INSTALL

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

※ Adjust the tension of the track link.



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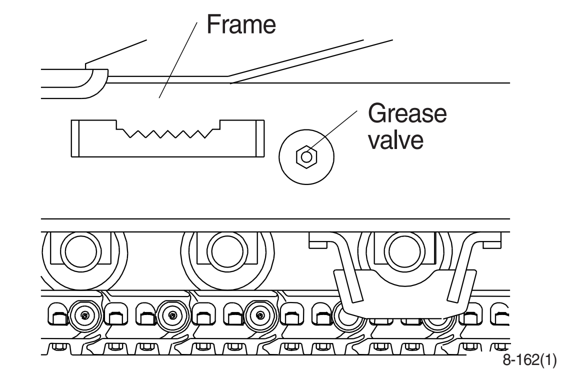
2. UPPER ROLLER

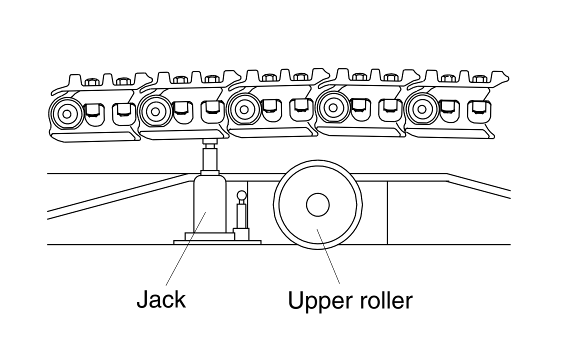
1) REMOVAL

(1) Loosen tension of the track link.



8-162(1)

(2) Jack up the track link height enough to permit upper roller removal.



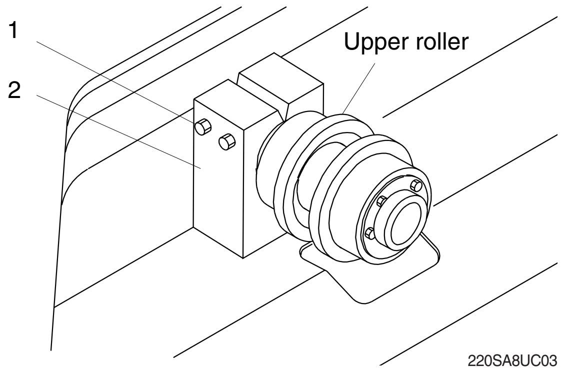
220SA8UC02

(3) Loosen the lock nut (1).

(4) Open bracket(2) with a screwdriver, push out from inside, and remove upper roller assembly.

· Weight : 21 kg (45 lb)

· Tightening torque : 29.7±4.5 kgf·m (215±32.5 lbf · ft)



220SA8UC03

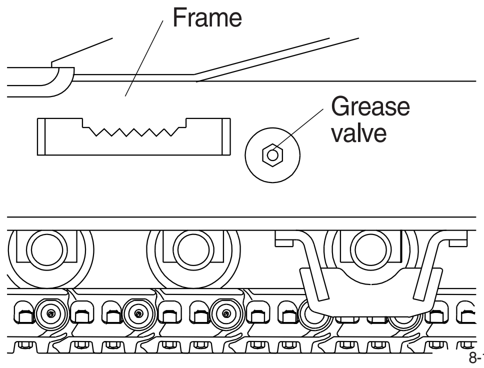
2) INSTALL

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

3. LOWER ROLLER

1) REMOVAL

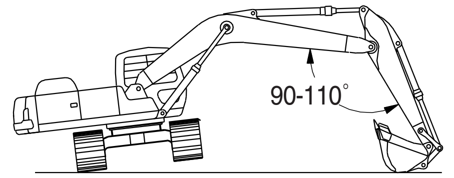
(1) Loosen tension of the track link.



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.

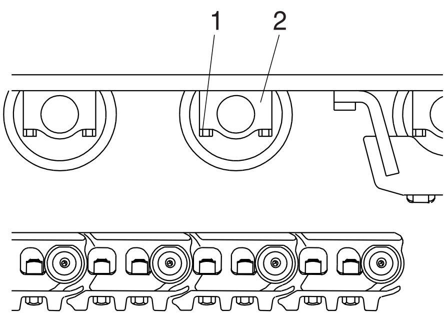


8-163(2)

(3) Remove the mounting bolt (1) and draw out the lower roller (2).

· Weight : 40 ㎏ (88 ℔)

· Tightening torque : 29.7±4.5 kgf·m (215±32.5 lbf · ft)



8-163(3)

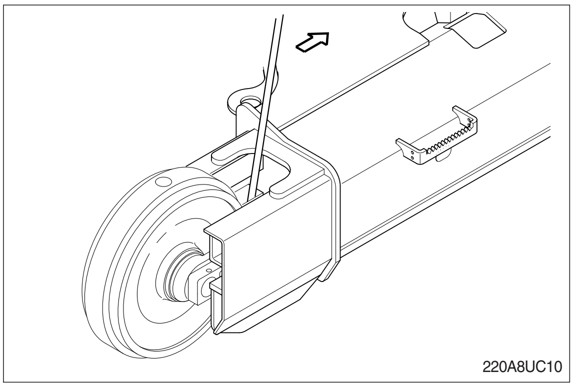
2) INSTALL

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

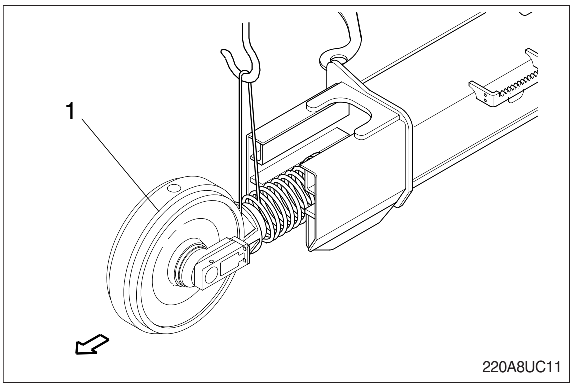
4. IDLER AND RECOIL SPRING

1) REMOVAL

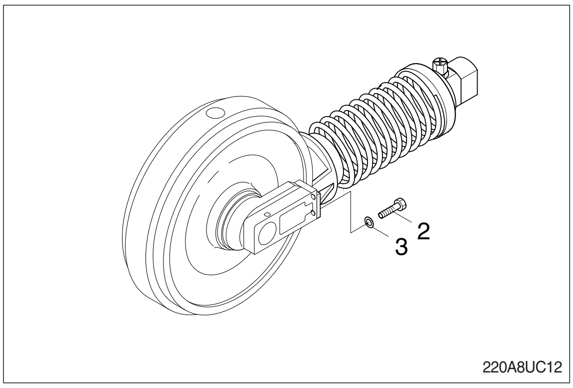
(1) Remove the track link.
For detail, see removal of track link.



(2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 283 kg (624 lb)

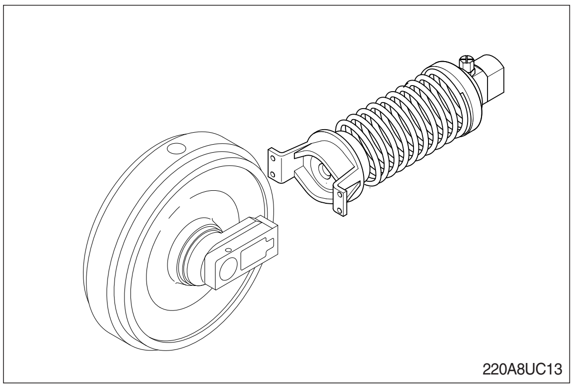


(3) Remove the bolts (2), washers (3) and separate ilder from recoil spring.
· Tightening torque : 29.7±4.5 kgf·m
(215±32.5 lbf · ft)



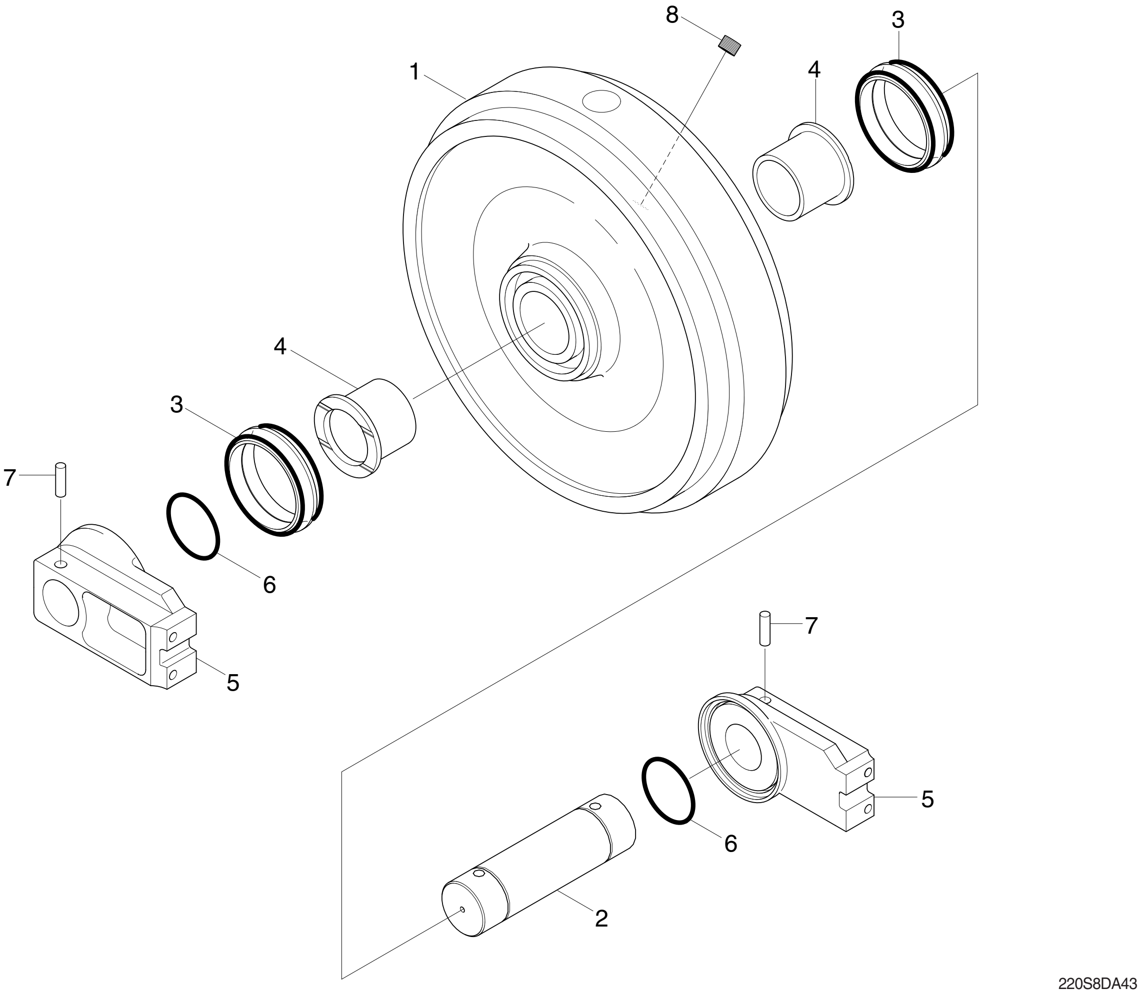
2) INSTALL

(1) Carry out installation in the reverse order to removal.
※ Make sure that the boss on the end face of the recoil cylinder rod is in the hole of the track frame.



3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure

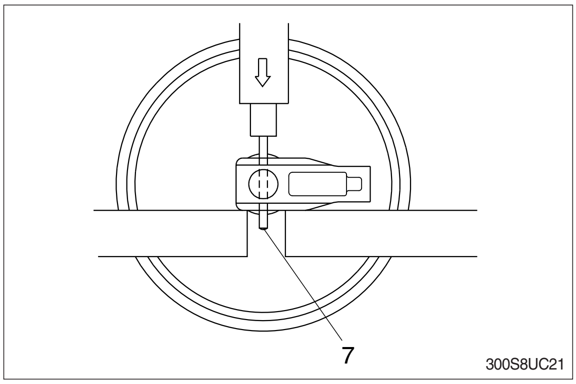


1	Shell	4	Bushing	7	Spring pin
2	Shaft	5	Bracket	8	Plug
3	Seal assembly	6	O-ring		

(2) Disassembly

① Remove plug and drain oil.

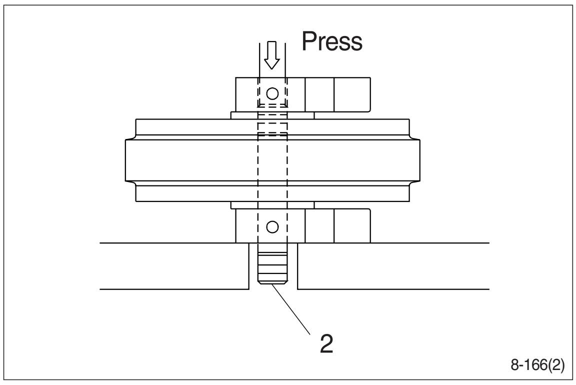
② Draw out the spring pin (7), using a press.



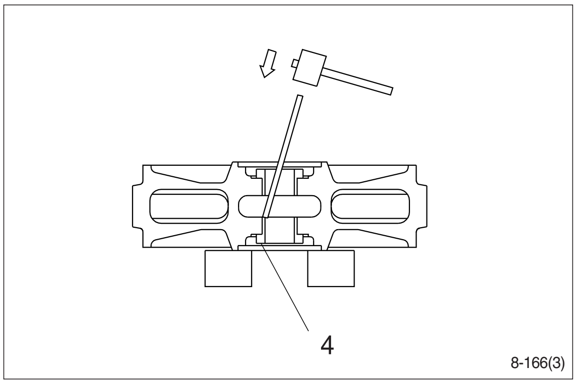
③ Pull out the shaft (2) with a press.

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.

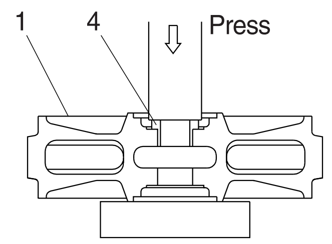


(3) Assembly

※ Before assembly, clean the parts.

※ Coat the sliding surfaces of all parts with oil.

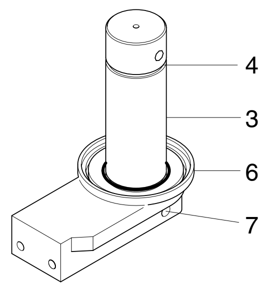
① Cool up bushing (4) fully by some dry ice and press it into shell (1).
Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.



8-167(1)

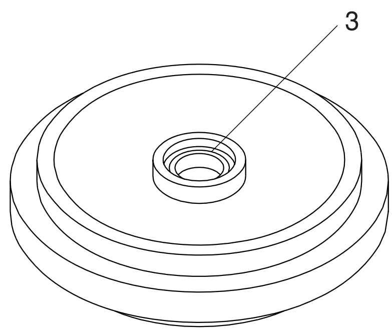
② Coat O-ring (6) with grease thinly, and install it to shaft (2).

③ Insert shaft (2) into bracket (5) and drive in the spring pin (7).



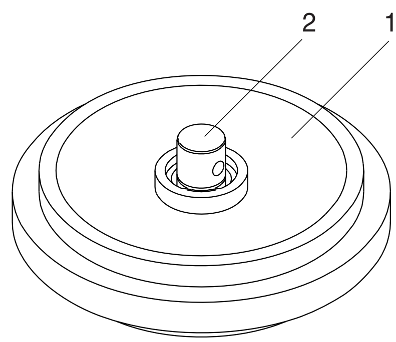
300S8UC22

④ Install seal (3) to shell (1) and bracket (5).



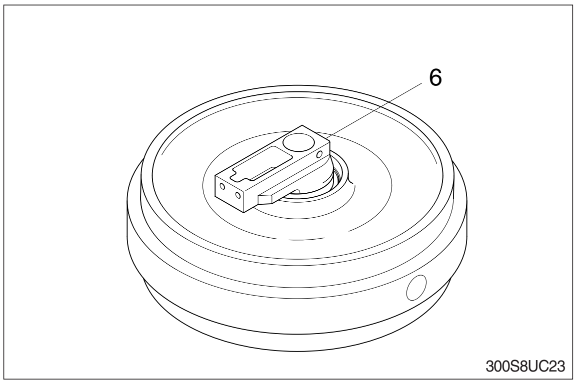
8-167(3)

⑤ Install shaft (2) to shell (1).



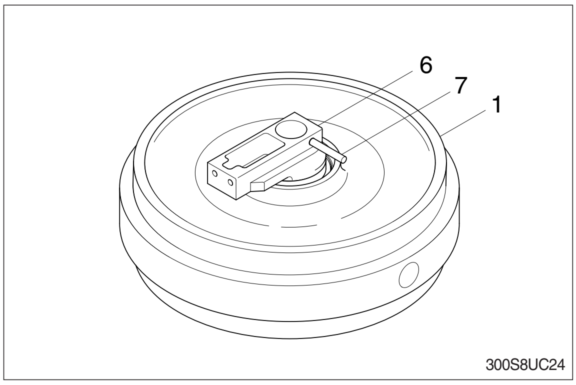
8-167(4)

⑥ Install bracket (5) attached with seal (3).



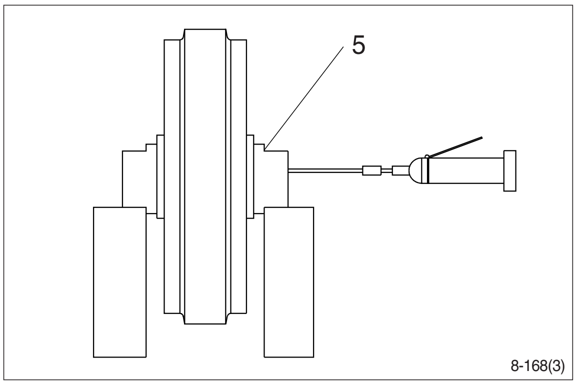
300S8UC23

⑦ Knock in the spring pin (7) with a hammer.



300S8UC24

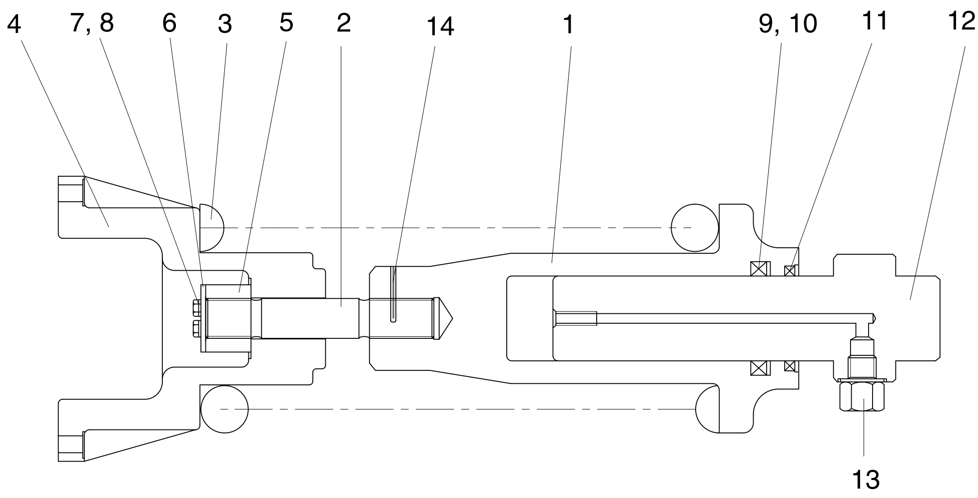
⑧ Lay bracket (5) on its side.
Supply engine oil to the specified level, and tighten plug.



8-168(3)

4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure (standard)



220L8UC100

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		

(2) Disassembly

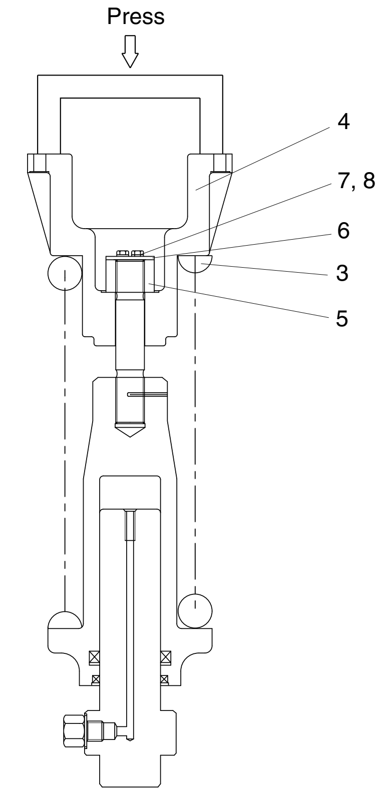
① Apply pressure on spring (3) with a press.

※ The spring is under a large installed load. This is dangerous, so be sure to set properly.

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.

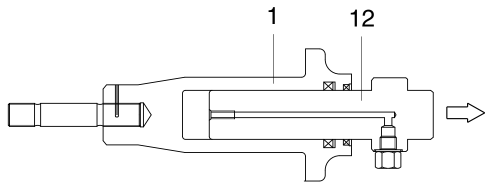
④ Lighten the press load slowly and remove bracket (4) and spring (3).



220S8UCG01

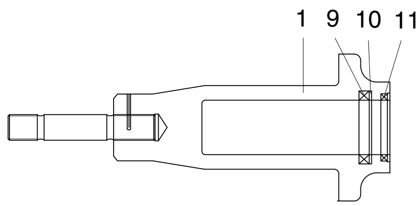
⑤ Remove rod (12) from body (1).

⑥ Remove grease valve (13) from rod (12).



220S8UCG02

⑦ Remove rod seal (9), back up ring (10) and dust seal (11).

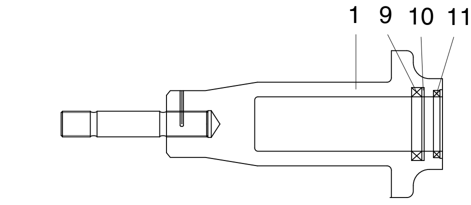


220S8UCG03

(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.

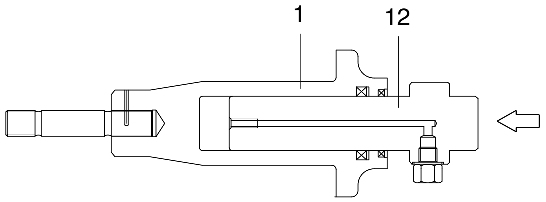


220S8UCG03

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±1.0 kgf·m
(94±7.2 lbf·ft)



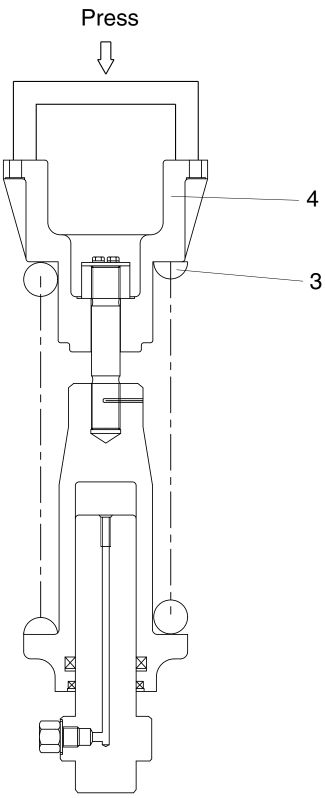
220S8UCG04

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 : 13716 kg (30239 lb)

※ Apply sealant before assembling.

※ During the operation, pay attention specially to prevent the press from slipping out.



220S8UCG05

⑥ Lighten the press load and confirm the set length of spring (3).

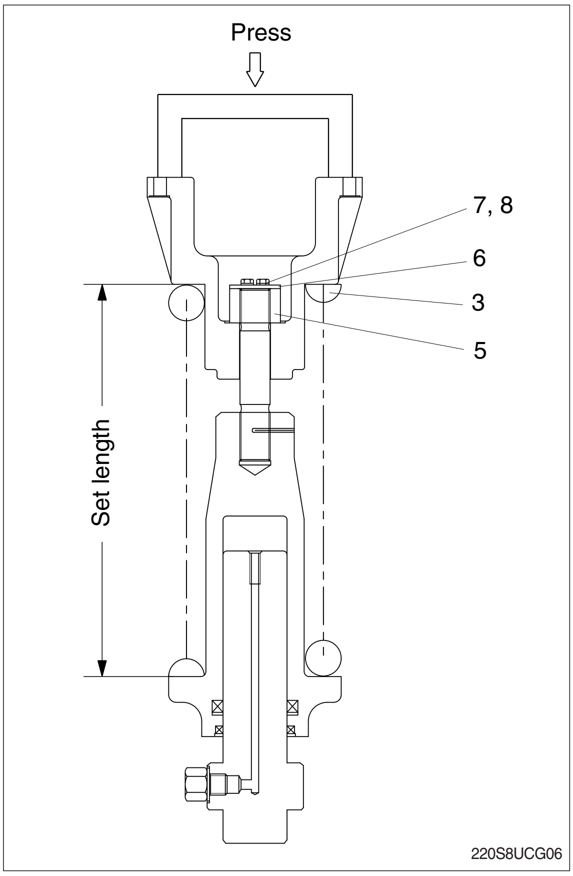
- Set length : 420±1.5 mm

(17±0.06 in)

⑦ After the setting of spring (3), install lock plate (6), spring washer (8) and bolt (7).

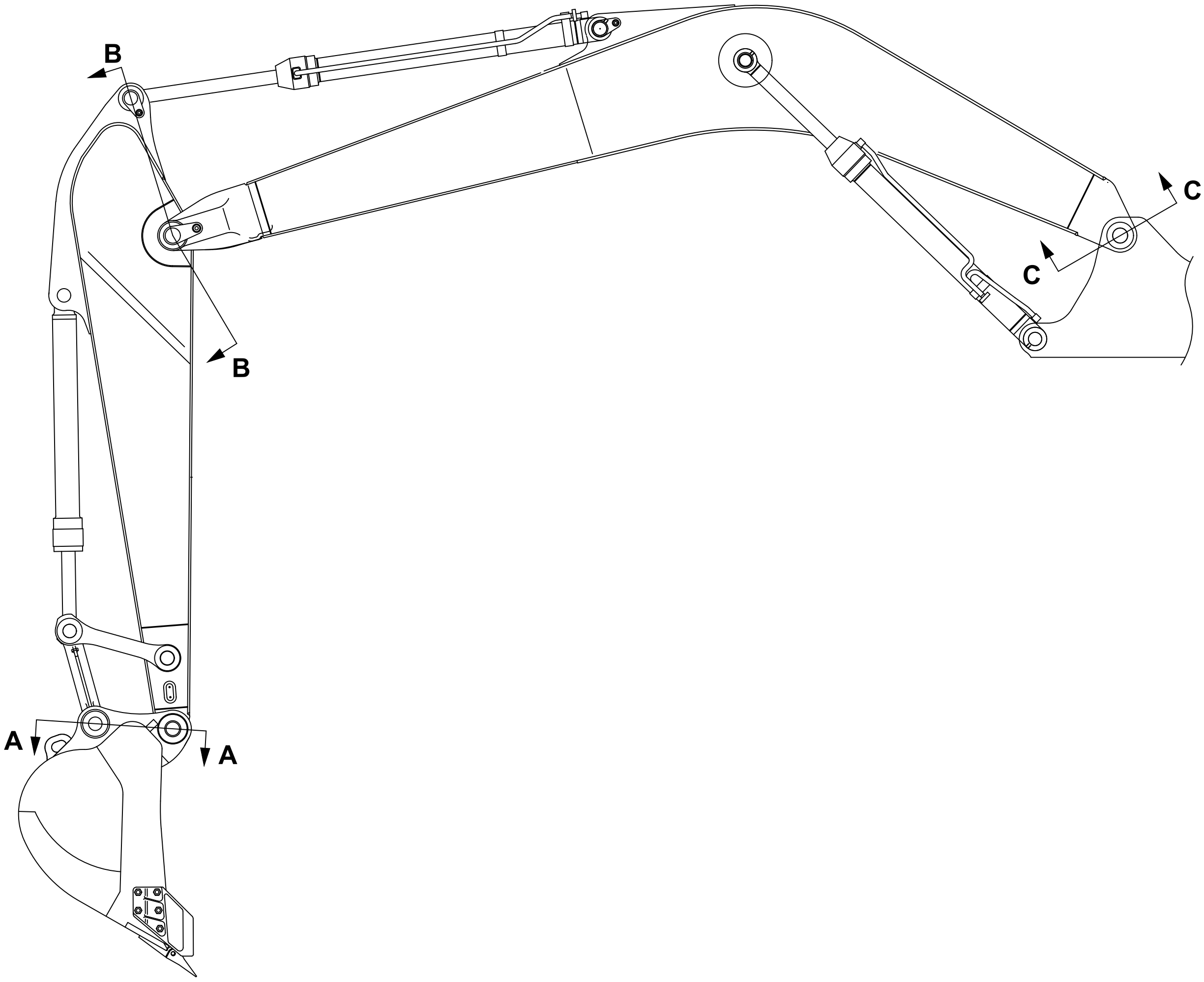
· Tightening torque : 15±0.5 kgf·m

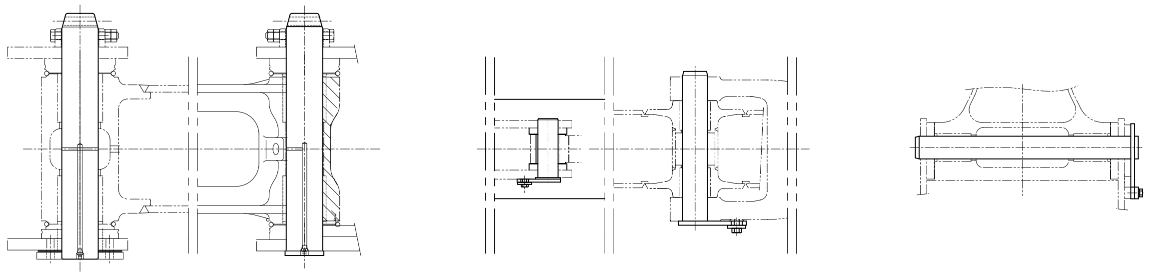
(108±3.6 lbf·ft)



GROUP 11 WORK EQUIPMENT

1. STRUCTURE





SECTION A SECTION B SECTION C

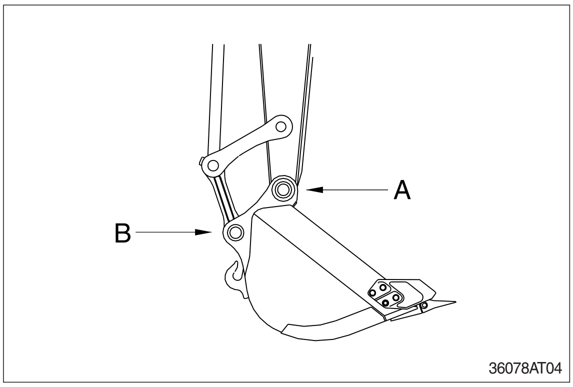
220A8WE10

2. REMOVAL AND INSTALL

1) BUCKET ASSEMBLY

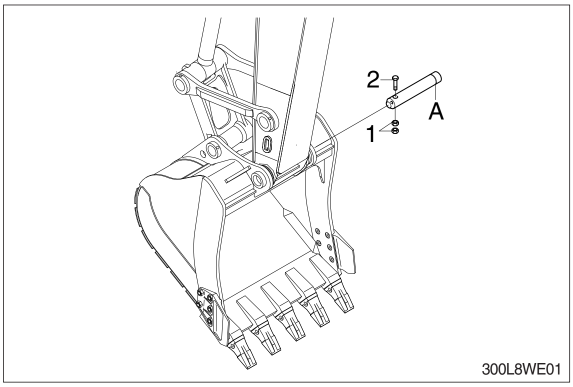
(1) Removal

① Lower the work equipment completely to ground with back of bucket facing down.



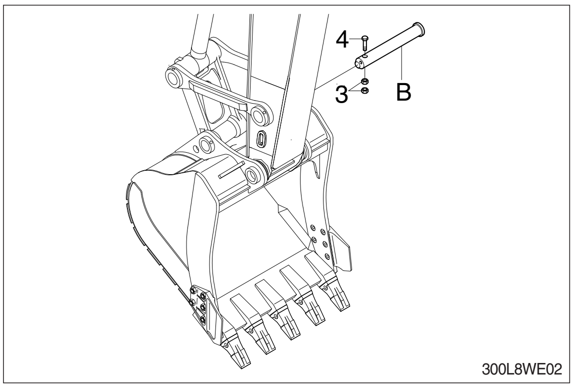
② Remove nut (1), bolt (2) and draw out the pin (A).

· Tightening torque (1) : 29.7±4.5 kgf·m (215± 32.5 lbf·ft)



③ Remove nut (3), bolt (4) and draw out the pin (B).

· Tightening torque (3) : 29.7±4.5 kgf·m (215± 32.5 lbf·ft)

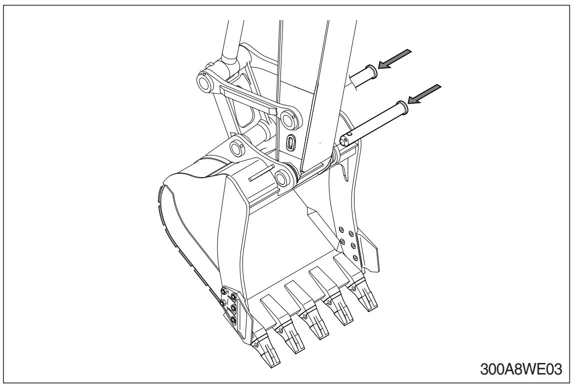


(2) Install

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.



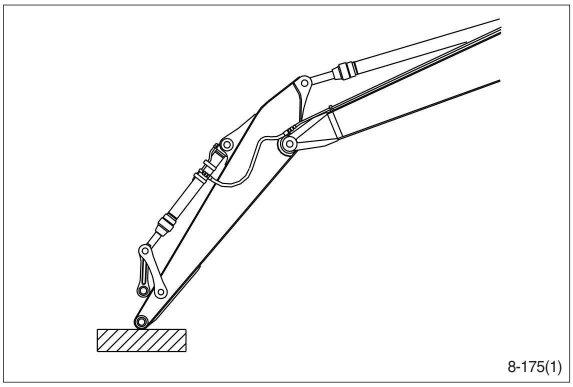
2) ARM ASSEMBLY

(1) Removal

※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

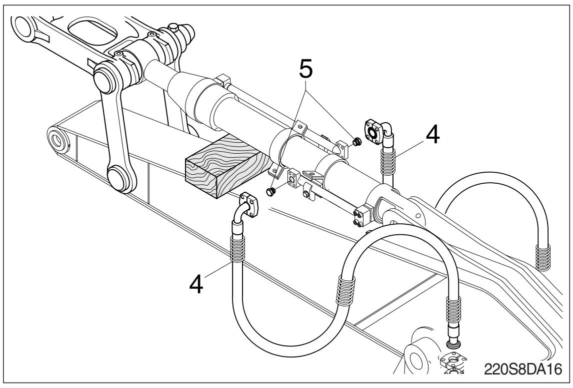
⚠ **Escaping fluid under pressure can penetrated the skin causing serious injury.**

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.**



220S8DA16

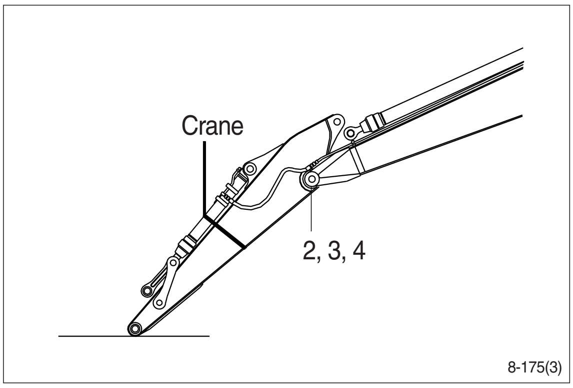
③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

※ 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 : 860 ㎏ (1900 ㏌)
- · 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.