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1. STRUCTURE

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

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

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

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

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

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

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

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

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

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

2. HOW TO READ THE SERVICE MANUAL

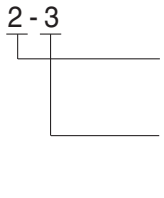
Distribution and updating

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

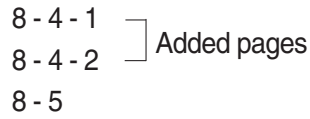
Get the most up-to-date information before you start any work.

Filing method

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



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



Revised edition mark (①②③…)

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

Revisions

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

Symbols

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

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

3. CONVERSION TABLE

Method of using the Conversion Table

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

Example

1. Method of using the Conversion Table to convert from millimeters to inches

Convert 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 5in the row across the top, take this as ⓑ, then draw a perpendicular line down from ⓑ.

(3) Take the point where the two lines cross as ⓒ. This point ⓒ gives the value when converting from millimeters to inches. Therefore, 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 Hints 1-1
Group 2 Specifications 1-10

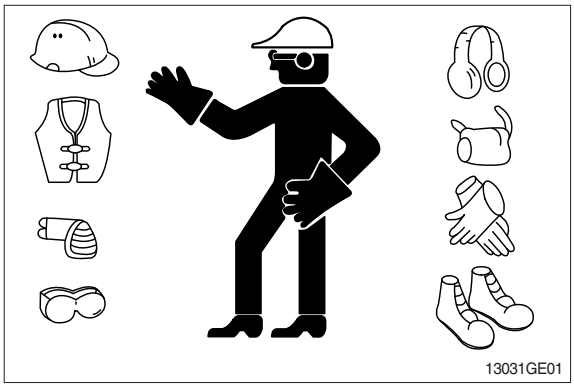
GROUP 1 SAFETY HINTS

FOLLOW SAFE PROCEDURE

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

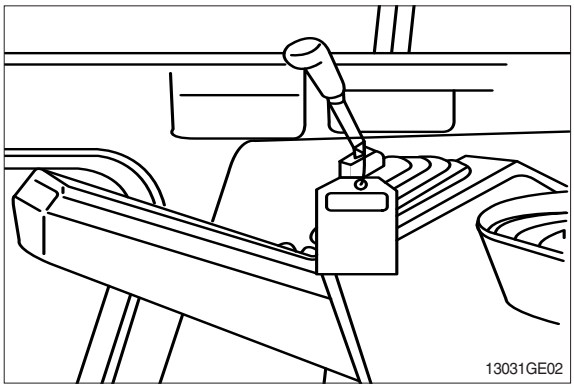
WEAR PROTECTIVE CLOTHING

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



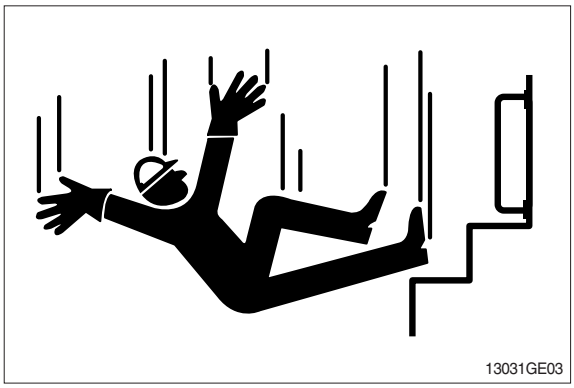
WARN OTHERS OF SERVICE WORK

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



USE HANDHOLDS AND STEPS

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

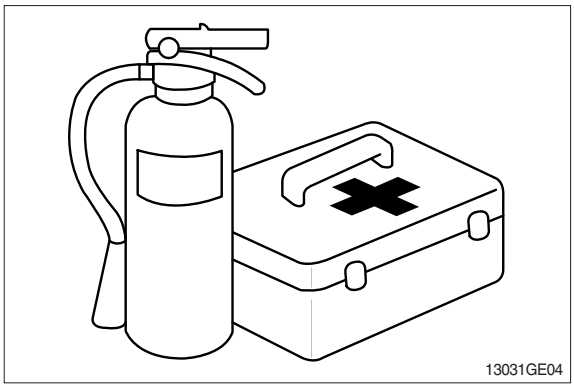


PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

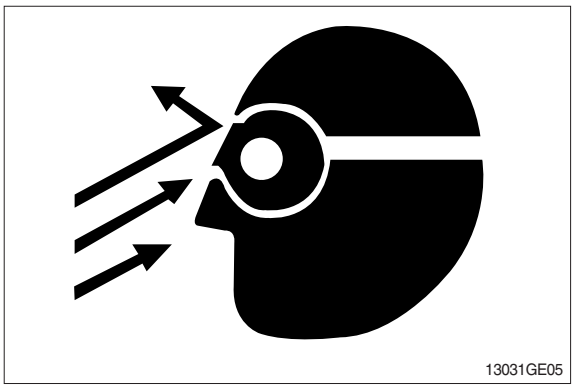
Keep a first aid kit and fire extinguisher handy.

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



PROTECT AGAINST FLYING DEBRIS

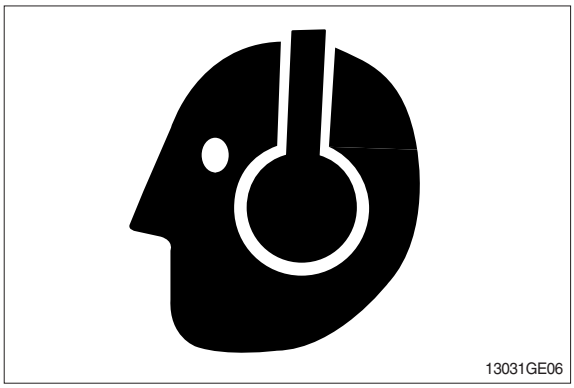
Guard against injury from flying pieces of metal or debris; Wear goggles or safety glasses.



PROTECT AGAINST NOISE

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

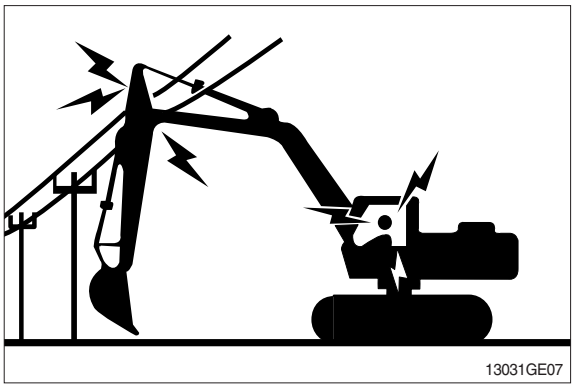
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.



AVOID POWER LINES

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

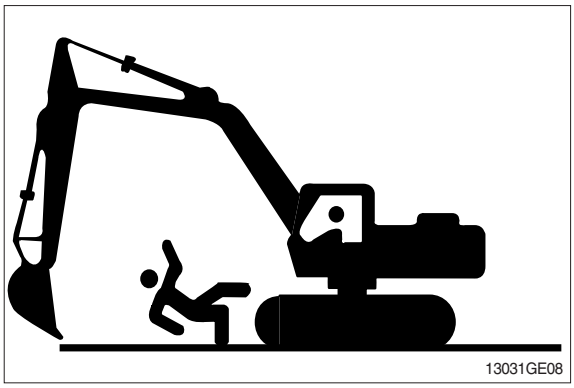
Never move any part of the machine or load closer to electric line than 3m(10ft) plus twice the line insulator length.



KEEP RIDERS OFF EXCAVATOR

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

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

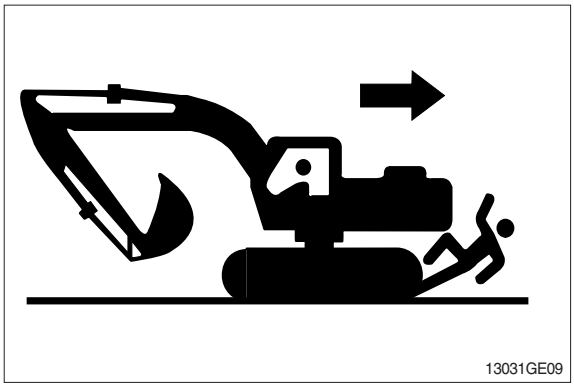

13031GE08

MOVE AND OPERATE MACHINE SAFELY

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

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

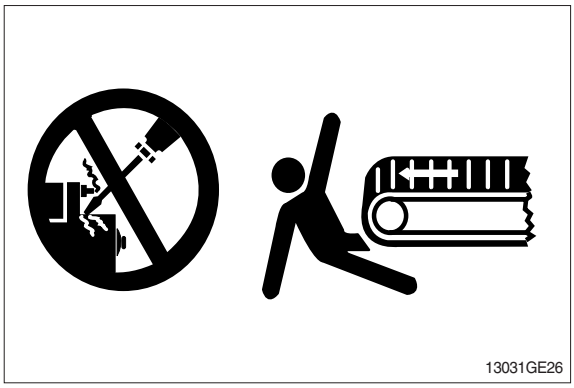
Use a signal person when moving, swinging, or operating the machine in congested areas. Coordinate hand signals before starting the excavator.


13031GE09

OPERATE ONLY FORM OPERATOR'S SEAT

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

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


13031GE26

PARK MACHINE SAFELY

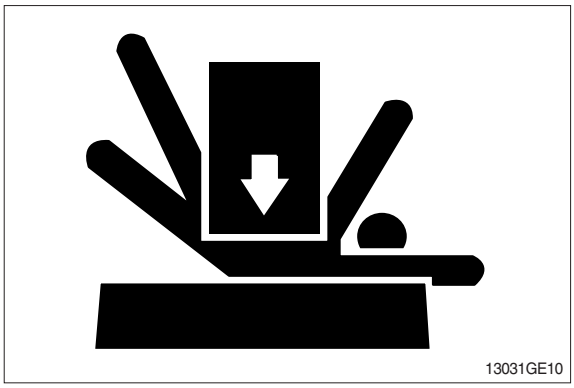
Before working on the machine:

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

SUPPORT MACHINE PROPERLY

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

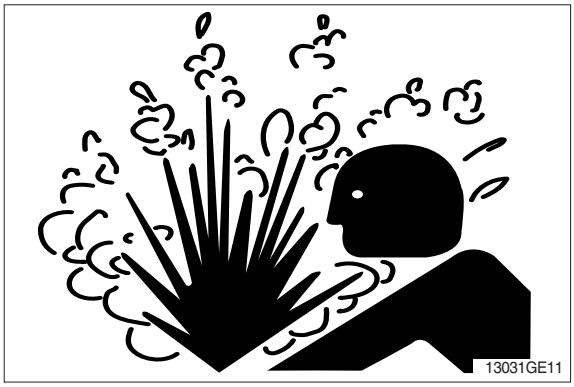
Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load.
Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.


13031GE10

SERVICE COOLING SYSTEM SAFELY

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

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


13031GE11

HANDLE FLUIDS SAFELY-AVOID FIRES

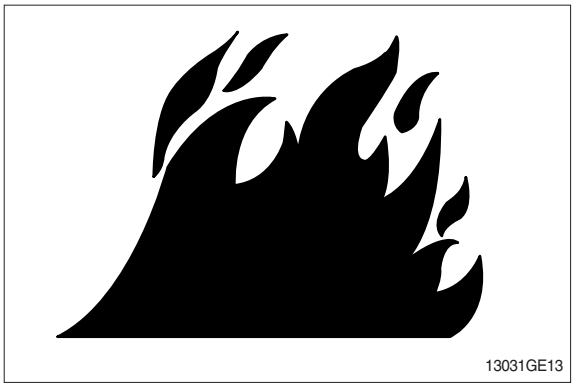
Handle fuel with care; It is highly flammable. Do not refuel the machine while smoking or when near open flame or sparks. Always stop engine before refueling machine.
Fill fuel tank outdoors.


13031GE12

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

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

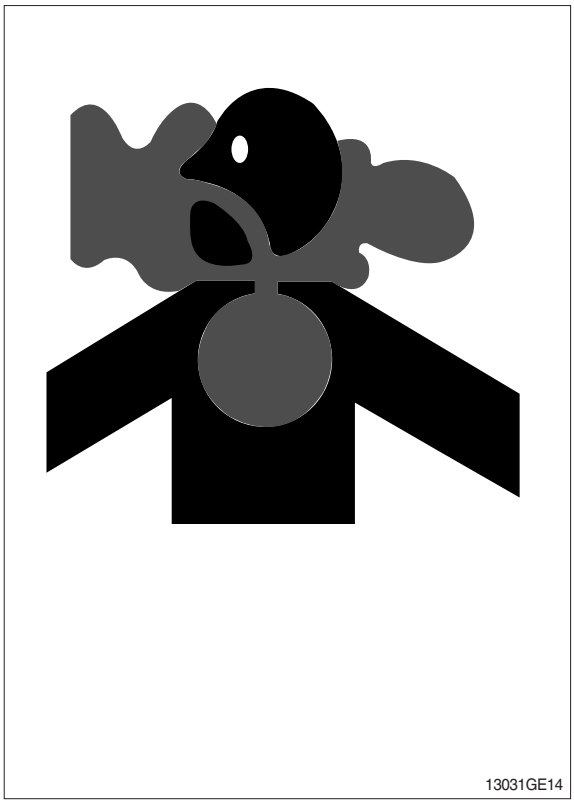
Do not store oily rags; They can ignite and burn spontaneously.


13031GE13

BEWARE OF EXHAUST FUMES

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

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


13031GE14

REMOVE PAINT BEFORE WELDING OR HEATING

Avoid potentially toxic fumes and dust.

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

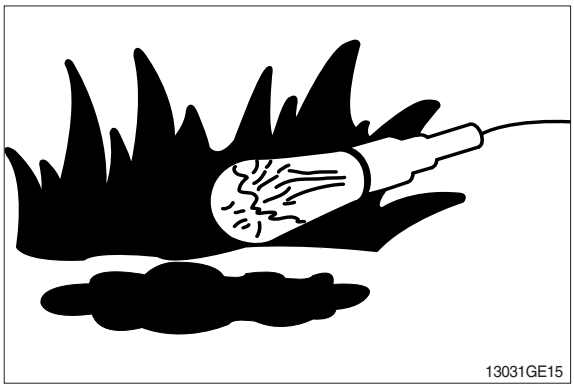
Do all work outside or in a well ventilated area. Dispose of paint and solvent properly.

Remove paint before welding or heating:

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

ILLUMINATE WORK AREA SAFELY

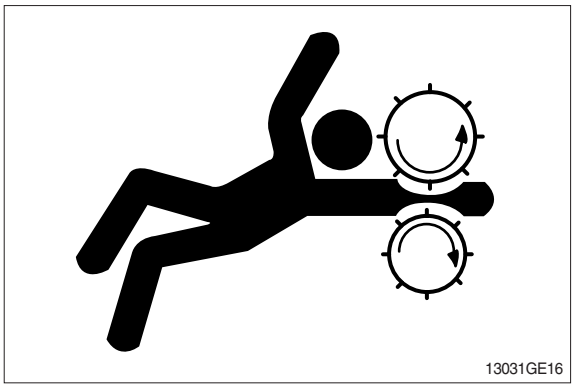
Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.


13031GE15

SERVICE MACHINE SAFELY

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

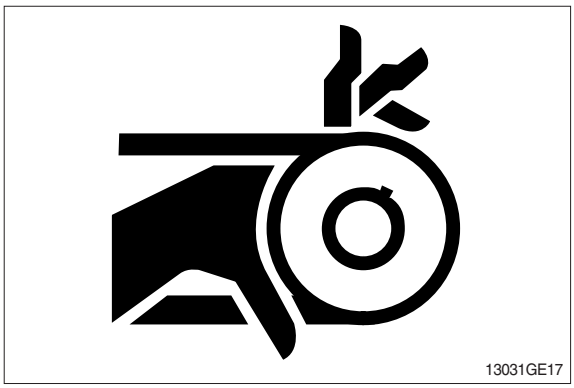
Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

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



AVOID HIGH PRESSURE FLUIDS

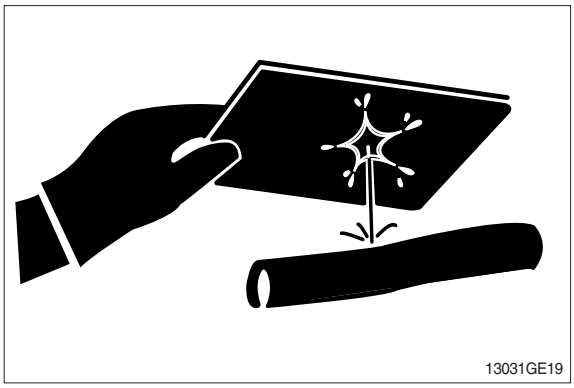
Escaping fluid under pressure can penetrate the skin causing serious injury.

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

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

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





AVOID HEATING NEAR PRESSURIZED FLUID LINES

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

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



PREVENT BATTERY EXPLOSIONS

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

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

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



PREVENT ACID BURNS

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

Avoid the hazard by:

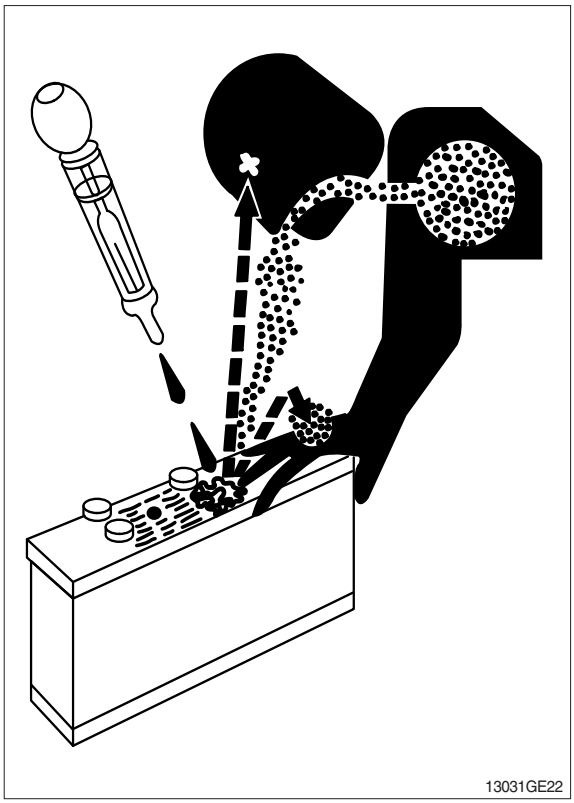
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling of dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

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

If acid is swallowed:

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



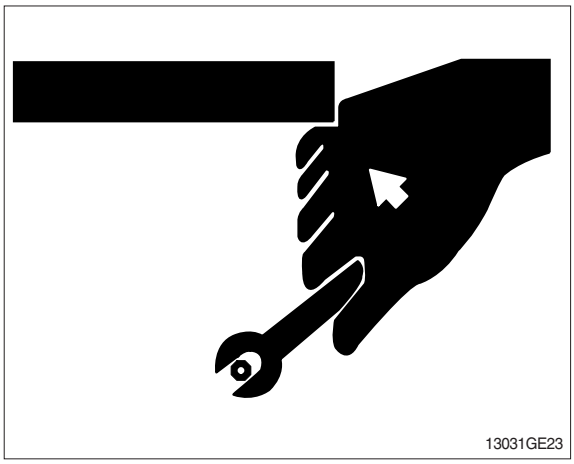
USE TOOLS PROPERLY

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

Use power tools only to loosen threaded tools and fasteners.

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

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

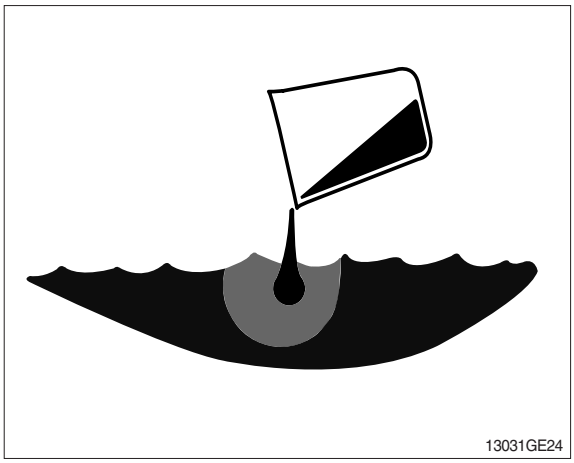


DISPOSE OF FLUIDS PROPERLY

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

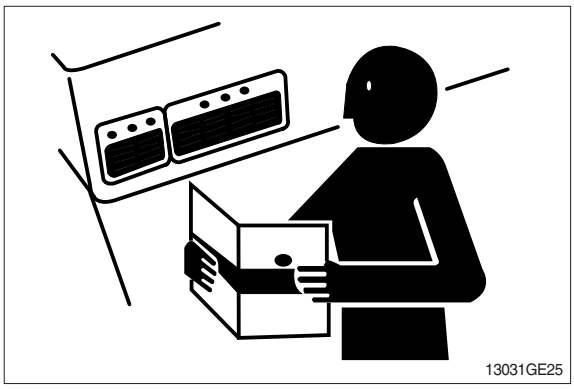
Use proper containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

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


13031GE24

REPLACE SAFETY SIGNS

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

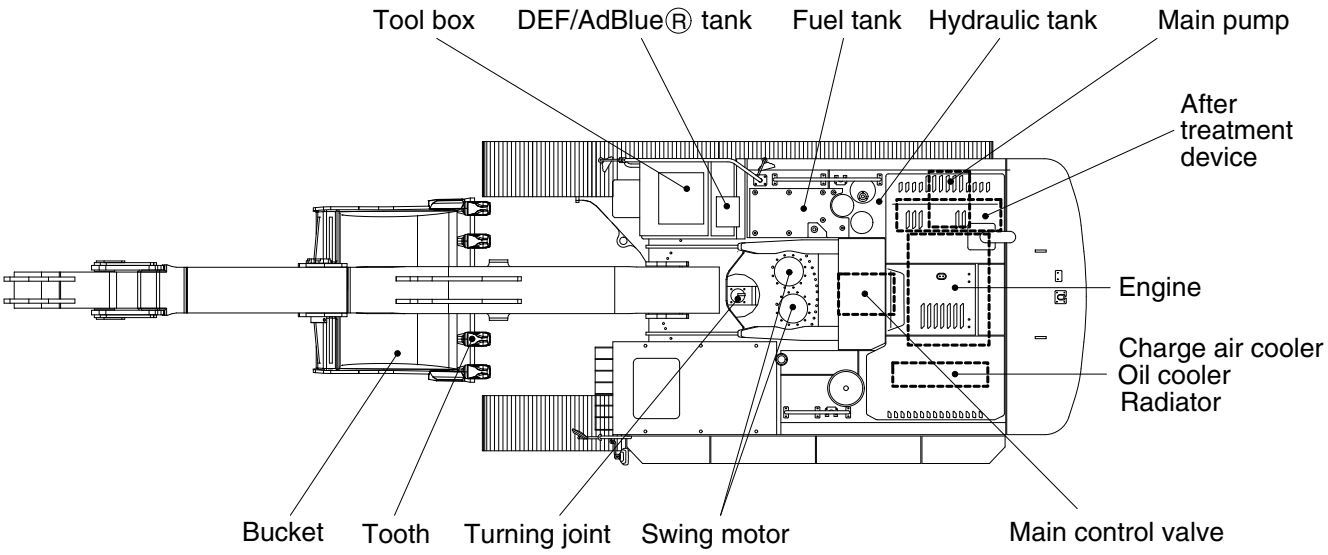

13031GE25

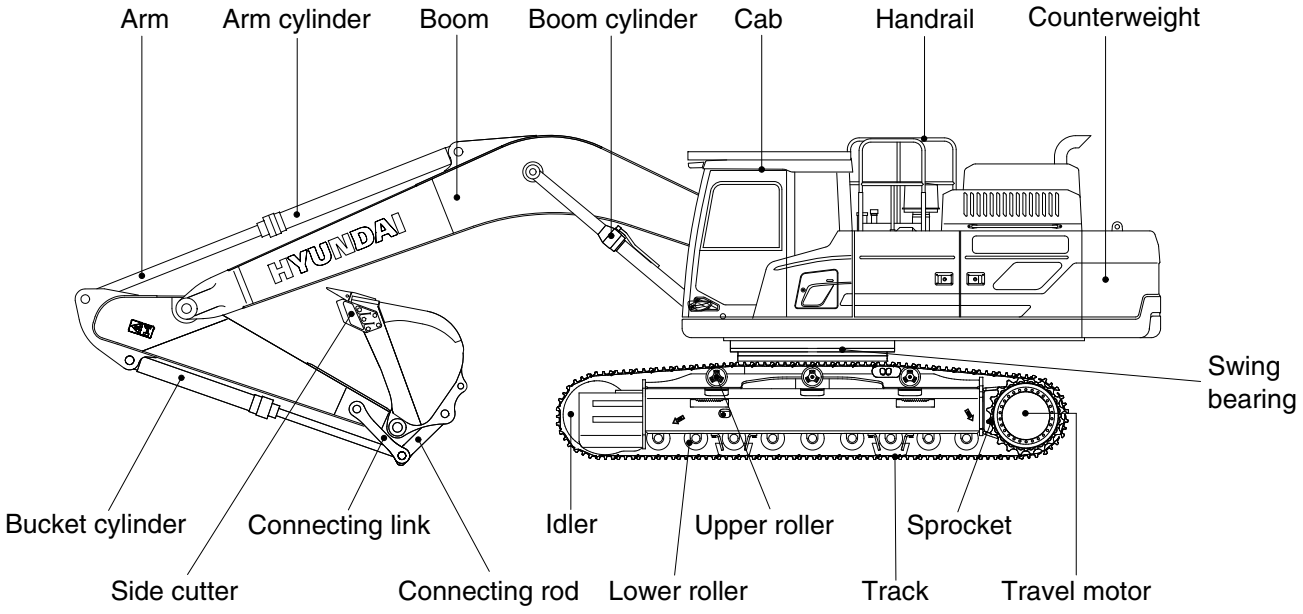
LIVE WITH SAFETY

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

GROUP 2 SPECIFICATIONS

1. MAJOR COMPONENT

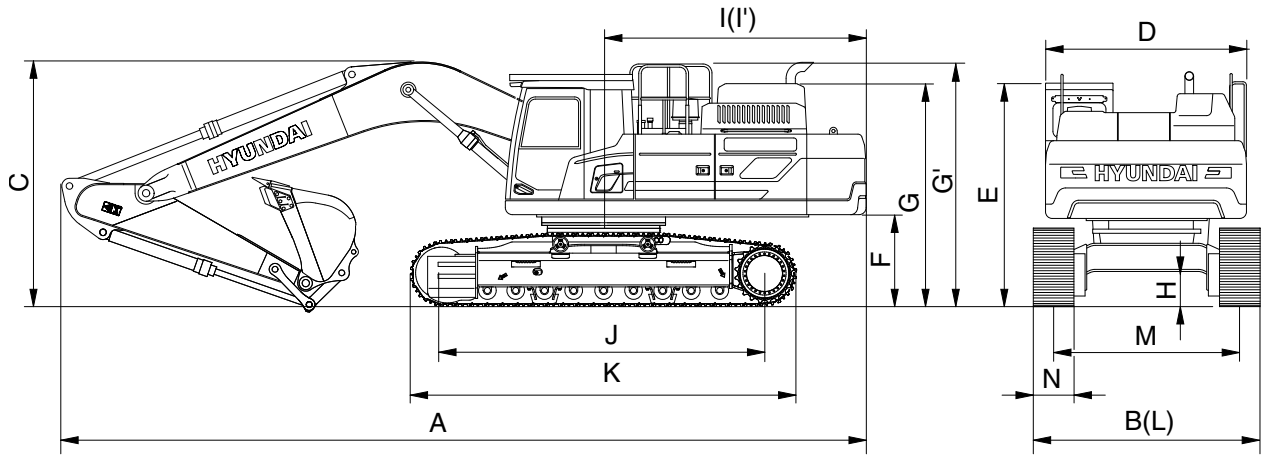




480A2SP01

2. SPECIFICATIONS

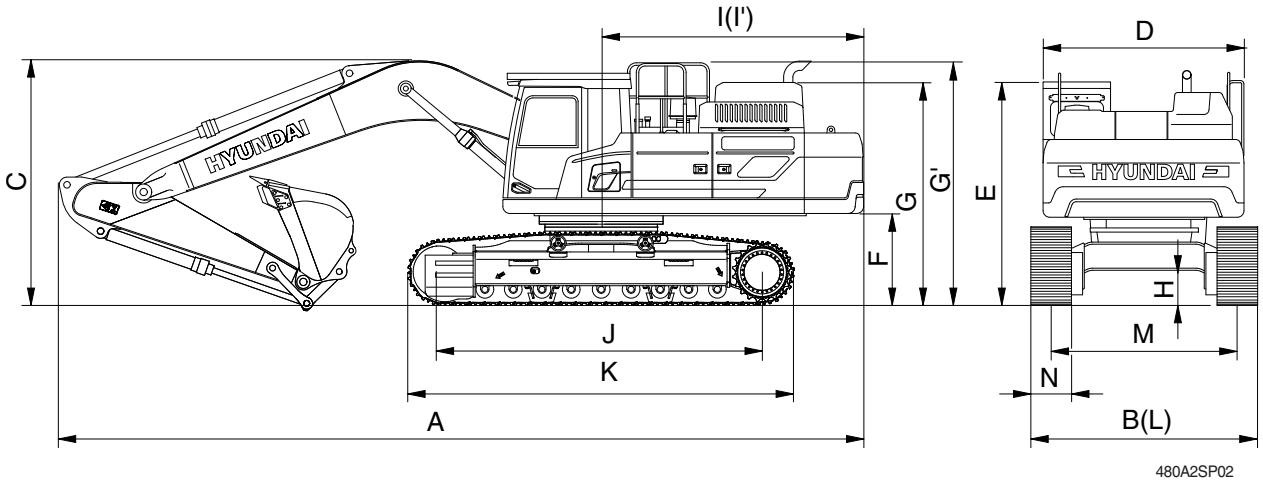
1) HX480A L (1/4)



480A2SP02

Description		Unit		Specification	
		m (ft-in)	Boom	7.06 (23' 2")	
			Arm	3.38 (11' 1")	
		mm (in)	Shoe	600 (24)	800 (32)
Operating weight		kg (lb)		50870 (112150)	51920 (114460)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)		2.20 (2.88)	2.20 (2.88)
Overall length	A	mm (ft-in)		12160 (39' 11")	12160 (39' 11")
Overall width	B			3340 (10' 11")	3540 (11' 7")
Overall height of boom	C			3850 (12' 8")	3850 (12' 8")
Superstructure width	D			2980 (9' 9")	2980 (9' 9")
Overall height of cab	E			3220 (10' 7")	3220 (10' 7")
Ground clearance of counterweight	F			1300 (4' 3")	1300 (4' 3")
Overall height of engine hood	G			3016 (9' 11")	3016 (9' 11")
Overall height of handrail	G'			3450 (11' 4")	3450 (11' 4")
Minimum ground clearance	H			565 (1' 10")	565 (1' 10")
Rear-end distance	I			3745 (12' 3")	3745 (12' 3")
Rear-end swing radius	I'			3800 (12' 6")	3800 (12' 6")
Distance between tumblers	J			4470 (14' 8")	4470 (14' 8")
Undercarriage length (without grouser)	K			5416 (17' 9")	5416 (17' 9")
Undercarriage length (with grouser)				5490 (18' 0")	5490 (18' 0")
Undercarriage width	L			3340 (10' 11")	3340 (10' 11")
Track gauge	M			2740 (9' 0")	2740 (9' 0")
Track shoe width, standard	N			600 (24")	800 (32")
Travel speed (low/high)		km/hr (mph)		3.3/5.3 (2.1/3.3)	3.3/5.3 (2.1/3.3)
Swing speed		rpm		8.8	8.8
Gradeability		Degree (%)		35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.88 (12.6)	0.68 (9.6)
Max traction force		kg (lb)		39674 (87446)	39674 (87466)

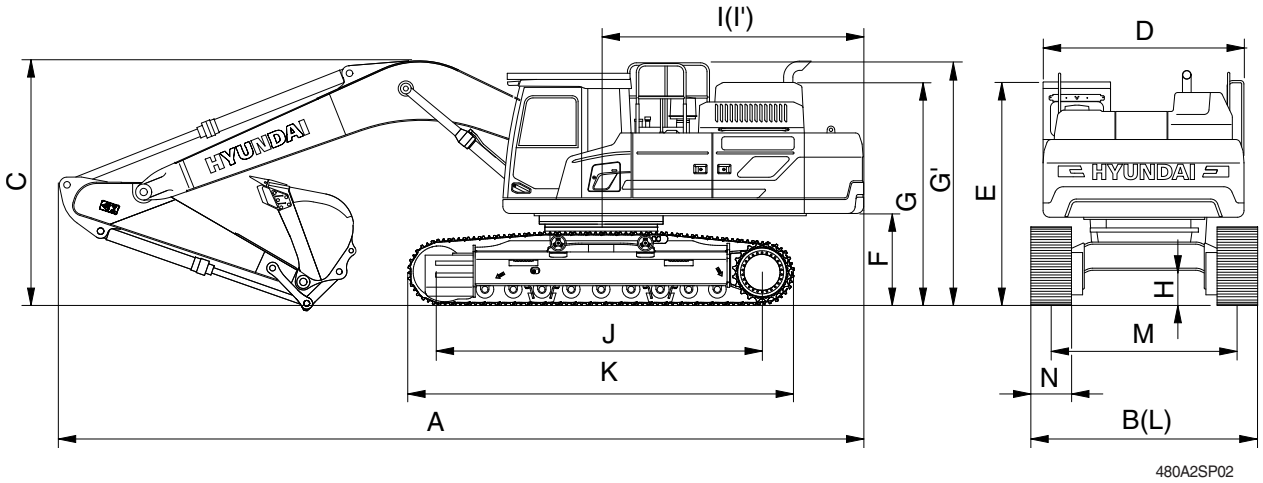
HX480A L (2/4)



480A2SP02

Description		Unit		Specification		
		m (ft-in)	Boom	7.06 (23' 2")		
			Arm	2.90 (9' 6")	4.00 (13' 1")	2.55 (8' 4")
		mm (in)	Shoe	600 (24)		
Operating weight		kg (lb)		50850 (112100)	50920 (112260)	50690 (111750)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)		2.20 (2.88)	2.20 (2.88)	2.20 (2.88)
Overall length	A	mm (ft-in)		12220 (40' 1")	12150 (39' 10")	12210 (40' 1")
Overall width	B			3340 (10' 11")	3340 (10' 11")	3340 (10' 11")
Overall height of boom	C			3850 (12' 8")	3890 (12' 9")	3790 (12' 5")
Superstructure width	D			2980 (9' 9")	2980 (9' 9")	2980 (9' 9")
Overall height of cab	E			3220 (10' 7")	3220 (10' 7")	3220 (10' 7")
Ground clearance of counterweight	F			1300 (4' 3")	1300 (4' 3")	1300 (4' 3")
Overall height of engine hood	G			3016 (9' 11")	3016 (9' 11")	3016 (9' 11")
Overall height of handrail	G'			3450 (11' 4")	3450 (11' 4")	3450 (11' 4")
Minimum ground clearance	H			565 (1' 10")	565 (1' 10")	565 (1' 10")
Rear-end distance	I			3745 (12' 3")	3745 (12' 3")	3745 (12' 3")
Rear-end swing radius	I'			3800 (12' 6")	3800 (12' 6")	3800 (12' 6")
Distance between tumblers	J			4470 (14' 8")	4470 (14' 8")	4470 (14' 8")
Undercarriage length (without grouser)	K			5416 (17' 9")	5416 (17' 9")	5416 (17' 9")
Undercarriage length (with grouser)				5490 (18' 0")	5490 (18' 0")	5490 (18' 0")
Undercarriage width	L			3340 (10' 11")	3340 (10' 11")	3340 (10' 11")
Track gauge	M			2740 (9' 0")	2740 (9' 0")	2740 (9' 0")
Track shoe width, standard	N			600 (24")	600 (24")	600 (24")
Travel speed (low/high)		km/hr (mph)		3.3/5.3 (2.1/3.3)	3.3/5.3 (2.1/3.3)	3.3/5.3 (2.1/3.3)
Swing speed		rpm		8.8	8.8	8.8
Gradeability		Degree (%)		35 (70)	35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.88 (12.6)	0.88 (12.6)	0.88 (12.5)
Max traction force		kg (lb)		39674 (87446)	39674 (87446)	39674 (87446)

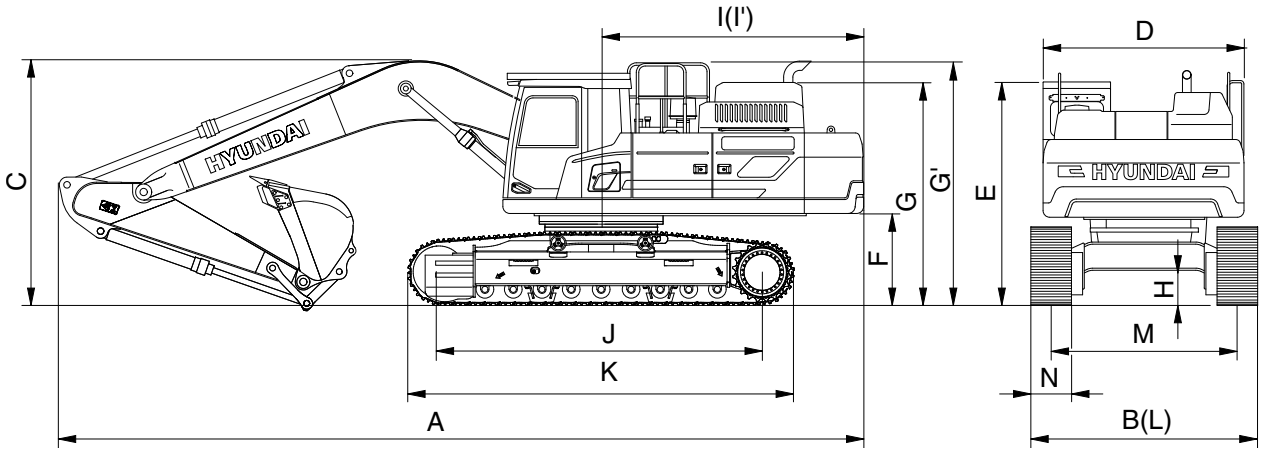
HX480A L (3/4)



480A2SP02

Description		Unit		Specification	
		m (ft-in)	Boom	6.55 (21' 6")	
			Arm	2.90 (9' 6")	2.55 (8' 4")
		mm (in)	Shoe	600 (24)	
Operating weight		kg (lb)		50680 (111730)	50510 (111360)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)		2.20 (2.88)	2.20 (2.88)
Overall length	A	mm (ft-in)		11690 (38' 4")	11680 (38' 4")
Overall width	B			3340 (10' 11")	3340 (10' 11")
Overall height of boom	C			3950 (13' 0")	3790 (12' 5")
Superstructure width	D			2980 (9' 9")	2980 (9' 9")
Overall height of cab	E			3220 (10' 7")	3220 (10' 7")
Ground clearance of counterweight	F			1300 (4' 3")	1300 (4' 3")
Overall height of engine hood	G			3016 (9' 11")	3016 (9' 11")
Overall height of handrail	G'			3450 (11' 4")	3450 (11' 4")
Minimum ground clearance	H			565 (1' 10")	565 (1' 10")
Rear-end distance	I			3745 (12' 3")	3745 (12' 3")
Rear-end swing radius	I'			3800 (12' 6")	3800 (12' 6")
Distance between tumblers	J			4470 (14' 8")	4470 (14' 8")
Undercarriage length (without grouser)	K			5416 (17' 9")	5416 (17' 9")
Undercarriage length (with grouser)				5490 (18' 0")	5490 (18' 0")
Undercarriage width	L			3340 (10' 11")	3340 (10' 11")
Track gauge	M			2740 (9' 0")	2740 (9' 0")
Track shoe width, standard	N			600 (24")	600 (24")
Travel speed (low/high)		km/hr (mph)		3.3/5.3 (2.1/3.3)	3.3/5.3 (2.1/3.3)
Swing speed		rpm		8.8	8.8
Gradeability		Degree (%)		35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.88 (12.5)	0.88 (12.5)
Max traction force		kg (lb)		39674 (87466)	39674 (87466)

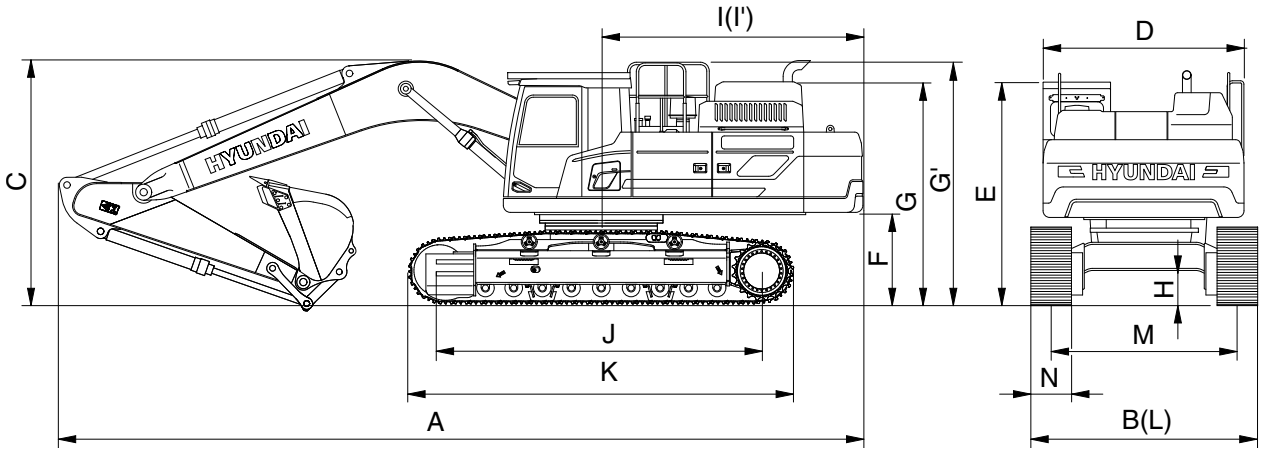
HX480A L (4/4)



480A2SP02

Description		Unit		Specification
		m (ft-in)	Boom	9.00 (29' 6")
			Arm	6.00 (19' 8")
		mm (in)	Shoe	600 (24)
Operating weight		kg (lb)		51790 (114180)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)		1.38 (1.8)
Overall length	A	mm (ft-in)		14070 (46' 2")
Overall width	B			3340 (10' 11")
Overall height of boom	C			3970 (13' 0")
Superstructure width	D			2980 (9' 9")
Overall height of cab	E			3220 (10' 7")
Ground clearance of counterweight	F			1300 (4' 3")
Overall height of engine hood	G			3016 (9' 11")
Overall height of handrail	G'			3450 (11' 4")
Minimum ground clearance	H			565 (1' 10")
Rear-end distance	I			3745 (12' 3")
Rear-end swing radius	I'			3800 (12' 6")
Distance between tumblers	J			4470 (14' 8")
Undercarriage length (without grouser)	K			5416 (17' 9")
Undercarriage length (with grouser)				5490 (18' 0")
Undercarriage width	L			3340 (10' 11")
Track gauge	M			2740 (9' 0")
Track shoe width, standard	N			600 (24")
Travel speed (low/high)		km/hr (mph)		3.3/5.3 (2.1/3.3)
Swing speed		rpm		8.8
Gradeability		Degree (%)		35 (70)
Ground pressure		kgf/cm^2 (psi)		0.90 (12.8)
Max traction force		kg (lb)		39674 (87466)

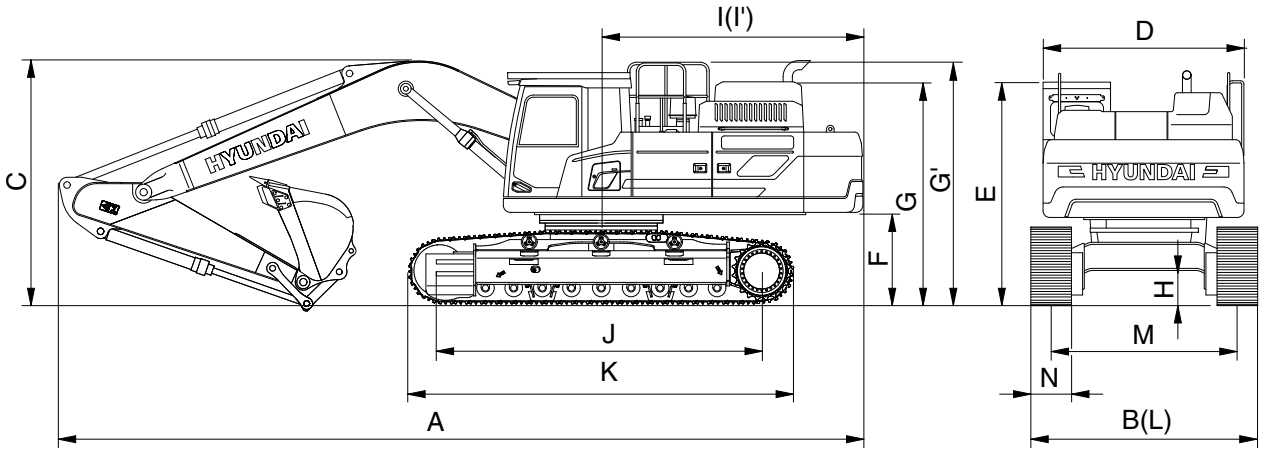
2) HX520A L (1/4)



520A2SP03

Description		Unit		Specification	
		m (ft-in)	Boom	7.06 (23' 2")	
			Arm	3.38 (11' 1")	
		mm (in)	Shoe	600 (24)	800 (32)
Operating weight		kg (lb)		52900 (116620)	53950 (118940)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)		2.20 (2.88)	2.20 (2.88)
Overall length	A	mm (ft-in)		12160 (39' 11")	12160 (39' 11")
Overall width (transport position)	B			2980 (9' 9")	3180 (10' 5")
Overall width (working position)				3540 (11' 7")	3740 (12' 3")
Overall height of boom	C			3850 (12' 8")	3850 (12' 8")
Superstructure width	D			2980 (9' 9")	2980 (9' 9")
Overall height of cab	E			3365 (11' 0")	3365 (11' 0")
Ground clearance of counterweight	F			1445 (4' 9")	1445 (4' 9")
Overall height of engine hood	G			3310 (10' 10")	3310 (10' 10")
Overall height of handrail	G'			3595 (11' 10")	3595 (11' 10")
Minimum ground clearance	H			770 (2' 6")	770 (2' 6")
Rear-end distance	I			3745 (12' 3")	3745 (12' 3")
Rear-end swing radius	I'			3800 (12' 6")	3800 (12' 6")
Distance between tumblers	J			4470 (14' 8")	4470 (14' 8")
Undercarriage length (without grouser)	K			5416 (17' 9")	5416 (17' 9")
Undercarriage length (with grouser)				5490 (18' 0")	5490 (18' 0")
Undercarriage width (transport position)	L			2980 (9' 9")	2980 (9' 9")
Undercarriage width (working position)				3540 (11' 7")	3540 (11' 7")
Track gauge (transport position)	M			2380 (7' 10")	2380 (7' 10")
Track gauge (working position)				2940 (9' 8")	2940 (9' 8")
Track shoe width, standard	N			600 (24")	800 (32")
Travel speed (low/high)		km/hr (mph)		3.3/5.3 (2.1/3.3)	3.3/5.3 (2.1/3.3)
Swing speed		rpm		8.8	8.8
Gradeability		Degree (%)		35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.92 (13.1)	0.70 (10.0)
Max traction force		kg (lb)		39674 (87466)	39674 (87466)

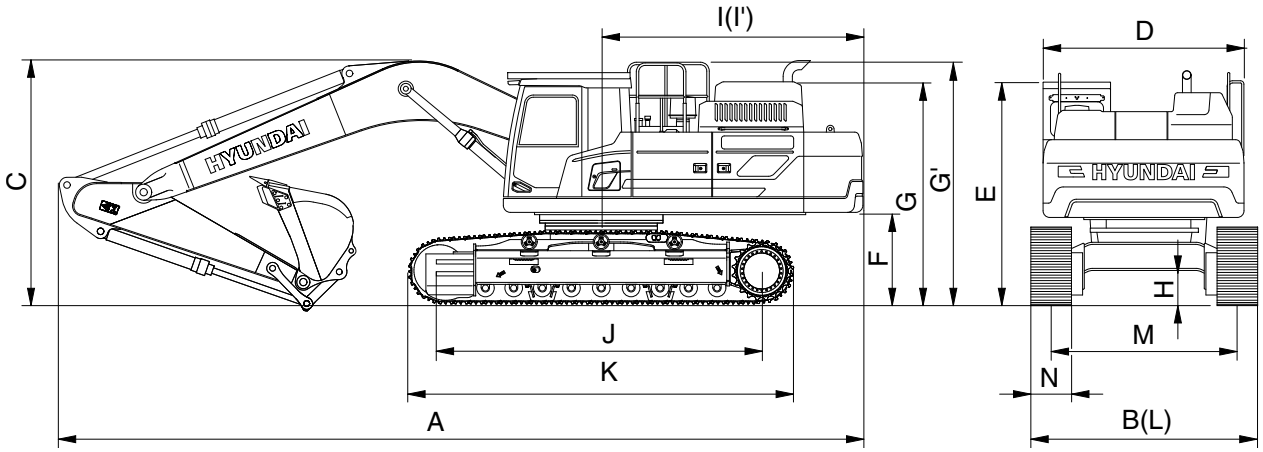
HX520A L (2/4)



520A2SP03

Description		Unit		Specification		
		m (ft-in)	Boom	7.06 (23' 2")		
			Arm	2.90 (9' 6")	4.00 (13' 1")	2.55 (8' 4")
		mm (in)	Shoe	600 (24)		
Operating weight		kg (lb)		52830 (116470)	52880 (116580)	52650 (116070)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)		2.20 (2.88)	2.20 (2.88)	2.20 (2.88)
Overall length	A	mm (ft-in)		12210 (40' 1")	12150 (39' 10")	12200 (40' 0")
Overall width (transport position)	B			2980 (9' 9")	2980 (9' 9")	2980 (9' 9")
Overall width (working position)				3540 (11' 7")	3540 (11' 7")	3540 (11' 7")
Overall height of boom	C			3890 (12' 9")	3980 (13' 1")	3830 (12' 7")
Superstructure width	D			2980 (9' 9")	2980 (9' 9")	2980 (9' 9")
Overall height of cab	E			3365 (11' 0")	3365 (11' 0")	3365 (11' 0")
Ground clearance of counterweight	F			1445 (4' 9")	1445 (4' 9")	1445 (4' 9")
Overall height of engine hood	G			3310 (10' 10")	3310 (10' 10")	3310 (10' 10")
Overall height of handrail	G'			3595 (11' 10")	3595 (11' 10")	3595 (11' 10")
Minimum ground clearance	H			770 (2' 6")	770 (2' 6")	770 (2' 6")
Rear-end distance	I			3745 (12' 3")	3745 (12' 3")	3745 (12' 3")
Rear-end swing radius	I'			3800 (12' 6")	3800 (12' 6")	3800 (12' 6")
Distance between tumblers	J			4470 (14' 8")	4470 (14' 8")	4470 (14' 8")
Undercarriage length (without grouser)	K			5416 (17' 9")	5416 (17' 9")	5416 (17' 9")
Undercarriage length (with grouser)				5490 (18' 0")	5490 (18' 0")	5490 (18' 0")
Undercarriage width (transport position)	L			2980 (9' 9")	2980 (9' 9")	2980 (9' 9")
Undercarriage width (working position)				3540 (11' 7")	3540 (11' 7")	3540 (11' 7")
Track gauge (transport position)	M			2380 (7' 10")	2380 (7' 10")	2380 (7' 10")
Track gauge (working position)				2940 (9' 8")	2940 (9' 8")	2940 (9' 8")
Track shoe width, standard	N			600 (24")	600 (24")	600 (24")
Travel speed (low/high)		km/hr (mph)		3.3/5.3 (2.1/3.3)	3.3/5.3 (2.1/3.3)	3.3/5.3 (2.1/3.3)
Swing speed		rpm		8.8	8.8	8.8
Gradeability		Degree (%)		35 (70)	35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.92 (13.0)	0.92 (13.1)	0.91 (13.0)
Max traction force		kg (lb)		39674 (87466)	39674 (87466)	39674 (87466)

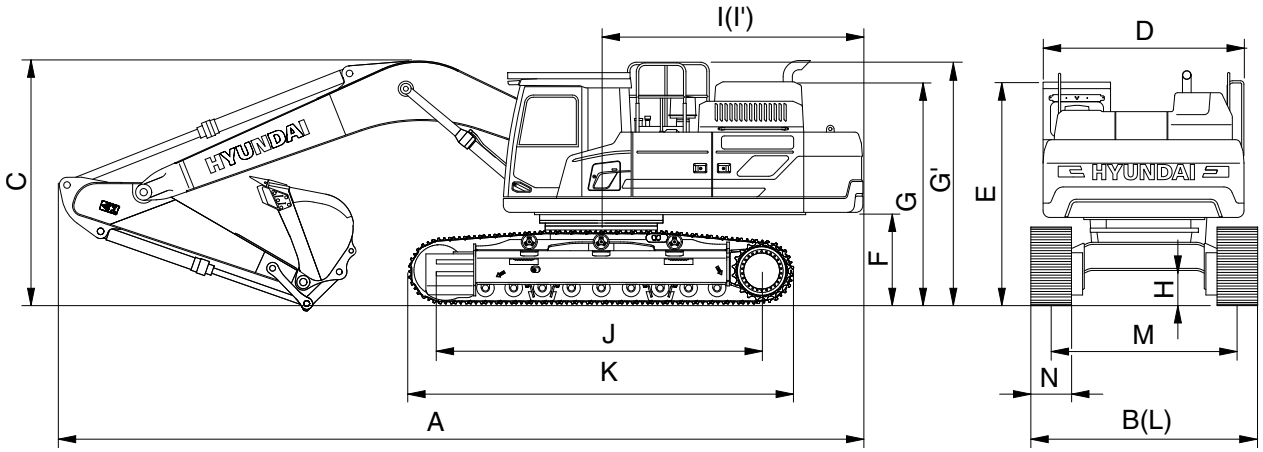
HX520A L (3/4)



520A2SP03

Description		Unit		Specification	
		m (ft-in)	Boom	6.55 (21' 6")	
			Arm	2.90 (9' 6")	2.55 (8' 4")
		mm (in)	Shoe	600 (24)	
Operating weight		kg (lb)		52610 (115990)	52440 (115610)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)		2.20 (2.88)	2.20 (2.88)
Overall length	A	mm (ft-in)		11690 (38' 4")	11680 (38' 4")
Overall width (transport position)	B			2980 (9' 9")	2980 (9' 9")
Overall width (working position)				3540 (11' 7")	3540 (11' 7")
Overall height of boom	C			3970 (13' 0")	3920 (12' 10")
Superstructure width	D			2980 (9' 9")	2980 (9' 9")
Overall height of cab	E			3365 (11' 0")	3365 (11' 0")
Ground clearance of counterweight	F			1445 (4' 9")	1445 (4' 9")
Overall height of engine hood	G			3310 (10' 10")	3310 (10' 10")
Overall height of handrail	G'			3595 (11' 10")	3595 (11' 10")
Minimum ground clearance	H			770 (2' 6")	770 (2' 6")
Rear-end distance	I			3745 (12' 3")	3745 (12' 3")
Rear-end swing radius	I'			3800 (12' 6")	3800 (12' 6")
Distance between tumblers	J			4470 (14' 8")	4470 (14' 8")
Undercarriage length (without grouser)	K			5416 (17' 9")	5416 (17' 9")
Undercarriage length (with grouser)				5490 (18' 0")	5490 (18' 0")
Undercarriage width (transport position)	L			2980 (9' 9")	2980 (9' 9")
Undercarriage width (working position)				3540 (11' 7")	3540 (11' 7")
Track gauge (transport position)	M			2380 (7' 10")	2380 (7' 10")
Track gauge (working position)				2940 (9' 8")	2940 (9' 8")
Track shoe width, standard	N			600 (24")	600 (24")
Travel speed (low/high)		km/hr (mph)		3.3/5.3 (2.1/3.3)	3.3/5.3 (2.1/3.3)
Swing speed		rpm		8.8	8.8
Gradeability		Degree (%)		35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.91 (13.0)	0.91 (12.9)
Max traction force		kg (lb)		39674 (87466)	39674 (87466)

HX520A L (4/4)

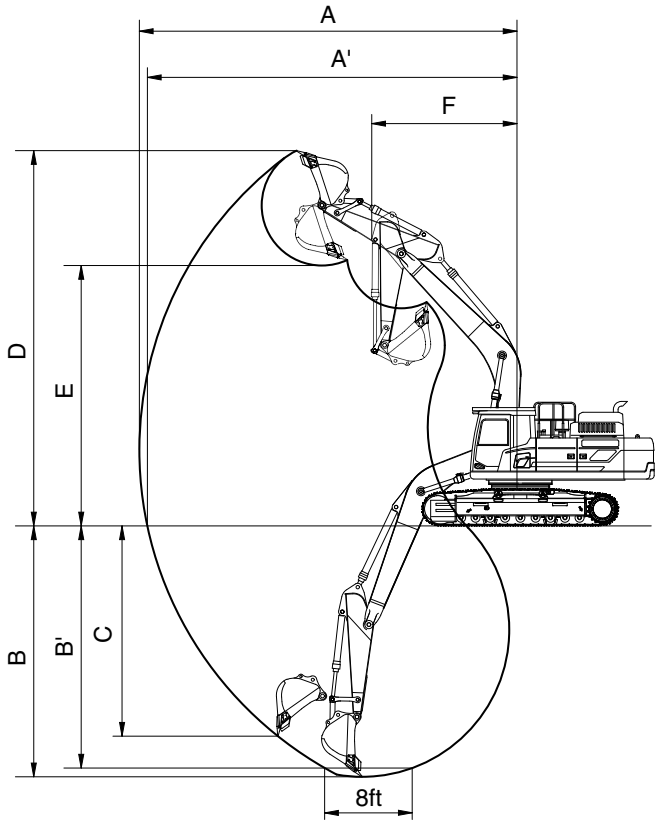


520A2SP03

Description		Unit		Specification
		m (ft-in)	Boom	9.00 (29' 6")
			Arm	6.00 (19' 8")
		mm (in)	Shoe	600 (24)
Operating weight		kg (lb)		53450 (117840)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)		1.38 (1.8)
Overall length	A	mm (ft-in)		14080 (46' 2")
Overall width (transport position)	B			2980 (9' 9")
Overall width (working position)				3540 (11' 7")
Overall height of boom	C			3970 (13' 0")
Superstructure width	D			2980 (9' 9")
Overall height of cab	E			3365 (11' 0")
Ground clearance of counterweight	F			1445 (4' 9")
Overall height of engine hood	G			3310 (10' 10")
Overall height of handrail	G'			3595 (11' 10")
Minimum ground clearance	H			770 (2' 6")
Rear-end distance	I			3745 (12' 3")
Rear-end swing radius	I'			3800 (12' 6")
Distance between tumblers	J			4470 (14' 8")
Undercarriage length (without grouser)	K			5416 (17' 9")
Undercarriage length (with grouser)				5490 (18' 0")
Undercarriage width (transport position)	L			2980 (9' 9")
Undercarriage width (working position)				3540 (11' 7")
Track gauge (transport position)	M			2380 (7' 10")
Track gauge (working position)				2940 (9' 8")
Track shoe width, standard	N			600 (24")
Travel speed (low/high)		km/hr (mph)		3.3/5.3 (2.1/3.3)
Swing speed		rpm		8.8
Gradeability		Degree (%)		35 (70)
Ground pressure		kgf/cm^2 (psi)		0.93 (13.2)
Max traction force		kg (lb)		39674 (87466)

3. WORKING RANGE AND DIGGING FORCE

1) HX480A L (1/2)

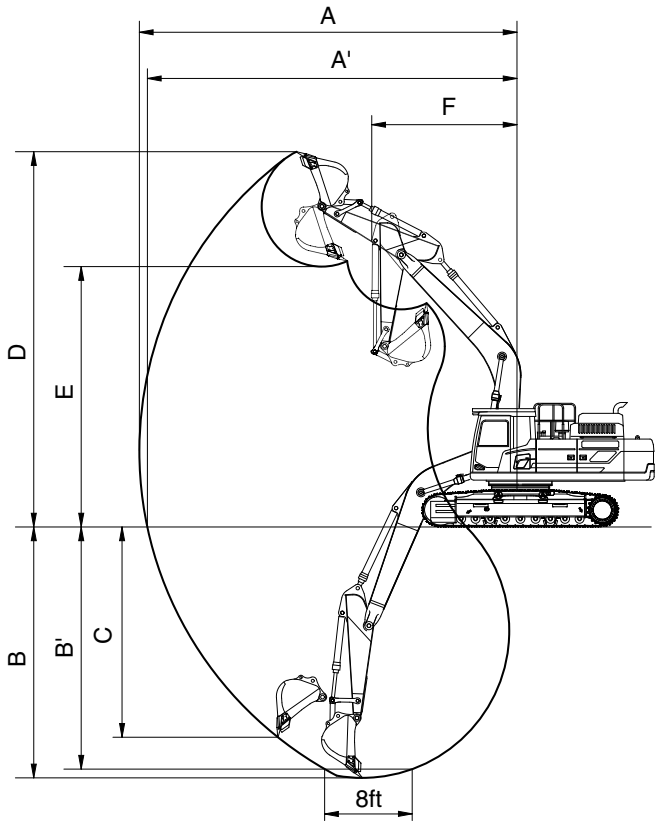


480A2SP05

Description	m (ft-in)	Boom	7.06 (23' 2")			
		Arm	2.55 (8' 4")	2.90 (9' 6")	3.38 (11' 1")	4.00 (13' 1")
Max digging reach	mm (ft-in)	A	11410 (37' 5")	11670 (38' 3")	12060 (39' 7")	12610 (41' 4")
Max digging reach on ground		A'	11190 (36' 9")	11460 (37' 7")	11850 (38' 11")	12410 (40' 9")
Max digging depth		B	6900 (22' 8")	7250 (23' 9")	7730 (25' 4")	8350 (27' 5")
Max digging depth (8 ft level)		B'	6730 (22' 1")	7090 (23' 3")	7590 (24' 11")	8220 (27' 0")
Max vertical wall digging depth		C	5280 (17' 4")	5710 (18' 9")	5490 (18' 0")	6170 (20' 3")
Max digging height		D	11070 (36' 4")	11090 (36' 5")	11060 (36' 3")	11330 (37' 2")
Max dumping height		E	7600 (24' 11")	7630 (25' 0")	7710 (25' 4")	7920 (26' 0")
Min swing radius		F	4820 (15' 10")	4880 (16' 0")	4870 (16' 0")	4630 (15' 2")
Bucket digging force	kN	SAE	212.8 [231.0]	212.8 [231.0]	212.8 [231.0]	212.8 [231.0]
	kgf		21700 [23560]	21700 [23560]	21700 [23560]	21700 [23560]
	lbf		47840 [51941]	47840 [51941]	47840 [51941]	47840 [51941]
	kN	ISO	247.1 [268.3]	247.1 [268.3]	247.1 [268.3]	247.1 [268.3]
	kgf		25200 [27360]	25200 [27360]	25200 [27360]	25200 [27360]
	lbf		55556 [60318]	55556 [60318]	55556 [60318]	55556 [60318]
Arm digging force	kN	SAE	235.4 [255.6]	218.7 [237.4]	198.1 [215.1]	173.6 [188.5]
	kgf		24000 [26060]	22300 [24210]	20200 [21930]	17700 [19220]
	lbf		52911 [57452]	49163 [53374]	44533 [48347]	39022 [42373]
	kN	ISO	246.1 [267.2]	227.5 [247.0]	205.0 [222.5]	179.5 [194.9]
	kgf		25100 [27250]	23200 [25190]	20900 [22690]	18300 [19870]
	lbf		55336 [60076]	51147 [55534]	46077 [50023]	40345 [43806]

[ ] : Power boost

HX480A L (2/2)

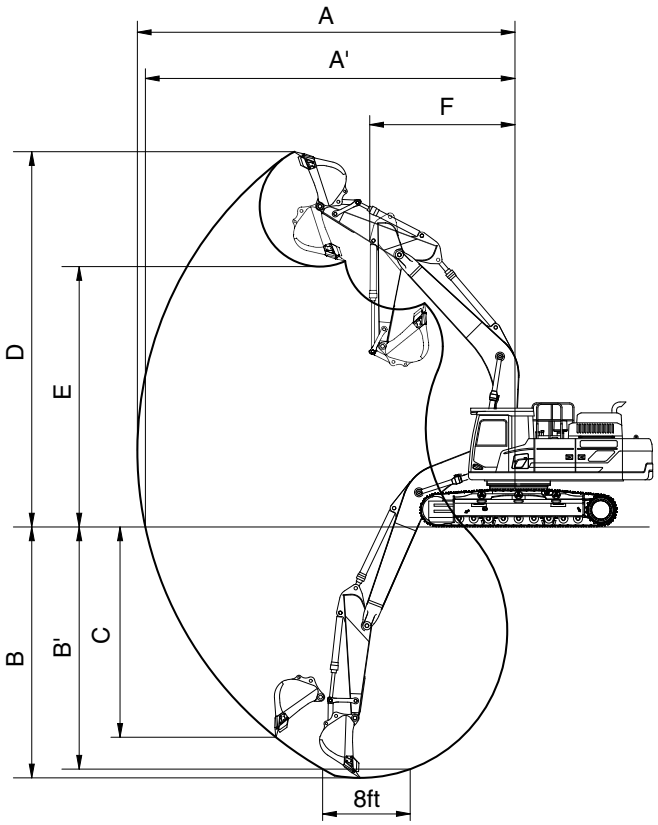


480A2SP05

Description	m (ft-in)	Boom	6.55 (21' 6")		9.00 (29' 6")
		Arm	2.90 (9' 6")	2.55 (8' 4")	6.00 (19' 8")
Max digging reach	mm (ft-in)	A	11130 (36' 6")	10870 (35' 8")	16110 (52' 10")
Max digging reach on ground		A'	10910 (35' 10")	10640 (34' 11")	15950 (52' 4")
Max digging depth		B	6810 (22' 4")	6460 (21' 2")	11710 (38' 5")
Max digging depth (8 ft level)		B'	6650 (21' 10")	6290 (20' 8")	11620 (38' 1")
Max vertical wall digging depth		C	4750 (15' 7")	4840 (15' 11")	8660 (28' 5")
Max digging height		D	10630 (34' 11")	10670 (35' 0")	13100 (43' 0")
Max dumping height		E	7240 (23' 9")	7210 (23' 8")	9800 (32' 2")
Min swing radius		F	4450 (14' 7")	4440 (14' 7")	5630 (18' 6")
Bucket digging force	kN	SAE	212.8 [231.0]	240.3 [260.9]	212.8 -
	kgf		21700 [23560]	24500 [26600]	21700 -
	lbf		47840 [51941]	54013 [58643]	47840 -
	kN	ISO	247.1 [268.3]	279.5 [303.4]	247.1 -
	kgf		25200 [27360]	28500 [30940]	25200 -
	lbf		55556 [60318]	62832 [68211]	55556 -
Arm digging force	kN	SAE	218.7 [237.4]	235.4 [255.6]	127.5 -
	kgf		22300 [24210]	24000 [26060]	13000 -
	lbf		49163 [53374]	52911 [57452]	28660 -
	kN	ISO	227.5 [247.0]	246.1 [267.2]	130.4 -
	kgf		23200 [25190]	25100 [27250]	13300 -
	lbf		51147 [55534]	55336 [60076]	29321 -

[ ] : Power boost

2) HX520A L (1/2)

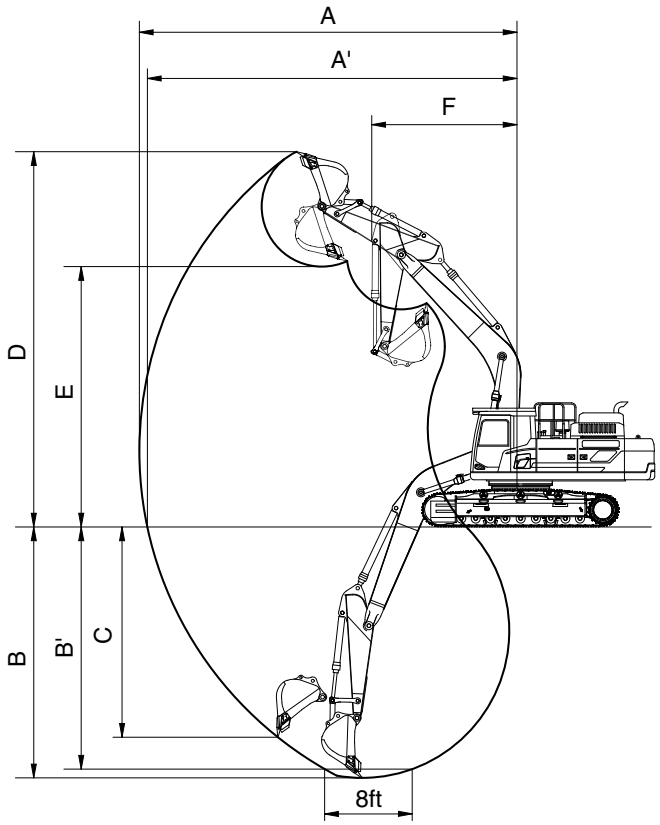


520A2SP06

Description	m (ft-in)	Boom	7.06 (23' 2")			
		Arm	2.55 (8' 4")	2.90 (9' 6")	3.38 (11' 1")	4.00 (13' 1")
Max digging reach	mm (ft-in)	A	11410 (37' 5")	11670 (38' 3")	12060 (39' 7")	12610 (41' 4")
Max digging reach on ground		A'	11170 (36' 8")	11440 (37' 6")	11840 (38' 10")	12400 (40' 8")
Max digging depth		B	6820 (22' 5")	7170 (23' 6")	7650 (25' 1")	8270 (27' 2")
Max digging depth (8 ft level)		B'	6650 (21' 10")	7010 (23' 0")	7510 (24' 8")	8140 (26' 8")
Max vertical wall digging depth		C	5200 (17' 1")	5630 (18' 6")	5410 (17' 9")	6090 (20' 0")
Max digging height		D	11150 (36' 7")	11170 (36' 8")	11140 (36' 7")	11410 (37' 5")
Max dumping height		E	7680 (25' 2")	7710 (25' 4")	7790 (25' 7")	8000 (26' 3")
Min swing radius		F	4820 (15' 10")	4880 (16' 0")	4870 (16' 0")	4630 (15' 2")
Bucket digging force	kN	SAE	240.3 [260.9]	240.3 [260.9]	240.3 [260.9]	240.3 [260.9]
	kgf		24500 [26600]	24500 [26600]	24500 [26600]	24500 [26600]
	lbf		54013 [58643]	54013 [58643]	54013 [58643]	54013 [58643]
	kN	ISO	279.5 [303.4]	279.5 [303.4]	279.5 [303.4]	279.5 [303.4]
	kgf		28500 [30940]	28500 [30940]	28500 [30940]	28500 [30940]
	lbf		62832 [68211]	62832 [68211]	62832 [68211]	62832 [68211]
Arm digging force	kN	SAE	235.4 [255.6]	218.7 [237.4]	198.1 [215.1]	173.6 [188.5]
	kgf		24000 [26060]	22300 [24210]	20200 [21930]	17700 [19220]
	lbf		52911 [57452]	49163 [53374]	44533 [48347]	39022 [42373]
	kN	ISO	246.1 [267.2]	227.5 [247.0]	205.0 [222.5]	179.5 [194.9]
	kgf		25100 [27250]	23200 [25190]	20900 [22690]	18300 [19870]
	lbf		55336 [60076]	51147 [55534]	46077 [50023]	40345 [43806]

[ ] : Power boost

HX520A L (2/2)



520A2SP06

Description	m (ft-in)	Boom	6.55 (21' 6")		9.00 (29' 6")
		Arm	2.90 (9' 6")	2.55 (8' 4")	6.00 (19' 8")
Max digging reach	mm (ft-in)	A	11130 (36' 6")	10870 (35' 8")	16110 (52' 10")
Max digging reach on ground		A'	10890 (35' 9")	10610 (34' 10")	15940 (52' 4")
Max digging depth		B	6730 (22' 1")	6380 (20' 11")	11550 (37' 11")
Max digging depth (8 ft level)		B'	6570 (21' 7")	6210 (20' 4")	11450 (37' 7")
Max vertical wall digging depth		C	4820 (15' 10")	4760 (15' 7")	8580 (28' 2")
Max digging height		D	10710 (35' 2")	10760 (35' 4")	13180 (43' 3")
Max dumping height		E	7320 (24' 0")	7290 (23' 11")	9880 (32' 5")
Min swing radius		F	4450 (14' 7")	4440 (14' 7")	5630 (18' 6")
Bucket digging force	kN	SAE	240.3 [260.9]	240.3 [260.9]	212.8 -
	kgf		24500 [26600]	24500 [26600]	21700 -
	lbf		54013 [58643]	54013 [58643]	47840 -
	kN	ISO	279.5 [303.4]	279.5 [303.4]	247.1 -
	kgf		28500 [30940]	28500 [30940]	25200 -
	lbf		62832 [68211]	62832 [68211]	55556 -
Arm digging force	kN	SAE	218.7 [237.4]	235.4 [255.6]	127.5 -
	kgf		22300 [24210]	24000 [26060]	13000 -
	lbf		49163 [53374]	52911 [57452]	28660 -
	kN	ISO	227.5 [247.0]	246.1 [267.2]	130.4 -
	kgf		23200 [25190]	25100 [27250]	13300 -
	lbf		51147 [55534]	55336 [60076]	29321 -

[ ] : Power boost

4. WEIGHT

Item	HX480A L		HX520A L	
	kg	lb	kg	lb
Upperstructure assembly				
· Main frame weld assembly	4,334	9,555	4,334	9,555
· Engine assembly	860	1,896	860	1,896
· Aftertreatment assembly	149	328	149	328
· Main pump assembly	194	428	194	428
· Main control valve assembly	421	928	421	928
· Swing motor assembly	680	1,499	680	1,499
· Hydraulic oil tank WA	290	639	290	639
· Fuel tank WA	347	765	347	765
· Counterweight	9,200	20,282	10,200	22,487
· Cab assembly	495	1,092	495	1,092
Lower chassis assembly				
· Track frame weld assembly	7,107	15,668	7,888	17,390
· Swing bearing	719	1,585	719	1,585
· Travel motor assembly (2EA)	1,264	2,787	1,264	2,787
· Turning joint	96	212	96	212
· Sprocket (2EA)	188	415	188	415
· Track recoil spring (2EA)	653	1,440	653	1,440
· Idler (2EA)	639	1,408	639	1,408
· Upper roller (HX480LA - 4EA / HX520LA - 4EA / 6EA)	350.92	774	243.84	538
· Lower roller (18EA)	1,579	3,481	1,531	3,375
· Track-chain assembly (600 mm triple grouser shoe) (2EA)	5,534	12,200	5,534	12,200
· Track-chain assembly (700 mm triple grouser shoe) (2EA)	6,054	13,347	6,054	13,347
· Track-chain assembly (800 mm triple grouser shoe) (2EA)	6,584	14,515	6,584	14,515
· Track-chain assembly (900 mm triple grouser shoe) (2EA)	7,092	15,635	-	
· Track-chain assembly (600 mm double grouser shoe) (2EA)	5,566	12,271	5,566	12,271
· Track-chain assembly (700 mm double grouser shoe) (2EA)	6,096	13,439	6,096	13,439
Front attachment assembly				
· 7.06 m boom assembly	3,640	8,025	3,640	8,025
· 3.38 m arm assembly	1,845	4,067	1,845	4,067
· 2.20 m^3 SAE heaped bucket	2,020	4,453	2,020	4,453
· Boom cylinder assembly (2EA)	370	816	370	816
· Arm cylinder assembly	589	1,299	589	1,299
· Bucket cylinder assembly	363	800	363	800
· Bucket control linkage total	280	617	280	617

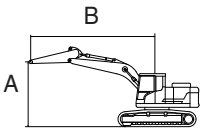
※ This information is different with operating and transportation weight because it is not including harness, pipe, oil, fuel so on.

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

5. LIFTING CAPACITIES

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
HX480A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		7060	3380	9200	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0 m (29.5 ft)	kg lb							*9510 *20970	*9510 *20970			*9450 *20830	*9450 *20830	7.51 (24.6)
7.5 m (24.6 ft)	kg lb							*10350 *22820	*10350 *22820			*8950 *19730	8370 18450	8.65 (28.4)
6.0 m (19.7 ft)	kg lb							*10850 *23920	10480 23100	*9990 *22020	7740 17060	*8830 *19470	7130 15720	9.41 (30.9)
4.5 m (14.8 ft)	kg lb			*18480 *40740	*18480 *40740	*14010 *30890	*14010 *30890	*11700 *25790	10060 22180	*10330 *22770	7540 16620	*8960 *19750	6420 14150	9.89 (32.5)
3.0 m (9.8 ft)	kg lb					*15810 *34860	13210 29120	*12650 *27890	9580 21120	*10790 *23790	7290 16070	*9350 *20610	6040 13320	10.12 (33.2)
1.5 m (4.9 ft)	kg lb					*17100 *37700	12500 27560	*13410 *29560	9160 20190	*11150 *24580	7050 15540	*9890 *21800	5910 13030	10.13 (33.2)
0.0 m (0.0 ft)	kg lb			*17130 *37770	*17130 *37770	*17540 *38670	12080 26630	*13740 *30290	8860 19530	*11240 *24780	6880 15170	*9970 *21980	6010 13250	9.91 (32.5)
-1.5 m (-4.9 ft)	kg lb	*12220 *26940	*12220 *26940	*22260 *49070	18360 40480	*17080 *37650	11920 26280	*13470 *29700	8730 19250	*10780 *23770	6820 15040	*10000 *22050	6400 14110	9.44 (31.0)
-3.0 m (-9.8 ft)	kg lb	*20690 *45610	*20690 *45610	*19920 *43920	18560 40920	*15660 *34520	11980 26410	*12340 *27210	8760 19310			*9900 *21830	7230 15940	8.69 (28.5)
-4.5 m (-14.8 ft)	kg lb	*19790 *43630	*19790 *43630	*16250 *35830	*16250 *35830	*12920 *28480	12250 27010	*9580 *21120	9040 19930			*9390 *20700	8940 19710	7.57 (24.8)

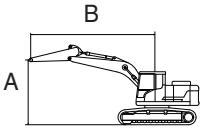
Note 1. Lifting capacity are based on ISO 10567.
2. Lifting capacity of the HX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates load limited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

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

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

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
HX480A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		7060	2550	9200	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0 m (29.5 ft)	kg											*12380	*12380	6.60
	lb											*27290	*27290	(21.6)
7.5 m (24.6 ft)	kg							*11560	10500			*11490	9630	7.87
	lb							*25490	23150			*25330	21230	(25.8)
6.0 m (19.7 ft)	kg					*13640	*13640	*11840	10300			*11100	8030	8.71
	lb					*30070	*30070	*26100	22710			*24470	17700	(28.6)
4.5 m (14.8 ft)	kg					*15260	13770	*12560	9920	*11060	7470	*10910	7170	9.22
	lb					*33640	30360	*27690	21870	*24380	16470	*24050	15810	(30.3)
3.0 m (9.8 ft)	kg					*16820	12950	*13340	9490	*11320	7280	*10840	6730	9.47
	lb					*37080	28550	*29410	20920	*24960	16050	*23900	14840	(31.1)
1.5 m (4.9 ft)	kg					*17670	12390	*13860	9150	*11470	7100	*10810	6600	9.48
	lb					*38960	27320	*30560	20170	*25290	15650	*23830	14550	(31.1)
0.0 m (0.0 ft)	kg					*17570	12130	*13880	8940	*11210	7010	*10770	6770	9.24
	lb					*38740	26740	*30600	19710	*24710	15450	*23740	14930	(30.3)
-1.5 m (-4.9 ft)	kg			*20510	18740	*16560	12110	*13170	8900			*10610	7320	8.74
	lb			*45220	41310	*36510	26700	*29030	19620			*23390	16140	(28.7)
-3.0 m (-9.8 ft)	kg	*19190	*19190	*17720	*17720	*14510	12280	*11260	9060			*10150	8480	7.92
	lb	*42310	*42310	*39070	*39070	*31990	27070	*24820	19970			*22380	18700	(26.0)
-4.5 m (-14.8 ft)	kg			*13240	*13240	*10610	*10610					*8830	*8830	6.66
	lb			*29190	*29190	*23390	*23390					*19470	*19470	(21.9)

Note 1. Lifting capacity are based on ISO 10567.

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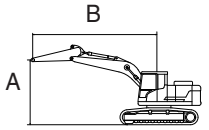
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Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
HX480A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		7060	2900	9200	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0 m (29.5 ft)	kg											*11510	*11510	6.97
	lb											*25380	*25380	(22.9)
7.5 m (24.6 ft)	kg							*10980	10580			*10810	9050	8.19
	lb							*24210	23320			*23830	19950	(26.9)
6.0 m (19.7 ft)	kg					*13030	*13030	*11370	10330			*10500	7610	8.99
	lb					*28730	*28730	*25070	22770			*23150	16780	(29.5)
4.5 m (14.8 ft)	kg			*19780	*19780	*14660	13840	*12140	9910	*10690	7450	*10370	6810	9.49
	lb			*43610	*43610	*32320	30510	*26760	21850	*23570	16420	*22860	15010	(31.1)
3.0 m (9.8 ft)	kg					*16310	12960	*12980	9450	*11040	7220	*10340	6390	9.74
	lb					*35960	28570	*28620	20830	*24340	15920	*22800	14090	(31.9)
1.5 m (4.9 ft)	kg					*17350	12310	*13600	9070	*11280	7010	*10360	6250	9.74
	lb					*38250	27140	*29980	20000	*24870	15450	*22840	13780	(32.0)
0.0 m (0.0 ft)	kg			*14480	*14480	*17470	11980	*13750	8820	*11190	6880	*10380	6390	9.51
	lb			*31920	*31920	*38510	26410	*30310	19440	*24670	15170	*22880	14090	(31.2)
-1.5 m (-4.9 ft)	kg			*21210	18400	*16700	11910	*13230	8740	*10370	6880	*10320	6860	9.02
	lb			*46760	40570	*36820	26260	*29170	19270	*22860	15170	*22750	15120	(29.6)
-3.0 m (-9.8 ft)	kg	*21630	*21630	*18580	*18580	*14930	12040	*11720	8840			*10040	7870	8.23
	lb	*47690	*47690	*40960	*40960	*32910	26540	*25840	19490			*22130	17350	(27.0)
-4.5 m (-14.8 ft)	kg			*14450	*14450	*11610	*11610					*9130	*9130	7.04
	lb			*31860	*31860	*25600	*25600					*20130	*20130	(23.1)

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).

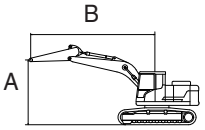
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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
HX480A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		7060	3380	9200	800	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0 m (29.5 ft)	kg							*9510	*9510			*9450	*9450	7.51
	lb							*20970	*20970			*20830	*20830	(24.6)
7.5 m (24.6 ft)	kg							*10350	*10350			*8950	8570	8.65
	lb							*22820	*22820			*19730	18890	(28.4)
6.0 m (19.7 ft)	kg							*10850	10720	*9990	7920	*8830	7310	9.41
	lb							*23920	23630	*22020	17460	*19470	16120	(30.9)
4.5 m (14.8 ft)	kg			*18480	*18480	*14010	*14010	*11700	10290	*10330	7730	*8960	6590	9.89
	lb			*40740	*40740	*30890	*30890	*25790	22690	*22770	17040	*19750	14530	(32.5)
3.0 m (9.8 ft)	kg					*15810	13530	*12650	9810	*10790	7480	*9350	6210	10.12
	lb					*34860	29830	*27890	21630	*23790	16490	*20610	13690	(33.2)
1.5 m (4.9 ft)	kg					*17100	12810	*13410	9390	*11150	7240	*9890	6070	10.13
	lb					*37700	28240	*29560	20700	*24580	15960	*21800	13380	(33.2)
0.0 m (0.0 ft)	kg			*17130	*17130	*17540	12390	*13740	9100	*11240	7070	*9970	6180	9.91
	lb			*37770	*37770	*38670	27320	*30290	20060	*24780	15590	*21980	13620	(32.5)
-1.5 m (-4.9 ft)	kg	*12220	*12220	*22260	18830	*17080	12240	*13470	8970	*10780	7000	*10000	6580	9.44
	lb	*26940	*26940	*49070	41510	*37650	26980	*29700	19780	*23770	15430	*22050	14510	(31.0)
-3.0 m (-9.8 ft)	kg	*20690	*20690	*19920	19030	*15660	12290	*12340	9000			*9900	7430	8.69
	lb	*45610	*45610	*43920	41950	*34520	27090	*27210	19840			*21830	16380	(28.5)
-4.5 m (-14.8 ft)	kg	*19790	*19790	*16250	*16250	*12920	12570	*9580	9280			*9390	9170	7.57
	lb	*43630	*43630	*35830	*35830	*28480	27710	*21120	20460			*20700	20220	(24.8)

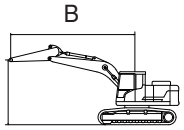
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Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
HX480A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		7060	4000	9200	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)														At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		10.5 m (34.4 ft)		Capacity		Reach
																		m (ft)
9.0m	kg															*7340	*7340	8.24
29.5ft	lb															*16180	*16180	(27.0)
7.5m	kg											*8410	8030			*7010	*7010	9.29
24.6ft	lb											*18540	17700			*15450	*15450	(30.5)
6.0m	kg									*10200	*10200	*9450	7920			*6930	6560	10.01
19.7ft	lb									*22490	*22490	*20830	17460			*15280	14460	(32.8)
4.5m	kg							*13140	*13140	*11140	10280	*9910	7700			*7030	5960	10.46
14.8ft	lb							*28970	*28970	*24560	22660	*21850	16980			*15500	13140	(34.3)
3.0m	kg					*20800	20710	*15100	13570	*12210	9780	*10480	7420	*8720	5790	*7320	5630	10.68
9.8ft	lb					*45860	45660	*33290	29920	*26920	21560	*23100	16360	*19220	12760	*16140	12410	(35.0)
1.5m	kg					*20070	19240	*16700	12770	*13140	9320	*10990	7150	*9480	5660	*7820	5510	10.68
4.9ft	lb					*44250	42420	*36820	28150	*28970	20550	*24230	15760	*20900	12480	*17240	12150	(35.0)
0.0m	kg					*19100	18580	*17520	12250	*13700	8980	*11260	6950			*8600	5580	10.47
0.0ft	lb					*42110	40960	*38620	27010	*30200	19800	*24820	15320			*18960	12300	(34.4)
-1.5m	kg			*12230	*12230	*23290	18400	*17450	12000	*13710	8780	*11110	6830			*9540	5890	10.03
-4.9ft	lb			*26960	*26960	*51350	40570	*38470	26460	*30230	19360	*24490	15060			*21030	12990	(32.9)
-3.0m	kg	*14130	*14130	*18540	*18540	*21430	18500	*16470	11980	*12980	8750	*10210	6850			*9570	6540	9.33
-9.8ft	lb	*31150	*31150	*40870	*40870	*47250	40790	*36310	26410	*28620	19290	*22510	15100			*21100	14420	(30.6)
-4.5m	kg			*23840	*23840	*18340	*18340	*14340	12150	*11120	8900					*9360	7810	8.30
-14.8ft	lb			*52560	*52560	*40430	*40430	*31610	26790	*24520	19620					*20640	17220	(27.2)
-6.0m	kg					*13350	*13350	*10290	*10290							*8450	*8450	6.78
-19.7ft	lb					*29430	*29430	*22690	*22690							*18630	*18630	(22.3)

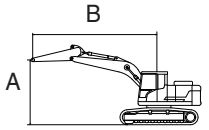
Note 1. Lifting capacity are based on ISO 10567.
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Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
HX480A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6550	2550	9200	600	-	-	-	-	-

· : Rating over-front



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0 m (29.5 ft)	kg											*13880	*13880	5.79
	lb											*30600	*30600	(19.0)
7.5 m (24.6 ft)	kg					*13190	*13190					*12600	11120	7.22
	lb					*29080	*29080					*27780	24520	(23.7)
6.0 m (19.7 ft)	kg					*13980	*13980	*12410	10350			*12070	9040	8.12
	lb					*30820	*30820	*27360	22820			*26610	19930	(26.6)
4.5 m (14.8 ft)	kg			*20370	*20370	*15430	14080	*12960	10050			*11830	7970	8.67
	lb			*44910	*44910	*34020	31040	*28570	22160			*26080	17570	(28.4)
3.0 m (9.8 ft)	kg					*16960	13300	*13650	9670			*11730	7440	8.94
	lb					*37390	29320	*30090	21320			*25860	16400	(29.3)
1.5 m (4.9 ft)	kg					*17890	12720	*14120	9340			*11690	7300	8.94
	lb					*39440	28040	*31130	20590			*25770	16090	(29.3)
0.0 m (0.0 ft)	kg			*21030	18920	*17850	12420	*14030	9140			*11620	7520	8.69
	lb			*46360	41710	*39350	27380	*30930	20150			*25620	16580	(28.5)
-1.5 m (-4.9 ft)	kg	*15060	*15060	*21280	19020	*16720	12370	*13030	9120			*11390	8210	8.15
	lb	*33200	*33200	*46910	41930	*36860	27270	*28730	20110			*25110	18100	(26.7)
-3.0 m (-9.8 ft)	kg	*20530	*20530	*17830	*17830	*14160	12560					*10720	9750	7.26
	lb	*45260	*45260	*39310	*39310	*31220	27690					*23630	21500	(23.8)
-4.5 m (-14.8 ft)	kg			*12770	*12770							*9300	*9300	5.90
	lb			*28150	*28150							*20500	*20500	(19.4)

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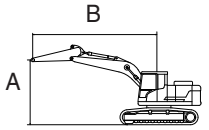
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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
HX480A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6550	2900	9200	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0 m (29.5 ft)	kg lb											*11820 *26060	*11820 *26060	6.19 (20.3)
7.5 m (24.6 ft)	kg lb							*11250 *24800	10500 23150			*10890 *24010	10410 22950	7.54 (24.7)
6.0 m (19.7 ft)	kg lb					*13340 *29410	*13340 *29410	*11880 *26190	10400 22930			*10600 *23370	8550 18850	8.41 (27.6)
4.5 m (14.8 ft)	kg lb			*19300 *42550	*19300 *42550	*14830 *32690	14150 31200	*12520 *27600	10050 22160			*10710 *23610	7570 16690	8.94 (29.3)
3.0 m (9.8 ft)	kg lb			*22770 *50200	20130 44380	*16450 *36270	13320 29370	*13290 *29300	9640 21250	*11400 *25130	7320 16140	*11180 *24650	7070 15590	9.20 (30.2)
1.5 m (4.9 ft)	kg lb			*19910 *43890	19030 41950	*17560 *38710	12660 27910	*13870 *30580	9270 20440	*11500 *25350	7140 15740	*11210 *24710	6920 15260	9.20 (30.2)
0.0 m (0.0 ft)	kg lb			*23720 *52290	18690 41200	*17760 *39150	12280 27070	*13950 *30750	9030 19910			*11220 *24740	7090 15630	8.96 (29.4)
-1.5 m (-4.9 ft)	kg lb	*16270 *35870	*16270 *35870	*21890 *48260	18720 41270	*16900 *37260	12180 26850	*13220 *29150	8960 19750			*11120 *24520	7690 16950	8.44 (27.7)
-3.0 m (-9.8 ft)	kg lb	*22850 *50380	*22850 *50380	*18760 *41360	*18760 *41360	*14740 *32500	12320 27160	*10960 *24160	9130 20130			*10700 *23590	9000 19840	7.58 (24.9)
-4.5 m (-14.8 ft)	kg lb			*13560 *29890	*13560 *29890	*10150 *22380	*10150 *22380					*9330 *20570	*9330 *20570	6.27 (20.6)

Note 1. Lifting capacity are based on ISO 10567.

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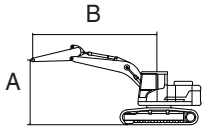
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Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
HX480A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		9000	6000	10200	600	-	-	-	-	-

· : Rating over-front



Lift-point height (A)		Lift-point radius (B)																		At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		10.5 m (34.4 ft)		12.0 m (39.4 ft)		13.5 m (44.3 ft)		Capacity		Reach
10.5m	kg																			*4060	*4060	11.51
34.4ft	lb																			*8950	*8950	(37.7)
9.0m	kg															*4870	*4870			*3950	*3950	12.46
29.5ft	lb															*10740	*10740			*8710	*8710	(40.9)
7.5m	kg													*5930	*5930	*5620	5080			*3940	*3940	13.17
24.6ft	lb													*13070	*13070	*12390	11200			*8690	*8690	(43.2)
6.0m	kg													*6270	*6270	*5810	4930	*4500	3830	*3990	3710	13.69
19.7ft	lb													*13820	*13820	*12810	10870	*9920	8440	*8800	8180	(44.9)
4.5m	kg									*8790	*8790	*7540	*7540	*6680	6040	*6060	4720	*5520	3720	*4110	3420	14.02
14.8ft	lb									*19380	*19380	*16620	*16620	*14730	13320	*13360	10410	*12170	8200	*9060	7540	(46.0)
3.0m	kg					*17920	*17920	*12630	*12630	*9890	9670	*8240	7320	*7130	5690	*6350	4500	*5750	3580	*4300	3230	14.18
9.8ft	lb					*39510	*39510	*27840	*27840	*21800	21320	*18170	16140	*15720	12540	*14000	9920	*12680	7890	*9480	7120	(46.5)
1.5m	kg					*9790	*9790	*14170	12140	*10870	8900	*8880	6820	*7550	5360	*6610	4280	*5890	3450	*4580	3120	14.19
4.9ft	lb					*21580	*21580	*31240	26760	*23960	19620	*19580	15040	*16640	11820	*14570	9440	*12990	7610	*10100	6880	(46.5)
0.0m	kg					*9020	*9020	*15100	11270	*11570	8300	*9370	6410	*7880	5080	*6810	4090	*5960	3330	*4970	3100	14.03
0.0ft	lb					*19890	*19890	*33290	24850	*25510	18300	*20660	14130	*17370	11200	*15010	9020	*13140	7340	*10960	6830	(46.0)
-1.5m	kg	*4710	*4710	*6130	*6130	*10400	*10400	*15390	10790	*11920	7900	*9650	6100	*8060	4860	*6890	3940	*5910	3250	*5510	3160	13.70
-4.9ft	lb	*10380	*10380	*13510	*13510	*22930	*22930	*33930	23790	*26280	17420	*21270	13450	*17770	10710	*15190	8690	*13030	7170	*12150	6970	(45.0)
-3.0m	kg	*7100	*7100	*8690	*8690	*12720	*12720	*15140	10590	*11890	7680	*9660	5920	*8040	4720	*6790	3860			*5880	3330	13.20
-9.8ft	lb	*15650	*15650	*19160	*19160	*28040	*28040	*33380	23350	*26210	16930	*21300	13050	*17730	10410	*14970	8510			*12960	7340	(43.3)
-4.5m	kg	*9580	*9580	*11500	*11500	*15760	*15760	*14400	10580	*11470	7620	*9360	5850	*7750	4680	*6400	3850			*5950	3640	12.50
-14.8ft	lb	*21120	*21120	*25350	*25350	*34740	*34740	*31750	23320	*25290	16800	*20640	12900	*17090	10320	*14110	8490			*13120	8020	(41.0)
-6.0m	kg	*12310	*12310	*14730	*14730	*16720	*16720	*13140	10740	*10590	7690	*8650	5900	*7060	4740					*5980	4160	11.55
-19.7ft	lb	*27140	*27140	*32470	*32470	*36860	*36860	*28970	23680	*23350	16950	*19070	13010	*15560	10450					*13180	9170	(37.9)
-7.5m	kg			*18050	*18050	*13990	*13990	*11240	11050	*9120	7910	*7360	6090							*5870	5060	10.31
-24.6ft	lb			*39790	*39790	*30840	*30840	*24780	24360	*20110	17440	*16230	13430							*12940	11160	(33.8)
-9.0m	kg					*10190	*10190	*8390	*8390	*6720	*6720									*5410	*5410	8.62
-29.5ft	lb					*22470	*22470	*18500	*18500	*14820	*14820									*11930	*11930	(28.3)

Note 1. Lifting capacity are based on ISO 10567.

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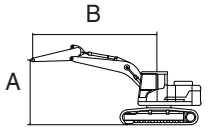
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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
HX520A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		7060	3380	10200	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0 m (29.5 ft)	kg							*10020	*10020			*9400	*9400	7.61
	lb							*22090	*22090			*20720	*20720	(25.0)
7.5 m (24.6 ft)	kg							*10370	*10370			*8930	*8930	8.71
	lb							*22860	*22860			*19690	*19690	(28.6)
6.0 m (19.7 ft)	kg							*10900	*10900	*10010	9030	*8830	8280	9.46
	lb							*24030	*24030	*22070	19910	*19470	18250	(31.0)
4.5 m (14.8 ft)	kg			*18770	*18770	*14140	*14140	*11770	11690	*10360	8820	*8980	7530	9.92
	lb			*41380	*41380	*31170	*31170	*25950	25770	*22840	19440	*19800	16600	(32.5)
3.0 m (9.8 ft)	kg					*15920	15450	*12710	11200	*10820	8560	*9390	7130	10.13
	lb					*35100	34060	*28020	24690	*23850	18870	*20700	15720	(33.2)
1.5 m (4.9 ft)	kg					*17160	14740	*13450	10780	*11170	8330	*9890	7020	10.12
	lb					*37830	32500	*29650	23770	*24630	18360	*21800	15480	(33.2)
0.0 m (0.0 ft)	kg			*17510	*17510	*17540	14330	*13750	10500	*11230	8160	*9970	7170	9.88
	lb			*38600	*38600	*38670	31590	*30310	23150	*24760	17990	*21980	15810	(32.4)
-1.5 m (-4.9 ft)	kg	*12800	*12800	*22130	22020	*17010	14190	*13420	10370	*10720	8100	*10000	7660	9.40
	lb	*28220	*28220	*48790	48550	*37500	31280	*29590	22860	*23630	17860	*22050	16890	(30.8)
-3.0 m (-9.8 ft)	kg	*21350	*21350	*19710	*19710	*15510	14270	*12210	10420			*9880	8680	8.62
	lb	*47070	*47070	*43450	*43450	*34190	31460	*26920	22970			*21780	19140	(28.3)
-4.5 m (-14.8 ft)	kg	*19320	*19320	*15920	*15920	*12650	*12650					*9320	*9320	7.47
	lb	*42590	*42590	*35100	*35100	*27890	*27890					*20550	*20550	(24.5)

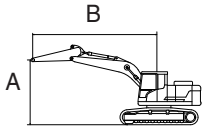
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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
HX520A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		7060	2550	10200	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0 m (29.5 ft)	kg											*12280	*12280	6.71
	lb											*27070	*27070	(22.0)
7.5 m (24.6 ft)	kg							*11560	*11560			*11450	11020	7.94
	lb							*25490	*25490			*25240	24290	(26.1)
6.0 m (19.7 ft)	kg					*13750	*13750	*11880	*11880			*11080	9300	8.75
	lb					*30310	*30310	*26190	*26190			*24430	20500	(28.7)
4.5 m (14.8 ft)	kg					*15380	*15380	*12620	11550	*11070	8750	*10910	8370	9.25
	lb					*33910	*33910	*27820	25460	*24410	19290	*24050	18450	(30.3)
3.0 m (9.8 ft)	kg					*16910	15190	*13390	11120	*11340	8560	*10840	7920	9.48
	lb					*37280	33490	*29520	24520	*25000	18870	*23900	17460	(31.1)
1.5 m (4.9 ft)	kg					*17700	14640	*13880	10780	*11470	8380	*10810	7810	9.47
	lb					*39020	32280	*30600	23770	*25290	18470	*23830	17220	(31.1)
0.0 m (0.0 ft)	kg					*17530	14400	*13850	10580	*11160	8290	*10760	8050	9.21
	lb					*38650	31750	*30530	23320	*24600	18280	*23720	17750	(30.2)
-1.5 m (-4.9 ft)	kg			*20350	*20350	*16450	14390	*13080	10550			*10600	8730	8.69
	lb			*44860	*44860	*36270	31720	*28840	23260			*23370	19250	(28.5)
-3.0 m (-9.8 ft)	kg	*18970	*18970	*17470	*17470	*14320	*14320	*11040	10730			*10090	*10090	7.84
	lb	*41820	*41820	*38510	*38510	*31570	*31570	*24340	23660			*22240	*22240	(25.7)
-4.5 m (-14.8 ft)	kg			*12820	*12820	*10190	*10190					*8660	*8660	6.55
	lb			*28260	*28260	*22470	*22470					*19090	*19090	(21.5)

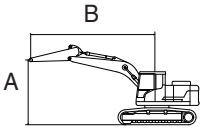
Note 1. Lifting capacity are based on ISO 10567.
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Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
HX520A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		7060	2900	10200	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0 m (29.5 ft)	kg											*11430	*11430	7.08
	lb											*25200	*25200	(23.2)
7.5 m (24.6 ft)	kg							*10990	*10990			*10780	10370	8.26
	lb							*24230	*24230			*23770	22860	(27.1)
6.0 m (19.7 ft)	kg					*13130	*13130	*11410	*11410	*10500	8890	*10480	8820	9.04
	lb					*28950	*28950	*25150	*25150	*23150	19600	*23100	19440	(29.7)
4.5 m (14.8 ft)	kg			*20070	*20070	*14790	*14790	*12200	11540	*10710	8730	*10370	7970	9.52
	lb			*44250	*44250	*32610	*32610	*26900	25440	*23610	19250	*22860	17570	(31.2)
3.0 m (9.8 ft)	kg					*16410	15200	*13040	11080	*11060	8500	*10340	7530	9.74
	lb					*36180	33510	*28750	24430	*24380	18740	*22800	16600	(32.0)
1.5 m (4.9 ft)	kg					*17390	14560	*13630	10690	*11290	8290	*10370	7420	9.73
	lb					*38340	32100	*30050	23570	*24890	18280	*22860	16360	(31.9)
0.0 m (0.0 ft)	kg			*15060	*15060	*17450	14240	*13740	10450	*11160	8160	*10380	7610	9.48
	lb			*33200	*33200	*38470	31390	*30290	23040	*24600	17990	*22880	16780	(31.1)
-1.5 m (-4.9 ft)	kg			*21050	*21050	*16610	14180	*13170	10380			*10310	8200	8.98
	lb			*46410	*46410	*36620	31260	*29030	22880			*22730	18080	(29.5)
-3.0 m (-9.8 ft)	kg	*21360	*21360	*18340	*18340	*14760	14330	*11550	10510			*10000	9440	8.16
	lb	*47090	*47090	*40430	*40430	*32540	31590	*25460	23170			*22050	20810	(26.8)
-4.5 m (-14.8 ft)	kg			*14070	*14070	*11280	*11280					*9020	*9020	6.93
	lb			*31020	*31020	*24870	*24870					*19890	*19890	(22.7)

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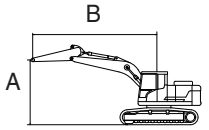
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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
HX520A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		7060	3380	10200	800	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0 m (29.5 ft)	kg							*10020	*10020			*9400	*9400	7.61
	lb							*22090	*22090			*20720	*20720	(25.0)
7.5 m (24.6 ft)	kg							*10370	*10370			*8930	*8930	8.71
	lb							*22860	*22860			*19690	*19690	(28.6)
6.0 m (19.7 ft)	kg							*10900	*10900	*10010	9170	*8830	8420	9.46
	lb							*24030	*24030	*22070	20220	*19470	18560	(31.0)
4.5 m (14.8 ft)	kg			*18770	*18770	*14140	*14140	*11770	*11770	*10360	8970	*8980	7660	9.92
	lb			*41380	*41380	*31170	*31170	*25950	*25950	*22840	19780	*19800	16890	(32.5)
3.0 m (9.8 ft)	kg					*15920	15700	*12710	11390	*10820	8710	*9390	7260	10.13
	lb					*35100	34610	*28020	25110	*23850	19200	*20700	16010	(33.2)
1.5 m (4.9 ft)	kg					*17160	14990	*13450	10970	*11170	8470	*9890	7150	10.12
	lb					*37830	33050	*29650	24180	*24630	18670	*21800	15760	(33.2)
0.0 m (0.0 ft)	kg			*17510	*17510	*17540	14580	*13750	10680	*11230	8310	*9970	7310	9.88
	lb			*38600	*38600	*38670	32140	*30310	23550	*24760	18320	*21980	16120	(32.4)
-1.5 m (-4.9 ft)	kg	*12800	*12800	*22130	*22130	*17010	14440	*13420	10560	*10720	8250	*10000	7810	9.40
	lb	*28220	*28220	*48790	*48790	*37500	31830	*29590	23280	*23630	18190	*22050	17220	(30.8)
-3.0 m (-9.8 ft)	kg	*21350	*21350	*19710	*19710	*15510	14520	*12210	10610			*9880	8840	8.62
	lb	*47070	*47070	*43450	*43450	*34190	32010	*26920	23390			*21780	19490	(28.3)
-4.5 m (-14.8 ft)	kg	*19320	*19320	*15920	*15920	*12650	*12650					*9320	*9320	7.47
	lb	*42590	*42590	*35100	*35100	*27890	*27890					*20550	*20550	(24.5)

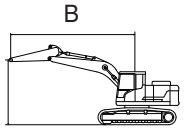
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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
HX520A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		7060	4000	10200	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)												At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		10.5 m (34.4 ft)		Capacity		Reach
																m (ft)
9.0m	kg													*7310	*7310	8.33
29.5ft	lb													*16120	*16120	(27.3)
7.5m	kg									*8630	*8630			*6990	*6990	9.35
24.6ft	lb									*19030	*19030			*15410	*15410	(30.7)
6.0m	kg							*10230	*10230	*9440	9210			*6930	*6930	10.05
19.7ft	lb							*22550	*22550	*20810	20300			*15280	*15280	(33.0)
4.5m	kg					*13240	*13240	*11180	*11180	*9910	8960			*7050	6970	10.48
14.8ft	lb					*29190	*29190	*24650	*24650	*21850	19750			*15540	15370	(34.4)
3.0m	kg			*20970	*20970	*15180	*15180	*12230	11390	*10470	8680	*8810	6820	*7350	6630	10.69
9.8ft	lb			*46230	*46230	*33470	*33470	*26960	25110	*23080	19140	*19420	15040	*16200	14620	(35.1)
1.5m	kg			*19680	*19680	*16710	14970	*13130	10920	*10960	8400	*9440	6680	*7860	6510	10.67
4.9ft	lb			*43390	*43390	*36840	33000	*28950	24070	*24160	18520	*20810	14730	*17330	14350	(35.0)
0.0m	kg			*19280	*19280	*17450	14450	*13650	10570	*11200	8190			*8670	6630	10.45
0.0ft	lb			*42510	*42510	*38470	31860	*30090	23300	*24690	18060			*19110	14620	(34.3)
-1.5m	kg	*12650	*12650	*23060	21950	*17320	14200	*13600	10370	*11010	8070			*9490	7020	9.99
-4.9ft	lb	*27890	*27890	*50840	48390	*38180	31310	*29980	22860	*24270	17790			*20920	15480	(32.8)
-3.0m	kg	*19040	*19040	*21120	*21120	*16250	14180	*12810	10340	*10030	8100			*9500	7800	9.27
-9.8ft	lb	*41980	*41980	*46560	*46560	*35830	31260	*28240	22800	*22110	17860			*20940	17200	(30.4)
-4.5m	kg	*23210	*23210	*17930	*17930	*14030	*14030	*10830	10510					*9250	*9250	8.21
-14.8ft	lb	*51170	*51170	*39530	*39530	*30930	*30930	*23880	23170					*20390	*20390	(26.9)
-6.0m	kg			*12760	*12760	*9770	*9770							*8240	*8240	6.65
-19.7ft	lb			*28130	*28130	*21540	*21540							*18170	*18170	(21.8)

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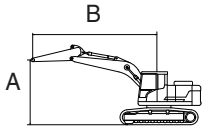
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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
HX520A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6550	2550	10200	600	-	-	-	-	-

· : Rating over-front



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0 m (29.5 ft)	kg											*13740	*13740	5.92
	lb											*30290	*30290	(19.4)
7.5 m (24.6 ft)	kg					*13220	*13220					*12550	*12550	7.29
	lb					*29150	*29150					*27670	*27670	(23.9)
6.0 m (19.7 ft)	kg					*14060	*14060	*12430	12010			*12050	10420	8.17
	lb					*31000	*31000	*27400	26480			*26570	22970	(26.8)
4.5 m (14.8 ft)	kg			*20650	*20650	*15550	*15550	*13010	11690			*11820	9280	8.70
	lb			*45530	*45530	*34280	*34280	*28680	25770			*26060	20460	(28.5)
3.0 m (9.8 ft)	kg					*17050	15550	*13700	11300			*11730	8720	8.94
	lb					*37590	34280	*30200	24910			*25860	19220	(29.3)
1.5 m (4.9 ft)	kg					*17930	14970	*14130	10980			*11690	8600	8.93
	lb					*39530	33000	*31150	24210			*25770	18960	(29.3)
0.0 m (0.0 ft)	kg			*21780	*21780	*17810	14690	*14000	10790			*11610	8900	8.66
	lb			*48020	*48020	*39260	32390	*30860	23790			*25600	19620	(28.4)
-1.5 m (-4.9 ft)	kg	*16090	*16090	*21090	*21090	*16590	14660	*12900	10780			*11370	9770	8.10
	lb	*35470	*35470	*46500	*46500	*36570	32320	*28440	23770			*25070	21540	(26.6)
-3.0 m (-9.8 ft)	kg	*20140	*20140	*17510	*17510	*13900	*13900					*10640	*10640	7.18
	lb	*44400	*44400	*38600	*38600	*30640	*30640					*23460	*23460	(23.6)
-4.5 m (-14.8 ft)	kg			*12770	*12770							*9300	*9300	5.90
	lb			*28150	*28150							*20500	*20500	(19.4)

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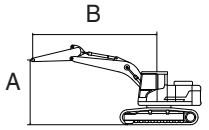
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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
HX520A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6550	2900	10200	600	-	-	-	-	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0 m (29.5 ft)	kg lb											*11720 *25840	*11720 *25840	6.31 (20.7)
7.5 m (24.6 ft)	kg lb							*11790 *25990	*11790 *25990			*10850 *23920	*10850 *23920	7.61 (25.0)
6.0 m (19.7 ft)	kg lb					*13430 *29610	*13430 *29610	*11920 *26280	*11920 *26280			*10600 *23370	9880 21780	8.45 (27.7)
4.5 m (14.8 ft)	kg lb			*19570 *43140	*19570 *43140	*14950 *32960	*14950 *32960	*12570 *27710	11690 25770			*10730 *23660	8830 19470	8.97 (29.4)
3.0 m (9.8 ft)	kg lb			*22960 *50620	*22960 *50620	*16550 *36490	15560 34300	*13340 *29410	11270 24850	*11410 *25150	8600 18960	*11190 *24670	8300 18300	9.21 (30.2)
1.5 m (4.9 ft)	kg lb			*19880 *43830	*19880 *43830	*17610 *38820	14910 32870	*13890 *30620	10900 24030	*11490 *25330	8420 18560	*11210 *24710	8170 18010	9.19 (30.2)
0.0 m (0.0 ft)	kg lb			*23620 *52070	22350 49270	*17730 *39090	14550 32080	*13920 *30690	10670 23520			*11210 *24710	8420 18560	8.93 (29.3)
-1.5 m (-4.9 ft)	kg lb	*17060 *37610	*17060 *37610	*21710 *47860	*21710 *47860	*16790 *37020	14460 31880	*13120 *28920	10610 23390			*11100 *24470	9170 20220	8.39 (27.5)
-3.0 m (-9.8 ft)	kg lb	*22460 *49520	*22460 *49520	*18470 *40720	*18470 *40720	*14520 *32010	*14520 *32010	*10680 *23550	*10680 *23550			*10650 *23480	*10650 *23480	7.51 (24.6)
-4.5 m (-14.8 ft)	kg lb			*13060 *28790	*13060 *28790	*9620 *21210	*9620 *21210					*9150 *20170	*9150 *20170	6.15 (20.2)

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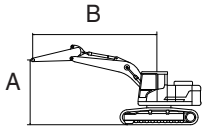
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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
HX520A L	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		9000	6000	11700	600	-	-	-	-	-

· : Rating over-front



Lift-point height (A)		Lift-point radius (B)																		At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		10.5 m (34.4 ft)		12.0 m (39.4 ft)		13.5 m (44.3 ft)		Capacity		Reach
																						m (ft)
10.5m	kg																			*4050	*4050	11.58
34.4ft	lb																			*8930	*8930	(38.0)
9.0m	kg															*4970	*4970			*3950	*3950	12.52
29.5ft	lb															*10960	*10960			*8710	*8710	(41.1)
7.5m	kg													*5950	*5950	*5630	*5630			*3940	*3940	13.22
24.6ft	lb													*13120	*13120	*12410	*12410			*8690	*8690	(43.4)
6.0m	kg													*6290	*6290	*5830	*5830	*4580	*4580	*3990	*3990	13.71
19.7ft	lb													*13870	*13870	*12850	*12850	*10100	*10100	*8800	*8800	(45.0)
4.5m	kg									*8870	*8870	*7590	*7590	*6720	*6720	*6080	5790	*5580	4650	*4120	*4120	14.03
14.8ft	lb									*19550	*19550	*16730	*16730	*14820	*14820	*13400	12760	*12300	10250	*9080	*9080	(46.0)
3.0m	kg					*18150	*18150	*12750	*12750	*9970	*9970	*8290	*8290	*7160	6950	*6370	5570	*5760	4510	*4320	4100	14.19
9.8ft	lb					*40010	*40010	*28110	*28110	*21980	*21980	*18280	*18280	*15790	15320	*14040	12280	*12700	9940	*9520	9040	(46.5)
1.5m	kg					*9590	*9590	*14260	*14260	*10930	10830	*8920	8340	*7580	6620	*6620	5350	*5900	4380	*4610	4000	14.18
4.9ft	lb					*21140	*21140	*31440	*31440	*24100	23880	*19670	18390	*16710	14590	*14590	11790	*13010	9660	*10160	8820	(46.5)
0.0m	kg					*9080	*9080	*15140	13920	*11610	10230	*9400	7930	*7900	6330	*6820	5160	*5960	4260	*5000	4000	14.01
0.0ft	lb					*20020	*20020	*33380	30690	*25600	22550	*20720	17480	*17420	13960	*15040	11380	*13140	9390	*11020	8820	(46.0)
-1.5m	kg	*4880	*4880	*6310	*6310	*10540	*10540	*15390	13460	*11930	9840	*9660	7630	*8070	6120	*6890	5010	*5900	4180	*5560	4100	13.67
-4.9ft	lb	*10760	*10760	*13910	*13910	*23240	*23240	*33930	29670	*26300	21690	*21300	16820	*17790	13490	*15190	11050	*13010	9220	*12260	9040	(44.9)
-3.0m	kg	*7270	*7270	*8890	*8890	*12910	*12910	*15110	13270	*11880	9630	*9650	7450	*8030	5980	*6770	4930			*5880	4310	13.16
-9.8ft	lb	*16030	*16030	*19600	*19600	*28460	*28460	*33310	29260	*26190	21230	*21270	16420	*17700	13180	*14930	10870			*12960	9500	(43.2)
-4.5m	kg	*9770	*9770	*11720	*11720	*16010	*16010	*14330	13270	*11420	9580	*9320	7390	*7710	5950	*6360	4930			*5960	4700	12.44
-14.8ft	lb	*21540	*21540	*25840	*25840	*35300	*35300	*31590	29260	*25180	21120	*20550	16290	*17000	13120	*14020	10870			*13140	10360	(40.8)
-6.0m	kg	*12520	*12520	*14980	*14980	*16550	*16550	*13030	*13030	*10510	9660	*8580	7450	*6980	6010					*5970	5340	11.48
-19.7ft	lb	*27600	*27600	*33030	*33030	*36490	*36490	*28730	*28730	*23170	21300	*18920	16420	*15390	13250					*13160	11770	(37.6)
-7.5m	kg			*17690	*17690	*13760	*13760	*11070	*11070	*8990	*8990	*7230	*7230							*5850	*5850	10.20
-24.6ft	lb			*39000	*39000	*30340	*30340	*24410	*24410	*19820	*19820	*15940	*15940							*12900	*12900	(33.5)
-9.0m	kg					*9860	*9860	*8140	*8140	*6490	*6490									*5350	*5350	8.48
-29.5ft	lb					*21740	*21740	*17950	*17950	*14310	*14310									*11790	*11790	(27.8)

Note 1. Lifting capacity are based on ISO 10567.

2. Lifting capacity of the HX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.

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

4. *Indicates load limited by hydraulic capacity.

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

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

6. BUCKET SELECTION GUIDE

1) HX480A L

(1) 9200 kg counterweight



General bucket



Heavy duty
(with side cutter)



Rock heavy duty

Type	Capacity		Width	Weight	Tooth	MONO						
						Recommendation						
	SAE Heaped	CECE heaped	Without side cutter			6.55 m (21' 6") Boom		7.06 m (23' 2") Boom				9.00 m (29' 6") Boom
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.55 m (8' 4') Arm	2.90 m (9' 6') Arm	2.55 m (8' 4') Arm	2.90 m (9' 6') Arm	3.38 m (11' 1') Arm	4.00 m (13' 1') Arm	6.00 m (19' 8') Arm
General bucket	1.38 (1.80)	1.24 (1.62)	1,135 (44.7")	1,670 (3,680)	4	-	-	-	-	-	-	-
	2.20 (2.88)	1.93 (2.52)	1,575 (62.0")	2,030 (4,480)	5	●	●	●	◐	◐	■	-
	3.00 (3.92)	2.70 (3.53)	1,905 (75.0")	2,460 (5,420)	6	■	■	■	▲	▲	X	-
Heavy duty	2.20 (2.88)	1.93 (2.52)	1,605 (63.2")	2,320 (5,110)	5	●	●	◐	◐	■	■	-
	2.61 (3.41)	2.33 (3.05)	1,525 (60.0")	2,395 (5,280)	6	◐	◐	■	■	■	▲	-
	2.79 (3.65)	2.47 (3.23)	1,785 (70.3")	2,630 (5,800)	5	◐	■	■	▲	▲	X	-
	2.92 (3.82)	2.60 (3.40)	1,675 (65.9")	2,525 (5,570)	6	■	■	■	▲	▲	X	-
Rock heavy duty	2.20 (2.88)	1.93 (2.52)	1,605 (63.2")	2,610 (5,750)	5	●	●	◐	◐	■	■	-
	2.43 (3.18)	2.11 (2.76)	1,750 (68.9")	2,730 (6,020)	5	◐	◐	■	■	■	▲	-
	2.79 (3.65)	2.47 (3.23)	1,785 (70.3")	2,950 (6,500)	5	■	■	■	▲	▲	X	-
	3.20 (4.19)	2.82 (3.69)	1,995 (78.5")	3,230 (7,120)	6	▲	▲	▲	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
-	Not available

※ 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.

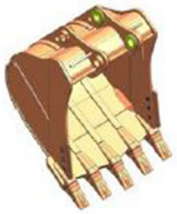
(2) 9700 kg counterweight



General bucket



Heavy duty
(with side cutter)



Rock heavy duty

Type	Capacity		Width	Weight	Tooth	MONO						
						Recommendation						
	SAE Heaped	CECE heaped	Without side cutter			6.55 m (21' 6") Boom		7.06 m (23' 2") Boom				9.00 m (29' 6") Boom
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.55 m (8' 4') Arm	2.90 m (9' 6') Arm	2.55 m (8' 4') Arm	2.90 m (9' 6') Arm	3.38 m (11' 1') Arm	4.00 m (13' 1') Arm	6.00 m (19' 8') Arm
General bucket	1.38 (1.80)	1.24 (1.62)	1,135 (44.7")	1,670 (3,680)	4	-	-	-	-	-	-	-
	2.20 (2.88)	1.93 (2.52)	1,575 (62.0")	2,030 (4,480)	5	●	●	●	●	◐	■	-
	3.00 (3.92)	2.70 (3.53)	1,905 (75.0")	2,460 (5,420)	6	◐	■	■	▲	▲	▲	-
Heavy duty	2.20 (2.88)	1.93 (2.52)	1,605 (63.2")	2,320 (5,110)	5	●	●	●	◐	◐	■	-
	2.61 (3.41)	2.33 (3.05)	1,525 (60.0")	2,395 (5,280)	6	◐	◐	◐	■	■	▲	-
	2.79 (3.65)	2.47 (3.23)	1,785 (70.3")	2,630 (5,800)	5	◐	■	■	■	▲	▲	-
	2.92 (3.82)	2.60 (3.40)	1,675 (65.9")	2,525 (5,570)	6	◐	■	■	▲	▲	▲	-
Rock heavy duty	2.20 (2.88)	1.93 (2.52)	1,605 (63.2")	2,610 (5,750)	5	●	●	●	◐	◐	■	-
	2.43 (3.18)	2.11 (2.76)	1,750 (68.9")	2,730 (6,020)	5	●	◐	◐	■	■	▲	-
	2.79 (3.65)	2.47 (3.23)	1,785 (70.3")	2,950 (6,500)	5	◐	■	■	▲	▲	X	-
	3.20 (4.19)	2.82 (3.69)	1,995 (78.5")	3,230 (7,120)	6	■	▲	▲	▲	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
-	Not available

※ 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.

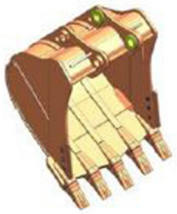
(3) 10200 kg counterweight



General bucket



Heavy duty
(with side cutter)



Rock heavy duty

Type	Capacity		Width	Weight	Tooth	MONO						
						Recommendation						
	SAE Heaped	CECE heaped	Without side cutter			6.55 m (21' 6") Boom		7.06 m (23' 2") Boom				9.00 m (29' 6") Boom
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.55 m (8' 4') Arm	2.90 m (9' 6') Arm	2.55 m (8' 4') Arm	2.90 m (9' 6') Arm	3.38 m (11' 1') Arm	4.00 m (13' 1') Arm	6.00 m (19' 8') Arm
General bucket	1.38 (1.80)	1.24 (1.62)	1,135 (44.7")	1,670 (3,680)	4	-	-	-	-	-	-	▲
	2.20 (2.88)	1.93 (2.52)	1,575 (62.0")	2,030 (4,480)	5	●	●	●	●	◐	◐	-
	3.00 (3.92)	2.70 (3.53)	1,905 (75.0")	2,460 (5,420)	6	◐	■	■	■	▲	▲	-
Heavy duty	2.20 (2.88)	1.93 (2.52)	1,605 (63.2")	2,320 (5,110)	5	●	●	●	●	◐	■	-
	2.61 (3.41)	2.33 (3.05)	1,525 (60.0")	2,395 (5,280)	6	●	◐	◐	■	■	▲	-
	2.79 (3.65)	2.47 (3.23)	1,785 (70.3")	2,630 (5,800)	5	◐	◐	■	■	▲	▲	-
	2.92 (3.82)	2.60 (3.40)	1,675 (65.9")	2,525 (5,570)	6	◐	■	■	■	▲	▲	-
Rock heavy duty	2.20 (2.88)	1.93 (2.52)	1,605 (63.2")	2,610 (5,750)	5	●	●	●	◐	◐	■	-
	2.43 (3.18)	2.11 (2.76)	1,750 (68.9")	2,730 (6,020)	5	●	●	◐	◐	■	▲	-
	2.79 (3.65)	2.47 (3.23)	1,785 (70.3")	2,950 (6,500)	5	◐	■	■	■	▲	X	-
	3.20 (4.19)	2.82 (3.69)	1,995 (78.5")	3,230 (7,120)	6	■	▲	▲	▲	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
-	Not available

※ 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.

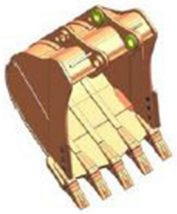
(4) 10700 kg counterweight



General bucket



Heavy duty
(with side cutter)



Rock heavy duty

Type	Capacity		Width	Weight	Tooth	MONO						
						Recommendation						
	SAE Heaped	CECE heaped	Without side cutter			6.55 m (21' 6") Boom		7.06 m (23' 2") Boom				9.00 m (29' 6") Boom
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.55 m (8' 4') Arm	2.90 m (9' 6') Arm	2.55 m (8' 4') Arm	2.90 m (9' 6') Arm	3.38 m (11' 1') Arm	4.00 m (13' 1') Arm	6.00 m (19' 8') Arm
General bucket	1.38 (1.80)	1.24 (1.62)	1,135 (44.7")	1,670 (3,680)	4	-	-	-	-	-	-	▲
	2.20 (2.88)	1.93 (2.52)	1,575 (62.0")	2,030 (4,480)	5	●	●	●	●	●	◐	-
	3.00 (3.92)	2.70 (3.53)	1,905 (75.0")	2,460 (5,420)	6	◐	◐	■	■	▲	▲	-
Heavy duty	2.20 (2.88)	1.93 (2.52)	1,605 (63.2")	2,320 (5,110)	5	●	●	●	●	◐	◐	-
	2.61 (3.41)	2.33 (3.05)	1,525 (60.0")	2,395 (5,280)	6	●	●	◐	◐	■	■	-
	2.79 (3.65)	2.47 (3.23)	1,785 (70.3")	2,630 (5,800)	5	◐	◐	◐	■	■	▲	-
	2.92 (3.82)	2.60 (3.40)	1,675 (65.9")	2,525 (5,570)	6	◐	◐	■	■	■	▲	-
Rock heavy duty	2.20 (2.88)	1.93 (2.52)	1,605 (63.2")	2,610 (5,750)	5	●	●	●	●	◐	■	-
	2.43 (3.18)	2.11 (2.76)	1,750 (68.9")	2,730 (6,020)	5	●	●	◐	◐	■	■	-
	2.79 (3.65)	2.47 (3.23)	1,785 (70.3")	2,950 (6,500)	5	◐	◐	■	■	▲	▲	-
	3.20 (4.19)	2.82 (3.69)	1,995 (78.5")	3,230 (7,120)	6	■	■	▲	▲	▲	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
-	Not available

※ 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.

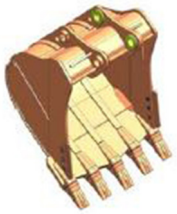
(5) 11700 kg counterweight



General bucket



Heavy duty
(with side cutter)



Rock heavy duty

Type	Capacity		Width	Weight	Tooth	MONO						
						Recommendation						
	SAE Heaped	CECE heaped	Without side cutter			6.55 m (21' 6") Boom		7.06 m (23' 2") Boom				9.00 m (29' 6") Boom
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.55 m (8' 4') Arm	2.90 m (9' 6') Arm	2.55 m (8' 4') Arm	2.90 m (9' 6') Arm	3.38 m (11' 1') Arm	4.00 m (13' 1') Arm	6.00 m (19' 8') Arm
General bucket	1.38 (1.80)	1.24 (1.62)	1,135 (44.7")	1,670 (3,680)	4	-	-	-	-	-	-	■
	2.20 (2.88)	1.93 (2.52)	1,575 (62.0")	2,030 (4,480)	5	●	●	●	●	●	◐	-
	3.00 (3.92)	2.70 (3.53)	1,905 (75.0")	2,460 (5,420)	6	●	◐	◐	■	■	▲	-
Heavy duty	2.20 (2.88)	1.93 (2.52)	1,605 (63.2")	2,320 (5,110)	5	●	●	●	●	●	◐	-
	2.61 (3.41)	2.33 (3.05)	1,525 (60.0")	2,395 (5,280)	6	●	●	●	◐	◐	■	-
	2.79 (3.65)	2.47 (3.23)	1,785 (70.3")	2,630 (5,800)	5	●	◐	◐	◐	■	■	-
	2.92 (3.82)	2.60 (3.40)	1,675 (65.9")	2,525 (5,570)	6	●	◐	◐	■	■	▲	-
Rock heavy duty	2.20 (2.88)	1.93 (2.52)	1,605 (63.2")	2,610 (5,750)	5	●	●	●	●	●	◐	-
	2.43 (3.18)	2.11 (2.76)	1,750 (68.9")	2,730 (6,020)	5	●	●	●	◐	◐	■	-
	2.79 (3.65)	2.47 (3.23)	1,785 (70.3")	2,950 (6,500)	5	●	◐	◐	■	■	▲	-
	3.20 (4.19)	2.82 (3.69)	1,995 (78.5")	3,230 (7,120)	6	◐	■	■	▲	▲	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
-	Not available

※ 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) HX520A L

(1) 10200 kg counterweight



General bucket



Heavy duty
(with side cutter)



Rock heavy duty

Type	Capacity		Width	Weight	Tooth	MONO						
						Recommendation						
	SAE Heaped	CECE heaped	Without side cutter			6.55 m (21' 6") Boom		7.06 m (23' 2") Boom				9.00 m (29' 6") Boom
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.55 m (8' 4') Arm	2.90 m (9' 6') Arm	2.55 m (8' 4') Arm	2.90 m (9' 6') Arm	3.38 m (11' 1') Arm	4.00 m (13' 1') Arm	6.00 m (19' 8') Arm
General bucket	1.00 (1.31)	0.90 (1.18)	950 (37.4")	1,450 (3,200)	3	-	-	-	-	-	-	●
	1.38 (1.80)	1.24 (1.62)	1,135 (44.7")	1,670 (3,680)	4	-	-	-	-	-	-	■
	2.20 (2.88)	1.93 (2.52)	1,575 (62.0")	2,030 (4,480)	5	●	●	●	●	●	●	-
	2.79 (3.65)	2.47 (3.23)	1,785 (70.3")	2,300 (5,070)	5	●	●	◐	◐	■	■	-
	3.00 (3.92)	2.70 (3.53)	1,905 (75.0")	2,460 (5,420)	6	●	◐	◐	■	■	▲	-
Heavy duty	2.43 (3.18)	2.11 (2.76)	1,750 (68.9")	2,450 (5,400)	5	●	●	●	●	◐	■	-
	2.61 (3.41)	2.33 (3.05)	1,525 (60.0")	2,395 (5,280)	6	●	●	●	◐	◐	■	-
	2.92 (3.82)	2.60 (3.40)	1,675 (65.9")	2,525 (5,570)	6	●	◐	◐	■	■	▲	-
	3.20 (4.19)	2.82 (3.69)	1,995 (78.5")	2,870 (6,330)	6	◐	◐	■	■	▲	▲	-
Rock heavy duty	1.81 (2.37)	1.50 (1.96)	1,460 (57.5")	2,650 (5,840)	4	●	●	●	●	●	●	-
	2.20 (2.88)	1.93 (2.52)	1,605 (63.2")	2,610 (5,750)	5	●	●	●	●	●	◐	-
	2.43 (3.18)	2.11 (2.76)	1,750 (68.9")	2,730 (6,020)	5	●	●	●	●	◐	■	-
	2.70 (3.53)	2.39 (3.13)	1,755 (69.1")	2,770 (6,110)	5	●	●	◐	◐	■	■	-
	2.79 (3.65)	2.47 (3.23)	1,785 (70.3")	2,950 (6,500)	5	●	◐	◐	■	■	▲	-
	3.00 (3.92)	2.76 (3.61)	1,950 (76.8")	3,040 (6,770)	6	◐	◐	■	■	■	▲	-
	3.20 (4.19)	2.82 (3.69)	1,995 (78.5")	3,230 (7,120)	6	◐	■	■	▲	▲	▲	-

●	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
-	Not available

※ 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) 10700 kg counterweight



General bucket



Heavy duty
(with side cutter)



Rock heavy duty

Type	Capacity		Width	Weight	Tooth	MONO						
						Recommendation						
	SAE Heaped	CECE heaped	Without side cutter			6.55 m (21' 6") Boom		7.06 m (23' 2") Boom				9.00 m (29' 6") Boom
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.55 m (8' 4') Arm	2.90 m (9' 6') Arm	2.55 m (8' 4') Arm	2.90 m (9' 6') Arm	3.38 m (11' 1') Arm	4.00 m (13' 1') Arm	6.00 m (19' 8') Arm
General bucket	1.00 (1.31)	0.90 (1.18)	950 (37.4")	1,450 (3,200)	3	-	-	-	-	-	-	●
	1.38 (1.80)	1.24 (1.62)	1,135 (44.7")	1,670 (3,680)	4	-	-	-	-	-	-	■
	2.20 (2.88)	1.93 (2.52)	1,575 (62.0")	2,030 (4,480)	5	●	●	●	●	●	●	-
	2.79 (3.65)	2.47 (3.23)	1,785 (70.3")	2,300 (5,070)	5	●	●	●	◐	◐	■	-
	3.00 (3.92)	2.70 (3.53)	1,905 (75.0")	2,460 (5,420)	6	●	◐	◐	◐	■	■	-
Heavy duty	2.43 (3.18)	2.11 (2.76)	1,750 (68.9")	2,450 (5,400)	5	●	●	●	●	◐	◐	-
	2.61 (3.41)	2.33 (3.05)	1,525 (60.0")	2,395 (5,280)	6	●	●	●	●	◐	■	-
	2.92 (3.82)	2.60 (3.40)	1,675 (65.9")	2,525 (5,570)	6	◐	◐	■	■	■	▲	-
	3.20 (4.19)	2.82 (3.69)	1,995 (78.5")	2,870 (6,330)	6	●	●	◐	◐	■	■	-
Rock heavy duty	1.81 (2.37)	1.50 (1.96)	1,460 (57.5")	2,650 (5,840)	4	●	●	●	●	●	●	-
	2.20 (2.88)	1.93 (2.52)	1,605 (63.2")	2,610 (5,750)	5	●	●	●	●	●	◐	-
	2.43 (3.18)	2.11 (2.76)	1,750 (68.9")	2,730 (6,020)	5	●	●	●	●	◐	■	-
	2.70 (3.53)	2.39 (3.13)	1,755 (69.1")	2,770 (6,110)	5	●	●	◐	◐	◐	■	-
	2.79 (3.65)	2.47 (3.23)	1,785 (70.3")	2,950 (6,500)	5	●	●	◐	◐	■	■	-
	3.00 (3.92)	2.76 (3.61)	1,950 (76.8")	3,040 (6,770)	6	◐	◐	◐	■	■	▲	-
	3.20 (4.19)	2.82 (3.69)	1,995 (78.5")	3,230 (7,120)	6	◐	■	■	■	▲	▲	-

● 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

\- Not available

※ 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.

(3) 11700 kg counterweight



General bucket



Heavy duty
(with side cutter)



Rock heavy duty

Type	Capacity		Width	Weight	Tooth	MONO						
						Recommendation						
	SAE Heaped	CECE heaped	Without side cutter			6.55 m (21' 6") Boom		7.06 m (23' 2") Boom				9.00 m (29' 6") Boom
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.55 m (8' 4') Arm	2.90 m (9' 6') Arm	2.55 m (8' 4') Arm	2.90 m (9' 6') Arm	3.38 m (11' 1') Arm	4.00 m (13' 1') Arm	6.00 m (19' 8') Arm
General bucket	1.00 (1.31)	0.90 (1.18)	950 (37.4")	1,450 (3,200)	3	-	-	-	-	-	-	●
	1.38 (1.80)	1.24 (1.62)	1,135 (44.7")	1,670 (3,680)	4	-	-	-	-	-	-	◐
	2.20 (2.88)	1.93 (2.52)	1,575 (62.0")	2,030 (4,480)	5	●	●	●	●	●	●	-
	2.79 (3.65)	2.47 (3.23)	1,785 (70.3")	2,300 (5,070)	5	●	●	●	●	◐	■	-
	3.00 (3.92)	2.70 (3.53)	1,905 (75.0")	2,460 (5,420)	6	●	●	◐	◐	◐	■	-
Heavy duty	2.43 (3.18)	2.11 (2.76)	1,750 (68.9")	2,450 (5,400)	5	●	●	●	●	●	◐	-
	2.61 (3.41)	2.33 (3.05)	1,525 (60.0")	2,395 (5,280)	6	●	●	●	●	●	◐	-
	2.92 (3.82)	2.60 (3.40)	1,675 (65.9")	2,525 (5,570)	6	●	◐	◐	■	■	▲	-
	3.20 (4.19)	2.82 (3.69)	1,995 (78.5")	2,870 (6,330)	6	●	●	●	◐	◐	■	-
Rock heavy duty	1.81 (2.37)	1.50 (1.96)	1,460 (57.5")	2,650 (5,840)	4	●	●	●	●	●	●	-
	2.20 (2.88)	1.93 (2.52)	1,605 (63.2")	2,610 (5,750)	5	●	●	●	●	●	●	-
	2.43 (3.18)	2.11 (2.76)	1,750 (68.9")	2,730 (6,020)	5	●	●	●	●	●	◐	-
	2.70 (3.53)	2.39 (3.13)	1,755 (69.1")	2,770 (6,110)	5	●	●	●	●	◐	■	-
	2.79 (3.65)	2.47 (3.23)	1,785 (70.3")	2,950 (6,500)	5	●	●	●	◐	◐	■	-
	3.00 (3.92)	2.76 (3.61)	1,950 (76.8")	3,040 (6,770)	6	●	●	◐	◐	■	■	-
	3.20 (4.19)	2.82 (3.69)	1,995 (78.5")	3,230 (7,120)	6	◐	◐	◐	■	■	▲	-

● 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

\- Not available

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

7. UNDERCARRIAGE

1) TYPES OF SHOES

Model	Description	Unit		Triple grouser								Double grouser			
	width	mm	(in)	600	(24)	700	(28)	800	(32)	900	(36)	600	(24)	700	(28)
HX480A L	Operating weight	kg	(lb)	50870	112150	51390	113300	51920	114460	52420	115570	50900	112220	51430	113380
	Ground pressure	kgf/cm²	(psi)	0.88	12.6	0.77	10.9	0.68	9.6	0.61	8.6	0.88	12.6	0.77	10.9
	Overall width	mm	(ft-in)	3340	10' 11"	3440	11' 3"	3540	11' 7"	3640	11' 11"	3340	10' 11"	3440	11' 3"
	Link quantity	EA		53		53		53		53		53		53	
HX520A L	Operating weight	kg	(lb)	52900	116620	53420	117770	53950	118940	-		52930	116690	53460	117860
	Ground pressure	kgf/cm²	(psi)	0.92	13.1	0.80	11.3	0.70	10.0			0.92	13.1	0.80	11.3
	Overall width	mm	(ft-in)	3540	11' 7"	3640	11' 11"	3740	12' 3"			3540	11' 7"	3640	11' 11"
	Link quantity	EA		53		53		53				53		53	

2) SELECTION OF TRACK SHOE

Suitable track shoes should be selected according to operating conditions.

Method of selecting shoes

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

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

Table 1

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

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 / X12
Type	4-cycle, turbocharged, charge air cooled, electronic controlled diesel engine
Cooling method	Water cooled
Number of cylinders and arrangement	6 cylinders, in-line
Firing order	1-5-3-6-2-4
Combustion chamber type	Direct injection type
Cylinder bore × stroke	132 × 144 mm (5.2" × 5.67")
Displacement	11.8 ℓ (720 cu in)
Compression ratio	17 : 1
Gross power	400 Hp (298 kW) at 2100 rpm
Net power	395 Hp (295 kW) at 2100 rpm
Max. power	402 Hp (300 kW) at 1800 rpm
Peak Torque	1898 N·m (1400 lbf·ft) at 1400 rpm
Engine oil quantity	34 ℓ (9 U.S. gal)
Wet weight	860 kg (1896 lb)
Starter motor	24 V-7.5 kW
Alternator	24 V-110 A

2) MAIN PUMP

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 × 225 cc/rev
Maximum pressure	330 kgf/cm^2 (4690 psi) [360 kgf/cm^2 (5120 psi)]
Rated oil flow	2 × 394 ℓ /min (104 U.S. gpm/86.7 U.K. gpm)
Rated speed	1750 rpm

[ ] : Power boost

3) GEAR PUMP

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	13.7 cc/rev
Maximum pressure	40 kgf/cm^2 (570 psi)
Rated oil flow	23.5 ℓ/min (6.3 U.S. gpm/5.3 U.K. gpm)

4) MAIN CONTROL VALVE

Item		Specification
Type		9 spools
Operating method		Hydraulic pilot system
Main relief valve pressure		330 kgf/cm^2 (4690 psi) [360 kgf/cm^2 (5120 psi)] *1 330 kgf/cm^2 (4690 psi) [Not applied power boost]
Port relief valve pressure	Boom	400 kgf/cm^2 (5690 psi), *1 380 kgf/cm^2 (5400 psi)
	Arm	400 kgf/cm^2 (5690 psi), *1 280 kgf/cm^2 (3980 psi)
	Bucket	400 kgf/cm^2 (5690 psi), *1 280 kgf/cm^2 (3980 psi)

[ ] : Power boost *1 : Long reach only

5) SWING MOTOR

Item		Specification
Type		Axial piston motor
Capacity		142.8 cc/rev
Relief pressure		285 kgf/cm^2 (4054 psi)
Braking system		Automatic, spring applied hydraulic released
Braking torque		63 kgf · m (456 lbf·ft) over
Brake release pressure	Cranking	20.9~35.5 kgf ·m (151~257 lbf·ft)
	Full stroke	20.9~35.5 kgf ·m (151~257 lbf·ft)
Reduction gear type		2 - stage planetary

6) TRAVEL MOTOR (Type 1, 2)

Item	Specification
Type	Variable displacement axial piston motor
Capacity	281.7/175.9 cc/rev
Relief pressure	360 kgf/cm^2 (5120 psi)
Braking system	Auto matic, spring applied hydraulic released
Braking torque	119.7 kgf · m (866 lbf · ft)
Brake release pressure	11.3~15.7 kgf/cm^2 (161~223 psi)
Reduction gear type	2-stage planetary

7) CYLINDER

Item			Specification
Boom cylinder	Bore dia × Stroke		Ø170 × 1580 mm
	Cushion		Extend only
Arm cylinder	Bore dia × Stroke		Ø190 × 1850 mm
	Cushion		Extend and retract
Bucket cylinder	Bore dia × Stroke	HX480A L	Ø160 × 1360 mm
		HX480A L★ HX520A L	Ø170 × 1360 mm
	Cushion		Extend only

★ Only for 6.55 m (21' 6") boom and 2.55 m (8' 4") arm

※ 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	34.0 (9.0)	★SAE 5W-40 SAE 30 SAE 10W SAE 10W-30 SAE 15W-40
DEF/ AdBlue® tank	Mixture of urea and deionized water	70 (18.5)	ISO 22241, High-purity urea + deionized water (32.5:67.5)
Swing drive	Gear oil	7.0 (1.8) × 2	★SAE 75W-90
Final drive		12.0 (3.0) × 2	SAE 80W-90
Hydraulic tank	Hydraulic oil	Tank : 275 (72.6) System : 499 (132)	★ISO VG 15 ISO VG 32 ISO VG 46, HBHO VG 46★3 ISO VG 68
Fuel tank	Diesel fuel★1	600 (159)	★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	43.0 (11.4)	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 dealers.

SECTION 2 STRUCTURE AND FUNCTION

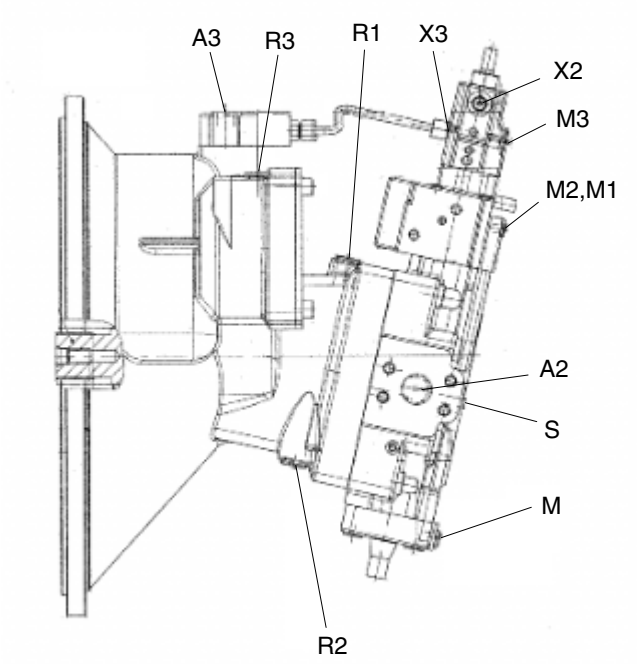
Group 1 Pump Device 2-1
Group 2 Main Control Valve 2-17
Group 3 Swing Device 2-46
Group 4 Travel Device 2-57
Group 5 RCV Lever 2-72
Group 6 RCV Pedal 2-79

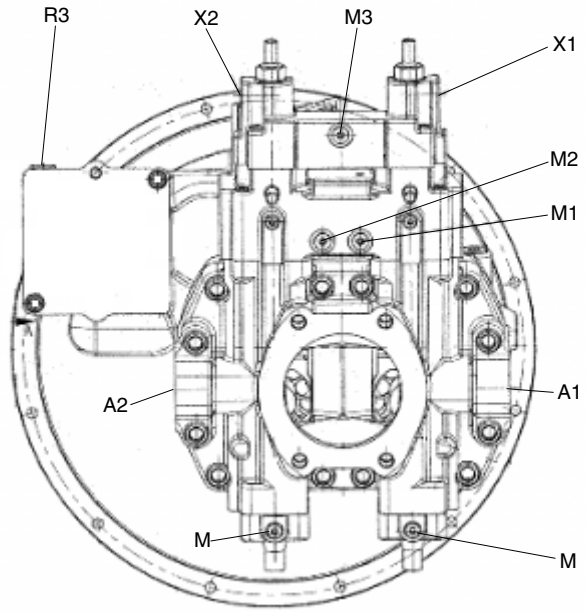
GROUP 1 PUMP DEVICE

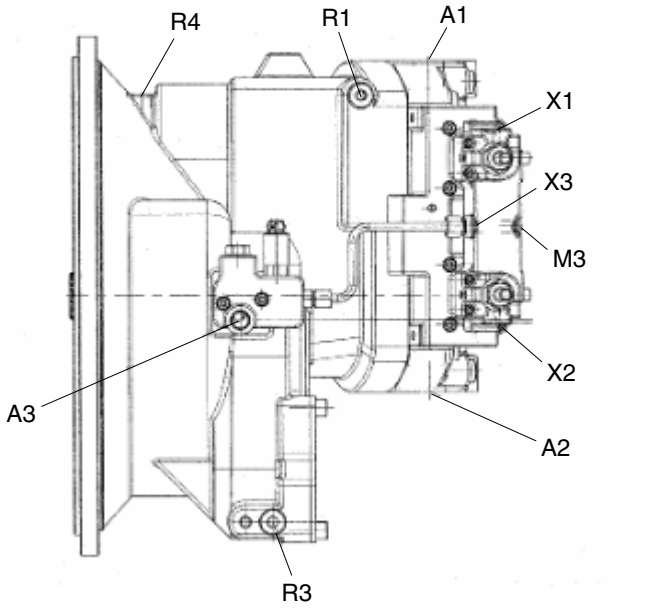
1. STRUCTURE

The pump device consists of main pump, regulator.

· STANDARD



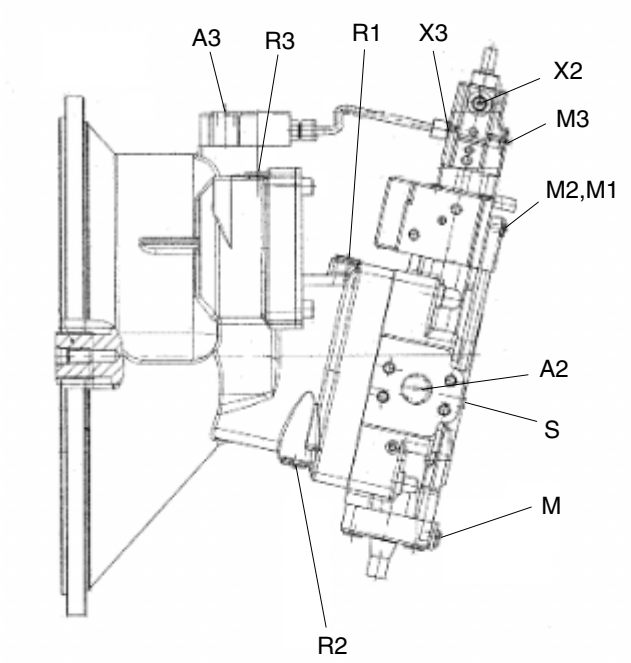


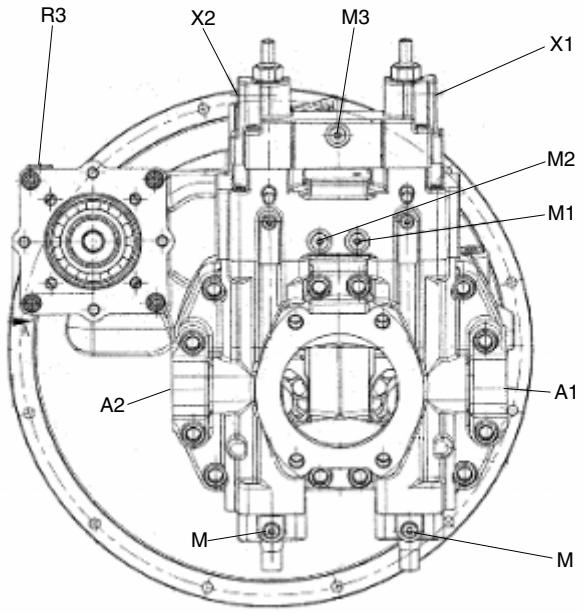


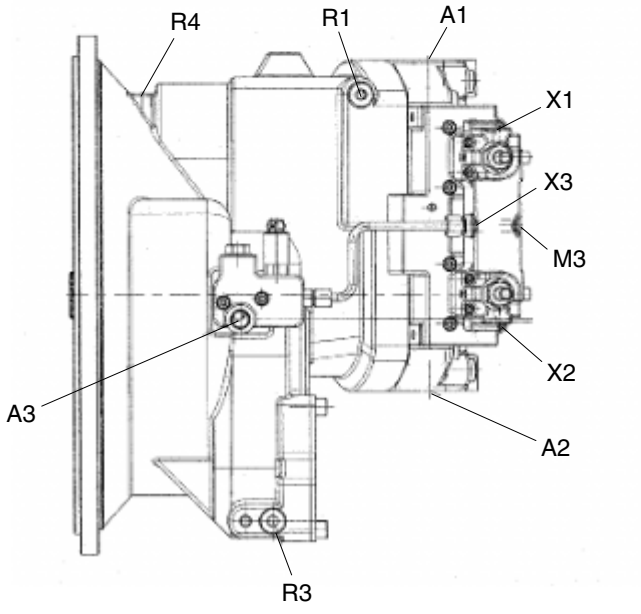
480A2MP01

Port	Port name	Port size
A1,A2	Service port	1 1/4"
S	Suction port	5"
A3	Auxiliary pump service port	3/4-16UNF
R1	Bleed port	M22x1.5
R2	Oil drain port	M22x1.5
R3	Bleed port	M22x1.5
R4	Flushing port	3/4-16UNF
X1	Control pressure ports for negative control	9/16-18UNF
X2	Control pressure ports for negative control	9/16-18UNF
X3	Control pressure ports for power override	M14x1.5
M	Measurement port	M12x1.5
M1	Measurement port A1	9/16-18UNF
M2	Measurement port A2	9/16-16UNF
M3	Measurement port for power override	9/16-16UNF

· OPTION-ROTATING WITH PROPORTIONAL



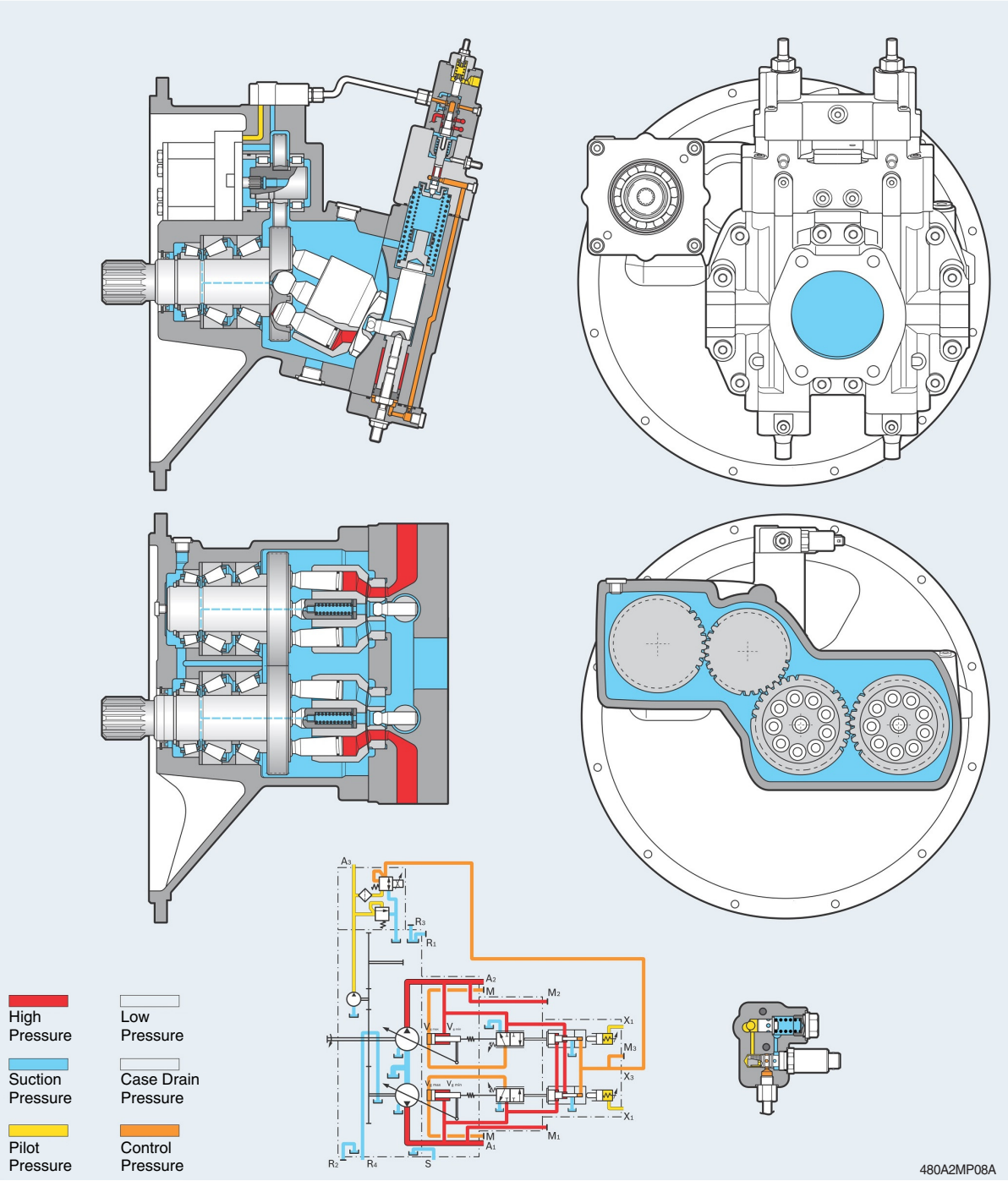




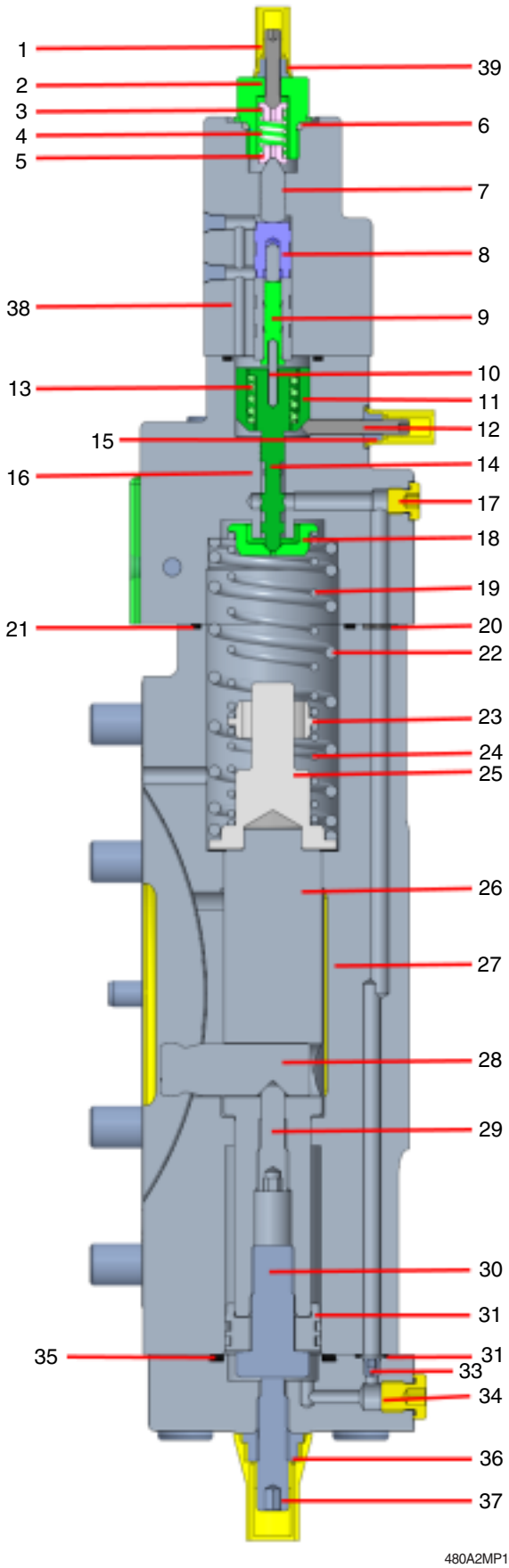
480A2MP03

Port	Port name	Port size
A1,A2	Service port	1 1/4"
S	Suction port1	5"
A3	Auxiliary pump service port	3/4-16UNF
R1	Bleed pory	M22x1.5
R2	Oil drain port	M22x1.5
R3	Bleed port	M22x1.5
R4	Flushing port	3/4-16UNF
X1	Control pressure ports for negative control	9/16-18UNF
X2	Control pressure ports for negative control	9/16-18UNF
X3	Control pressure ports for power override	M14x1.5
M	Measurement port	M12x1.5
M1	Measurement port A1	9/16-18UNF
M2	Measurement port A2	9/16-16UNF
M3	Measurement port for power override	9/16-16UNF

2. SCHEMATIC


High Pressure
Low Pressure
Suction Pressure
Case Drain Pressure
Pilot Pressure
Control Pressure
480A2MP08A

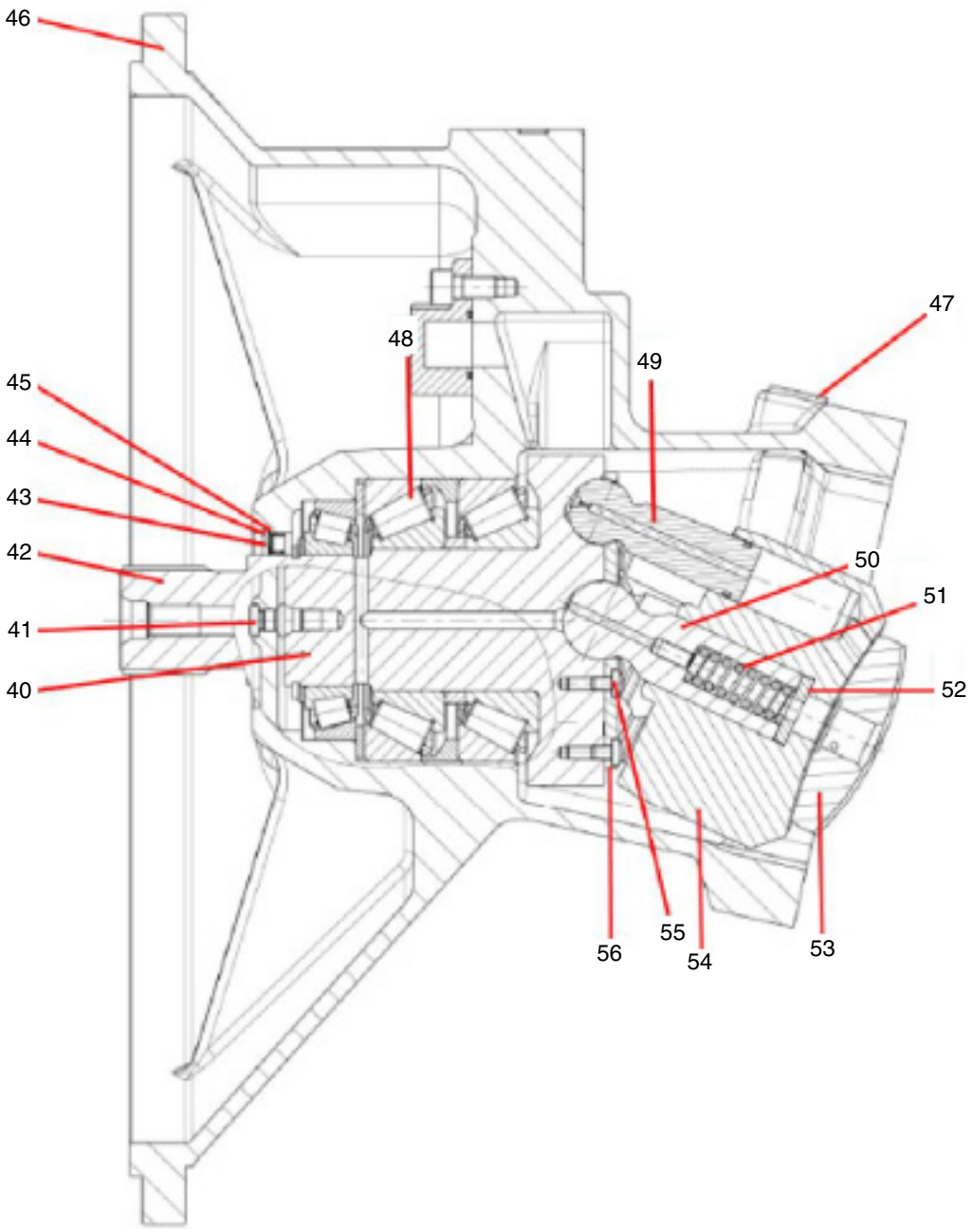
3. PART LIST (1/3)



1	Setting screw
2	Screw plug
3	Spring cup
4	Spring
5	Spring cup
6	O-ring
7	HNC control piston
8	Control bushing
9	LLC control piston
10	Pin
11	Spring bushing
12	Adjustment screw
13	Setting screw
14	Control piston for stroking
15	Sealing screw
16	HNC controller housing
17	Sealing screw
18	Spring cup
19	Spring
20	O-ring
21	O-ring
22	Spring
23	Double spring collar
24	Spring
25	Spring collar
26	Stroke piston
27	Port plate
28	Setting pin
29	Locating screws
30	Bolt
31	Piston with steal rings
32	O-ring
33	Orifice
34	Sealing screw
35	O-ring
36	Sealing screw
37	Setting screw
38	Stroke controller housing
39	Sealing screw

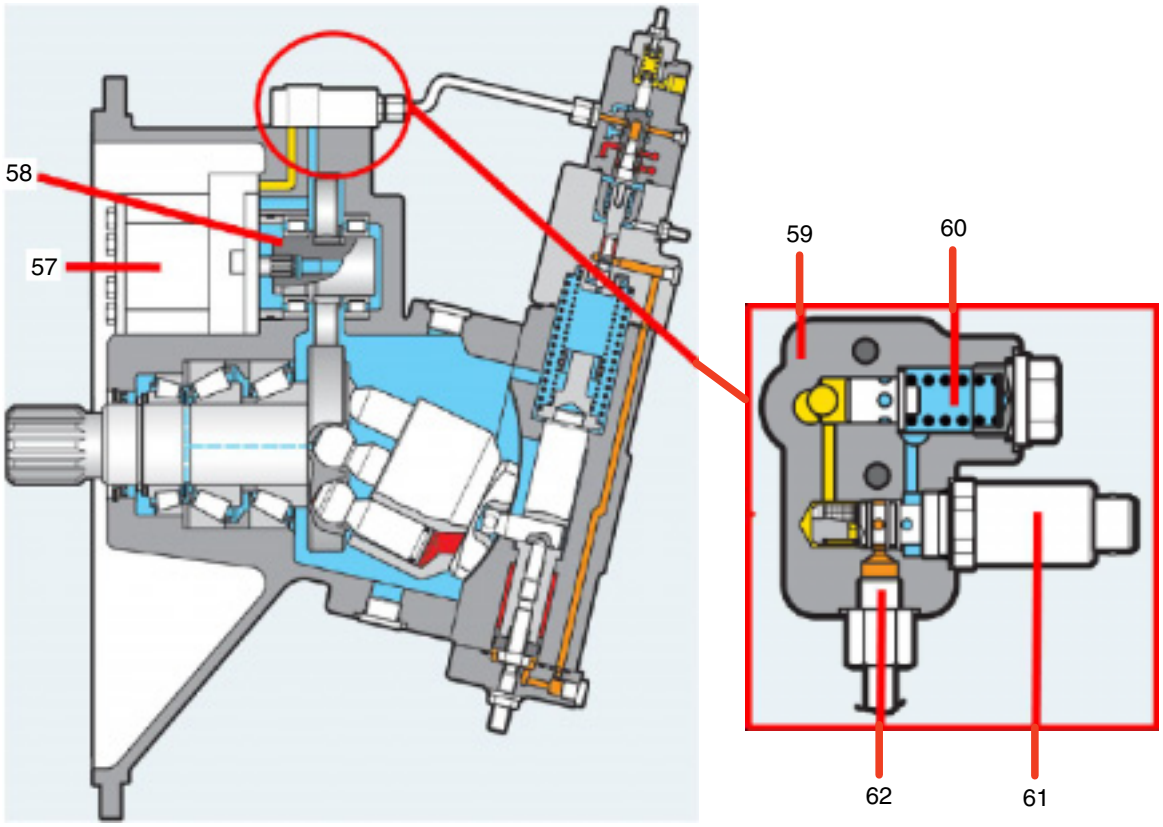
※ HNC : Hydraulic Negative Control
※ LCC : Load Limiting Control

PART LIST (2/3)



40	Rotary group	46	Pump housing	52	Shim
41	Sealing screw	47	Sealing screw	53	Control lense
42	Rotary group	48	Bearings	54	Cylinder
43	Snap ring	49	Piston with steal rings	55	Bolt
44	Shim	50	Center pin	56	Retreat plate
45	Shaft seal ring	51	Spring		

PART LIST (3/3)



480A2MP12

57	Gear pump	59	Valve plate	61	EPPR valve
58	Gear wheel	60	Pressure relieve valve	62	Hydraulic pipe

4. FUNCTIONAL EXPLANATIONS OF THE CONTROLLERS

Basically, we can say that there is a priority between the individual controllers. The lowest priority has the flow control (H1). This is directly influenced by the negative control pressure from the MCV.

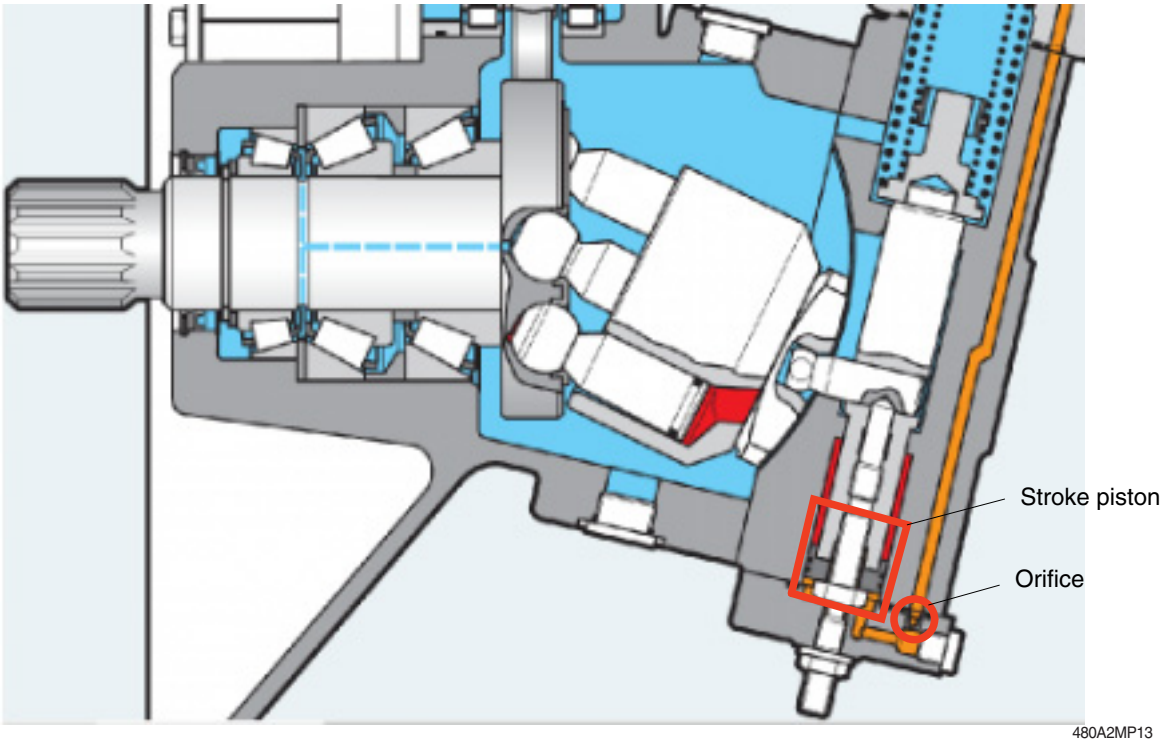
Second priority has the torque control (K). An internal bore in the housing allows a high-pressure signal from each rotary group to be applied to both power controllers. Each individual rotary group considers the high pressure on the regulator individually. If the total power of both rotary groups exceeds the total max. set power, then both rotary groups reduce the flow by swiveling back.

The controller with the highest priority is the power override control (LA1). This protects the diesel engine from overloading. When the diesel engine is over-loaded, it causes the engine speed to decrease and, in the worst case, the diesel engine is being stalled. We counteract the fact, that active the diesel speed is observed. When the diesel speed is too far away from the target speed, e.g. 50 rpm lower. The ECM detects this engine speed drop and provides the pump an electric signal to swivel the pump back, till the engine is recovering to the target speed. This ensures that both rotary groups are reducing their swing angle so far that the speed is recovered back to its target speed.

1) BASIC FUNCTION

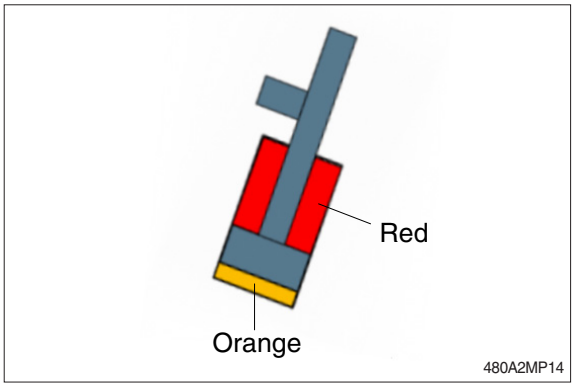
The pump is an axial piston pump in bent axis design.

The basic function of each rotary group is as follows.
The high pressure (red) serves for the rotary group as a signal pressure. This causes the rotary group to swivel to Vgmax (large swivel angle). The rotary group remains in this position until it gets a stroke pressure from the regulator. This is ensured by the larger piston area for the stroke pressure, inside the stroke piston we have area ratio of (3 : 1). If the forces of the stroke side are bigger than those of the high pressure side, then the unit swivel from Vgmax (large swivel angle) → Vgmin (small swivel angle). The swivel time can additionally be influenced by the orifice in picture below.



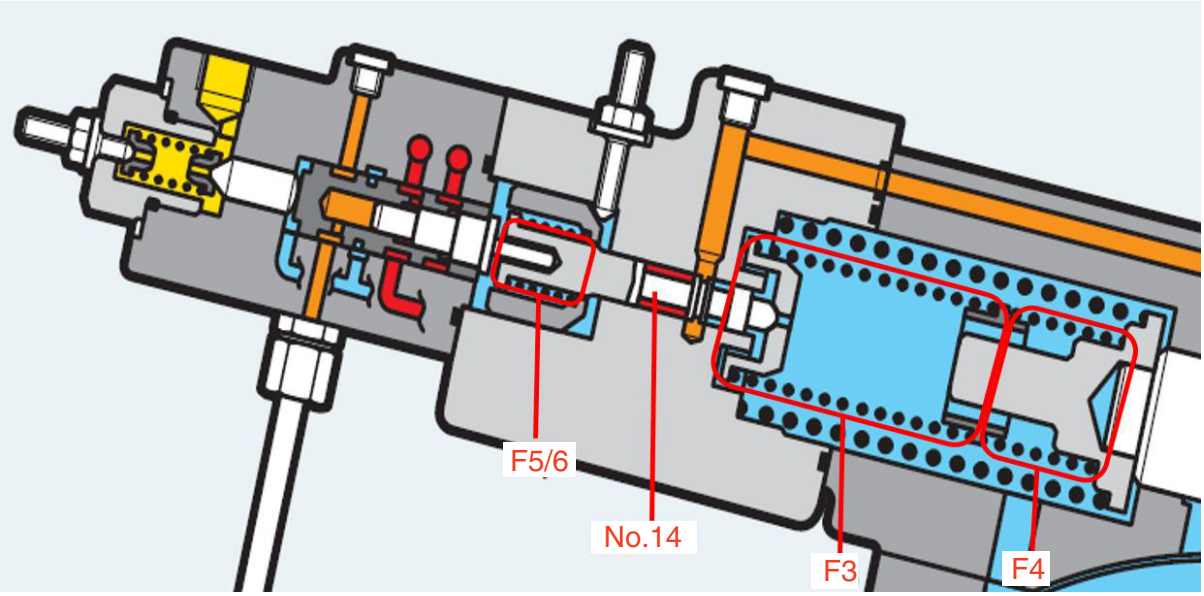
480A2MP13

The stroke piston and the piston with steal rings (31) have an area ration of 3 (orange) and 1 (red).



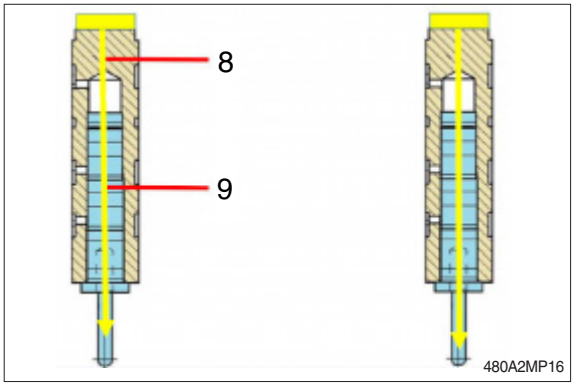
480A2MP14

The basic function of the controller is as follows shown in picture above. If the control piston (14) opens the connection area from high pressure to the orange stroke pressure, then the unit swivel from Vgmax to Vgmin. We can say that first the spring force (F5/6) has to be overcome.
When the unit swivels, the spring F3 is compressed until it is limited by the spring cup. Then the spring F4 is compressed. If the flow is interrupted by the connection area, the unit stops at this swivel angle and is holding its position.
These two springs (F3 and F4) compression characteristic leads to the typical two spring control behavior.



480A2MP15

There are three ways how the control piston (14) can be pushed for connecting the high pressure with stroke pressure area.



480A2MP16

(1) Negative control H1

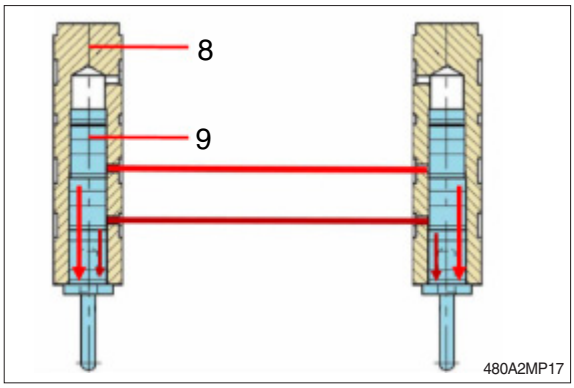
Movement of control bushing (8), via the negative control pressure from main control valve.

The yellow marked control bushing (8) can be operated, until enough power is available. i.e. power control (hydraulic coupling) or LLC (load limiting control) is not active. In this case the blue control piston (9) is pressed down by the control bushing (8).

(2) Hydraulic coupling for power control K

Movement of control piston (9) inside the upper control housing, via high pressure from own rotary group, or hydraulic coupling, via the other rotary group.

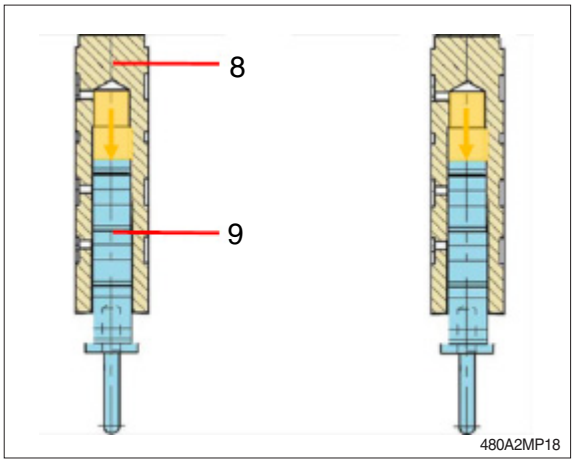
In case the load pressure of consumer is increasing, pressure is given to both control pistons (9) (A1 and A2). The rotary group with higher flow demand (swivel angle) is starting to swivel back at first. Until both rotary groups have the same power demand. up from this point, both rotary groups are swiveling in parallel.



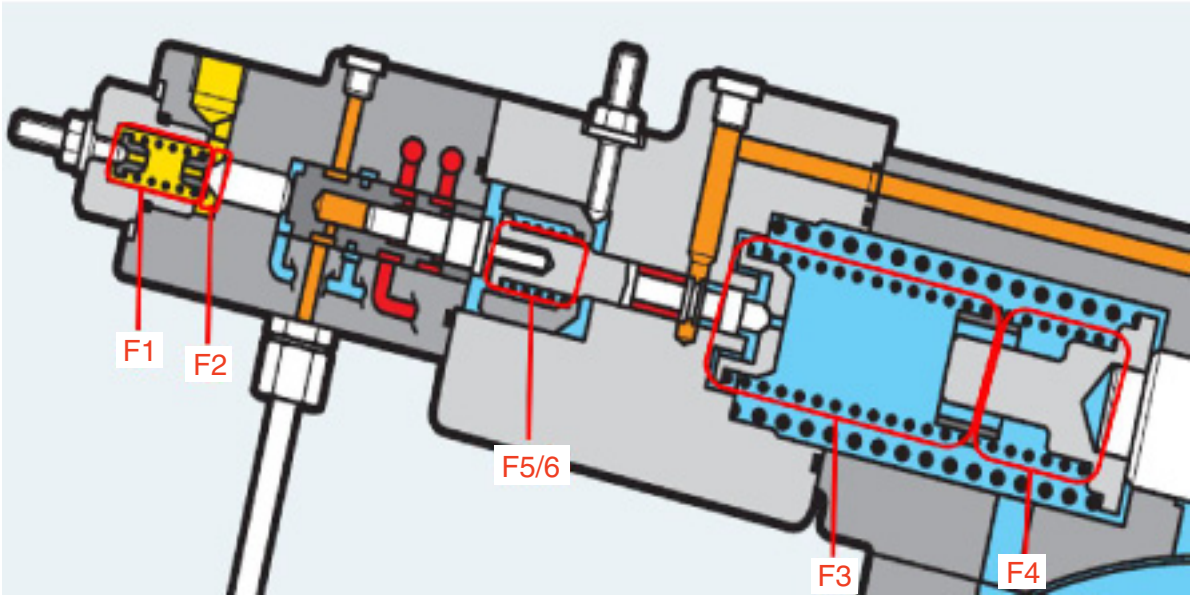
(3) Power override LA1

Movement of control piston (9) inside the upper control housing, via the pilot pressure from the electric proportional pressure-reducing valve, for power control.

In case the engine power is overloaded, the blue marked control piston is moving down, independent from the negative control pressure (control bushing (8)).
In case the high pressure is increasing over the available set power on one or the other rotary group, control piston (9) is also moving downwards and providing stroke pressure for swiveling back the pump.



2) FLOW CONTROL



480A2MP19

The flow controller is the regulator with the lowest priority. This becomes dependent on an external control pressure. This control pressure is generated as follows.

The MCV inside the open center system is getting closed, when the operator doesn`t move the joystick. The remaining flow rate of the pump is sent via a metering orifice. This creates a control pressure, e.g. 25 bar.
This ensures that the unit is swiveling to Vgmin. If the operator now requires more volume flow. Then the control pressure is reduced, the unit continues to swivel out to Vgmax.

There are two forces in the marked control chamber.
F1 = spring force
F2 = control pressure multiplied with the area of the control piston

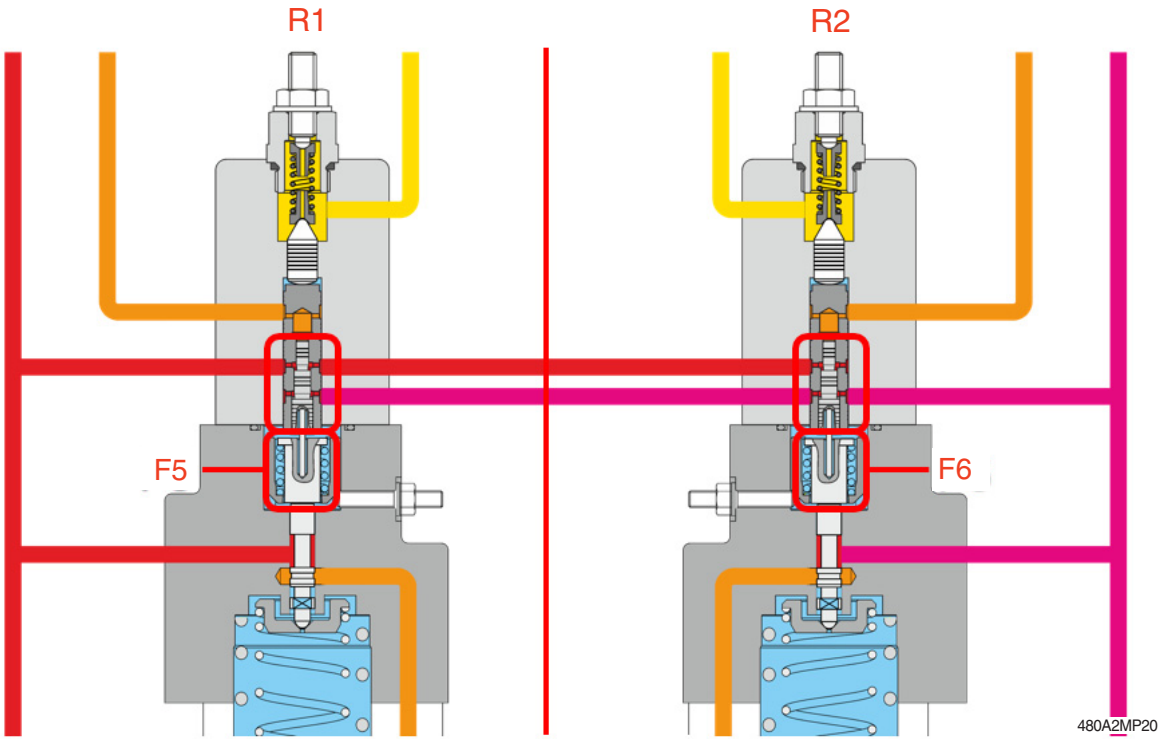
These forces work against the spring forces of the power controller F3 and F4. The important factor is the control pressure.
If the control pressure is increasing, the force of F2 increase too and ensures that the control piston (14) opens the channel between the high pressure and the stroke pressure. Due to that a feedback comes up, that the unit generates too much volume flow. The unit swivel to a smaller swivel angle.

The two compression springs allow us to set up a fine control range. This is realized by installing two differently strong compression springs. The softer compression spring (F4) is compressed until it is limited by the double spring collar (23). At this point, the harder spring (F3) takes over.

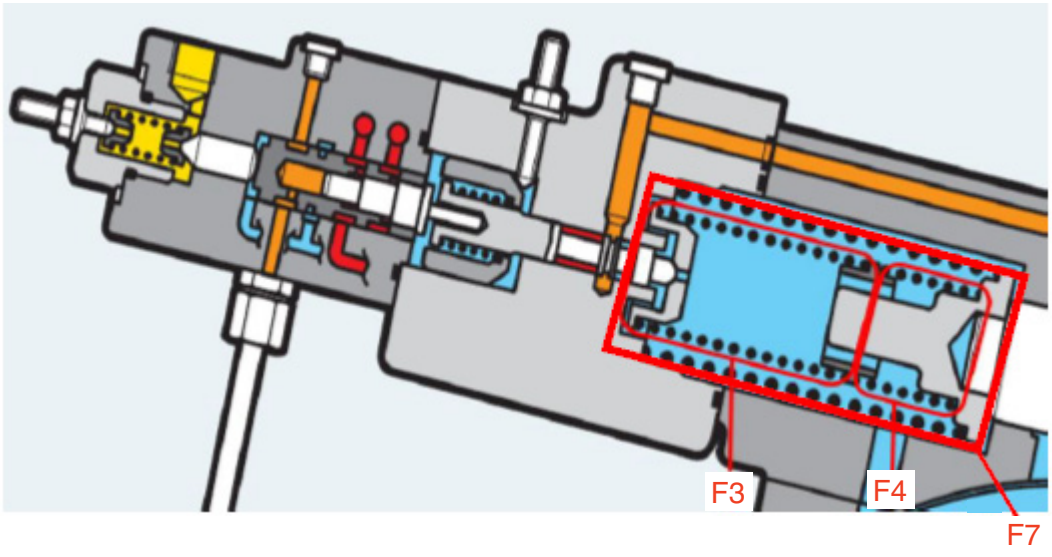
3) POWER CONTROL

Next we take a look at the power controller. The basic understanding is that we have two rotary groups and two independent controllers. The power controller for the rotary group A1 and A2. We connect both power controllers to each other via the hydraulic coupling. In each case, the high pressure of the rotary group A1 and A2 acts on the controller. We look at the picture below. The red line (P1) and the pink line (P2) set the high pressure of the respective rotary group.

Both high pressures are applied to the control piston. Over the surfaces, these pressures generate a force which works against the adjusted spring force (F5/F6). If the force is bigger than the spring force (F5), the control edge opens and the pump swivels back.



Here it is important that the rotary group swivels according to the characteristics of the spring force F3 and F4.
The spring force F7 is pushing every rotary group to maximum swivel angle without high pressure, e.g. engine stopped.

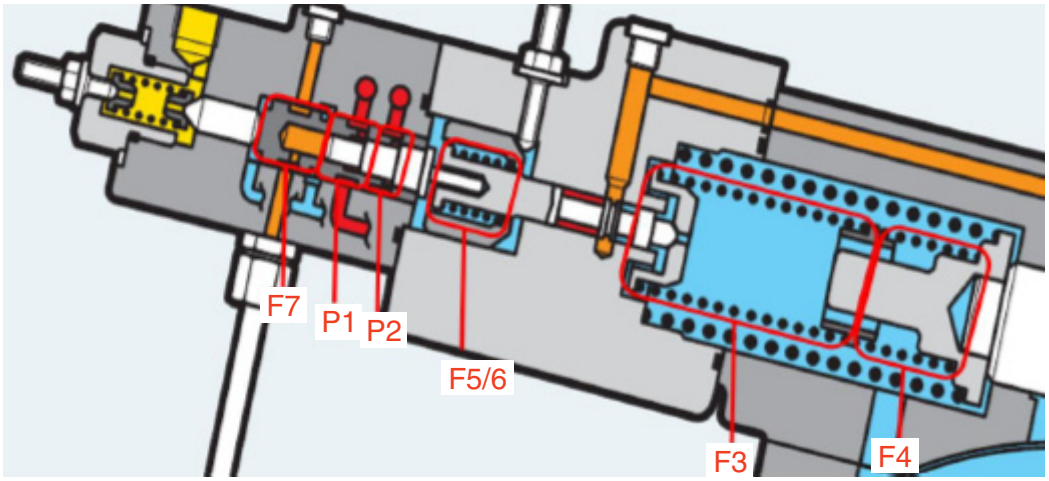


4) ANTI STALL CONTROL OR POWER SHIFTING FUNCTION

First, let's take a look at the anti-stall function. In this case, the power override is integrated into the pump control. Externally, the diesel engine speed is monitored via the ECM. If the engine is overloaded, e.g. more than 50 rpm and thereby reduces the diesel speed. Then the LLC (load limiting control) activates the anti-stall function of the pump. In this case, an external control pressure is applied to the control piston (9). This force (F7) stand over all other functions and swivel back the unit until the diesel speed recovers.

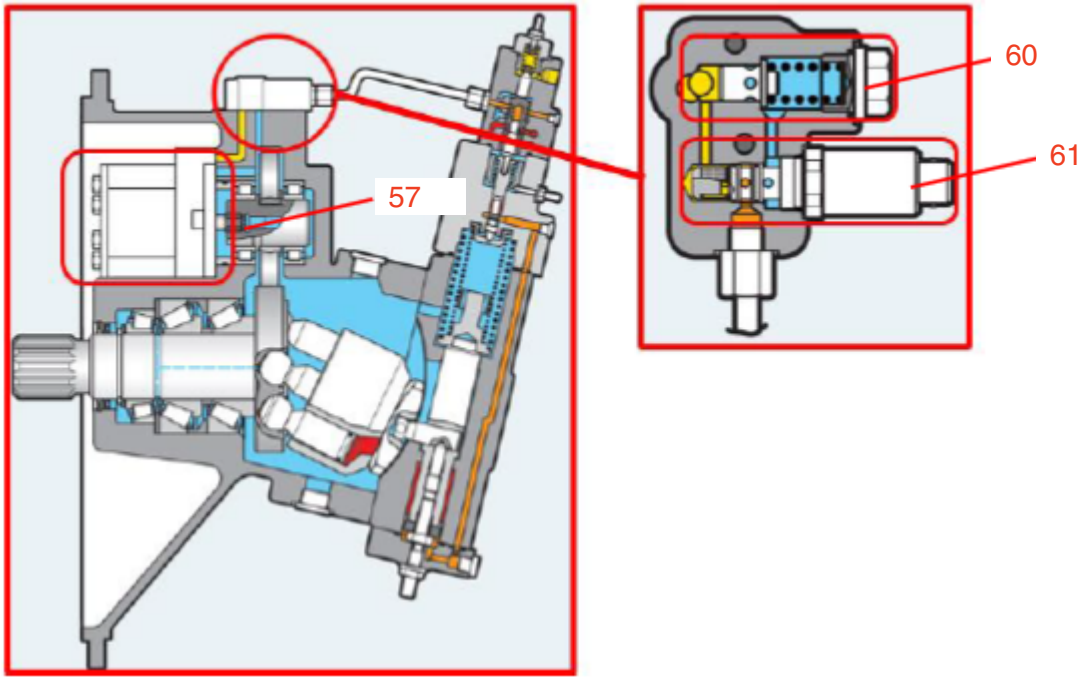
So second, let's look at the power shifting function. Here it is possible to approach different driving modes.

It can be seen very well in the picture No. 10, that the external control pressure (F7) and the two high pressures (P1/P2) of the hydraulic coupling work together against the springs (F5/6, F3 and F4). If we now increase the external control pressure (F7), less pressure is needed to open the spring F5/6. This gives us a new power setting.



480A2MP22

The external control pressure is generated as follows. A gear pump (57) is integrated in the main pump fly wheel housing. The pressure of the gear pump flow is limited by a pressure relief valve (60), this setting is made via shims. This pressure can be used external via A3 port or is used via the electric proportional pressure reducing valve (61), which can be controlled in the two ways mentioned above: 1. LLC (load limiting control) or 2. Power mode controller.



480A2MP23

5. ADJUSTMENT OF THE CONTROLLERS

For the adjustment of the controller, you need a power diagram. Please get in touch with your Hyundai dealer.

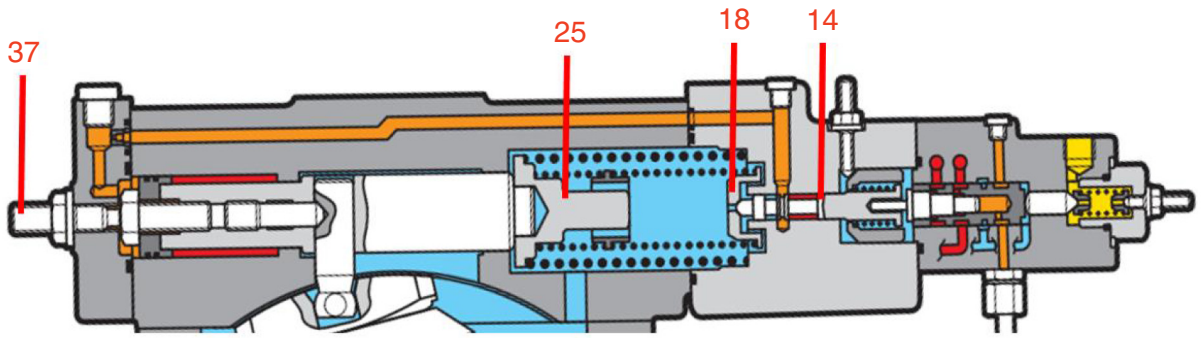
1) FLOW

(1) Maximum flow (mechanical)

The limitation for the maximum flow is done via the setting screw (37)

(2) Minimum flow (hydraulic)

The limitation over the minimum volumetric flow (residual flow) results from the spring collar (25). The spring collar (25) is pressing again the spring cup (18)/control piston (14).



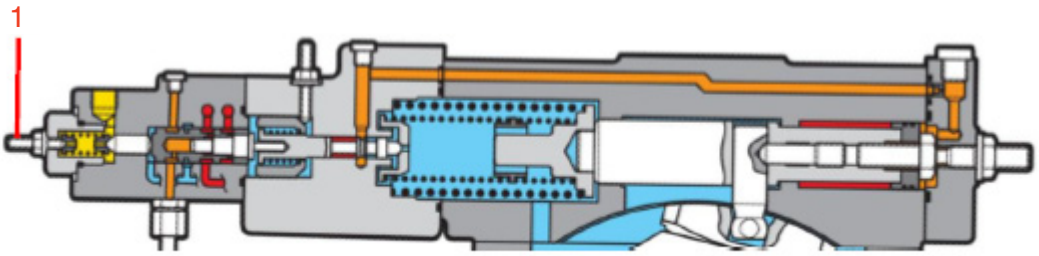
480A2MP24

(3) Flow controller

When you turn the setting screw (1) inside you move the px1 downstairs. When you turn the setting screw (1) out than move the px1 upstairs.

※ Adjustment M6x1 : 1 turn = 1 mm = +11 bar (counter-clockwise)

※ Adjustment area piQ : 10~5.1 bar (delta 4.9 bar)



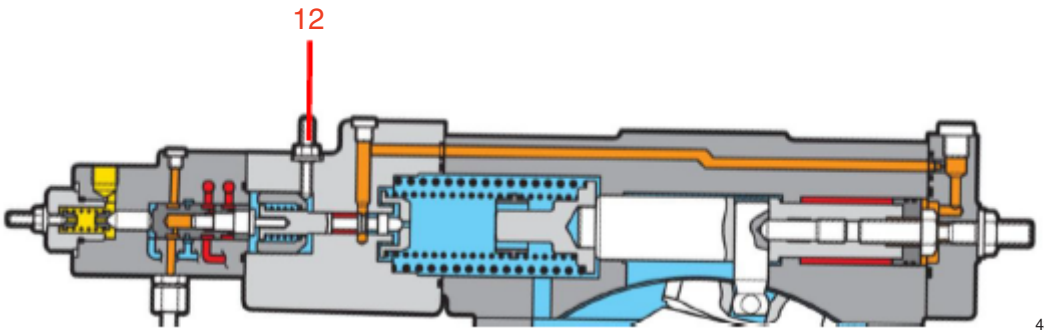
480A2MP25

2) POWER CONTROL SETTING

With the volumetric flow controller, fully control the A1 rotary group. Then increase the high pressure to the control point of the power controller. You realize that the power regulator is engaged when the speed of the movement slows down. Use the adjustment screw (12).
Turn the screw inside for a higher power setting, turn it out for a lower power setting.

Then repeat the same procedure for the A2 rotary group.

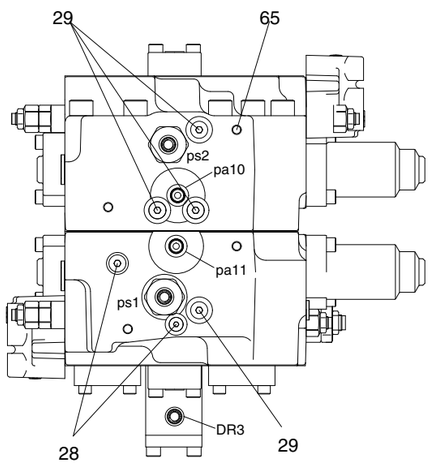
Afterwards, control both rotary group together and check if the hydraulic coupling works.
1. rotary group A1: 100% volume flow (speed), high pressure 300 bar
2. rotary group A2: 100% volume flow (speed), high pressure 300 bar
3. rotary group A1 and A2: 100% volume flow (speed), high pressure 150 bar

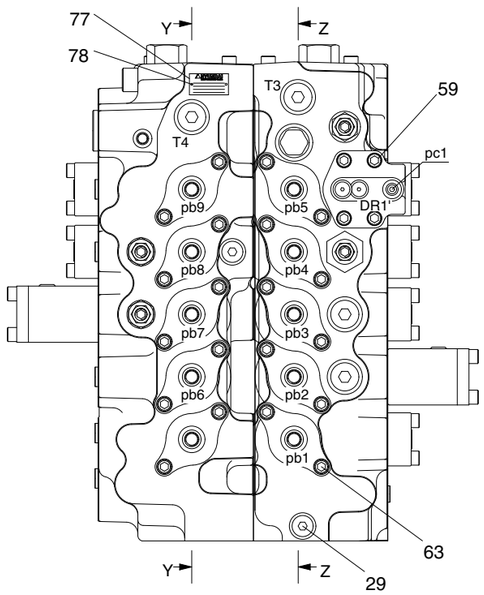


480A2MP26

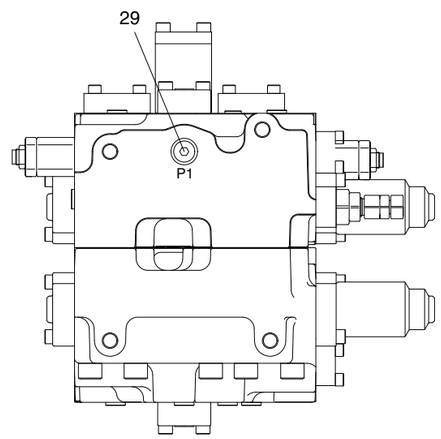
※ Adjustment M6x1 : 1 turn = 1 mm = +85.8 bar
(clockwise adjustment range of pQ: 150 ~ 300 bar (delta 150 bar)
(max. input torque 1.788 Nm of pump to be considered,
i.e. Vgmax and delta p = 250 bar, both rotary groups)

1. STRUCTURE



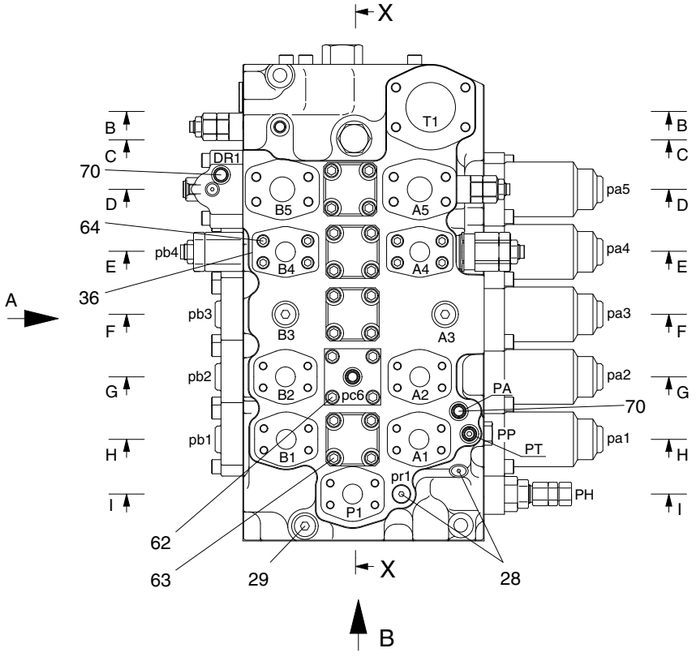


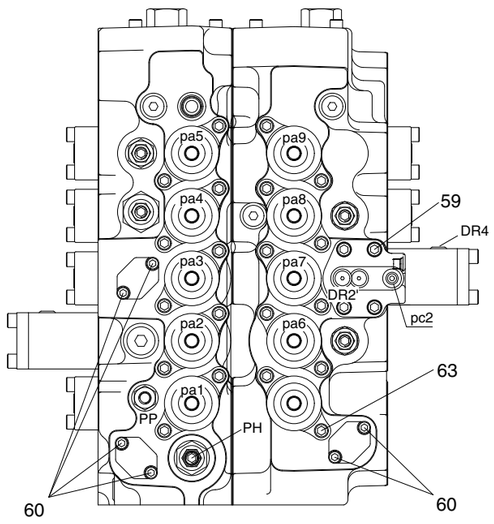
VIEW A

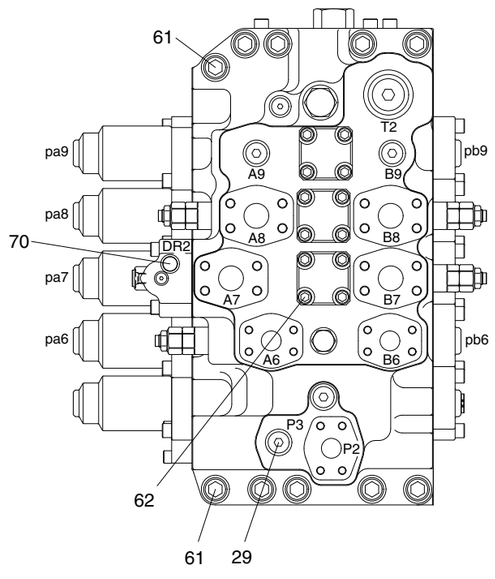


VIEW B

Port name	Port size	Thread depth (mm)
DR1, DR2, DR3, DR4, DR1', DR2', pr1, ps1, ps2, pc1, pc2, pc6, pc7, pa10, pa11, PA, PP, PH, PT	PF 1/4	12
pa1~pa9, pb1~pb9	PF 3/8	14
A3, A9, B3, B9, P1, P3	PF 1/2	16
T3, T4	PF 3/4	17
T2	PF 1	21



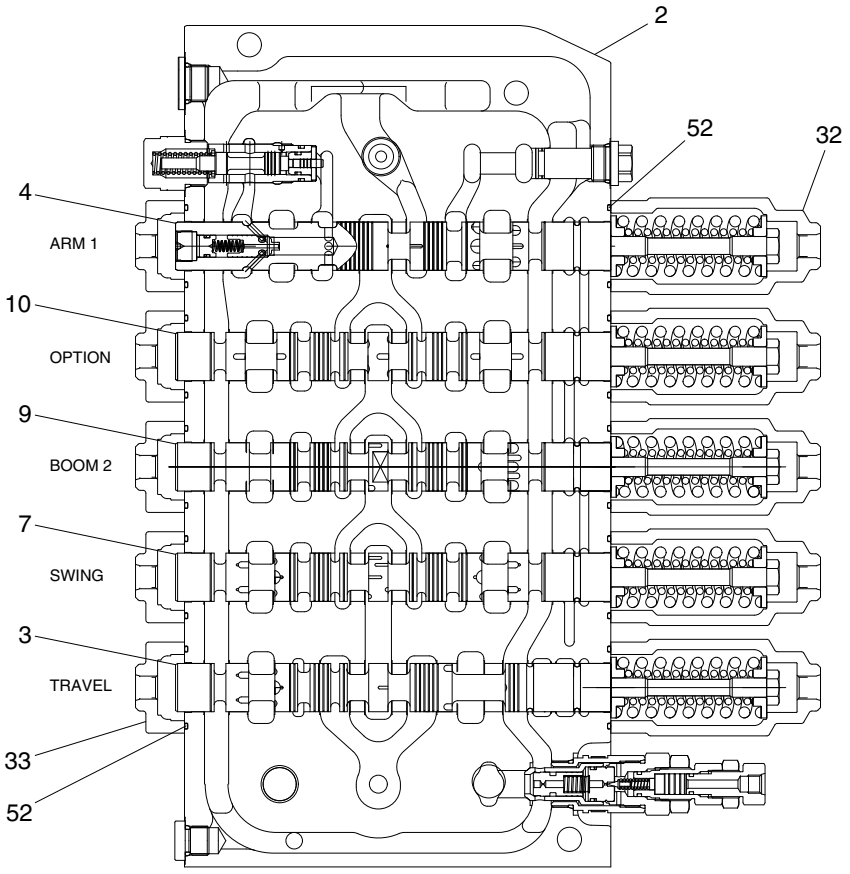




480A2MC02

28	Plug assy
29	Plug assy
36	Flange
59	Socket head bolt
60	Socket head bolt
61	Socket head bolt
62	Socket head bolt
63	Socket head bolt
64	Socket head bolt
65	Socket head bolt
70	Dust cap
77	Name plate
78	Rivet

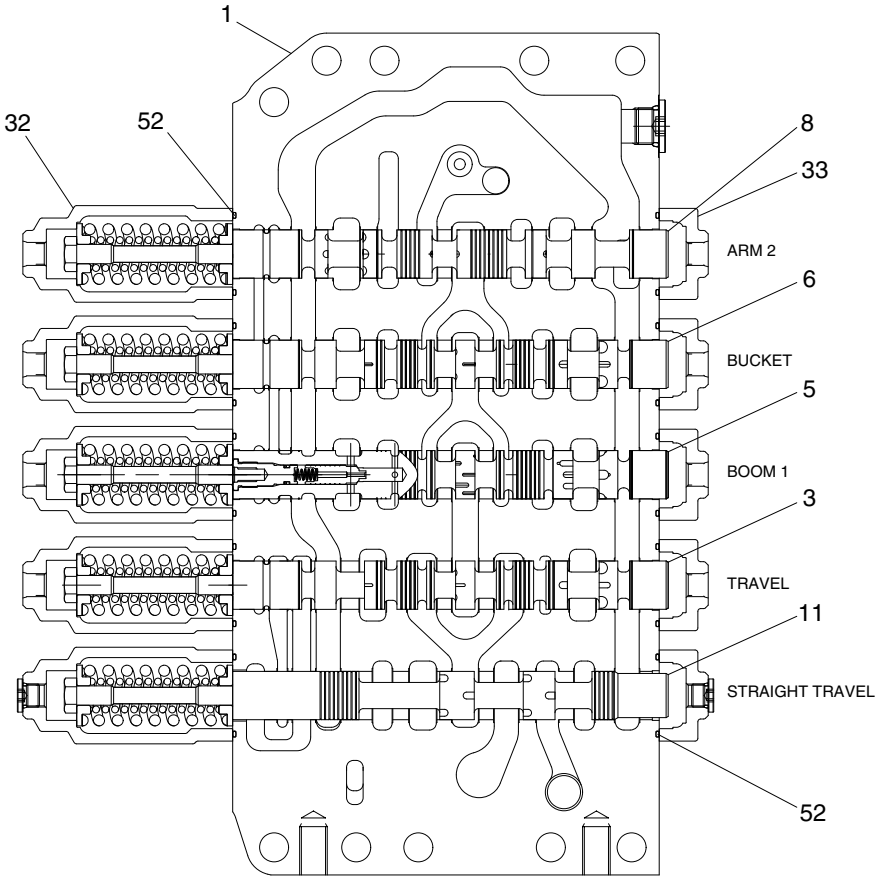
STRUCTURE (2/7)



SECTION Z-Z

480A2MC03

2 Housing P2
3 Travel spool kit
4 Arm 1 spool kit
7 Swing spool kit
9 Boom 2 spool kit
10 Option spool kit
32 Spool cap (L)
33 Spool cap (S)
52 O-ring

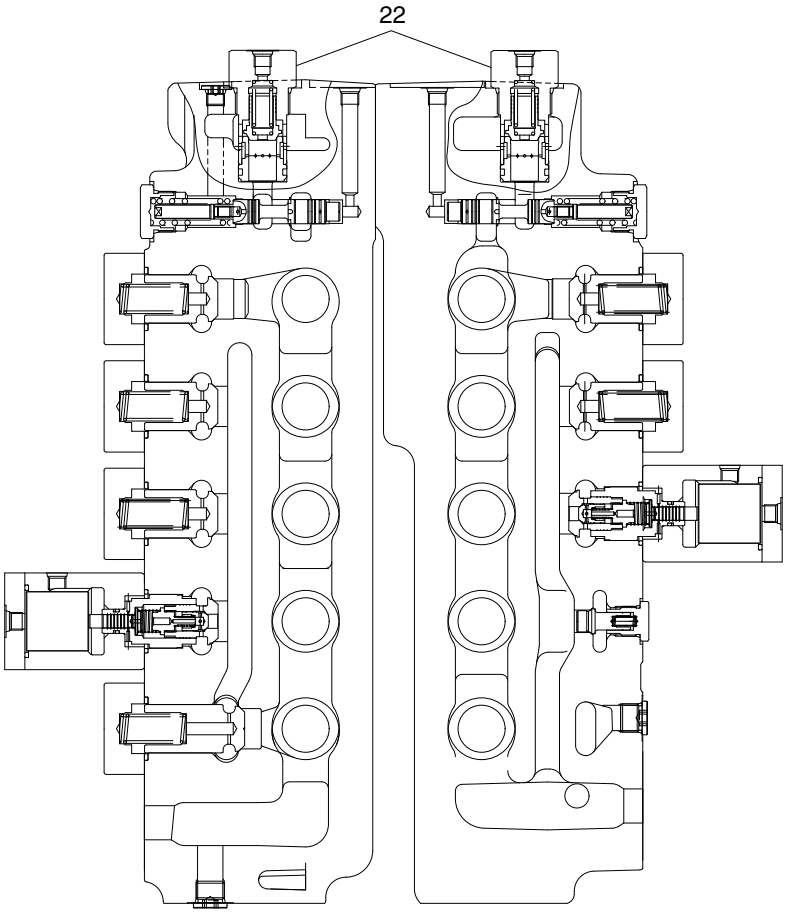


SECTION Y-Y

480A2MC04

1 Housing P1
3 Travel spool kit
5 Boom 1 spool kit
6 Bucket spool kit
8 Arm 2 spool kit
11 Straight travel spool kit
32 Spool cap (L)
33 Spool cap (S)
52 O-ring

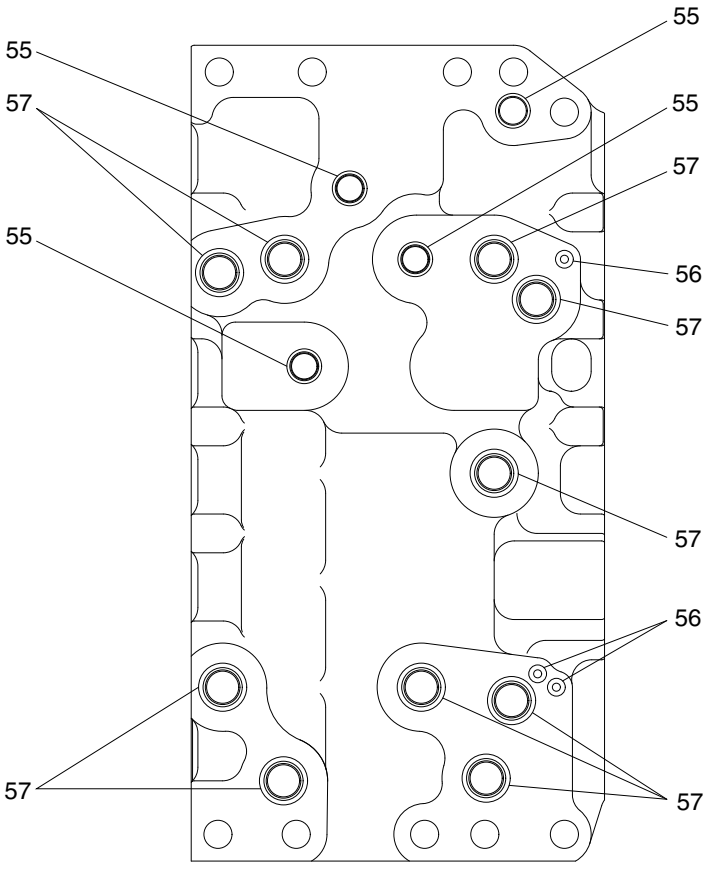
STRUCTURE (3/7)



SECTION X-X

480A2MC05

22 Negacon valve assy

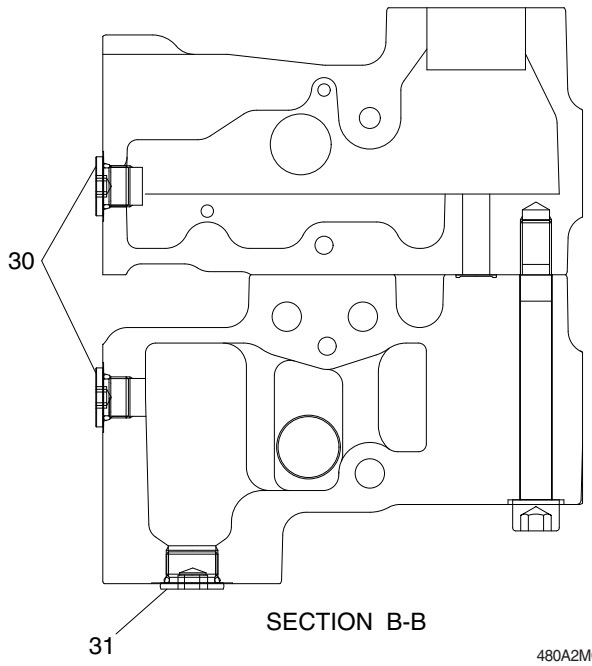


DETAIL OF COMBINED PLANE

480A2MC06

55 O-ring
56 O-ring
57 O-ring

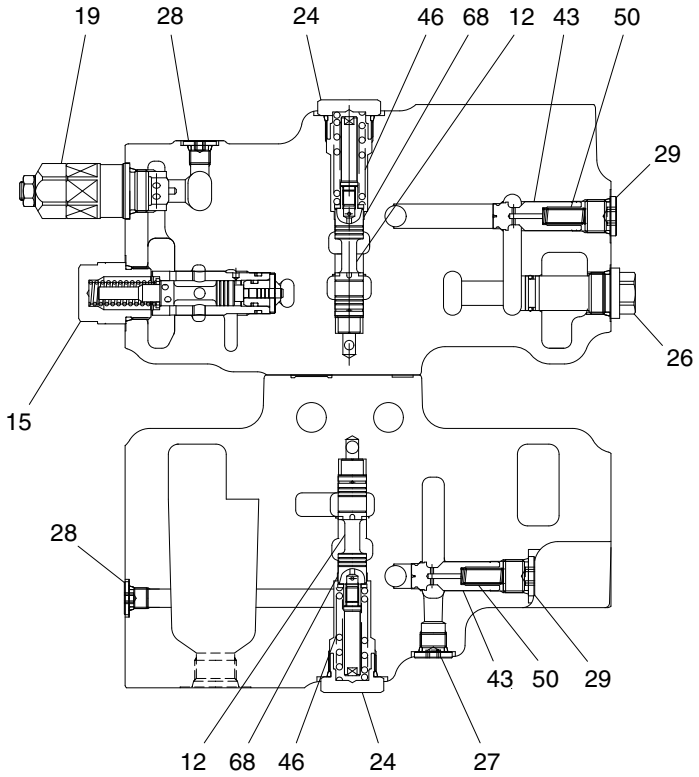
STRUCTURE (4/7)



SECTION B-B

480A2MC07

30 Plug assy
31 Plug assy
66 Socket head bolt

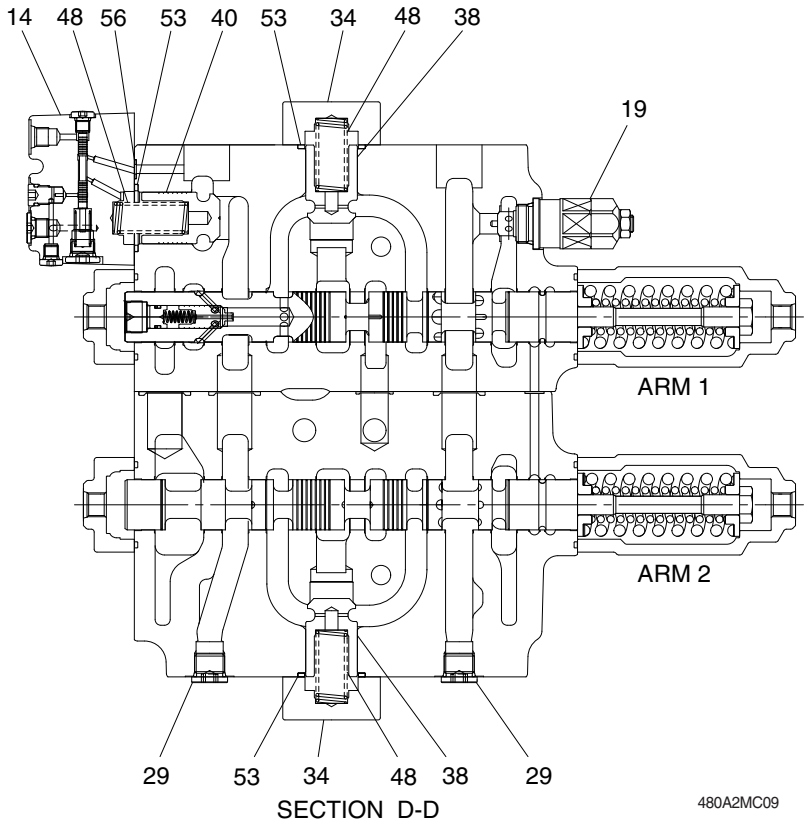


SECTION C-C

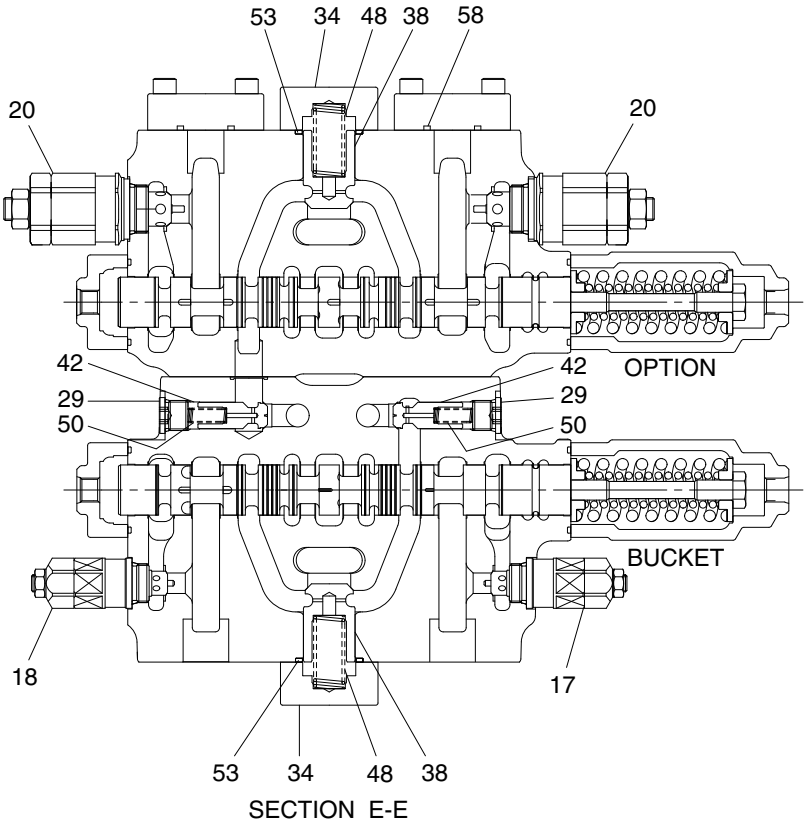
480A2MC08

12 Spool kit-BC
15 Arm regen cut valve
19 Overload relief valve assy
24 Plug assy-BC
26 Plug assy
27 Plug assy
28 Plug assy
29 Plug assy
43 Poppet
46 Spring-BC
50 Spring
68 Spring seat-BC

STRUCTURE (5/7)

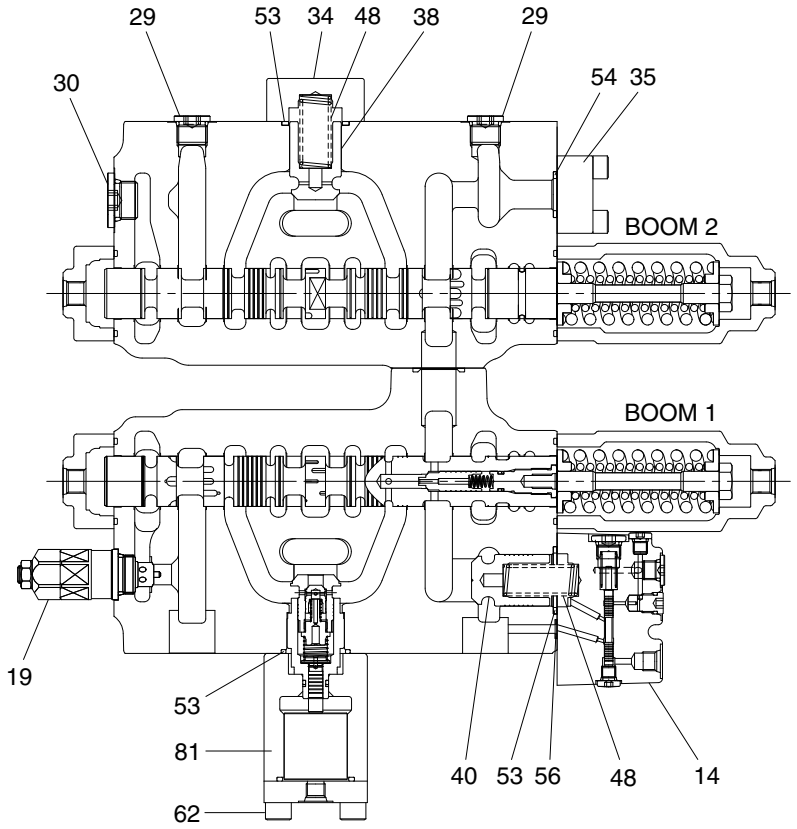


14 Holding valve assy
19 Overload relief valve assy
29 Plug assy
34 Flange-LC
38 Poppet
40 Poppet
48 Spring
53 O-ring
56 O-ring
66 Socket head bolt



17 Overload relief valve assy
18 Overload relief valve assy
20 Overload relief valve assy
29 Plug assy
34 Flange-LC
38 Poppet
42 Poppet
48 Spring
50 Spring
53 O-ring
58 O-ring

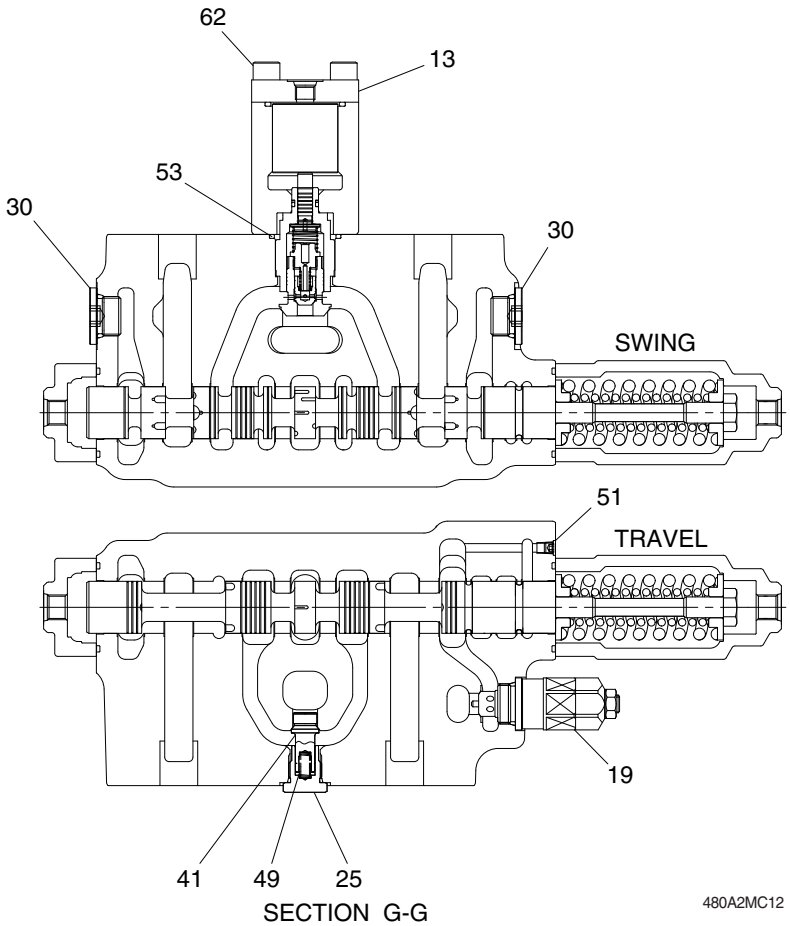
STRUCTURE (6/7)



SECTION F-F

480A2MC11

14 Holding valve assy
19 Overload relief valve assy
29 Plug assy
30 Plug assy
34 Spool cap
35 Flange-MR
38 Poppet
40 Poppet
48 Spring
53 O-ring
54 O-ring
56 O-ring
62 Socket head bolt
81 Boom logic valve assy

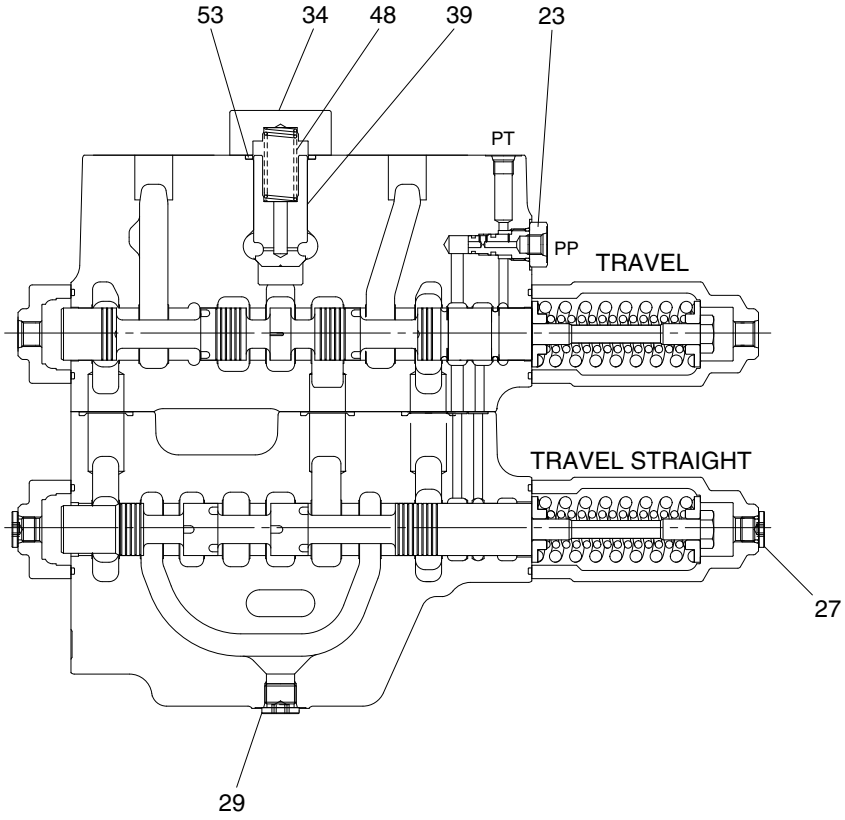


SECTION G-G

480A2MC12

13 Swing logic valve assy
19 Overload relief assy
25 Plug assy
30 Plug assy
41 Poppet
49 Spring
51 O-ring
53 O-ring
62 Socket head bolt

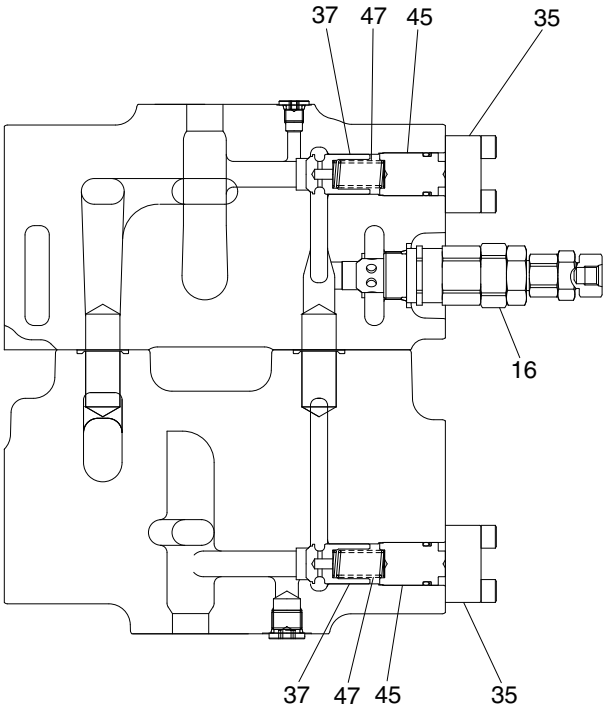
STRUCTURE (7/7)



SECTION H-H

480A2MC13

23 Signal plug assy
27 Plug assy
29 Plug assy
34 Flange-LC
39 Poppet
48 Spring
53 O-ring

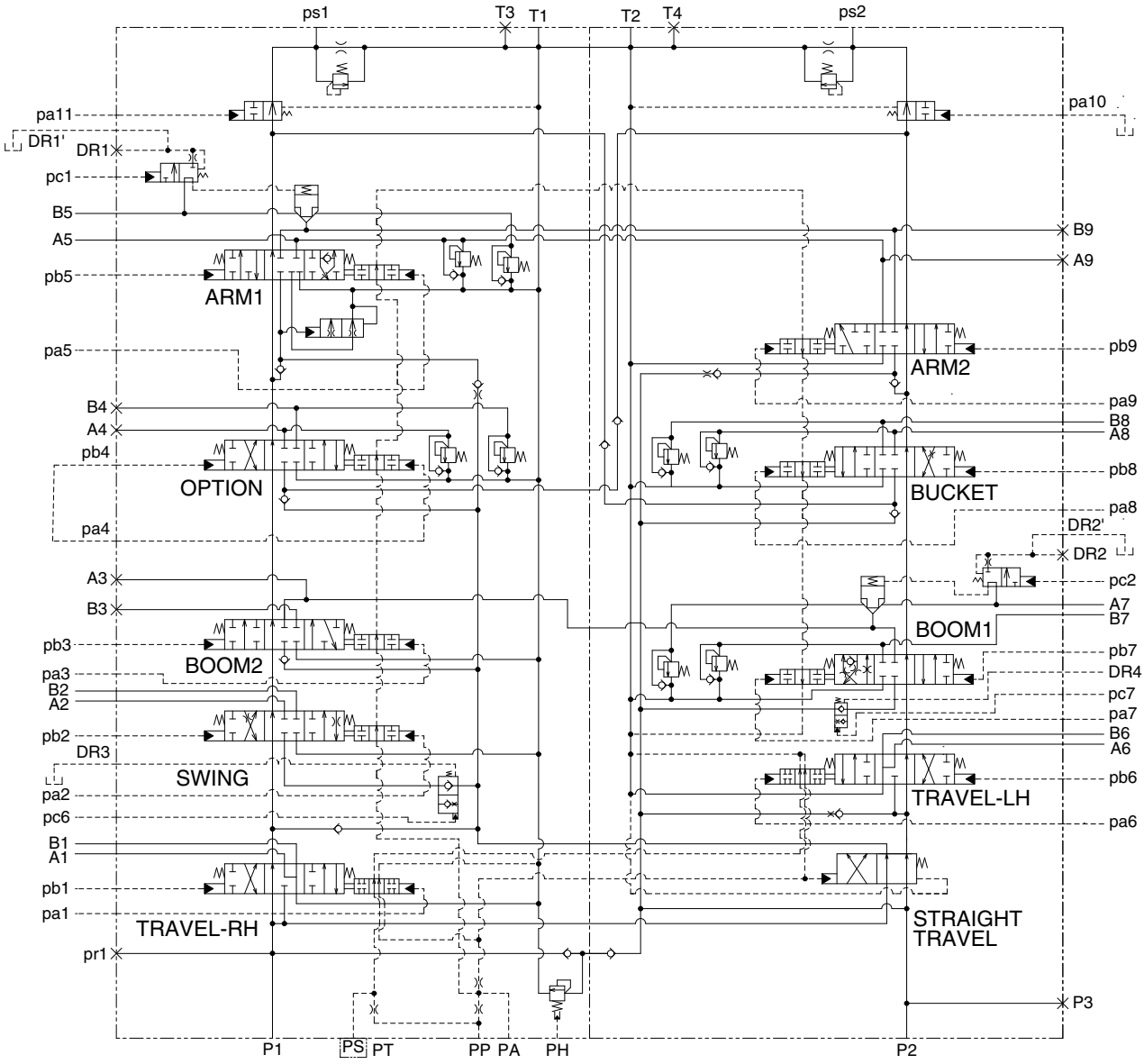


SECTION I-I

480A2MC14

16 Main relief valve assy
35 Flange-MR
37 Poppet
45 Spacer assy-MR
47 Spring

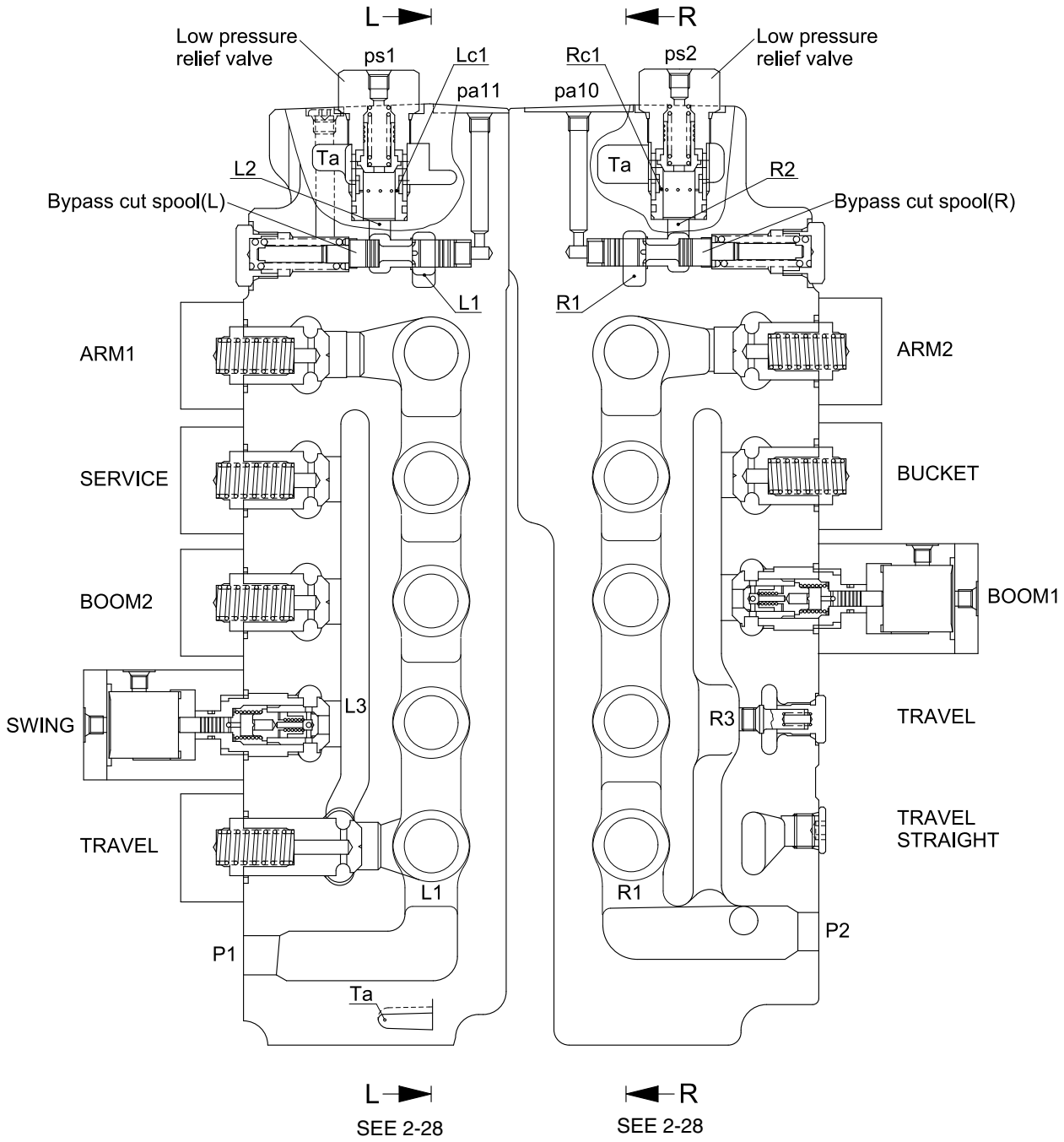
2. HYDRAULIC CIRCUIT



480A2MC15

3. OPERATION

1) ALL SPOOL NEUTRAL



480A2MC16

(1) Neutral passage

① Oil from pump A1 goes through neutral passage (L1) to the orifice (Lc1) of the low pressure relief valve and then oil returns to port T1 and T3 via tank passage (Ta).

② Oil from pump A2 goes through neutral passage (R1) to the orifice (Rc1) of the low pressure relief valve and then oil returns to port T1 and T3 via tank passage (Ta).

③ The pressure of upper chamber (L2), (R2) for the low pressure relief valve flow into pump through port ps1, ps2 and then controls the discharge of pump A1, A2.

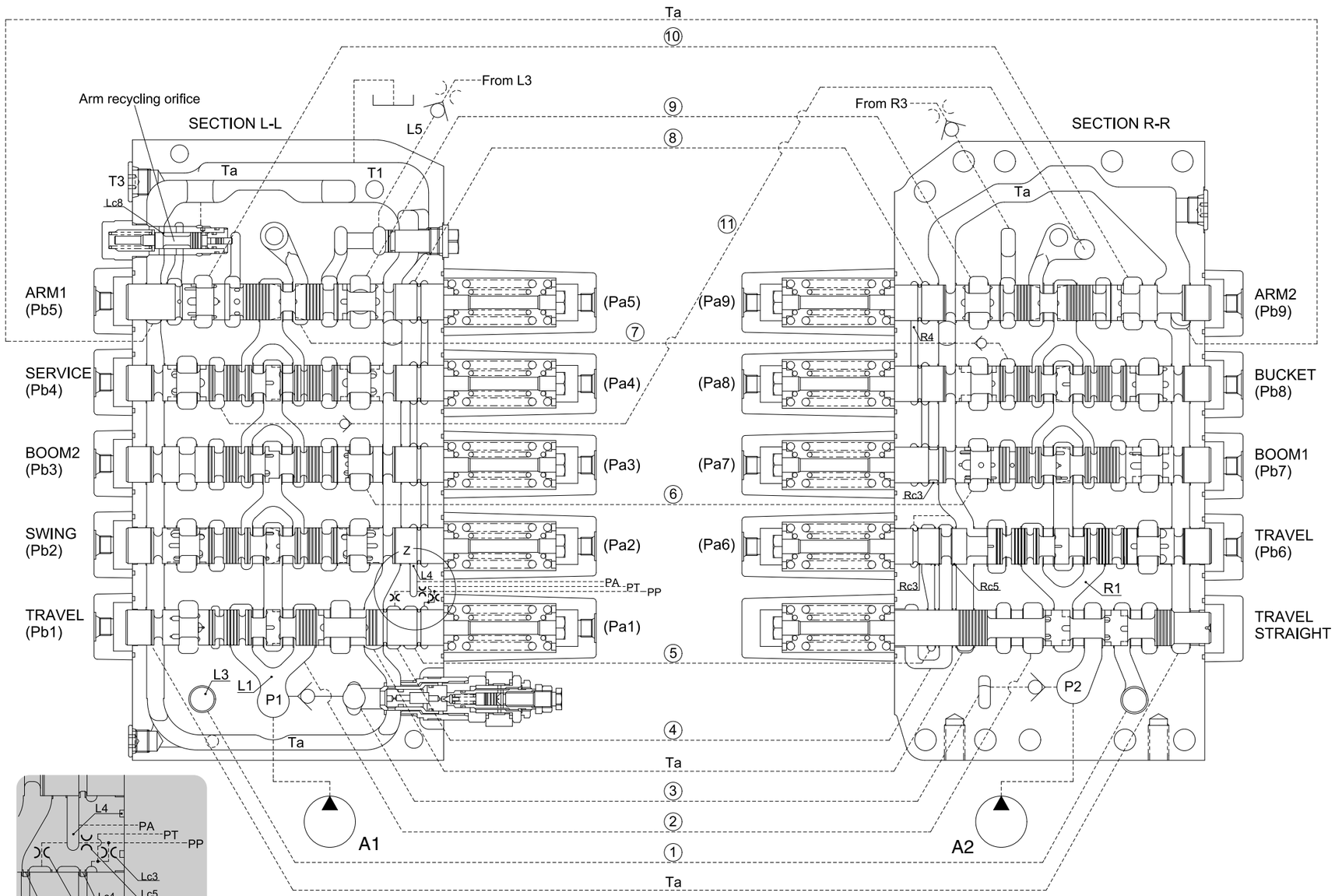
④ When a large amount of oil flows the neutral passage, the low pressure relief valves is operated. As a result, the shock pressure of port ps1, ps2 is prevented.

(2) Signal passage

① Oil from port PP flows into port PT via orifice (Lc3). At the same time, after passing through passage (⑤) via land (Lc4), oil returns to the tank passage (Ta) via land (Rc3).

② Meanwhile, some of oil from port PP flows into port PA via orifice (Lc5) and return to the tank passage (Ta) from boom 1 spool land (Rc4) via passage (L4, ⑧ , R4).

③ Oil via orifice (Lc6) flows into the tank passage (Ta) from land (Lc7) and return to the tank passage (Ta) via travel spool land (Rc5) through the passage ④.



480A2MC17

2) SINGLE OPERATION

(1) Travel spool

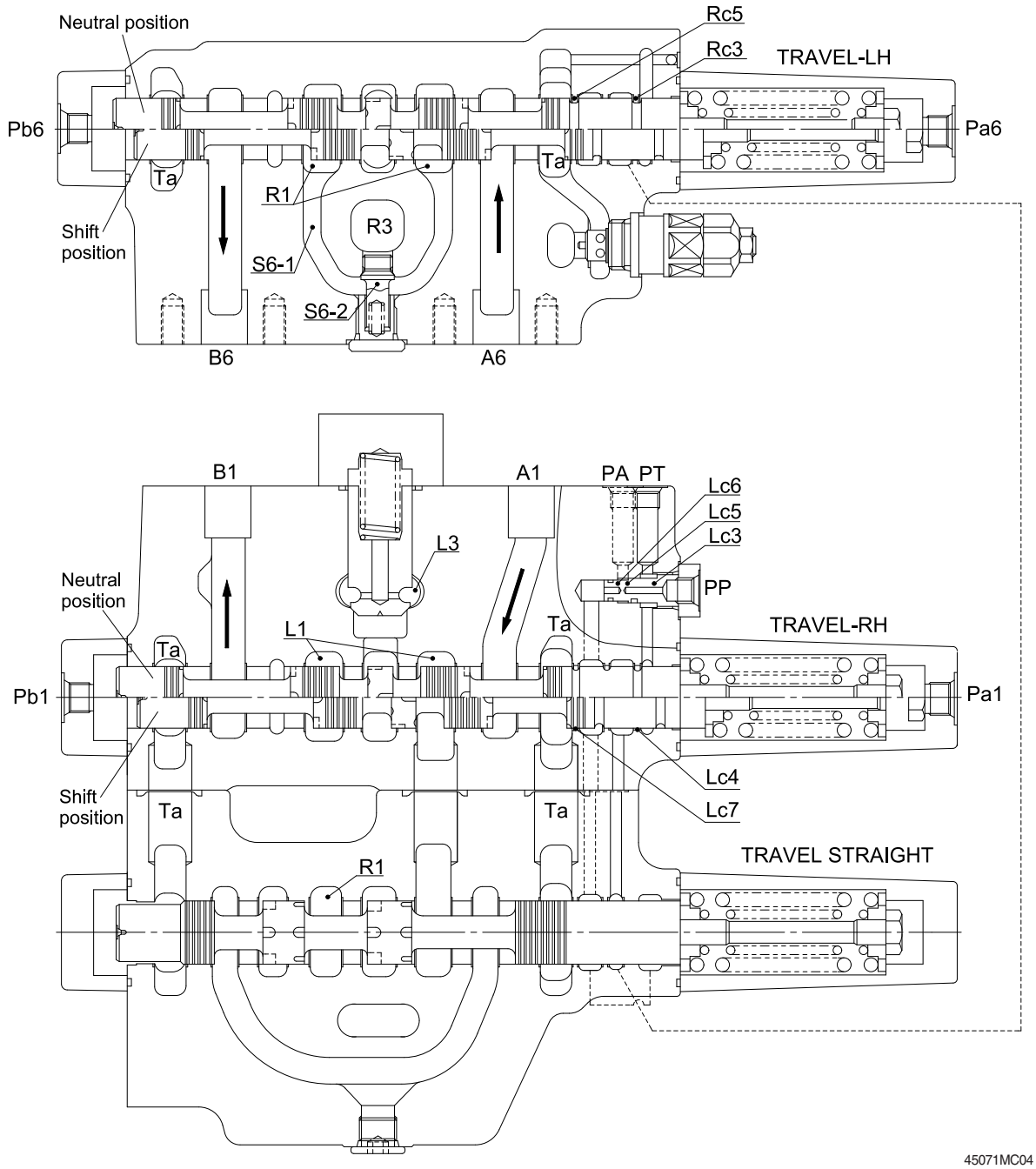
When the RH travel spool is pushed to right by the pilot pressure of port Pb1 the oil discharged from P1 port flows from the neutral passage (L1) to B1 port.

The oil from port A1 return to the tank via the tank passage (Ta).

When the LH travel spool is pushed to right by the pilot pressure of port Pb6 the oil discharged from P2 port flows from the neutral passage (R1) to B6 port through the passage S6-1.

At this time, the parallel passage (R3) and passage (S6-1) are to be maintained as same pressure as poppet (S6-2) is closed. The oil from A6 returns to the tank via the tank passage (Ta).

When the travel spool is pushed to the right by the pilot pressure, the land (Lc4, Rc3) is closed and the tank passage of the oil discharged from port PP is closed, and then the pressure of PT port is increased.

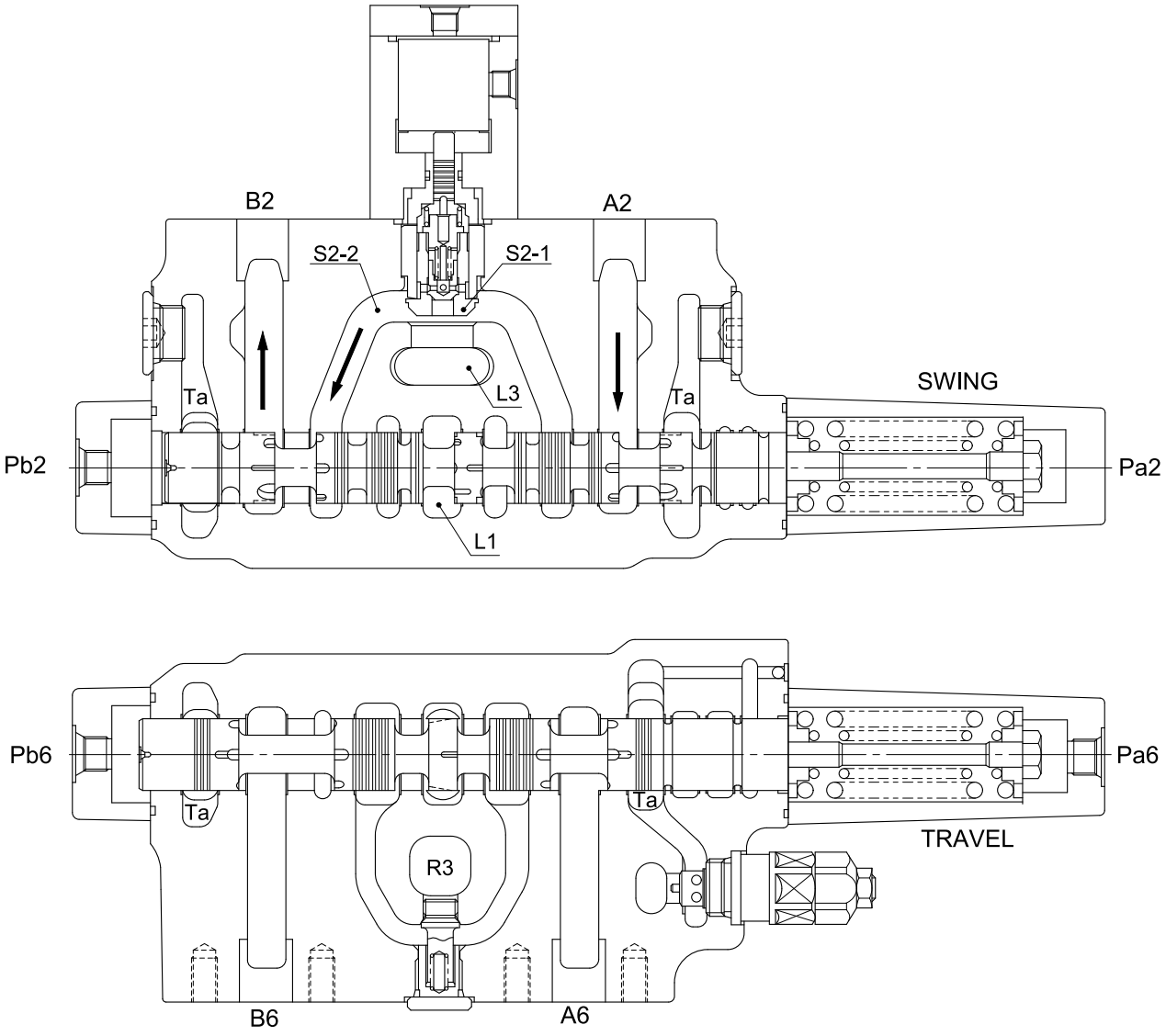


45071MC04

(2) Swing spool

When the swing spool is pushed to the right by the pilot pressure of port Pb2, the neutral passage (L1) is closed, the oil discharged from pump P1 pushes up the load check valve (S2-1), passage (S2-2) via parallel passage (L3) and then flows into port B2.

The oil from port A2 return to the tank via the tank passage (Ta).

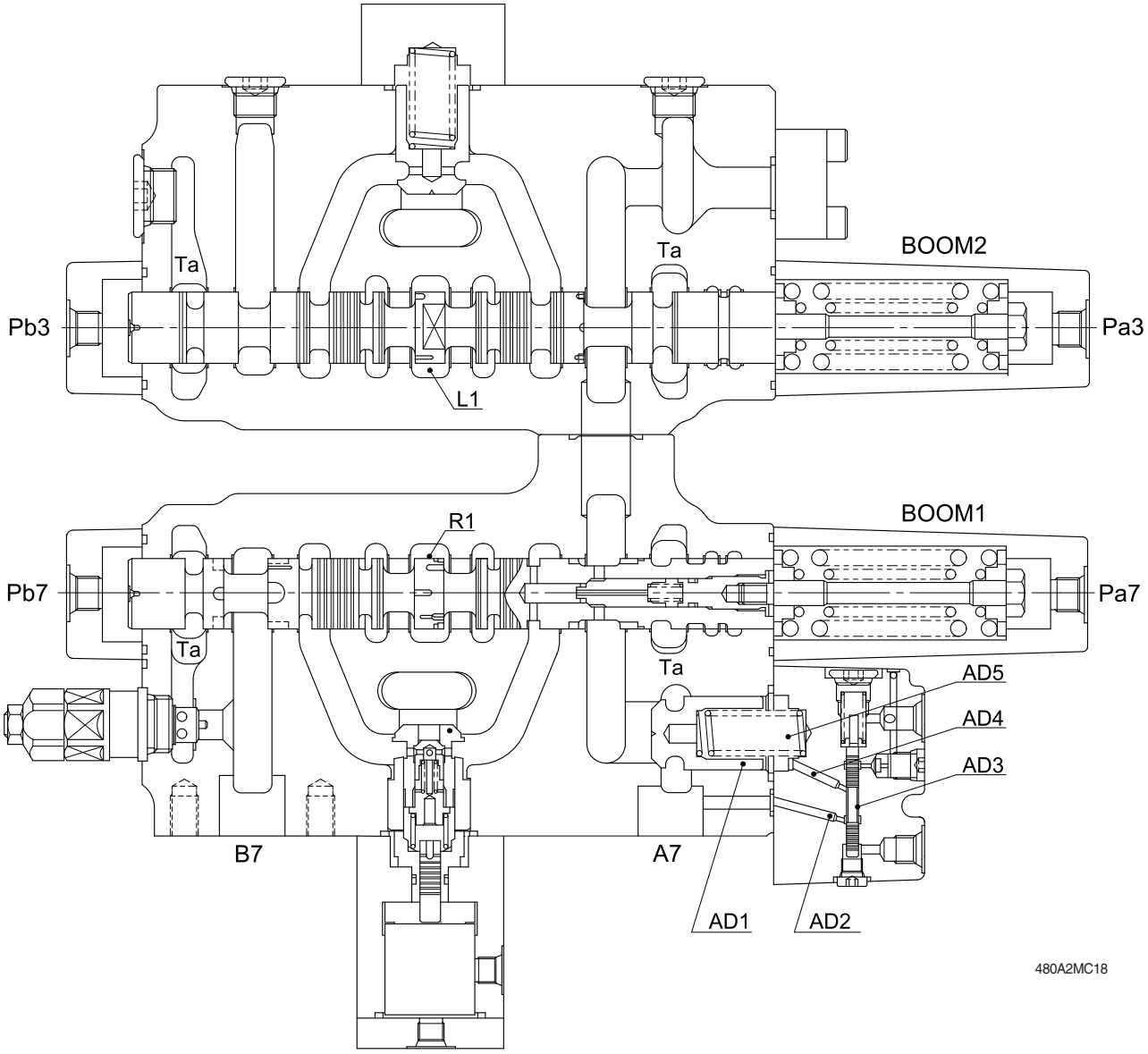


45071MC05

3) BOOM SPOOL

(1) Neutral

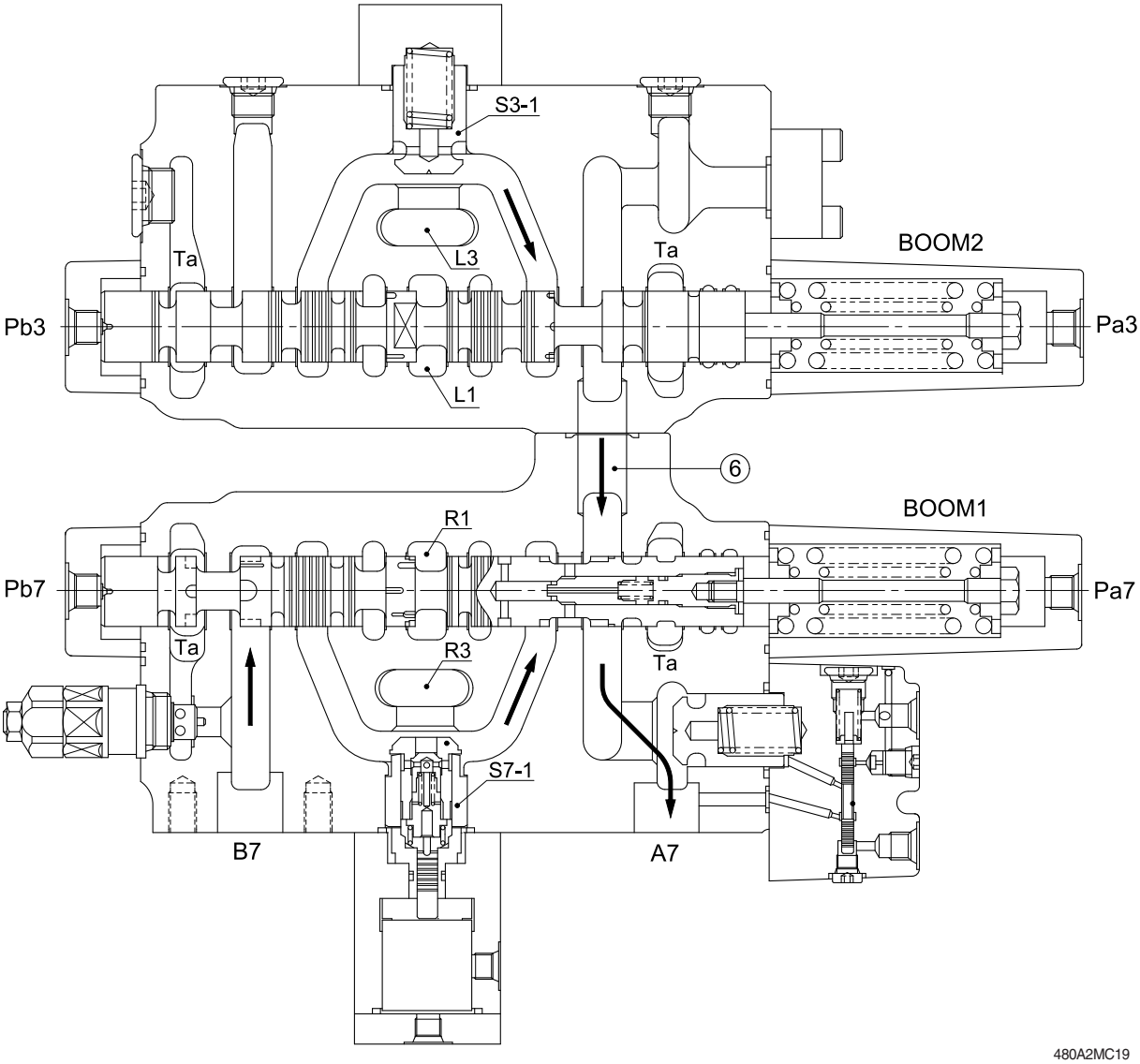
This valve is providing the anti-drift valve on the cylinder bottom side of boom 1 section. In neutral, the poppet (AD1) is seated by the pressure of spring chamber (AD5) because the oil from the port A7 is connection with spring chamber (AD5) via passage (AD2), spool (AD3) and passage (AD4).



(2) Boom up (flow summation)

When the boom 1 spool is pushed to the left by the pilot pressure of port Pa7, the neutral passage (R1) is closed, the oil discharged from pump P2 flows into the port A7 via parallel passage (R3), the load check valve (S7-1). At the same time, the boom 2 spool is pushed to the left by the pilot pressure of port Pa3, the neutral passage (L1) is closed, the oil discharged from pump P1 flows into the port A7 via parallel passage (L3), the load check valve (S3-1) and then joins to the passage (⑥).

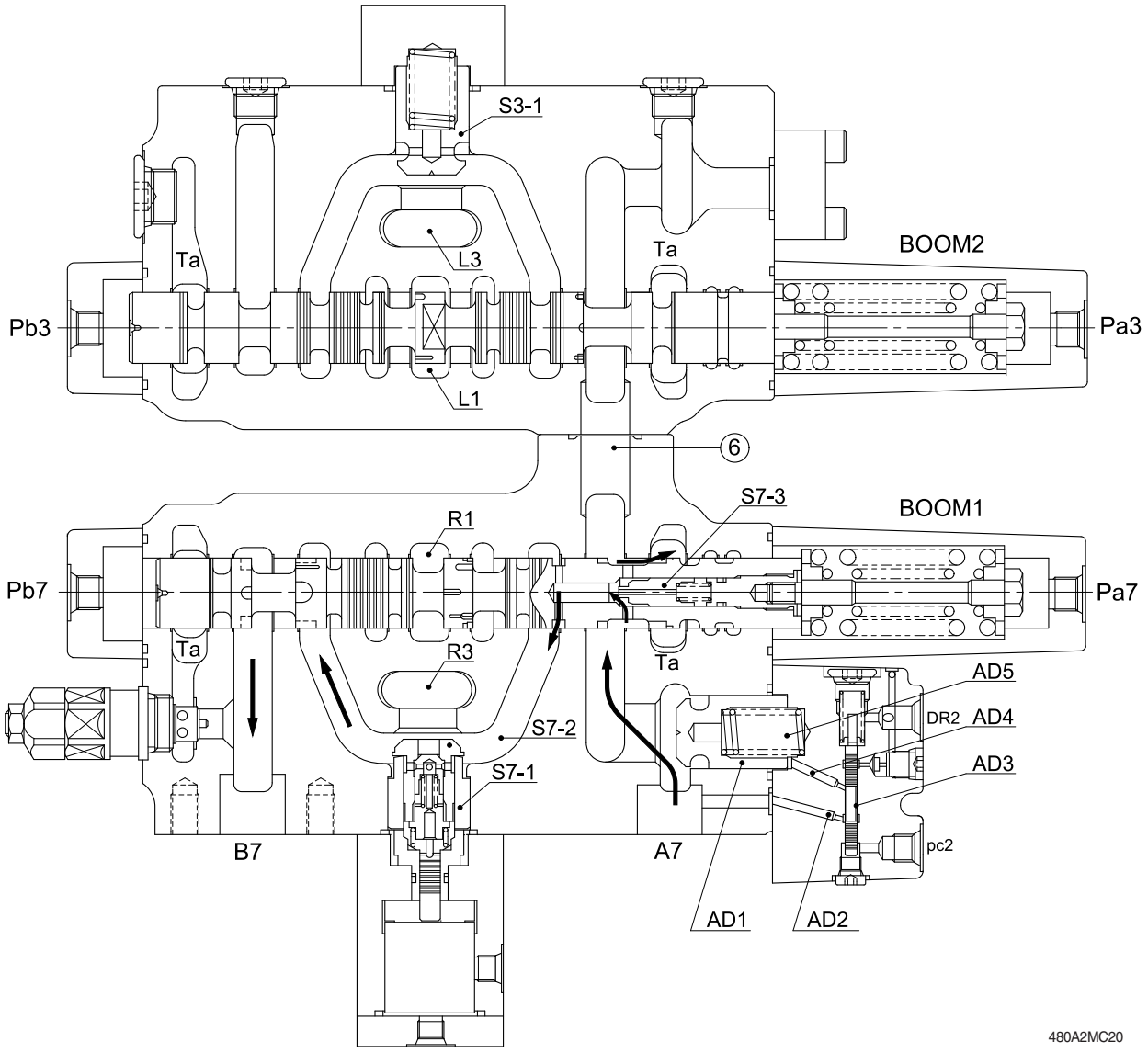
The return oil from port B7 flows into the tank via the tank passage (Ta).



(3) Boom down (recycling)

When the boom 1 spool is pushed to the right by the pilot pressure of port Pb7, the neutral passage (R1) is closed, the oil discharged from pump P2 flows into the port B7 via parallel passage (R3) and the load check valve (S7-1). At the same time, as the port pc2 is pressurizing, the spool (AD3) of anti-drift valve is pushed up, the pressure of spring chamber (AD5) is released and the poppet (AD1) is opened and then the oil from port A7 flows into the tank passage (Ta). Some of returned oil makes the poppet (S7-3) inside boom 1 spool to open and is connected to the passage (S7-2) and flows together into the port B7.

This prevents the cavitation of cylinder rod side.



4) SERVICE SPOOL

When the service spool is pushed to the left by the pilot pressure of port Pb4, the neutral passage (L1) is closed, the oil discharged from pump P1 flows into the port B4 via parallel passage (L3), the load check valve (S4-1) and passage (S4-2).

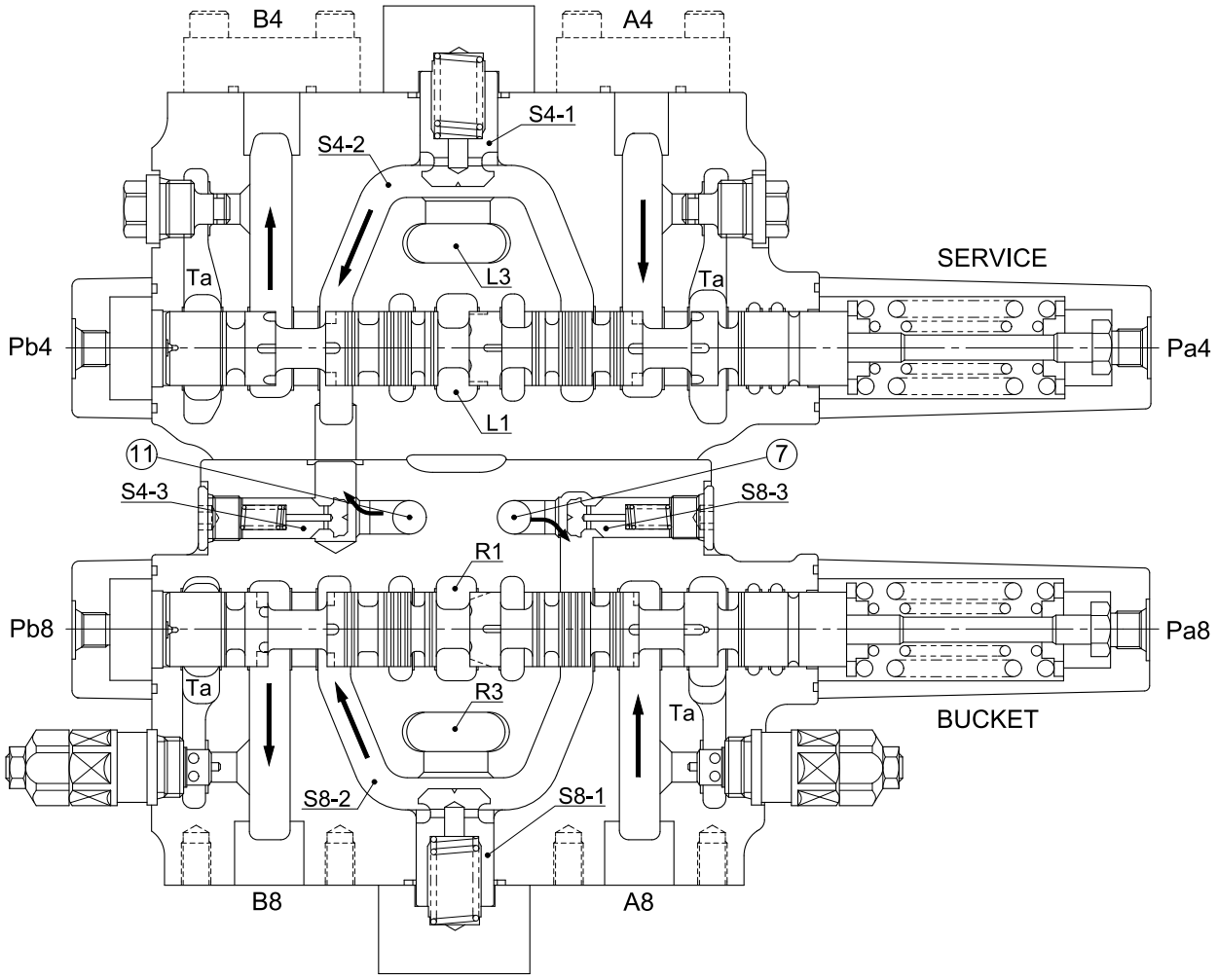
At the same time, as the port pa10 (see 2-24 page) is pressurizing and the bypass cut spool (R) is pushed, the oil discharged from pump P2 flows together into the port B7 via passage (11), poppet (S4-3). The oil returned from port A4 flows into the tank via the tank passage (Ta).

5) BUCKET SPOOL

When the bucket spool is pushed to the left by the pilot pressure of port Pb8, the neutral passage (R1) is closed, the oil discharged from pump P2 flows into the port B8 via parallel passage (R3), the load check valve (S8-1) and passage (S8-2).

At the same time, as the port pa11 is pressurizing and the bypass cut spool (R) is pushed, the oil discharged from pump P1 flows together the passage (S8-2) via passage (7), poppet (S8-3).

The return oil from port A8 flows into the tank via the tank passage (Ta).



45071MC09

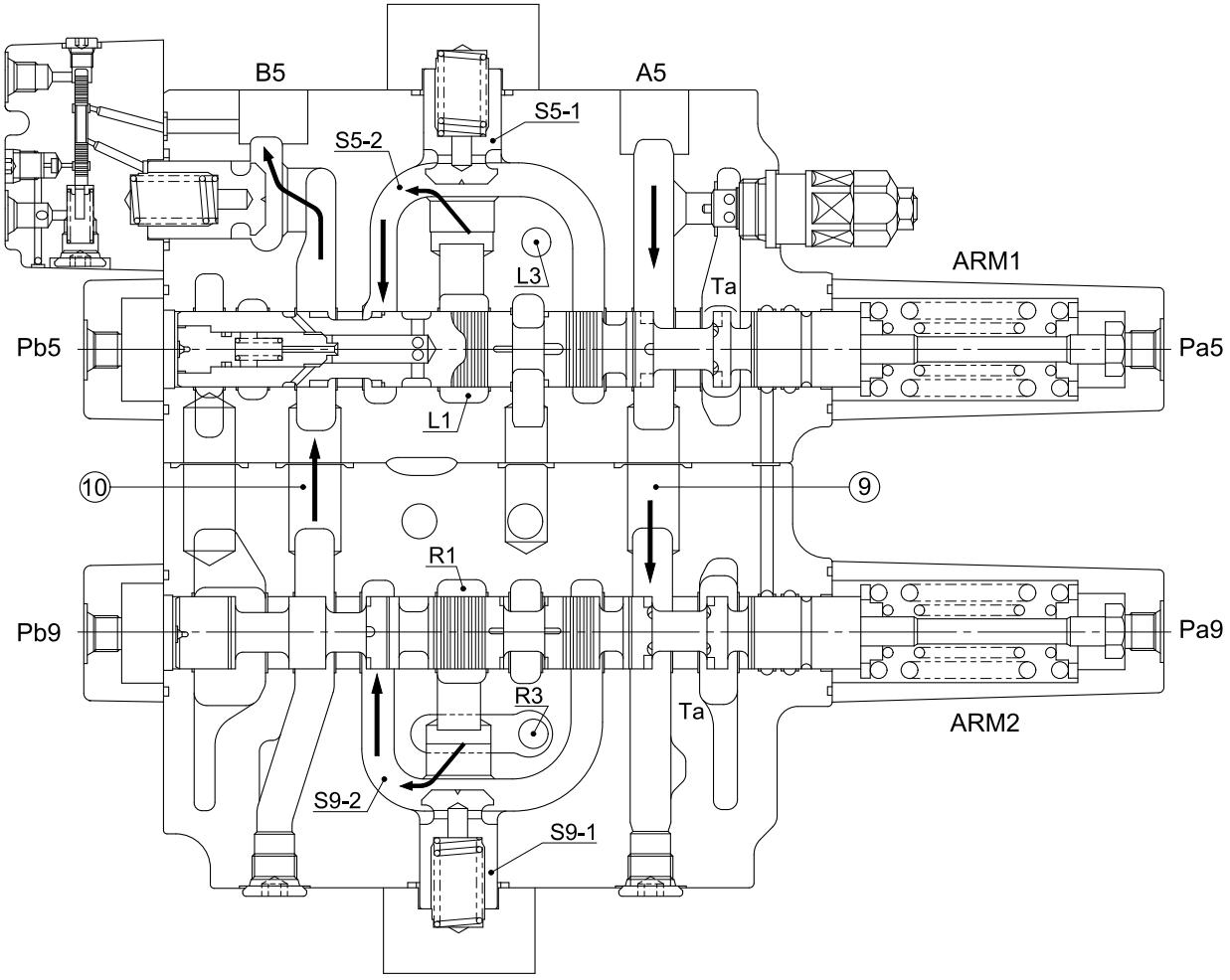
6) ARM SPOOL

(1) Arm out (flow summation)

When the arm 1 spool is pushed to the right by the pilot pressure of port Pb5, the oil discharged from pump P1 flows into the port B5 via neutral passage (L1), the load check valve (S5-1) and passage (S5-2).

When the arm 2 spool is pushed to the right by the pilot pressure of port Pb9, the oil discharged from pump P2 flows together the port B5 the passage (⑩) via the neutral passage (R1), the load check valve (S9-1) and passage (S9-2).

The return oil from port A5 flows into the tank via the tank passage (Ta).



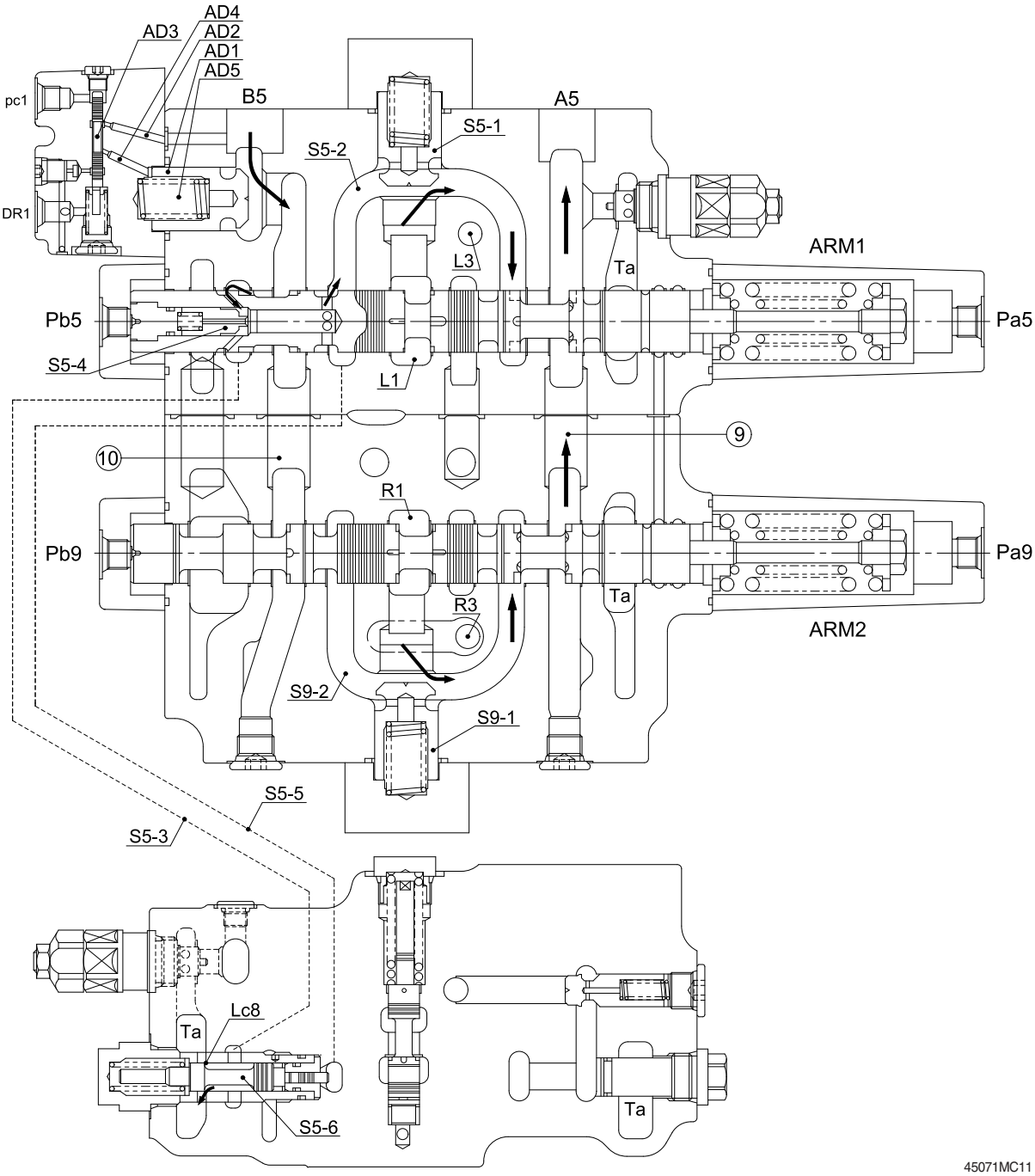
45071MC10

(2) Arm in (flow summation)

When the arm 1 spool is pushed to the left by the pilot pressure of port Pa5, the oil discharged from pump P1 flow into the port A5 via neutral passage (L1), the load check valve (S5-1) and passage (S5-2).

When the arm 2 spool is pushed to the left by the pilot pressure of port Pa9, the oil discharged from pump P2 flows together into the port A5 via neutral passage (R1), the load check valve (S9-1) and passage (S9-2).

At the same time, as the port pc1 is pressurizing and the spool (AD3) of anti-drift valve is pushed down, the pressure of spring chamber (AD5) is released and the poppet (AD1) is opened and then the oil returned from port B5 flows into the tank passage (Ta) through the passage (S5-4) inside arm 1 spool to open and is connected to the passage (S5-2) and flows together into the port A5, the cylinder speed is raised and also is prevents the cavitation of bottom side.

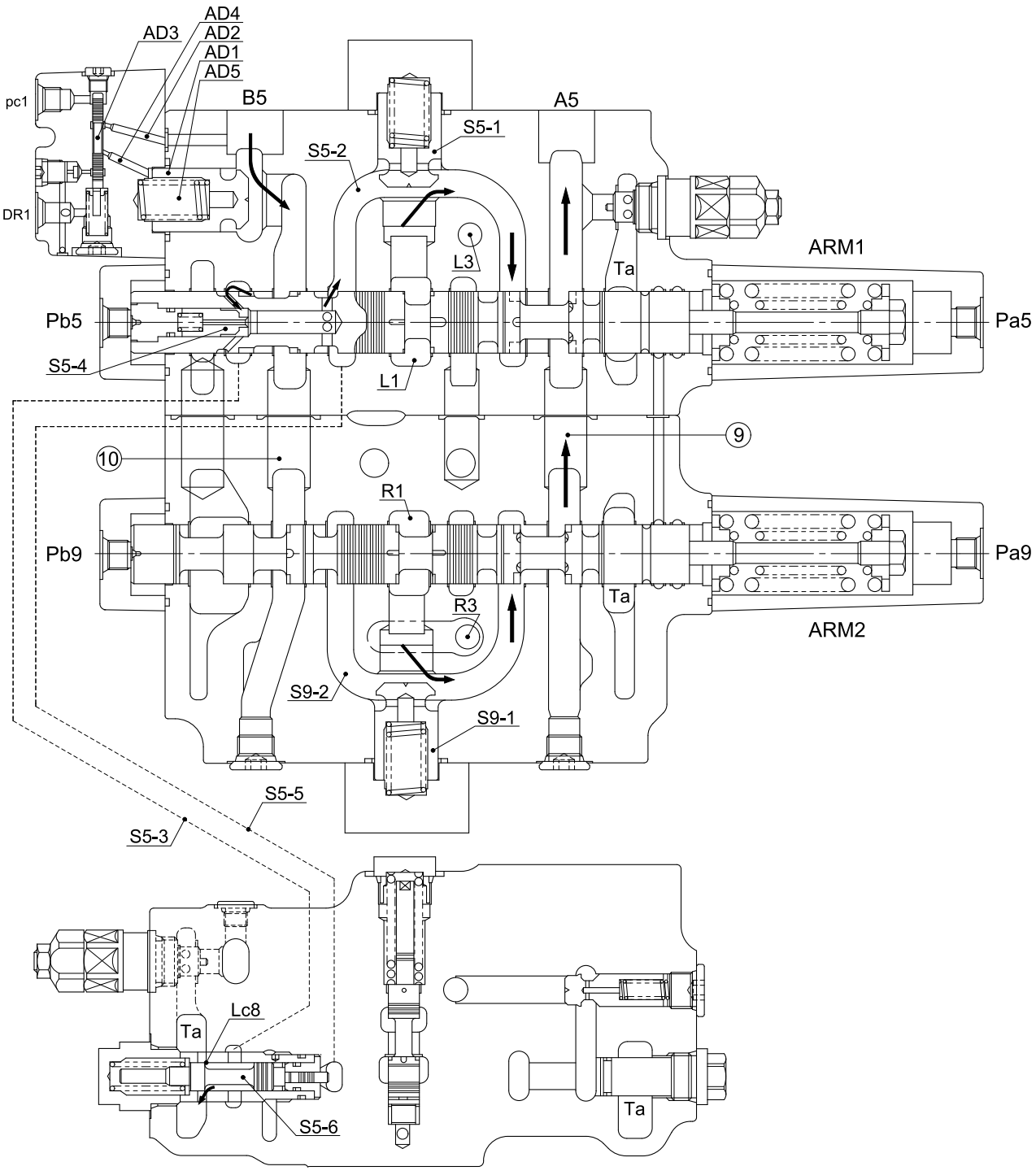


(3) Arm recycling (arm in)

When the arm is at in position, the spool (S5-6) stroke against the passage (S5-2) pressure guided from the passage (S5-5) is changed according to the opening angle of arm recycling orifice (Lc8).

When the pressure of the passage (S5-2) is high and this stroke is increased, the opening angle of orifice (Lc8) become large. On the contrary, when the pressure of passage (S5-2) is low, this stroke is decreased, the opening angle of orifice (Lc8) become small.

Therefore, the flow rate for arm recycling is changed by the pressure in bottom side of arm cylinder.



45071MC11

7) BYPASS CUT SPOOL

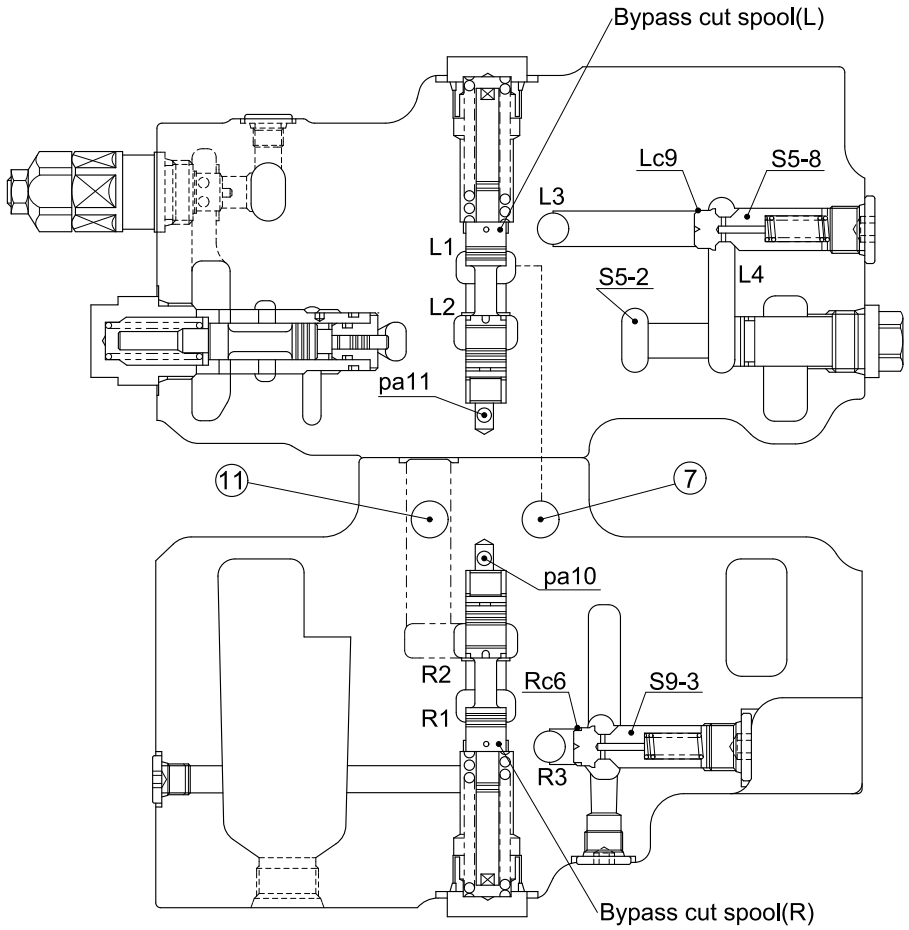
This valve is providing the bypass cut spool at the lowest stream of (upper stream of the low pressure relief valve) the neutral passage (L1, R1).

As the port pa10 (pa11) is pressurizing and the bypass cut spool (L, R) is pushed, the neutral passage (L1, R1) is closed. The oil discharged from port P1 flows together into the passage (S8-2, see 2-32 page) of bucket section via passage (⑦), poppet (S8-3) and the oil discharged from P2 port flows together into the passage (S4-2) of service section via the passage (⑪) and poppet (S4-3, see 2-32 page).

8) PARALLEL ORIFICE FOR ARM

The arm 1 and arm 2 section of this valve has orifices in the parallel circuit for arm. These orifices controls the speed of arm at combined operation.

The parallel circuit of arm 2 section is connected to the passage (S9-2, see 2-34) through orifice (Rc6) in the edge of the poppet (S9-3) from the parallel passage (R3), the parallel circuit of arm 1 section is connected to the passage (S5-2, see 2-34) through orifice (Lc9) in the edge of the poppet (S5-8) from the parallel passage (L3).



45071MC12

9) RELIEF VALVE

(1) Main relief valve

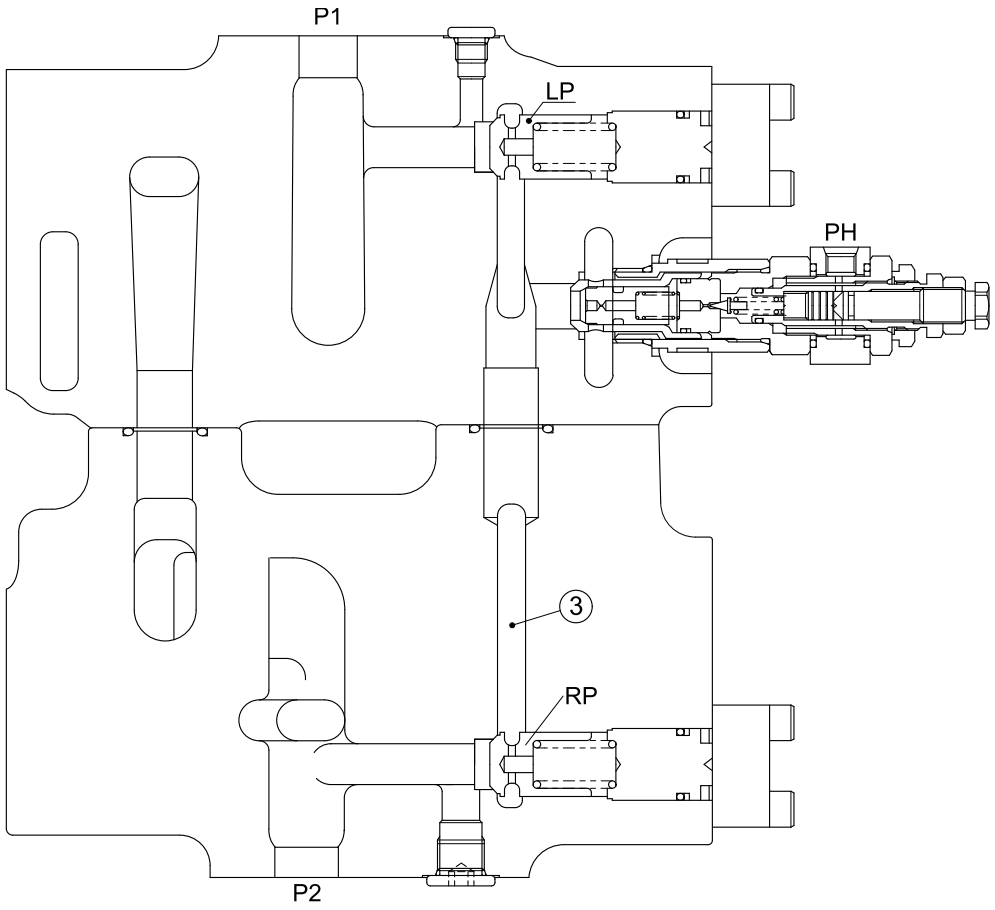
The oil discharged from P1 port via the poppet (LP) and the oil discharged from P2 port via the poppet (RP) flow into the main relief valve through the passage (3).

When the main relief valve is operating, the maximum pressure of pump P1, P2 is controlled.

(2) Overload relief valve

Overload relief valves are provided each cylinder ports of boom1, arm1 and bucket. These prevents the abnormal high pressure of actuators by external force.

Also, when the pressure of cylinder ports create back pressure, this valve opens allowing oil from tank to cylinder port; and then prevents cavitation.

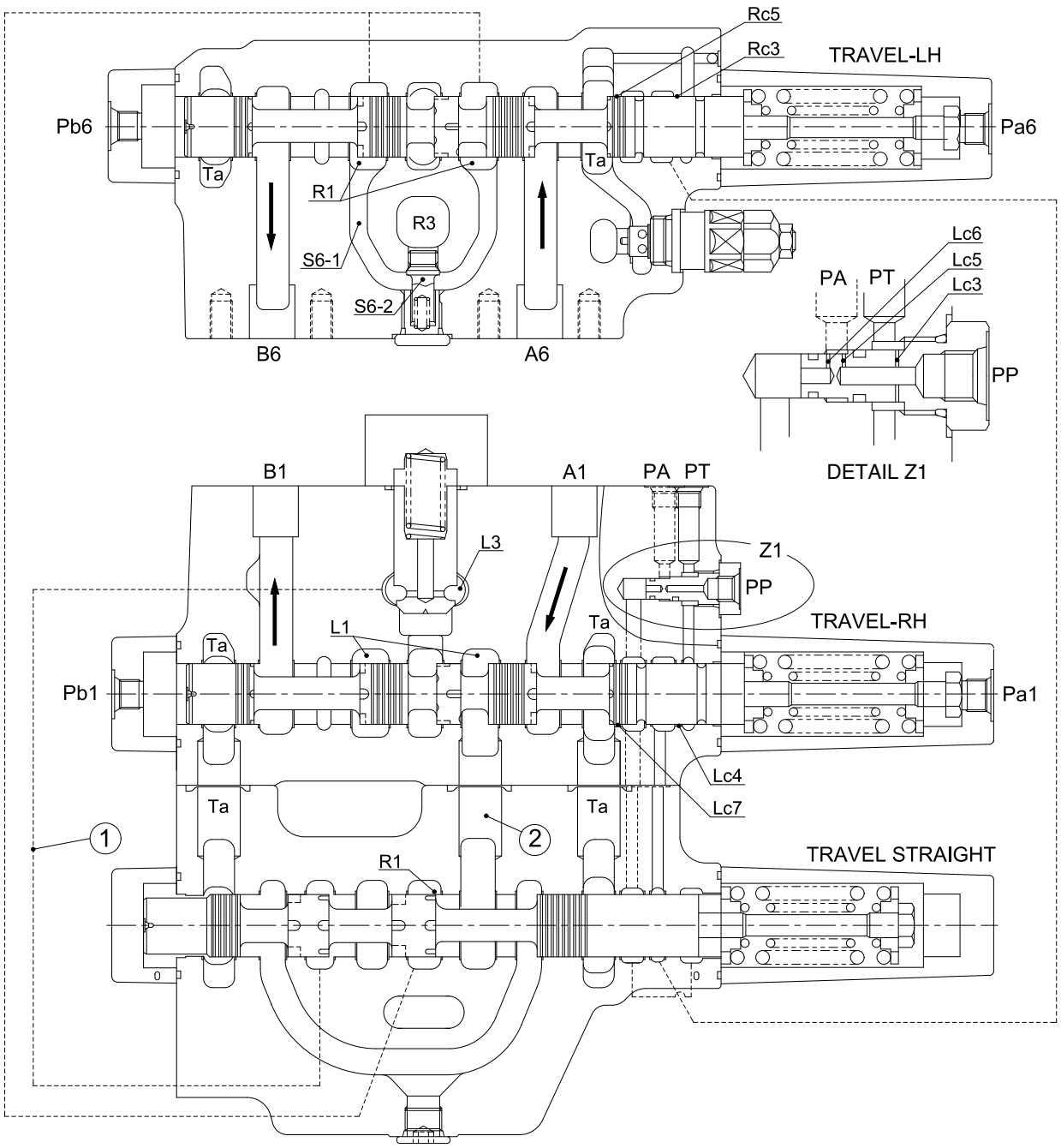


45071MC13

4. COMBINED OPERATION

1) TRAVEL COMBINED OPERATION

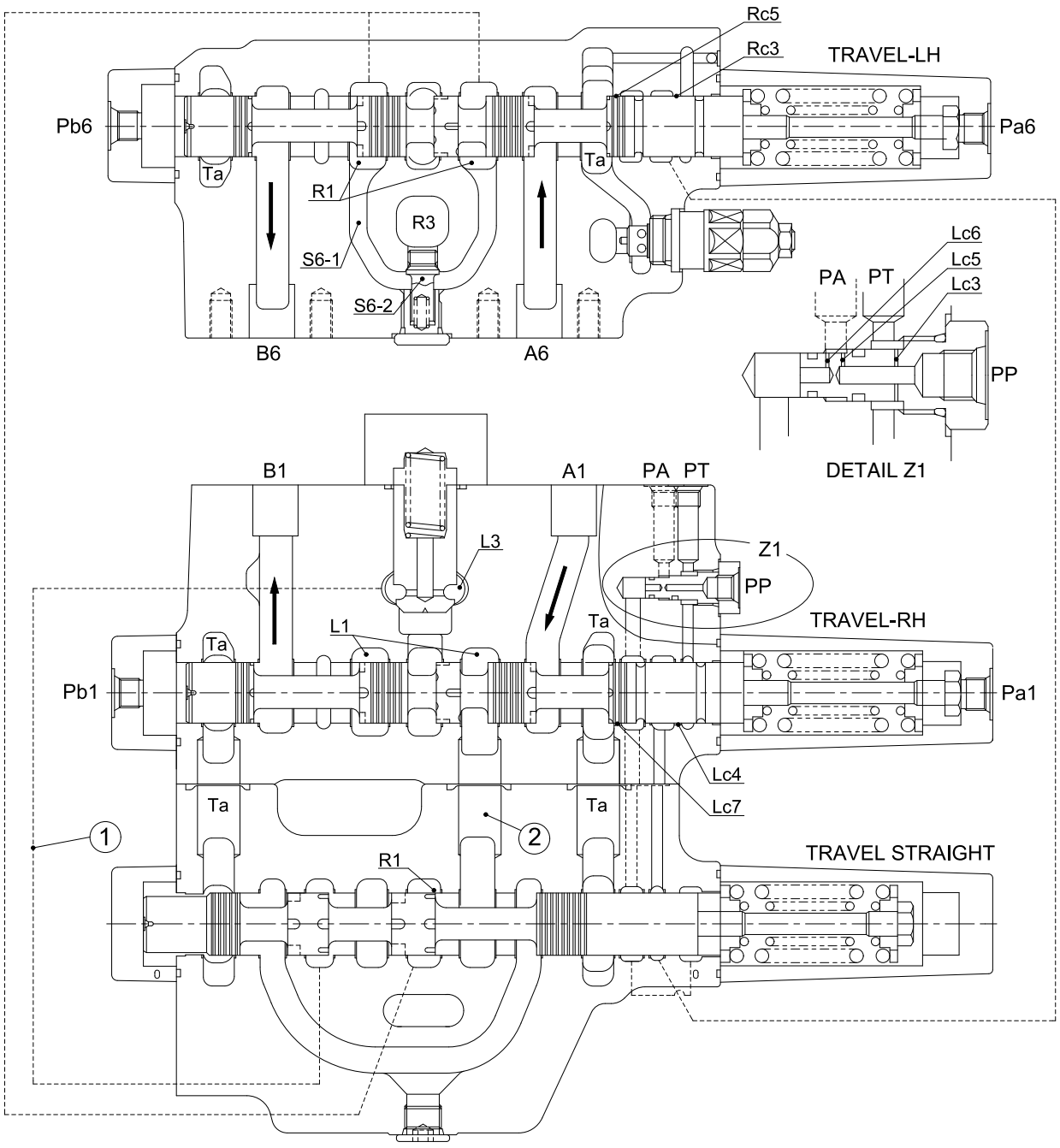
① While travel (forward, reverse and pivot turn) and front attachment (except travel section) functions are operated, the oil discharged from port PP is cut via land (Lc4, Lc7, Rc3, Rc5) and blocked from signal land except travel section to tank passage (Ta), the pressure of signal passage rises to the relief setting pressure of pilot pump and the straight travel spool is pushed to the left by raising of signal pressure and also, the pressure of port PT, PA port rises.



480A2MC21

② When the straight travel spool is operated, the oil discharged from port P1 flows into RH travel section through the neutral passage (L1) and also flows into LH travel section via the neutral passage (R1) and passage (②). The oil discharged from port P2 flows into the parallel passage (L3) via passage (①).

③ In case the load pressure of the section except travel is higher than that of the RH travel section, the partial oil of discharged from port P2 pushes open the poppet (S6-2) and flows together into the passage (S6-1) through the orifice at the edge of poppet. The travel (LH, RH) is operated by the discharged oil from port P1 and the other actuators are operated by the discharged oil from port P2. Thus, when travel and front attachment functions are operated simultaneously, keeps the straight travel.

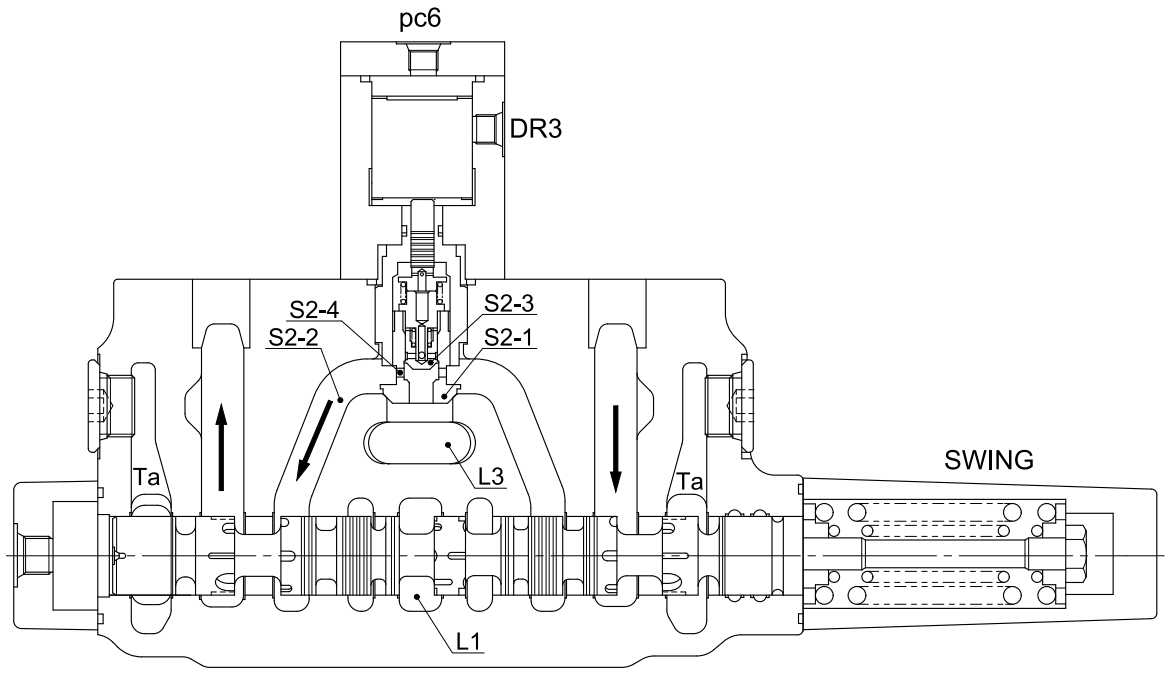


480A2MC21

2) SWING COMBINED OPERATION

When swing and boom up functions are operated, the poppet (S2-1) is seated by pressure of port pc6 and the poppet (S2-3) only opened and the supply pressure of the parallel passage (L3) is rises by orifice (S2-4).

As a result, boom and swing simultaneous operation is ensured even if lower load of swing section.



45071MC15

5. ANTI-DRIFT VALVE

The anti-drift valve is provided the boom bottom and arm rod side of cylinder port for prevention of self drifting by boom weight or bucket loads.

1) WHEN NEUTRAL

The oil from cylinder port flows into spring chamber (AD5) via passage (AD2), the around of spool (AD3) and passage (AD4).

Because of the difference of poppet area and spring force, the poppet (AD1) is seated certainly.

2) WHEN BOOM UP OR ARM OUT

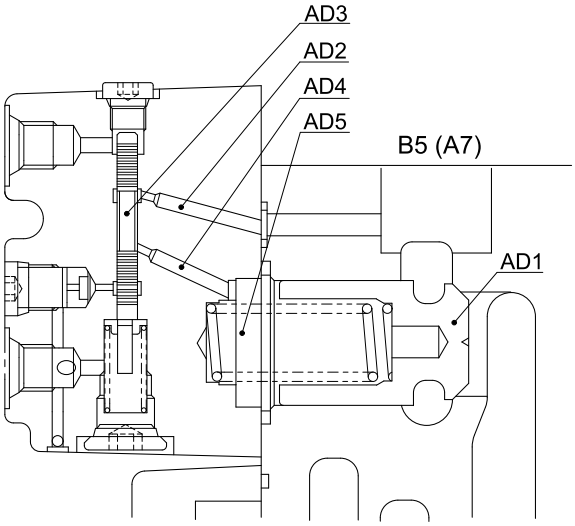
The oil from pump flows into cylinder by pushes open the poppet (AD1).

3) WHEN BOOM DOWN OR ARM IN

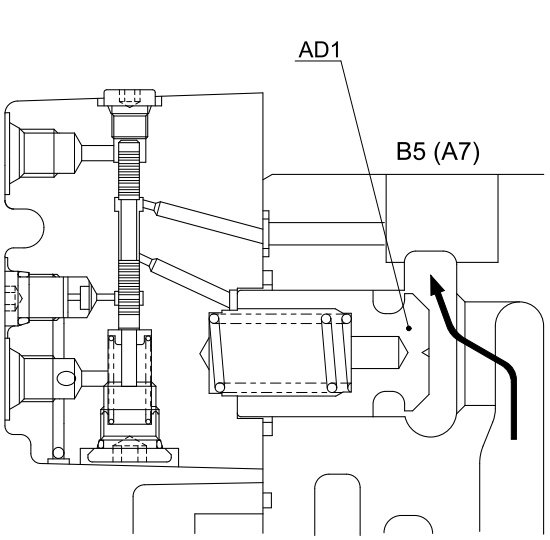
The spool (AD3) is pushed down by the pressure of pc1 (pc2).

Then the oil of spring chamber (AD5) flows into the drain port DR1 (DR2) and pushes open the poppet (AD1).

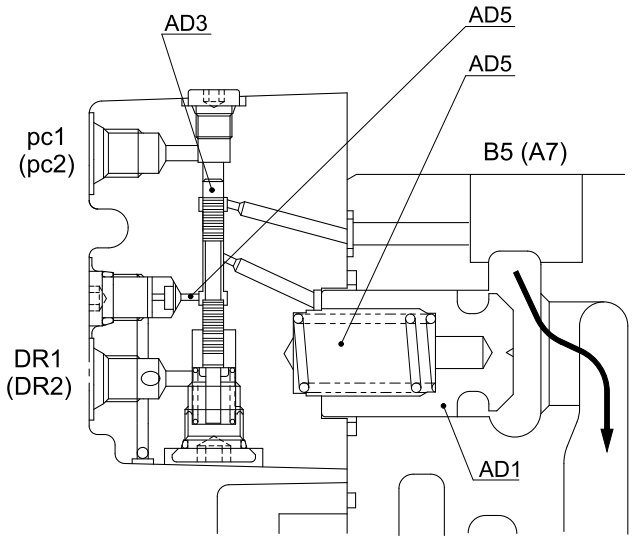
As a result, the oil from the cylinder port returns to tank passage (Ta).



NEUTRAL



ARM OUT
(BOOM UP)



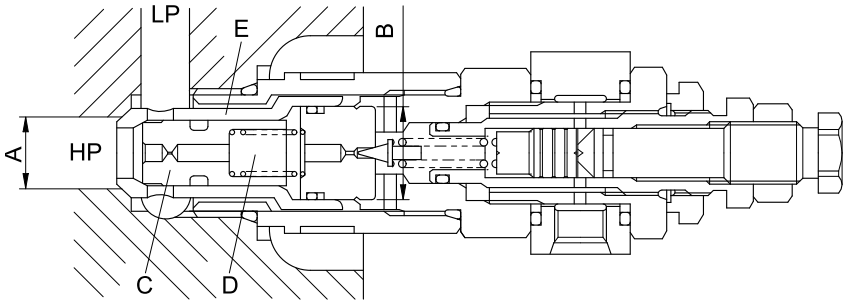
ARM IN
(BOOM DOWN)

45071MC16

6. RELIEF VALVE OPERATION

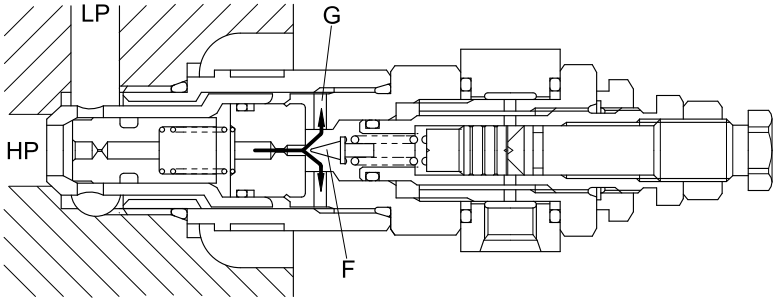
1) MAIN RELIEF VALVE

(1) This relief valve is built-in between the neutral passage (HP) and low pressure passage (LP), and the pressure oil fills up chamber (D) inside via orifice of main poppet (C).
Thus the sleeve (E) and the main poppet (C) are securely seated by difference area of A an B.



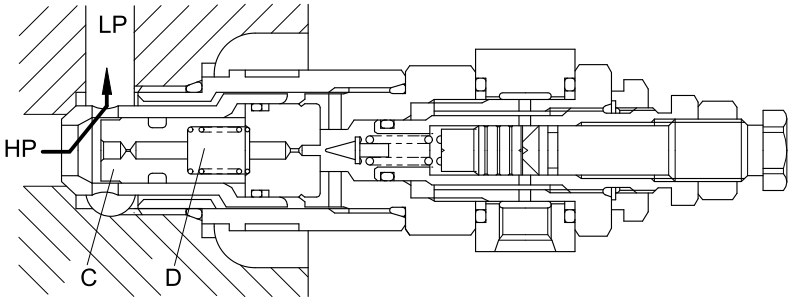
45071MC17

(2) When the pressure in neutral passage (HP) reaches the setting force of spring, pilot poppet (F) is opened. The oil flows around poppet and into the low pressure passage(LP) via hole(G).



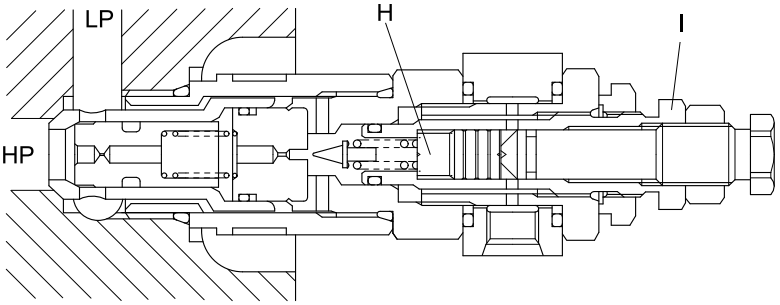
45071MC17-1

(3) When above flow is formed, the pilot poppet is opened; the pressure of chamber (D) drops, the main poppet (C) is opened and then the oil directly flows into the low pressure passage (LP).



45071MC17-2

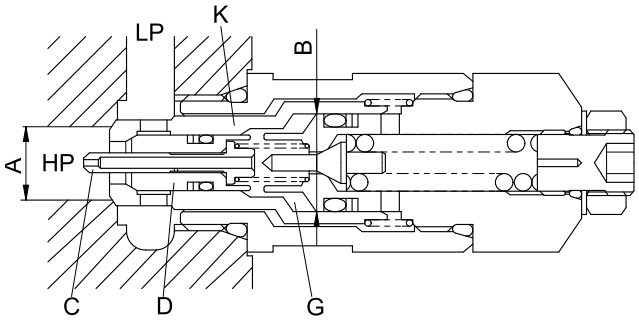
(4) High pressure setting pilot signal (Pi) : ON
The piston (H) moves to left by pilot pressure (Pi); set pressure of spring rises, making high pressure setting.



45071MC17-3

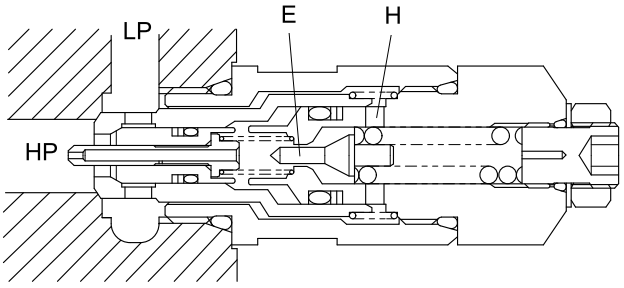
2) OVERLOAD RELIEF VALVE

(1) This relief valve is built-in the cylinder port (HP) and the low pressure (LP), and the pressure oil fills up camber (G) inside via hole of piston (C).
Thus the sleeve (K) and the main poppet (D) are securely seated by difference area of A and B.



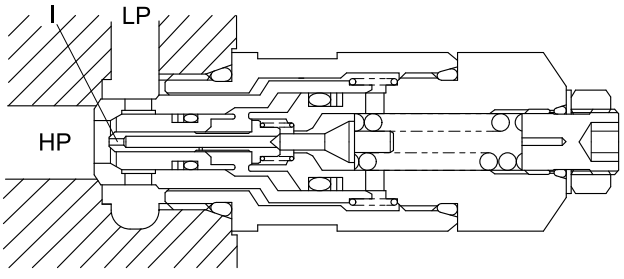
45071MC18

(2) When the pressure in cylinder port (HP) reaches the setting force of spring, the pilot poppet (E) is opened.
The oil flows around poppet and into the low pressure passage (LP) via hole (H).



45071MC18-1

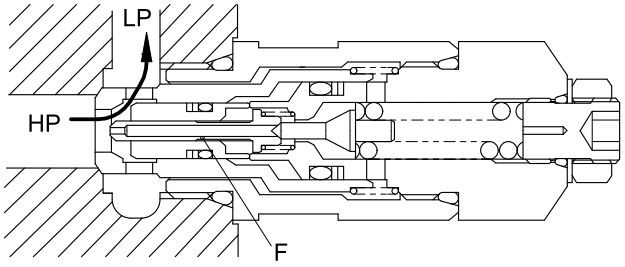
(3) When above flow is formed, the pilot poppet (E) is opened.
The pressure drops before and behind orifice (I); piston (C) moves to right and the piston (C) is seated at the tip of poppet (E).



45071MC18-2

(4) The oil flow from the high pressure passage (HP) to the poppet (D) behind is only around poppet and orifice (F); then the high pressure passage (HP) is higher than the poppet (D)behind pressure.

Thus the poppet (D) is pushed open and the oil directly flows into low pressure passage (LP).

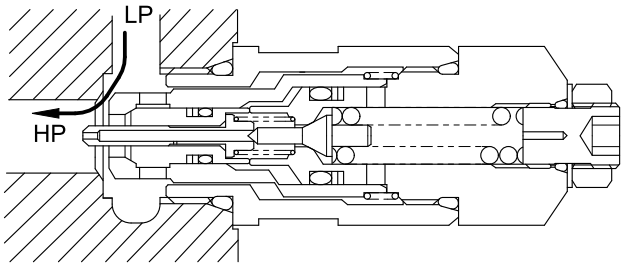


45071MC18-3

(5) Make up operation

This relief valve is built-in the cylinder port (HP) and the low pressure passage (LP), and the pressure oil fills up camber (G) inside via hole of piston (C).

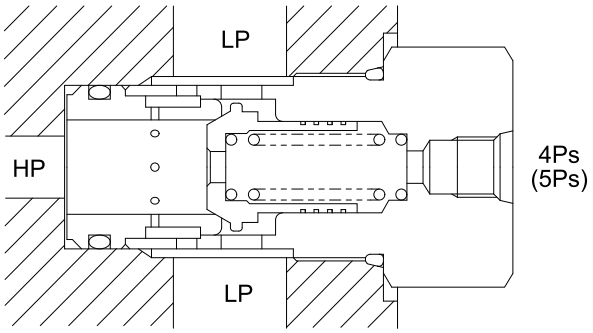
Thus the sleeve (K) and the main poppet (D) are securely seated by difference area of A and B.



45071MC18-4

3) LOW PRESSURE RELIEF VALVE

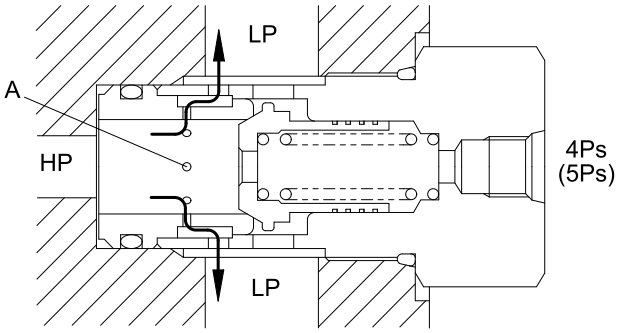
(1) When pump does not operational



45071MC19

(2) When spool neutral

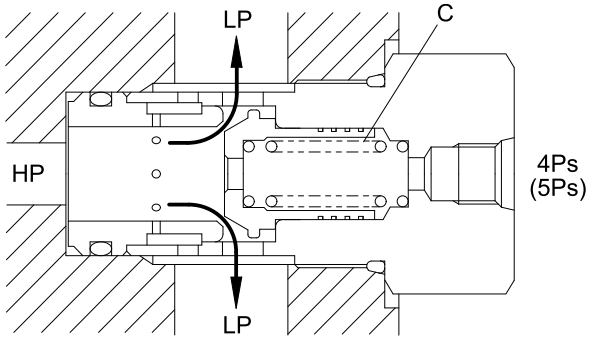
The neutral passage (HP) oil flows into the low pressure passage (LP) via signal orifice (S).
The signal port 4Ps (5Ps) pressure is raise by negative control orifice (A).



45071MC19-1

(3) Operation of low pressure relief

When the oil pressure neutral passage (HP) reaches the setting force of spring, the poppet is pushes open; the oil directly flows through passage (HP) to passage (LP) in order to prevent abnormal pressure.



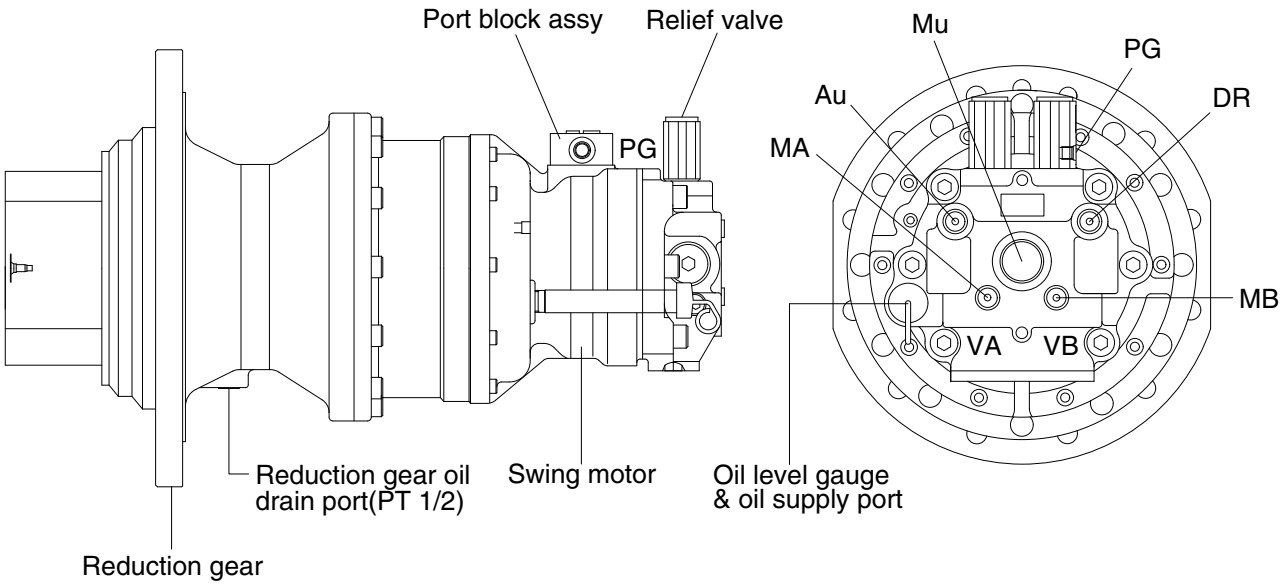
45071MC19-2

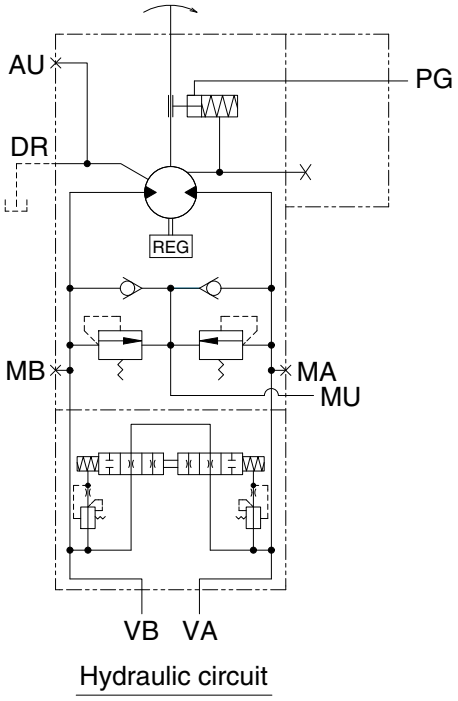
GROUP 3 SWING DEVICE

1. STRUCTURE

Swing device consists swing motor, swing reduction gear.

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



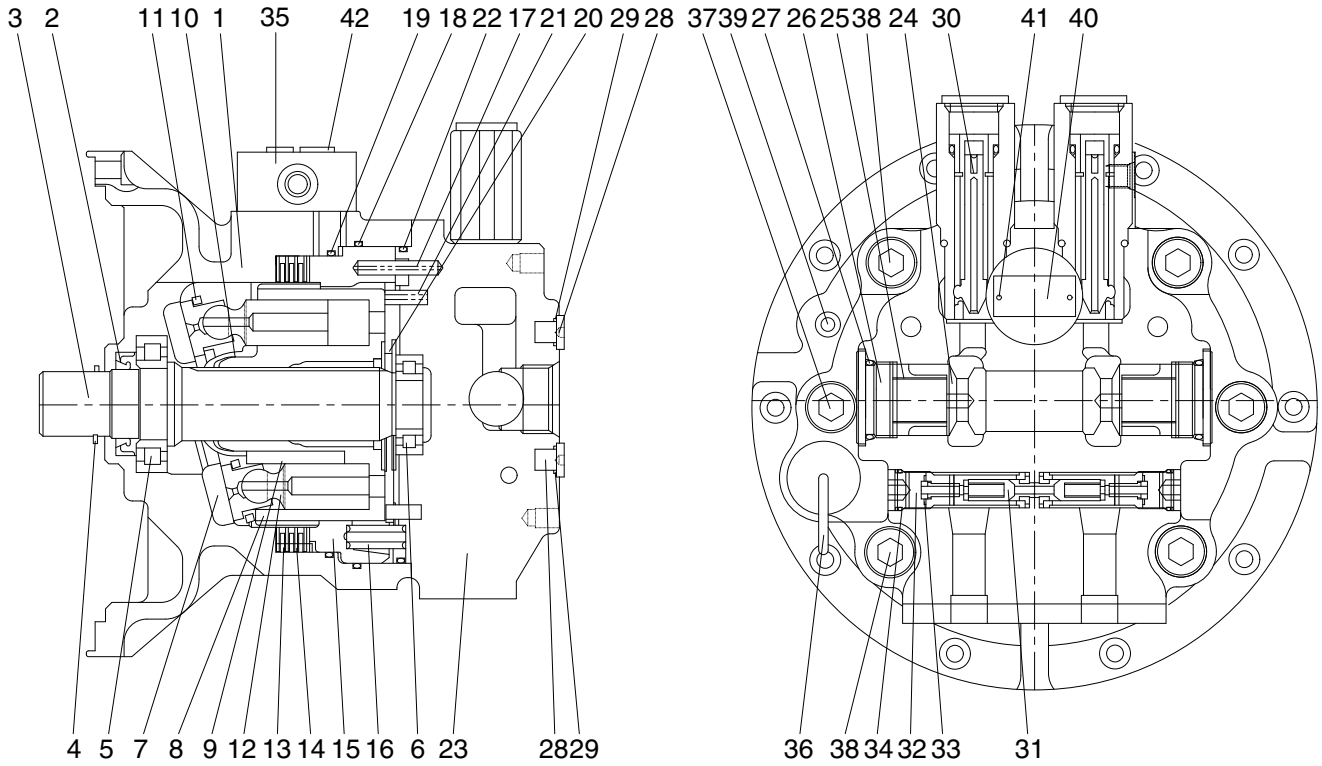


Hydraulic circuit

480A2SM01

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

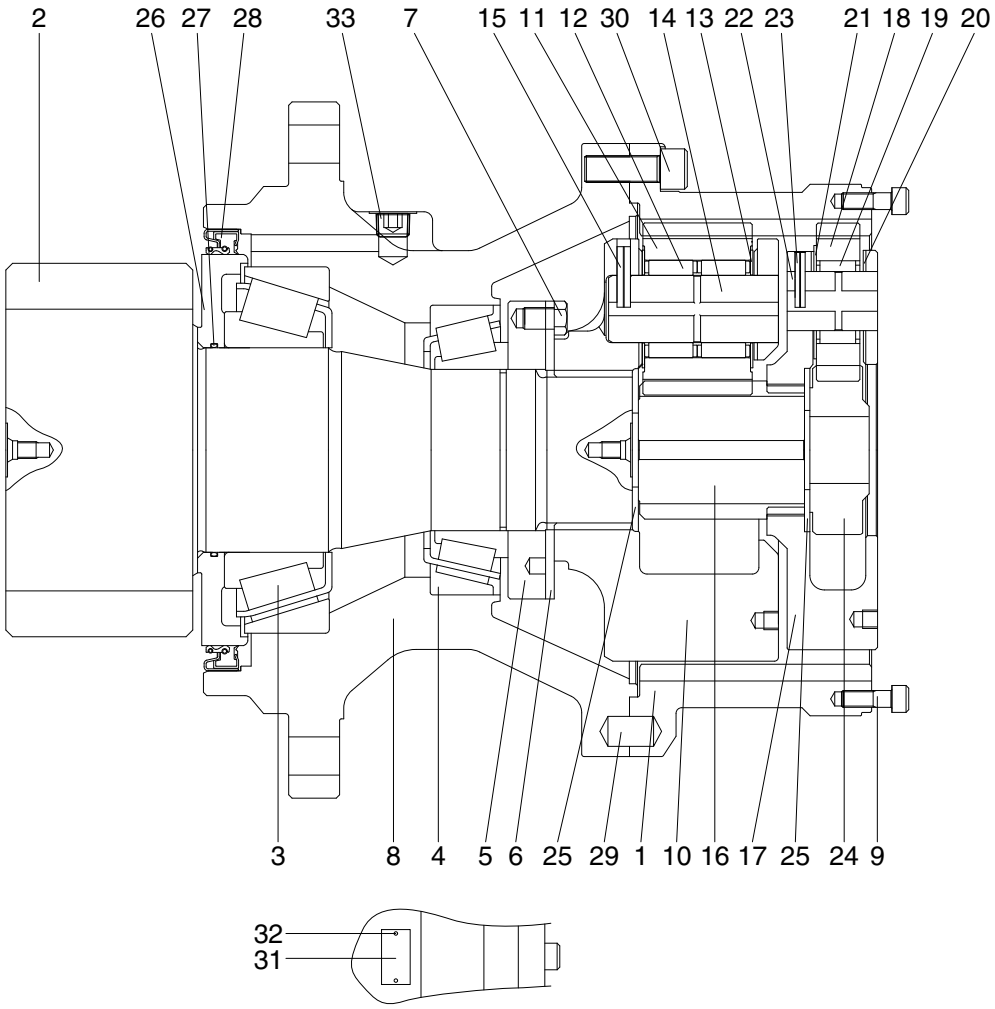
1) SWING MOTOR



480A2SM02

1	Casing	15	Parking piston	29	O-ring
2	Oil seal	16	Spring	30	Relief valve assy
3	Shaft	17	Spring pin	31	Anti-rotating valve assy
4	Retainer 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	Rotary block	22	O-ring	36	Level gauge assy
9	Spring	23	Valve casing	37	Hexagon socket head bolt
10	Ball guide	24	Check valve	38	Hexagon socket head bolt
11	Retainer plate	25	Spring	39	Plug
12	Piston & shoe	26	Plug	40	Name plate
13	Friction plate	27	O-ring	41	Rivet
14	Separate plate	28	Plug	42	Hex socket head bolt

2) REDUCTION GEAR



480F2SM03

1	Ring gear	12	Needle bearing	23	Spring pin
2	Drive shaft	13	Thrust washer	24	Sun gear No. 1
3	Taper roller bearing	14	Carrier pin No. 2	25	Thrust plate
4	Taper roller bearing	15	Spring pin	26	Sleeve
5	Ring nut	16	Sun gear No. 2	27	O-ring
6	Lock plate	17	Carrier No. 1	28	Oil seal
7	Hexagon head bolt	18	Planetary gear No. 1	29	Parallel pin
8	Casing	19	Needle bearing	30	Hexagon socket head bolt
9	Hexagon socket head bolt	20	Thrust washer-upper	31	Name plate
10	Carrier No. 2	21	Thrust washer-lower	32	Rivet
11	Planetary gear No. 2	22	Carrier pin No. 1	33	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 (1) of motor, and valve plate (20).

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

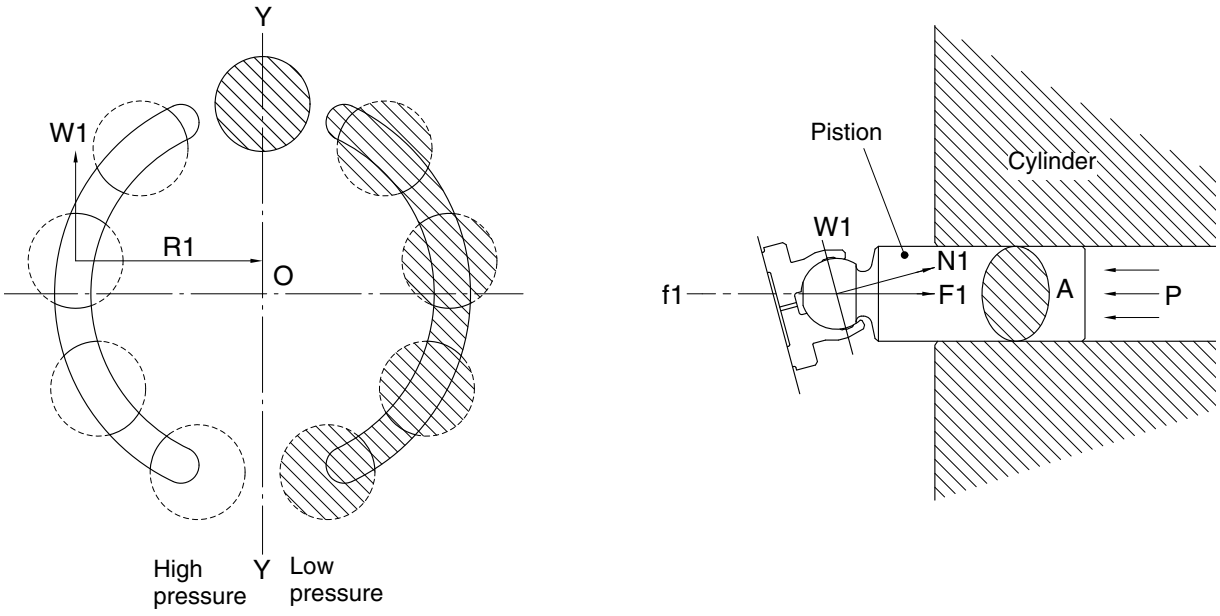
The high hydraulic can generate the force, F1=P×A (P : supplied pressure, A : water pressure area), like following pictures, working on a piston.

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

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

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

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



21078TM05

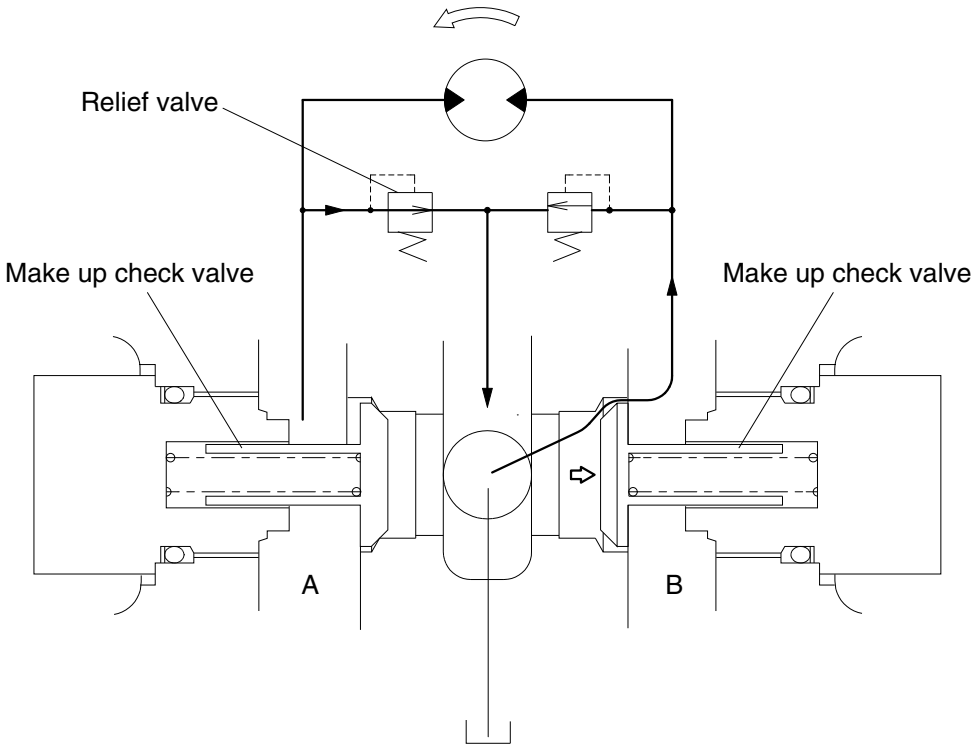
2) MAKE UP VALVE

In the system using this type of motor, there is no counter balance functioning valve and there happens the case of revolution exceeding hydraulic supply of motor. To prevent the cavitation caused by insufficient oil flow there is a make up valve to fill up the oil insufficiency.

A make up valve is provided immediately before the port leading to the hydraulic oil tank to secure feed pressure required when the hydraulic motor makes a pumping action. The boost pressure acts on the hydraulic motor's feed port via the make up valve.

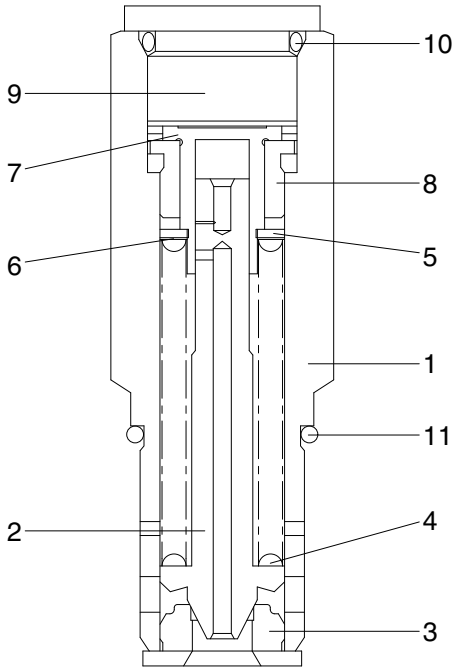
Pressurized oil into the port B, the motor rotate counterclockwise.

If the plunger of MCV moves neutral position, the oil in the motor is drain via left relief valve, the drain oil run into motor via right make up valve, which prevent the cavitation of motor.



21092SM04

3) RELIEF VALVE



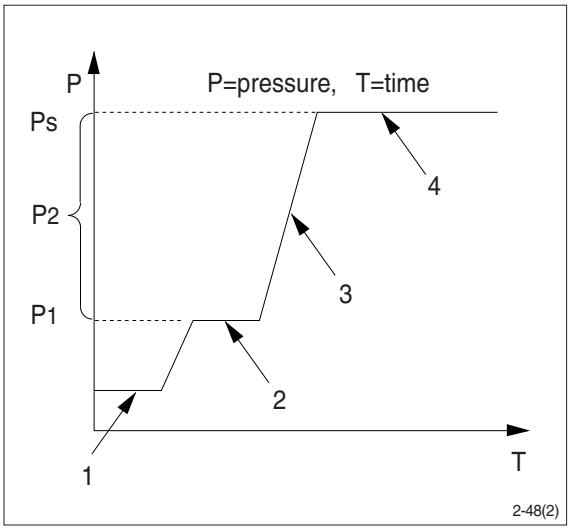
1	Sleeve
2	Poppet
3	Poppet seat
4	Spring
5	Spring seat
6	Shim
7	Piston
8	Stopper
9	Plug
10	O-ring
11	O-ring

(1) Construction of relief valve

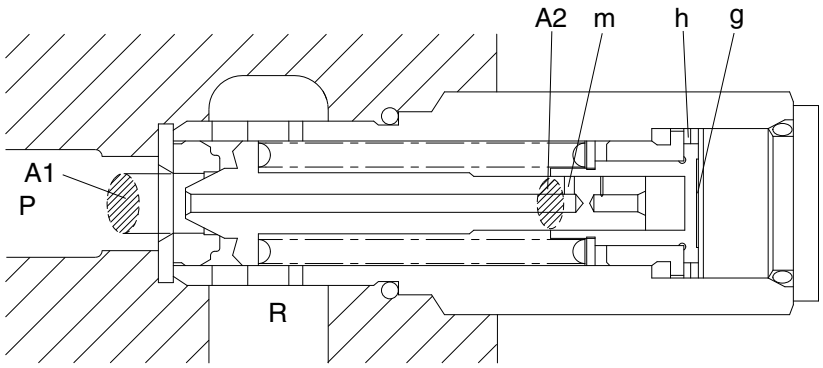
The valve casing contains two cartridge type relief valves that stop the regular and reverse rotations of the hydraulic motor. The relief valves relieve high pressure at start or at stop of swing motion and can control the relief pressure in two steps, high and low, in order to insure smooth operation.

(2) Function of relief valve

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



Ports (P,R) at tank pressure.

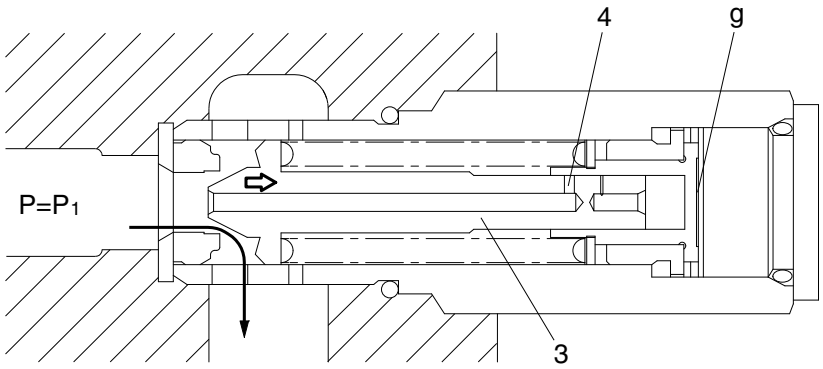


480F2SM06

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

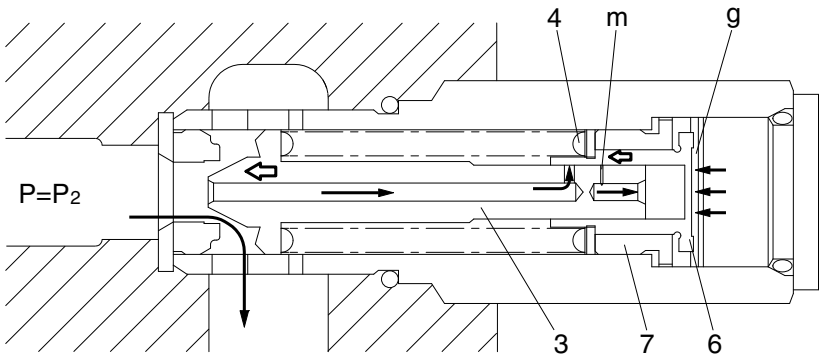
$P_1 \times A_1 = Fsp + Pg \times A_2$

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



480F2SM07

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

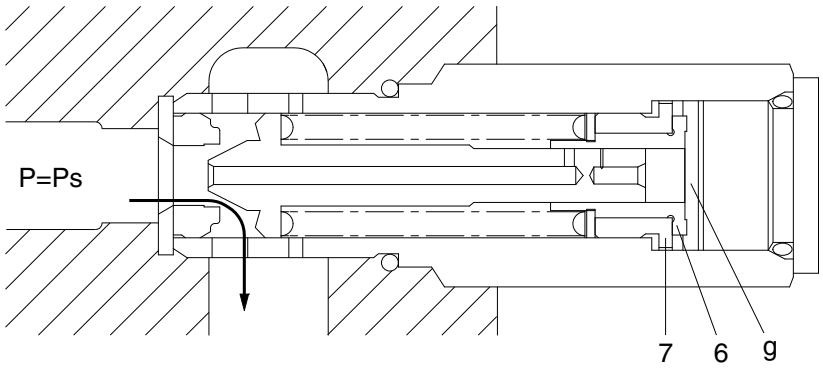


480F2SM08

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

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

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



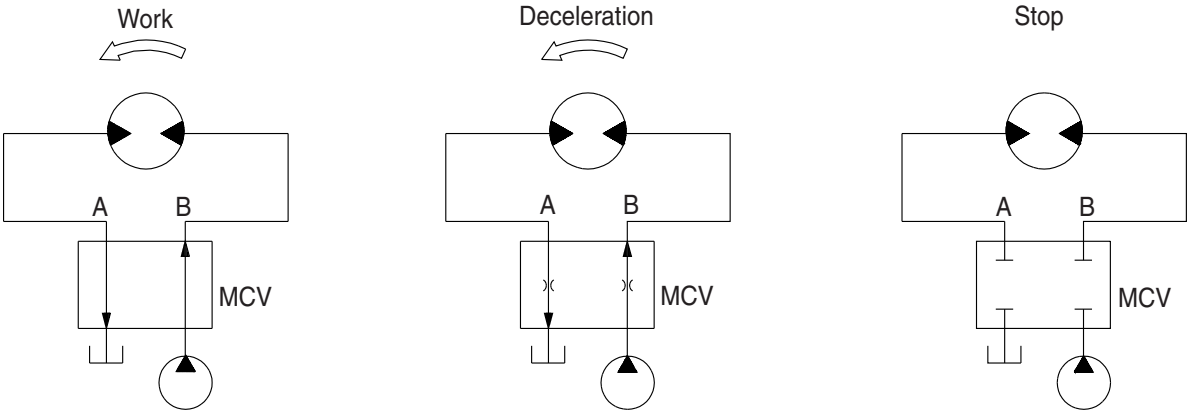
480F2SM09

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)

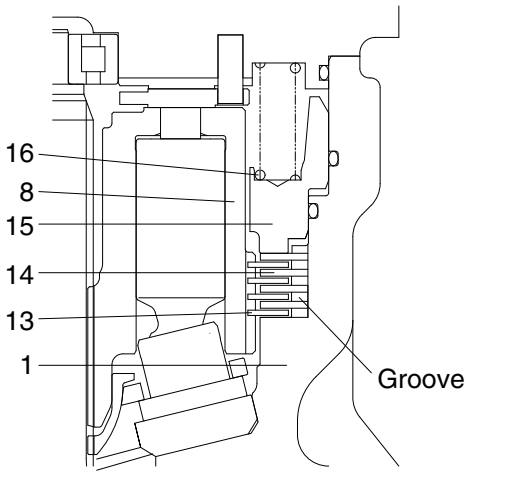
(2) Mechanical swing parking brake system

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

① Brake assembly

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

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



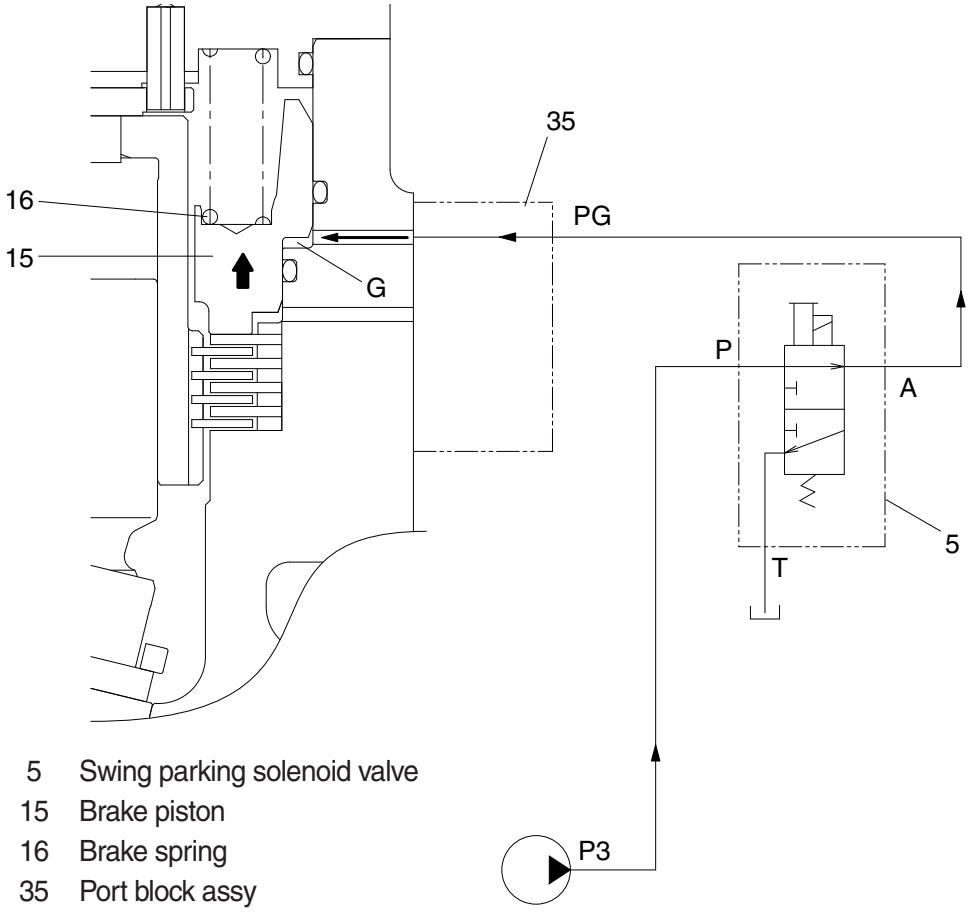
480A2SM03

1	Casing	14	Separate plate
8	Rotary block	15	Parking piston
13	Friction plate	16	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 Brake piston
16 Brake spring
35 Port block assy

210A2SM10

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.

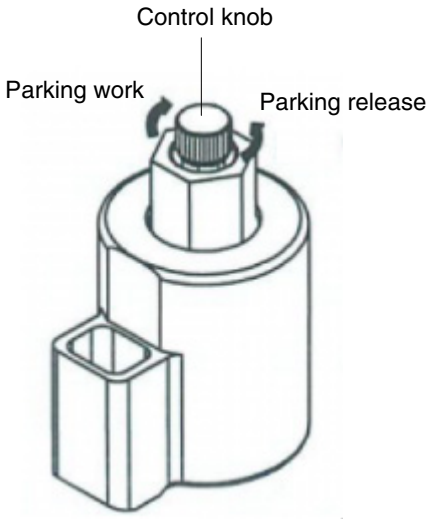
※ **Manual override solenoid valve**

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.



Swing parking solenoid valve

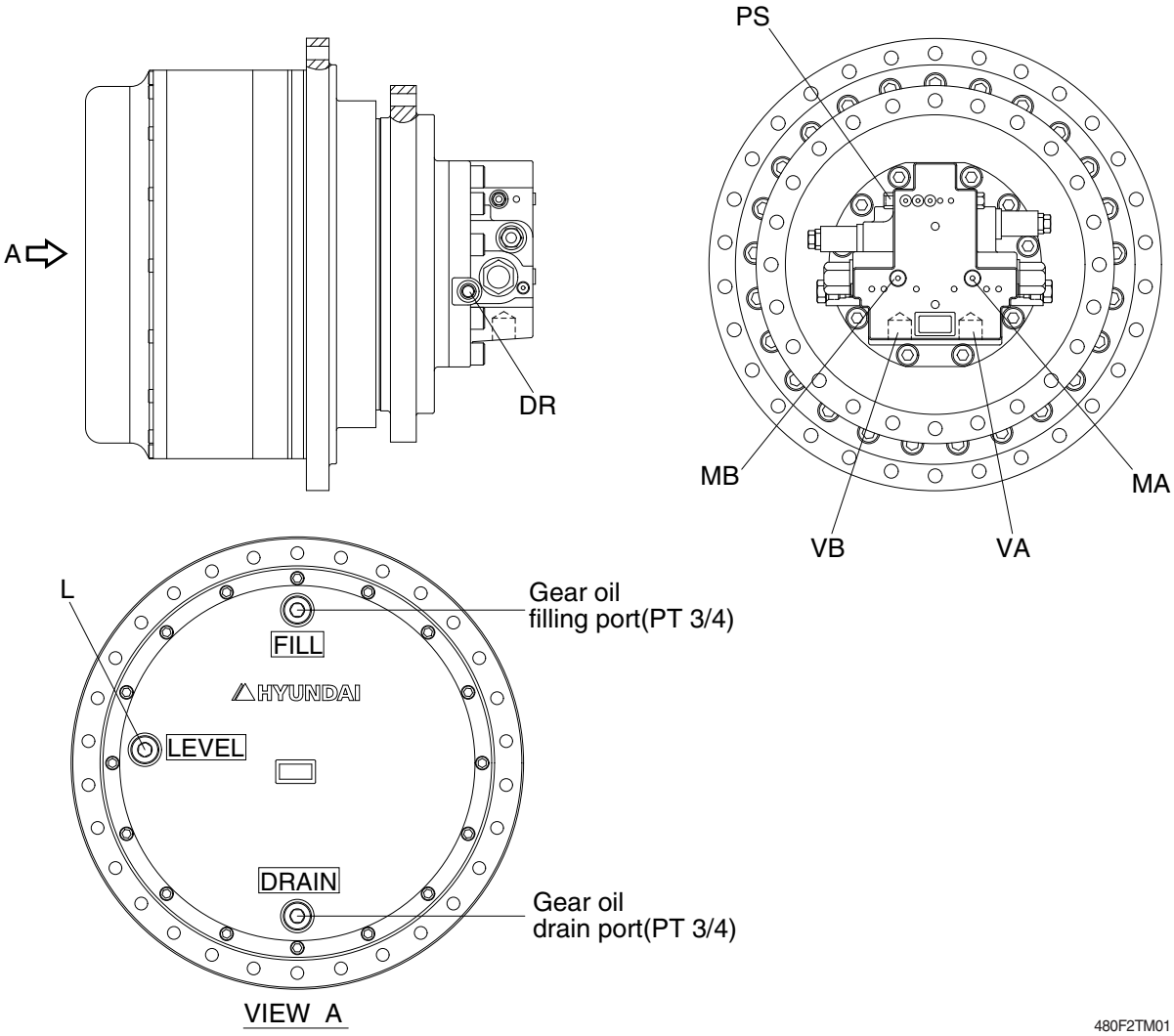
160A2SM11

GROUP 4 TRAVEL DEVICE (TYPE 1, 2)

1. CONSTRUCTION

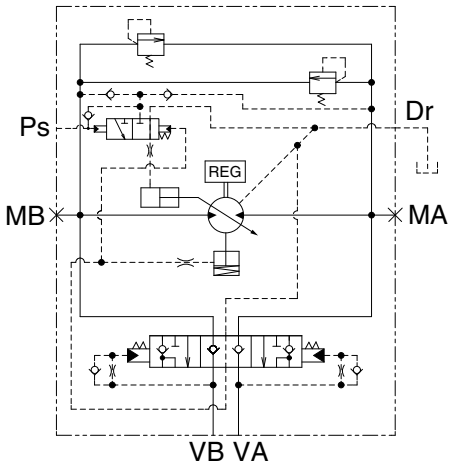
Travel device consists travel motor and gear box.

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



VIEW A

480F2TM01

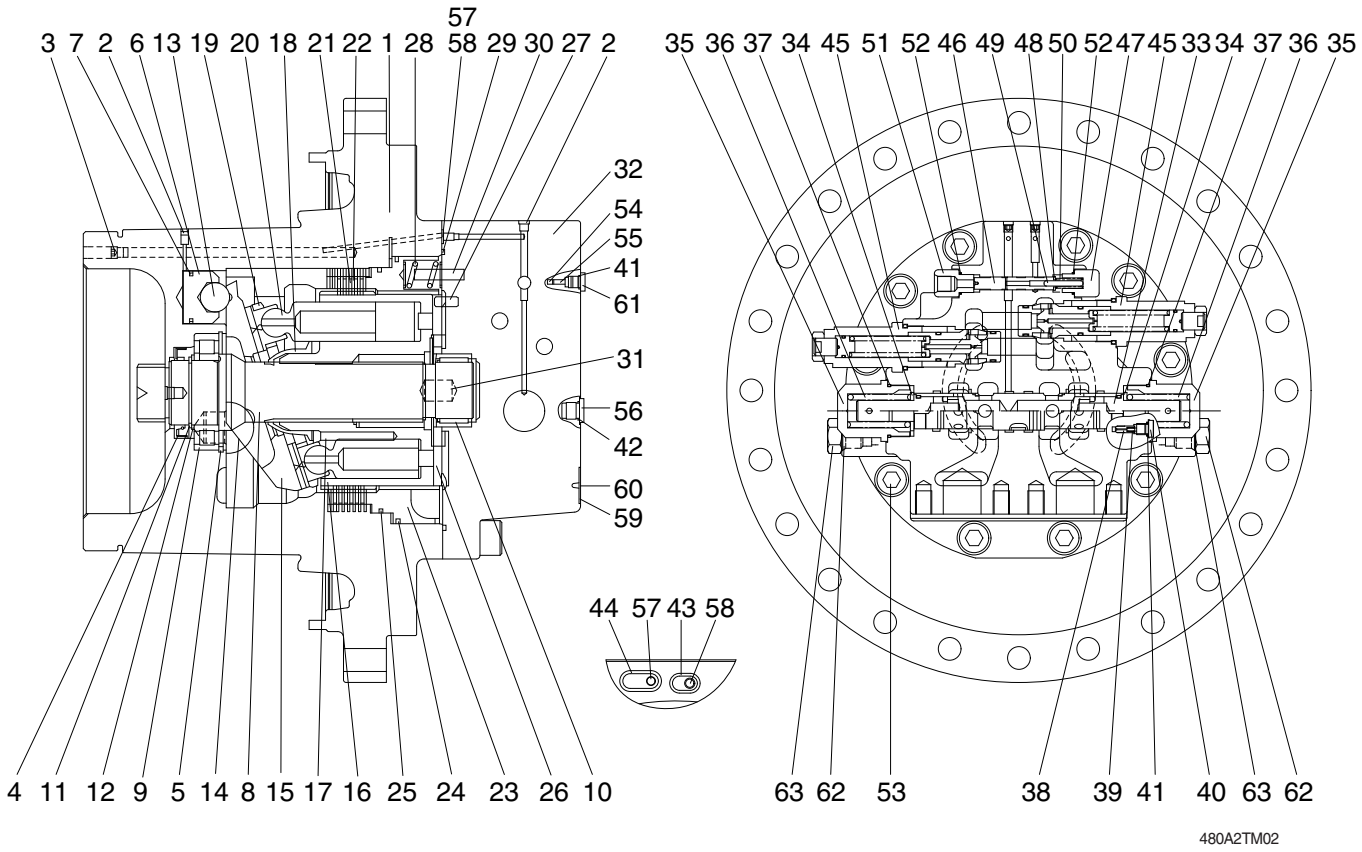


HYDRAULIC CIRCUIT

Port	Port name	Port size
VA, VB	Main port	PF1
MA, MB	Pressure gauge port	PF 1/4
PS	Pilot port	PF 1/4
DR	Drain port	PF 1/2
L	Level gauge	PF 3/4

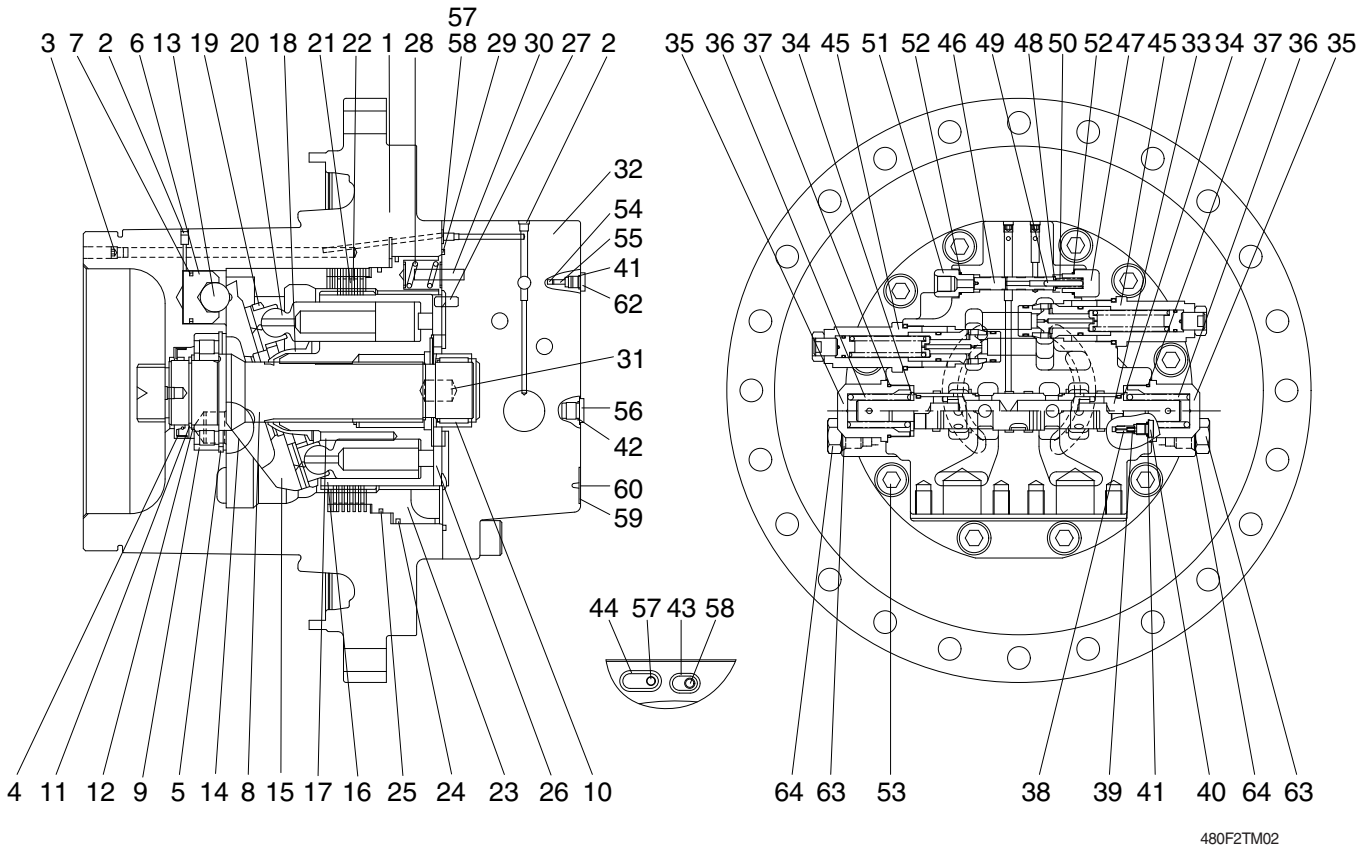
2. STRUCTURE

1) TRAVEL MOTOR (TYPE 1)



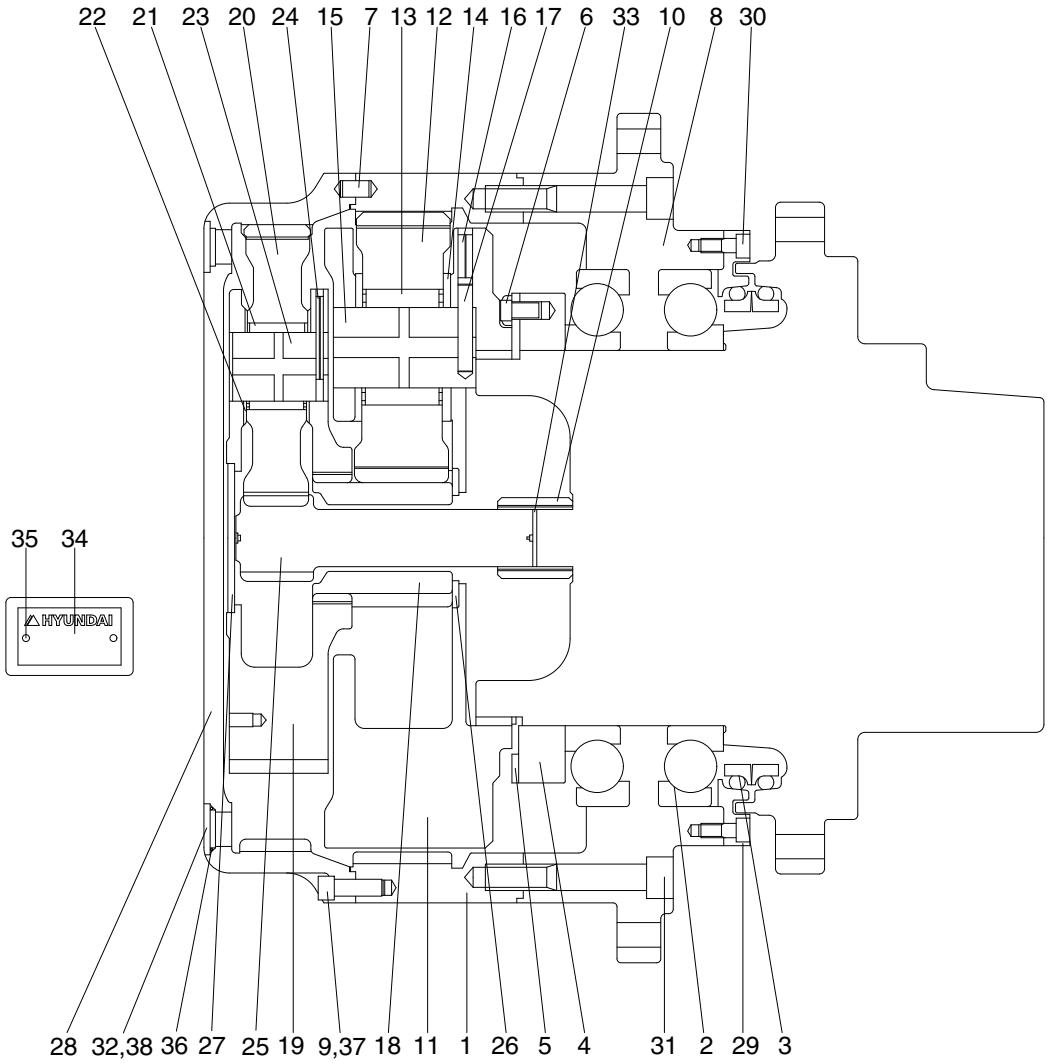
1	Casing	22	Separate plate	43	O-ring
2	Plug	23	Parking piston	44	O-ring
3	Plug	24	D-ring	45	Relief valve assy
4	Oil seal	25	D-ring	46	Spool
5	Retainer ring	26	Valve plate	47	Plug
6	Piston	27	Parallel pin	48	Spring seat
7	Piston seal	28	Spring	49	Parallel pin
8	Shaft	29	O-ring	50	Spring
9	Roller bearing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

TRAVEL MOTOR (TYPE 2)



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

2) REDUCTION GEAR



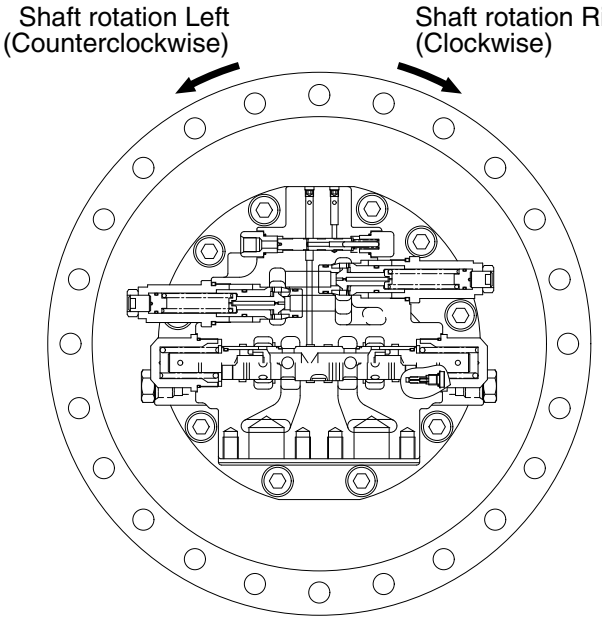
480A2TM03

1	Ring gear	14	Thrust washer	27	Thrust plate
2	Ball bearing	15	Carrier pin No. 2	28	Cover
3	Floating seal assy	16	Spring pin	29	Cover seal
4	Ring nut	17	Solid pin No. 2	30	Hex socket head bolt
5	Lock plate	18	Sun gear No. 2	31	Hex socket head bolt
6	Hexagon head bolt	19	Carrier No. 1	32	Plug
7	Parallel pin	20	Planetary gear No. 1	33	Retainer ring
8	Housing	21	Needle bearing	34	Name plate
9	Hexagon socket head bolt	22	Thrust washer	35	Rivet
10	Coupling	23	Carrier pin No. 1	36	O-ring
11	Carrier No. 2	24	Spring pin	37	Rubber cap
12	Planetary gear No. 2	25	Sun gear No. 1	38	Rubber cap
13	Needle bearing	26	Thrust plate		

3. OPERATION

1) MOTOR

High pressure oil delivered form hydraulic pump is led to inlet port that is provided in the brake valve portion and, through the rear cover (32) and valve plate (26), led to rotary block (16).
The oil flow and direction of shaft rotation are indicated in table.



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

480F2TM04

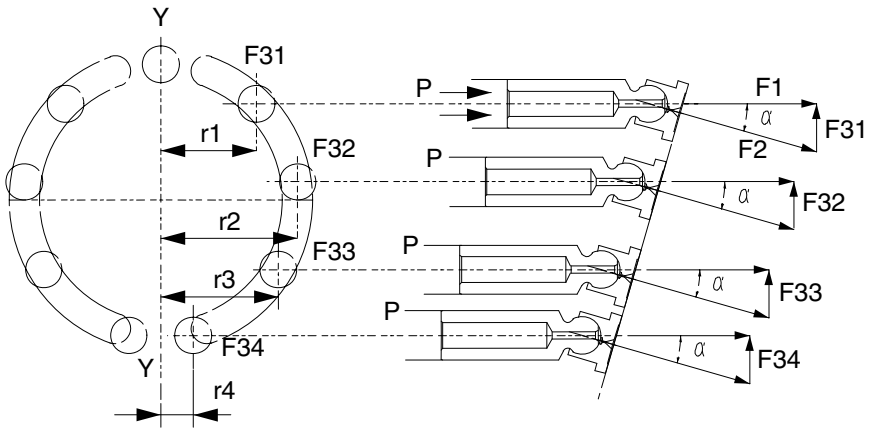
As shown in below figure, high pressure oil is supplied to the pistons which are on one side of the line Y-Y that connects upper and lower dead points and produces force F1.

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

The swash plate (15) with inclined angle of α divides this force F1 into thrust force F2 and radial force F31-34.
This radial force is applied to axis Y-Y as turning force and generate drive torque of T.

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

This drive torque is transmitted via rotary block (16) to driving shaft (8).

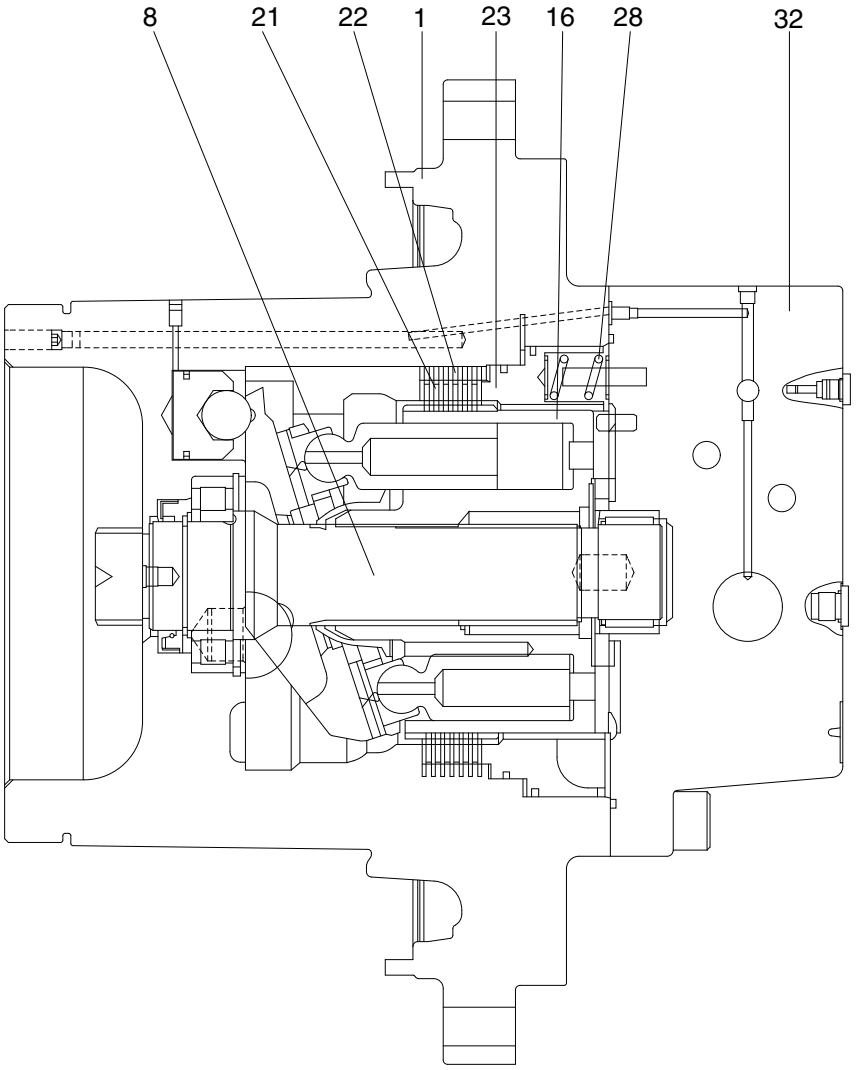


29092TM07

2) PARKING BRAKE

Parking brake is released when high pressure oil selected by the brake valve portion that is connected directly to the rear cover (32), is applied to the parking piston (23).
Otherwise the braking torque is always applied.

This braking torque is generated by the friction between the separated plates (22), inserted into the casing (1), and friction plates (21), coupled to rotary block (16) by the outer splines.
When no pressure is activated on the parking piston (23), it is pushed by the brake springs (28) and it pushes friction plates (21) and separated plates (22) towards casing (1) and generates the friction force which brakes the rotation of rotary block (16) and hence the shaft (8).



480F2TM05A

3) CAPACITY CONTROL MECHANISM

Figure typically shows the capacity control mechanism.

When high speed pilot line is charged with the pressure P_A that overcome the spring (50), the spring (50) is compressed and spool (46) shifts to the right to connect the port P and port C.

Then, the highest pressure is selected by the check valve (54) from inlet and outlet pressure of the motor and high speed pilot line pressure and pushes shifter piston (6). As a result, swash plate (15) turns around the line L which connect the two pivots (14) as shown by dotted lines. The turn stops at the stopper (1-1) of casing and swash plate (15) keeps the position.

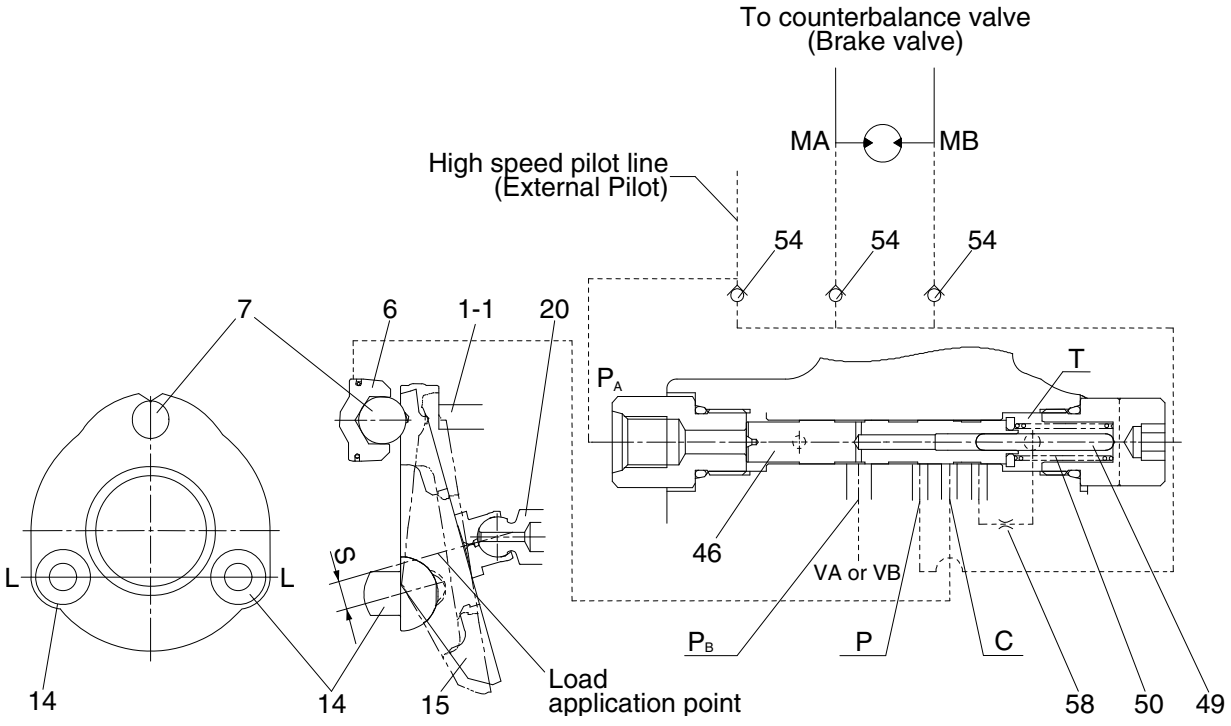
In this case, the piston stroke become shorter and motor capacity become smaller and motor rotates faster, around 1.60 times, by the same volume of oil.

When no pressure is in the high speed pilot line P_A, main spool (33) is pushed back by the spring (50) and pressure that pressed the shifter piston (6) is released to the hydraulic tank through restrictor (58).

Here, nine pistons are there and they equally spaced on the swash plate (15). The force that summed up those of pistons comes to almost the center of the swash plate (15) as shown. Since the pivots (14) are off-set by S from the center, the rotating force of product S and the force moves swash plate (15) to the former position and the speed returns to low.

When the power demand exceeds the engine power, such as in steep slope climbing or turning at high speed mode, the system step down to the low speed automatically. The mechanism is that: pump pressure is led to the port P_B and this pressure activate on pin parallel (49). When the pressure at P_B exceeds predetermined value, spool (46) returns to the left by the counter-pressure against parallel pin (49) and the pressure on the shifter piston (6) through port C is released to the tank and the motor comes to low speed.

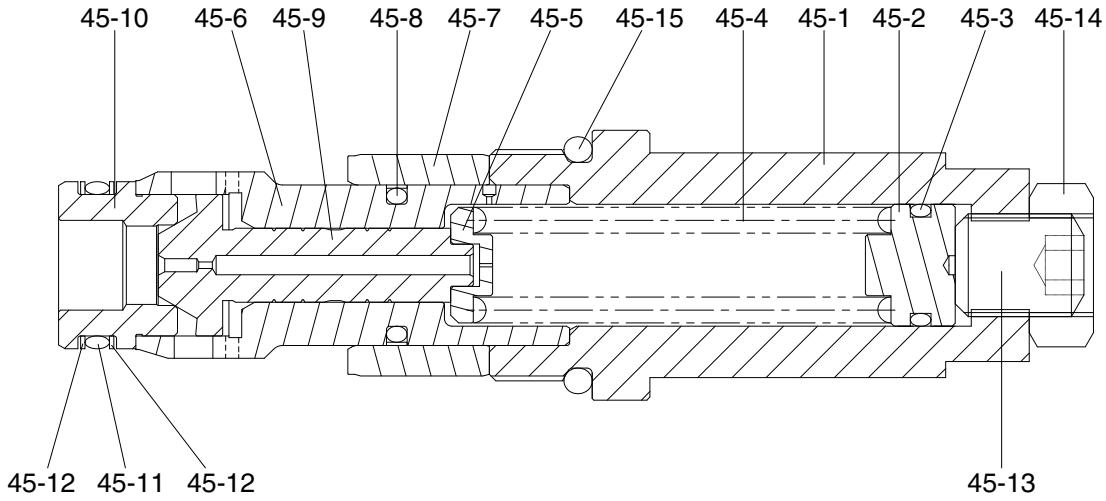
When P_B goes down, the spool (46) moves to the right and the speed become high.



4) OVERLOAD RELIEF VALVE

(1) Structure

This valve is screwed in the motor rear cover (32) and consists of : plug (45-1) that is screwed and fixed in the rear cover (32), poppet (45-9) and supports the poppet seat (45-10), spring (45-4) that is operating relief valve setting pressure and supports the spring seat (45-5), that is inserted in the sleeve (45-6), screw (45-13) that is adjust the spring force, nut (45-14) that fix screw (45-13), piston (45-7) that reduce the shock.



480F2TM07

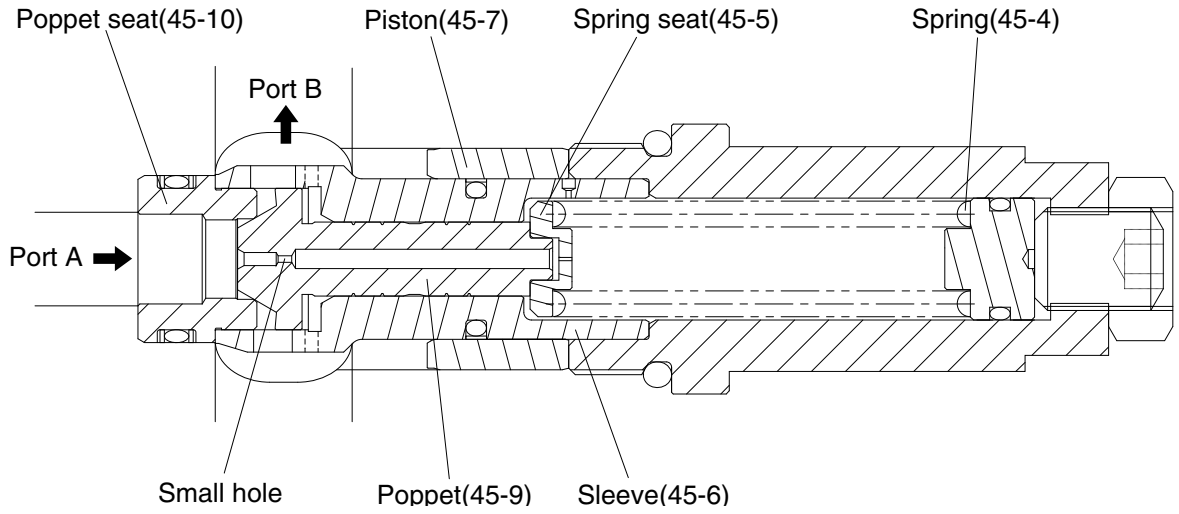
45-1 Plug	45-6 Sleeve	45-11 O-ring
45-2 Guide	45-7 Piston	45-12 Back-up ring
45-3 O-ring	45-8 Seal	45-13 Socket screw
45-4 Spring	45-9 Poppet	45-14 Hexagon nut
45-5 Spring seat	45-10 Poppet seat	45-15 O-ring

(2) Operation

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

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

When starting, "A" port pressure of overload valve increases, this pressure is applied to the effective diameter of poppet (45-9) which seats on the poppet seat (45-10) and, at the same time, is delivered, via small hole, to the spring seat (45-5) located inside the sleeve (45-6) and the seat bore pressure increases up to "A" port pressure. The poppet (45-9) opposes to spring (45-4) by the force of the pressure exerted on the area difference between poppet seat's effective diameter and spring seat bore and keep the predetermined pressure.
When hydraulically braking, the piston (45-7) is at the left position by the driving pressure, and when "A" port pressure increases, the pressure is applied also to the piston (45-7) through the small hole in the poppet (45-9) and piston (45-7) moves rightward until it touches the stopper in rear cover. In this while, the poppet (45-9) maintains "A" port pressure at comparatively low against the spring (45-4) force and exhaust oil to "B" port side. After the piston reached to the plug, the valve acts the same as at starting.



480F2TM08

5) BRAKE VALVE

(1) Structure

The brake valve portion mainly consists of the following parts:

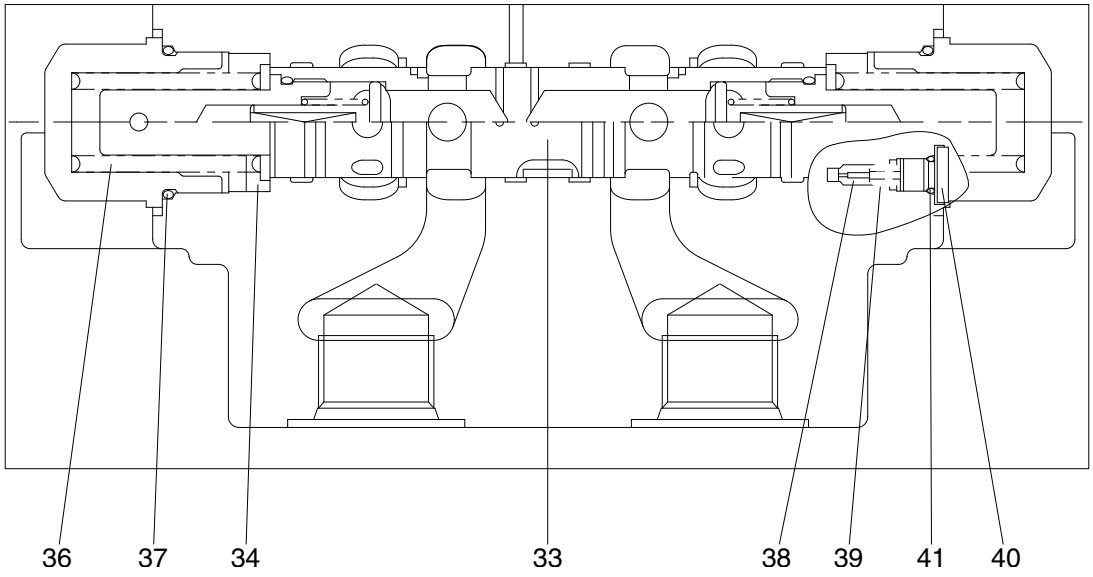
① **Spool**

By shifting the spool (33), the discharged oil from hydraulic motor is automatically shut off or restricted according to the condition and give the effect of holding, accelerating, stopping and counterbalance operations.

(See page 2-67, (2) Operation)

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

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



480F2TM09

33	Main spool	37	O-ring	40	Plug
34	Spring seat	38	Restrictor	41	O-ring
36	Spring	39	Restrictor spring		

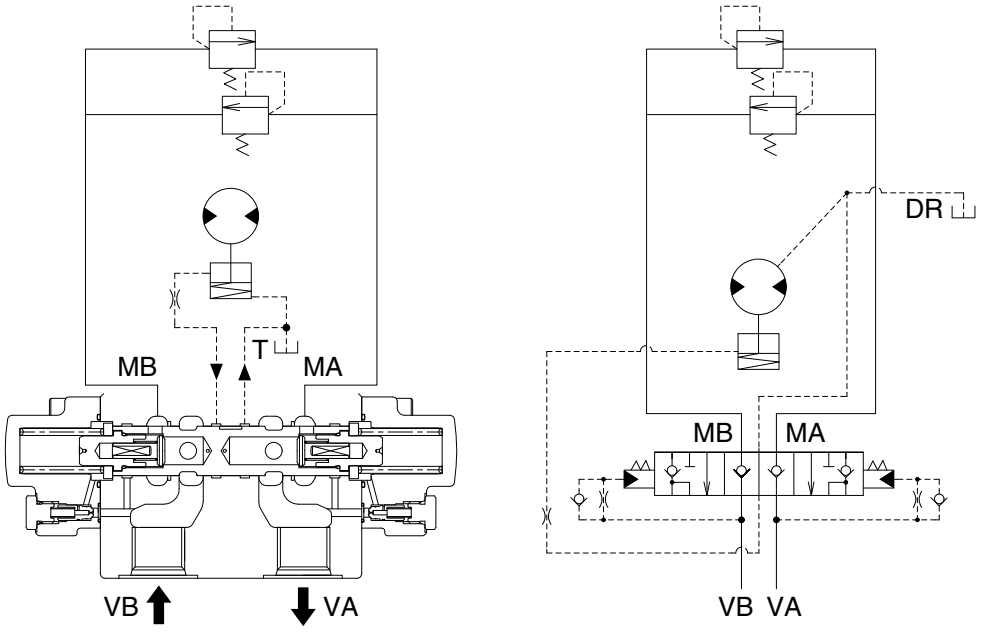
(2) Operation

① Holding operation

When the control valve is at neutral position, VA and VB ports are connected to the tank, and the spring (36) located on both spool ends holds the main spool (33) at central position.
Therefore, the passages from VA to MA and VB to MB are closed, which result in closing MA and MB ports connected to hydraulic motor.

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

In case the brake should be released for some reason, pressure is built on MA or MB port. But, due to oil leakage inside hydraulic motor or so, high-pressure oil escapes from the closed circuit and motor rotates a bit. So, the cavitation tends to occur in the lower pressure side of the closed circuit. Then, the check valve, built in the main spool (33), operates to avoid the cavitation and opens the passage from VA to MA or from VB to MB. Then the oil equivalent to the leakage is sucked from the tank line to the closed circuit.



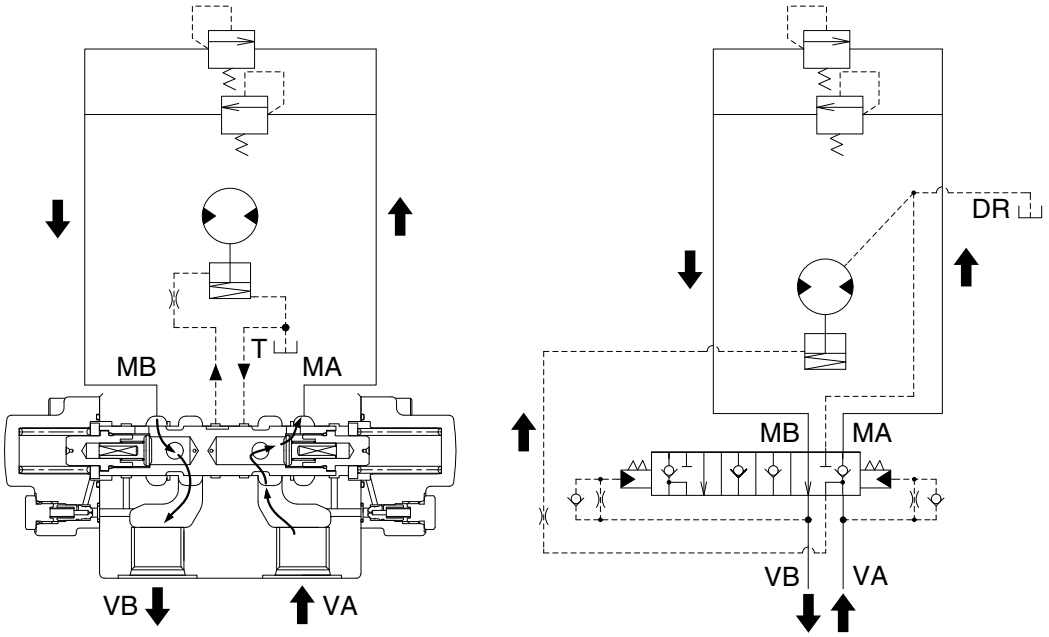
25092TM29

② Accelerating operation

When VA and VB ports are connected respectively to pump and tank by operating the control valve, hydraulic oil from pump is forwarded through VA port to push open the check valve provided inside main spool (33), and oil flows to motor via MA port to rotate the motor.

Therefore, the pressure increases and negative brake is released by the pressure supplied from pump. At the same time, the pressure of pilot chamber increases to push and move the main spool (33) leftwards, overcoming the spring (36) force. Thus, the return line from MB to VB opens to rotate the motor.

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



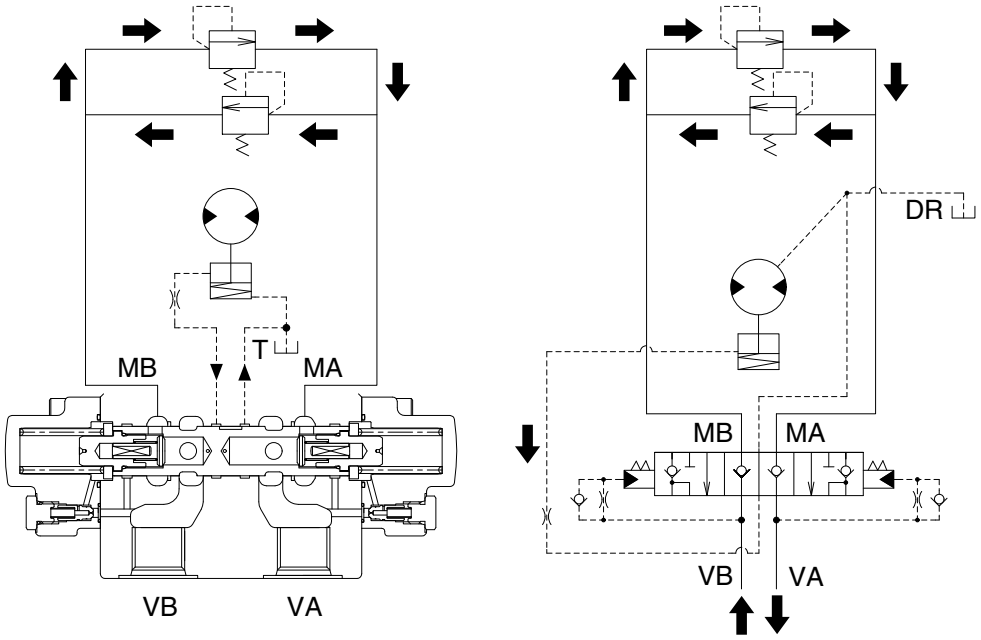
25092TM30

③ **Stopping operation**

Returning the control valve to neutral position while running the motor, the oil supply is cut off and VA and VB ports are connected to the tank line. Then the pressure of the pilot chamber located on both spool ends become equal, and the main spool (33) returns to the neutral position by spring (36) force. Thus, the passage from MA to VA is closed.

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

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



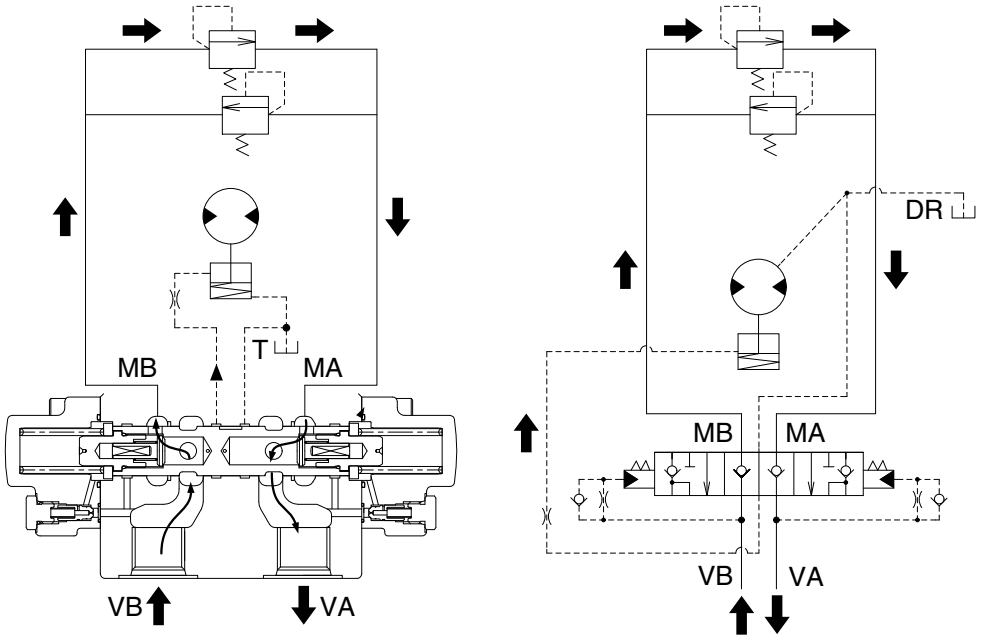
25092TM31

④ Counterbalance operation

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

In case the hydraulic oil is gradually decreased from pump to VB port, the drive shaft of hydraulic motor tends to rotate faster than that matched to the volume of oil supply.
Consequently, the pilot chamber pressure on MB to VB side decreases and the spring (36) force moves the main spool (33) leftwards towards neutral position.
Therefore, the area of passage from MA to VA becomes smaller and the pressure on MA side rises due to increased resistance in the passage and the motor receives hydraulic braking effect.

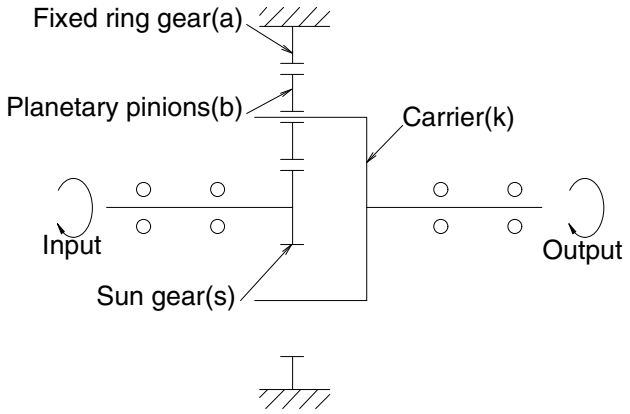
If the motor rotates slower than that matched to the volume of supplied oil, the pilot chamber pressure on VB port increases, and main spool (33) moves rightwards to enlarge the area of passage from MA to VA. Therefore the braking effect becomes smaller and the rotational speed of motor is controlled to correspond to the volume of supplied oil.
In order to give stable counterbalance operation, the restrictors (38) are set in the pilot chamber to damp the main spool (33) movement.
The parking brake is released during pressure adjusting action of the main spool (33).



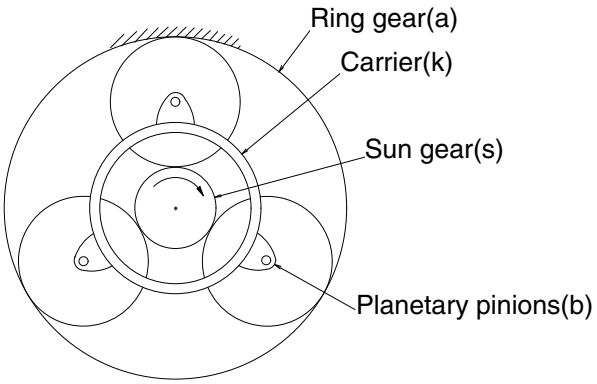
25092TM32

6) REDUCTION GEAR

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

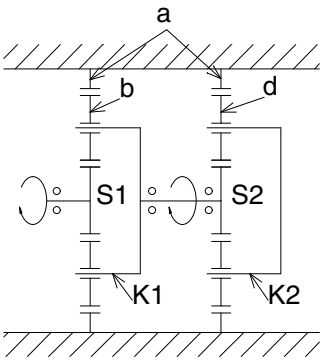


29072TM10



29072TM11

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



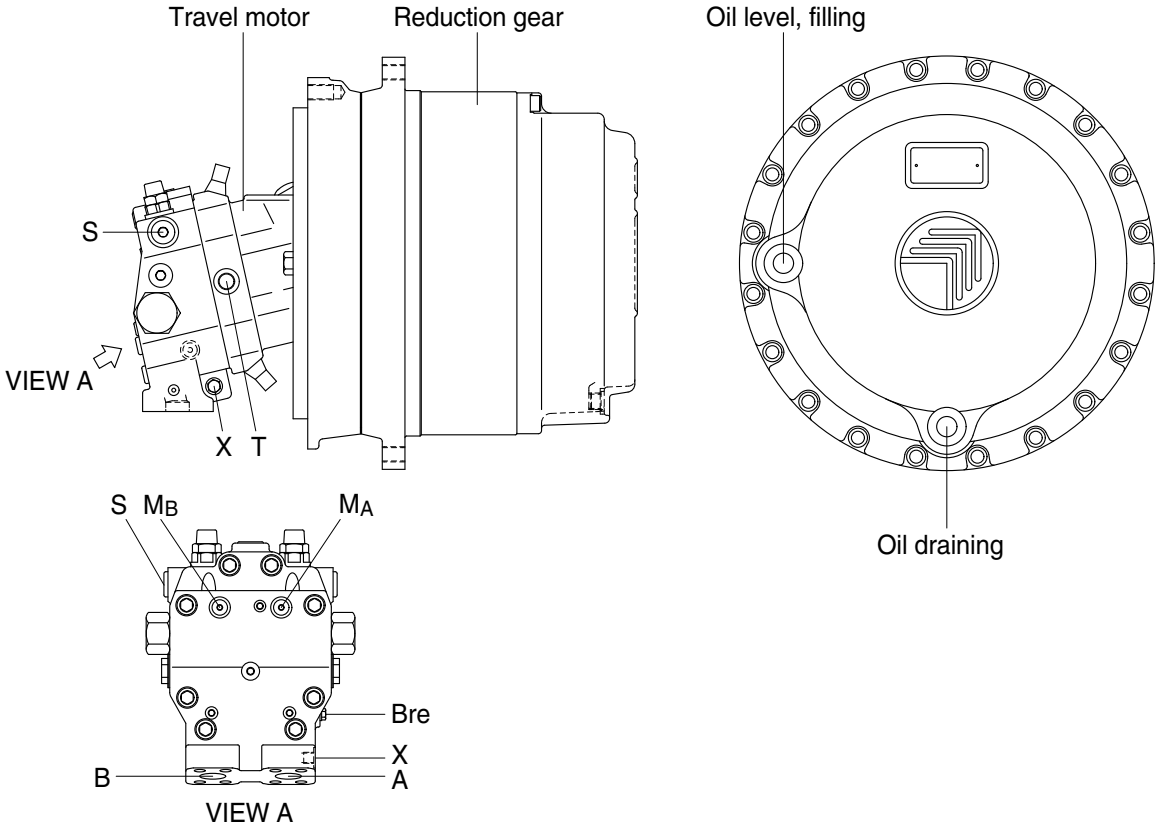
29072TM12

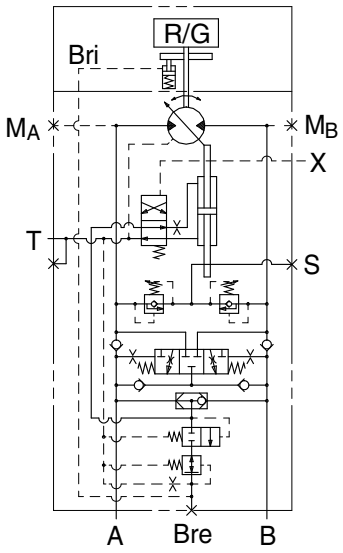
TRAVEL DEVICE (TYPE 3)

1. CONSTRUCTION

Travel device consists travel motor and gear box.

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



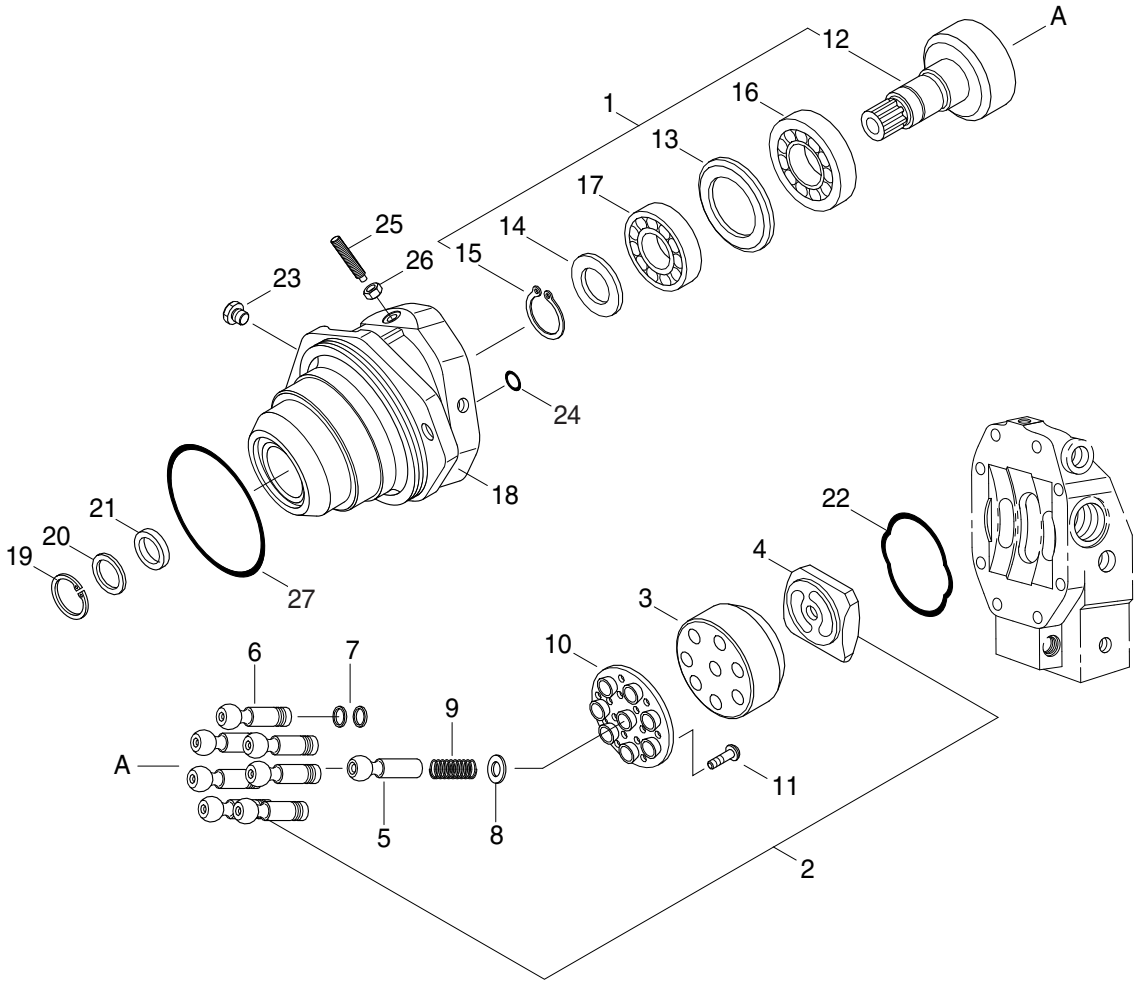


Hydraulic circuit

450A2TO01

Port	Port name	Port size
A	Main port	SAE 6000 psi 1 1/4"
B	Main port	SAE 6000 psi 1 1/4"
MA, MB	Gauge port	M14×1.5
T	Drain port	M26×1.5
X	2 speed control port	M14×1.5
Bre	Gauge port	M14×1.5
Bri	Brake release port	Internal

1) TRAVEL MOTOR (1/2)

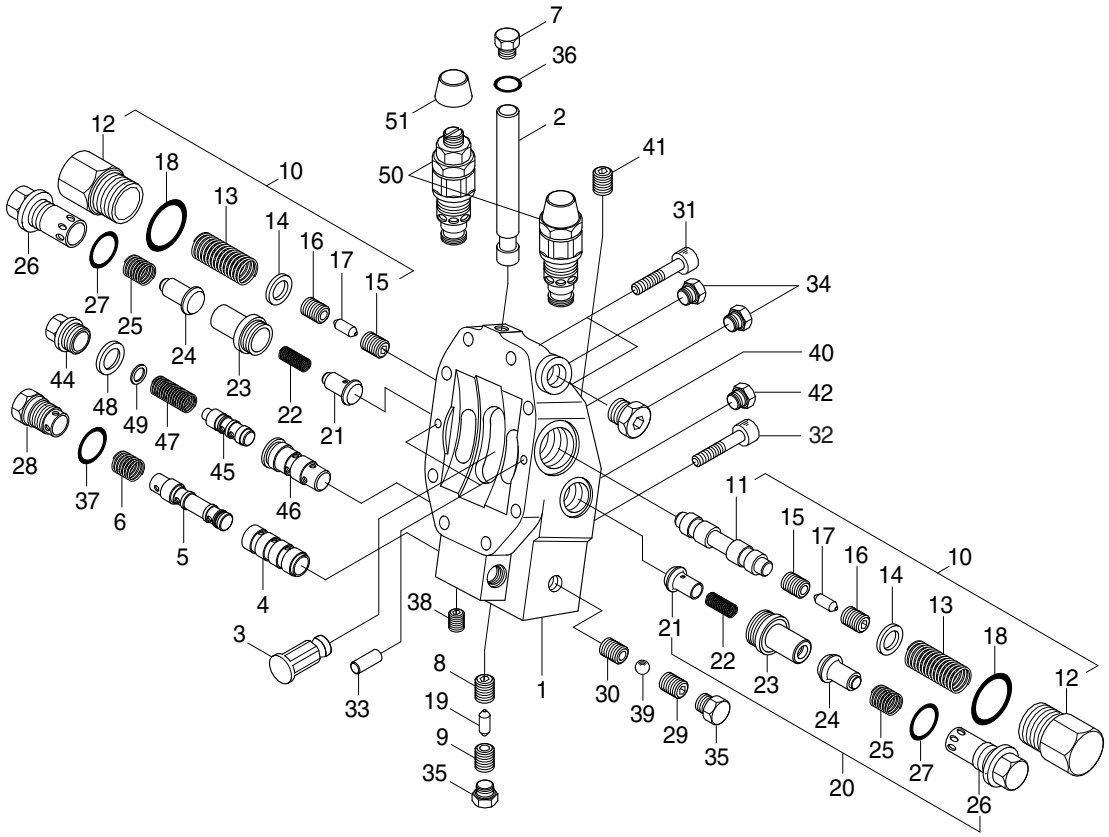


450A8TO02

1	Rotary group	10	Retainer plate	19	Retainer ring
2	Hyd section rotary	11	Screw	20	Shaft seal ring
3	Cylinder	12	Drive shaft	21	Back up plate
4	Control lens	13	Shim	22	O-ring
5	center pin	14	Back up plate	23	Locking screw
6	Piston	15	Retainer ring	24	O-ring
7	Steel ring	16	Roller bearing	25	Threaded pin
8	Adjustment shim	17	Roller bearing	26	Seal lock nut
9	Pressure spring	18	Housing	27	O-ring

TRAVEL MOTOR (2/2)

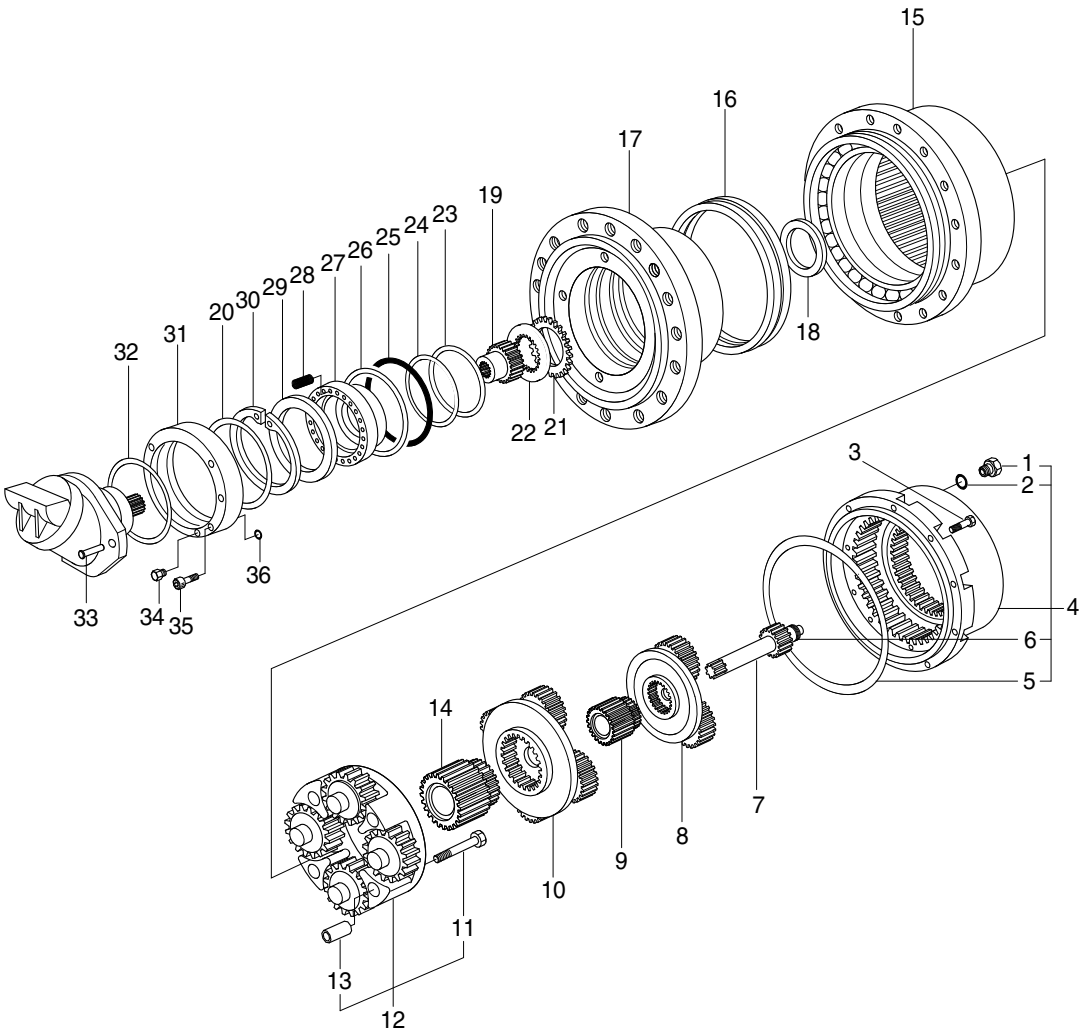
· Control part



450A8TO03

1	Port plate	18	O-ring	35	Locking screw
2	Position piston	19	Throttle pin	36	O-ring
3	Position turnnion	20	Valve	37	O-ring
4	Control bushing	21	Poppet valve	38	Brake off pin
5	Control piston	22	Pressure spring	39	Ball
6	Pressure spring	23	Seat poppet	40	Locking screw
7	Locking screw	24	Poppet valve	41	Brake off pin
8	Throttle screw	25	Pressure spring	42	Locking screw
9	Throttle screw	26	Locking screw	43	Pressure control valve
10	Brake valve	27	O-ring	44	Locking screw
11	Brake piston	28	Locking screw	45	Control piston
12	Locking screw	29	Valve screw	46	Control bushing
13	Pressure spring	30	Bushing	47	Pressure spring
14	Washer	31	Socket screw	48	O-ring
15	Throttle screw	32	Socket screw	49	Shim
16	Throttle screw	33	Cylinder pin	50	Relief pressure valve
17	Throttle pin	34	Locking screw	51	Cap

2) REDUCTION GEAR

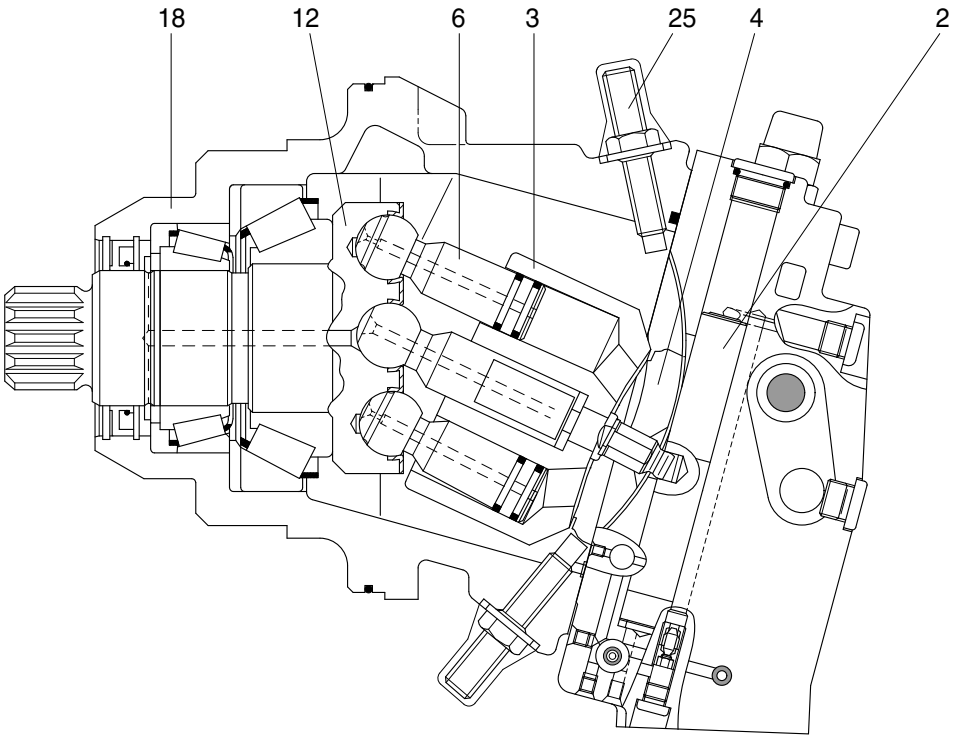


450A8TR01

1	Washer	13	Bushing	25	O-ring
2	Breather plug	14	Sun gear	26	Spiral ring
3	Screw	15	Housing	27	Piston
4	Cover set	16	Lifetime seal	28	Spring
5	O-ring	17	Hub	29	Spacer
6	Pad	18	Spacer	30	Circlip
7	Sun gear	19	Brake shaft	31	Flange
8	Reduction assy (1st)	20	O-ring	32	O-ring
9	Sun gear	21	Brake disc	33	Screw
10	Reduction assy (2nd)	22	Steel ring	34	Plug
11	Screw	23	Back up ring	35	Screw
12	Reduction assy (3rd)	24	O-ring	36	O-ring

2. FUNCTION

1) HYDRAULIC MOTOR (plug-in motor with intergrated counter balance valve)



450A2TO02

The variable displacement motor has a rotary group in bent axis design.
The torque is generated directly at the drive shaft (12).
The cylinder barrel (3) is driven by a tapered piston (6) arrangement.
The change of displacement is generated by the control lens (4) via positioning piston (2). The control lens (4) slides on a circular shaped surface.

In case of constant pump flow volume and high pressure
- the output speed is increased at smaller swivel angle, the torque is reduced
- the torque rises at swivel angle increase, the output speed is decreased.

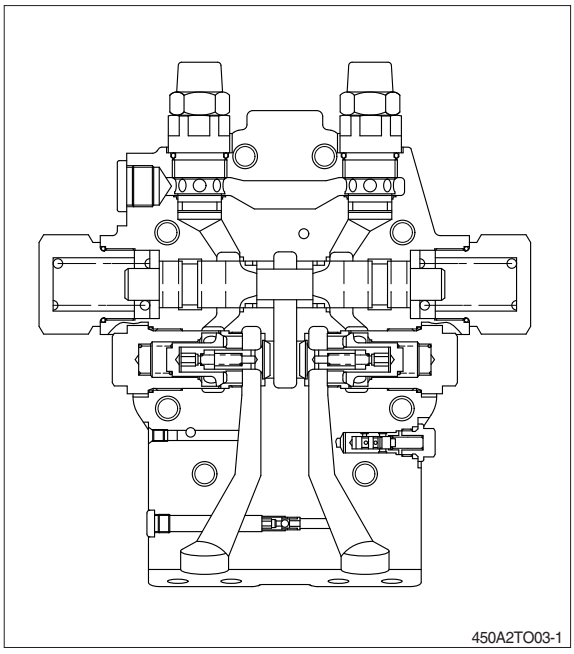
The max. swivel angle is 25˚, the min. swivel angle is 5˚.

The variable displacement motor with integrated counterbalance valve is designed to be operated in open loop.

The min. displacement is limited by a threaded pin (25) in the housing (18). Min. displacement is set according to requirement. Stepless adjustment to various higher values is possible.
※ Reduction to smaller displacement may result in overspeeding the motor.

2) PORT PLATE

With hydraulic two-speed control, integrated counterbalance valve and secondary pressure relief valves, gauge and boosting ports, control pressure ports, brake release pressure ports and service ports.



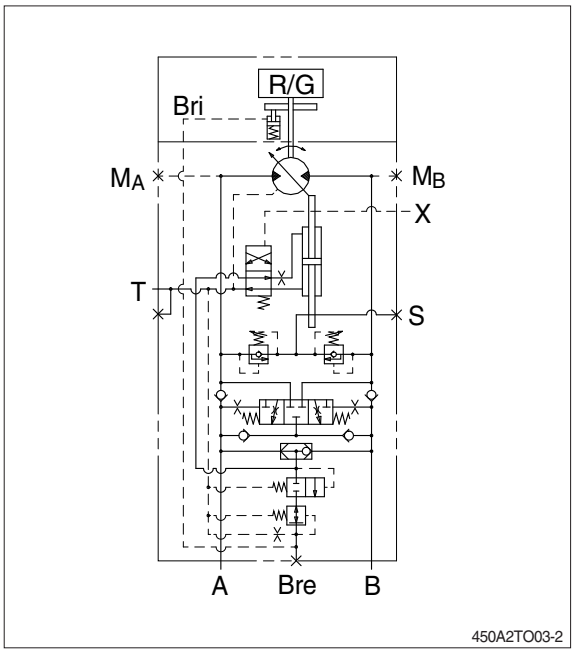
3) HYDRAULIC TWO-SPEED CONTROL

Operated by control pressure at port X a 4/2 directional valve guides high pressure to the positioning piston to switch the motor from min. to max. displacement and vice versa.

At control pressure 0 bar at port X the motor is at max. displacement.
At control pressure > 10bar at port X the motor is at min. displacement.
Intermediate positions are not possible.

The necessary positioning energy is taken from the respective high pressure side via shuttle valve. For this an operating pressure of at least 15bar is necessary.

Swivelling results in a change of the displacement.
Swivel time is controlled by an orifice.



4) COUNTERBALANCE VALVE (for traveling)

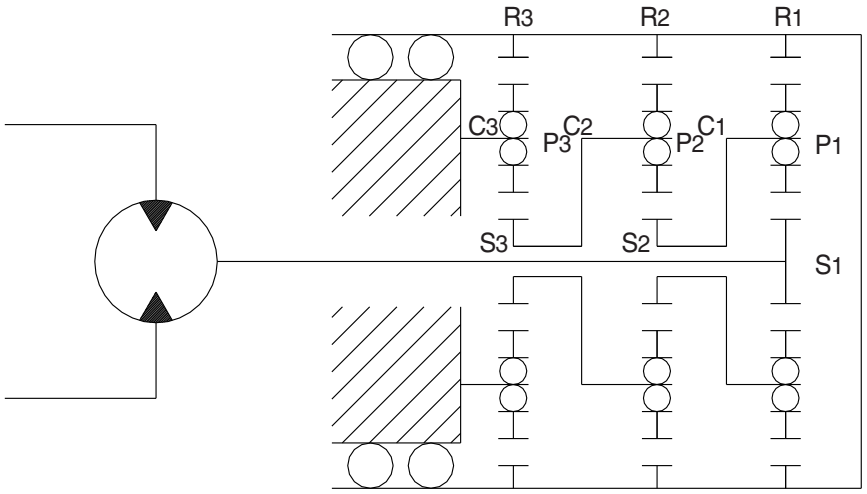
Integrated into the port plate including a brake release valve.
In case of downhill traveling or deceleration of the vehicle a counterbalance valve avoids overspeeding and cavitation of hydraulic motors.

5) FUNCTION AS TO CIRCUIT DIAGRAM

Check valves in the inlet line A and B for by-passing of the counterbalance valve.
At traveling forward the return oil flow is controlled by a counterbalance spool. At drop in inlet pressure the counterbalance spool throttles the return oil flow. The motor is locked. The oil flow behind the spool is led to the low pressure side via an additional check valve. Same function for traveling forward and backward. For limitation of the max. pressure during braking operation two cross-over relief valves are installed. Cavitation can be prevented via cross-over relief valves functioning as a check valve. A brake release valve pressurized by one of the inlet pressure sides via shuttle valve builds up a maximum of 30-50bar to release parking brake. The brake release valve delays the engagement of parking brake after travelling.

6) REDUCTION GEAR

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



R290TM08(1)

The input rotation of the hydraulic motor is transmitted to No. 1 sun gear (S1) and this drives No. 1 planetary gears (P1). This No. 1 planetary gears (P1) drive No.1 ring gear (R1) with the same force as the meshing tangential force with No. 1 sun gear (S1), and also No. 1 carrier (C1) with the same force as the meshing reaction force. In other words, No. 1 planetary gears (P1) revolve rotating. This rotation of No. 1 carrier (C1) becomes the output of the 1st stage, and is transmitted directly to No. 2 sun gear (S2).

(No. 1 carrier is spline-coupled with No. 2 sun gear.) Similarly the revolution of No. 2 planetary gear (P2) are transmitted via No.2 carrier (C2) to No. 3 sun gear (S3). Since No. 3 carrier (C3) supporting No. 3 planetary gears (P3) are fixed, No. 3 planetary gears (P3) do not revolve, but rotates to drive No. 3 ring gears (R3).

Therefore, the rotating case is driven by the overall driving torque of numbers.

1,2 and 3 ring gears. This reduction ratio is expressed as shown below:

$$i = \frac{(Z_{S1} + Z_{r1})\,(Z_{S2} + Z_{r2})\,(Z_{S3} + Z_{r3})}{Z_{S1} \cdot Z_{S2} \cdot Z_{S3}} - 1$$

Where Z : Number of teeth of each gear

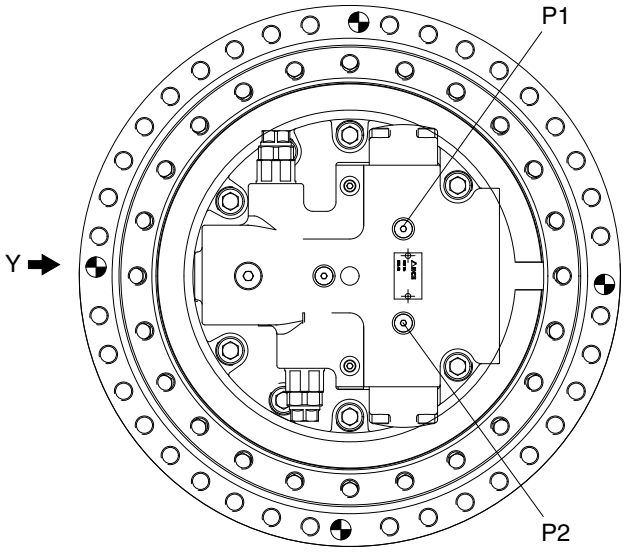
The direction of rotation is reverse to that of the input shaft.

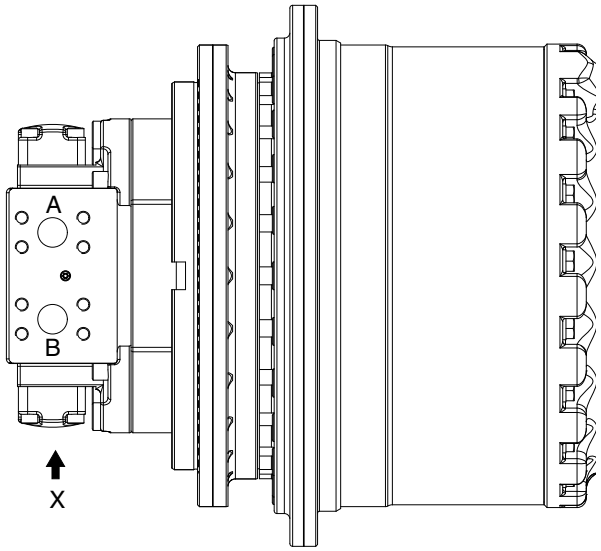
TRAVEL DEVICE (TYPE 4)

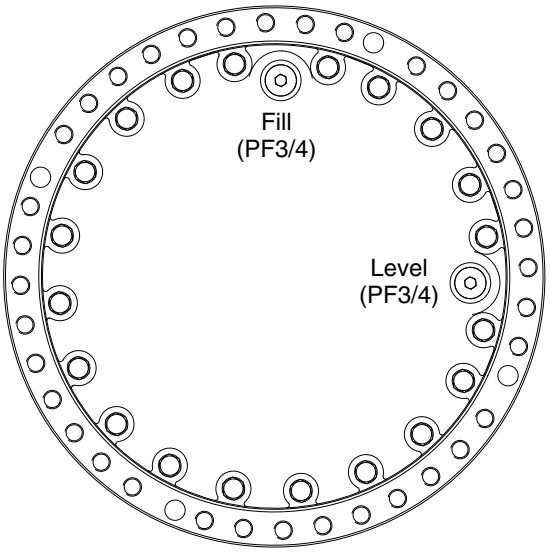
1. CONSTRUCTION

Travel device consists travel motor and gear box.

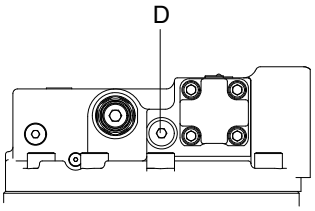
Travel motor includes brake valve, parking brake and high/low speed changeover mechanism.



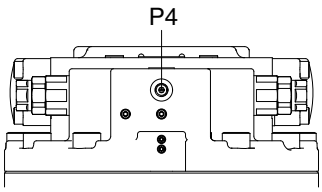




VIEW Z

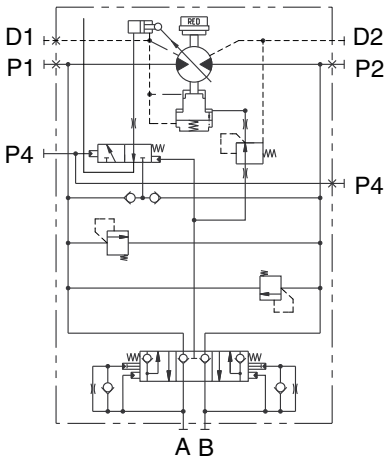


VIEW X



VIEW Y

480A2TM01

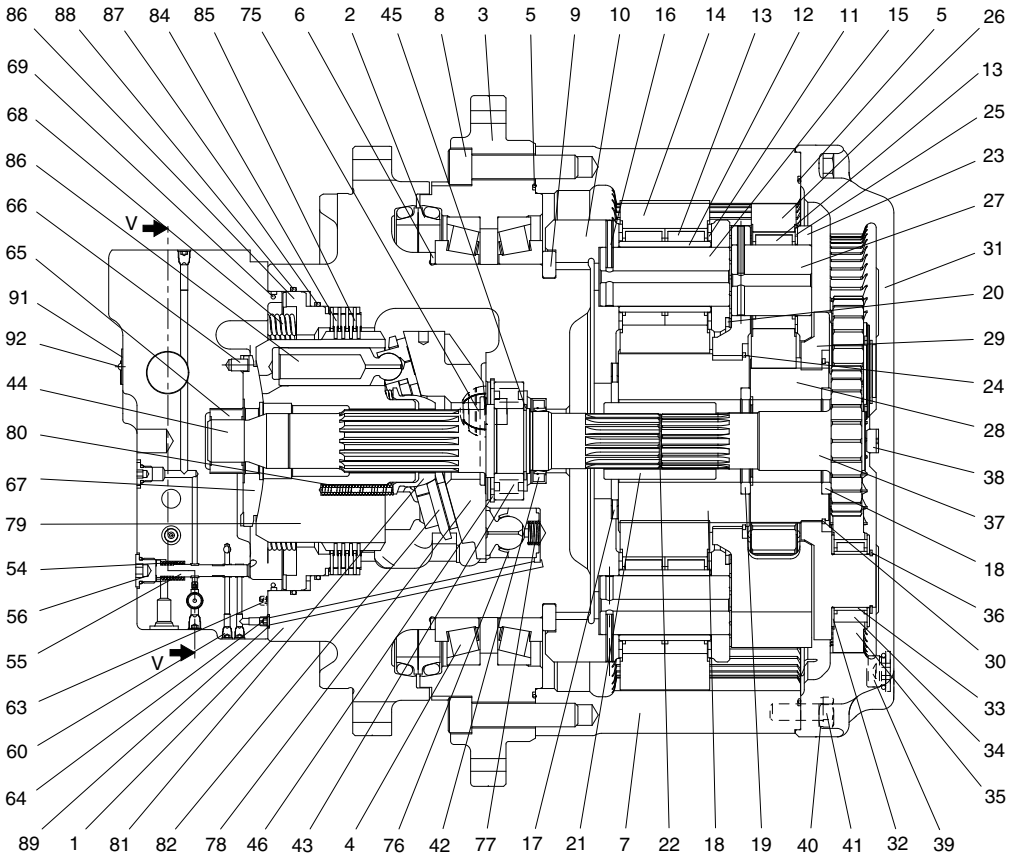


Hydraulic circuit

Port	Port name	Port size
A, B	Main port	PF1
P1, P2	Pressure gauge port	PF 1/4
P4	Pilot port	PF 1/4
D	Drain port	PF 1/2

2. STRUCTURE

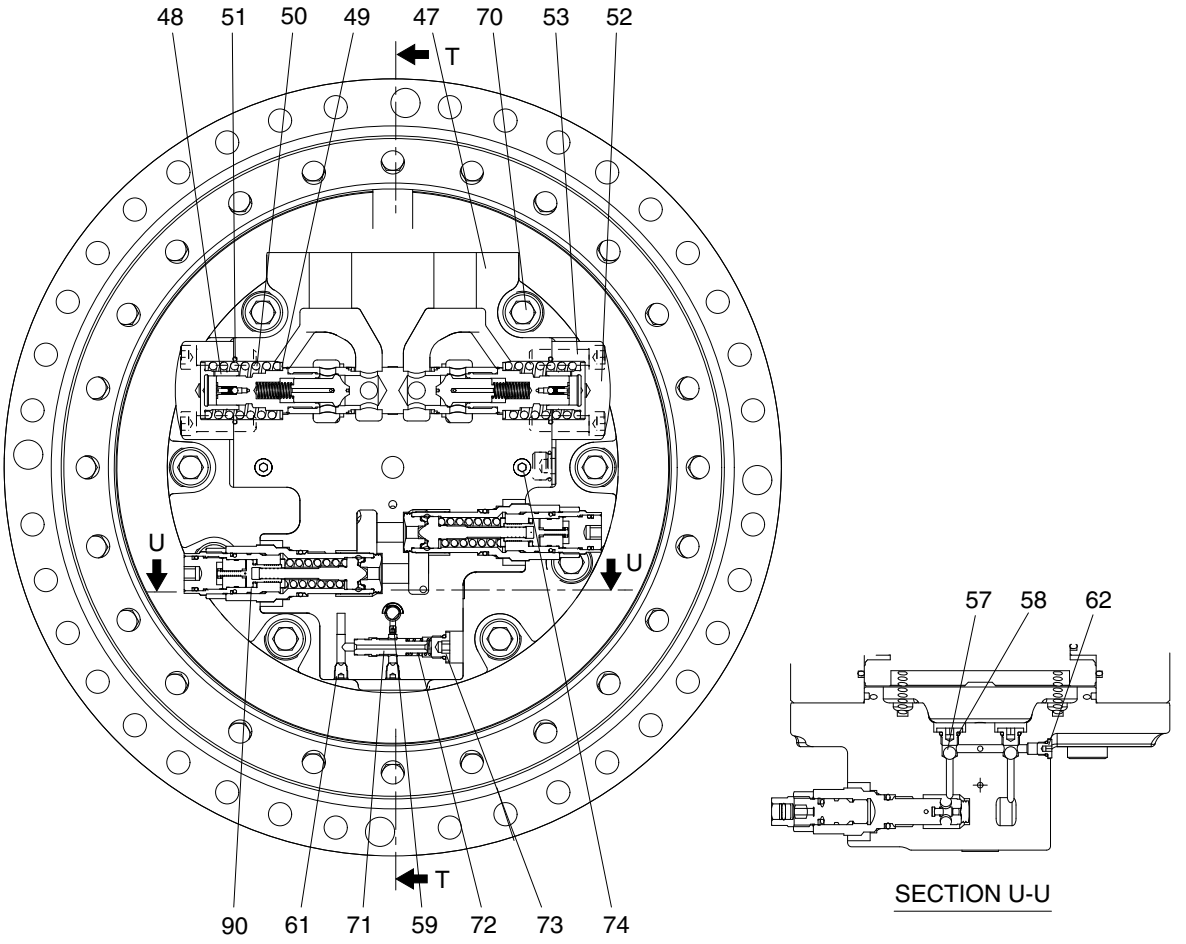
1) TRAVEL MOTOR



480A2TM02

1	Casing	26	Planetary gear no.2	63	Orifice
2	Floating seal	27	Shaft no.2	64	Orifice
3	Hub	28	Sun gear no.2	65	Needle bearing
4	Taper roller bearing	29	Carrier no.1	66	Parallel pin
5	O-ring	30	Clip	67	Valve plate
6	Distance piece	31	Cover	68	Spring
7	Ring gear	32	Side plate	69	O-ring
8	Socket bolt	33	Ring inner	75	Pivot
9	Shim plate	34	Needle bearing	76	2 speed piston assy
10	Carrier no.3	35	Planetary gear no.1	77	2 speed piston spring
11	Thrust washer	36	Snap ring	78	Swash plate
12	Floating bushing	37	Drive gear	79	Cylinder block
13	Needle bearing	38	Thrust washer	80	Cylinder block spring
14	Planetary gear no.3	39	HS plug assy	81	Spherical bushing
15	Shaft no.3	40	Spring washer	82	Retainer plate
16	Spring pin	41	Hex bolt	83	Piston assy
17	Thrust plate	42	Shaft seal	84	Friction plate
18	Sun gear no.3	43	Roller bearing	85	Separation plate
19	Thrust ring	44	Drive shaft	86	Brake piston
20	Thrust ring	45	Snap ring	87	O-ring
21	Coupling	46	Snap ring	88	O-ring
22	Snap ring	54	2 speed spring	89	O-ring
23	Carrier no.2	55	2 speed spool	91	Name plate
24	Clip	56	HS plug assy	92	Rivet screw
25	Thrust washer	60	MW 08		

TRAVEL MOTOR



SECTION V-V

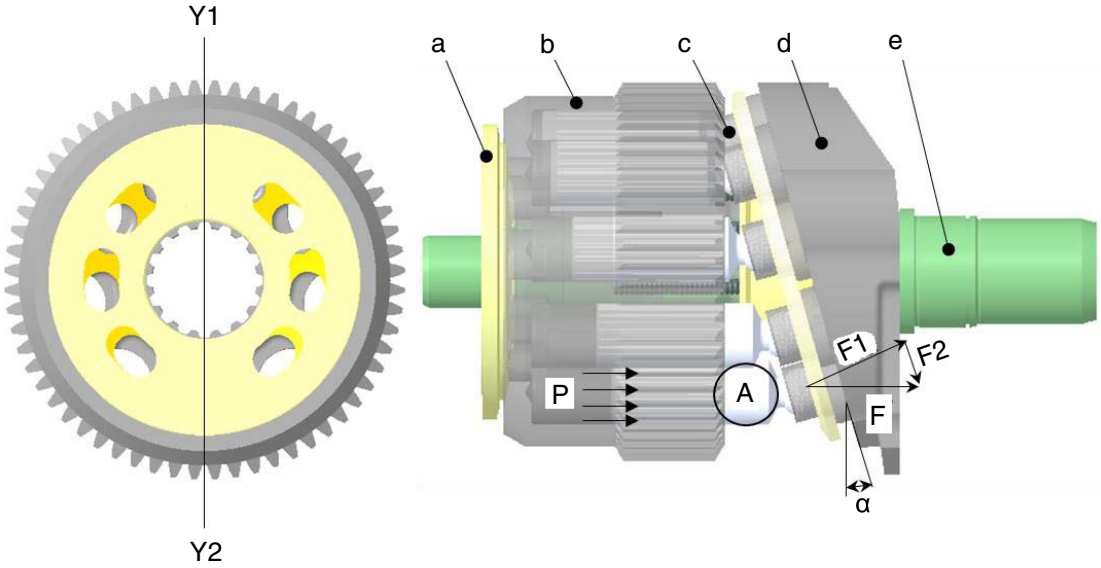
SECTION U-U

480A2TM03

47	Valve casing	53	Socket bolt	70	Socket bolt
48	Counterbalance spool sssy	57	Steel ball	71	Reducing valve
49	CB Washer	58	HS plug assy	72	Reducing spring
50	CB main spring	59	Orifice	73	HS plug assy
51	O-ring	61	MW 10	74	PT plug
52	CB cover	62	HS plug assy	90	Relief valve

3. OPERATION

1) MOTOR



320A2TM05

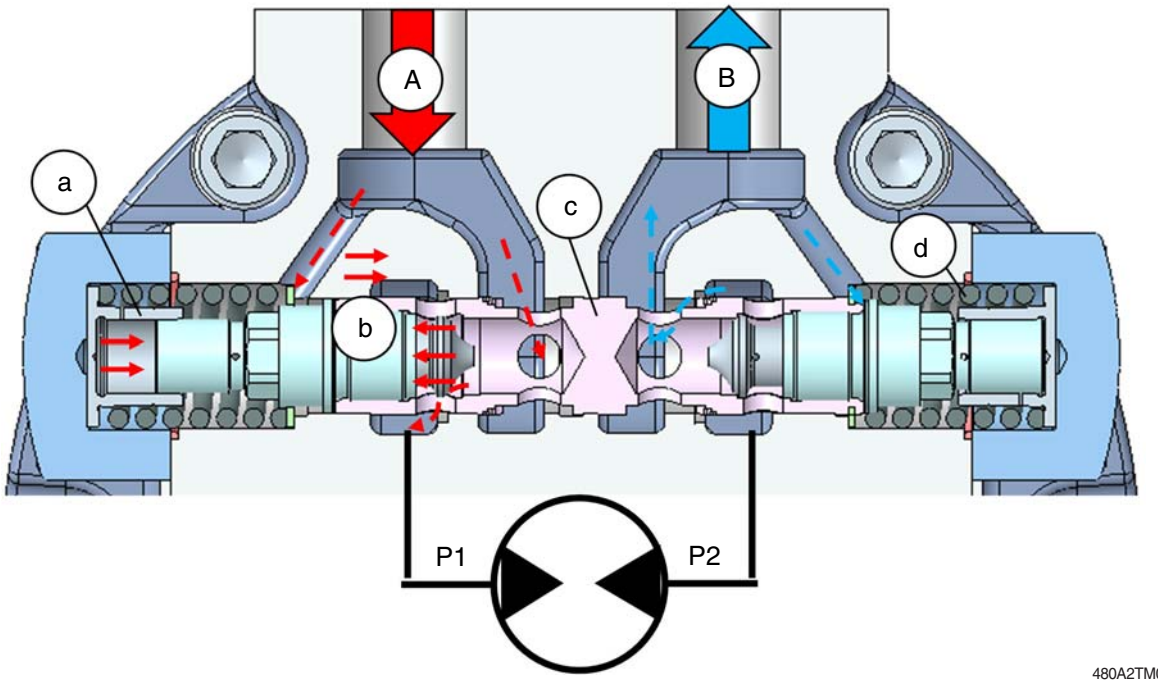
(1) The fluid supplied from the main control valve flows into the cylinder block (b) through the valve plate (a) of the hydraulic motor. This time, half of the fluid will flow in and half will flow out based on Y1-Y2 connecting the top dead center (TDC) and the bottom dead center (BDC) of the piston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

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

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

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

2) COUNTERBALANCE VALVE



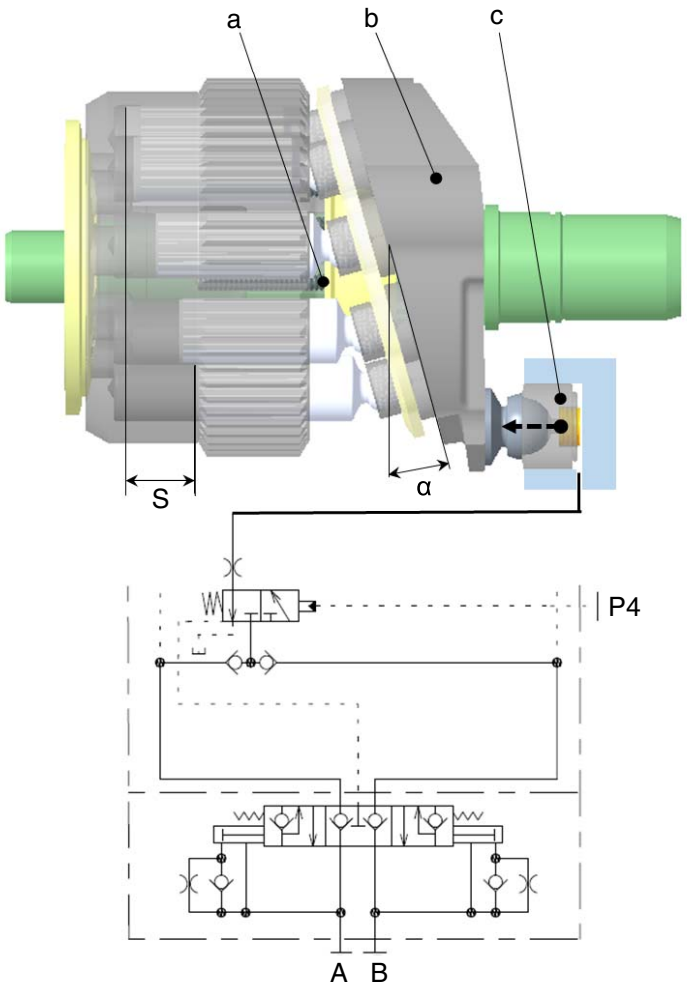
(1) If a fluid is supplied to port A rhrough the main control valve, the check valve (b) is pushed to the left to feed the inlet flow path (P1) and rotate the hydraulic motor.

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

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

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

3) 2-SPEED SHIFT

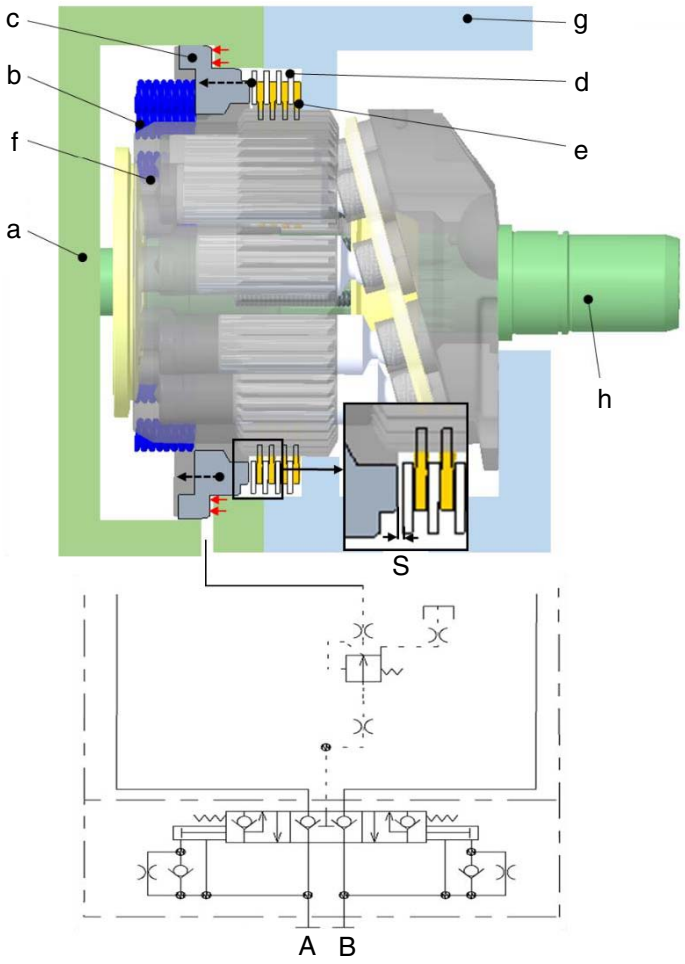


320A2TM07

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

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

4) PARKING BRAKE

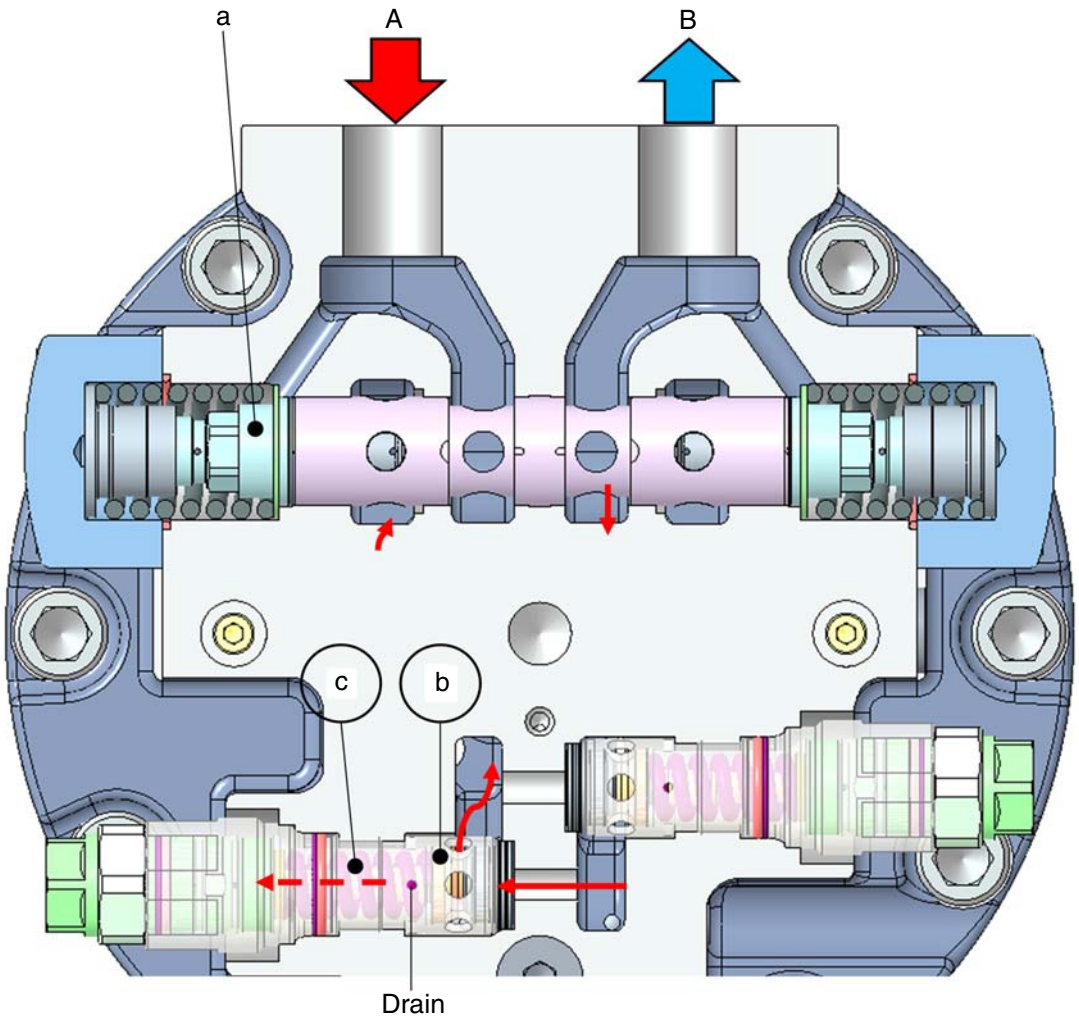


320A2TM08

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

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

5) RELIEF VALVE



480A2TM09

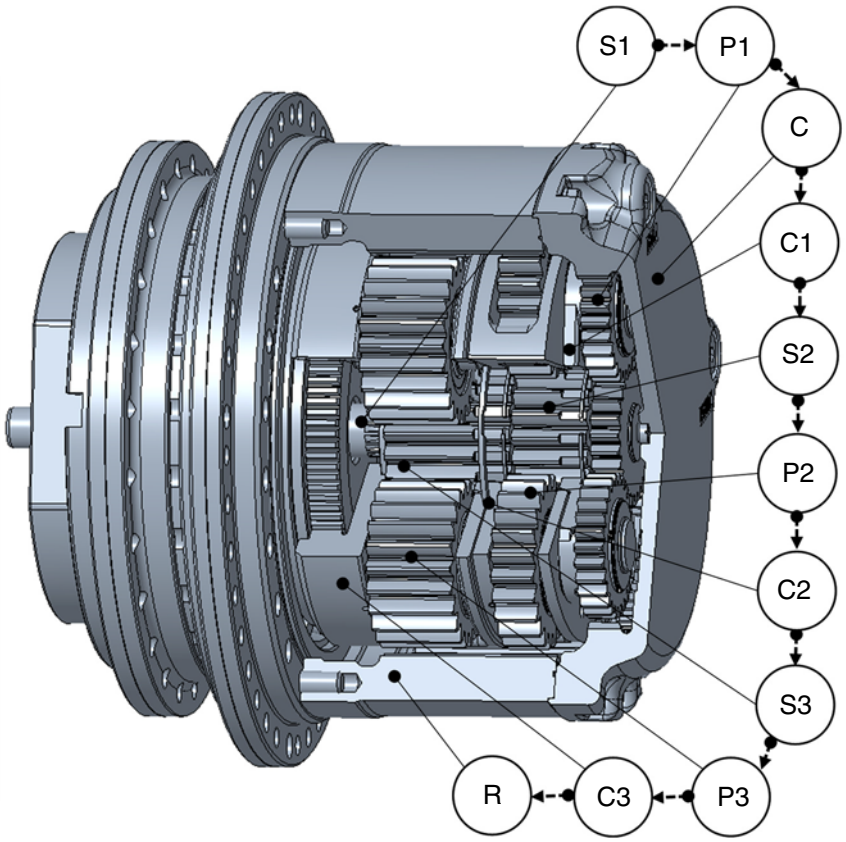
(1) The counterbalance valve (a) slides to the neutral position and blocks the flow path between the inlet (A) and outlet (B) when the motor stops while rotating.

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

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

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

6) REDUCTION GEAR



480A2TM10

(1) The torque of the hydraulic motor is transmitted to the first stage sun gear (S1), which drives the first stage planet gear (P1).

(2) The rotational force of the 1st stage planet gear (P1) is transmitted to the cover (C).
Since the cover (C) is fixed, a reaction force will be generated to run idle and drive the 1st stage carrier (C1).
The rotational force of the 1st stage carrier (C1) is transmitted to the 2nd stage sun gear (S2), which drives the 2nd stage planet gear (P2)

(3) The rotational force of the 2nd stage planet gear (P2) is transmitted to the ring gear (R), Since the ring gear (R) is fixed, a reaction force will be generated to run idle and drive the 2nd stage carrier (C2).

(4) The rotational force of the 2nd stage carrier (C2) is transmitted to the 3rd stage sun gear (S3), which drives the 3rd stage planet gear (P3).
3rd stage carrier (C3) is fixed to the motor casing, so the rotational force of the 3rd stage planet gear (P3) which drives the ring gear (R). This is the final rotational force of the travel device.

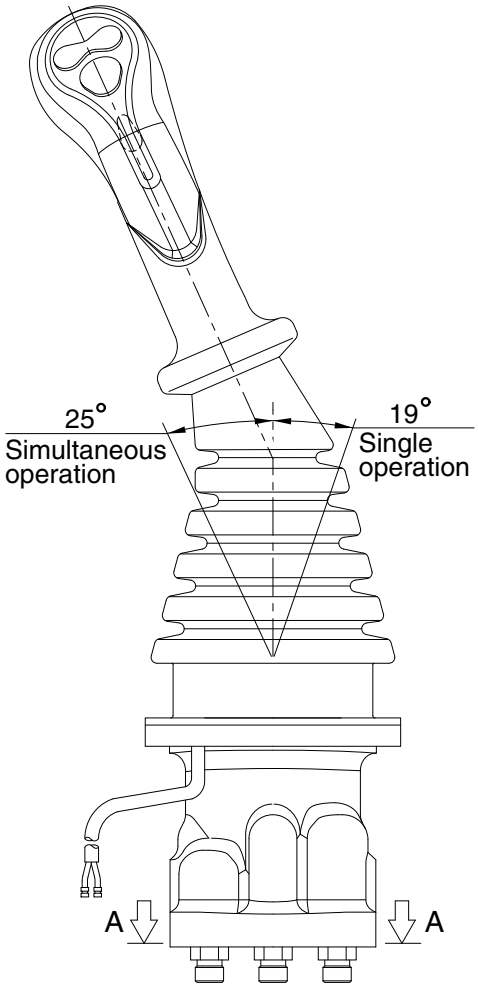
GROUP 5 RCV LEVER

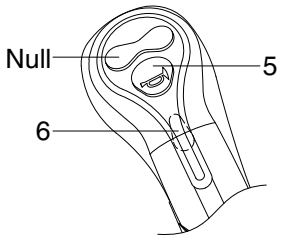
1. STRUCTURE

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

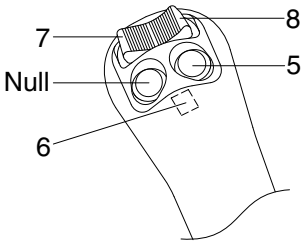
※ Refer to the parts manual for the types of the RCV lever.

1) TYPE M1, M10





TYPE M1, M10

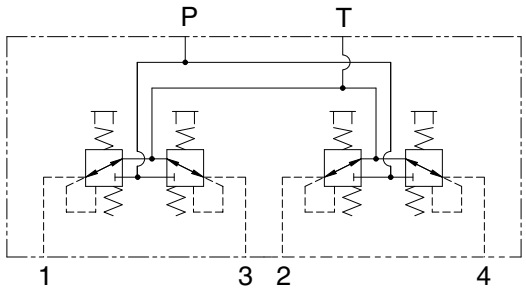


NONE

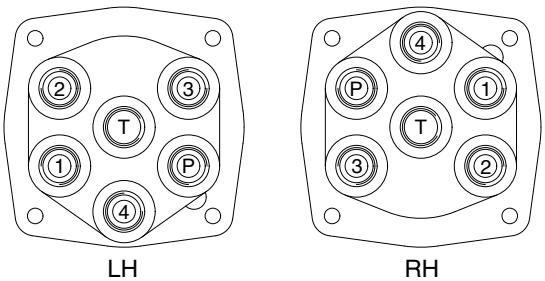
Switches

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

※ Number 7 and 8 : Option attachment



Hydraulic circuit



LH RH

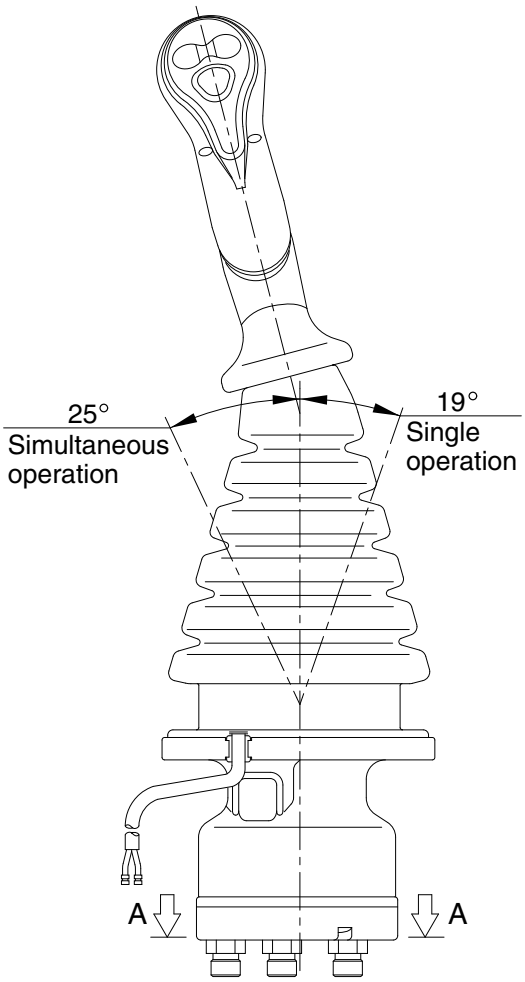
VIEW A-A

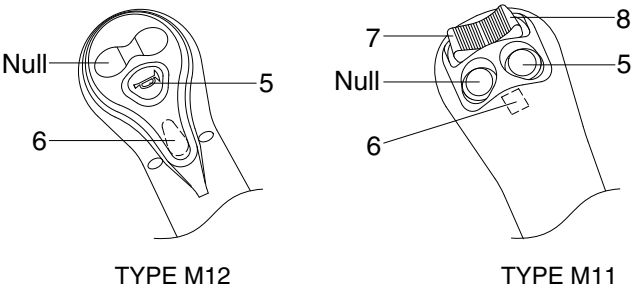
Pilot ports

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

480A2RL01

2) TYPE M11, M12



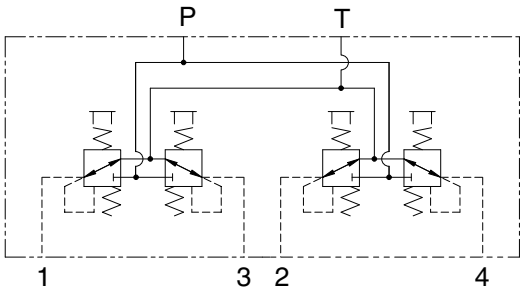


TYPE M12 TYPE M11

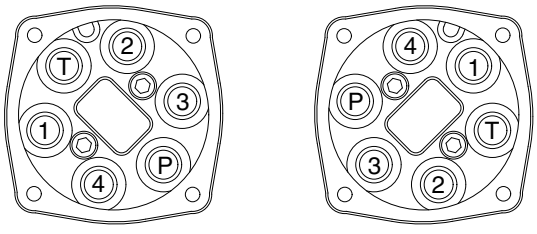
Switches

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

※ Number 7 and 8 : Option attachment



Hydraulic circuit



LH RH

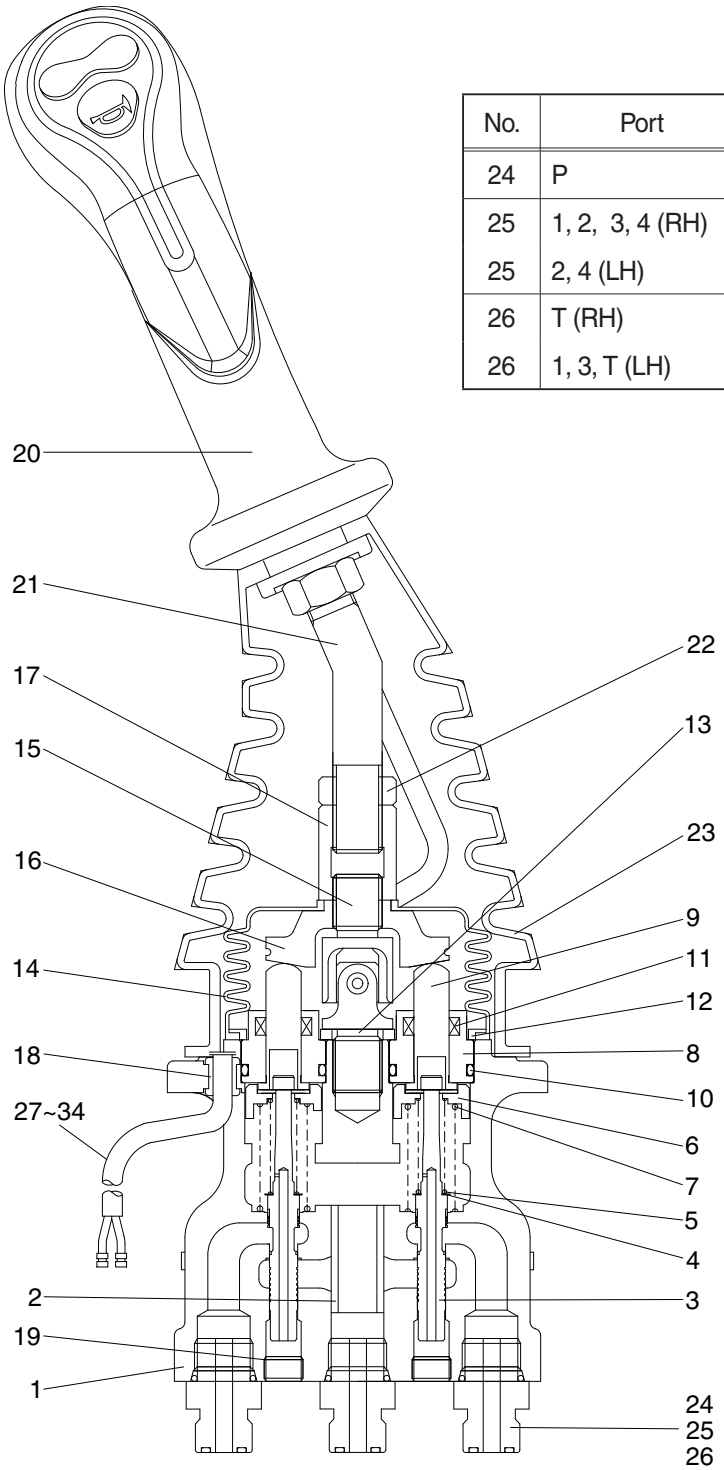
VIEW A-A

Pilot ports

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

480A2RL05

3) CROSS SECTION



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

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

210S2RL06

Item numbers are based on the type M1.

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

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

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

2. FUNCTIONS

1) FUNDAMENTAL FUNCTIONS

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

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

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

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

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

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

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

2) FUNCTIONS OF MAJOR SECTIONS

Item numbers are based on the type M1.

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

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

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

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

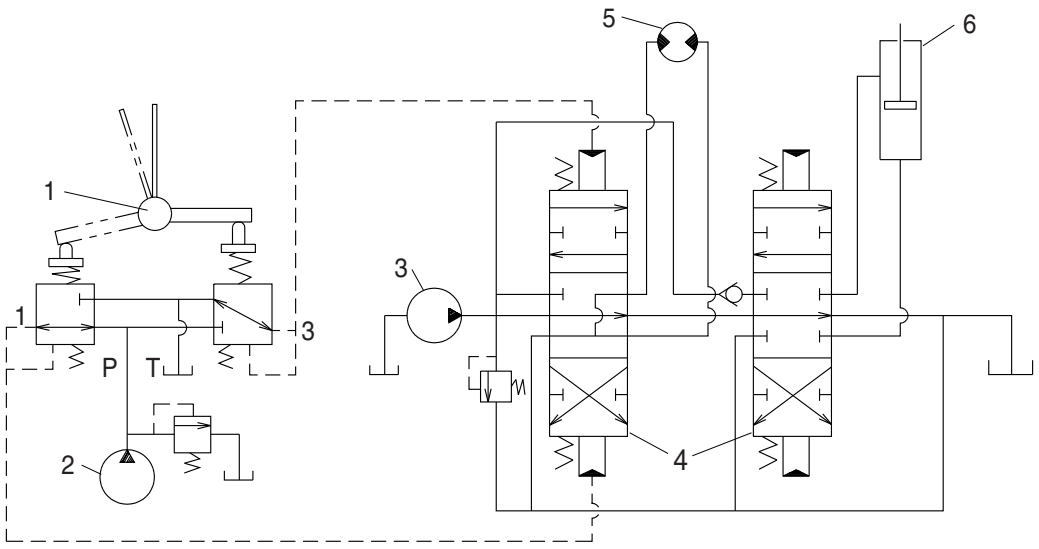
The spring (7) works on the case (1) and spring seat (6) and tries to return the push rod (9) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

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

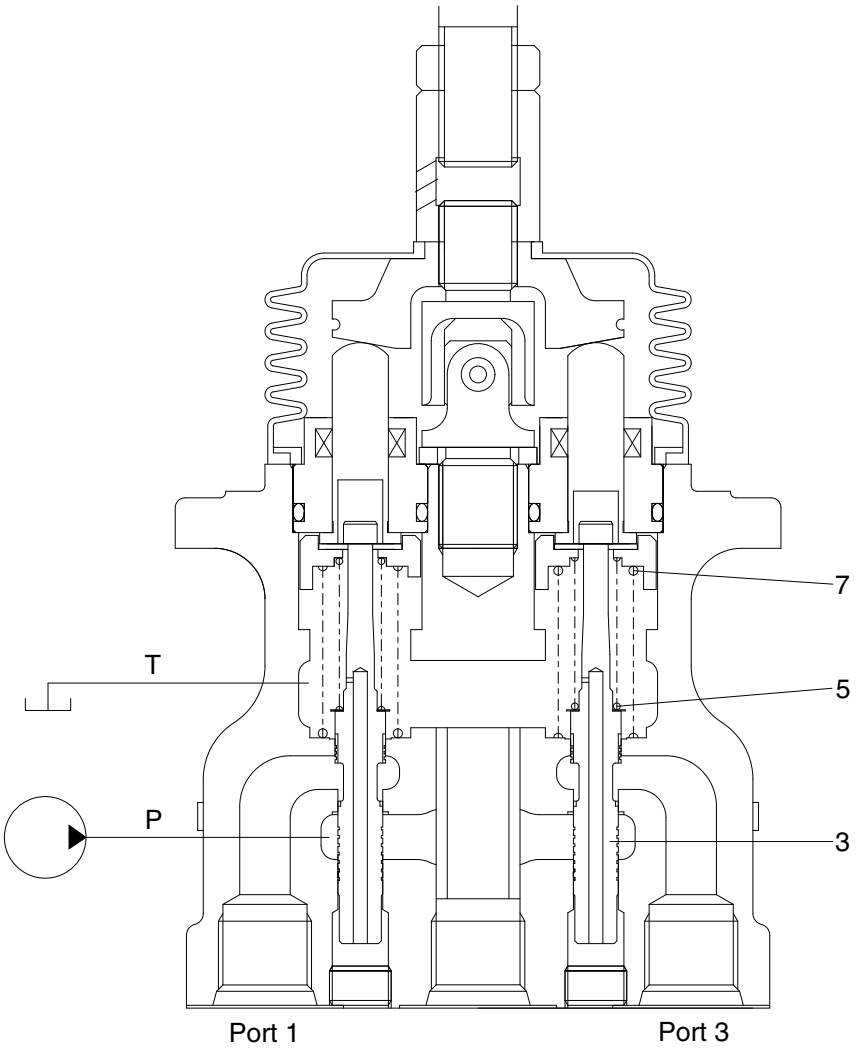
The diagram shown below is the typical application example of the pilot valve.



2-70

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

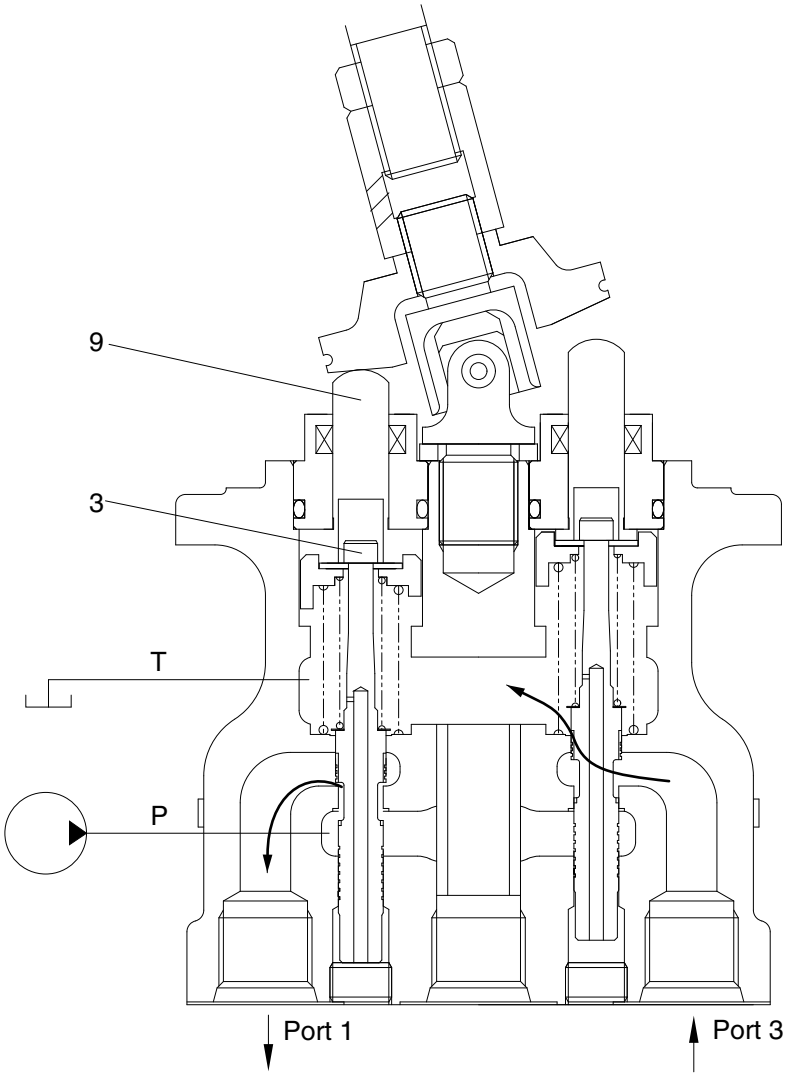
(1) Case where handle is in neutral position



300L2RL03

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

(2) Case where handle is tilted



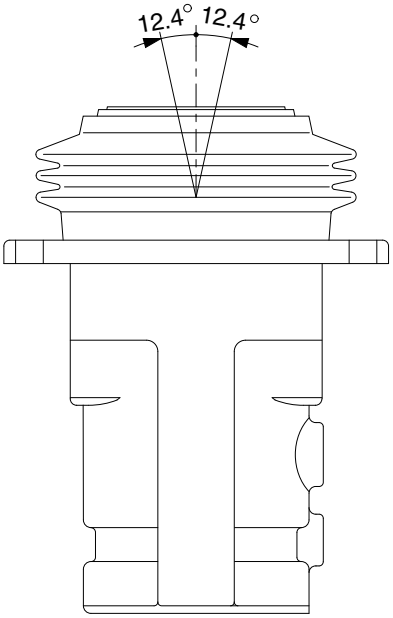
300L2RL04

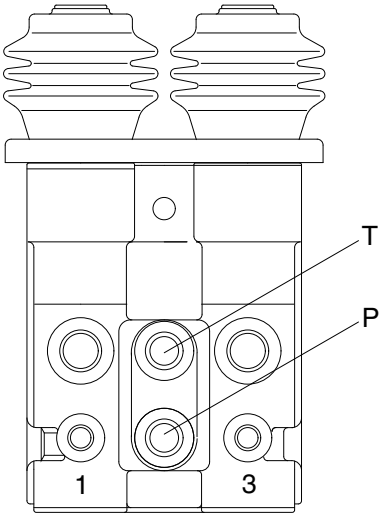
When the push rod (9) is stroked, the spool (3) moves downwards.
Then port P is connected with port (1) and the oil supplied from the pilot pump flows through port (1) to generate the pressure.
When the pressure at port (1) increases to the value corresponding to the spring force set by tilting the handle,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

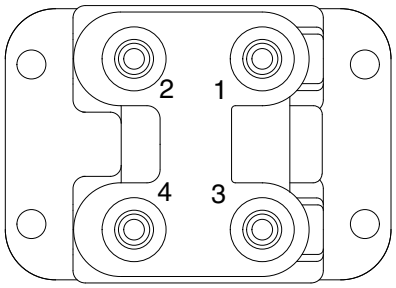
GROUP 6 RCV PEDAL

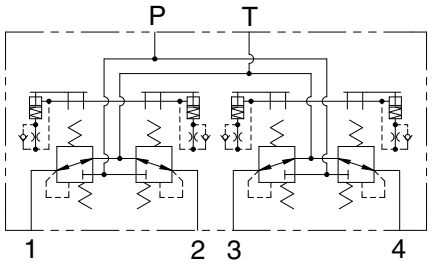
1. STRUCTURE

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









Hydraulic circuit

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

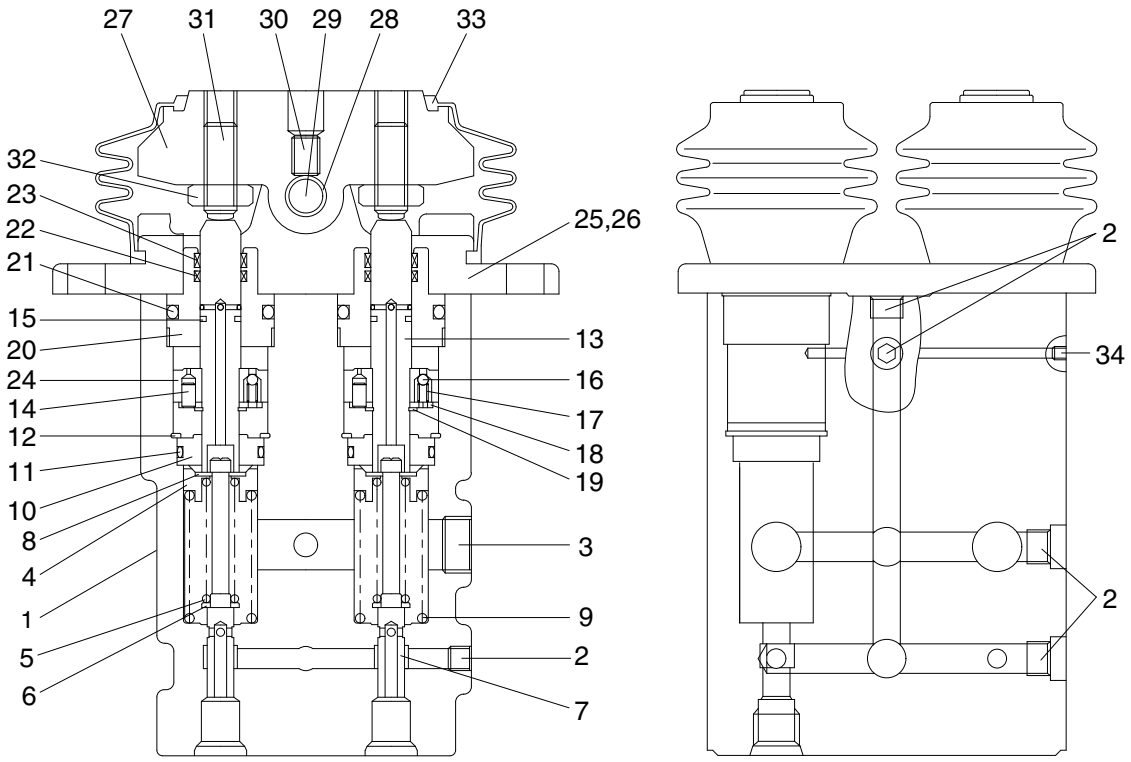
480A2RP01

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.

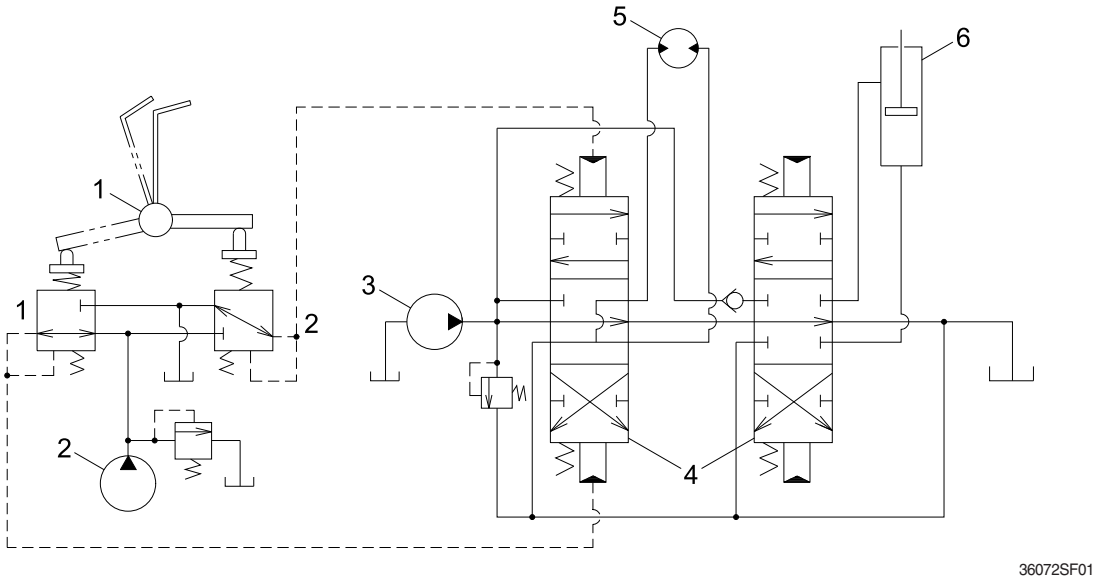
The spring (9) works on the body (1) and spring seat (6) and tries to return the push rod (13) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

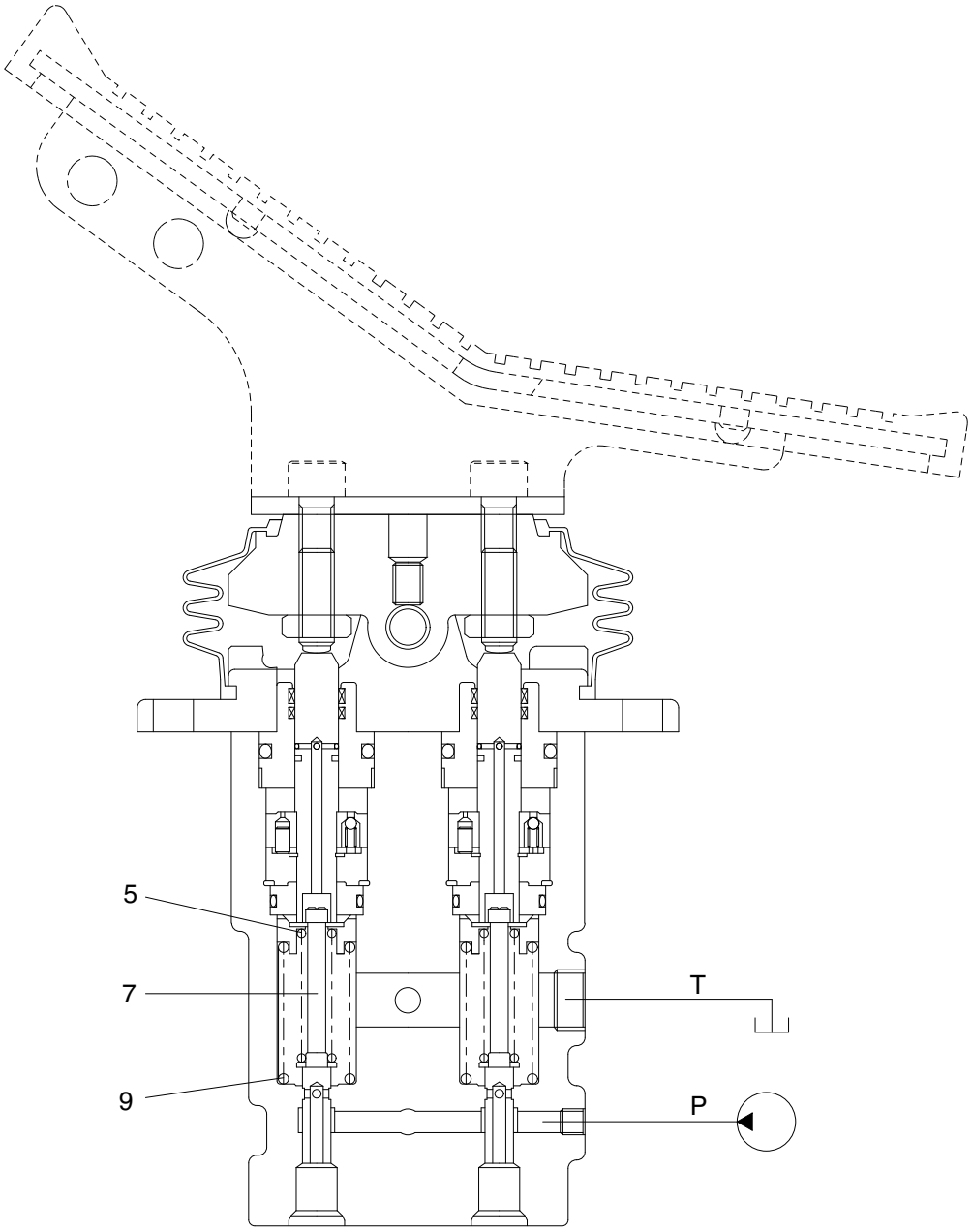
The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below and the attached operation explanation drawing.

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

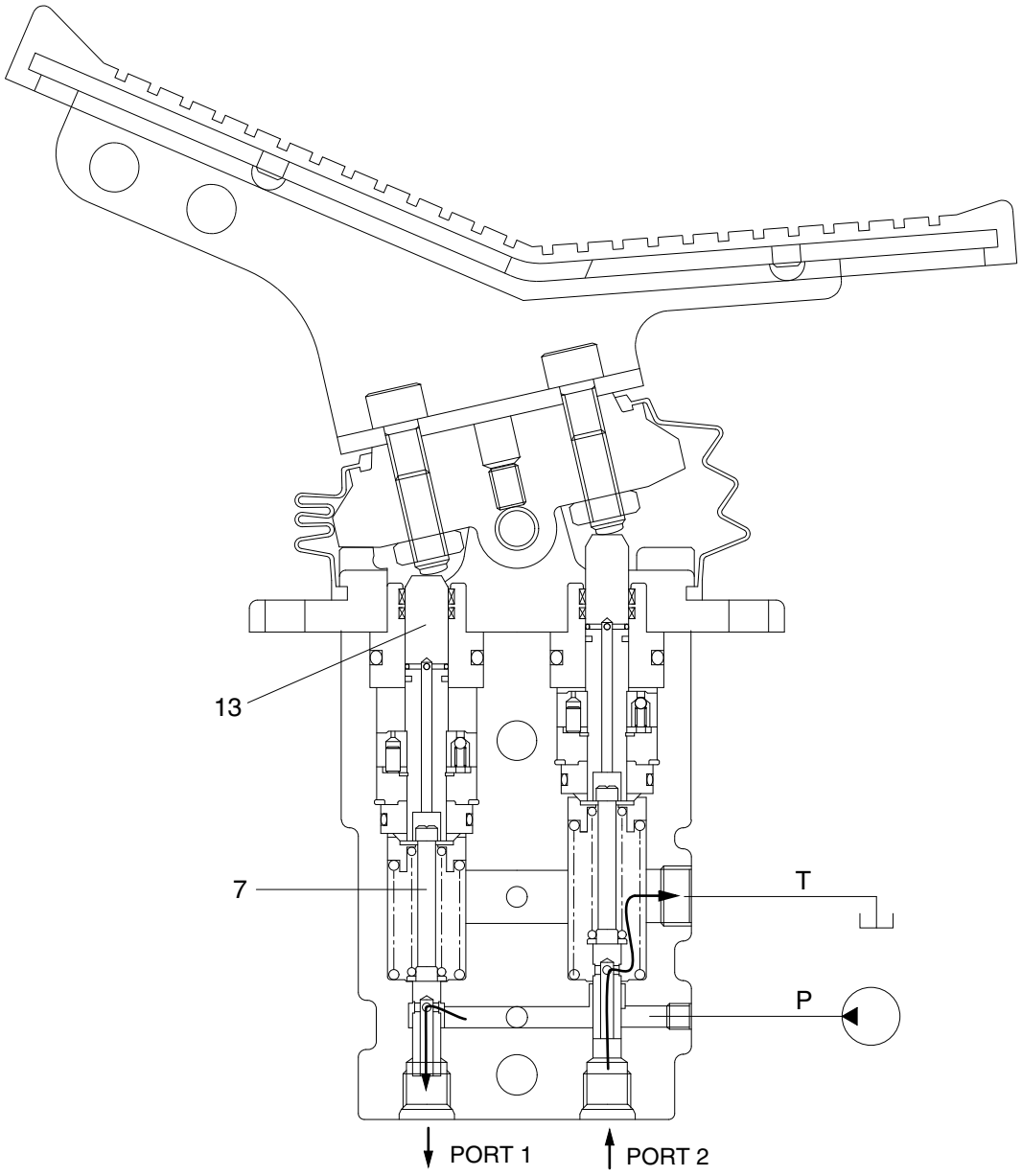
(1) Case where pedal is in neutral position



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

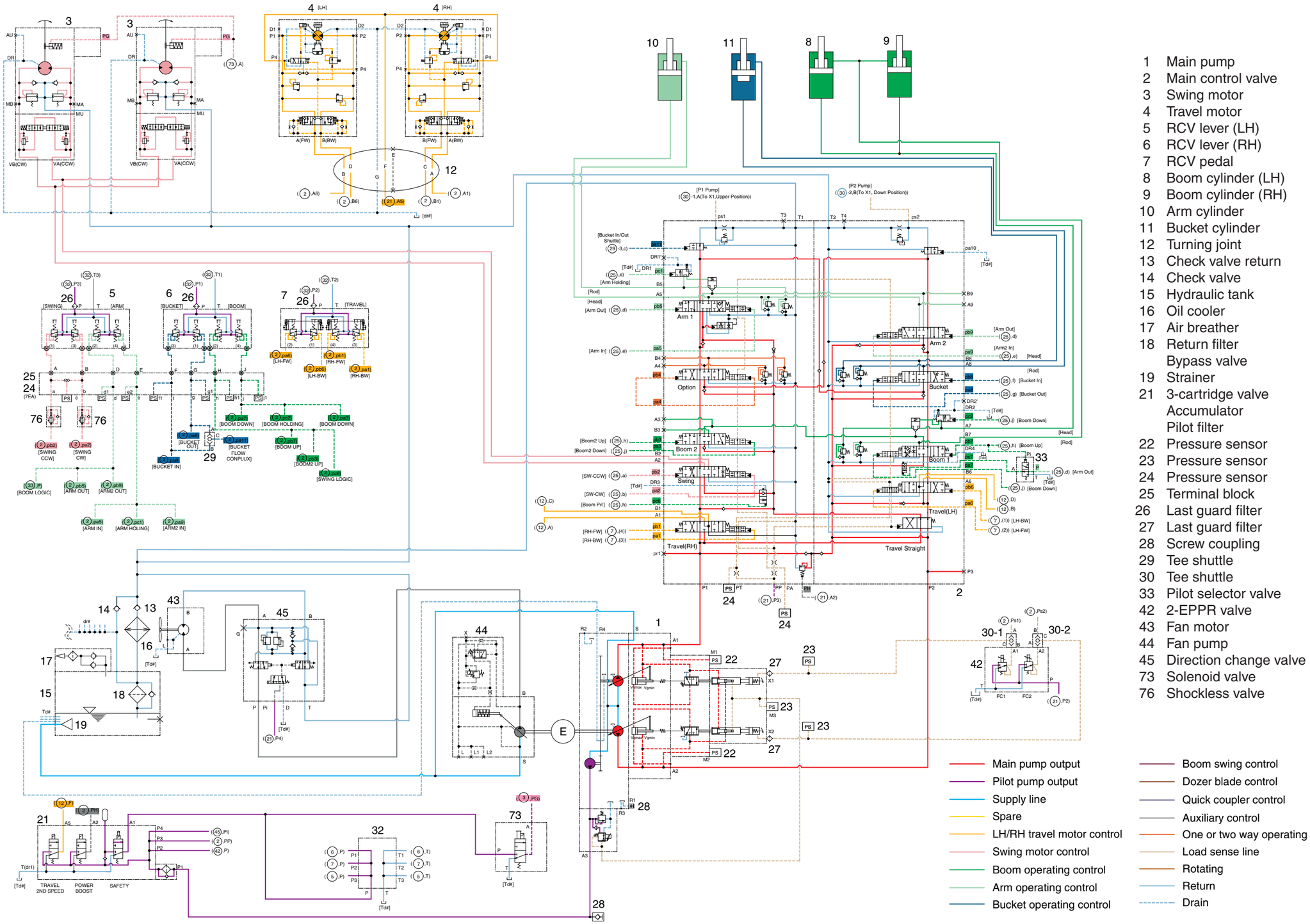
When the push rod (13) is stroked, the spool kit (7) moves downwards.
Then port P is connected with port 1, and the oil supplied from the pilot pump flows through port 1 to generate the pressure.
When the pressure at port 1 increases to the value corresponding to the spring force set by tilting the handle, 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 3-1
Group 2 Main Circuit 3-2
Group 3 Pilot Circuit 3-5
Group 4 Single Operation 3-14
Group 5 Combined Operation 3-24

GROUP 1 HYDRAULIC CIRCUIT

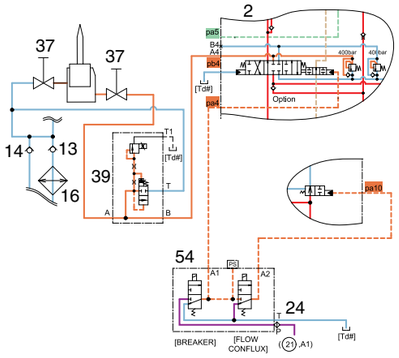
1. HYDRAULIC CIRCUIT (1/2)



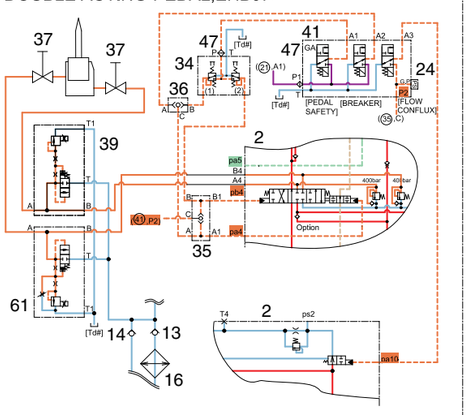
1 Main pump
2 Main control valve
3 Swing motor
4 Travel motor
5 RCV lever (LH)
6 RCV lever (RH)
7 RCV pedal
8 Boom cylinder (LH)
9 Boom cylinder (RH)
10 Arm cylinder
11 Bucket cylinder
12 Turning joint
13 Check valve return
14 Check valve
15 Hydraulic tank
16 Oil cooler
17 Air breather
18 Return filter
Bypass valve
19 Strainer
21 3-cartridge valve
Accumulator
Pilot filter
22 Pressure sensor
23 Pressure sensor
24 Pressure sensor
25 Terminal block
26 Last guard filter
27 Last guard filter
28 Screw coupling
29 Tee shuttle
30 Tee shuttle
33 Pilot selector valve
42 2-EPPR valve
43 Fan motor
44 Fan pump
45 Direction change valve
73 Solenoid valve
76 Shockless valve

2. HYDRAULIC CIRCUIT (2/2)

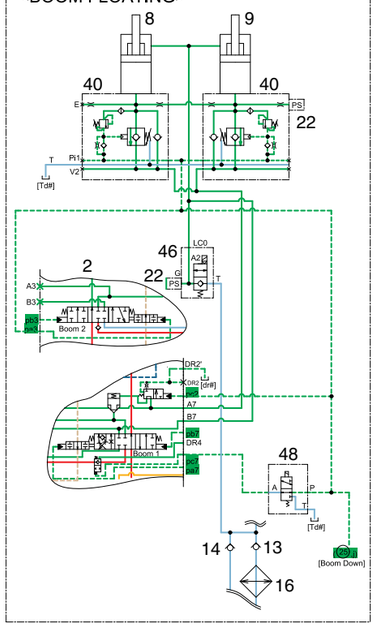
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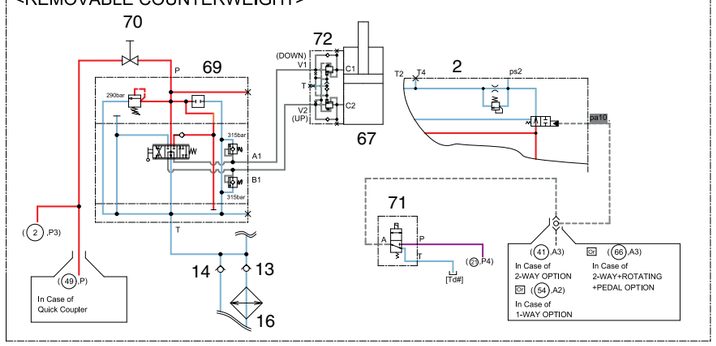
<DOUBLE ACTING-PEDAL,EHB07>



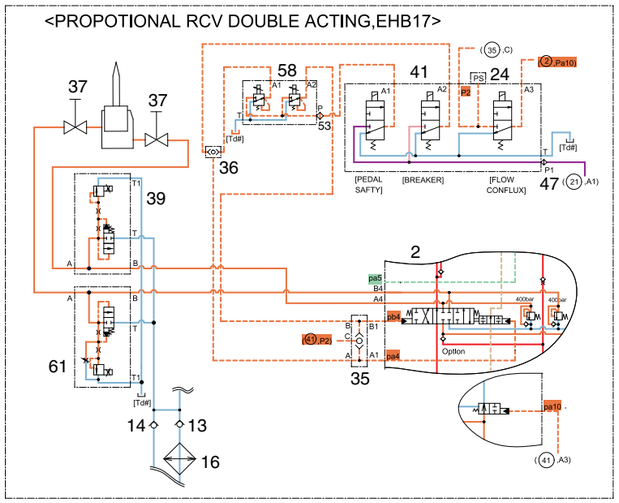
<BOOM FLOATING>



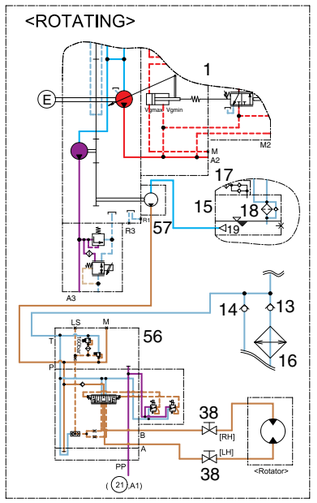
<REMOVABLE COUNTERWEIGHT>



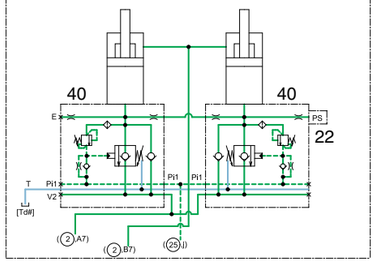
<PROPOTIONAL RCV DOUBLE ACTING,EHB17>



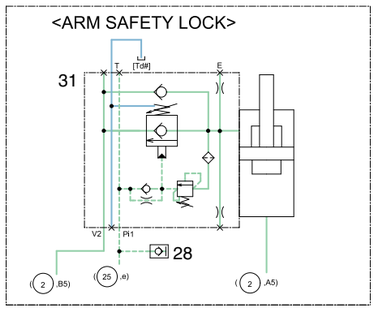
<ROTATING>



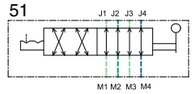
<BOOM SAFETY LOCK>



<ARM SAFETY LOCK>



<PATTERN CHANGE>



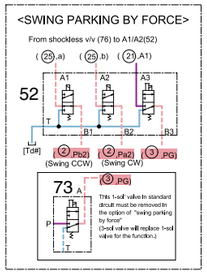
FROM		TO	
ITEM	PORT	ITEM	PORT
5	2	50	J1
	4		J3
6	2		J4
	4		J2
50	M1	25	D
	M2		J
	M3		E
	M4		H

<RCV OPTION>

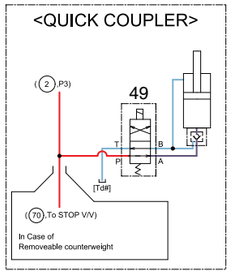
ITEM	OPT(1)	OPT(2)	PART NO.	NOTE
5 / 6	ERR00 (STD)	EJA01	31K9-21011/21	19?,EATON
		EJA21	31K9-21411/21	19?,KPM+DAEHYUN
		EJA23	31K8-21410/20	19?,KPM+DAEHYUN
	ERR01 (PRO)	EJA01	31K9-21131/41	19?,EATON
		EJA21	31K9-21431/41	19?,KPM+DAEHYUN
		EJA23	31K8-21430/40	19?,KPM+DAEHYUN

(EJA23 is just lower operating force than EJA21)

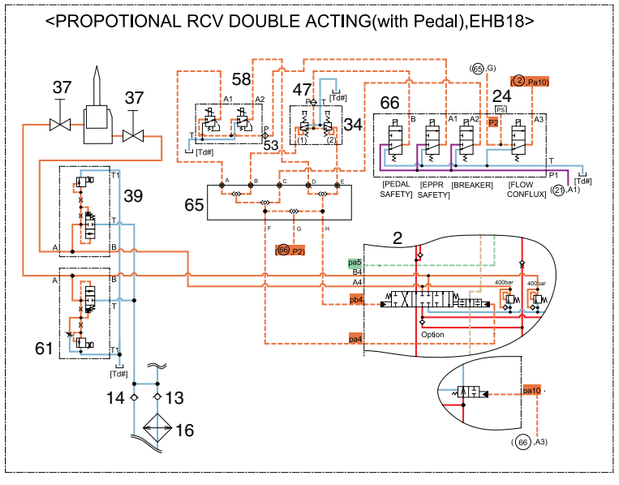
<SWING PARKING BY FORCE>



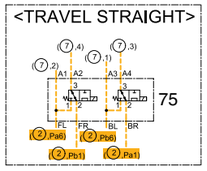
<QUICK COUPLER>



<PROPOTIONAL RCV DOUBLE ACTING(with Pedal),EHB18>



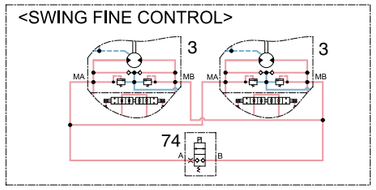
<TRAVEL STRAIGHT>



<TRAVEL MOTOR ASS'Y OPTION>

PART NO.	OPTION CODE	MAKER
34E7-03051	EHM02	REXROTH
31KB-40200	EHM05(STD)	MOTTROL
39QB-40102	EHM06	DANFOSS
38QB-40102	EHM07	HG

<SWING FINE CONTROL>



1 Main pump
22 Pressure sensor
24 Pressure sensor
28 Screw coupling
30 Cylinder safety valve
31 Cylinder safety valve
34 2-way pedal
35 5-shuttle valve
36 Tee shuttle
37 Stop valve (LH, RH)
38 Stop valve (LH, RH)
39 Proportional relief valve
40 Cylinder safety valve (LH, RH)
41 Solenoid valve
46 Floating cartridge valve
47 Last guard filter
48 Solenoid valve
49 Solenoid valve
51 Pattern change valve
52 Solenoid valve
53 Last guard filter
54 Solenoid valve
56 Proportional valve
57 Gear pump
58 2-EPPR valve
61 Proportional relief valve
65 Shuttle block
66 Solenoid valve
67 Cylinder
69 Control valve
70 Stop valve
71 Solenoid valve
72 Safety valve
74 Solenoid valve
75 Solenoid valve

Main pump output
Pilot pump output
Supply line
Spare
LH/RH travel motor control
Swing motor control
Boom operating control
Arm operating control
Bucket operating control
Boom swing control
Dozer blade control
Quick coupler control
Auxiliary control

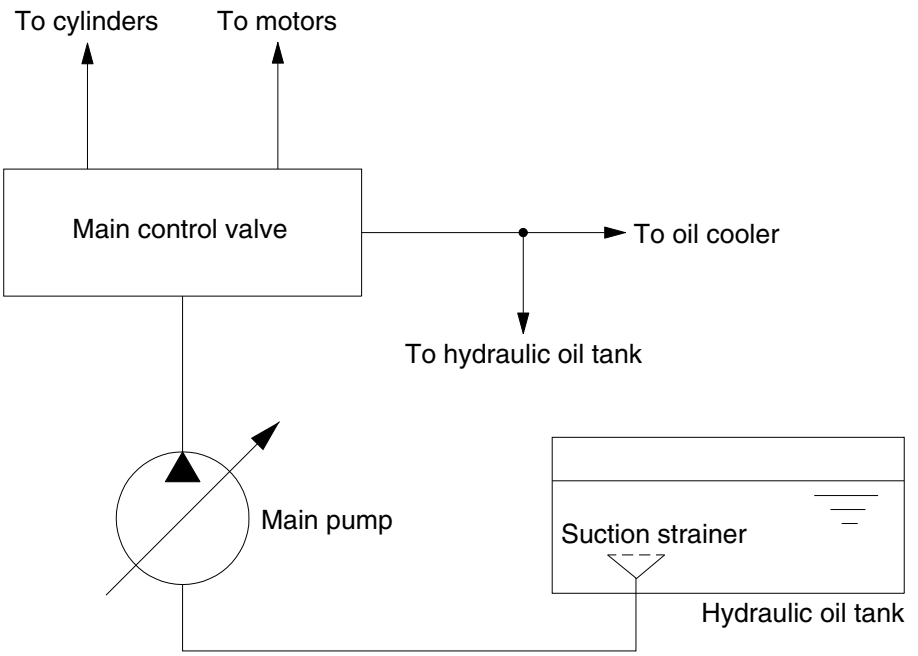
One or two way operating
Load sense line
Rotating
Return
Drain

C30KB-27100-06 2OF2

GROUP 2 MAIN CIRCUIT

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

1. SUCTION AND DELIVERY CIRCUIT

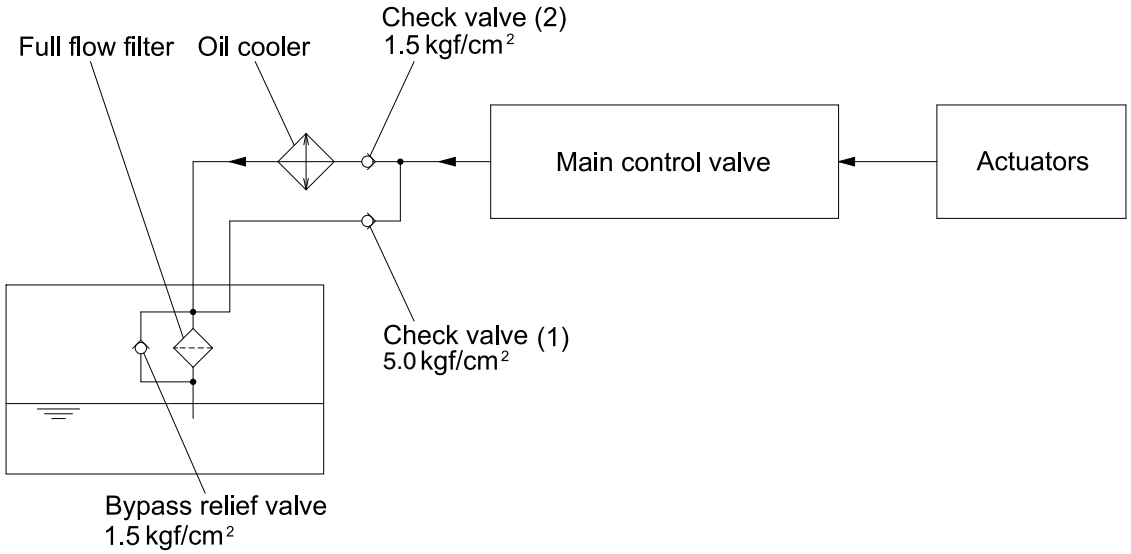


140L3CI01

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

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

2. RETURN CIRCUIT



480A3CI01

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

The bypass check valves are provided in the return circuit.

The setting pressure of bypass check valves are 1.5 kgf/cm² (21 psi) and 5.0 kgf/cm² (71 psi). Usually, oil returns to the hydraulic tank from the left side of control valve through oil cooler.

When oil temperature is low, viscosity becomes higher and flow resistance increases when passing through the oil cooler. The oil pressure exceeds 5.0 kgf/cm² (71 psi), the oil returns directly to the hydraulic tank, resulting in the oil temperature being raised quickly at an appropriate level.

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

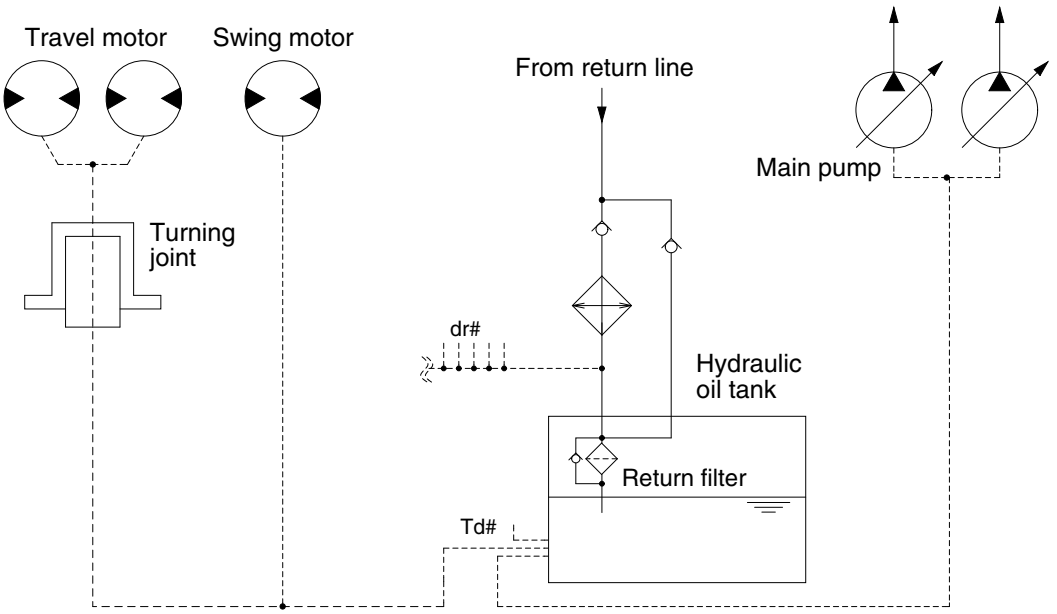
The full-flow filter and bypass relief valve are provided in the hydraulic tank.

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

When the filter element is clogged, the bypass relief valve opens at 1.5 kgf/cm² (21 psi) differential pressure.

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

3. DRAIN CIRCUIT



480A3CI02

Besides internal leaks from the motors and main pump, the oil for lubrication circulates. These oil returns to the hydraulic tank directly.

1) TRAVEL MOTOR DRAIN CIRCUIT

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

2) SWING MOTOR DRAIN CIRCUIT

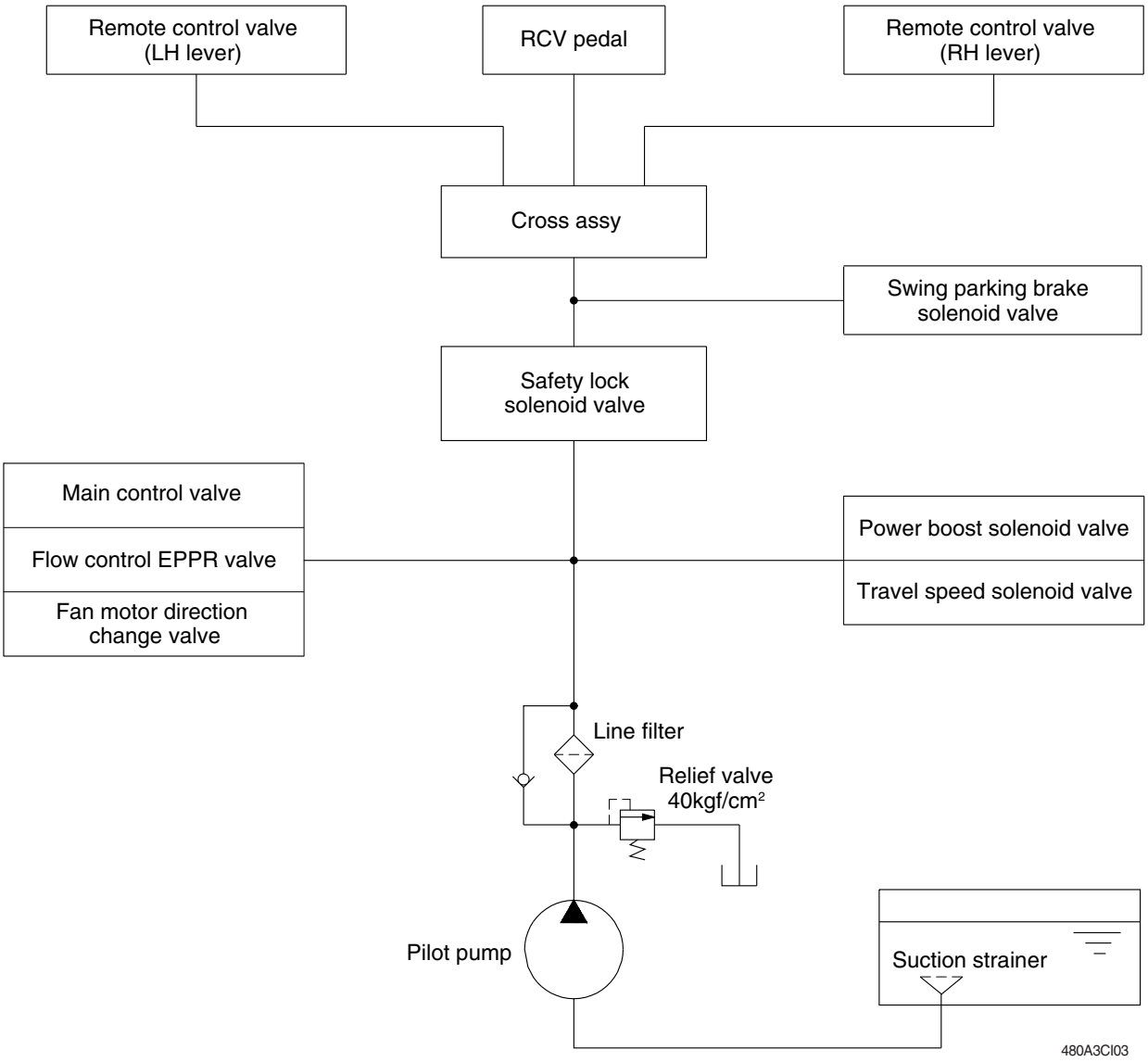
Oil leaking from the swing motor come out and joins the travel motor drain line and return to the hydraulic tank.

3) MAIN PUMP DRAIN CIRCUIT

Oil leaking from main pump come out and return to the hydraulic tank directly.

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

GROUP 3 PILOT CIRCUIT



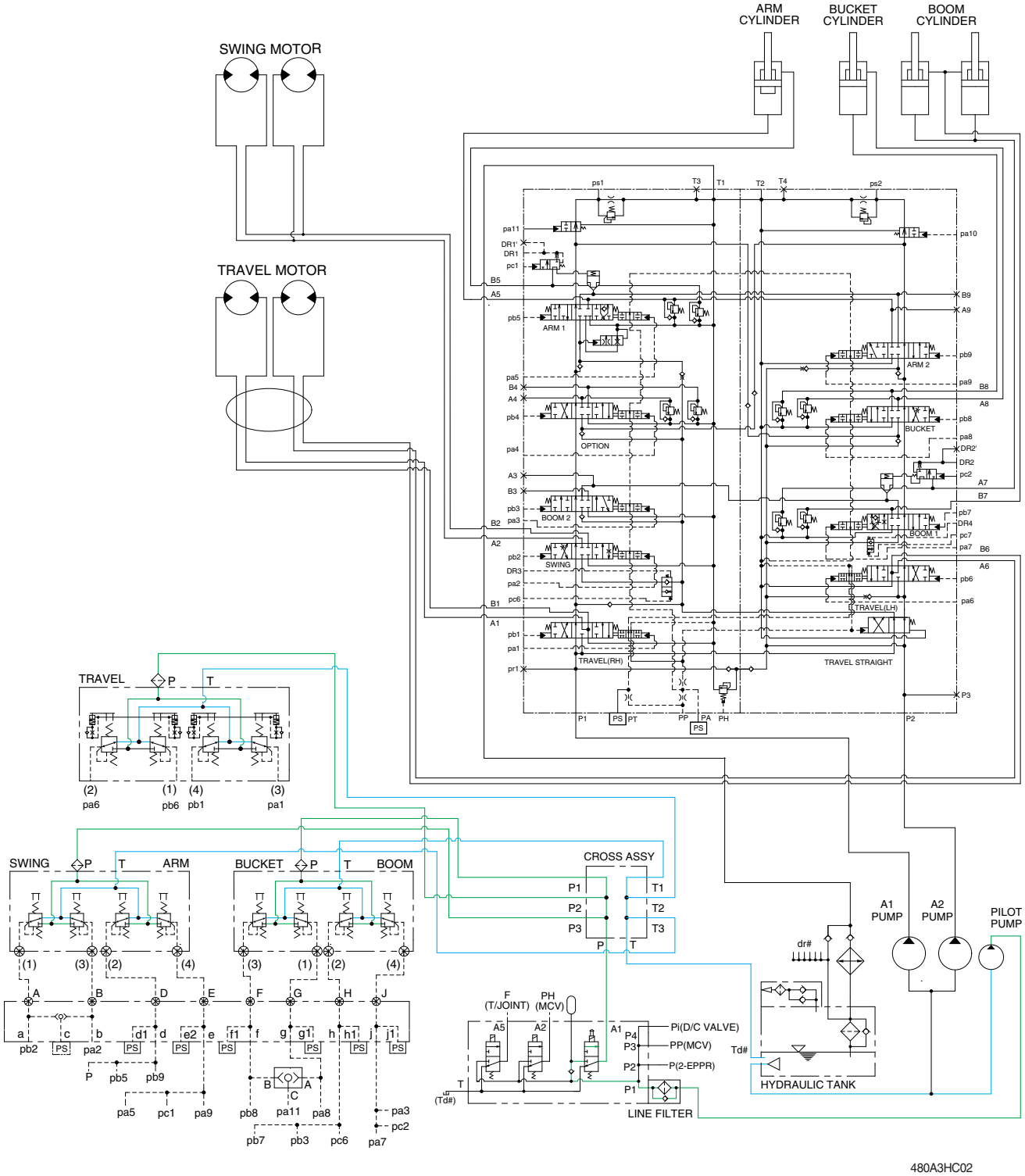
The pilot circuit consists of suction circuit, delivery circuit and return circuit.

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

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

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

1. SUCTION, DELIVERY AND RETURN CIRCUIT



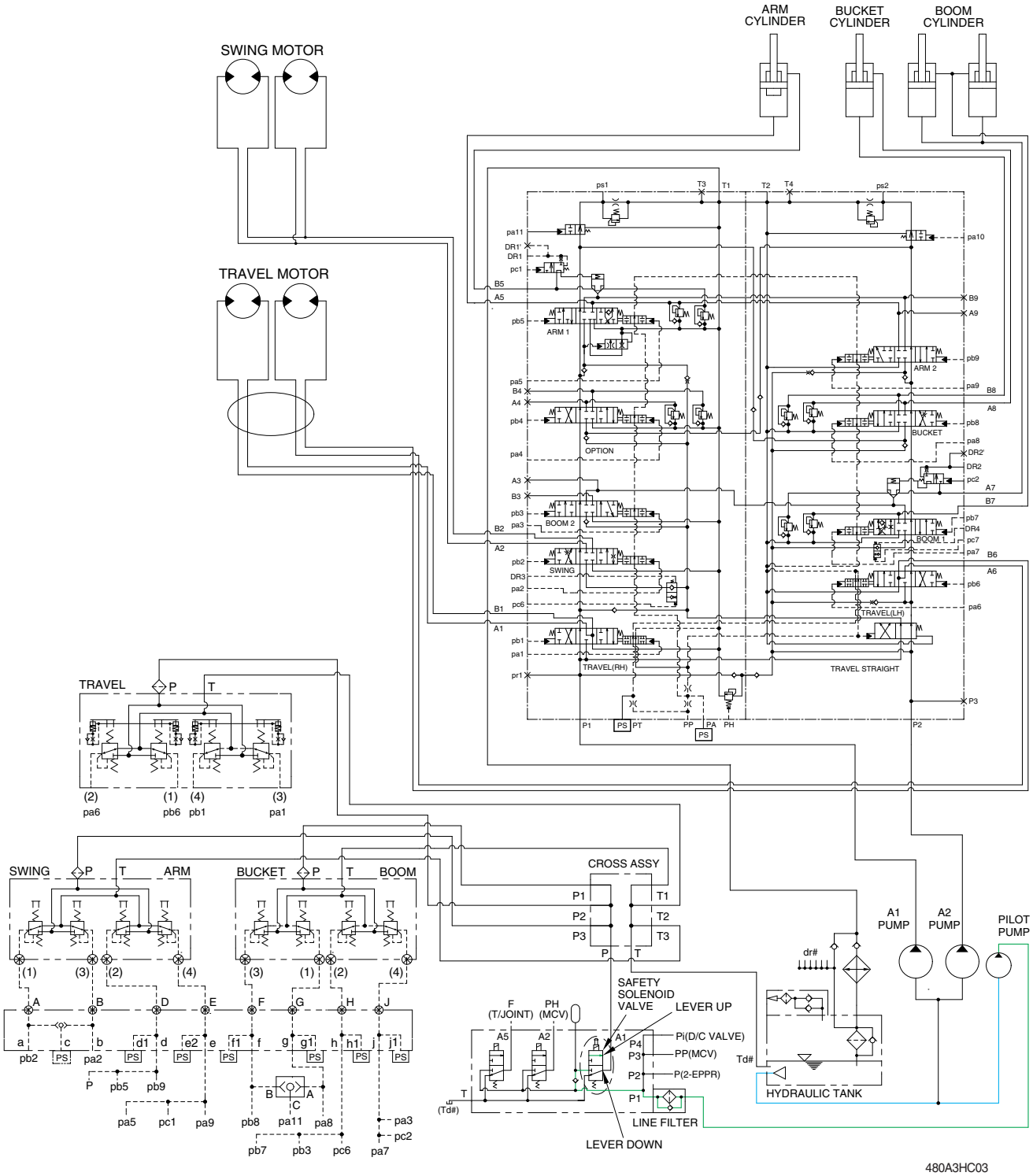
The pilot pump receive oil from the hydraulic tank. The discharged oil from the pilot pump flows to the safety solenoid valve through the line filter. The oil is filtered by the line filter. The pilot relief valve is provided in the pilot pump for limiting the pilot circuit pressure.

The oil filtered by line filter flows remote control valve through safety solenoid valve and cross assy. Also, the oil flows 3-cartridge valve, swing parking solenoid valve, main control valve and flow control 2-EPPR valve.

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

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

2. SAFETY SOLENOID VALVE (SAFETY KNOB)

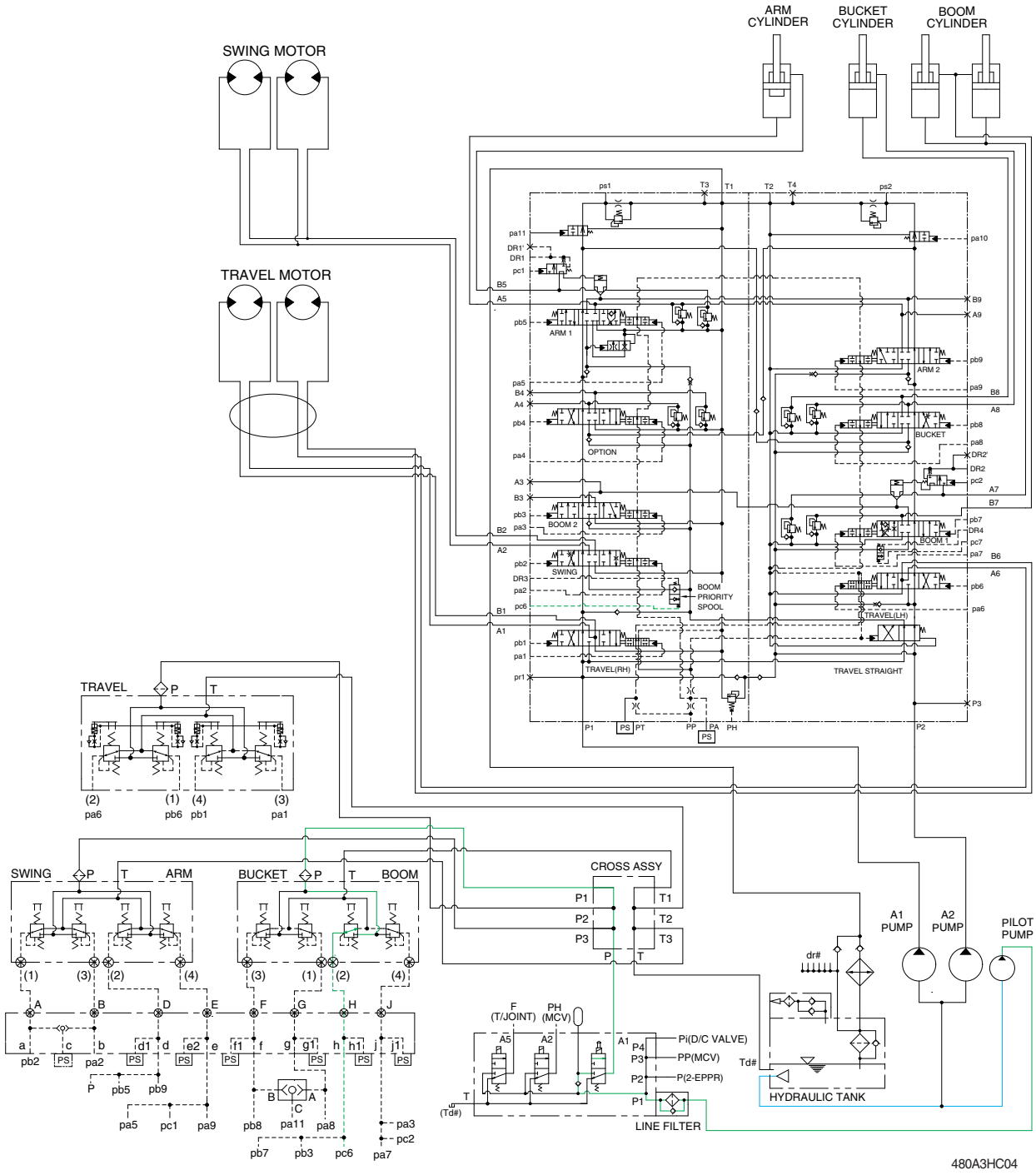


When the knob of the safety solenoid valve is moved downward, oil flows into the remote control valve through line filter, safety solenoid valve and corss assy.

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

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

3. BOOM PRIORITY SYSTEM



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

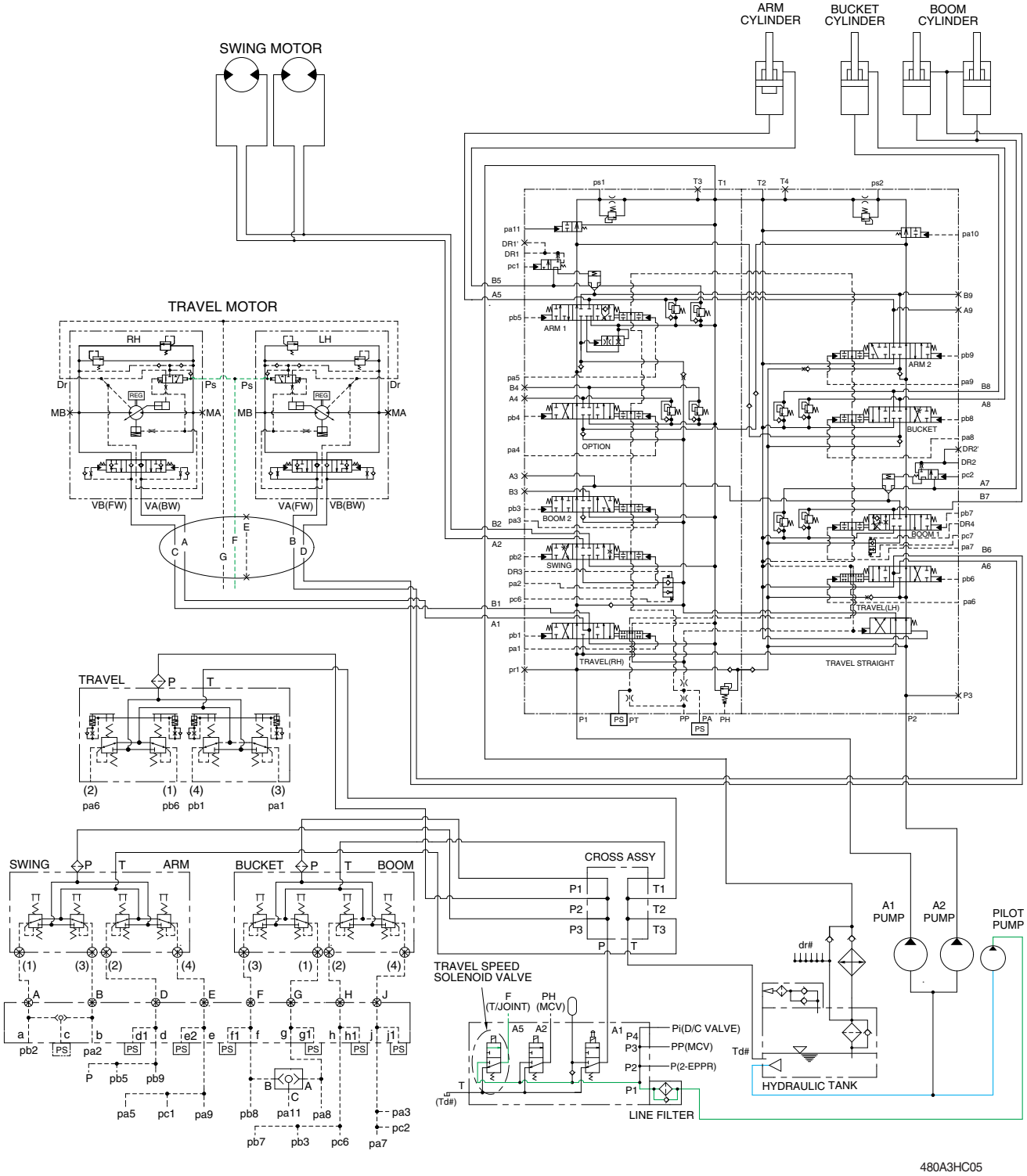
To increase working efficiency, swing speed reducing system is used.

The pilot oil from pilot pump flow into **Pc6** port in main control valve. **Pc6** oil pressure moves boom priority spool to upper position and oil flow rate to the swing motor decreased.

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

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

4. TRAVEL SPEED CONTROL SYSTEM

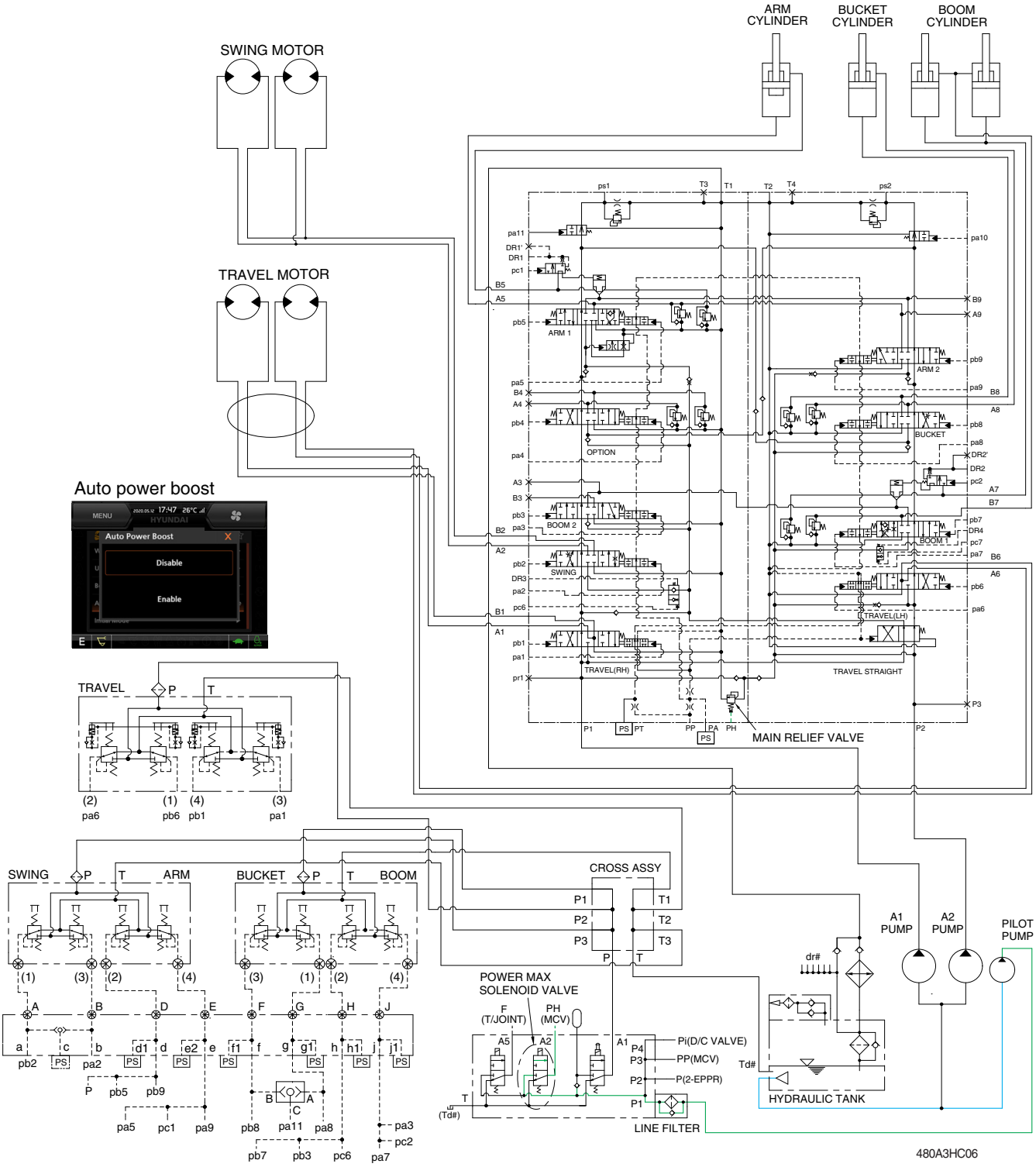


When the travel speed solenoid valve was placed in the Hi position, the pressure oil from pilot pump through line filter flows to port **Ps** of travel speed change over valve, and the control piston is pushed up, thus minimizing the displacement.

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

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

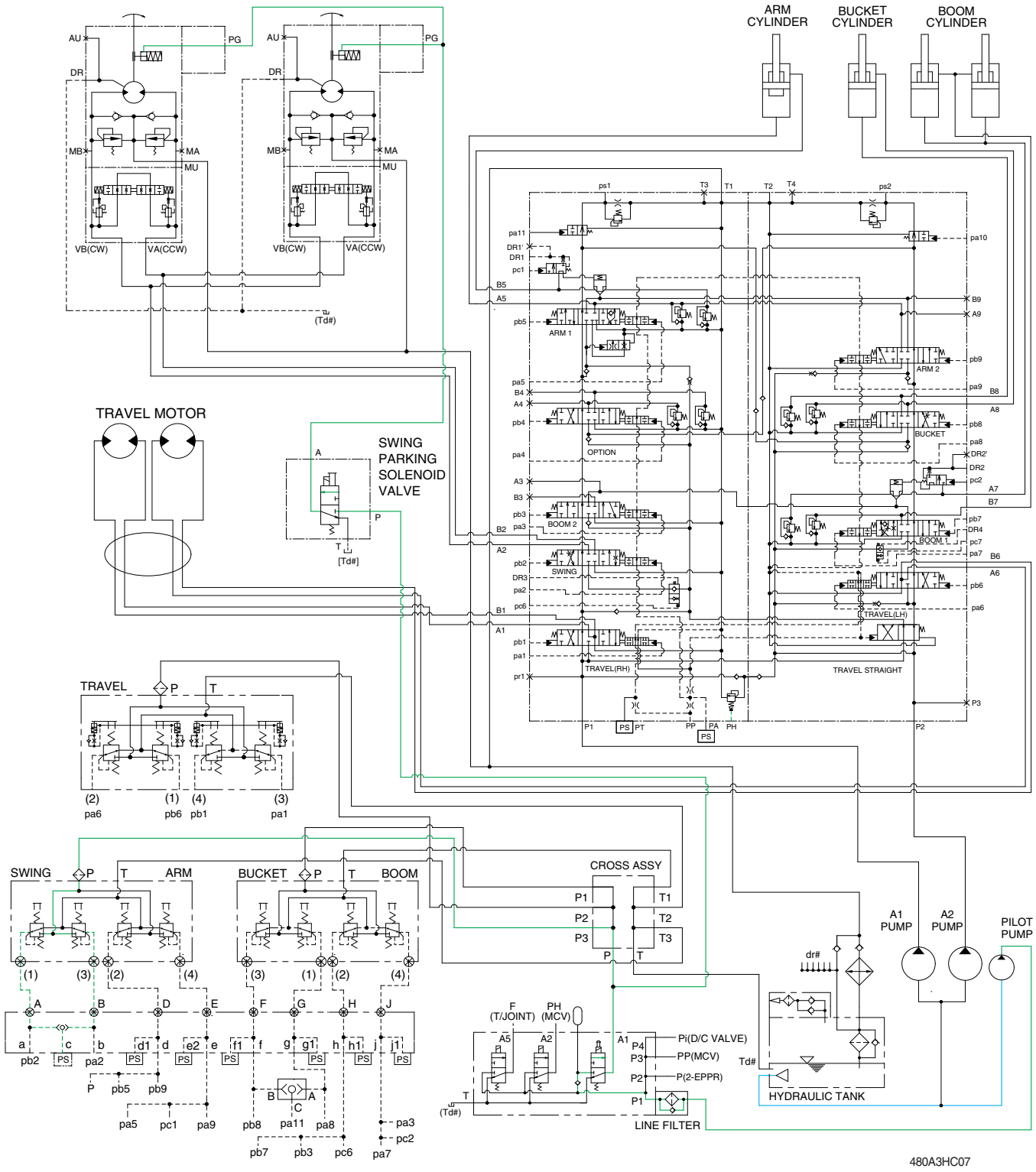
5. MAIN RELIEF PRESSURE CHANGE CIRCUIT



When the power max switch on the left control lever is pushed ON, the power max solenoid valve is actuated, the discharged oil from the pilot pump into PH port of the main relief valve of main control valve ; Then the setting pressure of the main control valve is raises from 330 kgf/cm² to 360 kgf/cm² for increasing the digging power. And even when press continuously, it is canceled after 8 seconds.
Also, the auto power boost function is selected to enable on the cluster, the pressure of the main relief valve is automatically increased to 360 kgf/cm² as working condition by the MCU. It is also operated max 8 seconds.

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

6. SWING PARKING BRAKE RELEASE



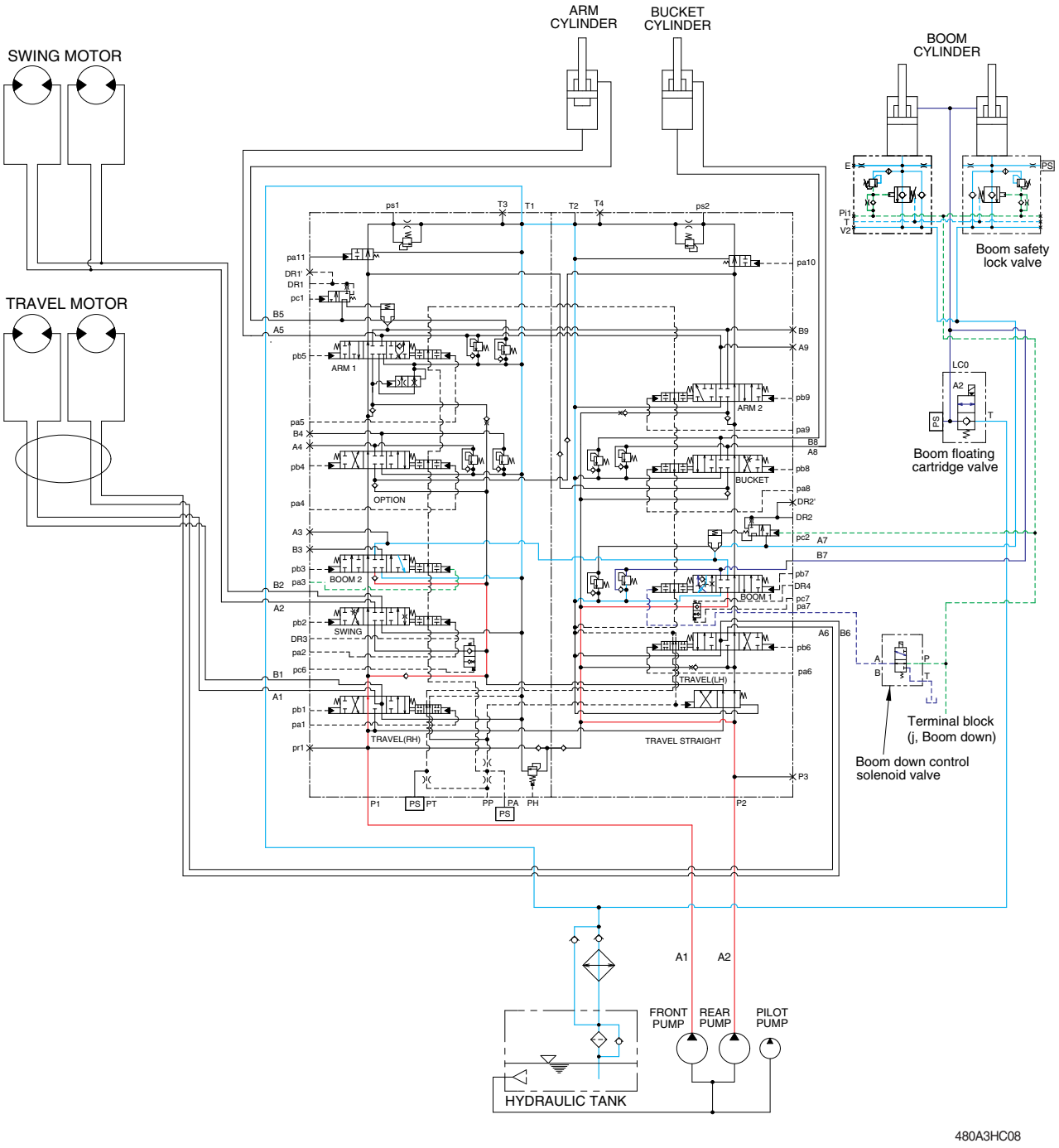
When the swing control lever is tilted, the swing solenoid valve is shifted to the down ward by the MCU that senses the pilot pressure of the swing control lever.

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

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

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

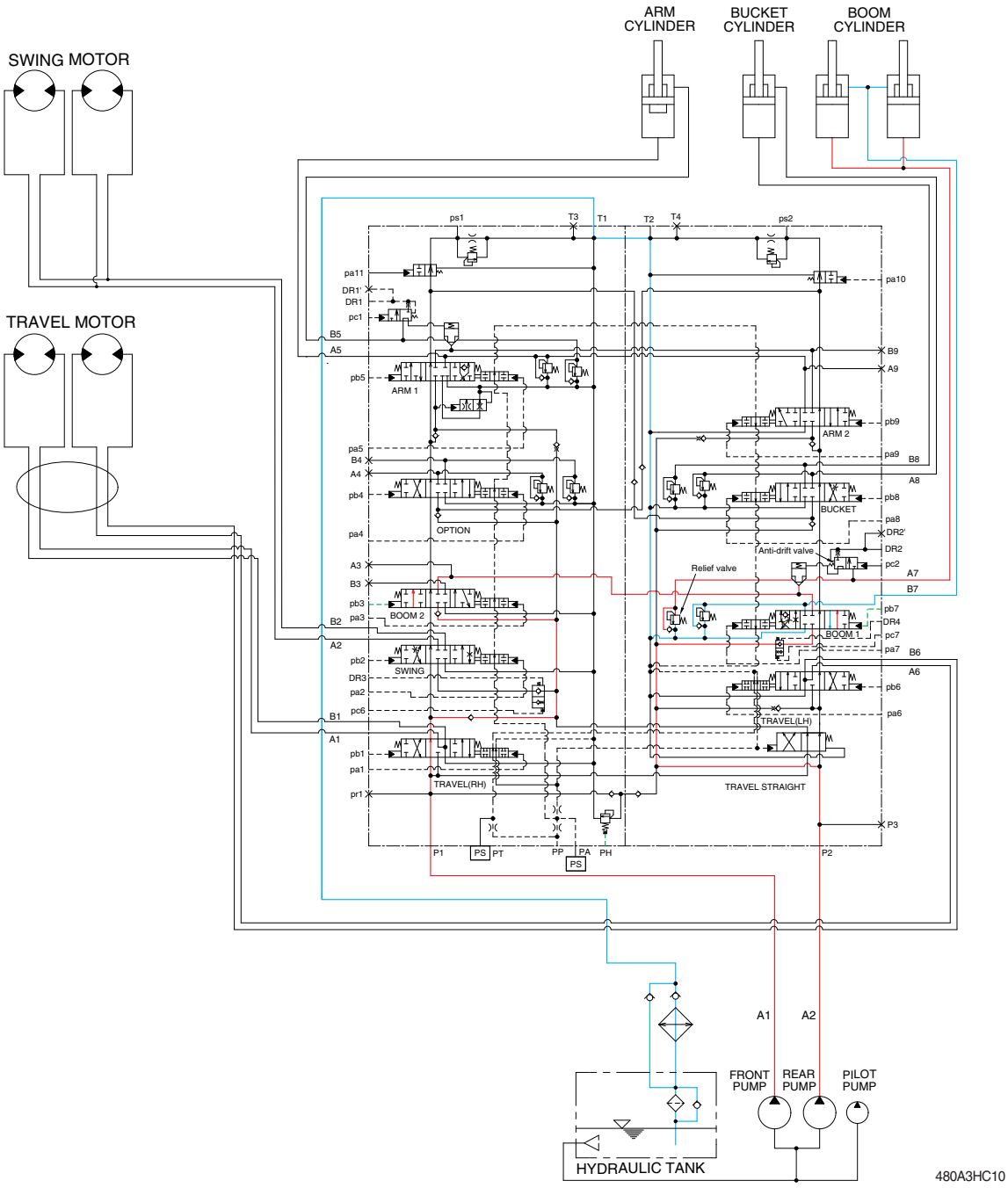
7. BOOM FLOATING SYSTEM



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

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

1. BOOM UP OPERATION



When the RH control lever is pulled back, the boom spools in the main control valve are moved to the up position by the pilot oil pressure (pb3, pb7) 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.

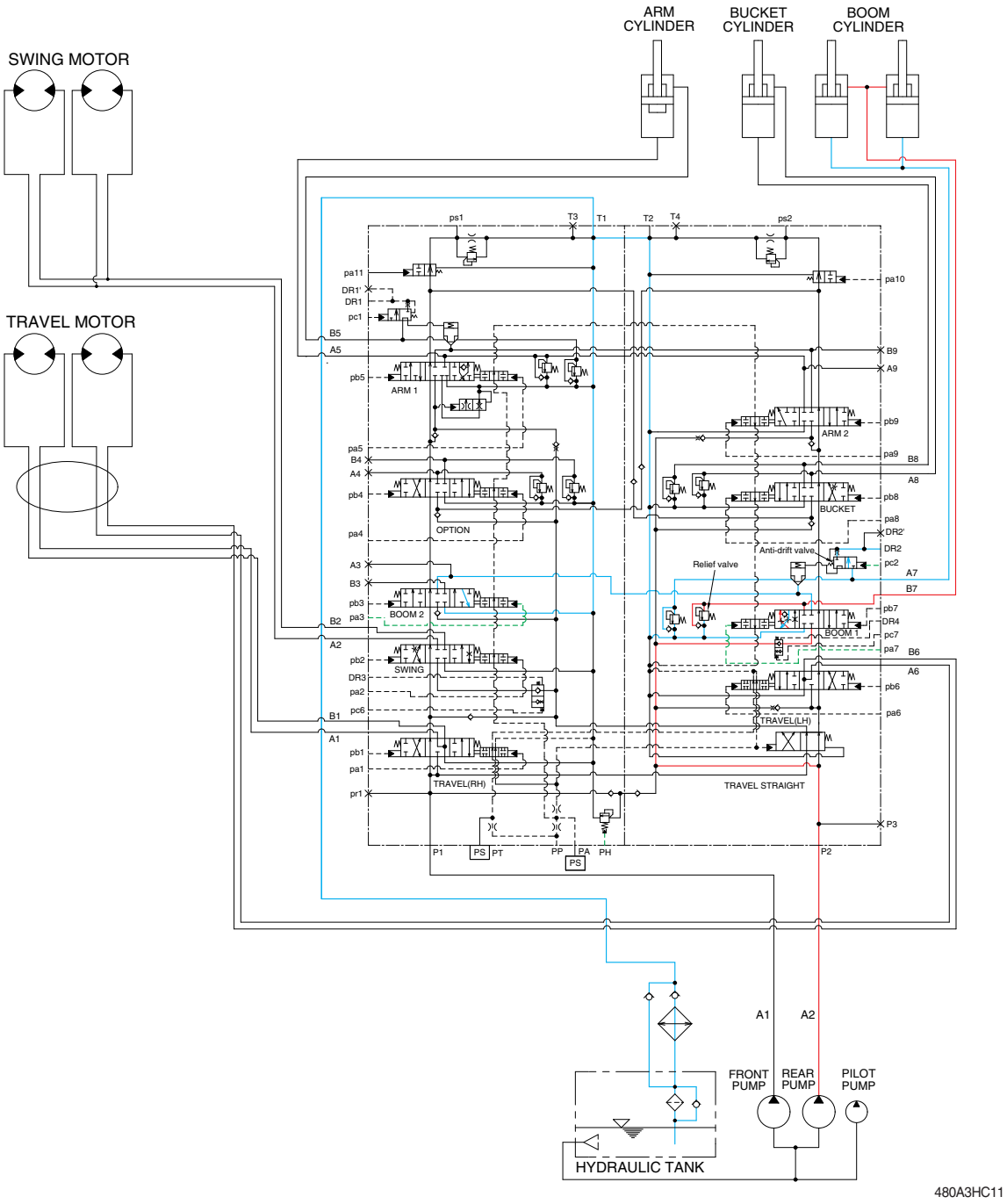
The excessive pressure in the boom cylinder bottom end circuit is prevented by relief valve.

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

This prevents the hydraulic drift of boom cylinders. For more details, refer to page 2-43.

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

2. BOOM DOWN OPERATION



When the RH control lever is pushed forward, the boom spools in the main control valve are moved to the down position by the pilot oil pressure (pa3, pa7) from the remote control valve.

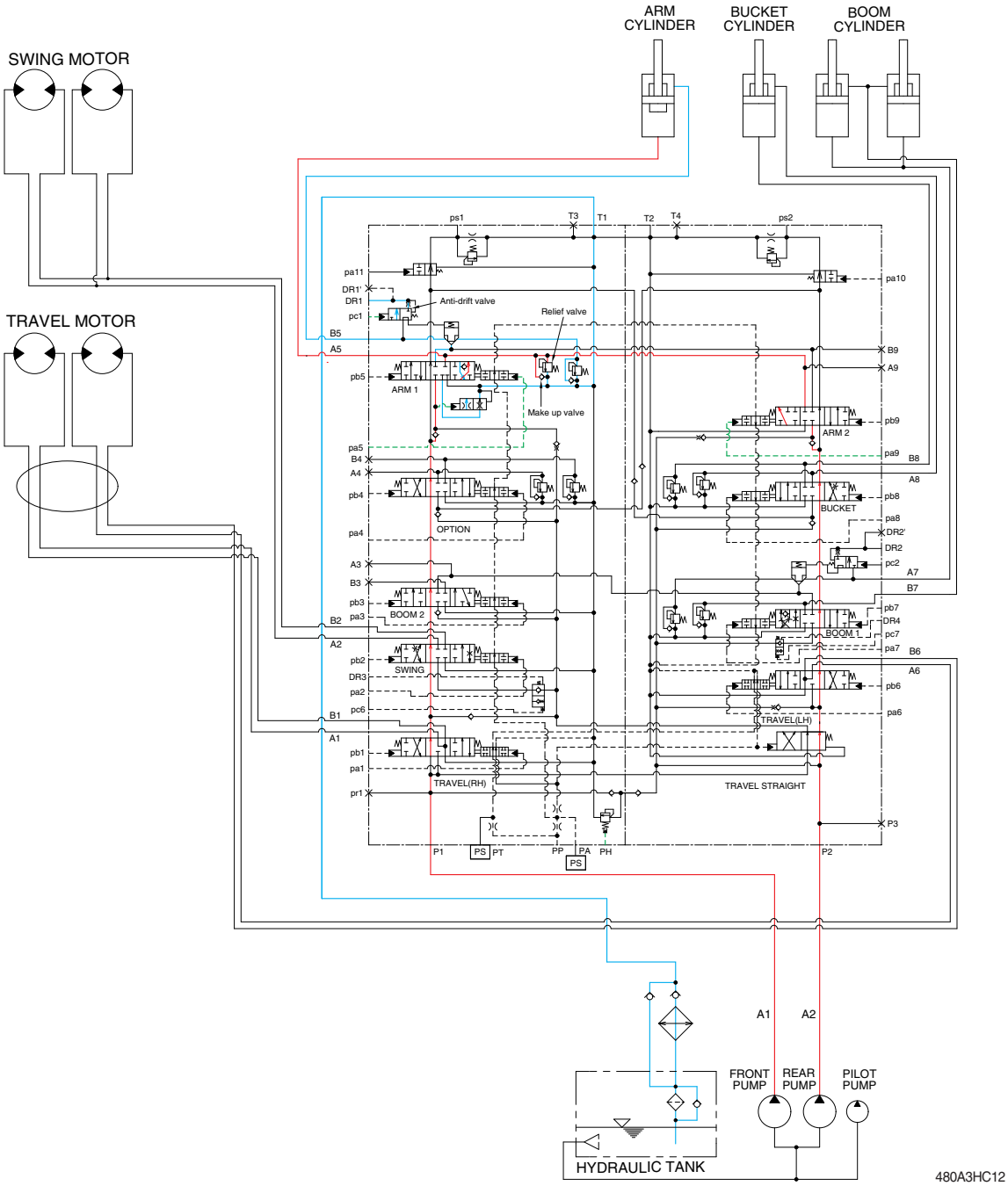
The oil from the A2 pump flows into the main control valve and then goes to the small chamber of boom cylinders. At the same time, the oil from the large chamber of boom cylinders returns to the hydraulic tank through the boom spools in the main control valve.

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 boom cylinders.

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 end circuit 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 LH control lever is pulled back, the arm spools in the main control valve are moved the to roll in position by the pilot oil pressure (pa5, pa9) 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.

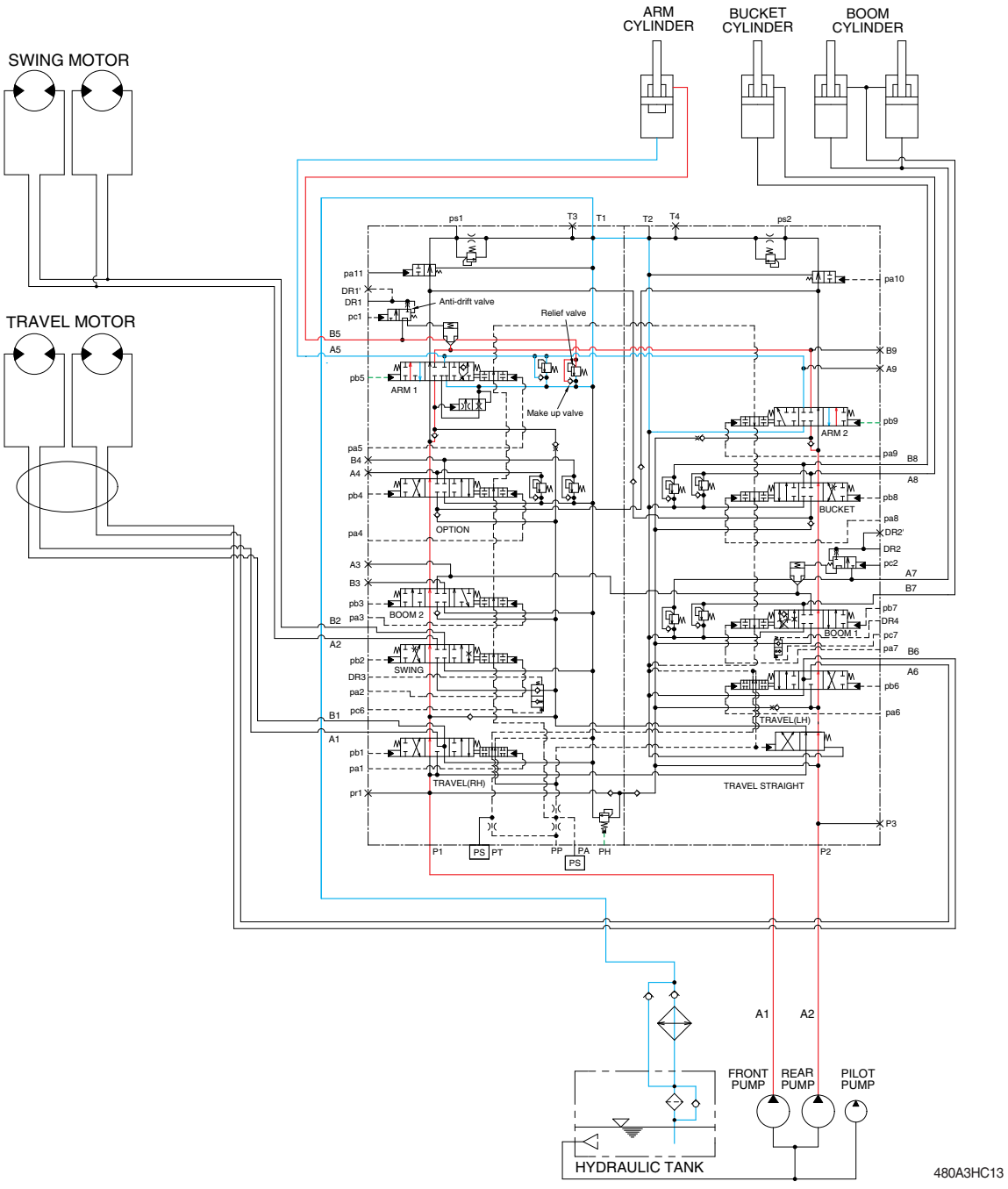
At the same time, the oil from small chamber of arm cylinder returns to the hydraulic oil tank through the arm 1 spool in the main control valve. When this happens, the arm rolls in.

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 LH control lever is pushed forward, the arm spools in the main control valve are moved to the roll out position by the pilot oil pressure (pb5, pb9) from the remote control valve.

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

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

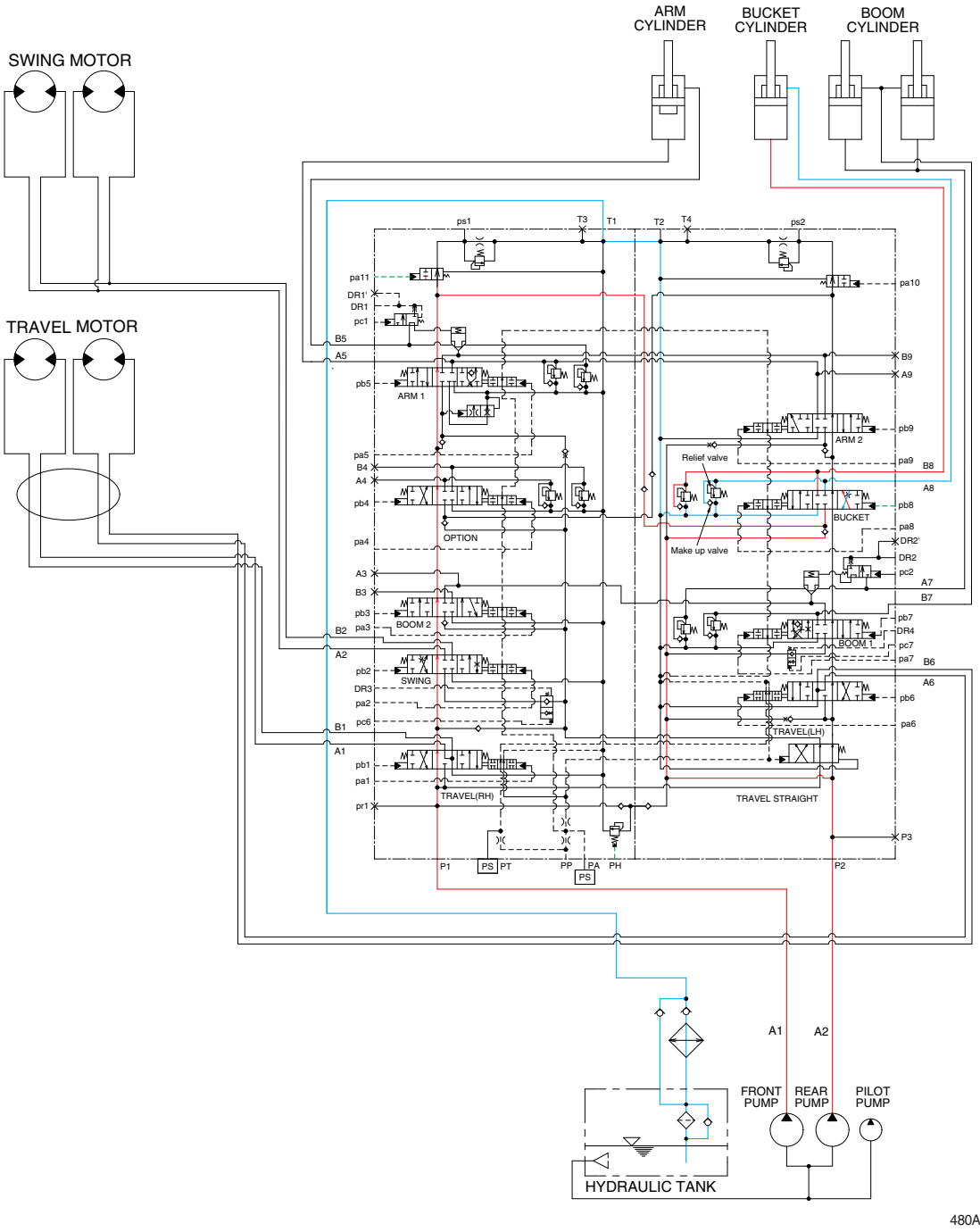
The excessive pressure in the arm cylinder rod side is prevented by relief valve.

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



480A3HC14

When the RH 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 (pb8) from the remote control valve.

The oil from the A2 pump flows into the main control valve and then goes to the large chamber of bucket cylinder. The oil form the A1 pump flows into the large chamber of bucket cylinder through confluence oil passage in the main control valve by bypass cut pilot pressure (pa11).

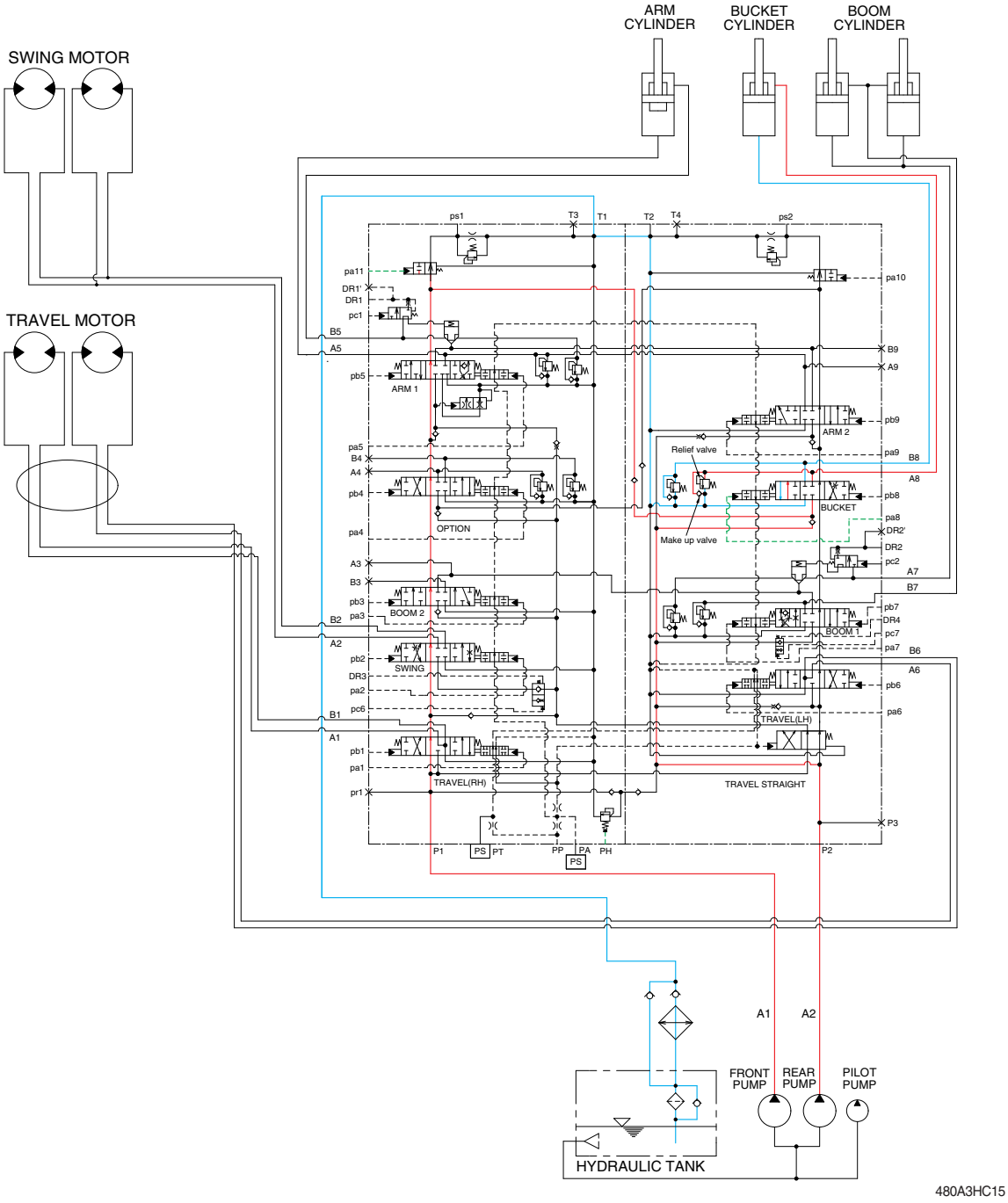
At the same time, the oil from the small chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls in.

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 RH 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 (pa8) from the remote control valve.

The oil from the A2 pump flows into the main control valve and then goes to the small chamber of bucket cylinder. The oil form the A1 pump flows into the large chamber of bucket cylinder through confluence oil passage in the main control valve by bypass cut pilot pressure (pa11).

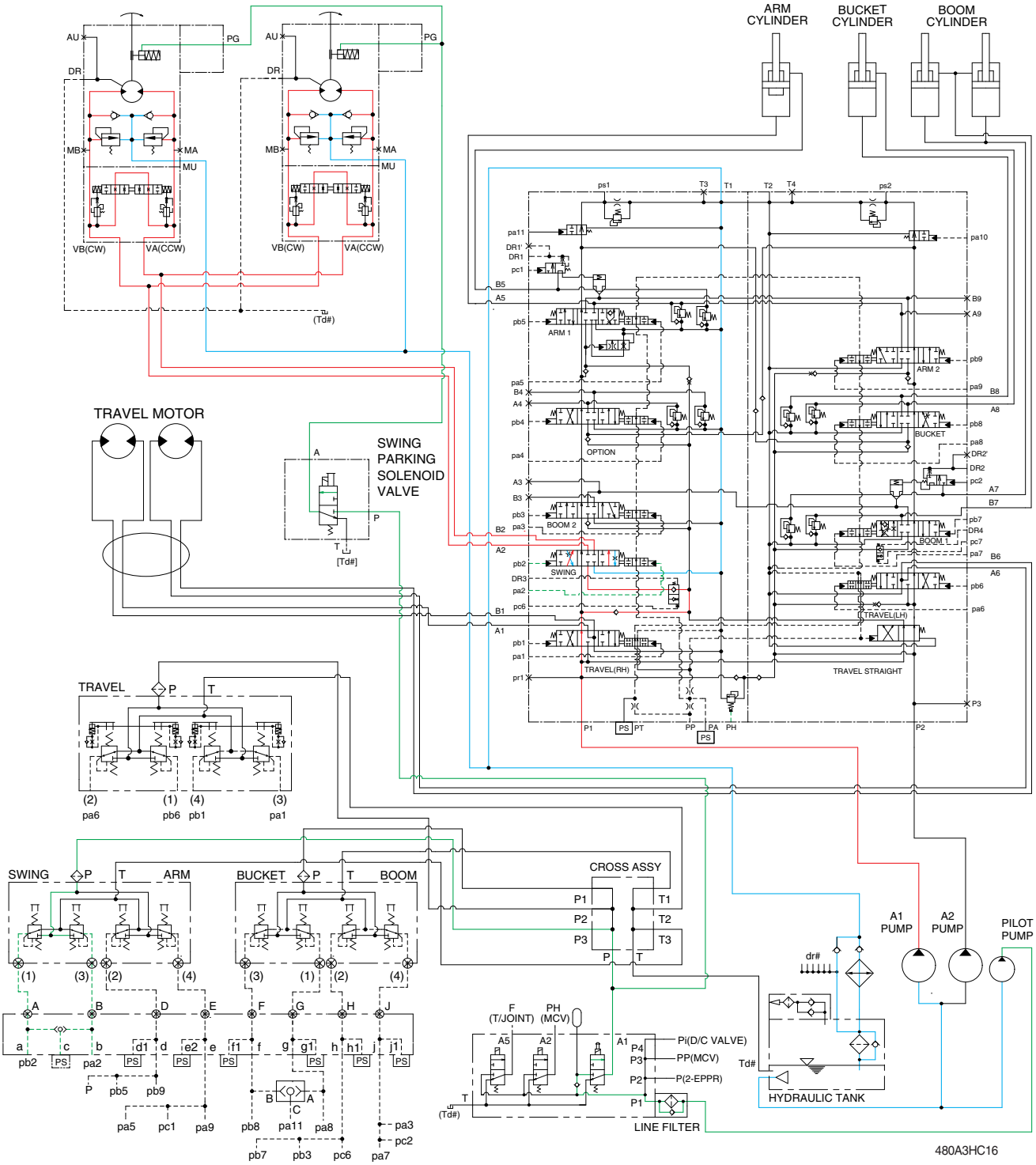
At the same time, the oil from the large chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls out.

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

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

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

7. SWING OPERATION



When the LH 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 (pa2, pb2) from the remote control valve.

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.

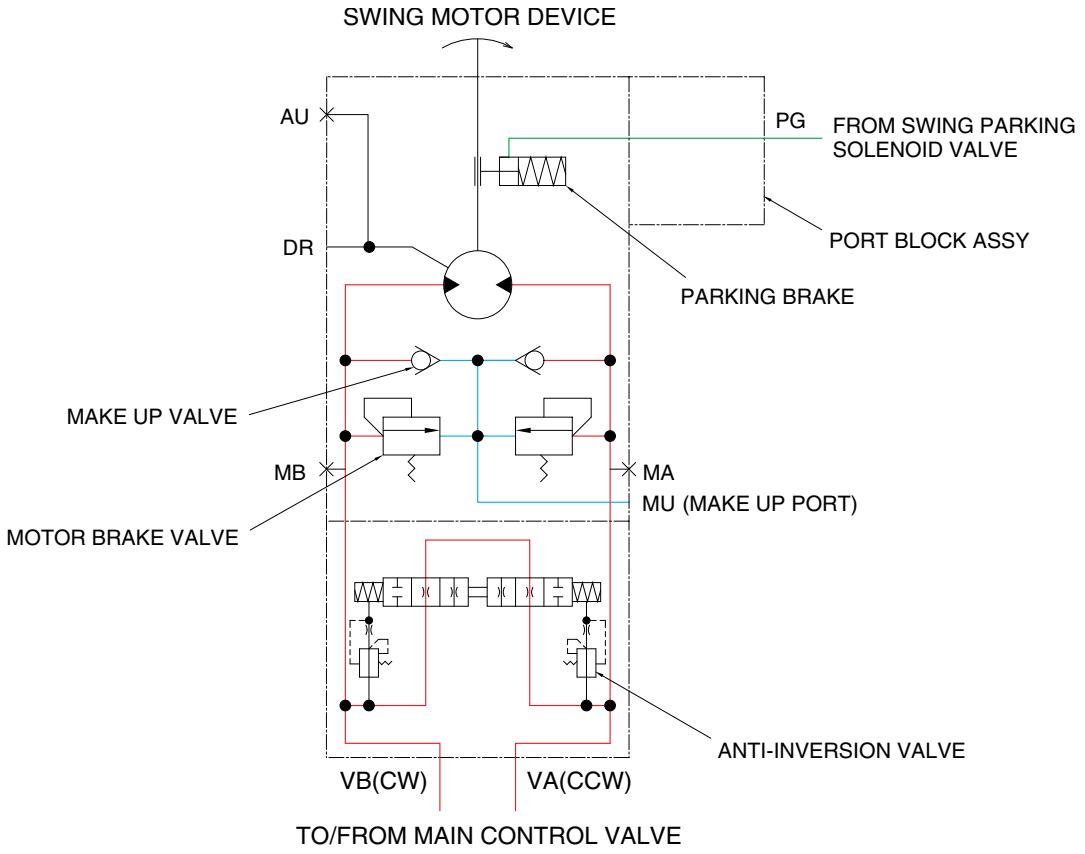
When this happens, the upper structure swings to the left or right.

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



480A3HC17

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 (4054 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 parking solenoid valve is energized by the MCU that senses the pilot oil pressure of the swing control lever.

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

PARKING BRAKE "ON" OPERATION

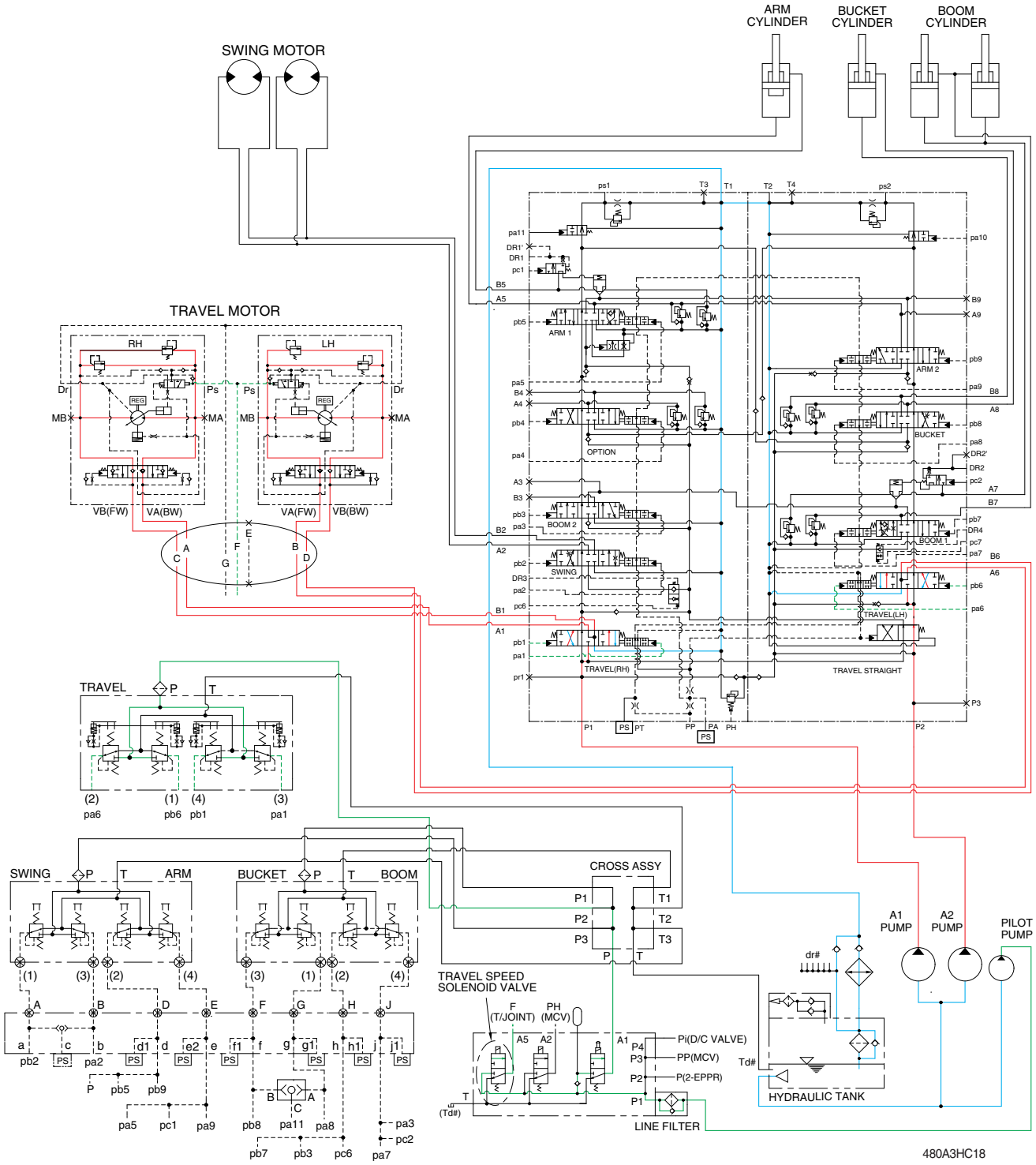
When the swing control lever is set in the neutral position, the swing parking solenoid valve is de-energized, oil in the swing parking brake chamber is drained through the the swing parking solenoid valve, thus the brake is applied by spring force.

4) ANTI-INVERSION VALVE

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

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

8. TRAVEL FORWARD AND REVERSE OPERATION



When the travel levers are pushed forward or reverse position, the travel spools in the main control valve are moved to the forward or reverse travel position by the pilot oil pressure (pa1, pb1, pa6, pb6) from the remote control valve.

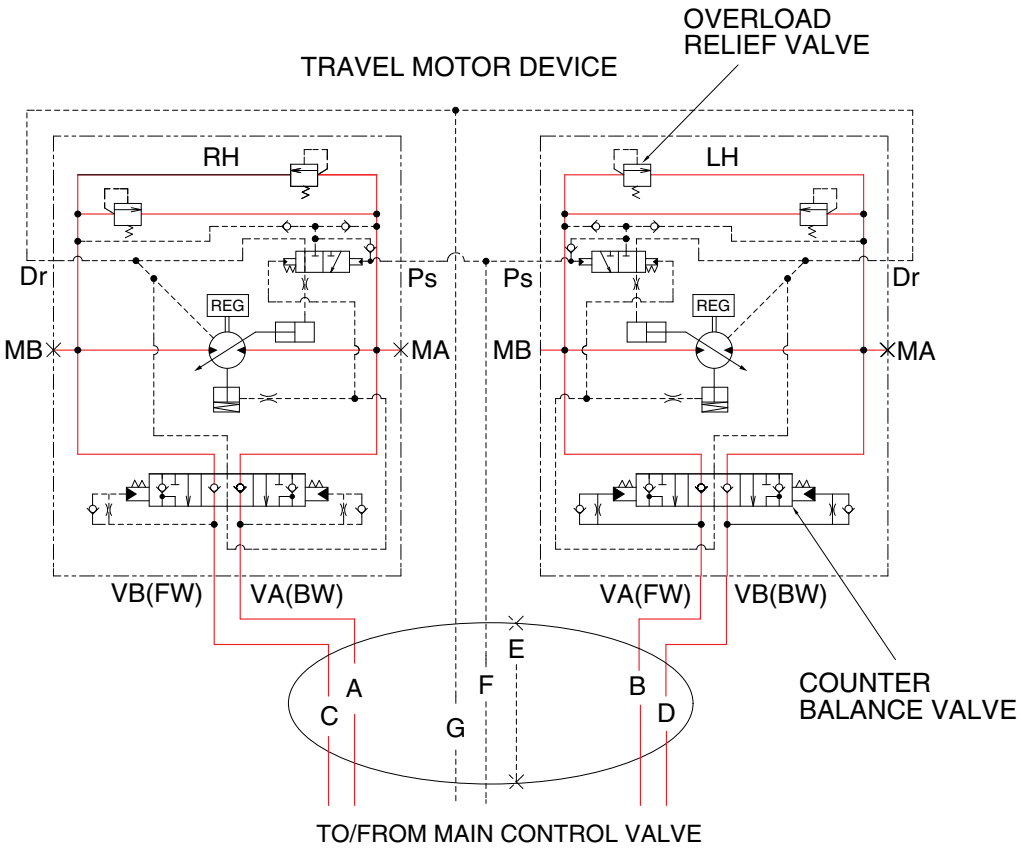
The oil from the each pump flows into the main control valve and then goes to the each travel motor through the turning joint.

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

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

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

TRAVEL CIRCUIT OPERATION



480A3HC19

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

1) COUNTER BALANCE VALVE

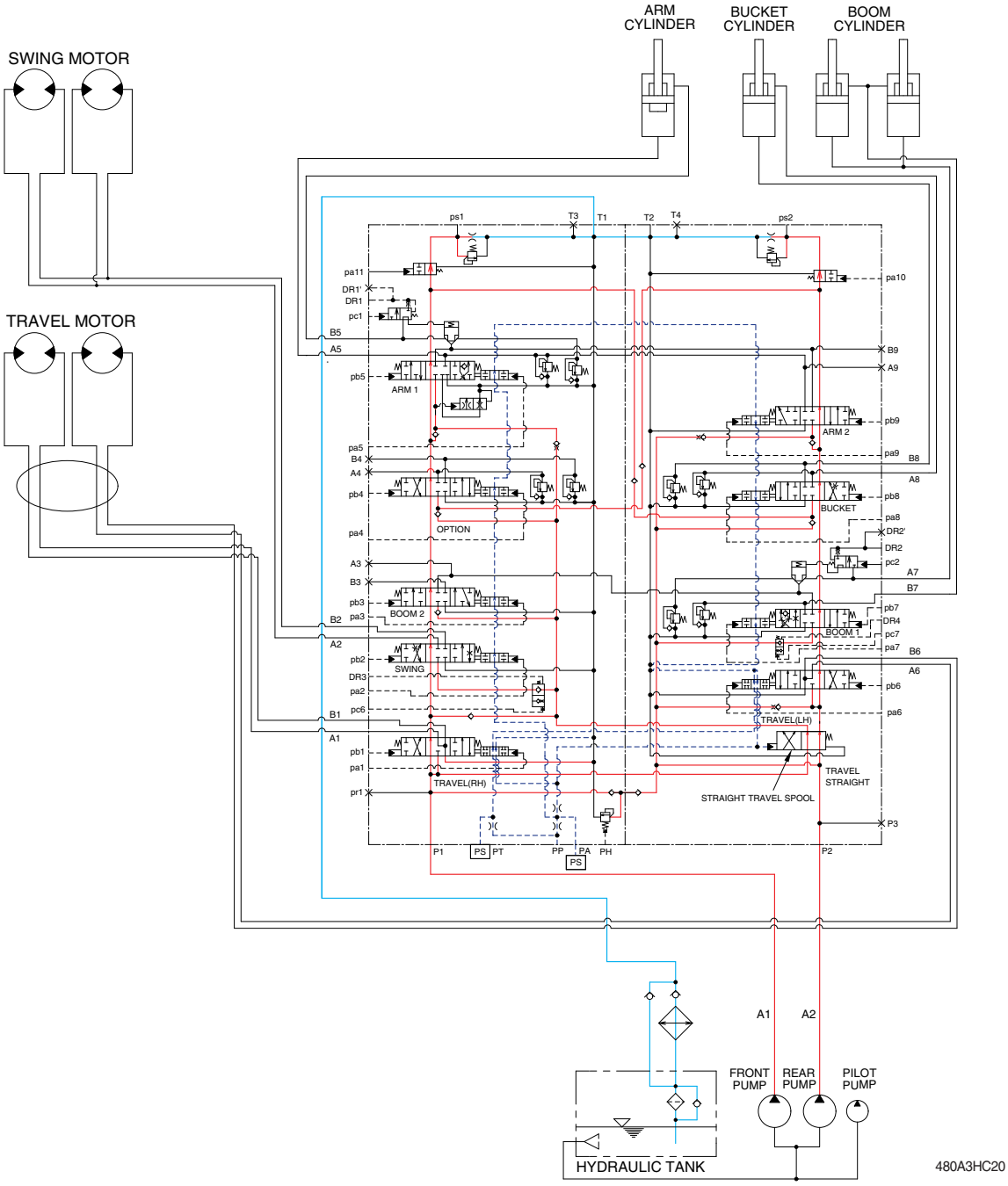
When stopping the motor of slope descending, this valve to prevent the motor over run.

2) OVERLOAD RELIEF VALVE

Relief valve limit the circuit pressure below 360 kgf/cm^2 (5120 psi) to prevent high pressure generated at a time of stopping the machine. Stopping the motor, this valve sucks the oil from lower pressure passage for preventing the negative pressure and the cavitation of the motor.

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

1. OUTLINE



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

STRAIGHT TRAVEL SPOOL

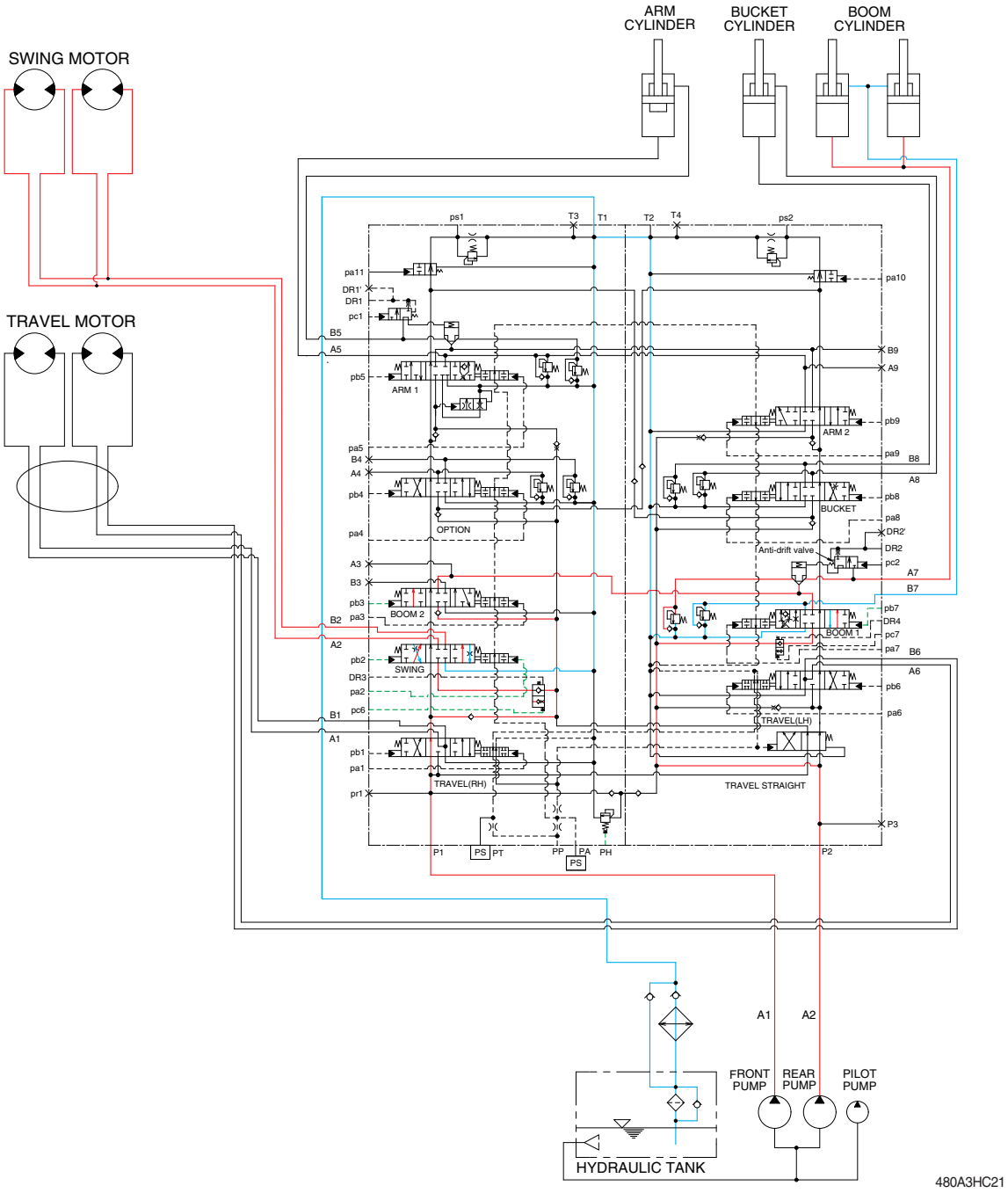
This straight travel spool is provided in the main control valve.

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

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

※ 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 (pa2, pb2, pb3, pb7) from the remote control valve.

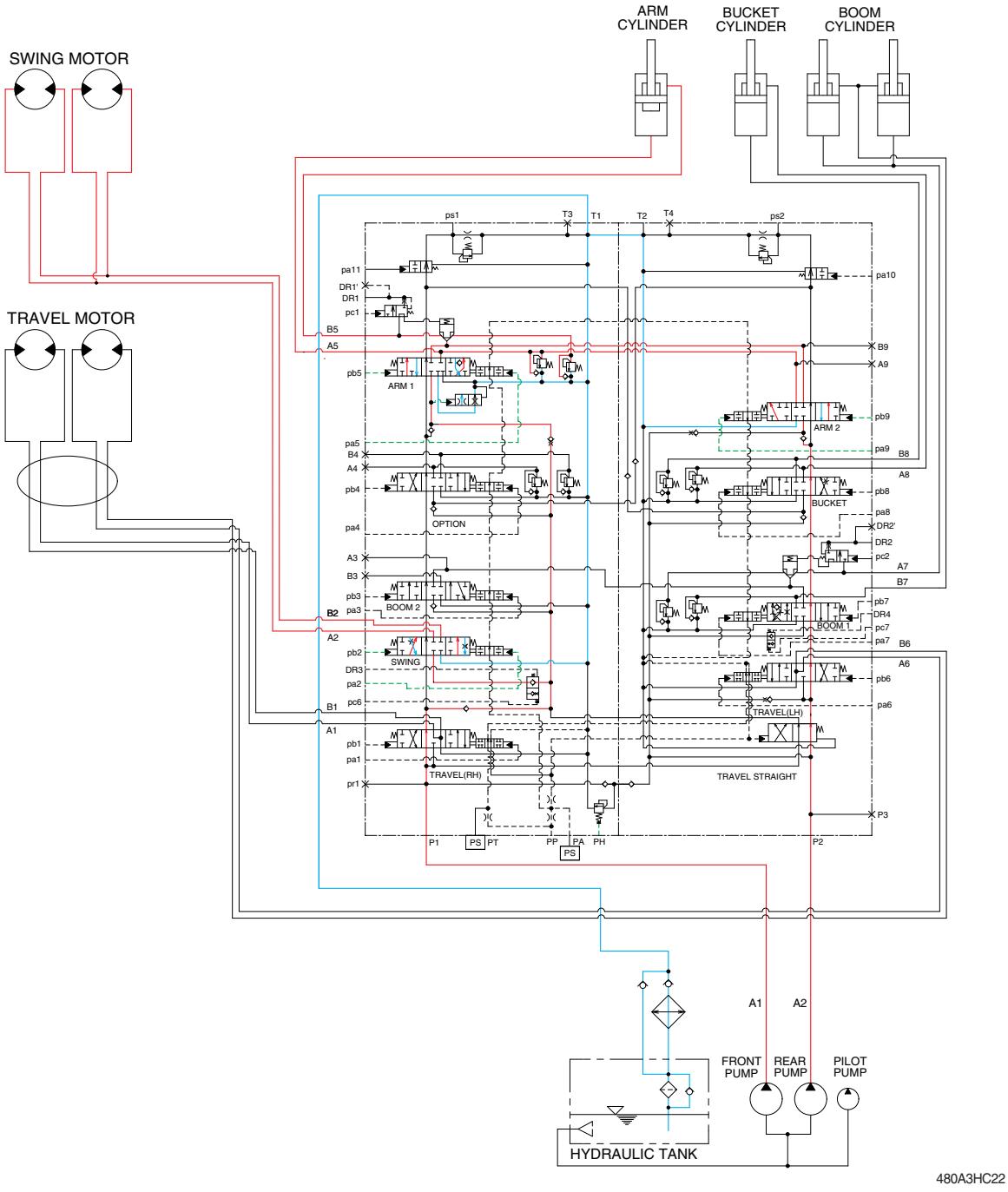
The oil from the A1 pump flows into the swing motor through swing spool and the boom cylinder through boom 2 spool.

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

Refer to page 3-9 for the boom priority system.

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

3. COMBINED SWING AND ARM OPERATION



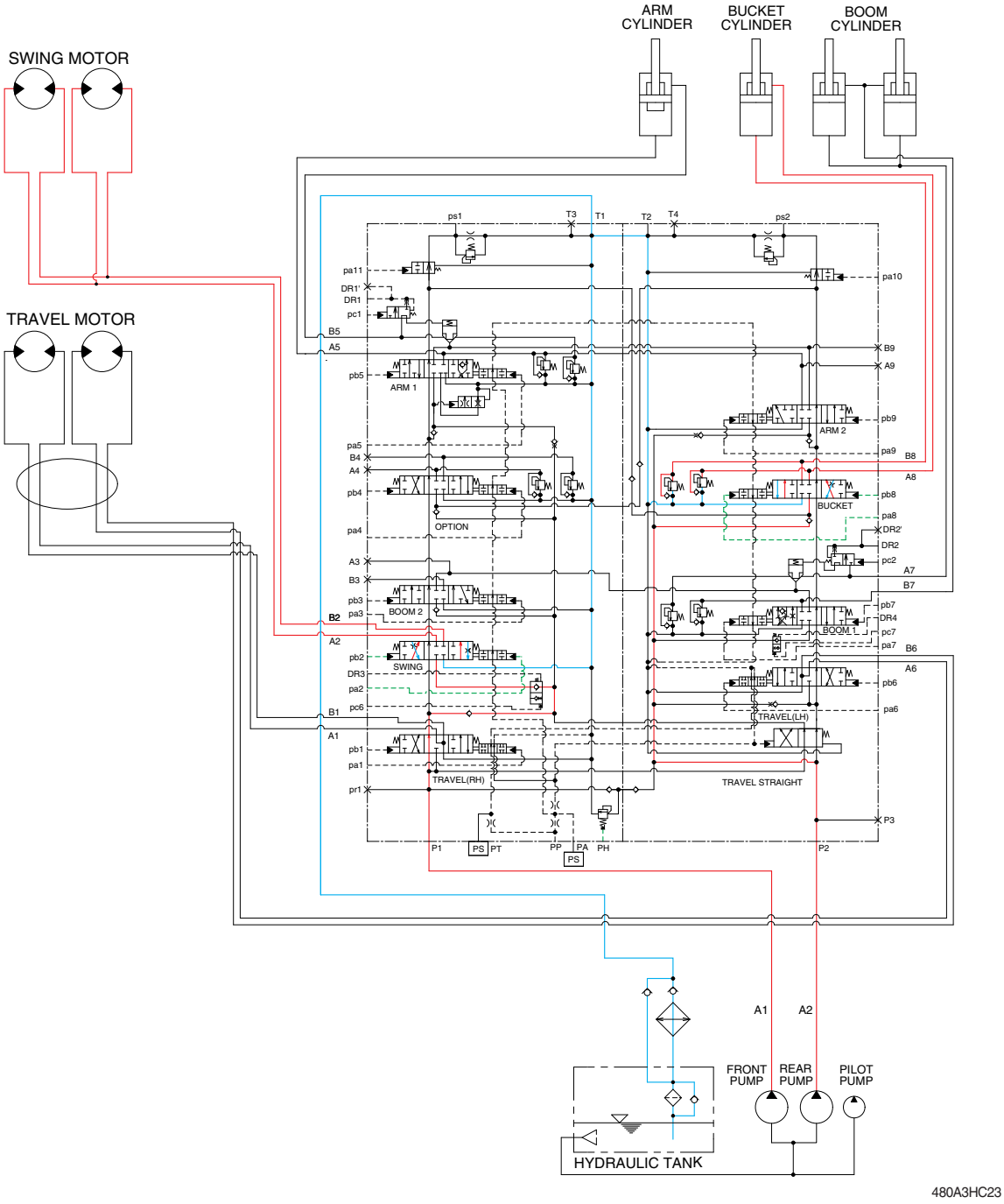
When the swing and arm functions are operated, simultaneously the swing spool and arm spools in the main control valve are moved to the functional position by the pilot oil pressure (pa2, pb2, pa5, pa9, pb5, pb9) from the remote control valve.

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.

※ 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 (pa2, pb2, pa8, pb8) from the remote control valve.

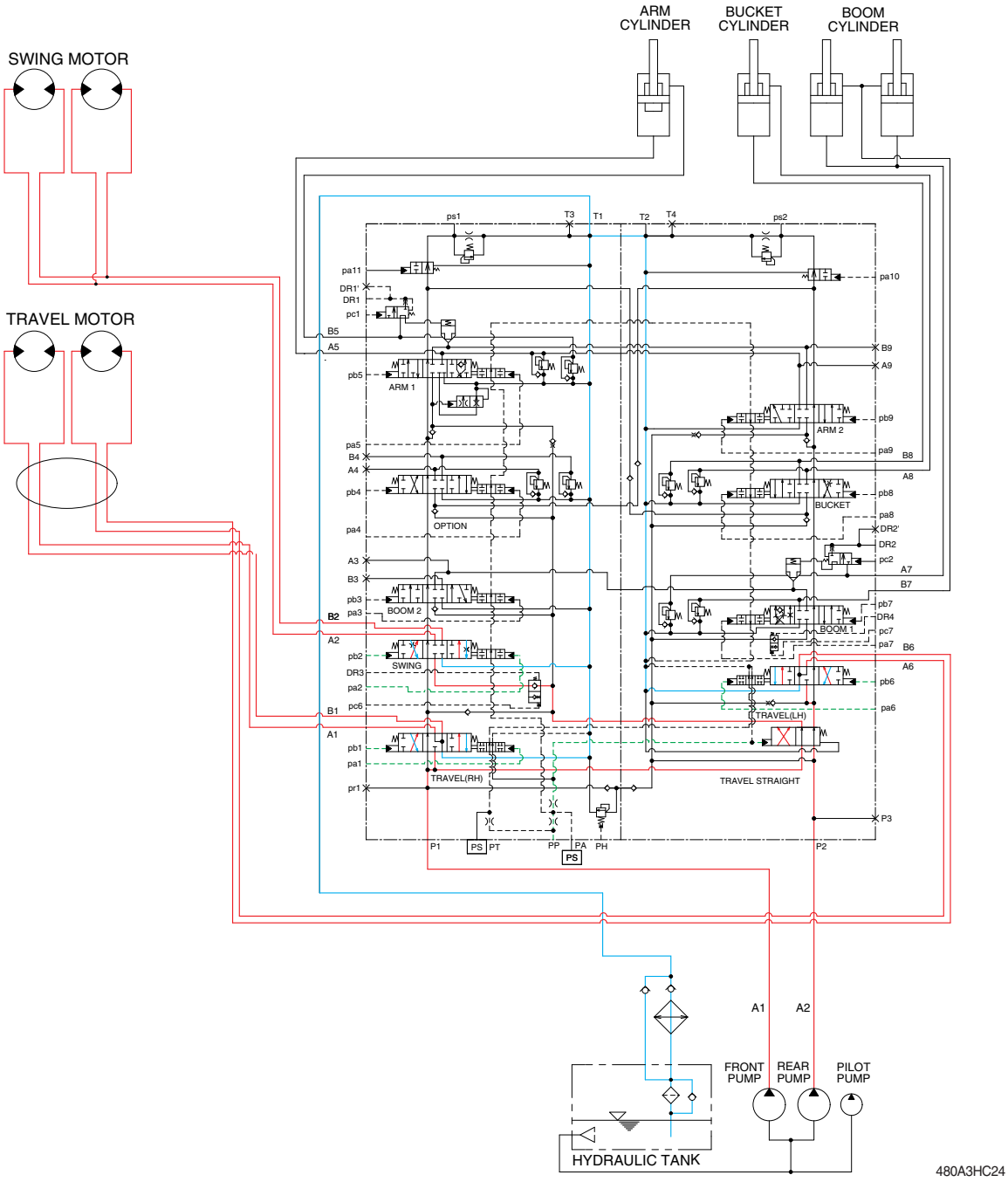
The oil from the A1 pump flows into the swing motor through the swing spool in the left control valve.

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 (pa2, pb2, pa2, pb2, pb3, pb7, pa1, pb1, pa6, pb6) from the remote control valve and straight travel spool is pushed to the right by the pilot oil pressure from the pilot pump.

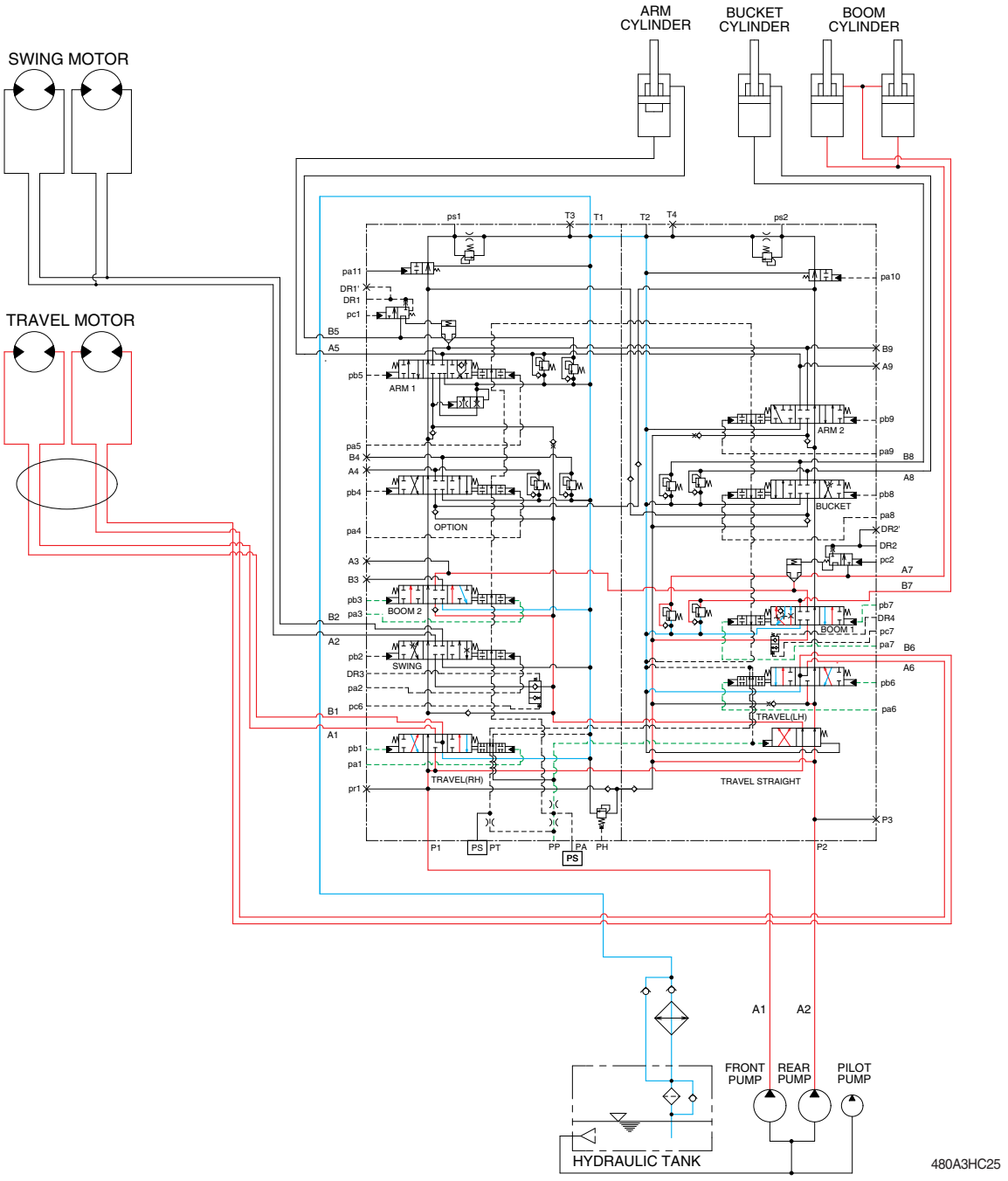
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

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

The upper structure swings and the machine travels straight.

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

6. COMBINED BOOM AND TRAVEL OPERATION



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 (pa2, pb2, pb3, pb7, pa1, pb1, pa6, pb6) from the remote control valve and the straight travel spool is pushed to the right by the oil pressure from pilot pump.

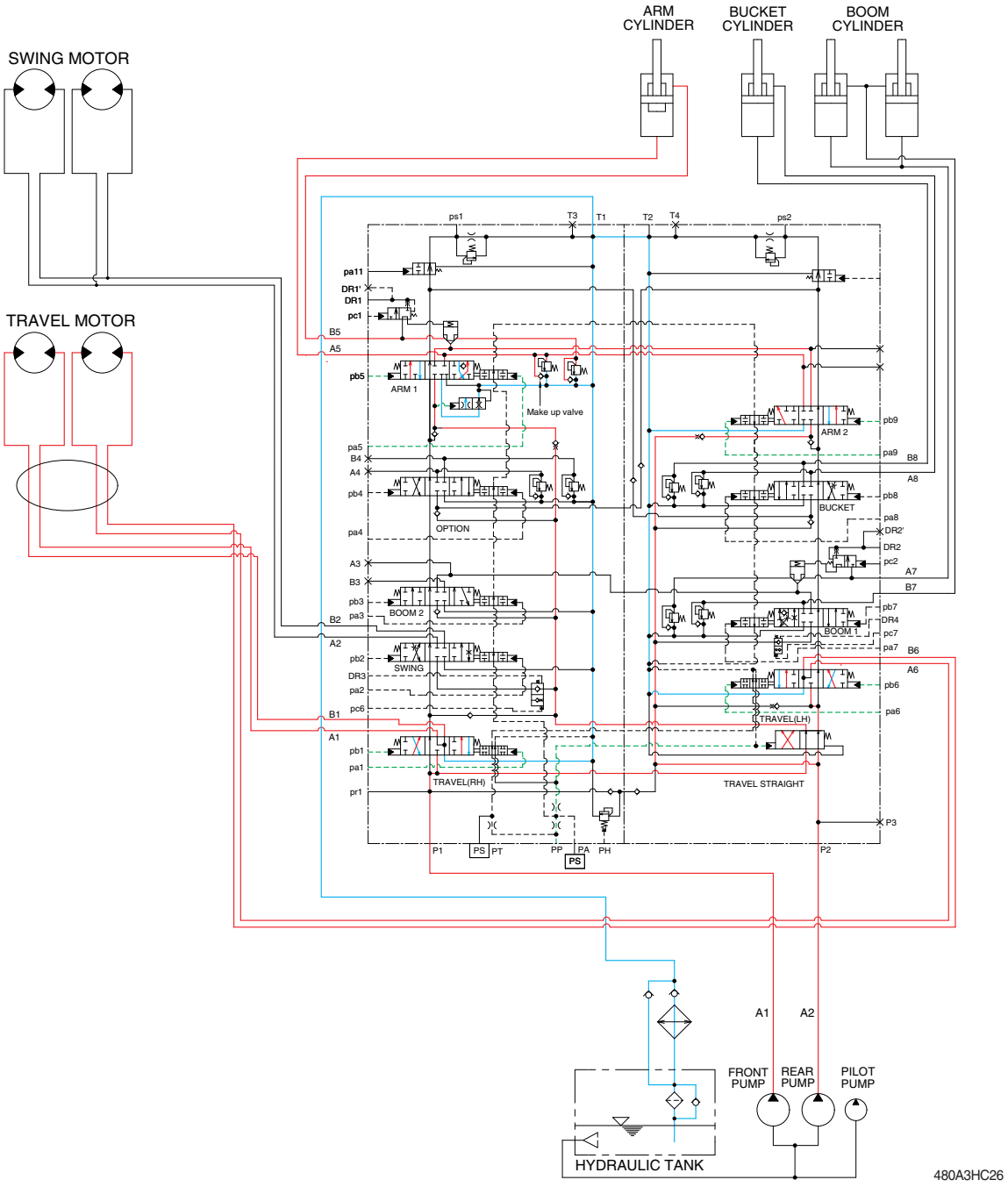
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

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

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 (pa5, pa9, pb5, pb9, pa1, pb1, pa6, pb6) from the remote control valve and the straight travel spool is pushed to the right by the oil pressure from pilot pump.

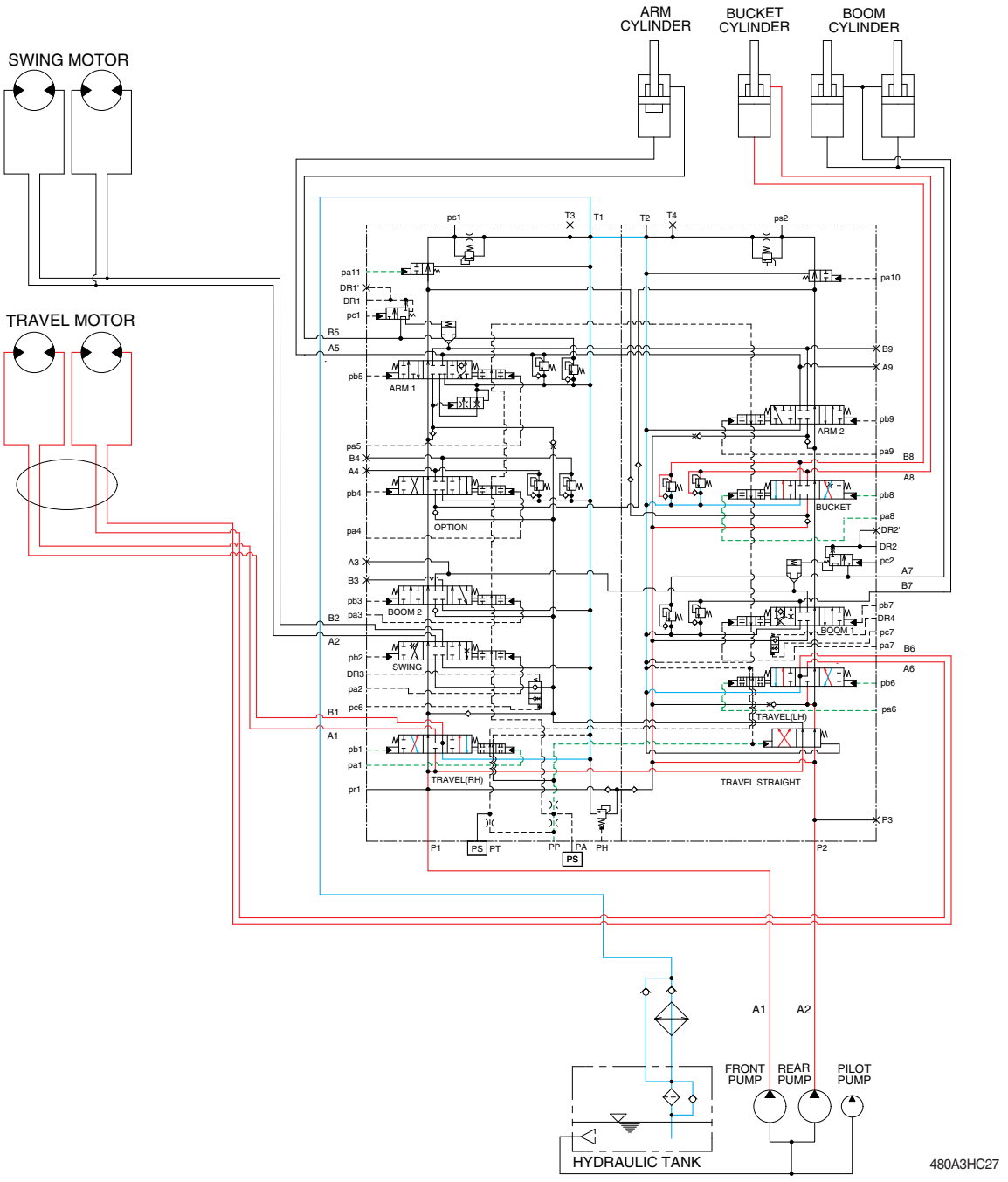
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

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

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



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 (pa8, pb8, pa1, pb1, pa6, pb6) from the remote control valve, and the straight travel spool is pushed to the right by the oil pressure from pilot pump. The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool of the control valve.

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

The bucket is operated and the machine travels straight.

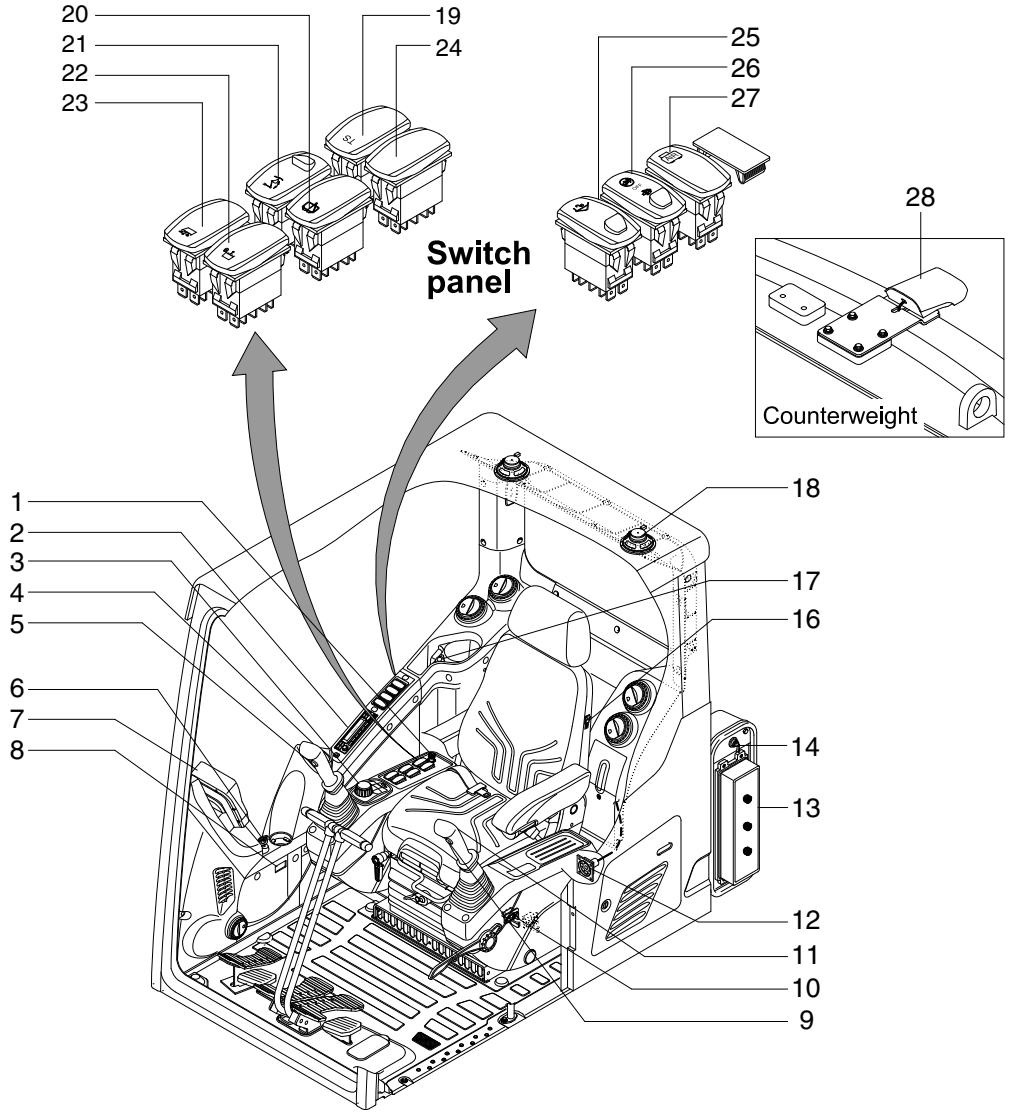
※ The circuit diagram may differ from the equipment, so please check before a repair.

SECTION 4 ELECTRICAL SYSTEM

Group 1 Component Location 4-1
Group 2 Electrical Circuit 4-3
Group 3 Electrical Component Specification 4-23
Group 4 Connectors 4-37

GROUP 1 COMPONENT LOCATION

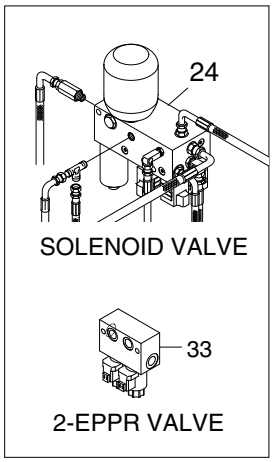
1. LOCATION 1

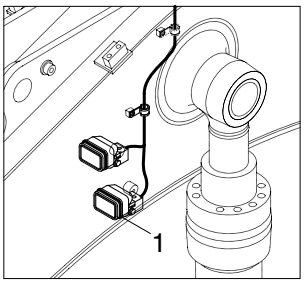


480A4EL01

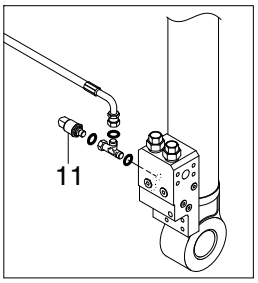
1	Cigar lighter	10	Emergency engine stop switch	20	Lower wiper & washer switch
2	Radio & USB player	11	One touch decel switch	21	Boom floating switch
3	Jod dial module	12	RS232 & J1939 service socket	22	Swing lock switch
4	Horn switch	13	Fuse & relay box	23	Free/fine swing switch
5	Cluster	14	Master switch	24	Option attach switch (opt)
6	Breaker operation switch	16	Seat heater switch	25	Quick clamp switch
7	Starting switch	17	Service socket	26	Exhaust system cleaning switch
8	Service meter	18	Speaker	27	Air compressor switch
9	Power max switch	19	Travel straight switch	28	Rear view camera

2. LOCATION 2

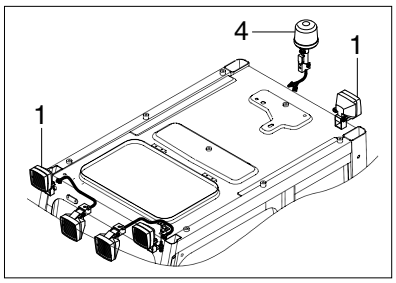




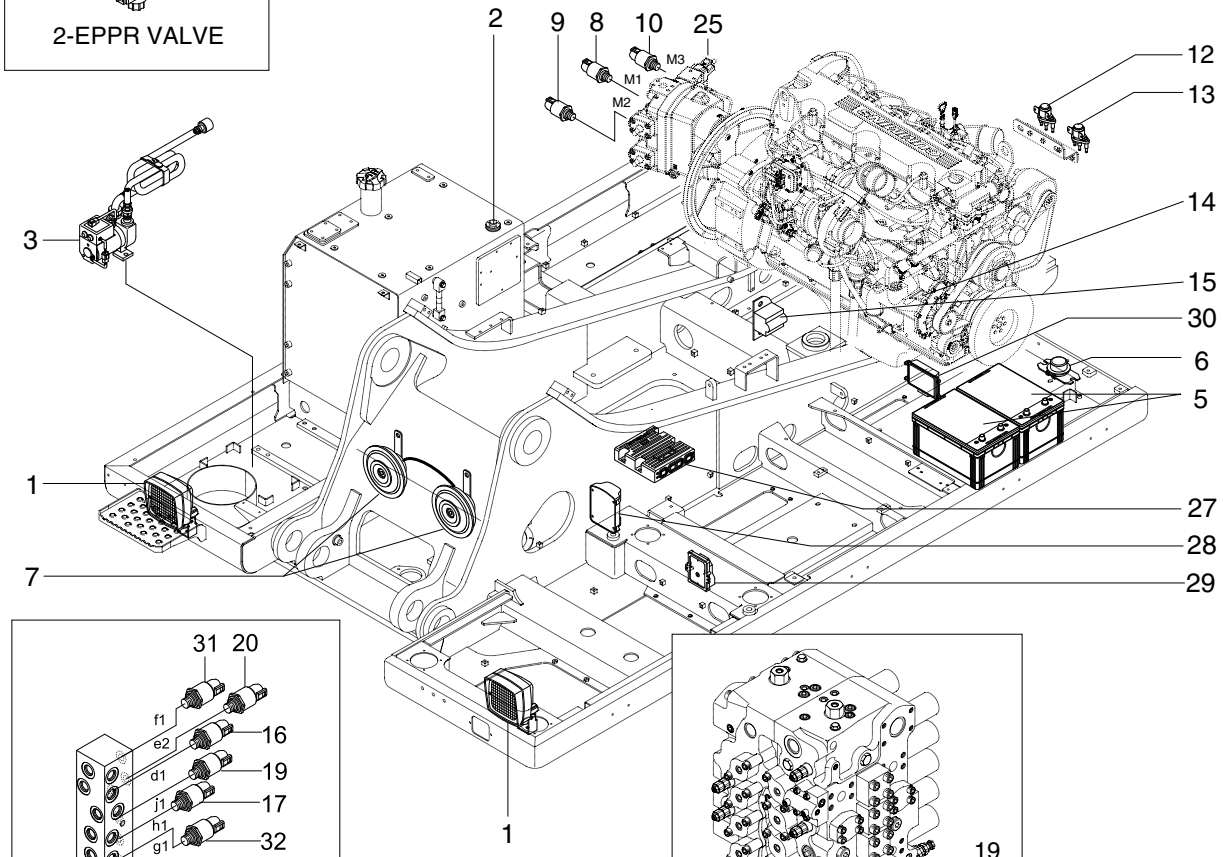
BOOM

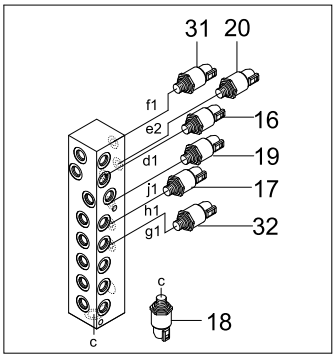


BOOM SAFETY VALVE

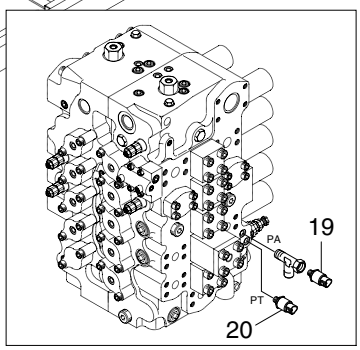


CAB





TERMINAL BLOCK



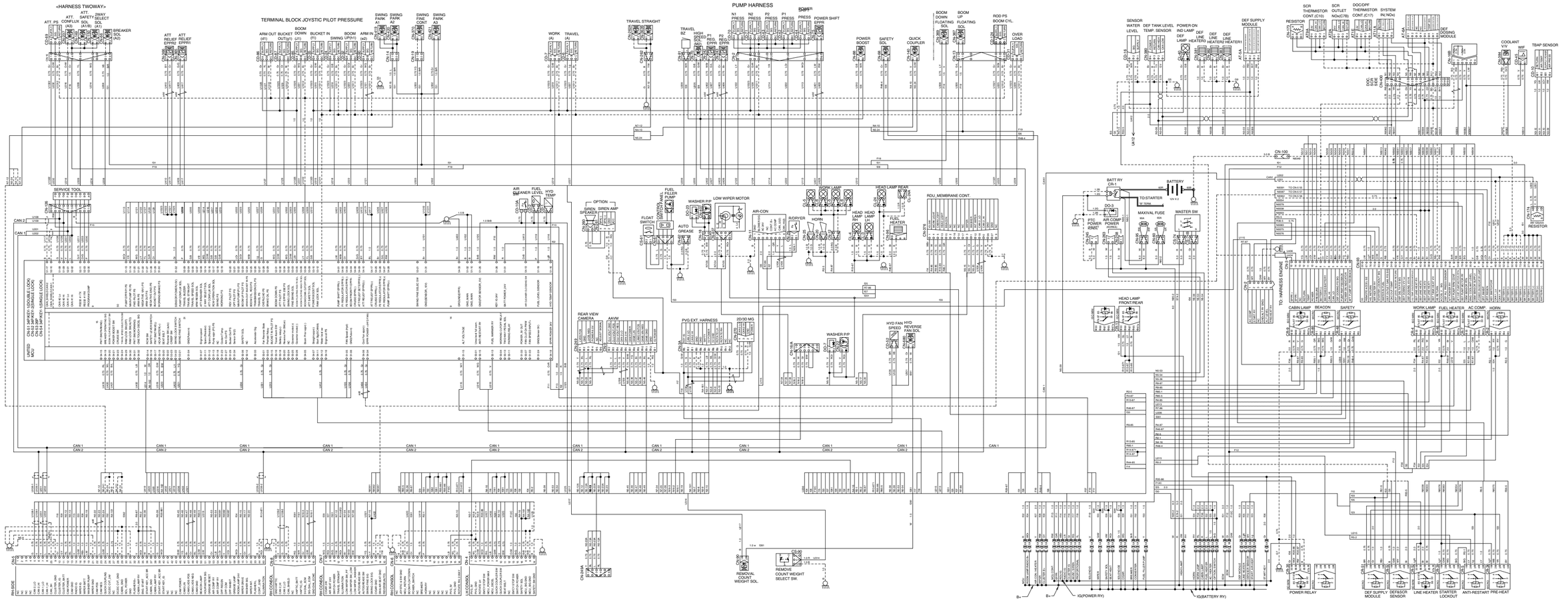
MAIN CONTROL VALVE

480A4EL02A

1	Lamp	12	Start relay	24	4 cartridge valve
2	Fuel sender	13	Heater relay	25	Pump EPPR valve
3	Fuel filler pump	14	Alternator	27	United MCU
4	Beacon lamp	15	Travel alarm buzzer	28	RMCU assy
5	Battery	16	Arm in pressure sensor	29	RDU assy
6	Battery relay	17	Boom up pressure sensor	30	View controller
7	Horn	18	Swing pressure sensor	31	Bucket in pressure sensor
8	A1 pump pressure sensor	19	Boom down pressure sensor	32	Bucket out pressure sensor
9	A2 pump pressure sensor	20	Arm out pressure sensor	33	2 EPPR cartridge valve
10	EPPR pressure sensor	21	Attach pressure sensor		
11	Overload pressure sensor	22	Travel pressure sensor		

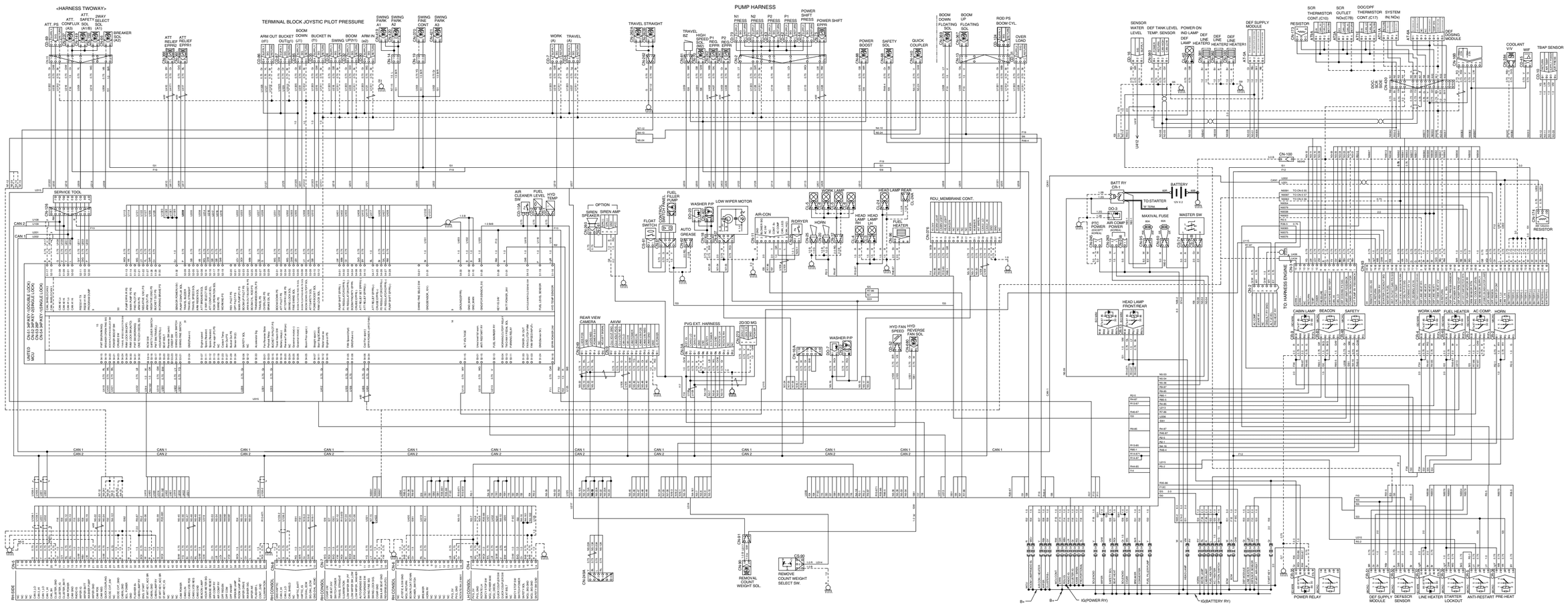
· ELECTRICAL CIRCUIT (1/4)

- MACHINE SERIAL NO.
  HX480A L : -#00002
  HX520A L : -#00002



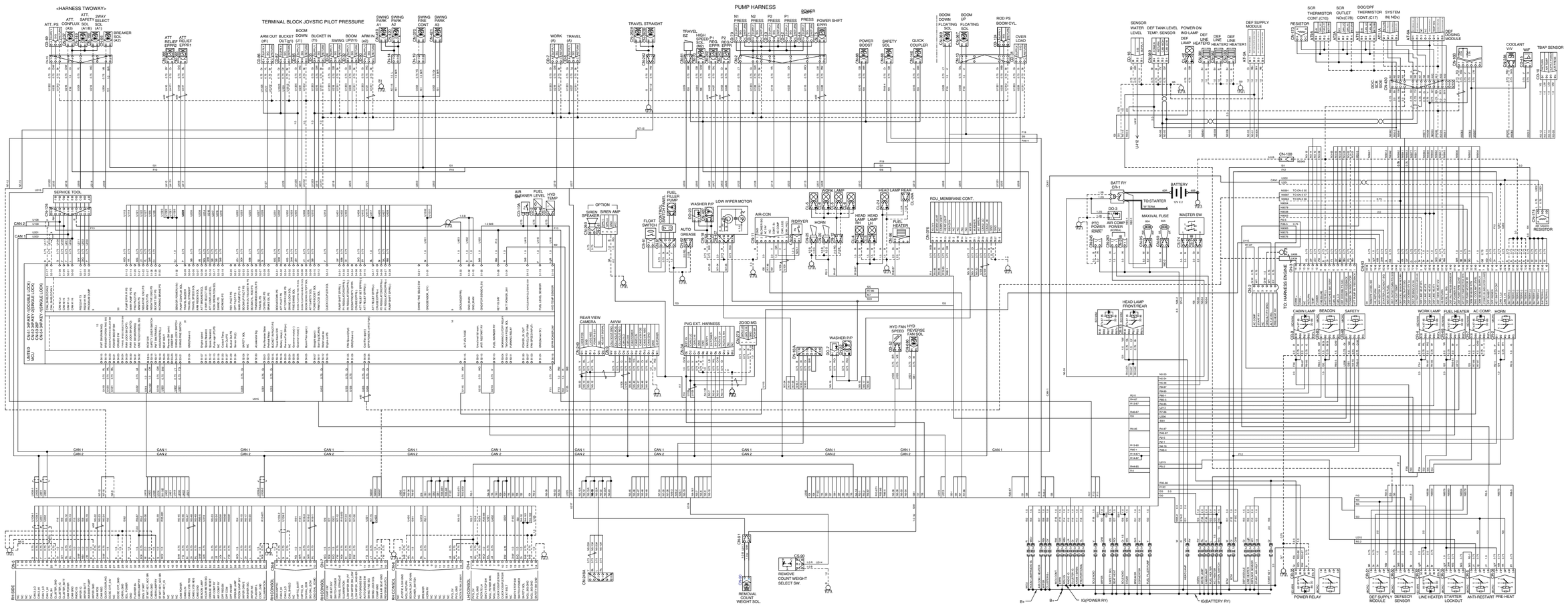
20KB-93201-00

- MACHINE SERIAL NO.
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  HX520A L : #00003-#00099



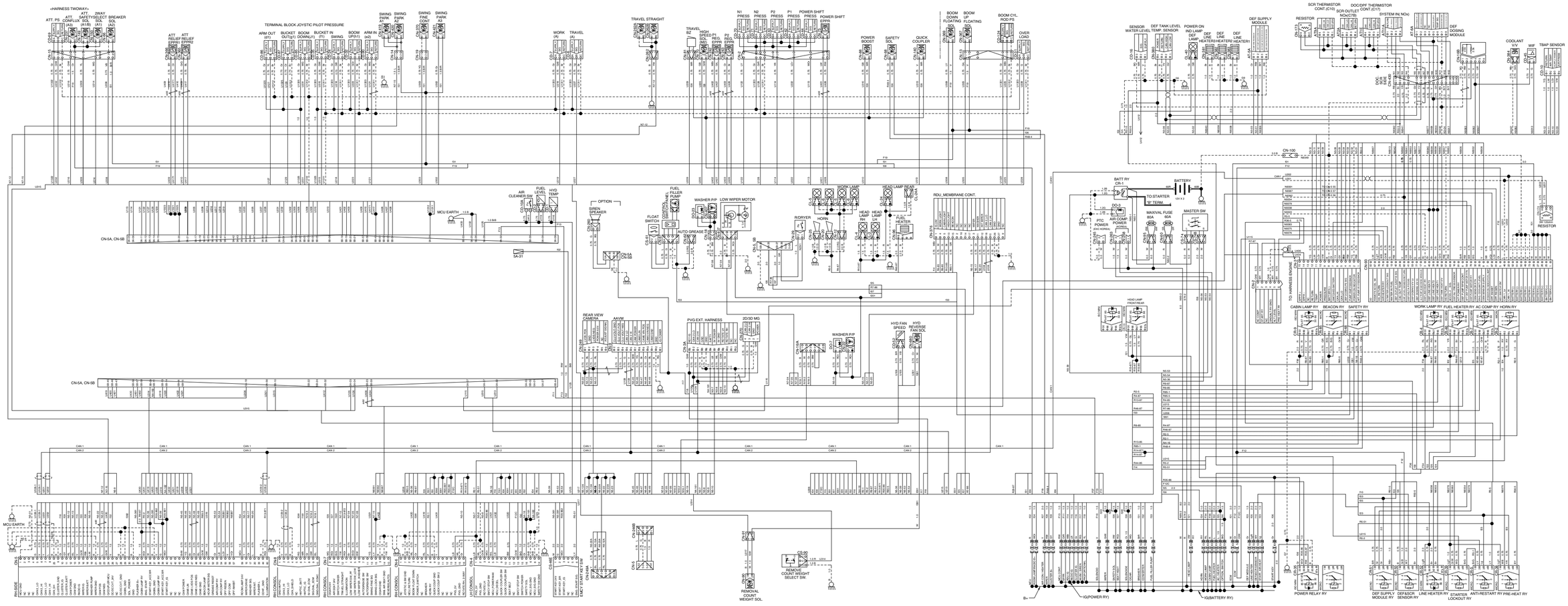
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- MACHINE SERIAL NO.
  HX480A L : #00062-#00107
  HX520A L : #00100-#00173



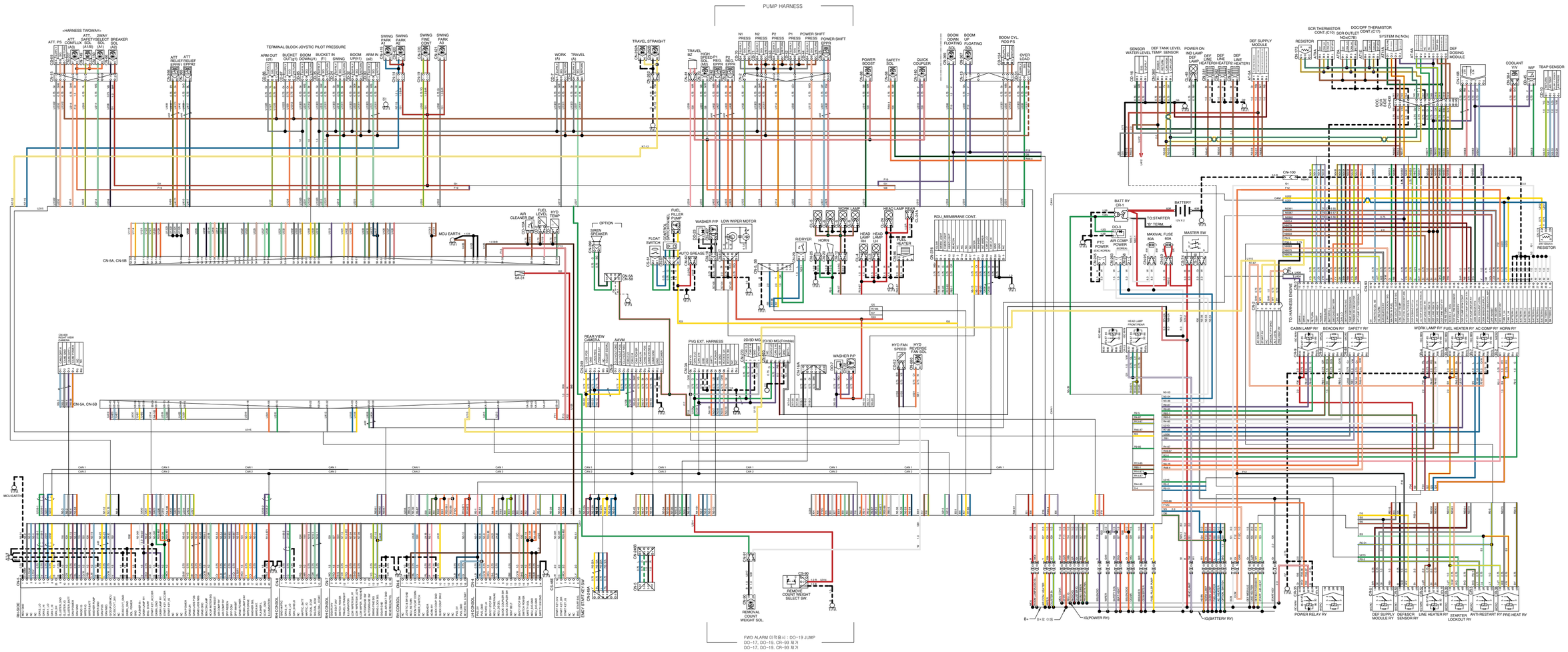
20KB-93203-00

- MACHINE SERIAL NO.
  HX480A L : #00108-
  HX520A L : #00174-



20KB-93204-01

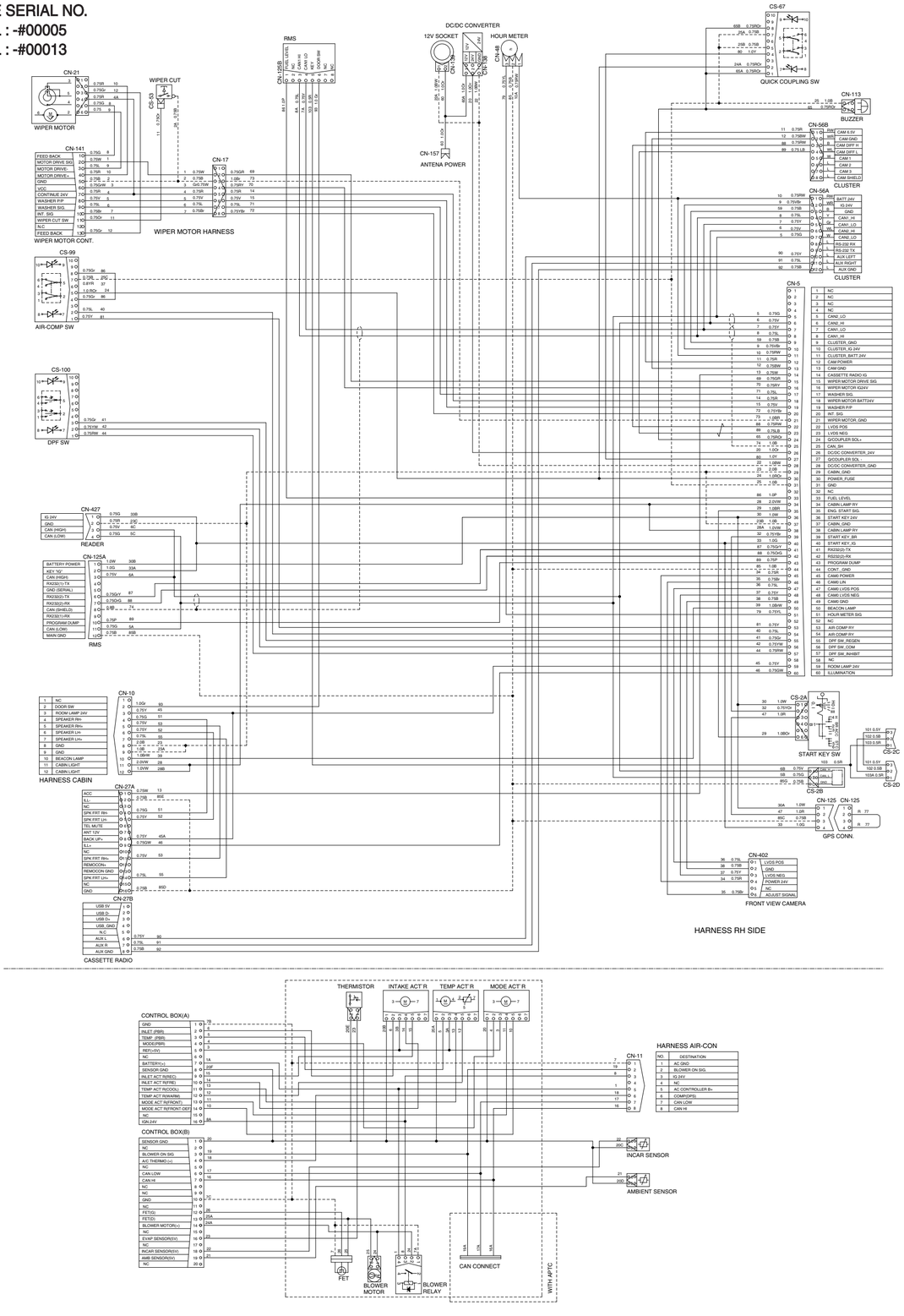
- MACHINE SERIAL NO. : CURRENT



20KB-93205-00

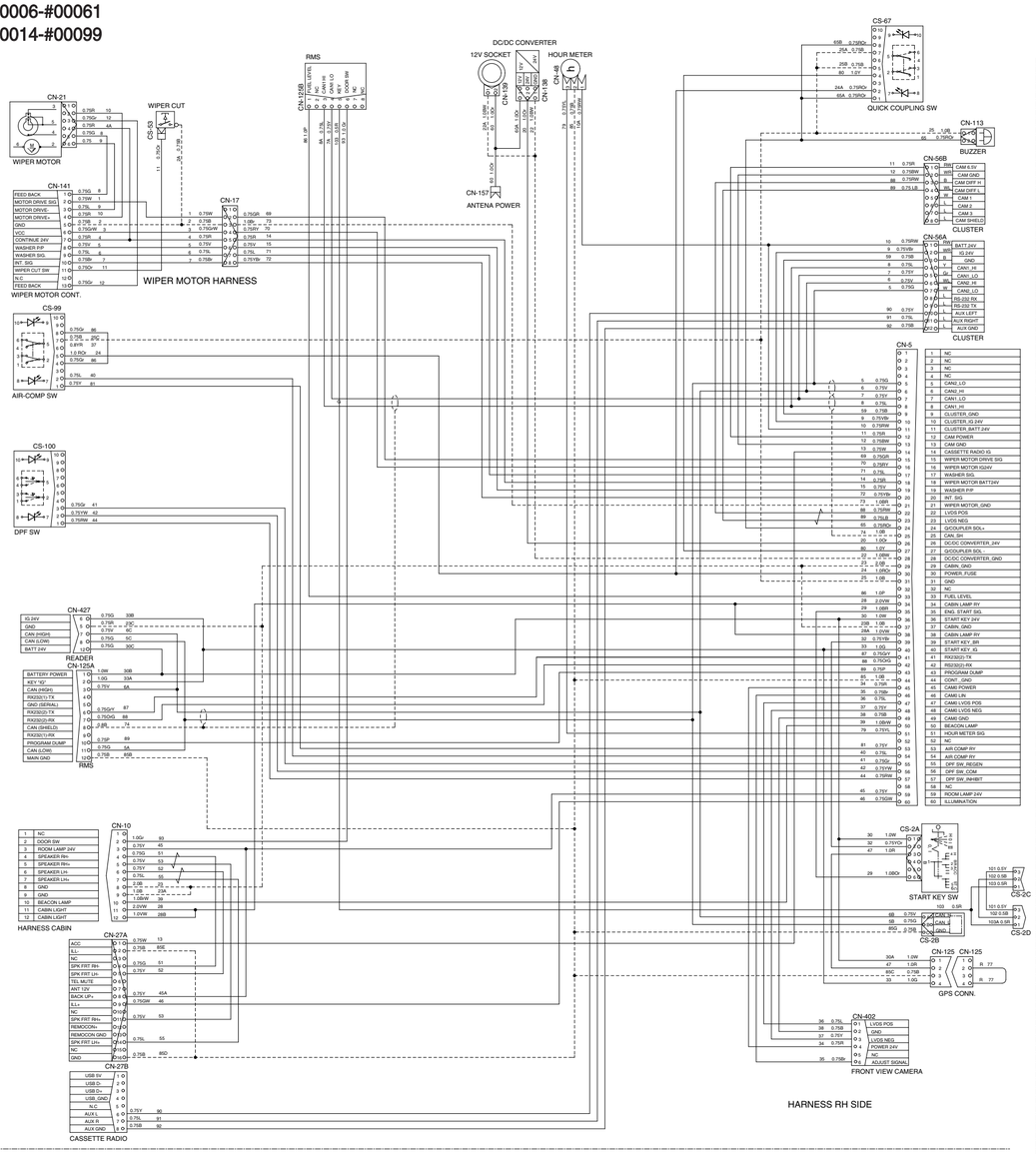
· ELECTRICAL CIRCUIT (2/4)

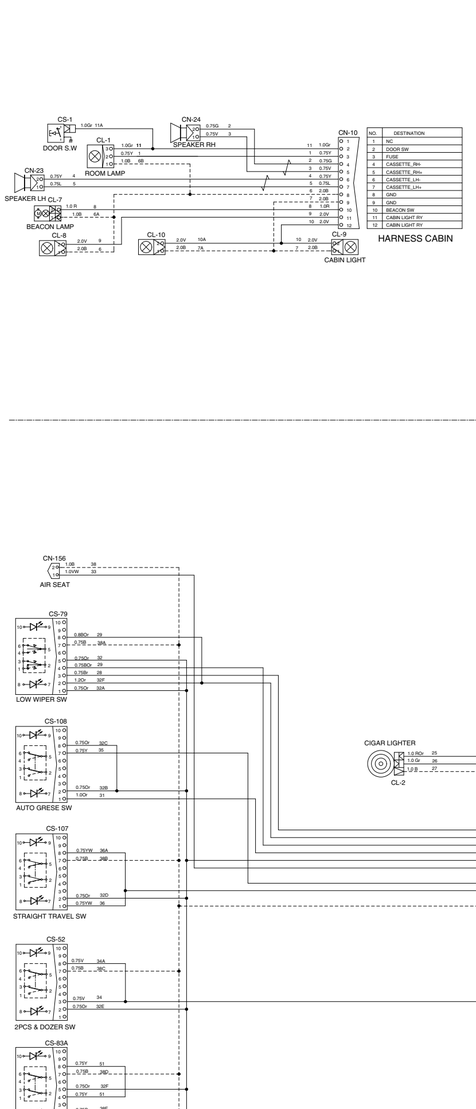
- MACHINE SERIAL NO.
  HX480A L : -#00005
  HX520A L : -#00013

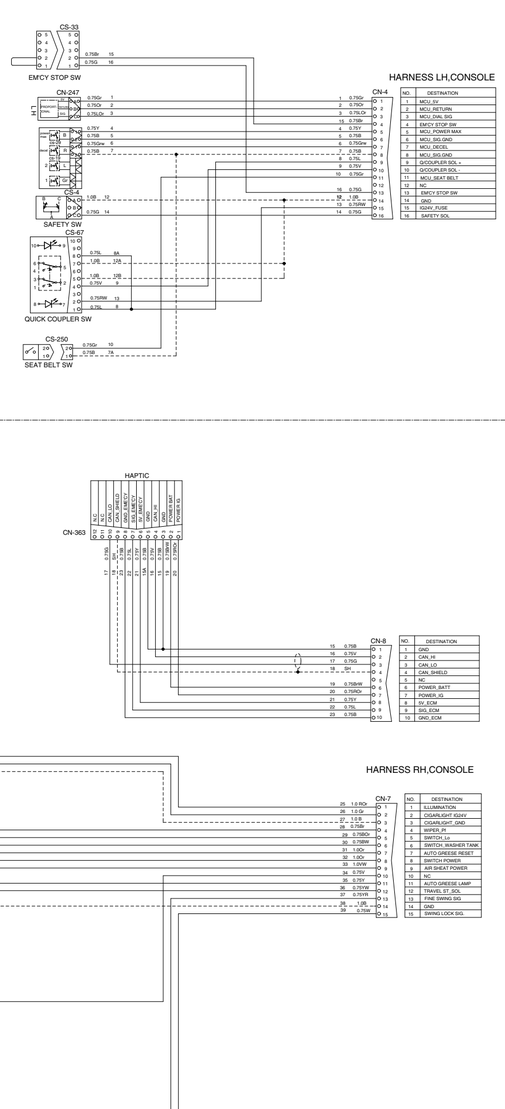


20KB-93101-01

- MACHINE SERIAL NO.
  HX480A L : #00006-#00061
  HX520A L : #00014-#00099

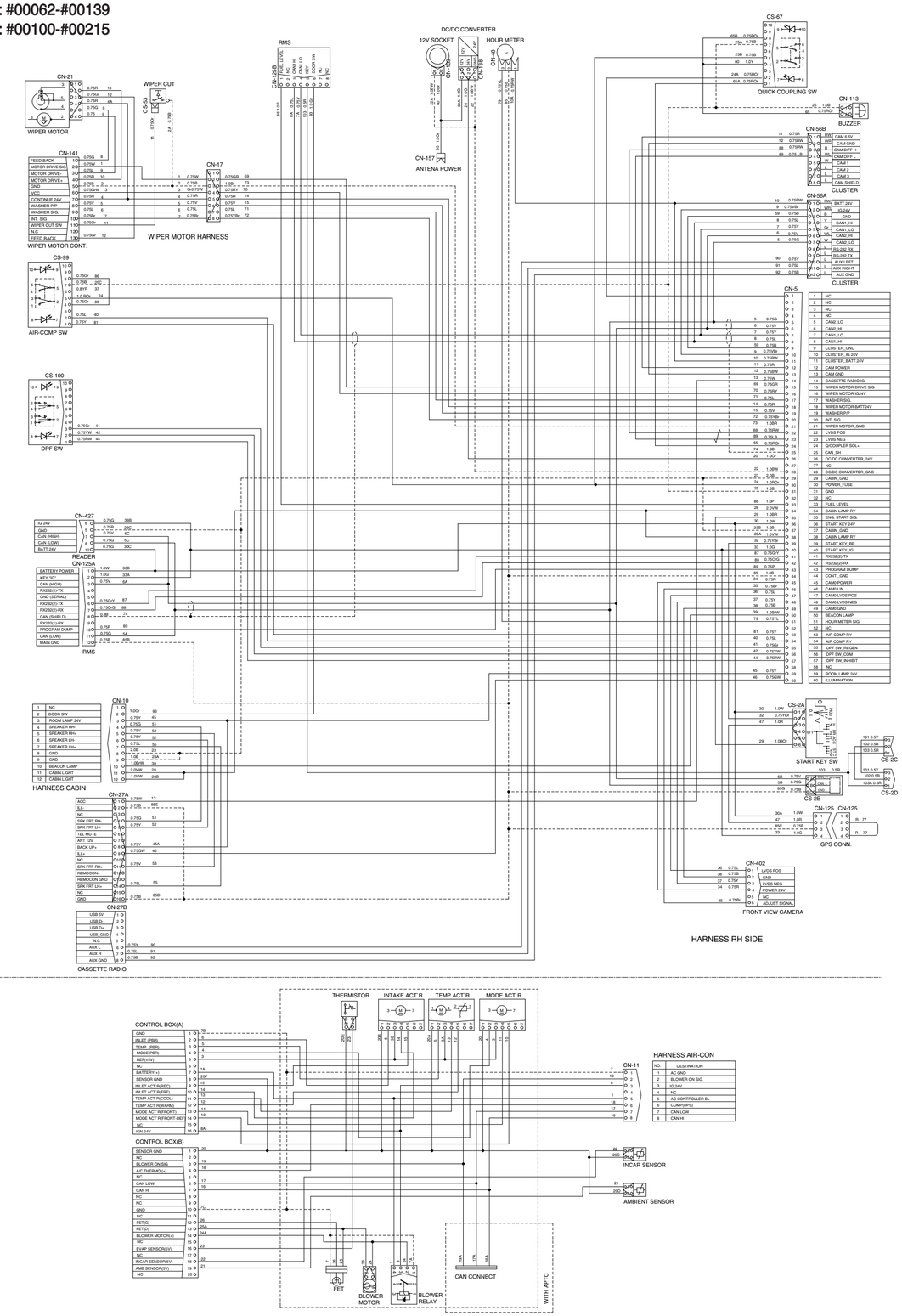


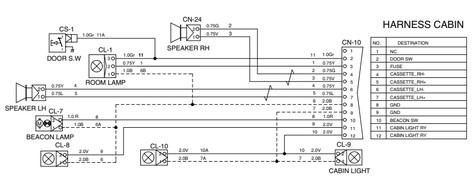


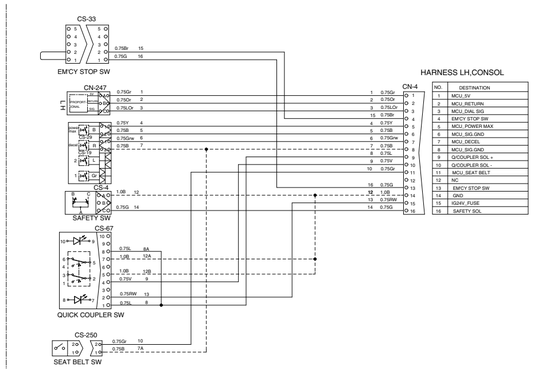


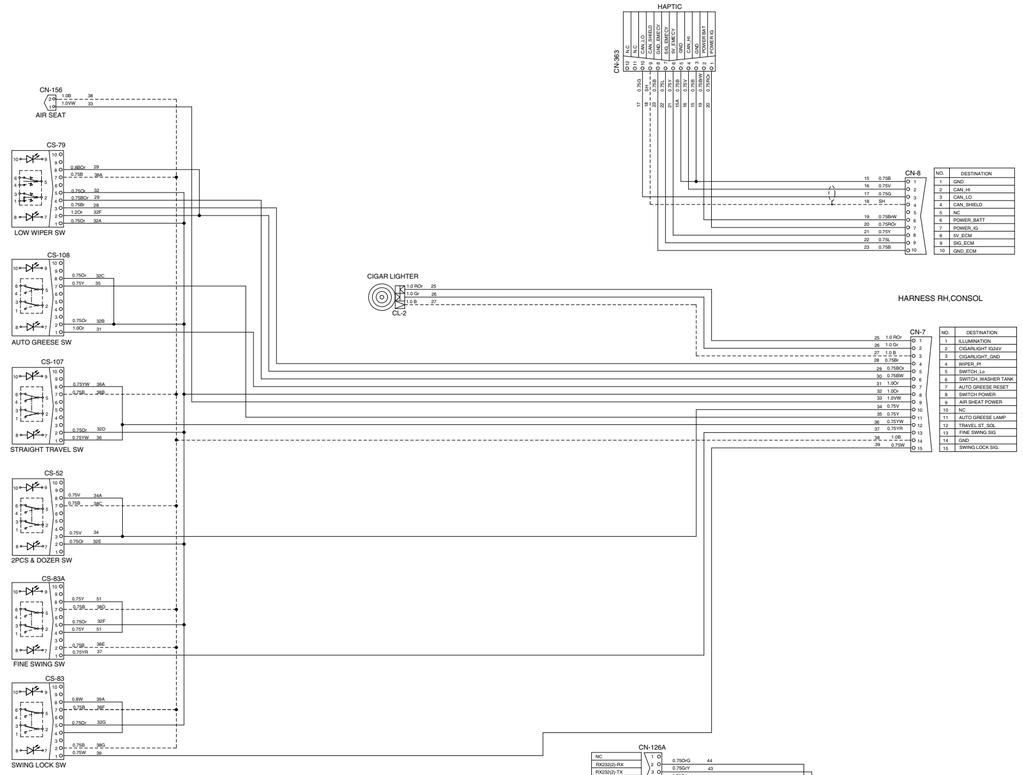
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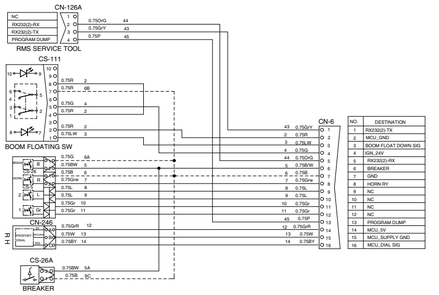
- MACHINE SERIAL NO.
  HX480A L : #00062-#00139
  HX520A L : #00100-#00215





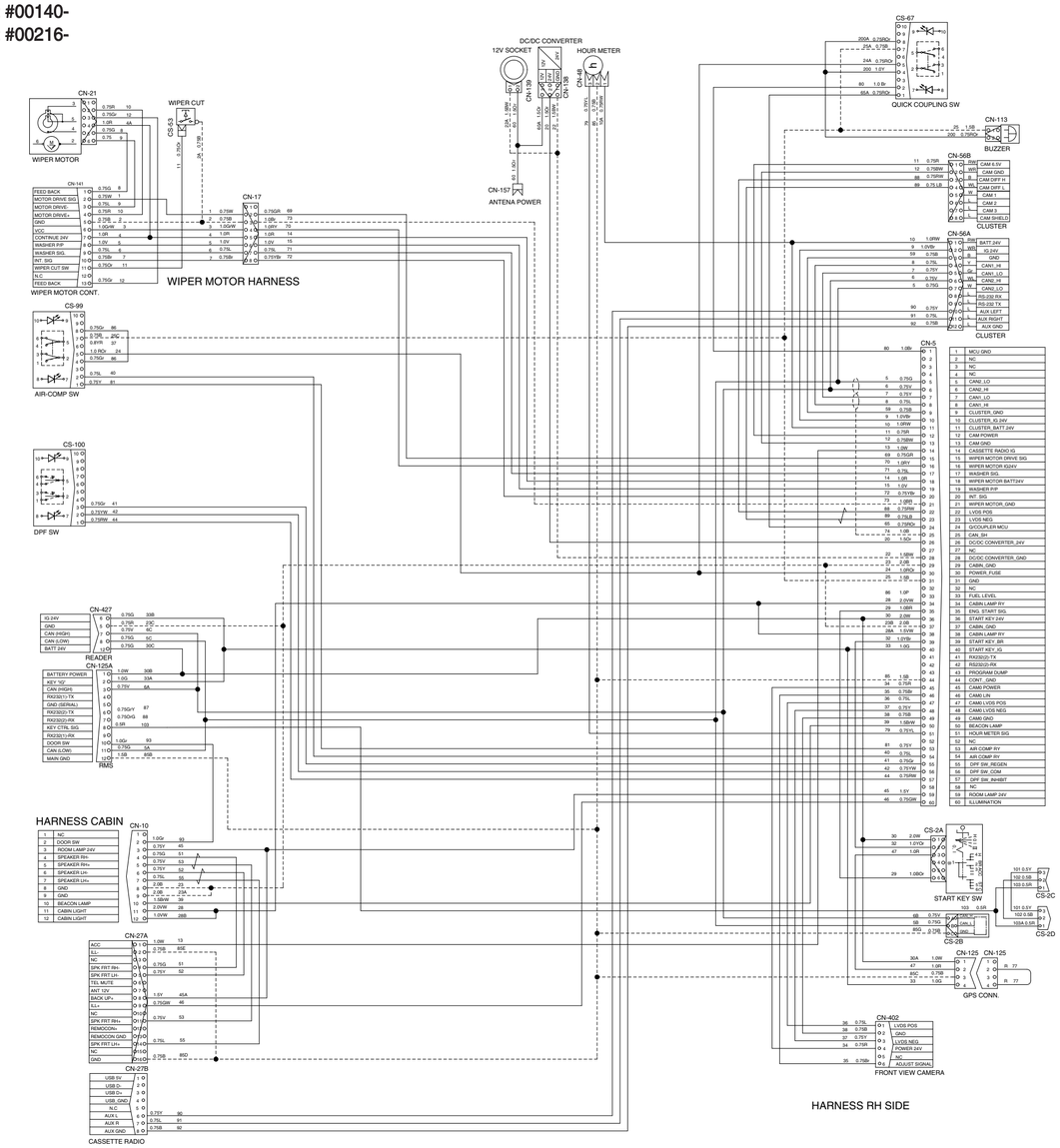


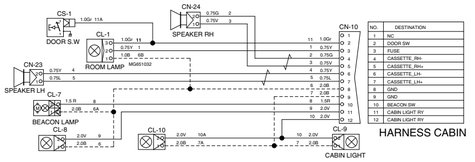


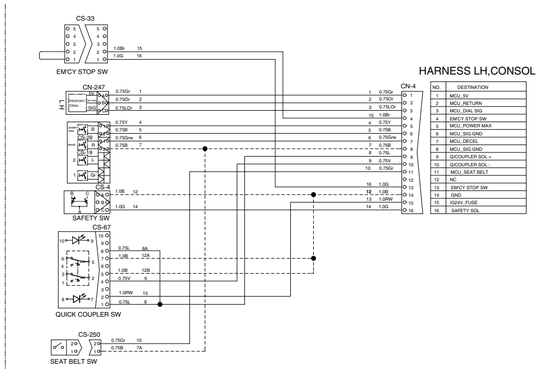


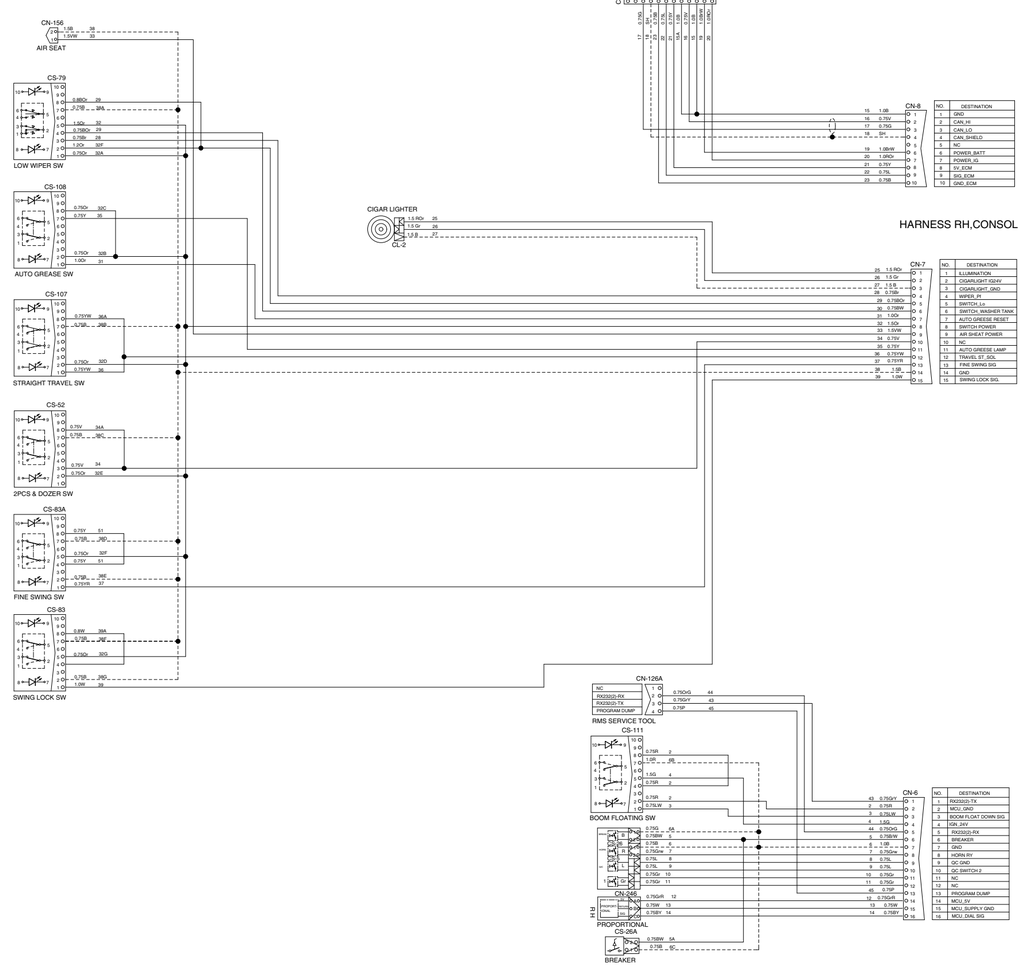
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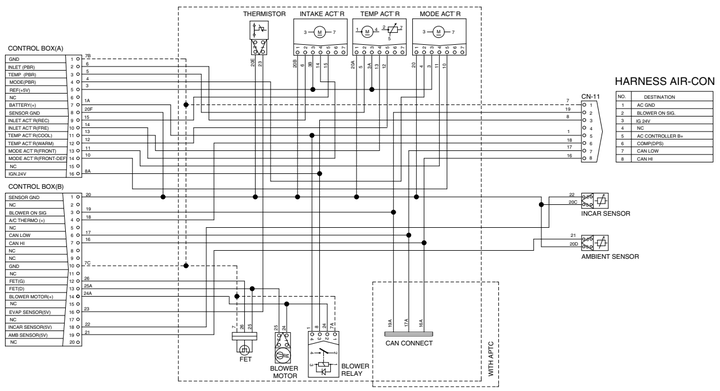
- MACHINE SERIAL NO.
  HX480A L : #00140-
  HX520A L : #00216-



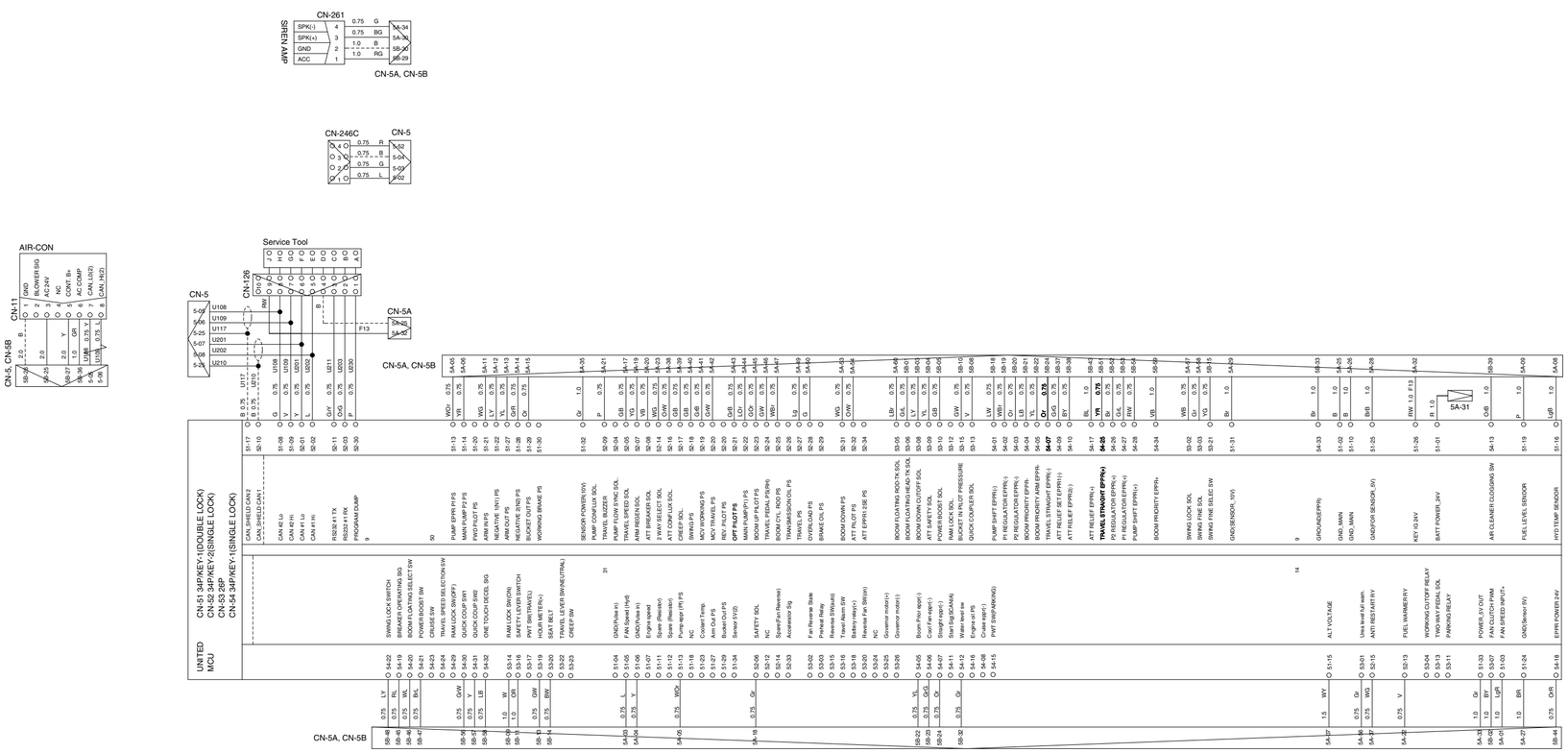




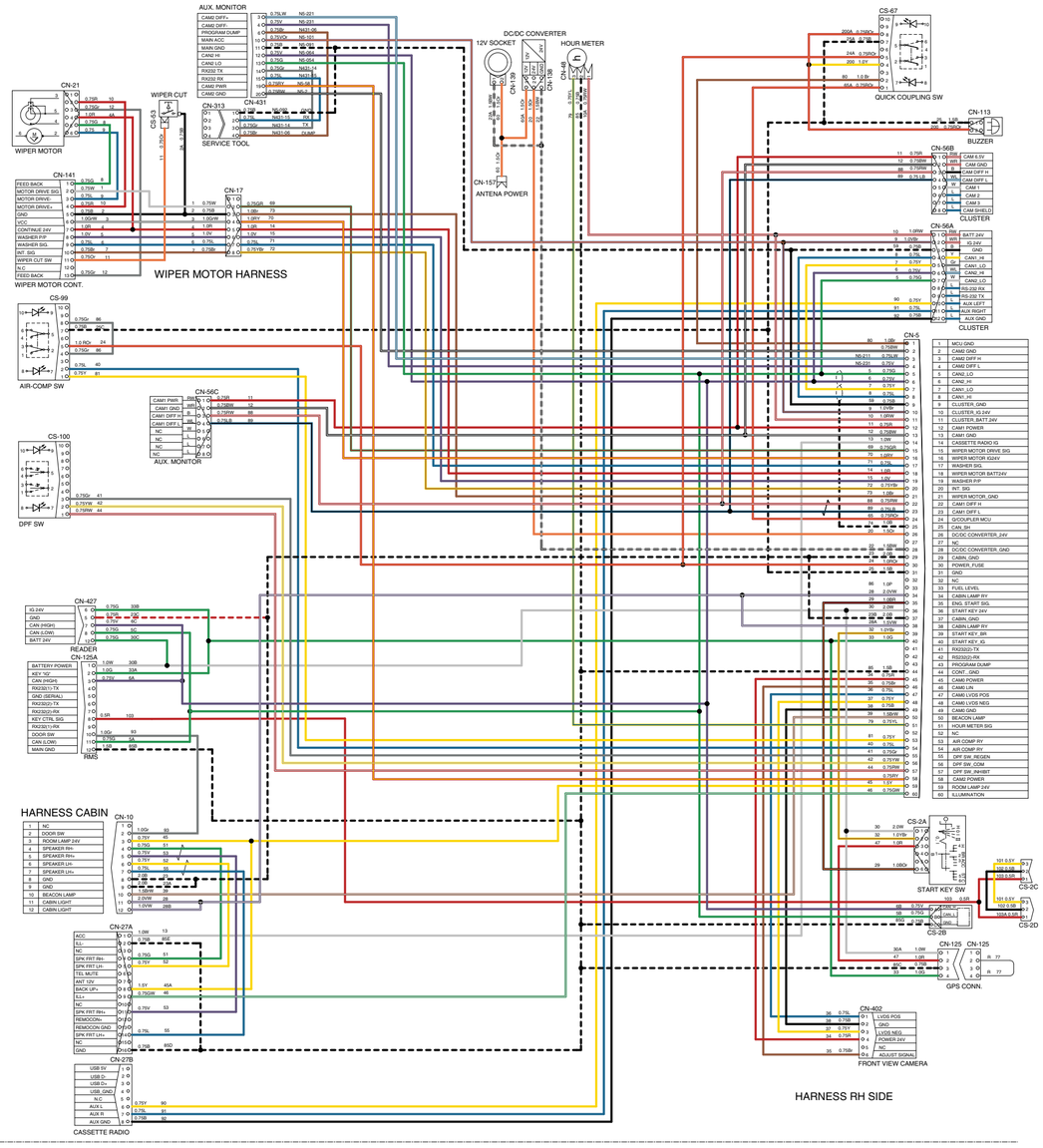




- MACHINE SERIAL NO.
  HX480A L : #00140-
  HX520A L : #00216-



- MACHINE SERIAL NO. : CURRENT

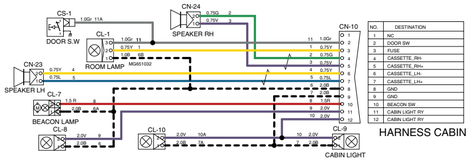


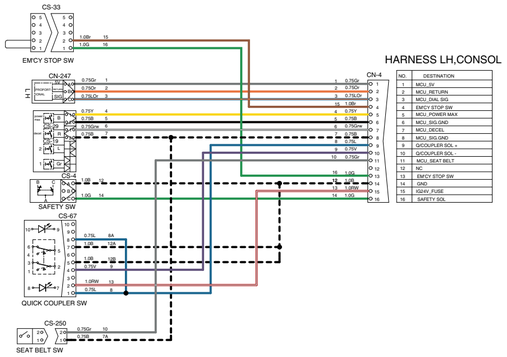
NO.	DESTINATION
1	MCU_5V
2	MCU_RETURN
3	MCU_DIAL SIG
4	EMCY STOP SW
5	MCU_POWER MAX
6	MCU_SIG.GND
7	MCU_DECEL
8	MCU_SIG.GND
9	G/COUPLER SOL +
10	G/COUPLER SOL -
11	MCU_SEAT BELT
12	NC
13	EMCY STOP SW
14	GND
15	IG24V_FUSE
16	SAFETY SOL

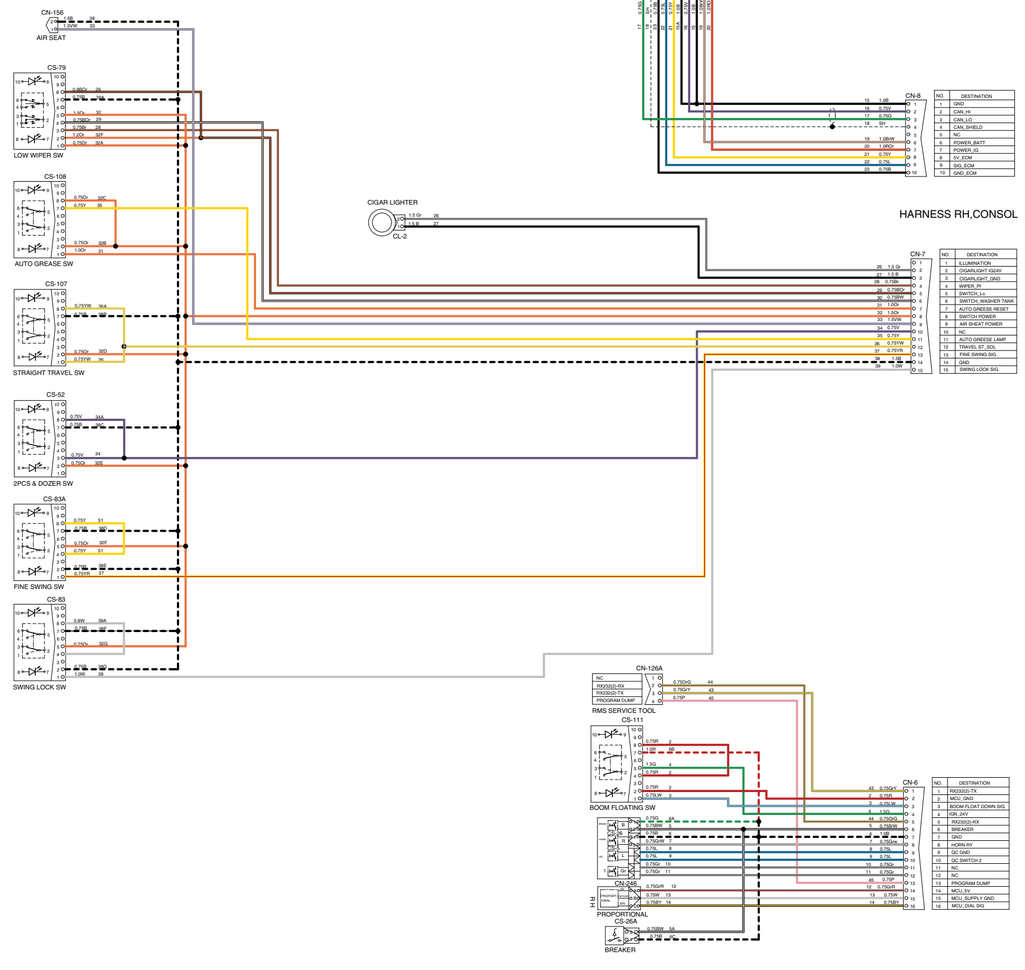
NO.	DESTINATION
1	NC
2	DOOR SW
3	FUSE
4	CASSETTE_RH
5	CASSETTE_RH-
6	CASSETTE_LH-
7	CASSETTE_LH+
8	GND
9	GND
10	BEACON SW
11	CABIN LIGHT RY
12	CABIN LIGHT RY

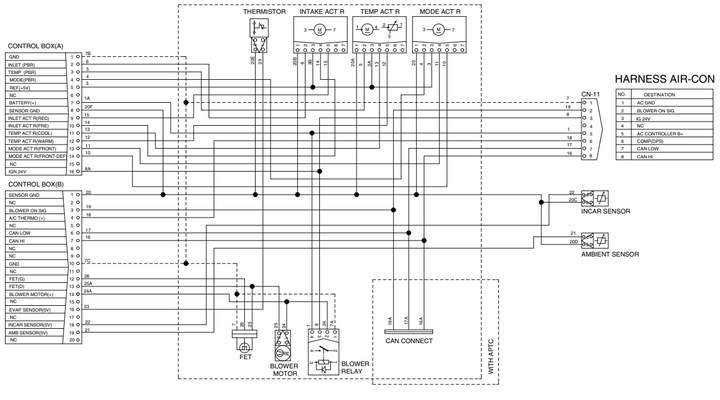
NO.	DESTINATION
1	MCU_GND
2	CAN0_GND
3	CAN0_DIFF H
4	CAN0_DIFF L
5	CAN2_LO
6	CAN2_HI
7	CAN1_LO
8	CAN1_HI
9	CLUSTER_GND
10	CLUSTER_IG.24V
11	CLUSTER_BATT.24V
12	CAM1 POWER
13	CAM1 GND
14	CASSETTE RADIO IG
15	WIPER MOTOR DRIVE SIG
16	WIPER MOTOR 4GEAV
17	WASHER SIG.
18	WIPER MOTOR BATT24V
19	WASHER P/P
20	INT. SIG
21	WIPER MOTOR_GND
22	CAM1 DIFF H
23	CAM1 DIFF L
24	G/COUPLER MCU
25	CAN_SH
26	DC/DC CONVERTER_24V
27	NC
28	DC/DC CONVERTER_GND
29	CABIN_GND
30	POWER_FUSE
31	GND
32	NC
33	FUEL LEVEL
34	CABIN LAMP RY
35	ENG. START SIG.
36	START KEY 24V
37	CABIN_GND
38	CABIN LAMP RY
39	START KEY_BR
40	START KEY_IG
41	RX232D-TX
42	RS232D-RX
43	PROGRAM DUMP
44	CONT_GND
45	CAN0 POWER
46	CAN0 LIN
47	CAN0 LVDS POS
48	CAN0 LVDS NEG
49	CAN0 GND
50	BEACON LAMP
51	HOUR METER SIG
52	NC
53	AIR COMP RY
54	AIR COMP RY
55	DPF SW_REGEN
56	DPF SW_COM
57	DPF SW_INHIBIT
58	CAM2 POWER
59	ROOM LAMP 24V
60	ILLUMINATION

NO.	DESTINATION
1	CAN0_GND
2	CAN0_HI
3	CAN_LG
4	CAN_SHIELD
5	NC
6	POWER_BATT
7	POWER_IG
8	5V_ECM
9	SIG_ECM
10	GND_ECM





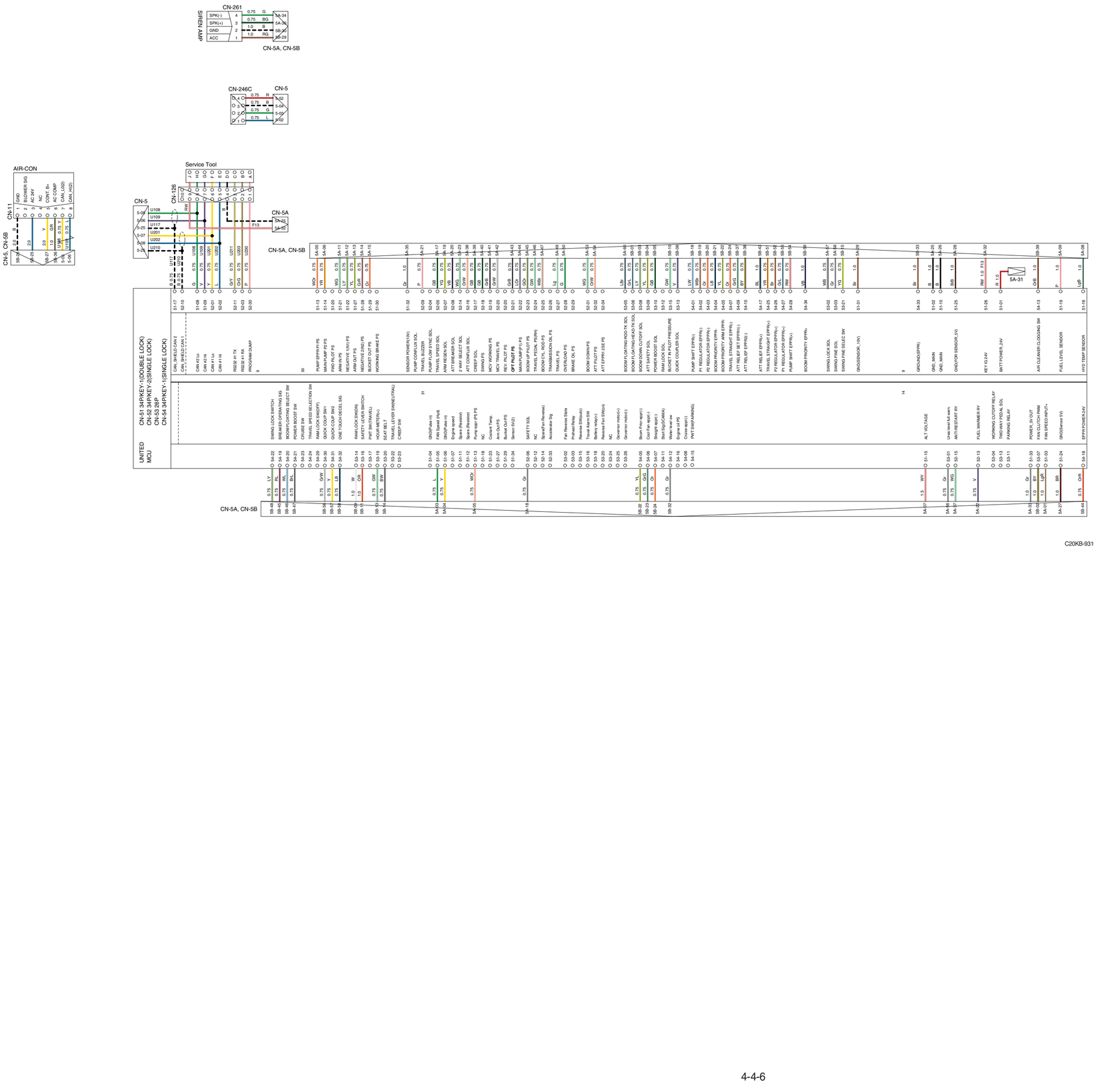




NO.	DESTINATION
1	AC GND
2	BLOWER ON SIG.
3	IG.24V
4	NC
5	AC CONTROLLER B+
6	COMP(DPS)
7	CAN LOW
8	CAN HI

C20KB-93106-00 1OF2

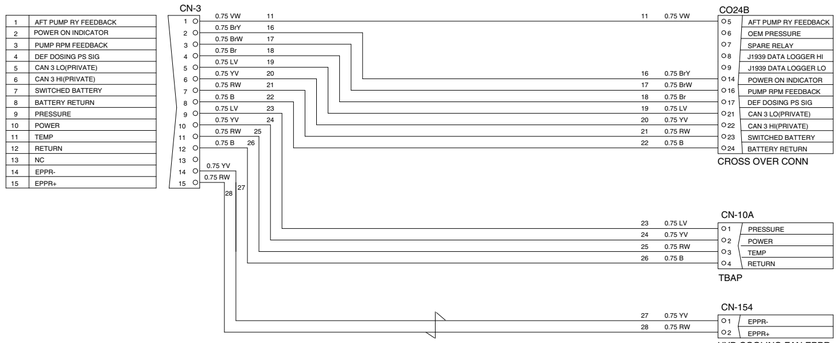
- MACHINE SERIAL NO. : CURRENT

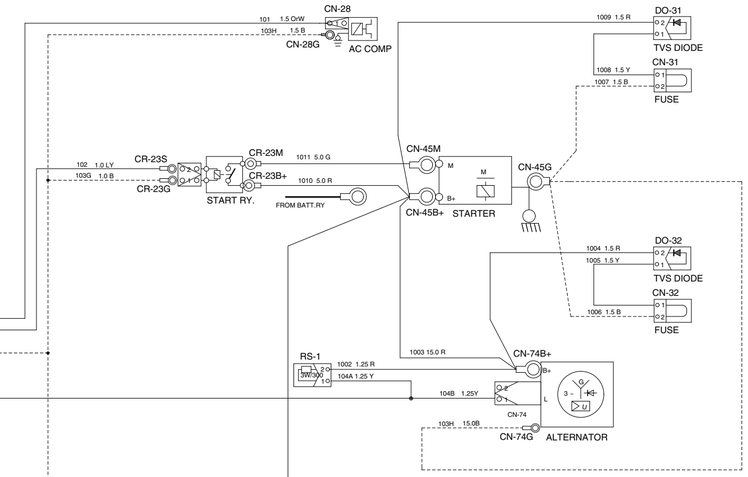


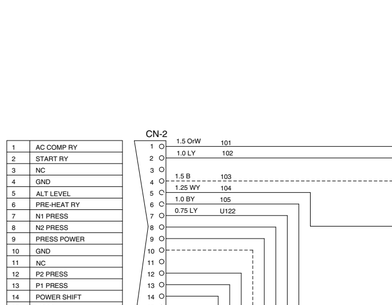
C20KB-93106-00 2OF2

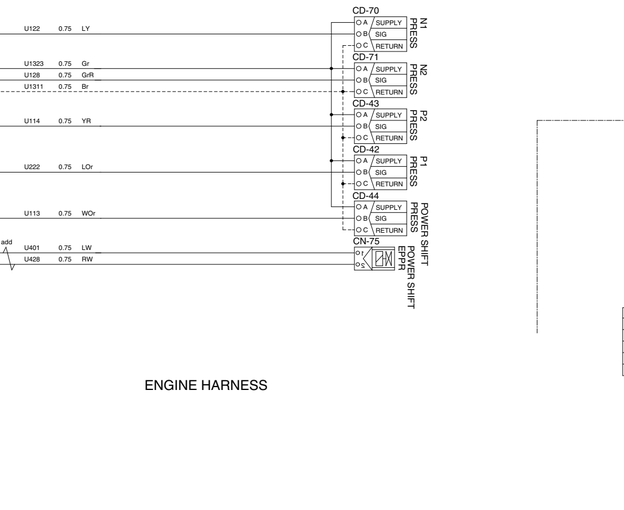
· ELECTRICAL CIRCUIT (3/4)

- MACHINE SERIAL NO.
  HX480A L : -#00002
  HX520A L : -#00002

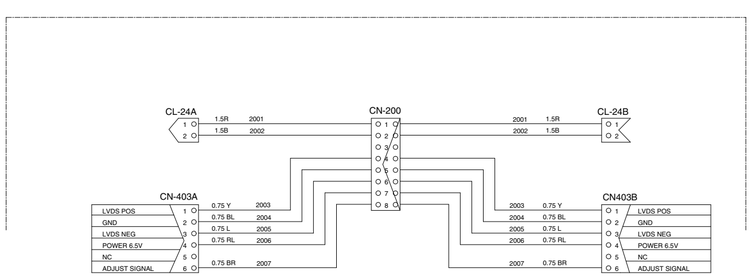




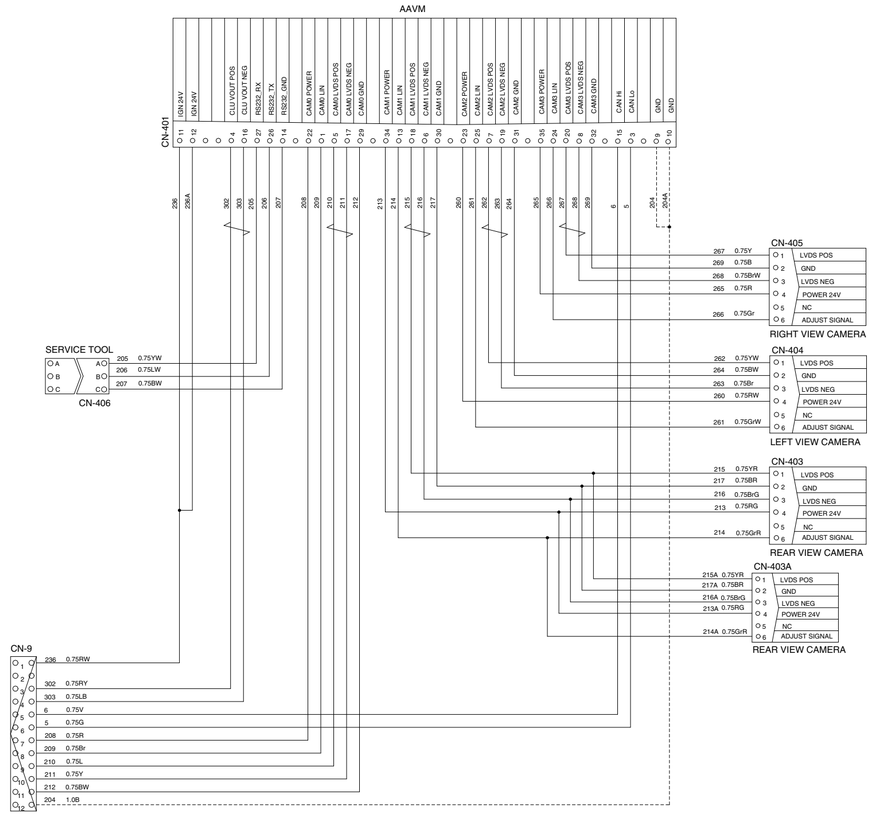


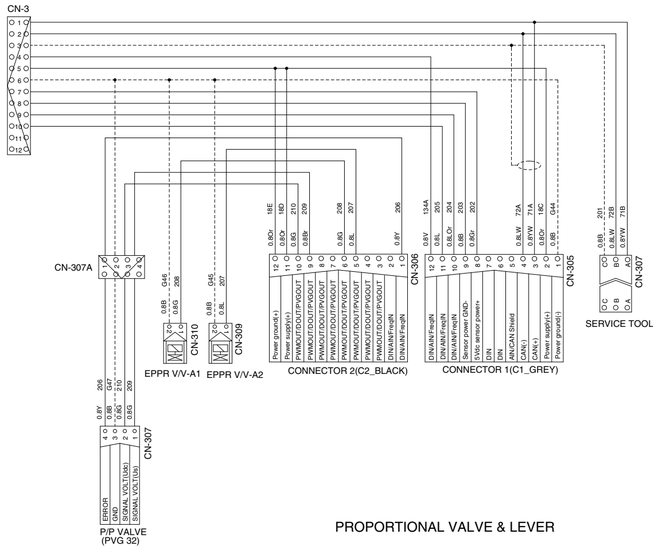


ENGINE HARNESS



REMOVEABLE COUNTER WEIGHT

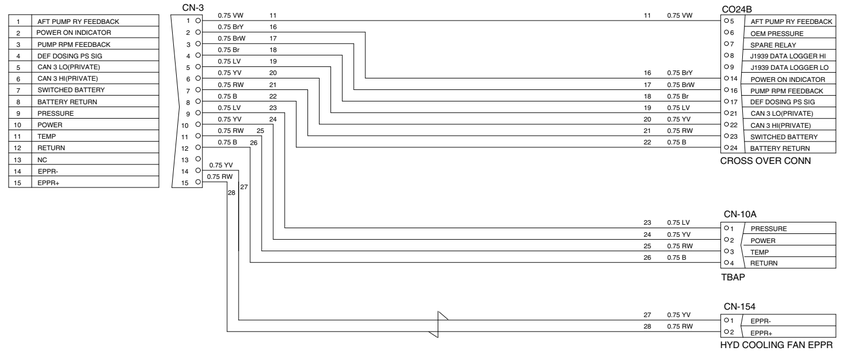


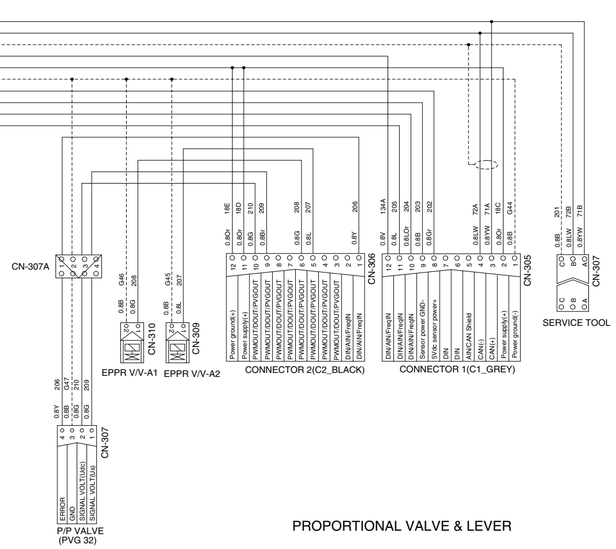


PROPORTIONAL VALVE & LEVER

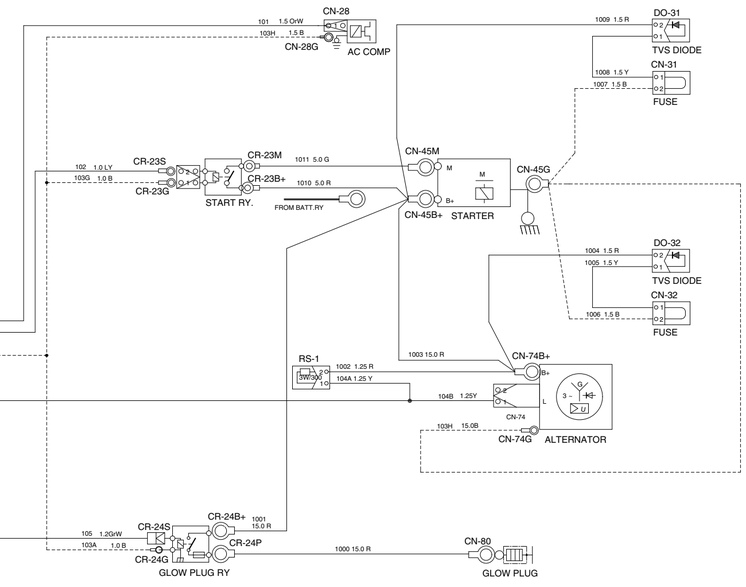
20KB-93301-01

- MACHINE SERIAL NO.
  HX480A L : #00003-#00038
  HX520A L : #00003-#00072

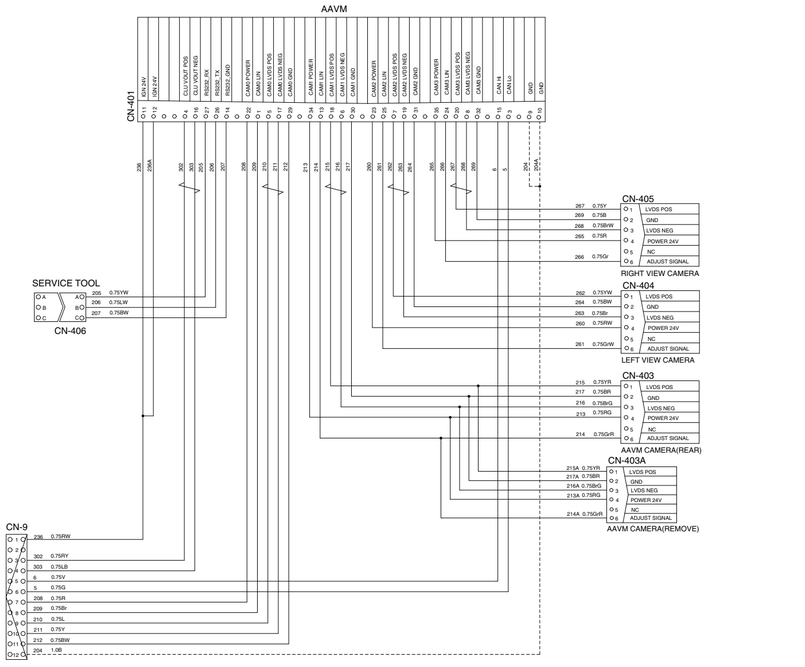


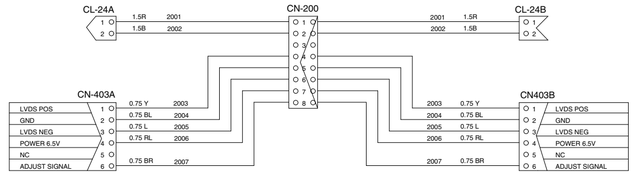


PROPORTIONAL VALVE & LEVER



ENGINE HARNESS

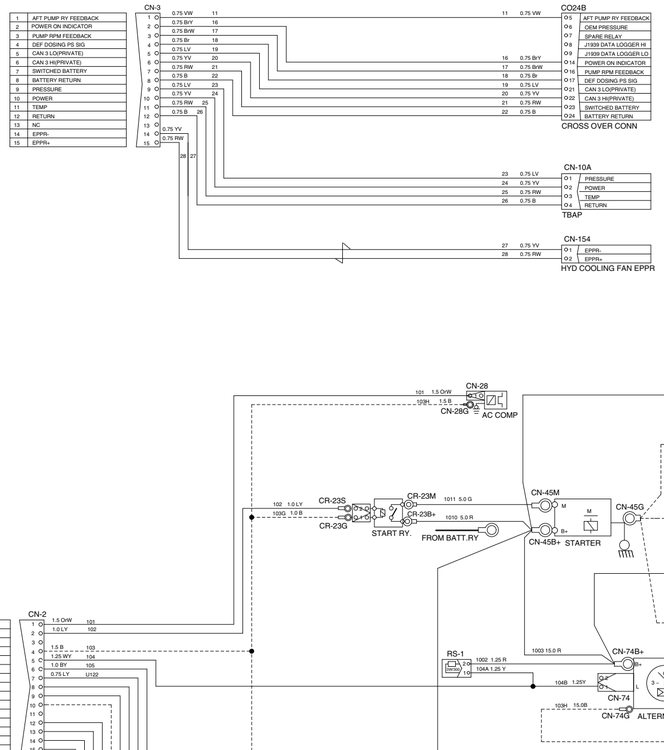


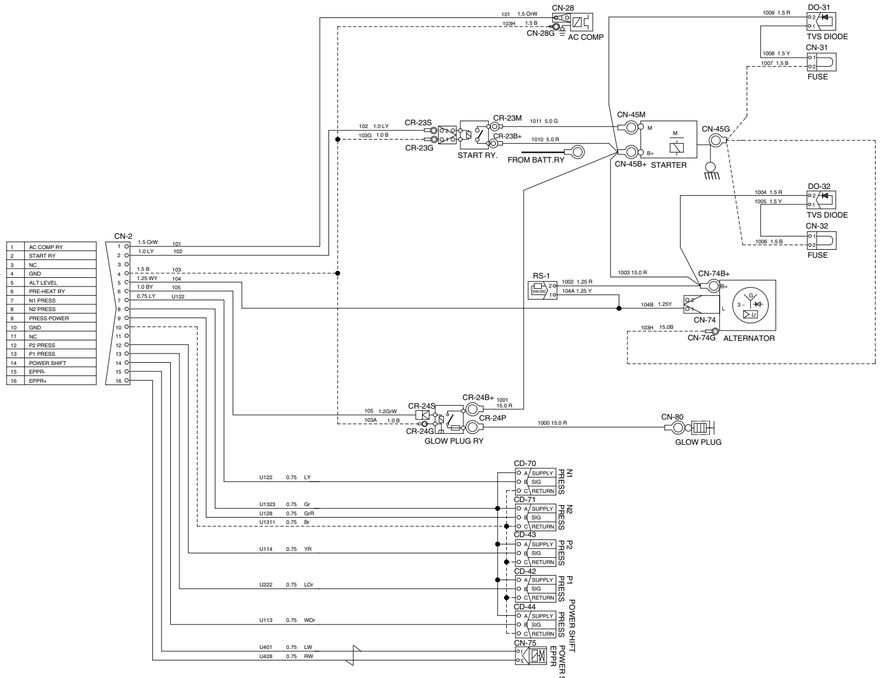


REMOVEABLE COUNTER WEIGHT

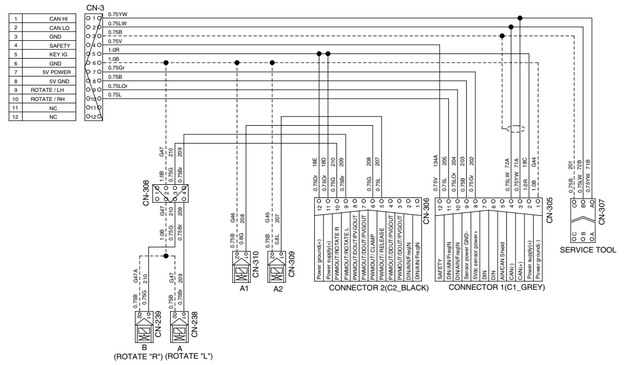
20KB-93302-00

- MACHINE SERIAL NO.
  HX480A L : #00039-
  HX520A L : #00073-

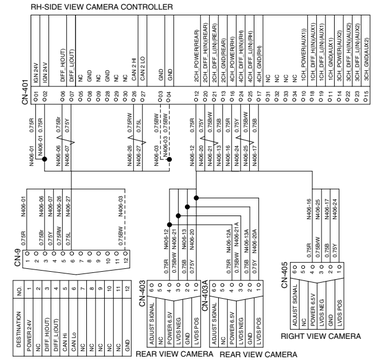




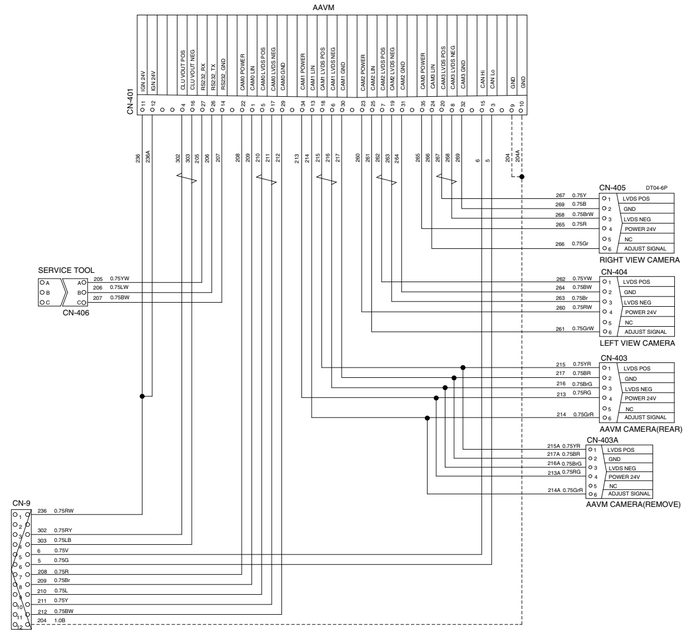
E/G HARNESS



PROPORTIONAL VALVE & LEVER

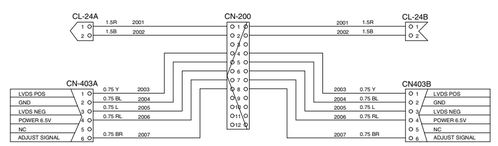


RH-SIDE VIEW CAMERA SYSTEM



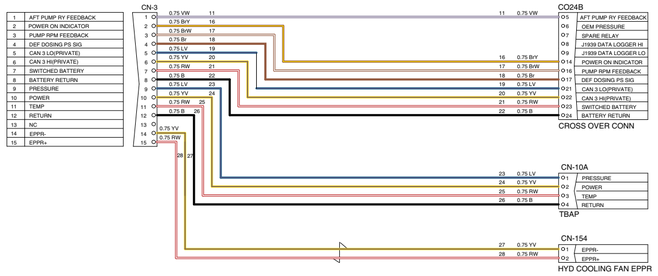
AAVM HARNESS

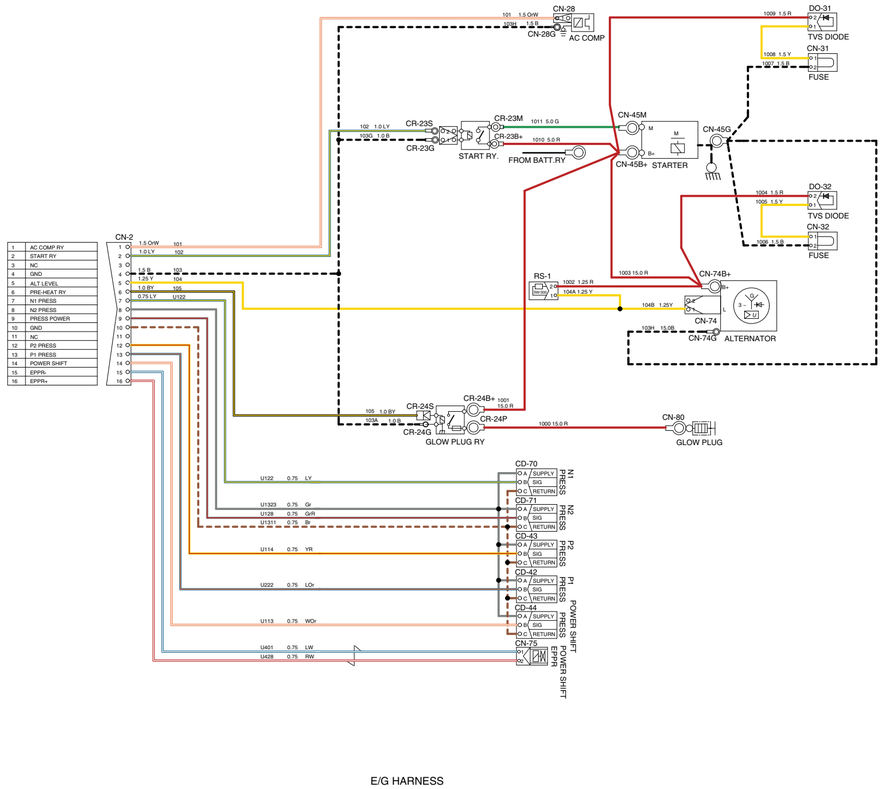
REMOVEABLE COUNTER WEIGHT



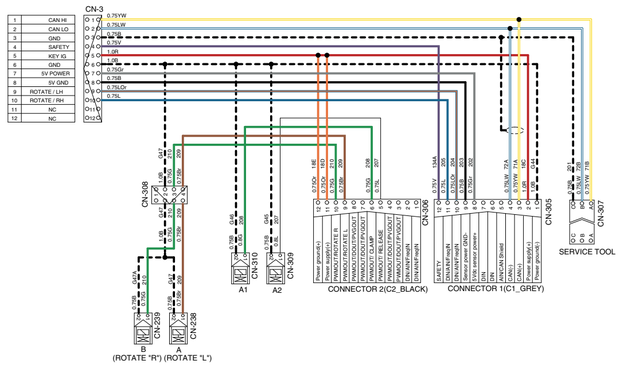
20KB-93303-01

- MACHINE SERIAL NO. : CURRENT

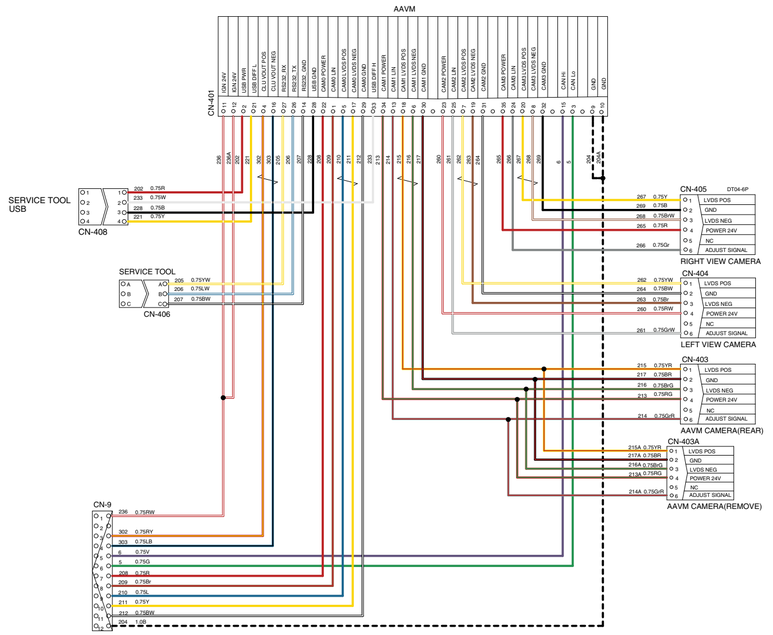




E/G HARNESS

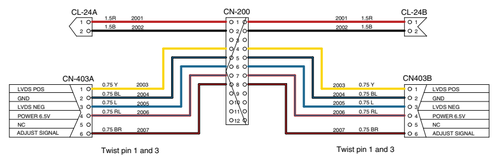


PROPORTIONAL VALVE & LEVER



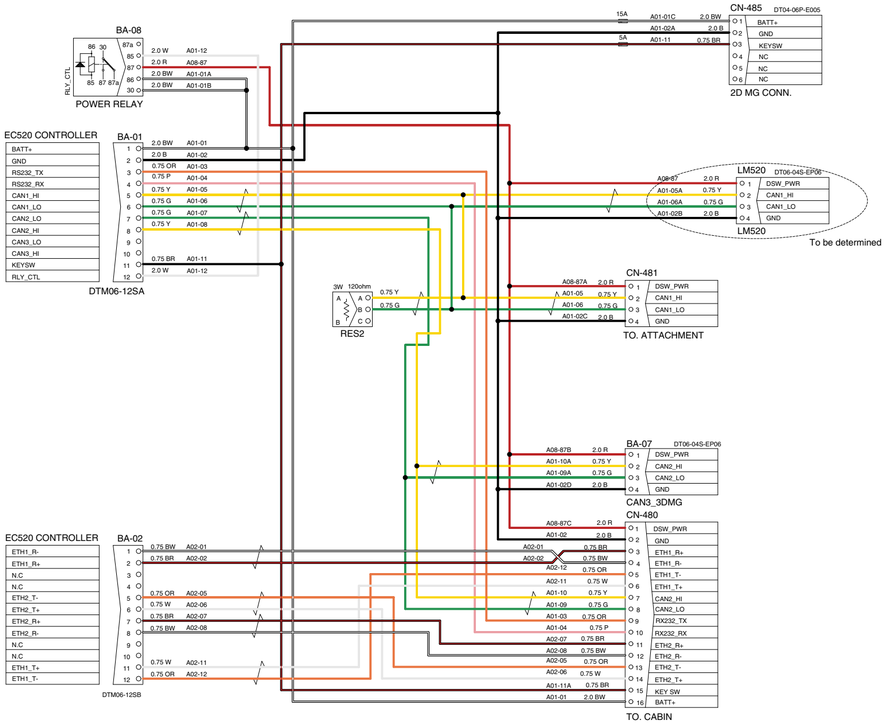
AAVM HARNESS

REMOVEABLE COUNTER WEIGHT



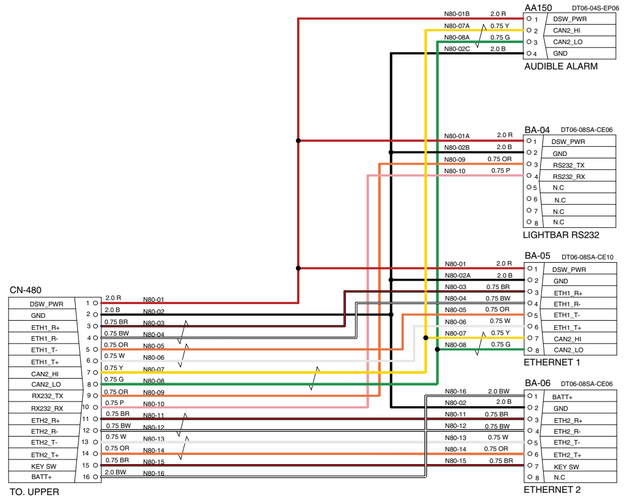
C20KB-93304-00

· ELECTRICAL CIRCUIT (4/4, OPTION : 2D MG)



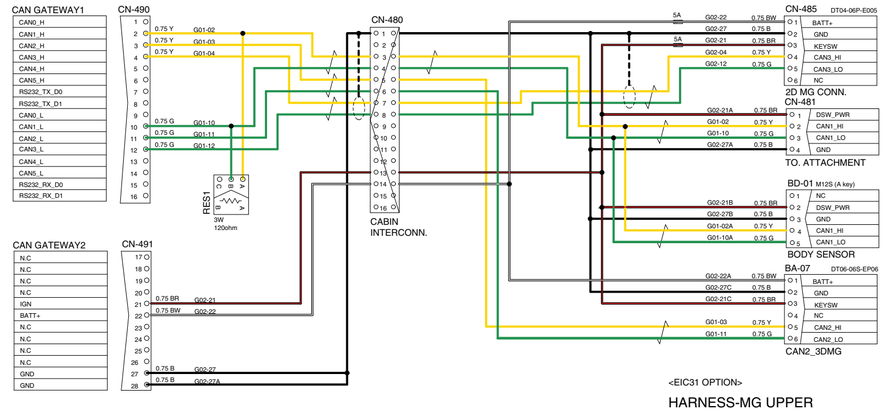
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HARNESS-MG UPPER



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HARNESS-MG CABIN

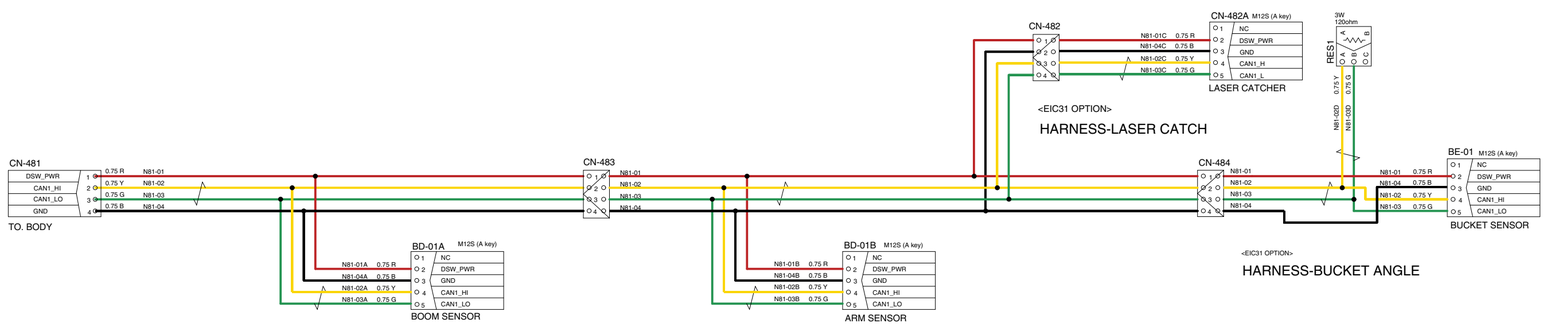


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HARNESS-MG CABIN

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HARNESS-MG UPPER



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HARNESS-BOOM ANGLE

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HARNESS-ARM ANGLE

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HARNESS-LASER CATCH

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HARNESS-BUCKET ANGLE

C20K4-94311-00

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-1] → Maxival fuse [CN-60] → Master switch [CS-74]

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

※ I/conn : Intermediate connector

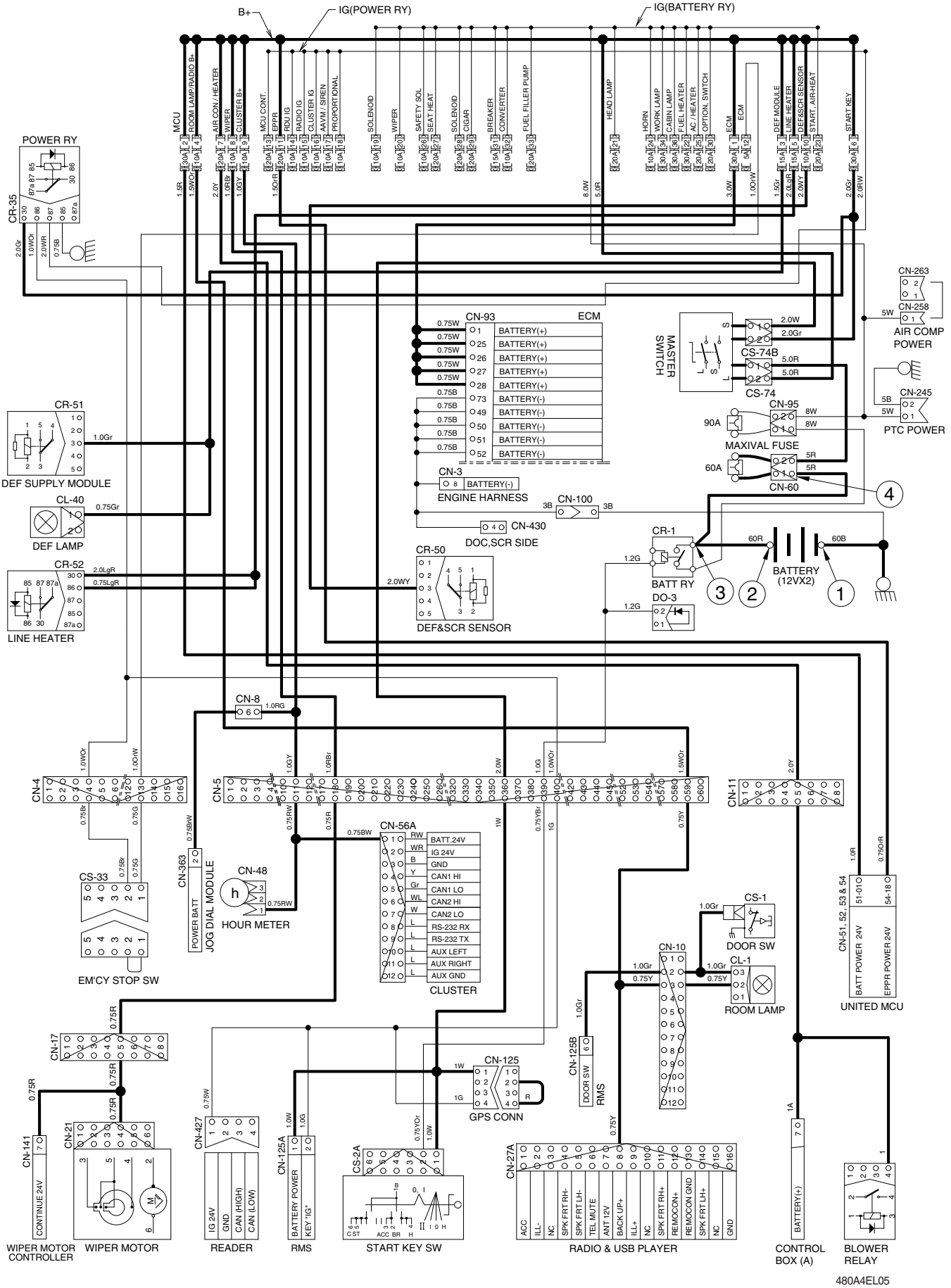
2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	OFF	① - GND (battery 1EA)	10~12.5V
		② - GND (battery 2EA)	20~25V
		③ - GND (battery relay)	20~25V
		④ - GND (maxival fuse)	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] → Maxival fuse [CN-60] → Master switch [CS-74]
→ Fuse box [No.6] → Master switch [CS-74B] → I/conn [CN-5 (36)] → Start switch [CS-2A (1)]
→ Power relay [CR-35 (30)]

(1) When start switch is in ON position

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

(2) When start switch is in START position

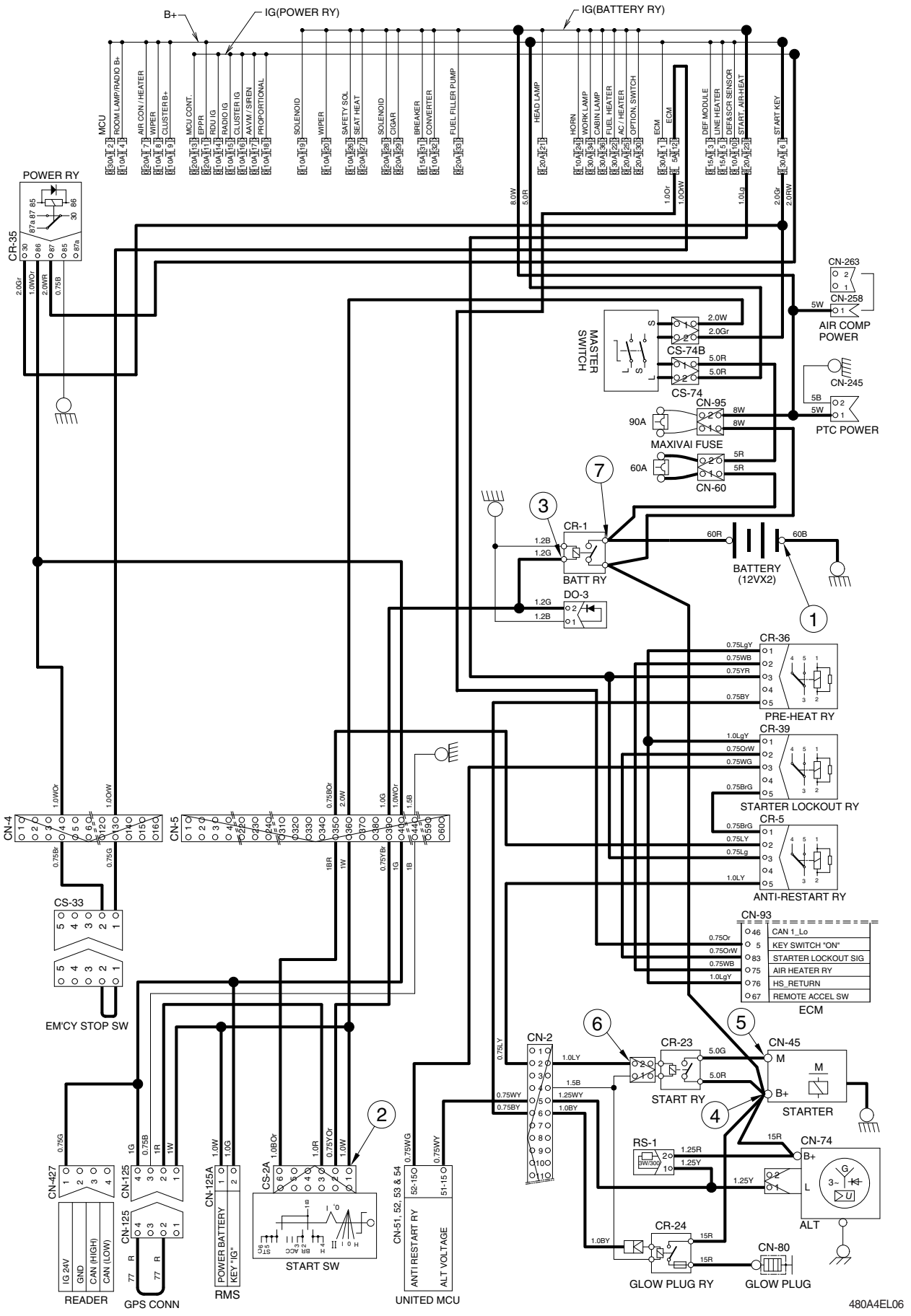
Start switch START [CS-2A (6)] → I/conn [CN-5 (35)] → Anti-restart relay [CR-5 (2) → (5)]
→ I/conn [CN-2 (2)] → Start relay [CR-23 (2)] → Starter motor operating

2) CHECK POINT

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

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

STARTING CIRCUIT



※ 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 alternator flows into the battery through the battery relay [CR-1].

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

1) OPERATING FLOW

(1) Warning flow

Alternator "L" terminal → I/conn [CN-2 (5)] → United MCU alternator voltage [CN-51 (15)]
→ Cluster charging warning lamp (Via CAN interface)

(2) Charging flow

Alternator "B^+" terminal → Starter [CN-45 (B^+)] → Battery relay (CR-1)
- → Battery (+) terminal
- → Maxival fuse [CN-60] → Master switch [CS-74] → Fuse box [B^+]
- → Maxival fuse [CN-95] → Fuse box [IG, battery] → Power relay [CR-35 (30)→(87)]
  → Fuse box [IG, power]

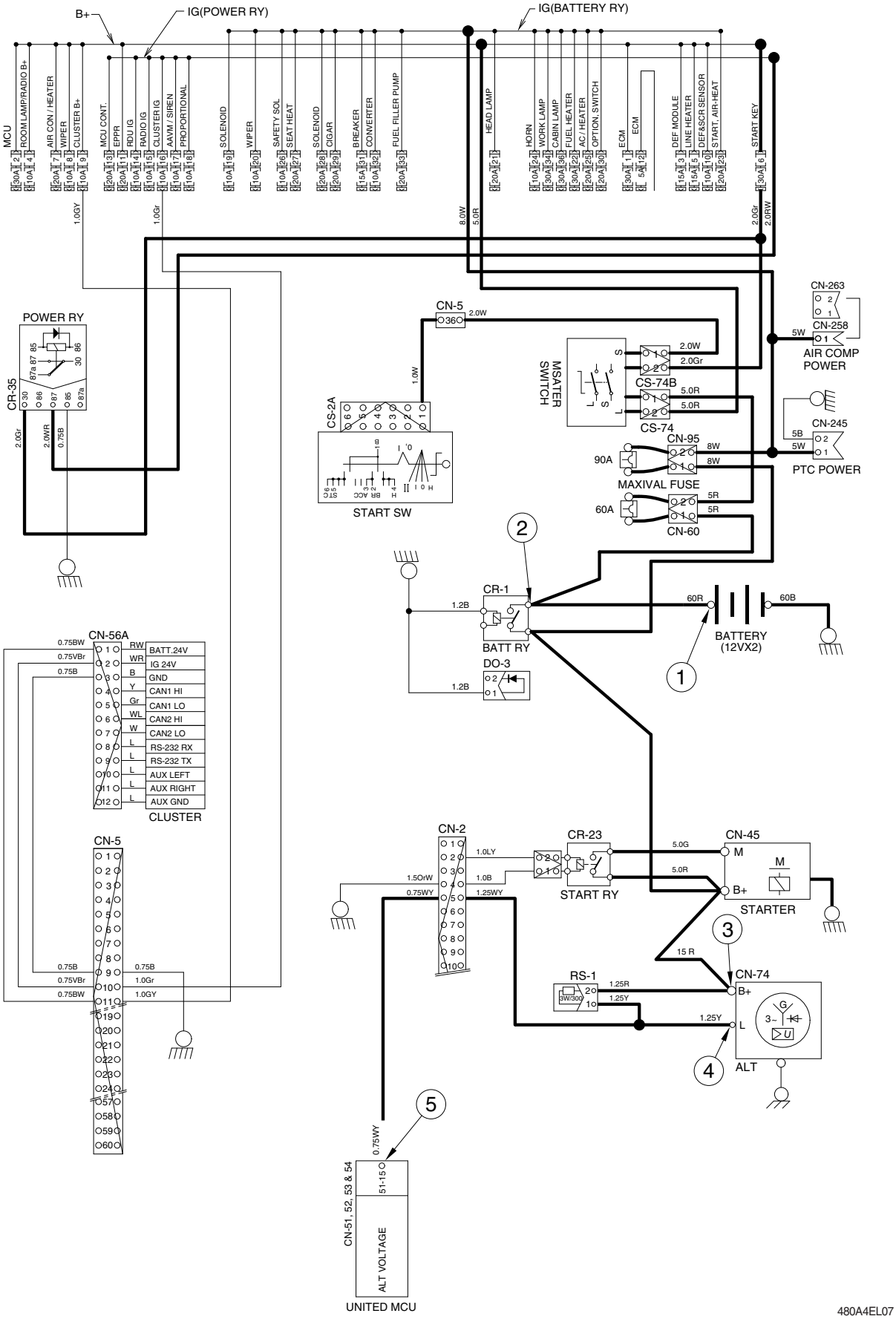
2) CHECK POINT

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

※ GND : Ground

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

CHARGING CIRCUIT



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

(1) Head light switch ON

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

(2) Work light switch ON

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

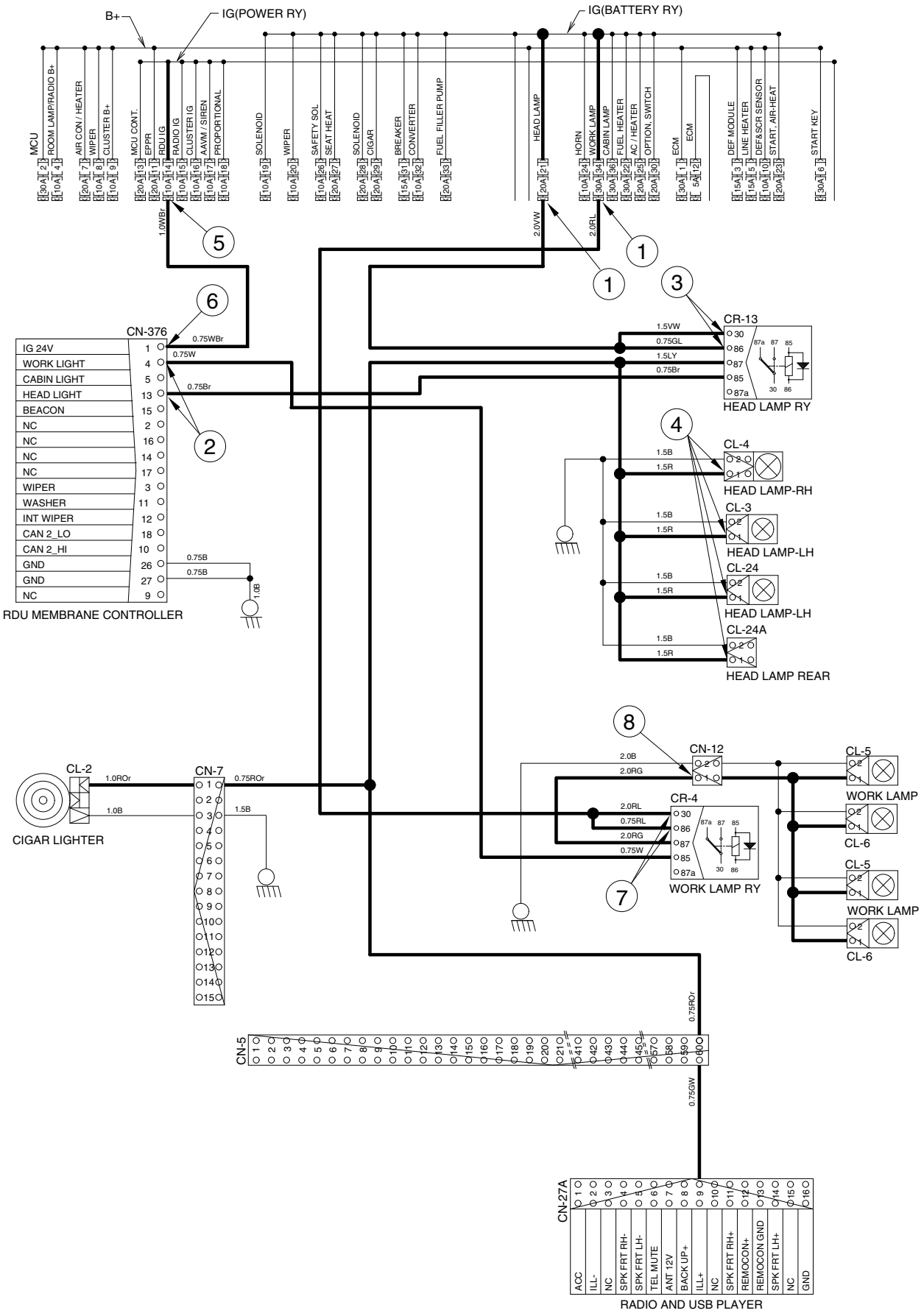
2) CHECK POINT

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

※ GND : Ground

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

HEAD AND WORK LIGHT CIRCUIT



480A4EL08

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

(1) Beacon lamp switch ON

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

(2) Cab light switch ON

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

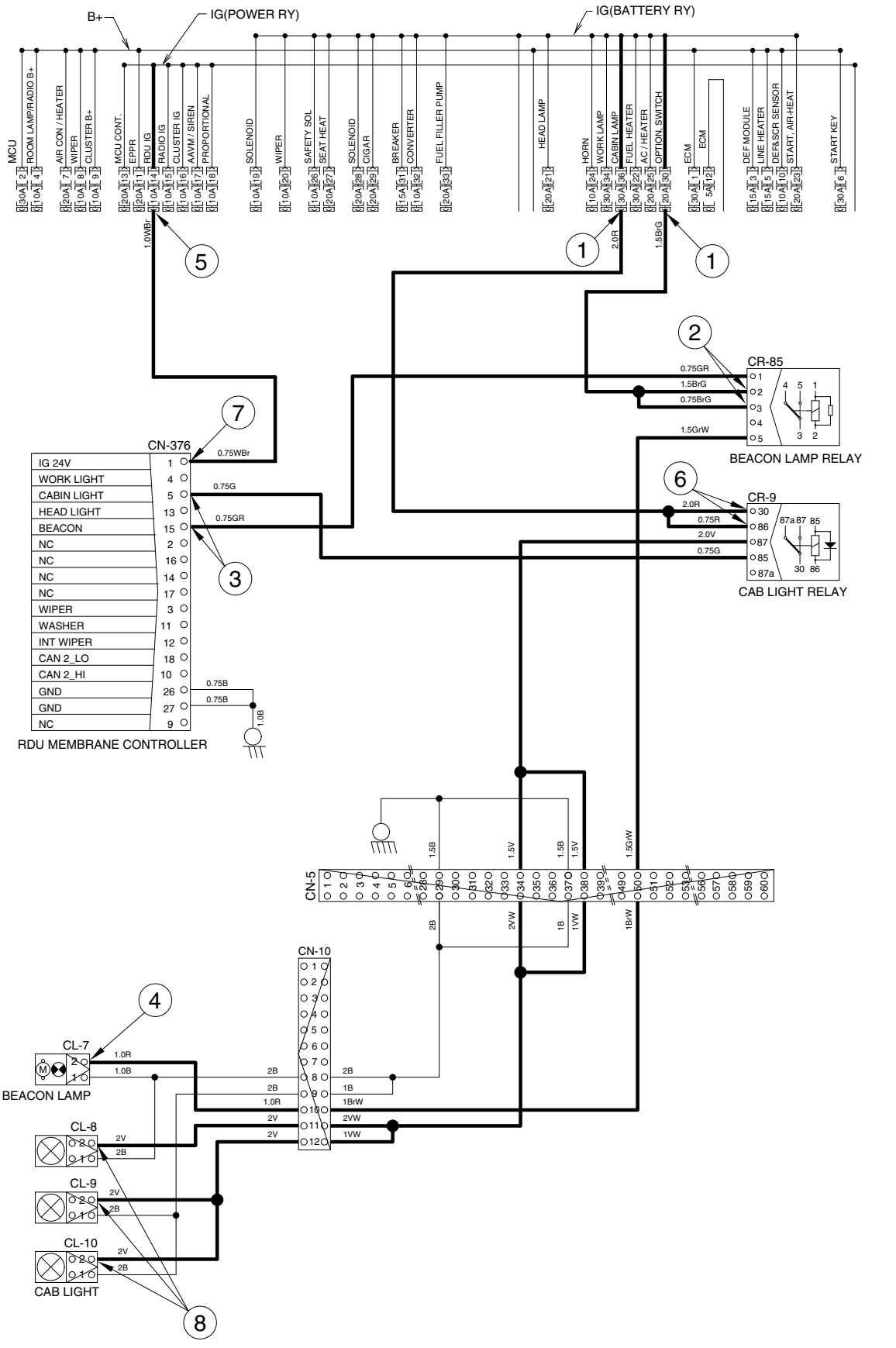
2) CHECK POINT

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

※ GND : Ground

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

BEACON LAMP AND CAB LIGHT CIRCUIT



480A4EL09

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

6. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

(1) Start switch ON

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

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

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

(2) Wiper switch ON (Intermittent)

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

(3) Wiper switch ON (continual)

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

(4) Washer switch ON

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

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

(5) Auto parking (when switch OFF)

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

2) OPERATING FLOW (LOW WIPER)

(1) Start switch ON

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

(2) Wiper switch ON (1st)

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

(3) Wiper switch ON (2nd)

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

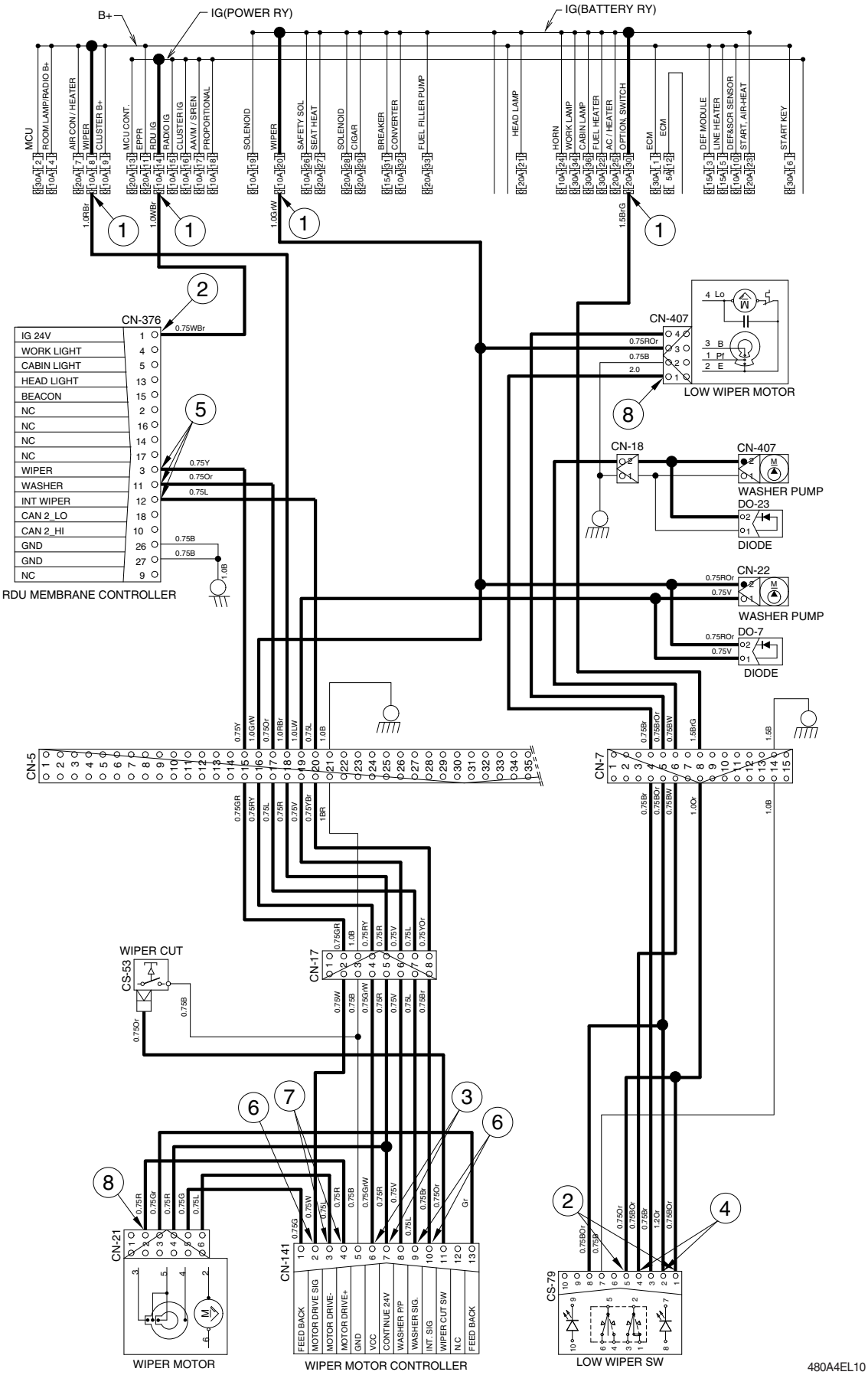
3) CHECK POINT

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

※ GND : Ground

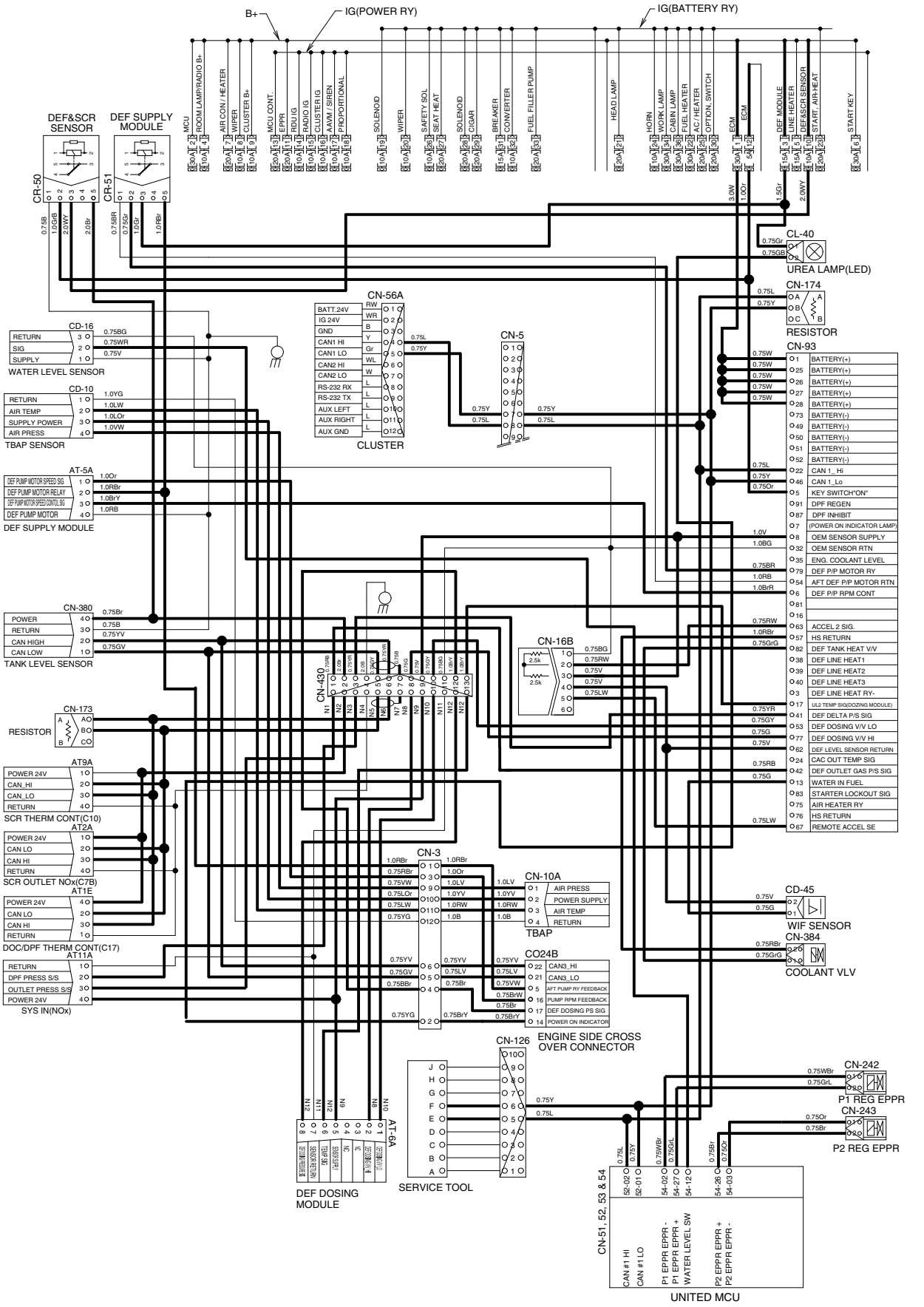
※ The circuit diagram may differ from the equipment, so please check before a repair.

WIPER AND WASHER CIRCUIT



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

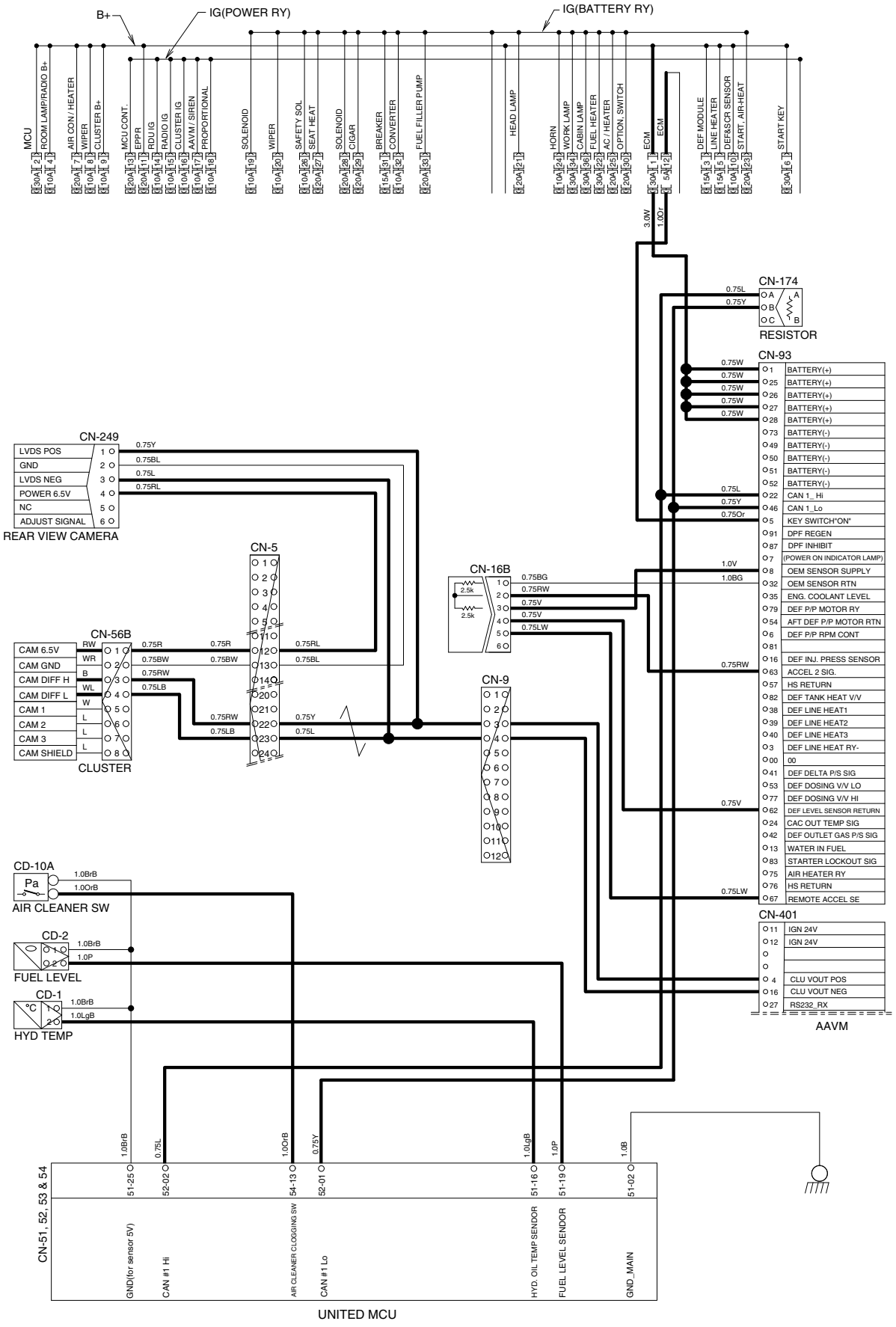
CONTROLLER CIRCUIT



480A4EL11

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

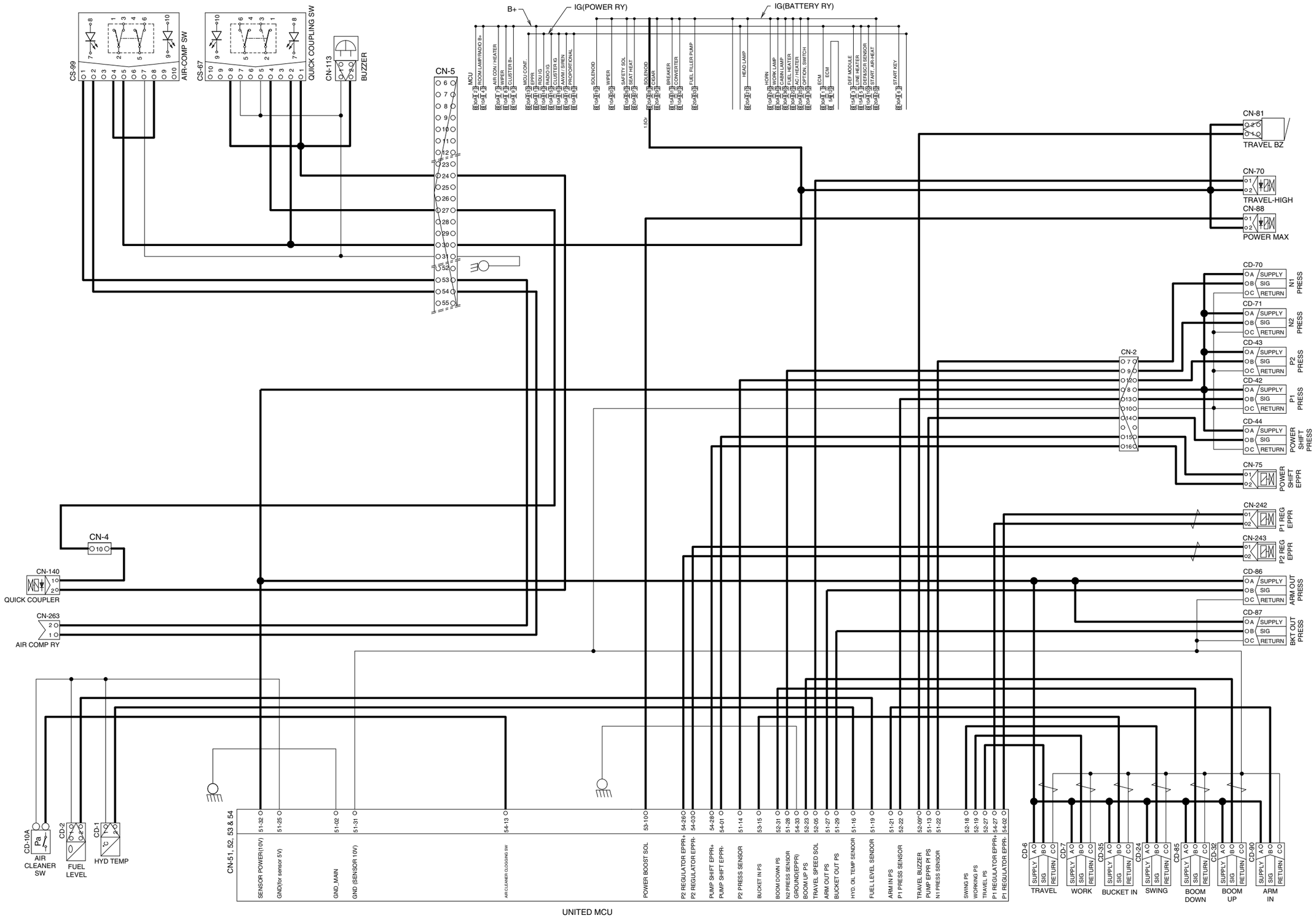
MONITORING CIRCUIT



480A4EL12

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

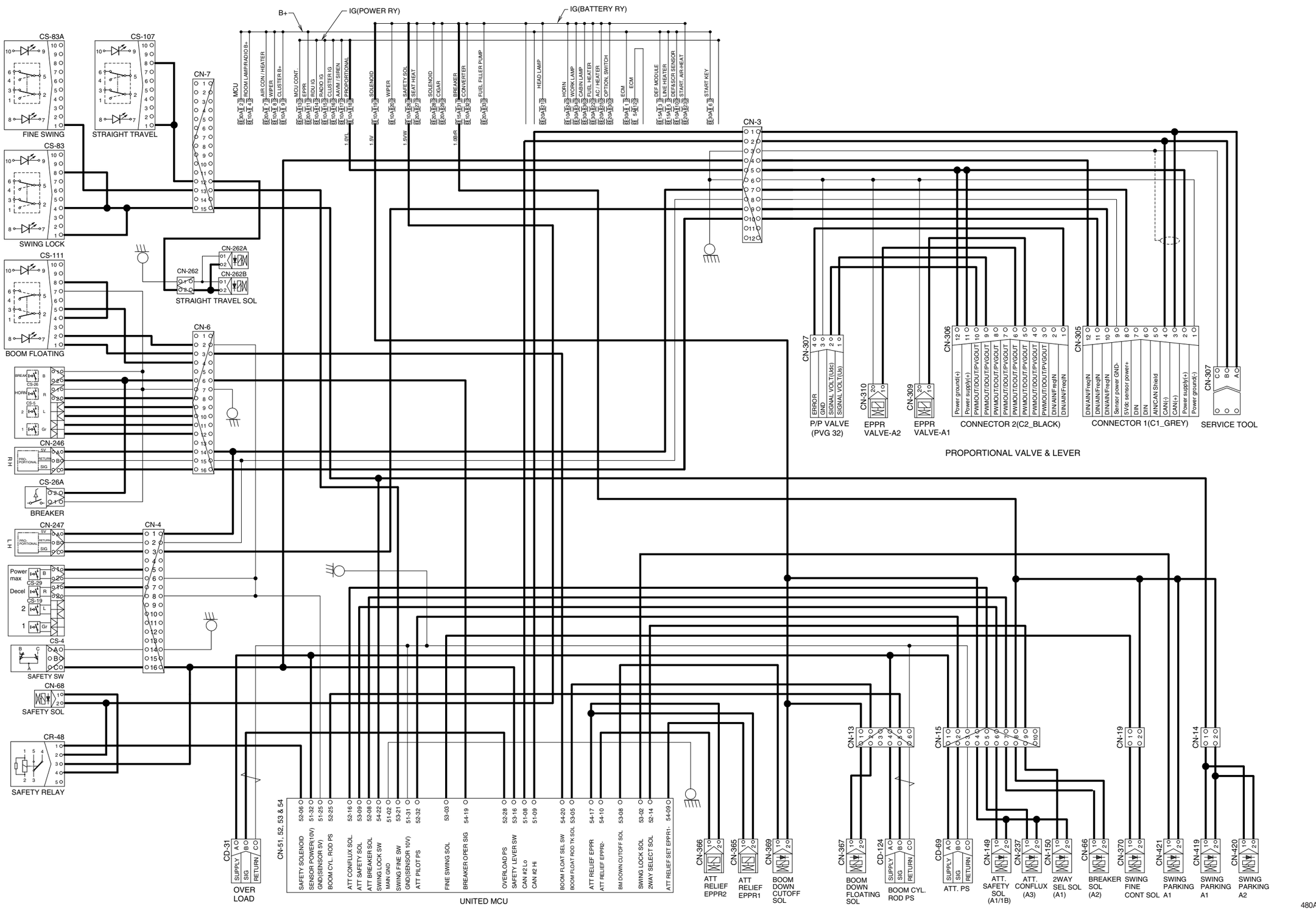
ELECTRIC CIRCUIT FOR HYDRAULIC (1/2)



480A4EL13

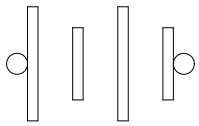
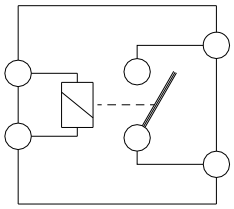
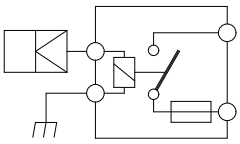
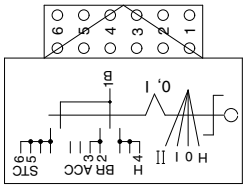
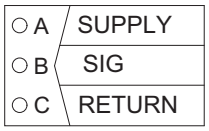
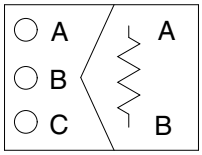
※ The circuit diagram may differ from the equipment, so please check before a repair.

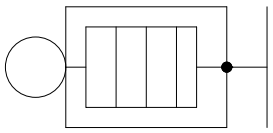
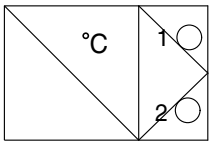
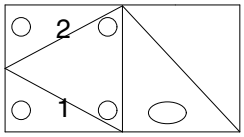
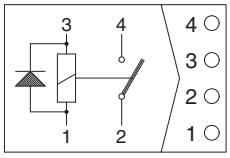
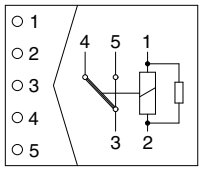
ELECTRIC CIRCUIT FOR HYDRAULIC (2/2)

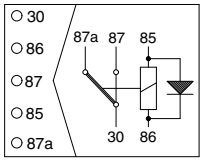
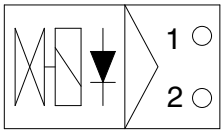
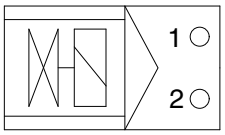
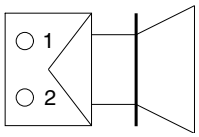
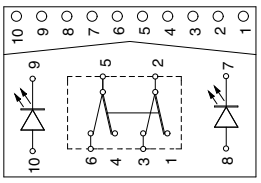
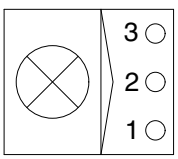


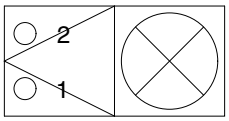
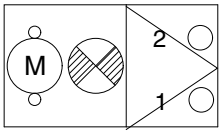
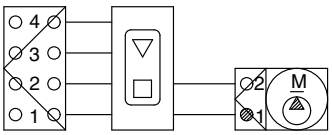
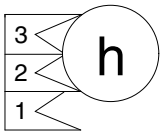
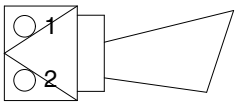
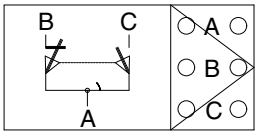
※ The circuit diagram may differ from the equipment, so please check before a repair.

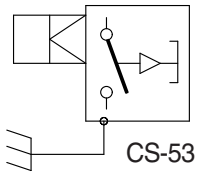
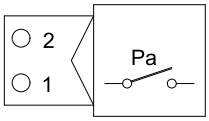
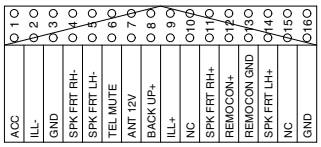
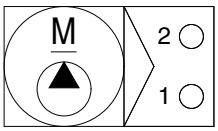
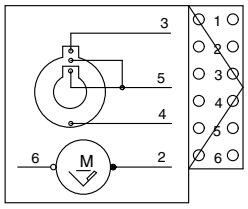
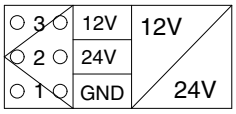
GROUP 3 ELECTRICAL COMPONENT SPECIFICATION

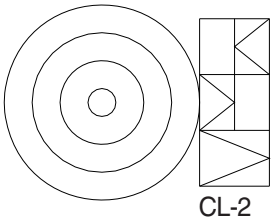
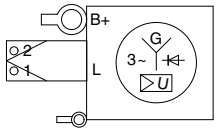
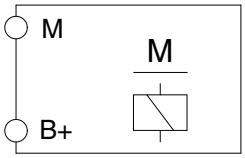
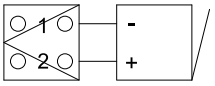
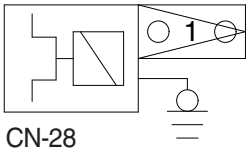
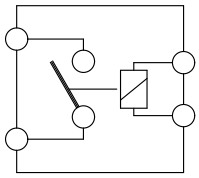
Part name	Symbol	Specifications	Check
Battery		12V × 160Ah (2EA)	※ Check specific gravity 1.280 over : Over charged 1.280 ~ 1.250 : Normal 1.250 below : Recharging
Battery relay	 CR-1	Rated load : 24V 100A (continuity) 1000A (30seconds)	※ Check coil resistance(M4 to M4) Normal : About 50Ω ※ Check contact Normal : ∞Ω
Glow plug relay	 CR-24	24V 200A	※ Check contact Normal : 0.942Ω (for terminal 1-GND)
Start key	 CS-2A	B-BR : 24V 1A B-ACC : 24V 10A B-ST : 24V 40A	※ Check contact OFF : ∞Ω (for each terminal) ON : 0Ω (for terminal 1-3 and 1-2) START : 0Ω (for terminal 1-6)
Pressure sensor	 CD-6 CD-7 CD-16 CD-24 CD-31 CD-32 CD-35 CD-42 CD-43 CD-44 CD-69 CD-70 CD-71 CD-85 CD-86 CD-87 CD-90 CD-124	8~30V	※ Check contact Normal : 0.1Ω
Resistor	 CN-173 CN-174	3W	※ Check resistance A-B : 120Ω

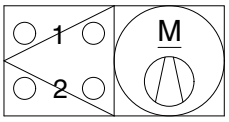
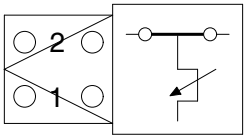
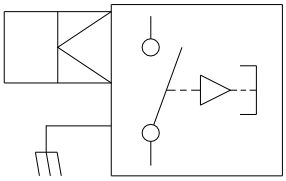
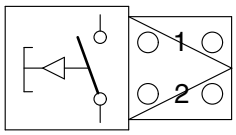
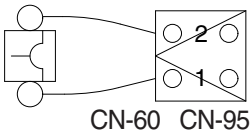
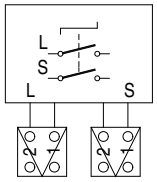
Part name	Symbol	Specifications	Check
Glow plug	 CN-80	24V 200A	※ Check resistance 0.25~0.12Ω
Temperature sensor (hydraulic)	 CD-1	-	※ Check resistance 50˚C : 804Ω 80˚C : 310Ω 100˚C : 180Ω
Fuel sender	 CD-2	-	※ Check resistance Full : 50Ω 6/12 : 350Ω 11/12 : 100Ω 5/12 : 400Ω 10/12 : 150Ω 4/12 : 450Ω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

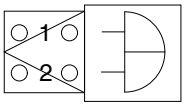
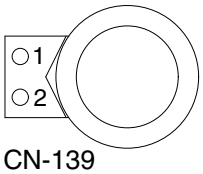
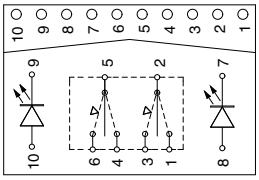
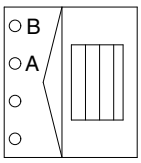
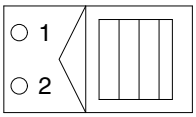
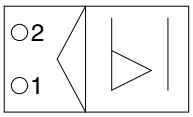
Part name	Symbol	Specifications	Check
Relay	 CR-4 CR-7 CR-9 CR-13 CR-35 CR-46 CR-52	24V 16A	※ Check resistance Normal : About 160 Ω (for terminal 85-86) 0 Ω (for terminal 30-87a) ∞ Ω (for terminal 30-87)
Solenoid valve	 CN-66 CN-68 CN-70 CN-88 CN-90 CN-135 CN-140 CN-149 CN-150 CN-237 CN-262A CN-262B CN-367 CN-369 CN-370 CN-419 CN-420 CN-421 CN-680	24V 1A	※ Check resistance Normal : 15~25 Ω (for terminal 1-2)
EPPR valve	 CN-75 CN-133 CN-154 CN-242 CN-243 CN-309 CN-310 CN-365 CN-366	700mA	※ Check resistance Normal : 15~25 Ω (for terminal 1-2)
Speaker	 CN-23(LH) CN-260 CN-24(RH)	20W	※ Check resistance Normal : A few Ω
Switch (locking type)	 CS-52 CS-67 CS-83 CS-83A CS-99 CS-107 CS-108 CS-111	24V 8A	※ Check contact Normal ON : ∞ Ω (for terminal 2-3, 5-6) 0 Ω (for terminal 2-1, 5-4) OFF : 0 Ω (for terminal 2-3, 5-6) ∞ Ω (for terminal 2-1, 5-4)
Room lamp	 CL-1	24V 10W	※ Check disconnection Normal : 1.0 Ω ON : 0 Ω (For terminal 1-2) ∞ Ω (For terminal 1-3) OFF : ∞ Ω (For terminal 1-2) 0 Ω (For terminal 1-3)

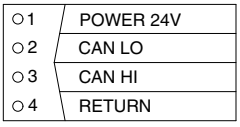
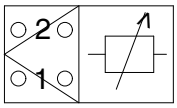
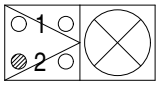
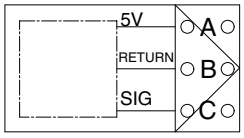
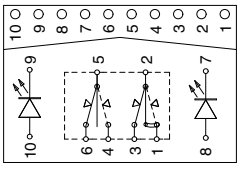
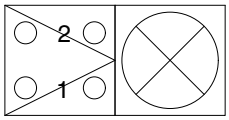
Part name	Symbol	Specifications	Check
Cab lamp	 CL-8 CL-9 CL-10	24V 65W (H3 Type)	※ Check disconnection Normal : 1.2Ω
Beacon lamp	 CL-7	24V 70W (H1 Type)	※ Check disconnection Normal : A few Ω
Fuel filler pump	 CN-61	24V 10A 35 ℓ /min	※ Check resistance Normal : 1.0Ω
Hour meter	 CN-48	16~32V	※ Check 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)

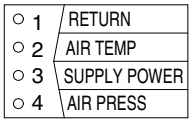
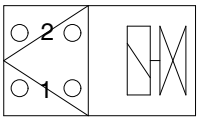
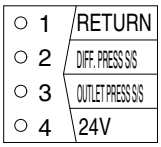
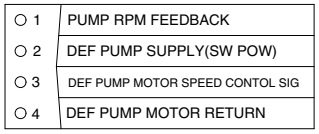
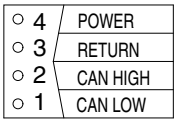
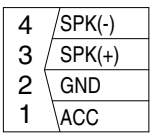
Part name	Symbol	Specifications	Check
Wiper cut switch		24V (N.O TYPE)	※ Check contact Normal : 0Ω(one pin to ground)
Receiver dryer	 CN-29	24V 2.5A (N.O TYPE)	※ Check contact Normal : ∞Ω
Radio & USB player	 CN-27A	24V 2A	※ Check voltage 20~25V (for terminal 1-3, 3-8)
Washer pump	 CN-22 CN-408	24V 3.8A	※ Check contact Normal : 10.7Ω(for terminal 1-2)
Wiper motor	 CN-21	24V 2A	※ Check disconnection Normal : 7Ω(for terminal 2-6)
DC/DC Converter	 CN-138	12V 3A	※ Check voltage 24V (for terminal 1-2) 12V (for terminal 1-3)

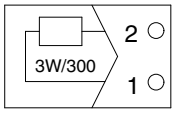
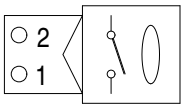
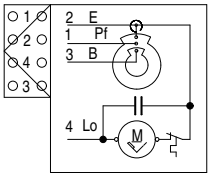
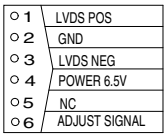
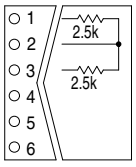
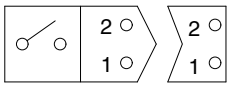
Part name	Symbol	Specifications	Check
Cigar lighter	 CL-2	24V 5A 1.4W	※ Check coil resistance Normal : About 1MΩ ※ Check contact Normal : ∞Ω Operating time : 5~15sec
Alternator	 CN-74	24V 110A	※ Check contact Normal : 0Ω (for terminal B^+-L) Normal : 24~27.5V
Starter	 CN-45	24V 7.5kW	※ Check contact Normal : 0.1Ω
Travel alarm	 CN-81	24V 0.5A	※ Check contact Normal : 5.2Ω
Aircon compressor	 CN-28	24V 79W	※ Check contact Normal : 13.4Ω
Start relay	 CR-23	24V 300A	※ Check contact Normal : 0.94Ω (for terminal 1-2)

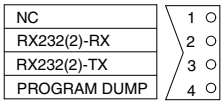
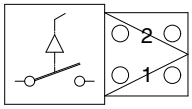
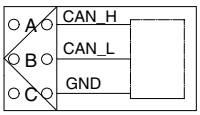
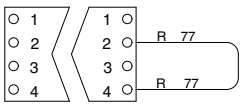
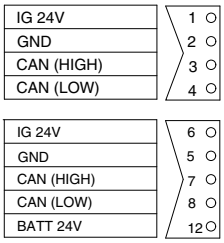
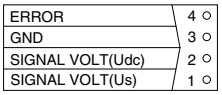
Part name	Symbol	Specifications	Check
Blower motor		24V 9.5A	※ Check resistance Normal : 2.5Ω(for terminal 1-2)
Thermistor (switch)		1˚C OFF 4˚C ON	※ Check resistance Normal : 0Ω(for terminal 1-2), the atmosphere temp : Over 4˚C
Door switch	 CS-1	24V 2W	※ Check resistance Normal : About 5MΩ
Switch (power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

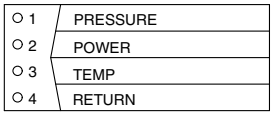
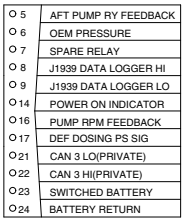
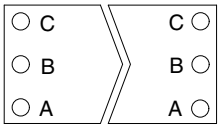
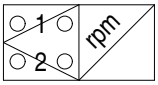
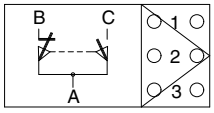
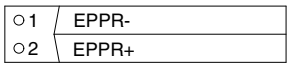
Part name	Symbol	Specifications	Check
Quick clamp buzzer	 CN-113	24V 200mA 107±4dB	
Socket	 CN-139	12V 10A	
Switch	 CS-100	24V 8A	※ Check contact Normal ON : 0Ω(for terminal 2-1, 2-3) OFF : ∞Ω(for terminal 2-1, 2-3)
Fuel heater	 CN-96	-	
DEF/AdBlue® line heater	 CN-381 CN-382 CN-383	-	
WIF sensor	 CD-45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

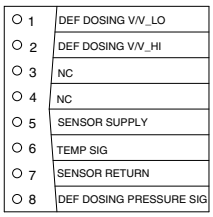
Part name	Symbol	Specifications	Check
DEF/AdBlue® sensor	 AT1E AT2A AT9A	-	
Temperature sensor (A/C)		-	
DEF/AdBlue® fill up warning lamp (LED)	 CL-40	-	
Proportional valve sensor	 CN-246 CN-247	-	
Switch	 CS-79	24V 8A	※ Check disconnection Normal ON 1st step : 0Ω (for terminal 1-2) 2nd step : 0Ω (for terminal 1-2, 4-5) OFF 0Ω (for terminal 2-3, 5-6)
Head lamp Work lamp	 CL-3 CL-4 CL-5 CL-6 CL-24 CL-24A	24V 65W (H3 Type)	※ Check disconnection Normal : 1.2 Ω

Part name	Symbol	Specifications	Check
TBAP sensor	 CD-10	-	
Coolant valve	 CN-384	-	
System in pressure sensor (NOx)	 AT11A	-	
DEF supply module	 AT-5A	-	
Tank level sensor	 CN-380	-	
Siren AMP	 CN-261	-	

Part name	Symbol	Specifications	Check
Resistor	 RS-1	3W	※ Check resistance Normal : 300Ω
Float switch	 CS-61	-	
Low wiper motor	 CN-407	-	
Camera (front, rear, side)	 CN-249 CN-402 CN-403 CN-403A CN-404 CN-405	-	
Resistor	 CN-16B	-	
Seat belt sw	 CS-250	-	

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

Part name	Symbol	Specifications	Check
TBAP	 CN-10A	-	
Engine side cross over connector	 CO24B	-	
Service tool	 CN-307 CN-407	-	
Fan speed	 CD-52	-	
Remove count weight select SW	 CS-90	-	
Hydraulic cooling fan EPPR	 CN-154	-	

Part name	Symbol	Specifications	Check
DEF dosing module	 AT-6A	-	

GROUP 4 CONNECTORS

1. CONNECTOR DESTINATION

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-2	AMP	16	I/conn (Frame harness-Engine harness)	1-368047-1	368050-1
CN-3	AMP	15	I/conn (Frame harness-Engine harness)	2-85262-1	368301-1
CN-3A	TE	12	I/conn (Frame harness-Pro vlv harness)	174661-2	368537-1
CN-4	TE	16	I/conn (Console harness LH-Frame harness)	368047-1	368050-1
CN-5	DEUTSCH	60	I/conn (Side harness RH-Frame harness)	DRB16-60SAE-L018	DRB12-60PAE-L018
CN-6	TE	16	I/conn (Console harness RH-Frame harness)	368047-1	368050-1
CN-7	TE	15	I/conn (Console harness RH-Frame harness)	2-85262-1	368301-1
CN-8	TE	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-13	AMP	6	I/conn (Frame harness-Boom floating)	174262-2	174264-2
CN-14	TE	2	I/conn (Frame harness-Swing parking control)	174352-2	174354-2
CN-15	TE	10	I/conn (Frame harness-Breaker sol)	174655-2	174657-2
CN-16	TE	6	Emergency engine start & speed control	174262-2	174264-2
CN-16B	TE	6	Emergency engine start	174262-2	21NB-10710
CN-17	AMP	8	I/conn (Side harness RH-Wiper harness)	S816-008002	S816-108002
CN-18	TE	2	I/conn (Frame harness-Low washer pump)	174352-2	174354-2
CN-19	DEUTSCH	2	I/conn (Frame harness-Swing fine harness)	DT06-2S-EP06	DT04-2P-E005
CN-20	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-21	AMP	6	Wiper motor	S810-006202	-
CN-22	KET	2	Washer pump	MG640605	-
CN-23	KET	2	Speaker-LH	MG610070	-
CN-24	KET	2	Speaker-RH	MG610070	-
CN-25	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-27A	KUM	16	Radio & USB player	PK145-16017	-
CN-27B	AMP	8	Radio & USB player	-	174984-2
CN-28	KET	2	Aircon compressor	PB625-01027	-
CN-28G	RING TERM	1	Aircon compressor ground	ST710286-2	-
CN-29	KET	2	Receiver dryer	MG640795	-
CN-31	AMP	2	Fuse	174352-2	-
CN-32	AMP	2	Fuse	174352-2	-
CN-36	-	-	Fuse & relay box	21Q7-10910	21WD-00240
CN-45B+	RING-TERM	1	Starter motor B^+	S820-406001	-
CN-45G	RING-TERM	1	Starter motor ground	S820-406001	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-48	KET	1	Hour meter	2-520193-2	-
CN-51	TE	34	United MCU	2-1437285-3	3-6437285-0
CN-52	TE	34	United MCU	4-1437290-1	6473427-1
CN-53	TE	26	United MCU	1473416-1	6473427-1
CN-54	TE	34	United MCU	4-1437290-0	6437288-1
CN-56A	AMP	12	Cluster	-	174663-2
CN-56B	AMP	8	Cluster	-	174984-2
CN-60	YAZAKI	2	Maxival fuse	MG630778-4	21K9-03270
CN-61	DEUTSCH	4	Fuel filler pump	DT06-4S-EP06	-
CN-62	DEUTSCH	2	Auto grease connector	DT06-2S-EP06	DT04-2P-E005
CN-62	DEUTSCH	2	I/conn (Auto grease harness-Frame harness)	DT06-2S	-
CN-62A	DEUTSCH	2	Auto grease	DT06-2S	-
CN-66	DEUTSCH	2	Breaker solenoid	DT06-2S-EP06	-
CN-68	DEUTSCH	2	Safety solenoid (A1)	DT06-2S-EP06	-
CN-70	DEUTSCH	2	Travel high solenoid (A4)	DT06-2S-EP06	-
CN-74	-	2	Alternator	1-967412-2	-
CN-74B+	RING-TERM	1	Alternator "B+" terminal	S820-408001	-
CN-74G	RING-TERM	1	Alternator ground	S820-412001	-
CN-75	AMP	2	Power shift EPPR	85202-1	-
CN-80	RING-TERM	1	Glow plug	S820-406001	-
CN-81	DEUTSCH	2	Travel buzzer solenoid	DT06-2S-EP06	-
CN-88	DEUTSCH	2	Power max solenoid (A2)	DT06-2S-EP06	-
CN-90	DEUTSCH	2	Removable CWT solenoid	DT06-2S-EP06	DT04-2P-E005
CN-93	DELPHI	96	ECM	13964572	-
CN-95	YAZAKI	2	Maxival fuse	MG630778	21K9-03270
CN-96	-	2	Fuel heater	15300027	-
CN-100	KET	1	ECM ground	MG640944-5	-
CN-113	KET	2	Buzzer	MG651205-5	-
CN-125	Econoseal J	4	GPS connector	S816-004002	S816-104002
CN-125A	DEUTSCH	12	RMS	DT06-12S-P021	DT04-12PA-P021
CN-125B	DEUTSCH	8	RMS	DT06-8S	DT04-8P
CN-126	AMP	10	Service tool	174655-2	S816-110002
CN-126A	DEUTSCH	4	RMS Service tool	DT06-4S	DT04-4P
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	Attach safety solenoid (A1)	DT06-2S-EP06	-
CN-150	DEUTSCH	2	2 way select solenoid (B)	DT06-2S-EP06	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-154	DEUTSCH	2	Hydraulic cooling fan	DT06-2S	-
CN-156	DEUTSCH	2	Seat heat	DT06-2S	DT04-2P
CN-157	AMP	1	Antena power	S822-014002	-
CN-173	DEUTSCH	3	Resistor	DT06-3S-EP06	-
CN-174	DEUTSCH	3	Resistor	DT06-3S-EP06	-
CN-200	DEUTSCH	8	Removable CWT main connector	-	DT04-8PD
CN-237	DEUTSCH	2	Attach conflux solenoid (A3)	DT06-2S-EP06	-
CN-242	DEUTSCH	2	P1 regulator EPPR	DT06-2S-EP06	-
CN-243	DEUTSCH	2	P2 regulator EPPR	DT06-2S-EP06	-
CN-245	KET	2	PTC power	MG620558	-
CN-246	DEUTSCH	3	Proportional valve-RH	DT06-3S	DT04-3P
CN-247	DEUTSCH	3	Proportional valve-LH	DT06-3S	DT04-3P
CN-249	DEUTSCH	6	Rear view camera	DT06-6S-EP06	DT04-6P-E005
CN-258	KET	1	Air compressor power	MG640944-5	MG650943-2
CN-260	AMP	2	Siren speak	174352-2	174354-2
CN-261	KET	4	Siren AMP	MG610047	MG620046
CN-262	DEUTSCH	2	I/conn (Frame harness - Straight travel solenoid harness)	DT06-2S-EP06	DT04-2P-E005
CN-262A	DEUTSCH	2	Travel solenoid 1 (A2)	DT06-2S-EP06	-
CN-262B	DEUTSCH	2	Travel solenoid 2 (A1)	DT06-2S-EP06	-
CN-263	DEUTSCH	2	Air compressor relay	DT06-2S-EP06	-
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	DT04-3P-E005
CN-307A	DEUTSCH	4	Proportional valve connector	DT06-4S	DT04-4P-E005
CN-308	AMP	4	Proportional-PVG32	2-967059-1	-
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 relief EPPR valve1	DT06-2S-EP06	DT04-2P-E005
CN-366	DEUTSCH	2	Attach relief EPPR valve2	DT06-2S-EP06	DT04-2P-E005
CN-367	DEUTSCH	2	Boom up floating solenoid	DT06-2S-EP06	-
CN-369	DEUTSCH	2	Boom down floating solenoid	DT06-2S-EP06	-
CN-370	DEUTSCH	2	Swing fine control solenoid	DT06-2S-EP06	-
CN-376	TE	34	Membrane controller	4-1437290-1	-
CN-380	DEUTSCH	4	DEF/AdBlue® 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	TE	2	Coolant valve	-	1-967325-3

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
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-P021
CN-403A	DEUTSCH	6	To removable CWT harness	DT06-6S-EP06	DT04-6P-EP04
CN-403B	DEUTSCH	6	Rear view camera	DT06-6S-EP06	DT04-6P-EP04
CN-404	DEUTSCH	6	LH view camera	DT06-6S-EP06	DT04-6P-EP14
CN-405	DEUTSCH	6	RH view camera	DT06-6S-EP06	DT04-6P-EP14
CN-406	DEUTSCH	3	Service tool	DT06-3S-EP06	DT04-3P-E005
CN-407	DEUTSCH	4	Low wiper motor	DT06-4S-EP06	DT04-4P-E005
CN-419	DEUTSCH	2	Swing parking-A1	DT06-2S-EP06	-
CN-420	DEUTSCH	2	Swing parking-A2	DT06-2S-EP06	-
CN-421	DEUTSCH	2	Swing parking-A3	DT06-2S-EP06	-
CN-427	MOLEX	4	Reader-RMS	039012040	026013096
		12		5557-12R	5559-12P
CN-430	TE	15	I/conn (Frame harness-Aftertreatment harness)	2-85262-1	368301-1
CN-680	DEUTSCH	15	Hydraulic reverse fan solenoid	DT06-2S-EP06	-
AT1E	TYCO	4	DOC/DPF thermistor	4-1418390-1	-
AT2A	TYCO	4	SCR Outlet Nox sensor	1-1418390-1	-
AT-5A	TYCO	4	SCR supply module	2-1418390-1	-
AT-6A	TYCO	8	DEF/AdBlue® dosing module	1-141-8479-1	-
AT9A	TYCO	4	SCR thermistor cont sensor	3-1418390-1	-
AT11A	FRAMATOME	4	System in NOx sensor	F715600	-
CO24B	-	24	Engine side cross over connector	PPI0000656	-
· Relay					
CR-1	RING-TERM	-	Battery relay	ST710289-2	-
CR-2	-	5	Horn relay	-	-
CR-4	-	5	Working lamp relay	-	-
CR-5	-	5	Anti restart relay	-	-
CR-7	-	5	Aircon compressor relay	-	-
CR-9	-	5	Cabin lamp relay	-	-
CR-13	-	5	Head lamp relay	-	-
CR-23	KET	2	Start relay	S814-002001	S814-102001
CR-23S	RING TERM	1	Start relay	ST710286-2	-
CR-24B+	RING TERM	1	Preheat relay B+	S820-406001	-
CR-24G	RING TERM	1	Preheat relay	ST710287-2	-
CR-24P	RING TERM	1	Preheat relay	S820-406001	-
CR-24S	RING TERM	1	Preheat relay	ST730018-3	-
CR-35	-	5	Power relay	-	-
CR-36	-	5	Preheat relay	-	-

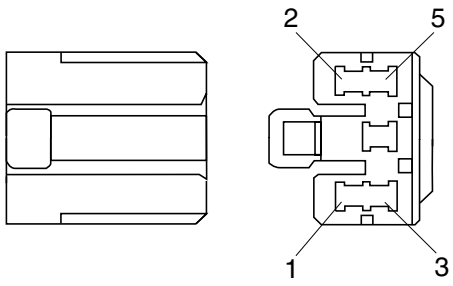
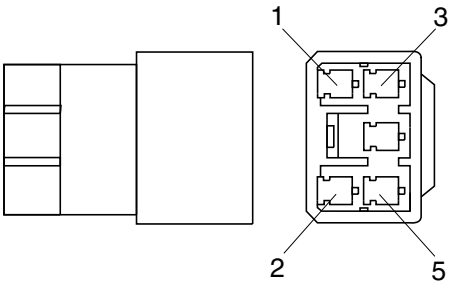
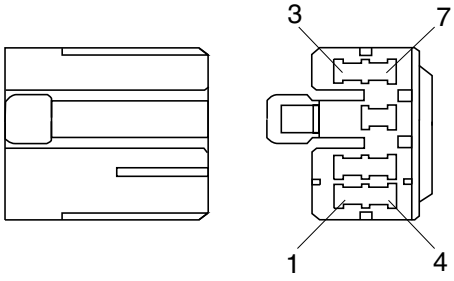
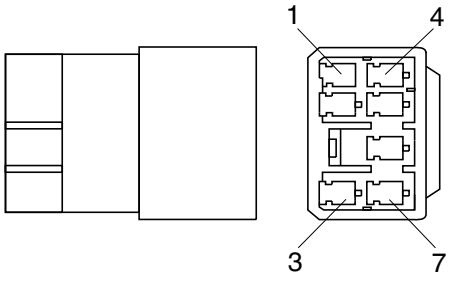
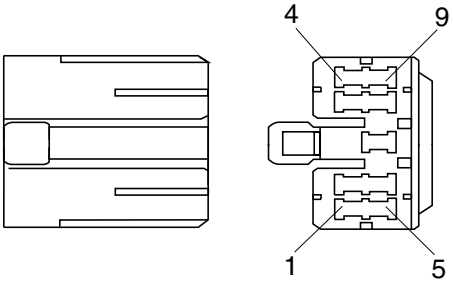
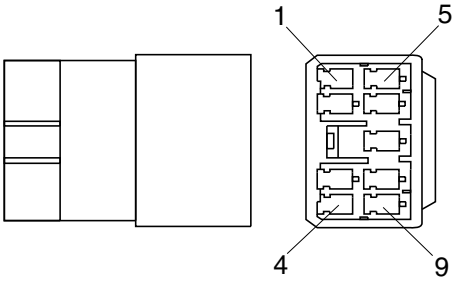
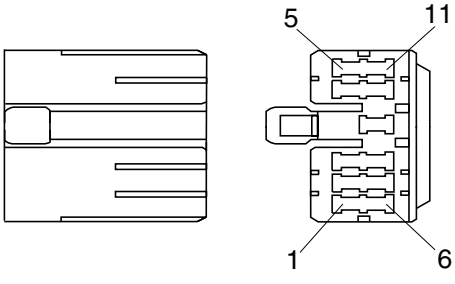
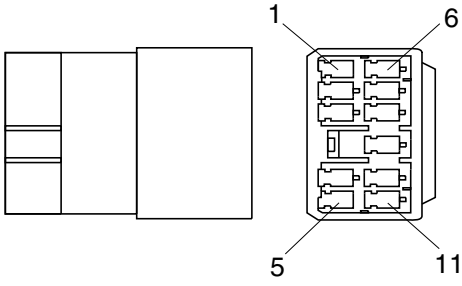
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CR-39	-	5	Starter lock out relay	-	-
CR-46	-	5	Fuel warmer relay	-	-
CR-48	-	5	Safety relay	-	-
CR-50	-	5	DEF&SCR sensor relay	-	-
CR-51	-	5	DEF/AdBlue® module relay	-	-
CR-52	-	5	Line heater relay	-	-
CR-85	-	5	Beacon lamp relay	-	-
· Switch					
CS-1	SHUR	1	Door switch	S822-014002	S822-114002
CS-2A	WP	6	Start switch	S814-006100	-
CS-2B	DEUTSCH	3	Start button	DT06-3S-EP06	DT04-3P-E005
CS-2C	KET	3	Button start	MG651032	-
CS-2D	KET	3	Button start 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	6	Emergency engine stop switch	S816-006002	S816-106002
CS-52	CARLING	10	2 Piece switch	VC2-01	-
CS-53	AMP	1	Wiper cut switch	S822-014002	-
CS-61	TE	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	Swing fine switch	VC2-01	-
CS-74	KET	2	Master switch	MG610557-5	-
CS-74B	DEUTSCH	2	Master switch	DT06-2S-EP06	-
CS-79	CARLING	10	Lower wiper switch	VC2-01	-
CS-83	CARLING	10	Swing lock switch	VC2-01	-
CS-83A	CARLING	10	Fine swing switch	VC2-01	-
CS-90	TE	6	Removable CWT select switch	174262-2	174264-2
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					

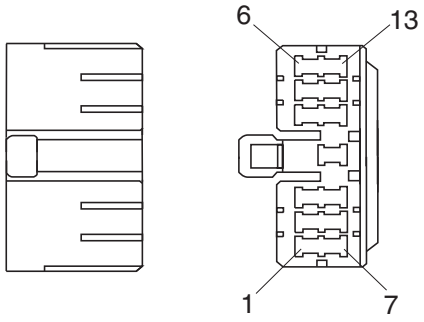
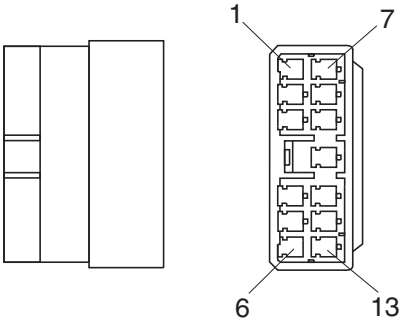
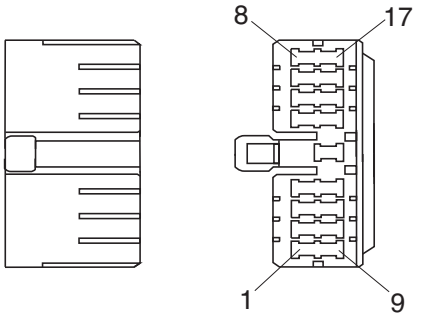
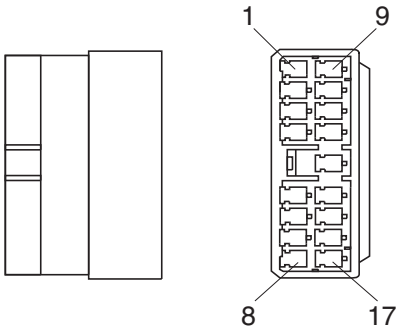
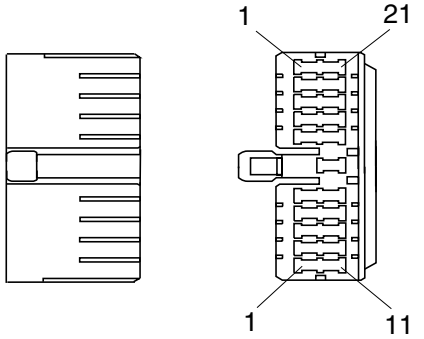
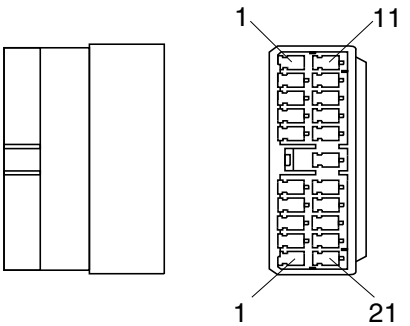
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CL-1	KET	3	Room lamp	MG651032	-
CL-2	AMP	1	Cigar lighter	S822-014002	S822-114002
				S822-014002	-
CL-3	DEUTSCH	2	Head lamp-LH	DT06-2S-EP06	-
CL-4	DEUTSCH	2	Head lamp-RH	DT06-2S-EP06	-
CL-5	DEUTSCH	2	Work lamp-LH	DT06-2S-EP06	DT04-2P
CL-6	DEUTSCH	2	Work lamp-RH	DT06-2S-EP06	DT04-2P
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-24A	DEUTSCH	2	Head lamp-rear	DT06-2S-EP06	DT04-2P-E005
CL-24B	DEUTSCH	2	Head lamp-rear (removable CWT)	DT06-2S-EP06	DT04-2P-E005
CL-36	DEUTSCH	2	Work lamp - LH	DT06-2S-EP06	-
CL-37	DEUTSCH	2	Work lamp - RH	DT06-2S-EP06	-
CL-40	DEUTSCH	2	DEF/AdBlue® lamp	DT06-2S-EP06	-
· Sensor, sendor					
CD-1	AMP	2	Hydraulic oil temp sender	85202-1	-
CD-2	DEUTSCH	2	Fuel sender	DT06-2S-EP06	-
CD-6	DEUTSCH	3	Travel pressure switch	DT06-3S-EP06	-
CD-7	DEUTSCH	3	Working pressure switch	DT06-3S-EP06	-
CD-10	SUMITOMO	4	TBAP sensor	6098-0144	-
CD-16	-	2	Water level sensor	E-5931	-
CD-24	DEUTSCH	3	Swing pressure sensor	DT06-3S-EP06	-
CD-31	DEUTSCH	3	Overload pressure sensor	DT06-3S-EP06	DT04-3P-E005
CD-32	DEUTSCH	3	Boom up pressure sensor	DT06-3S-EP06	-
CD-35	DEUTSCH	3	Bucket in pressure sensor	DT06-3S-EP06	-
CD-42	DEUTSCH	3	Pump pressure 1 (M1)	DT06-3S-EP06	-
CD-43	DEUTSCH	3	Pump pressure 2 (M2)	DT06-3S-EP06	-
CD-44	DEUTSCH	3	Power shift pressure 3 (M3)	DT06-3S-EP06	-
CD-45	DEUTSCH	2	WIF sensor	DT06-2S-EP06	-
CD-52	TE	2	Fan speed sensor	174352-2	-
CD-69	DEUTSCH	3	Attach pressure sensor	DT06-3S-EP06	-
CD-70	DEUTSCH	3	N1 pressure sensor (X1)	DT06-3S-EP06	-
CD-71	DEUTSCH	3	N2 pressure sensor (X2)	DT06-3S-EP06	-
CD-85	DEUTSCH	3	Boom down pressure sensor	DT06-3S-EP06	-
CD-86	DEUTSCH	3	Arm out pressure sensor	DT06-3S-EP06	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CD-87	DEUTSCH	3	Bucket out pressure sensor	DT06-3S-EP06	-
CD-90	DEUTSCH	3	Arm in pressure sensor	DT06-3S-EP06	-
CD-124	DEUTSCH	3	Boom cylinder rod pressure snensor	DT06-3S-EP06	-

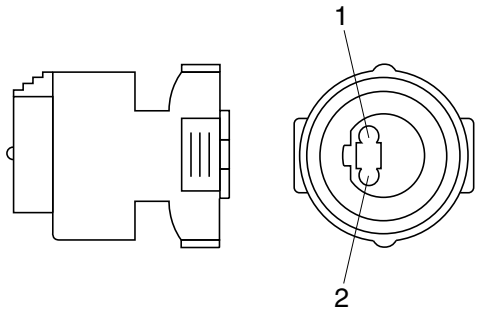
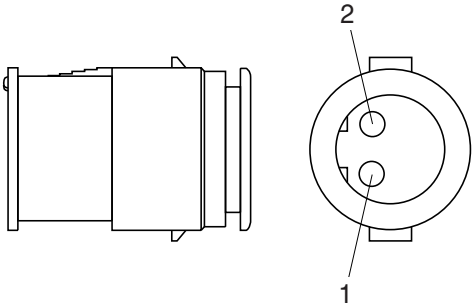
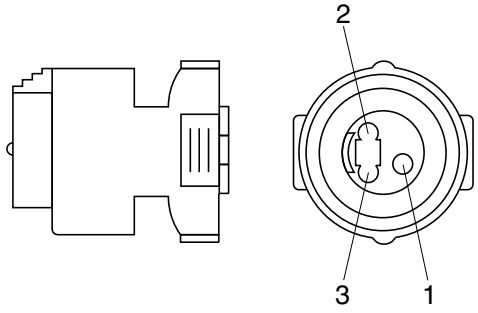
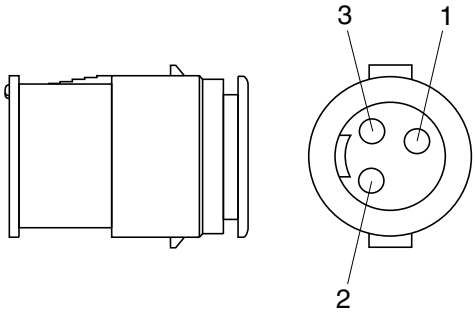
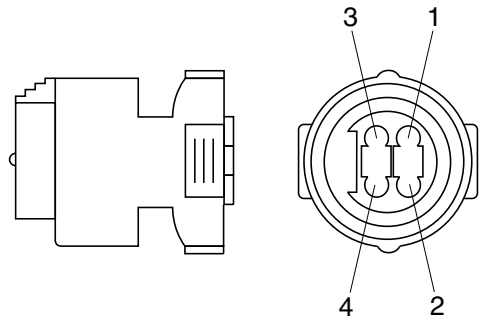
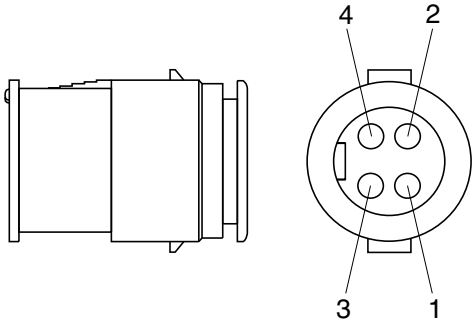
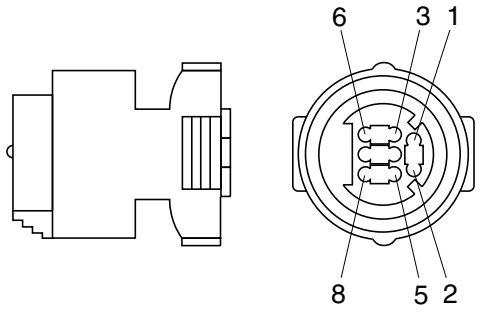
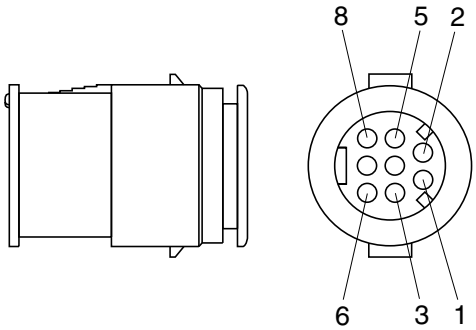
2. CONNECTION TABLE FOR CONNECTORS

1) PA TYPE CONNECTOR

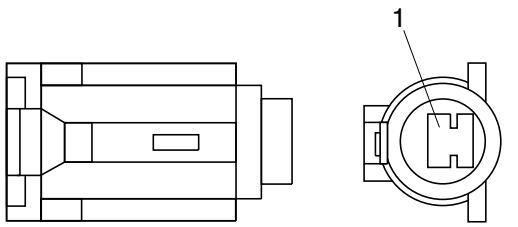
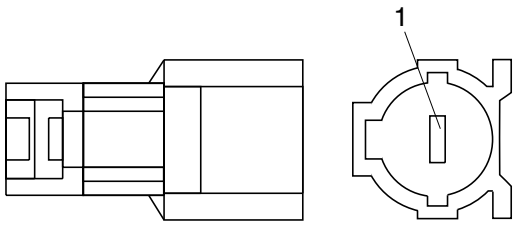
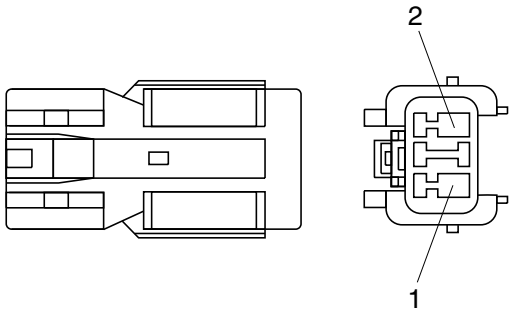
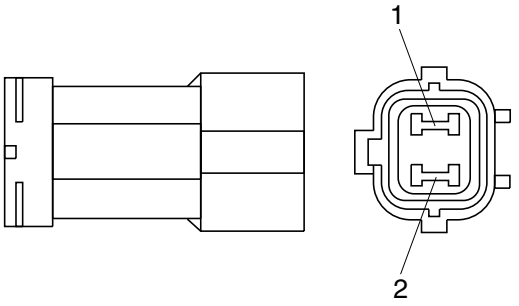
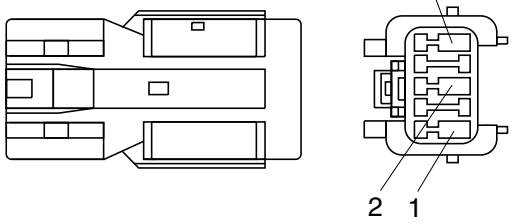
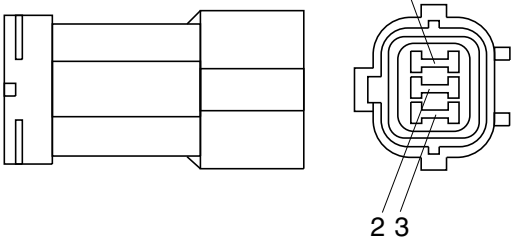
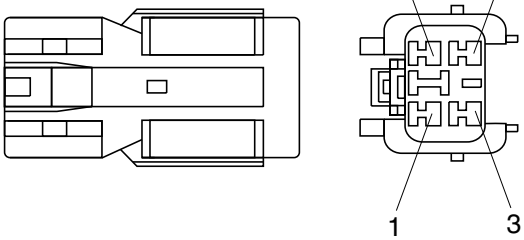
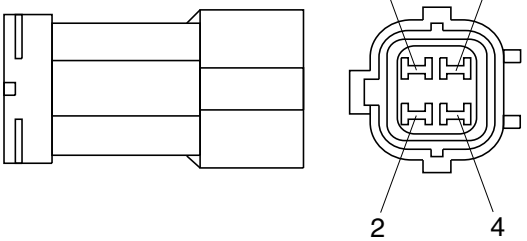
No. of pin	Receptacle connector (female)	Plug connector (male)
5	 S811-005002	 S811-105002
7	 S811-007002	 S811-107002
9	 S811-009002	 3S811-109002
11	 S811-011002	 S811-111002

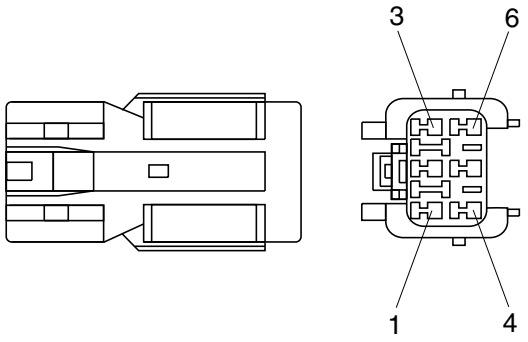
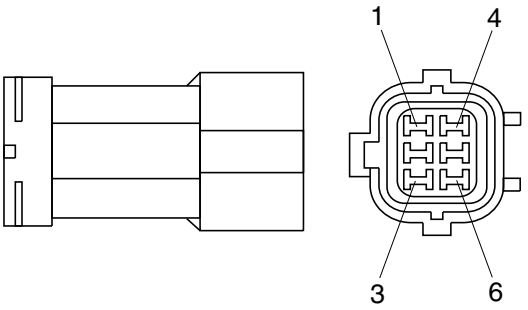
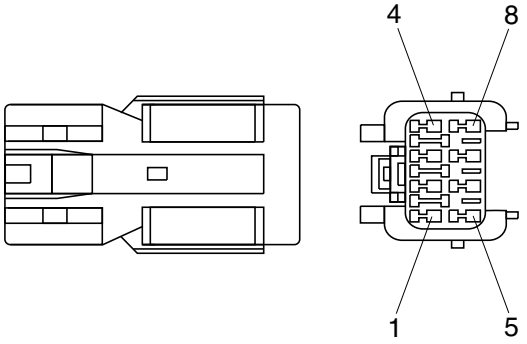
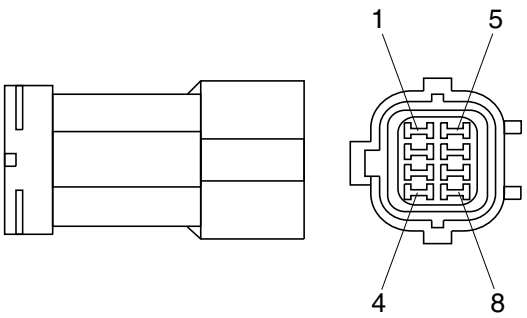
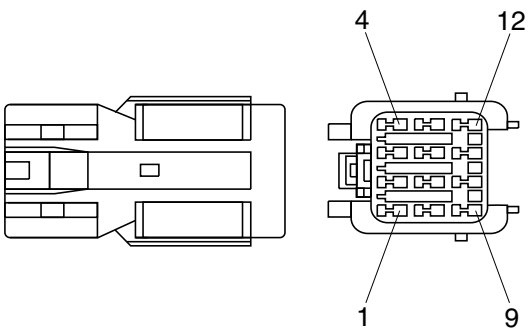
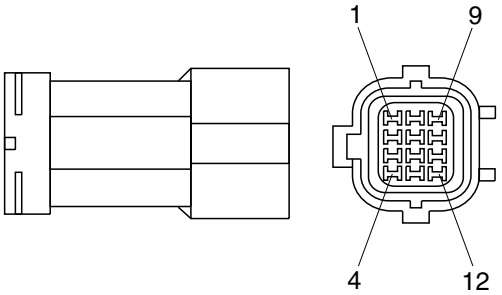
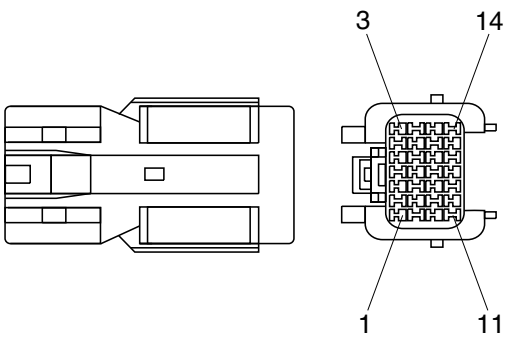
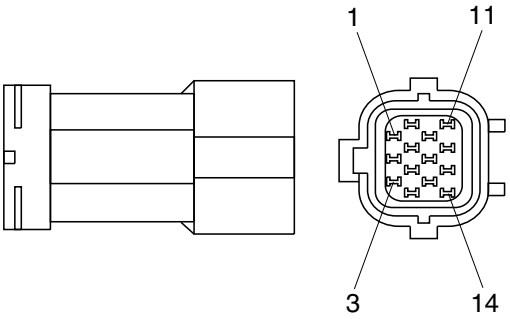
No. of pin	Receptacle connector (female)	Plug connector (male)
13	 S811-013002	 S811-113002
17	 S811-017002	 S811-117002
21	 S811-021002	 S811-121002

2) J TYPE CONNECTOR

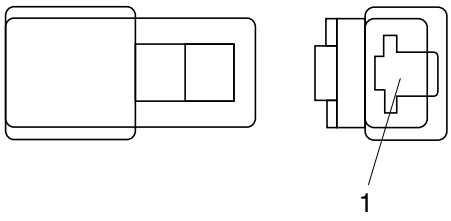
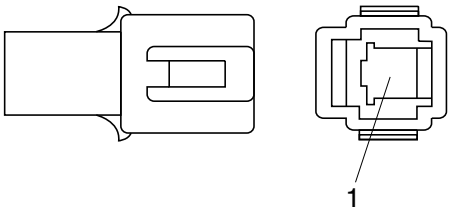
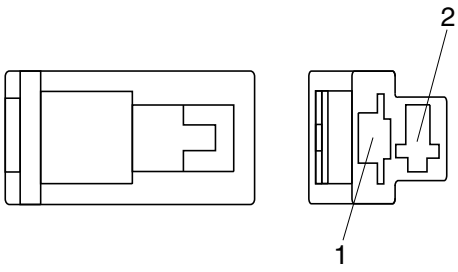
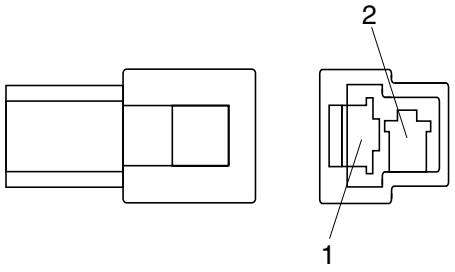
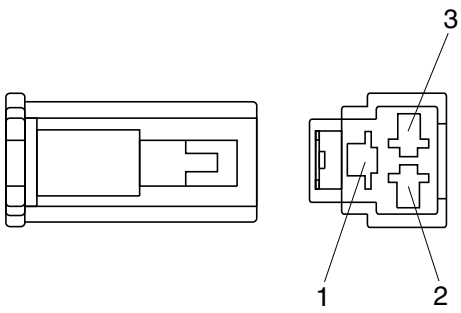
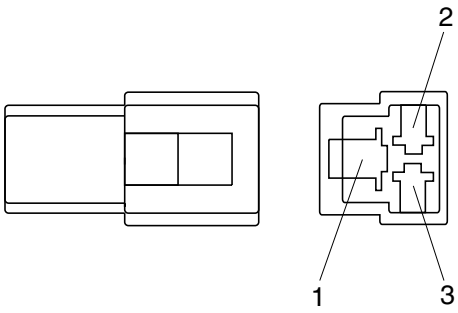
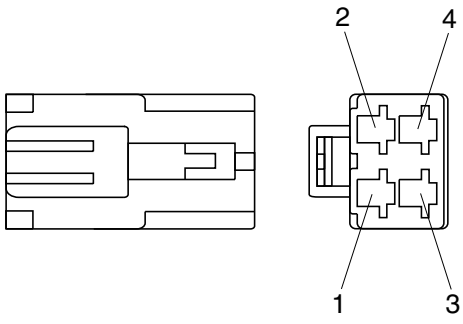
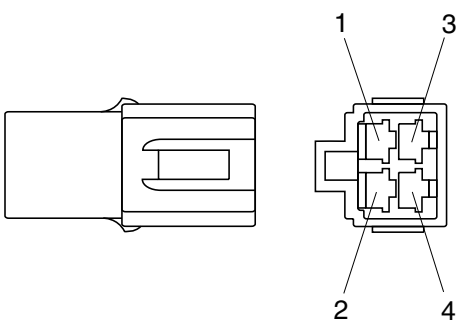
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 S816-002001	 S816-102001
3	 S816-003001	 S816-103001
4	 S816-004001	 S816-104001
8	 S816-008001	 S816-108001

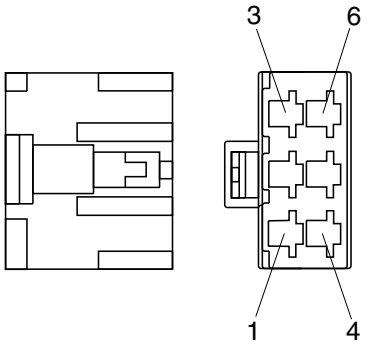
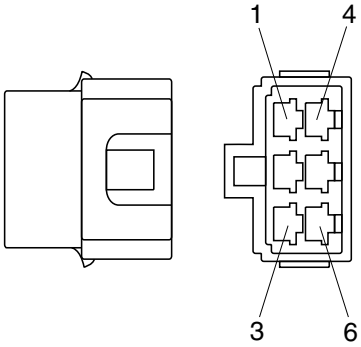
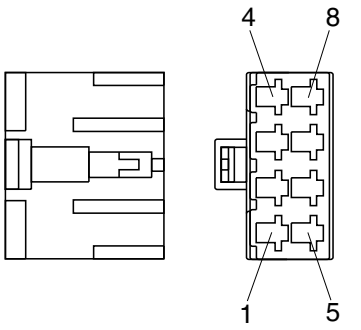
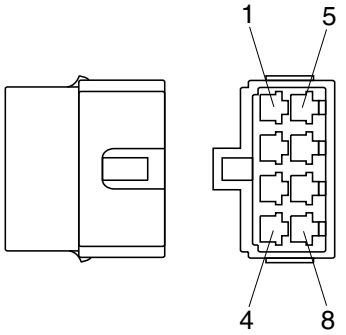
3) SWP TYPE CONNECTOR

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

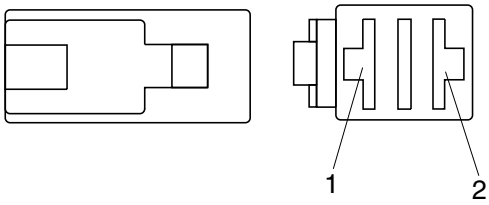
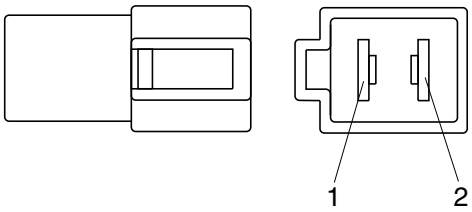
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S814-006000	 S814-106000
8	 S814-008000	 S814-108000
12	 S814-012000	 S814-112000
14	 S814-014000	 S814-114000

4) CN TYPE CONNECTOR

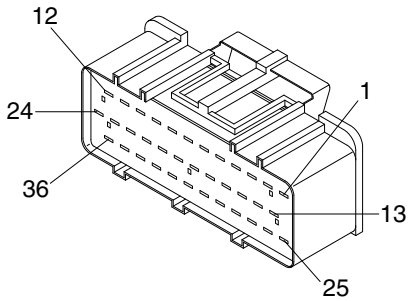
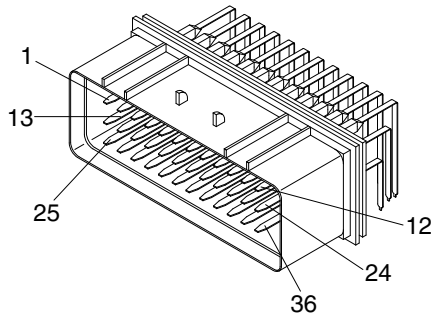
No. of pin	Receptacle connector (female)	Plug connector (male)
1	 S810-001202	 S810-101202
2	 S810-002202	 S810-102202
3	 S810-003202	 S810-103202
4	 S810-004202	 S810-104202

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

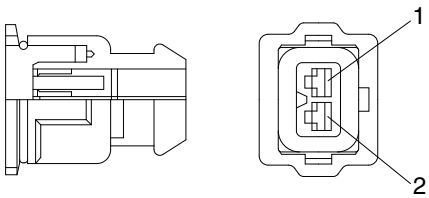
5) 375 FASTEN TYPE CONNECTOR

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

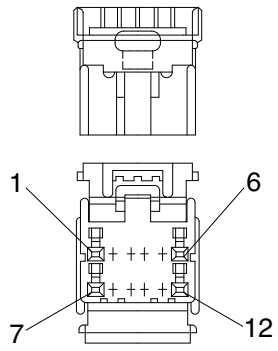
6) AMP ECONOSEAL CONNECTOR

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

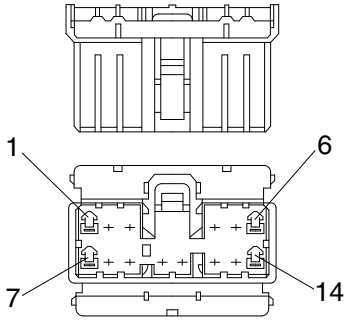
7) AMP TIMER CONNECTOR

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

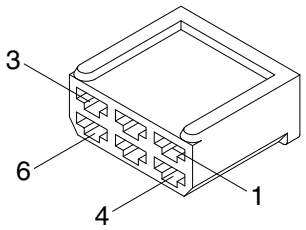
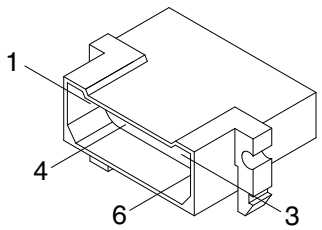
8) AMP 040 MULTILOCK CONNECTOR

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

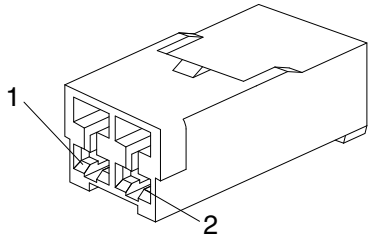
9) AMP 070 MULTILOCK CONNECTOR

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

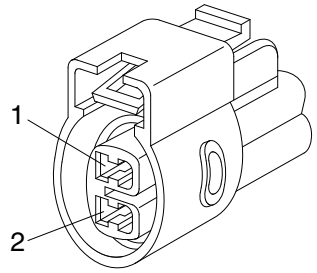
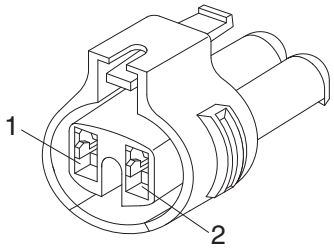
10) AMP FASTIN - FASTON CONNECTOR

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

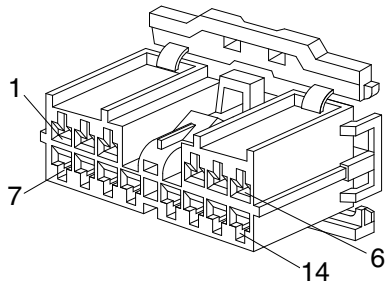
11) KET 090 CONNECTOR

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

12) KET 090 WP CONNECTORS

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

13) KET SDL CONNECTOR

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

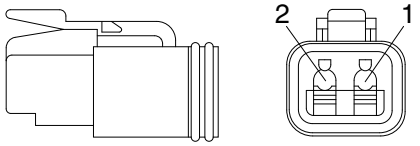
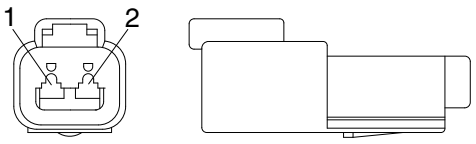
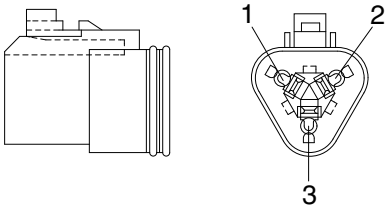
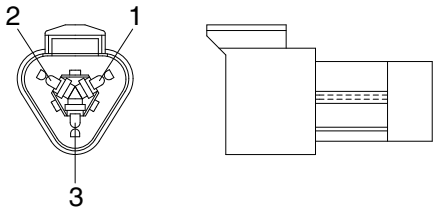
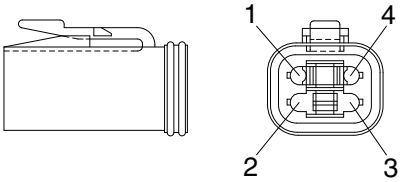
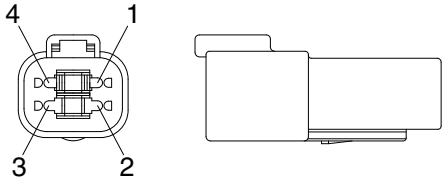
14) DEUTSCH DT CONNECTORS

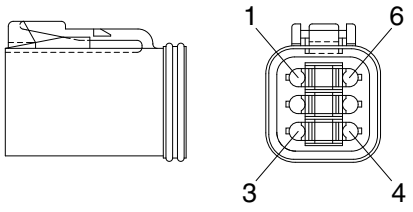
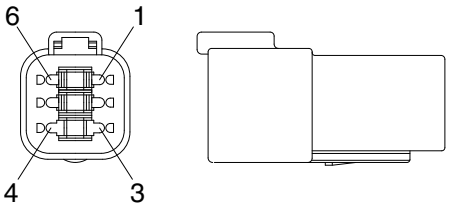
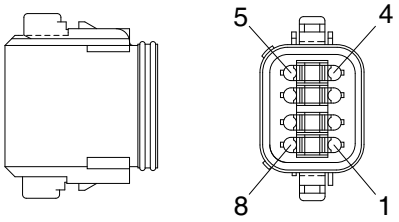
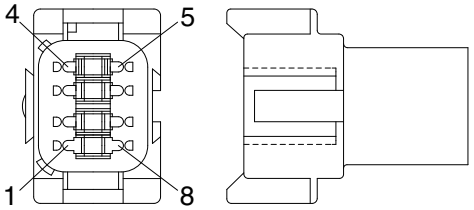
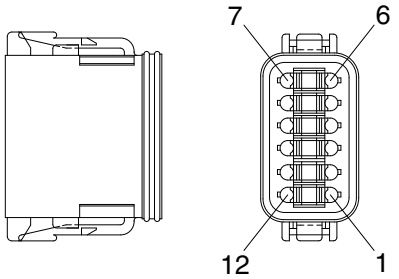
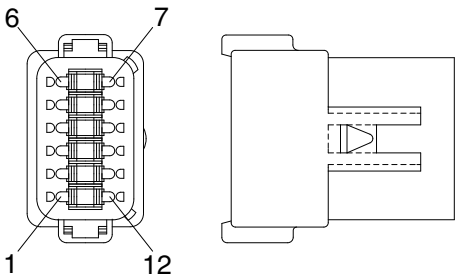
DT 06 - 3S - ★★★★

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

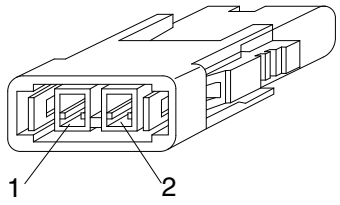
※ Modification

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

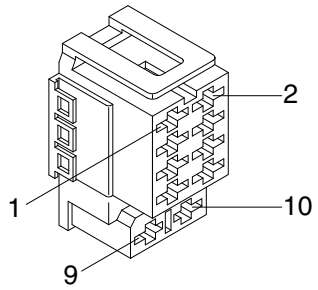
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 DT06-2S	 DT04-2P
3	 DT06-3S	 DT04-3P
4	 DT06-4S	 DT04-4P

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

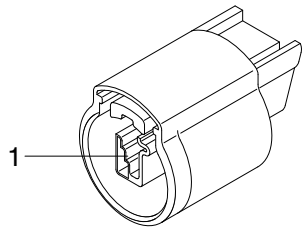
15) MOLEX 2CKTS CONNECTOR

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

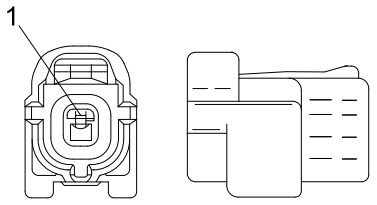
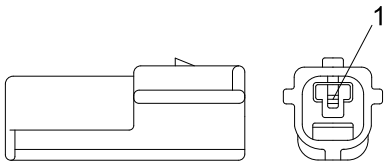
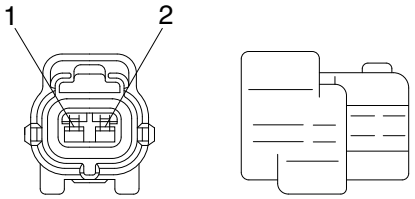
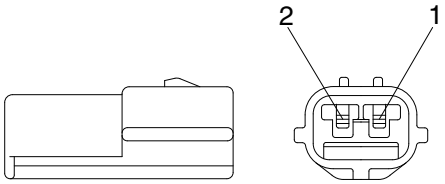
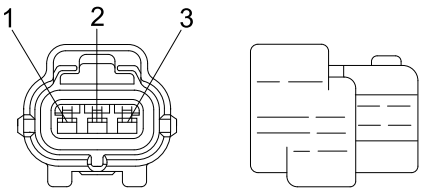
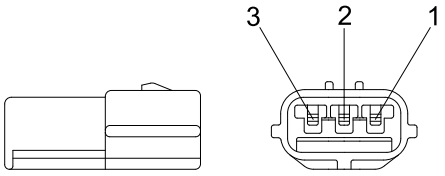
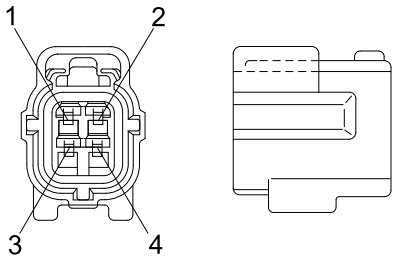
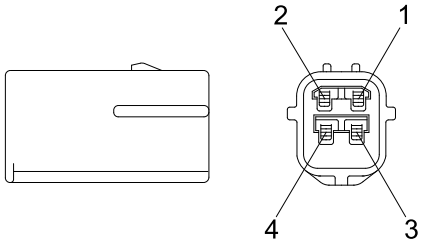
16) ITT SWF CONNECTOR

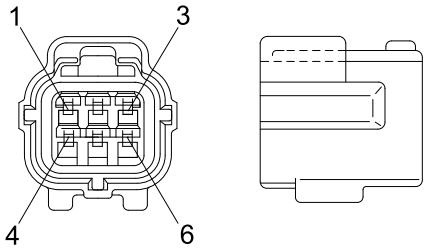
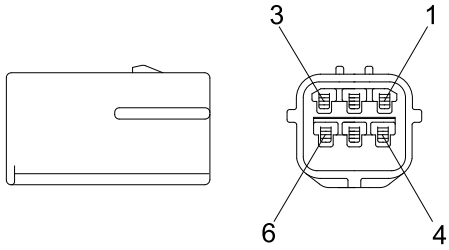
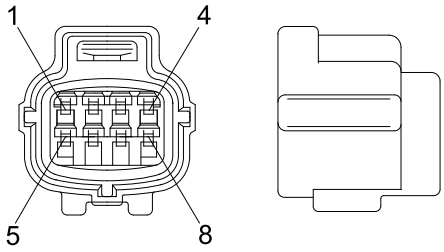
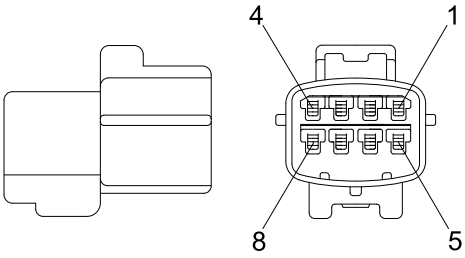
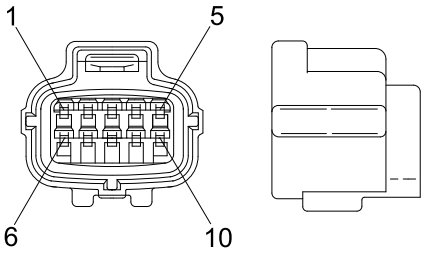
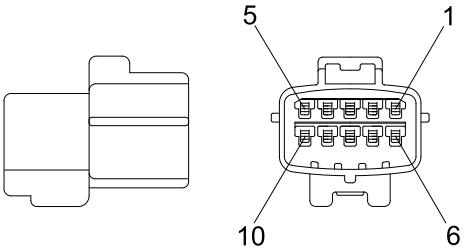
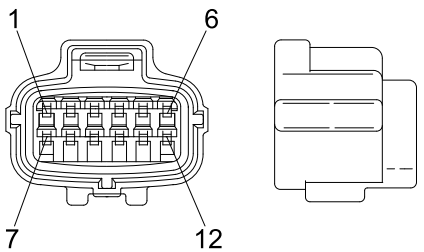
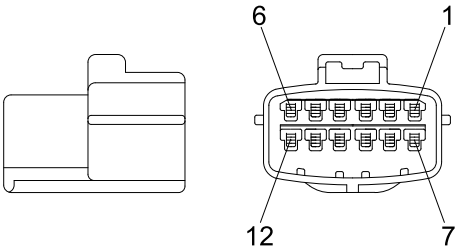
No. of pin	Receptacle connector (female)	Plug connector (male)
10	 SWF593757	

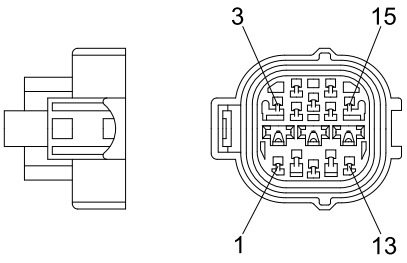
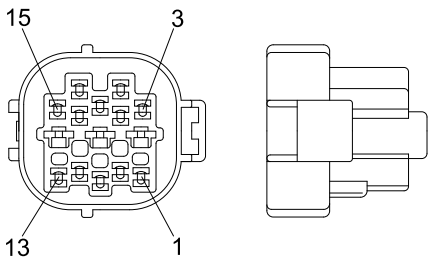
17) MWP NMWP CONNECTOR

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

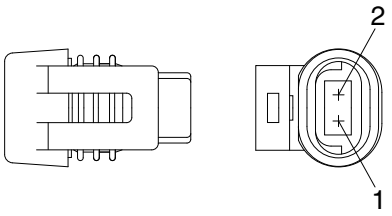
18) ECONOSEAL J TYPE CONNECTORS

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

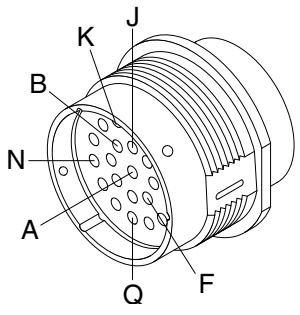
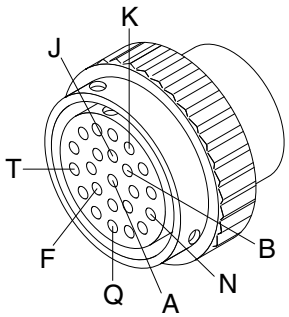
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S816-006002	 S816-106002
8	 S816-008002	 S816-108002
10	 S816-010002	 S816-110002
12	 S816-012002	 S816-112002

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

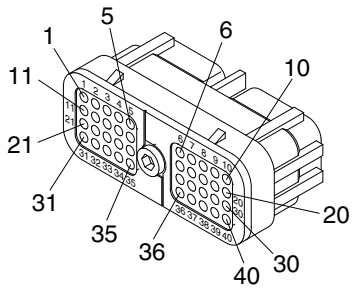
19) METRI-PACK TYPE CONNECTOR

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

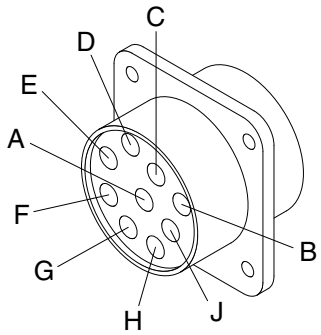
20) DEUTSCH HD30 CONNECTOR

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

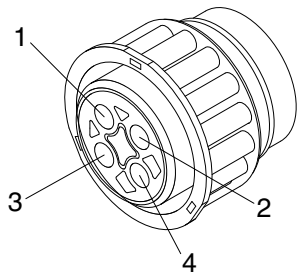
21) DEUTSCH MCU CONNECTOR

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

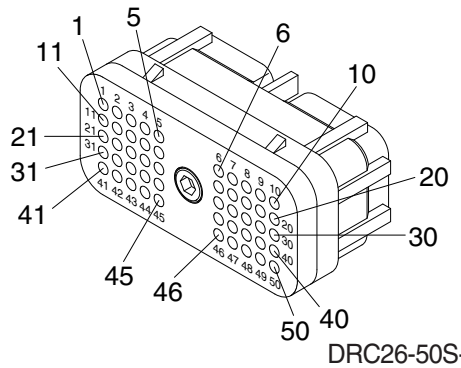
22) DEUTSCH SERVICE TOOL CONNECTOR

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

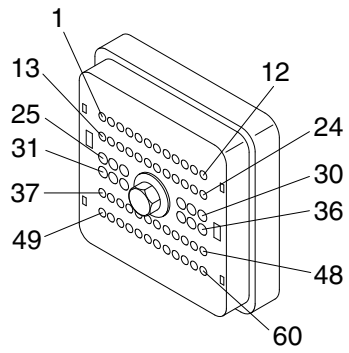
23) AMP FUEL WARMER CONNECTOR

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

24) DEUTSCH ENGINE ECM CONNECTOR

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

25) DEUTSCH INTERMEDIATE CONNECTOR

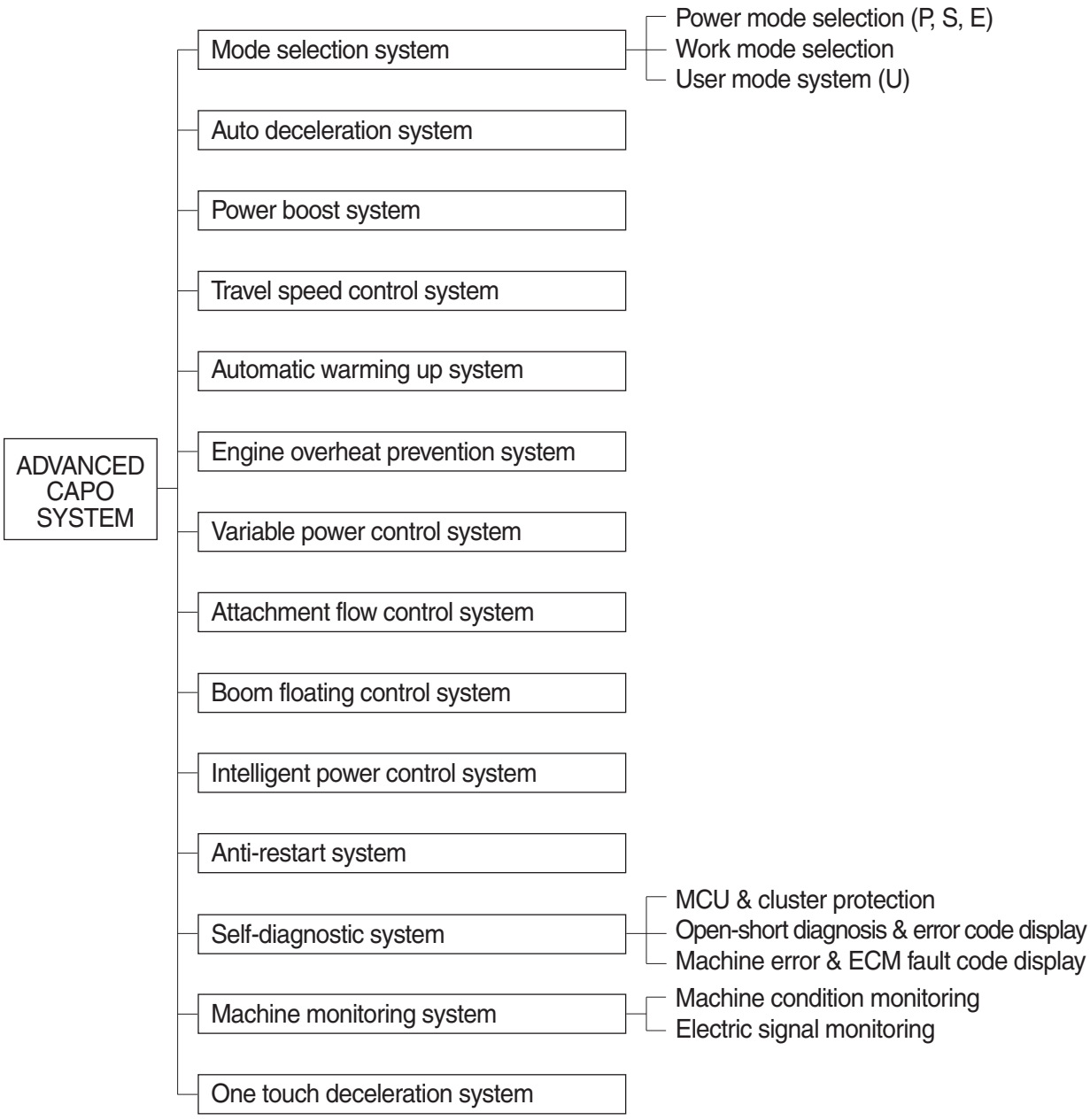
No. of pin	Receptacle connector (Female)	Plug connector (Male)
60	 DRB16-60SAE-L018	

SECTION 5 MECHATRONICS SYSTEM

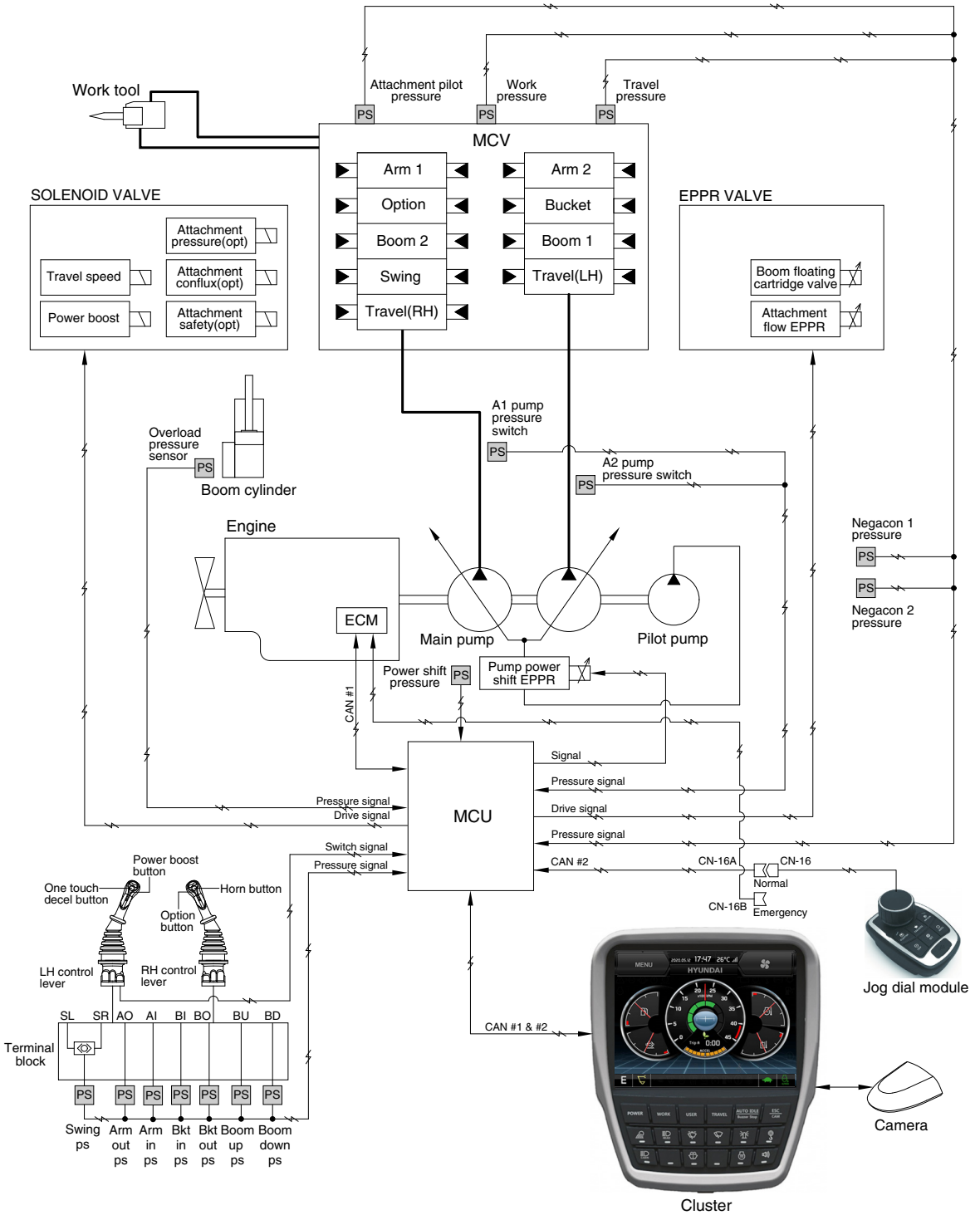
Group 1 Outline 5-1
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GROUP 1 OUTLINE

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



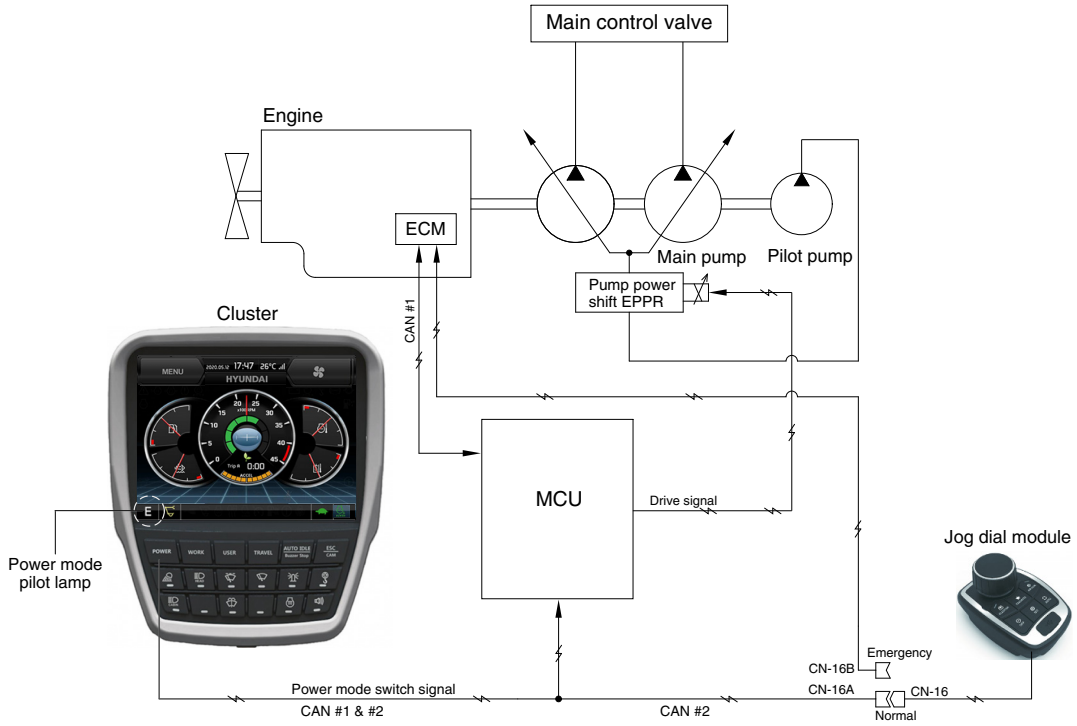
SYSTEM DIAGRAM



480A5MS01

GROUP 2 MODE SELECTION SYSTEM

1. POWER MODE SELECTION SYSTEM



480A5MS02

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

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

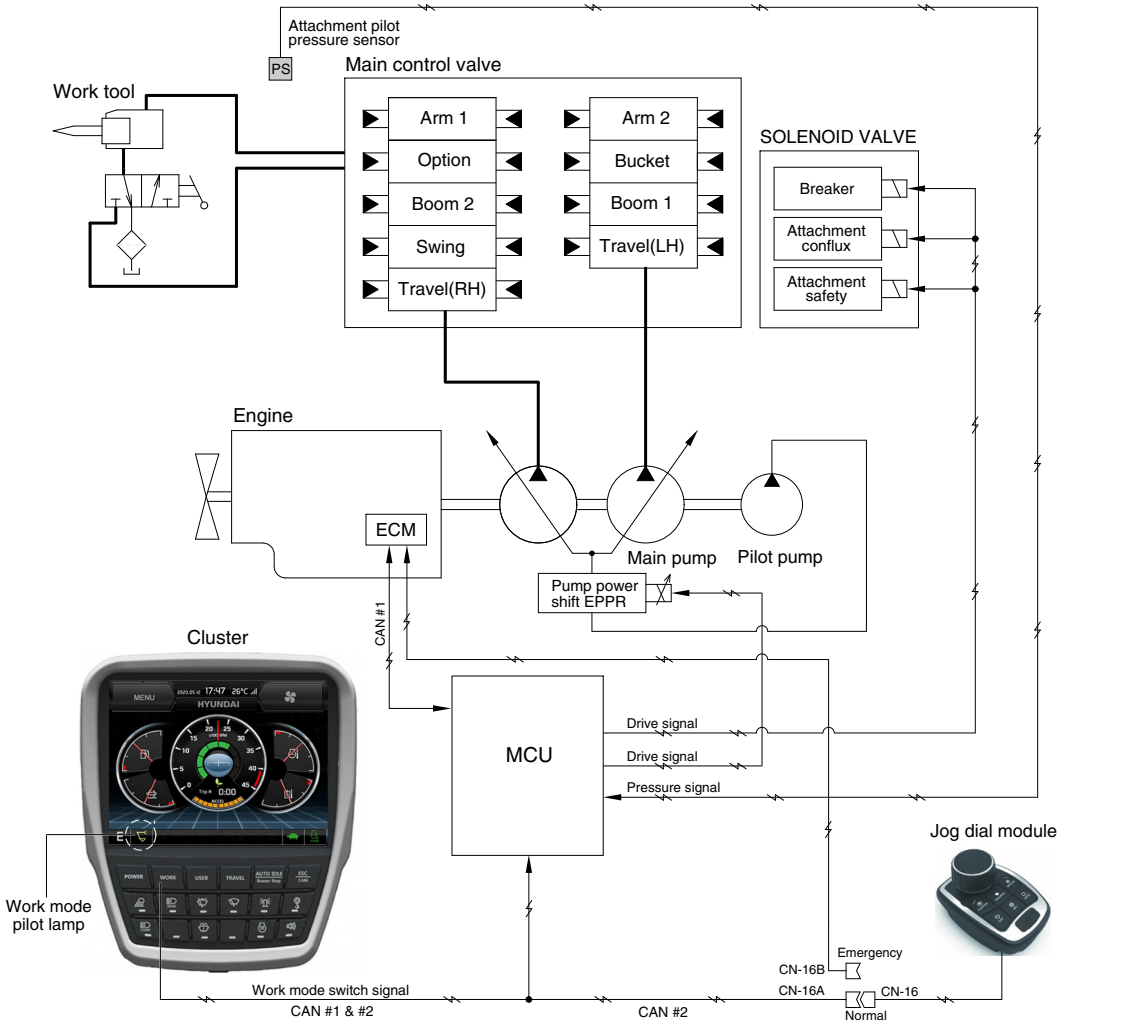
Power mode	Application	Engine rpm				Pump EPPR			
		Standard		Option		Standard		Option	
		Unload	Load	Unload	Load	Current (mA)	Pressure (kgf/cm²)	Current (mA)	Pressure (kgf/cm²)
P	Heavy duty power	1850	1750	1850	1850	393	8.3 (7.8)	323	4.8
S	Standard power	1750	1650	1750	1750	402	8.8 (8.3)	337	5.3
E	Economy operation	1650	1550	1650	1650	411	9.3 (8.8)	346	5.8
AUTO DECEL	Engine deceleration	1000	-	1000	-	700	25	700	25
One touch decel	Engine quick deceleration	800	-	800	-	700	25	700	25
KEY START	Key switch start position	800	-	800	-	700	25	700	25

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

※ ( ) : Load

2. WORK MODE SELECTION SYSTEM

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



1) GENERAL WORK MODE (bucket)

This mode is used to general digging work.

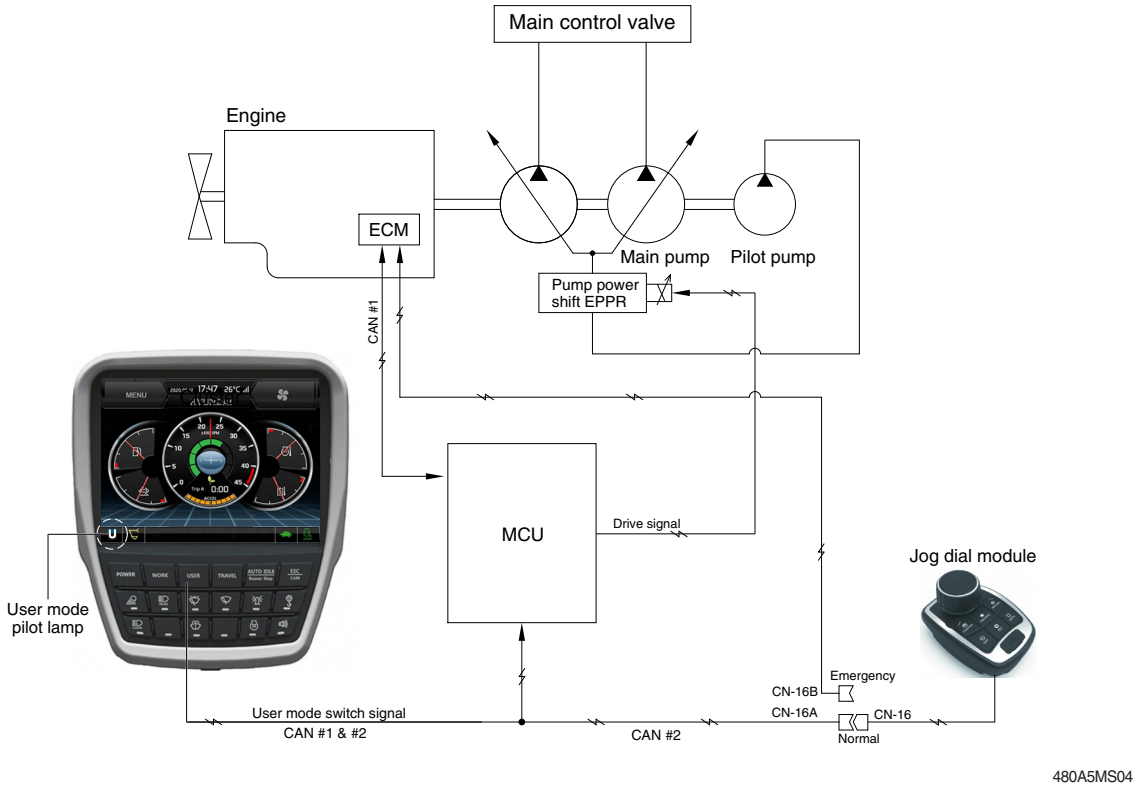
2) ATT WORK MODE (breaker, crusher)

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

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

★ When breaker operating button is pushed.

3. USER MODE SELECTION SYSTEM



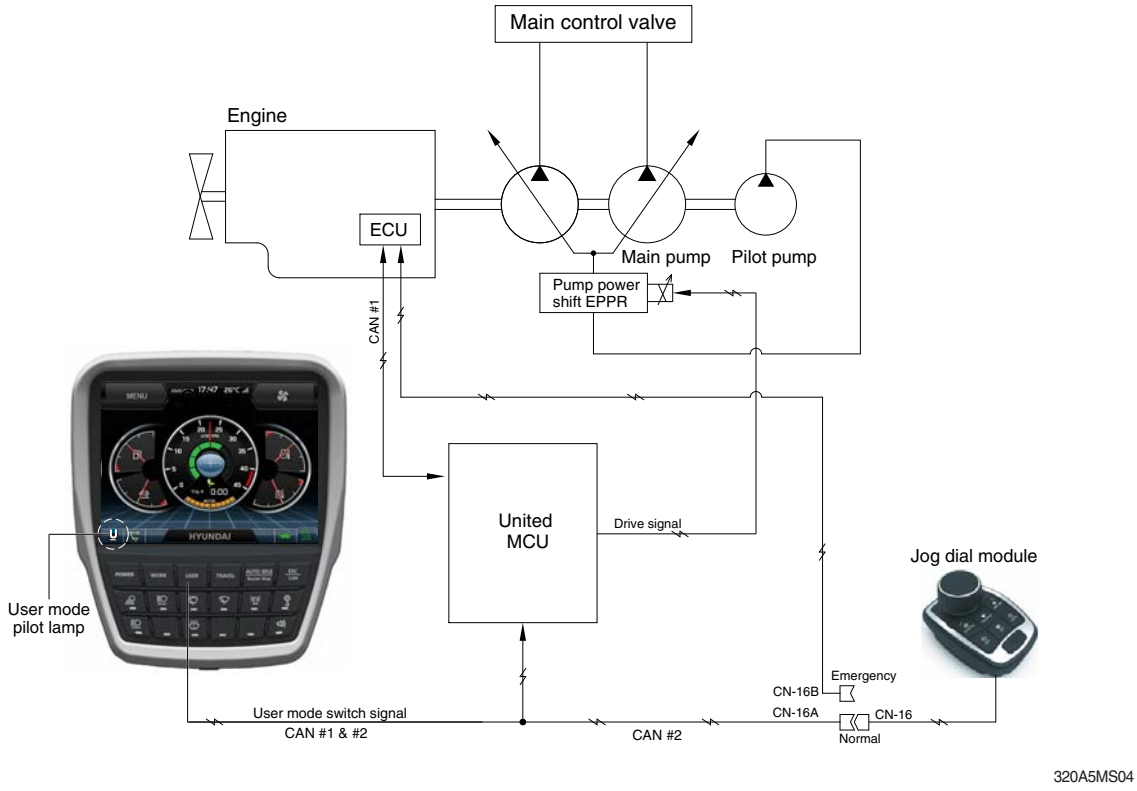
1) High idle rpm, auto idle rpm and EPPR pressure can be adjusted and memorized in the U-mode.

2) LCD segment vs parameter setting

Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1300	750	0
2	1400	800	3
3	1500	850	6
4	1600	900	9
5	1650	950	12
6	1700	1000 (auto decel)	16
7	1750	1050	20
8	1800	1100	26
9	1850	1150	32
10	1900	1200	38

※ Refer to page 5-99.

3. USER MODE SELECTION SYSTEM



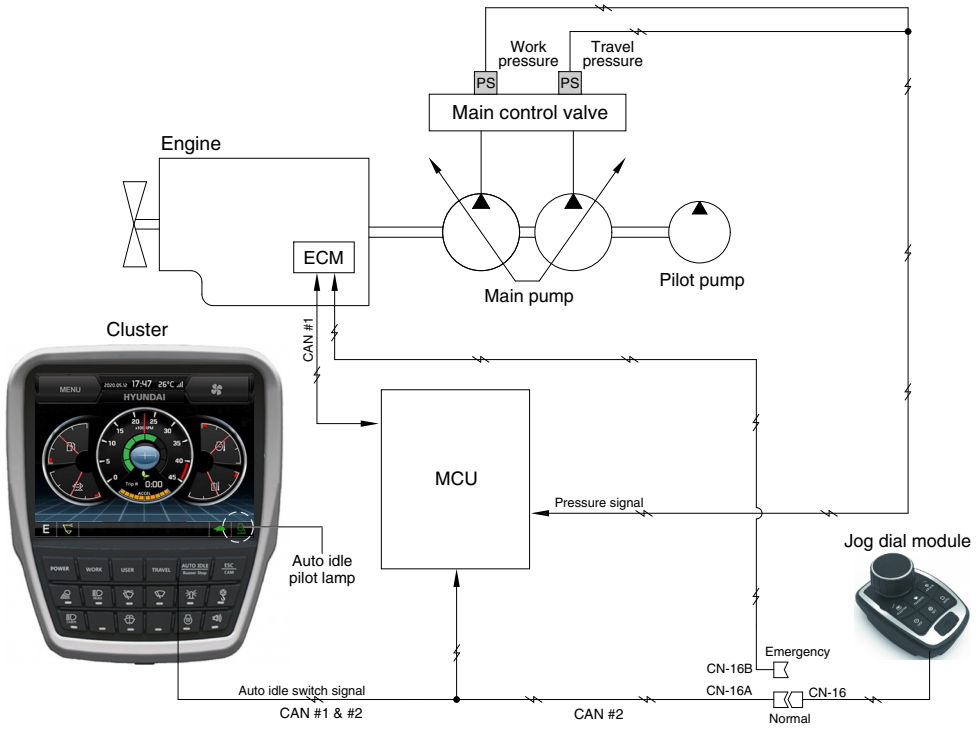
1) High idle rpm, auto idle rpm and EPPR pressure can be adjusted and memorized in the U-mode.

2) LCD segment vs parameter setting

Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1300	650	0
2	1400	800	3
3	1450	850	6
4	1500	900	9
5	1550	950	12
6	1600	1000 (auto decel)	16
7	1650	1050	20
8	1700	1100	26
9	1750	1150	32
10	1800	1200	38

※ Refer to page 5-89.

GROUP 3 AUTOMATIC DECELERATION SYSTEM

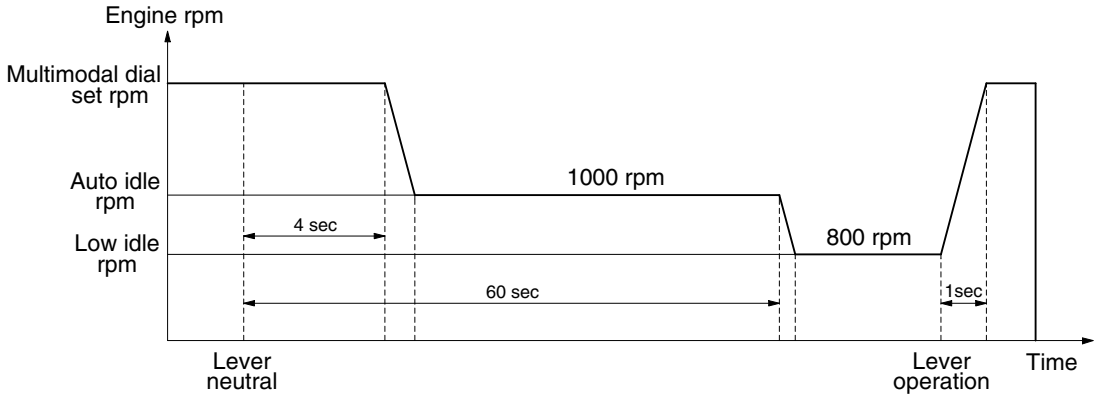


480A5MS05

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 1000 rpm. If the control levers are at neutral for 1 minute, MCU reduces the engine speed to 800 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.



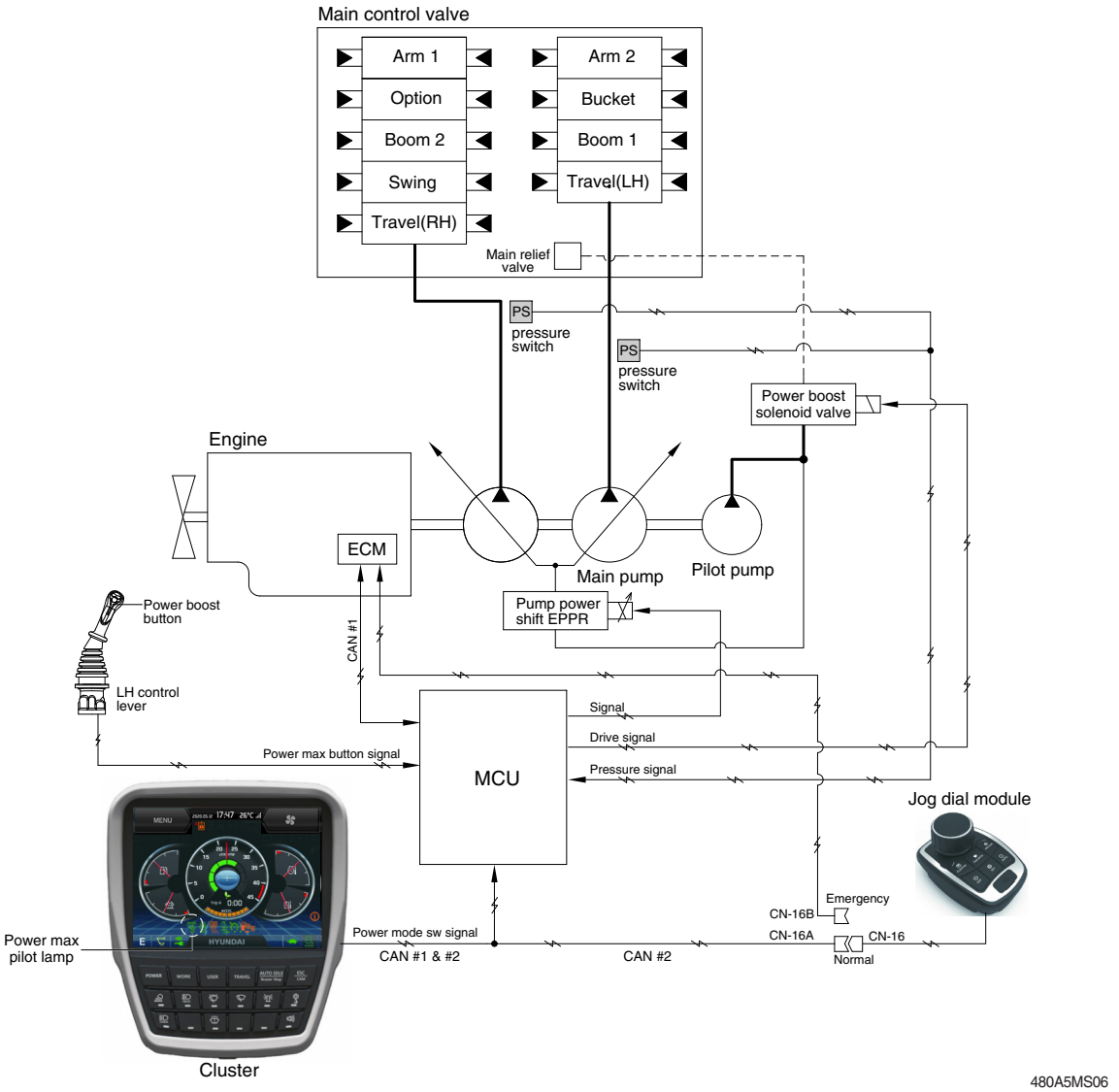
480A5MS35

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



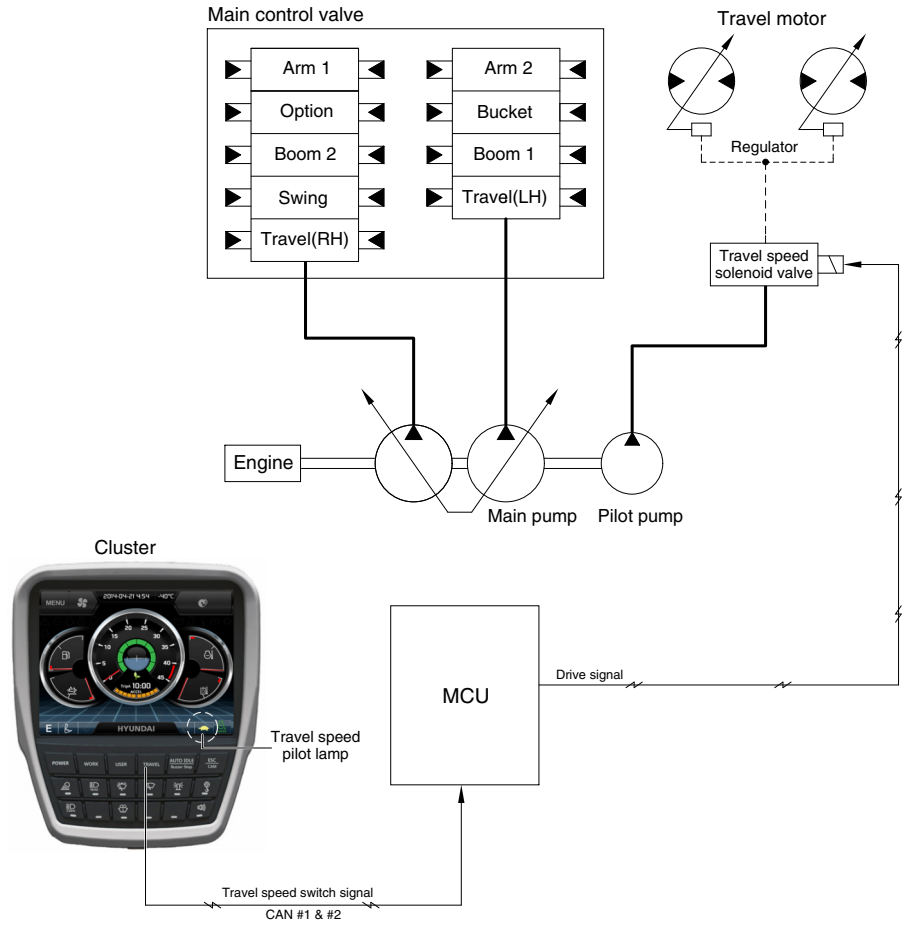
· When the power boost switch on the left control lever knob is pushed ON, the power mode is set P mode and maximum digging power is increased by 10 %.

· 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



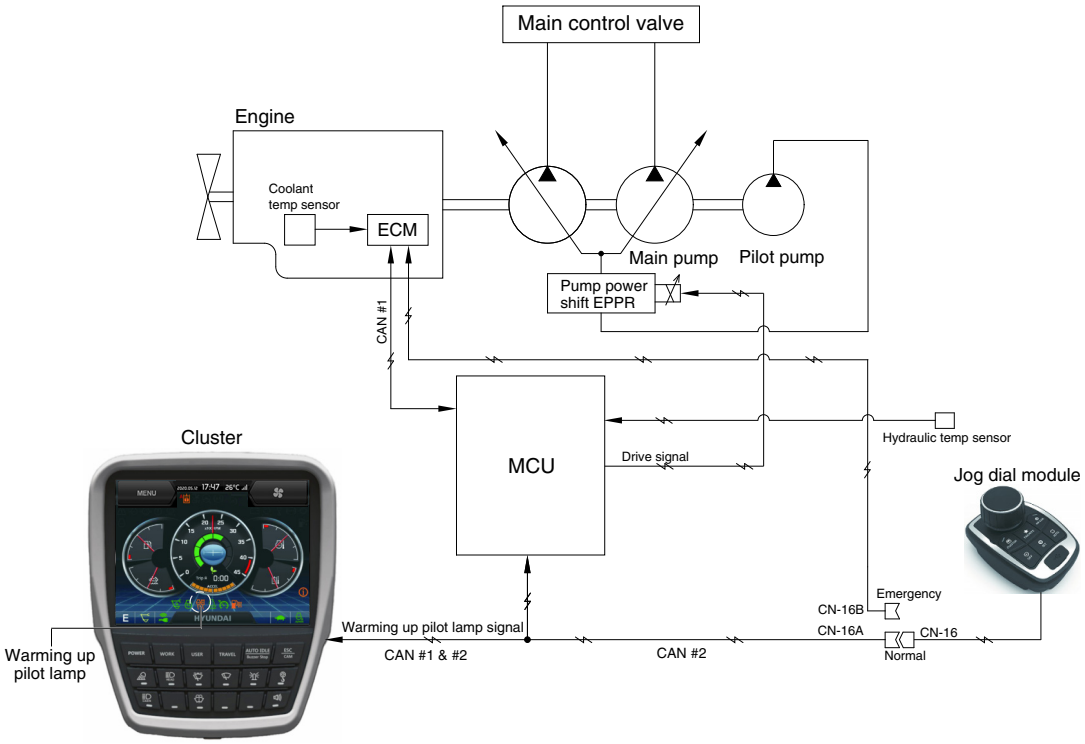
480A5MS07

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

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

※ Default : Turtle (Low)

GROUP 6 AUTOMATIC WARMING UP SYSTEM



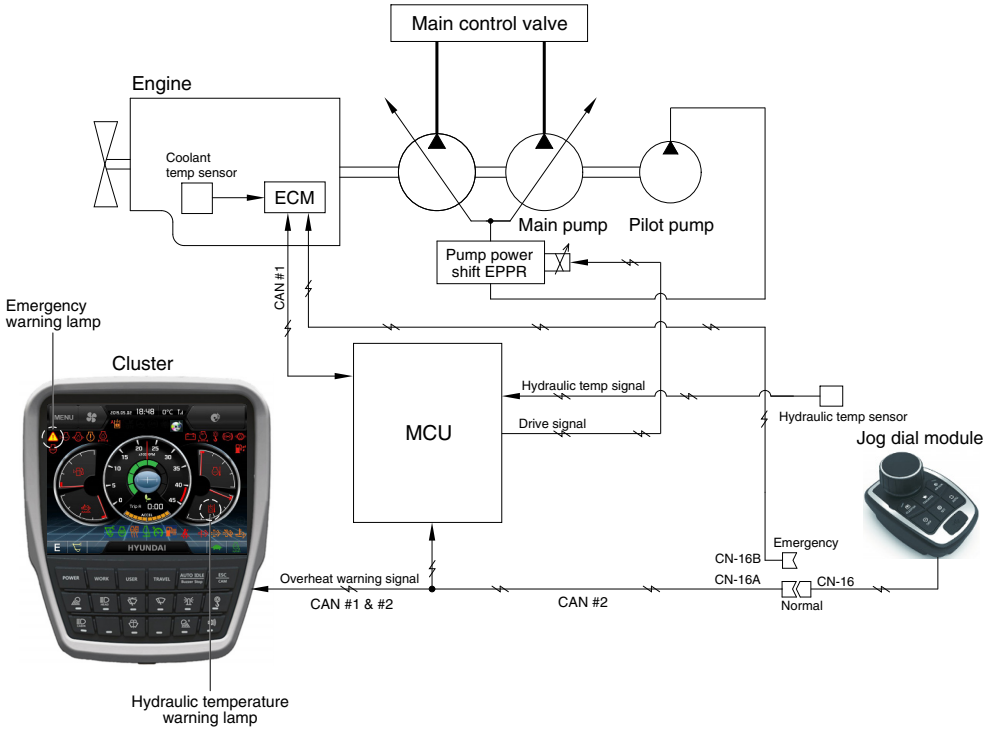
1. The MCU receives the engine coolant temperature from the ECM, and if the coolant temperature is below 30˚C, it increases the engine speed from key start rpm to 1200 rpm. At this time the mode does not change. If the coolant temperature sensor has fault, the hydraulic oil temperature signal is substituted.

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

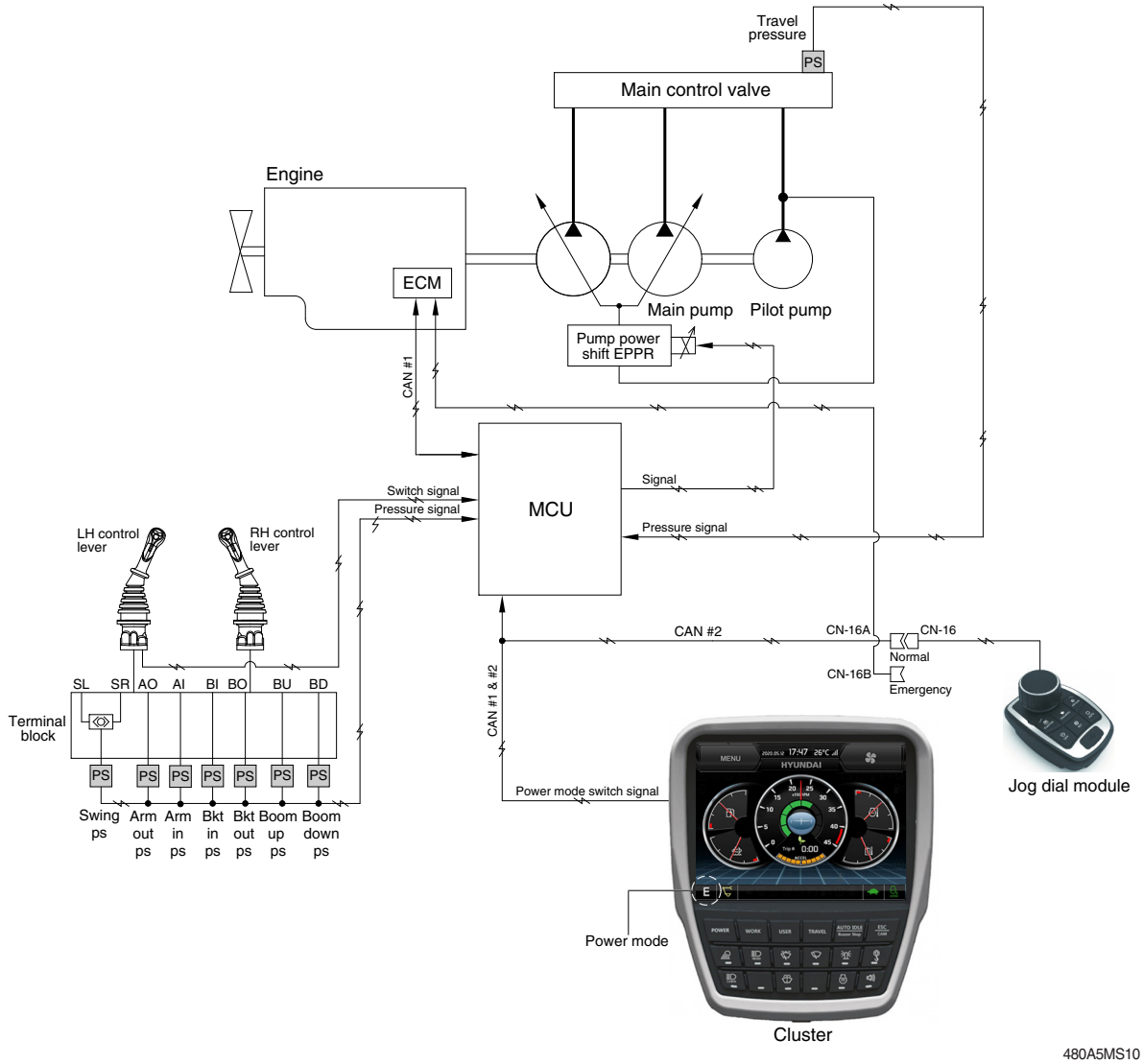


1. If the engine coolant temperature is overheated over 103˚C or the hydraulic oil temperature is overheated over 100˚C, the warning lamp is ON and the pump input torque or the engine speed is reduced as below logic table.

2. LOGIC TABLE

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

GROUP 8 VARIABLE POWER CONTROL SYSTEM

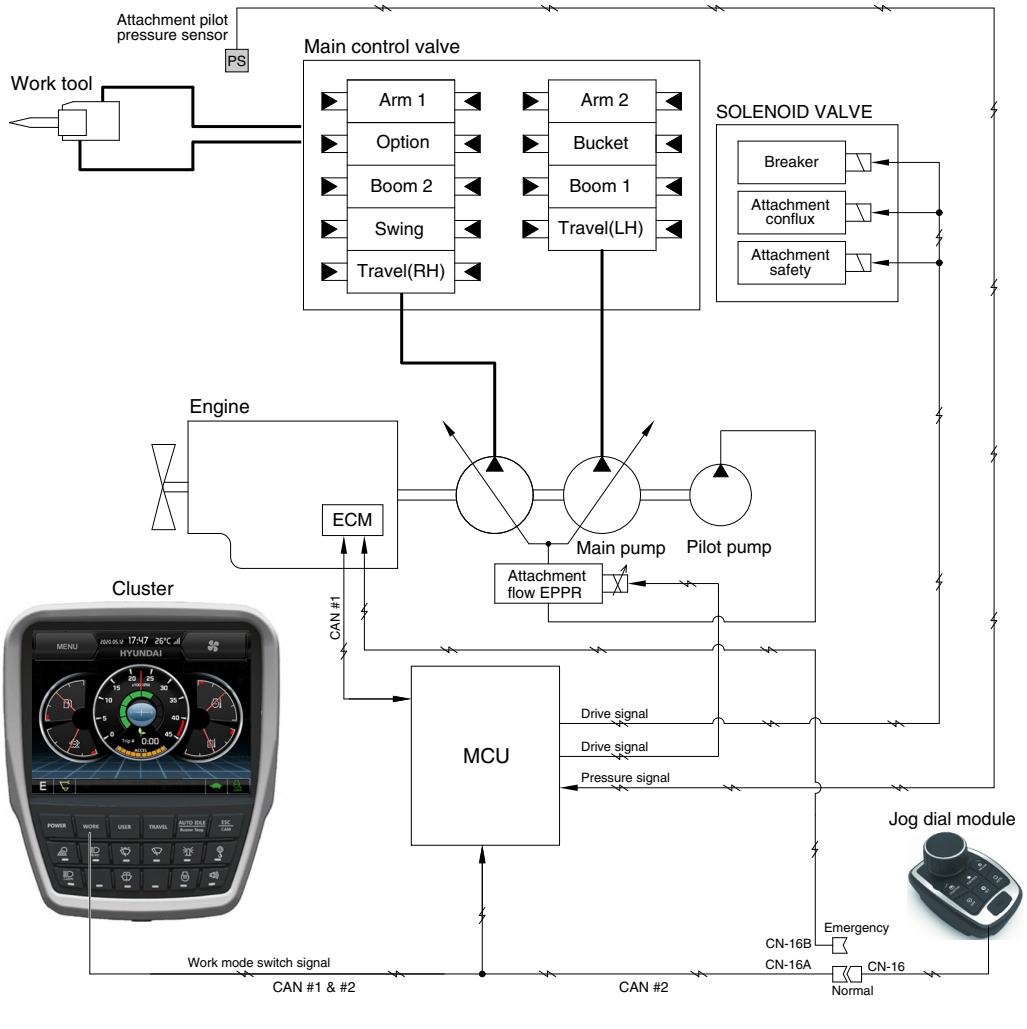


· The variable power control system controls the engine and pump mutual power according to RCV lever stroke and pump load.
It makes fuel saving and smooth control at precise work.

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

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

GROUP 9 ATTACHMENT FLOW CONTROL SYSTEM



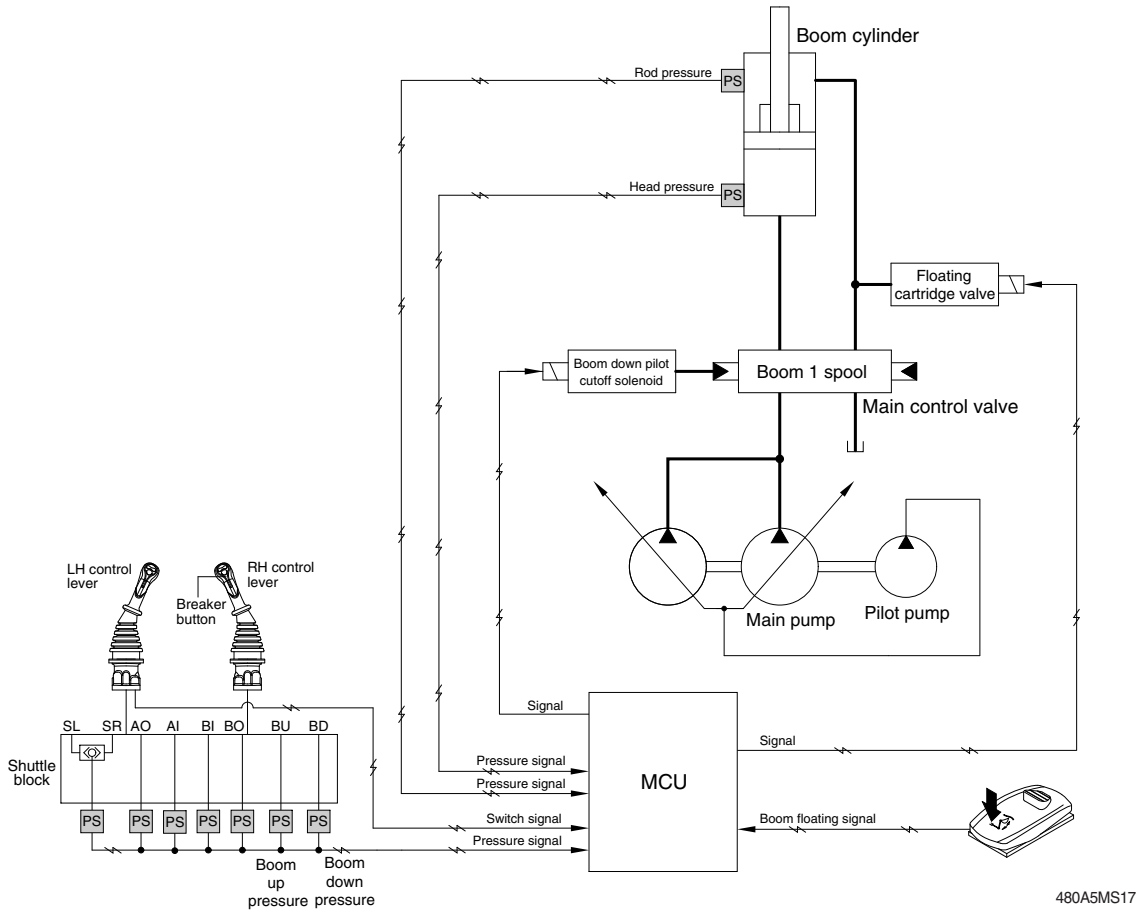
· The system is used to control the pump delivery flow according to set of the work tool on the cluster by the attachment flow EPPR valve.

Description	Work tool	
	Breaker	Crusher
Flow level	100 ~ 220 lpm	100 ~ 520 lpm
Attach safety solenoid	-	ON
Attach conflux solenoid	ON/OFF	ON/OFF
Breaker solenoid★	ON	-

※ Refer to the page 5-99 for the attachment kinds and max flow.

★ When breaker operating button is pushed.

GROUP 10 BOOM FLOATING CONTROL SYSTEM



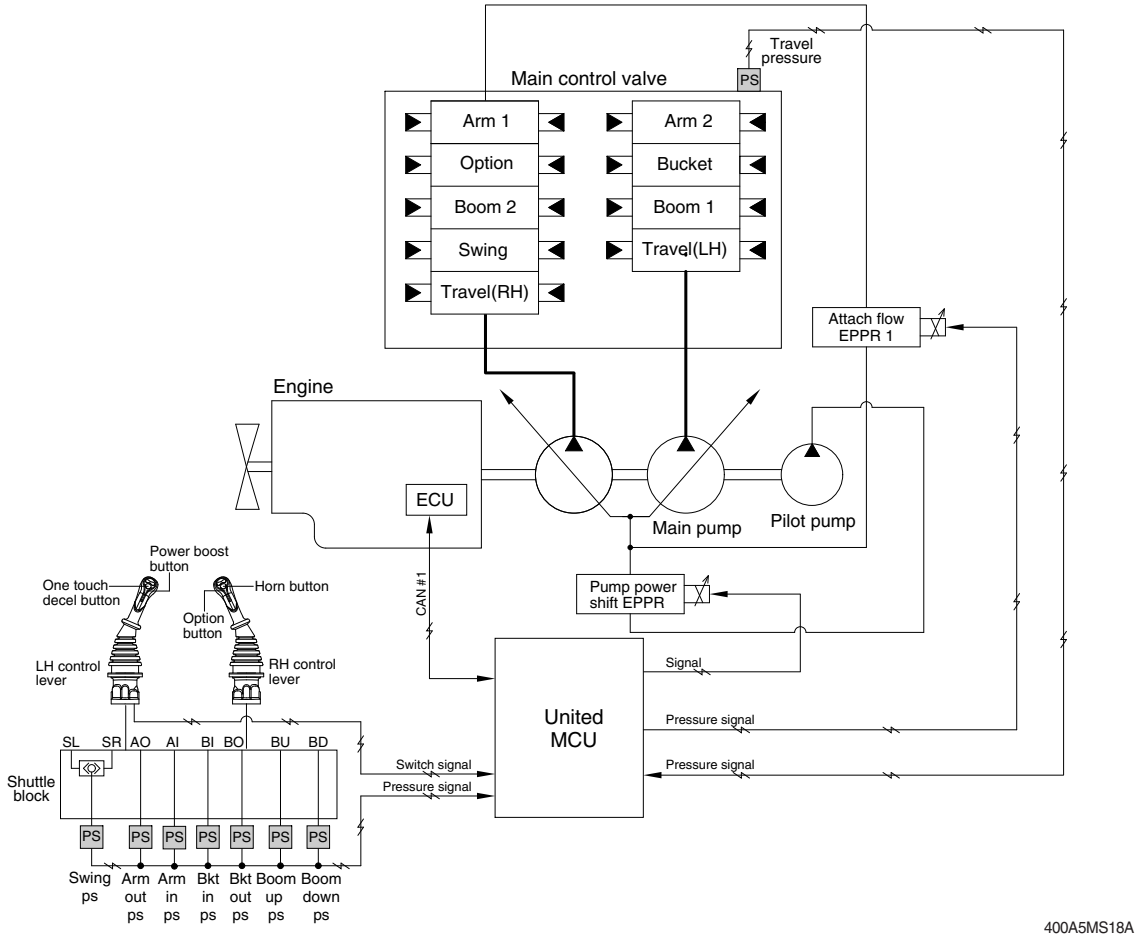
· Boom floating automatically controls boom cylinder along the ground by operating arm cylinder only.

Description		Condition	Function
Work mode★1	Floating mode		
General mode	Boom up floating★2	Floating mode sw : ON	Floating cartridge valve : ON Boom down cutoff solenoid : OFF
	Boom up/down floating★2	Floating mode sw : ON Breaker button : Pressed Boom down pilot pressure > 25 bar Boom up pilot pressure < 5 bar	Floating cartridge valve : ON Boom down cutoff solenoid : ON
Breaker mode	Boom down floating	Floating mode sw : ON Breaker button : Pressed Boom down pilot pressure > 25 bar Boom up pilot pressure < 5 bar	Floating cartridge valve : OFF Boom down cutoff solenoid : ON
Temporarily canceled		During operation of boom floating Boost sw : Pressed	Floating cartridge valve : OFF Boom down cutoff solenoid : OFF

★1 Boom floating is not activated when work mode is crusher mode.

★2 These functions are activated just in case the excavator is not in jack up status.

GROUP 11 INTELLIGENT POWER CONTROL SYSTEM



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

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

1) ARM IN WITH BOOM UP

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

2) BOOM DOWN WITH OTHER ACTUATOR

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

3) STARTING POINT WHEN SWING OPERATION

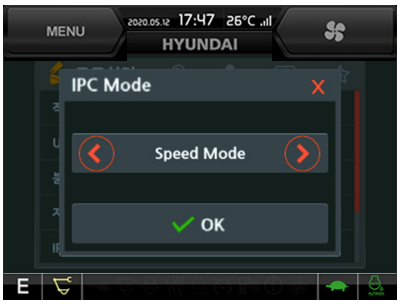
A technology reduces the amount of flow that is wasted to the swing relief due to the inertia at the beginning of the swing start.

4) REDUCTION FOR FUEL WHEN IDLE CONDITION

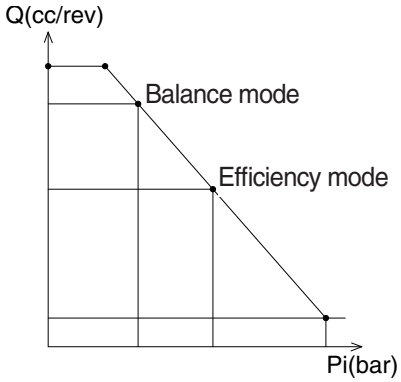
A technology reduces energy loss due to unnecessary pump volume increase in idle state before the machine operation.

2. IPC MODE SELECTION

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



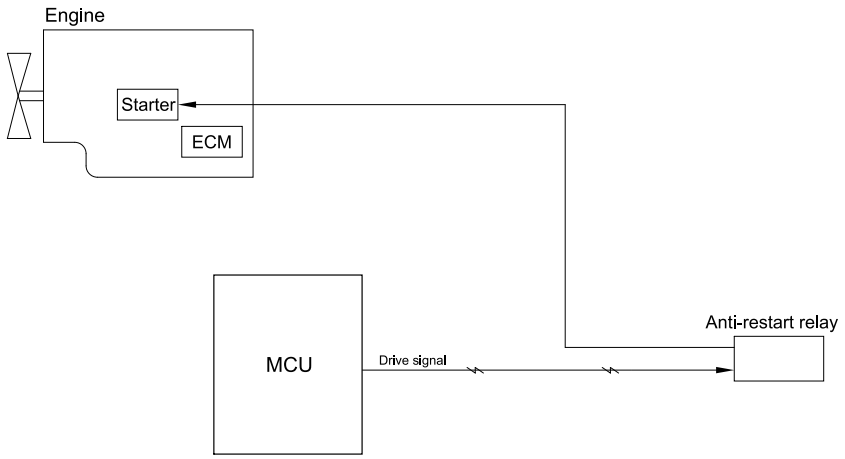
300A3CD52A



290F3CD311

IPC mode	Description
Balance mode	Fuel eifficiency ON, limit level 1
Efficiency mode	Fuel eifficiency ON, limit level 2
Speed mode	Fuel eifficiency OFF

GROUP 12 ANTI-RESTART SYSTEM



140L5MS12

1. ANTI-RESTART FUNCTION

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

GROUP 13 SELF-DIAGNOSTIC SYSTEM

1. OUTLINE

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

2. MONITORING

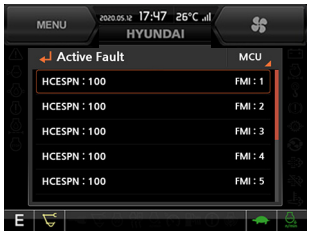
1) Active fault



300A3CD65A



300A3CD66A



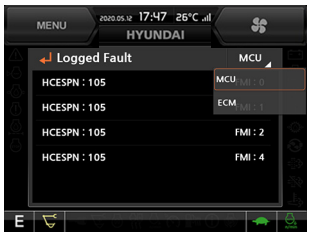
300A3CD67A

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

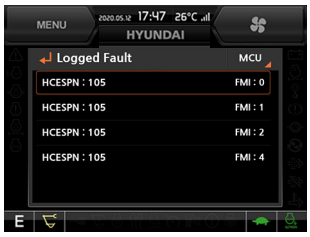
2) Logged fault



300A3CD68A



300A3CD69A



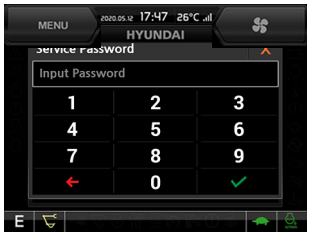
300A3CD70A

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

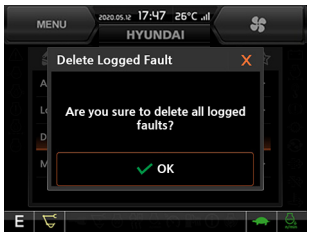
3) Delete logged fault



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

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
101	3	10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage > 3.8V	●		
	4	10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Hydraulic oil temperature display failure 2. Control Function – Fan revolutions control failure (Checking list) 1. CD-1 (#2) - CN-51 (#16) Checking Open/Short 2. CD-1 (#1) - CN-51 (#25) Checking Open/Short				
105	0	10 seconds continuous, Working Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Working Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Working Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Working Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure (Checking list) 1. CD-7 (#B) – CN-52 (#19) Checking Open/Short 2. CD-7 (#A) – CN-51 (#32) Checking Open/Short 3. CD-7 (#C) – CN-51 (#31) Checking Open/Short				
108	0	10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V		●	
	1	10 seconds continuous, 0.3V ≤ Travel Oil Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Travel Oil Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list) 1. CD-6 (#B) – CN-52 (#27) Checking Open/Short 2. CD-6 (#A) – CN-51 (#32) Checking Open/Short 3. CD-6 (#C) – CN-51 (#31) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
120	0	10 seconds continuous, Main Pump 1 (P1) Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V ≤ Main Pump 1 (P1) Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Main Pump 1 (P1) Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Main Pump 1 (P1) Press. display failure 2. Control Function – Automatic voltage increase operation failure, Overload at compensation control failure (Checking list) 1. CD-42 (#B) – CN-52 (#22) Checking Open/Short 2. CD-42 (#A) – CN-51 (#32) Checking Open/Short 3. CD-42 (#C) – CN-51 (#31) Checking Open/Short				
121	0	10 seconds continuous, Main Pump 2 (P2) Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Main Pump 2 (P2) Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Main Pump 2 (P2) Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Main Pump 2 (P2) Press. display failure 2. Control Function – Automatic voltage increase operation failure, Overload at compensation control failure (Checking list) 1. CD-43 (#B) – CN-51 (#14) Checking Open/Short 2. CD-43 (#A) – CN-51 (#32) Checking Open/Short 3. CD-43 (#C) – CN-51 (#31) Checking Open/Short				
122	1	(when you had conditions mounting pressure sensor) 10 seconds continuous, 0.3V ≤ Overload Press. Sensor Measurement Voltage < 0.8V	●		
	4	(when you had conditions mounting pressure sensor) 10 seconds continuous, Overload Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Overload Press. display failure 2. Control Function – Overload warning alarm failure (Checking list) 1. CD-31 (#B) – CN-52 (#28) Checking Open/Short 2. CD-31 (#A) – CN-51 (#32) Checking Open/Short 3. CD-31 (#C) – CN-51 (#31) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
123	0	10 seconds continuous, Negative 1 Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Negative 1 Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Negative 1 Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Negative 1 Press. display failure 2. Control Function – IPC operation failure, Option attachment flow control operation failure (Checking list) 1. CD-70 (#B) – CN-51 (#22) Checking Open/Short 2. CD-70 (#A) – CN-51 (#32) Checking Open/Short 3. CD-70 (#C) – CN-51 (#31) Checking Open/Short				
124	0	10 seconds continuous, Negative 2 Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Negative 2 Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Negative 2 Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Negative 2 Press. display failure 2. Control Function – Option attachment flow control operation failure (Checking list) 1. CD-71 (#B) – CN-51 (#28) Checking Open/Short 2. CD-71 (#A) – CN-51 (#32) Checking Open/Short 3. CD-71 (#C) – CN-51 (#31) Checking Open/Short				
127	0	10 seconds continuous, Boom Up Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Boom Up Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Boom Up Pilot Press. Sensor Measurement < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Boom Up Pilot Press. display failure 2. Control Function – Engine/Pump variable horse power control operation failure, IPC operation failure, Boom first operation failure (Checking list) 1. CD-32 (#B) – CN-52 (#23) Checking Open/Short 2. CD-32 (#A) – CN-51 (#32) Checking Open/Short 3. CD-32 (#C) – CN-5 1(#31) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
128	0	(when you had conditions mounting pressure sensor) 10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	(when you had conditions mounting pressure sensor) 10 seconds continuous, 0.3V≤ Boom Down Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	(when you had conditions mounting pressure sensor) 10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Boom Down Pilot Press. display failure 2. Control Function – Boom floating operation failure (Checking list) 1. CD-85 (#B) – CN-52 (#31) Checking Open/Short 2. CD-85 (#A) – CN-51 (#32) Checking Open/Short 3. CD-85 (#C) – CN-51 (#31) Checking Open/Short				
129	0	10 seconds continuous, Arm In Pilot Press. Sensor Measurement Voltage > 4.8V	●		
	1	10 seconds continuous, 0.3V≤ Arm In Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Arm In Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Arm In Pilot Press. display failure 2. Control Function – IPC operation failure (Checking list) 1. CD-90 (#B) – CN-51 (#21) Checking Open/Short 2. CD-90 (#A) – CN-51 (#32) Checking Open/Short 3. CD-90 (#C) – CN-51 (#31) Checking Open/Short				
133	0	10 seconds continuous, Bucket In Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Bucket In Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Bucket In Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Bucket In Pilot Press. display failure 2. Control Function – Engine variable horse power control operation failure (Checking list) 1. CD-35 (#B) – CN-53 (#15) Checking Open/Short 2. CD-35 (#A) – CN-51 (#32) Checking Open/Short 3. CD-35 (#C) – CN-51 (#31) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
135	0	10 seconds continuous, Swing Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Swing Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Swing Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Swing Pilot Press. display failure 2. Control Function – IPC operation, Boom first operation failure (Checking list) 1. CD-24 (#B) – CN-52 (#18) Checking Open/Short 2. CD-24 (#A) – CN-51 (#32) Checking Open/Short 3. CD-24 (#C) – CN-51 (#31) Checking Open/Short				
138	0	Monitor – Select Attachment (breaker / crusher) 10 seconds continuous, Attachment Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	Monitor – Select Attachment (breaker / crusher) 10 seconds continuous, 0.3V≤ Attachment Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	Monitor – Select Attachment (breaker / crusher) 10 seconds continuous, Attachment Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Attachment Pilot Press. display failure 2. Control Function – Option attachment flow control operation failure (Checking list) 1. CD-69 (#B) – CN-52 (#32) Checking Open/Short 2. CD-69 (#A) – CN-51 (#32) Checking Open/Short 3. CD-69 (#C) – CN-51 (#31) Checking Open/Short				
139 (N.A)	1	10 seconds continuous, 0.3V≤ Option Pilot Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Option Pilot Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Option Pilot Press. display failure 2. Control Function – Auto Idle operation failure (Checking list) 1. CD-100 (#B) – CN-52 (#21) Checking Open/Short 2. CD-100 (#A) – CN-51 (#3) Checking Open/Short 3. CD-100 (#C) – CN-1 (#6) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

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

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
143 (N.A)	5	(Detection) (When Travel EPPR Current is more than 10 mA) 10 seconds continuous, Travel EPPR drive current = 0 mA (Cancellation) (When Travel EPPR Current is more than 100 mA) 3 seconds continuous, Travel EPPR drive current ≥ 10 mA			●
	6	(Detection) 10 seconds continuous, Travel EPPR drive current > 1.0 A (Cancellation) 3 seconds continuous, Travel EPPR drive current ≤ 1.0 A			●
	(Results / Symptoms) 1. Control Function – cruise control operation failure (Checking list) 1. CN-246 (#2) – CN-54 (#39) Checking Open/Short 2. CN-246 (#1) – CN-51 (#40) Checking Open/Short				
145	5	(Model Parameter) mounting Hydraulic Cooling Fan EPPR (Detection) (When Hydraulic Cooling Fan EPPR Current is more than 10 mA) 10 seconds continuous, Hydraulic Cooling Fan EPPR drive current = 0 mA (Cancellation) (When Remote Cooling Fan EPPR Current is more than 10 mA) 3 seconds continuous, Hydraulic Cooling Fan EPPR drive current ≥ 10 mA	●		
	6	(Detection) 10 seconds continuous, Hydraulic Cooling Fan EPPR drive current > 1.0 A (Cancellation) 3 seconds continuous, Hydraulic Cooling Fan EPPR drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Remote fan control operation failure (Checking list) 1. CN-154 (#1) – CN-54 (#6) Checking Open/Short 2. CN-154 (#2) – CN-54 (#34) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

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

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
167	4	(Detection) (When Travel Speed Solenoid is Off) 10 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Travel Speed Solenoid is Off) 3 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage > 3.0V		●	
		(When Parking mode is not) (Detection) (When Travel Speed Solenoid is Off) 10 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Travel Speed Solenoid is Off) 3 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Travel Speed Solenoid is On) 10 seconds continuous, Travel Speed Solenoid drive current > 4.5 A (Cancellation) (When Travel Speed Solenoid is On) 3 seconds continuous, Travel Speed Solenoid drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – driving in 1/2 transmission operation failure (Checking list) 1. CN-70 (#1) – CN-52 (#05) Checking Open/Short 2. CN-70 (#2) – Fuse box (#28) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
169	4	Monitor – Selecting attachment (breaker / crusher) (Detection) (When Attachment Conflux Solenoid is Off) 10 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Attachment Conflux Solenoid is Off) 3 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Attachment Conflux Solenoid is On) 10 seconds continuous, Attachment Conflux Solenoid drive Current > 6.5 A (Cancellation) (When Attachment Conflux Solenoid is On) 3 seconds continuous, Attachment Conflux Solenoid drive Current ≤ 6.5 A	●		
	(Results / symptoms) 1. Control Function – Option attachment flow control – Joining operation failure (Eco breaker mode, crusher mode) (Checking list) 1. CN-237 (#1) – CN-52 (#16) Checking Open/Short 2. CN-237 (#2) – Fuse box (#19) Checking Open/Short				
170 (N.A)	4	(Model Parameter) mounting Arm Regenerating Solenoid (Detection) (When Arm Regeneration Solenoid is Off) 10 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Arm Regeneration Solenoid is Off) 3 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Arm Regeneration Solenoid is On) 10 seconds continuous, Arm Regeneration Solenoid drive current > 4.5 A (Cancellation) (When Arm Regeneration Solenoid is On) 3 seconds continuous, Arm Regeneration Solenoid drive current ≤ 4.5 A	●		
	(Results / symptoms) 1. Control Function – Arm regeneration operation failure (Checking list) 1. CN-135 (#1) – CN-52 (#07) Checking Open/Short 2. CN-135 (#2) – Fuse box (#28) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

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

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
181	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) (Checking list) 1. CN-680 (#2) – Fuse box (#28) Checking Open/Short 2. CN-680 (#1) – CN-53 (#01) Checking Open/Short				
188	5	(Detection) (When Pump P1 regulator EPPR current is equal or more than 300 mA) 10 seconds continuous, Pump P1 regulator EPPR drive current < 100 mA (Cancellation) (When Pump P1 regulator EPPR current is equal or more than 300 mA) 3 seconds continuous, Pump P1 regulator EPPR drive current ≥ 100 mA	●		
	6	(Detection) 10 seconds continuous, Pump P1 regulator EPPR drive current > 1.0 A (Cancellation) 3 seconds continuous, Pump P1 regulator EPPR drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – IPC operation failure, Option attachment flow control operation failure (Checking list) 1. CN-242 (#2) – CN-54 (#27) Checking Open/Short 2. CN-242 (#1) – CN-54 (#02) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
189	5	(Detection) (When Pump P2 regulator EPPR current is equal or more than 300 mA) 10 seconds continuous, Pump P2 regulator EPPR drive current < 100 mA (Cancellation) (When Pump P2 regulator EPPR current is equal or more than 300 mA) 3 seconds continuous, Pump P2 regulator EPPR drive current ≥ 100 mA	●		
	6	(Detection) 10 seconds continuous, Attachment Flow EPPR 2 drive current > 1.0 A (Cancellation) 3 seconds continuous, Attachment Flow EPPR 2 drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control operation failure (Checking list) 1. CN-243 (#2) – CN-54 (#26) Checking Open/Short 2. CN-243 (#1) – CN-54 (#03) Checking Open/Short				
196 (N.A)	0	HW145 10 seconds continuous, Attachment flow control EPPR 1 press. Sensor Measurement Voltage > 5.2V			
	1	HW145 10 seconds continuous, 0.3V≤ Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.8V			
	4	HW145 10 seconds continuous, Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.3V			
	(Results / Symptoms) 1. Control Function – Driving second pump joining function operation failure (Checking list) 1. CD-93 (#B) – CN-52 (#34) Checking Open/Short 2. CD-93 (#A) – CN-51 (#32) Checking Open/Short 3. CD-93 (#C) – CN-51 (#31) Checking Open/Short				
200	0	10 seconds continuous, Pump power shift Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Pump power shift Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Pump power shift Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Pump power shift Press. display failure 2. Control Function – Pump input horse power control failure, Overload at compensation control operation failure (Fuel efficiency/speed performance failure) (Checking list) 1. CD-44 (#B) – CN-51 (#13) Checking Open/Short 2. CD-44 (#A) – CN-51 (#32) Checking Open/Short 3. CD-44 (#C) – CN-51 (#31) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
205	0	(Mounting pressure sensor) 10 seconds continuous, Boom Cylinder Rod Press. Sensor Measurement Voltage > 5.2V	●		
	1	(Mounting pressure sensor) 10 seconds continuous, 0.3V≤ Boom Cylinder Rod Press. Sensor Measurement Voltage < 0.8V	●		
	4	(Mounting pressure sensor) 10 seconds continuous, Boom Cylinder Rod Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Boom Cylinder Rod Press. display failure 2. Control Function – Boom floating control operation failure (Checking list) 1. CD-124 (#B) – CN-52 (#25) Checking Open/Short 2. CD-124 (#A) – CN-51 (#32) Checking Open/Short 3. CD-124 (#C) – CN-51 (#31) Checking Open/Short				
218	4	Mounting pressure sensor (HCESPN128 or HCESPN 205) (Detection) (When Boom Up Floating Solenoid is Off) 10 seconds continuous, Boom Up Floating Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Boom Up Floating Solenoid is Off) 3 seconds continuous, Boom Up Floating Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Boom Up Floating Solenoid is On) 10 seconds continuous, Boom Up Floating Solenoid drive current > 6.5 A (Cancellation) (When Boom Up Floating Solenoid is On) 3 seconds continuous, Boom Up Floating Solenoid drive current ≤ 6.5 A	●		
	(Results / Symptoms) 1. Control Function – Boom floating control operation failure (Checking list) 1. CN-367 (#1) – CN-53 (#05) Checking Open/Short 2. CN-367 (#2) – Fuse box (#19) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
220	4	Mounting pressure sensor (HCESPN 128 or 205) (Detection) (When Boom Down Pilot Pressure Cutoff Solenoid is Off) 10 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Boom Down Pilot Pressure Cutoff Solenoid is Off) 3 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Boom Down Pilot Pressure Cutoff Solenoid is On) 10 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive current > 6.5 A (Cancellation) (When Boom Down Pilot Pressure Cutoff Solenoid is On) 3 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive current ≤ 6.5 A	●		
	(Results / Symptoms) 1. Control Function – Boom floating control operation failure (Checking list) 1. CN-369 (#1) – CN-53 (#08) Checking Open/Short 2. CN-369 (#2) – Fuse box (#19) Checking Open/Short				
221	5	Monitor – Selecting attachment(breaker / crusher) (Detection) (When ATT Relief Setting EPPR 1 Current is equal or more than 10 mA) 10 seconds continuous, ATT Relief Setting EPPR 1 drive current = 0 mA (Cancellation) ATT Relief Setting EPPR 1 Current is equal or more than 10 mA) 3 seconds continuous, ATT Relief Setting EPPR 1 drive current ≥ 10 mA	●		
	6	(Detection) 10 seconds continuous, ATT Relief Setting EPPR 1 drive current > 1.0 A (Cancellation) 3 seconds continuous, ATT Relief Setting EPPR 1 drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control – P1 relief pressure setting failure (Checking list) 1. CN-365 (#2) – CN-54 (#17) Checking Open/Short 2. CN-365 (#1) – CN-54 (#09) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
222	5	Monitor – Selecting attachment(crusher) (Detection) (When ATT Relief Setting EPPR 2 Current is equal or more than 10 mA) 10 seconds continuous, ATT Relief Setting EPPR 2 drive current = 0 mA (Cancellation) (When ATT Relief Setting EPPR 2 Current is equal or more than 10 mA) 3 seconds continuous, ATT Relief Setting EPPR 2 drive current ≥ 10mA	●		
	6	(Detection) 10 seconds continuous, ATT Relief Setting EPPR 2 drive current > 1.0 A (Cancellation) 3 seconds continuous, ATT Relief Setting EPPR 2 drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control – P2 relief pressure setting failure (Checking list) 1. CN-366 (#2) – CN-54 (#17) Checking Open/Short 2. CN-366 (#1) – CN-54 (#10) Checking Open/Short				
301	3	10 seconds continuous, Fuel Level Measurement Voltage > 3.8V	●		
	4	10 seconds continuous, Fuel Level Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Fuel remaining display failure (Checking list) 1. CD-2 (#2) – CN-51 (#19) Checking Open/Short 2. CD-2 (#1) – CN-51 (#25) Checking Open/Short				
325	4	(Model Parameter) mounting Fuel Warmer Relay (Detection) (When Fuel Warmer Relay is Off) 10 seconds continuous, Fuel Warmer Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Fuel Warmer Relay is Off) 3 seconds continuous, Fuel Warmer Relay drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Fuel Warmer Relay is On) 10 seconds continuous, Fuel Warmer Relay drive current > 4.5 A (Cancellation) (When Fuel Warmer Relay is On) 3 seconds continuous, Fuel Warmer Relay drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – Fuel warmer operation failure (Checking list) 1. CR-46 (#85) – CN-52 (#13) Checking Open/Short 2. CR-46 (#86) – Fuse box (#22) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

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

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

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

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
525 (N.A)	4	(Detection) (When Ram Lock Solenoid is Off) 10 seconds continuous, Ram Lock Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Ram Lock Solenoid is Off) 3 seconds continuous, Ram Lock Solenoid drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Ram Lock Solenoid is On) 10 seconds continuous, Ram Lock Solenoid drive current > 6.5 A (Cancellation) (When Ram Lock Solenoid is On) 3 seconds continuous, Ram Lock Solenoid drive current ≤ 6.5 A			●
	(Results / Symptoms) 1. Control Function – Ram lock control operation failure (Checking list) 1. CN-69 (#1) – CN-53 (#12) Checking Open/Short 2. CN-69 (#2) – Fuse box (#33) Checking Open/Short				
527 (N.A)	4	(Detection) (When Creep Solenoid is Off) 10 seconds continuous, Creep Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Creep Solenoid is Off) 3 seconds continuous, Creep Solenoid drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Creep Solenoid is On) 10 seconds continuous, Creep Solenoid drive current > 6.5 A (Cancellation) (When Creep Solenoid is On) 3 seconds continuous, Creep Solenoid drive current ≤ 6.5 A			●
	(Results / Symptoms) 1. Control Function – Creep mode operation failure (Checking list) 1. CN-206 (#1) – CN-52 (#17) Checking Open/Short 2. CN-206 (#2) – Fuse box (#30) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
530 (N.A)	0	10 seconds continuous, Travel Forward Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V≤ Travel Forward Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Travel Forward Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Travel Forward Press. display failure 2. Control Function – Driving interoperability power control operation failure (Checking list) 1. CD-73 (#B) – CN-51 (#20) Checking Open/Short 2. CD-73 (#A) – CN-51 (#32) Checking Open/Short 3. CD-73 (#C) – CN-51 (#31) Checking Open/Short				
531 (N.A)	1	10 seconds continuous, 0.3V≤ Travel Reverse Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Travel Reverse Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Travel Reverse Press. display failure 2. Control Function – Driving interoperability power control operation failure (Checking list) 1. CD-74 (#B) – CN-52 (#20) Checking Open/Short 2. CD-74 (#A) – CN-51 (#32) Checking Open/Short 3. CD-74 (#C) – CN-51 (#31) Checking Open/Short				
705	0	10 seconds continuous, Battery input Voltage > 35V	●		
	1	10 seconds continuous, Battery input Voltage < 18V	●		
	(Results / Symptoms) 1. Control Function – Startup impossibility (Checking list) 1. CS-74 (#1) – CN-74 (B+) Checking Open/Short				
707	1	(When Engine is equal or more than 400 rpm) 10 seconds continuous, Alternator Node I Measurement Voltage < 18V (In case 12v goods, Alternator Node I Measurement Voltage < 9V)	●		
	(Results / Symptoms) 1. Control Function – Battery charging circuit failure (Checking list) 1. CS-74 (#1) – CN-74 (B+) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
714 (N.A)	3	(Model Parameter) Mounting Acc. Dial 10 seconds continuous, Acc. Dial Measurement Voltage > 5.2V	●		
	4	(Model Parameter) Mounting Acc. Dial 10 seconds continuous, Acc. Dial Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Acc. Dial Voltage display failure 2. Control Function – Engine rpm control failure (Checking list) 1. CN-7 (#15) – CN-52 (#33) Checking Open/Short				
722	4	(Detection) (When Travel Alarm (Buzzer) Sound is Off) 10 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Travel Alarm (Buzzer) Sound Relay is Off) 3 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Travel Alarm (Buzzer) Sound is On) 10 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive current > 4.5 A (Cancellation) (When Travel Alarm (Buzzer) Sound is On) 3 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – Driving alarm operation failure (Checking list) 1. CN-81 (#1) – CN-52 (#09) Checking Open/Short 2. CN-81 (#2) – Fuse box (#28) Checking Open/Short				
831	2	(When mounting the A/C Controller) 60 seconds continuous, A/C Controller Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – A/C Controller operation failure (Checking list) 1. CN-11 (#8) – CN-51 (#09) Checking Open/Short 2. CN-11 (#7) – CN-51 (#08) Checking Open/Short				
840	2	60 seconds continuous, Cluster Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – Cluster operation failure (Checking list) 1. CN-56A (#5) – CN-52 (#01) Checking Open/Short 2. CN-56A (#4) – CN-52 (#02) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
841	2	10 seconds continuous, ECM Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – ECM operation failure (Checking list) 1. CN-93 (#22) – CN-52 (#02) Checking Open/Short 2. CN-93 (#46) – CN-52 (#01) Checking Open/Short				
848	2	(When mounting the Jog dial module) 60 seconds continuous, Jog dial module Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – Jog dial module operation failure (Checking list) 1. CN-363 (#4) – CN-51 (#09) Checking Open/Short 2. CN-363 (#10) – CN-51 (#08) Checking Open/Short				
850	2	(When mounting the RMCU) 60 seconds continuous, RMCU communication Data Error	●		
	(Resuluts / Symptoms) 1. Control Function – RMCU operation failure (Checking list) 1. CN-125A (#3) – CN-51 (#09) Checking Open/Short 2. CN-125A (#11) – CN-51 (#08) Checking Open/Short				
866	2	(When mounting the AAVM) 60 seconds continuous, AAVM communication Data Error	●		
	(Results / Symptoms) 1. Control Function – AAVM operation failure (Checking list) 1. CN-9 (#5) – CN-51 (#09) Checking Open/Short 2. CN-9 (#6) – CN-51 (#08) Checking Open/Short				
867	2	60 seconds continuous, RDU communication Data Error	●		
	(Results / Symptoms) 1. Control Function – RDU operation failure (Checking list) 1. CN-376 (#10) – CN-51 (#09) Checking Open/Short 2. CN-376 (#18) – CN-51 (#08) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
868	2	60 seconds continuous, Switch Controller communication Data Error	●		
	(Results / Symptoms) 1. Control Function – Switch Controller operation failure (Checking list) 1. CN-56A (#7) – CN-51 (#08) Checking Open/Short 2. CN-56A (#6) – CN-51 (#09) Checking Open/Short				
869	2	(When mounting the BKCU) 60 seconds continuous, BKCU communication Data Error	●		
	(Results / Symptoms) 1. Control Function – BKCU operation failure (Checking list) 1. CS-2B (#A) – CN-51 (#09) Checking Open/Short 2. CS-2B (#B) – CN-51 (#08) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

4) ENGINE FAULT CODE

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
111 629 12	Engine control module critical internal failure - Bad intelligent device or component. Error internal to the ECM related to memory hardware failures or internal ECM voltage supply circuits.	Possible no noticeable performance effects, engine dying, or hard starting.
115 612 2	Engine magnetic crankshaft speed/position lost both of two signals - Data erratic, intermittent, or incorrect. The ECM has detected the primary and backup speed sensor signals are connected backwards.	The engine will shut down or will not start.
122 102 3	Intake manifold 1 pressure sensor circuit - Voltage above normal, or shorted to high source. High signal voltage detected at the intake manifold pressure circuit.	Engine power derate.
123 102 4	Intake manifold 1 pressure sensor circuit - Voltage below normal, or shorted to low Source. Low signal voltage or open circuit detected at the intake manifold pressure circuit.	Engine power derate.
124 102 16	Intake manifold 1 pressure - Data valid but above normal operational range - Moderately severe level. Intake manifold pressure is above the maximum operating limit.	Engine power derate.
125 102 18	Intake Manifold 1 Pressure - Data valid but below normal operating range - Moderately severe level. Intake manifold pressure is below the minimum operating limit.	Engine power derate.
131 91 3	Accelerator pedal or lever position sensor 1 circuit - Voltage above normal, or shorted to high source. High voltage detected at accelerator pedal position number 1 circuit.	The engine will operate in limp home mode.
132 91 4	Accelerator pedal or lever position sensor 1 circuit - Voltage below normal, or shorted to low source. Low voltage detected at accelerator pedal position number 1 signal circuit.	The engine will operate in limp home mode.
133 974 3	Remote accelerator pedal or lever position sensor 1 circuit - Voltage above normal, or shorted to high source. High voltage detected at remote accelerator pedal position signal circuit.	Remote accelerator will not operate.
134 974 4	Remote accelerator pedal or lever position sensor 1 circuit - Voltage below normal, or shorted to low source. Low voltage detected at remote accelerator pedal position signal circuit.	Remote accelerator will not operate.
143 100 18	Engine oil rifle pressure - Data valid but below normal operational range - Moderately severe level. Engine oil pressure signal indicates engine oil pressure is below the engine protection warning limit.	Engine power derate.

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

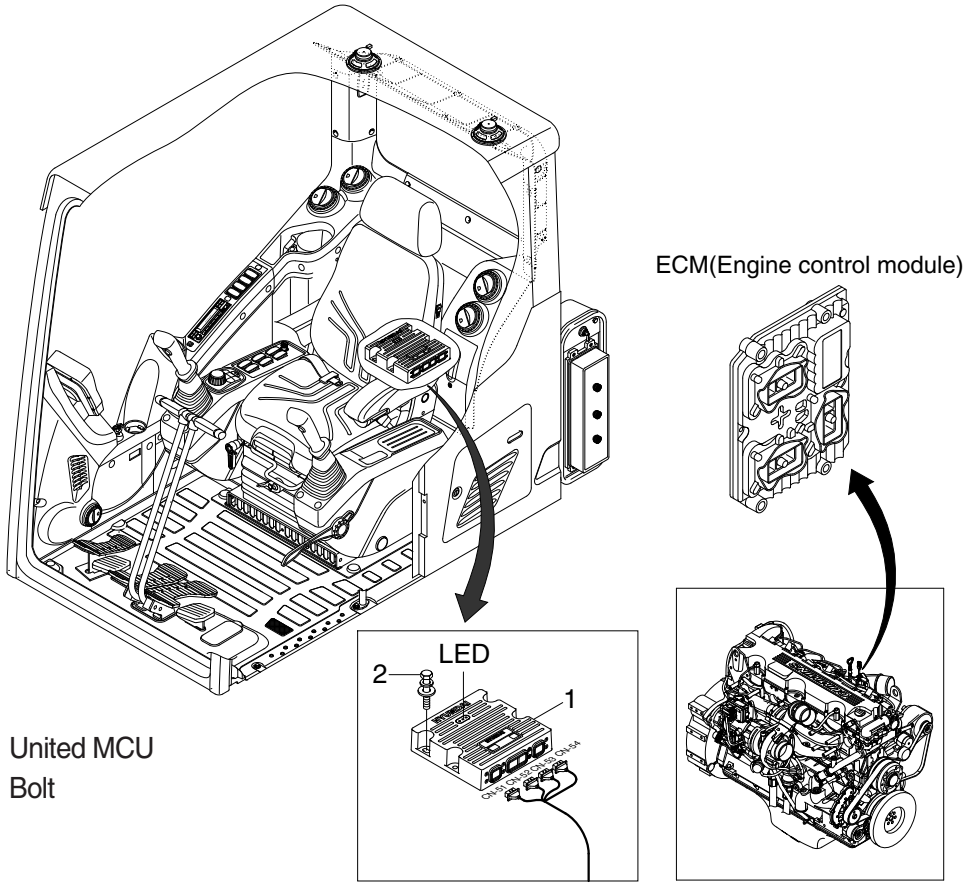
Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
4518 5862 3	Aftertreatment SCR Intermediate gas temperature sensor circuit - Voltage above normal, or shorted to high source. High signal voltage detected at the aftreatment SCR intermediate temperature sensor circuit.	Possible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

※ Some fault codes are not applied to this machine.

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

※ Some fault codes are not applied to this machine.

1. MCU and Engine ECM (Electronic Control Module)



1 United MCU
2 Bolt

480A5MS13

2. MCU ASSEMBLY

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

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

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

G : green, R : red, Y : yellow

GROUP 15 EPPR VALVE

1. PUMP EPPR VALVE

1) COMPOSITION

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

(1) Electro magnet valve

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

(2) Spool valve

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

(3) Pressure and electric current value for each mode

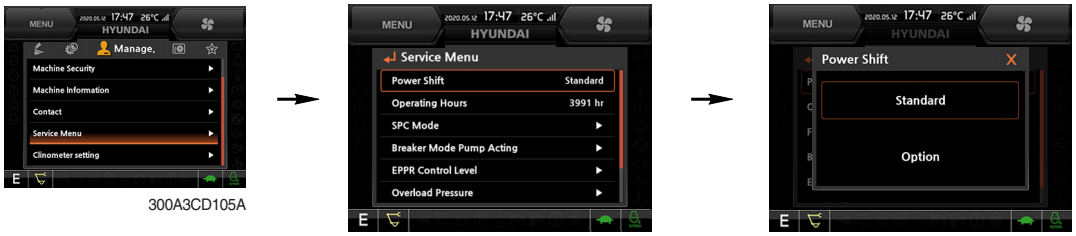
Mode		Pressure		Electric current (mA)	Engine rpm (at accel dial 10)
		kgf/cm²	psi		
Standard	P	8.3	118	393	1850
	S	8.8	125	402	1750
	E	9.3	132	411	1650
Option	P	4.8	68.3	323	1850
	S	5.3	75.4	337	1750
	E	5.8	82.5	346	1650

※ No load conditions.

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

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

- Management
  · Service menu

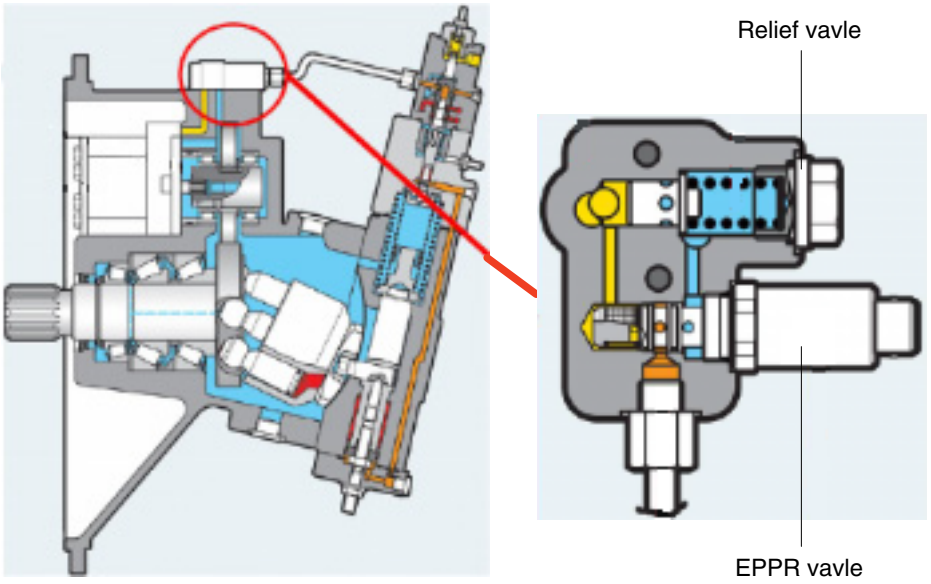


300A3CD105A　300A3CD106A　300A3CD107A

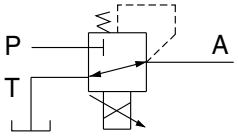
· Power shift (standard/option) : Power shift pressure can be set by option menu.

3) OPERATING PRINCIPLE (pump EPPR valve)

(1) Structure



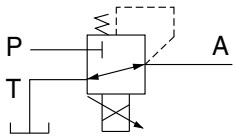
480A5MP15

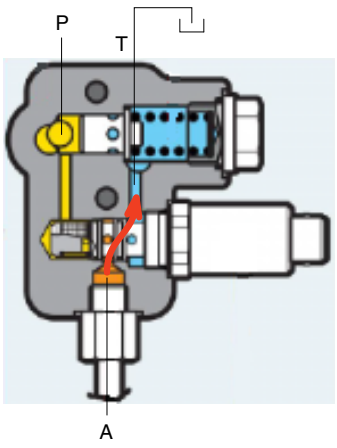


P Pilot oil supply line (pilot pressure)
T Return to tank
A Negative control pressure to main pump

(2) Neutral

Pressure line is blocked and A oil returns to tank.

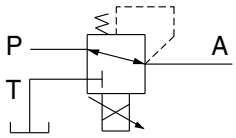


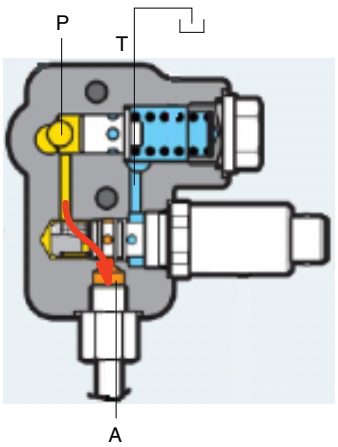


480A5MP16

(3) Operating

Negative control pressure enters into A.





480A5MP17

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.

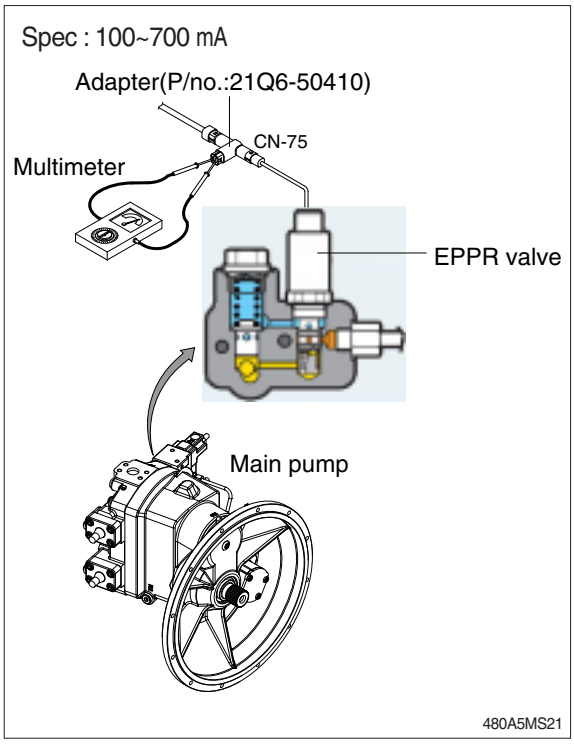
③ Start engine.

④ Set S-mode and cancel auto decel mode.

⑤ Position the accel dial at 10.

⑥ If rpm display show approx 1750±50 rpm check electric current at bucket circuit relief position.

⑦ Check electric current at bucket circuit relief position.



(2) Check pressure at EPPR valve

① Start engine.

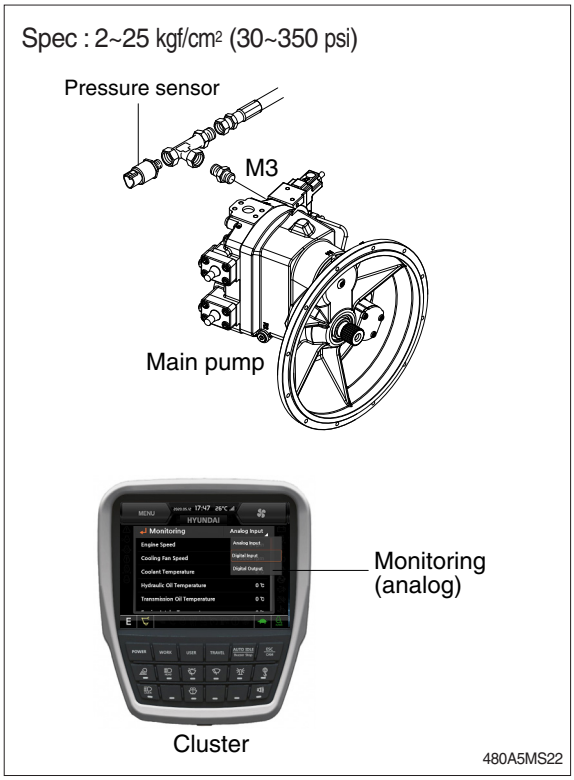
② Set S-mode and cancel auto decel mode.

③ Position the accel dial at 10.

④ If tachometer show approx 1750±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.

⑤ If pressure is not correct, adjust it.

⑥ After adjust, test the machine.



GROUP 16 MONITORING SYSTEM

1. OUTLINE

Monitoring system consists of the monitor part and switch part.

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

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

2. CLUSTER

1) MONITOR PANEL



480A5CD20A

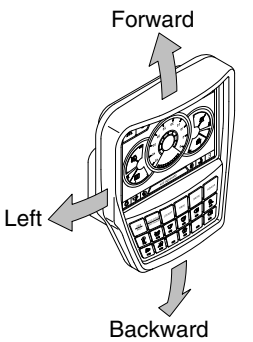
※ **The warning lamp pops up and/or blinks and the buzzer sounds when the machine has a problem.**

The warning lamp blinks until the problem is cleared. Refer to page 5-82 for details.

※ **This cluster is adjustable.**

· Vertical (forward/backward) : each 15°

· Horizontal (left only) : 8°



290F3CD47

2) CLUSTER CHECK PROCEDURE

(1) Start key : ON

① Check monitor

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

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

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

a. Engine rpm display : 0 rpm
b. Engine coolant temperature gauge : White range
c. Hydraulic oil temperature gauge : White range
d. Fuel level gauge : White range

③ Indicating lamp state

a. Power mode pilot lamp : E mode or U mode
b. Work mode pilot lamp : General operation mode (bucket)
c. Travel speed pilot lamp : Low (turtle)

(2) Start of engine

① Check machine condition

a. RPM display indicates at present rpm
b. Gauge and warning lamp : Indicate at present condition.

※ When normal condition : All warning lamp OFF

c. Work mode selection : General work
d. Power mode selection : E mode or U mode
e. Travel speed pilot lamp : Low (turtle)

② When warming up operation

a. Warming up pilot lamp : ON
b. After engine started, engine speed increases 1100 rpm.

※ Others same as above.

③ When abnormal condition

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

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

3) CLUSTER CONNECTOR

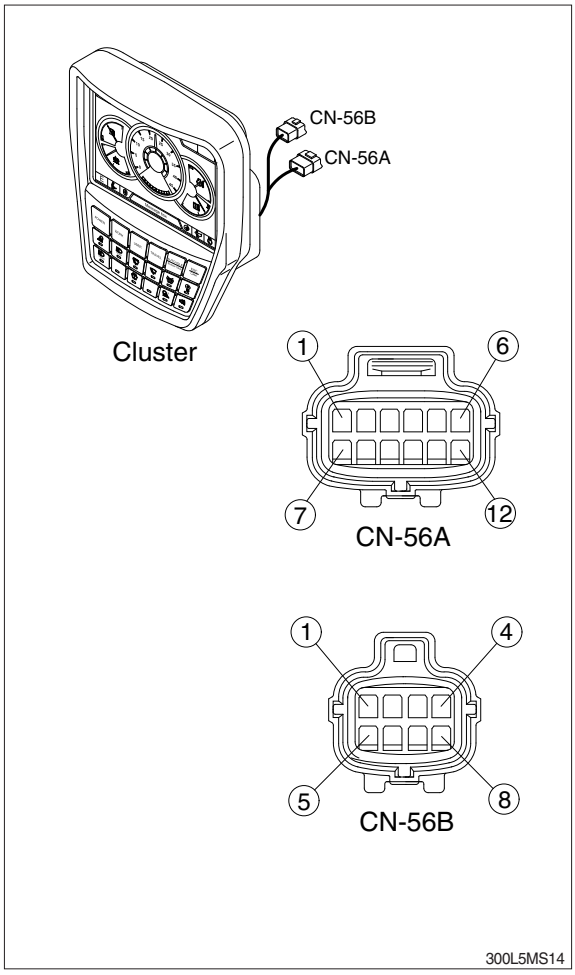
(1) CN-56A

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

(2) CN-56B

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

NTSC : National Television System Committee



4) GAUGE

(1) Operation screen

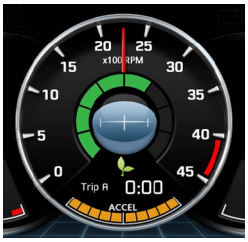
When you first turn starting switch ON, the operation screen will appear.



300A3CD21A

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

(2) RPM / Speed gauge



300A3CD22

① This displays the engine speed.

(3) Engine coolant temperature gauge



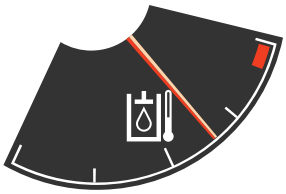
290F3CD53

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

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

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

(4) Hydraulic oil temperature gauge



290F3CD54

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

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

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

(5) Fuel level gauge



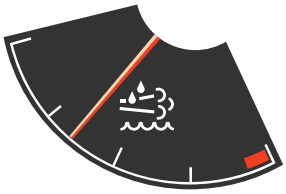
290F3CD55

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

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

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

(6) DEF/AdBlue® Level gauge



290F3CD57

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

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

③ Do not overfull DEF/AdBlue®.

※ Refer to page 5-87.

※ 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 5-112 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.

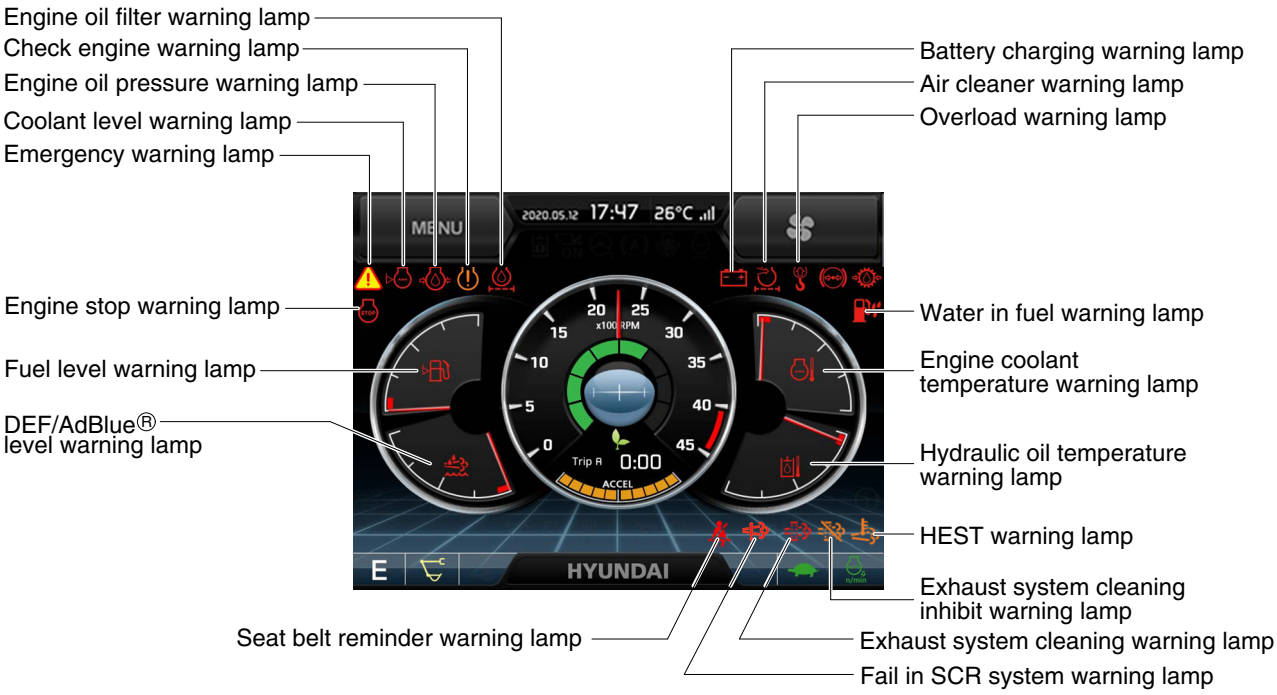
(9) Accel dial gauge



290F3CD59

① This gauge indicates the level of accel dial.

5) WARNING LAMPS



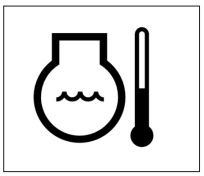
300A3CD23B

※ **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 AUTO IDLE Buzzer Stop is pushed - the knob of the jog dial module is pushed - the lamp of the LCD is touched
	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position, lights up or blinks and the buzzer stops when; - the buzzer stop switch AUTO IDLE Buzzer Stop is pushed - the knob of the jog dial module is pushed - the lamp of the LCD is touched **※ Refer to page 5-87 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 5-83 for details.**
	Warning lamp lights up and the buzzer sounds	**※ Refer to page 5-87 for details.**

※ **Refer to page 5-95 for the buzzer stop switch** AUTO IDLE Buzzer Stop **and operator's manual page 3-66 for the jog dial module.**

(1) Engine coolant temperature warning lamp



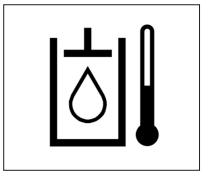
290F3CD61

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 AUTO IDLE Buzzer Stop is pushed. The buzzer will stop and , lamps will blink.

③ Check the cooling system when the lamps keep blinking.

(2) Hydraulic oil temperature warning lamp



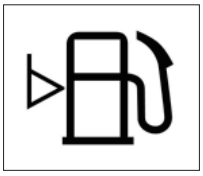
290F3CD62

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

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

③ Check the hydraulic oil level and hydraulic cooling system.

(3) Fuel level warning lamp



290F3CD63

① This warning lamp pops up and the buzzer sounds when the fuel level is below 103 ℓ (27.2 U.S. gal).

② Fill the fuel immediately after the lamp blinks.

(4) Emergency warning lamp



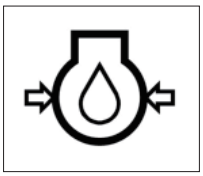
290F3CD64

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 AUTO IDLE Buzzer Stop is pushed. The buzzer will stop.

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

(5) Engine oil pressure warning lamp



290F3CD65

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

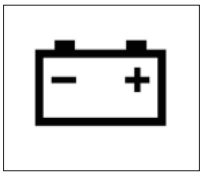
(6) Check engine warning lamp



290F3CD66

① This warning lamp pops up and the buzzer sounds when the communication between MCU and engine ECM 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.

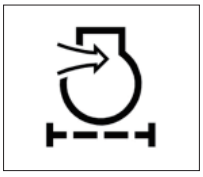
(7) Battery charging warning lamp



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 5-87.

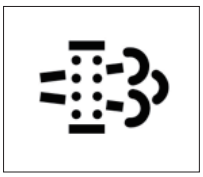
③ This lamp pops up and the buzzer sounds when the maual (stationary) exhuast system cleaning is not performed.

※ Refer to page 5-85.

※ 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

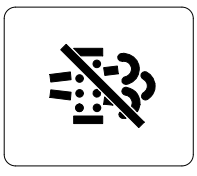


290F3CD70

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 5-86.**
On	On	Off	· The aftertreatment exhaust system needs to be cleaned immediately. · Engine power will be reduced automatically if action is not taken. ※ The exhaust system cleaning can be accomplished by: - Changing to a more challenging duty cycle. - Performing a manual (stationary) exhaust system cleaning.
On	On	On	· These lamps will be ON when a manual (stationary) exhaust system cleaning is not performed. · Stop the engine immediately. · Please contact your HD Hyundai Construction Equipment service center or local dealer.

(12) Exhaust system cleaning inhibit warning lamp

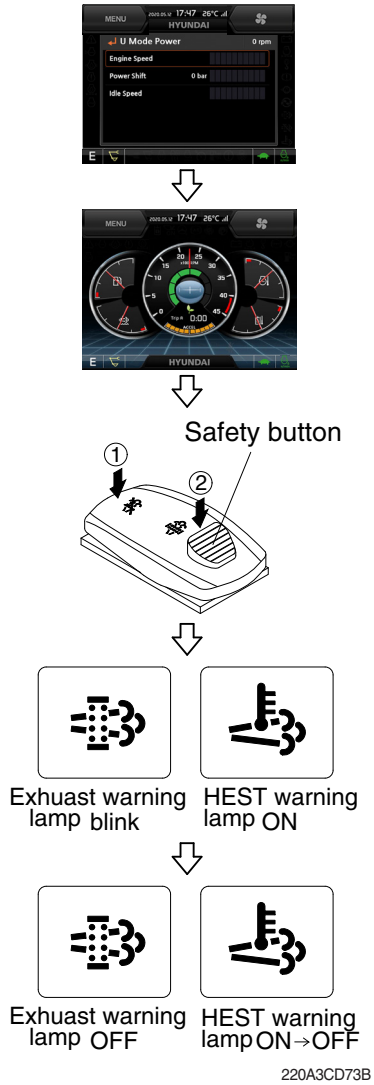


2609A3CD20

① This warning lamp indicates the exhaust system cleaning switch is pushed to the inhibit position, therefore automatic and manual exhaust system cleaning can not occur.

※ Refer to the operator's manual page 3-43 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.

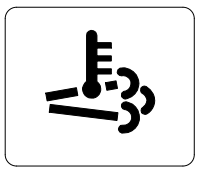
※ Refer to the operator's manual page 3-43 for the exhaust system cleaning switch operation.

※ 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



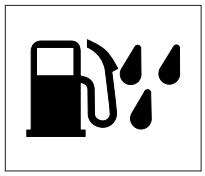
290F3CD257

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.**

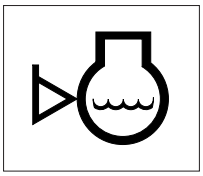
(16) Seat belt reminder warning lamp



300A3CD25

① When operator does not fasten the operator's the seat belt, the seat belt reminder warning lamp pops up and the buzzer
② sounds.
Fasten the seat belt.

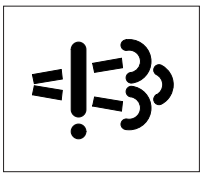
(17) Coolant level warning lamp



760F3CD58

① This warning lamp indicates lack of coolant.
② Check and refill coolant.

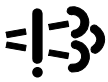
(18) Fail in SCR system warning lamp



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.

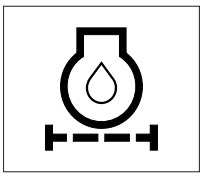
※ Please contact your HD Hyundai Construction Equipment service center or local dealer.

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) Eninge oil filter warning lamp

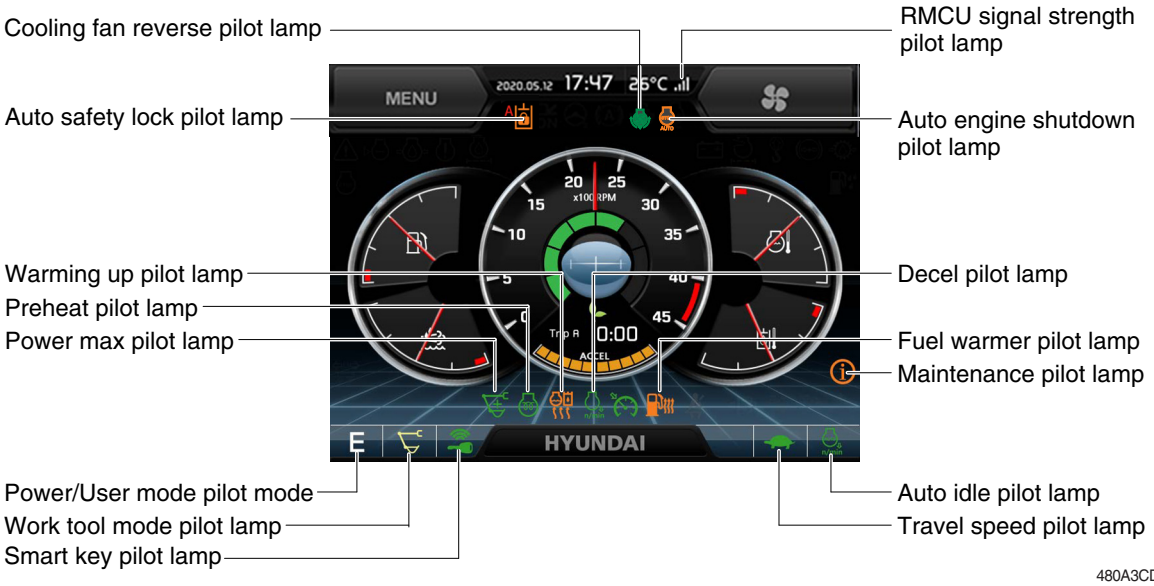


300A3CD306

① This warning lamp pops up and the buzzer sounds when the filter of eninge oil is clogged.

② Check, clean or replace filter.

6) PILOT LAMPS



480A3CD26

(1) Mode pilot lamps

No	Mode	Pilot lamp	Selected mode
1	Power mode	P	Heavy duty power work mode
		S	Standard power mode
		E	Economy power mode
2	User mode	U	User preferable power mode
3	Work tool mode		General operation - IPC speed mode
			General operation - IPC balance mode
			General operation - IPC efficiency mode
			Breaker operation mode
			Crusher operation mode
			Lifting mode
4	Travel mode		Low speed traveling
			High speed traveling
5	Auto idle mode		Auto idle

(2) Power max pilot lamp



300A3CD32

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

② The power max function operates for a max period of 8 seconds.

※ **Refer to the operator's manual page 3-46 for power max function.**

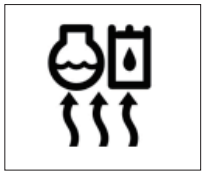
(3) Preheat pilot lamp



290F3CD79

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

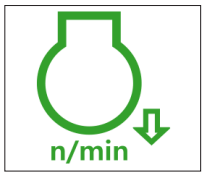
(4) Warming up pilot lamp



290F3CD80

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

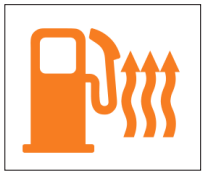
(5) Decel pilot lamp



300A3CD33

① Operating one touch decel switch on the RCV lever makes the lamp light up.
② Also, the lamp will light up and engine speed will be reduced automatically to save fuel when all levers and pedals are in the neutral position, and the auto idle function is selected.
※ **One touch decel is not available when the auto idle pilot lamp is turned ON.**
※ **Refer to the operator's manual page 3-46.**

(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 5-105.**

(8) RMCU signal strength pilot lamp (mobile only)



220A3CD200

① This lamp indicates RMCU signal strength as below.

: Searching

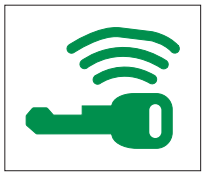
: Bad

: Normal

: Good

: Excellent

(9) Smart key pilot lamp (opt)



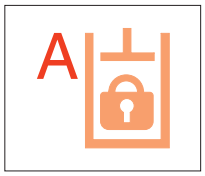
300A3CD36A

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 5-105.**

(10) Auto safety lock pilot lamp



300A3CD37A

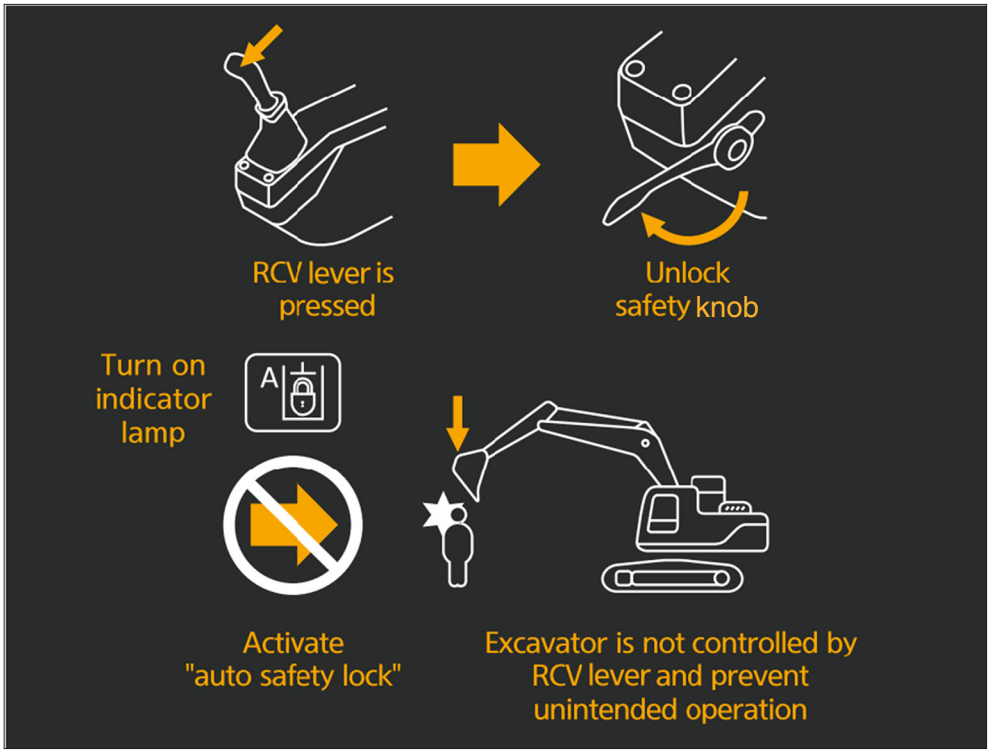
① Auto safety lock system prevents unintended operation of the machine in order to improve safety.

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 5-101.**

(12) Cooling fan reverse pilot lamp



480A3CD205

① This lamp lights up when the cooling fan reverse function is activated.

※ **Refer to page 5-101-1.**

(13) 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

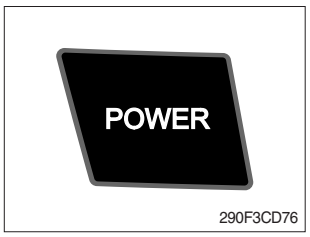
7) SWITCHES



300A3CD39A

※ **When some of the switches are selected, the pilot lamps are displayed on the LCD. Refer to page 5-90 for details.**

(1) Power mode switch

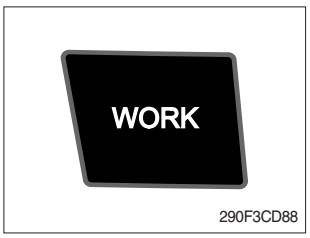


290F3CD76

① This switch is to select the machine power mode and when pressed, the power mode pilot lamp will be displayed on the section of the monitor.
- P : Heavy duty power work.
- S : Standard power work.
- E : Economy power work.

② The pilot lamp changes E → S → P → E in this order.

(2) Work mode switch



290F3CD88

① This switch is to select the machine work mode, which shifts from general operation mode to optional attachment operation mode.
- : General operation mode
- : Breaker operation mode (if equipped)
- : Crusher operation mode (if equipped)
- : Lifting mode
- Not installed : Breaker or crusher is not installed.

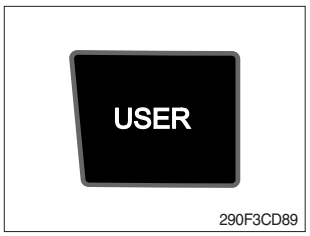
※ **Refer to the operator's manual page 2-7 for details.**



300A3CD168

② If you press this switch for a time (1 second), quick pop-up will appear. When you select an attachment from the popup, the operation mode will immediately switch to selected attachment.

(3) User mode switch



① This switch is used to select the user mode.
② Refer to page 5-99 for another set of the user mode.

(4) Travel speed switch



① This switch is used to select the travel speed alternatively.
- : Low speed
- : High speed

※ Do not change the setting of the travel speed switch while machine is moving. Machine stability may be adversely affected.

⚠ Serious injury or death can result from sudden changes in machine stability.

(5) Auto idle/ buzzer stop switch



① This switch is used to activate or cancel the auto idle function.
- Pilot lamp ON : Auto idle function is activated.
- Pilot lamp OFF : Auto idle function is cancelled.

② The buzzer sounds when the machine has a problem.
In this case, push this switch and buzzer stops, but the warning lamp blinks until the problem is cleared.

(6) Escape/Camera switch



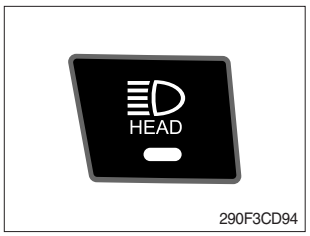
① This switch is used to return to the previous menu or parent menu.
② In the operation screen, pushing this switch will display the view of the camera on the machine (if equipped).
Please refer to page 5-112 for the camera.
③ If the camera is not installed, this switch is used only ESC function.

(7) Work light switch



① This switch is used to operate the work light.
② The pilot lamp lights up when this switch is pressed.

(8) Head light switch



① This switch is used to operate the head light.
② The pilot lamp lights up when this switch is pressed.

(9) Intermittent wiper switch



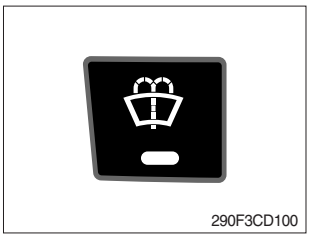
① When this switch is pressed, wipers operate intermittently.
② The pilot lamp lights up when this switch is pressed.

(10) Wiper switch



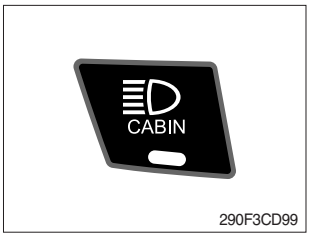
① This switch is used to operate the wiper.
② Note that the wiper will self-park when switched off.
③ The pilot lamp lights up when this switch is pressed.
△ **If the wiper does not operate with the switch in ON position, turn the switch OFF immediately. Check the cause. If the switch remains ON, motor failure can result.**

(11) Washer switch



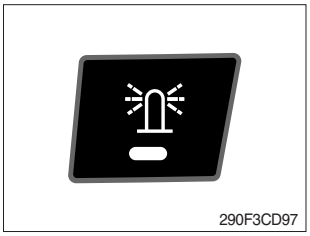
① Washer fluid is sprayed and the wiper is operated only when this switch is pressed.
② The pilot lamp lights up when this switch is pressed.

(12) Cab light switch



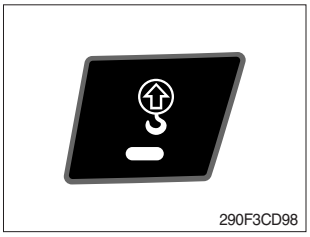
① This switch turns on the cab light.
② The pilot lamp lights up when this switch is pressed.

(13) Beacon switch (opt)



① This switch activates the rotary light on the cab.
② The pilot lamp lights up when this switch is pressed.

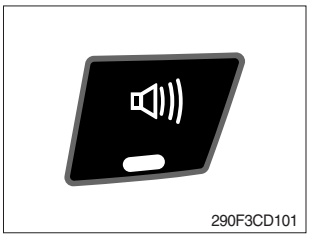
(14) Overload switch (opt)



① When this switch is activated, buzzer makes sound and overload warning lamp lights up in the event that the machine is or becomes in an overloaded situation.
② When the switch is inactivated, buzzer stops and warning lamp goes off.

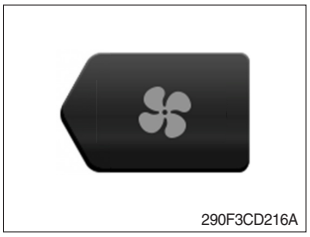
⚠ Overloading the machine could impact the machines stability which could result in tipover hazard. A tipover hazard could result in serious injury or death. Always activate the overload warning device before you handle or lift objects.

(15) Travel alarm switch



① This switch is to activate travel alarm function surrounding when the machine travels.
- ON : The travel alarm function is activated.
- OFF : The travel alarm function is not activated.

(16) Air conditioner quick touch switch



① This switch used to select air conditioner control mode.
※ Refer to page 5-114.

(17) Main menu quick touch switch



① This switch is to activate the main menu in the cluster.
※ Refer to page 5-97.

8) MAIN MENU

※ You can select or set the menu by the jog dial module or touch screen.
On the operation screen, tap MENU to access the main menu screen.
On the sub menu screen, you can tap the menu bar to access functions or applications.

· Operation screen



300A3CD40A

※ Please refer to the jog dial module, the operator's manual page 3-66 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 (null) Auto power boost IPC mode Auto engine shutdown Initial mode Cooling fan reverse 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 Auto, Manual 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

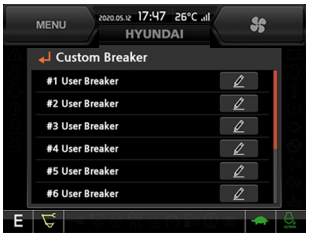
(2) Mode setup

① Work tool (Machine Serial No. HX480A L: -#0112, HX520A L: -#0180)



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. HX480A L: #0113-, HX520A L: #0181-)



300A3CD41A

A



300A3CD42A

B

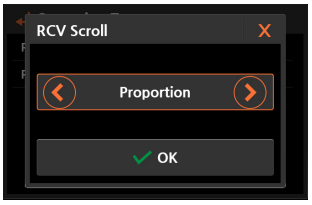


3003CD43B

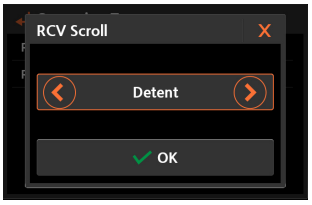
· Select installed optional attachment
- A : It can set the user's attachment.
  It is available in setting #1~#10.
- B : Max flow - Set the maximum flow for the attachment.
  Relief pressure - Set the relief pressure.
  Operation type - Set the operation type for attachment.



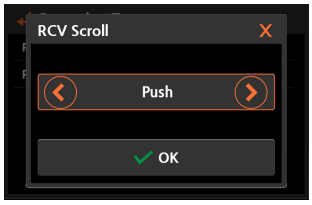
300A3CD651



140WA3CD652A



140WA3CD653A

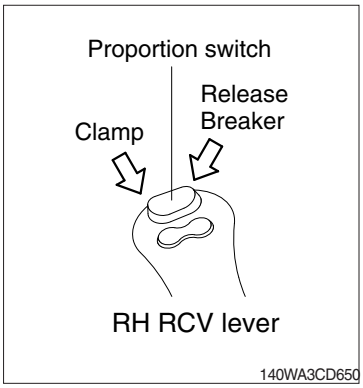


140WA3CD654A

■ Operation type

Operation type is used to set the operation of the proportion switch on the RCV lever if equipped proportional function.

- Push : Switch actuation will be deactivated when the proportion switch is released.
- Detent : Switch actuation will remain even if the proportion switch is released.
  To deactivate, move the switch in the same direction again or to the opposite direction.
- Proportion : Switch actuation is proportional to the movement of the proportion switch.

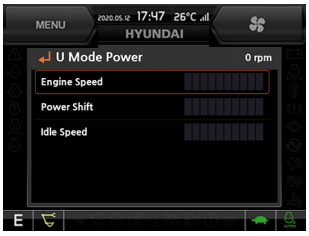


140WA3CD650

② U mode power



300A3CD44A



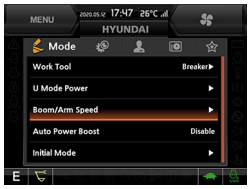
300A3CD45B

- Engine high idle rpm, auto idle rpm and pump torque (power shift) can be modulated and memorized separately in U-mode.
- U-mode can be activated by user mode switch.

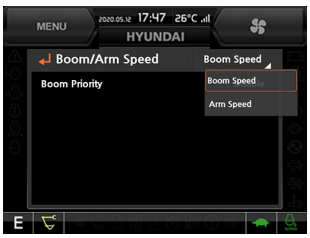
Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1300	750	0
2	1400	800	3
3	1500	850	6
4	1600	900	9
5	1650	950	12
6	1700	1000 (auto decel)	16
7	1750	1050	20
8	1800	1100	26
9	1850	1150	32
10	1900	1200	38

※One touch decel & low idle : 800 rpm

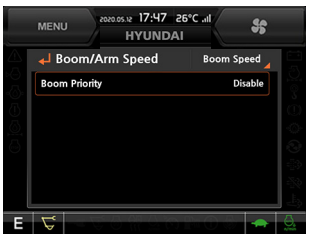
③ Boom/Arm speed (null)



300A3CD46A



300A3CD47A



300A3CD48A

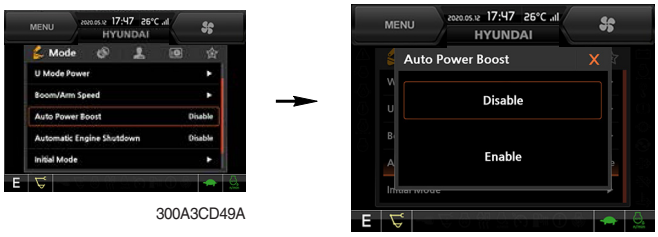
- **Boom speed**

  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 5-108.**

⑥ Automatic engine shutdown



300A3CD58A



300A3CD59A



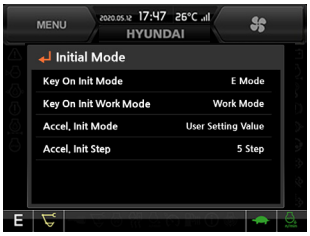
300A3CD60A

· 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 Cooling fan reverse mode

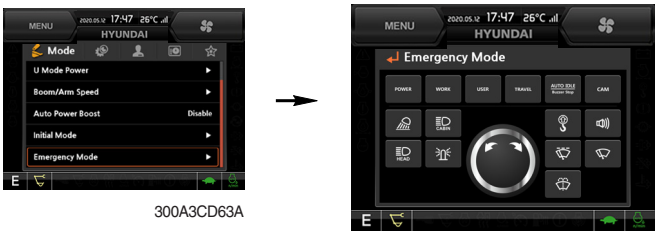


480A3CD314 480A3CD315 480A3CD316

· Automatic : Rotate the fan with reverse direction by preset cycle.
  - Interval : 30 minutes ~ 5 hours
  - Time : 30 seconds ~ 5 minutes
· Manual : Rotate the fan with reverse direction while pressing the Execute button.

※ Default : interval (60 minutes), time (120 seconds)

⑨ Emergency mode



300A3CD63A 300A3CD64A

· This mode can be used when the switches are abnormal on the cluster.
· The cluster switches can be selected by touching each icon.

(3) Monitoring

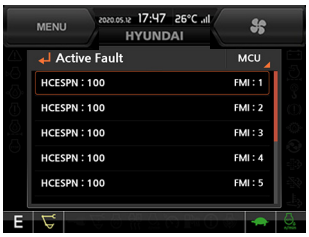
① Active fault



300A3CD65A



300A3CD66A



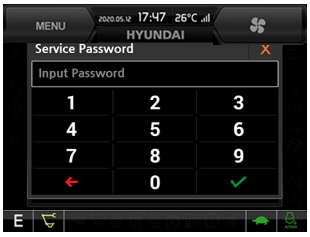
300A3CD67A

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

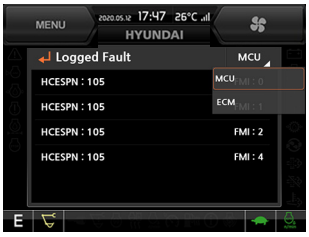
② Logged fault



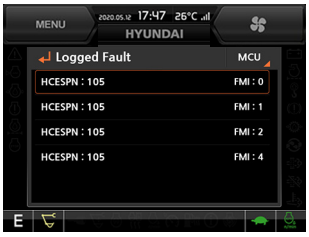
300A3CD68A



300A3CD72A



300A3CD69A



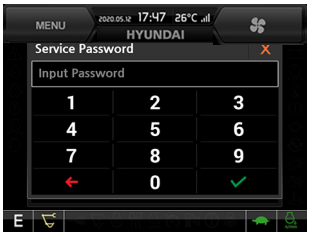
300A3CD70A

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

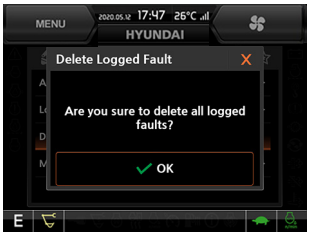
③ Delete logged fault



300A3CD71A



300A3CD72A



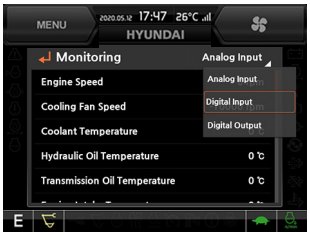
300A3CD73A

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

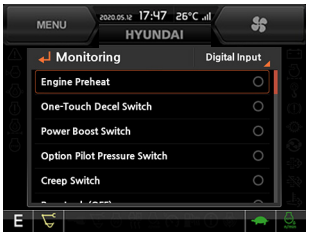
④ Monitoring



300A3CD74A



300A3CD75A



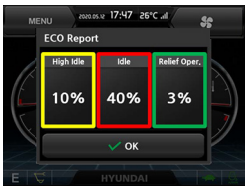
300A3CD76A

- The machine status such as the engine rpm, oil temperature, voltage and pressure etc. can be checked by this menu (Analog input).
- The switch status or output status can be confirmed by this menu (Digital input & Digital output).
- The activated switch or output pilot lamps ● will light up.

(4) Management

① ECO report

This reports the machine's inefficient operation status in order to improve operator's improper working habit.



300A3CD77A

High idle



300A3CD78A

- Shows a breakdown of high idle, idle and relief operation when monitor is on.
- Gives a daily usage breakdown record for a 7 day period and an overall accumulated record from the first operation.

Idle



300A3CD79A

Relief operation



300A3CD80A

② Fuel rate information



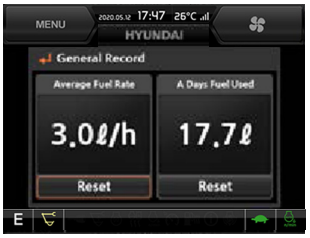
300A3CD81A



300A3CD82A

A

· **General record (A)**
  - Average fuel rate (left) (from "Reset" to now)
    Fuel consumption divided by engine run time (service meter time).
  - A days fuel used (right)
    Fuel consumption from 24:00 (or "Reset" time) to now (MCU real time).



300A3CD83A

B

· **Hourly record (B)**
  - Hourly fuel rates for past 12 hours (service meter time).
  - No record during key-off time.
  - One step shift to the right for every one hour.
  - Automatic deletion of data from 12 hours and earlier.
  - "Reset" deletes all hourly records.



300A3CD84A

C

· **Daily record (C)**
  - Daily fuel consumption for past seven days (MCU real time).
  - No record during key-off time.
  - One step shift to the right at 24:00 for every day.
  - Automatically deletes data from 7 days and earlier.
  - All daily records deletion by "Reset".



300A3CD85A

D

· **Mode record (D)**
  - Average fuel rate for each power mode/accel dial (at least 7) from "Reset" till present.
  - No record during idle.
  - All records can be deleted by "Reset".

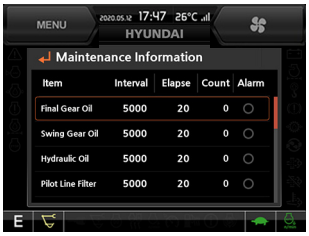


300A3CD86A

③ Maintenance information



300A3CD87A



300A3CD88A



300A3CD89A

- Alarm lamp (●) is ON when oil or filter needs to be changed or replaced.
- Replacement : The elapsed time will be reset to zero (0).
- Change interval : The change intervals can be changed in hour increments of 50.

※ **Refer to section, Maintenance chart for further information of maintenance interval.**

④ Machine security



300A3CD90A



300A3CD91A



300A3CD92A

· **ESL mode setting**

- ESL : Engine Starting Limit
- ESL mode is desingned to be a theft deterrent or will prevent the unauthorized operation of the machine.
- When you Enable the ESL mode, the password will be required when the starting switch is turned to the on position.
- **Machine security**

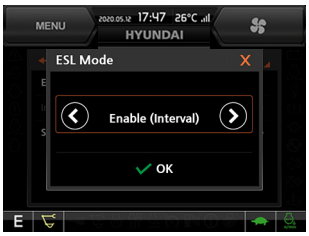
  Disable : ESL function is disabled and password is not required to start engine.

  Enable (always) : The password is required whenever the operator starts engine.
- **Interval** : The password is required when the operator starts engine first. But the operator can restart the engine within the interval time without inputting the password. The interval time can be set to a maximum 4 hours.

※**Default password : 00000 +** ✔

※**Password length : (5~10 digits) +** ✔

- **Smart key** (option) : Refer to next page.



300A3CD93A



300A3CD94A

· **Password change**

- The password is 5~10 digits.



300A3CD95A



300A3CD96A



300A3CD91A

Enter the current password



300A3CD99A

Enter the new password



300A3CD98A

Enter the new password again

※ **Before first use, please set user password and owner password in advance for machine security.**

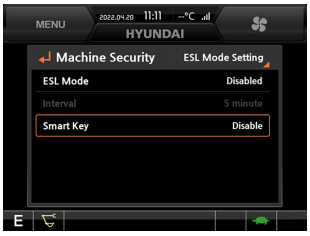
- Smart key



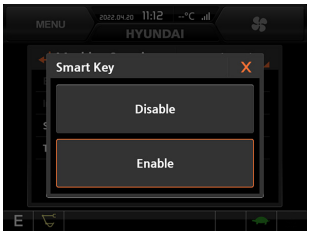
300A3CD90A



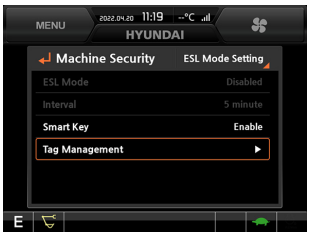
300A3CD91A



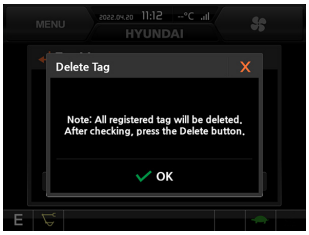
300A3CD001



300A3CD002

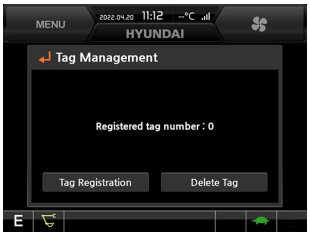


300A3CD003



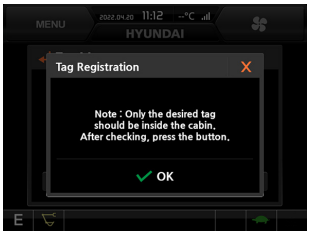
300A3CD006

Deleting



300A3CD004

Registering



300A3CD005

· Smart key is registered when equipped with optional smart key. If smart key is not inside of the cabin, authentication process fails and the password is needed.

· Tag management menu is activated when the Smart key menu is Enabled.
You can register and delete the tags.

- Tag management

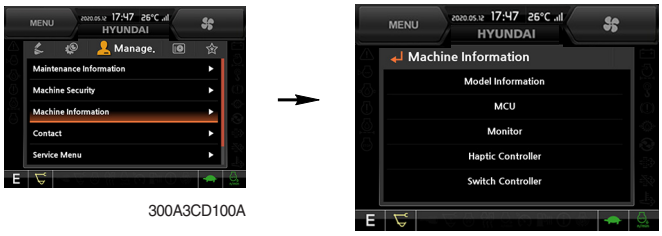
· When registering a tag : Only the tag you want to register must be in the cabin.

· When deleting a tag : All registered tags are deleted.

※ Engine Starting Condition

Case	ESL Mode	Smart Key	Condition
1	Disable	Disable	- With registered tag : Engine can be started without password input. - Without registered tag : Engine can be started without password input.
2	Disable	Enable	If Smart Key is enabled, ESL Mode is automatically enabled. This Case 2 work the same as the Case 4.
3	Enable	Disable	- With registered tag : Engine can be started with password input. - Without registered tag : Engine can be started with password input.
4	Enable	Enable	- With registered tag : Engine can be started without password input. - Without registered tag : Engine can be started with password input.

⑤ Machine Information



300A3CD100A

300A3CD101A

· This can confirm the identification of the model information (ECU), MCU, monitor, jog dial module, switch controller, RMCU, relay driver unit, FATC (air conditioner controller), AAVM (opt).

⑥ Contact (A/S phone number)



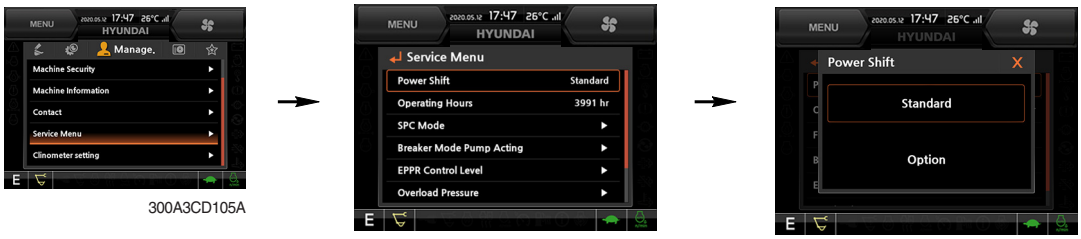
300A3CD102A

300A3CD103A

300A3CD104A

Enter the new A/S phone number

⑦ Service menu



300A3CD105A

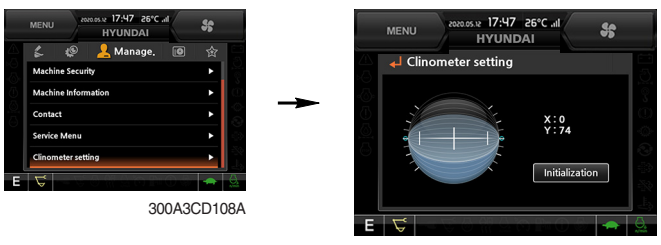
300A3CD106A

300A3CD107A

※ This menu can be used only HCE service man and can not be accessible by the owner and the operator.

· Power shift (standard / option) : Power shift pressure can be set by option menu.
· Operating hours : Operating hours since the machine line out can be checked by this menu.
· Breaker mode pump acting (1 pump / 2 pump)
· EPPR current level (attach flow EPPR 1 & 2, 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

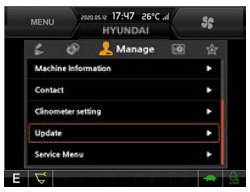


300A3CD108A

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.

⑧ Update (cluster & ETC devices)



300A3CD110A



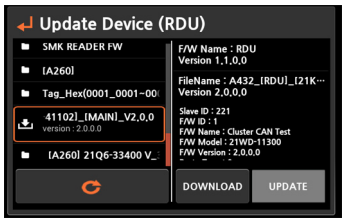
300A3CD111A



300A3CD112A



300A3CD114A



380F3CD06

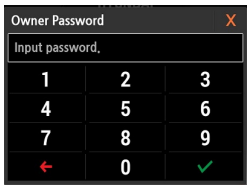
- ETC devices and cluster can be updated through CAN 2 network.
- Insert USB memory stick which includes program files, start download.

⑨ OME (owner menu editing)

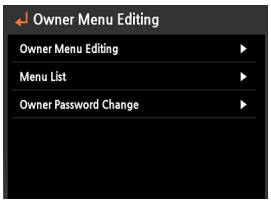
The owner of machine can restrict operator access to set functions.



300A3CD115A



300A3CD115B



300A3CD115C

- **Owner can set the status of the function.**
  - Enable
  - Disable
- **In the menu, owner can set the list of functions in which they would like to lock or leave unlocked.**
- **Owner password (default password : 11111)**
  - Owner can manage and change the password.
  - Necessary to input the password to access function menu.



300A3CD116A



300A3CD117A



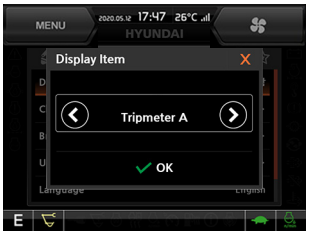
300A3CD118A

(5) Display

① Display item



300A3CD119A



300A3CD120A



300A3CD121A

- The center display type of the LCD can be selected by this menu.
- The engine speed or the tripmeter menu (A,B,C) is displayed on the center display.

② Clock



300A3CD122A



300A3CD123A

- The first row of boxes indicate Year/Month/Day.
- The second row shows the current time. (0:00~23:59)

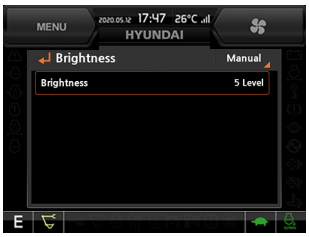
③ Brightness



300A3CD124A



300A3CD125A



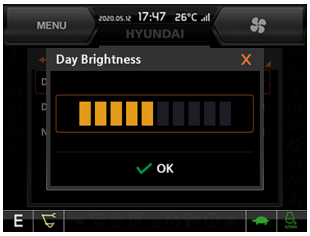
300A3CD126A



300A3CD127A



300A3CD128A



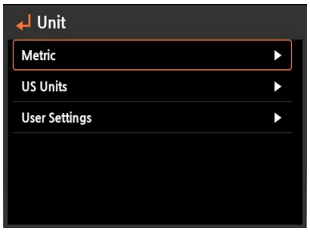
300A3CD129A

· If "Auto" is chosen, brightness for day and night can be set accordingly. Also by using the bar in lower side, users can define which an operation interval belongs to day and night. (in bar figure, white area represents night time while orange shows day time)

④ Unit



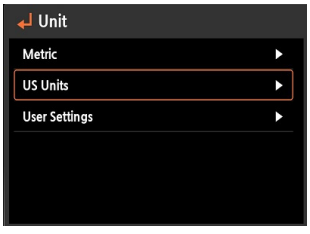
300A3CD130A



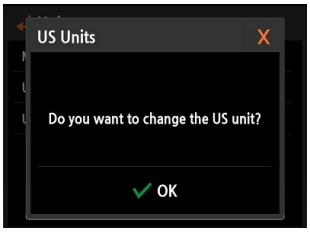
300A3CD130B



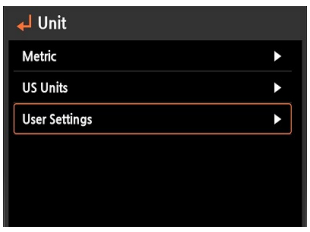
300A3CD130C



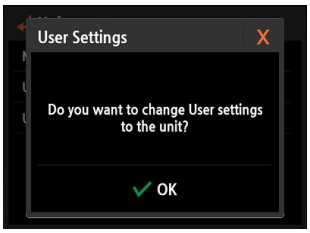
300A3CD130D



300A3CD130E



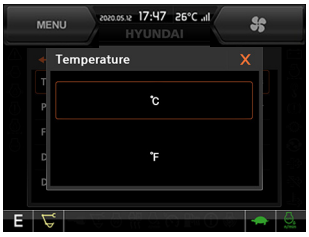
300A3CD130F



300A3CD130G



300A3CD131A



300A3CD132A

- Temperature : ˚C ↔ ˚F
- Pressure : bar ↔ MPa ↔ kgf/cm²
- Volume : ℓ ↔ gal
- Flow : lpm ↔ gpm
- Distance : km ↔ mile
- Date format : yy/mm/dd ↔ mm/dd/yy ↔ dd-mm-yy

⑤ Language



300A3CD133A



300A3CD134A

- User can select preferable language and all displays are changed to the selected language.

(6) Utilities

① Tripmeter



300A3CD143A



300A3CD144A

- A maximum of 3 types of tripmeters can be used at the same time.
- Each tripmeter can be turned on by choosing "Start". It can be turned off by choosing "Stop".
- If the tripmeter icon is activated in the operation screen, it can be controlled directly in this screen.

② Camera setting

- If the rear camera is not installed on the machine, set disable.
- If the rear camera is installed on the machine, set enable.



300A3CD145A



300A3CD146B



300A3CD147A

- Auto Mode (Travel) : Enable
  The cluster will automatically show camera view while machine is traveling.
- In the operation screen, rear camera screen shows up when ESC/CAM switch is pushed.



300A3CD97A





290F3CD221

③ Auto idle time setting



300A3CD166



300A3CD167

- The auto idle time is can be set by this menu.
- Time : 3~30 seconds

④ **AAVM** (Advanced Around View Monitoring, option)

· The AAVM switchs of the cluster consist of ESC/CAM and AUTO IDLE/Buzzer stop.



300A3CD149A

- **Escape switch**

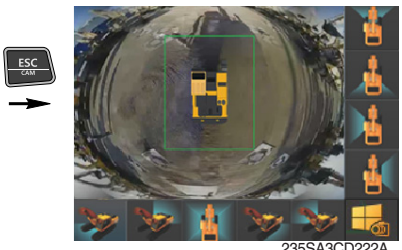
· Activates AAVM mode from the beginning if AAVM is installed.

· While in the AAVM mode, select the ESC switch to return to the home screen.



300A3CD97A

Home screen



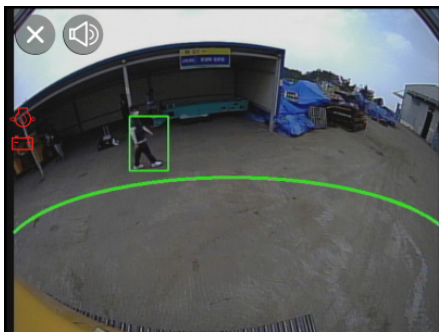
235SA3CD222A

AAVM mode

- **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 (radius 5 m / 16 ft), 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 (radius 3 m / 10 ft), 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.

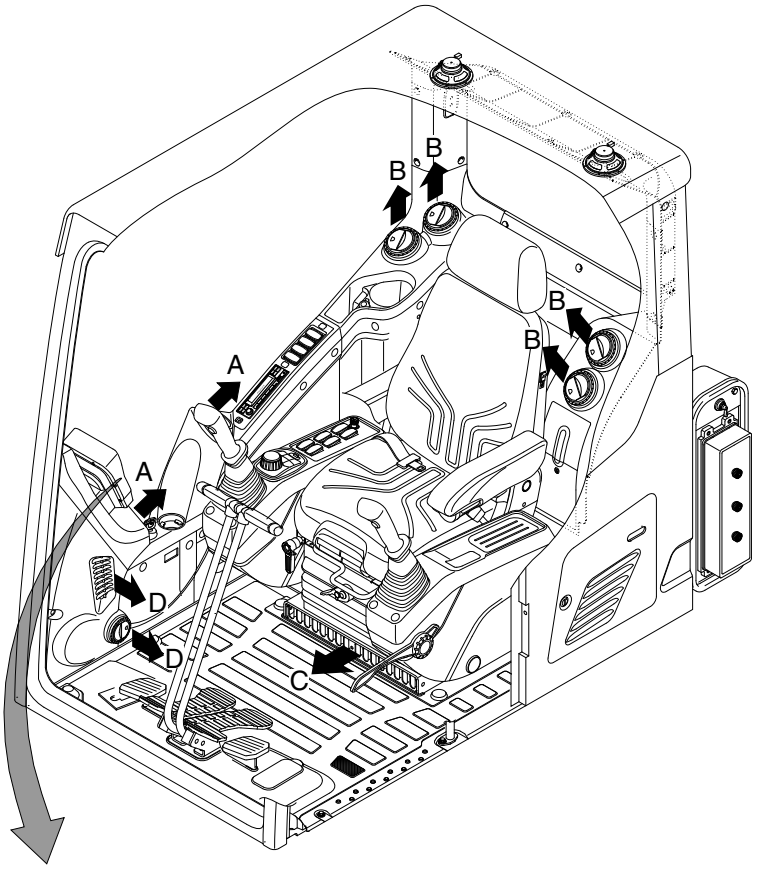
⚠ **Failure to comply may result in serious injury or death.**

※ **In AAVM mode, a touch screen of the LCD is available only. The multimodal dial of the jog dial module is not available.**

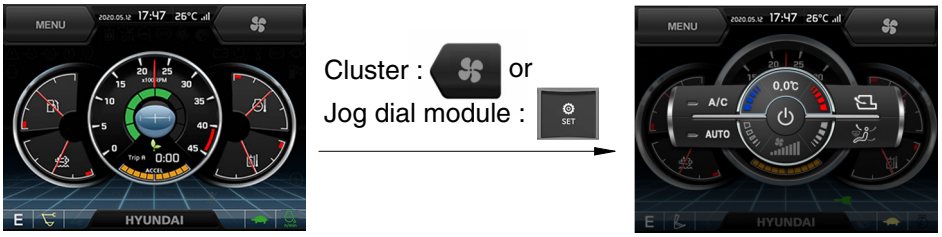
9) AIR CONDITIONER AND HEATER

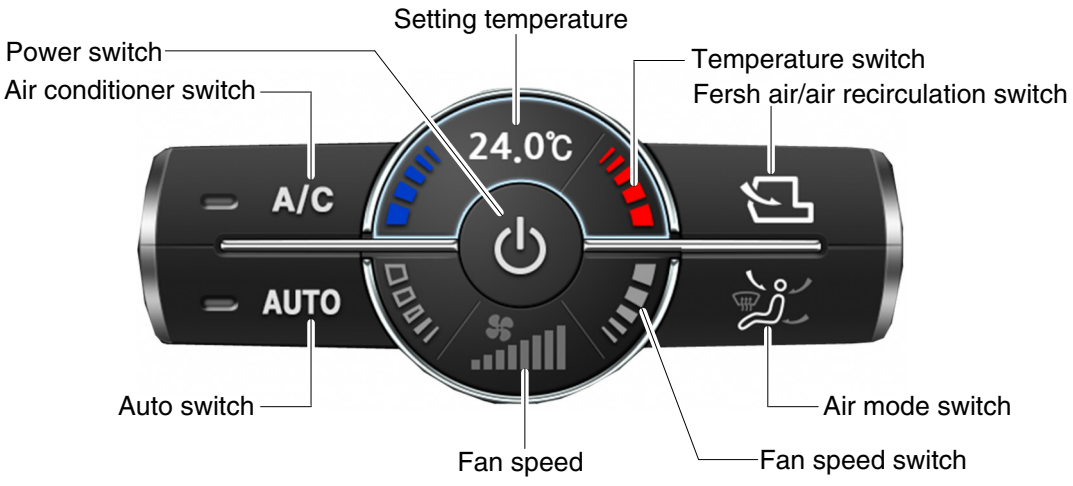
Full auto air conditioner and heater system automatically keeps the optimum condition in accordance with operator's temperature configuration, sensing ambient and cabin inside temperature.

· **Location of air flow ducts**



Cluster LCD

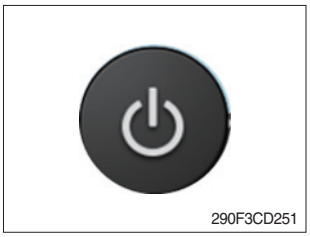




380A3CD21B

※ **Jog dial module : Refer to the the operator's manual page 3-66.**

(1) Power switch



① This switch turns the system ON and OFF.
Just before powering OFF, set values are stored.
② Default setting values

Function	Air conditioner	In/outlet	LCD	Temperature	Mode
Value	OFF	Inlet	OFF	Previous sw OFF	Previous sw OFF

(2) Air conditioner switch



① This switch turns the compressor ON/OFF.
※ Air conditioner operates to remove vapor and drains water through a drain hose. Water can be sprayed into the cab in case that the drain cock at the ending point of drain hose has a problem.
In this case, exchange the drain cock.

(3) Auto switch



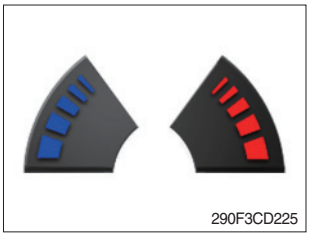
① Auto air conditioner and heater system automatically keeps the optimum condition in accordance with operator's temperature configuration sensing ambient and cabin inside temperature.

(4) Setting temperature



① Displays the temperature setting.

(5) Temperature switch

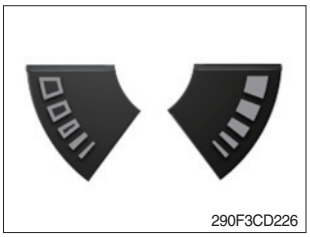


① Setting temperature indication
· Lo (17˚C), 17.5~31.5˚C, Hi (32˚C)
② Max cool and max warm beeps 5 times.
③ The max cool or the max warm position operates per the following table.

Temperature	Compressor	Fan speed	In/outlet	Mode
Max cool	ON	Hi (8 step)	Recirculation	Face
Max warm	OFF	Hi (7 step)	Fresh	Def/Foot

④ Temperature unit can be changed between celsius (˚C) and fahrenheit (˚F)
a. Default status (˚C)
b. The temperature unit can be changed (℃ ↔ ℉) by pressing temperature switchs (Up/Down) simultaneously for more than 5 seconds.

(6) Fan speed switch



① Fan speed is controlled automatically by set temperature.
② This switch controls fan speed manually.
- There are 8 up/down steps to control fan speed.
- The maximum step or the minimum step beeps 5 times.

(7) Fan speed



① Steps 1 through 8 to display the amount of air being circulated.

(8) Fresh air/air recirculation switch



① It is possible to change the air-inlet method.
a. **Fresh air ( )**
Inhaling air from the outside.
b. **Air recirculation ( )**
It recycles the heated or cooled air to increase the energy efficiency.
※ **Change air occasionally when using recirculation for a long periods of time.**
※ **Check condition of fresh air filter and recirculation filter periodically to maintain good efficiency of the system.**

(9) Air mode switch



① Operating this switch, it beeps and displays symbol of each mode in the following order. (Face → Face/Rear → Face/Rear/Foot → Foot → Def/Foot)

Mode switch		Face	Face/Rear	Face/Rear/Foot	Foot	Def/Foot
Outlet	A	●	●	●		
	B		●	●		
	C			●	●	●
	D					●

② When operating defroste, FRESH AIR/AIR RECIRCULATION switch turns to FRESH AIR mode and air conditioner switch turns ON.

(10) Self Diagnosis Function

① Diagnostic methods : Diagnostic information window, select

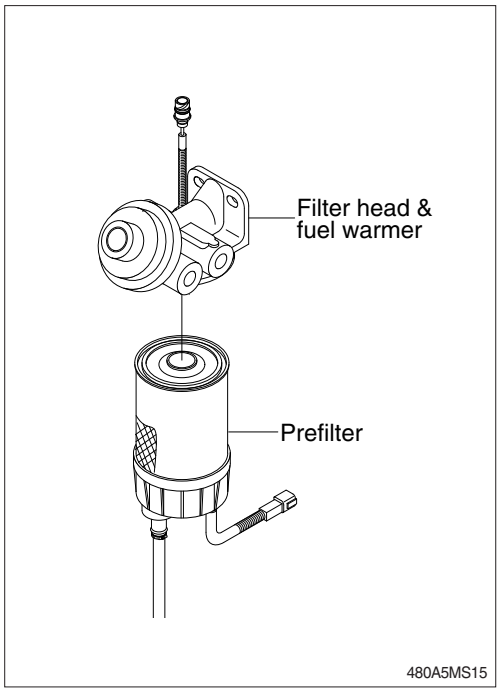
② Diagnostic indication (Displays fault)

Fault code	Description	Fail safe function
F01	Ambient temperature sensor open	20˚C alternate value control
F02	Ambient temperature sensor short	
F03	Cab inside temperature sensor open	25˚C alternate value control
F04	Cab inside temperature sensor short	
F05	Evaporate temperature sensor open	0˚C alternate value control
F06	Evaporate temperature sensor short	
F07	Null	-
F08	Null	-
F09	Mode 1 actuator open/short	The alternate value is face
F10	Mode 1 actuator drive circuit malfunction	If not, the alternate value is Def/Foot
F11	Intake actuator open/short	The alternate value is air recirculation
F12	Intake actuator drive circuit malfunction	The alternate fresh air
F13	Temperature actuator open/short	If opening amount is 0 %, the alternate value is 0 %
F14	Temperature actuator drive circuit malfunction	If not, the alternate value is 100 %
F15	Null	-
F16	Null	-

GROUP 17 FUEL WARMER SYSTEM

1. SPECIFICATION

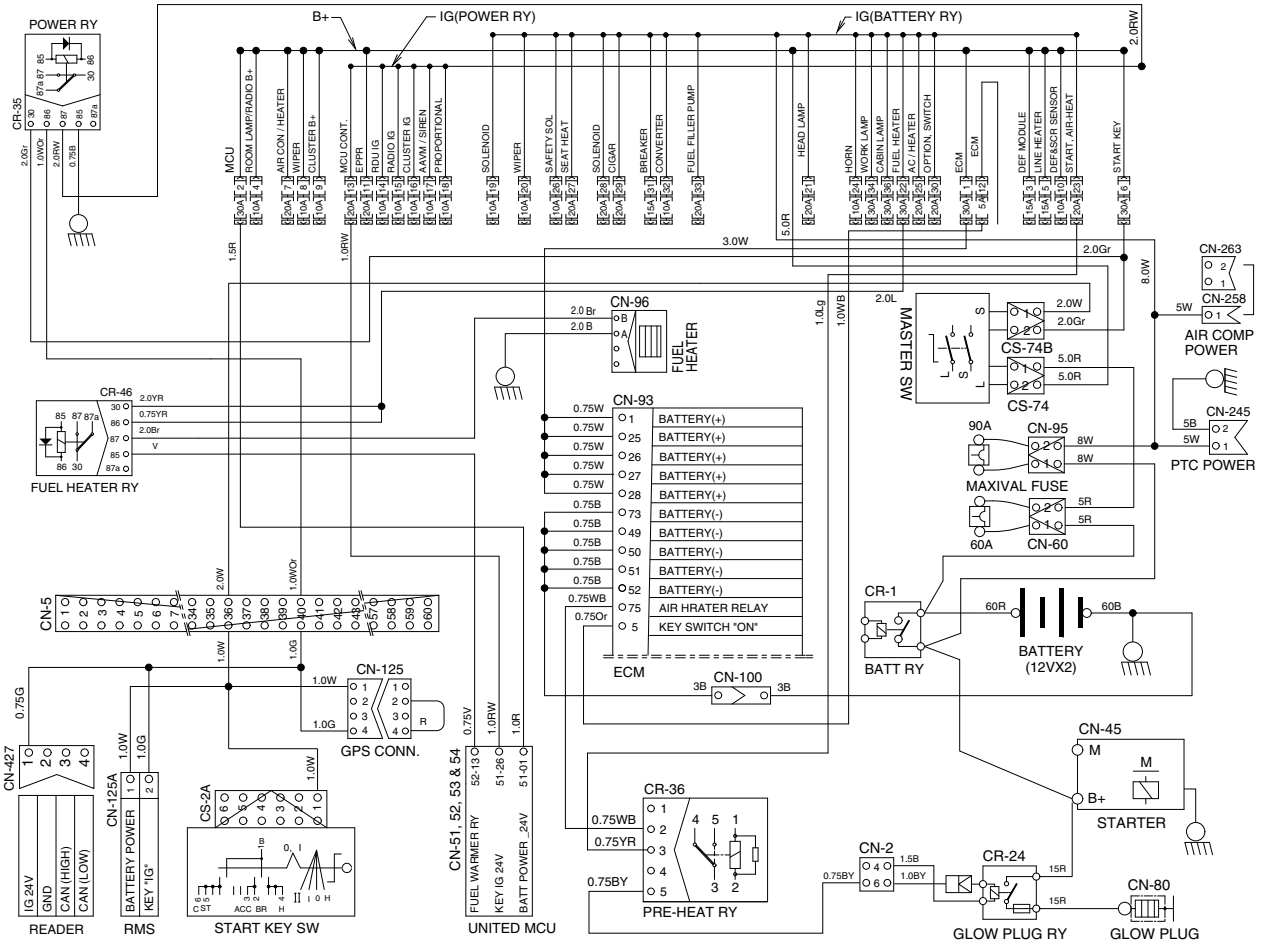
1) Operating voltage : 24±4 V
2) Power : 350±50 W
3) Current : 15 A



2. OPERATION

1) The current of fuel warmer system is automatically controlled without thermostat according to fuel temperature.
2) At the first state, the 15 A current flows to the fuel warmer and engine may be started in 1~2 minutes.
3) If the fuel starts to flow, ceramic-disk in the fuel warmer heater senses the fuel temperature to reduce the current as low as 1.5 A.
   So, fuel is protected from overheating by this mechanism.

3. ELECTRIC CIRCUIT



480A5MS16

GROUP 18 1 or 2-WAY OPTIONAL PIPING PRESSURE REMOVAL SYSTEM

1. OUTLINE

This system can be removed the residual pressure of the optional attachment hydraulic piping when the quick coupler is operated by the switch of the RCV lever and then the oil quick function of the optional attachment is performed.

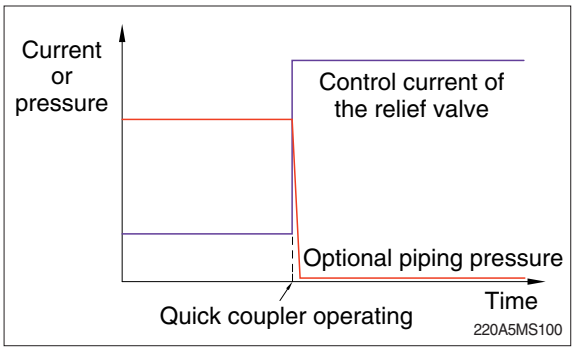
※ Oil quick function

In a convention work, the optional attachments such as breaker or grab are installed on the machine and needed to connect hydraulic piping additionally.

But currently, the hydraulic piping connection is not needed by the work man. The attachment is installed on the machine and the hydraulic pipings are connected by a coupler that is built in the quick coupler automatically and the attachment can be ready to operate immediately. This is called the oil quick function.

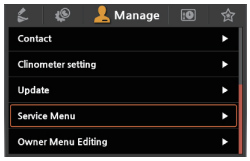
2. OPERATING PRINCIPLE

This is operated by controlling the setting pressure of the electric type relief valve when you operate the quick coupler with the switch of the RCV lever.

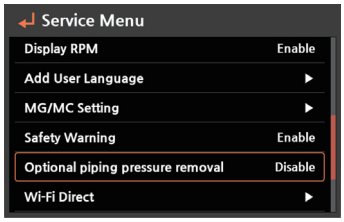


220A5MS100

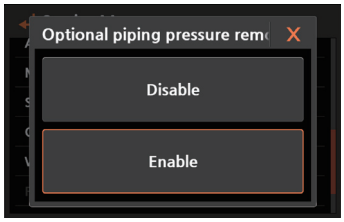
3. SETTING METHOD



220A5MS101

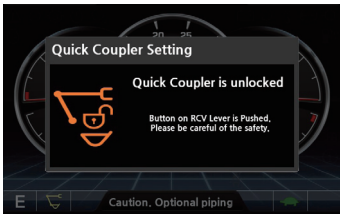


220A5MS102



220A5MS103

1) Optional piping pressure removal is set to Disable in the factory.
2) Optional piping pressure removal is set to Enable then the oil quick function is operated. Also, the caution letter is display on the lower side of the cluster.
3) The setting condition is saved even if shut the engine off.



220A5MS104

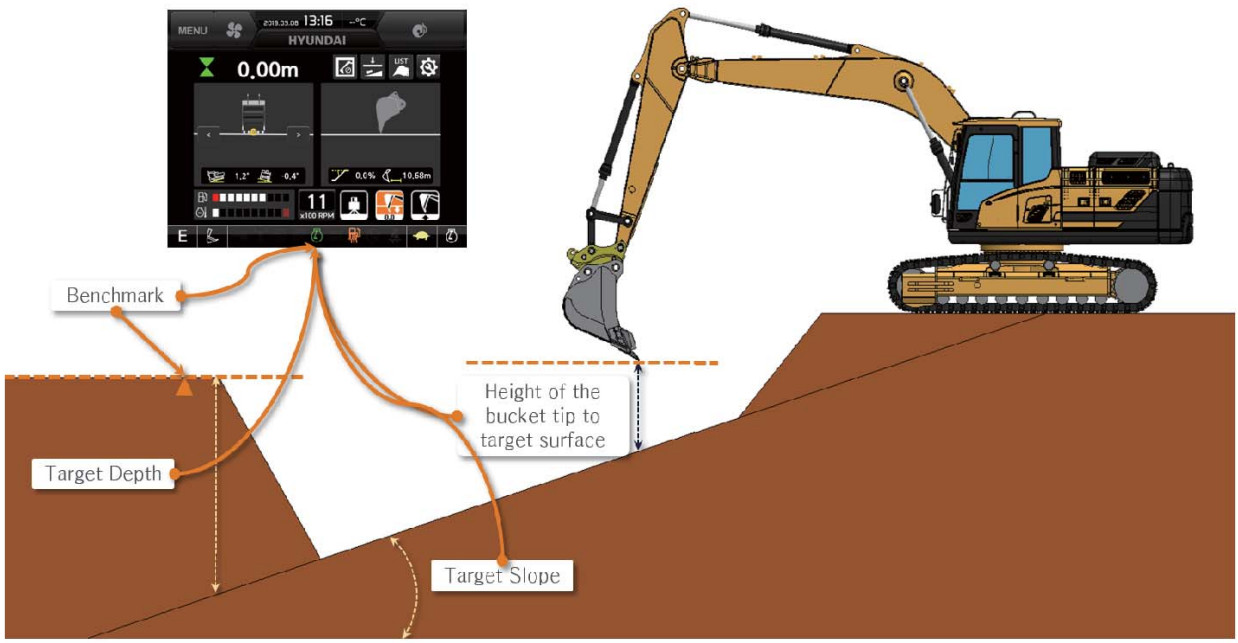
4. CAUTION

1) When the oil quick function is used, the hydraulic drift and etc can be occurred as the modified equipment specification.
2) The status of the cluster must be changed by a manager that is well-acquainted with the function and the operator must be well-informed of the oil quick function and safety work.

GROUP 19 2DMG+ SYSTEM

1. FUNCTION DEFINITION

HD Hyundai Construction Equipment 2DMG+ is a function that calculates the position of the tip of the bucket and transmits distance information to the target surface to the operator in the form of visual indicators and audible alarms through the cluster.



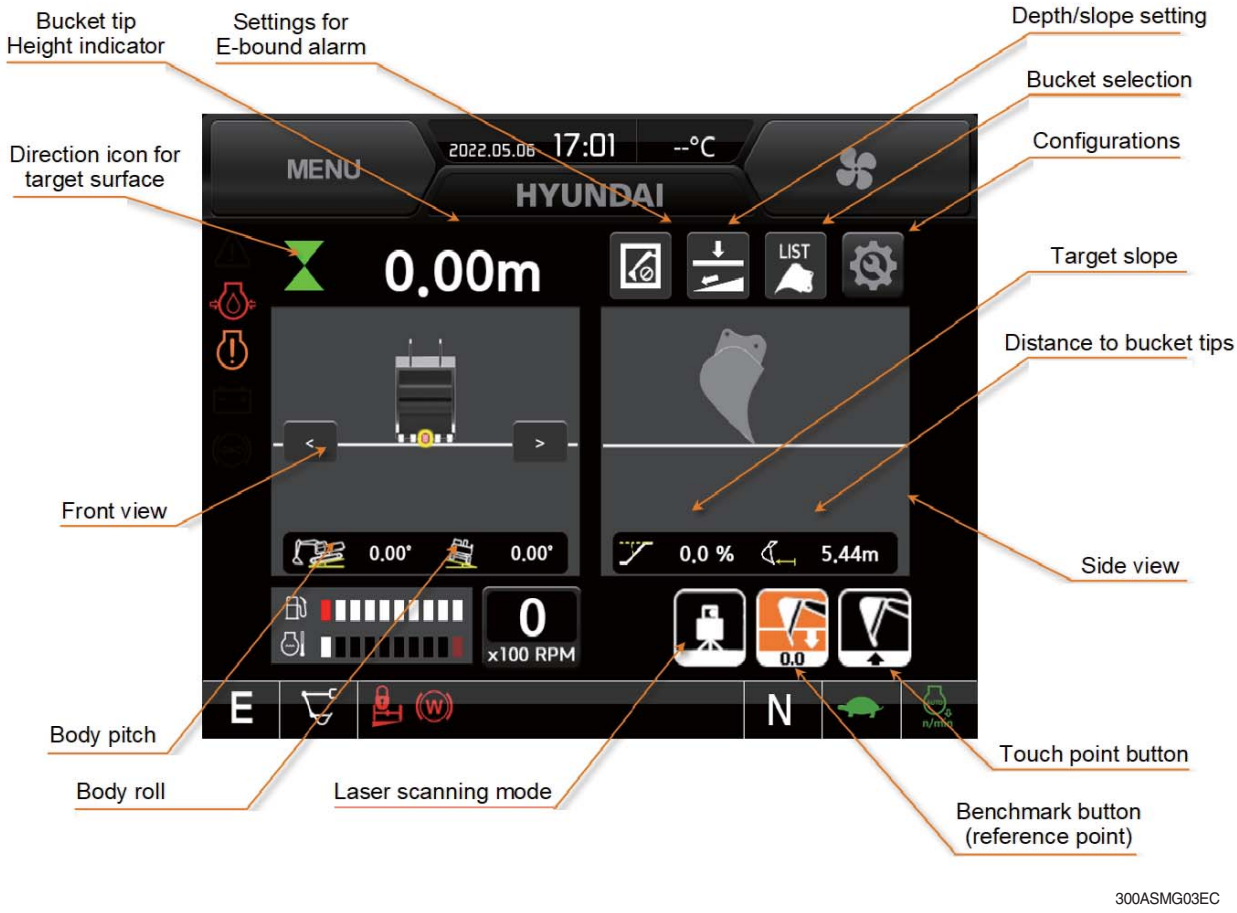
300ASMG01EC

2. SYSTEM LAYOUT



300ASMG02EC

3. 2DMG+ Main Screen



300ASMG03EC

4. 2DMG+ PROBLEM TYPE

No.	Problem	Cause and remedy	Remark
1	Action when the "Sensor failure" message is output	1. Check whether the angle sensor harness is damaged or loosened.	
		2. Check whether the angle sensor function abnormality	
		3. Check whether the CAN gateway function abnormality	
		4. Check whether the CAN termination resistor is damaged	
2	Action when the bucket end height measurement accuracy is abnormal	1. Data error due to internal damage of the angle sensor	
		2. Check current selected bucket	Corresponds to inexperience in user operation
		3. Check compliance with the vertical posture when entering bucket dimensions.	
		4. Check bucket dimensions	
		5. Check design surface (depth/slope) information	
		6. Check compliance with reference point movement procedures	
		7. Enter 2DMG+ setting value after replacing MCU	This needs to be checked in case of MCU or cluster replacement
3	Can not enter MG menu	1. 2DMG+ function not set after cluster replacement	

1) ACTION WHEN THE "SENSOR FAILURE" MESSAGE IS OUTPUT

(1) Check whether the angle sensor harness is damaged or loosened.

① Enter the cluster's 'Current Fault' menu.

a. From the cluster main menu, go through the following path.

b. Monitoring → Active fault

c. If all sensors are defective, refer to ⑤-b Short circuit test (page 5-117) or (3) CAN gateway function error (page 5-119).

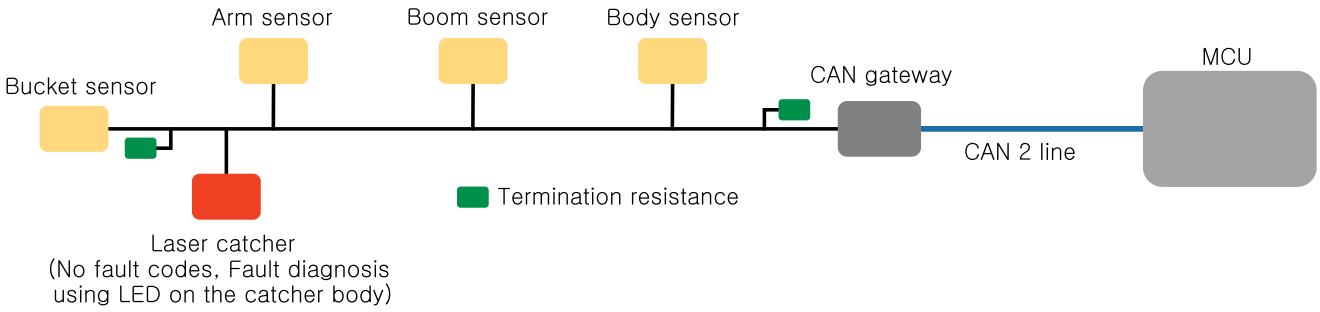


300ASMG10EC

② Check faulty sensors.

No.	Fault code	Fault sensor
1	HCESPN 900	Bucket sensor
2	HCESPN 901	Arm sensor
3	HCESPN 902	Boom sensor
4	HCESPN 903	Body sensor

③ Sensor connection configuration



300ASMG11EC

④ Check the connector of fault sensor is loosened.

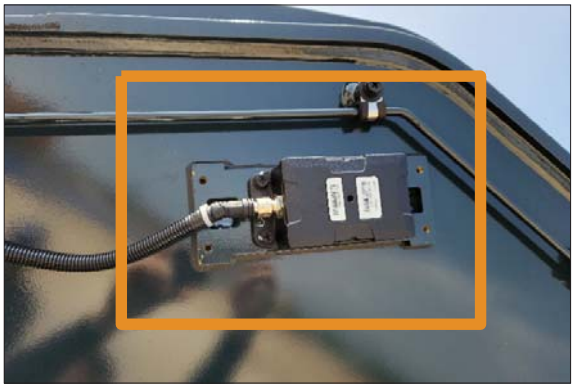
※ When checking the loosened part, re-perform 2DMG+ after tightening

a. Bucket sensor



300ASMG12K

b. Arm sensor



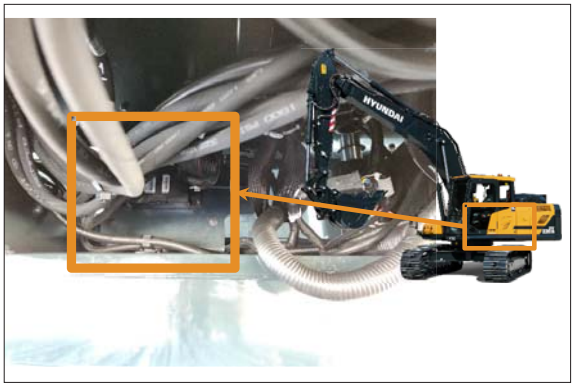
300ASMG13K

c. Boom sensor



300ASMG14K

d. Body sensor

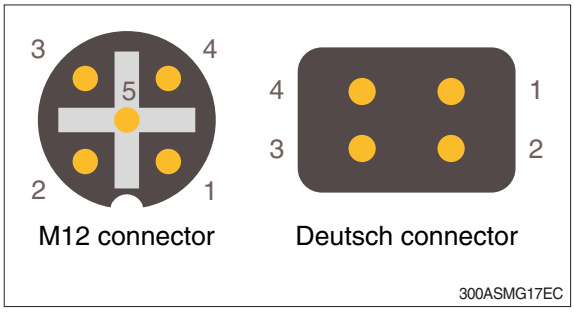


300ASMG15K

⑤ If the connector is not loosened, remove the harness and check for damage.

a. Harness connector pin map (required to check pin number)

Signal	Pin number	
	M12 connector	Deutsch connector
CAN shield	1	-
Vcc : 24V	2	1
GND	3	2
CAN High	4	3
CAN Low	5	4



b. Check for damage using a multimeter.

- Conduct an energization test for each pin between both ends of the harness connector.

- Perform a short circuit test between each pin of the connector.

※ In the case of short circuit, it may occur intermittently due to changes in the posture of the attachment, so short circuit tests are required for various postures.

※ If damage to the harness is confirmed, replace the harness.

(2) Check whether the angle sensor function abnormality.

① Test the operation of the angle sensor.

a. After disconnecting the connector of the laser catcher (other sensors such as boom, arm, bucket, etc. are also possible), install the angle sensor that occurred the fault code instead and check whether the signal is received.

b. If a signal is received, it can be judged to be a problem with the harness connected to the sensor.

c. If the signal is not received, it can be judged as a failure of the sensor itself.

※ After removing the laser catcher cable, perform a mounting test for the sensor that occurred the fault code.



(3) Check whether the can gateway function abnormality.

① Check CAN data of attachment sensor line.

a. Disconnect the Deutsch 4-pin connector near the laser catcher and connect a CAN data collector (PCAN, CANoe, etc.)

b. Check whether the CAN ID data in the table below is being output.

c. If it is output at a period of 20 ms, suspect a malfunction of the CAN gateway itself.



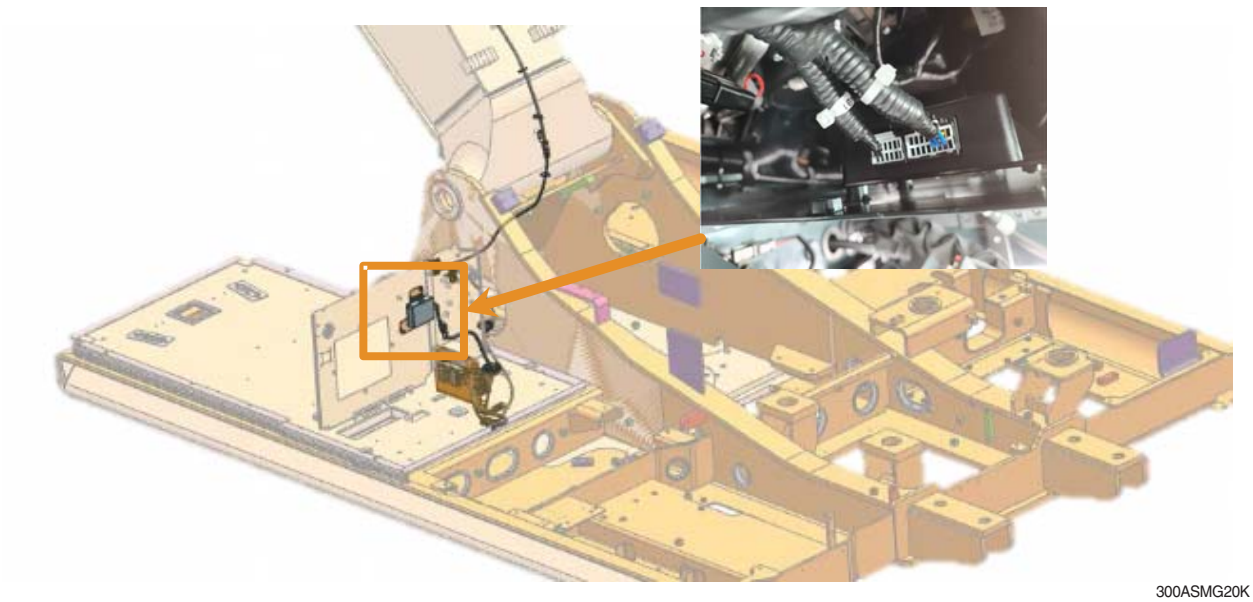
300ASMG19EC

※ CAN ID matching information for each sensor

Sensor	CAN ID
Boom sensor	0x18F029C1
Arm sensor	0x18F029C2
Bucket sensor	0x18F029C3
Body sensor	0x18F029C4

② Mounting location of CAN gateway

It is located near the RMCU at the bottom behind the seat in the cab.



300ASMG20K

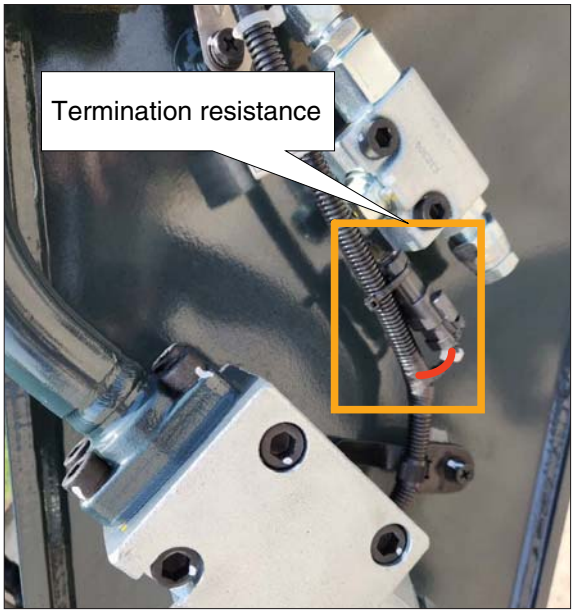
(4) Check whether the can termination resistor is damaged.

① Check whether the termination resistance of the attachment sensor line is normal.

a. If an error occurs in the termination resistance, the CAN line of the attachment will not function properly.

b. After disconnecting the termination resistor, measure the resistance at both ends of the internal pin and check whether a 60 Ω resistance value is output.

c. If the resistance value is normal, check whether the connector branch line indicated in red in the right picture is damaged.



300ASMG21EC

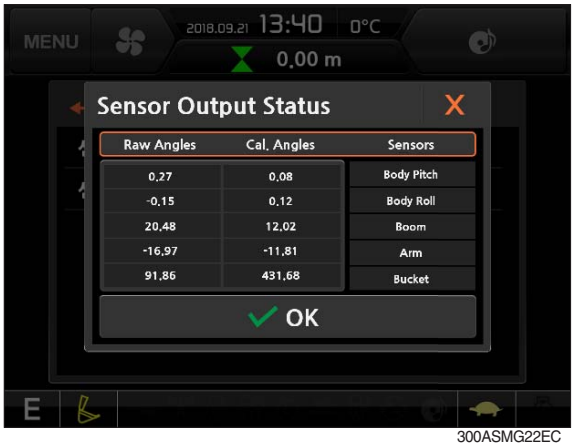
2) ACTION WHEN THE BUCKET END HEIGHT MEASUREMENT ACCURACY IS ABNORMAL

(1) Data error due to internal damage of the angle sensor

① Enter cluster 'Sensor Output Status' menu.

a. From the cluster main menu, go through the following path.

b. Management → Service menu → MG/MC Function set → MG/MC Default set → Monitoring → Sensor Output Status



300ASMG22EC

② Check operation of boom sensor.

a. After adjusting the boom so that the boom 'compensation angle' data is near 0 degrees, check whether the boom remains parallel to the ground as shown in the right picture.

b. Repeat boom up and down operation to check if the 'compensation angle' data of the boom, arm, and bucket changes. (The compensation angle value of the body may change due to vibration, but the change range is less than 1 degree.)



300ASMG23K

※ If abnormal operation is confirmed, replace the boom sensor.

③ Check operation of arm sensor.

a. After adjusting the arm so that the arm 'compensation angle' data is near -90 degrees, check whether the arm's posture remains vertical to the ground as shown in the right picture.

b. Repeat arm in and out operation to check if the 'compensation angle' data of the arm and bucket changes. (The compensation angle value of the body may change due to vibration, but the change range is less than 1 degree.)



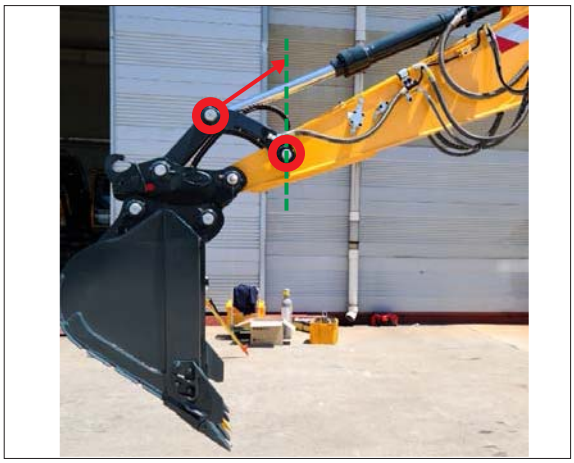
300ASMG24K

※ If abnormal operation is confirmed, replace the arm sensor.

④ Check operation of bucket sensor.

a. After adjusting the bucket so that the bucket 'compensation angle' data is near 90 degrees, check whether the link equipped with the bucket sensor is in a vertical position.

b. Repeat bucket in and out operation to check if the 'compensation angle' data of the bucket changes. (The compensation angle value of the body may change due to vibration, but the change range is less than 1 degree.)



300ASMG25K

※ If abnormal operation is confirmed, replace the bucket sensor.

(2) Check current selected bucket.

① Enter cluster 'Bucket Selection' menu.

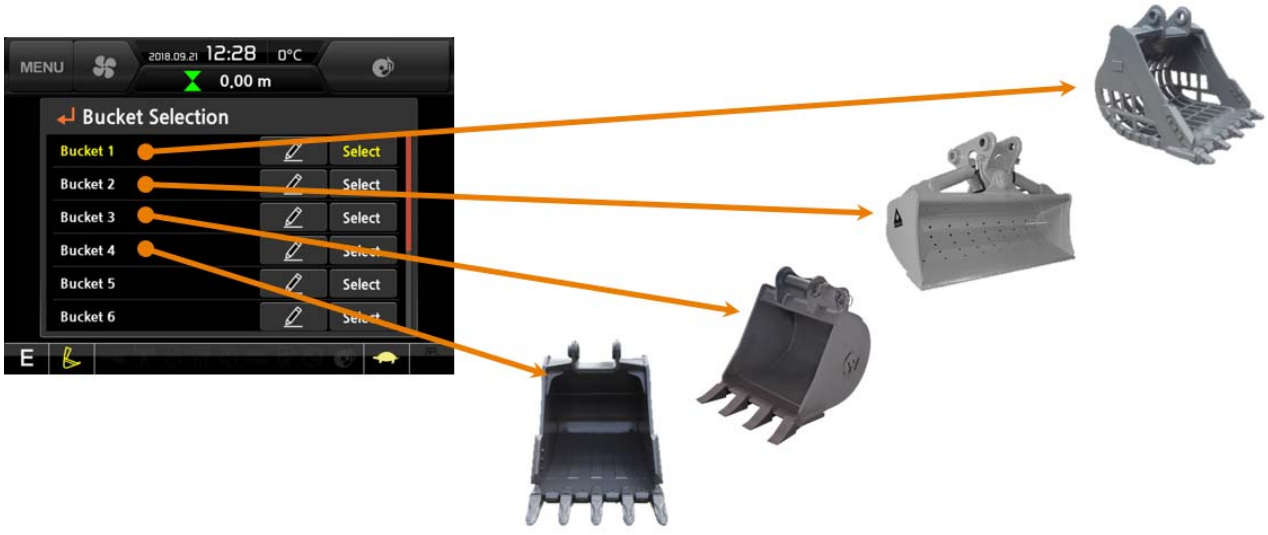
a. From the cluster main menu, go through the following path.

b. MG Main Screen → ⚙ → Bucket selection



300ASMG26EC

② Check that the bucket selected on the menu (highlighted in yellow) matches the currently installed bucket.



300ASMG27EC

※ If a discrepancy is confirmed with the currently installed bucket, change the bucket selection information.

(3) Check compliance with the vertival posture when entering bucket dimensions.

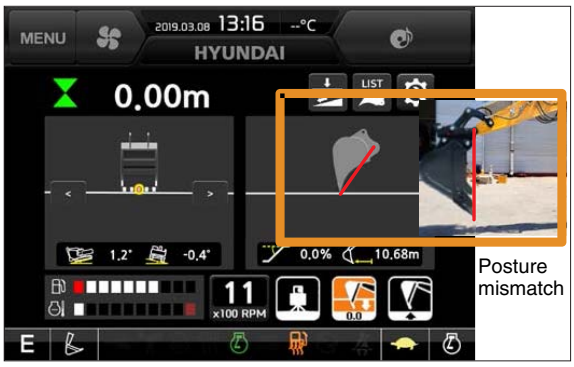
① Adjust the bucket posture to a vertical position using the plumb bob.



300ASMG28K

② Check whether the bucket posture is vertical on the bucket side view screen on the right side of the 2DMG+ main screen.

※ **When a discrepancy in the vertical posture is confirmed, the dimension input procedure is performed again with the bucket in a vertical position.**



300ASMG29EC

(4) Check bucket dimensions.

① Enter cluster 'Bucket Selection' menu.

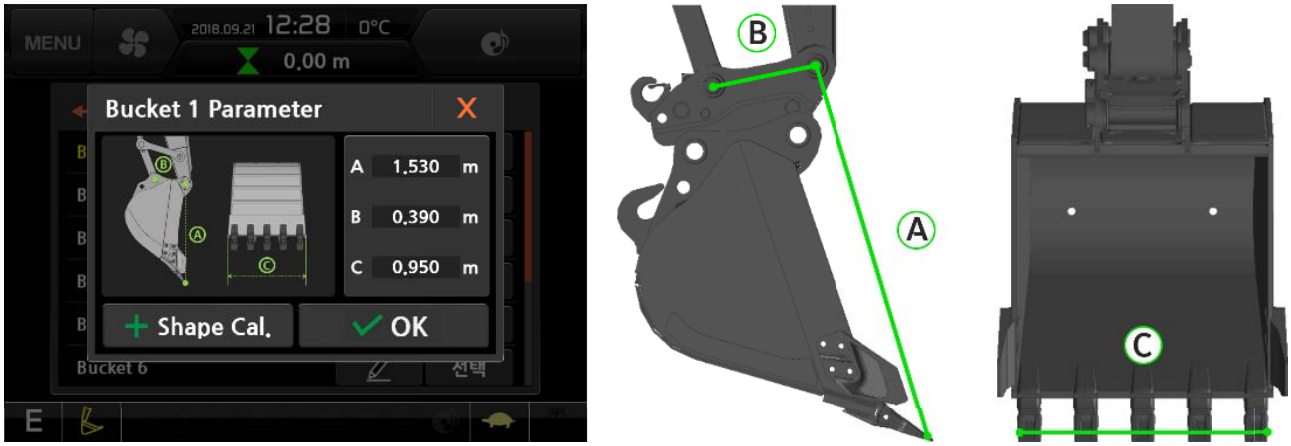
a. From the cluster main menu, go through the following path.

b. MG Main Screen → ⚙ → Bucket selection



300ASMG30EC

② Click on the currently selected bucket to view the dimension information window, then measure and compare the dimensions of the installed bucket.



300ASMG31EC

※ **When discrepancy is confirmed, perform the bucket dimension input procedure.**

※ **If a quick coupler is installed, measure the dimensions based on the bucket rotation center pin at the top of the quick coupler as shown in the picture above.**

(5) Check design surface (depth/slope) information.

① When trenching work is in progress.

a. Enter the depth setting screen and check the set depth.

a) Enter the depth/slope setting screen on the cluster screen

b) MG Main Screen → →



300ASMG32EC

b. After checking the depth settings, check the gradient information on the 2DMG+ main screen.

a) Refer to the right picture and check whether the current slope is set.

b) If a gradient is set, enter the gradient settings screen and initialize the gradient value.
(→ → 초기화 → Confirm button)



300ASMG33EC

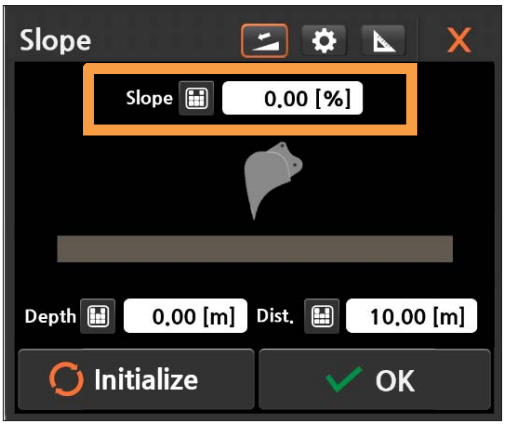
※ **If a slope is set during trenching work, the height measurement error increases as the bucket position moves away from the reference point.**

② When a slope work is in progress.

a. Enter the slope setting screen and check the set slope.

a) Enter the depth/slope setting screen on the cluster screen.

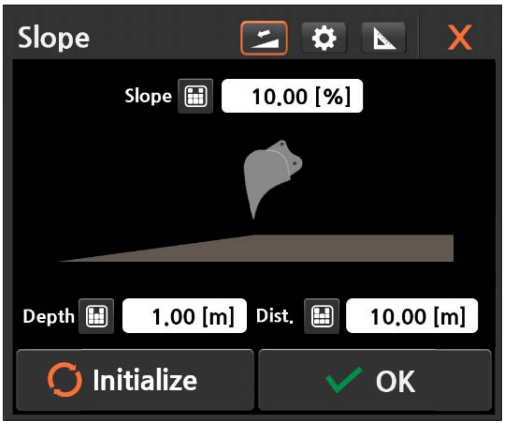
b) MG Main Screen →  → 



300ASMG34EC

b. Check the +/- mark according to the gradient setting value and gradient direction.

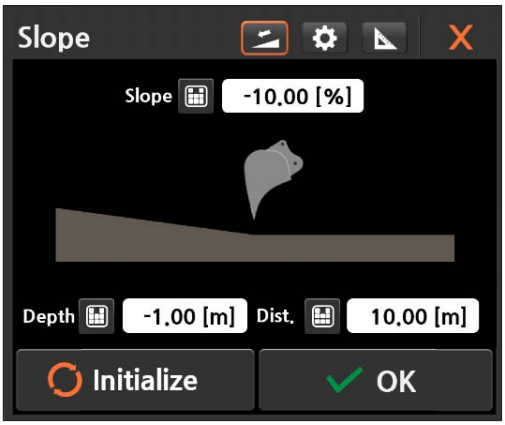
a) In case of (+) slope, slope downward in the direction of the attachment.



300ASMG35EC

b) In case of (-) slope, slope upward in the direction of the attachment.

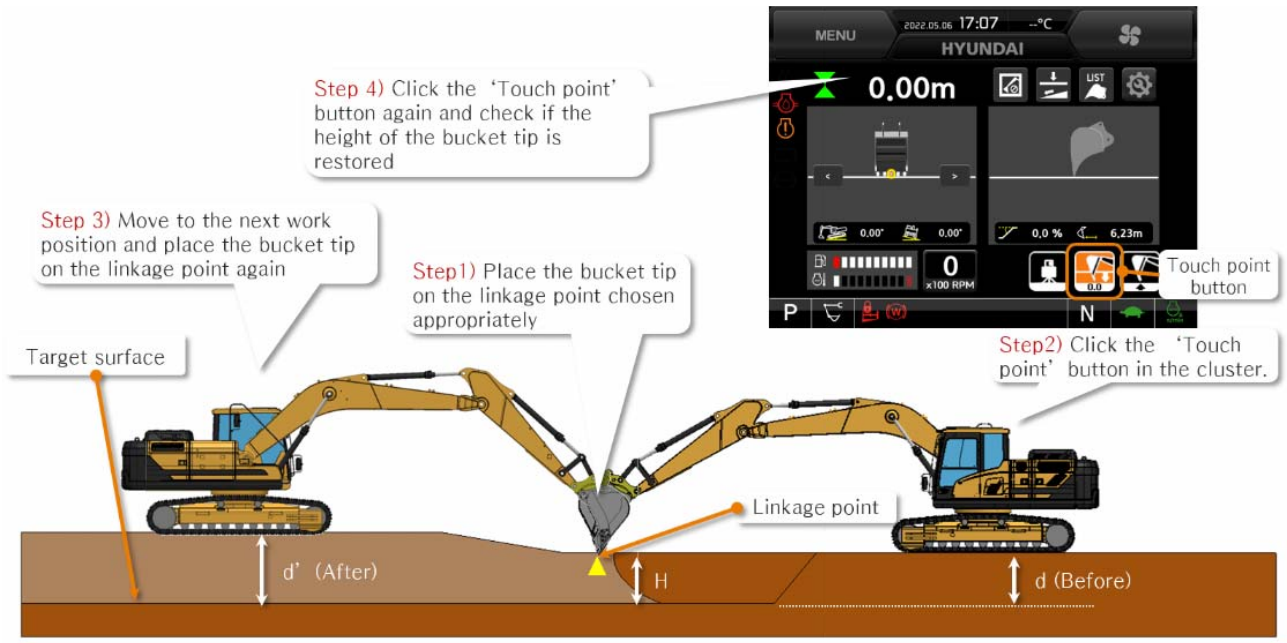
※ **It is necessary to check the value and direction of the currently set gradient by referring to the right picture.**



300ASMG36EC

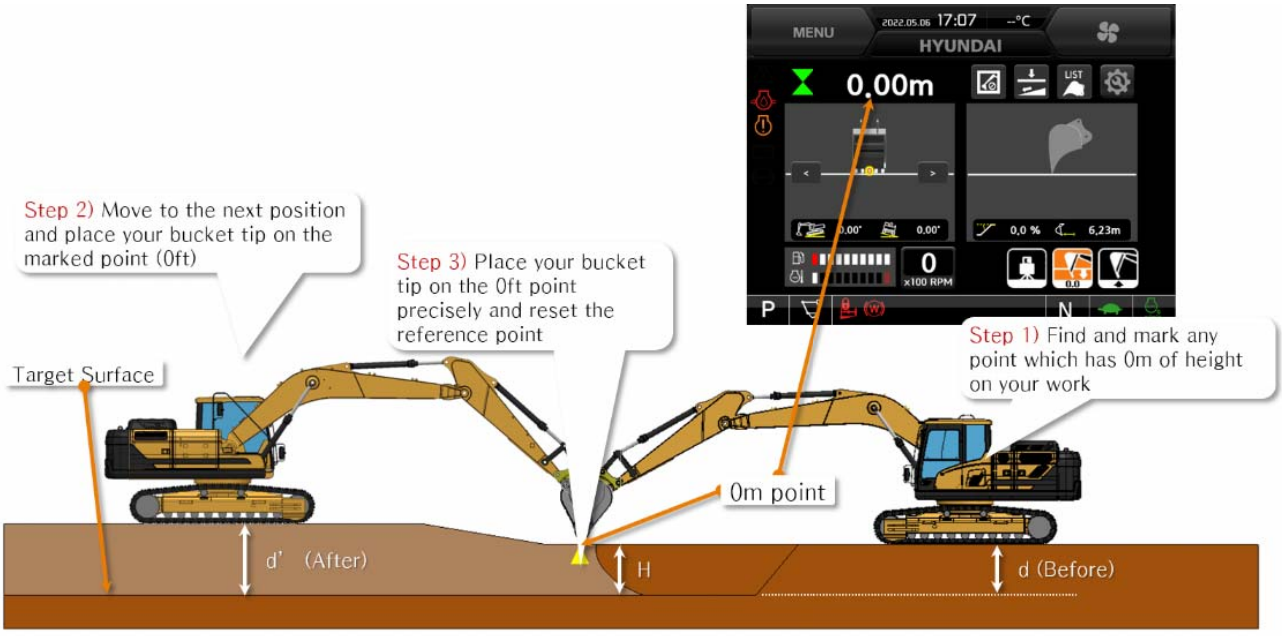
(4) Check compliance with reference point movement procedures.
When moving to a location, check whether the reference point movement function is used according to the procedure. (Refer to operator's manual)

① Touch point utilization



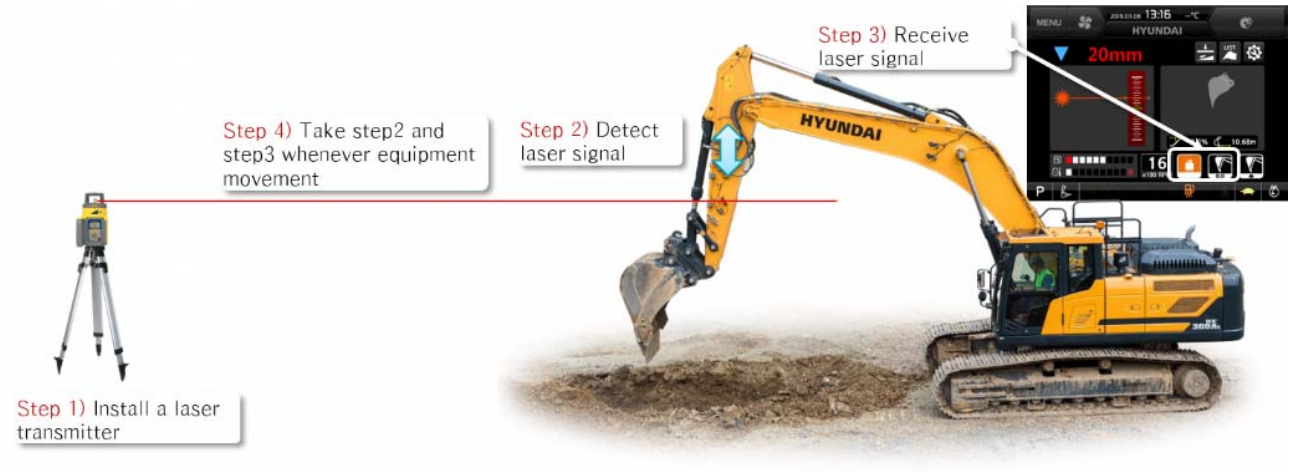
300ASMG38EC

② Reference height utilization



300ASMG39EC

③ Laser catcher utilization



300ASMG40EC

※ If the reference point movement procedures in ①, ②, ③ above are not followed and the work location is moved, measurement errors are likely higher to occur.

(5) Enter 2DMG+ setting value after replacing MCU.

① When replacing MCU, 2DMG+ related information needs to be re-entered.

a. During the 2DMG+ installation process, create a '2DMG+ Option Installation' check sheet that separately organizes 2DMG+ setting data for each machine.

b. After requesting the 2DMG+ person in charge of PS to deliver the check sheet along with the model and serial number, enter the setting information of the check sheet into the cluster.

Check Sheet for 2D MG Option Installation

Date	2020. 9. 18.	Site	■ Ulsan □ Dang-Jin □ etc	Draft	Review	Approval
Model	■ HX145SLCR □ HX260SLA □ HX220SLA □ HX300SLA □ HX235SLCR □ HX330SLA	#	0005			

1. Verification for Installation

① The brackets are properly touched-up after welding	Yes ■	No □
② The bucket-arm connecting harness is not interferred	Yes ■	No □
③ The arm-boom connecting harness is not overstreched	Yes ■	No □
④ The boom-body connecting harness is not overstreched	Yes ■	No □
⑤ The data from each sensor are normal	Yes ■	No □

2. Dimensions

Boom (A-B)	4.603 m	Bucket Pin to Link Pin (C-D)	0.340 m
		Bucket Link (D-E)	0.470 m
Arm (B-C)	2.495 m	Bucket Rod (E-F)	0.415 m

3. Calibration

Offset Angles	Pitch	-0.01	Check List		
	Roll	-0.08	① Are the measurement results for each bucket position the same?	Yes ■	No □
	Boom	10.09	② Are the measurement results the same with the real ones?	Yes ■	No □
	Arm	-9.93	③ Are the data for dimensions and calibration angles properly maintained after restarting?	Yes ■	No □
	Bucket	-0.37	④ Are there any problems on the machine?	Yes ■	No □

4. Laser Receiver (Yes □, No ■)

Data	Arm Pin	m	Check List		
	Bucket Pin	m	① Is it possible to receive the laser signal?	Yes □	No □
	Arm Width	m	② Is the measurement result using laser singal correct?	Yes □	No □
	Arm Edge	m	③ Is the reference height properly maintained after moving the machine?	Yes □	No □
	Mounting Angle	°	④ Are the data for dimensions and mounting angles properly maintained after restarting?	Yes □	No □

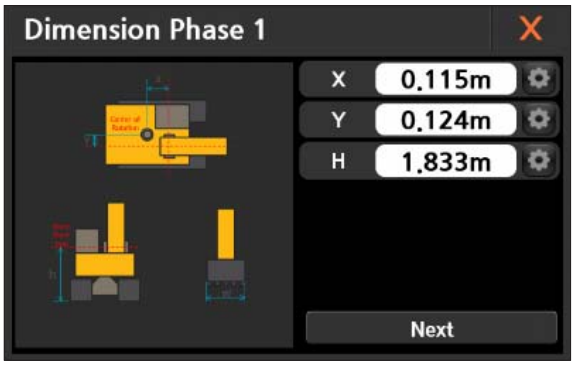
300ASMG41EC

② Input dimensions for 2DMG+ machine.

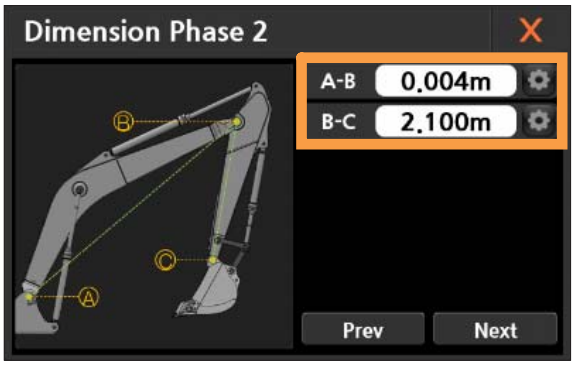
a. Enter the Dimension Phase 1 menu on the cluster menu.

b. Management → Service menu → MG/MC Function set → MG/MC Default set → Dimension set

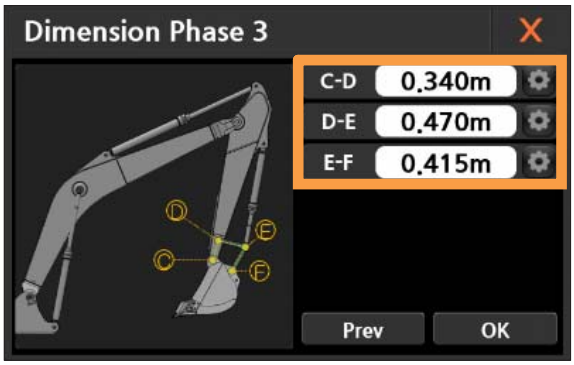
c. In step 1, 'Dimension Phase 1', be careful not to change the default values, and only enter the dimensions of the boom, arm, and bucket link in steps 2 and 3.



300ASMG42EC



300ASMG43EC



300ASMG44EC

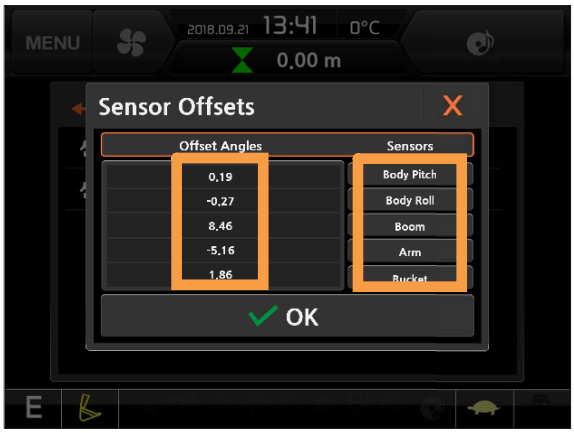
③ Input the angle sensor offset for 2DMG+.

a. Enter the sensor offset menu on the cluster menu.

b. Management → Service menu → MG/MC Function set → MG/MC Default set → Monitoring → Sensor Offsets

c. Refer to the check sheet and enter all offset values for the body roll, body pitch, boom, arm and bucket.

※ If dimension information and sensor offset are not entered after replacing the MCU, the accuracy of 2DMG+ measurement cannot be secured.



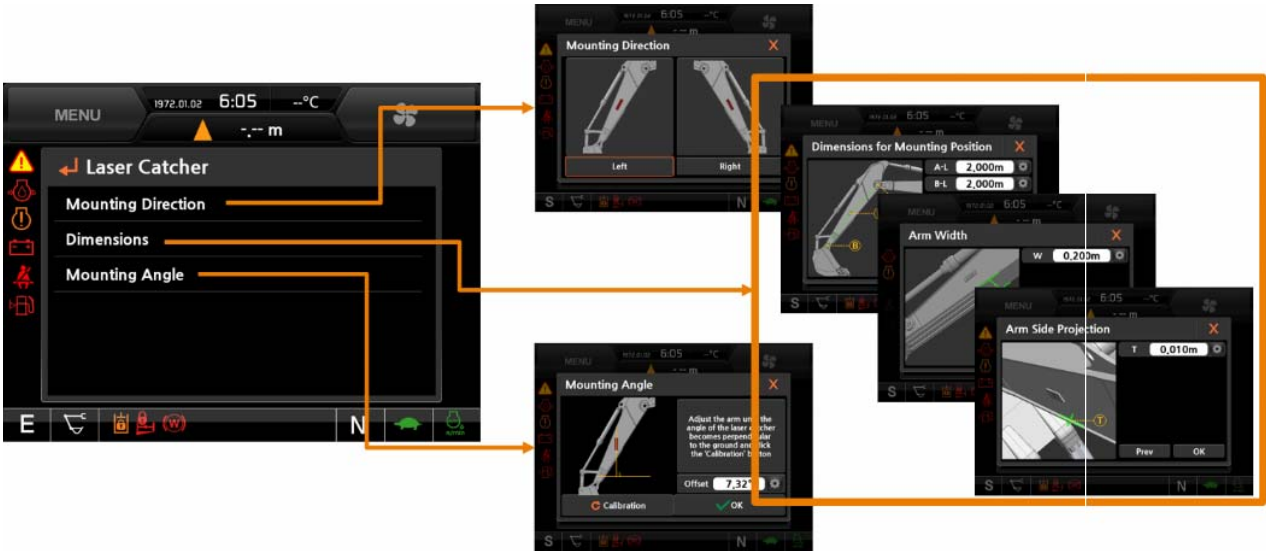
300ASMG45EC

④ Input laser catcher setup information. (If equipped with the laser catcher option.)

a. Enter the laser catcher menu on the cluster menu.

b. Management → Service menu → MG/MC Function set → Laser Catcher

c. Refer to the check sheet and enter the laser mounting location, laser catcher dimensions and laser catcher installation angle.



300ASMG46EC

⑤ Input bucket dimensions.

The bucket dimension input procedure is performed for all buckets owned by the user.



Bucket vertical posture adjustment



Keep vertical posture, input bucket dim (A,B,C)

300ASMG47EC

3) ACTION WHEN YOU CAN NOT ENTER THE CLUSTER'S 2DMG+ MENU

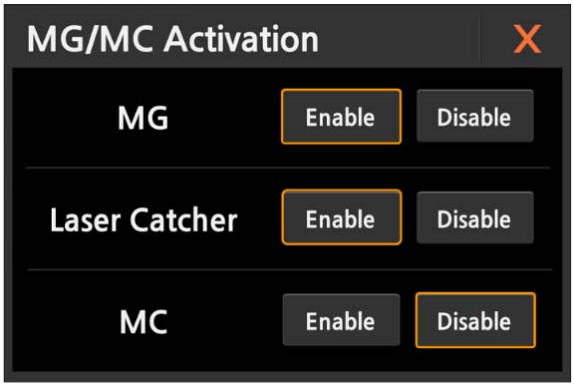
(1) 2DMG+ FUNCTION NOT SET AFTER CLUSTER REPLACEMENT

① Change cluster default settings.

a. From the cluster main menu, enter the function selection menu through the following path.

b. Management → Service menu → MG/MC Function set → MG/MC Activation select

c. Change MG function and laser catcher to "Enable".



300ASMG48EC

SECTION 6 TROUBLESHOOTING

Group 1 Before Troubleshooting ····· 6-1
Group 2 Hydraulic and Mechanical System ····· 6-4
Group 3 Electrical System ····· 6-25
Group 4 Mechatronics System ····· 6-43
Group 5 Air con & Heater System ····· 6-71

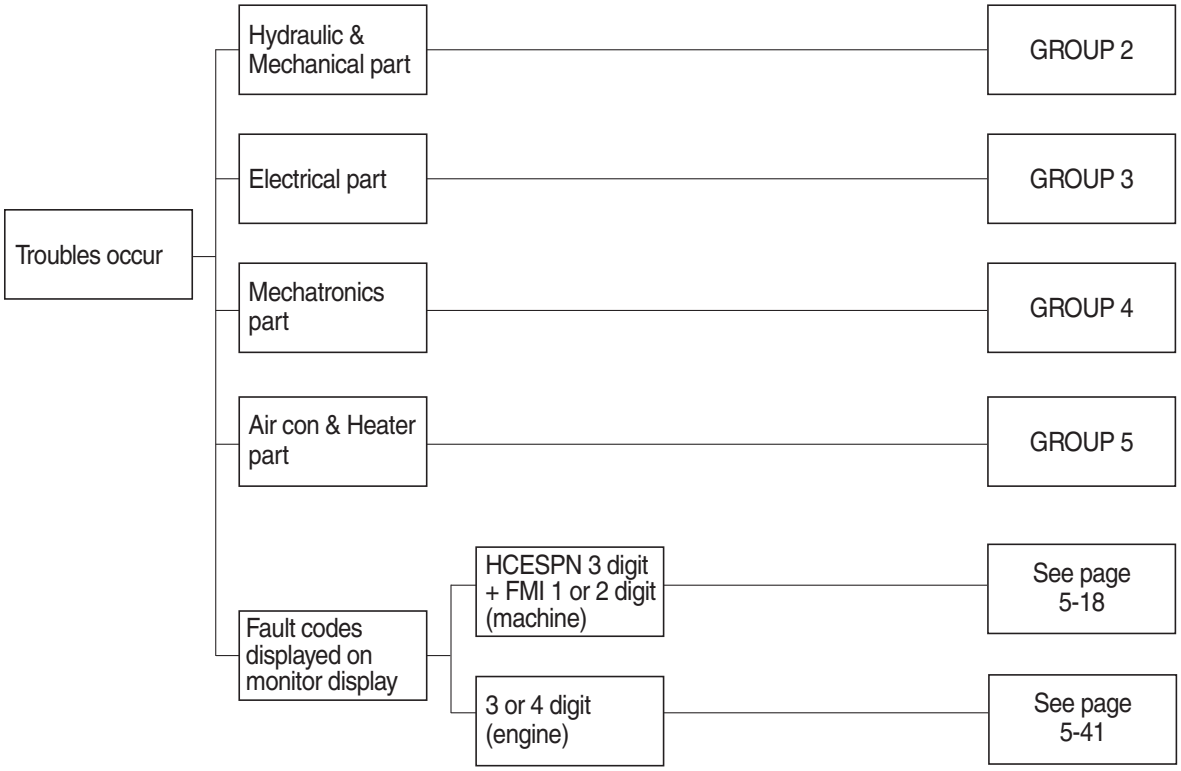
GROUP 1 BEFORE TROUBLESHOOTING

1. INTRODUCTION

When a trouble is occurred in the machine, this section will help a service man to repair to maintain the machine with easy.

The trouble of machine is parted Hydraulic & Mechanical system, Electrical system, Mechatronics system and Air con & Heater system. (fault codes displayed on monitor display) At each system part, a service man can check the machine according to the troubleshooting process diagram.

※ **Before carring out troubleshooting procedure, check monitoring menu in the cluster.**

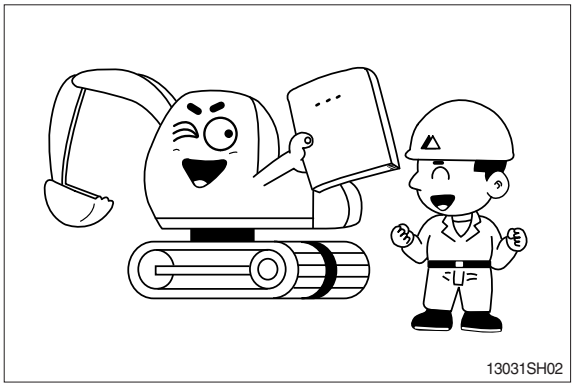


2. DIAGNOSING PROCEDURE

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

STEP 1. Study the machine system

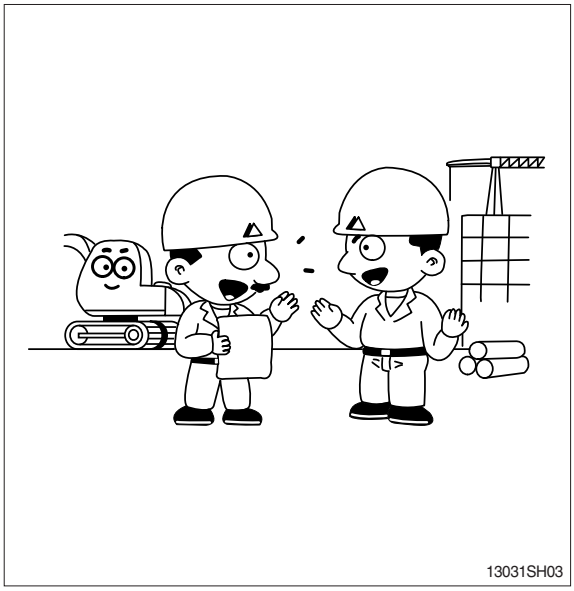
Study and know how the machine is operating, how the system is composing, what kinds of function are installed in the machine and what are specifications of the system components by the machine service manual.
Especially, deepen the knowledge for the related parts of the trouble.


13031SH02

STEP 2. Ask the operator

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

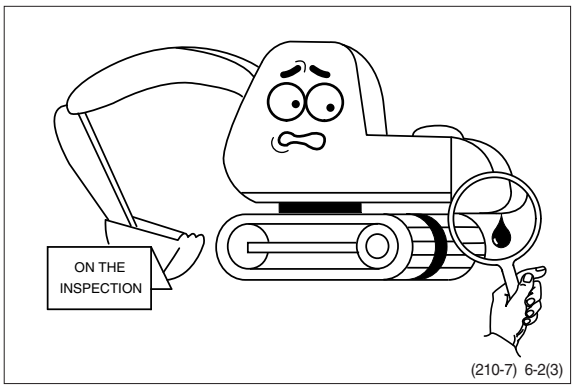
1) How the machine is used and when it is serviced?
2) When the trouble was noticed and what work the machine was doing at that time?
3) What is the phenomenon of the trouble? Was the trouble getting worse, or did it come out suddenly for the first time?
4) Did the machine have any troubles previously?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

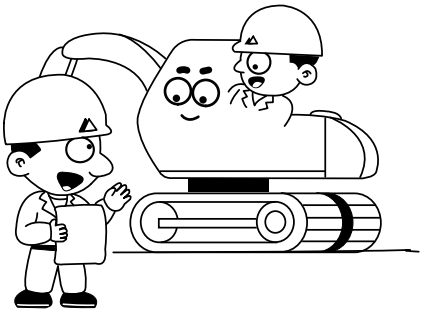
And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.



(210-7) 6-2(3)

STEP 4. Inspect the trouble actually on the machine

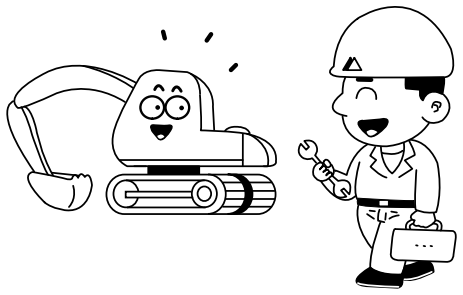
In case that some trouble cannot be confirmed, obtain the details of the malfunction from the operator.
Also, check if there are any in complete connections of the wire harnesses are or not.



(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.

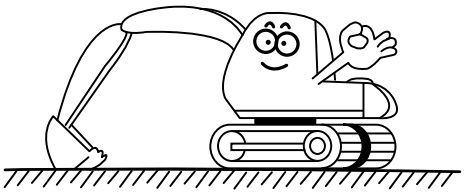


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STEP 6. Trace a cause

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

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



(210-7) 6-3(3)

GROUP 2 HYDRAULIC AND MECHANICAL SYSTEM

1. INTRODUCTION

1) MACHINE IN GENERAL

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

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

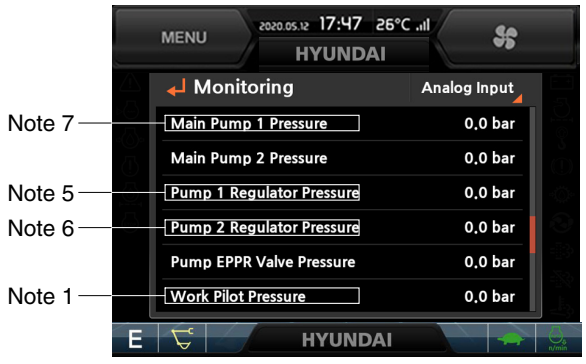
(3) When carrying out troubleshooting, do not hurry to disassemble the components.
It will become impossible to find the cause of the problem.

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

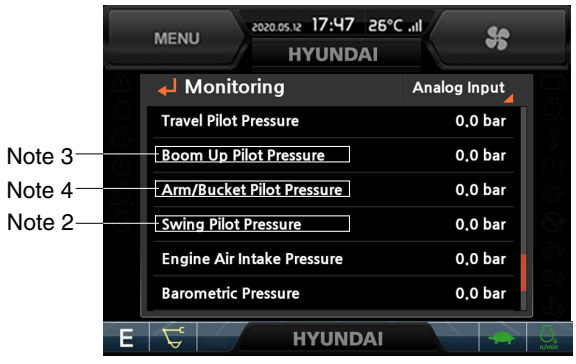
(5) Check before troubleshooting.
① Check oil and fuel level.
② Check for any external leakage of oil from components.
③ Check for loose or damage of wiring and connections.

2) MACHINE STATUS MONITORING ON THE CLUSTER

(1) The machine status such as the engine rpm, oil temperature, voltage and pressure etc. can be checked by this menu.



Analog 1



Analog 2

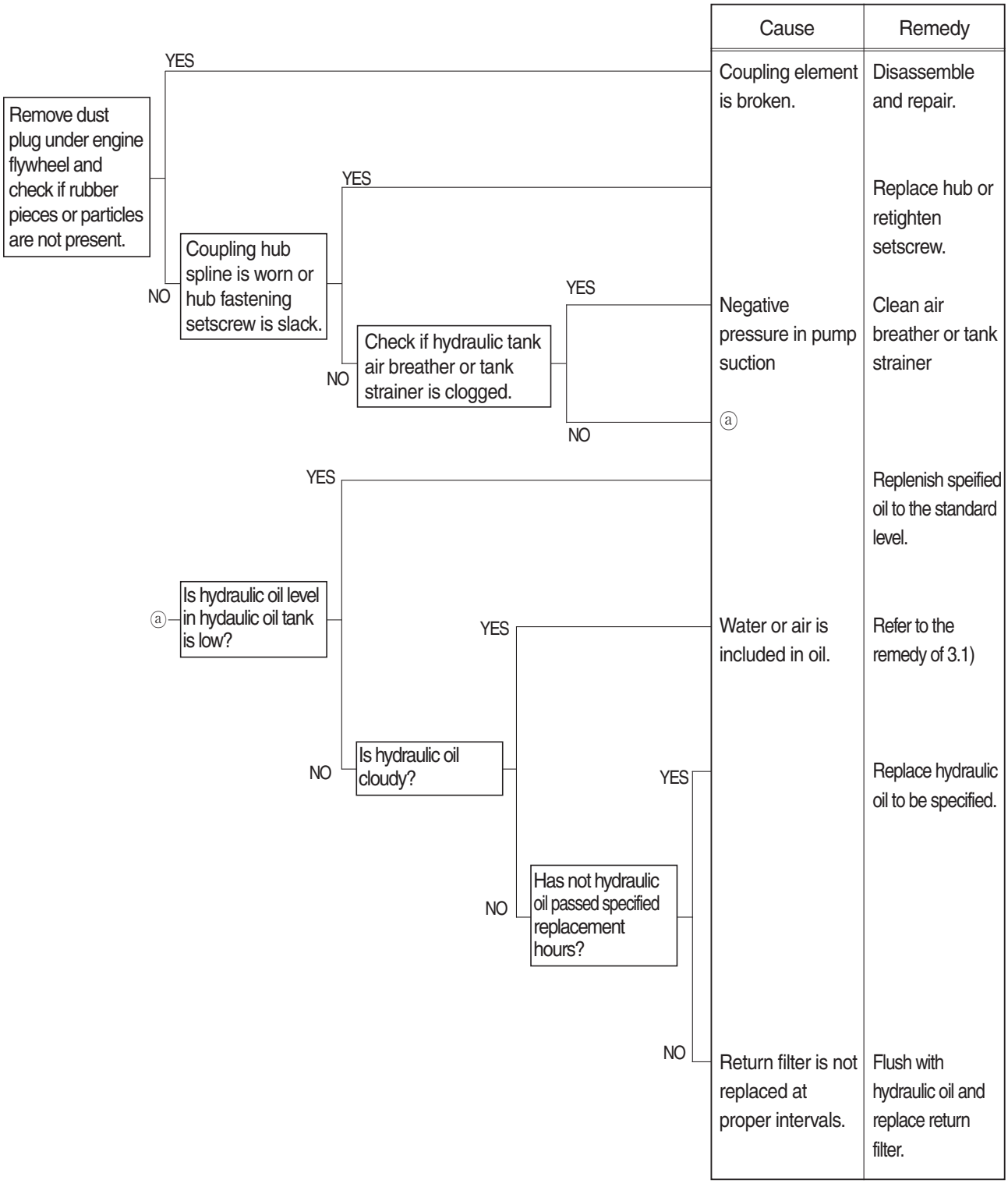
210A6HS01

(2) Specification

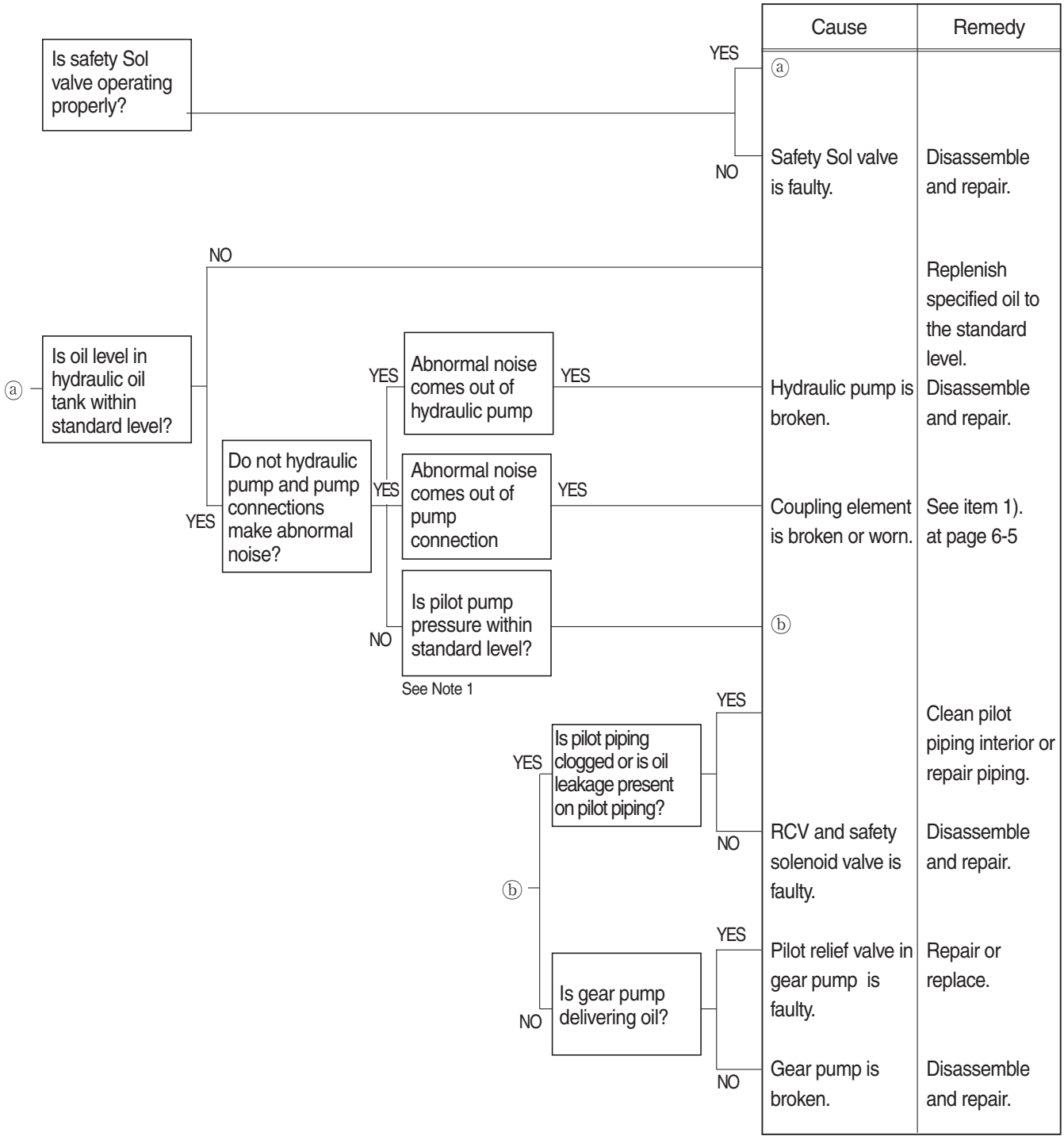
No.	Description	Specification
Note 1	Work pilot pressure	40^{+2}_{0} bar
Note 2	Swing pilot pressure	0~40 bar
Note 3	Boom up pilot pressure	0~40 bar
Note 4	Arm/bucket pilot pressure	0~40 bar
Note 5	Pump 1 regulator pressure	0~50 bar
Note 6	Pump 2 regulator pressure	0~50 bar
Note 7	Pump 1 pressure	350 bar

2. DRIVE SYSTEM

1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION



2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL



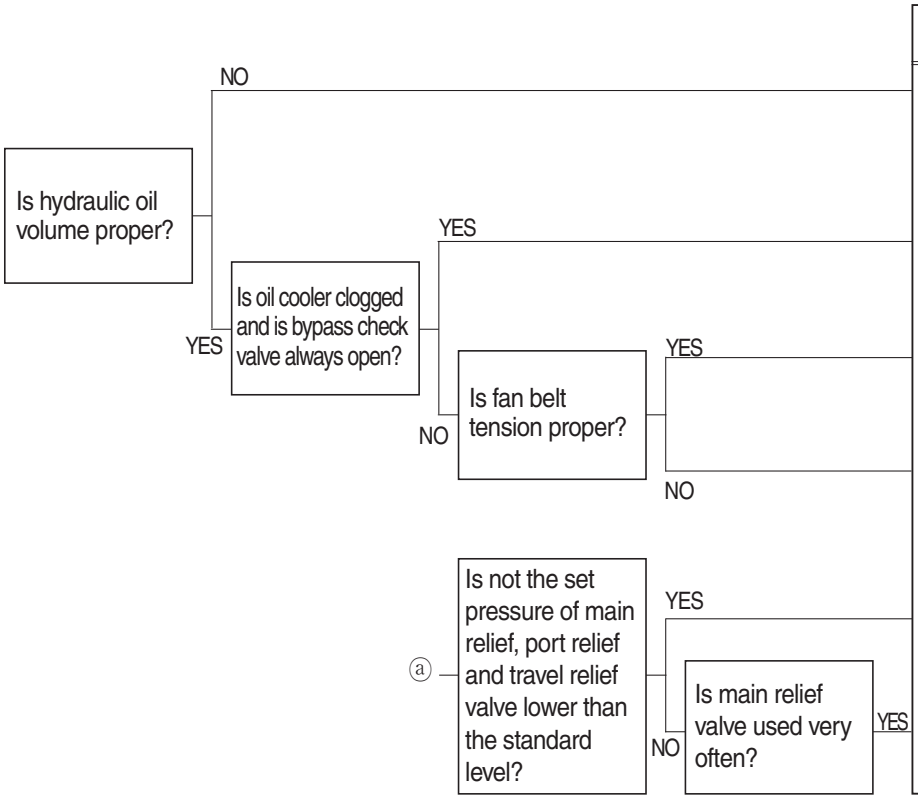
3. HYDRAULIC SYSTEM

1) HYDRAULIC OIL IS CLOUDY



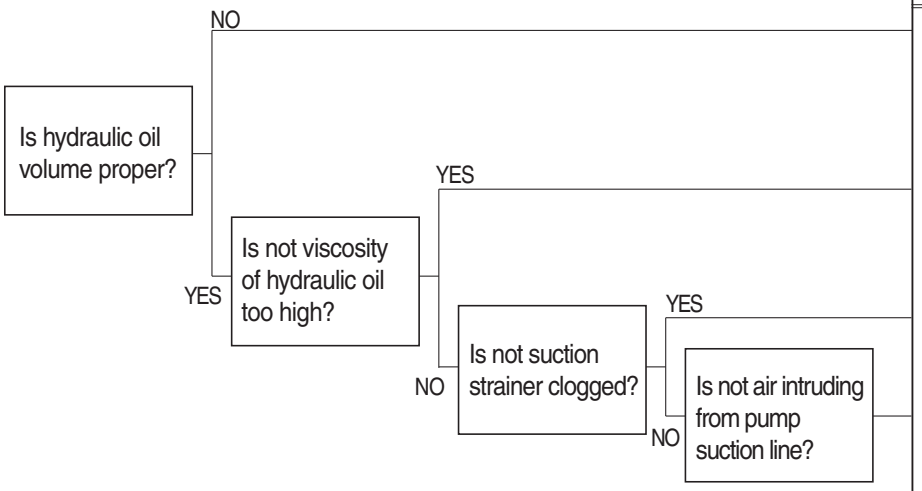
Cause	Remedy
Water is mixed.	Put hydraulic oil still, separate water and dispose it or replace hydraulic oil.
Air is intruded.	Check suction line and return line and eliminate the air intruding source.

2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY



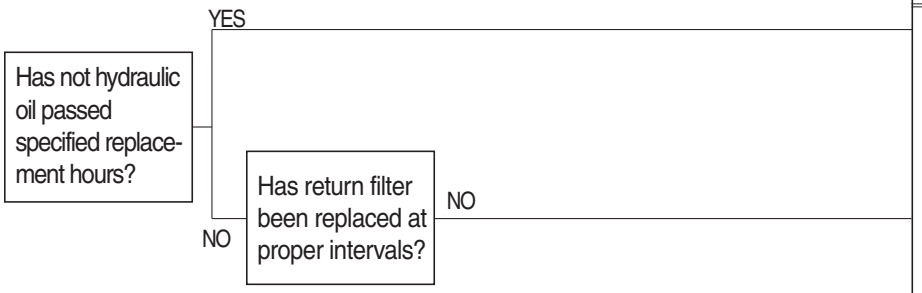
Cause	Remedy
Oil cooler clogged. Bypass check valve is defective. ⓐ	Replenish specified oil to the standard level. Clean oil cooler. Replace
	Adjust belt tension or replace belt.
	Readjust set pressure.
	Reduce load.

3) CAVITATION OCCURS WITH PUMP



Cause	Remedy
	Replenish specified oil to the standard level. Replace oil with one of proper viscosity. Clean suction strainer. Check for air intrusion in suction line and retighten or replace parts.

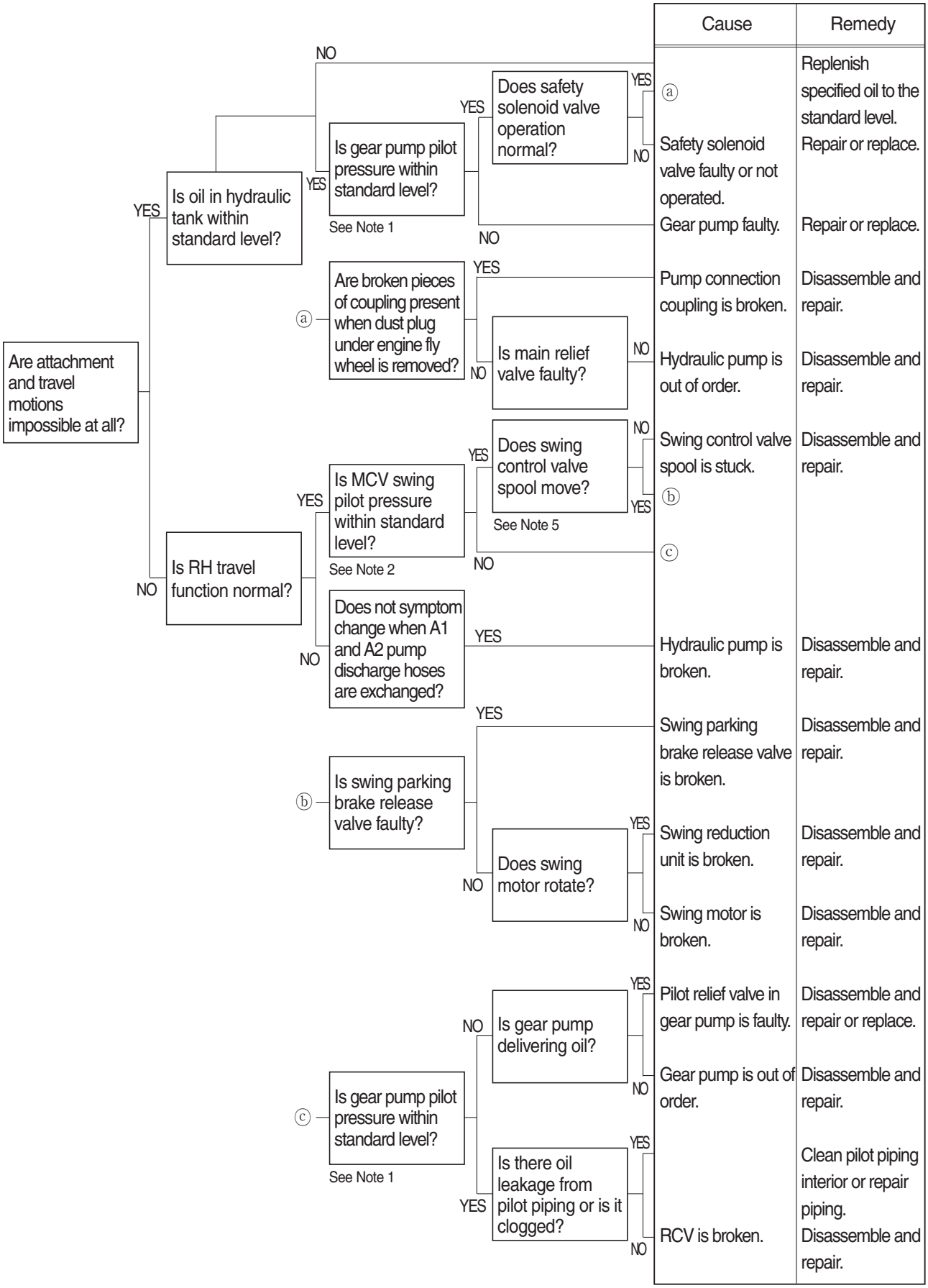
4) HYDRAULIC OIL IS CONTAMINATED



Cause	Remedy
	Replace hydraulic oil to be specified. Flush with hydraulic oil and replace return filter.

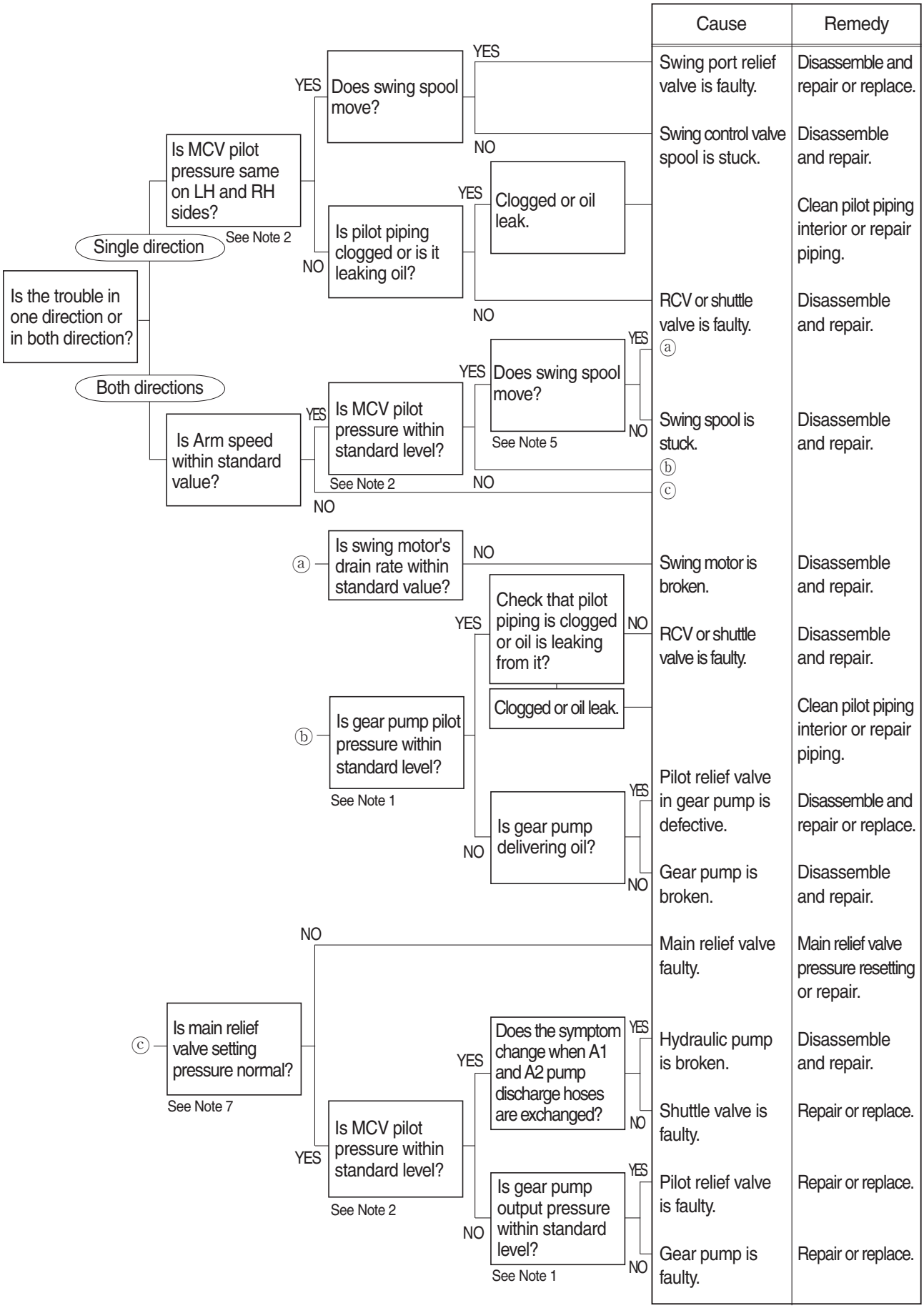
4. SWING SYSTEM

1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE

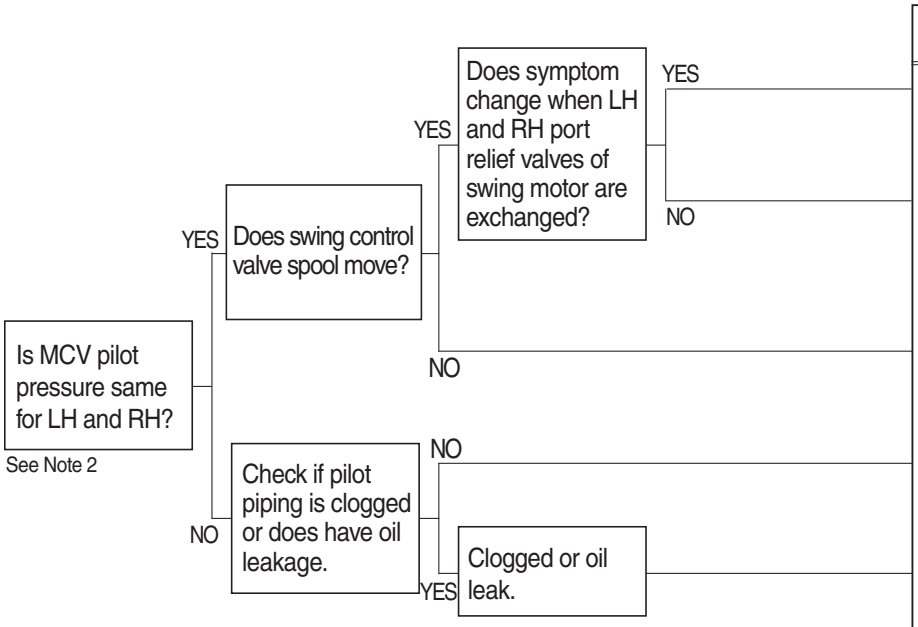


Cause	Remedy
ⓐ	Replenish specified oil to the standard level.
Safety solenoid valve faulty or not operated.	Repair or replace.
Gear pump faulty.	Repair or replace.
Pump connection coupling is broken.	Disassemble and repair.
Hydraulic pump is out of order.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
ⓑ	
ⓒ	
Hydraulic pump is broken.	Disassemble and repair.
Swing parking brake release valve is broken.	Disassemble and repair.
Swing reduction unit is broken.	Disassemble and repair.
Swing motor is broken.	Disassemble and repair.
Pilot relief valve in gear pump is faulty.	Disassemble and repair or replace.
Gear pump is out of order.	Disassemble and repair.
RCV is broken.	Clean pilot piping interior or repair piping. Disassemble and repair.

2) SWING SPEED IS LOW

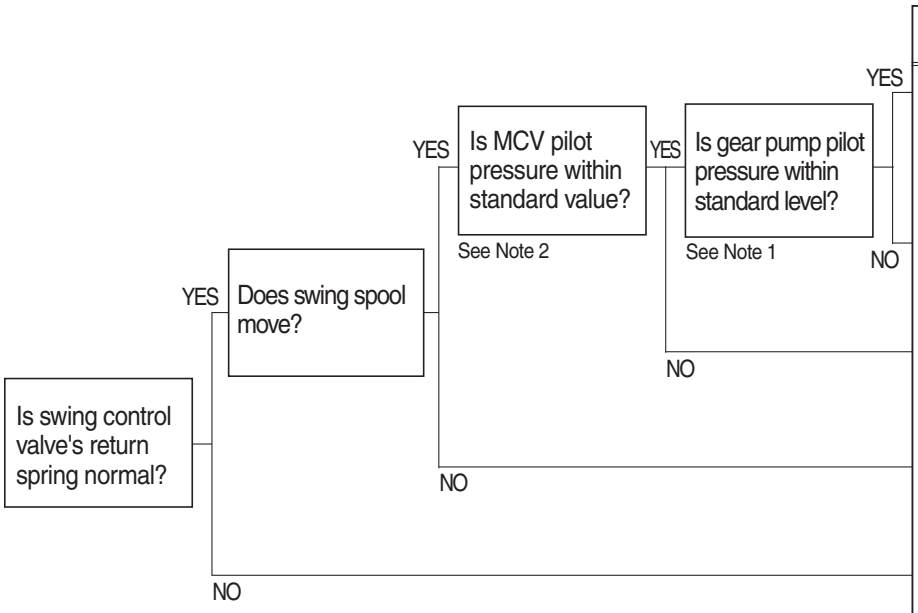


3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



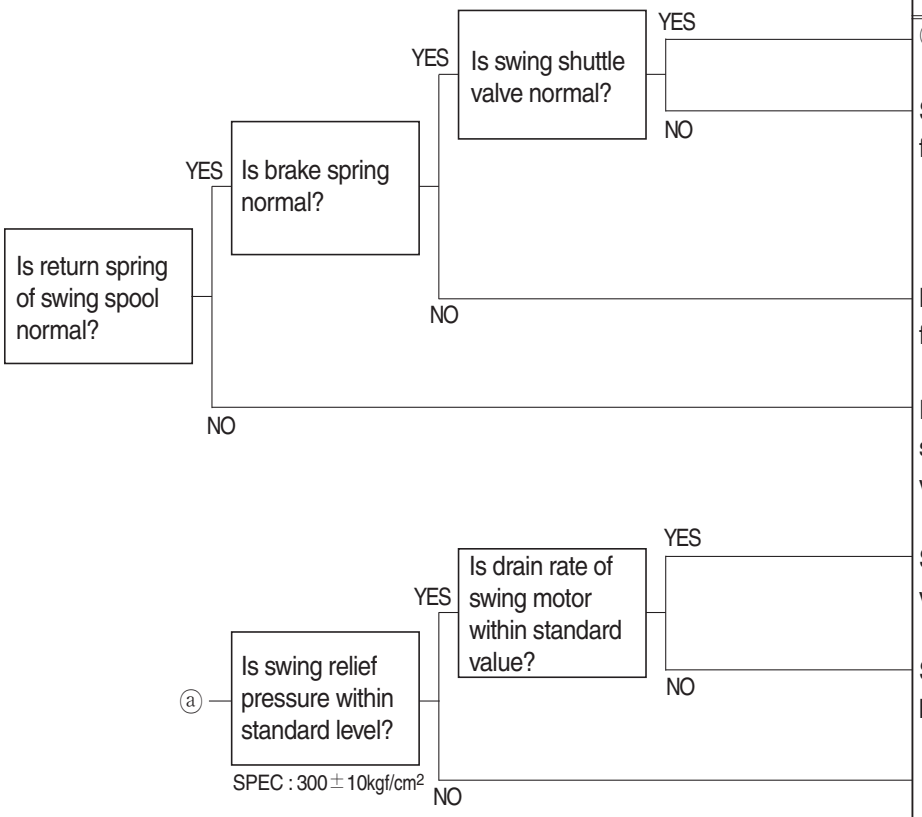
Cause	Remedy
Swing port relief valve is faulty.	Disassemble and repair.
Shuttle valve is faulty.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
RCV is faulty.	Disassemble and repair.
	Clean pilot piping interior or repair piping.

4) MACHINE SWINGS BUT DOES NOT STOP



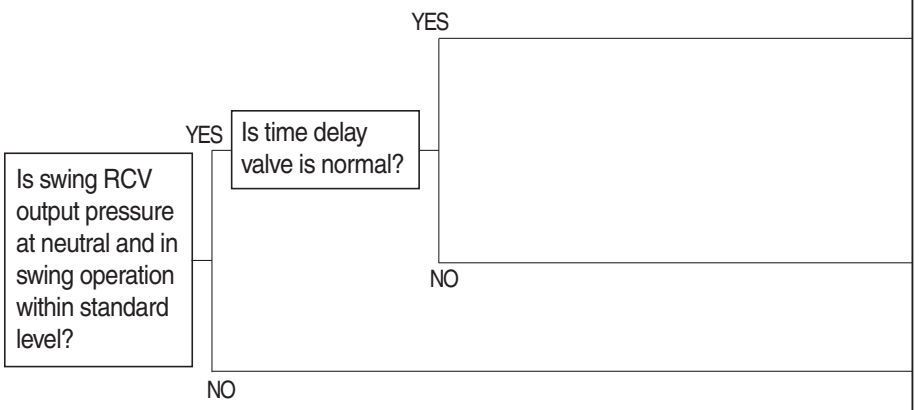
Cause	Remedy
Pilot relief valve is faulty.	Disassemble and repair or replace.
Gear pump is broken.	Disassemble and repair.
RCV is faulty.	Disassemble and repair.
Swing spool is stuck.	Disassemble and repair.
Return spring is faulty.	Disassemble and replace.

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



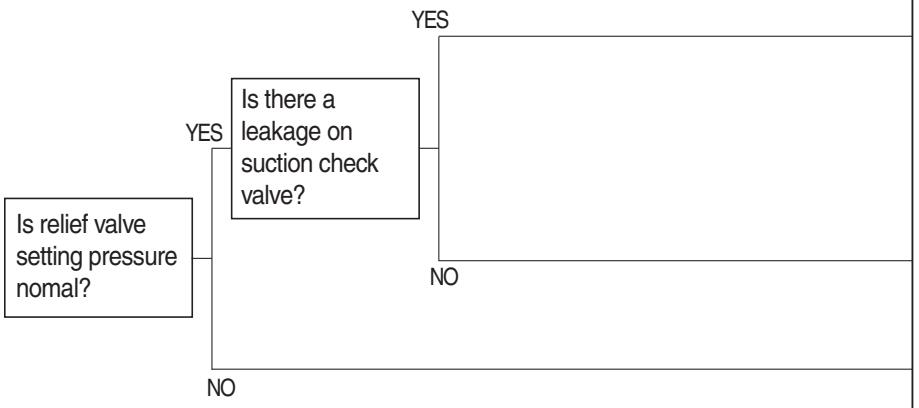
Cause	Remedy
ⓐ	
Shuttle valve is faulty.	Disassemble and replace.
Brake spring is faulty.	Disassemble and replace.
Return spring of swing control valve is faulty.	Disassemble and replace.
Swing port relief valve is faulty.	Disassemble and repair or replace.
Swing motor is broken.	Disassemble and repair.
	Adjust swing relief valve pressure or replace swing relief valve.

6) LARGE SHOCK OCCURS WHEN STOP SWINGING



Cause	Remedy
Swing motor is broken.	Disassemble and repair.
Time delay valve is faulty.	Disassemble and repair or replace.
Malfunction of swing RCV	Disassemble and repair.

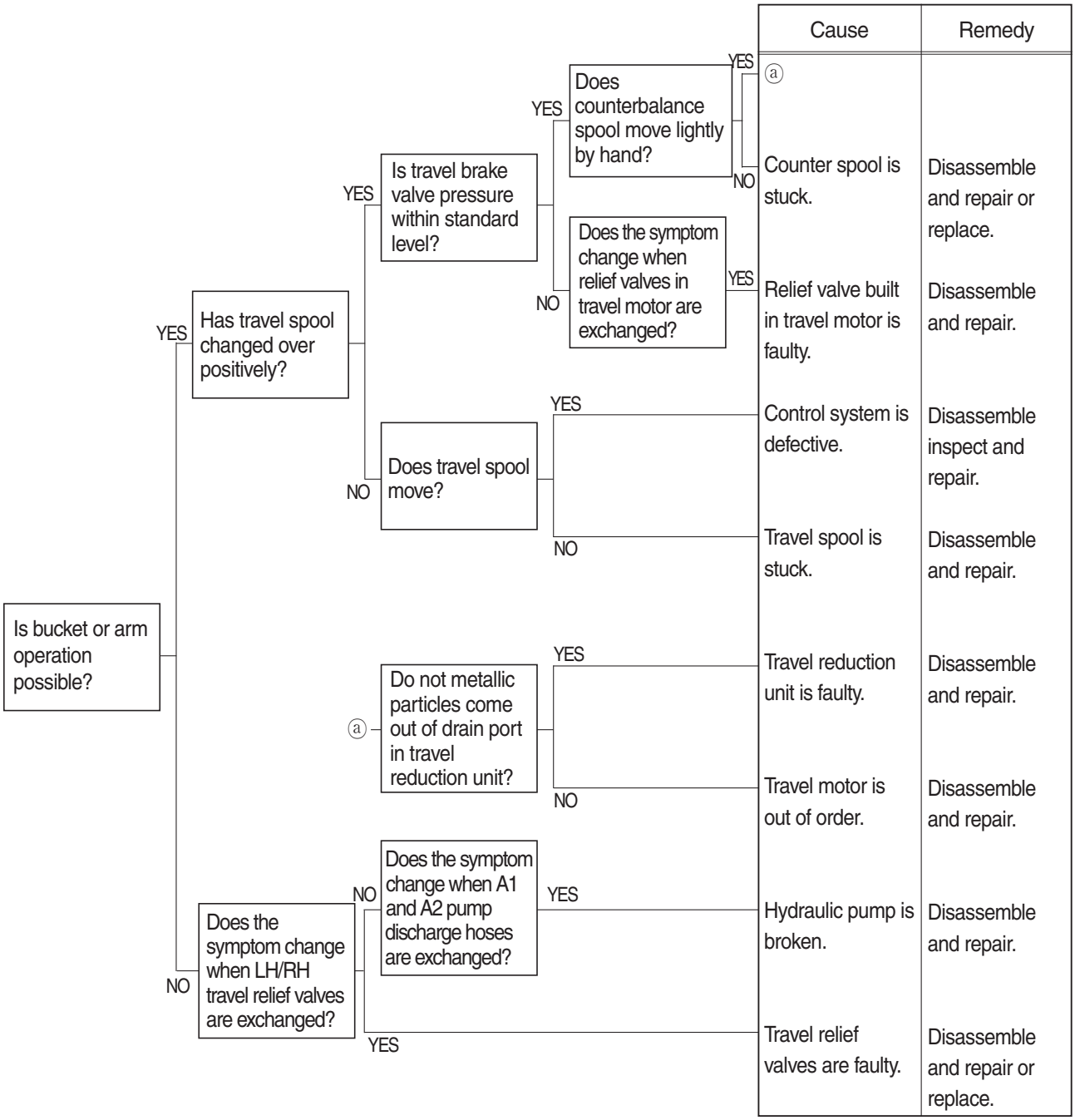
7) LARGE SOUND OCCURS WHEN STOP SWINGING



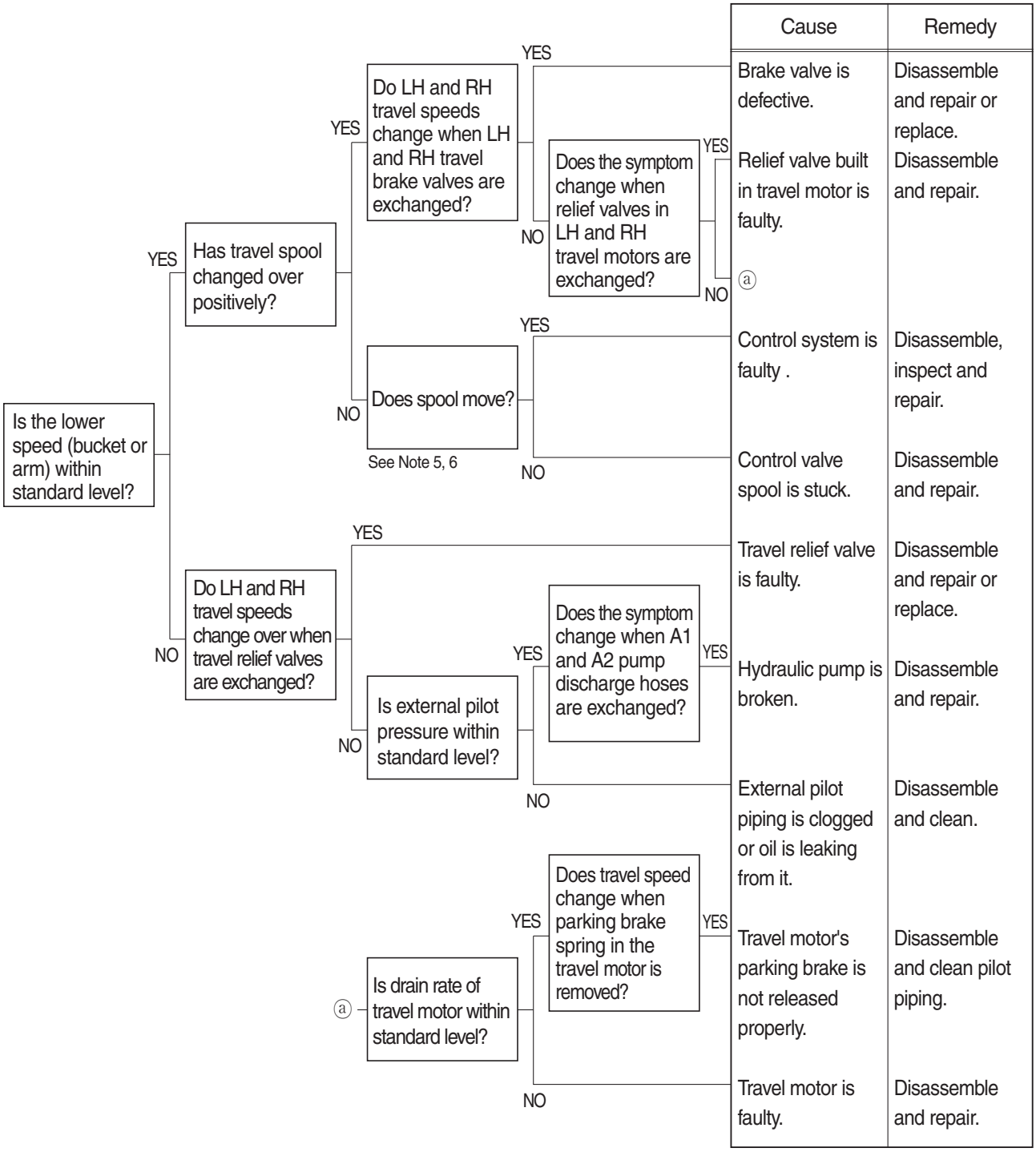
Cause	Remedy
Seal of suction valve is faulty.	Disassemble and repair.
Internal defect of swing motor.	Disassemble and repair.
Malfunction of relief valve.	Adjust swing relief valve pressure or replace swing relief valve.

5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION AT ALL ON ONE SIDE

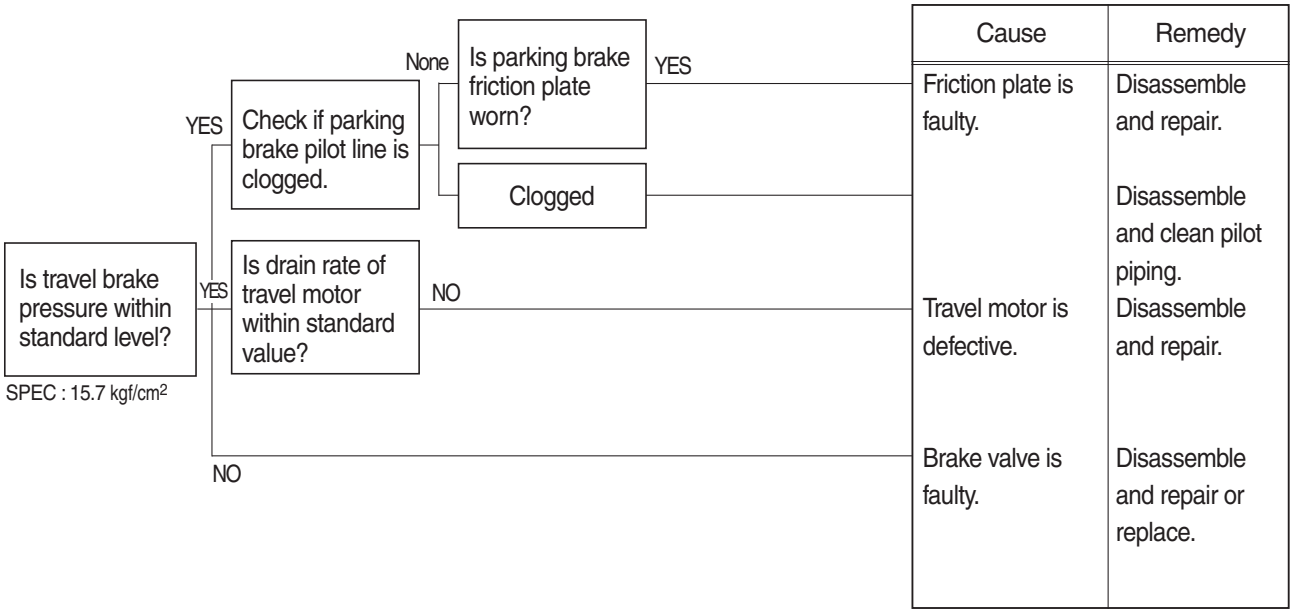


2) SPEED ON ONE SIDE FALLS AND THE MACHINE CURVES



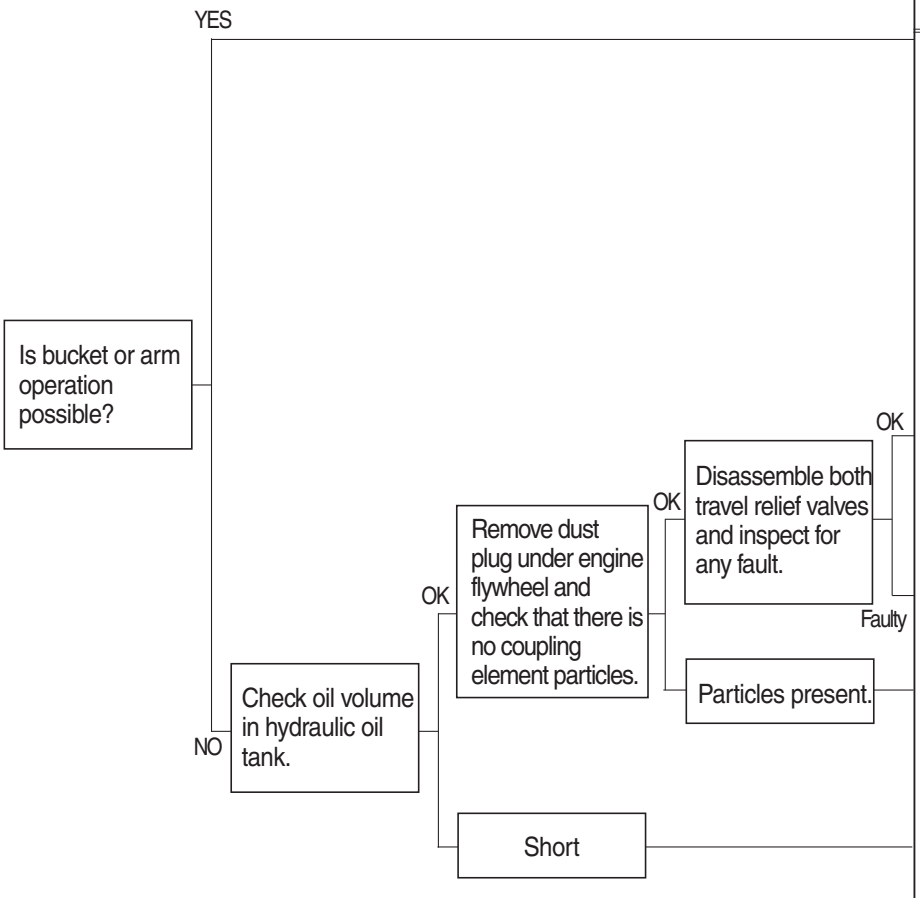
3) MACHINE DOES NOT STOP ON A SLOPE

Machine is pulled forward as sprocket rotates during digging operation.



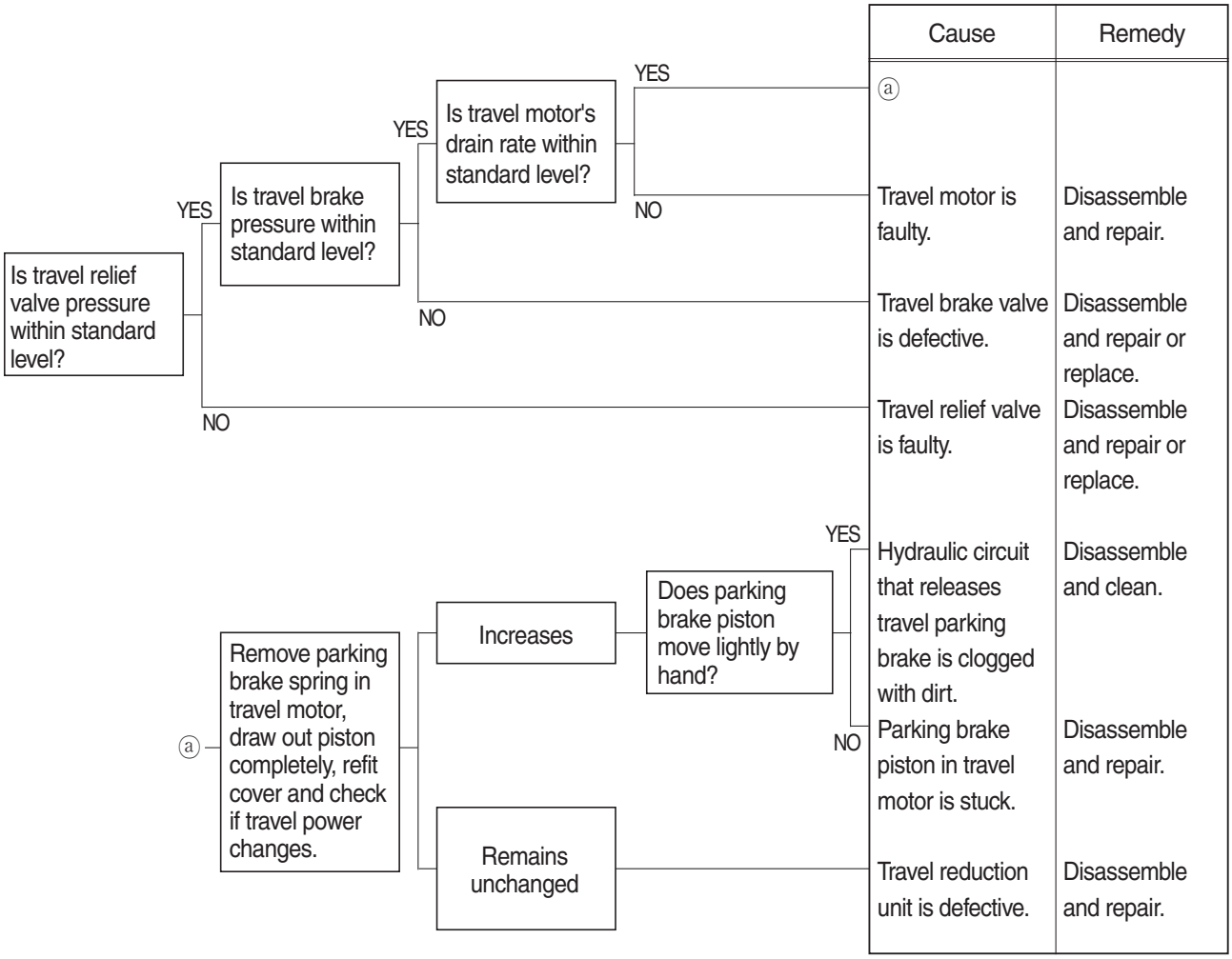
Cause	Remedy
Friction plate is faulty.	Disassemble and repair.
Clogged	Disassemble and clean pilot piping.
Travel motor is defective.	Disassemble and repair.
Brake valve is faulty.	Disassemble and repair or replace.

4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE



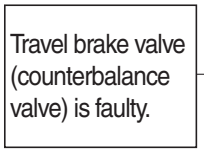
Cause	Remedy
	Inspect according to the procedure "Travel does not function at all on one side." However, a case where both LH and RH travel motions are disabled is extremely seldom statistically.
Hydraulic pump is faulty.	Disassemble and repair.
Travel relief valve is faulty.	Disassemble and repair or replace.
Coupling at pump connection is broken.	Disassemble and repair.
	Replenish hydraulic oil.

5) TRAVEL ACTION IS POWERLESS (travel only)



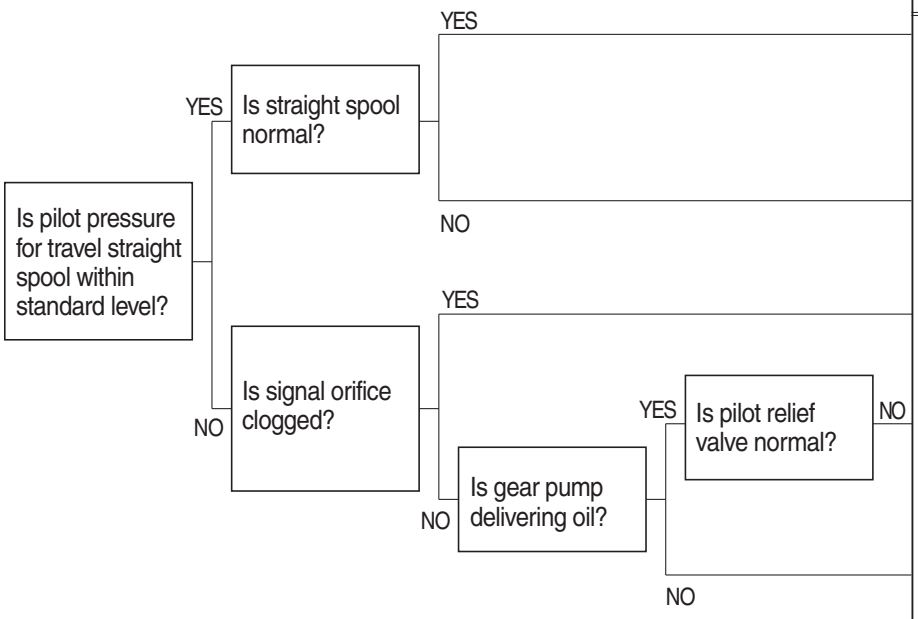
Cause	Remedy
ⓐ	
Travel motor is faulty.	Disassemble and repair.
Travel brake valve is defective.	Disassemble and repair or replace.
Travel relief valve is faulty.	Disassemble and repair or replace.
Hydraulic circuit that releases travel parking brake is clogged with dirt.	Disassemble and clean.
Parking brake piston in travel motor is stuck.	Disassemble and repair.
Travel reduction unit is defective.	Disassemble and repair.

6) MACHINE RUNS RECKLESSLY ON A SLOPE



Cause	Remedy
	Disassemble and repair or replace.

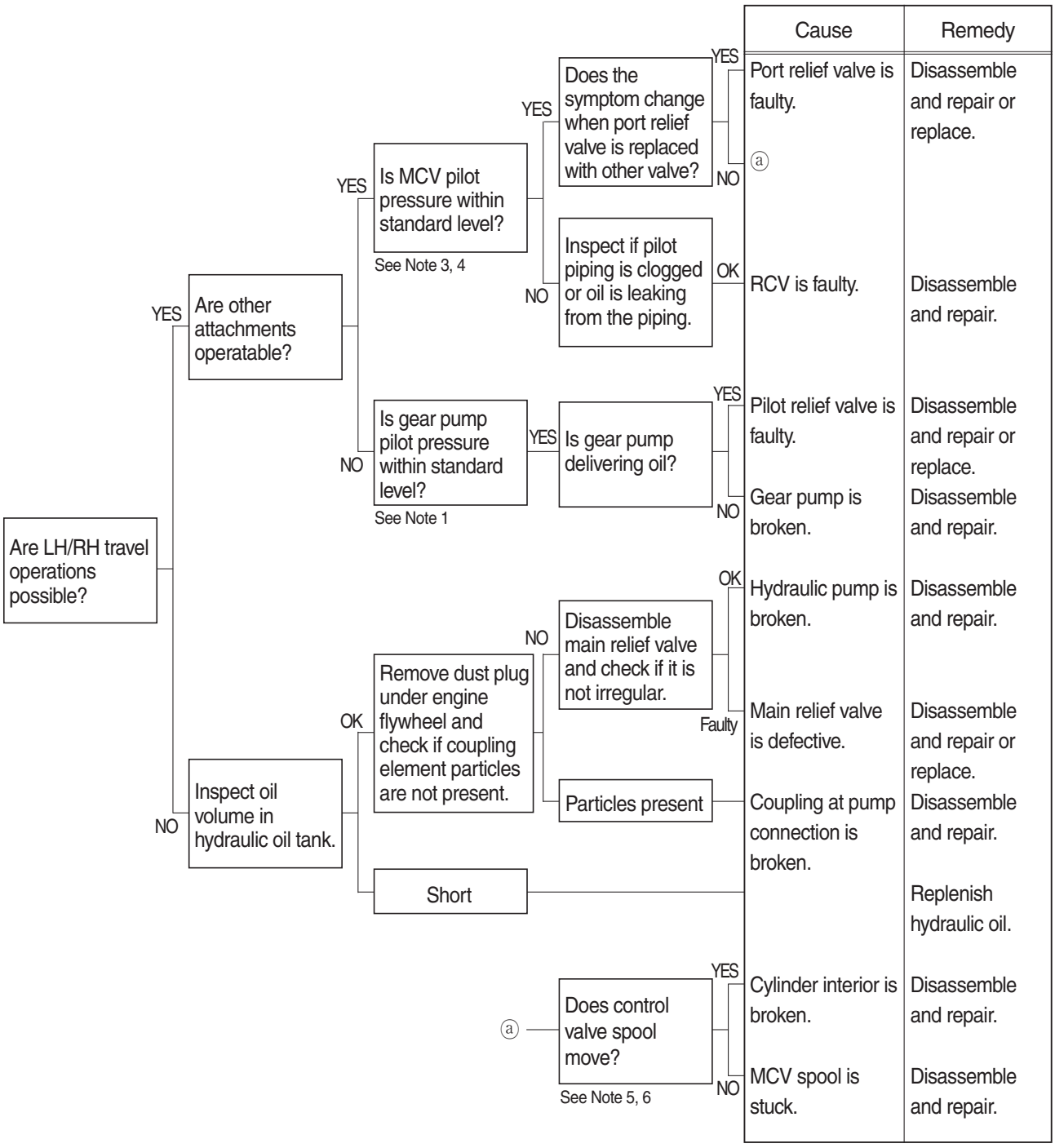
7) MACHINE MAKES A CURVED TRAVEL OR DOES NOT TRAVEL AT ALL WHEN TRAVEL AND ATTACHMENT OPERATIONS ARE EXECUTED AT THE SAME TIME



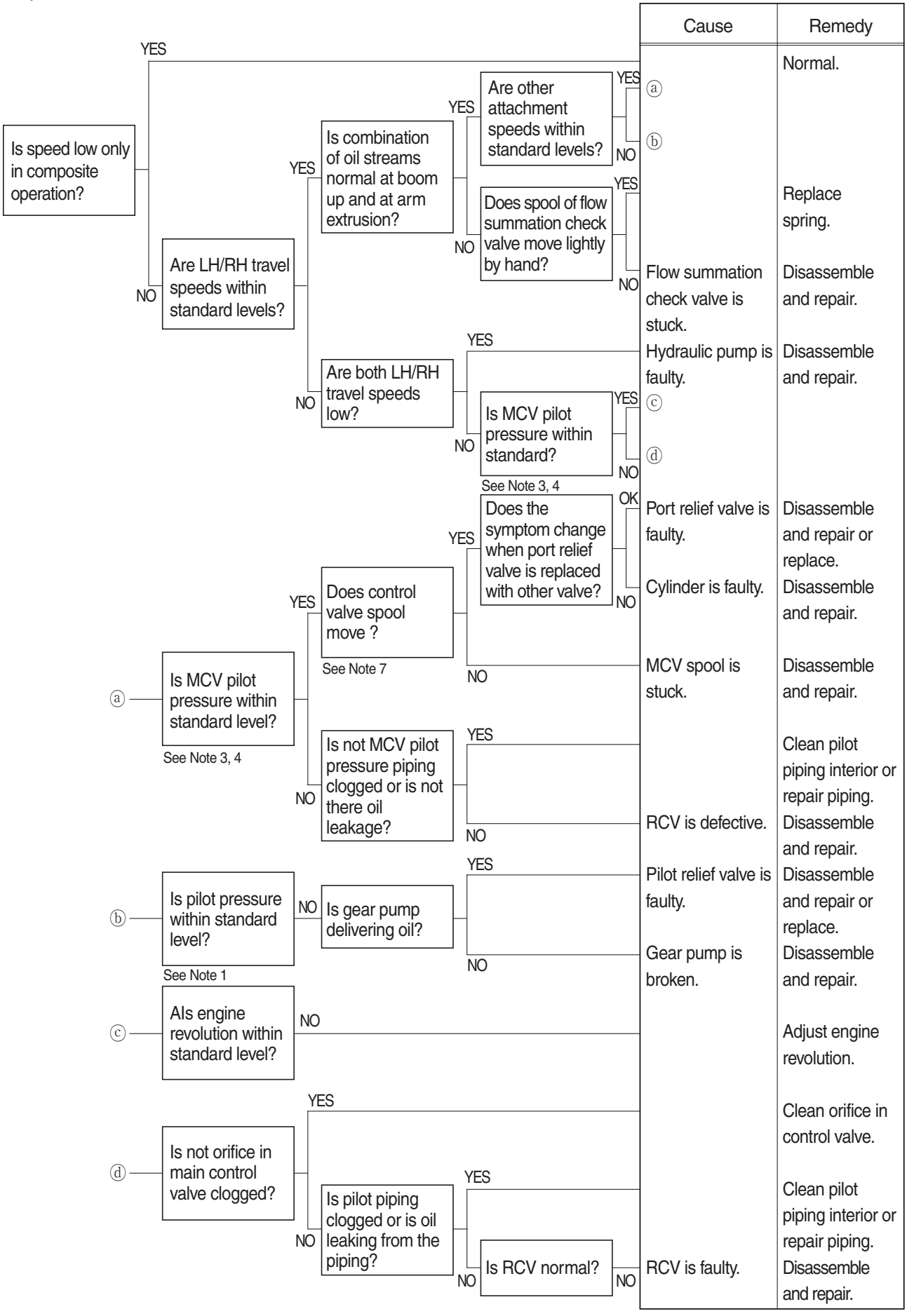
Cause	Remedy
	Normal.
Straight spool is faulty.	Repair or replace.
	Remove dirt on signal orifice.
Pilot relief valve is defective.	Disassemble and repair or replace.
Gear pump is broken.	Disassemble and repair.

6. ATTACHMENT SYSTEM

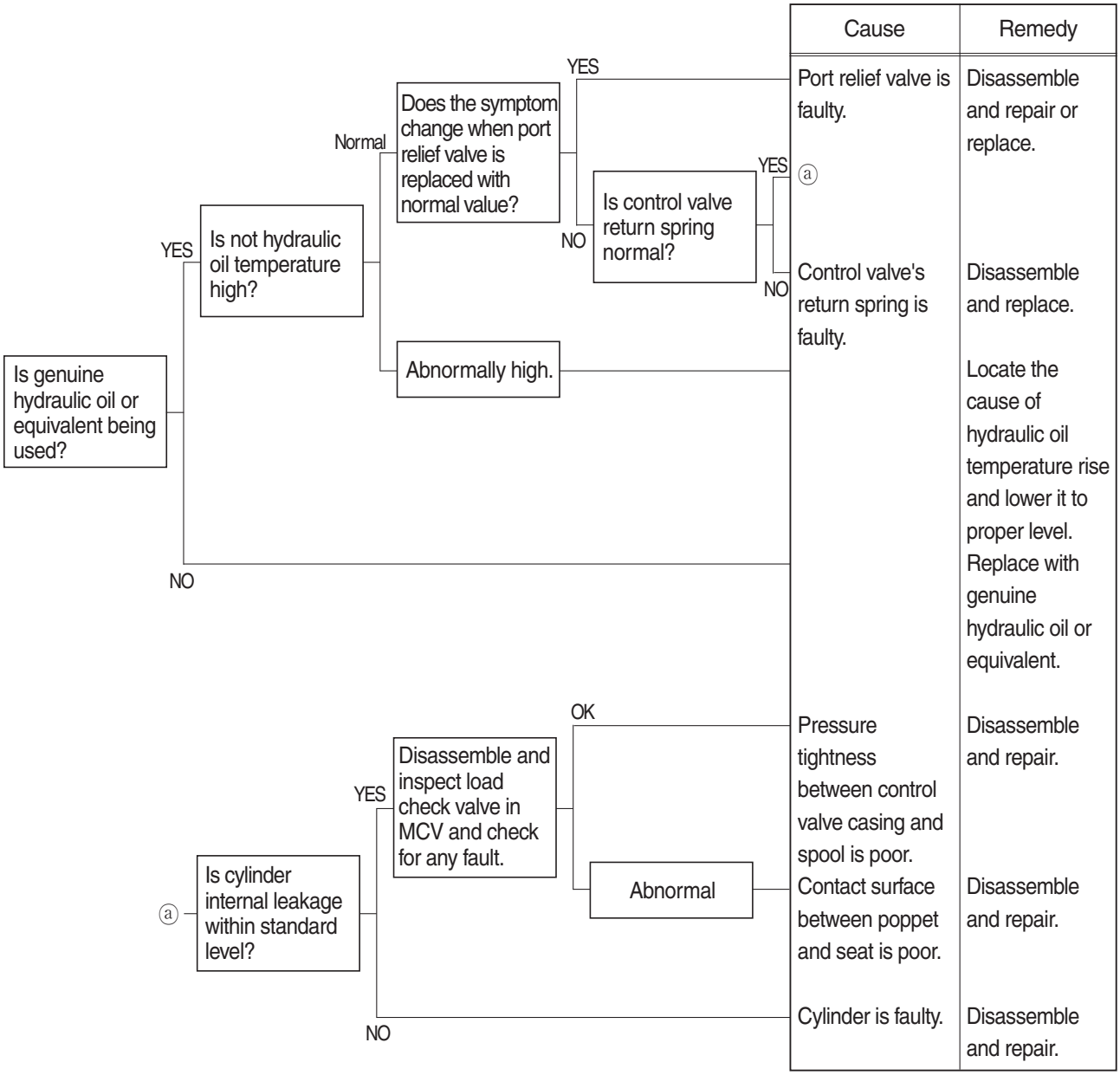
1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



2) BOOM, ARM OR BUCKET SPEED IS LOW

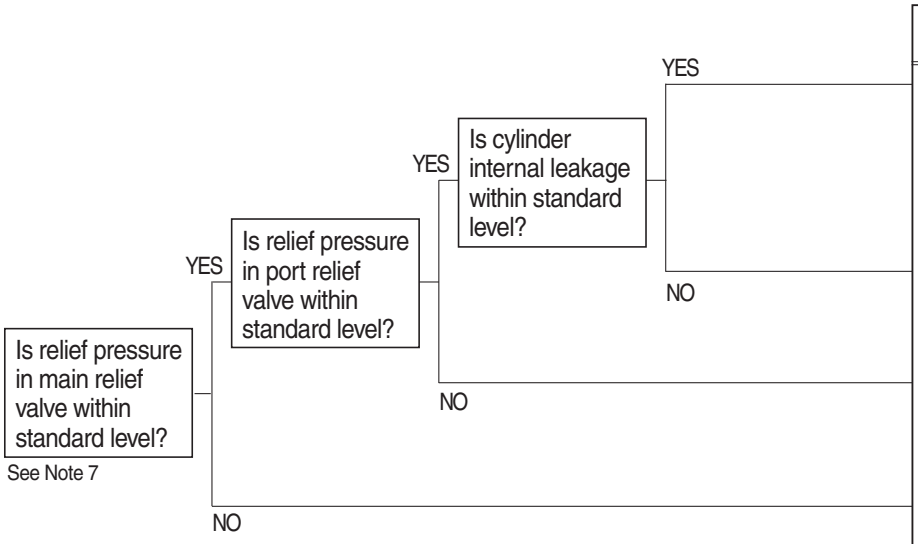


3) BOOM, ARM OR BUCKET CYLINDER EXTENDS OR CONTRACTS ITSELF AND ATTACHMENT FALLS



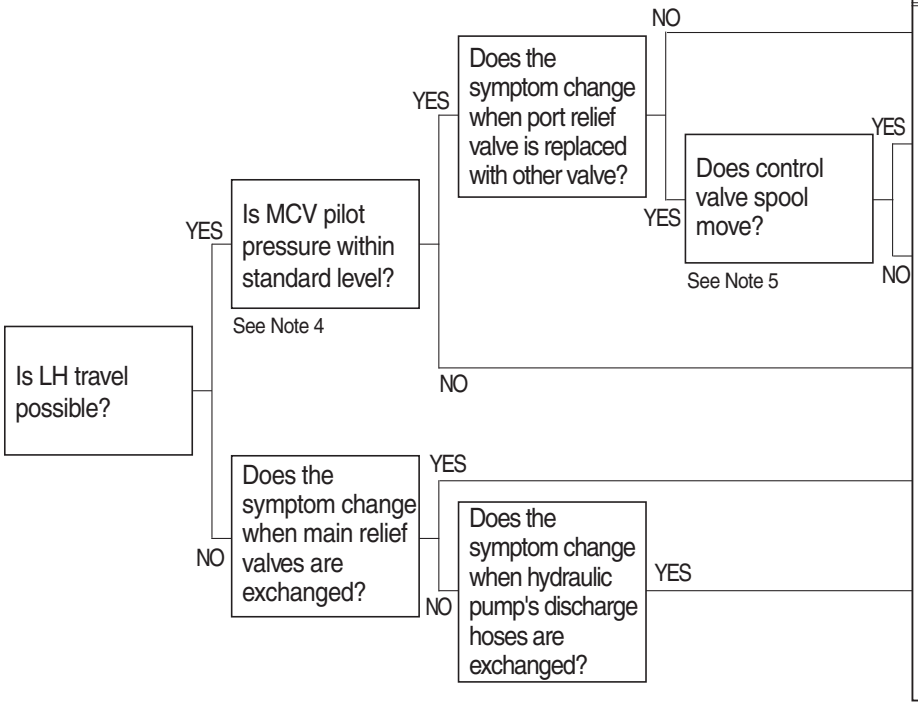
Cause	Remedy
Port relief valve is faulty.	Disassemble and repair or replace.
ⓐ	
Control valve's return spring is faulty.	Disassemble and replace.
	Locate the cause of hydraulic oil temperature rise and lower it to proper level. Replace with genuine hydraulic oil or equivalent.
Pressure tightness between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

4) BOOM, ARM OR BUCKET POWER IS WEAK



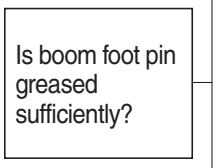
Cause	Remedy
Cylinder is faulty.	Check according to the procedure in Item "Speed is low". Disassemble and repair.
Port relief valve is faulty.	Adjust pressure, repair or replace.
Main relief valve is defective.	Adjust pressure, repair or replace.

5) ONLY BUCKET OPERATION IS TOTALLY IMPOSSIBLE



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

6) BOOM MAKES A SQUEAKING NOISE WHEN BOOM IS OPERATED

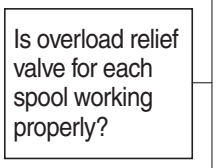


YES

NO

Cause	Remedy
	Frictional noise occurs between the sliding faces of boom cylinder's oil seal and boom proper. ※ Frictional noise will disappear if they are kept used.
Boom foot pin has run out of grease.	Supply grease to it. ※ If seizure is in an initial stage, supply sufficient grease. If seizure is in a grown state, correct it by paper lapping or with an oil stone.

7) TIME LAG OF MACHINE WORKING IS LARGE.



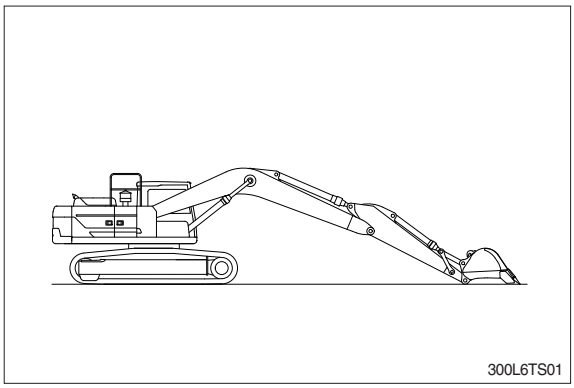
YES

NO

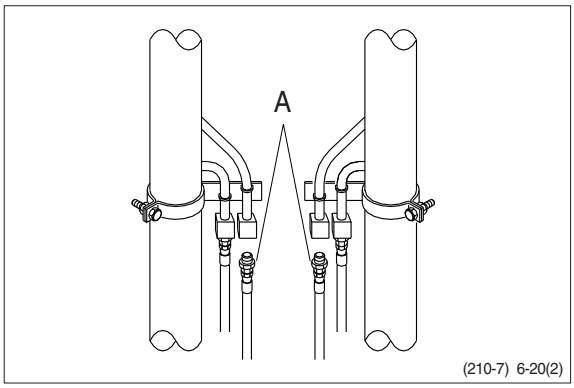
Cause	Remedy
	Refer to 2)
Overload relief valve is faulty.	Disassemble and repair.

※ HOW TO CHECK INTERNAL BOOM CYLINDER LEAKAGE

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

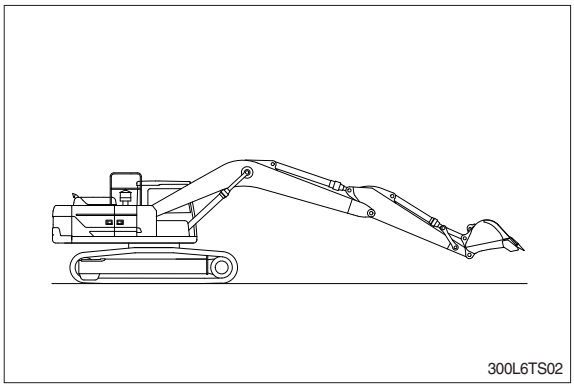


2. Disconnect hose (A) from rod side of boom cylinder and drain oil from cylinders and hose. (put cups on piping and hose ends)



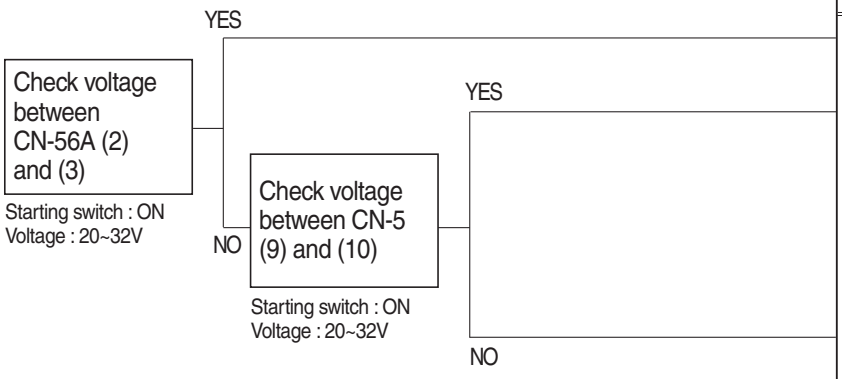
3. Raise bucket OFF the ground by retracting the arm cylinder rod.

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



1. WHEN STARTING SWITCH IS TURNED ON, CLUSTER DISPLAY DOES NOT APPEAR

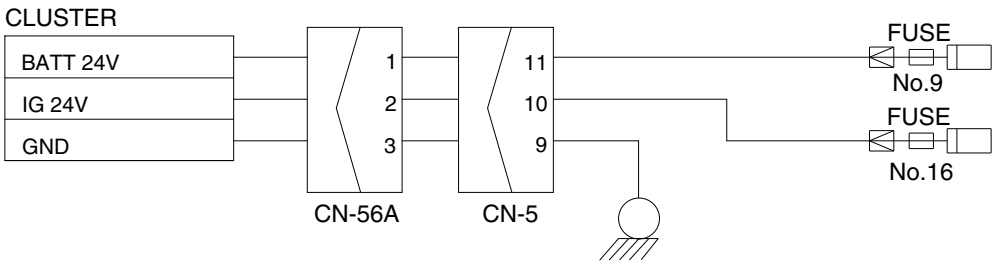
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 9, 16.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective cluster	Replace
Disconnection in wiring harness or poor contact between CN-5-CN-56A	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-5 (9) -GND or fuse No. 9, 16	Repair or replace (after clean)

Check voltage

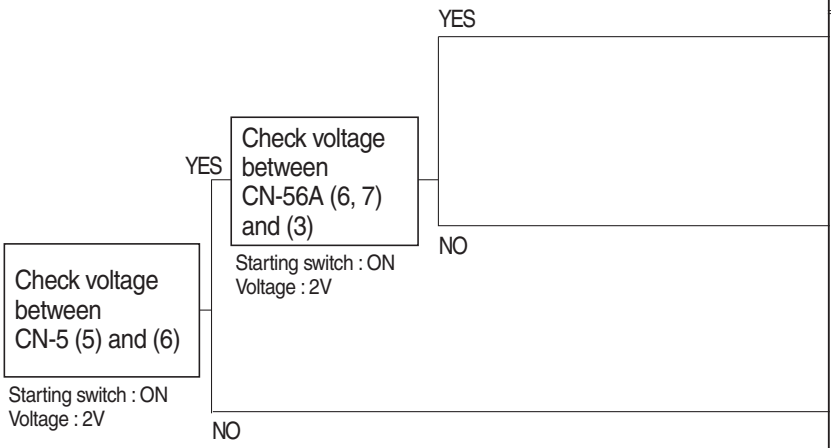
YES	20~32V
NO	0V



300L6ES101

2. ⚠ COMMUNICATION ERROR FLASHES ON THE CLUSTER (HCESPN 840, FMI 2)

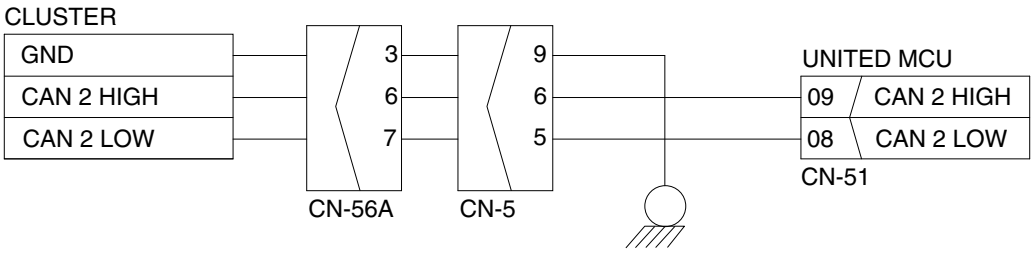
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective cluster	Replace
Disconnection in wiring harness or poor contact between CN-56A (6, 7)-CN-5 (5, 6)	Repair or replace (after clean)
Defective united MCU Disconnection in wiring harness or poor contact between CN-5 (5, 6)- CN-51 (08, 09)	Replace Repair or replace (after clean)

Check voltage

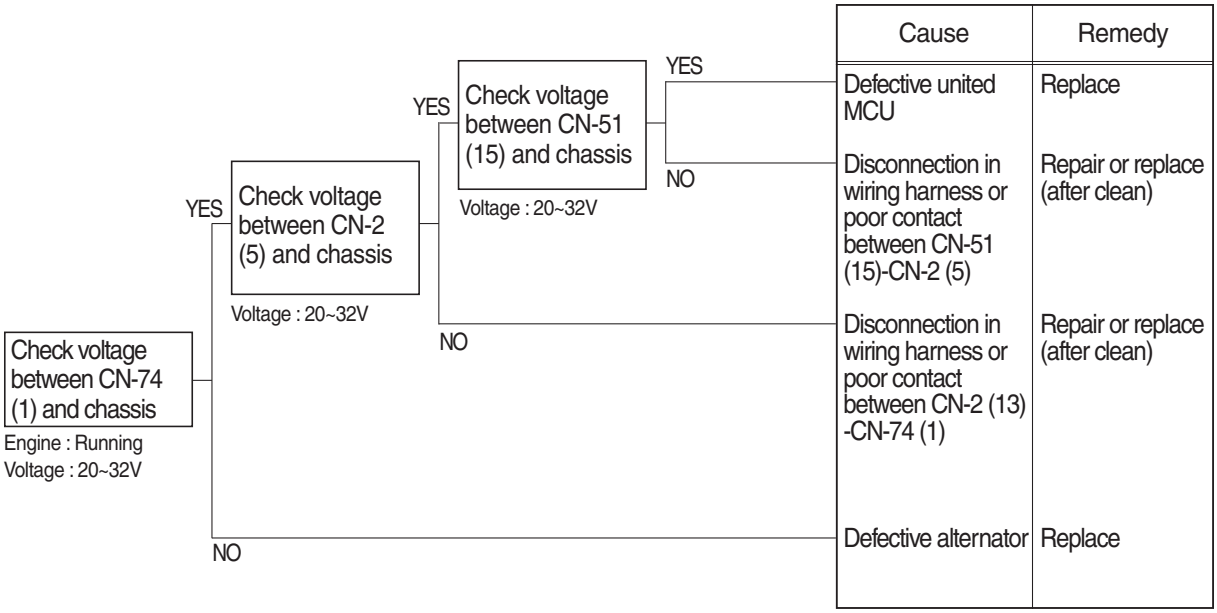
YES	2V
NO	0V



140L6ES102

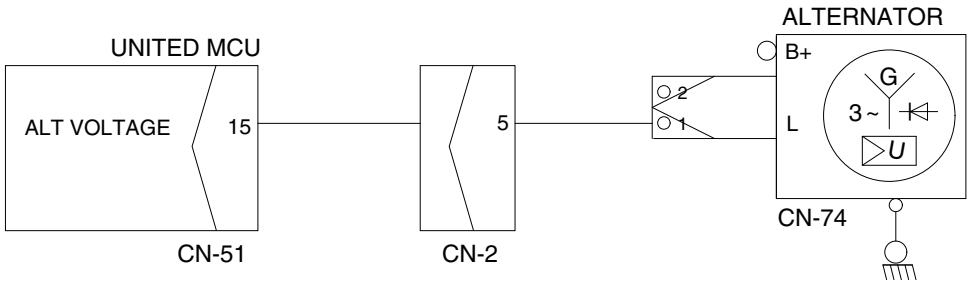
3. BATTERY CHARGING WARNING LAMP LIGHTS UP (Starting switch : ON)

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



Check voltage

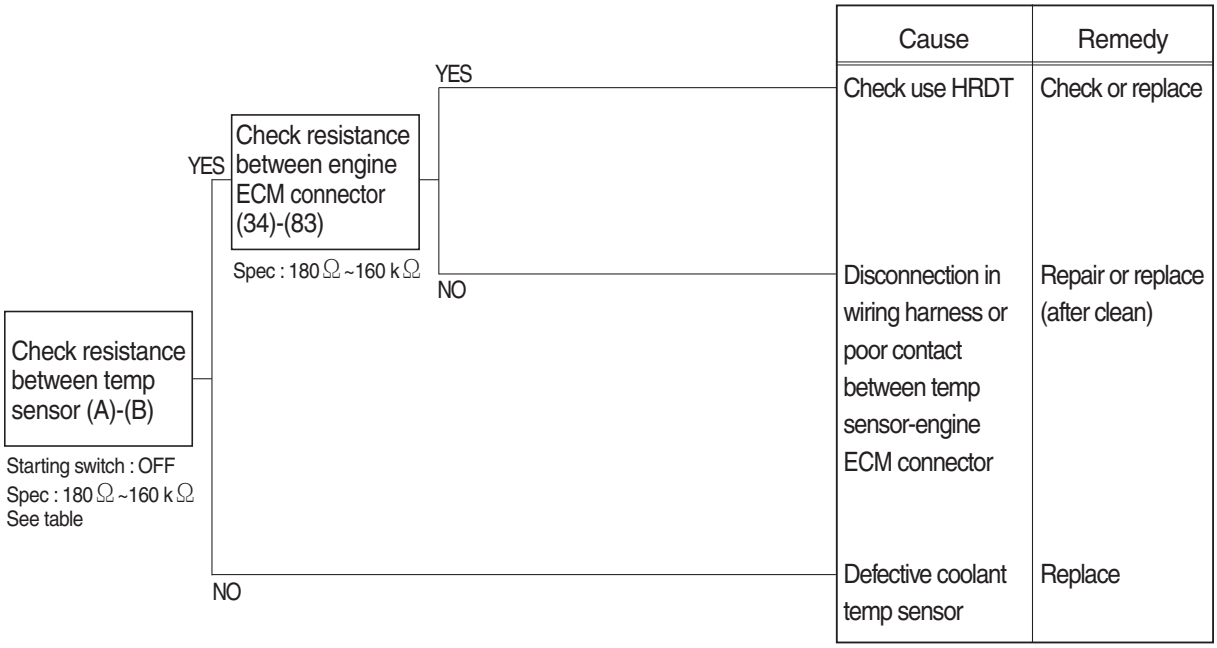
YES	20~32V
NO	0V



480A6ES103

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

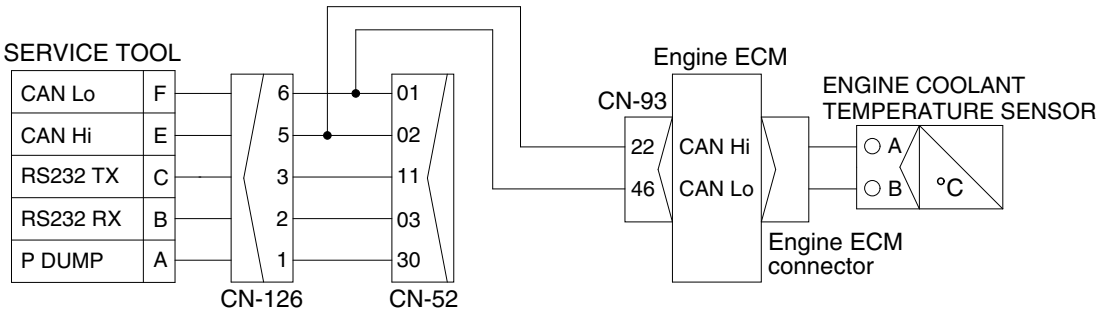
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

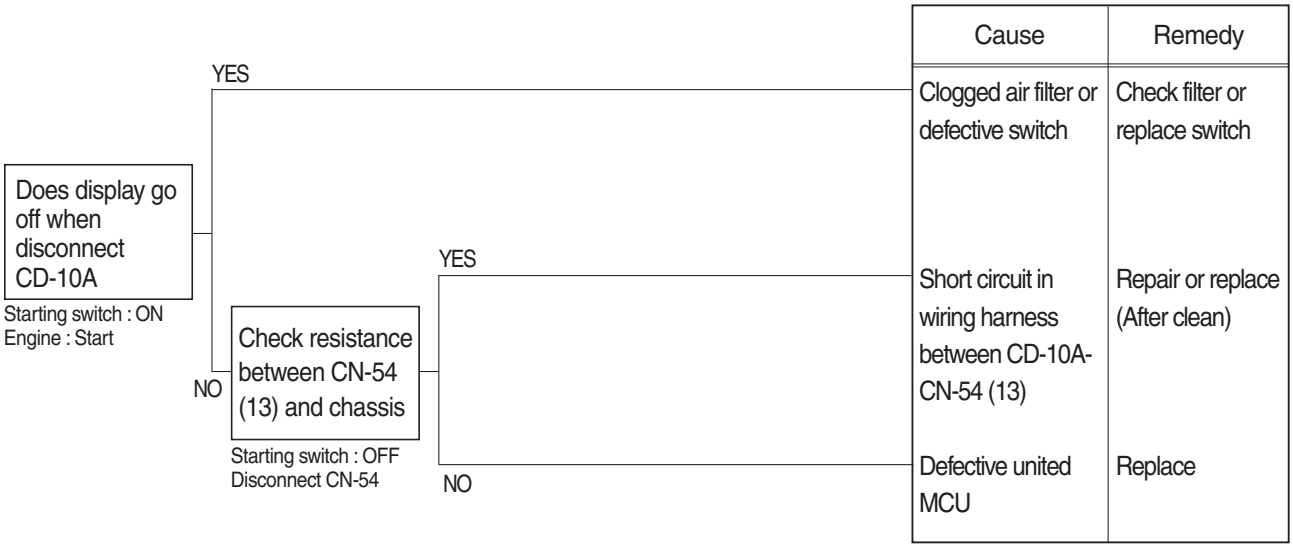
Temperature (˚C)	0	25	50	80	95
Resistance (kΩ)	30~37	9.3~10.7	3.2~3.8	1.0~1.3	0.7~0.8



480A6ES104

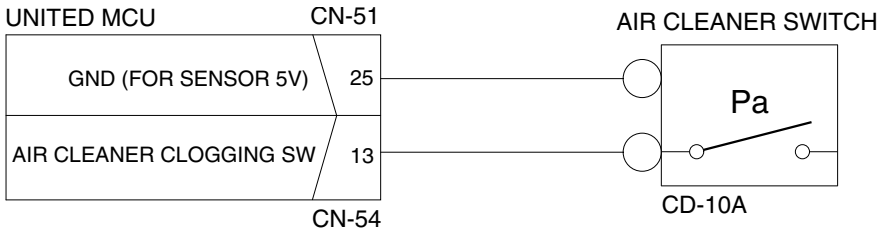
5. WHEN AIR CLEANER WARNING LAMP LIGHTS UP (engine is started)

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



Check resistance

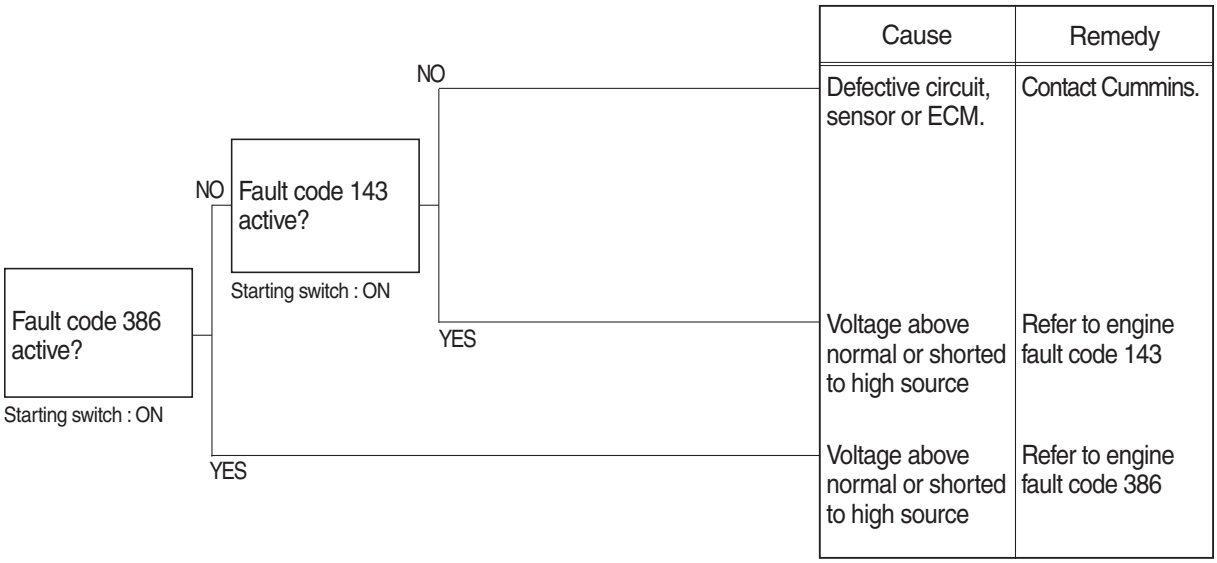
YES	MAX 1Ω
NO	MIN 1MΩ

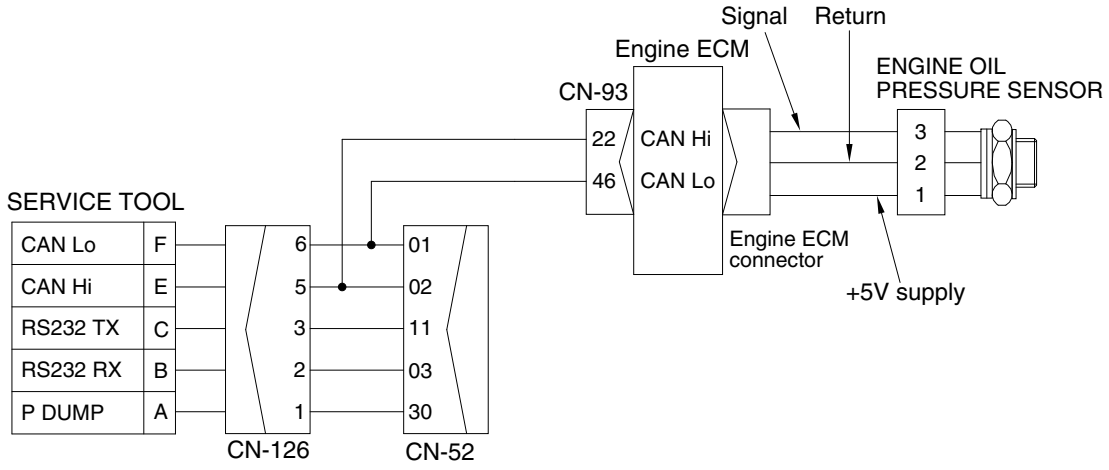


140L6ES106

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

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

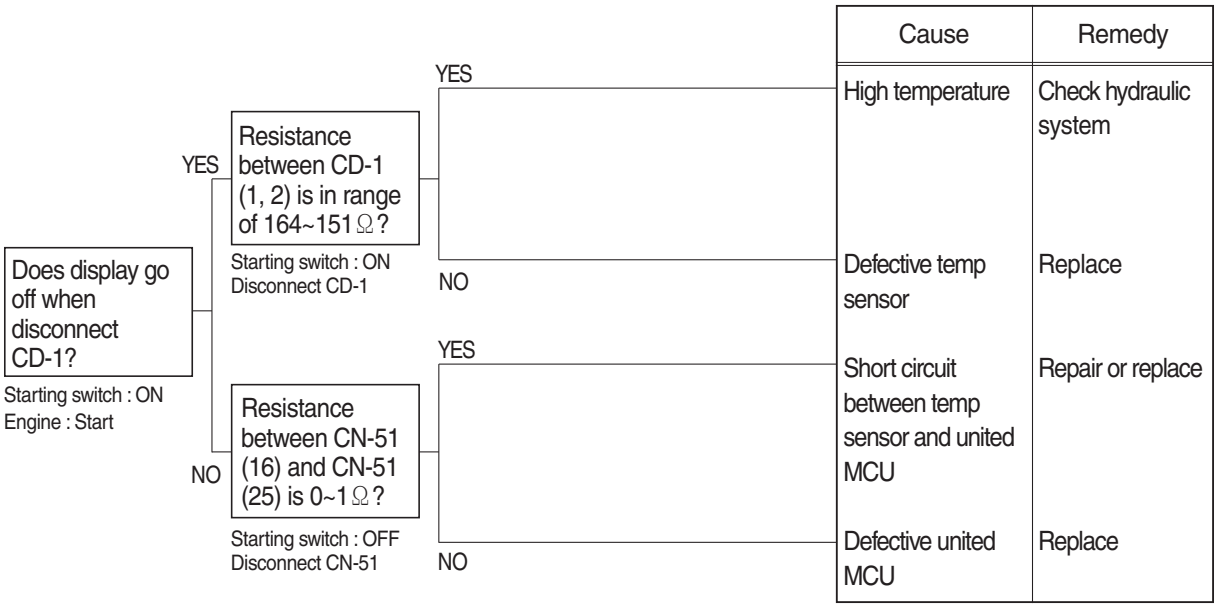


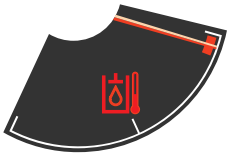


480A6ES107

7. WHEN HYDRAULIC OIL TEMPERATURE WARNING LAMP LIGHTS UP (engine is started)

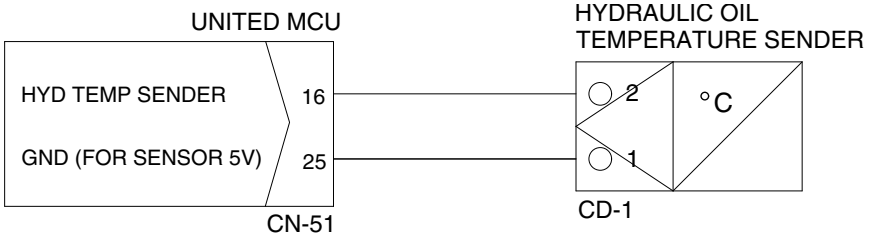
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

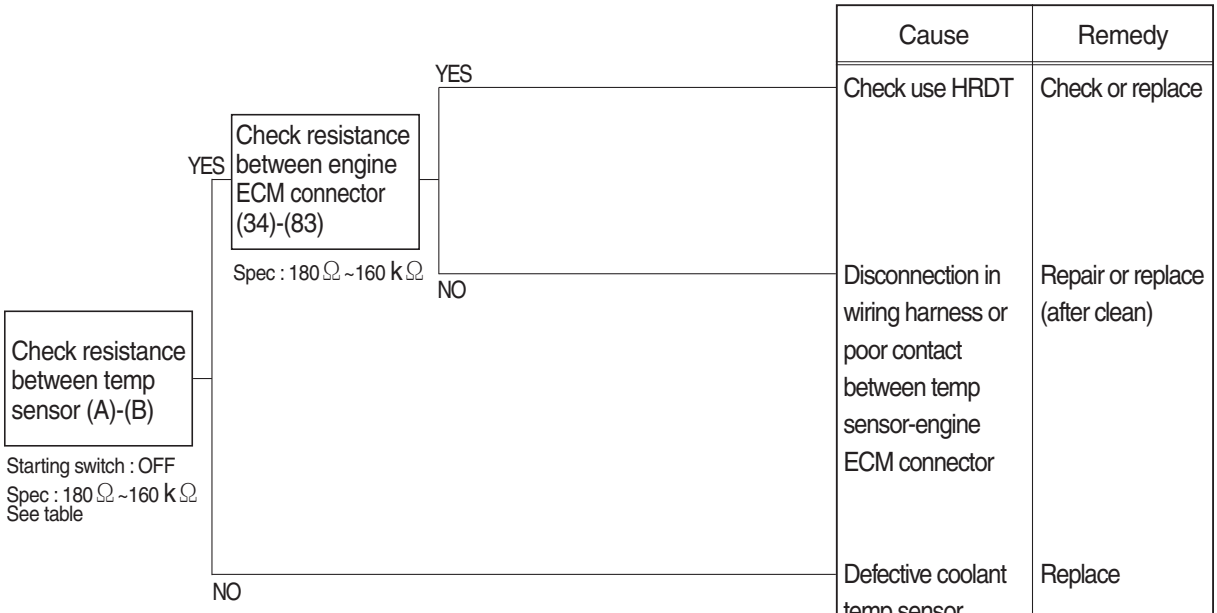
Temperature (˚C)	~ -30	~ -10	~ 0	~ 40	~ 70	~ 80	~ 90	~ 100	105~
Resistance (kΩ)	22.22 ~31.78	8.16 ~10.74	5.18 ~ 6.6	1.06 ~1.28	0.39 ~0.476	0.322 ~0.298	0.243 ~0.219	0.185 ~0.167	0.164 ~0.151



140L6ES108

8. WHE RE GAUGE DOES NOT OPERATE

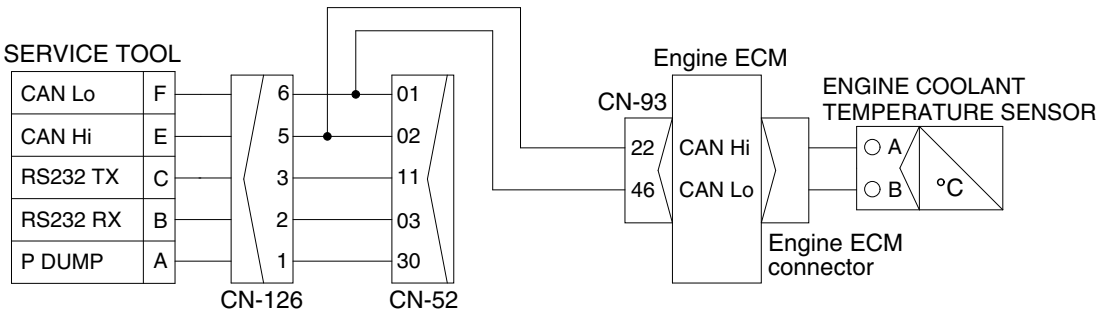
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

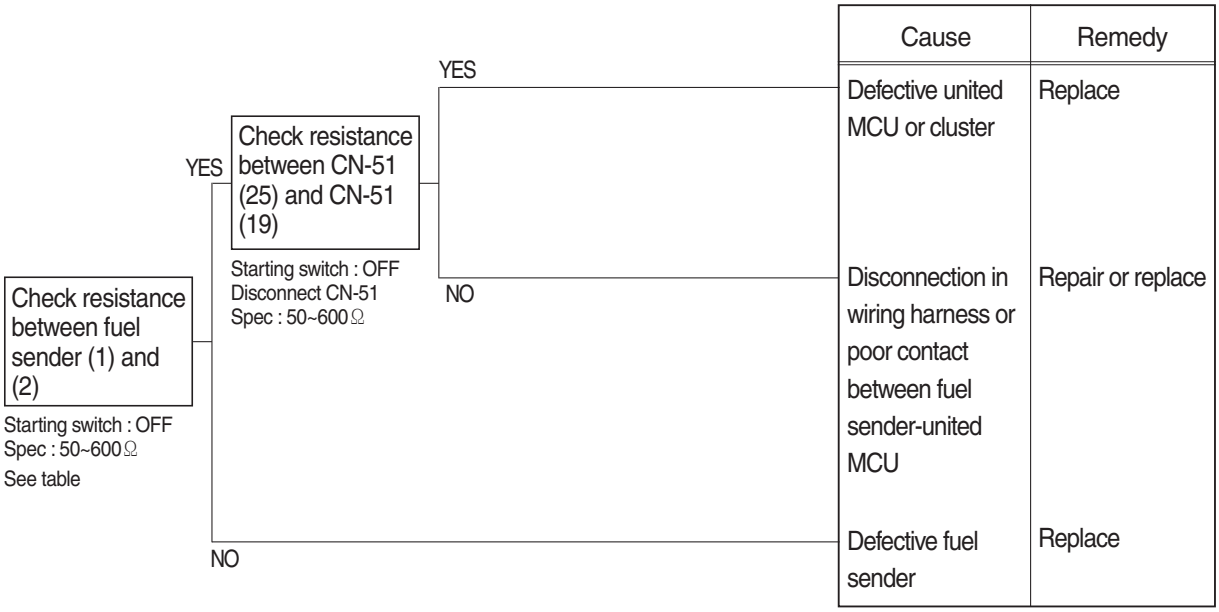
Temperature (˚C)	0	25	50	80	95
Resistance (kΩ)	30~37	9.3~10.7	3.2~3.8	1.0~1.3	0.7~0.8

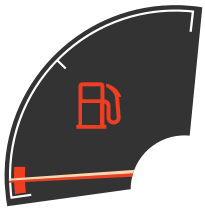


480A6ES104

9. WHEN FUEL GAUGE DOES NOT OPERATE (HCESPN 301, FMI 3 or 4)

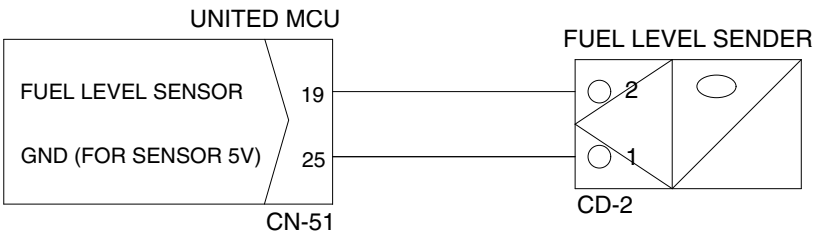
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

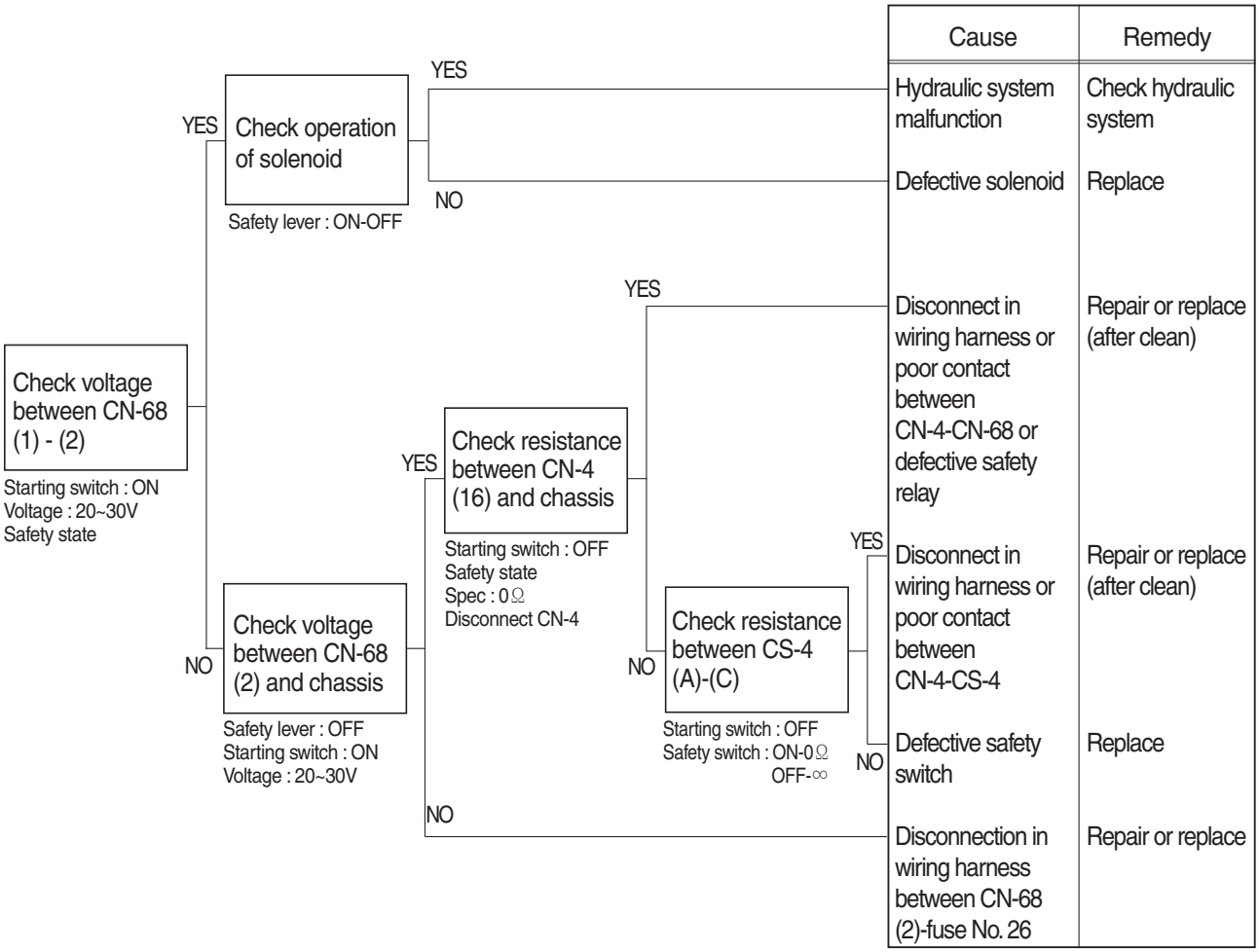
Range	Resistance (Ω)	Range	Resistance (Ω)
Full	50	5/12	400
11/12	100	4/12	450
10/12	150	3/12	500
9/12	200	2/12	550
8/12	250	1/12	600
7/12	300	Empty warning	700
6/12	350	-	-

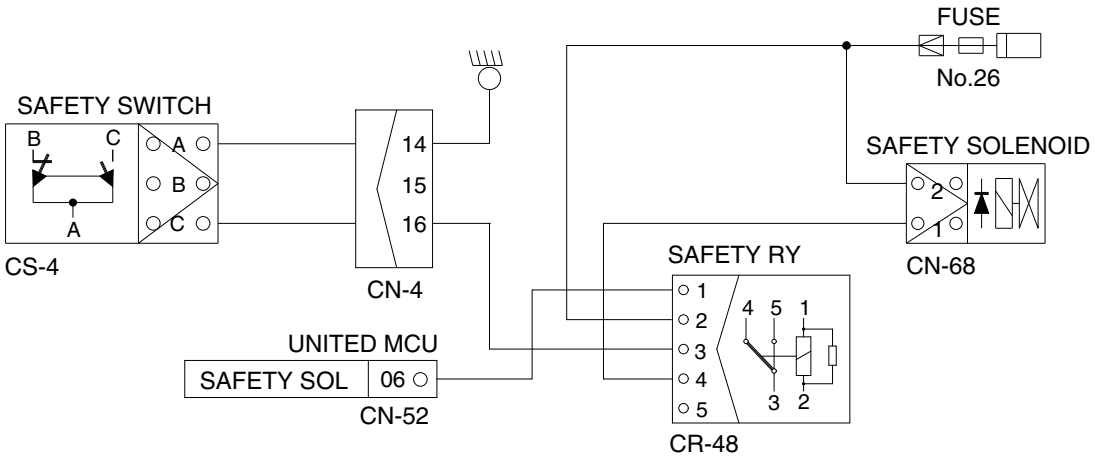


140L6ES110

10. WHEN SAFETY SOLENOID DOES NOT OPERATE

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 26.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.
· Auto safety lock function execution condition : When the RCV pilot pressure increases above certain pressure within the standard time after changing the safety knob LOCK → UNLOCK
· Under the above conditions, the electric current is turned off to the safety solenoid, and the function of RCV and pedal is disabled.

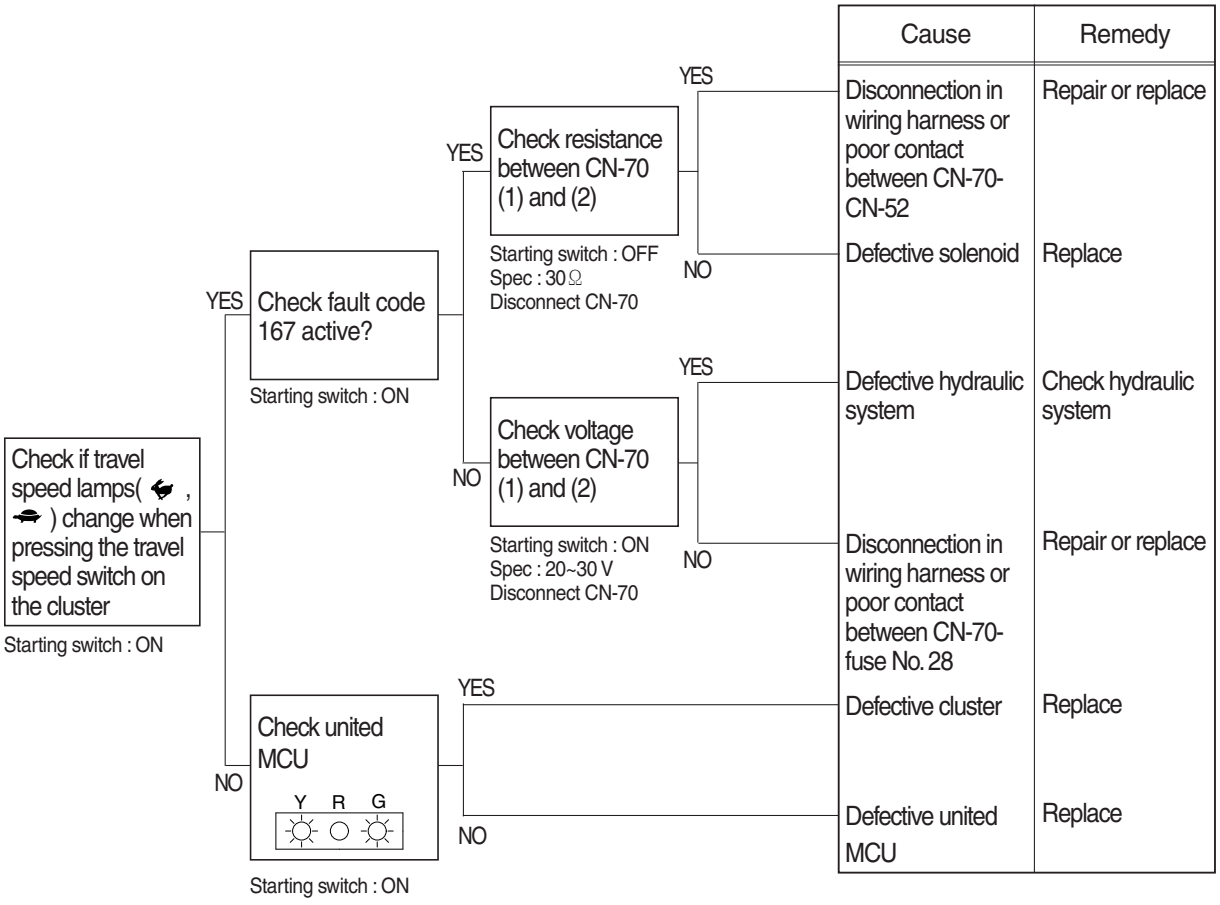


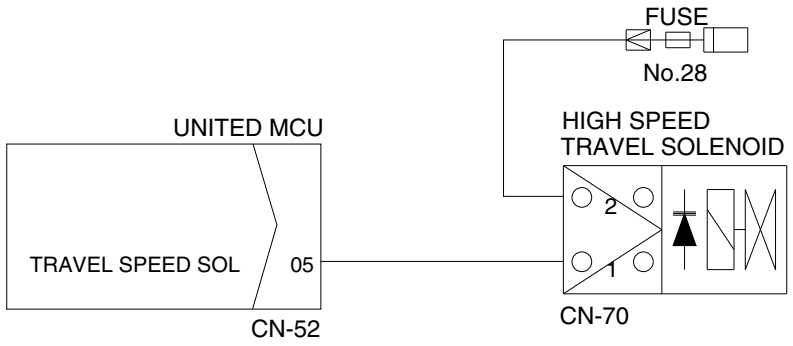


220A6ES109

11. WHEN TRAVEL SPEED 1, 2 DOES NOT OPERATE (HCESPN 167, FMI 4 or 6)

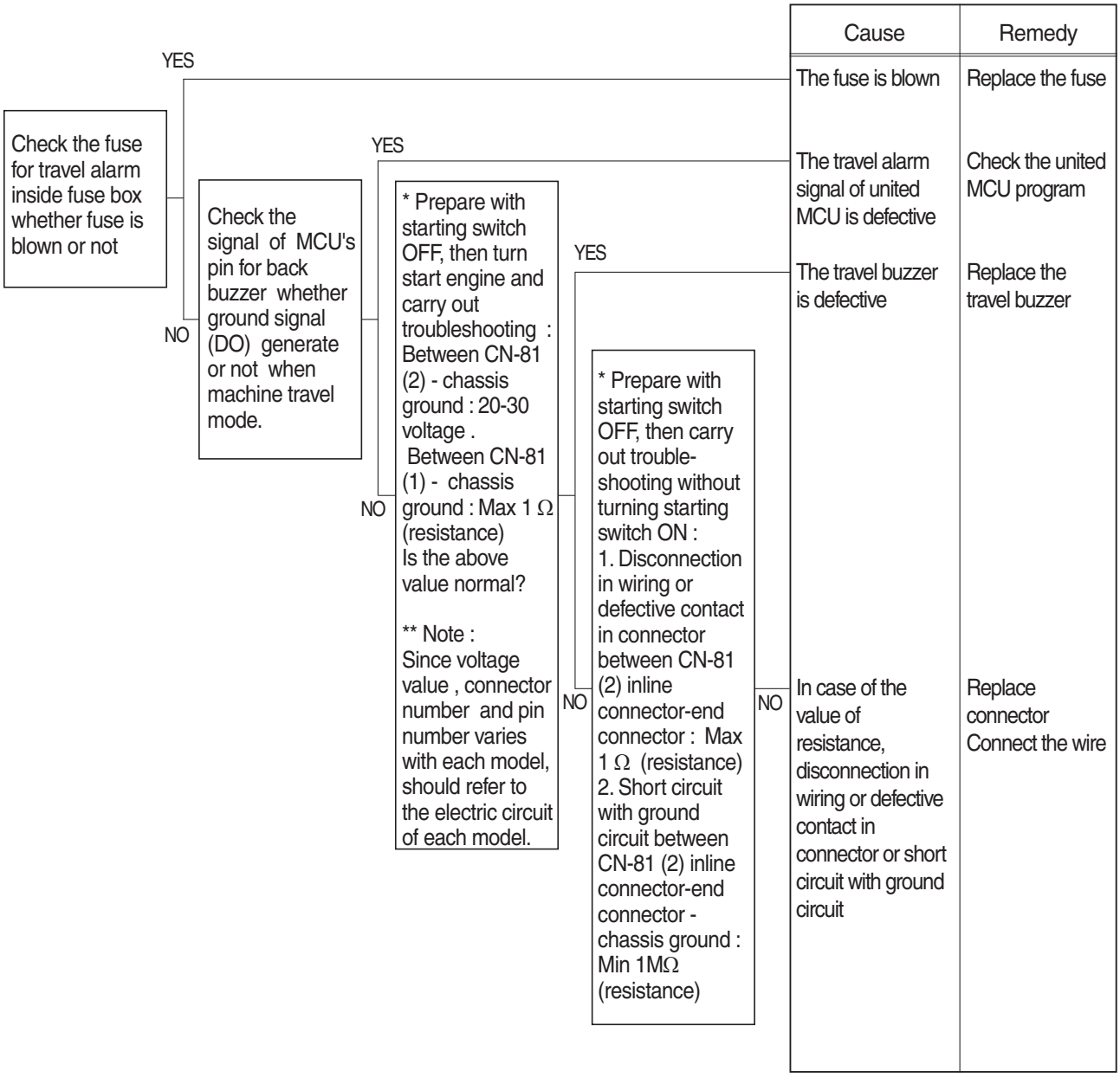
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 28.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



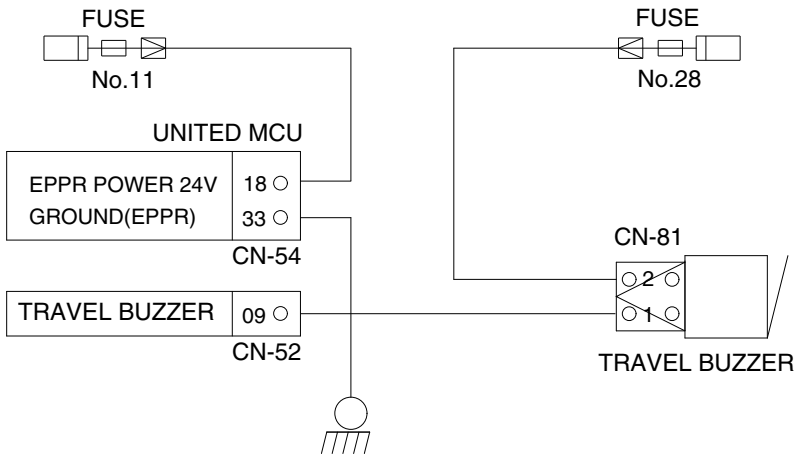


140L6ES107

12. TRAVEL ALARM DOES NOT SOUND OR DOES NOT STOP SOUNDING

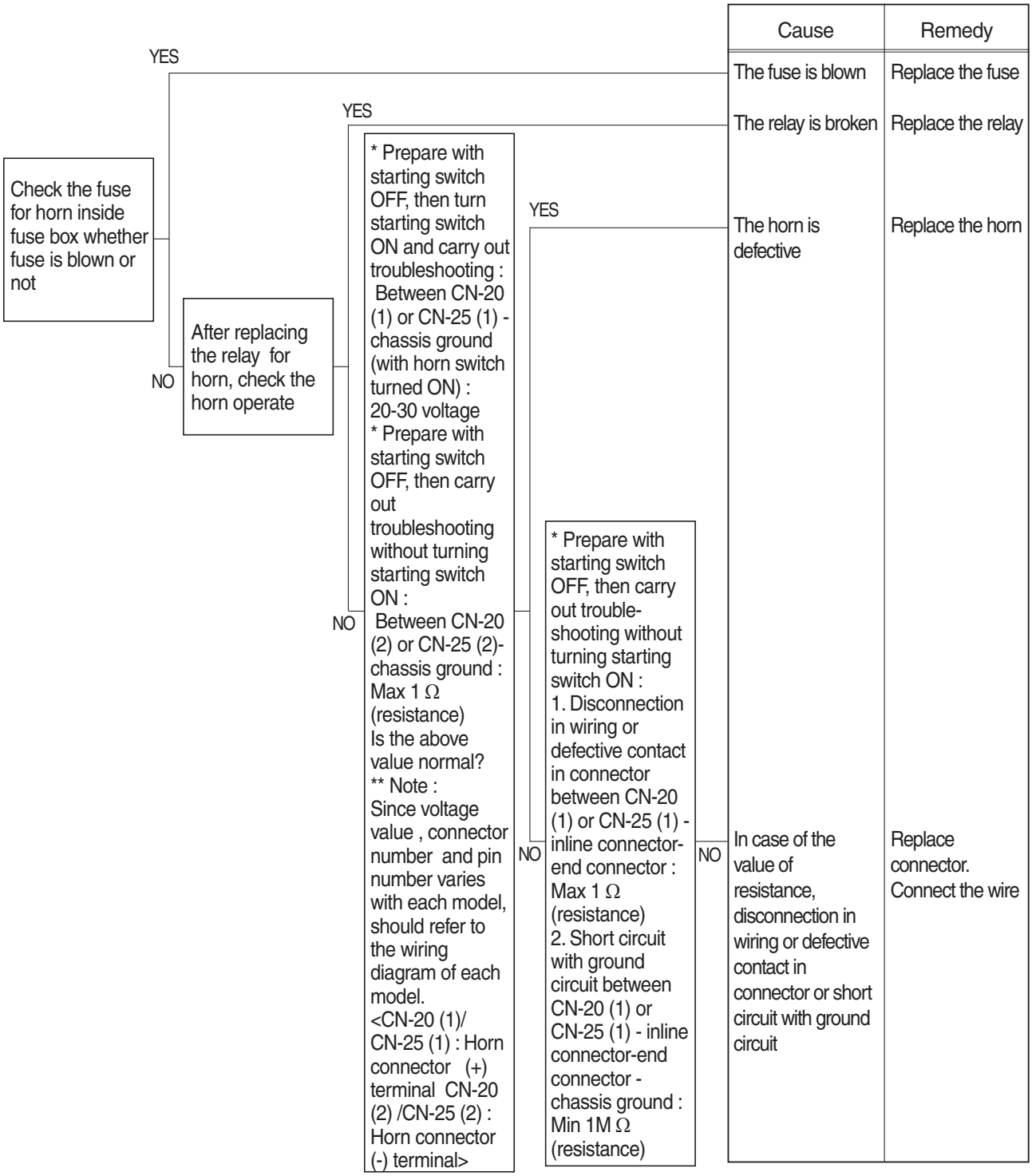


Cause	Remedy
The fuse is blown	Replace the fuse
The travel alarm signal of united MCU is defective	Check the united MCU program
The travel buzzer is defective	Replace the travel buzzer
In case of the value of resistance, disconnection in wiring or defective contact in connector or short circuit with ground circuit	Replace connector Connect the wire



220A6ES150

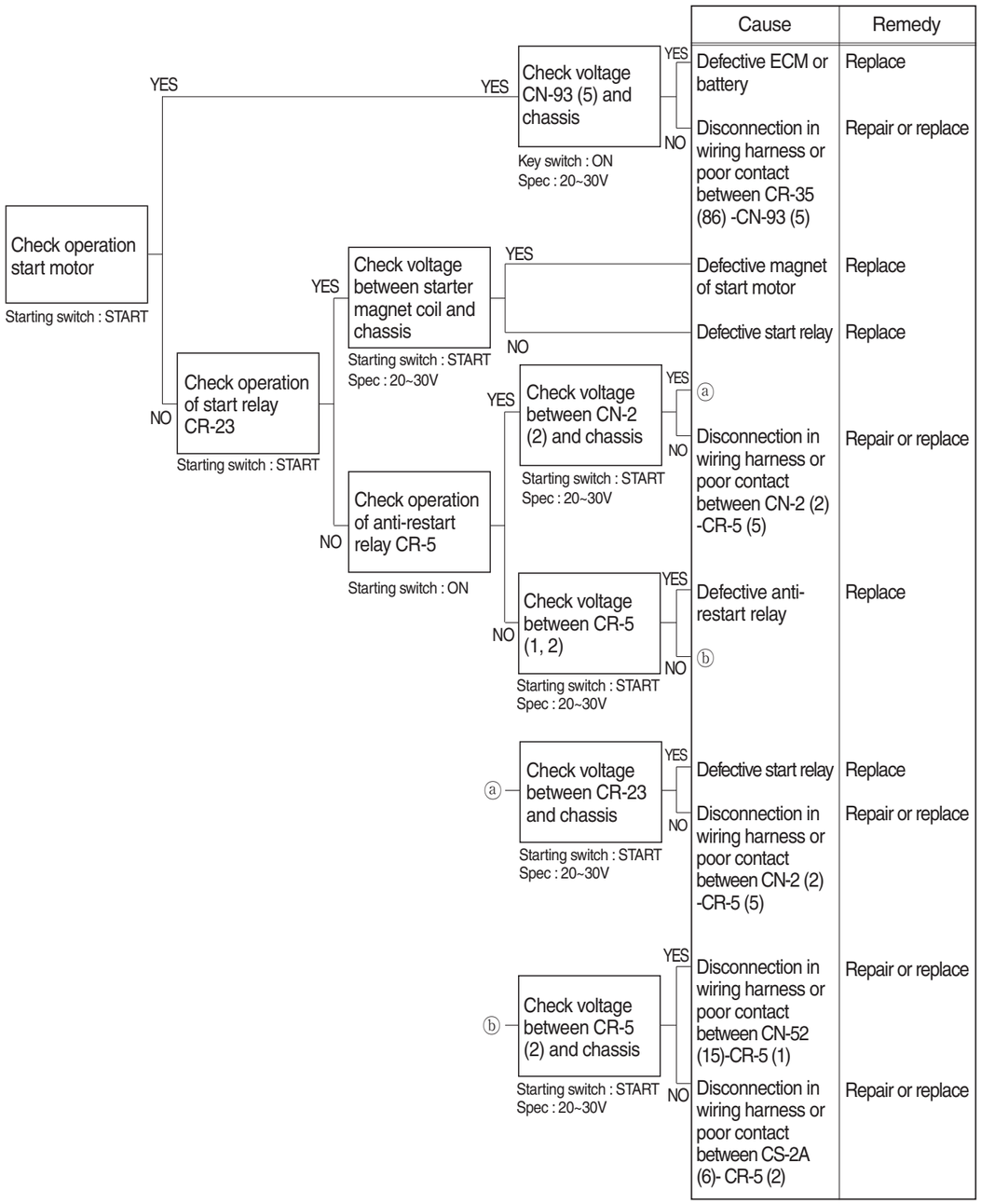
13. HORN DOES NOT SOUND



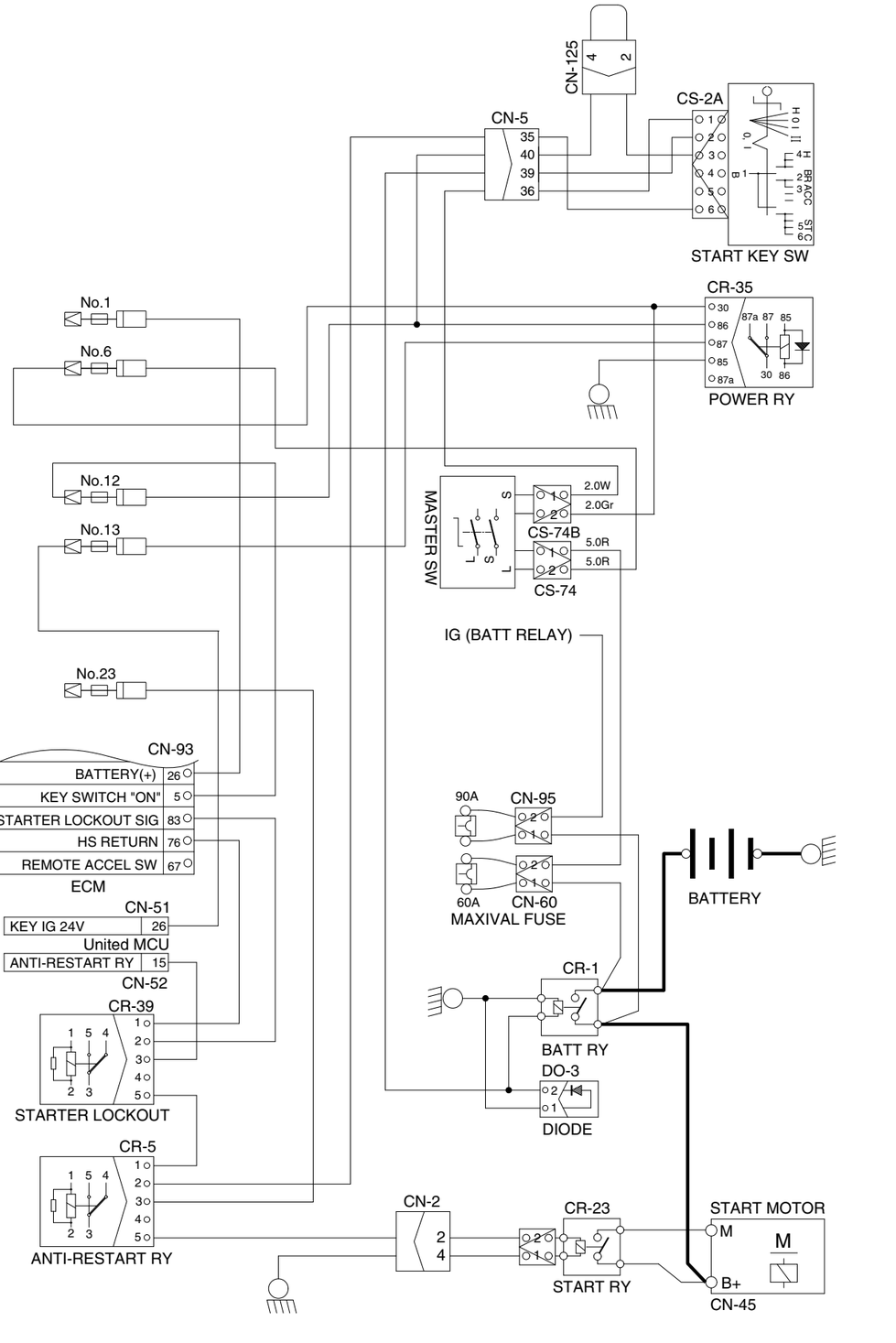
220A6ES151

14. WHEN ENGINE DOES NOT START ([- +] lights up condition)

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 1, 6, 12, 13, 23.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



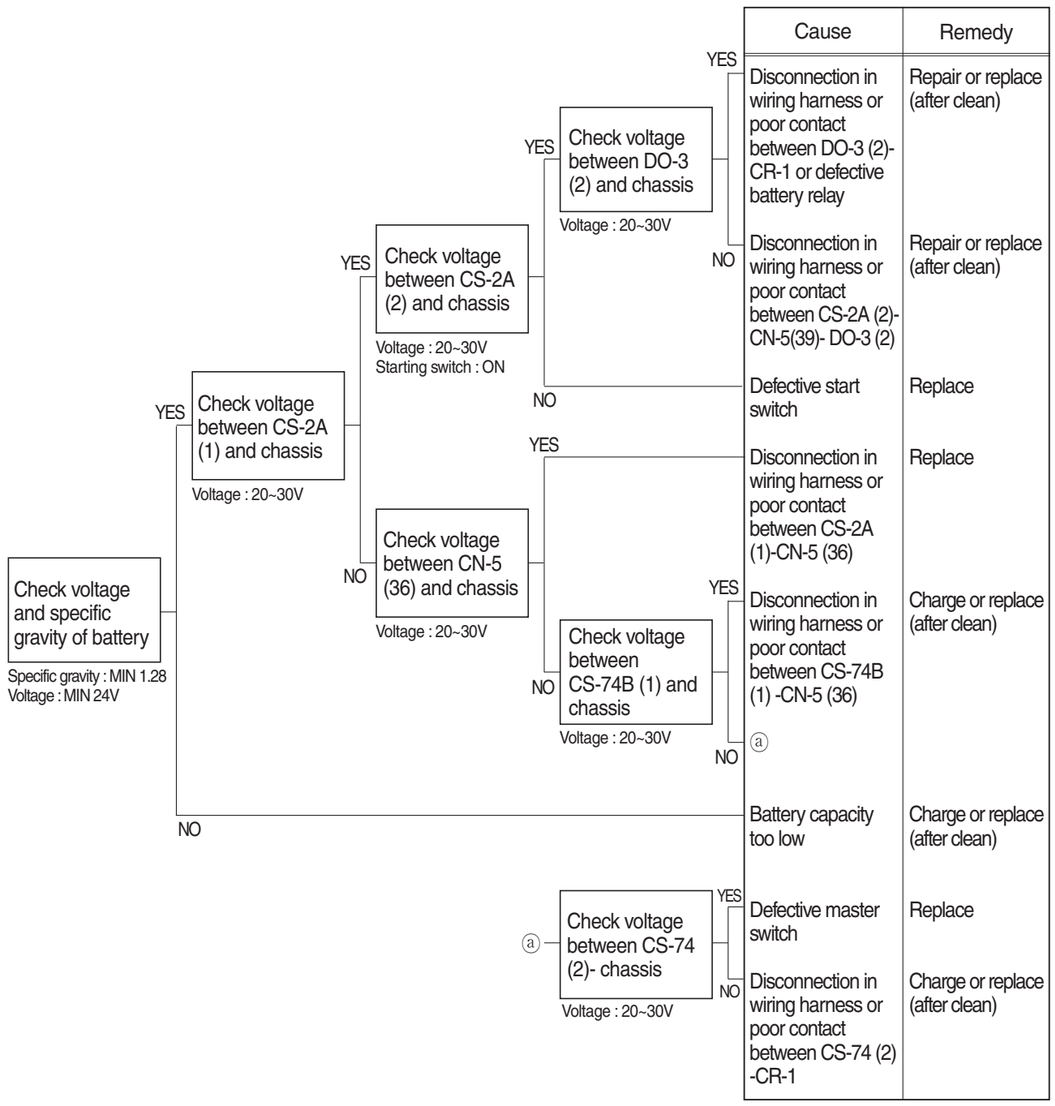
Cause	Remedy
Defective ECM or battery	Replace
Disconnection in wiring harness or poor contact between CR-35 (86) -CN-93 (5)	Repair or replace
Defective magnet of start motor	Replace
Defective start relay	Replace
ⓐ	
Disconnection in wiring harness or poor contact between CN-2 (2) -CR-5 (5)	Repair or replace
Defective anti-restart relay	Replace
ⓑ	
Defective start relay	Replace
Disconnection in wiring harness or poor contact between CN-2 (2) -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

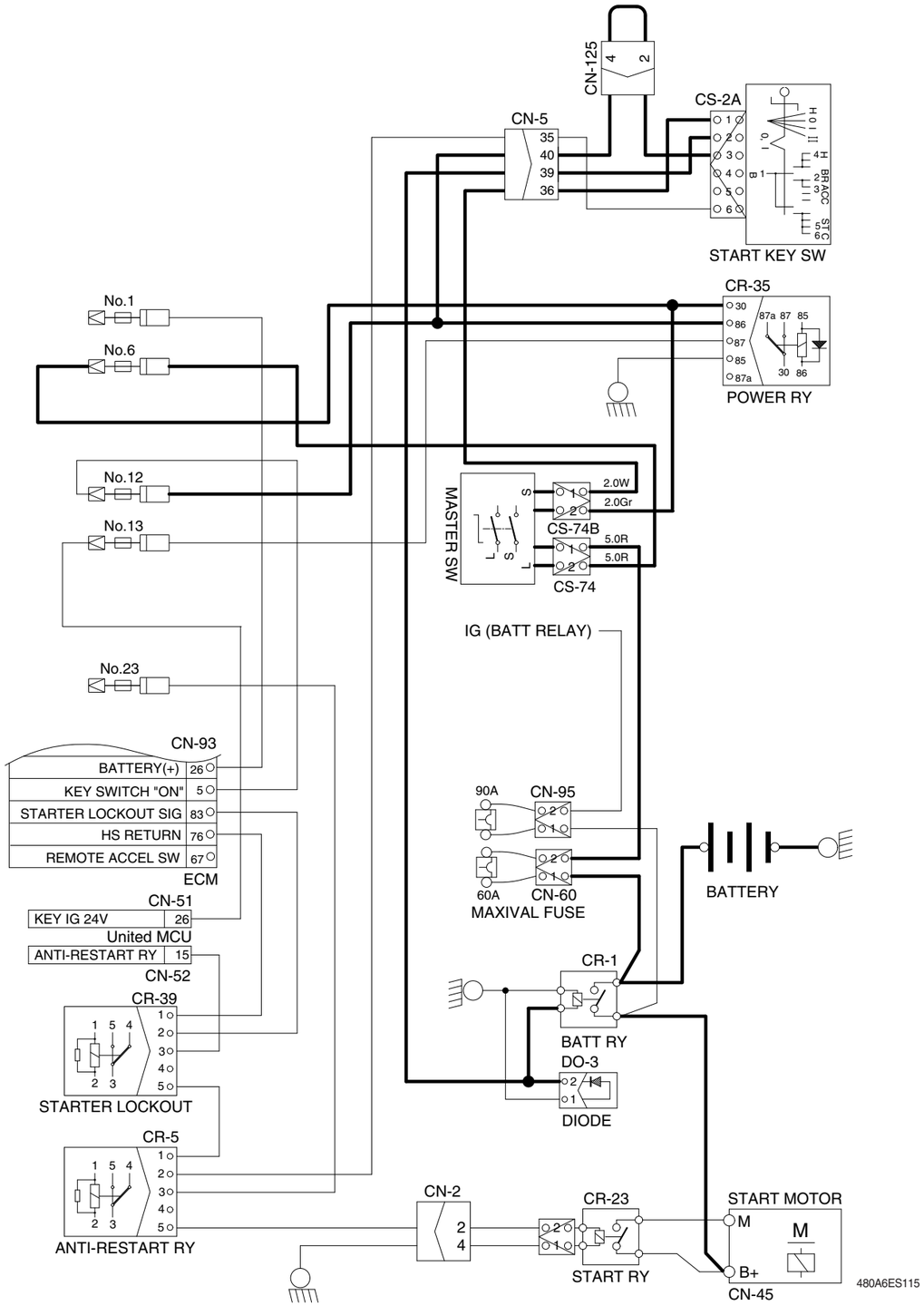


480A6ES114

15. WHEN STARTING SWITCH ON DOES NOT OPERATE

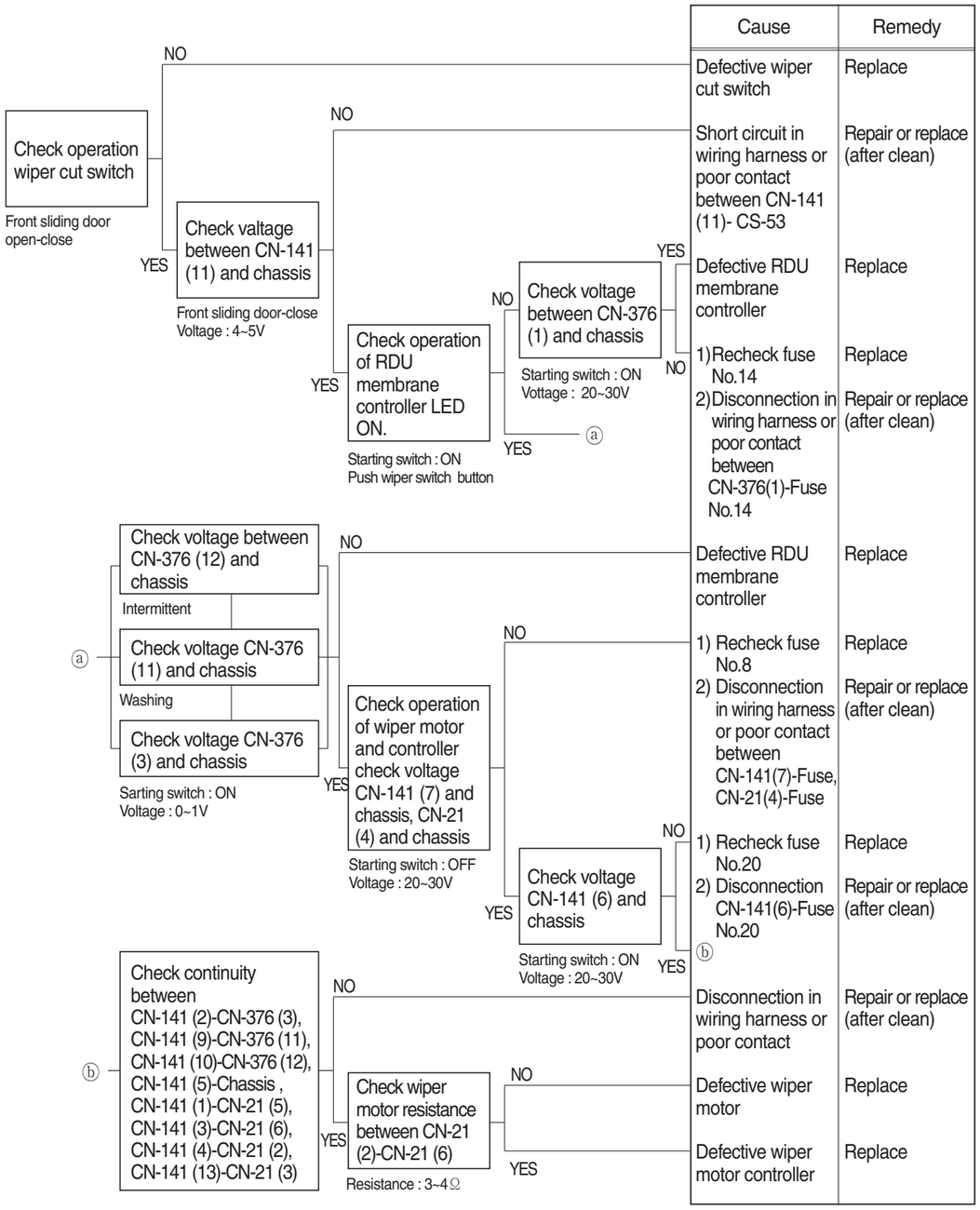
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted, master switch ON and check open circuit of maxival fuse (CN-60).
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



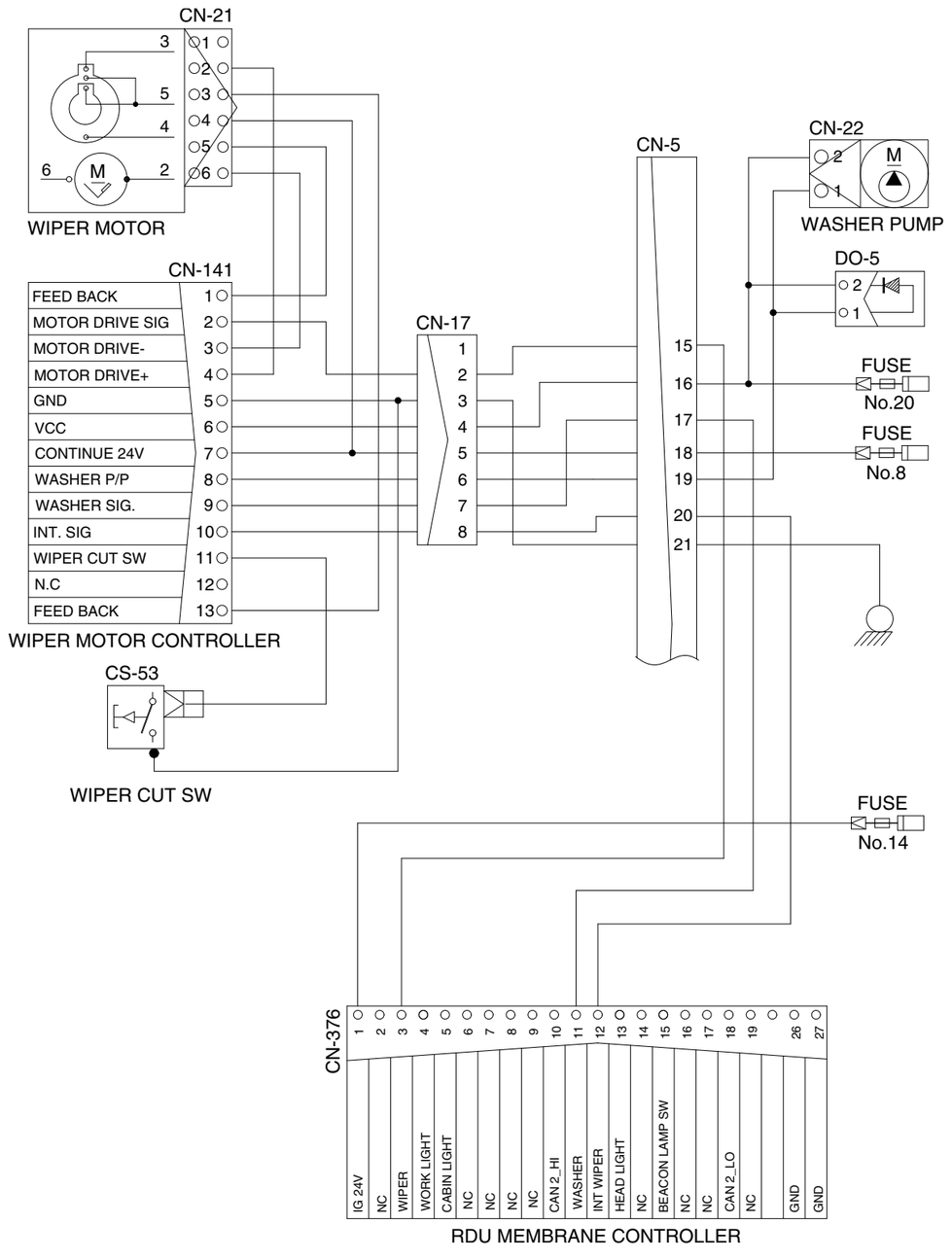


16. WHEN STARTING SWITCH IS TURNED ON, WIPER MOTOR DOES NOT OPERATE

- 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. 8, 14 and 20 is not blown out.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



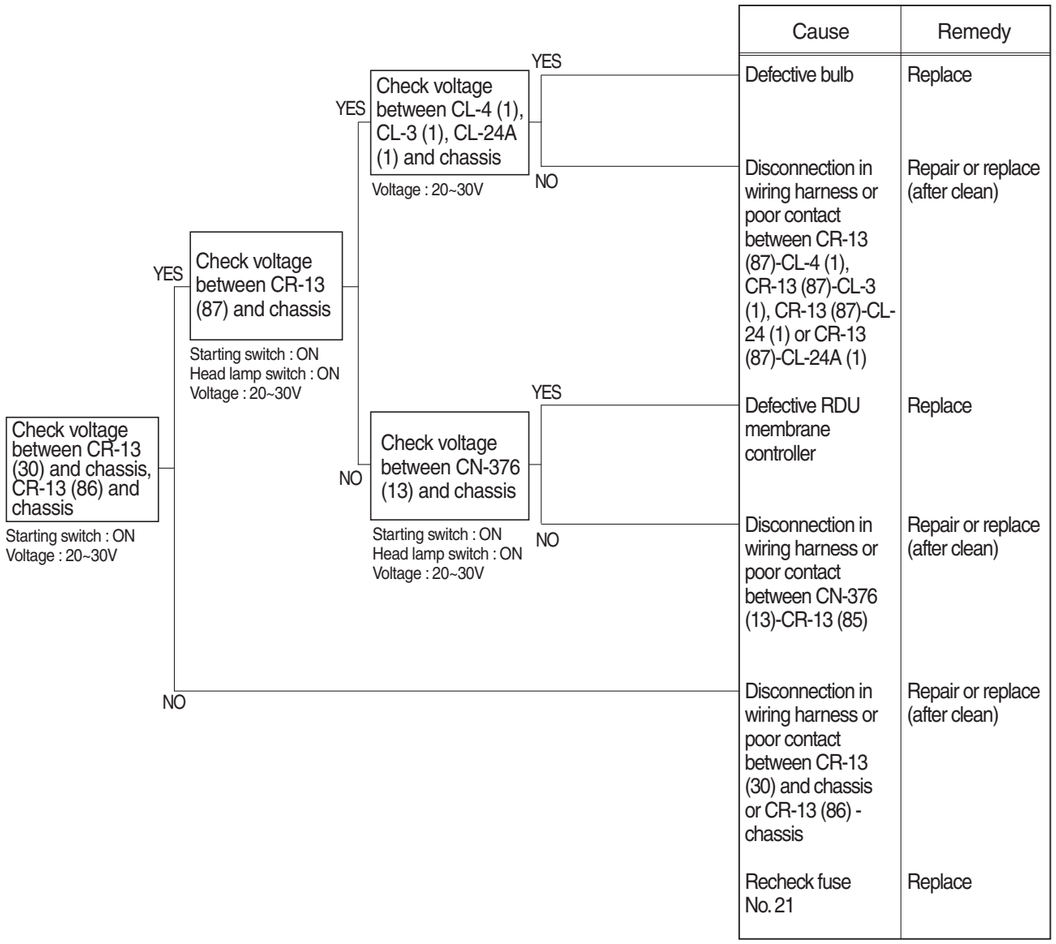
Cause	Remedy
Defective wiper cut switch	Replace
Short circuit in wiring harness or poor contact between CN-141 (11)- CS-53	Repair or replace (after clean)
Defective RDU membrane controller	Replace
1)Recheck fuse No.14	Replace
2)Disconnection in wiring harness or poor contact between CN-376(1)-Fuse No.14	Repair or replace (after clean)
Defective RDU membrane controller	Replace
1) Recheck fuse No.8	Replace
2) Disconnection in wiring harness or poor contact between CN-141(7)-Fuse, CN-21(4)-Fuse	Repair or replace (after clean)
1) Recheck fuse No.20	Replace
2) Disconnection CN-141(6)-Fuse No.20	Repair or replace (after clean)
Disconnection in wiring harness or poor contact	Repair or replace (after clean)
Defective wiper motor	Replace
Defective wiper motor controller	Replace



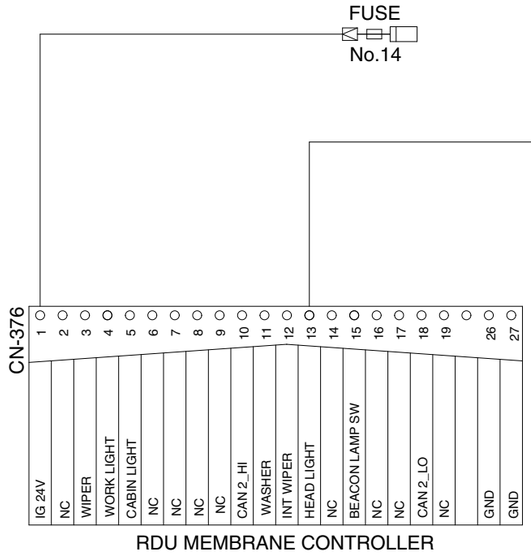
220A6ES116

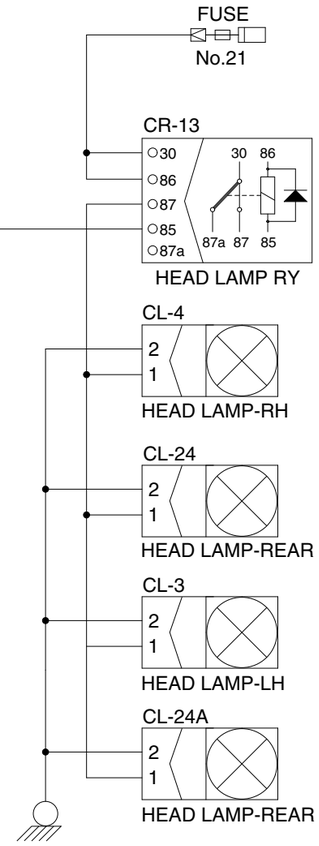
17. WHEN STARTING SWITCH IS TURNED ON, HEAD LAMP DOES NOT LIGHTS UP

· 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), CR-13 (87)-CL-24 (1) or CR-13 (87)-CL-24A (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

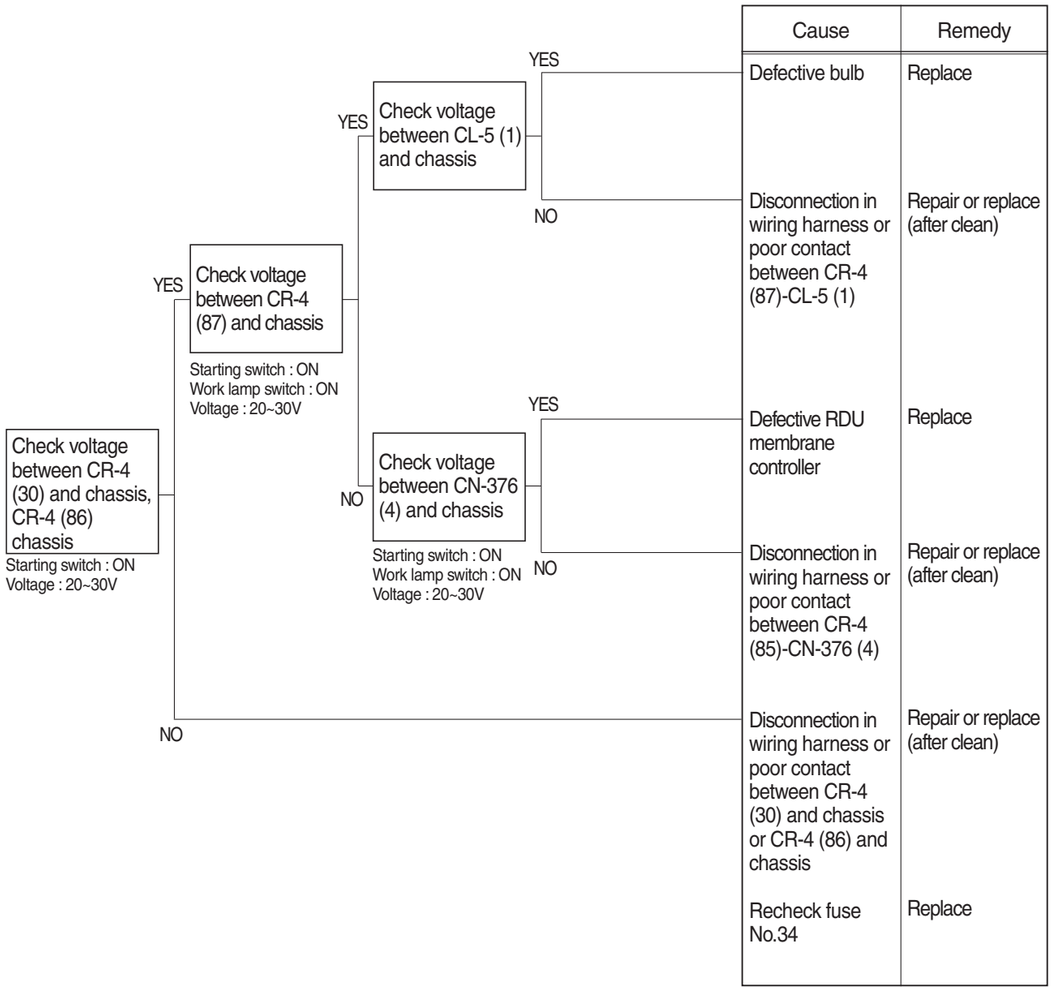


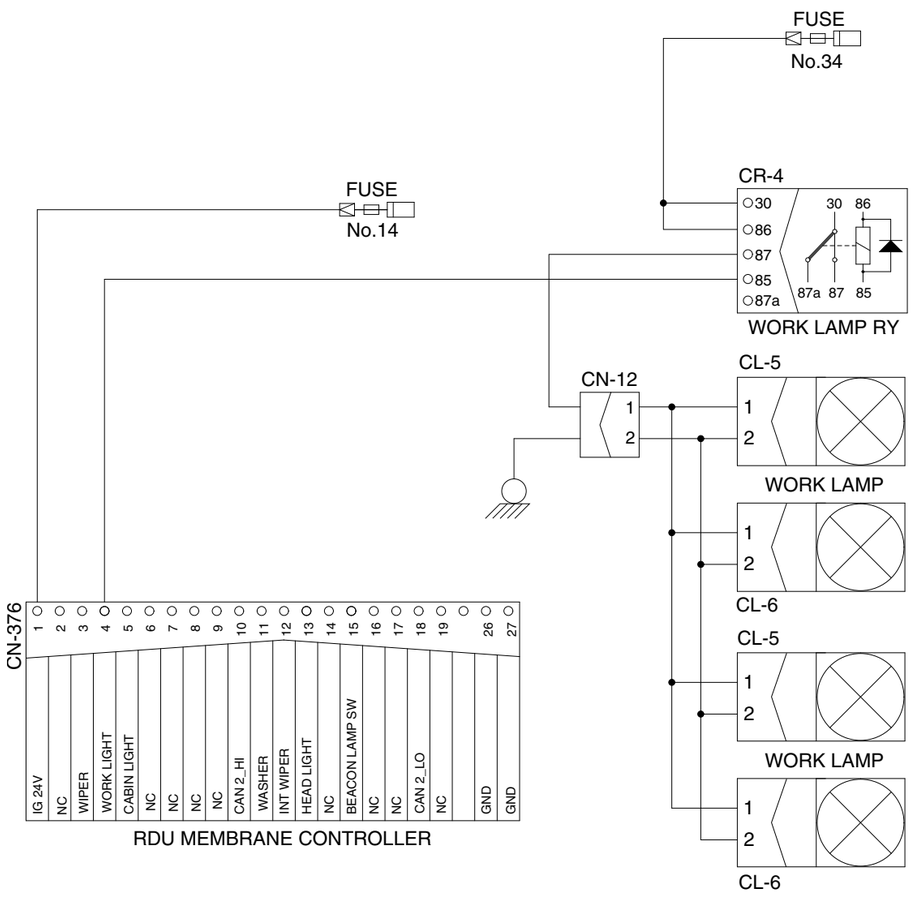


480A6ES117

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 & 34.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





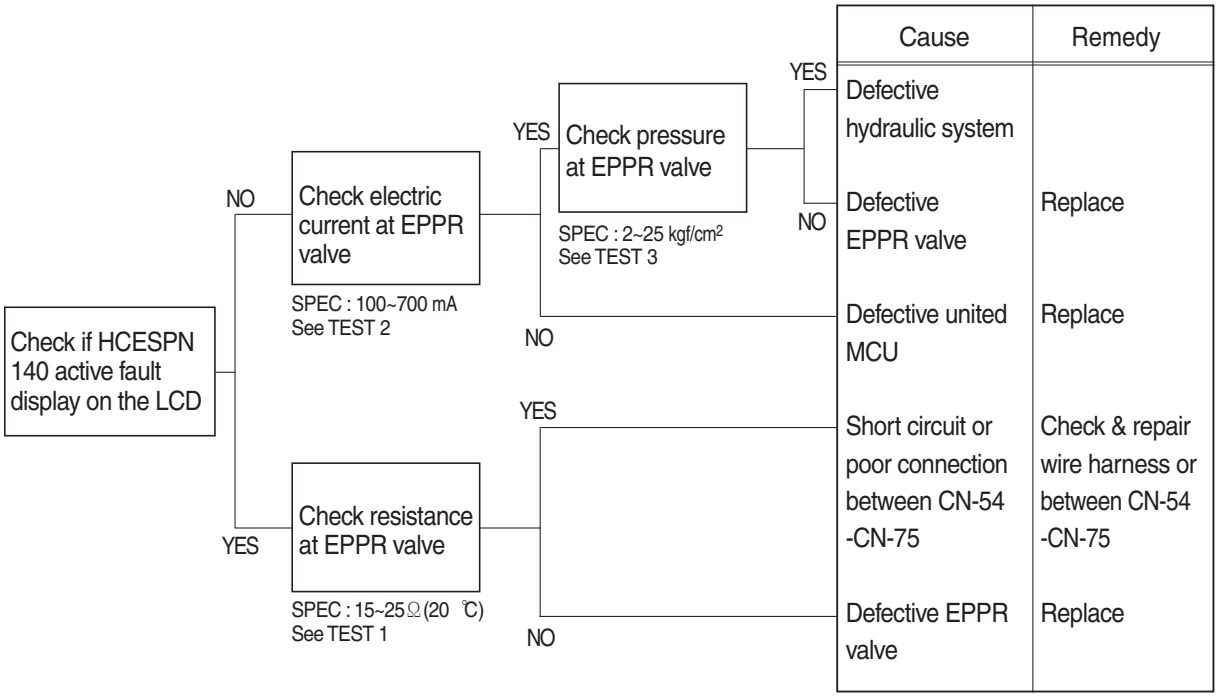
220A6ES118

4. MECHATRONICS SYSTEM

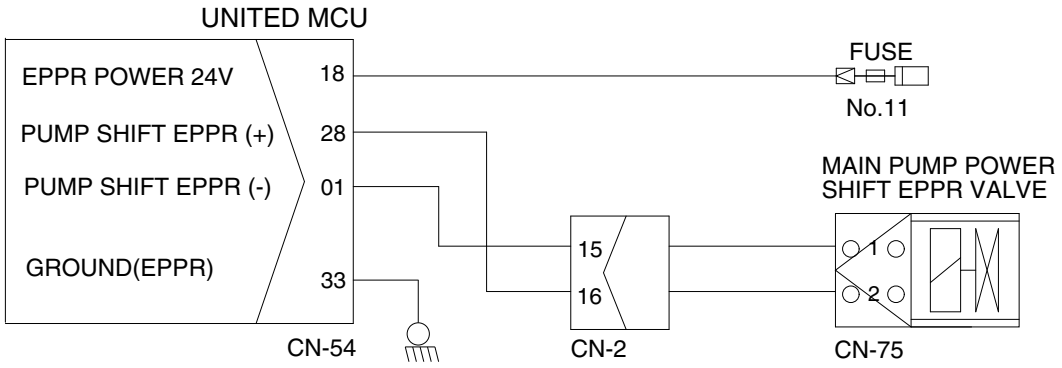
1. ALL ACTUATORS SPEED ARE SLOW

※ Boom, Arm, Bucket, Swing and travel speed are slow, but engine speed is good.
※ Spec : P-mode 1850 ± 50 rpm S -mode 1750 ± 50 rpm E-mode 1650 ± 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



480A6MS01

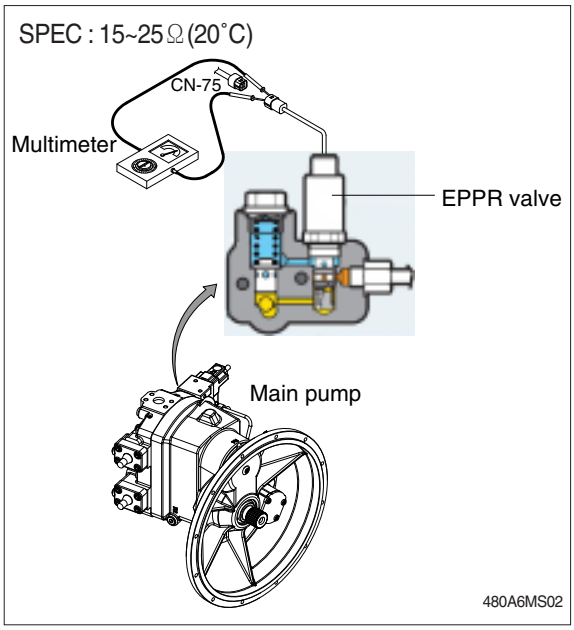
2) TEST PROCEDURE

(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.

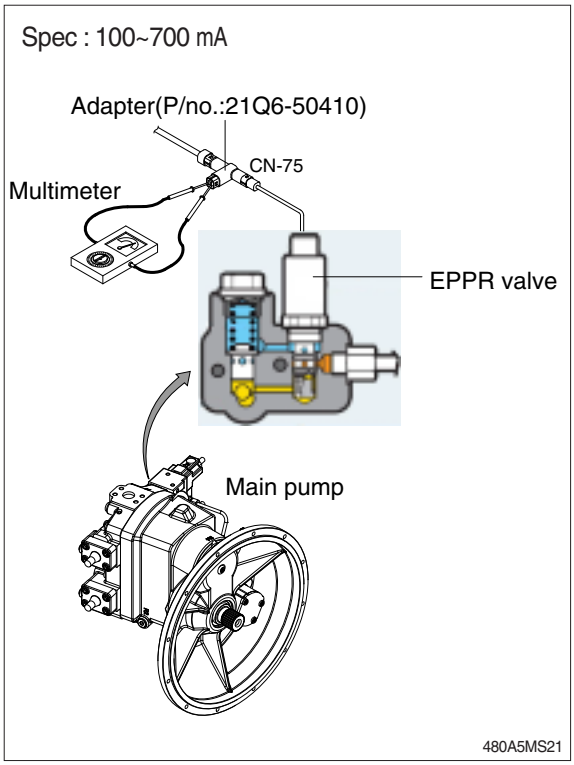
③ Start engine.

④ Set S-mode and cancel auto decel mode.

⑤ Position the multimodal dial at 10.

⑥ If tachometer show approx 1750±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

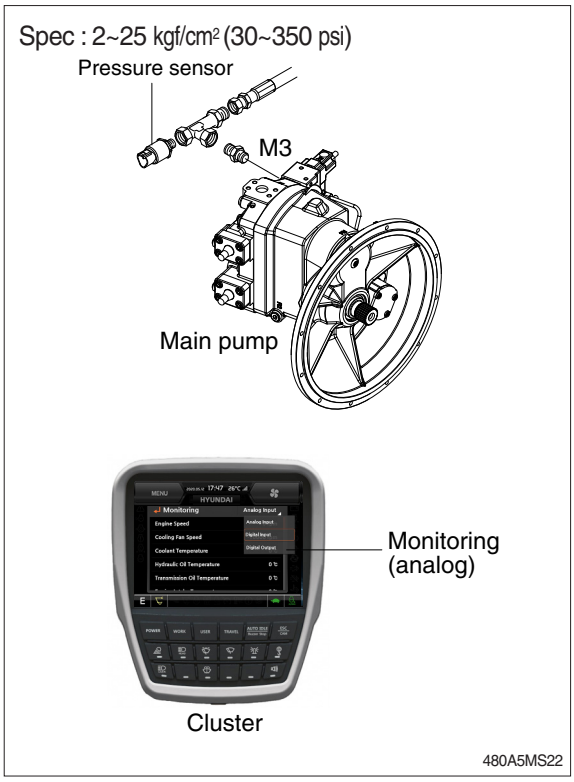
③ mode.

Position the multimodal dial at 10.

④ If tachometer show approx 1750±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.

⑤ If pressure is not correct, adjust it.

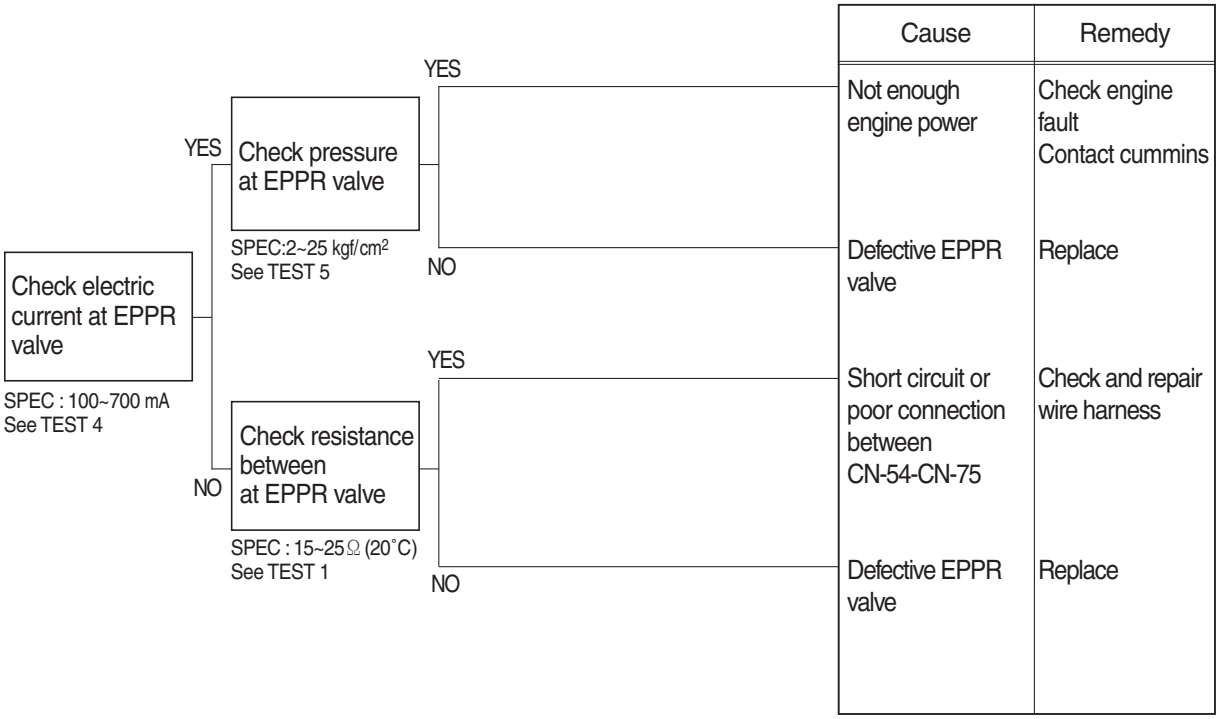
⑥ After adjust, test the machine.



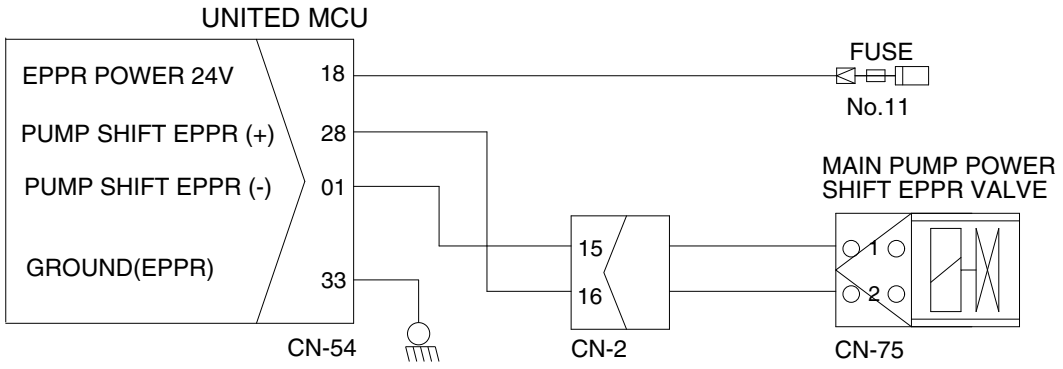
2. ENGINE STALL

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

1) INSPECTION PROCEDURE



Wiring diagram

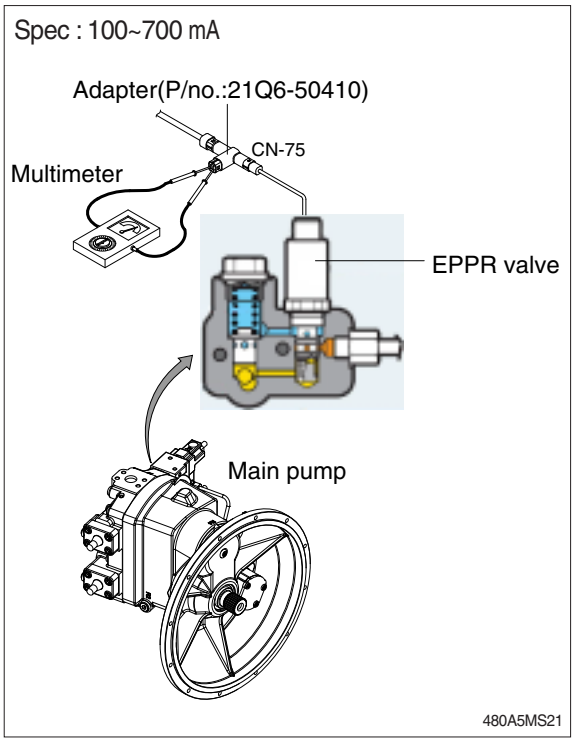


480A6MS01

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 1750±50 rpm disconnect one wire harness from EPPR valve.
⑦ Check electric current at bucket circuit relief position.



(2) Test 5 : Check pressure at EPPR valve.

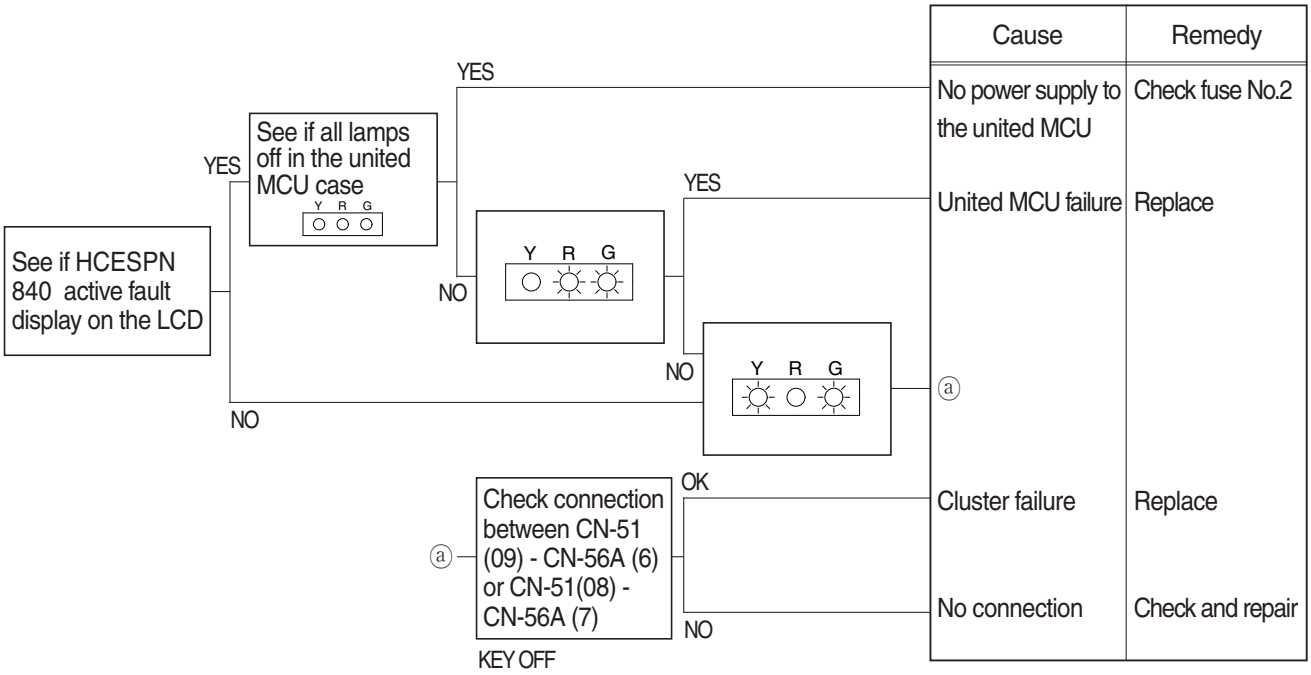
① Start engine.
② Set S-mode and cancel auto decel mode.
③ Position the multimodal dial at 10.
④ If rpm show approx 1750±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.
⑤ If pressure is not correct, adjust it.
⑥ After adjust, test the machine.



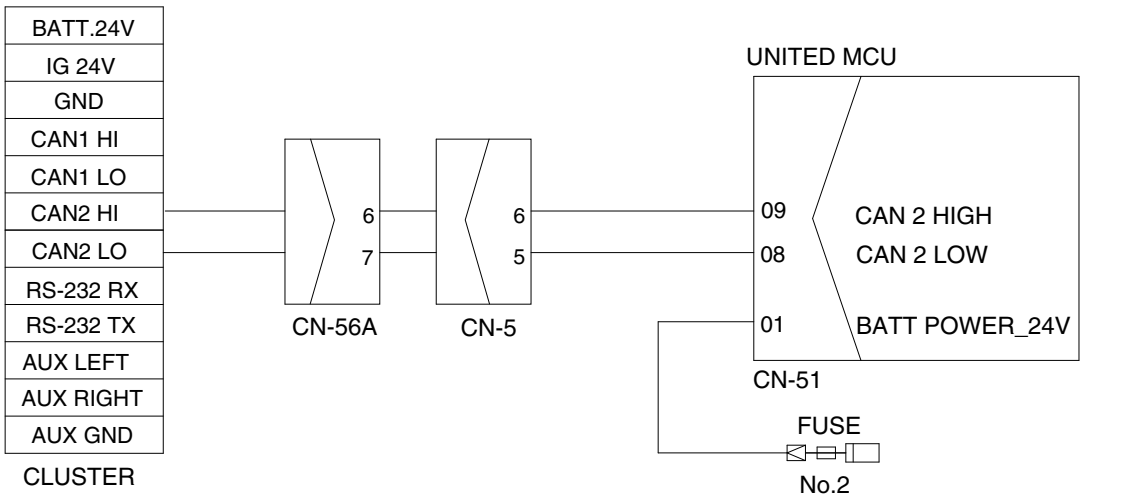
3. MALFUNCTION OF CLUSTER OR MODE SELECTION SYSTEM

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

1) INSPECTION PROCEDURE



Wiring diagram



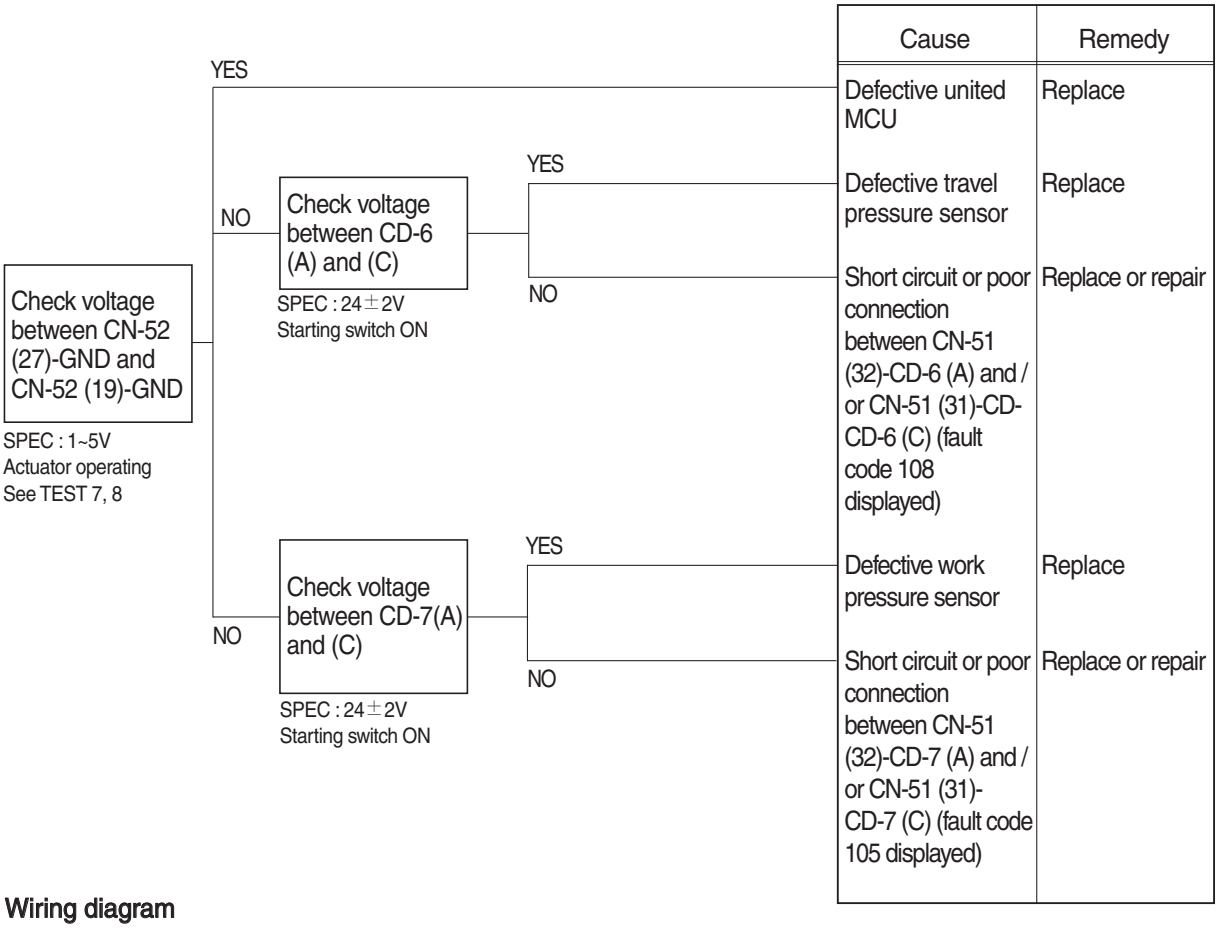
220F6MS102

4. AUTO DECEL SYSTEM DOES NOT WORK (N.A)

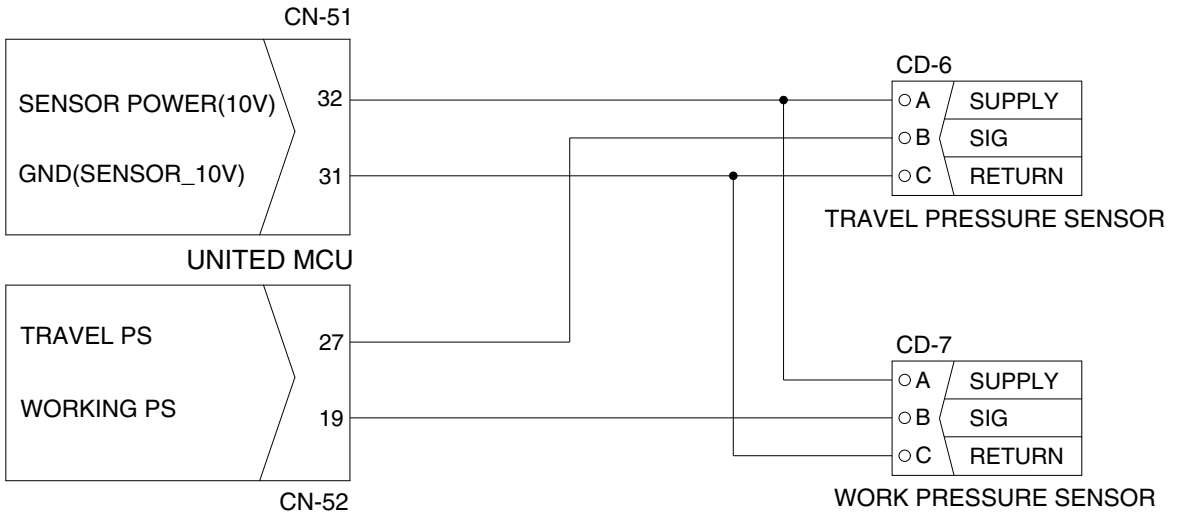
· Fault code : HCESPN 105, FMI 0~4 (work pressure sensor)
HCESPN 108, FMI 0~4 (travel oil pressure sensor)

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

1) INSPECTION PROCEDURE



Wiring diagram



300A6MS03

2) TEST PROCEDURE (N.A)

(1) Test 7 : Check voltage at CN-52 (27) and ground.

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

② Insert prepared pin to rear side of connectors : One pin to (27) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

(2) Test 8 : Check voltage at CN-52 (19) and ground.

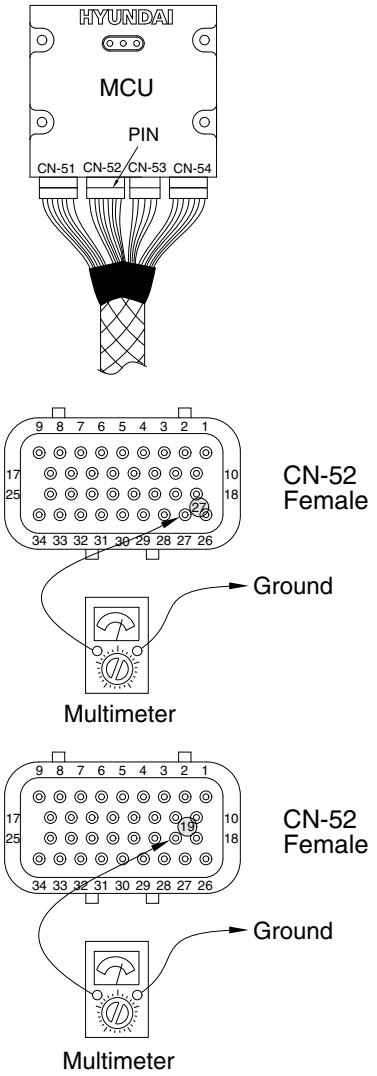
① Prepare 1 piece of thin sharp pin, steel or copper

② Insert prepared pin to rear side of connectors : One pin to (19) of CN-52.

③ Starting key ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



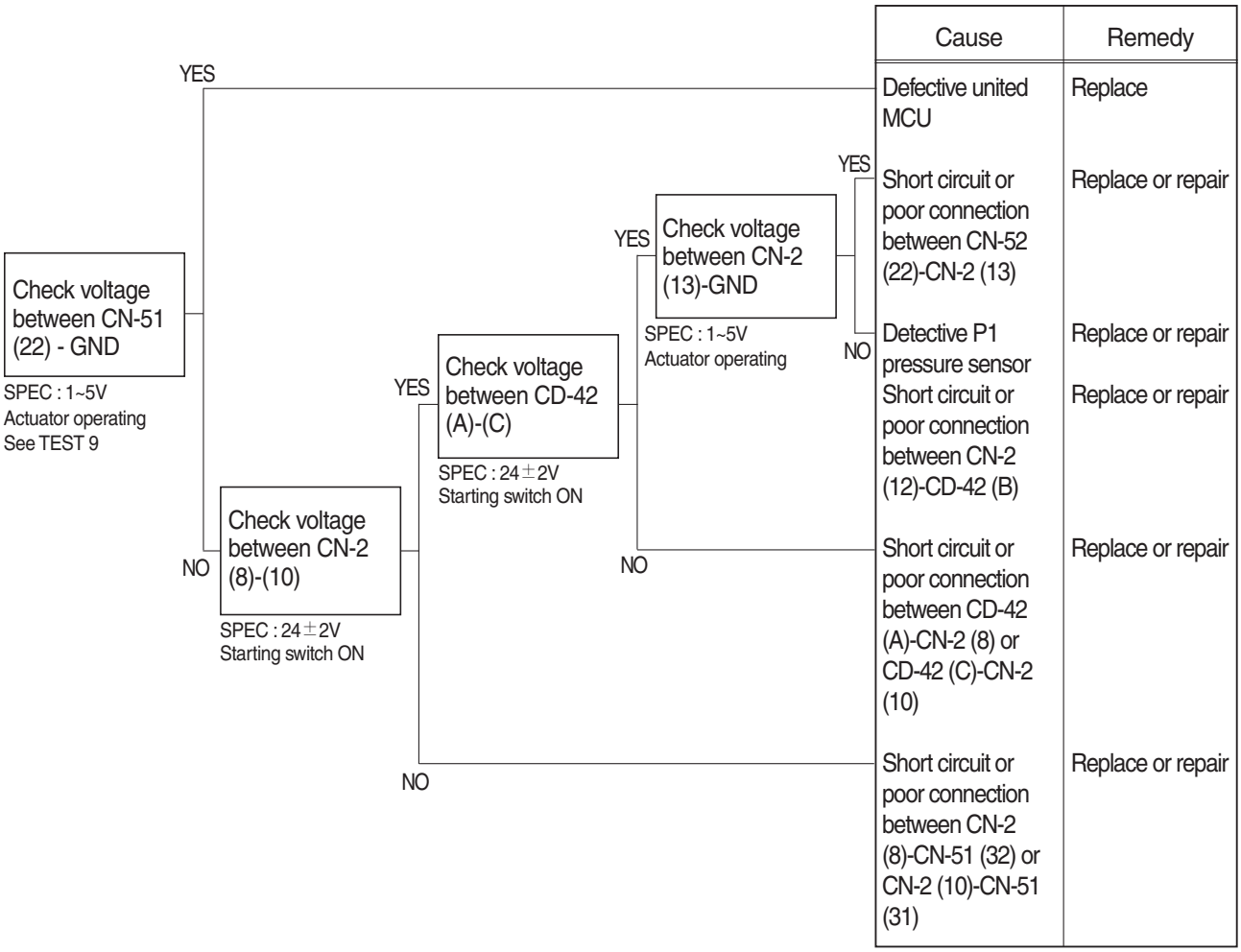
140L6MS104

5. MALFUNCTION OF PUMP 1 PRESSURE SENSOR

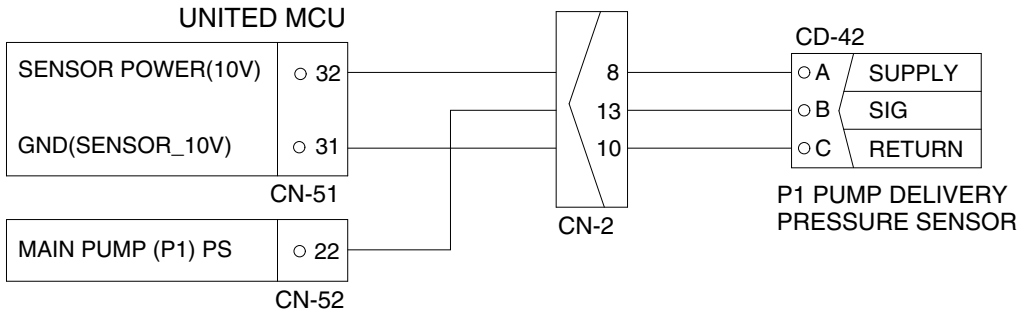
· Fault code : HCESPN 120, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



480A6MS05

2) TEST PROCEDURE

(1) Test 9 : Check voltage at CN-52 (22) and ground.

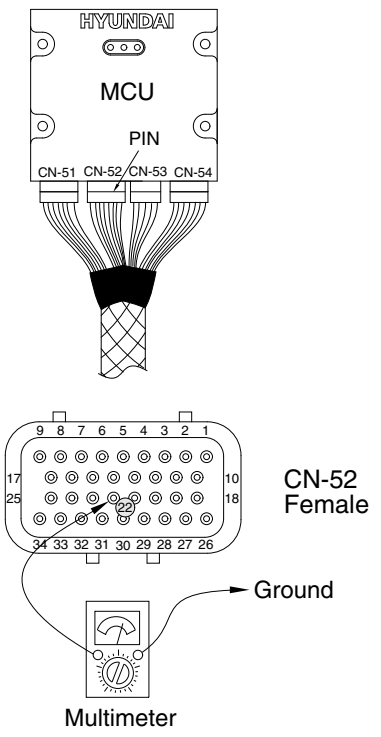
① Prepare 1 piece of thin sharp pin, steel or copper.

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



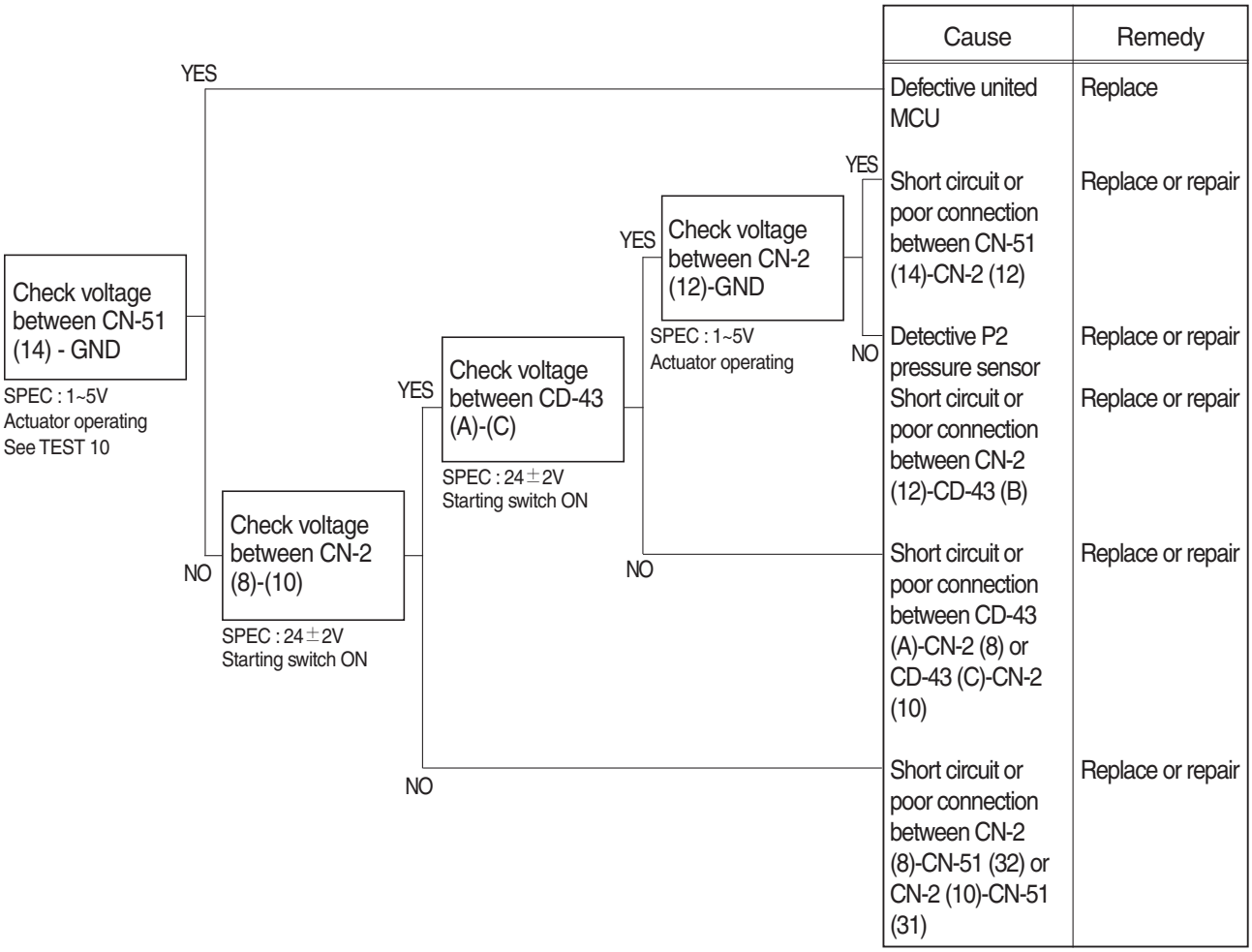
220A6MS106

6. MALFUNCTION OF PUMP 2 PRESSURE SENSOR

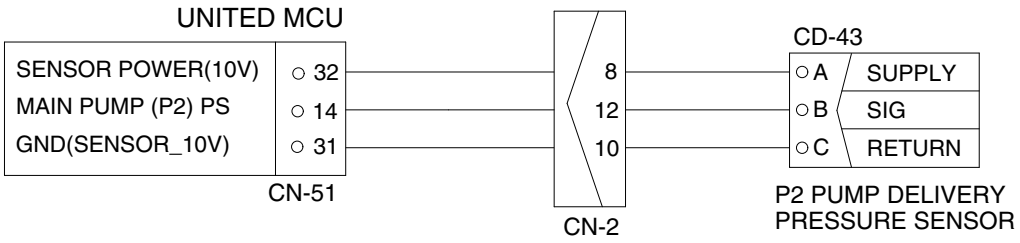
· Fault code : HCESPN 121, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



480A6MS07

2) TEST PROCEDURE

(1) Test 10 : Check voltage at CN-51 (14) and ground.

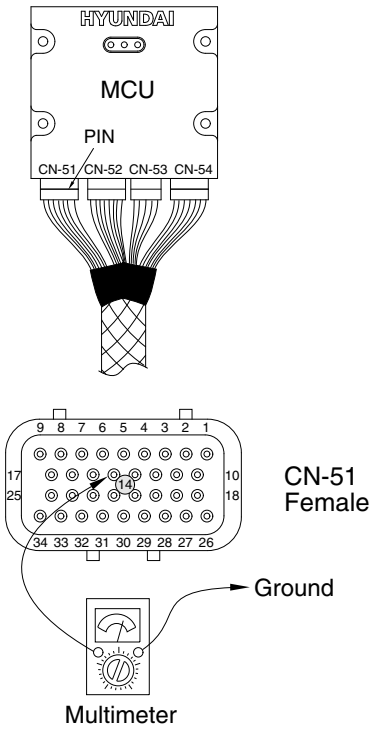
① Prepare 1 piece of thin sharp pin, steel or copper.

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

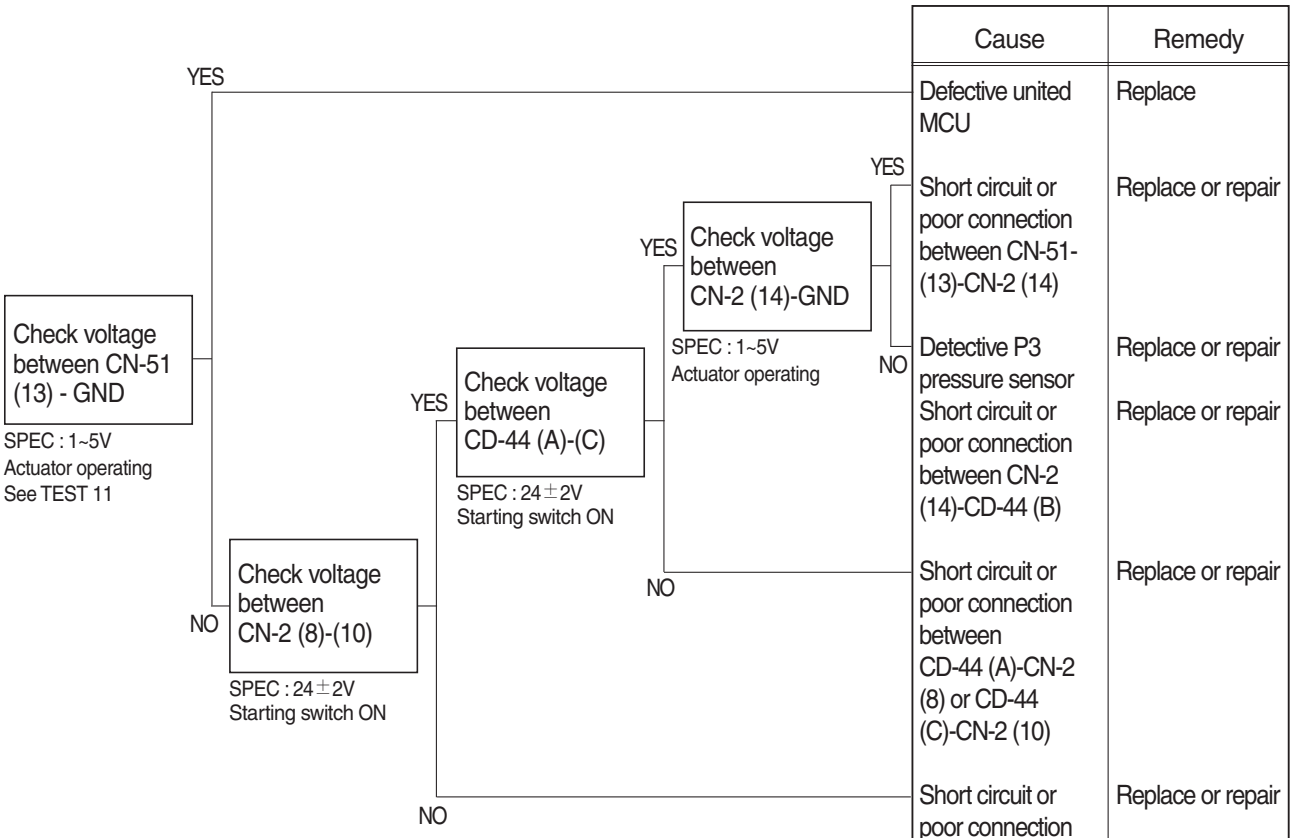


220A6MS108

7. MALFUNCTION OF PUMP 3 PRESSURE SENSOR

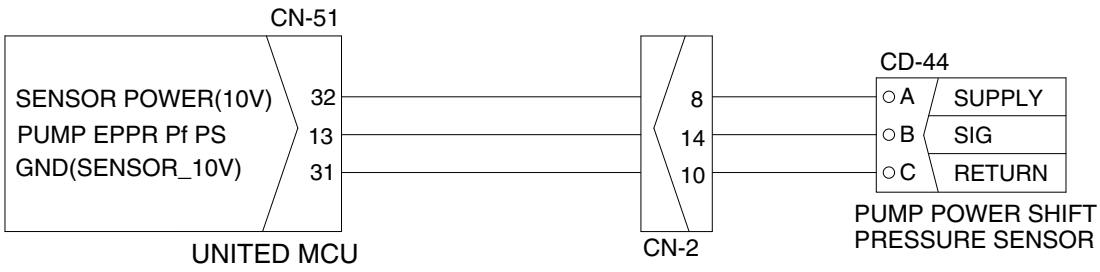
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective united MCU	Replace
Short circuit or poor connection between CN-51-(13)-CN-2 (14)	Replace or repair
Detective P3 pressure sensor	Replace or repair
Short circuit or poor connection between CN-2 (14)-CD-44 (B)	Replace or repair
Short circuit or poor connection between CD-44 (A)-CN-2 (8) or CD-44 (C)-CN-2 (10)	Replace or repair
Short circuit or poor connection between CN-2 (8)-CN-51 (32) or CN-2 (10) - CN-51 (31)	Replace or repair

Wiring diagram



480A6MS09

2) TEST PROCEDURE

(1) Test 11 : Check voltage at CN-51 (13) and ground.

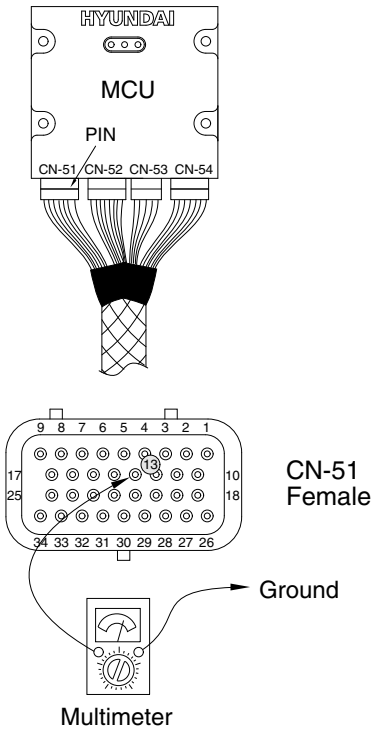
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (13) of CN-51.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



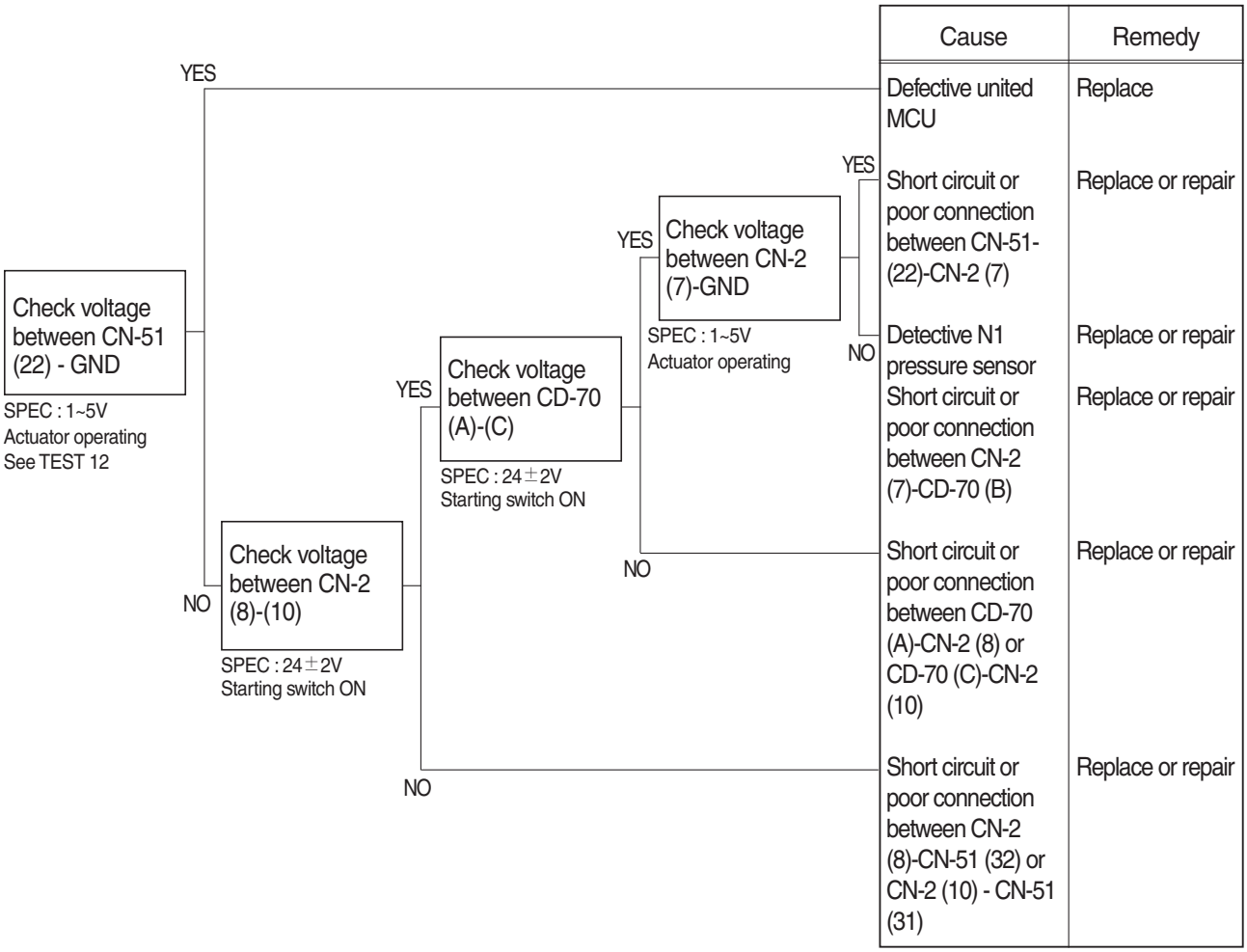
140L6MS110

8. MALFUNCTION OF NEGATIVE 1 PRESSURE SENSOR

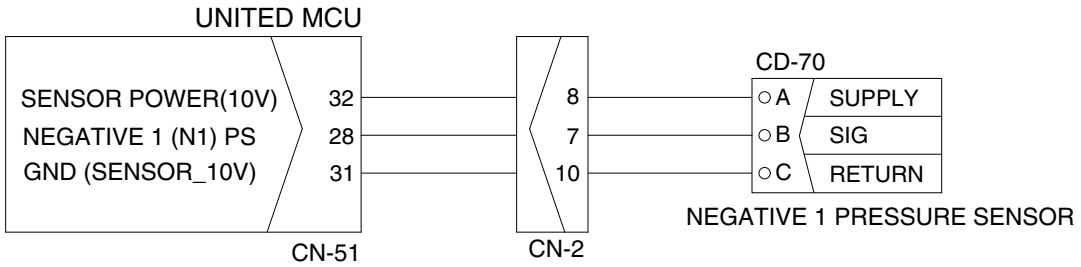
· Fault code : HCESPN 123, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



480A6MS11

2) TEST PROCEDURE

(1) Test 12 : Check voltage at CN-51 (22) and ground.

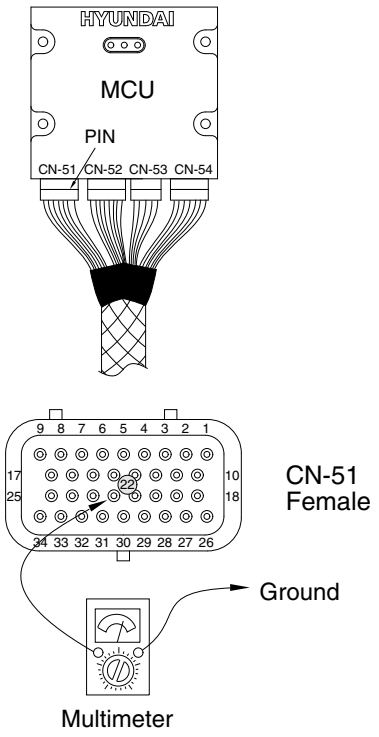
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (22) of CN-51.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



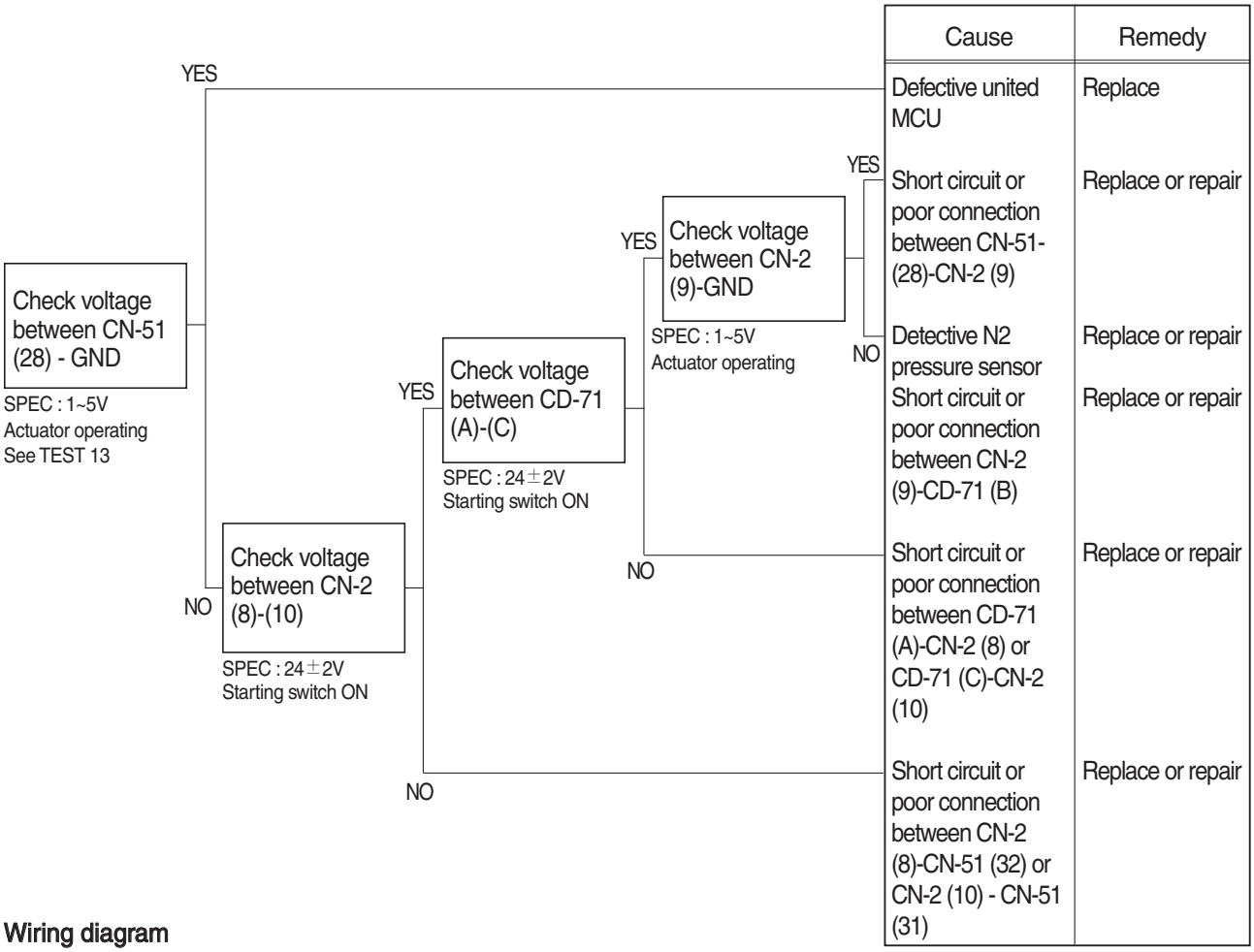
140L6MS112

9. MALFUNCTION OF NEGATIVE 2 PRESSURE SENSOR

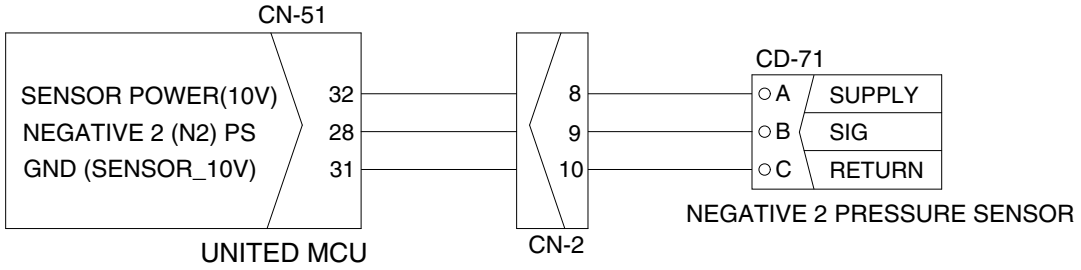
· Fault code : HCESPN 124, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



480A6MS13

2) TEST PROCEDURE

(1) Test 13 : Check voltage at CN-51 (28) and ground.

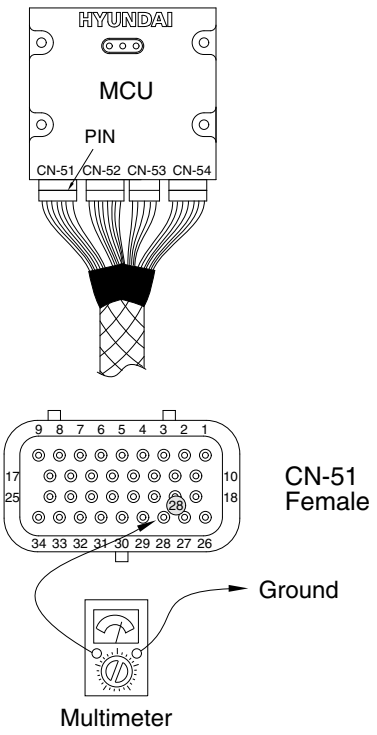
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (28) of CN-51.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



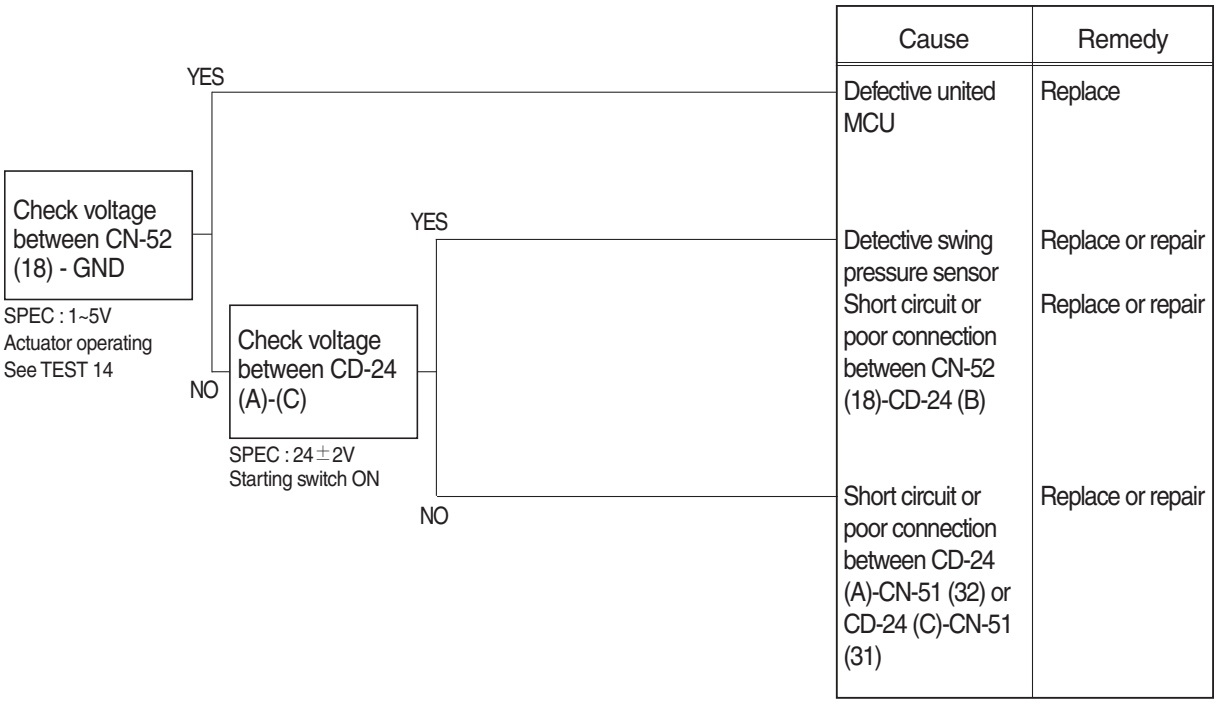
140L6MS114

10. MALFUNCTION OF SWING PRESSURE SENSOR

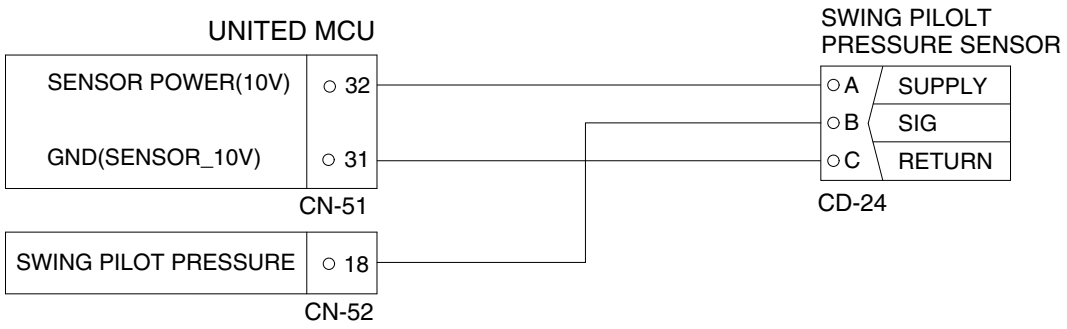
· Fault code : HCESPN 135, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



220A6MS114

2) TEST PROCEDURE

(1) Test 14 : Check voltage at CN-52 (18) and ground.

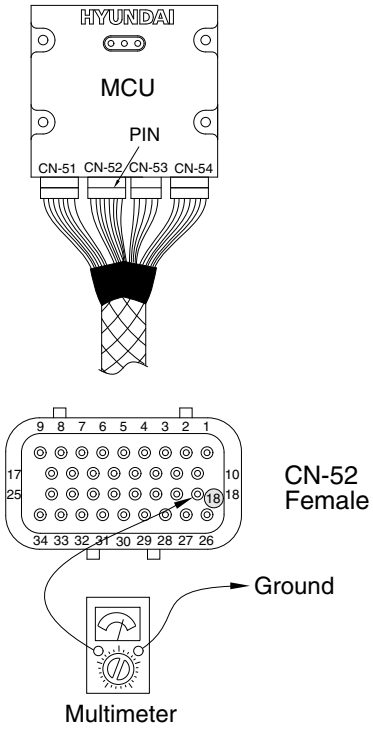
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (18) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



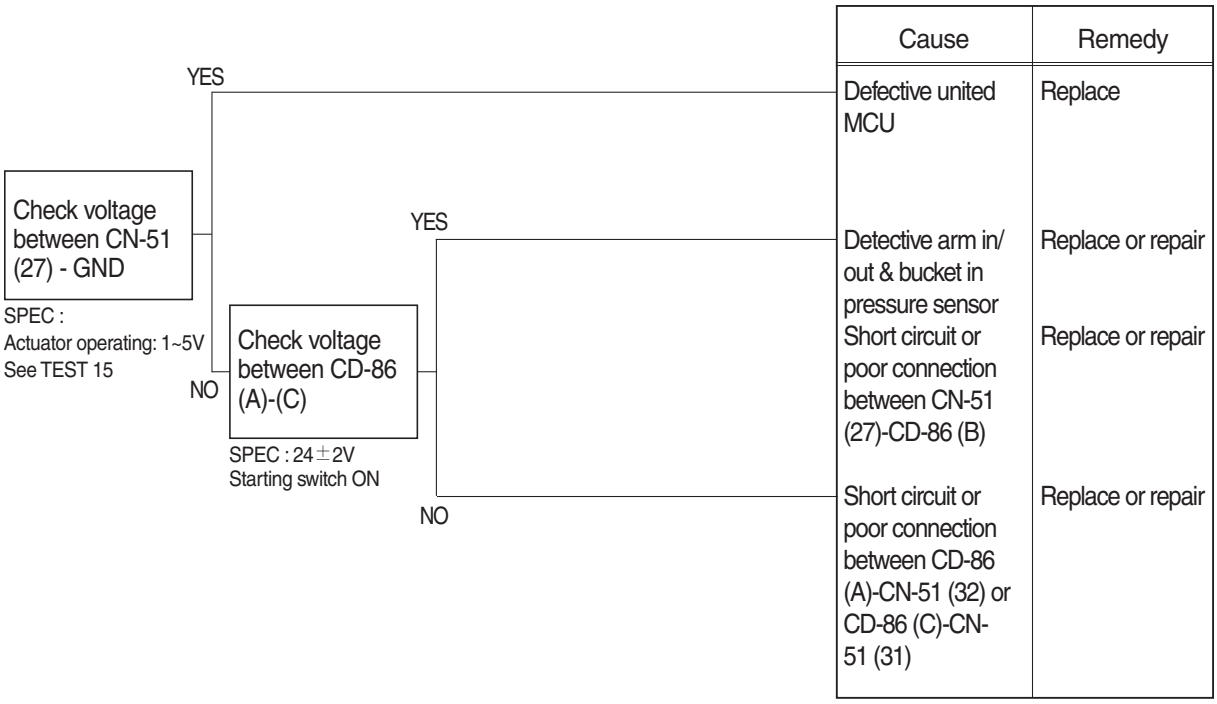
220A6MS116

11. MALFUNCTION OF ARM OUT PRESSURE SENSOR

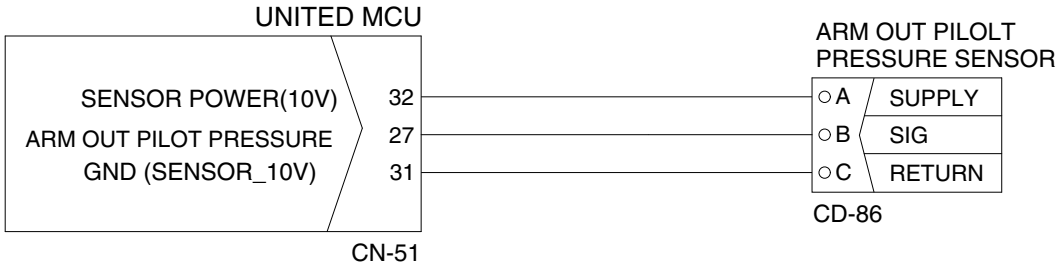
· Fault code : HCESPN 133, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



220A6MS117

2) TEST PROCEDURE

(1) Test 15 : Check voltage at CN-51 (27) and ground.

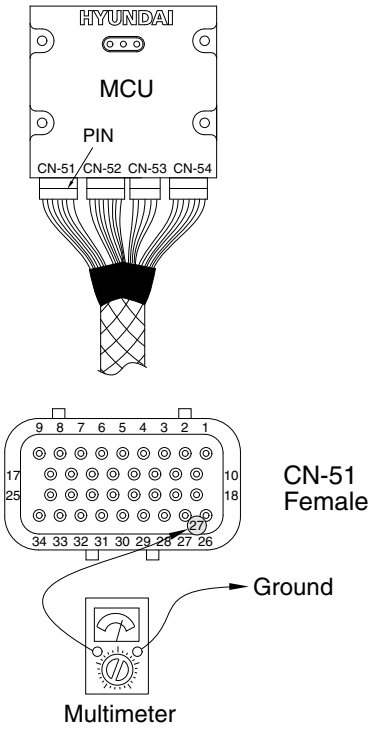
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (27) of CN-51.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



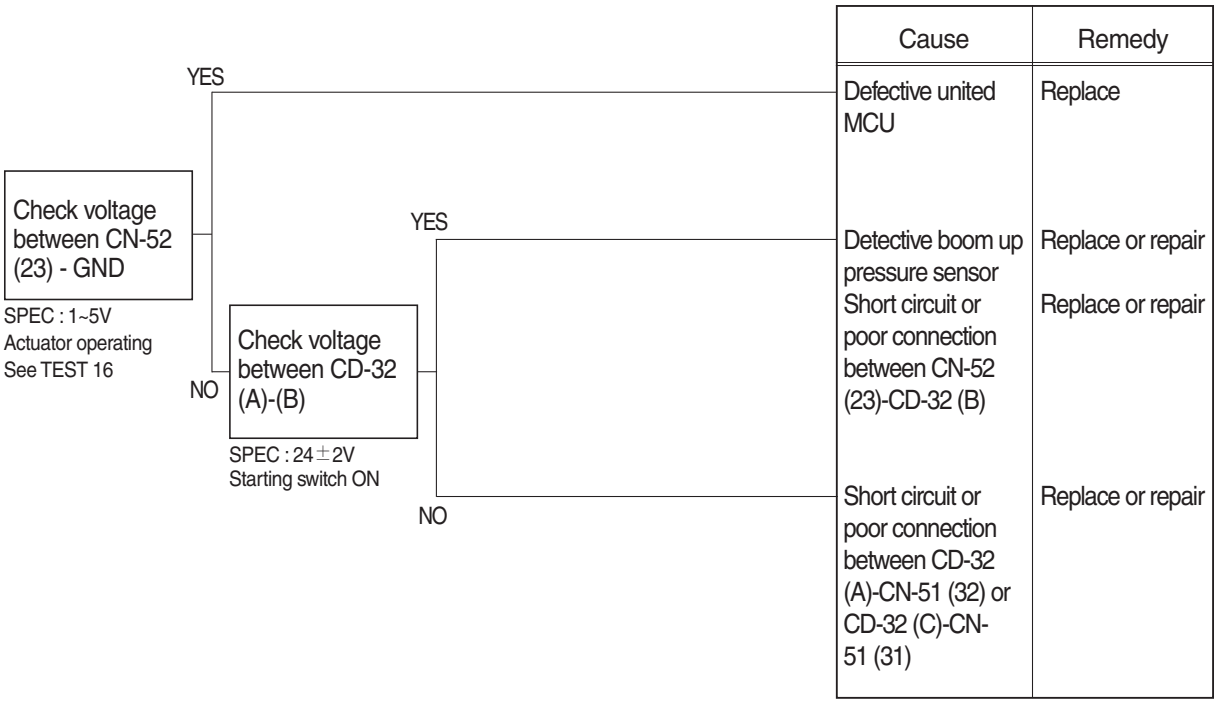
220A6MS118

12 . MALFUNCTION OF BOOM UP PRESSURE SENSOR

· Fault code : HCESPN 127, FMI 0~4

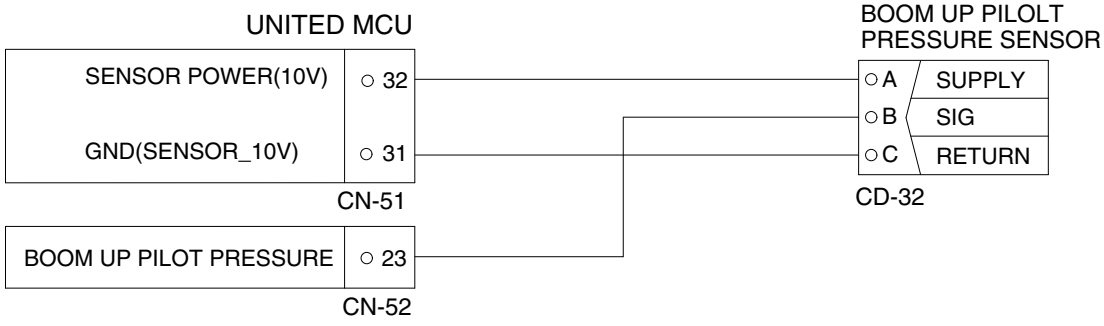
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective united MCU	Replace
Detective boom up pressure sensor	Replace or repair
Short circuit or poor connection between CN-52 (23)-CD-32 (B)	Replace or repair
Short circuit or poor connection between CD-32 (A)-CN-51 (32) or CD-32 (C)-CN-51 (31)	Replace or repair

Wiring diagram



220A6MS119

2) TEST PROCEDURE

(1) Test 16 : Check voltage at CN-52 (23) and ground.

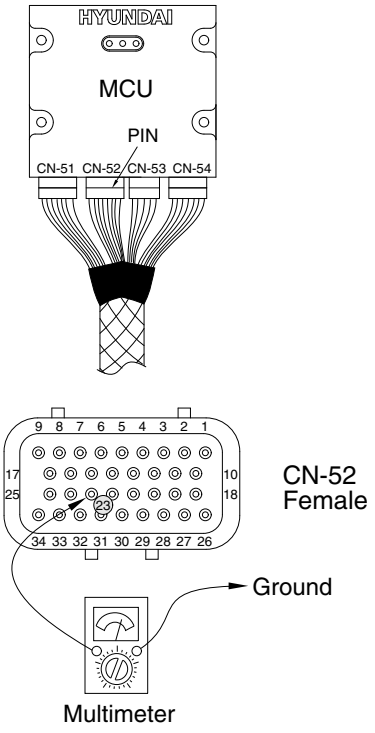
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (23) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



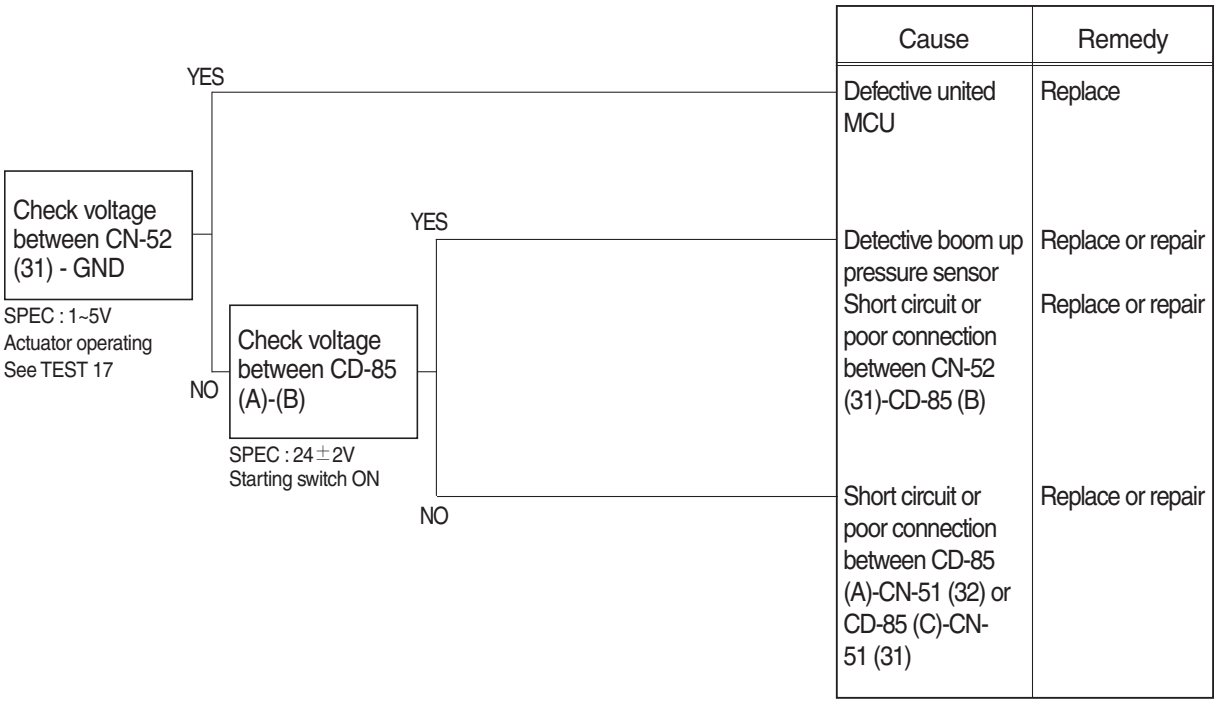
220A6MS120

13. MALFUNCTION OF BOOM DOWN PRESSURE SENSOR

· Fault code : HCESPN 128, FMI 0~4

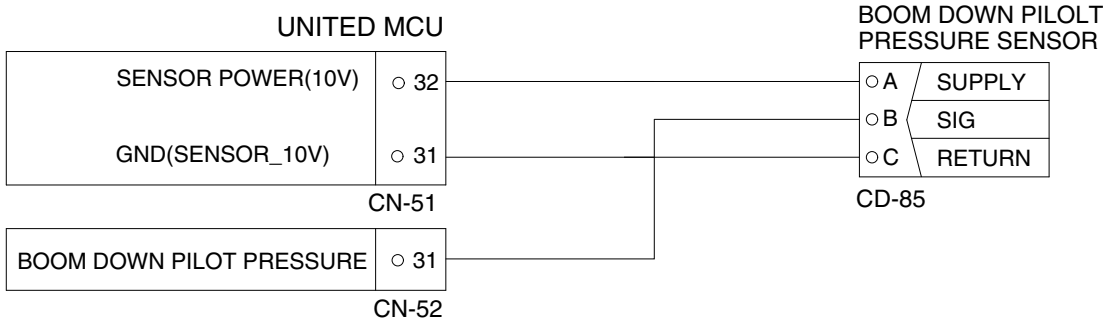
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective united MCU	Replace
Detective boom up pressure sensor	Replace or repair
Short circuit or poor connection between CN-52 (31)-CD-85 (B)	Replace or repair
Short circuit or poor connection between CD-85 (A)-CN-51 (32) or CD-85 (C)-CN-51 (31)	Replace or repair

Wiring diagram



220A6MS121

2) TEST PROCEDURE

(1) Test 17 : Check voltage at CN-52 (31) and ground.

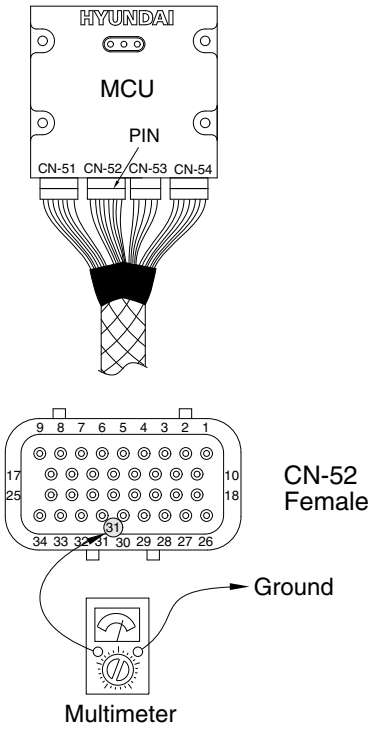
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (31) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



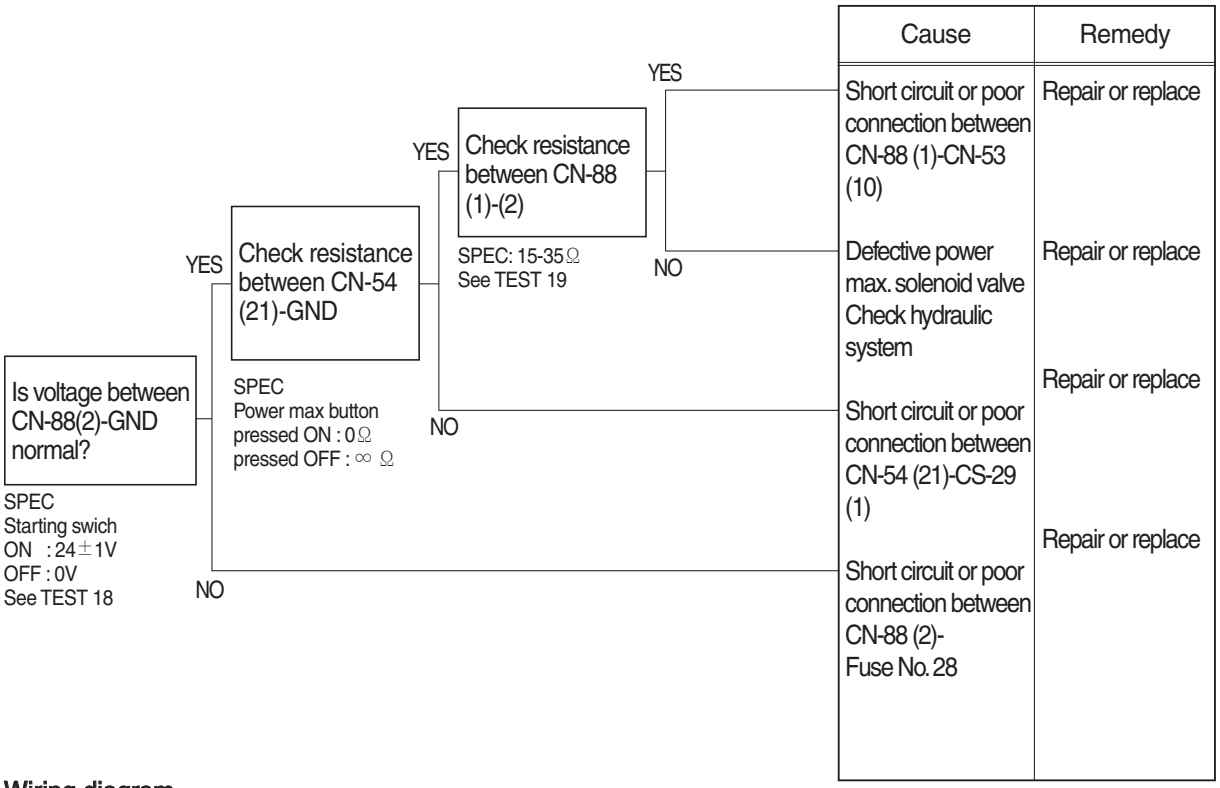
220A6MS122

14. MALFUNCTION OF POWER MAX

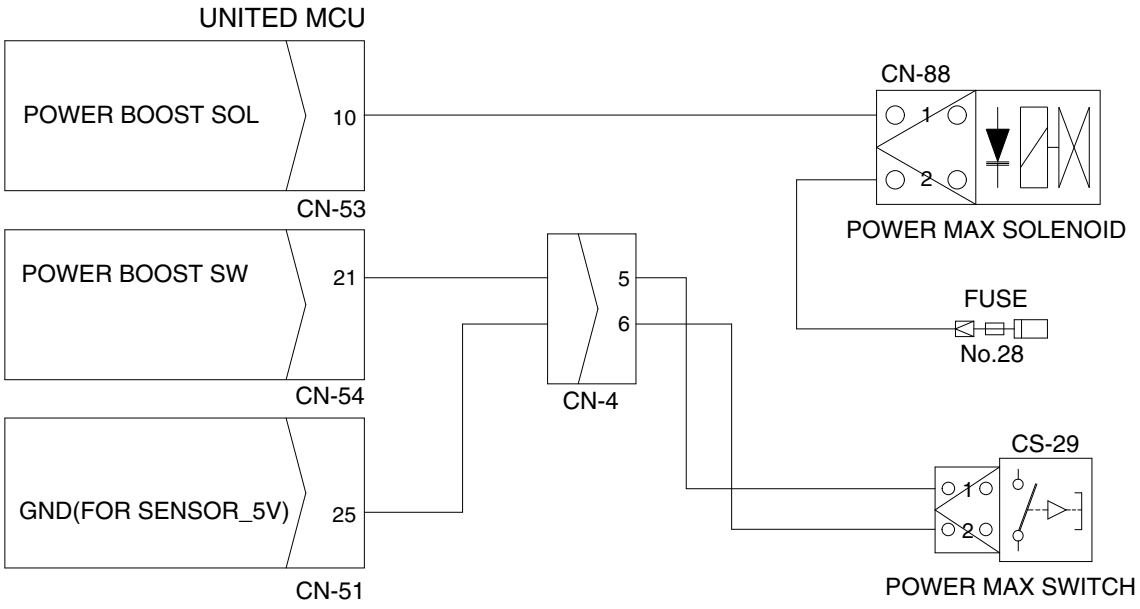
· Fault code : HCESPN 166, FMI 4 or 6

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

1) INSPECTION PROCEDURE



Wiring diagram



220A6MS21

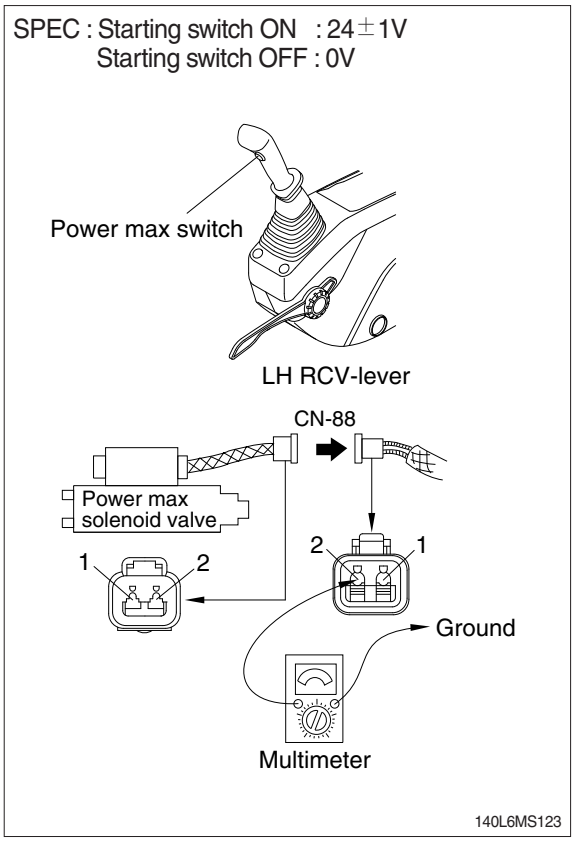
2) TEST PROCEDURE

(1) Test 18: Check voltage between connector CN-88 (2) - GND.

① Disconnect connector CN-88 from power max solenoid valve.

② Start switch ON.

③ Check voltage as figure.

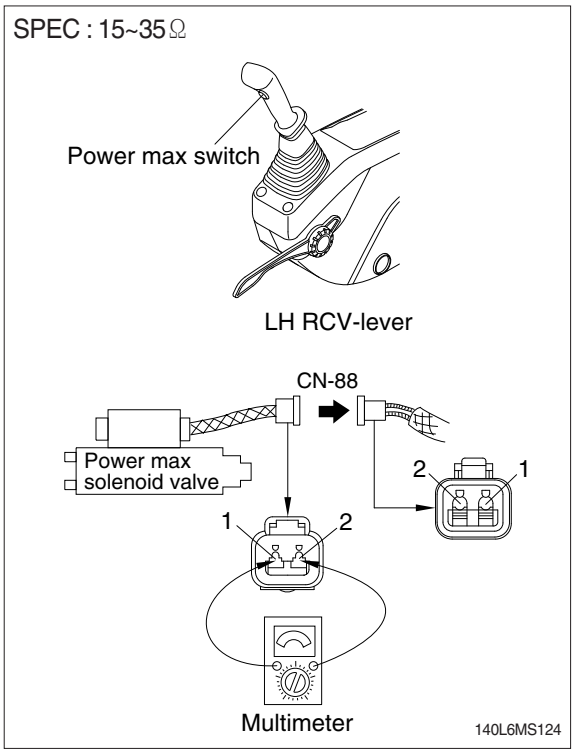


(2) Test 19: Check resistance of the solenoid valve between CN-88 (1)-(2).

① Starting switch OFF.

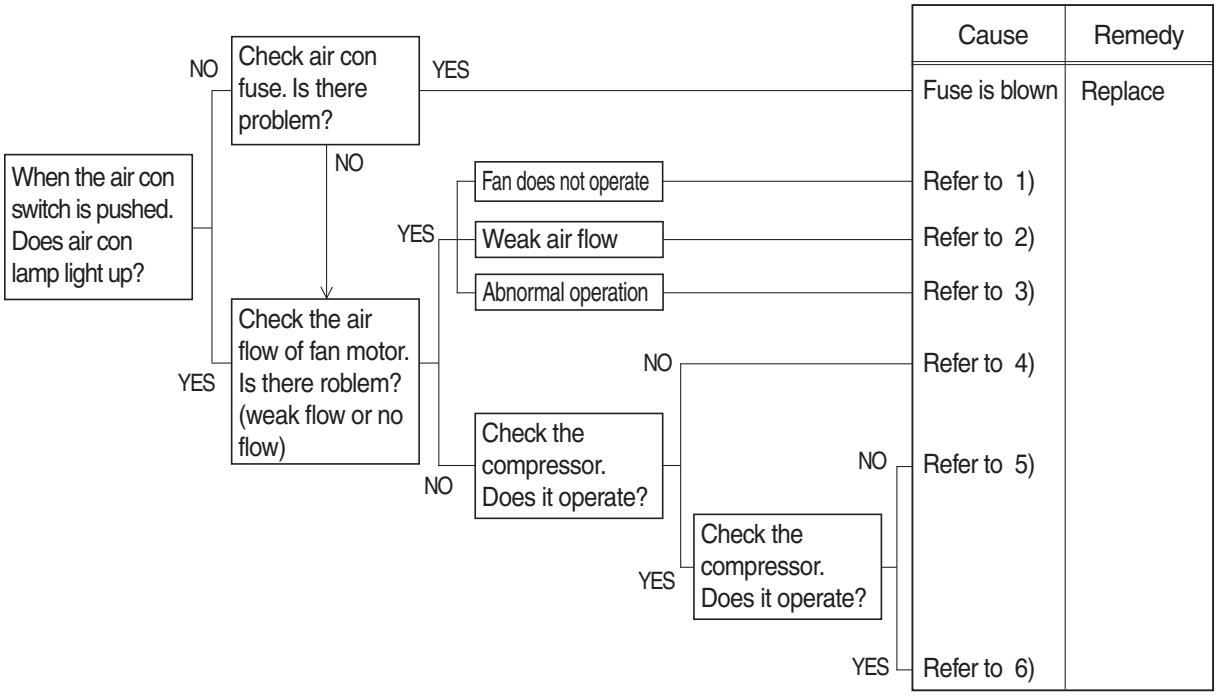
② Disconnect connector CN-88 from power max solenoid valve.

③ Check resistance as figure.



GROUP 5 AIR CONDITIONER & HEATER SYSTEM

1. AIR CONDITIONER DOES NOT OPERATE



1) FAN DOES NOT OPERATE

Cause	Check	Remedy
Fuse is blown or abnormal relay operation	* Fuse * Does relay normally operate?	Replace
Harness short or poor contact	Check any harness short or abnormal contact of connnector	Repair shortage
Fan motor failure	Supply 24V to 2 lead wire from motor and check the operation	Replace
Resistor is broken	Check current flow of resistor with tester	Replace
Fan switch failure	Push fan switch by turn and check the operation	Replace

2) WEAK AIR FLOW FROM FAN MOTOR

Cause	Check	Remedy
Clogged evaporator or obstacles around air inlet	Check if evaporator is contaminated	Clean
Leakage of air flow	Check HVAC case assembly	Adjust
Duct sensor failure	Check if evaporator is frozen	Replace

3) ABNORMAL OPERATION OF FAN MOTOR

Cause	Check	Remedy
Abnormal operation of each step of control	4 step only operate	Replace resistor
	1 or 2 step does not operate	Replace control
	3 or 4 step does not operate	Replace relay

4) COMPRESSOR DOES NOT ROTATE OR HARDLY ROTATE

Cause	Check	Remedy
Loose belt	Belt shaking is severe	Adjust tension
Failure of compressor itself	Belt slip	Repair or Replace
Low voltage of battery	Slip when rotate	Charge battery
Fieldcoil short	Slip when rotate	Replace magnetic clutch
Oily clutch face	Contamination around clutch	Replace magnetic clutch, clean
Fieldcoil is broken	Magnetic clutch does not operate or "∞" resistance	Replace compressor
Leakage of refrigerant or oil inside	Check if wet with oil	Replace compressor Charge refrigerant

5) COMPRESSOR OPERATE NORMALLY AND AIR FLOW IS NORMAL

Cause	Check	Remedy
Shortage of refrigerant	When air con operate during 5~10 min small temperature difference between high and low pressure pipes.	Repair leakage joint Charge refrigerant
Overcharge of refrigerant	*Magnetic clutch on/off rapidly *High pressure over specification *Lukewarm air from nozzle	Recharge refrigerant following specification
Lower pressure than normal condition at low side	Shortage of refrigerant	Make up refrigerant
	Clogged receive dryer	Replace receive dryer
	Clogged expansion valve	Replace expansion valve
	Clogged or crushed pipe	Replace pipe or clean
	Failure of duct sensor	Replace duct sensor

6) COMPRESSOR OPERATE NORMALLY AND AIR FLOW IS NORMAL

Cause	Check	Remedy
Lower pressure than normal condition at low side	Failure of duct sensor Magnetic clutch off before air temperature sufficiently down	Replace duct sensor or adjust location
	Defective compressor gasket When compressor off, high and low pressure balance immediatly	Repair compressor or Replace
Higher pressure than normal condition at high side	Failure of condensing Contamination on condenser or insufficient air flow from fan	Clean the condenser Repair fan
	Overcharge of refrigerant	Adjust refrigerant
	Entrained air	Vacuum and recharge
Lower pressure than normal condition at high side	Shortage of refrigerant	Make up refrigerant

SECTION 7 MAINTENANCE STANDARD

Group 1 Operational Performance Test 7-1
Group 2 Major Components 7-21
Group 3 Track and Work Equipment 7-29

GROUP 1 OPERATIONAL PERFORMANCE TEST

1. PURPOSE

Performance tests are used to check :

1) OPERATIONAL PERFORMANCE OF A NEW MACHINE

Whenever a new machine is delivered in parts and reassembled at a customer's site, it must be tested to confirm that the operational performance of the machine meets HD Hyundai Construction Equipment spec.

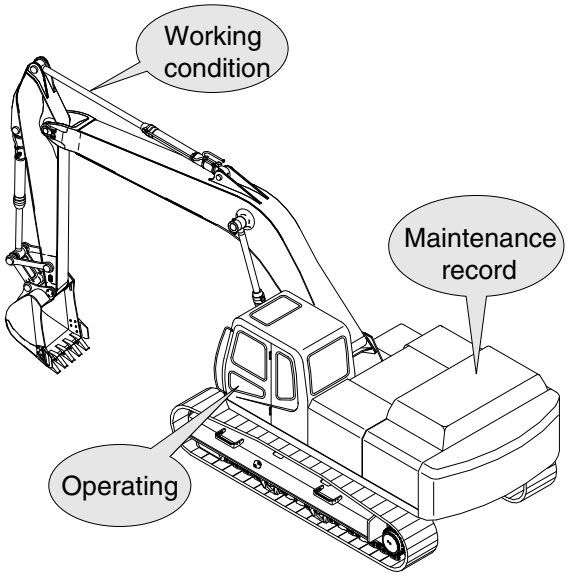
2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

With the passage of time, the machine's operational performance deteriorates, so that the machine needs to be serviced periodically to restore it to its original performance level.

Before servicing the machine, conduct performance tests to check the extent of deterioration, and to decide what kind of service needs to be done(by referring to the "Service Limits" in this manual).

3) OPERATIONAL PERFORMANCE OF A REPAIRED MACHINE

After the machine is repaired or serviced, it must be tested to confirm that its operational performance was restored by the repair and/or service work done.

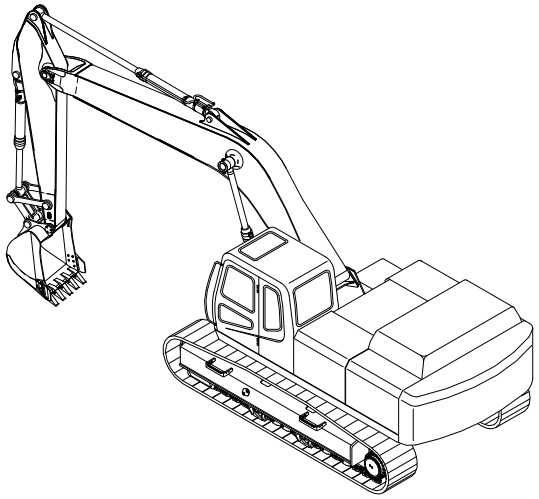


21077MS01

2. TERMINOLOGY

1) STANDARD

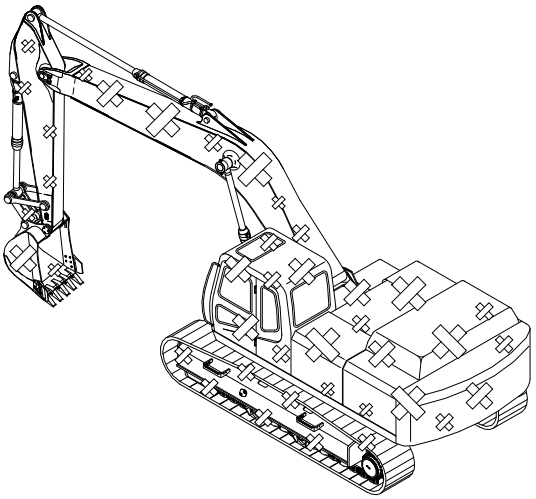
Specifications applied to the brand-new machine, components and parts.



21077MS02

2) SERVICE LIMIT

The lowest acceptable performance level. When the performance level of the machine falls below this level, the machine must be removed from work and repaired. Necessary parts and components must be replaced.



21077MS03

3. OPERATION FOR PERFORMANCE TESTS

1) Observe the following rules in order to carry out performance tests accurately and safely.

(1) The machine

Repair any defects and damage found, such as oil or water leaks, loose bolts, cracks and so on, before starting to test.

(2) Test area

① Select a hard, flat surface.

② Secure enough space to allow the machine to run straight more than 20 m, and to make a full swing with the front attachment extended.

③ If required, rope off the test area and provide signboards to keep unauthorized personnel away.

(3) Precautions

① Before starting to test, agree upon the signals to be employed for communication among coworkers. Once the test is started, be sure to communicate with each other using these signals, and to follow them without fail.

② Operate the machine carefully and always give first priority to safety.

③ While testing, always take care to avoid accidents due to landslides or contact with high voltage power lines. Always confirm that there is sufficient space for full swings.

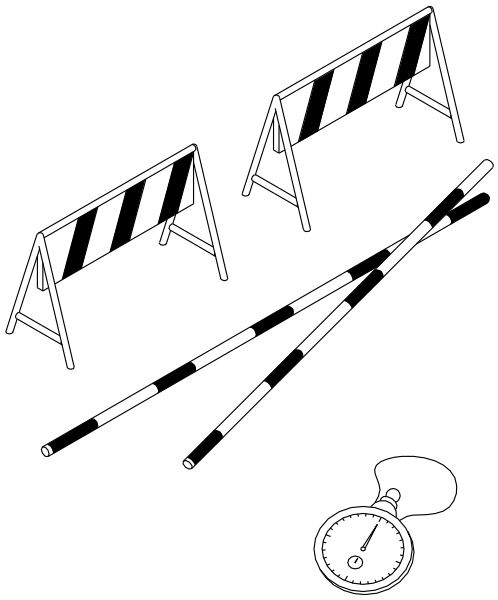
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

(4) Make precise measurements

① Accurately calibrate test instruments in advance to obtain correct data.

② Carry out tests under the exact test conditions prescribed for each test item.

③ Repeat the same test and confirm that the test data obtained can be procured repeatedly. Use mean values of measurements if necessary.



(210-7) 7-3

2) ENGINE SPEED

(1) Measure the engine speed at each power mode

※ The engine speed at each power mode must meet standard RPM; if not, all other operational performance data will be unreliable. It is essential to perform this test first.

(2) Preparation

① Warm up the machine, until the engine coolant temperature reaches 50˚C or more, and the hydraulic oil is 50±5˚C.

② Set the accel dial at 10 (Max) position.

③ Measure the engine RPM.

(3) Measurement

① Start the engine. The engine will run at start idle speed. Measure engine speed with a engine rpm display.

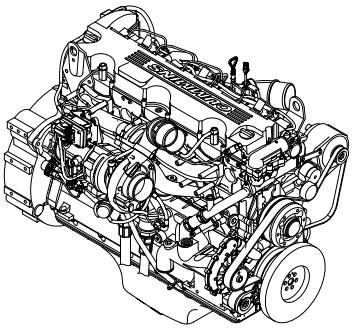
② Measure and record the engine speed at each mode (P, S, E).

③ Select the P-mode.

④ Lightly operate the bucket control lever a few times, then return the control lever to neutral; The engine will automatically enter the auto-idle speed after 4 seconds.

⑤ Measure and record the auto deceleration speed.





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(4) Evaluation

The measured speeds should meet the following specifications.

Unit : rpm

Model	Engine speed	Standard	Remarks
HX480A L HX520A L	Start idle	800±100	
	P mode	1850±50	
	S mode	1750±50	
	E mode	1650±50	
	Auto decel	1000±100	
	One touch decel	800±100	

Condition : Set the accel dial at 10 (Max) position.

3) TRAVEL SPEED

(1) Measure the time required for the excavator to travel a 20 m test track.

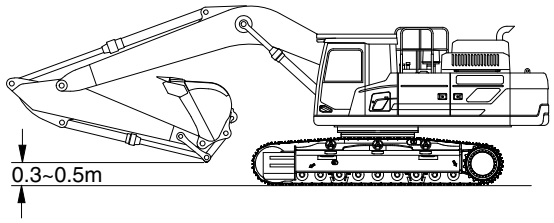
(2) Preparation

① Adjust the tension of both tracks to be equal.

② Prepare a flat and solid test track 20m in length, with extra length of 3 to 5 m on both ends for machine acceleration and deceleration.

③ Hold the bucket 0.3 to 0.5 m above the ground with the arm and bucket rolled in.

④ Keep the hydraulic oil temperature at 50±5˚C.



480A7MS02

(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.

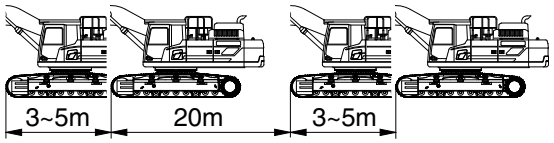
· Power mode switch : P mode

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.



480A7MS03

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds / 20 m

Model	Travel speed	Standard	Maximum allowable	Remarks
HX480A L HX520A L	1 Speed	21.8±2.0	29.6	
	2 Speed	13.6±1.0	19.1	

4) TRACK REVOLUTION SPEED

(1) Measure the track revolution cycle time with the track raised off ground.

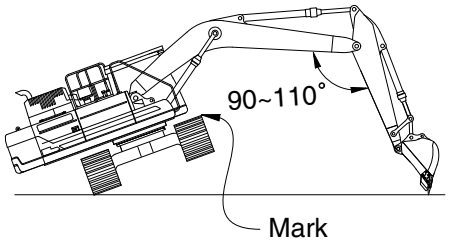
(2) Preparation

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.



480A7MS04

(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
HX480A L HX520A L	1 Speed	37.5±2.0	51
	2 Speed	23.3±1.0	32.2

5) TRAVEL DEVIATION

(1) Measure the deviation by the tracks from a 20 m straight line.

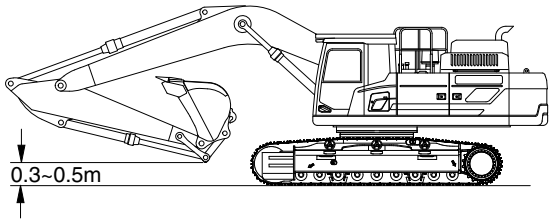
(2) Preparation

① Adjust the tension of both tracks to be equal.

② Provide a flat, solid test yard 20 m in length, with extra length of 3 to 5 m on both ends for machine acceleration and deceleration.

③ Hold the bucket 0.3 to 0.5 m above the ground with the arm and bucket rolled in.

④ Keep the hydraulic oil temperature at 50±5°C.



480A7MS02

(3) Measurement

① Measure the amount of mistracking at high and low travel speeds.

② Before beginning each test, select the following switch positions.

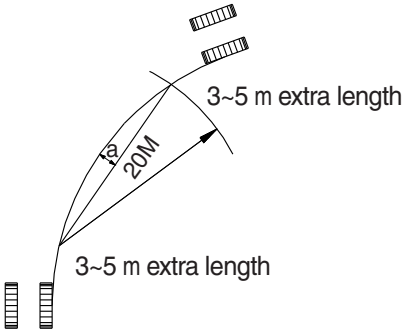
· Power mode switch : P mode

③ Start traveling the machine in the acceleration zone with the travel levers at full stroke.

④ Measure the distance between a straight 20 m line and the track made by the machine. (Dimension a)

⑤ After measuring the tracking in forward travel, turn the upperstructure 180 °and measure that in reverse travel.

⑥ Repeat steps ④ and ⑤ three times and calculate the average values.



(210-7) 7-7(2)

(4) Evaluation

Mistrack should be within the following specifications.

Unit : mm / 20 m

Model	Standard	Maximum allowable	Remarks
HX480A L HX520A L	200 below	250	-

6) SWING SPEED

(1) Measure the time required to swing three complete turns.

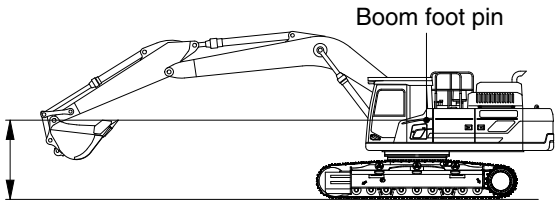
(2) Preparation

① Check the lubrication of the swing gear and swing bearing.

② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.

③ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. The bucket must be empty.

④ Keep the hydraulic oil temperature at 50±5˚C.



480A7MS05

(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
HX480A L HX520A L	P mode	20.0±1.5	26.8

7) SWING FUNCTION DRIFT CHECK

(1) Measure the swing drift on the bearing outer circumference when stopping after a 360˚ full speed swing.

(2) Preparation

① Check the lubrication of the swing gear and swing bearing.

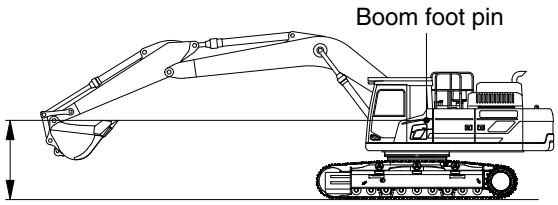
② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.

③ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. The bucket must be empty.

④ Make two chalk marks: one on the swing bearing and one directly below it on the track frame.

⑤ Swing the upperstructure 360˚.

⑥ Keep the hydraulic oil temperature at 50±5˚C.



480A7MS05

(3) Measurement

① Conduct this test in the M mode.

② Select the following switch positions.

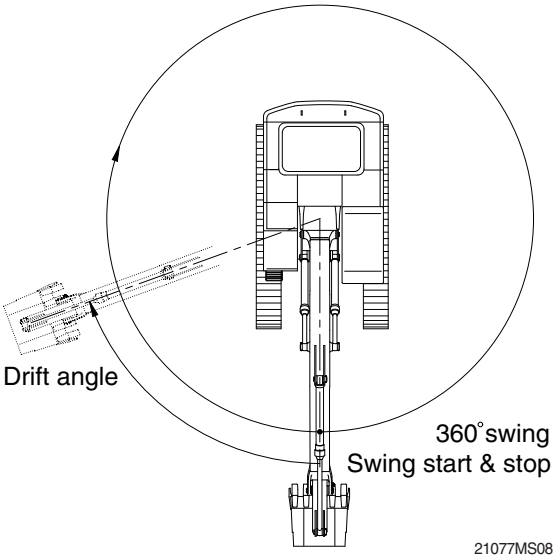
· Power mode switch : P mode

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

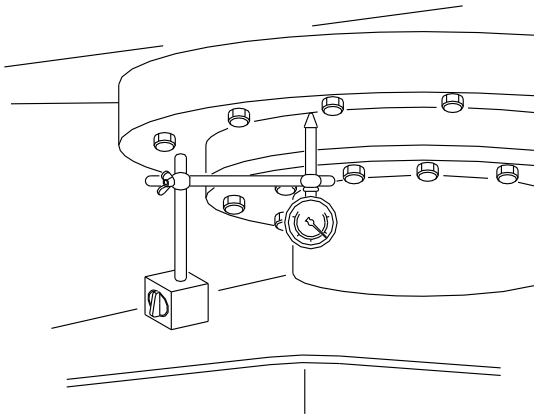
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Power mode switch	Standard	Maximum allowable	Remarks
HX480A L HX520A L	P mode	90 below	112.5	

8) SWING BEARING PLAY

(1) Measure the swing bearing play using a dial gauge to check the wear of bearing races and balls.



(210-7) 7-10(1)

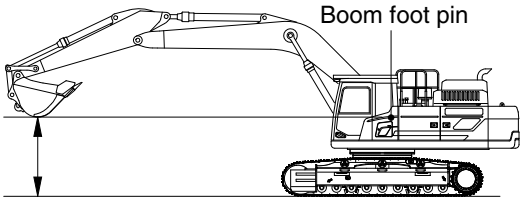
(2) Preparation

① Check swing bearing mounting cap screws for loosening.
② Check the lubrication of the swing bearing. Confirm that bearing rotation is smooth and without noise.
③ Install a dial gauge on the track frame as shown, using a magnetic base.
④ Position the upperstructure so that the boom aligns with the tracks facing towards the front idlers.
⑤ Position the dial gauge so that its needle point comes into contact with the bottom face of the bearing outer race.
⑥ Bucket should be empty.

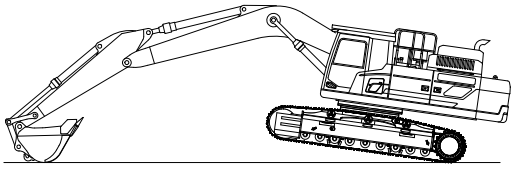
(3) Measurement

① With the arm rolled out and bucket rolled in, hold the bottom face of the bucket to the same height of the boom foot pin. Record the dial gauge reading (h1).
② Lower the bucket to the ground and use it to raise the front idler 50 ㎝. Record the dial gauge reading (h2).
③ Calculate bearing play (H) from this data (h1 and h2) as follows.
H=h2-h1

Measurement : (h1)



Measurement : (h2)



480A7MS06

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Standard	Maximum allowable	Remarks
HX480A L HX520A L	0.5 ~ 1.5	3.0	

9) HYDRAULIC CYLINDER CYCLE TIME

(1) Measure the cycle time of the boom, standard arm, and standard bucket cylinders.

(2) Preparation

① To measure the cycle time of the boom cylinders:
With the arm rolled out and the empty bucket rolled out, lower the bucket to the ground, as shown.

② To measure the cycle time of the arm cylinder.
With the empty bucket rolled in, position the arm so that it is vertical to the ground. Lower the boom until the bucket is 0.5 m above the ground.

③ To measure the cycle time of the bucket cylinder.
The empty bucket should be positioned at midstroke between roll-in and roll-out, so that the sideplate edges are vertical to the ground.

④ Keep the hydraulic oil temperature at 50±5˚C.

(3) Measurement

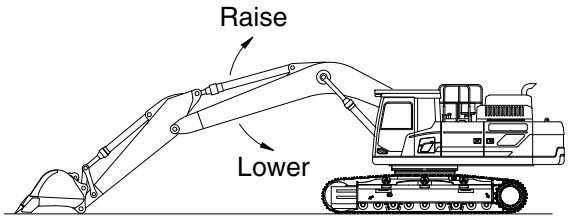
① Select the following switch positions.

· Power mode switch : P mode

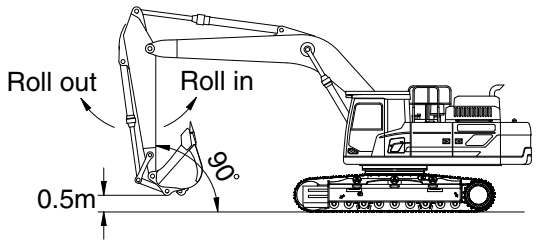
② To measure cylinder cycle times.

- Boom cylinders.
  Measure the time it takes to raise the boom, and the time it takes to lower the boom. To do so, position the boom at one stroke end then move the control lever to the other stroke end as quickly as possible.
- Arm cylinder.
  Measure the time it takes to roll in the arm, and the time it takes to roll out the arm. To do so, position the bucket at one stroke end, then move the control lever to the other stroke end as quickly as possible.

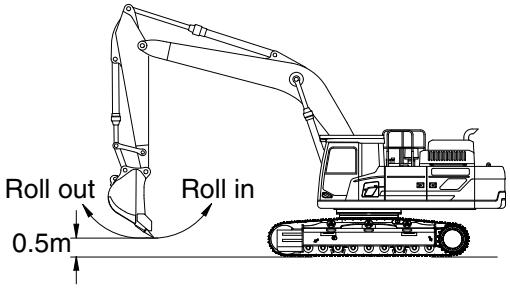
Boom cylinder



Arm cylinder



Bucket cylinder



480A7MS07

- 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
HX480A L	Boom raise	4.2±0.4	5.1	
	Boom lower	2.7±0.4	3.4	
	Arm in	3.0±0.4	4.1	
	Arm out	3.3±0.4	3.9	
	Bucket load	3.1±0.4	3.8	
	Bucket dump	2.5±0.4	3.2	
HX520A L	Boom raise	4.3±0.4	5.0	
	Boom lower	3.0±0.4	3.9	
	Arm in	3.6±0.4	4.5	
	Arm out	3.2±0.4	4.0	
	Bucket load	3.1±0.4	3.6	
	Bucket dump	2.4±0.4	3.1	

10) DIG FUNCTION DRIFT CHECK

(1) Measure dig function drift, which can be caused by oil leakage in the control valve and boom, standard arm, and standard bucket cylinders, with the loaded bucket.
When testing the dig function drift just after cylinder replacement, slowly operate each cylinder to its stroke end to purge air.

(2) Preparation

① Load bucket fully. Instead of loading the bucket, weight(W) of the following specification can be used.

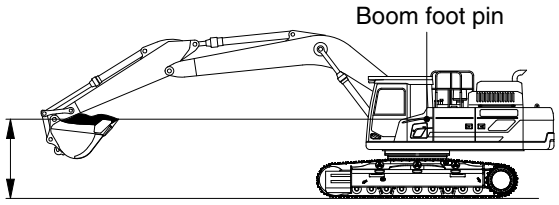
· $W=M^3 \times 1.5$
Where :
M^3 = Bucket heaped capacity (m^3)
1.5 = Soil specific gravity

② Position the arm cylinder with the rod 20 to 30 ㎜ extended from the fully retracted position.

③ Position the bucket cylinder with the rod 20 to 30 ㎜ retracted from the fully extended position.

④ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin.

⑤ Keep the hydraulic oil temperature at 50±5˚C.



480A7MS08

(3) Measurement

① Stop the engine.

② Five minutes after the engine has been stopped, measure the changes in the positions of the boom, arm and bucket cylinders.

③ Repeat step ② three times and calculate the average values.

(4) The measured drift should be within the following specifications.

Unit : mm / 5min

Model	Drift to be measured	Standard	Maximum allowable	Remarks
HX480A L HX520A L	Boom cylinder	10 below	15	
	Arm cylinder	10 below	15	
	Bucket cylinder	40 below	50	

11) CONTROL LEVER OPERATING FORCE

(1) Use a spring scale to measure the maximum resistance of each control lever at the middle of the grip.

(2) Preparation

① Keep the hydraulic oil temperature at 50±5˚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
HX480A L HX520A L	Boom lever	1.3 or below	1.7	
	Arm lever	1.3 or below	1.7	
	Bucket lever	1.3 or below	1.7	
	Swing lever	1.3 or below	1.7	
	Travel lever	2.1 or below	3.15	

12) CONTROL LEVER STROKE

(1) Measure each lever stroke at the lever top using a ruler.

※ When the lever has play, take a half of this value and add it to the measured stroke.

(2) Preparation

Keep the hydraulic oil temperature at 50±5˚C.

(3) Measurement

① Stop the engine.

② Measure each lever stroke at the lever top from neutral to the stroke end using a ruler.

③ Repeat step ② three times and calculate the average values.

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Kind of lever	Standard	Maximum allowable	Remarks
HX480A L HX520A 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.

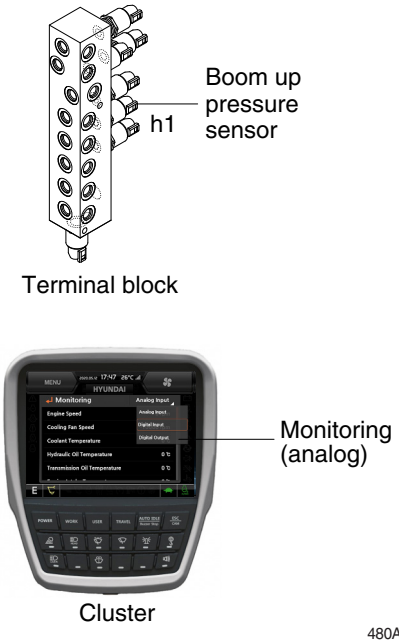
(2) Measurement

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.



480A7MS12

(3) Evaluation

The average measured pressure should meet the following specifications:

Unit : kgf / cm²

Model	Engine speed	Standard	Allowable limits	Remarks
HX480A L HX520A L	P mode	40^{+2}_{0}	-	

14) FOR TRAVEL SPEED SELECTING PRESSURE:

(1) Preparation

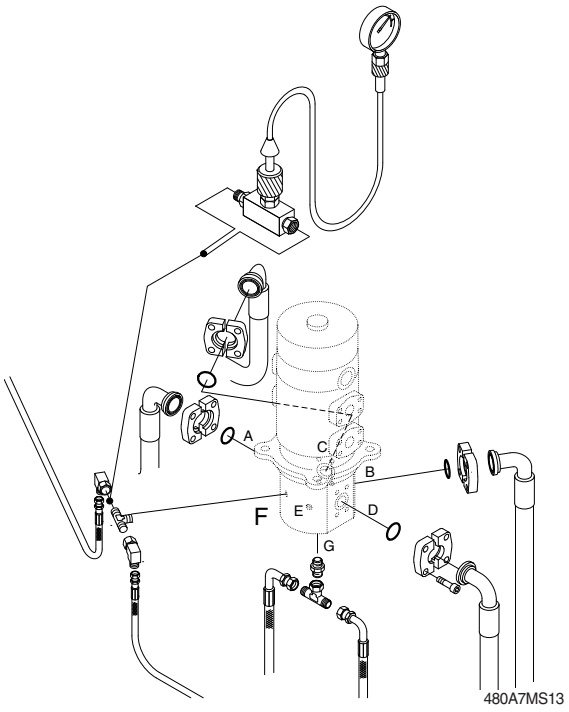
① Stop the engine.

② Loosen the cap and relieve the pressure in the tank by pushing the top of the air breather.

③ To measure the speed selecting pressure: Install a connector and pressure gauge

④ assembly to turning joint P port as shown. Start the engine and check for on leakage from the adapter.

⑤ Keep the hydraulic oil temperature at 50±5˚C.



(2) Measurement

① Select the following switch positions.

· Power mode switch : P mode

· Travel mode switch : 1 speed
2 speed

② Measure the travel speed selecting pressure in the Hi or Lo mode.

③ Lower the bucket to the ground to raise the track off the ground. Operate the travel lever at full stroke and measure the fast speed pressure.

④ Repeat steps ② and ③ three times and calculate the average values.

(3) Evaluation

The average measured pressure should be within the following specifications.

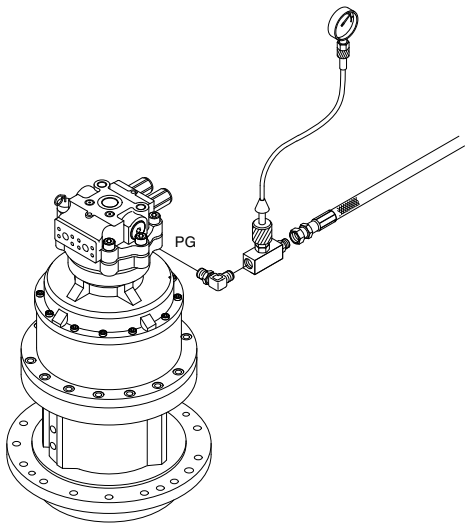
Unit : kgf / cm²

Model	Travel speed mode	Standard	Maximum allowable	Remarks
HX480A L HX520A L	1 Speed	0	-	
	2 Speed	40±5	-	

15) SWING PARKING BRAKE RELEASING PRESSURE

(1) Preparation

① Stop the engine.
② Loosen the cap and relieve the pressure in the tank by pushing the top of the air breather.
③ The pressure release L wrench to bleed air.
④ Install a connector and pressure gauge assembly to swing motor PG port, as shown.
⑤ Start the engine and check for oil leakage from the adapter.
⑥ Keep the hydraulic oil temperature at 50±5˚C.



480A7MS15

(2) Measurement

① Select the following switch positions.
· Power mode switch : P mode
② Operate the swing function release and measure the swing brake pressure with the brake disengaged. Release the control lever to return to neutral and measure the control pressure when the brake is applied.
Repeat step ② three times and calculate the average values.

(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm²

Model	Description	Standard	Allowable limits	Remarks
HX480A L HX520A L	Brake disengaged	40	31~42	
	Brake applied	0	-	

16) MAIN PUMP DELIVERY PRESSURE

(1) Preparation

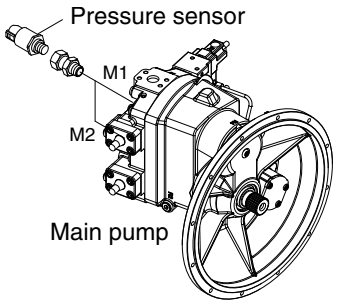
① Keep the hydraulic oil temperature at 50±5˚C.

(2) Measurement

① Select the following switch positions.

· Power mode switch : P mode

② Measure the main pump delivery pressure in the P mode (high idle).





Cluster

480A7MS16

(3) Evaluation

The average measured pressure should meet the following specifications.

Unit : kgf / cm²

Model	Engine speed	Standard	Allowable limits	Remarks
HX480A L HX520A L	High idle	40±5	-	

17) SYSTEM PRESSURE REGULATOR RELIEF SETTING

(1) Preparation

① Keep the hydraulic oil temperature at 50±5˚C.

(2) Measurement

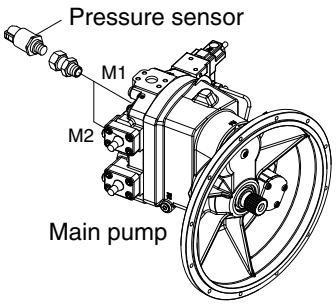
① Select the following switch positions.

· Power mode switch : P mode

② Slowly operate each control lever of boom, arm and bucket functions at full stroke over relief and measure the pressure.

③ In the swing function, place bucket against an immovable object and measure the relief pressure.

④ In the travel function, lock undercarriage with an immovable object and measure the relief pressure.





480A7MS16

(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm²

Model	Function to be tested	Standard	Port relief setting
HX480A L HX520A L	Boom	330 (360)±10	400
	Arm	330 (360)±10	400
	Bucket	330 (360)±10	400
	Travel	360±10	-
	Swing	285±10	-

( ) : Power boost

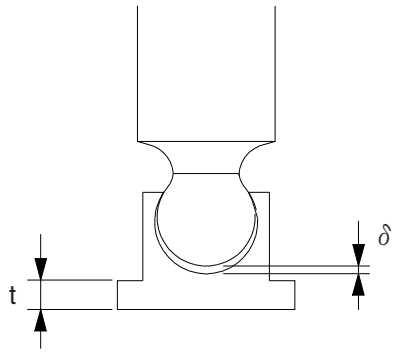
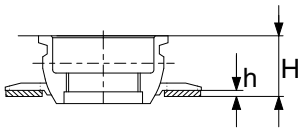
GROUP 2 MAJOR COMPONENT

1. MAIN CONTROL VALVE

Part name	Inspection item	Criteria & measure
Casing	· Existence of scratches, rust or corrosion.	· In case of damage in following section, replace casing. - Sliding sections of casing hole and spool, especially land sections applied with held pressure. - Seal pocket section where spool is inserted. - Sealing section of port where O-ring contacts. - Sealing section of each relief valve for main and port. - Sealing section of plug. - Other damages that may damage normal function.
Spool	· Existence of scratch, gnawing, rusting or corrosion. · O-ring seal sections at both ends. · Insert spool into casing hole, rotate and reciprocate it.	· Replacement when its outside sliding section has scratch (especially on seals-contacting section). · Replacement when its sliding section has scratch. · Correction or replacement when O-ring is damaged or when spool does not move smoothly.
Poppet	· Damage of spring · Damage of poppet · Insert poppet into casing and function it.	· Replacement. · Correction or replacement when sealing is incomplete. · Normal when it can function lightly and smoothly without sticking.
Spring and related parts	· Rusting, corrosion, deformation or breakage of spring, spring seat, plug or cover.	· Replacement for significant damage.
Around seal for spool	· External oil leakage. · Rusting, corrosion or deformation of seal plate.	· Correction or replacement. · Correction or replacement.
Main relief valve, port relief valve & negative control valve	· External rusting or damage. · Contacting face of valve seat. · Contacting face of poppet. · O-rings and back up rings.	· Replacement. · Replacement when damaged. · Replacement when damaged. · Replacement in principle.

2. SWING DEVICE

1) WEARING PARTS

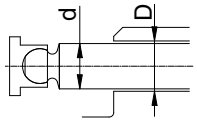
Inspection item	Standard dimension	Recommended replacement value	Counter measures
Clearance between piston and cylinder block bore	0.041	0.060	Replace piston or cylinder block
Thickness of valve plate	6	5.88	Replace
Play between piston and shoe caulking section (δ)	0.025	0.1	Replace assembly of piston and shoe
Thickness of shoe (t)	6.6	6.5	Replace assembly of piston and shoe
Combined height of retainer plate and spherical bushing (H-h)	17.6	17.3	Replace set of retainer plate and sperical bushing
Thickness of friction plate	2.94	2.7	Replace
 140W77MS12		 2609A7MS01	

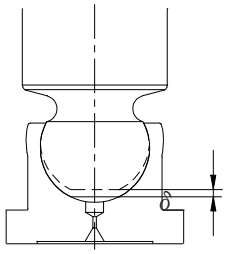
2) SLIDING PARTS

Part name	Standard roughness	Allowable roughness	Remark
Shoe	Rmax=1S (Ra=0.2a) (LAPPING)	4S (Ra=0.1a)	
Shoe plate	Rmax=0.4S (Ra=0.1a) (LAPPING)	3S (Ra=0.8a)	
Cylinder	Rmax=0.4S (Ra=0.1a) (LAPPING)	3S (Ra=0.8a)	
Valve plate	Rmax=0.4S (Ra=0.1a) (LAPPING)	2S (Ra=0.5a)	

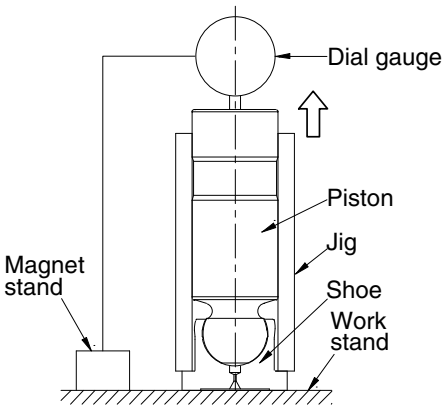
3. TRAVEL MOTOR

The followings are the general maintenance standards. However, it is the most important to determine which parts should be replaced, depending on the characteristics before disassembling, damages and discoloration of exterior view, the purpose of disassembling, the expected remaining service life. etc..

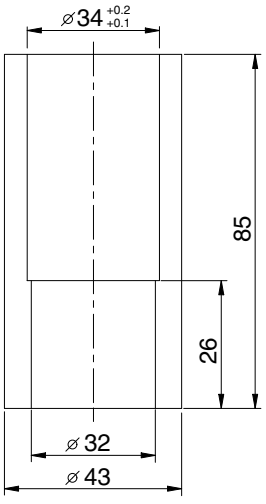
Check item		Measuring method	Criteria	Allowable	Remedy
Sliding surface of cylinder block, valve plate and swash plate	Surface roughness of cylinder block, valve plate and swas plate	Measure the surface roughness by roughness tester	Below 0.4 Z μ	Below 3.0 Z μ	Replace or repair ※ Lap together the surfaces of both cylinder block and valve plate to remedy their roughness (# 1200 power)
	Swash plate - hardness of sliding surface	Measure the surface hardness of swash plate by hardness tester	Over HS78	HS74	Replace
Clearance between piston and cylinder block  Measurement position	Outer dia of piston d max - d min	Measure outer dia of piston and bore of cylinder block at least 3 places in the longitudinal direction with micrometer and obtain : max outer dia = d max min outer dia = d min max inner dia = D max min inner dia = D min	0.01 mm	0.05 mm	Replace piston or cylinder block ※ In exchanging pistons, replace all of nine pistons at the same time
	Inner dia of cylinder bore D max - D min		0.01 mm	0.022 mm	
	Clearance D-d		0.037~ 0.047 mm	0.065 mm	
Play between piston and shoe	Play between calked piston and shoe (δ)	With the jig, hold down the shoe on work stand and pull up the piston vertical direction to measure the play between piston and shoe	0~0.1 mm	0.3 mm	Replace piston



Play



Method



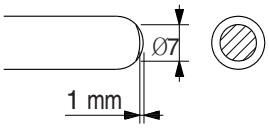
Jig for measuring play

29097MS10

Check item	Measuring method	Criteria	Allowable	Remedy
Parking brake torque	After completion of assembly, set the torque wrench on the shaft end, and measure the braking torque generated when the shaft starts to rotate	92.6 kgf · m (670 lbf · ft)	82.8 kgf · m (599 lbf · ft)	Replace all of separator, friction plates and springs
Standard of replacing friction and separating plate. When measuring parking brake torque, it needs to disassemble traveling unit to motor and reduction gear portion, and it's so hard. The right allowable value is a standard of replacing friction and separating plate. If it is impossible to disassemble traveling unit, refer to the right value.	Measure the total thickness of 4 pieces of friction plate and 5 pieces of separating plate.	22.76 mm	Thickness : 21.3 mm	Replace all separating and friction plates and springs.

Check item	Measuring method	Judging criteria and remedy
Shaft	Measure the wear at contacting surface of oil seal (3) with the surface roughness tester	If the depth of shaft wear is less than 0.05 mm, the shaft is reusable. ※ In case of replacing the shaft (9), replace oil seal (3) at the same time.
Bearings	Replace bearings (10, 51) after decided hours	Replace bearings (10, 51) before hour meter of host machine indicates 10,000 hours. ※ In case replacing the bearings (10, 51), replace both inner and outer races at the same time. ※ Also the bearing shims (52) must be readjusted when replaced shaft (9) and/or bearings (10, 51). Contact dealers for jigs and tools required.
Splines	Replace if the wear of splines exceeds the allowable value	If the wear of splines is less than 0.3 mm, the spline is reusable.
Overload relief valve	Do not try to adjust the valve, since special hydraulic test bench is required for inspecting and adjusting the pressure	Replace relief valve part as an assembly each time the host machine works for 10,000 hours.

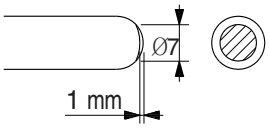
4. RCV LEVER

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 : 30 kgf/cm^2 Oil viscosity : 23 cSt
Spool	This is to be replaced when the sliding surface has worn more than 10 μm, compared with the non-sliding surface.	The leakage at the left condition is estimated to be nearly equal to the above leakage.
Push rod	 This is to be replaced when the top end has worn more than 1 mm.	
Play at operating section	The pin, shaft, and joint of the operating section are to be replaced when their plays become more than 2 mm due to wears or so on.	When a play is due to looseness of a tightened section, adjust it.
Operation stability	When abnormal noises, hunting, primary pressure drop, etc. are generated during operation, and these cannot be remedied, referring to section 6. Troubleshooting, replace the related parts.	

Notes 1. It is desirable to replace seal materials, such as O-rings, every disassembling. However, they may be reused, after being confirmed to be free of damage.

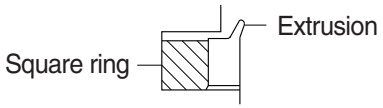
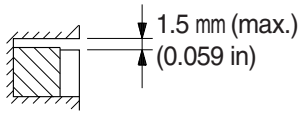
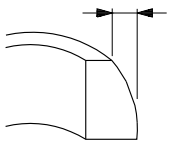
2. When loosening the hexagon socket head cap screw (125), replace the seal washers (121) without fail.

5. 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 : 30 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.

6. TURNING JOINT

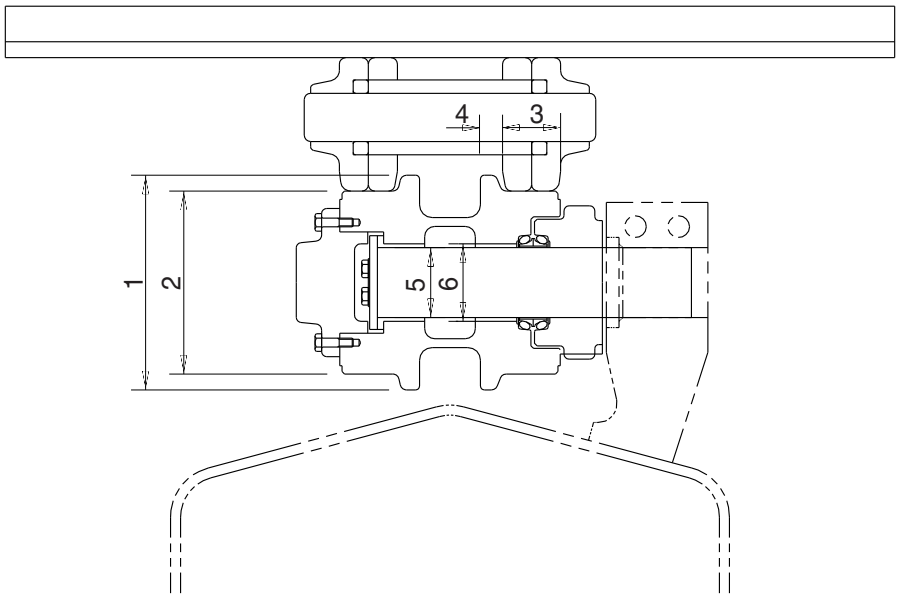
Part name		Maintenance standards	Remedy
Body, Stem	Sliding surface with sealing sections.	Plating worn or peeled due to seizure or contamination.	Replace
	Sliding surface between body and stem other than sealing section.	· Worn abnormality or damaged more than 0.1 mm (0.0039 in) in depth due to seizure 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

7. CYLINDER

Part name	Inspecting section	Inspection item	Remedy
Piston rod	· Neck of rod pin	· Presence of crack	· Replace
	· Weld on rod hub	· Presence of crack	· Replace
	· Stepped part to which piston is attached.	· Presence of crack	· Replace
	· Threads	· Presence of crack	· Recondition or replace
	· Plated surface	· Plating is not worn off to base metal.	· Replace or replate
		· Rust is not present on plating.	· Replace or replate
		· Scratches are not present.	· Recondition, replate or replace
	· Rod	· Wear of O.D.	· Recondition, replate or replace
	· Bushing at mounting part	· Wear of I.D.	· Replace
Cylinder tube	· Weld on bottom	· Presence of crack	· Replace
	· Weld on head	· Presence of crack	· Replace
	· Weld on hub	· Presence of crack	· Replace
	· Tube interior	· Presence of faults	· Replace if oil leak is seen
	· Bushing at mounting part	· Wear on inner surface	· Replace
Gland	· Bushing	· Flaw on inner surface	· Replace if flaw is deeper than coating

1. TRACK

1) UPPER ROLLER

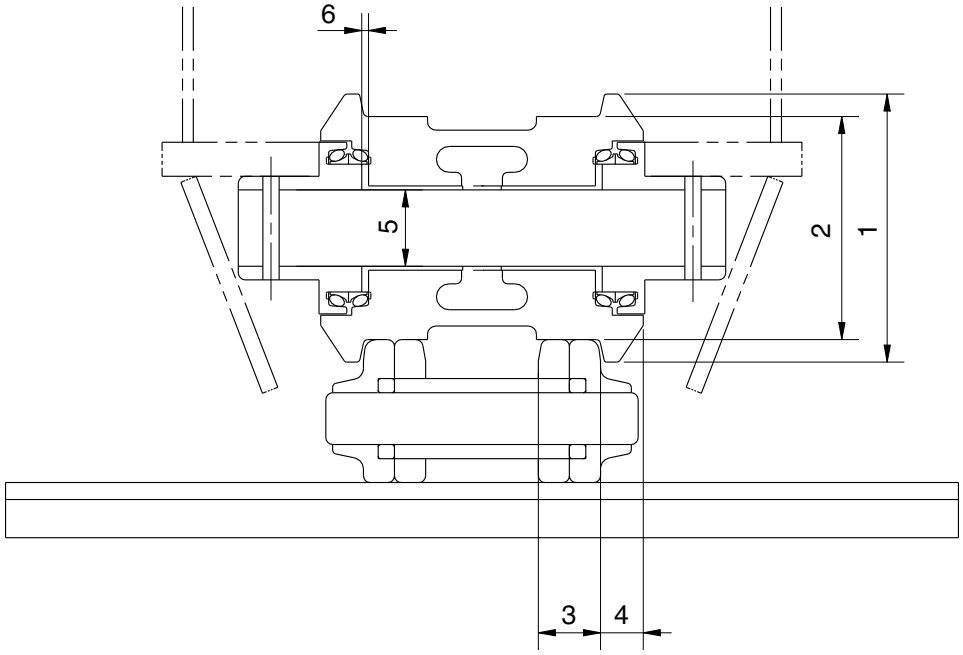


32037MA37

Unit : mm

No.	Check item	Criteria						Remedy
1	Outside diameter of flange	Standard size				Repair limit		Rebuild or replace
		Ø200				–		
2	Outside diameter of tread	Ø191				Ø181		
3	Width of tread	51				56		
4	Width of flange	20				–		
5	Clearance between shaft and busing	Standard size & Tolerance				Standard clearance	Clearance limit	Replace bushing
		Shaft		Hole				
		Dimension	Tolerance	Dimension	Tolerance			
		Ø55	0 -0.03	Ø55.37	0.05 0	0.37~0.45	2.0	
6	Clearance between shaft and support	Ø57.15	0 -0.1	Ø58	0.5 0.3	0.3~0.6	1.2	Replace

2) LOWER ROLLER

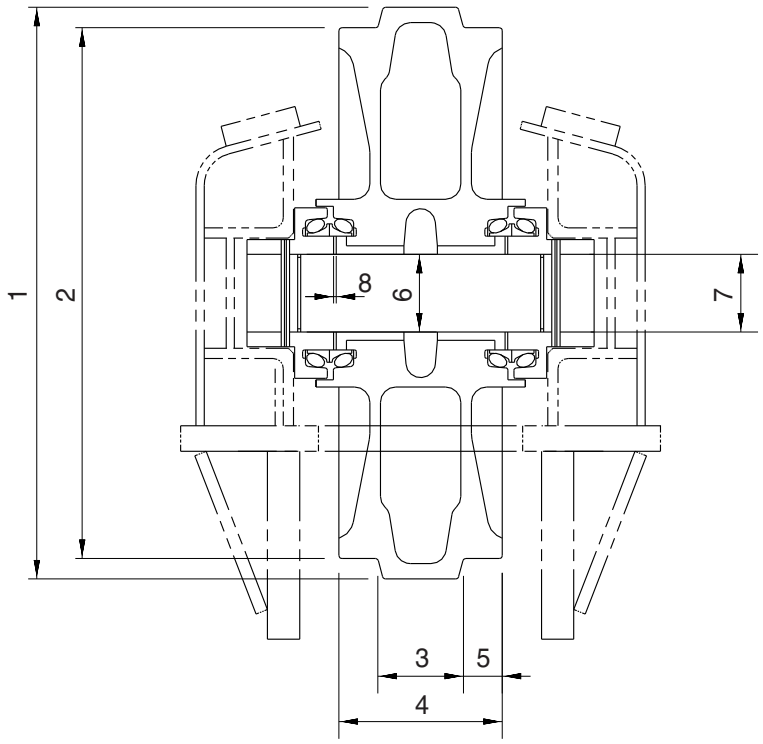


21037MS01

Unit : mm

No.	Check item	Criteria						Remedy
1	Outside diameter of flange	Standard size				Repair limit		Rebuild or replace
		Ø260				–		
2	Outside diameter of tread	Ø210				Ø198		
3	Width of tread	57				63		
4	Width of flange	37.5				–		
5	Clearance between shaft and bushing	Standard size and tolerance				Standard clearance	Clearance limit	Replace bushing
		Shaft		Hole				
		Dimension	Tolerance	Dimension	Tolerance			
		Ø90	0 -0.03	Ø90.37	0.05 0	0.37~0.45	2.0	
6	Side clearance of roller (both side)	Standard clearance				Clearance limit		Replace
		0.36~1.14				2.0		

3) IDLER



21037MS03

Unit : mm

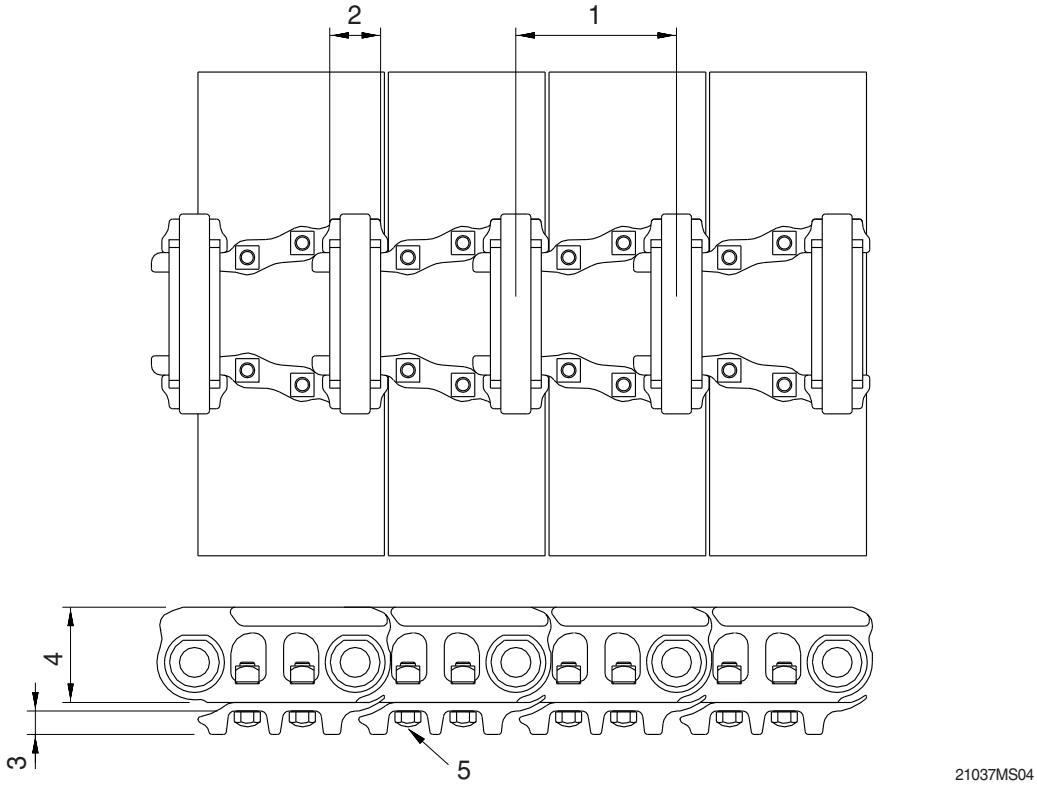
No.	Check item	Criteria						Remedy
1	Outside diameter of flange	Standard size				Repair limit		Rebuild or replace
		Ø687				–		
2	Outside diameter of tread	Ø635				Ø629		
3	Width of protrusion	102				–		
4	Total width	203				–		
5	Width of tread	50.5				56.5		
6	Clearance between shaft and bushing	Standard size & Tolerance				Standard clearance	Clearance limit	Replace bushing
		Shaft		Hole				
		Dimension	Tolerance	Dimension	Tolerance			
		Ø95	0 -0.035	Ø95	0.50 0.45	0.45~0.535	2.0	
7	Clearance between shaft and support	Ø95	0 -0.035	Ø95	0.126 0.072	0.072~0.126	1.2	Replace
8	Side clearance of idler (both side)	Standard clearance				Clearance limit		Replace bushing
		0.4~1.2				2.0		

(Mahcine Serial No. HX480A L : #0155-, HX520A L : #0246-)

Unit : mm

No.	Check item	Criteria						Remedy
1	Outside diameter of flange	Standard size				Repair limit		Rebuild or replace
		Ø682				–		
2	Outside diameter of tread	Ø630				Ø622		
3	Width of protrusion	102				–		
4	Total width	203				–		
5	Width of tread	50.5				56.5		
6	Clearance between shaft and bushing	Standard size & Tolerance				Standard clearance	Clearance limit	Replace bushing
		Shaft		Hole				
		Dimension	Tolerance	Dimension	Tolerance			
		Ø110	0 -0.03	Ø110	0.5 0.48	0.48~0.53	2.0	
7	Clearance between shaft and support	Ø110	0 -0.03	Ø110	0.09 0.036	0.036~0.12	1.2	Replace
8	Side clearance of idler (both side)	Standard clearance				Clearance limit		Replace bushing
		0.4~1.2				2.0		

4) TRACK



Unit : mm

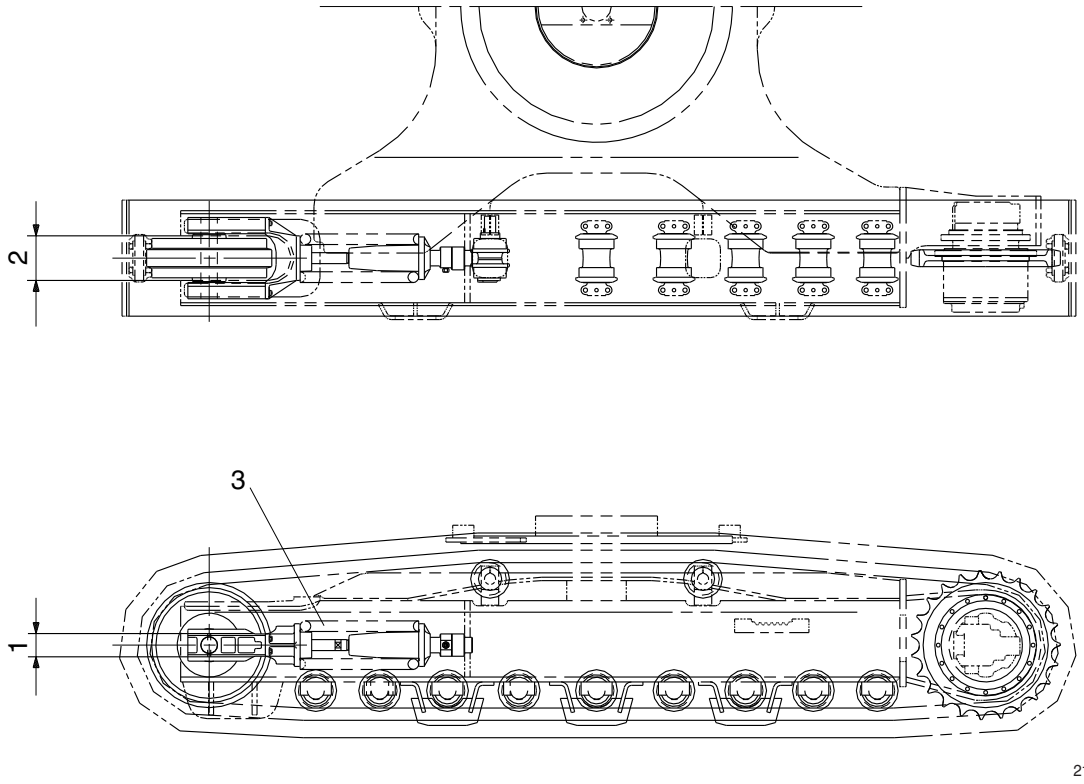
No.	Check item	Criteria		Remedy
1	Link pitch	Standard size	Repair limit	Turn or replace
		216	221	
2	Outside diameter of bushing	Ø71.4	Ø61.4	Rebuild or replace
3	Height of grouser	36	23	
4	Height of link	134	129	
5	Tightening torque	Initial tightening torque : 145 ± 5 kgf · m		Retighten

(Mahcine Serial No. HX480A L : #0155-, HX520A L : #0246-)

Unit : mm

No.	Check item	Criteria		Remedy
1	Link pitch	Standard size	Repair limit	Turn or replace
		215.9	220.9	
2	Outside diameter of bushing	Ø73.4	Ø63.4	Rebuild or replace
3	Height of grouser	36	23	
4	Height of link	129	124	
5	Tightening torque (Tightening angle method)	Initial tightening torque : 50 ± 5 kgf · m Additional tightening angle : 120 ± 10°		Retighten

5) TRACK FRAME AND RECOIL SPRING



21037MS05

Unit : mm

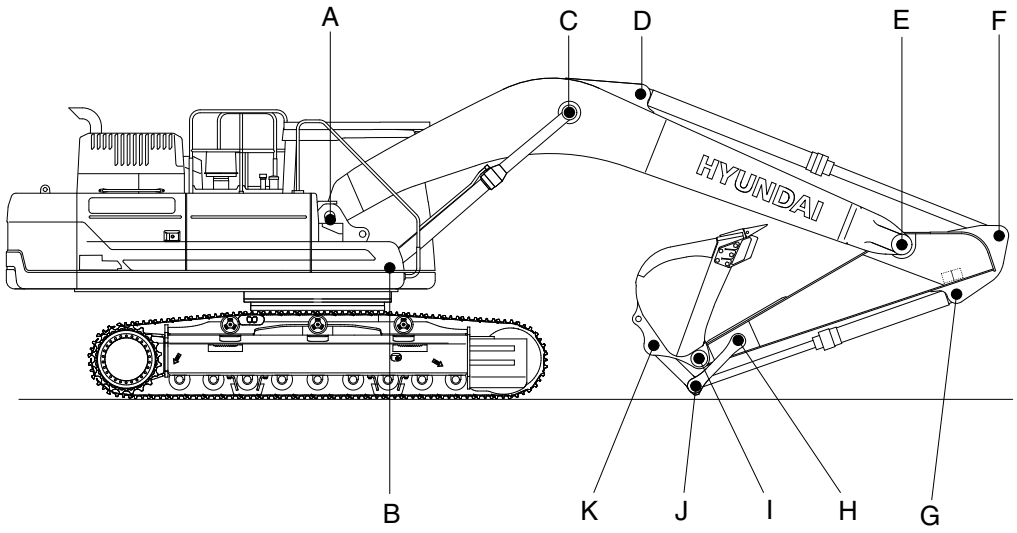
No.	Check item	Criteria					Remedy
1	Vertical width of idler guide			Standard size	Tolerance	Repair limit	Rebuild or replace
		Track frame		132	2.0 0	136	
		Idler support		130	0 -1.5	126	
2	Horizontal width of idler guide	Track frame		292	2.0 0	297	
		Idler support		290	–	288	
3	Recoil spring	Standard size			Repair limit		Replace
		Free length	Installation length	Installation load	Free length	Installation load	
		865	707	28840 kg	–	23073 kg	

(Mahcine Serial No. HX480A L : #0155-, HX520A L : #0246-)

Unit : mm

No.	Check item	Criteria					Remedy
1	Vertical width of idler guide			Standard size	Tolerance	Repair limit	Rebuild or replace
		Track frame		147	2.0 0	151	
		Idler support		145	0 -0.5	141	
2	Horizontal width of idler guide	Track frame		313	2.0 0	317	
		Idler support		310	–	306	
3	Recoil spring	Standard size			Repair limit		Replace
		Free length	Installation length	Installation load	Free length	Installation load	
		824	683	28039 kg	–	22431 kg	

2. WORK EQUIPMENT



480A7MS20

Unit : mm

Mark	Measuring point (Pin and Bushing)	Normal value	Pin		Bushing		Remedy & Remark
			Recomm. service limit	Limit of use	Recomm. service limit	Limit of use	
A	Boom Rear	125	124	123.5	125.5	126	Replacement
B	Boom Cylinder Head	120	119	118.5	120.5	121	
C	Boom Cylinder Rod	120	119	118.5	120.5	121	
D	Arm Cylinder Head	120	119	118.5	120.5	121	
E	Boom Front	125	124	123.5	125.5	126	
F	Arm Cylinder Rod	120	119	118.5	120.5	121	
G	Bucket Cylinder Head (HX480A L)	100	99	98.5	100.5	101	
	Bucket Cylinder Head (HX520A L)	110	109	108.5	110.5	111	
H	Arm Link	100	99	98.5	100.5	101	
I	Bucket and Arm Link (HX480A L)	100	99	98.5	100.5	101	
	Bucket and Arm Link (HX520A L)	120	119	118.5	120.5	121	
J	Bucket Cylinder Rod (HX480A L)	100	99	98.5	100.5	101	
	Bucket Cylinder Rod (HX520A L)	110	109	108.5	110.5	111	
K	Bucket Link (HX480A L)	100	99	98.5	100.5	101	
	Bucket Link (HX520A L)	120	119	118.5	120.5	121	

SECTION 8 DISASSEMBLY AND ASSEMBLY

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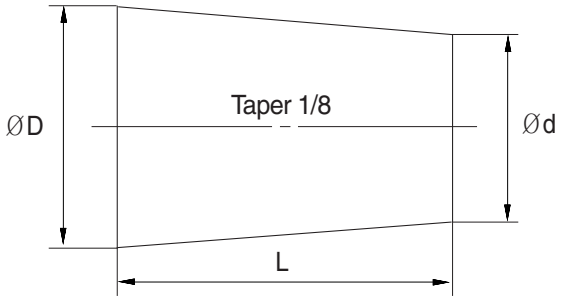
SECTION 8 DISASSEMBLY AND ASSEMBLY

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

· HX480A L

No.	Descriptions		Bolt size	Torque	
				kgf · m	lbf · ft
1	Engine	Engine mounting bolt (FR, bracket)	M14×2.0	18.4±2.0	133±14.5
2		Engine mounting bolt (RR, bracket)	M14×2.0	18.4±2.0	133±14.5
3		Engine mounting bolt (frame)	M22×2.5	69.6±7.0	503±50.6
4		Radiator mounting bolt	M16×2.0	29.7±4.5	215±32.5
5		Coupling mounting socket bolt	M20×2.5	46.5±2.5	336±18.1
6		Main pump coupling plate mounting bolt	M10×1.5	8.3±1.7	59.8±12.3
7		Fuel tank mounting bolt	M20×2.5	57.8±5.8	418±42.0
8	Hydraulic system	Main pump mounting bolt	M10×1.5	6.7±1.0	48.5±7.2
9		Main control valve mounting nut	M20×2.5	57.9±8.7	419±62.9
10		Hydraulic oil tank mounting bolt	M20×2.5	57.9±8.0	419±57.9
11		Turning joint mounting bolt, nut	M16×2.0	29.7±4.5	215±32.5
12	Power train system	Swing motor mounting bolt	M20×2.5	57.9±8.7	419±62.9
13		Swing bearing upper part mounting bolt	M24×3.0	100±10	723±72.3
14		Swing bearing lower part mounting bolt	M24×3.0	100±10	723±72.3
15		Travel motor mounting bolt	M20×2.5	57.9±8.7	419±62.9
16		Sprocket mounting bolt	M20×2.5 M22×2.5	57.9±6.0 77.4±8.0	419±43.4 560±57.9
17	Under carriage	Upper roller mounting bolt, nut	M16×2.0 M24×3.0★	29.7±3.0 100±10★	215±21.7 723±72.3★
18		Lower roller mounting bolt	M24×3.0	100±10	723±72.3
19		Track tension cylinder mounting bolt	M22×1.5 M20×2.5★	87.2±12.5 57.9±6.0★	631±90.4 419±43.4★
20		Track shoe mounting bolt, nut	M24×3.0 M24×1.5★	140±14 50.0±5.0 + 70°★	1012±101 362±36.2 + 70°★
21		Track guard mounting bolt	M24×3.0	100±15	723±108
22	Others	Counterweight mounting bolt	M42×3.0	390±40	2821±289
23		Cab mounting bolt	M12×1.75	12.8±3.0	92.6±21.7
24		Operator's seat mounting bolt	M8×1.25	4.05±0.8	29.3±5.8
25		Under cover mounting bolt	M12×1.75	12.8±3.0	92.6±21.7

★ : Machine Serial No. #0155-

※ For tightening torque of engine and hydraulic components, see engine maintenance guide and service manual.

· HX520A L

No.	Descriptions		Bolt size	Torque	
				kgf · m	lbf · ft
1	Engine	Engine mounting bolt (FR, bracket)	M14×2.0	18.4±2.0	133±14.5
2		Engine mounting bolt (RR, bracket)	M14×2.0	18.4±2.0	133±14.5
3		Engine mounting bolt (frame)	M22×2.5	69.6±7.0	503±50.6
4		Radiator mounting bolt	M16×2.0	29.7±4.5	215±32.5
5		Coupling mounting socket bolt	M20×2.5	46.5±2.5	336±18.1
6		Main pump coupling plate mounting bolt	M10×1.5	8.3±1.7	59.8±12.3
7		Fuel tank mounting bolt	M20×2.5	57.8±5.8	418±42.0
8	Hydraulic system	Main pump mounting bolt	M10×1.5	6.7±1.0	48.5±7.2
9		Main control valve mounting nut	M20×2.5	57.9±8.7	419±62.9
10		Hydraulic oil tank mounting bolt	M20×2.5	57.9±8.0	419±57.9
11		Turning joint mounting bolt, nut	M16×2.0	29.7±4.5	215±32.5
12	Power train system	Swing motor mounting bolt	M20×2.5	57.9±8.7	419±62.9
13		Swing bearing upper part mounting bolt	M24×3.0	100±10	723±72.3
14		Swing bearing lower part mounting bolt	M24×3.0	100±10	723±72.3
15		Travel motor mounting bolt	M20×2.5	57.9±8.7	419±62.9
16		Sprocket mounting bolt	M20×2.5	57.9±6.0	419±43.4
17	Under carriage	Upper roller mounting bolt, nut	M16×2.0	29.7±3.0	215±21.7
18		Lower roller mounting bolt	M24×3.0	100±10	723±72.3
19		Track tension cylinder mounting bolt	M22×1.5 M20×2.5★	87.2±12.5 57.9±6.0★	631±90.4 419±43.4★
20		Track shoe mounting bolt, nut	M24×3.0 M24×1.5★	140±14 50.0±5.0 + 70°★	1012±101 362±36.2 + 70°★
21		Track guard mounting bolt	M24×3.0	100±15	723±108
22		Adjustable track gauge bolt	M33×3.5	220±20	1590±145
23	Others	Counterweight mounting bolt	M42×3.0	390±40	2821±289
24		Center frame support & lower track mounting bolt	M33×3.5	220±20	1591±145
25		Cab mounting bolt	M12×1.75	12.8±3.0	92.6±21.7
26		Operator's seat mounting bolt	M8×1.25	4.05±0.8	29.3±5.8
27		Under cover mounting bolt	M12×1.75	12.8±3.0	92.6±21.7

★ : Machine Serial No. #0246-

※ For tightening torque of engine and hydraulic components, see engine maintenance guide and service manual.

2. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

Bolt size	8.8T		10.9T		12.9T	
	kgf · m	lbf · ft	kgf · m	lbf · ft	kgf · m	lbf · ft
M 6×1.0	0.8 ~ 1.2	5.8 ~ 8.6	1.2 ~ 1.8	8.7 ~ 13.0	1.5 ~ 2.1	10.9 ~ 15.1
M 8×1.25	2.0 ~ 3.0	14.5 ~ 21.6	2.8 ~ 4.2	20.3 ~ 30.4	3.4 ~ 5.0	24.6 ~ 36.1
M10×1.5	4.0 ~ 6.0	29.0 ~ 43.3	5.6 ~ 8.4	40.5 ~ 60.8	6.8 ~ 10.0	49.2 ~ 72.3
M12×1.75	6.8 ~ 10.2	50.0 ~ 73.7	9.6 ~ 14.4	69.5 ~ 104	12.3 ~ 16.5	89.0 ~ 119
M14×2.0	10.9 ~ 16.3	78.9 ~ 117	16.3 ~ 21.9	118 ~ 158	19.5 ~ 26.3	141 ~ 190
M16×2.0	17.9 ~ 24.1	130 ~ 174	25.1 ~ 33.9	182 ~ 245	30.2 ~ 40.8	141 ~ 295
M18×2.5	24.8 ~ 33.4	180 ~ 241	34.8 ~ 47.0	252 ~ 340	41.8 ~ 56.4	302 ~ 407
M20×2.5	34.9 ~ 47.1	253 ~ 340	49.1 ~ 66.3	355 ~ 479	58.9 ~ 79.5	426 ~ 575
M22×2.5	46.8 ~ 63.2	339 ~ 457	65.8 ~ 88.8	476 ~ 642	78.9 ~ 106	570 ~ 766
M24×3.0	60.2 ~ 81.4	436 ~ 588	84.6 ~ 114	612 ~ 824	102 ~ 137	738 ~ 991
M30×3.5	120 ~161	868 ~ 1164	168 ~ 227	1216 ~ 1641	202 ~ 272	1461 ~ 1967

(2) Fine thread

Bolt size	8.8T		10.9T		12.9T	
	kgf · m	lbf · ft	kgf · m	lbf · ft	kgf · m	lbf · ft
M 8×1.0	2.1 ~ 3.1	15.2 ~ 22.4	3.0 ~ 4.4	21.7 ~ 31.8	3.6 ~ 5.4	26.1 ~ 39.0
M10×1.25	4.2 ~ 6.2	30.4 ~ 44.9	5.9 ~ 8.7	42.7 ~ 62.9	7.0 ~ 10.4	50.1 ~ 75.2
M12×1.25	7.3 ~ 10.9	52.8 ~ 78.8	10.3 ~ 15.3	74.5 ~ 110	13.1 ~ 17.7	94.8 ~ 128
M14×1.5	12.4 ~ 16.6	89.7 ~ 120	17.4 ~ 23.4	126 ~ 169	20.8 ~ 28.0	151 ~ 202
M16×1.5	18.7 ~ 25.3	136 ~ 182	26.3 ~ 35.5	191 ~ 256	31.6 ~ 42.6	229 ~ 308
M18×1.5	27.1 ~ 36.5	196 ~ 264	38.0 ~ 51.4	275 ~ 371	45.7 ~ 61.7	331 ~ 446
M20×1.5	37.7 ~ 50.9	273 ~ 368	53.1 ~ 71.7	384 ~ 518	63.6 ~ 86.0	460 ~ 622
M22×1.5	51.2 ~ 69.2	370 ~ 500	72.0 ~ 97.2	521 ~ 703	86.4 ~ 116	625 ~ 839
M24×2.0	64.1 ~ 86.5	464 ~ 625	90.1 ~ 121	652 ~ 875	108 ~ 146	782 ~ 1056
M30×2.0	129 ~ 174	933 ~ 1258	181 ~ 245	1310 ~ 1772	217 ~ 294	1570 ~ 2126

2) PIPE AND HOSE (FLARE TYPE)

Thread size (PF)	Width across flat (mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130.2
1"	41	21	151.9
1-1/4"	50	35	253.2

3) PIPE AND HOSE (ORFS TYPE)

Thread size (UNF)	Width across flat (mm)	kgf · m	lbf · ft
9/16-18	19	4	28.9
11/16-16	22	5	36.2
13/16-16	27	9.5	68.7
1-3/16-12	36	18	130.2
1-7/16-12	41	21	151.9
1-11/16-12	50	35	253.2

4) FITTING

Thread size	Width across flat (mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130.2
1"	41	21	151.9
1-1/4"	50	35	253.2

1. REMOVAL AND INSTALL

1) REMOVAL

(1) Lower the work equipment to the ground and stop the engine.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

(4) Loosen the drain plug under the hydraulic tank and drain the oil from the hydraulic tank.

· Hydraulic tank quantity : 275 ℓ

(5) Remove socket bolts (3, 4) and disconnect block with hoses (1, 2).

(6) Disconnect pilot line hoses (6, 7, 8, 9, 10).

(7) Remove socket bolts (6) and disconnect pump suction tube (5).

※ When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.

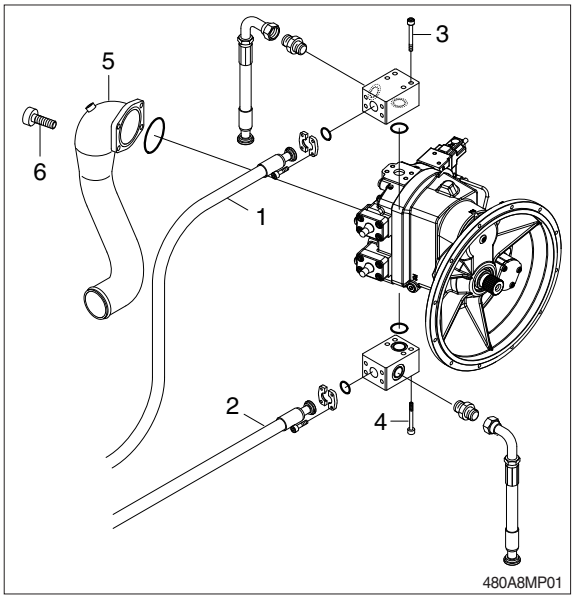
(8) Sling the pump assembly and remove the pump mounting bolts (15).

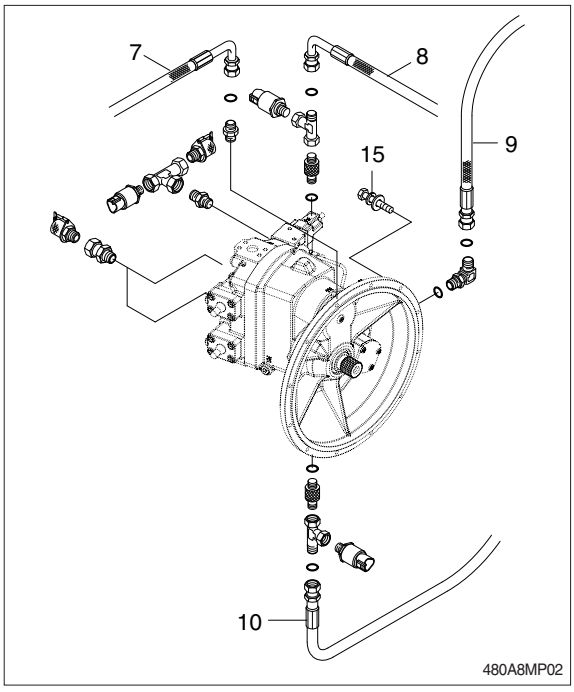
· Weight : 194 kg (428 lb)

· Tightening torque : 6.7±1.0 kgf · m (48.5±7.2 lbf · ft)

※ Pull out the pump assembly from housing. When removing the pump assembly, check that all the hoses have been disconnected.







2) INSTALL

(1) Carry out installation in the reverse order to removal.

(2) Remove the suction strainer and clean it.

(3) Replace return filter with new one.

(4) Remove breather and clean it.

(5) After adding oil to the hydraulic tank to the specified level.

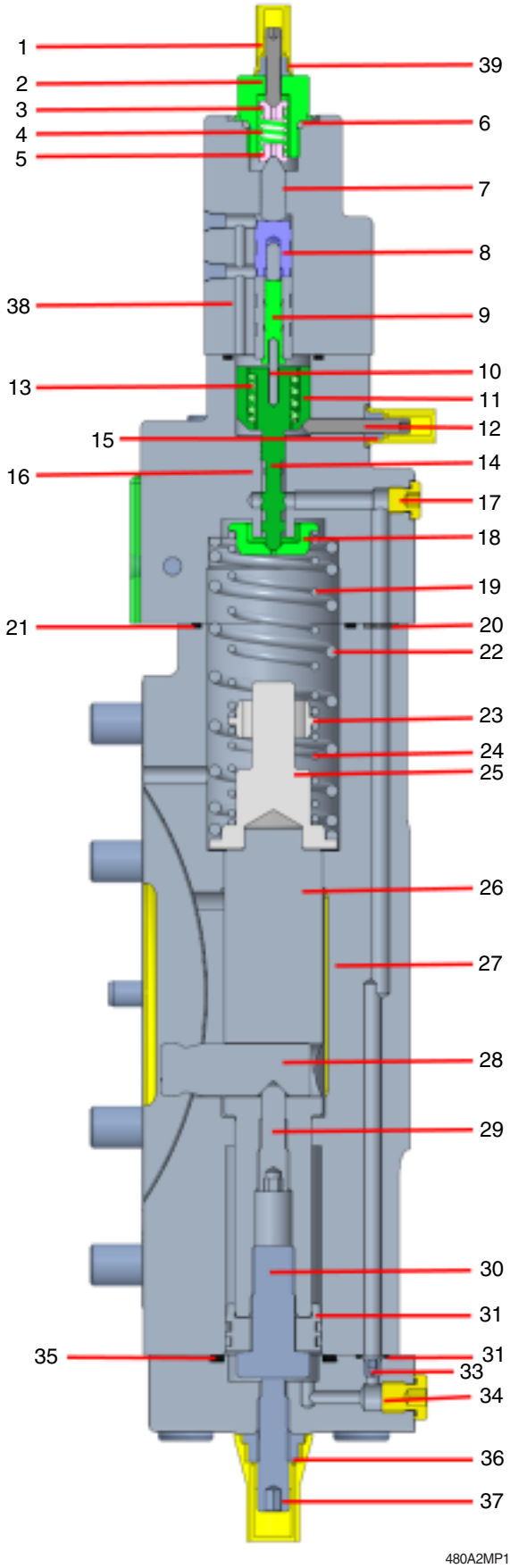
(6) Bleed the air from the hydraulic pump.
① Remove the air vent plug (2EA).
② Tighten plug lightly.
③ Start the engine, run at low idling, and check oil come out from plug.
④ Tighten plug.

(7) Start the engine, run at low idling (3~5 minutes) to circulate the oil through the system.

(8) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. REPAIR GUIDELINES

1) PART LIST (1/3)

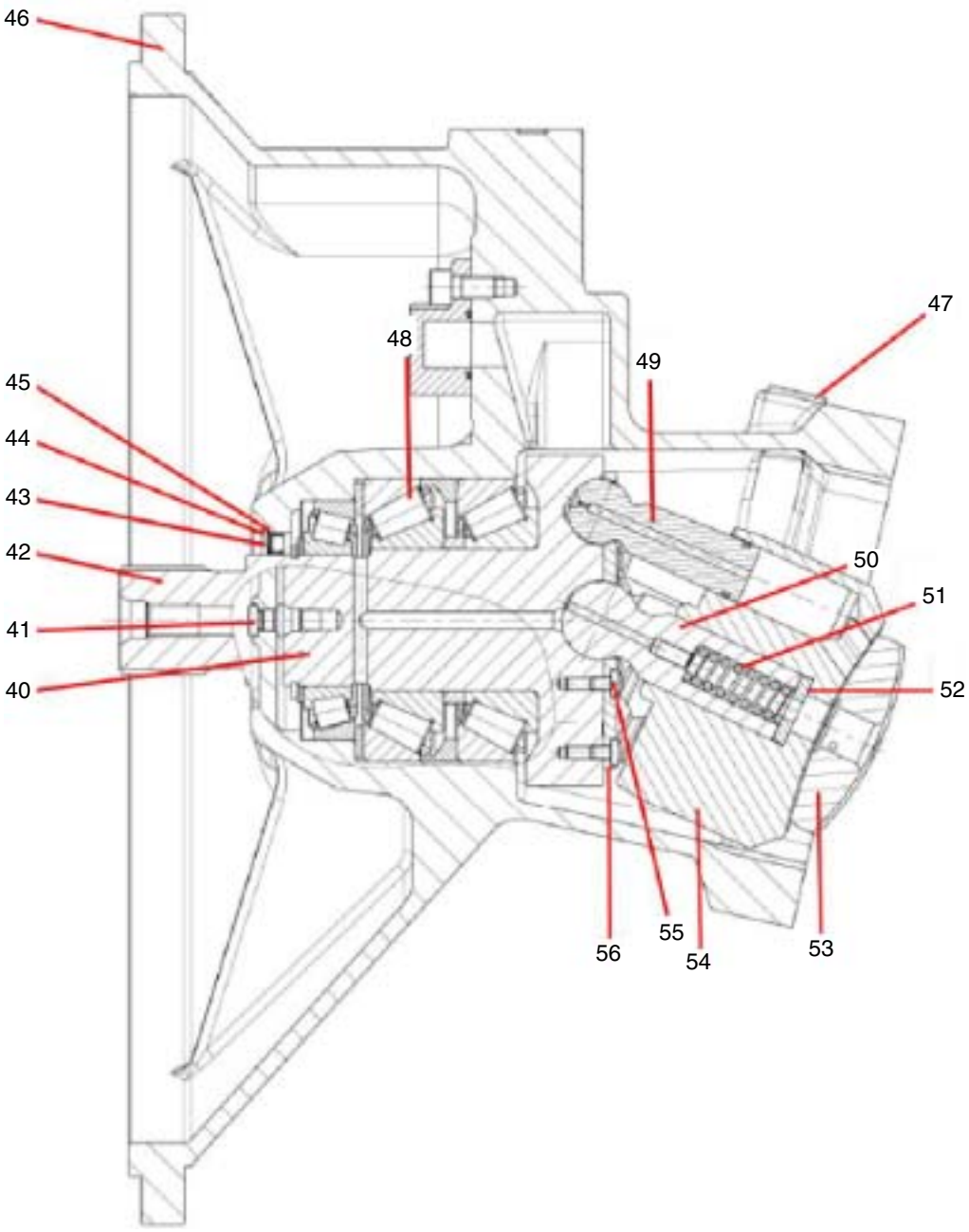


480A2MP10

1	Setting screw
2	Screw plug
3	Spring cup
4	Spring
5	Spring cup
6	O-ring
7	HNC control piston
8	Control bushing
9	LLC control piston
10	Pin
11	Spring bushing
12	Adjustment screw
13	Setting screw
14	Control piston for stroking
15	Sealing screw
16	HNC controller housing
17	Sealing screw
18	Spring cup
19	Spring
20	O-ring
21	O-ring
22	Spring
23	Double spring collar
24	Spring
25	Spring collar
26	Stroke piston
27	Port plate
28	Setting pin
29	Locating screws
30	Bolt
31	Piston with steal rings
32	O-ring
33	Orifice
34	Sealing screw
35	O-ring
36	Sealing screw
37	Setting screw
38	Stroke controller housing
39	Sealing screw

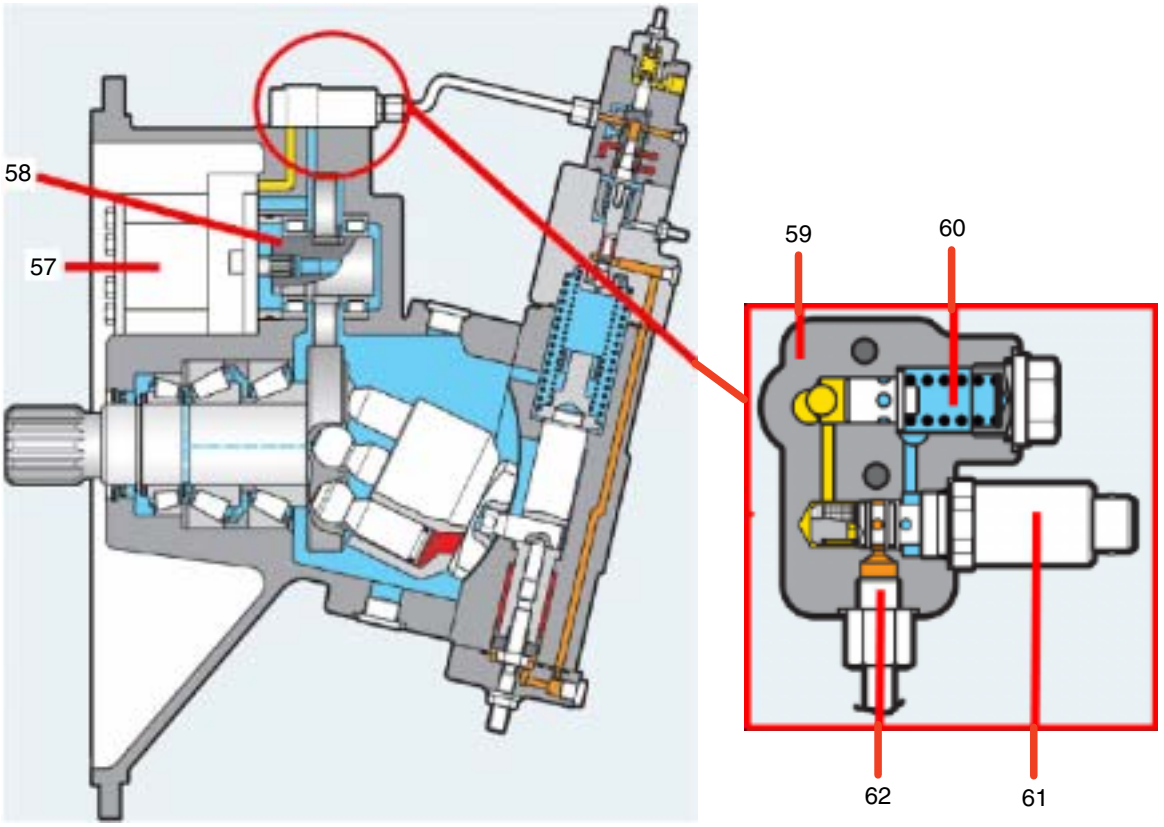
※ HNC : Hydraulic Negative Control
※ LCC : Load Limiting Control

PART LIST (2/3)



40	Rotary group	46	Pump housing	52	Shim
41	Sealing screw	47	Sealing screw	53	Control lense
42	Rotary group	48	Bearings	54	Cylinder
43	Snap ring	49	Piston with steal rings	55	Bolt
44	Shim	50	Center pin	56	Retreat plate
45	Shaft seal ring	51	Spring		

PART LIST (3/3)



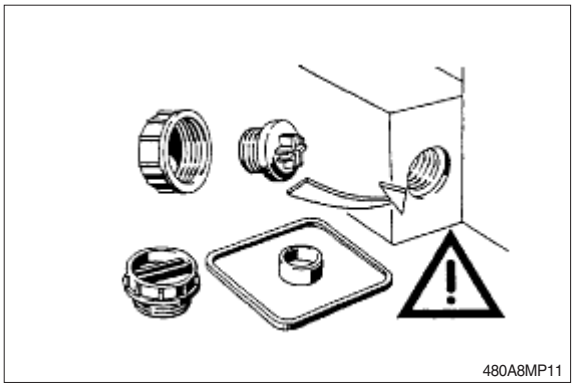
480A2MP12

57	Gear pump	59	Valve plate	61	EPPR valve
58	Gear wheel	60	Pressure relieve valve	62	Hydraulic pipe

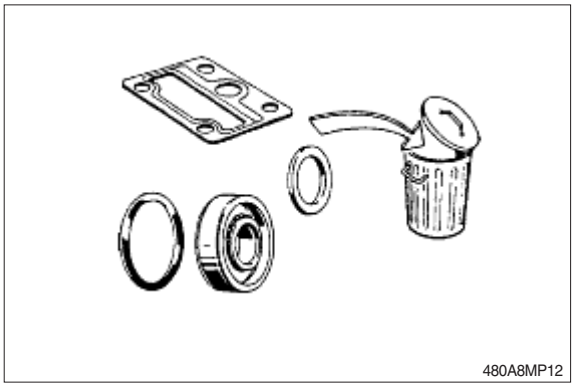
2) GENERAL REPAIR GUIDELINES

※ Observe the following notices when carrying out repairs on hydraulic pumps.

(1) Close off all openings of the hydraulic unit.

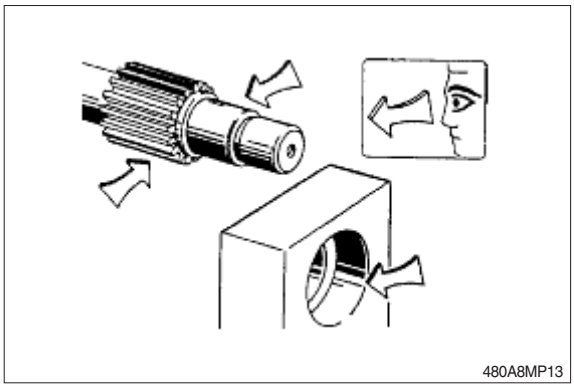

480A8MP11

(2) Replace all of the seals.
Use only HYUNDAI spare parts.

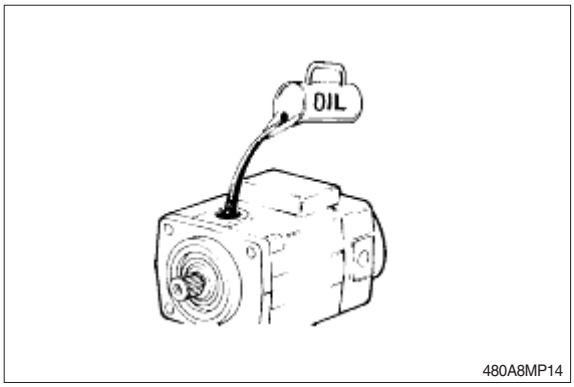

480A8MP12

(3) Check all sealing and sliding surfaces for wear.

※ Re-work of the sliding surfaces by using, for example with abrasive paper, can damage the surface.


480A8MP13

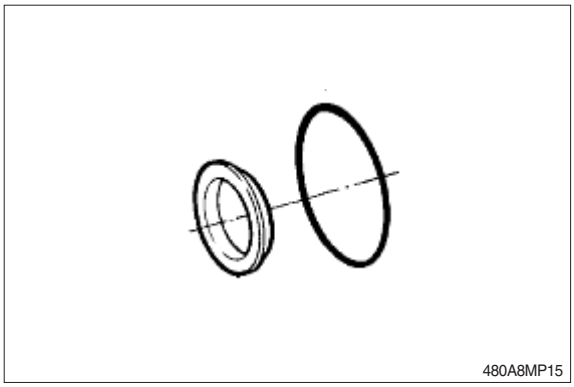
(4) Fill the hydraulic unit with hydraulic oil before commissioning.



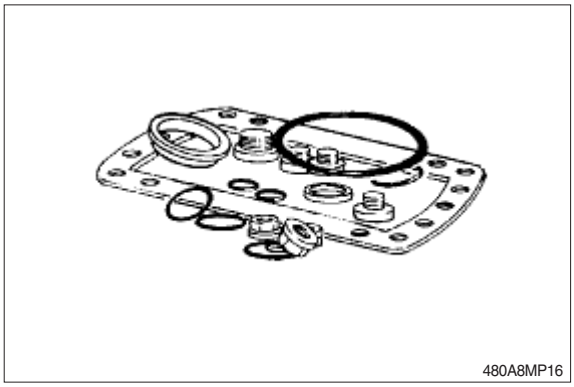
480A8MP14

3) SEAL KITS AND SUB ASSEMBLIES

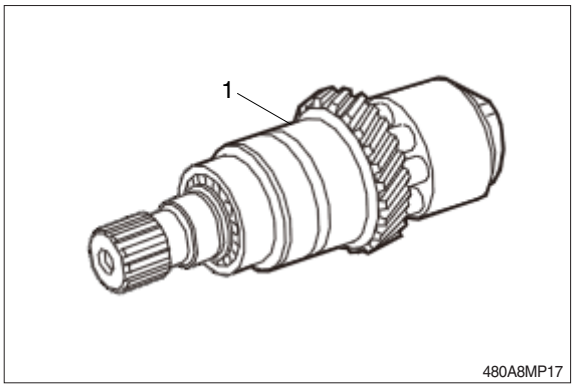
(1) Seal kit for drive shaft.



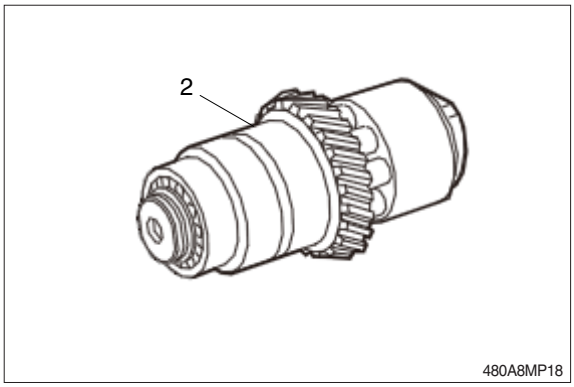
(2) Peripheral seal kit.



(3) Rotary group (1) ready to install.

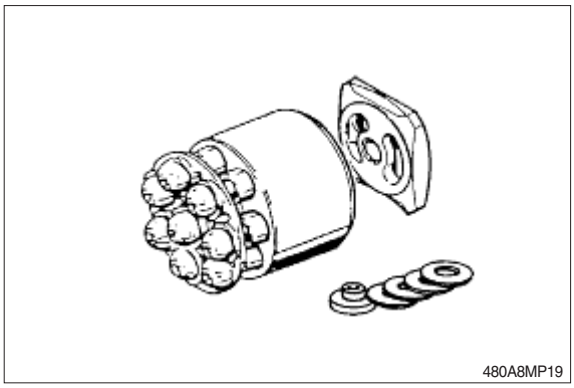


(4) Rotary group (2) ready to install.



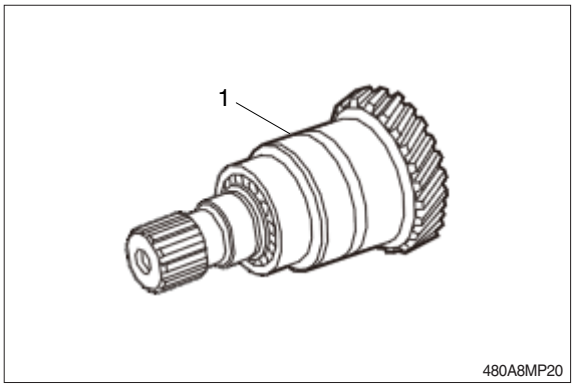
(5) Rotary group, hydraulic component (order rotary groups (1) and (2) separately). Adjustment is necessary.

※ Direction of rotation



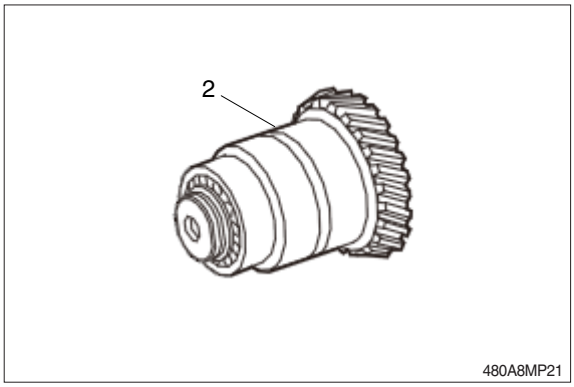
480A8MP19

(6) Rotary group (1) mechanical section, ready to install.



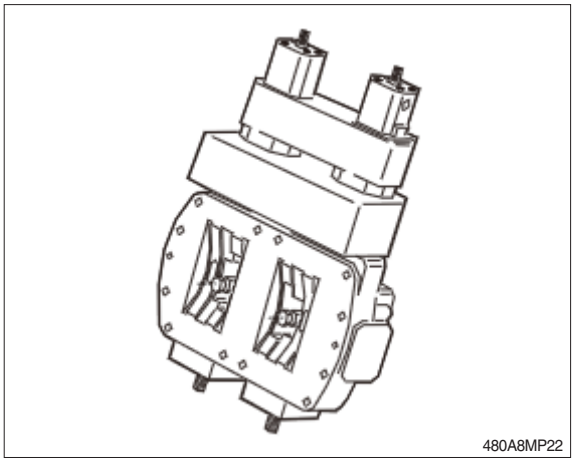
480A8MP20

(7) Rotary group (2) mechanical section, ready to install.



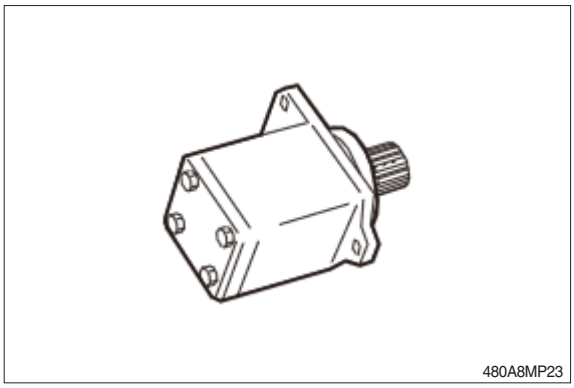
480A8MP21

(8) Control, pre-adjusted.

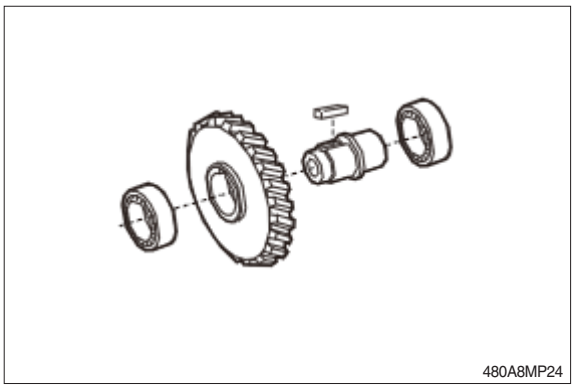


480A8MP22

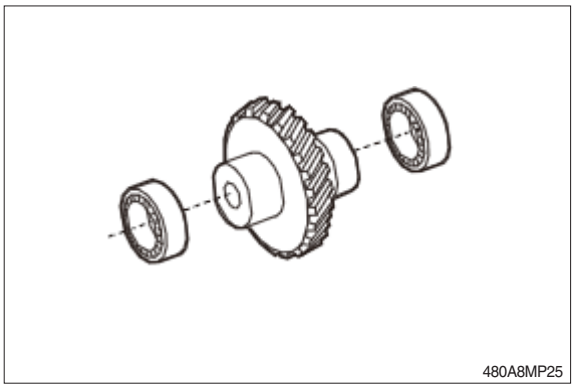
(9) Gear pump, complete.



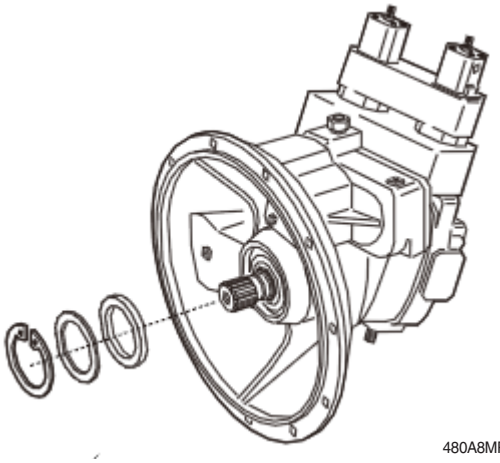
(10) Intermediate gear



(11) Auxiliary drive

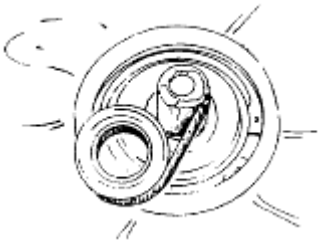


4) SEALING THE DRIVE SHAFT



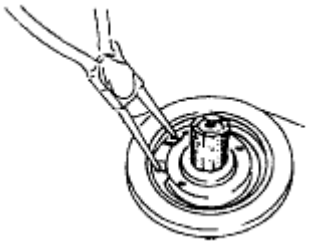
480A8MP26

(1) Protect drive shaft. (e.g. tape).



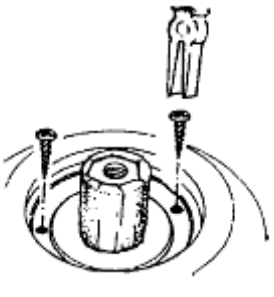
480A8MP27

(2) Remove retaining ring and shim.



480A8MP28

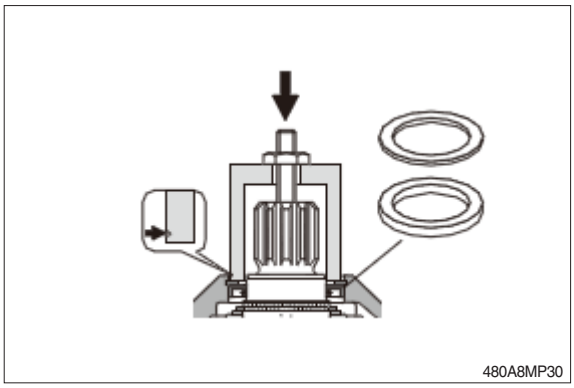
(3) Screw in sheet metal screw into the holes fitted with rubber.
Pull out seal with pliers.



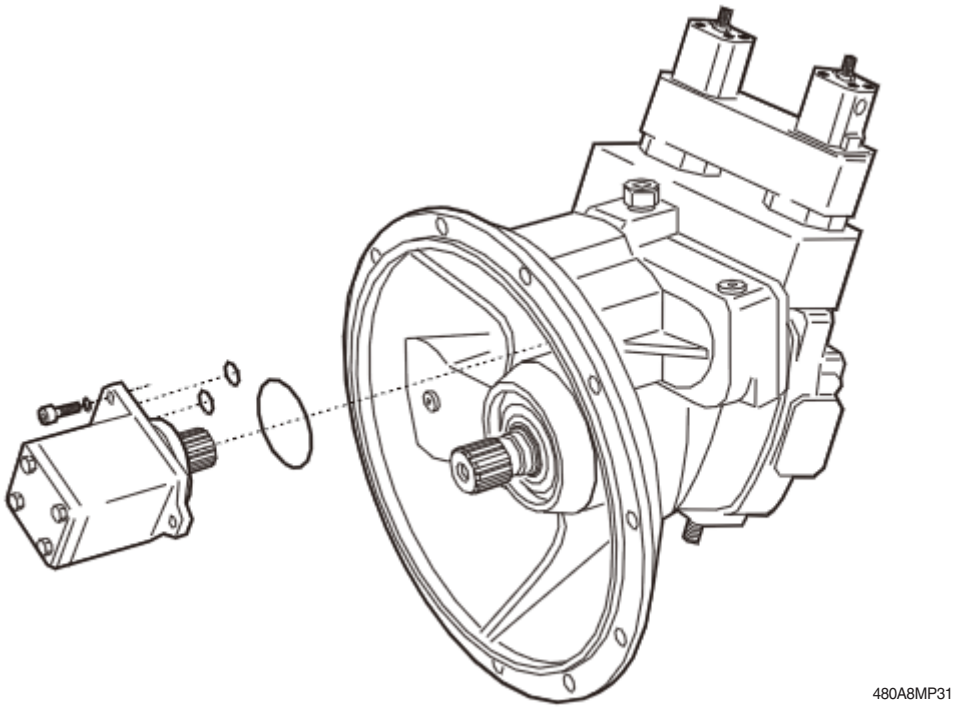
480A8MP29

(4) Press in shaft seal ring and shim with bush to stop.
Take note of press-in depth.

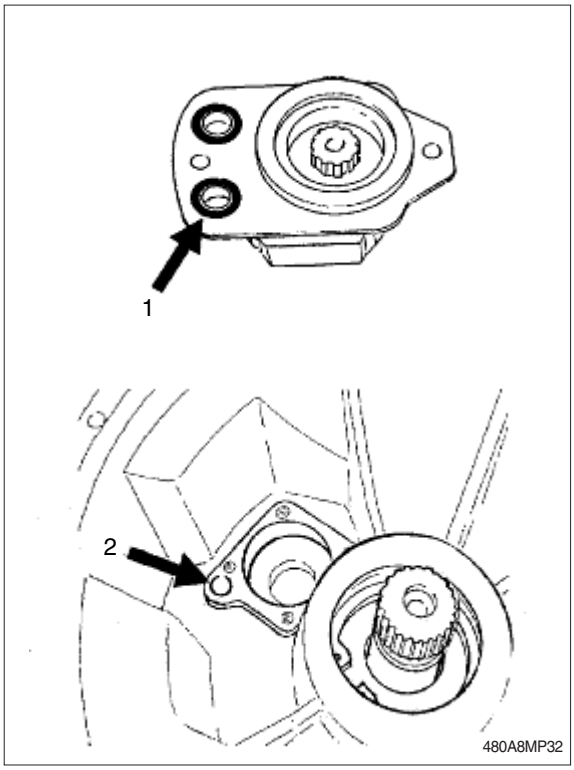
※ Install mark for press-in depth of safety ring.



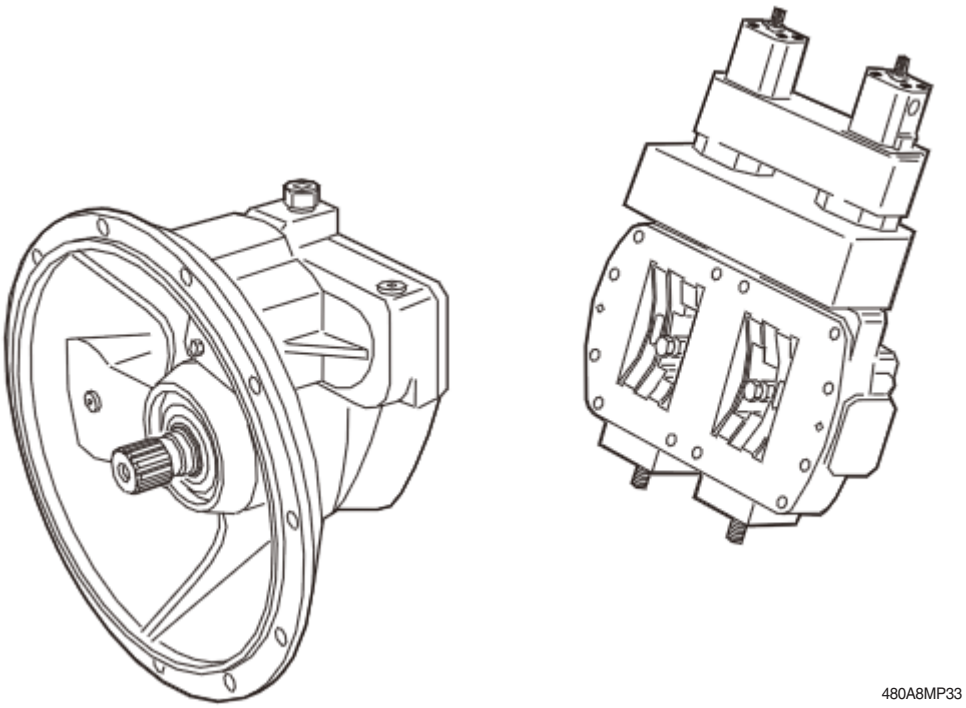
5) GEAR PUMP SEALING



(1) Remove gear pump.
Visual check:
1 O-ring
2 Sealing surface of the housing.

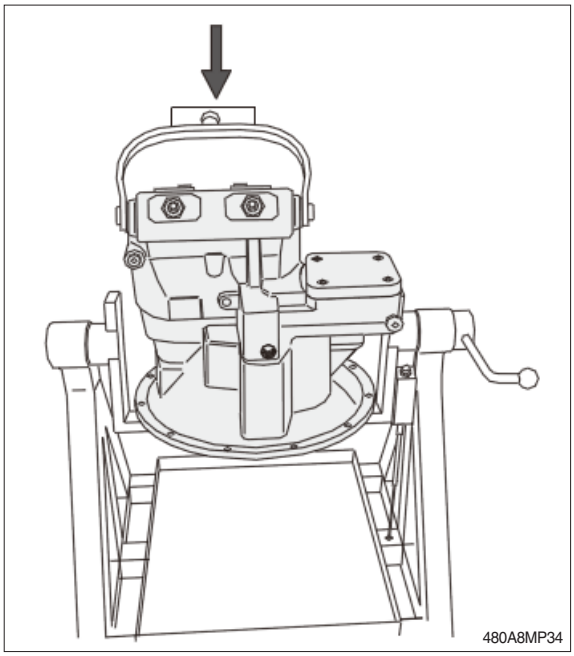


6) REMOVE THE CONTROL HOUSING



480A8MP33

(1) Place the pump into a disassembly/ assembly device with a crane and fix it.

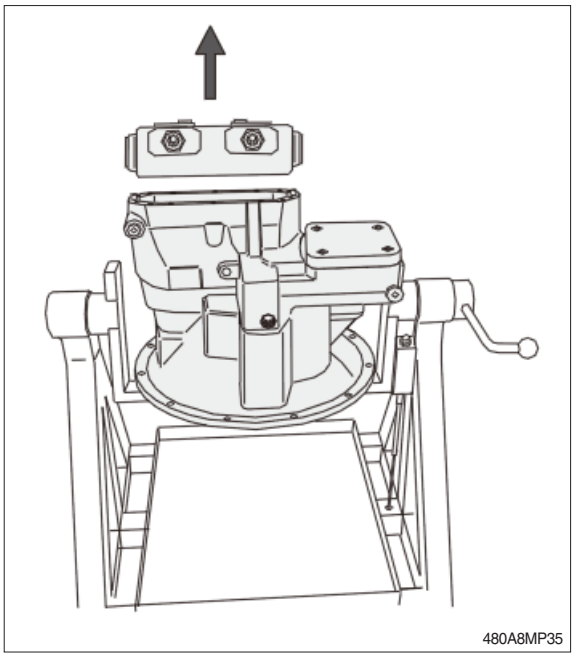


480A8MP34

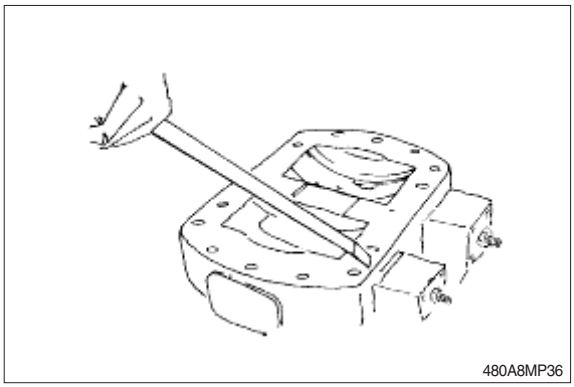
※ Mark installation position.

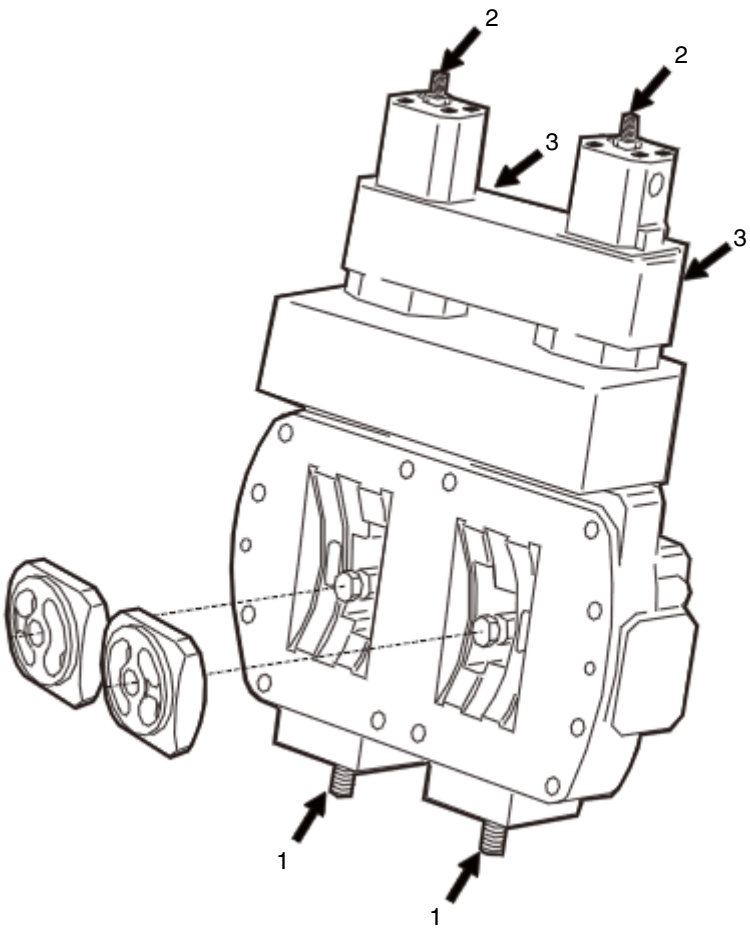
(2) Loosen fixing screws of port plate and remove the port plate.
Lift the port plate away with a crane.

※ Control lenses can fall down.


480A8MP35

(3) Remove paper seal, clean sealing surface.

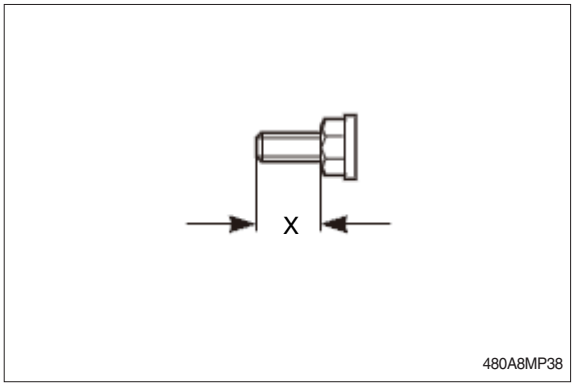

480A8MP36



480A8MP37

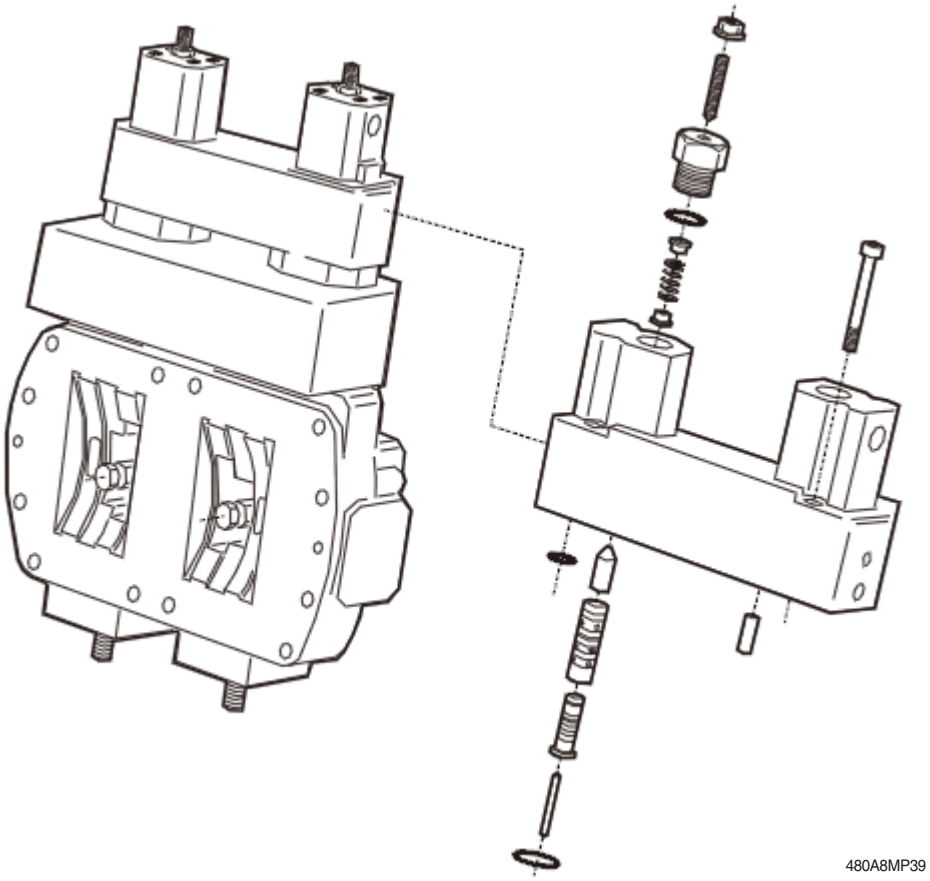
Item 1 ⇒ setting screw Qmax
Item 2 ⇒ setting screw Hydraulic stroke limitation
Item 3 ⇒ setting screw Power characteristic (begin of regulation)

※ Before carrying out a setting or disassembly of the regulator, measure the measurement (X) and note of the setting screw.

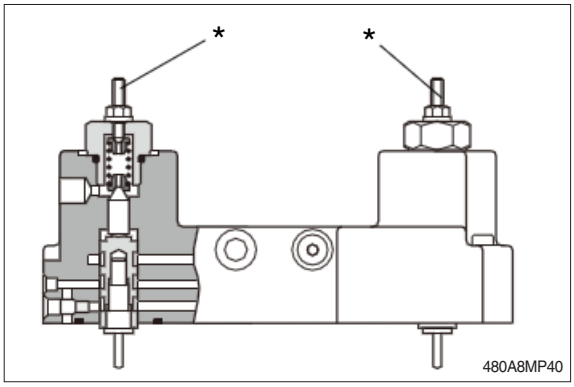


480A8MP38

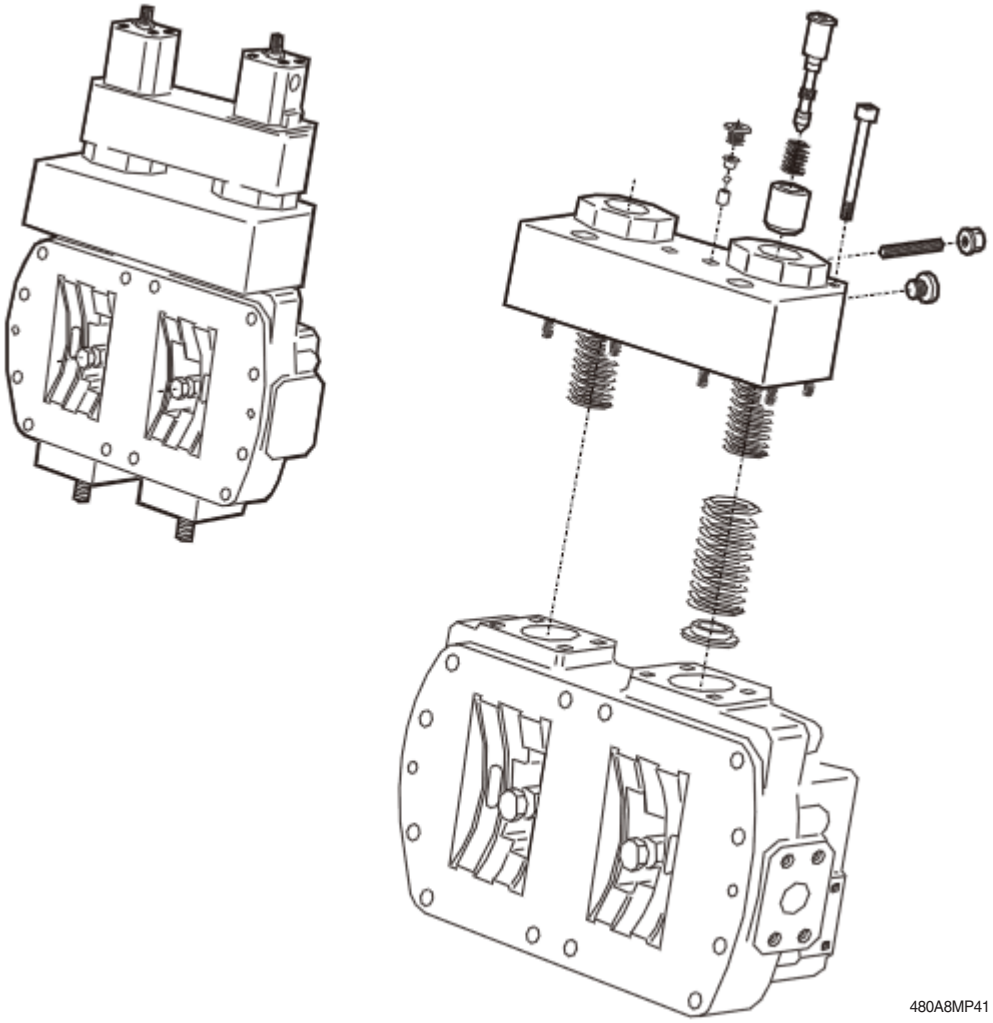
7) CONTROL MODULE LR



* Remove and disassemble control module LR.

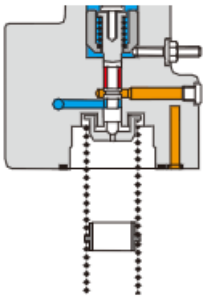


8) CONTROL MODULE H



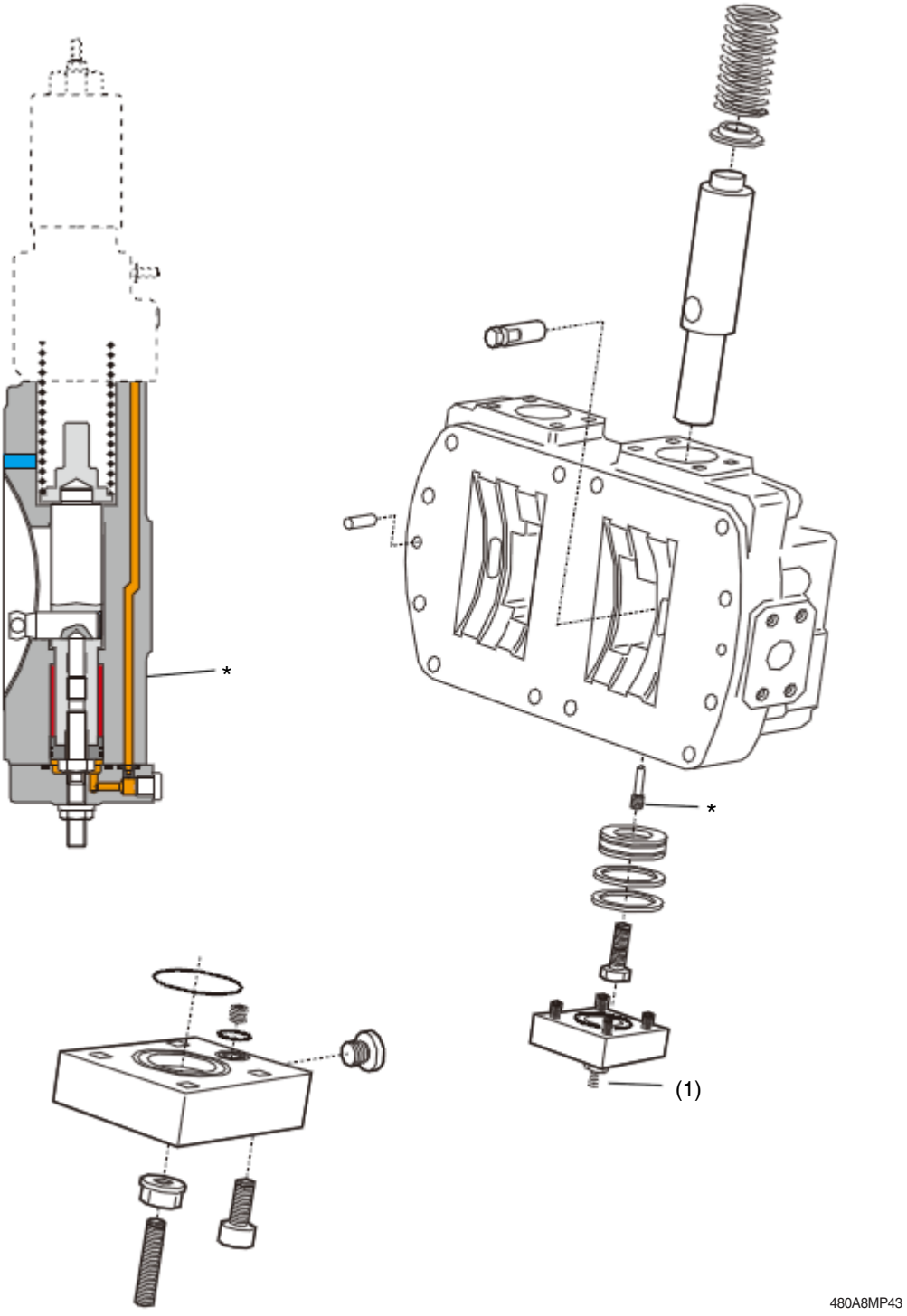
480A8MP41

※ Remove and disassemble control module H.



480A8MP42

9) REMOVING THE CONTROLLER

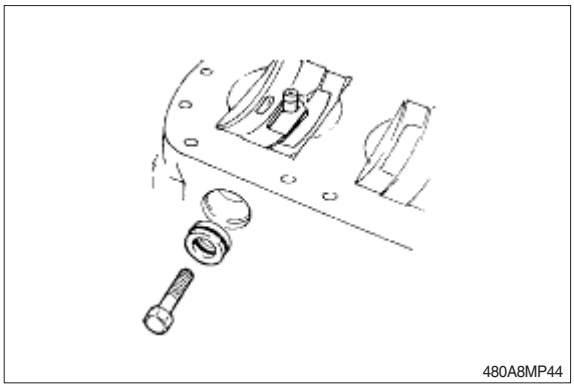


(1) Remove cover.

※ Do not change the setting screw (1).

(2) Loosen fixing screws.

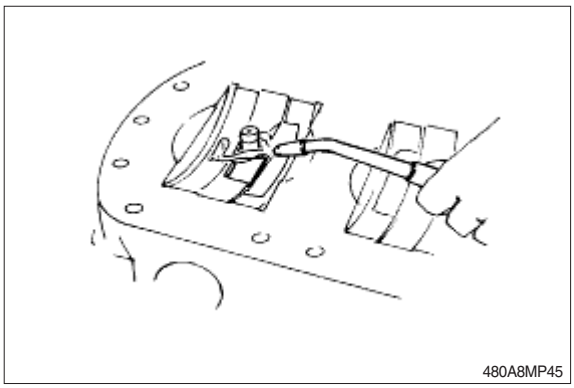
※ Fit control lens - torque support.



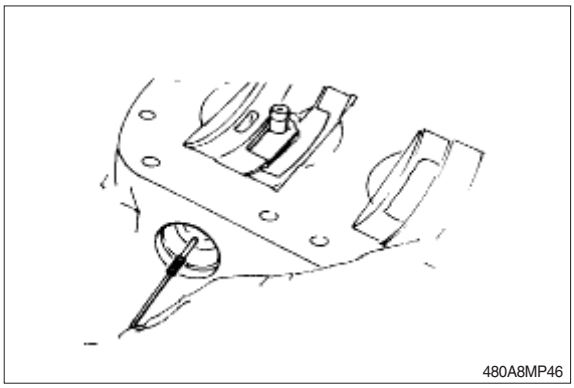
480A8MP44

(3) Remove locking screw and replace with a new locking screw.

※ Loosen adhesive with a "gentle" flame (approx. 120℃).

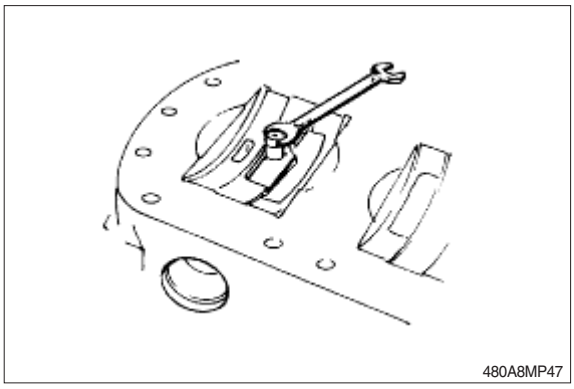


480A8MP45



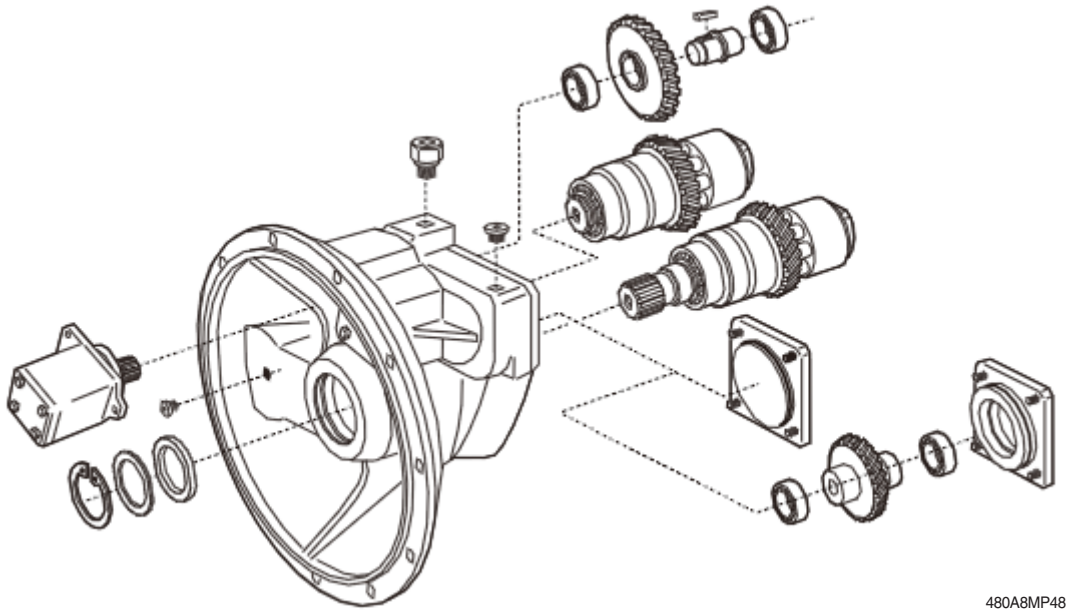
480A8MP46

(4) Loosen swivel pin and then remove it



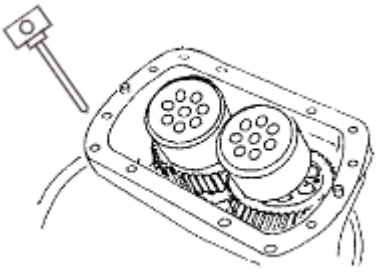
480A8MP47

10) REMOVE THE ROTARY GROUPS



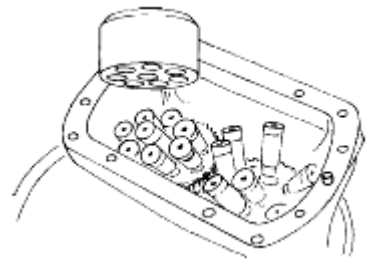
480A8MP48

(1) Keep the cylinder with a device (remove it completely with the drive shaft).



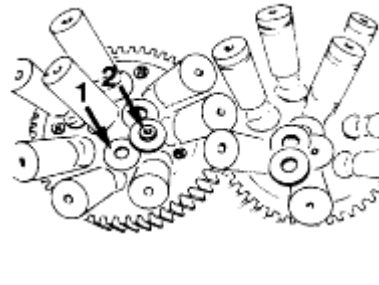
480A8MP49

(2) Remove cylinder (take out the drive shaft without cylinder).



480A8MP50

(3) Remove spring cup (1) and spring cup (2).



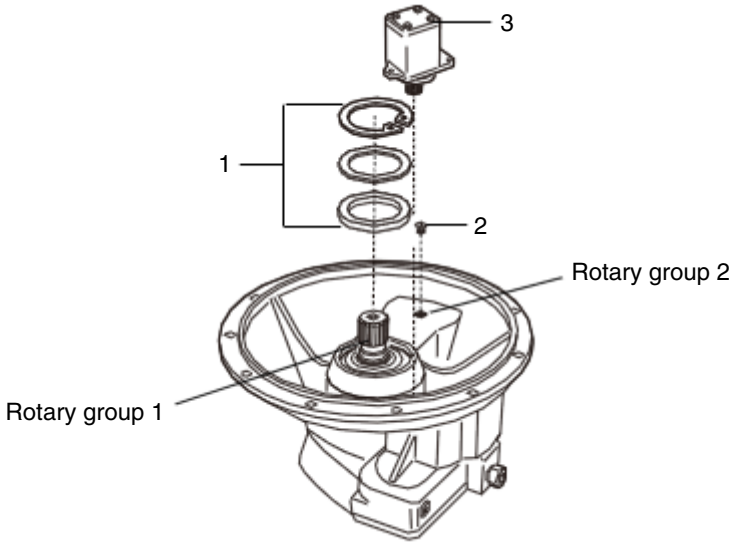
480A8MP51

(4) New disassembly position

Pos.1 Remove

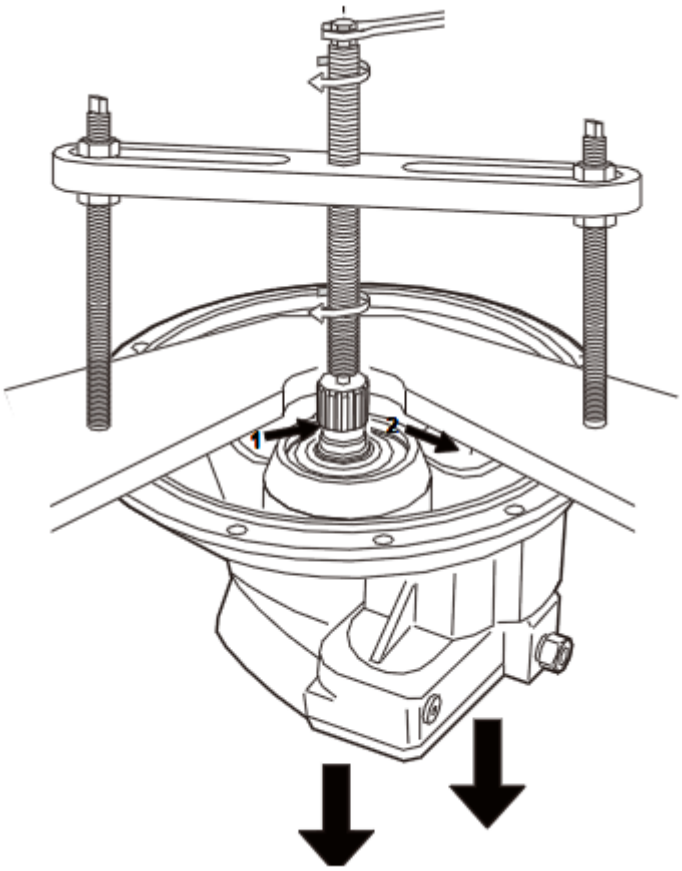
Pos.2 Remove

Pos.3 Remove

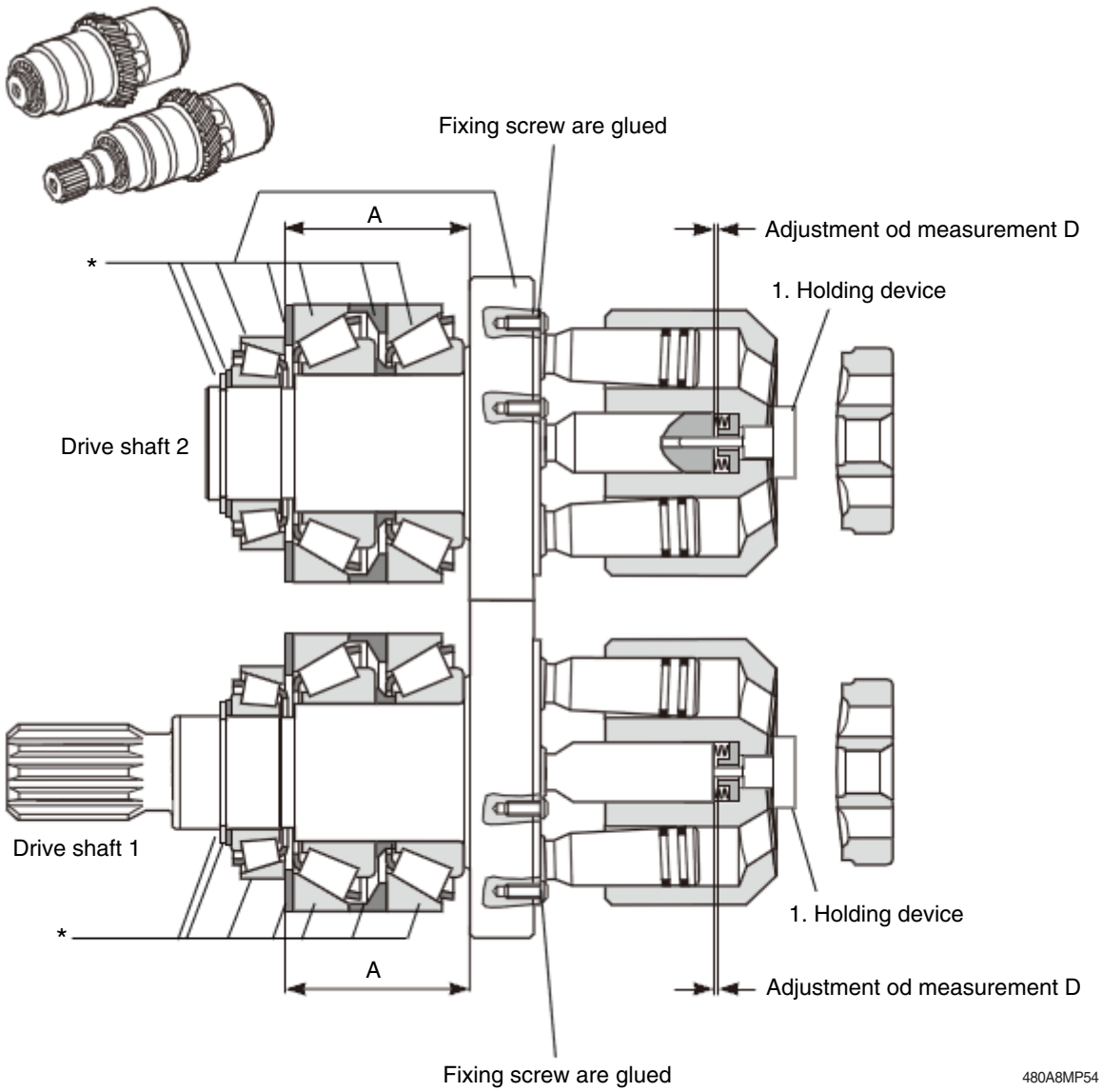


480A8MP52

(5) Press out hydraulically or mechanically rotary group with a tool device.



480A8MP53



※ Pos. * Drive shafts with bearing set are the smallest assembly group.

(1) The assembly group is adjusted to measurement (A)
The tapered roller bearings are adjusted to the specified through-torque.

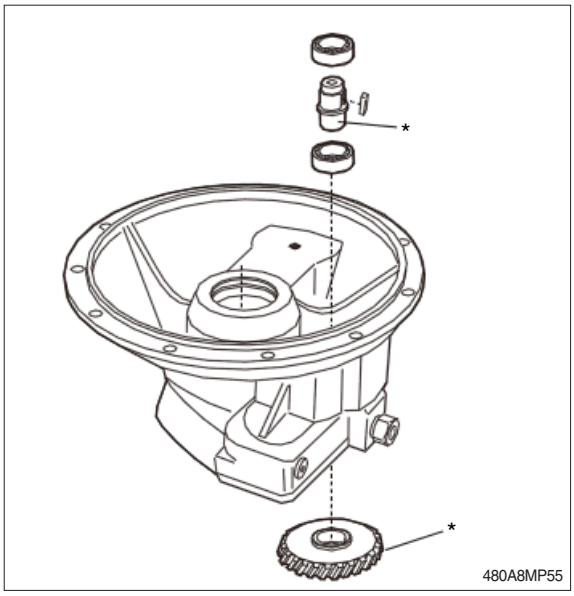
※ Fixing screw - Retaining device

(2) Loosen of the screws is only possible if the drive shaft is warmed up at a temperature of approx. 120℃,1/2 hour in an oil bath or heat air furnace.
Screw out the screw quickly.

12) REMOVE THE INTERMEDIATE WHEEL

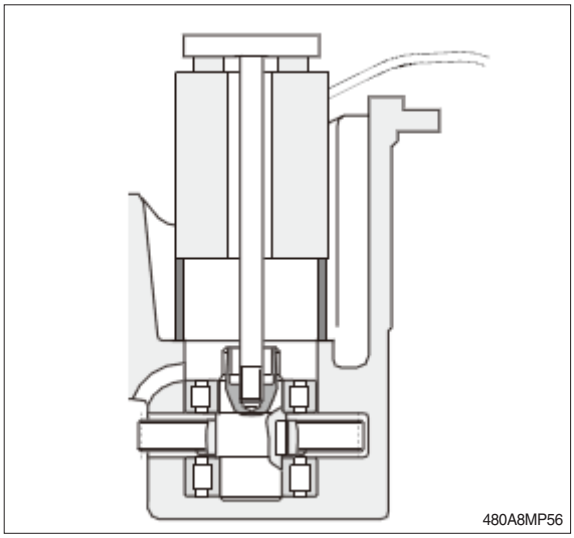
* Press in bolt into the gear wheel.
  (Fixed pressing fit).

(1) Can only be disassembled with a hydraulic press.

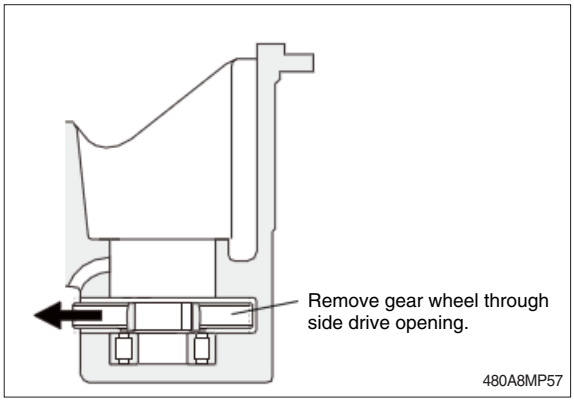


(2) Install sleeve.

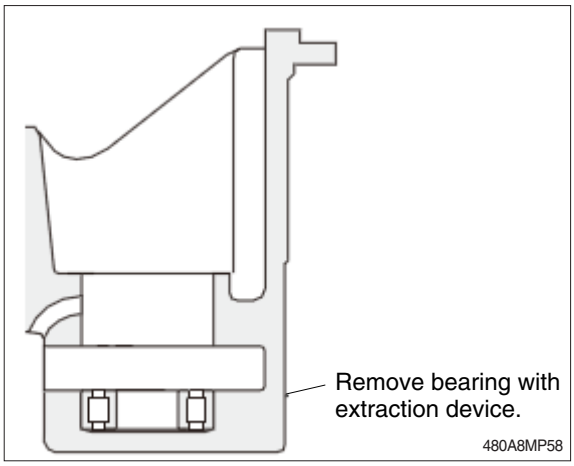
⚠ Press out bolt with a hydraulic manual press.



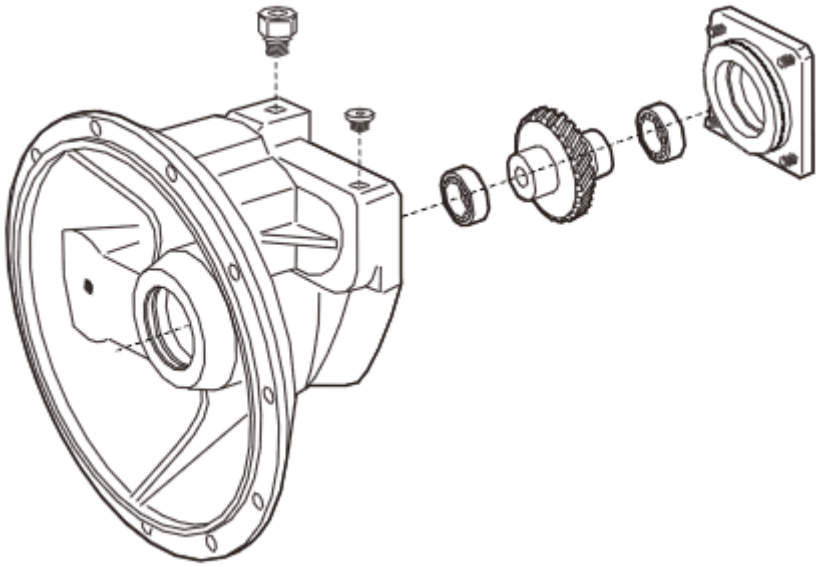
(3) Remove gear wheel through side drive opening.



(4) Remove bearing with extraction device.

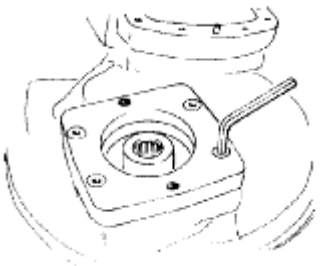


14) REMOVE AUXILIARY DRIVE



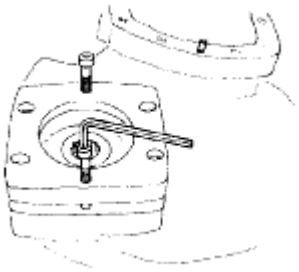
480A8MP59

(1) Remove fixing screws - auxiliary drive.



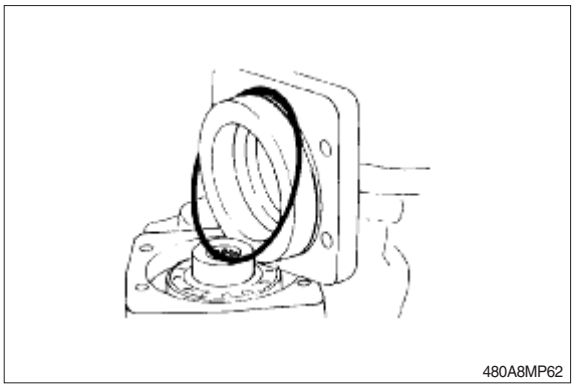
480A8MP60

(2) Press off bearing cap.

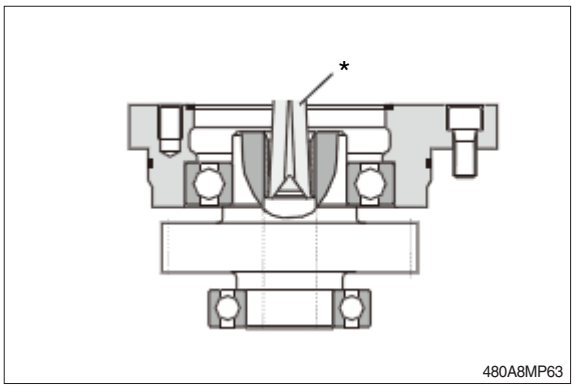


480A8MP61

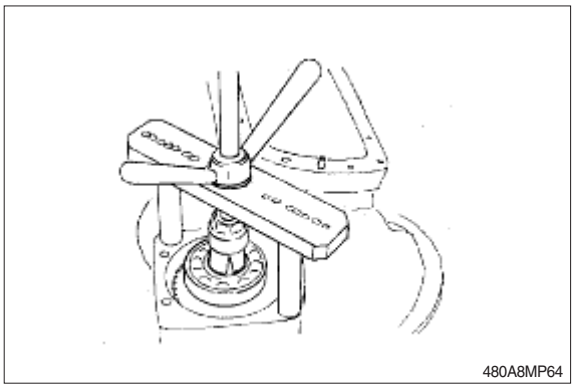
(3) In the event of leakage, visual check of O-ring, housing and groove.


480A8MP62

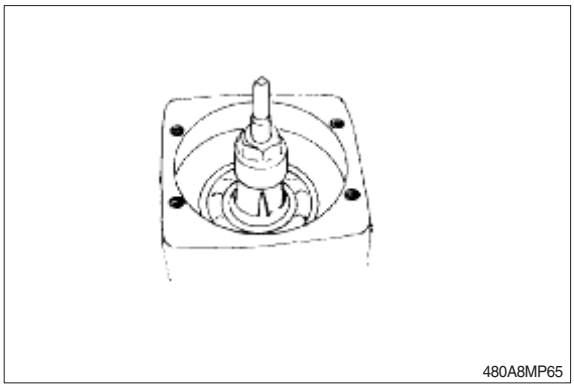
(4) Fit extractor device (*).
Pull out output pinion.



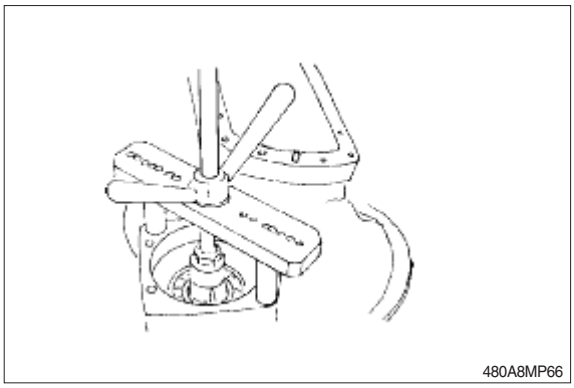
480A8MP63


480A8MP64

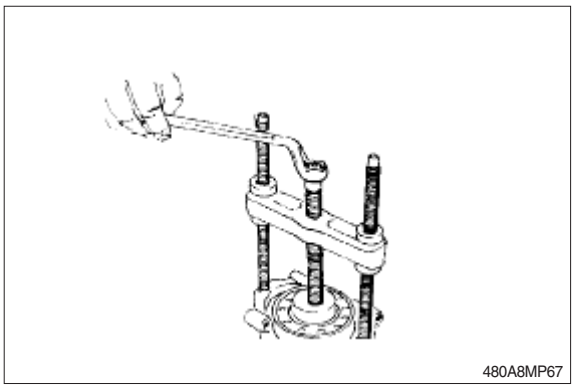
(5) Fit bearing extractor device.


480A8MP65

(6) Completely mount device and pull out bearing.

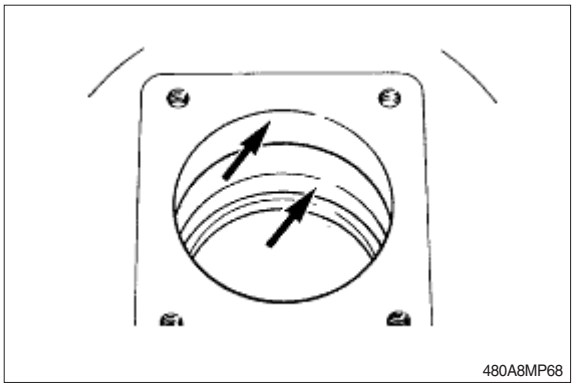


(7) Pull out pinion bearing.

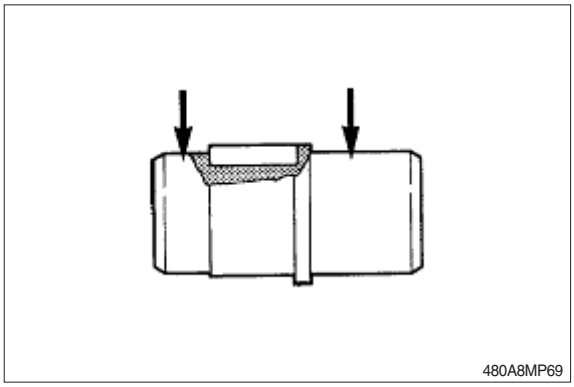


15) INSPECTION HINTS

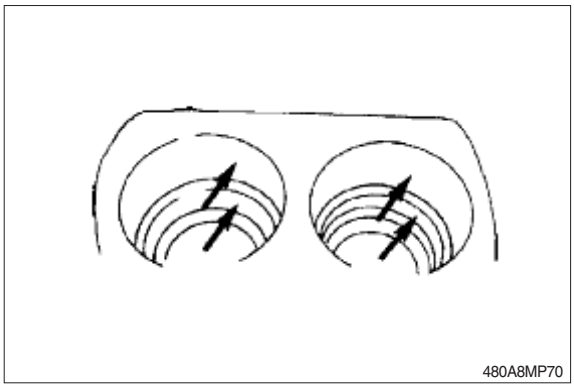
(1) Check to see that the bearing area is free of scores and that there is no evidence of wear.



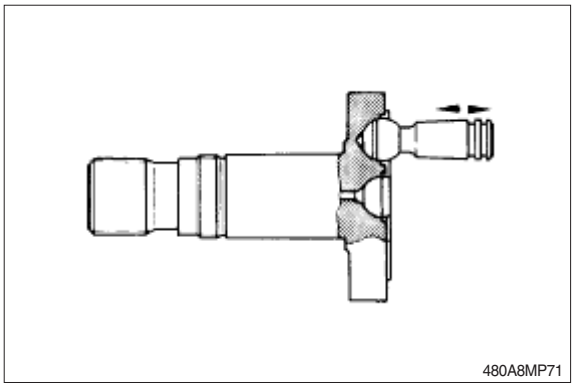
(2) Visual check
To ensure that the bearing seats are free of scores.



(3) Visual check
Check to see that the bearing area is free of scores and that there is no evidence of wear.



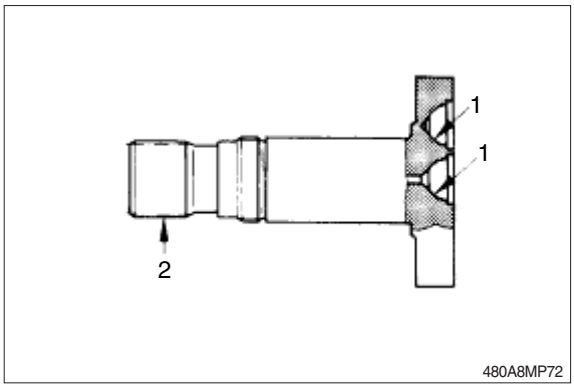
(4) Axial piston play
Checked with the retaining plate fitted.



(5) Drive shafts

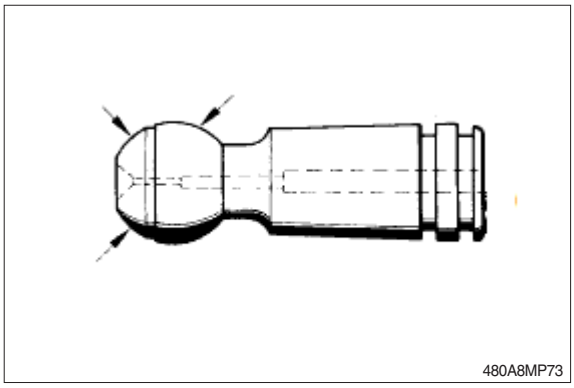
1 Check to ensure that the cups are free of scores and that there are no pittings.

2 Check to see that there is no evidence of corrosion and wear steps.



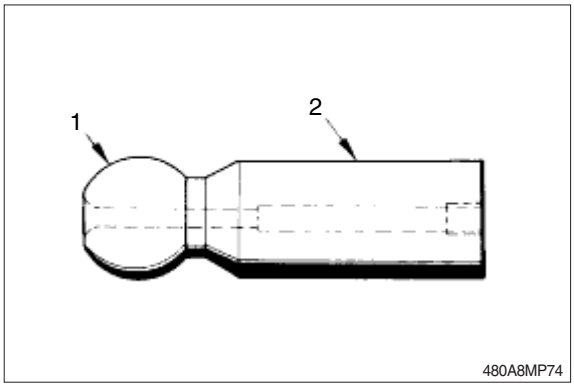
(6) Piston

Check to ensure that they are free of scores and that there are no pittings.



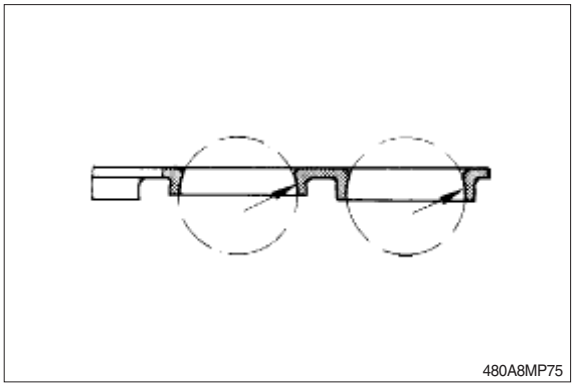
(7) Central pin

Check to ensure that it is free of scores and that there are no pittings.



(8) Retaining plate

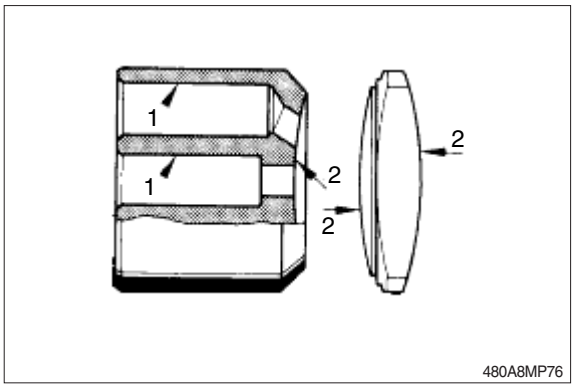
Check to ensure that it is free of scores and that there is no evidence of wear.



(9) Cylinder block / control lens

Check to ensure that :

- The bores (1) are free of scores, no evidence of wear.
- The faces (2) are even, that there are no cracks, no scores.
- The side guides (3) show no evidence of wear, fre of scores.

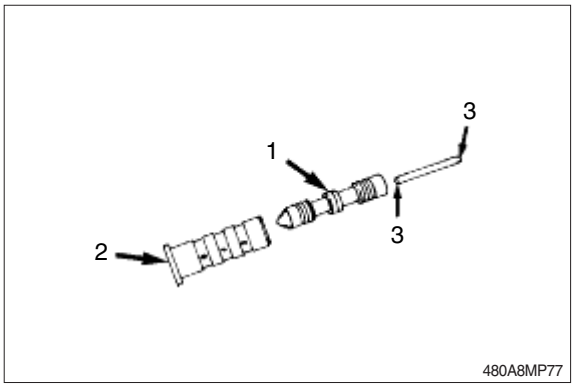


(10) Check

1 Control land

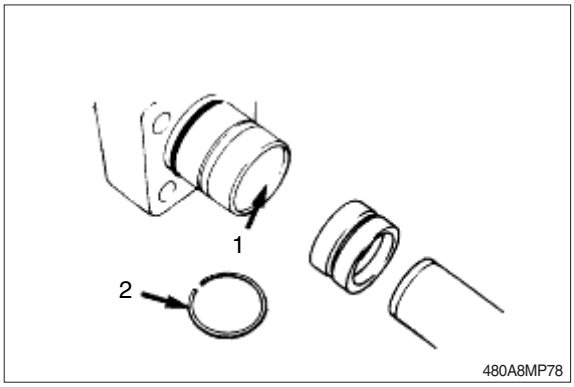
2 Internal control drilling

3 Pin cups



(11) Check

That sliding surfaces (1) are free of scor-es, seal (2).



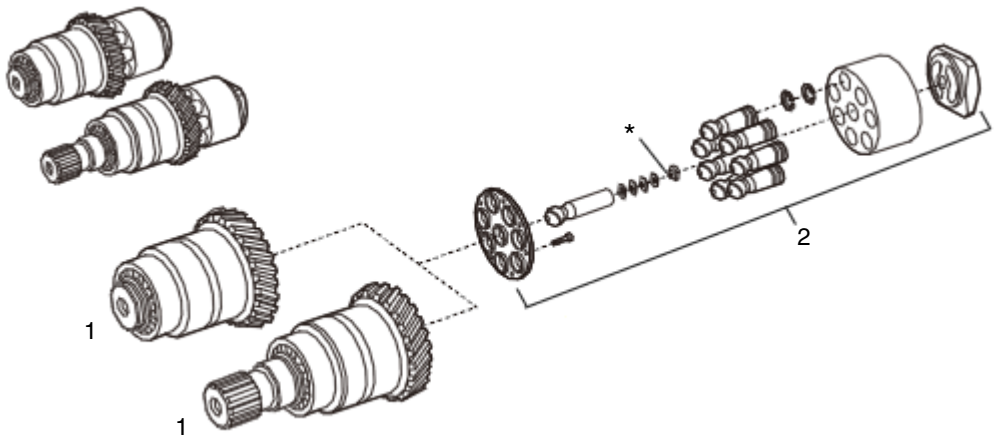
(12) Complete rotary group

※ Adjustment of the hydraulic component is necessary

① Rotary group

1 Mechanical component: drive shaft is adjusted with the bearing

2 Hydraulic component: Adjustment (*) is necessary.

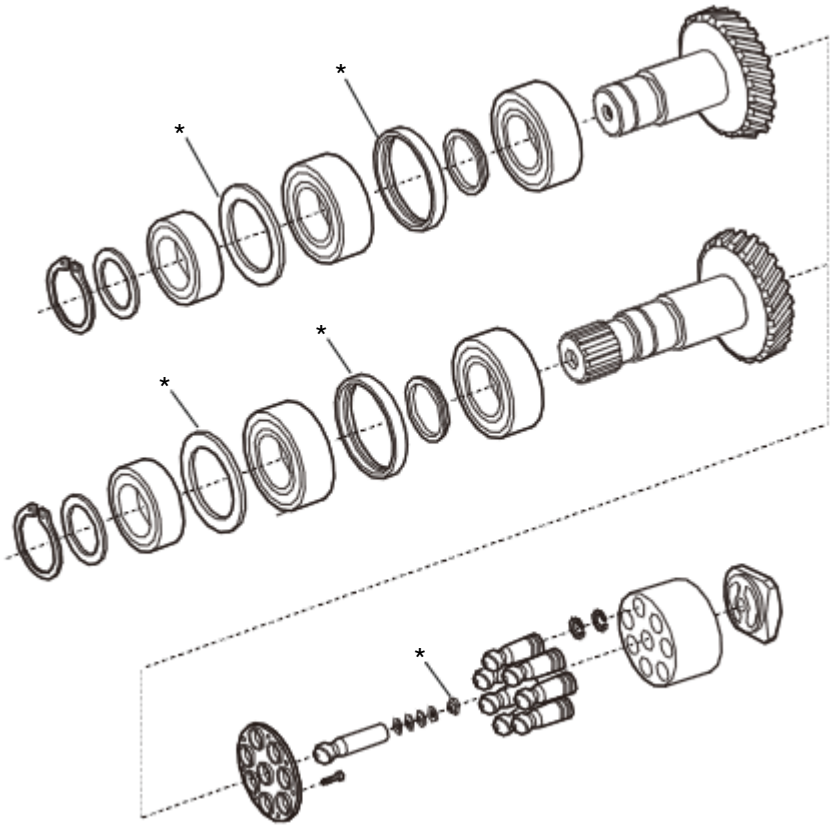


480A8MP79

② Rotary group : All of the components

Adjustment (*)

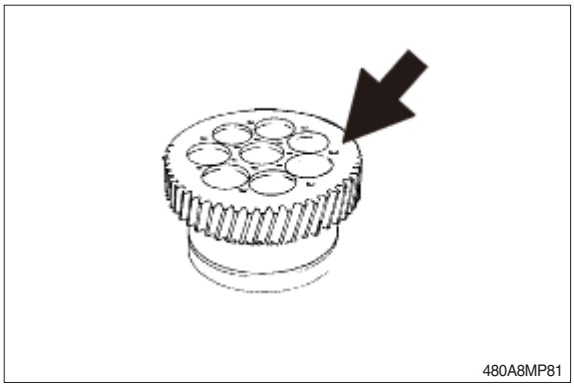
For adjustment values, torque values, see service information



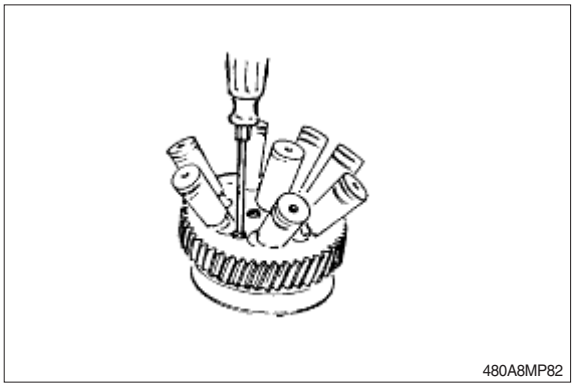
480A8MP80

16) RE-FITTING THE ROTARY GROUP

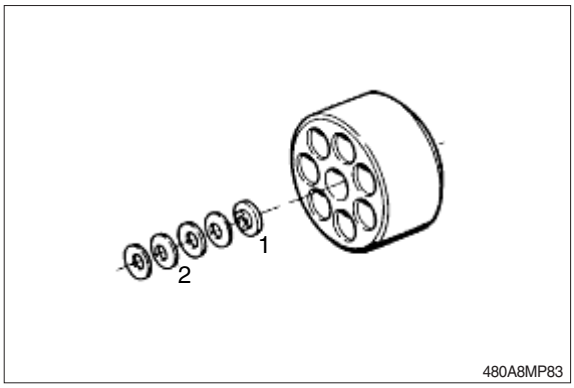
(1) The threads must be free of oil, grease, dust or any other contaminants which may impair the locking of the screws.


480A8MP81

(2) Fit the retaining plate with pistons and centre pin into place.
Use screws that have a Precote coating.
※ For tightening torques, see service information.

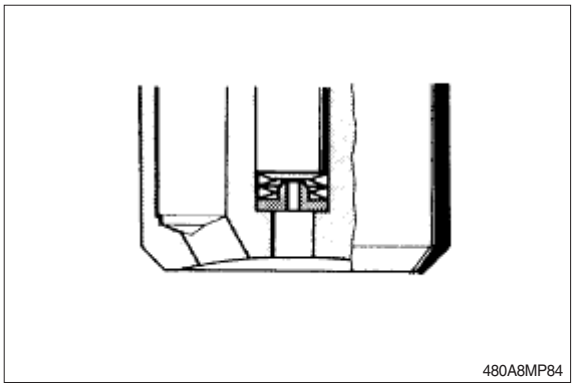

480A8MP82

(3) Fit the spring plate (1) and cup springs (2) into their correct position (and orientation) using grease to hold them into place.

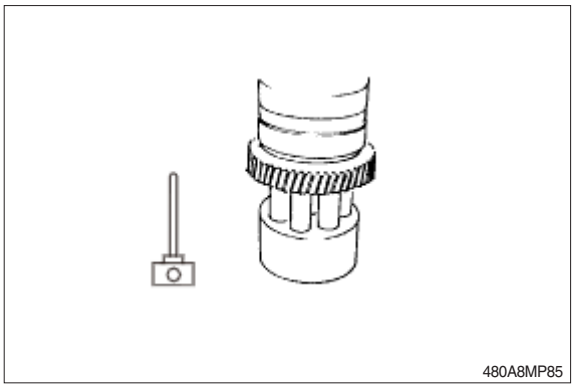


480A8MP83

(4) Ensure that all of te parts are assembled in correct order and orientation.

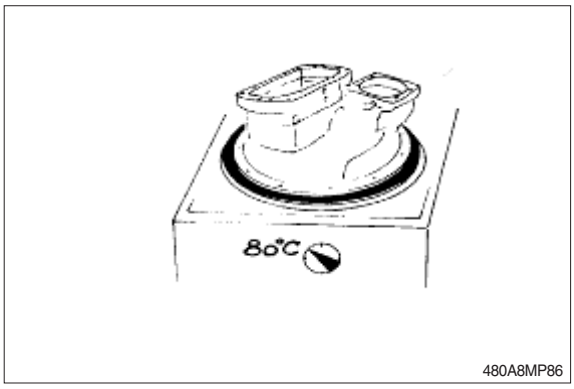

480A8MP84

(5) Insert pistons into the cylinder. Using a soft surface as a support to prevent the sliding surfaces from being damaged. Pre-assemble both of the rotary groups in this manner.



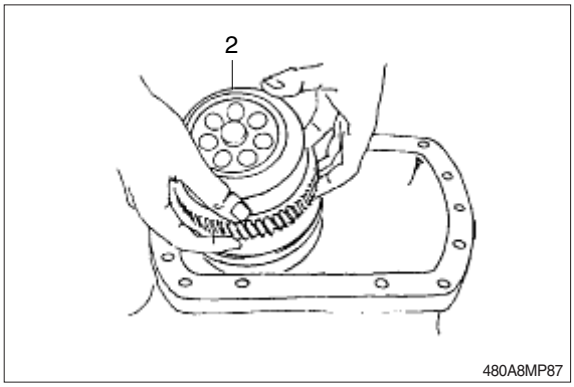
17) PUMP ASSEMBLY

(1) Warm up the housing to approx. 80℃.



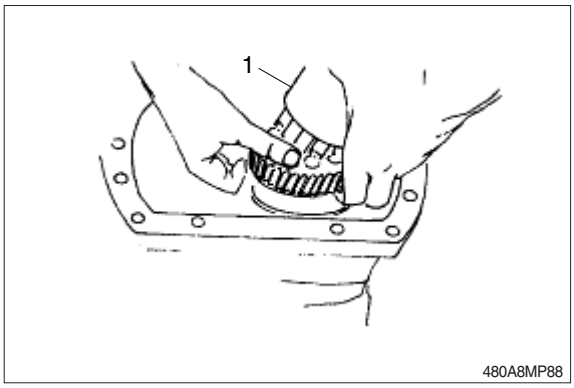
480A8MP86

(2) Insert the pre-assembled rotary group (2) taking into account gear tooth markers.



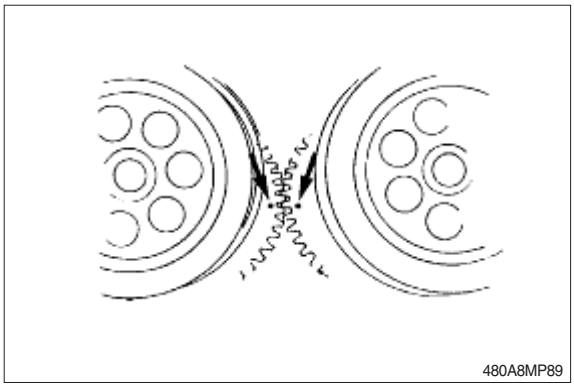
480A8MP87

(3) Insert rotary group (1). Align the marked gear teeth.



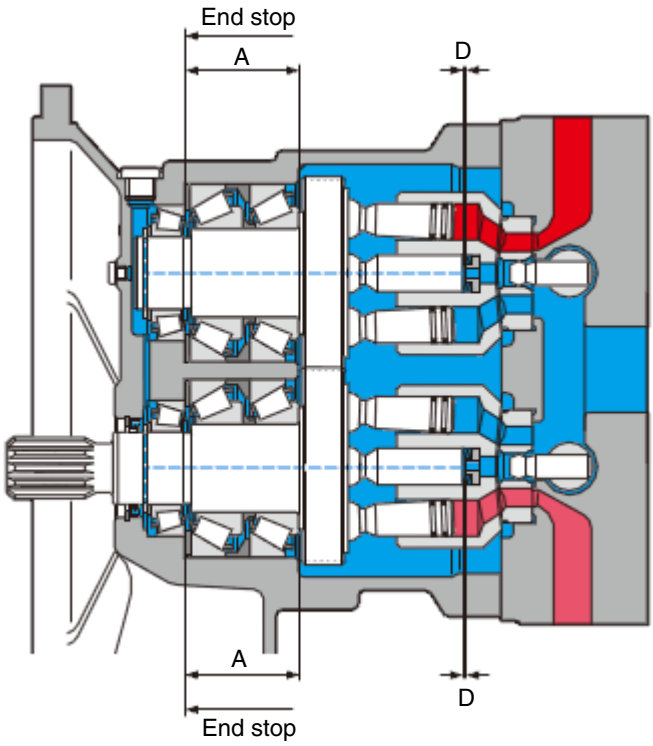
480A8MP88

(4) The gear tooth markers must coincide.


480A8MP89

(5) Adjustment of measurement D

Control hydraulic part.



480A8MP90

※ Drive shafts with bearing set

The assembly group is adjusted to dimension (A). The tapered roller bearings are adjusted to the stipulated breakaway torque.

① Assembly guideline

Retaining force

After the rotary group has been fitted into the housing, it has to be pressed in until the end stop is reached.

Allow the housing to cool down from its assembly temperature (approx.80℃) to room temperature.

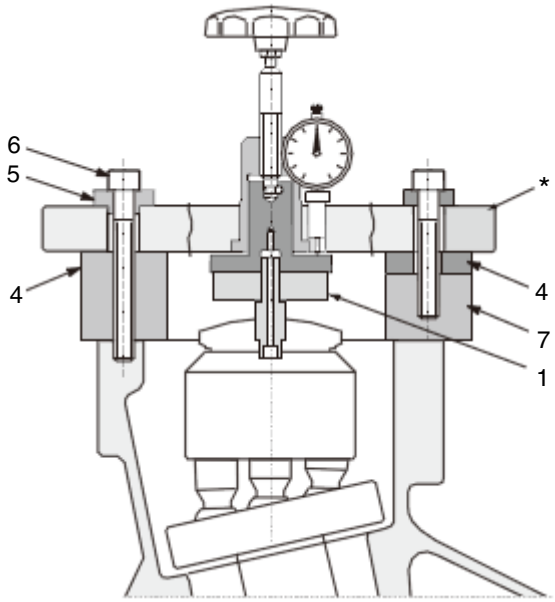
② Adjustment of the hydraulic component of the rotary group

The adjustment of dimension (D) is carried out using spring plates of differing thickness, so that the correct clearance is achieved between the rotary group which is fitted in the housing and the centre pin and spring plates.

Dimension (D) = 0.4 ± 0.1 mm

③ After assembly of the complete unit the breakaway torque of the rotary group has to be checked with the torque wrench.

④ Measuring device

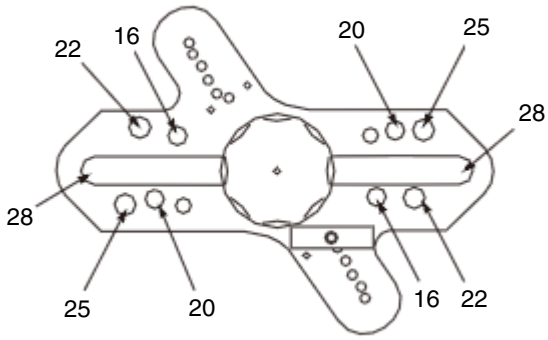


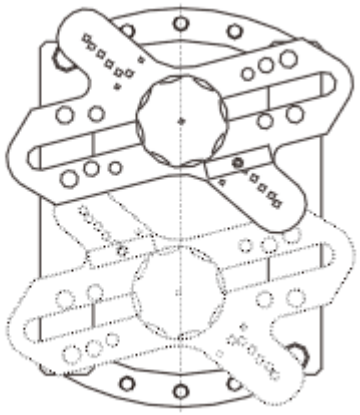
* Measuring device
1 Centering device
4 Intermediate ring
5 Shim
6 Socket screw
7 Intermediate plate

480A8MP91

⑤ Mounting position

Ensure that the correct mounting position is used.
The numbers on the top of the measuring device (∗) refer to the piston diameter.

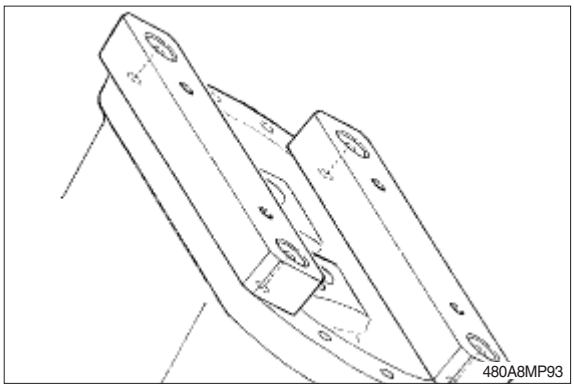




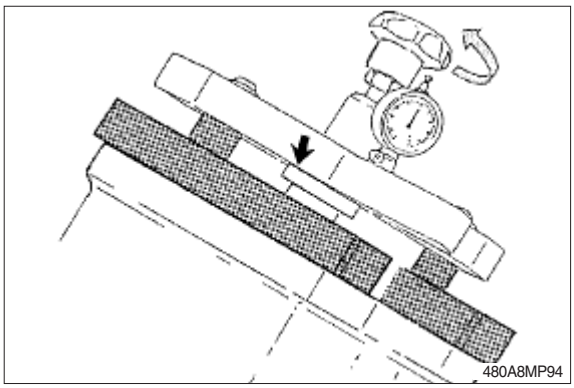
480A8MP92

Mounting position (28)

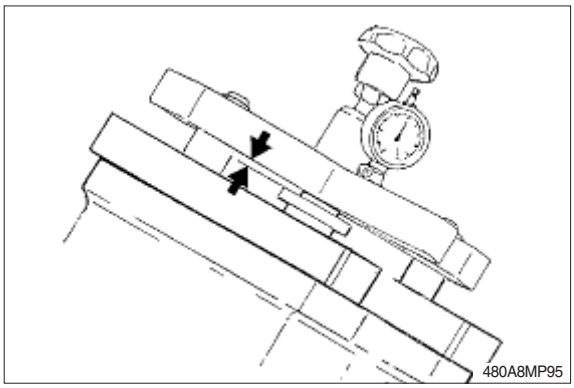
⑥ Fit the intermediate plates onto the housing.



⑦ Zero adjustment - measuring device
Turn using the hand wheel until the stop is reached.
- Set dial gauge to zero

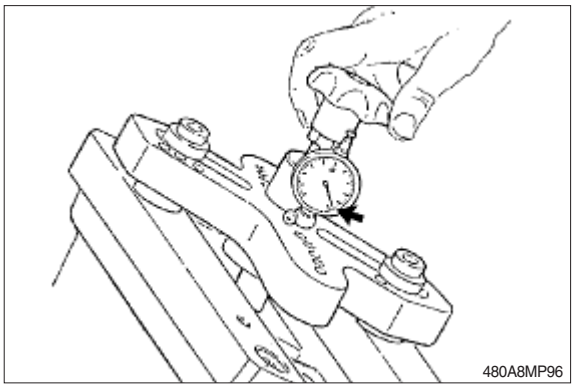


⑧ Measuring procedure
Turn down by 4 turns on the dial gauge.
Check:
2 mm clearance, set dial gauge to "Zero".
Clearance : 0.4 ± 0.1 mm

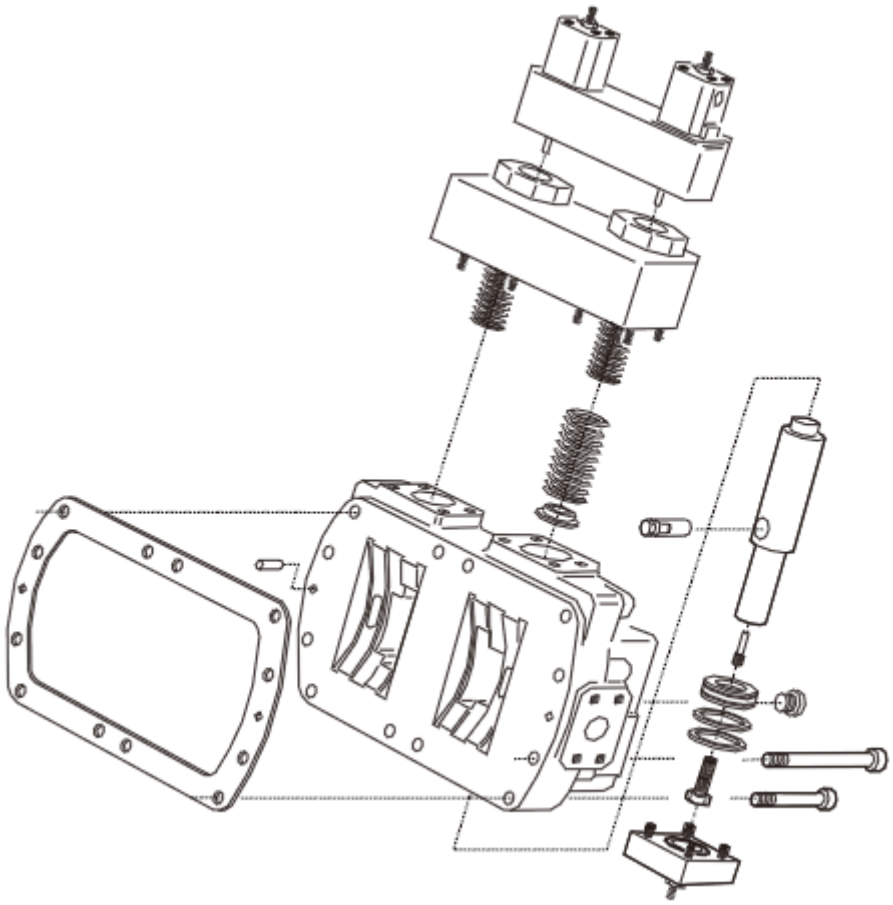


⑨ Measuring procedure
Turn down, using the hand wheel, until resistance is met.
Read the measured value.

※ Don't use excessive force.

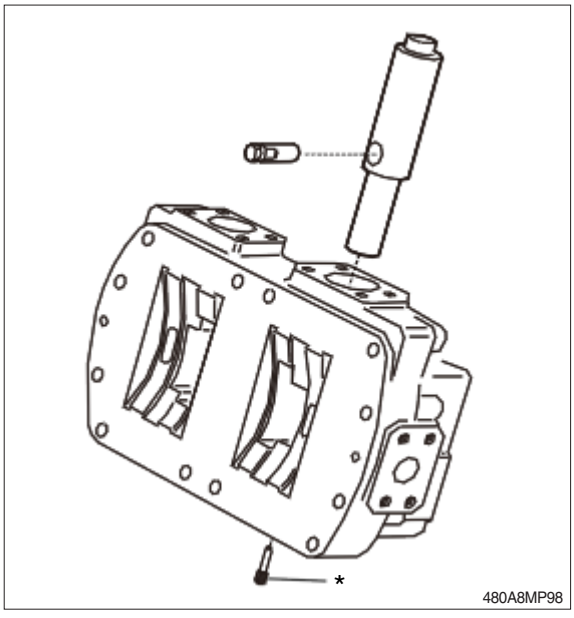


18) FIT CONTROL HOUSING



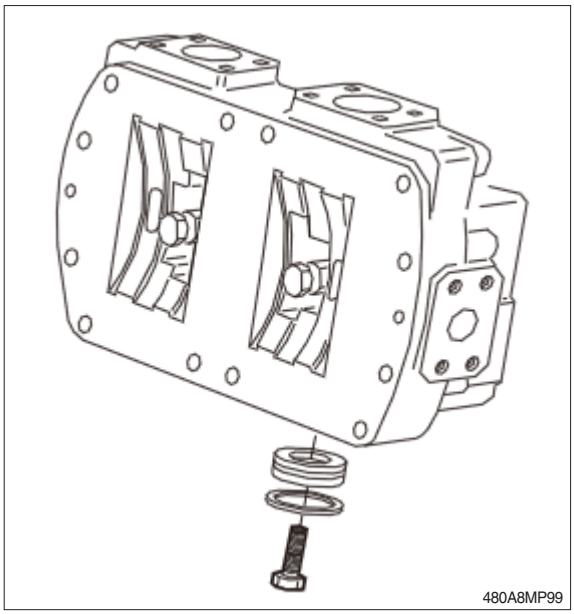
480A8MP97

(1) Fit the swivel pin into correct position and orientation.
(2) Take the hardening time and tightening torque into account.
M6 : 0.9 kgf · m (6.3 lbf · ft)
M8 : 1.4 kgf · m (10.3 lbf · ft)
M10 : 3.6 kgf · m (25.8 lbf · ft)
M12 : 7.0 kgf · m (50.9 lbf · ft)

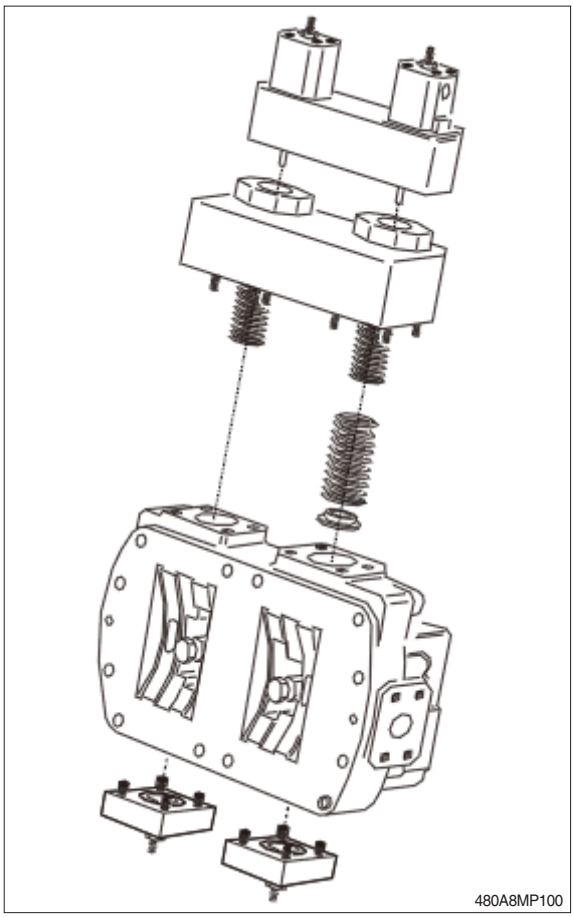


480A8MP98

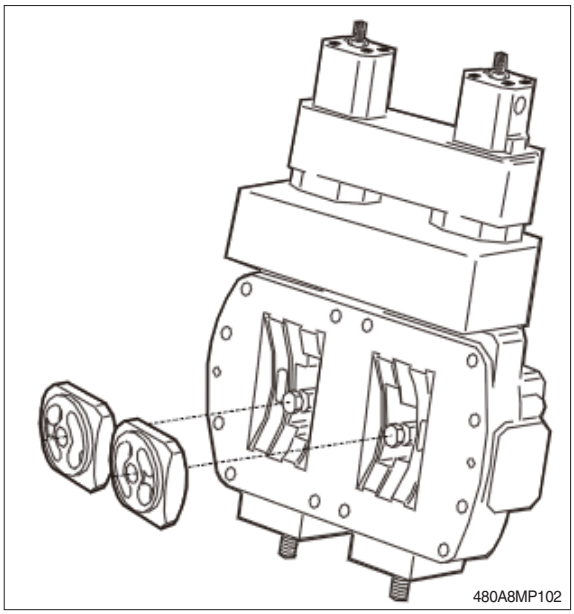
(3) Push on the piston ring by hand.
(4) Fix adjustment piston.
(5) Take the tightening torques into account.

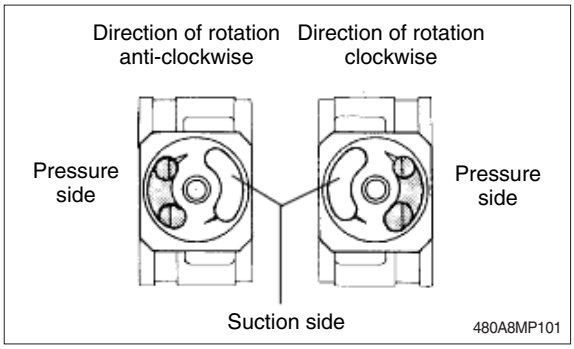


(6) Fit control housing.

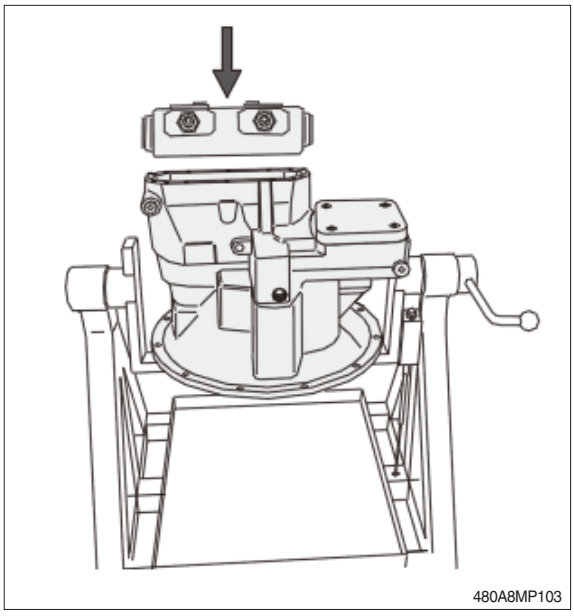


(7) Fit the control lens in its correct position using grease to hold it in place.

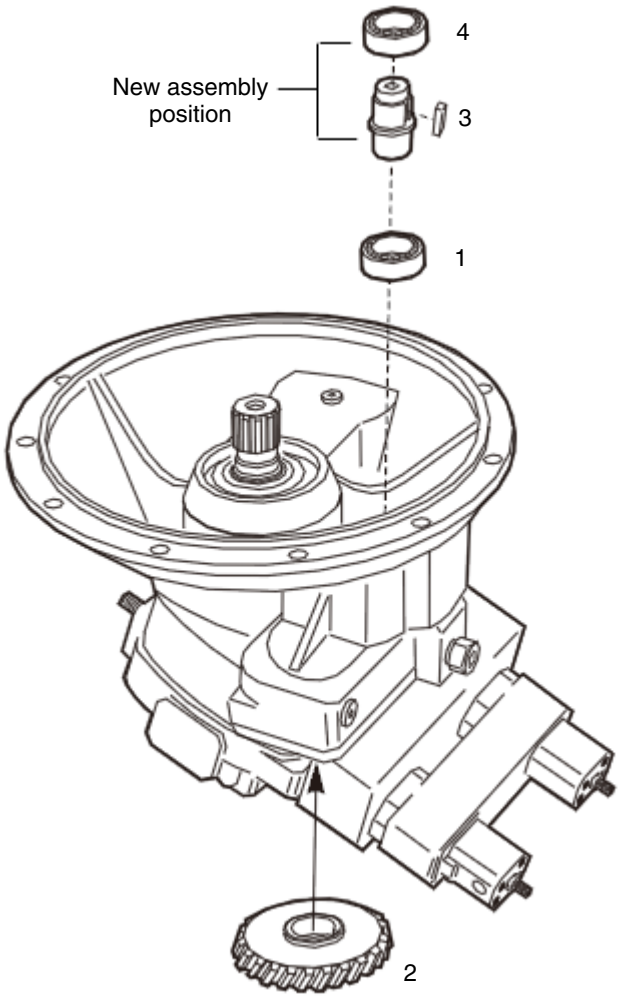




(8) Fit seal and controller.

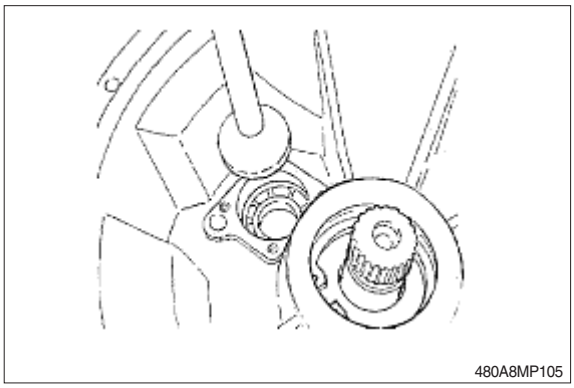


19) ASSEMBLY OF THE INTERMEDIATE WHEEL

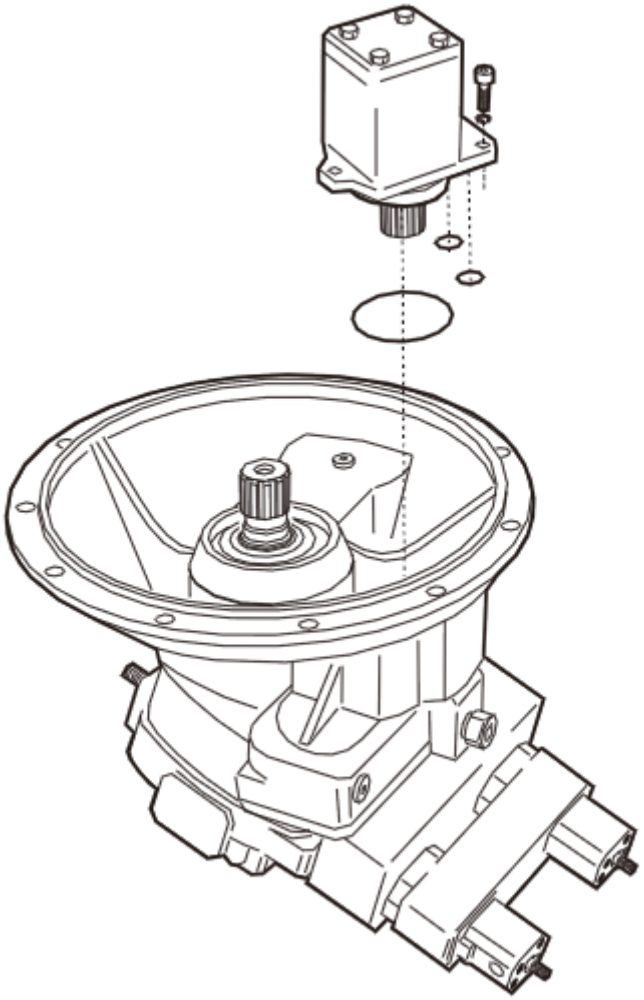


(1) Press in bearing into housing.
(2) Install and align the intermediate wheel through side drive opening.
(3) Cool down the bolt with nitrogen and place it.
(4) Press in bearing.

(5) Press in the bearing into the housing.

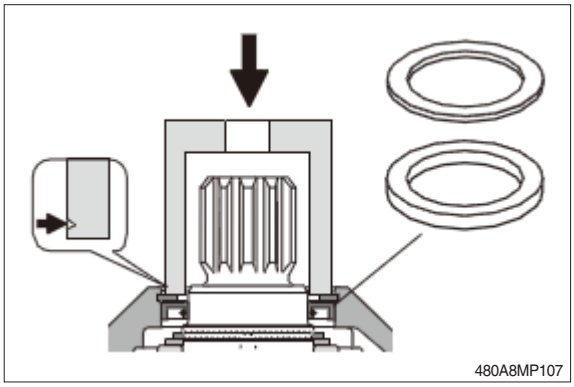


20) FIT THE GEAR PUMP



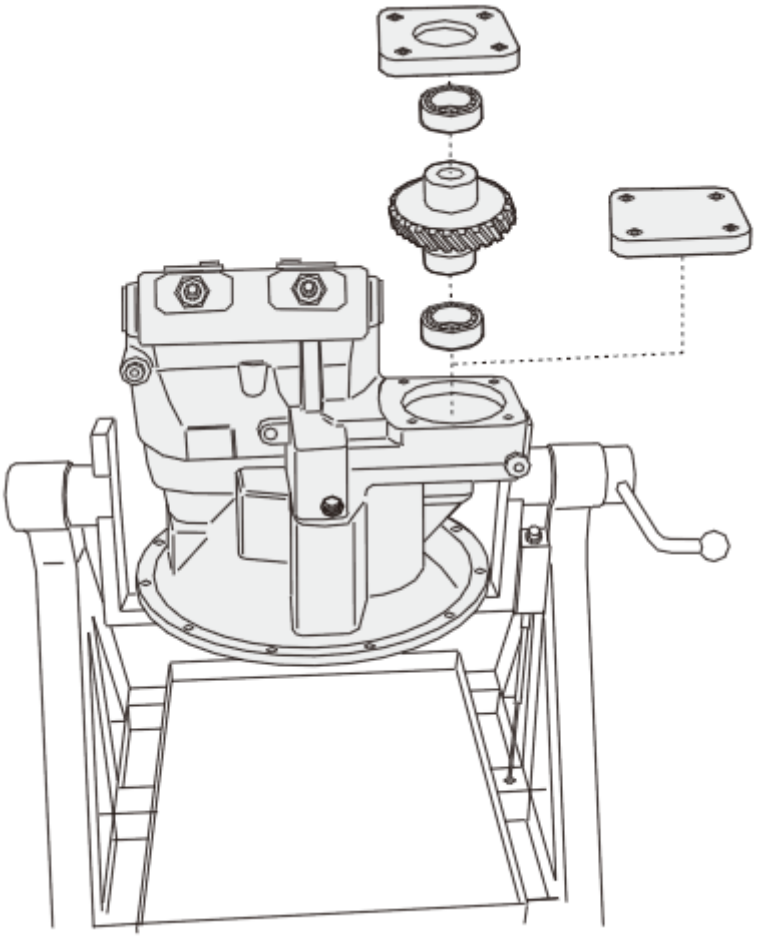
480A8MP106

(1) Assemble shaft seal, disc and safety ring.
(2) Press-in with assemble sleeve.
※ Take care of press-in depth.



480A8MP107

21) FIT THE COVER AND AUXILARY DRIVE



480A8MP108

1. REMOVAL AND INSTALL

1) REMOVAL

(1) Lower the work equipment to the ground and stop the engine.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(4) Remove the wirings for the pressure sensor and so on.

(5) Remove bolts and disconnect pipe.

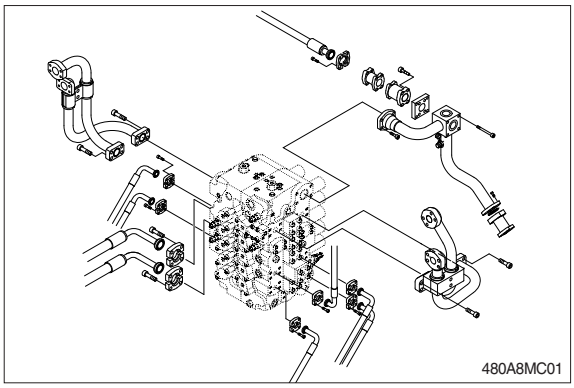
(6) Disconnect pilot line hoses.

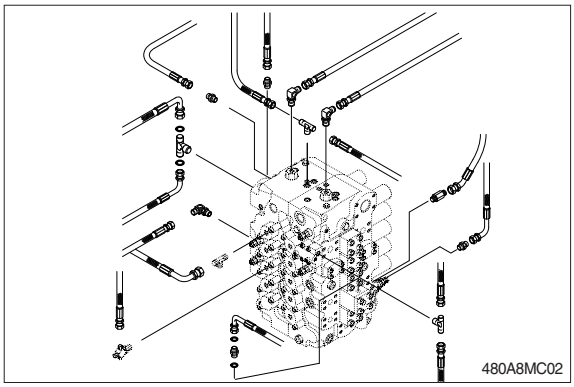
(7) Disconnect pilot piping.

(8) Sling the control valve assembly and remove the control valve mounting bolt.
- Weight : 421 kg (928 lb)
- Tightening torque : 57.9 ± 8.7 kgf·m (419 ± 62.9 lbf·ft)

(9) Remove the control valve assembly.
When removing the control valve assembly, check that all the piping have been disconnected.





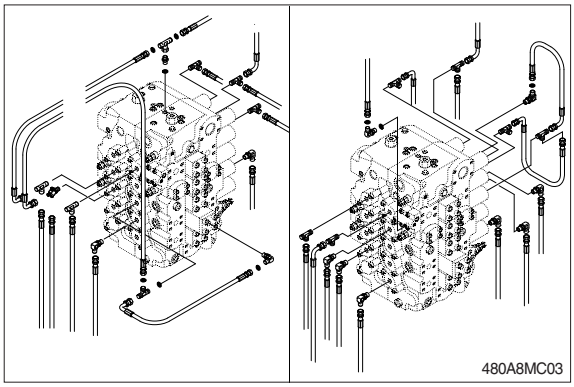


2) INSTALL

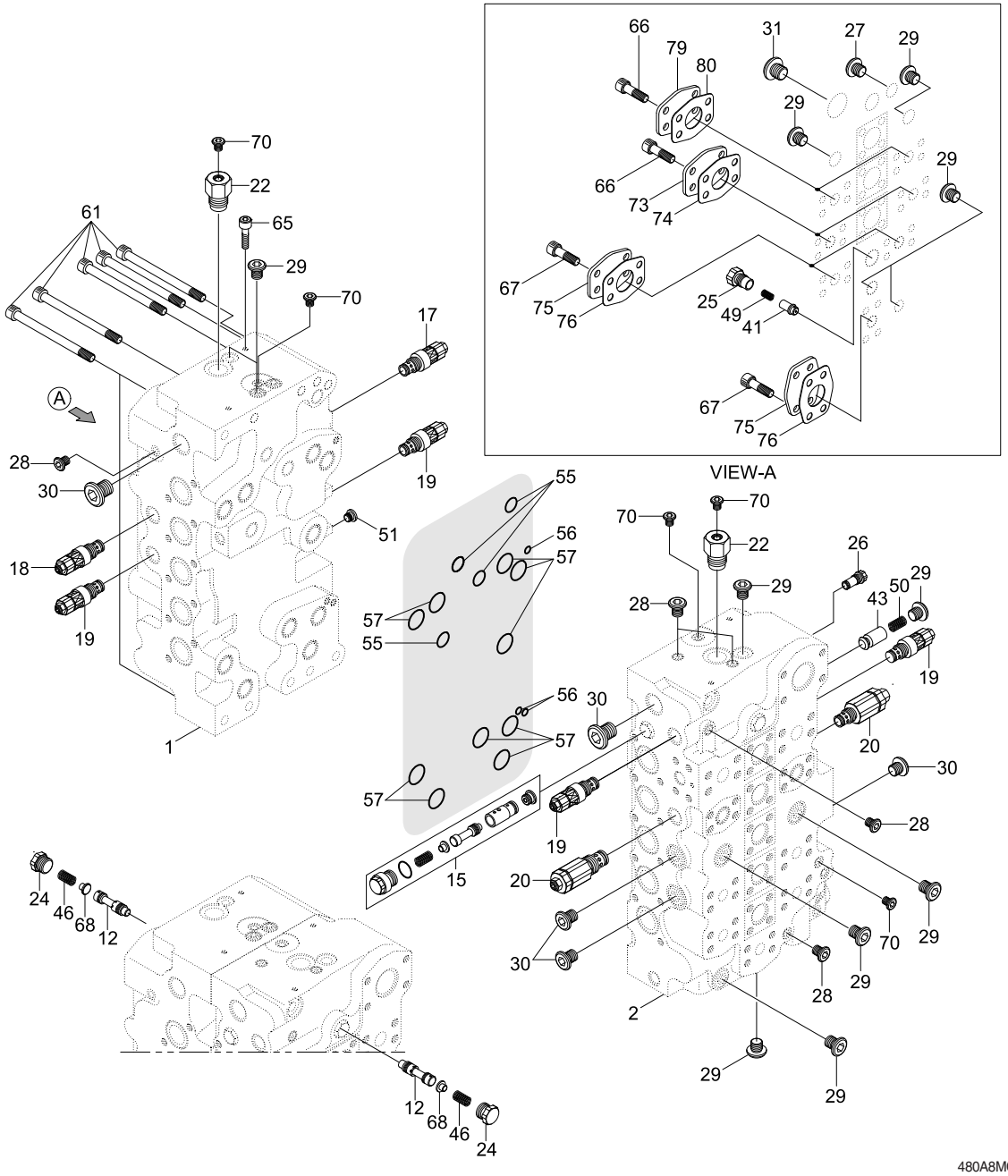
(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from below items.
① Cylinder (boom, arm, bucket)
② Swing motor
③ Travel motor
※ See each item removal and install.

(3) Confirm the hydraulic oil level and recheck the hydraulic oil leak or not.

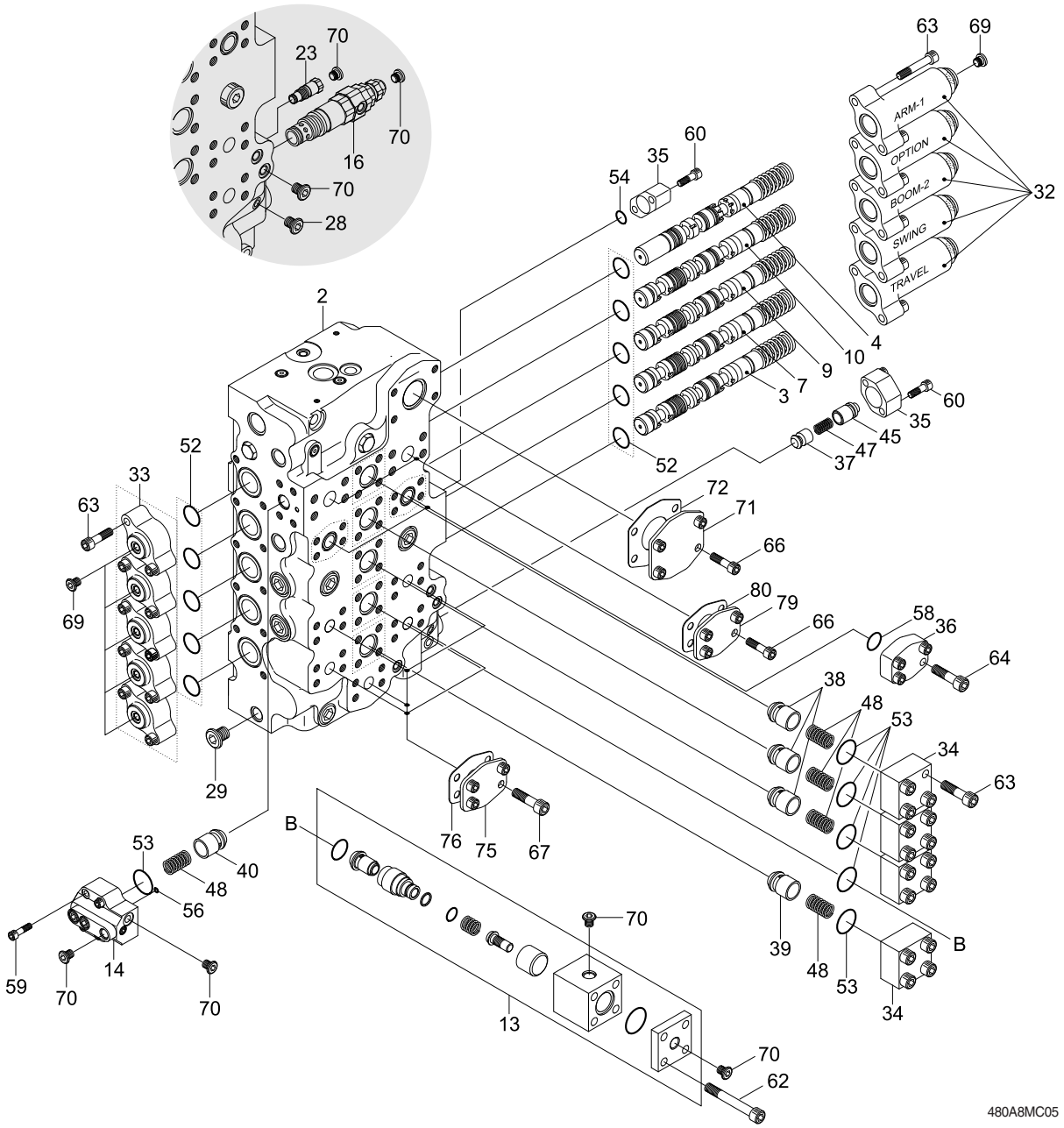


2. STRUCTURE (1/3)



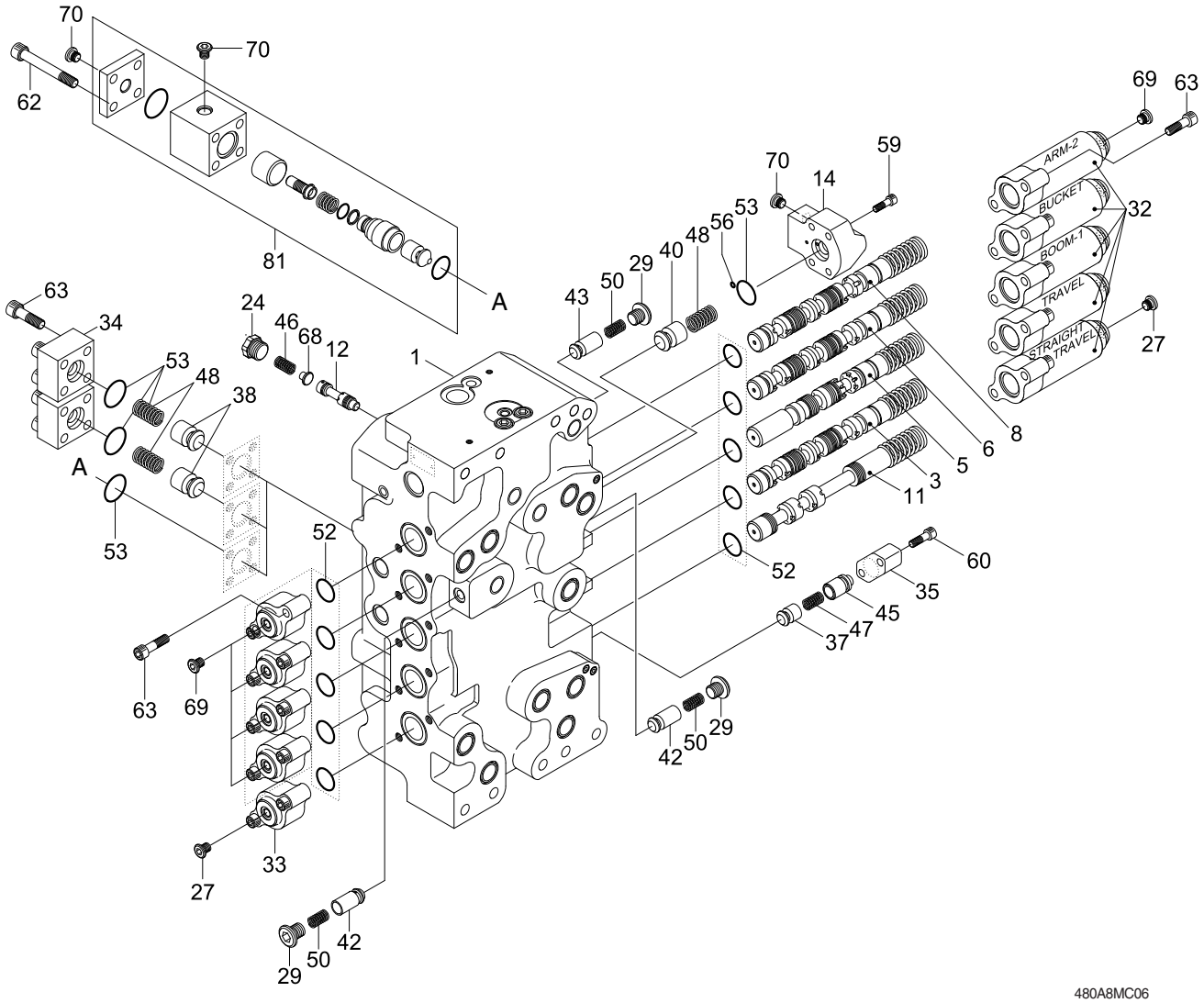
12	Spool assy	29	Plug	65	Socket bolt
15	Arm regen cut spool kit	30	Plug	66	Socket bolt
17	Port relief valve	31	Plug	67	Socket bolt
18	Port relief valve	41	Poppet	68	Socket bolt
19	Port relief valve	43	Poppet	70	Dust cap
20	Port relief valve	46	Spring	73	Cover
21	Port relief valve	49	Spring	74	Gasket
22	Relief valve	50	Spring	75	Cover
24	Plug assy	51	Plug	76	Gasket
25	Plug	55	O-ring	79	Cover
26	Plug	56	O-ring	80	Gasket
27	Plug	57	O-ring		
28	Plug	61	Socket bolt		

STRUCTURE (2/3)



2	Housing	35	Flange	60	Socket bolt
3	Travel spool kit	36	Flange	62	Socket bolt
4	Arm 1 spool kit	37	Poppet	63	Socket bolt
7	Swing spool kit	38	Poppet	64	Socket bolt
9	Boom 2 spool kit	39	Poppet	66	Socket bolt
10	Option spool kit	40	Poppet	67	Socket bolt
13	Swing logic valve	45	Spacer	69	Dust cap
14	Holding valve	47	Spring	70	Dust cap
16	Main relief valve	48	Spring	71	Cover
23	Plug assy	52	O-ring	72	Gasket
28	Plug	53	O-ring	75	Cover
29	Plug	54	O-ring	76	Gasket
32	Pilot cap-large	56	O-ring	79	Cover
33	Pilot cap-small	58	O-ring	80	Gasket
34	Flange	59	Socket bolt		

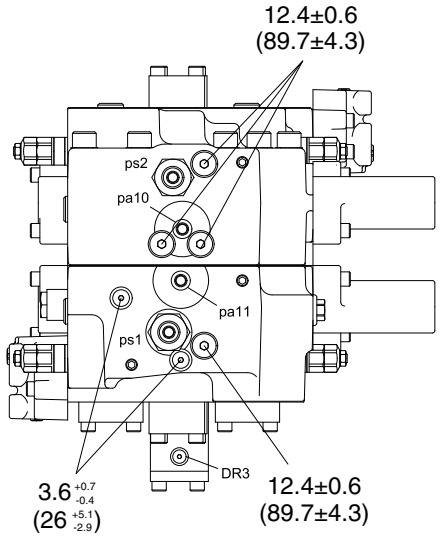
STRUCTURE (3/3)

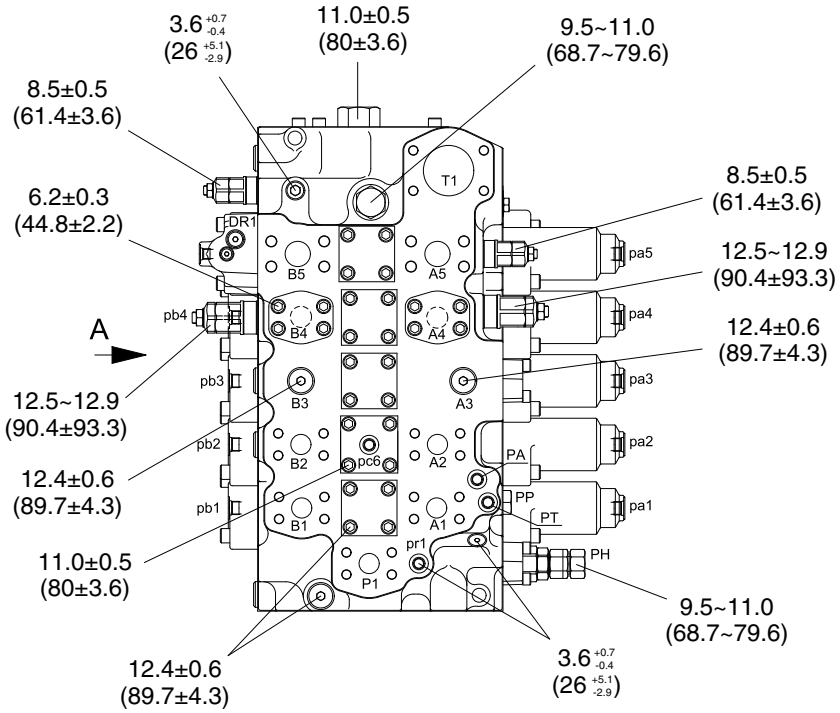


1	Housing	33	Pilot cap-small	50	Spring
3	Travel spool kit	34	Flange	52	O-ring
5	Boom 1 spool kit	35	Flange	53	O-ring
6	Bucket spool kit	37	Poppet	56	O-ring
8	Arm 2 spool kit	38	Poppet	59	Socket bolt
11	Straight travel spool kit	40	Poppet	60	Socket bolt
12	Bypass cut spool kit	42	Poppet	62	Socket bolt
14	Holding valve	43	Poppet	63	Socket bolt
24	Bypass plug	45	Spacer	68	Spring seat
27	Plug	46	Spring	69	Dust cap
29	Plug	47	Spring	70	Dust cap
32	Pilot cap-large	48	Spring	81	Boom 1 logic valve

3. TIGHTENING TORQUE (1/2)

※ Unit : kgf · m (lbf · ft)

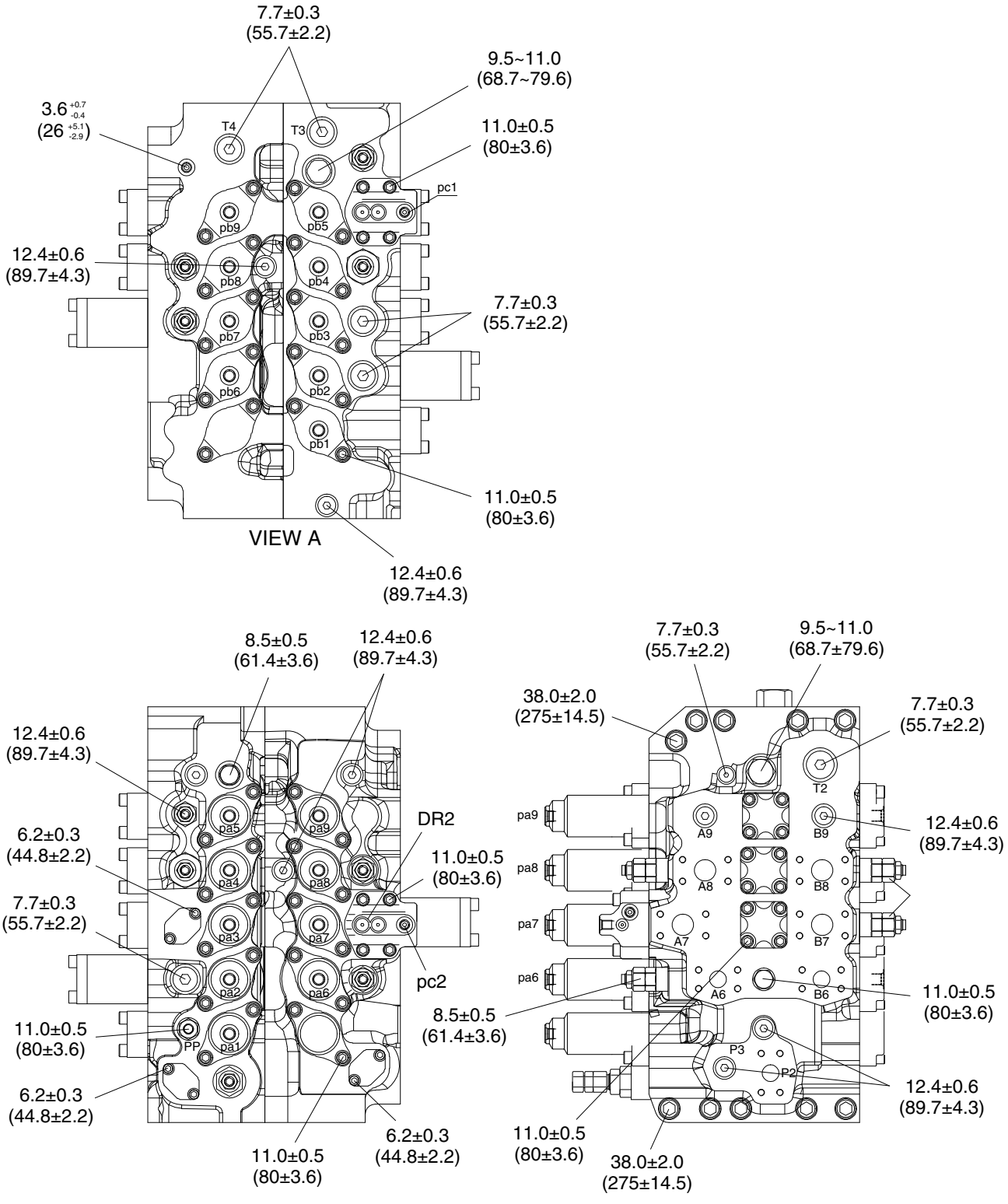




480A8MV07

TIGHTENING TORQUE (2/2)

※ Unit : kgf · m (lbf · ft)



4. 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 the 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) DISASSEMBLY

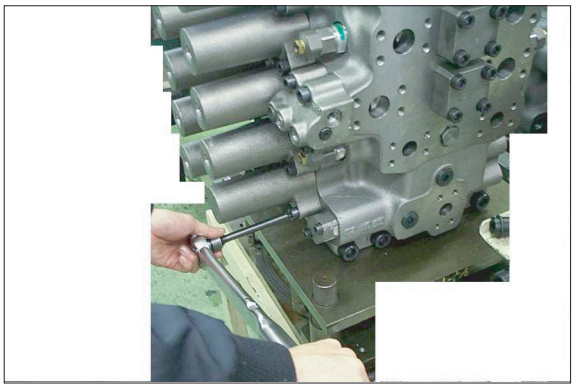
The figure in ( ) shown after the part name in explanation sentence shows its number in the construction figures.

(1) Place control valve on working bench

※ Disassemble the valve in a clean and dry environment and pay careful attention not to damage the sealing flange faces.

(2) Main spool

① Loosen socket head bolts (63) and remove the pilot cap (32).
Pull out O-ring (52) from valve housing.



45078MC07

② Remove all spool (3~11) of subassembly itself from valve housing.

※ Be careful not to be damaged while pulling out spools. Identify them with a tag to prevent from being mistaken at disassembly.



45078MC08

③ Spools sub assy (3, 4, 5, 6, 7, 8, 9, 10, 11).



45078MC10

④ Spool sub assy (5).



45078MC11

⑤ Spool sub assy (4).

※ When disassemble the spool assembly, fix the spool with vise. On this occasion attach wood between vise blades to prevent the spool from damaging.

※ Heat the outer race of spool with industrial drier and then loosen easily. (Temperature : 200~250˚C)



45078MC12

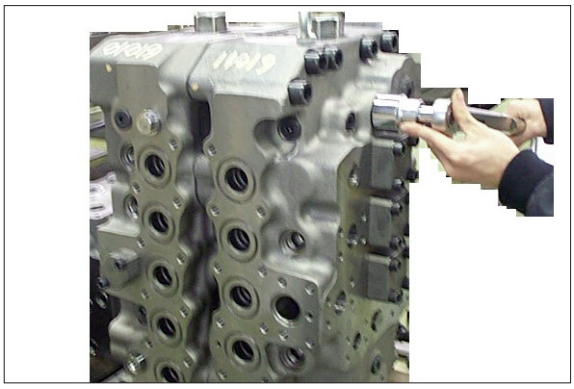
⑥ Loosen the socket head bolt (63) and remove the small pilot cap (33).
Pull out O-ring (14) from valve housing.



45078MC09

(3) Center bypass cut spool assy (12)

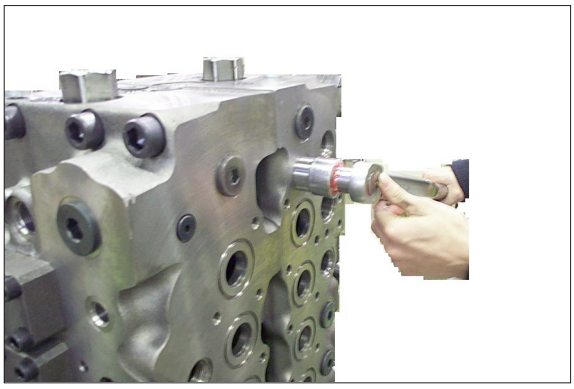
① Loosen the plug (24) and remove spring (46), spring seat (68) and the spool (12).



45078MC13

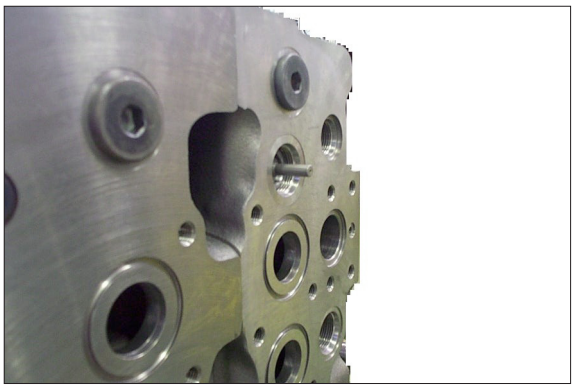
(4) Arm1 regeneration spool assy (15)

① Loosen the plug and pull out O-ring.



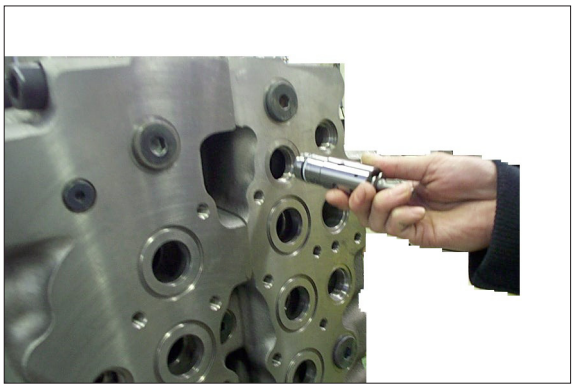
45078MC15

② Disassemble spring, spring seat and spool.



45078MC16

③ Pull out sleeve of hole inside at same time, disassemble sleeve and piston.



45078MC18

(5) General precautions

Clean all disassembled parts with clean mineral oil fully, and dry them with compressed air. Then, place them on clean papers or cloths for inspection.

① Control valve

a. Check whole surfaces of all parts for burrs, scratches, notches and other defects.

b. Confirm that seal groove faces of casing and block are smooth and free of dust, dent, rust etc.

c. Correct dents and damages and check seat faces within the casing, if any, by lapping.
※ Pay careful attention not to leave any lapping agent within the casing.

d. Confirm that all sliding and fitting parts can be moved manually and that all grooves and paths are free from foreign matter.

e. If any spring is broken or deformed, replace it with new one.

f. When a relief valve does not function properly, repair it, following the prescribed disassembly and assembly procedures.

g. Replace all seals and O-rings with new ones.

② Relief valve

a. Confirm that all seat faces at ends of all poppets and seats are free of defects and show uniform and consistent contact faces.

b. Confirm manually that main poppet and seat can slide lightly and smoothly.

c. Confirm that outside face of main poppet and inside face of seat are free from scratches and so on.

d. Confirm that springs are free from breakage, deformation, and wear.

e. Confirm that orifices of main poppet and seat section are not clogged with foreign matter.

f. Replace all O-rings with new ones.

g. When any light damage is found in above inspections, correct it by lapping.

h. When any abnormal part is found, replace it with a completely new relief valve assembly.

3) ASSEMBLY

(1) General comments

① In this assembly section, explanation only is shown.
For further understanding, please refer to the figures and photographs shown in the previous disassembly section.

② Figure in ( ) shown after the part name in the explanation refers to the reference identity number shown on the construction figure shown in the spares section.

③ Cautions in assembling seal

a. Pay close attention to keeping all seals free from handling damage and inspect carefully for damage before using them.

b. Apply clean grease or hydraulic oil to the seal so as to ensure it is fully lubricated before assembly.

c. Do not stretch seals so much as to deform them permanently.

d. In fitting O-rings, pay close attention not to roll them into their final position in addition, a twisted O-ring cannot easily untwist itself naturally and could thereby cause inadequate sealing and thereby both internal and external oil leakage.

e. Tighten fitting bolts for all sections with a torque wrench adjusted to the respective tightening torque as shown on the corss section drawings of the spares section.

(2) Main spool

① Apply loctite to thread of spools (3, 4, 5, 6, 7, 8, 9, 10, 11) and assemble spring seat, spring and spool end. Assemble spool end to spool after fixing spool with a vise attached wood.

※ Be careful not to applying loctite too much.

· Tightening torque : 2.5 ~ 2.7 kgf · m (18.1 ~ 19.5 lbf · ft)

Fit O-ring into housing and assemble spools (3, 4, 5, 6, 7, 8, 9, 10, 11) into housing.

Assemble lock cap on housing and tighten hex socket bolt.

· Tightening torque : 11±0.5 kgf · m (79.7±3.7 lbf · ft)

② Insert poppet, spring into spool (5) and then apply loctite to thread of spool.

Fit O-ring and backup ring on the plug and then tighten plug.

Assemble spring seat, spring, and spool end and then assemble spool end sub assy to spool after fixing spool with a vise attached wood.

· Tightening torque : 2.5 ~ 2.7 kgf · m (18.1 ~ 19.5 lbf · ft)

Fit O-ring into housing and assemble spool (5) into housing.

Assemble lock cap on housing and tighten hex socket bolt.

· Tightening torque : 11±0.5 kgf · m (79.7±3.7 lbf · ft)

③ Insert poppet, spring into spool (4) and then apply loctite to thread for spool.

Fit O-ring and backup ring on the plug and then tighten plug.

Assemble spring seat, spring, and spool end and then assemble spool end sub assy to spool after fixing spool with a vise attached wood.

· Tightening torque : 2.5 ~ 2.7 kgf · m (18.1 ~ 19.5 lbf · ft)

Fit O-ring into housing and assemble spool (4) into housing.

Assemble lock cap on housing and tighten hex socket bolt.

· Tightening torque : 2.5±2.7 kgf · m (18.1±19.5 lbf · ft)

④ Assemble short cap on housing and tighten hex socket bolt.

· Tightening torque : 11±0.5 kgf · m (79.7±3.7 lbf · ft)

(3) Center bypass cut spool assy (12)

① Apply loctite to thread of spool, assemble spool end to spool.
※ Be careful not to appling loctite too much.
② Assemble spool assy, spring seat, spring and tighten plug with O-ring.
· Tightening torque : 9.5 ~ 11.0 kgf · m (68.6 ~ 79.7 lbf · ft)

(4) Arm1 regeneration spool assy (15)

① Assemble backup rings and O-rings to sleeve respectively.
② Assemble piston to sleeve which seal is assemble, and insert spool into sleeve.
③ Assemble spool assy, spring seat, spring and tighten plug with O-ring.
· Tightening torque : 9.5 ~ 11.0 kgf · m (68.6 ~ 79.7 lbf · ft)

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

(1) Lower the work equipment to the ground and stop the engine.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(4) Disconnect hose assembly (1, 2, 3, 4).

(5) Disconnect pilot line hoses (5, 6, 7, 8, 9, 10, 11, 12, 13, 14).

(6) Sling the swing motor assembly (16) and remove the swing motor mounting socket bolts (15).

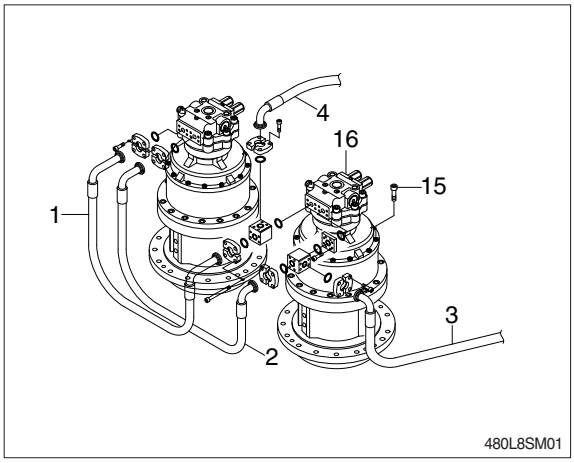
· Weight : 340 kg (725 lb) x 2

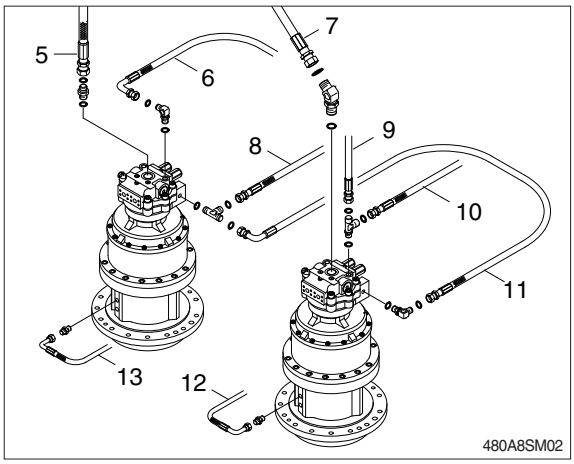
· Tightening torque : 57.9 ± 8.7 kgf·m (419 ± 62.9 lbf·ft)

(7) Remove the swing motor assembly.

※ When removing the swing motor assembly, check that all the piping have been disconnected.







2) INSTALL

(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from the swing motor.

① Remove the air vent plug.

② Pour in hydraulic oil until it overflows from the port.

③ Tighten plug lightly.

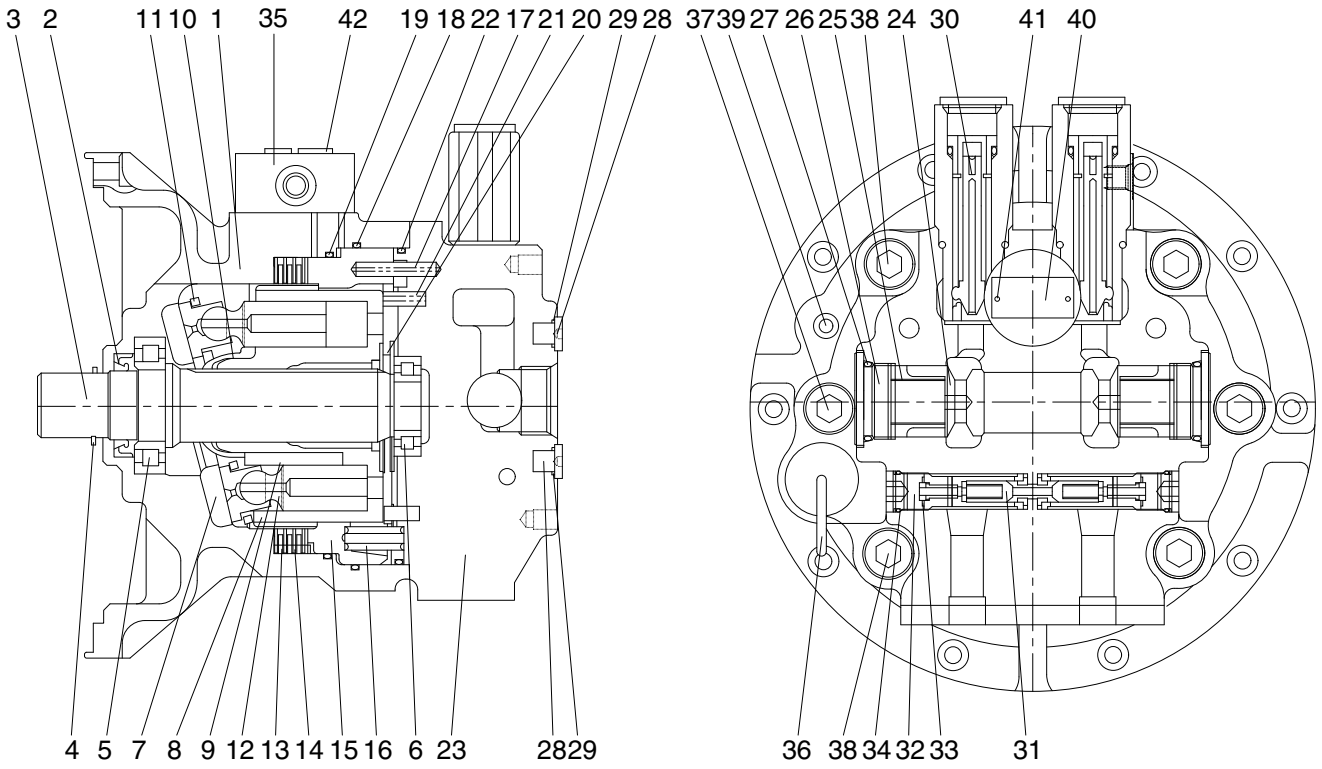
④ Start the engine, run at low idling and check oil come out from plug.

⑤ Tighten plug fully.

(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



480A2SM02

1	Casing	15	Parking piston	29	O-ring
2	Oil seal	16	Spring	30	Relief valve assy
3	Shaft	17	Spring pin	31	Anti-rotating valve assy
4	Retainer 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	Rotary block	22	O-ring	36	Level gauge assy
9	Spring	23	Valve casing	37	Hexagon socket head bolt
10	Ball guide	24	Check valve	38	Hexagon socket head bolt
11	Retainer plate	25	Spring	39	Plug
12	Piston & shoe	26	Plug	40	Name plate
13	Friction plate	27	O-ring	41	Rivet
14	Separate plate	28	Plug		

2) DISASSEMBLING

(1) Disassembly the sub of a turning axis

① Unloosing socket bolt (42) and disassemble port block assy (35) from casing (1).



480L2SM10

② Disassemble level gauge assy (36) from casing (1).



480L2SM11

③ Hang buckles on valve casing (23) and unloose socket bolt (37, 38) from casing (1).



480L2SM12

④ Take springs (16) out of parking piston (15) and disassemble a parking piston (15) from casing (1) using a jig.



480L2SM13

⑤ Take rotary block sub assy (8), friction plates (13), seperate plates (14) out of casing (1) in order.



480L2SM14

⑥ Disassemble swash plate (7) from casing (1).



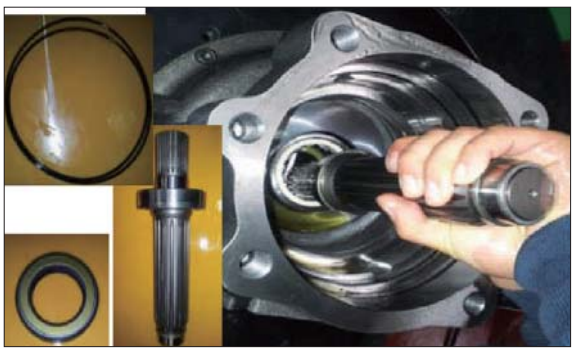
480L2SM15

⑦ Using a pair of pliers, take retainer ring (4) out of casing (1).



480L2SM16

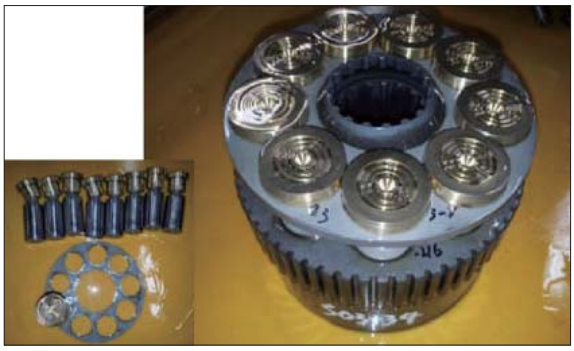
⑧ Disassemble shaft sub assy (3), oil seal (2), O-rings (18, 22) from casing (1).



480L2SM17

(2) Disassemble rotary block assy

① Disassemble pistion and shoe (12) from rotary block assy (8).



480L2SM18

② Disassemble ball guide (10) and springs (9) from rotary block assy (8).

· Ball guide × 1EA

· Spring × 9EA



480L2SM19

(3) Disassemble valve casing assy

① Take spring pin (17, 21), valve plate (20), O-ring (22) out of valve casing (23) in order.



480L2SM20

② Using a torque wrench, disassemble relief valve assy (30) from valve casing (23).



480L2SM21

③ Disassemble plug (32), O-rings (33, 34) and anti-rotating valves (31) from valve casing (23) in order with torque wrench.



480L2SM22

④ Disassemble plug (26), O-rings (27) and check valve (24) from casing in order with torque wrench.



480L2SM23

⑤ Disassemble plug (28), O-ring (29) from valve casing (23).



480L2SM24

3) ASSEMBLING

(1) Assemble the sub of a shaft assy

① Put bearing-cylinder roller on heating conveyor, inner bearings is being heated around 5 min (Temperature on conveyor : 120˚C, 3~5 min)



480L2SM25

② Using robot M/C, heated inner bearing (5, 6) is assembled on shaft (3) with pressure.



480L2SM26

(2) Assemble the sub of rotary block assy

① Put springs (9, rotary block) on holes of rotary block.

· Spring × 9EA



480L2SM27

② Put ball guide (10) on rotary block (8).

· Ball guide × 1EA



480L2SM28

③ Assemble piston and shoe (12) with retainer plate (11).
- Piston and shoe × 9EA
- Retainer plate × 1EA



480L2SM29

④ Put ② and ③ together as one.



480L2SM30

(3) Assemble the sub of valve casing assy

① Assemble the sub of check valve assy.
Assemble check valve (24), spring (25), O-ring (27), and plug (26) into valve casing (23) in order.
- Check valve (24) × 2EA
- Spring (25) × 2EA
- Plug (26) × 2EA
- O-ring (27) × 2EA



480L2SM31

② Assemble the sub of anti-rotating valve assy.
Assemble anti-rotating valve (31), O-ring (33, 34), and plug (32) into valve casing (23) in order.
- Anti-rotating valve assy (31) × 2EA
- Plug (32) × 2EA
- O-ring (33, 34) × 2EA



480L2SM32

③ Assemble relief valve assy (30) 2 set into valve casing (23) with torque wrench (bilateral symmetry assembling).
· Relief valve assy (30)×2EA



480L2SM33

④ Assemble plug (28) and O-ring (29) into valve casing with a torque wrench.
· Plug (28)×3EA
· O-ring (29)×3EA



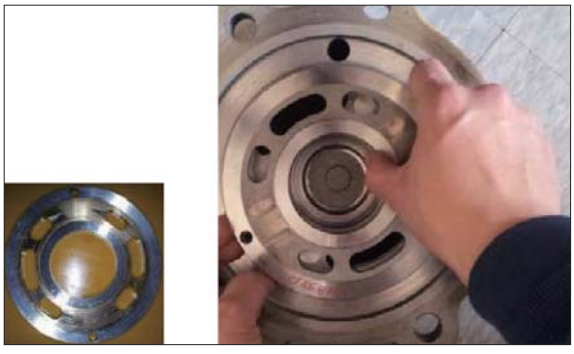
480L2SM34

⑤ After assembling roller bearing (6) into valve casing, assemble spring pin (17, 21).
· Roller bearing (6) ×1EA
· Spring pin (17, 21) ×1EA



480L2SM35

⑥ After applying grease on valve plate (20), attach it to valve casing (23).
· Valve plate (20) ×1EA



480L2SM36

(4) Assemble the sub of moving axis

① Using jig and compressing tool, assemble oil seal into casing.
· Oil seal (2)×1EA



480L2SM37

② Insert above shaft sub into casing (1) and assemble it with a jig.



480L2SM38

③ Fix retainer ring (4) to shaft with a pair of plier jig.
· Retainer ring×1EA



480L2SM39

④ Apply grease on swash plate (7) and assemble it on the casing.
· Swash plate×1EA



480L2SM40

⑤ Put O-ring (18, 19) into casing (1).
- O-ring (18) × 1EA
- O-ring (19) × 1EA



480L2SM41

⑥ Insert rotary block assy (8) into casing (1).



480L2SM42

⑦ After assemble 4 set of seperate plates (14), friction plate (13) step by step into casing, put parking piston (15) with compressing tool.
- Seperate plate × 4EA
- Friction plate × 4EA
- Parking piston × 1EA



480L2SM43

⑧ After putting grease on contact surface of spring, assemble spring (16) into parking piston (15).
- Spring × 26EA



480L2SM44

⑨ After hang valve casing (23) on hook, assemble it on casing (1) gently, then, tighten hex socket bolt (37, 38) tightly.



480L2SM45

⑩ Assemble level gauge assy (36) and plug (39) into casing (1).



480L2SM46

⑪ After assembling port block assy (35) into valve casing (23), tighten hex socket bolt (42).

· Port block assy × 1EA
· Hex socket bolt × 3EA



480L2SM47

⑫ Air leak test

After putting assembled swing motor into test tank, excute the air leak test for 2 min at 2 kgf/cm^2.



480L2SM48

⑬ Leakage test

After putting assembled motor into bench tester, spraying the color check and be sure of leakage.



480L2SM49

⑭ Mount test bench

Mount assembled motor on bench tester, check the availability of each specified tests.



480L2SM50

3. REMOVAL AND INSTALL OF REDUCTION GEAR

1) REMOVAL

(1) Remove the swing motor assembly.
For details, see removal of swing motor assembly.

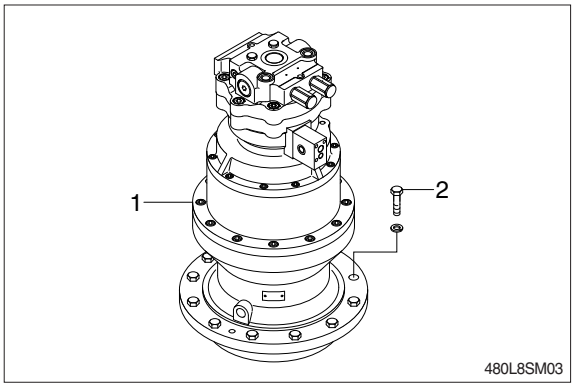
(2) Sling reduction gear assembly (1) and remove mounting bolts (2).

(3) Remove the reduction gear assembly.
· Reduction gear device weight : 271 kg (597 lb)



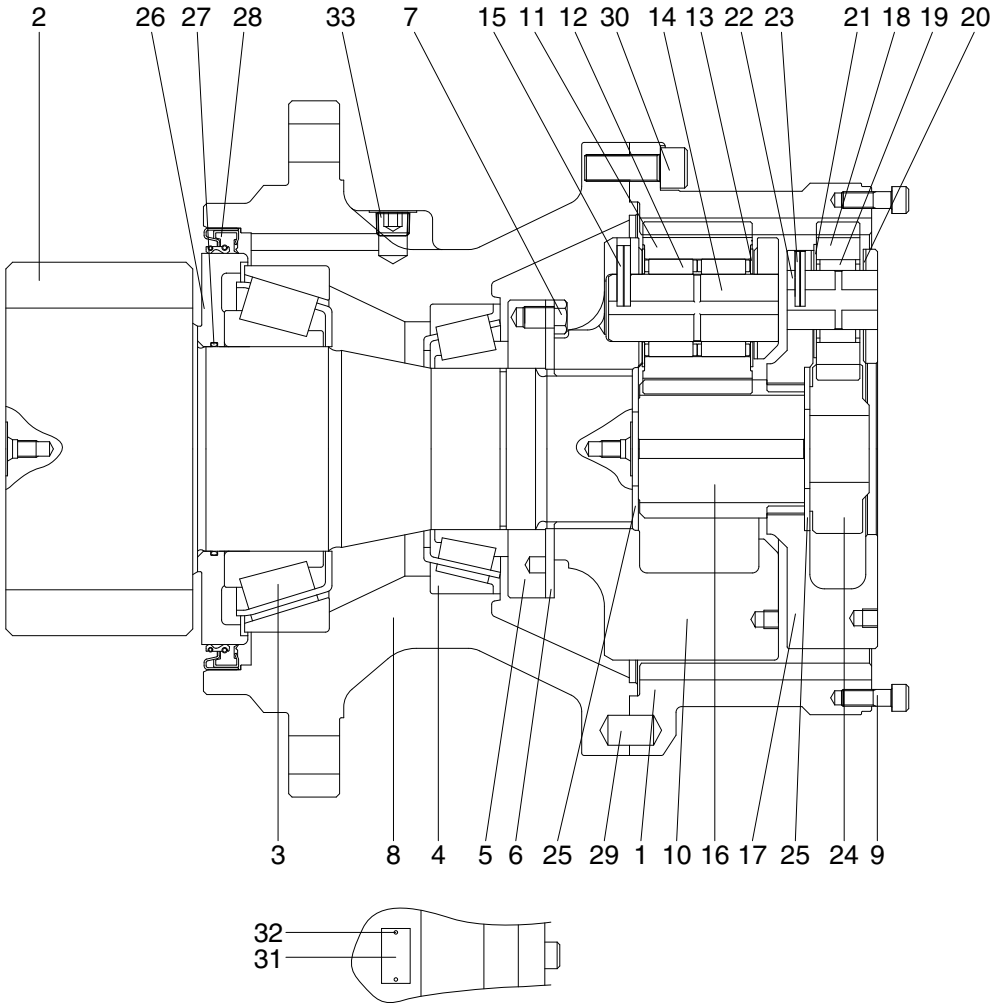
2) INSTALL

(1) Carry out installation in the reverse order to removal.
· Tightening torque : 57.9±8.7 kgf · m (419±62.9 lbf · ft)



4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE



1	Ring gear	12	Needle bearing	23	Spring pin
2	Drive shaft	13	Thrust washer	24	Sun gear No. 1
3	Taper roller bearing	14	Carrier pin No. 2	25	Thrust plate
4	Taper roller bearing	15	Spring pin	26	Sleeve
5	Ring nut	16	Sun gear No. 2	27	O-ring
6	Lock plate	17	Carrier No. 1	28	Oil seal
7	Hexagon head bolt	18	Planetary gear No. 1	29	Parallel pin
8	Casing	19	Needle bearing	30	Hexagon socket head bolt
9	Hexagon socket head bolt	20	Thrust washer-upper	31	Name plate
10	Carrier No. 2	21	Thrust washer-lower	32	Rivet
11	Planetary gear No. 2	22	Carrier pin No. 1	33	Plug

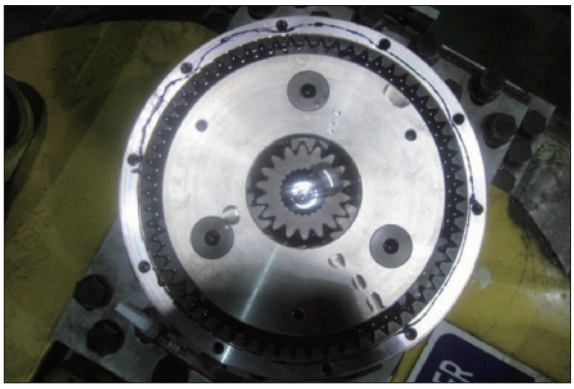
2) PREPARATION FOR DISASSEMBLING

(1) The reduction units removed from excavator are usually covered with mud. Wash out side of unit and dry it.

(2) Setting reduction unit 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 left fall parts on your foot while lifting them.**



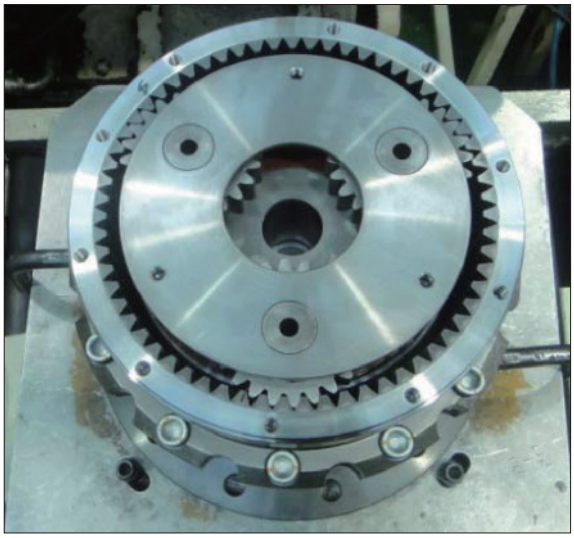
480L2SM51

3) DISASSEMBLY

(1) Remove every “socket bolt (M10)” that secure hydraulic motor and reduction gear.

(2) Removing carrier sub assy & sun gear

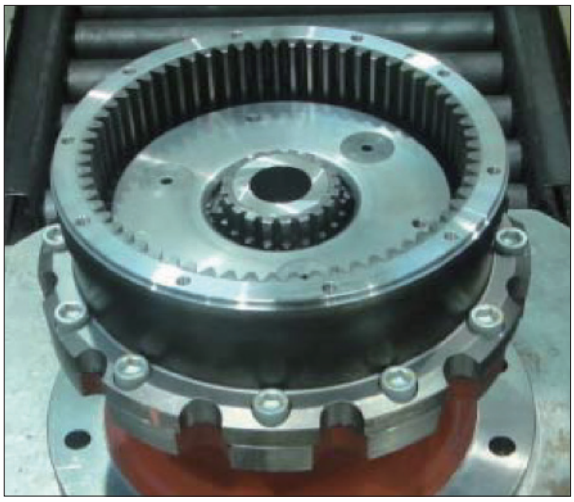
① Removing No.1 sun gear from No.1 carrier sub assy. (Be sure maintaining it vertical with ground when disassembling No.1 sun gear.)



480L2SM52

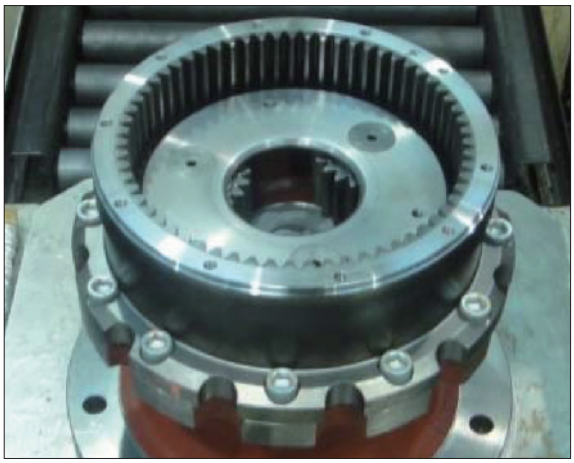
② Removing No.1 carrier sub assy screwing I-bolt to tab hole (M10) in No.1 carrier. (Lifting it gradually maintaining it vertical with ground.)

※ It’s impossible to disassemble spring pin. If spring pin has problem, change whole No.1 carrier sub assy .



480L2SM53

③ Removing No.2 sun gear from No.2 carrier sub assy. (Be sure maintaining it vertical with ground when disassembling No.2 sun gear.)



480L2SM54

④ 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 spring pin. If spring pin has problem, change whole No.2 carrier sub assy.



480L2SM55

(3) Removing ring gear

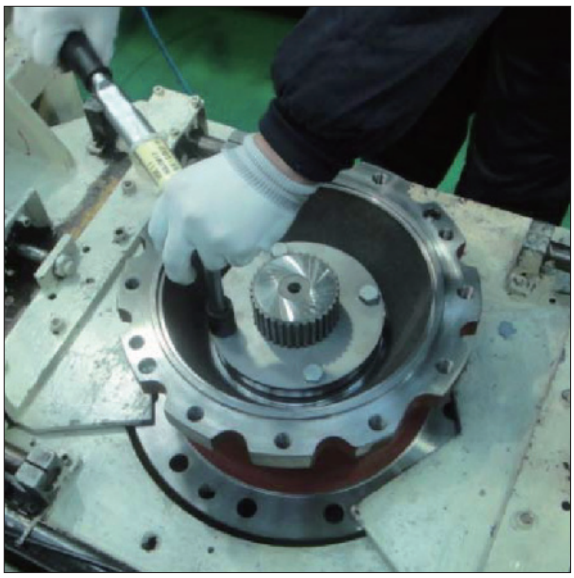
After unscrewing every socket bolt (M16), remove ring gear from casing.
(Because of liquid gaskets between ring gear and casing, put sharp punch between ring gear and casing and tapping it to remove them.)



480L2SM56

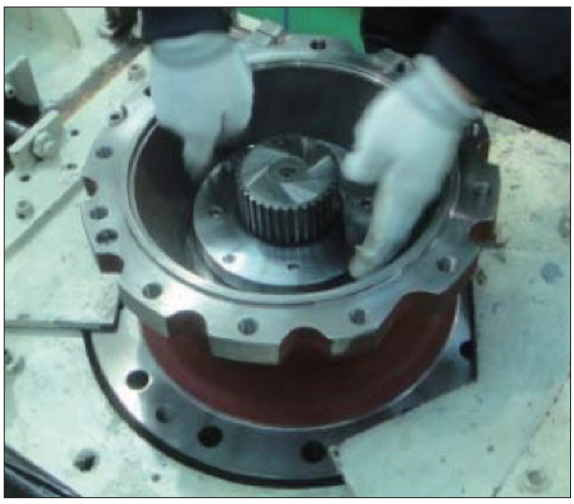
(4) Removing drive shaft sub assy

① Unscrew every hex head bolt (M12) to remove lock plate.



480L2SM57

② Rolling ring nut for removing them from drive shaft sub assy.
(Use special tool to roll ring nut to counter clock wise.)



480L2SM58

③ 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.)

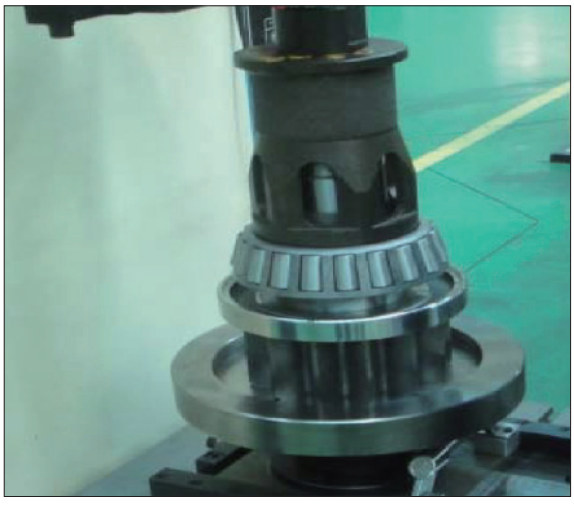


480L2SM59

④ Remove oil seal & taper roller bearing (small) from casing.
(Caution, do not re-use oil seal. It is impossible to disassemble drive shaft sub assy.)



480L2SM60



480L2SM61

4) ASSEMBLY

(1) General notes

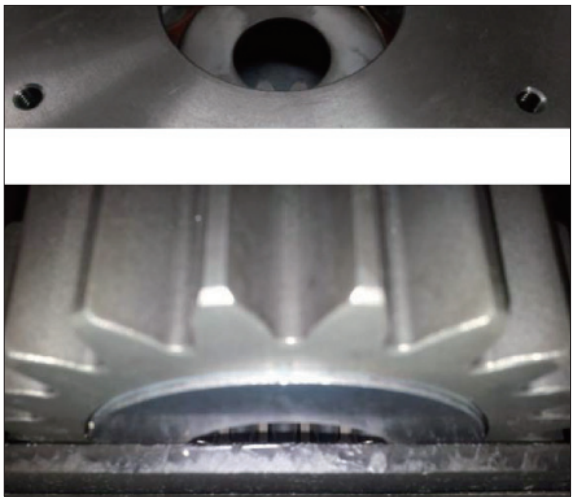
① Clean every part by kerosene and dry them in a cool and dry place.
② Loctite on surface must be removed by solvent.
③ Check every part for any abnormal.
④ Each hexagon socket head bolt should be used with loctite #242 applied on its threads.
⑤ Apply gear oil slightly on each part before assembling.
⑥ Take great care not to pinch your hand between parts or tools while assembling nor let fall parts on your foot while lifting them.
⑦ Inspection before assembling.
⑧ **Thrust washer**
- Check the seizure, abnormal wear or uneven wear.
- Check the unallowable wear.

⑨ **Gears**
- Checnk the pitting or seizure on tooth surface.
- Checnk the cracks on the root of tooth.

⑩ **Bearing**
- Rotate it by hands to check such noise or uneven rotation.

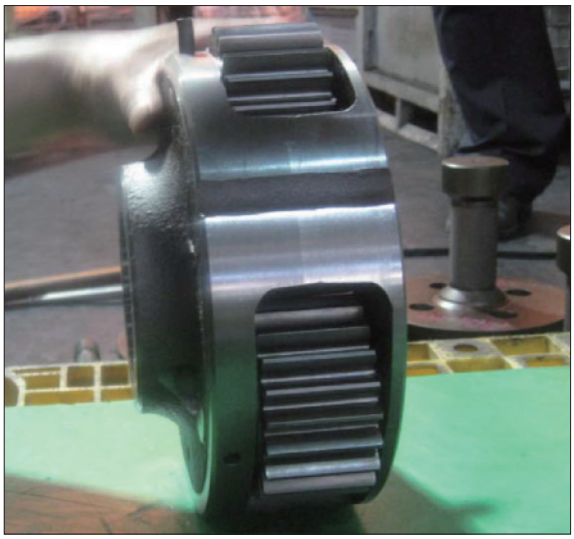
(2) Assembling No.1 carrier sub assy

① Put thrust plate firmly in No.1 carrier.
② After assembling needle bearing to No.1 planetary gear, put a pair of thrust washer on both sides of bearing and install them to No.1 carrier.



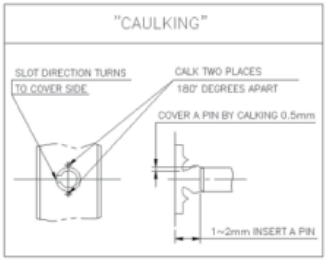
480L2SM62

③ Make spring pin hole and No.1 carrier's spring pin hole in line, press spring pin into the holes.
(Make spring pin hole head for No.1 planetary gear.)



480L2SM63

④ Caulk carrier holes to make spring pin settle down stably.
(Caution : Refer to “caulking details”)
※ Use paint marker for marking after caulking.



480L2SM64



480L2SM65

(3) Assembling No.2 carrier sub assy

① Put thrust plate in firmly No.2 carrier.



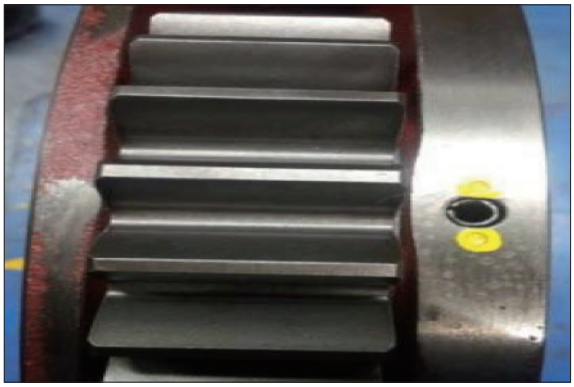
480L2SM66

② After assembling needle bearing to No.2 planetary gear, put 2 pieces of thrust washer on both sides of bearing and install them to No.2 carrier.



480L2SM67

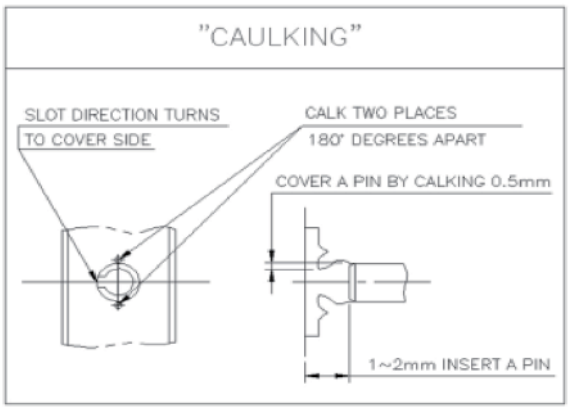
③ Align spring pin hole and No.2 carrier spring pin hole, put spring pin into the holes.
(Make spring pin cutting line face to No.2 planetary gear.)



480L2SM68

④ Caulk carrier holes to make spring pin settle down stably.
(Caution : Refer to “caulking details”)

※ Use paint marker for marking after caulking.



480L2SM69

(4) Assembling pinion gear sub assy

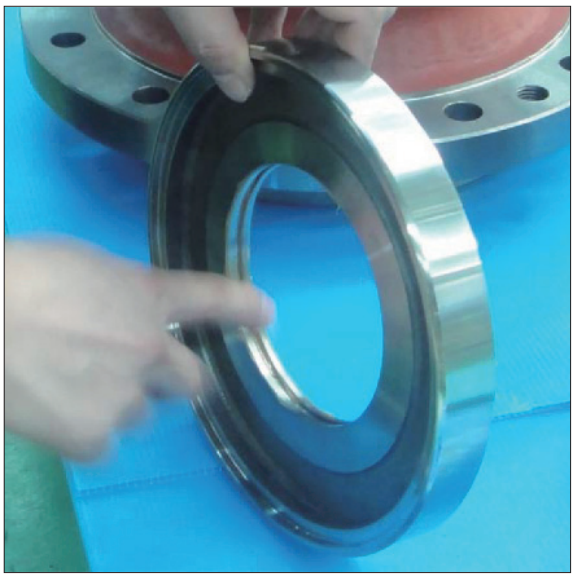
① Prepare drive shaft pinion gear vertical with ground.



480L2SM70

② Fully apply grease (albania ep02) to sleeve's O-ring gutter.
(Be sure to maintain it vertical with ground when assembling it.)

③ Put O-ring into sleeve's O-ring gutter.
(Fully apply grease on O-ring.)



480L2SM71

④ Assemble taper roller bearing and sleeve into drive shaft using press jig.
(Use special jig for pressing. Leave no space between sleeve and taper roller bearing.)



480L2SM72

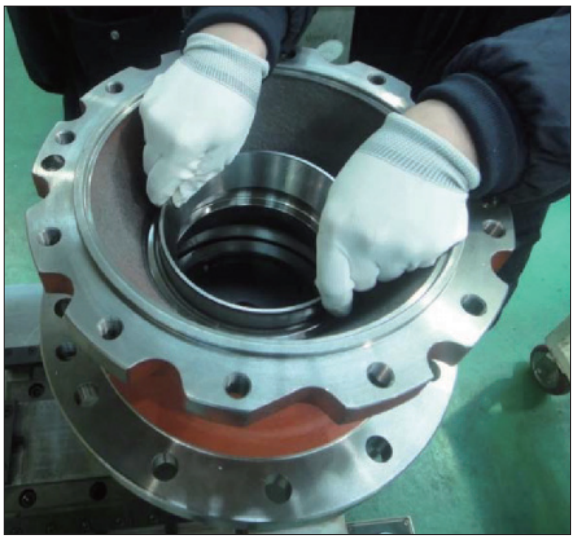


480L2SM73

(5) Assembling bearing cup & oil seal

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.

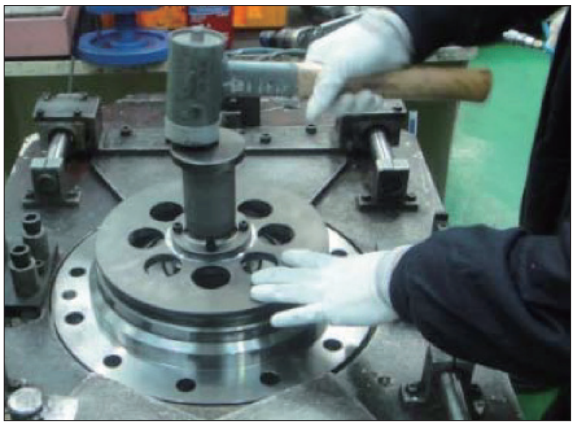


480L2SM74



480L2SM75

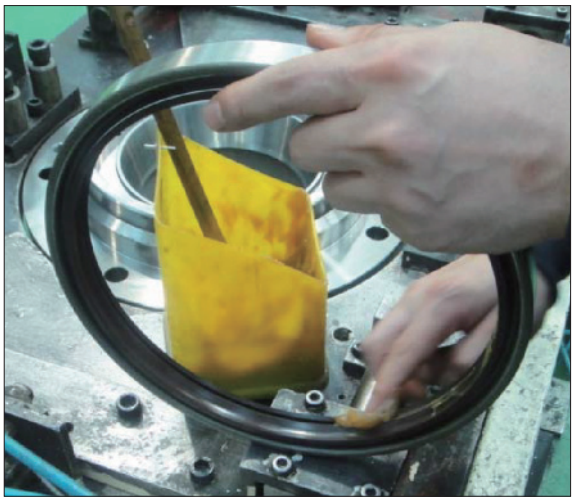
② Assemble oil seal to casing.
(Use special jig for pressing. Pay attention to direction of dust seal and dent.)



480L2SM76

While assembling oil seal

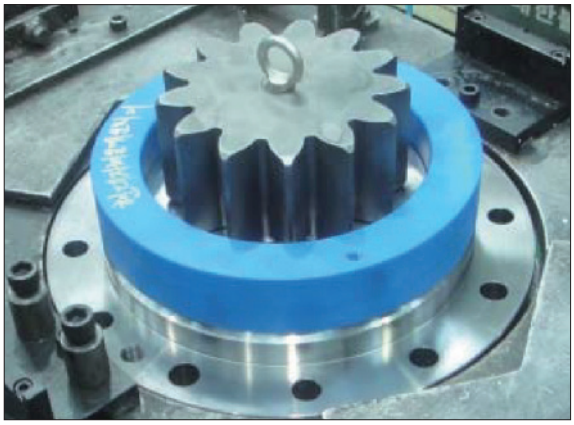
1. Be sure to set dust seal to gear oil.
2. Before assembling, charge enough grease in oil seal.
3. Before assembling, apply enough grease in and outside of oil seal.



480L2SM77

(6) Assembling shaft sub assy & nut ring

① After assembling casing & drive shaft sub assy, flip it over.



480L2SM78

② Put drive shaft sub assy into casing. (Be sure to maintain it vertical with ground when assembling it.)



480L2SM79

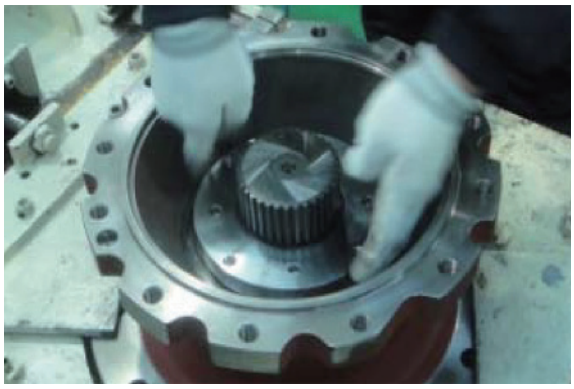
③ Put taper roller bearing into it.
(Rotate bearing by hands for checking after assembly.)



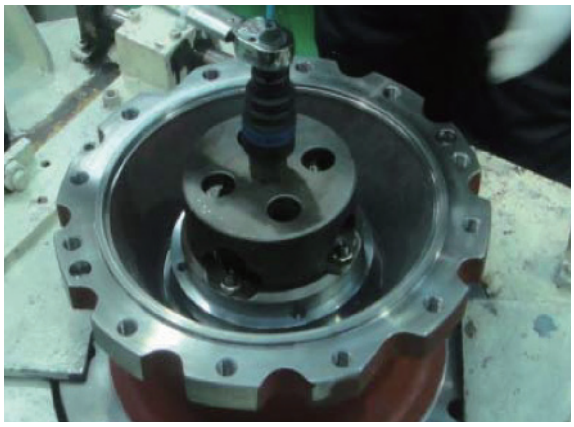
480L2SM80

④ Put ring nut into drive shaft sub assy by using special jig.
· M95 / The tightening torque :
3.5±0.4 kgf · m (25.3±2.9 lbf · ft)

※ Apply enough loctite #242 before screwing bolts.

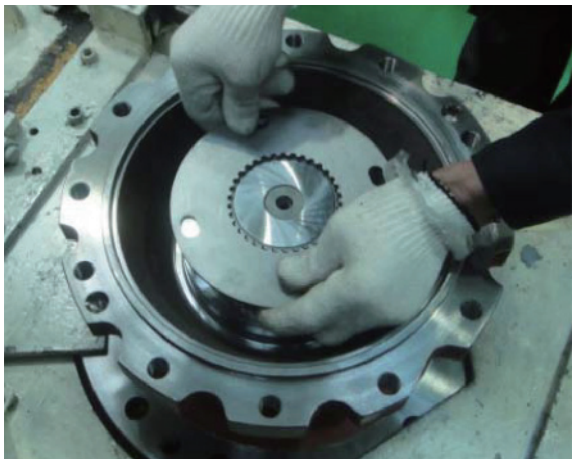


480L2SM81

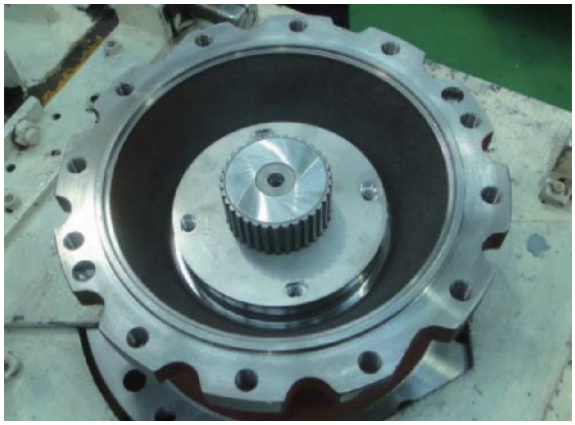


480L2SM82

⑤ Align ring nut's bolt screw with lock plate's hole.
(In case of misalign between ring nut's bolt screw and lock plate's hole, put lock plate's hole as near as possible to ring nut's bolt screw and make it in line by increasing tightening torque.)

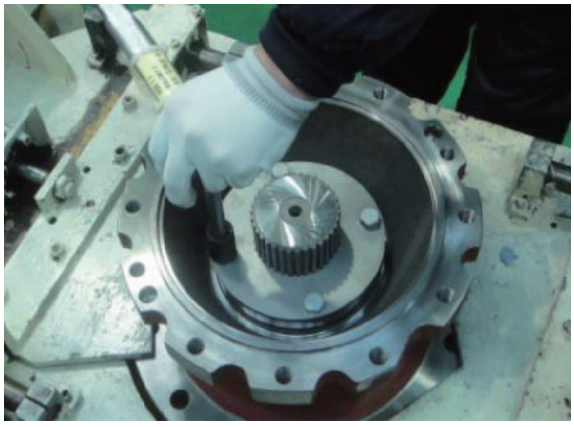


480L2SM83



480L2SM84

⑥ Screw 4 bolts (M12×16) to connect ring nut and lock plate by using torque wrench.
· 4-M12 / bolt = 12.9T
· The tightening torque :
8.8±0.9 kgf · m (63.7±6.5 lbf · ft)
※ Apply enough loctite #242 before screwing bolts.



480L2SM85

⑦ Use paint marker for checking surplus parts after assembling.



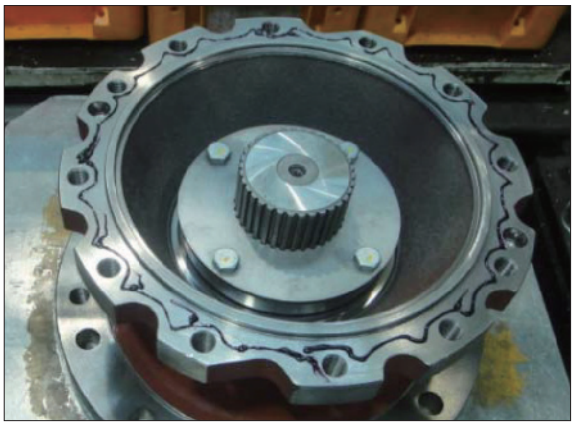
480L2SM86

(7) Assembling ring gear

① Apply loctite #515 bottom of casing sub assy contacting with ring gear without disconnection. (Refer to loctite detail)

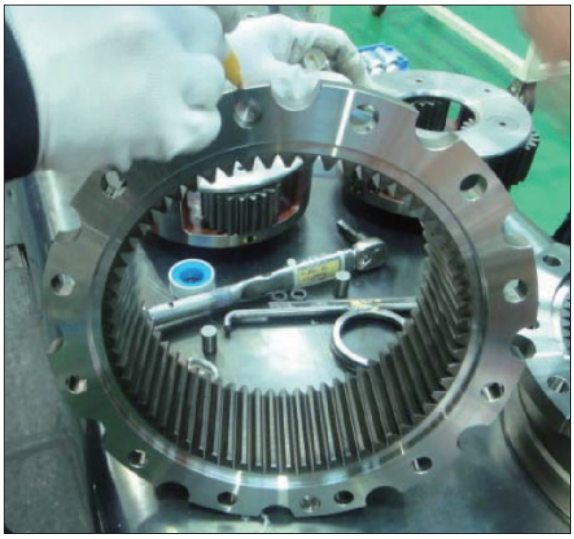


480L2SM87



480L2SM88

② Put parallel pin into casing sub assy hole. (Mark parallel pin position using paint marker.)



480L2SM89

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.)



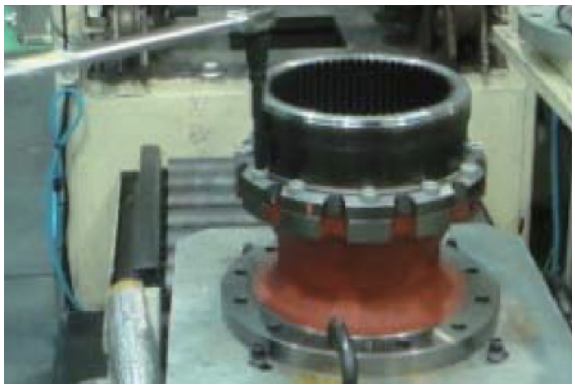
480L2SM90

④ Screw 12 bolts (M16×45) to connect casing sub assy and ring gear (1) by using torque wrench.

· 12-M16 / bolt : 12.9T

· Tightening torque : 27±2.7 kgf · m
(195±19.5 lbf · ft)

※ Apply enough loctite #242 before screwing bolts.



480L2SM91

⑤ Use paint marker for checking surplus parts after assembling.





480L2SM92

(8) Assembling carrier sub assy & sun gear

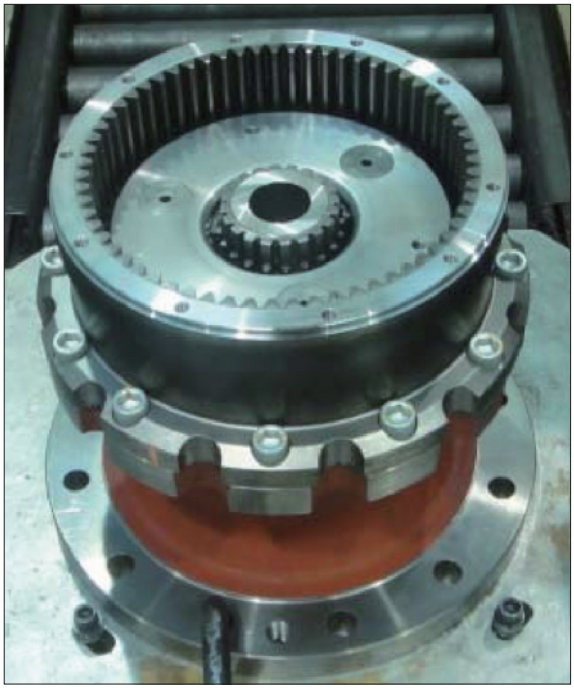
① Put No.2 carrier sub assy along drive shaft's spline.

- Screw M10 I-bolt to No.2 carrier sub assy.
- Lifting up No.2 carrier sub assy and align planetary gear and ring gear's tooth 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.



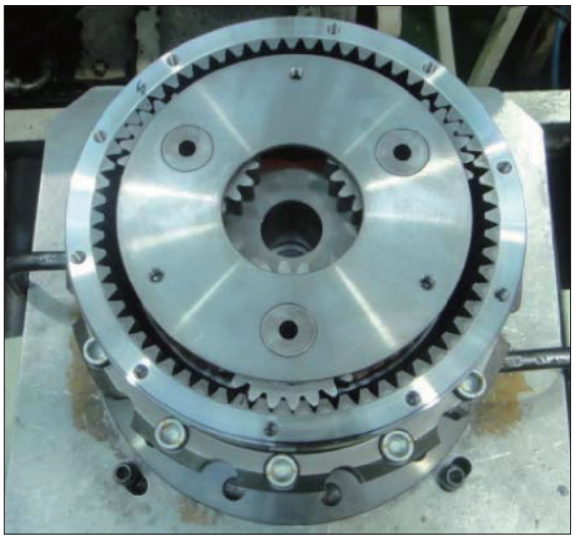
480L2SM93

② Put No.2 sun gear into No.2 carrier sub assy.



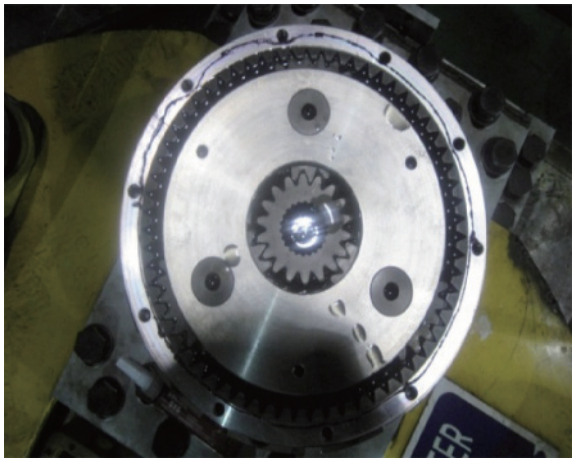
480L2SM94

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 ring gear's tooth 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.



480L2SM95

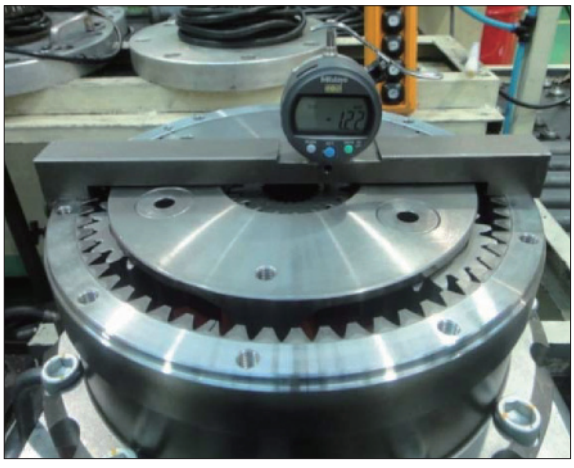
④ Put No.1 sun gear into No.1 carrier sub assy.
(Be sure to maintain it vertical with ground. And align with No.1 planetary gear spline.)
⑤ Rotate No.1 carrier sub assy by hands to check noise.



480L2SM96

(9) Measuring clearance

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)



480L2SM97

1. REMOVAL AND INSTALL

1) REMOVAL



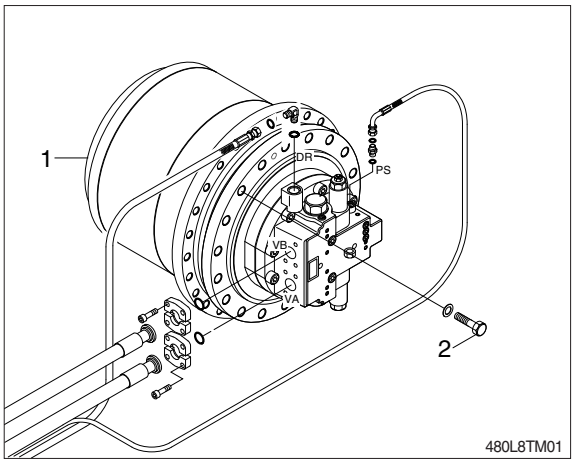
(1) Swing the work equipment 90 °and lower it completely to the ground.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.



(4) Remove the track shoe assembly.
For details, see removal of track shoe assembly.

(5) Remove the cover.

(6) Remove the hoses.

※ Fit blind plugs to the disconnected hoses.

(7) Remove the bolts and the sprocket.

(8) Sling travel device assembly (1).

(9) Remove the mounting bolts (2), then remove the travel device assembly.
- Weight : 632 kg (1393 lb)
- Tightening torque : 57.9±8.7 kgf · m (419±62.9 lbf · ft)

2) INSTALL

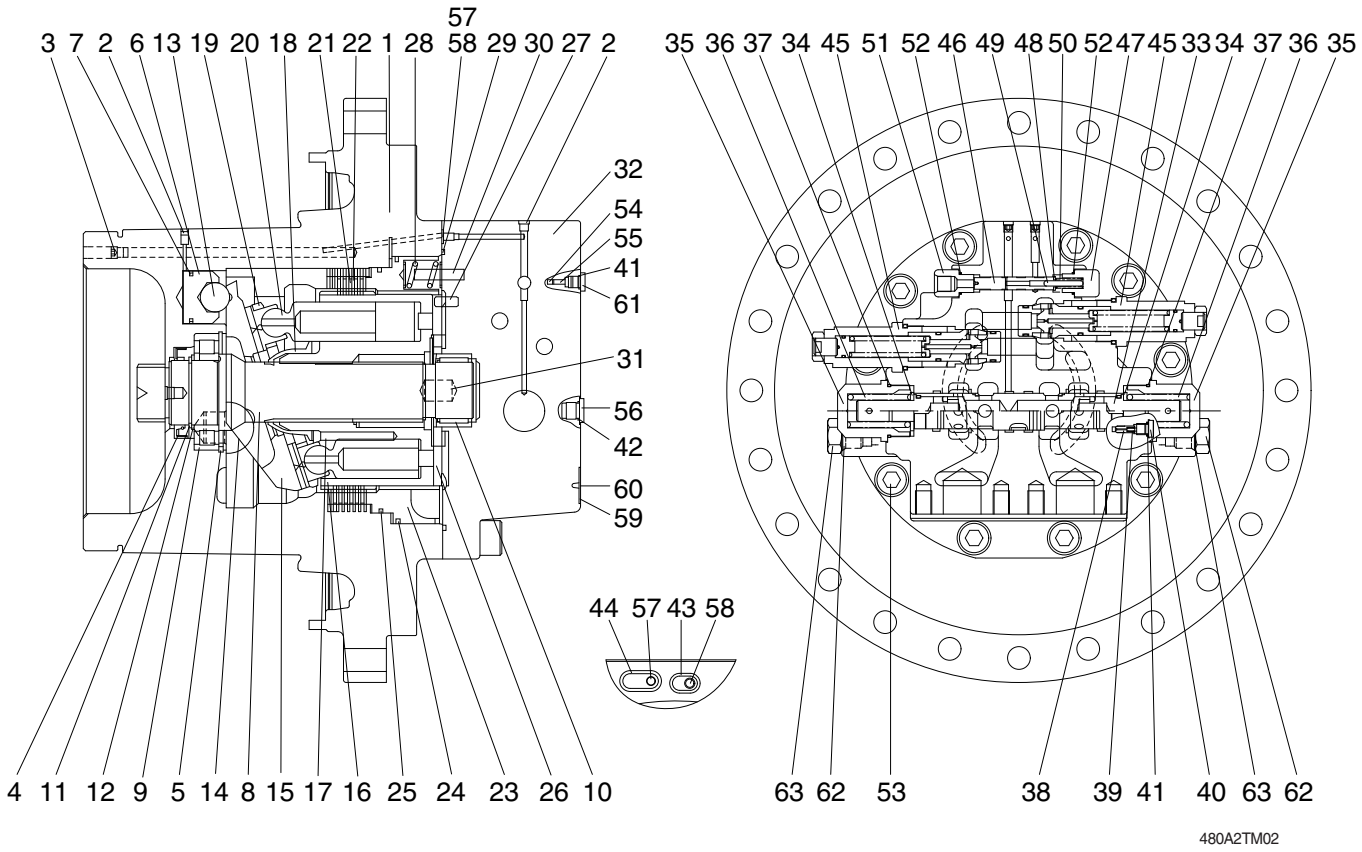
(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from the travel motor.
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling, and check oil come out from plug.
⑤ Tighten plug fully.

(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

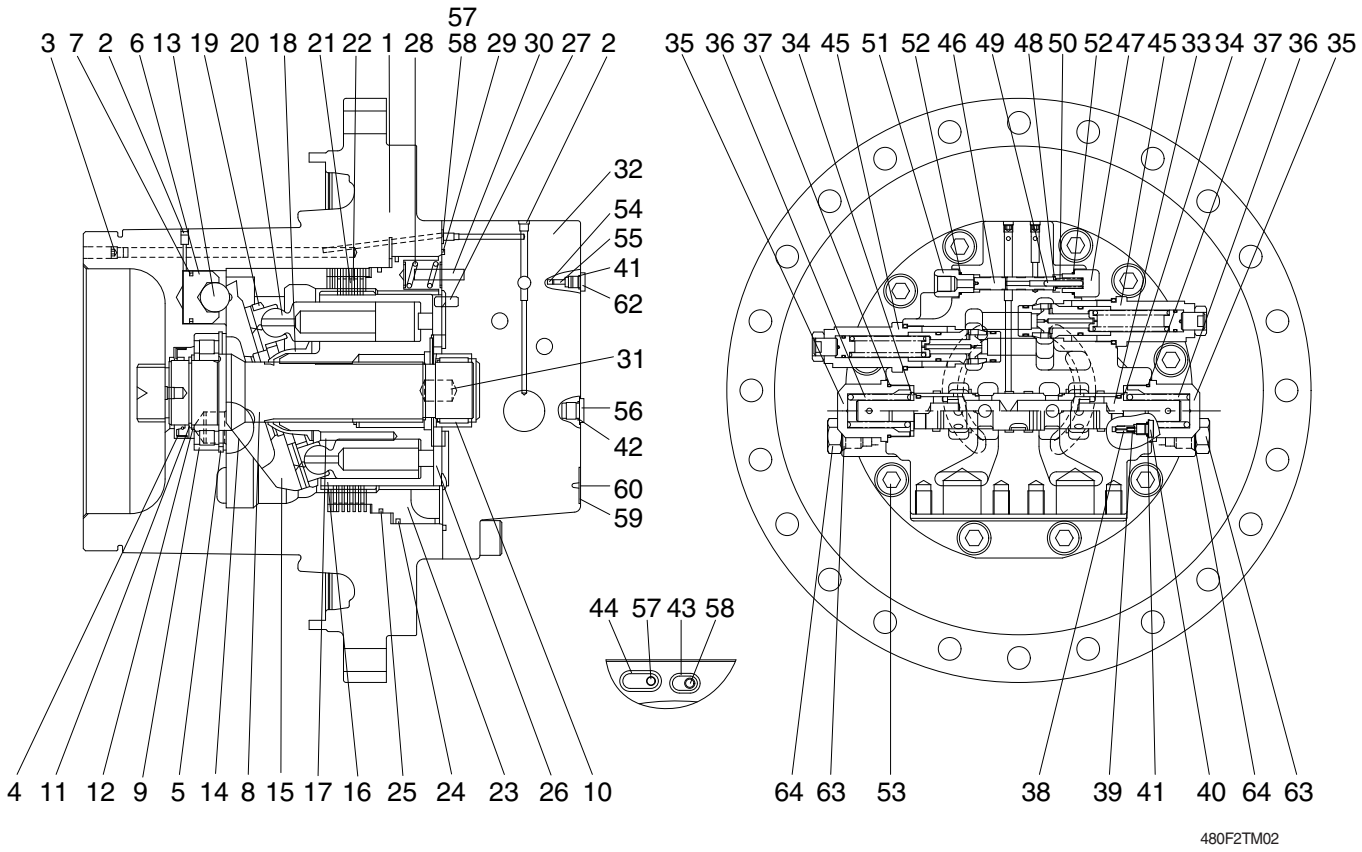
2. TRAVEL MOTOR

1) STRUCTURE (TYPE 1)



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

STRUCTURE (TYPE 2)



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

3. DISASSEMBLING OF MOTOR

1) GENERAL PRECAUTIONS

(1) Pay attention to not damaging contact surfaces for O-rings, oil seals, etc. and contact/sliding surfaces for gears, pins, bearings, etc.

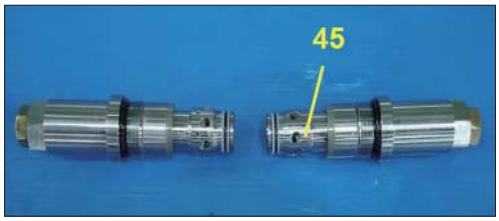
(2) This motor can be disassembled even in a state on the reduction gear.
However, in that case, pay full attention to preventing mud, dust, etc. from entering in it.

(3) The numerical in parentheses following each part name indicates its part number shown in the attached **assembly drawings.**

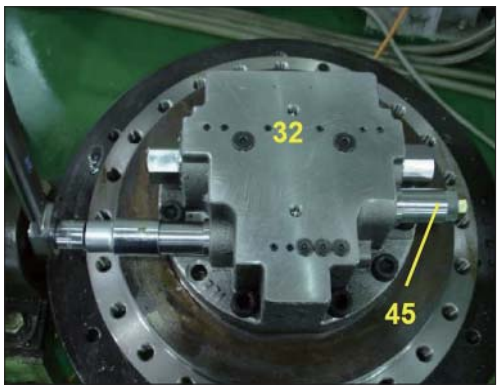
(4) The piping side of the motor is referred to as the rear side, and the output side as the front side.

2) DISASSEMBLY OF REDUCTION GEAR

(1) Disassemble relief valve assy (45) from rear cover (32) using spanner and torque wrench.

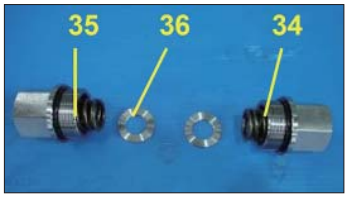


480L2TM11

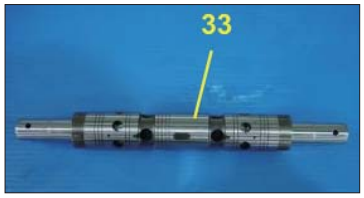


480L2TM12

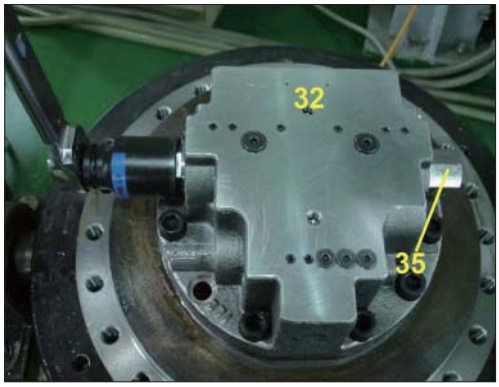
(2) Disassemble plug (35) from rear cover (32) and then disassemble spring (36), spring seat (34), main spool kit (33) in regular sequence.



480L2TM13

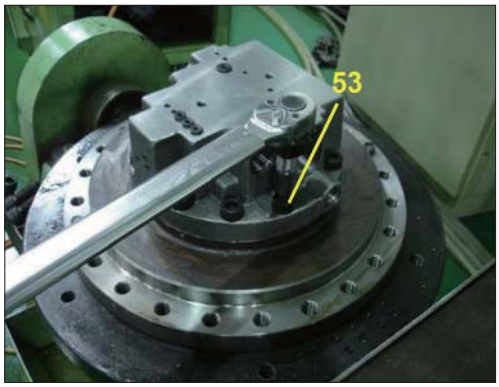


480L2TM14



480L2TM15

(3) Disassemble socket bolt (53)-10EA using torque wrench.



480L2TM16

(4) Take out rear cover (32) from casing (1).



480L2TM17

(5) Disassemble parking piston (23) using jig.

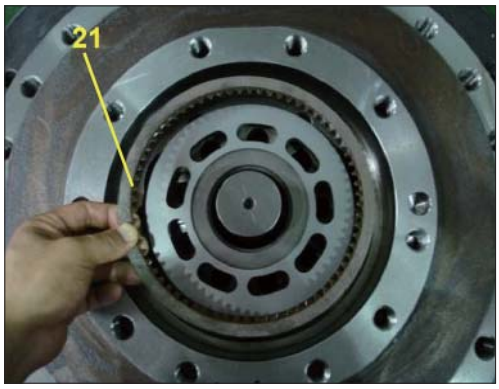


480L2TM19



480L2TM18

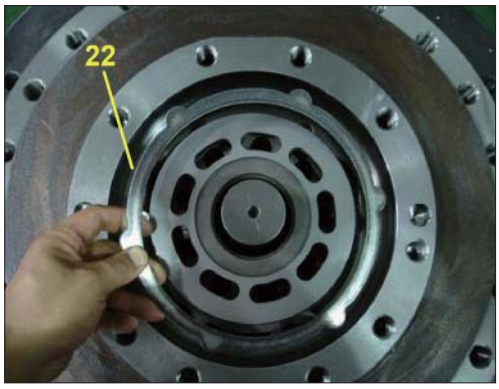
(6) Disassemble separate plate (22)-7EA, friction plate (21)-6EA



480L2TM21



480L2TM20

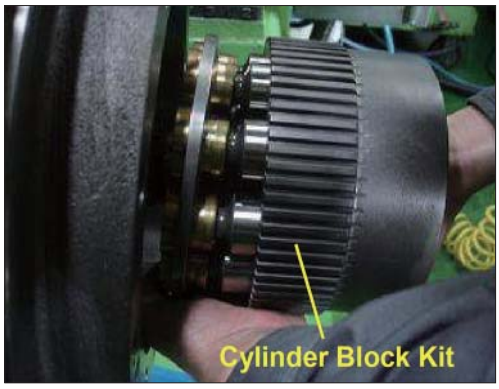


480L2TM23



480L2TM22

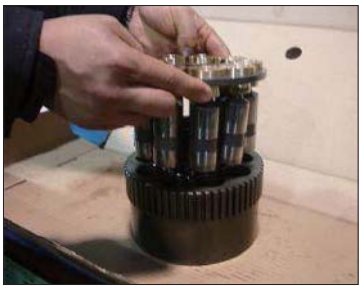
(7) Remove rotary block kit.
It is easier to work by placing the casing (1) horizontal.

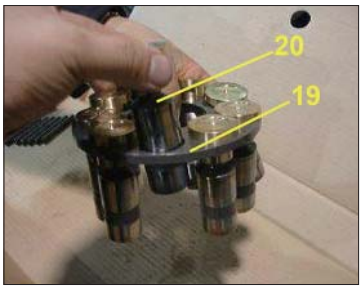


480L2TM24

(8) Disassemble rotary block (16), retaner plate (19), piston and shoe (20), ball guide (18), spring (17) from rotary block kit.


480L2TM25

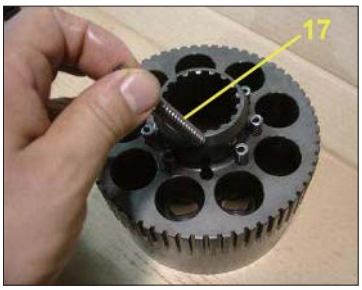

480L2TM26



480L2TM27



480L2TM28



480L2TM29

(9) Disassemble swash plate (15) from shaft casing (1).



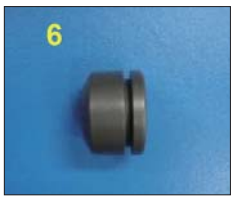
480L2TM30


480L2TM31

(10) Disassemble steel ball (13), swash piston (6) Hole in the casing (1) of two speed line is decomposed by injecting oil.



480L2TM32



480L2TM33



480L2TM34

(11) Disassemble pivot (14)-2EA from casing (1).



480L2TM35

(12) Disassemble retainer ring (5) using pliers.

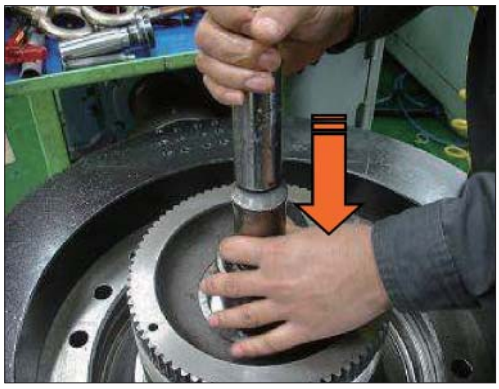


480L2TM36

(13) In the casing (1), the arrow part of the shaft (8) using a rubber mallet taps and then disassemble the shaft (8) and roller bearing (9) to the other side.



480L2TM37



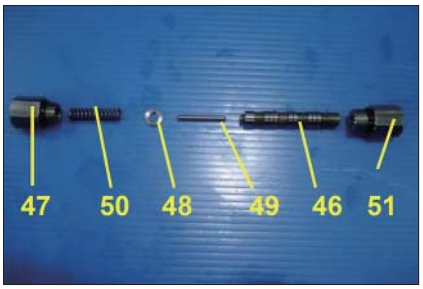
480L2TM38

(14) Disassemble valve plate (36) from rear cover (32).



480L2TM39

(15) Disassemble plug (47), connector (51) from rear cover (32) and then disassemble spring (50), spring seat (48), parallel pin (49), spool (46) in regular sequence.

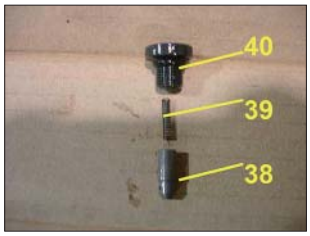


480L2TM40

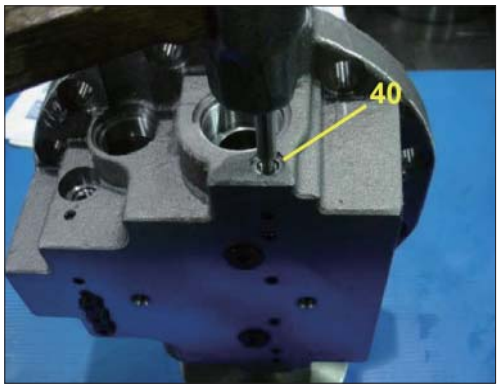

480L2TM41


480L2TM42

(16) Disassemble plug (40) from rear cover (32) and then disassemble spring (39), restictor (38) from rear cover (34) in regular sequence.

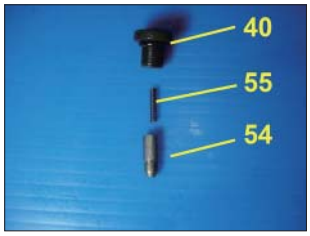


480L2TM43

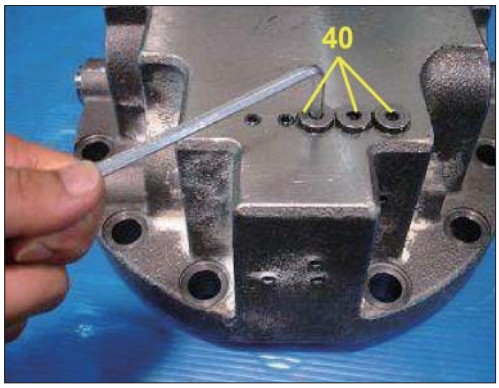


480L2TM44

(17) Disassemble plug (40) from rear cover (32) and then disassemble spring (55), check valve (54) from rear cover (32) in regular sequence.

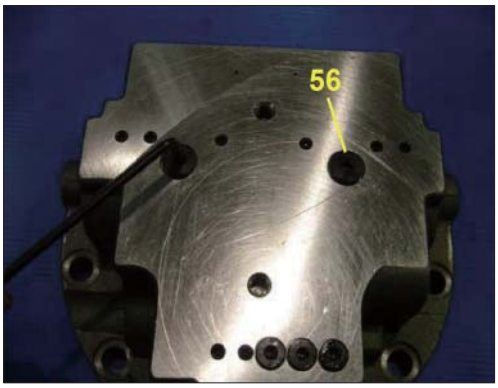


480L2TM45



480L2TM46

(18) Disassemble plug (56) from rear cover (32).

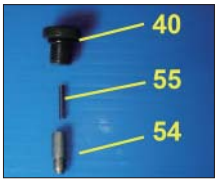


480L2TM47

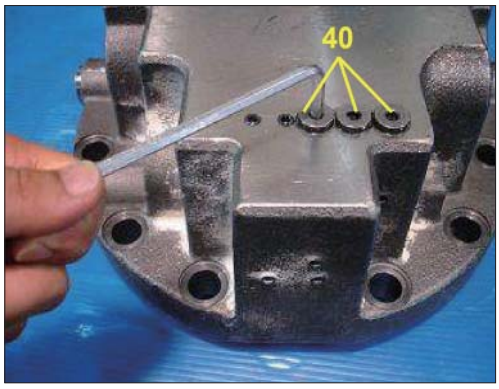
2) ASSEMBLY OF MOTOR

(1) Insert check valve (54), spring (55) into rear cover (32) and then assemble plug (40) using torque wrench.

· Tightening torque : 3.0±0.3 kgf · m
(21.7±2.2 lbf · ft)



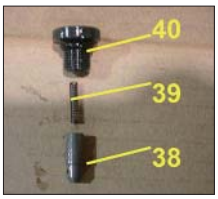
480L2TM48



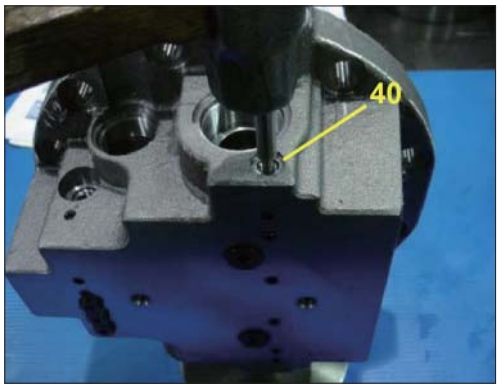
480L2TM49

(2) Insert restrictor (38), spring (39) into rear cover (32) and then assemble plug (40) using torque-wrench.

· Tightening torque : 3.0±0.3 kgf · m
(21.7±2.2 lbf · ft)



480L2TM50

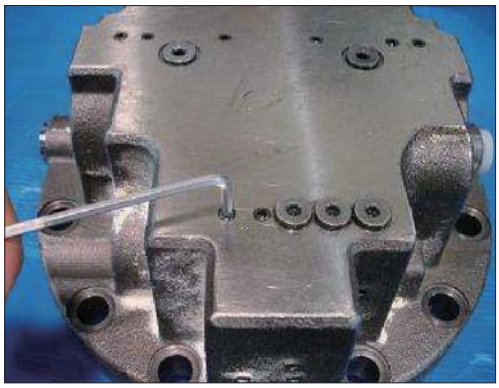


480L2TM51

(3) Apply loctitle #242 on the 14-NPTF 1/16 plug (2) and then assemble 14-NPTF 1/16 plug (2) into rear cover (32).



480L2TM52

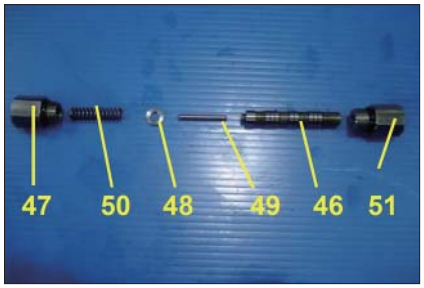

480L2TM53

(4) Assemble 2-PF1/4 plug (56, 61) using torque-wrench.

· Tightening torque : 4.5±0.5 kgf · m
(32.5±3.6 lbf · ft)


480L2TM54

(5) Insert spool (46), parallel pin (49), spring seat (48), spring (50) in regular sequence and then assemble plug (47), connector (51) using torque wrench.
・Tightening torque : 5.5±0.5 kgf・m (40±3.6 lbf・ft)



480L2TM55


480L2TM56


480L2TM57

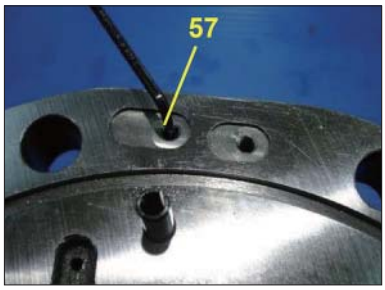
(6) Press needle bearing (10) into rear cover (32) using jig.


480L2TM58

(7) Assemble spring pin (30), parallel pin (27) using small hammer.


480L2TM59

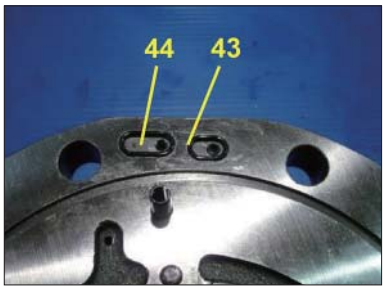
(8) Apply loctitle #242 on the restrictor (57, 58) and then assemble restrictor (57, 58), O-ring (43, 44) into rear cover (32).



480L2TM60



480L2TM61



480L2TM62

(9) Assemble valve plate (26) into rear cover (32). Apply grease to the valve plate contact and then assemble valve plate into rear cover (32).



480L2TM63

(10) Apply grease to the O-ring (29), and then assemble O-ring into rear cover (32).

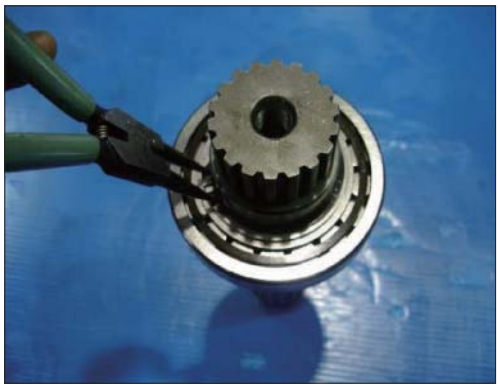


480L2TM64

(11) Assemble the heated roller bearing (9) onto the shaft (8) and then assemble retainer ring (5) into shaft (8).

① The temperature of the roller bearing : 100˚C
* Using tool : heater.

② Be careful not to damage the sliding surface for the oil seal on the shaft.



480L2TM65



480L2TM66



480L2TM67



480L2TM68

(12) Install casing (1) into assembling jig.



480L2TM69

(13) Assemble plug (2), (3) into casing (1).

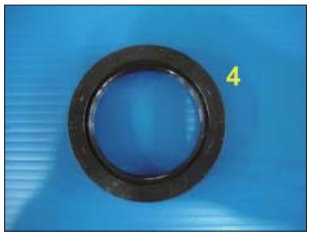


480L2TM70



480L2TM71

(14) Assemble oil seal (4) into casing (1) with assembling jig.

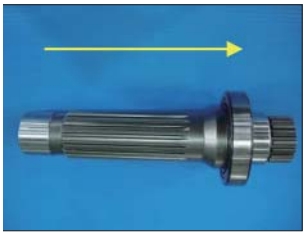


480L2TM72

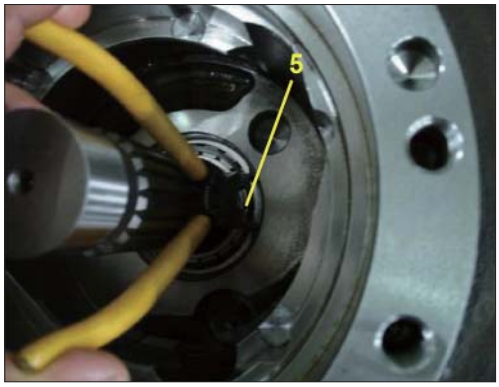


480L2TM73

(15) Insert assembled shaft assy in the direction of the arrow into casing (1) using a rubber mallet.

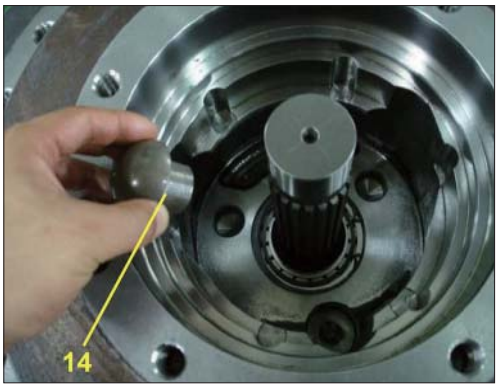

480L2TM74


480L2TM75



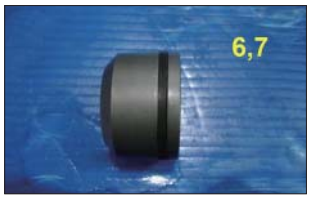
480L2TM76

(16) Apply the grease to pivot (14)-2EA and then assemble pivot (14) into casing (1).

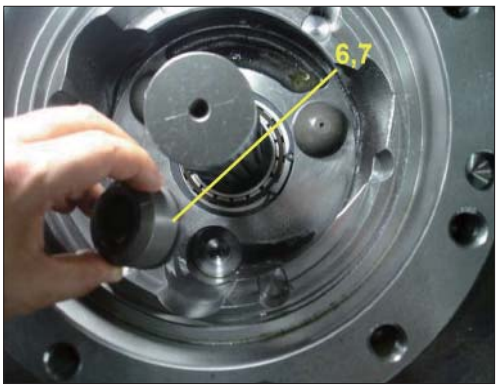


480L2TM77

(17) Warm piston seal (7) and assemble it on swash piston (6) and then bind the piston seal (7) with a bend for a minute.
Remove the bend and assemble it into casing (1).



480L2TM78

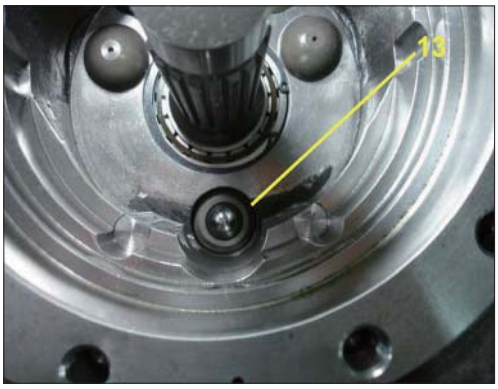


480L2TM79

(18) Apply the grease to steel ball (13) and then assemble steel ball (13) into casing (1).



480L2TM80

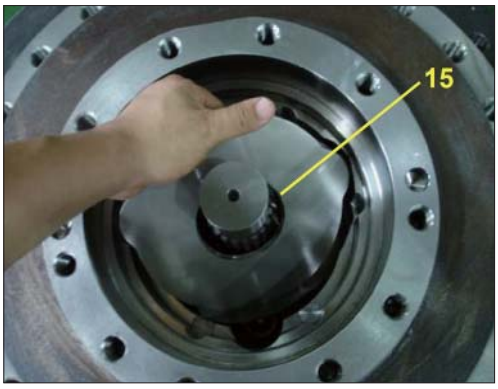


480L2TM81

(19) Apply the grease to swash plate (15) and then assemble swash plate (15) into casing (1).

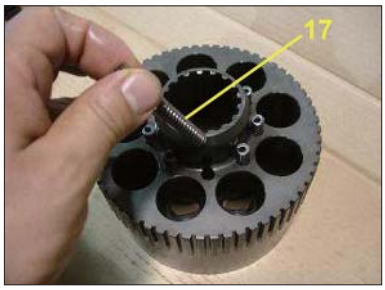


480L2TM82



480L2TM83

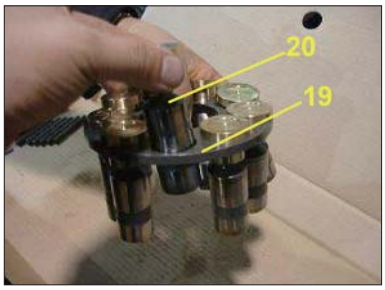
(20) Assemble spring (17), ball guide (18), retainer plate (19), piston and shoe (20) into rotary block (16) in regular sequence.



480L2TM84



480L2TM85

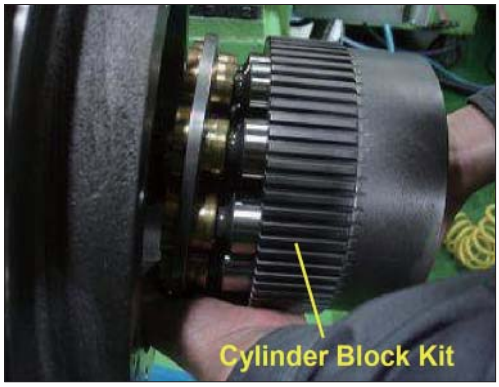


480L2TM86


480L2TM87

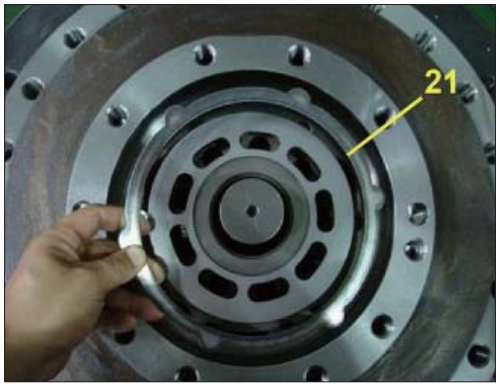

480L2TM88

(21) Assemble rotary block kit into casing (1).

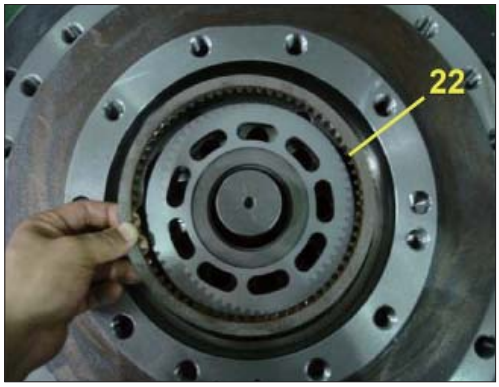


480L2TM89

(22) Assemble separate plate (22), friction plate (21) into rotary block in regular sequence.
Friction plate : 6 EA
Separate plate : 7 EA



480L2TM90



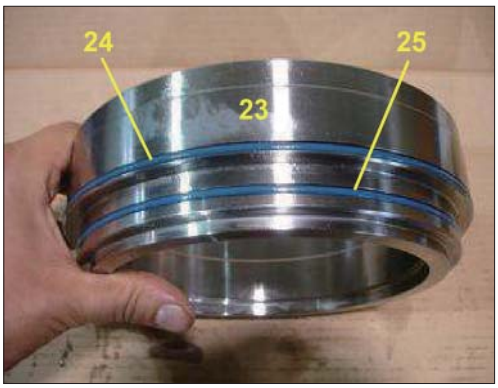
480L2TM91

(23) Assemble parallel pin (31) into casing (1).



480L2TM92

(24) Apply the grease to D-ring (24,25) and then assemble D-ring (24, 25) into parking piston (23)



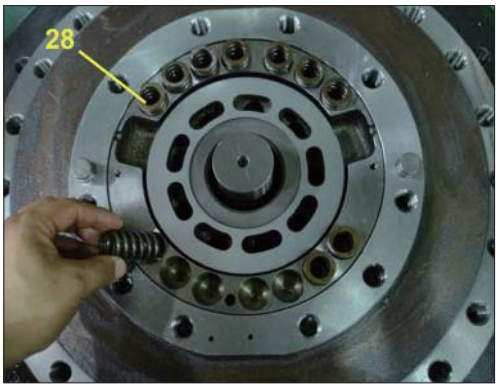
480L2TM93

(25) Assemble parking piston (23) into casing using jig.



480L2TM94

(26) Assemble parking spring (28)-14EA.



480L2TM95

(27) Put on the rear cover (32) on the casing (1).



480L2TM96



480L2TM97

(28) Assemble rear cover (32) into casing (1) and then tighten the socket bolt (53) using torque wrench.

・Tightening torque : 33±3.3 kgf・m
(239±23.9 lbf・ft)

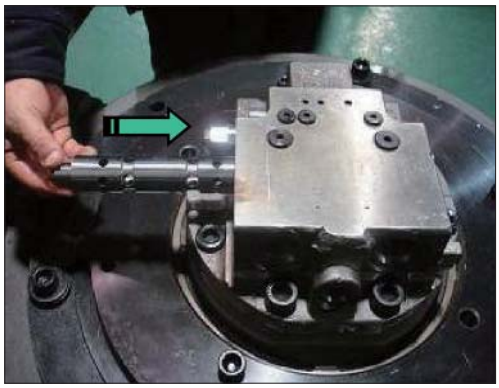


480L2TM98

(29) Assemble main spool kit (33) into rear cover (32) after checking the direction to be correct.



480L2TM99



480L2TM100

(30) Assemble spring (36), plug (35) into rear cover (32) in regular sequence and then plug (35) into rear cover (32) using torque wrench.

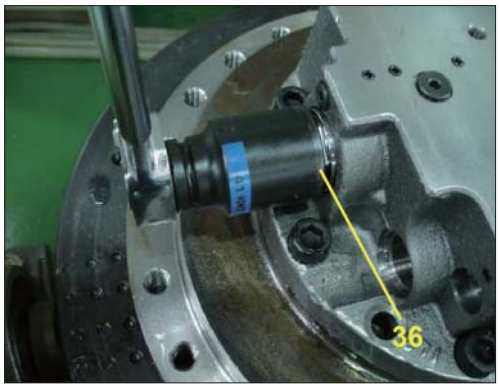
・Tightening torque : 45±4.5 kgf・m (325±32.5 lbf・ft)



480L2TM101



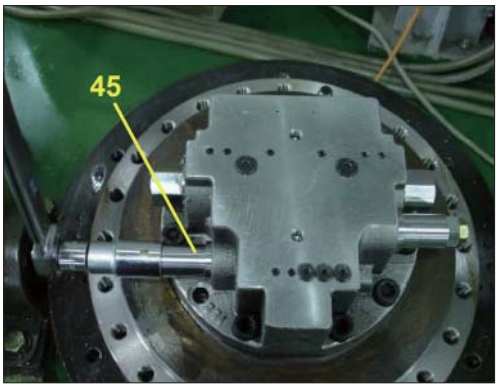
480L2TM102



480L2TM103

(31) Assemble relief valve assy (45) using torque wrench.

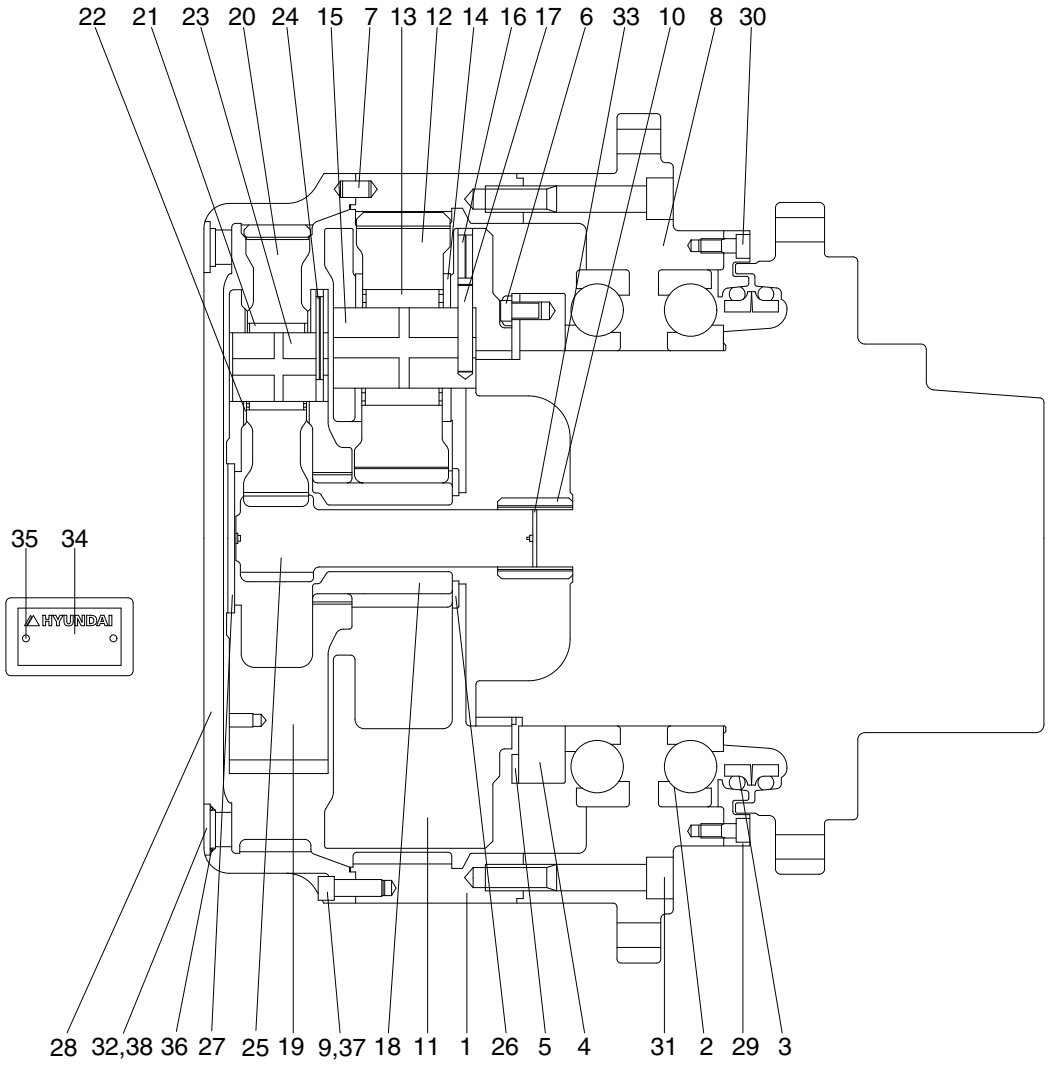
· Tightening torque : 26±2.6 kgf·m
(188±18.8 lbf·ft)



480L2TM104

4. TRAVEL REDUCTION GEAR

1) STRUCTURE



480A2TM03

1	Ring gear	14	Thrust washer	27	Thrust plate
2	Ball bearing	15	Carrier pin No. 2	28	Cover
3	Floating seal assy	16	Spring pin	29	Cover seal
4	Ring nut	17	Solid pin No. 2	30	Hex socket head bolt
5	Lock plate	18	Sun gear No. 2	31	Hex socket head bolt
6	Hexagon head bolt	19	Carrier No. 1	32	Plug
7	Parallel pin	20	Planetary gear No. 1	33	Retainer ring
8	Housing	21	Needle bearing	34	Name plate
9	Hexagon socket head bolt	22	Thrust washer	35	Rivet
10	Coupling	23	Carrier pin No. 1	36	O-ring
11	Carrier No. 2	24	Spring pin	37	Rubber cap
12	Planetary gear No. 2	25	Sun gear No. 1	38	Rubber cap
13	Needle bearing	26	Thrust plate		

5. DISASSEMBLY OF REDUCTION GEAR

1) READY FOR DISASSEMBLING

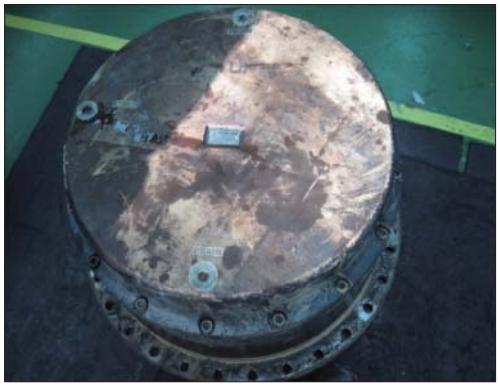
(1) Reduction gear removed from machine usually covered with dirt, so clean it with cleaning liquid and dry it.

(2) Put reduction gear on stable place with drain port down side and remove oil plug (PF3/4) to pull-out gear oil through drain port.

※ When the oil is hot, there are high chance to blow out hot oil because of the pressure difference between container and out side.

(3) Set reduction gear on work table.

(4) Mark surface of cover, ring gear and housing for proper reassembly.



480L2TM201

2) PUT REDUCTION GEAR ON WORK TABLE TO DISASSEMBLE

(1) Set eye bolt (M20) into M20 tap hole on housing flange. Make reduction gear cover upper direction using hoist machine.

⚠ **Be aware of safety. There are some chances of accidents when put down the reduction gear. Do not place the part pall on your foot.**



480L2TM202

3) COVER REMOVE

(1) Remove 16 of bolt-hex. socket head (M12X35L) connecting cover and ring gear using torque wrench.

(2) Using sharp tools to separate cover and ring gear. Put sharp tools into the gap between ring gear and cover and tap the tool tenderly.



480L2TM203

4) REMOVE THRUST PLATE AND NO.1 CARRIER SUB

(1) Remove thrust plate first, set eye bolt (M10) in No.1 carrier tap hole. After these, pull-up No.1 carrier assy slowly.



480L2TM204

(2) Remove No.1 sun gear from reduction gear slowly.

※ When disassemble No.1 sun gear, be sure to keep vertical against ground with No.1 sun gear.

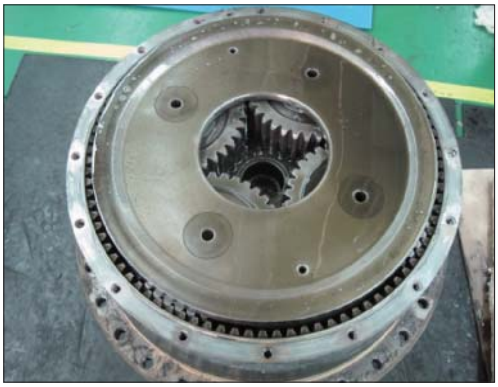


480L2TM205

5) REMOVE NO.2 CARRIER SUB

(1) Remove No.2 sun gear slowly.

※ When disassemble No.2 sun gear, be sure to keep vertical against ground with No.2 sun gear.



480L2TM206

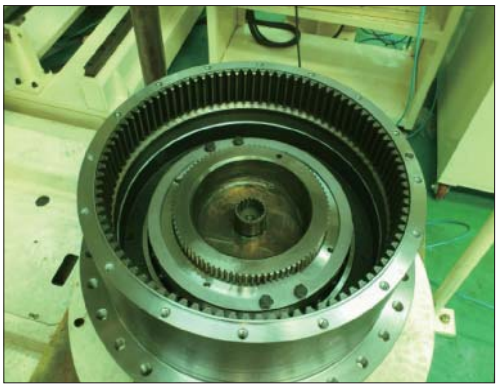
(2) Set eye bolt (M10) in No.2 carrier assy, pull-up slowly.



480L2TM207

6) REMOVE COUPLING

(1) Remove coupling on motor spline.

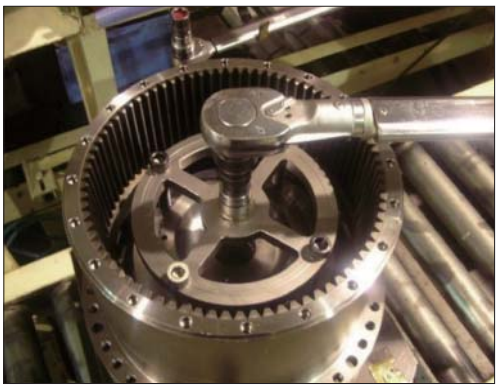


480L2TM208

7) REMOVE RING NUT AND LOCK PLATE

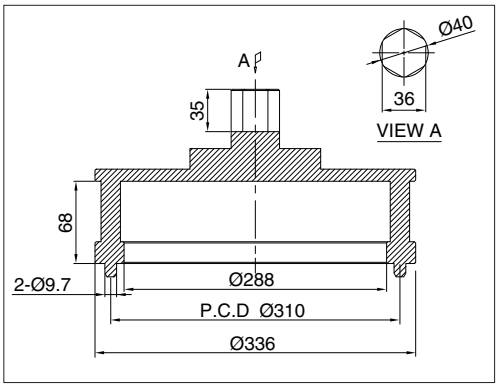
(1) Remove hex head bolt (M12×20L) using torque wrench which is connecting ring nut and lock plate.

(2) Remove lock plate from motor casing spline.



480L2TM209

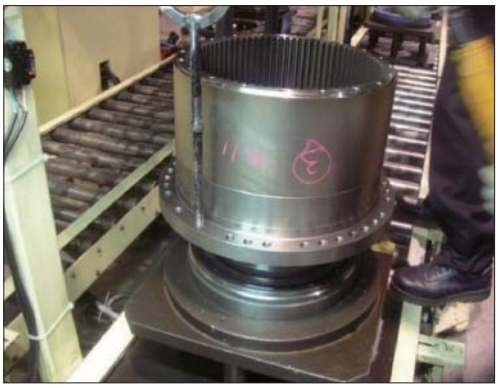
(3) Remove ring nut using designed tools.



480L8TM03

8) DISASSEMBLE RING GEAR AND HOUSING

(1) Set eye bolt (M20) in flange of housing, pulling ring gear and housing from motor.



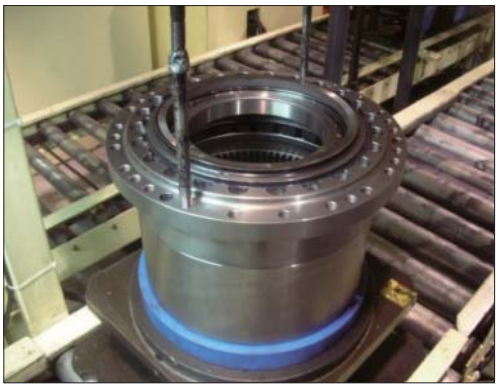
480L2TM210

(2) Put disassembled ring gear and housing on work table. Be sure to set floating seal upper side, and remove floating seal.

※ Do not re-use floating seal.

(3) Remove hex socket head bolt (M20×120L) connecting housing and ring gear using torque wrench.

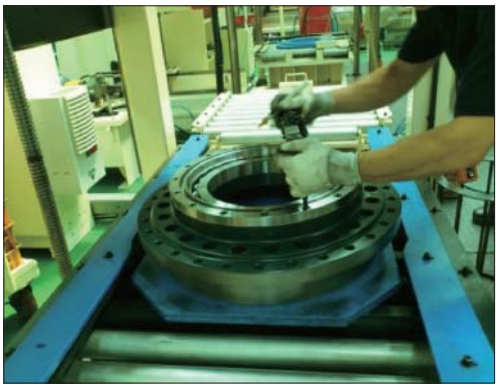
(4) Put sharp tool into gap between ring gear and housing and tap it tenderly to separate gear and housing.



480L2TM212

9) DISASSEMBLE HOUSING COMPONENTS

Hex socket head bolt (M10×25L) connecting housing and seal cover using torque wrench, and remove seal cover.

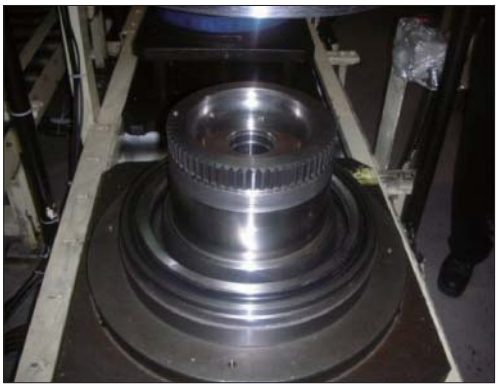


480L2TM213

10) SEPARATE MOTOR CASING AND FLOATING SEAL

Pull floating seal in motor casing slowly and remove floating seal from motor casing.

※ Do not re-use floacting seal.



480L2TM211

11) NO.1 CARRIER ASS'Y DISASSEMBLE

(1) Put spring pin into spring pin hole using specially designed tool.



480L2TM214

(2) Disassemble No.1 planetary gear, thrust washer, spring pin, needle bearing form No.1 carrier.

※ Do not re-use spring pin.



480L2TM215

12) NO.2 CARRIER ASS'Y DISASSEMBLE

(1) Cut No.2 solid pin by pressing spring pin using press machine.

⚠ **Be aware of scattering of components when operator use press machine.**

(2) Disassemble No.2 planetary gear, thrust washer, spring pin, needle bearing from No.2 carrier.

※ Do not re-use spring pin.



480L2TM216

3. ASSEMBLY OF REDUCTION GEAR

1) GENERAL PRECAUTIONS

(1) Clean all components with kerosene and dry them in shade. Remove all loctite with solvent. Check the components.
Apply loctite #262 on thread of bolt-hex.socket head.
Be aware of dropping of parts on foot and safety accident.
Check the quantity of all parts in advance.

(2) Check the abnormality of thrust washer like twist or wear.

(3) Check the surface of every gear. Whether there is pitting or crack on them.

(4) Rolling the bearing and check the rolling condition and the noise.

(5) Check the surface of floating seal and crack of O-ring.

2) NO.1 CARRIER ASSEMBLY

(1) Set No.1 carrier on stable and even place.
(2) Put needle bearing in No.1 planetary gear and place thrust washer 2 pcs on both side of gear. Assemble gear in carrier.



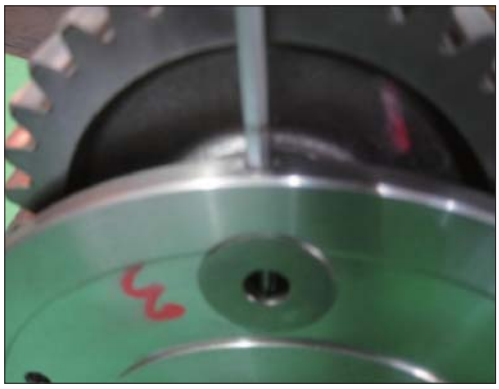
480L2TM217

(3) Align spring pin with No.1 carrier spring pin hole and assemble spring pin accordingly.



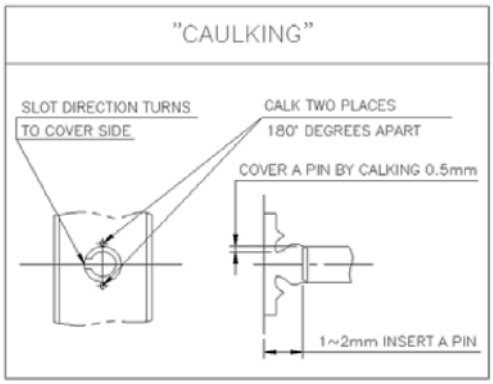
480L2TM218

(4) Put spring pin into No.1 carrier using jig with force.



480L2TM221

(5) Caulking both side of pressed spring pin 180˚ using caulking jig.



480L2TM219

3) NO.2 CARRIER ASSEMBLY

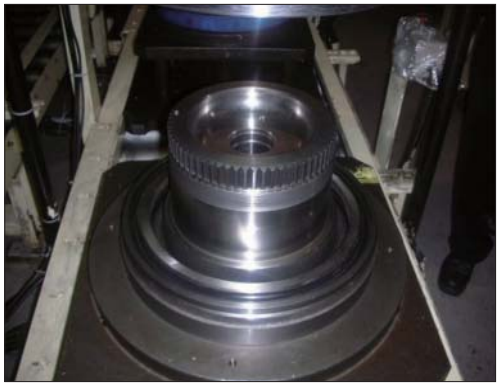
(1) Set No.2 carrier on stable and even place.
(2) Put needle bearing in No.2 planetary gear and place thrust washer 2 pcs on both side of gear. Assemble gear in carrier.
(3) Align solid pin hole of spring pin and No.2 carrier spring pin hole. and assemble spring pin accordingly.
(4) After assembly solid pin, put spring pin with force.
(5) Caulking both sides of pressed spring pin 180˚ using caulking jig.


480L2TM220

4) FLOATING SEAL ASSEMBLY

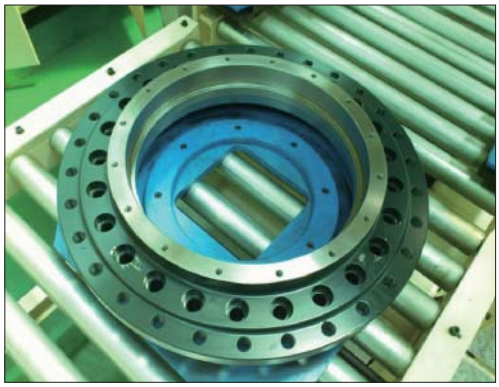
Wipe O-ring side of floating seal and contact surface of floating seal of motor casing with oil applied lint free towel, and press fitting floating seal into motor casing with special jig.

※ Keep the floating seal vertical against ground.


480L2TM222

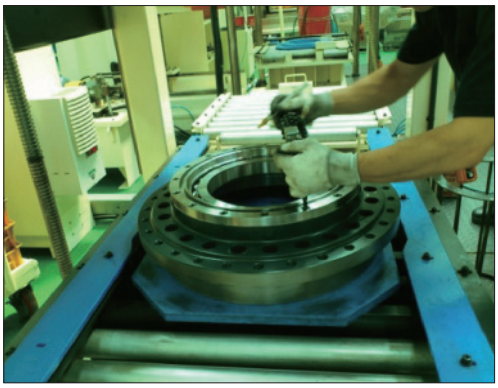
5) HOUSING & MAIN BEARING ASSEMBLY

(1) Heating and cleaning housing with 60~70˚C temperature.
(2) Set the housing on working table safely, press fitting main bearing into both side of housing.


480L2TM224

6) SEAL COVER ASSEMBLY

Apply three bond #1194 on contact surface of housing and seal cover, tighten hex socket head bolt (M10×25L) with designed torque 6.3±0.6 kgf · m (45.6±4.3 lbf · ft) using torque wrench.

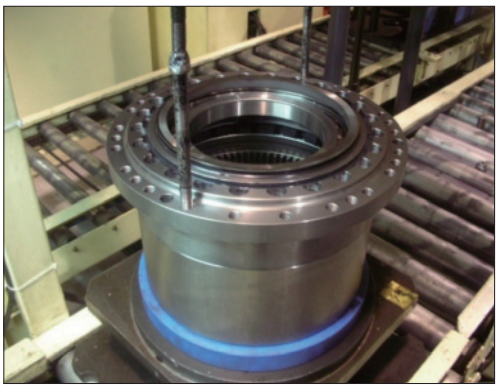


480L2TM225

7) HOUSING COMPONENTS AND RING GEAR ASSEMBLY

(1) Apply three bond #1194 on the surface of ring gear and housing contact surface, tighten hex socket head bolt (M20×120L) with designed torque 53±5.3 kgf · m (383±38.3 lbf · ft) using torque wrench.

(2) Wipe O-ring side of floating seal and contact surface of floating seal of seal cover with oil applied lint free towel, and press fitting floating seal into seal cover.



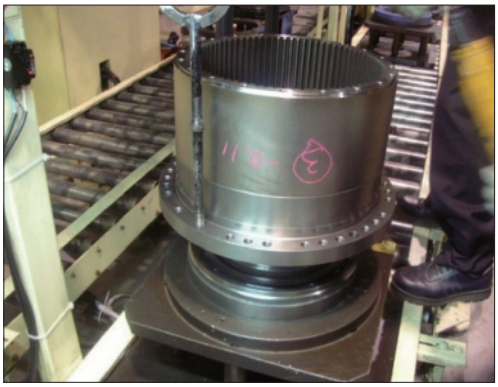
480L2TM223

8) MOTOR & ASSEMBLED HOUSING COMPONENTS ASSEMBLY

(1) Set eye bolt (M20) in housing flange tap hole.

(2) Assemble assembled housing components on motor using hoist.

※ Be sure set eye bolt firmly to keep operator safe.



480L2TM226

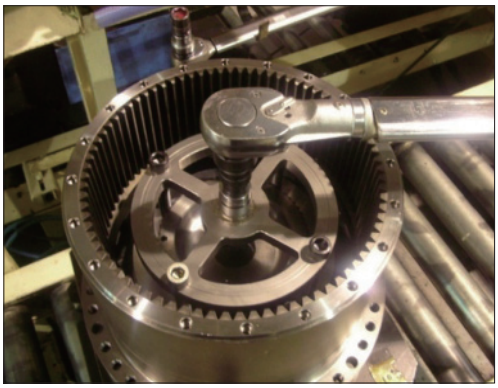
9) NUT RING AND LOCK PLATE ASSEMBLY

(1) Tighten nut ring with designed torque using torque wrench.

· Tightening torque : 66±6 kgf · m
(477±43.4 lbf · ft)

(2) Set lock plate along with bolt hole of nut ring and assemble them.

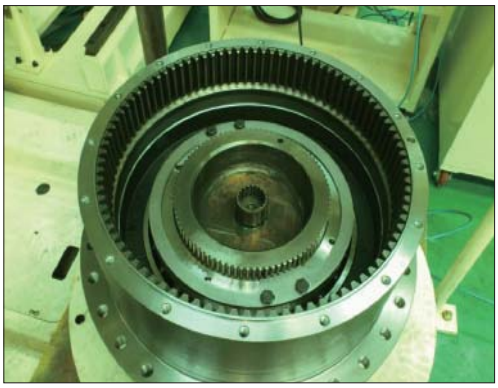
(3) Tighten hex head bolt (M12×20L) with designed torque 8.8±0.9 kgf · m (63.6±6.5 lbf · ft).



480L2TM228

10) COUPLING ASSEMBLY

Assemble coupling with motor's spline.



480L2TM230

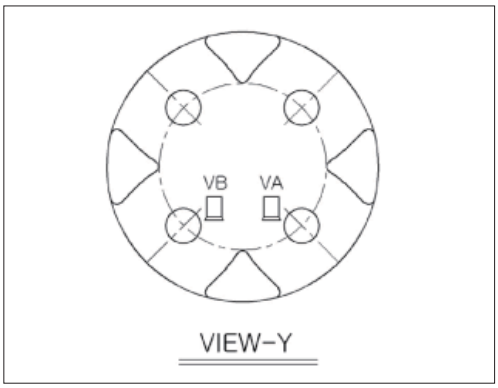
11) NO.2 CARRIER SUB ASSEMBLY

(1) Set eye bolt (M10) in No.2 carrier assy, lift them using hoist and set down No.2 carrier assy into motor.



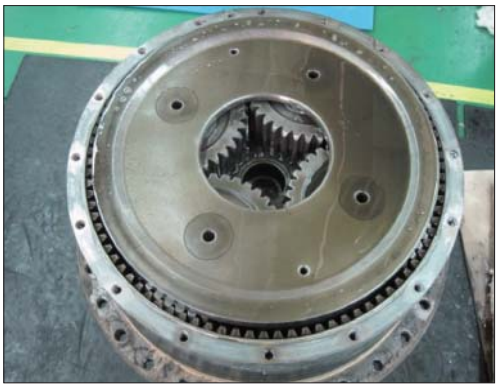
480L2TM229

※ To set the align valve ports, refer to right drawing.



480L2TM231

(2) Assemble No.2 sun gear into No.2 carrier assy.



480L2TM227

12) NO.1 CARRIER SUB ASSEMBLY

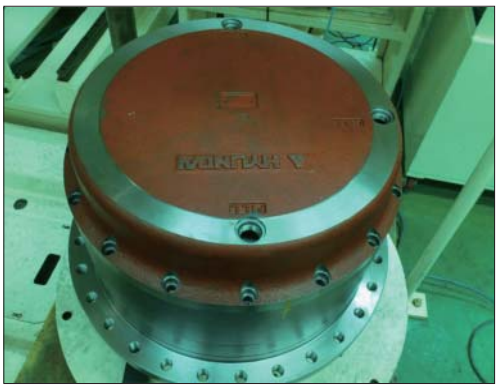
(1) Set eye bolt (M10) in No.1 carrier tap hole and set down No.1 carrier assy slowly.
(2) Assemble No.1 sun gear and No.1 carrier assy.
(3) Assemble thrust plate and carrier.



480L2TM232

13) COVER ASSEMBLY

(1) Put parallel pin (Ø13×20L) into parallel pin hole of ring gear with rubber hammer.
(2) Apply three bond #1194 on cover contacting surface of ring gear and assemble cover.
(3) Tighten 16 of hex socket head bolt (M12×35L) with designed torque 14.3±1.4 kgf · m (103± 10.1 lbf · ft) using torque wrench.



480L2TM233

14) PUTTING GEAR OIL

(1) Put gear oil 12±0.5L through drain port and check the level gage.
(2) Tighten oil plug with torque 10±1.0 kgf · m (72.3±7.2 lbf · ft).

TRAVEL DEVICE (TYPE 3)

1. REMOVAL AND INSTALL

1) REMOVAL

(1) Swing the work equipment 90˚and lower it completely to the ground.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(4) Remove the track shoe assembly.
For details, see removal of track shoe assembly.

(5) Remove the cover.

(6) Remove the hose.

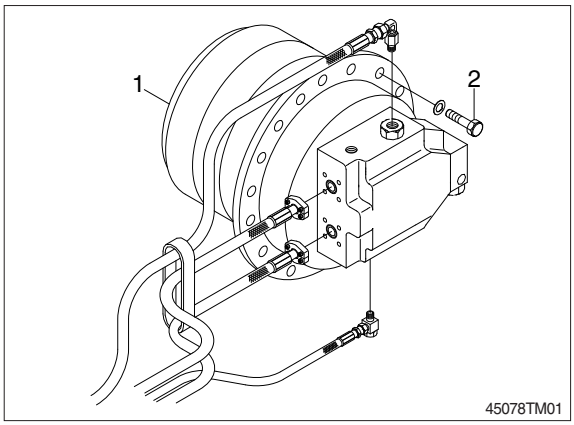
※ Fit blind plugs to the disconnected hoses.

(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 : 360 kg (790 lb)
- Tightening torque : 57.9±8.7 kgf · m (419±62.9 lbf · ft)





2) INSTALL

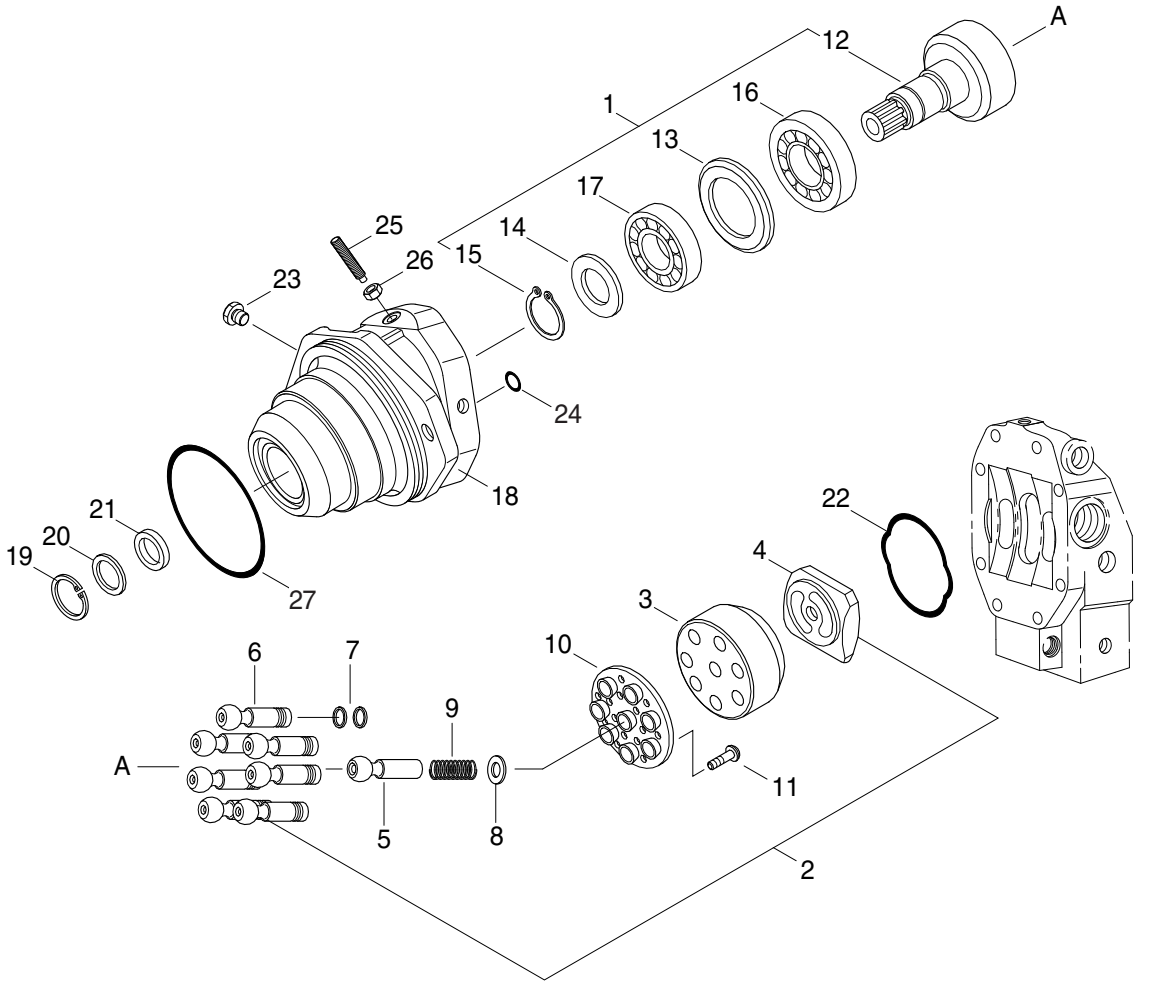
(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from the travel motor.
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling, and check oil come out from plug.
⑤ Tighten plug fully.

(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. TRAVEL MOTOR (1/2)

1) STRUCTURE

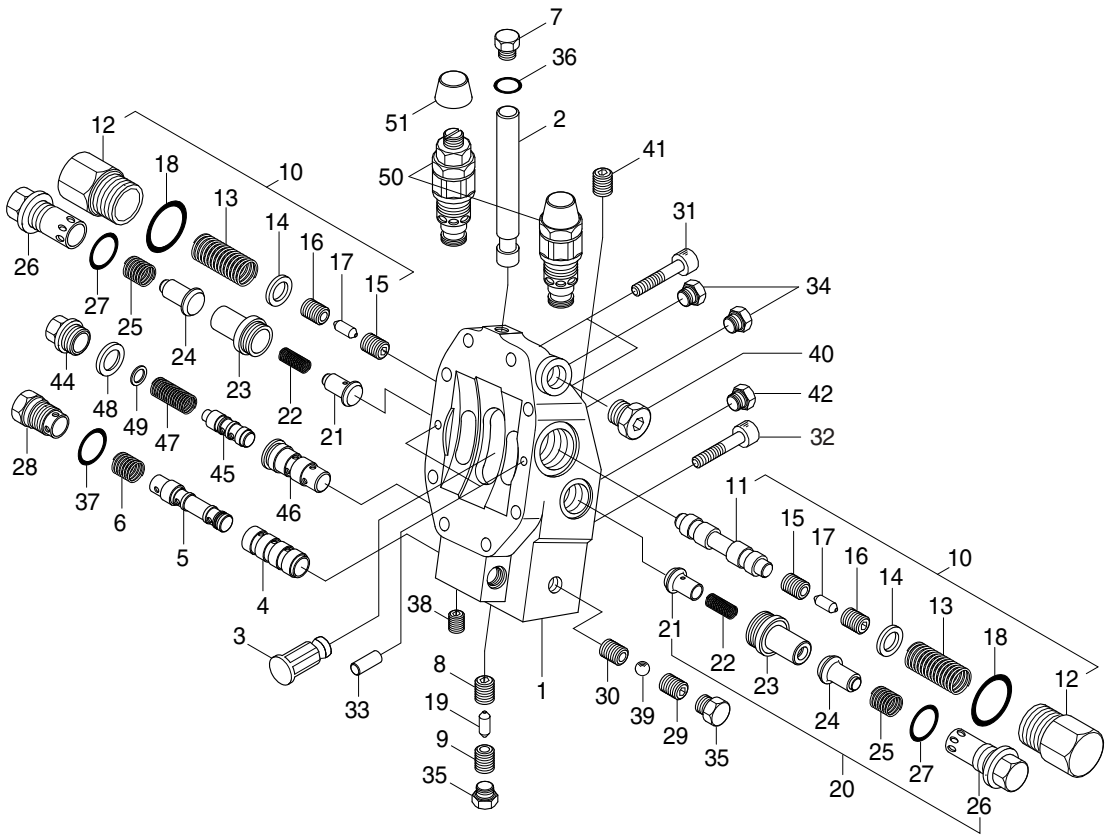


450A8TO02

1	Rotary group	10	Retainer plate	19	Retainer ring
2	Hyd section rotary	11	Screw	20	Shaft seal ring
3	Cylinder	12	Drive shaft	21	Back up plate
4	Control lens	13	Shim	22	O-ring
5	Center pin	14	Back up plate	23	Locking screw
6	Piston	15	Retainer ring	24	O-ring
7	Steel ring	16	Roller bearing	25	Threaded pin
8	Adjustment shim	17	Roller bearing	26	Seal lock nut
9	Pressure spring	18	Housing	27	O-ring

TRAVEL MOTOR (2/2)

· Control part

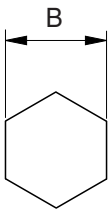


450A8TO03

1	Port plate	18	O-ring	35	Locking screw
2	Position piston	19	Throttle pin	36	O-ring
3	Position turnnion	20	Valve	37	O-ring
4	Control bushing	21	Poppet valve	38	Brake off pin
5	Control piston	22	Pressure spring	39	Ball
6	Pressure spring	23	Seat poppet	40	Locking screw
7	Locking screw	24	Poppet valve	41	Brake off pin
8	Throttle screw	25	Pressure spring	42	Locking screw
9	Throttle screw	26	Locking screw	43	Pressure control valve
10	Brake valve	27	O-ring	44	Locking screw
11	Brake piston	28	Locking screw	45	Control piston
12	Locking screw	29	Valve screw	46	Control bushing
13	Pressure spring	30	Bushing	47	Pressure spring
14	Washer	31	Socket screw	48	O-ring
15	Throttle screw	32	Socket screw	49	Shim
16	Throttle screw	33	Cylinder pin	50	Relief pressure valve
17	Throttle pin	34	Locking screw	51	Cap

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Allen wrench	2.5	
	4	
	6	
	8	
	10	
	14	
Socket for socket wrench, spanner	19	
Torque wrench	Capable of tightening with the specified torques.	
Pliers	-	
(-) Driver	150 mm	
Plastic and iron hammer	Wooden hammer allowed. Nominal 1 or so	
Steel rod approx	7×7×200 mm	
Monkey wrench	-	
Oil seal inserting jig	-	
Bearing pliers	-	
Seal tape	-	
Press (0.5 ton)	-	
Oil stone	-	
Bearing assembling jig	-	
Liquid packing	Loctite #577	
Screw lock	Loctite #243	

(2) Tightening torque

Part name	Item	Size	Torque	
			kgf·m	lbf·ft
Locking screw	11	M 6×20	1.0	7.4
Locking screw	13	M26×1.5	7.0	50.9
Locking nut	18	M12	7.0	50.9
Socket head screw	20, 21	M16×90	-	-
Socket head screw	22	M16×120	-	-
Locking screw	24	M14×1.5	3.0	22
Locking screw	25	M10×1	1.0	7
Locking screw	30	M27×2.0	9.1	66
Locking screw	32	M16×1.5	7.0	50.9

3) DISASSEMBLY

(1) General precautions

① Before disassembling the motor, check the items to be inspected and, for remedy against trouble, closely examine the nature of the trouble, so that the motor can be disassembled effectively.

② To disassemble the motor, use the disassembling procedures described in section 2) and select a clean place.

③ Place a rubber or vinyl sheet or other such protective materials on your working bench to protect the surface of the motor to be serviced.

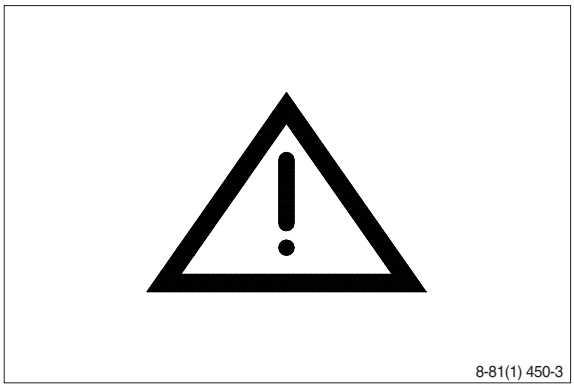
④ During disassembly, give a match mark to the mating surfaces of each part.

⑤ Arrange removed parts in order so that they will not become damaged or missing during disassembly.

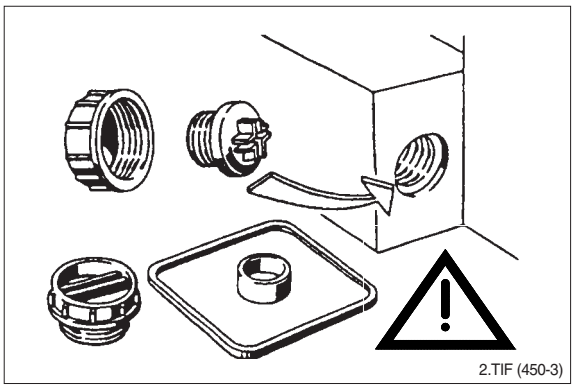
⑥ Once seals have been disassembled, they should be replaced even if damage is not observed. Have replacement seals ready on hand before starting your disassembling job.

(2) Seal kit and component groups

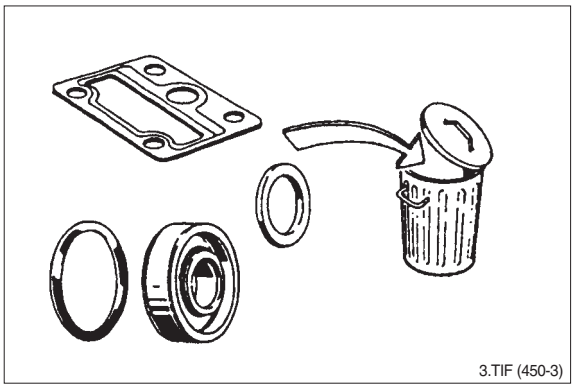
① Attention
Observe the following notices when carrying out repair work at hydraulic aggregates!



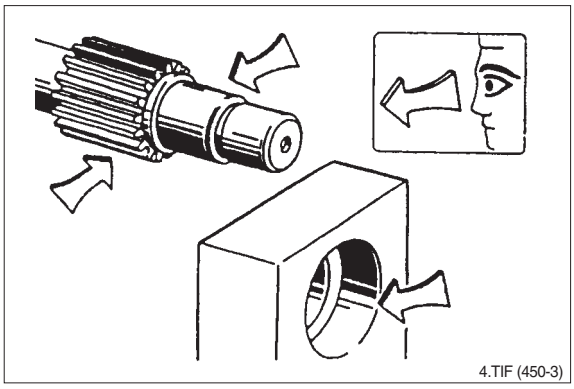
② Close all ports of the hydraulic aggregates.



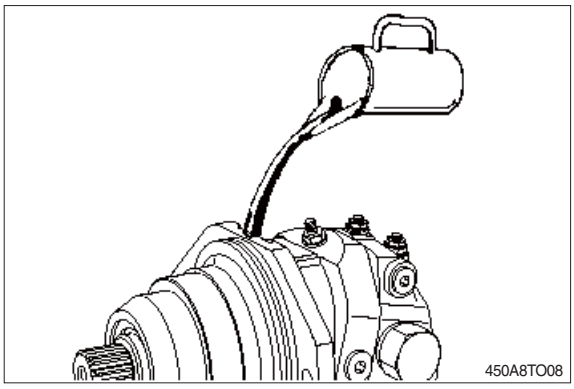
③ Replace all seals.
Use only original spare parts.



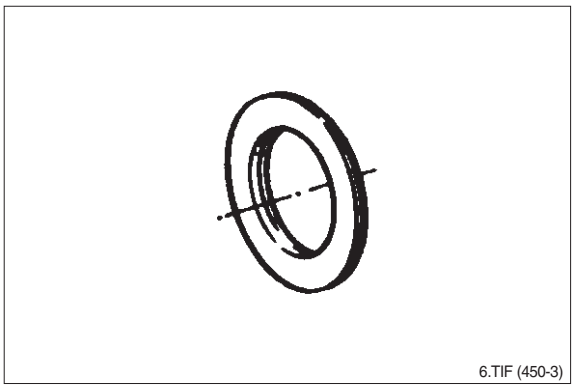
④ Check all seal and sliding surfaces for wear.
Rework of sealing area for example with abrasive paper can damage surface.



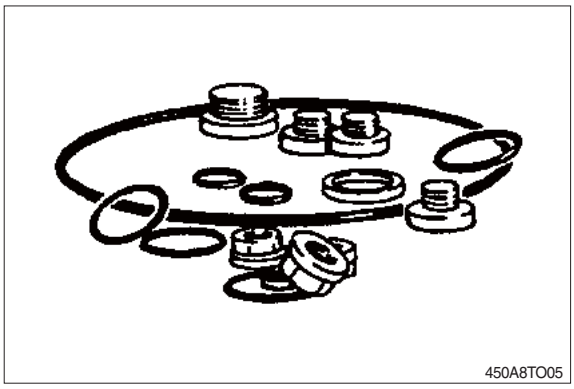
⑤ Fill up hydraulic aggregates with hydraulic oil before start-up.



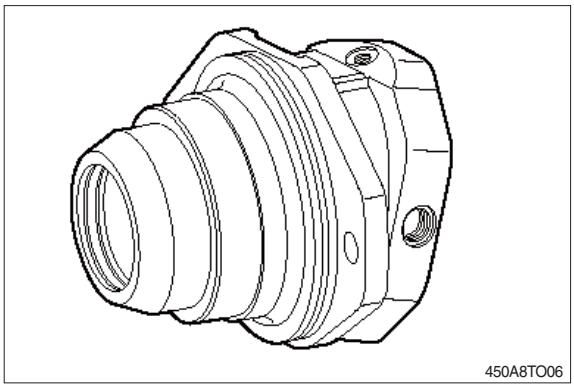
⑥ Seal kit for drive shaft.



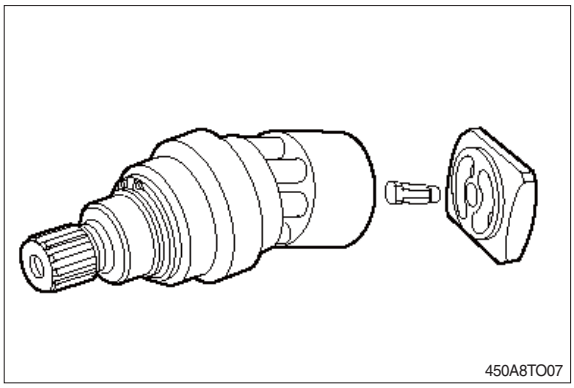
⑦ External seal kit.



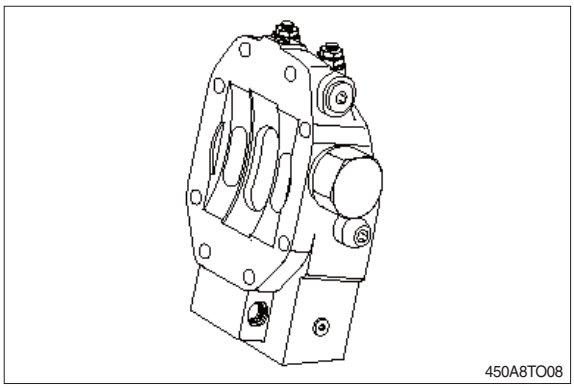
⑧ Housing.



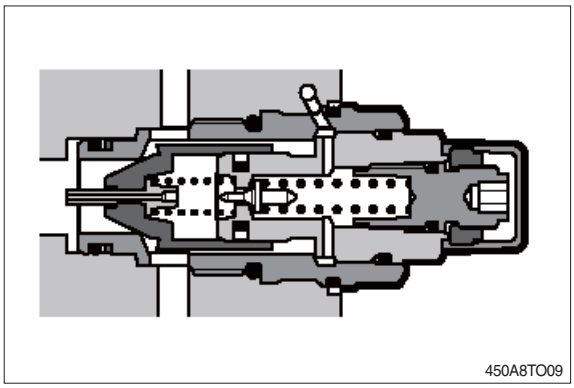
⑨ Complete rotary group.



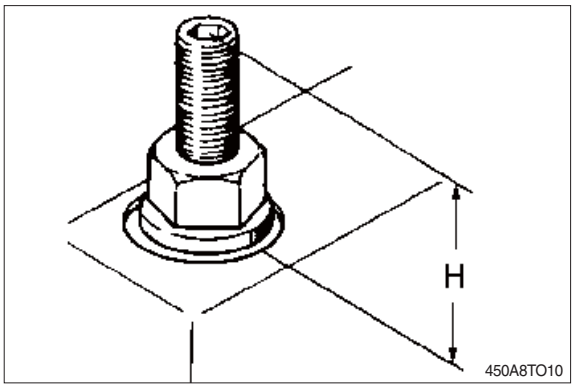
⑩ Port plate with control piston and counter-balance valve.



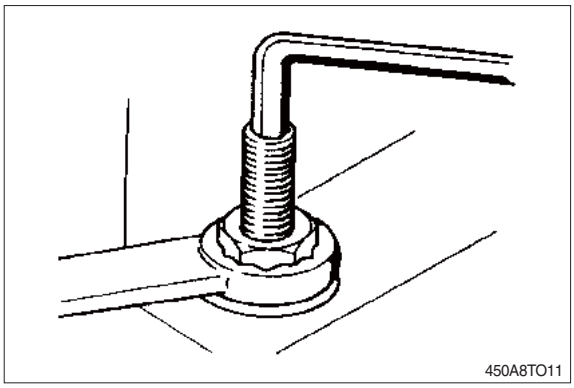
⑪ Relief valve/Make up check valve



⑫ Replace seal nut.
First measure and record setting height.

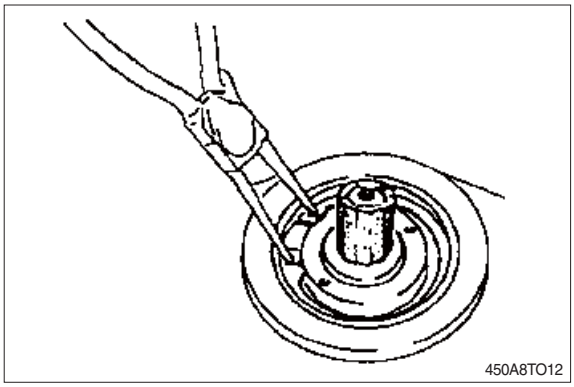


⑬ When tightening, counterhold setting screw, then check setting height.

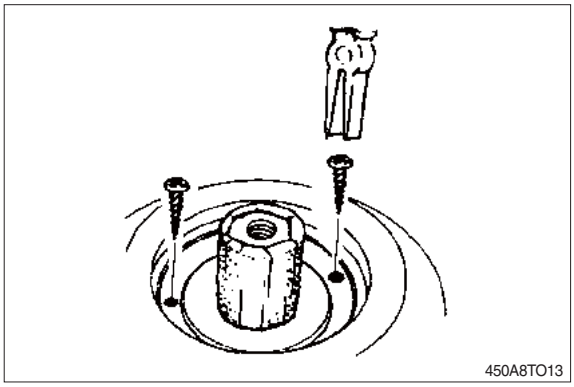


(3) Sealing the drive shaft

① Protecting the drive shaft.
Remove retaining ring and shim.

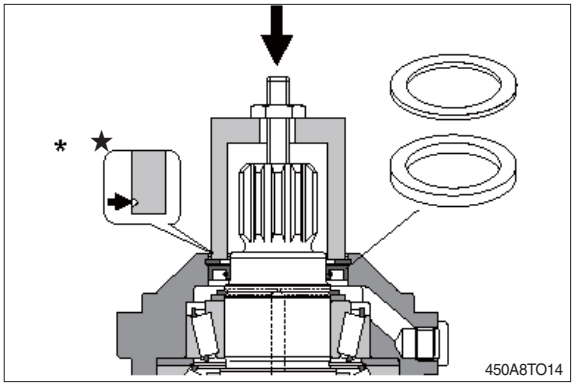


② Screw in sheet metal screw into the holes fitted with rubber.
Pull out seal with pliers.



③ Press in shaft seal and shim with bush to stop.

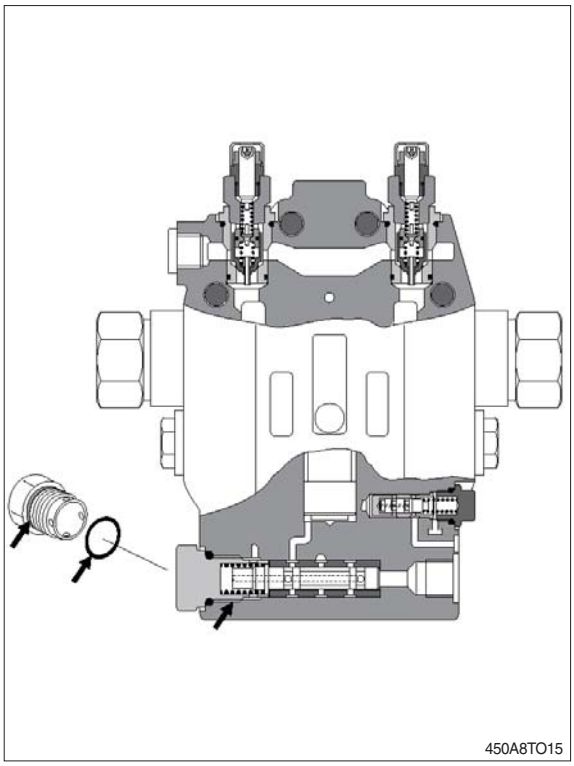
※ Pay attention to pressing depth!
★Mark for pressing depth.
Assemble retaining ring.



(4) Sealing of the control parts

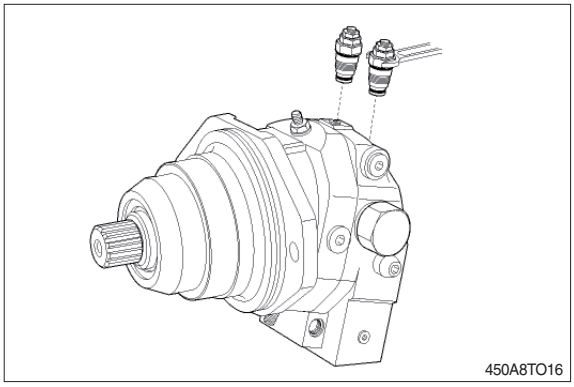
① HZ-Controller

※ O-ring, O-ring groove, housing.

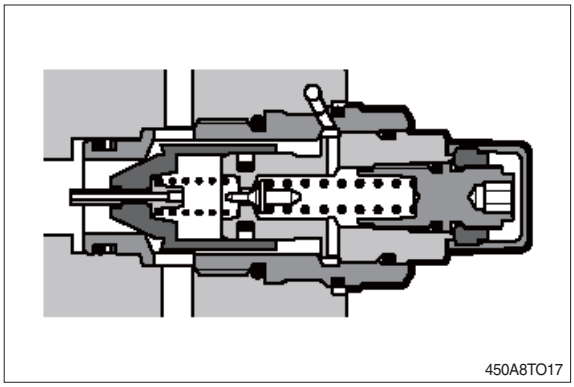


(5) Sealing of the relief valve

① Remove relief valve.

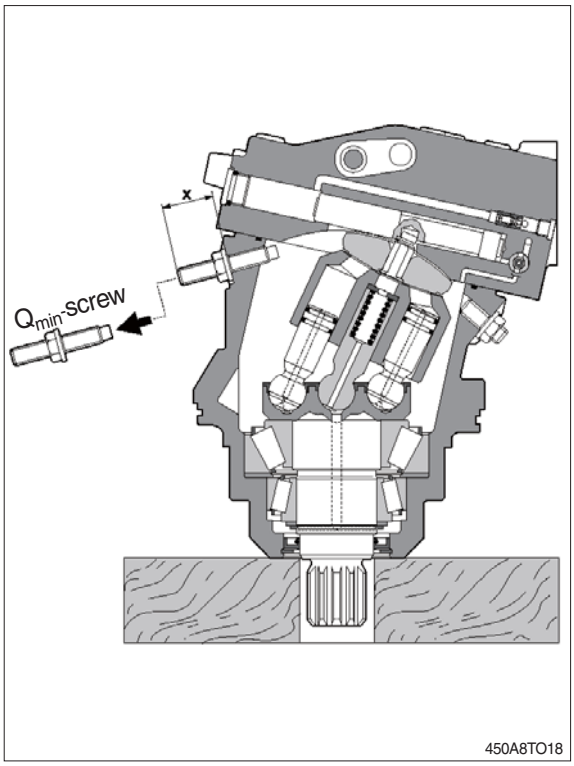


② Inspect
O-ring.

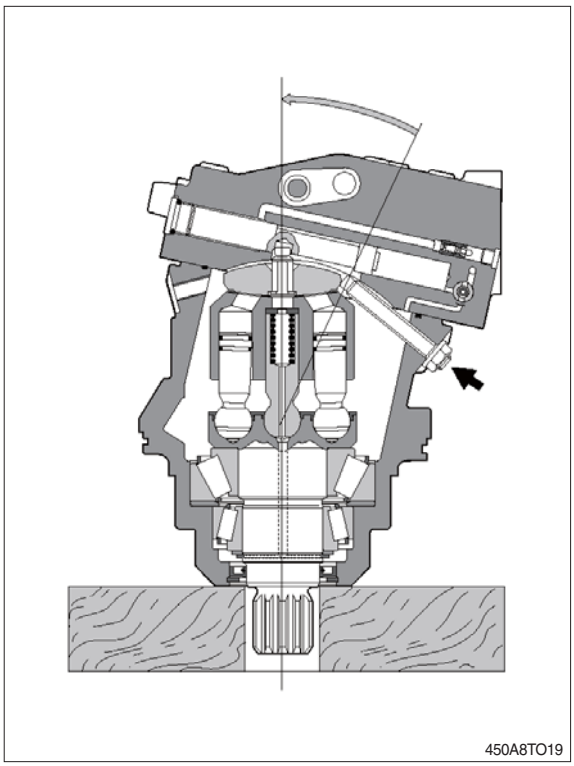


(6) Disassembly of the port plate

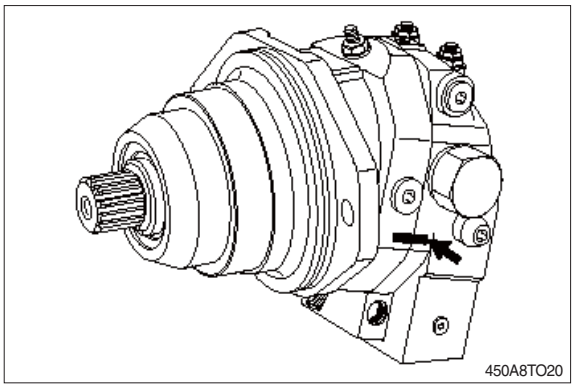
① Note dimension x.
Remove Q_{min}-screw.



② For disassembly of the port plate, swivel always rotary group to zero position. Piston rings to hang out of the cylinder boring.
Swivel rotary group to zero position with screw Q_{max}.

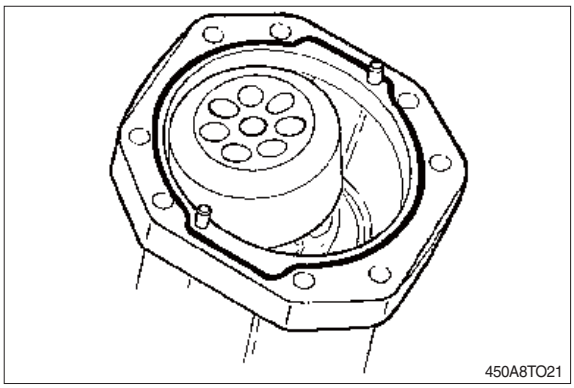


③ Port plate
Mark position. Loosen screws.
Removal.



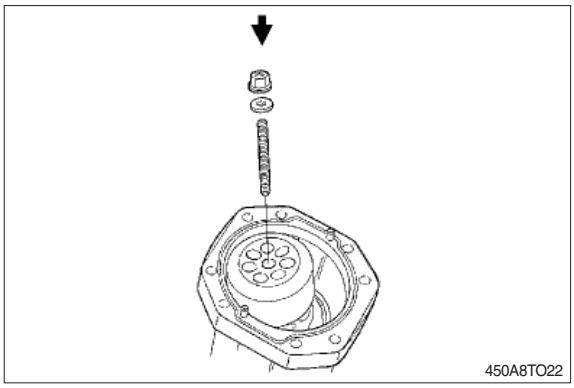
④ Check O-ring.

※ Stick new O-ring with some grease. Do not swivel rotary group. Piston rings to hang out from the cylinder boring.

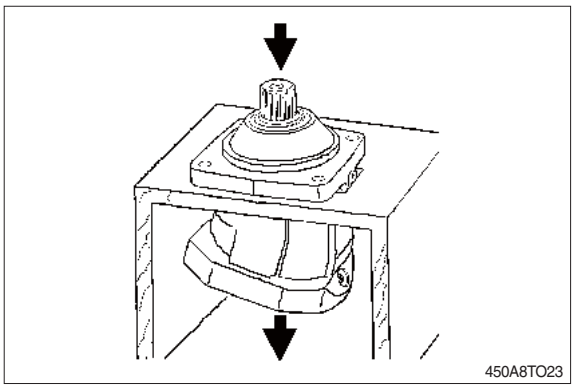


(7) Remove rotary group

① Screw in threaded pin into center pin.
Fix the cylinder with disc and lock nut.
Size : M8×105 ㎜

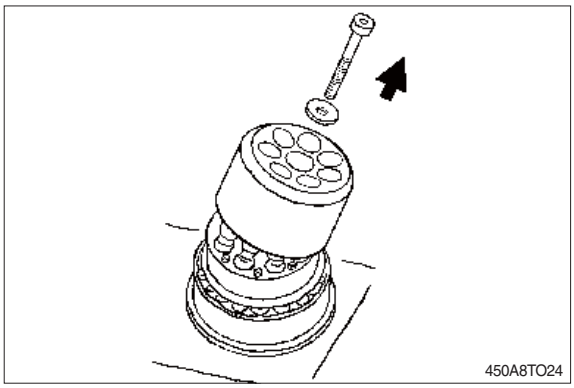


② Press out rotary group!
※ If the bearings are used again do not hit on the drive shaft.

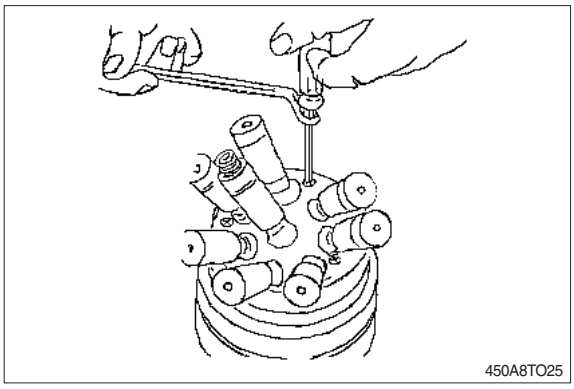


(8) Exchanging of the rotary group

① Remove fixing screw (cylinder).
Remove cylinder.



② Disassemble retaining plate.
※ Screws are glued. Use Torx-tools.



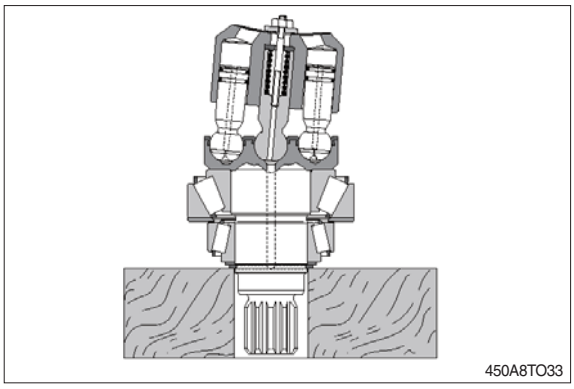
4) ASSEMBLY

(1) General precautions

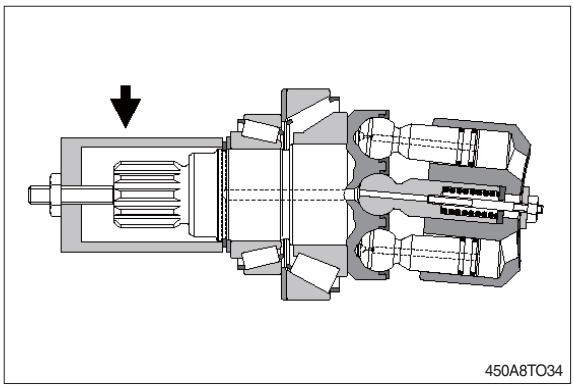
① Reassemble in a work area that is clean and free from dust and grit.
② Handle parts with bare hands to keep them free of linty contaminates.
③ Repair or replace the damaged parts.
Each parts must be free of burrs its corners.
④ Do not reuse O-rings, oil seal and floating seal that were removed in disassembly.
Provide the new parts.
⑤ Wash all parts thoroughly in a suitable solvent.
Dry thoroughly with compressed air.
Do not use the cloths.
⑥ When reassembling oil motor components of motor, be sure to coat the sliding parts of the motor and valve with fresh hydraulic oil. (NAS class 9 or above)
⑦ Use a torque wrench to tighten bolts and plugs, to the torque specified as follows.

(2) Rotary group assembly

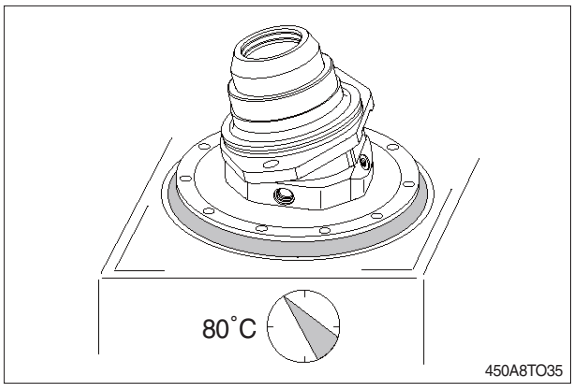
① Rotary group completely assembled ready for assembly.



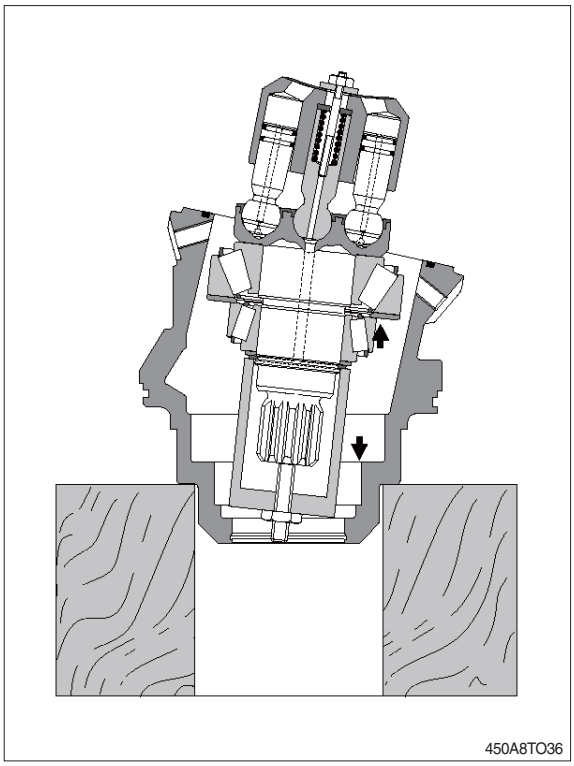
② Place assembly sleeve.



③ Warm up housing to 80˚C.



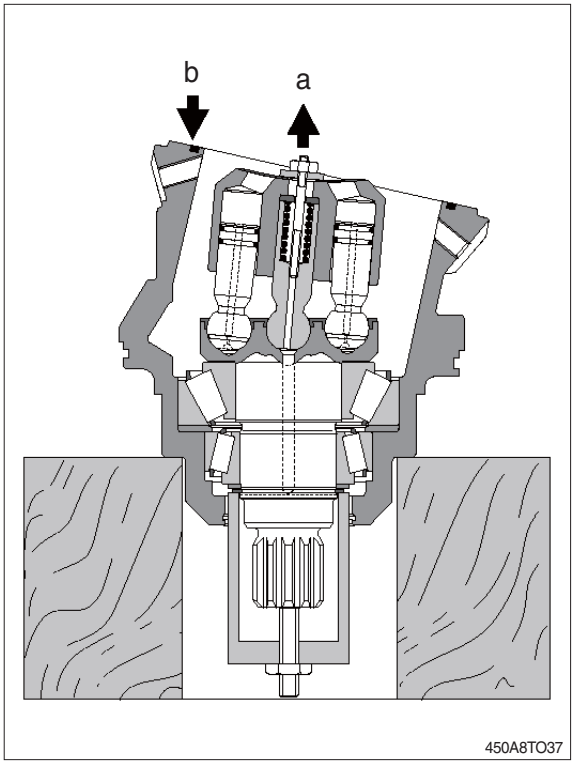
④ Insert rotary group into housing to seat position.



⑤ Fix zero position of cylinder with Q_{max} screw.

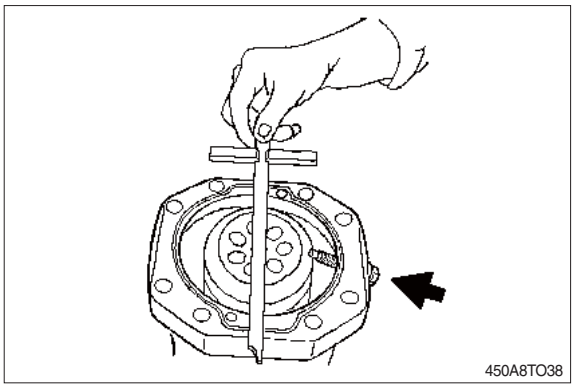
a. Disassemble cylinder fixing screw.

b. Insert O-ring.

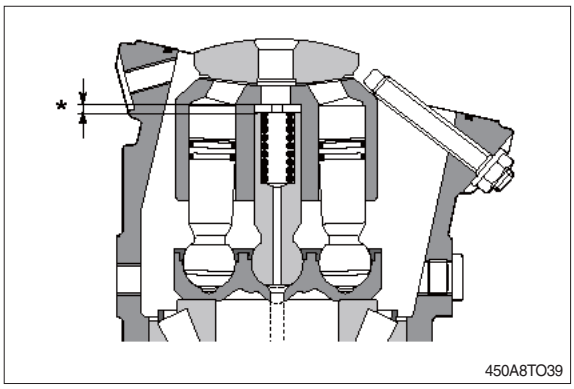


(3) Rotary group adjustment

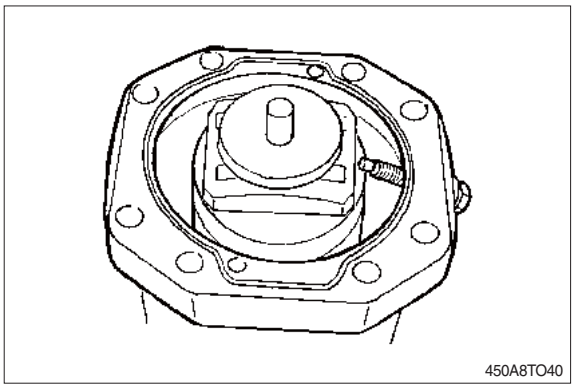
① Determine cylinder swivel range to max angle with screw.



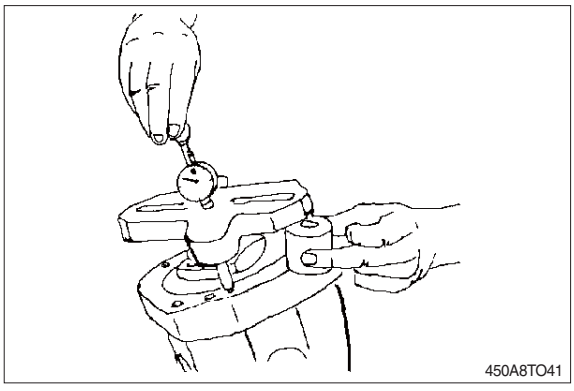
② *Disc



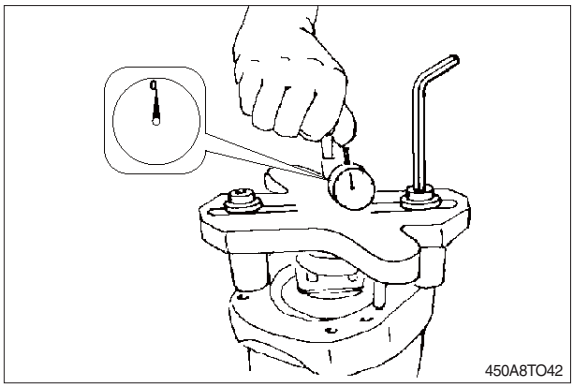
③ Place centering disc.



④ Mount measuring device.

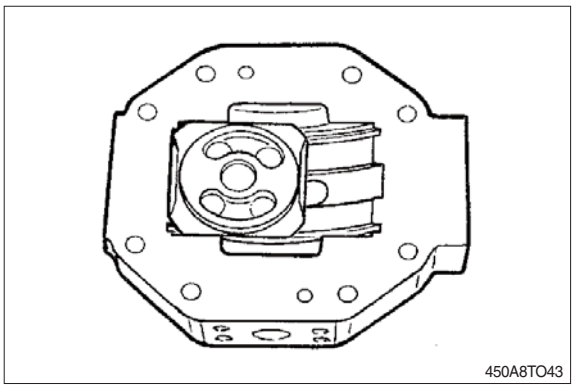


⑤ Check dimension X.



(4) Assembly of the port plate

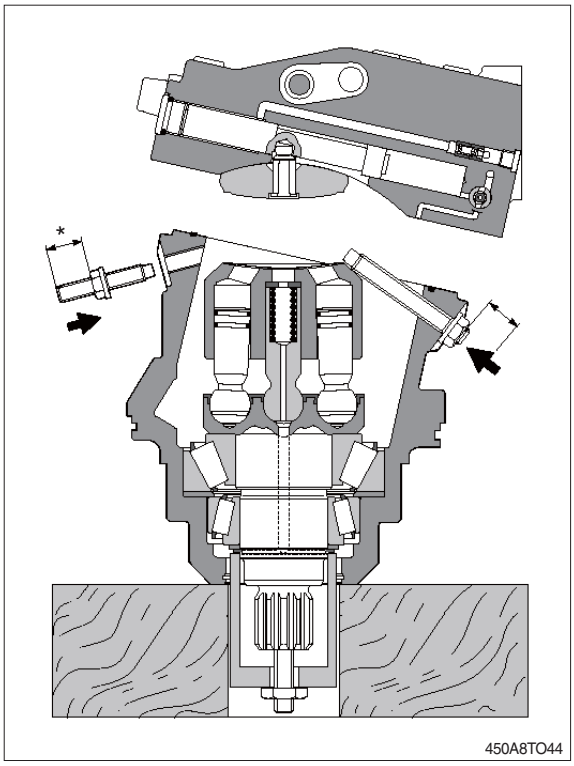
※ Stick centrol lens in sliding surface with grease. Assembly in reversal order. Mount port plate.



① Assembly port plate.

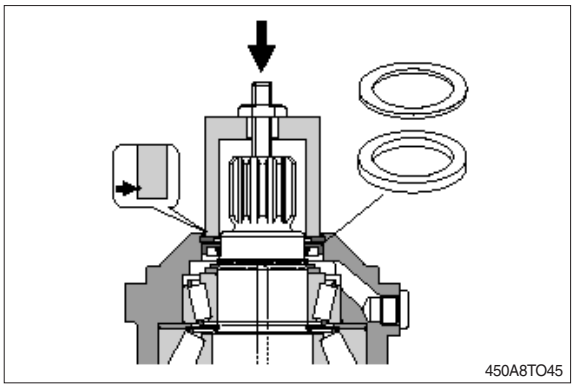
※ Take care of assembly design! Tighten fixing screws with torque.

a. Set Q_{min}-screw to dimension*.
b. Assemble plug.
c. Remove assembly sleeve.



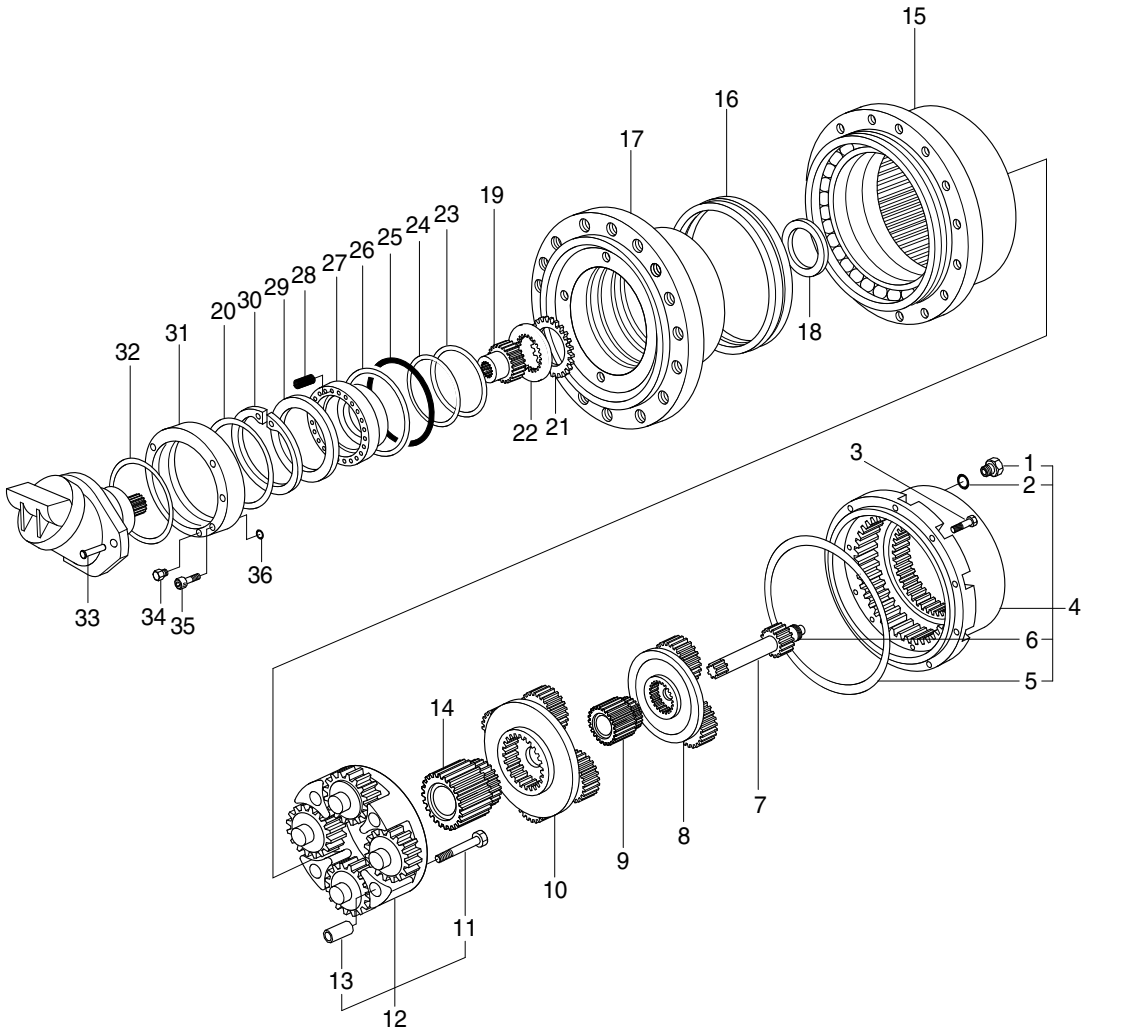
② Assemble shaft seal, disc and safety ring. Press-in with assembly sleeve.

※ Take care of press-in depth.



3. REDUCTION GEAR

1) STRUCTURE



450A8TR01

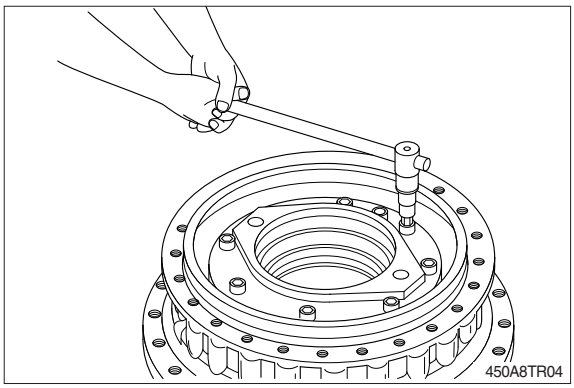
1	Washer	13	Bushing	25	O-ring
2	Breather plug	14	Sun gear	26	Spiral ring
3	Screw	15	Housing	27	Piston
4	Cover set	16	Lifetime seal	28	Spring
5	O-ring	17	Hub	29	Spacer
6	Pad	18	Spacer	30	Circlip
7	Sun gear	19	Brake shaft	31	Flange
8	Reduction assy (1st)	20	O-ring	32	O-ring
9	Sun gear	21	Brake disc	33	Screw
10	Reduction assy (2nd)	22	Steel ring	34	Plug
11	Screw	23	Back up ring	35	Screw
12	Reduction assy (3rd)	24	O-ring	36	O-ring

2) DISASSEMBLING

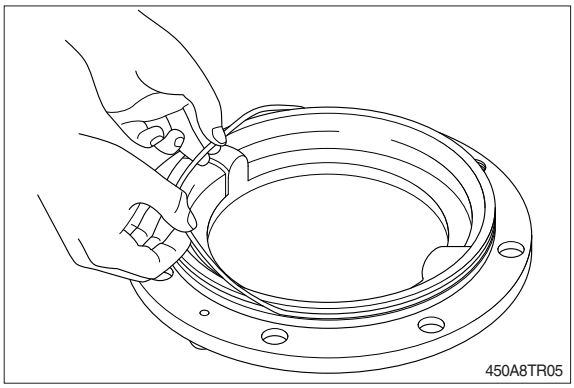
Initial inspection of the gears and the travel motor, can be made without disassembling the track and the gearmotor from the machine.

Prior to disassembling make sure that the oil is discharged, unscrew and remove the 2 screws (33), and remove the travel motor and the O-ring (32).

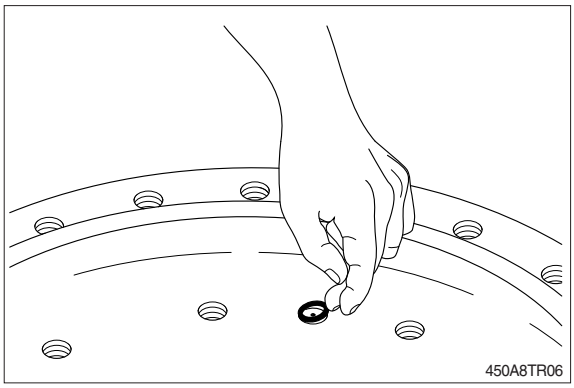
(1) Unscrew the 8 socket head screws (3) and remove the motor flange from the flanged hub (17).



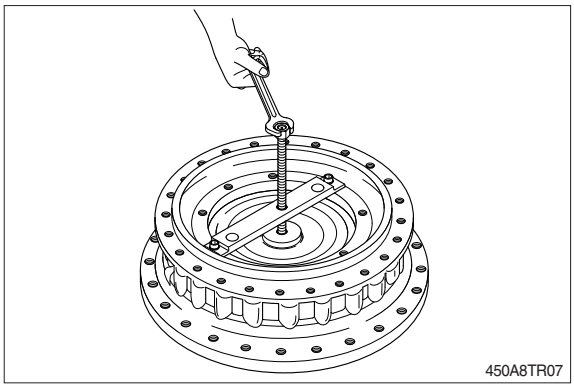
(2) Remove the O-ring (20) from its grove in the motor flange (31).



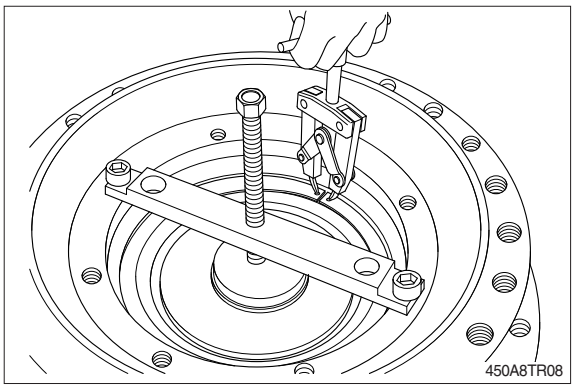
(3) Remove the O-ring (36) from its grove in the flanged hub (17).



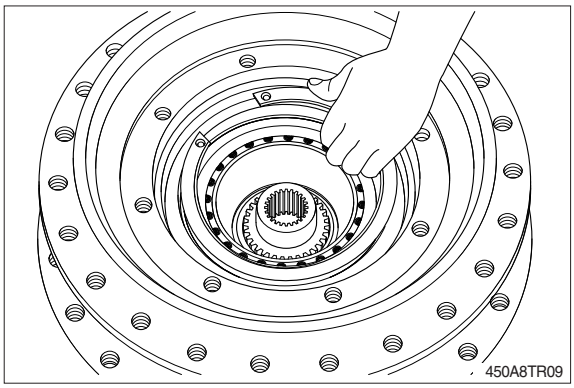
(4) After having places the disc on the spring retainer (29), fix the pusher on the flanged hub (17) as shown in the scheme by screwing the threaded bar, push the disc on the retainer, thus removing the force of the springs (28) on the circlip (30) and allowing its disassembling.



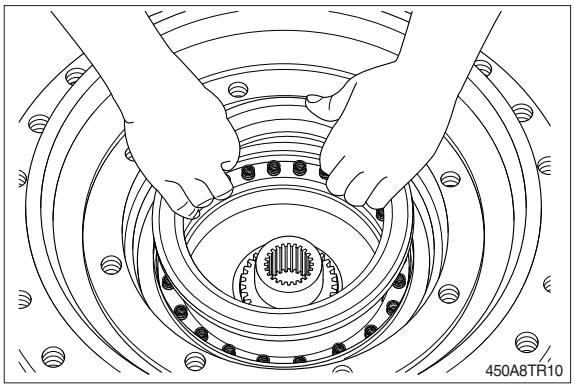
(5) Using pliers remove the circlip (30) from its grove in the flanged hub (17).



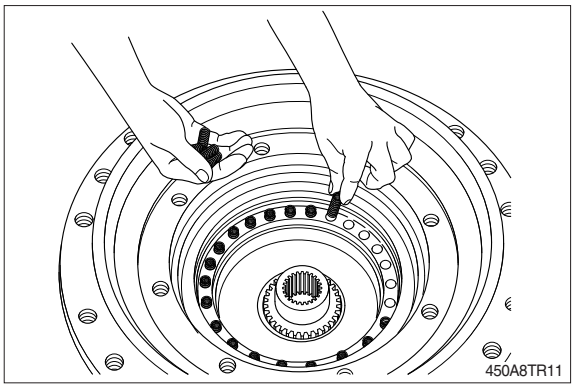
(6) Disassemble the equipment from the flanged hub (17) and remove the circlip (30).



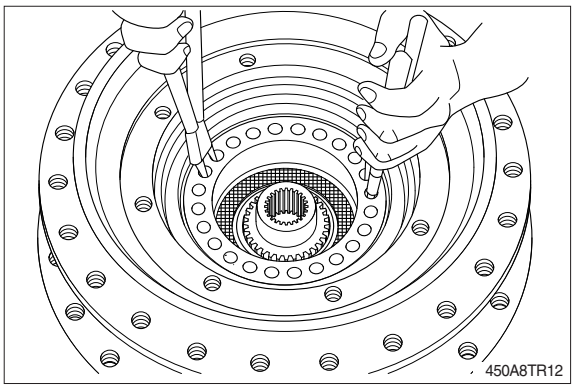
(7) Remove the springs retainer (29).



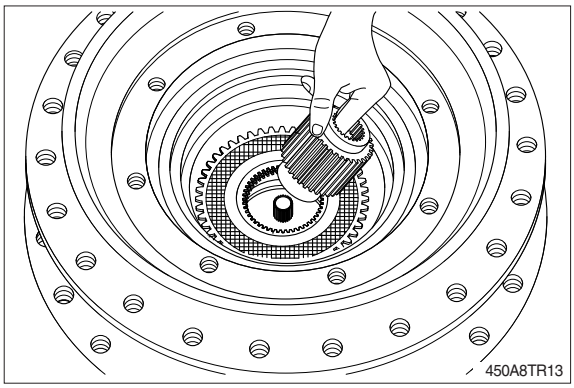
(8) Remove the springs (28) from their groves.



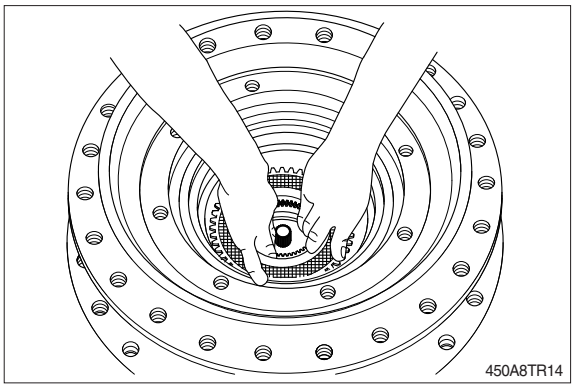
(9) Using pliers remove the brake piston (27).
※ To get it easier, pumping compressed air into the brake port hole.



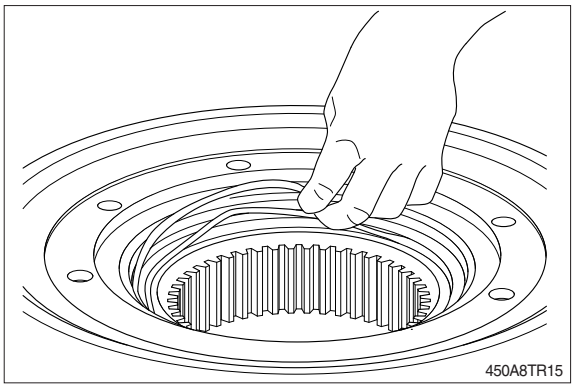
(10) Remove the brake shaft (19).



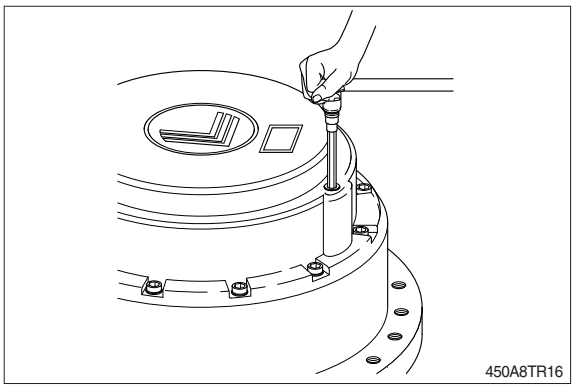
(11) Remove brake discs pack (21, 22).



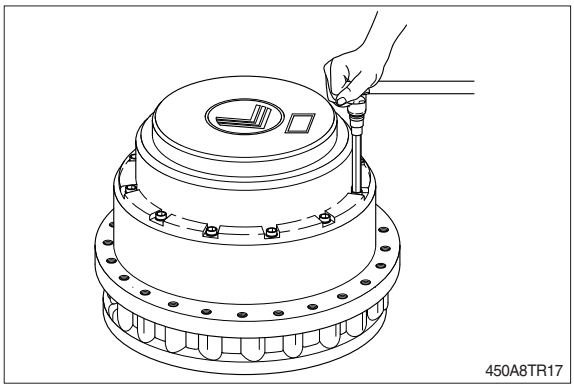
(12) Remove the O-rings (24,25) and the backup rings (23, 26) from their groves in the flanged hub (17).



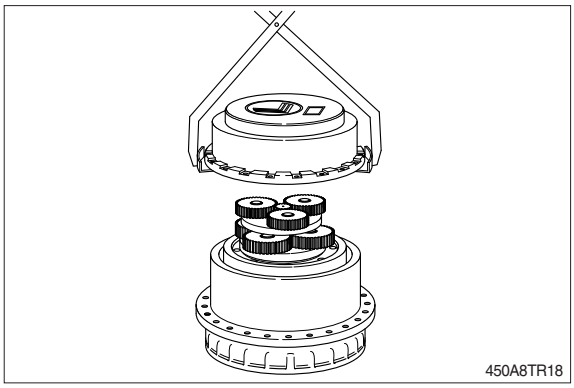
(13) Turn the gearbox around, unscrew and remove the 2 plugs (2) and the 2 washers (1) from the end cover (4).



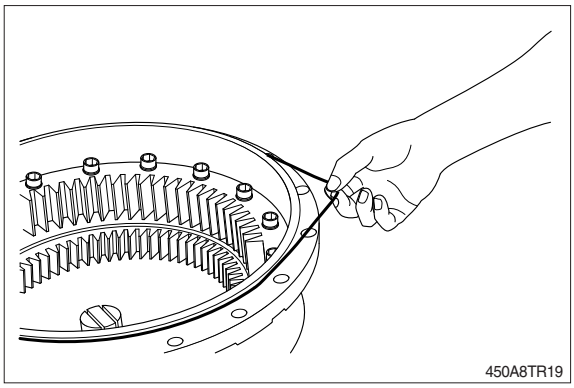
(14) Unscrew and remove the 16 socket head screws (3).



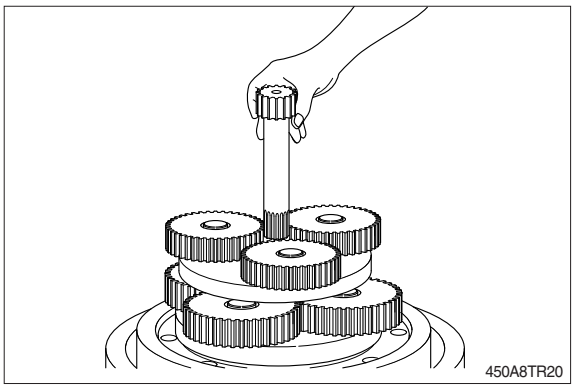
(15) By means of a puller remove the end cover (4).



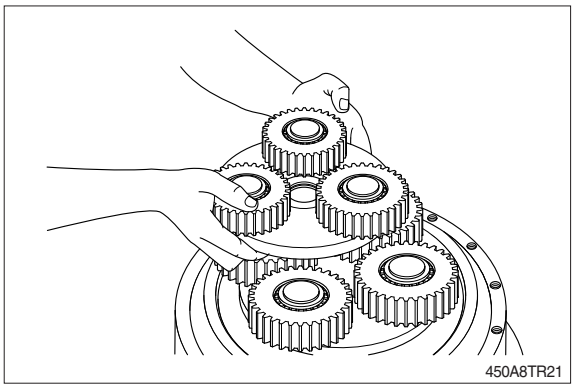
(16) Remove the O-ring (5) from its grove in the end cover (4).



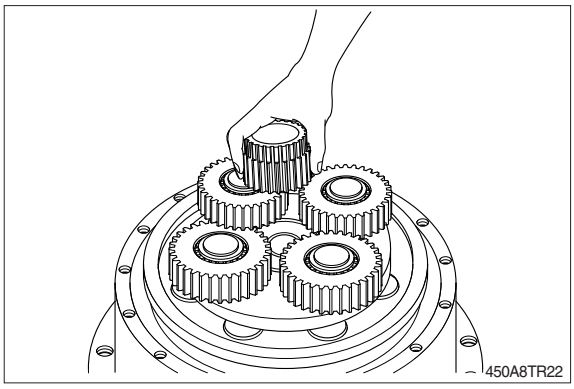
(17) Remove the 1st stage sun gear (7).



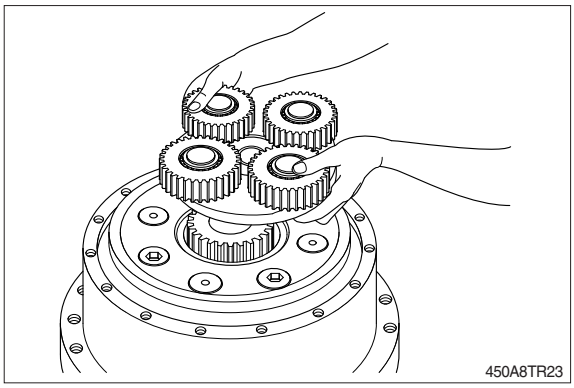
(18) Remove the 1st reduction assembly (8).



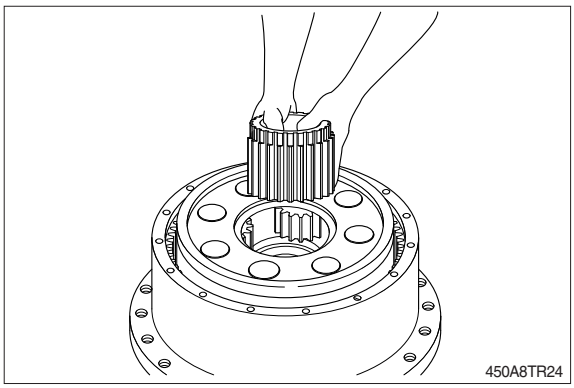
(19) Remove the 2nd stage sun gear (9).



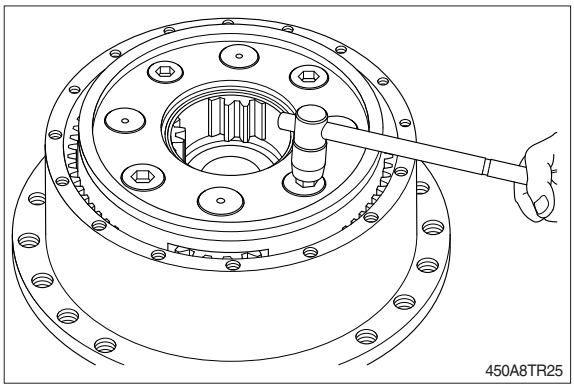
(20) Remove the 2nd reduction assembly (10).



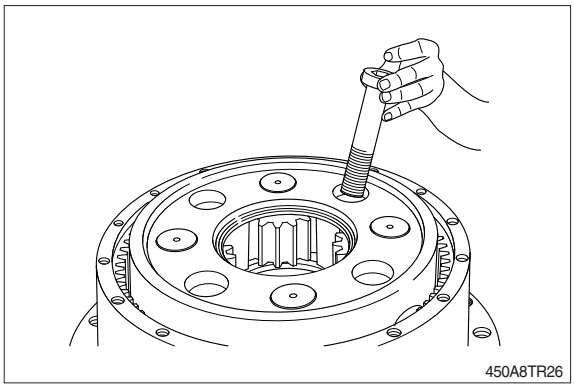
(21) Remove the 3rd stage sun gear (14).



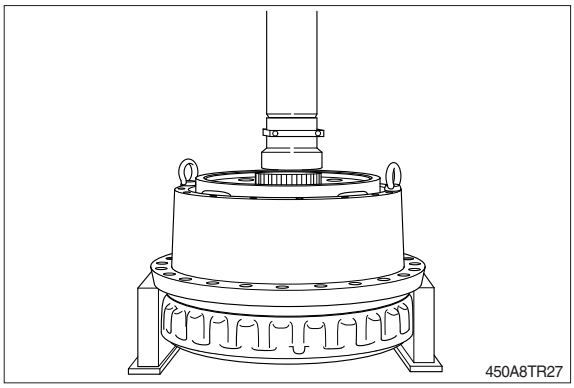
(22) Unscrew the 4 socket head screws (11), fixing the 3rd reduction assembly (12) to the flanged hub (17).



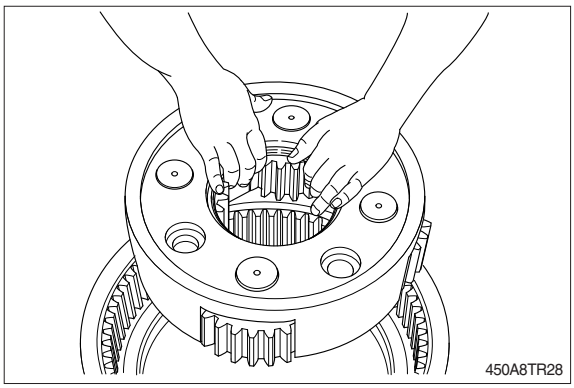
(23) Remove the 4 screws (11).



(24) Using a press and a metal stopper, remove the flanged hub (17) from the gearbox housing (14), paying attention to the eventual falling down of the main bearing's balls.



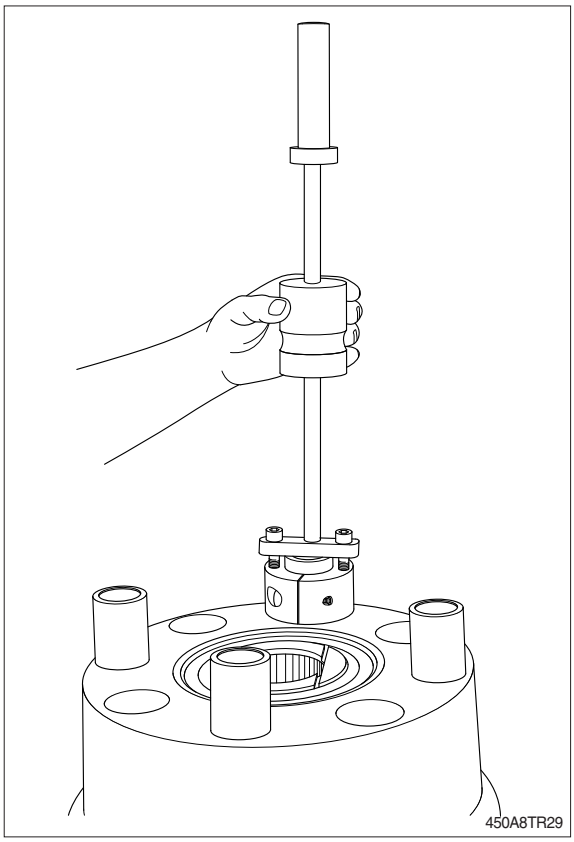
(25) Remove the 3rd reduction assembly (12) from the flanged hub (17).



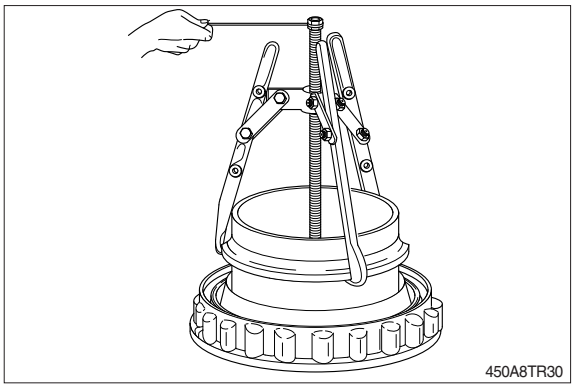
(26) Using the equipment, remove bushes (13) from the flanged hub (17).

※ It is possible that the planet assemblies (see reassembly (11))remain assembled to the planet-carrier. In this case it is sufficient to push on them by means of a rubber pad or a press.

In case the planet assemblies remain assembled to the flanged hub, it is better to use the fixture (for this operation).



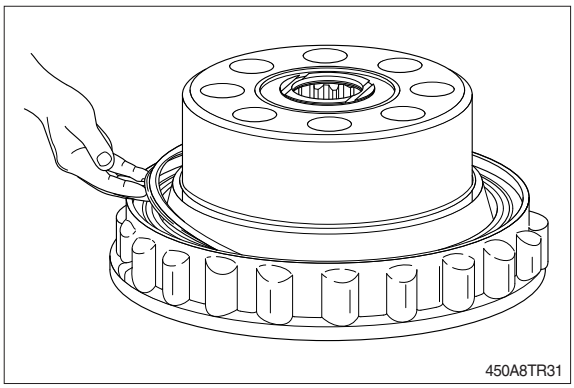
(27) By means of an extractor, remove the inner race of the bearing and spacer kept on the flanged hub (17).



(28) Withdraw both the half-seals (16) from the flanged hub (17) and from the gearbox housing (15).

※ Lifetime seal check
In case of oil leakages, it should be necessary to check and eventually replace the lifetime seal (16), which means both the metal rings parts and the O-rings. In this case it is necessary to disassemble the gearbox from the machine.

※ The gearbox disassembly ends with the above operation: All items are now available for the necessary checks.



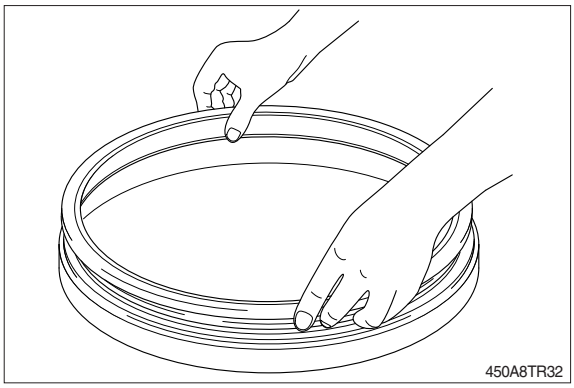
3) REASSEMBLY

※ For the correct assemble of gearbox please follow these basic instructions:
In case of damaged gears, for example a planetary, replace all the reduction assembly and not only the damaged gear.

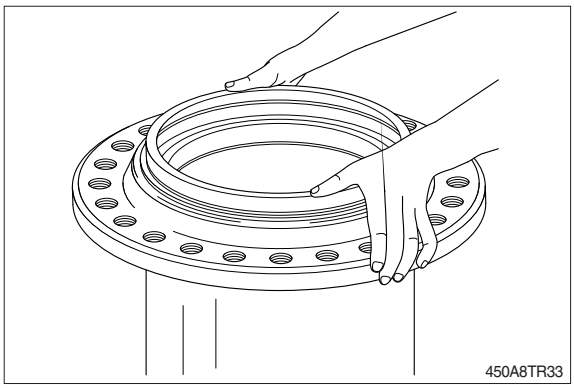
※ Before reassembling the O-ring, gaskets and the oil seals:
Concerned should be removed.
Clean with care all the housing of the seal and put some grease on the gasket before mounting.

※ Never change only one part of the lifetime seal, always the two rings together.

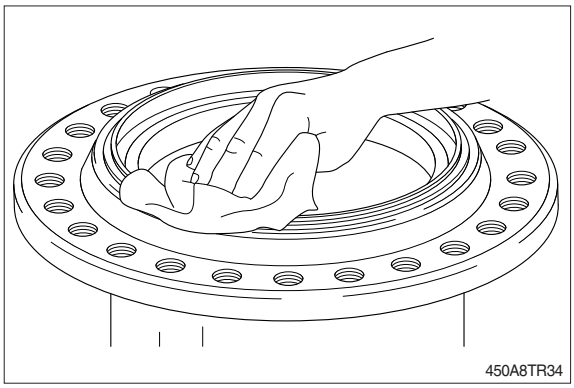
(1) Fit the half seals (16) on the tool.



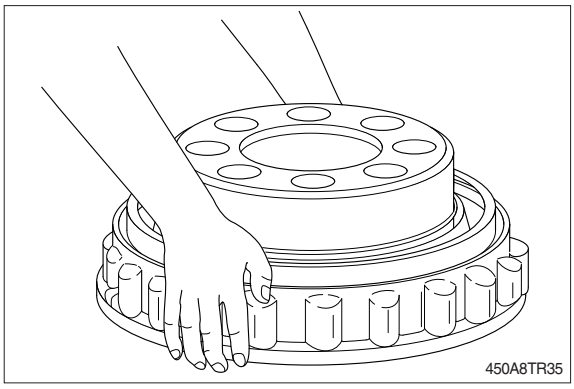
(2) Fit the half seals (16) inside the gearbox housing (15).



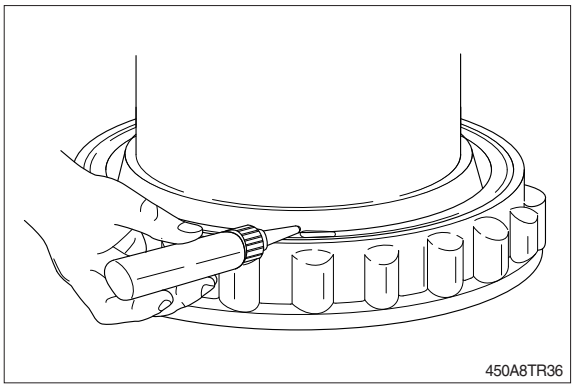
(3) Clean carefully the metallic face of the half-seal.



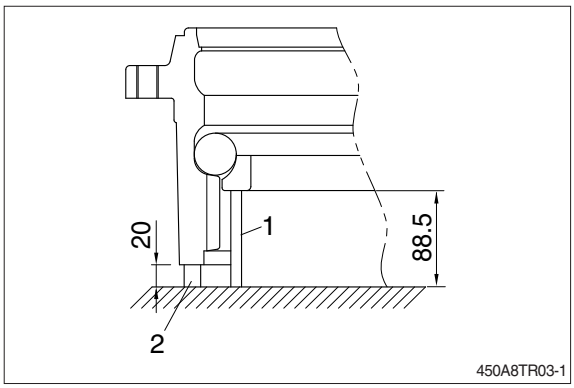
(4) Assemble, by using the same tool, the half seal (16) on the flanged hub (17).



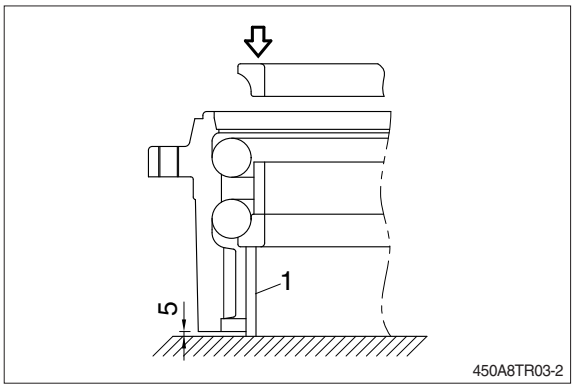
(5) Lube the metallic face of the half seal with a thin oil film.



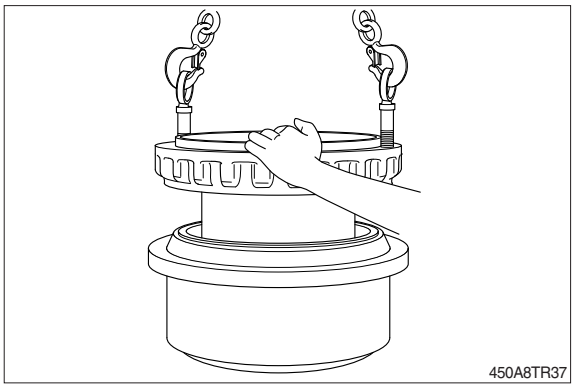
(6) Fit on the housing the lower ball row, withstanding the ball race throught the spacers 1 and 2.
Between the balls, insert the proper spacers.



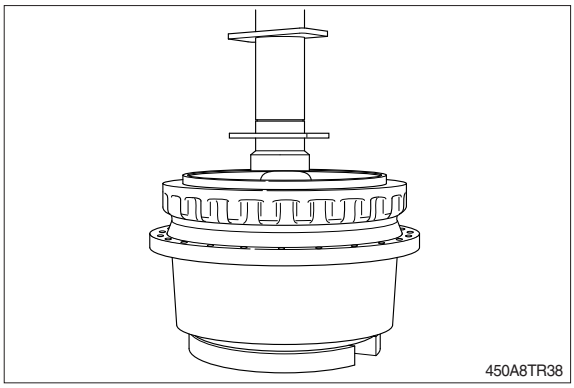
(7) After having placed the bearing spacer fit the upper ball row.
Then place the upper inner race.



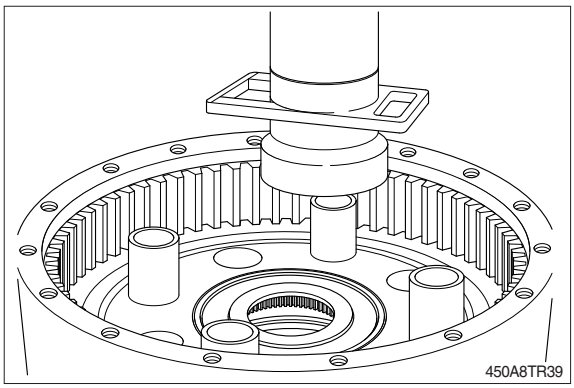
(8) Lift the flanged hub (17) then lower it inside the gearbox housing (15).



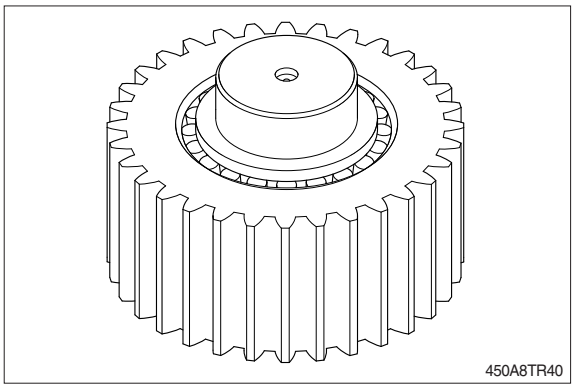
(9) Using a press and a metal stopper, push the flanged hub (17) against the shoulder on the gearbox housing (15) until assembling is complete.



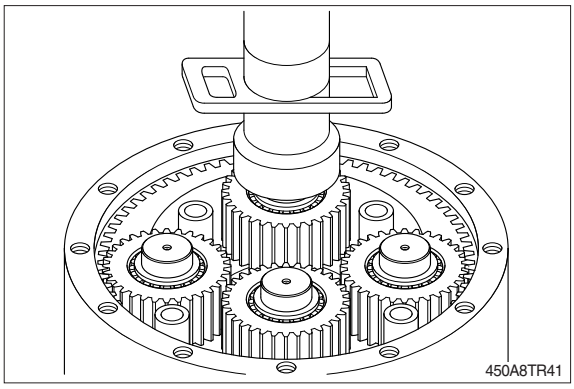
(10) Using a press, place and push the 4 bush, inside their seats on the flanged hub (17).



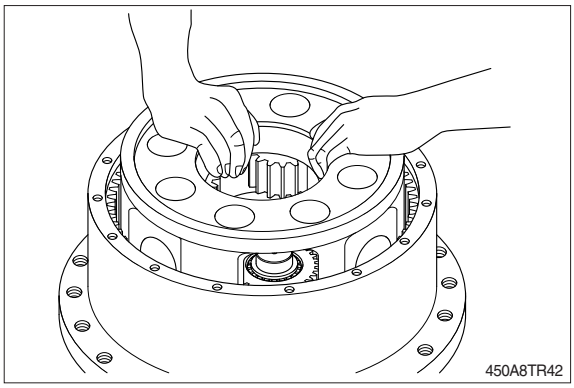
(11) View of the 3rd reduction's planet assembly.



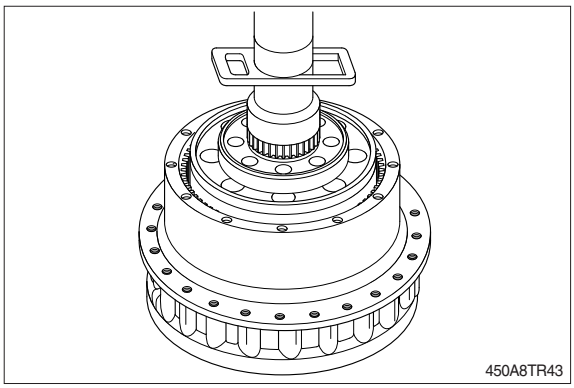
(12) Using a press push the 4 planet assemblies against the shoulder on the flanged hub (17).



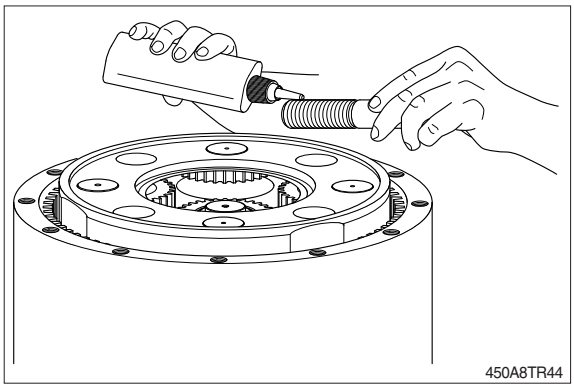
(13) Place the 3rd reduction planet carrier on the hub (17).



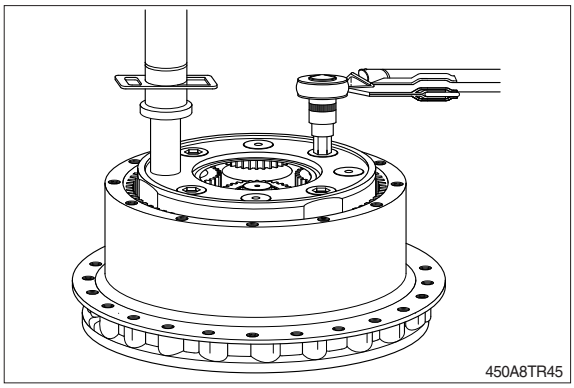
(14) Using a press push the 3rd reduction planet carrier against the shoulder on the flanged hub (17) until complete assembly.



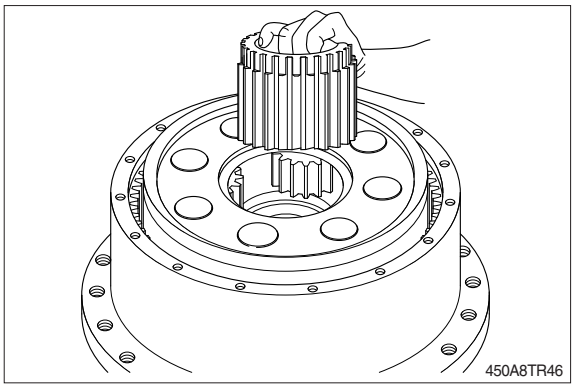
(15) Apply LOCTITE type 243 on the 4 socket head screws (11), and insert them in the thread holes.



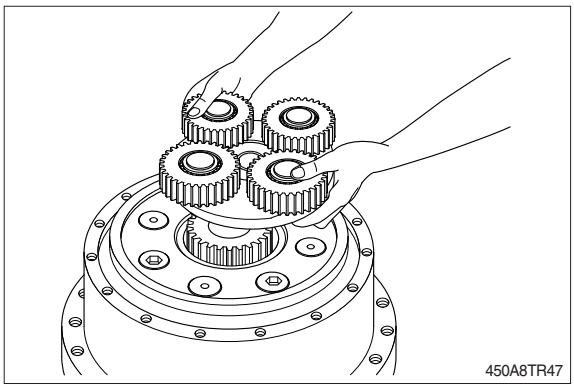
(16) Tighten the screws by a torque wrench at a torque of 153kgf · m(1107lbf · ft), locking the gearbox acting with the press on a 3rd reduction's planet.



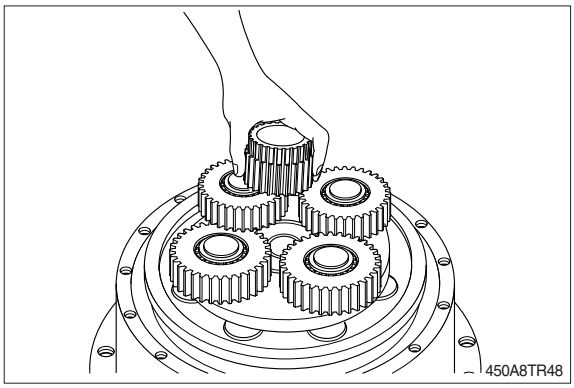
(17) Insert the 3rd stage sun gear (14).



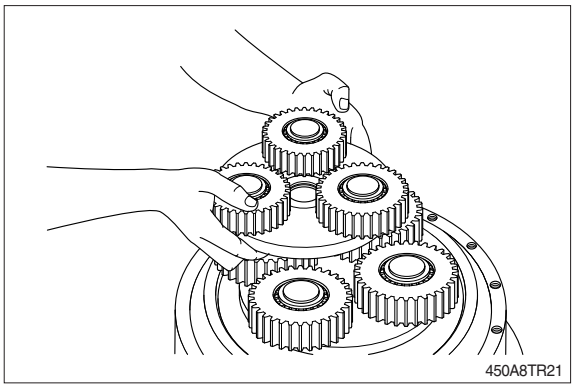
(18) Insert the 2nd reduction assembly (10).



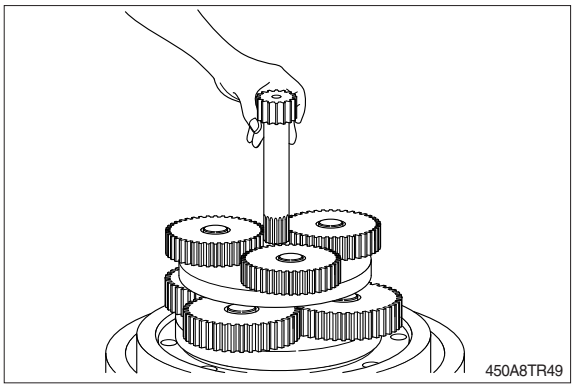
(19) Insert the 2nd stage sun gear (9).



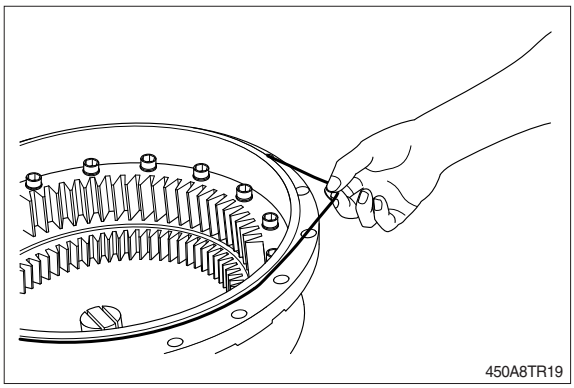
(20) Insert the 1st reduction assembly (8).



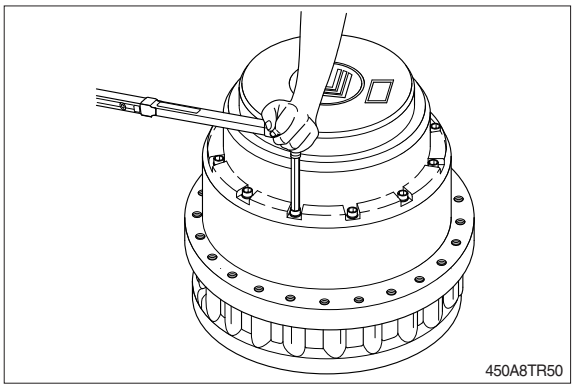
(21) Insert the 1st stage sun gear (7).



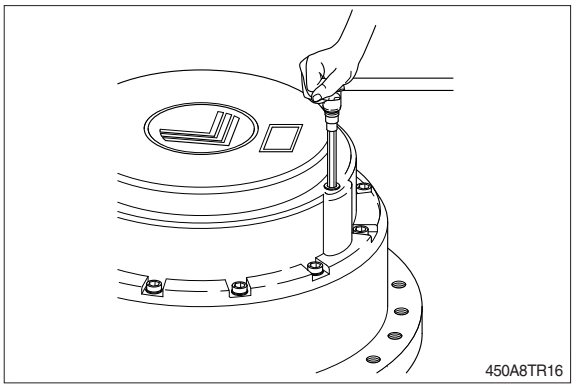
(22) Fit the O-ring (5) into its grove in the end cover (4).



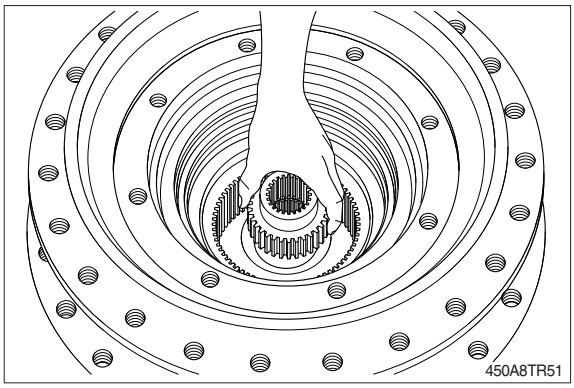
(23) Place the end cover (4) on the gearbox housing (15).
Apply LOCTITE type 243 on the 16 socket head screws (3), and tighten them by a torque wrench at a torque of 19.4 kgf · m (140 lbf · ft).



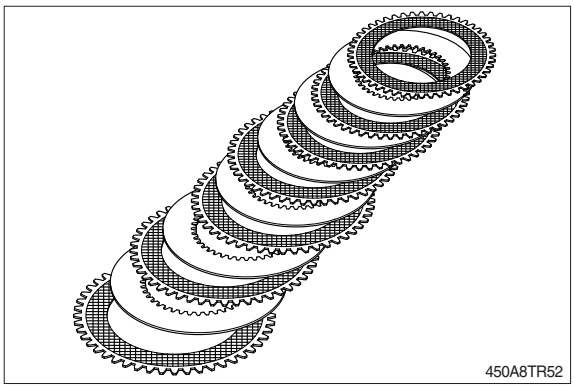
(24) Place the 2 washer (1) in their groves and tighten the 2 plugs at a torque of 6.1~8.2 kgf · m (44.1~59.3 lbf · ft).



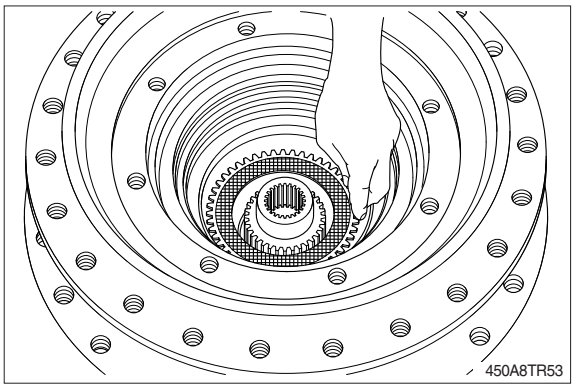
(25) Turn the gearbox around and insert the brake shaft (19).



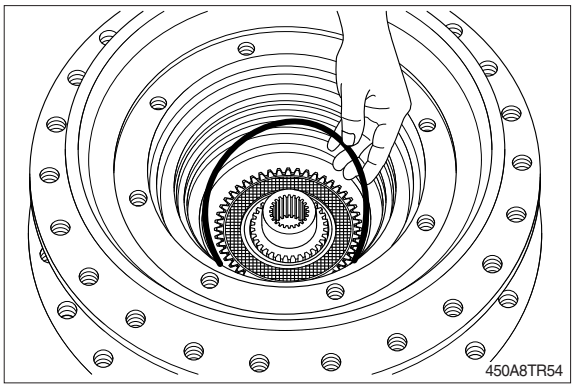
(26) View of the brake discs (21, 22).



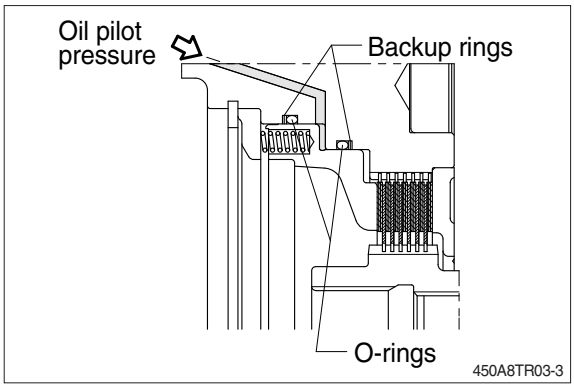
(27) Assemble the brake discs package according to the following order: Firstly insert an external toothed sintered bronze disc (21). Then insert, an internal toothed steel disc (22). Repete the operation until reaching the number of 7 bronze and 6 steel discs.



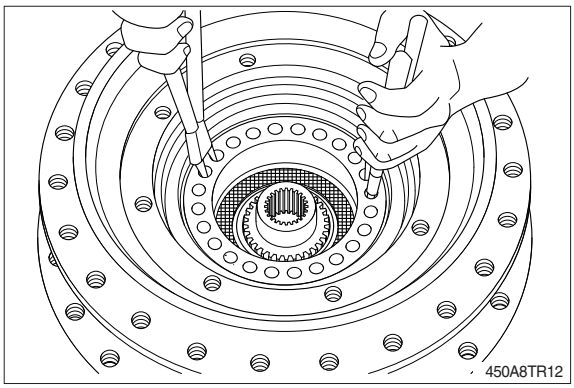
(28) Fit the backup rings (23, 26) and the O-rings (24, 25) inside the two internal groves of the flanged hub (17, see drawing).



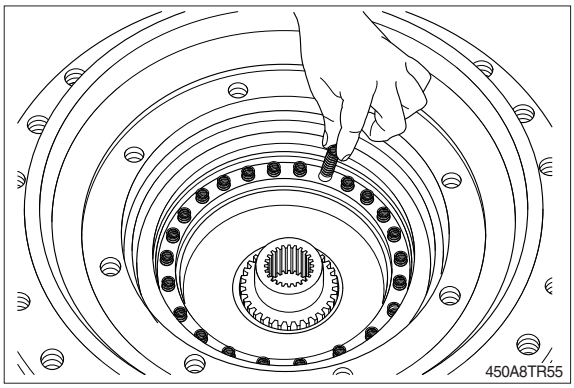
※ An O-ring and a backup ring must be fitted in the grove paying attention that the backup ring must always be beyond the O-ring against the oil flow.



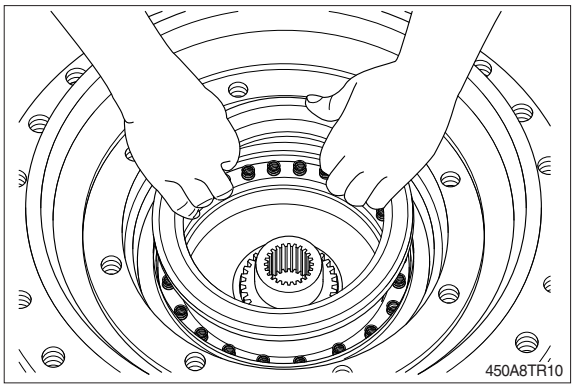
(29) Insert the brake piston (27) inside the flanged hub (17), paying attention not to damage the seals already fitted.



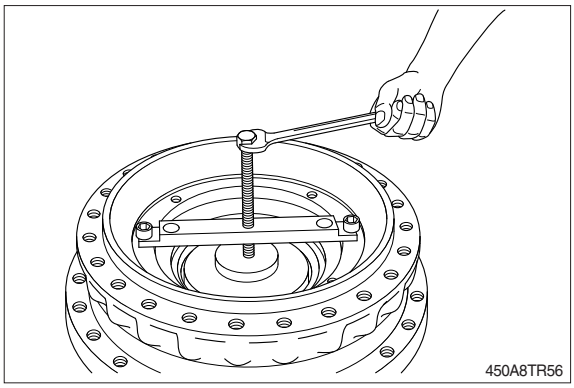
(30) Insert the springs (28) into the groves in the brake piston (27).



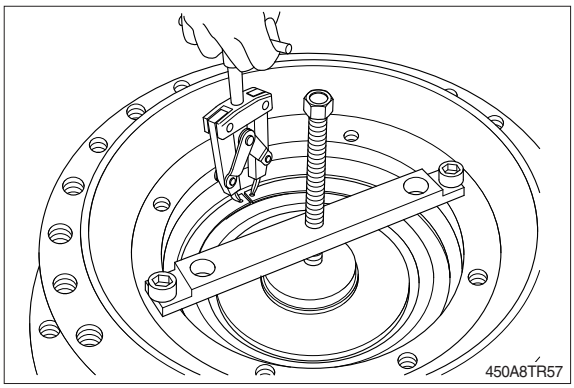
(31) Insert the retainer disc (29).



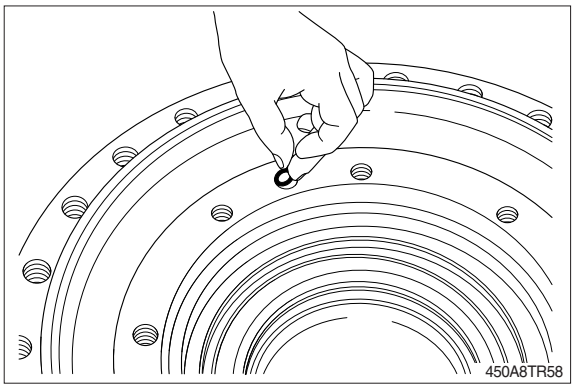
(32) Fixed the equipment to the flanged hub (17) and screw the threaded screw up the springs retainer disc (29) is lowered below the circlip seat (30).



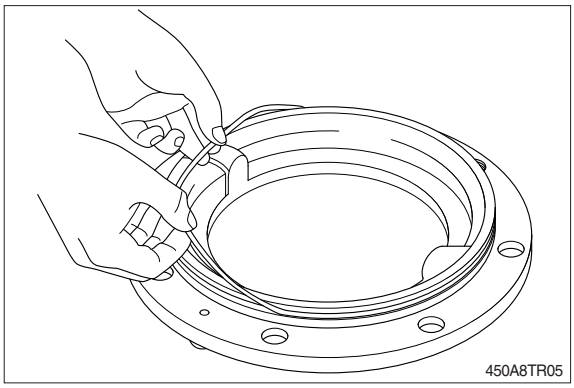
(33) By means of pliers, place the circlip (30) into its grove.



(34) Fit the O-ring (36) into its grove in the flanged hub (17).

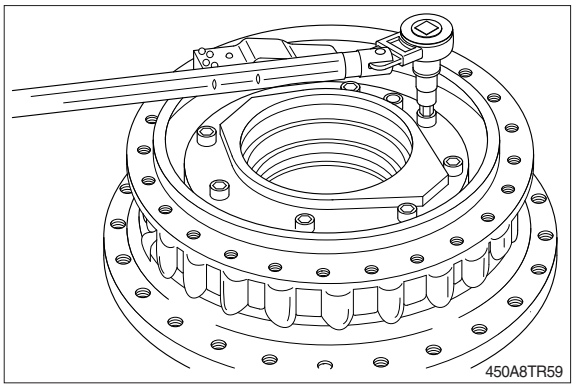


(35) Fit the O-ring (20) into the grove of the motor flange (32).



(36) Place and fix the motor flange (32) to the flanged hub (17) through 8 screws (35) tightened by a torque wrench at a torque of 21.9 kgf · m (158.4 lbf · ft).

※ After having reassembled the gearbox, fit the travel motor (taking care to include the O-ring(32), by means of 2 fixing screws(33), tightened at 42.3kgf · m (306.0lbf · ft). Fill the gearbox with the lubricant oil.



1. REMOVAL AND INSTALL

1) REMOVAL



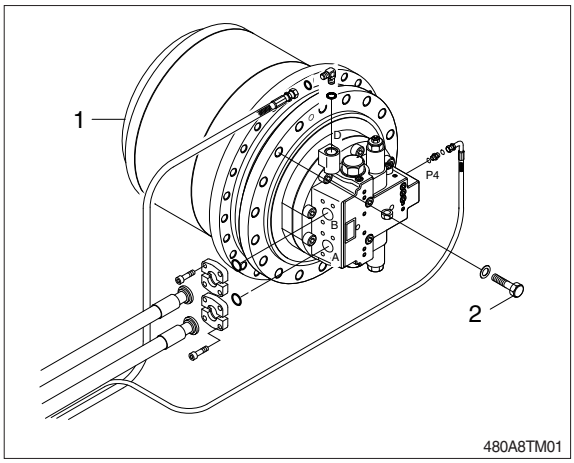
(1) Swing the work equipment 90 °and lower it completely to the ground.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.



(4) Remove the track shoe assembly.
For details, see removal of track shoe assembly.

(5) Remove the cover.

(6) Remove the hoses.

※ Fit blind plugs to the disconnected hoses.

(7) Remove the bolts and the sprocket.

(8) Sling travel device assembly (1).

(9) Remove the mounting bolts (2), then remove the travel device assembly.
- Weight : 632 kg (1393 lb)
- Tightening torque : 57.9±8.7 kgf · m (419±62.9 lbf · ft)

2) INSTALL

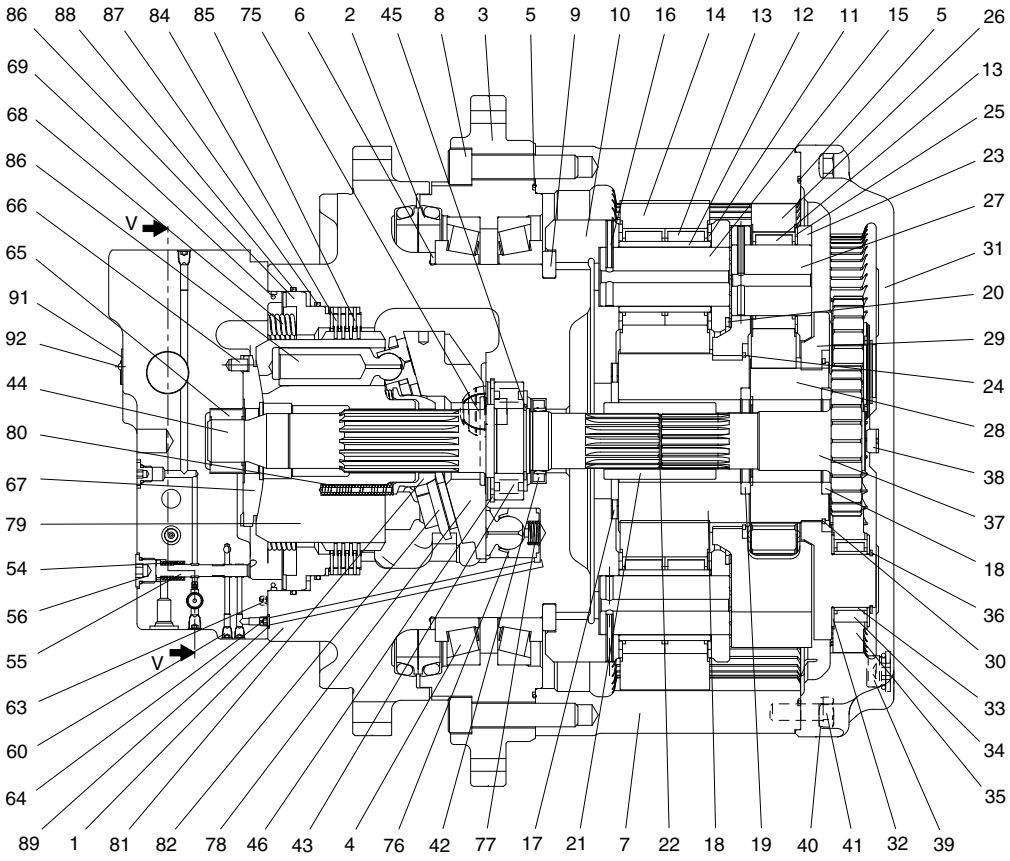
(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from the travel motor.
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling, and check oil come out from plug.
⑤ Tighten plug fully.

(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. TRAVEL MOTOR

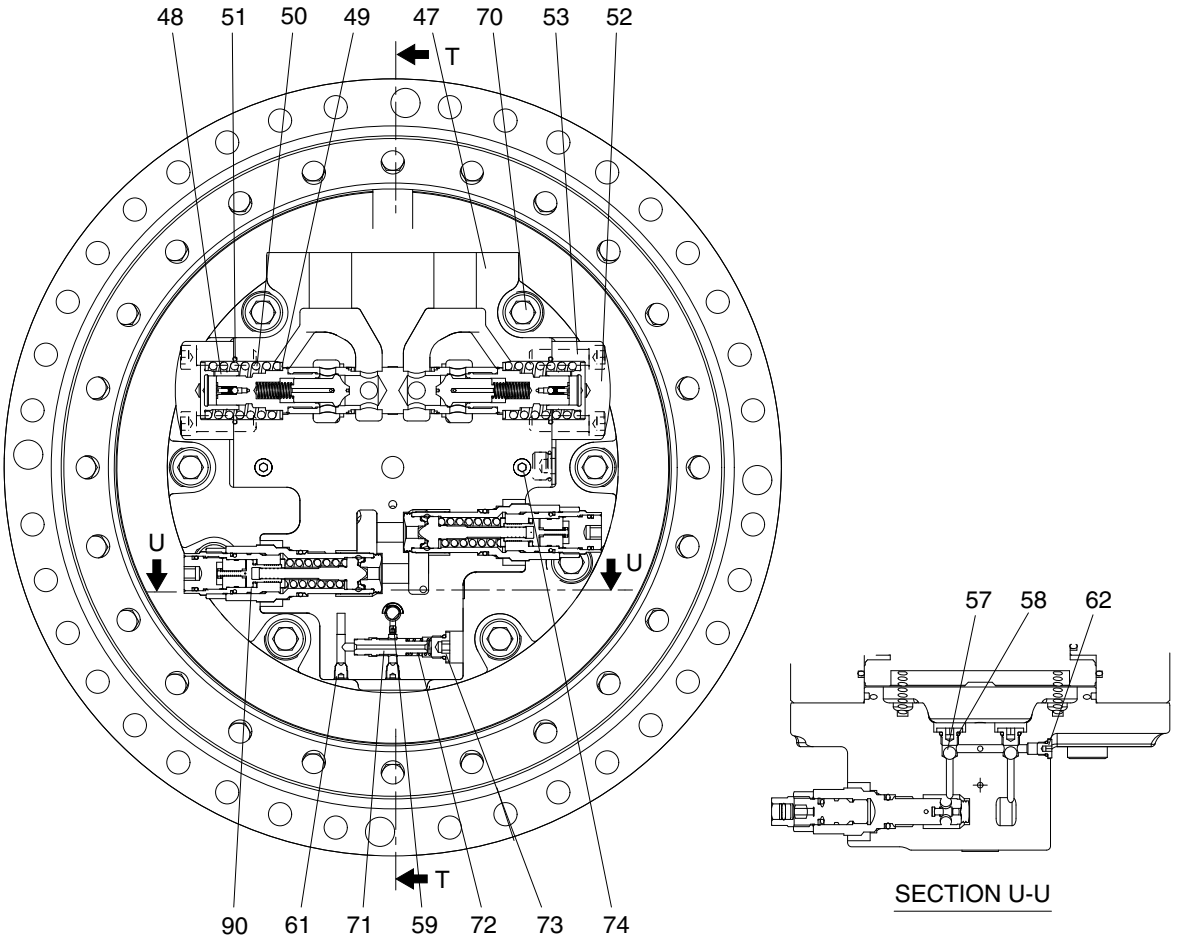
1) STRUCTURE (1/2)



480A2TM02

1	Casing	26	Planetary gear no.2	63	Orifice
2	Floating seal	27	Shaft no.2	64	Orifice
3	Hub	28	Sun gear no.2	65	Needle bearing
4	Taper roller bearing	29	Carrier no.1	66	Parallel pin
5	O-ring	30	Clip	67	Valve plate
6	Distance piece	31	Cover	68	Spring
7	Ring gear	32	Side plate	69	O-ring
8	Socket bolt	33	Ring inner	75	Pivot
9	Shim plate	34	Needle bearing	76	2 speed piston assy
10	Carrier no.3	35	Planetary gear no.1	77	2 speed piston spring
11	Thrust washer	36	Snap ring	78	Swash plate
12	Floating bushing	37	Drive gear	79	Cylinder block
13	Needle bearing	38	Thrust washer	80	Cylinder block spring
14	Planetary gear no.3	39	HS plug assy	81	Spherical bushing
15	Shaft no.3	40	Spring washer	82	Retainer plate
16	Spring pin	41	Hex bolt	83	Piston assy
17	Thrust plate	42	Shaft seal	84	Friction plate
18	Sun gear no.3	43	Roller bearing	85	Separation plate
19	Thrust ring	44	Drive shaft	86	Brake piston
20	Thrust ring	45	Snap ring	87	O-ring
21	Coupling	46	Snap ring	88	O-ring
22	Snap ring	54	2 speed spring	89	O-ring
23	Carrier no.2	55	2 speed spool	91	Name plate
24	Clip	56	HS plug assy	92	Rivet screw
25	Thrust washer	60	MW 08		

STRUCTURE (2/2)



47	Valve casing	53	Socket bolt	70	Socket bolt
48	Counterbalance spool sssy	57	Steel ball	71	Reducing valve
49	CB Washer	58	HS plug assy	72	Reducing spring
50	CB main spring	59	Orifice	73	HS plug assy
51	O-ring	61	MW 10	74	PT plug
52	CB cover	62	HS plug assy	90	Relief valve

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark
Hex bit	8, 10, 17㎜
Hex socket	22, 41㎜
Eye bolt	M16x2
Guide pin	M20x2.5x45
Torque wrench	Capable of tightening with the specified torques.
Ball bearing assembly press-fit jig	-
Floating seal assembly jig	-
Caliper	-
Plastic hammer	-
Air gun	-
Compressed air	-

(2) Tightening torque

Item	Part name	Torque	
		kgf · m	lbf · ft
39	Plug	17.0±3.0	123±21.7
41	Socket bolt	10.4±1.6	75.2±11.6
53	Socket bolt	17.4±2.5	126±18.1
56	Plug	10.0±2.0	72.3±14.5
58	Plug	6.0±1.5	43.4±10.8
70	Socket bolt	50.3±8.0	364±57.9
90	Relief valve	18.0±3.6	130±26.0

4. DISASSEMBLY AND ASSEMBLY

1) PRECAUTIONS

(1) Be careful not to damage the seal contact surface of the floating seal, O-ring, shaft seal, etc. and the contact surface of the gear, pin, bearing.

(2) When disassembling after mounted on the equipment, make sure no foreign substances enter the equipment.

(3) Clean each part with oil sufficiently and dry it with the compressed air before assembly.

(4) When using oil absorbent or oil mop, be careful not to scratch the parts. Clean it thoroughly with lint-free cloths before assembly.

(5) When tightening the bolt and plug, use a torque wrench and tighten the bolt and plug to the specified tightening torque.

(6) Use a plastic hammer to tap the non-functional parts.

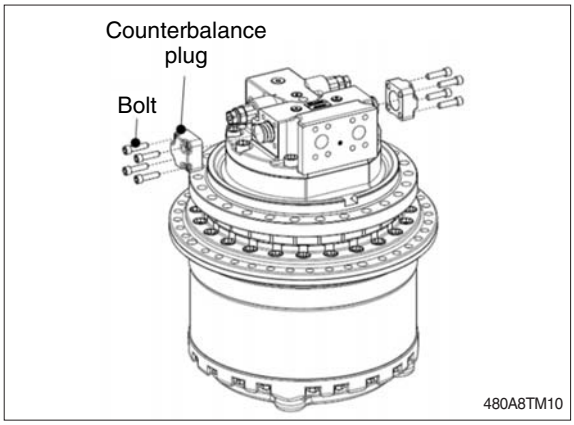
(7) eplace the floating seal, O-ring, shaft seal with a new one when disassembly.

(8) For the assembly of bearing preload/floating seal, please contact Hyundai dealer for the detailed assembly method.

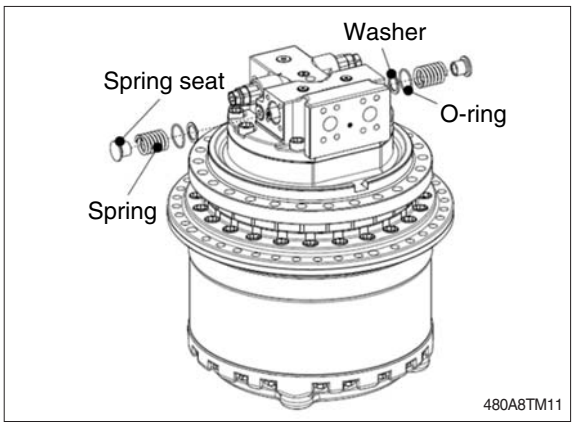
2) DISASSEMBLY

(1) Disassemble the counterbalance plug and bolt.

※ Required tools : torque wrench, hex bit 10 mm.

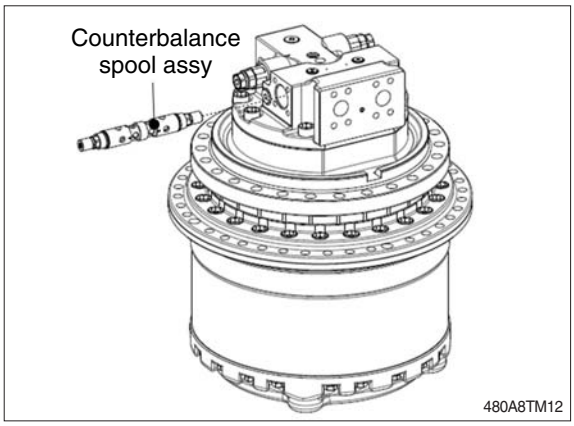


(2) Disassemble the spring, spring seat, O-ring, washer.



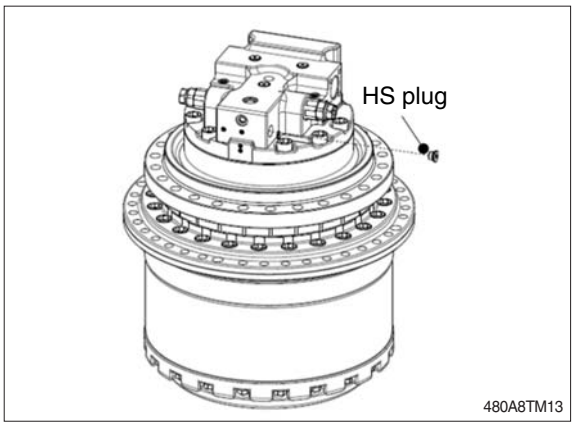
(3) Turn the counterbalance spool assy slowly to disassemble .

※ Damage caution of counterbalance spool surface.



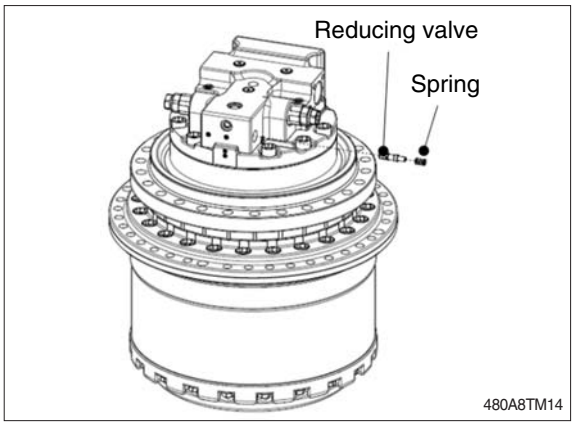
(4) Disassemble the HS plug.

※ Required tools : torque wrench, hex bit 8 mm.



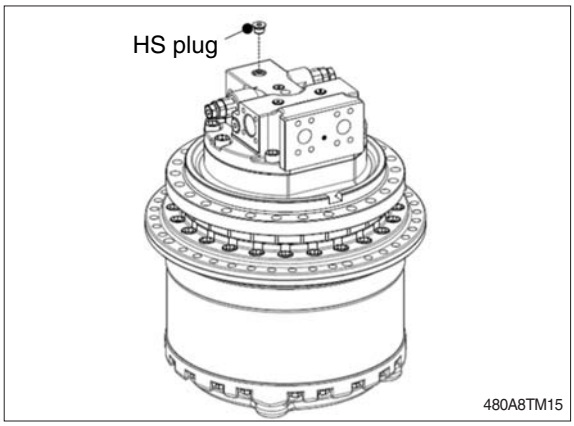
(5) Disassemble the reducing valve, spring.

※ Damage caution of reducing valve surface.



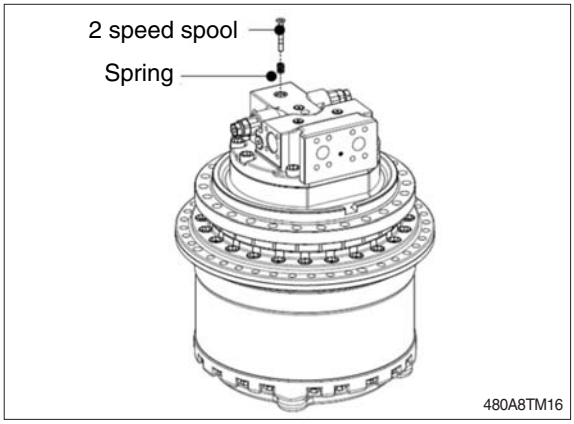
(6) Disassemble the HS plug.

※ Required tools : torque wrench, hex bit 10 mm.



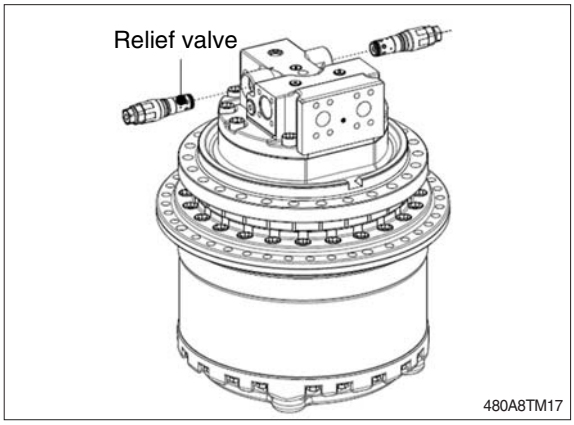
(7) Disassemble the 2 speed spool and spring.

※ Damage caution of 2 speed spool surface.



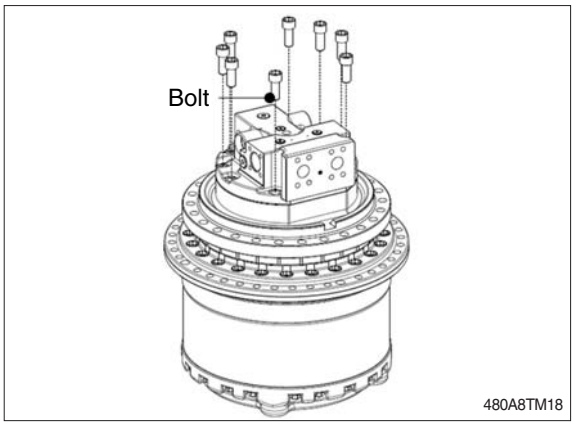
(8) Disassemble the relief valves.

※ Required tools : torque wrench, hex socket 41 mm.

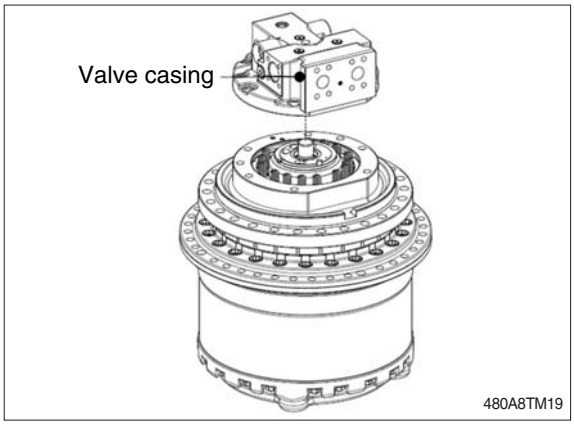


(9) Loosen each bolt evenly to disassemble.

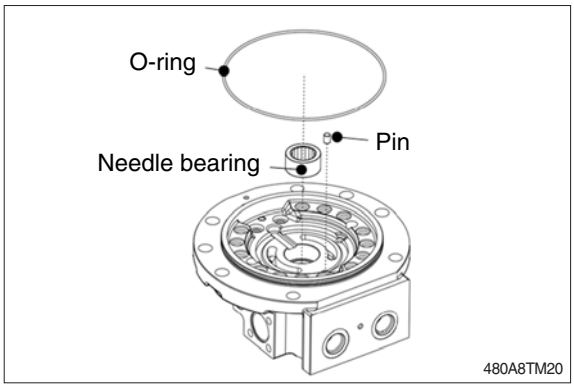
※ Required tools : torque wrench, hex bit 17 mm.



(10) Disassemble the valve casing.

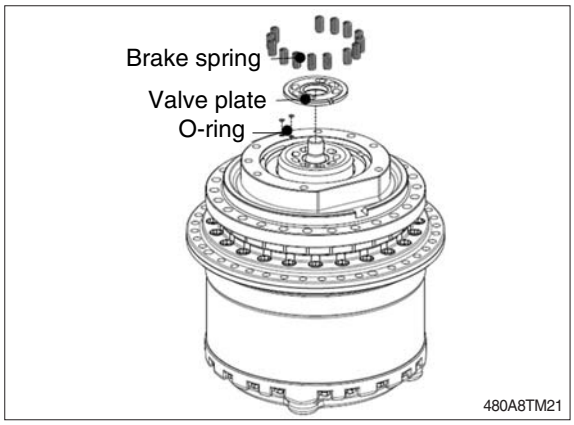


(11) Disassemble the needle bearing, O-ring, pin.



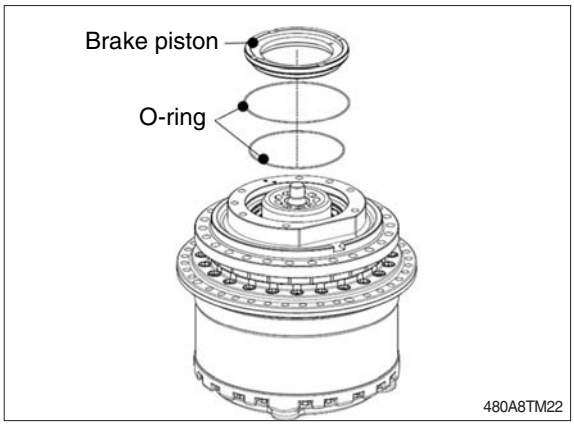
(12) Disassemble the brake spring.

※ Quantity of the brake springs could be different of each model.
Disassemble the valve plate and O-ring.



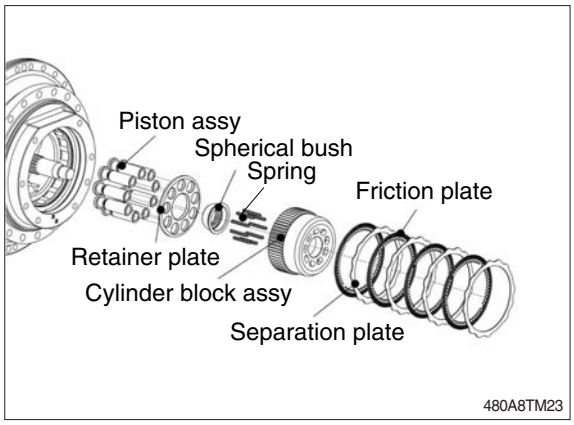
(13) Cover the top of a motor with cloths and disassembly the brake piston by blowing compressed air into the brake releasing line of the motor casing.
Disassemble the O-ring.

※ Required tools : compressed air, air gun.

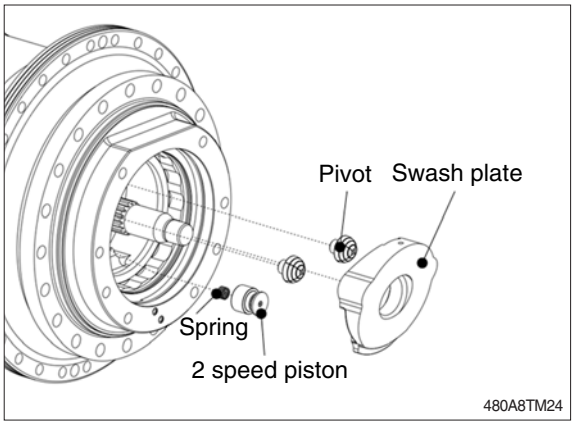


(14) Disassemble separation plate, friction plate, cylinder block assembly, spherical bush, spring, retaining plate and piston assembly.

※ Quantity of separation and friction plates could be different of each model.

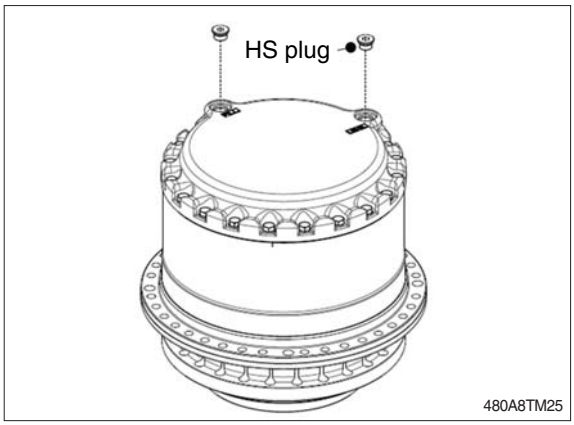


(15) Disassemble the swash plate, pivot, 2 speed piston and spring.



(16) Disassemble the HS plug and discharge the reduction gear oil.

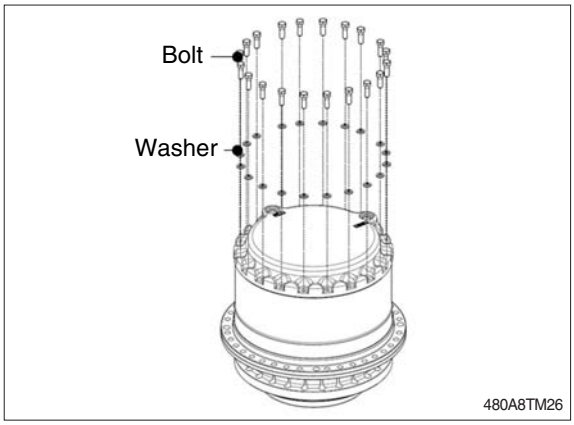
※ Required tools : torque wrench, hex bit 10 mm.



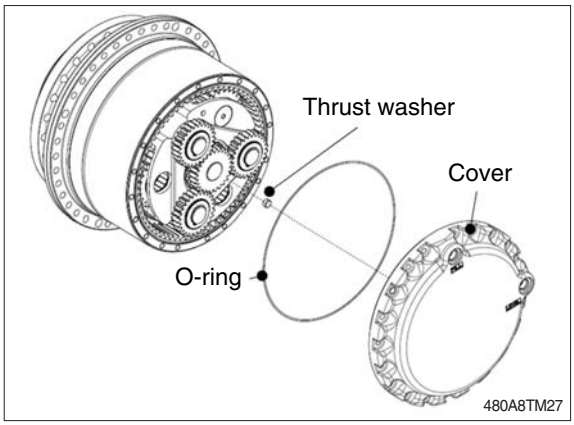
(17) Disassemble the bolt and washer.

※ Do not re-use.

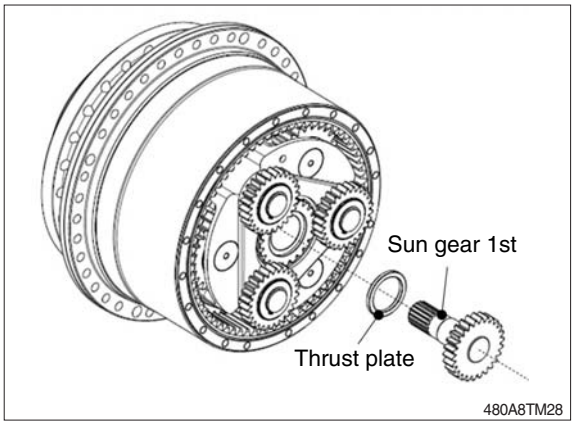
※ Required tools : torque wrench, hex socket 22 mm.



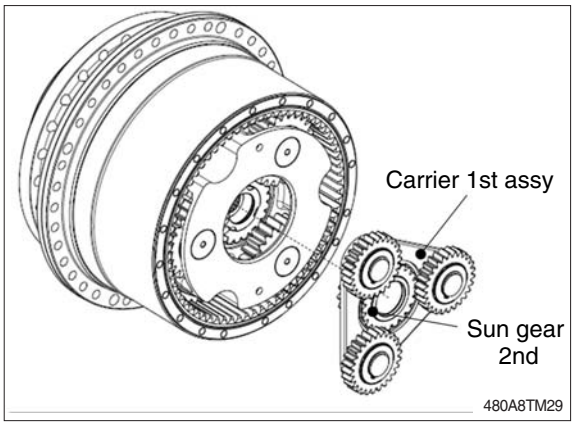
(18) Disassemble the cover, thrust washer and O-ring.



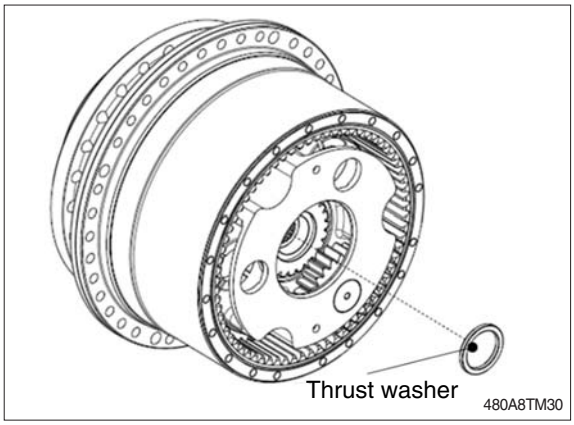
(19) Disassemble the sun gear 1st and thrust plate.



(20) Disassemble the carrier 1st assembly and sun gear 2nd.

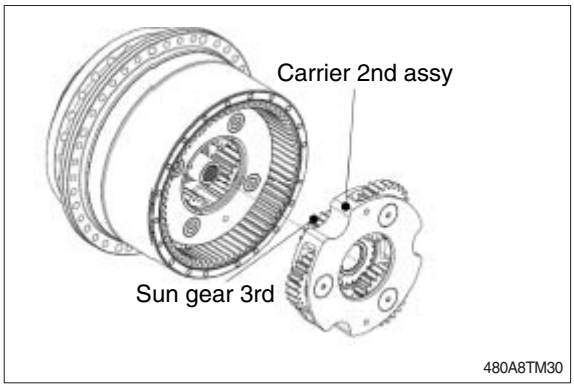


(21) Disassemble the thrust washer.

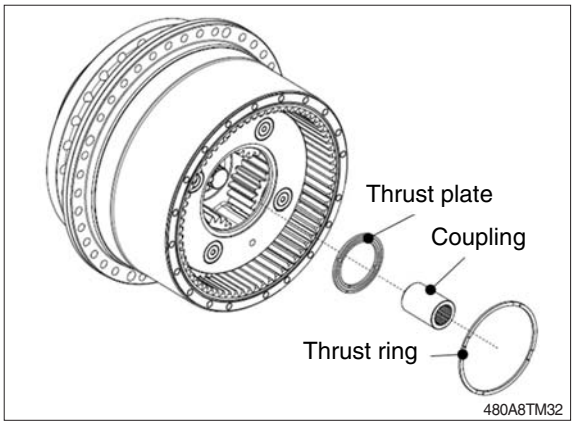


(22) Disassemble the carrier 2nd assembly and sun gear 3rd.

※ Required tools : eye bolt M16x2 (2ea)

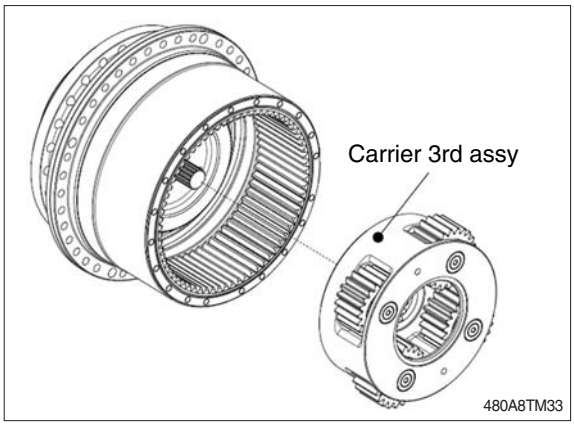


(23) Disassemble the thrust ring, coupling and thrust plate.

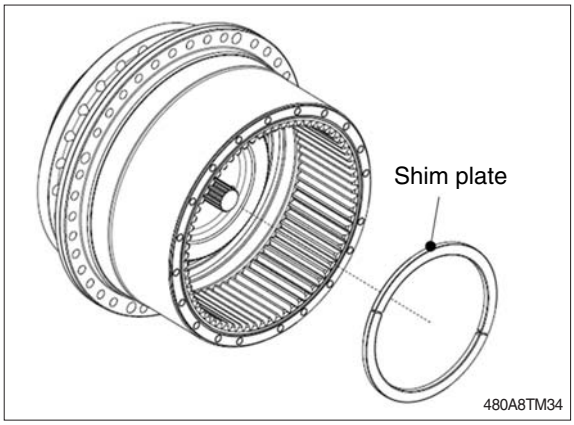


(24) Disassemble the carrier 3rd assembly.

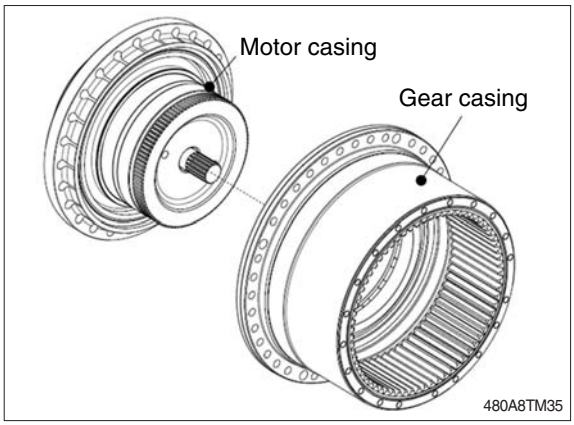
※ Required tools : eye bolt M16x2 (2ea)



(25) Disassemble the shim plate.

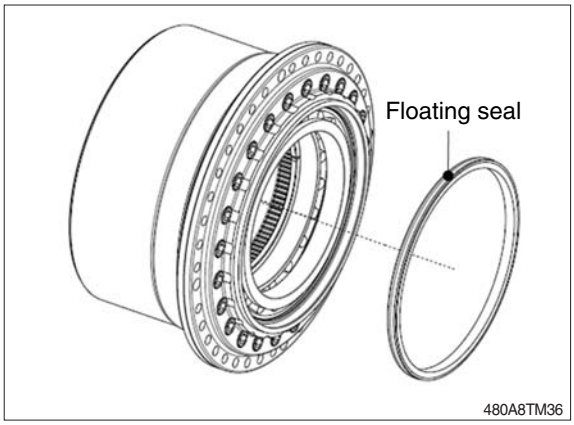


(26) Disassemble the gear casing.

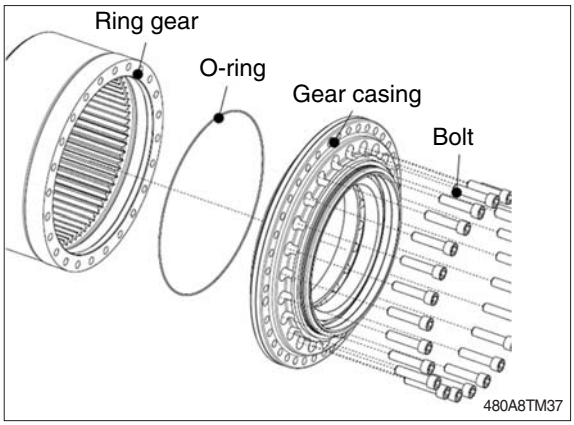


(27) Disassemble the floating seals and O-ring.

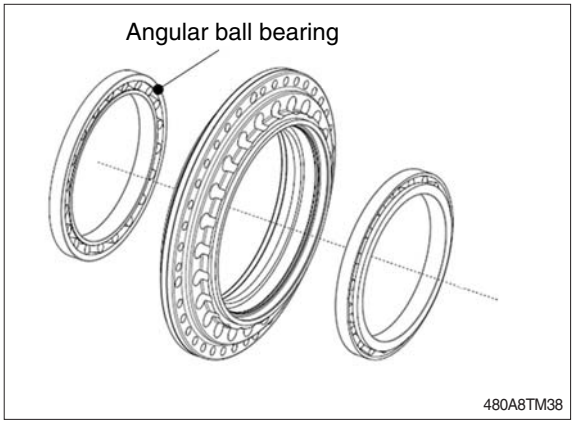
※ Damage caution of floating seal.



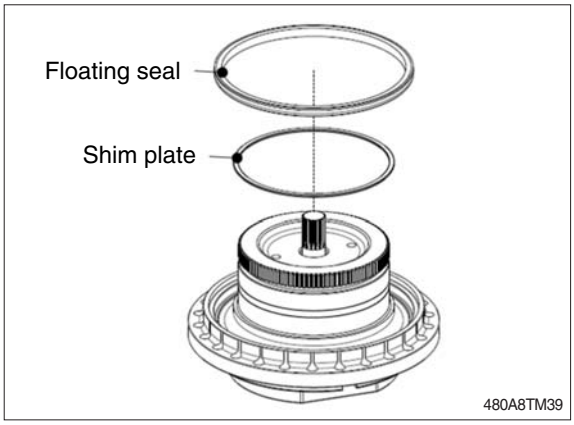
(28) Disassemble the bolt, gear casing, O-ring and ring gear.



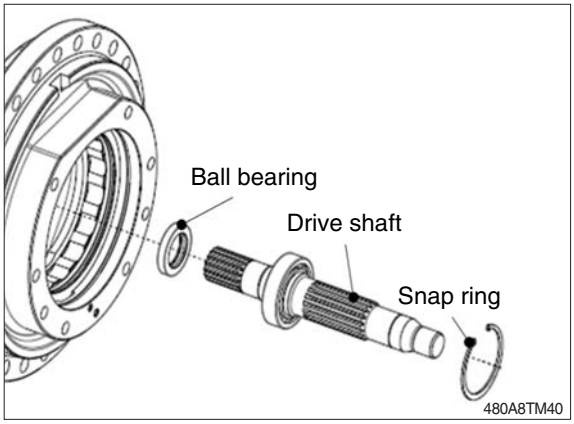
(29) Disassemble the angular ball bearing.
※ Do not disassemble if not necessary.



(30) Disassemble the floating seal and shim plate.
※ Damage caution of floating seal.

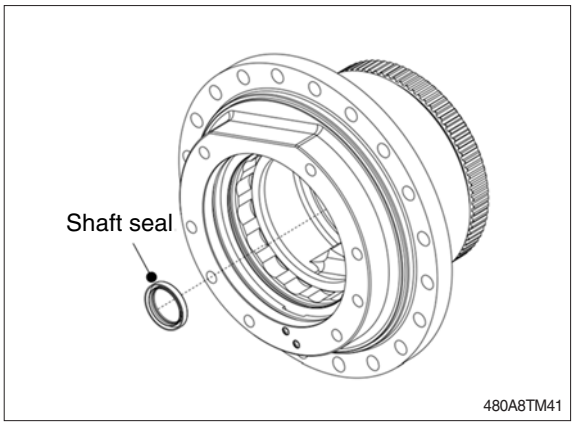


(31) Disassemble the drive shaft and ball bearing and snap ring.
※ Required tools : plier



(32) Disassemble the shaft seal.

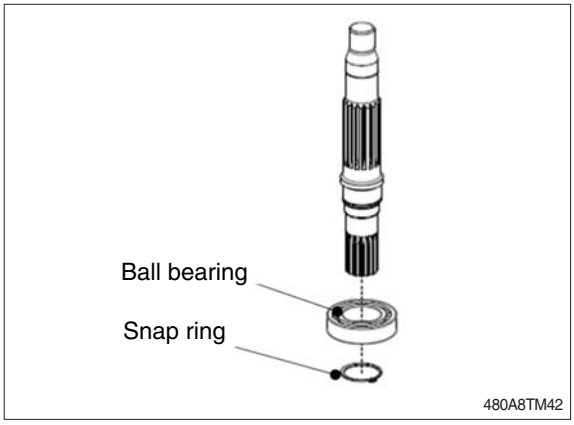
※ Do not re-use.



(33) Disassemble the ball bearing and snap ring.

※ Do not disassemble if not necessary.

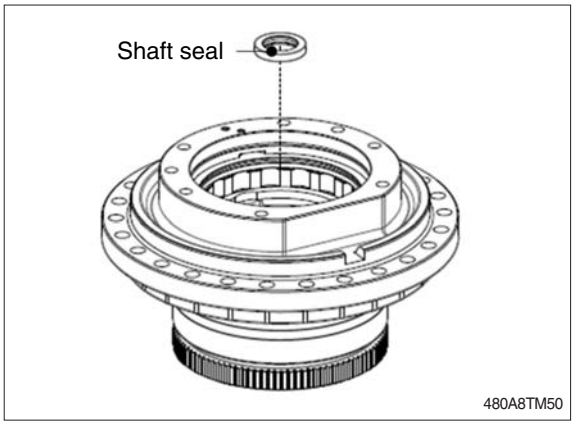
※ Required tools : plier



3) ASSEMBLY

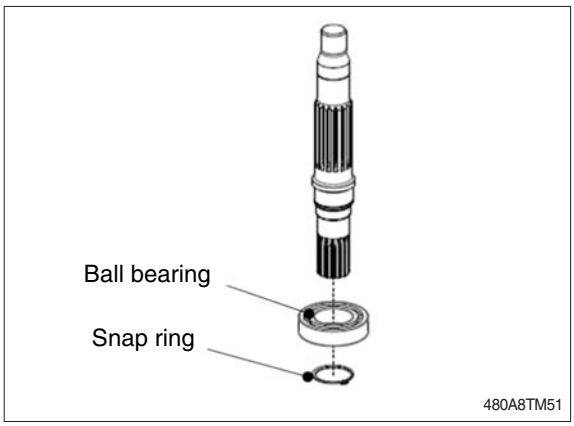
(1) Apply a small amount of hydraulic fluid to the outer diameter of the shaft seal and assemble it to the motor casing

※ Required tools : shaft seal press-fit jig



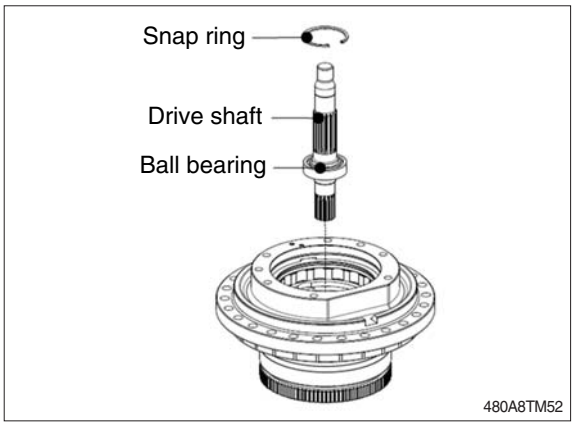
(2) Assemble the ball bearing and snap ring to the drive shaft.

※ Required tools : ball bearing assembly press-fit jig, plier.



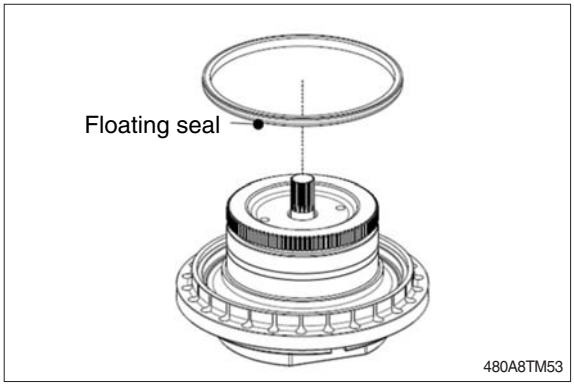
(3) Assemble the drive shaft, ball bearing and snap ring to the motor casing.

※ Required tools : plier



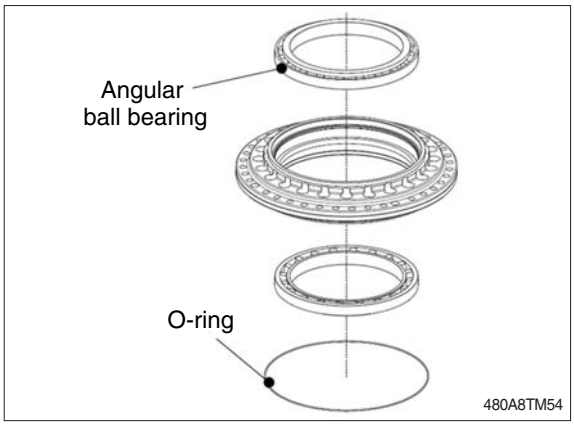
(4) Apply vaporizing lubricant to the O-ring outside of the floating seal and assemble it to the motor casing so that the parallelism can be 0.5 mm or less. After assembly, apply a small amount of hydraulic fluid to the polishing surface.

※ Required tools : floating seal assembly jig.



(5) Assemble the angular ball bearing into the gear casing.
Assemble the O-ring into the gear casing.

※ Required tools : angular ball bearing assembly press-fit jig.

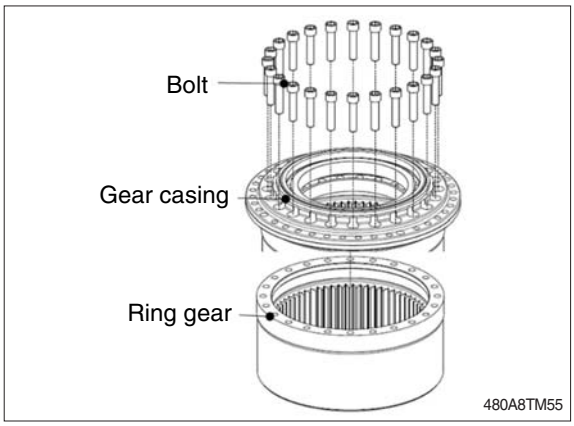


(6) Assemble the gear casing and ring gear.
Assemble the bolt after applying loctite 638.

※ Required tools : torque wrench, hex bit 17 mm.

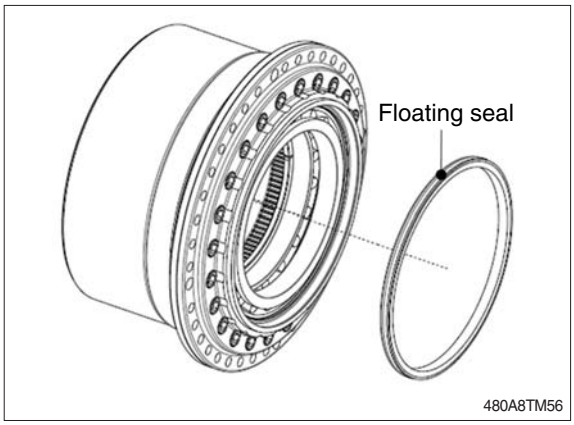
※ Bolt size : M20x2.5

※ Tightening torque : 50.3±8.0 kgf·m
(364±57.9 lbf·ft)



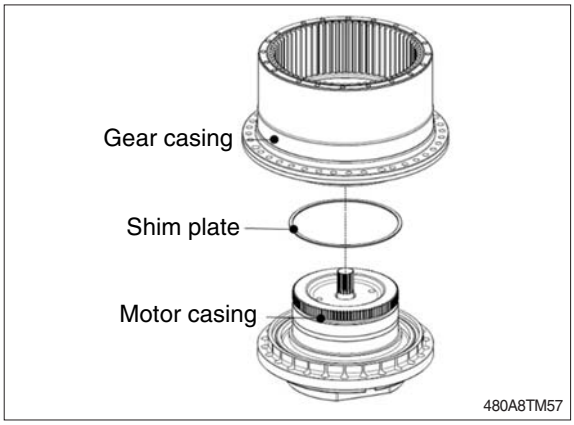
(7) Apply vaporizing lubricant to the O-ring outside of the floating seal and assemble it to the gear casing so that the parallelism can be 0.5 mm or less. After assembly, apply a small amount of hydraulic fluid to the polishing surface.

※ Required tools : floating seal assembly jig.

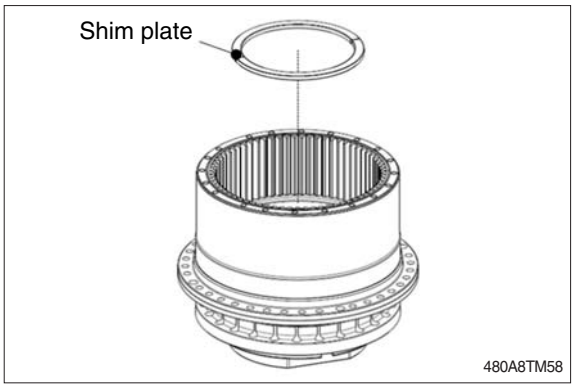


(8) Assemble the shim plate and gear casing to motor casing.

※ Damage caution of floating seal.

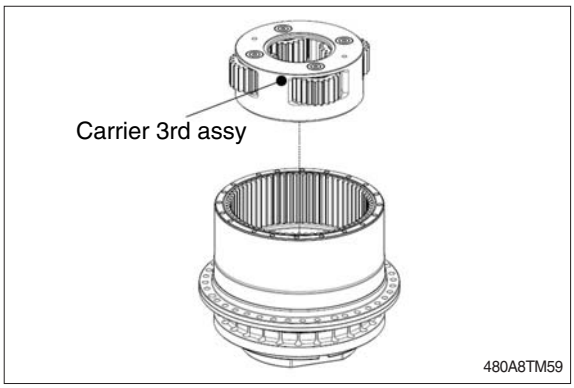


(9) Assemble the shim plate into the motor casing.

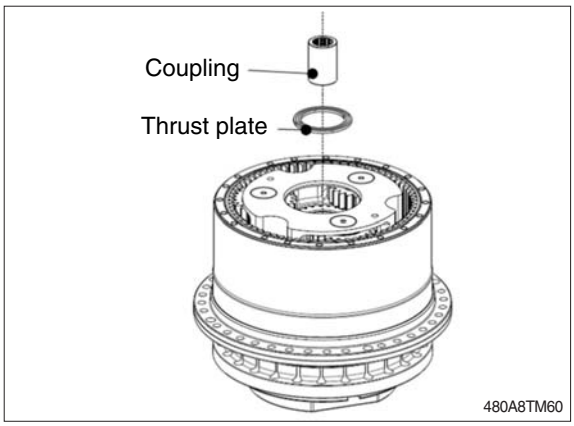


(10) Assemble the carrier 3rd assembly to gear casing.

※ Required tools : eye bolt M16x2 (2ea)

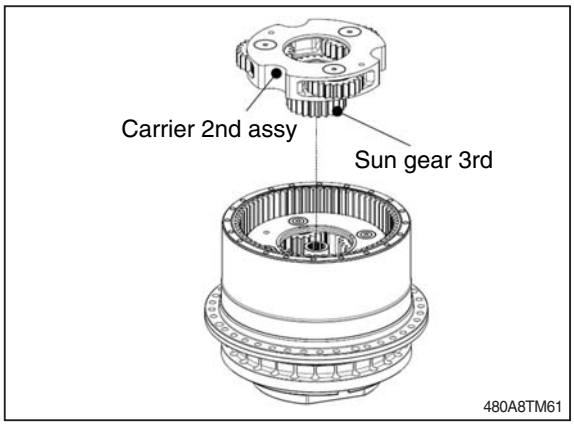


(11) Assemble the coupling and thrust plate.

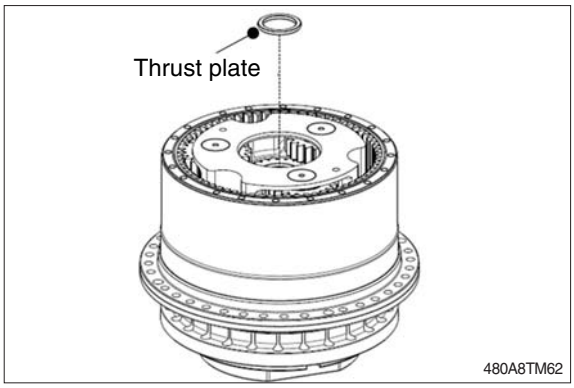


(12) Assemble the carrier 2nd assembly and sun gear 3rd to gear casing.

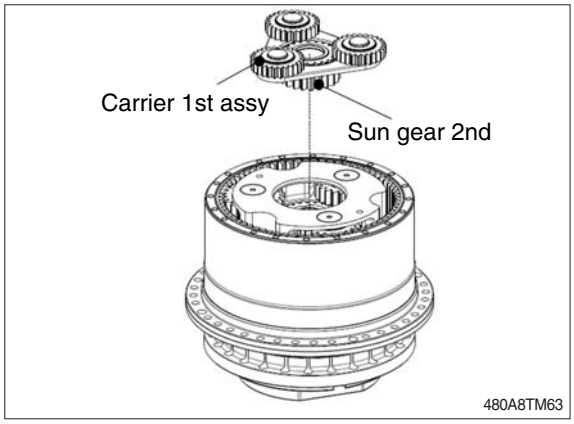
※ Required tools : eye bolt M16x2 (2ea)



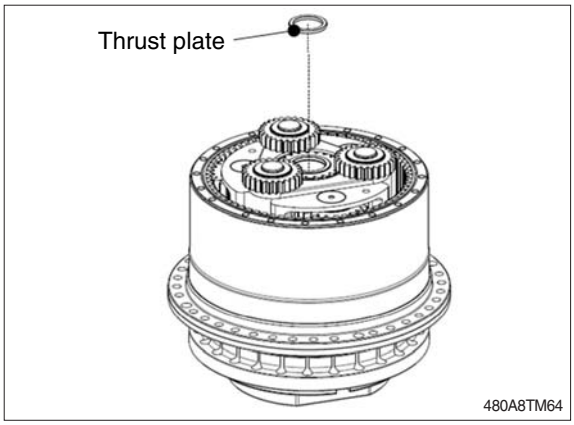
(13) Assemble the thrust plate.



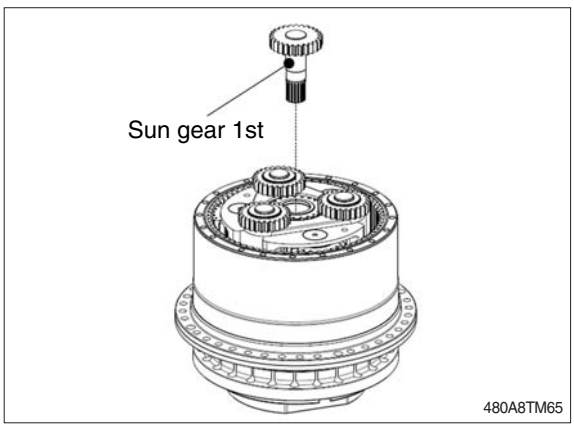
(14) Assemble the carrier no.1 assembly and sun gear 2nd.



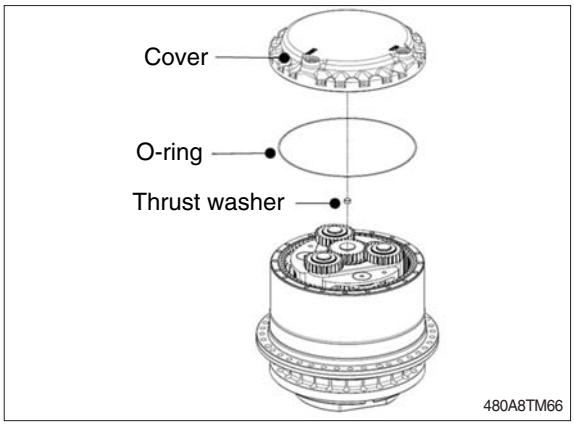
(15) Assemble the thrust plate.



(16) Assemble the sun gear 1st.



(17) Apply grease to thrust washer and assemble it to cover.
Assemble the O-ring and cover to gear casing.

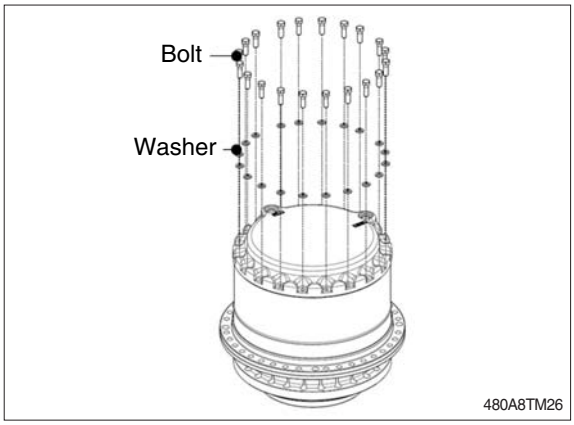


(18) Assemble the bolt and washer.

※ Required tools : torque wrench, hex socket 22 mm.

※ Bolt size : M14x2.0

※ Tightening torque : 17.4±2.5 kgf·m
(126±18.1 lbf·ft)

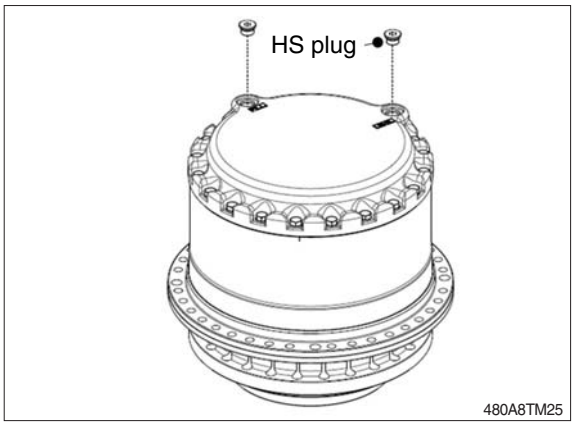


(19) Fill gear oil of 9 liter minimum and assemble HS plug to cover.

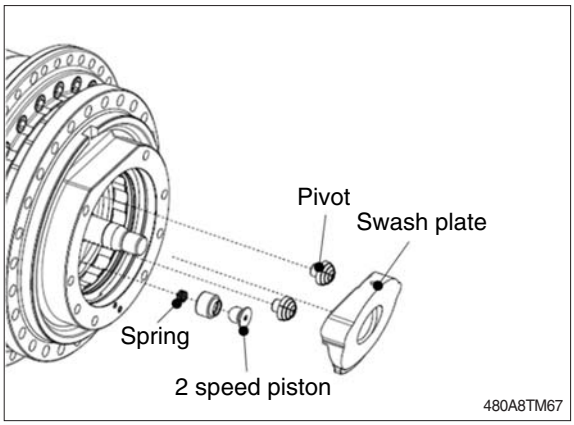
※ Required tools : torque wrench, hex bit 10 mm.

※ HH plug size : G 3/4

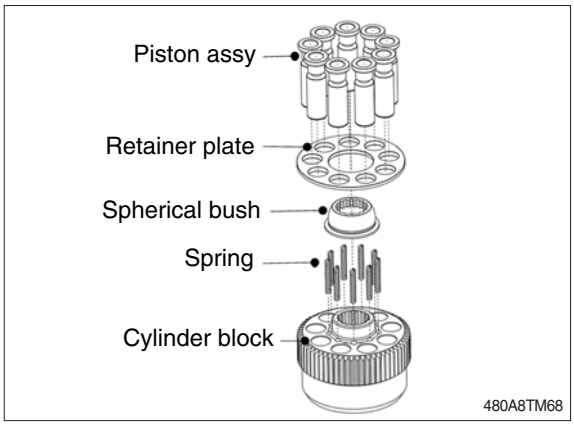
※ Tightening torque : 17.0±3.0 kgf·m
(123±21.7 lbf·ft)



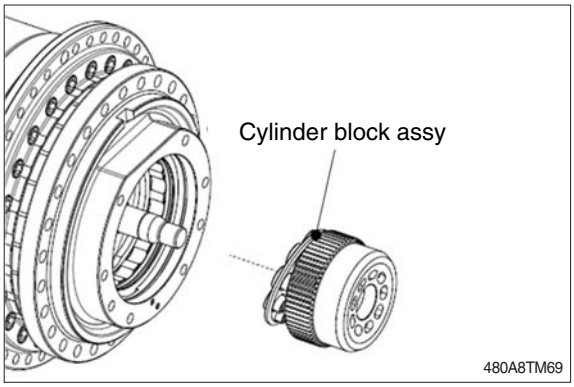
(20) Apply hydraulic fluid to the 2 speed piston outer diameter and swash plate polishing surface.
Apply grease to spring and assemble it to 2 speed piston. Assemble its to the motor casing.
※ Check whether assembled well by pushing 2 speed piston by hand.
Assemble pivot and swash plate to motor casing.
※ Check whether assembled well by pushing 2 speed piston by hand.



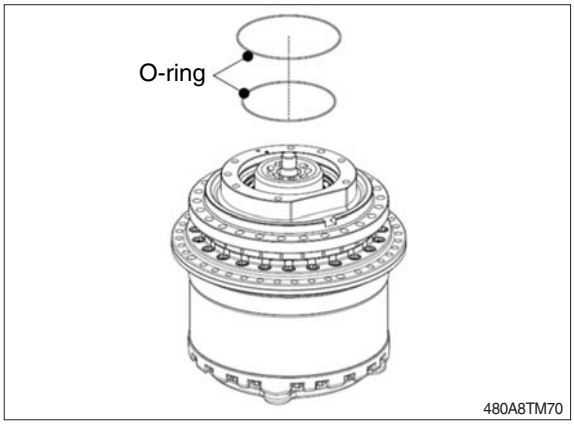
(21) Assemble the cylinder spring, cylinder block, spherical bush, retainer plate and piston assembly.



(22) Apply hydraulic fluid to the shoe.
Assemble the cylinder block assembly to drive shaft.
Apply hydraulic fluid to the cylinder block polishing surface.



(23) Assemble the O-ring to the motor casing.



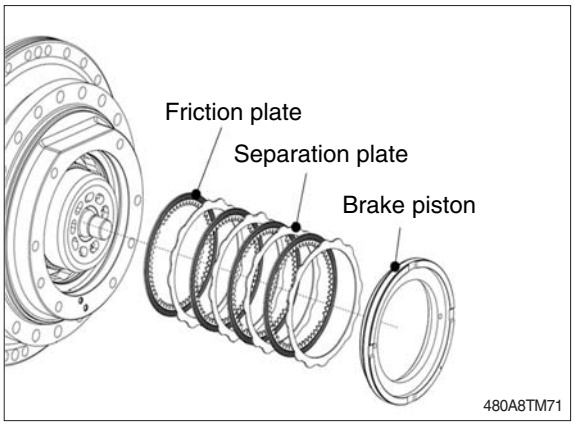
(24) Assemble the friction plate, separation plate to the motor casing in turn.

※ Be careful that the friction plate is in contact with the brake piston.

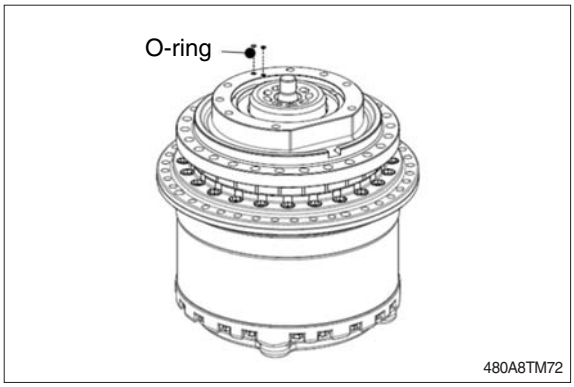
Assemble the brake piston to motor casing.

Check the brake piston is assembled completely to tap the the brake piston with a plastic hammer.

※ Quantity of friction plates and separation plates could be different of each model.



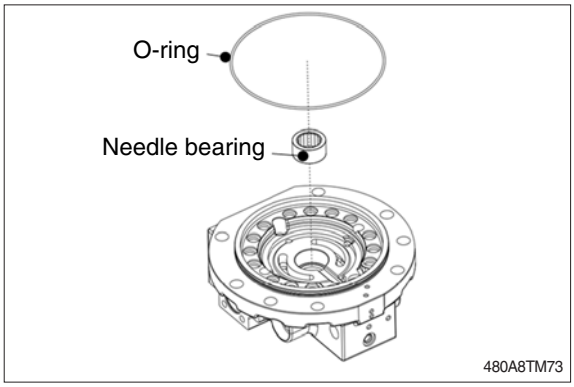
(25) Assemble the O-ring to the motor casing.



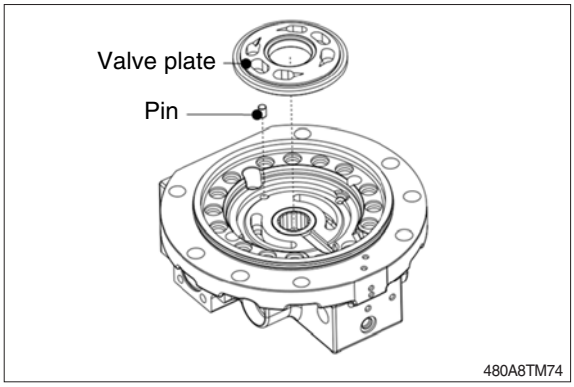
(26) Assemble the needle bearing to the valve casing.

Apply grease to the inner race of ball bearing.

Assemble the O-ring to the valve casing.

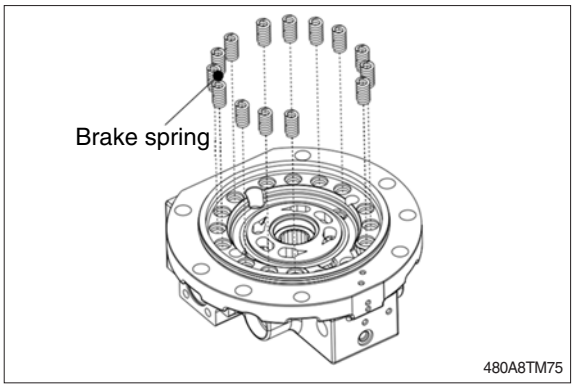


(27) Apply grease to the other side of the valve plate and assemble a valve plate and pin to valve casing.



(28) Apply grease to brake spring and assemble it to the valve casing.

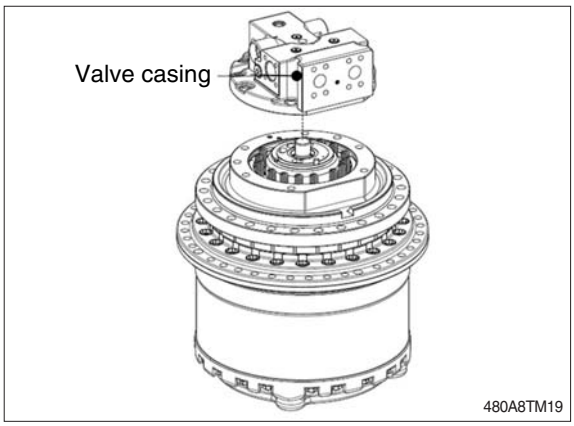
※ Quantity of brake springs could be different of each model.



(29) Assemble the valve casing to the motor casing.

※ Required tools : guide pin

※ Guide pin size : M20x2.5x45
(total length 150 mm or more)

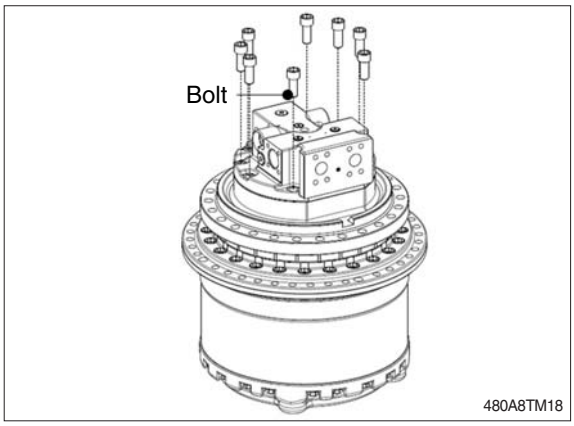


(30) Tighten each bolt evenly to assemble.

※ Required tools : torque wrench, hex bit 17 mm.

※ Bolt size : M20x2.5

※ Tightening torque : 50.3±8.0 kgf·m
(364±57.9 lbf·ft)

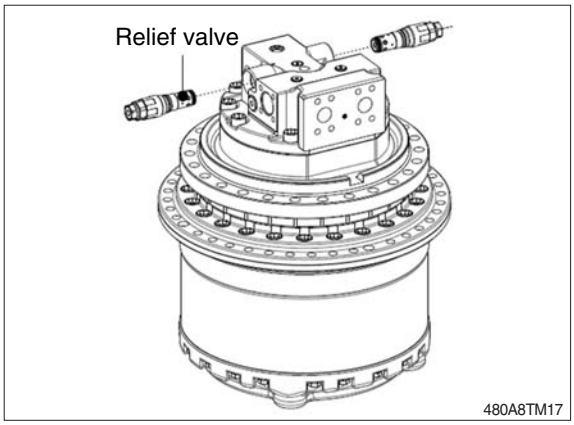


(31) Assemble the relief valve to valve casing.

※ Required tools : torque wrench, hex socket 41 mm.

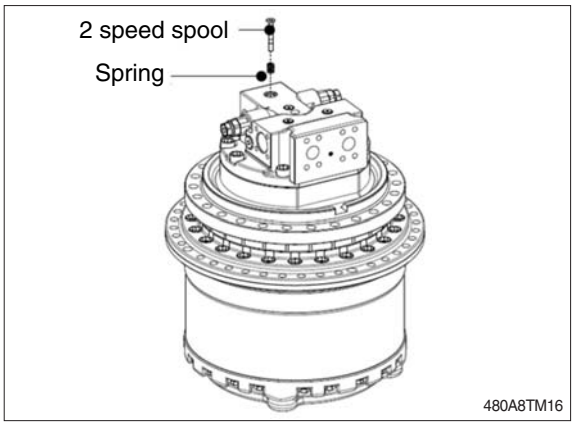
※ Tap size : M33x1.5

※ Tightening torque : 18.0±3.6 kgf·m
(130±26.0 lbf·ft)



(32) Assemble the 2 speed spool, spring to valve casing.

※ Damage caution of 2 speed spool surface.

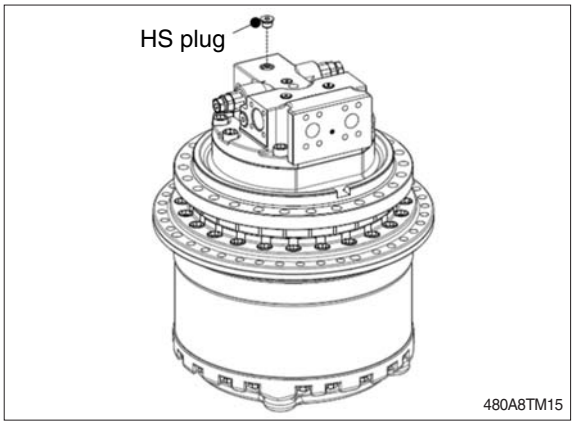


(33) Assemble the HS plug to valve casing.

※ Required tools : torque wrench, hex bit 10 mm.

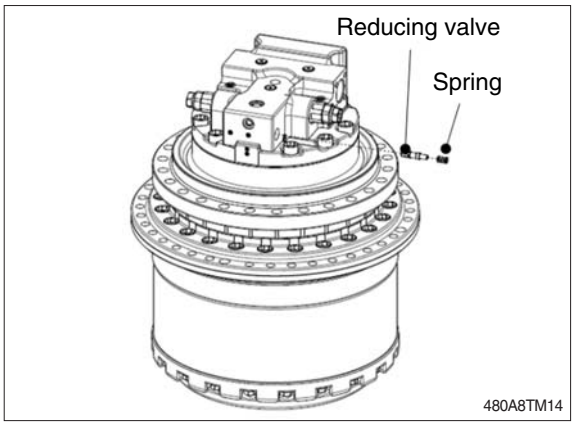
※ Bolt size : G 1/2

※ Tightening torque : 10.0±2.0 kgf·m (72.3±14.5 lbf·ft)



(34) Assemble the reducing valve and spring to valve casing.

※ Damage caution of reducing valve surface.

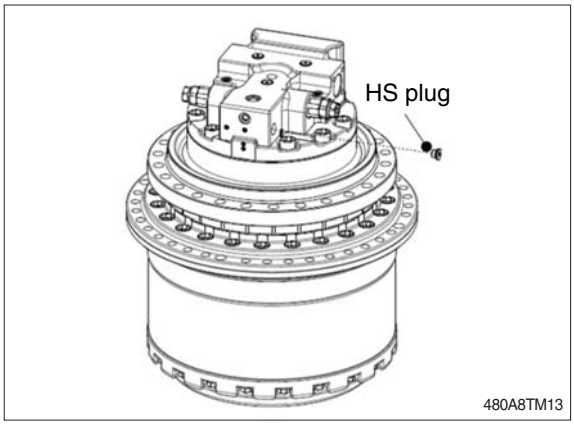


(35) Assemble the HS plug to valve casing.

※ Required tools : torque wrench, hex bit 8 mm.

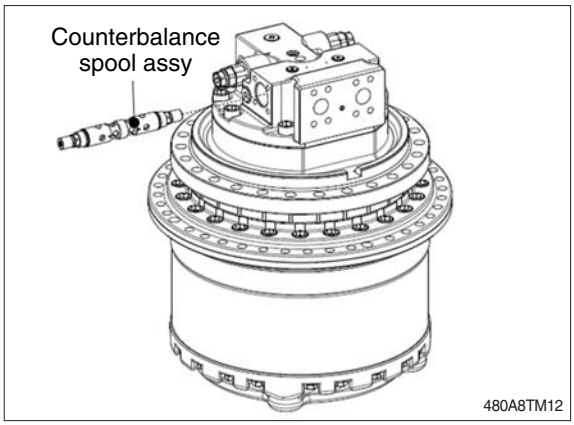
※ Bolt size : G 3/8

※ Tightening torque : 6.0±1.5 kgf·m (43.4±10.8 lbf·ft)



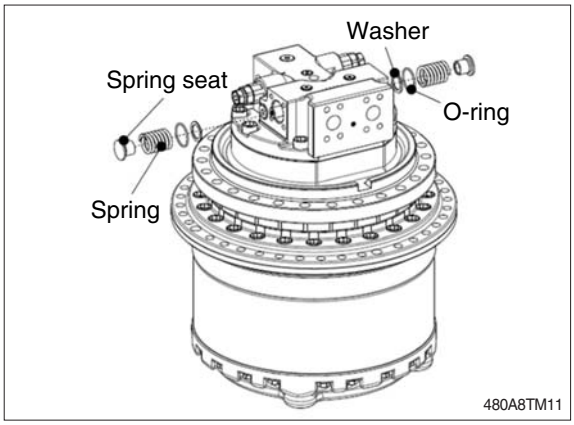
(36) Apply hydraulic fluid to counterbalance spool assy outer diameter and rotate the counterbalance spool assy slowly to assemble.

※ Damage caution of counterbalance spool surface.



(37) Assemble the spring, spring seat, O-ring and washer to the valve casing.

※ Assemble the counterbalance plug and bolt to valve casing.

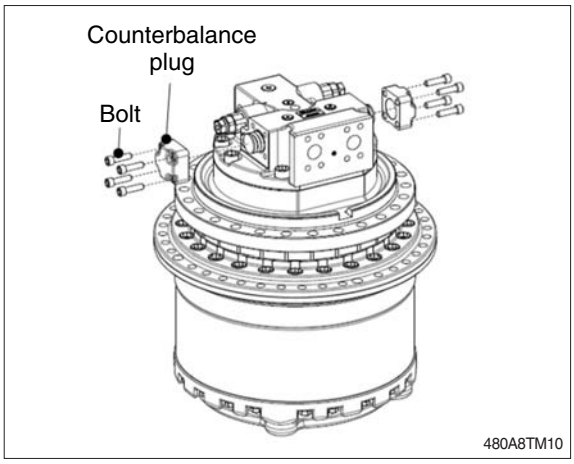


(38) Assemble the counterbalance plug and bolt to valve casing.

※ Required tools : torque wrench, hex bit 10 mm.

※ Bolt size : M12x1.75

※ Tightening torque : 10.4±1.6 kgf·m
(75.2±11.6 lbf·ft)



4) CHECKLIST AFTER ASSEMBLY

(1) Supply sufficient hydraulic fluid to the hydraulic motor part, fill the reduction gear with the appropriate amount of reduction gear oil and then perform a trial run.

(2) In a trial run, perform rotation test at low speed under no load and then a jack up test after mounted on equipment.

GROUP 7 RCV LEVER

1. REMOVAL AND INSTALL

1) REMOVAL

(1) Lower the work equipment to the ground and stop the engine.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

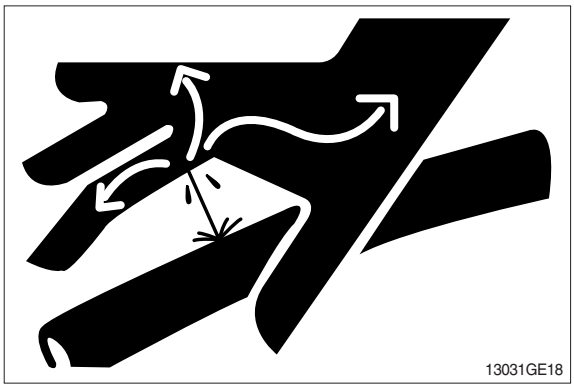
(4) Loosen the socket bolt (1).
Tightening torque : 1.05 ± 0.2 kgf · m
(7.6 ± 1.45 lbf · ft)

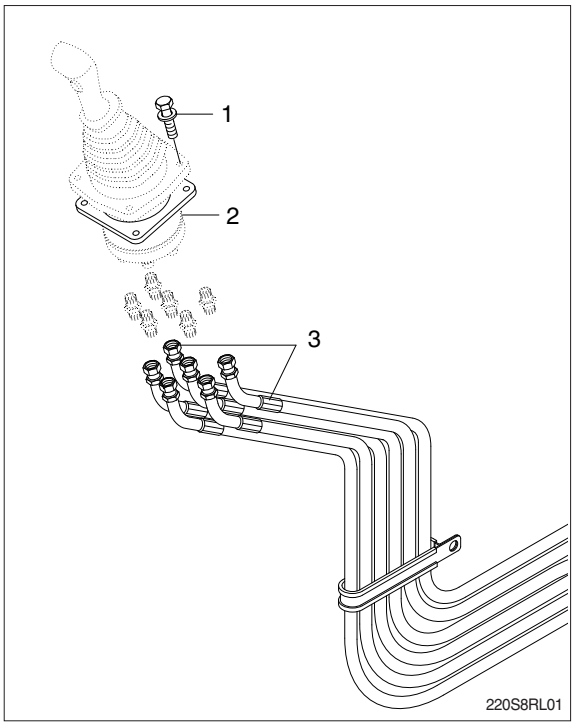
(5) Remove the cover of the console box.

(6) Disconnect pilot line hoses (3).

(7) Remove the pilot valve assembly (2).

※ When removing the pilot valve assembly, check that all the hoses have been disconnected.





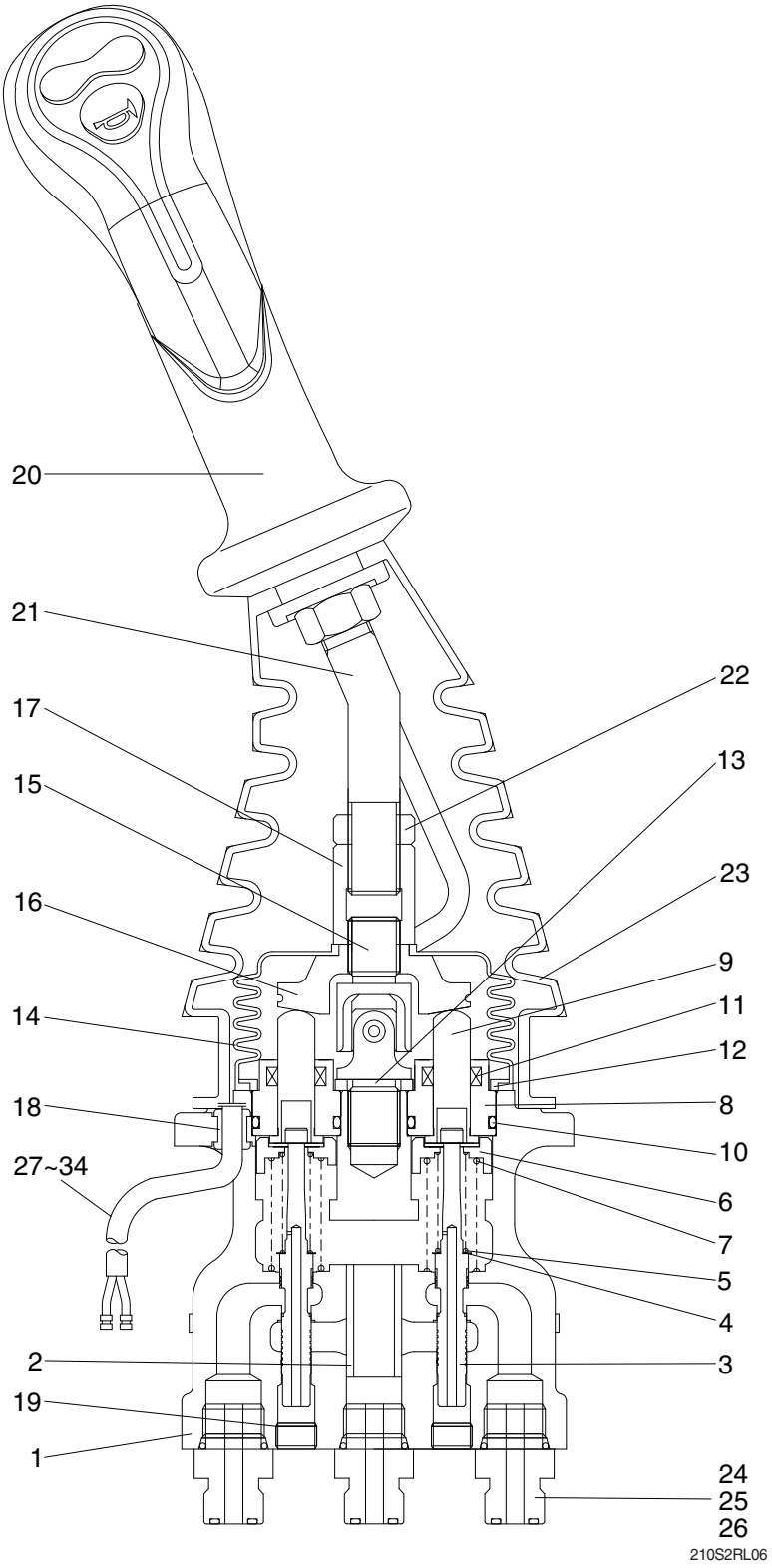
2) INSTALL

(1) Carry out installation in the reverse order to removal.

(2) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

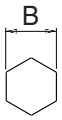
1) STRUCTURE



1	Case
2	Bushing
3	Spool
4	Shim
5	Spring
6	Spring seat
7	Spring
8	Plug
9	Push rod
10	O-ring
11	Rod seal
12	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

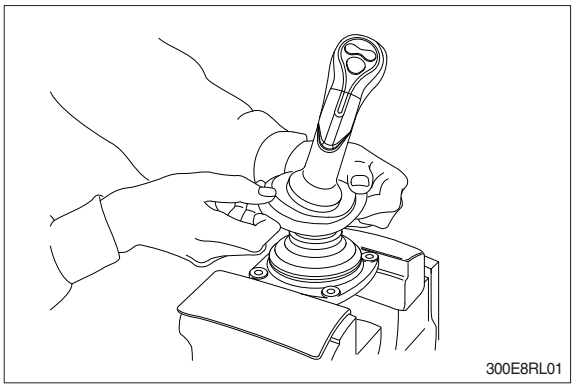
※ Procedures are based on the type M1.

(1) Clean pilot valve with kerosene.

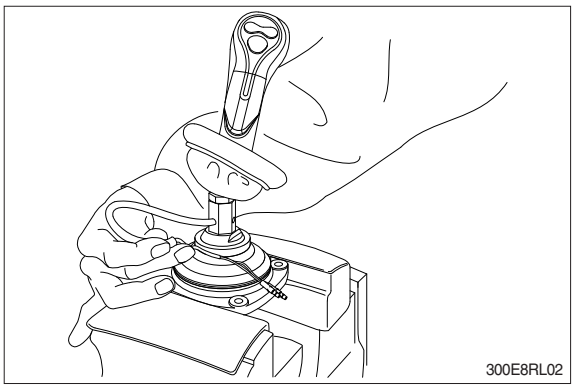
※ Put blind plugs into all ports

(2) Fix pilot valve in a vise with copper (or lead) sheets.

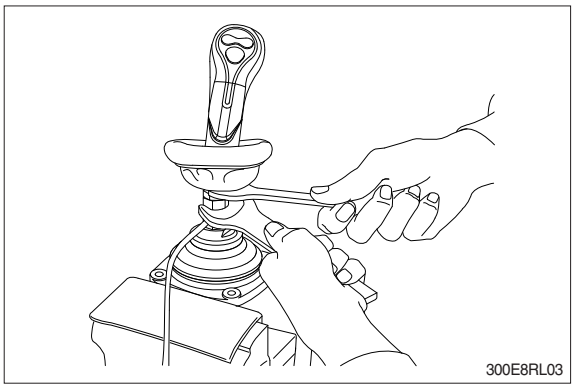
(3) Remove end of boot (23) from case (1) and take it out upwards.



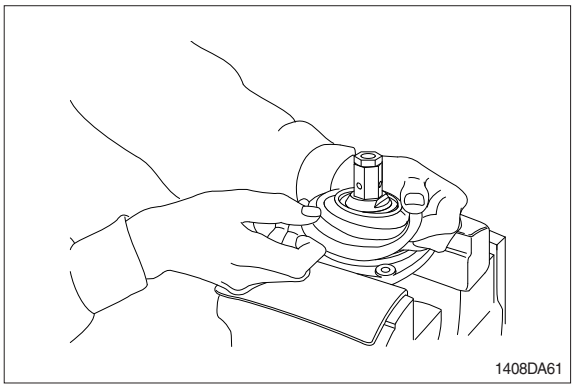
※ For valve with switch, remove cord also through hole of casing.



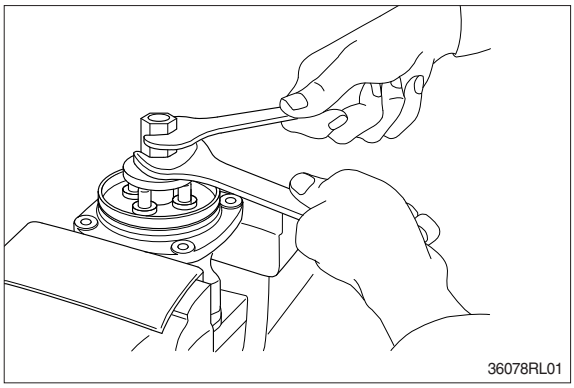
(4) Loosen lock nut (22) and adjusting nut (17) with spanners on them respectively, and take out handle section as one body.

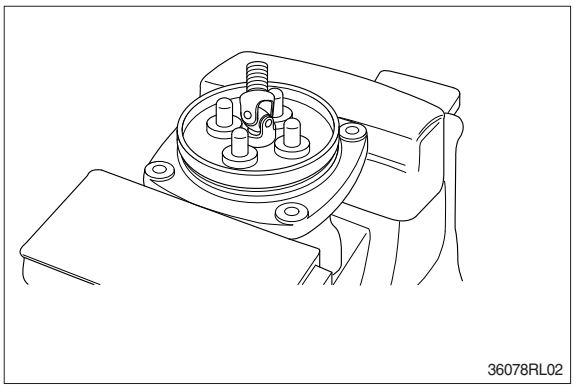


(5) Remove the boot (14).



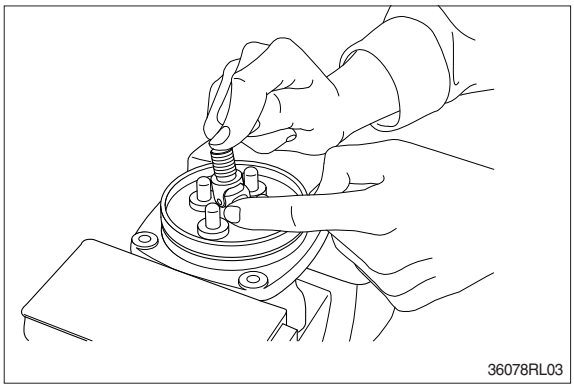
(6) Loosen adjusting nut (17) and swash plate (16) with spanners on them respectively, and remove them.

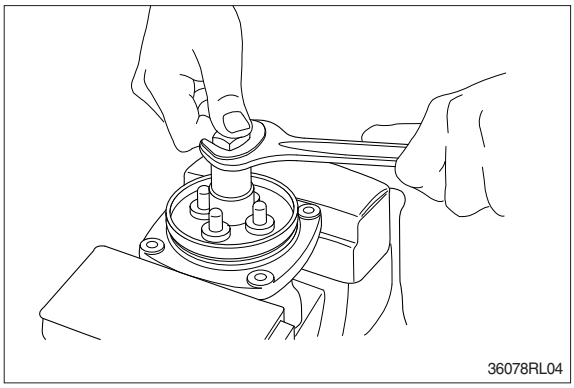




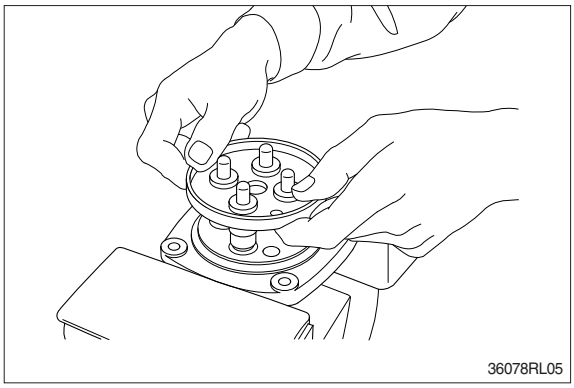
(7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).

※ When return spring (7) is strong in force, plate (12), plug (8) and push rod (9) will come up on loosening joint.
Pay attention to this.





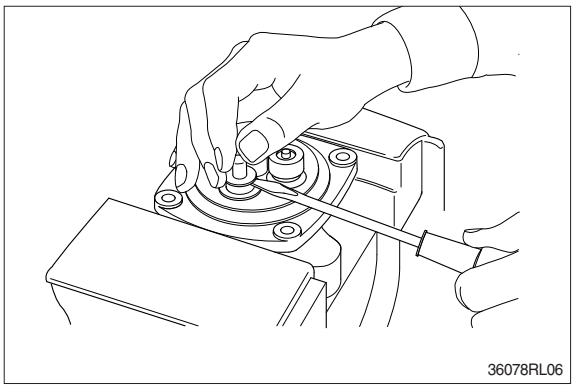
(8) Remove plate (12).



(9) When return spring (7) is weak in force, plug (8) stays in casing because of sliding resistance of O-ring.

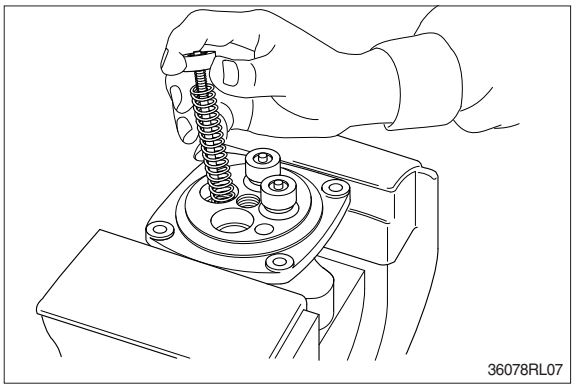
※ Take it out with minus screwdriver.
Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.

※ During taking out, plug may jump up due to return spring (7) force.
Pay attention to this.



(10) Remove reducing valve subassembly and return spring (7) out of casing.

※ Record relative position of reducing valve subassembly and return springs.

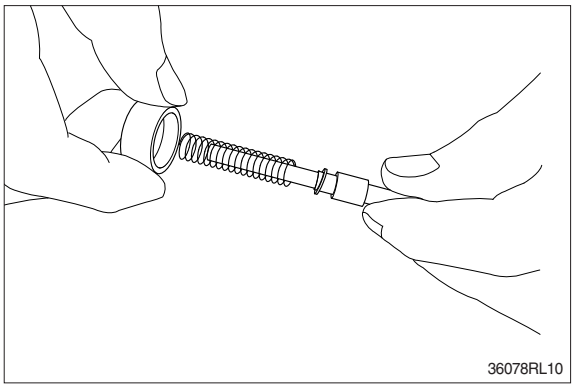


(11) Separate spool (3), spring seat (6), spring (5) and shim (4) individually.

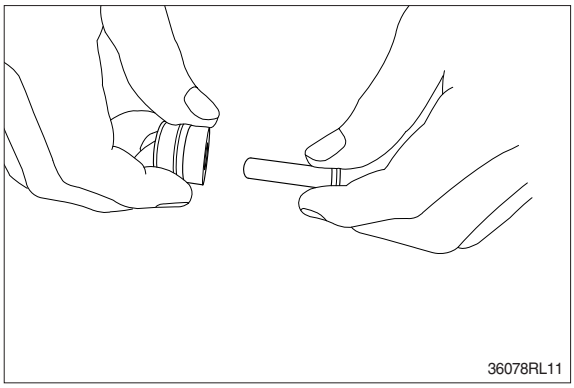
※ Pay attention not to damage spool surface.

※ Record original position of spring seat (6).

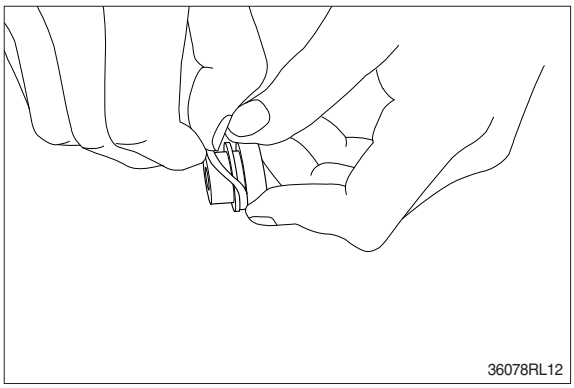
※ Until being assembled, they should be handled as one subassembly group.

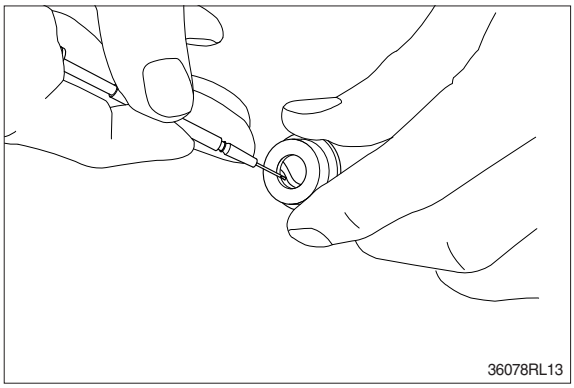


(12) Take push rod (9) out of plug (8).

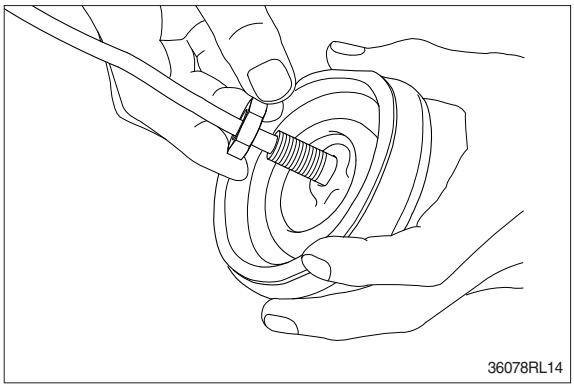


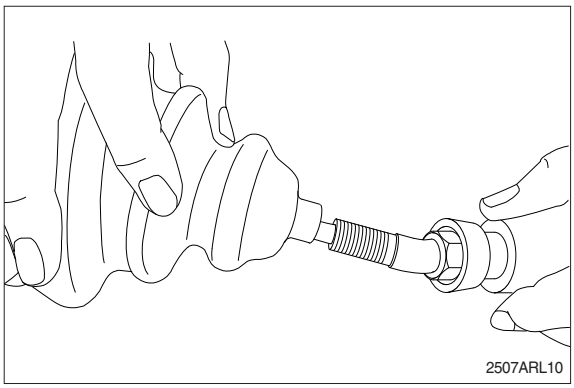
(13) Remove O-ring (10) and seal (11) from plug (8).
Use small minus screwdriver or so on to remove this seal.





(14) Remove lock nut (22) and then boot (23).





(15) Cleaning of parts

① Put all parts in rough cleaning vessel filled with kerosene and clean them (rough cleaning).

※ If dirty part is cleaned with kerosene just after putting it in vessel, it may be damaged. Leave it in kerosene for a while to loosen dust and dirty oil.

※ If this kerosene is polluted, parts will be damaged and functions of reassembled valve will be degraded.
Therefore, control cleanliness of kerosene fully.

② Put parts in final cleaning vessel filled with kerosene, turning it slowly to clean them even to their insides (finish cleaning).

※ Do not dry parts with compressed air, since they will be damaged and/or rusted by dust and moisture in air.

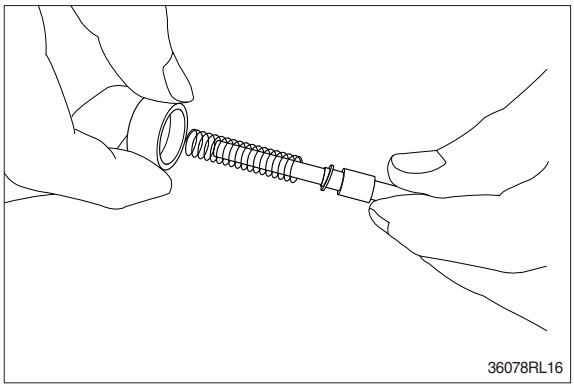
(16) Rust prevention of parts

Apply rust-preventives to all parts.

※ If left as they after being cleaned, they will be rusted and will not display their functions fully after being reassembled.

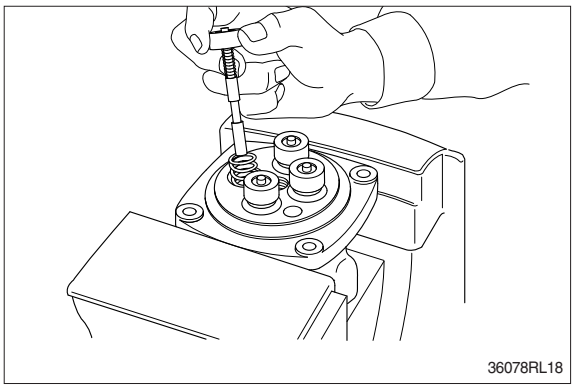
4) ASSEMBLY

(1) Put shim (4), springs (5) and spring seat (6) onto spool (3) in this order.

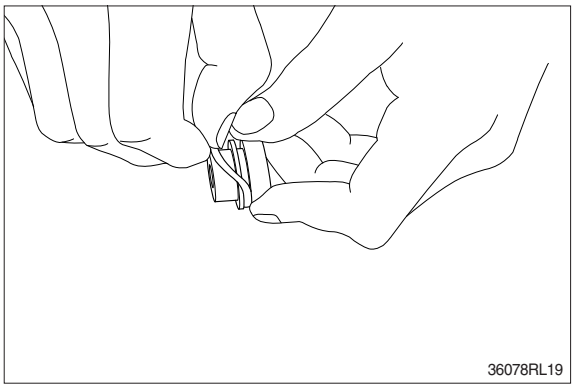


(2) Assemble spring (7) into casing (1). Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.

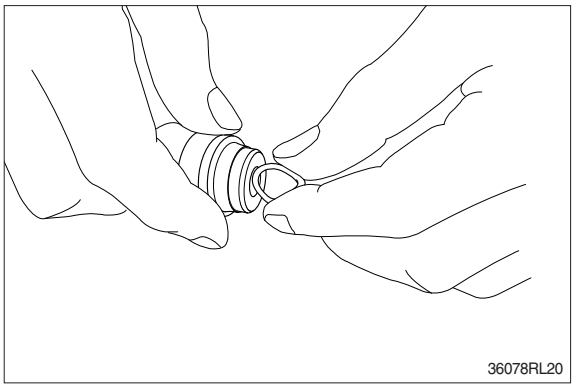


(3) Assemble O-ring (10) onto plug (8).



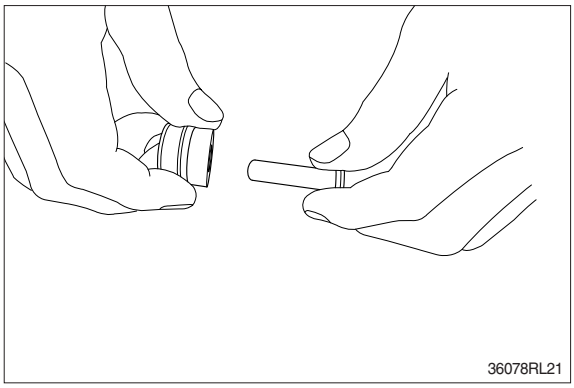
(4) Assemble seal (11) to plug (8).

※ Assemble seal in such lip direction as shown below.



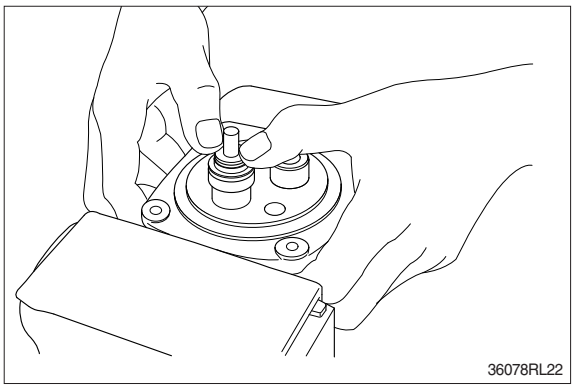
(5) Assemble push rod (9) to plug (8).

※ Apply working oil on push-rod surface.

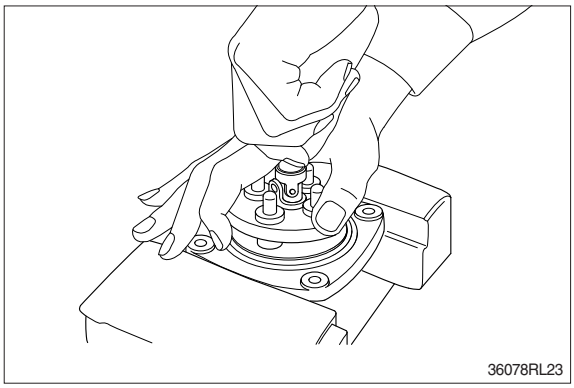


(6) Assemble plug subassembly to casing.

※ When return spring is weak in force, subassembly stops due to resistance of O-ring.

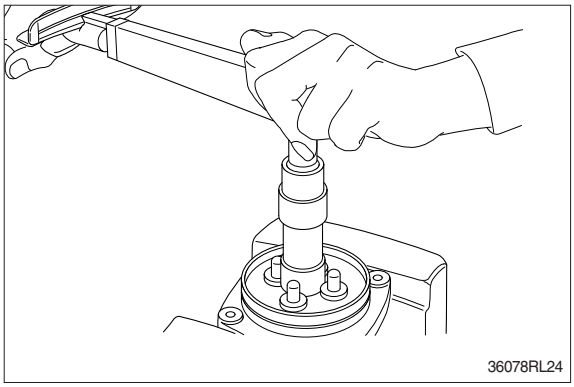


(7) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (12), and tighten joint (15) temporarily.



(8) Fit plate (12).

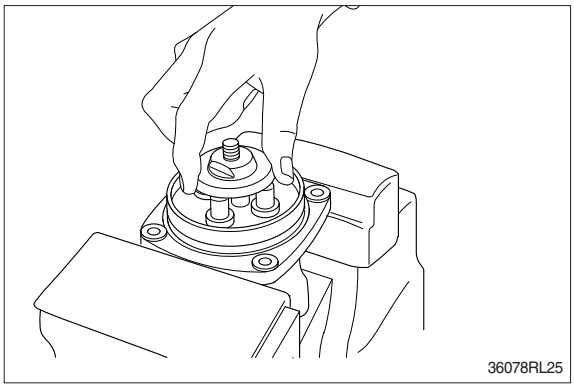
(9) Tighten joint (15) with the specified torque to casing, utilizing jig.



(10) Assemble swash plate (16) to joint (15).

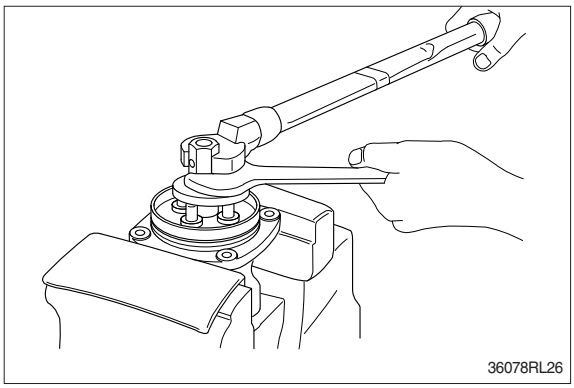
※ Screw it to position that it contacts with 4 push rods evenly.

※ Do not screw it over.

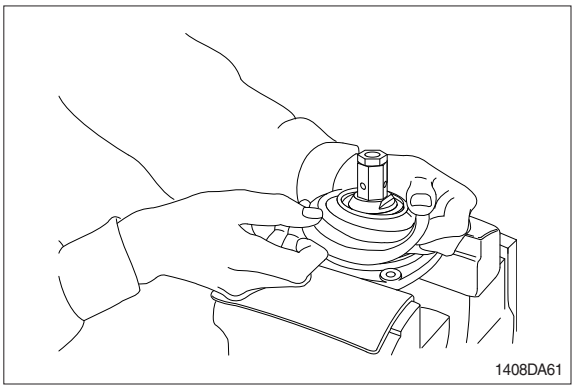


(11) Assemble adjusting nut (17), apply spanner to width across flat of plate (16) to fix it, and tighten adjusting nut to the specified torque.

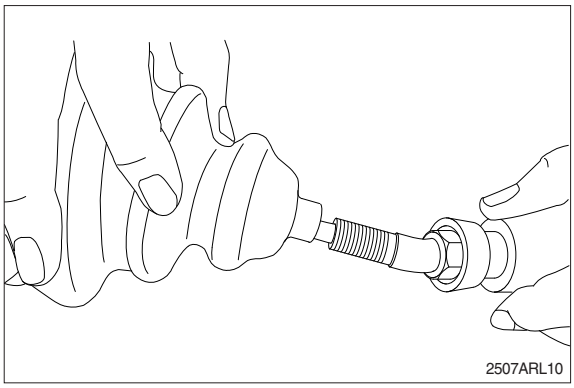
※ During tightening, do not change position of disk.

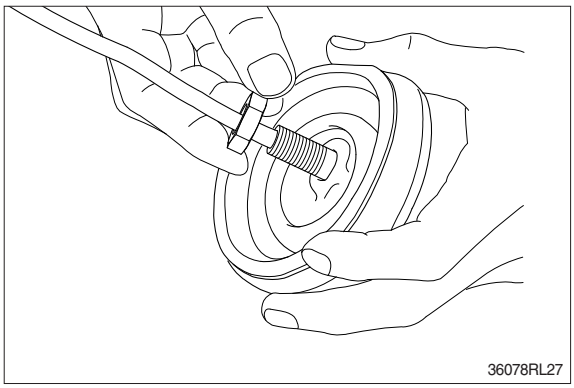


(12) Fit boot (14) to plate.

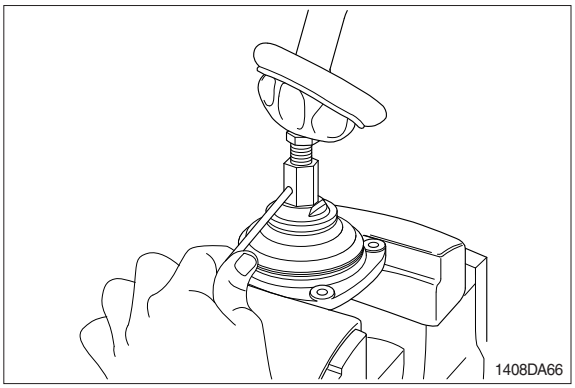


(13) Fit boot (23) and lock nut (22), and handle subassembly is assembled completely.



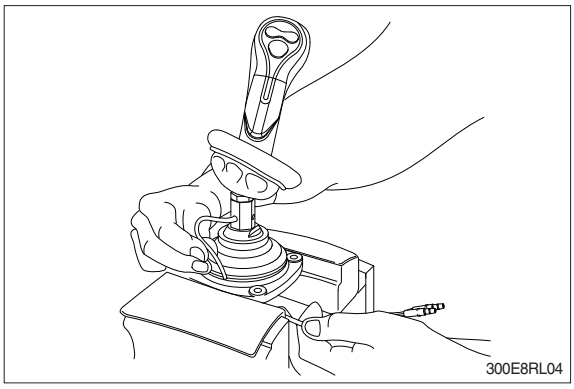


(14) Pull out cord and tube through adjusting nut hole provided in direction 60 ° to 120 ° from casing hole.

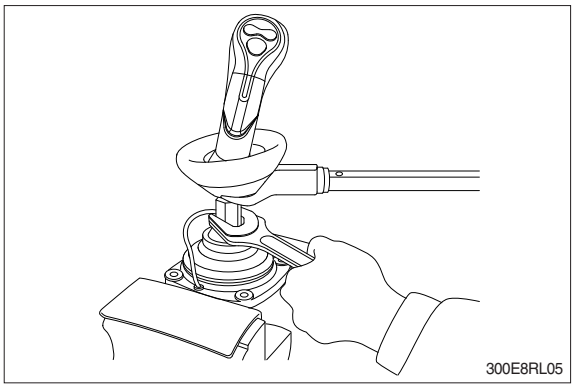


(15) Assemble bushing (18) to plate and pass cord and tube through it.

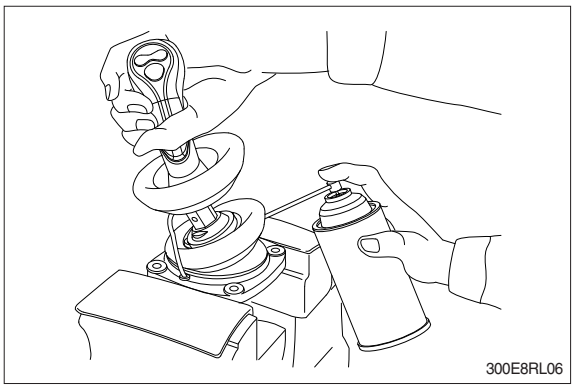
※ Provide margin necessary to operation.



(16) Determine handle direction, tighten lock nut (22) to specified torque to fix handle.

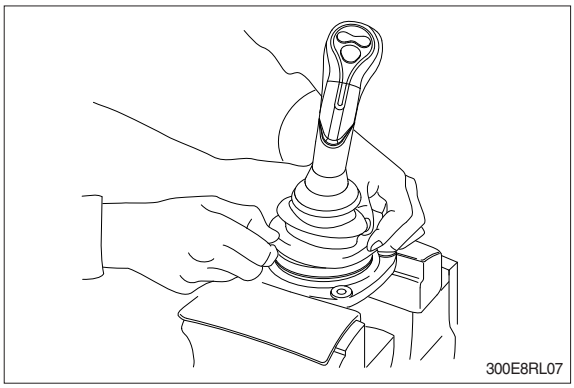


(17) Apply grease to rotating section of joint and contacting faces of disk and push rod.



(18) Assemble lower end of bellows to casing.

(19) Inject volatile rust-preventives through all ports and then put blind plugs in ports.



1. REMOVAL AND INSTALL

1) REMOVAL

(1) Lower the work equipment to the ground and stop the engine.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

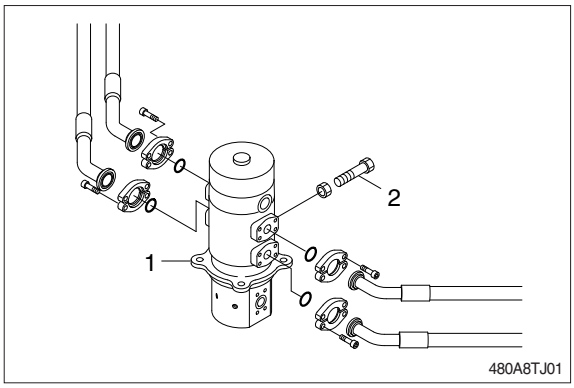
(4) Disconnect all hoses.

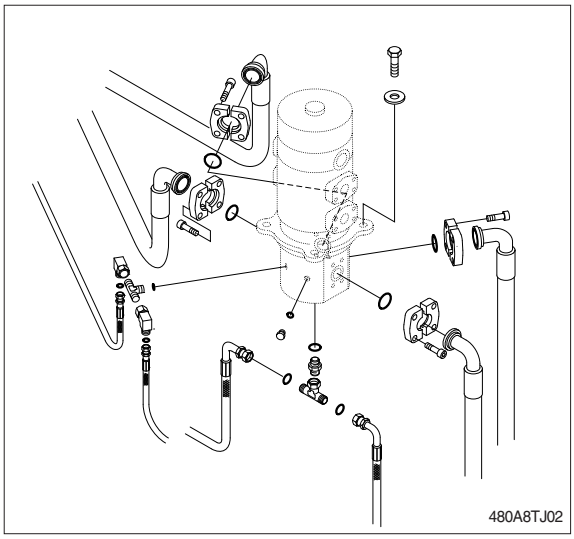
(5) Sling the turning joint assembly (1) and remove the mounting bolt (2).
Weight : 96 kg (212 lb)
Tightening torque : 29.7±4.5 kgf · m
(215±32.5 lbf · ft)

(6) Remove the turning joint assembly.

※ When removing the turning joint, check that all the hoses have been disconnected.







2) INSTALL

(1) Carry out installation in the reverse order to removal.

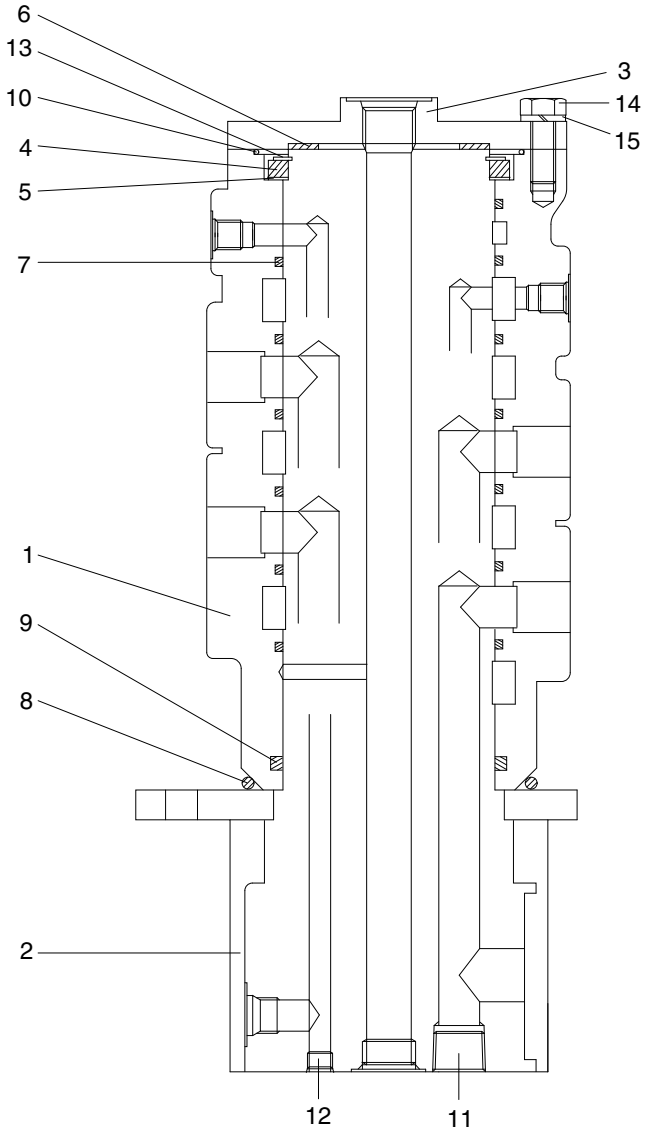
※ Take care of turning joint direction.

※ Assemble hoses to their original

※ positions.
Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



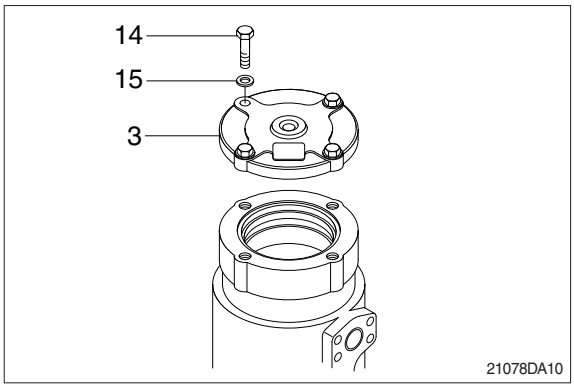
480A8TJ10

1	Hub	6	Shim	11	Socket plug
2	Shaft assy	7	Slipper seal	12	Socket plug
3	Cover	8	O-ring	13	Retainer ring
4	Spacer	9	O-ring	14	Hexagon bolt
5	Shim	10	O-ring	15	Spring washer

2) DISASSEMBLY

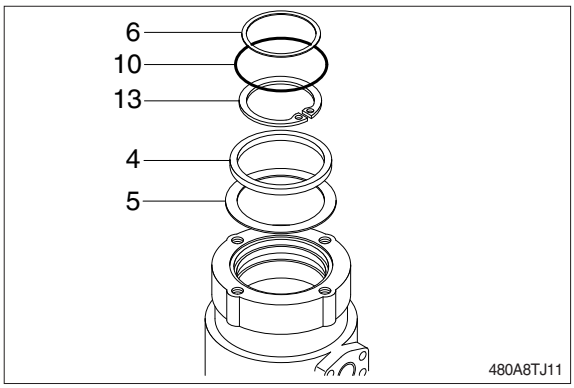
※ Before the disassembly, clean the turning joint.

(1) Remove bolts (14), washer (15) and cover (3).



(2) Remove shim (6) and O-ring (10).

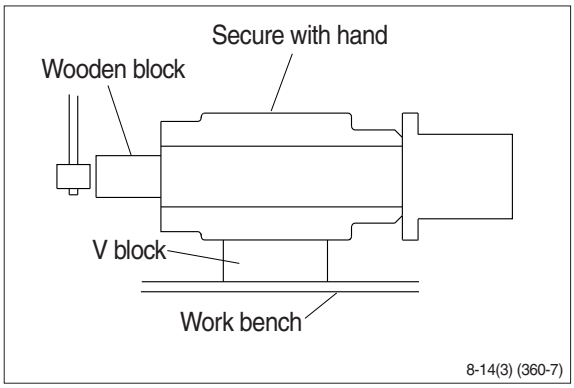
(3) Remove retainer ring (13), spacer (4) and shim (5).



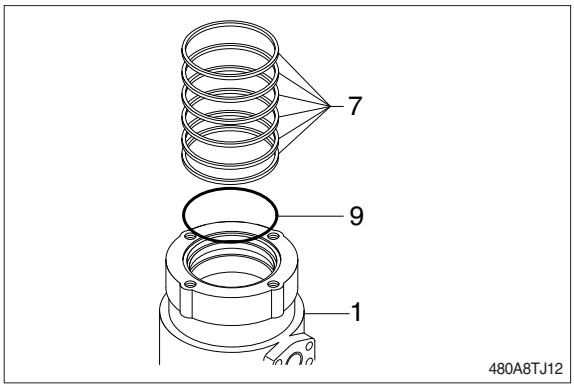
(4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

※ Take care not to damage the shaft (2) when remove hub (1) or rest it sideway.

※ Put a fitting mark on hub (1) and shaft (2).



(5) Remove six slipper seals (7) and O-ring (9) from hub (1).

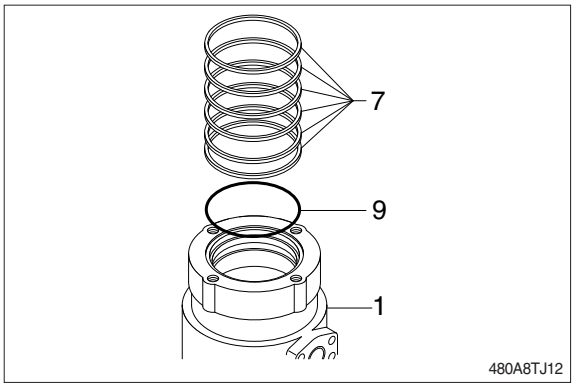


3) ASSEMBLY

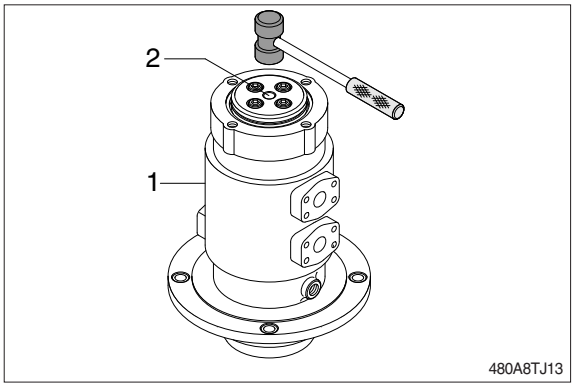
※ Clean all parts.
※ As a general rule, replace oil seals and O-ring.
※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(1) Fix seven slipper seal (7) and O-ring (9) to hub (1).

(2) Fit O-ring (8) to shaft (2).



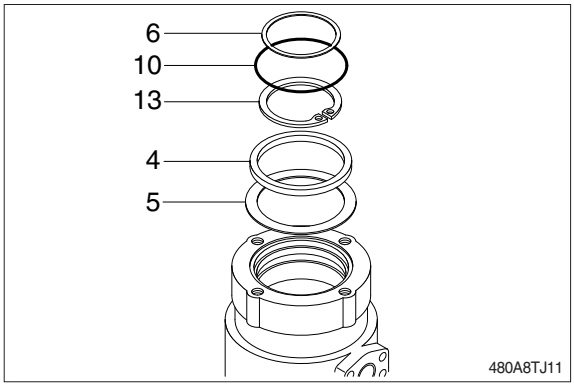
(3) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.



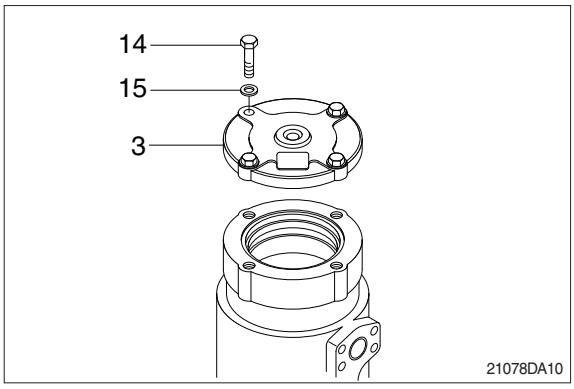
(4) Fit shim (5), spacer (4) and retainer ring (13) to shaft (2).

(5) Fit O-ring (10) to hub (1).

(6) Fit shim (6) to shaft (2).



(7) Install cover (3) to hub (1) and tighten bolts (14).
· Torque : 10~12.5 kgf · m
(72.3~90.4 lbf · ft)



1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

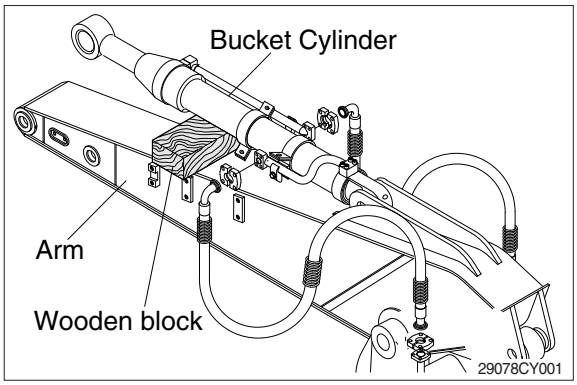
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

⚠ **Loosen the breather slowly to release the pressure inside the hydraulic tank.**

※ Escaping fluid under pressure can penetrate the skin causing serious injury.
Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.



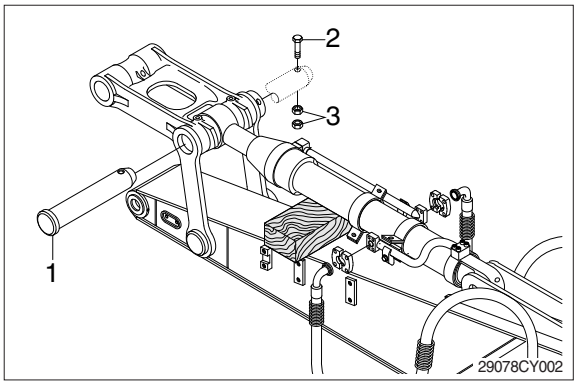
① Set block between bucket cylinder and arm.



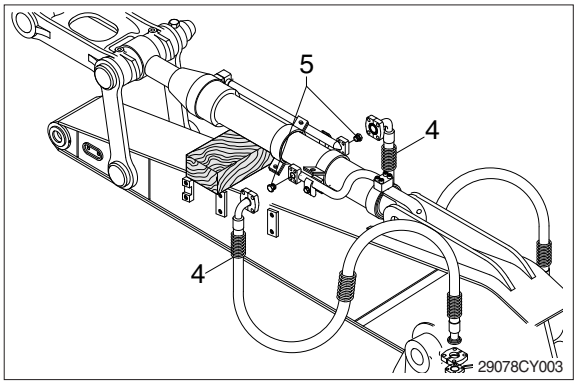
② Remove bolt (2), nut (3) and pull out pin (1).

※ Tie the rod with wire to prevent it from coming out.

· Tightening torque (2) : 100±10 kgf·m (723±72.3 lbf·ft)

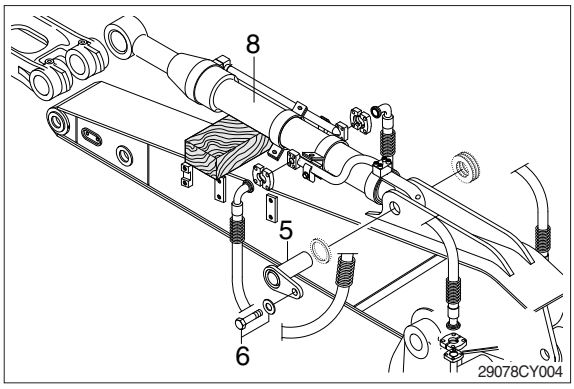


③ Disconnect bucket cylinder hoses (4) and put plugs (5) on cylinder pipe.



④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).
· Tightening torque (6) : 57.9±8.7 kgf·m (419±62.9 lbf·ft)

⑤ Remove bucket cylinder assembly (8).
· Weight : 363 kg (800 lb)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

※ Bleed the air from the bucket cylinder.

※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2) ARM CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

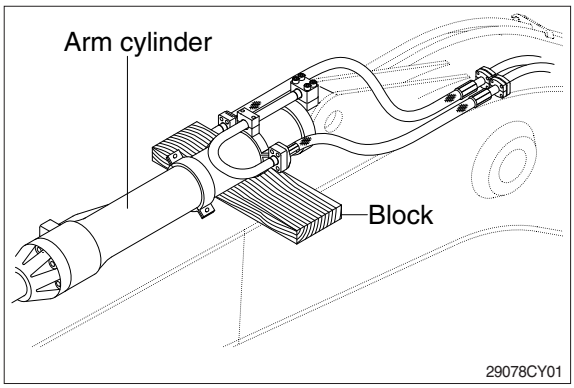
⚠ **Loosen the breather slowly to release the pressure inside the hydraulic tank.**

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

Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between arm cylinder and boom.

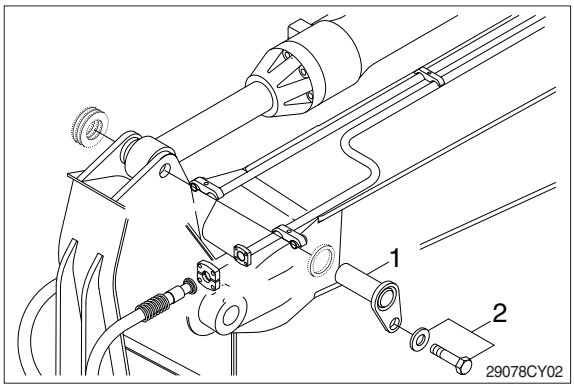




② Remove bolt (2) and pull out pin (1).

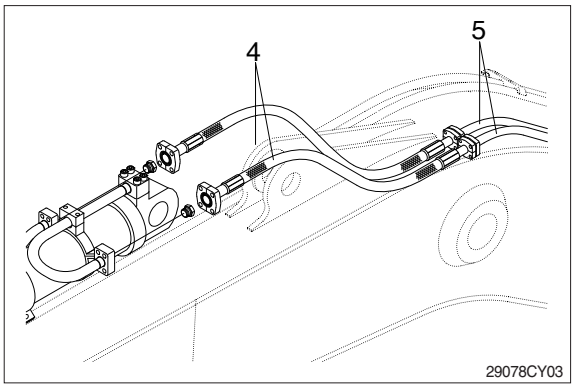
※ Tie the rod with wire to prevent it from coming out.

· Tightening torque (2) : 57.9±8.7 kgf·m (419±62.9 lbf·ft)



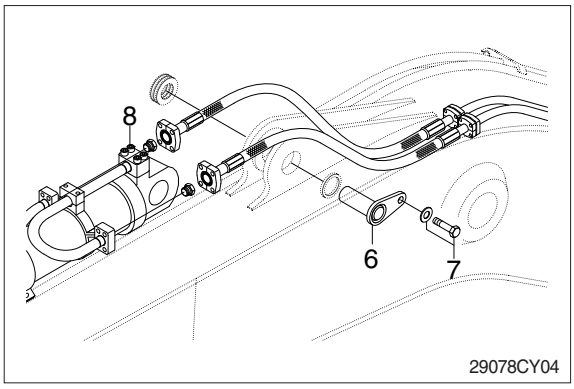
③ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

④ Disconnect greasing pipings (5).



⑤ Sling arm assembly (8) and remove bolt (7) then pull out pin (6).
· Tightening torque (7) : 57.9±8.7 kgf·m (419±62.9 lbf·ft)

⑥ Remove arm cylinder assembly (8).
· Weight : 589 kg (1299 lb)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

※ Bleed the air from the arm cylinder.

※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

3) BOOM CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

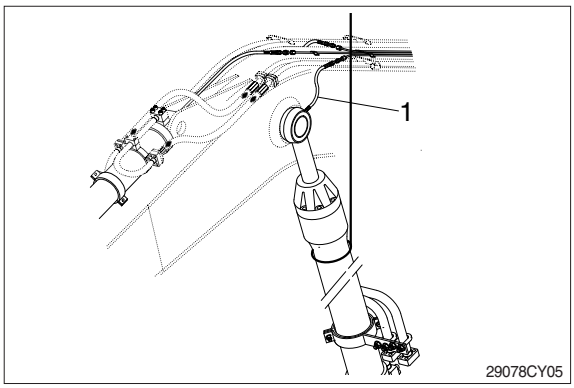
⚠ **Loosen the breather slowly to release the pressure inside the hydraulic tank.**

※ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Disconnect greasing hoses (1).

② Sling boom cylinder assembly.

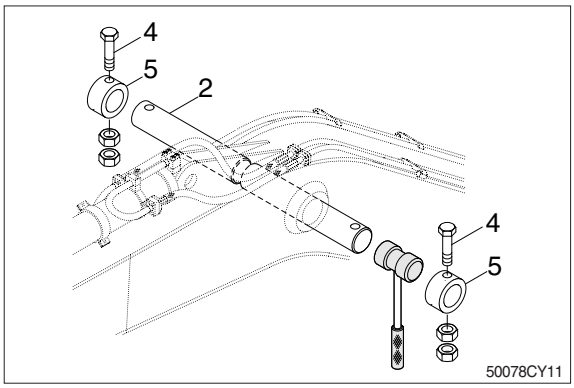




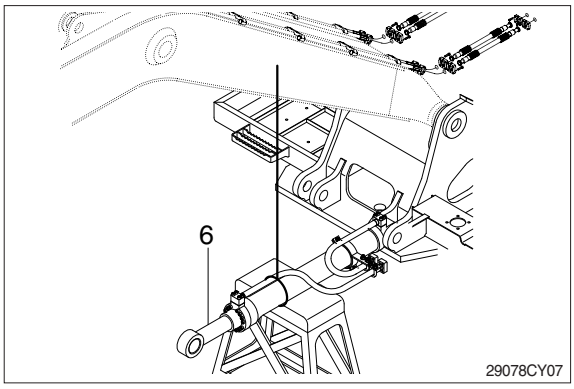
③ Remove bolt (4), pin stopper (5) and pull out pin (2).

※ Tie the rod with wire to prevent it from coming out.

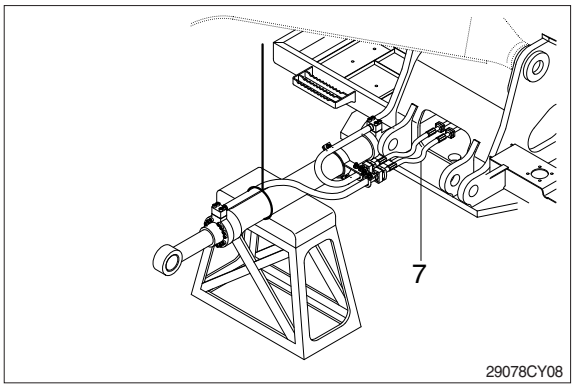
· Tightening torque (4) : 100±10 kgf·m (723±72.3 lbf·ft)



④ Lower the boom cylinder assembly (6) on a stand.

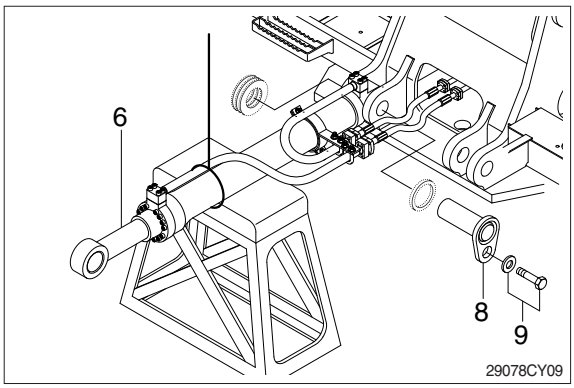


⑤ Disconnect boom cylinder hoses (7) and put plugs on cylinder pipe.



⑥ Remove bolt (9) and pull out pin (8).
· Tightening torque (9) : 57.9±8.7 kgf·m (419±62.9 lbf·ft)

⑦ Remove boom cylinder assembly (6).
· Weight : 370 kg (816 lb)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

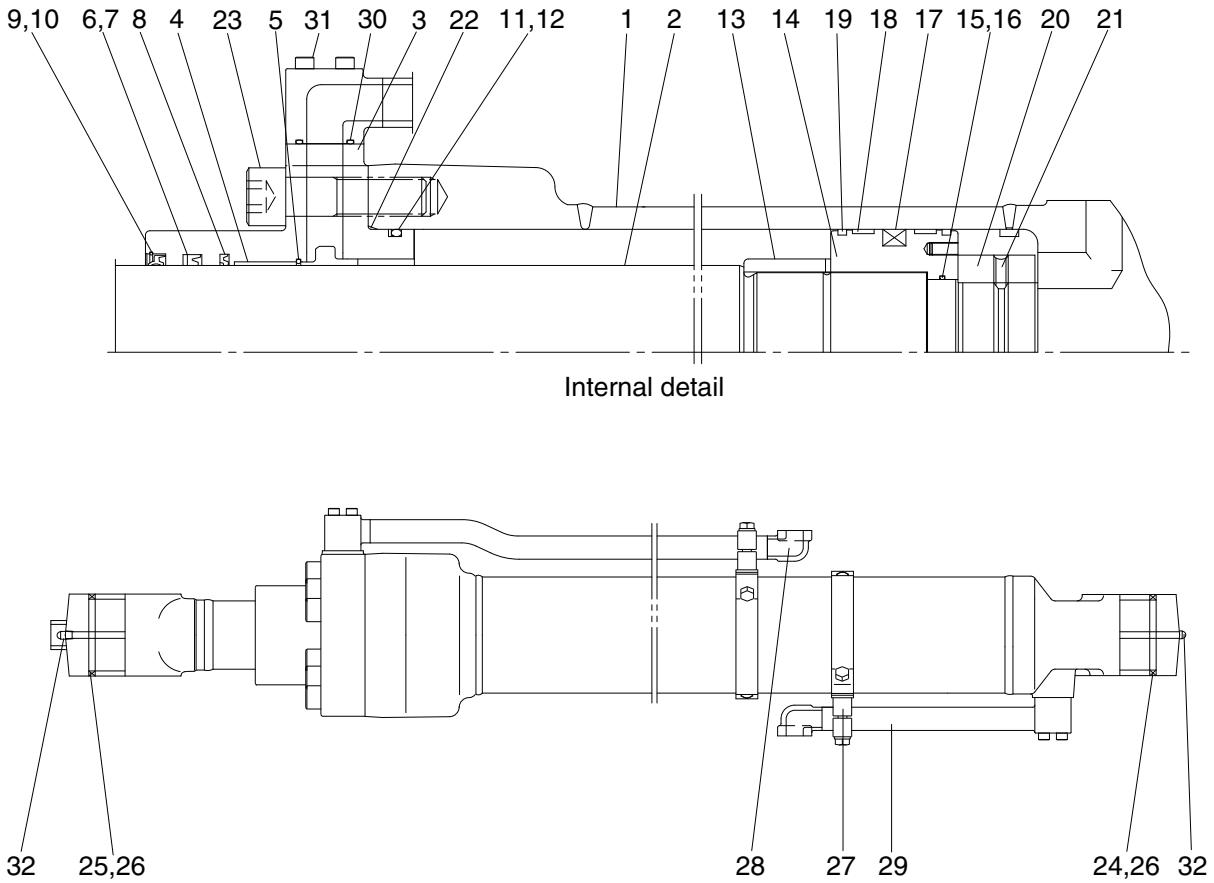
※ Bleed the air from the boom cylinder.

※ Conformed the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

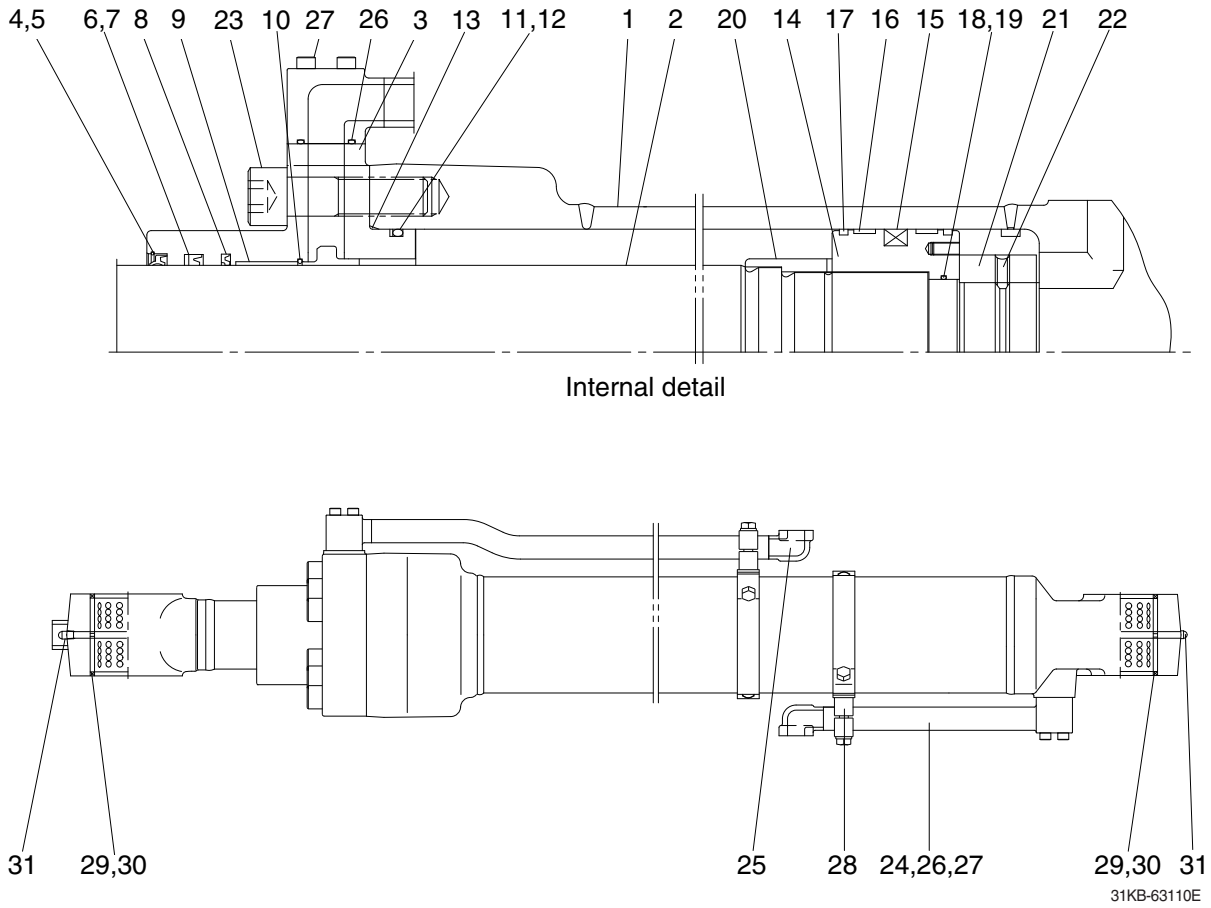
1) STRUCTURE

(1) Bucket cylinder (CHANZHOU)



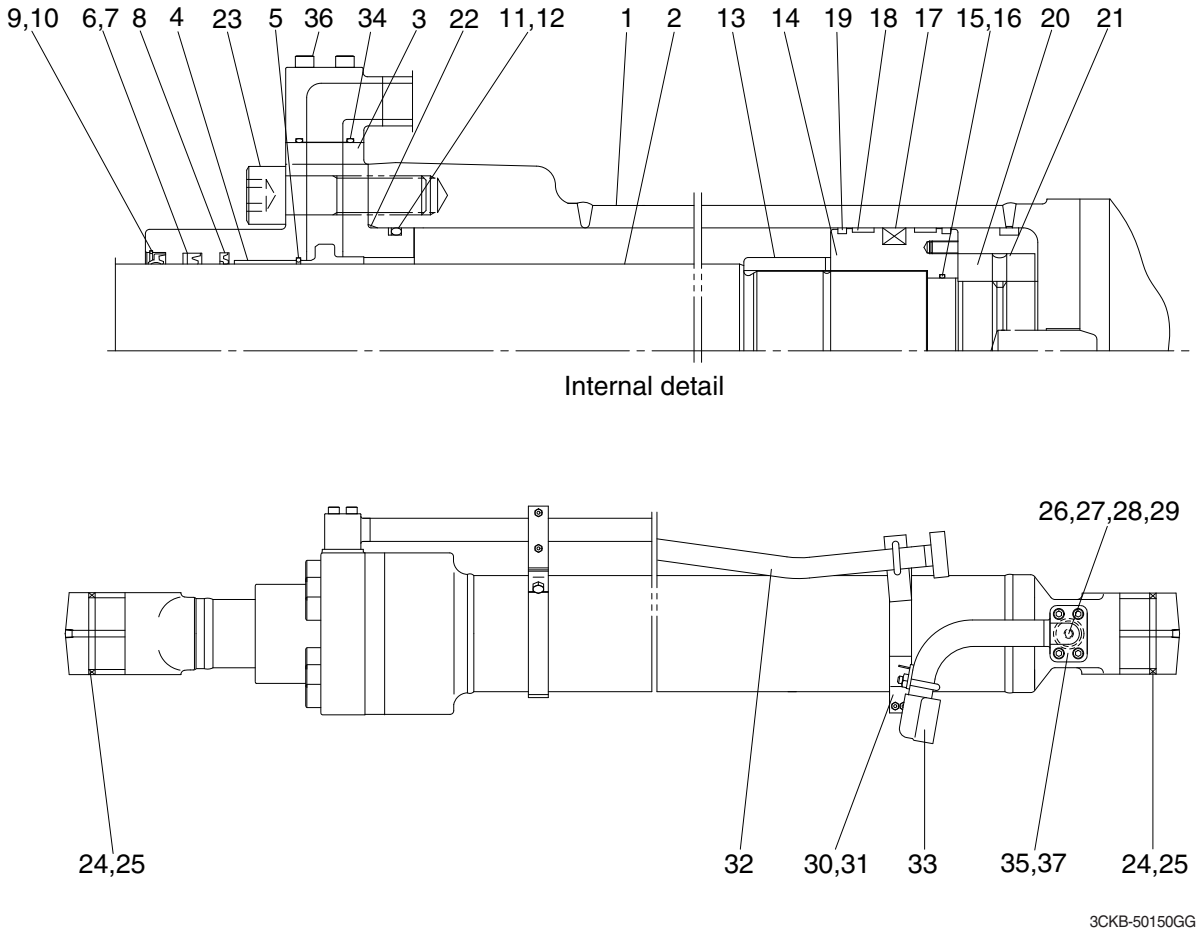
1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Dimple bushing
3	Gland	14	Piston	25	Dimple bushing
4	DD2 bushing	15	O-ring	26	Dust seal
5	Snap ring	16	Back up ring	27	Band assembly
6	Rod seal	17	Piston seal	28	Pipe assembly-R
7	Back up ring	18	Wear ring	29	Pipe assembly-B
8	Buffer ring	19	Dust ring	30	O-ring
9	Dust wiper	20	Lock nut	31	Hexagon socket head bolt
10	Snap ring	21	Hexagon socket head screw	32	Grease nipple
11	O-ring	22	O-ring		

Bucket cylinder (SHPAC)



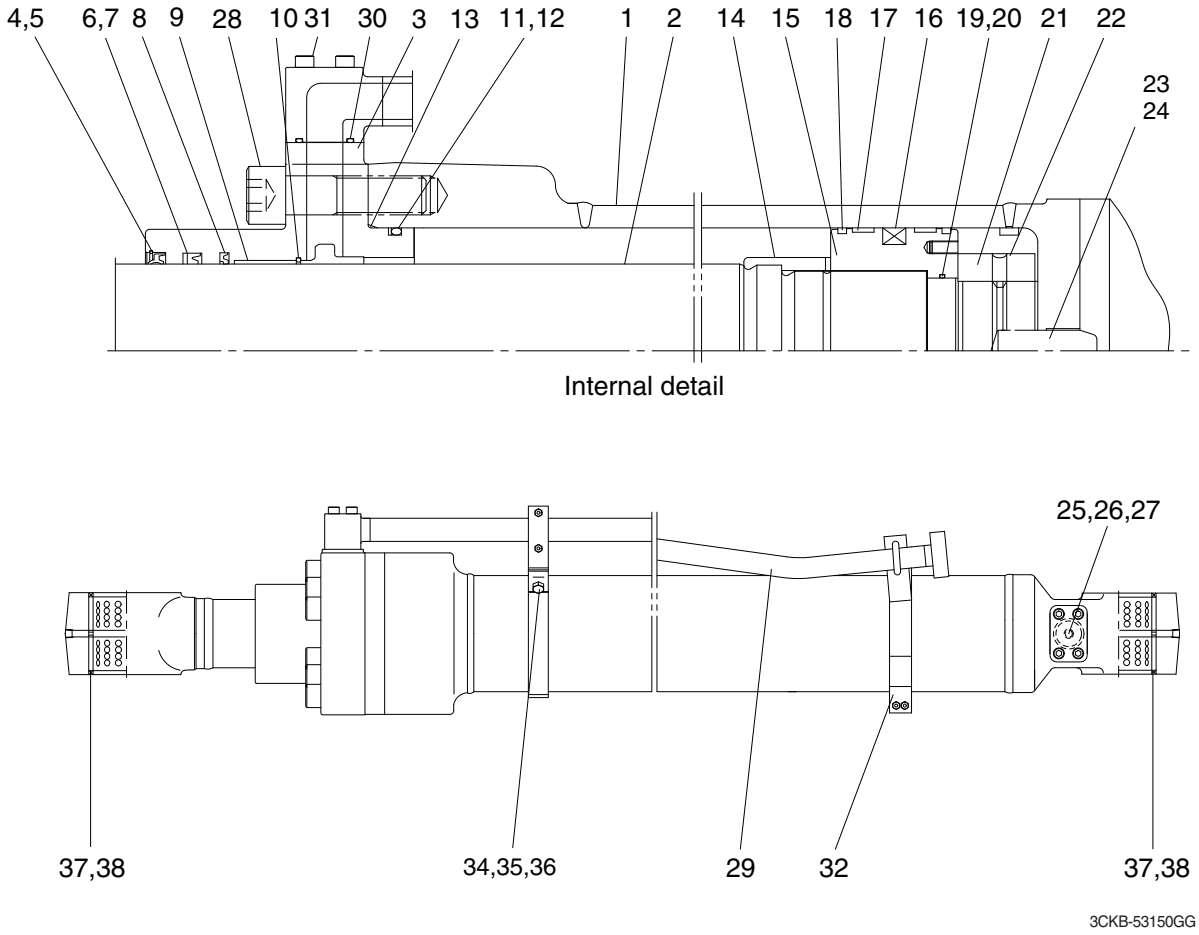
1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	O-ring	24	Pipe assembly-B
3	Gland	14	Piston	25	Pipe assembly-R
4	Dust wiper	15	Piston seal	26	O-ring
5	Retaining ring	16	Wear ring	27	Hexagon socket head bolt
6	Rod seal	17	Dust ring	28	Band assembly
7	Back up ring	18	O-ring	29	Dimple bushing
8	Buffer ring	19	Back up ring	30	Dust seal
9	Dry bearing	20	Cushion ring	31	Grease nipple
10	Retaining ring	21	Lock nut		
11	O-ring	22	Hexagon socket set screw		

(2) Arm cylinder (CHANZHOU)



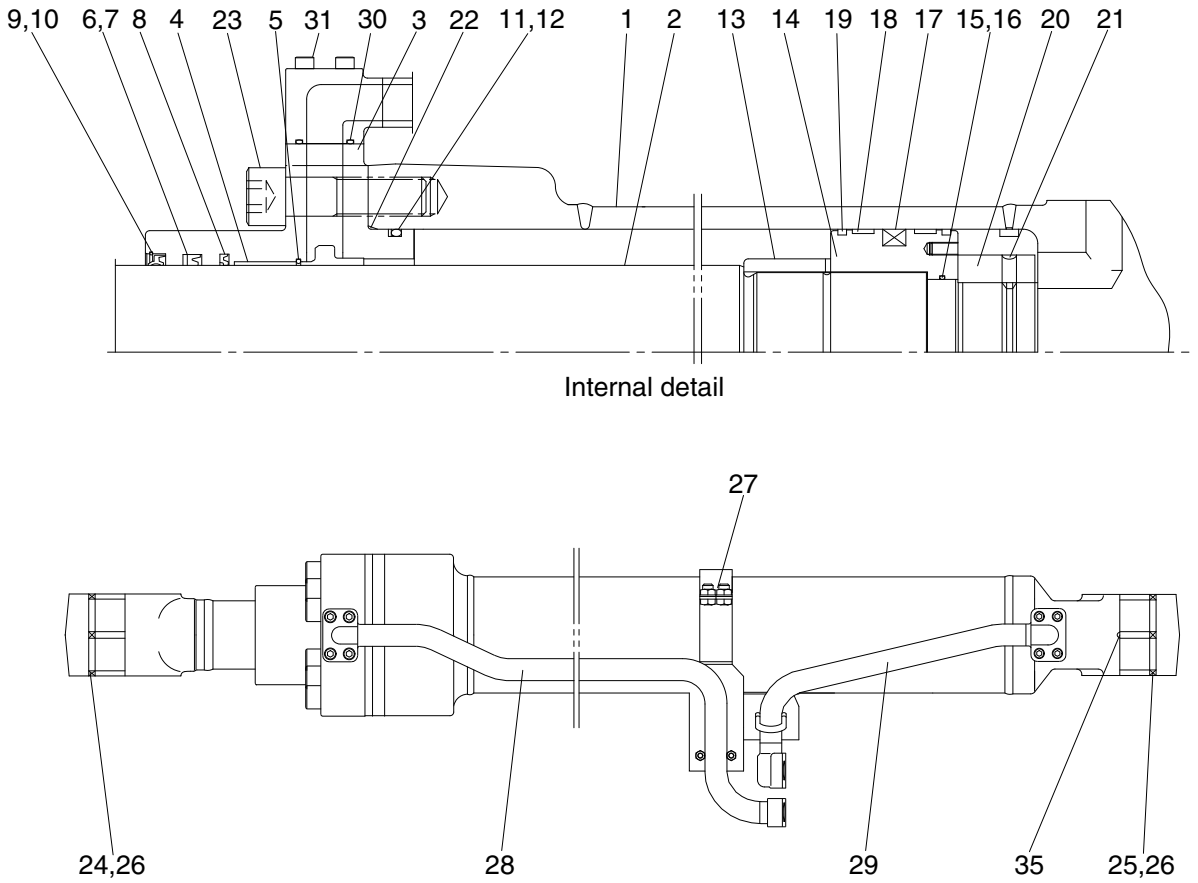
1	Tube assembly	14	Piston	27	Coil spring
2	Rod assembly	15	O-ring	28	O-ring
3	Gland	16	Back up ring	29	Plug
4	DD2 bushing	17	Piston seal	30	Band assembly
5	Snap ring	18	Wear ring	31	Band assembly
6	Rod seal	19	Dust ring	32	Pipe assembly
7	Back up ring	20	Lock nut	33	Pipe assembly
8	Buffer ring	21	Hexagon socket set screw	34	O-ring
9	Dust wiper	22	O-ring	35	O-ring
10	Snap ring	23	Hexagon socket head bolt	36	Hexagon socket head bolt
11	O-ring	24	Pin bushing	37	Hexagon socket head bolt
12	Back up ring	25	Dust seal		
13	Cushion ring	26	Check valve		

Arm cylinder (SHPAC)



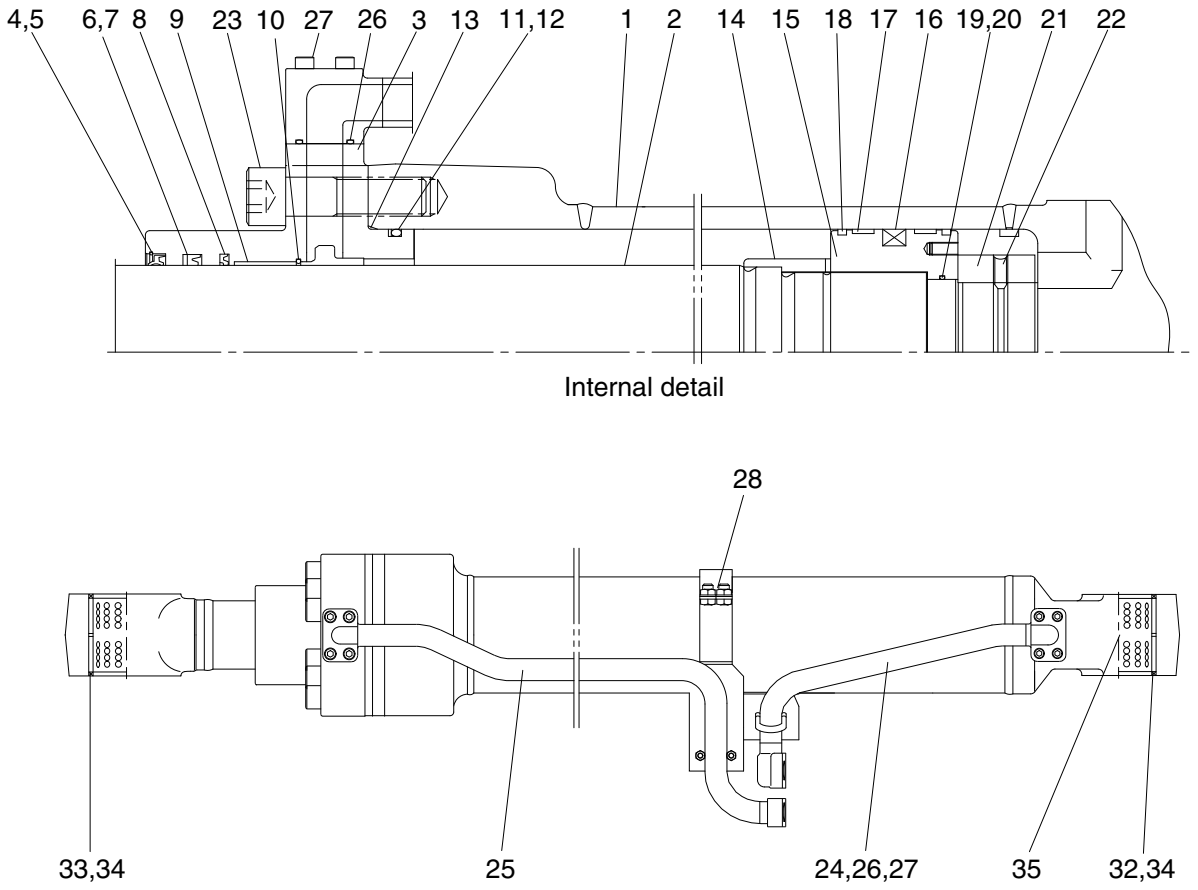
1	Tube assembly	14	Cushion ring	27	Hexagon plug
2	Rod assembly	15	Piston	28	Hexagon socket head bolt
3	Gland	16	Piston seal	29	Pipe assembly-R
4	Dust wiper	17	Wear ring	30	O-ring
5	Retaining ring	18	Dust ring	31	Hexagon socket head bolt
6	Rod seal	19	O-ring	32	Band assembly-B
7	Back up ring	20	Back up ring	33	Band assembly-R
8	Buffer ring	21	Lock nut	34	U-bolt
9	Dry bearing	22	Hexagon socket set screw	35	Hexagon nut
10	Retaining ring	23	Cushion plunger	36	Spring washer
11	O-ring	24	Stop ring	37	Pin bushing
12	Back up ring	25	Check valve	38	Dust seal
13	O-ring	26	Coil spring		

(3) Boom cylinder (CHANZHOU)



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	O-ring	26	Dust seal
5	Snap ring	16	Back up ring	27	Band assembly
6	Rod seal	17	Piston seal	28	Pipe assembly-R
7	Back up ring	18	Wear ring	29	Pipe assembly-B
8	Buffer ring	19	Dust ring	30	O-ring
9	Dust wiper	20	Lock nut	31	Hexagon socket head bolt
10	Snap ring	21	Hexagon socket set screw	35	Grease nipple
11	O-ring	22	O-ring		

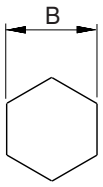
Boom cylinder (SHPAC)



1	Tube assembly	13	O-ring	25	Pipe assembly-R
2	Rod assembly	14	Cushion ring	26	O-ring
3	Gland	15	Piston	27	Hexagon socket head bolt
4	Dust wiper	16	Piston seal	28	Band assembly
5	Retaining ring	17	Wear ring	29	U-bolt
6	Rod seal	18	Dust ring	30	Hexagon nut
7	Back up ring	19	O-ring	31	Spring washer
8	Buffer ring	20	Back up ring	32	Dimple bushing
9	Dry bearing	21	Lock nut	33	Dimple bushing
10	Retaining ring	22	Hexagon socket set screw	34	Dust seal
11	O-ring	23	Hexagon socket head bolt	35	Grease nipple
12	Back up ring	24	Pipe assembly-B		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tools		Remark
Allen wrench	5	
	8	
	10	
	12	
	14	
	17	
Spanner	7	
	8	
(-) Driver		Small and large sizes
Torque wrench		Capable of tightening with the specified torques

(2) Tightening torque

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Socket head bolt	Bucket cylinder	23★1★3 23★1★4	M22 M22	63.0±6.0 69.4±6.9	456±45.6 502±49.9
		31★3 27★4	M12 M12	9 4±1.0 11.3±1.1	68.0±7.2 81.7±8.0
	Boom cylinder	22★1★3 23★1★4	M22 M22	63.0±6.0 69.4±6.9	456±45.6 502±49.9
		31★3 27★4	M12 M12	9.4±1.0 11.3±1.1	68.0±7.2 81.7±8.0
	Arm cylinder	23★1★3 28★1★4	M22 M24	63.0±6.0 90.2±9.0	456±43.4 652±65.1
		36★3 31★4	M12 M12	9.4±1.0 11.3±1.1	68.0±7.2 81.7±8.0

★1 : Apply loctite #243 on the thread of bolt.

★3 : CHANGZHOU

★4 : SHPAC

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Lock nut	Bucket cylinder	20★3 21★4	- M90	150±15.0 150±15.0	1085±108 1085±108
	Boom cylinder	20★3 21★4	- M85	100±10.0 100±10.0	723±72.3 723±72.3
	Arm cylinder	20★3 21★4	- M100	200±20.0 150±15.0	1447±145 1085±108
Piston	Bucket cylinder	14★3 14★4	- M95	200±20.0 200±20.0	1447±145 1447±145
	Boom cylinder	14★3 15★4	- M105	150±15.0 150±15.0	1085±108 1085±108
	Arm cylinder	14★3 15★4	- M120	200±20.0 200±20.0	1447±145 1447±145
Set screw	Bucket cylinder	21★3 22★4	M10 M10	5.4±0.5 2.5±0.25	39.1±3.6 18.1±1.8
	Boom cylinder	21★3 22★4	M10 M10	5.4±0.5 2.5±0.3	39.1±3.6 18.1±2.2
	Arm cylinder	21★3 22★4	M10 M10	5.4±0.5 2.5±0.3	39.1±3.6 18.1±2.2

★1 : Apply loctite #243 on the thread of bolt.

★3 : CHANGZHOU

★4 : SHPAC

3) DISASSEMBLY

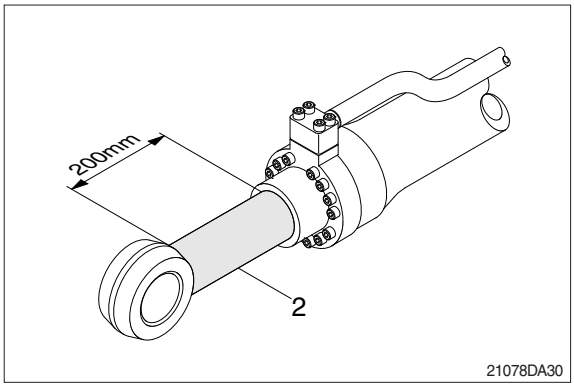
(1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder.

① Hold the clevis section of the tube in a vise.

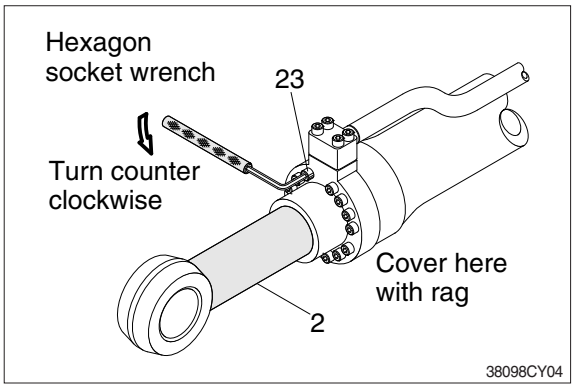
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

② Pull out rod assembly (2) about 200 ㎜ (7.1in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



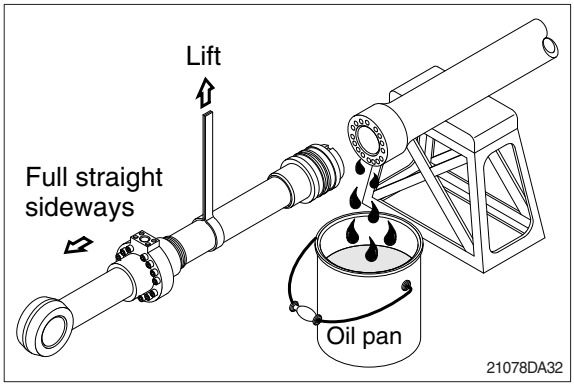
③ Loosen and remove socket bolts (23) of the gland in sequence.

※ Cover the extracted rod assembly (2) with rag to prevent it from being accidentally damaged during operation.



④ Draw out cylinder head and rod assembly together from tube assembly (1).

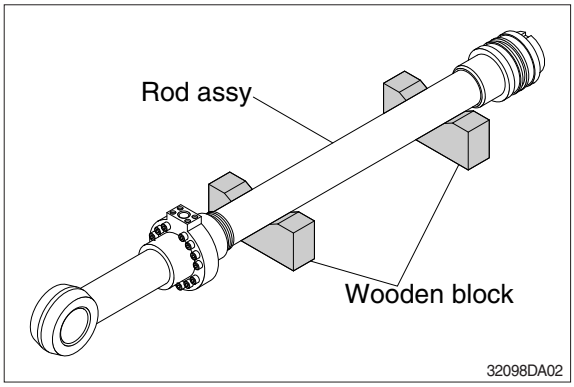
※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (2) with a crane or some means and draw it out. However, when rod assembly (2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



Note that the plated surface of rod assembly (2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

⑤ Place the removed rod assembly on a wooden V-block that is set level.

※ Cover a V-block with soft rag.

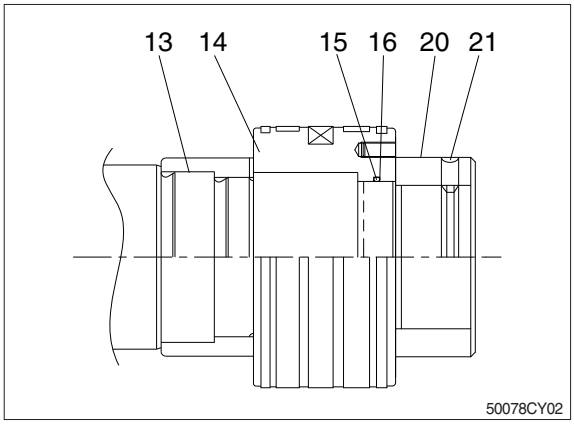


(3) Remove piston and cylinder head

① Loosen socket set screw (21) and remove lock nut (20).

※ Since lock nut (20) is tightened to a high torque use a hydraulic and power wrench that utilizers a hydraulic cylinder, to remove lock nut (20).

② Remove piston assembly (14), back up ring (16), and O-ring (15).

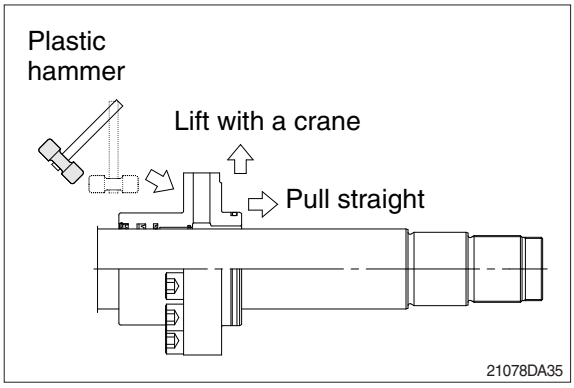


③ Remove the cylinder head assembly from rod assembly (2).

※ If it is too heavy to move, move it by striking the flanged part of cylinder head with a plastic hammer.

※ Pull it straight with cylinder head assembly lifted with a crane.

Exercise care so as not to damage the lip of rod bushing (4) and packing (5, 6, 7, 8, 9, 10) by the threads of rod assembly (2).

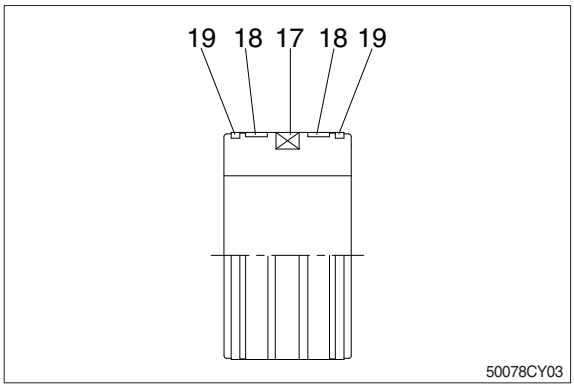


(3) Disassemble the piston assembly

① Remove wear ring (18).

② Remove dust ring (19) and piston seal (17).

※ Exercise care in this operation not to damage the grooves.



(4) Disassemble cylinder head assembly

① Remove back up ring (12), O-ring (11), and O-ring (22).

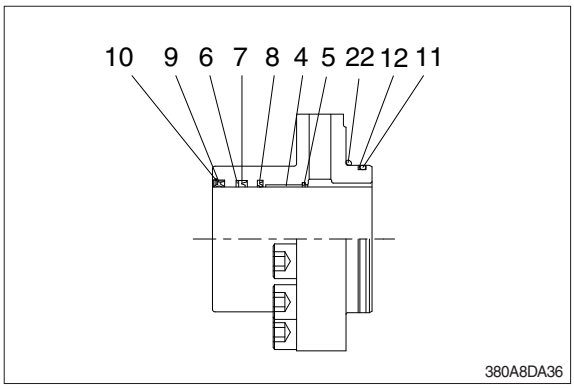
② Remove snap ring (10), dust wiper (9).

③ Remove back up ring (7), rod seal (6) and buffer ring (8) and snap ring (5).

※ Exercise care in this operation not to damage the grooves.

※ Do not remove seal and ring, if does not damaged.

※ Do not remove bushing (4).

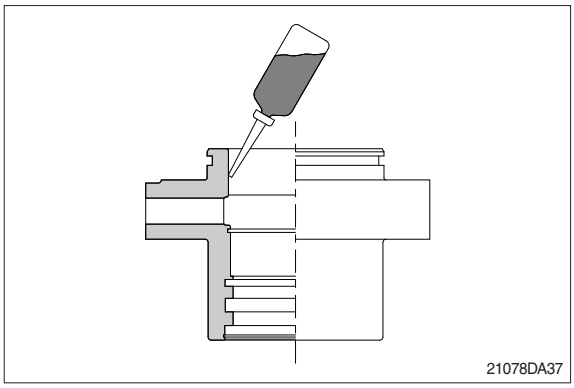


3) ASSEMBLY

(1) Assemble cylinder head assembly

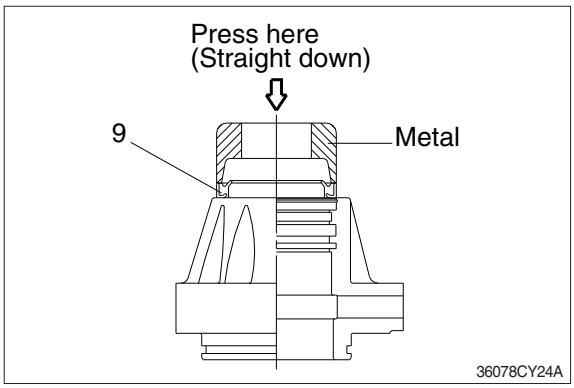
※ Check for scratches or rough surfaces if found smooth with an oil stone.

① Coat the inner face of gland (3) with hydraulic oil.



② Coat dust wiper (9) with grease and fit dust wiper (9) to the bottom of the hole of dust seal.
At this time, press a pad metal to the metal ring of dust seal.

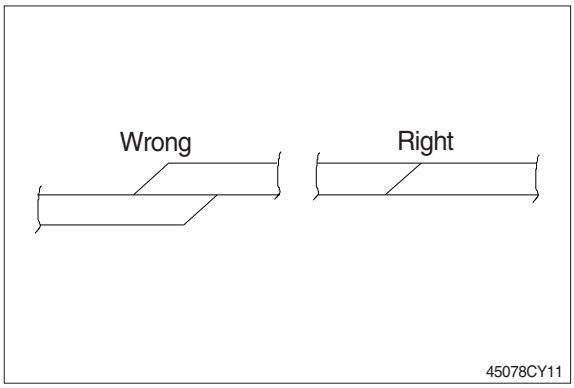
③ Fit snap ring (10) to the stop face.



④ Fit back up ring (7), rod seal (6) and buffer ring (8) to corresponding grooves, in that order.

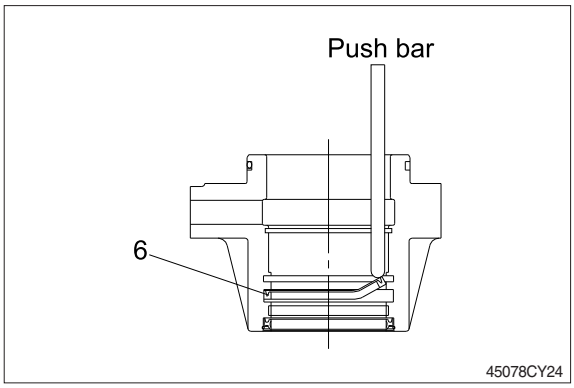
※ Coat each packing with hydraulic oil before fitting it.

※ Insert the backup ring until one side of it is inserted into groove.



※ Rod seal (6) has its own fitting direction. Therefore, confirm it before fitting them.

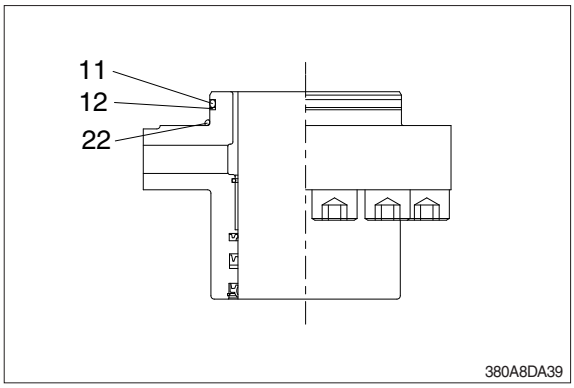
※ Fitting rod seal (6) upside down may damage its lip. Therefore check the correct direction that is shown in fig.



⑤ Fit back up ring (12) to gland (3).

※ Put the backup ring in the warm water of 30~50˚C.

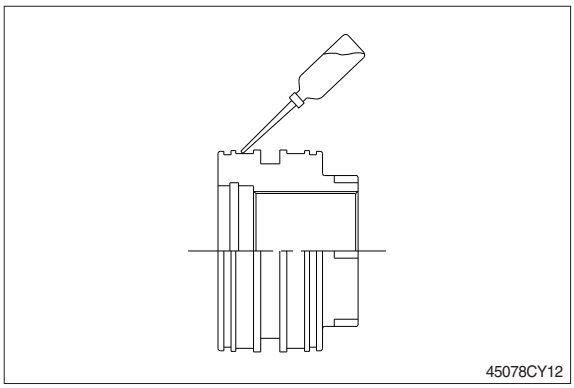
⑥ Fit O-ring (11) and O-ring (22) to gland (3).



(2) Assemble piston assembly

※ Check for scratches or rough surfaces. If found smooth with an oil stone.

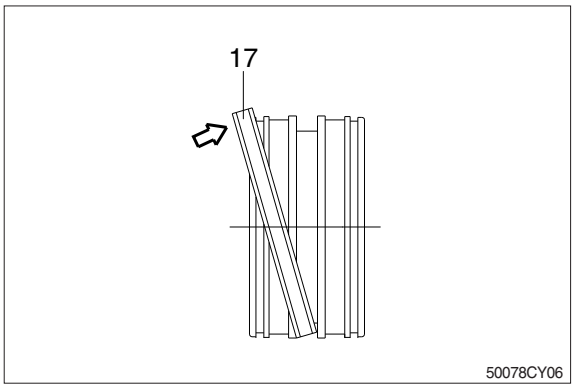
① Coat the outer face of piston (14) with hydraulic oil.



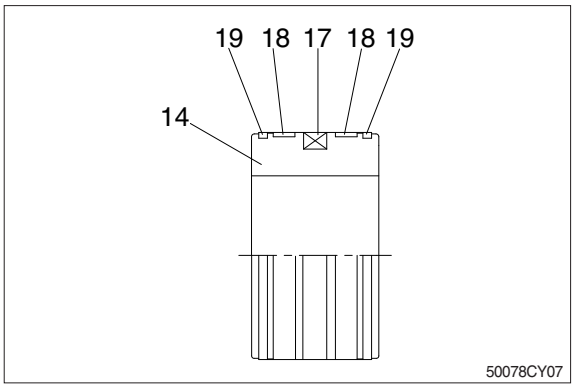
② Fit piston seal (17) to piston.

※ Put the piston seal in the warm water of 60~100˚C for more than 5 minutes.

※ After assembling the piston seal, press its outer diameter to fit in.



③ Fit wear ring (18) and dust ring (19) to piston (14).

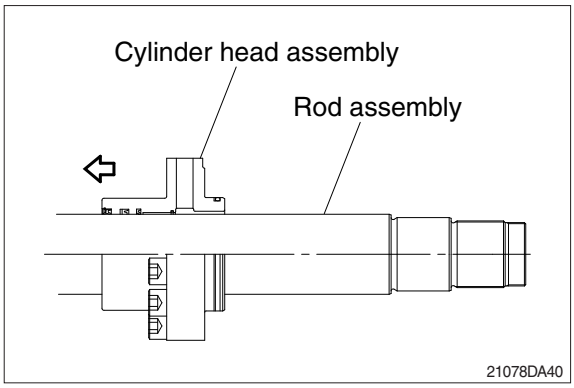


(3) Install piston and cylinder head

① Fix the rod assembly to the work bench.

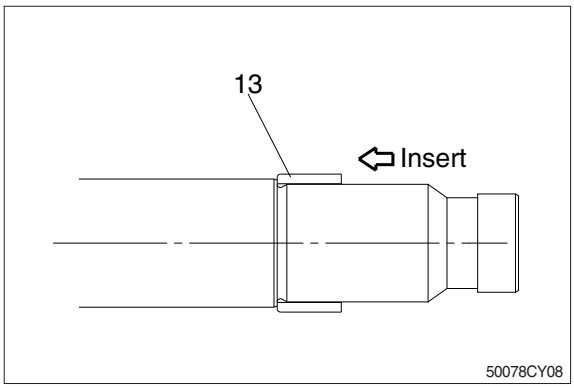
② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and cylinder head.

③ Insert cylinder head assembly to rod assembly.



④ Insert cushion ring (13) to rod assembly.

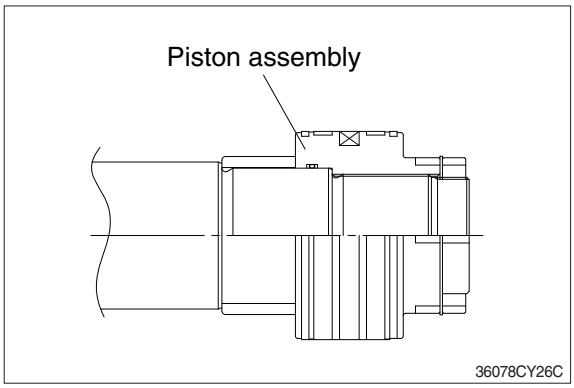
※ Note that cushion ring (13) has a direction in which it should be fitted.



⑤ Fit piston assembly to rod assembly.

· Tightening torque : 200±20 kgf · m
(1447±145 lbf · ft)

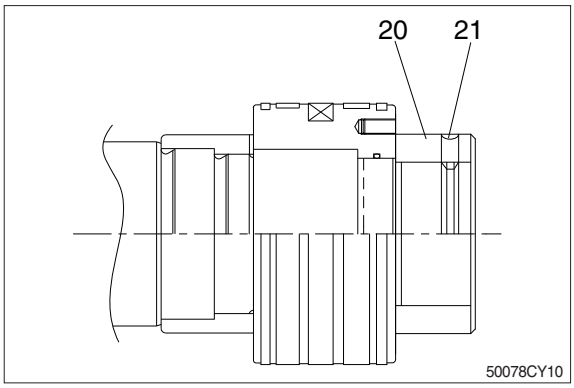
※ Refer to page 8-158.



⑥ Fit lock nut (20) and tighten the set screw (21).

· Tightening torque
Item 20 : 150±15 kgf · m
(1085±108 lbf · ft)
Item 21 : 5.4±0.5 kgf · m
(39.1±3.6 lbf · ft)

※ Refer to page 8-158.



(3) Overall assemble

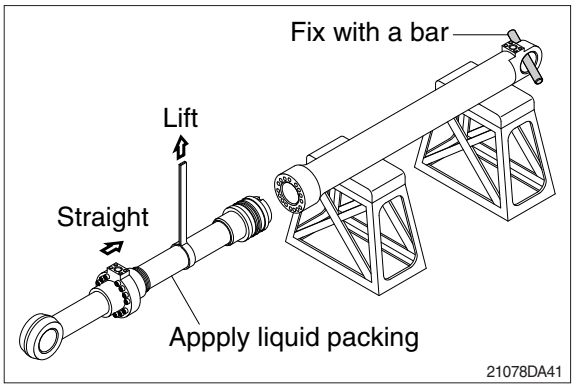
① Place a V-block on a rigid work bench. Mount the tube assembly (1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

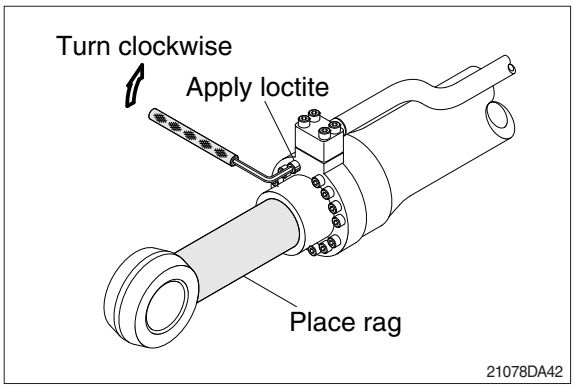
② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.

※ Be careful not to damage piston seal by thread of tube assembly.

③ Match the bolt holes in the cylinder head flange to the tapped holes in the tube assembly and tighten socket bolts to a specified torque.

※ Refer to the table of tightening torque.





1. TRACK LINK

1) REMOVAL

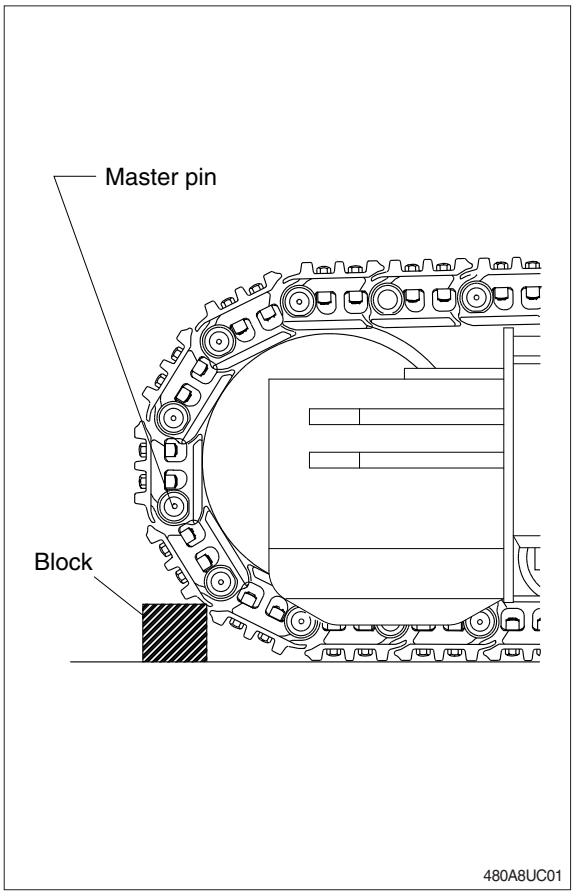
(1) Move track link until master pin is over front idler in the position put wooden block as shown.

(2) Loosen tension of the track link.

※ If track tension is not relieved when the grease valve is loosened, move the machine backwards and forwards.

※ Unscrew the grease nipple after release the tension by pushing the poppet only when necessarily required.
Grease leaking hole is not existing. So, while unscrew the grease nipple, grease is not leaking until the grease nipple is completely coming out. If the tension is not released in advance, the grease nipple can be suddenly popped out by pressurized grease.

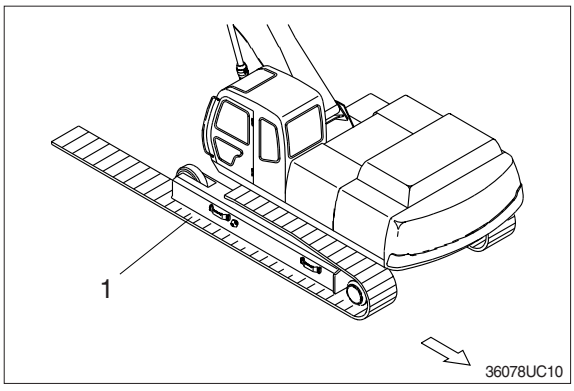
(3) Push out master pin by using a suitable tool.



(4) Move the machine slowly in reverse, and lay out track link assembly (1).

※ Jack up the machine and put wooden block under the machine.

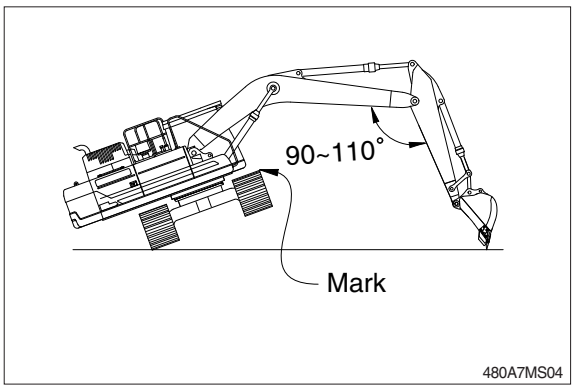
※ Don't get close to the sprocket side as the track shoe plate may fall down on your feet.



2) INSTALL

(1) Carry out installation in the reverse order to removal.

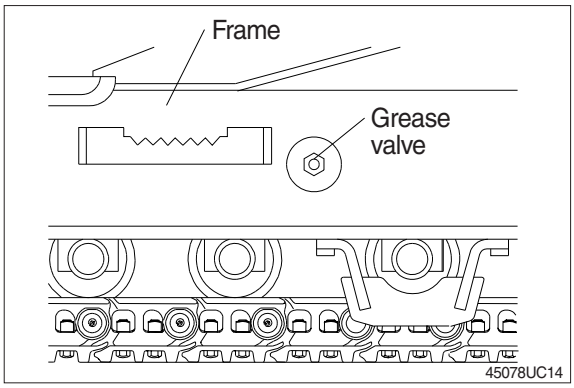
※ Adjust the tension of the track link.



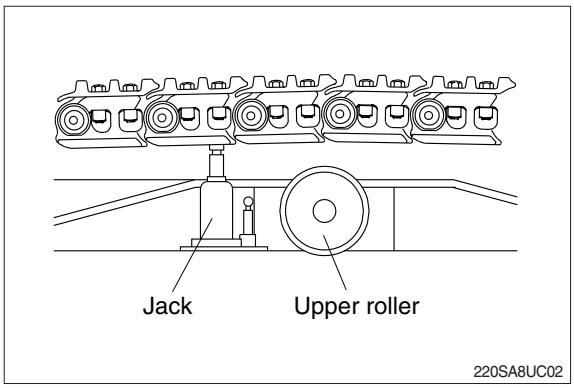
2. UPPER ROLLER

1) REMOVAL

(1) Loosen tension of the track link.

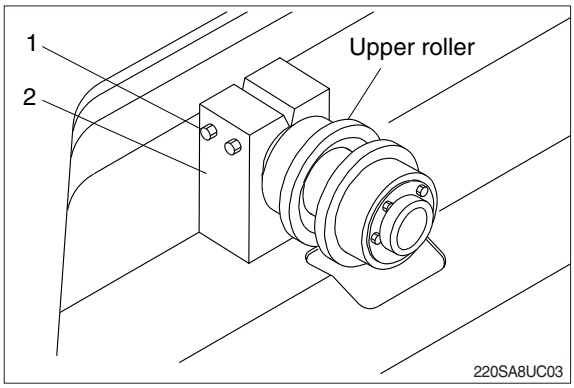


(2) Jack up the track link height enough to permit upper roller removal.



(3) Loosen the lock nut (1).

(4) Open bracket (2) with a screwdriver, push out from inside, and remove upper roller assembly.
- Weight
  HX480A L : 80 kg (176 lb)
  HX520A L : 41 kg (90.4 lb)
- Tightening torque : 29.7±3.0 kgf · m
  (215±21.7 lbf · ft)



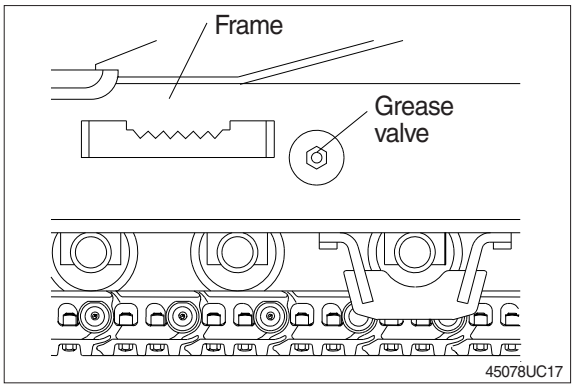
2) INSTALL

(1) Carry out installation in the reverse order to removal.

3. LOWER ROLLER

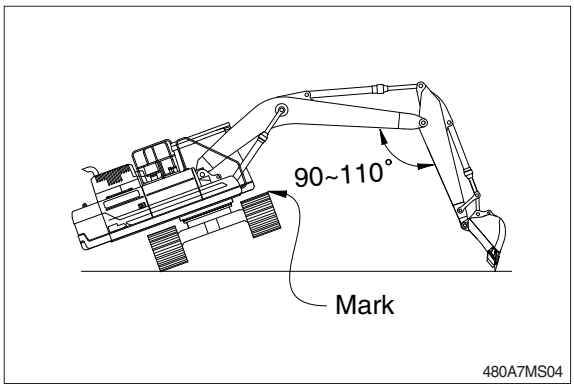
1) REMOVAL

(1) Loosen tension of the track link.



(2) Using the work equipment, push up track frame on side which is to be removed.

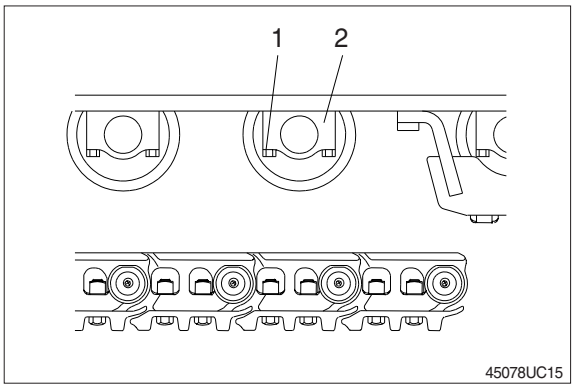
※ After jack up the machine, set a block under the unit.



(3) Remove the mounting bolt (1) and draw out the lower roller (2).

· Weight
HX480A L : 88 kg (194 lb)
HX520A L : 174 kg (386 lb)

· Tightening torque : 100±10 kgf · m
(723±72.3 lbf · ft)



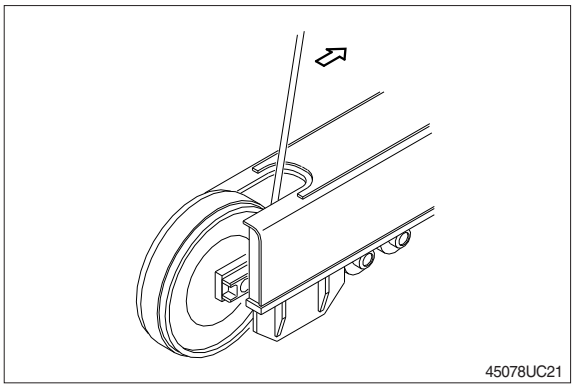
2) INSTALL

(1) Carry out installation in the reverse order to removal.

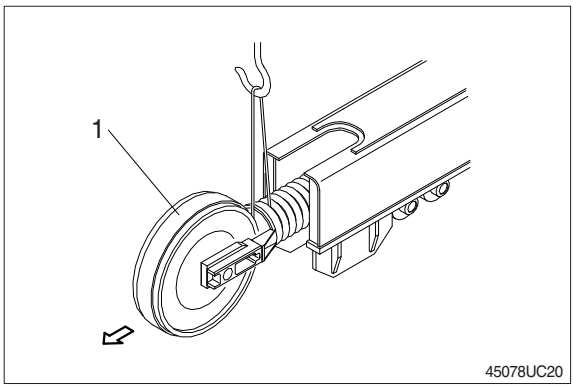
4. IDLER AND RECOIL SPRING

1) REMOVAL

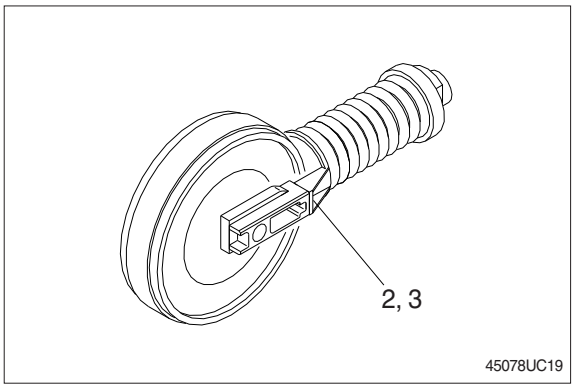
(1) Remove the track link.
For detail, see removal of track link.



(2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 622 kg (1371 lb)



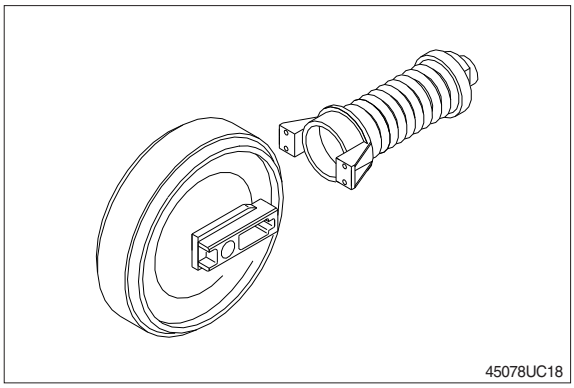
(3) Remove the bolts (2), washers (3) and separate ilder from recoil spring.
· Tightening torque (2) : 87.2±12.5 kgf·m
(631±90.4 lbf·ft)



2) INSTALL

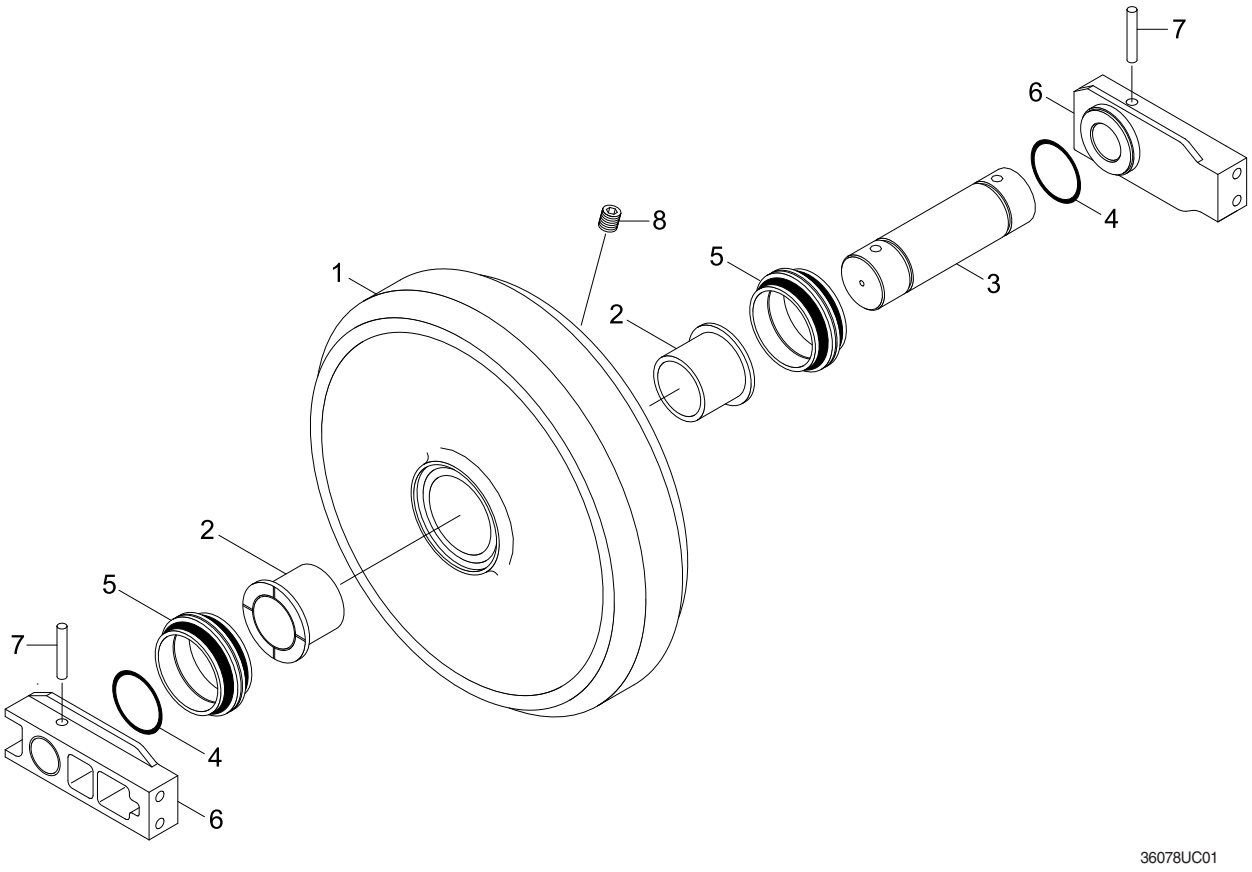
(1) Carry out installation in the reverse order to removal.

※ 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

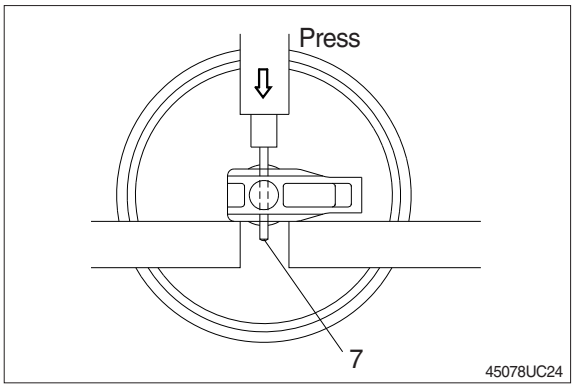


1	Shell	4	O-ring	7	Spring pin
2	Bushing	5	Seal assembly	8	Plug
3	Shaft	6	Bracket		

(2) Disassembly

① Remove plug and drain oil.

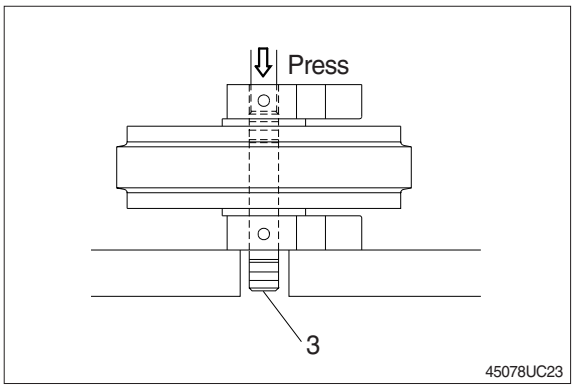
② Draw out the spring pin (7), using a press.



③ Pull out the shaft (2) with a press.

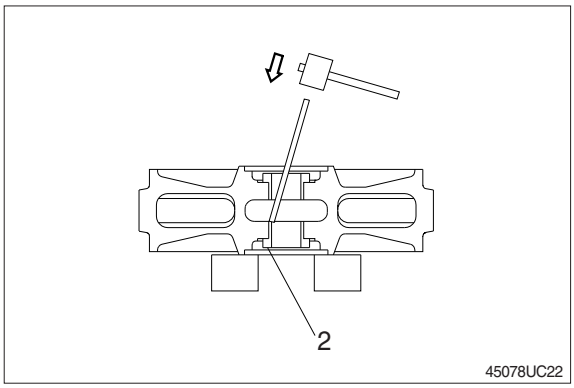
④ Remove seal (5) from shell (1) and bracket (6).

⑤ Remove O-ring (4) from shaft.



⑥ Remove the bushing (2) from idler, using a special tool.

※ Only remove bushing if replacement is necessity.

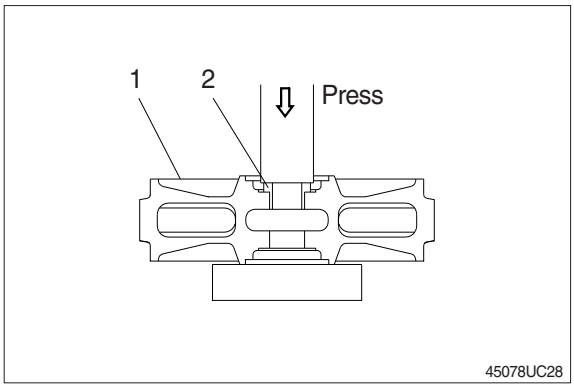


(3) Assembly

※ Before assembly, clean the parts.

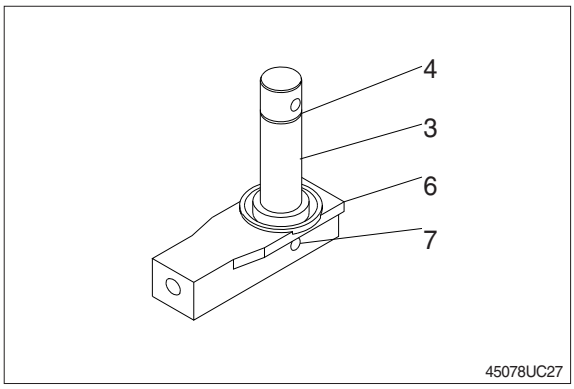
※ Coat the sliding surfaces of all parts with oil.

① Cool up bushing (2) fully by some dry ice and press it into shell (1).
Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.

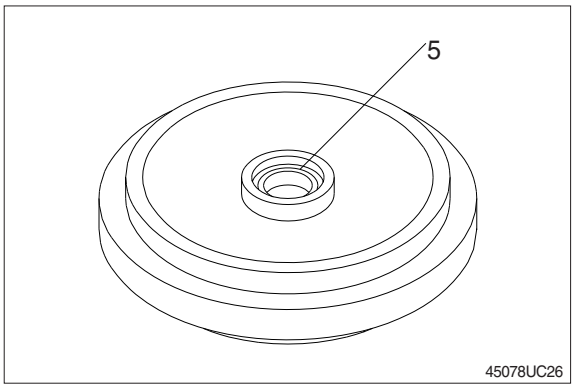


② Coat O-ring (4) with grease thinly, and install it to shaft (3).

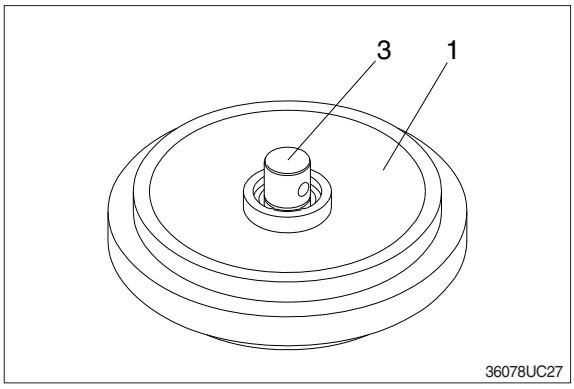
③ Insert shaft (3) into bracket (6) and drive in the spring pin (7).



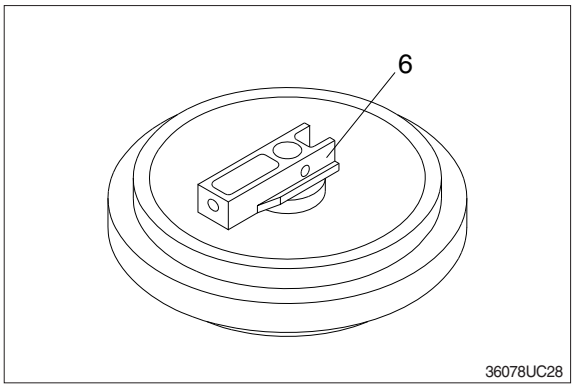
④ Install seal (5) to shell (1) and bracket (6).



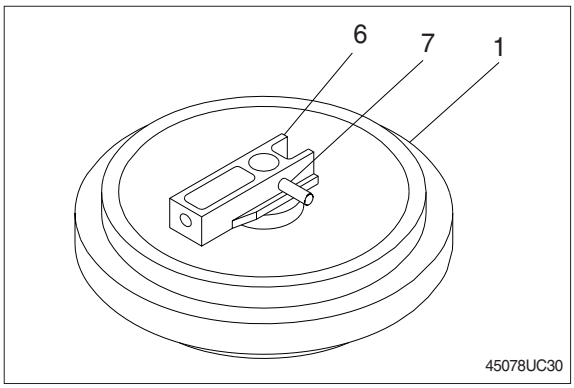
⑤ Install shaft (3) to shell (1).



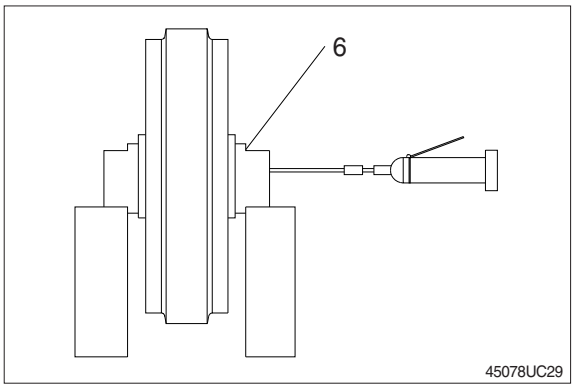
⑥ Install bracket (6) attached with seal (5).



⑦ Knock in the spring pin (7) with a hammer.

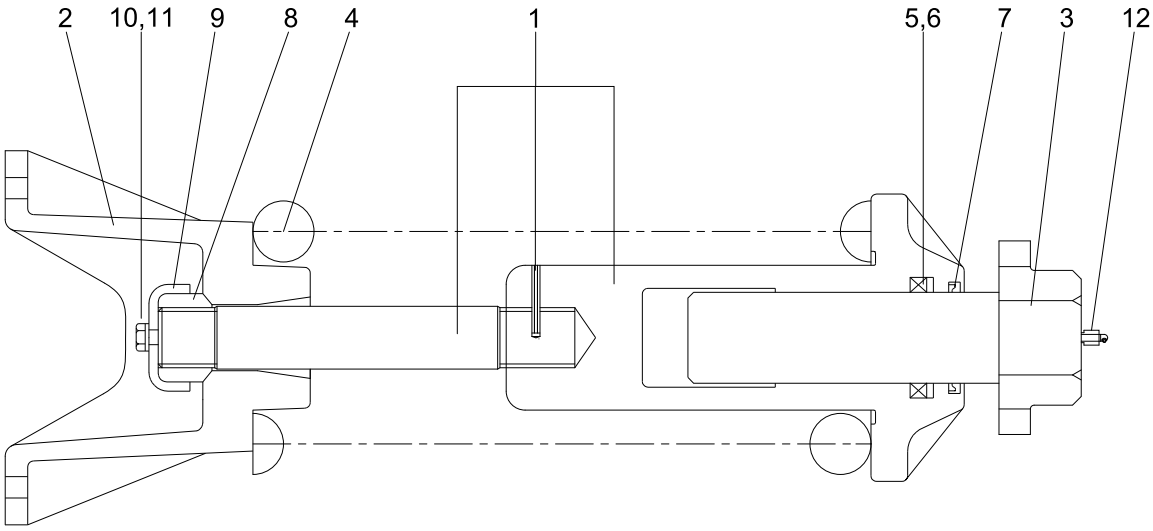


⑧ Lay bracket (6) on its side.
Supply engine oil to the specified level, and tighten plug.



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure



45078UC02

1	Body	5	Rod seal	9	Lock plate
2	Bracket	6	Back up ring	10	Hex bolt
3	Rod assembly	7	Dust seal	11	Spring washer
4	Spring	8	Lock nut	12	Grease valve

(2) Disassembly

① Apply pressure on spring (4) with a press.

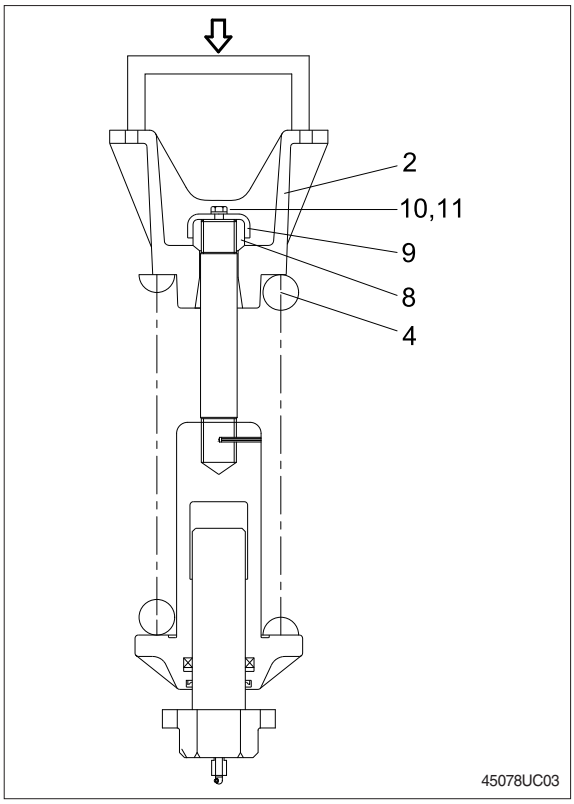
※ The spring is under a large installed load. This is dangerous, so be sure to set properly.

· Spring set load : 28840 kg (63580 lb)

② Remove bolt (10), spring washer (11) and lock plate (9).

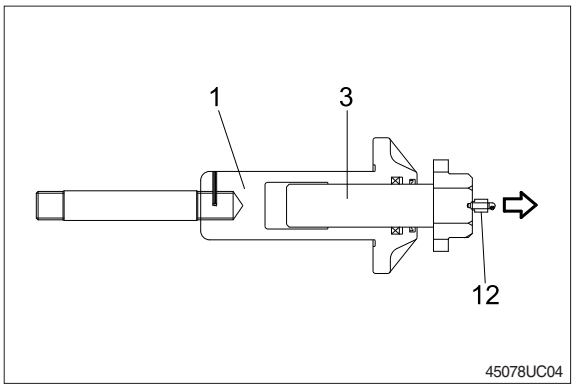
③ Remove lock nut (8).

④ Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.
Lighten the press load slowly and remove bracket (2) and spring (4).

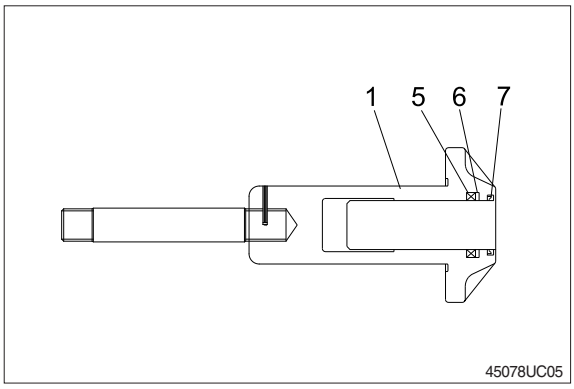


⑤ Remove rod (3) from body (1).

⑥ Remove grease valve (12) from rod (3).



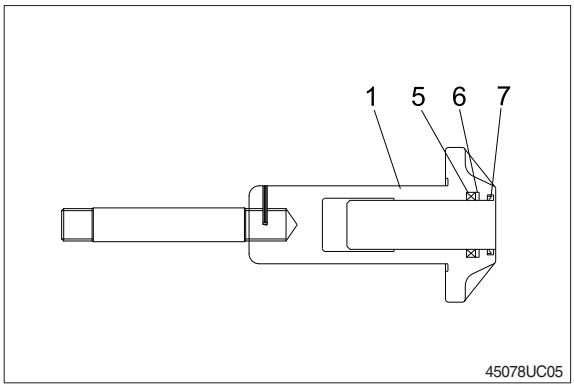
⑦ Remove rod seal (5), back up ring (6) and dust seal (11).



(3) Assembly

① Install dust seal (7), back up ring (6) and rod seal (5) to body (1).

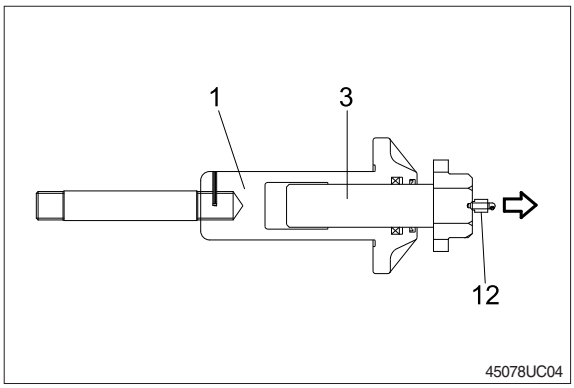
※ When installing dust seal (7) and rod seal (5), take full care so as not to damage the lip.



② Pour grease into body (1), then push in rod (3) 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 (12) to rod (3).
· Tightening torque : 13.0±1.0 kgf · m
(94±7.2lbf · ft)

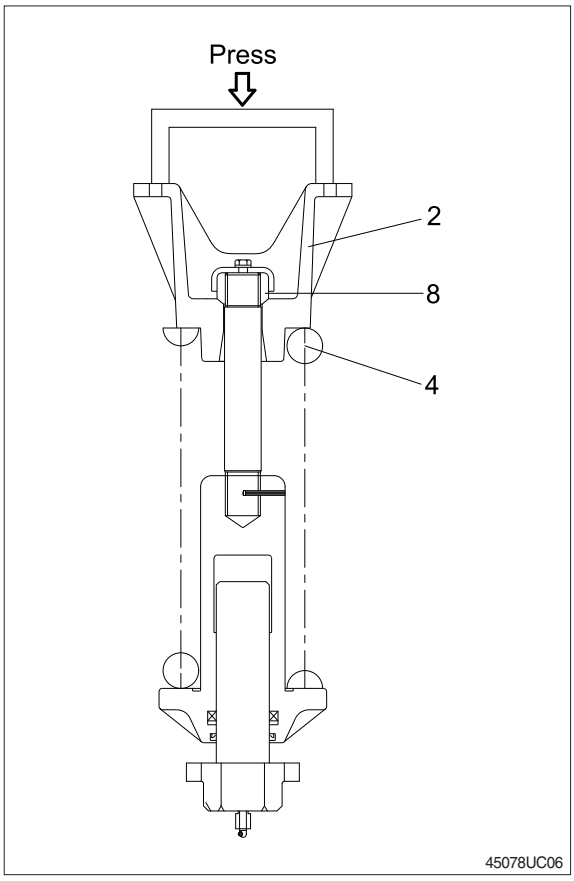


④ Install spring (4) and bracket (2) to body (1).

⑤ Apply pressure to spring (4) with a press and tighten lock nut (8).

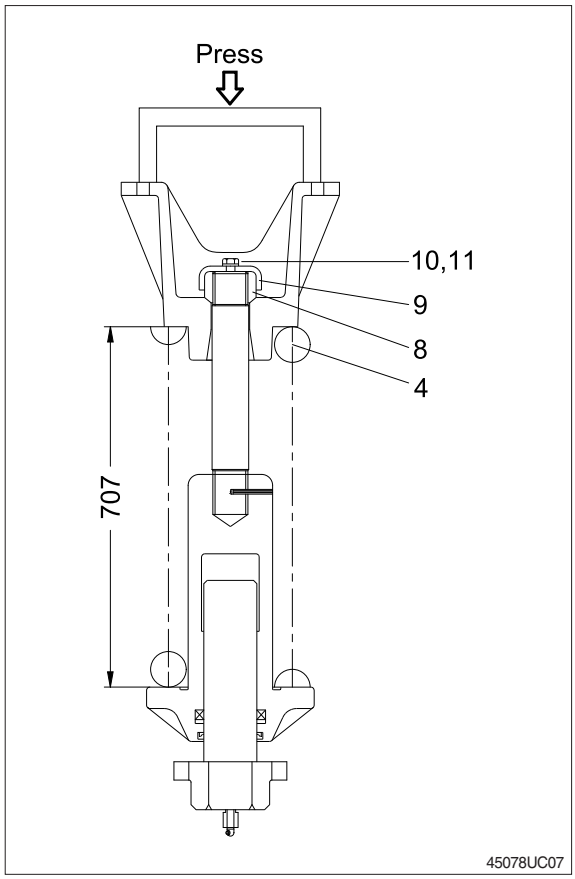
※ Apply sealant before assembling.

※ During the operation, pay attention specially to prevent the press from slipping out.

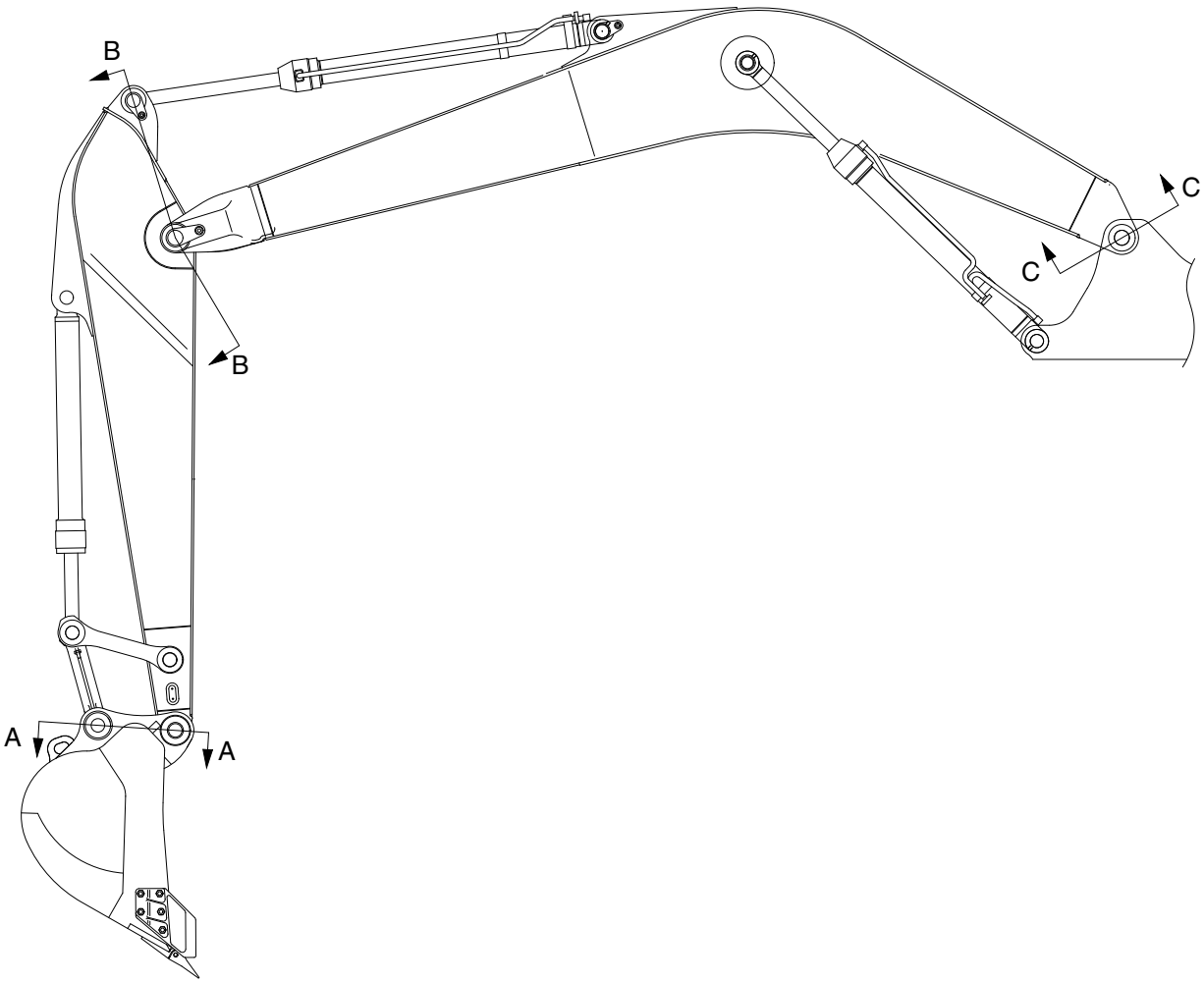


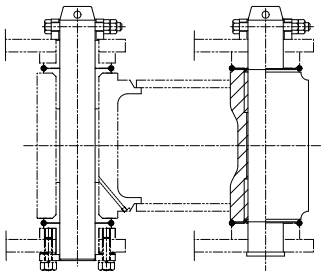
⑥ Lighten the press load and confirm the set length of spring (4).

⑦ After the setting of spring (4), install lock plate (9), spring washer (11) and bolt (10).

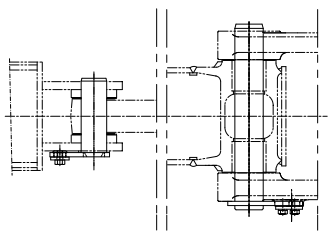


1. STRUCTURE

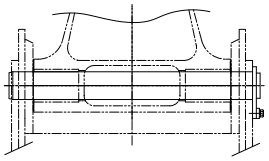




SECTION A



SECTION B



SECTION C

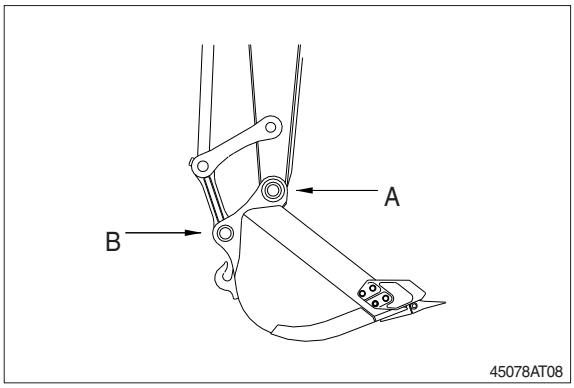
29078WE01

2. REMOVAL AND INSTALL

1) BUCKET ASSEMBLY

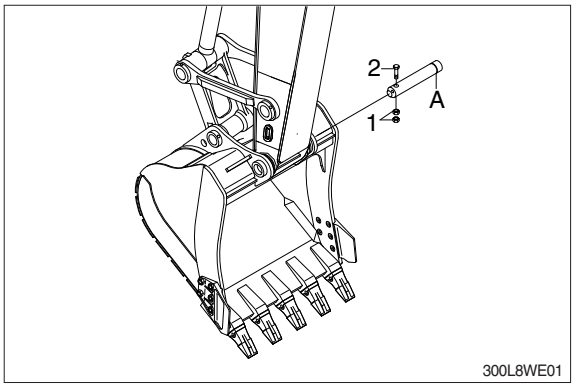
(1) Removal

① Lower the work equipment completely to ground with back of bucket facing down.



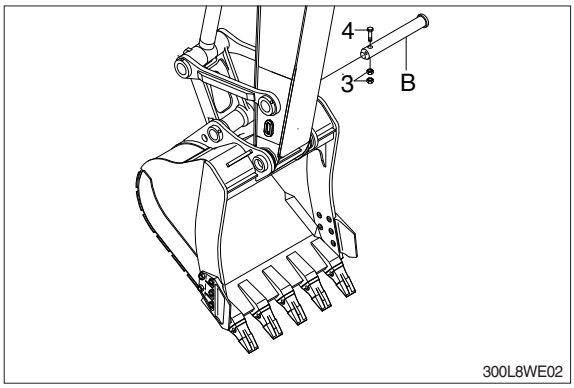
② Remove nut (1), bolt (2) and draw out the pin (A).

· Tightening torque : 100±10 kgf · m
(723±72.3 lbf · ft)



③ Remove nut (3), bolt (4) and draw out the pin (B).

· Tightening torque : 100±10 kgf · m
(723±72.3 lbf · ft)

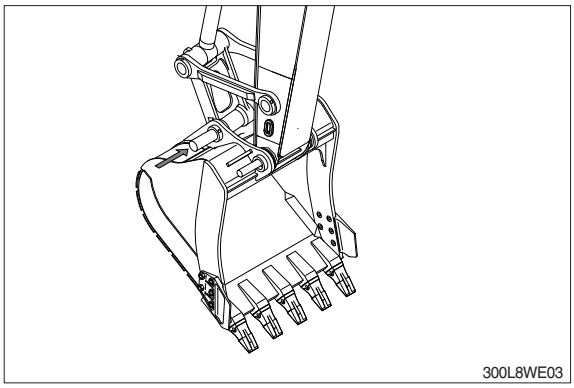


(2) Install

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.

② Disconnect bucket cylinder hose (1).

⚠ Fit blind plugs in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.

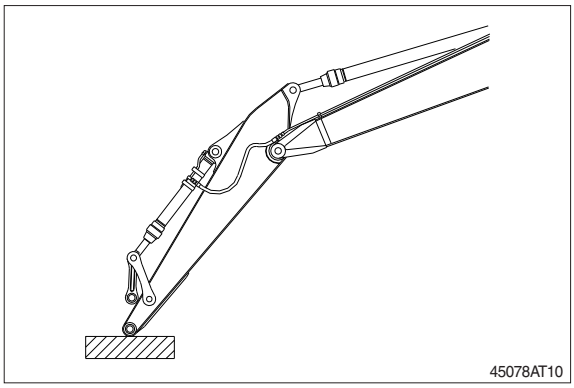
③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

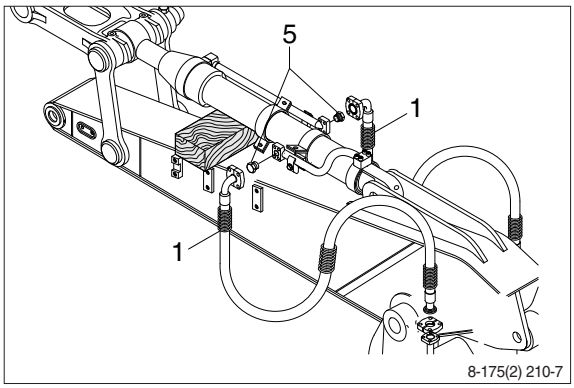
※ Tie the rod with wire to prevent it from coming out.

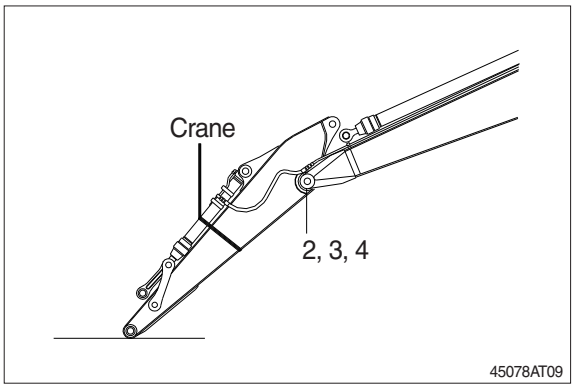
④ For details, see removal of arm cylinder assembly.
Place a wooden block under the cylinder and bring the cylinder down to it.

⑤ Remove bolt (2), plate (3) and pull out the pin (4) then remove the arm assembly.
· Weight : 2780 kg (6130 lb)
· Tightening torque : 29.7±4.5 kgf · m (215±32.5 lbf · ft)

※ When lifting the arm assembly, always lift the center of gravity.







(2) Install

① Carry out installation in the reverse order to removal.

⚠ When lifting the arm assembly, always lift the center of gravity.

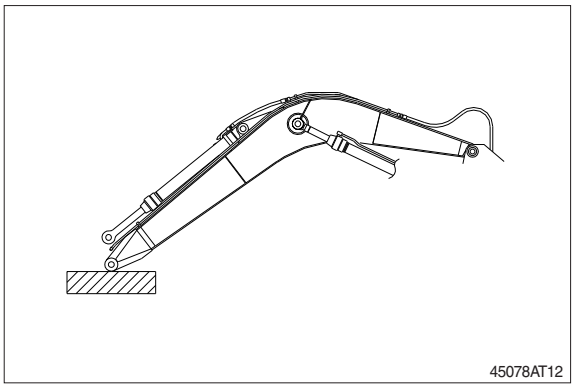
※ Bleed the air from the cylinder.

3) BOOM ASSEMBLY

(1) Removal

① Remove arm and bucket assembly.

② For details, see removal of arm and bucket assembly.
Remove boom cylinder assembly from boom.
For details, see removal of boom cylinder assembly.

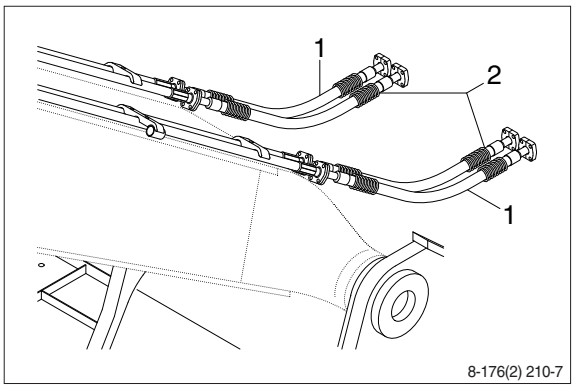


③ Disconnect head lamp wiring.

④ Disconnect bucket cylinder hose (2) and arm cylinder hose (1).

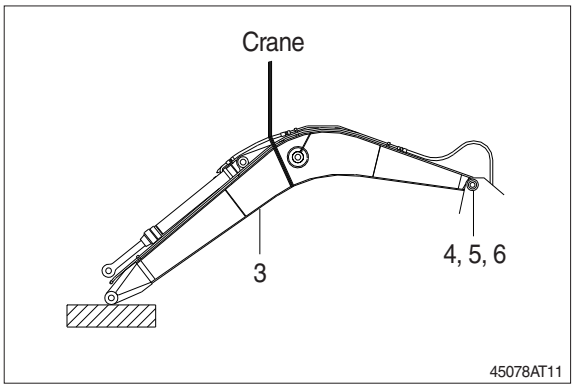
※ When the hose are disconnected, oil may spurt out.

⑤ Sling boom assembly (3).



⑥ Remove bolt (4), plate (5) and pull out the pin (6) then remove boom assembly.
- Weight : 4540 kg (10010 lb)
- Tightening torque : 57.9±8.7 kgf · m (419±62.9 lbf · ft)

※ When lifting the boom assembly always lift the center of gravity.



(2) Install

① Carry out installation in the reverse order to removal.

⚠ When lifting the boom assembly, always lift the center of gravity.

※ Bleed the air from the cylinder.

