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1. STRUCTURE

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

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

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

SECTION 1 GENERAL

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

SECTION 2 STRUCTURE AND FUNCTION

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

SECTION 3 HYDRAULIC SYSTEM

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

SECTION 4 ELECTRICAL SYSTEM

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

SECTION 5 MECHATRONICS SYSTEM

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

SECTION 6 TROUBLESHOOTING

This section explains the troubleshooting charts correlating problems to causes.

SECTION 7 MAINTENANCE STANDARD

This section gives the judgement standards when inspecting disassembled parts.

SECTION 8 DISASSEMBLY AND ASSEMBLY

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

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

2. HOW TO READ THE SERVICE MANUAL

Distribution and updating

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

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

Filing method

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

Revised edition mark(①②③⋯)

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

Revisions

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

Symbols

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

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

3. CONVERSION TABLE

Method of using the Conversion Table

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

Example

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

   Convert 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/cm^2 to lbf/in^2

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

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

TEMPERATURE

Fahrenheit-Centigrade Conversion.

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

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

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

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

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

SECTION 1 GENERAL

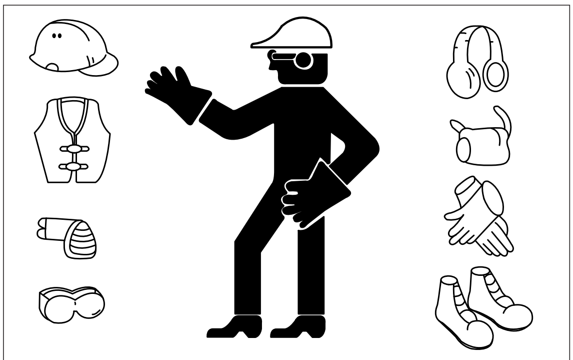
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

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

WEAR PROTECTIVE CLOTHING

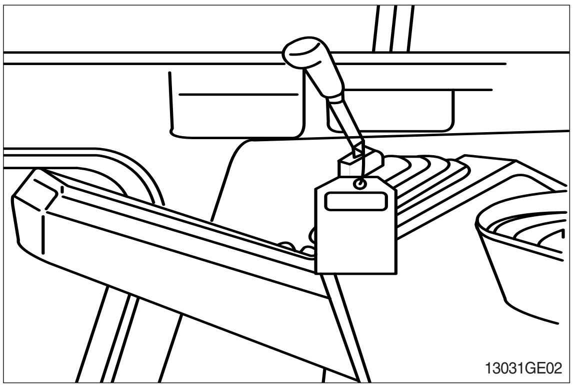
Wear close fitting clothing and safety equipment appropriate to the job.



13031GE01

WARN OTHERS OF SERVICE WORK

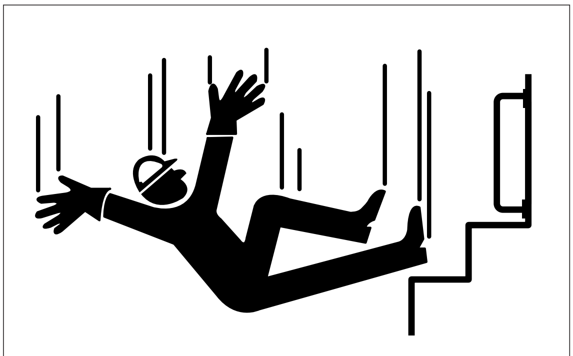
Unexpected machine movement can cause serious injury.
Before performing any work on the excavator, attach a 「**Do Not Operate**」 tag on the right side control lever.



13031GE02

USE HANDHOLDS AND STEPS

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



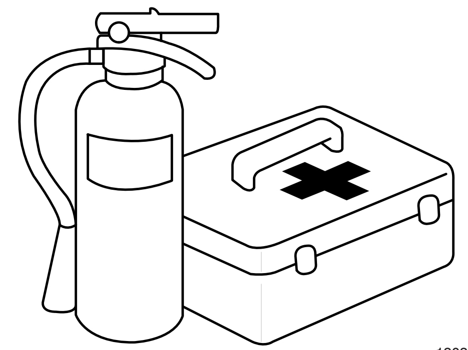
13031GE03

PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

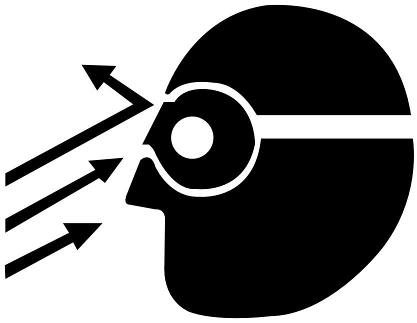
Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



13031GE04

PROTECT AGAINST FLYING DEBRIS

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



13031GE05

PROTECT AGAINST NOISE

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

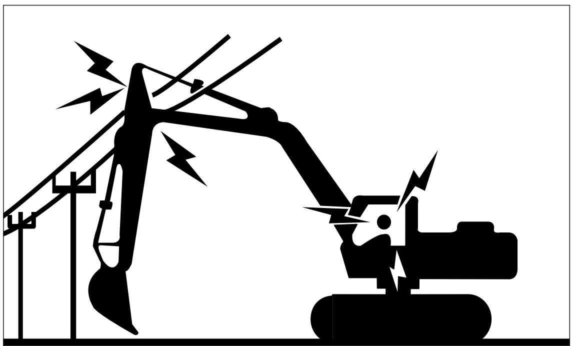
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

13031GE06

AVOID POWER LINES

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

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

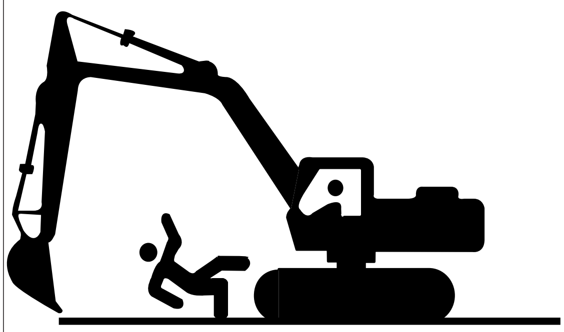


13031GE07

KEEP RIDERS OFF EXCAVATOR

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

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



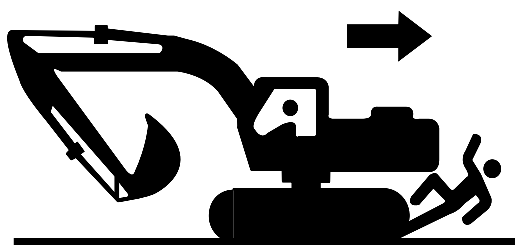
13031GE08

MOVE AND OPERATE MACHINE SAFELY

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

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

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

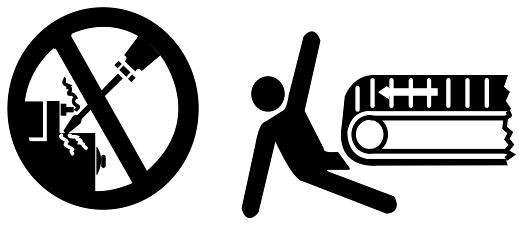


13031GE09

OPERATE ONLY FORM OPERATOR'S SEAT

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

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



13031GE26

PARK MACHINE SAFELY

Before working on the machine:

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

SUPPORT MACHINE PROPERLY

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

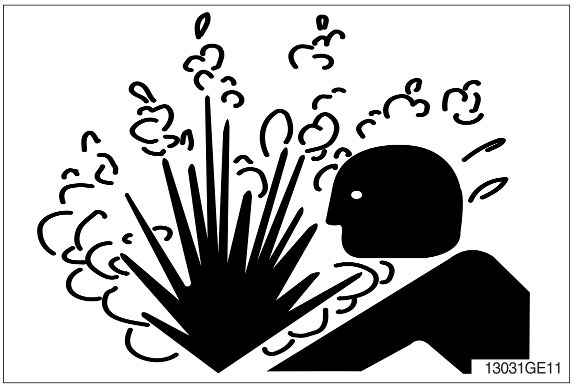
Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load.
Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.


13031GE10

SERVICE COOLING SYSTEM SAFELY

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

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


13031GE11

HANDLE FLUIDS SAFELY-AVOID FIRES

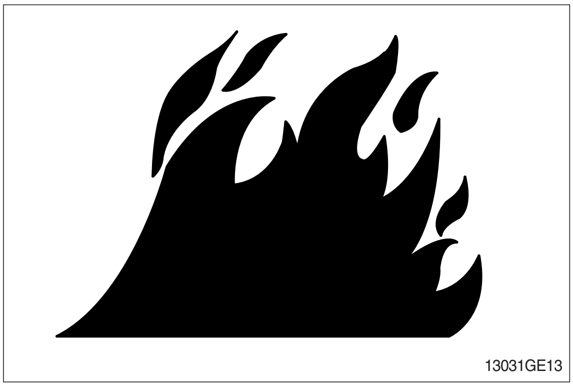
Handle fuel with care; It is highly flammable. Do not refuel the machine while smoking or when near open flame or sparks. Always stop engine before refueling machine.
Fill fuel tank outdoors.


13031GE12

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

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

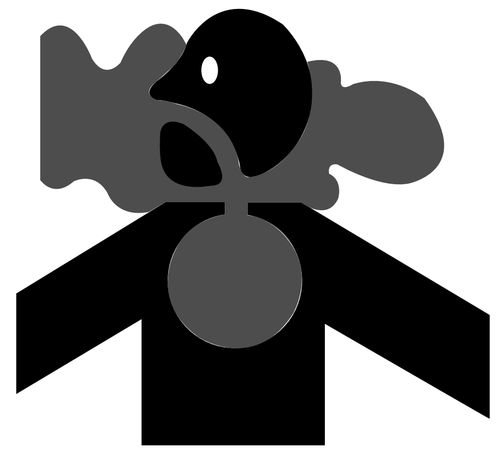
Do not store oily rags; They can ignite and burn spontaneously.


13031GE13

BEWARE OF EXHAUST FUMES

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

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



13031GE14

REMOVE PAINT BEFORE WELDING OR HEATING

Avoid potentially toxic fumes and dust.

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

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

Remove paint before welding or heating:

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

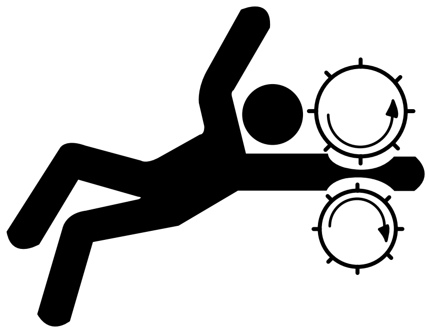
· If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

ILLUMINATE WORK AREA SAFELY

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

13031GE15

SERVICE MACHINE SAFELY

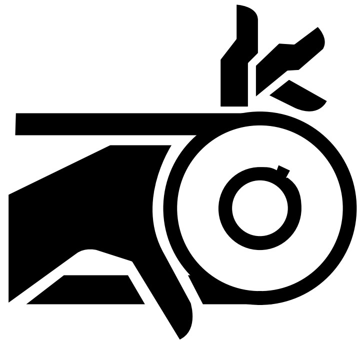


13031GE16

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



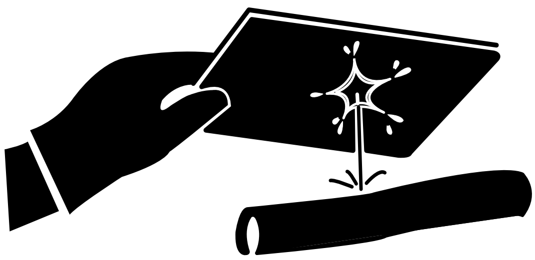
13031GE17

Entanglements in moving parts can cause serious injury.

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

AVOID HIGH PRESSURE FLUIDS

13031GE18



13031GE19

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

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

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

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

AVOID HEATING NEAR PRESSURIZED FLUID LINES

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

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

13031GE20

PREVENT BATTERY EXPLOSIONS

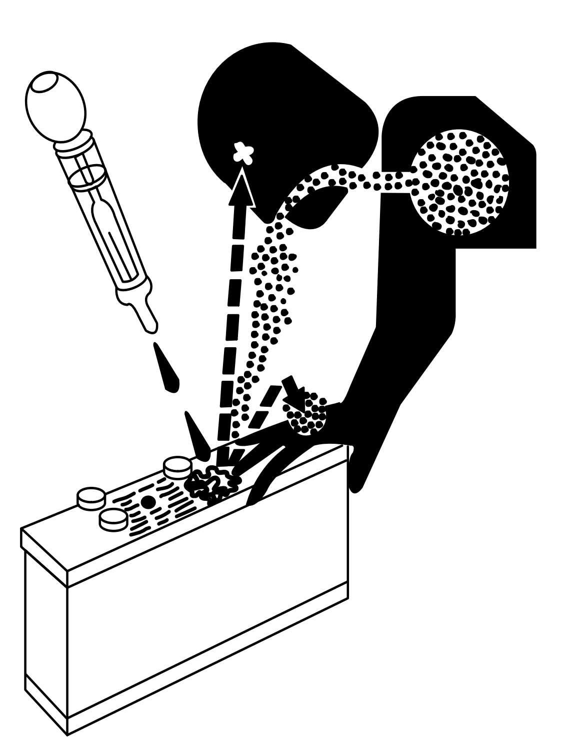
Keep sparks, lighted matches, and flame away from the top of battery. Battery gas can explode.

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

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

13031GE21

PREVENT ACID BURNS


13031GE22

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.

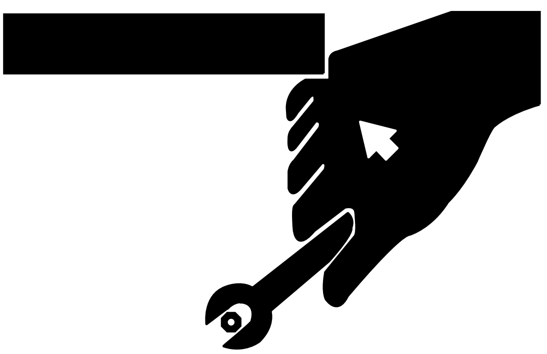
If you spill acid on yourself:

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


13031GE23

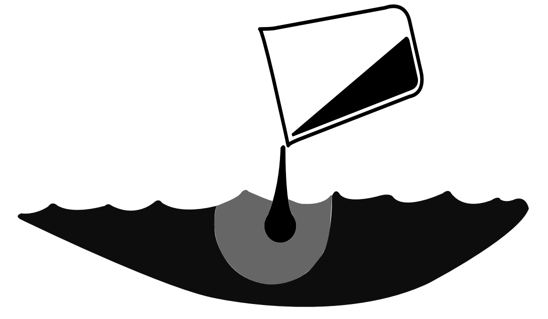
Use tools appropriate to the work. Makeshift tools, parts, and procedures can create safety hazards.

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



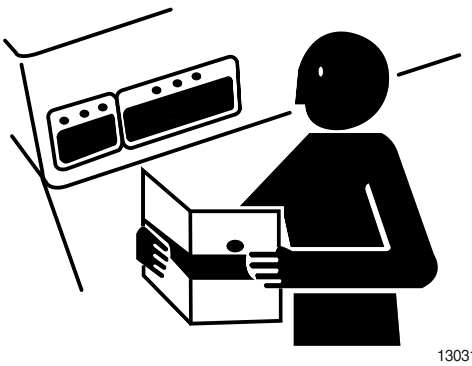
13031GE24

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

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

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

REPLACE SAFETY SIGNS



13031GE25

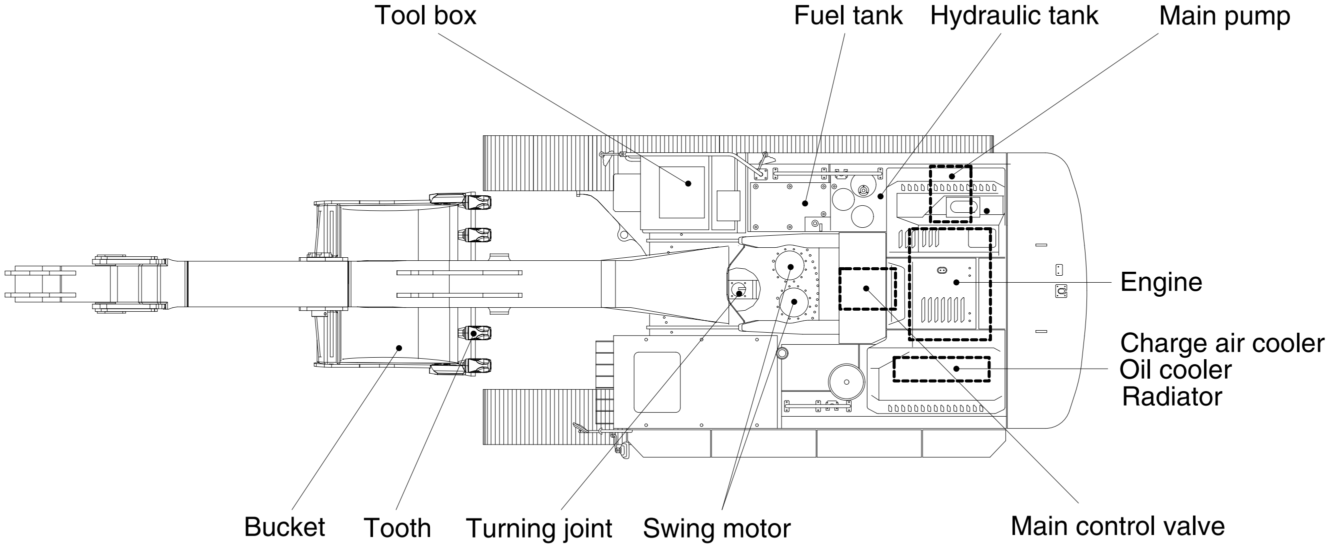
Replace missing or damaged safety signs. See the machine operator's manual for correct safety sign placement.

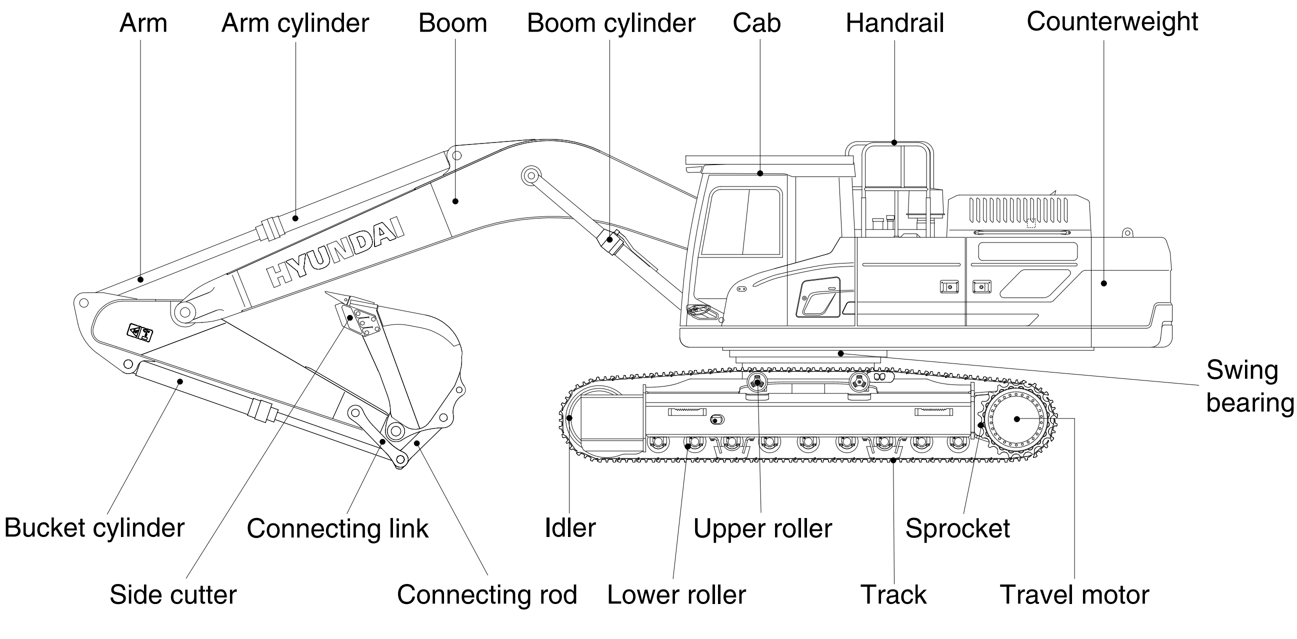
LIVE WITH SAFETY

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

GROUP 2 SPECIFICATIONS

1. MAJOR COMPONENT

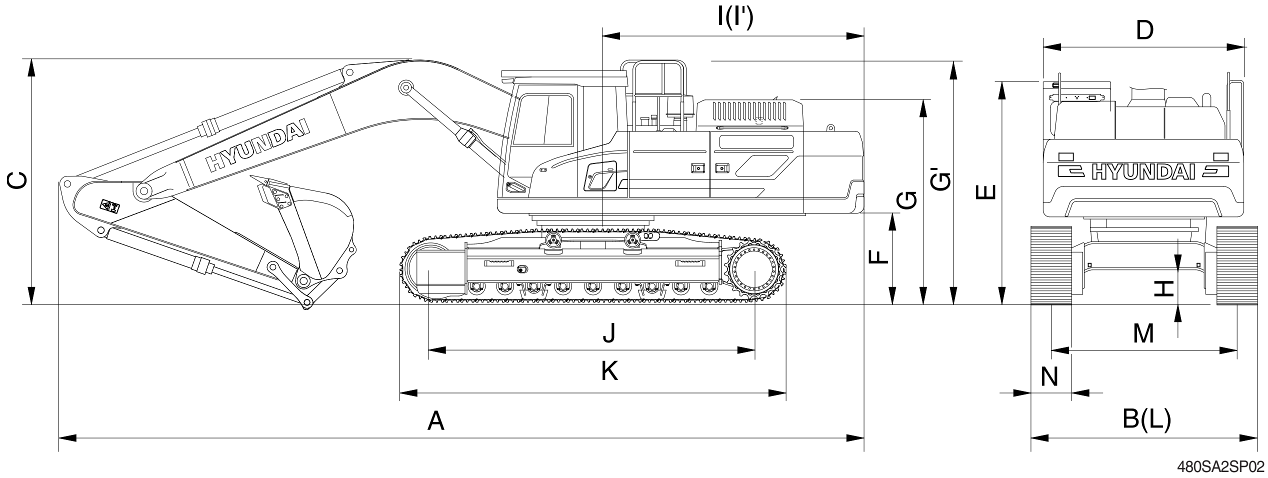




480SA2SP01

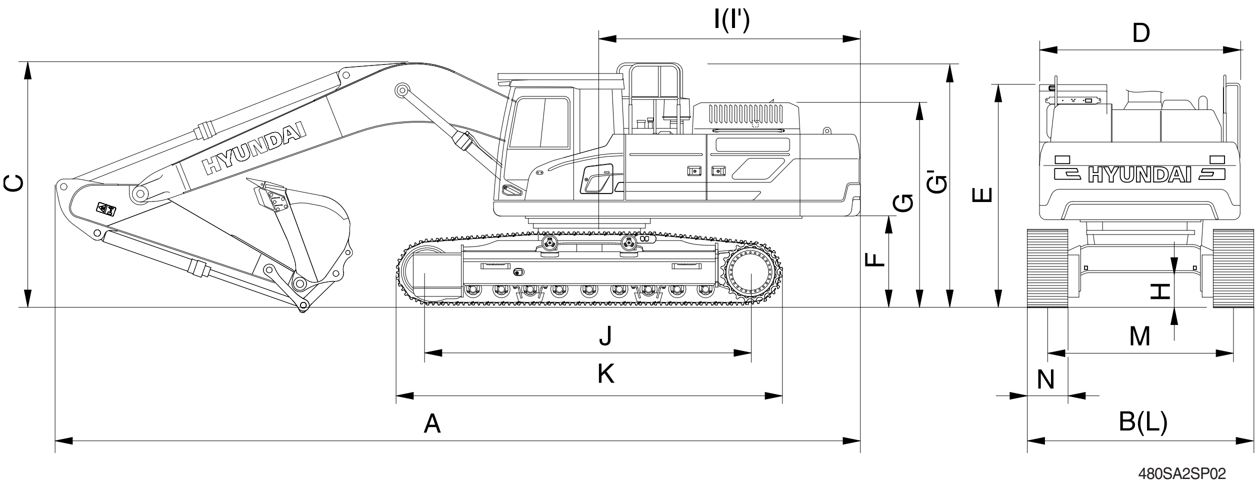
2. SPECIFICATIONS

1) HX500LT3 (1/2)



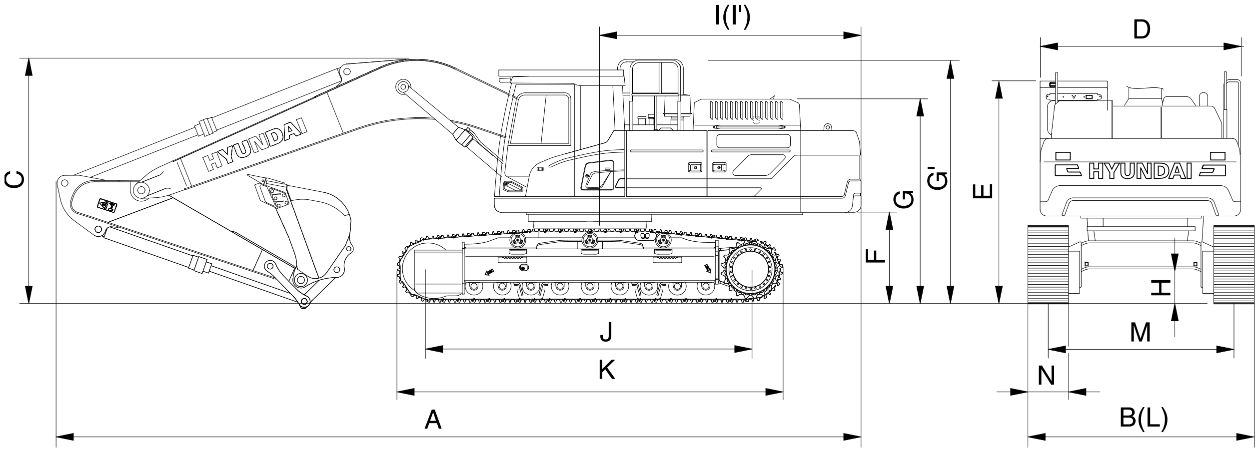
Description		Unit		Specification			
		m (ft-in)	Boom	7.06 (23' 2")			
		m (ft-in)	Arm	3.38 (11' 1")	2.90 (9' 6")	4.00 (13' 1")	2.55 (8' 4")
		mm (in)	Shoe	600 (24)			
Operating weight		kg (lb)		48860 (107720)	48790 (107560)	48850 (107700)	48620 (107190)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)		2.20 (2.88)	2.20 (2.88)	2.20 (2.88)	2.20 (2.88)
Overall length	A	mm (ft-in)		12210 (40' 1")	12220 (40' 1")	12160 (39' 11")	12150 (39' 10")
Overall width	B	mm (ft-in)		3340 (10' 11")	3340 (10' 11")	3340 (10' 11")	3340 (10' 11")
Overall height of boom	C	mm (ft-in)		3790 (12' 5")	3850 (12' 8")	3850 (12' 8")	3890 (12' 9")
Superstructure width	D	mm (ft-in)		2980 (9' 9")	2980 (9' 9")	2980 (9' 9")	2980 (9' 9")
Overall height of cab	E	mm (ft-in)		3240 (10' 8")	3240 (10' 8")	3240 (10' 8")	3240 (10' 8")
Ground clearance of counterweight	F	mm (ft-in)		1370 (4' 6")	1370 (4' 6")	1370 (4' 6")	1370 (4' 6")
Overall height of engine hood	G	mm (ft-in)		3140 (10' 4")	3140 (10' 4")	3140 (10' 4")	3140 (10' 4")
Overall height of handrail	G'	mm (ft-in)		3610 (11' 10")	3610 (11' 10")	3610 (11' 10")	3610 (11' 10")
Minimum ground clearance	H	mm (ft-in)		585 (1' 11")	585 (1' 11")	585 (1' 11")	585 (1' 11")
Rear-end distance	I	mm (ft-in)		3745 (12' 3")	3745 (12' 3")	3745 (12' 3")	3745 (12' 3")
Rear-end swing radius	I'	mm (ft-in)		3800 (12' 6")	3800 (12' 6")	3800 (12' 6")	3800 (12' 6")
Distance between tumblers	J	mm (ft-in)		4470 (14' 8")	4470 (14' 8")	4470 (14' 8")	4470 (14' 8")
Undercarriage length (without grouser)	K	mm (ft-in)		5416 (17' 9")	5416 (17' 9")	5416 (17' 9")	5416 (17' 9")
Undercarriage length (with grouser)	K	mm (ft-in)		5490 (18' 0")	5490 (18' 0")	5490 (18' 0")	5490 (18' 0")
Undercarriage width	L	mm (ft-in)		3340 (10' 11")	3340 (10' 11")	3340 (10' 11")	3340 (10' 11")
Track gauge	M	mm (ft-in)		2740 (9' 0")	2740 (9' 0")	2740 (9' 0")	2740 (9' 0")
Track shoe width, standard	N	mm (ft-in)		600 (24")	600 (24")	600 (24")	600 (24")
Travel speed (low/high)		km/hr (mph)		3.2/5.2 (2.0/3.2)	3.2/5.2 (2.0/3.2)	3.2/5.2 (2.0/3.2)	3.2/5.2 (2.0/3.2)
Swing speed		rpm		8.8	8.8	8.8	8.8
Gradeability		Degree (%)		35 (70)	35 (70)	35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.85 (12.1)	0.85 (12.1)	0.85 (12.1)	0.84 (12.0)
Max traction force		kg (lb)		39674 (87466)	39674 (87466)	39674 (87466)	39674 (87466)

2) HX500LT3 (2/2)



Description		Unit		Specification	
		m (ft-in)	Boom	6.55 (21' 6")	9.00 (29' 6")
			Arm	2.55 (8' 4")	6.00 (19' 8")
		mm (in)	Shoe	600 (24)	
Operating weight		kg (lb)		48430 (106770)	49690 (109550)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)		2.20 (2.88)	1.38 (1.80)
Overall length	A	mm (ft-in)		11680 (38' 4")	14070 (46' 2")
Overall width	B			3340 (10' 11")	3340 (10' 11")
Overall height of boom	C			3790 (12' 5")	3970 (13' 0")
Superstructure width	D			2980 (9' 9")	2980 (9' 9")
Overall height of cab	E			3240 (10' 8")	3240 (10' 8")
Ground clearance of counterweight	F			1370 (4' 6")	1370 (4' 6")
Overall height of engine hood	G			3140 (10' 4")	3140 (10' 4")
Overall height of handrail	G'			3610 (11' 10")	3610 (11' 10")
Minimum ground clearance	H			585 (1' 11")	585 (1' 11")
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)	K			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)		3.2/5.2 (2.0/3.2)	3.2/5.2 (2.0/3.2)
Swing speed		rpm		8.8	8.8
Gradeability		Degree (%)		35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.84 (12.0)	0.86 (12.3)
Max traction force		kg (lb)		39674 (87466)	39674 (87466)

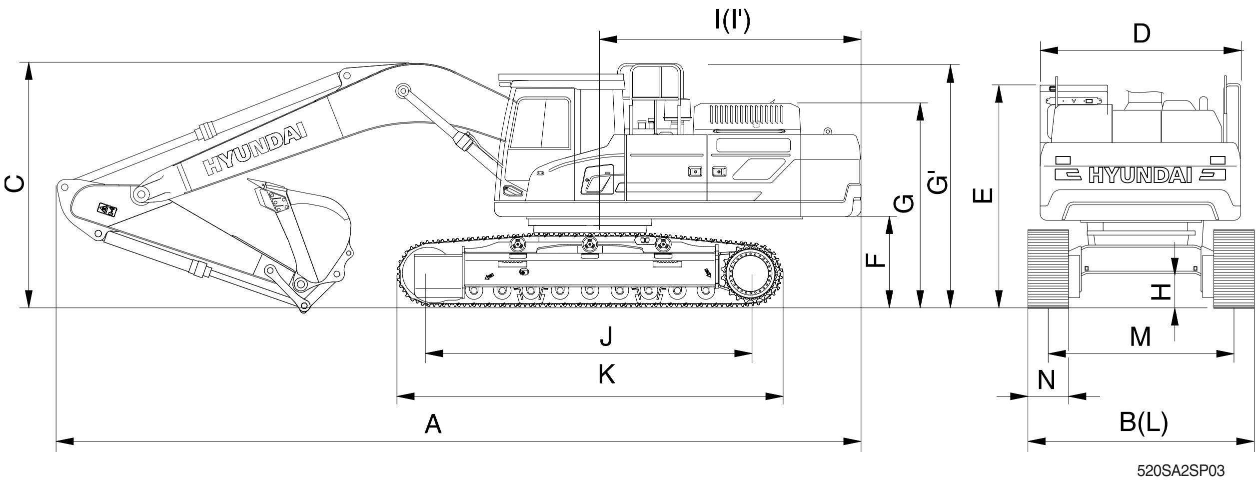
3) HX520LT3 (1/2)



520SA2SP03

Description		Unit		Specification			
		m (ft-in)	Boom	7.06 (23' 2")			
			Arm	3.38 (11' 1")	2.90 (9' 6")	4.00 (13' 1")	2.55 (8' 4")
		mm (in)	Shoe	600 (24)			
Operating weight		kg (lb)		51390 (113300)	51320 (113140)	51380 (113270)	51140 (112740)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)		2.20 (2.88)	2.20 (2.88)	2.20 (2.88)	2.20 (2.88)
Overall length	A	mm (ft-in)		12200 (40' 0")	12210 (40' 1")	12160 (39' 11")	12150 (39' 10")
Overall width (transport position)	B			2980 (9' 9")	2980 (9' 9")	2980 (9' 9")	2980 (9' 9")
Overall width (working position)	B			3540 (11' 7")	3540 (11' 7")	3540 (11' 7")	3540 (11' 7")
Overall height of boom	C			3830 (12' 7")	3890 (12' 9")	3850 (12' 8")	3980 (13' 1")
Superstructure width	D			2980 (9' 9")	2980 (9' 9")	2980 (9' 9")	2980 (9' 9")
Overall height of cab	E			3385 (11' 1")	3385 (11' 1")	3385 (11' 1")	3385 (11' 1")
Ground clearance of counterweight	F			1445 (4' 9")	1445 (4' 9")	1445 (4' 9")	1445 (4' 9")
Overall height of engine hood	G			3140 (10' 4")	3140 (10' 4")	3140 (10' 4")	3140 (10' 4")
Overall height of handrail	G'			3600 (11' 10")	3600 (11' 10")	3600 (11' 10")	3600 (11' 10")
Minimum ground clearance	H			780 (2' 7")	780 (2' 7")	780 (2' 7")	780 (2' 7")
Rear-end distance	I			3745 (12' 3")	3745 (12' 3")	3745 (12' 3")	3745 (12' 3")
Rear-end swing radius	I'			3800 (12' 6")	3800 (12' 6")	3800 (12' 6")	3800 (12' 6")
Distance between tumblers	J			4470 (14' 8")	4470 (14' 8")	4470 (14' 8")	4470 (14' 8")
Undercarriage length (transport position)	K			5416 (17' 9")	5416 (17' 9")	5416 (17' 9")	5416 (17' 9")
Undercarriage length (working position)	K			5490 (18' 0")	5490 (18' 0")	5490 (18' 0")	5490 (18' 0")
Undercarriage width (transport position)	L			2980 (9' 9")	2980 (9' 9")	2980 (9' 9")	2980 (9' 9")
Undercarriage width (working position)	L			3540 (11' 7")	3540 (11' 7")	3540 (11' 7")	3540 (11' 7")
Track gauge (transport position)	M			2380 (7' 10")	2380 (7' 10")	2380 (7' 10")	2380 (7' 10")
Track gauge (working position)	M			2940 (9' 8")	2940 (9' 8")	2940 (9' 8")	2940 (9' 8")
Track shoe width, standard	N			600 (24")	600 (24")	600 (24")	600 (24")
Travel speed (low/high)		km/hr (mph)		3.2/5.2 (2.0/3.2)	3.2/5.2 (2.0/3.2)	3.2/5.2 (2.0/3.2)	3.2/5.2 (2.0/3.2)
Swing speed		rpm		8.8	8.8	8.8	8.8
Gradeability		Degree (%)		35 (70)	35 (70)	35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.89 (12.7)	0.89 (12.7)	0.89 (12.7)	0.89 (12.6)
Max traction force		kg (lb)		39674 (87466)	39674 (87466)	39674 (87466)	34100 (87466)

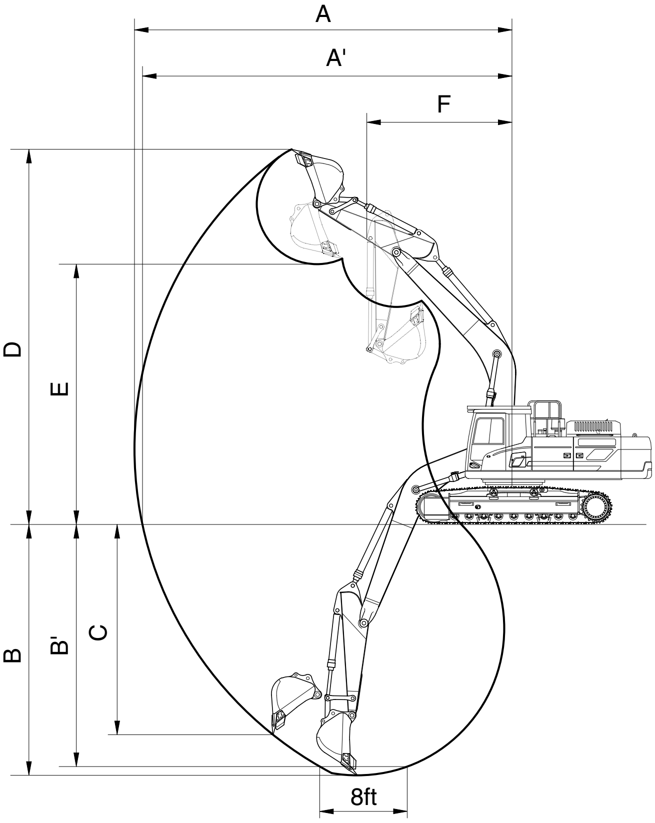
4) HX520LT3 (2/2)



Description		Unit		Specification			
		m (ft-in)	Boom	6.55 (21' 6")			9.00 (29' 6")
			Arm	3.38 (11' 1")	2.90 (9' 6")	2.55 (8' 4")	6.00 (19' 8")
		mm (in)	Shoe	600 (24)			
Operating weight		kg (lb)		51200 (112880)	51130 (112720)	50960 (112350)	52200 (115080)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)		2.20 (2.88)	2.20 (2.88)	2.20 (2.88)	1.38 (1.80)
Overall length	A	mm (ft-in)		11680 (38' 4")	11690 (38' 4")	11650 (38' 3")	14080 (46' 2")
Overall width (transport position)	B			2980 (9' 9")	2980 (9' 9")	2980 (9' 9")	2980 (9' 9")
Overall width (working position)	B			3540 (11' 7")	3540 (11' 7")	3540 (11' 7")	3540 (11' 7")
Overall height of boom	C			3920 (12' 10")	3970 (13' 0")	3900 (12' 10")	3970 (13' 0")
Superstructure width	D			2980 (9' 9")	2980 (9' 9")	2980 (9' 9")	2980 (9' 9")
Overall height of cab	E			3385 (11' 1")	3385 (11' 1")	3385 (11' 1")	3385 (11' 1")
Ground clearance of counterweight	F			1445 (4' 9")	1445 (4' 9")	1445 (4' 9")	1445 (4' 9")
Overall height of engine hood	G			3140 (10' 4")	3140 (10' 4")	3140 (10' 4")	3140 (10' 4")
Overall height of handrail	G'			3600 (11' 10")	3600 (11' 10")	3600 (11' 10")	3600 (11' 10")
Minimum ground clearance	H			770 (2' 6")	770 (2' 6")	770 (2' 6")	770 (2' 6")
Rear-end distance	I			3745 (12' 3")	3745 (12' 3")	3745 (12' 3")	3745 (12' 3")
Rear-end swing radius	I'			3800 (12' 6")	3800 (12' 6")	3800 (12' 6")	3800 (12' 6")
Distance between tumblers	J			4470 (14' 8")	4470 (14' 8")	4470 (14' 8")	4470 (14' 8")
Undercarriage length (transport position)	K			5416 (17' 9")	5416 (17' 9")	5416 (17' 9")	5416 (17' 9")
Undercarriage length (working position)	K			5490 (18' 0")	5490 (18' 0")	5490 (18' 0")	5490 (18' 0")
Undercarriage width (transport position)	L			2980 (9' 9")	2980 (9' 9")	2980 (9' 9")	2980 (9' 9")
Undercarriage width (working position)	L			3540 (11' 7")	3540 (11' 7")	3540 (11' 7")	3540 (11' 7")
Track gauge (transport position)	M			2380 (7' 10")	2380 (7' 10")	2380 (7' 10")	2380 (7' 10")
Track gauge (working position)	M			2940 (9' 8")	2940 (9' 8")	2940 (9' 8")	2940 (9' 8")
Track shoe width, standard	N			600 (24")	600 (24")	600 (24")	600 (24")
Travel speed (low/high)		km/hr (mph)		3.2/5.2 (2.0/3.2)	3.2/5.2 (2.0/3.2)	3.2/5.2 (2.0/3.2)	3.2/5.2 (2.0/3.2)
Swing speed		rpm		8.8	8.8	8.8	8.8
Gradeability		Degree (%)		35 (70)	35 (70)	35 (70)	35 (70)
Ground pressure		kgf/cm^2 (psi)		0.89 (12.6)	0.89 (12.6)	0.89 (12.6)	0.91 (12.9)
Max traction force		kg (lb)		39674 (87466)	39674 (87466)	39674 (87466)	34100 (87466)

3. WORKING RANGE AND DIGGING FORCE

1) HX500LT3 (1/2)

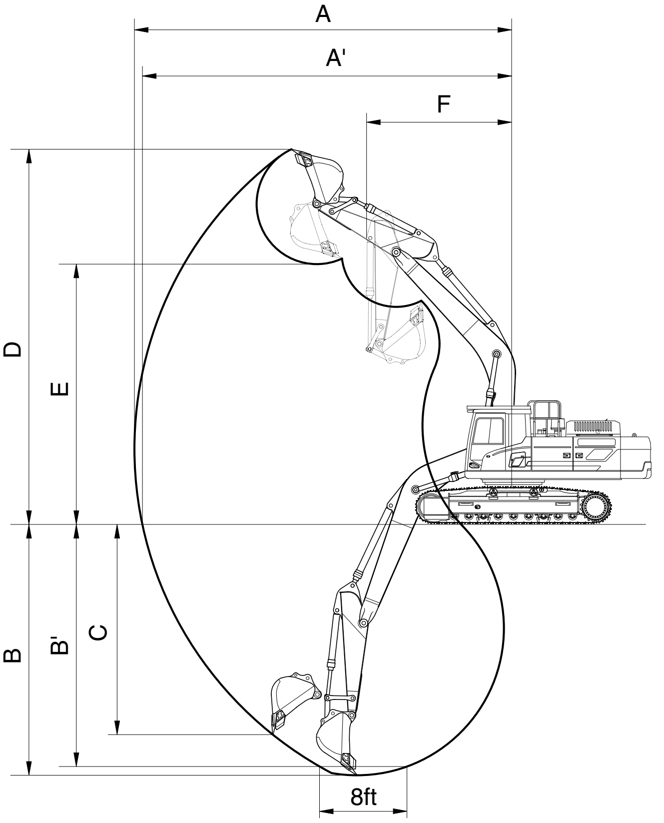


480SA2SP05

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

2) HX500LT3 (2/2)

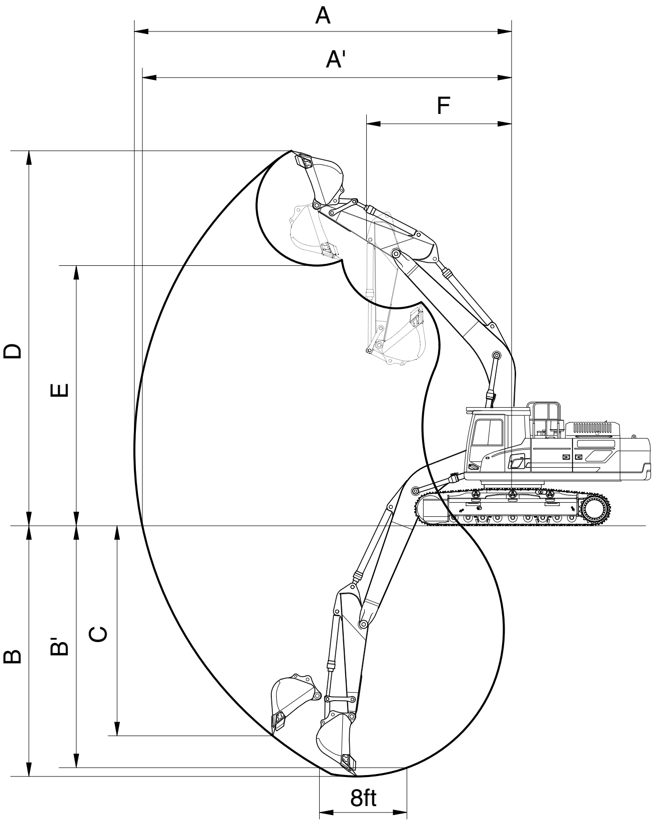


480SA2SP05

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

[ ] : Power boost

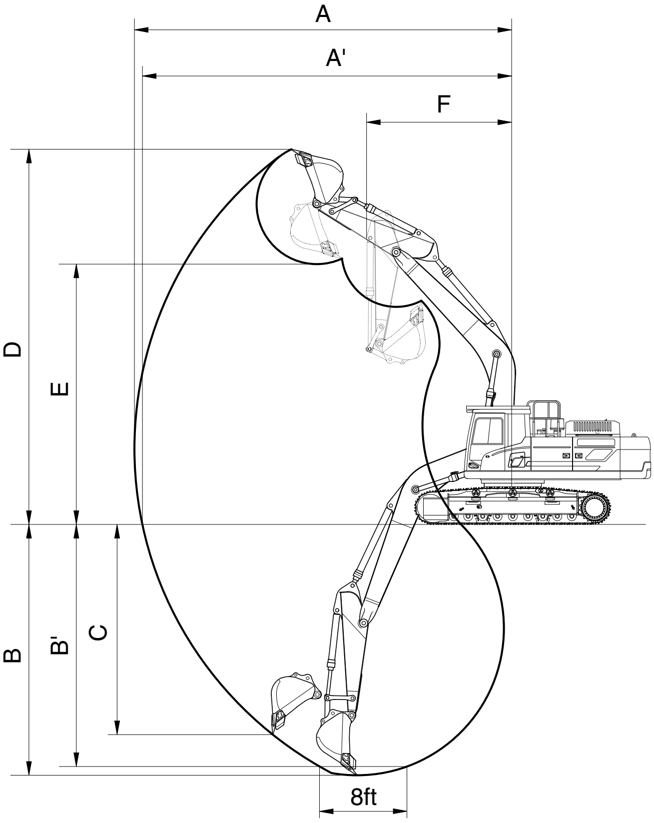
3) HX520LT3 (1/2)



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

4) HX520LT3 (2/2)



520SA2SP06

Description	m (ft-in)	Boom	6.55 (21' 6")			9.00 (29' 6")
		Arm	2.55 (8' 4")	2.90 (9' 6")	3.38 (11' 1")	6.00 (19' 8")
Max digging reach	mm (ft-in)	A	10870 (35' 8")	11130 (36' 6")	11520 (37' 10")	16110 (52' 10")
Max digging reach on ground		A'	10610 (34' 10")	10890 (35' 9")	11280 (37' 0")	15940 (52' 4")
Max digging depth		B	6380 (20' 11")	6730 (22' 1")	7210 (23' 8")	11550 (37' 11")
Max digging depth (8 ft level)		B'	6210 (20' 4")	6570 (21' 7")	7070 (23' 2")	11450 (37' 7")
Max vertical wall digging depth		C	4760 (15' 7")	4820 (15' 10")	4990 (16' 4")	8580 (28' 2")
Max digging height		D	10760 (35' 4")	10710 (35' 2")	10740 (35' 3")	13180 (43' 3")
Max dumping height		E	7290 (23' 11")	7320 (24' 0")	7400 (24' 3")	9880 (32' 5")
Min swing radius		F	4440 (14' 7")	4450 (14' 7")	4490 (14' 9")	5630 (18' 6")
Bucket digging force	kN	SAE	240.3 [260.9]	240.3 [260.9]	240.3 [260.9]	212.8 -
	kgf		24500 [26600]	24500 [26600]	24500 [26600]	21700 -
	lbf		54013 [58643]	54013 [58643]	54013 [58643]	47840 -
	kN	ISO	279.5 [303.4]	279.5 [303.4]	279.5 [303.4]	247.1 -
	kgf		28500 [30940]	28500 [30940]	28500 [30940]	25200 -
	lbf		62832 [68211]	62832 [68211]	62832 [68211]	55556 -
Arm digging force	kN	SAE	235.4 [255.6]	218.7 [237.4]	198.1 [215.1]	127.5 -
	kgf		24000 [26060]	22300 [24210]	20200 [21930]	13000 -
	lbf		52911 [57452]	49163 [53374]	44533 [48347]	28660 -
	kN	ISO	246.1 [267.2]	227.5 [247.0]	205.0 [222.5]	130.4 -
	kgf		25100 [27250]	23200 [25190]	20900 [22690]	13300 -
	lbf		55336 [60076]	51147 [55534]	46077 [50023]	29321 -

[ ] : Power boost

4. WEIGHT

Item	HX500LT3		HX520LT3	
	kg	lb	kg	lb
Upperstructure assembly				
· Main frame weld assembly	4313	9508	4313	9508
· Engine assembly	860	1896	860	1896
· Main pump assembly	194	428	194	428
· Main control valve assembly	421	928	421	928
· Swing motor assembly	667	1470	667	1470
· Hydraulic oil tank WA	418	922	418	922
· Fuel tank WA	376	829	376	829
· Counterweight	9700	21385	10700	23589
· Cab assembly	495	1092	495	1092
Lower chassis assembly				
· Track frame weld assembly	6600	14550	7888	17390
· Swing bearing	719	1585	719	1585
· Travel motor assembly (2EA)	1264	2787	1264	2787
· Turning joint	96	212	96	212
· Sprocket (2EA)	188	415	188	415
· Track recoil spring (2EA)	653	1440	653	1440
· Idler (2EA)	639	1408	639	1408
· Upper roller (HX500LT3 - 4EA / HX520LT3 - 6EA)	351	774	244	538
· Lower roller (18EA)	1579	3481	1531	3375
· Track-chain assembly (600 mm triple grouser shoe) (2EA)	5534	12200	5534	12200
· Track-chain assembly (700 mm triple grouser shoe) (2EA)	6054	13347	6054	13347
· Track-chain assembly (800 mm triple grouser shoe) (2EA)	6584	14515	6584	14515
· Track-chain assembly (900 mm triple grouser shoe) (2EA)	7092	15635	7092	15635
· Track-chain assembly (600 mm double grouser shoe) (2EA)	5566	12271	5566	12271
· Track-chain assembly (600 mm HD triple grouser shoe) (2EA)	5714	12597	5714	12597
Front attachment assembly				
· 7.06 m boom assembly	3640	8025	3640	8025
· 3.38 m arm assembly	1845	4067	1845	4067
· 2.20 m^3 SAE heaped bucket	2020	4453	2020	4453
· Boom cylinder assembly (2EA)	1142	2518	1142	2518
· Arm cylinder assembly	591	1303	591	1303
· Bucket cylinder assembly	366	807	366	807
· Bucket control linkage total	519	1144	519	1144

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

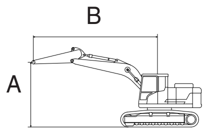
※ Refer to Transportation for actual weight information and Specifications for operating weight.

5. LIFTING CAPACITIES

1) HX500LT3

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX500LT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6550	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)		Capacity		Reach
												m (ft)
9.0 m	kg									*13880	*13880	5.79
(29.5 ft)	lb									*30600	*30600	(19.0)
7.5 m	kg					*13190	*13190			*12600	10960	7.22
(24.6 ft)	lb					*29080	*29080			*27780	24160	(23.7)
6.0 m	kg					*13980	*13980	*12410	10200	*12070	8900	8.12
(19.7 ft)	lb					*30820	*30820	*27360	22490	*26610	19620	(26.6)
4.5 m	kg			*20370	*20370	*15430	13870	*12960	9900	*11830	7840	8.67
(14.8 ft)	lb			*44910	*44910	*34020	30580	*28570	21830	*26080	17280	(28.4)
3.0 m	kg					*16960	13100	*13650	9520	*11730	7320	8.94
(9.8 ft)	lb					*37390	28880	*30090	20990	*25860	16140	(29.3)
1.5 m	kg					*17890	12510	*14120	9190	*11690	7170	8.94
(4.9 ft)	lb					*39440	27580	*31130	20260	*25770	15810	(29.3)
0.0 m	kg			*21030	18620	*17850	12210	*14030	8990	*11620	7390	8.69
(0.0 ft)	lb			*46360	41050	*39350	26920	*30930	19820	*25620	16290	(28.5)
-1.5 m	kg	*15060	*15060	*21280	18720	*16720	12170	*13030	8970	*11390	8070	8.15
(-4.9 ft)	lb	*33200	*33200	*46910	41270	*36860	26830	*28730	19780	*25110	17790	(26.7)
-3.0 m	kg	*20530	*20530	*17830	*17830	*14160	12360			*10720	9590	7.26
(-9.8 ft)	lb	*45260	*45260	*39310	*39310	*31220	27250			*23630	21140	(23.8)

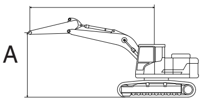
Note 1. Lifting capacity are based on ISO 10567.
2. Lifting capacity of the HX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates load limited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

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

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

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX500LT3	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	kg											*11820	*11820	6.19
(29.5 ft)	lb											*26060	*26060	(20.3)
7.5 m	kg							*11250	10350			*10890	10250	7.54
(24.6 ft)	lb							*24800	22820			*24010	22600	(24.7)
6.0 m	kg					*13340	*13340	*11880	10240			*10600	8420	8.41
(19.7 ft)	lb					*29410	*29410	*26190	22580			*23370	18560	(27.6)
4.5 m	kg			*19300	*19300	*14830	13940	*12520	9900			*10710	7450	8.94
(14.8 ft)	lb			*42550	*42550	*32690	30730	*27600	21830			*23610	16420	(29.3)
3.0 m	kg			*22770	19820	*16450	13110	*13290	9480	*11400	7190	*11180	6950	9.20
(9.8 ft)	lb			*50200	43700	*36270	28900	*29300	20900	*25130	15850	*24650	15320	(30.2)
1.5 m	kg			*19910	18720	*17560	12450	*13870	9110	*11500	7020	*11210	6800	9.20
(4.9 ft)	lb			*43890	41270	*38710	27450	*30580	20080	*25350	15480	*24710	14990	(30.2)
0.0 m	kg			*23720	18390	*17760	12080	*13950	8870			*11220	6970	8.96
(0.0 ft)	lb			*52290	40540	*39150	26630	*30750	19550			*24740	15370	(29.4)
-1.5 m	kg	*16270	*16270	*21890	18420	*16900	11980	*13220	8800			*11120	7550	8.44
(-4.9 ft)	lb	*35870	*35870	*48260	40610	*37260	26410	*29150	19400			*24520	16640	(27.7)
-3.0 m	kg	*22850	*22850	*18760	18700	*14740	12120	*10960	8970			*10700	8850	7.58
(-9.8 ft)	lb	*50380	*50380	*41360	41230	*32500	26720	*24160	19780			*23590	19510	(24.9)
-4.5 m	kg			*13560	*13560	*10150	*10150					*9330	*9330	6.27
(-14.8 ft)	lb			*29890	*29890	*22380	*22380					*20570	*20570	(20.6)

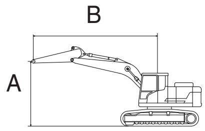
Note 1. Lifting capacity are based on ISO 10567.
2. Lifting capacity of the HX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates load limited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

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

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

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX500LT3	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) 3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		At max. reach Capacity		Reach m (ft)
9.0 m	kg											*12380	*12380	6.60
(29.5 ft)	lb											*27290	*27290	(21.6)
7.5 m	kg							*11560	10350			*11490	9480	7.87
(24.6 ft)	lb							*25490	22820			*25330	20900	(25.8)
6.0 m	kg					*13640	*13640	*11840	10150			*11100	7900	8.71
(19.7 ft)	lb					*30070	*30070	*26100	22380			*24470	17420	(28.6)
4.5 m	kg					*15260	13570	*12560	9760	*11060	7350	*10910	7050	9.22
(14.8 ft)	lb					*33640	29920	*27690	21520	*24380	16200	*24050	15540	(30.3)
3.0 m	kg					*16820	12750	*13340	9340	*11320	7160	*10840	6610	9.47
(9.8 ft)	lb					*37080	28110	*29410	20590	*24960	15790	*23900	14570	(31.1)
1.5 m	kg					*17670	12180	*13860	8990	*11470	6980	*10810	6490	9.48
(4.9 ft)	lb					*38960	26850	*30560	19820	*25290	15390	*23830	14310	(31.1)
0.0 m	kg					*17570	11930	*13880	8790	*11210	6880	*10770	6650	9.24
(0.0 ft)	lb					*38740	26300	*30600	19380	*24710	15170	*23740	14660	(30.3)
-1.5 m	kg			*20510	18440	*16560	11900	*13170	8750			*10610	7190	8.74
(-4.9 ft)	lb			*45220	40650	*36510	26230	*29030	19290			*23390	15850	(28.7)
-3.0 m	kg	*19190	*19190	*17720	*17720	*14510	12070	*11260	8900			*10150	8340	7.92
(-9.8 ft)	lb	*42310	*42310	*39070	*39070	*31990	26610	*24820	19620			*22380	18390	(26.0)
-4.5 m	kg			*13240	*13240	*10610	*10610					*8830	*8830	6.66
(-14.8 ft)	lb			*29190	*29190	*23390	*23390					*19470	*19470	(21.9)

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

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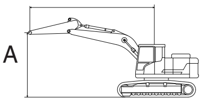
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX500LT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		7060	2900	9200	600	-	-	-	-	-



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

Lift-point height (A)		Lift-point radius (B) 3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		At max. reach Capacity		Reach
		over-front	over-side	over-front	over-side	over-front	over-side	over-front	over-side	over-front	over-side	over-front	over-side	m (ft)
9.0 m	kg											*11510	*11510	6.97
(29.5 ft)	lb											*25380	*25380	(22.9)
7.5 m	kg							*10980	10420			*10810	8910	8.19
(24.6 ft)	lb							*24210	22970			*23830	19640	(26.9)
6.0 m	kg					*13030	*13030	*11370	10180			*10500	7480	8.99
(19.7 ft)	lb					*28730	*28730	*25070	22440			*23150	16490	(29.5)
4.5 m	kg			*19780	*19780	*14660	13630	*12140	9760	*10690	7330	*10370	6690	9.49
(14.8 ft)	lb			*43610	*43610	*32320	30050	*26760	21520	*23570	16160	*22860	14750	(31.1)
3.0 m	kg					*16310	12750	*12980	9300	*11040	7100	*10340	6280	9.74
(9.8 ft)	lb					*35960	28110	*28620	20500	*24340	15650	*22800	13850	(31.9)
1.5 m	kg					*17350	12110	*13600	8910	*11280	6890	*10360	6140	9.74
(4.9 ft)	lb					*38250	26700	*29980	19640	*24870	15190	*22840	13540	(32.0)
0.0 m	kg			*14480	*14480	*17470	11780	*13750	8670	*11190	6760	*10380	6270	9.51
(0.0 ft)	lb			*31920	*31920	*38510	25970	*30310	19110	*24670	14900	*22880	13820	(31.2)
-1.5 m	kg			*21210	18090	*16700	11700	*13230	8580	*10370	6760	*10320	6740	9.02
(-4.9 ft)	lb			*46760	39880	*36820	25790	*29170	18920	*22860	14900	*22750	14860	(29.6)
-3.0 m	kg	*21630	*21630	*18580	18360	*14930	11830	*11720	8690			*10040	7730	8.23
(-9.8 ft)	lb	*47690	*47690	*40960	40480	*32910	26080	*25840	19160			*22130	17040	(27.0)
-4.5 m	kg			*14450	*14450	*11610	*11610					*9130	*9130	7.04
(-14.8 ft)	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).
4. *Indicates load limited by hydraulic capacity.

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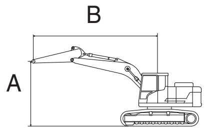
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX500LT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		7060	3380	9200	600	-	-	-	-	-



· : 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
		Over-front	Over-side or 360 degree	Over-front	Over-side or 360 degree	Over-front	Over-side or 360 degree	Over-front	Over-side or 360 degree	Over-front	Over-side or 360 degree	Over-front	Over-side or 360 degree	m (ft)
9.0 m	kg							*9510	*9510			*9450	*9450	7.51
(29.5 ft)	lb							*20970	*20970			*20830	*20830	(24.6)
7.5 m	kg							*10350	*10350			*8950	8240	8.65
(24.6 ft)	lb							*22820	*22820			*19730	18170	(28.4)
6.0 m	kg							*10850	10330	*9990	7610	*8830	7020	9.41
(19.7 ft)	lb							*23920	22770	*22020	16780	*19470	15480	(30.9)
4.5 m	kg			*18480	*18480	*14010	13910	*11700	9900	*10330	7420	*8960	6310	9.89
(14.8 ft)	lb			*40740	*40740	*30890	30670	*25790	21830	*22770	16360	*19750	13910	(32.5)
3.0 m	kg					*15810	13010	*12650	9420	*10790	7160	*9350	5930	10.12
(9.8 ft)	lb					*34860	28680	*27890	20770	*23790	15790	*20610	13070	(33.2)
1.5 m	kg					*17100	12290	*13410	9000	*11150	6930	9870	5800	10.13
(4.9 ft)	lb					*37700	27090	*29560	19840	*24580	15280	21760	12790	(33.2)
0.0 m	kg			*17130	*17130	*17540	11870	*13740	8710	*11240	6750	*9970	5900	9.91
(0.0 ft)	lb			*37770	*37770	*38670	26170	*30290	19200	*24780	14880	*21980	13010	(32.5)
-1.5 m	kg	*12220	*12220	*22260	18060	*17080	11720	*13470	8580	*10790	6690	*10000	6290	9.44
(-4.9 ft)	lb	*26940	*26940	*49070	39820	*37650	25840	*29700	18920	*23790	14750	*22050	13870	(31.0)
-3.0 m	kg	*20690	*20690	*19920	18260	*15660	11780	*12340	8610			*9900	7100	8.69
(-9.8 ft)	lb	*45610	*45610	*43920	40260	*34520	25970	*27210	18980			*21830	15650	(28.5)
-4.5 m	kg	*19790	*19790	*16250	*16250	*12920	12050	*9580	8890			*9390	8790	7.57
(-14.8 ft)	lb	*43630	*43630	*35830	*35830	*28480	26570	*21120	19600			*20700	19380	(24.8)

Note 1. Lifting capacity are based on ISO 10567.
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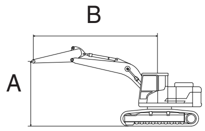
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX500LT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		7060	4000	9200	600	-	-	-	-	-

· : 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	7900			*7010	*7010	9.29
24.6ft	lb											*18540	17420			*15450	*15450	(30.5)
6.0m	kg									*10200	*10200	*9450	7800			*6930	6450	10.01
19.7ft	lb									*22490	*22490	*20830	17200			*15280	14220	(32.8)
4.5m	kg							*13140	*13140	*11140	10130	*9910	7580			*7030	5860	10.46
14.8ft	lb							*28970	*28970	*24560	22330	*21850	16710			*15500	12920	(34.3)
3.0m	kg					*20800	20410	*15100	13370	*12210	9630	*10480	7300	*8720	5690	*7320	5530	10.68
9.8ft	lb					*45860	45000	*33290	29480	*26920	21230	*23100	16090	*19220	12540	*16140	12190	(35.0)
1.5m	kg					*20070	18940	*16700	12570	*13140	9170	*10990	7030	9410	5560	*7820	5410	10.68
4.9ft	lb					*44250	41760	*36820	27710	*28970	20220	*24230	15500	20750	12260	*17240	11930	(35.0)
0.0m	kg					*19100	18270	*17520	12050	*13700	8820	*11260	6820			*8600	5480	10.47
0.0ft	lb					*42110	40280	*38620	26570	*30200	19440	*24820	15040			*18960	12080	(34.4)
-1.5m	kg			*12230	*12230	*23290	18100	*17450	11800	*13710	8630	*11110	6710			*9540	5790	10.03
-4.9ft	lb			*26960	*26960	*51350	39900	*38470	26010	*30230	19030	*24490	14790			*21030	12760	(32.9)
-3.0m	kg	*14130	*14130	*18540	*18540	*21430	18190	*16470	11770	*12980	8600	*10210	6720			*9570	6420	9.33
-9.8ft	lb	*31150	*31150	*40870	*40870	*47250	40100	*36310	25950	*28620	18960	*22510	14820			*21100	14150	(30.6)
-4.5m	kg			*23840	*23840	*18340	*18340	*14340	11950	*11120	8740					*9360	7670	8.30
-14.8ft	lb			*52560	*52560	*40430	*40430	*31610	26350	*24520	19270					*20640	16910	(27.2)
-6.0m	kg					*13350	*13350	*10290	*10290							*8450	*8450	6.78
-19.7ft	lb					*29430	*29430	*22690	*22690							*18630	*18630	(22.3)

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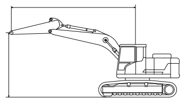
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX500LT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		9000	6000	10700	600	-	-	-	-	-

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

B

A



Lift-point height (A)		Lift-point radius (B) 1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		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)		At max. reach Capacity		Reach
		Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	m (ft)
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	5150			*3940	*3940	13.17
24.6ft	lb													*13070	*13070	*12390	11350			*8690	*8690	(43.2)
6.0m	kg													*6270	*6270	*5810	5000	*4500	3900	*3990	3770	13.69
19.7ft	lb													*13820	*13820	*12810	11020	*9920	8600	*8800	8310	(44.9)
4.5m	kg									*8790	*8790	*7540	*7540	*6680	6130	*6060	4800	*5520	3790	*4110	3480	14.02
14.8ft	lb									*19380	*19380	*16620	*16620	*14730	13510	*13360	10580	*12170	8360	*9060	7670	(46.0)
3.0m	kg					*17920	*17920	*12630	*12630	*9890	9810	*8240	7430	*7130	5780	*6350	4580	*5750	3650	*4300	3290	14.18
9.8ft	lb					*39510	*39510	*27840	*27840	*21800	21630	*18170	16380	*15720	12740	*14000	10100	*12680	8050	*9480	7250	(46.5)
1.5m	kg					*9790	*9790	*14170	12320	*10870	9040	*8880	6930	*7550	5450	*6610	4360	*5890	3510	*4580	3190	14.19
4.9ft	lb					*21580	*21580	*31240	27160	*23960	19930	*19580	15280	*16640	12020	*14570	9610	*12990	7740	*10100	7030	(46.5)
0.0m	kg					*9020	*9020	*15100	11450	*11570	8440	*9370	6520	*7880	5170	*6810	4170	*5960	3400	*4970	3170	14.03
0.0ft	lb					*19890	*19890	*33290	25240	*25510	18610	*20660	14370	*17370	11400	*15010	9190	*13140	7500	*10960	6990	(46.0)
-1.5m	kg	*4710	*4710	*6130	*6130	*10400	*10400	*15390	10970	*11920	8030	*9650	6210	*8060	4950	*6890	4020	*5910	3310	*5510	3230	13.70
-4.9ft	lb	*10380	*10380	*13510	*13510	*22930	*22930	*33930	24180	*26280	17700	*21270	13690	*17770	10910	*15190	8860	*13030	7300	*12150	7120	(45.0)
-3.0m	kg	*7100	*7100	*8690	*8690	*12720	*12720	*15140	10770	*11890	7820	*9660	6030	*8040	4810	*6790	3930			*5880	3400	13.20
-9.8ft	lb	*15650	*15650	*19160	*19160	*28040	*28040	*33380	23740	*26210	17240	*21300	13290	*17730	10600	*14970	8660			*12960	7500	(43.3)
-4.5m	kg	*9580	*9580	*11500	*11500	*15760	*15760	*14400	10760	*11470	7750	*9360	5960	*7750	4770	*6400	3930			*5950	3710	12.50
-14.8ft	lb	*21120	*21120	*25350	*25350	*34740	*34740	*31750	23720	*25290	17090	*20640	13140	*17090	10520	*14110	8660			*13120	8180	(41.0)
-6.0m	kg	*12310	*12310	*14730	*14730	*16720	*16720	*13140	10920	*10590	7830	*8650	6010	*7060	4830					*5980	4240	11.55
-19.7ft	lb	*27140	*27140	*32470	*32470	*36860	*36860	*28970	24070	*23350	17260	*19070	13250	*15560	10650					*13180	9350	(37.9)
-7.5m	kg			*18050	*18050	*13990	*13990	*11240	11230	*9120	8040	*7360	6190							*5870	5160	10.31
-24.6ft	lb			*39790	*39790	*30840	*30840	*24780	24760	*20110	17730	*16230	13650							*12940	11380	(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)

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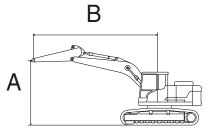
2) HX520LT3

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX520LT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6550	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)		Capacity		Reach
												m (ft)
9.0 m	kg									*13740	*13740	5.92
(29.5 ft)	lb									*30290	*30290	(19.4)
7.5 m	kg					*13220	*13220			*12550	12490	7.29
(24.6 ft)	lb					*29150	*29150			*27670	27540	(23.9)
6.0 m	kg					*14060	*14060	*12430	11850	*12050	10280	8.17
(19.7 ft)	lb					*31000	*31000	*27400	26120	*26570	22660	(26.8)
4.5 m	kg			*20650	*20650	*15550	*15550	*13010	11530	*11820	9140	8.70
(14.8 ft)	lb			*45530	*45530	*34280	*34280	*28680	25420	*26060	20150	(28.5)
3.0 m	kg					*17050	15340	*13700	11140	*11730	8600	8.94
(9.8 ft)	lb					*37590	33820	*30200	24560	*25860	18960	(29.3)
1.5 m	kg					*17930	14760	*14130	10820	*11690	8480	8.93
(4.9 ft)	lb					*39530	32540	*31150	23850	*25770	18700	(29.3)
0.0 m	kg			*21780	*21780	*17810	14470	*14000	10630	*11610	8770	8.66
(0.0 ft)	lb			*48020	*48020	*39260	31900	*30860	23440	*25600	19330	(28.4)
-1.5 m	kg	*16090	*16090	*21090	*21090	*16590	14440	*12900	10620	*11370	9630	8.10
(-4.9 ft)	lb	*35470	*35470	*46500	*46500	*36570	31830	*28440	23410	*25070	21230	(26.6)
-3.0 m	kg	*20140	*20140	*17510	*17510	*13900	*13900			*10640	*10640	7.18
(-9.8 ft)	lb	*44400	*44400	*38600	*38600	*30640	*30640			*23460	*23460	(23.6)

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

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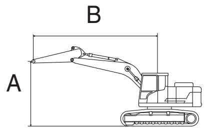
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX520LT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		6550	2900	10200	600	-	-	-	-	-

· : 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	kg											*11720	*11720	6.31
(29.5 ft)	lb											*25840	*25840	(20.7)
7.5 m	kg							*11790	*11790			*10850	*10850	7.61
(24.6 ft)	lb							*25990	*25990			*23920	*23920	(25.0)
6.0 m	kg					*13430	*13430	*11920	11890			*10600	9740	8.45
(19.7 ft)	lb					*29610	*29610	*26280	26210			*23370	21470	(27.7)
4.5 m	kg			*19570	*19570	*14950	*14950	*12570	11530			*10730	8700	8.97
(14.8 ft)	lb			*43140	*43140	*32960	*32960	*27710	25420			*23660	19180	(29.4)
3.0 m	kg			*22960	*22960	*16550	15350	*13340	11110	*11410	8470	*11190	8180	9.21
(9.8 ft)	lb			*50620	*50620	*36490	33840	*29410	24490	*25150	18670	*24670	18030	(30.2)
1.5 m	kg			*19880	*19880	*17610	14700	*13890	10740	*11490	8300	*11210	8050	9.19
(4.9 ft)	lb			*43830	*43830	*38820	32410	*30620	23680	*25330	18300	*24710	17750	(30.2)
0.0 m	kg			*23620	22030	*17730	14340	*13920	10510			*11210	8300	8.93
(0.0 ft)	lb			*52070	48570	*39090	31610	*30690	23170			*24710	18300	(29.3)
-1.5 m	kg	*17060	*17060	*21710	*21710	*16790	14250	*13120	10450			*11100	9030	8.39
(-4.9 ft)	lb	*37610	*37610	*47860	*47860	*37020	31420	*28920	23040			*24470	19910	(27.5)
-3.0 m	kg	*22460	*22460	*18470	*18470	*14520	14410	*10680	10650			*10650	10630	7.51
(-9.8 ft)	lb	*49520	*49520	*40720	*40720	*32010	31770	*23550	23480			*23480	23440	(24.6)
-4.5 m	kg			*13060	*13060	*9620	*9620					*9150	*9150	6.15
(-14.8 ft)	lb			*28790	*28790	*21210	*21210					*20170	*20170	(20.2)

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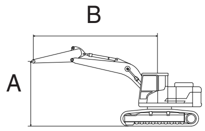
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX520LT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		7060	2550	10200	600	-	-	-	-	-



· : 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	kg											*12280	*12280	6.71
(29.5 ft)	lb											*27070	*27070	(22.0)
7.5 m	kg							*11560	*11560			*11450	10870	7.94
(24.6 ft)	lb							*25490	*25490			*25240	23960	(26.1)
6.0 m	kg					*13750	*13750	*11890	11790			*11080	9170	8.75
(19.7 ft)	lb					*30310	*30310	*26210	25990			*24430	20220	(28.7)
4.5 m	kg					*15380	*15380	*12620	11390	*11070	8630	*10910	8250	9.25
(14.8 ft)	lb					*33910	*33910	*27820	25110	*24410	19030	*24050	18190	(30.3)
3.0 m	kg					*16910	14980	*13390	10960	*11340	8430	*10840	7800	9.48
(9.8 ft)	lb					*37280	33030	*29520	24160	*25000	18580	*23900	17200	(31.1)
1.5 m	kg					*17700	14430	*13880	10620	*11470	8260	*10810	7690	9.47
(4.9 ft)	lb					*39020	31810	*30600	23410	*25290	18210	*23830	16950	(31.1)
0.0 m	kg					*17530	14190	*13850	10420	*11160	8170	*10760	7930	9.21
(0.0 ft)	lb					*38650	31280	*30530	22970	*24600	18010	*23720	17480	(30.2)
-1.5 m	kg			*20350	*20350	*16450	14180	*13080	10390			*10600	8600	8.69
(-4.9 ft)	lb			*44860	*44860	*36270	31260	*28840	22910			*23370	18960	(28.5)
-3.0 m	kg	*18970	*18970	*17470	*17470	*14320	*14320	*11040	10570			*10090	10010	7.84
(-9.8 ft)	lb	*41820	*41820	*38510	*38510	*31570	*31570	*24340	23300			*22240	22070	(25.7)
-4.5 m	kg			*12820	*12820	*10190	*10190					*8660	*8660	6.55
(-14.8 ft)	lb			*28260	*28260	*22470	*22470					*19090	*19090	(21.5)

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX520LT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		7060	2900	10200	600	-	-	-	-	-

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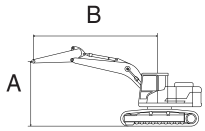

Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0 m	kg											*11430	*11430	7.08
(29.5 ft)	lb											*25200	*25200	(23.2)
7.5 m	kg							*10990	*10990			*10780	10230	8.26
(24.6 ft)	lb							*24230	*24230			*23770	22550	(27.1)
6.0 m	kg					*13130	*13130	*11410	*11410	*10500	8770	*10480	8700	9.04
(19.7 ft)	lb					*28950	*28950	*25150	*25150	*23150	19330	*23100	19180	(29.7)
4.5 m	kg			*20070	*20070	*14790	*14790	*12200	11390	*10710	8610	*10370	7850	9.52
(14.8 ft)	lb			*44250	*44250	*32610	*32610	*26900	25110	*23610	18980	*22860	17310	(31.2)
3.0 m	kg					*16410	14990	*13040	10920	*11060	8370	*10340	7420	9.74
(9.8 ft)	lb					*36180	33050	*28750	24070	*24380	18450	*22800	16360	(32.0)
1.5 m	kg					*17390	14350	*13630	10540	*11290	8160	*10370	7300	9.73
(4.9 ft)	lb					*38340	31640	*30050	23240	*24890	17990	*22860	16090	(31.9)
0.0 m	kg			*15060	*15060	*17450	14030	*13740	10300	*11160	8040	*10380	7500	9.48
(0.0 ft)	lb			*33200	*33200	*38470	30930	*30290	22710	*24600	17730	*22880	16530	(31.1)
-1.5 m	kg			*21050	*21050	*16610	13970	*13170	10230			*10310	8080	8.98
(-4.9 ft)	lb			*46410	*46410	*36620	30800	*29030	22550			*22730	17810	(29.5)
-3.0 m	kg	*21360	*21360	*18340	*18340	*14760	14120	*11550	10350			*10000	9300	8.16
(-9.8 ft)	lb	*47090	*47090	*40430	*40430	*32540	31130	*25460	22820			*22050	20500	(26.8)
-4.5 m	kg			*14070	*14070	*11280	*11280					*9020	*9020	6.93
(-14.8 ft)	lb			*31020	*31020	*24870	*24870					*19890	*19890	(22.7)

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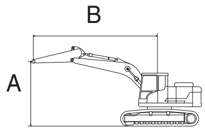
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX520LT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		7060	3380	10200	600	-	-	-	-	-

· : 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	kg							*10020	*10020			*9400	*9400	7.61
(29.5 ft)	lb							*22090	*22090			*20720	*20720	(25.0)
7.5 m	kg							*10370	*10370			*8930	*8930	8.71
(24.6 ft)	lb							*22860	*22860			*19690	*19690	(28.6)
6.0 m	kg							*10900	*10900	*10010	8900	*8830	8170	9.46
(19.7 ft)	lb							*24030	*24030	*22070	19620	*19470	18010	(31.0)
4.5 m	kg			*18770	*18770	*14140	*14140	*11770	11530	*10360	8690	*8980	7420	9.92
(14.8 ft)	lb			*41380	*41380	*31170	*31170	*25950	25420	*22840	19160	*19800	16360	(32.5)
3.0 m	kg					*15920	15240	*12710	11050	*10820	8440	*9390	7020	10.13
(9.8 ft)	lb					*35100	33600	*28020	24360	*23850	18610	*20700	15480	(33.2)
1.5 m	kg					*17160	14530	*13450	10620	*11170	8200	*9890	6910	10.12
(4.9 ft)	lb					*37830	32030	*29650	23410	*24630	18080	*21800	15230	(33.2)
0.0 m	kg			*17510	*17510	*17540	14120	*13750	10340	*11230	8030	*9970	7060	9.88
(0.0 ft)	lb			*38600	*38600	*38670	31130	*30310	22800	*24760	17700	*21980	15560	(32.4)
-1.5 m	kg	*12800	*12800	*22130	21700	*17010	13980	*13420	10210	*10720	7980	*10000	7550	9.40
(-4.9 ft)	lb	*28220	*28220	*48790	47840	*37500	30820	*29590	22510	*23630	17590	*22050	16640	(30.8)
-3.0 m	kg	*21350	*21350	*19710	*19710	*15510	14060	*12210	10260			*9880	8550	8.62
(-9.8 ft)	lb	*47070	*47070	*43450	*43450	*34190	31000	*26920	22620			*21780	18850	(28.3)
-4.5 m	kg	*19320	*19320	*15920	*15920	*12650	*12650					*9320	*9320	7.47
(-14.8 ft)	lb	*42590	*42590	*35100	*35100	*27890	*27890					*20550	*20550	(24.5)

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX520LT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		7060	4000	10200	600	-	-	-	-	-

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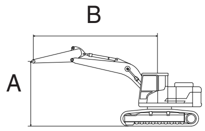

Lift-point height (A)		Lift-point radius (B)												At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		10.5 m (34.4 ft)		Capacity		Reach
																m (ft)
9.0 m	kg													*7310	*7310	8.33
(29.5 ft)	lb													*16120	*16120	(27.3)
7.5 m	kg									*8630	*8630			*6990	*6990	9.35
(24.6 ft)	lb									*19030	*19030			*15410	*15410	(30.7)
6.0 m	kg							*10230	*10230	*9440	9080			*6930	*6930	10.05
(19.7 ft)	lb							*22550	*22550	*20810	20020			*15280	*15280	(33.0)
4.5 m	kg					*13240	*13240	*11180	*11180	*9910	8840			*7050	6870	10.48
(14.8 ft)	lb					*29190	*29190	*24650	*24650	*21850	19490			*15540	15150	(34.4)
3.0 m	kg			*20970	*20970	*15180	*15180	*12230	11230	*10470	8550	*8810	6710	*7350	6520	10.69
(9.8 ft)	lb			*46230	*46230	*33470	*33470	*26960	24760	*23080	18850	*19420	14790	*16200	14370	(35.1)
1.5 m	kg			*19680	*19680	*16710	14760	*13130	10760	*10960	8270	*9440	6570	*7860	6410	10.67
(4.9 ft)	lb			*43390	*43390	*36840	32540	*28950	23720	*24160	18230	*20810	14480	*17330	14130	(35.0)
0.0 m	kg			*19280	*19280	*17450	14230	*13650	10410	*11200	8060			*8670	6520	10.45
(0.0 ft)	lb			*42510	*42510	*38470	31370	*30090	22950	*24690	17770			*19110	14370	(34.3)
-1.5 m	kg	*12650	*12650	*23060	21630	*17320	13990	*13600	10210	*11010	7950			*9490	6900	9.99
(-4.9 ft)	lb	*27890	*27890	*50840	47690	*38180	30840	*29980	22510	*24270	17530			*20920	15210	(32.8)
-3.0 m	kg	*19040	*19040	*21120	*21120	*16250	13970	*12810	10190	*10030	7970			*9500	7680	9.27
(-9.8 ft)	lb	*41980	*41980	*46560	*46560	*35830	30800	*28240	22470	*22110	17570			*20940	16930	(30.4)
-4.5 m	kg	*23210	*23210	*17930	*17930	*14030	*14030	*10830	10360					*9250	9210	8.21
(-14.8 ft)	lb	*51170	*51170	*39530	*39530	*30930	*30930	*23880	22840					*20390	20300	(26.9)
-6.0 m	kg			*12760	*12760	*9770	*9770							*8240	*8240	6.65
(-19.7 ft)	lb			*28130	*28130	*21540	*21540							*18170	*18170	(21.8)

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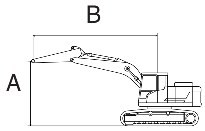
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HX520LT3	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		9000	6000	11700	600	-	-	-	-	-

· : 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)		12.0 m (39.4 ft)		13.5 m (44.3 ft)		Capacity		Reach
		Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	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	5700	*5580	4570	*4120	*4120	14.03
14.8ft	lb									*19550	*19550	*16730	*16730	*14820	*14820	*13400	12570	*12300	10080	*9080	*9080	(46.0)
3.0m	kg					*18150	*18150	*12750	*12750	*9970	*9970	*8290	*8290	*7160	6840	*6370	5480	*5760	4430	*4320	4030	14.19
9.8ft	lb					*40010	*40010	*28110	*28110	*21980	*21980	*18280	*18280	*15790	15080	*14040	12080	*12700	9770	*9520	8880	(46.5)
1.5m	kg					*9590	*9590	*14260	*14260	*10930	10670	*8920	8210	*7580	6510	*6620	5260	*5900	4300	*4610	3930	14.18
4.9ft	lb					*21140	*21140	*31440	*31440	*24100	23520	*19670	18100	*16710	14350	*14590	11600	*13010	9480	*10160	8660	(46.5)
0.0m	kg					*9080	*9080	*15140	13710	*11610	10080	*9400	7800	*7900	6230	*6820	5070	*5960	4180	*5000	3920	14.01
0.0ft	lb					*20020	*20020	*33380	30230	*25600	22220	*20720	17200	*17420	13730	*15040	11180	*13140	9220	*11020	8640	(46.0)
-1.5m	kg	*4880	*4880	*6310	*6310	*10540	*10540	*15390	13250	*11930	9680	*9660	7500	*8070	6010	*6890	4920	*5900	4100	*5560	4020	13.67
-4.9ft	lb	*10760	*10760	*13910	*13910	*23240	*23240	*33930	29210	*26300	21340	*21300	16530	*17790	13250	*15190	10850	*13010	9040	*12260	8860	(44.9)
-3.0m	kg	*7270	*7270	*8890	*8890	*12910	*12910	*15110	13060	*11880	9470	*9650	7320	*8030	5880	*6770	4840			*5880	4230	13.16
-9.8ft	lb	*16030	*16030	*19600	*19600	*28460	*28460	*33310	28790	*26190	20880	*21270	16140	*17700	12960	*14930	10670			*12960	9330	(43.2)
-4.5m	kg	*9770	*9770	*11720	*11720	*16010	*16010	*14330	13060	*11420	9420	*9320	7260	*7710	5840	*6360	4840			*5960	4610	12.44
-14.8ft	lb	*21540	*21540	*25840	*25840	*35300	*35300	*31590	28790	*25180	20770	*20550	16010	*17000	12870	*14020	10670			*13140	10160	(40.8)
-6.0m	kg	*12520	*12520	*14980	*14980	*16550	*16550	*13030	*13030	*10510	9500	*8580	7320	*6980	5910					*5970	5250	11.48
-19.7ft	lb	*27600	*27600	*33030	*33030	*36490	*36490	*28730	*28730	*23170	20940	*18920	16140	*15390	13030					*13160	11570	(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 necessary for non-standard configurations.

6. BUCKET SELECTION GUIDE

1) HX500LT3

(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			
	m³ (yd³)	m³ (yd³)	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
General bucket	1.38 (1.80)	1.24 (1.62)	1130 (44.5)	1640 (3620)	4	●	●	●	●	●	●
	2.20 (2.88)	1.93 (2.52)	1600 (63.0)	2020 (4450)	5	●	●	●	◐	◐	■
	3.00 (3.92)	2.64 (3.45)	1905 (75.0)	2425 (5350)	6	■	■	▲	▲	▲	X
Heavy duty	2.20 (2.88)	1.93 (2.52)	1600 (63.0)	2325 (5130)	5	●	●	◐	◐	■	■
	2.79 (3.65)	2.46 (3.22)	1795 (70.7)	2615 (5770)	5	■	■	■	▲	▲	X
	3.20 (4.19)	2.82 (3.69)	2015 (79.3)	2860 (6310)	6	■	▲	▲	▲	X	X
Rock heavy duty	2.20 (2.88)	2.11 (2.76)	1600 (63.0)	2605 (5740)	5	●	●	◐	◐	■	-
	2.43 (3.18)	0.76 (0.99)	1745 (68.7)	2730 (6020)	5	◐	◐	■	■	▲	-
	2.79 (3.65)	2.46 (3.22)	1795 (70.7)	2970 (6550)	5	■	■	▲	▲	▲	-
	3.20 (4.19)	2.82 (3.69)	2015 (79.3)	3235 (7130)	6	▲	▲	▲	X	X	-

●	Applicable for materials with density of 2100 kg/m³ (3500 lb/yd³) or less
◐	Applicable for materials with density of 1800 kg/m³ (3000 lb/yd³) or less
■	Applicable for materials with density of 1500 kg/m³ (2500 lb/yd³) or less
▲	Applicable for materials with density of 1200 kg/m³ (2000 lb/yd³) or less
X	Not recommended
-	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			
	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
General bucket	1.38 (1.80)	1.24 (1.62)	1130 (44.5)	1640 (3620)	4	●	●	●	●	●	●
	2.20 (2.88)	1.93 (2.52)	1600 (63.0)	2020 (4450)	5	●	●	●	◐	◐	■
	3.00 (3.92)	2.64 (3.45)	1905 (75.0)	2425 (5350)	6	■	■	■	▲	▲	X
Heavy duty	2.20 (2.88)	1.93 (2.52)	1600 (63.0)	2325 (5130)	5	●	●	●	◐	◐	■
	2.79 (3.65)	2.46 (3.22)	1795 (70.7)	2615 (5770)	5	◐	■	■	■	▲	▲
	3.20 (4.19)	2.82 (3.69)	2015 (79.3)	2860 (6310)	6	■	▲	▲	▲	X	X
Rock heavy duty	2.20 (2.88)	2.11 (2.76)	1600 (63.0)	2605 (5740)	5	●	●	◐	◐	■	-
	2.43 (3.18)	0.76 (0.99)	1745 (68.7)	2730 (6020)	5	●	◐	◐	■	■	-
	2.79 (3.65)	2.46 (3.22)	1795 (70.7)	2970 (6550)	5	■	■	■	▲	▲	-
	3.20 (4.19)	2.82 (3.69)	2015 (79.3)	3235 (7130)	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					
						6.55 m (21' 6") Boom		7.06 m (23' 2") Boom			
	SAE Heaped	CECE heaped	Without side cutter								
	m³ (yd³)	m³ (yd³)	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
General bucket	1.38 (1.80)	1.24 (1.62)	1130 (44.5)	1640 (3620)	4	●	●	●	●	●	●
	2.20 (2.88)	1.93 (2.52)	1600 (63.0)	2020 (4450)	5	●	●	●	●	◐	◐
	3.00 (3.92)	2.64 (3.45)	1905 (75.0)	2425 (5350)	6	◐	■	■	■	▲	▲
Heavy duty	2.20 (2.88)	1.93 (2.52)	1600 (63.0)	2325 (5130)	5	●	●	●	◐	◐	■
	2.79 (3.65)	2.46 (3.22)	1795 (70.7)	2615 (5770)	5	◐	◐	■	■	▲	▲
	3.20 (4.19)	2.82 (3.69)	2015 (79.3)	2860 (6310)	6	■	■	▲	▲	▲	X
Rock heavy duty	2.20 (2.88)	2.11 (2.76)	1600 (63.0)	2605 (5740)	5	●	●	●	◐	◐	-
	2.43 (3.18)	0.76 (0.99)	1745 (68.7)	2730 (6020)	5	●	◐	◐	■	■	-
	2.79 (3.65)	2.46 (3.22)	1795 (70.7)	2970 (6550)	5	◐	■	■	▲	▲	-
	3.20 (4.19)	2.82 (3.69)	2015 (79.3)	3235 (7130)	6	■	▲	▲	▲	X	-

●	Applicable for materials with density of 2100 kg/m³ (3500 lb/yd³) or less
◐	Applicable for materials with density of 1800 kg/m³ (3000 lb/yd³) or less
■	Applicable for materials with density of 1500 kg/m³ (2500 lb/yd³) or less
▲	Applicable for materials with density of 1200 kg/m³ (2000 lb/yd³) or less
X	Not recommended
-	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)	1130 (44.5)	1640 (3620)	4	●	●	●	●	●	●	▲
	2.20 (2.88)	1.93 (2.52)	1600 (63.0)	2020 (4450)	5	●	●	●	●	◐	◐	-
	3.00 (3.92)	2.64 (3.45)	1905 (75.0)	2425 (5350)	6	◐	■	■	■	▲	▲	-
Heavy duty	2.20 (2.88)	1.93 (2.52)	1600 (63.0)	2325 (5130)	5	●	●	●	●	◐	■	-
	2.79 (3.65)	2.46 (3.22)	1795 (70.7)	2615 (5770)	5	◐	◐	■	■	■	▲	-
	3.20 (4.19)	2.82 (3.69)	2015 (79.3)	2860 (6310)	6	■	■	▲	▲	▲	X	-
Rock heavy duty	2.20 (2.88)	2.11 (2.76)	1600 (63.0)	2605 (5740)	5	●	●	●	◐	◐	-	-
	2.43 (3.18)	0.76 (0.99)	1745 (68.7)	2730 (6020)	5	●	●	◐	◐	■	-	-
	2.79 (3.65)	2.46 (3.22)	1795 (70.7)	2970 (6550)	5	◐	◐	■	■	▲	-	-
	3.20 (4.19)	2.82 (3.69)	2015 (79.3)	3235 (7130)	6	■	■	▲	▲	▲	-	-

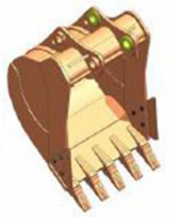
●	Applicable for materials with density of 2100 kg/m^3 (3500 lb/yd^3) or less
◐	Applicable for materials with density of 1800 kg/m^3 (3000 lb/yd^3) or less
■	Applicable for materials with density of 1500 kg/m^3 (2500 lb/yd^3) or less
▲	Applicable for materials with density of 1200 kg/m^3 (2000 lb/yd^3) 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) HX520LT3

(1) 10200 kg counterweight

General bucket



Heavy duty
(with side cutter)

Rock heavy duty

Type	Capacity SAE Heaped m³ (yd³)	Capacity CECE heaped m³ (yd³)	Width Without side cutter mm (in)	Weight kg (lb)	Tooth EA	MONO Recommendation 6.55 m (21' 6") Boom 2.55 m (8' 4') Arm	6.55 m (21' 6") Boom 2.90 m (9' 6') Arm	7.06 m (23' 2") Boom 2.55 m (8' 4') Arm	7.06 m (23' 2") Boom 2.90 m (9' 6') Arm	7.06 m (23' 2") Boom 3.38 m (11' 1') Arm	7.06 m (23' 2") Boom 4.00 m (13' 1') Arm
General bucket	1.00 (1.31)	0.90 (1.18)	910 (37.0)	1424 (3140)	3	●	●	●	●	●	●
	1.38 (1.18)	1.24 (1.62)	1130 (44.5)	1640 (3620)	4	●	●	●	●	●	●
	2.20 (2.88)	1.93 (2.52)	1600 (63.0)	2020 (4450)	5	●	●	●	●	●	◐
	2.79 (3.65)	2.46 (3.22)	1795 (70.7)	2295 (5060)	5	●	●	◐	◐	■	■
	3.00 (3.92)	2.64 (3.45)	1905 (75.0)	2425 (5350)	6	●	◐	◐	■	■	▲
Heavy duty	2.43 (3.18)	2.11 (2.76)	1745 (68.7)	2445 (5390)	5	●	●	●	●	◐	■
	3.20 (4.19)	2.82 (3.69)	2015 (79.3)	2860 (6310)	6	◐	■	■	■	▲	▲
Rock heavy duty	2.20 (2.88)	1.93 (2.52)	1600 (63.0)	2605 (5740)	5	●	●	●	●	●	-
	2.43 (3.18)	2.11 (2.76)	1745 (68.7)	2730 (6020)	5	●	●	●	◐	◐	-
	2.79 (3.65)	2.46 (3.22)	1795 (70.7)	2970 (6550)	5	●	◐	◐	■	■	-
	3.00 (3.92)	2.64 (3.45)	1905 (75.0)	3115 (6870)	6	◐	◐	■	■	▲	-
	3.20 (4.19)	2.82 (3.69)	2015 (79.3)	3235 (7130)	6	◐	■	■	▲	▲	-
Rock heavy duty (special)	1.81 (2.37)	1.50 (1.96)	1325 (52.2)	2685 (5920)	4	●	●	●	●	●	-
	2.70 (3.53)	2.39 (3.13)	1760 (69.3)	2755 (6070)	5	●	●	◐	◐	■	-
	3.00 (3.92)	2.76 (3.61)	1955 (77.0)	3040 (6700)	6	◐	◐	■	■	▲	-

●	Applicable for materials with density of 2100 kg/m³ (3500 lb/yd³) or less
◐	Applicable for materials with density of 1800 kg/m³ (3000 lb/yd³) or less
■	Applicable for materials with density of 1500 kg/m³ (2500 lb/yd³) or less
▲	Applicable for materials with density of 1200 kg/m³ (2000 lb/yd³) or less
X	Not recommended
-	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			
	m³ (yd³)	m³ (yd³)	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
General bucket	1.00 (1.31)	0.90 (1.18)	910 (37.0)	1424 (3140)	3	●	●	●	●	●	●
	1.38 (1.18)	1.24 (1.62)	1130 (44.5)	1640 (3620)	4	●	●	●	●	●	●
	2.20 (2.88)	1.93 (2.52)	1600 (63.0)	2020 (4450)	5	●	●	●	●	●	●
	2.79 (3.65)	2.46 (3.22)	1795 (70.7)	2295 (5060)	5	●	●	◐	◐	◐	■
	3.00 (3.92)	2.64 (3.45)	1905 (75.0)	2425 (5350)	6	●	◐	◐	■	■	▲
Heavy duty	2.43 (3.18)	2.11 (2.76)	1745 (68.7)	2445 (5390)	5	●	●	●	●	◐	◐
	3.20 (4.19)	2.82 (3.69)	2015 (79.3)	2860 (6310)	6	◐	◐	■	■	▲	▲
Rock heavy duty	2.20 (2.88)	1.93 (2.52)	1600 (63.0)	2605 (5740)	5	●	●	●	●	●	-
	2.43 (3.18)	2.11 (2.76)	1745 (68.7)	2730 (6020)	5	●	●	●	●	◐	-
	2.79 (3.65)	2.46 (3.22)	1795 (70.7)	2970 (6550)	5	●	◐	◐	◐	■	-
	3.00 (3.92)	2.64 (3.45)	1905 (75.0)	3115 (6870)	6	◐	◐	■	■	■	-
	3.20 (4.19)	2.82 (3.69)	2015 (79.3)	3235 (7130)	6	◐	■	■	■	▲	-
Rock heavy duty (special)	1.81 (2.37)	1.50 (1.96)	1325 (52.2)	2685 (5920)	4	●	●	●	●	●	-
	2.70 (3.53)	2.39 (3.13)	1760 (69.3)	2755 (6070)	5	●	●	◐	◐	■	-
	3.00 (3.92)	2.76 (3.61)	1955 (77.0)	3040 (6700)	6	◐	◐	■	■	■	-

●	Applicable for materials with density of 2100 kg/m³ (3500 lb/yd³) or less
◐	Applicable for materials with density of 1800 kg/m³ (3000 lb/yd³) or less
■	Applicable for materials with density of 1500 kg/m³ (2500 lb/yd³) or less
▲	Applicable for materials with density of 1200 kg/m³ (2000 lb/yd³) or less
X	Not recommended
-	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
	m³ (yd³)	m³ (yd³)	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)	910 (37.0)	1424 (3140)	3	●	●	●	●	●	●	●
	1.38 (1.18)	1.24 (1.62)	1130 (44.5)	1640 (3620)	4	●	●	●	●	●	●	◐
	2.20 (2.88)	1.93 (2.52)	1600 (63.0)	2020 (4450)	5	●	●	●	●	●	●	-
	2.79 (3.65)	2.46 (3.22)	1795 (70.7)	2295 (5060)	5	●	●	●	●	◐	■	-
	3.00 (3.92)	2.64 (3.45)	1905 (75.0)	2425 (5350)	6	●	●	◐	◐	■	■	-
Heavy duty	2.43 (3.18)	2.11 (2.76)	1745 (68.7)	2445 (5390)	5	●	●	●	●	●	◐	-
	3.20 (4.19)	2.82 (3.69)	2015 (79.3)	2860 (6310)	6	●	◐	◐	■	■	▲	-
Rock heavy duty	2.20 (2.88)	1.93 (2.52)	1600 (63.0)	2605 (5740)	5	●	●	●	●	●	X	-
	2.43 (3.18)	2.11 (2.76)	1745 (68.7)	2730 (6020)	5	●	●	●	●	●	X	-
	2.79 (3.65)	2.46 (3.22)	1795 (70.7)	2970 (6550)	5	●	●	◐	◐	◐	X	-
	3.00 (3.92)	2.64 (3.45)	1905 (75.0)	3115 (6870)	6	●	◐	◐	■	■	X	-
	3.20 (4.19)	2.82 (3.69)	2015 (79.3)	3235 (7130)	6	◐	◐	■	■	■	X	-
Rock heavy duty (special)	1.81 (2.37)	1.50 (1.96)	1325 (52.2)	2685 (5920)	4	●	●	●	●	●	X	-
	2.70 (3.53)	2.39 (3.13)	1760 (69.3)	2755 (6070)	5	●	●	●	◐	◐	X	-
	3.00 (3.92)	2.76 (3.61)	1955 (77.0)	3040 (6700)	6	●	◐	◐	◐	■	X	-

●	Applicable for materials with density of 2100 kg/m³ (3500 lb/yd³) or less
◐	Applicable for materials with density of 1800 kg/m³ (3000 lb/yd³) or less
■	Applicable for materials with density of 1500 kg/m³ (2500 lb/yd³) or less
▲	Applicable for materials with density of 1200 kg/m³ (2000 lb/yd³) or less
X	Not recommended
-	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 HD	(24)	600	(24)
HX500LT3	Operating weight	kg	(lb)	48860	107720	49580	109310	50110	110470	50620	111600	49250	108580	49100	108250
	Ground pressure	kgf/cm²	(psi)	0.85	(12.1)	0.74	(10.5)	0.65	(9.3)	0.59	(8.3)	0.86	(12.2)	0.85	(12.1)
	Overall width	mm	(ft-in)	3340	(10' 11")	3440	(11' 3")	3540	(11' 7")	3640	(11' 11")	3340	(10' 11")	3340	(10' 11")
	Link quantity	EA		53		53		53		53		53		53	
HX520LT3	Operating weight	kg	(lb)	51390	113300	52120	114900	52650	116070	53160	117200	51780	114160	51630	113820
	Ground pressure	kgf/cm²	(psi)	0.89	(12.7)	0.78	(11.0)	0.69	(9.7)	0.62	(8.8)	0.90	(12.8)	0.90	(12.7)
	Overall width	mm	(ft-in)	3540	(11' 7")	3640	(11' 11")	3740	(12' 3")	3840	(12' 7")	3540	(11' 7")	3540	(11' 7")
	Link quantity	EA		53		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

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	335 Hp (250 kW) at 2100 rpm
Net power	330 Hp (246 kW) at 2100 rpm
Max. power	370 Hp (276 kW) at 1800 rpm
Peak torque	1674 N·m (1235 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 × 405 ℓ/min (107 U.S. gpm/89.1 U.K. gpm)
Rated speed	1800 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	24.7 ℓ/min (6.5 U.S. gpm/5.4 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)]
Port relief valve pressure	Boom	400 kgf/cm^2 (5690 psi)
	Arm	400 kgf/cm^2 (5690 psi)
	Bucket	400 kgf/cm^2 (5690 psi)

[ ] : Power boost

5) SWING MOTOR

Item		Specification
Type		Two fixed displacement 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)
Brake release pressure	Cranking	20.9 kgf · m (151 lbf·ft)
	Full stroke	35.5 kgf · m (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	HX500LT3	Ø160 × 1360 mm
		HX500LT3★ HX520LT3	Ø170 × 1360 mm
	Cushion		Extend only

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

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

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

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	HX500LT3 : -#00252 HX520LT3 : -#00265	34.0 (9.0)	★SAE 5W-40 SAE 30 SAE 10W SAE 10W-30 SAE 15W-40
		HX500LT3 : #00253- HX520LT3 : #00266-	42.5 (11.2)	
Swing drive	Gear oil		7.0 (1.8)×2	★SAE 75W-90 SAE 80W-90
Final drive			12.5 (3.3)×2	
Hydraulic tank	Hydraulic oil		Tank : 275 (72.6) System : 499 (132)	★ISO VG 15 ISO VG 32 ISO VG 46 ISO VG 68
Fuel tank	Diesel fuel		660 (174)	★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★1		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 : Soft water
City water or distilled water

※ **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.**

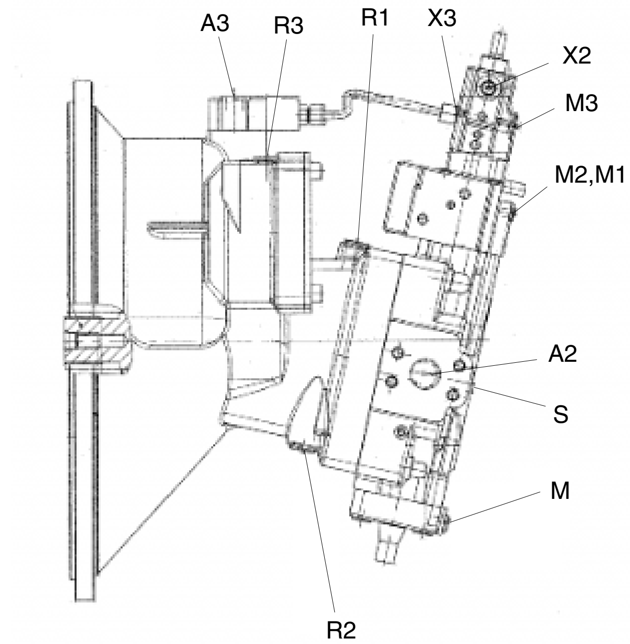
SECTION 2 STRUCTURE AND FUNCTION

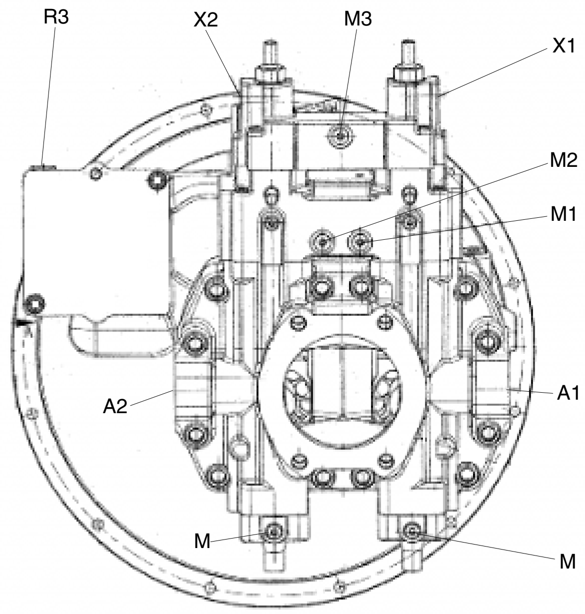
GROUP 1 PUMP DEVICE

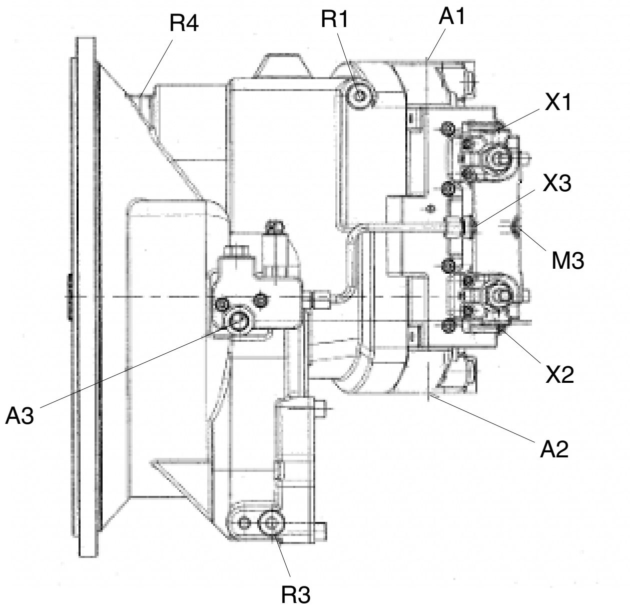
1. STRUCTURE

The pump device consists of main pump, regulator.

· STANDARD



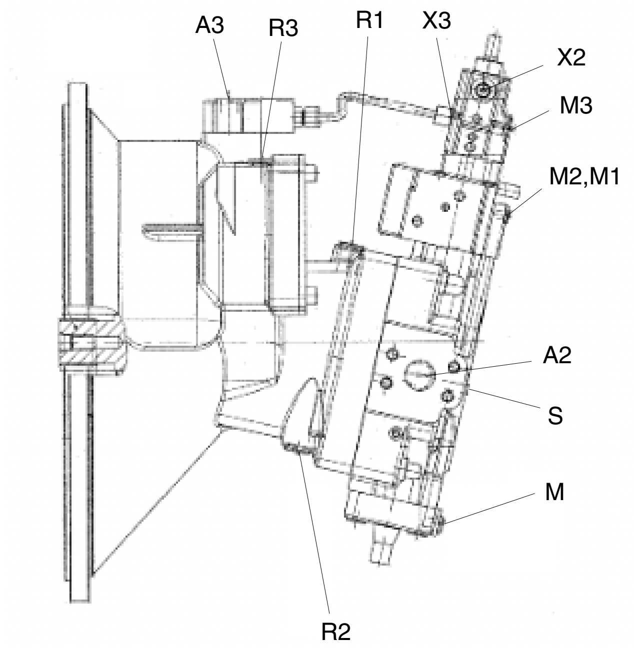


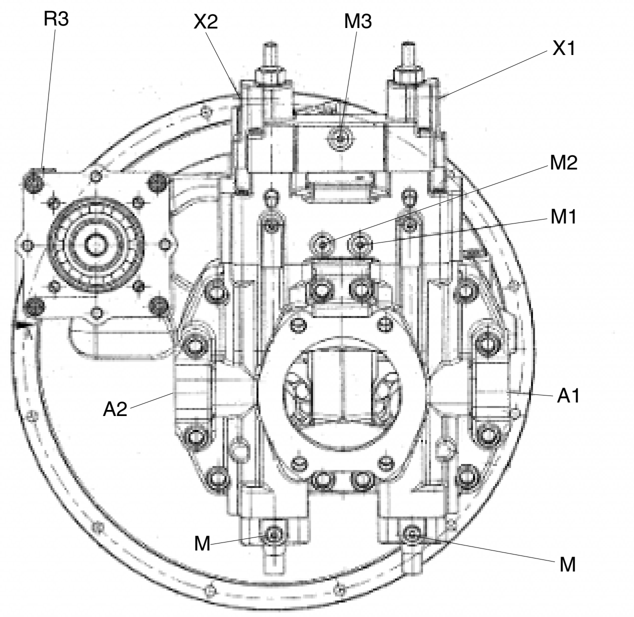


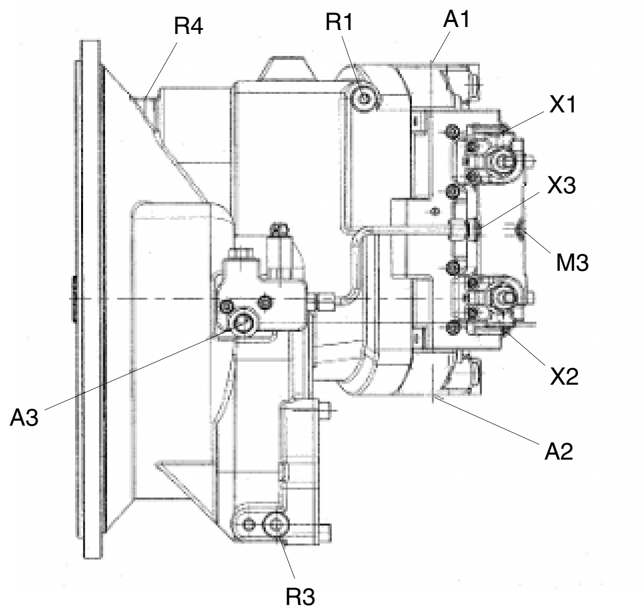
480A2MP01

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



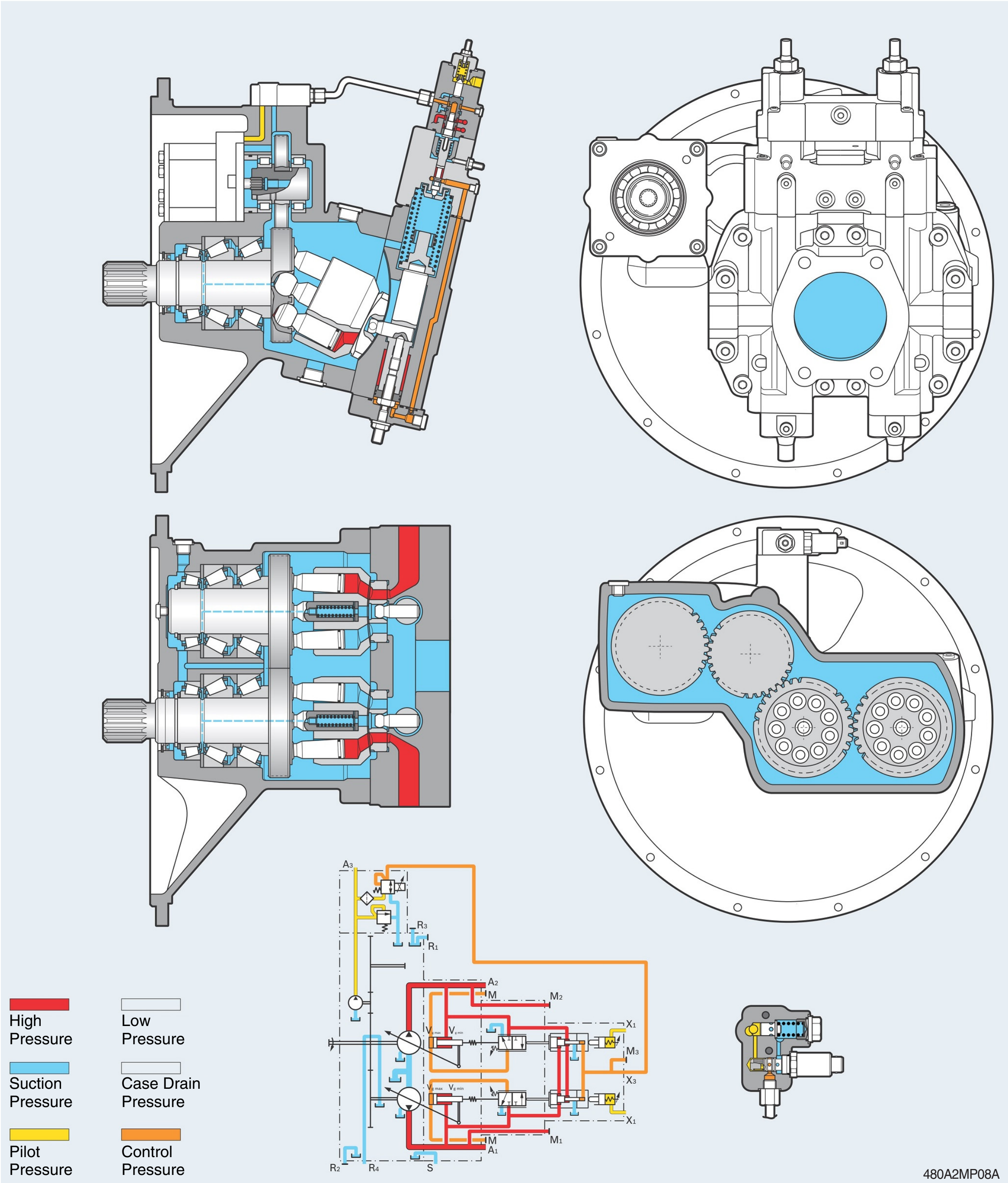




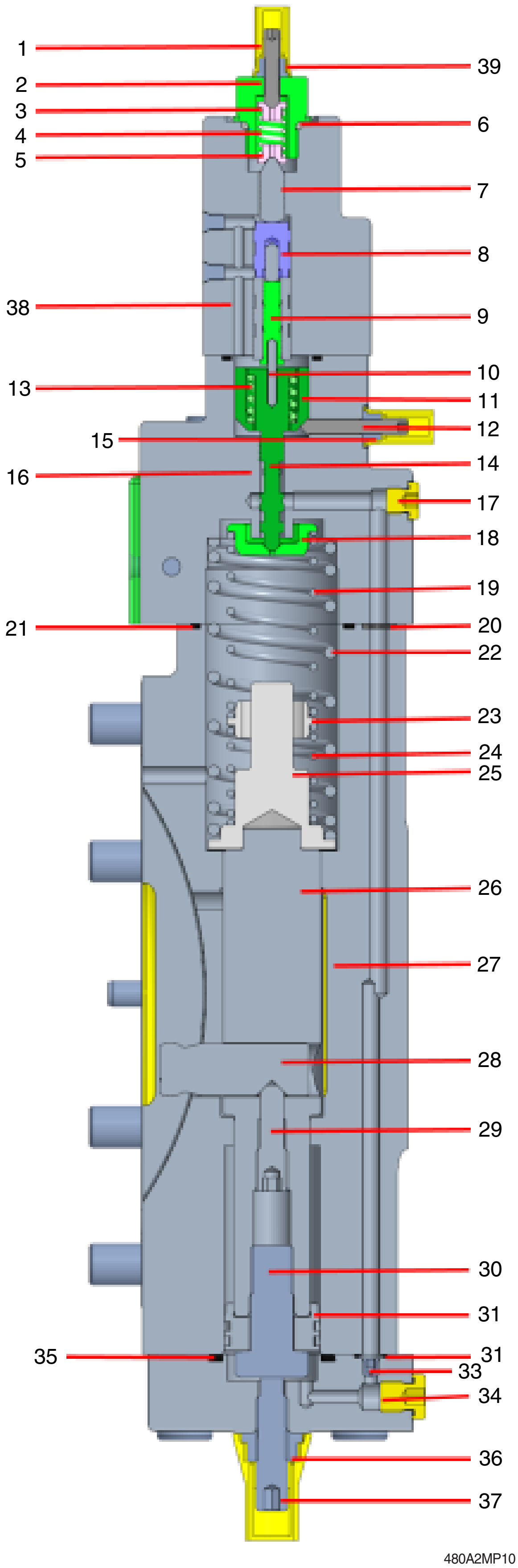
480A2MP03

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
A3
R3
R1
A2
M
M2
X1
M3
X3
X1
M
A1
M1
R2
R4
S
480A2MP08A

3. PART LIST (1/3)

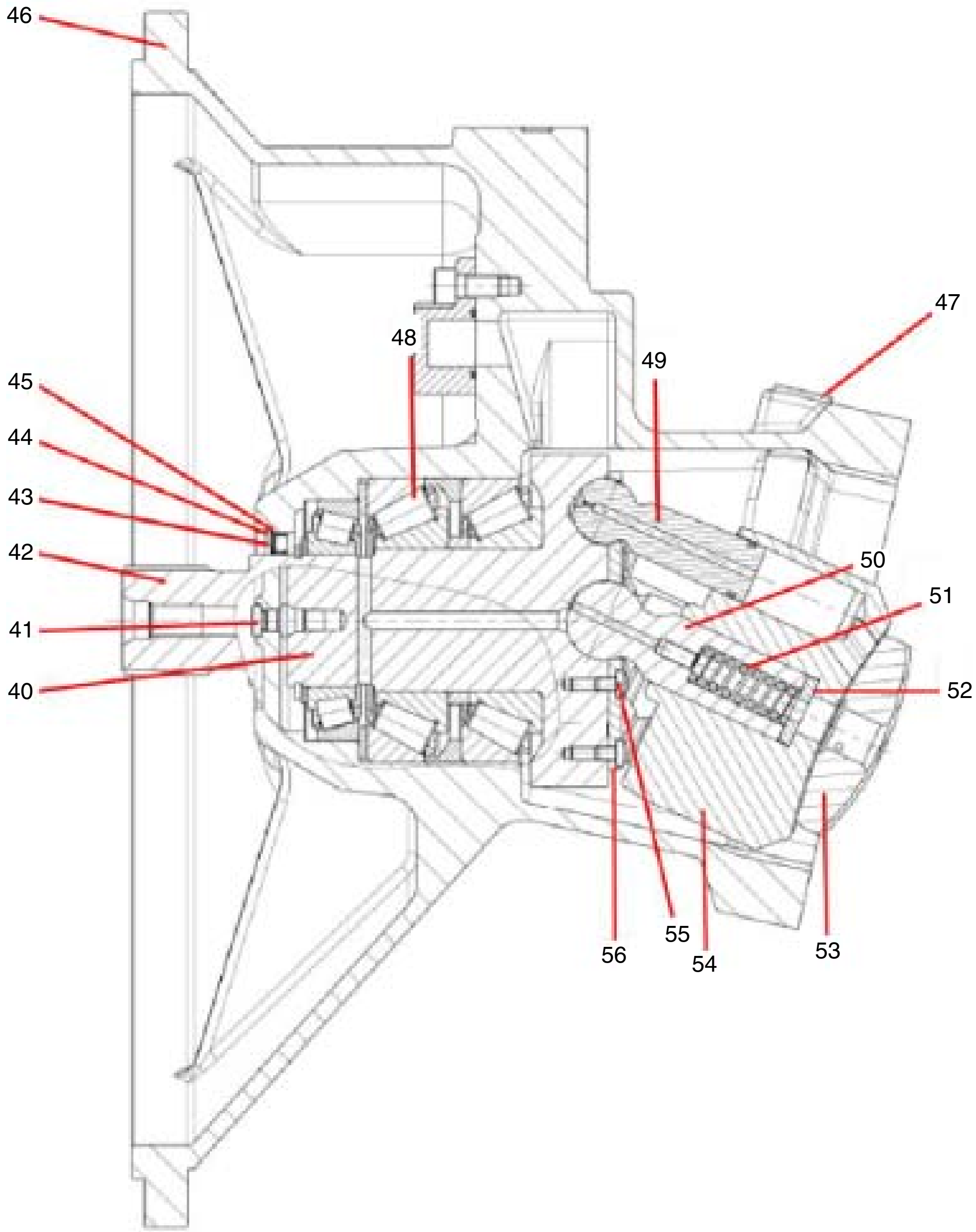


1	Setting screw
2	Screw plug
3	Spring cup
4	Spring
5	Spring cup
6	O-ring
7	HNC control piston
8	Control bushing
9	LLC control piston
10	Pin
11	Spring bushing
12	Adjustment screw
13	Setting screw
14	Control piston for stroking
15	Sealing screw
16	HNC controller housing
17	Sealing screw
18	Spring cup
19	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

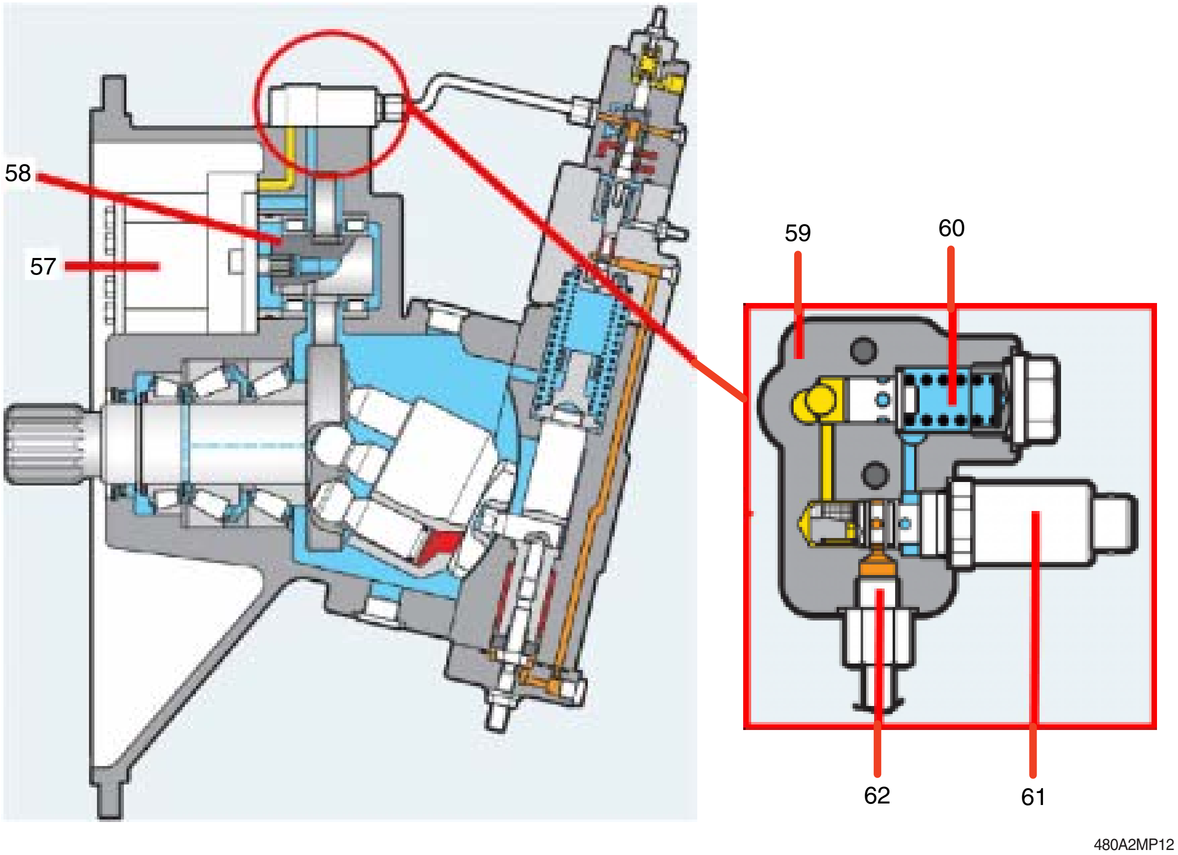
PART LIST (2/3)



480A2MP11

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)



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.

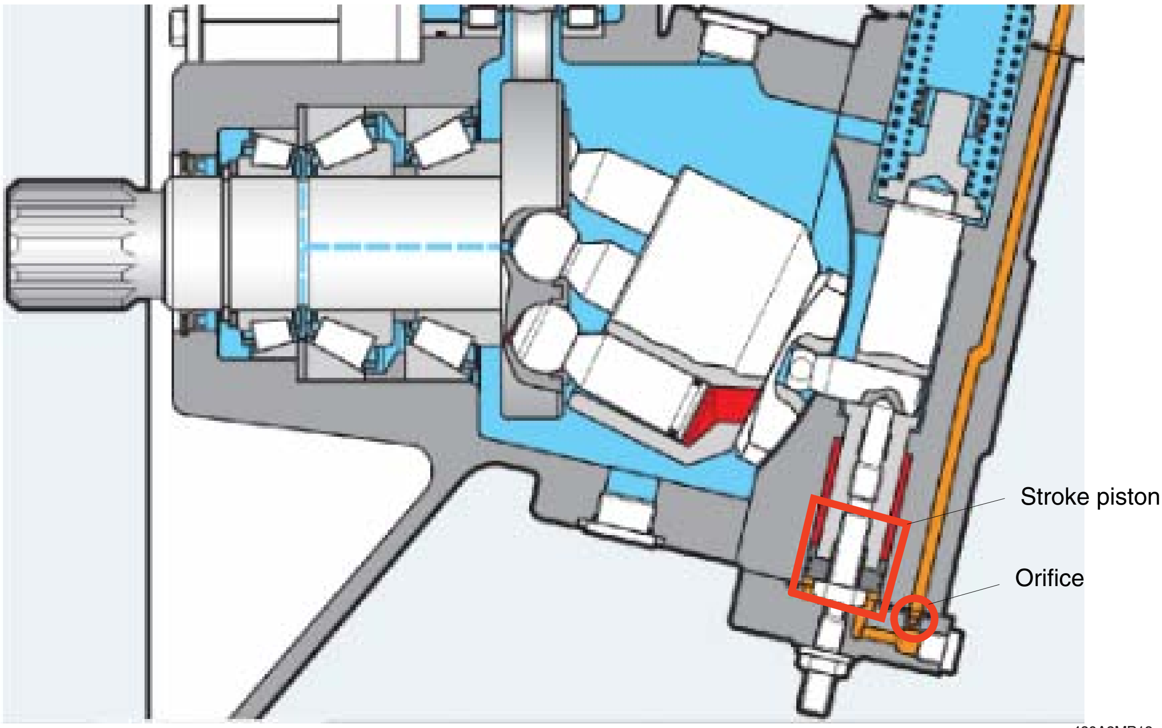
The controller with the highest priority is the power override control (LA1). This protects the diesel engine from overloading. When the diesel engine is over-loaded, it causes the engine speed to decrease and, in the worst case, the diesel engine is being stalled. We counteract the fact, that active 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.

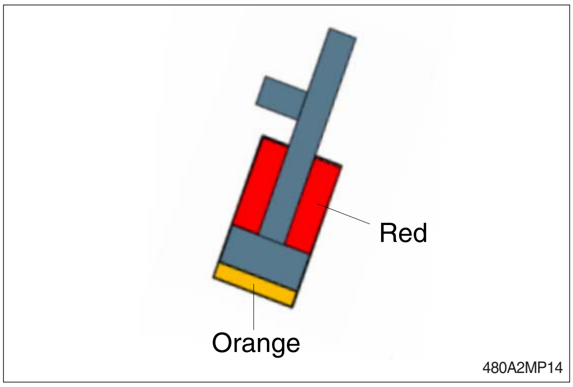
The basic function of each rotary group is as follows.

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.



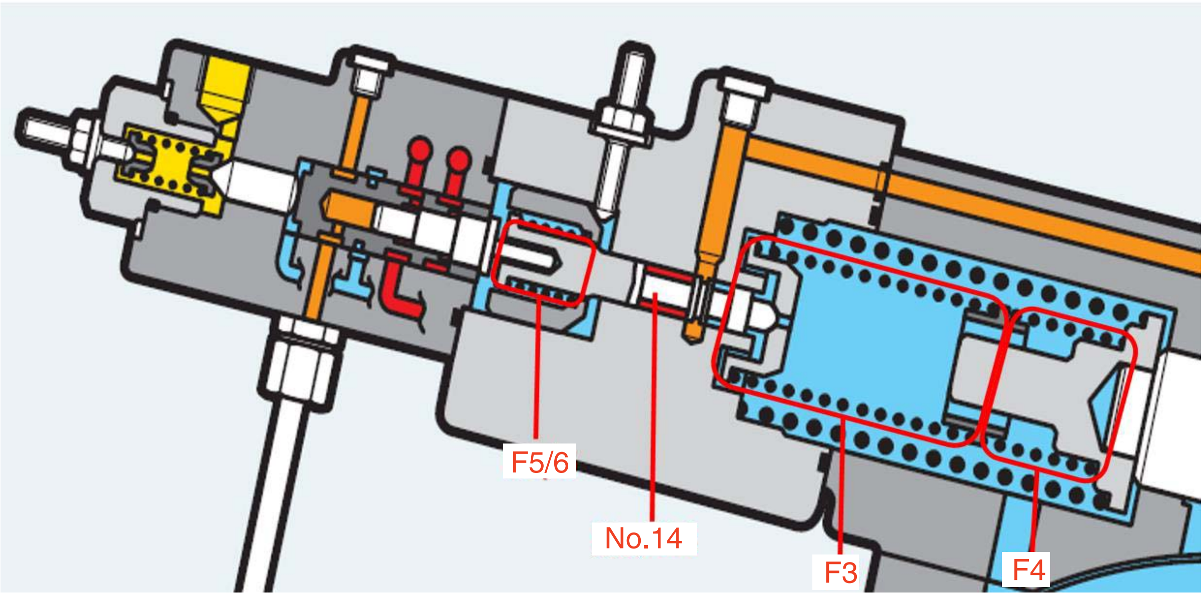
480A2MP13

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.

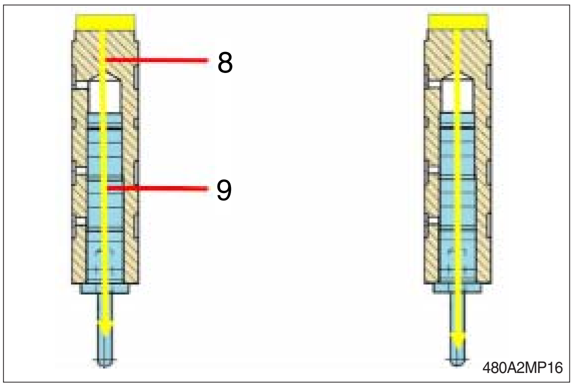


480A2MP15

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

(1) Negative control H1

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



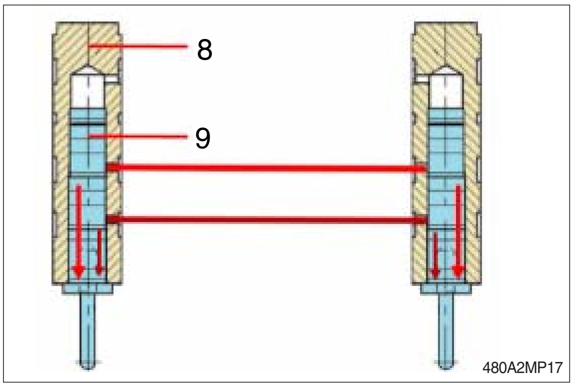
480A2MP16

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.

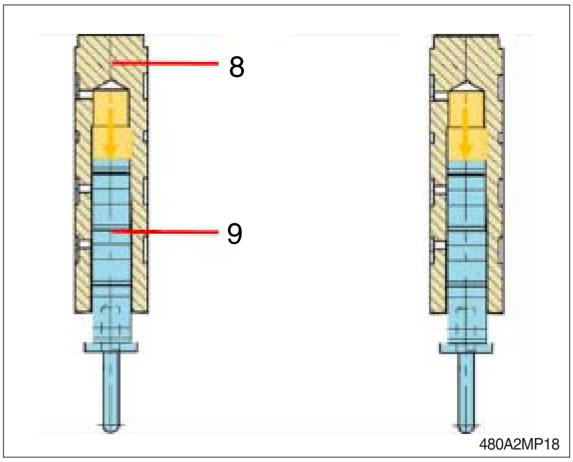


480A2MP17

(3) Power override LA1

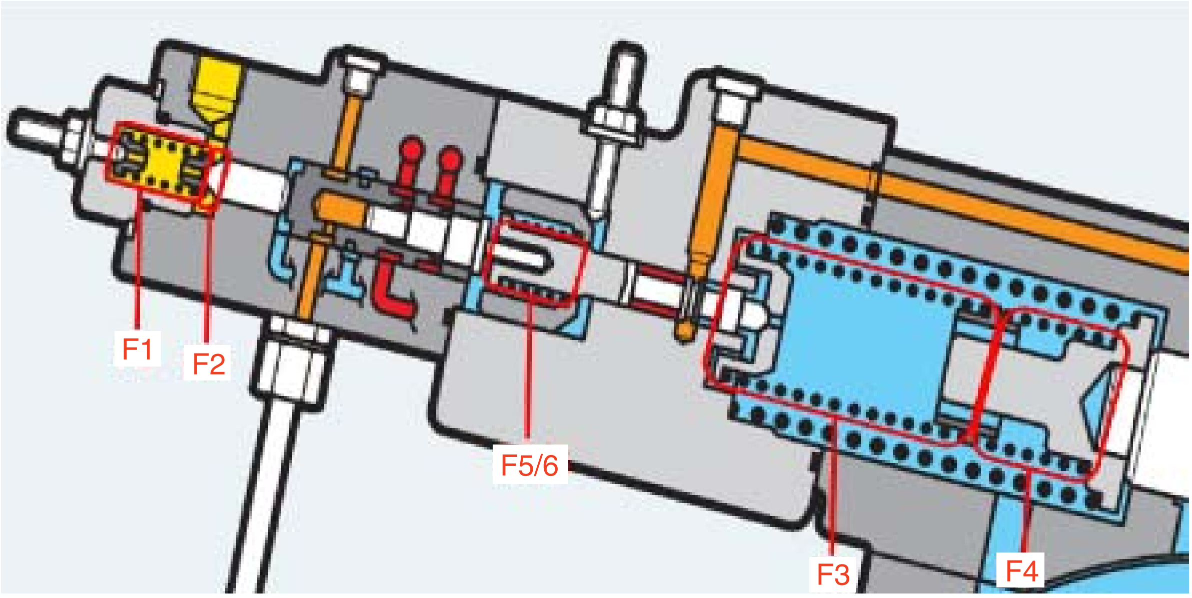
Movement of control piston (9) inside the upper control housing, via the pilot pressure from the electric proportional pressure-reducing valve, for power control.

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.



480A2MP18

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

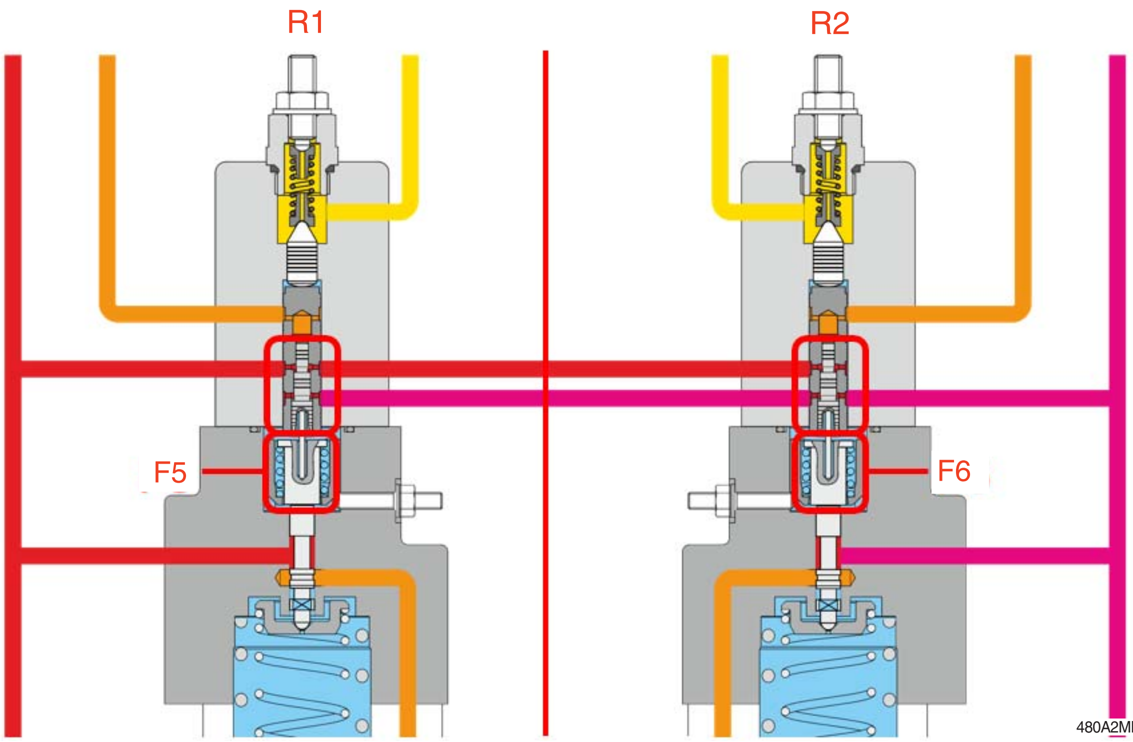
These forces work against the spring forces of the power controller F3 and F4. The important factor is the control pressure.
If the control pressure is increasing, the force of F2 increase too and ensures that the control piston (14) opens the channel between the high pressure and the stroke pressure. 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.

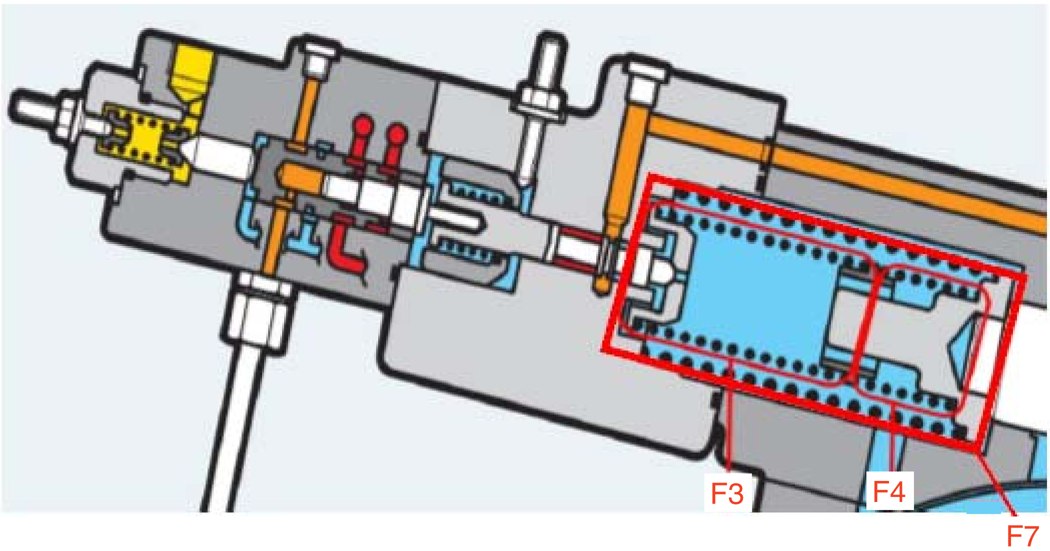
Both high pressures are applied to the control piston. Over the surfaces, these pressures generate a force which works against the adjusted spring force (F5/F6). If the force is bigger than the spring force (F5), the control edge opens and the pump swivels back.



480A2MP20

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.



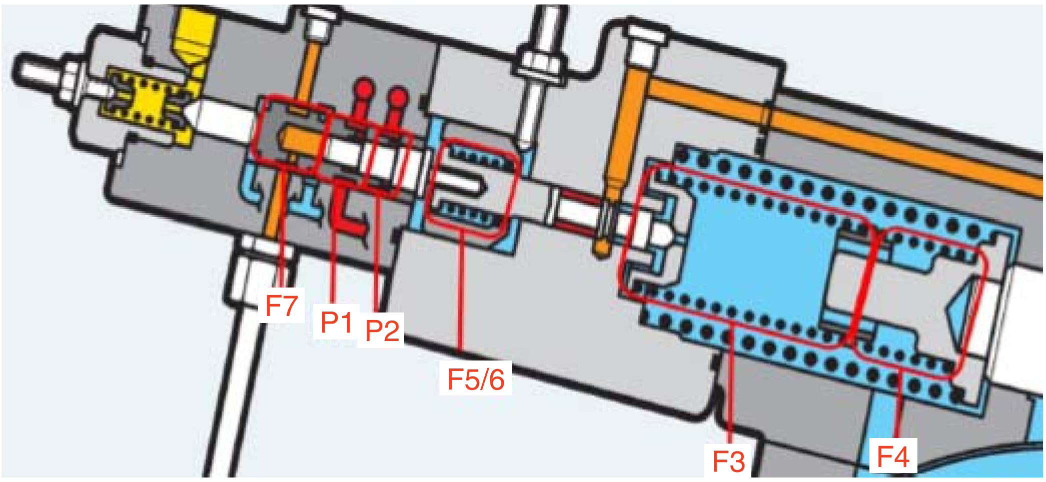
480A2MP21

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.

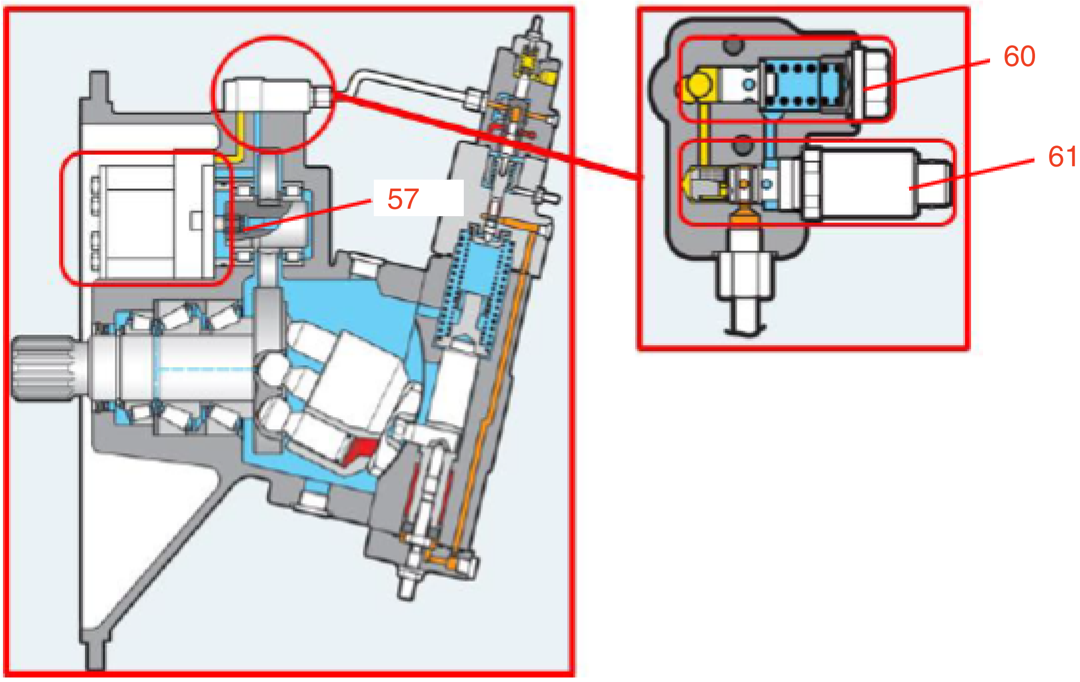
So second, let's look at the power shifting function. Here it is possible to approach different driving modes.

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 HD Hyundai Construction Equipment dealer.

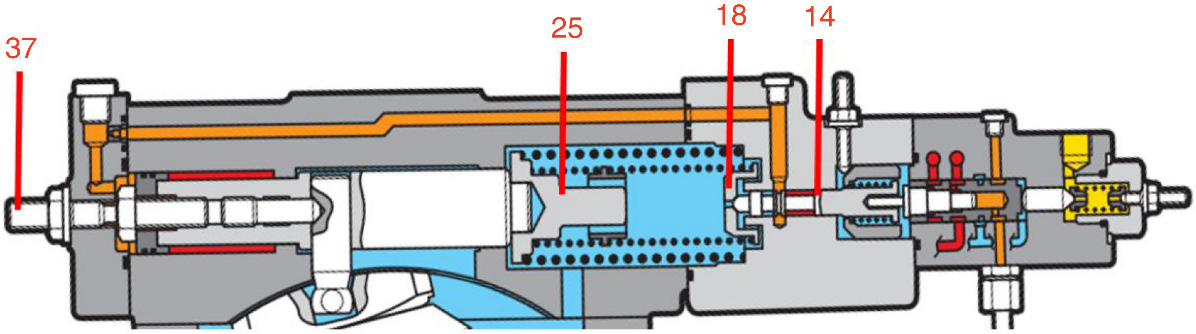
1) FLOW

(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).



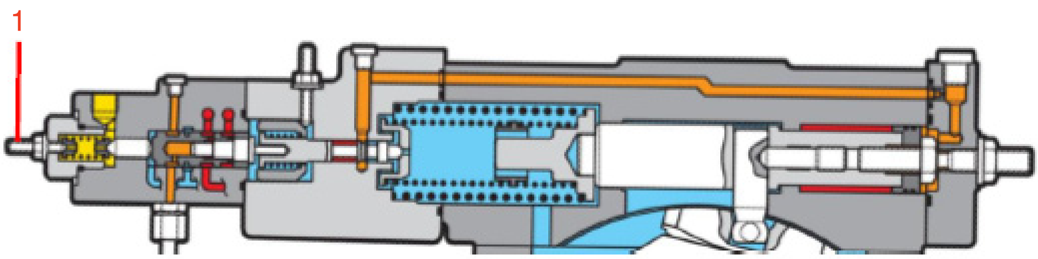
480A2MP24

(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

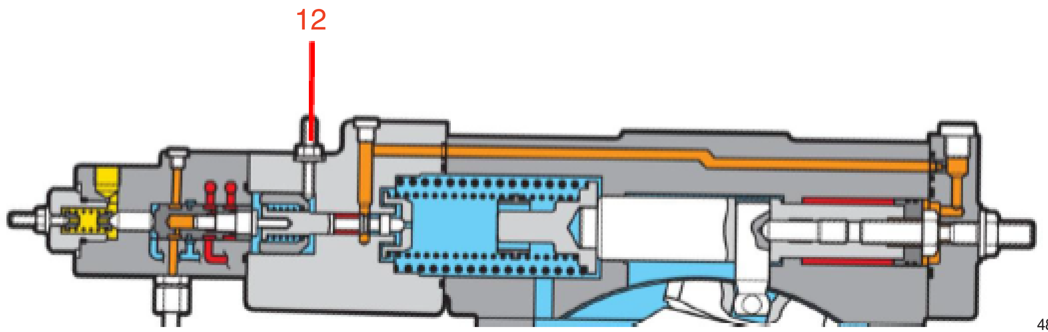
With the volumetric flow controller, fully control the A1 rotary group. Then increase the high pressure to the control point of the power controller. You realize that the power regulator is engaged when the speed of the movement slows down. Use the adjustment screw (12).

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.

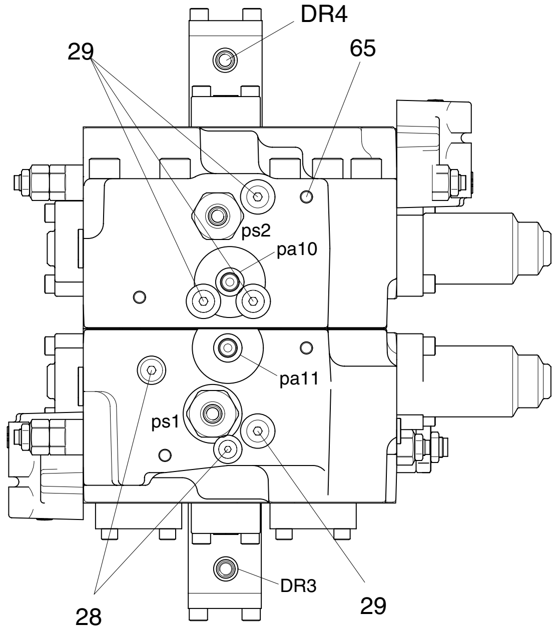
1. rotary group A1: 100% volume flow (speed), high pressure 300 bar
2. rotary group A2: 100% volume flow (speed), high pressure 300 bar
3. rotary group A1 and A2: 100% volume flow (speed), high pressure 150 bar

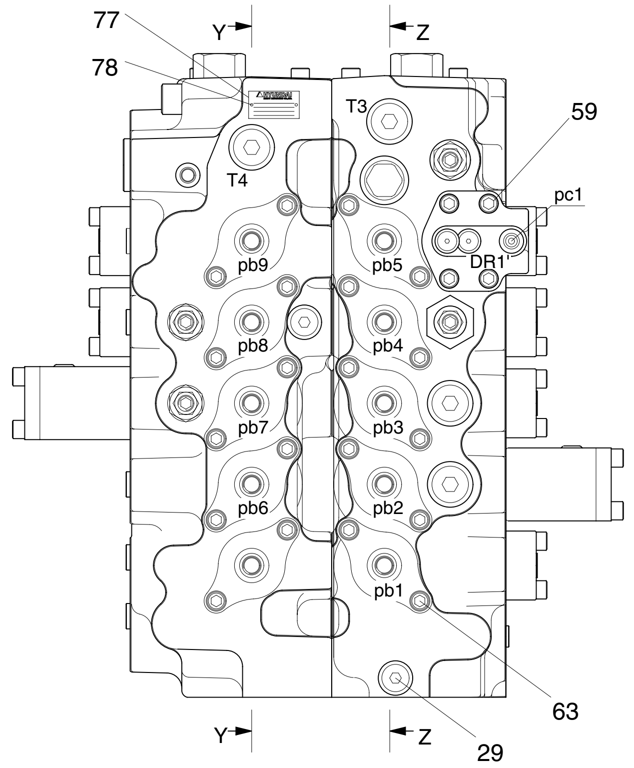


480A2MP26

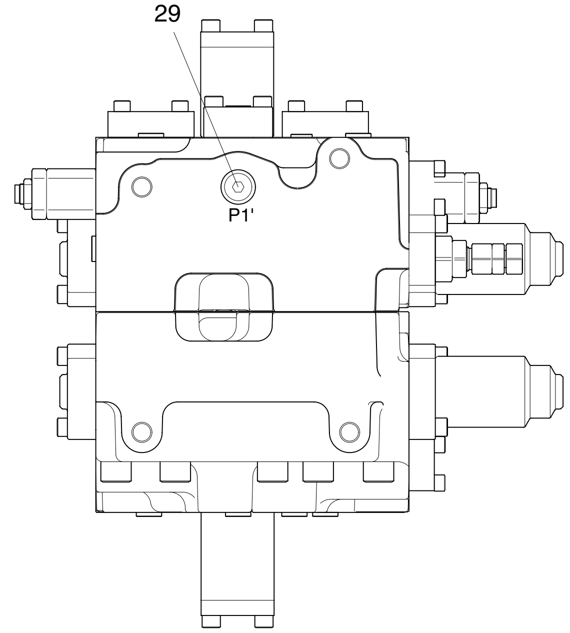
※ Adjustment M6x1 : 1 turn = 1 mm = +85.8 bar
(clockwise adjustment range of pQ: 150 ~ 300 bar (delta 150 bar)
(max. input torque 1.788 Nm of pump to be considered,
i.e. Vgmax and delta p = 250 bar, both rotary groups)

1. STRUCTURE



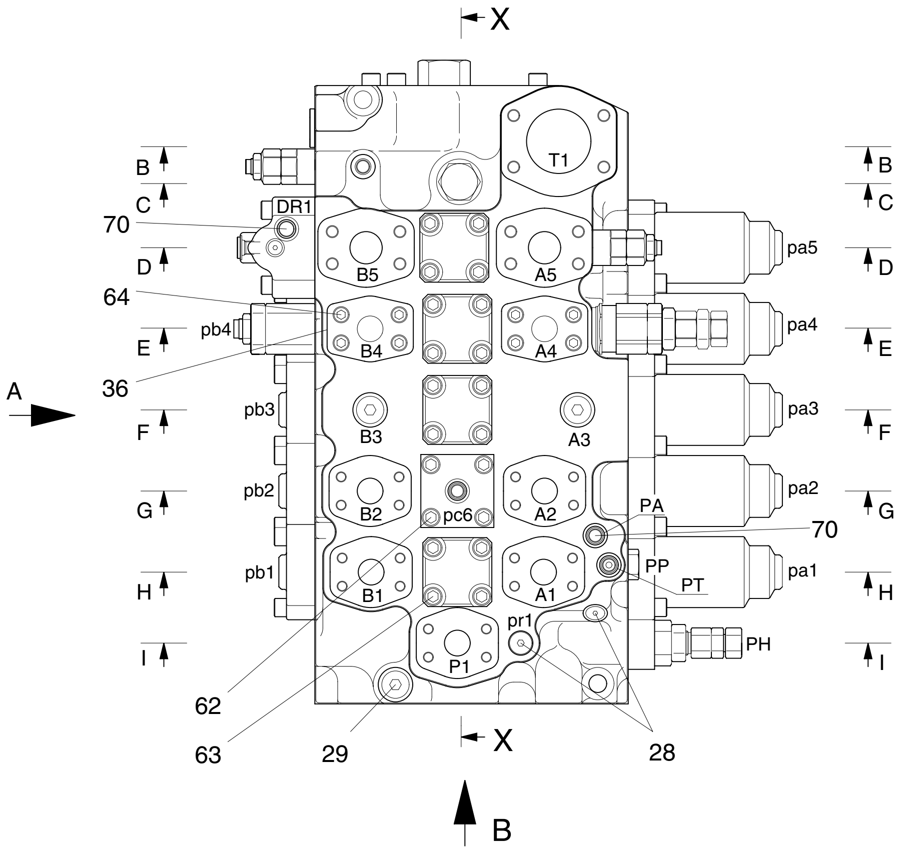


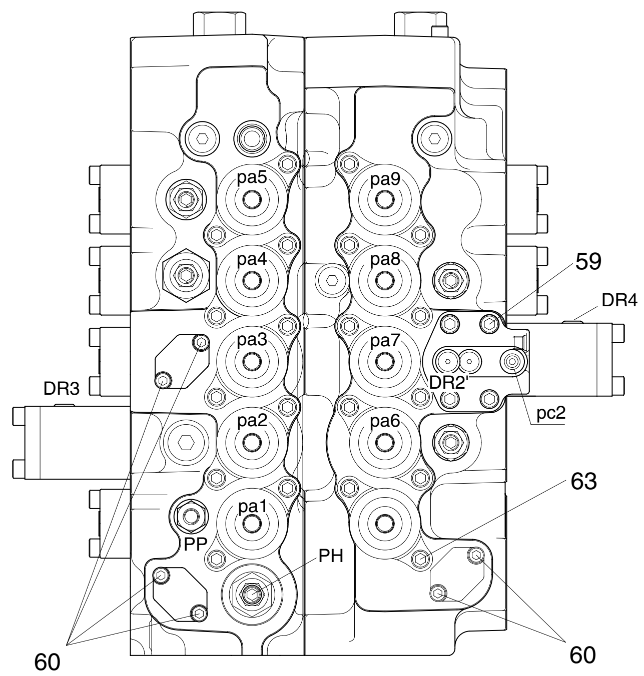
VIEW A

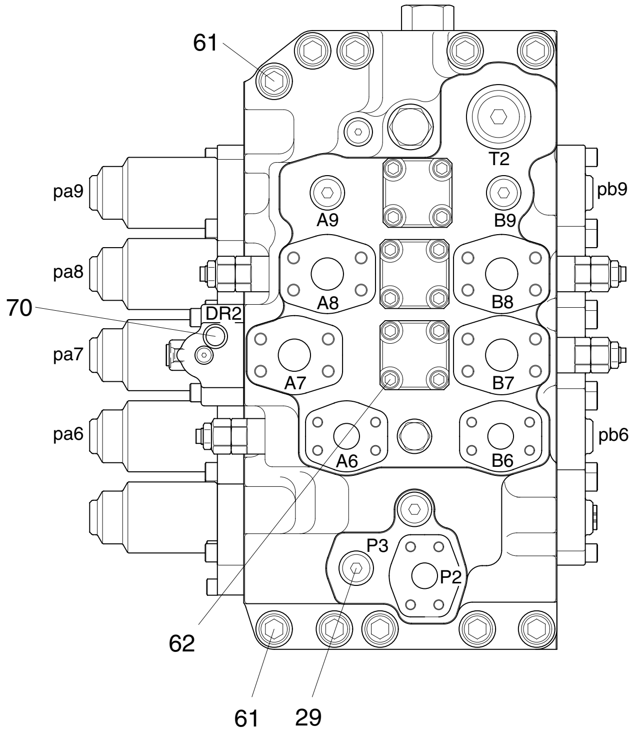


VIEW B

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, p0	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



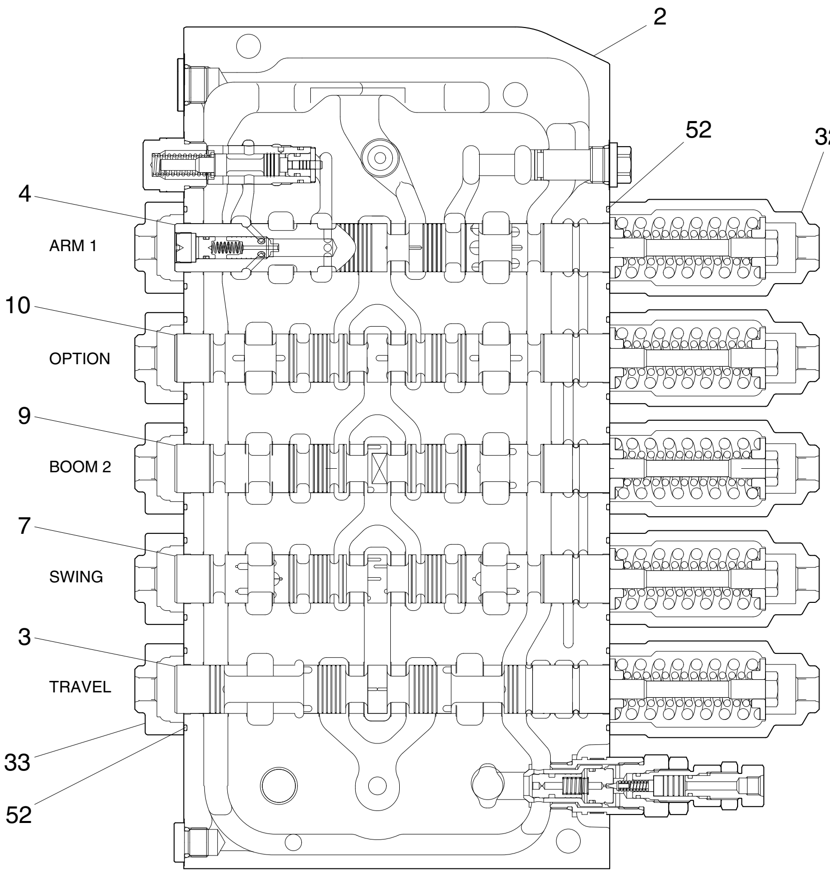




28 Plug assy
29 Plug assy
36 Flange
59 Socket head bolt
60 Socket head bolt
61 Socket head bolt
62 Socket head bolt
63 Socket head bolt
64 Socket head bolt
65 Socket head bolt
70 Dust cap
77 Name plate
78 Rivet

480SA2MC02

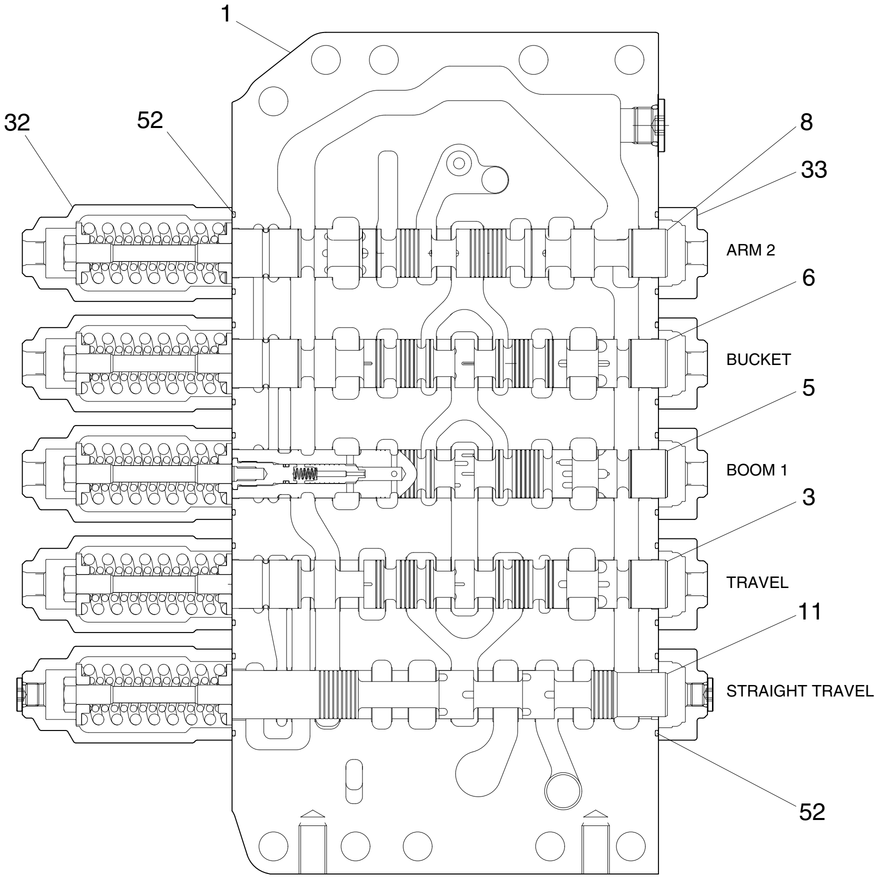
STRUCTURE (2/7)



SECTION Z-Z

480SA2MC03

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

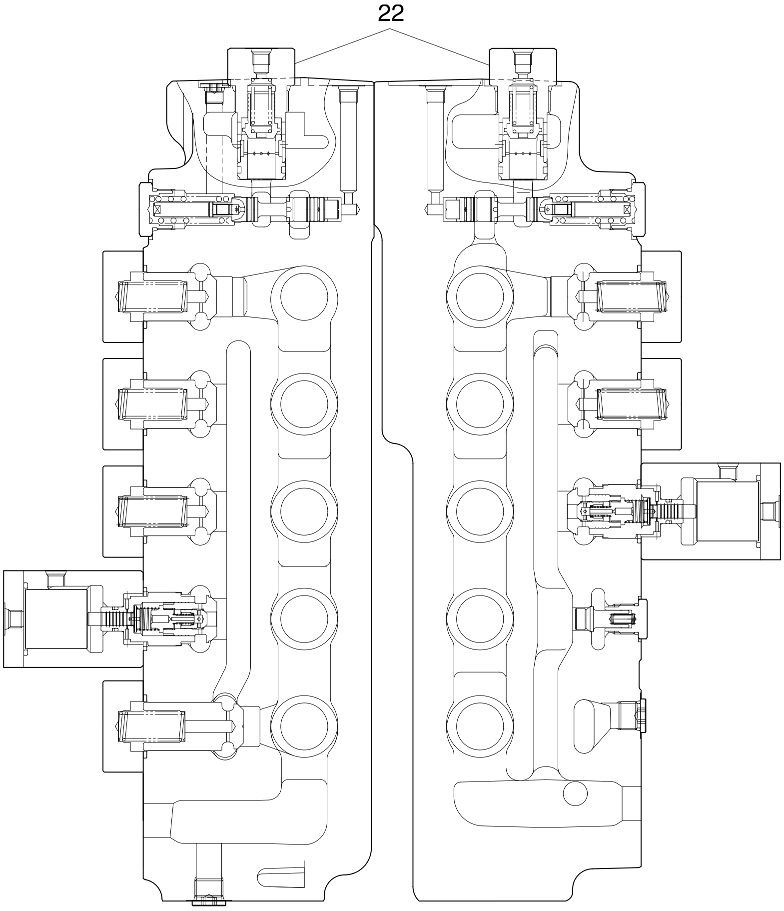


SECTION Y-Y

480SA2MC04

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

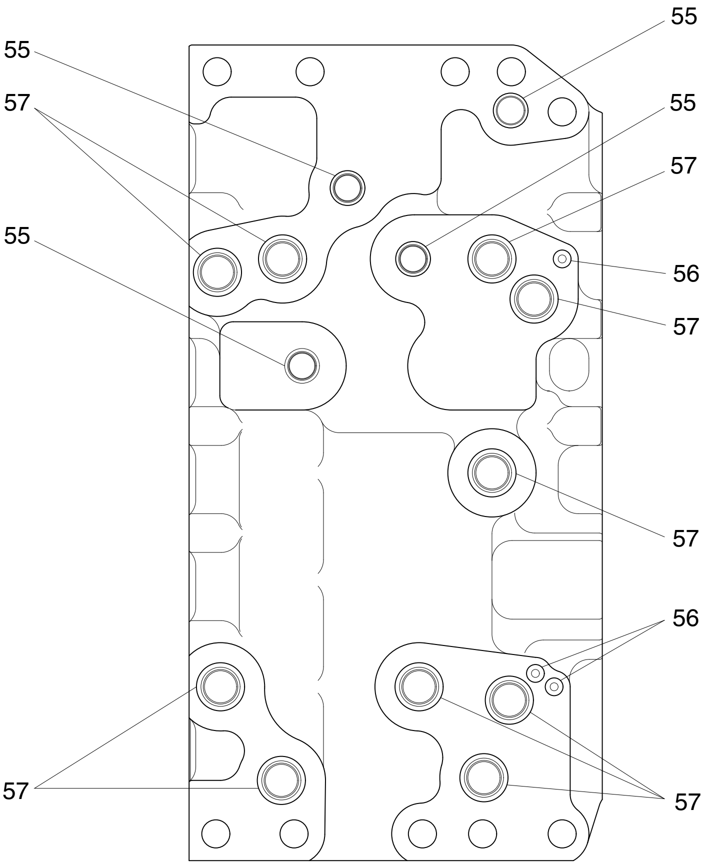
STRUCTURE (3/7)



SECTION X-X

480SA2MC05

22 Negacon valve assy

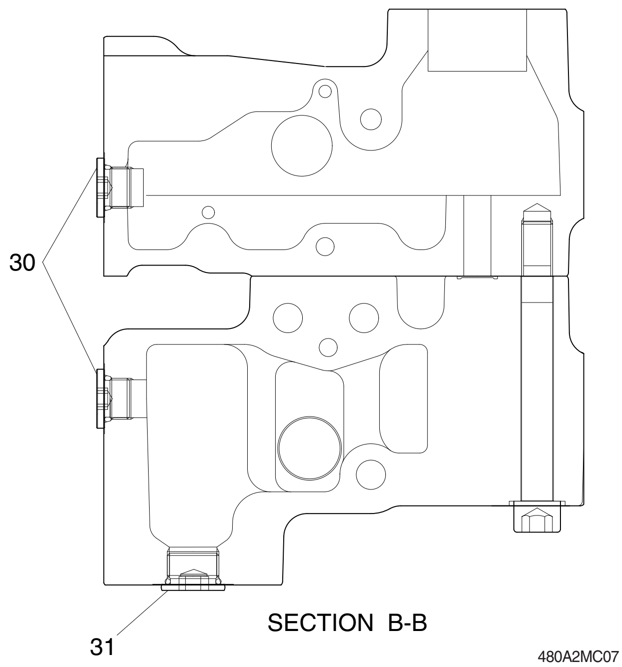


DETAIL OF COMBINED PLANE

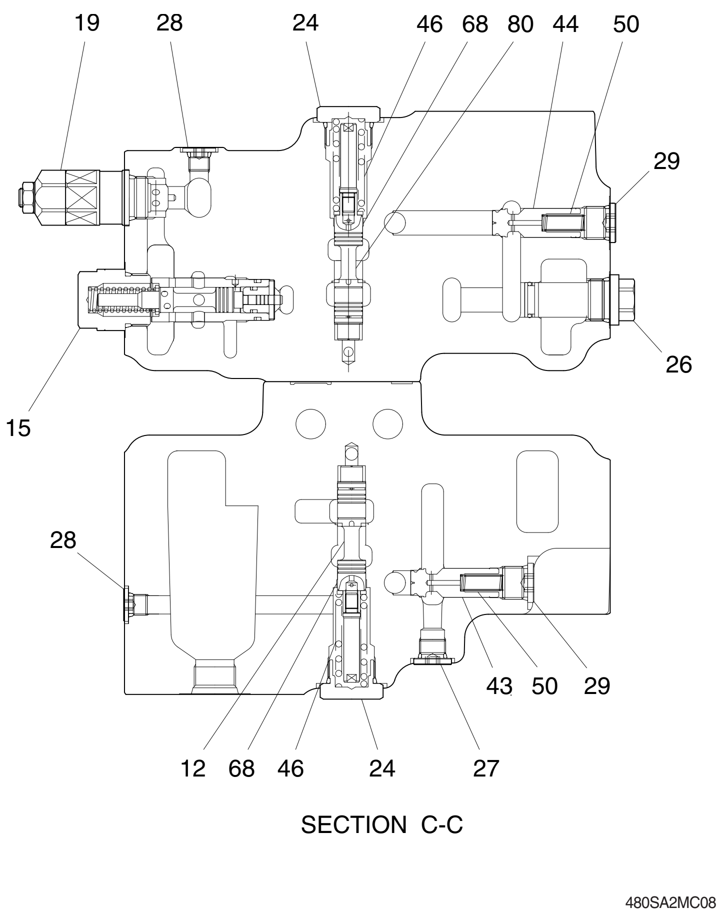
480A2MC06

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

STRUCTURE (4/7)

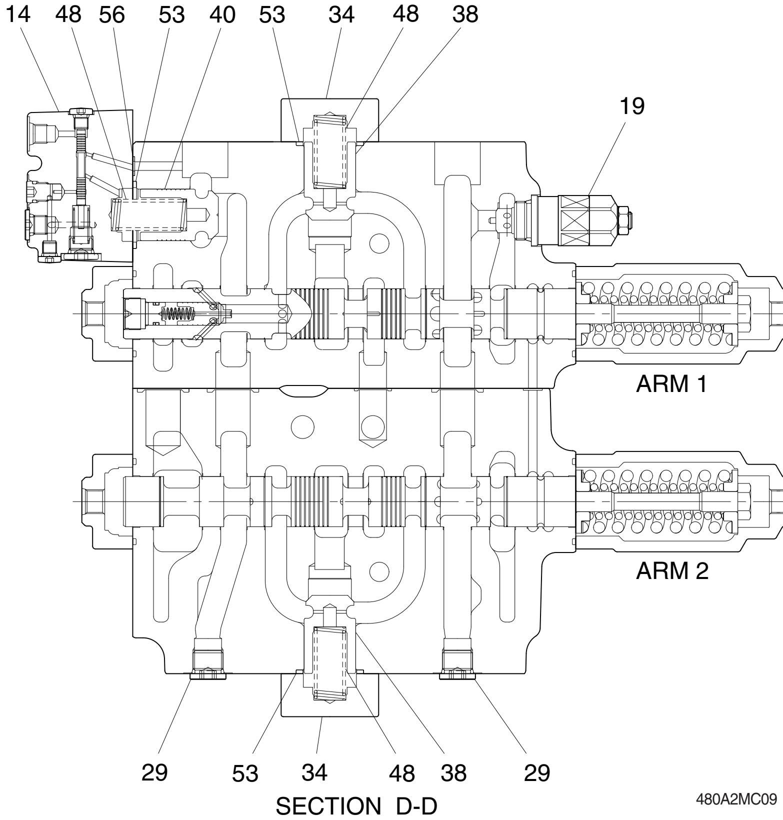


30 Plug assy
31 Plug assy

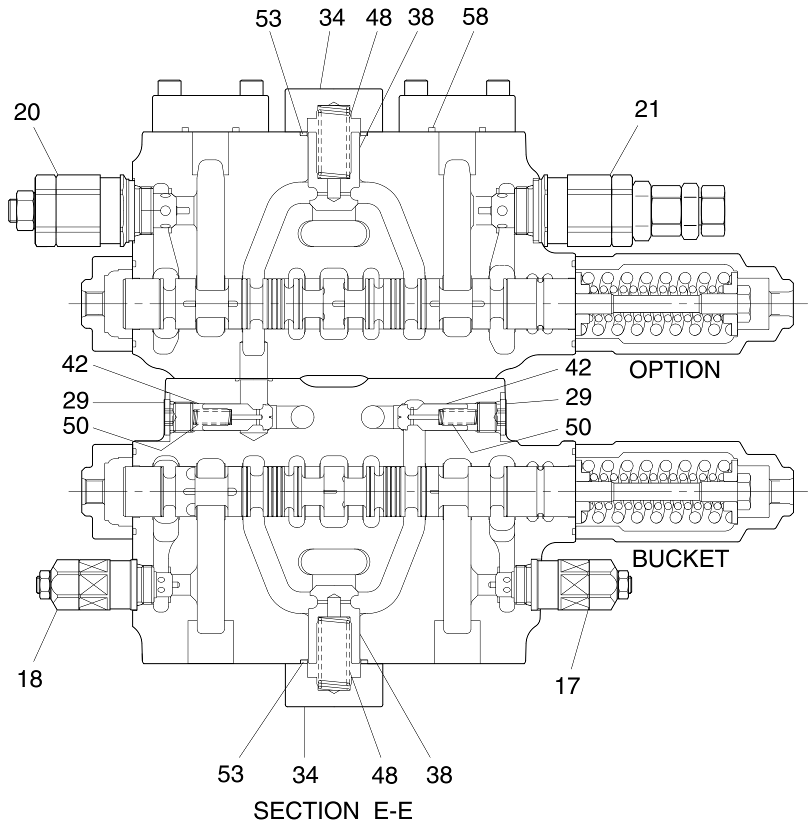


12 Spool kit-BC
15 Arm regen cut valve
19 Overload relief valve assy
24 Plug assy-BC
26 Plug assy
27 Plug assy
28 Plug assy
29 Plug assy
43 Poppet
44 Poppet
46 Spring-BC
50 Spring
68 Spring seat-BC
80 Spool kit-BC

STRUCTURE (5/7)

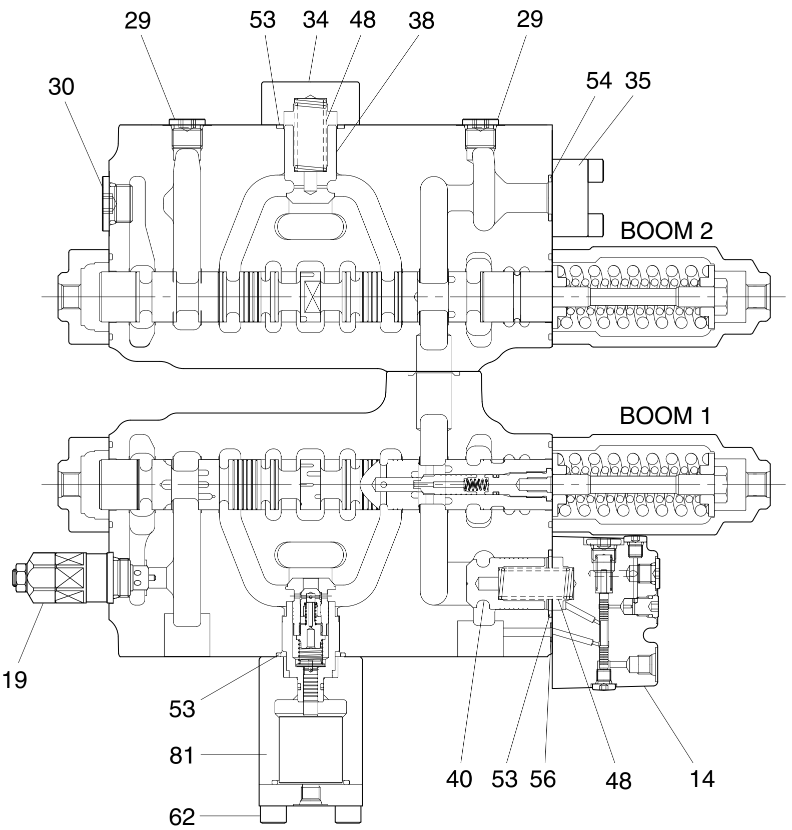


14 Holding valve assy
19 Overload relief valve assy
29 Plug assy
34 Flange-LC
38 Poppet
40 Poppet
48 Spring
53 O-ring
56 O-ring



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

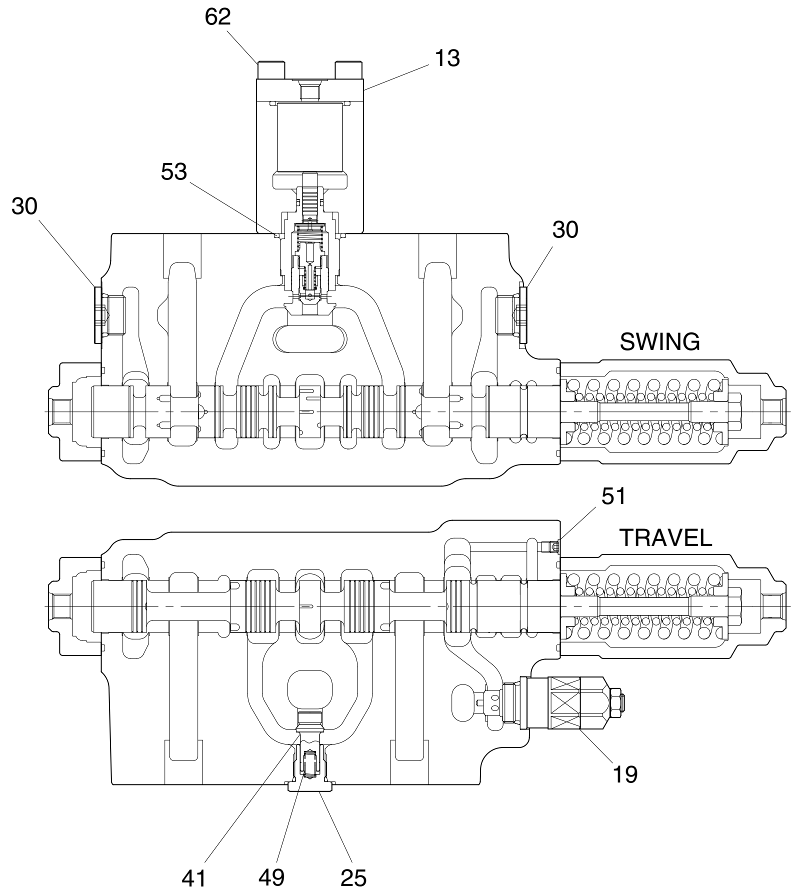
STRUCTURE (6/7)



SECTION F-F

480SA2MC11

14 Holding valve assy
19 Overload relief valve assy
29 Plug assy
30 Plug assy
34 Flange-LC
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

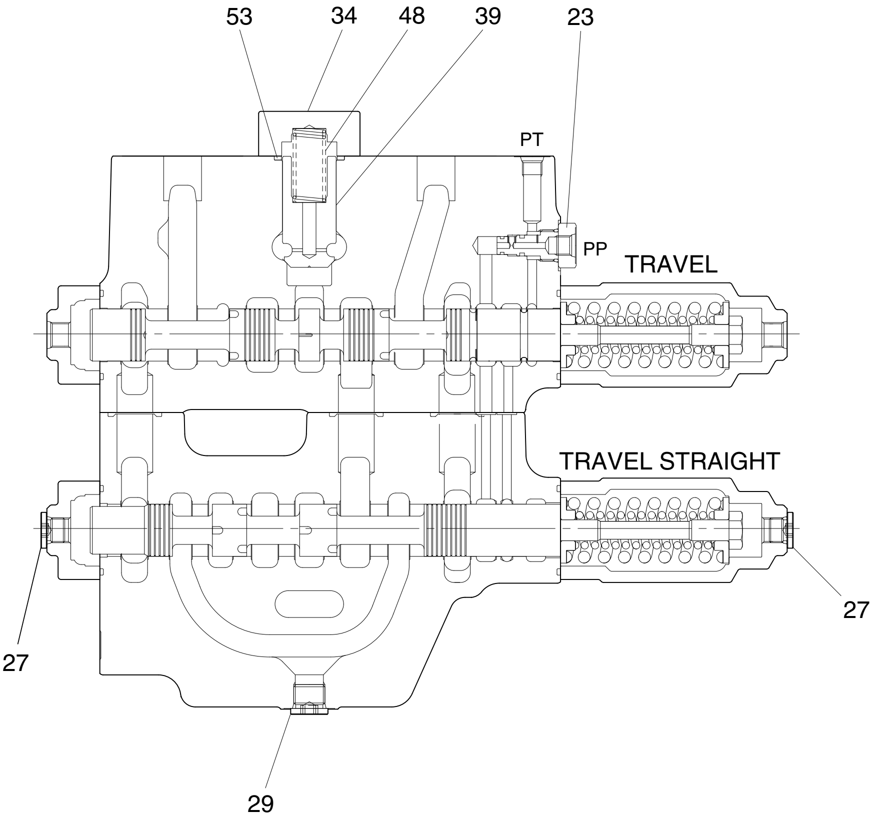


SECTION G-G

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

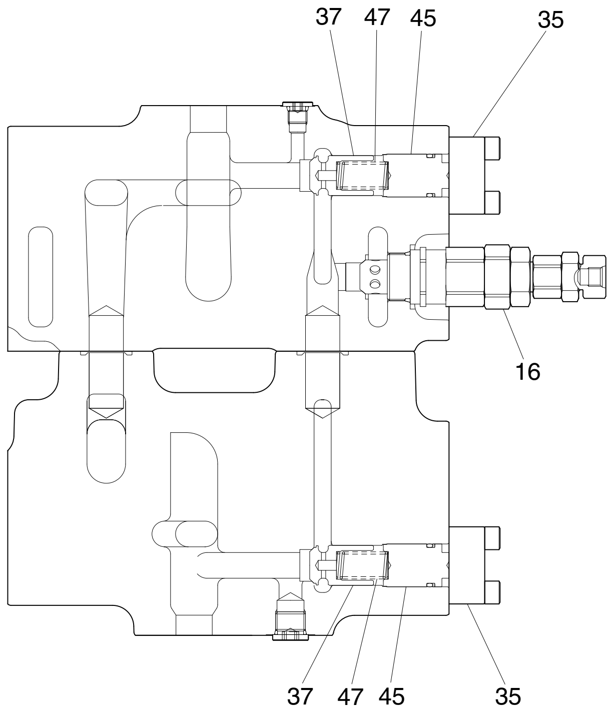
STRUCTURE (7/7)



SECTION H-H

480SA2MC13

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

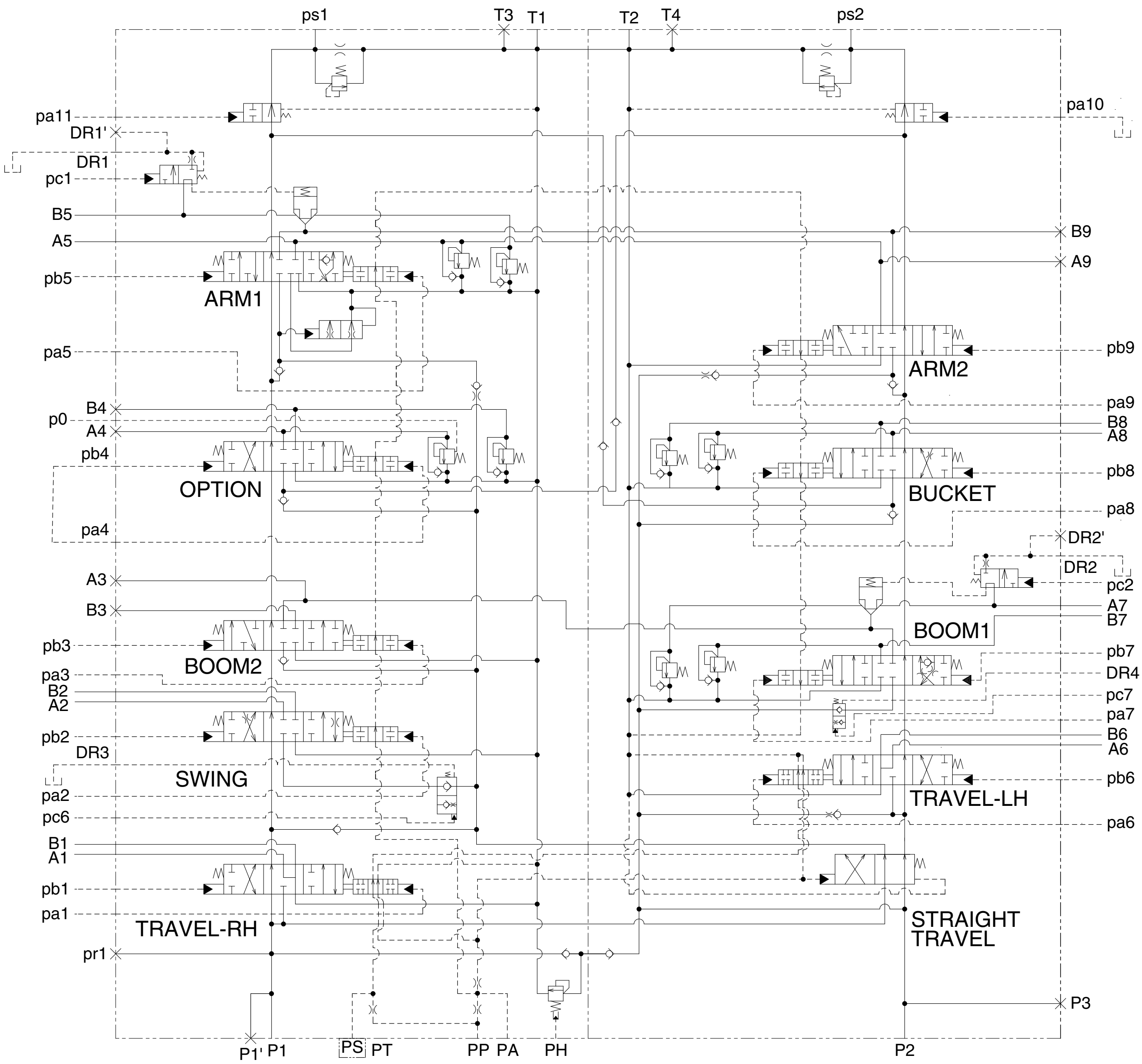


SECTION I-I

480A2MC14

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

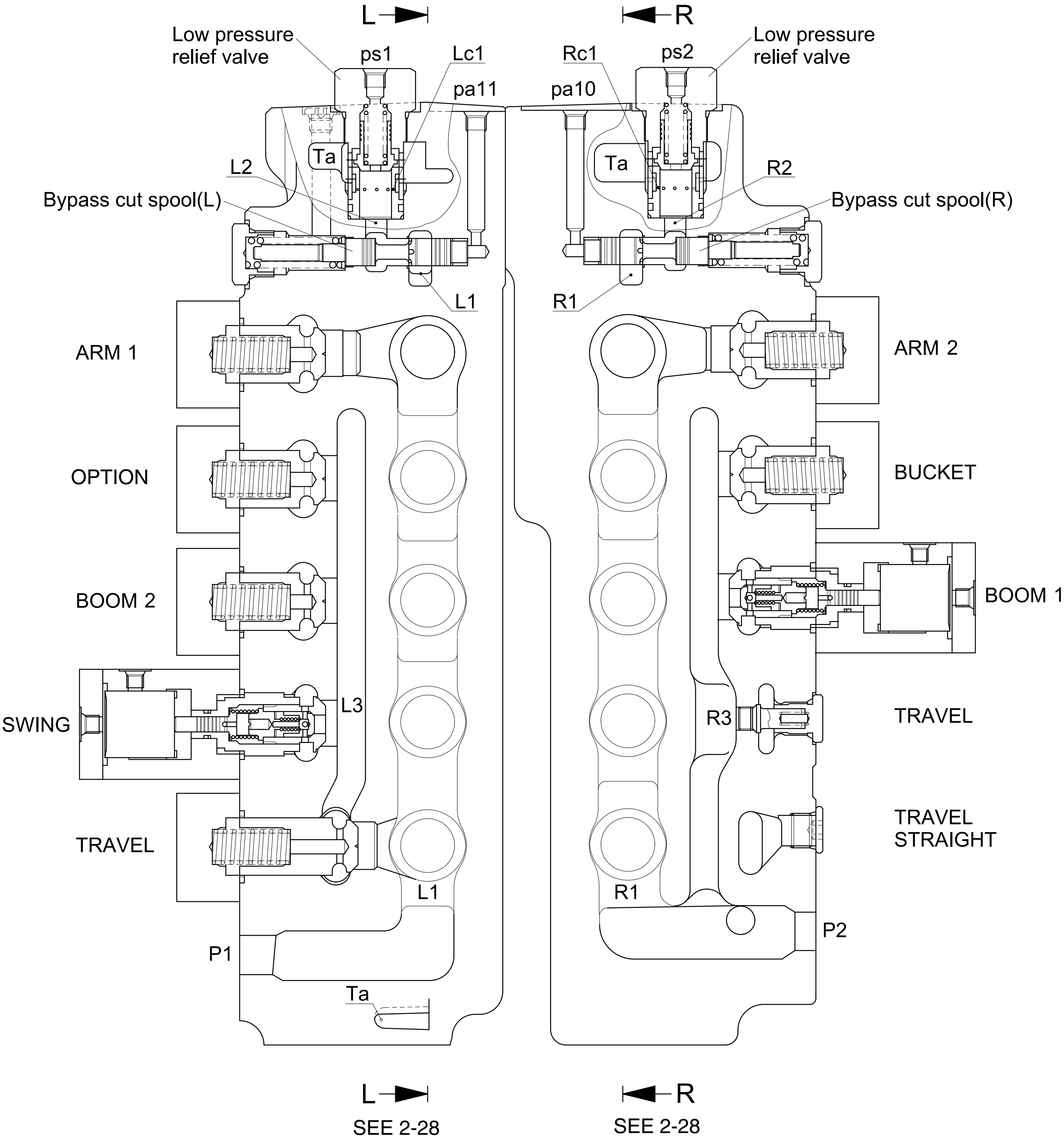
2. HYDRAULIC CIRCUIT



480SA2MC15

3. OPERATION

1) ALL SPOOL NEUTRAL



(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.

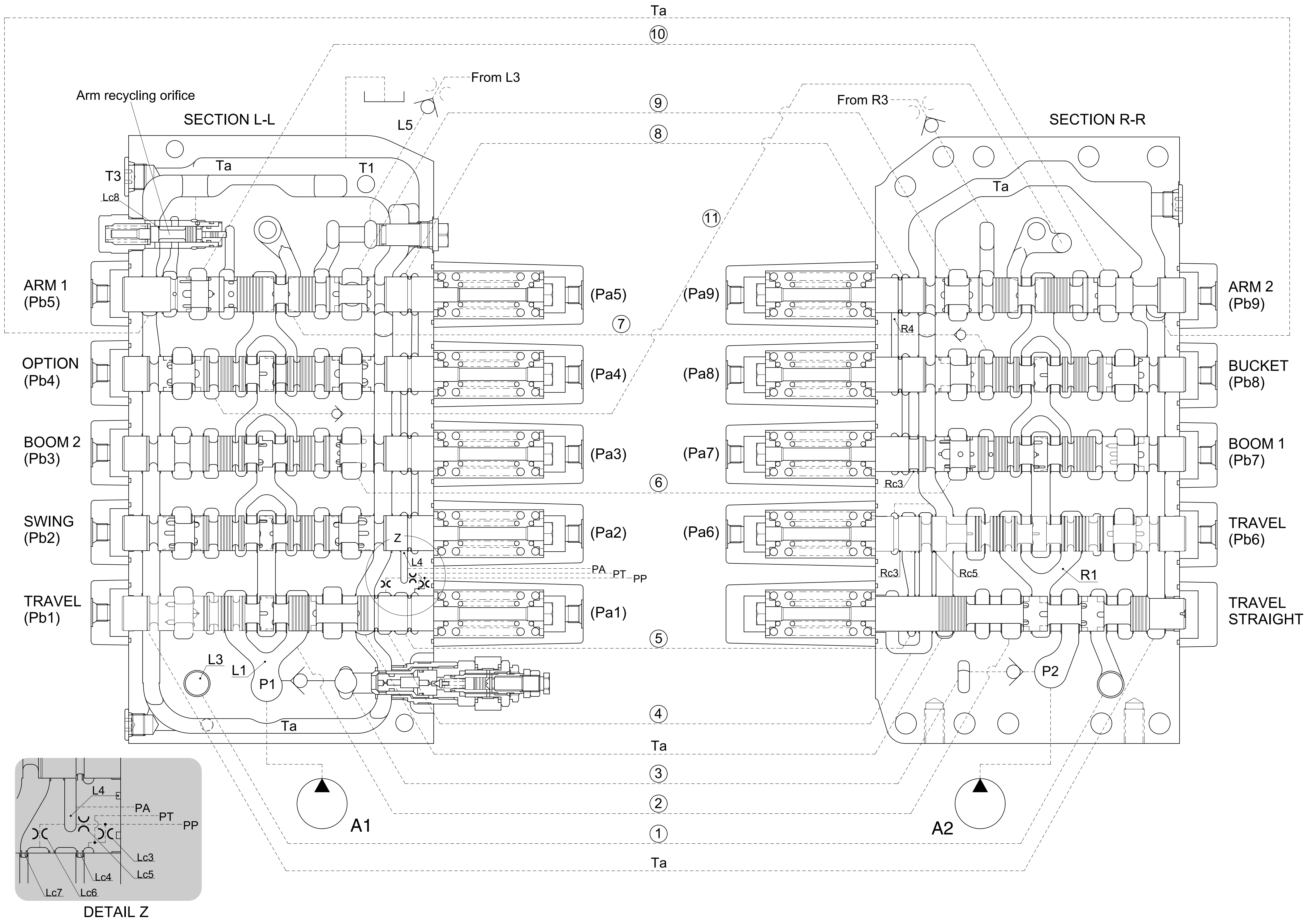
④ When a large amount of oil flows the neutral passage, the low pressure relief valves is operated. As a result, the shock pressure of port ps1, ps2 is prevented.

(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.



2) SINGLE OPERATION

(1) Travel spool

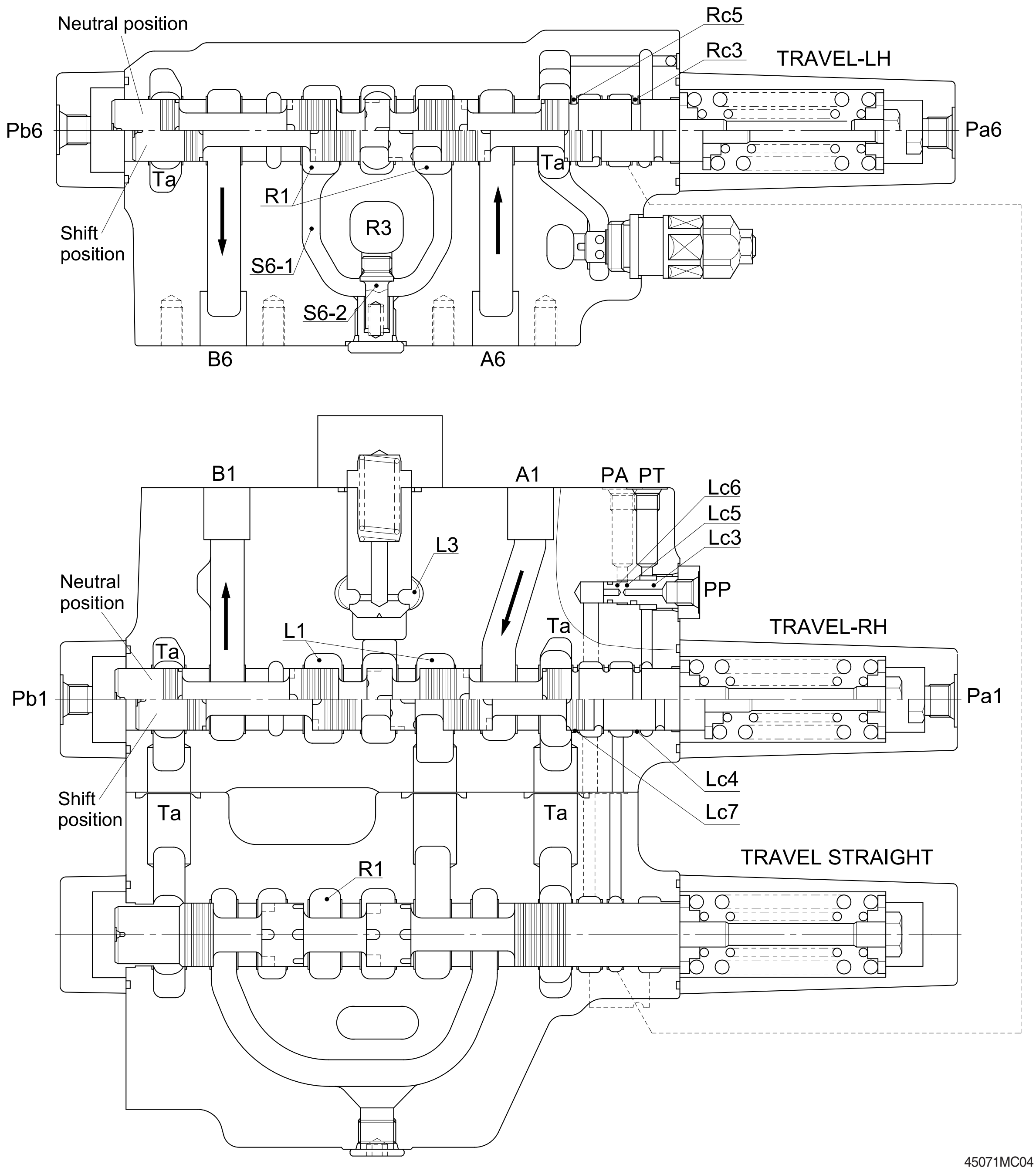
When the RH travel spool is pushed to right by the pilot pressure of port Pb1 the oil discharged from P1 port flows from the neutral passage (L1) to B1 port.

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.

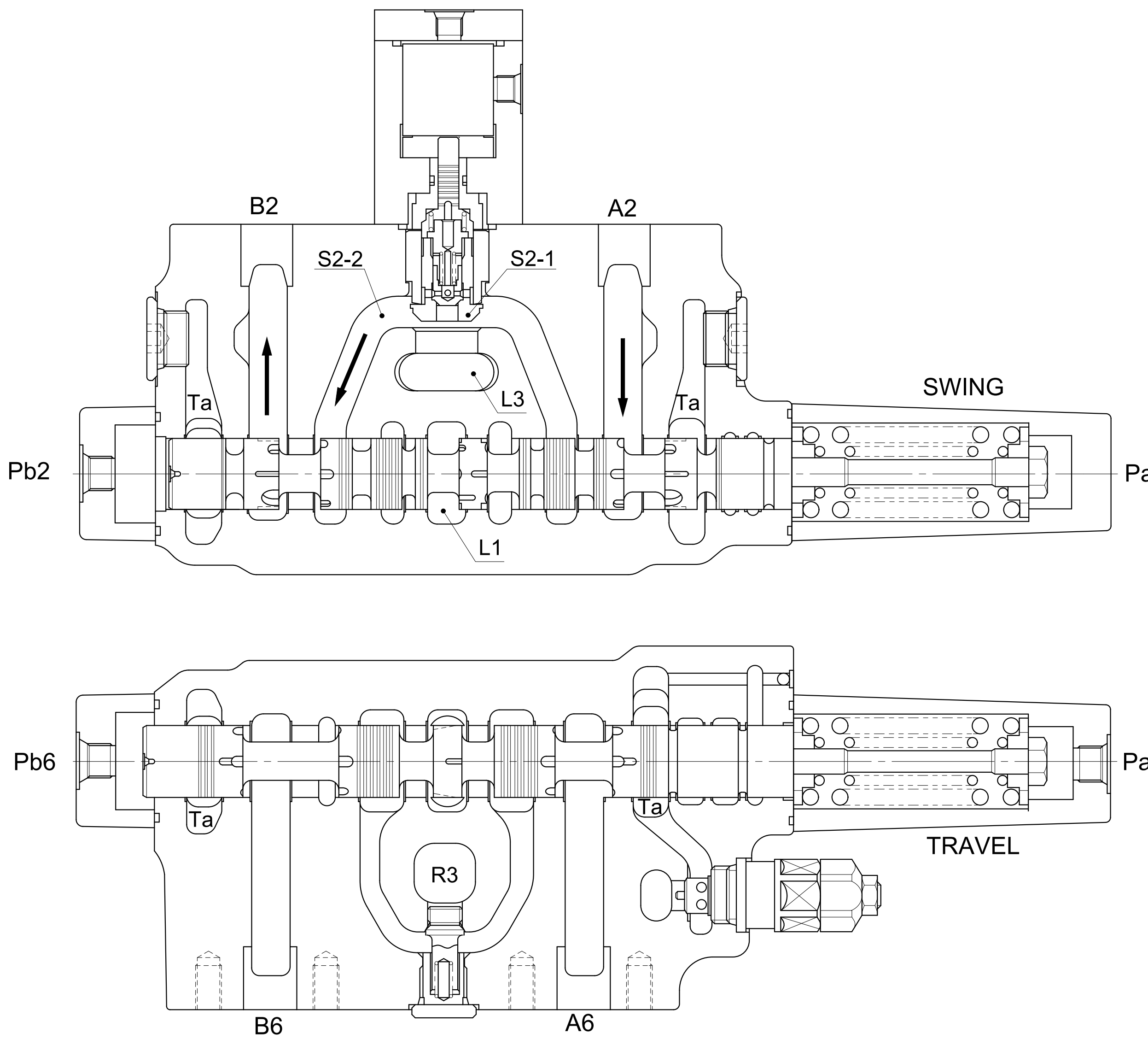


45071MC04

(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).

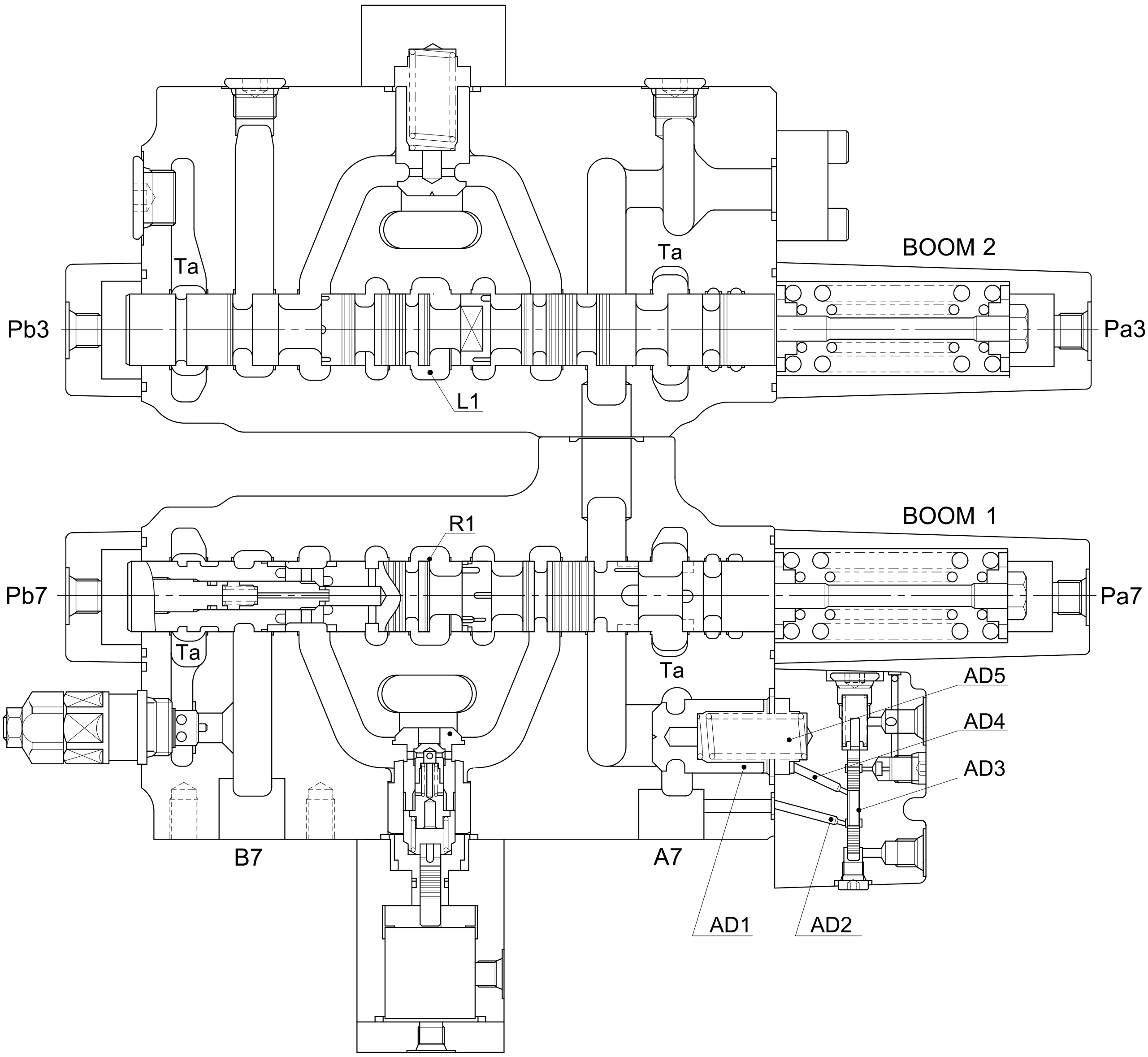


45071MC05

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).

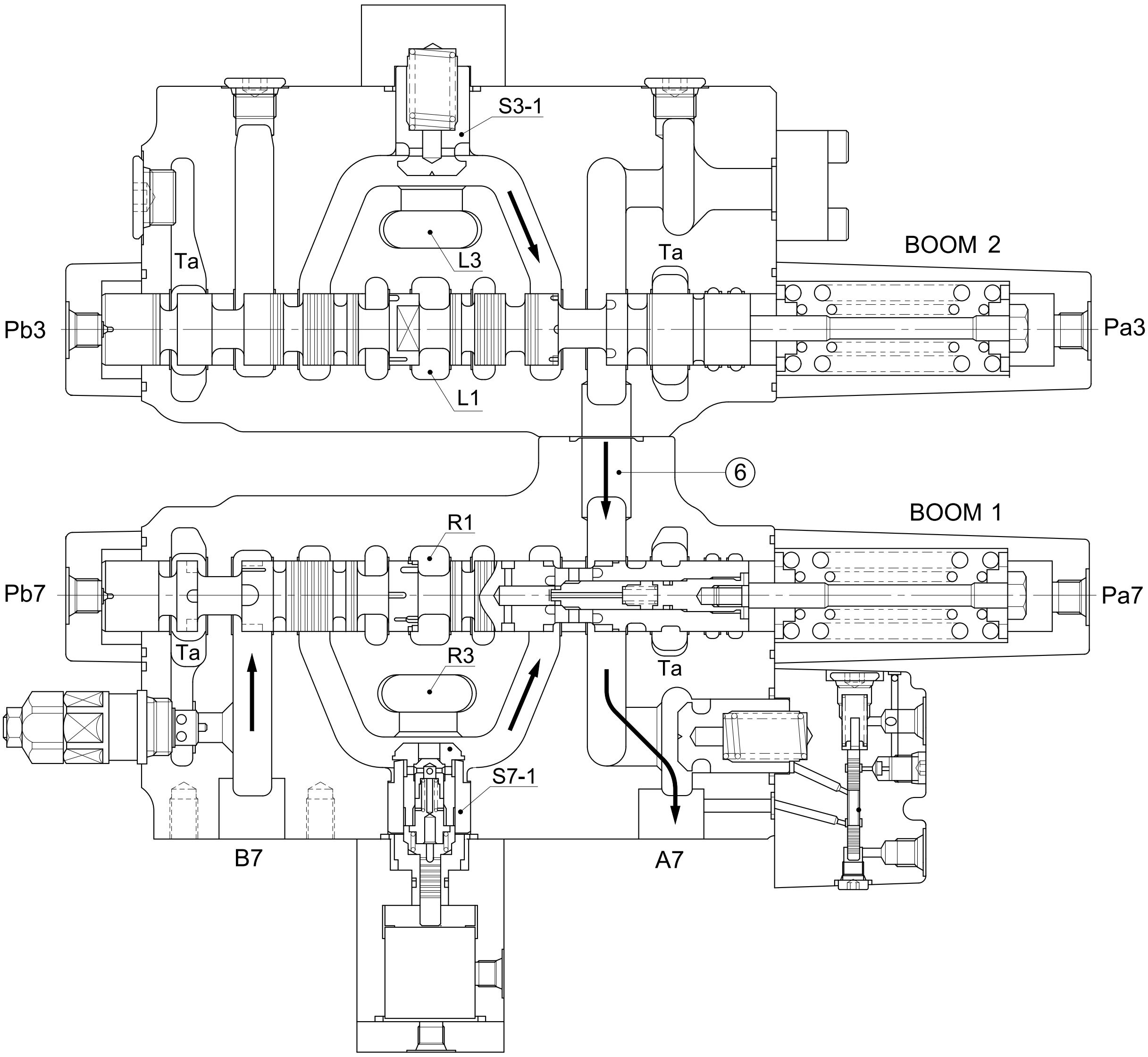


480SA2MC18

(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).

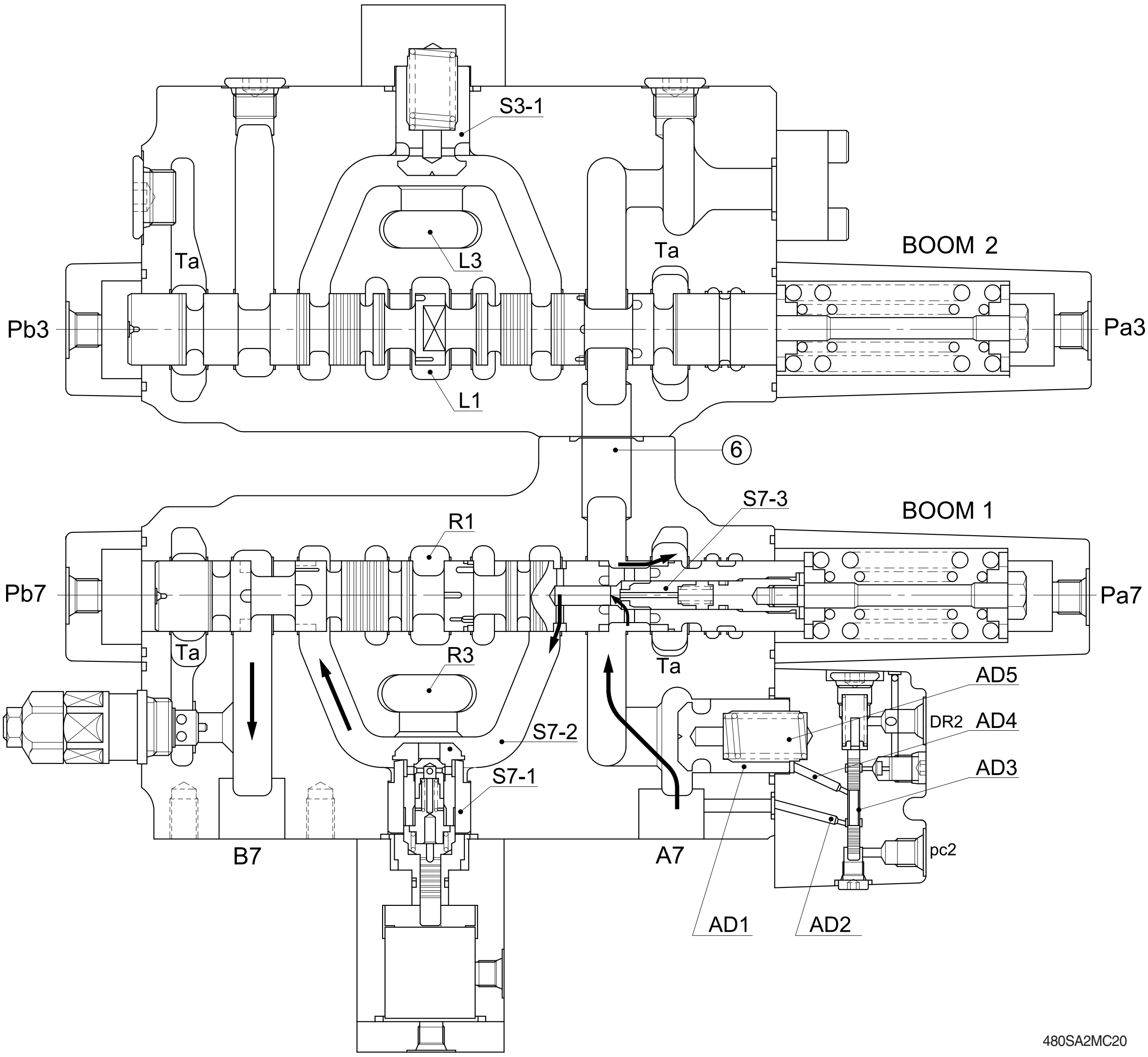


480SA2MC19

(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.



480SA2MC20

4) OPTION SPOOL

When the option 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).

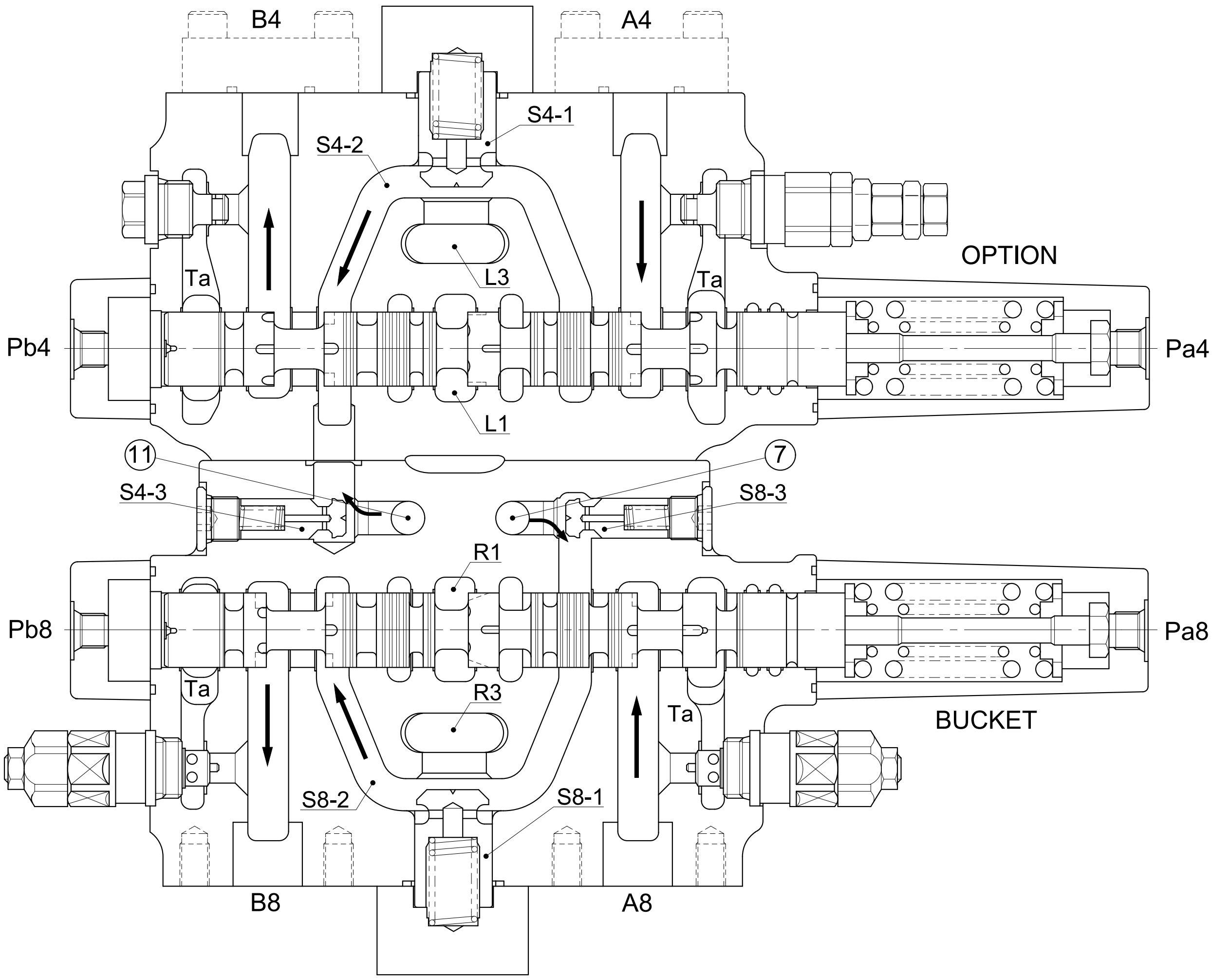
At the same time, as the port pa10 (see 2-25 page) is pressurizing and the bypass cut spool (R) is pushed, the oil discharged from pump P2 flows together into the port B7 via passage (11), poppet (S4-3). The oil returned from port A4 flows into the tank via the tank passage (Ta).

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).



480SA2MC21

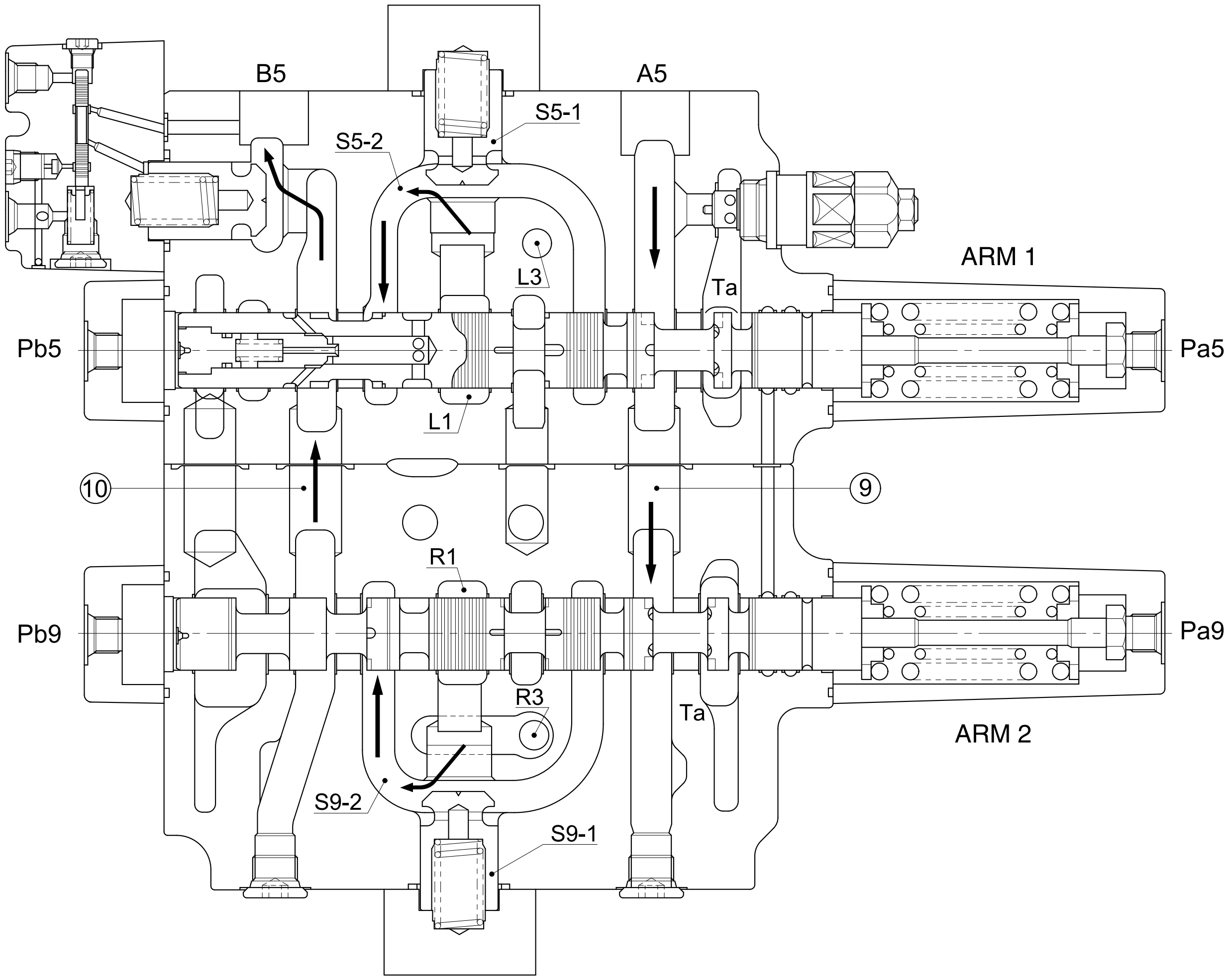
6) ARM SPOOL

(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).



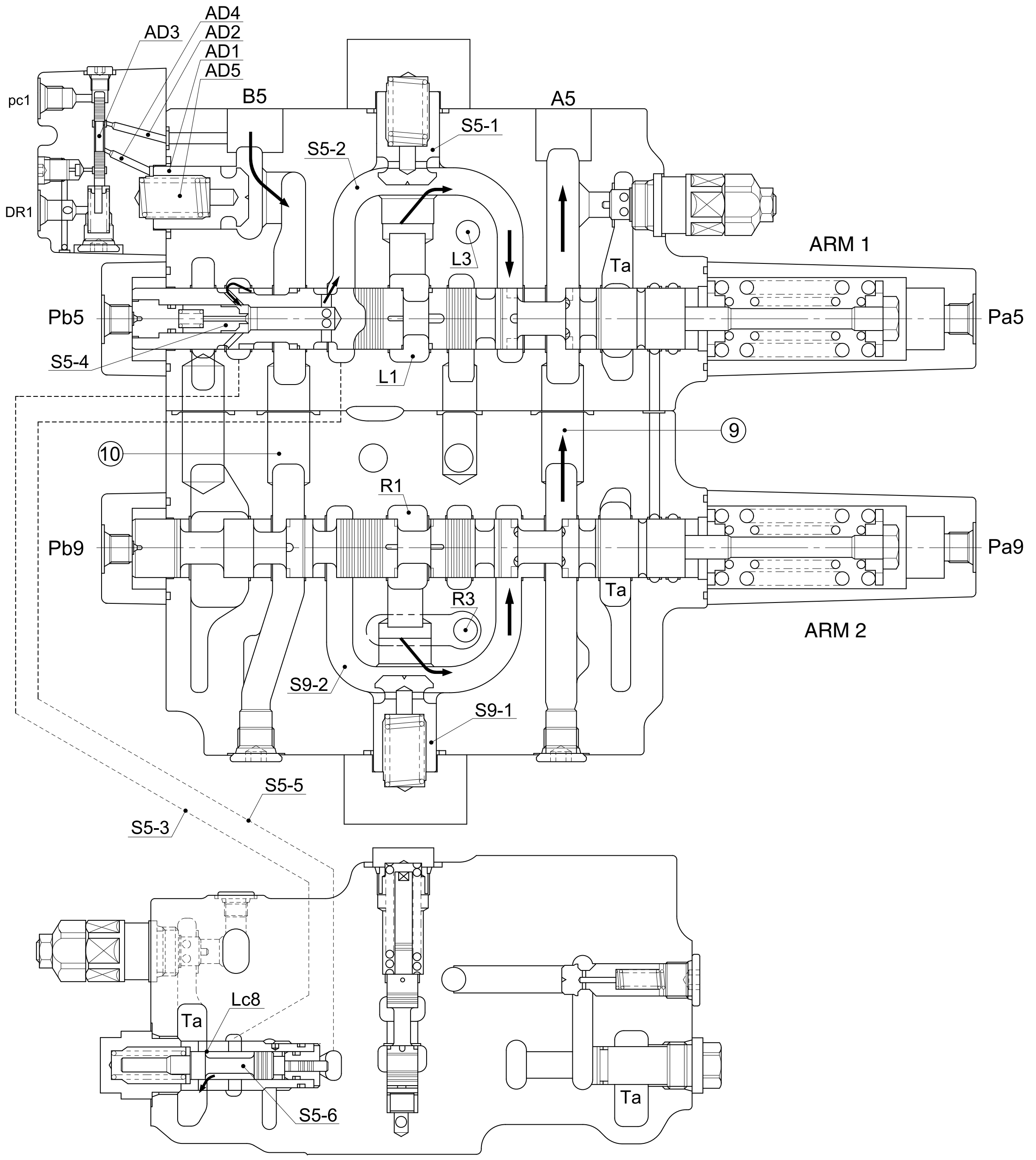
480SA2MC22

(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.



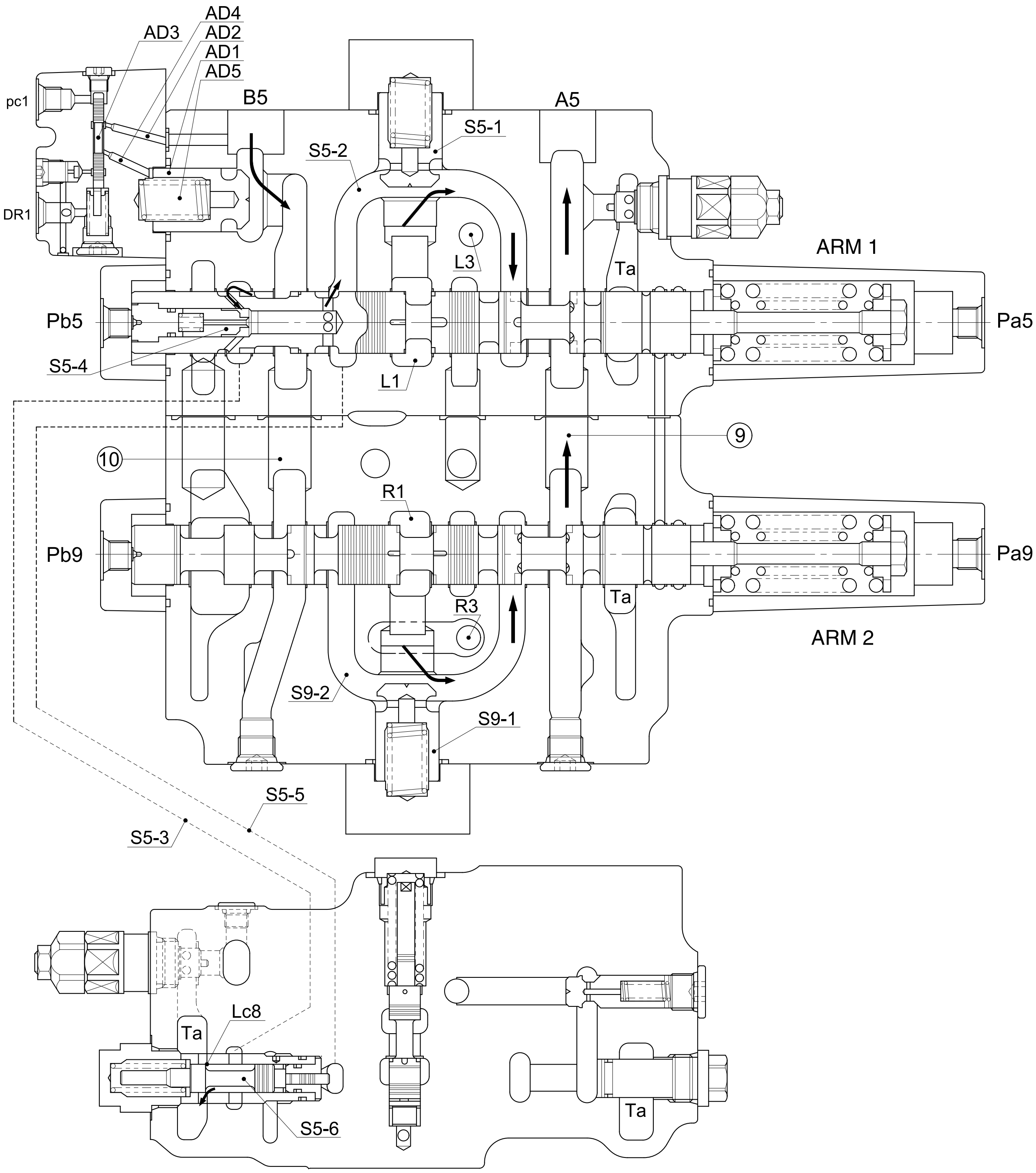
480SA2MC23

(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.



7) BYPASS CUT SPOOL

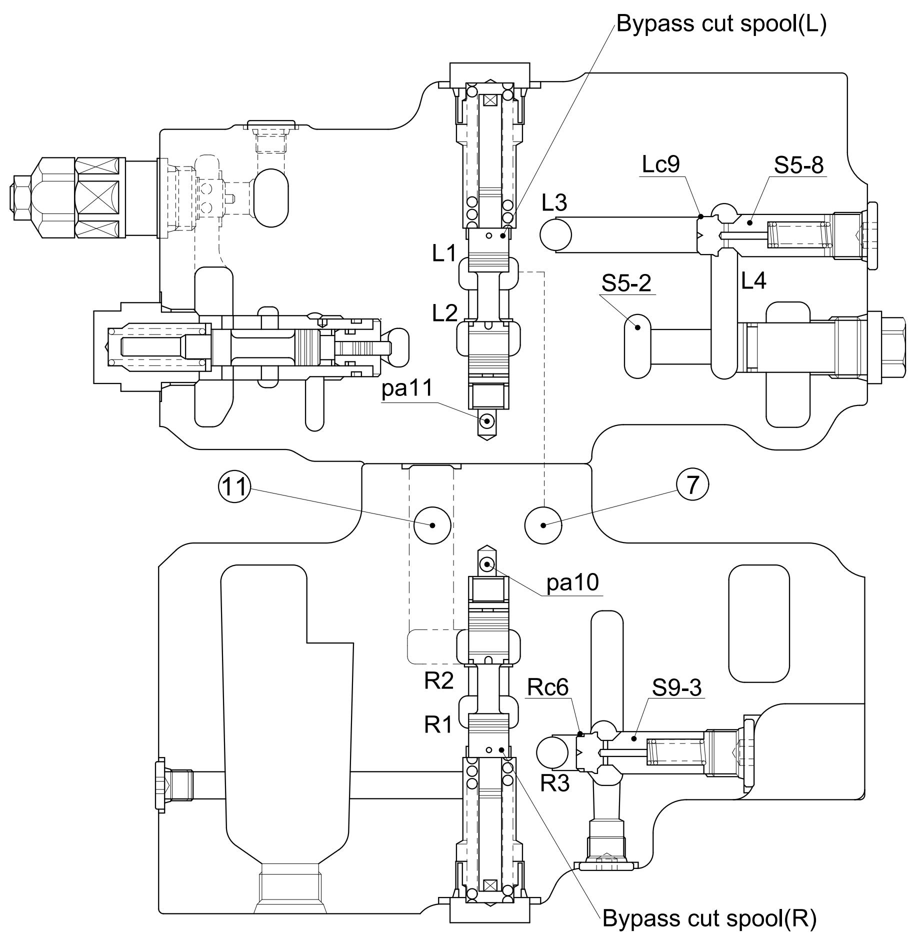
This valve is providing the bypass cut spool at the lowest stream of (upper stream of the low pressure relief valve) the neutral passage (L1, R1).

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 option 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).



480SA2MC24

9) RELIEF VALVE

(1) Main relief valve

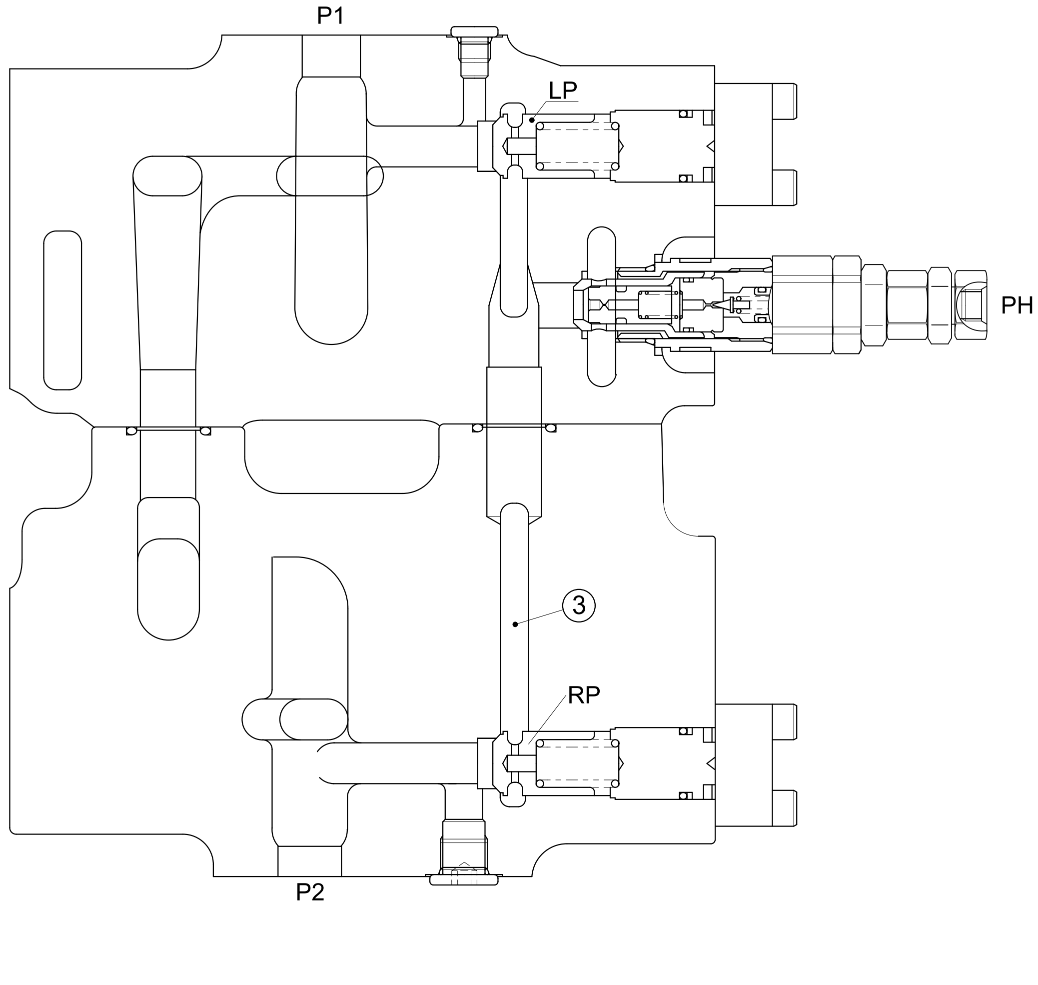
The oil discharged from P1 port via the poppet (LP) and the oil discharged from P2 port via the poppet (RP) flow into the main relief valve through the passage (3).

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.

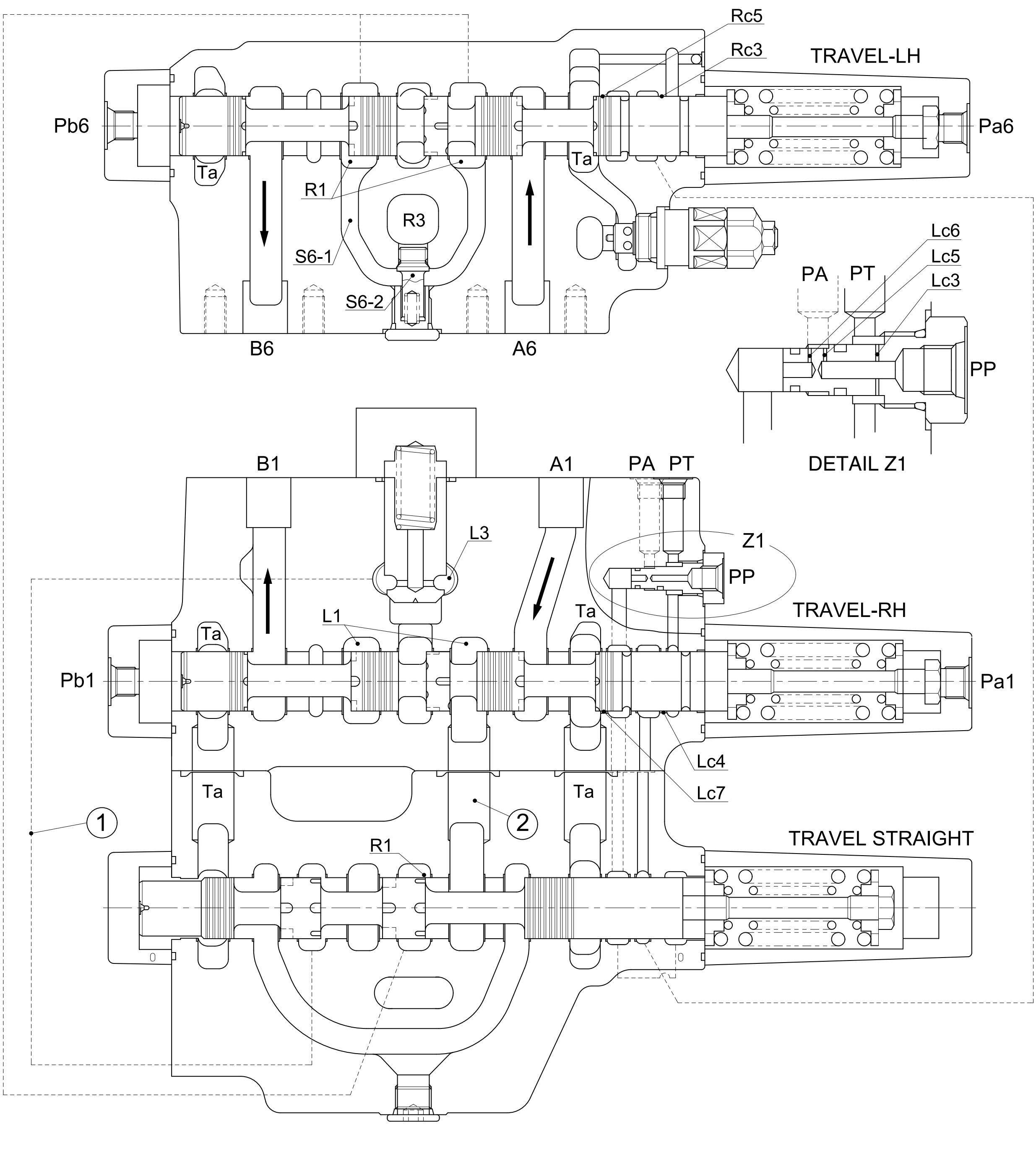


480SA2MC25

4. COMBINED OPERATION

1) TRAVEL COMBINED OPERATION

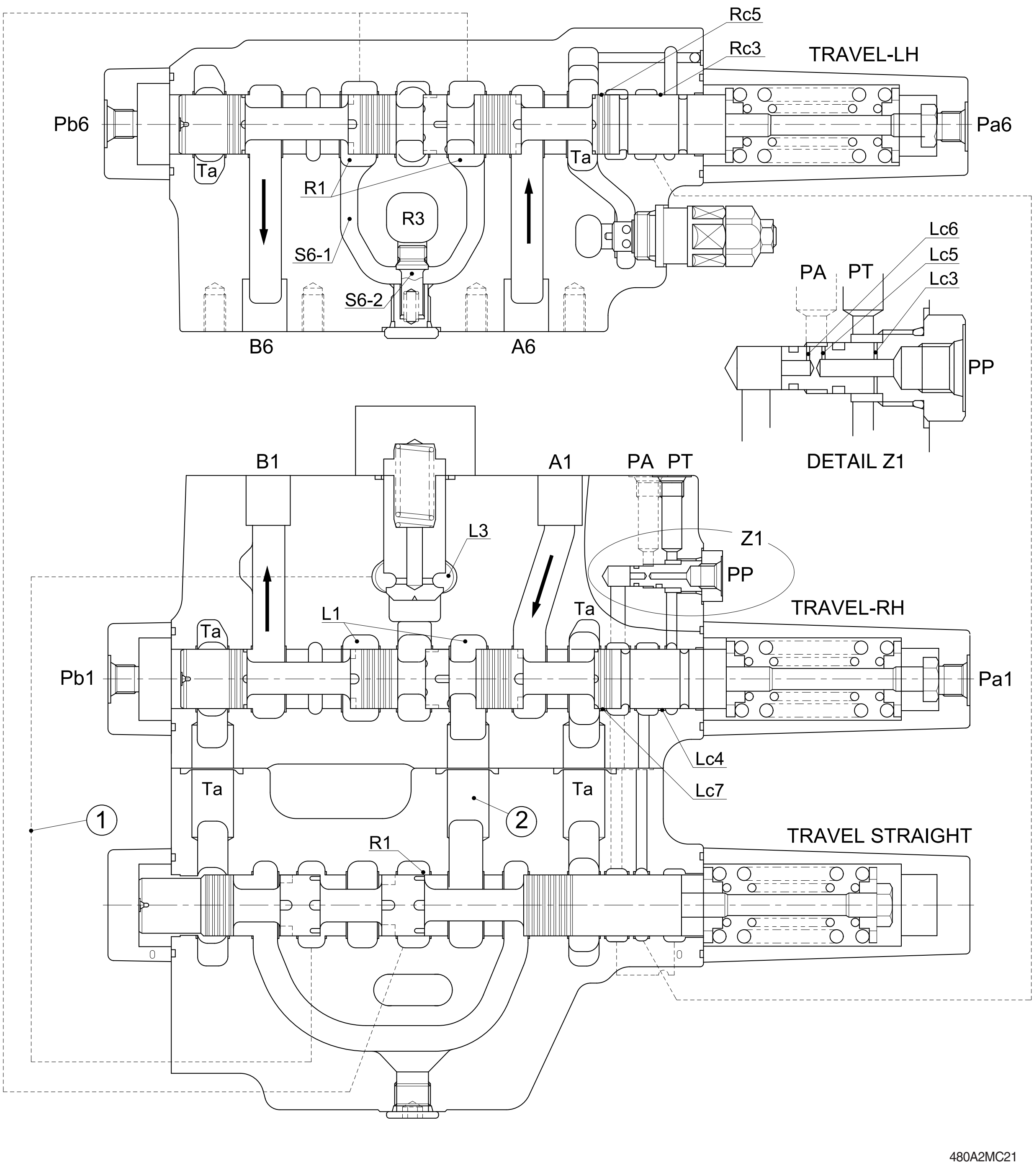
① While travel (forward, reverse and pivot turn) and front attachment (except travel section) functions are operated, the oil discharged from port PP is cut via land (Lc4, Lc7, Rc3, Rc5) and blocked from signal land except travel section to tank passage (Ta), the pressure of signal passage rises to the 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).

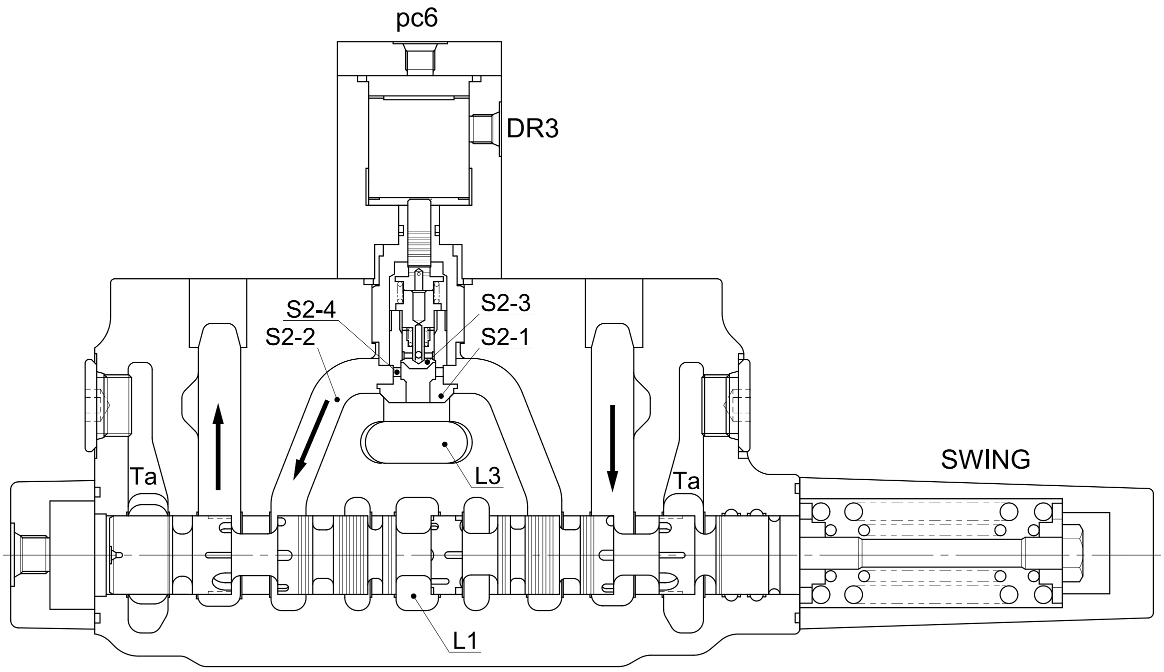
③ In case the load pressure of the section except travel is higher than that of the RH travel section, the partial oil of discharged from port P2 pushes open the poppet (S6-2) and flows together into the passage (S6-1) through the orifice at the edge of poppet. The travel (LH, RH) is operated by the 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.



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

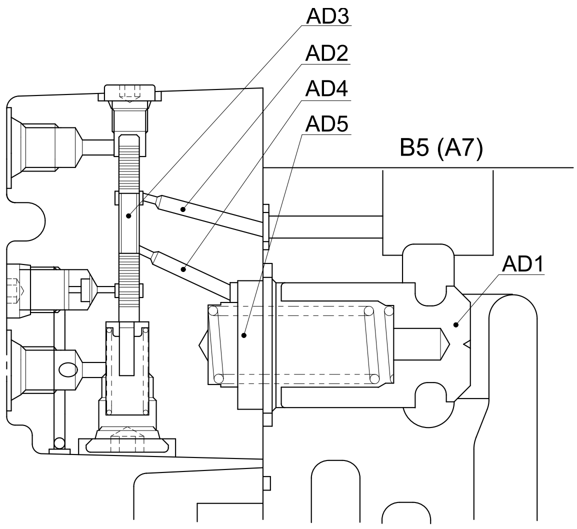
The oil from pump flows into cylinder by pushes open the poppet (AD1).

3) WHEN BOOM DOWN OR ARM IN

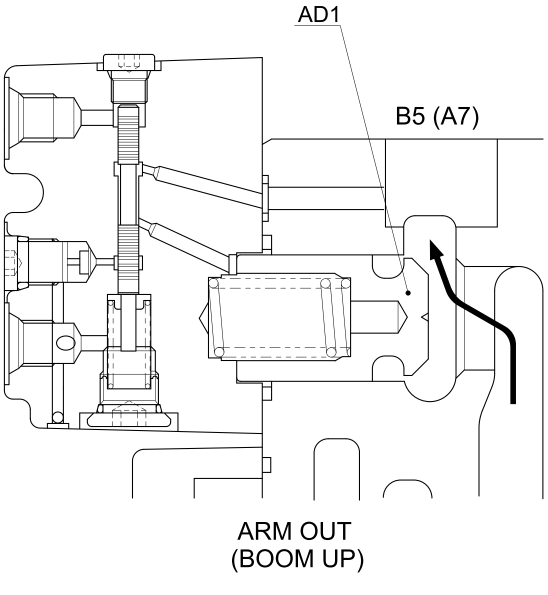
The spool (AD3) is pushed down by the pressure of pc1 (pc2).

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

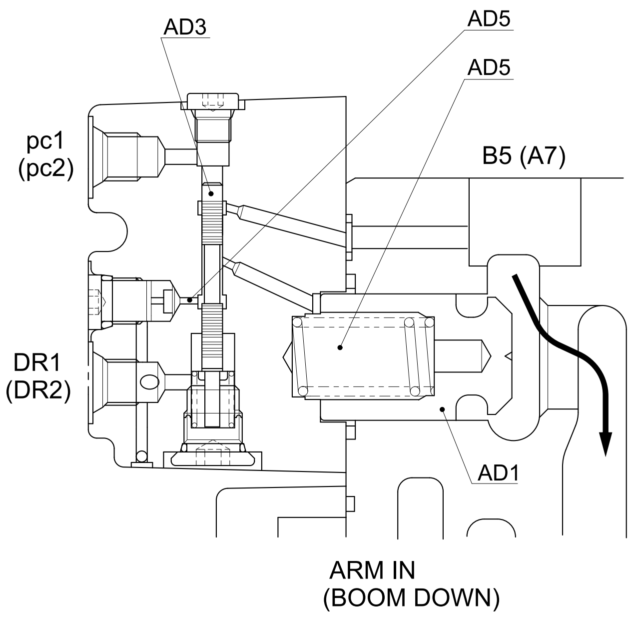
As a result, the oil from the cylinder port returns to tank passage (Ta).



NEUTRAL



ARM OUT
(BOOM UP)



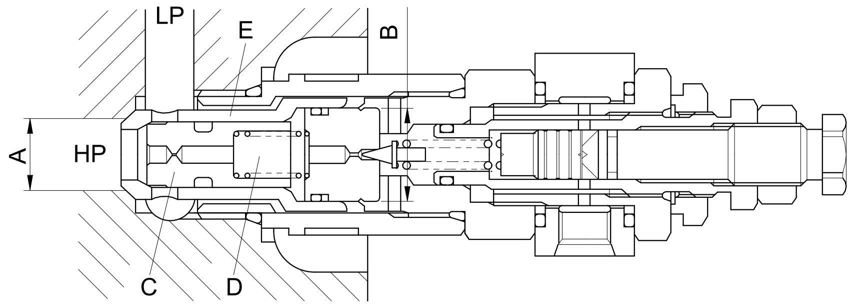
ARM IN
(BOOM DOWN)

45071MC16

6. RELIEF VALVE OPERATION

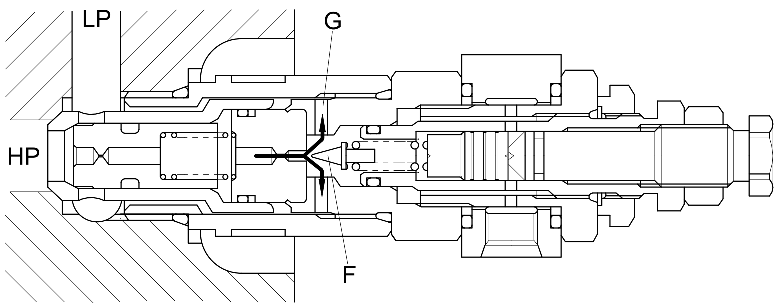
1) MAIN RELIEF VALVE

(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.



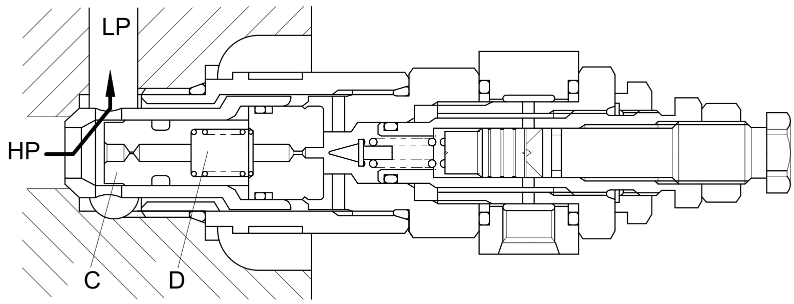
45071MC17

(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).



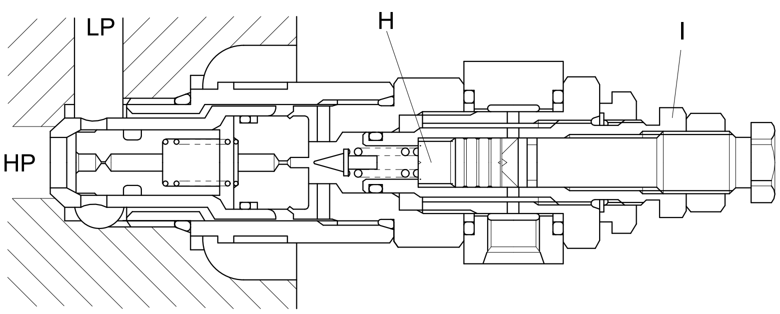
45071MC17-1

(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

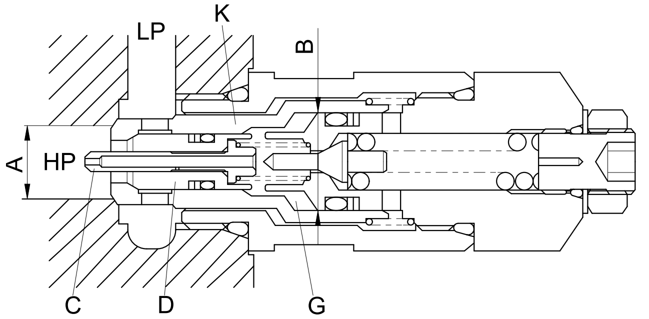
(4) High pressure setting pilot signal (Pi) : ON
The piston (H) moves to left by pilot pressure (Pi); set pressure of spring rises, making high pressure setting.



45071MC17-3

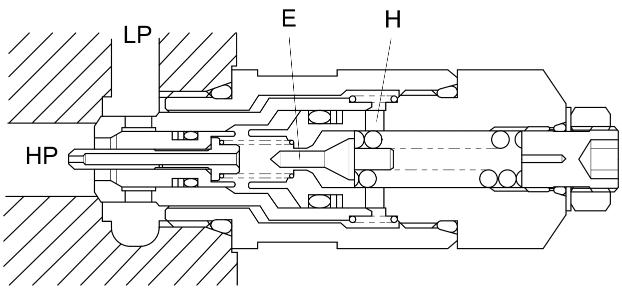
2) OVERLOAD RELIEF VALVE

(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.



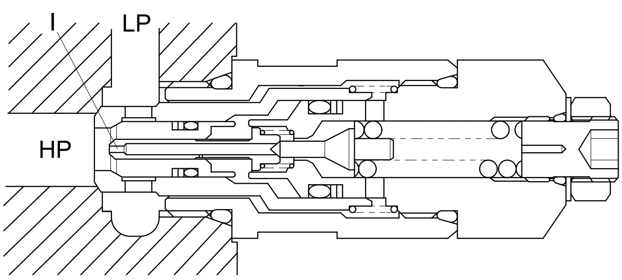
45071MC18

(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

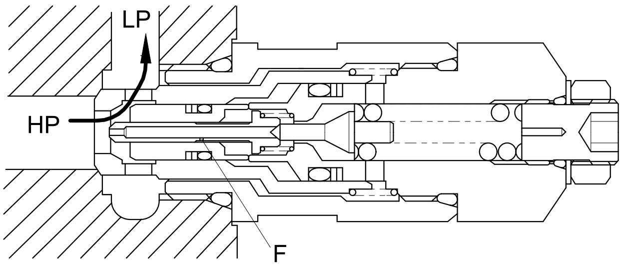
(3) When above flow is formed, the pilot poppet (E) is opened.
The pressure drops before and behind orifice (I); piston (C) moves to right and the piston (C) is seated at the tip of poppet (E).



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).

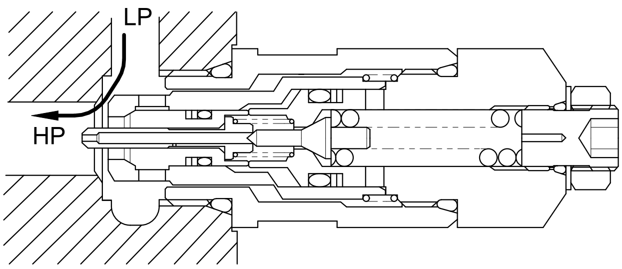


45071MC18-3

(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).

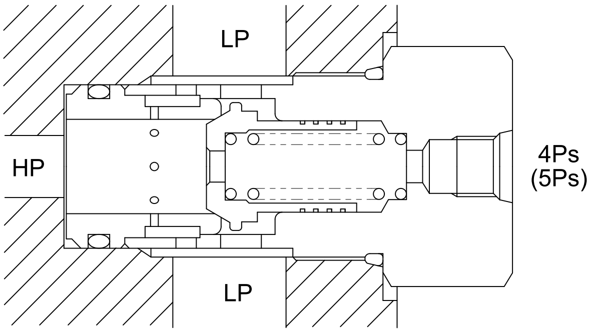
Thus the sleeve (K) and the main poppet (D) are securely seated by difference area of A and B.



45071MC18-4

3) LOW PRESSURE RELIEF VALVE

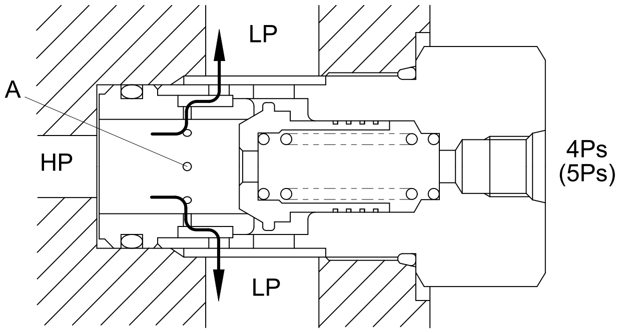
(1) When pump does not operational



45071MC19

(2) When spool neutral

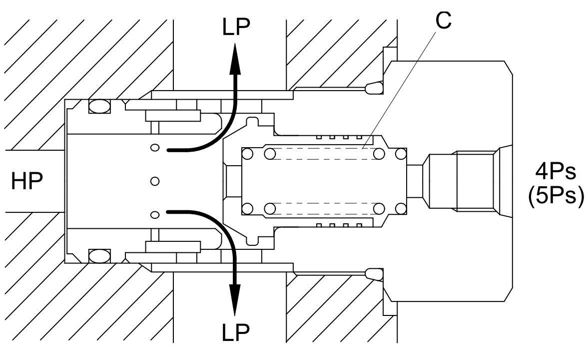
The neutral passage (HP) oil flows into the low pressure passage (LP) via signal orifice (S).
The signal port 4Ps (5Ps) pressure is raise by negative control orifice (A).



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.



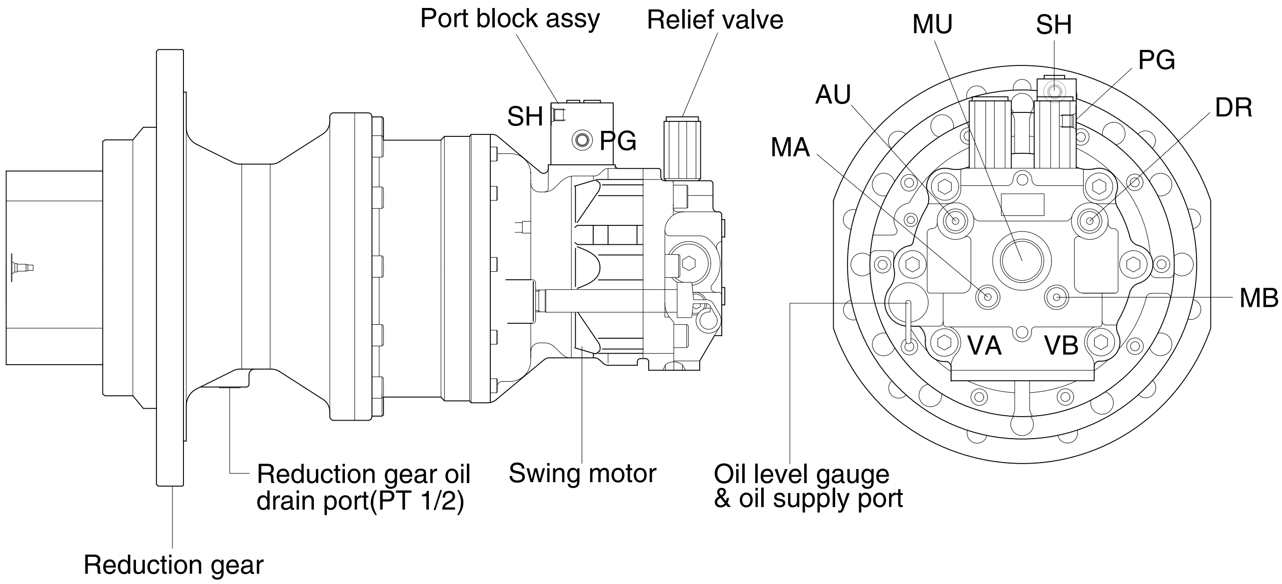
45071MC19-2

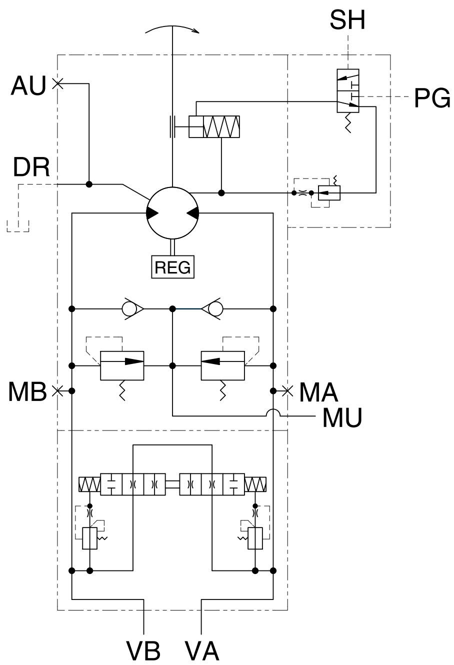
GROUP 3 SWING DEVICE

1. STRUCTURE

Swing device consists swing motor, swing reduction gear.

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



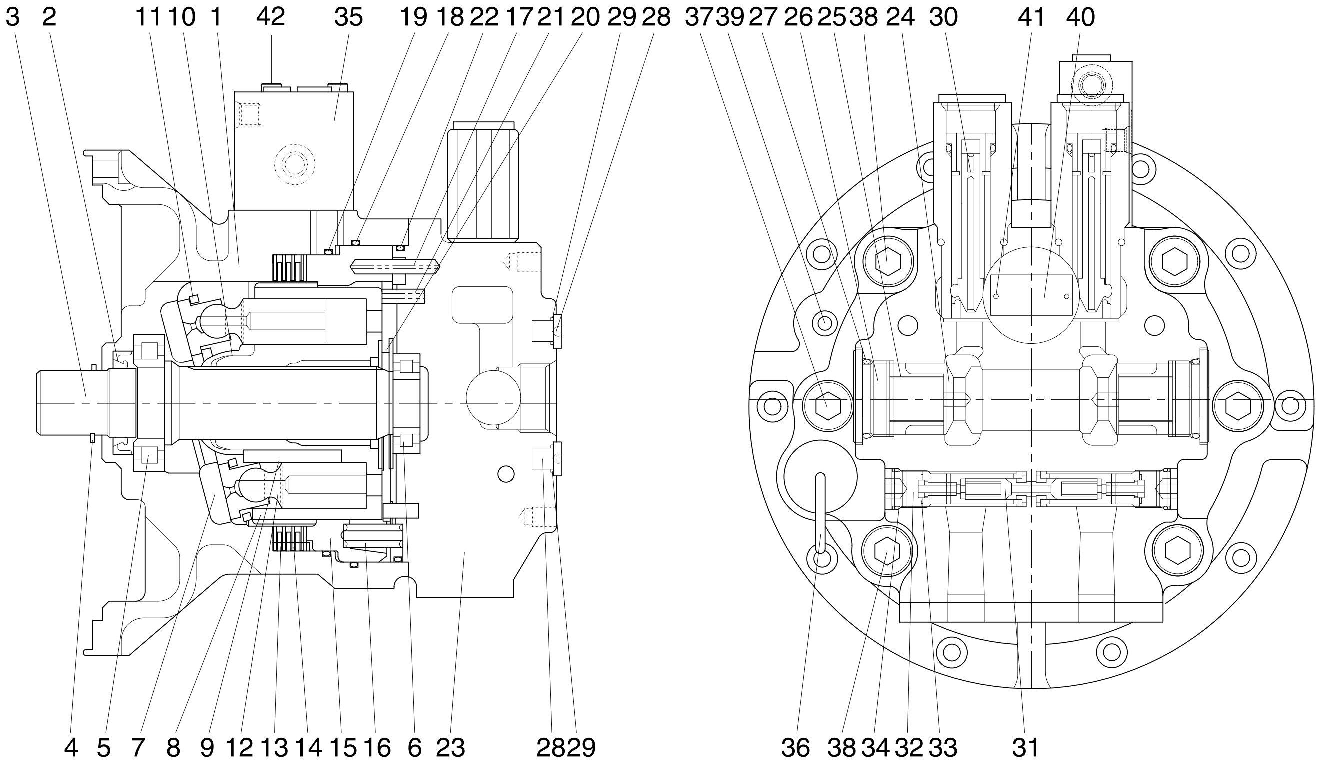


Hydraulic circuit

480SA2SM01

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
SH	Brake pilot port	PF 1/4

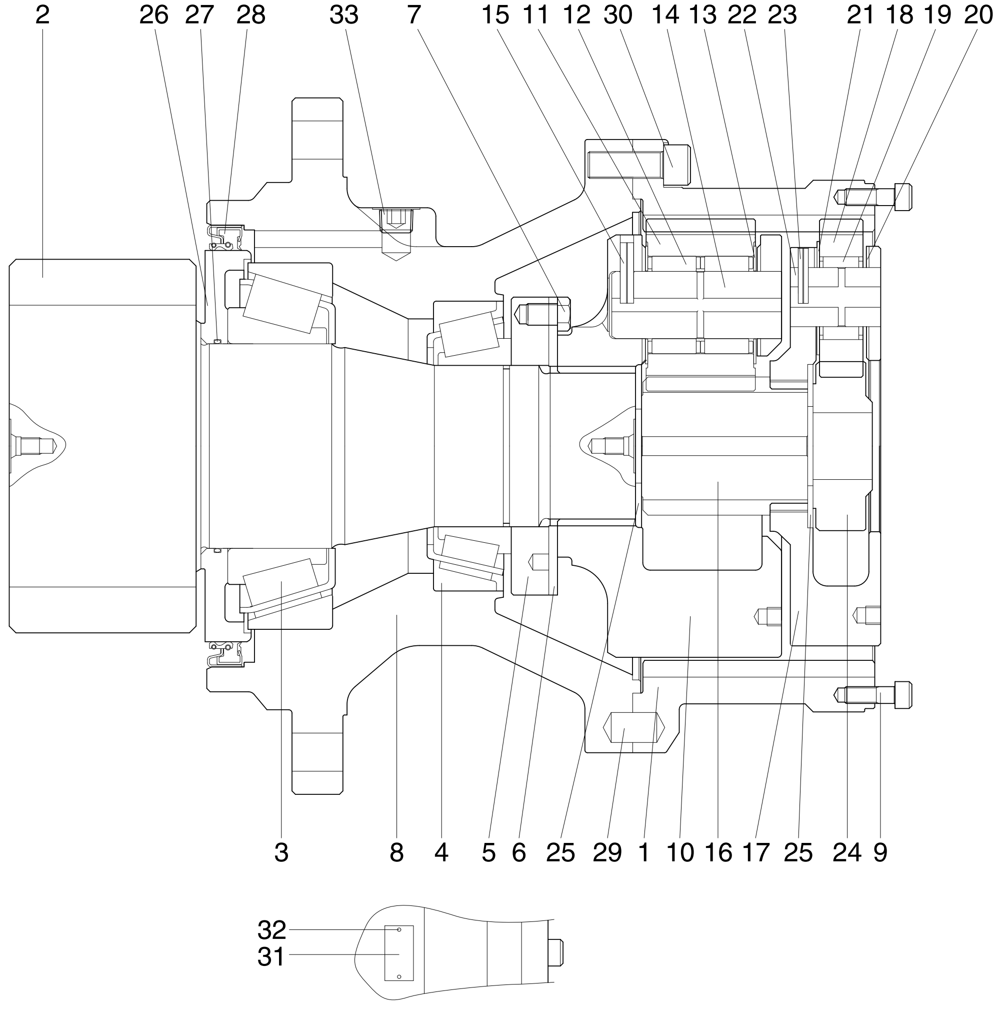
1) SWING MOTOR



480SA2SM02

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	Retaining 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 kit	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	Hexagon 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

2.1 Generating the turning force

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

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

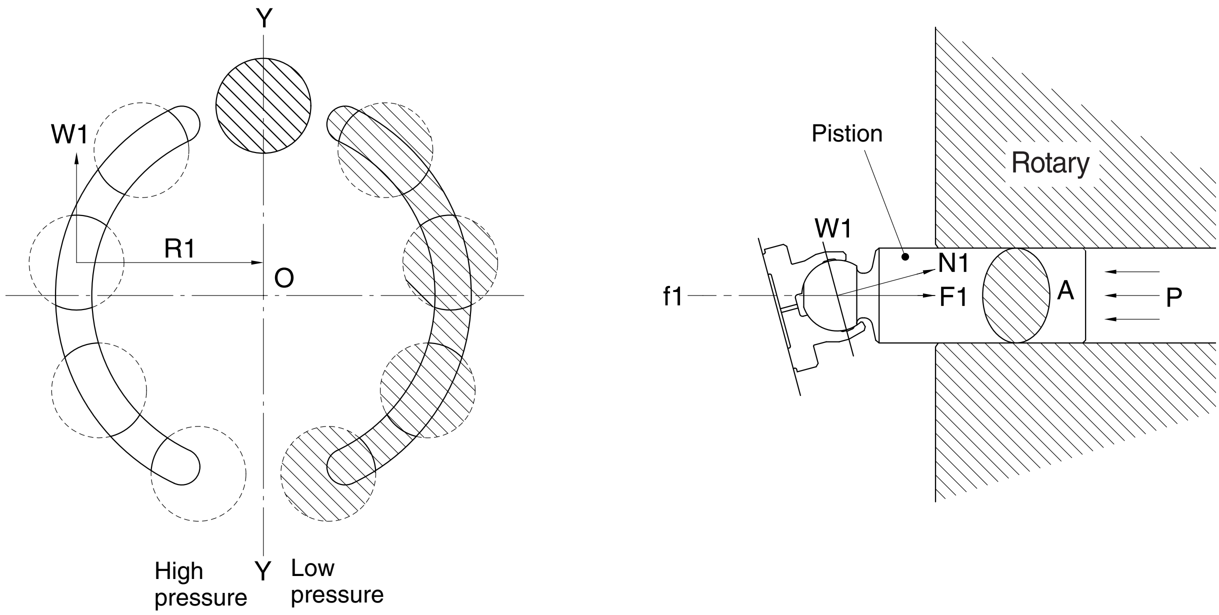
The high hydraulic can generate the force, $F1=P \times A$ (P : supplied pressure, A : water pressure area), like following pictures, working on a piston.

This force, F1, is divided as N1 thrust partial pressure and W1 radial partial pressure, in case of the plate 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 ($\Sigma W1 \times R1$), generated from each piston (4~5 pieces) on the side of a high hydraulic, generates the turning force.

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



21078TM05

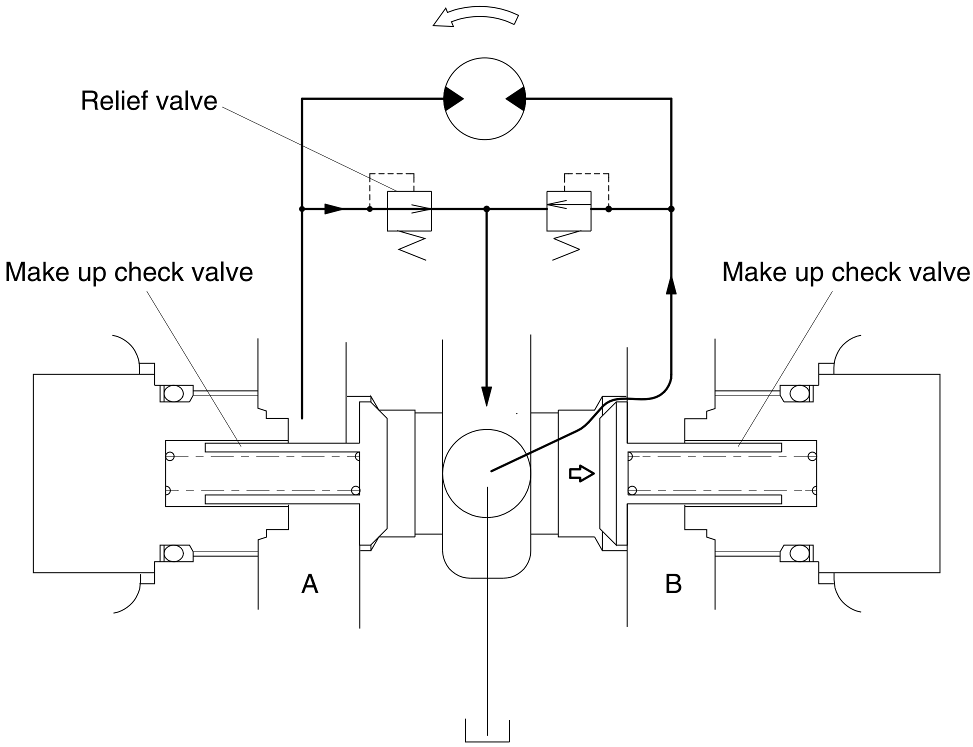
2) MAKE UP VALVE

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

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

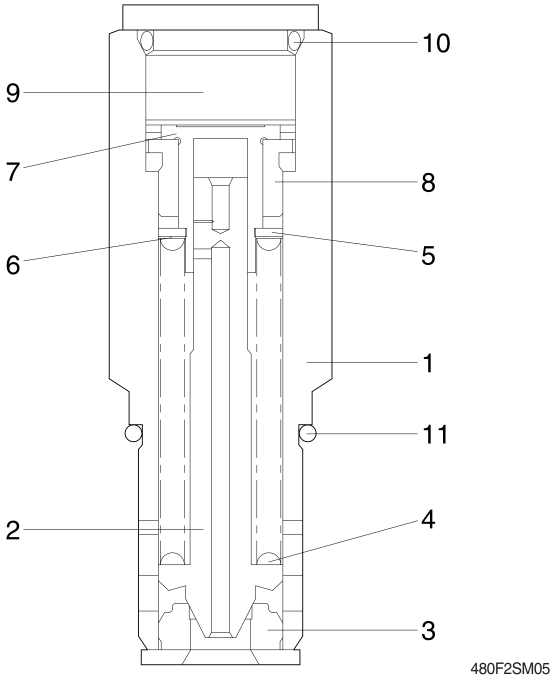
Pressurized oil into the port B, the motor rotate counterclockwise.

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



21092SM04

3) RELIEF VALVE



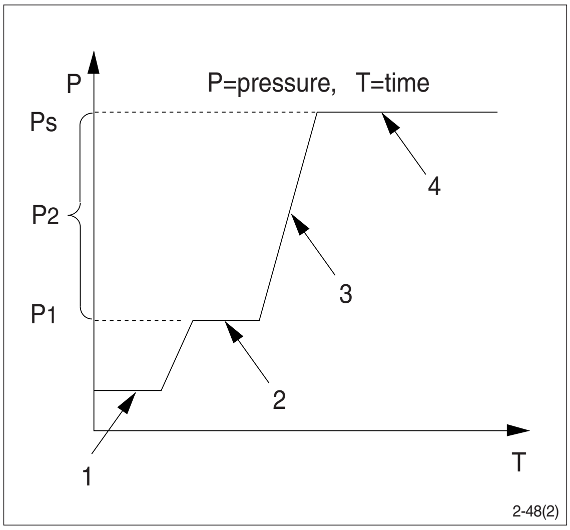
1	Sleeve
2	Poppet
3	Poppet seat
4	Spring
5	Spring seat
6	Shim
7	Piston
8	Stopper
9	Plug
10	O-ring
11	O-ring

(1) Construction of relief valve

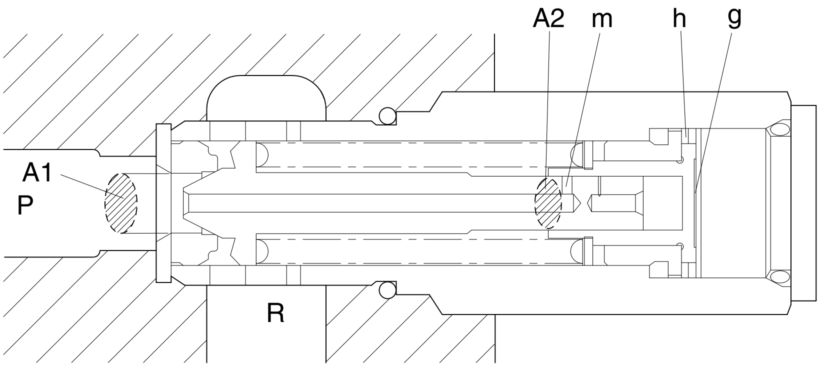
The valve casing contains two cartridge type relief valves that stop the regular and reverse rotations of the hydraulic motor. The relief valves relieve high pressure at start or at stop of swing motion and can control the relief pressure in two steps, high and low, in order to insure smooth operation.

(2) Function of relief valve

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



① Ports (P,R) at tank pressure.

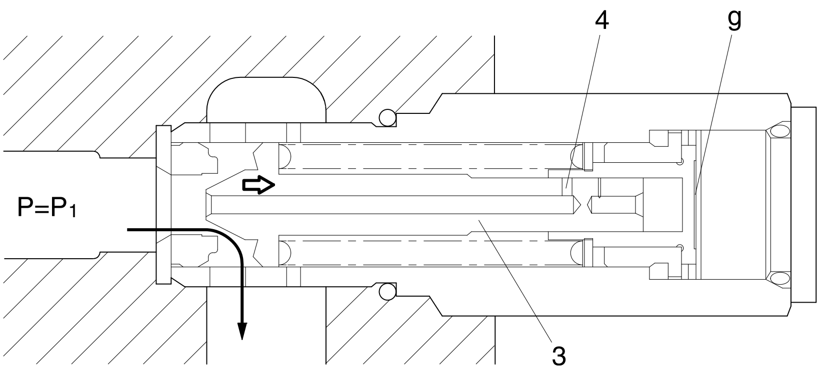


480F2SM06

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

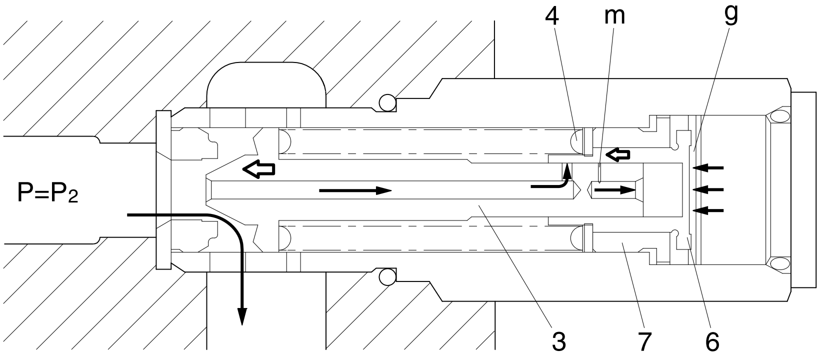
$P_1 \times A_1 = Fsp + Pg \times A_2$

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



480F2SM07

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

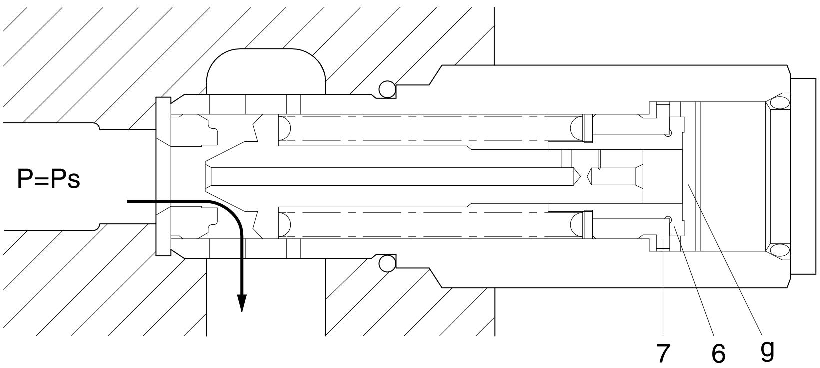


480F2SM08

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

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

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



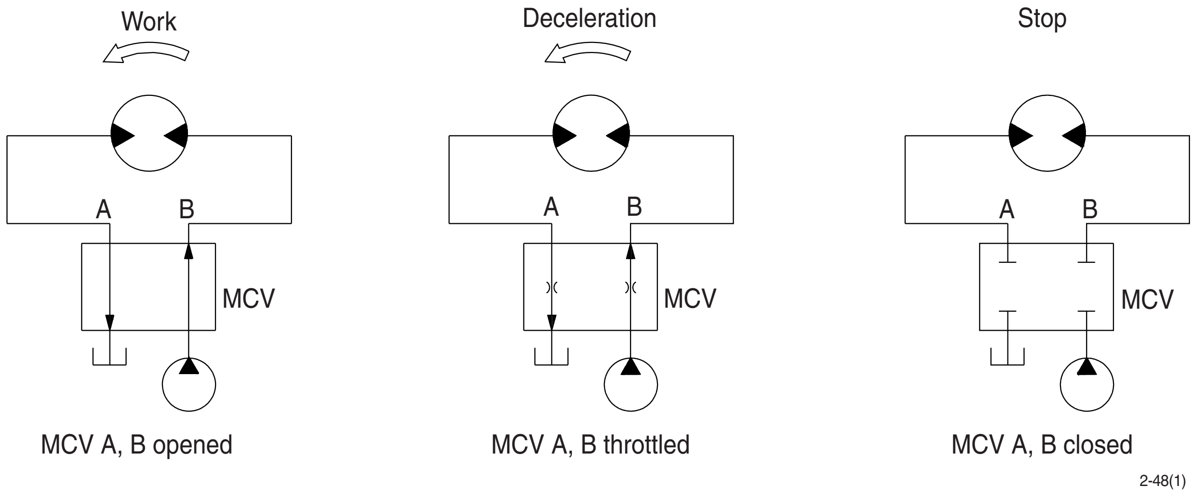
480F2SM09

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.



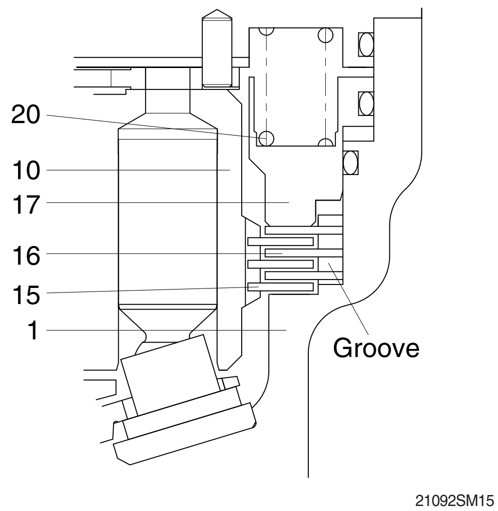
(2) Mechanical swing parking brake system

This is function as a parking brake only when all of the RCV lever (except travel pedal) are not operated.

① Brake assembly

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

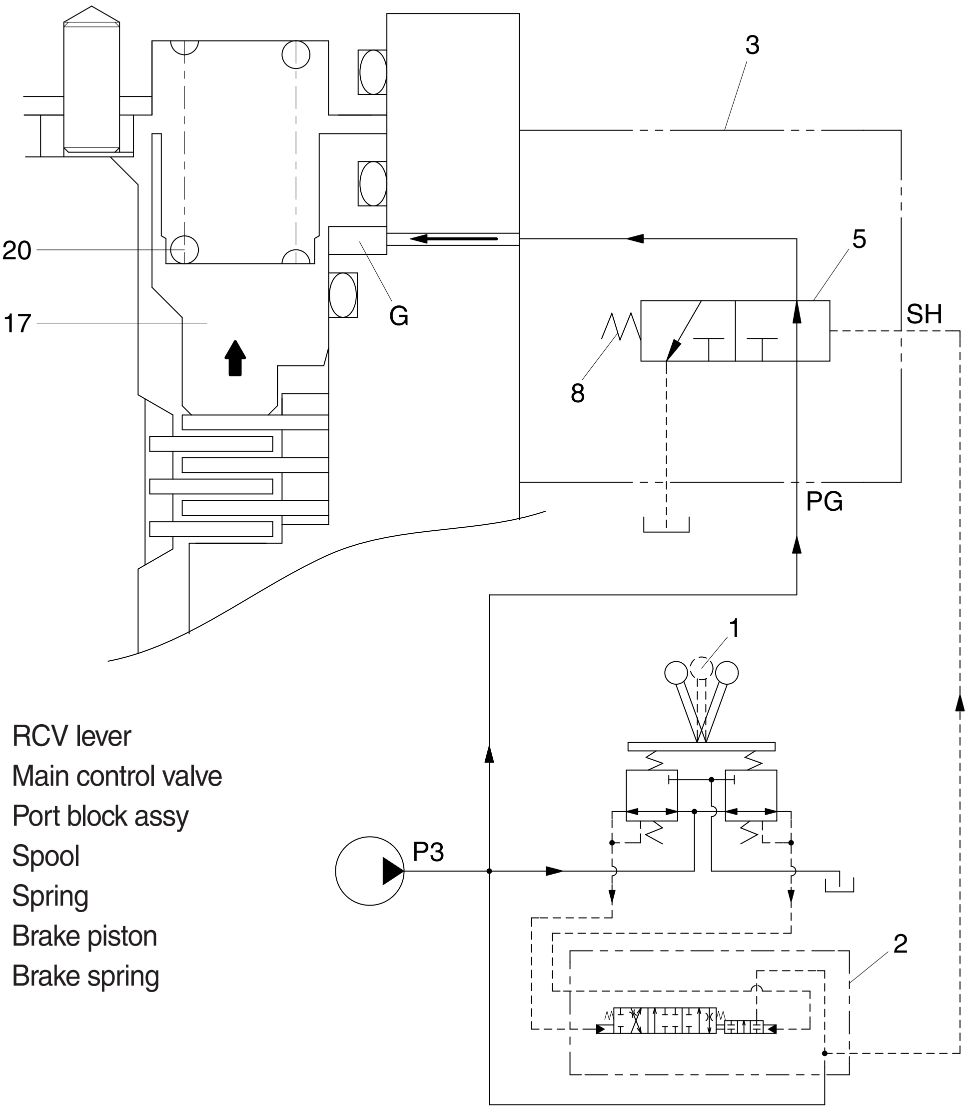
Cylinder block (10) is constrained by this friction force and brake acts, while brake releases when hydraulic force exceeds spring force.



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

② Operating principle

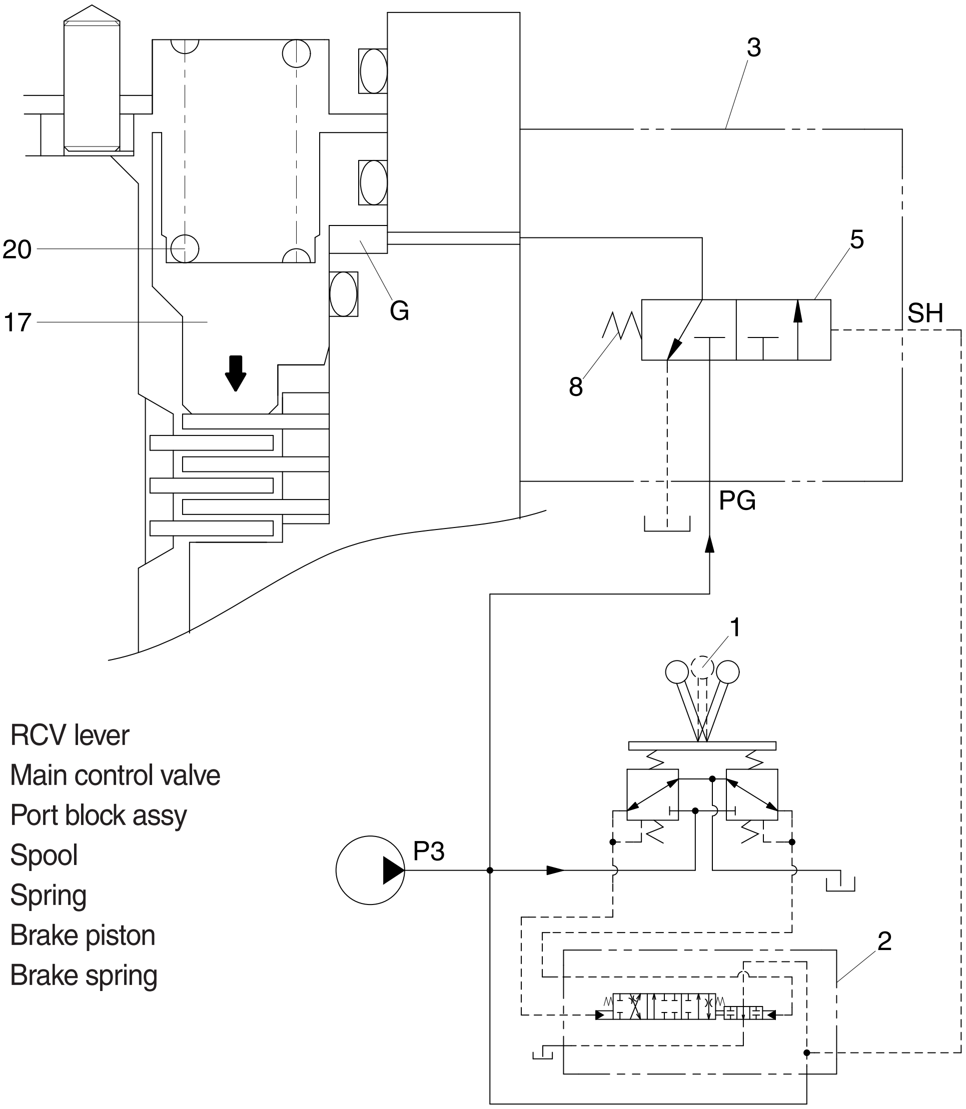
a. When one of the RCV lever (1) is set to the operation position, the each spool is shifted to left or right and the pilot oil flow is blocked. Then the pilot oil go to SH of the port block assy (3).
This pressure moves spool (5) to the leftward against the force of the spring(8), so pilot pump charged oil (P3) goes to the chamber G through port PG.
This pressure is applied to move the piston (16) to the upward against the force of the spring (19). Thus, it releases the brake force.



1	RCV lever
2	Main control valve
3	Port block assy
5	Spool
8	Spring
16	Brake piston
19	Brake spring

48092SM04

b. When all of the RCV lever (1) are set the neutral position, the spool (5) returns to right.
Then, the piston (16) is moved lower by spring force and the return oil from the chamber G flows back to tank port.
At this time, the brake works.



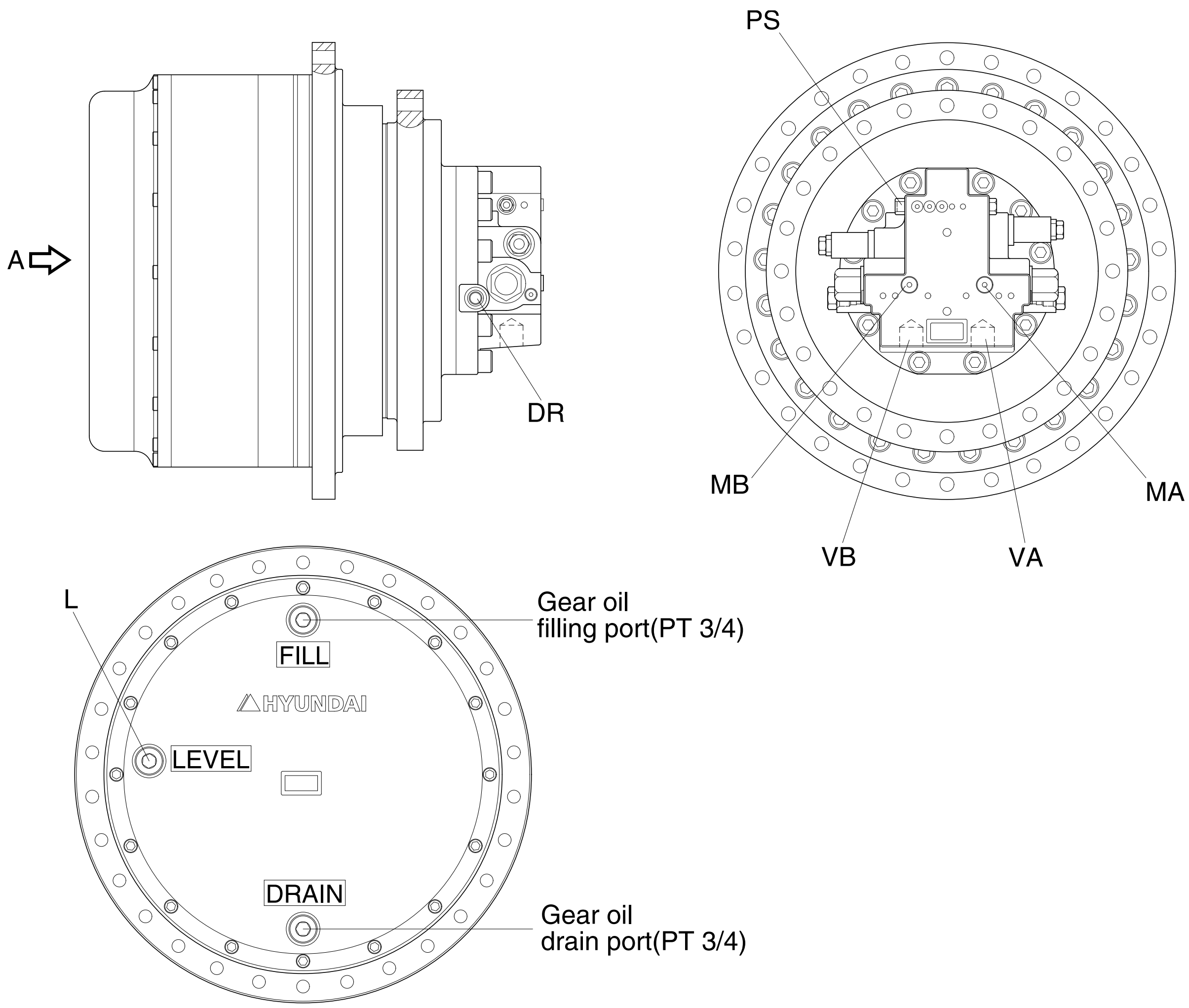
1	RCV lever
2	Main control valve
3	Port block assy
5	Spool
8	Spring
16	Brake piston
19	Brake spring

48092SM05

GROUP 4 TRAVEL DEVICE (TYPE 1, 2)

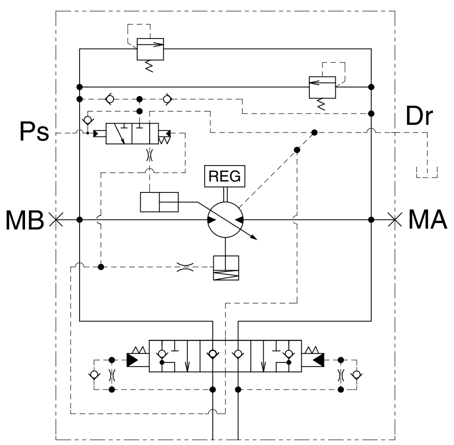
1. CONSTRUCTION

Travel device consists travel motor and gear box.
Travel motor includes brake valve, parking brake and high/low speed changeover mechanism.



VIEW A

480F2TM01

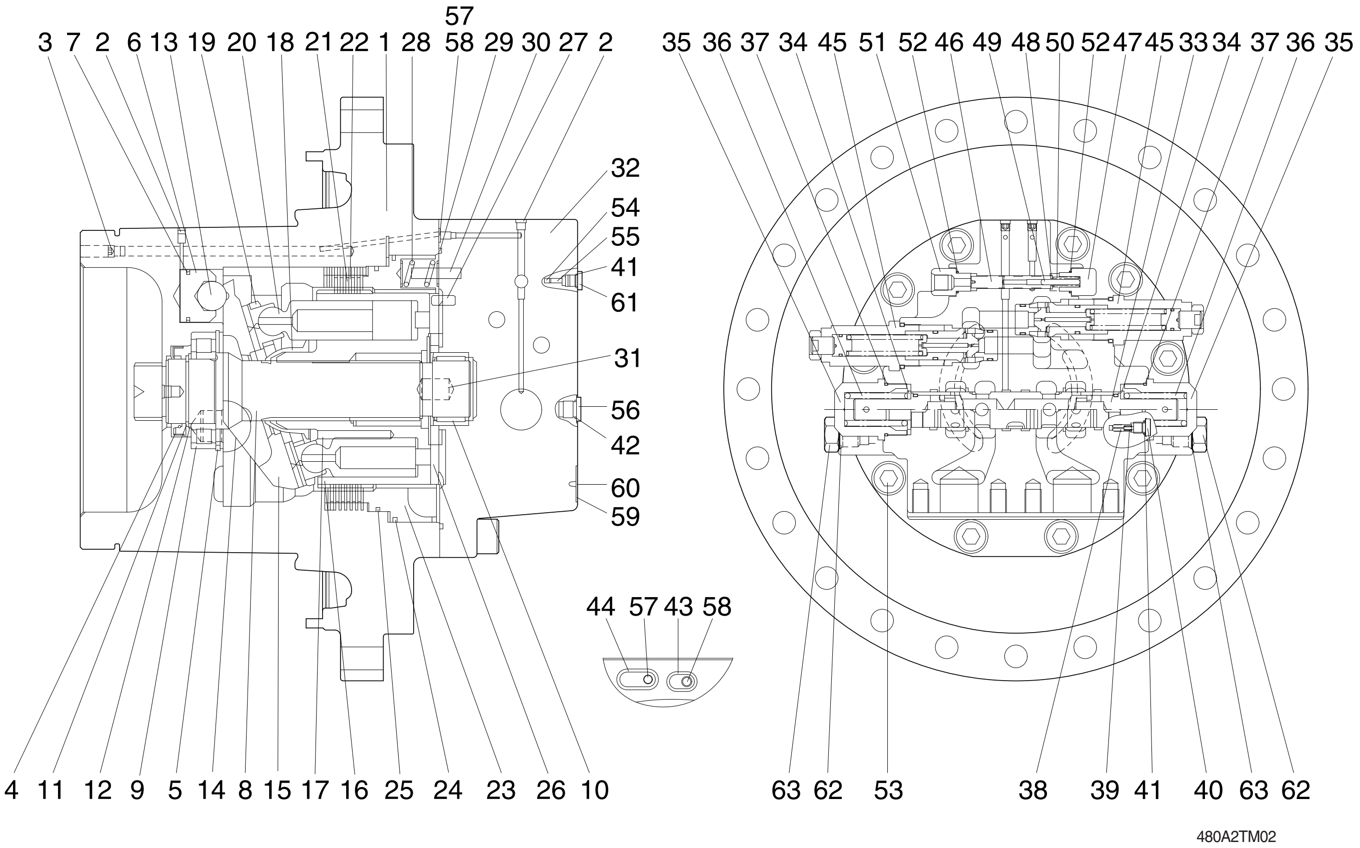


HYDRAULIC CIRCUIT

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

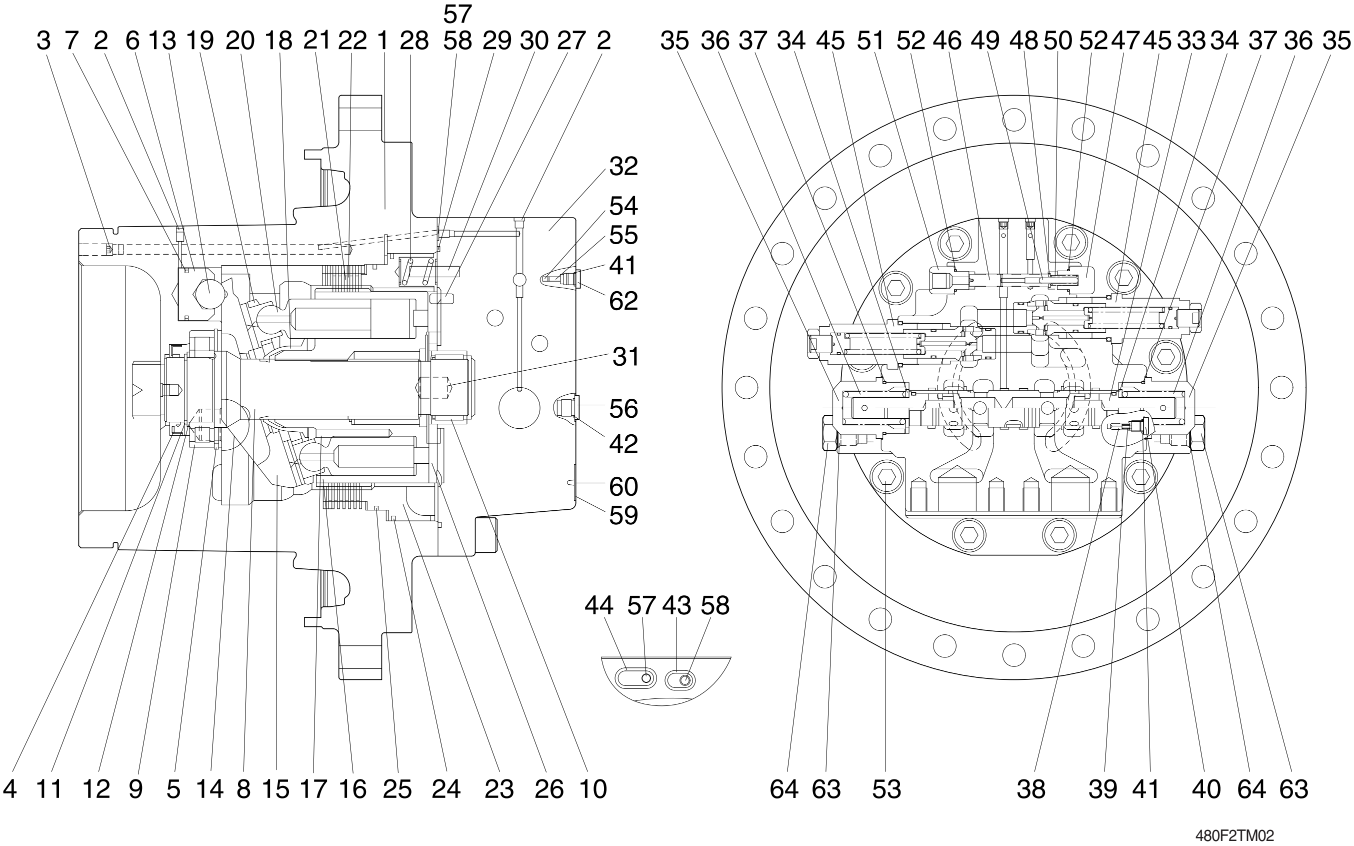
2. STRUCTURE

1) TRAVEL MOTOR (TYPE 1)



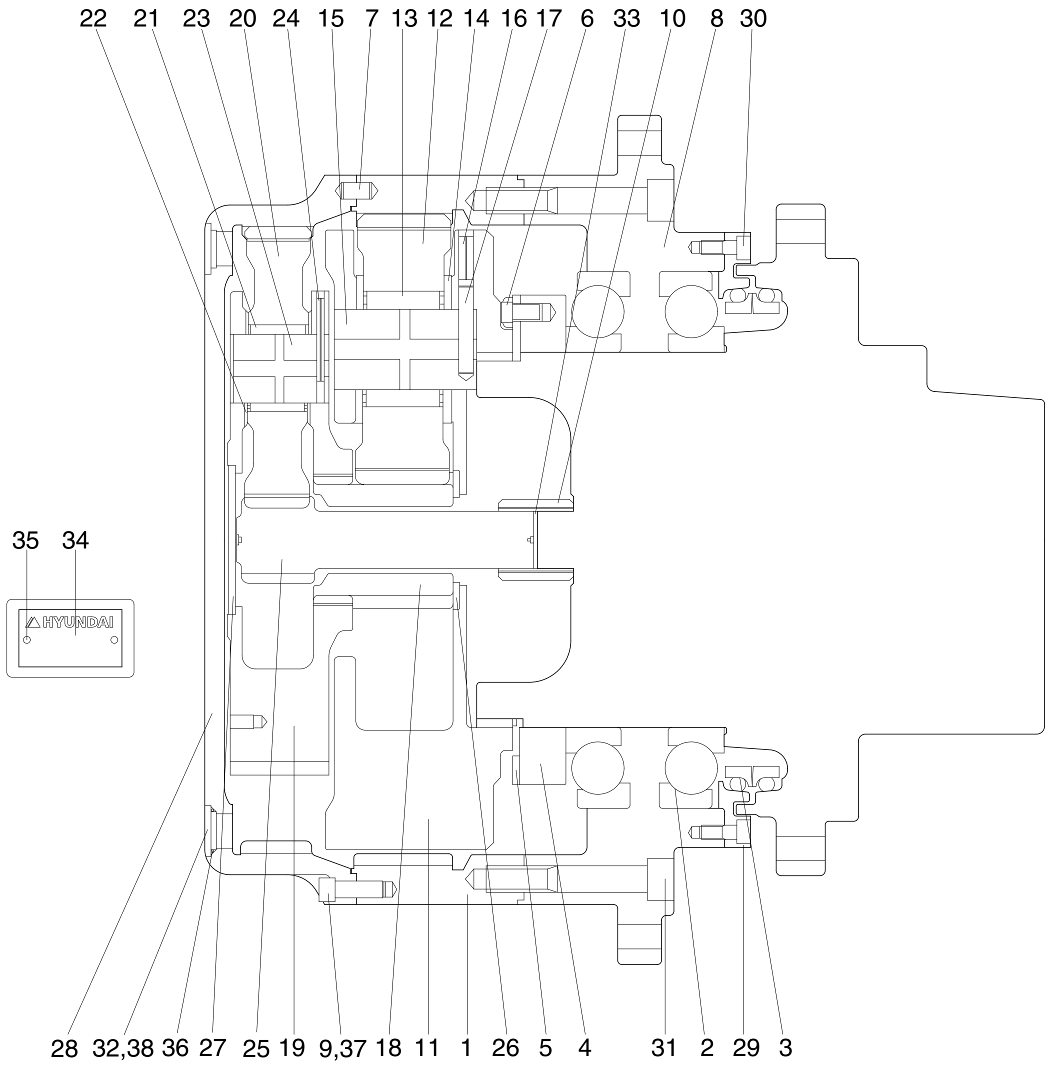
1	Casing	22	Separate plate	43	O-ring
2	Plug	23	Parking piston	44	O-ring
3	Plug	24	D-ring	45	Relief valve assy
4	Oil seal	25	D-ring	46	Spool
5	Retainer ring	26	Valve plate	47	Plug
6	Piston	27	Parallel pin	48	Spring seat
7	Piston seal	28	Spring	49	Parallel pin
8	Shaft	29	O-ring	50	Spring
9	Roller bearing	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

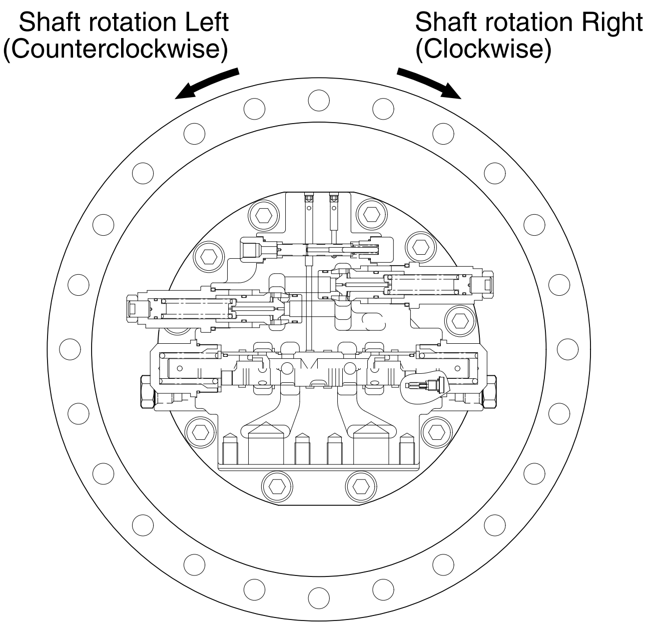


1	Ring gear	14	Thrust washer	27	Thrust plate
2	Ball bearing	15	Carrier pin No. 2	28	Cover
3	Floating seal assy	16	Spring pin	29	Cover seal
4	Ring nut	17	Solid pin No. 2	30	Hex socket head bolt
5	Lock plate	18	Sun gear No. 2	31	Hex socket head bolt
6	Hexagon head bolt	19	Carrier No. 1	32	Plug
7	Parallel 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

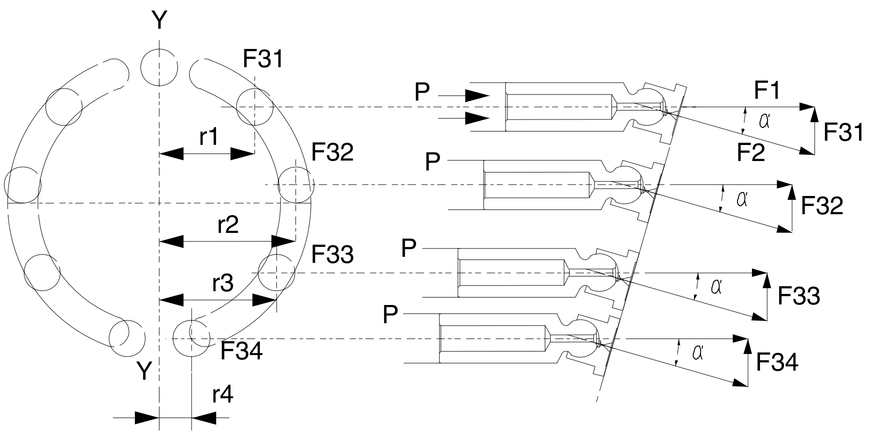
As shown in below figure, high pressure oil is supplied to the pistons which are on one side of the line Y-Y that connects upper and lower dead points and produces force F1.

F1 = P$\times$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).

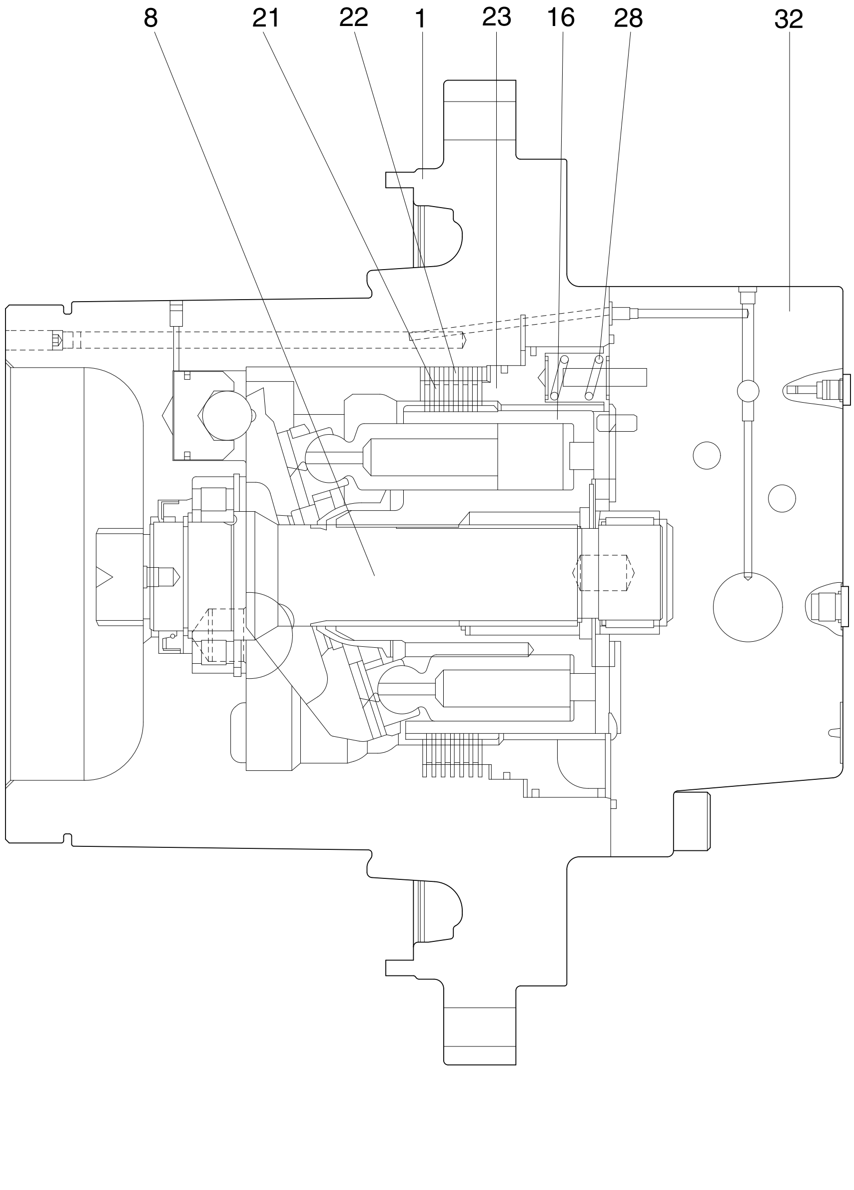


29092TM07

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.

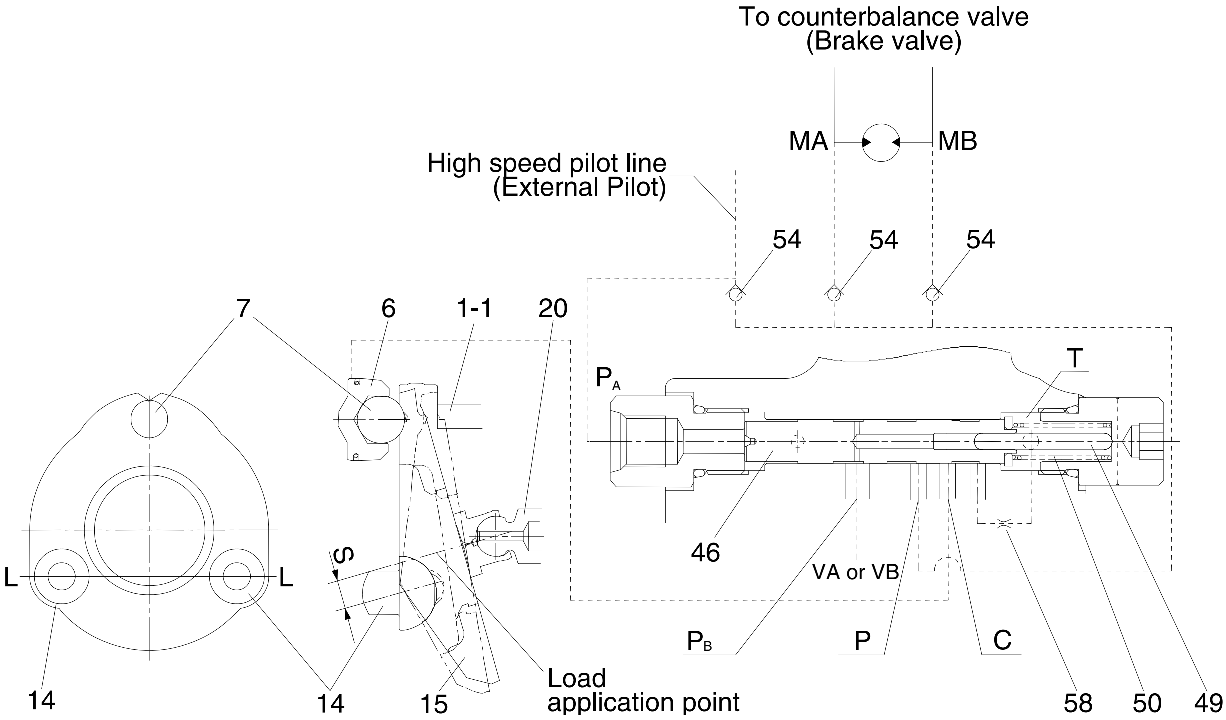
In this case, the piston stroke become shorter and motor capacity become smaller and motor rotates faster, around 1.60 times, by the same volume of oil.

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.

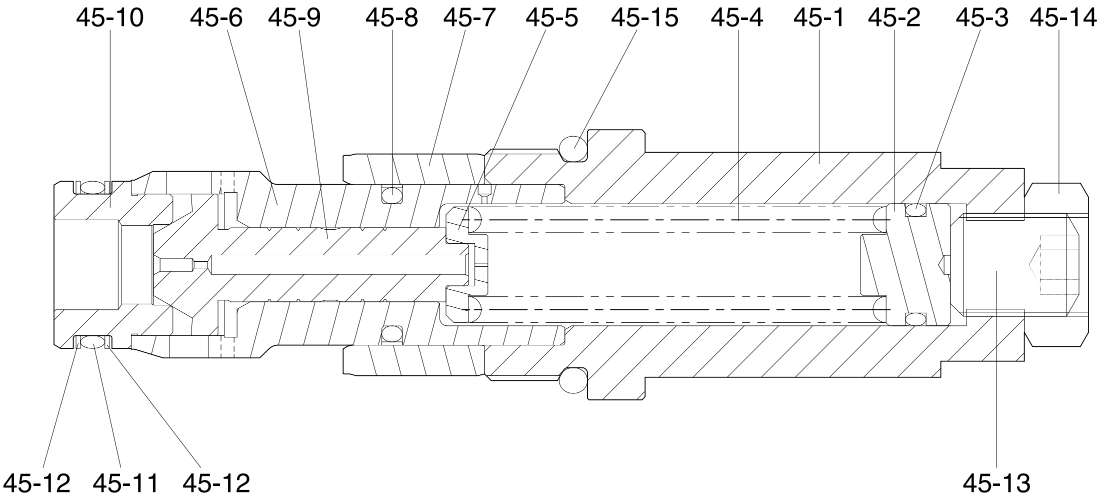


480F2TM06

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

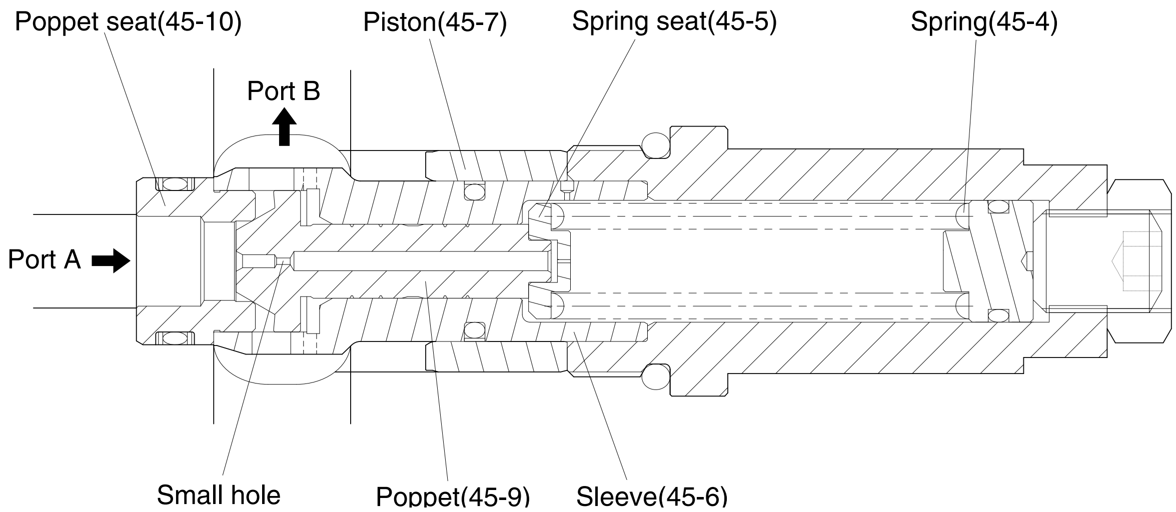
45-1	Plug	45-6	Sleeve	45-11	O-ring
45-2	Guide	45-7	Piston	45-12	Back-up ring
45-3	O-ring	45-8	Seal	45-13	Socket screw
45-4	Spring	45-9	Poppet	45-14	Hexagon nut
45-5	Spring seat	45-10	Poppet seat	45-15	O-ring

(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:

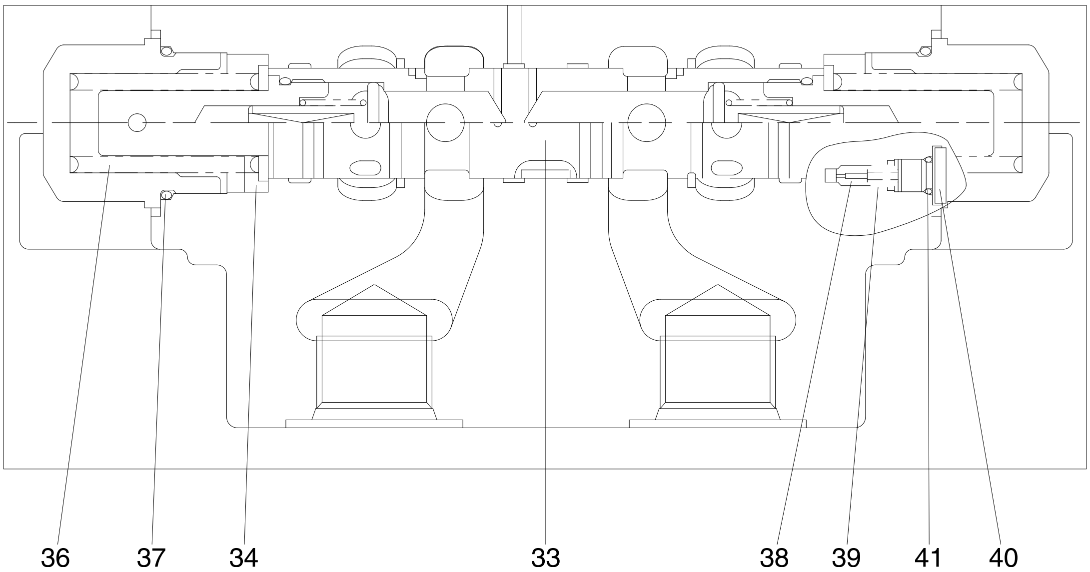
① Spool

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		

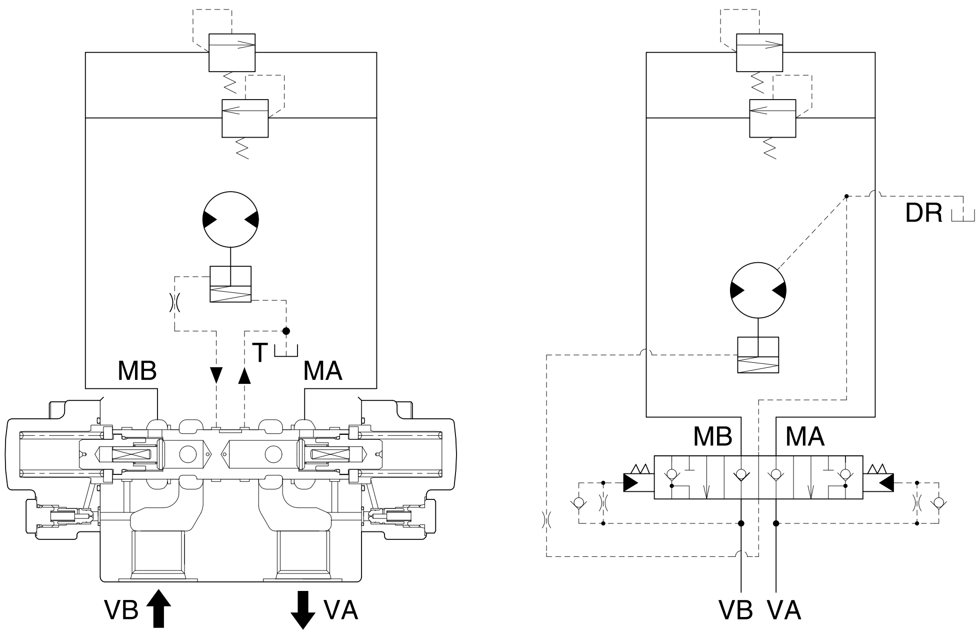
(2) Operation

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.



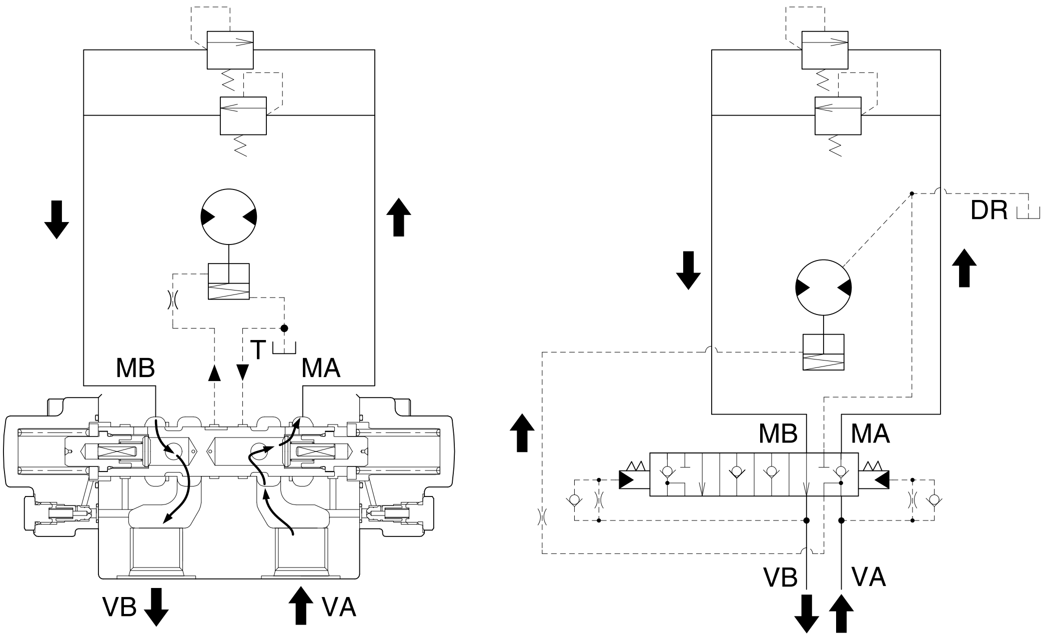
25092TM29

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.



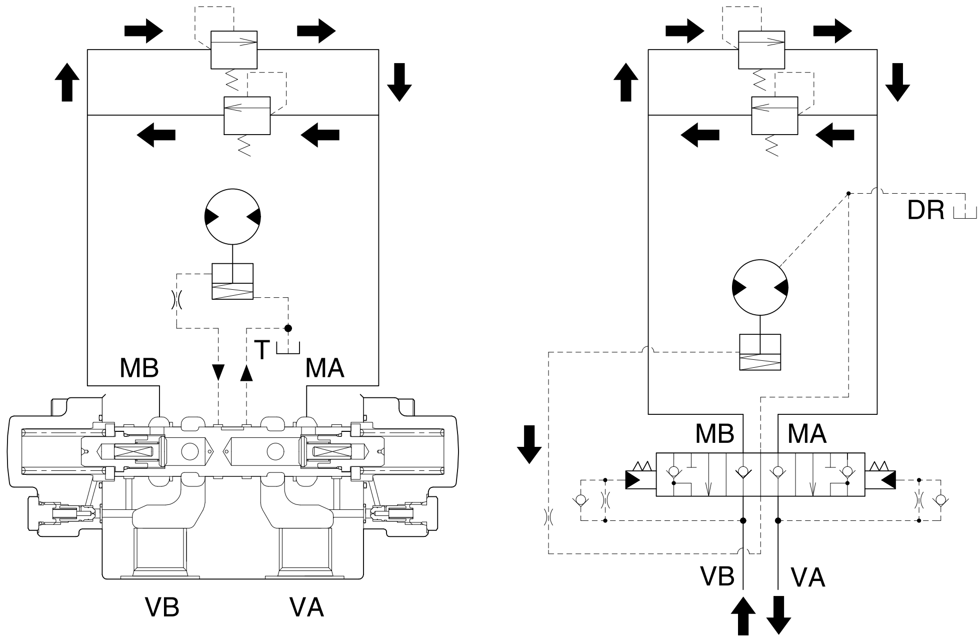
25092TM30

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.



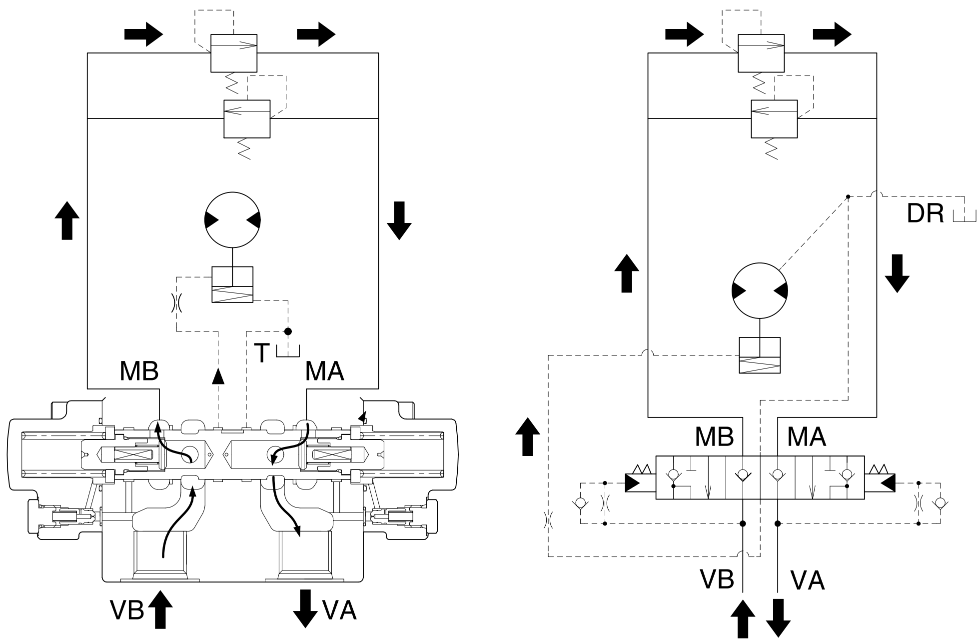
25092TM31

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.

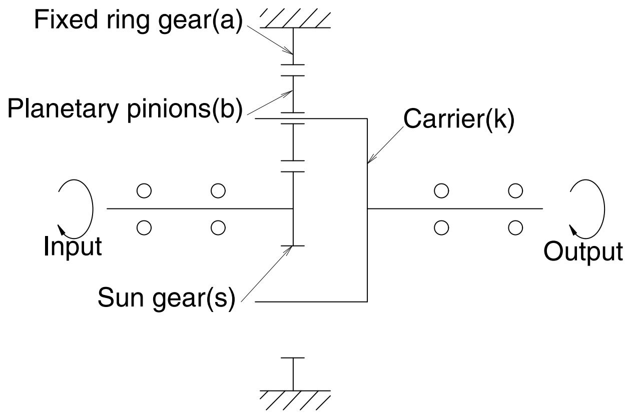
If the motor rotates slower than that matched to the volume of supplied oil, the pilot chamber pressure on VB port increases, and main spool (33) moves rightwards to enlarge the area of passage from MA to VA. Therefore the braking effect becomes smaller and the rotational speed of motor is controlled 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).



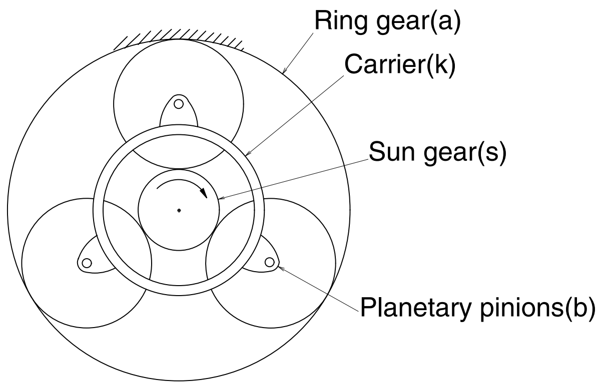
25092TM32

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.

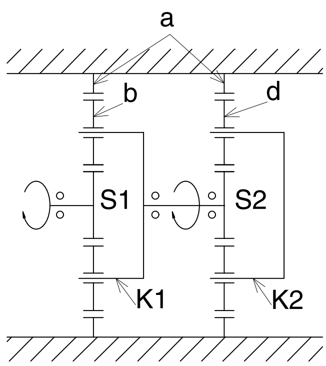


29072TM10



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.



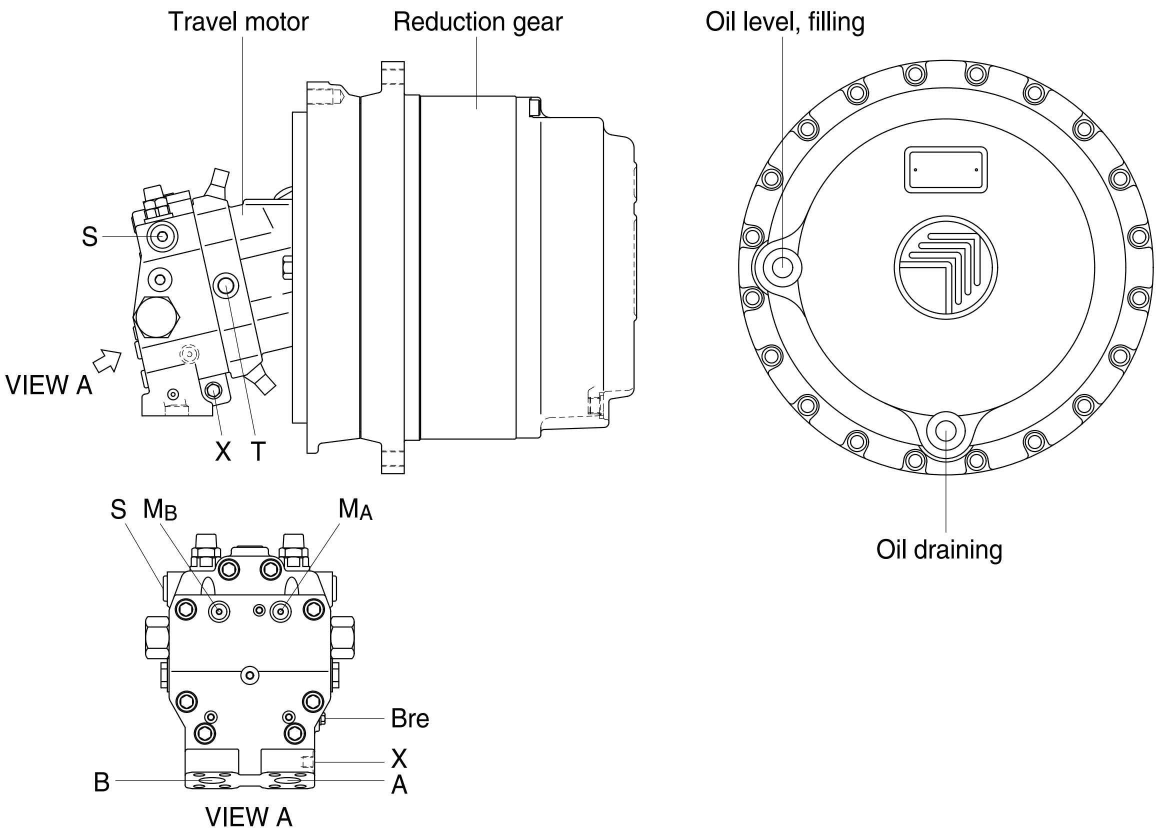
29072TM12

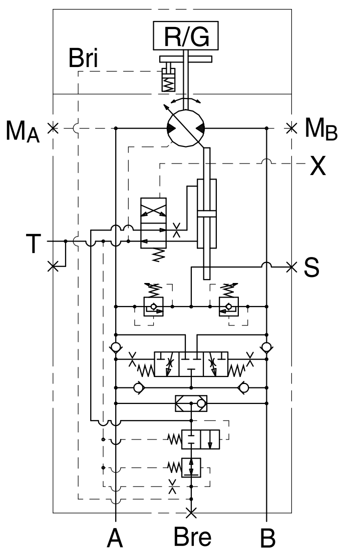
TRAVEL DEVICE (TYPE 3)

1. CONSTRUCTION

Travel device consists travel motor and gear box.

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



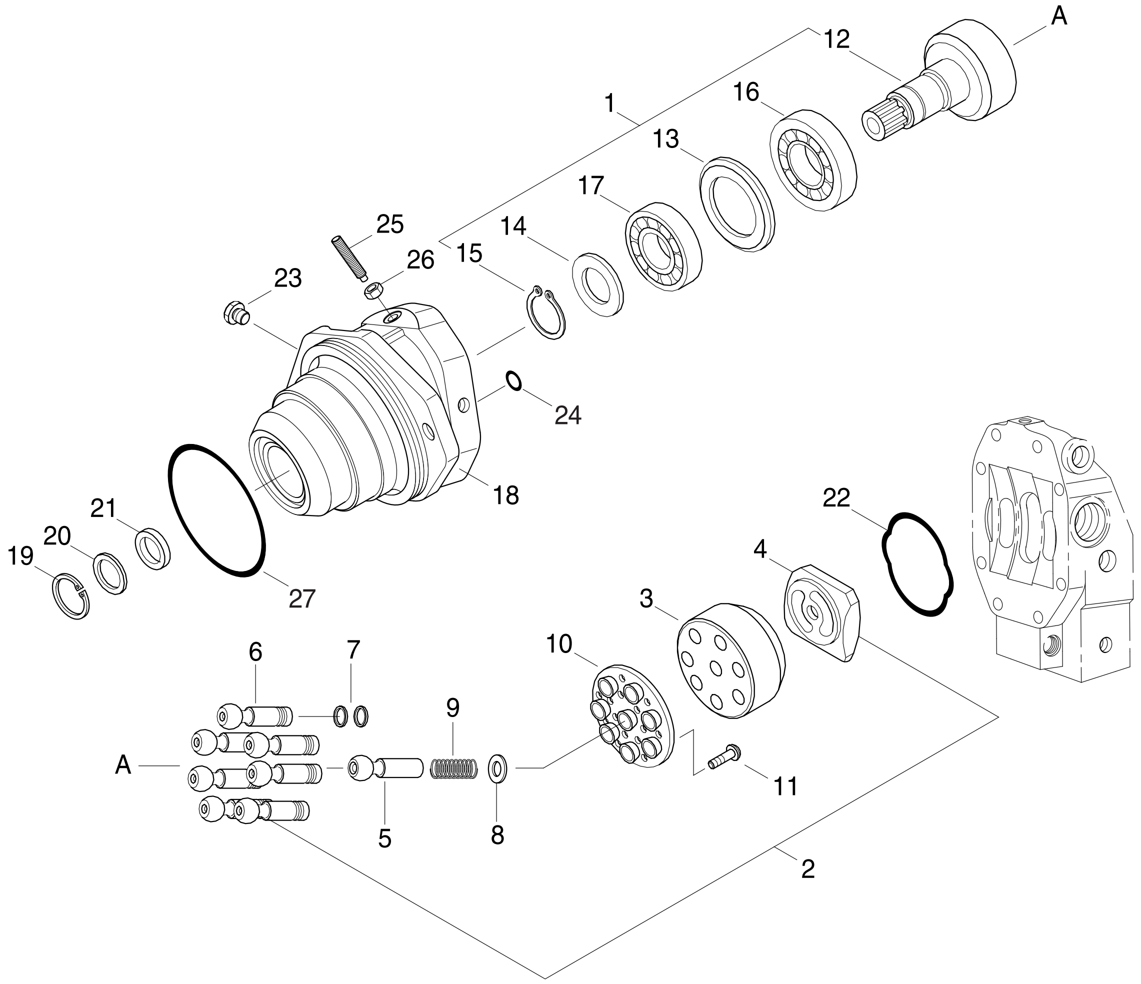


450A2TO01

Port	Port name	Port size
A	Main port	SAE 6000 psi 1 1/4"
B	Main port	SAE 6000 psi 1 1/4"
M_A, M_B	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

Hydraulic circuit

1) TRAVEL MOTOR (1/2)

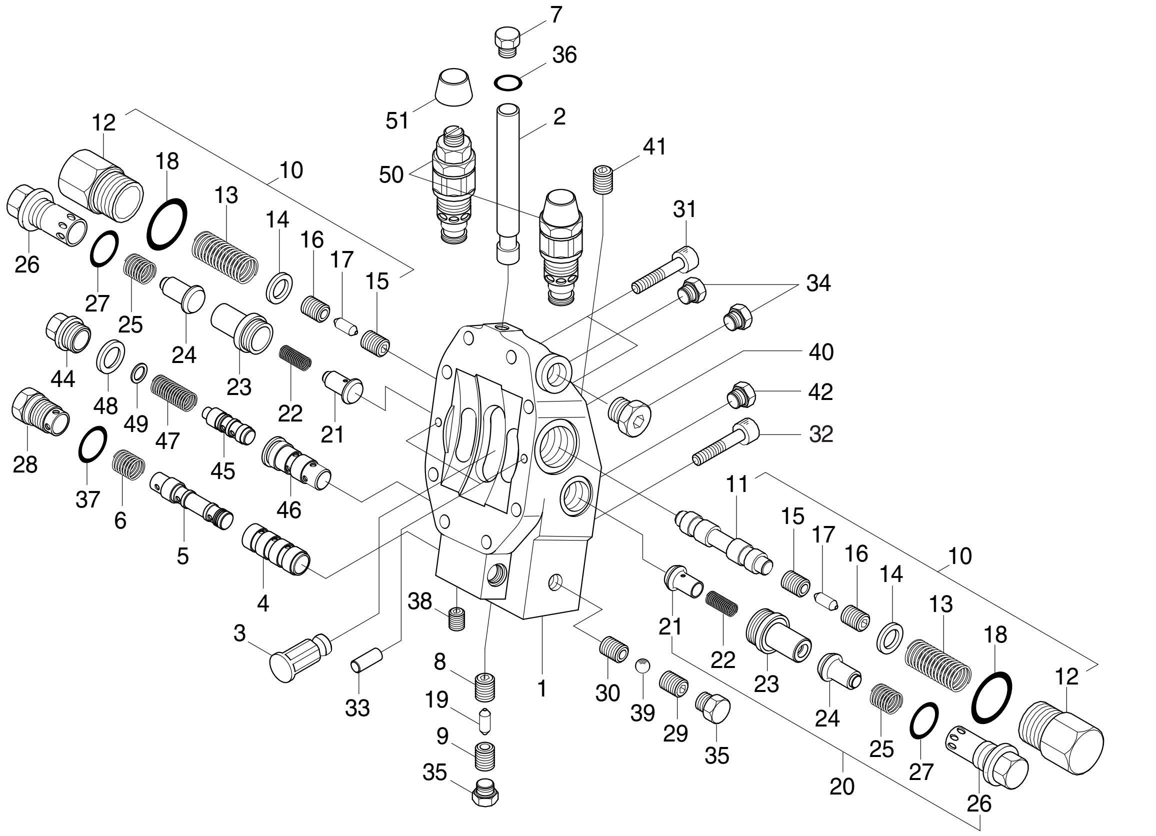


450A8TO02

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)

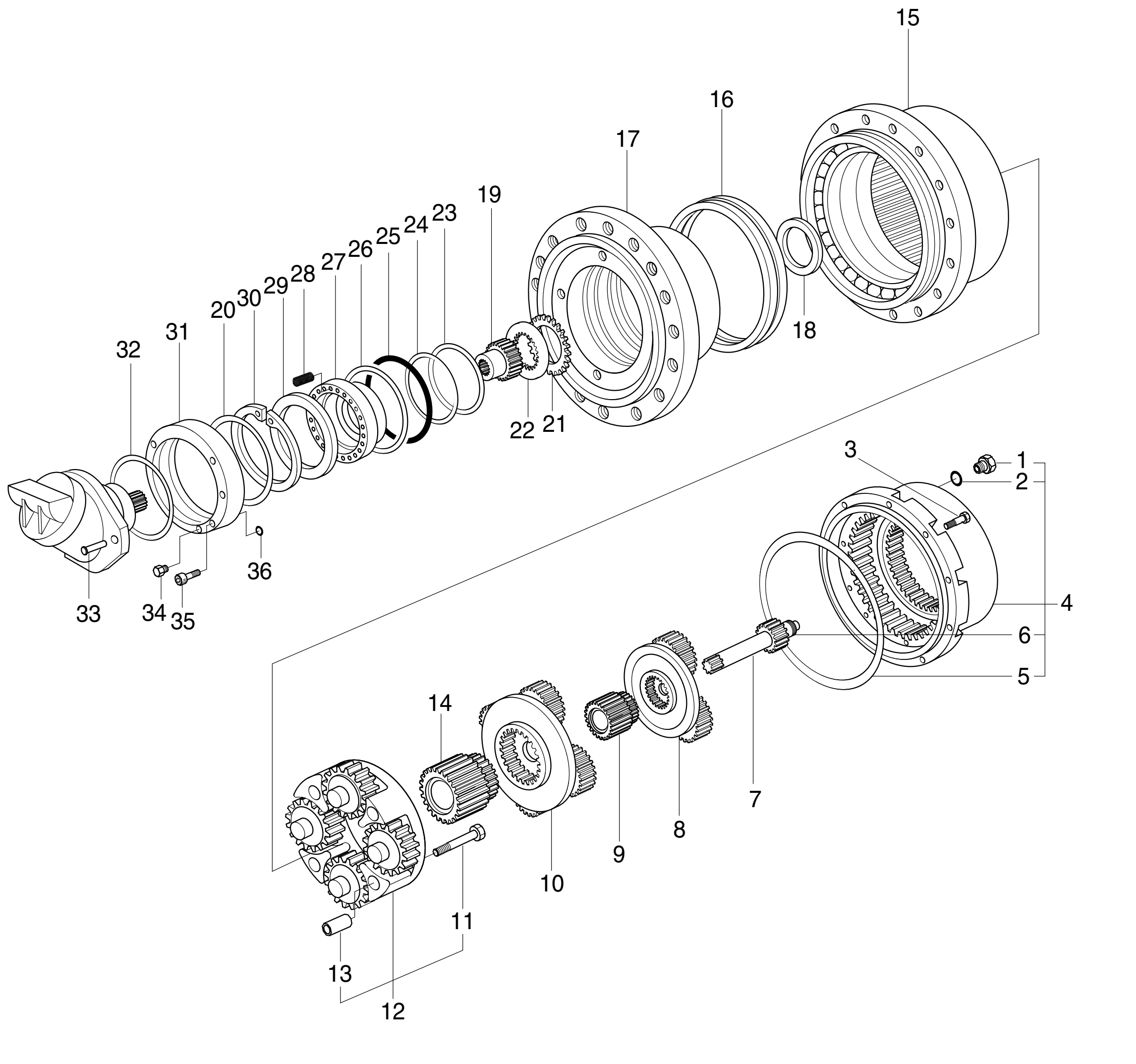
· Control part



450A8TO03

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

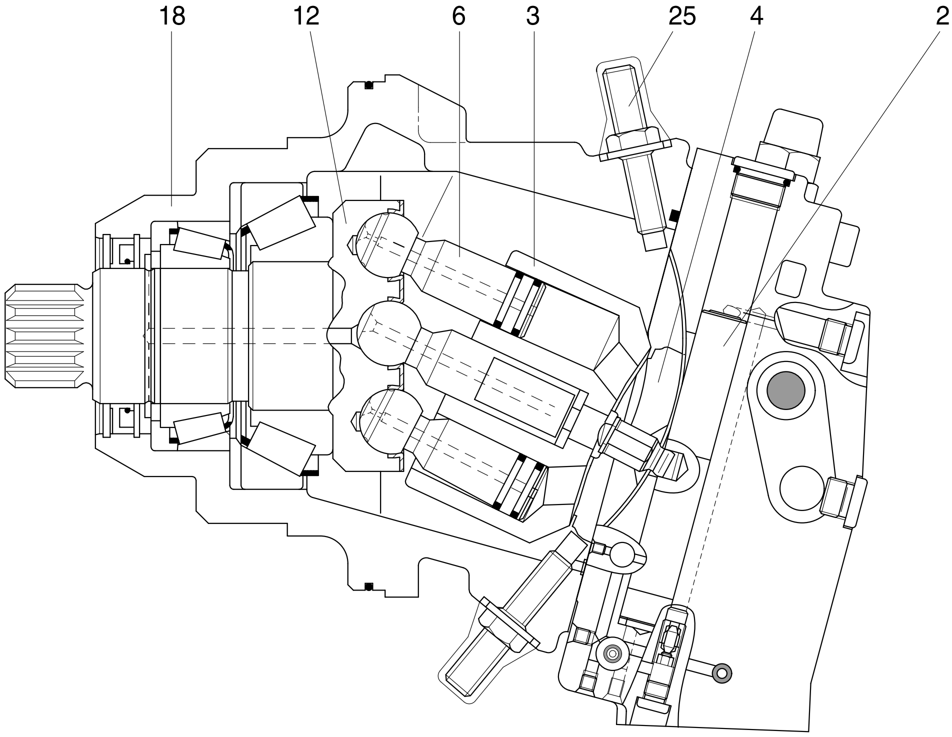
2) REDUCTION GEAR



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.

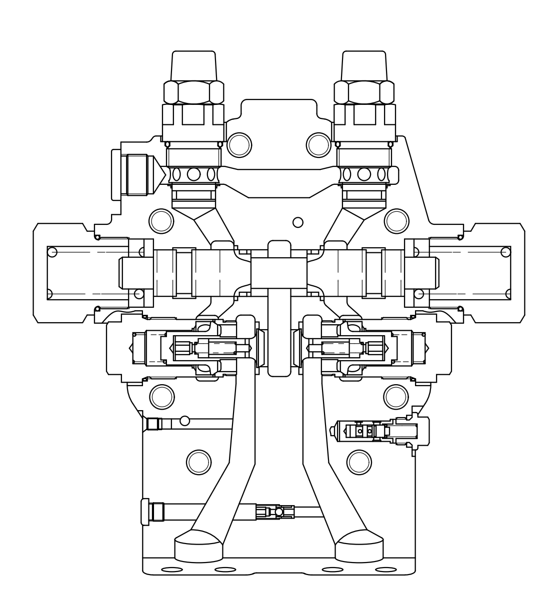
The max. swivel angle is 25˚, the min. swivel angle is 5˚.

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.



450A2TO03-1

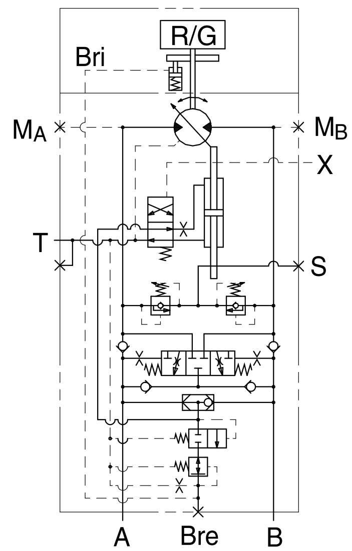
3) HYDRAULIC TWO-SPEED CONTROL

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.



450A2TO03-2

4) COUNTERBALANCE VALVE (for traveling)

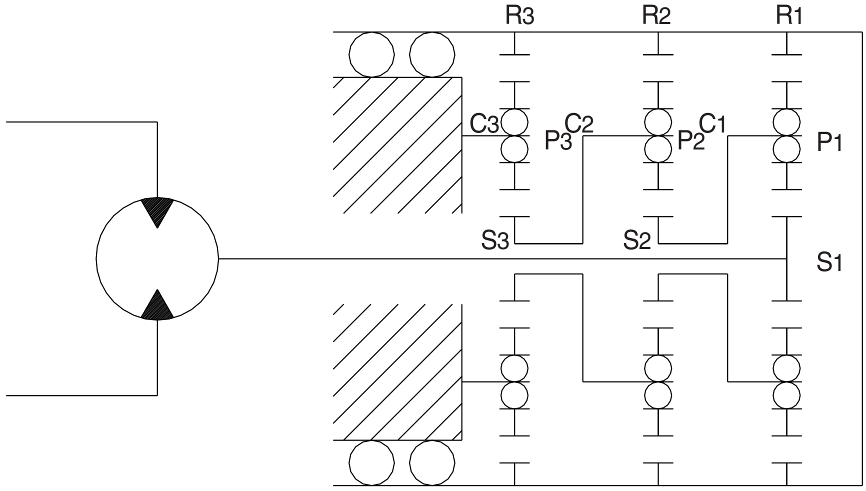
Integrated into the port plate including a brake release valve.
In case of downhill traveling or deceleration of the vehicle a counterbalance valve avoids overspeeding and cavitation of hydraulic motors.

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:

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

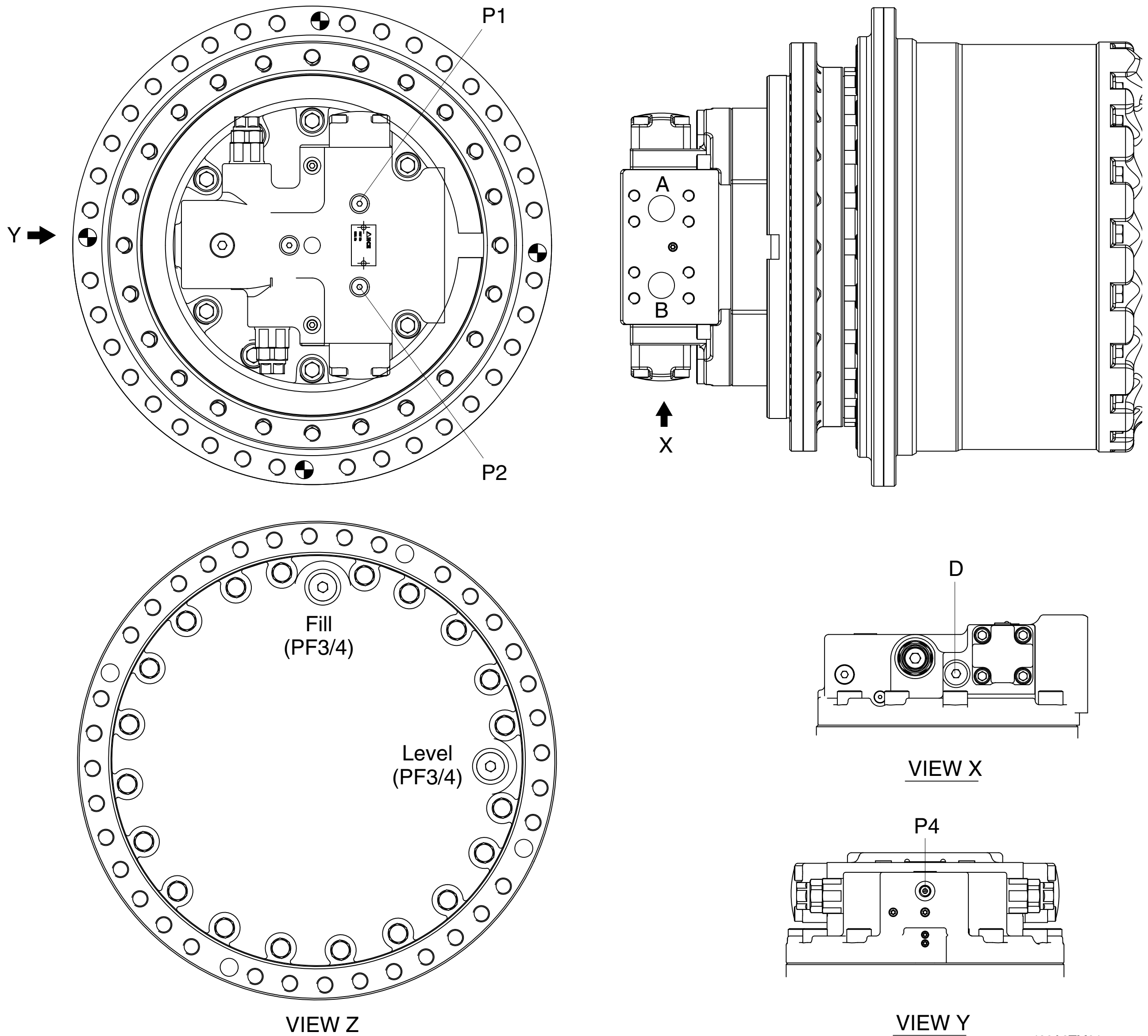
Where Z : Number of teeth of each gear
The direction of rotation is reverse to that of the input shaft.

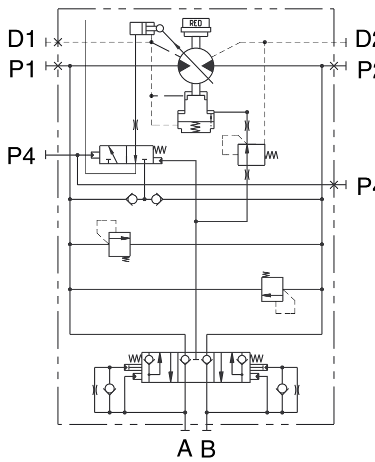
TRAVEL DEVICE (TYPE 4)

1. CONSTRUCTION

Travel device consists travel motor and gear box.

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



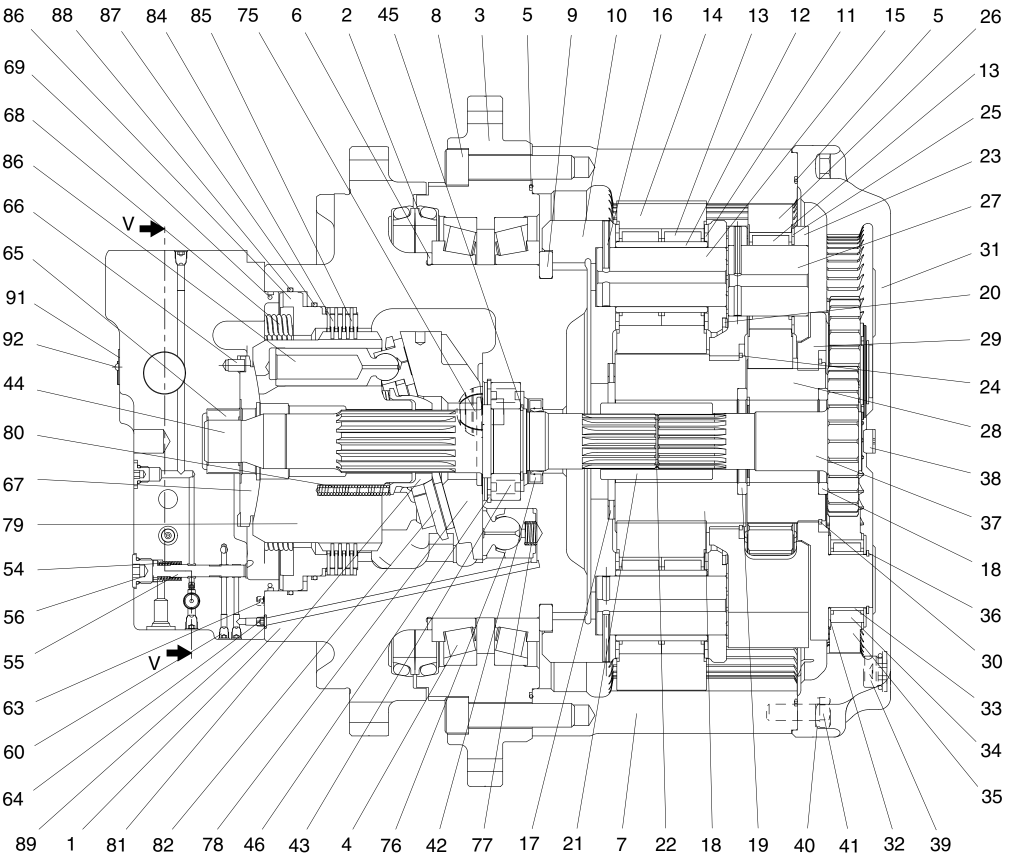


Hydraulic circuit

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

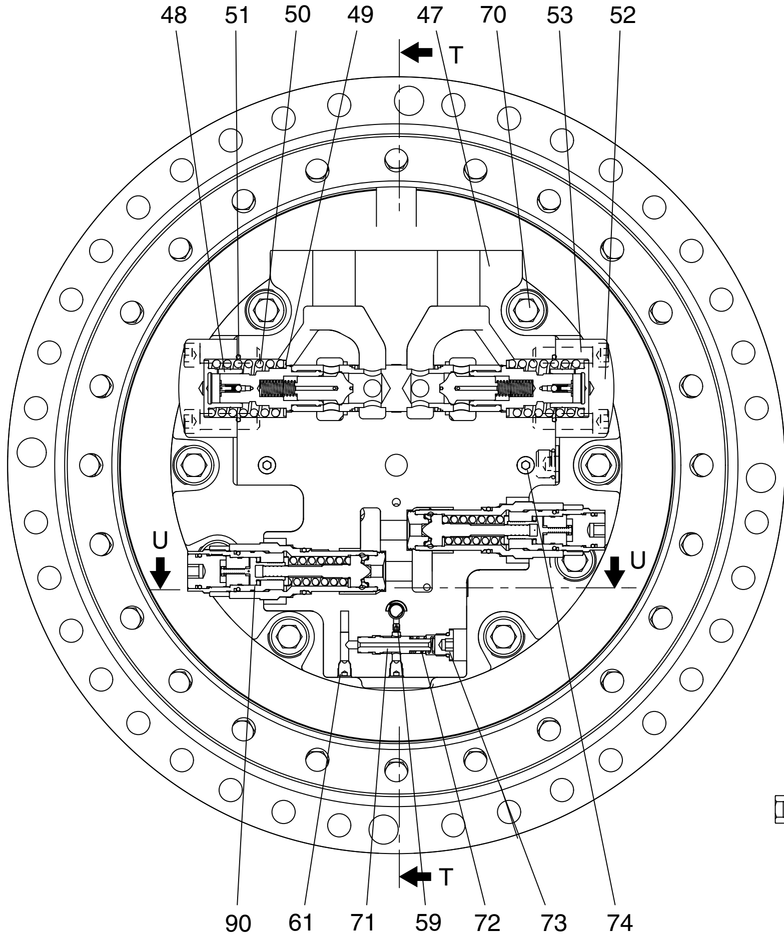
1) TRAVEL MOTOR



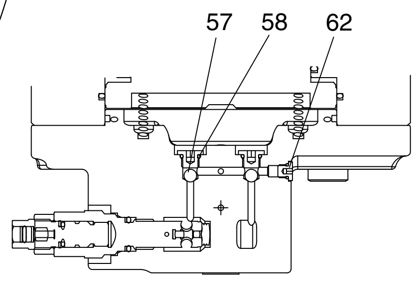
480A2TM02

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

TRAVEL MOTOR



SECTION V-V



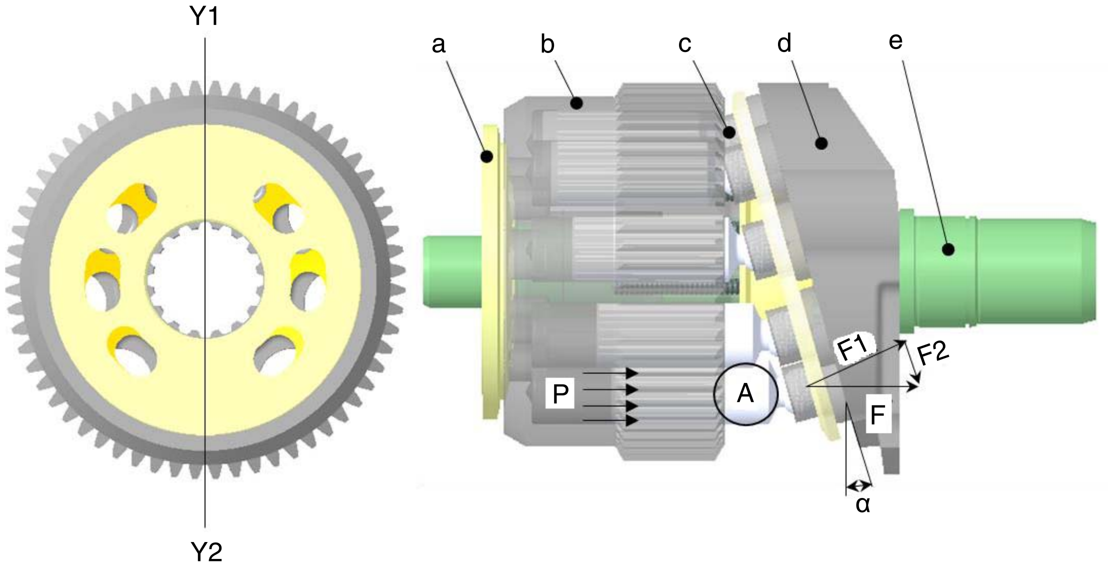
SECTION U-U

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

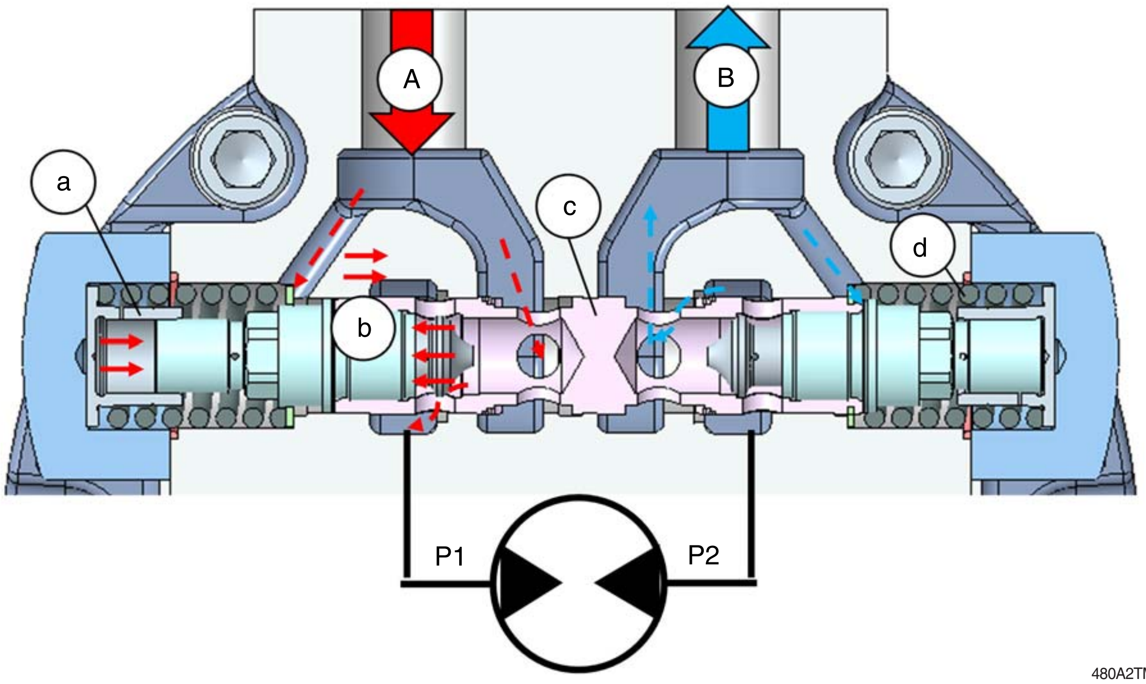
(1) The fluid supplied from the main control valve flows into the cylinder block (b) through the valve plate (a) of the hydraulic motor. This time, half of the fluid will flow in and half will flow out based on Y1-Y2 connecting the top dead center (TDC) and the bottom dead center (BDC) of the piston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

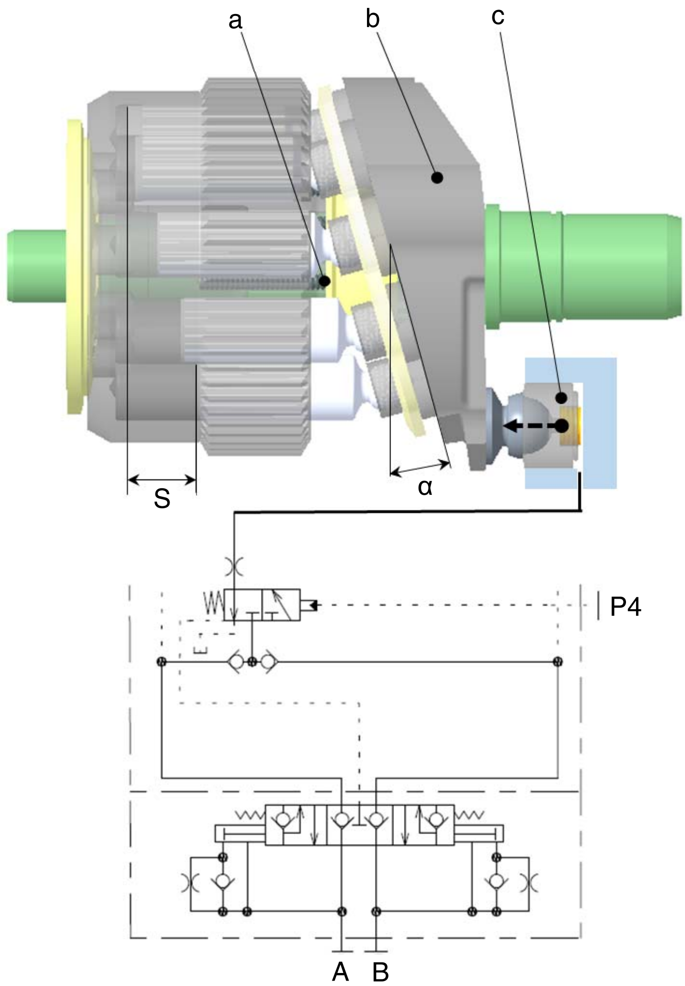
2) COUNTERBALANCE VALVE



480A2TM06

(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.

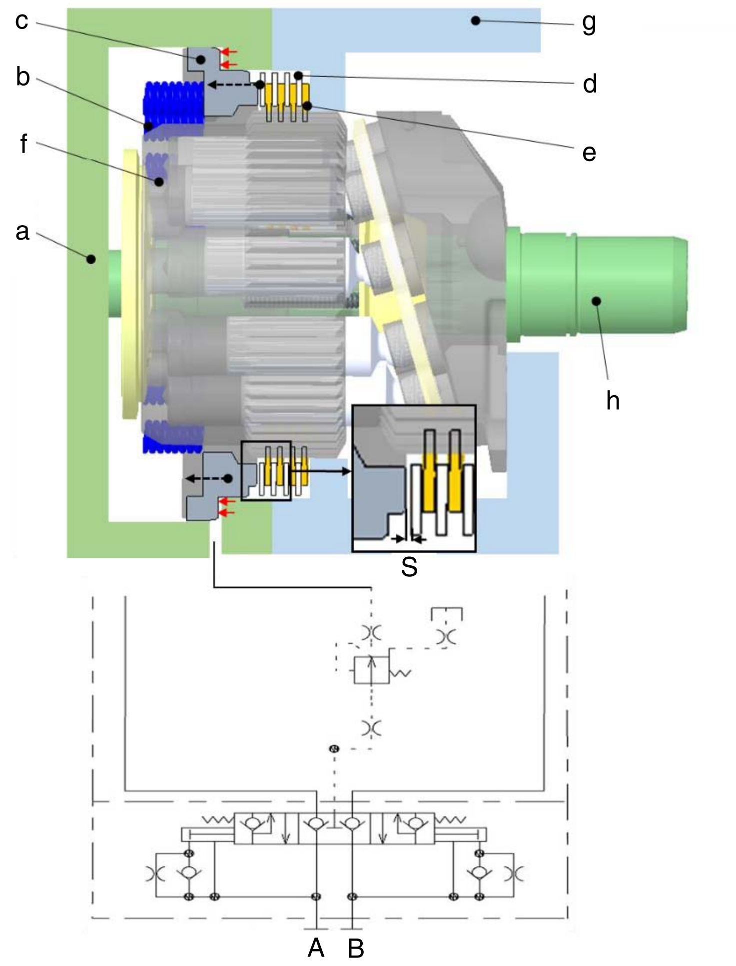
3) 2-SPEED SHIFT



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

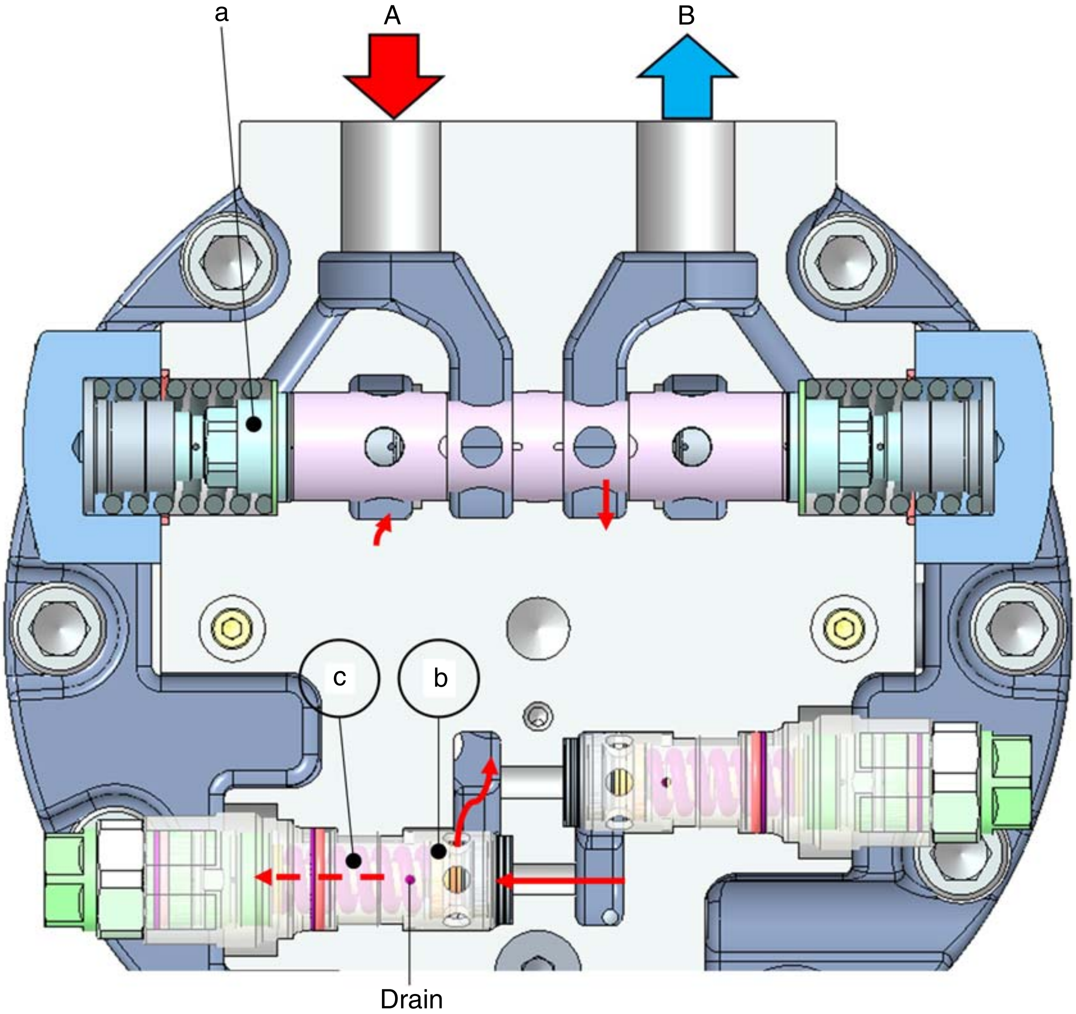


320A2TM08

(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

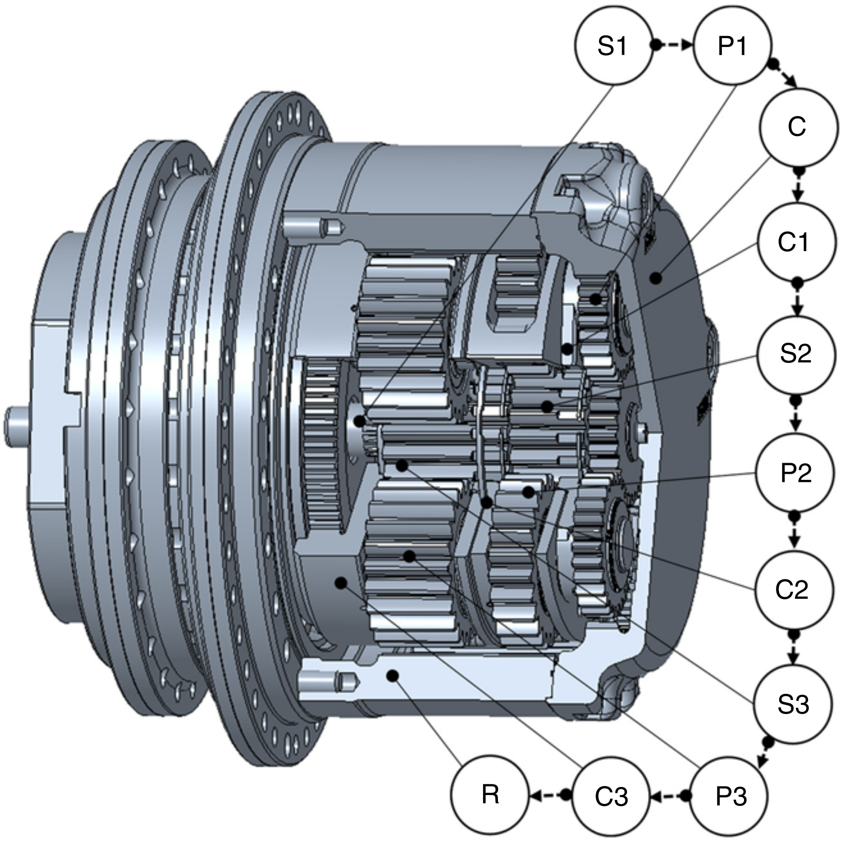
(1) The counterbalance valve (a) slides to the neutral position and blocks the flow path between the inlet (A) and outlet (B) when the motor stops while rotating.

(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



(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.

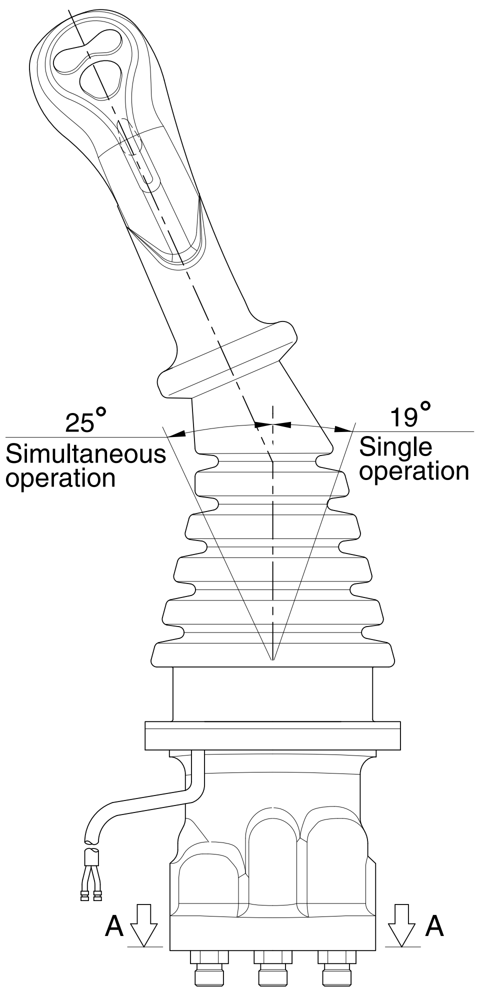
GROUP 5 RCV LEVER

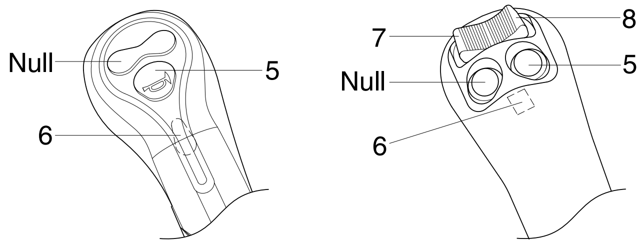
1. STRUCTURE

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



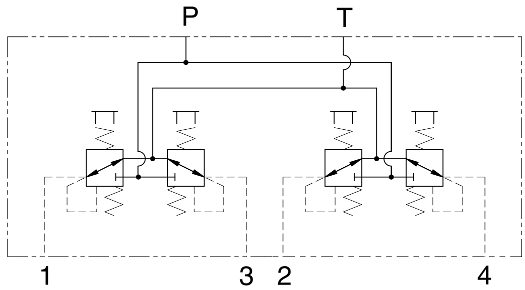


TYPE M1, M10 NONE

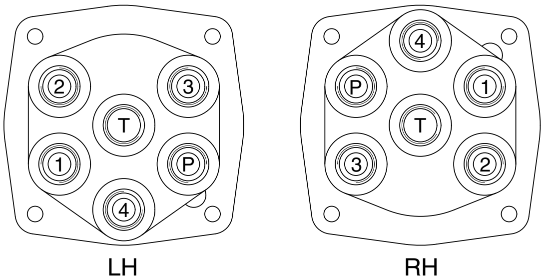
Switches

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



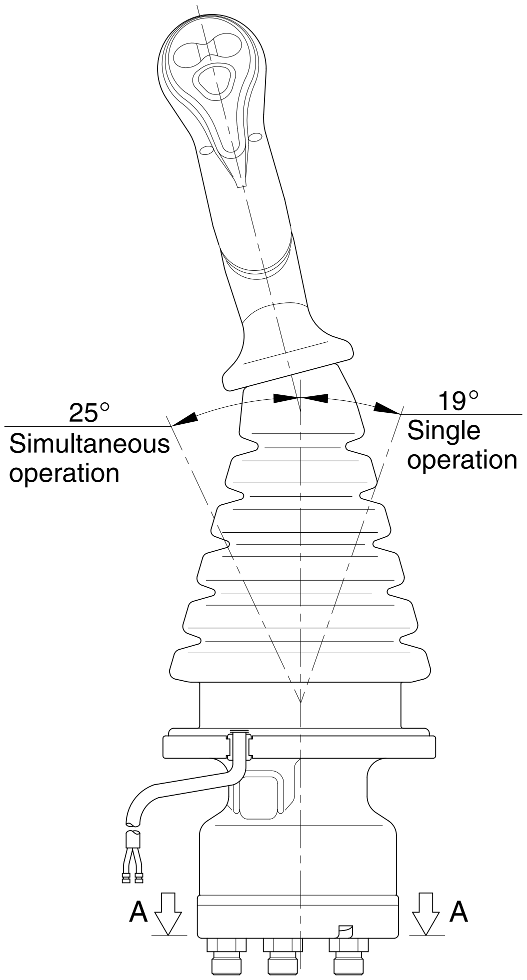
VIEW A-A

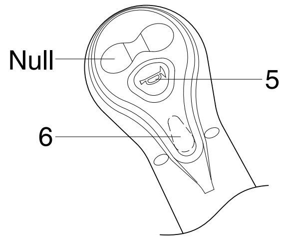
Pilot ports

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	

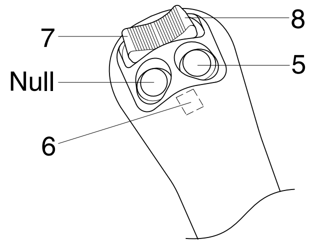
480A2RL01

2) TYPE M11, M12





TYPE M12

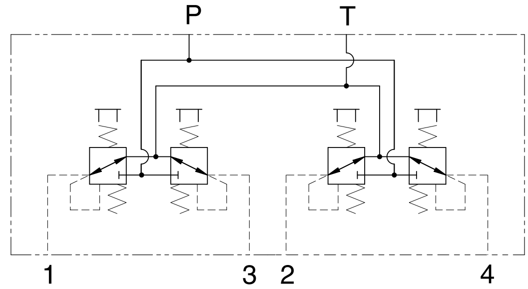


TYPE M11

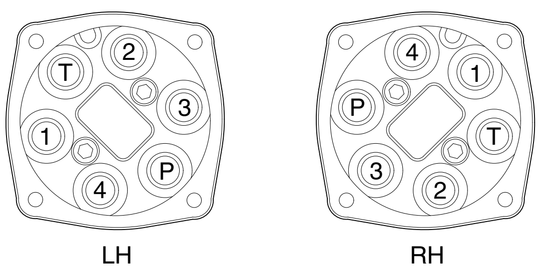
Switches

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



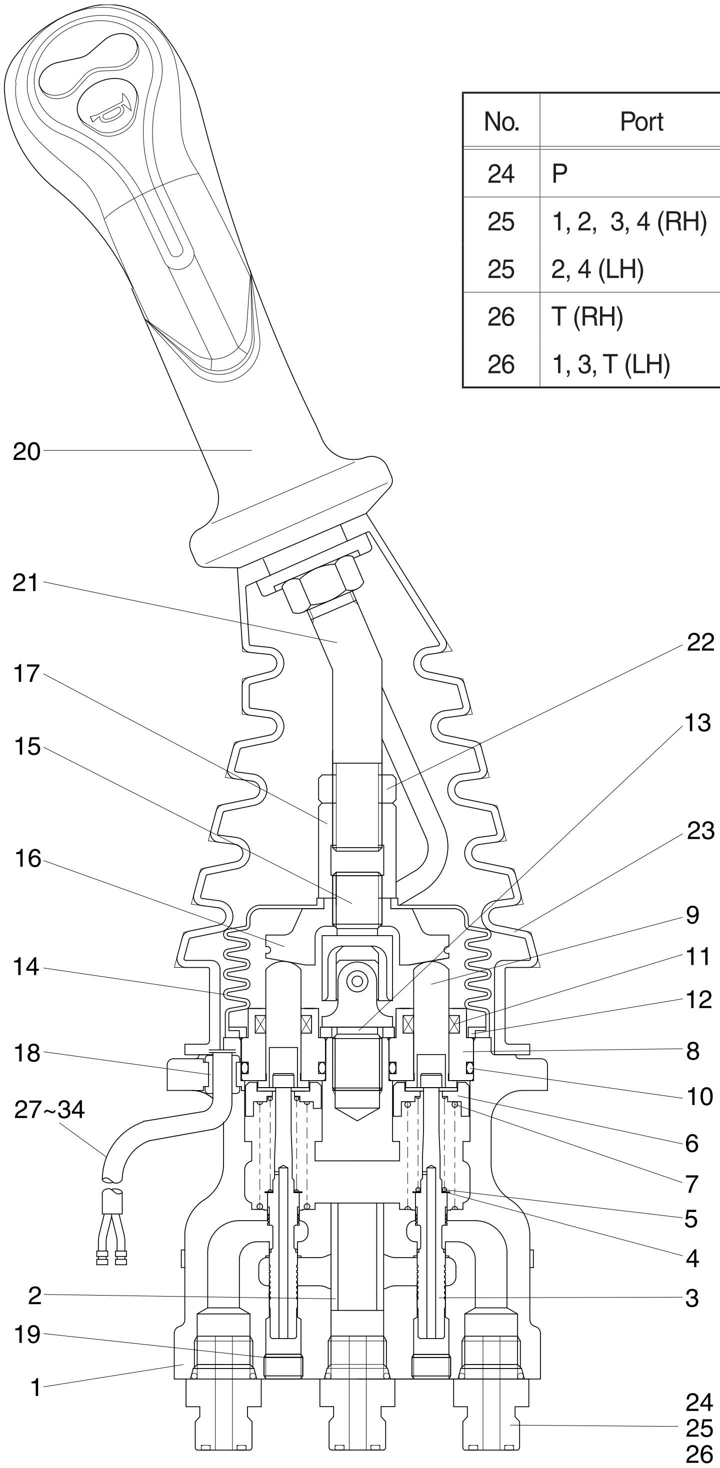
VIEW A-A

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.

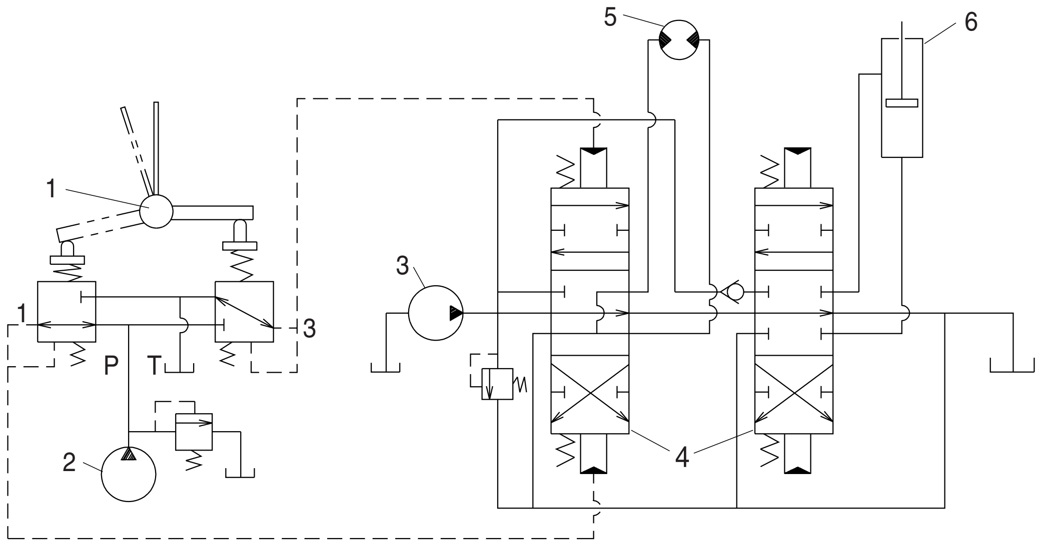
The spring (7) works on the case (1) and spring seat (6) and tries to return the push rod (9) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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.

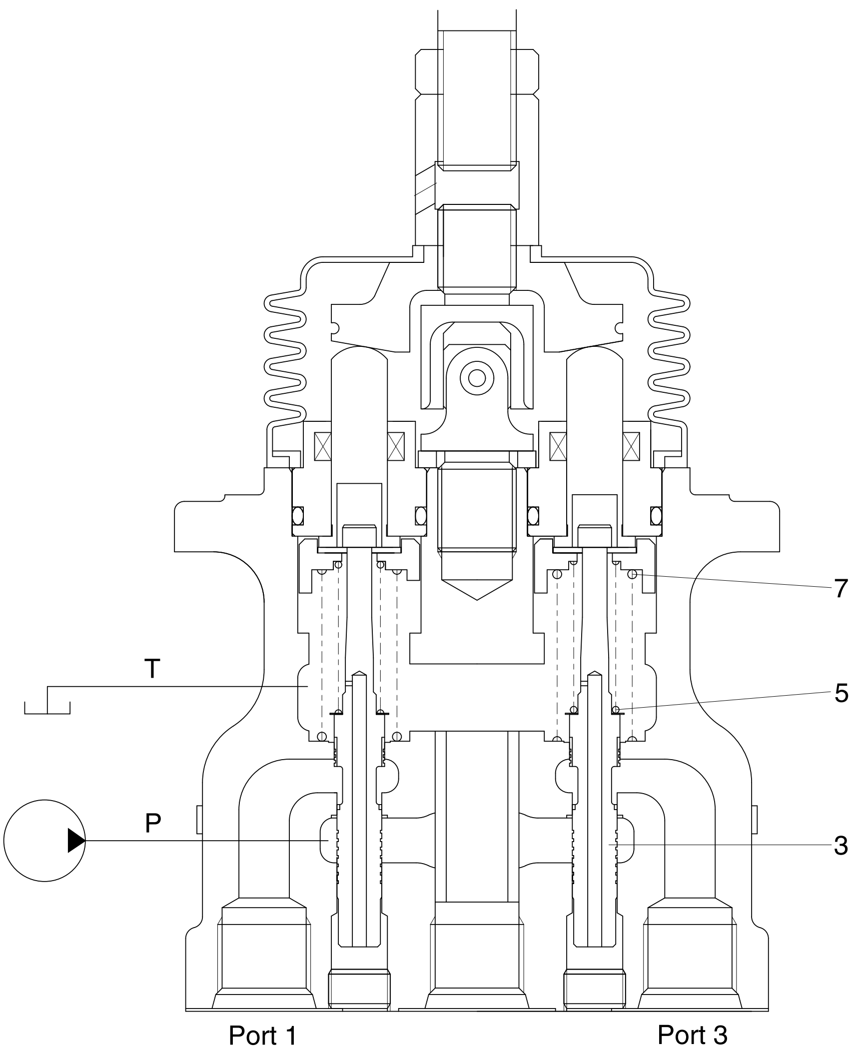
The diagram shown below is the typical application example of the pilot valve.



2-70

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

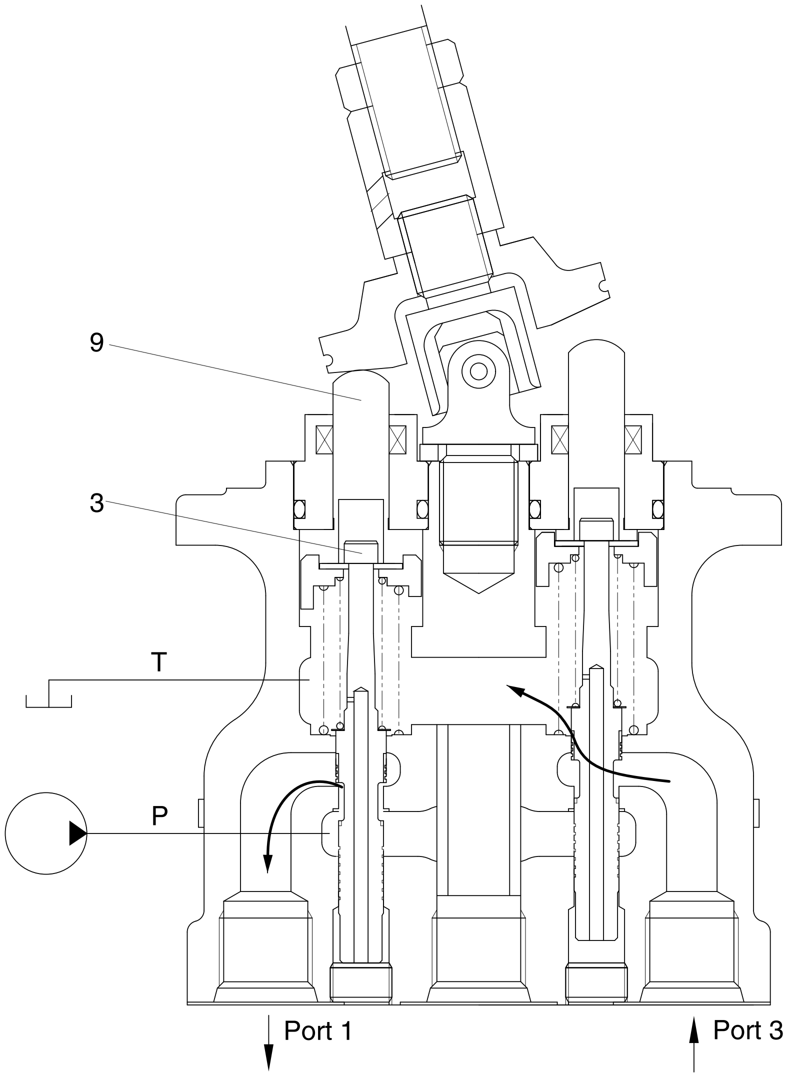
(1) Case where handle is in neutral position



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.

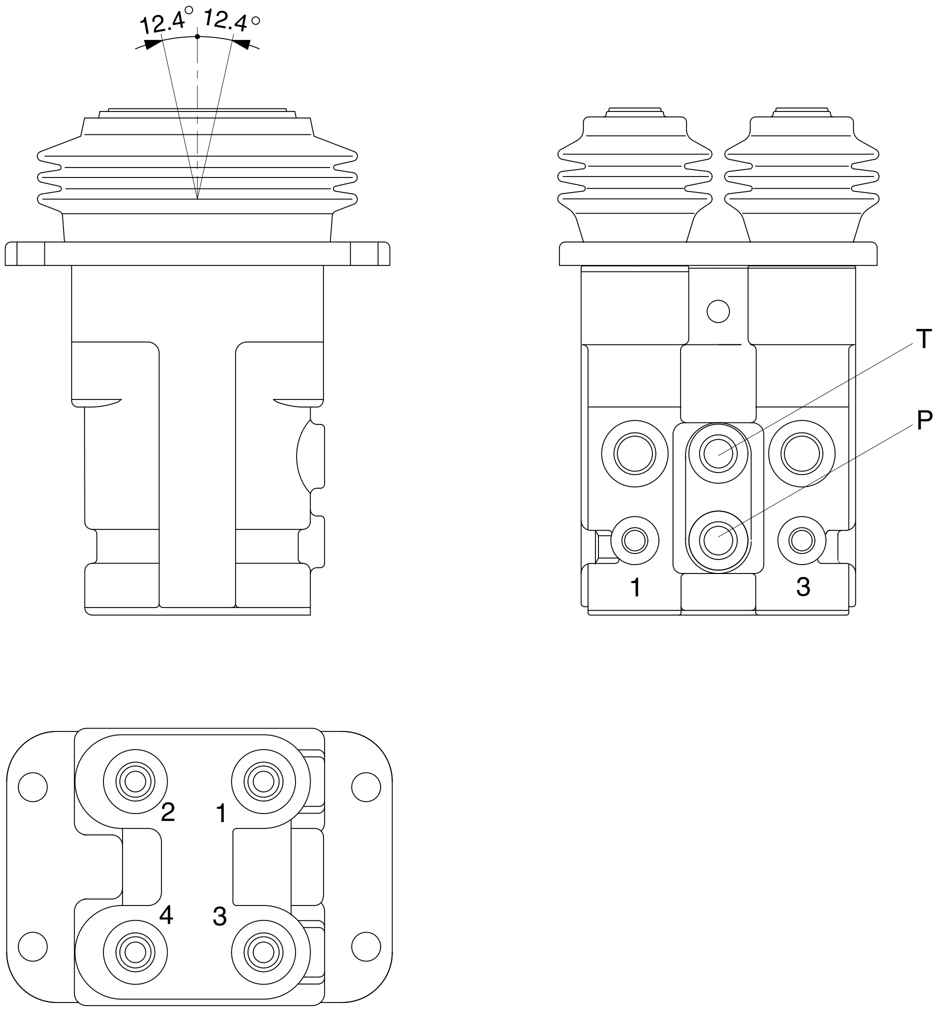
In this manner the secondary pressure is kept at the constant value.

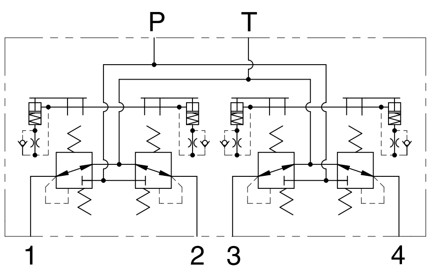
Besides, in some type, when the handle is tilted more than a certain angle, the upper end of the spool contacts with the inside bottom of the push rod and the output pressure is left to be connected with port P.

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)	

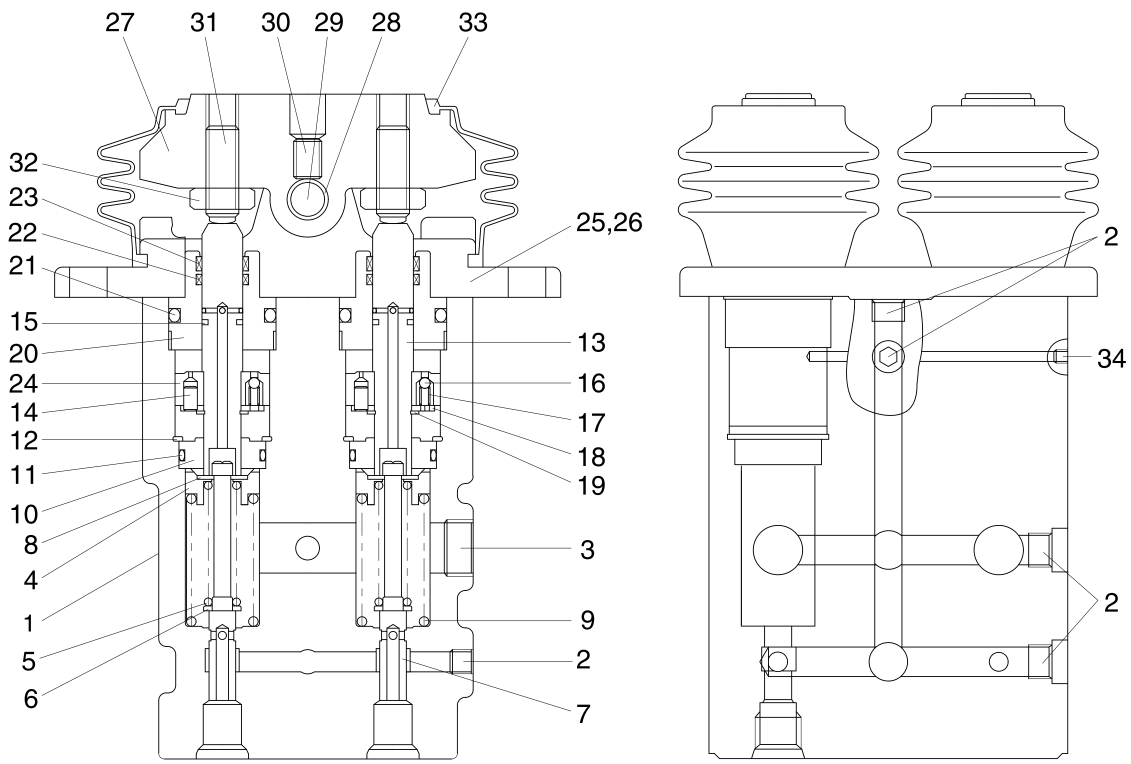
480A2RP01

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.

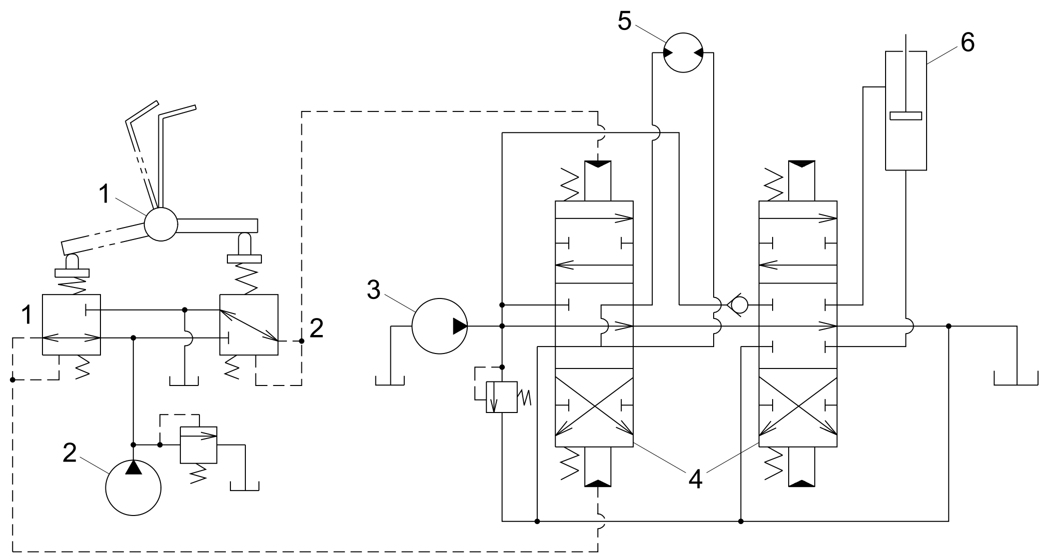
The spring (9) works on the body (1) and spring seat (6) and tries to return the push rod (13) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

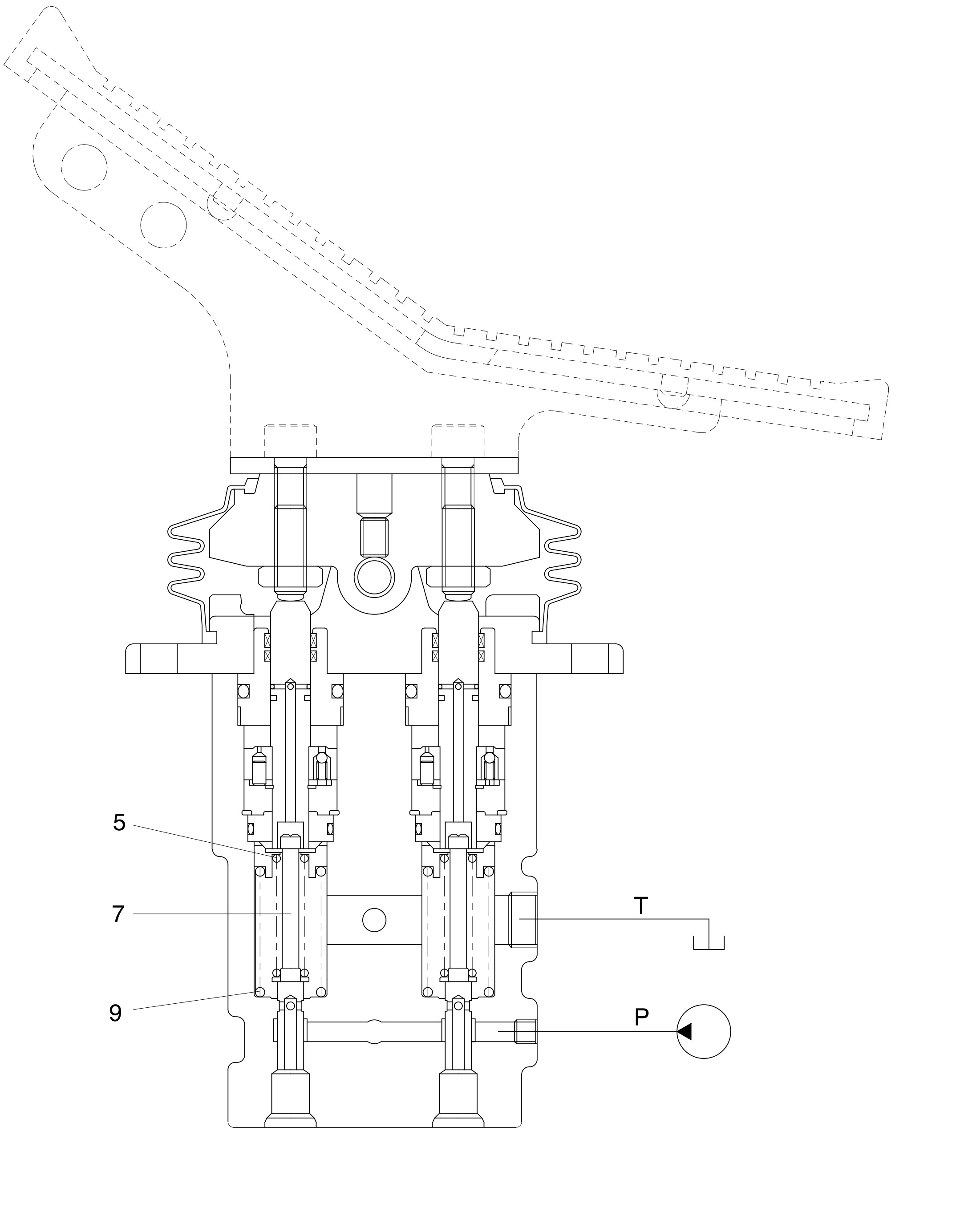
The operation of the pilot valve will be described on the basis of the hydraulic circuit diagram shown below and the attached operation explanation drawing.

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



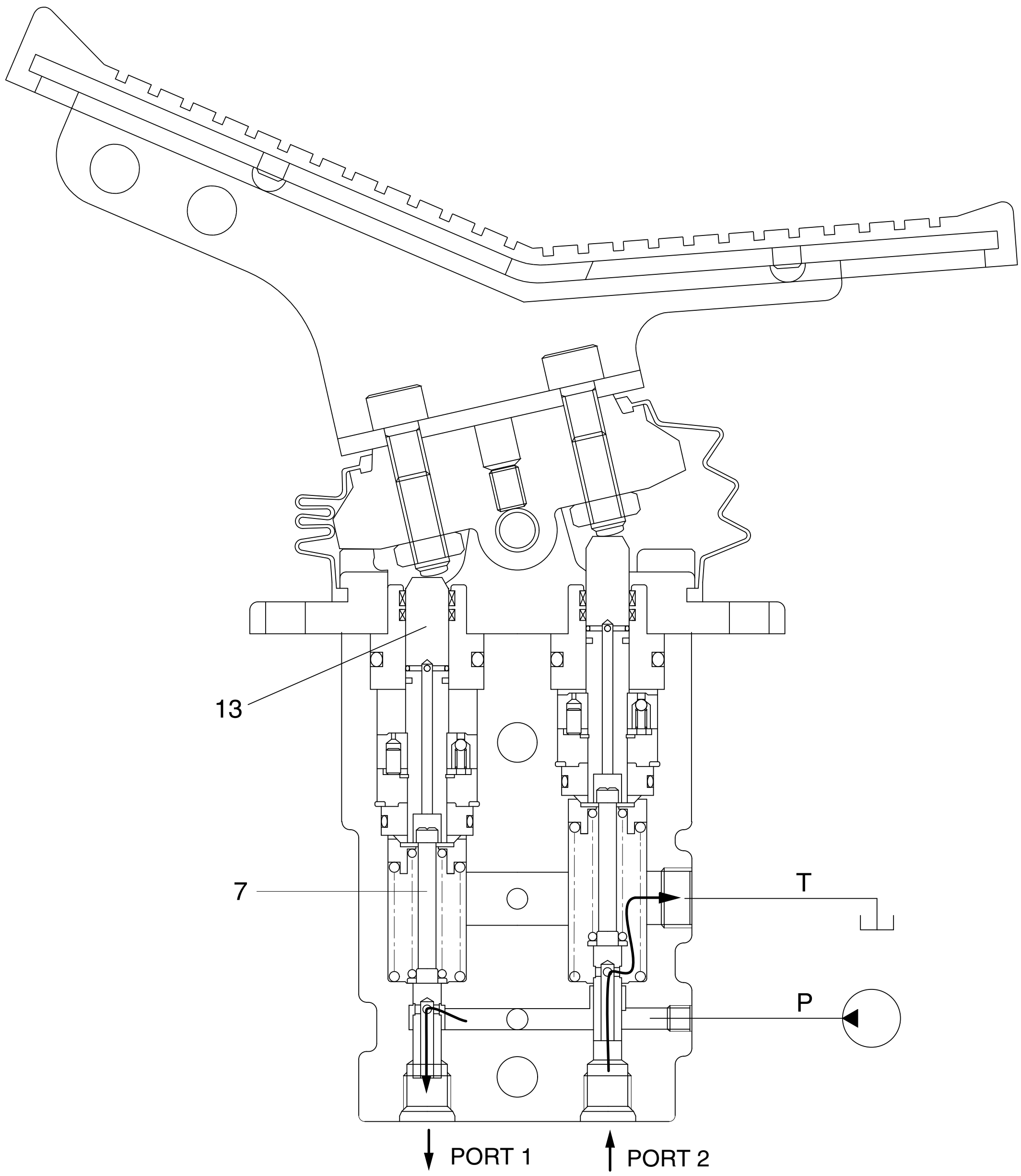
1	Pilot valve	3	Main pump	5	Hydraulic motor
2	Pilot pump	4	Main control valve	6	Hydraulic cylinder

(1) Case where pedal is in neutral position



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

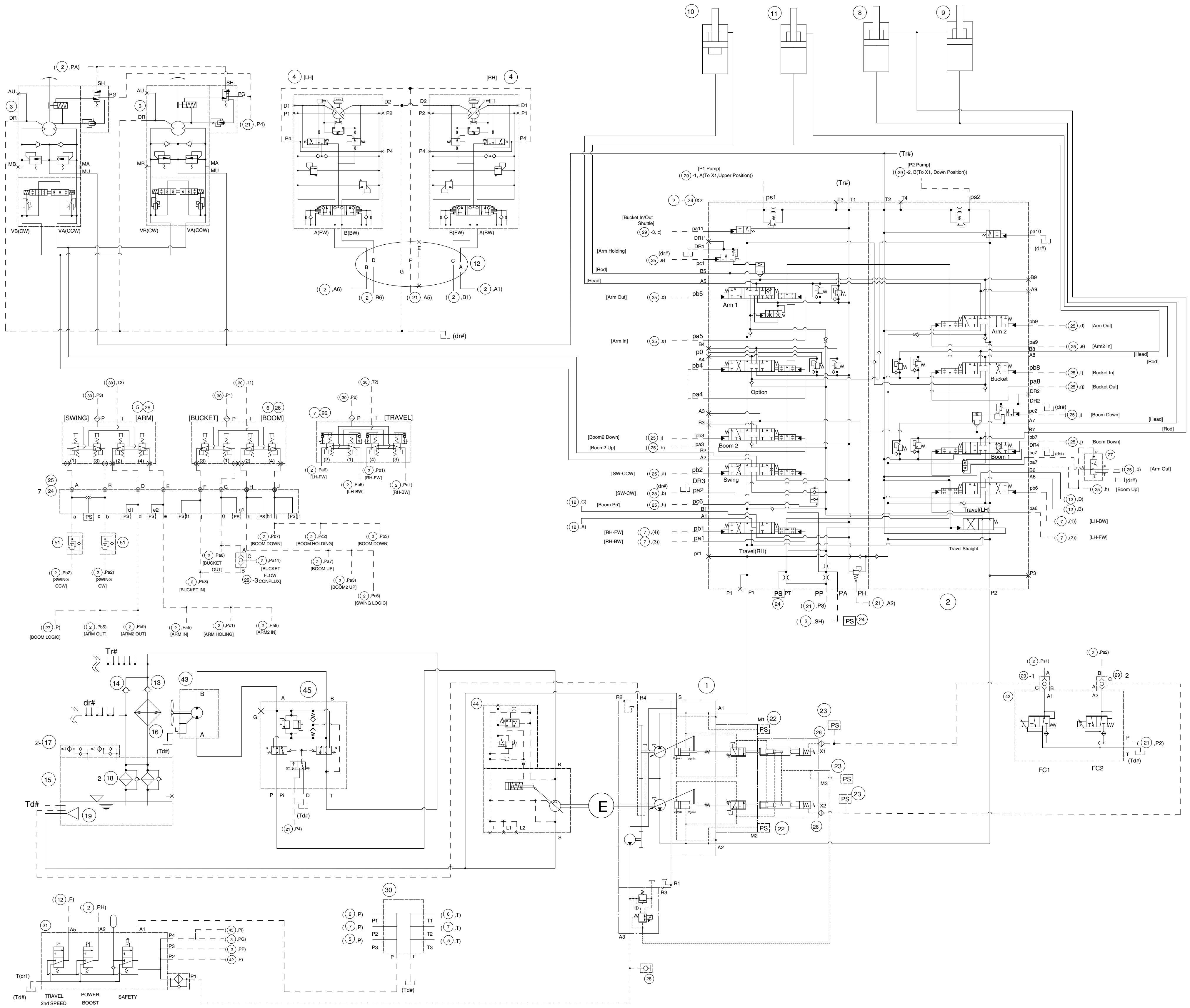


220F2RP04

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

1. HYDRAULIC CIRCUIT (1/2)

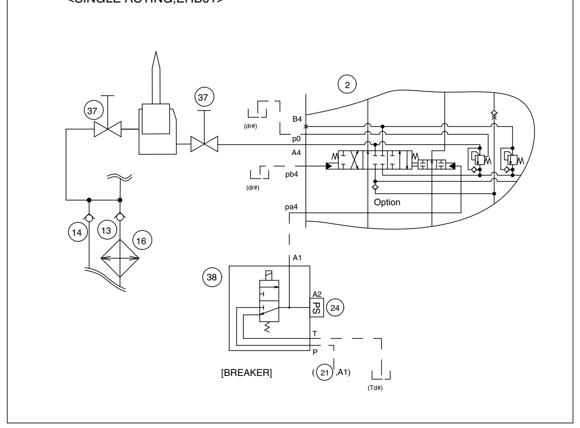


1 Main pump
2 Main control valve
3 Swing motor
4 Travel motor
5 RCV lever (LH)
6 RCV lever (RH)
7 RCV pedl
8 Boom cylinder (LH)
9 Boom cylinder (RH)
10 Arm cylinder
11 Bucket cylinder
12 Turning joint
13 Check valve return
14 Check valve
15 Hydraulic tank
16 Oil cooler
17 Air breather
18 Return filter
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 Pilot selector valve
28 Screw coupling
29 Tee shuttle
30 Cross assembly
42 2-EPPR valve
43 Fan motor
44 Fan pump
45 Direction change valve
51 Shockless valve

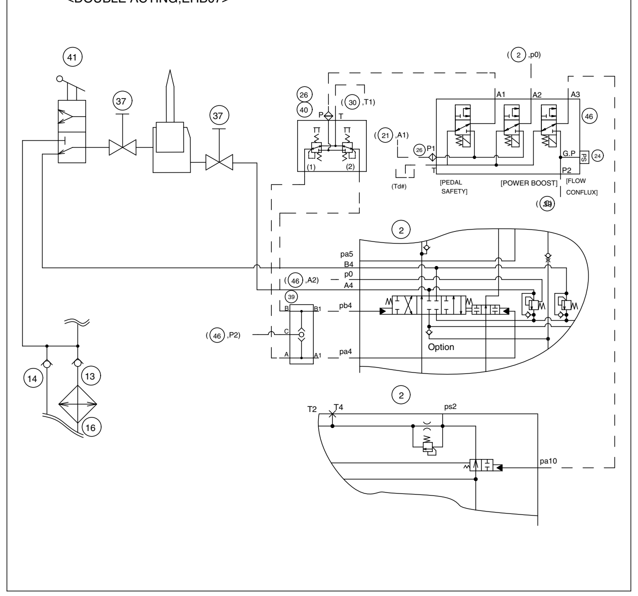
30KB-37100-04 1OF2

2. HYDRAULIC CIRCUIT (2/2)

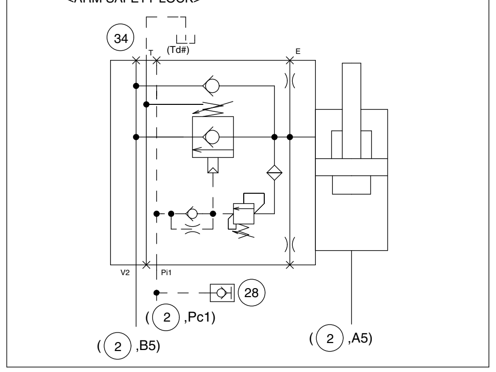
<SINGLE ACTING,EHB01>



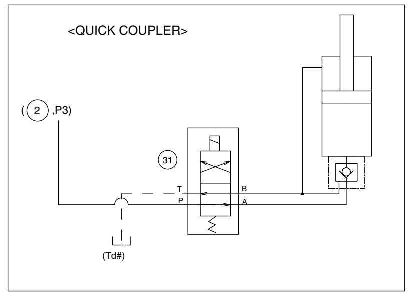
<DOUBLE ACTING,EHB07>



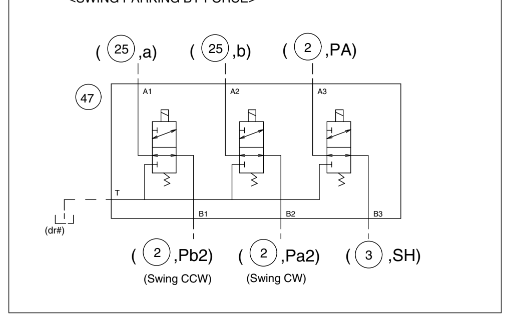
<ARM SAFETY LOCK>



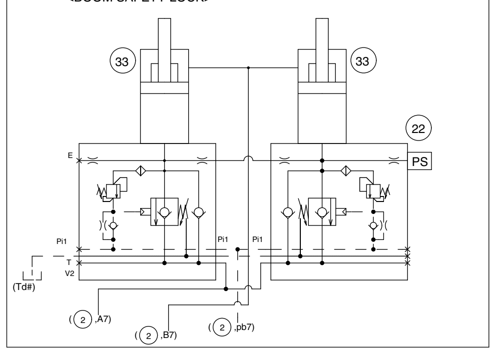
<QUICK COUPLER>



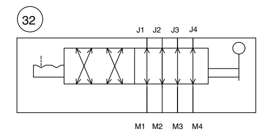
<SWING PARKING BY FORCE>



<BOOM SAFETY LOCK>

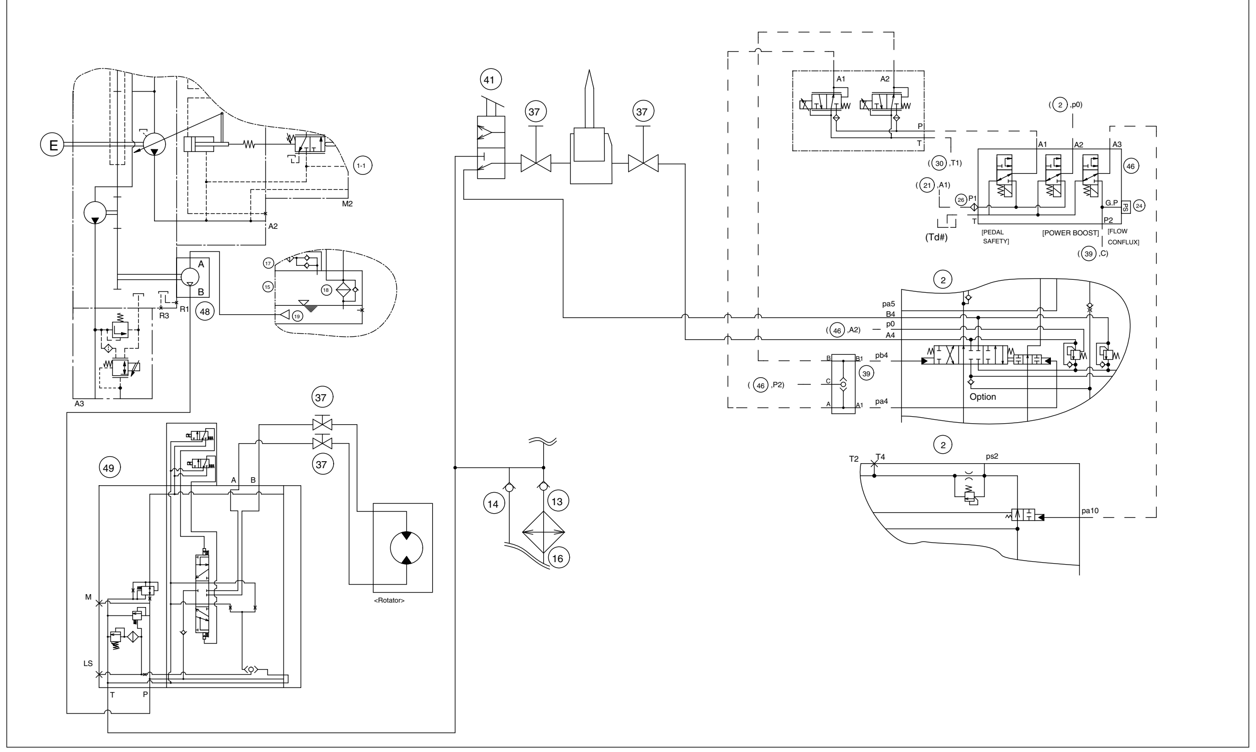


<PATTERN CHANGE>



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

<PROPOTIONAL RCV DOUBLE ACTING.EHB17 & ROTATING>



1-1 Main pump
22 Pressure sensor
24 Pressure sensor
26 Last guard filter
28 Screw coupling
31 Solenoid valve
32 Pattern change valve
33 Cylinder safety valve (LH, RH)
37 Stop valve
38 Solenoid valve
39 Shuttel vavlve
40 2-Way pedal
41 3-Way joint
46 Solenoid valve
47 Solenoid valve
48 Gear pump
49 Proportional valve
50 2-EPPR valve

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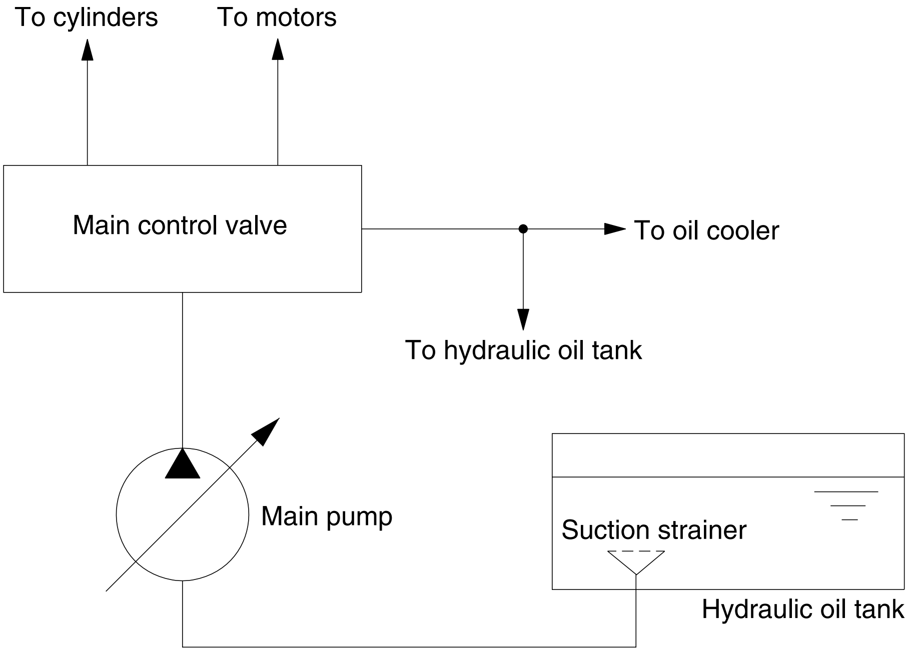
GROUP 2 MAIN CIRCUIT

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

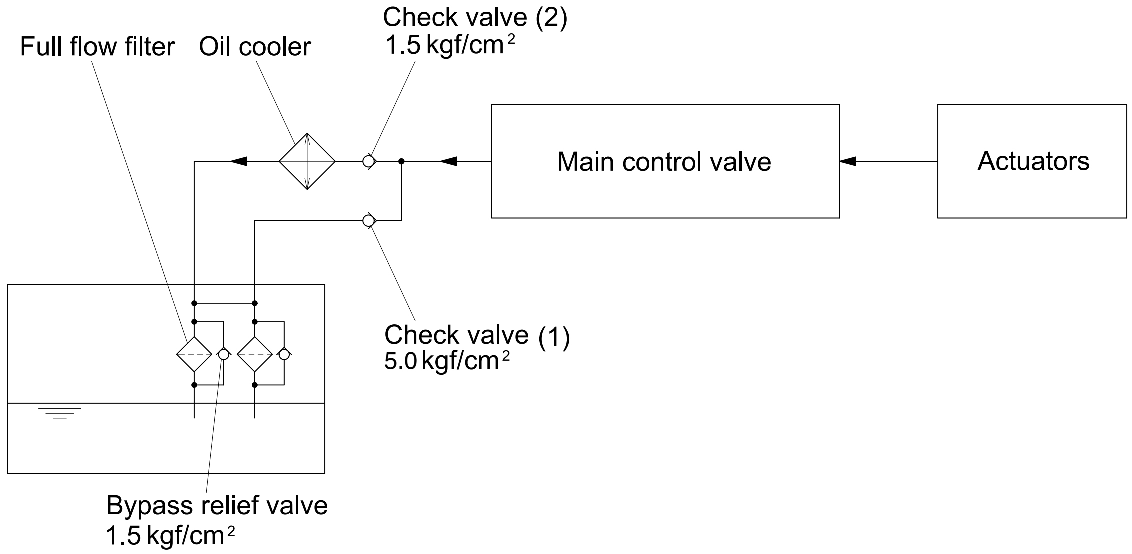


140L3CI01

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



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

The bypass check valves are provided in the return circuit.

The setting pressure of bypass check valves are 1.5 kgf/cm^2 (21 psi) and 5.0 kgf/cm^2 (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/cm^2 (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).

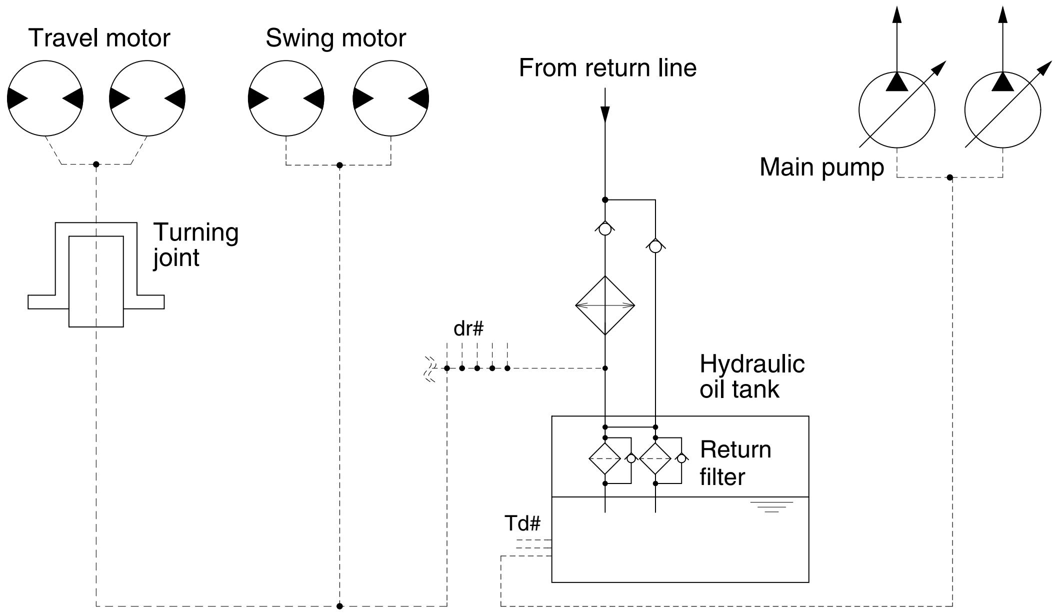
The full-flow filters and bypass relief valves are provided in the hydraulic tank.

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 filters.

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

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

3. DRAIN CIRCUIT



480SA3CI02

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

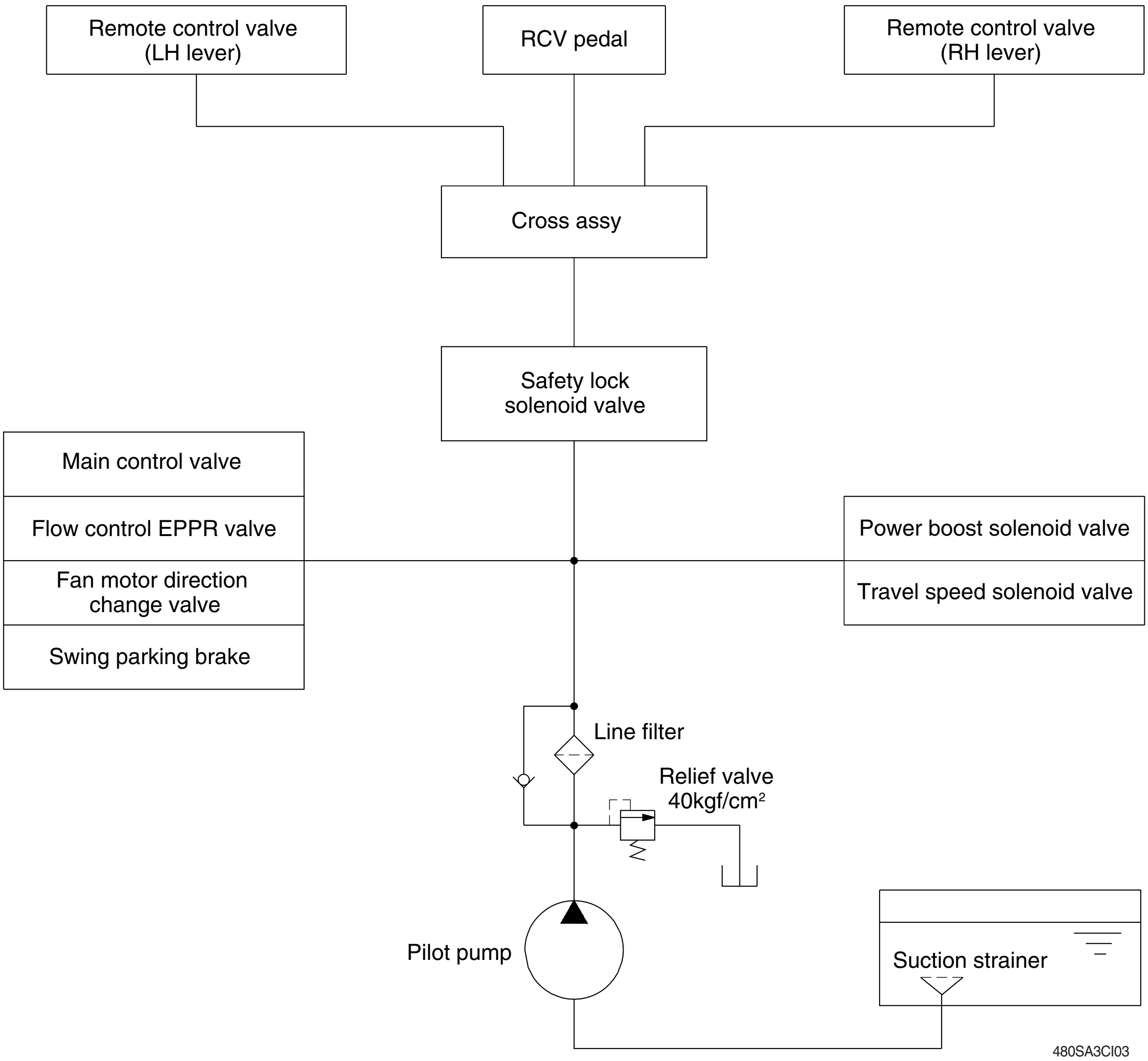
Oil leaking from the swing motors comes out and joins the travel motors drain line and return to the hydraulic tank.

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.

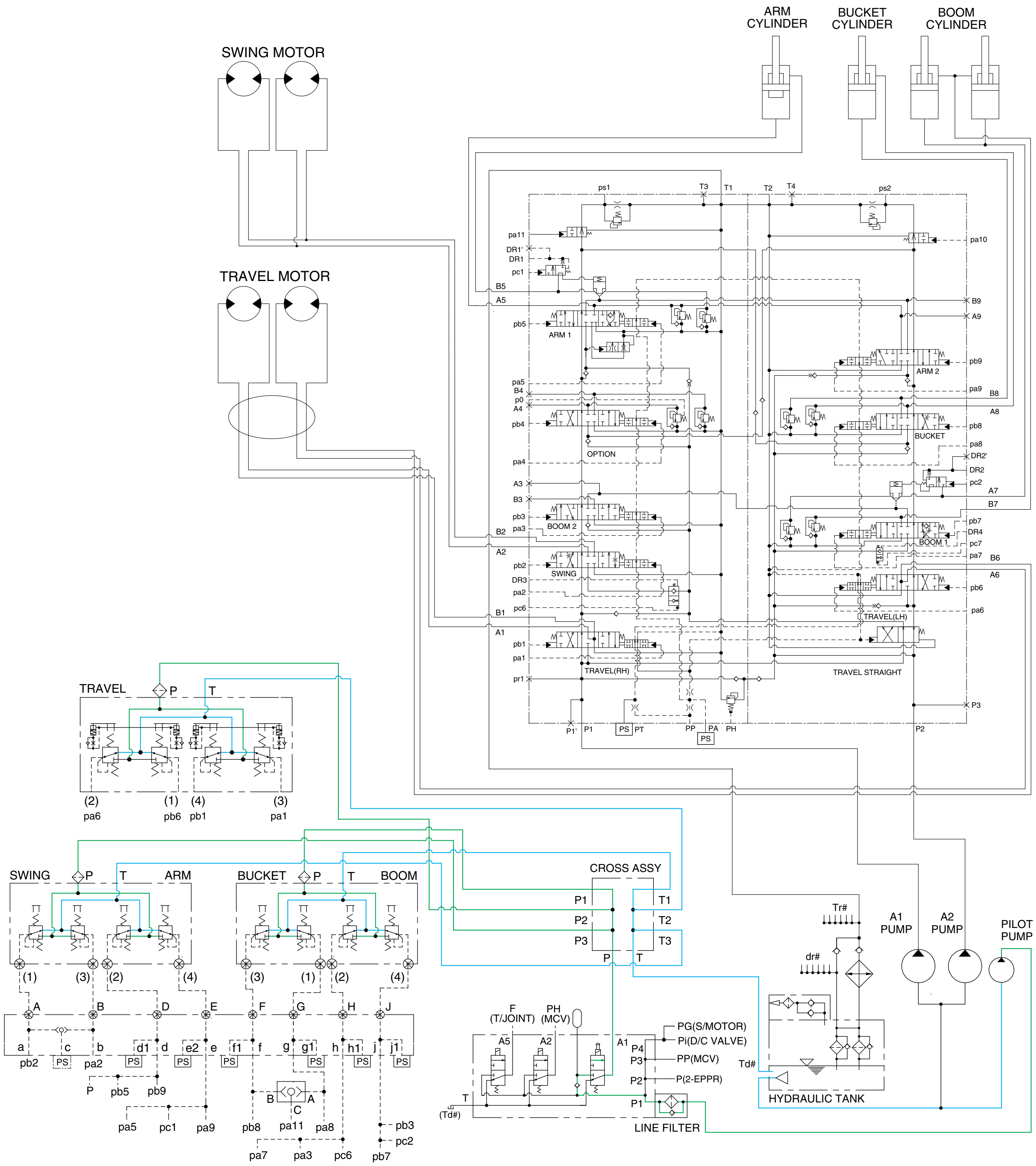
GROUP 3 PILOT CIRCUIT



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, safety lock solenoid valve and cross assembly.
Also, it flows to the solenoid valve assemblies, swing parking brake, main control valve, fan motor direction change valve and flow control EPPR valve.

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

1. SUCTION, DELIVERY AND RETURN CIRCUIT



480SA3HC02

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.

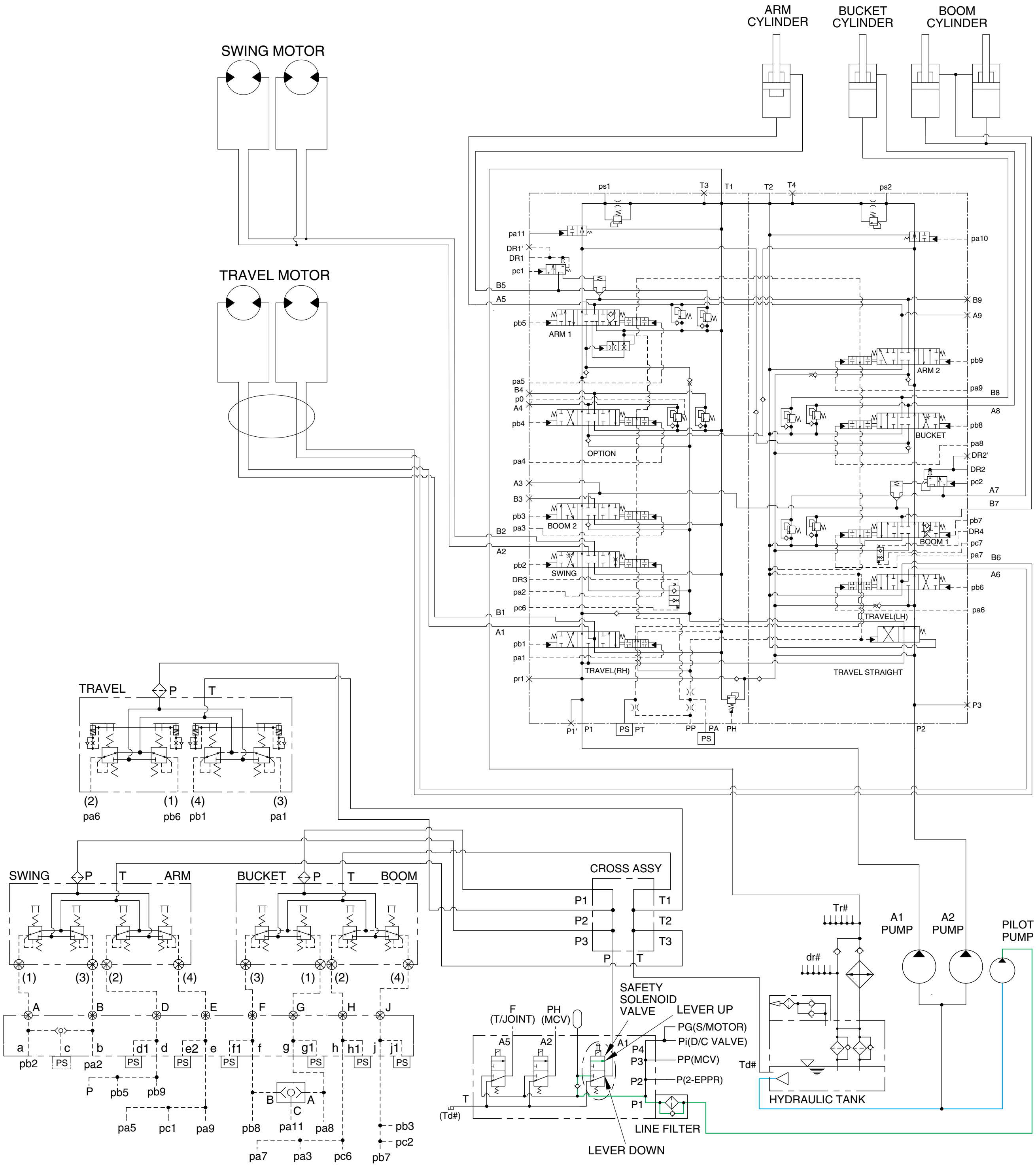
The oil filtered by line filter flows remote control valve through safety solenoid valve and cross assy.

Also, the oil flows 3-cartridge valve, swing parking valve, main control valve, fan motor direction change 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)

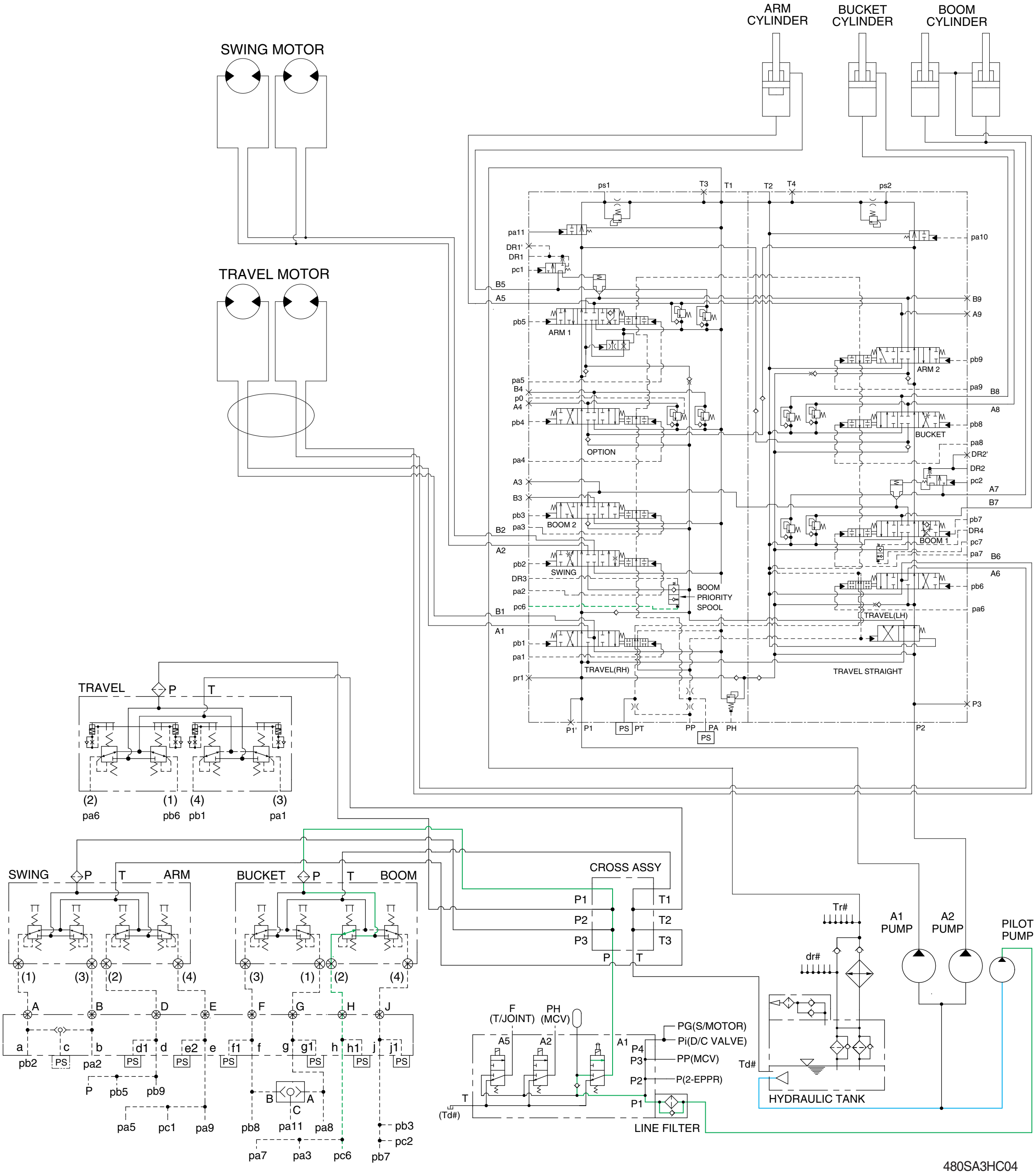


480SA3HC03

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



480SA3HC04

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

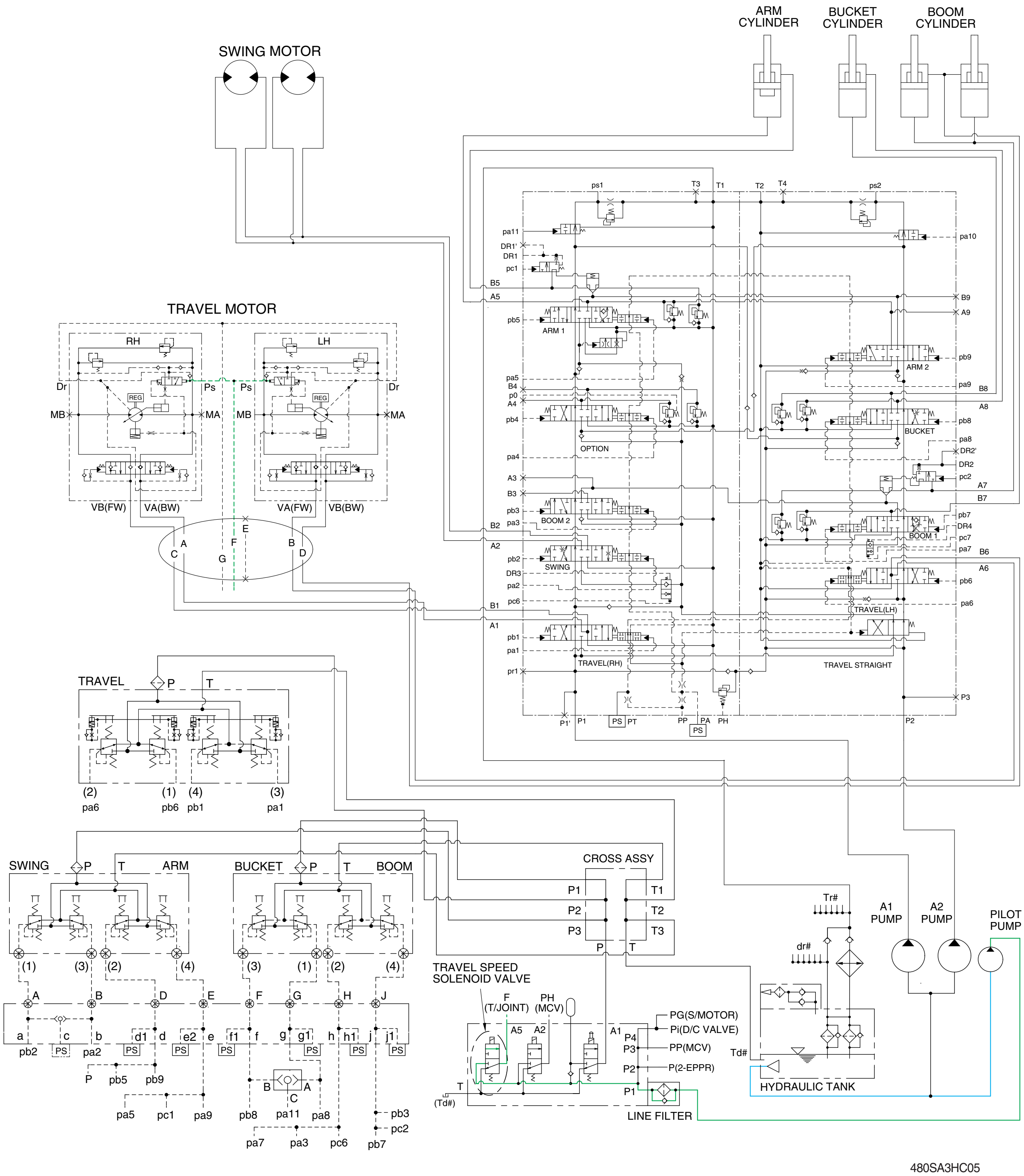
To increase working efficiency, swing speed reducing system is used.

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.

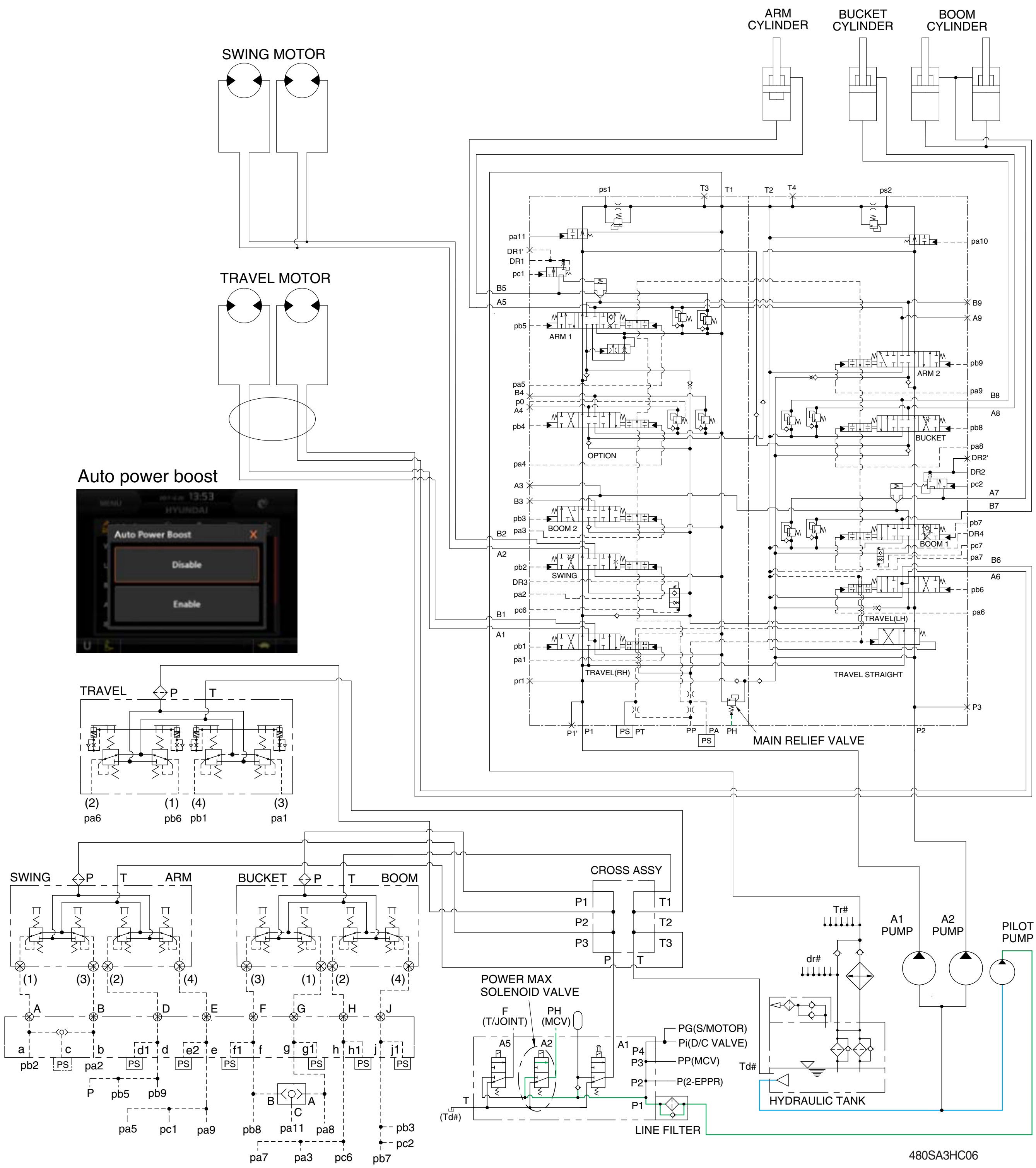
4. TRAVEL SPEED CONTROL SYSTEM



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.

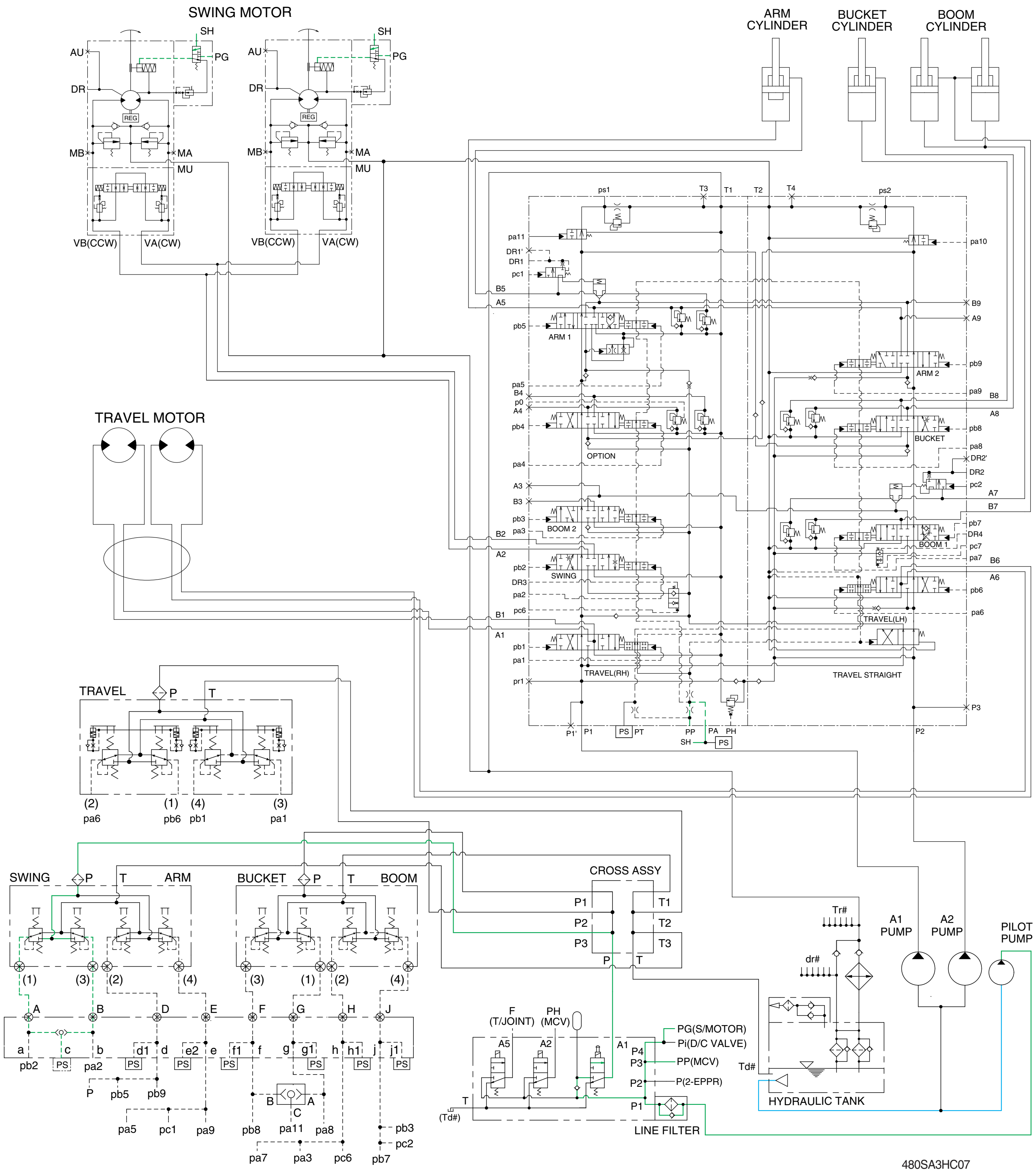
5. MAIN RELIEF PRESSURE CHANGE CIRCUIT



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 one of the RCV lever (except travel lever) is tilted, the pilot oil flows into SH port through main control valve.

This pressure moves spool so, discharged oil from pilot pump flows to swing motor PG port.

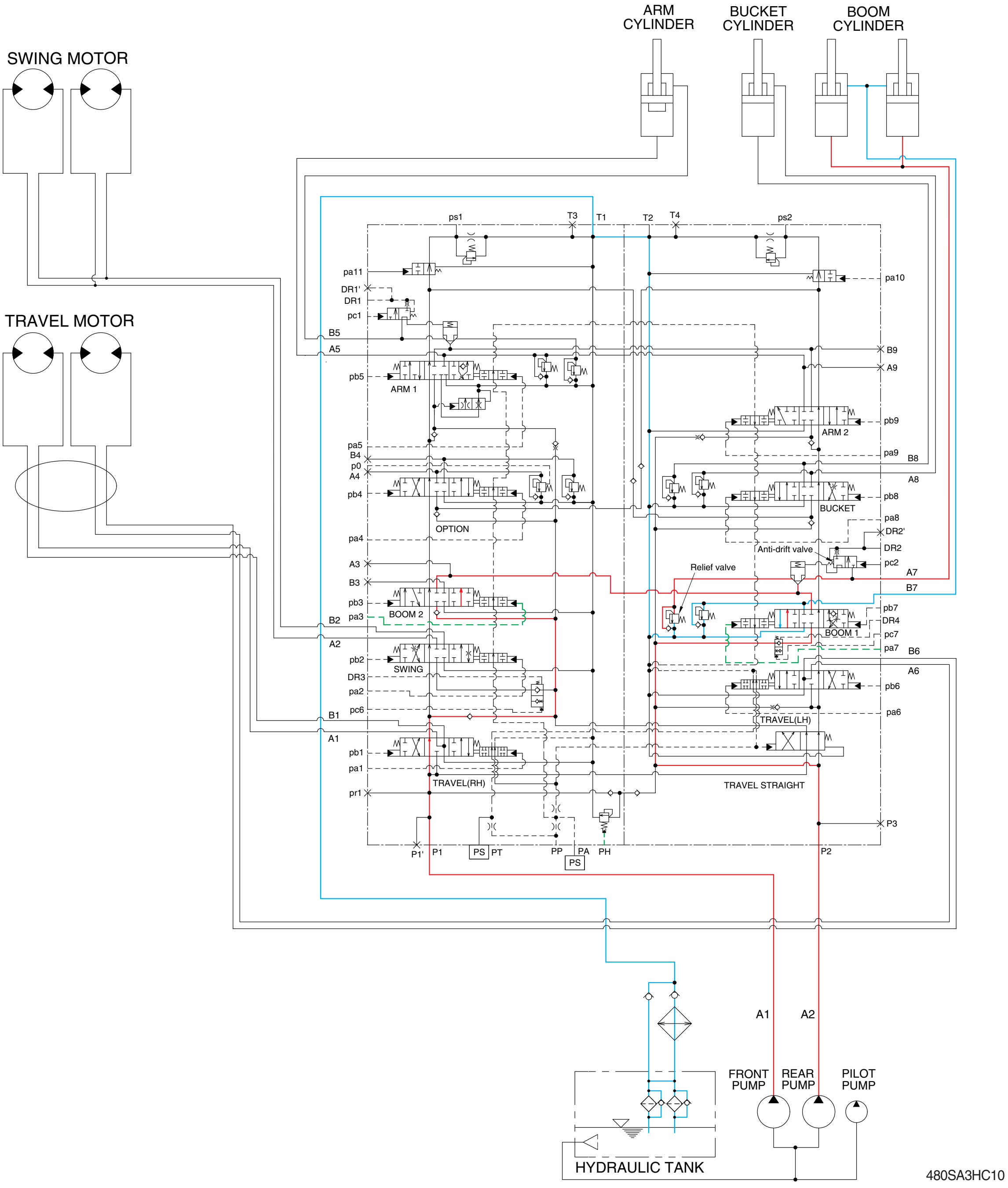
This pressure is applied to swing motor disc, thus the brake is released.

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

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

GROUP 4 SINGLE OPERATION

1. BOOM UP OPERATION



When the RH control lever is pulled back, the boom spools in the main control valve are moved to the up position by the pilot oil pressure (pa3, pa7) 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.

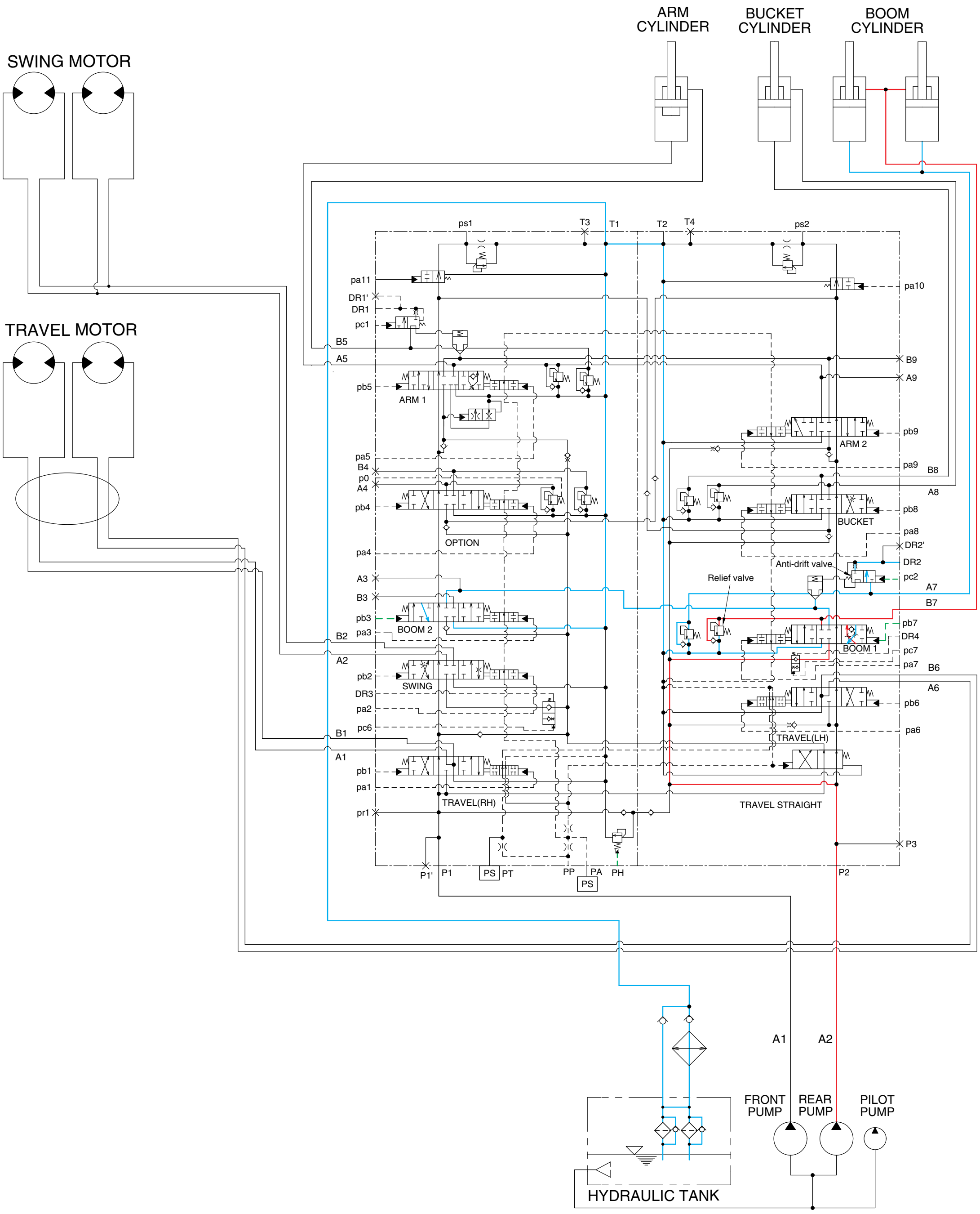
The excessive pressure in the boom cylinder bottom end circuit is prevented by relief valve.

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



480SA3HC11

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 (pb3, pb7) from the remote control valve.

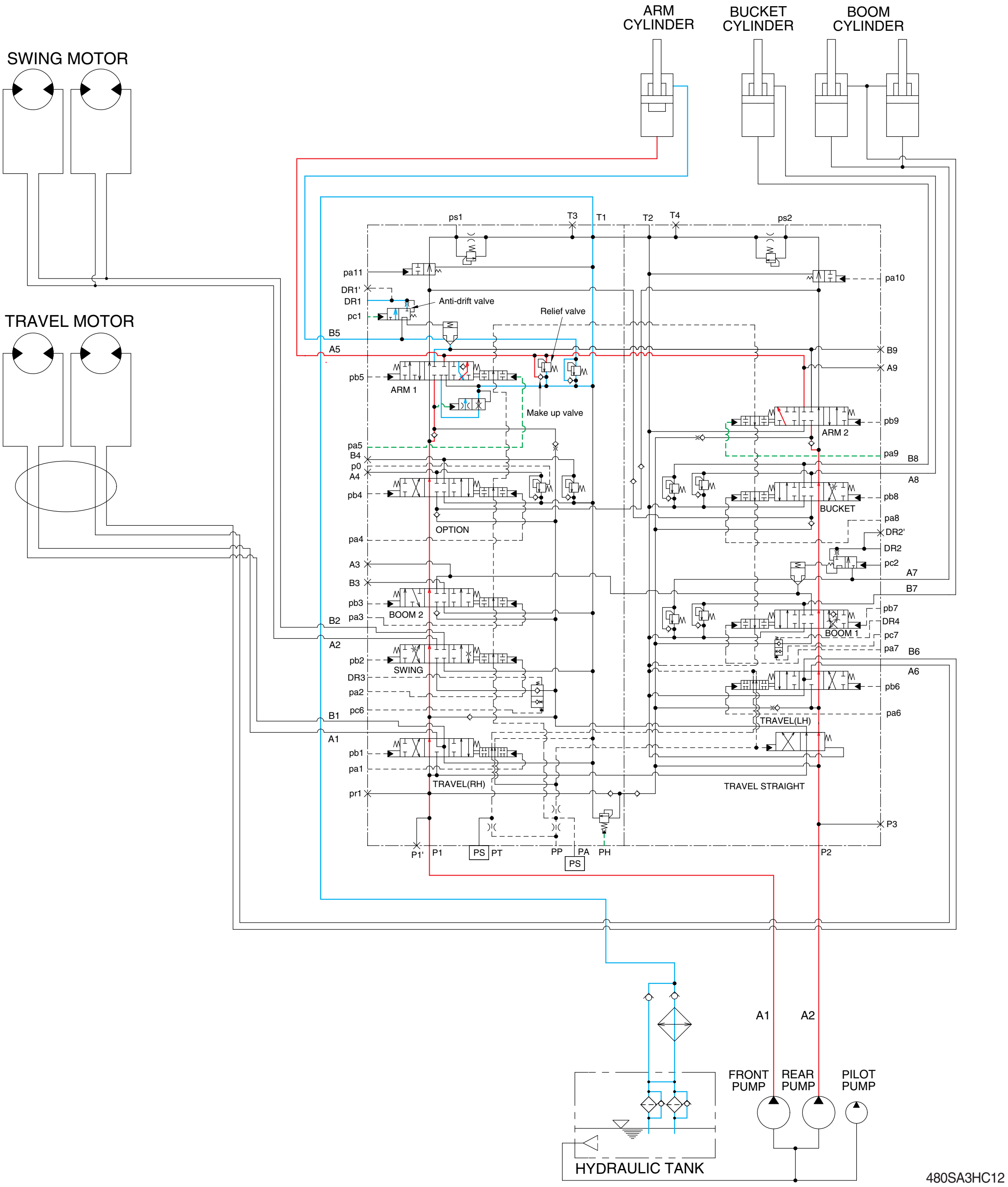
The oil from the A2 pump flows into the main control valve and then goes to the small chamber of boom cylinders. At the same time, the oil from the large chamber of boom cylinders returns to the hydraulic tank through the boom spools in the main control valve.

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.

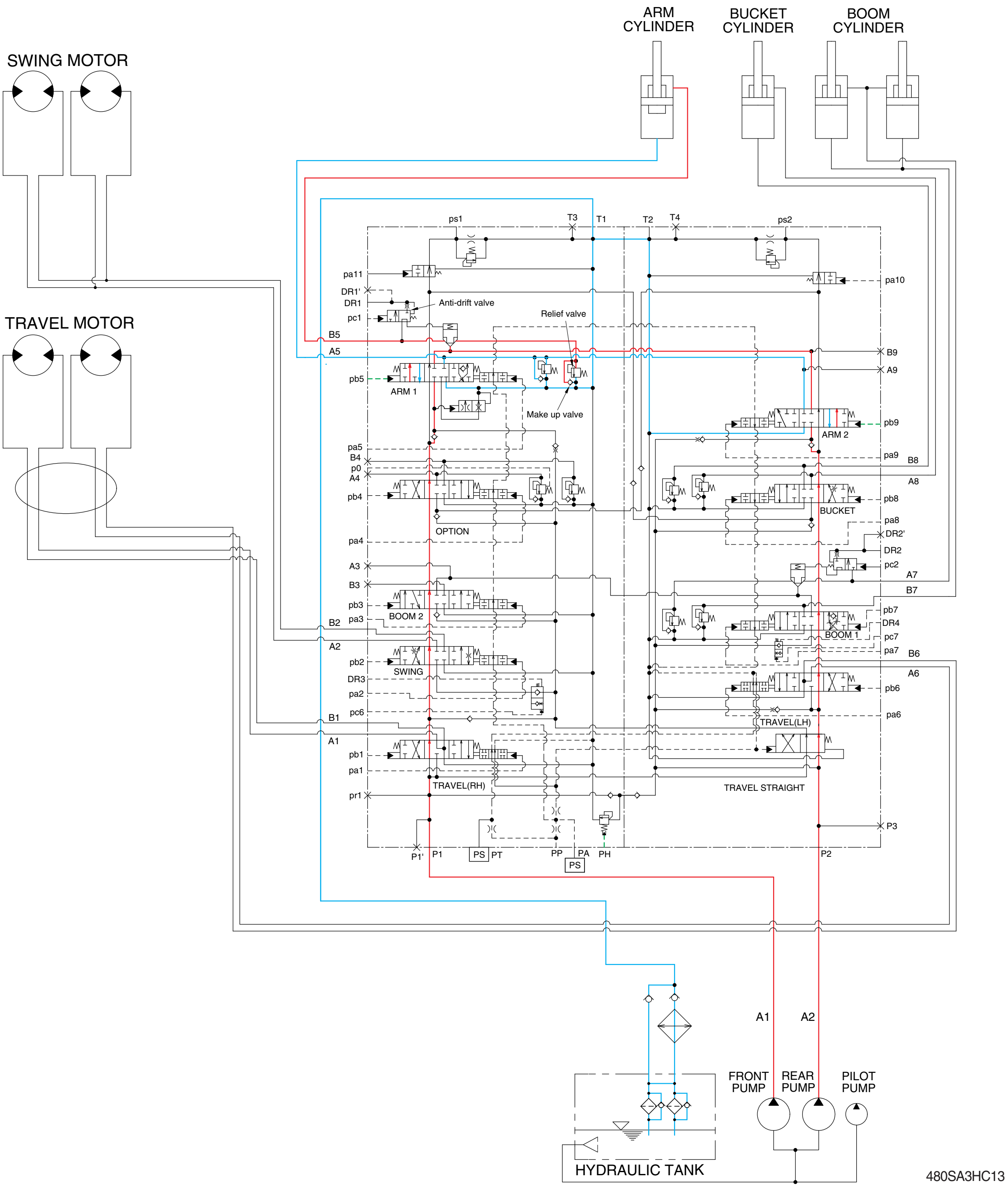
At the same time, the oil from small chamber of arm cylinder returns to the hydraulic oil tank through the arm 1 spool in the main control valve. When this happens, the arm rolls in.

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.

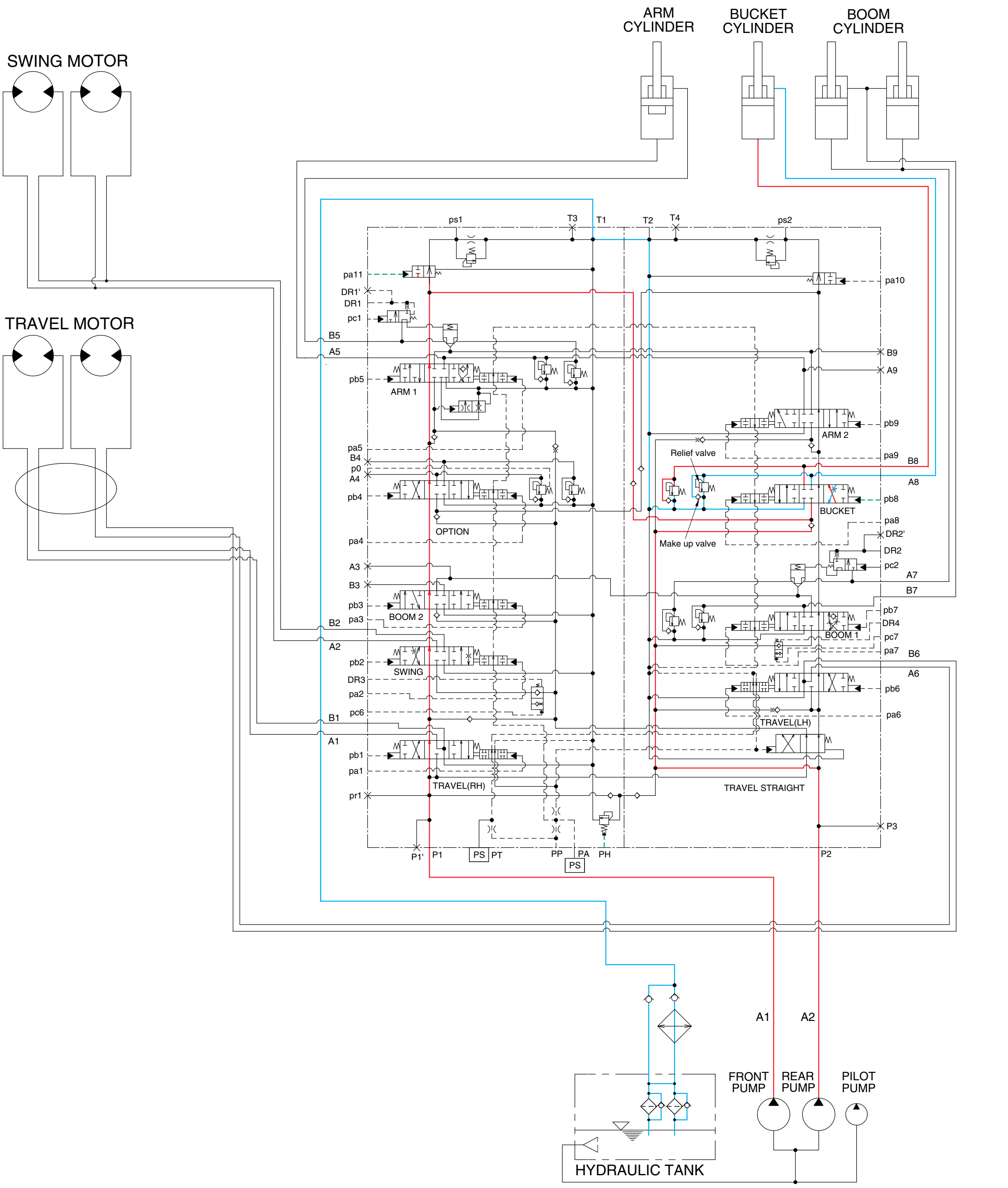
The excessive pressure in the arm cylinder rod side is prevented by relief valve.

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



480SA3HC14

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).

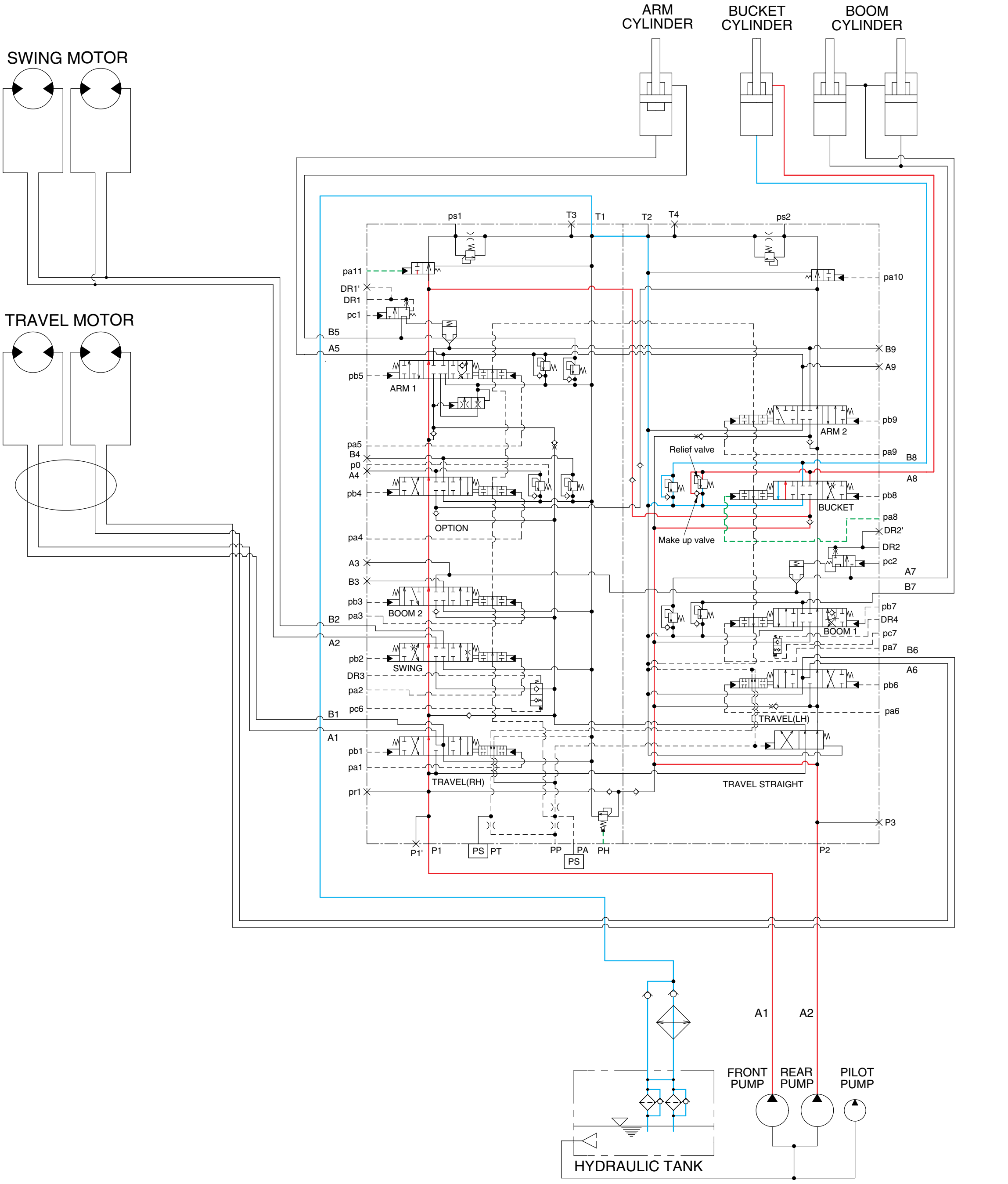
At the same time, the oil from the small chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls in.

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



480SA3HC15

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).

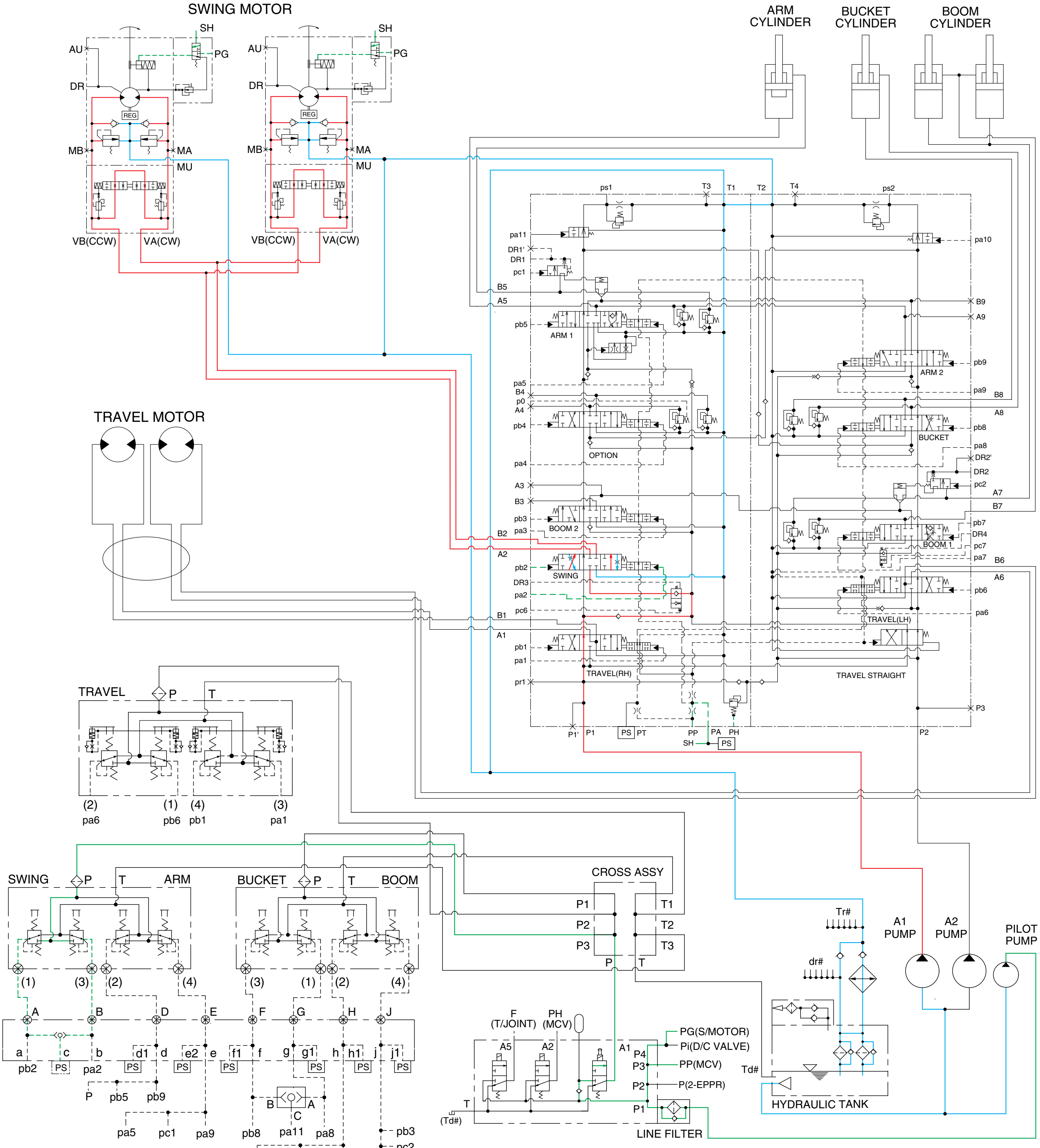
At the same time, the oil from the large chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls out.

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



480SA3HC16

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 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.

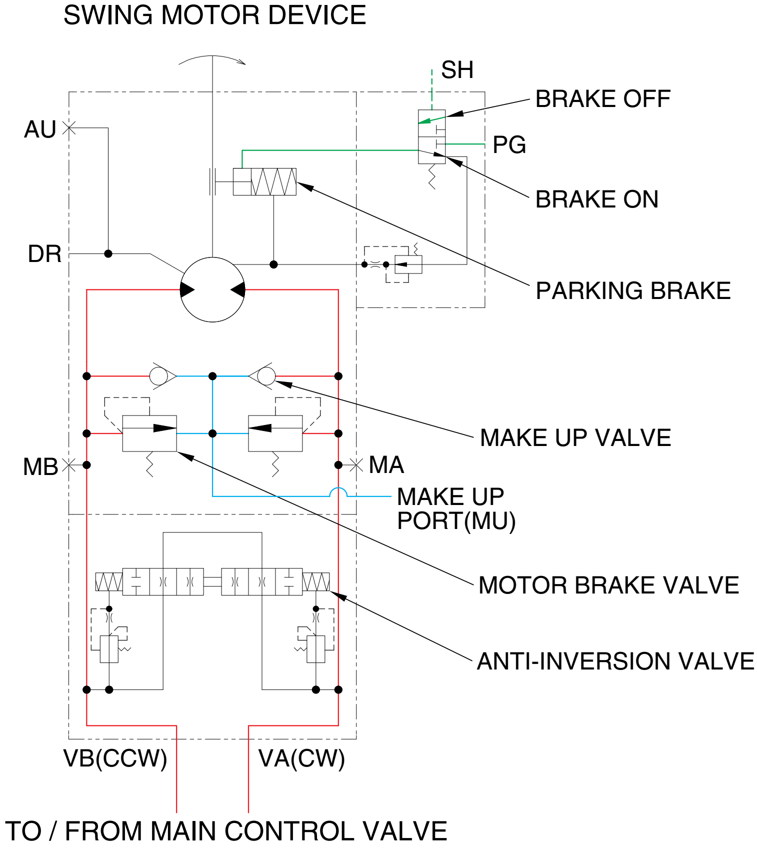
When this happens, the upper structure swings to the left or right.

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



480SA3HC17

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 all of the RCV lever (except travel pedal) are not operated.

PARKING BRAKE "OFF" OPERATION

The parking brake is released by the pilot pressure oil from the pilot pump.

When the RCV lever placed in the operating position, the pilot oil flows into SH port through the MCV. This pressure transferred to the brake release valve and the brake release valve is change over. Then the pilot oil pressure PG lift the brake piston and release the parking brake.

PARKING BRAKE "ON" OPERATION

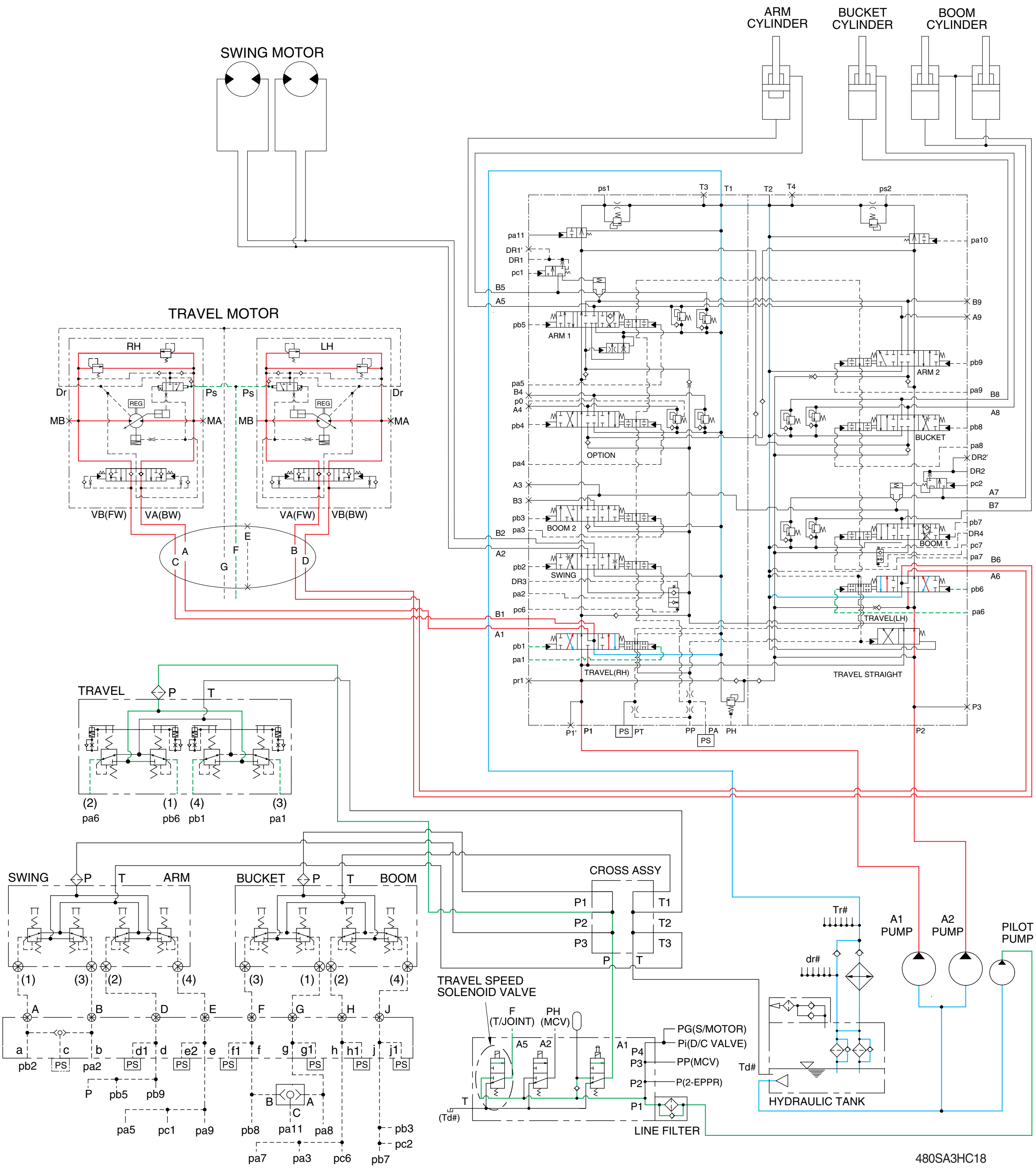
When all of the RCV lever placed in the neutral position, the pressure of the pilot oil passage down. Then the brake release valve returned to the neutral position and the oil is returned from the brake piston to the tank. And the brake is set to 'ON".

4) ANTI-INVERSION VALVE

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

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

8. TRAVEL FORWARD AND REVERSE OPERATION



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

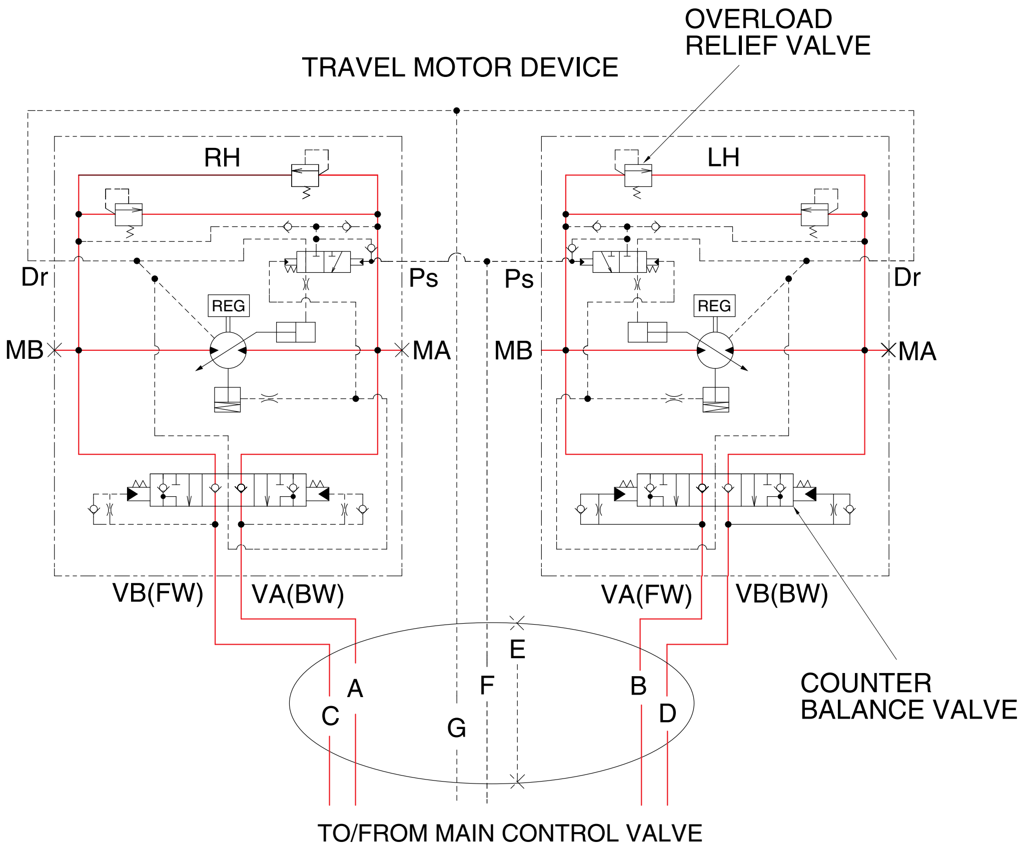
The oil from the each pump flows into the main control valve and then goes to the each travel motor through the turning joint.

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.

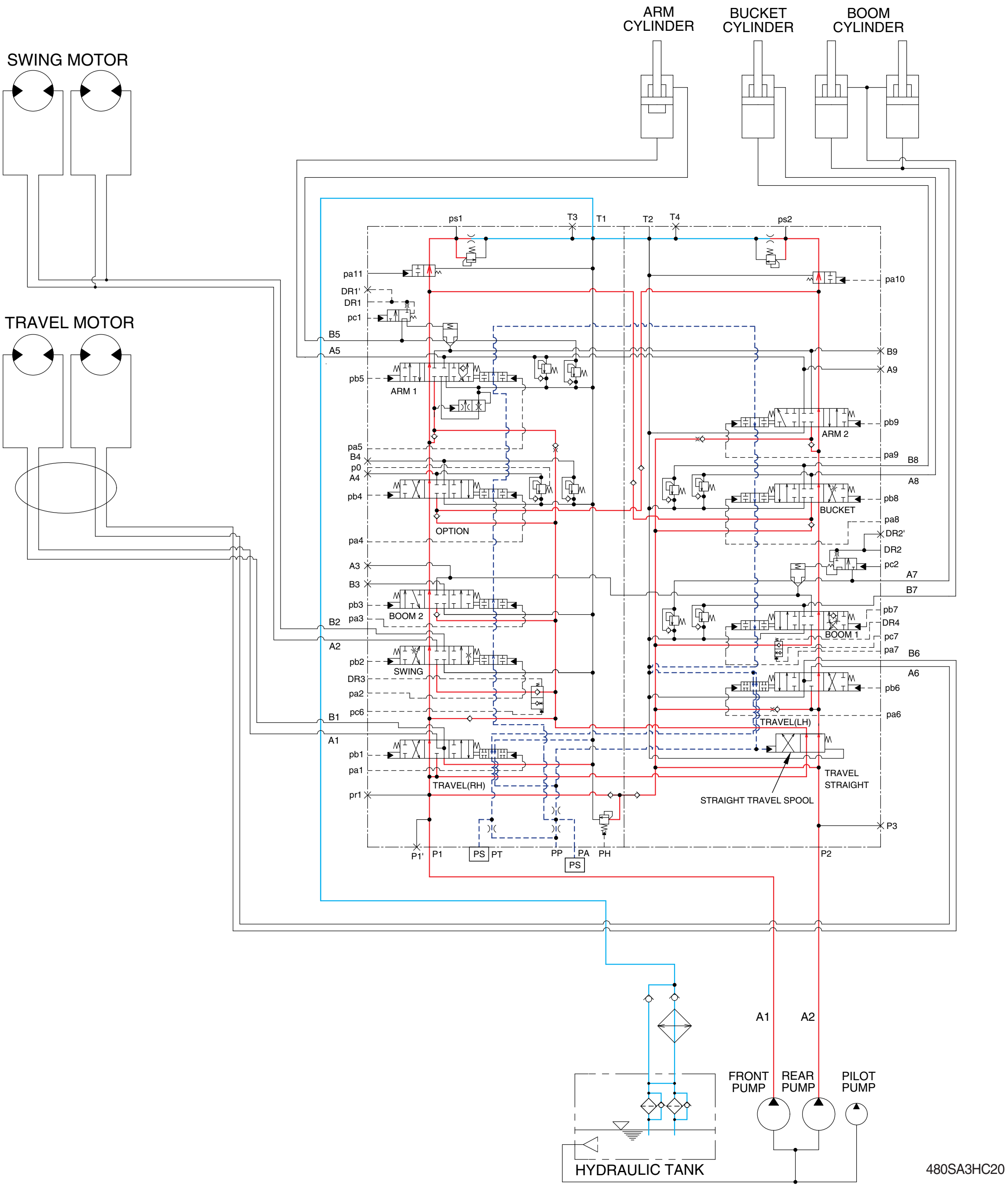
2) OVERLOAD RELIEF VALVE

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.

GROUP 5 COMBINED OPERATION

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

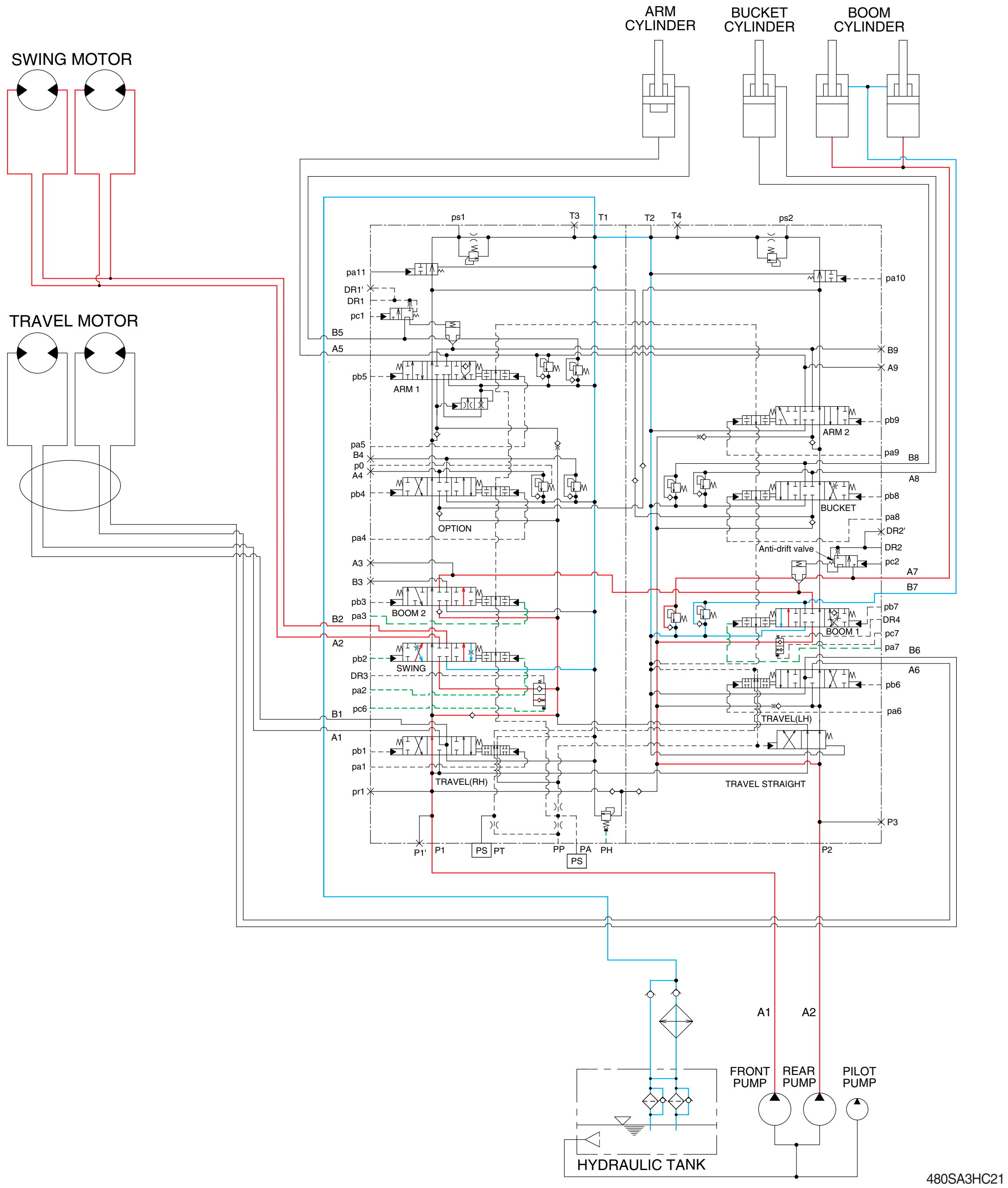
This straight travel spool is provided in the main control valve.

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, pa3, pa7) from the remote control valve.

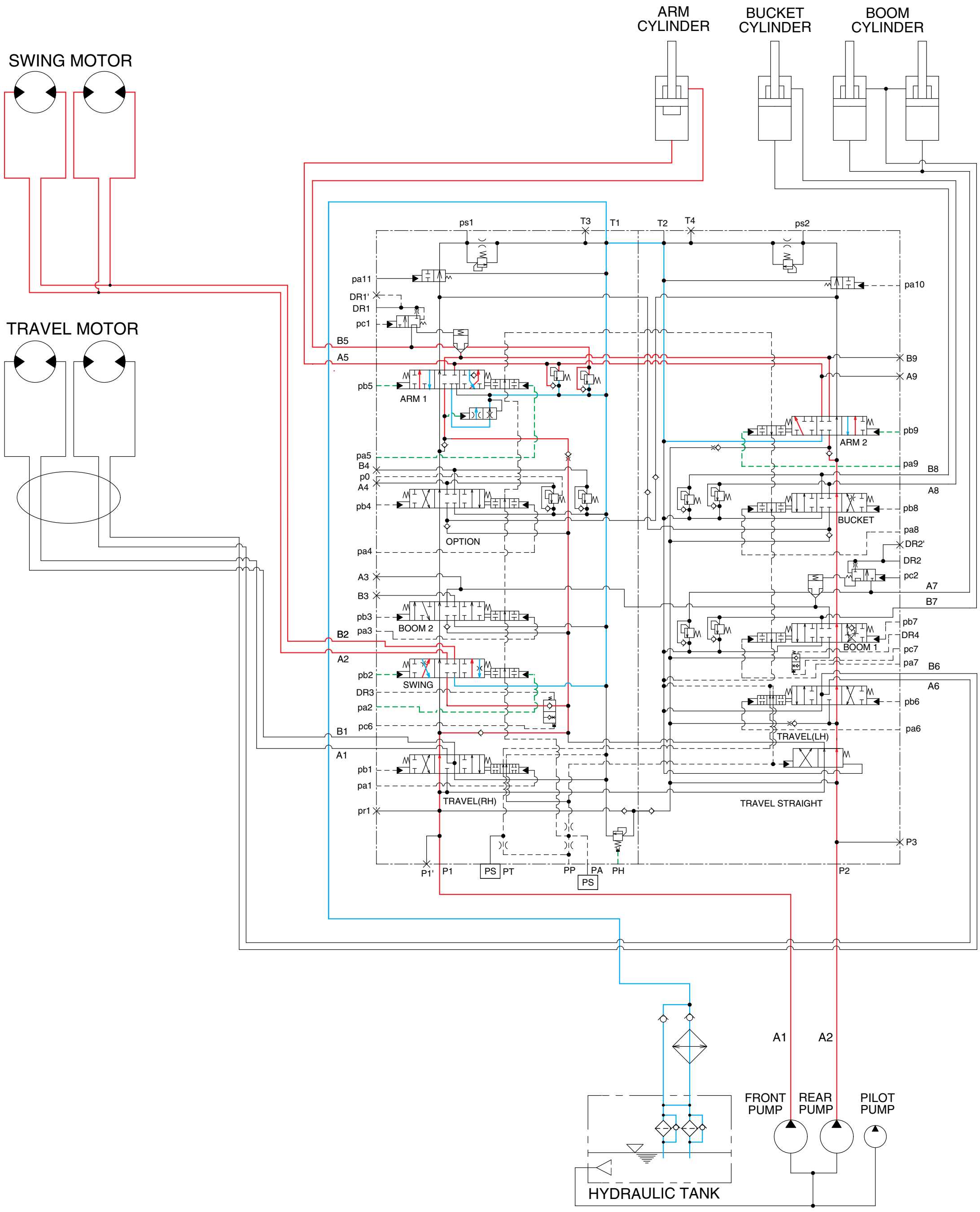
The oil from the A1 pump flows into the swing motor through swing spool and the boom cylinder through boom 2 spool.

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

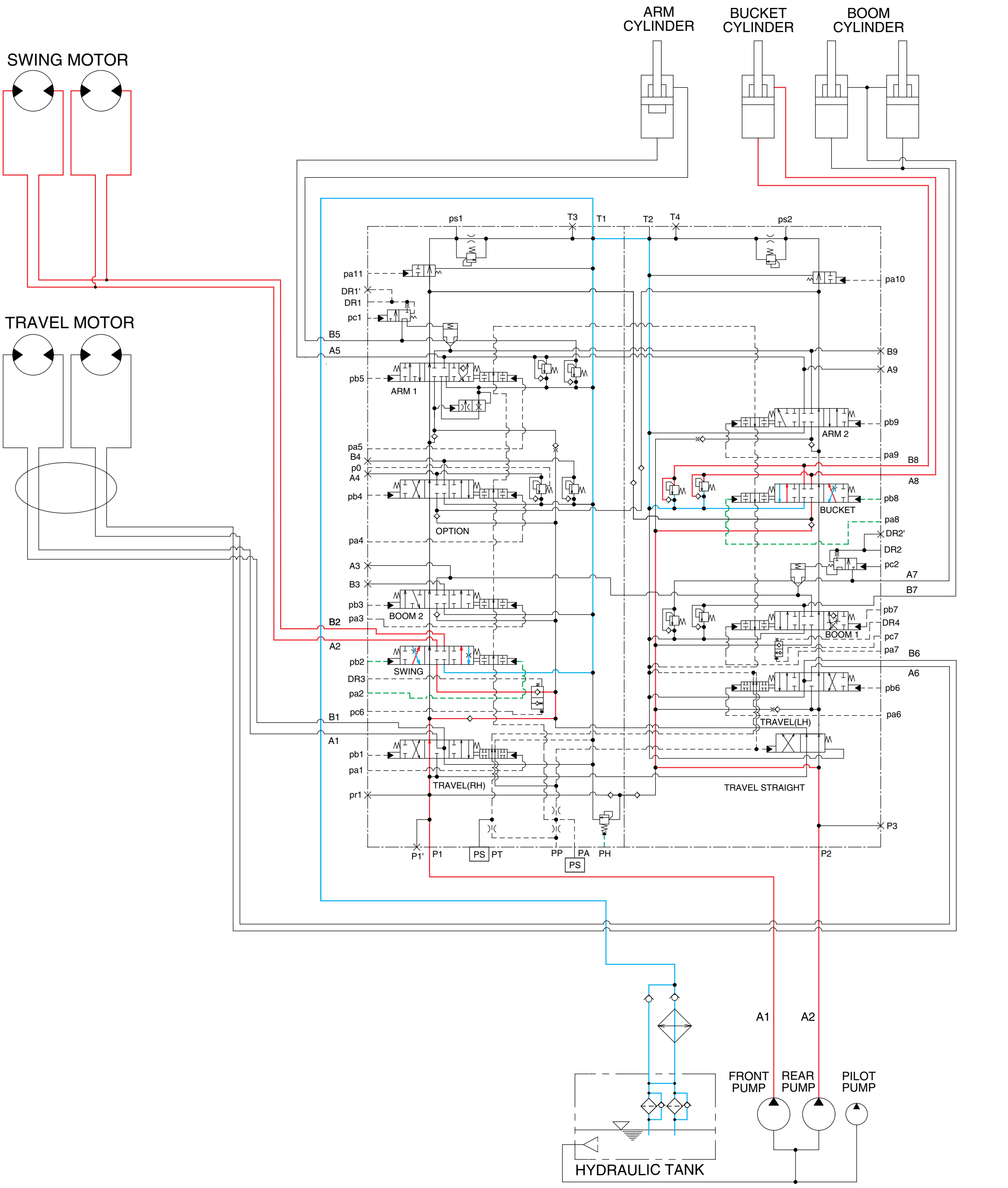


480SA3HC22

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



480SA3HC23

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.

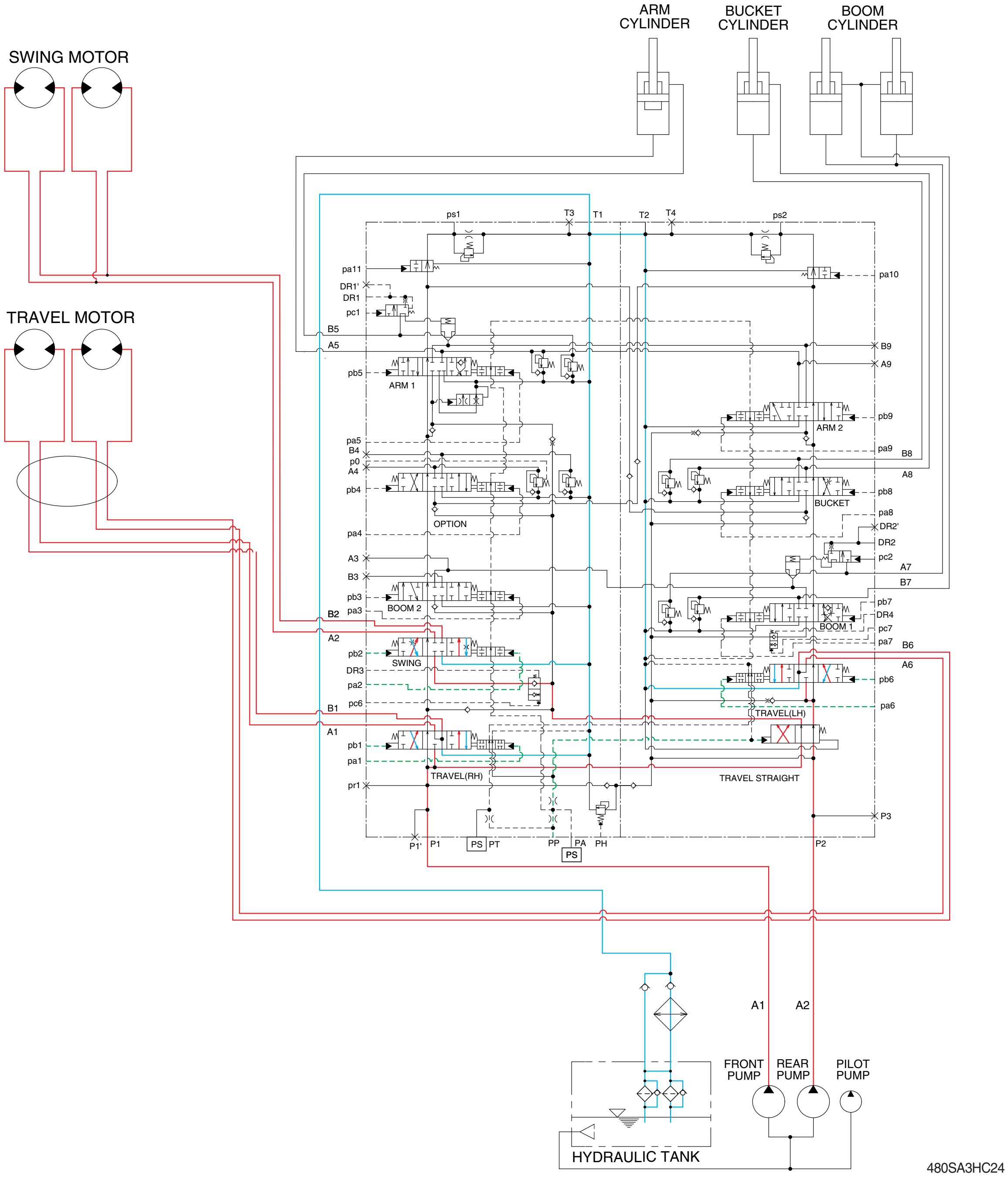
The oil from the A1 pump flows into the swing motor through the swing spool in the left control valve.

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.

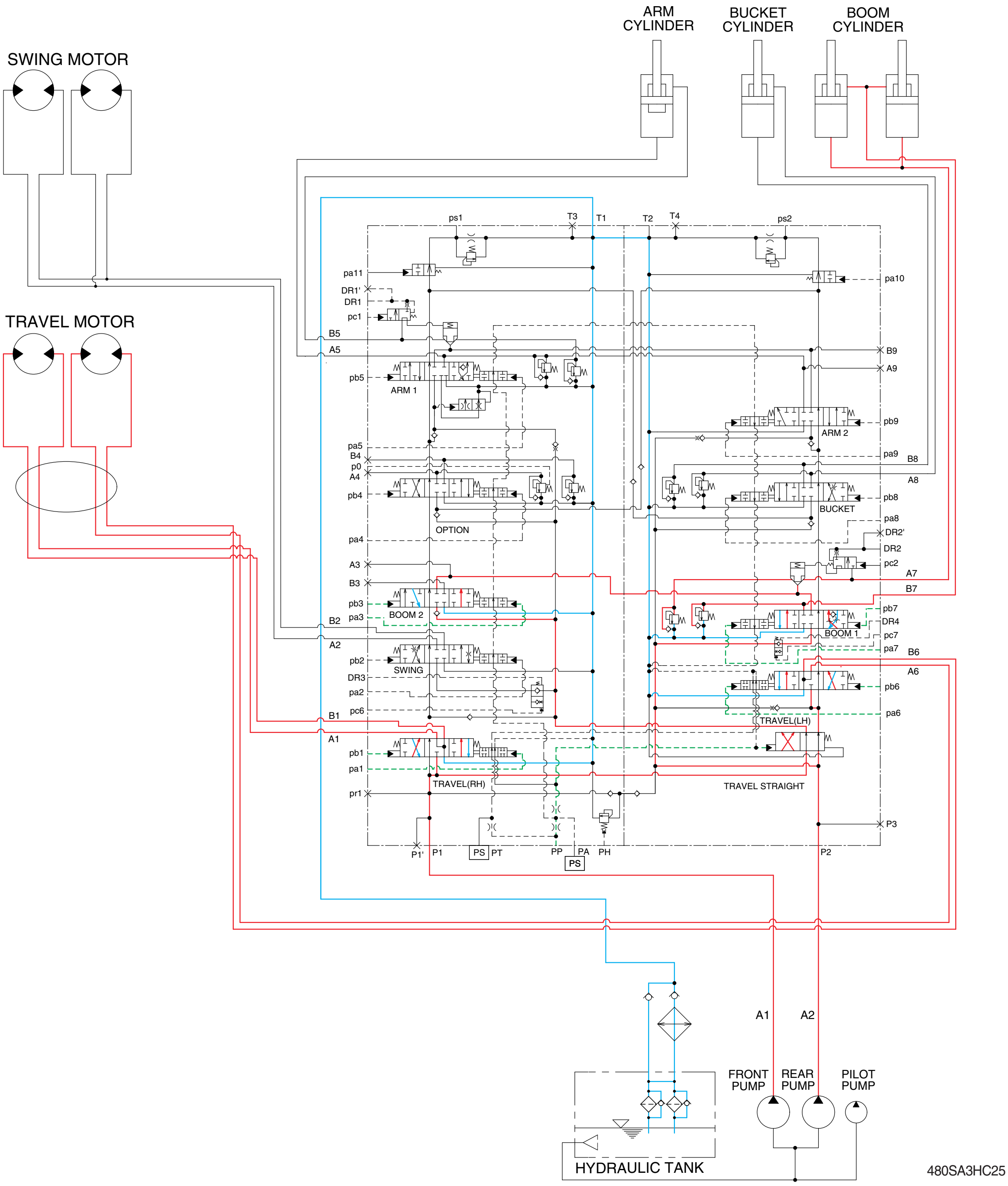
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

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 (Pa3, pa7, 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.

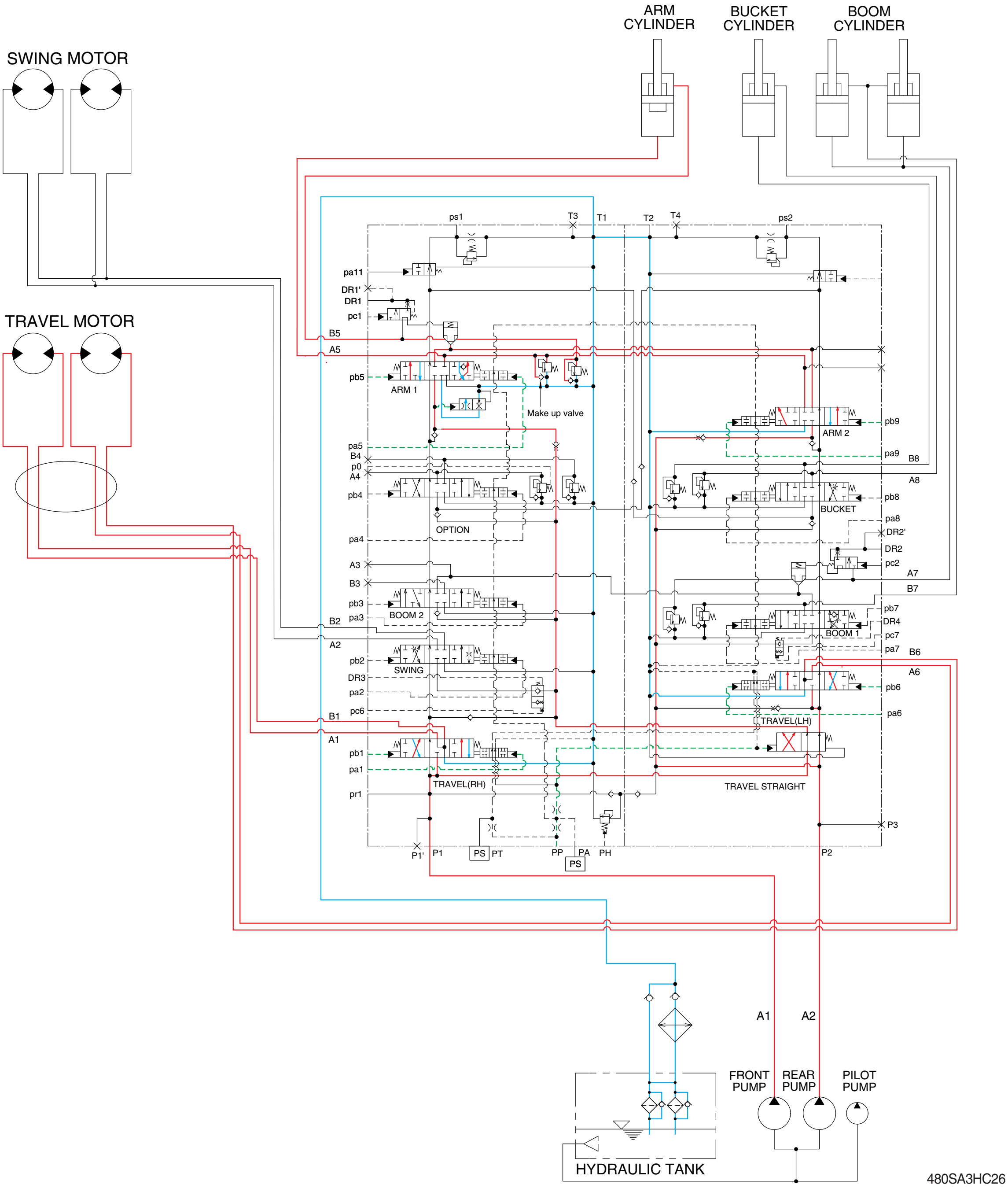
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

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.

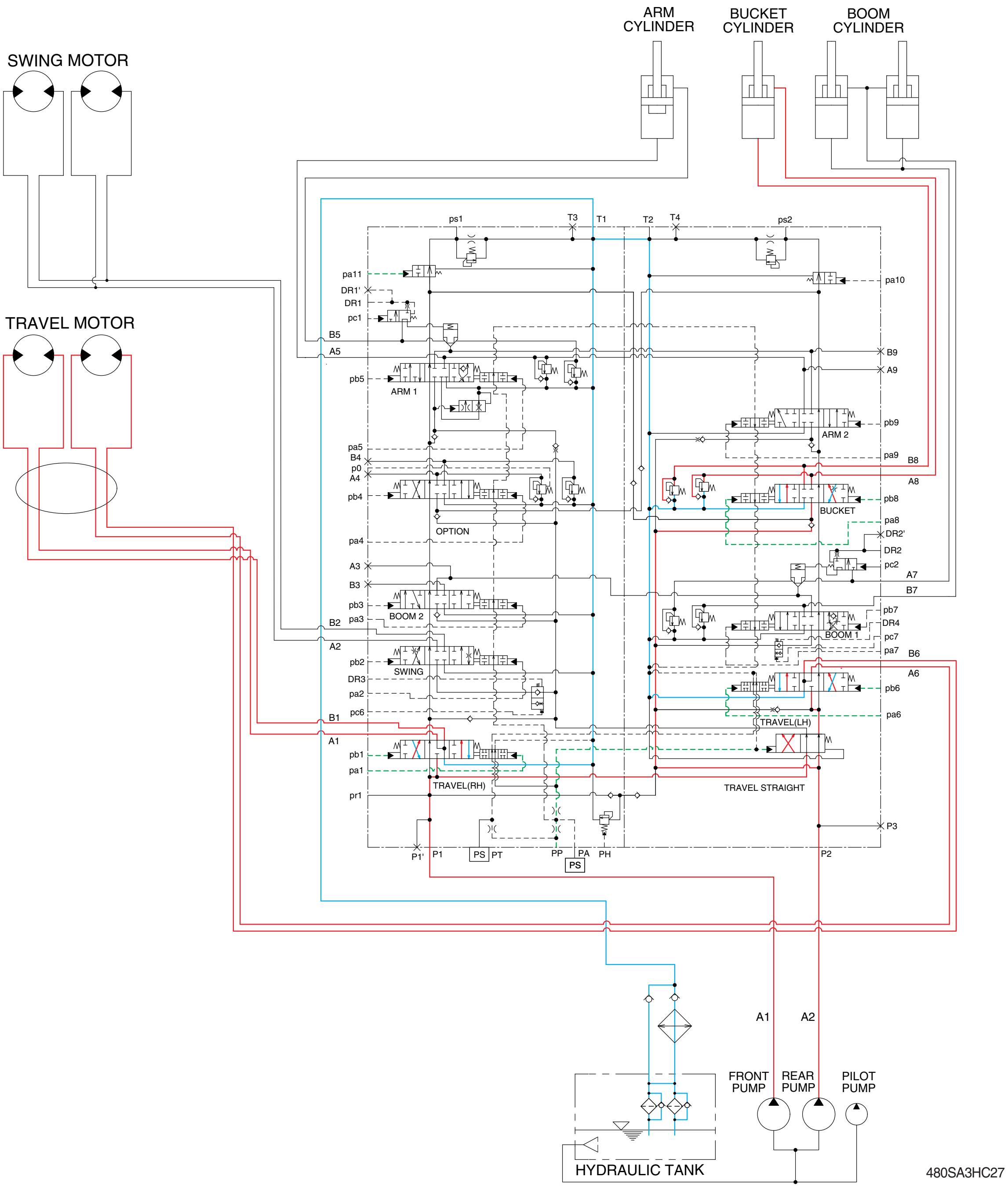
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

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.

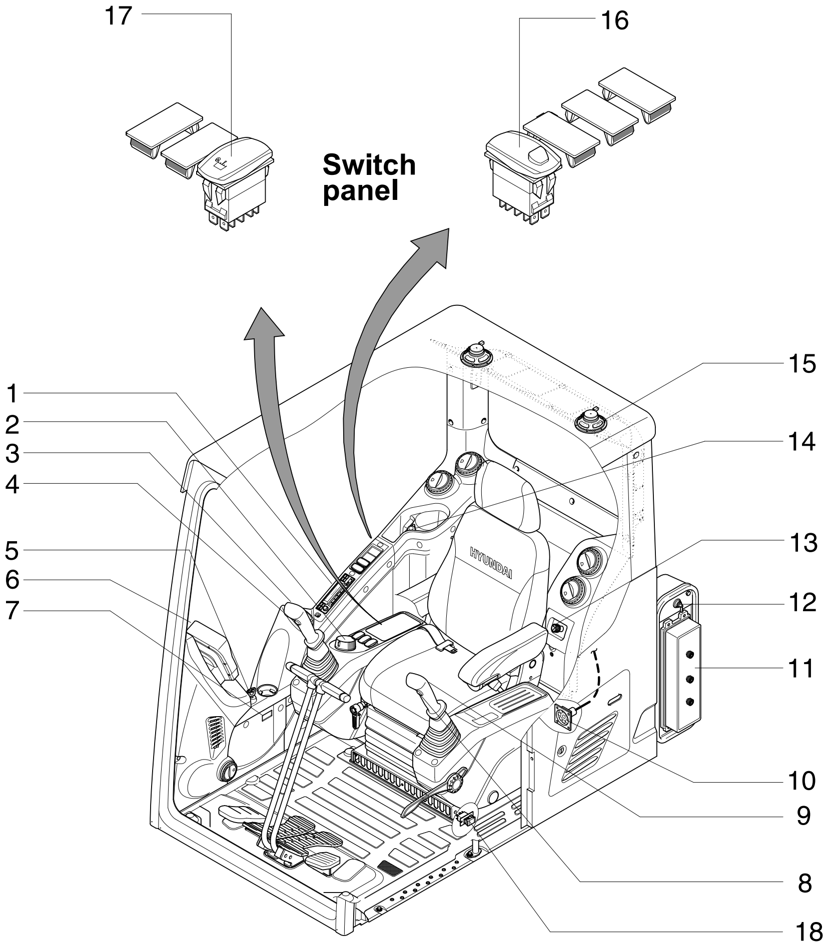
The bucket is operated and the machine travels straight.

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

SECTION 4 ELECTRICAL SYSTEM

GROUP 1 COMPONENT LOCATION

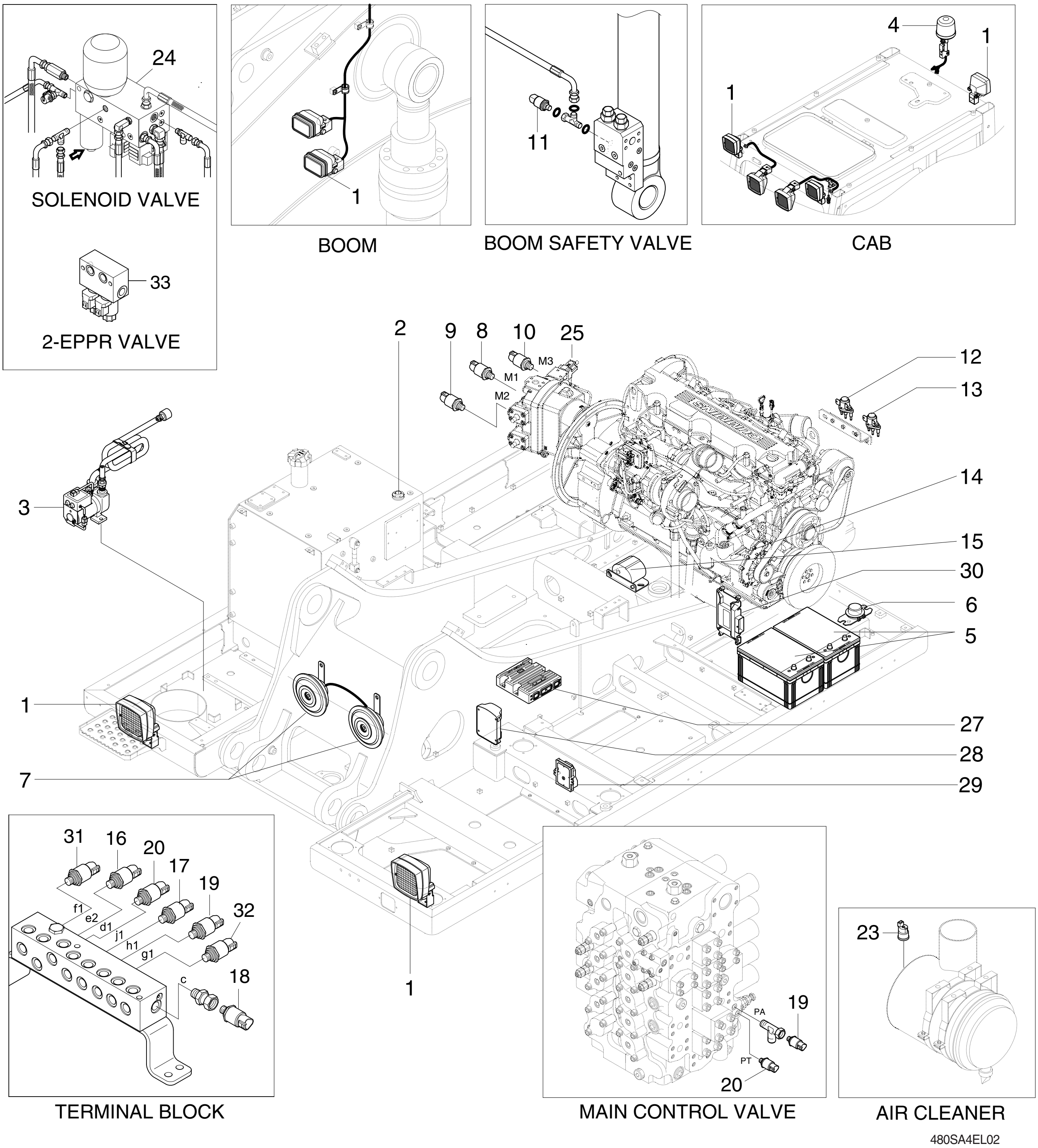
1. LOCATION 1



480SA4EL01

1	Radio & USB player	8	Power max switch	15	Speaker
2	Accel dial	9	One touch decel switch	16	Quick clamp switch
3	Horn switch	10	RS232 service socket	17	Swing lock switch
4	Breaker operation switch	11	Fuse & relay box	18	Emergency engine stop switch
5	Starting switch	12	Master switch		
6	Cluster	13	Cigar lighter		
7	Service meter	14	12V socket		

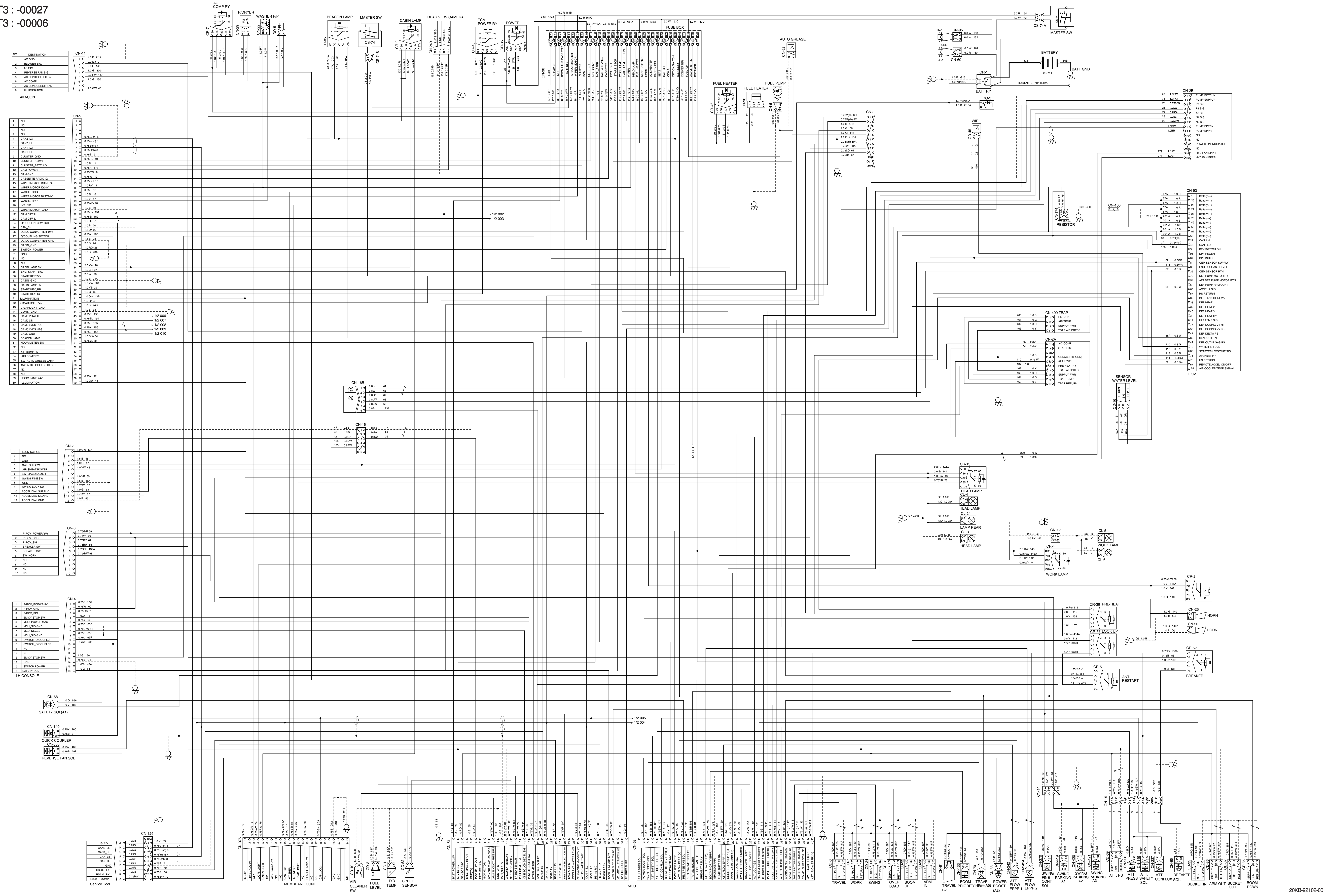
2. LOCATION 2



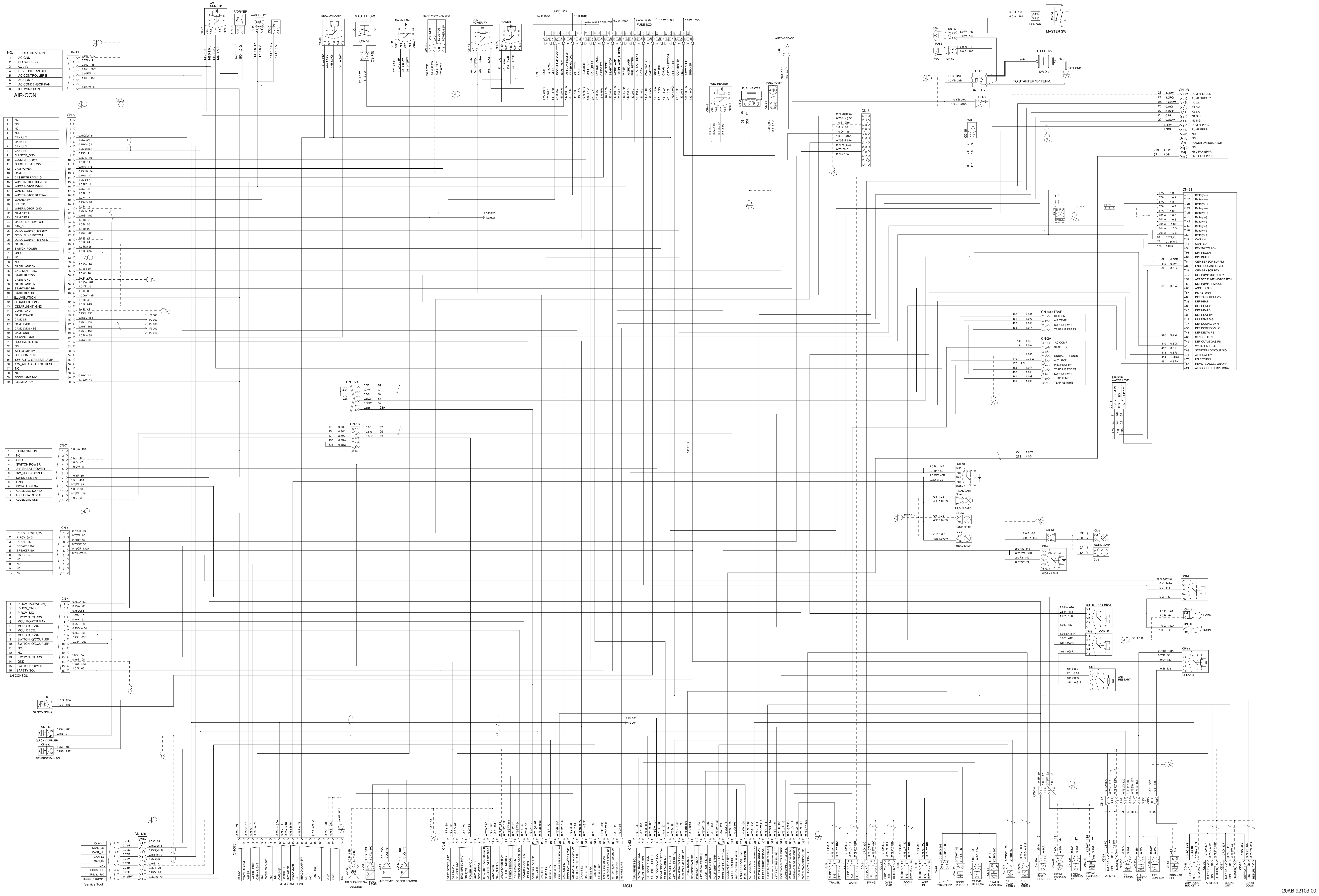
1 Lamp
2 Fuel sender
3 Fuel filler pump
4 Beacon lamp
5 Battery
6 Battery relay
7 Horn
8 A1 pump pressure sensor
9 A2 pump pressure sensor
10 EPPR pressure sensor
11 Overload pressure sensor
12 Start relay
13 Heater relay
14 Alternator
15 Travel alarm buzzer
16 Arm in pressure sensor
17 Boom up pressure sensor
18 Swing pressure sensor
19 Boom down pressure sensor
20 Arm out pressure sensor
21 Attach pressure sensor
22 Travel pressure sensor
23 Air cleaner sensor
(HX500LT3 : -#00027)
(HX520LT3 : -#00006)
24 4 cartridge valve
25 Pump EPPR valve
27 MCU
28 RMCU assy
29 RDU assy
30 View controller
31 Bucket in pressure sensor
32 Bucket out pressure sensor
33 2 EPPR cartridge valve

· ELECTRICAL CIRCUIT (1/3)

- MACHINE SERIAL NO.
  HX500LT3 : -00027
  HX520LT3 : -00006

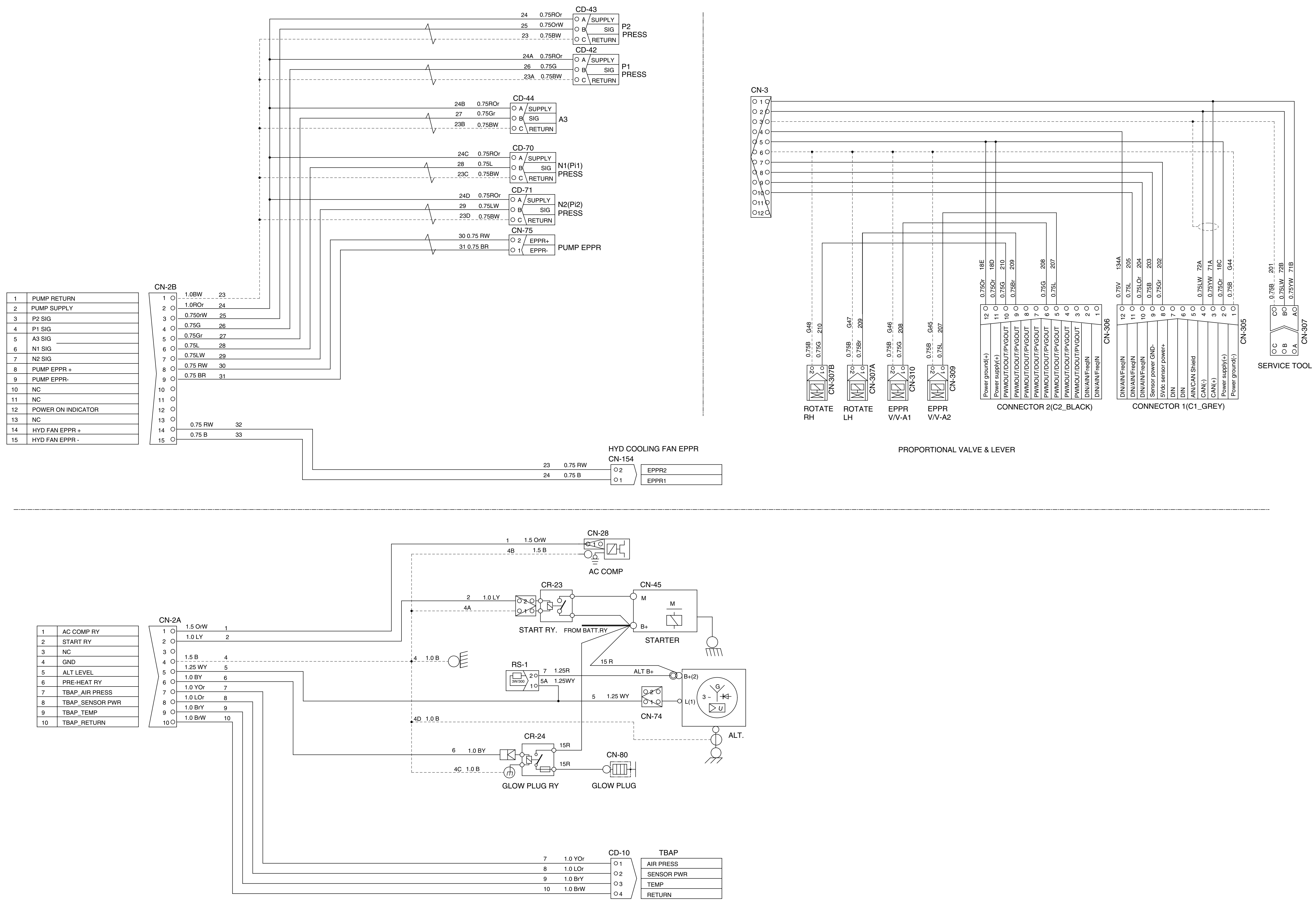


- MACHINE SERIAL NO.
  HX500LT3 : 00028-
  HX520LT3 : 00007-



20KB-92103-00

· ELECTRICAL CIRCUIT (3/3)



20KB-92201-00

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] → Fuse [CN-60] → Master switch [CS-74A]

→ Fuse box [No.1] → ECM [CN-94 (1, 25, 26, 27, 28)]

→ Fuse box [No.2] → Power relay [CR-35 (30)]
  → ECM power relay [CR-45 (3)]

→ Fuse box [No.3] → MCU [CN-51 (1)]

→ Fuse box [No.4] → I/conn [CN-5 (59)] → I/conn [CN-10 (3)] → Room lamp [CL-1 (2)]
  → Door switch [CS-1]
  → Radio & USB player [CN-27A (8)]

→ Fuse box [No.5] → Master switch [CS-74B] → I/conn [CN-5 (36)] → Start switch [CS-2A (1)]
  → RMS [CN-125A (1)]
  → GPS connection [CN-125 (1)]

→ Fuse box [No.6] → I/conn [CN-11 (5)] → AC & Heater controller box (A)

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

→ Fuse box [No.8] → I/conn [CN - 5 (11)] → Cluster [CN -56A (1)]
  → Hour meter [CN-48 (1)]

※ I/conn : Intermediate connector

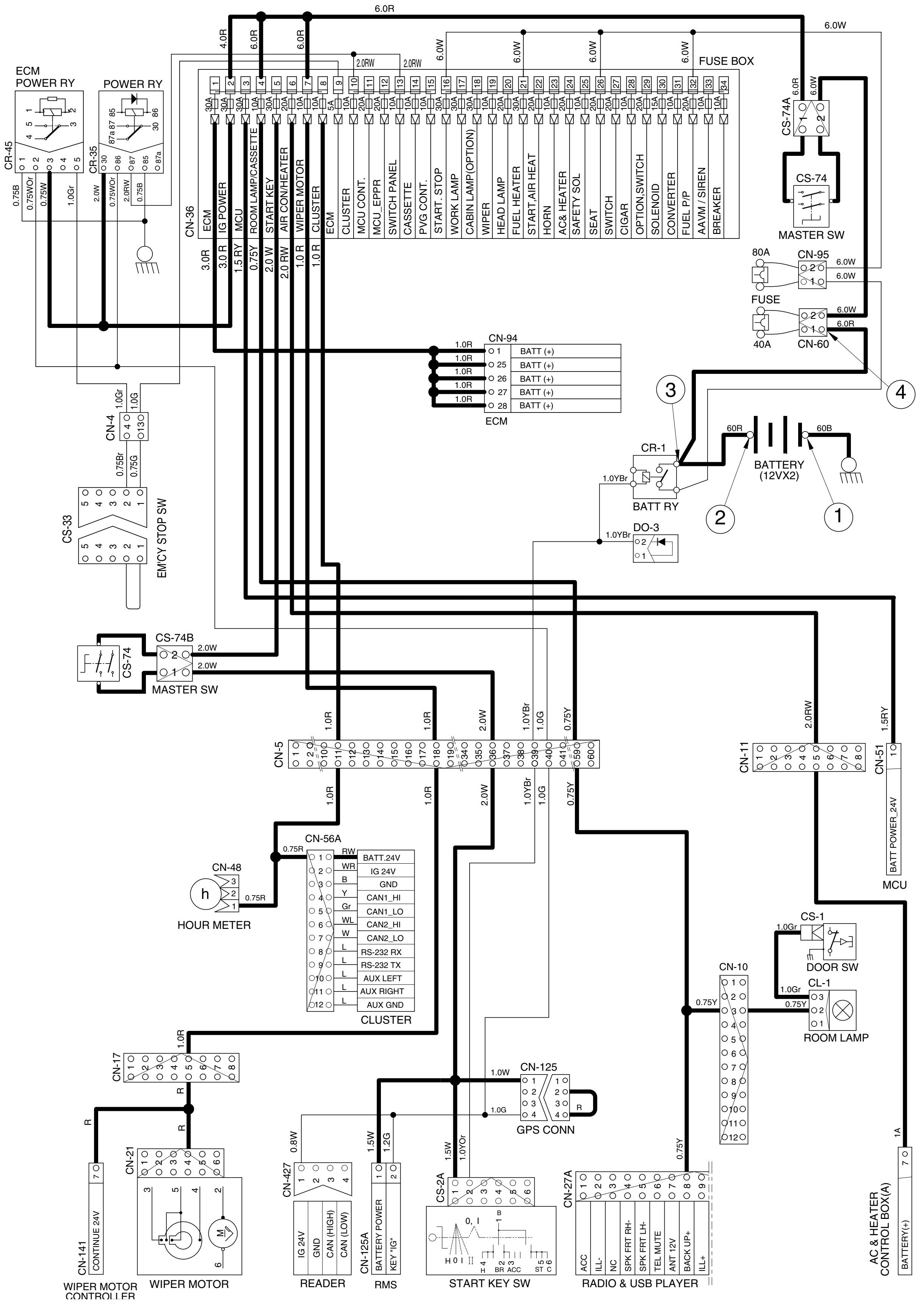
2) CHECK POINT

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

※ GND : Ground

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

POWER CIRCUIT



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

2. STARTING CIRCUIT

1) OPERATING FLOW

Battery (+) terminal → Battery relay [CR-1] → Fuse [CN-60] → Master switch [CS-74A]
→ Fuse box [No.5] → Master switch [CS-74B] → I/conn [CN-5 (36)] → Start switch [CS-2A (1)]
→ Fuse box [No.2] → Power relay [CR-35 (30)]
→ ECM power relay [CR-45 (3)]

(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 [No.11] → MCU [CN-51 (2)]
→ ECM Power relay [CR-45 (2) → (5)] → I/conn [CN-4 (4)]
→ Emergency engine stop sw [CS-33 (2)→(1)] → I/conn [CN-4 (13)]
→ Fuse box [No. 9] → Engine ECM [CN-93 (5)]
→ Reader [CN-427 (1)]
→ RMS [CN-125A (2)]

(2) When start switch is in START position

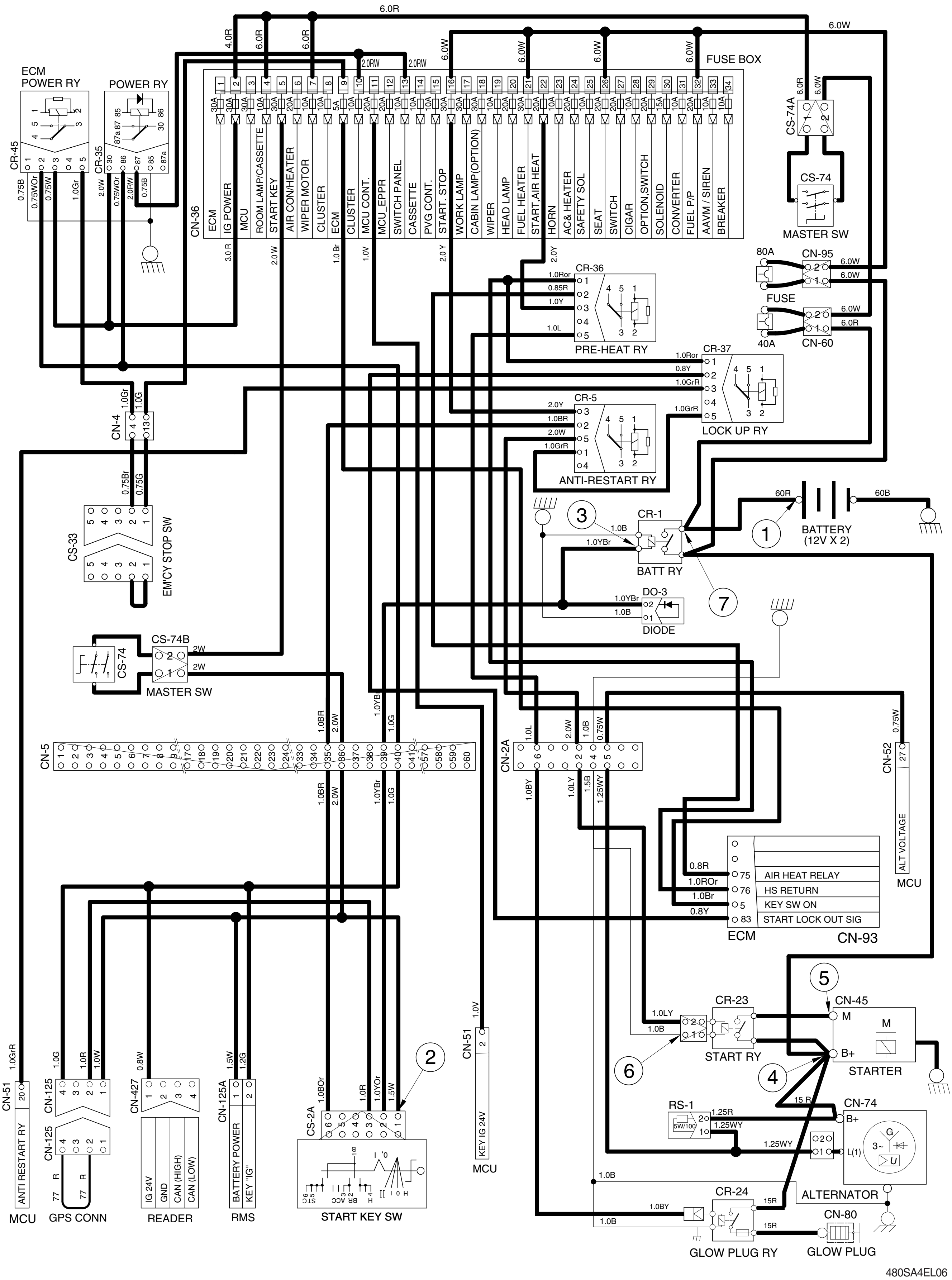
Start switch START [CS-2A (6)] → I/conn [CN-5 (35)] → Anti-restart relay [CR-5 (2) → (5)]
→ I/conn CN-2A (2) → Start relay [CR-23 (2)] → Starter motor operating

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 [CN-74 (1)] → I/conn [CN-2A (5)] → MCU alternator voltage [CN-52 (27)]
→ Cluster charging warning lamp (Via CANbus interface)

(2) Charging flow

Alternator [CN-74 (B^+)] → Start motor [CR-45 (B^+)] → Battery relay (CR-1)
→ Battery (+) terminal
→ Fuse [CN-60] → Master switch [CS-74A] → Fuse box [No.1~8]
→ Fuse [CN-95] → Fuse box [No.16~34]

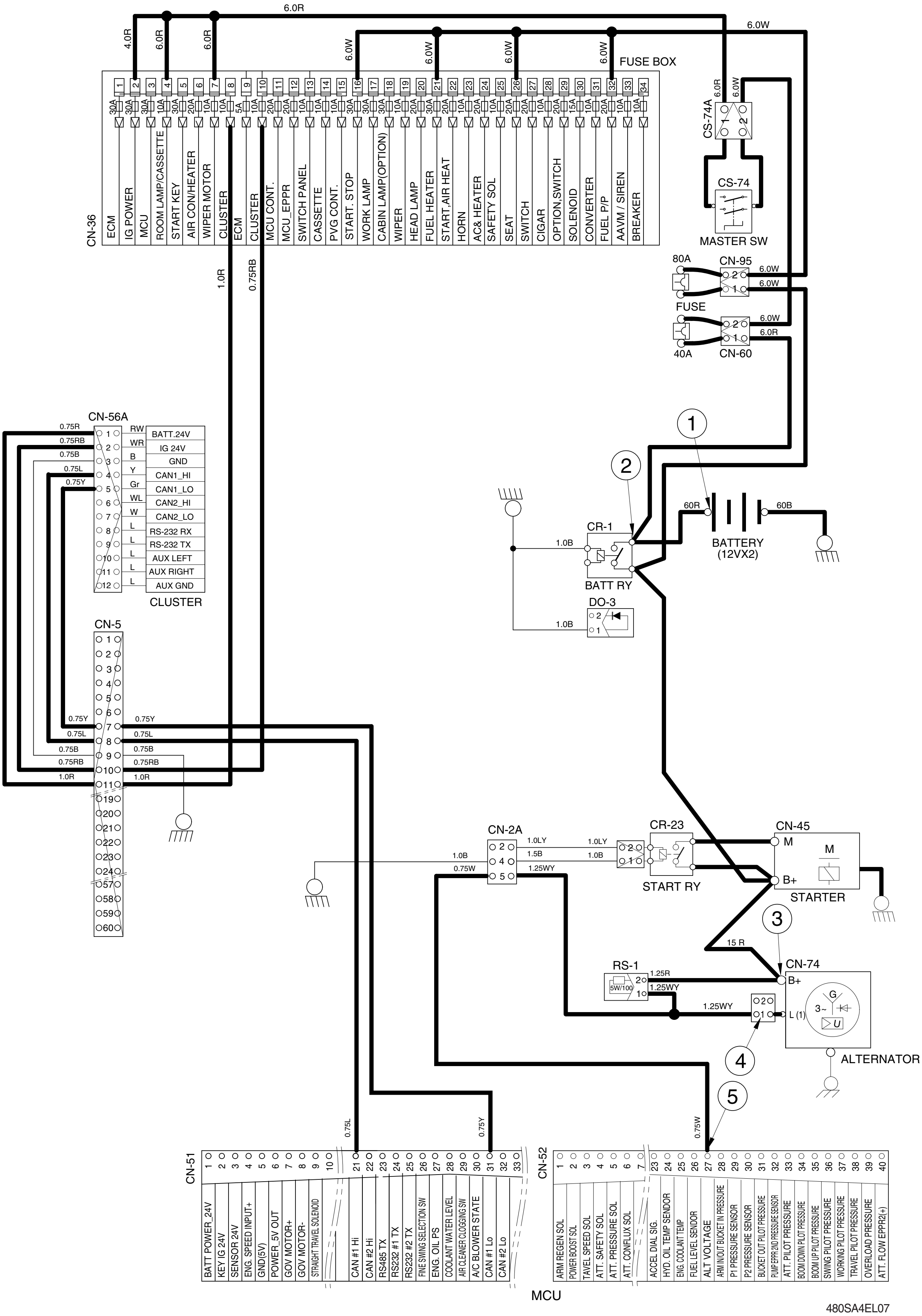
2) CHECK POINT

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

※ GND : Ground

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

CHARGING CIRCUIT



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

4. HEAD AND WORK LIGHT CIRCUIT

1) OPERATING FLOW

Fuse box (No.20) → Head light relay [CR-13 (30, 86)]
Fuse box (No.17) → Work light relay [CR-4 (30, 86)]
Fuse box (No.13) → Membrane controller [CN-376 (1)]

(1) Head light switch ON

Head light switch ON [CN-376 (13)] → Head light relay [CR-13 (85) → (87)]
→ Head light ON [CL-3 (2), CL-4 (1), CL-24 (2)]
→ I/conn [CN-5 (41)] → I/conn [CN-432 (1)] → Cigar lighter [CL-2]
→ I/conn [CN-5 (60)] → Radio & USB player illumination ON [CN-27A (9)]
→ I/conn [CN-7 (1)] → Accel dial LED [CN-279 (2)]

(2) Work light switch ON

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

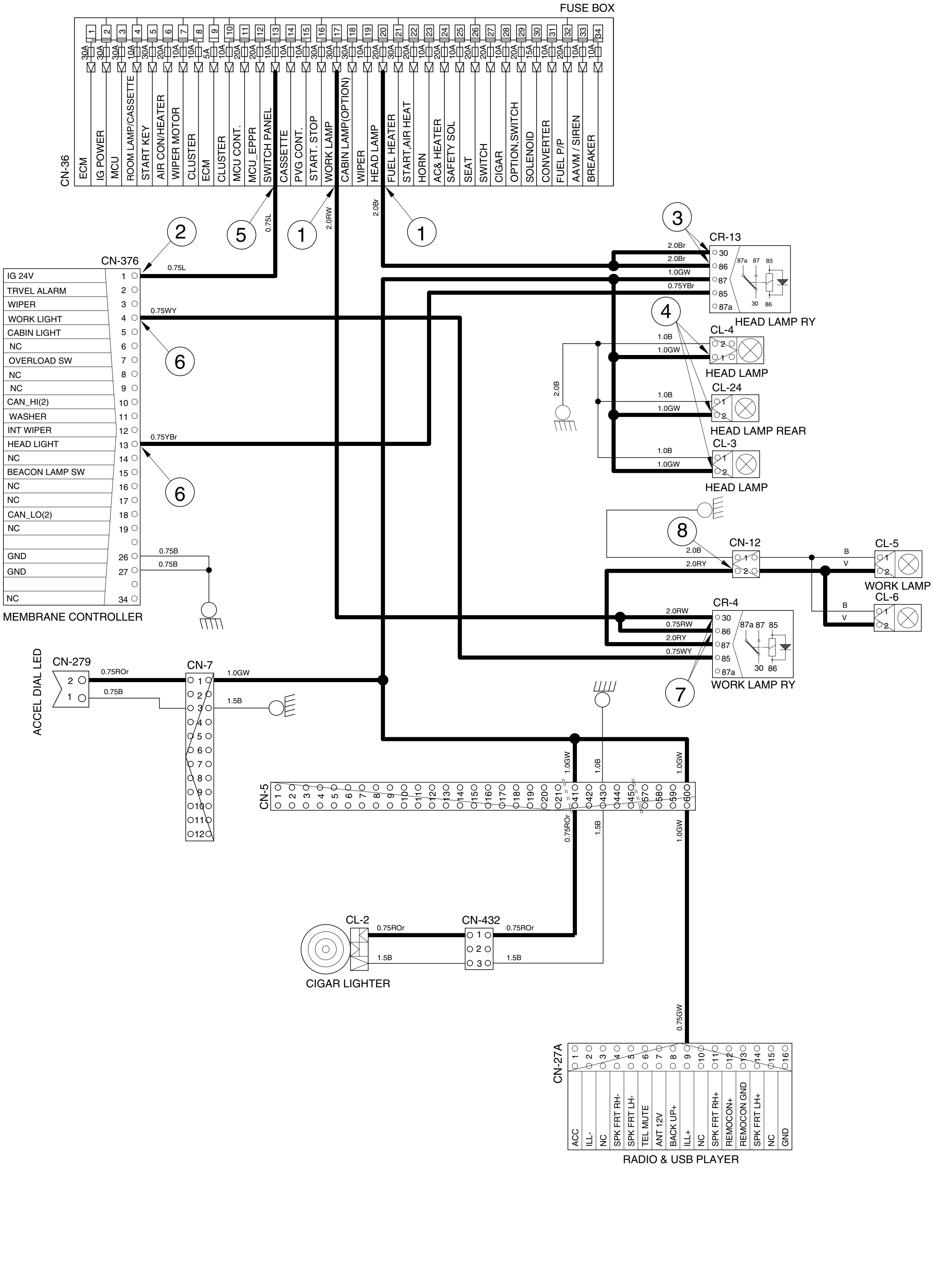
2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box) ② - GND (switch power input) ③ - GND (head light relay) ④ - GND (head light) ⑤ - GND (fuse box) ⑥ - GND (switch power output) 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



※ 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.29) → Beacon lamp relay [CR-85 (2, 3)]
Fuse box (No.18) → Cab light relay [CR-9 (30, 86)]
Fuse box (No.13) → Membrane controller [CN-376 (1)]

(1) Beacon lamp switch ON

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

(2) Cab light switch ON

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

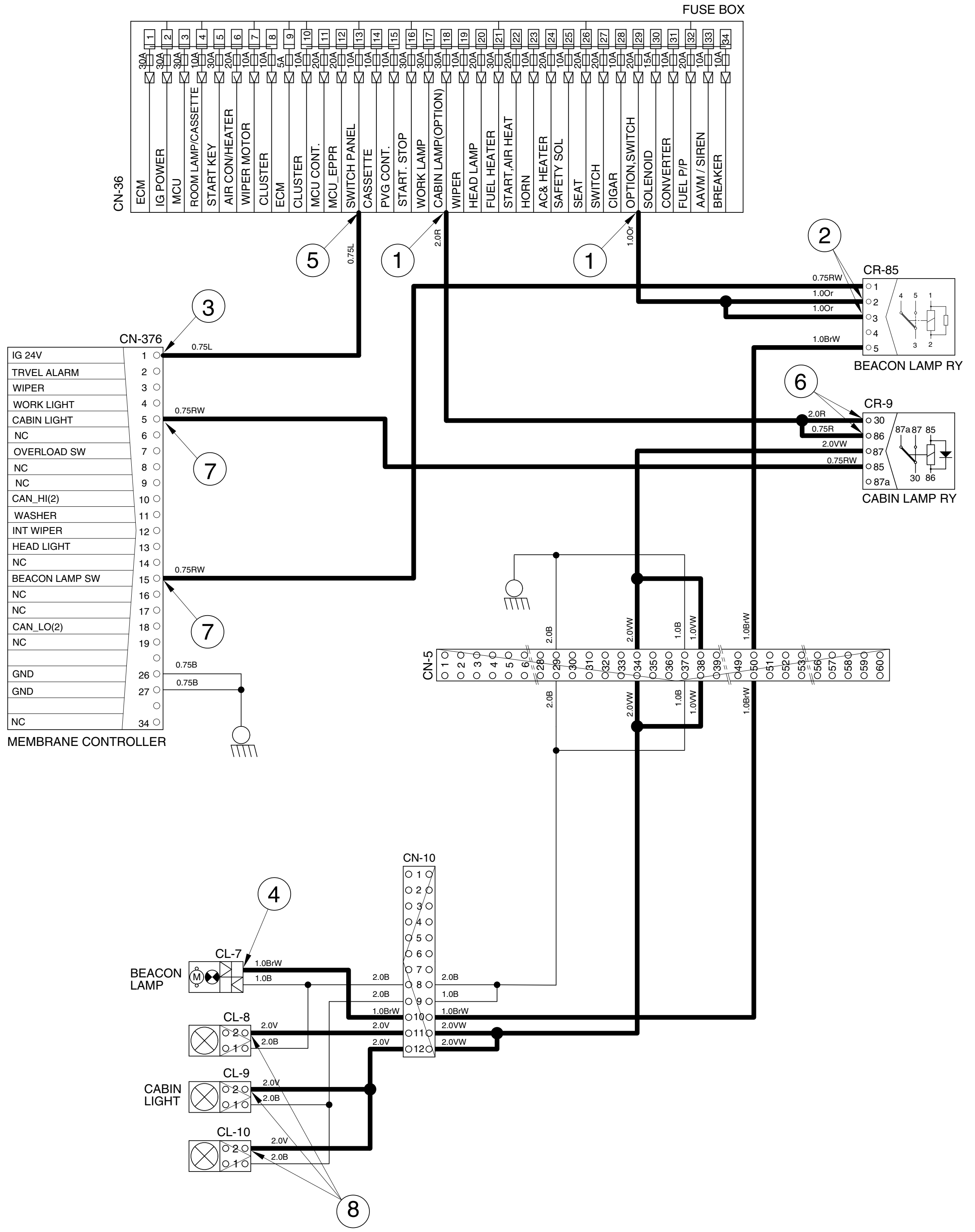
2) CHECK POINT

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

※ GND : Ground

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

BEACON LAMP AND CAB LIGHT CIRCUIT



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

6. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

(1) Start switch ON

Fuse box (No.13) → RDU membrance controller [CN-376 (1)]

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

Fuse box (No.19) ┬→ I/conn [CN-5 (16)] → I/conn [CN-17 (4)] → Wiper motor controller [CN-141 (6)]
└→ Wiper 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)] → Wiper motor parking position by wiper motor controller

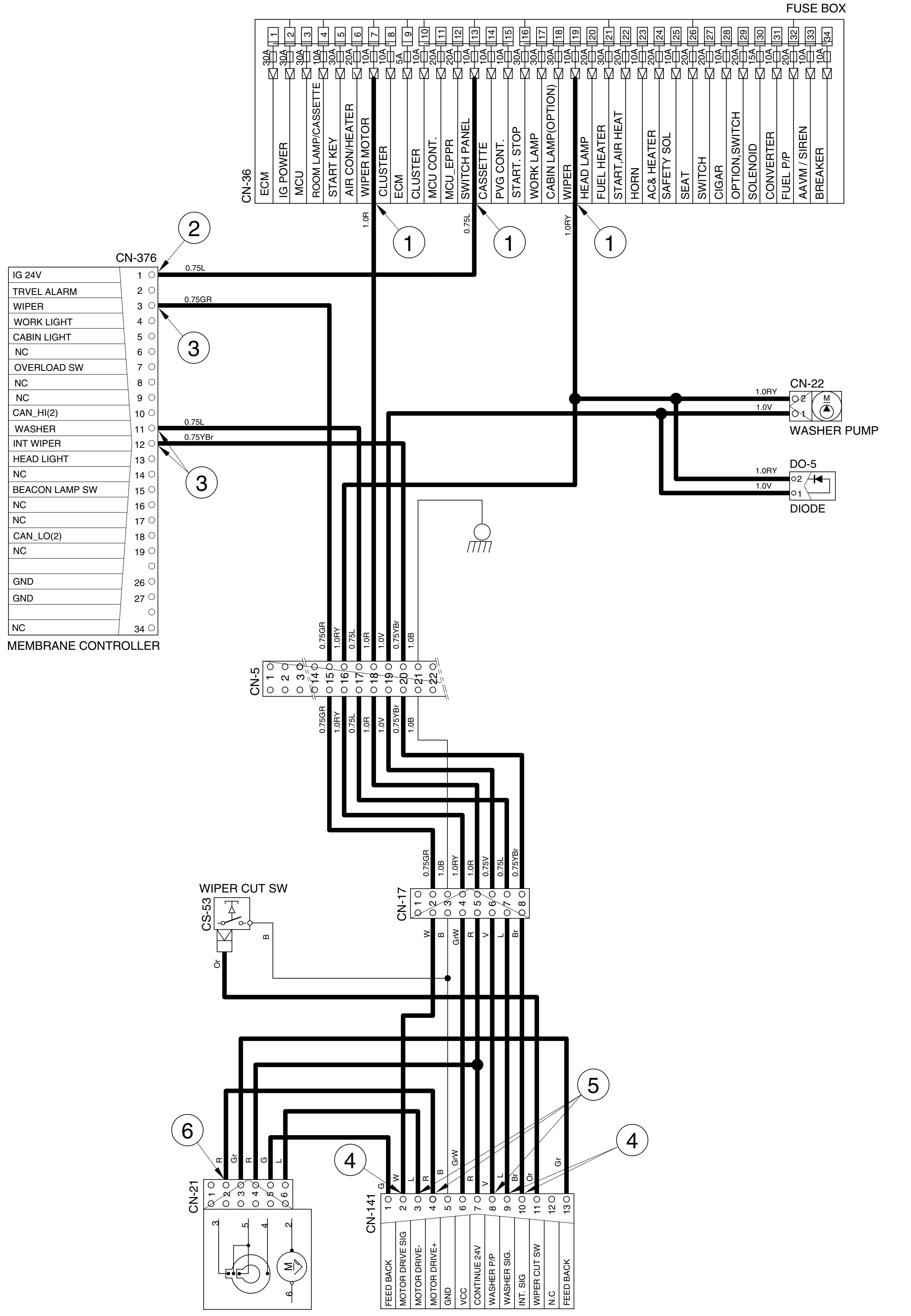
3) CHECK POINT

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

※ GND : Ground

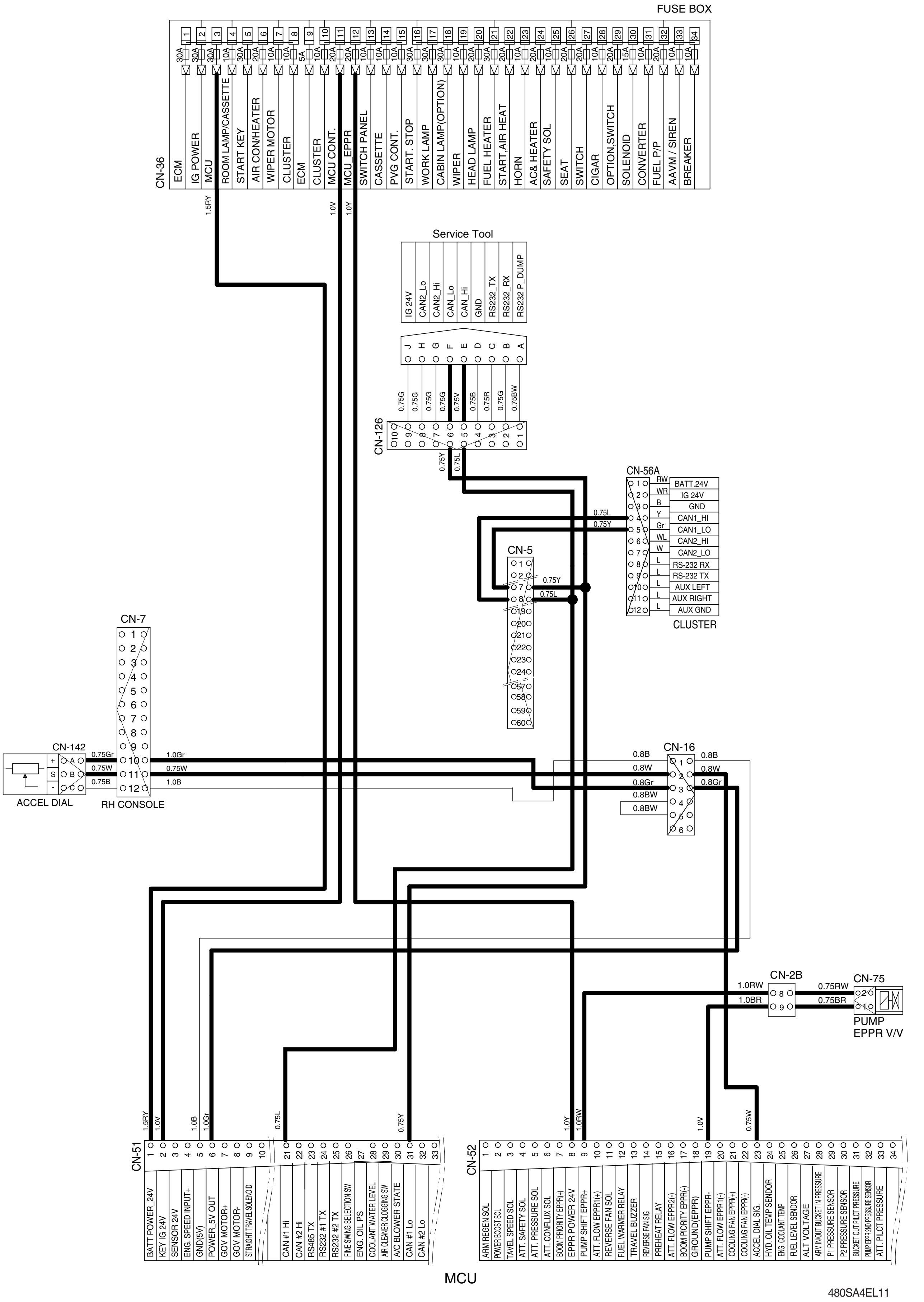
※ The circuit diagram may differ from the equipment, so please check before a repair.

WIPER AND WASHER CIRCUIT



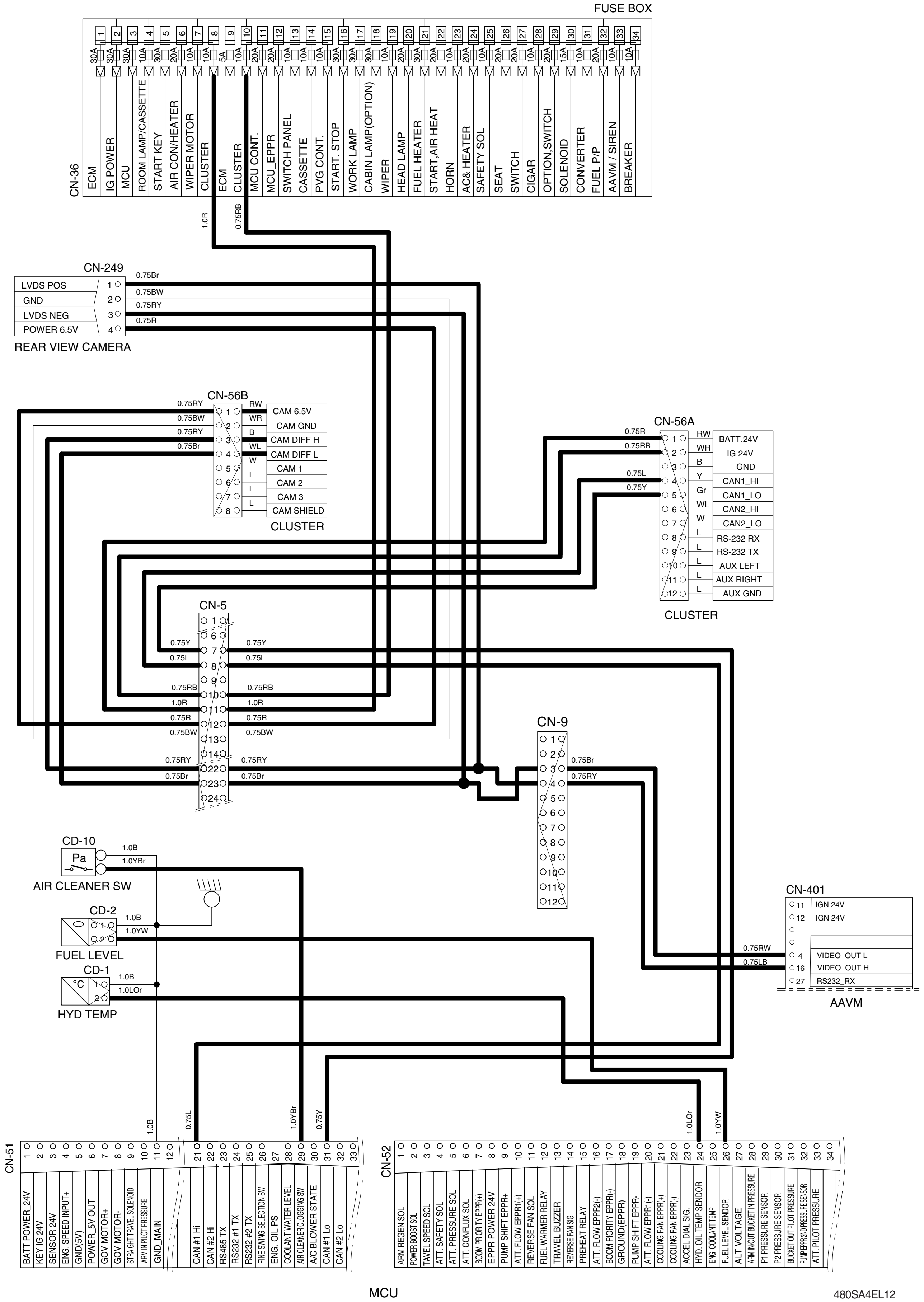
※ The circuit diagram may differ from the equipment, so please check before a repair.

CONTROLLER CIRCUIT



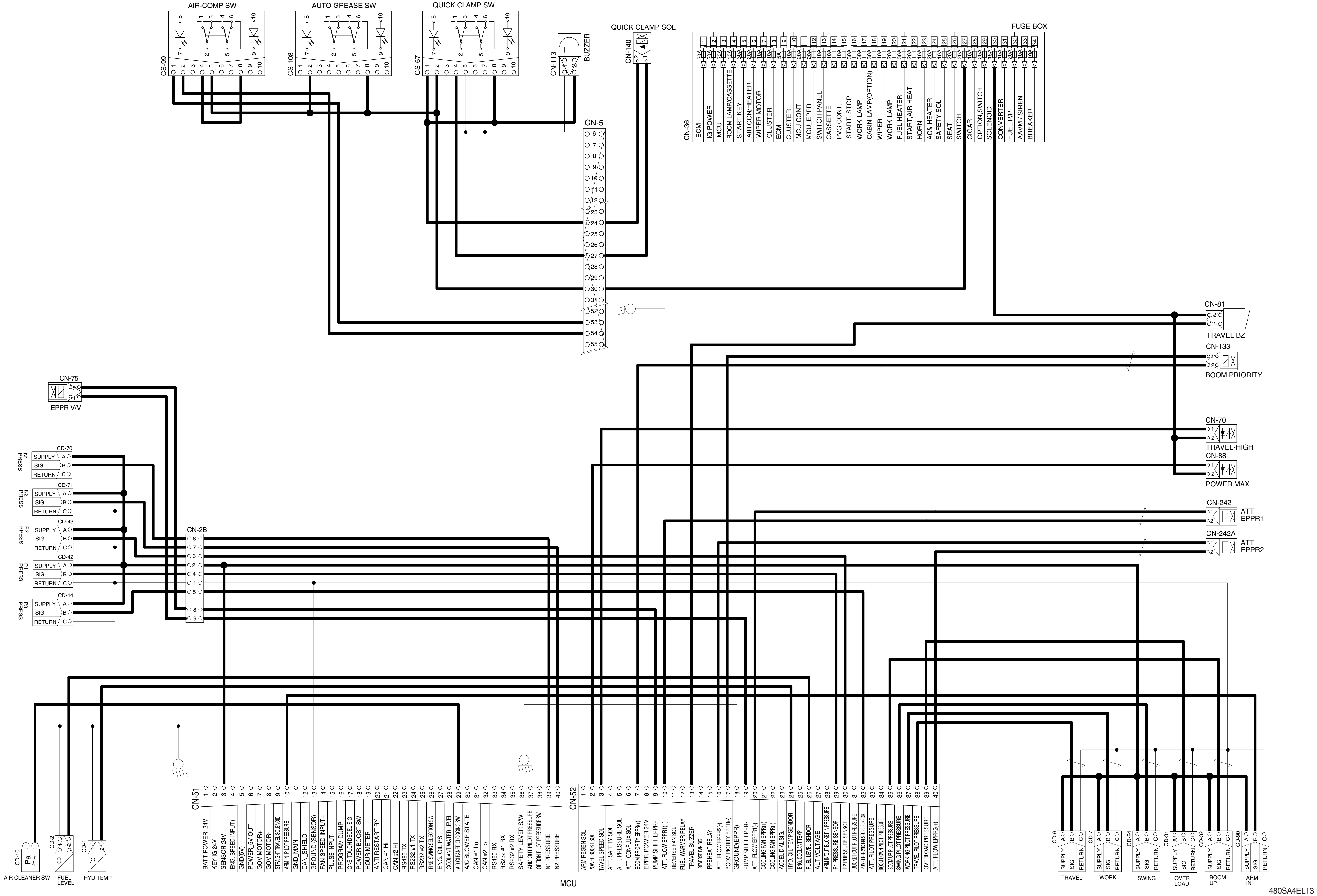
※ The circuit diagram may differ from the equipment, so please check before a repair.

MONITORING CIRCUIT



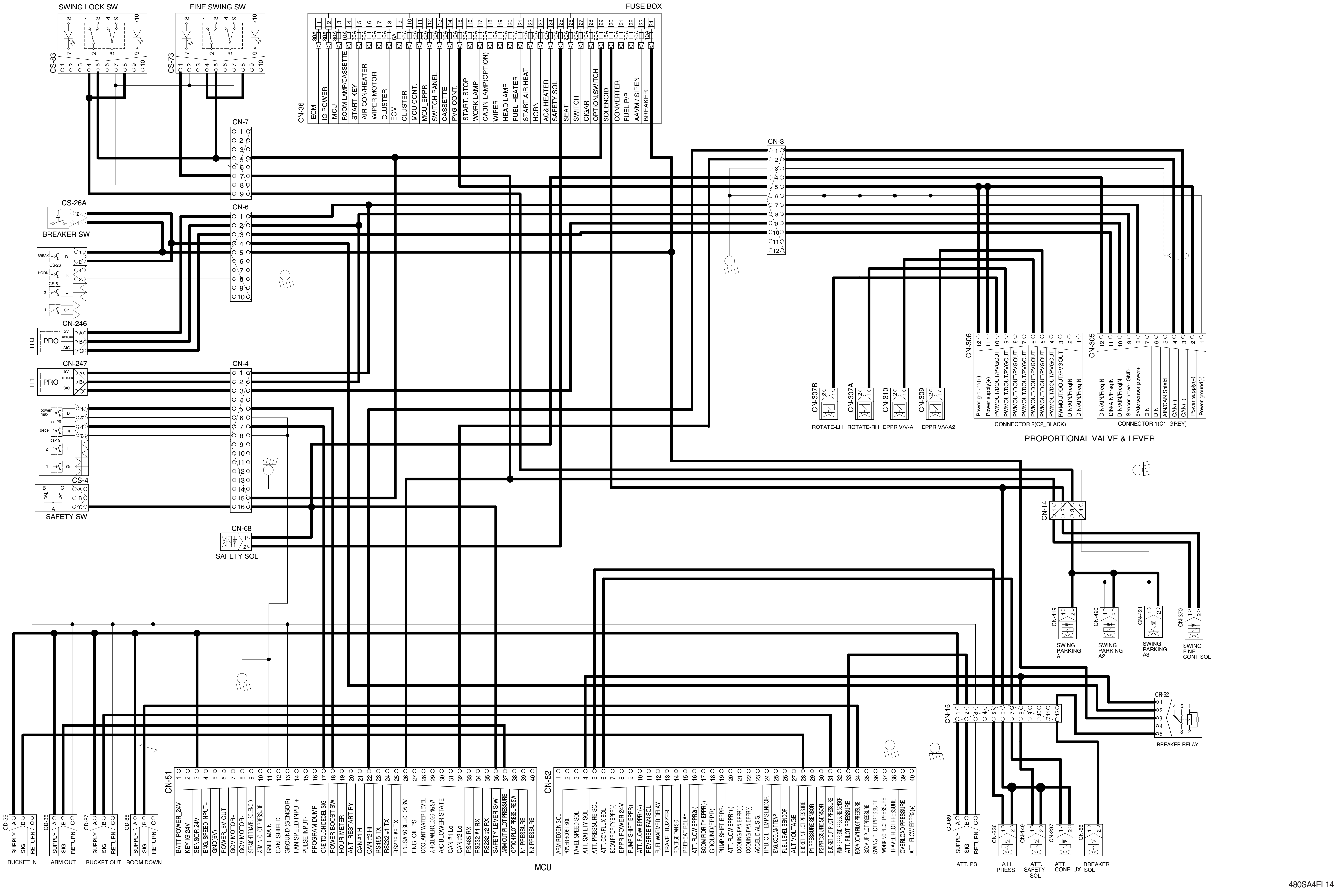
※ The circuit diagram may differ from the equipment, so please check before a repair.

ELECTRIC CIRCUIT FOR HYDRAULIC (1/2)



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

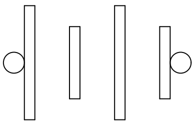
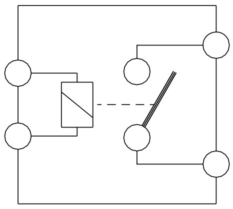
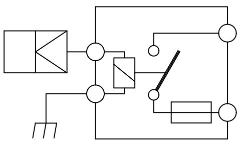
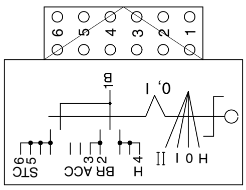
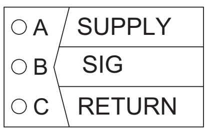
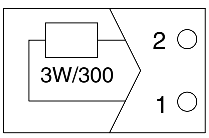
ELECTRIC CIRCUIT FOR HYDRAULIC (2/2)

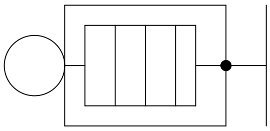
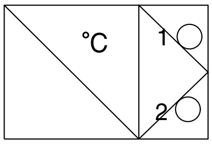
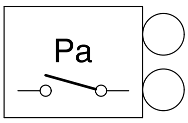
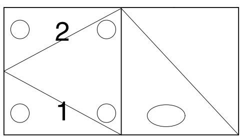
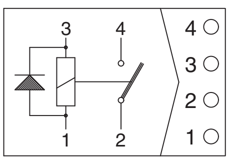
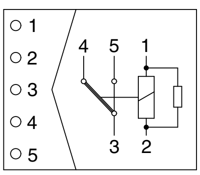


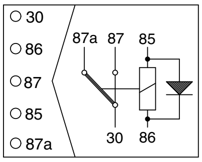
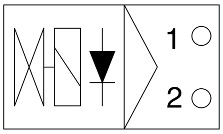
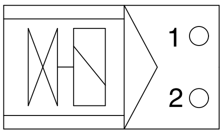
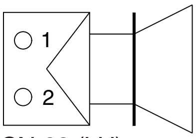
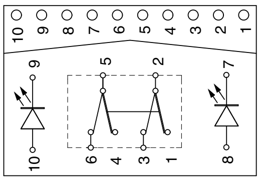
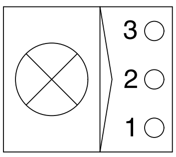
480SA4EL14

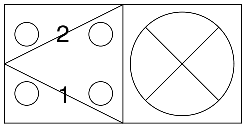
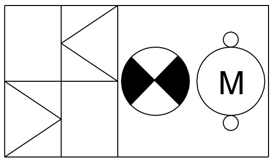
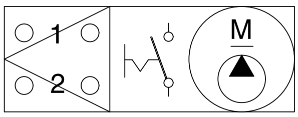
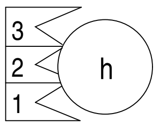
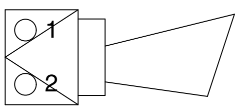
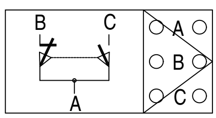
※ The circuit diagram may differ from the equipment, so please check before a repair.

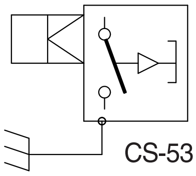
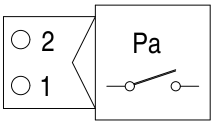
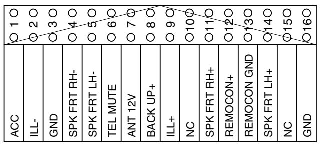
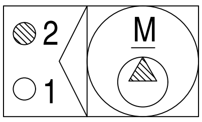
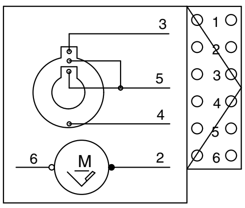
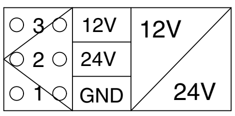
GROUP 3 ELECTRICAL COMPONENT SPECIFICATION

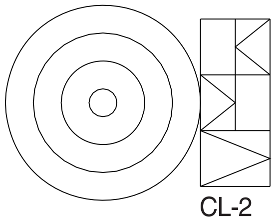
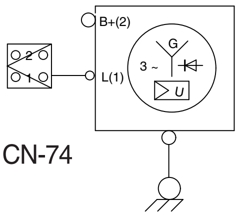
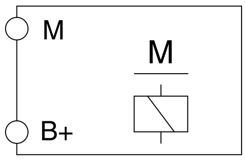
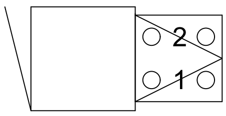
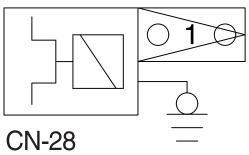
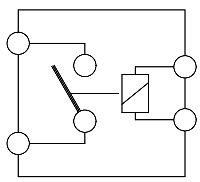
Part name	Symbol	Specifications	Check
Battery		12V×160Ah (2EA)	※ Check specific gravity 1.280 over : Over charged 1.280 ~ 1.250 : Normal 1.250 below : Recharging
Battery relay	 CR-1	Rated load : 24V 100A (continuity) 1000A (30seconds)	※ Check coil resistance(M4 to M4) Normal : About 50Ω ※ Check contact Normal : ∞Ω
Glow plug relay	 CR-24	24V 200A	※ Check contact Normal : 0.942Ω (For terminal 1-GND)
Start switch	 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-24 CD-31 CD-32 CD-35 CD-36 CD-42 CD-43 CD-44 CD-69 CD-70 CD-71 CD-85 CD-87 CD-90	8~30V	※ Check contact Normal : 0.1Ω
Resistor	 RS-1	3W 300Ω	※ Check resistance Normal : 300Ω (For terminal 1-2)

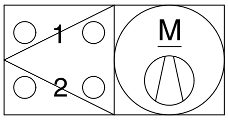
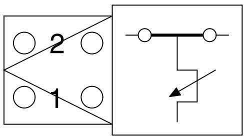
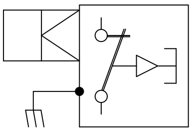
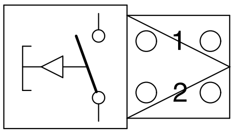
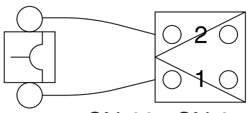
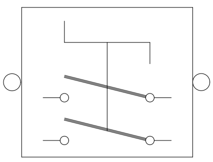
Part name	Symbol	Specifications	Check
Glow plug	 CN-80	24V 200A	※ Check resistance 0.25~0.12Ω
Temperature sensor (hydraulic)	 CD-1	-	※ Check resistance 50˚C : 804Ω 80˚C : 310Ω 100˚C : 180Ω
Air cleaner pressure switch (HX500LT3 : -#00027, HX520LT3 : -#00006)	 CD-10	N.O TYPE	※ Check contact High level : ∞Ω Low level : 0Ω
Fuel level sender	 CD-2	-	※ Check resistance Full : 50Ω 6/12 : 350Ω 11/12 : 100Ω 5/12 : 400Ω 10/12 : 150Ω 4/12 : 450Ω 9/12 : 200Ω 3/12 : 500Ω 8/12 : 250Ω 2/12 : 550Ω 7/12 : 300Ω 1/12 : 600Ω Empty warning : 700Ω
Relay (air con blower)		24V 20A	※ Check resistance Normal : About 200Ω (for terminal 1-3) ∞Ω (for terminal 2-4)
Relay	 CR-2 CR-5 CR-36 CR-37 CR-45 CR-62 CR-85	24V 16A	※ Check resistance Normal : About 160 Ω (for terminal 1-2) 0Ω (for terminal 3-4) ∞Ω (for terminal 3-5)

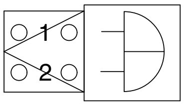
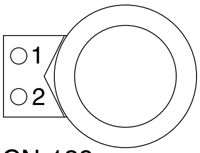
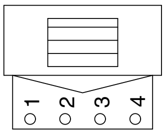
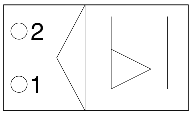
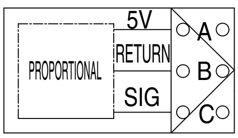
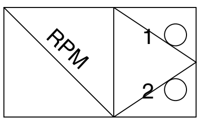
Part name	Symbol	Specifications	Check
Relay	 CR-4 CR-7 CR-9 CR-13 CR-35 CR-46	24V 16A	※ Check resistance Normal : About 160 Ω (for terminal 85-86) 0Ω (for terminal 30-87a) ∞Ω (for terminal 30-87)
Solenoid valve	 CN-66 CN-68 CN-70 CN-88 CN-140 CN-149 CN-236 CN-237 CN-370 CN-419 CN-420 CN-421 CN-680	24V 1A	※ Check resistance Normal : 15~25Ω (for terminal 1-2)
EPPR valve	 CN-75 CN-133 CN-242 CN-242A CN-307A CN-307B CN-309 CN-310	700mA	※ Check resistance Normal : 15~25Ω (for terminal 1-2)
Speaker	 CN-23 (LH) CN-24 (RH)	20W	※ Check resistance Normal : A few Ω
Switch (locking type)	 CS-52 CS-67 CS-73 CS-83 CS-99 CS-108	24V 8A	※ Check contact Normal ON : 0 Ω (for terminal 2-3, 5-6) ∞Ω (for terminal 1-2, 4-5) OFF : ∞Ω (for terminal 2-3, 5-6) 0 Ω (for terminal 1-2, 4-5)
Room lamp	 CL-1	24V 10W	※ Check disconnection Normal : 1.0Ω ON : 0Ω (For terminal 1-2) ∞Ω (For terminal 1-3) OFF : ∞Ω (For terminal 1-2) 0Ω (For terminal 1-3)

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

Part name	Symbol	Specifications	Check
Wiper cut switch	 CS-53	24V (N.O TYPE)	※ Check contact Normal : 0Ω(one pin to ground)
Receiver dryer	 CN-29	24V 2.5A	※ Check contact Normal : ∞Ω
Radio & USB player	 CN-27A	24V 2A	※ Check voltage 20~25V (for terminal 1-3, 3-8)
Washer pump	 CN-22	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		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
Fuse	 CN-60 CN-95	CN-60 : 40A CN-95 : 80A	※ Check disconnection Normal : 0Ω (connect ring terminal and check resist between terminal 1 and 2)
Master switch	 CS-74	6-36V	※ Check disconnection Normal : 0.1Ω

Part name	Symbol	Specifications	Check
Quick clamp buzzer	 CN-113	24V 200mA 107±4dB	-
Socket	 CN-139	12V 10A	-
Fuel heater	 CN-96	-	-
Sensor (WIF)	 CD-45	-	-
Proportional valve sensor	 CN-246 CN-247	-	-
Fan speed sensor	 CD-52	-	-

GROUP 4 CONNECTORS

1. CONNECTOR DESTINATION

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-2A	AMP	10	I/conn (Frame harness-Engine harness)	174655-2	174657-2
CN-2B	AMP	15	I/conn (Frame harness-Engine harness)	2-85262-1	368301-1
CN-3	TYCO	12	I/conn (Frame harness-Pro vlv harness)	174661-2	368537-1
CN-4	AMP	16	I/conn (Console harness LH-Frame harness)	368047-1	368050-1
CN-5	DEUTSCH	60	I/conn (Side harness RH-Frame harness)	DRB16-60SAE-L018	DRB14-60PAE-L018
CN-6	AMP	10	I/conn (Console harness RH-Frame harness)	S816-010002	174655-2
CN-7	AMP	12	I/conn (Console harness RH-Frame harness)	S816-012002	S816-112002
CN-9	DEUTSCH	12	I/conn (Frame harness-AAVM harness)	DT06-12SA-P021	DT04-12PA-P021
CN-10	DEUTSCH	12	I/conn (Cab harness-Side harness RH)	DT06-12S-EP06	DT04-12PA-P021
CN-11	DEUTSCH	8	I/conn (Frame harness-Aircon harness)	DT06-8S-EP06	-
CN-12	DEUTSCH	2	I/conn (Frame harness-Boom wire harness)	DT06-2S-EP06	DT04-2P-E005
CN-14	AMP	4	I/conn (Fream harness-Swing parking & fine control)	174257-2	174259-2
CN-15	AMP	12	I/conn (Frame harness-Breaker sol)	174661-2	S816-112002
CN-16	TYCO	6	Emergency engine start & speed control	-	174264-2
CN-16A	-	6	Emergency engine start & speed control	174262-2	-
CN-16B	-	6	Emergency engine start & speed control	174262-2	-
CN-17	AMP	8	I/conn (Side harness RH-Wiper harness)	S816-008002	S816-108002
CN-20	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-21	AMP	6	Wiper motor	S810-006202	-
CN-22	KET	2	Washer 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	-	1	Aircon compressor	PB625-01027	-
CN-29	KET	2	Receiver dryer	MG640795	-
CN-36	-	-	Fuse & relay box	21Q7-20510	-
CN-45	RING-TERM	-	Starter motor B^+	S820-108000	-
CN-48	KET	3	Hour meter	2-520193-2	-
CN-51	TE	40	MCU	DRC23-40SA	-
CN-52	TE	40	MCU	DRC23-40SB	-
CN-56A	AMP	12	Cluster	-	174663-2
CN-56B	AMP	8	Cluster	-	174984-2
CN-60	R/TERM/-	2	Fuse	ST710285-2	21LM-30140
CN-61	DEUTSCH	2	Fuel filler pump	DT06-2S-EP06	DT04-2P-E005

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-62	DEUTSCH	2	Auto grease	DT06-2S-EP06	DT04-2P-E005
CN-66	DEUTSCH	1	Breaker solenoid	DT06-2S-EP06	-
CN-68	DEUTSCH	2	Safety solenoid (A1)	DT06-2S-EP06	-
CN-70	DEUTSCH	2	Travel high solenoid (A5)	DT06-2S-EP06	-
CN-74	-	2	Alternator terminal	1-967412-2	-
CN-75	AMP	2	Pump EPPR	85202-1	-
CN-80	RING-TERM	-	Glow plug	S820-306000	-
CN-81	DEUTSCH	2	Travel buzzer solenoid	DT06-2S-EP06	-
CN-88	DEUTSCH	2	Power max solenoid (A2)	DT06-2S-EP06	-
CN-93	DELPHI	-	ECM	13964572	-
CN-95	R/TERM/-	2	Fuse	ST710285-2	21LM-03180
CN-96	DELPHI	2	Fuel warmer	15300027	-
CN-100	KET	1	ECM earth	MG640944-5	-
CN-113	KET	2	Buzzer	MG651205-5	-
CN-125	Econoseal J	4	RMS connector	S816-004002	S816-104002
CN-125A	DEUTSCH	12	RMS	DT06-12S-P021	DT04-12PA-P021
CN-126	AMP	10	Service tool	174259-2	S816-110002
CN-133	DEUTSCH	2	Boom priority solenoid	DT06-2S-EP06	-
CN-138	FASTEN	3	DC/DC Converter	S810-003202	-
CN-139	FASTEN	2	12V socket	172434-2	-
CN-140	DEUTSCH	2	Quick clamp solenoid	DT06-2S-EP06	DT04-2P-E005
CN-141	AMP	13	Wiper motor controller	172498-1	-
CN-142	DEUTSCH	3	Accel dial switch	DT06-3S	-
CN-149	DEUTSCH	2	Attach safety solenoid (A1)	DT06-2S-EP06	-
CN-154	DEUTSCH	2	Fam EPPR	DT06-2S	-
CN-156	DEUTSCH	2	Seat heat	DT06-2S-EP06	DT04-2P
CN-157	AMP	1	Antena power	S822-014002	-
CN-174	DEUTSCH	3	Resistor	DT06-3S-EP10	-
CN-236	DEUTSCH	2	Attach pressure solenoid	DT06-2S-EP06	-
CN-237	DEUTSCH	2	Attach conflux solenoid (A3)	DT06-2S-EP06	-
CN-242	DEUTSCH	2	Attach EPPR 1 (A1)	DT06-2S-EP06	-
CN-242A	DEUTSCH	2	Attach EPPR 2 (A2)	DT06-2S-EP06	-
CN-246	DEUTSCH	3	Proportional valve-RH	DT06-3S	DT04-3P
CN-247	DEUTSCH	3	Proportional valve-LH	DT06-3S	DT04-3P
CN-249	DEUTSCH	4	Rear view camera	DT06-4S-EP06	DT04-4P-E005
CN-279	AMP	2	Accel dial LED	S816-002002	-
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

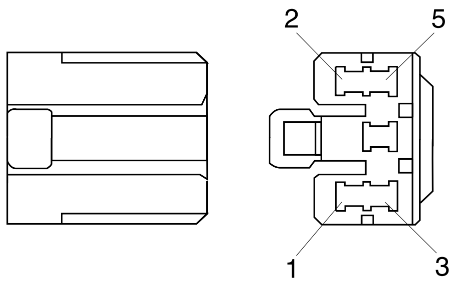
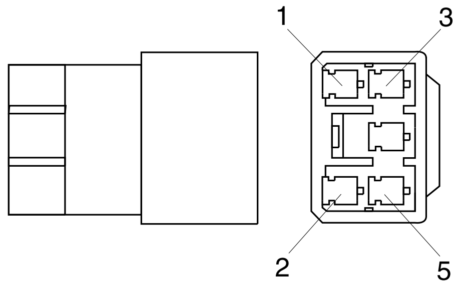
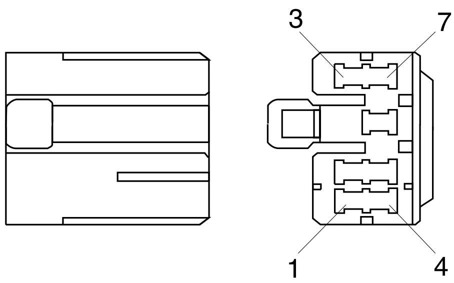
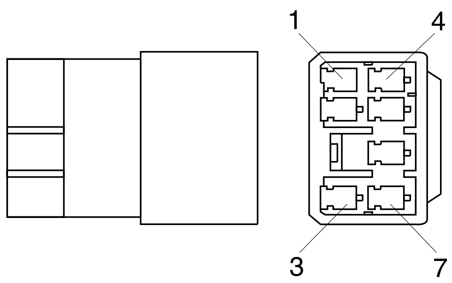
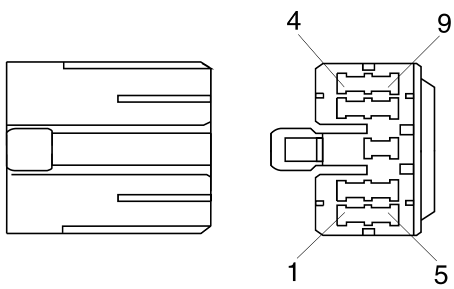
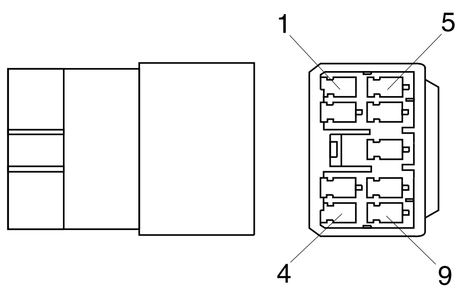
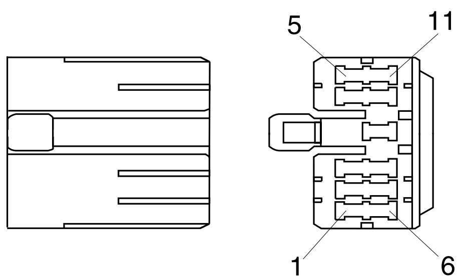
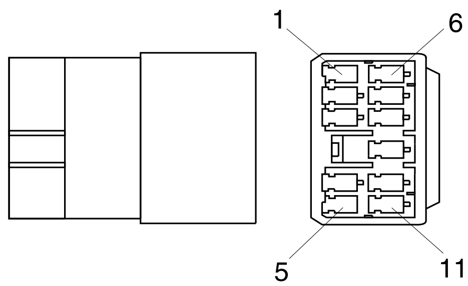
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-307A	DEUTSCH	2	Rotate EPPR valve-LH	DT06-2S-EP06	DT04-2P-E005
CN-307B	DEUTSCH	2	Rotate EPPR valve-RH	DT06-2S-EP06	DT04-2P-E005
CN-309	DEUTSCH	2	Proportional-EPPR valve A2	DT06-2S-EP06	-
CN-310	DEUTSCH	2	Proportional-EPPR valve A1	DT06-2S-EP06	-
CN-370	DEUTSCH	2	Swing fine control solenoid	DT06-2S-EP06	-
CN-376	TYCO	34	Membrane controller	4-1437290-1	-
CN-400	-	4	Temperateur sensor	6098-0144	-
CN-401	TE	35	AAVM controller	776164-1	-
CN-402	DEUTSCH	6	Front view camera	DT06-6S-P021	DT04-6P-P021
CN-403	DEUTSCH	6	Rear view camera	DT06-6S-EP06	DT04-6P-EP14
CN-404	DEUTSCH	6	LH view camera	DT06-6S-EP06	DT04-6P-EP14
CN-405	DEUTSCH	6	RH view camera	DT06-6S-EP06	DT04-6P-EP14
CN-406	DEUTSCH	3	RS 232	DT06-3S-EP06	DT04-3P-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
CN-432	AMP	3	Cigar lighter	174357-2	174359-2
CN-680	DEUTSCH	2	Reverse fan solenoid	DT06-2S-EP06	-
· Relay					
CR-1	RING-TERM	-	Battery relay	ST710289-2	-
CR-2	-	5	Horn relay	-	-
CR-4	-	5	Working lamp relay	-	-
CR-5	-	5	Anti restart relay	-	-
CR-7	-	5	Aircon compressor relay	-	-
CR-9	-	5	Cabin lamp relay	-	-
CR-13	-	5	Head lamp relay	-	-
CR-23	KET	2	Start relay	MG610320	S814-102001
CR-24	RING TERM	1	Preheat relay	S822-014000	-
CR-35	-	5	Power relay	-	-
CR-36	-	5	Preheat relay	-	-
CR-37	-	5	Lock up relay	-	-
CR-45	-	5	ECM power relay	-	-
CR-46	-	5	Fuel warmer relay	-	-
CR-62	-	5	Breaker relay	-	-
CR-85	-	5	Beacon lamp relay	-	-
· Switch					
CS-1	SHUR	1	Door switch	S822-014002	S822-114002
CS-2A	WP	6	Start key switch	S814-006100	-

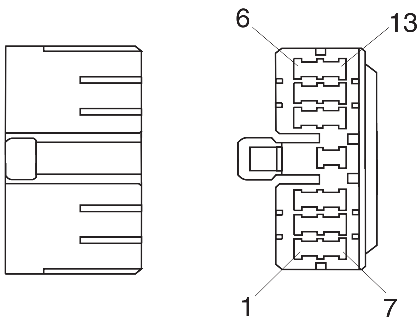
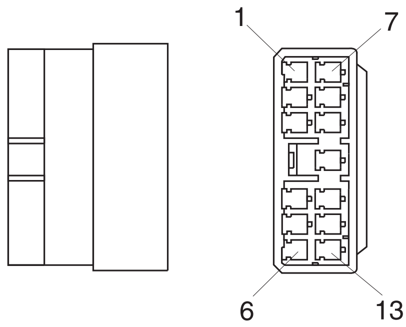
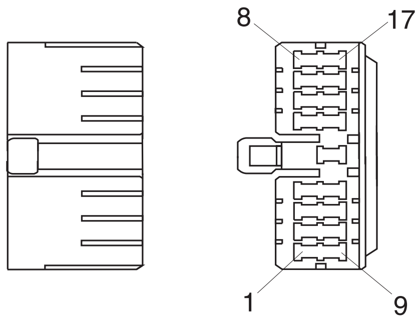
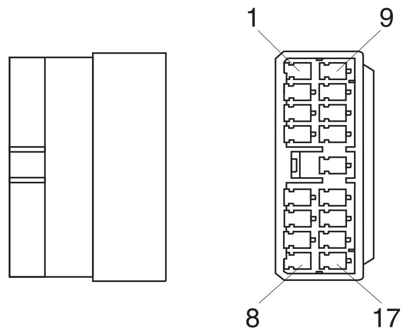
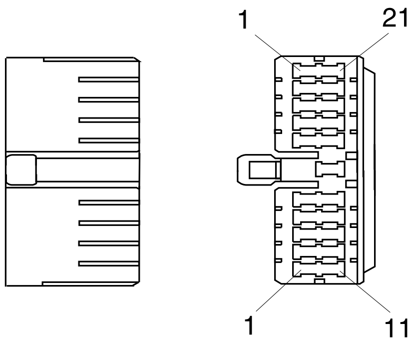
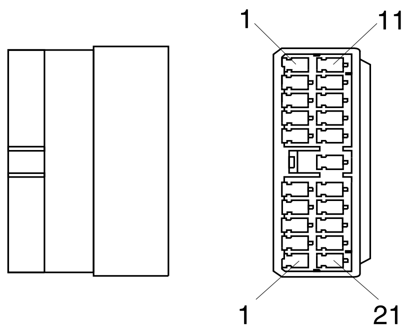
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CS-2B	DEUTSCH	3	BKCU	DT06-3S-EP06	DT04-3P-E005
CS-4	DEUTSCH	3	Safety switch	DT06-3S	-
CS-5	DEUTSCH	2	Horn switch	-	DT04-2P
CS-19	DEUTSCH	2	One touch decel switch	-	DT04-2P
CS-26	DEUTSCH	2	Breaker switch	DT06-2S	-
CS-26A	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 pcs and dozer switch	VC2-01	-
CS-53	AMP	1	Wiper cut switch	S822-014002	-
CS-67	CARLING	10	Quick clamp switch	VC2-01	-
CS-73	CARLING	10	Fine swing switch	VC2-01	-
CS-74A	KET	2	Master switch	MG610557-5	-
CS-74B	DEUTSCH	2	Master switch	DT06-2S-EP06	-
CS-83	CARLING	10	Swing lock switch	VC2-01	-
CS-99	CARLING	10	Air compressor switch	VC2-01	-
CS-108	CARLING	10	Auto grease switch	VC2-01	-
· Light					
CL-1	KET	3	Room lamp	MG651032	-
CL-2	AMP	1	Cigar lighter	S822-014002	S822-114002
CL-3	DEUTSCH	2	Head lamp-LH	DT06-2S-EP06	-
CL-4	DEUTSCH	2	Head lamp-RH	DT06-2S-EP06	-
CL-5	DEUTSCH	2	Work lamp-LH	DT06-2S-EP06	-
CL-6	DEUTSCH	2	Work lamp-RH	DT06-2S-EP06	-
CL-7	DEUTSCH	2	Beacon lamp	DT06-2S-EP06	DT04-2P
CL-8	DEUTSCH	2	Cab light-LH	DT06-2S-EP06	DT04-2P
CL-9	DEUTSCH	2	Cab light-RH	DT06-2S-EP06	DT04-2P
CL-10	DEUTSCH	2	Cab lighter	DT06-2S-EP06	DT04-2P
CL-24	DEUTSCH	2	Head lamp-rear	DT06-2S-EP06	DT04-2P-E005
· 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	AMP	2	Air cleaner switch (HX500LT3 : -#00027, HX520LT3 : -#00006)	85202-1	-
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	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CD-35	DEUTSCH	3	Bucket in pressure sensor	DT06-3S-EP06	-
CD-36	DEUTSCH	3	Arm out pressure sensor	DT06-3S-EP06	-
CD-42	DEUTSCH	3	P1 pump pressure sensor	DT06-3S-EP06	-
CD-43	DEUTSCH	3	P2 pump pressure sensor	DT06-3S-EP06	-
CD-44	DEUTSCH	3	P3 pump pressure sensor	DT06-3S-EP06	-
CD-45	DEUTSCH	2	WIF sensor	DT06-2S-EP06	-
CD-52	AMP	2	Fan speed sensor	174352-2	-
CD-69	DEUTSCH	3	Attach pressure sensor	DT06-3S-EP06	-
CD-70	DEUTSCH	3	N1 pressure sensor	DT06-3S-EP06	-
CD-71	DEUTSCH	3	N2 pressure sensor	DT06-3S-EP06	-
CD-85	DEUTSCH	3	Boom down pressure sensor	DT06-3S-EP06	-
CD-87	DEUTSCH	3	Bucket out pressure sensor	DT06-3S-EP06	-
CD-90	DEUTSCH	3	Arm in pressure sensor	DT06-3S-EP06	-

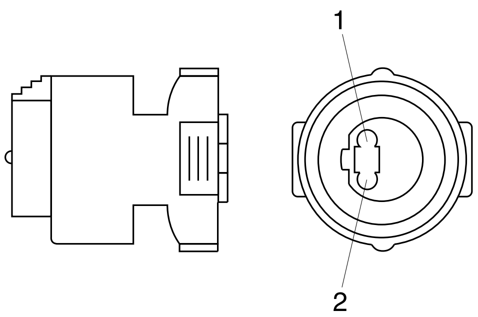
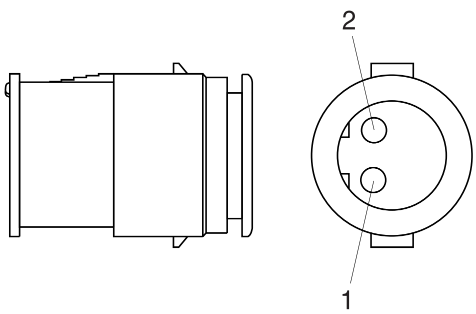
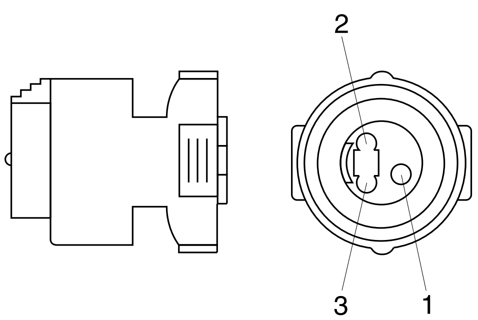
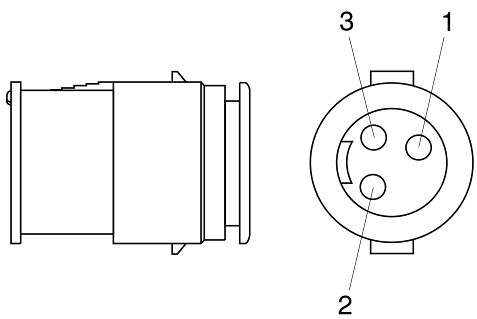
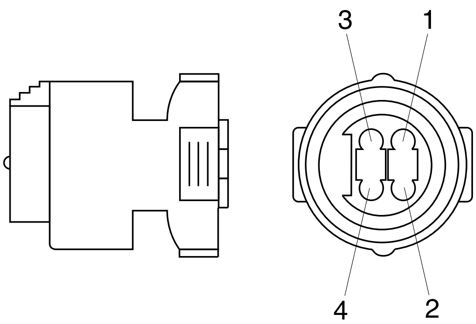
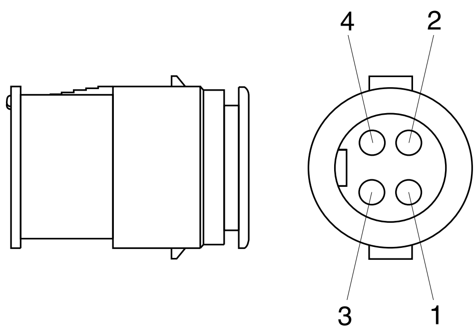
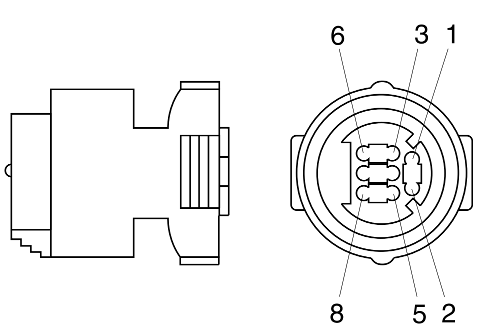
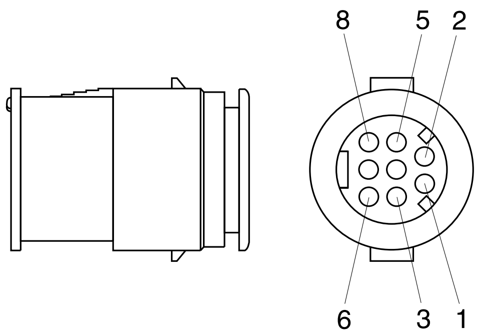
2. CONNECTION TABLE FOR CONNECTORS

1) PA TYPE CONNECTOR

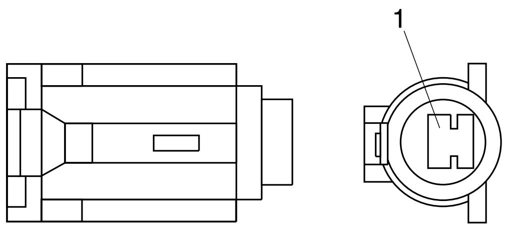
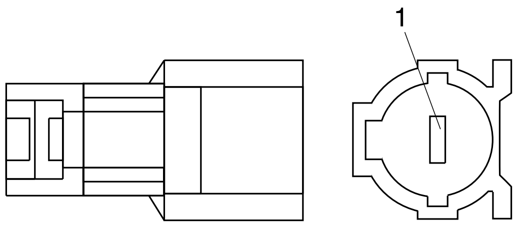
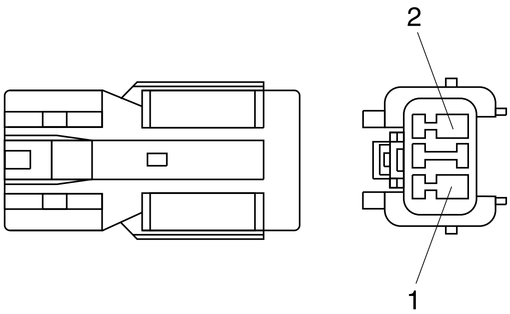
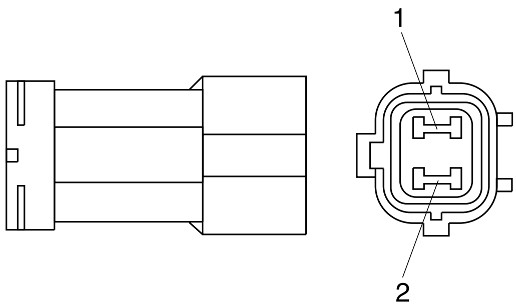
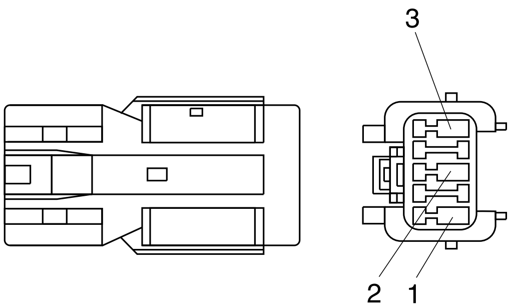
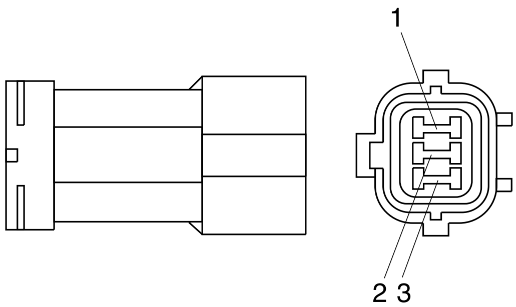
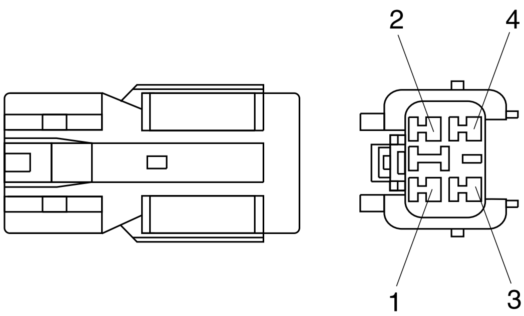
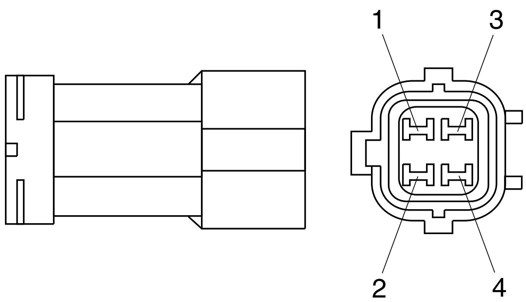
No. of pin	Receptacle connector (female)	Plug connector (male)
5	 S811-005002	 S811-105002
7	 S811-007002	 S811-107002
9	 S811-009002	 3S811-109002
11	 S811-011002	 S811-111002

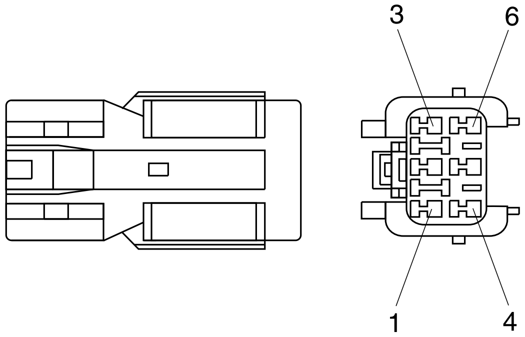
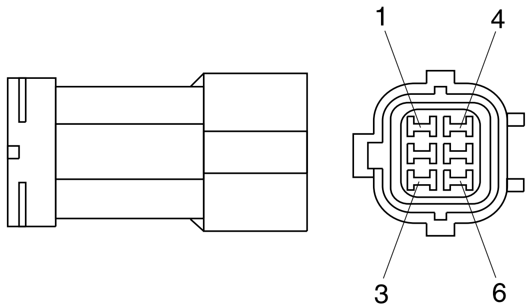
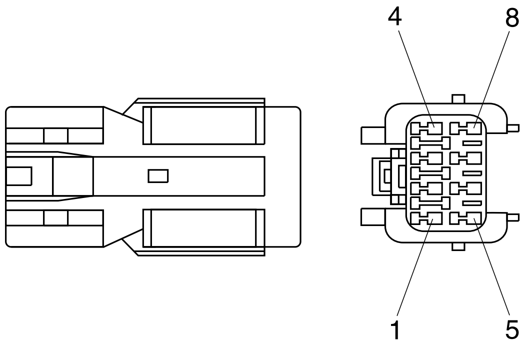
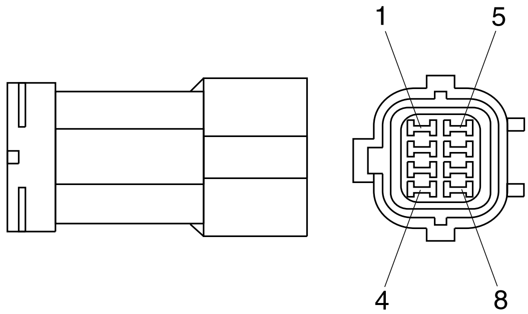
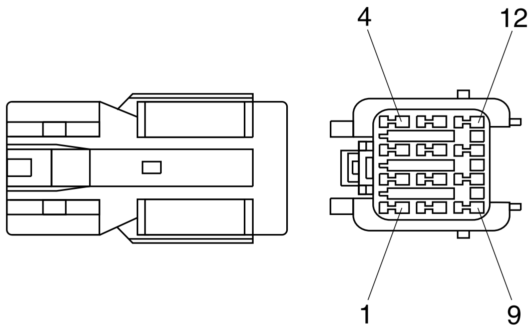
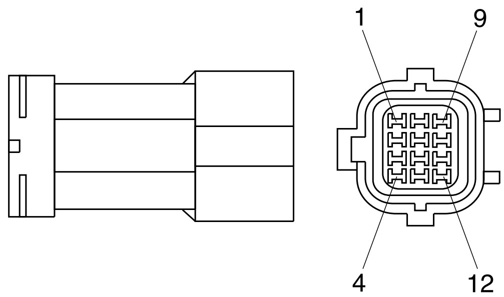
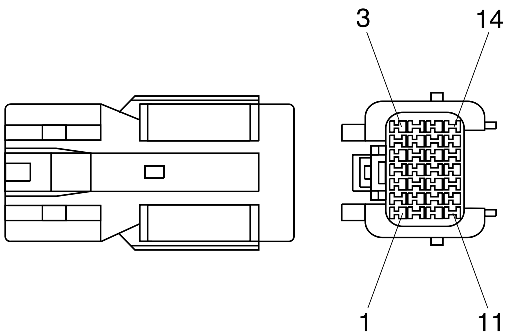
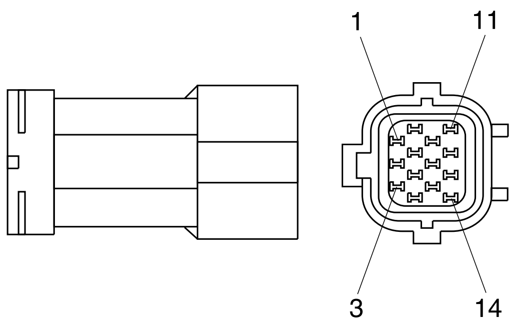
No. of pin	Receptacle connector (female)	Plug connector (male)
13	 S811-013002	 S811-113002
17	 S811-017002	 S811-117002
21	 S811-021002	 S811-121002

2) J TYPE CONNECTOR

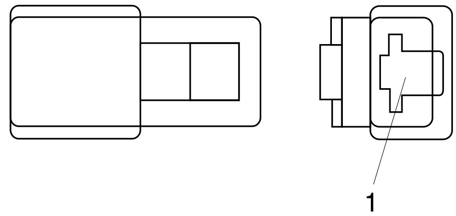
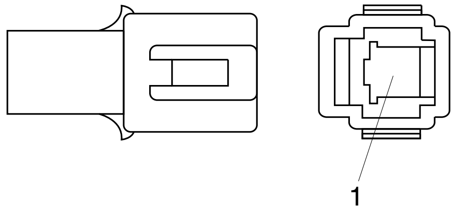
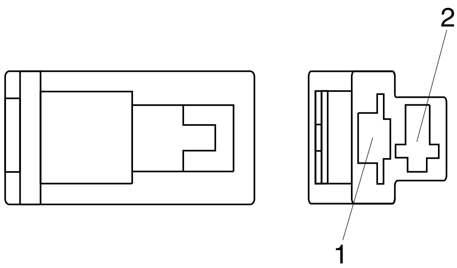
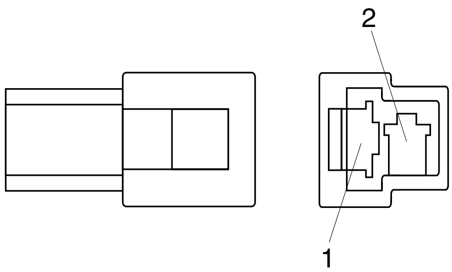
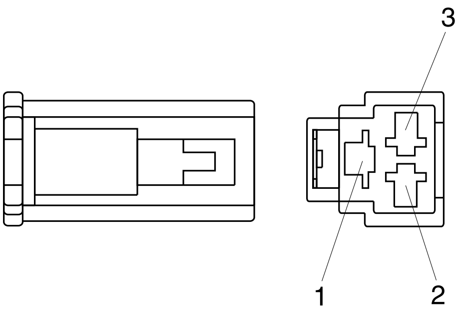
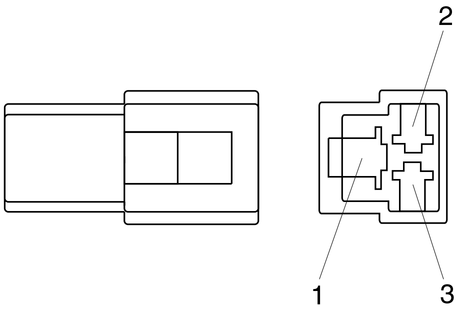
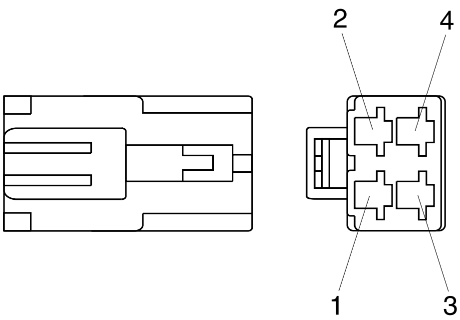
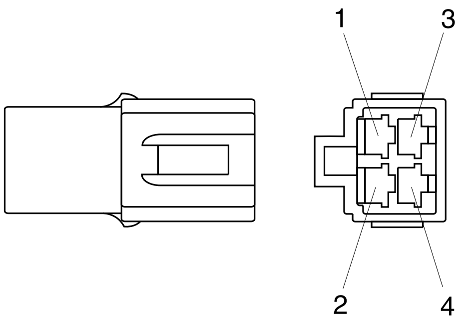
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 S816-002001	 S816-102001
3	 S816-003001	 S816-103001
4	 S816-004001	 S816-104001
8	 S816-008001	 S816-108001

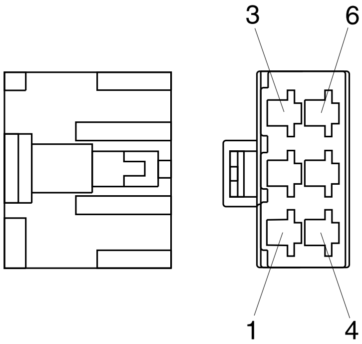
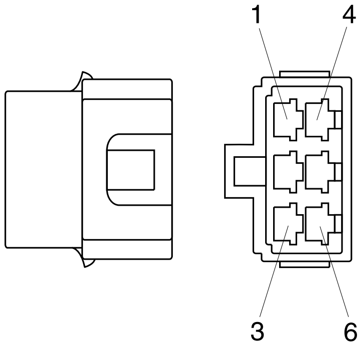
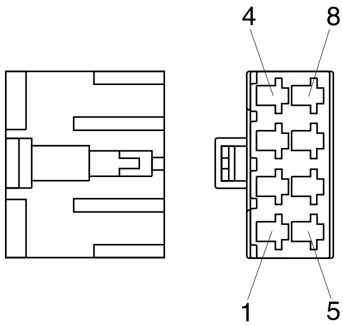
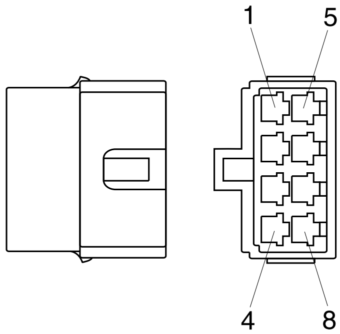
3) SWP TYPE CONNECTOR

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

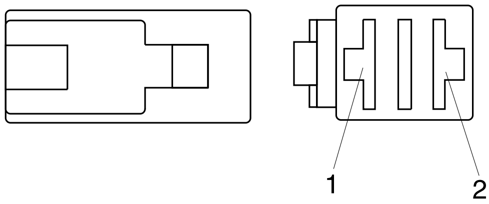
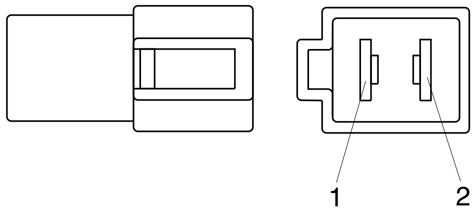
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S814-006000	 S814-106000
8	 S814-008000	 S814-108000
12	 S814-012000	 S814-112000
14	 S814-014000	 S814-114000

4) CN TYPE CONNECTOR

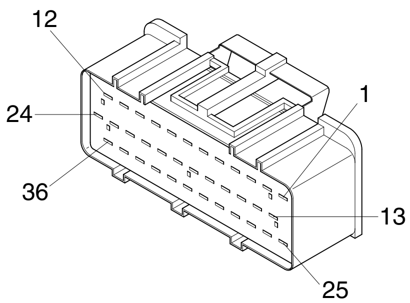
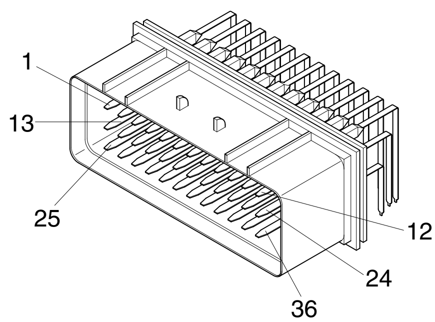
No. of pin	Receptacle connector (female)	Plug connector (male)
1	 S810-001202	 S810-101202
2	 S810-002202	 S810-102202
3	 S810-003202	 S810-103202
4	 S810-004202	 S810-104202

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

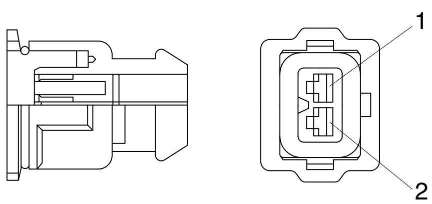
5) 375 FASTEN TYPE CONNECTOR

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

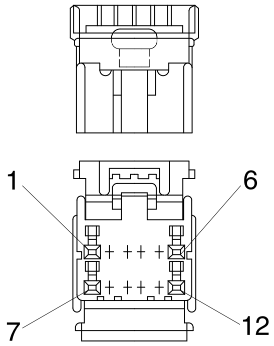
6) AMP ECONOSEAL CONNECTOR

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

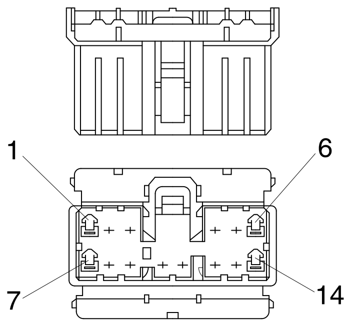
7) AMP TIMER CONNECTOR

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

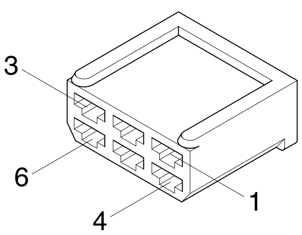
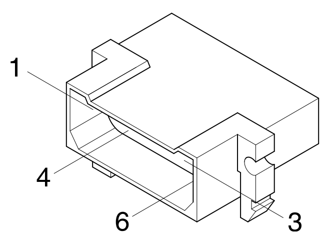
8) AMP 040 MULTILOCK CONNECTOR

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

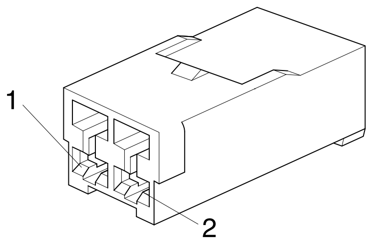
9) AMP 070 MULTILOCK CONNECTOR

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

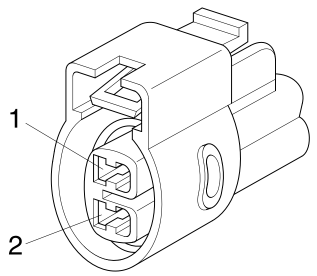
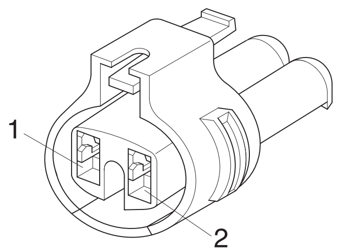
10) AMP FASTIN - FASTON CONNECTOR

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

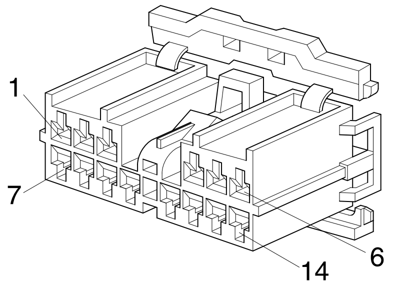
11) KET 090 CONNECTOR

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	

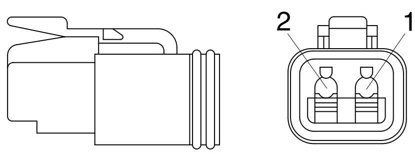
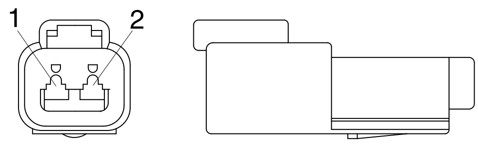
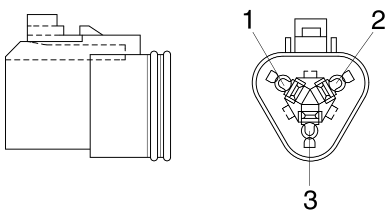
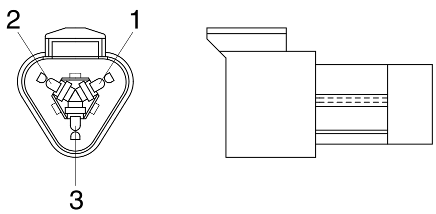
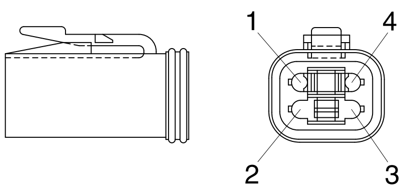
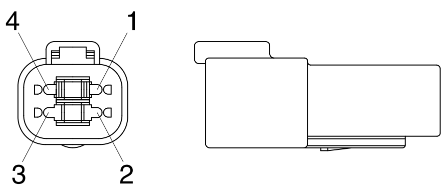
14) DEUTSCH DT CONNECTORS

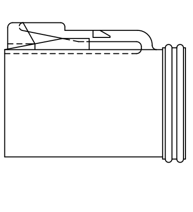
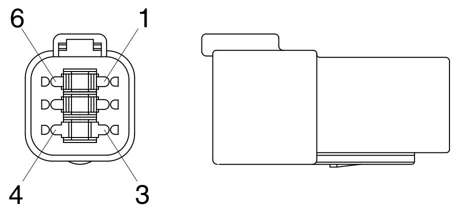
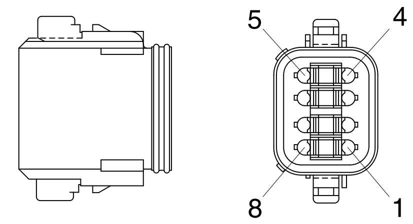
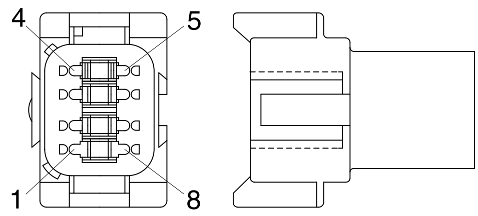
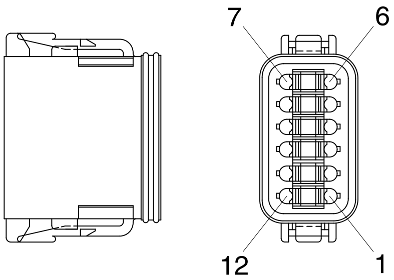
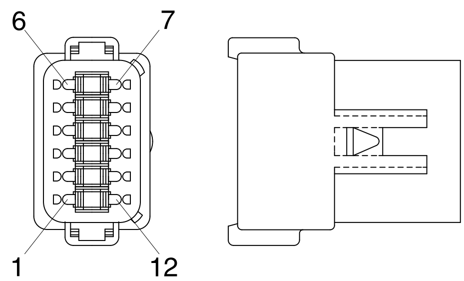
DT 06 - 3S - ★★★★

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

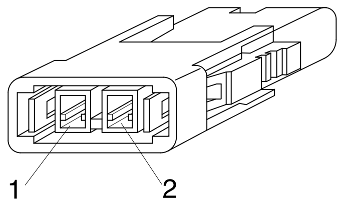
※ Modification

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

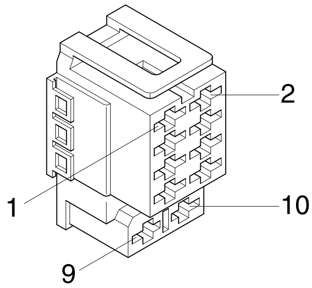
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 DT06-2S	 DT04-2P
3	 DT06-3S	 DT04-3P
4	 DT06-4S	 DT04-4P

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

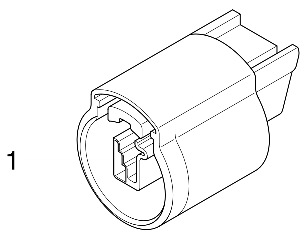
15) MOLEX 2CKTS CONNECTOR

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

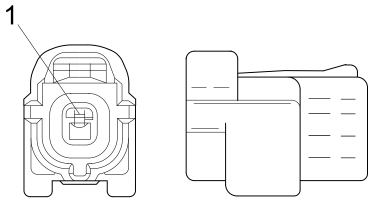
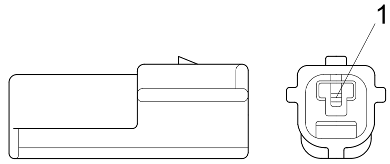
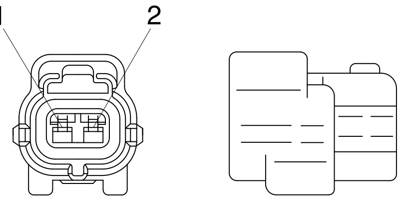
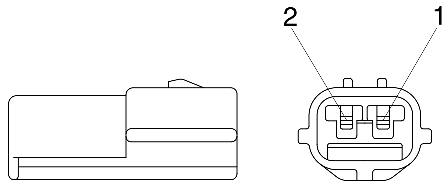
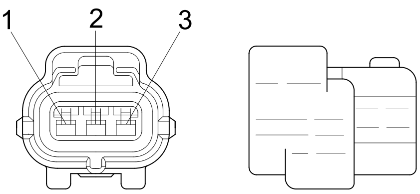
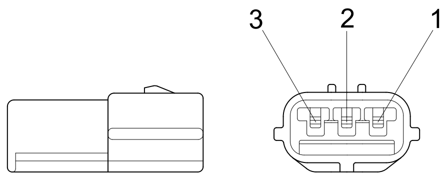
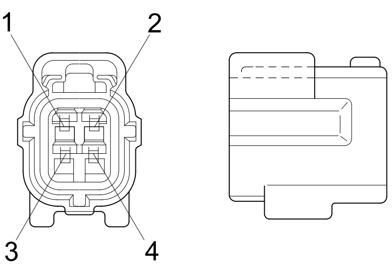
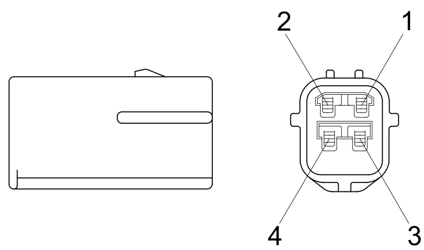
16) ITT SWF CONNECTOR

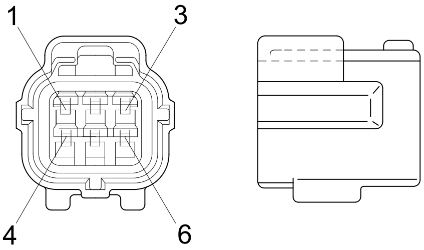
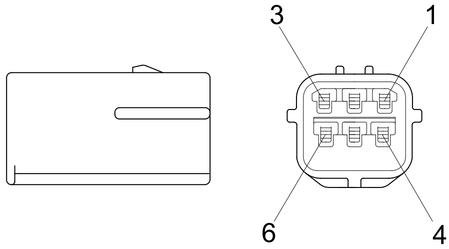
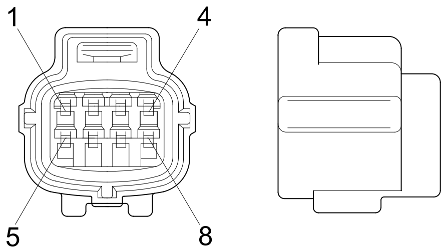
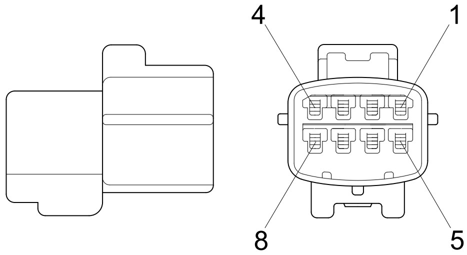
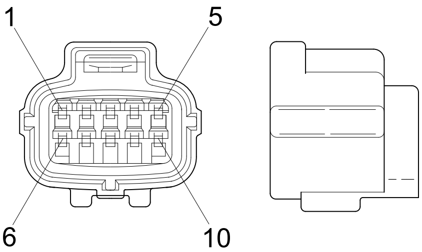
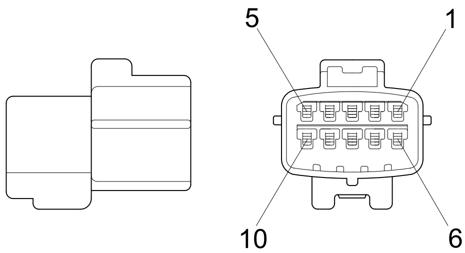
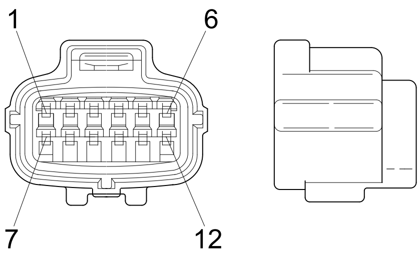
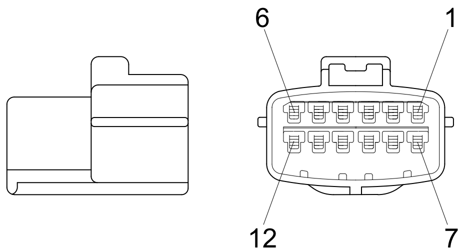
No. of pin	Receptacle connector (female)	Plug connector (male)
10	 SWF593757	

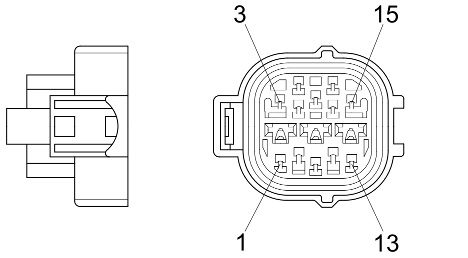
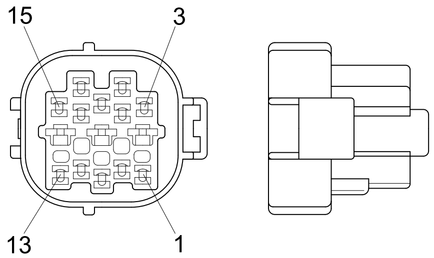
17) MWP NMWP CONNECTOR

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

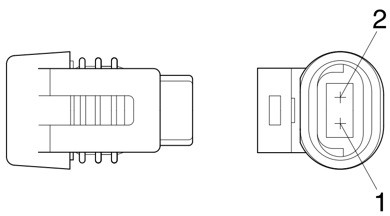
18) ECONOSEAL J TYPE CONNECTORS

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

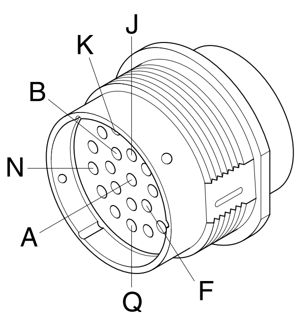
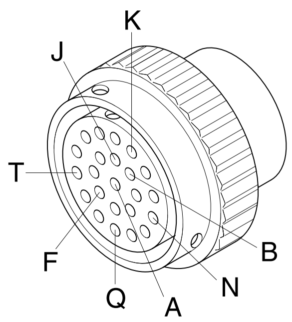
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S816-006002	 S816-106002
8	 S816-008002	 S816-108002
10	 S816-010002	 S816-110002
12	 S816-012002	 S816-112002

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

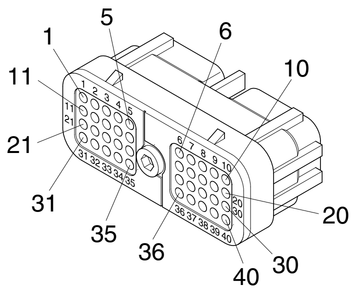
19) METRI-PACK TYPE CONNECTOR

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

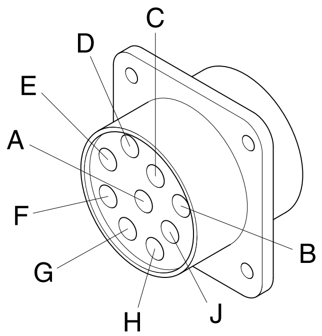
20) DEUTSCH HD30 CONNECTOR

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

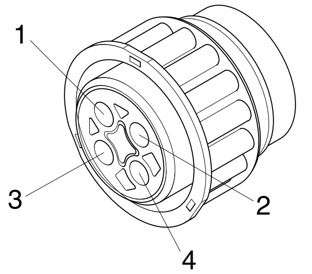
21) DEUTSCH MCU CONNECTOR

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

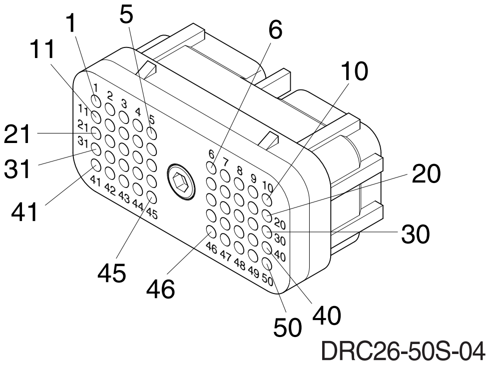
22) DEUTSCH SERVICE TOOL CONNECTOR

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

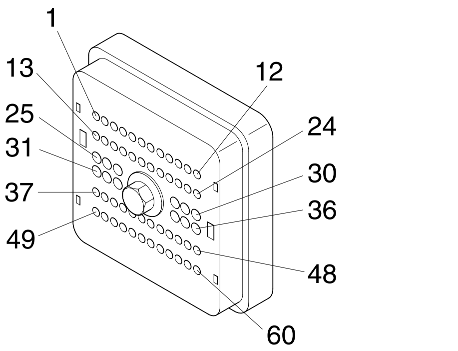
23) AMP FUEL WARMER CONNECTOR

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

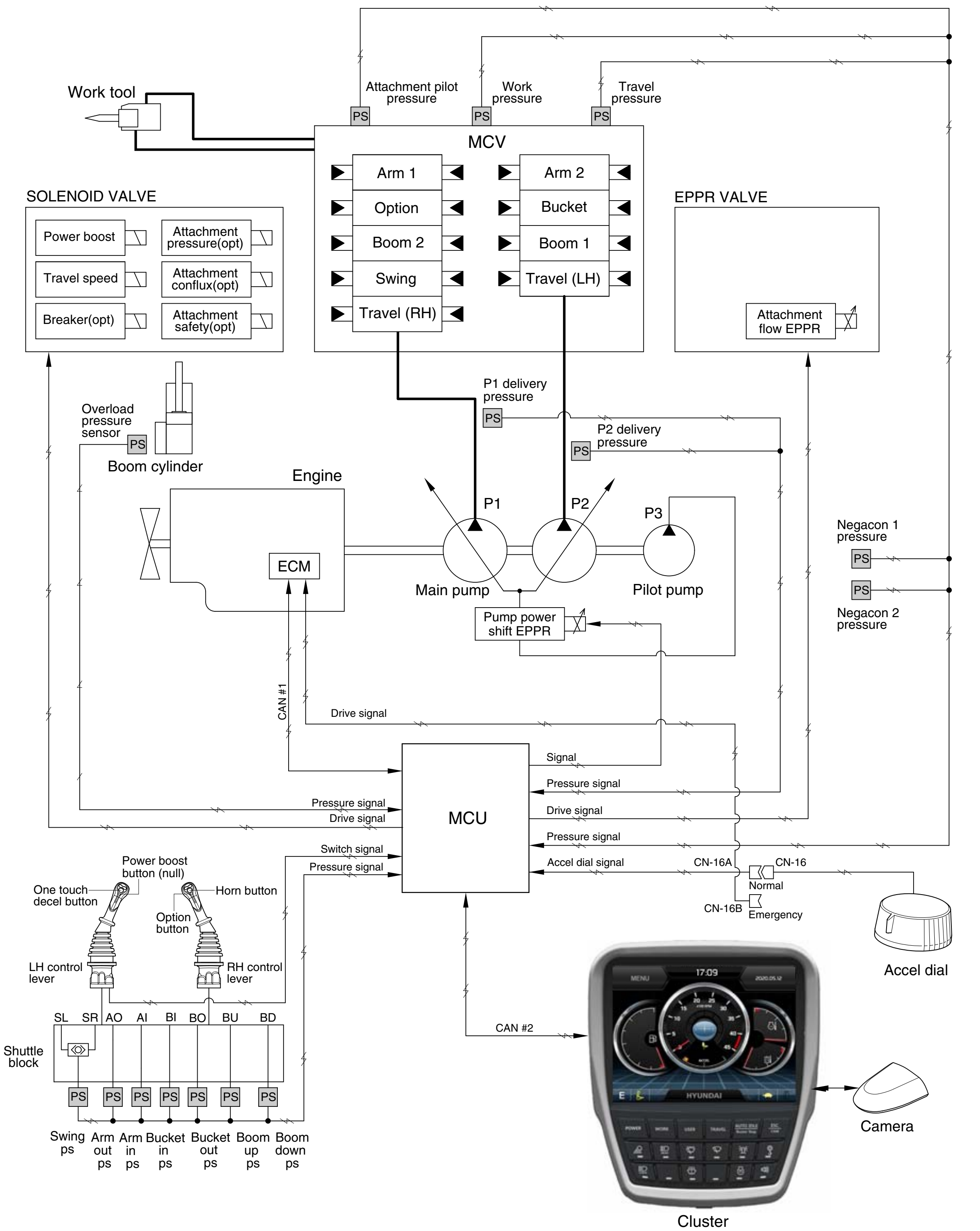
SECTION 5 MECHATRONICS SYSTEM

GROUP 1 OUTLINE

The ADVANCED CAPO (Computer Aided Power Optimization) system controls engine and pump mutual power at an optimum and less fuel consuming state for the selected work by mode selection, auto-deceleration, power boost function, etc. It monitors machine conditions, for instance, engine speed, coolant temperature, hydraulic oil temperature, and hydraulic oil pressure, etc.
It consists of a MCU, a cluster, an ECM, EPPR valves, and other components. The MCU and the cluster protect themselves from over-current and high voltage input, and diagnose malfunctions caused by short or open circuit in electric system, and display error codes on the cluster.

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

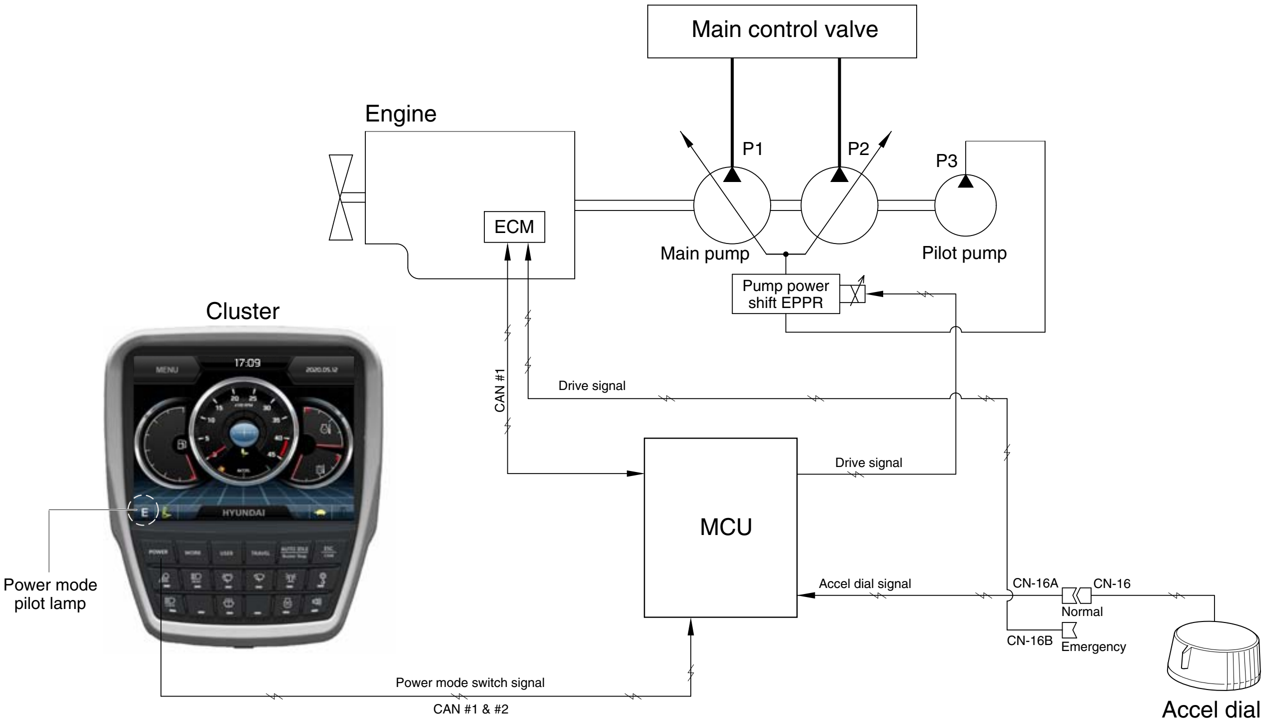
SYSTEM DIAGRAM



480SA5MS01

GROUP 2 MODE SELECTION SYSTEM

1. POWER MODE SELECTION SYSTEM



400SA5MS02

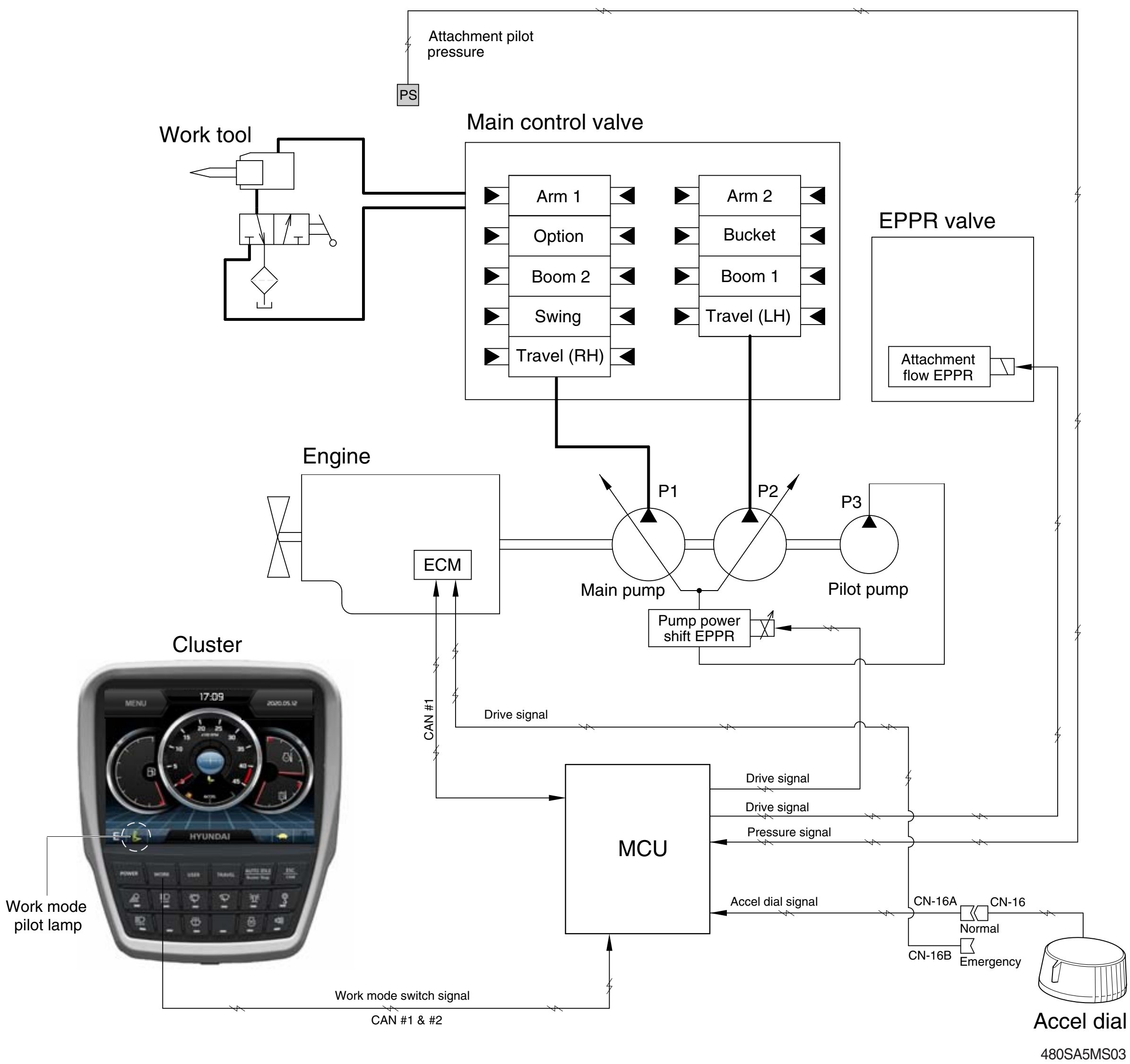
Mode selection system (micro computer based electro-hydraulic pump and engine mutual control system) optimizes the engine and pump performance.

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		Engine rpm		Pressure (Pf)		
				No load	Load	
		No load	Load	-	Boom up full stroke & pump no relief	Boom up full stroke & pump relief
Standard	P	1700	1800	8.5	8~5	8
	S	1600	1700	9	8.5~5.5	8.5
	E	1500	1600	9	8.5~5.5	8.5
Option	P	1800	1800	5	5	5
	S	1700	1700	5.5	5.5	5.5
	E	1600	1600	5.5	5.5	5.5
Auto decel		1000	-	25	25	25
One touch decel		800	-	25	25	25
Key start (low idle)		800	-	25	25	25

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.

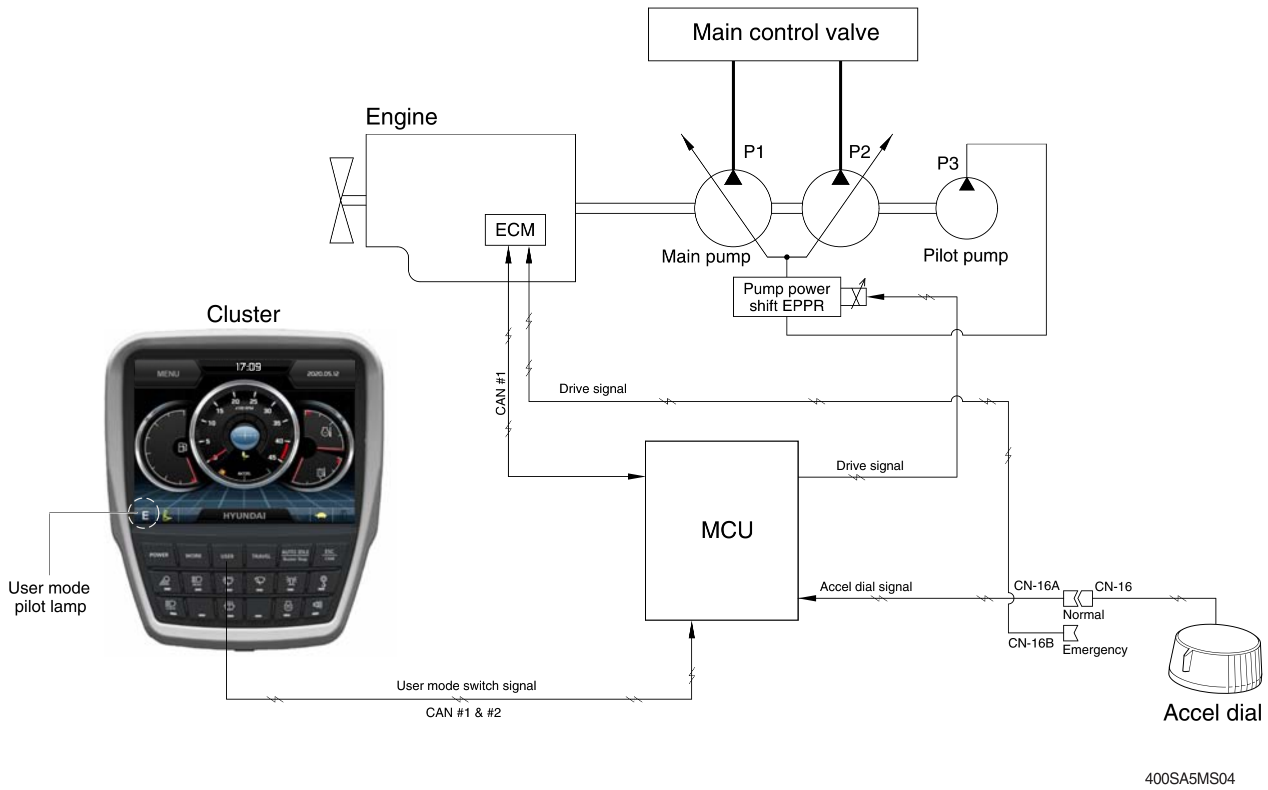
2) ATT WORK MODE (breaker, crusher)

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

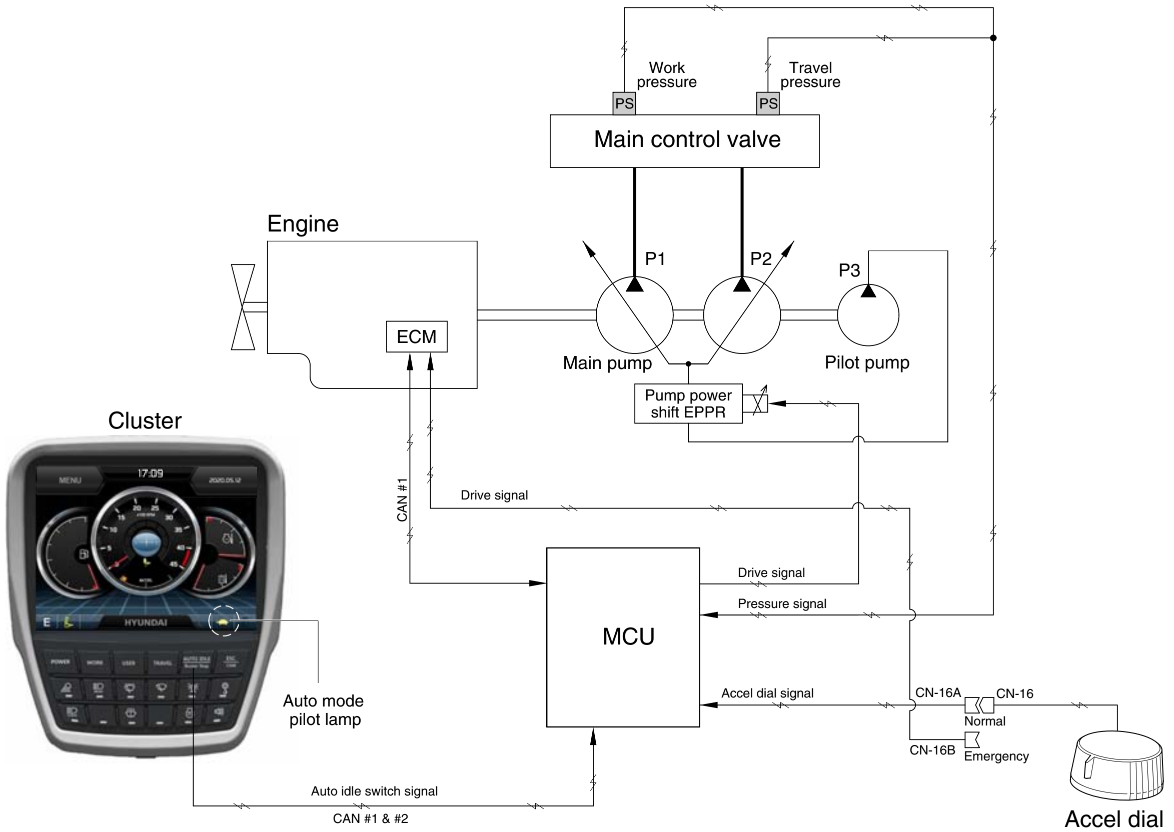


1) High idle rpm, auto idle rpm and EPPR pressure can be adjusted and memorized in the U-mode.

2) LCD segment vs parameter setting

Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1400	800	0
2	1450	850	2
3	1500	900	4
4	1550	950	7
5	1600	1000 (auto decel)	10
6	1650	1050	13
7	1700	1100	16
8	1750	1150	19
9	1800	1200	22
10	1850	1250	25

GROUP 3 AUTOMATIC DECELERATION SYSTEM

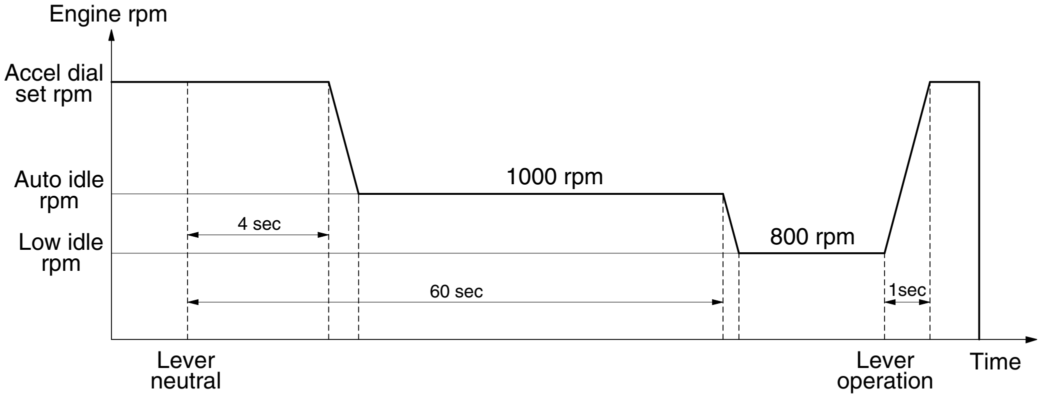


400SA5MS05

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 drive the governor moter 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.



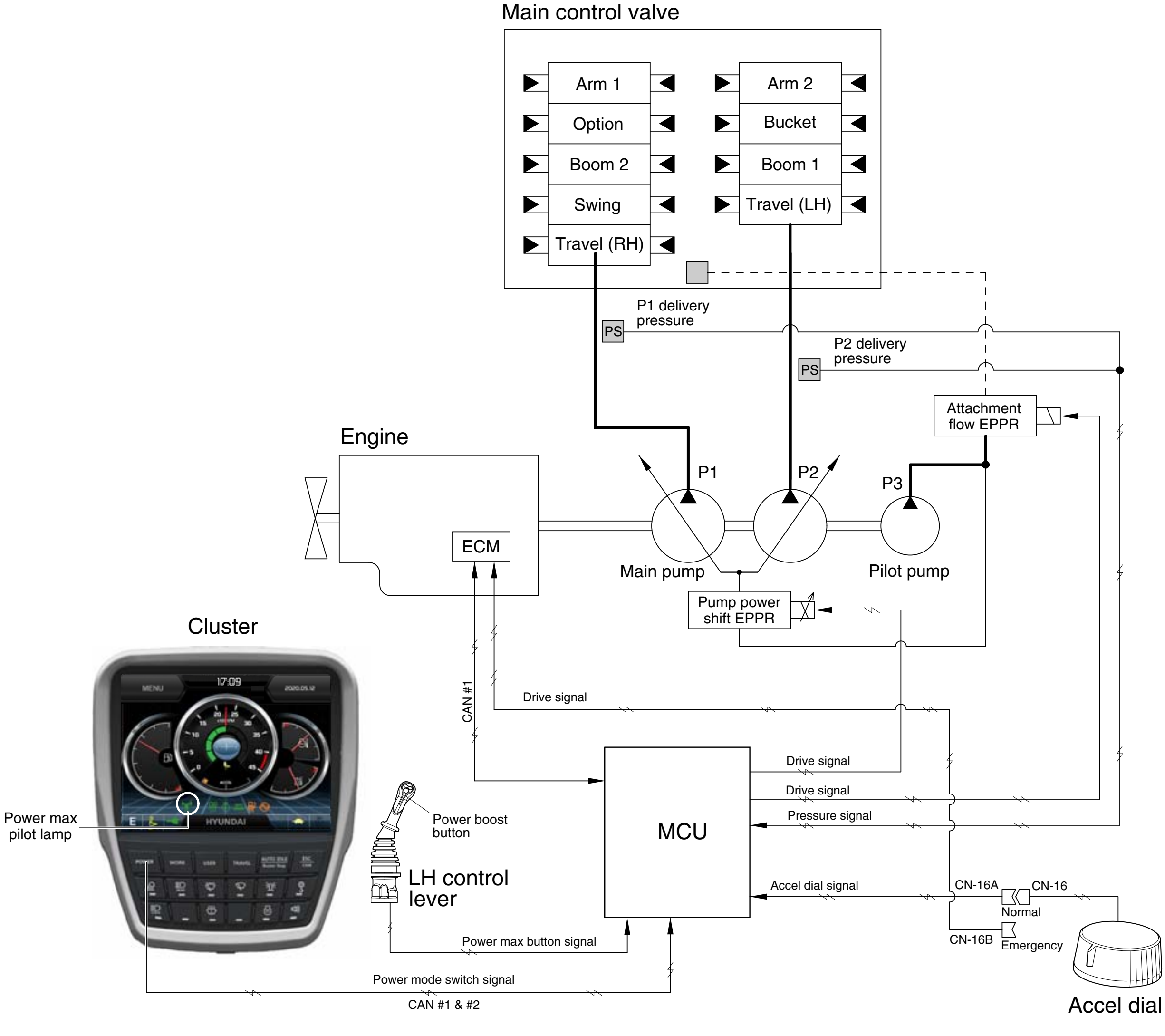
480SA5MS56

2. WHEN AUTO IDLE PILOT LAMP OFF

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

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

GROUP 4 POWER BOOST SYSTEM (NULL)



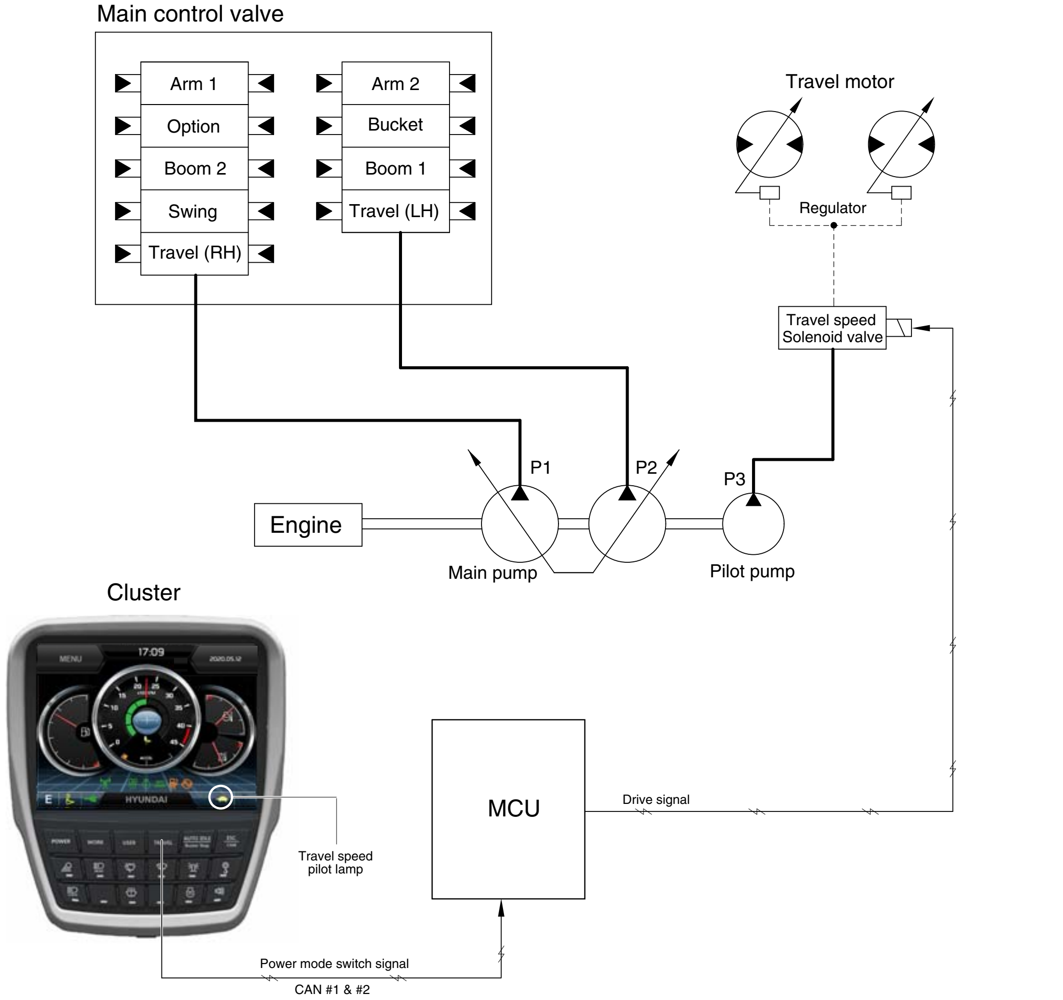
· When the power boost switch on the left control lever knob is pushed ON, the power mode is set P mode and maximum digging power is increased by 10 %.

· 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



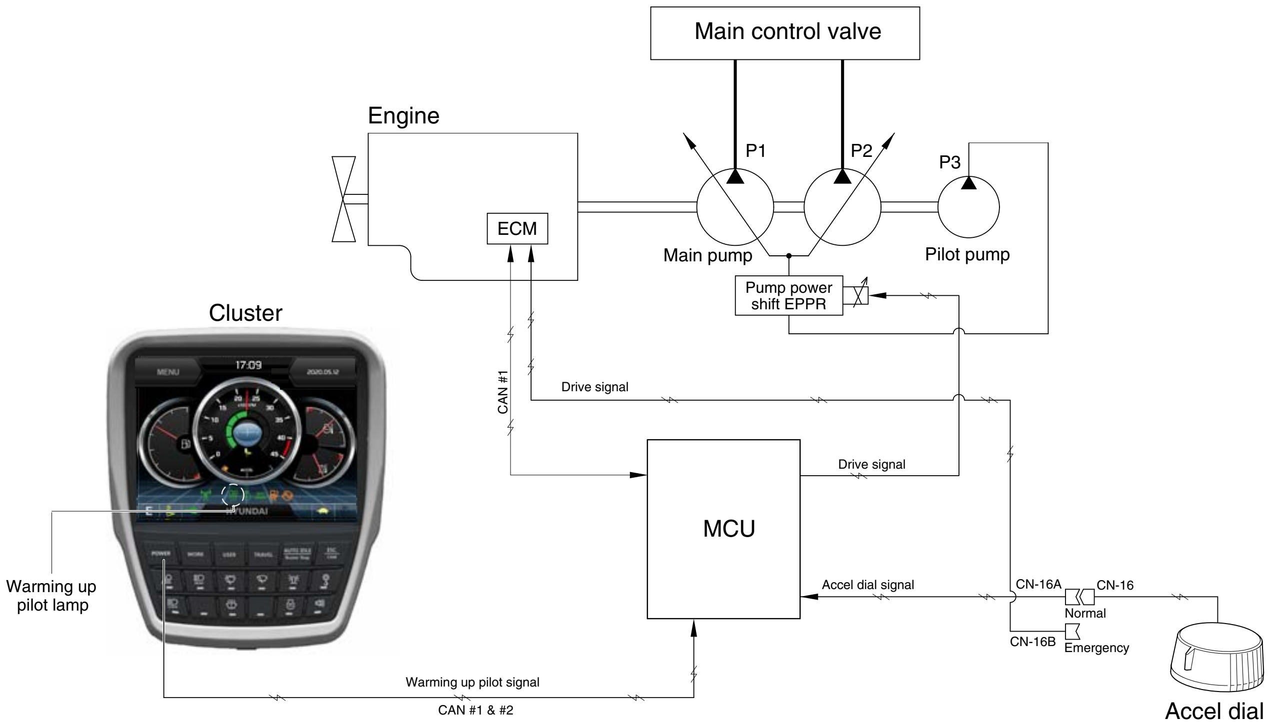
480SA5MS10

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



400SA5MS07

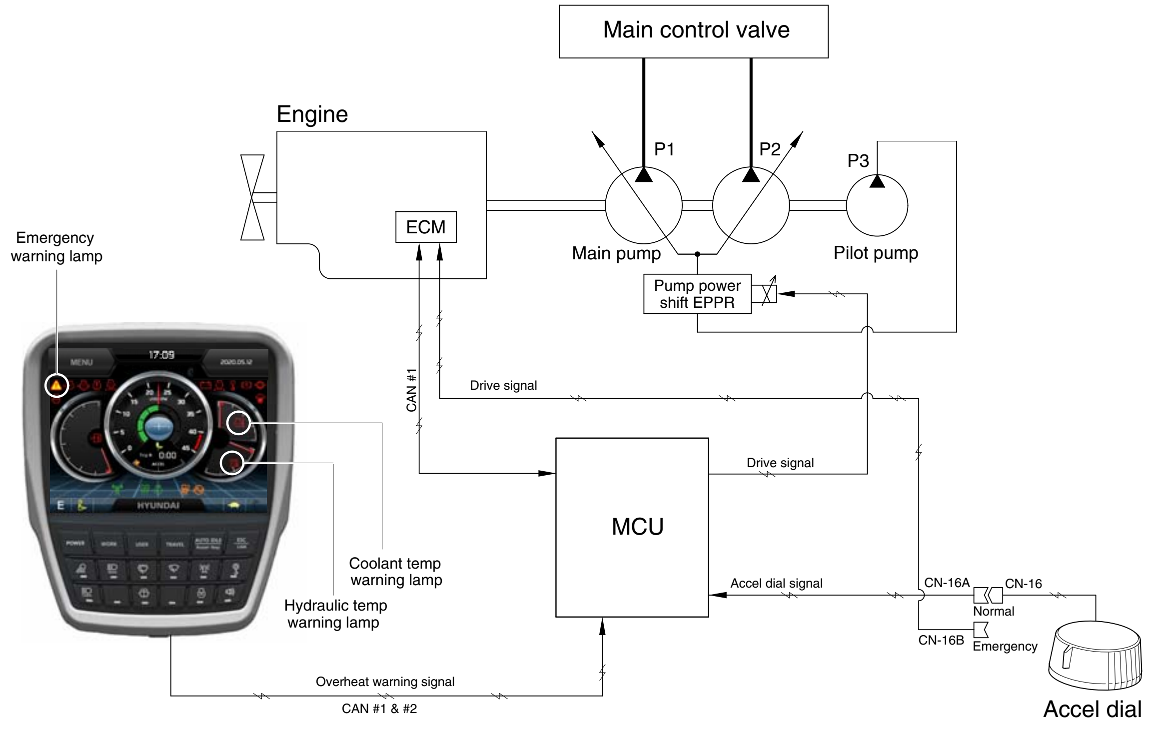
1. The MCU receives the engine coolant temperature thought the temperature sensor, and if the coolant temperature is below 30˚C, it increases the engine speed from key start rpm to 1400 rpm. At this time the mode does not change. If the coolant temperature sensor has fault, the hydraulic oil temperature 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



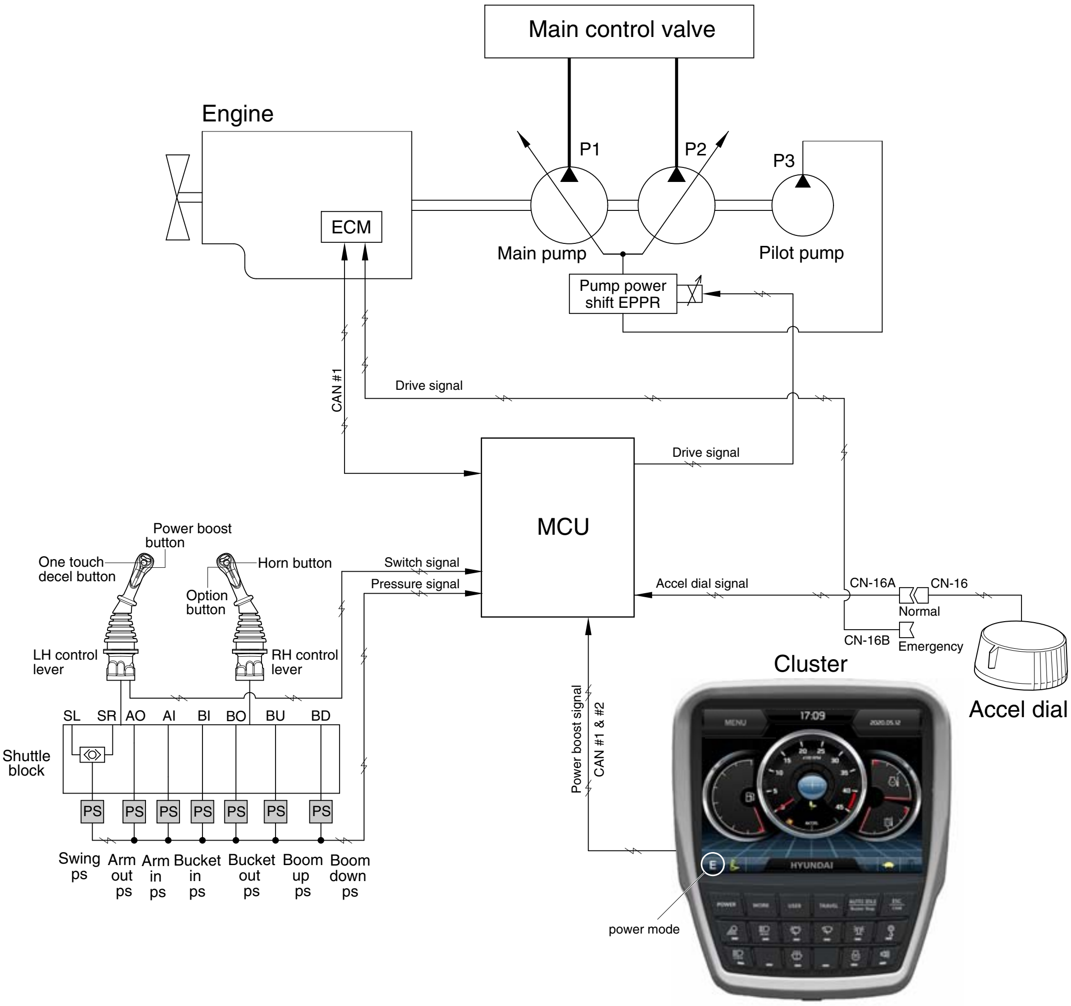
400SA5MS08

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

2. LOGIC TABLE

Description		Condition	Function
First step warning	Activated	- Coolant temperature : Above 107˚C	- Warning lamp : ON , buzzer : OFF - Pump input torque is reduced.
		- Hydraulic oil temperature : Above 100˚C	- Warning lamp & buzzer : ON - Pump input torque is reduced.
	Canceled	- Coolant temperature : Less than 107˚C - Hydraulic oil temperature : Less than 100˚C	- Return to pre-set the pump absorption torque.
Second step warning	Activated	- Coolant temperature : Above 113˚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 107˚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



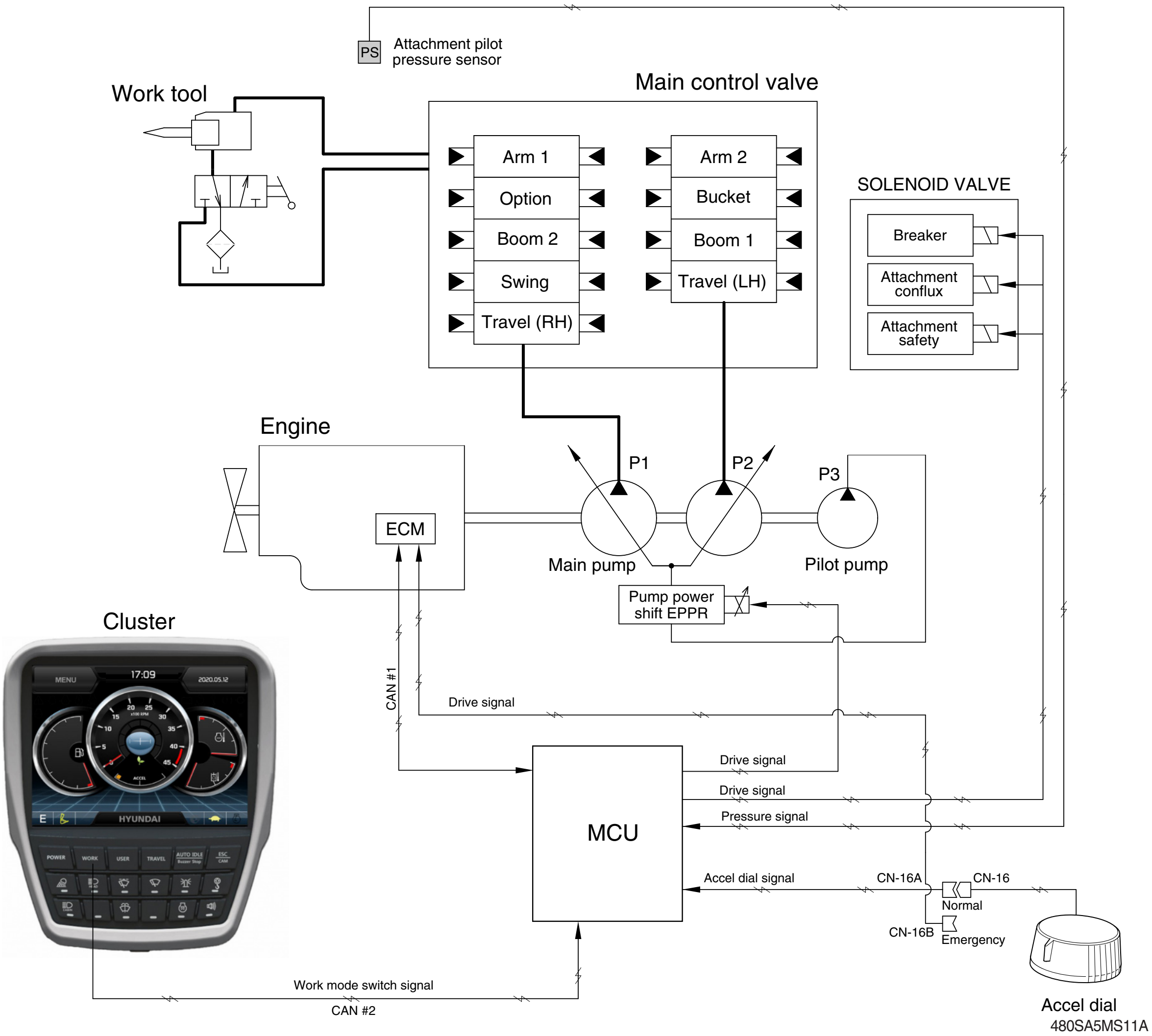
400SA5MS09

· 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



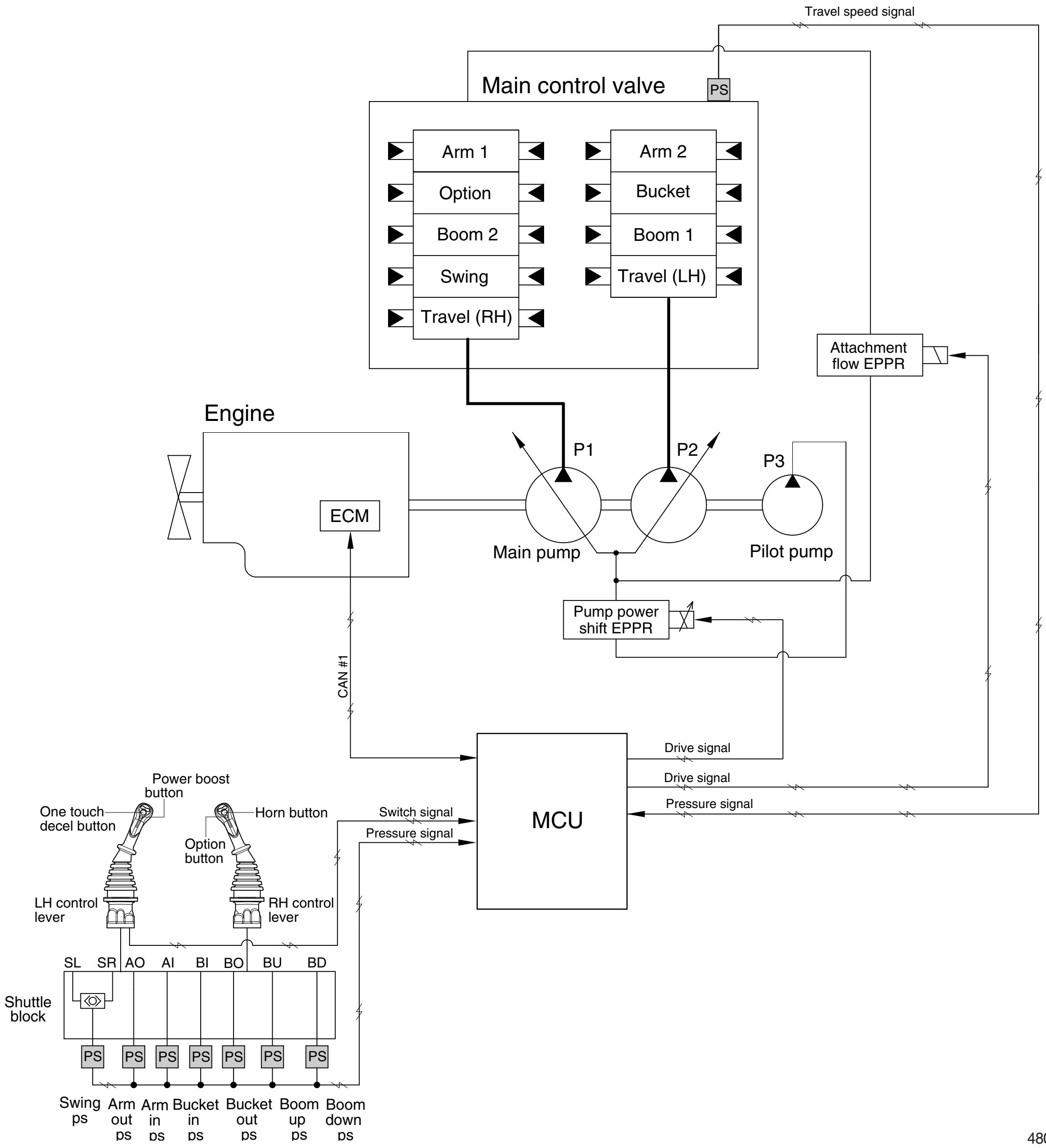
· The system is used to control the pump delivery flow according to set of the work tool on the cluster by the attachment flow EPPR valve.

Description	Work tool	
	Breaker	Crusher
Flow level	100 ~ 250 lpm	100 ~ 580 lpm
Attach safety solenoid	-	ON
Attach conflux solenoid	-	ON/OFF
Breaker solenoid★	ON	-

※ Refer to the page 5-73 for the attachment kinds and max flow.

★ When breaker operating button is pushed.

GROUP 10 INTELLIGENT POWER CONTROL SYSTEM



480SA5MS12

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

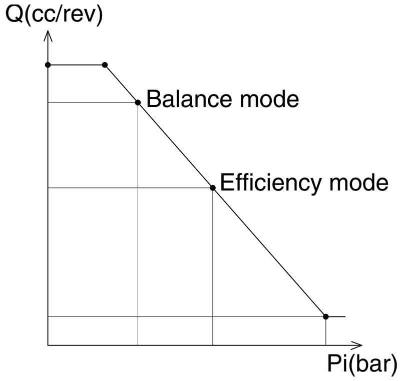
Condition★1	Function
IPC mode : ON★2 Boom up Arm in Not travel motion Not swing motion	Limitation of pump flow rate : Activated
None of upper condition	Limitation of pump flow rate : Canceled

★1 AND condition

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

2. IPC MODE SELECTION

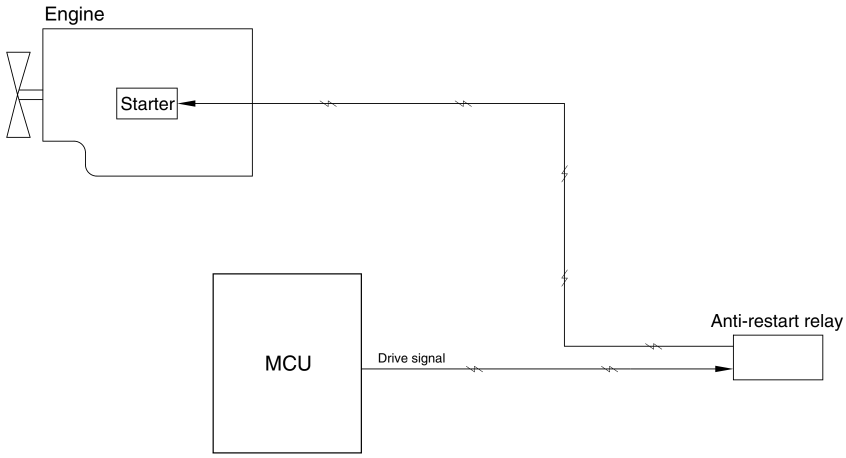
IPC mode ON/OFF and the levels of flow rate limit can be selected at "Mode setup > IPC mode"



145SA5MS19

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

GROUP 11 ANTI-RESTART SYSTEM



220S5MS18

1. ANTI-RESTART FUNCTION

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

GROUP 12 SELF-DIAGNOSTIC SYSTEM

1. OUTLINE

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

2. MONITORING

1) Active fault

220S3CD120A

220S3CD125A

· The active faults of the MCU can be checked by this menu.

2) Logged fault

220S3CD128A

220S3CD124A

· The logged faults of the MCU can be checked by this menu.

3) Delete logged fault

220S3CD134A

220S3CD126A

220S3CD127A

· The logged faults of the MCU can be deleted by this menu.

3. MACHINE ERROR CODES TABLE

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">101</td><td>3</td><td>10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage > 3.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Hydraulic oil temperature display failure
2. Control Function – Fan revolutions control failure
(Checking list)
1. CD-1 (#2) – CN-52 (#24) Checking Open/Short
2. CD-1 (#1) – CN-51 (#11) Checking Open/Short</td></tr>
<tr><td rowspan="4">105</td><td>0</td><td>10 seconds continuous, Working Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V≤ Working Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Working Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Working Press. display failure
2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure
(Checking list)
1. CD-7 (#B) – CN-52 (#37) Checking Open/Short
2. CD-7 (#A) – CN-51 (#3) Checking Open/Short
3. CD-7 (#C) – CN-51 (#13) Checking Open/Short</td></tr>
<tr><td rowspan="4">108</td><td>0</td><td>10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V</td><td></td><td>●</td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V ≤ Travel Oil Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Travel Oil Press. display failure
2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure
(Checking list)
1. CD-6 (#B) – CN-52 (#38) Checking Open/Short
2. CD-6 (#A) – CN-51 (#3) Checking Open/Short
3. CD-6 (#C) – CN-51 (#13) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
120	0	10 seconds continuous, Main Pump 1 (P1) Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V ≤ Main Pump 1 (P1) Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Main Pump 1 (P1) Press. Sensor Measurement Voltage < 0.3V	●		
		(Results / Symptoms) 1. Monitor – Main Pump 1 (P1) Press. display failure 2. Control Function – Automatic voltage increase operation failure, Overload at compensation control failure (Checking list) 1. CD-42 (#B) – CN-52 (#29) Checking Open/Short 2. CD-42 (#A) – CN-51 (#3) Checking Open/Short 3. CD-42 (#C) – CN-51 (#13) Checking Open/Short			
121	0	10 seconds continuous, Main Pump 2 (P2) Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Main Pump 2 (P2) Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Main Pump 2 (P2) Press. Sensor Measurement Voltage < 0.3V	●		
		(Results / Symptoms) 1. Monitor – Main Pump 2 (P2) Press. display failure 2. Control Function – Automatic voltage increase operation failure, Overload at compensation control failure (Checking list) 1. CD-43 (#B) – CN-52 (#30) Checking Open/Short 2. CD-43 (#A) – CN-51 (#3) Checking Open/Short 3. CD-43 (#C) – CN-51 (#13) Checking Open/Short			
122	1	(when you had conditions mounting pressure sensor) 10 seconds continuous, 0.3V ≤ Overload Press. Sensor Measurement Voltage < 0.8V	●		
	4	(when you had conditions mounting pressure sensor) 10 seconds continuous, Overload Press. Sensor Measurement Voltage < 0.3V	●		
		(Results / Symptoms) 1. Monitor – Overload Press. display failure 2. Control Function – Overload warning alarm failure (Checking list) 1. CD-31 (#B) – CN-52 (#39) Checking Open/Short 2. CD-31 (#A) – CN-51 (#3) Checking Open/Short 3. CD-31 (#C) – CN-51 (#13) Checking Open/Short			

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC HCESPN	DTC FMI	Diagnostic Criteria	Application G	Application C	Application 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 (#39) Checking Open/Short 2. CD-70 (#A) – CN-51 (#3) Checking Open/Short 3. CD-70 (#C) – CN-51 (#13) Checking Open/Short			
124	0	10 seconds continuous, Negative 2 Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Negative 2 Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Negative 2 Press. Sensor Measurement Voltage < 0.3V	●		
		(Results / Symptoms) 1. Monitor – Negative 2 Press. display failure 2. Control Function – Option attachment flow control operation failure (Checking list) 1. CD-71 (#B) – CN-51 (#40) Checking Open/Short 2. CD-71 (#A) – CN-51 (#3) Checking Open/Short 3. CD-71 (#C) – CN-51 (#13) Checking Open/Short			
127	0	10 seconds continuous, Boom Up Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Boom Up Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Boom Up Pilot Press. Sensor Measurement < 0.3V	●		
		(Results / Symptoms) 1. Monitor – Boom Up Pilot Press. display failure 2. Control Function – Engine/Pump variable horse power control operation failure, IPC operation failure, Boom first operation failure (Checking list) 1. CD-32 (#B) – CN-52 (#35) Checking Open/Short 2. CD-32 (#A) – CN-51 (#3) Checking Open/Short 3. CD-32 (#C) – CN-5 1(#13) Checking Open/Short			

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="4">128</td><td>0</td><td>(when you had conditions mounting pressure sensor)
10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>(when you had conditions mounting pressure sensor)
10 seconds continuous, 0.3V≤ Boom Down Pilot Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>(when you had conditions mounting pressure sensor)
10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Boom Down Pilot Press. display failure
2. Control Function – Boom floating operation failure
(Checking list)
1. CD-85 (#B) – CN-52 (#34) Checking Open/Short
2. CD-85 (#A) – CN-51 (#3) Checking Open/Short
3. CD-85 (#C) – CN-51 (#13) Checking Open/Short</td></tr>
<tr><td rowspan="4">129</td><td>0</td><td>10 seconds continuous, Arm In Pilot Press. Sensor Measurement Voltage > 4.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V≤ Arm In Pilot Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Arm In Pilot Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Arm In Pilot Press. display failure
2. Control Function – IPC operation failure
(Checking list)
1. CD-90 (#B) – CN-51 (#10) Checking Open/Short
2. CD-90 (#A) – CN-51 (#3) Checking Open/Short
3. CD-90 (#C) – CN-51 (#13) Checking Open/Short</td></tr>
<tr><td rowspan="4">133</td><td>0</td><td>10 seconds continuous,
Bucket in Pilot Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous,
0.3V≤ Bucket in Pilot Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous,
Bucket in Pilot Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Bucket in Pilot Press. display failure
2. Control Function – Engine variable horse power control operation failure
(Checking list)
1. CD-35 (#B) – CN-52 (#28) Checking Open/Short
2. CD-35 (#A) – CN-51 (#3) Checking Open/Short
3. CD-35 (#C) – CN-51 (#13) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
135	0	10 seconds continuous, Swing Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Swing Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Swing Pilot Press. Sensor Measurement Voltage < 0.3V	●		
		(Results / Symptoms) 1. Monitor – Swing Pilot Press. display failure 2. Control Function – IPC operation, Boom first operation failure (Checking list) 1. CD-24 (#B) – CN-52 (#36) Checking Open/Short 2. CD-24 (#A) – CN-51 (#3) Checking Open/Short 3. CD-24 (#C) – CN-51 (#13) Checking Open/Short			
138	0	Monitor – Select Attachment(breaker / crusher) 10 seconds continuous, Attachment Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	Monitor – Select Attachment(breaker / crusher) 10 seconds continuous, 0.3V≤ Attachment Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	Monitor – Select Attachment(breaker / crusher) 10 seconds continuous, Attachment Pilot Press. Sensor Measurement Voltage < 0.3V	●		
		(Results / Symptoms) 1. Monitor – Attachment Pilot Press. display failure 2. Control Function – Option attachment flow control operation failure (Checking list) 1. CD-69 (#B) – CN-52 (#33) Checking Open/Short 2. CD-69 (#A) – CN-51 (#3) Checking Open/Short 3. CD-69 (#C) – CN-51 (#13) Checking Open/Short			
139 (NA)	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

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">140</td><td>5</td><td>(Detection)
(When Pump EPPR Current is more than 10 mA)
10 seconds continuous, Pump EPPR drive current < 0 mA
(Cancellation)
(When Pump EPPR Current is more than 10 mA)
3 seconds continuous, Pump EPPR drive current ≥10 mA</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Pump EPPR drive current > 1.0A
(Cancellation)
3 seconds continuous, Pump EPPR drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Pump horse power setting specification difference
(Fuel efficiency/speed specification failure)
(Checking list)
1. CN-75 (#2) – CN-52 (#9) Checking Open/Short
2. CN-75 (#1) – CN-52 (#19) Checking Open/Short</td></tr>
<tr><td rowspan="3">141
(NA)</td><td>5</td><td>(Model Parameter) mounting Boom Priority EPPR
(Detection)
(When Boom Priority EPPR Current is more than 10 mA)
10 seconds continuous, Boom Priority EPPR drive current < 0 mA
(Cancellation)
(When Boom Priority EPPR Current is more than 10 mA)
3 seconds continuous, Boom Priority EPPR drive current ≥ 10 mA</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Boom Priority EPPR drive current > 1.0 A
(Cancellation)
3 seconds continuous, Boom Priority EPPR drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Boom first control operation failure
(Checking list)
1. CN-133 (#2) – CN-52 (#7) Checking Open/Short
2. CN-133 (#1) – CN-52 (#17) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General   C : Crawler Type   W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">143
(NA)</td><td>5</td><td>(Detection)
(When Travel EPPR Current is more than 10 mA)
10 seconds continuous, Travel EPPR drive current = 0 mA
(Cancellation)
(When Travel EPPR Current is more than 100 mA)
3 seconds continuous, Travel EPPR drive current ≥ 10 mA</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Travel EPPR drive current > 1.0 A
(Cancellation)
3 seconds continuous, Travel EPPR drive current ≤ 1.0 A</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – cruise control operation failure
(Checking list)
1. CN-246 (#2) – CN-54 (#39) Checking Open/Short
2. CN-246 (#1) – CN-51 (#40) Checking Open/Short</td></tr>
<tr><td rowspan="3">145</td><td>5</td><td>(Model Parameter) mounting Remote Cooling Fan EPPR
(Detection)
(When Remote Cooling Fan EPPR Current is more than 10 mA)
10 seconds continuous, Remote Cooling Fan EPPR drive current = 0 mA
(Cancellation)
(When Remote Cooling Fan EPPR Current is more than 10 mA)
3 seconds continuous, Remote Cooling Fan EPPR drive current ≥ 10 mA</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Remote Cooling Fan EPPR drive current > 1.0 A
(Cancellation)
3 seconds continuous, Remote Cooling Fan EPPR drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Remote fan control operation failure
(Checking list)
1. CN-154 (#1) – CN-52 (#21) Checking Open/Short
2. CN-154 (#2) – CN-52 (#22) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

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

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="4">167</td><td rowspan="2">4</td><td>(Detection)
(When Travel Speed Solenoid is Off)
10 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Travel Speed Solenoid is Off)
3 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage > 3.0V</td><td></td><td>●</td><td></td></tr>
<tr><td>(When Parking mode is not)
(Detection)
(When Travel Speed Solenoid is Off)
10 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Travel Speed Solenoid is Off)
3 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage > 3.0V</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(Detection)
(When Travel Speed Solenoid is On)
10 seconds continuous, Travel Speed Solenoid drive current > 4.5 A
(Cancellation)
(When Travel Speed Solenoid is On)
3 seconds continuous, Travel Speed Solenoid drive current ≤ 4.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – driving in 1/2 transmission operation failure
(Checking list)
1. CN-70 (#1) – CN-52 (#3) Checking Open/Short
2. CN-70 (#2) – Fuse box (#30) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">169</td><td>4</td><td>Monitor – Selecting attachment(breaker / crusher)
(Detection)
(When Attachment Conflux Solenoid is Off)
10 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Attachment Conflux Solenoid is Off)
3 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Attachment Conflux Solenoid is On)
10 seconds continuous, Attachment Conflux Solenoid drive Current > 6.5 A
(Cancellation)
(When Attachment Conflux Solenoid is On)
3 seconds continuous, Attachment Conflux Solenoid drive Current ≤ 6.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / symptoms)
1. Control Function – Option attachment flow control – Joining operation failure
(Eco breaker mode, crusher mode)
(Checking list)
1. CN-237 (#1) – CN-52 (#6) Checking Open/Short
2. CN-237 (#2) – Fuse box (#30) Checking Open/Short</td></tr>
<tr><td rowspan="3">170
(NA)</td><td>4</td><td>(Model Parameter) mounting Arm Regenerating Solenoid
(Detection)
(When Arm Regeneration Solenoid is Off)
10 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Arm Regeneration Solenoid is Off)
3 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Arm Regeneration Solenoid is On)
10 seconds continuous, Arm Regeneration Solenoid drive current > 4.5 A
(Cancellation)
(When Arm Regeneration Solenoid is On)
3 seconds continuous, Arm Regeneration Solenoid drive current ≤ 4.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / symptoms)
1. Control Function – Arm regeneration operation failure
(Checking list)
1. CN-135 (#1) – CN-52 (#1) Checking Open/Short
2. CN-135 (#2) – Fuse box (#28) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">171</td><td>4</td><td>Monitor – Selecting attachment(crusher)
(Detection)
(When Attachment Safety Solenoid is Off)
10 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Attachment Safety Solenoid is Off)
3 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Attachment Safety Solenoid is On)
10 seconds continuous, Attachment Safety Solenoid drive current > 6.5 A
(Cancellation)
(When Attachment Safety Solenoid is On)
3 seconds continuous, Attachment Safety Solenoid drive current ≤ 6.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Option attachment flow control – Option spool pilot pressure cut off failure (crusher mode)
(Checking list)
1. CN-149 (#1) – CN-52 (#4) Checking Open/Short
2. CN-149 (#2) – Fuse box (#30) Checking Open/Short</td></tr>
<tr><td rowspan="3">179</td><td>4</td><td>Monitor – Selecting attachment(breaker / crusher)
(Detection)
(When Breaker Operating Solenoid is Off)
10 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Breaker Operating Solenoid is Off)
3 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Breaker Operating Solenoid is On)
10 seconds continuous, Attachment Safety Solenoid drive current > 6.5 A
(Cancellation)
(When Breaker Operating Solenoid is On)
3 seconds continuous, Attachment Safety Solenoid drive current ≤ 6.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Option attachment flow control – Breaker operation failure (breaker mode)
(Checking list)
1. CN-66 (#1) – Ground Checking Open/Short
2. CN-66 (#2) – CR-62 (#5) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
181	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 (Checking list) 1. CN-680 (#1) – CN-52 (#11) Checking Open/Short 2. CN-680 (#2) – fuse box (#30) Checking Open/Short				
188	5	(Detection) (When Attachment Flow EPPR 1 current is equal or more than 300 mA) 10 seconds continuous, Attachment Flow EPPR drive current < 100 mA (Cancellation) (When Attachment Flow EPPR 1 current is equal or more than 300 mA) 3 seconds continuous, Attachment Flow EPPR drive current ≥ 100 mA	●		
	6	(Detection) 10 seconds continuous, Attachment Flow EPPR 1 drive current > 1.0 A (Cancellation) 3 seconds continuous, Attachment Flow EPPR 1 drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – IPC operation failure, Option attachment flow control operation failure (Checking list) 1. CN-242 (#2) – CN-52 (#10) Checking Open/Short 2. CN-242 (#1) – CN-52 (#20) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC HCESPN	DTC FMI	Diagnostic Criteria	Application G	Application C	Application W
189	5	(Detection) (When Attachment Flow EPPR 2 current is equal or more than 300 mA) 10 seconds continuous, Attachment Flow EPPR drive current < 100 mA (Cancellation) (When Attachment Flow EPPR 2 current is equal or more than 300 mA) 3 seconds continuous, Attachment Flow EPPR drive current ≥ 100 mA	●		
	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-242A (#2) – CN-52 (#40) Checking Open/Short 2. CN-242A (#1) – CN-52 (#16) Checking Open/Short			
196 (NA)	0	HW145 10 seconds continuous, Attachment flow control EPPR 1 press. Sensor Measurement Voltage > 5.2V			
	1	HW145 10 seconds continuous, 0.3V≤ Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.8V			
	4	HW145 10 seconds continuous, Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.3V			
		(Results / Symptoms) 1. Control Function – Driving second pump joining function operation failure (Checking list) 1. CD-93 (#B) – CN-52 (#34) Checking Open/Short 2. CD-93 (#A) – CN-51 (#32) Checking Open/Short 3. CD-93 (#C) – CN-51 (#31) Checking Open/Short			
200	0	10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Pump EPPR Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage < 0.3V	●		
		(Results / Symptoms) 1. Monitor – Pump EPPR Press. display failure 2. Control Function – Pump input horse power control failure, Overload at compensation control operation failure (Fuel efficiency/speed performance failure) (Checking list) 1. CD-44 (#B) – CN-52 (#32) Checking Open/Short 2. CD-44 (#A) – CN-51 (#3) Checking Open/Short 3. CD-44 (#C) – CN-51 (#13) Checking Open/Short			

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
205 (NA)	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-53 (#5) Checking Open/Short 2. CD-124 (#A) – CN-53 (#3) Checking Open/Short 3. CD-124 (#C) – CN-53 (#13) Checking Open/Short				
218 (NA)	4	Mounting pressure sensor (HCESPN128 or HCESPN 205) (Detection) (When Boom Up Floating Solenoid is Off) 10 seconds continuous, Boom Up Floating Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Boom Up Floating Solenoid is Off) 3 seconds continuous, Boom Up Floating Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Boom Up Floating Solenoid is On) 10 seconds continuous, Boom Up Floating Solenoid drive current > 6.5 A (Cancellation) (When Boom Up Floating Solenoid is On) 3 seconds continuous, Boom Up Floating Solenoid drive current ≤ 6.5 A	●		
	(Results / Symptoms) 1. Control Function – Boom floating control operation failure (Checking list) 1. CN-368 (#1) – CN-53 (#20) Checking Open/Short 2. CN-368 (#2) – Fuse box (#17) 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 (NA)	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 (#35) Checking Open/Short 2. CN-369 (#2) – Fuse box (#17) Checking Open/Short				
221 (NA)	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-53 (#39) Checking Open/Short 2. CN-365 (#1) – CN-53 (#40) 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 (NA)	5	Monitor – Selecting attachment(crusher) (Detection) (When ATT Relief Setting EPPR 2 Current is equal or more than 10 mA) 10 seconds continuous, ATT Relief Setting EPPR 2 drive current = 0 mA (Cancellation) (When ATT Relief Setting EPPR 2 Current is equal or more than 10 mA) 3 seconds continuous, ATT Relief Setting EPPR 2 drive current ≥ 10mA	●		
	6	(Detection) 10 seconds continuous, ATT Relief Setting EPPR 2 drive current > 1.0 A (Cancellation) 3 seconds continuous, ATT Relief Setting EPPR 2 drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control – P2 relief pressure setting failure (Checking list) 1. CN-366 (#2) – CN-53 (#32) Checking Open/Short 2. CN-366 (#1) – CN-53 (#33) Checking Open/Short				
301	3	10 seconds continuous, Fuel Level Measurement Voltage > 3.8V	●		
	4	10 seconds continuous, Fuel Level Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Fuel remaining display failure (Checking list) 1. CD-2 (#2) – CN-52 (#26) Checking Open/Short 2. CD-2 (#1) – CN-51 (#11) Checking Open/Short				
325	4	(Model Parameter) mounting Fuel Heater Relay (Detection) (When Fuel Heater Relay is Off) 10 seconds continuous, Fuel Heater Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Fuel Heater Relay is Off) 3 seconds continuous, Fuel Heater Relay drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Fuel Heater Relay is On) 10 seconds continuous, Fuel Heater Relay drive current > 4.5 A (Cancellation) (When Fuel Heater Relay is On) 3 seconds continuous, Fuel Heater Relay drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – Fuel heater operation failure (Checking list) 1. CR-46 (#85) – CN-52 (#12) Checking Open/Short 2. CR-46 (#30, #86) – Fuse box (#21) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

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

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
514 (NA)	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-54 (#20) Checking Open/Short 2. CR-66 (#2) – Fuse box (#30) Checking Open/Short				
517 (NA)	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-54 (#9) 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

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">525
(NA)</td><td>4</td><td>(Detection)
(When Ram Lock Solenoid is Off)
10 seconds continuous, Ram Lock Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Ram Lock Solenoid is Off)
3 seconds continuous, Ram Lock Solenoid drive unit Measurement Voltage > 3.0V</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(Detection)
(When Ram Lock Solenoid is On)
10 seconds continuous, Ram Lock Solenoid drive current > 6.5 A
(Cancellation)
(When Ram Lock Solenoid is On)
3 seconds continuous, Ram Lock Solenoid drive current ≤ 6.5 A</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Ram lock control operation failure
(Checking list)
1. CN-69 (#1) – CN-54 (#8) Checking Open/Short
2. CN-69 (#2) – Fuse box (#33) Checking Open/Short</td></tr>
<tr><td rowspan="3">527
(NA)</td><td>4</td><td>(Detection)
(When Creep Solenoid is Off)
10 seconds continuous, Creep Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Creep Solenoid is Off)
3 seconds continuous, Creep Solenoid drive unit Measurement Voltage > 3.0V</td><td></td><td></td><td>●</td></tr>
<tr><td>6</td><td>(Detection)
(When Creep Solenoid is On)
10 seconds continuous, Creep Solenoid drive current > 6.5 A
(Cancellation)
(When Creep Solenoid is On)
3 seconds continuous, Creep Solenoid drive current ≤ 6.5 A</td><td></td><td></td><td>●</td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Creep mode operation failure
(Checking list)
1. CN-206 (#1) – CN-54 (#7) Checking Open/Short
2. CN-206 (#2) – Fuse box (#30) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

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

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">714</td><td>3</td><td>(Model Parameter) Mounting Acc. Dial
10 seconds continuous, Acc. Dial Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>(Model Parameter) Mounting Acc. Dial
10 seconds continuous, Acc. Dial Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Acc. Dial Voltage display failure
2. Control Function – Engine rpm control failure
(Checking list)
1. CN-142 (#B) – CN-52 (#23) Checking Open/Short</td></tr>
<tr><td rowspan="3">722</td><td>4</td><td>(Detection)
(When Travel Alarm (Buzzer) Sound is Off)
10 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Travel Alarm (Buzzer) Sound Relay is Off)
3 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Travel Alarm (Buzzer) Sound is On)
10 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive current > 4.5 A
(Cancellation)
(When Travel Alarm (Buzzer) Sound is On)
3 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive current ≤ 4.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Driving alarm operation failure
(Checking list)
1. CN-81 (#1) – CN-52 (#13) Checking Open/Short
2. CN-81 (#2) – Fuse box (#30) Checking Open/Short</td></tr>
<tr><td rowspan="2">831
(N.A)</td><td>2</td><td>(When mounting the A/C Controller)
60 seconds continuous, A/C Controller Communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – A/C Controller operation failure
(Checking list)
1. CN-11 (#8) – CN-51 (#22) Checking Open/Short
2. CN-11 (#7) – CN-51 (#32) Checking Open/Short</td></tr>
<tr><td rowspan="2">840</td><td>2</td><td>60 seconds continuous, Cluster Communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Cluster operation failure
(Checking list)
1. CN-56A (#7) – CN-51 (#32) Checking Open/Short
2. CN-56A (#6) – CN-51 (#22) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

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

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="2">866</td><td>2</td><td>(When mounting the AAVM)
60 seconds continuous, AAVM communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – AAVM operation failure
(Checking list)
1. CN-401 (#15) – CN-51 (#22) Checking Open/Short
2. CN-401 (#3) – CN-51 (#32) Checking Open/Short</td></tr>
<tr><td rowspan="2">867</td><td>2</td><td>60 seconds continuous, RDU communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – RDU operation failure
(Checking list)
1. CN-376 (#10) – CN-51 (#22) Checking Open/Short
2. CN-376 (#18) – CN-51 (#32) Checking Open/Short</td></tr>
<tr><td rowspan="2">868</td><td>2</td><td>60 seconds continuous, Switch Controller communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Switch Controller operation failure
(Checking list)
1. CN-56A (#7) – CN-51 (#32) Checking Open/Short
2. CN-56A (#6) – CN-51 (#22) Checking Open/Short</td></tr>
<tr><td rowspan="2">869</td><td>2</td><td>(When mounting the BKCU)
60 seconds continuous, BKCU communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – BKCU operation failure
(Checking list)
1. CS-2B (#A) – CN-51 (#22) Checking Open/Short
2. CS-2B (#B) – CN-51 (#32) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

4. ENGINE FAULT CODE

Fault code	J1939 SPN	J1939 FMI	Item	Description
111	629	12	Controller #1	Engine Control Module Critical Internal Failure - Bad intelligent device or component
115	612	2	System Diagnostic Code #2	Engine Magnetic Speed/Position Lost Both of Two Signals - Data erratic, intermittent or incorrect
122	102	3	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure Sensor Circuit - Voltage above normal, or shorted to high source
123	102	4	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure Sensor Circuit - Voltage below normal, or shorted to low source
124	102	16	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level
125	102	18	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level
131	91	3	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage above normal, or shorted to high source
132	91	4	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage below normal, or shorted to low source
133	974	3	Remote Accelerator Pedal Position	Remote Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage above normal, or shorted to high source
134	974	4	Remote Accelerator Pedal Position	Remote Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage below normal, or shorted to low source
135	100	3	Engine Oil Pressure 1	Engine Oil Rifle Pressure 1 Sensor Circuit - Voltage above normal, or shorted to high source
141	100	4	Engine Oil Pressure 1	Engine Oil Rifle Pressure 1 Sensor Circuit - Voltage below normal, or shorted to low source
143	100	18	Engine Oil Pressure 1	Engine Oil Rifle Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level
144	110	3	Engine Coolant Temperature	Engine Coolant Temperature 1 Sensor Circuit - Voltage above normal, or shorted to high source
145	110	4	Engine Coolant Temperature	Engine Coolant Temperature 1 Sensor Circuit - Voltage below normal, or shorted to low source
146	110	16	Engine Coolant Temperature	Engine Coolant Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
147	91	1	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position 1 Sensor Circuit Frequency - Data valid but below normal operating Range
148	91	0	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position Sensor 1 - Data valid but above normal operational range - Most Severe Level
151	110	0	Engine Coolant Temperature	Engine Coolant Temperature - Data valid but above normal operational range - Most Severe Level
153	105	3	Engine Intake Manifold 1 Temperature	Intake Manifold 1 Temperature Sensor Circuit - Voltage above normal, or shorted to high source
154	105	4	Engine Intake Manifold 1 Temperature	Intake Manifold 1 Temperature Sensor Circuit - Voltage below normal, or shorted to low source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
155	105	0	Engine Intake Manifold 1 Temperature	Intake Manifold 1 Temperature - Data valid but above normal operational range - Most Severe Level
187	3510	4	Sensor supply voltage 2	Sensor Supply 2 Circuit - Voltage below normal, or shorted to low source
193	520199	3	Cruise Control	Cruise Control (Resistive) Signal Circuit - Voltage above normal, or shorted to high source
194	520199	4	Cruise Control	Cruise Control (Resistive) Signal Circuit - Voltage below normal, or shorted to low source
195	111	3	Engine Coolant Level 1	Coolant Level Sensor 1 Circuit - Voltage above normal, or shorted to high source
196	111	4	Engine Coolant Level 1	Coolant Level Sensor 1 Circuit - Voltage below normal, or shorted to low source
197	111	18	Engine Coolant Level 1	Coolant Level - Data Valid But Below Normal Operating Range - Moderately Severe Level
212	175	3	Engine Oil Temperature 1	Engine Oil Temperature Sensor 1 Circuit - Voltage above normal, or shorted to high source
213	175	4	Engine Oil Temperature 1	Engine Oil Temperature Sensor 1 Circuit - Voltage below normal, or shorted to low source
214	175	0	Engine Oil Temperature 1	Engine Oil Temperature - Data valid but above normal operational range - Most Severe Level
221	108	3	Barometric Pressure	Barometric Pressure Sensor Circuit - Voltage above normal, or shorted to high source
222	108	4	Barometric Pressure	Barometric Pressure Sensor Circuit - Voltage above normal, or shorted to low source
227	3510	3	Sensor supply voltage 2	Sensor Supply 2 Circuit - Voltage above normal, or shorted to high source
228	109	1	Engine Coolant Pressure 1	Coolant Pressure - Data Valid But Below Normal Operating Range - Most Severe Level
231	109	3	Engine Coolant Pressure 1	Coolant Pressure Sensor Circuit - Voltage above normal, or shorted to high source
232	109	4	Engine Coolant Pressure 1	Coolant Pressure Sensor Circuit - Voltage below normal, or shorted to low source
233	109	18	Engine Coolant Pressure 1	Coolant Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level
234	190	0	Engine Speed	Engine Crankshaft Speed/Position - Data valid but above normal operational range - Most Severe Level
235	111	1	Engine Coolant Level 1	Coolant Level - Data valid but below normal operational range - Most Severe Level
237	644	2	Engine External Speed Command Input	External Speed Command Input (Multiple Unit Synchronization) - Data erratic, intermittent or incorrect
238	3511	4	Sensor supply voltage 3	Sensor Supply 3 Circuit - Voltage below normal, or shorted to low source
239	3511	3	Sensor supply voltage 3	Sensor Supply 3 Circuit - Voltage above normal, or shorted to high source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
241	84	2	Wheel-Based Vehicle Speed	Wheel-Based Vehicle Speed - Data erratic, intermittent or incorrect
242	84	10	Wheel-Based Vehicle Speed	Wheel-Based Vehicle Speed Sensor Circuit tampering has been detected - Abnormal rate of change
245	647	4	Engine Fan Clutch 1 Output Driver	Fan Control Circuit - Voltage below normal, or shorted to low source
249	171	3	Ambient Air Temperature	Ambient Air Temperature Sensor 1 Circuit - Voltage above normal, or shorted to high source
256	171	4	Ambient Air Temperature	Ambient Air Temperature Sensor 1 Circuit - Voltage below normal, or shorted to low source
261	174	16	Engine Fuel 1 Temperature 1	Engine Fuel Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
263	174	3	Engine Fuel 1 Temperature 1	Engine Fuel Temperature Sensor 1 Circuit - Voltage above normal, or shorted to high source
265	174	4	Engine Fuel 1 Temperature 1	Engine Fuel Temperature Sensor 1 Circuit - Voltage below normal, or shorted to low source
266	174	0	Engine Fuel 1 Temperature 1	Engine Fuel Temperature - Data valid but above normal operational range - Most Severe Level
269	1195	2	Anti-theft Password Valid Indicator	Antitheft Password Valid Indicator - Data erratic, intermittent or incorrect
271	1347	4	Engine Fuel Pump Pressurizing Assembly #1	Engine Fuel Pump Pressurizing Assembly 1 Circuit - Voltage below normal, or shorted to low source
272	1347	3	Engine Fuel Pump Pressurizing Assembly #1	Engine Fuel Pump Pressurizing Assembly 1 Circuit - Voltage above normal, or shorted to high source
281	1347	7	Engine Fuel Pump Pressurizing Assembly #1	Engine Fuel Pump Pressurizing Assembly 1 - Mechanical system not responding or out of adjustment
285	639	9	J1939 Network #1, Primary Vehicle Network	SAE J1939 Multiplexing PGN Timeout Error - Abnormal update rate
286	639	13	J1939 Network #1, Primary Vehicle Network	SAE J1939 Multiplexing Configuration Error - Out of Calibration
288	974	19	Remote Accelerator Pedal Position	SAE J1939 Multiplexing Remote Accelerator Pedal or Lever Position Sensor System - Received Network Data In Error
291	625	9	Proprietary Network #1	Proprietary Datalink Error (OEM/Vehicle Datalink) - Abnormal update rate
292	441	14	Auxiliary Temperature 1	Auxiliary Temperature Sensor Input 1 - Special Instructions
293	441	3	Auxiliary Temperature 1	Auxiliary Temperature Sensor Input 1 Circuit - Voltage above normal, or shorted to high source
294	441	4	Auxiliary Temperature 1	Auxiliary Temperature Sensor Input 1 Circuit - Voltage below normal, or shorted to low source
295	108	2	Barometric Pressure	Barometric Pressure - Data erratic, intermittent or incorrect
296	1388	14	Auxiliary Pressure #2	Auxiliary Pressure Sensor Input 2 - Special Instructions
297	1388	3	Auxiliary Pressure #2	Auxiliary Pressure Sensor Input 2 Circuit - Voltage above normal, or shorted to high source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
298	1388	4	Auxiliary Pressure #2	Auxiliary Pressure Sensor Input 2 Circuit - Voltage below normal, or shorted to low source
319	251	2	Time	Real Time Clock - Data erratic, intermittent or incorrect
322	651	5	Engine Fuel 1 Injector Cylinder 1	Injector Solenoid Driver Cylinder 1 Circuit - Current below normal or open circuit
323	655	5	Engine Fuel 1 Injector Cylinder 5	Injector Solenoid Driver Cylinder 5 Circuit - Current below normal or open circuit
324	653	5	Engine Fuel 1 Injector Cylinder 3	Injector Solenoid Driver Cylinder 3 Circuit - Current below normal or open circuit
325	656	5	Engine Fuel 1 Injector Cylinder 6	Injector Solenoid Driver Cylinder 6 Circuit - Current below normal or open circuit
331	652	5	Engine Fuel 1 Injector Cylinder 2	Injector Solenoid Driver Cylinder 2 Circuit - Current below normal or open circuit
332	654	5	Engine Fuel 1 Injector Cylinder 4	Injector Solenoid Driver Cylinder 4 Circuit - Current below normal or open circuit
334	110	2	Engine Coolant Temperature	Engine Coolant Temperature - Data erratic, intermittent or incorrect
338	1267	3	Idle Shutdown Vehicle Accessories Relay Driver Circuit	Idle Shutdown Vehicle Accessories Relay Driver Circuit - Voltage above normal, or shorted to high source
339	1267	4	Idle Shutdown Vehicle Accessories Relay Driver Circuit	Idle Shutdown Vehicle Accessories Relay Driver Circuit - Voltage below normal, or shorted to low source
343	629	12	Controller #1	Engine Control Module Warning Internal Hardware Failure - Bad intelligent device or component
346	630	12	Calibration Memory	Engine Control Module Calibration Memory Software - Bad Intelligent Device or Component
349	191	16	Transmission 1 Output Shaft Speed	Transmission Output Shaft Speed - Data Valid But Above Normal Operating Range - Moderately Severe Level
351	3597	12	ECU Power Output Supply Voltage #1	Injector Power Supply - Bad intelligent device or component
352	3509	4	Sensor supply voltage 1	Sensor Supply 1 Circuit - Voltage below normal, or shorted to low source
386	3509	3	Sensor supply voltage 1	Sensor Supply 1 Circuit - Voltage above normal, or shorted to high source
415	100	1	Engine Oil Pressure 1	Engine Oil Rifle Pressure - Data valid but below normal operational range - Most Severe Level
418	97	15	Water In Fuel Indicator 1	Water in Fuel Indicator - Data Valid But Above Normal Operating Range - Least Severe Level
421	175	16	Engine Oil Temperature 1	Engine Oil Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
422	111	2	Engine Coolant Level 1	Coolant Level - Data erratic, intermittent or incorrect
425	175	2	Engine Oil Temperature 1	Engine Oil Temperature - Data erratic, intermittent or incorrect
428	97	3	Water In Fuel Indicator 1	Water in Fuel Indicator Sensor Circuit - Voltage above normal, or shorted to high source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
429	97	4	Water In Fuel Indicator 1	Water in Fuel Indicator Sensor Circuit - Voltage below normal, or shorted to low source
431	558	2	Accelerator Pedal 1 Low Idle Switch	Accelerator Pedal or Lever Idle Validation Switch - Data erratic, intermittent or incorrect
432	558	13	Accelerator Pedal 1 Low Idle Switch	Accelerator Pedal or Lever Idle Validation Switch Circuit - Out of Calibration
435	100	2	Engine Oil Pressure 1	Engine Oil Rifle Pressure - Data erratic, intermittent or incorrect
436	105	2	Engine Intake Manifold 1 Temperature	Intake Manifold 1 Temperature - Data erratic, intermittent or incorrect
441	168	18	Battery Potential / Power Input 1	Battery 1 Voltage - Data Valid But Below Normal Operating Range - Moderately Severe Level
442	168	16	Battery Potential / Power Input 1	Battery 1 Voltage - Data Valid But Above Normal Operating Range - Moderately Severe Level
449	157	0	Engine Fuel 1 Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Data valid but above normal operational range - Most Severe Level
451	157	3	Engine Fuel 1 Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure Sensor Circuit - Voltage above normal, or shorted to high source
452	157	4	Engine Fuel 1 Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure Sensor Circuit - Voltage below normal, or shorted to low source
483	1349	3	Engine Fuel 1 Injector Metering Rail 2 Pressure	Injector Metering Rail 2 Pressure Sensor Circuit - Voltage above normal, or shorted to high source
484	1349	4	Engine Fuel 1 Injector Metering Rail 2 Pressure	Injector Metering Rail 2 Pressure Sensor Circuit - Voltage below normal, or shorted to low source
487	626	18	Engine Start Enable Device 1	Start Enable Device 1 Canister Empty (Ether Injection) - Data Valid But Below Normal Operating Range
488	105	16	Engine Intake Manifold 1 Temperature	Intake Manifold 1 Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
489	191	18	Transmission 1 Output Shaft Speed	Transmission Output Shaft Speed - Data Valid But Below Normal Operating Range - Moderately Severe Level
497	1377	2	Engine Synchronization Switch	Multiple Unit Synchronization Switch - Data erratic, intermittent or incorrect
515	3514	3	Sensor supply voltage 6	Sensor Supply 6 Circuit - Voltage above normal, or shorted to high source
516	3514	4	Sensor supply voltage 6	Sensor Supply 6 Circuit - Voltage below normal, or shorted to low source
523	611	2	System Diagnostic Code #1	Auxiliary Intermediate (PTO) Speed Switch Validation - Data erratic, intermittent or incorrect
527	702	3	Auxiliary I/O #02	Auxiliary Input/Output 2 Circuit - Voltage above normal, or shorted to high source
528	93	2	Engine Net Brake Torque	Auxiliary Alternate Torque Validation Switch - Data erratic, intermittent or incorrect
529	703	3	Auxiliary I/O #03	Auxiliary Input/Output 3 Circuit - Voltage above normal, or shorted to high source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
535	174	2	Engine Fuel 1 Temperature 1	Engine Fuel Temperature - Data erratic, intermittent or incorrect
546	94	3	Engine Fuel Delivery Pressure	Fuel Delivery Pressure Sensor Circuit - Voltage above normal, or shorted to high source
547	94	4	Engine Fuel Delivery Pressure	Fuel Delivery Pressure Sensor Circuit - Voltage below normal, or shorted to low source
553	157	16	Engine Fuel 1 Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level
555	101	16	Engine Crankcase Pressure 1	Crankcase Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level
556	101	0	Engine Crankcase Pressure 1	Crankcase Pressure - Data valid but above normal operational range - Most Severe Level
559	157	18	Engine Fuel 1 Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level
584	677	3	Engine Starter Motor Relay	Starter Relay Driver Circuit - Voltage above normal, or shorted to high source
585	677	4	Engine Starter Motor Relay	Starter Relay Driver Circuit - Voltage below normal, or shorted to low source
595	103	16	Engine Turbocharger 1 Speed	Turbocharger 1 Speed - Data Valid But Above Normal Operating Range - Moderately Severe Level
599	640	14	Engine External Protection Input	Auxiliary Commanded Dual Output Shutdown - Special Instructions
611	1383	31	Engine was Shut Down Hot	Engine Shut Down Hot - Condition Exists
629	1176	18	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure - Data Valid But Below Normal Operating Range - Moderately
649	1378	31	Engine Oil Change Interval	Engine Oil Change Interval - Condition Exists
687	103	18	Engine Turbocharger 1 Speed	Turbocharger 1 Speed - Data Valid But Below Normal Operating Range - Moderately Severe Level
689	190	2	Engine Speed	Engine Crankshaft Speed/Position - Data erratic, intermittent or incorrect
691	1172	3	Engine Turbocharger 1 Compressor Intake Temperature	Turbocharger 1 Compressor Intake Temperature Circuit - Voltage above normal, or shorted to high source
692	1172	4	Engine Turbocharger 1 Compressor Intake Temperature	Turbocharger 1 Compressor Intake Temperature Circuit - Voltage below normal, or shorted to low source
693	1172	2	Engine Turbocharger 1 Compressor Intake Temperature	Turbocharger 1 Compressor Intake Temperature - Data erratic, intermittent or incorrect
696	1173	2	Engine Turbocharger 2 Compressor Intake Temperature	Turbocharger 2 Compressor Intake Temperature - Data Erratic, Intermittent, or Incorrect
697	1136	3	Engine ECU Temperature	Engine ECU Temperature Sensor Circuit - Voltage above normal, or shorted to high source
698	1136	4	Engine ECU Temperature	Engine ECU Temperature Sensor Circuit - Voltage below normal, or shorted to low source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
699	1136	2	Engine ECU Temperature	Engine ECU Temperature - Data erratic, intermittent or incorrect
731	723	7	Engine Speed 2	Engine Speed / Position Camshaft and Crankshaft Misalignment - Mechanical system not responding or out of adjustment
741	1176	3	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure Circuit - Voltage above normal, or shorted to high source
742	1176	4	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure Circuit - Voltage below normal, or shorted to low source
743	1176	2	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure - Data erratic, intermittent or incorrect
755	157	7	Engine Fuel 1 Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Mechanical system not responding or out of adjustment
769	597	3	Brake Switch	Brake Switch Circuit - Voltage above normal, or shorted to high source
771	597	4	Brake Switch	Brake Switch Circuit - Voltage below normal, or shorted to low source
778	723	2	Engine Speed 2	Engine Camshaft Speed / Position Sensor - Data erratic, intermittent or incorrect
784	1590	2	Adaptive Cruise Control Mode	Adaptive Cruise Control Mode - Data erratic, intermittent or incorrect
1117	3597	2	ECU Power Output Supply Voltage #1	Power Supply Lost With Ignition On - Data erratic, intermittent or incorrect
1139	651	7	Engine Fuel 1 Injector Cylinder 1	Injector Solenoid Driver Cylinder 1 - Mechanical system not responding or out of adjustment
1141	652	7	Engine Fuel 1 Injector Cylinder 2	Injector Solenoid Driver Cylinder 2 - Mechanical system not responding or out of adjustment
1142	653	7	Engine Fuel 1 Injector Cylinder 3	Injector Solenoid Driver Cylinder 3 - Mechanical system not responding or out of adjustment
1143	654	7	Engine Fuel 1 Injector Cylinder 4	Injector Solenoid Driver Cylinder 4 - Mechanical system not responding or out of adjustment
1144	655	7	Engine Fuel 1 Injector Cylinder 5	Injector Solenoid Driver Cylinder 5 - Mechanical system not responding or out of adjustment
1145	656	7	Engine Fuel 1 Injector Cylinder 6	Injector Solenoid Driver Cylinder 6 - Mechanical system not responding or out of adjustment
1239	2623	3	Accelerator Pedal #1 Channel 2	Accelerator Pedal or Lever Position Sensor 2 Circuit - Voltage above normal, or shorted to high source
1241	2623	4	Accelerator Pedal #1 Channel 2	Accelerator Pedal or Lever Position Sensor 2 Circuit - Voltage below normal, or shorted to low source
1242	91	2	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position Sensor 1 - Data erratic, intermittent or incorrect
1256	1563	2	Incompatible Monitor/Controller	Control Module Identification Input State Error - Data erratic, intermittent or incorrect
1257	1563	2	Incompatible Monitor/Controller	Control Module Identification Input State Error - Data erratic, intermittent or incorrect
1358	91	3	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage above normal, or shorted to high source
1359	91	4	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage below normal, or shorted to low source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
1427	4185	31	Overspeed Shutdown Relay Driver	Overspeed Shutdown Relay Driver Diagnostic has detected an error - Condition Exists
1428	4186	31	Low Oil Pressure Shutdown Relay Driver	Low Oil Pressure (LOP) Shutdown Relay Driver Diagnostic has detected an error - Condition Exists
1429	4187	31	High Engine Temperature Shutdown Relay Driver	High Engine Temperature (HET) Shutdown Relay Driver Diagnostic has detected an error - Condition Exists
1431	4188	31	Pre-Low Oil Pressure Indicator Relay Driver	Pre-Low Oil Pressure Warning Relay Driver Diagnostic has detected an error - Condition Exists
1432	4223	31	Pre-High Engine Temperature Warning Relay Driver	Pre-High Engine Temperature Warning Relay Driver Diagnostic has detected an error - Condition Exists
1433	611	31	System Diagnostic Code #1	Operator Interface Mode Transition to Emergency Stop (Due to E-Stop) - Condition Exists
1515	91	19	Accelerator Pedal Position 1	SAE J1939 Multiplexed Accelerator Pedal or Lever Sensor System - Received Network Data In Error
1539	1387	3	Auxiliary Pressure #1	Auxiliary Pressure Sensor Input 1 Circuit - Voltage above normal, or shorted to high source
1621	1387	4	Auxiliary Pressure #1	Auxiliary Pressure Sensor Input 1 Circuit - Voltage below normal, or shorted to low source
1654	1323	31	Engine Cylinder 1 Misfire Rate	Engine Misfire Cylinder 1 - Condition Exists
1655	1324	31	Engine Cylinder 2 Misfire Rate	Engine Misfire Cylinder 2 - Condition Exists
1656	1325	31	Engine Cylinder 3 Misfire Rate	Engine Misfire Cylinder 3 - Condition Exists
1657	1326	31	Engine Cylinder 4 Misfire Rate	Engine Misfire Cylinder 4 - Condition Exists
1658	1327	31	Engine Cylinder 5 Misfire Rate	Engine Misfire Cylinder 5 - Condition Exists
1659	1328	31	Engine Cylinder 6 Misfire Rate	Engine Misfire Cylinder 6 - Condition Exists
1695	3513	3	Sensor supply voltage 5	Sensor Supply 5 - Voltage above normal, or shorted to high source
1696	3513	4	Sensor supply voltage 5	Sensor Supply 5 - Voltage below normal, or shorted to low source
1718	1322	31	Engine Misfire for Multiple Cylinders	Engine Misfire for Multiple Cylinders - Condition Exists
1776	2634	3	Power Relay	Power Relay Driver Circuit - Voltage above normal, or shorted to high source
1777	2634	4	Power Relay	Power Relay Driver Circuit - Voltage below normal, or shorted to low source
1843	101	3	Engine Crankcase Pressure 1	Crankcase Pressure Circuit - Voltage above normal, or shorted to high source
1844	101	4	Engine Crankcase Pressure 1	Crankcase Pressure Circuit - Voltage below normal, or shorted to low source
1847	110	14	Engine Coolant Temperature	Engine Coolant Temperature - Special Instructions
1852	97	16	Water In Fuel Indicator 1	Water in Fuel Indicator - Data Valid But Above Normal Operating Range - Moderately Severe Level
1894	641	9	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Driver Circuit - Abnormal update rate
1898	641	13	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Controller - Out of Calibration

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
1938	3597	18	ECU Power Output Supply Voltage #1	ECU Power Output Supply Voltage 1 - Data Valid But Below Normal Operating Range - Moderately Severe Level
1939	3597	3	ECU Power Output Supply Voltage #1	ECU Power Output Supply Voltage 1 - Voltage above normal, or shorted to high source
1941	3597	4	ECU Power Output Supply Voltage #1	ECU Power Output Supply Voltage 1 - Voltage below normal, or shorted to low source
1942	101	2	Engine Crankcase Pressure 1	Crankcase Pressure - Data erratic, intermittent or incorrect
1943	3555	17	Ambient Air Density	Ambient Air Density - Data Valid But Below Normal Operating Range - Least Severe Level
1974	101	15	Engine Crankcase Pressure 1	Crankcase Pressure - Data Valid But Above Normal Operating Range - Least Severe Level
1976	641	15	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Driver Over Temperature (Calculated) - Data Valid But Above Normal Operating Range - Least Severe Level
2185	3512	3	Sensor supply voltage 4	Sensor Supply 4 Circuit - Voltage above normal, or shorted to high source
2186	3512	4	Sensor supply voltage 4	Sensor Supply 4 Circuit - Voltage below normal, or shorted to low source
2191	102	31	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure Sensor - Condition Exists
2198	641	11	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Driver Circuit - Root Cause Not Known
2215	94	18	Engine Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level
2249	157	1	Engine Fuel 1 Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Data valid but below normal operational range - Most Severe Level
2261	94	15	Engine Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid But Above Normal Operating Range - Least Severe Level
2262	94	17	Engine Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid But Below Normal Operating Range - Least Severe Level
2265	1075	3	Engine Electric Lift Pump	Electric Lift Pump for Engine Fuel Supply Circuit - Voltage above normal, or shorted to high source
2266	1075	4	Engine Electric Lift Pump	Electric Lift Pump for Engine Fuel Supply Circuit - Voltage below normal, or shorted to low source
2288	103	15	Engine Turbocharger 1 Speed	Turbocharger 1 Speed - Data Valid But Above Normal Operating Range - Least Severe Level
2292	611	16	System Diagnostic Code #1	Fuel Inlet Meter Device - Data Valid But Above Normal Operating Range - Moderately Severe Level
2293	611	18	System Diagnostic Code #1	Fuel Inlet Meter Device flow demand lower than expected - Data Valid But Below Normal Operating Range - Moderately Severe Level
2311	633	31	Engine Fuel Actuator 1 Control Command	Electronic Fuel Injection Control Valve Circuit - Condition Exists

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
2321	190	2	Engine Speed	Engine Crankshaft Speed/Position - Data erratic, intermittent or incorrect
2322	723	2	Engine Speed 2	Engine Camshaft Speed / Position Sensor - Data erratic, intermittent or incorrect
2346	2789	15	Engine Turbocharger 1 Calculated Turbine Intake Temperature	Turbocharger Turbine Intake Temperature - Data Valid But Above Normal Operating Range - Least Severe
2347	2629	15	Engine Turbocharger 1 Compressor Outlet Temperature	Turbocharger Compressor Outlet Temperature (Calculated) - Data Valid But Above Normal Operating Range
2372	95	16	Engine Fuel Filter Differential Pressure	Fuel Filter Differential Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level
2373	1209	3	Engine Exhaust Pressure 1	Exhaust Gas Pressure Sensor 1 Circuit - Voltage above normal, or shorted to high source
2374	1209	4	Engine Exhaust Pressure 1	Exhaust Gas Pressure Sensor 1 Circuit - Voltage below normal, or shorted to low source
2377	647	3	Engine Fan Clutch 1 Output Driver	Fan Control Circuit - Voltage above normal, or shorted to high source
2387	641	7	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Driver Circuit (Motor) - Mechanical system not responding or out of adjustment
2398	171	2	Ambient Air Temperature	Ambient Air Temperature - Data erratic, intermittent or incorrect
2448	111	17	Engine Coolant Level 1	Coolant Level - Data Valid But Below Normal Operating Range - Least Severe Level
2451	2789	16	Engine Turbocharger 1 Calculated Turbine Intake Temperature	Turbocharger Turbine Intake Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
2468	190	16	Engine Speed	Engine Crankshaft Speed/Position - Data Valid But Above Normal Operating Range - Moderately Severe Level
2554	1209	2	Engine Exhaust Pressure 1	Exhaust Gas Pressure 1 - Data erratic, intermittent or incorrect
2555	729	3	Engine Intake Air Heater Driver #1	Engine Intake Air Heater 1 Circuit - Voltage above normal, or shorted to high source
2556	729	4	Engine Intake Air Heater Driver #1	Engine Intake Air Heater 1 Circuit - Voltage below normal, or shorted to low source
2557	697	3	Auxiliary PWM Driver #1	Auxiliary PWM Driver 1 Circuit - Voltage above normal, or shorted to high source
2558	697	4	Auxiliary PWM Driver #1	Auxiliary PWM Driver 1 Circuit - Voltage below normal, or shorted to low source
2571	2630	3	Engine Charge Air Cooler 1 Outlet Temperature	Engine Charge Air Cooler Outlet Temperature - Voltage above normal, or shorted to high source
2572	2630	4	Engine Charge Air Cooler 1 Outlet Temperature	Engine Charge Air Cooler Outlet Temperature - Voltage below normal, or shorted to low source
2634	641	12	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Controller - Bad intelligent device or component

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
2635	641	31	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Driver Circuit - Condition Exists
2636	641	9	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Driver Circuit - Abnormal update rate
2646	110	31	Engine Coolant Temperature	Engine Coolant Temperature - Condition Exists
2659	110	31	Engine Coolant Temperature	Engine Coolant Temperature - Condition Exists
2661	629	31	Controller #1	At Least One Unacknowledged Most Severe Fault - Condition Exists
2662	629	31	Controller #1	At Least One Unacknowledged Moderately Severe Fault - Condition Exists
2699	520320	7	Crankcase Depression Valve	Crankcase Depression Valve - Mechanical system not responding or out of adjustment
2738	626	3	Engine Start Enable Device 1	Start Enable Device 1 Circuit (Ether Injection) - Voltage above normal, or shorted to high source
2739	626	4	Engine Start Enable Device 1	Start Enable Device 1Circuit (Ether Injection) - Voltage below normal, or shorted to low source
2764	1209	16	Engine Exhaust Pressure 1	Exhaust Gas Pressure 1 - Data Valid But Above Normal Operating Range - Moderately Severe Level
2765	2797	13	Engine Fuel 1 Injector Group 1	Engine Injector Bank 1 Barcodes - Out of Calibration
2777	3703	31	Diesel Particulate Filter Active Regeneration Inhibited Due to Inhibit Switch	Particulate Trap Active Regeneration Inhibited Due to Inhibit Switch - Condition Exists
2789	110	18	Engine Coolant Temperature	Engine Coolant Temperature - Data Valid But Below Normal Operating Range - Moderately Severe Level
2963	110	15	Engine Coolant Temperature	Engine Coolant Temperature - Data Valid But Above Normal Operating Range - Least Severe Level
2964	105	15	Engine Intake Manifold 1 Temperature	Intake Manifold 1 Temperature - Data Valid But Above Normal Operating Range - Least Severe Level
2973	102	2	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure - Data erratic, intermittent or incorrect
2998	1632	14	Engine Torque Limit Feature	Engine Torque Limit Feature - Special Instructions
3131	190	14	Engine Speed	Engine Crankshaft Speed/Position - Special Instructions
3139	3667	3	Engine Air Shutoff Status	Engine Air Shutoff Circuit - Voltage above normal, or shorted to high source
3141	3667	4	Engine Air Shutoff Status	Engine Air Shutoff Circuit - Voltage below normal, or shorted to low source
3186	1623	9	Tachograph output shaft speed	Tachograph Output Shaft Speed - Abnormal update rate
3213	1623	19	Tachograph output shaft speed	Tachograph Output Shaft Speed - Received Network Data In Error
3222	520435	12	Glow Plug Module	Glow Plug Module - Bad intelligent device or component
3243	3060	18	Engine Cooling System Monitor	Engine Cooling System Monitor - Data Valid But Below Normal Operating Range - Moderately Severe Level

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
3298	1194	13	Anti-theft Encryption Seed Present Indicator	Anti-theft Encryption Seed - Out of Calibration
3326	91	9	Accelerator Pedal Position 1	SAE J1939 Multiplexed Accelerator Pedal or Lever Sensor System - Abnormal update rate
3328	191	9	Transmission 1 Output Shaft Speed	Transmission Output Shaft Speed - Abnormal update rate
3329	1231	2	J1939 Network #2	J1939 Network #2 - Data erratic, intermittent or incorrect
3331	1235	2	J1939 Network #3	J1939 Network #3 - Data erratic, intermittent or incorrect
3337	5395	16	Engine Idle Fuel Quantity	Engine Idle Fuel Quantity - Data Valid But Above Normal Operating Range - Moderately Severe Level
3338	5395	18	Engine Idle Fuel Quantity	Engine Idle Fuel Quantity - Data Valid But Below Normal Operating Range - Moderately Severe Level
3341	107	16	Engine Air Filter 1 Differential Pressure	Engine Air Filter Differential Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level
3348	1176	1	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure - Data valid but below normal operational range - Most Severe Level
3361	102	10	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure - Abnormal rate of change
3366	111	18	Engine Coolant Level 1	Coolant Level - Data Valid But Below Normal Operating Range - Moderately Severe Level
3367	4490	9	Specific Humidity	Specific Humidity Sensor - Abnormal update rate
3368	4490	19	Specific Humidity	Specific Humidity Sensor - Received Network Data In Error
3369	1172	9	Engine Turbocharger 1 Compressor Intake Temperature	Turbocharger 1 Compressor Intake Temperature Sensor - Abnormal update rate
3371	1172	19	Engine Turbocharger 1 Compressor Intake Temperature	Turbocharger 1 Compressor Intake Temperature Sensor - Received Network Data In Error
3372	1176	9	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure - Abnormal update rate
3373	1176	19	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure - Received Network Data In Error
3374	1818	31	ROP Brake Control active	Roll Over Protection Brake Control Active - Condition Exists
3377	5396	31	Engine Crankcase Ventilation Hose Disconnected	Engine Crankcase Ventilation Hose Disconnected - Condition Exists
3385	105	18	Engine Intake Manifold 1 Temperature	Intake Manifold 1 Temperature - Data Valid But Below Normal Operating Range - Moderately Severe Level
3418	191	19	Transmission 1 Output Shaft Speed	Transmission Output Shaft Speed - Received Network Data In Error
3419	5125	3	Sensor supply voltage 7	Sensor Supply 7 Circuit - Voltage above normal, or shorted to high source
3421	5125	4	Sensor supply voltage 7	Sensor Supply 7 Circuit - Voltage below normal, or shorted to low source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
3478	2630	2	Engine Charge Air Cooler 1 Outlet Temperature	Engine Charge Air Cooler Outlet Temperature - Data erratic, intermittent or incorrect
3488	563	9	Anti-Lock Braking (ABS) Active	Anti-Lock Braking (ABS) Controller - Abnormal update rate
3494	1081	7	Engine Wait to Start Lamp	Engine Wait to Start Lamp - Mechanical system not responding or out of adjustment
3525	84	19	Wheel-Based Vehicle Speed	Wheel-Based Vehicle Speed - Received Network Data In Error
3526	84	9	Wheel-Based Vehicle Speed	Wheel-Based Vehicle Speed - Abnormal update rate
3527	558	19	Accelerator Pedal 1 Low Idle Switch	Accelerator Pedal or Lever Idle Validation Switch - Received Network Data In Error
3528	558	9	Accelerator Pedal 1 Low Idle Switch	Accelerator Pedal or Lever Idle Validation Switch - Abnormal update rate
3531	171	9	Ambient Air Temperature	Ambient Air Temperature - Abnormal update rate
3532	171	19	Ambient Air Temperature	Ambient Air Temperature - Received Network Data In Error
3535	1213	9	Malfunction Indicator Lamp	Malfunction Indicator Lamp - Abnormal update rate
3555	1081	9	Engine Wait to Start Lamp	Engine Wait to Start Lamp - Abnormal update rate
3556	1081	19	Engine Wait to Start Lamp	Engine Wait to Start Lamp - Received Network Data In Error
3613	111	9	Engine Coolant Level 1	Coolant Level Sensor - Abnormal Update Rate
3614	111	19	Engine Coolant Level 1	Coolant Level Sensor - Received Network Data in Error
3616	2633	7	Engine Fan Clutch 2 Output Driver	Engine VGT Nozzle Position - Mechanical system not responding or out of adjustment
3633	5484	3	Engine Fan Clutch 2 Output Driver	Engine Fan Clutch 2 Control Circuit - Voltage above normal, or shorted to high source
3634	5484	4	Engine Fan Clutch 2 Output Driver	Engine Fan Clutch 2 Control Circuit - Voltage below normal, or shorted to low source
3641	748	9	Engine Exhaust 1 Gas Sensor 1 Power In Range	Transmission Output Retarder - Abnormal update rate
3683	1127	7	Engine Turbocharger 1 Boost Pressure	Engine Turbocharger 1 Boost Pressure - Mechanical system not responding or out of adjustment
3697	630	12	Calibration Memory	Engine Control Module Calibration Memory - Bad intelligent device or component
3714	1569	31	Engine Protection Torque Derate	Engine Protection Torque Derate - Condition Exists
3715	188	16	Engine Speed At Idle, Point 1	Engine Speed At Idle - Data Valid But Above Normal Operating Range - Moderately Severe Level
3716	188	18	Engine Speed At Idle, Point 1	Engine Speed At Idle - Data Valid But Below Normal Operating Range - Moderately Severe Level
3724	168	17	Battery Potential / Power Input 1	Battery 1 Voltage - Data Valid But Below Normal Operating Range - Least Severe Level
3727	5571	7	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Mechanical system not responding or out of adjustment

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
3733	862	3	Heater Circuit #09	Crankcase Breather Filter Heater Circuit - Voltage above normal, or shorted to high source
3734	862	4	Heater Circuit #09	Crankcase Breather Filter Heater Circuit - Voltage below normal, or shorted to low source
3735	2884	9	Engine Auxiliary Governor Switch	Engine Auxiliary Governor Switch - Abnormal update rate
3737	1675	31	Engine Starter Mode	Engine Starter Mode Overcrank Protection - Condition Exists
3741	5571	0	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Data valid but above normal operational range
3765	442	3	Auxiliary Temperature 2	Auxiliary Temperature Sensor Input 2 Circuit - Voltage above normal, or shorted to high source
3766	442	4	Auxiliary Temperature 2	Auxiliary Temperature Sensor Input 2 Circuit - Voltage below normal, or shorted to low source
3838	2978	9	Estimated Engine Parasitic Losses - Percent Torque	Estimated Engine Parasitic Losses - Percent Torque - Abnormal update rate
3841	596	2	Cruise Control Enable Switch	Cruise Control Enable Switch - Data erratic, intermittent or incorrect
3843	5603	9	Cruise Control Disable Command	Cruise Control Disable Command - Abnormal update rate
3844	5605	31	Cruise Control Pause Command	Cruise Control Pause Command - Condition Exists
3845	5603	31	Cruise Control Disable Command	Cruise Control Disable Command - Condition Exists
3917	104	18	Engine Turbocharger Lube Oil Pressure 1	Engine Turbocharger Lube Oil Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level
4215	563	31	Anti-Lock Braking (ABS) Active	Anti-Lock Braking (ABS) Active - Condition Exists
4252	1081	31	Engine Wait to Start Lamp	Engine Wait to Start Lamp - Condition Exists
4262	5571	3	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Voltage Above Normal, or Shorted to High Source
4263	5571	4	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Voltage below normal, or shorted to low source
4265	5571	11	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Root Cause Not Known
4284	5793	9	Desired Engine Fueling State	Desired Engine Fueling State - Abnormal Update Rate
4286	520595	3	Closed Crankcase Ventilation System Pressure Sensor	Closed Crankcase Ventilation System Pressure Sensor - Voltage Above Normal, or Shorted to High Source
4287	520595	4	Closed Crankcase Ventilation System Pressure Sensor	Closed Crankcase Ventilation System Pressure Sensor - Voltage below normal, or shorted to low source
4288	520595	2	Closed Crankcase Ventilation System Pressure	Closed Crankcase Ventilation System Pressure - Data erratic, intermittent or incorrect
4437	1668	2	J1939 Network #4	J1939 Network #4 - Data erratic, intermittent or incorrect

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
4484	3667	7	Engine Air Shutoff Status	Engine Air Shutoff - Mechanical System Not Responding or Out of Adjustment
4517	237	13	Vehicle Identification Number	Vehicle Identification Number - Out of Calibration
4526	521	2	Brake Pedal Position	Brake Pedal Position - Data erratic, intermittent or incorrect
4615	94	0	Engine Fuel Delivery Pressure	Engine Fuel Delivery Pressure - Data Valid but Above Normal Operational Range - Most Severe Level
4642	97	0	Water In Fuel Indicator 1	Water in Fuel Indicator - Data Valid But Above Normal Operating Range - Most Severe Level
4688	6301	3	Water in Fuel Indicator 2	Water in Fuel Indicator 2 Sensor Circuit - Voltage above normal, or shorted to high source
4689	6301	4	Water in Fuel Indicator 2	Water in Fuel Indicator 2 Sensor Circuit - Voltage below normal, or shorted to low source
4691	5585	18	Engine Fuel 1 Injector Metering Rail 1 Cranking Pressure	Engine Injector Metering Rail 1 Cranking Pressure - Data Valid But Below Normal Operating Range - Mo
4713	5357	31	Engine Fuel Injection Quantity Error for Multiple Cylinders	Engine Fuel Injection Quantity Error for Multiple Cylinders - Condition Exists
4721	237	31	Vehicle Identification Number	Vehicle Identification Number - Condition Exists
4722	237	2	Vehicle Identification Number	Vehicle Identification Number - Data erratic, intermittent or incorrect
4724	702	5	Auxiliary I/O #02	Auxiliary Input/Output 2 Circuit - Current below normal or open circuit
4725	702	6	Auxiliary I/O #02	Auxiliary Input/Output 2 Circuit - Current above normal or grounded circuit
4726	1239	16	Engine Fuel Leakage 1	Engine Fuel Leakage - Data Valid But Above Normal Operating Range - Moderately Severe Level
4727	157	15	Engine Fuel 1 Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Data Valid But Above Normal Operating Range - Least Severe Level
4734	701	14	Auxiliary I/O #01	Auxiliary Input/Output 1 - Special Instructions
4789	1639	0	Fan Speed	Fan Speed - Data Valid but Above Normal Operational Range - Most Severe Level
4791	1639	1	Fan Speed	Fan Speed - Data Valid but Below Normal Operational Range - Most Severe Level
4839	3667	31	Engine Air Shutoff Status	Engine Air Shutoff - Condition Exists
4841	6653	16	Engine Fuel 1 Injector Metering Rail 1 Cold Start Pressure	Cold Start Injector Metering Rail 1 Pressure - Data Valid But Above Normal Operating Range - Moderate Severe Level
4867	5571	31	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Condition Exists
4927	7026	12	Engine Diesel Fuel Metering Valve	Engine Diesel Fuel Metering Valve - Bad Intelligent Device or Component
4928	7027	2	Engine Diesel Fuel Metering Valve Power Supply	Engine Diesel Fuel Metering Valve Power Supply - Data Erratic, Intermittent, or Incorrect
4929	7027	3	Engine Diesel Fuel Metering Valve Power Supply	Engine Diesel Fuel Metering Valve Power Supply - Voltage Above Normal or Shorted to High Source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
4931	7027	4	Engine Diesel Fuel Metering Valve Power Supply	Engine Diesel Fuel Metering Valve Power Supply - Voltage Below Normal or Shorted to Low Source
4933	7029	19	Engine Diesel Fuel Metering Valve Position	Engine Diesel Fuel Metering Valve Position - Received Network Data in Error
4934	7026	3	Engine Diesel Fuel Metering Valve	Engine Diesel Fuel Metering Valve - Voltage Above Normal or Shorted to High Source
4935	7026	4	Engine Diesel Fuel Metering Valve	Engine Diesel Fuel Metering Valve - Voltage Below Normal or Shorted to Low Source
4936	5380	11	Engine Fuel Valve 1 Preliminary FMI	Engine Fuel Valve 1 - Root Cause Not Known
4937	5380	13	Engine Fuel Valve 1 Preliminary FMI	Engine Fuel Valve 1 - Out of Calibration
4951	6655	3	Maintain ECU Power Lamp	Maintain ECU Power Lamp - Voltage Above Normal, or Shorted to High Source
4952	6655	4	Maintain ECU Power Lamp	Maintain ECU Power Lamp - Voltage Below Normal, or Shorted to Low Source
4953	3353	3	Alternator 1 Status	Alternator 1 Status - Voltage Above Normal, or Shorted to High Source
4954	3353	4	Alternator 1 Status	Alternator 1 Status - Voltage Below Normal, or Shorted to Low Source
4956	6713	13	Engine Variable Geometry Turbocharger Actuator Software Identification	Variable Geometry Turbocharger Actuator Software - Out of Calibration
4957	6713	31	Engine Variable Geometry Turbocharger Actuator Software Identification	Variable Geometry Turbocharger Actuator Software - Condition Exists
4958	7026	2	Engine Diesel Fuel Metering Valve	Engine Diesel Fuel Metering Valve - Data Erratic, Intermittent, or Incorrect
4959	7026	31	Engine Diesel Fuel Metering Valve	Engine Diesel Fuel Metering Valve - Condition Exists
4961	7026	9	Engine Diesel Fuel Metering Valve	Engine Diesel Fuel Metering Valve - Abnormal Update Rate
5122	520754	2	Manufacturer Assignable SPN	Fuel Pump Oil Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect
5133	2006	9	Source Address 6	Source Address 6 - Abnormal Update Rate
5167	111	17	Engine Coolant Level 1	Coolant Level - Data Valid But Below Normal Operating Range - Least Severe Level
5173	2900	19	Transmission Engine Crank Enable	Transmission Engine Crank Enable - Received Network Data in Error
5174	2900	9	Transmission Engine Crank Enable	Transmission Engine Crank Enable - Abnormal Update Rate
5177	6713	9	Engine Variable Geometry Turbocharger Actuator Software Identification	VGT Actuator Driver Circuit - Abnormal update rate
5183	6799	3	Engine Fan Blade Pitch	Fan Blade Pitch Position Sensor Circuit - Voltage Above Normal, or Shorted to High Source
5184	6799	4	Engine Fan Blade Pitch	Fan Blade Pitch Position Sensor Circuit - Voltage Below Normal, or Shorted to Low Source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
5185	6799	7	Engine Fan Blade Pitch	Fan Blade Pitch - Mechanical system not responding or out of adjustment
5193	1632	31	Engine Torque Limit Feature	Engine Torque Limit Feature - Condition Exists
5215	520791	2	Engine Boost Curve Selection	Engine Boost Curve Selection - Data erratic, intermittent or incorrect
5221	3667	2	Engine Air Shutoff Status	Engine Air Shutoff Status - Data erratic, intermittent or incorrect
5248	1623	13	Tachograph Output Shaft Speed	Tachograph Output Shaft Speed - Out of Calibration
5273	649	5	Engine Exhaust Bank 1 Pressure Regulator Control Command	Engine Exhaust Back Pressure Regulator Control Circuit - Current Below Normal or Open Circuit
5274	5625	2	Engine Exhaust Bank 1 Pressure Regulator Position	Engine Exhaust Back Pressure Regulator Position - Data Erratic, Intermittent or Incorrect
5276	5625	4	Engine Exhaust Bank 1 Pressure Regulator Position	Engine Exhaust Back Pressure Regulator Position Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
5277	5626	13	Engine Exhaust Pressure Regulator Preliminary FMI	Engine Exhaust Back Pressure Regulator - Out of Calibration
5291	520808	31	Engine Emergency Shutdown Switch Actived	Engine Emergency Shutdown Switch Actived - Condition Exists
5292	520809	31	Excessive Time Since Last Engine Air Shutoff Maintenance Test	Excessive Time Since Last Engine Air Shutoff Maintenance Test - Condition Exists
5315	2629	16	Engine Turbocharger 1 Compressor Outlet Temperature	Turbocharger Compressor Outlet Temperature (Calculated) - Data Valid But Above Normal Operating Range - Moderately Severe Level
5316	2789	0	Engine Turbocharger 1 Calculated Turbine Intake Temperature	Turbocharger Turbine Intake Temperature - Data Valid But Above Normal Operating Range - Most Severe Level
5366	6301	16	Water in Fuel Indicator 2	Water in Fuel Indicator 2 - Data Valid But Above Normal Operating Range - Moderately Severe Level
5367	6301	0	Water in Fuel Indicator 2	Water in Fuel Indicator 2 - Data Valid But Above Normal Operating Range - Most Severe Level
5384	5502	16	Engine Unburned Fuel Percentage	Relative Unburned Fuel Mass - Data Valid But Above Normal Operating Range - Moderately Severe Level
5385	5502	0	Engine Unburned Fuel Percentage	Relative Unburned Fuel Mass - Data Valid But Above Normal Operating Range - Most Severe Level
5576	107	15	Engine Air Filter 1 Differential Pressure	Engine Air Filter Differential Pressure - Data Valid But Above Normal Operating Range - Least Severe Level
5585	5571	15	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Data Valid But Above Normal Operating Range - Least Severe Level
5588	5607	7	Cruise Control System Command State	Cruise Control System Command State - Mechanical System Not Responding or Out of Adjustment
5622	1632	31	Engine Torque Limit Feature	Engine Torque Limit Feature - Condition Exists

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
5652	1209	15	Engine Exhaust Pressure 1	Exhaust Pressure 1 - Data Valid But Above Normal Operating Range - Least Severe Level
5862	7029	3	Engine Diesel Fuel Metering Valve Position	Engine Diesel Fuel Metering Valve Position Sensor Circuit - Voltage Above Normal or Shorted to High Source
5863	7029	4	Engine Diesel Fuel Metering Valve Position	Engine Diesel Fuel Metering Valve Position Sensor Circuit - Voltage Below Normal or Shorted to Low Source
5866	520953	3	Manufacturer Assignable SPN	Aftertreatment Diesel Exhaust Fluid Dosing Unit Relay Feedback- Voltage Above Normal or Shorted to High Source.
5867	520953	4	Manufacturer Assignable SPN	Aftertreatment Diesel Exhaust Fluid Dosing Unit Relay Feedback- Voltage Below Normal or Shorted to Low Source.
5939	520968	9	Manufacturer Assignable SPN	Machine Constrained Operation- Abnormal Update Rate. No Communication or an invalid data transfer rate has been detected on the J1939 data link between the ECM and the machine electronic control unit.
5941	520968	19	Manufacturer Assignable SPN	Machine Constrained Operation- Received Network Data in Error. The received J1939 datalink message was not valid.
6256	168	15	Battery Potential / Power Input 1	Battery 1 Voltage - Data Valid But Above Normal Operating Range - Least Severe Level
6257	168	17	Battery Potential / Power Input 1	Battery 1 Voltage - Data Valid But Below Normal Operating Range - Moderately Severe Level
6258	1075	3	Engine Electric Lift Pump	Electric Lift Pump for Engine Fuel Supply Circuit - Voltage above normal, or shorted to high source
6259	1075	4	Engine Electric Lift Pump	Electric Lift Pump for Engine Fuel Supply Circuit - Voltage below normal, or shorted to low source
6263	647	3	Engine Fan Clutch 1 Output Driver	Fan Control Circuit - Voltage above normal, or shorted to high source
6264	647	4	Engine Fan Clutch 1 Output Driver	Fan Control Circuit - Voltage below normal, or shorted to low source
6336	862	3	Heater Circuit #09	Crankcase Breather Filter Heater Circuit - Voltage above normal, or shorted to high source
6337	862	4	Heater Circuit #09	Crankcase Breather Filter Heater Circuit - Voltage below normal, or shorted to low source
6456	5484	3	Engine Fan Clutch 2 Output Driver	Engine Fan Clutch 2 Control Circuit - Voltage above normal, or shorted to high source
6457	5484	4	Engine Fan Clutch 2 Output Driver	Engine Fan Clutch 2 Control Circuit - Voltage below normal, or shorted to low source
6467	1639	15	Fan Speed	Fan Speed - Data Valid but Above Normal Operational Range - Least Severe Level
6468	1639	17	Fan Speed	Fan Speed - Data Valid but Below Normal Operational Range - Most Severe Level
6469	1639	2	Fan Speed	Fan Speed – Data Erratic, Intermittent, or Incorrect
6471	6799	3	Engine Fan Blade Pitch	Fan Blade Pitch Position Sensor Circuit - Voltage Above Normal, or Shorted to High Source

※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
6472	6799	4	Engine Fan Blade Pitch	Fan Blade Pitch Position Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
6473	6799	2	Engine Fan Blade Pitch	Fan Blade Pitch – Data Erratic, Intermittent, or Incorrect
6493	3464	3	Engine Throttle Actuator 1 Control Command	Electronic Throttle Control Actuator Driver Circuit-Voltage above normal, or shorted to high source
6494	3464	4	Engine Throttle Actuator 1 Control Command	Electronic Throttle Control Actuator Driver Circuit-Voltage above normal, or shorted to low source
6496	3464	5	Engine Throttle Actuator 1 Control Command	Electronic Throttle Control Actuator Driver Circuit-Current Below Normal or Open Circuit
6497	51	3	Engine Throttle Valve 1 Position 1	Engine Intake Throttle Actuator Position Sensor Circuit- Voltage above normal, or shorted to high source
6498	51	4	Engine Throttle Valve 1 Position 1	Engine Intake Throttle Actuator Position Sensor Circuit- Voltage above normal, or shorted to low source
6499	3597	17	ECU Power Output Supply Voltage #1	ECU Power Output Supply Voltage 1 - Data Valid But Below Normal Operating Range - Moderately Severe Level
6511	6655	3	Maintain ECU Power Lamp	Maintain ECU Power Lamp - Voltage Above Normal, or Shorted to High Source
6512	6655	4	Maintain ECU Power Lamp	Maintain ECU Power Lamp - Voltage Below Normal, or Shorted to Low Source
6522	111	3	Engine Coolant Level 1	Coolant Level Sensor 1 Circuit - Voltage above normal, or shorted to high source
6523	111	4	Engine Coolant Level 1	Coolant Level Sensor 1 Circuit - Voltage below normal, or shorted to low source
6524	175	3	Engine Oil Temperature 1	Engine Oil Temperature Sensor 1 Circuit - Voltage above normal, or shorted to high source
6525	175	4	Engine Oil Temperature 1	Engine Oil Temperature Sensor 1 Circuit - Voltage below normal, or shorted to low source
6563	976	2	PTO Governor State	Auxiliary Intermediate (PTO) Speed Switch Validation - Data erratic, intermittent or incorrect
6573	7028	16	Engine Diesel Fuel Metering Valve Temperature	Engine Diesel Fuel Metering Valve Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
6574	7028	0	Engine Diesel Fuel Metering Valve Temperature	Engine Diesel Fuel Metering Valve Temperature - Data Valid But Above Normal Operating Range - Most Severe Level
6583	441	14	Auxiliary Temperature 1	Auxiliary Temperature Sensor Input 1 - Special Instructions
6584	1388	14	Auxiliary Pressure #2	Auxiliary Pressure Sensor Input 2 - Special Instructions
6599	521002	31	Manufacturer Assignable SPN	Engine Cranks Slowly - Condition Exists
6611	6385	3	Engine Starter Motor Relay Control	Engine Starter Motor Relay Control Circuit - Voltage Above Normal or Shorted to High Source
6612	6385	4	Engine Starter Motor Relay Control	Engine Starter Motor Relay Control Circuit - Voltage Below Normal or Shorted to Low Source

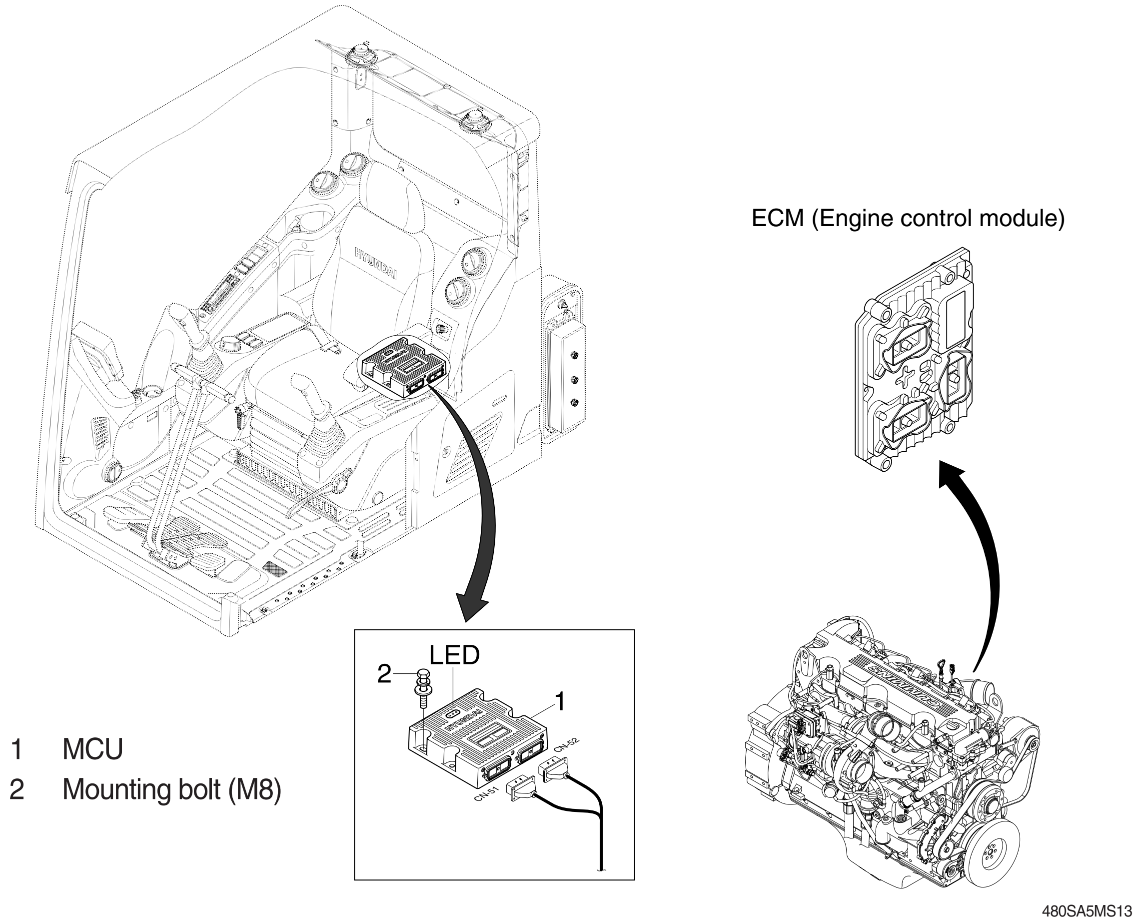
※ Some fault codes are not applied to this machine.

Fault code	J1939 SPN	J1939 FMI	Item	Description
6614	6806	31	ECU 1 Interface Mismatch	ECM 1 Data Link Interface Mismatch - Condition Exists
6618	70	2	Parking Brake Switch	Parking Brake Switch - Data Erratic, Intermittent, or Incorrect
6819	651	7	Engine Fuel 1 Injector Cylinder 1	Injector Solenoid Driver Cylinder 1 - Mechanical System Not Responding or Out of Adjustment
6821	652	7	Engine Fuel 1 Injector Cylinder 2	Injector Solenoid Driver Cylinder 2 - Mechanical System Not Responding or Out of Adjustment
6822	653	7	Engine Fuel 1 Injector Cylinder 3	Injector Solenoid Driver Cylinder 3 - Mechanical System Not Responding or Out of Adjustment
6823	654	7	Engine Fuel 1 Injector Cylinder 4	Injector Solenoid Driver Cylinder 4 - Mechanical System Not Responding or Out of Adjustment
6824	655	7	Engine Fuel 1 Injector Cylinder 5	Injector Solenoid Driver Cylinder 5 - Mechanical System Not Responding or Out of Adjustment
6825	656	7	Engine Fuel 1 Injector Cylinder 6	Injector Solenoid Driver Cylinder 6 - Mechanical System Not Responding or Out of Adjustment
6938	5793	9	Desired Engine Fueling State	Desired Engine Fueling State - Abnormal Update Rate
6939	7745	9	Engine Start Request	Engine Start Request - Abnormal Update Rate
7133	7745	13	Engine Start Request	Engine Start Request - Out of Calibration
7134	7746	13	Engine Start Consent	Engine Start Consent - Out of Calibration
7285	1569	14	Engine Protection Torque Derate	Engine Protection Torque Derate - Special Instructions
7385	524286	31	Manufacturer Assignable SPN	Engine Start Abort Request - Out of Calibration
7393	524286	31	Manufacturer Assignable SPN	Engine Start Request - Abnormal Update Rate
7394	524286	31	Manufacturer Assignable SPN	Engine Shutdown Command - Out of Calibration
7395	524286	31	Manufacturer Assignable SPN	Engine Shutdown Command - Abnormal Update Rate
9491	524286	31	Manufacturer Assignable SPN	Reserved for temporary use - Condition Exists
9799	524286	31	Manufacturer Assignable SPN	Reserved for temporary use - Condition Exists
9999	524286	31	Manufacturer Assignable SPN	Reserved for temporary use - Condition Exists

※ Some fault codes are not applied to this machine.

GROUP 13 ENGINE CONTROL SYSTEM

1. MCU (Machine Control Unit)



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 14 EPPR VALVE

1. PUMP EPPR VALVE

1) COMPOSITION

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

(1) Electro magnet valve

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

(2) Spool valve

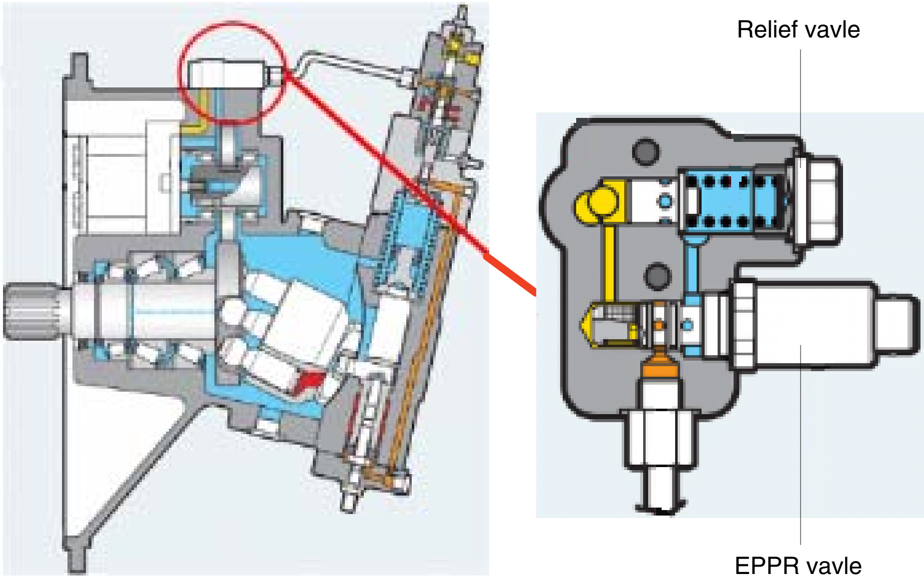
Is the two way direction control valve for pilot pressure to reduce main pump flow.
When the electro magnet valve is activated, pilot pressure enters into flow regulator of main pump.

(3) Pressure and electric current value for each mode

Power mode		Engine rpm		Pressure (Pf)		
		No load	Load	No load	Load	
				-	Boom up full stroke & pump no relief	Boom up full stroke & pump relief
Standard	P	1700	1800	8.5	8~5	8
	S	1600	1700	9	8.5~5.5	8.5
	E	1500	1600	9	8.5~5.5	8.5
Option	P	1800	1800	5	5	5
	S	1700	1700	5.5	5.5	5.5
	E	1600	1600	5.5	5.5	5.5

2) OPERATING PRINCIPLE (pump EPPR valve)

(1) Structure



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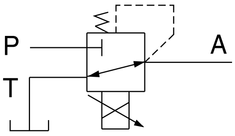
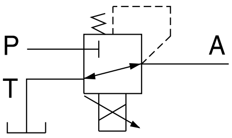
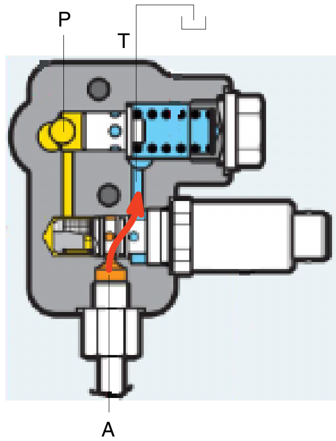


P Pilot oil supply line (pilot pressure)
T Return to tank
A Negative control pressure to main pump

(2) Neutral

Pressure line is blocked and A oil returns to tank.





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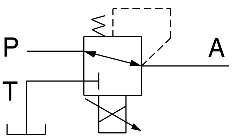
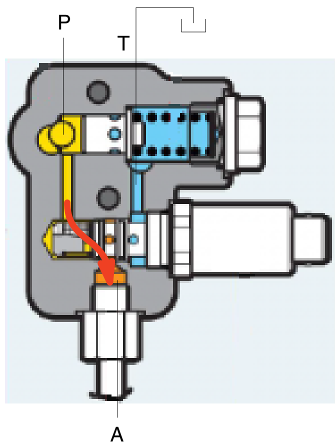
(3) Operating

Negative control pressure enters into A.





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3) 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.

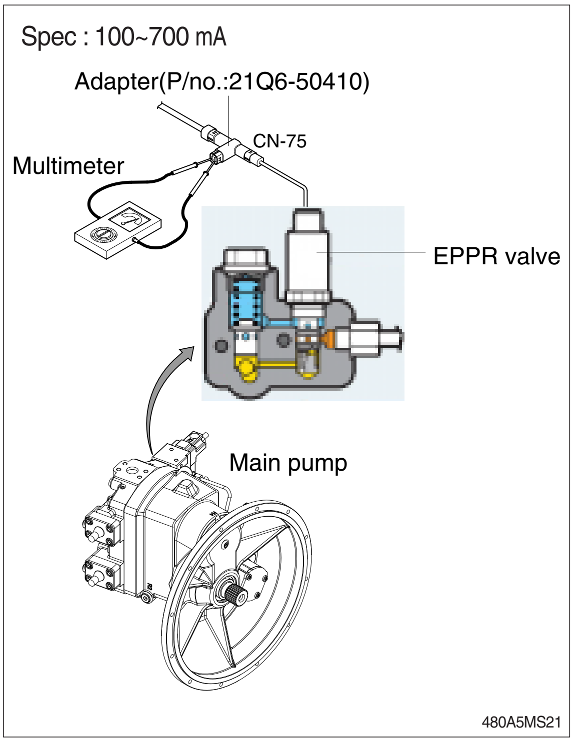
③ Start engine.

④ Set S-mode and cancel auto decel mode.

⑤ Position the accel dial at 10.

⑥ If rpm display show approx 1600±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.

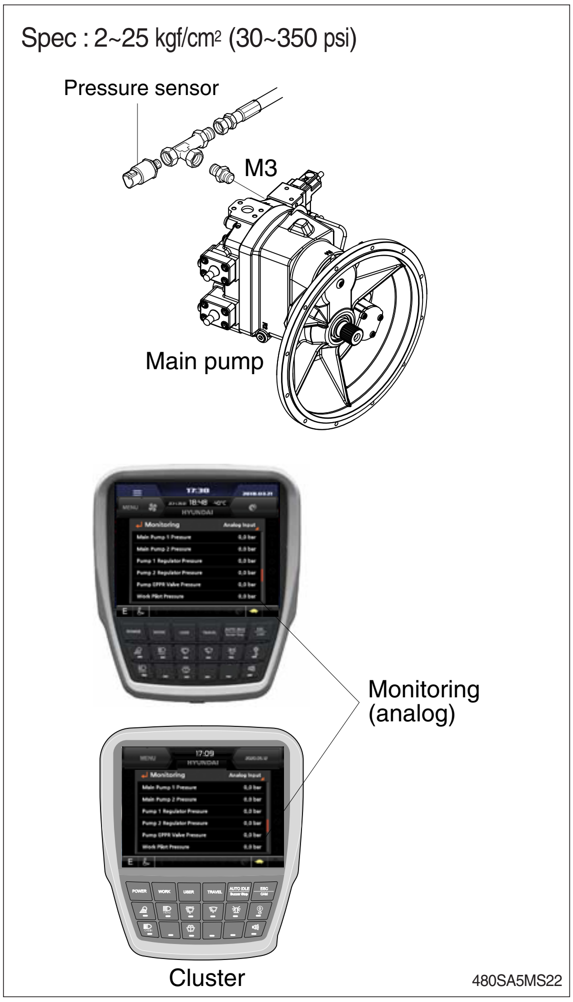
② Set S-mode and cancel auto decel mode.

③ Position the accel dial at 10.

④ If tachometer show approx 1600±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.



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

Normal type

480SA3CD50A

Premium type

480SA3CD51A

※ 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 5-60 for details.

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 to 1400 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.

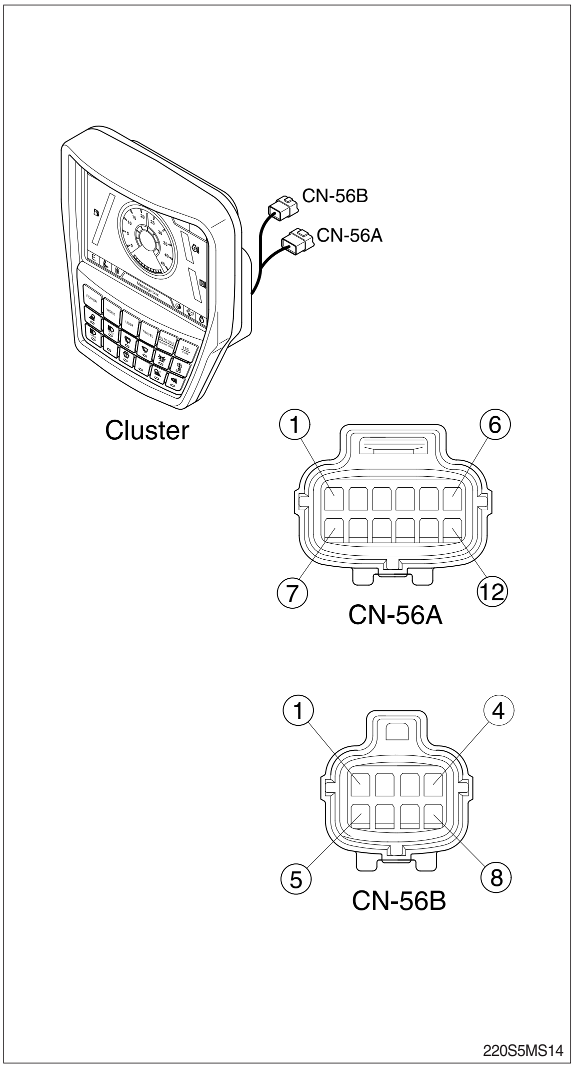
※ The pop-up warning lamp moves to the original position and blink when the buzzer stop switch is pushed. Also the buzzer stops.

3. CLUSTER CONNECTOR

1) NORMAL TYPE

(1) CN-56A

No.	Name	Signal
1	Battery 24V	20~32Vdc
2	Power IG {24V}	20~32Vdc
3	GND	-
4	N.C	-
5	N.C	-
6	CAN 2 (H)	0~5Vdc
7	CAN 2 (L)	20~32Vdc
8	N.C	-
9	N.C	-
10	N.C	-
11	N.C	-
12	N.C	-



(2) CN-56B

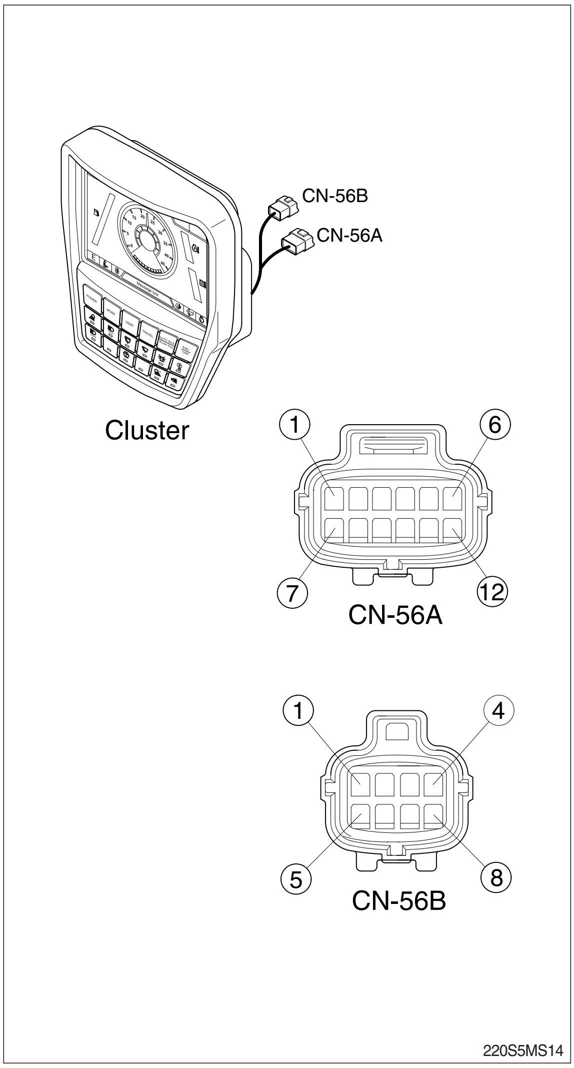
No.	Name	Signal
1	CAM + 6.5V	6.3~6.7Vdc
2	CAM GND	-
3	CAM DIFF (H)	0~5Vdc
4	CAM DIFF (L)	0~5Vdc
5	CAM 1	NTSC signal
6	CAM 2	NTSC signal
7	CAM 3	NTSC signal
8	CAM shield	0~5Vdc

NTSC : National Television System Committee

2) PREMIUM TYPE

(1) CN-56A

No.	Name	Signal
1	Battery 24V	20~32Vdc
2	Power IG {24V}	20~32Vdc
3	GND	-
4	N.C	-
5	N.C	-
6	CAN 2 (H)	0~5Vdc
7	CAN 2 (L)	20~32Vdc
8	N.C	-
9	N.C	-
10	N.C	-
11	N.C	-
12	N.C	-



(2) CN-56B

No.	Name	Signal
1	CAM + 6.5V	6.3~6.7Vdc
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	0~5Vdc

NTSC : National Television System Committee

3) GAUGE

(1) Operation screen

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

Normal type

220S3CD551A

Premium type

Default

Option

220S3CD151A

1 RPM / Speed gauge

2 Engine coolant temperature gauge

3 Hydraulic oil temperature gauge

4 Fuel level gauge

5 Tripmeter display

6 Eco guage

7 Accel dial gauge

※ Operation screen type can be set by the screen type menu of the display (premium type). Refer to page 5-84 for details.

(2) RPM / Speed gauge

Normal type

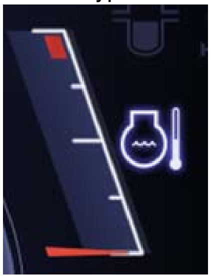
Premium type

220S3CD549

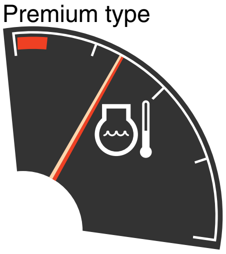
① This displays the engine speed.

(3) Engine coolant temperature gauge

Normal type



Premium type



220S3CD553

① This gauge indicates the temperature of coolant.
- · White range : 40-113˚C (104-235˚F)
- · Red range : Above 113˚C (235˚F)

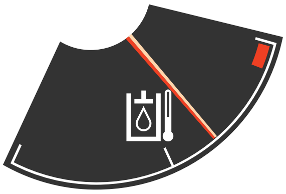
② If the indicator is in the red range or lamp pops up and the buzzer sounds, turn OFF the engine and check the engine cooling system.

※ 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

Normal type

Premium type



220S3CD554

① This gauge indicates the temperature of hydraulic oil.
- · White range : 40-100˚C (104-212˚F)
- · Red range : Above 100˚C (212˚F)

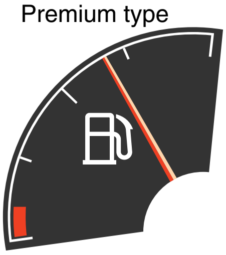
② If the indicator is in the red range or lamp pops up and the buzzer sounds reduce the load on the system. If the gauge stays in the red range, stop the machine and check the cause of the problem.

※ 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

Normal type

Premium type



220S3CD555

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) Tripmeter display

290F3CD56

① This displays the engine the tripmeter.
※ Refer to page 5-85 for details.

(7) 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.

(8) Accel dial gauge

290F3CD59

① This gauge indicates the level of accel dial.

4) WARNING LAMPS

Normal type

400SA3CD503

Premium type

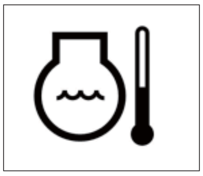
400SA3CD03

※ 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 lamp of the LCD is touched
	Warning lamp pops up on the center of the LCD and the buzzer sounds	※ **Refer to page 5-61 for details.**

※ Refer to page 5-67 for the buzzer stop switch AUTO IDLE Buzzer Stop .

(1) Engine coolant temperature warning lamp



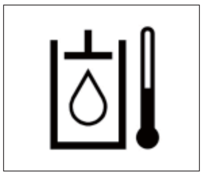
290F3CD61

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

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

③ Check the cooling system when the lamps keep blink.

(2) Hydraulic oil temperature warning lamp



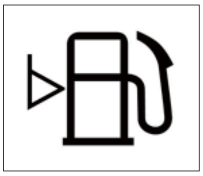
290F3CD62

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

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

③ Check the hydraulic oil level and hydraulic cooling system.

(3) Fuel level warning lamp



290F3CD63

① This warning lamp pops up and the buzzer sounds when the fuel level is below 136 ℓ (35.9 U.S. gal).

② Fill the fuel immediately after the lamp blinks.

(4) Emergency warning lamp

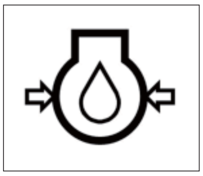
290F3CD64

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

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

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

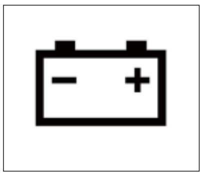
(5) Engine oil pressure warning lamp



290F3CD65

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

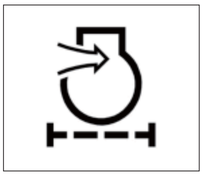
(6) Battery charging warning lamp



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.

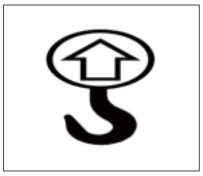
(7) Air cleaner warning lamp



290F3CD68

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

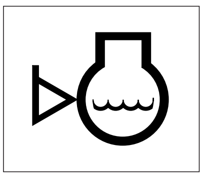
(8) Overload warning lamp (opt)



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.

(9) Coolant level warning lamp

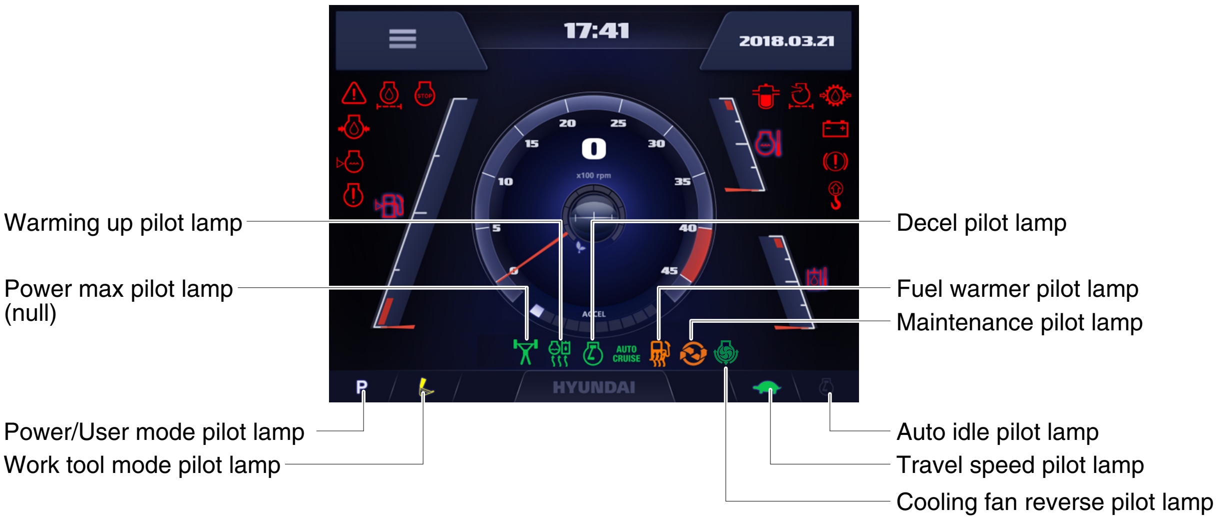


760F3CD58

① This warning lamp indicates lack of coolant.
② Check and refill coolant.

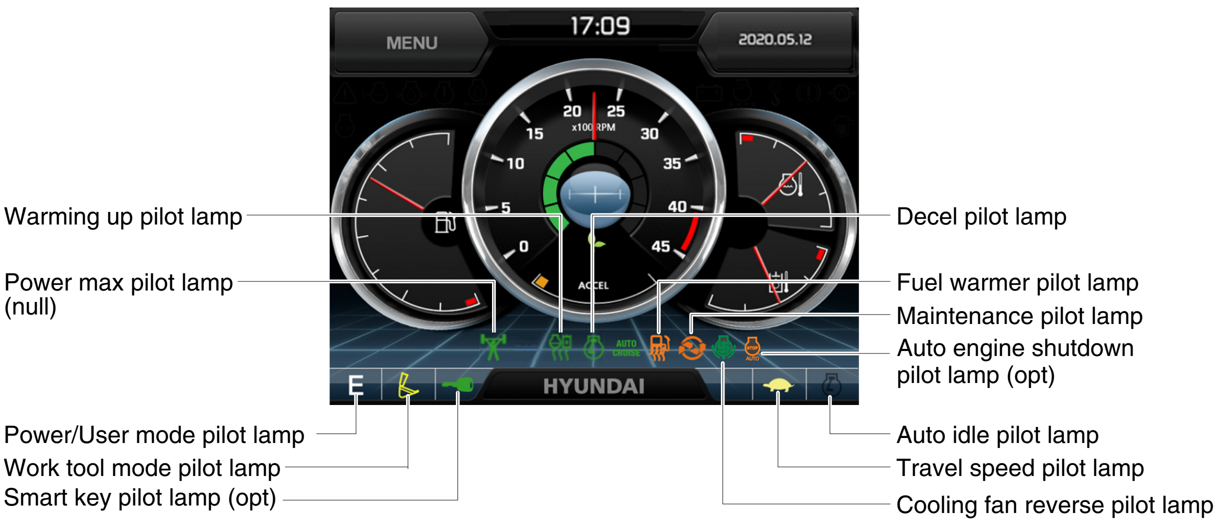
5) PILOT LAMPS

Normal type



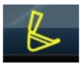
520SA3CD574

Premium type



520SA3CD74

(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
4	Travel mode		Low speed traveling
			High speed traveling
5	Auto idle mode		Auto idle

(2) Power max pilot lamp (null)

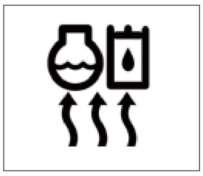
290F3CD78

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 3-36 for power max function.**

(3) Warming up pilot lamp

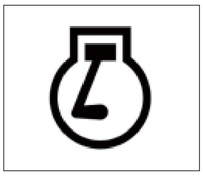


290F3CD80

① This lamp lights up when the coolant temperature is below 30˚C (86˚F).

② The automatic warming up is cancelled when the engine coolant temperature is above 30˚C (86˚F), or when 10 minutes have passed since starting the engine.

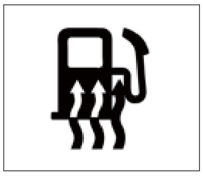
(4) Decel pilot lamp



290F3CD81

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 3-35.

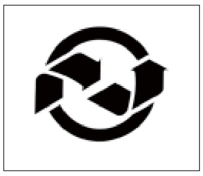
(5) Fuel warmer pilot lamp



290F3CD82

① This lamp lights up when the coolant temperature is below 10˚C (50˚F) or the hydraulic oil temperature 20˚C (68˚F).
② The automatic fuel warming is cancelled when the engine coolant temperature is above 60˚C (140˚F), and the hydraulic oil temperature is above 45˚C (113˚F) since the start switch was ON position.

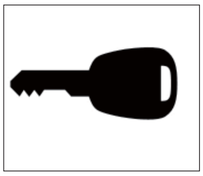
(6) Maintenance pilot lamp



290F3CD83

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 the page 5-78.

(7) Smart key pilot lamp (premium type, opt)



290F3CD214

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 5-79.

(8) Auto engine shutdown pilot lamp (premium type, opt)

220A3CD202A

① This lamp lights up when the auto engine shutdown is activated
※ Refer to the page 5-75.

(9) Cooling fan reverse pilot lamp

480A3CD205

① This lamp lights up when the cooling fan reverse function is activated.

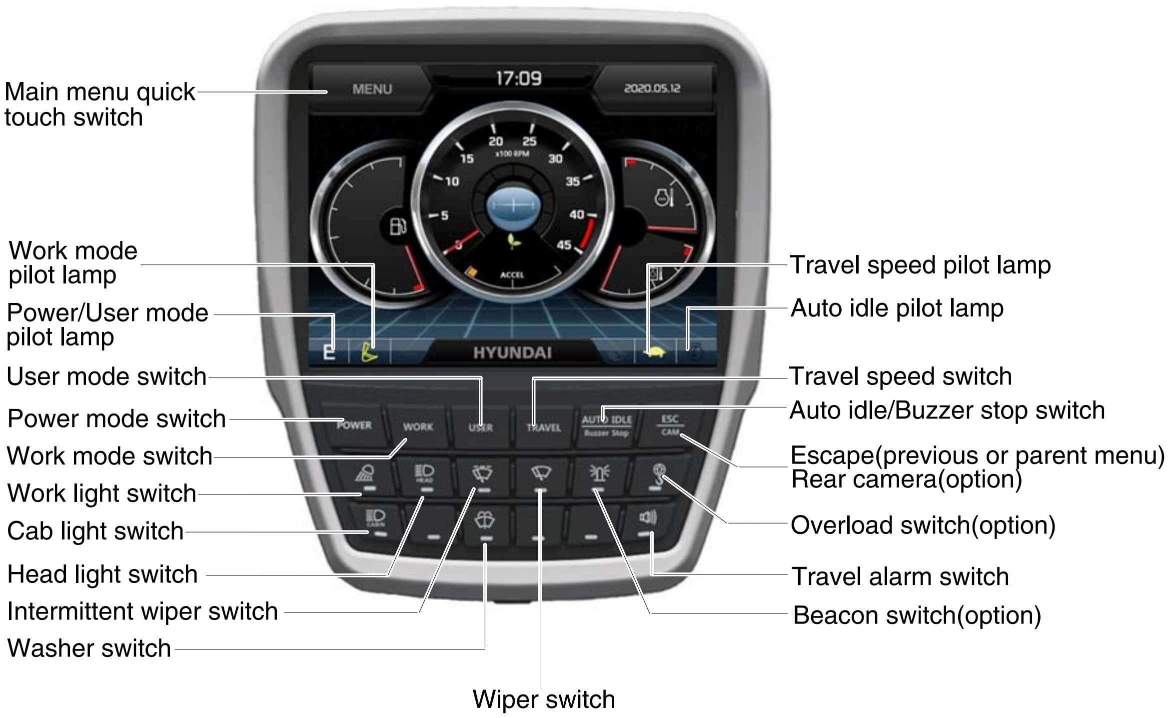
※ Refer to page 3-21.

6) SWITCHES

Normal type

220S3CD586A

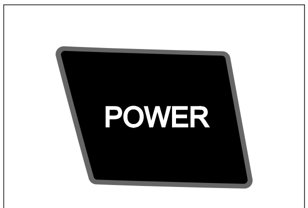
Premium type



220S3CD86B

※ When some of the switches are selected, the pilot lamps are displayed on the LCD. Refer to the page 5-63 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.
② · E : Economy power work.
  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)
  · Not installed : Breaker or crusher is not installed.

※ **Refer to the operator's manual page 2-7 for details.**

(3) User mode switch

290F3CD89

① This switch is used to select between user mode and general power mode.
  - U : User mode
  - P/S/E : General power mode

② Refer to the page 5-73 for another set of user mode.

(4) Travel speed switch

290F3CD91

① This switch is used to select the travel speed alternatively.
  · : Low speed
  · : High speed

※ **Do not change the setting of the travel speed switch while machine is moving. Machine stability may be adversely affected**

⚠ **Serious injury or death can result from sudden changes in machine stability.**

(5) Auto idle/ buzzer stop switch

290F3CD90

① This switch is used to activate or cancel the auto idle function.
  · Pilot lamp ON : Auto idle function is activated.
  · Pilot lamp OFF : Auto idle function is cancelled.

② The buzzer sounds when the machine has a problem.
  In this case, push this switch and buzzer stops, but the warning lamp blinks until the problem is cleared.

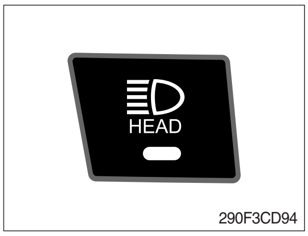
(6) Escape/Camera switch

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 5-85 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.

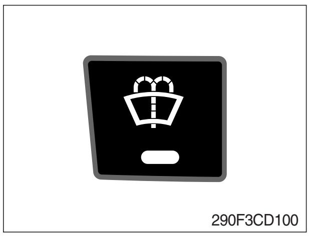
(9) Intermittent wiper switch

① This switch is used to wipe operates 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.

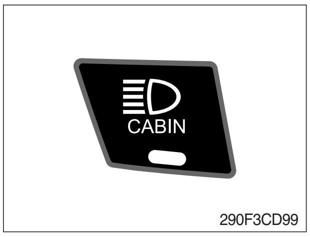
(11) Washer switch



290F3CD100

① Washer liquid is sprayed and the wiper is operated only when this switch is pressed.
② The pilot lamp lights up when this switch is pressed.

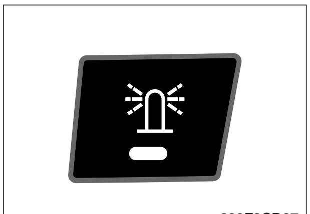
(12) Cab light switch



290F3CD99

① This switch turns on the cab light.
② The pilot lamp lights up when this switch is pressed.

(13) Beacon switch



290F3CD97

① This switch activates the rotary light on the cab.
② The pilot lamp lights up when this switch is pressed.

(14) Overload switch

290F3CD98

① When this switch is activated, buzzer makes sound and overload warning lamp lights up in the event that the machine is or becomes in an overloaded situation.
② When the switch is inactivated, buzzer stops and warning lamp goes off.
⚠ **Overloading the machine could impact the machines stability which could result in tipover hazard. A tipover hazard could result in serious injury or death. Always activate the overload warning device before you handle or lift objects.**

(15) Travel alarm switch

290F3CD101

① This switch is to activate travel alarm function surrounding when the machine travels to forward and backward.
② After activating this switch, the alarm operates only when the machine is traveling.
③ The pilot lamp lights up when this switch is pressed.

(16) Main menu quick touch switch

290F3CD217A

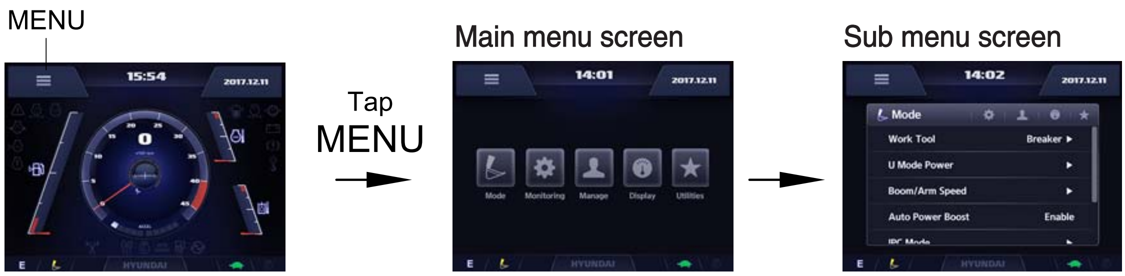
① This switch is to activate the main menu in the cluster.

※ Refer to the page 5-71.

7) MAIN MENU

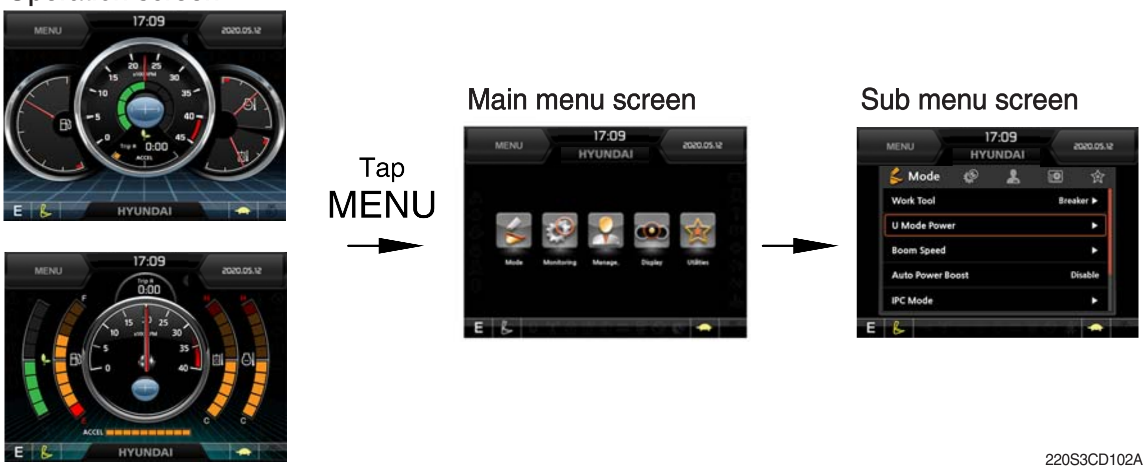
※ On the operation screen, tap MENU to access the main menu screen.
On the sub menu screen, you can tap the menu bar to access functions or applications.

Normal type
Operation screen



220S3CD502A

Premium type
Operation screen



220S3CD102A

(1) Structure

No	Main menu	Sub menu	Description
1	 Mode 220S3CD103	Work mode U mode power Boom speed (null) Auto power boost IPC mode Auto engine shutdown (opt) Initial mode Cooling fan reverse mode Emergency mode	Breaker, Crusher, Not installed User mode only Boom speed Enable, Disable Speed mode, Balance mode, Efficiency mode One time, Always, Disable Key on initial mode / initial work mode Auto, Manual Switch function
2	 Monitoring 220S3CD104	Active fault Logged fault Delete logged fault Monitoring	MCU, AAVM (opt) MCU, AAVM (opt) All logged fault delete, Initialization canceled Machine information, Switch status, Output status,
3	 Management 220S3CD105	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 RMCU, Relay drive unit, AAVM (opt) A/S phone number, A/S phone number change Power shift, Operating hour, Breaker mode pump acting, EPPR current level, Overload pressure Clinometer setting Cluster, ETC device
4	 Display 220S3CD106	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 220S3CD107	Tripmeter Camera setting AUX Manual	3 kinds (A, B, C) Number of active, Display order, AAVM (opt)★

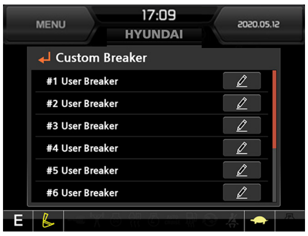
★ : premium type

(2) Mode setup

※ Illustrations are based on the premium type cluster.

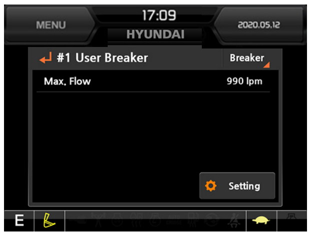
① Work mode

220S3CD108A



220S3CD253A

A



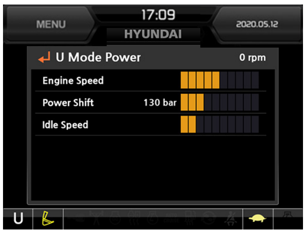
220S3CD254A

B

· 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.

② U mode power

220S3CD111A



220S3CD112A

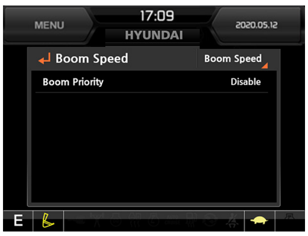
Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1400	800	0
2	1450	850	2
3	1500	900	4
4	1550	950	7
5	1600	1000 (auto decel)	10
6	1650	1050	13
7	1700	1100	16
8	1750	1150	19
9	1800	1200	22
10	1850	1250	25

※One touch decel & low idle : 800 rpm

· Engine high idle rpm, auto idle rpm and pump torque (power shift) can be modulated and memorized separately in U-mode.
· U-mode can be activated by user mode switch.

③ Boom speed (null)

220S3CD113A



220S3CD115A

· Boom speed
  - Boom priority function can be activated or cancelled
    Enable - Boom up speed is automatically adjusted as working conditions by the MCU.
    Disable - Normal operation

④ Auto power boost

220S3CD118A

220S3CD117A

· 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, then goes off for a period or 1 second and then activates again for 8 seconds and continues this cycle.
Disable - Not operated.

⑤ IPC mode

220S3CD310A

220S3CD311A

220S3CD304A

220S3CD312A

220S3CD305A

220S3CD313A

220S3CD306A

· The IPC mode can be selected by this menu.
- Speed mode
- Balance mode (default)
- Efficiency mode

⑥ Automatic engine shutdown (option)

220S3CD91A

220S3CD92A

220S3CD93A

· 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

220S3CD122A

220S3CD119A

· 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

⑧ Cooling fan reverse mode

520SA3CD314

520SA3CD315

520SA3CD316

· 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

220S3CD248A

220S3CD249A

· 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

220S3CD120A

220S3CD125A

· The active faults of the MCU can be checked by this menu.

② Logged fault

220S3CD128A

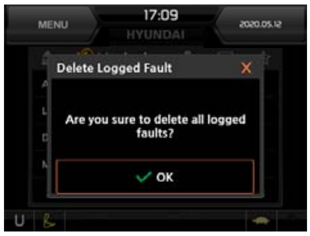
220S3CD124A

· The logged faults of the MCU can be checked by this menu.

③ Delete logged fault

220S3CD134A

220S3CD126A



220S3CD127A

· The logged faults of the MCU can be deleted by this menu.

④ Monitoring

220S3CD172A

220S3CD188A

220S3CD189A

· 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 Fuel rate information

220S3CD14A

220S3CD15A

A

220S3CD16A

· 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).

B

220S3CD17A

· 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.

C

220S3CD18A

· 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".

D

220S3CD19A

· 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".

② Maintenance information

220S3CD131A

220S3CD132A

220S3CD133A

· 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.**

③ Machine security

220S3CD190A

220S3CD135A

220S3CD136A

220S3CD137A

220S3CD138A

· ESL mode setting
- ESL : Engine Starting Limit
- ESL mode is desingned to be a theft deterrent or will prevent the unauthorized operation of the machine.
- When you Enable the ESL mode, the password will be required when the starting switch is turned to the on position.
- Machine security
  Disable : ESL function is disabled and password is not required to start engine.
  Enable (always) : The password is required whenever the operator starts engine.
- Interval : The password is required when the operator starts engine first. But the operator can restart the engine within the interval time without inputting the password. The interval time can be set to a maximum 4 hours.

  ※Default password : 00000 + ☑

  ※Password length : (5~10 digits) + ☑
- Smart key (option) : Refer to next page.

· Password change
- The password is 5~10 digits.

220S3CD190A

220S3CD140A

220S3CD135A

Enter the current password

220S3CD142A

Enter the new password

220S3CD143A

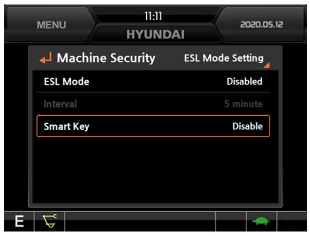
Enter the new password again

※ Before first use, please set user password and owner password in advance for machine security.

- Smart key

220S3CD190A

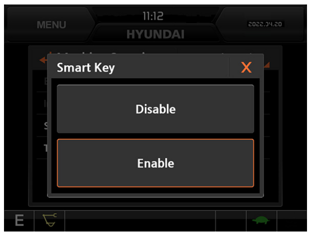
220S3CD135A



235F3CD001

· 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.

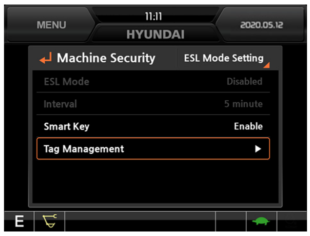


235F3CD002

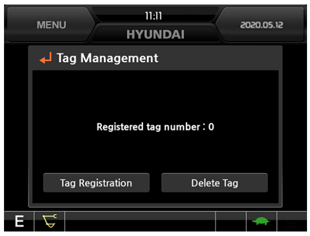
- Tag management

· 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.

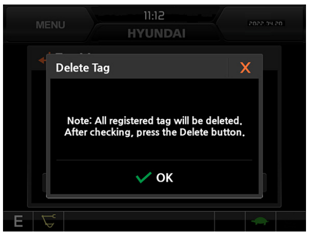


235F3CD003



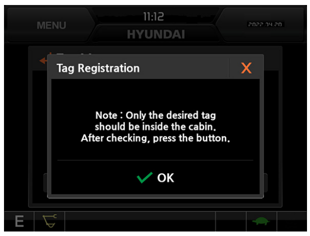
235F3CD004

Deleting



235F3CD006

Registering



235F3CD005

※ 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.

④Machine Information

220S3CD144A

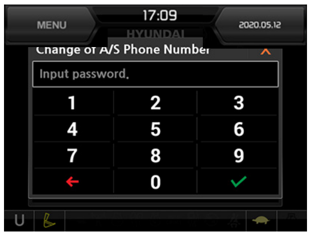
220S3CD145A

· This can confirm the identification of the model information (ECU), MCU, monitor, switch controller, RMCU, relay driver unit, AAVM (opt).

⑤ Contact (A/S phone number)

220S3CD146A

220S3CD147A



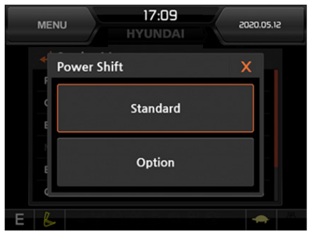
220S3CD148A

Enter the new A/S phone number

⑥ Service menu

220S3CD149A

220S3CD150B



220S3CD251A

※ 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 (null)
· EPPR current level (attach flow EPPR 1 & 2)
· Overload pressure : 100 ~ 350 bar

⑦ Clinometer

220S3CD152A

220S3CD153A

· 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)

220S3CD67A

220S3CD135A

220S3CD280A

· ETC devices and cluster can be updated through CAN 2 network.

· Insert USB memory stick or SD card which includes program files, start download.

220S3CD290A

220S3CD281A

220S3CD291A

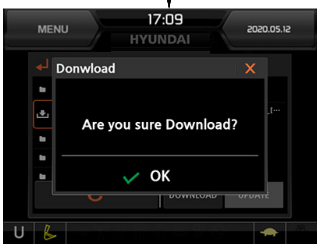
220S3CD282A

220S3CD299A

220S3CD292A

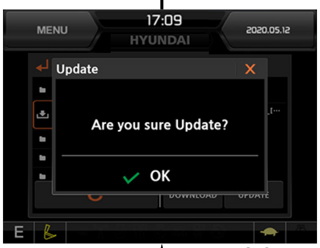
220S3CD283A

220S3CD298A



220S3CD293A

220S3CD284A

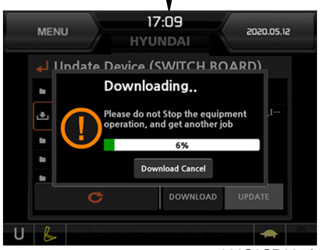


220S3CD297A

220S3CD294A

220S3CD285A

220S3CD296A



220S3CD295A

(5) Display

① Display item


220S3CD154A

220S3CD155A

220S3CD156A

· 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


220S3CD157A

220S3CD158A

· The first row of boxes indicate Year/Month/Day.
· The second row shows the current time. (0:00~23:59)

③ Brightness


220S3CD159A

220S3CD160A

220S3CD139A

220S3CD141A

220S3CD191A

220S3CD192A

· 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

220S3CD161A

220S3CD182A

220S3CD183A

220S3CD186A

220S3CD162A

220F3CD193A

- Temperature : ˚C ↔ ˚F
- Pressure : bar ↔ MPa ↔ kgf/cm^2
- Volume : ℓ ↔ gal
- Flow : lpm ↔ gpm
- Distance : km ↔ mile
- Date format : yy/mm/dd ↔ mm/dd/yy ↔ dd-mm-yy

⑤ Language

220S3CD163A

220S3CD164A

- User can select preferable language and all displays are changed to the selected language.

⑥ Screen type (premium type)

220S3CD165A

A Type (Default) 220S3CD166A

220S3CD156A

B Type (Option) 220S3CD174A

220S3CD167A

(6) Utilites

① Tripmeter

220S3CD168A

220S3CD169A

· A maximum of 3 kinds of tripmeters can be used at the same time.

· Each tripmeter can be turned on by choosing "Start". it also can be turned off by choosing "Stop".

· If the tripmeter icon is activated in the operation screen, it can be controlled directly there.

② Camera setting

· If the rear camera is not installed on the machine, set disable.

· If the rear camera is installed on the machine, set enable.

220S3CD225A

220S3CD255A

220S3CD256A

· In the operation screen, rear camera screen shows up when ESC/CAM switch is pushed.

220S3CD222A

290F3CD221

③ AAVM (Advanced Around View Monitoring, premium type, opt)

· The AAVM switches of the cluster consist of ESC/CAM and AUTO IDLE/Buzzer stop.

220S3CD244A

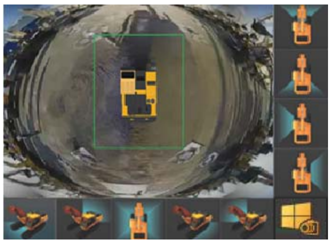
- **Escape switch**

· 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.

220S3CD156A

Home screen



AAVM mode 235SA3CD222A

- **Buzzer stop switch**

· AAVM mode detects surrounding pedestrians or objects and the warning buzzer sounds.

· User can turn OFF the warning sound by pressing buzzer stop switch.


290F3CD246A

· When a worker/pedestrian reaches the green line, which is an external danger area equipped on the cluster, warning buzzer sounds and it displays a green rectangular box recognizing the worker/pedestrian.
Stop work immediately. Stop the buzzer by pressing the buzzer stop switch. Then resume work after you confi rm that the area is safe and clear of workers/objects.


290F3CD247A

· When a worker/pedestrian reaches the red line, which is an external 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.

GROUP 16 FUEL WARMER SYSTEM

1. SPECIFICATION

1) Operating voltage : 24±4 V

2) Power : 350±50 W

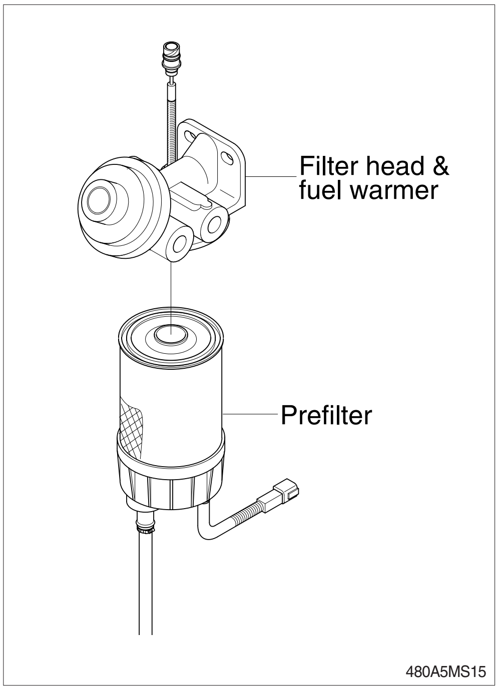
3) Current : 15 A

2. OPERATION

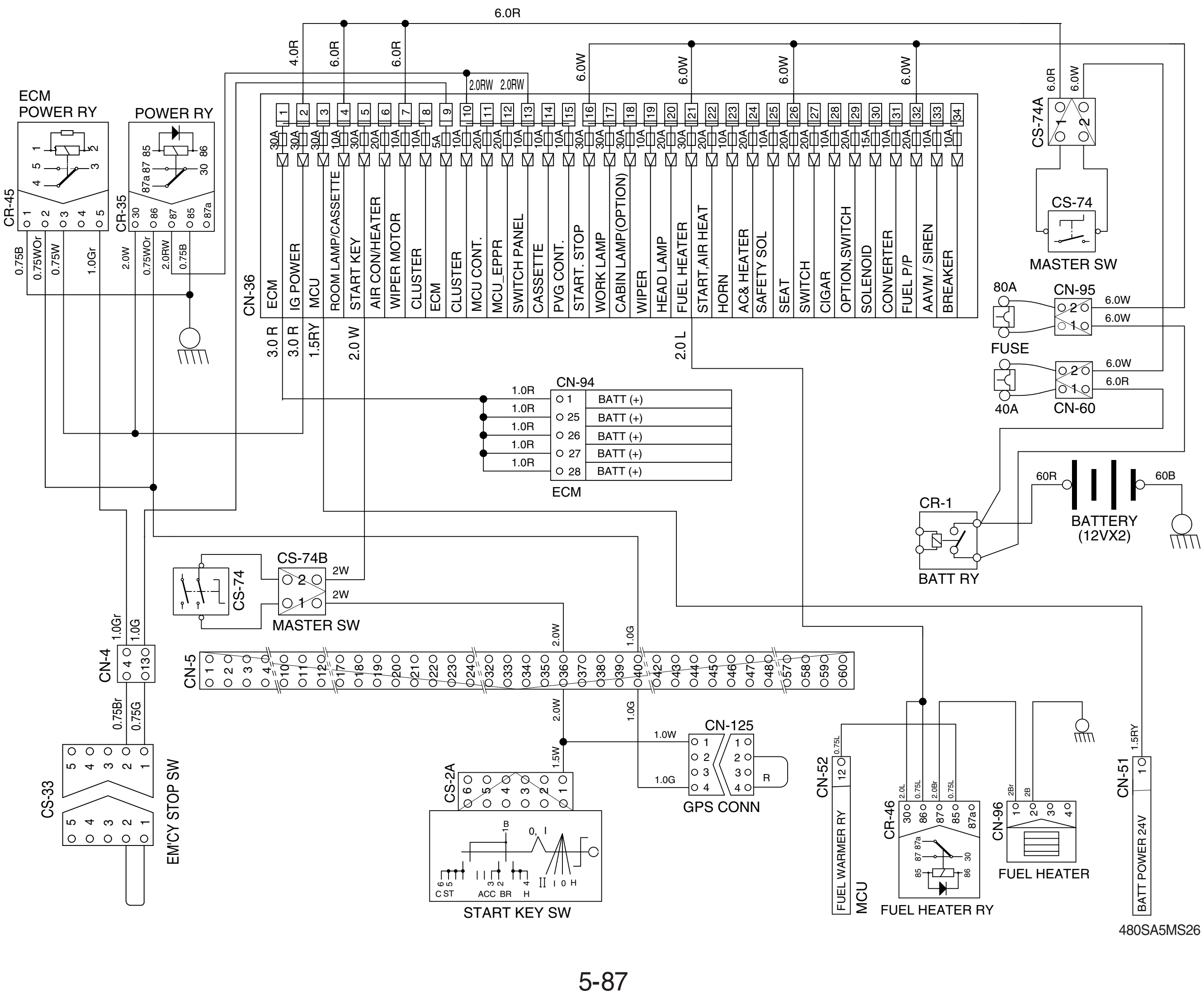
1) The current of fuel warmer system is automatically controlled without thermostat according to fuel temperature.

2) At the first state, the 15 A current flows to the fuel warmer and engine may be started in 1~2 minutes.

3) If the fuel starts to flow, ceramic-disk in the fuel warmer heater senses the fuel temperature to reduce the current as low as 1.5 A.
So, fuel is protected from overheating by this mechanism.



3. ELECTRIC CIRCUIT



SECTION 6 TROUBLESHOOTING

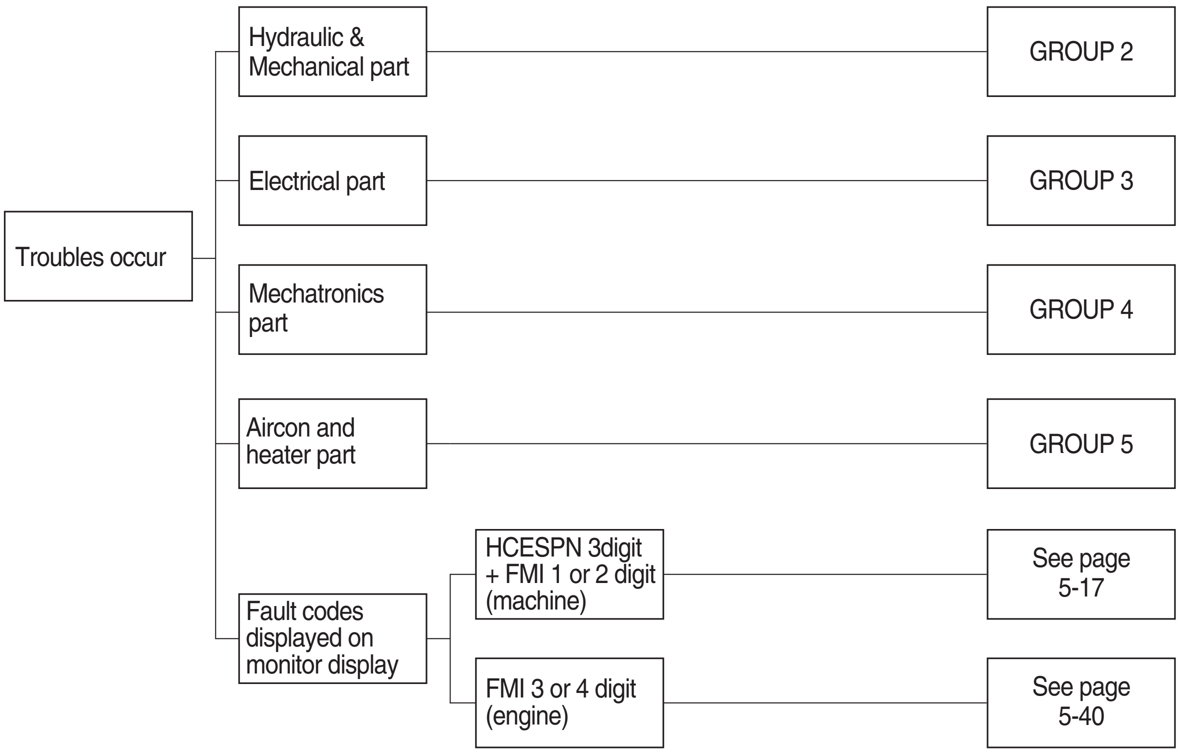
GROUP 1 BEFORE TROUBLESHOOTING

1. INTRODUCTION

When a trouble is occurred in the machine, this section will help an operator to maintain the machine with easy.

The trouble of machine is parted Hydraulic & Mechanical system, Electrical system, Mechatronics system and Air conditioner and heater system. At each system part, an operator can check the machine according to the troubleshooting process diagram.

※ **Before carring out troubleshooting procedure, check monitoring menu in the cluster.**

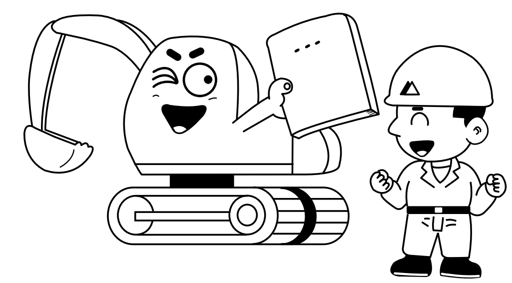


2. DIAGNOSING PROCEDURE

To carry out troubleshooting efficiently, the following steps must be observed.

STEP 1. Study the machine system

Study and know how the machine is operating, how the system is composing, what kinds of function are installed in the machine and what are specifications of the system components by the machine service manual.
Especially, deepen the knowledge for the related parts of the trouble.

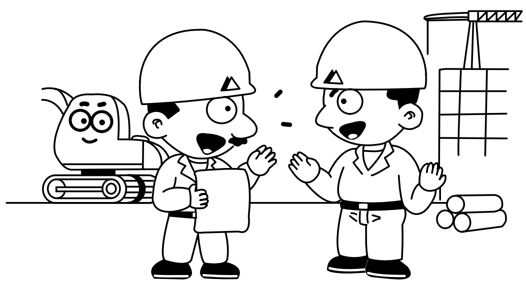


13031SH02

STEP 2. Ask the operator

Before inspecting, get the full story of malfunctions from a witness --- the operator.

1) How the machine is used and when it is serviced?
2) When the trouble was noticed and what work the machine was doing at that time?
3) What is the phenomenon of the trouble? Was the trouble getting worse, or did it come out suddenly for the first time?
4) Did the machine have any troubles previously? If so, which parts were repaired before.

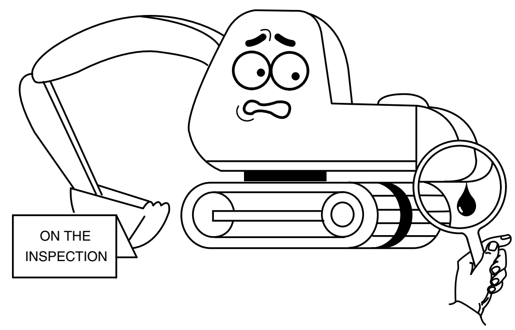


13031SH03

STEP 3. Inspect the machine

Before starting troubleshooting, check the machine for the daily maintenance points as shown in the operator's manual.

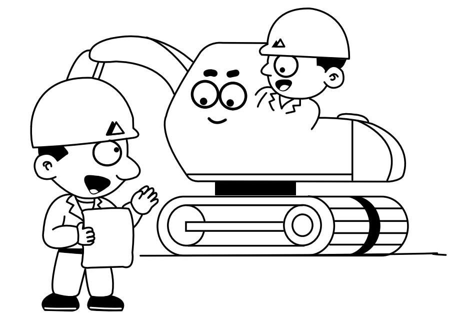
And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.



(210-7) 6-2(3)

STEP 4. Inspect the trouble actually on the machine

In case that some trouble cannot be confirmed, obtain the details of the malfunction from the operator.
Also, check if there are any in complete connections of the wire harnesses are or not.



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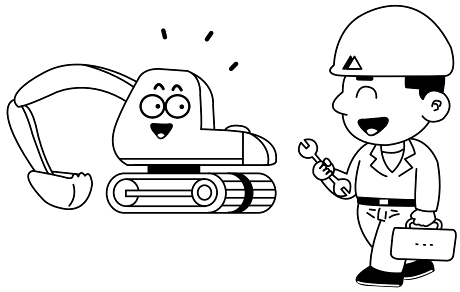
STEP 5. Perform troubleshooting

According to where the trouble parts are located, hydraulic & mechanical system part or electrical system part or mechatronics system part, perform troubleshooting the machine refer to the each system part's troubleshooting process diagram.

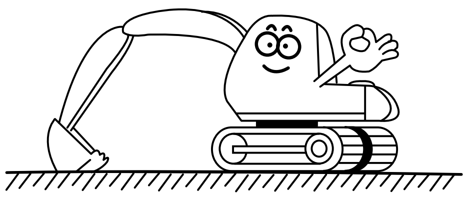


13031SH05

STEP 6. Trace a cause

Before reaching a conclusion, check the most suspectible causes again. Try to trace what the real cause of the trouble is.

Make a plan of the appropriate repairing procedure to avoid consequential malfunctions.



(210-7) 6-3(3)

GROUP 2 HYDRAULIC AND MECHANICAL SYSTEM

1. INTRODUCTION

1) MACHINE IN GENERAL

(1) If even a minor fault is left intact and operation is continued, a fatal failure may be caused, entailing a large sum of expenses and long hours of restoration.
Therefore when even a small trouble occurs, do not rely on your intuition and experience, but look for the cause based on the troubleshooting principle and perform maintenance and adjustment to prevent major failure from occurring. Keep in mind that a fault results from a combination of different causes.

(2) The following lists up commonly occurring faults and possible causes with this machine. For the troubleshooting of the engine, refer to the coming troubleshooting and repair.

(3) When carrying out troubleshooting, do not hurry to disassemble the components.
It will become impossible to find the cause of the problem.

(4) Ask user or operator the following.
① Was there any strange thing about machine before failure occurred?
② Under what conditions did the failure occur?
③ Have any repairs been carried out before the failure?

(5) Check before troubleshooting.
① Check oil and fuel level.
② Check for any external leakage of oil from components.
③ Check for loose or damage of wiring and connections.

2) MACHINE STATUS MONITORING ON THE CLUSTER

(1) The machine status such as the engine rpm, oil temperature, voltage and pressure etc. can be checked by this menu.

Analog 1

Analog 2

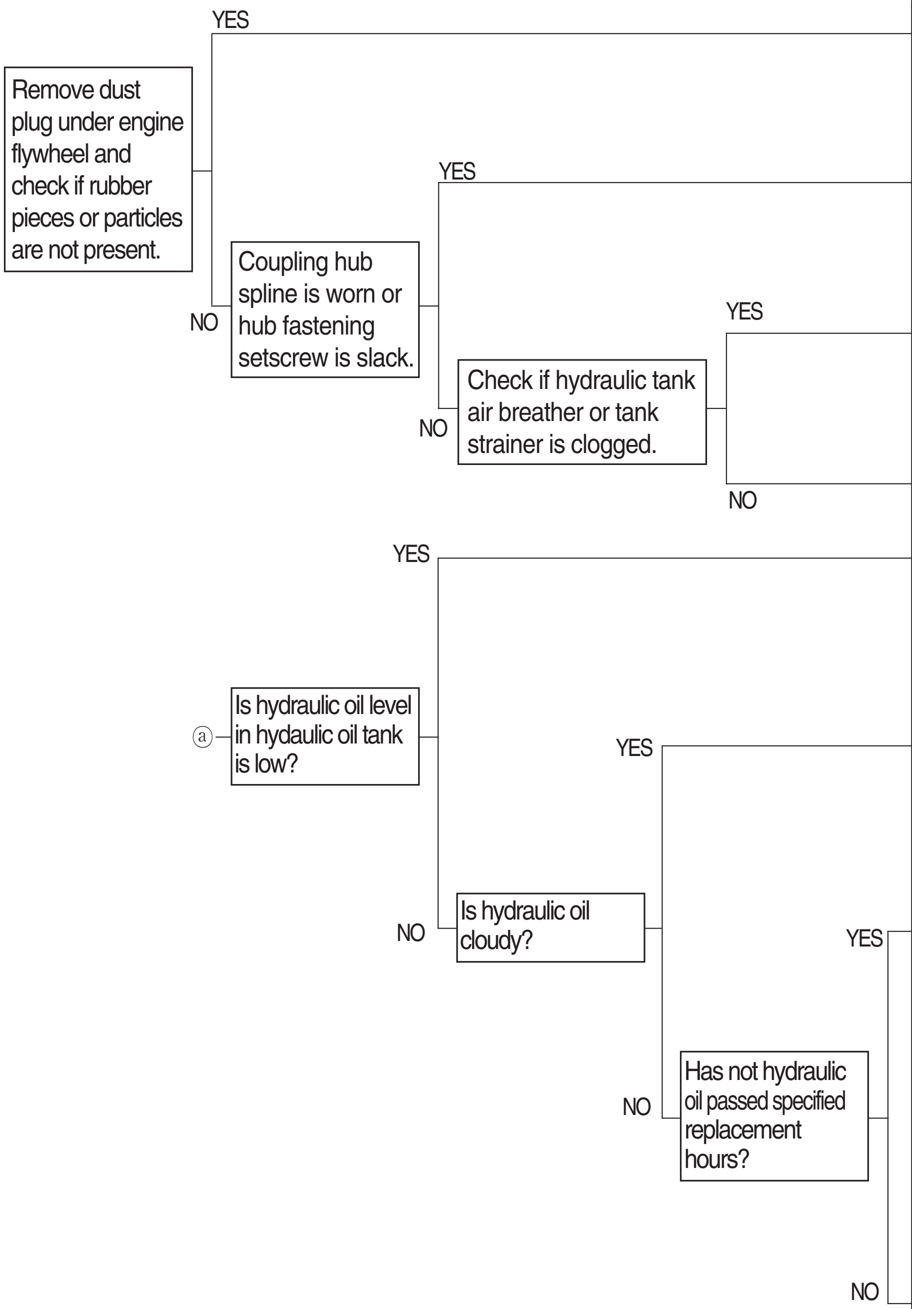
145SA6HS01

(2) Specification

No.	Description	Specification
Note 1	Work pilot pressure	40^{+2}_{0} bar
Note 2	Swing pilot pressure	0~40 bar
Note 3	Boom up pilot pressure	0~40 bar
Note 4	Arm/bucket pilot pressure	0~40 bar
Note 5	Pump 1 regulator pressure	0~50 bar
Note 6	Pump 2 regulator pressure	0~50 bar
Note 7	Pump 1 pressure	350 bar

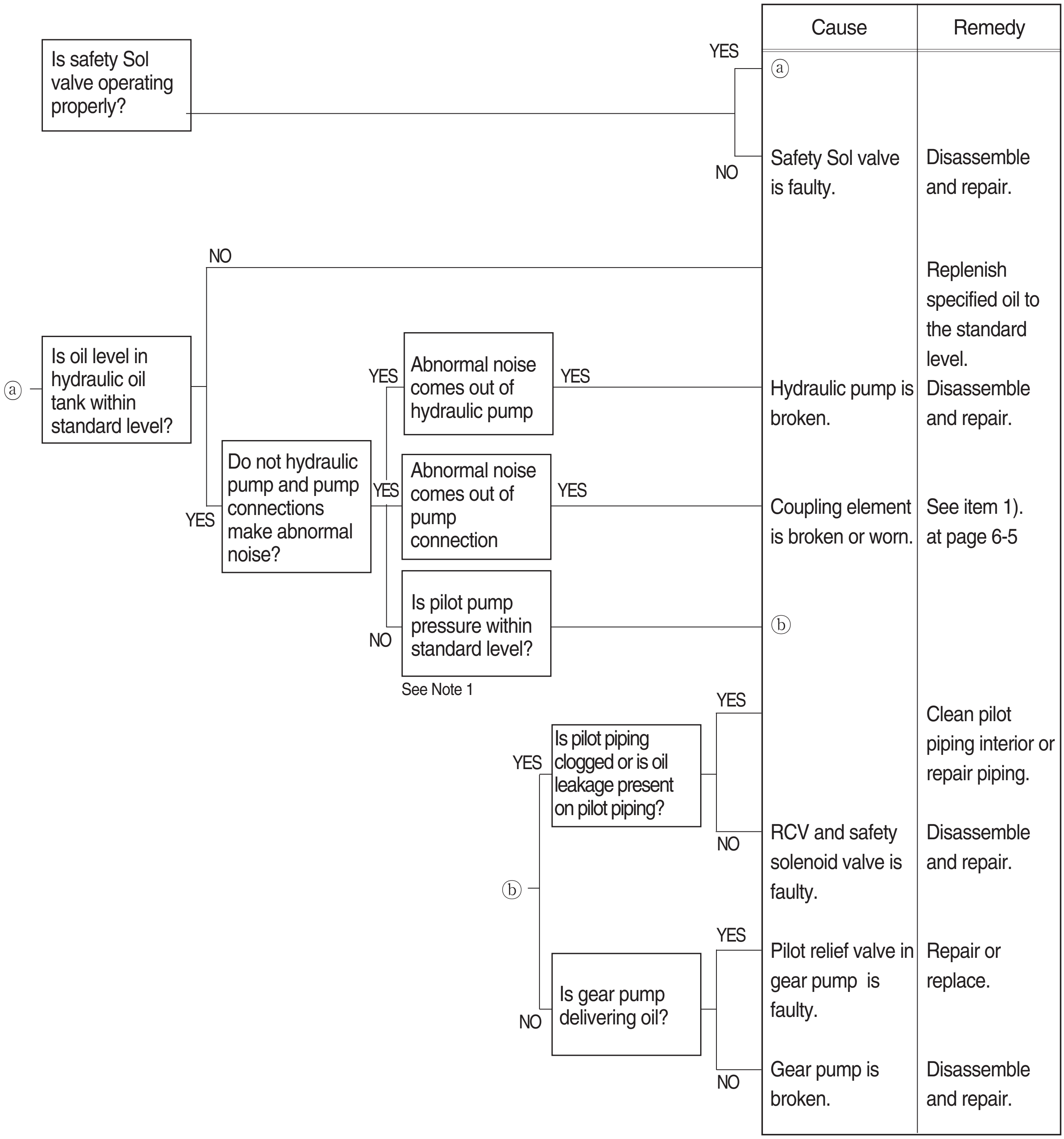
2. DRIVE SYSTEM

1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION



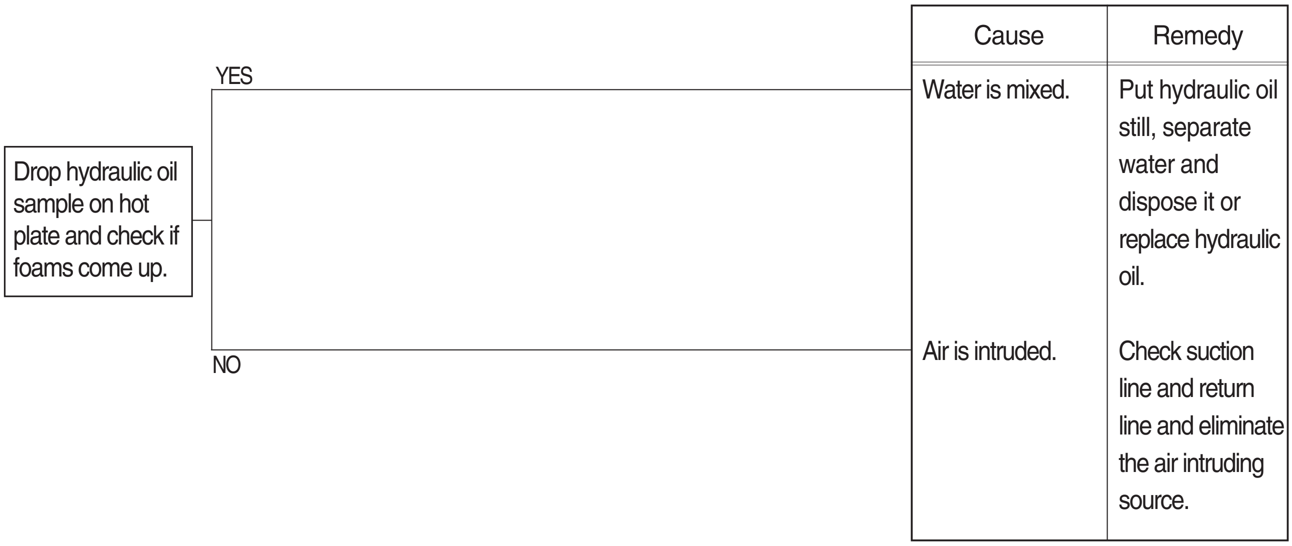
Cause	Remedy
Coupling element is broken.	Disassemble and repair.
	Replace hub or retighten setscrew.
Negative pressure in pump suction	Clean air breather or tank strainer
ⓐ	
	Replenish speified oil to the standard level.
Water or air is included in oil.	Refer to the remedy of 3.1)
	Replace hydraulic oil to be specified.
Return filter is not replaced at proper intervals.	Flush with hydraulic oil and replace return filter.

2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL

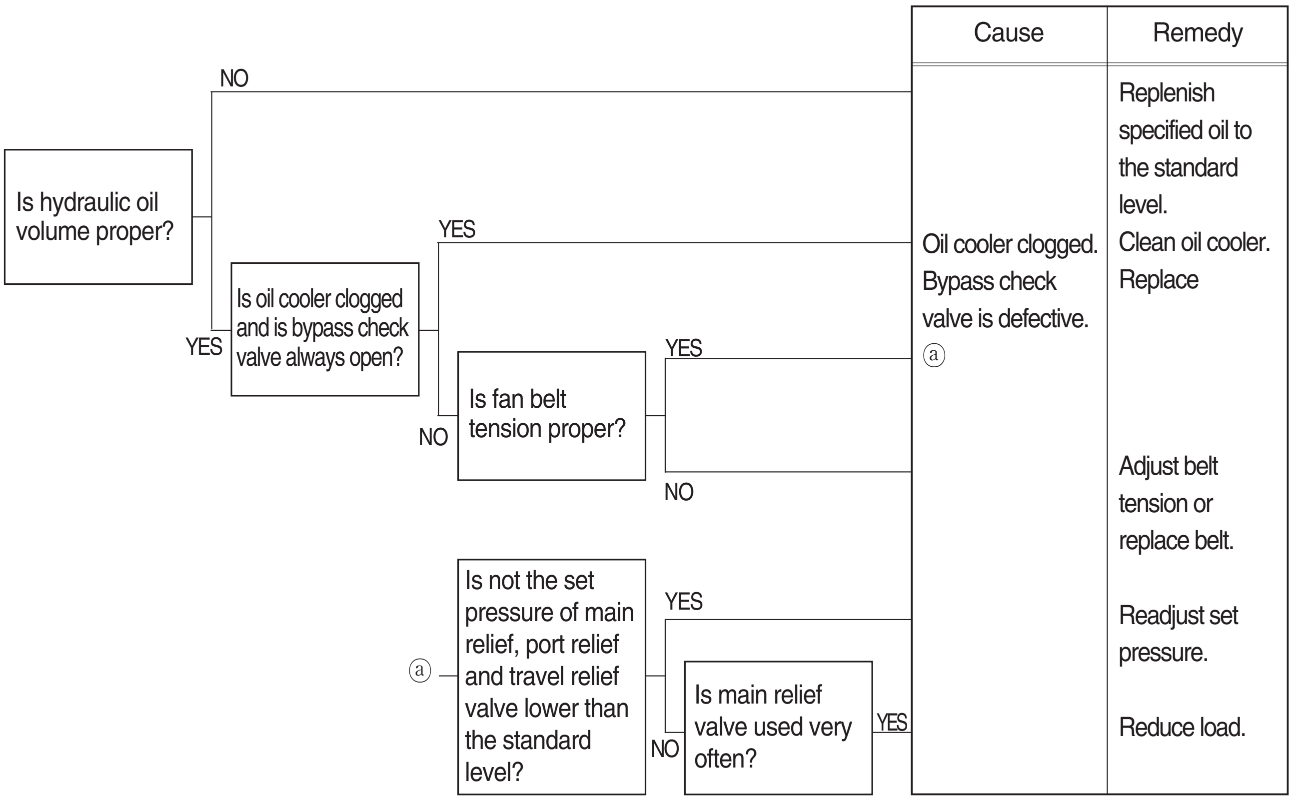


3. HYDRAULIC SYSTEM

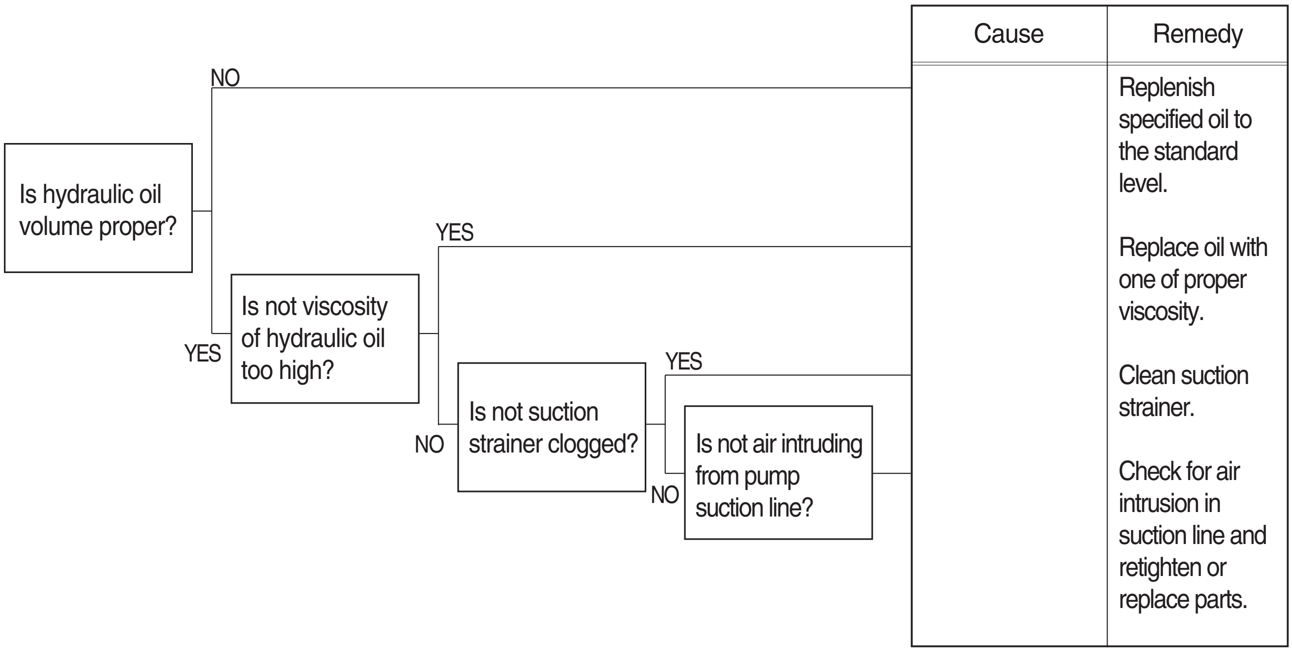
1) HYDRAULIC OIL IS CLOUDY



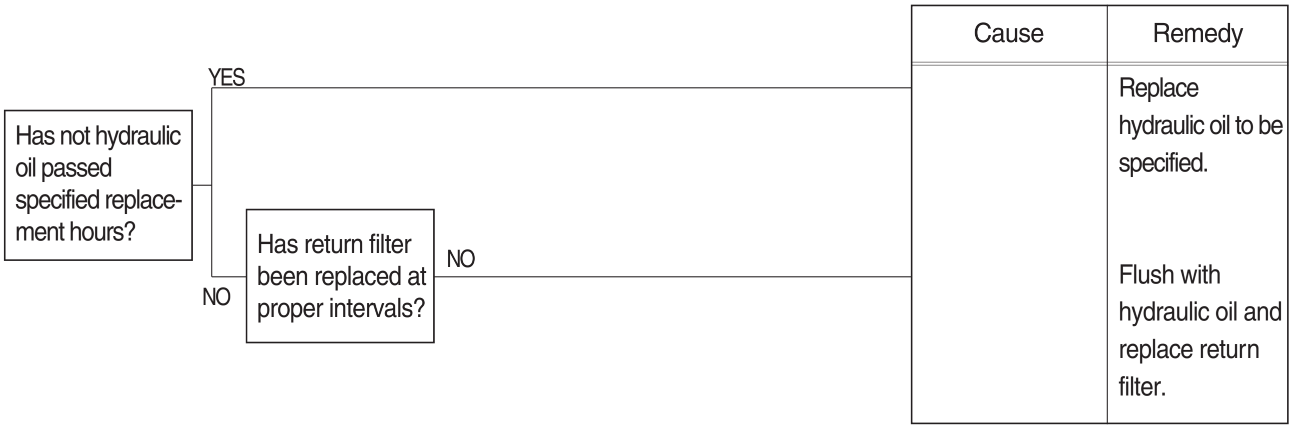
2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY



3) CAVITATION OCCURS WITH PUMP

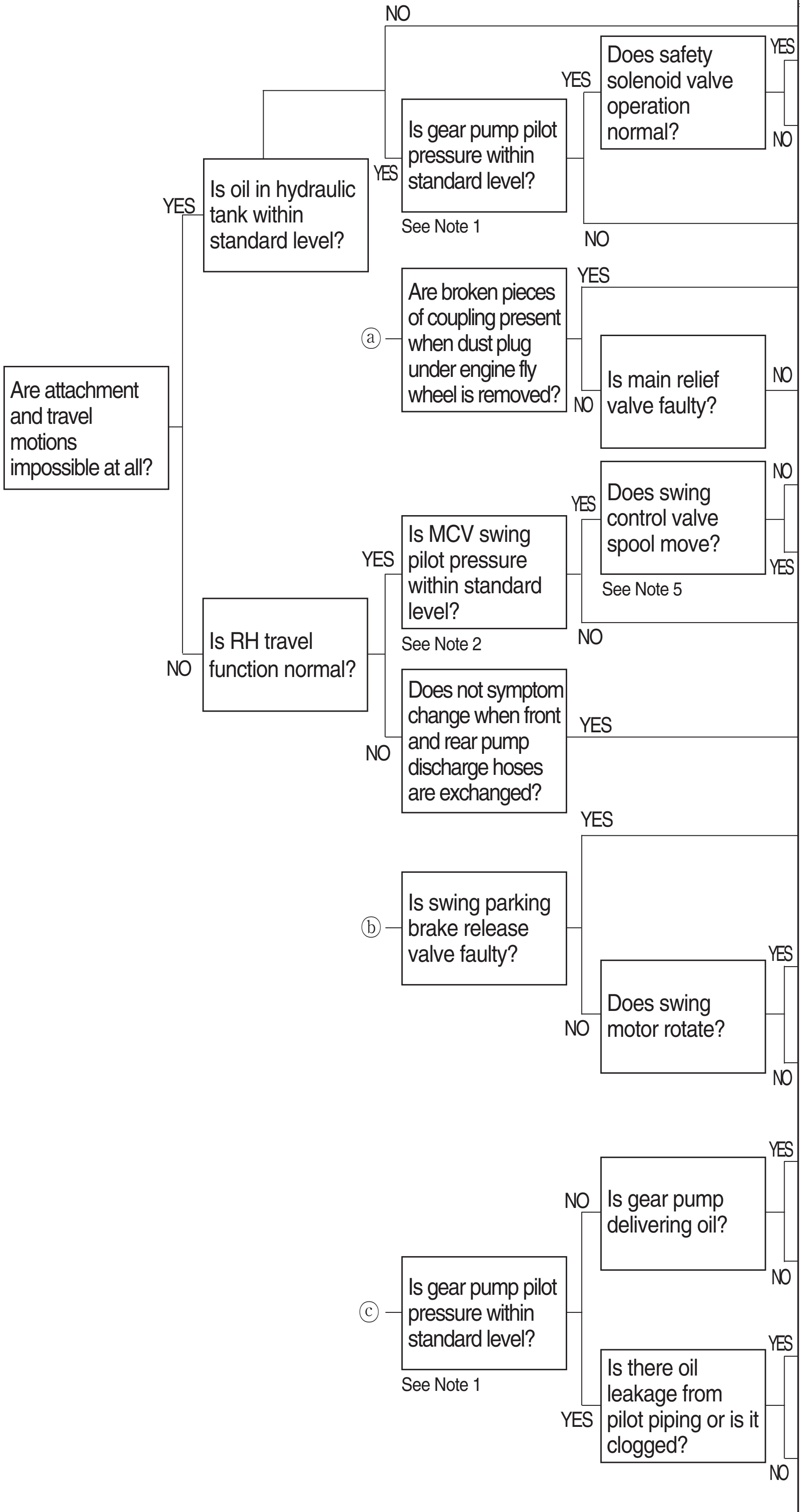


4) HYDRAULIC OIL IS CONTAMINATED



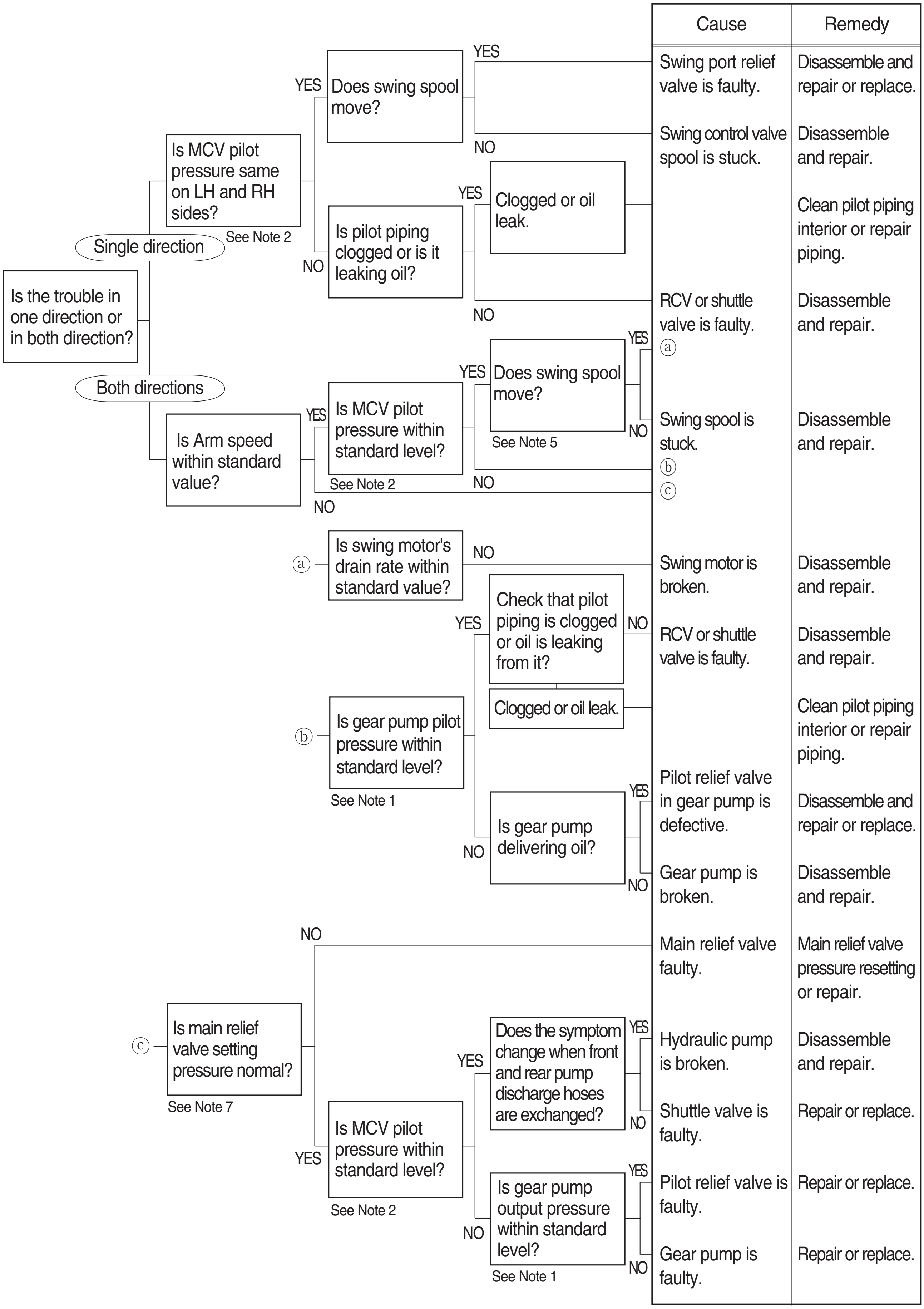
4. SWING SYSTEM

1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE

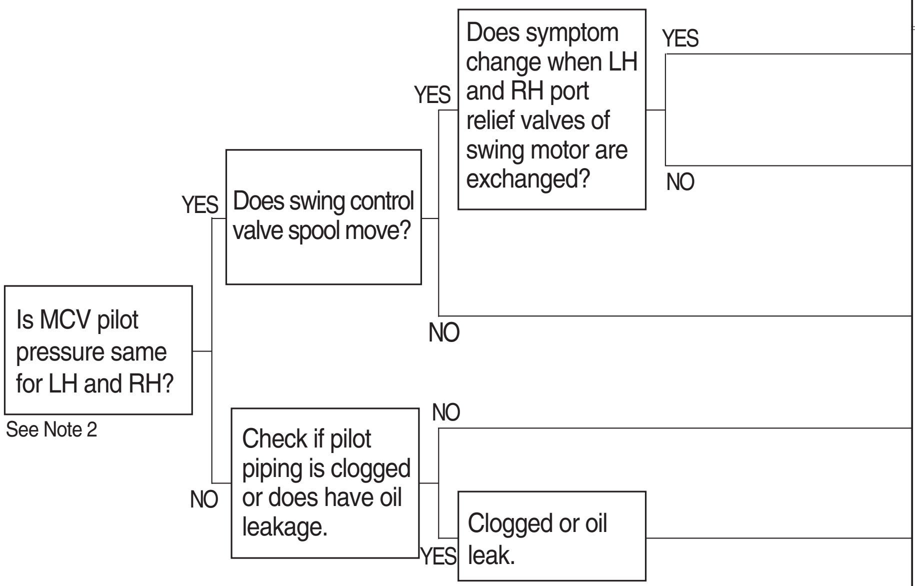


Cause	Remedy
	Replenish specified oil to the standard level.
ⓐ	
Safety solenoid valve faulty or not operated.	Repair or replace.
Gear pump faulty.	Repair or replace.
Pump connection coupling is broken.	Disassemble and repair.
Hydraulic pump is out of order.	Disassemble and repair.
Swing control valve 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.
	Clean pilot piping interior or repair piping.
RCV is broken.	Disassemble and repair.

2) SWING SPEED IS LOW

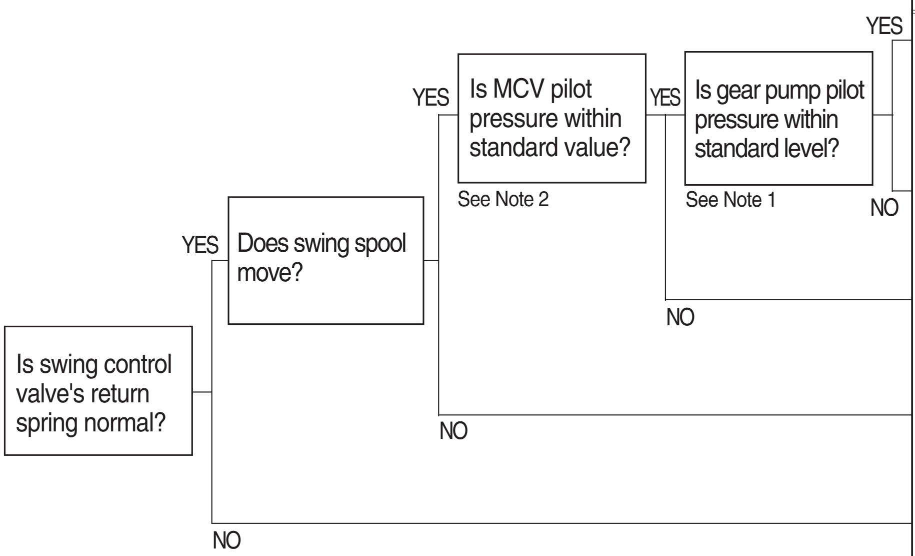


3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



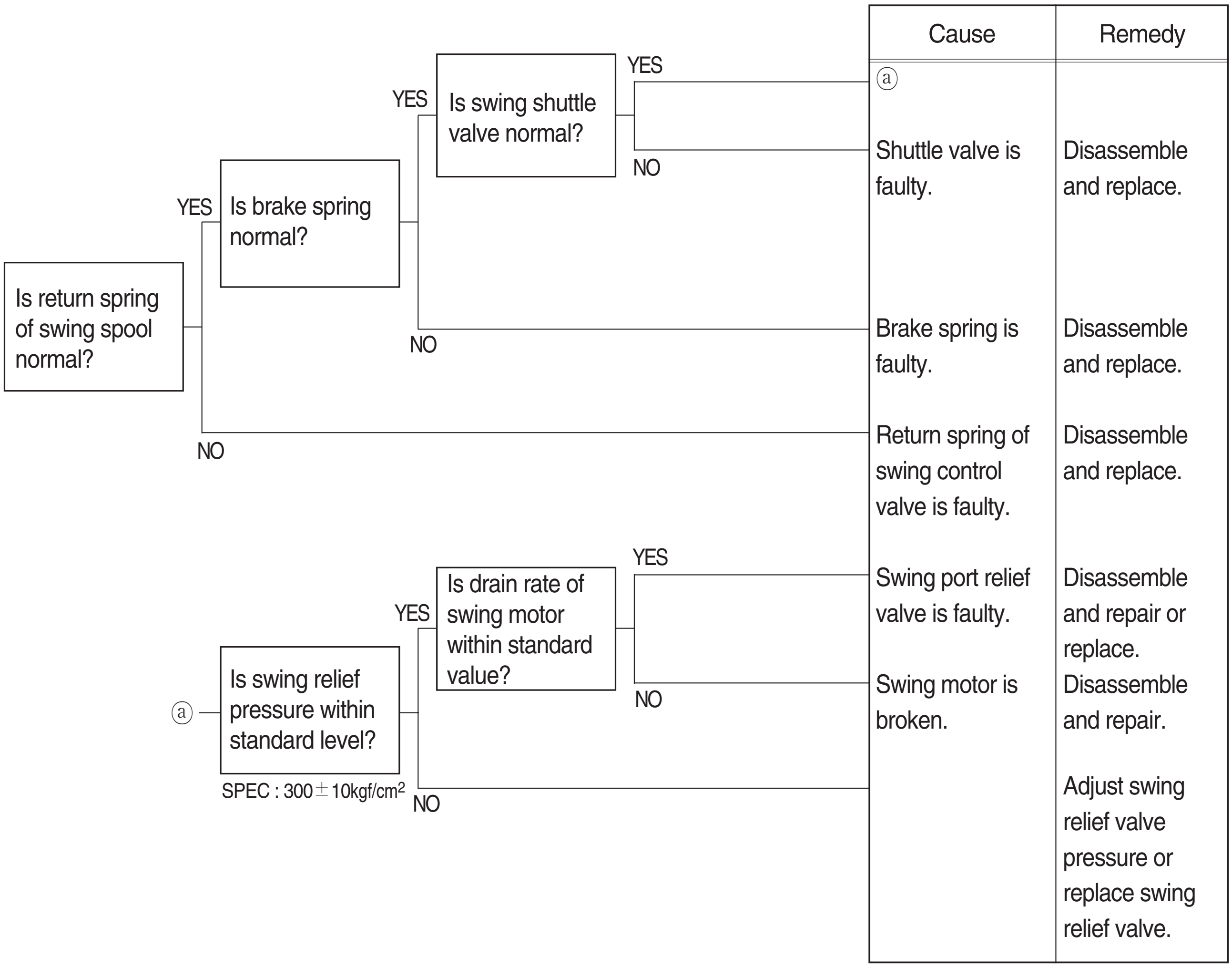
Cause	Remedy
Swing port relief valve is faulty.	Disassemble and repair.
Shuttle valve is faulty.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
RCV is faulty.	Disassemble and repair.
	Clean pilot piping interior or repair piping.

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



6) LARGE SHOCK OCCURS WHEN STOP SWINGING

Is swing RCV output pressure at neutral and in swing operation within standard level?

- YES → Is time delay valve is normal?
  - YES → Swing motor is broken.
  - NO → Time delay valve is faulty.
- NO → Malfunction of swing RCV

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

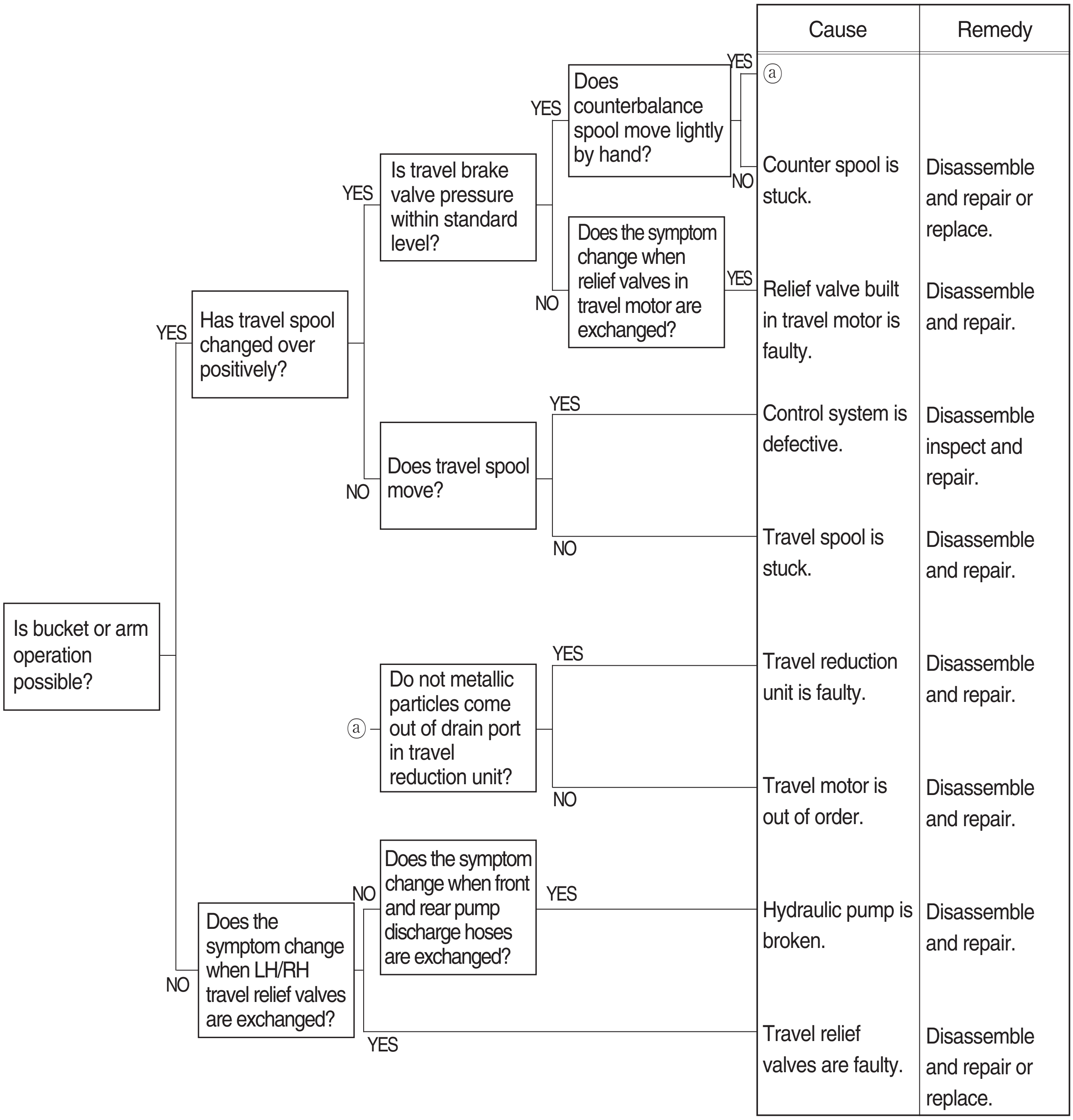
Is relief valve setting pressure nomal?

- YES → Is there a leakage on suction check valve?
  - YES → Seal of suction valve is faulty.
  - NO → Internal defect of swing motor.
- NO → Malfunction of relief valve.

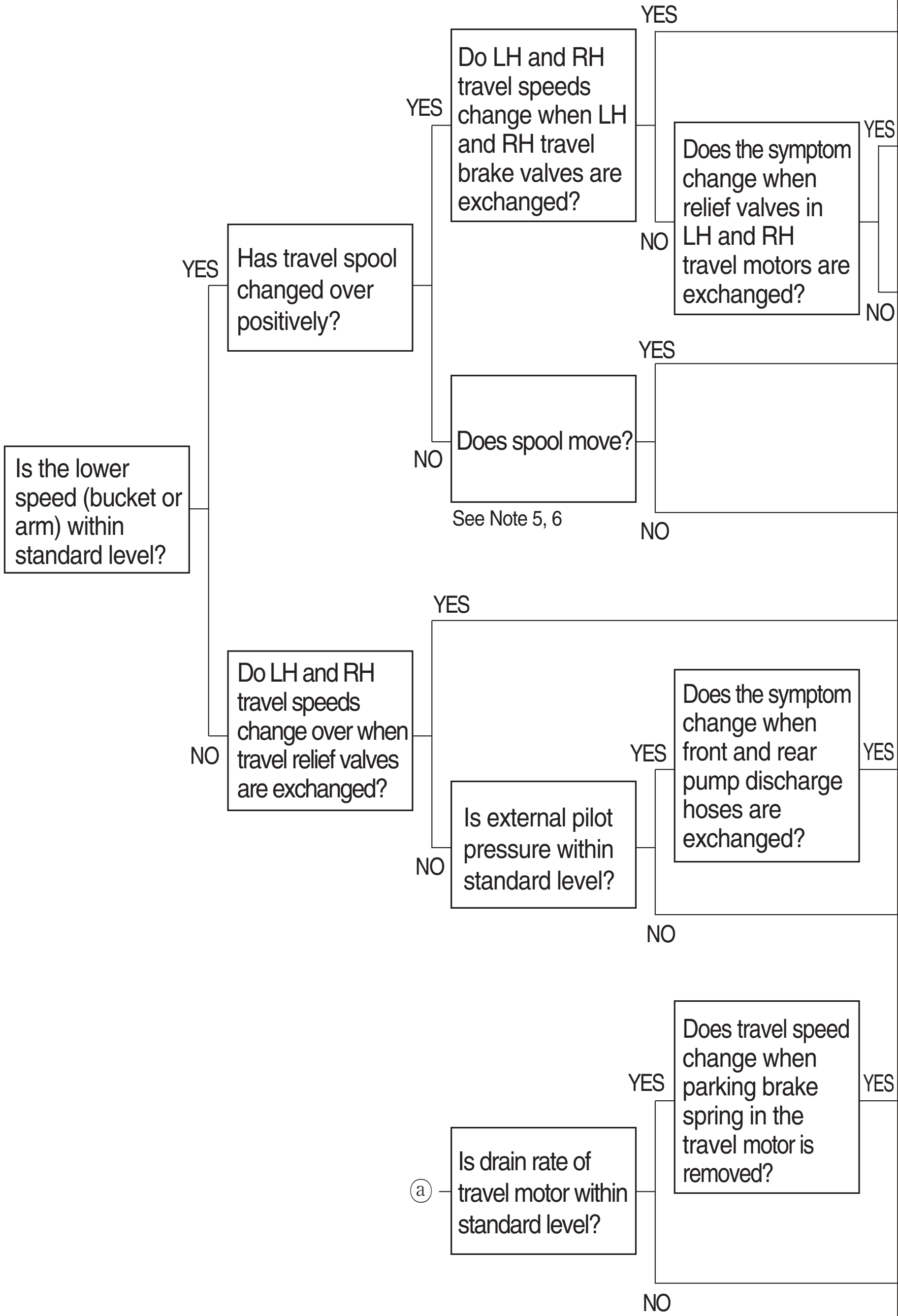
Cause	Remedy
Seal of suction valve is faulty.	Disassemble and repair.
Internal defect of swing motor.	Disassemble and repair.
Malfunction of relief valve.	Adjust swing relief valve pressure or replace swing relief valve.

5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION AT ALL ON ONE SIDE



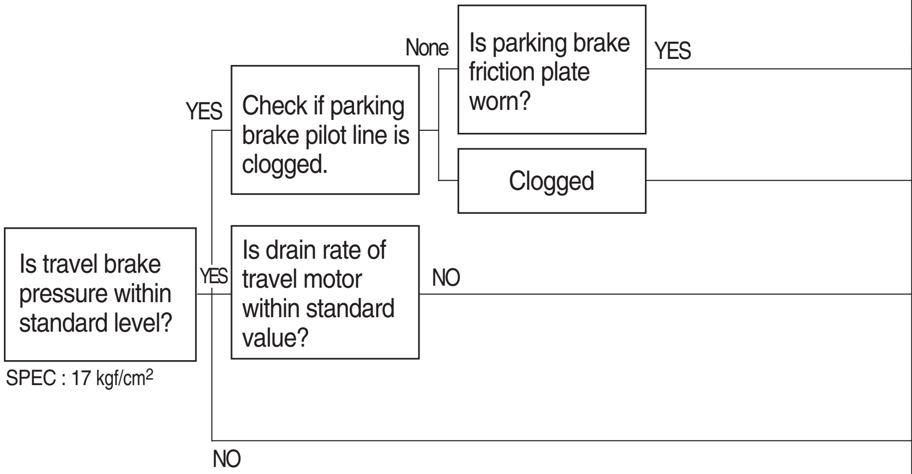
2) SPEED ON ONE SIDE FALLS AND THE MACHINE CURVES



Cause	Remedy
Brake valve is defective.	Disassemble and repair or replace.
Relief valve built in travel motor is faulty.	Disassemble and repair.
Control system is faulty .	Disassemble, inspect and repair.
Control valve spool is stuck.	Disassemble and repair.
Travel relief valve is faulty.	Disassemble and repair or replace.
Hydraulic pump is broken.	Disassemble and repair.
External pilot piping is clogged or oil is leaking from it.	Disassemble and clean.
Travel motor's parking brake is not released properly.	Disassemble and clean pilot piping.
Travel motor is faulty.	Disassemble and repair.

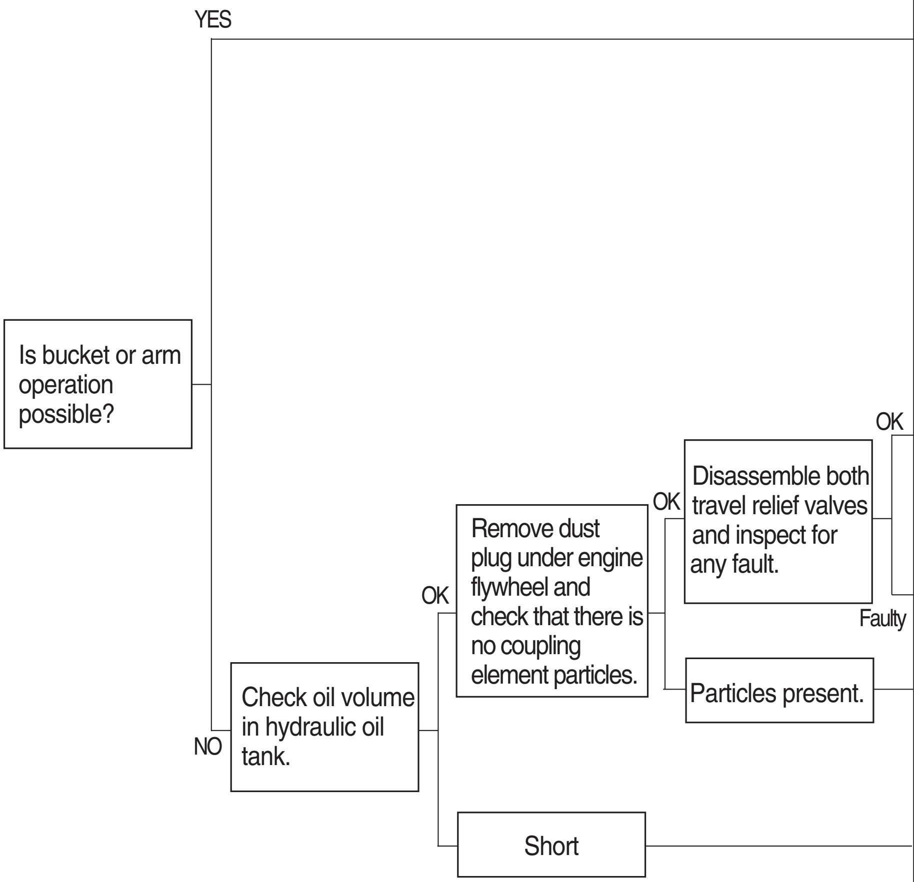
3) MACHINE DOES NOT STOP ON A SLOPE

Machine is pulled forward as sprocket rotates during digging operation.



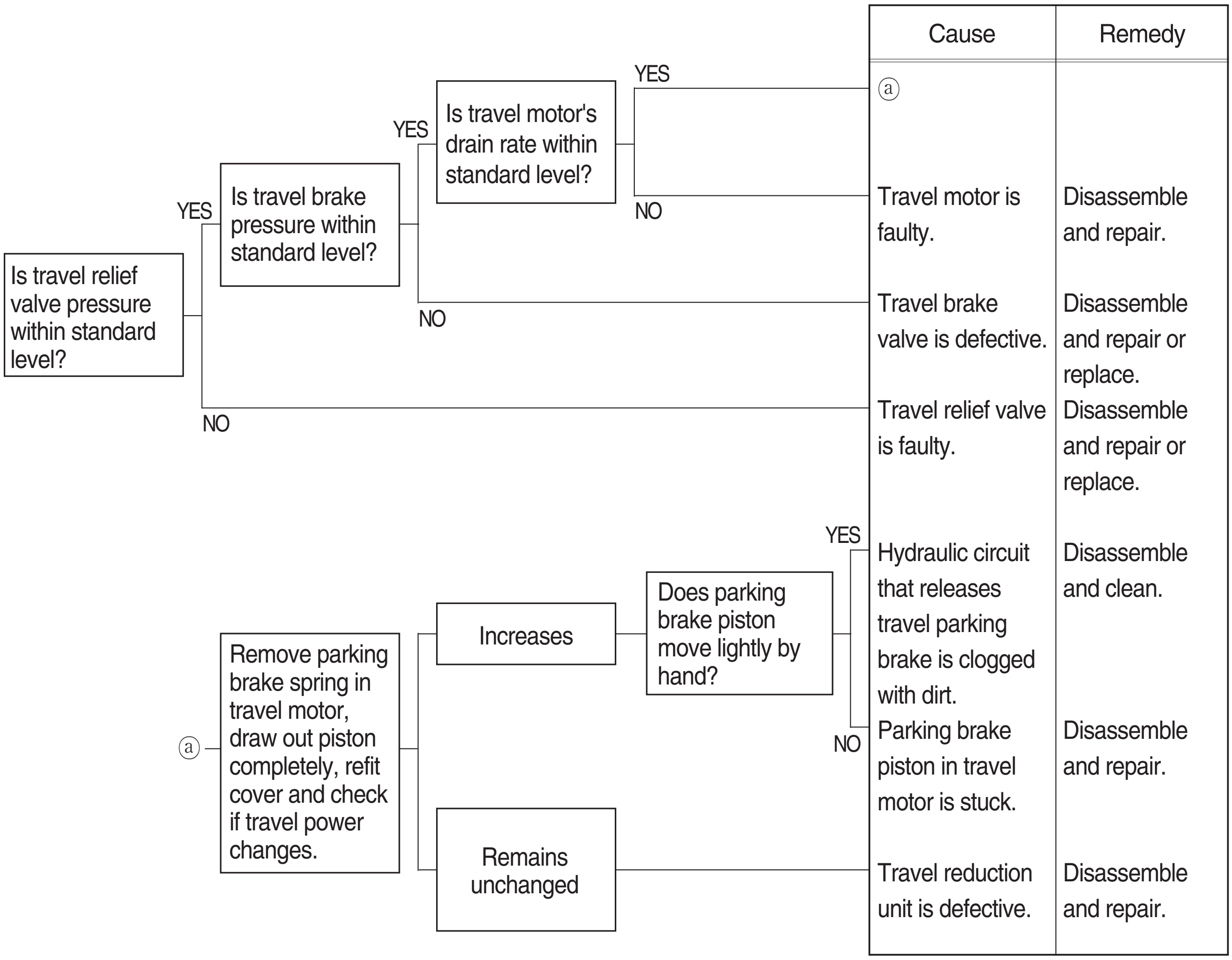
Cause	Remedy
Friction plate is faulty.	Disassemble and repair.
	Disassemble and clean pilot piping.
Travel motor is defective.	Disassemble and repair.
Brake valve is faulty.	Disassemble and repair or replace.

4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE



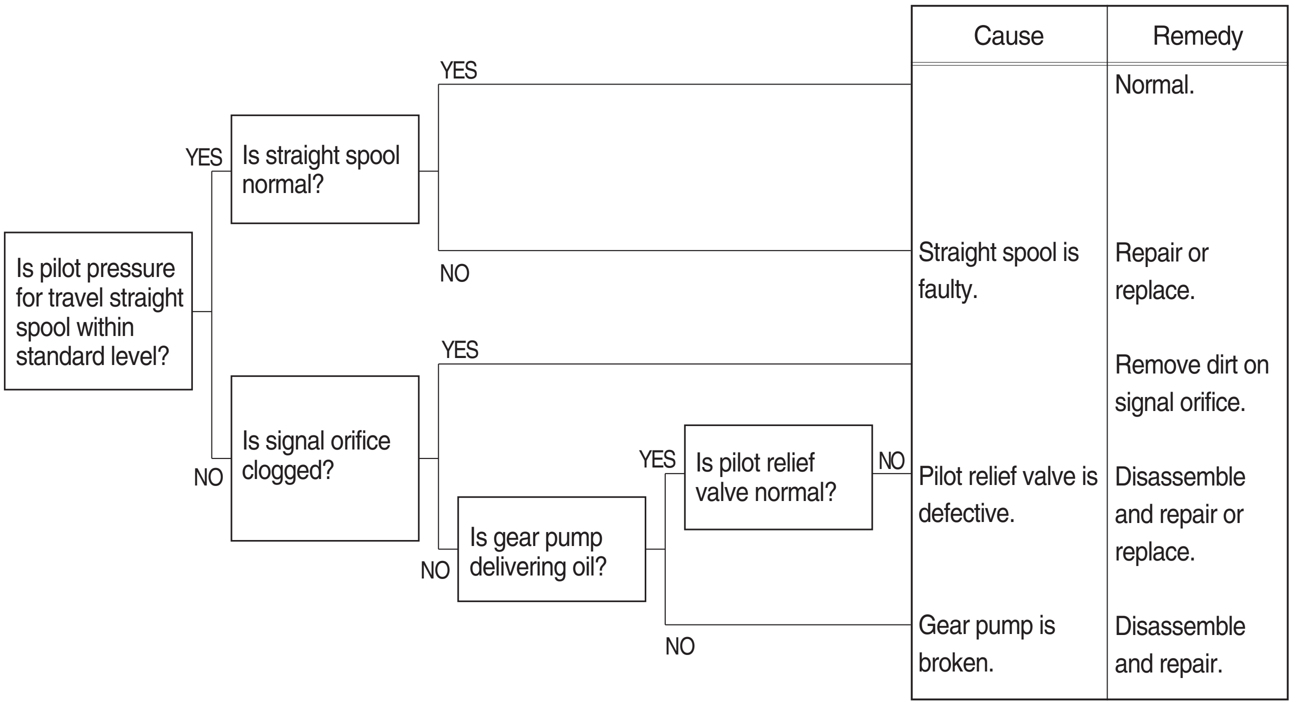
Cause	Remedy
	Inspect according to the procedure "Travel does not function at all on one side." However, a case where both LH and RH travel motions are disabled is extremely seldom statistically.
Hydraulic pump is faulty.	Disassemble and repair.
Travel relief valve is faulty.	Disassemble and repair or replace.
Coupling at pump connection is broken.	Disassemble and repair.
	Replenish hydraulic oil.

5) TRAVEL ACTION IS POWERLESS (travel only)



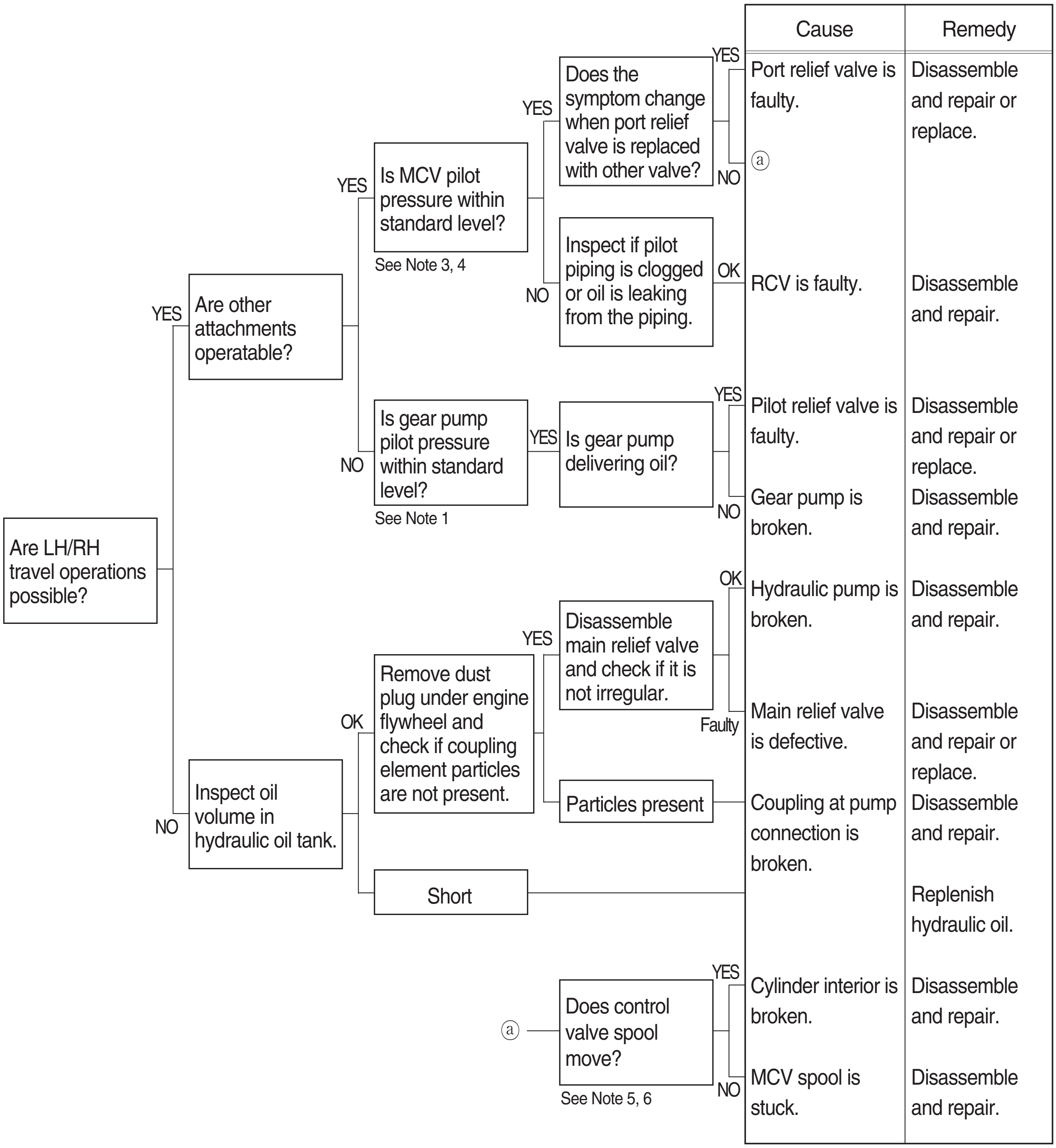
6) MACHINE RUNS RECKLESSLY ON A SLOPE

7) MACHINE MAKES A CURVED TRAVEL OR DOES NOT TRAVEL AT ALL WHEN TRAVEL AND ATTACHMENT OPERATIONS ARE EXECUTED AT THE SAME TIME

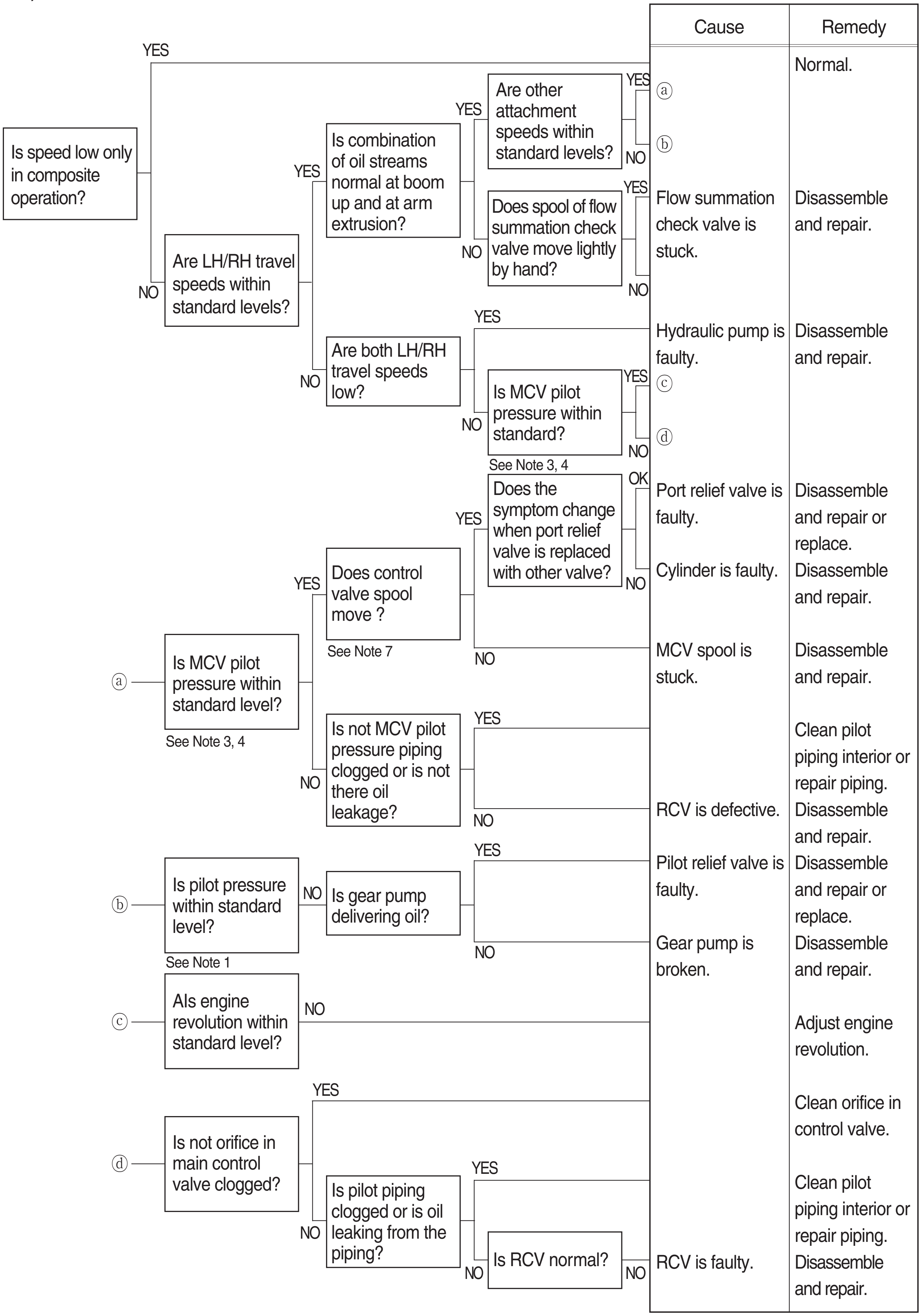


6. ATTACHMENT SYSTEM

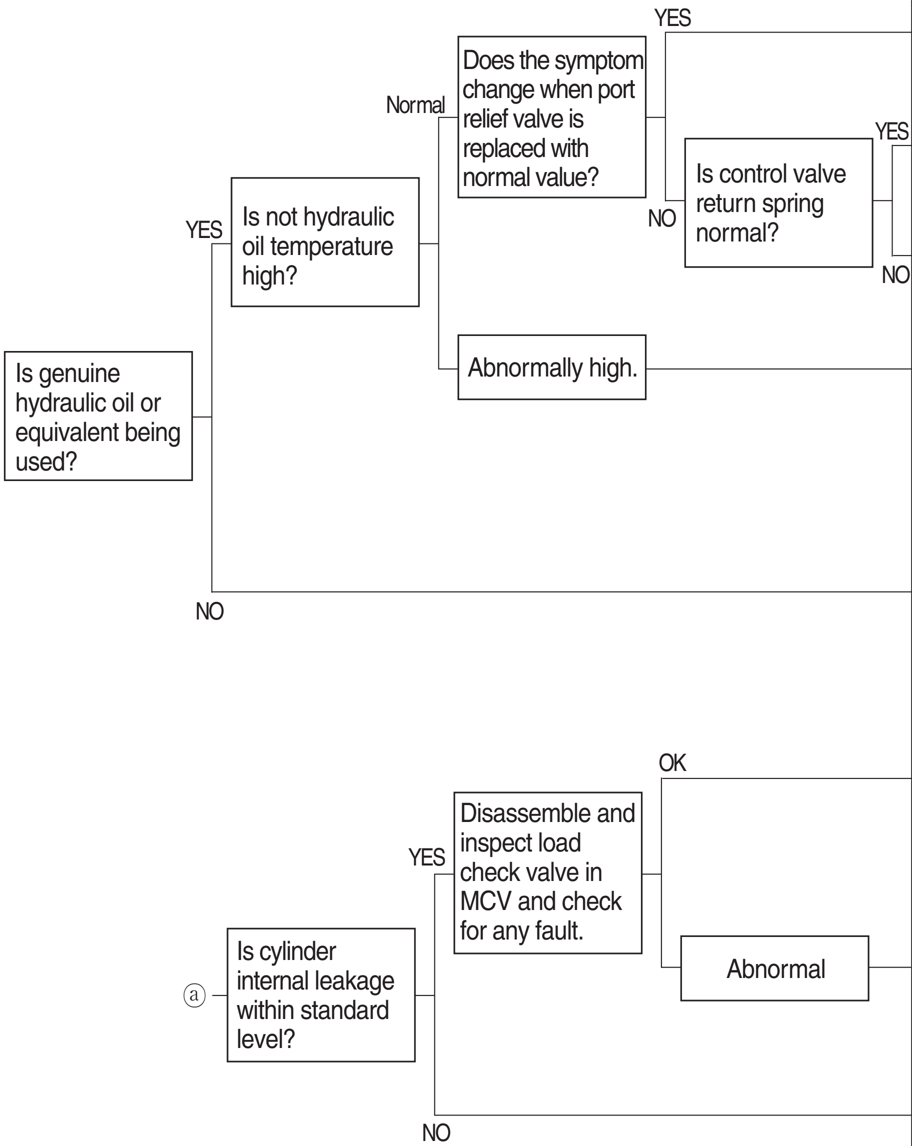
1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



2) BOOM, ARM OR BUCKET SPEED IS LOW

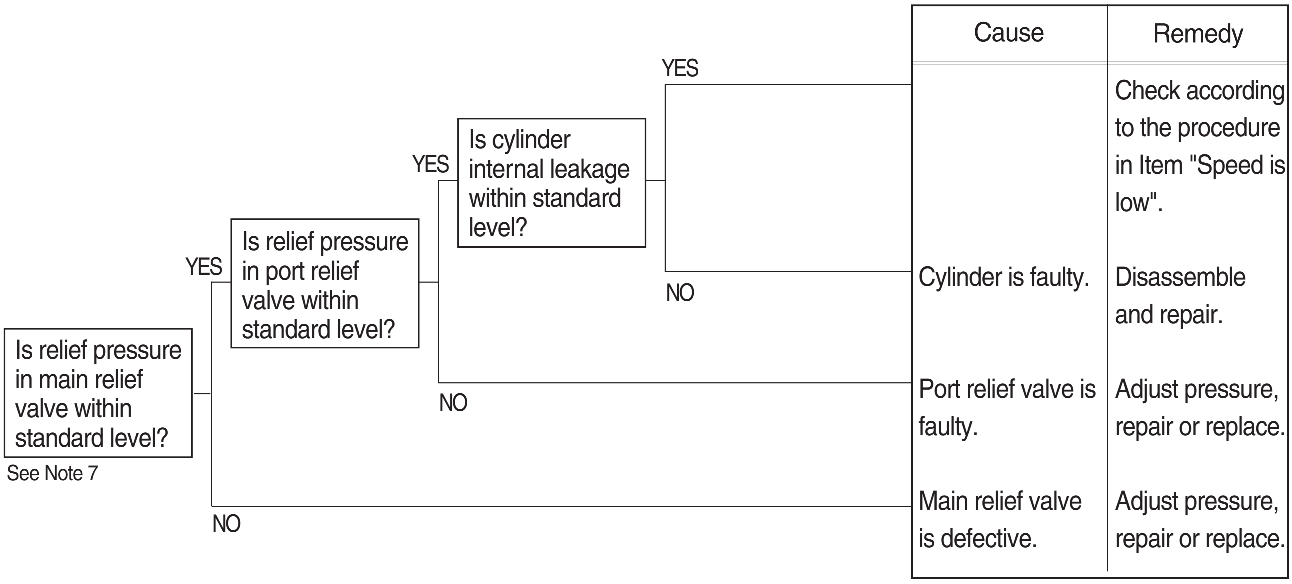


3) BOOM, ARM OR BUCKET CYLINDER EXTENDS OR CONTRACTS ITSELF AND ATTACHMENT FALLS

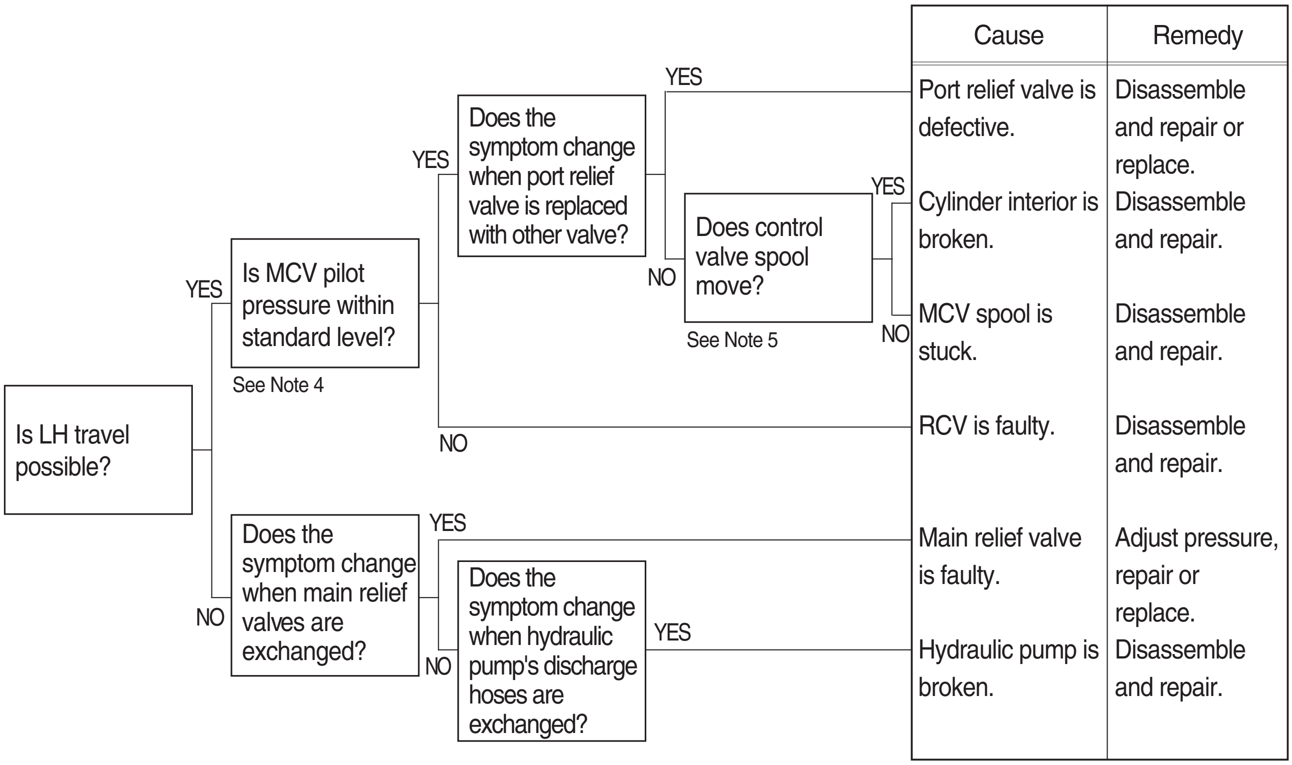


Cause	Remedy
Port relief valve is faulty.	Disassemble and repair or replace.
Control valve's return spring is faulty.	Disassemble and replace.
	Locate the cause of hydraulic oil temperature rise and lower it to proper level.
	Replace with genuine hydraulic oil or equivalent.
Pressure tightness between control valve casing and spool is poor.	Disassemble and repair.
Contact surface between poppet and seat is poor.	Disassemble and repair.
Cylinder is faulty.	Disassemble and repair.

4) BOOM, ARM OR BUCKET POWER IS WEAK



5) ONLY BUCKET OPERATION IS TOTALLY IMPOSSIBLE



6) BOOM MAKES A SQUEAKING NOISE WHEN BOOM IS OPERATED

Is boom foot pin greased sufficiently?

	Cause	Remedy
YES		Frictional noise occurs between the sliding faces of boom cylinder's oil seal and boom proper. ※ Frictional noise will disappear if they are kept used.
NO	Boom foot pin has run out of grease.	Supply grease to it. ※ If seizure is in an initial stage, supply sufficient grease. If seizure is in a grown state, correct it by paper lapping or with an oil stone.

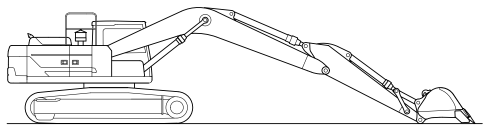
7) TIME LAG OF MACHINE WORKING IS LARGE.

Is overload relief valve for each spool working properly?

	Cause	Remedy
YES		Refer to 2)
NO	Overload relief valve is faulty.	Disassemble and repair.

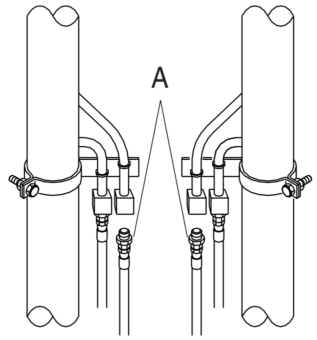
※ HOW TO CHECK INTERNAL BOOM CYLINDER LEAKAGE

1. Lower the bucket teeth to the ground with bucket cylinder fully retracted and arm cylinder rod retracted almost in full.



300L6TS01

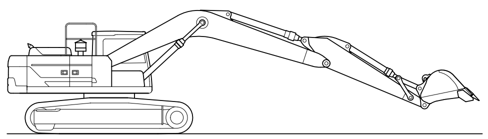
2. Disconnect hose (A) from rod side of boom cylinder and drain oil from cylinders and hose. (put cups on piping and hose ends)



(210-7) 6-20(2)

3. Raise bucket OFF the ground by retracting the arm cylinder rod.

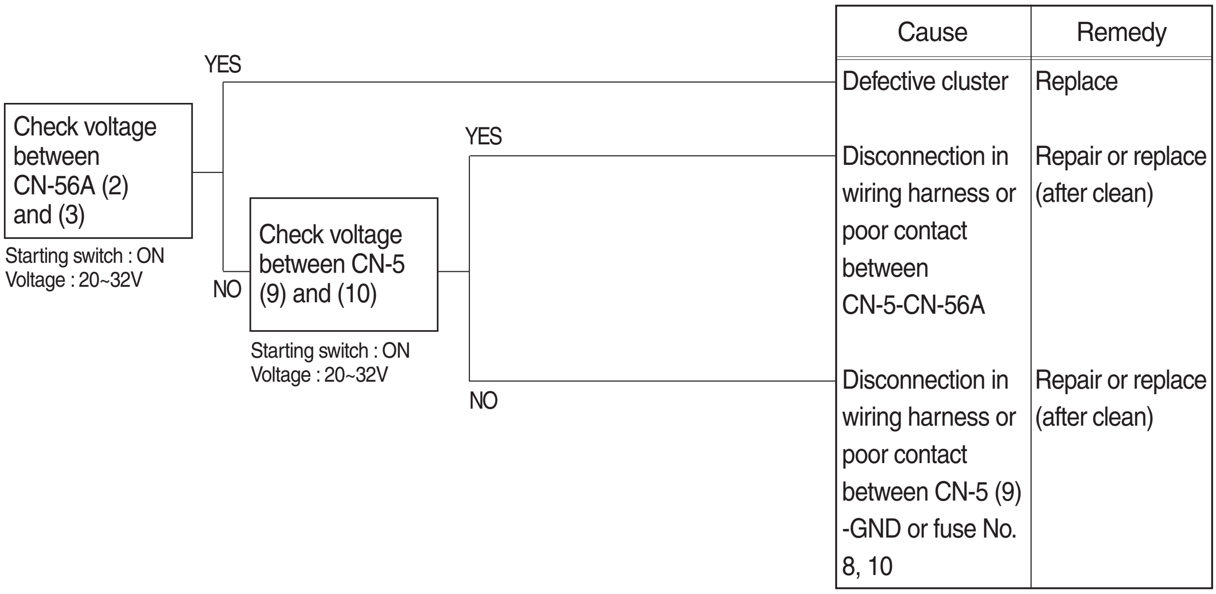
   If oil leaks from piping side and boom cylinder rod is retracted there is an internal leak in the cylinder.
   If no oil leaks from piping side and boom cylinder rod is retracted, there is an internal leak in the control valve.



300L6TS02

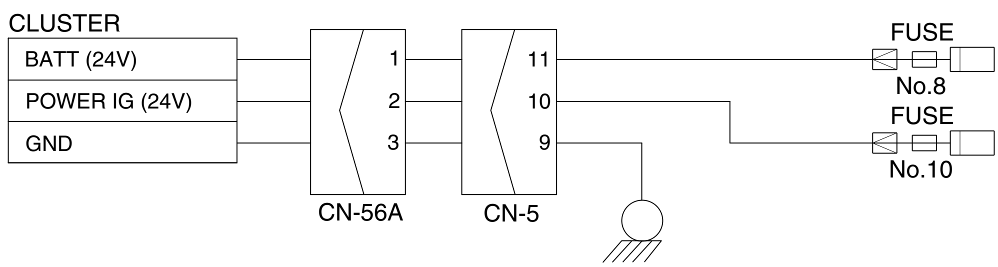
1. WHEN STARTING SWITCH IS TURNED ON, MONITOR PANEL DISPLAY DOES NOT APPEAR

· 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. 8, 10.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Check voltage

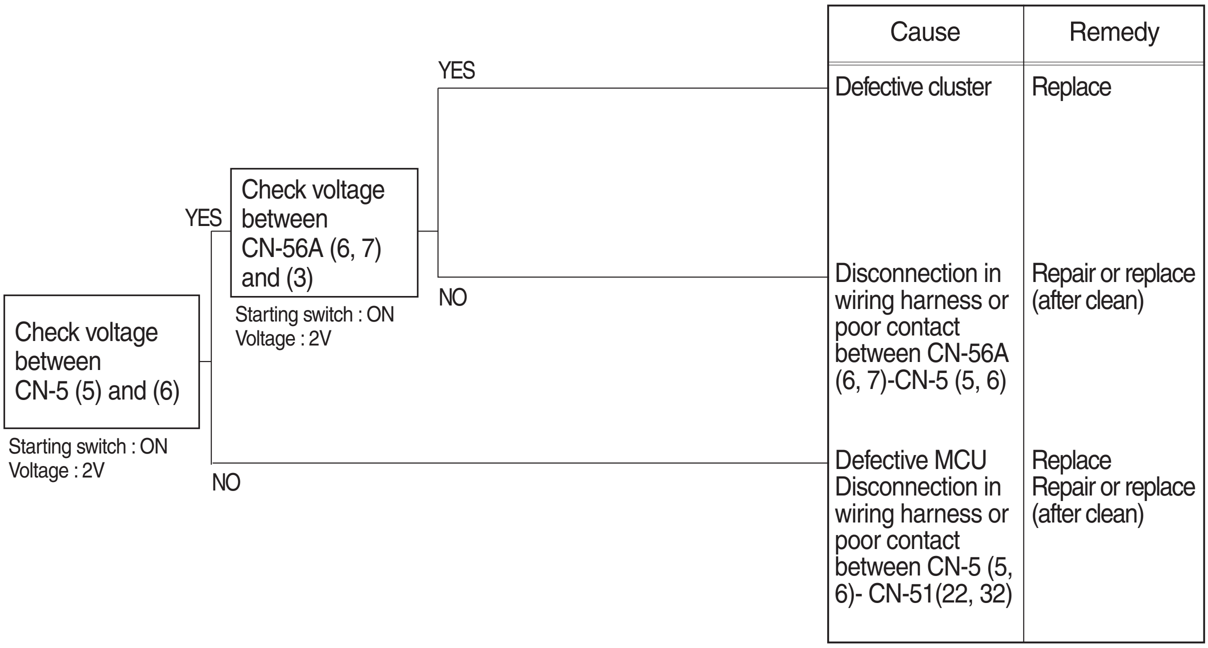
YES	20~32V
NO	0V



220S6ES01

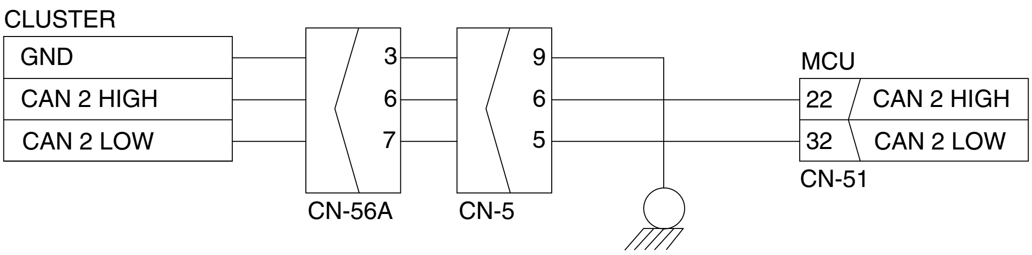
2. COMMUNICATION ERROR FLASHES ON THE CLUSTER (HCESPN 840, FMI 2)

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Check voltage

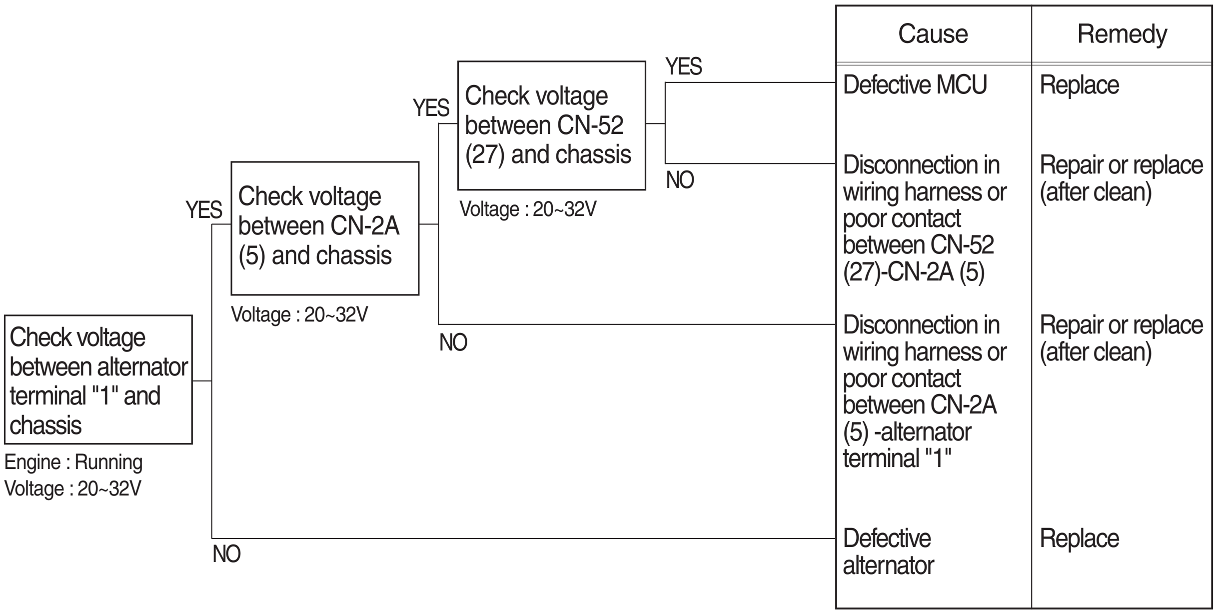
YES	2V
NO	0V



300L6ES02

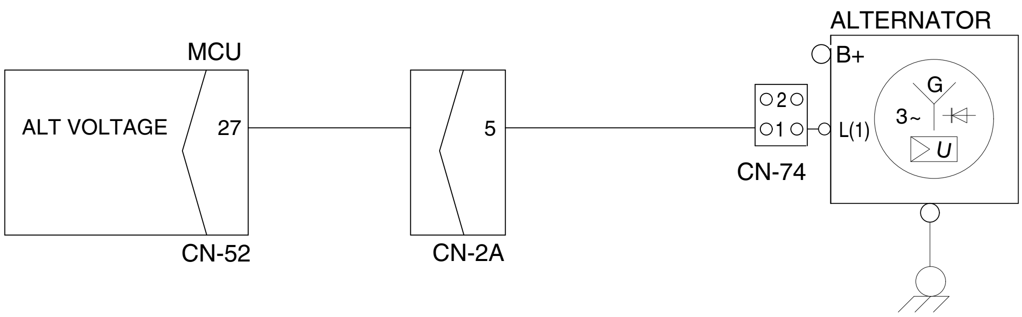
3. BATTERY CHARGING WARNING LAMP LIGHTS UP (Starting switch : ON)

· 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

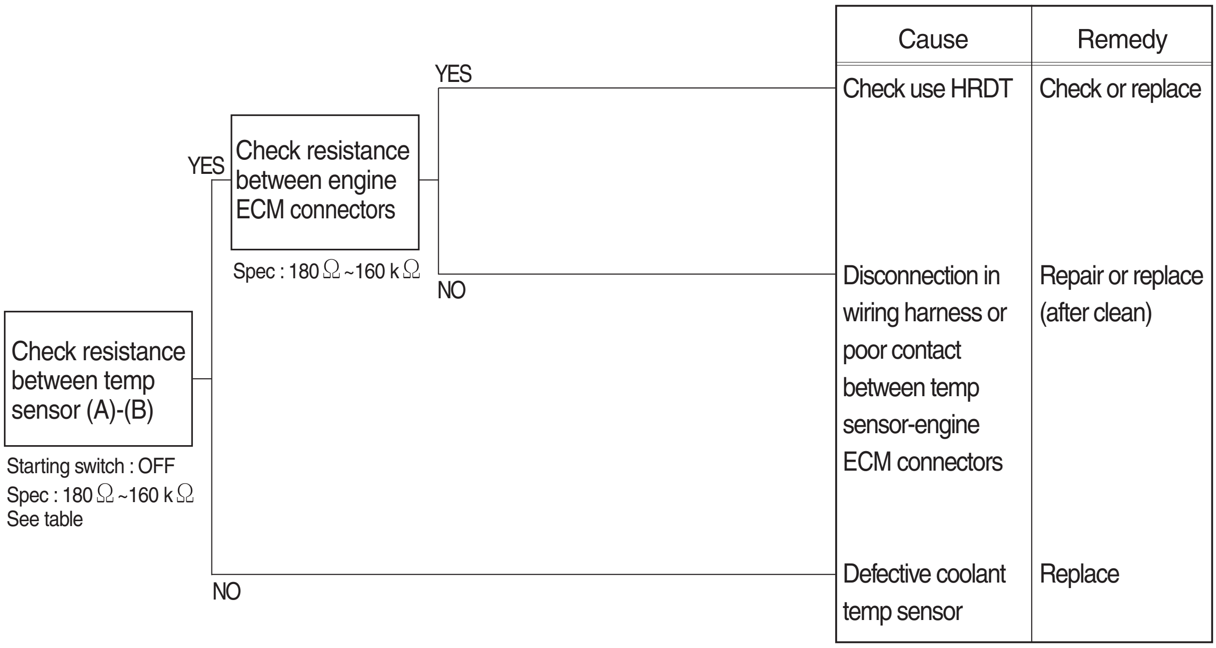
YES	20~32V
NO	0V



480SA6ES03

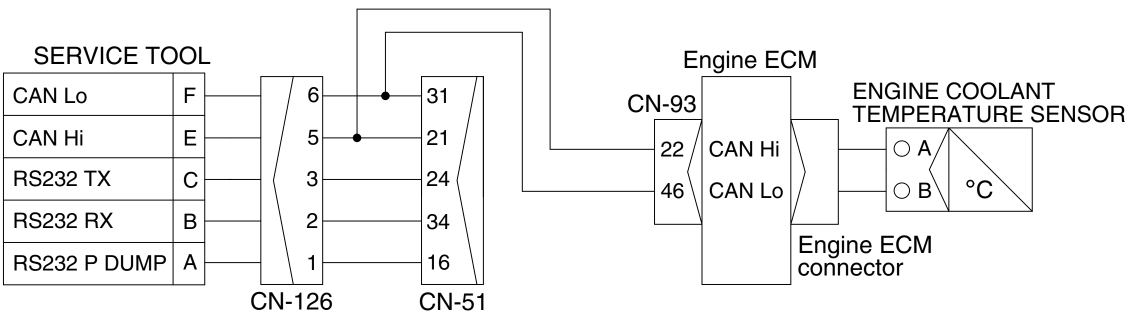
4. WHEN COOLANT OVERHEAT WARNING LAMP LIGHTS UP (engine is started)

· 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

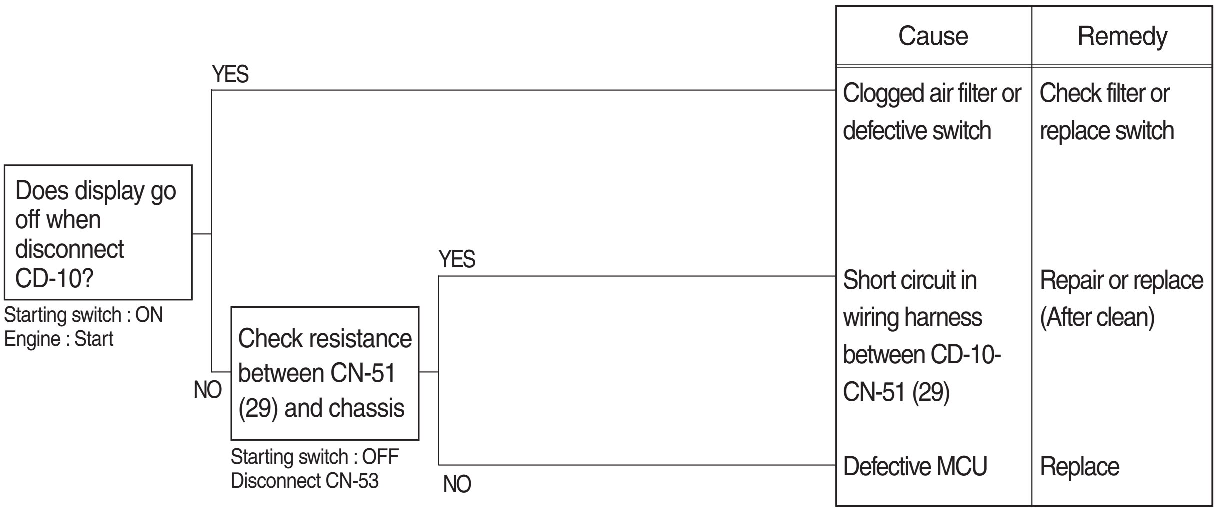
Temperature (˚C)	0	25	50	80	95
Resistance (kΩ)	30~37	9.3~10.7	3.2~3.8	1.0~1.3	0.7~0.8



480SA6ES04

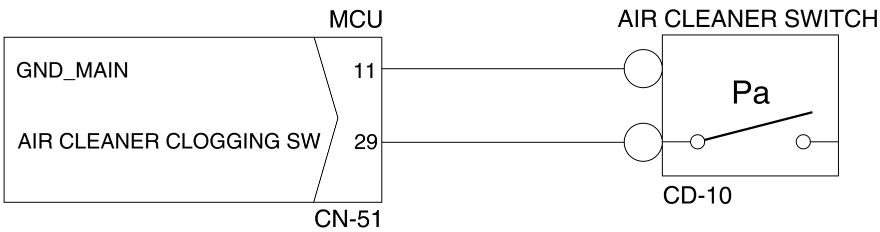
5. WHEN AIR CLEANER WARNING LAMP LIGHTS UP (engine is started)

· 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

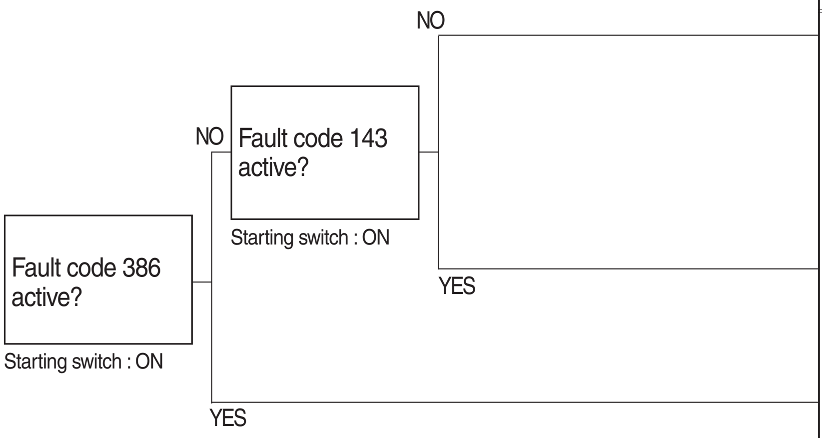
YES	MAX 1Ω
NO	MIN 1MΩ



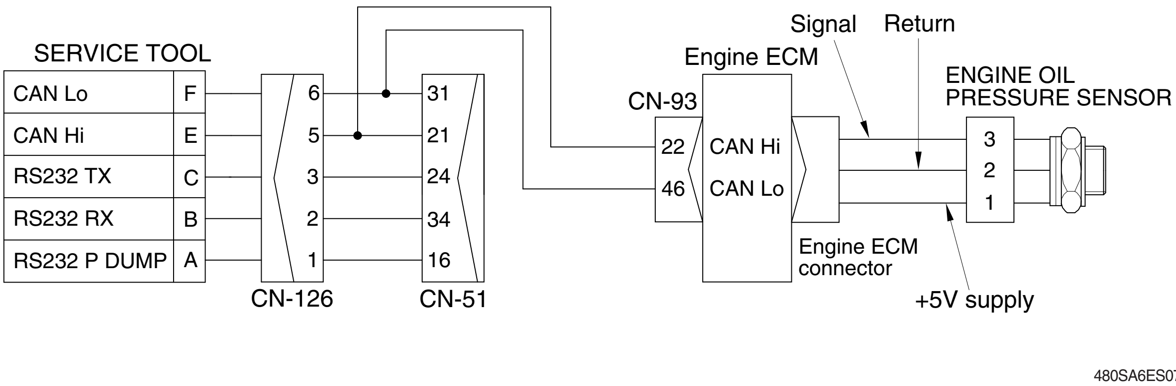
220S6ES05

6. WHEN ENGINE OIL PRESSURE WARNING LAMP LIGHTS UP (engine is started)

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective circuit, sensor or ECM.	Contact Cummins.
Voltage above normal or shorted to high source	Refer to engine fault code 143
Voltage above normal or shorted to high source	Refer to engine fault code 386



7. WHEN HYDRAULIC OIL TEMPERATURE WARNING LAMP LIGHTS UP (engine is started)

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

Does display go off when disconnect CD-1?
Starting switch : ON
Engine : Start

- YES → Resistance between CD-1 (1, 2) is in range of 164~151Ω?
  Starting switch : ON
  Disconnect CD-1
  - YES → High temperature
  - NO → Defective temp senser
- NO → Resistance between CN-52 (24) and chassis is 0~1Ω?
  Starting switch : OFF
  Disconnect CN-51
  - YES → Short circuit between temp senser and MCU
  - NO → Defective MCU

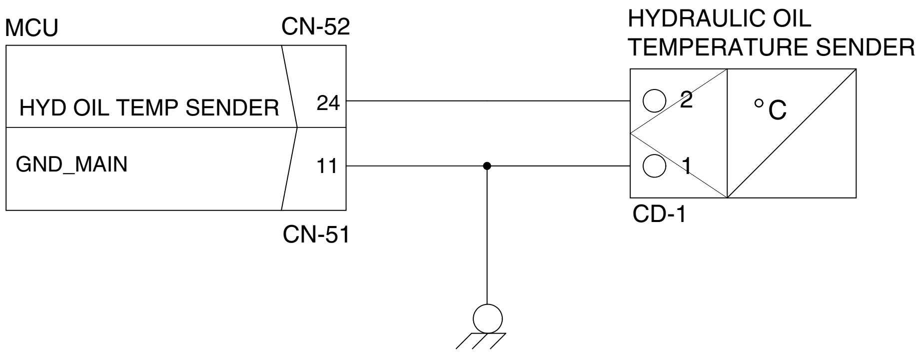
Cause	Remedy
High temperature	Check hydraulic system
Defective temp senser	Replace
Short circuit between temp senser and MCU	Repair or replace
Defective MCU	Replace

Normal type

Premium type

Check Table

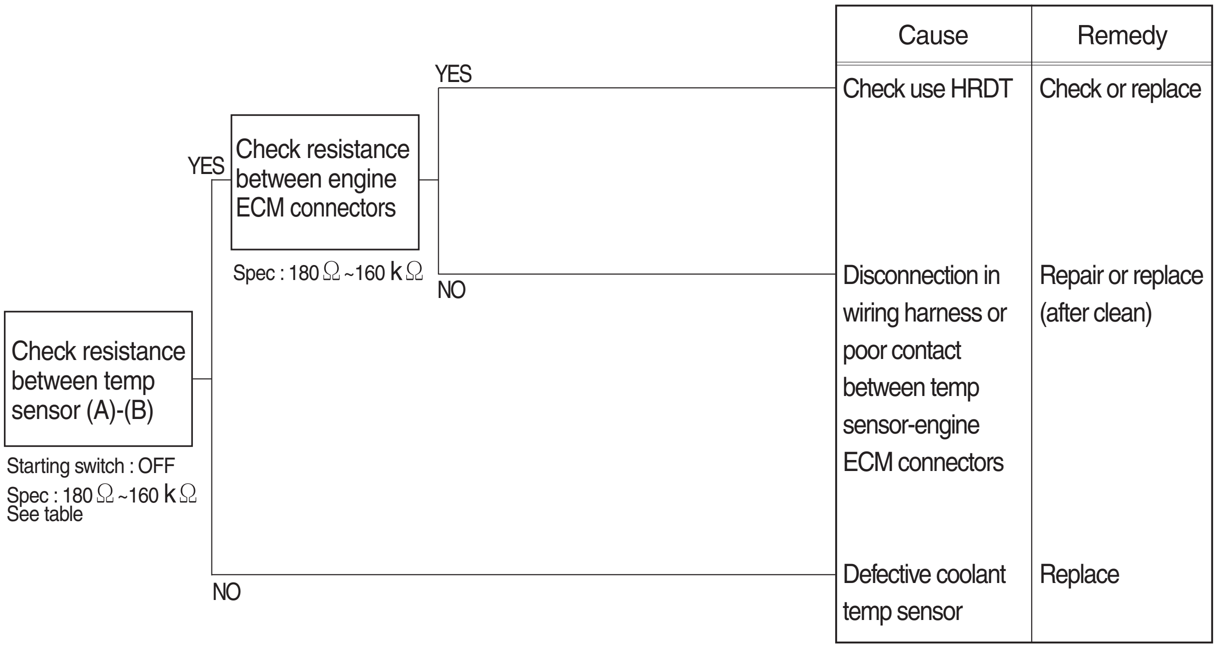
Temperature (˚C)	~ -30	~ -10	~ 0	~ 40	~ 70	~ 80	~ 90	~ 100	105~
Resistance (kΩ)	22.22 ~31.78	8.16 ~10.74	5.18 ~ 6.6	1.06 ~1.28	0.39 ~0.476	0.322 ~0.298	0.243 ~0.219	0.185 ~0.167	0.164 0.151



480SA6ES08

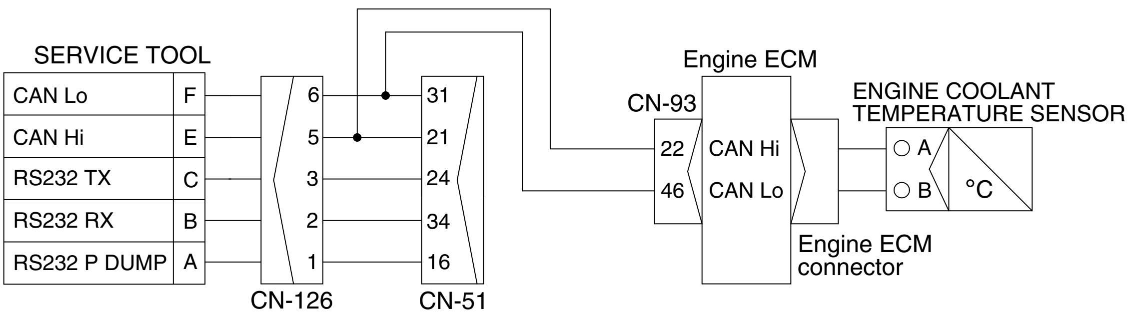
8. WHEN COOLANT TEMPERATURE GAUGE DOES NOT OPERATE (HCESPN 304, FMI 3 or 4) GAUGE DOES NOT OPERATE

· 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

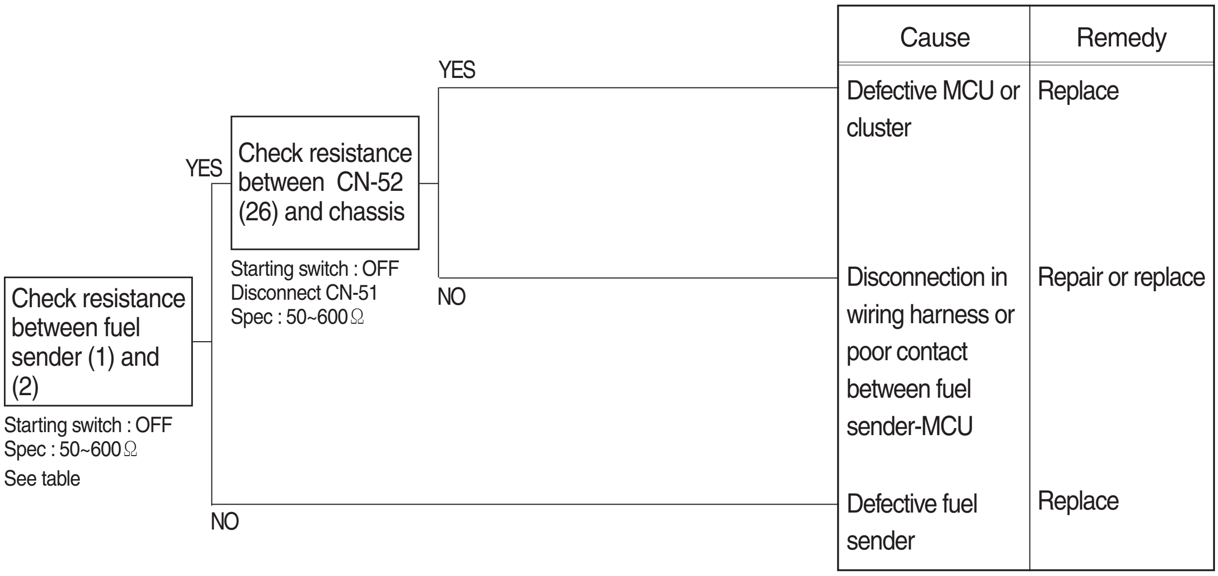
Temperature (˚C)	0	25	50	80	95
Resistance (kΩ)	30~37	9.3~10.7	3.2~3.8	1.0~1.3	0.7~0.8



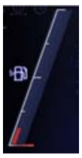
480SA6ES04

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.



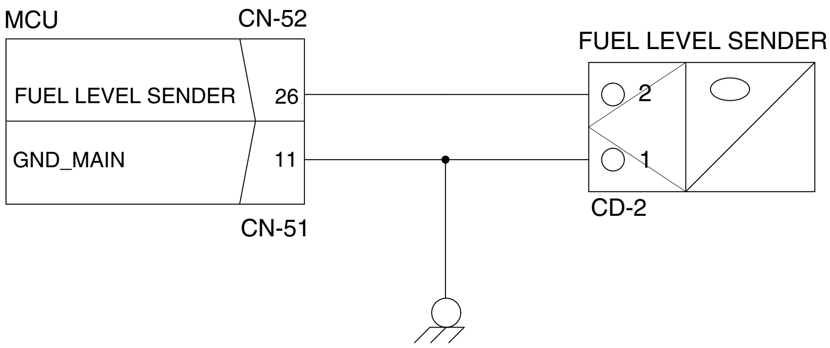
Normal type



Premium type

Check Table

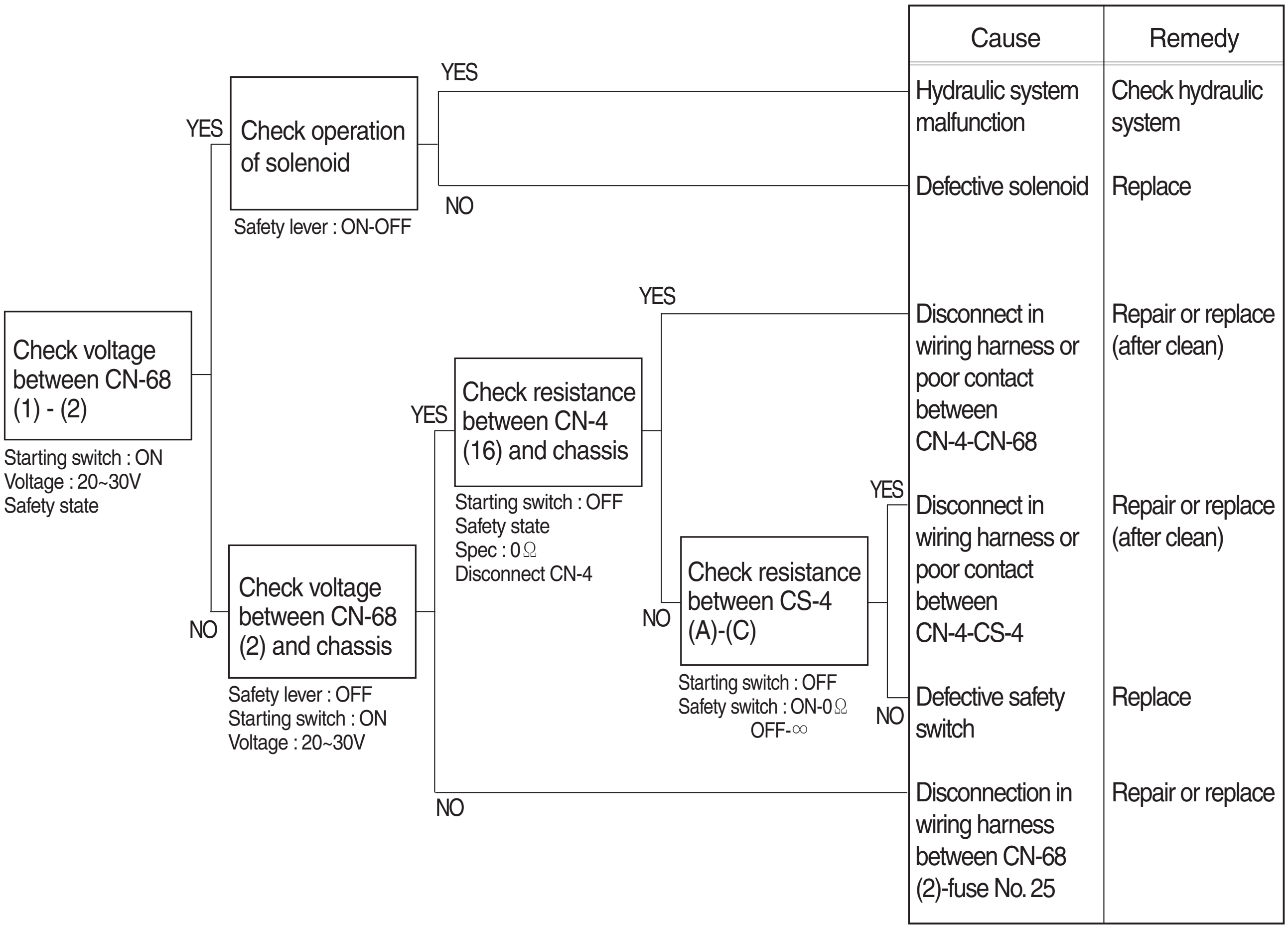
Range	Resistance (Ω)	Range	Resistance (Ω)
Full	50	5/12	400
11/12	100	4/12	450
10/12	150	3/12	500
9/12	200	2/12	550
8/12	250	1/12	600
7/12	300	Empty warning	700
6/12	350	-	-

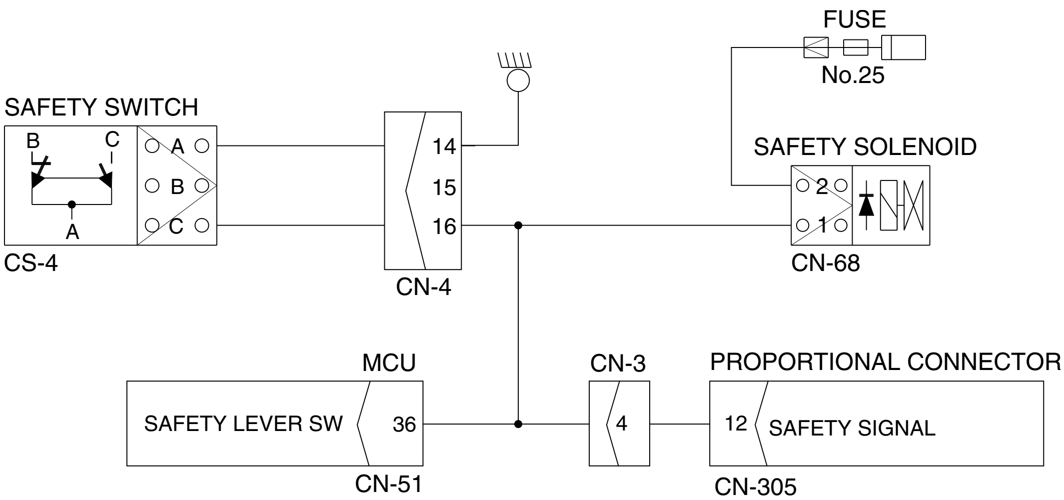


480SA6ES10

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. 25.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

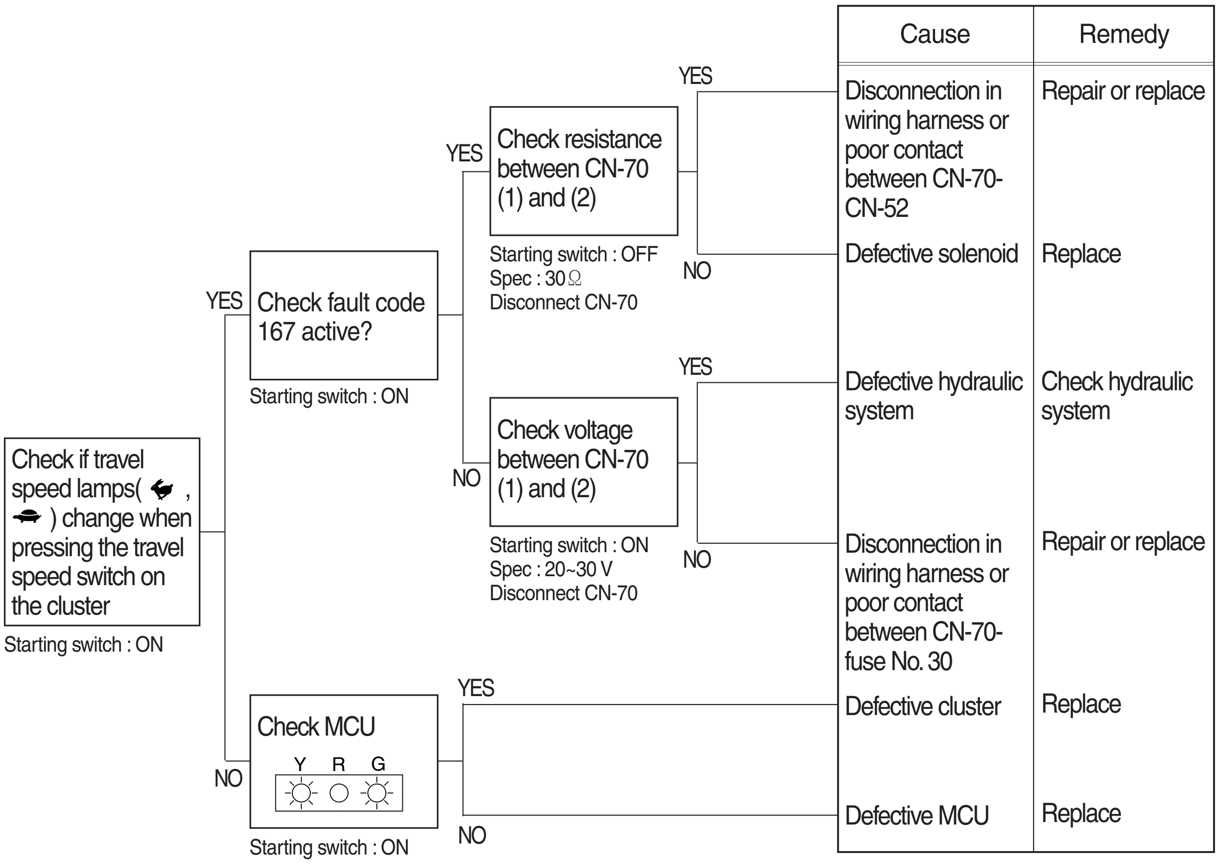


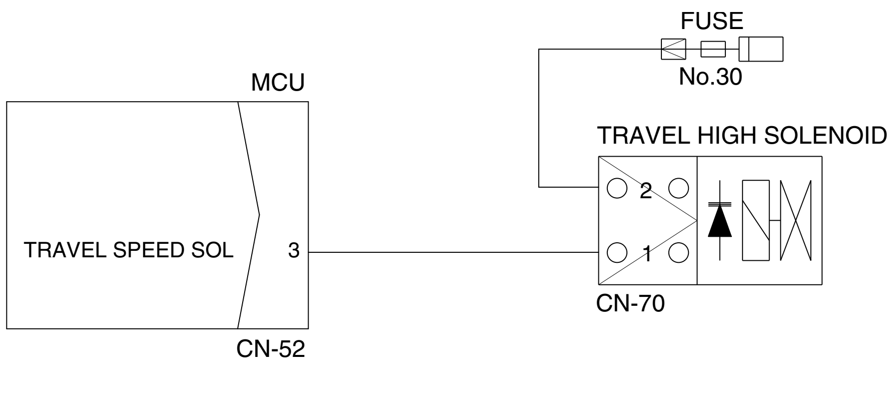


220SA6ES12

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. 30.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





12. TRAVEL ALARM DOES NOT SOUND OR DOES NOT STOP SOUNDING

Check the fuse for travel alarm inside fuse box whether fuse is blown or not

YES → The fuse is blown

NO → Check the signal of MCU's pin for back buzzer whether ground signal (DO) generate or not when machine travel mode.

YES → The travel alarm signal of united MCU is defective

NO → * Prepare with starting switch OFF, then turn start engine and carry out troubleshooting : Between CN-81 (2) - chassis ground : 20-30 voltage . Between CN-81 (1) - chassis ground : Max 1 Ω (resistance) Is the above value normal?

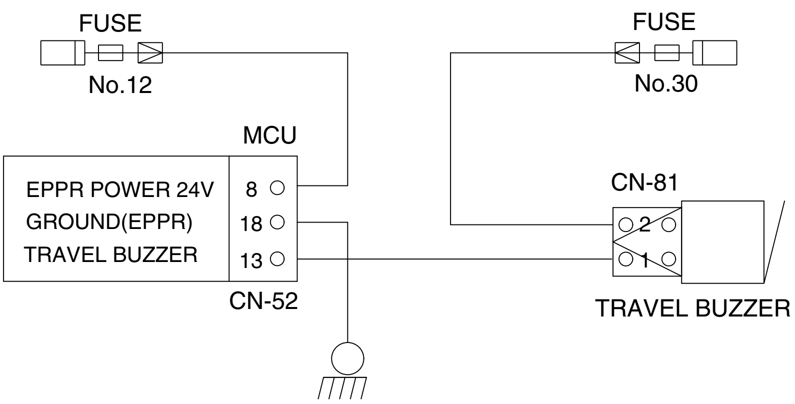
** Note : Since voltage value , connector number and pin number varies with each model, should refer to the electric circuit of each model.

YES → The travel buzzer is defective

NO → * Prepare with starting switch OFF, then carry out trouble-shooting without turning starting switch ON : 1. Disconnection in wiring or defective contact in connector between CN-81 (2) inline connector-end connector : Max 1 Ω (resistance) 2. Short circuit with ground circuit between CN-81 (2) inline connector-end connector - chassis ground : Min 1MΩ (resistance)

NO → In case of the value of resistance, disconnection in wiring or defective contact in connector or short circuit with ground circuit

Cause	Remedy
The fuse is blown	Replace the fuse
The travel alarm signal of united MCU is defective	Check the united MCU program
The travel buzzer is defective	Replace the travel buzzer
In case of the value of resistance, disconnection in wiring or defective contact in connector or short circuit with ground circuit	Replace connector Connect the wire



220SA6ES25

13. HORN DOES NOT SOUND

Check the fuse for horn inside fuse box whether fuse is blown or not

YES → The fuse is blown

NO → After replacing the relay for horn, check the horn operate

YES → The relay is broken

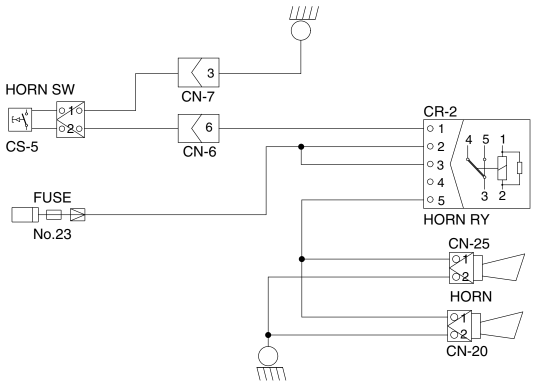
NO → * Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting : Between CN-20 (1) or CN-25 (1) - chassis ground (with horn switch turned ON) : 20-30 voltage
* Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON : Between CN-20 (2) or CN-25 (2)- chassis ground : Max 1 Ω (resistance)
Is the above value normal?
** Note : Since voltage value , connector number and pin number varies with each model, should refer to the wiring diagram of each model.
<CN-20 (1)/ CN-25 (1) : Horn connector (+) terminal CN-20 (2) /CN-25 (2) : Horn connector (-) terminal>

YES → The horn is defective

NO → * Prepare with starting switch OFF, then carry out trouble-shooting without turning starting switch ON :
1. Disconnection in wiring or defective contact in connector between CN-20 (1) or CN-25 (1) - inline connector-end connector : Max 1 Ω (resistance)
2. Short circuit with ground circuit between CN-20 (1) or CN-25 (1) - inline connector-end connector - chassis ground : Min 1M Ω (resistance)

NO → In case of the value of resistance, disconnection in wiring or defective contact in connector or short circuit with ground circuit

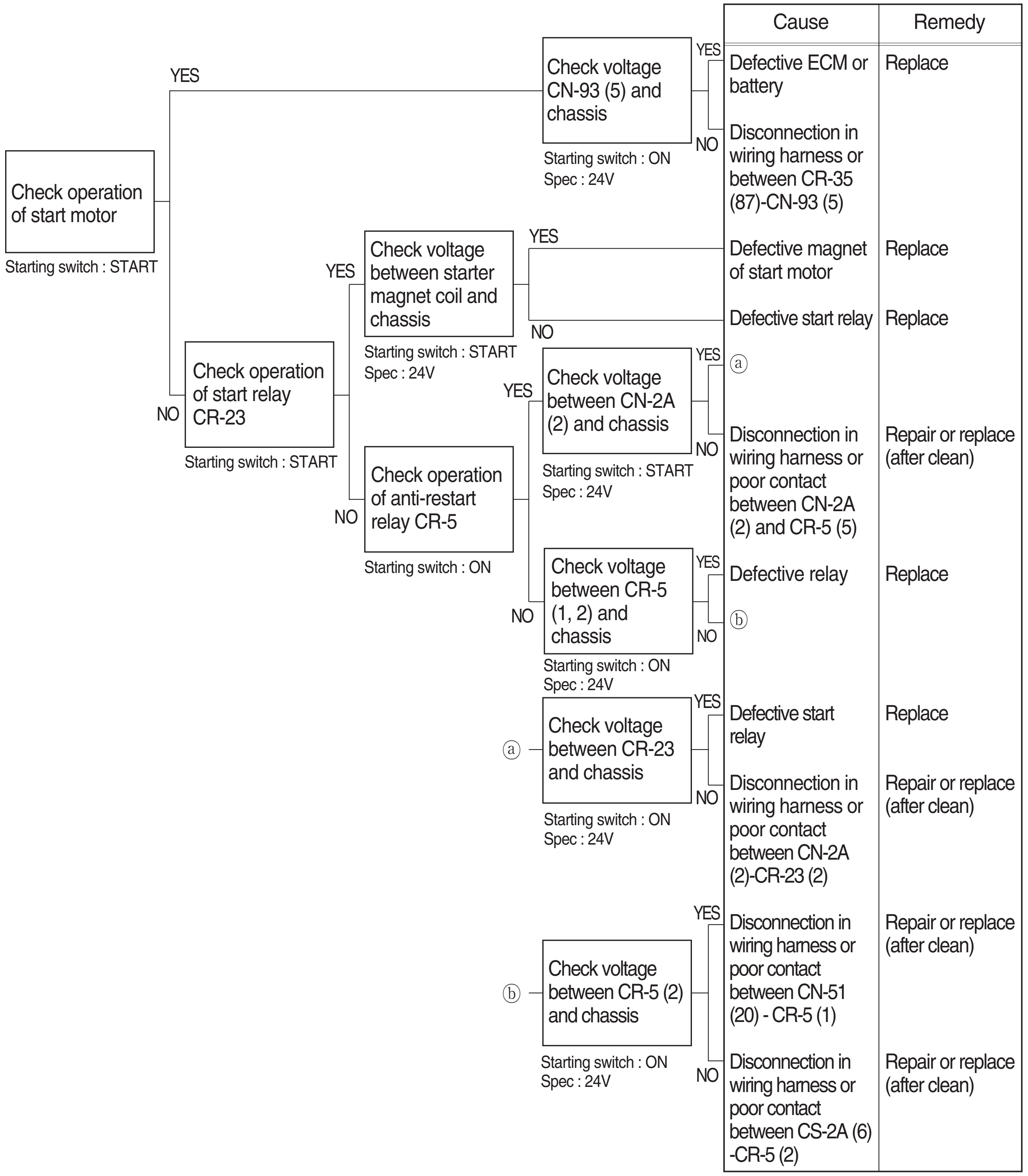
Cause	Remedy
The fuse is blown	Replace the fuse
The relay is broken	Replace the relay
The horn is defective	Replace the horn
In case of the value of resistance, disconnection in wiring or defective contact in connector or short circuit with ground circuit	Replace connector. Connect the wire

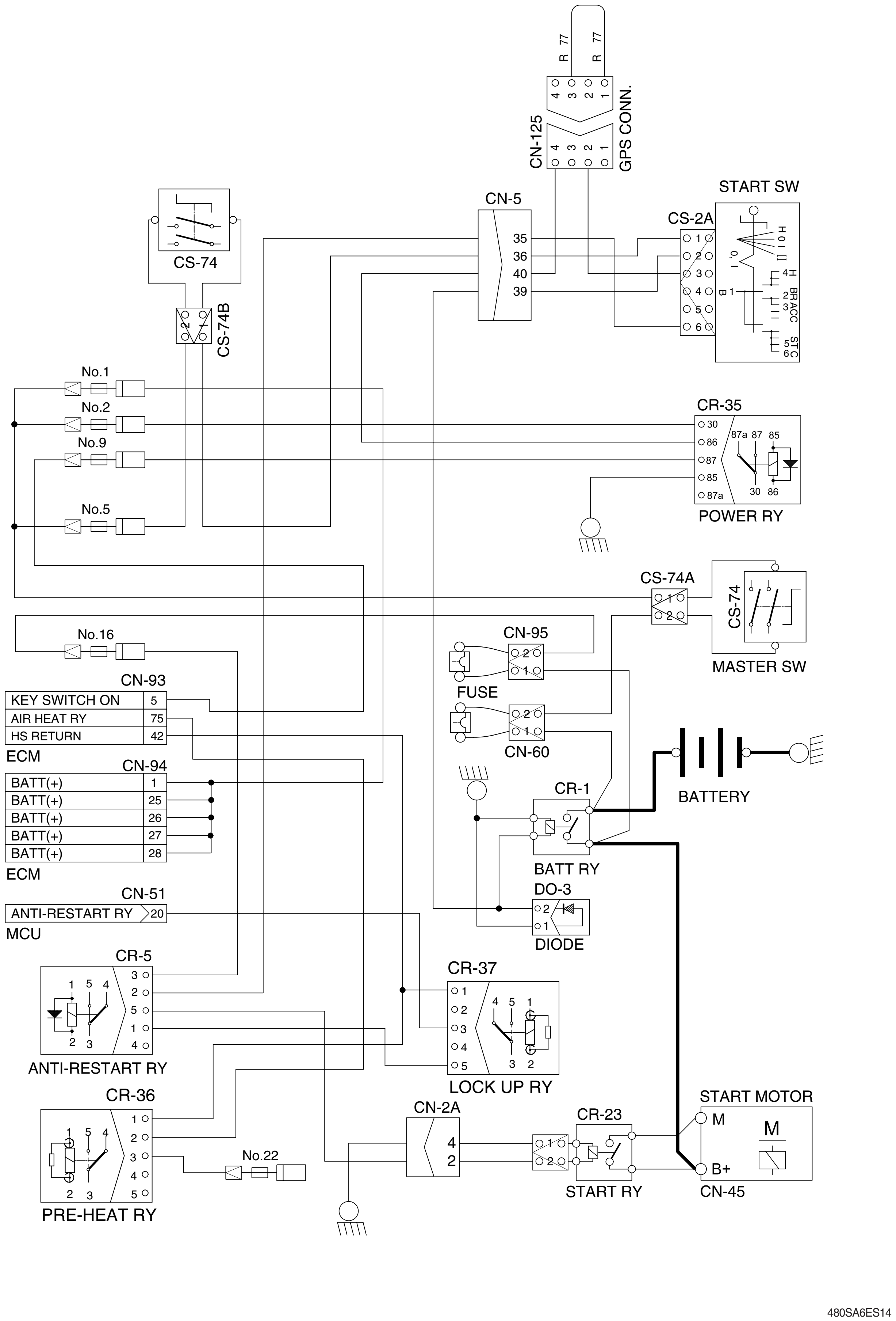


400SA6ES26

14. WHEN ENGINE DOES NOT START (lights up condition)

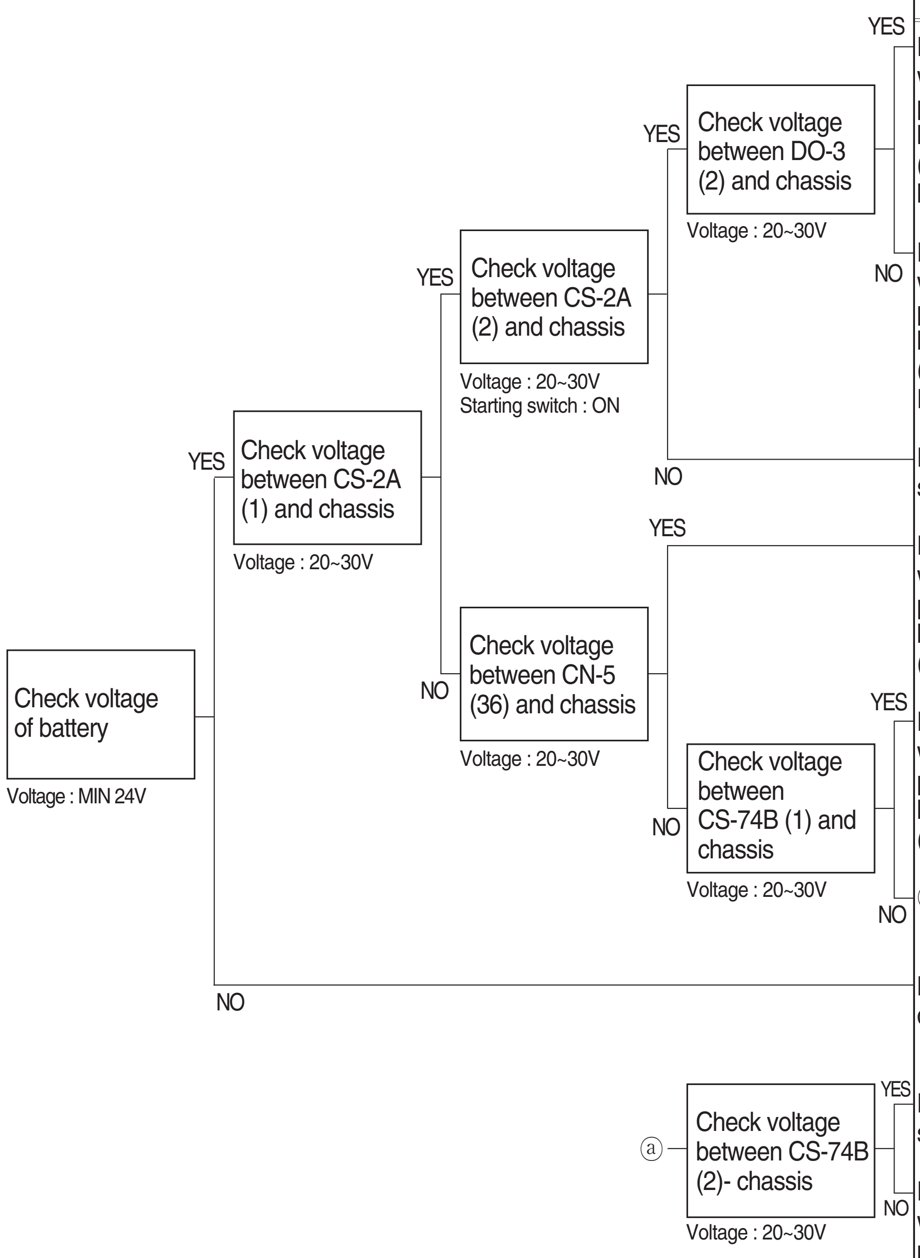
- Check supply of the power at engine stop solenoid while starting switch is ON.
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and fuse No. 1, 2, 5, 9 and 16 burnt out.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



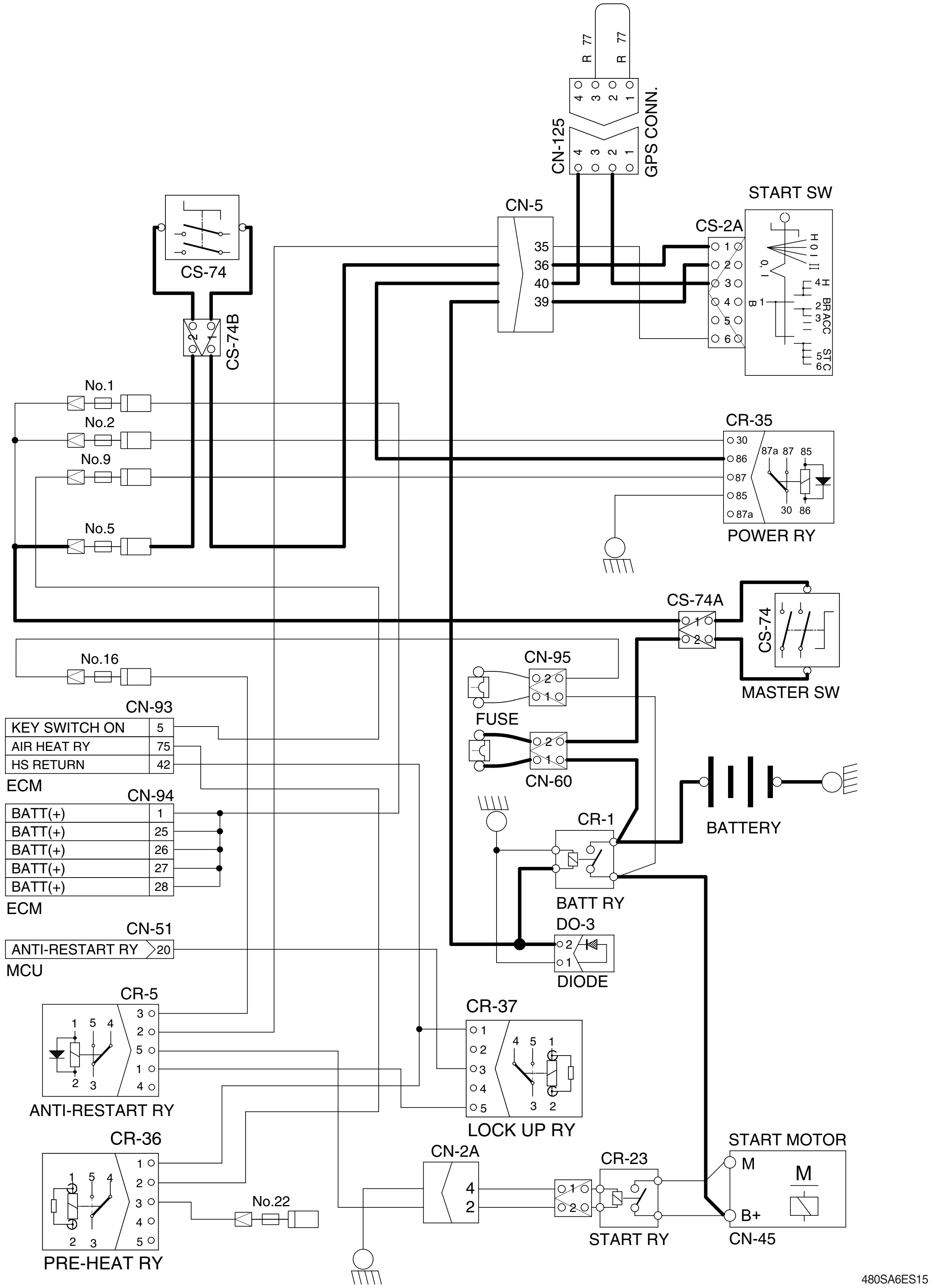


15. WHEN STARTING SWITCH ON DOES NOT OPERATE

- 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 blown out of the fuse (CN-60).
- After checking, insert the disconnected connectors again immediately unless otherwise specified.

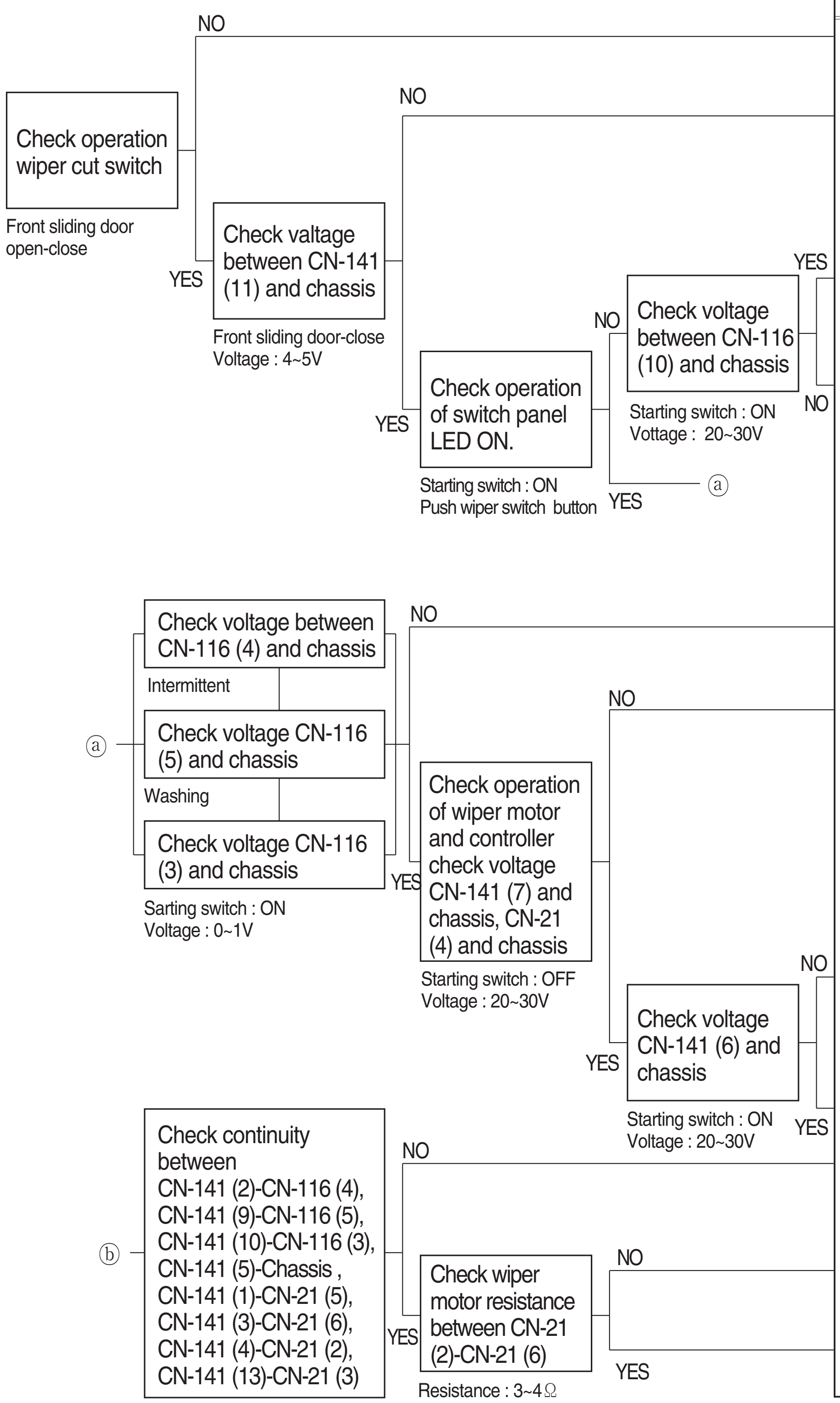


Cause	Remedy
Disconnection in wiring harness or poor contact between DO-3 (2)-CR-1 or defective battery relay	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CS-2A (2)-CN-5 (39)-DO-3 (2)	Repair or replace (after clean)
Defective start key switch	Replace
Disconnection in wiring harness or poor contact between CS-2A (1)-CN-5 (36)	Replace
Disconnection in wiring harness or poor contact between CS-74B (1) -CN-5 (36)	Charge or replace (after clean)
ⓐ	
Battery discharged	Replace
Defective master switch	Replace
Disconnection in wiring harness or poor contact between CS-74B (2) -CR-1	Charge or replace (after clean)

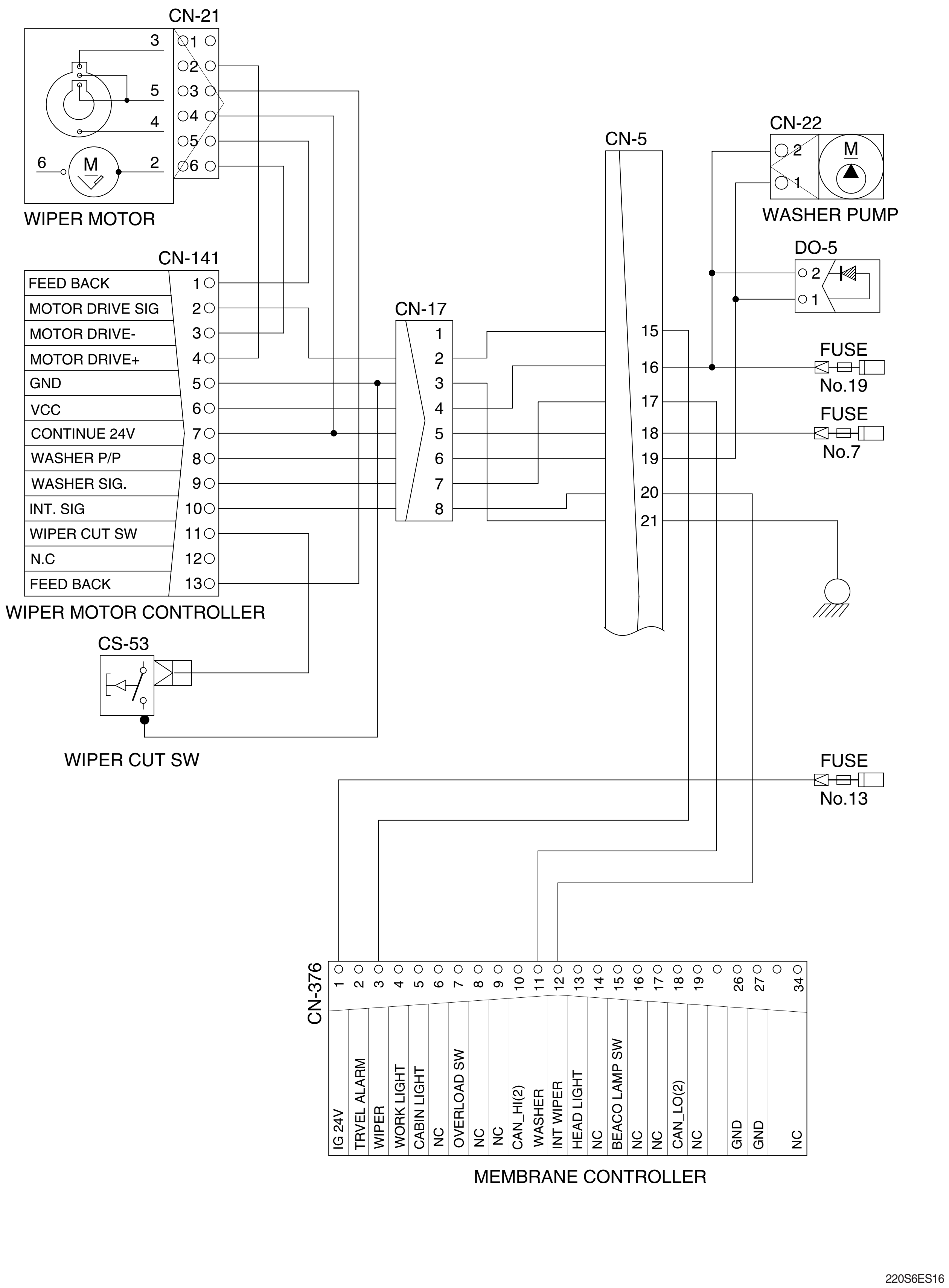


16. WHEN STARTING SWITCH IS TURNED ON, WIPER MOTOR DOES NOT OPERATE

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and fuse No. 7, 13 and 19 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 switch panel	Replace
1)Recheck fuse No.13 2)Disconnection in wiring harness or poor contact between CN-376 (1)-Fuse No.13	Replace Repair or replace (after clean)
Defective switch panel	Replace
1) Recheck fuse No.7 2) Disconnection in wiring harness or poor contact between CN-141(7)-Fuse No.7, CN-21 (4)-Fuse No.7	Replace Repair or replace (after clean)
1) Recheck fuse No.19 2) Disconnection CN-141(6)-Fuse No.19	Replace 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

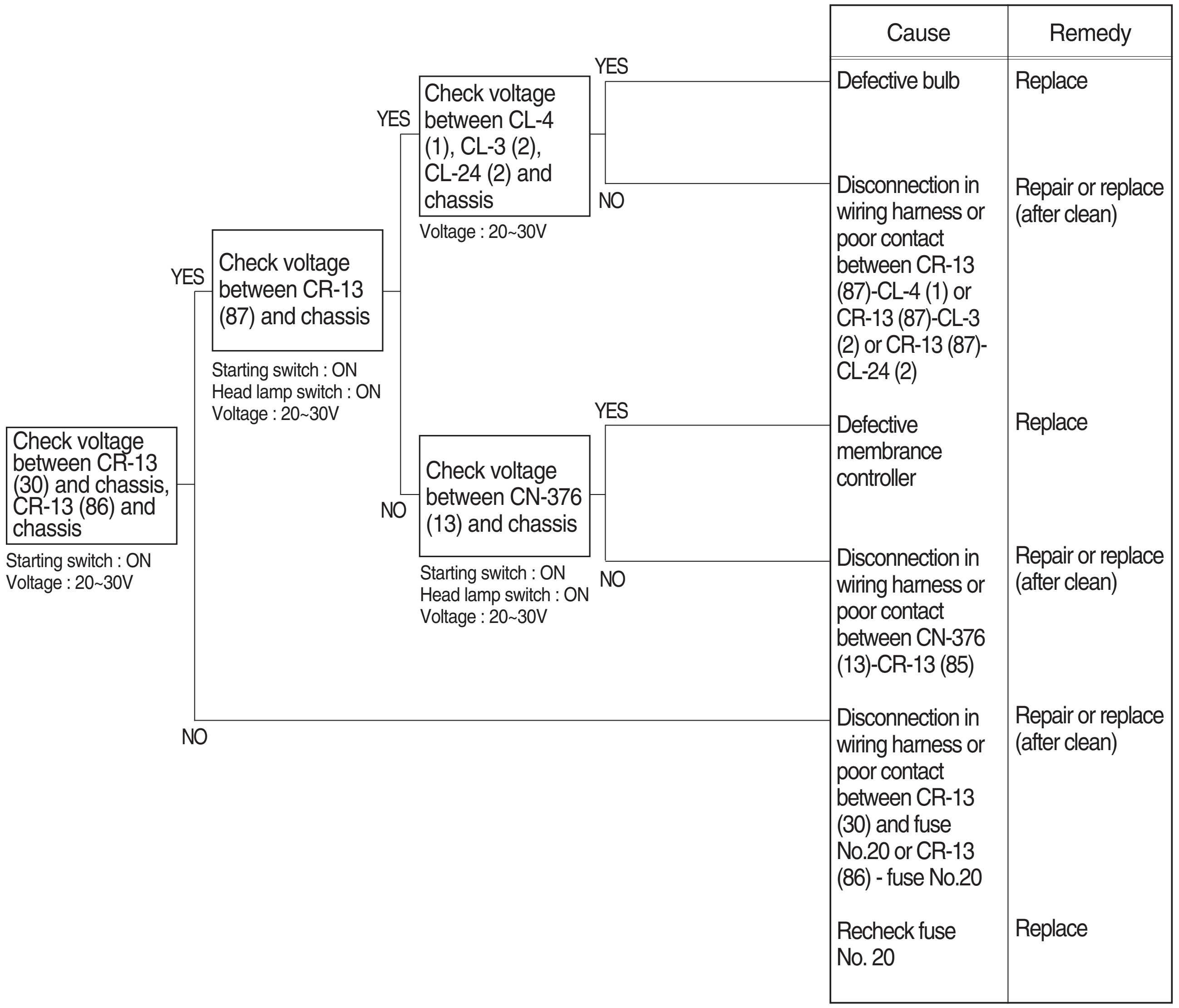


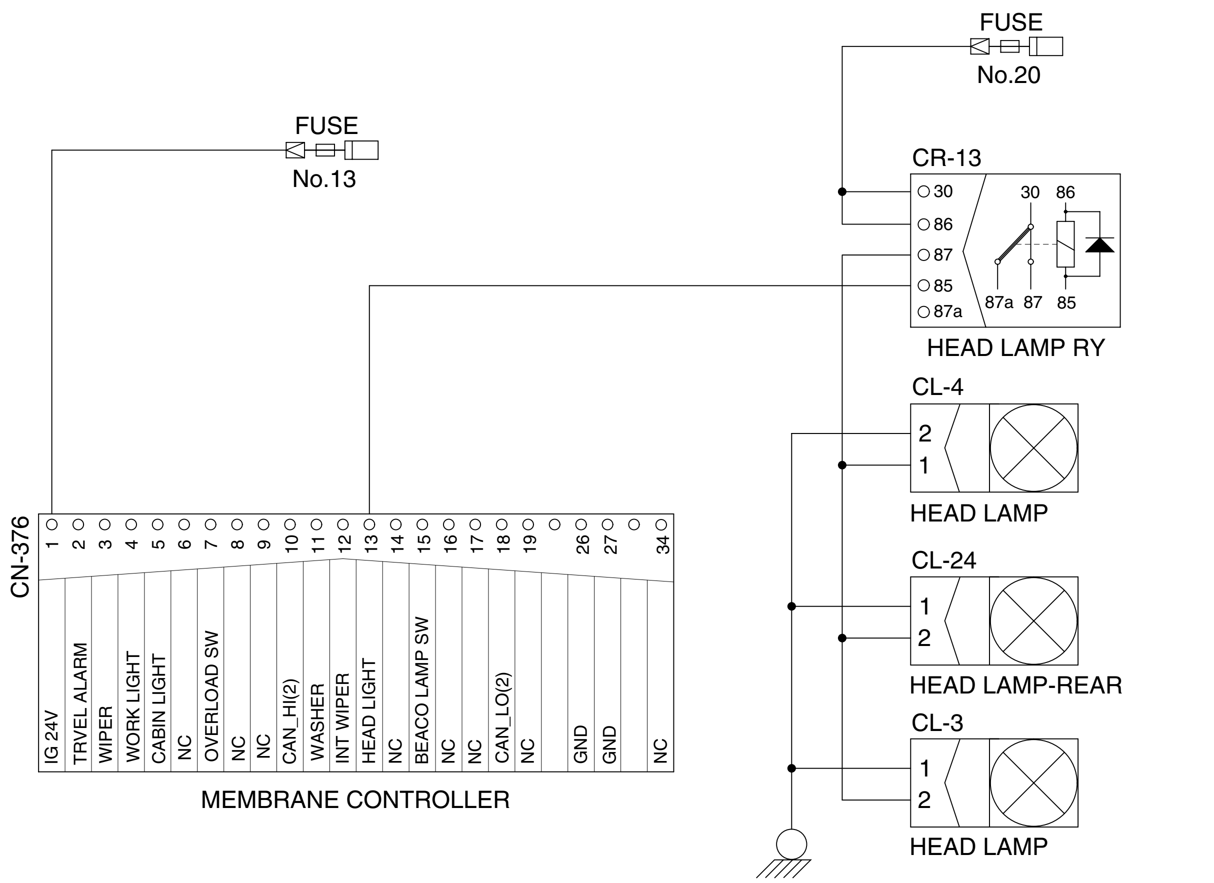
17. WHEN STARTING SWITCH IS TURNED ON, HEAD LAMP DOES NOT LIGHTS UP

· 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.13 and 20.

· After checking, insert the disconnected connectors again immediately unless otherwise specified.

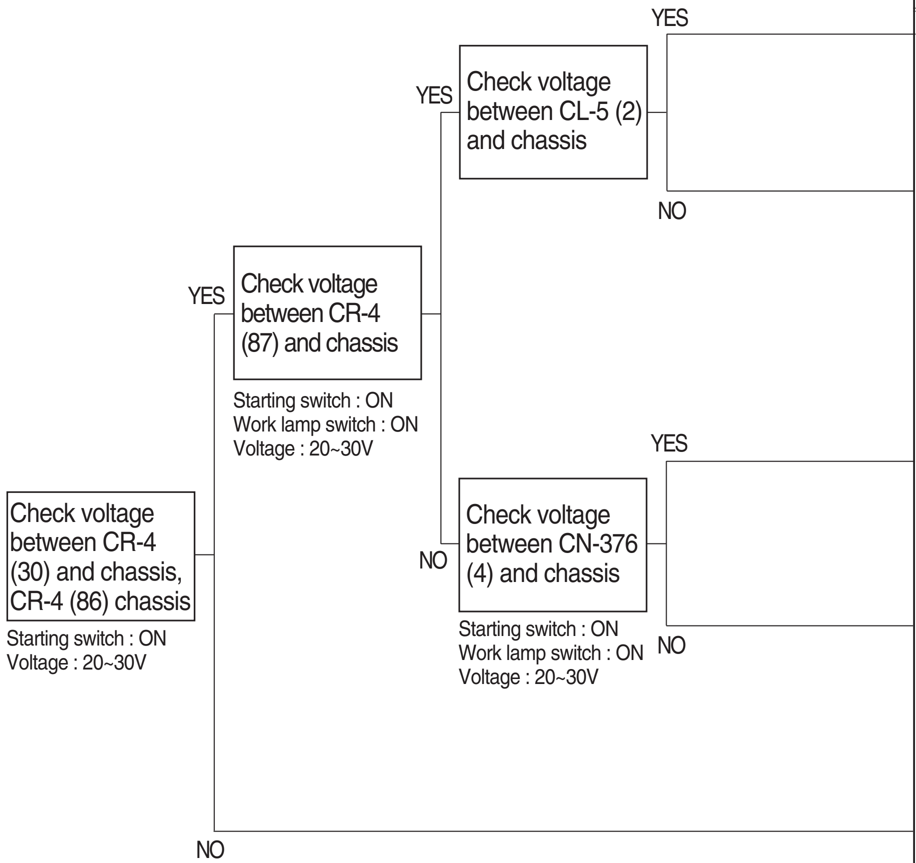




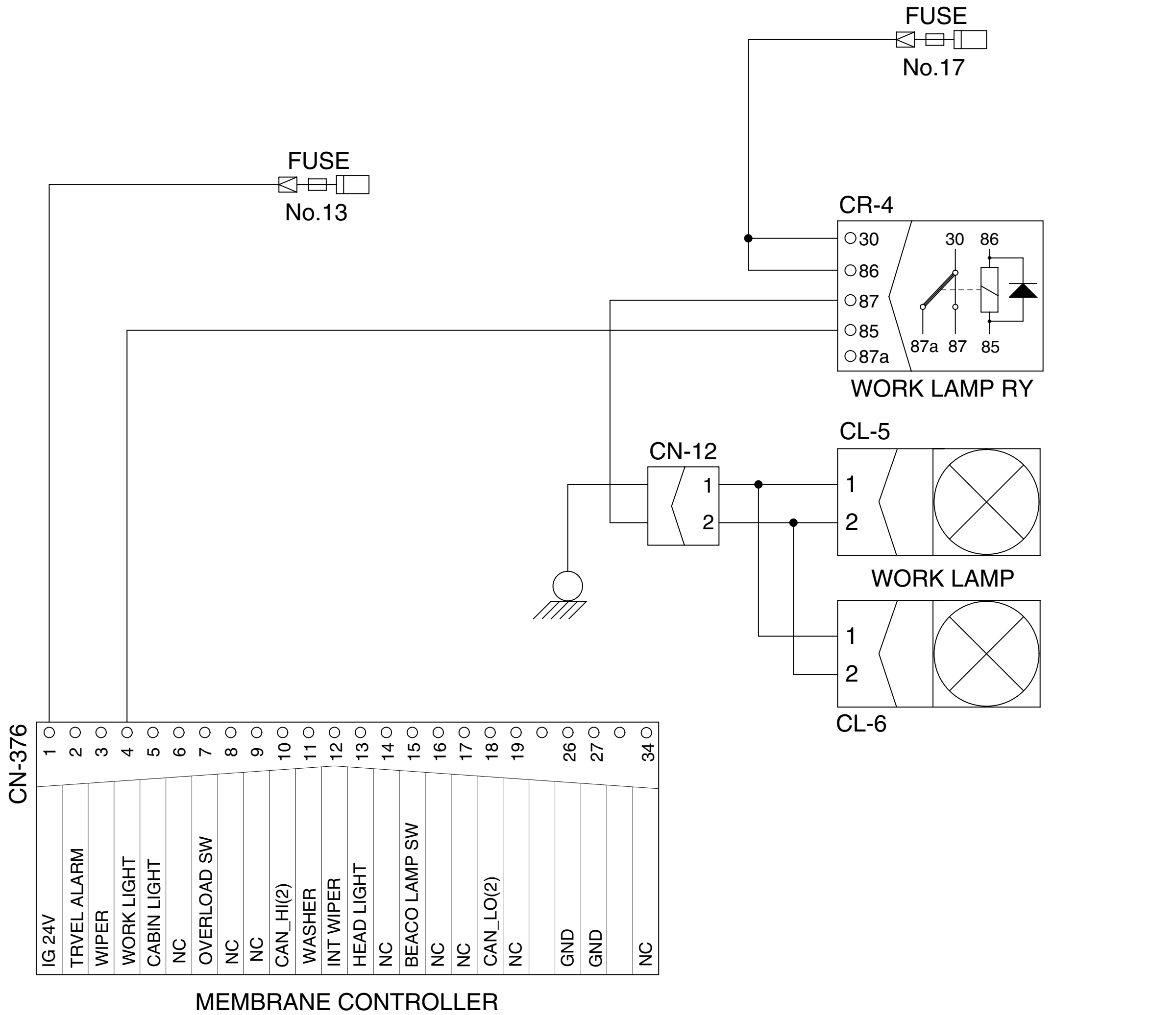
220S6ES17

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 13 and 17.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CR-4 (87)-CL-5 (2)	Repair or replace (after clean)
Defective membrance controller	Replace
Disconnection in wiring harness or poor contact between CR-4 (85)-CN-376 (4)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CR-4 (30) and fuse No.17 or CR-4 (86) and fuse No.17	Repair or replace (after clean)
Recheck fuse No.17	Replace



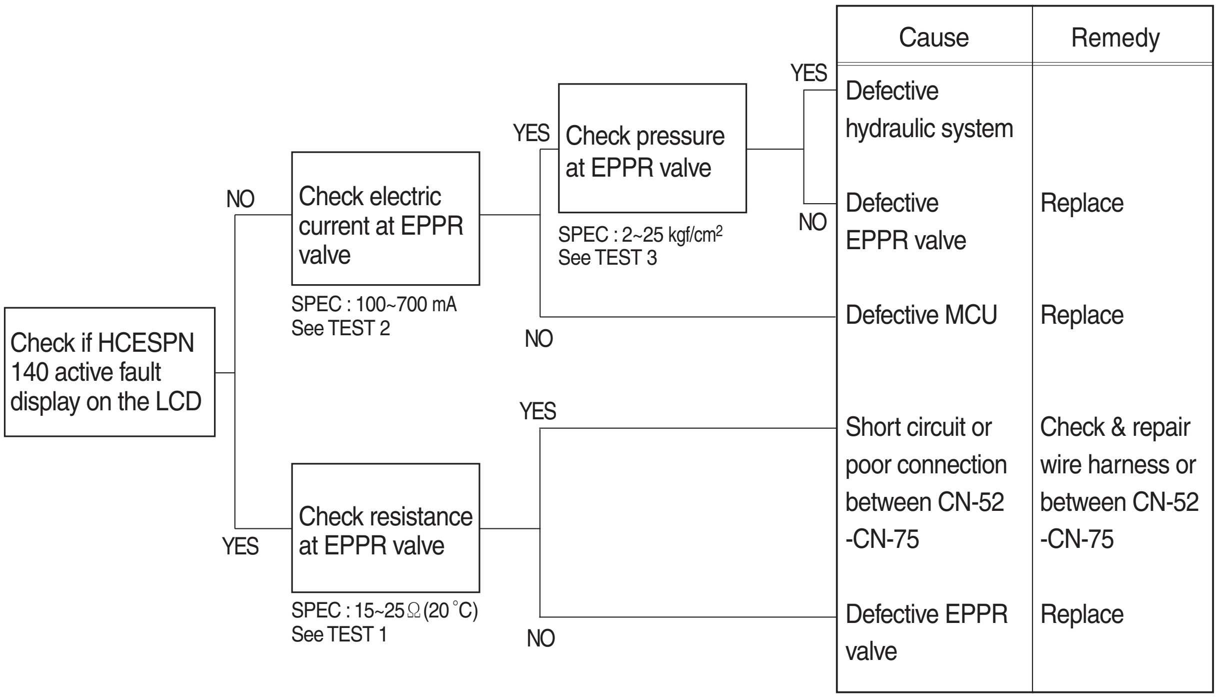
220S6ES18

GROUP 4 MECHATRONICS SYSTEM

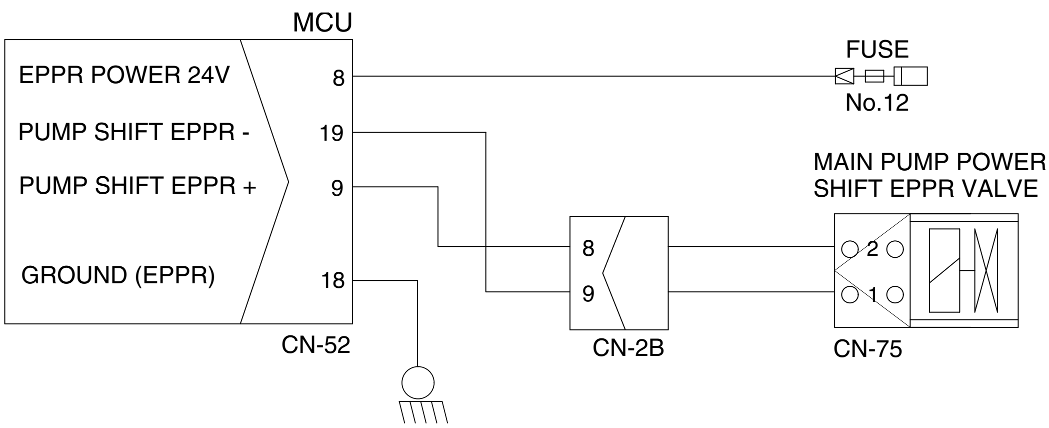
1. ALL ACTUATORS SPEED ARE SLOW

※ Boom, Arm, Bucket, Swing and travel speed are slow, but engine speed is good.
※ Spec : P-mode 1700 ± 50 rpm S -mode 1600 ± 50 rpm E-mode 1500 ± 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



480SA6MS01

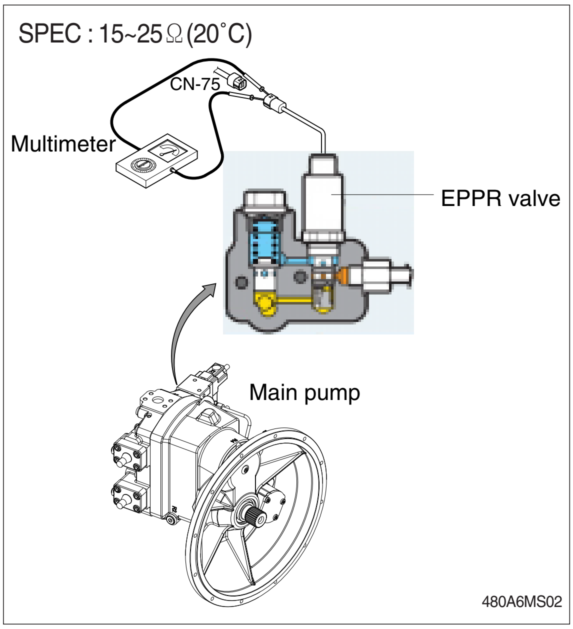
2) TEST PROCEDURE

(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.

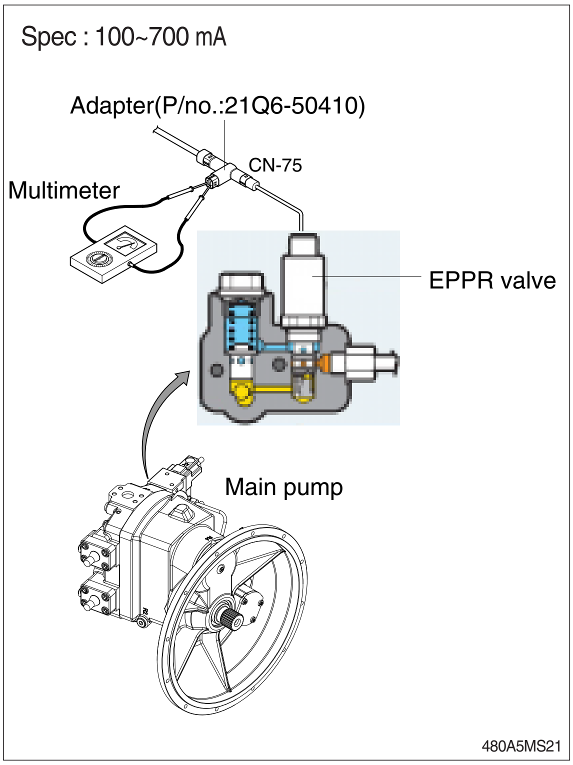
③ Start engine.

④ Set S-mode and cancel auto decel mode.

⑤ Position the accel dial at 10.

⑥ If tachometer show approx 1600±50 rpm disconnect one wire harness from EPPR valve.

⑦ Check electric current at bucket circuit relief position.



(3) **Test 3** : Check pressure at EPPR valve.

① Start engine.

② Set S-mode and cancel auto decel

③ mode.

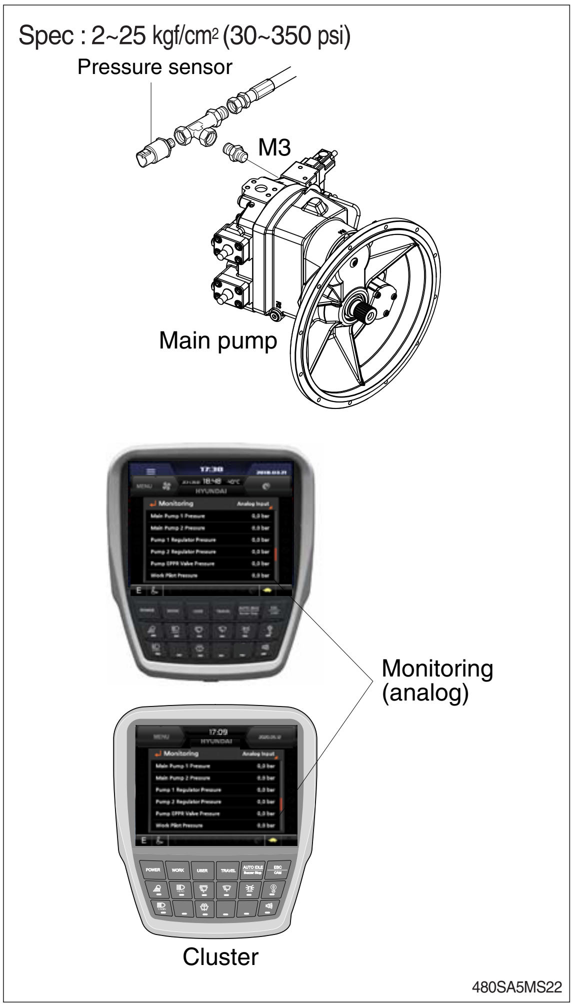
Position the accel dial at 10.

④ If tachometer show approx 1600±50 rpm check pressure at relief position of bucket circuit by operating bucket control

⑤ lever.

⑥ If pressure is not correct, adjust it.

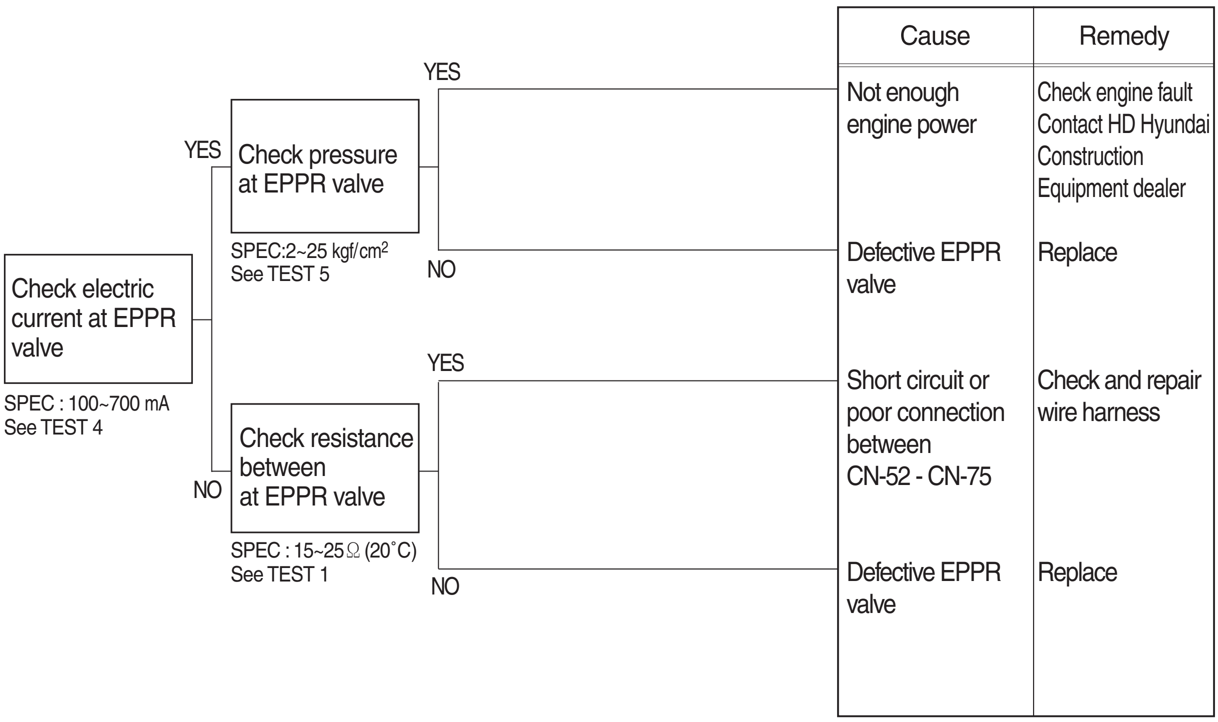
After adjust, test the machine.



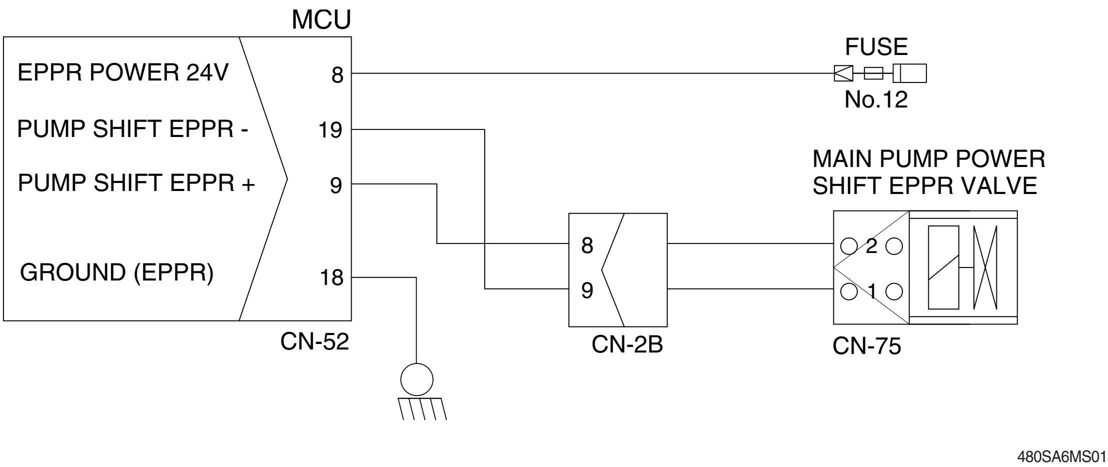
2. ENGINE STALL

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram

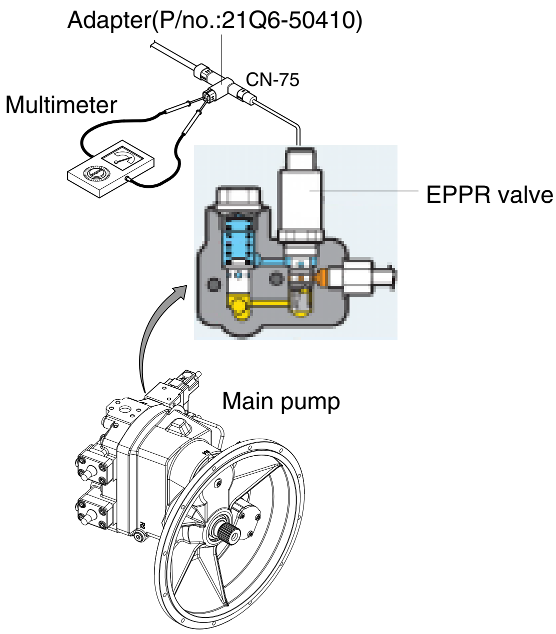


2) TEST PROCEDURE

(1) Test 4 : Check electric current at EPPR valve.

① Disconnect connector CN-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 show approx 1600±50 rpm disconnect one wire harness from EPPR valve.
⑦ Check electric current at bucket circuit relief position.

Spec : 100~700 mA

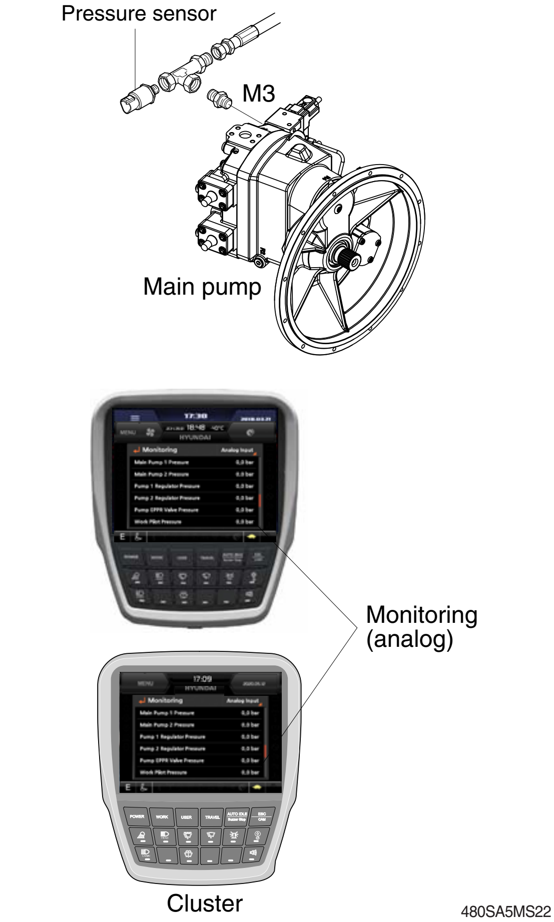


480A5MS21

(2) Test 5 : 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 rpm show approx 1600±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.

SPEC : 2~25 kgf/cm² (30~350 psi)

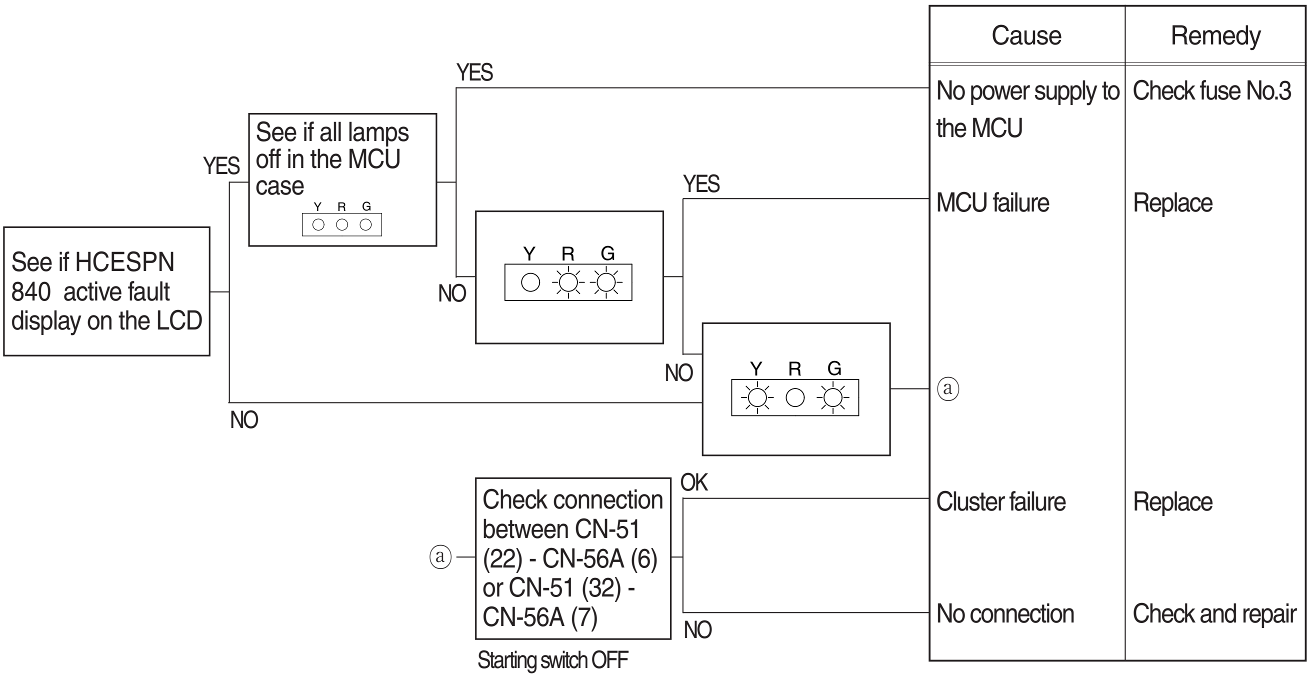


480SA5MS22

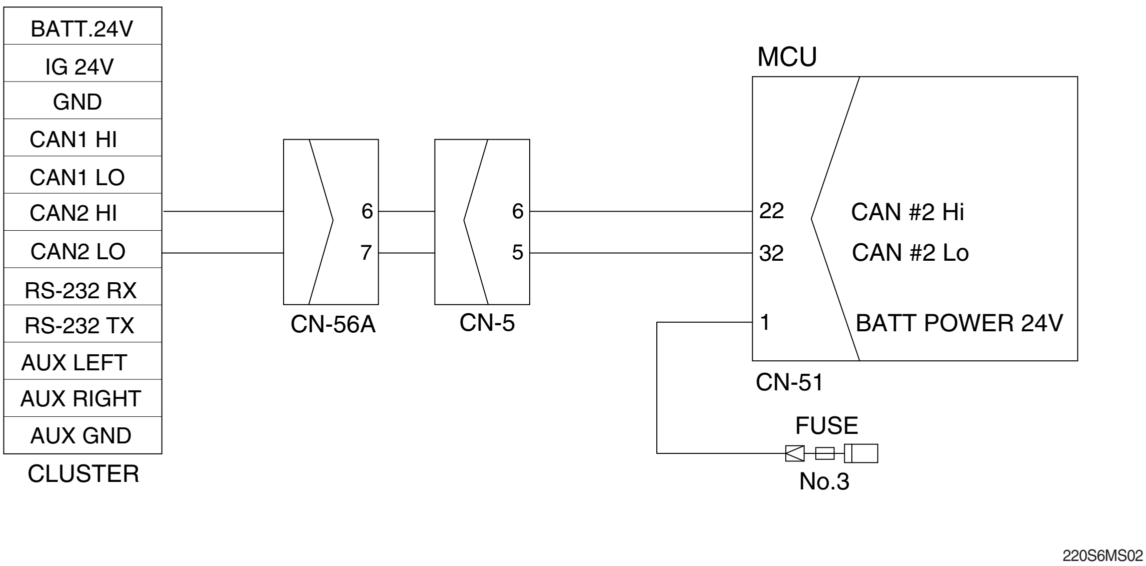
3. MALFUNCTION OF CLUSTER OR MODE SELECTION SYSTEM

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram

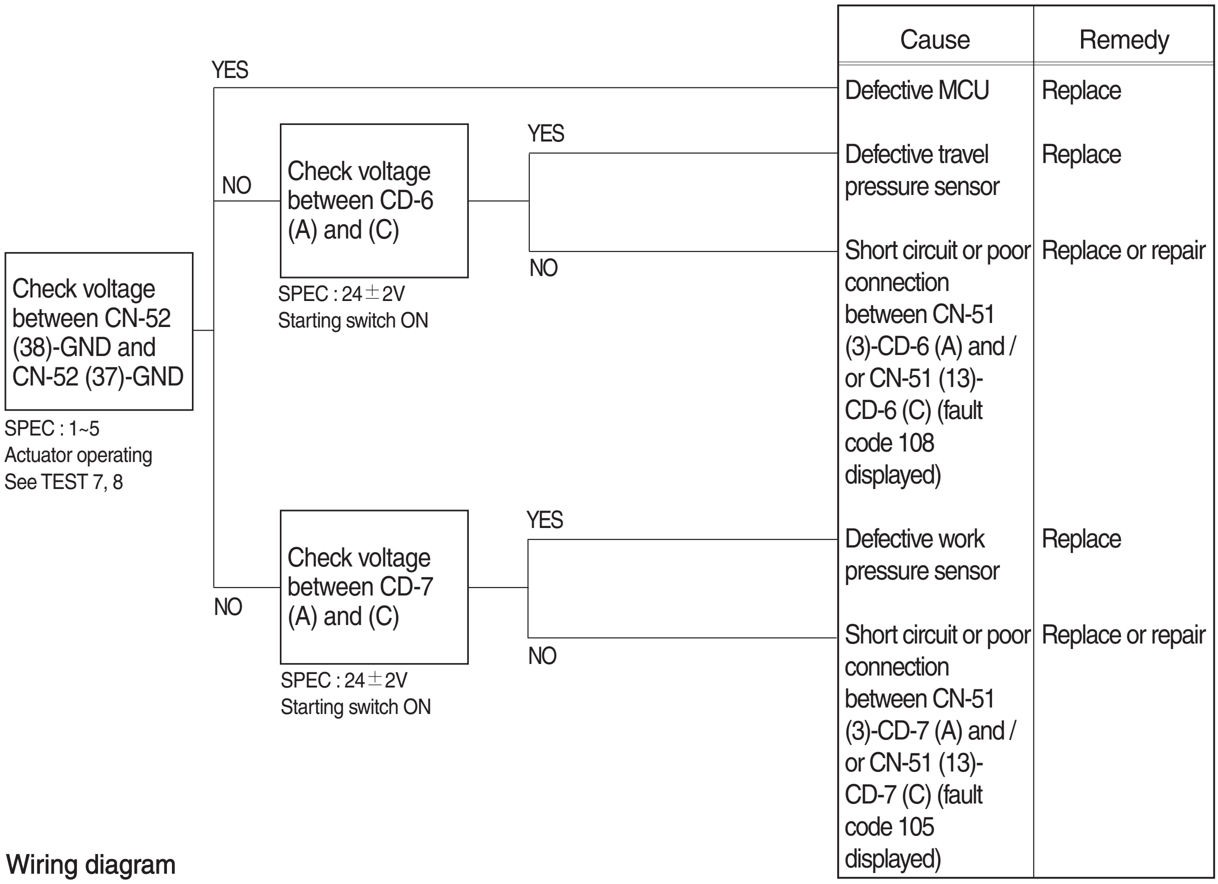


4. AUTO DECEL SYSTEM DOES NOT WORK

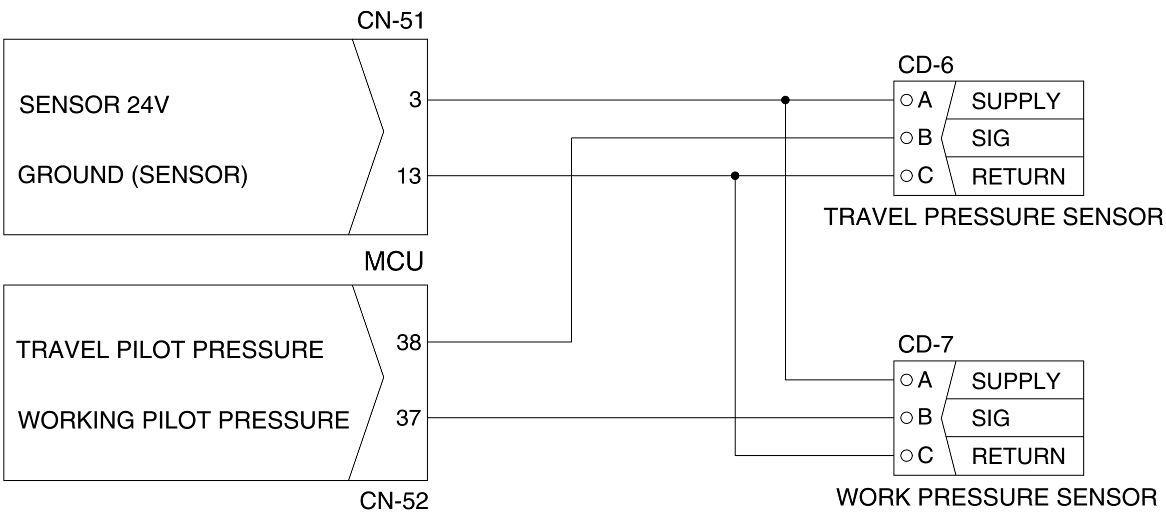
· Fault code : HCESPN 105, FMI 0~4 (work pressure sensor)
HCESPN 108, FMI 0~4 (travel oil pressure sensor)

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram



220S6MS03

2) TEST PROCEDURE

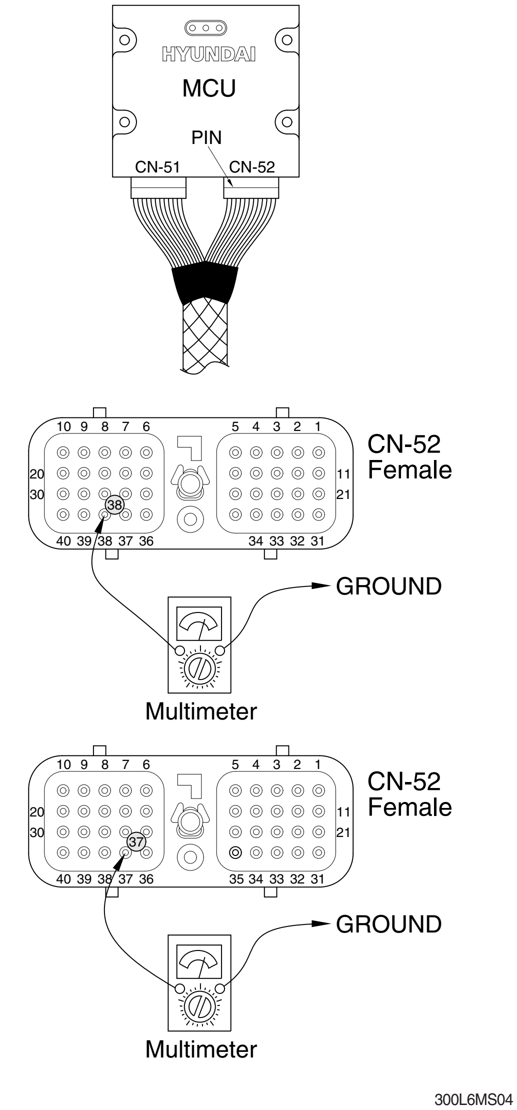
(1) Test 7 : Check voltage at CN-52 (38) and ground.

① Prepare 1 piece of thin sharp pin, steel or copper.
② Insert prepared pin to rear side of connectors : One pin to (38) of CN-52.
③ Starting switch key ON.
④ Check voltage as figure.

(2) Test 8 : Check voltage at CN-52 (37) and ground.

① Prepare 1 piece of thin sharp pin, steel or copper
② Insert prepared pin to rear side of connectors : One pin to (37) of CN-52.
③ Starting switch ON.
④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V

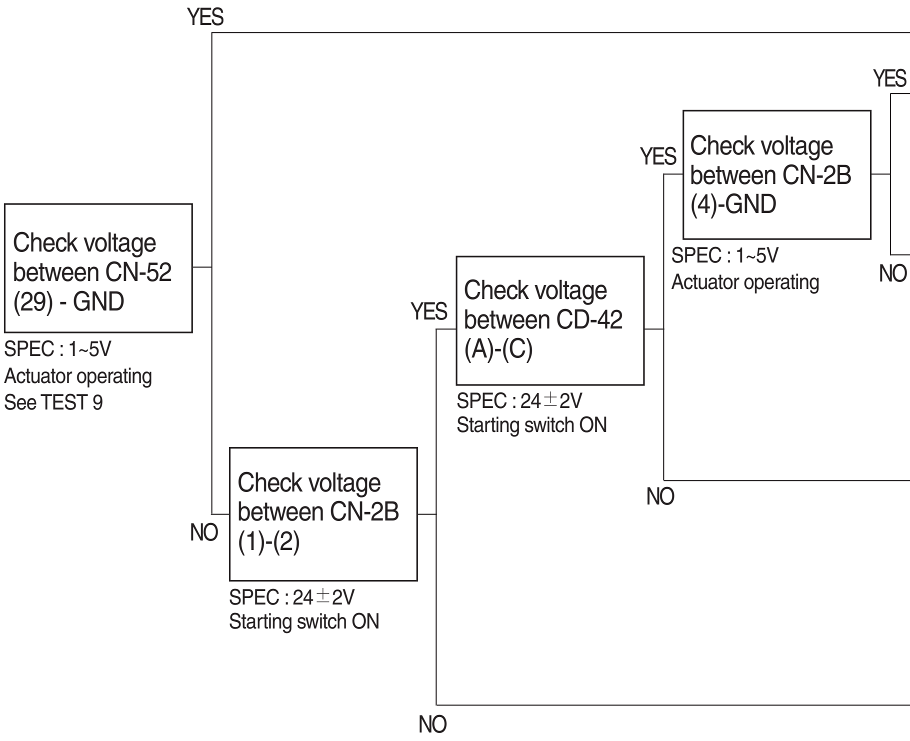


5. MALFUNCTION OF PUMP 1 PRESSURE SENSOR

· Fault code : HCESPN 120, FMI 0~4

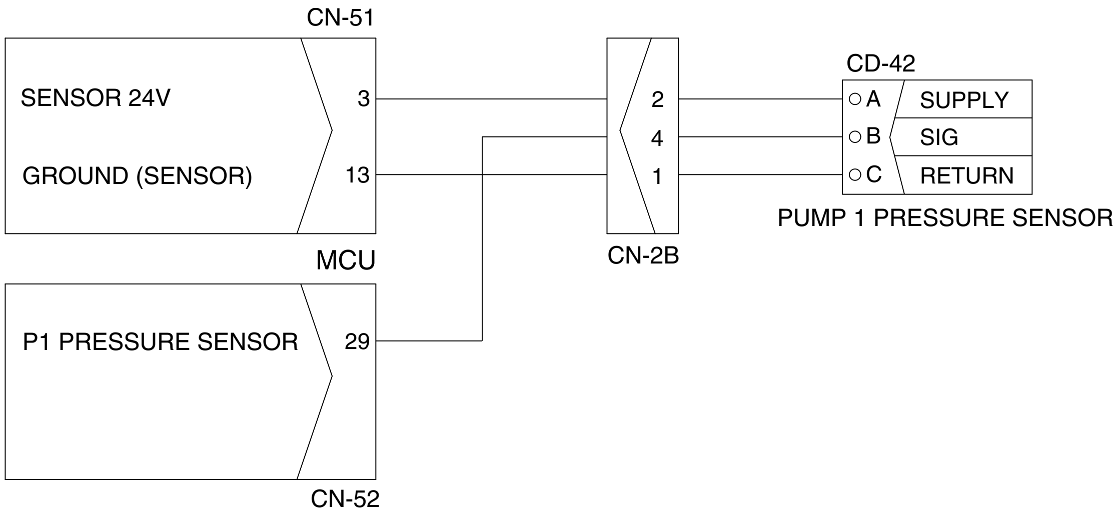
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Short circuit or poor connection between CN-52-(29)-CN-2B (4)	Replace or repair
Detective P1 pressure sensor	Replace or repair
Short circuit or poor connection between CN-2B (4)-CD-42 (B)	Replace or repair
Short circuit or poor connection between CD-42 (A)-CN-2B (2) or CD-42 (C)-CN-2B (1)	Replace or repair
Short circuit or poor connection between CN-2B (2)-CN-51 (3) or CN-2B (1) - CN-51 (13)	Replace or repair

Wiring diagram



480SA6MS05

2) TEST PROCEDURE

(1) Test 9 : Check voltage at CN-52 (29) and ground.

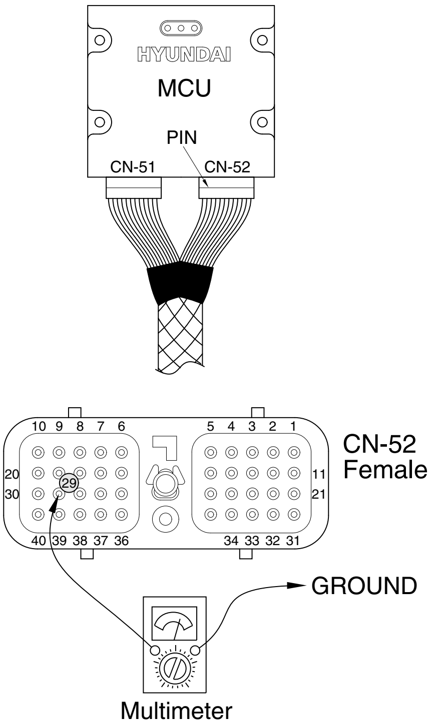
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (29) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



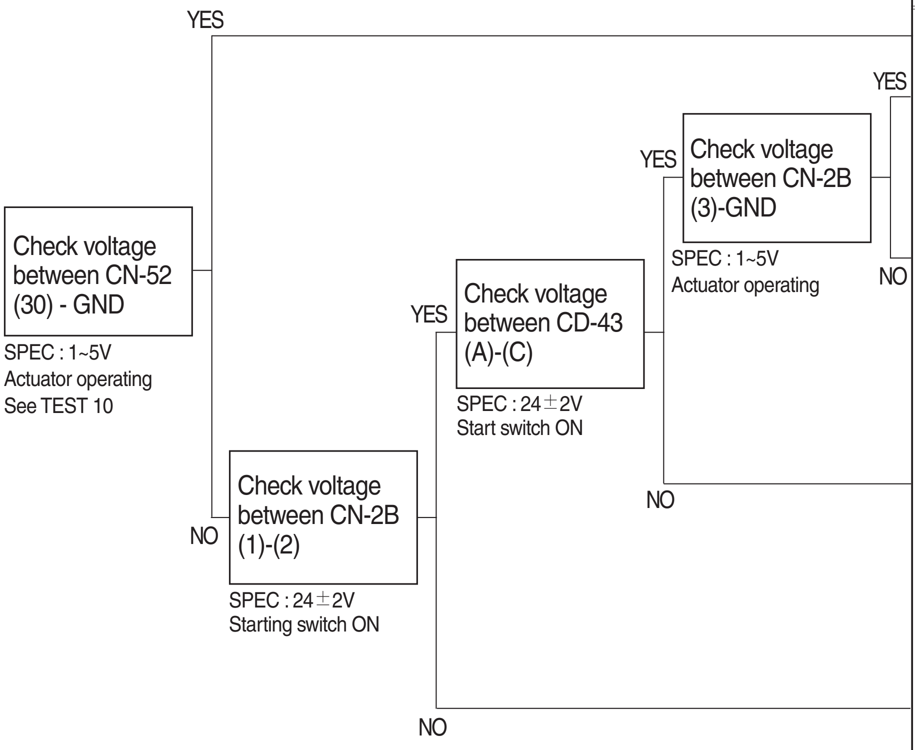
300L6MS06

6. MALFUNCTION OF PUMP 2 PRESSURE SENSOR

· Fault code : HCESPN 121, FMI 0~4

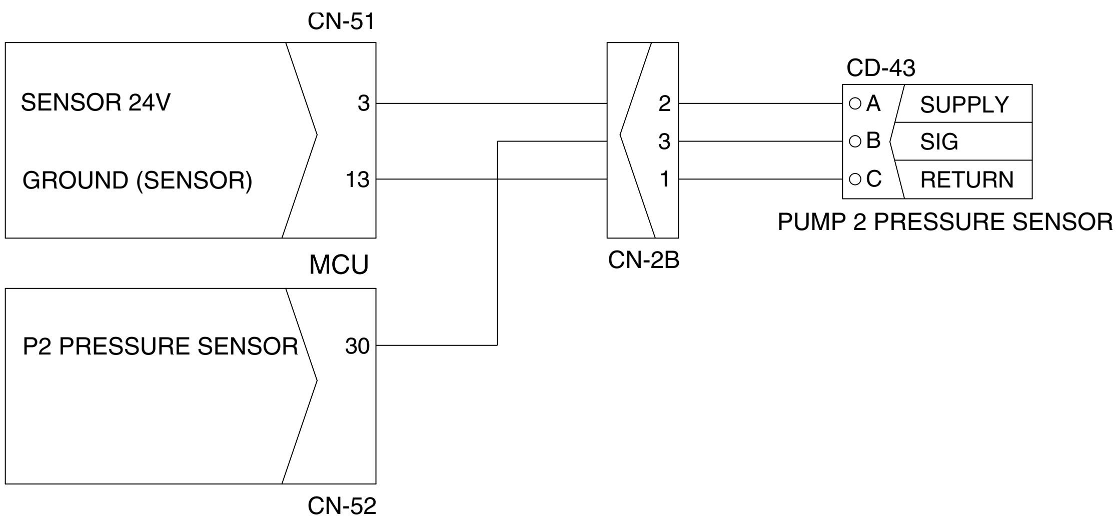
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Short circuit or poor connection between CN-52-(30)-CN-2B (3)	Replace or repair
Detective P2 pressure sensor	Replace or repair
Short circuit or poor connection between CN-2B (3) -CD-43 (B)	Replace or repair
Short circuit or poor connection between CD-43 (A)-CN-2B (2) or CD-43 (C)-CN-2B (1)	Replace or repair
Short circuit or poor connection between CN-2B (2)-CN-51 (3) or CN-2B (1) - CN-51 (13)	Replace or repair

Wiring diagram



480SA6MS07

2) TEST PROCEDURE

(1) Test 10 : Check voltage at CN-52 (30) and ground.

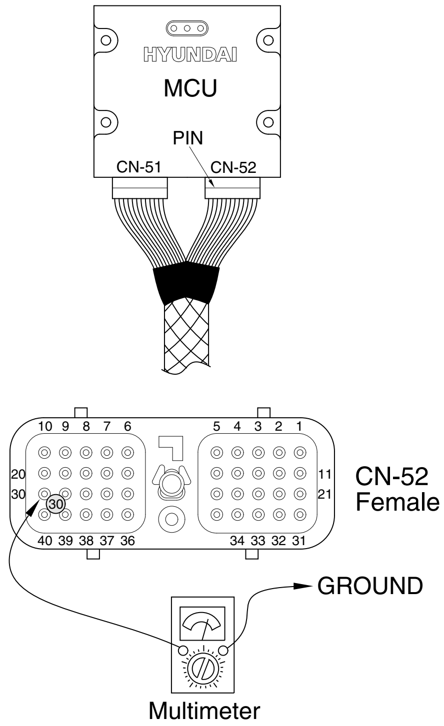
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (30) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



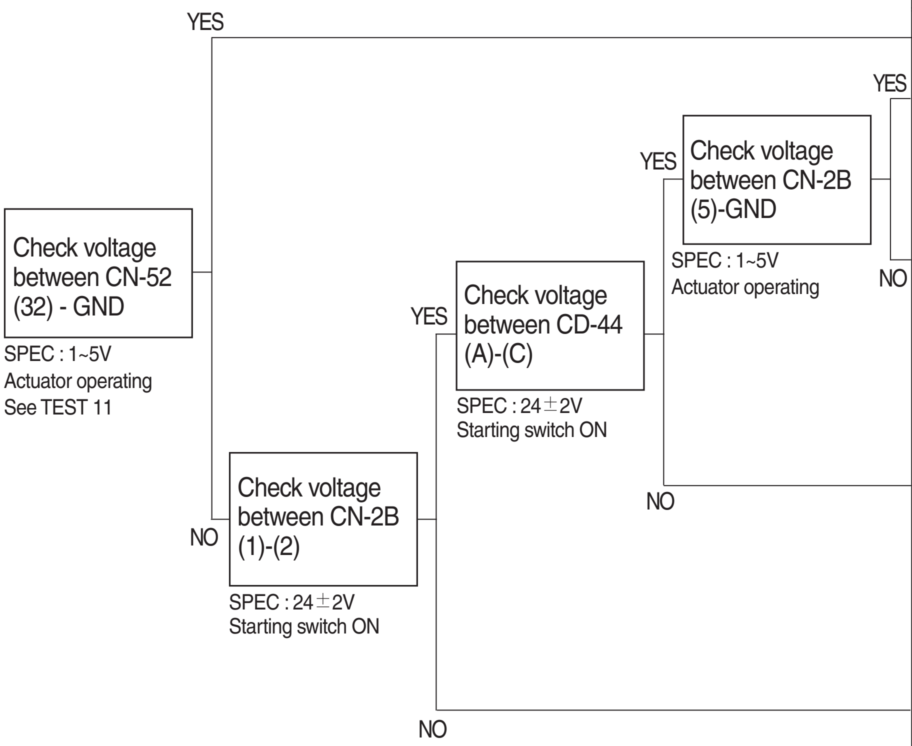
220S6MS08

7. MALFUNCTION OF PUMP 3 PRESSURE SENSOR

· Fault code : HCESPN 125, FMI 0~4

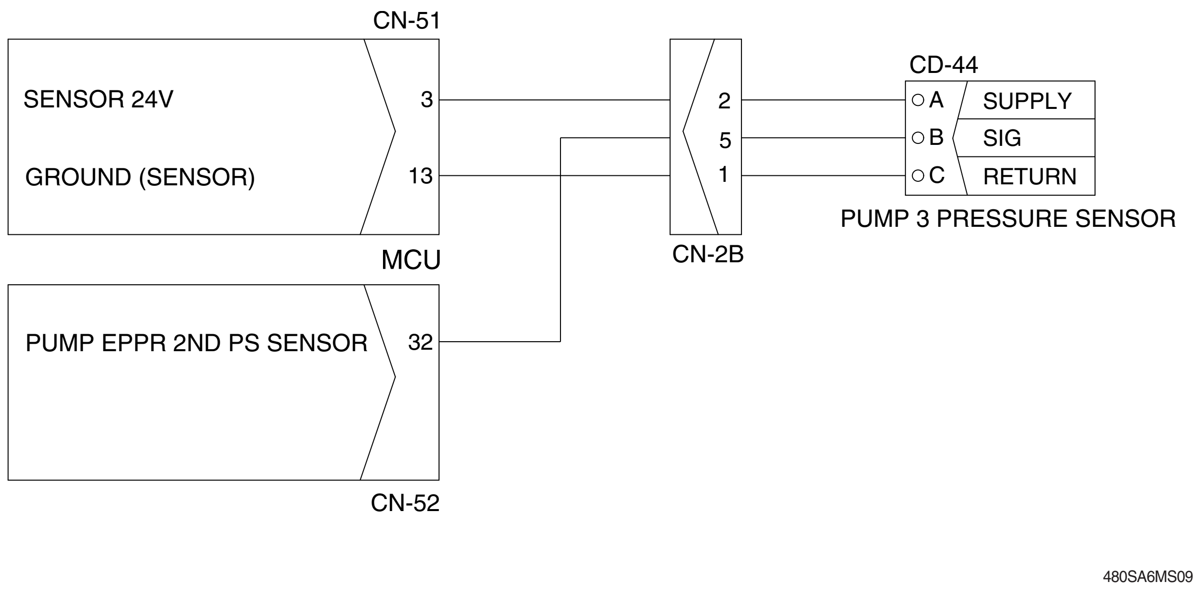
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Short circuit or poor connection between CN-52-(32)-CN-2B (5)	Replace or repair
Detective P3 pressure sensor	Replace or repair
Short circuit or poor connection between CN-2B (5) -CD-44 (B)	Replace or repair
Short circuit or poor connection between CD-44 (A)-CN-2B (2) or CD-44 (C)-CN-2B (1)	Replace or repair
Short circuit or poor connection between CN-2B (2)-CN-51 (3) or CN-2B (1) - CN-51 (13)	Replace or repair

Wiring diagram

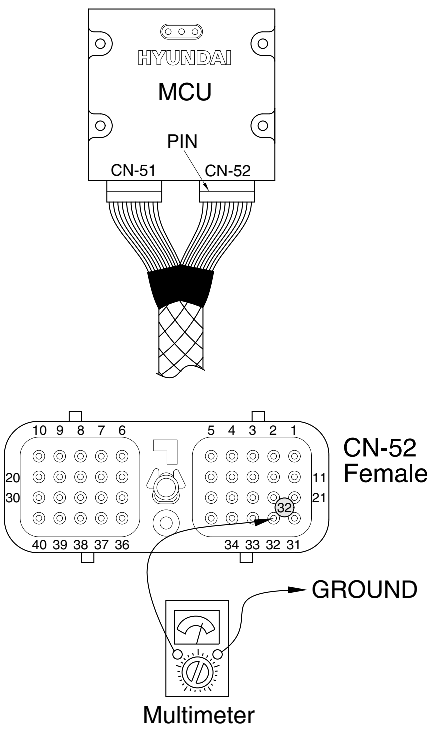


2) TEST PROCEDURE

(1) Test 11 : Check voltage at CN-52 (32) and ground.

① Prepare 1 piece of thin sharp pin, steel or copper.
② Insert prepared pin to rear side of connectors : One pin to (32) of CN-52.
③ Starting switch ON.
④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



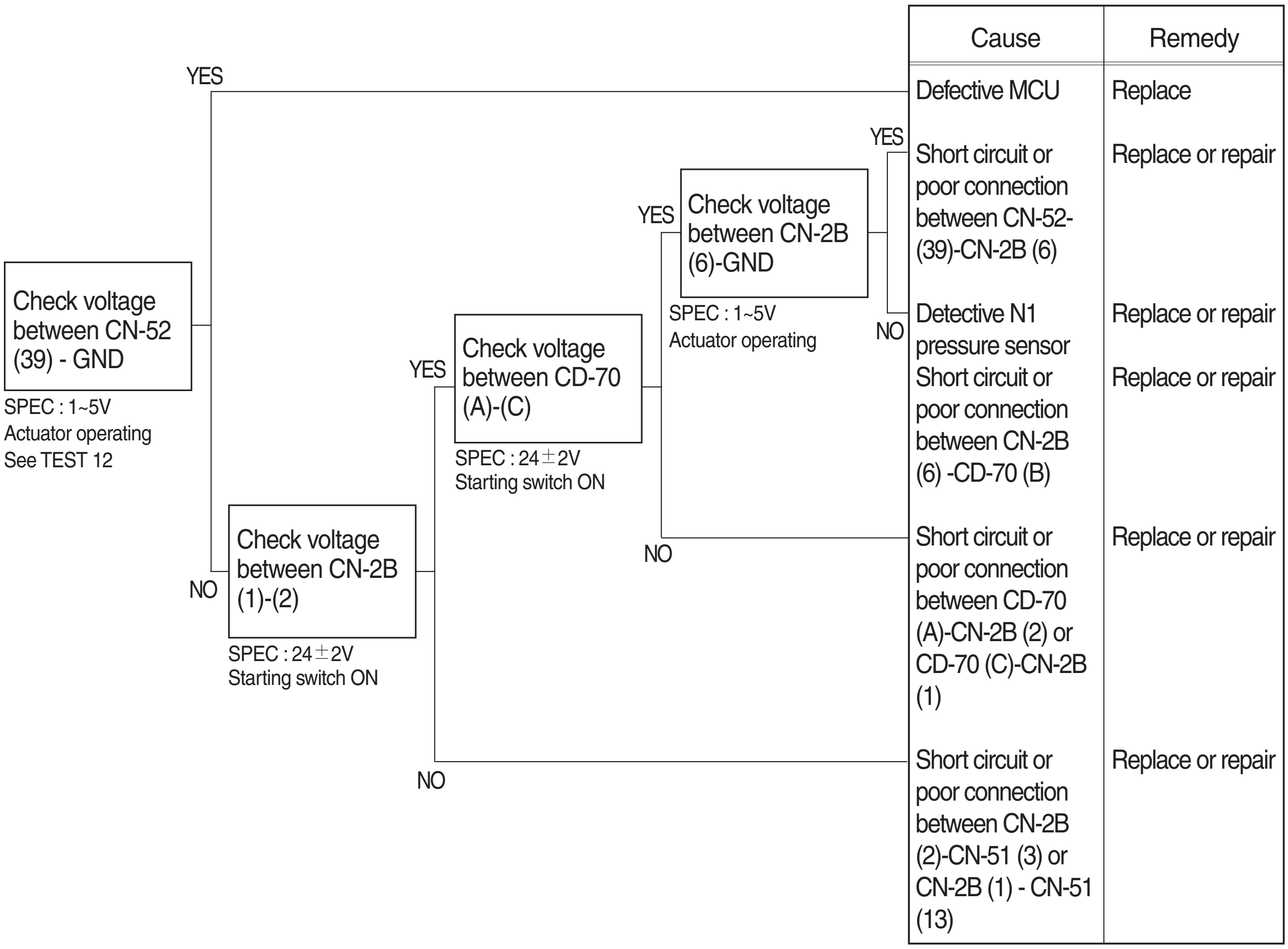
300L6MS10

8. MALFUNCTION OF NEGATIVE 1 PRESSURE SENSOR

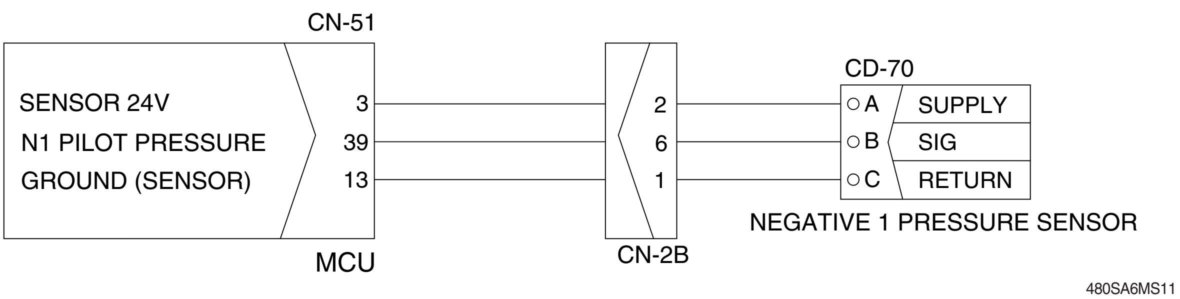
· Fault code : HCESPN 123, FMI 0~4

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram

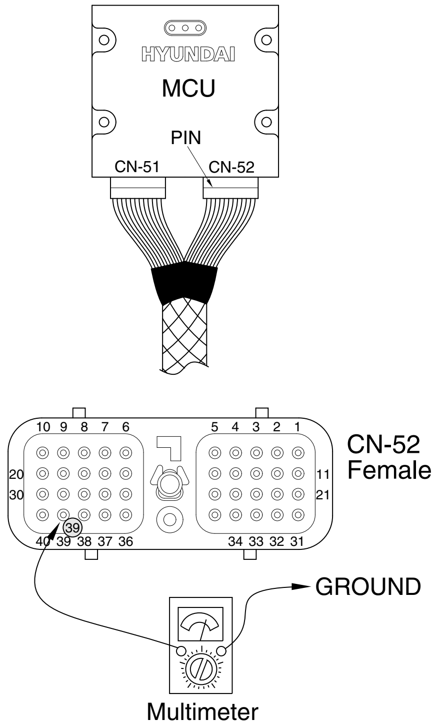


2) TEST PROCEDURE

(1) Test 12 : Check voltage at CN-52 (39) 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 (39) of CN-52.
③ Starting switch ON.
④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



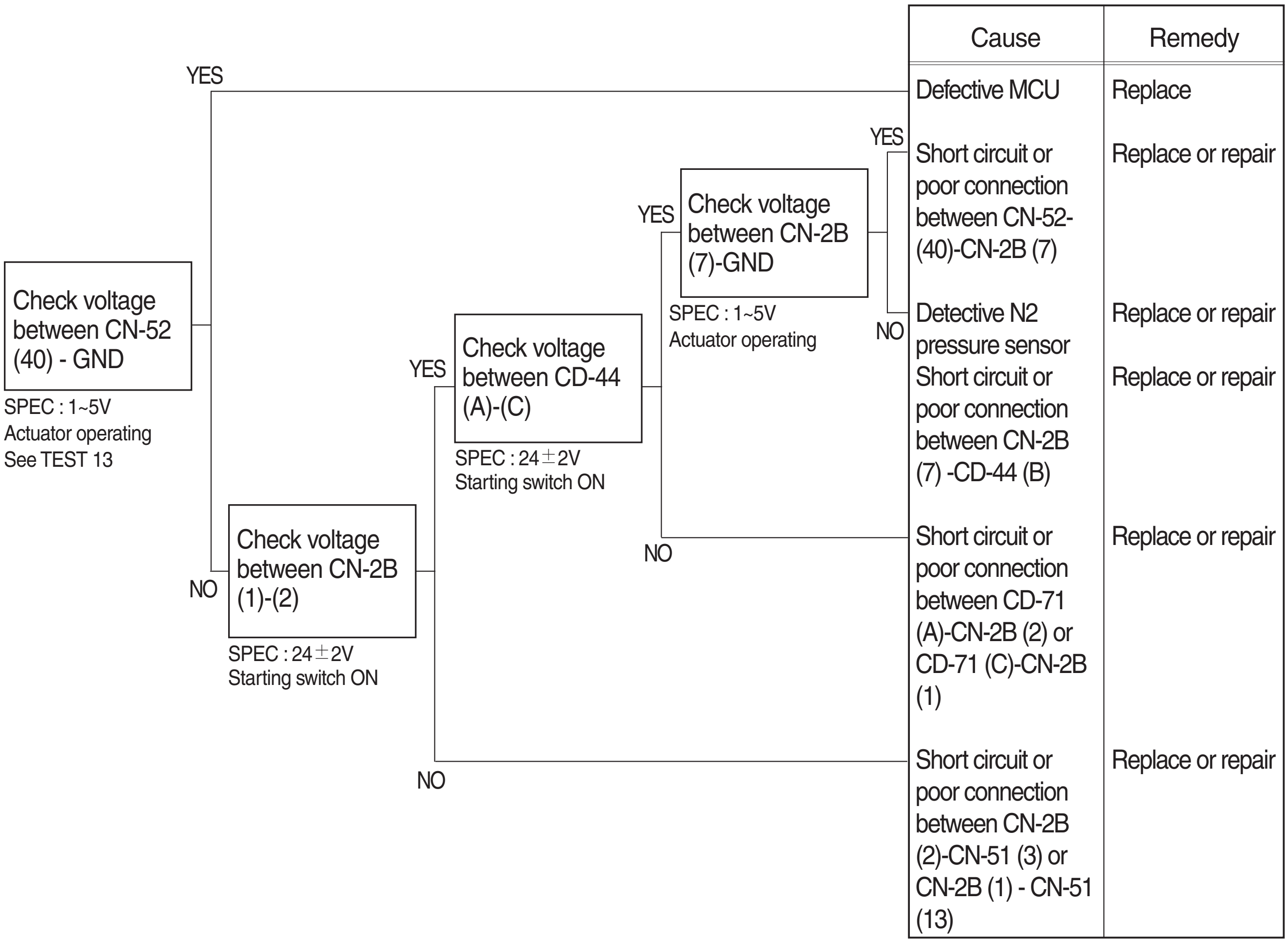
220S6MS12

9. MALFUNCTION OF NEGATIVE 2 PRESSURE SENSOR

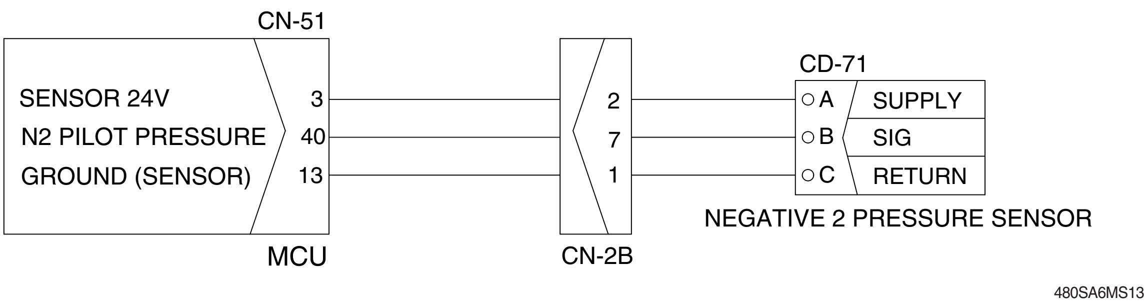
· Fault code : HCESPN 124, FMI 0~4

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram

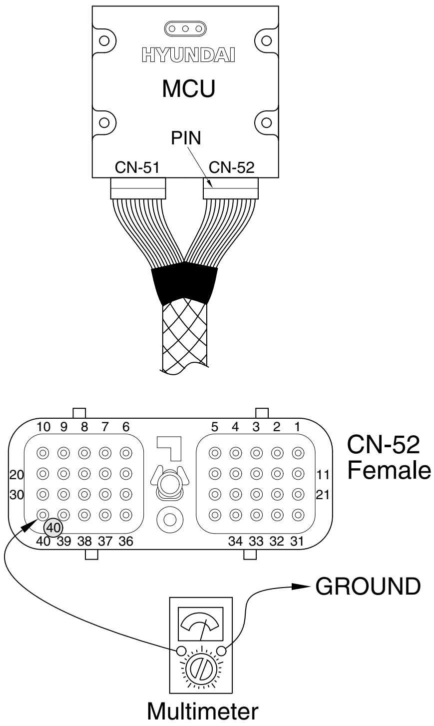


2) TEST PROCEDURE

(1) Test 13 : Check voltage at CN-52 (40) 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 (40) of CN-52.
③ Starting switch ON.
④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



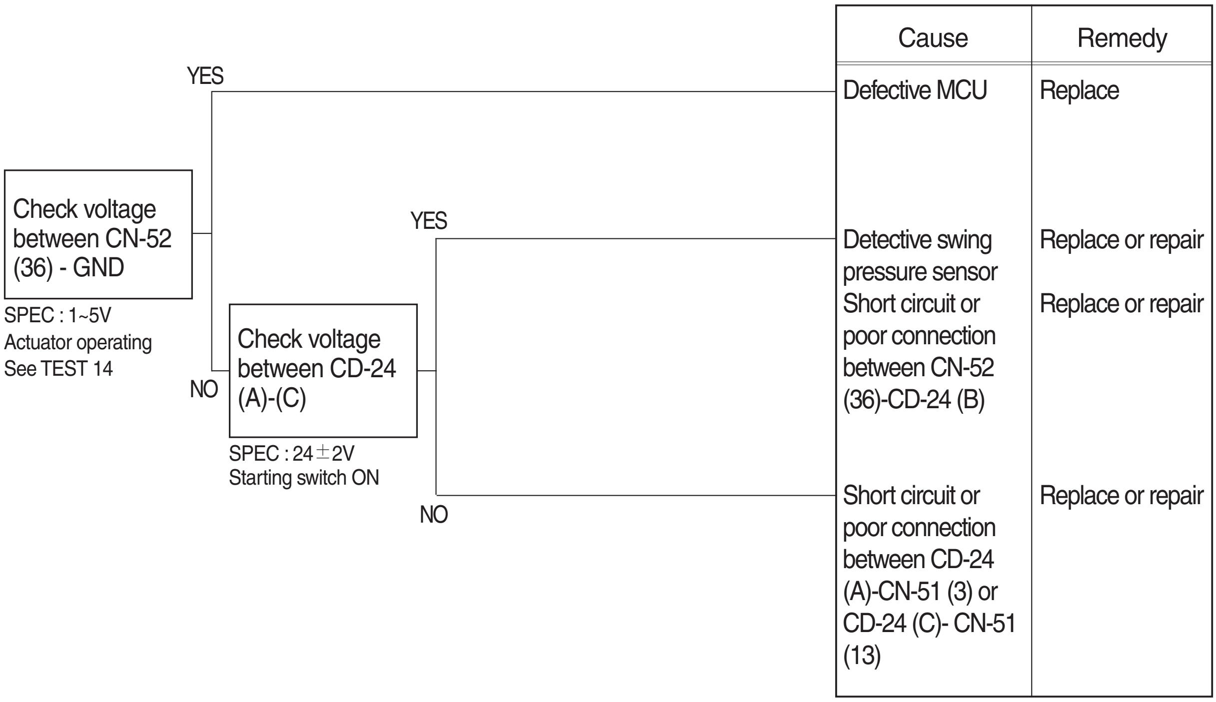
220S6MS14

10. MALFUNCTION OF SWING PRESSURE SENSOR

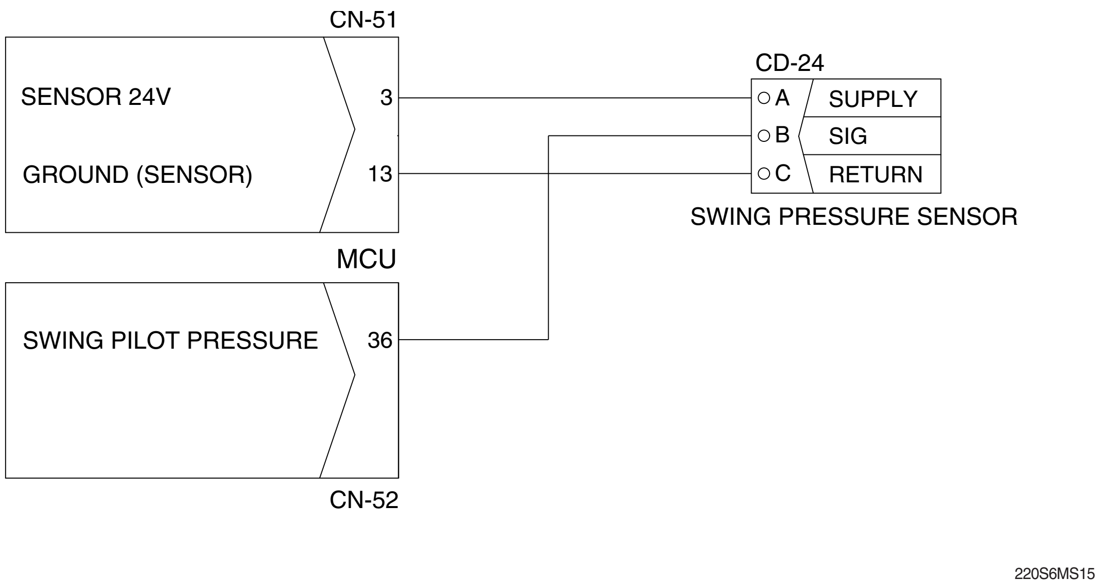
· Fault code : HCESPN 135, FMI 0~4

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram

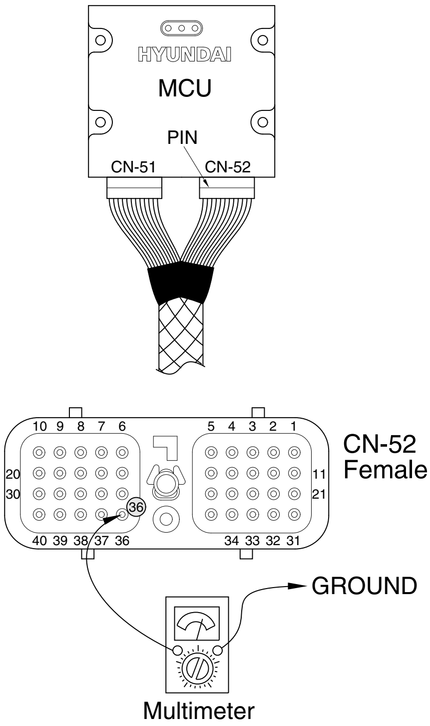


2) TEST PROCEDURE

(1) Test 14 : Check voltage at CN-52 (36) and ground.

① Prepare 1 piece of thin sharp pin, steel or copper.
② Insert prepared pin to rear side of connectors : One pin to (36) of CN-52.
③ Starting switch ON.
④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



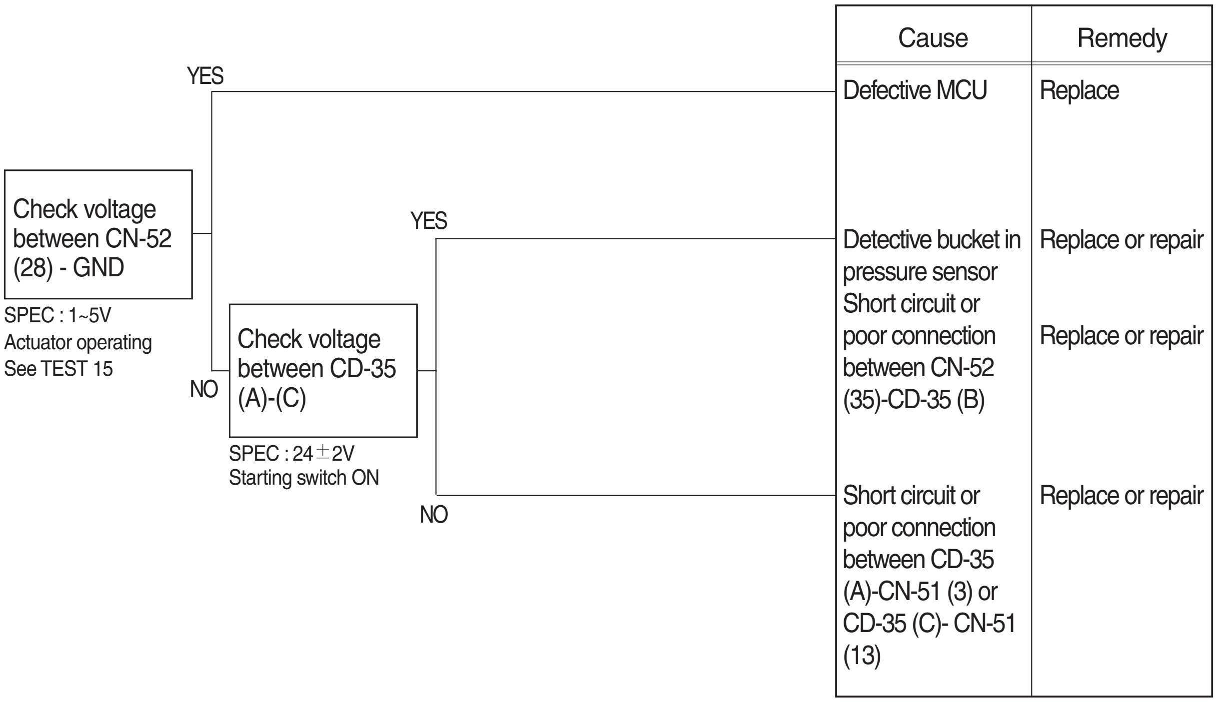
300L6MS16

11. MALFUNCTION OF BUCKET IN PRESSURE SENSOR

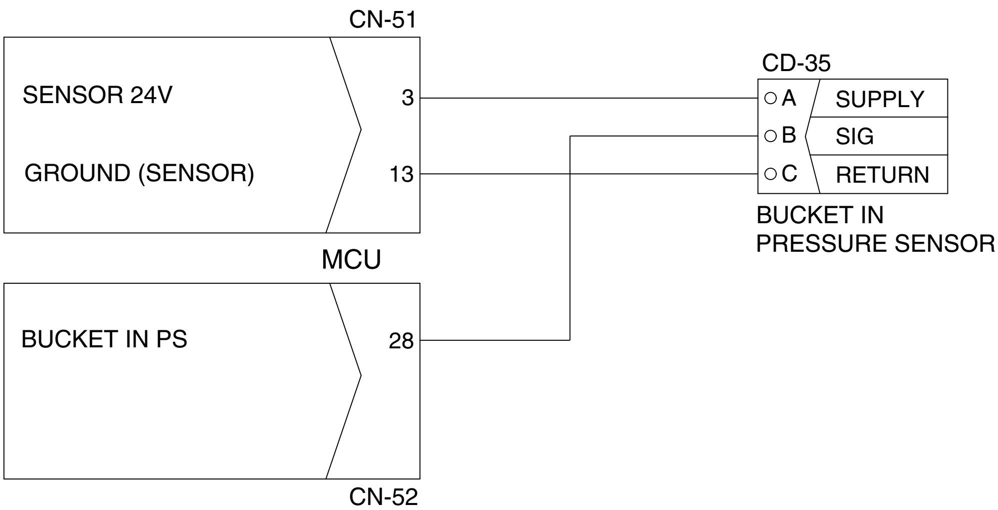
· Fault code : HCESPN 133, FMI 0~4

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram



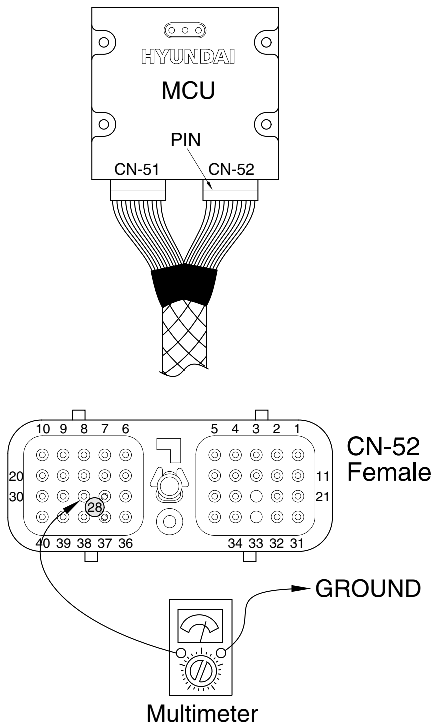
400SA6MS17

2) TEST PROCEDURE

(1) Test 15 : Check voltage at CN-52 (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-52.
③ Starting key ON.
④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



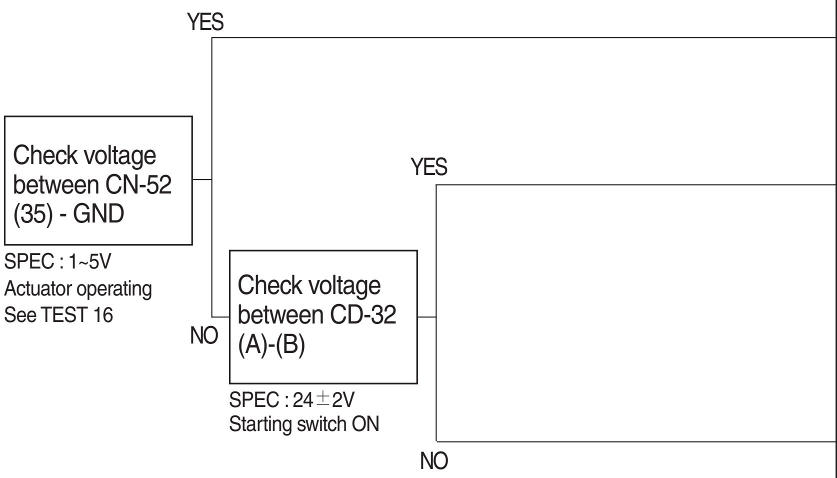
220S6MS18

12. MALFUNCTION OF BOOM UP PRESSURE SENSOR

· Fault code : HCESPN 127, FMI 0~4

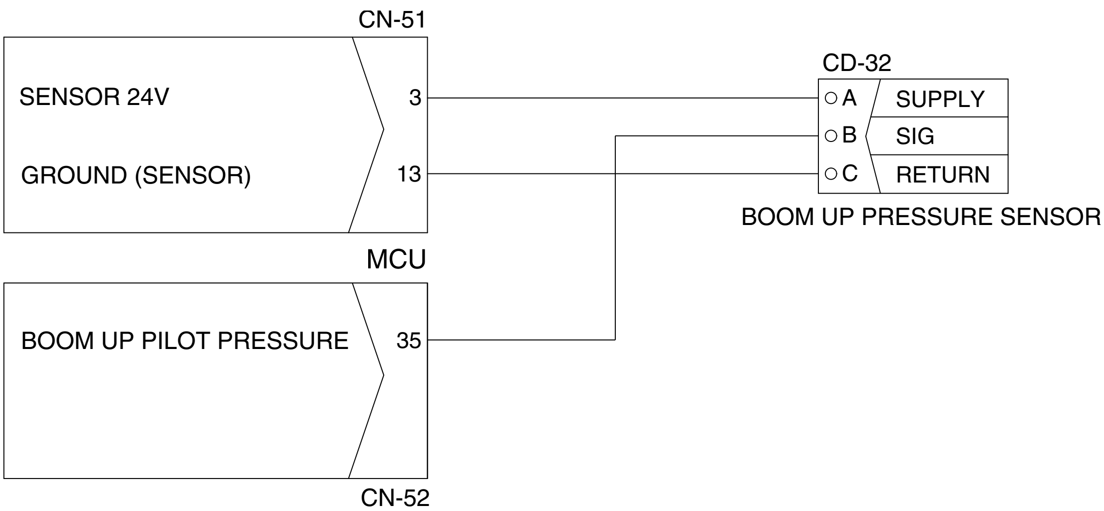
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Detective boom up pressure sensor	Replace or repair
Short circuit or poor connection between CN-52 (35)-CD-32 (B)	Replace or repair
Short circuit or poor connection between CD-32 (A)-CN-51 (3) or CD-32 (C)- CN-51 (13)	Replace or repair

Wiring diagram



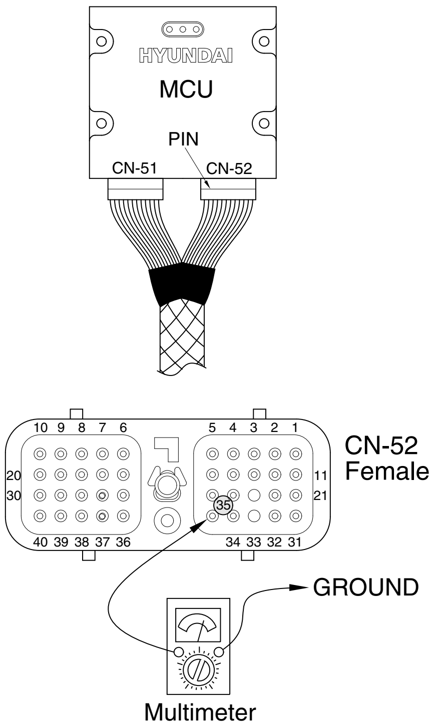
220S6MS19

2) TEST PROCEDURE

(1) Test 16 : Check voltage at CN-52 (35) 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 (35) of CN-52.
③ Starting switch ON.
④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



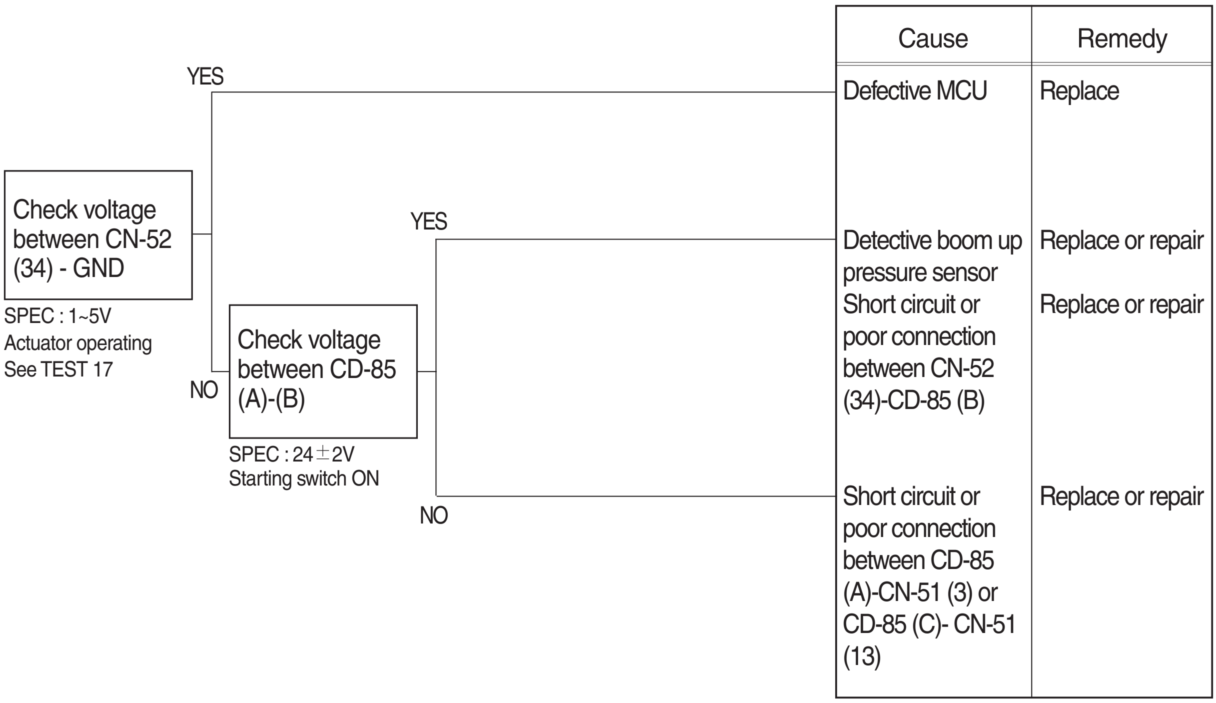
220S6MS20

13. MALFUNCTION OF BOOM DOWN PRESSURE SENSOR

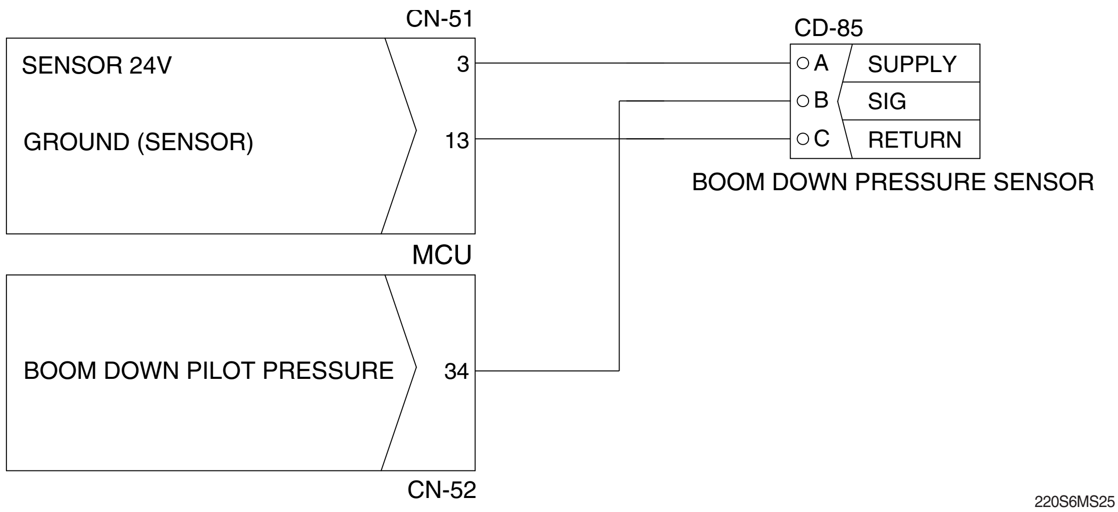
· Fault code : HCESPN 128, FMI 0~4

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram

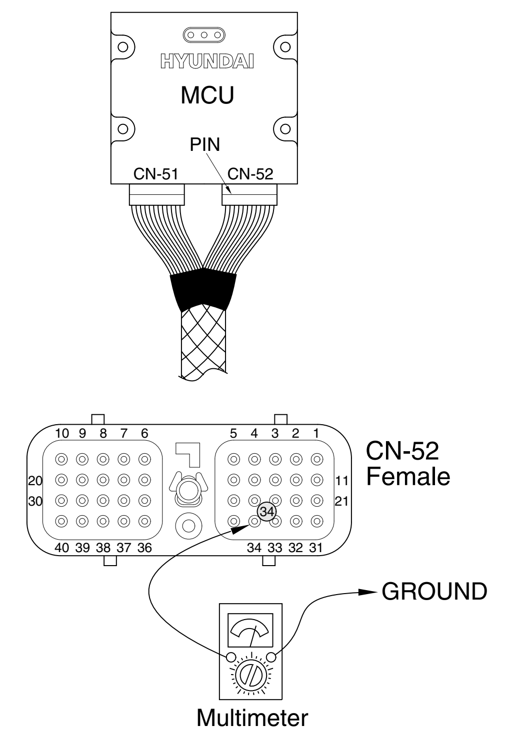


2) TEST PROCEDURE

(1) Test 17 : Check voltage at CN-52 (34) 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 (34) of CN-52.
③ Starting switch ON.
④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



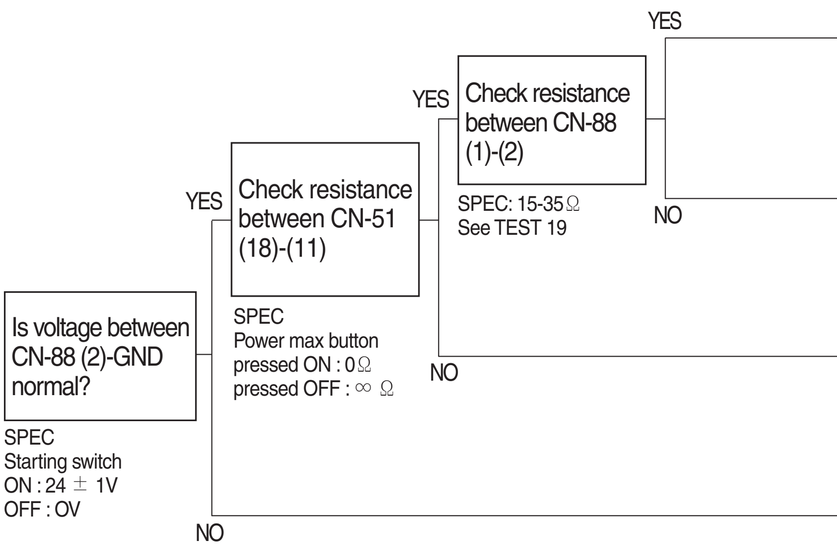
220S6MS26

14. MALFUNCTION OF POWER MAX (NULL)

· Fault code : HCESPN 166, FMI 4 or 6

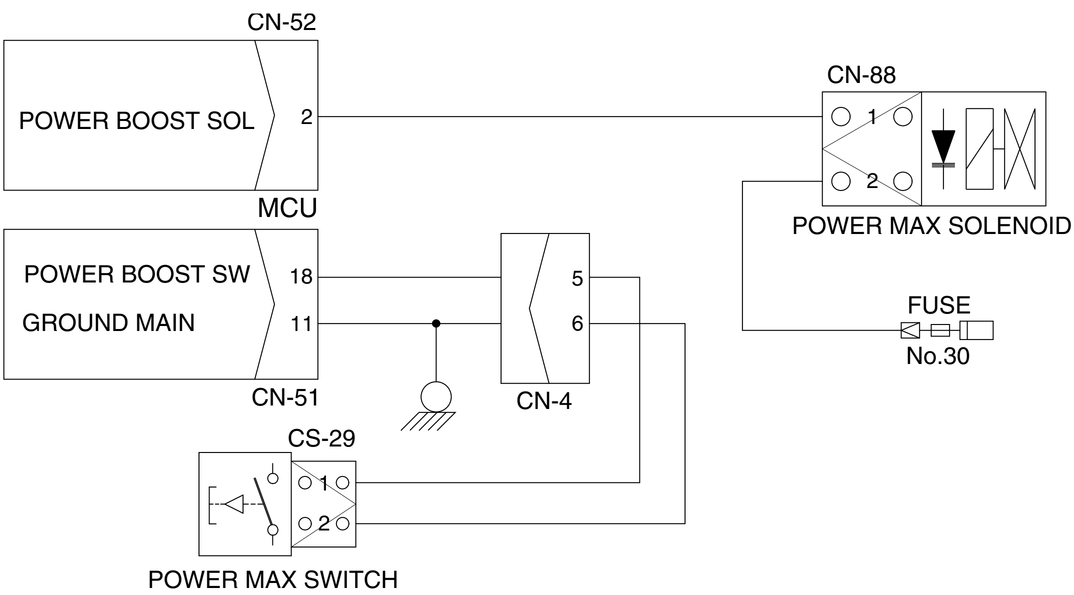
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Short circuit or poor connection between CN-88 (1)-CN-52 (2)	Repair or replace
Defective power max. solenoid valve Check hydraulic system	Repair or replace
Short circuit or poor connection between CN-51 (18)-CS-29 (1)	Repair or replace
Short circuit or poor connection between CN-88 (2)-Fuse No. 30	Repair or replace

Wiring diagram

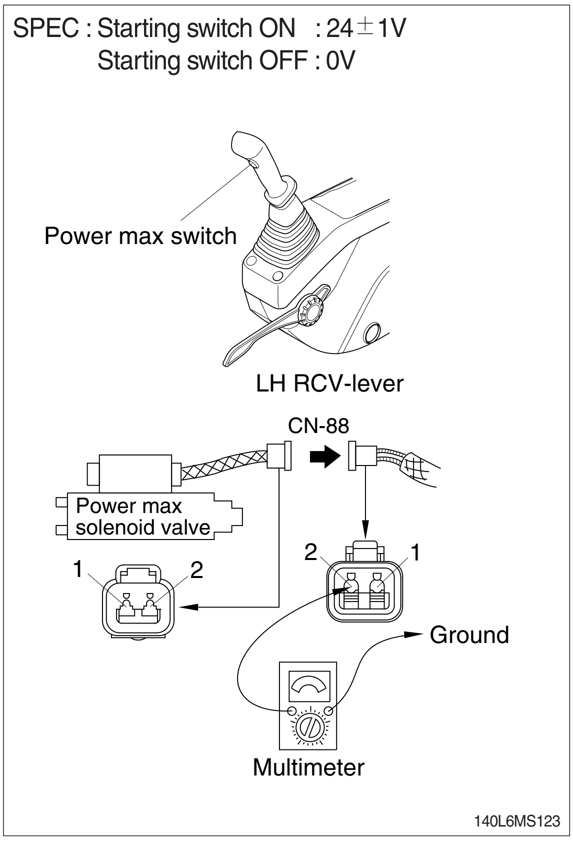


220S6MS21

2) TEST PROCEDURE

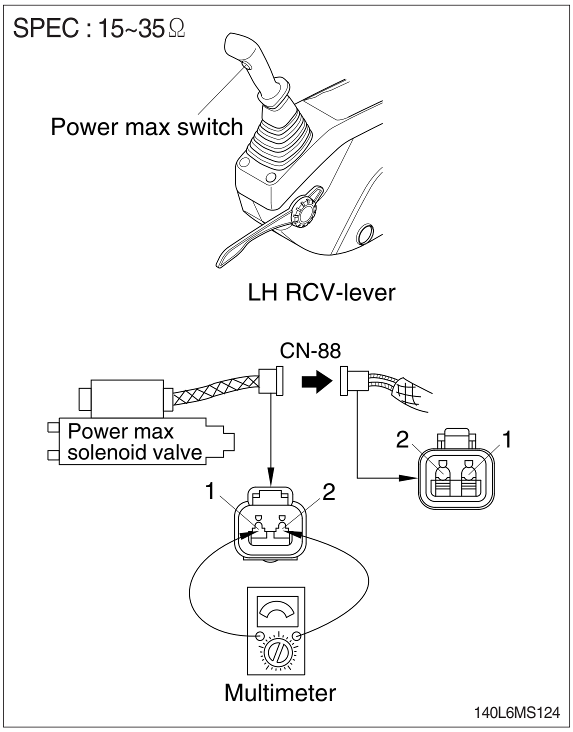
(1) Test 18: Check voltage between connector CN-88 (2) - GND.

① Disconnect connector CN-88 from power max solenoid valve.
② Start switch ON.
③ Check voltage as figure.



(2) Test 19: Check resistance of the solenoid valve between CN-88 (1)-(2).

① Starting switch OFF.
② Disconnect connector CN-88 from power max solenoid valve.
③ Check resistance as figure.



15. MALFUNCTION OF BOOM PRIORITY EPPR VALVE (NULL)

· Fault code : HCESPN 141, FMI 5 or 6

※ Before carrying out below procedure, check all the related connectors are properly inserted.

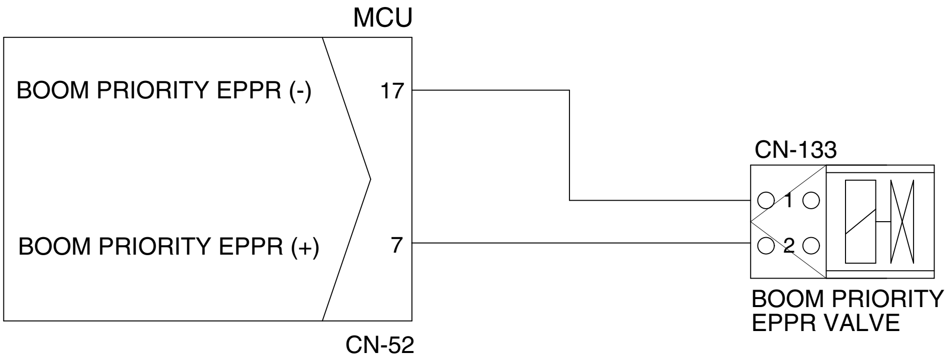
1) INSPECTION PROCEDURE

Check resistance between CN-133 (1)-(2)

SPEC : 20~30V
Starting switch : ON

	Cause	Remedy
YES	Short circuit or poor connection between CN-52 (17)-CN-133 (1) or CN-52 (7)-CN-133 (2)	Repair or replace
NO	Defective EPPR valve	Repair or replace

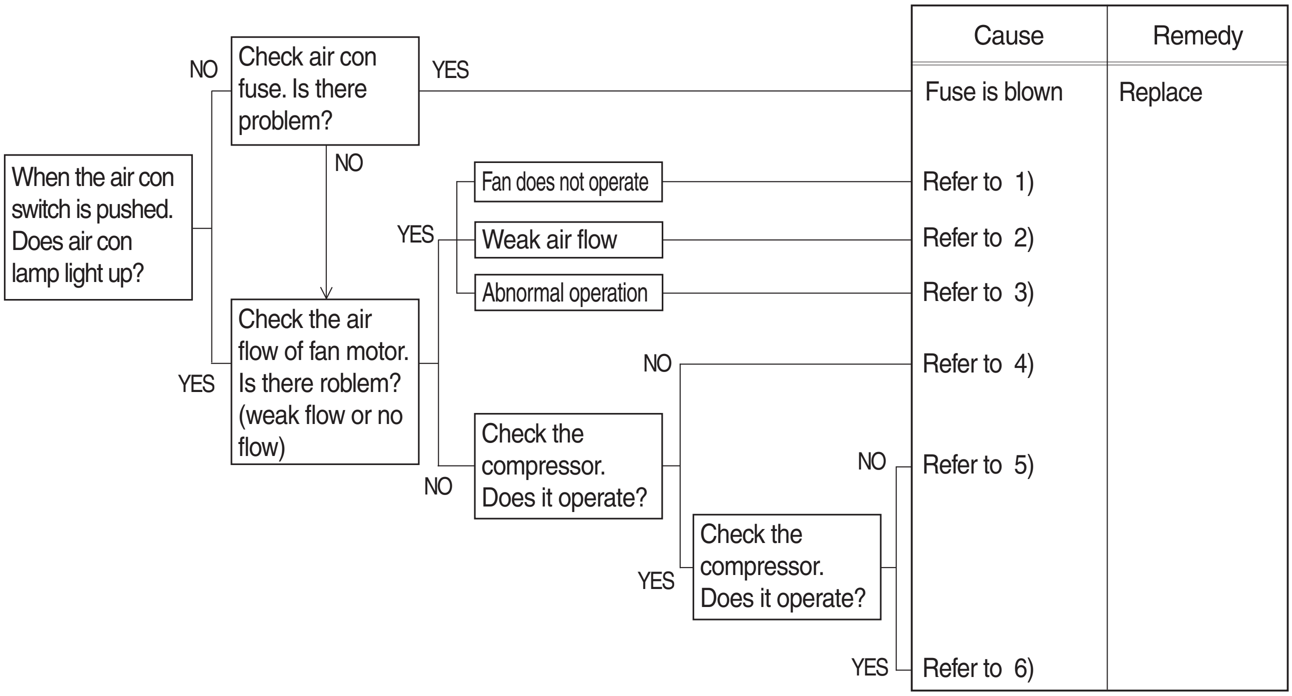
Wiring diagram



220S6MS23

GROUP 5 AIR CONDITIONER AND 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

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.

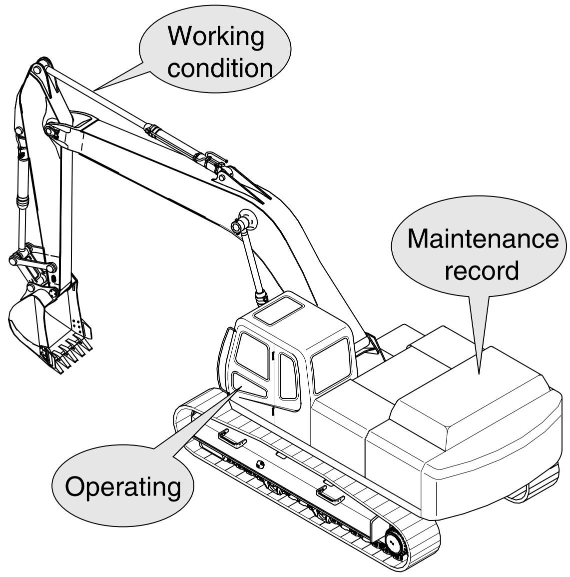
2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

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.

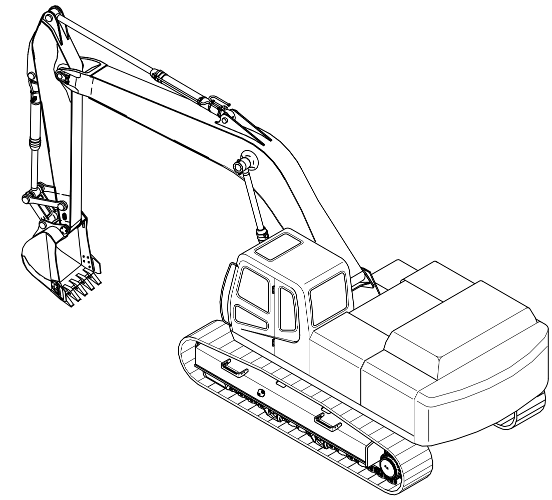


21077MS01

2. TERMINOLOGY

1) STANDARD

Specifications applied to the brand-new machine, components and parts.



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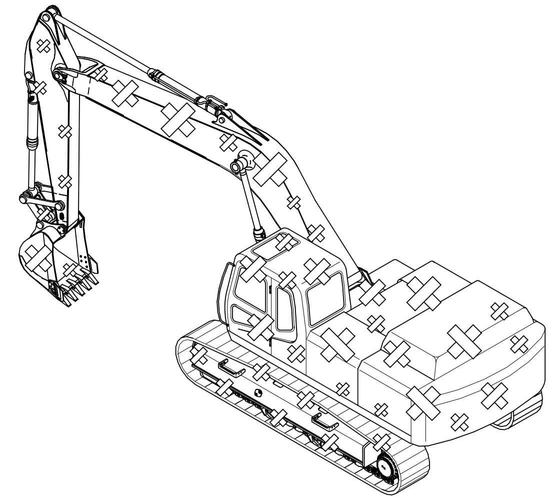
2) SERVICE LIMIT

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.

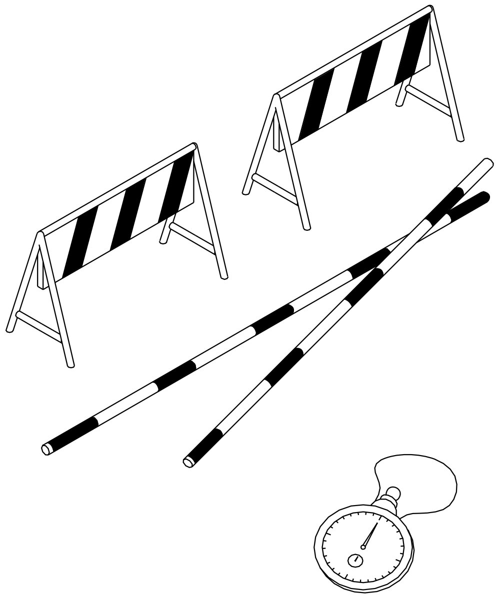
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

(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.

480SA7MS01

(4) Evaluation

The measured speeds should meet the following specifications.

Unit : rpm

Model	Engine speed	Standard	Remarks
HX500LT3 HX520LT3	Start idle	800±100	
	P mode	1700±50	
	S mode	1600±50	
	E mode	1500±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.

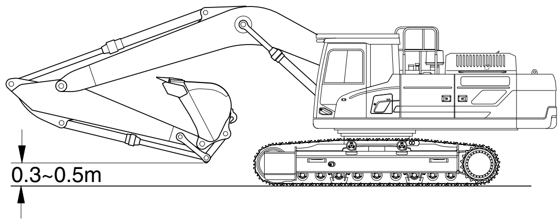
(2) Preparation

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.



480SA7MS02

(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.

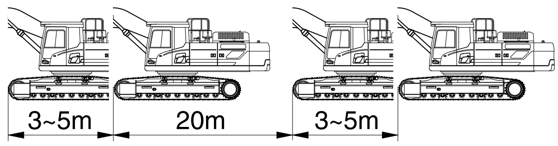
· Power mode switch : P mode

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.



480SA7MS03

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds / 20 m

Model	Travel speed	Standard	Maximum allowable	Remarks
HX500LT3 HX520LT3	1 Speed	22.2±2.0	30	
	2 Speed	13.9±1.0	19.4	

4) TRACK REVOLUTION SPEED

(1) Measure the track revolution cycle time with the track raised off ground.

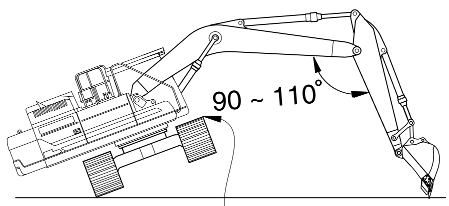
(2) Preparation

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.



480SA7MS04

(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
HX500LT3 HX520LT3	1 Speed	38.7±2.0	52.2
	2 Speed	24.1±1.0	33

5) TRAVEL DEVIATION

(1) Measure the deviation by the tracks from a 20 m straight line.

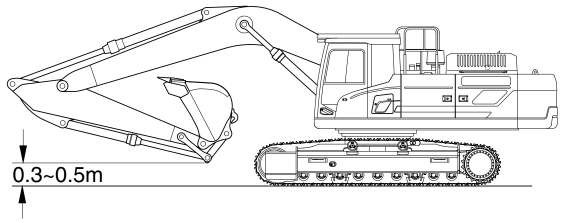
(2) Preparation

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.



480SA7MS02

(3) Measurement

① Measure the amount of mistracking at high and low travel speeds.

② Before beginning each test, select the following switch positions.

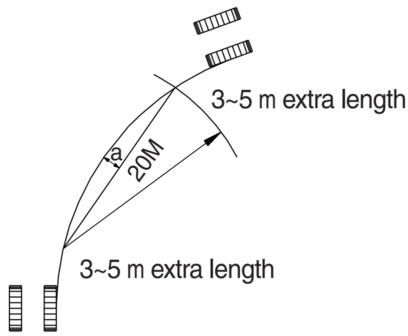
· Power mode switch : P mode

③ Start traveling the machine in the acceleration zone with the travel levers at full stroke.

④ Measure the distance between a straight 20 m line and the track made by the machine. (Dimension a)

⑤ After measuring the tracking in forward travel, turn the upperstructure 180 °and measure that in reverse travel.

⑥ Repeat steps ④ and ⑤ three times and calculate the average values.



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(4) Evaluation

Mistrack should be within the following specifications.

Unit : mm / 20 m

Model	Standard	Maximum allowable	Remarks
HX500LT3 HX520LT3	200 below	250	-

6) SWING SPEED

(1) Measure the time required to swing three complete turns.

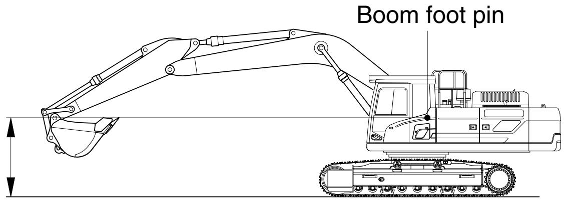
(2) Preparation

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.



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(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
HX500LT3 HX520LT3	P mode	20.5±1.5	27.3

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.

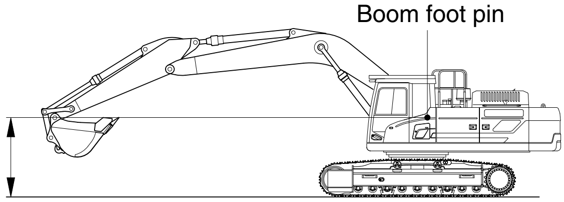
② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.

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.



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(3) Measurement

① Conduct this test in the M mode.

② Select the following switch positions.

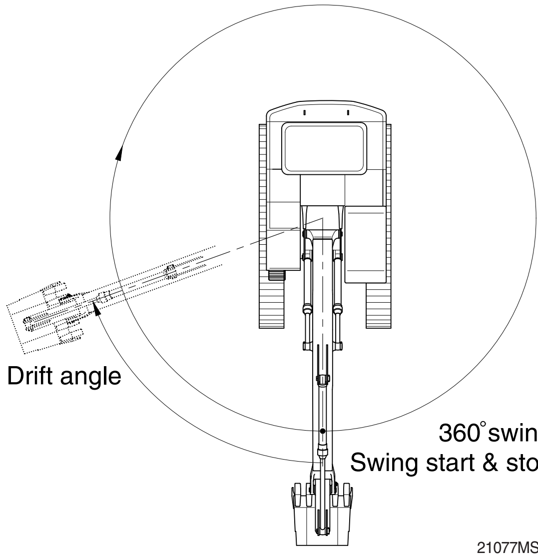
· Power mode switch : P mode

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.



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(4) Evaluation

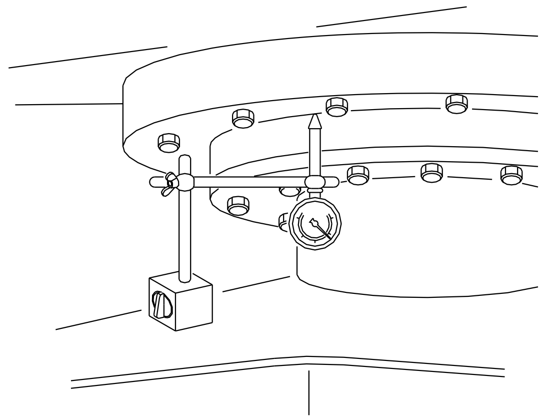
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Power mode switch	Standard	Maximum allowable	Remarks
HX500LT3 HX520LT3	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.

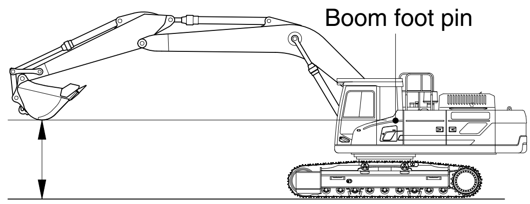
(3) Measurement

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).

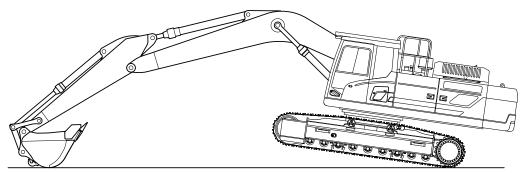
② Lower the bucket to the ground and use it to raise the front idler 50 ㎝.
Record the dial gauge reading (h2).

③ Calculate bearing play (H) from this data (h1 and h2) as follows.
H=h2-h1

Measurement : (h1)



Measurement : (h2)



480SA7MS06

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Standard	Maximum allowable	Remarks
HX500LT3 HX520LT3	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.

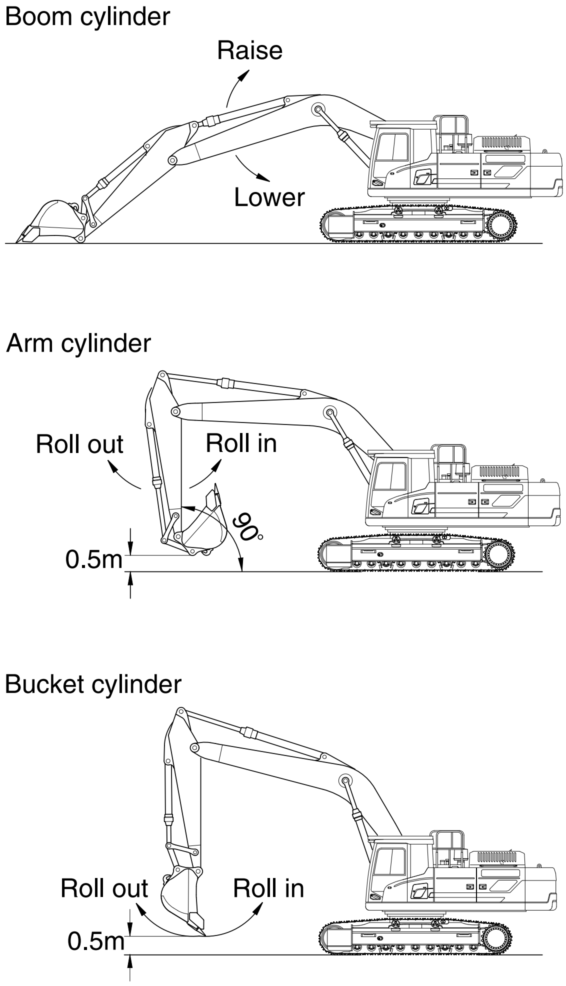
③ To measure the cycle time of the bucket cylinder.
The empty bucket should be positioned at midstroke between roll-in and roll-out, so that the sideplate edges are vertical to the ground.

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.



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- 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
HX500LT3	Boom raise	4.5±0.4	5.4	
	Boom lower	2.7±0.4	3.4	
	Arm in	3.3±0.4	4.4	
	Arm out	3.4±0.4	4.0	
	Bucket load	3.6±0.4	4.3	
	Bucket dump	2.8±0.4	3.5	
HX520LT3	Boom raise	4.5±0.4	5.4	
	Boom lower	2.7±0.4	3.4	
	Arm in	3.3±0.4	4.4	
	Arm out	3.4±0.4	4.0	
	Bucket load	3.6±0.4	4.3	
	Bucket dump	2.8±0.4	3.5	

10) DIG FUNCTION DRIFT CHECK

(1) Measure dig function drift, which can be caused by oil leakage in the control valve and boom, standard arm, and standard bucket cylinders, with the loaded bucket. When testing the dig function drift just after cylinder replacement, slowly operate each cylinder to its stroke end to purge air.

(2) Preparation

① Load bucket fully. Instead of loading the bucket, weight(W) of the following specification can be used.

· $W = M^3 \times 1.5$

Where :

M^3 = Bucket heaped capacity (m^3)

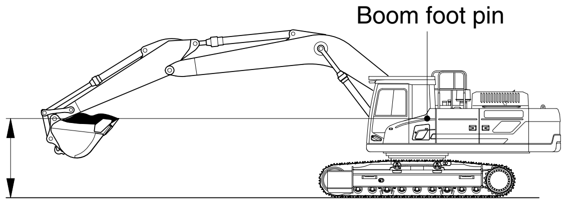
1.5 = Soil specific gravity

② Position the arm cylinder with the rod 20 to 30 mm extended from the fully retracted position.

③ Position the bucket cylinder with the rod 20 to 30 mm retracted from the fully extended position.

④ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin.

⑤ Keep the hydraulic oil temperature at 50±5˚C.



480SA7MS08

(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
HX500LT3 HX520LT3	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
HX500LT3 HX520LT3	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
HX500LT3 HX520LT3	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.

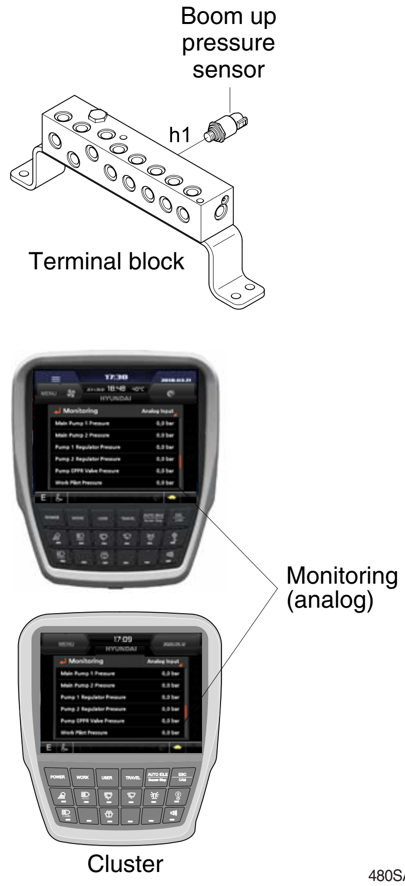
(2) Measurement

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.



480SA7MS13

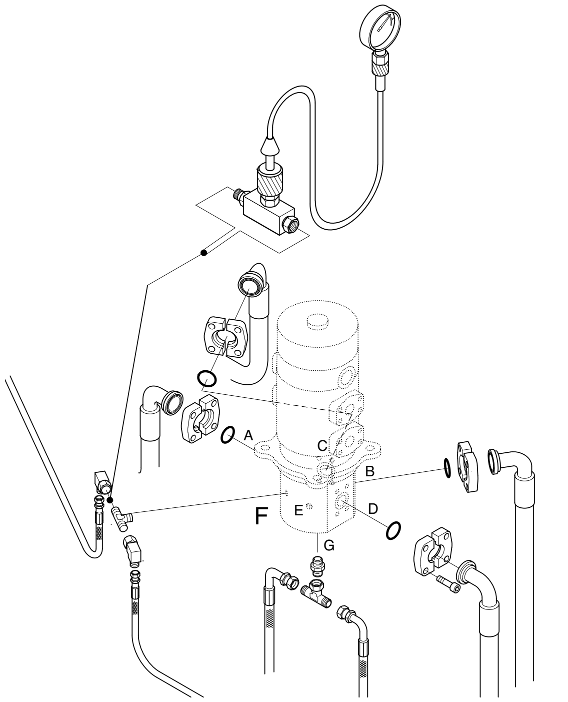
(3) Evaluation

The average measured pressure should meet the following specifications:

Unit : kgf / cm²

Model	Engine speed	Standard	Allowable limits	Remarks
HX500LT3 HX520LT3	P mode	40^{+2}_{0}	-	

14) FOR TRAVEL SPEED SELECTING PRESSURE:



(1) Preparation

① Stop the engine.
② Loosen the cap and relieve the pressure in the tank by pushing the top of the air breather.
③ To measure the speed selecting pressure: Install a connector and pressure gauge assembly to turning joint P port as shown.
④ Start the engine and check for on leakage from the adapter.
⑤ Keep the hydraulic oil temperature at 50±5˚C.

(2) Measurement

① Select the following switch positions.
· Power mode switch : P mode
· Travel mode switch : 1 speed
 2 speed
② Measure the travel speed selecting pressure in the Hi or Lo mode.
③ Lower the bucket to the ground to raise the track off the ground. Operate the travel lever at full stroke and measure the fast speed pressure.
④ Repeat steps ② and ③ three times and calculate the average values.

(3) Evaluation

The average measured pressure should be within the following specifications.

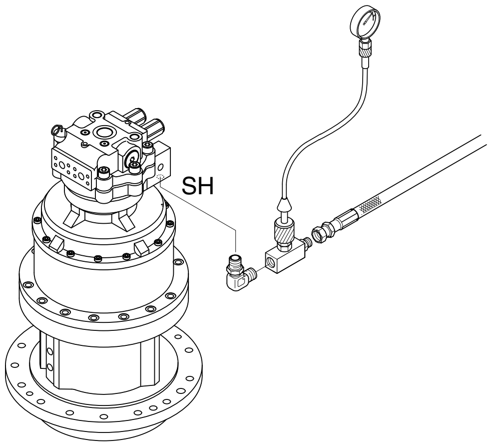
Unit : kgf / cm^2

Model	Travel speed mode	Standard	Maximum allowable	Remarks
HX500LT3 HX520LT3	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.



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(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 / cm^2

Model	Description	Standard	Allowable limits	Remarks
HX500LT3 HX520LT3	Brake disengaged	40	31~42	
	Brake applied	0	-	

16) MAIN PUMP DELIVERY PRESSURE

(1) Preparation

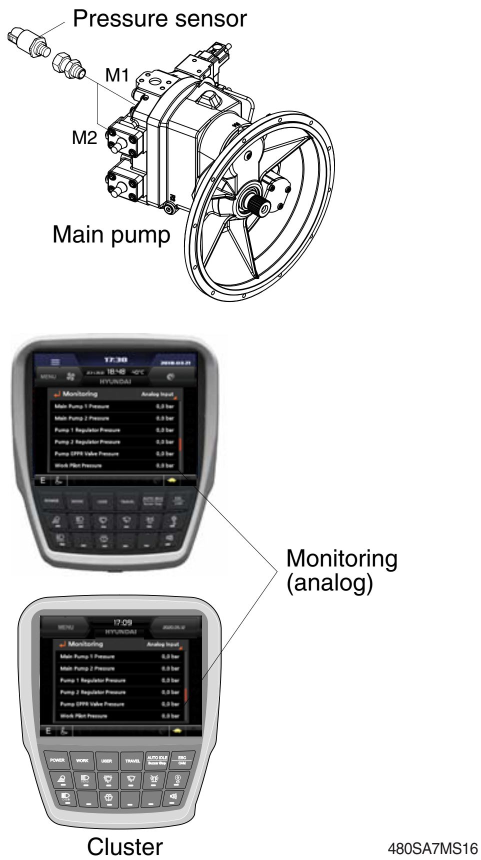
① Keep the hydraulic oil temperature at 50±5˚C.

(2) Measurement

① Select the following switch positions.

· Power mode switch : P mode

② Measure the main pump delivery pressure in the P mode (high idle).



(3) Evaluation

The average measured pressure should meet the following specifications.

Unit : kgf / cm^2

Model	Engine speed	Standard	Allowable limits	Remarks
HX500LT3 HX520LT3	High idle	40±5	-	

17) SYSTEM PRESSURE REGULATOR RELIEF SETTING

(1) Preparation

① Keep the hydraulic oil temperature at 50±5˚C.

(2) Measurement

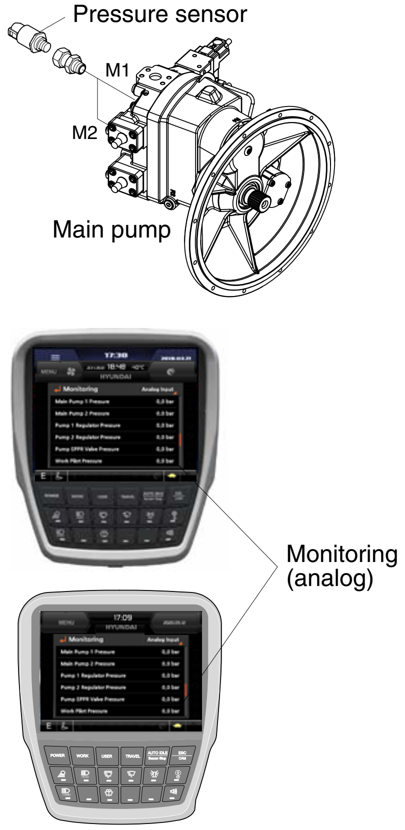
① Select the following switch positions.

· 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.



480SA7MS16

(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm²

Model	Function to be tested	Standard	Port relief setting
HX500LT3 HX520LT3	Boom	330 (360)±10	380
	Arm	330 (360)±10	380
	Bucket	330 (360)±10	380
	Travel	360±10	360
	Swing	285±10	285

(　) : Power boost

GROUP 2 MAJOR COMPONENT

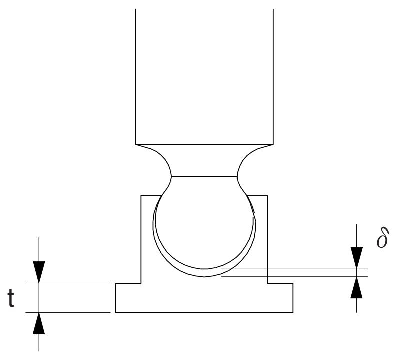
1. MAIN CONTROL VALVE

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



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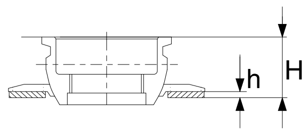

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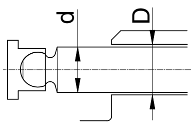
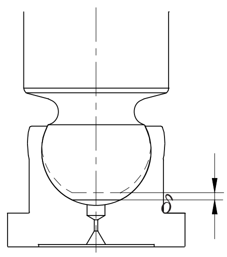
2) SLIDING PARTS

Part name	Standard roughness	Allowable roughness	Remark
Shoe	Rmax=1S (Ra=0.2a) (LAPPING)	4S (Ra=0.1a)	
Shoe plate	Rmax=0.4S (Ra=0.1a) (LAPPING)	3S (Ra=0.8a)	
Cylinder	Rmax=0.4S (Ra=0.1a) (LAPPING)	3S (Ra=0.8a)	
Valve plate	Rmax=0.4S (Ra=0.1a) (LAPPING)	2S (Ra=0.5a)	

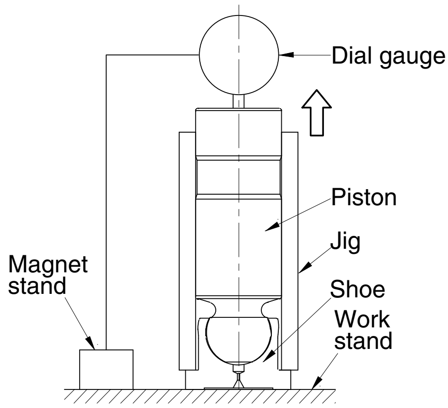
3. TRAVEL MOTOR

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..

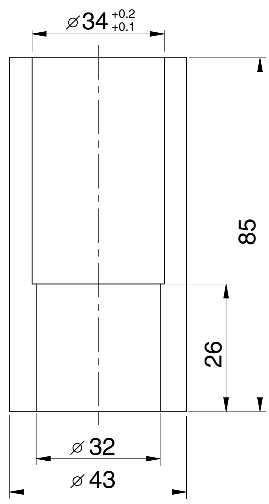
Check item		Measuring method	Criteria	Allowable	Remedy
Sliding surface of cylinder block, valve plate and swash plate	Surface roughness of cylinder block, valve plate and swas plate	Measure the surface roughness by roughness tester	Below 0.4 Zμ	Below 3.0 Zμ	Replace or repair ※ Lap together the surfaces of both cylinder block and valve plate to remedy their roughness (# 1200 power)
	Swash plate - hardness of sliding surface	Measure the surface hardness of swash plate by hardness 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

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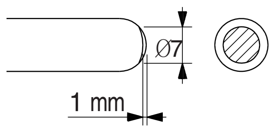
Check item	Measuring method	Criteria	Allowable	Remedy
Parking brake torque	After completion of assembly, set the torque wrench on the shaft end, and measure the braking torque generated when the shaft starts to rotate	92.6 kgf · m (670 lbf · ft)	82.8 kgf · m (599 lbf · ft)	Replace all of separator, friction 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.

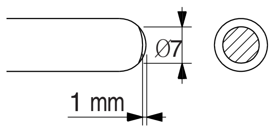
4. RCV LEVER

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.

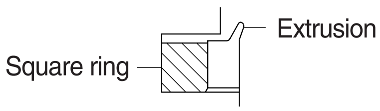
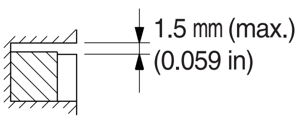
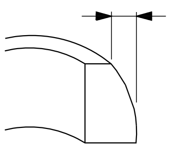
2. When loosening the hexagon socket head cap screw (125), replace the seal washers (121) without fail.

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

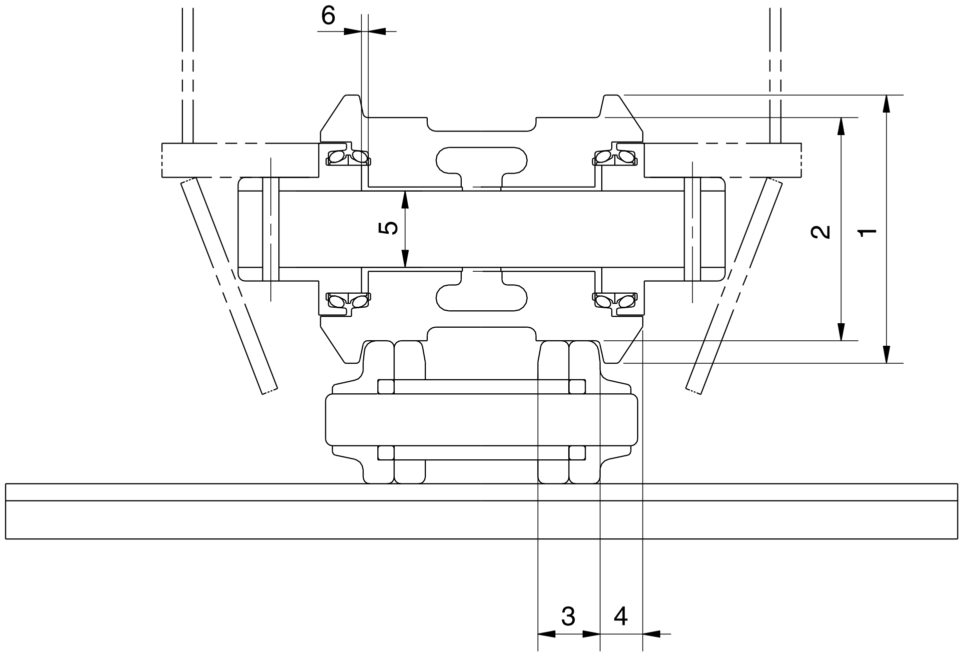
Part name	Inspecting section	Inspection item	Remedy
Piston rod	· Neck of rod pin	· Presence of crack	· Replace
	· Weld on rod hub	· Presence of crack	· Replace
	· Stepped part to which piston is attached.	· Presence of crack	· Replace
	· Threads	· Presence of crack	· Recondition or replace
	· Plated 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

GROUP 3 TRACK AND WORK EQUIPMENT

1. TRACK

1) LOWER ROLLER

(1) HX500LT3

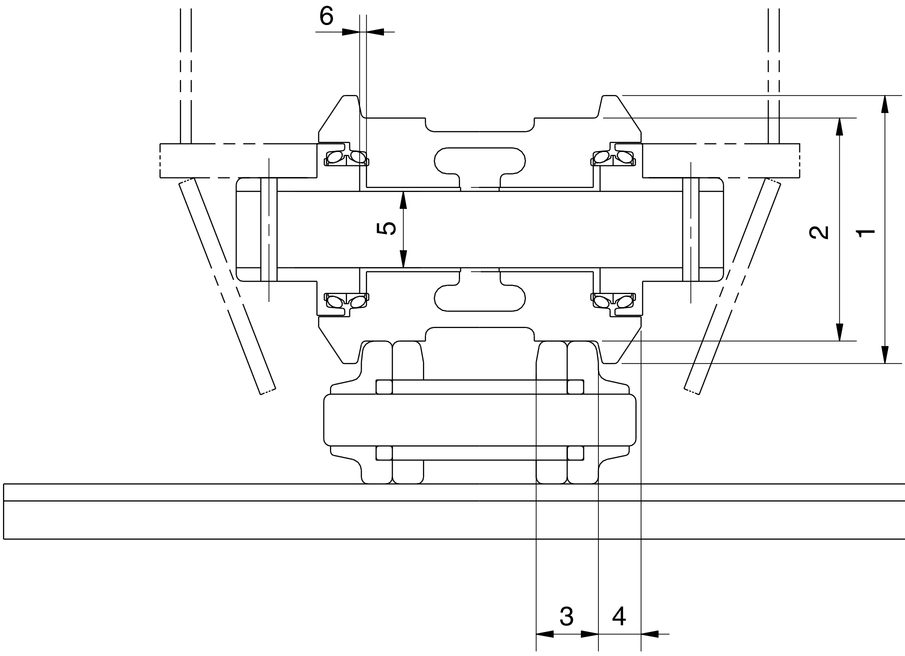


21037MS01

Unit : ㎜

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 & tolerance		Standard clearance	Clearance limit	Replace bushing
		Shaft	Hole			
		Ø90 0 / -0.03	Ø90 +0.32 / +0.254	0.254~0.35	2.0	
6	Side clearance of roller (both side)	Standard clearance		Clearance limit		Replace
		0.36~1.14		2.0		

(2) HX520LT3

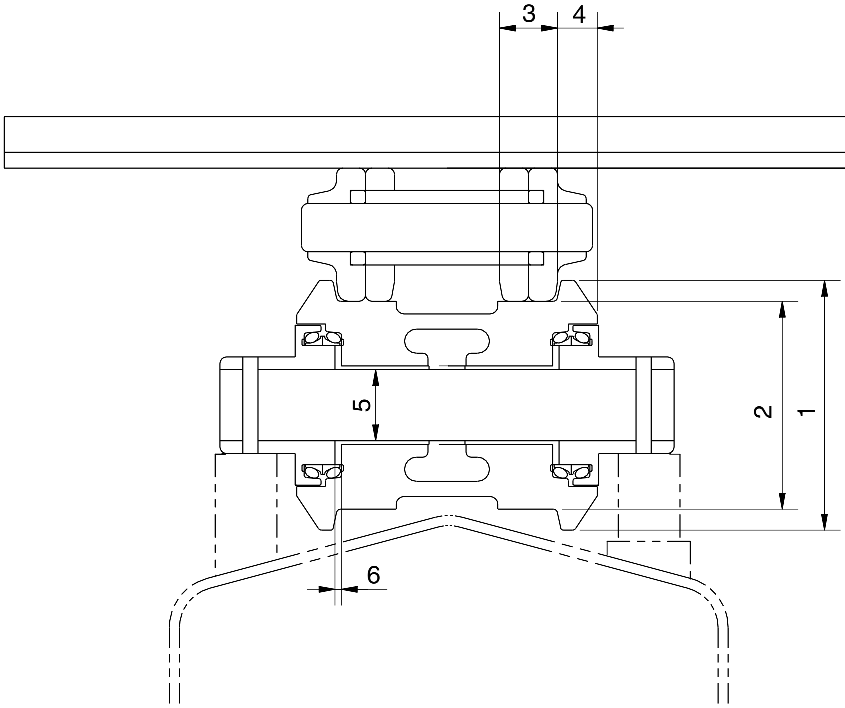


Unit : ㎜

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 & tolerance		Standard clearance	Clearance limit	Replace bushing
		Shaft	Hole			
		Ø90 $^{0}_{-0.035}$	Ø90 $^{+0.404}_{+0.302}$	0.302~0.439	2.0	
6	Side clearance of roller (both side)	Standard clearance		Clearance limit		Replace
		0.21~1.38		2.0		

2) UPPER ROLLER

(1) HX500LT3

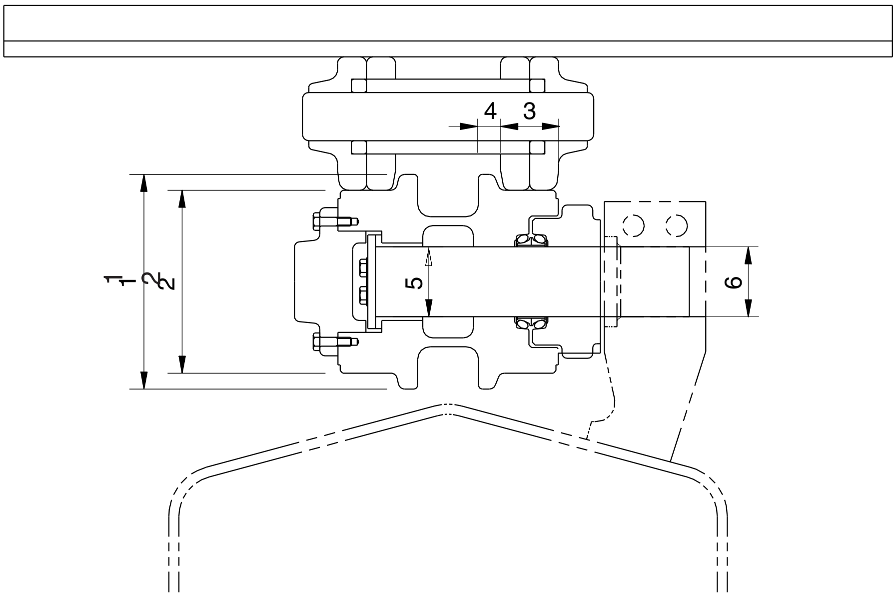


480SA7MA37

Unit : mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="4">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outside diameter of flange</td><td colspan="2">Standard size</td><td colspan="2">Repair limit</td><td rowspan="5">Rebuild or replace</td></tr>
<tr><td colspan="2">Ø260</td><td colspan="2">–</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="2">Ø210</td><td colspan="2">Ø198</td></tr>
<tr><td>3</td><td>Width of tread</td><td colspan="2">57</td><td colspan="2">63</td></tr>
<tr><td>4</td><td>Width of flange</td><td colspan="2">37.5</td><td colspan="2">–</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Clearance between shaft and bushing</td><td colspan="2">Standard size & tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="3">Replace bushing</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>Ø90 $^{0}_{-0.03}$</td><td>Ø90 $^{+0.32}_{+0.254}$</td><td>0.254~0.35</td><td>2.0</td></tr>
<tr><td>6</td><td>Side clearance of roller (both side)</td><td colspan="2">0.36~1.14</td><td colspan="2">2.0</td><td>Replace</td></tr>
</table>

(2) HX520LT3

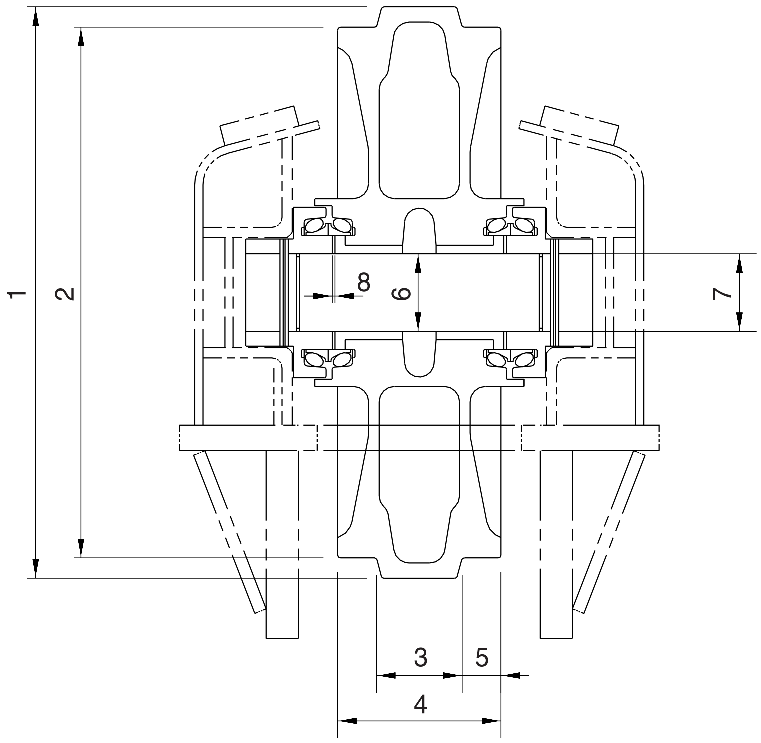


480SA7MA38

Unit : ㎜

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 bearing	Standard size & tolerance		Standard clearance	Clearance limit	Replace bushing
		Shaft	Hole			
		Ø50 +0.033 / +0.017	Ø50 +0.013 / 0	0.004~0.033	2.0	
6	Clearance between shaft and support	Ø57.15 0 / -0.1	Ø58 +0.5 / +0.3	0.3 to 0.6	1.2	Replace

3) IDLER

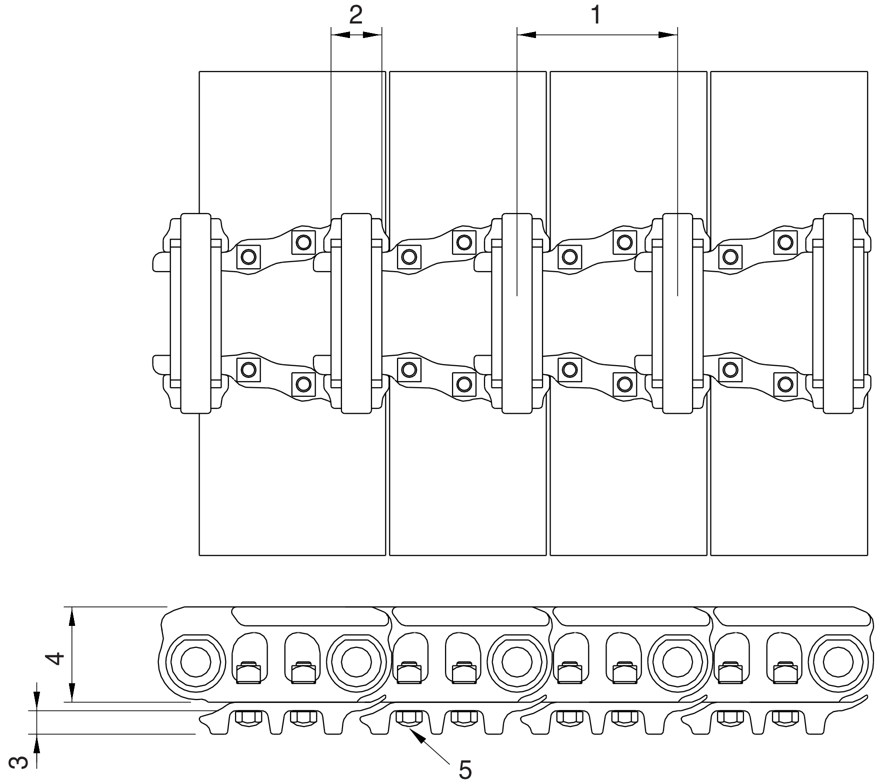


21037MS03

Unit : mm

No.	Check item	Criteria				Remedy
1	Outside diameter of protrusion	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			
		$\varnothing 95^{\ 0}_{-0.035}$	$\varnothing 95^{+0.50}_{+0.45}$	0.45 ~ 0.535	2.0	
7	Clearance between shaft and bracket	$\varnothing 95^{\ 0}_{-0.035}$	$\varnothing 95^{+0.126}_{+0.072}$	0.072 ~ 0.126	1.2	Replace
8	Side clearance of idler (both side)	Standard clearance 0.4 ~ 1.0		Clearance limit 2.0		Replace

4) TRACK



21037MS04

Unit : mm

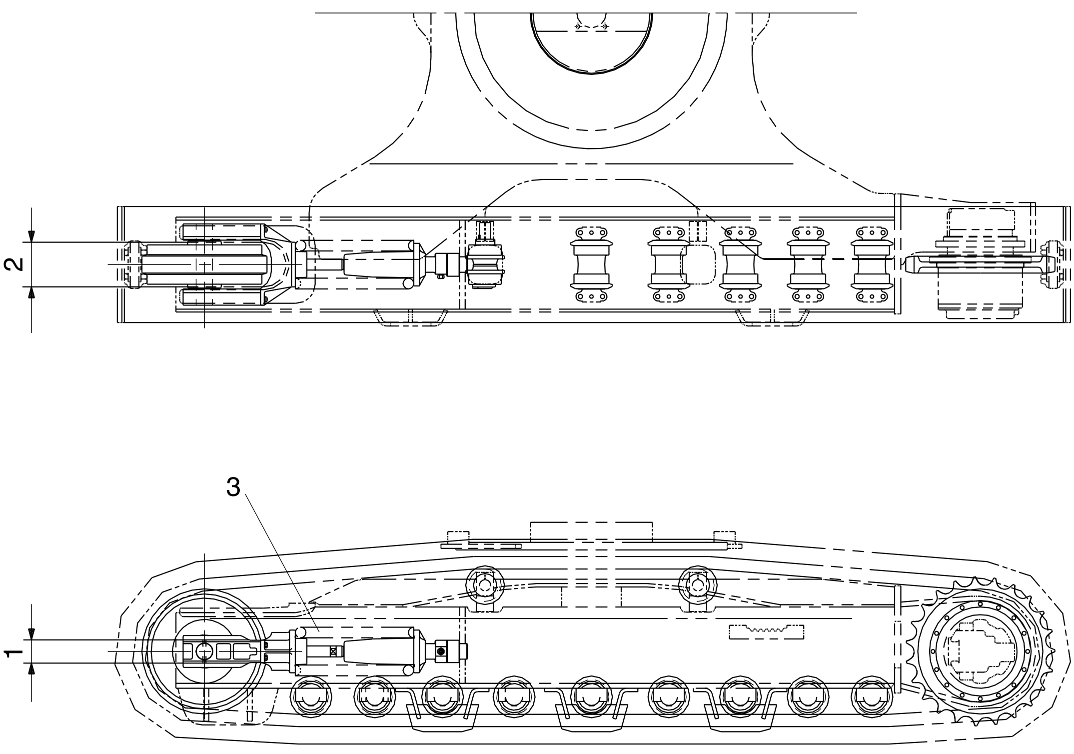
No.	Check item	Criteria		Remedy
1	Link pitch	Standard size	Repair limit	Turn or replace
		216	221	
2	Outside diameter of bushing	Ø73.4	Ø63.4	Rebuild or replace
3	Height of grouser	36	23	
4	Height of link	134	129	
5	Tightening torque	Initial tightening torque : 145±5 kgf · m		Retighten

(Mahcine Serial No. HX480LT3 : #0295-, HX520LT3 : #0275-)

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 : ㎜

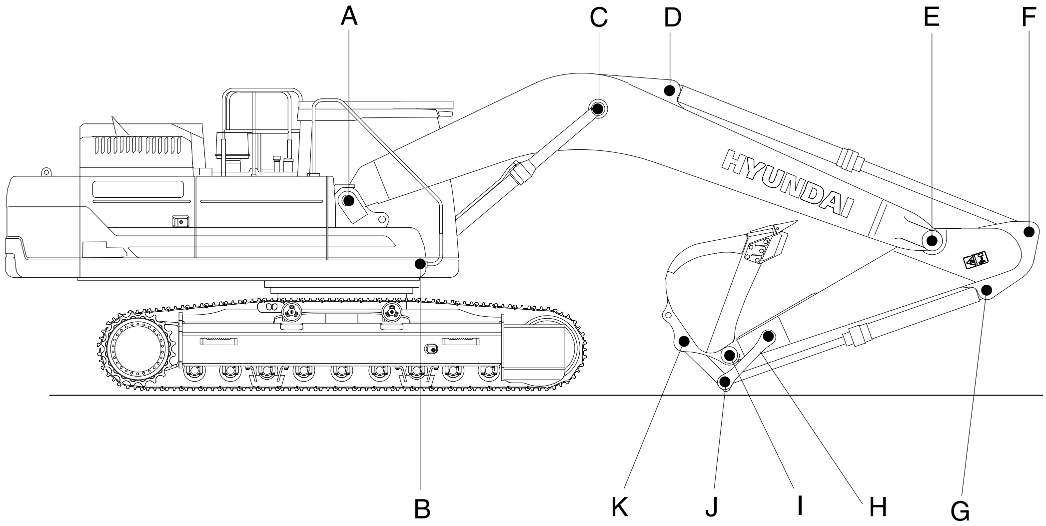
No.	Check item	Criteria					Remedy
1	Vertical width of idler guide			Standard size	Tolerance	Repair limit	Rebuild or replace
		Track frame		132	2.0 0	136	
		Idler support		130	0 -1.5	126	
2	Horizontal width of idler guide	Track frame		292	2.0 0	297	
		Idler support		290	-	288	
3	Recoil spring	Standard size			Repair limit		Replace
		Free length	Installation length	Installation load	Free length	Installation load	
		865	707	28840 kg	-	23073 kg	

(Mahcine Serial No. HX480LT3 : #0295-, HX520LT3 : #0275-)

Unit : ㎜

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



480SA7MS20

Unit : ㎜

Mark	Measuring point (Pin and Bushing)	Normal value	Pin		Bushing		Remedy & Remark
			Recomm. service limit	Limit of use	Recomm. service limit	Limit of use	
A	Boom Rear	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 (HX500LT3)	110	109	108.5	110.5	111	
	Bucket Cylinder Head (HX520LT3)	110	109	108.5	110.5	111	
H	Arm Link	100	99	98.5	100.5	101	
I	Bucket and Arm Link (HX500LT3)	120	119	118.5	120.5	121	
	Bucket and Arm Link (HX520LT3)	120	119	118.5	120.5	121	
J	Bucket Cylinder Rod (HX500LT3)	110	109	108.5	110.5	111	
	Bucket Cylinder Rod (HX520LT3)	110	109	108.5	110.5	111	
K	Bucket Link (HX500LT3)	120	119	118.5	120.5	121	
	Bucket Link (HX520LT3)	120	119	118.5	120.5	121	

SECTION 8 DISASSEMBLY AND ASSEMBLY

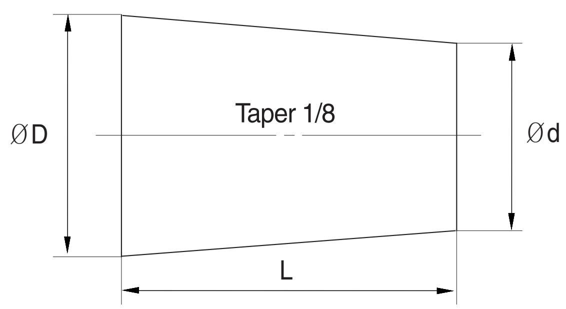
SECTION 8 DISASSEMBLY AND ASSEMBLY

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

1) Lower the work equipment completely to the ground.
   If the coolant contains antifreeze, dispose of it correctly.
2) After disconnecting hoses or tubes, cover them or fit blind plugs to prevent dirt or dust from entering.
3) When draining oil, prepare a container of adequate size to catch the oil.
4) Confirm the match marks showing the installation position, and make match marks in the necessary places before removal to prevent any mistake when assembling.
5) To prevent any excessive force from being applied to the wiring, always hold the connectors when disconnecting the connectors.
6) Fit wires and hoses with tags to show their installation position to prevent any mistake when installing.
7) Check the number and thickness of the shims, and keep in a safe place.
8) When raising components, be sure to use lifting equipment of ample strength.
9) When using forcing screws to remove any components, tighten the forcing screws alternately.
10) Before removing any unit, clean the surrounding area and fit a cover to prevent any dust or dirt from entering after removal.
11) When removing hydraulic equipment, first release the remaining pressure inside the hydraulic tank and the hydraulic piping.
12) If the part is not under hydraulic pressure, the following corks can be used.

Nominal number	Dimensions		
	D	d	L
06	6	5	8
08	8	6.5	11
10	10	8.5	12
12	12	10	15
14	14	11.5	18
16	16	13.5	20
18	18	15	22
20	20	17	25
22	22	18.5	28
24	24	20	30
27	27	22.5	34



2. INSTALL WORK

1) Tighten all bolts and nuts (sleeve nuts) to the specified torque.

2) Install the hoses without twisting or interference.

3) Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.

4) Bend the cotter pin or lock plate securely.

5) When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with 2-3 drops of adhesive.

6) When coating with gasket sealant, clean the surface and remove all oil and grease, check that there is no dirt or damage, then coat uniformly with gasket sealant.

7) Clean all parts, and correct any damage, dents, burrs, or rust.

8) Coat rotating parts and sliding parts with engine oil.

9) When press fitting parts, coat the surface with antifriction compound (LM-P).

10) After installing snap rings, check that the snap ring is fitted securely in the ring groove (check that the snap ring moves in the direction of rotation).

11) When connecting wiring connectors, clean the connector to remove all oil, dirt, or water, then connect securely.

12) When using eyebolts, check that there is no deformation or deterioration, and screw them in fully.

13) When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.

14) When operating the hydraulic cylinders for the first time after repairing and reassembling the hydraulic cylinders, pumps, or other hydraulic equipment or piping, always bleed the air from the hydraulic cylinders as follows:

   (1) Start the engine and run at low idling.

   (2) Operate the control lever and actuate the hydraulic cylinder 4-5 times, stopping 100mm before the end of the stroke.

   (3) Next, operate the piston rod to the end of its stroke to relieve the circuit. (The air bleed valve is actuated to bleed the air.)

   (4) After completing this operation, raise the engine speed to the normal operating condition.

   ※ If the hydraulic cylinder has been replaced, carry out this procedure before assembling the rod to
   ※ the work equipment.
   Carry out the same operation on machines that have been in storage for a long time after completion of repairs.

3. COMPLETING WORK

1) If the coolant has been drained, tighten the drain valve, and add water to the specified level. Run the engine to circulate the water through the system. Then check the water level again.

2) If the hydraulic equipment has been removed and installed again, add engine oil to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

3) If the piping or hydraulic equipment, such as hydraulic cylinders, pumps, or motors, have been removed for repair, always bleed the air from the system after reassembling the parts.

4) Add the specified amount of grease (molybdenum disulphied grease) to the work equipment related parts.

GROUP 2 TIGHTENING TORQUE

1. MAJOR COMPONENTS

1) HX500LT3

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	57.9 ± 8.7	419 ± 62.9
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 ± 8.7	419 ± 62.9
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	M24 × 3.0	100 ± 10	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	87.2 ± 12.5	631 ± 90.4
20		Track shoe mounting bolt, nut	M24 × 3.0	140 ± 14	1012 ± 101
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	M 8 × 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

※ For tightening torque of engine and hydraulic components, see engine maintenance guide and service manual.

2) HX520LT3

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	57.9 ± 8.7	419 ± 62.9
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 ± 8.7	419 ± 62.9
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	87.2 ± 12.5	631 ± 90.4
20		Track shoe mounting bolt, nut	M24 × 3.0	140 ± 14	1012 ± 101
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	M 8 × 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

※ For tightening torque of engine and hydraulic components, see engine maintenance guide and service manual.

2. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

Bolt size	8.8T		10.9T		12.9T	
	kgf · m	lbf · ft	kgf · m	lbf · ft	kgf · m	lbf · ft
M 6×1.0	0.8 ~ 1.2	5.8 ~ 8.6	1.2 ~ 1.8	8.7 ~ 13.0	1.5 ~ 2.1	10.9 ~ 15.1
M 8×1.25	2.0 ~ 3.0	14.5 ~ 21.6	2.8 ~ 4.2	20.3 ~ 30.4	3.4 ~ 5.0	24.6 ~ 36.1
M10×1.5	4.0 ~ 6.0	29.0 ~ 43.3	5.6 ~ 8.4	40.5 ~ 60.8	6.8 ~ 10.0	49.2 ~ 72.3
M12×1.75	6.8 ~ 10.2	50.0 ~ 73.7	9.6 ~ 14.4	69.5 ~ 104	12.3 ~ 16.5	89.0 ~ 119
M14×2.0	10.9 ~ 16.3	78.9 ~ 117	16.3 ~ 21.9	118 ~ 158	19.5 ~ 26.3	141 ~ 190
M16×2.0	17.9 ~ 24.1	130 ~ 174	25.1 ~ 33.9	182 ~ 245	30.2 ~ 40.8	141 ~ 295
M18×2.5	24.8 ~ 33.4	180 ~ 241	34.8 ~ 47.0	252 ~ 340	41.8 ~ 56.4	302 ~ 407
M20×2.5	34.9 ~ 47.1	253 ~ 340	49.1 ~ 66.3	355 ~ 479	58.9 ~ 79.5	426 ~ 575
M22×2.5	46.8 ~ 63.2	339 ~ 457	65.8 ~ 88.8	476 ~ 642	78.9 ~ 106	570 ~ 766
M24×3.0	60.2 ~ 81.4	436 ~ 588	84.6 ~ 114	612 ~ 824	102 ~ 137	738 ~ 991
M30×3.5	120 ~161	868 ~ 1164	168 ~ 227	1216 ~ 1641	202 ~ 272	1461 ~ 1967

(2) Fine thread

Bolt size	8.8T		10.9T		12.9T	
	kgf · m	lbf · ft	kgf · m	lbf · ft	kgf · m	lbf · ft
M 8×1.0	2.1 ~ 3.1	15.2 ~ 22.4	3.0 ~ 4.4	21.7 ~ 31.8	3.6 ~ 5.4	26.1 ~ 39.0
M10×1.25	4.2 ~ 6.2	30.4 ~ 44.9	5.9 ~ 8.7	42.7 ~ 62.9	7.0 ~ 10.4	50.1 ~ 75.2
M12×1.25	7.3 ~ 10.9	52.8 ~ 78.8	10.3 ~ 15.3	74.5 ~ 110	13.1 ~ 17.7	94.8 ~ 128
M14×1.5	12.4 ~ 16.6	89.7 ~ 120	17.4 ~ 23.4	126 ~ 169	20.8 ~ 28.0	151 ~ 202
M16×1.5	18.7 ~ 25.3	136 ~ 182	26.3 ~ 35.5	191 ~ 256	31.6 ~ 42.6	229 ~ 308
M18×1.5	27.1 ~ 36.5	196 ~ 264	38.0 ~ 51.4	275 ~ 371	45.7 ~ 61.7	331 ~ 446
M20×1.5	37.7 ~ 50.9	273 ~ 368	53.1 ~ 71.7	384 ~ 518	63.6 ~ 86.0	460 ~ 622
M22×1.5	51.2 ~ 69.2	370 ~ 500	72.0 ~ 97.2	521 ~ 703	86.4 ~ 116	625 ~ 839
M24×2.0	64.1 ~ 86.5	464 ~ 625	90.1 ~ 121	652 ~ 875	108 ~ 146	782 ~ 1056
M30×2.0	129 ~ 174	933 ~ 1258	181 ~ 245	1310 ~ 1772	217 ~ 294	1570 ~ 2126

2) PIPE AND HOSE (FLARE TYPE)

Thread size (PF)	Width across flat (mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130.2
1"	41	21	151.9
1-1/4"	50	35	253.2

3) PIPE AND HOSE (ORFS TYPE)

Thread size (UNF)	Width across flat (mm)	kgf · m	lbf · ft
9/16-18	19	4	28.9
11/16-16	22	5	36.2
13/16-16	27	9.5	68.7
1-3/16-12	36	18	130.2
1-7/16-12	41	21	151.9
1-11/16-12	50	35	253.2

4) FITTING

Thread size	Width across flat (mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130.2
1"	41	21	151.9
1-1/4"	50	35	253.2

GROUP 3 PUMP DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL

(1) Lower the work equipment to the ground and stop the engine.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

13031GE18

(4) Loosen the drain plug under the hydraulic tank and drain the oil from the hydraulic tank.

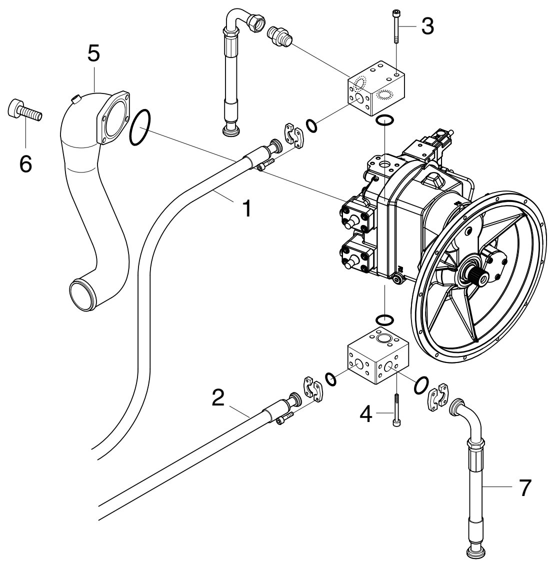
· Hydraulic tank quantity : 275 ℓ

(5) Remove socket bolts (3, 4) and disconnect block with hoses (1, 2, 7).

(6) Disconnect pilot line hoses (8, 9, 10, 11).

(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.



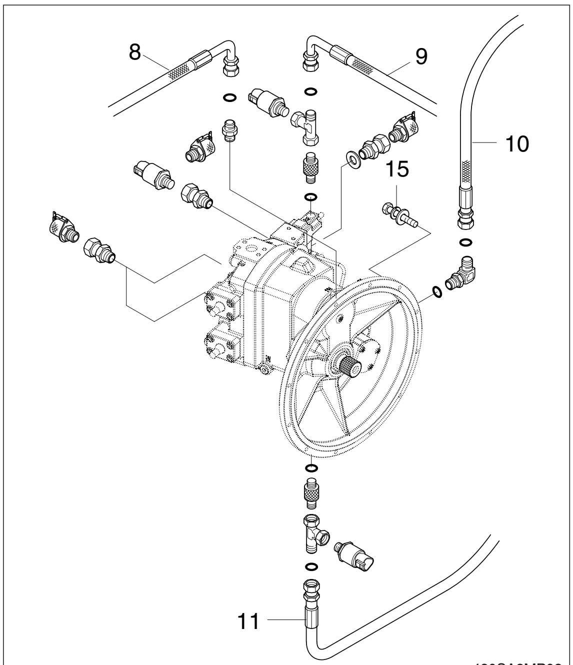
480SA8MP01

(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.



480SA8MP02

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.

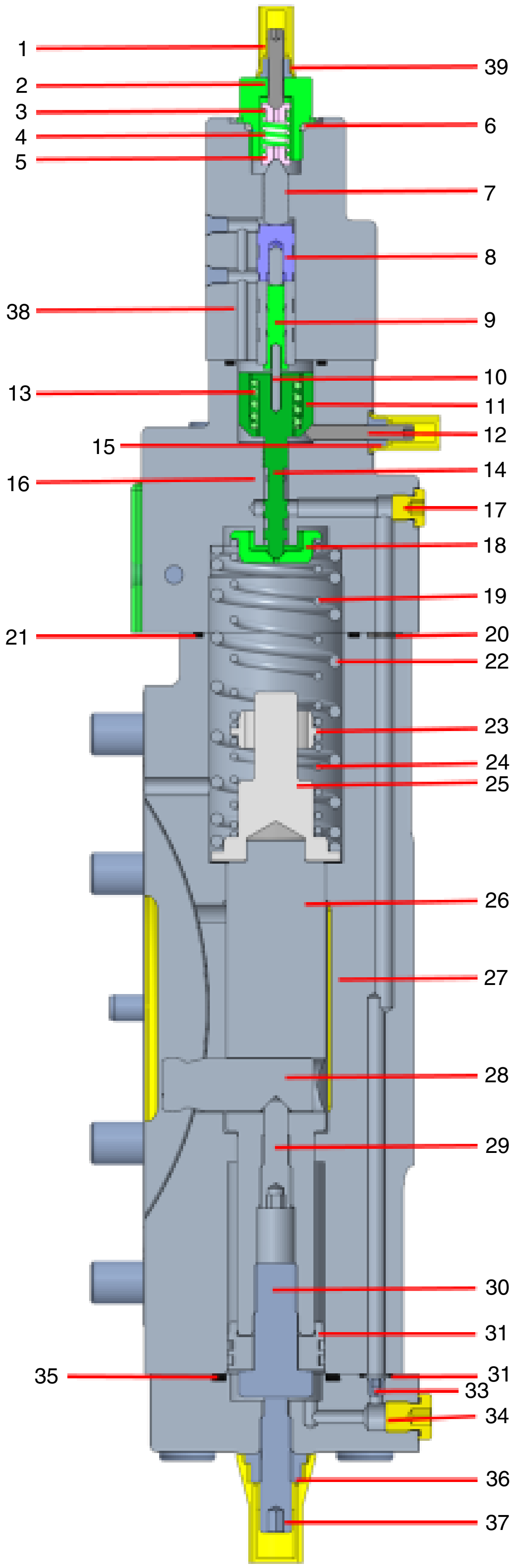
(6) Bleed the air from the hydraulic pump.
① Remove the air vent plug (2EA).
② Tighten plug lightly.
③ Start the engine, run at low idling, and check oil come out from plug.
④ Tighten plug.

(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)

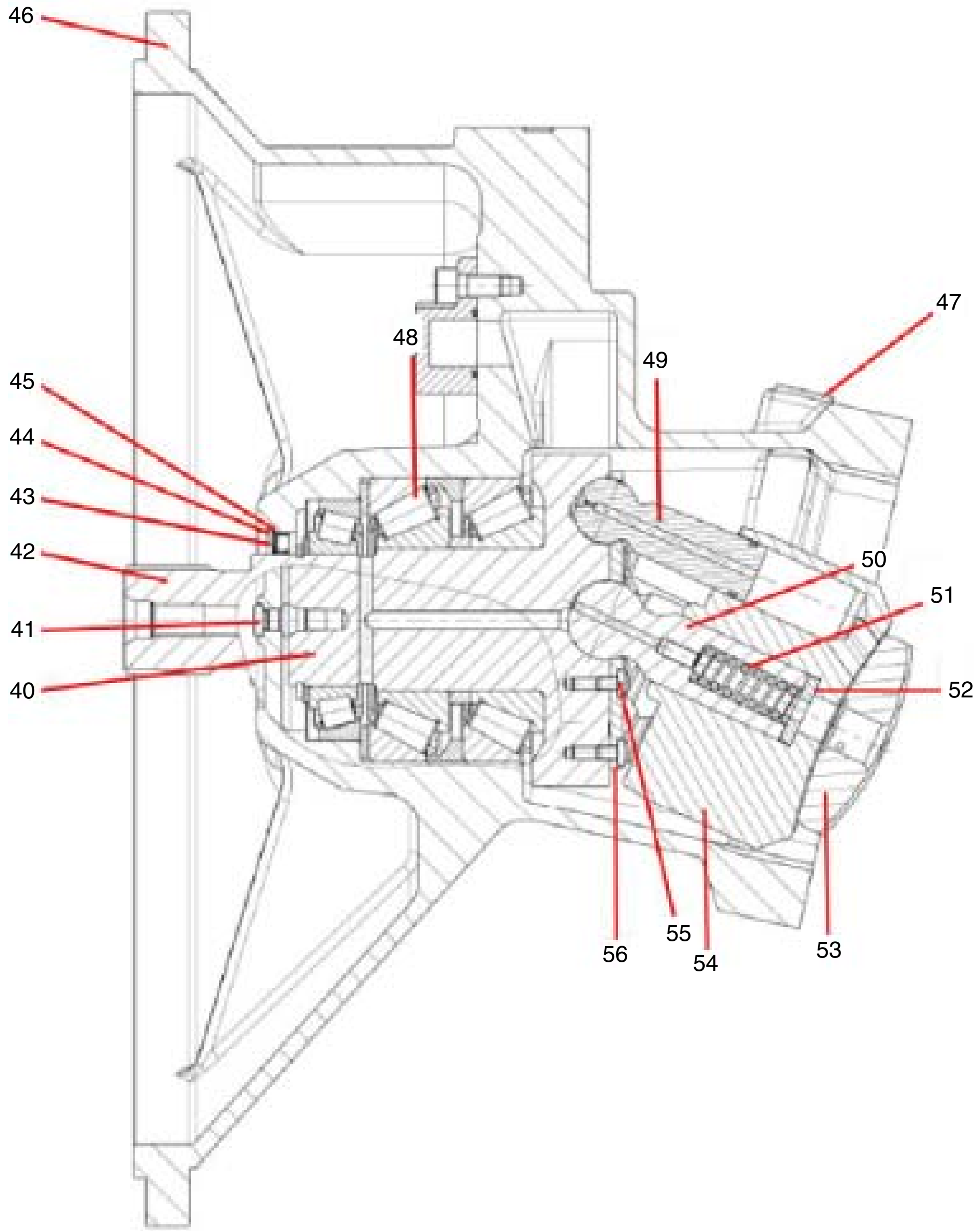


480A2MP10

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

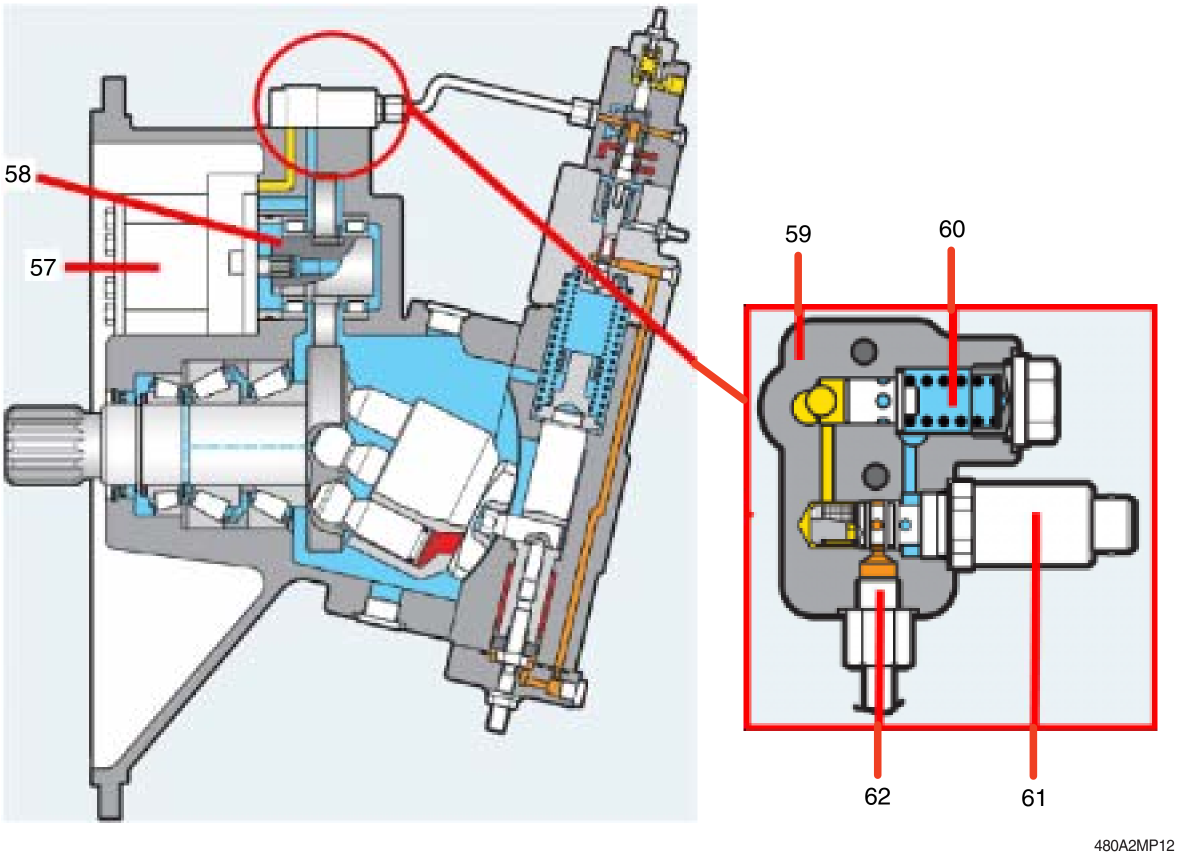
PART LIST (2/3)



480A2MP11

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)

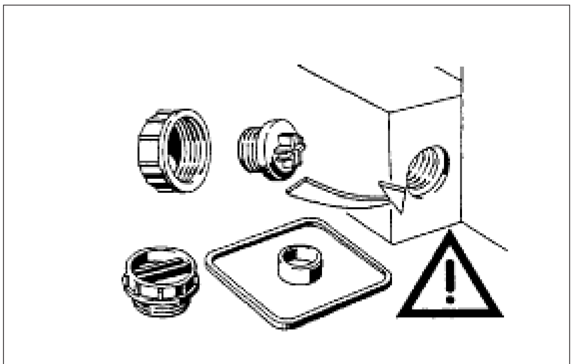


57	Gear pump	59	Valve plate	61	EPPR valve
58	Gear wheel	60	Pressure relieve valve	62	Hydraulic pipe

2) GENERAL REPAIR GUIDELINES

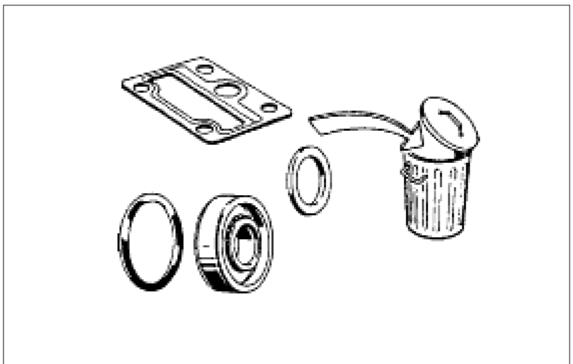
※ Observe the following notices when carrying out repairs on hydraulic pumps.

(1) Close off all openings of the hydraulic unit.



480A8MP11

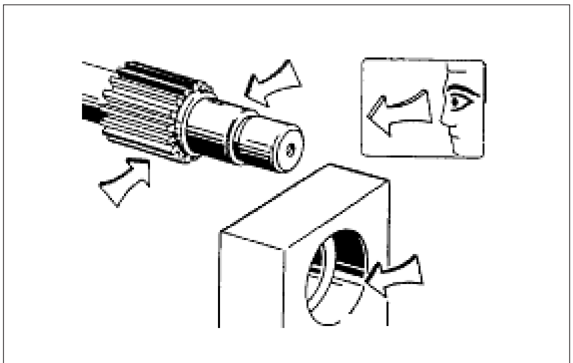
(2) Replace all of the seals.
Use only HYUNDAI spare parts.



480A8MP12

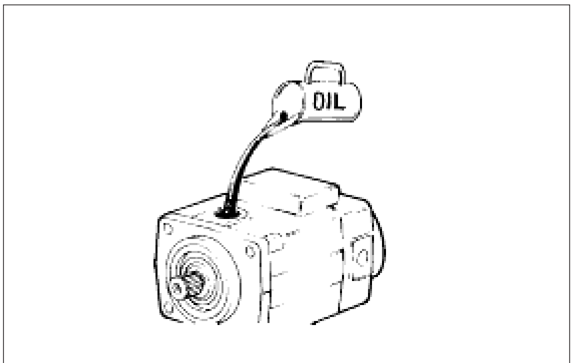
(3) Check all sealing and sliding surfaces for wear.

※ Re-work of the sliding surfaces by using, for example with abrasive paper, can damage the surface.



480A8MP13

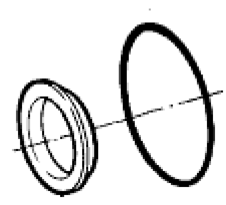
(4) Fill the hydraulic unit with hydraulic oil before commissioning.



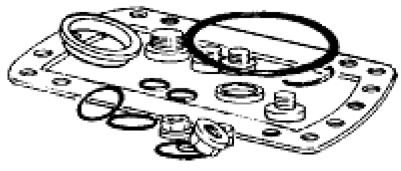
480A8MP14

3) SEAL KITS AND SUB ASSEMBLIES

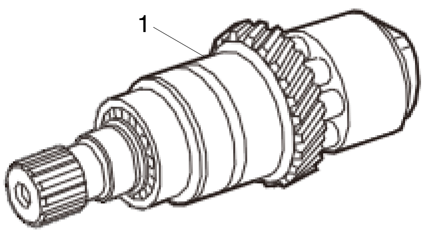
(1) Seal kit for drive shaft.


480A8MP15

(2) Peripheral seal kit.

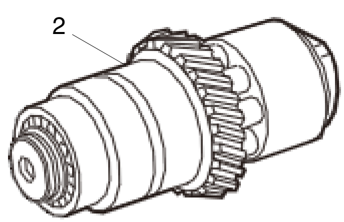

480A8MP16

(3) Rotary group (1) ready to install.



480A8MP17

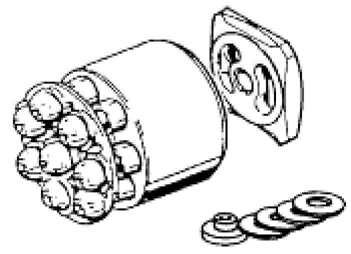
(4) Rotary group (2) ready to install.



480A8MP18

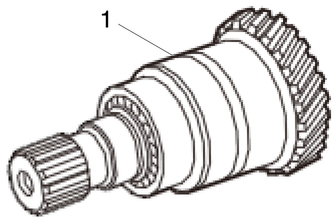
(5) Rotary group, hydraulic component (order rotary groups (1) and (2) separately). Adjustment is necessary.

※ Direction of rotation



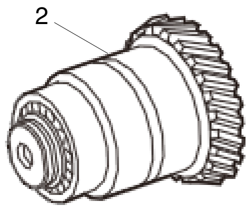
480A8MP19

(6) Rotary group (1) mechanical section, ready to install.



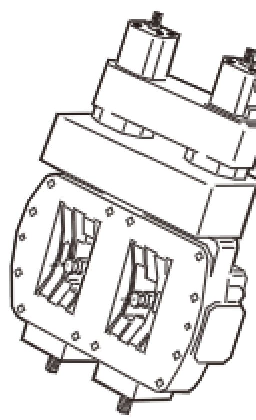
480A8MP20

(7) Rotary group (2) mechanical section, ready to install.



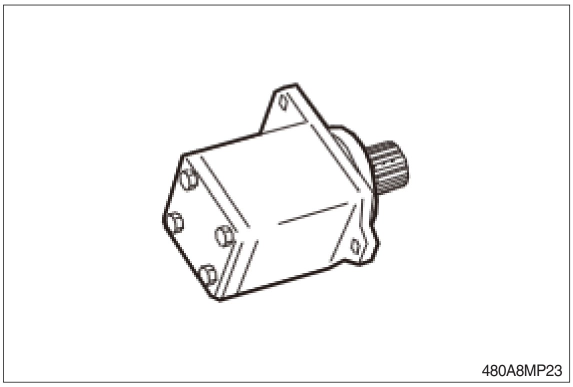
480A8MP21

(8) Control, pre-adjusted.

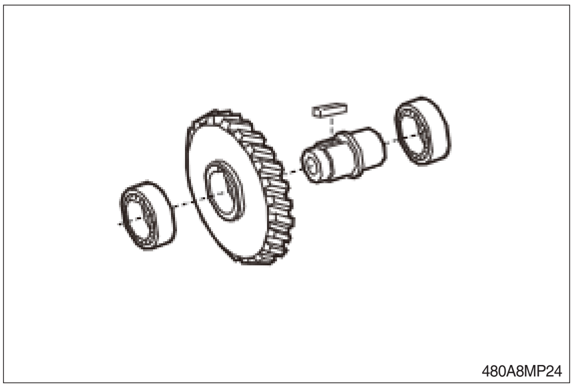


480A8MP22

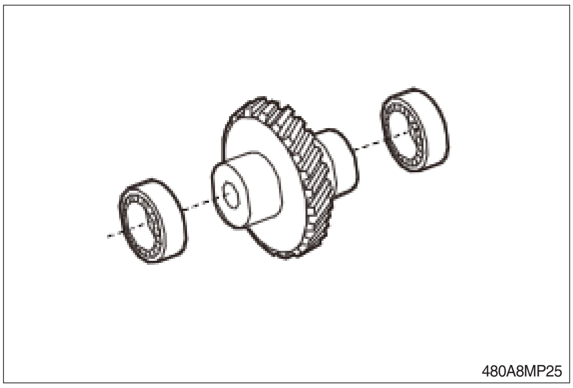
(9) Gear pump, complete.



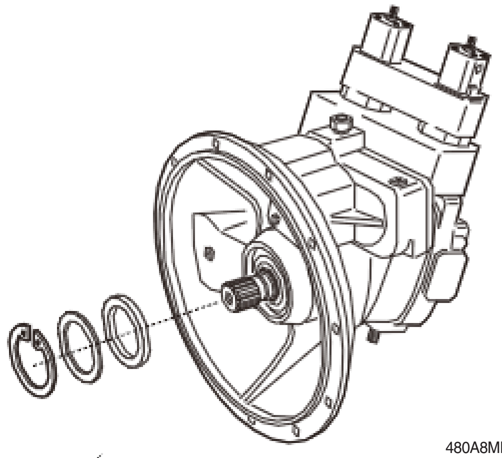
(10) Intermediate gear



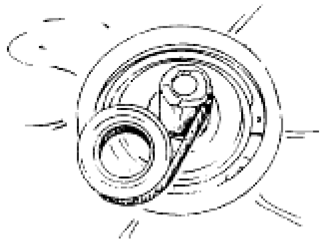
(11) Auxiliary drive



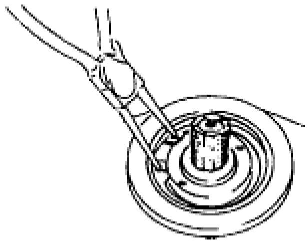
4) SEALING THE DRIVE SHAFT


480A8MP26

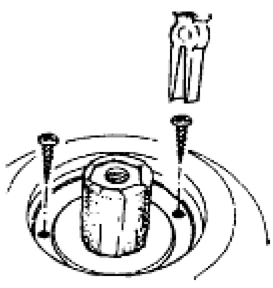
(1) Protect drive shaft. (e.g. tape).


480A8MP27

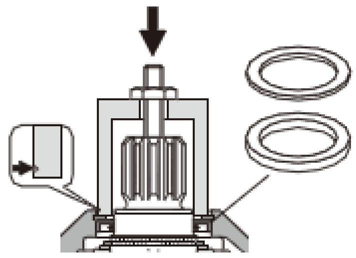
(2) Remove retaining ring and shim.


480A8MP28

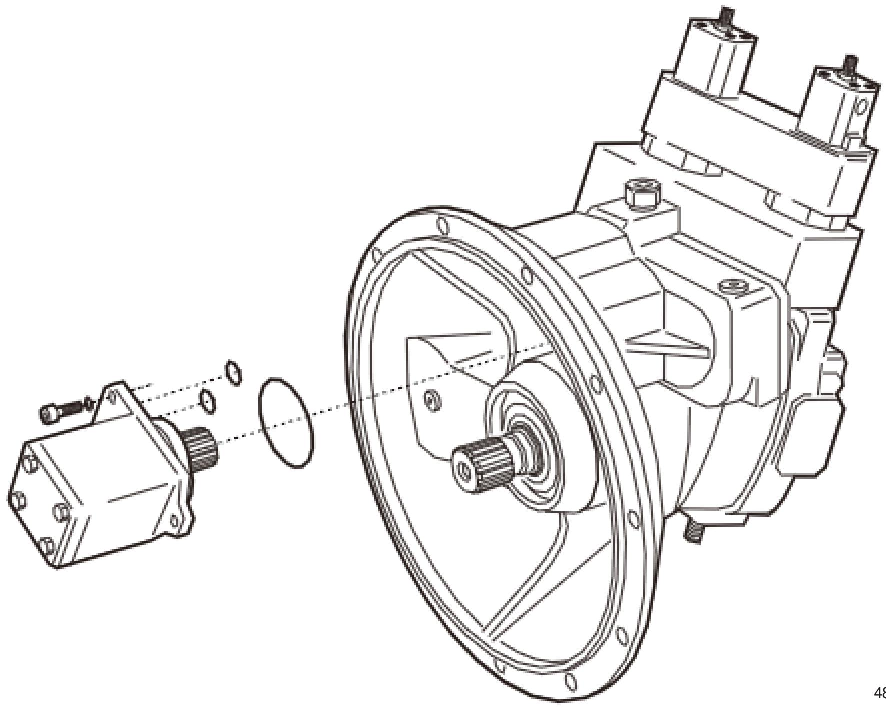
(3) Screw in sheet metal screw into the holes
fitted with rubber.
Pull out seal with pliers.


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.

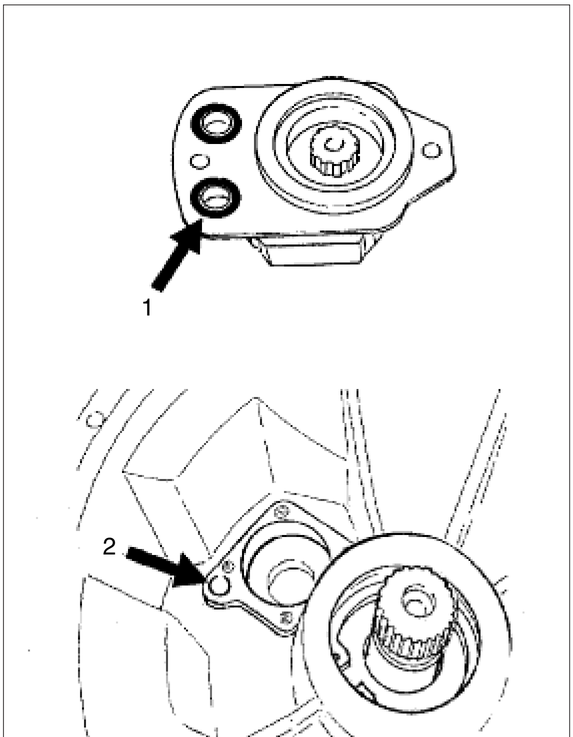

480A8MP30

5) GEAR PUMP SEALING



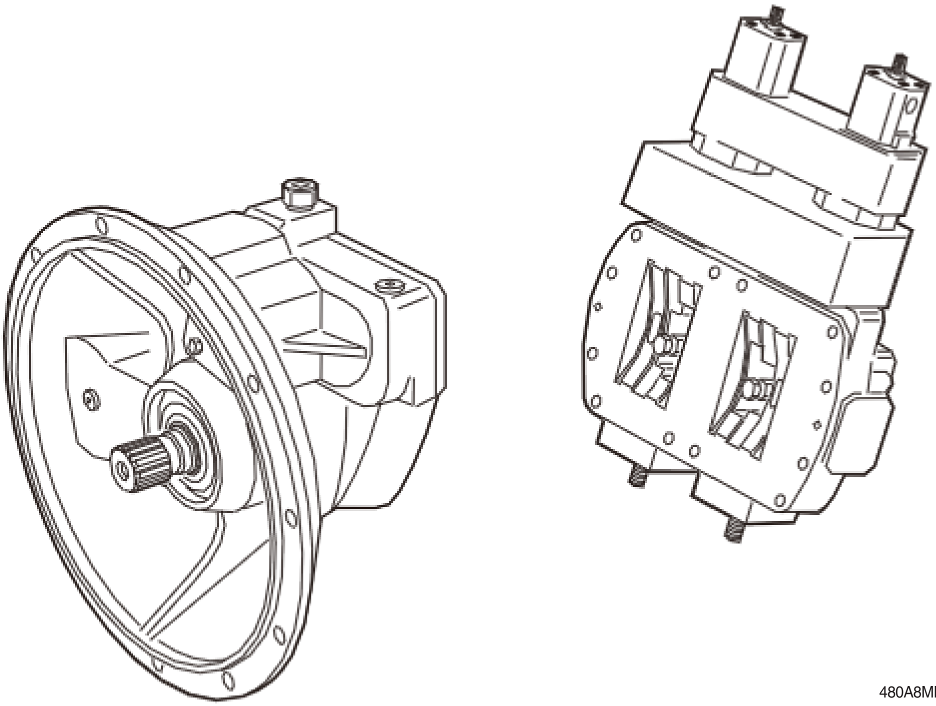
480A8MP31

(1) Remove gear pump.
Visual check:
1 O-ring
2 Sealing surface of the housing.



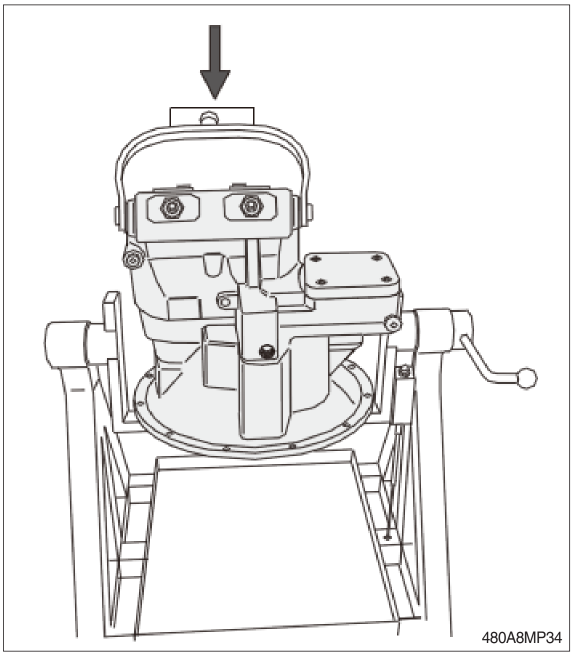
480A8MP32

6) REMOVE THE CONTROL HOUSING



480A8MP33

(1) Place the pump into a disassembly/ assembly device with a crane and fix it.

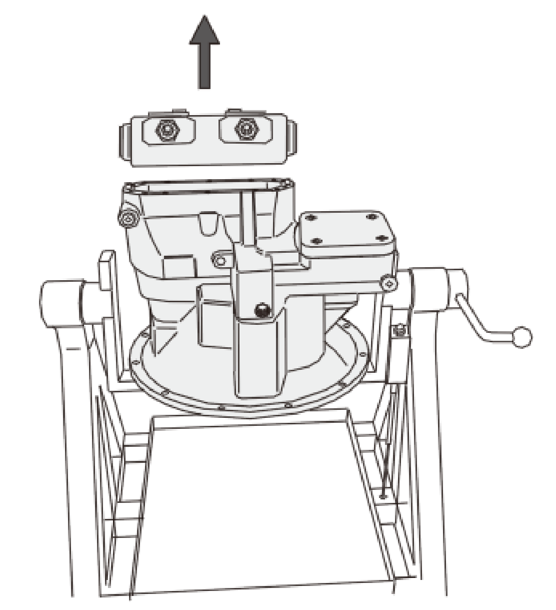


480A8MP34

※ Mark installation position.

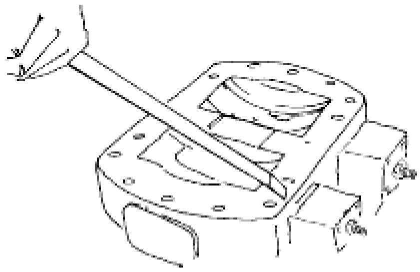
(2) Loosen fixing screws of port plate and remove the port plate.
Lift the port plate away with a crane.

※ Control lenses can fall down.

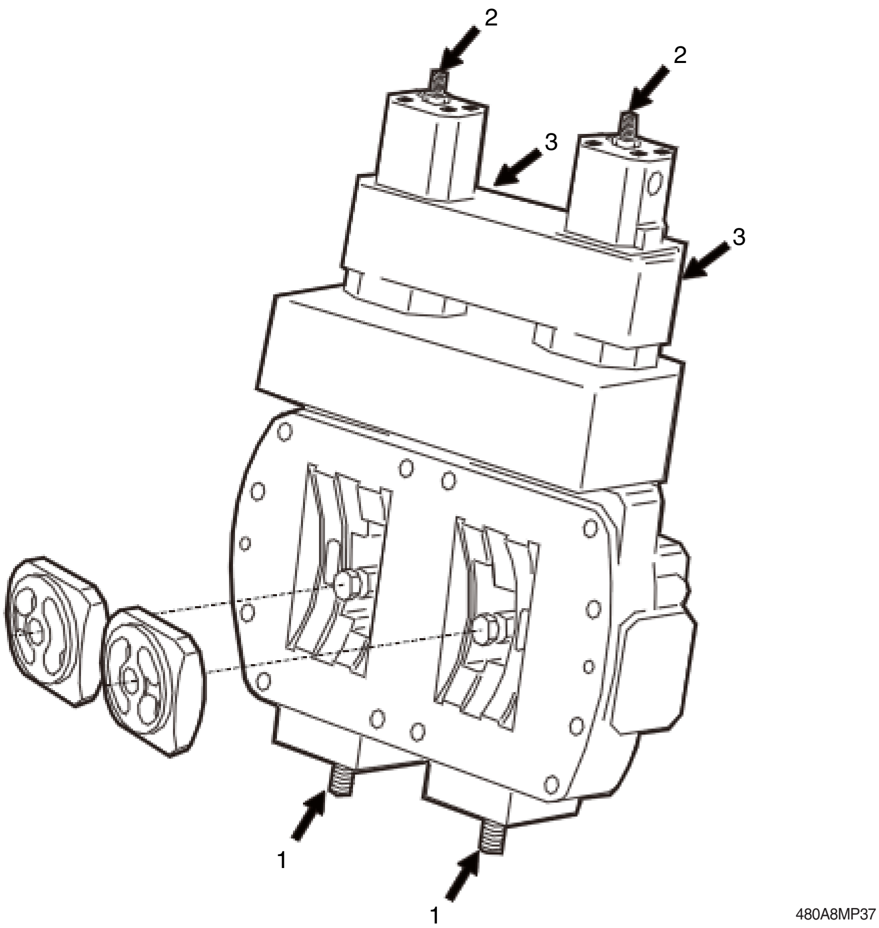


480A8MP35

(3) Remove paper seal, clean sealing surface.

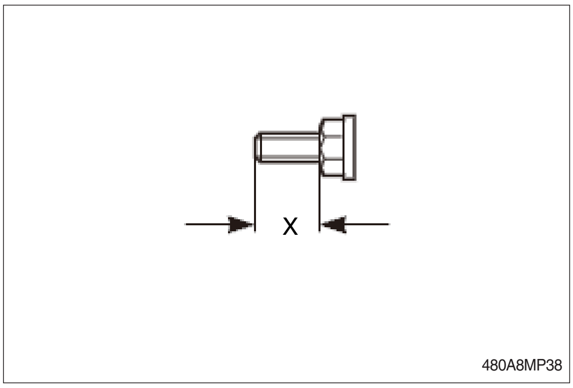


480A8MP36

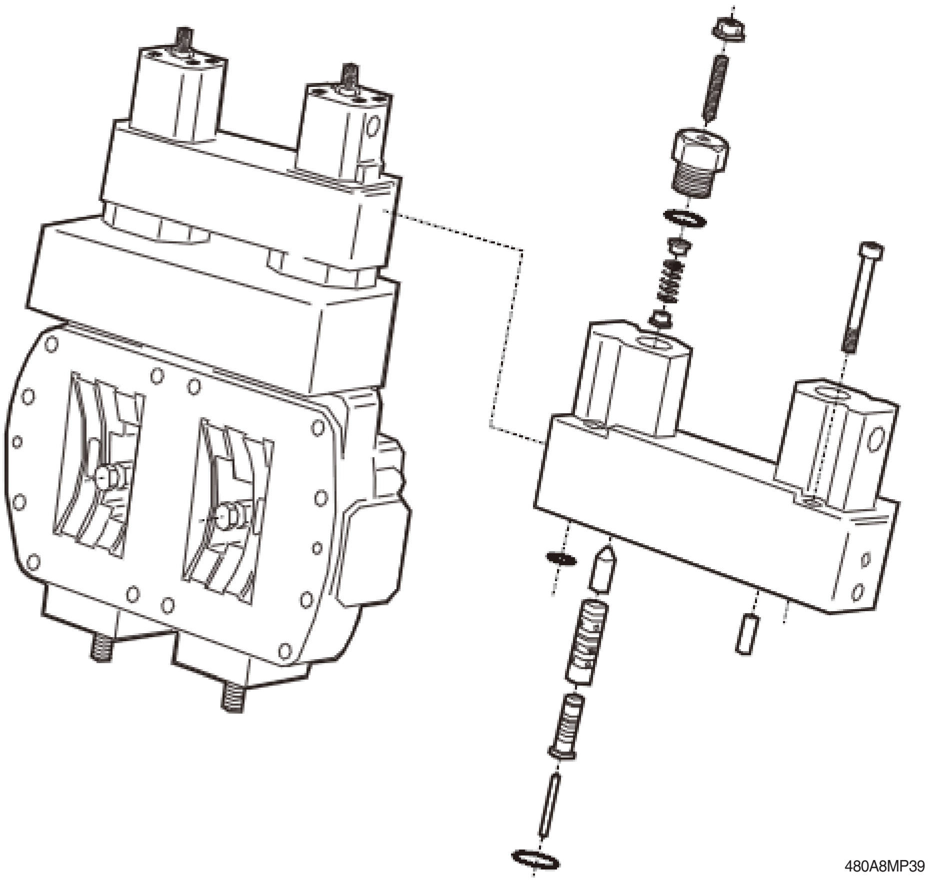


Item 1 ⇒ setting screw Qmax
Item 2 ⇒ setting screw Hydraulic stroke limitation
Item 3 ⇒ setting screw Power characteristic (begin of regulation)

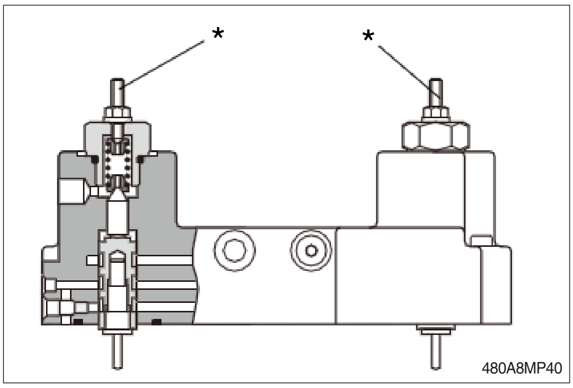
※ Before carrying out a setting or disassembly of the regulator, measure the measurement (X) and note of the setting screw.



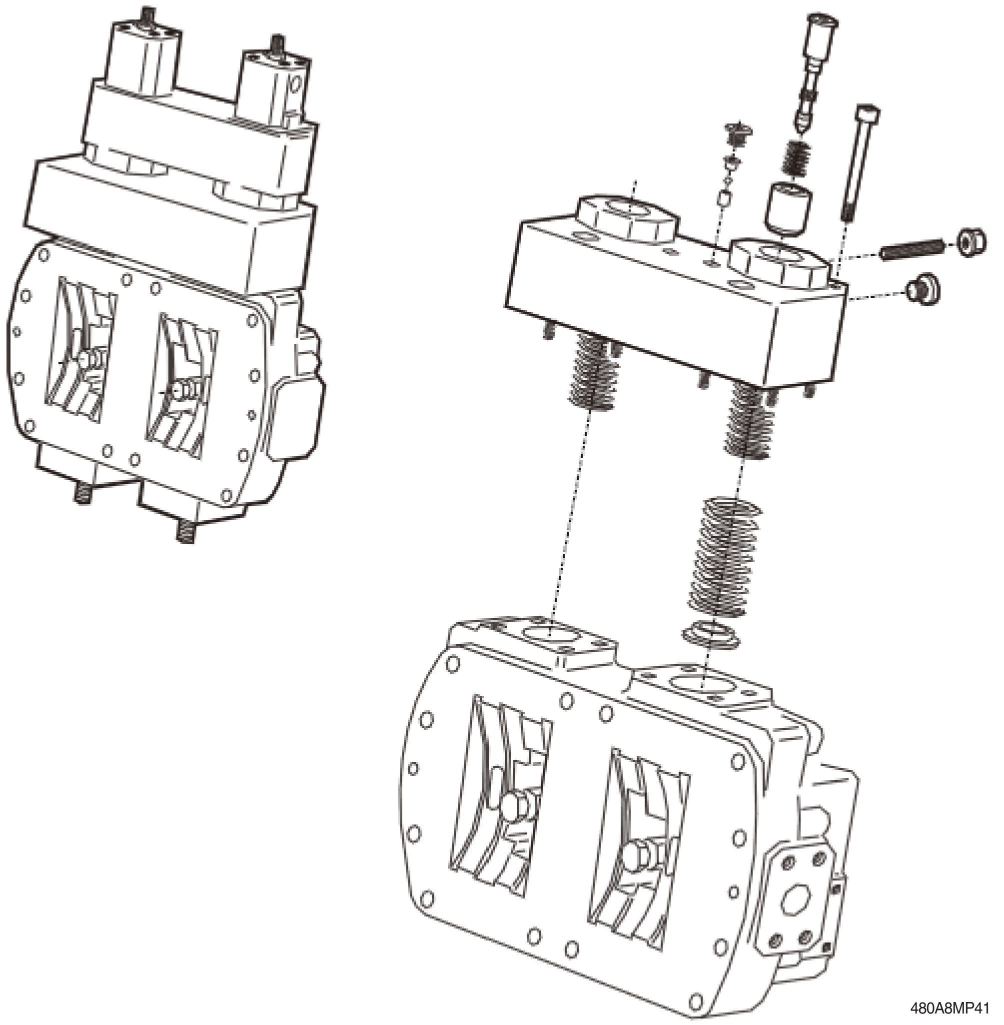
7) CONTROL MODULE LR



※ Remove and disassemble control module LR.

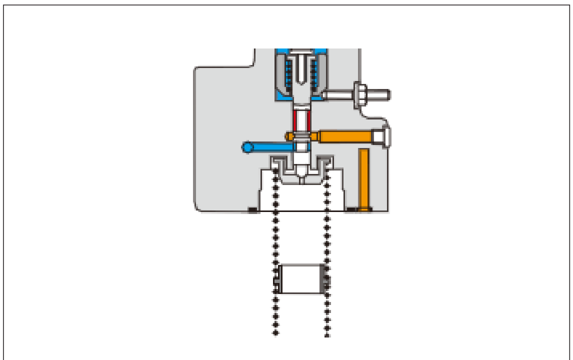


8) CONTROL MODULE H



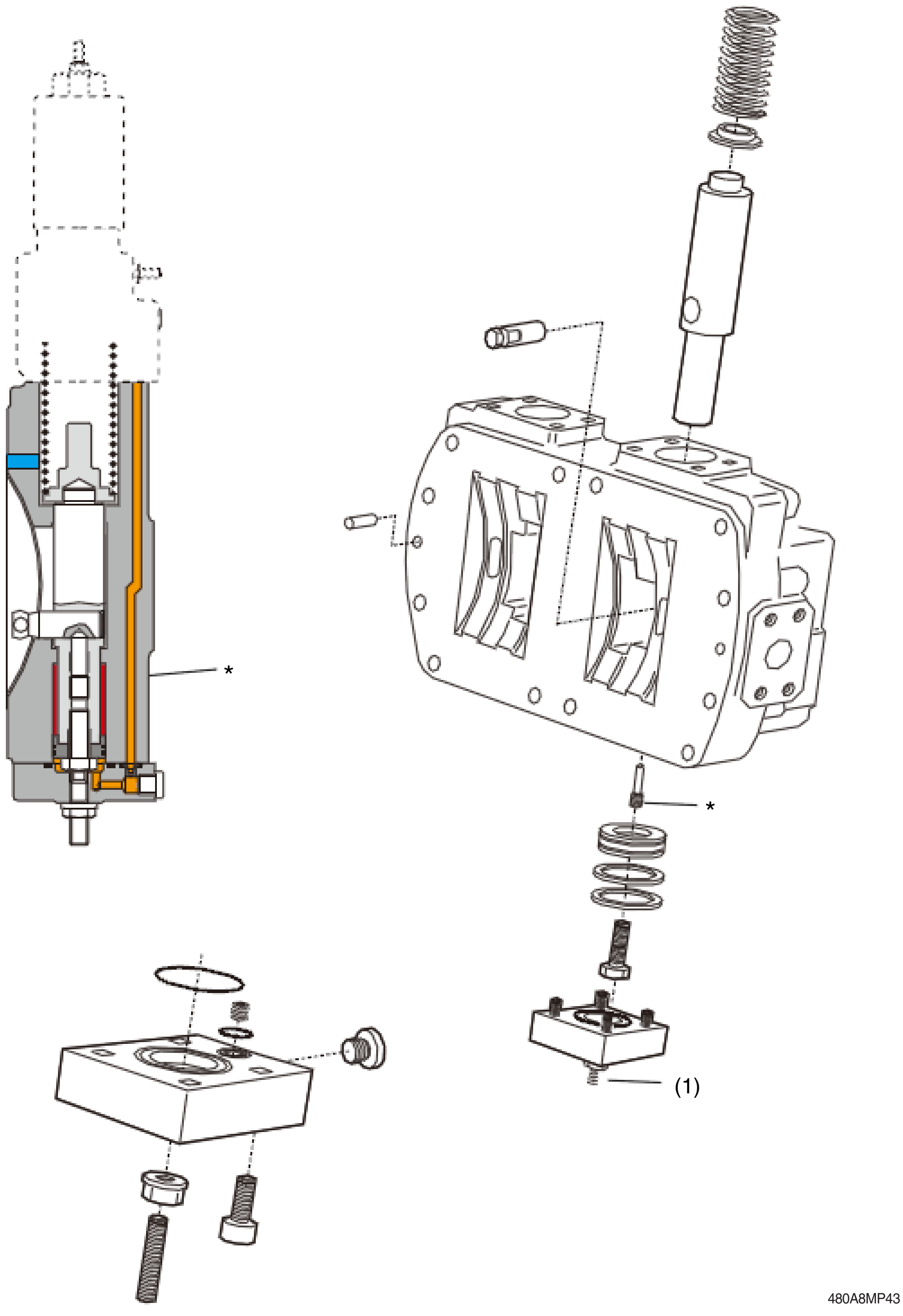
480A8MP41

※ Remove and disassemble control module H.



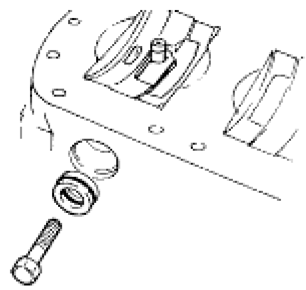
480A8MP42

9) REMOVING THE CONTROLLER



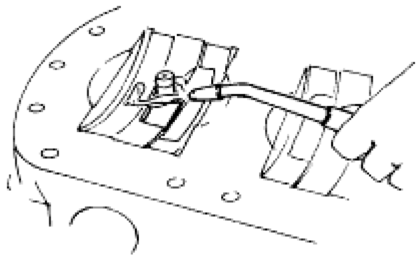
(1) Remove cover.
※ Do not change the setting screw (1).

(2) Loosen fixing screws.
※ Fit control lens - torque support.

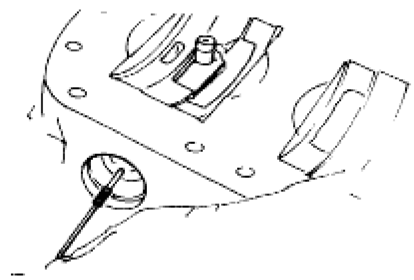


480A8MP44

(3) Remove locking screw and replace with a new locking screw.
※ Loosen adhesive with a "gentle" flame (approx. 120℃).

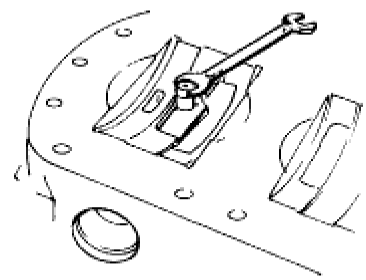


480A8MP45



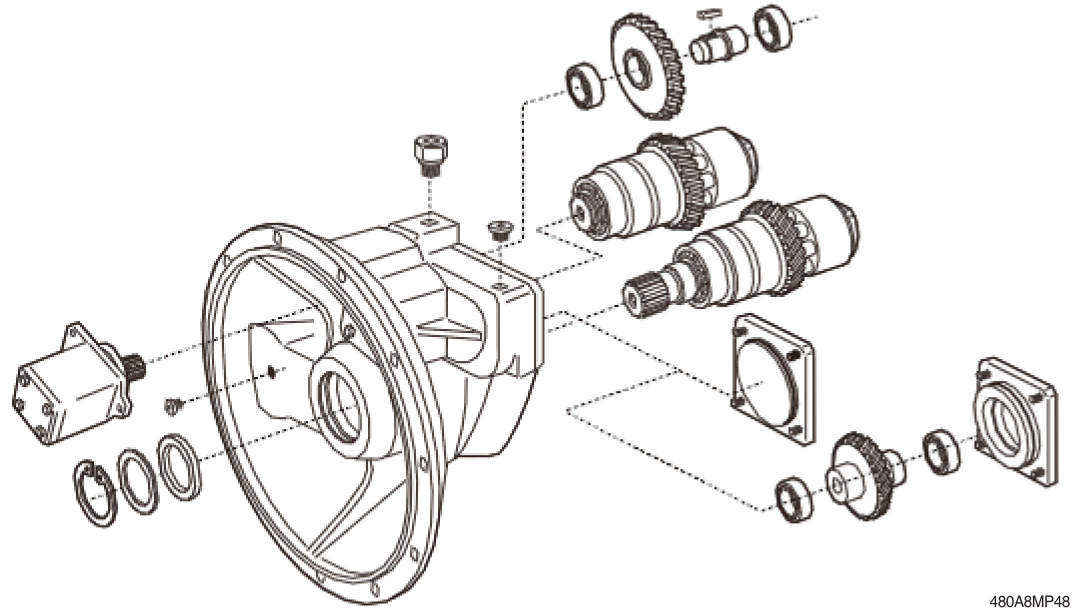
480A8MP46

(4) Loosen swivel pin and then remove it



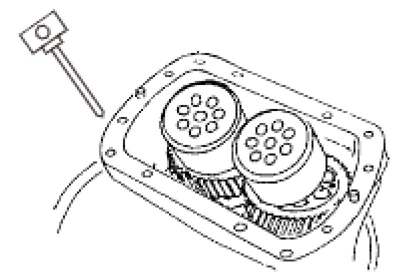
480A8MP47

10) REMOVE THE ROTARY GROUPS



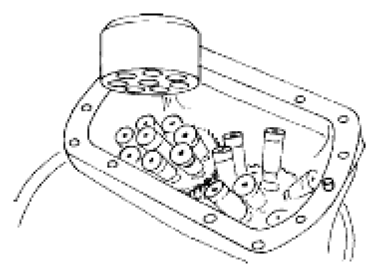
480A8MP48

(1) Keep the cylinder with a device (remove it completely with the drive shaft).



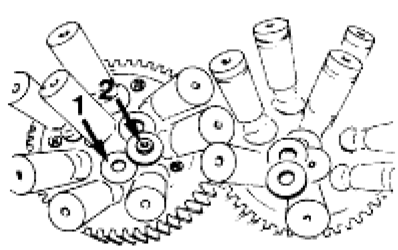
480A8MP49

(2) Remove cylinder (take out the drive shaft without cylinder).



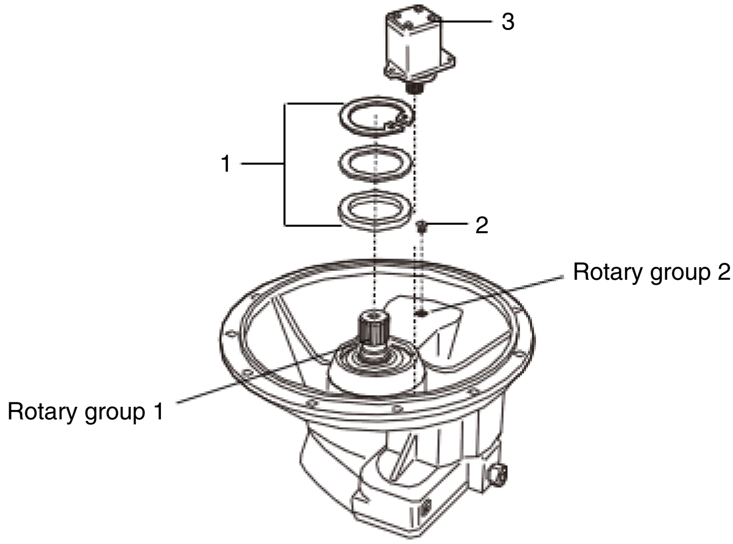
480A8MP50

(3) Remove spring cup (1) and spring cup (2).



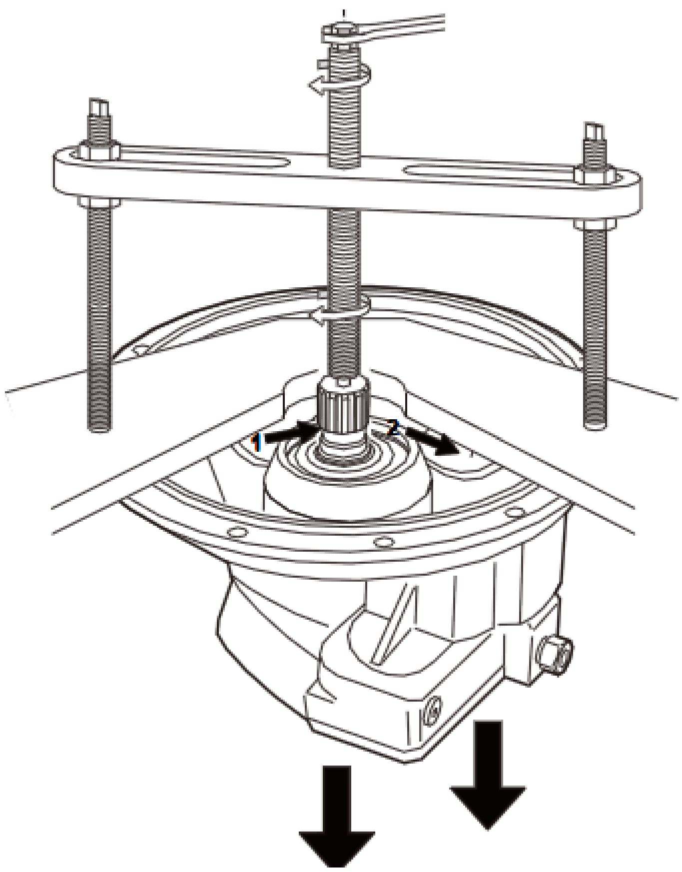
480A8MP51

(4) New disassembly position
Pos.1 Remove
Pos.2 Remove
Pos.3 Remove

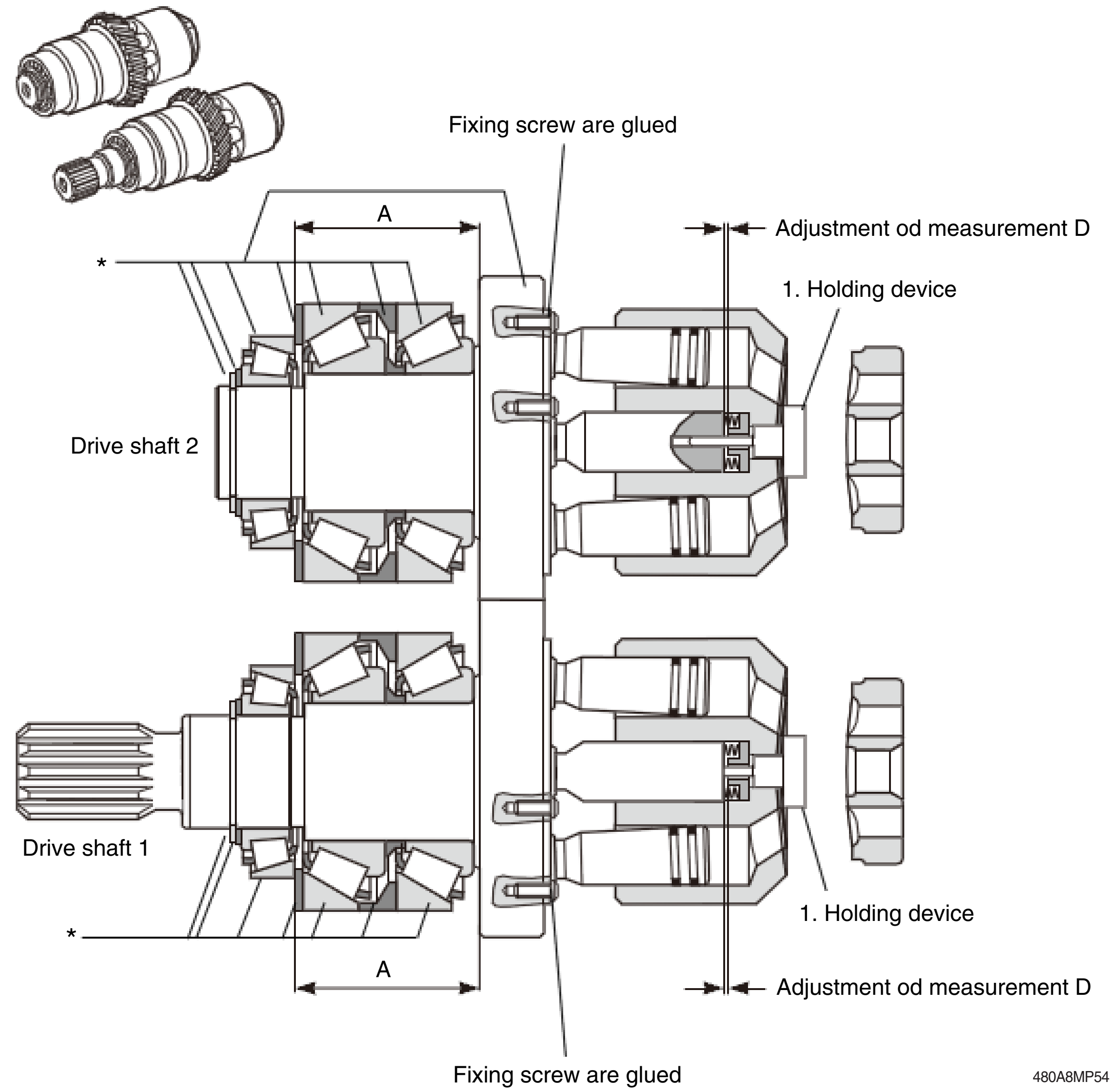


480A8MP52

(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.

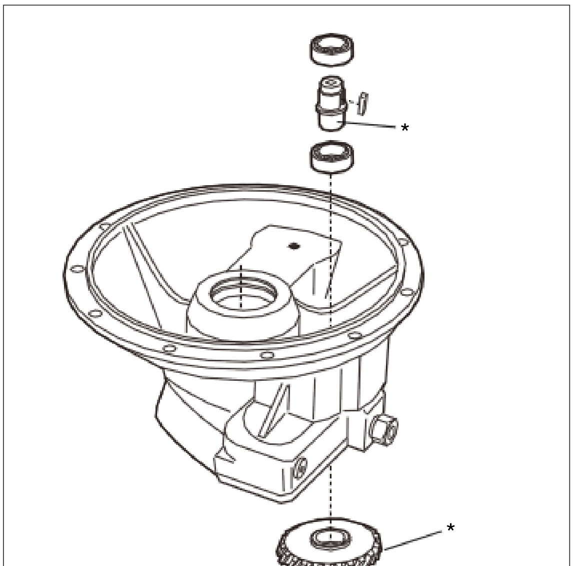
※ Fixing screw - Retaining device

(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).

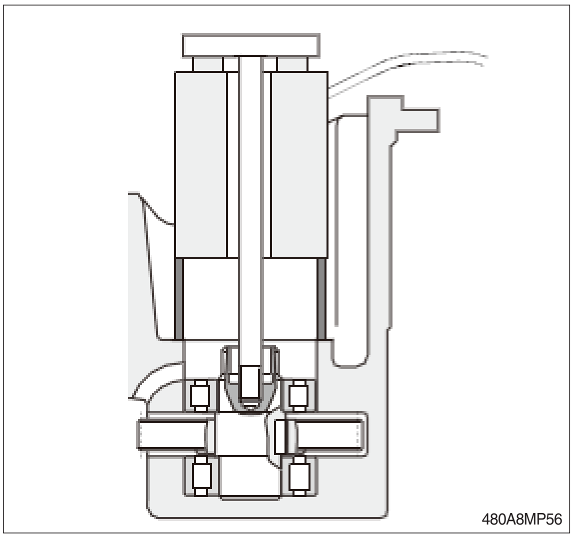
(1) Can only be disassembled with a hydraulic press.



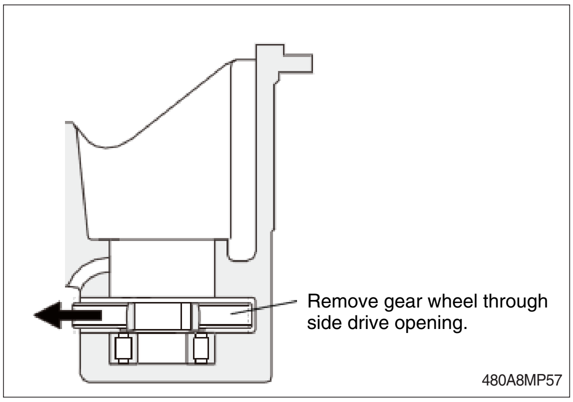
480A8MP55

(2) Install sleeve.

⚠ Press out bolt with a hydraulic manual press.

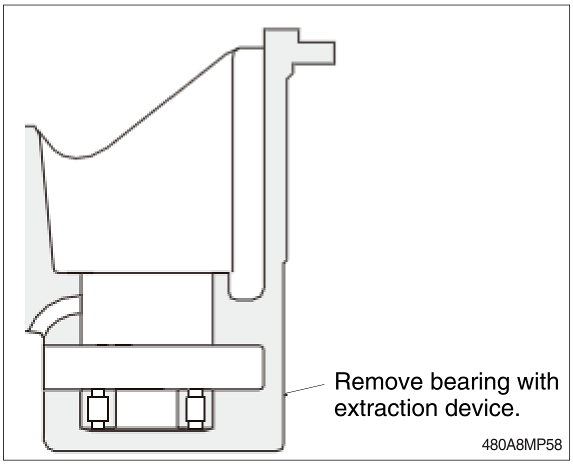

480A8MP56

(3) Remove gear wheel through side drive opening.

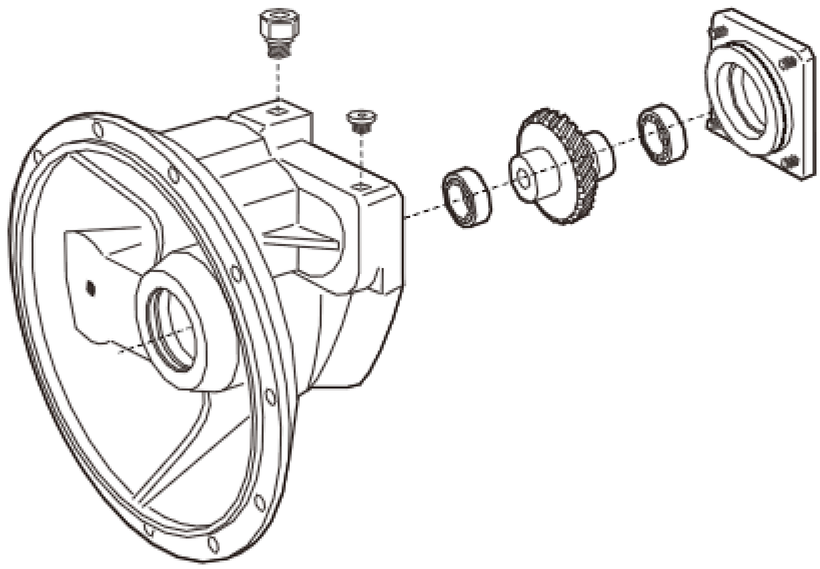


480A8MP57

(4) Remove bearing with extraction device.

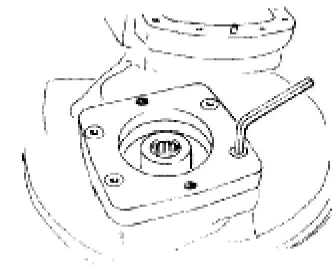


14) REMOVE AUXILIARY DRIVE



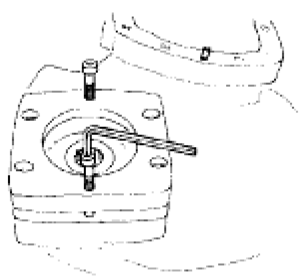
480A8MP59

(1) Remove fixing screws - auxiliary drive.



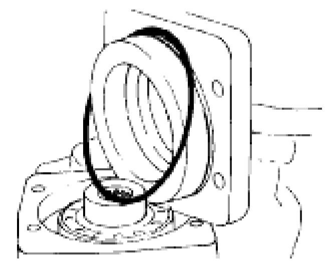
480A8MP60

(2) Press off bearing cap.



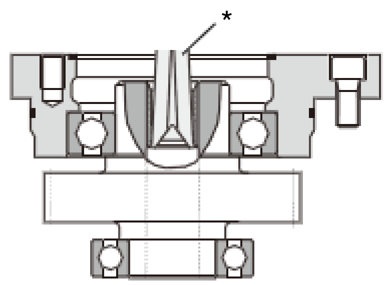
480A8MP61

(3) In the event of leakage, visual check of O-ring, housing and groove.

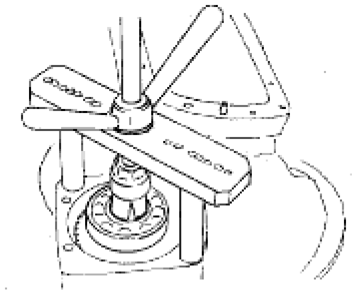


480A8MP62

(4) Fit extractor device (*).
Pull out output pinion.

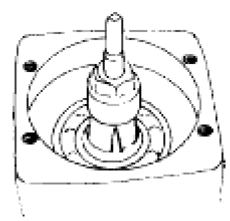


480A8MP63



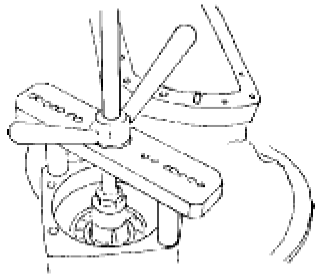
480A8MP64

(5) Fit bearing extractor device.



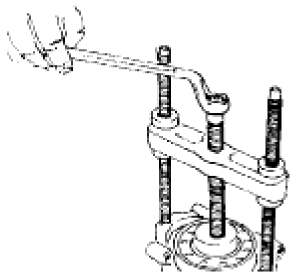
480A8MP65

(6) Completely mount device and pull out bearing.



480A8MP66

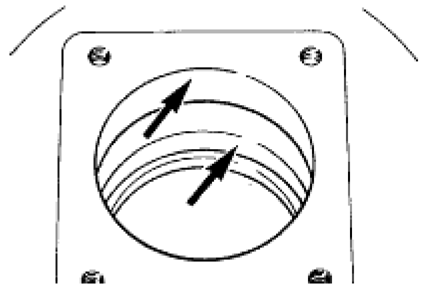
(7) Pull out pinion bearing.



480A8MP67

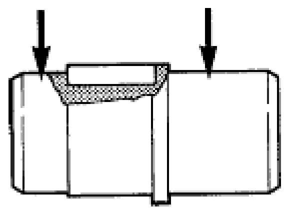
15) INSPECTION HINTS

(1) Check to see that the bearing area is free of scores and that there is no evidence of wear.



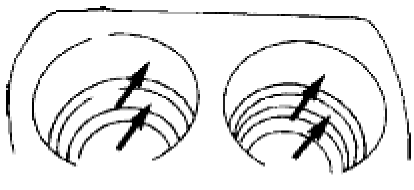
480A8MP68

(2) Visual check
To ensure that the bearing seats are free of scores.



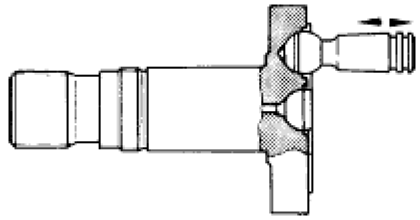
480A8MP69

(3) Visual check
Check to see that the bearing area is free of scores and that there is no evidence of wear.



480A8MP70

(4) Axial piston play
Checked with the retaining plate fitted.

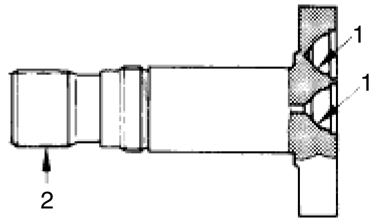


480A8MP71

(5) Drive shafts

1 Check to ensure that the cups are free of scores and that there are no pittings.

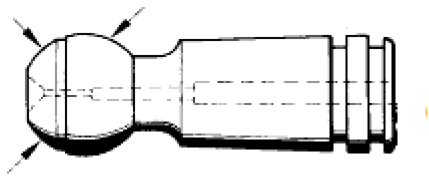
2 Check to see that there is no evidence of corrosion and wear steps.



480A8MP72

(6) Piston

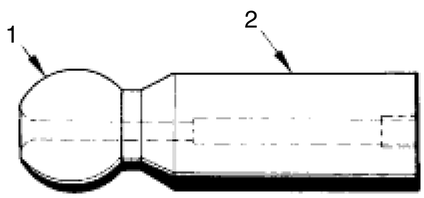
Check to ensure that they are free of scores and that there are no pittings.



480A8MP73

(7) Central pin

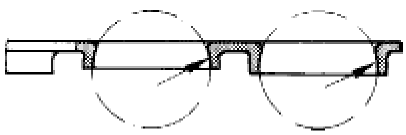
Check to ensure that it is free of scores and that there are no pittings.



480A8MP74

(8) Retaining plate

Check to ensure that it is free of scores and that there is no evidence of wear.

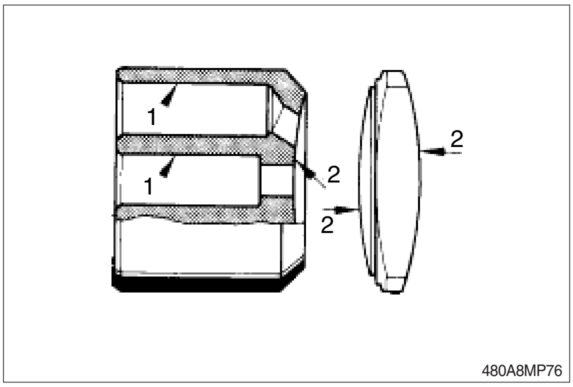


480A8MP75

(9) Cylinder block / control lens

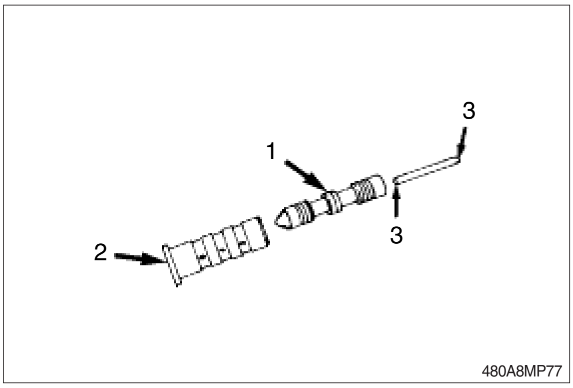
Check to ensure that :

- 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.



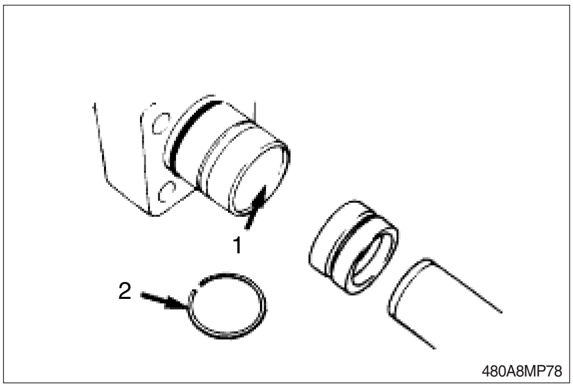
(10) Check

1 Control land
2 Internal control drilling
3 Pin cups



(11) Check

That sliding surfaces (1) are free of scores, seal (2).



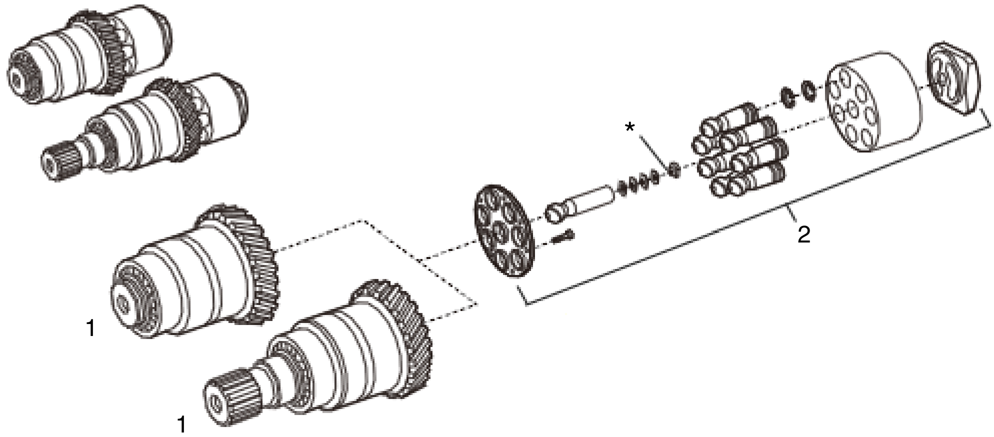
(12) Complete rotary group

※ 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.

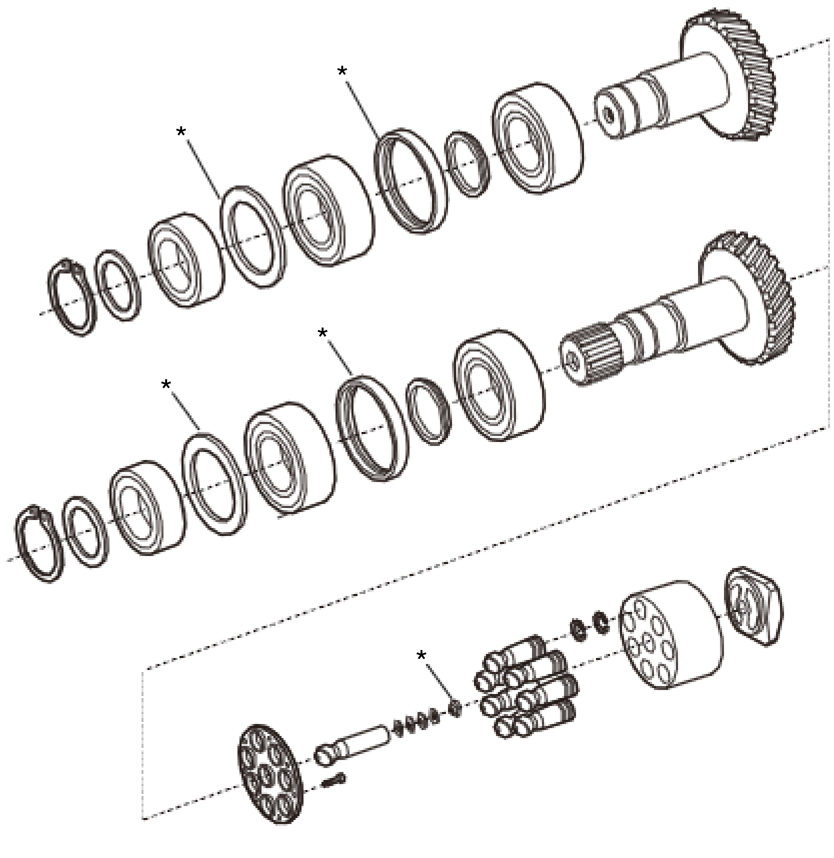


480A8MP79

② Rotary group : All of the components

Adjustment (*)

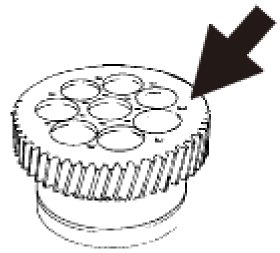
For adjustment values, torque values, see service information



480A8MP80

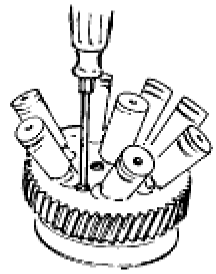
16) RE-FITTING THE ROTARY GROUP

(1) The threads must be free of oil, grease, dust or any other contaminants which may impair the locking of the screws.



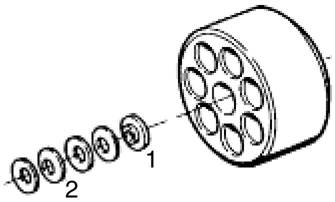
480A8MP81

(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.



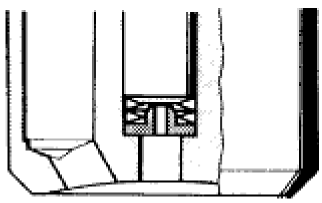
480A8MP82

(3) Fit the spring plate (1) and cup springs (2) into their correct position (and orientation) using grease to hold them into place.



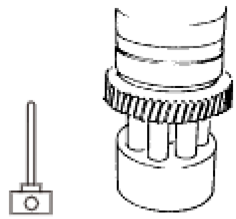
480A8MP83

(4) Ensure that all of te parts are assembled in correct order and orientation.



480A8MP84

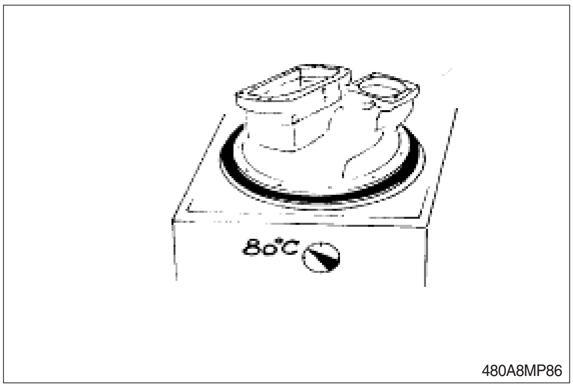
(5) Insert pistons into the cylinder. Using a soft surface as a support to prevent the sliding surfaces from being damaged. Pre-assemble both of the rotary groups in this manner.



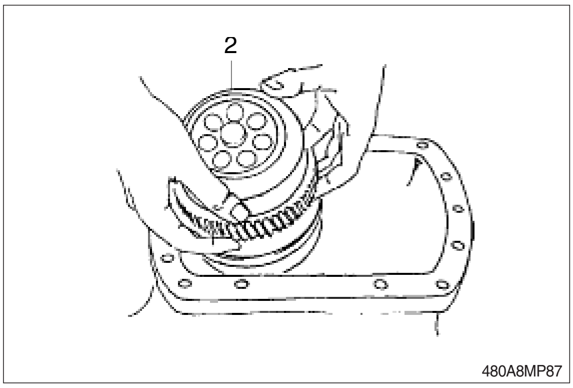
480A8MP85

17) PUMP ASSEMBLY

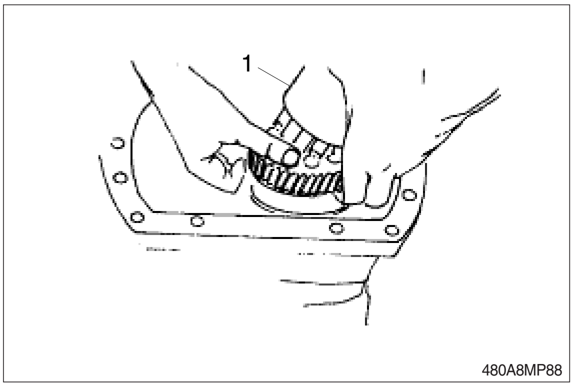
(1) Warm up the housing to approx. 80℃.



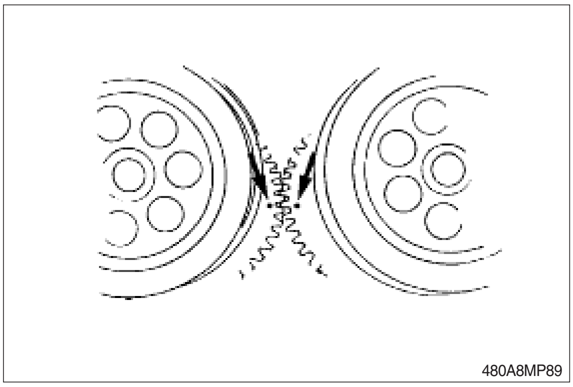
(2) Insert the pre-assembled rotary group (2) taking into account gear tooth markers.



(3) Insert rotary group (1). Align the marked gear teeth.

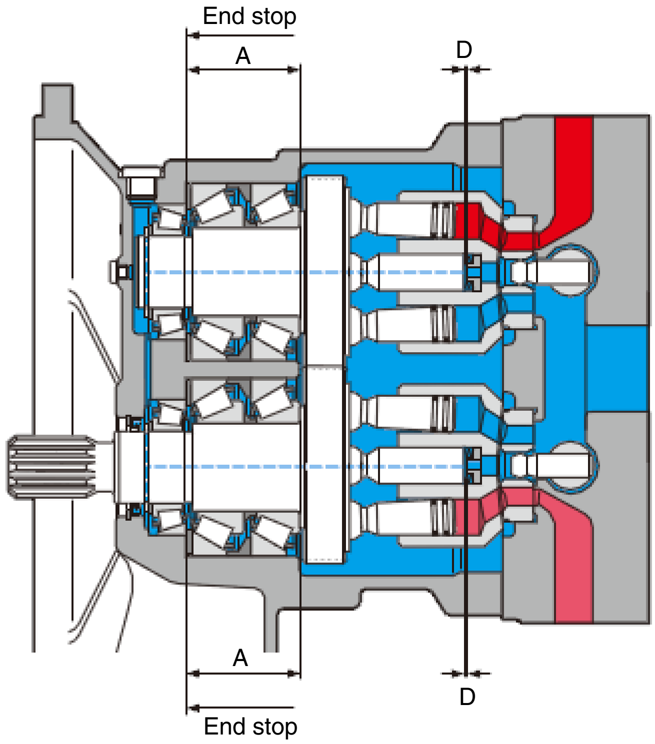


(4) The gear tooth markers must coincide.



(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.

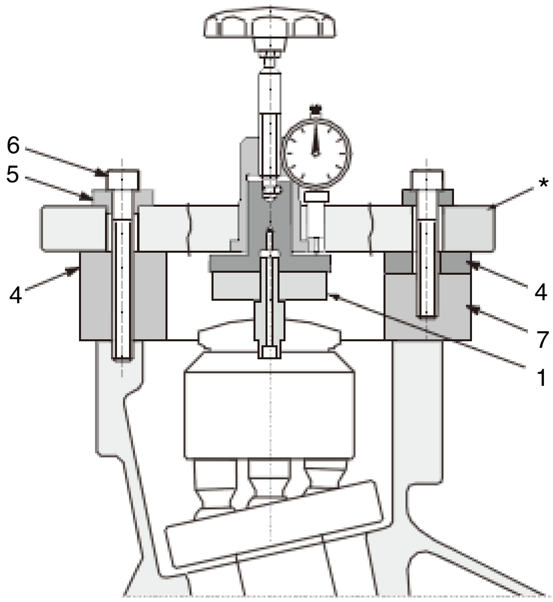
② Adjustment of the hydraulic component of the rotary group

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



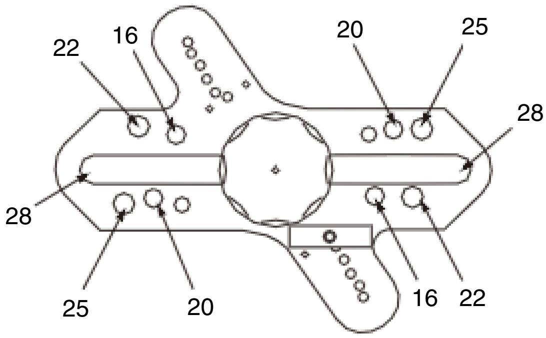
*	Measuring device
1	Centering device
4	Intermediate ring
5	Shim
6	Socket screw
7	Intermediate plate

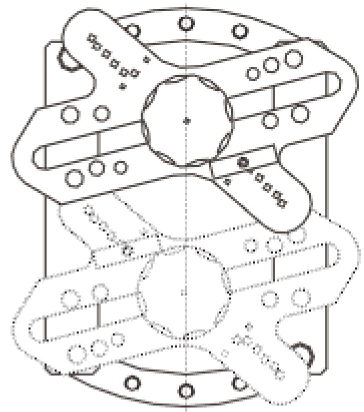
480A8MP91

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.

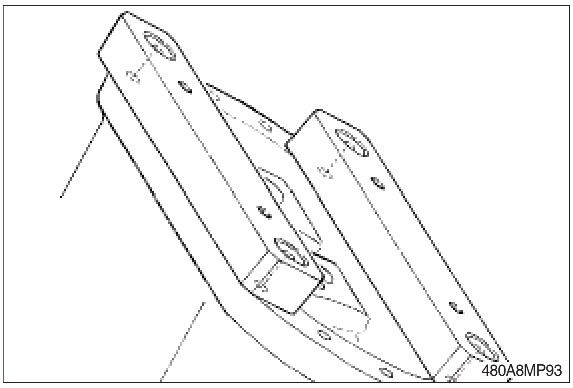




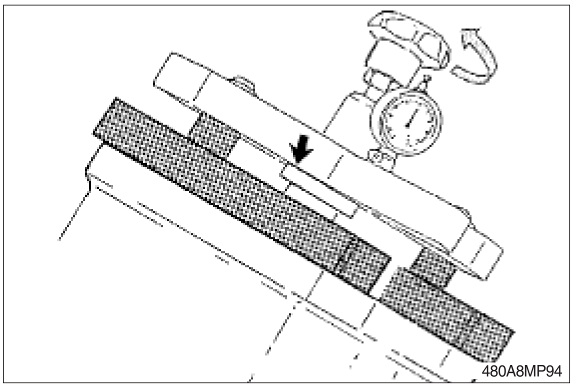
480A8MP92

Mounting position (28)

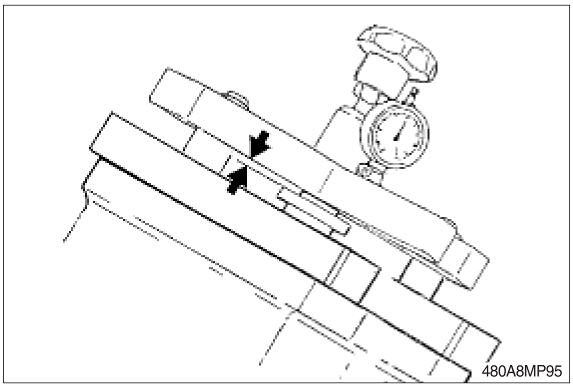
⑥ Fit the intermediate plates onto the housing.



⑦ Zero adjustment - measuring device
Turn using the hand wheel until the stop is reached.
- Set dial gauge to zero

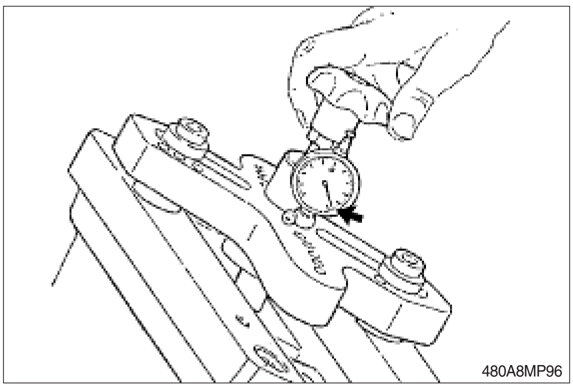


⑧ Measuring procedure
Turn down by 4 turns on the dial gauge.
Check:
2 mm clearance, set dial gauge to "Zero".
Clearance : 0.4 ± 0.1 mm

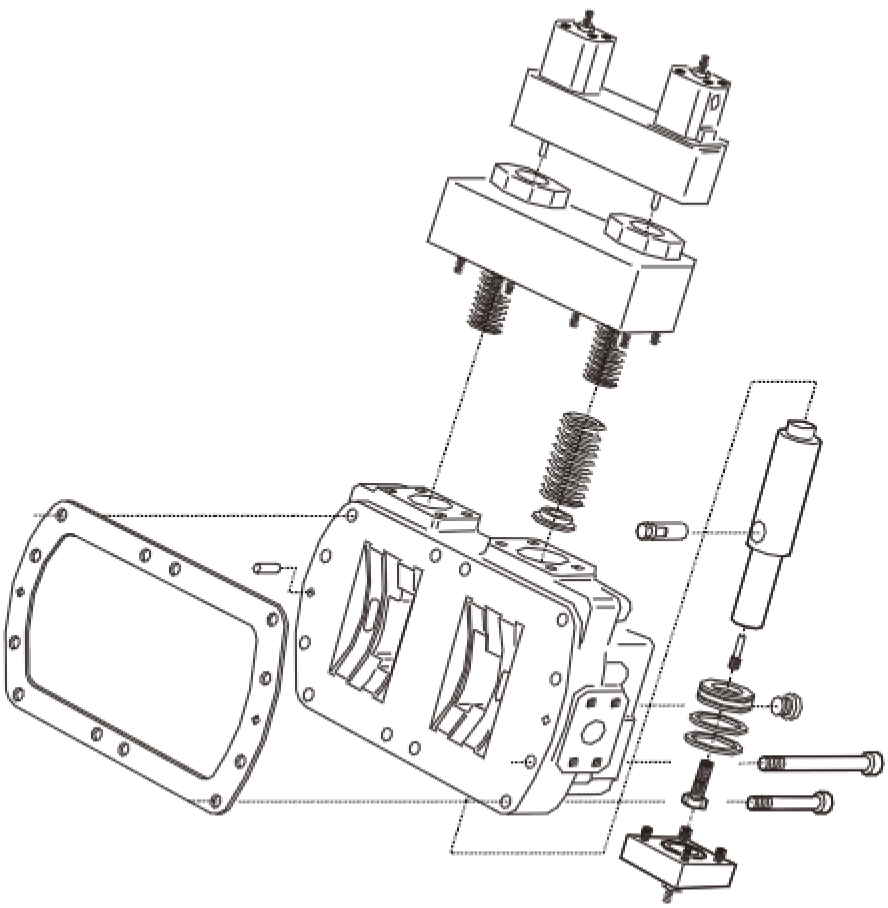


⑨ Measuring procedure
Turn down, using the hand wheel, until resistance is met.
Read the measured value.

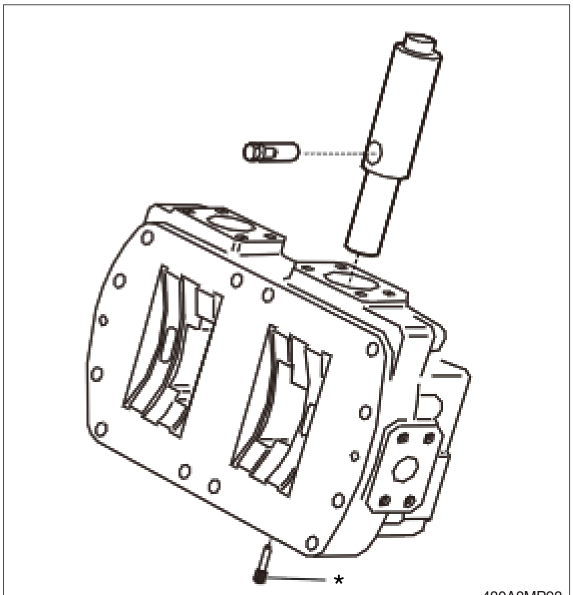
※ Don't use excessive force.



18) FIT CONTROL HOUSING

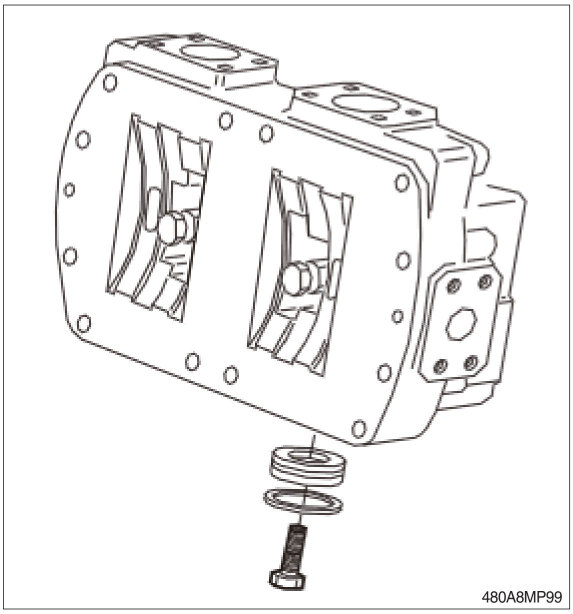

480A8MP97

(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)

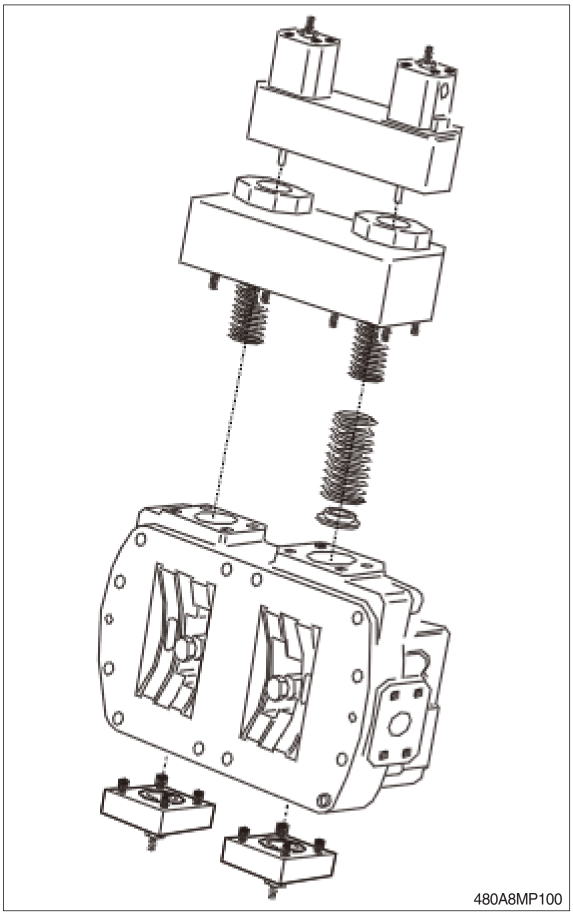


480A8MP98

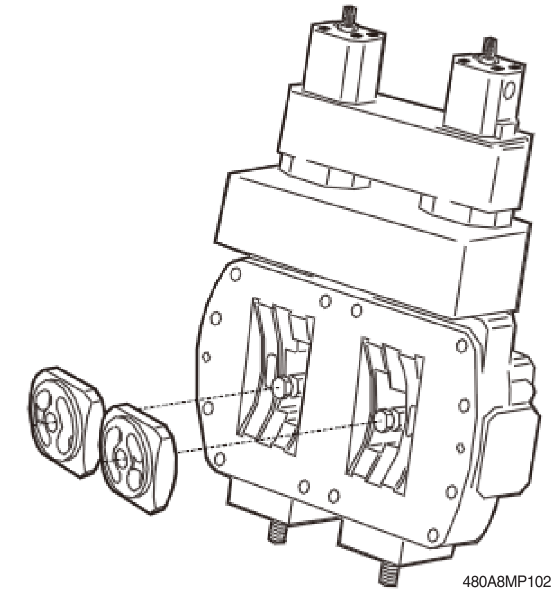
(3) Push on the piston ring by hand.
(4) Fix adjustment piston.
(5) Take the tightening torques into account.


480A8MP99

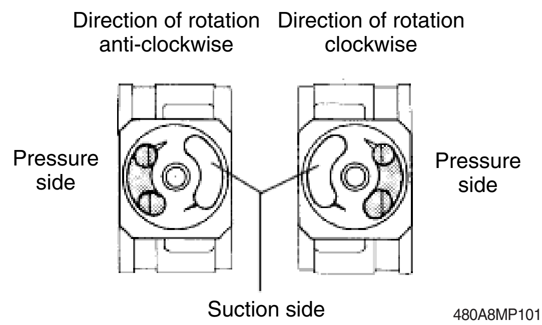
(6) Fit control housing.


480A8MP100

(7) Fit the control lens in its correct position using grease to hold it in place.

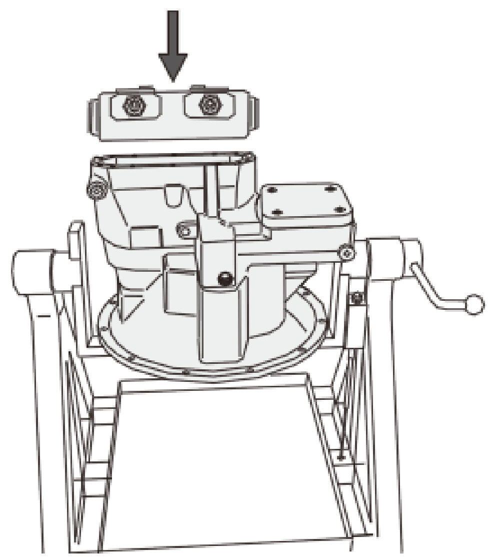


480A8MP102



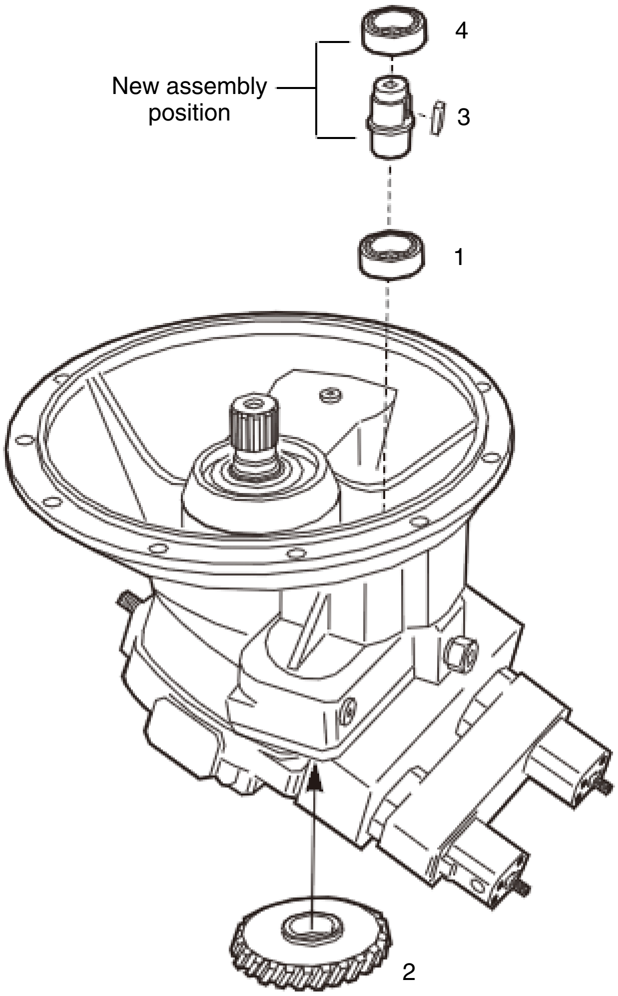
480A8MP101

(8) Fit seal and controller.



480A8MP103

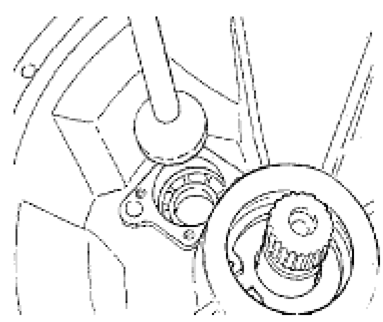
19) ASSEMBLY OF THE INTERMEDIATE WHEEL



480A8MP104

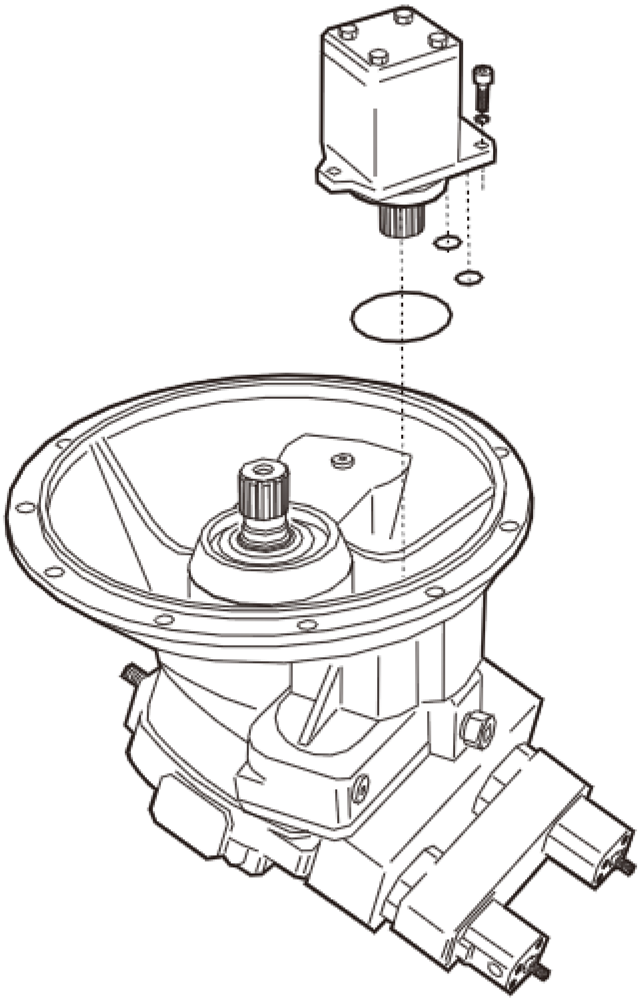
(1) Press in bearing into housing.
(2) Install and align the intermediate wheel through side drive opening.
(3) Cool down the bolt with nitrogen and place it.
(4) Press in bearing.

(5) Press in the bearing into the housing.



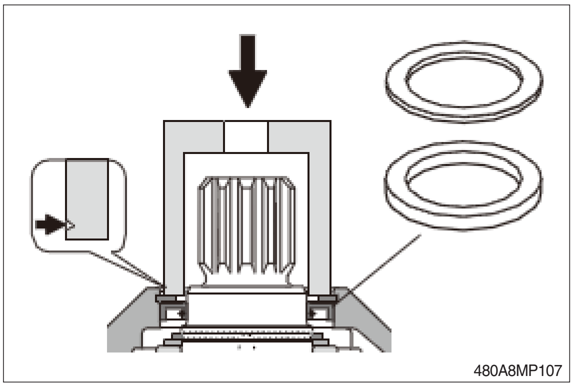
480A8MP105

20) FIT THE GEAR PUMP



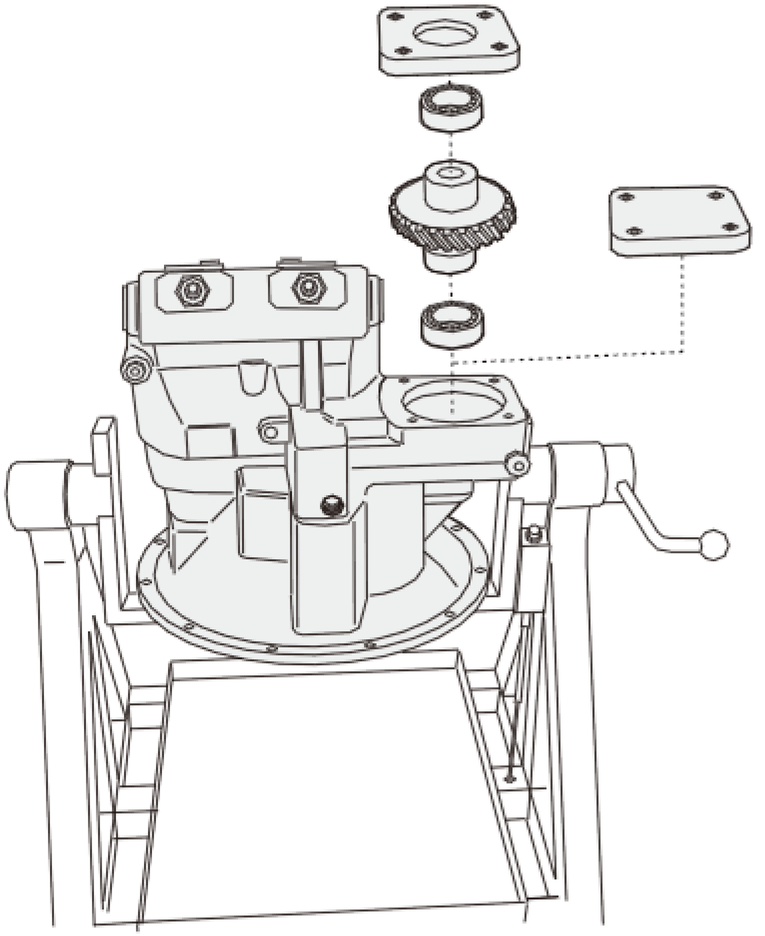
480A8MP106

(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

GROUP 4 MAIN CONTROL VALVE

1. REMOVAL AND INSTALL

1) REMOVAL

(1) Lower the work equipment to the ground and stop the engine.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

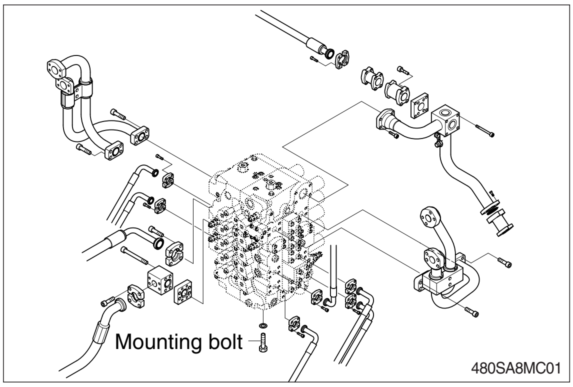
(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.


13031GE18

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(4) Remove the wirings for the pressure sensor and so on.



480SA8MC01

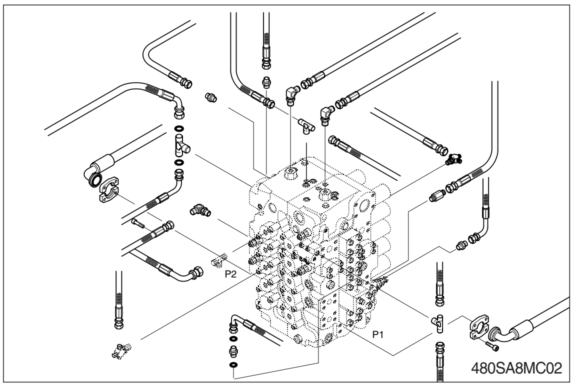
(5) Remove bolts and disconnect pipe.

(6) Disconnect pilot line hoses.

(7) Disconnect pilot piping.

(8) Sling the control valve assembly and remove the control valve mounting bolt.

- · Weight : 421 ㎏ (928 ㏐)
- · Tightening torque : 57.9 ± 8.7 kgf·m (419 ± 62.9 lbf·ft)



480SA8MC02

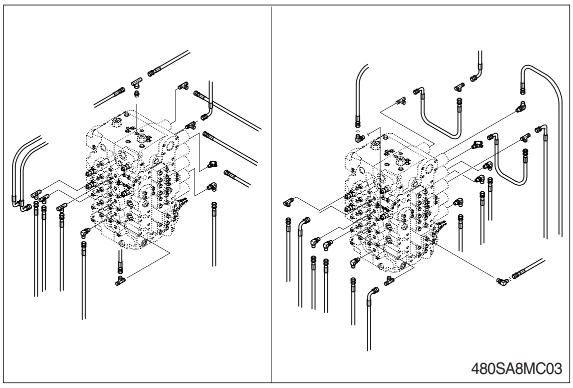
(9) Remove the control valve assembly.
When removing the control valve assembly, check that all the piping have been disconnected.

2) INSTALL

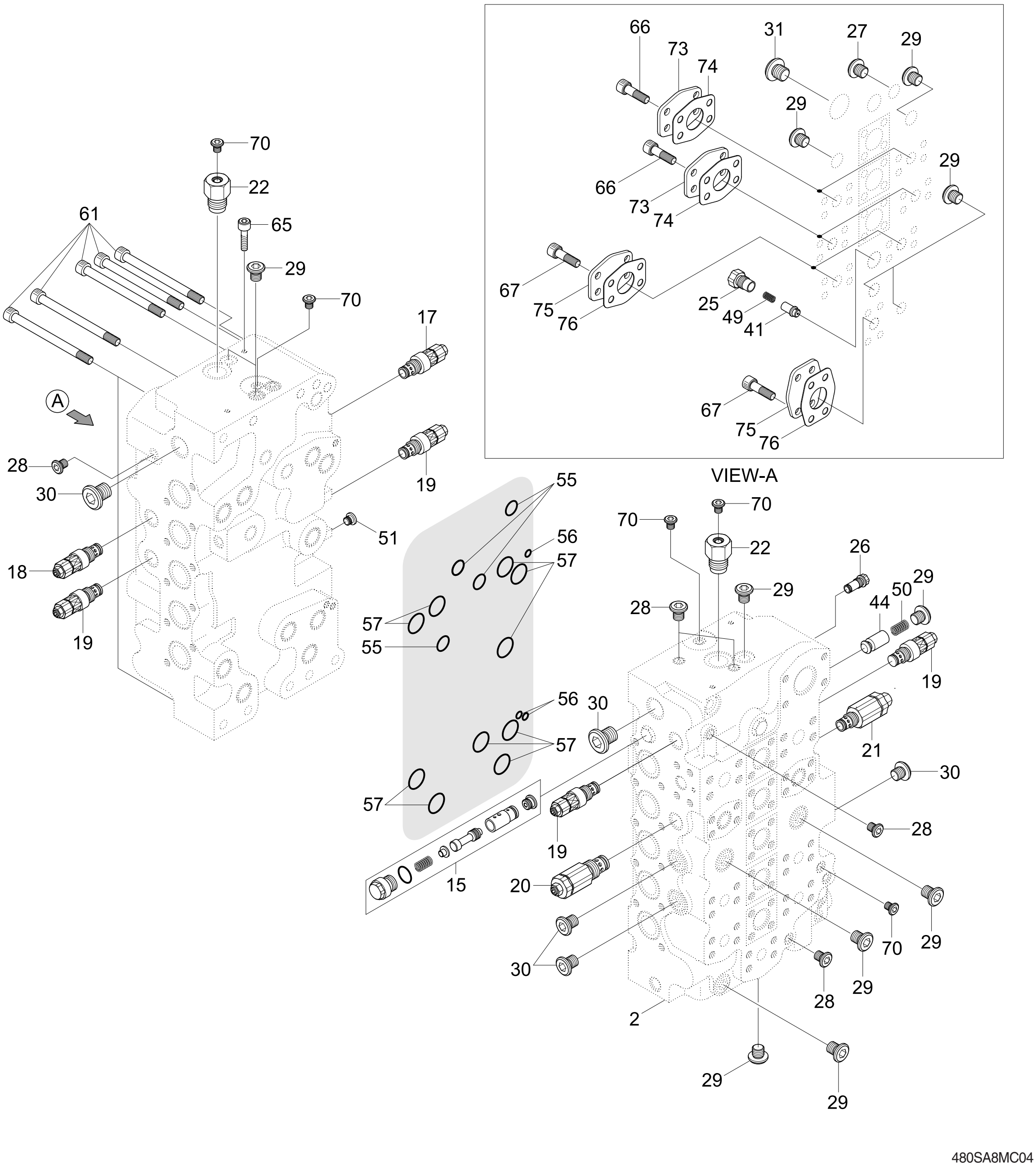
(1) Carry out installation in the reverse order to removal.

(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.

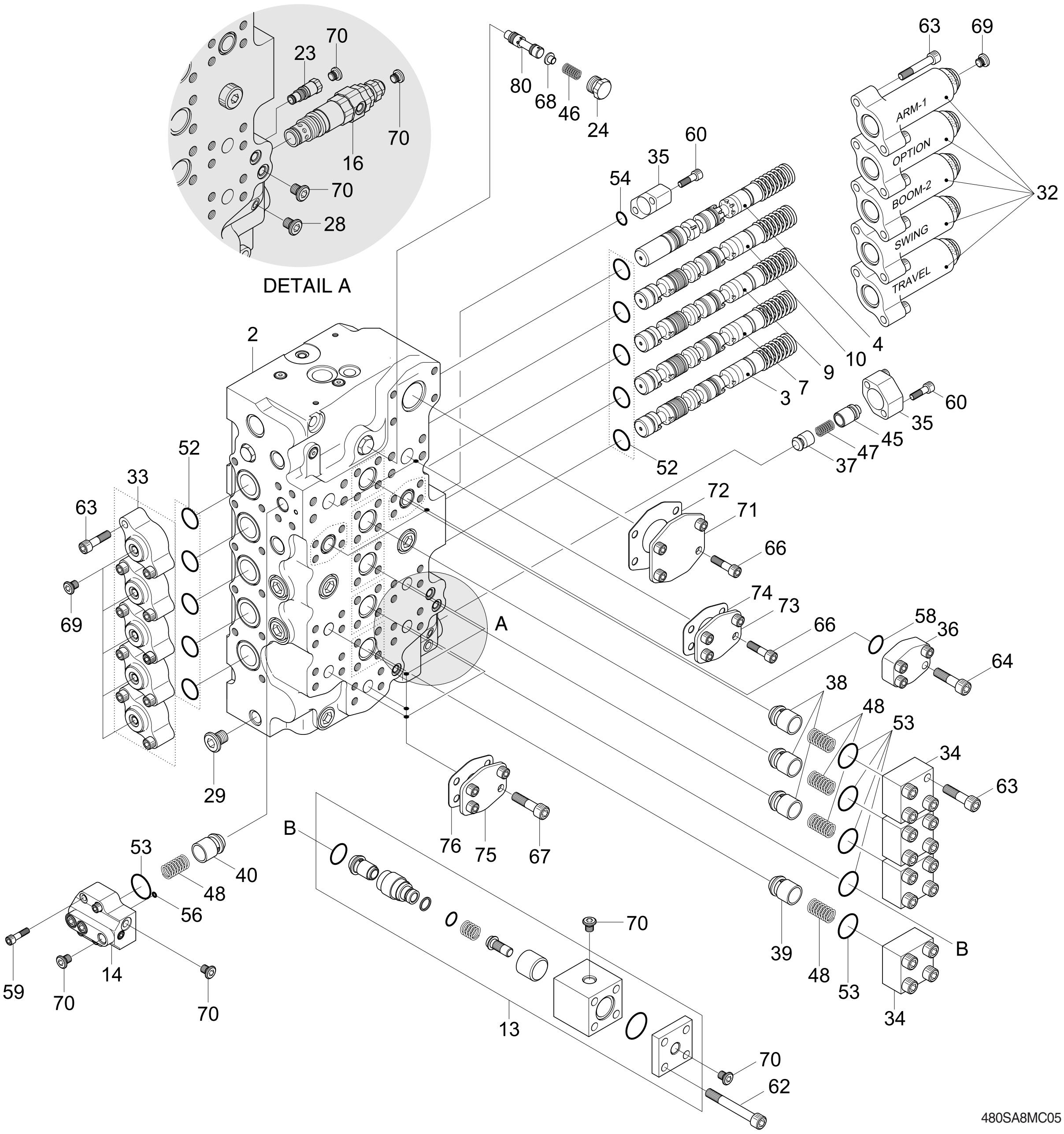

480SA8MC03

2. STRUCTURE (1/3)



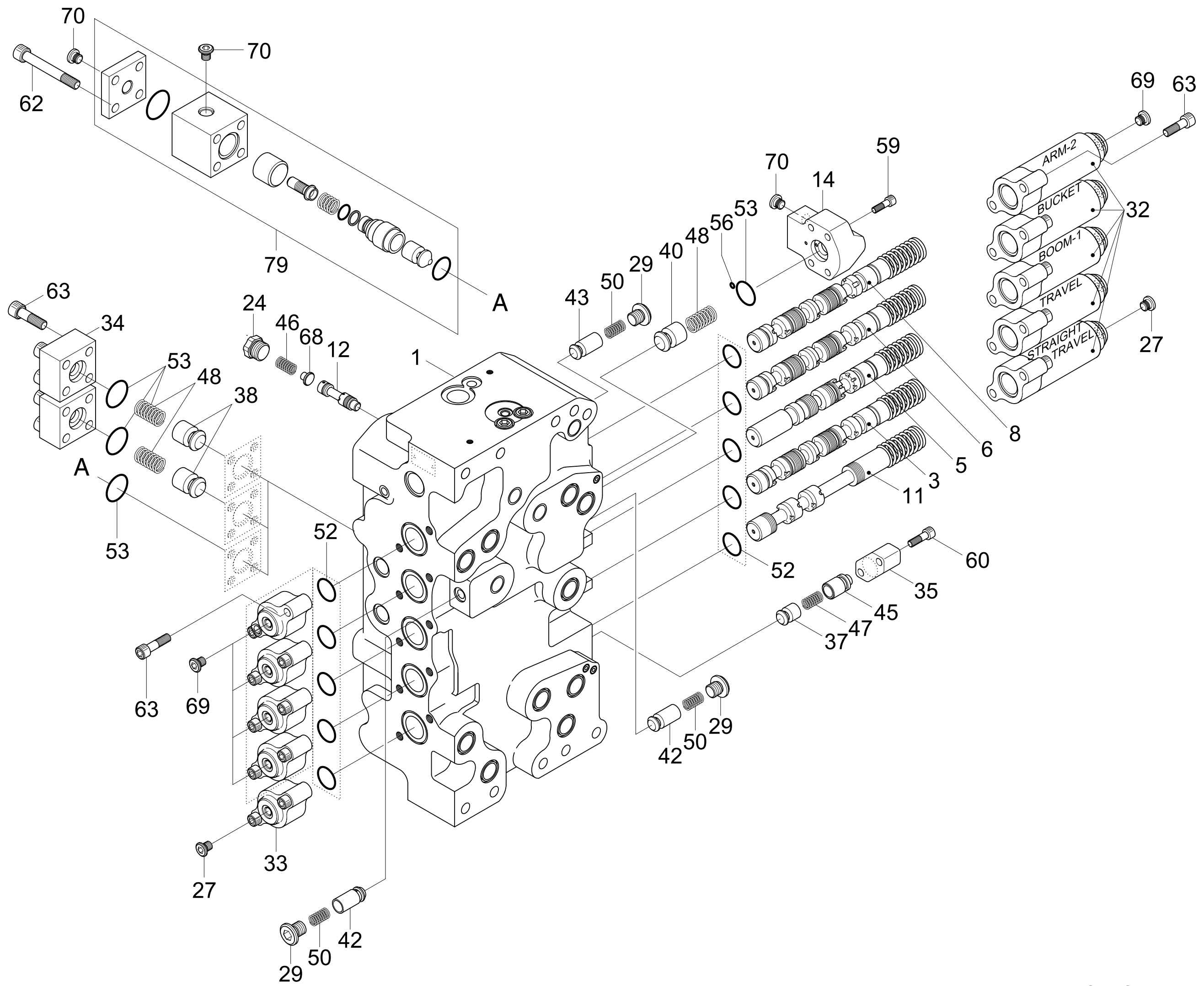
15	Arm regen cut spool kit	29	Plug	61	Socket bolt
17	Port relief valve	30	Plug	65	Socket bolt
18	Port relief valve	31	Plug	66	Socket bolt
19	Port relief valve	41	Poppet	67	Socket bolt
20	Port relief valve	44	Arm orifice	70	Dust cap
21	Port relief valve	49	Spring	73	Cover
22	Relief valve	50	Spring	74	Gasket
25	Plug	51	Plug	75	Cover
26	Plug	55	O-ring	76	Gasket
27	Plug	56	O-ring		
28	Plug	57	O-ring		

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	68	Spring seat
14	Holding valve	46	Spring	69	Dust cap
16	Main relief valve	47	Spring	70	Dust cap
23	Plug assy	48	Spring	71	Cover
24	Bypass 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	80	Bucket BC spool
33	Pilot cap-small	58	O-ring		
34	Flange	59	Socket bolt		

STRUCTURE (3/3)

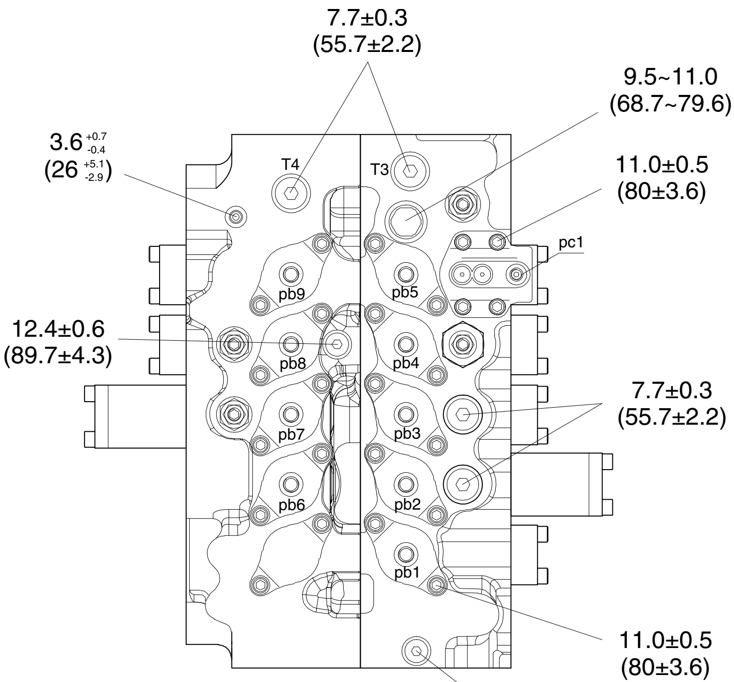


480SA8MC06

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 assy	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	79	Boom 1 logic valve

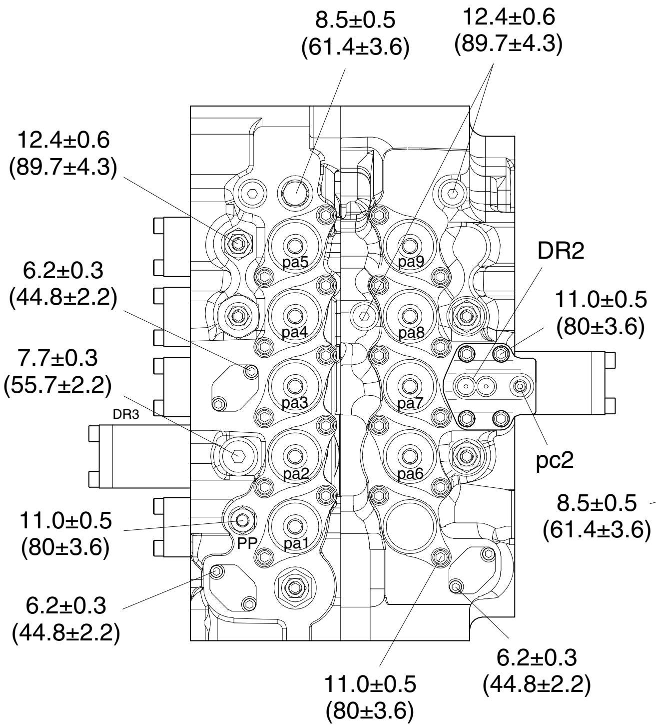
3. TIGHTENING TORQUE (1/2)

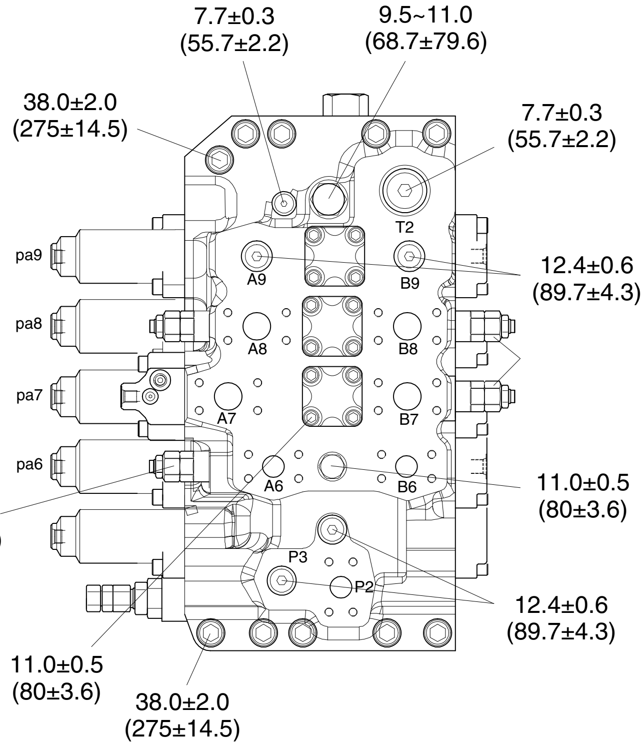
※ Unit : kgf · m (lbf · ft)



VIEW A

(See 8-57)

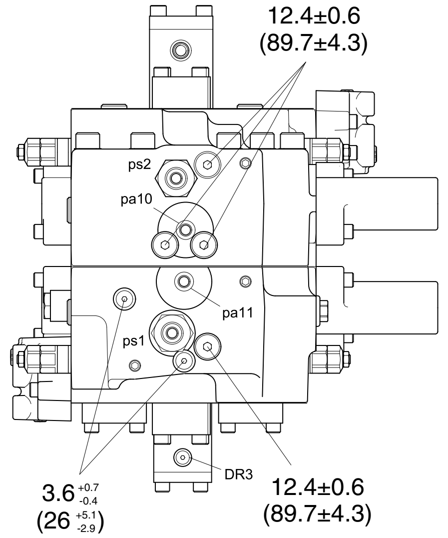


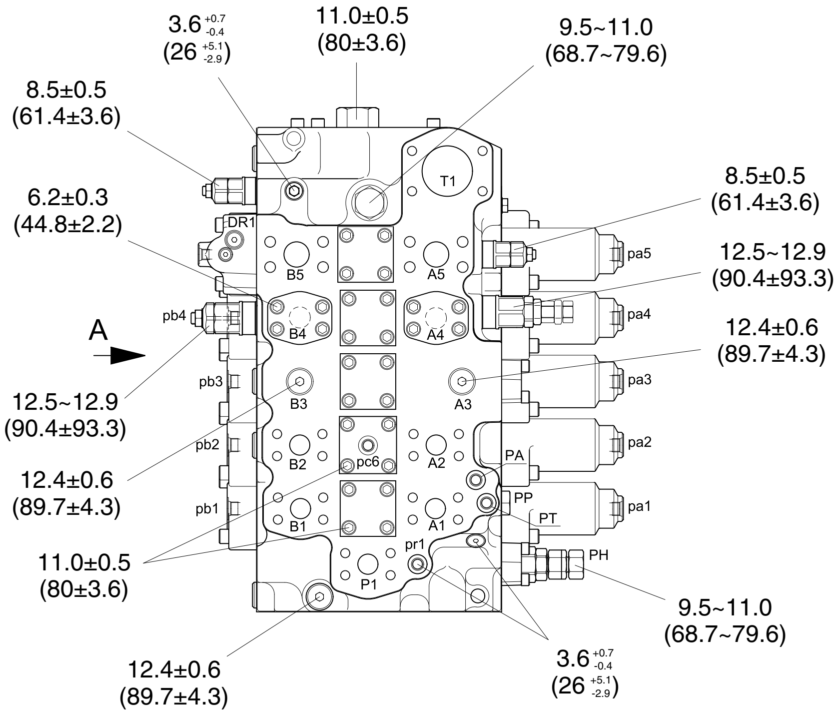


480SA8MV08

TIGHTENING TORQUE (2/2)

※ Unit : kgf · m (lbf · ft)





480SA8MV07

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

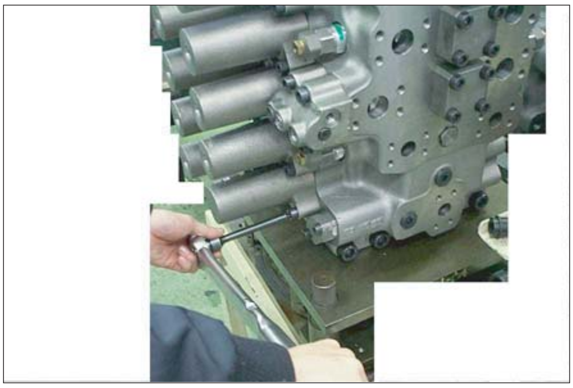
The figure in ( ) shown after the part name in explanation sentence shows its number in the construction figures.

(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, 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)

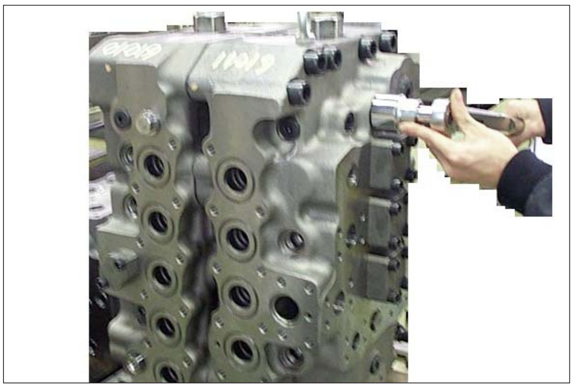
45078MC12

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)

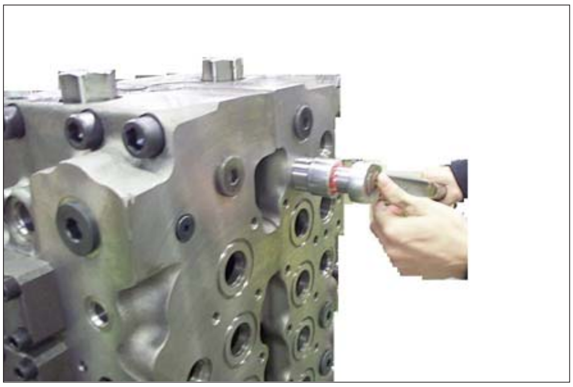
① Loosen the plug (24) and remove spring (46), spring seat (68) and the spool (12).



45078MC13

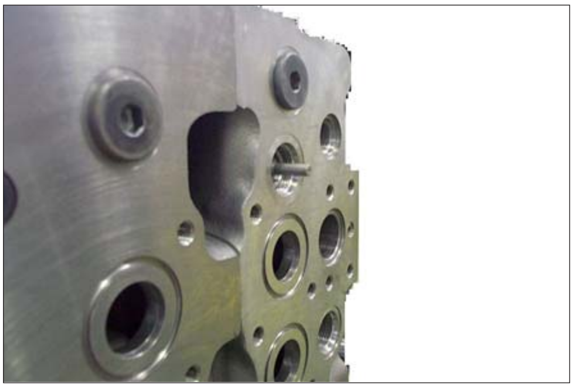
(4) Arm1 regeneration spool assy (15)

① Loosen the plug and pull out O-ring.



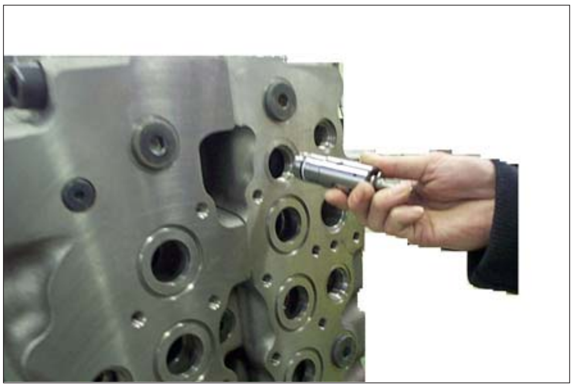
45078MC15

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)

GROUP 5 SWING DEVICE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL


13031GE18

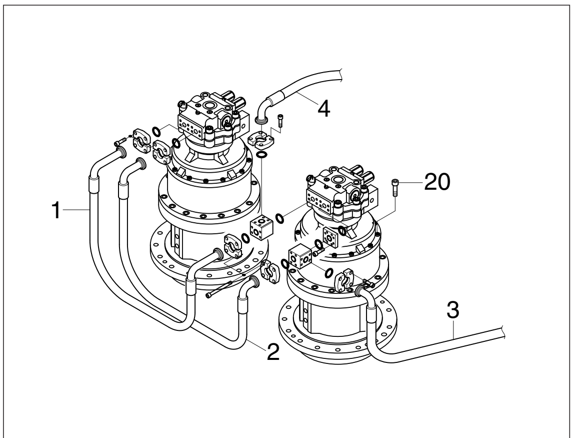
(1) Lower the work equipment to the ground and stop the engine.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.



480SA8SM01

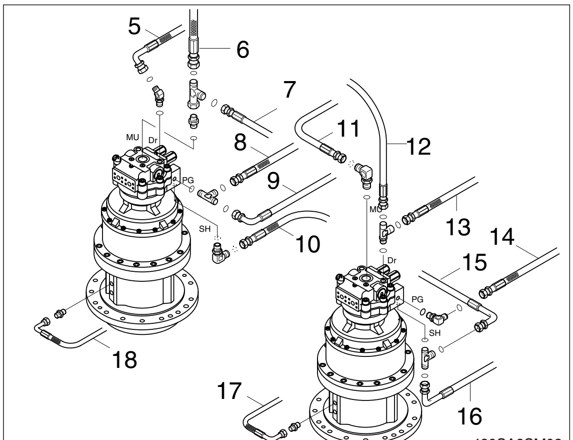
(4) Disconnect hose assembly (1, 2, 3, 4).

(5) Disconnect pilot line hoses (5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18).

(6) Sling the swing motor assembly and remove the swing motor mounting socket bolts (20).

· Weight : 667 kg (1470 lb) x 2

· Tightening torque : 57.9 ± 8.7 kgf·m (419 ± 62.9 lbf·ft)



480SA8SM02

(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.

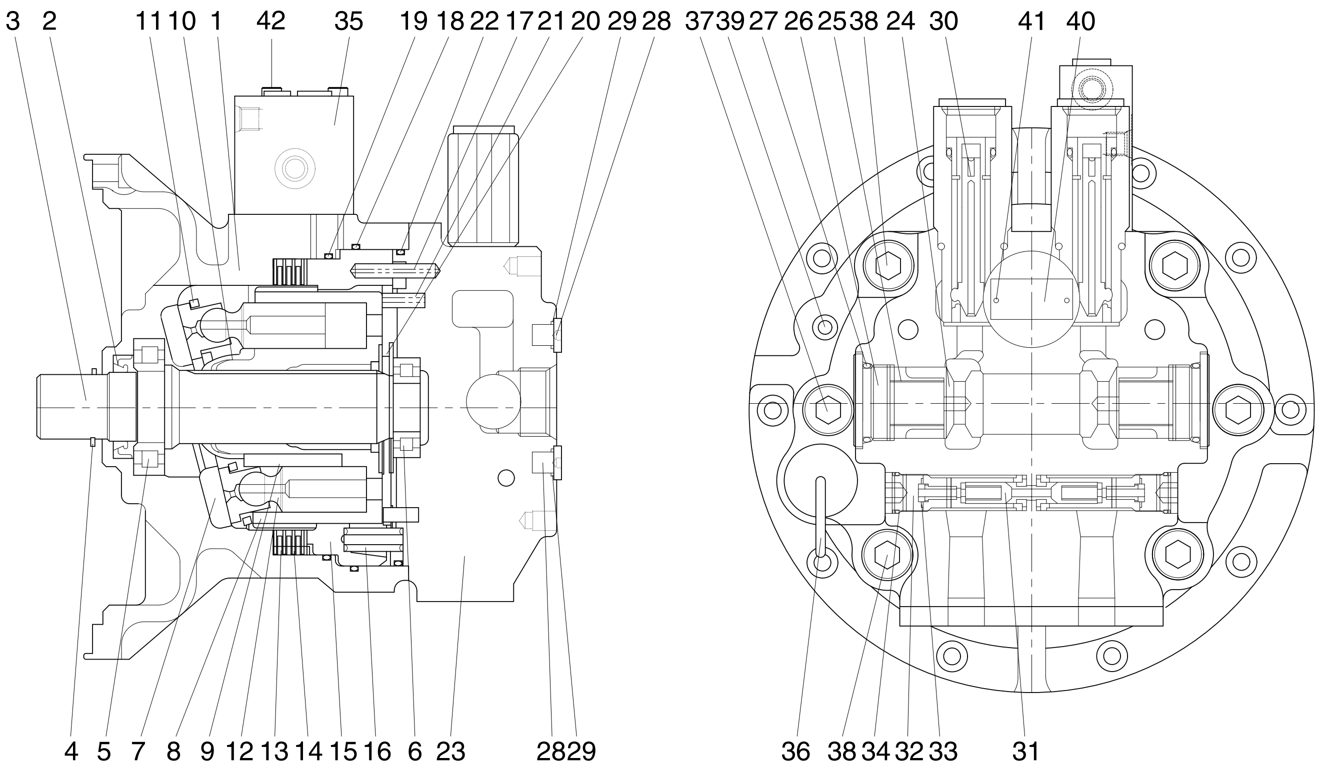
④ Start the engine, run at low idling and check oil come out from plug.

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



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	Retaining 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 kit	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	Hexagon socket head bolt

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

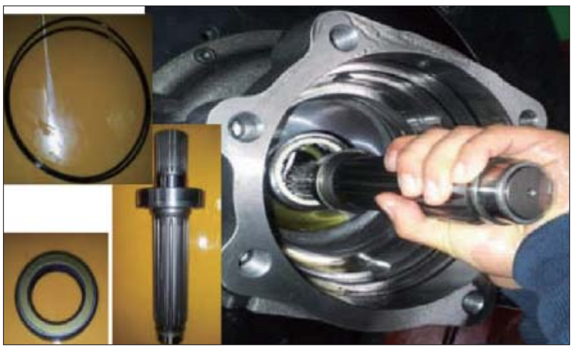
⑥ Disassemble swash plate (7) from casing (1).

480L2SM15

⑦ Using a pair of pliers, take retainer ring (4) out of casing (1).

480L2SM16

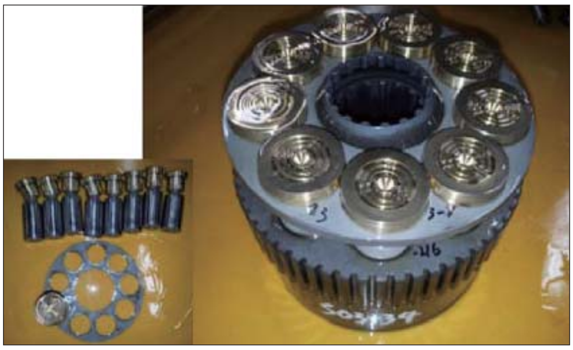
⑧ Disassemble shaft sub assy (3), oil seal (2), O-rings (18, 22) from casing (1).



480L2SM17

(2) Disassemble rotary block assy

① Disassemble pistion and shoe (12) from rotary block assy (8).

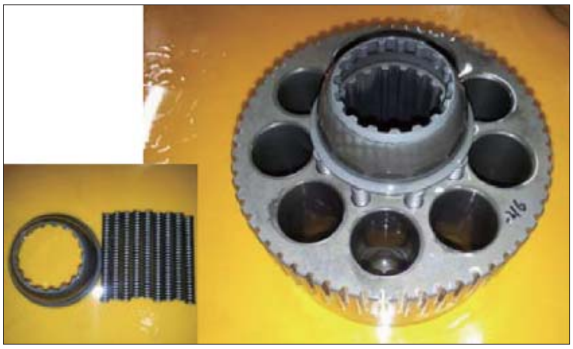


480L2SM18

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

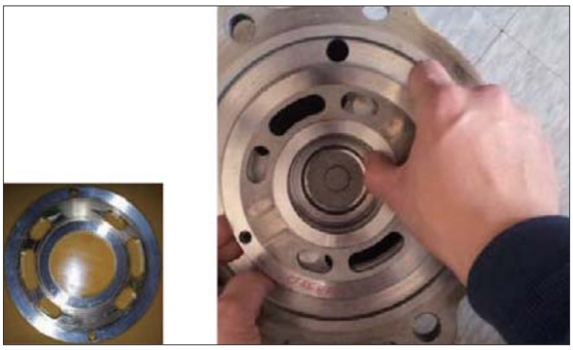
④ Assemble plug (28) and O-ring (29) into valve casing with a torque wrench.
· Plug (28)×3EA
· O-ring (29)×3EA

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.

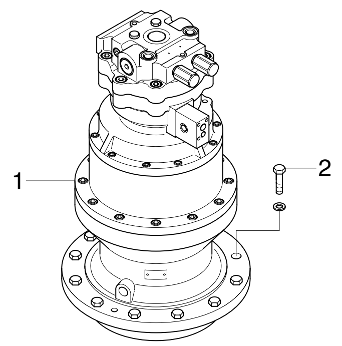
(2) Sling reduction gear assembly (1) and remove mounting bolts (2).

(3) Remove the reduction gear assembly.
· Reduction gear device weight : 271 kg (597 lb)

13031GE18

2) INSTALL

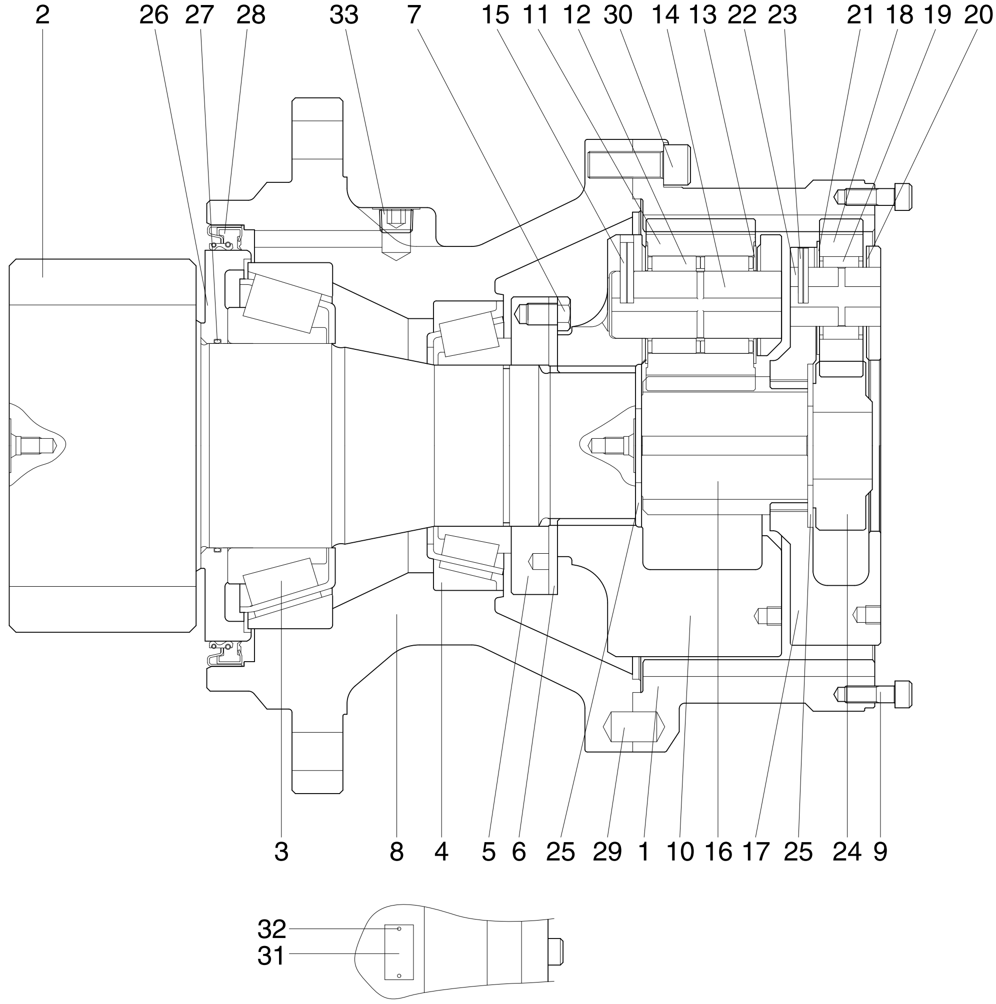
(1) Carry out installation in the reverse order to removal.
· Tightening torque : 57.9±8.7 kgf · m (419±62.9 lbf · ft)



480L8SM03

4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE



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) PREPARATION FOR DISASSEMBLING

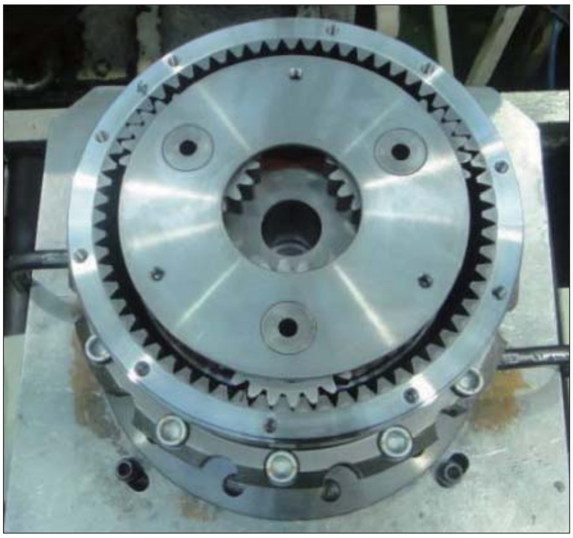
(1) The reduction units removed from excavator are usually covered with mud. Wash out side of unit and dry it.
(2) Setting reduction unit on work stand for disassembling.
(3) Mark for mating
Put marks on each mating parts when disassembling so as to reassemble correctly as before.

⚠ **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

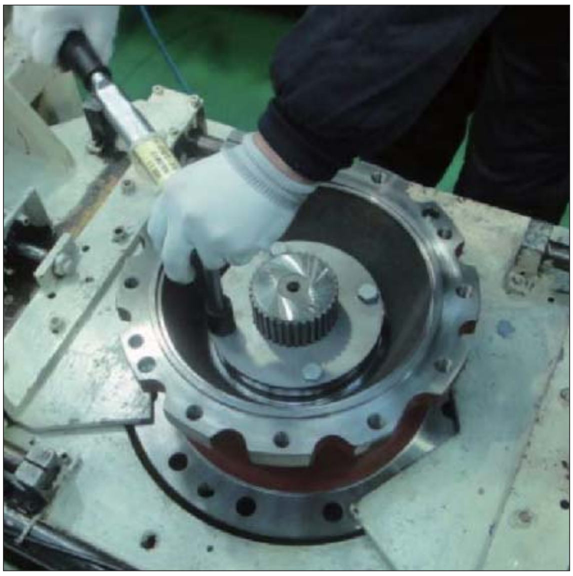
(3) Removing ring gear

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

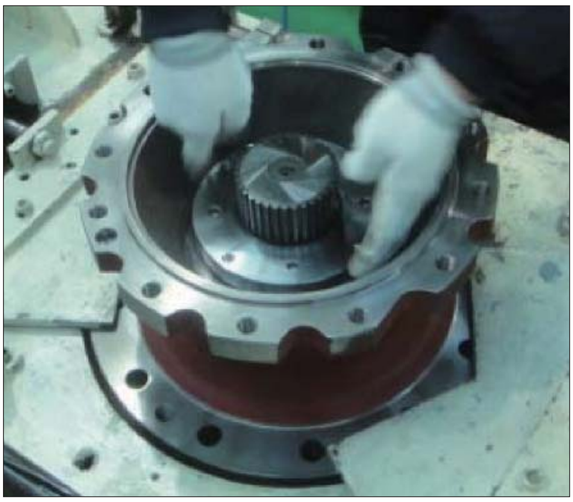
(4) Removing drive shaft sub assy

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.

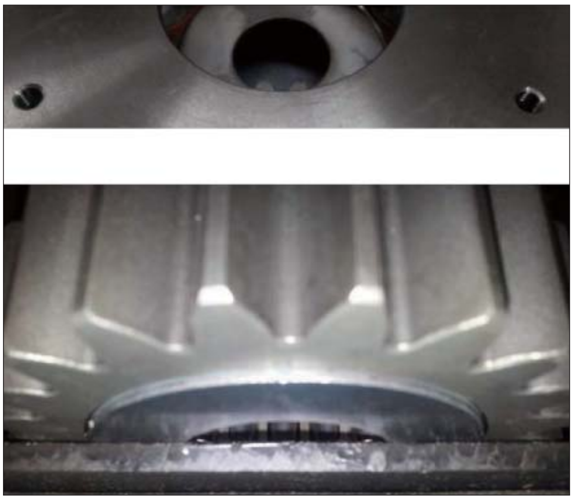
⑩ Bearing

- · 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.

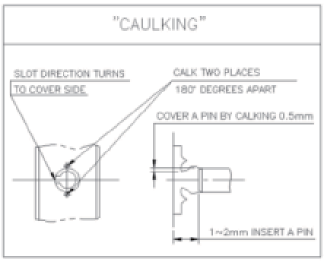


480L2SM62

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

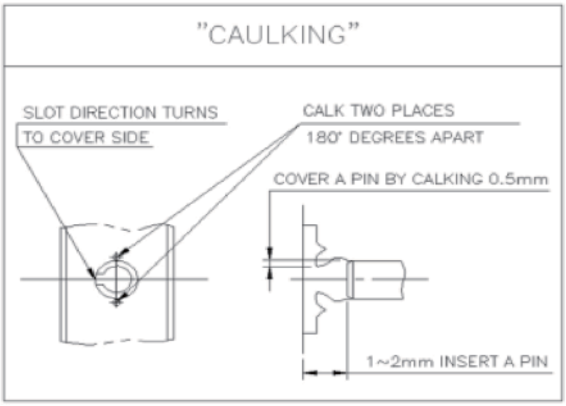
② After assembling needle bearing to No.2 planetary gear, put 2 pieces of thrust washer on both sides of bearing and install them to No.2 carrier.

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

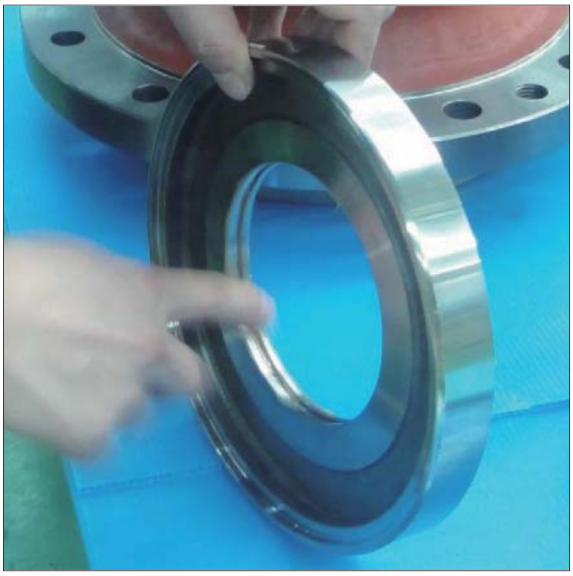
(4) Assembling pinion gear sub assy

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

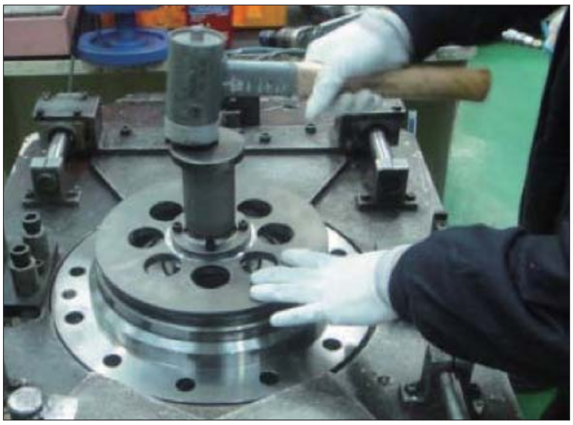
① Put top, bottom bearing cup into casing. (Use special jig for pressing. Pay attention to foreign materials while assembling bearing cup.)

※ Flip over casing to assemble oil seal.

480L2SM74

480L2SM75

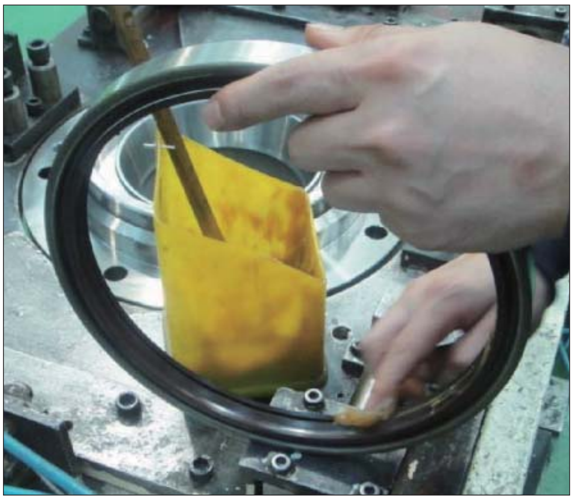
② Assemble oil seal to casing.
(Use special jig for pressing. Pay attention to direction of dust seal and dent.)



480L2SM76

While assembling oil seal

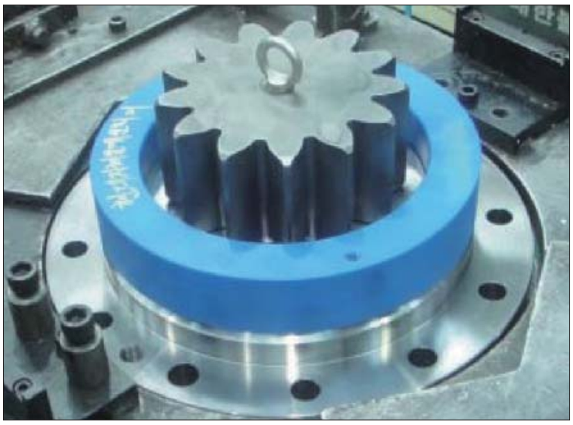
1. Be sure to set dust seal to gear oil.
2. Before assembling, charge enough grease in oil seal.
3. Before assembling, apply enough grease in and outside of oil seal.



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.)

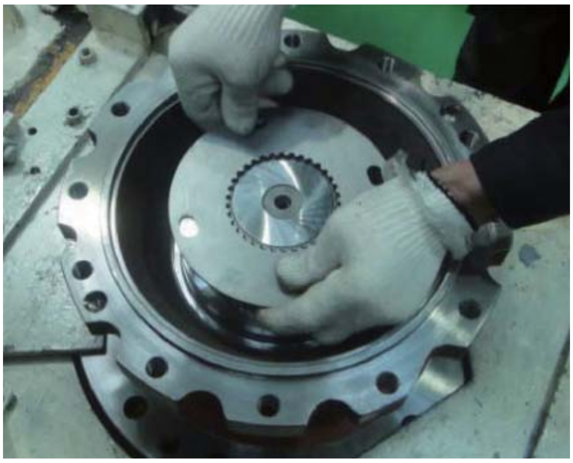
480L2SM80

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

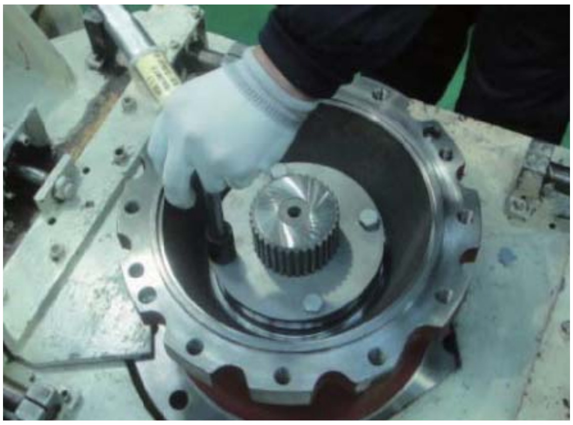
⑤ Align ring nut's bolt screw with lock plate's hole.
(In case of misalign between ring nut's bolt screw and lock plate's hole, put lock plate's hole as near as possible to ring nut's bolt screw and make it in line by increasing tightening torque.)


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

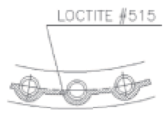
⑦ Use paint marker for checking surplus parts after assembling.


480L2SM86

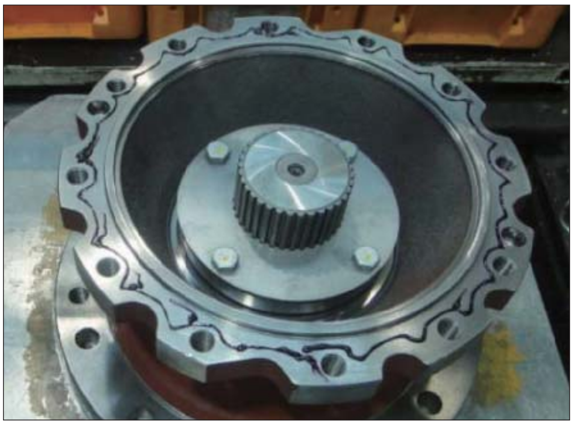
(7) Assembling ring gear

① Apply loctite #515 bottom of casing sub assy contacting with ring gear without disconnection. (Refer to loctite detail)

"LOCTITE DETAIL"

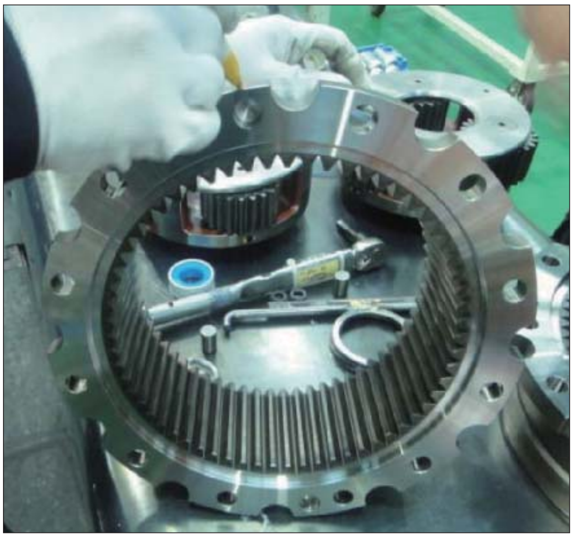


480L2SM87



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.

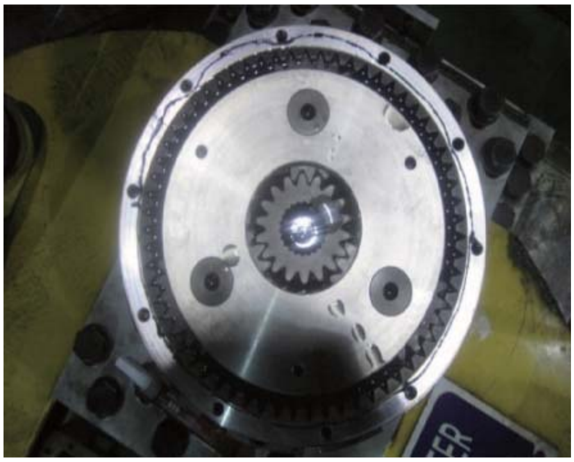
480L2SM94

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

GROUP 6 TRAVEL DEVICE (TYPE 1, 2)

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.

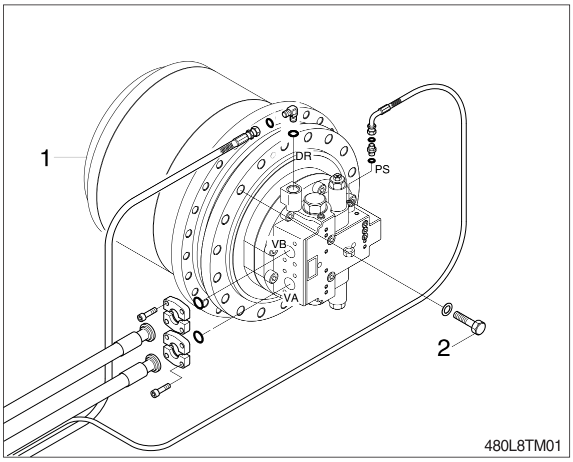
(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

13031GE18

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(4) Remove the track shoe assembly.
For details, see removal of track shoe assembly.



480L8TM01

(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

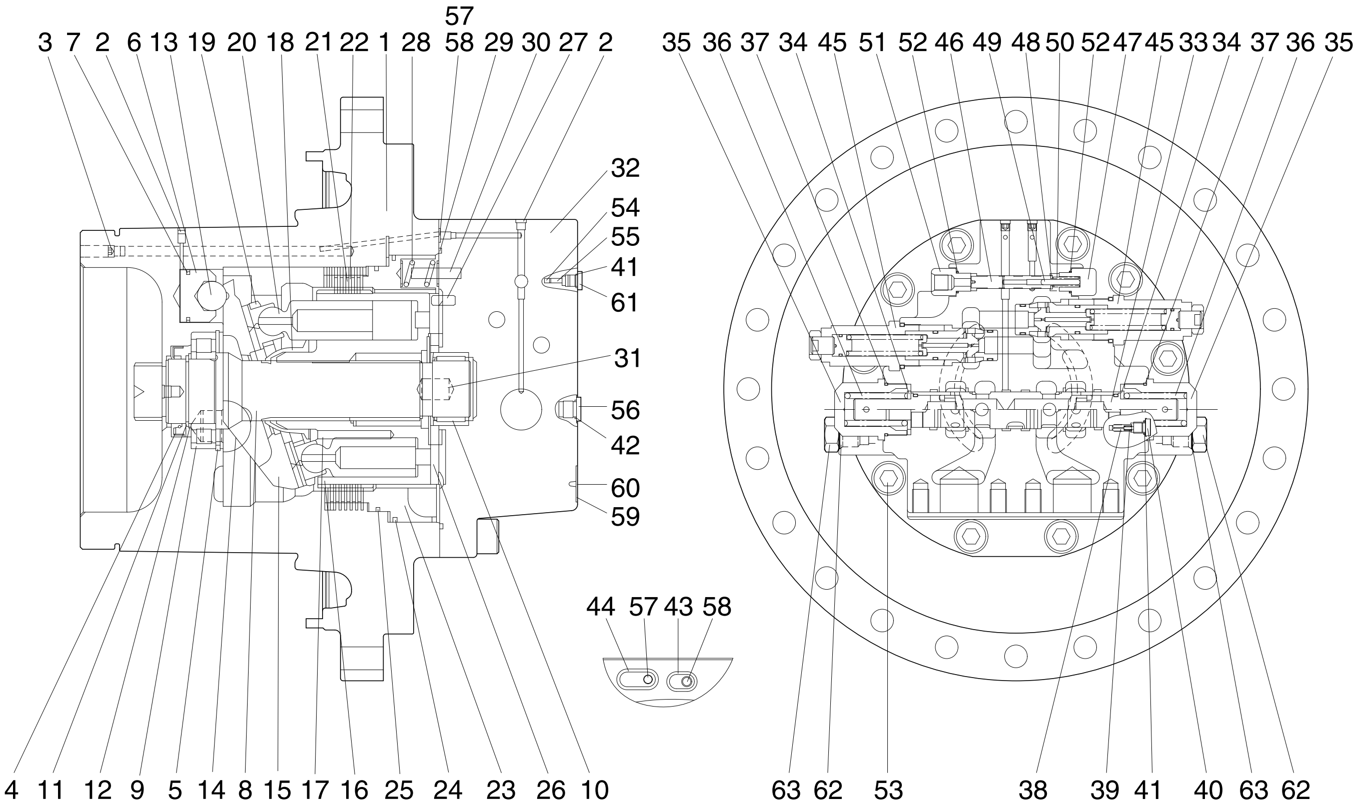
(1) Carry out installation in the reverse order to removal.

(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

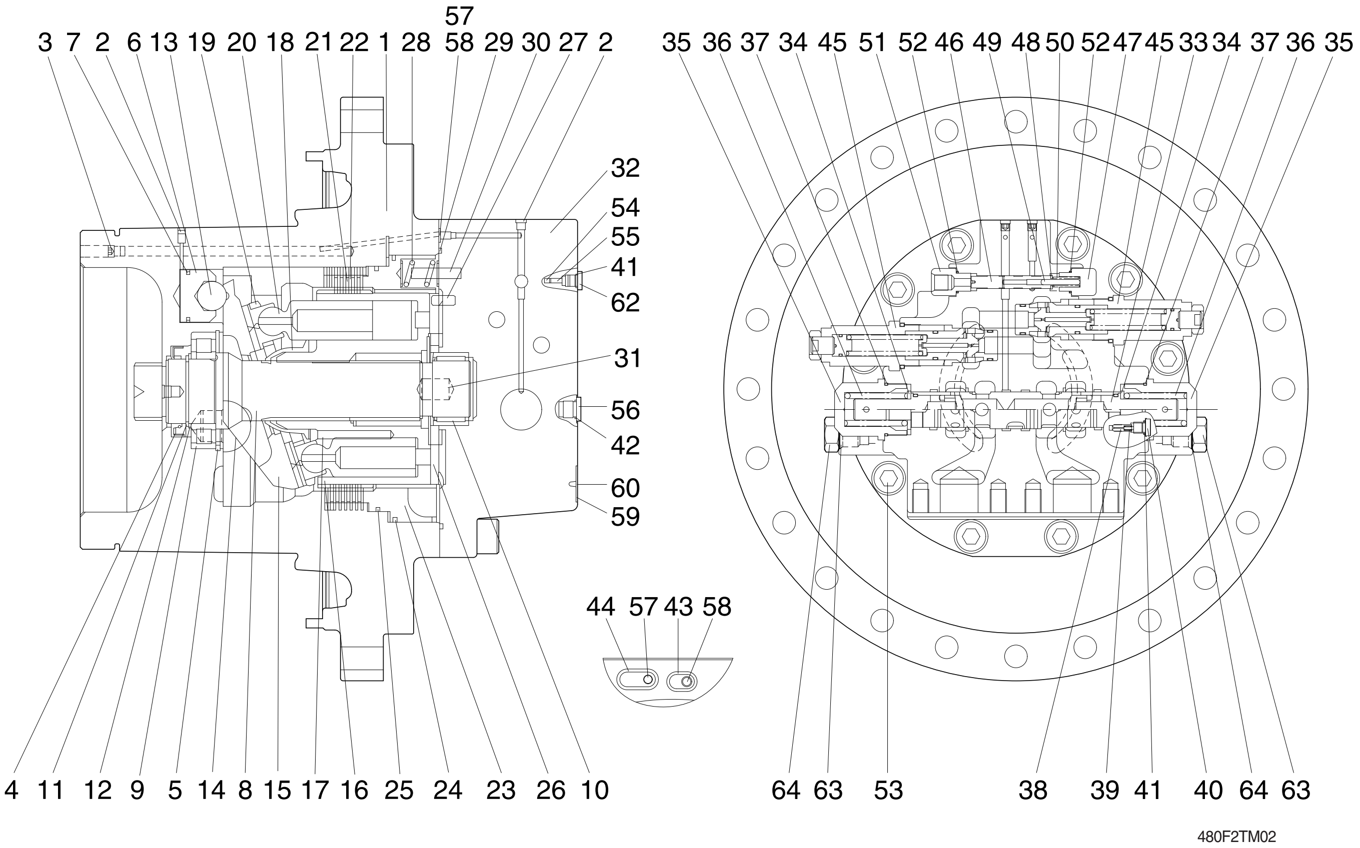
1) STRUCTURE (TYPE 1)



480A2TM02

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
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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.

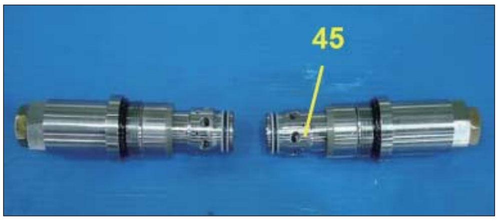
(2) This motor can be disassembled even in a state on the reduction gear.
However, in that case, pay full attention to preventing mud, dust, etc. from entering in it.

(3) The numerical in parentheses following each part name indicates its part number shown in the attached **assembly drawings.**

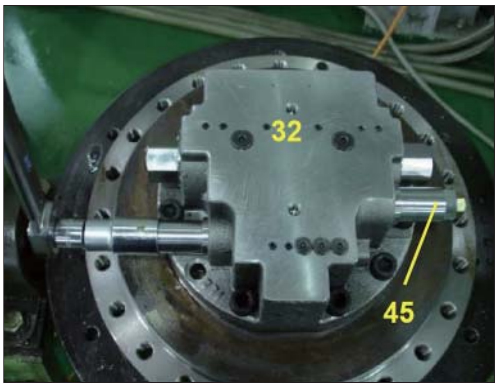
(4) The piping side of the motor is referred to as the rear side, and the output side as the front side.

2) DISASSEMBLY OF REDUCTION GEAR

(1) Disassemble relief valve assy (45) from rear cover (32) using spanner and torque wrench.

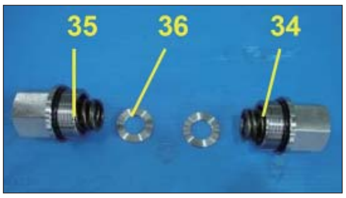


480L2TM11

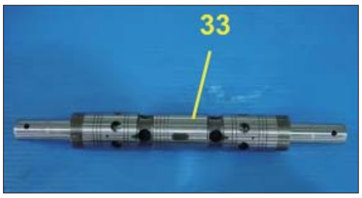


480L2TM12

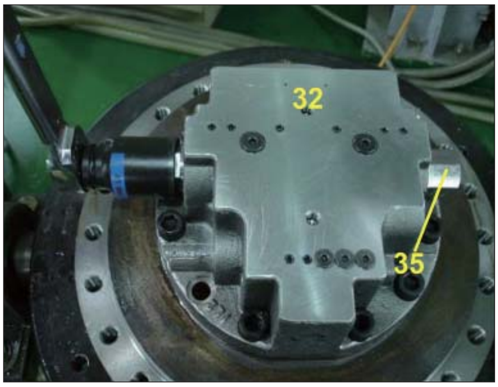
(2) Disassemble plug (35) from rear cover (32) and then disassemble spring (36), spring seat (34), main spool kit (33) in regular sequence.



480L2TM13

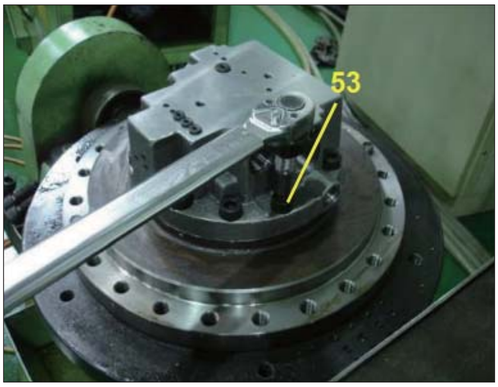


480L2TM14



480L2TM15

(3) Disassemble socket bolt (53)-10EA using torque wrench.



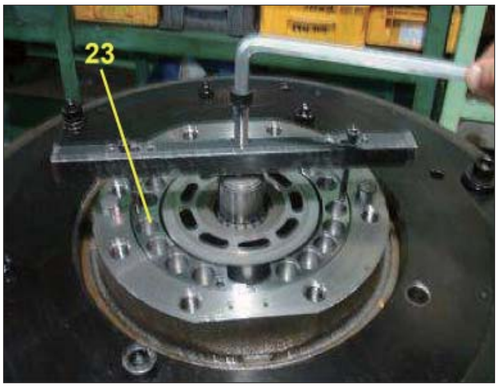
480L2TM16

(4) Take out rear cover (32) from casing (1).

480L2TM17

(5) Disassemble parking piston (23) using jig.

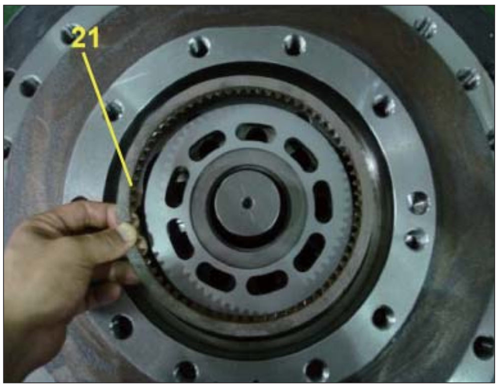
480L2TM18



480L2TM19

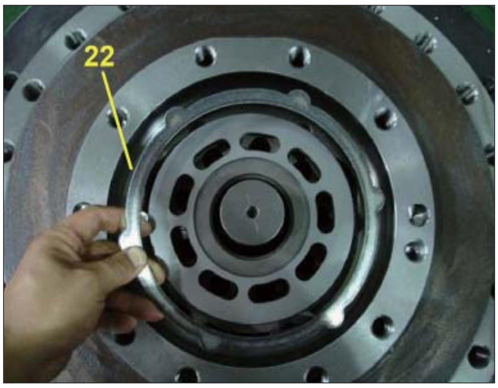
(6) Disassemble separate plate (22)-7EA, friction plate (21)-6EA

480L2TM20



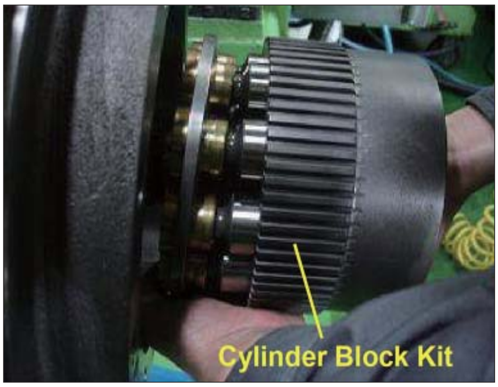
480L2TM21

480L2TM22



480L2TM23

(7) Remove rotary block kit.
It is easier to work by placing the casing (1) horizontal.

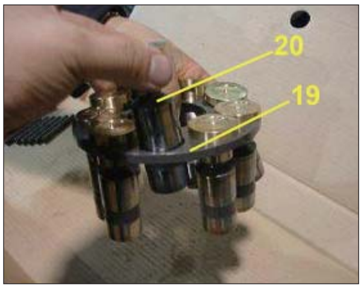


480L2TM24

(8) Disassemble rotary block (16), retaner plate (19), piston and shoe (20), ball guide (18), spring (17) from rotary block kit.

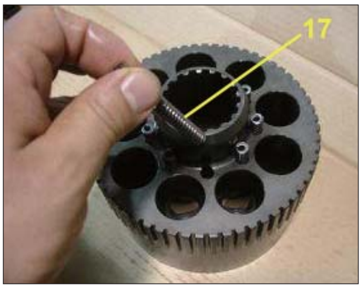

480L2TM25


480L2TM26



480L2TM27

480L2TM28



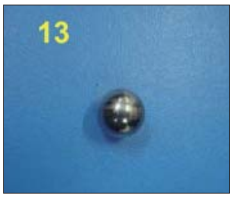
480L2TM29

(9) Disassemble swash plate (15) from shaft casing (1).

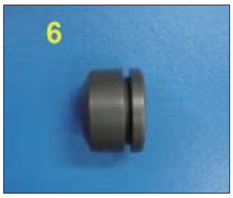
480L2TM30


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).

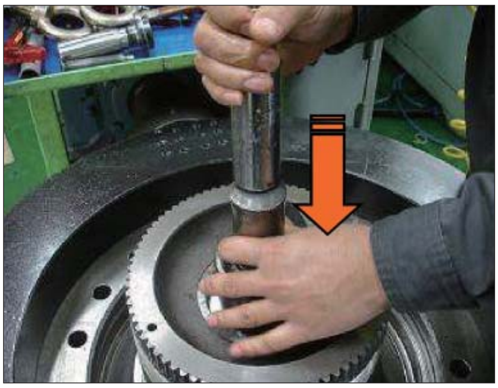
480L2TM35

(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

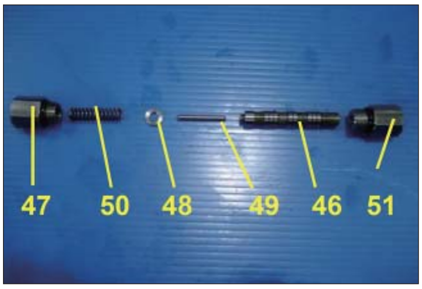


480L2TM38

(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.

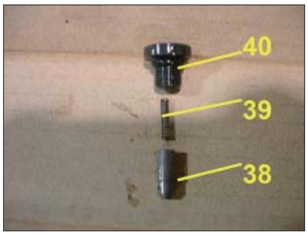


480L2TM40

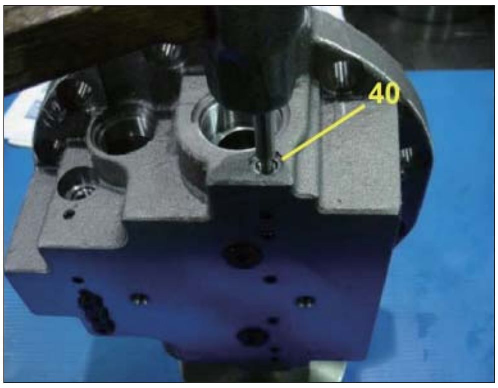

480L2TM41


480L2TM42

(16) Disassemble plug (40) from rear cover (32) and then disassemble spring (39), restictor (38) from rear cover (34) in regular sequence.

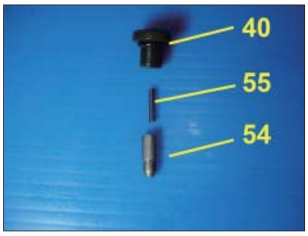


480L2TM43

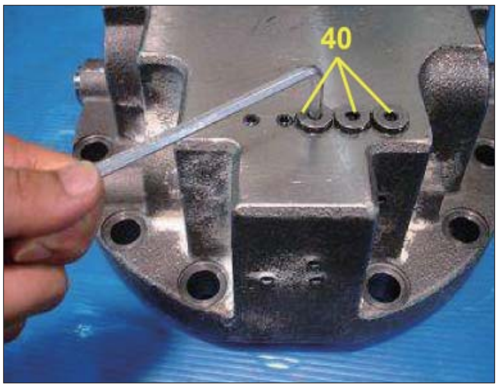


480L2TM44

(17) Disassemble plug (40) from rear cover (32) and then disassemble spring (55), check valve (54) from rear cover (32) in regular sequence.

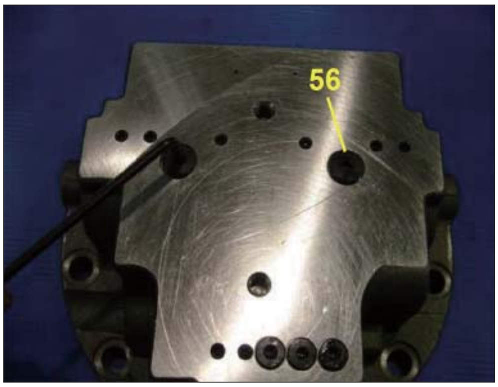


480L2TM45



480L2TM46

(18) Disassemble plug (56) from rear cover (32).

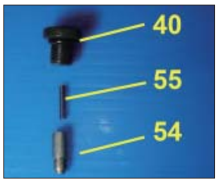


480L2TM47

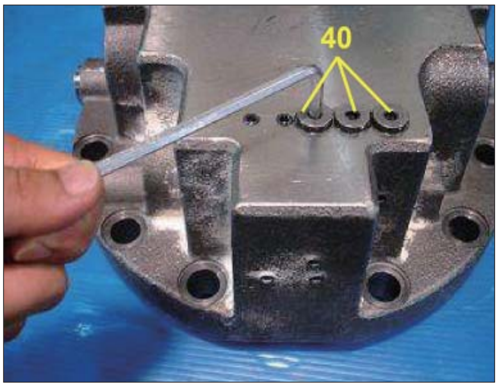
2) ASSEMBLY OF MOTOR

(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)



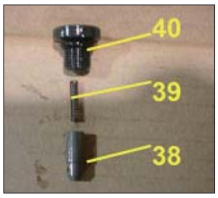
480L2TM48



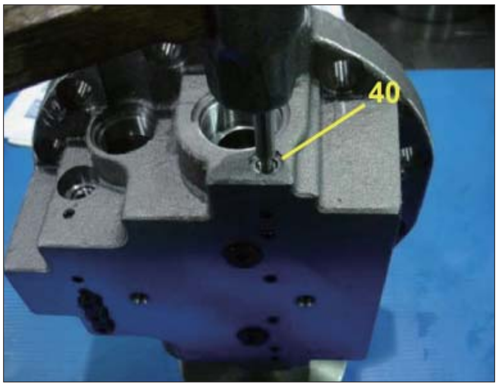
480L2TM49

(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)



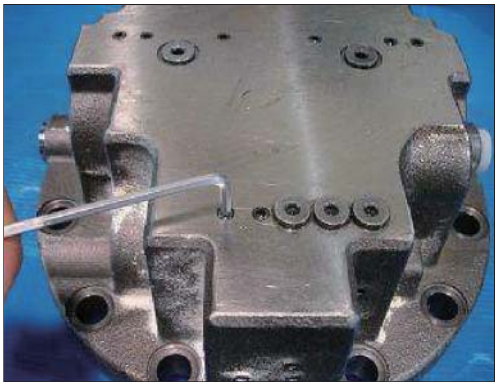
480L2TM50



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

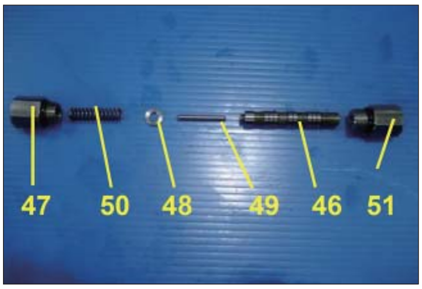
(4) Assemble 2-PF1/4 plug (56, 61) using torque-wrench.

· 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

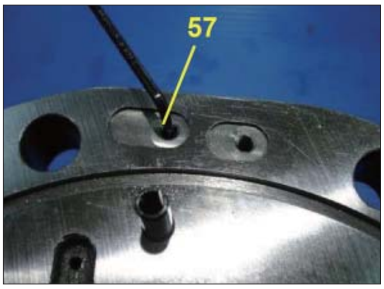
(6) Press needle bearing (10) into rear cover (32) using jig.

480L2TM58

(7) Assemble spring pin (30), parallel pin (27) using small hammer.

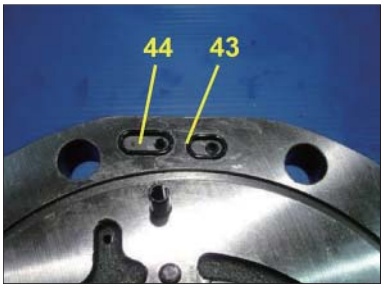
480L2TM59

(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

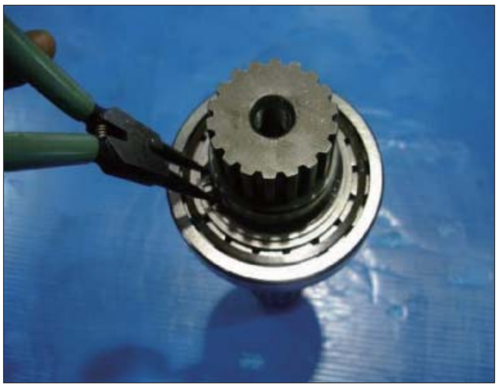
(9) Assemble valve plate (26) into rear cover (32).
Apply grease to the valve plate contact and then assemble valve plate into rear cover (32).

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.



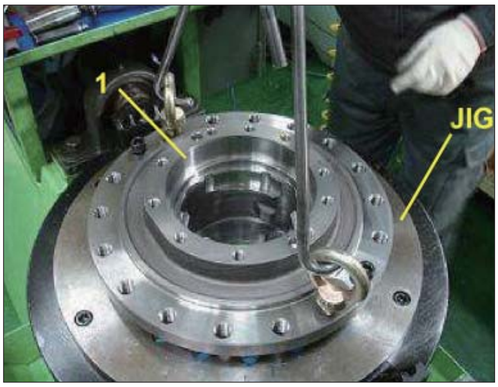
480L2TM65

480L2TM66

480L2TM67

480L2TM68

(12) Install casing (1) into assembling jig.



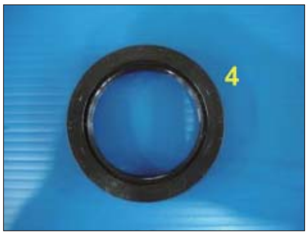
480L2TM69

(13) Assemble plug (2), (3) into casing (1).

480L2TM70

480L2TM71

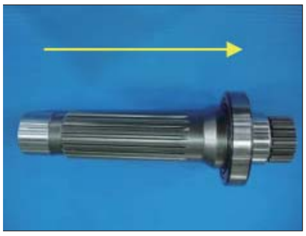
(14) Assemble oil seal (4) into casing (1) with assembling jig.



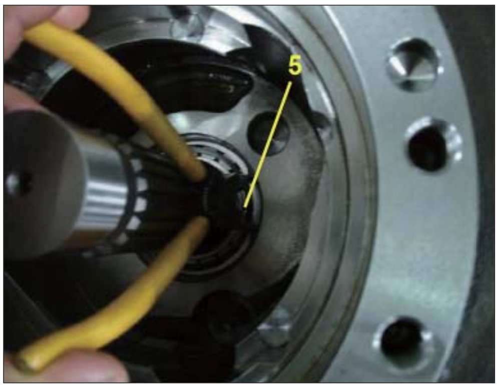
480L2TM72

480L2TM73

(15) Insert assembled shaft assy in the direction of the arrow into casing (1) using a rubber mallet.

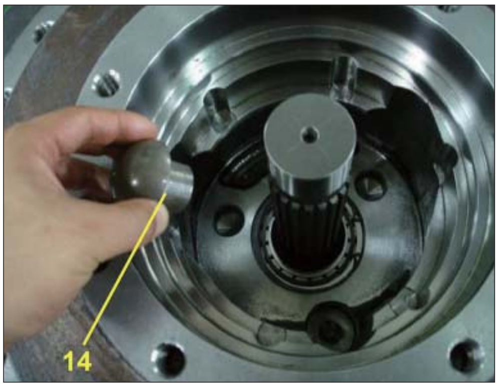

480L2TM74


480L2TM75



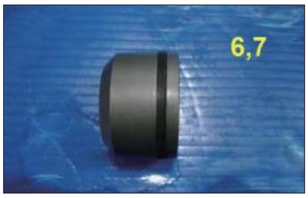
480L2TM76

(16) Apply the grease to pivot (14)-2EA and then assemble pivot (14) into casing (1).

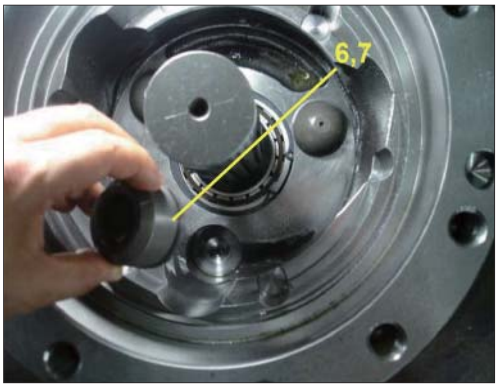


480L2TM77

(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).



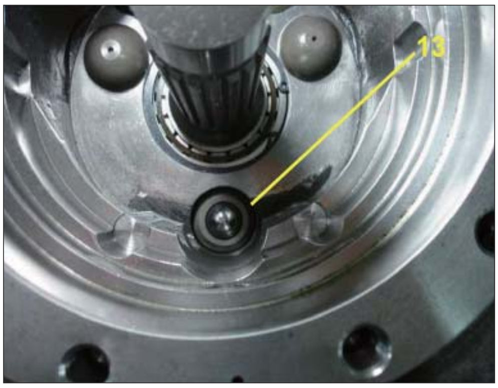
480L2TM78



480L2TM79

(18) Apply the grease to steel ball (13) and then assemble steel ball (13) into casing (1).

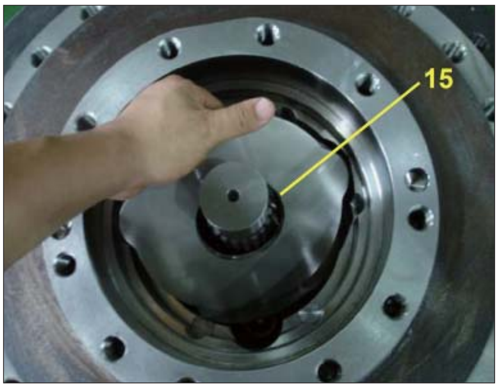
480L2TM80



480L2TM81

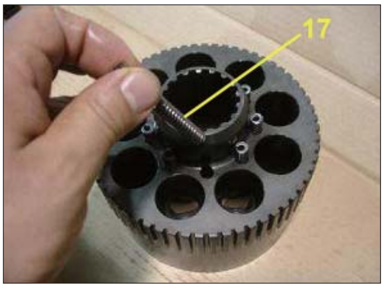
(19) Apply the grease to swash plate (15) and then assemble swash plate (15) into casing (1).

480L2TM82



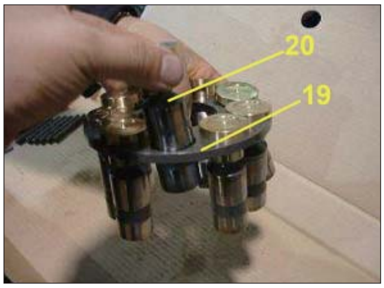
480L2TM83

(20) Assemble spring (17), ball guide (18), retainer plate (19), piston and shoe (20) into rotary block (16) in regular sequence.



480L2TM84

480L2TM85

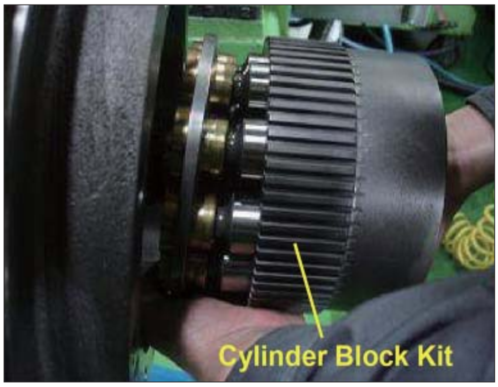


480L2TM86

480L2TM87

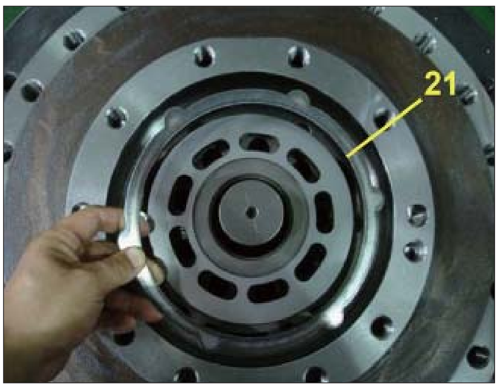
480L2TM88

(21) Assemble rotary block kit into casing (1).

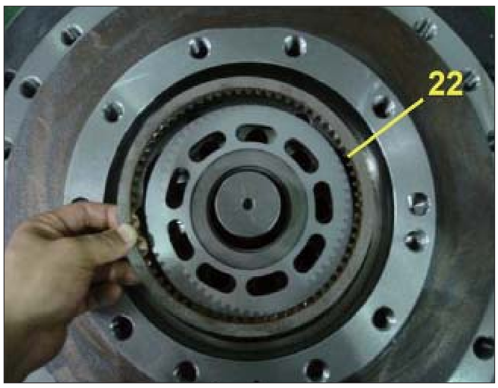


480L2TM89

(22) Assemble separate plate (22), friction plate (21) into rotary block in regular sequence.
Friction plate : 6 EA
Separate plate : 7 EA



480L2TM90

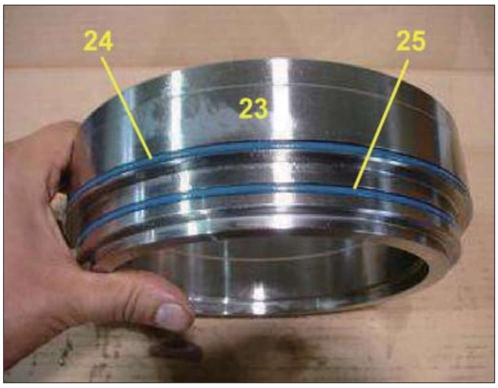


480L2TM91

(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)

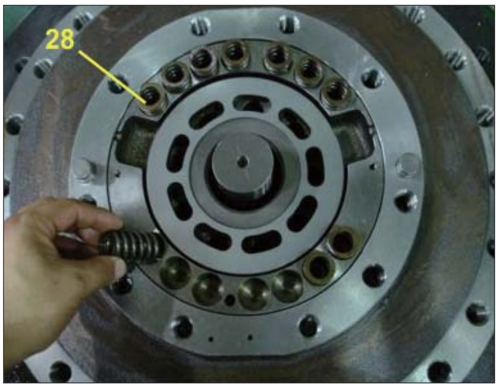


480L2TM93

(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

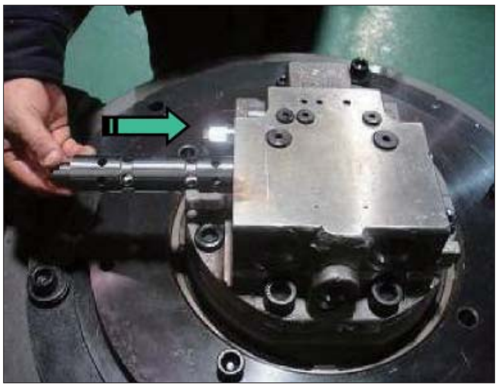

480L2TM97

(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.

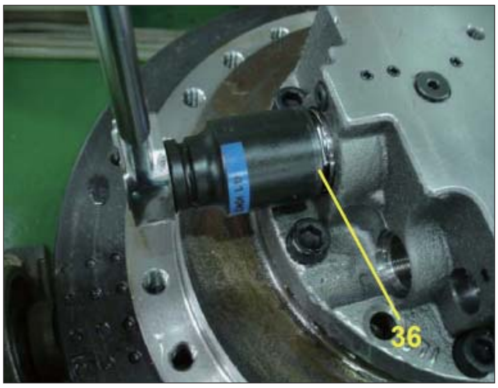

480L2TM99


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

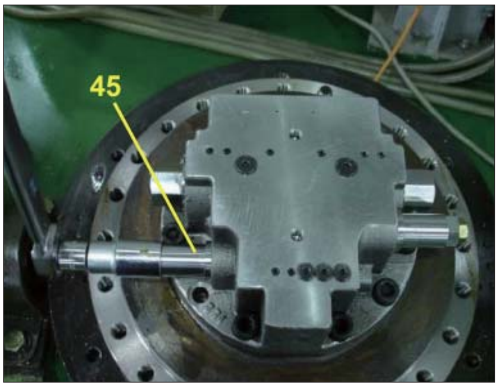

480L2TM102



480L2TM103

(31) Assemble relief valve assy (45) using torque wrench.

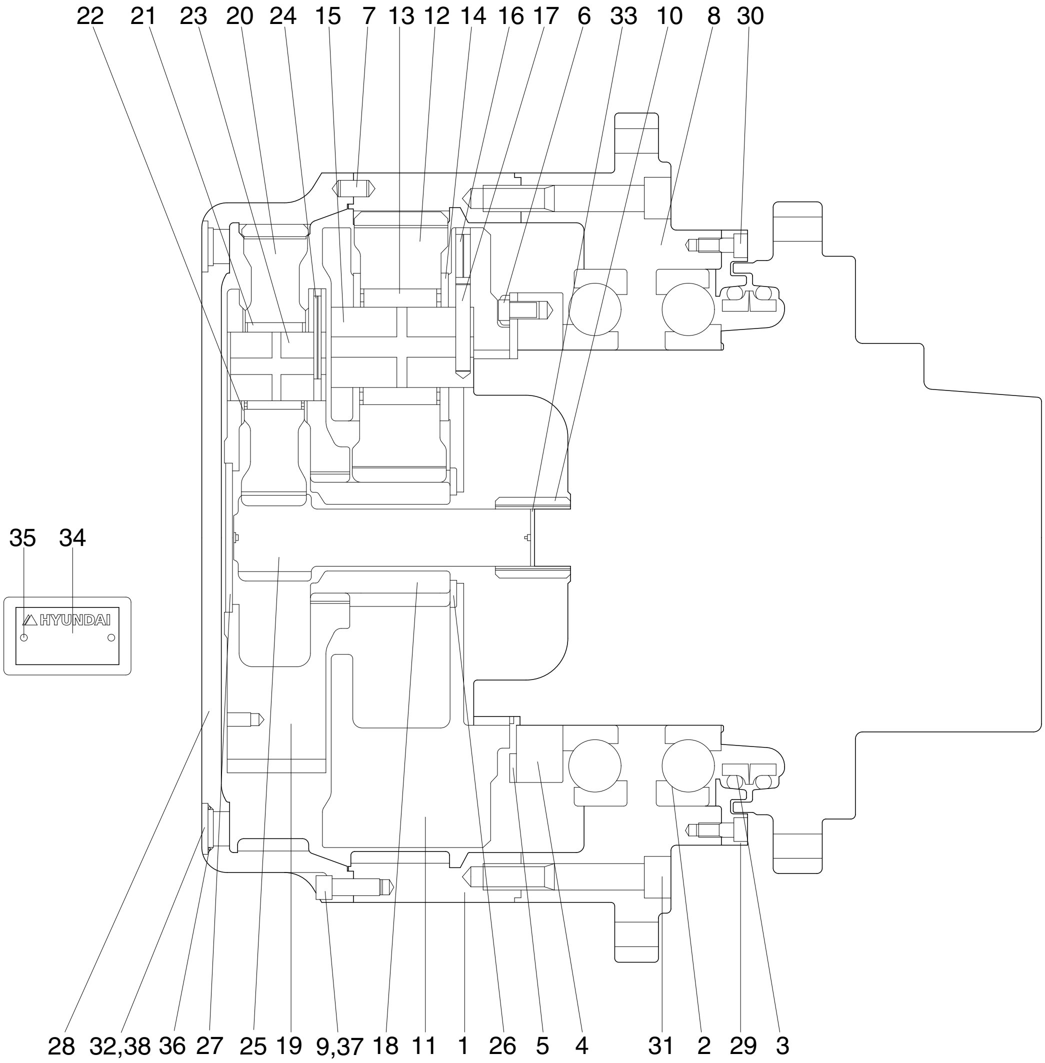
· Tightening torque : 26±2.6 kgf·m
(188±18.8 lbf·ft)



480L2TM104

4. TRAVEL REDUCTION GEAR

1) STRUCTURE

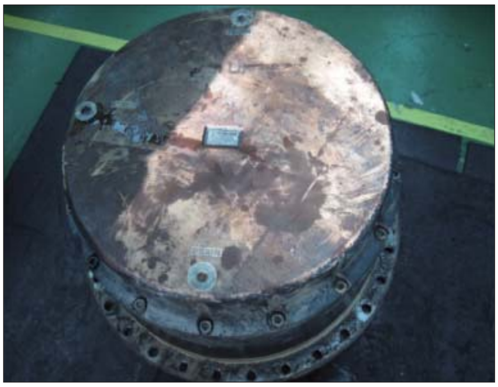


480A2TM03

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



480L2TM201

(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.

2) PUT REDUCTION GEAR ON WORK TABLE TO DISASSEMBLE

480L2TM202

(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.

3) COVER REMOVE

480L2TM203

(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.

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.

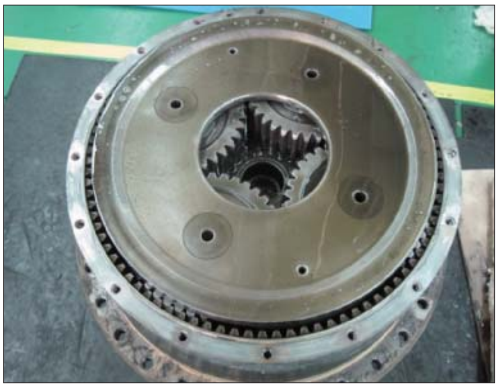
※ When disassemble No.1 sun gear, be sure to keep vertical against ground with No.1 sun gear.

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.



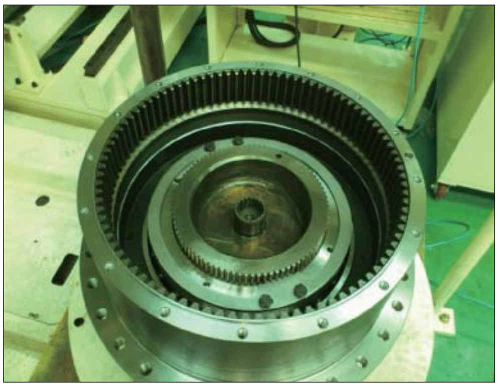
480L2TM206

(2) Set eye bolt (M10) in No.2 carrier assy, pull-up slowly.

480L2TM207

6) REMOVE COUPLING

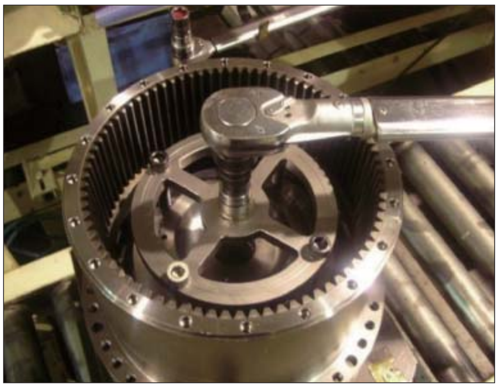
(1) Remove coupling on motor spline.



480L2TM208

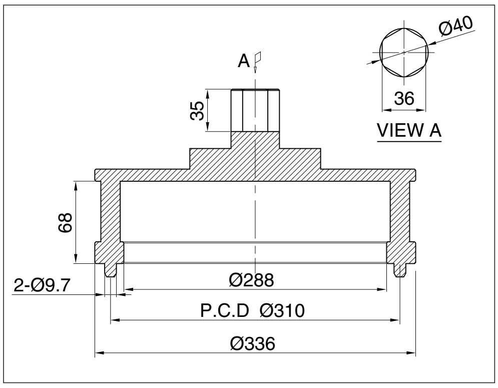
7) REMOVE RING NUT AND LOCK PLATE

(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

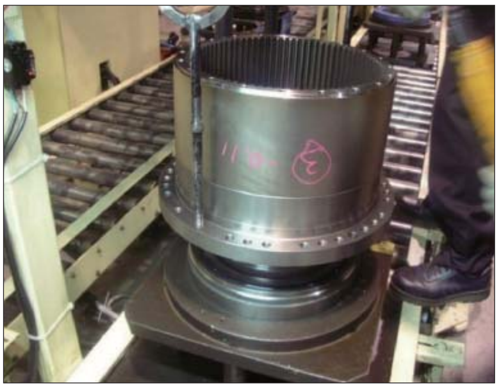
(3) Remove ring nut using designed tools.



480L8TM03

8) DISASSEMBLE RING GEAR AND HOUSING

(1) Set eye bolt (M20) in flange of housing, pulling ring gear and housing from motor.



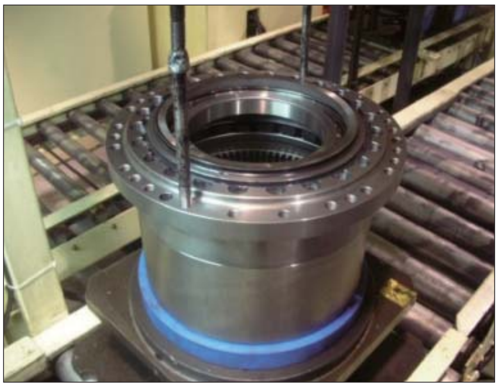
480L2TM210

(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.

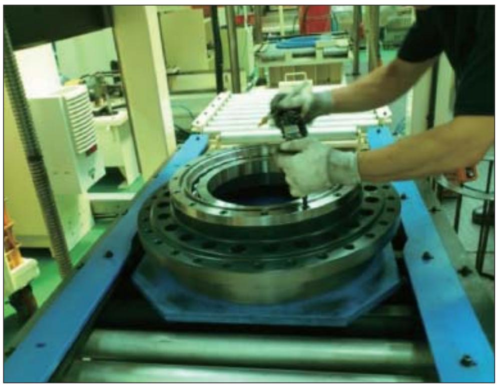
(4) Put sharp tool into gap between ring gear and housing and tap it tenderly to separate gear and housing.



480L2TM212

9) DISASSEMBLE HOUSING COMPONENTS

Hex socket head bolt (M10×25L) connecting housing and seal cover using torque wrench, and remove seal cover.

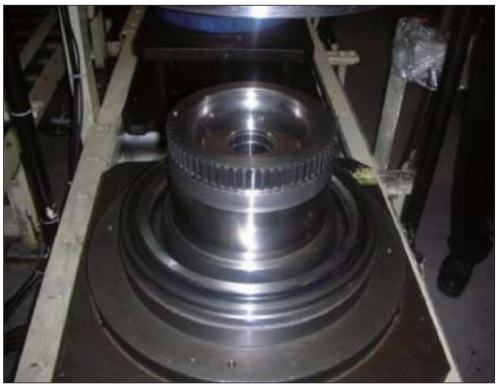


480L2TM213

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

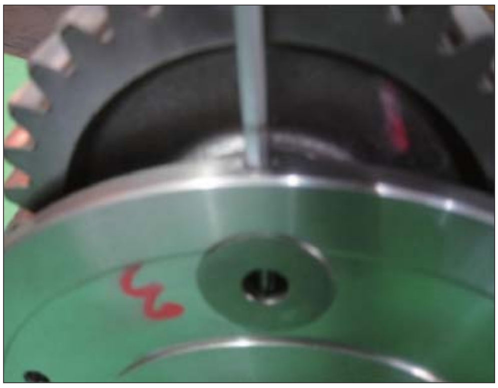
(1) Set No.1 carrier on stable and even place.
(2) Put needle bearing in No.1 planetary gear and place thrust washer 2 pcs on both side of gear. Assemble gear in carrier.

480L2TM217

(3) Align spring pin with No.1 carrier spring pin hole and assemble spring pin accordingly.

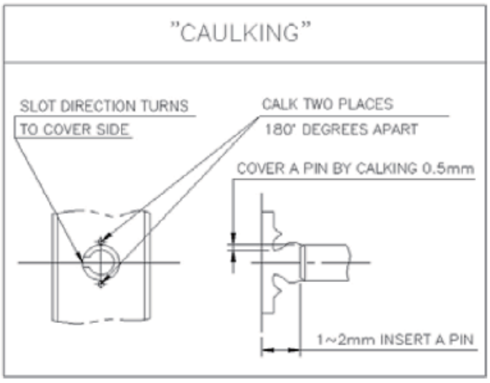
480L2TM218

(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

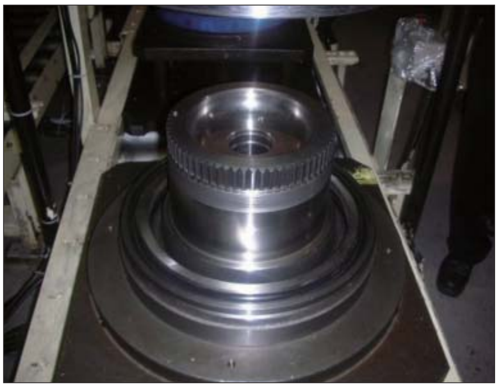
(1) Set No.2 carrier on stable and even place.
(2) Put needle bearing in No.2 planetary gear and place thrust washer 2 pcs on both side of gear. Assemble gear in carrier.
(3) Align solid pin hole of spring pin and No.2 carrier spring pin hole. and assemble spring pin accordingly.
(4) After assembly solid 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.

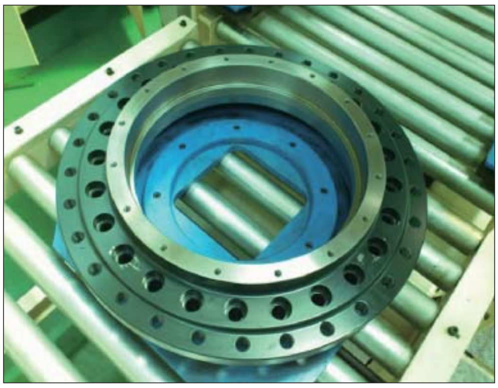
※ Keep the floating seal vertical against ground.



480L2TM222

5) HOUSING & MAIN BEARING ASSEMBLY

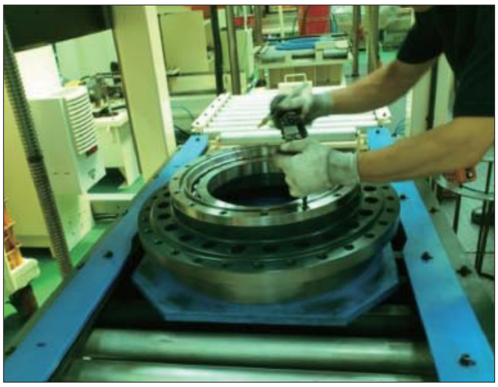
(1) Heating and cleaning housing with 60~70˚C temperature.
(2) Set the housing on working table safely, press fitting main bearing into both side of housing.



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.

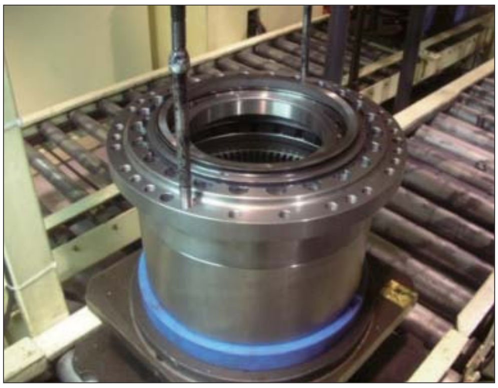


480L2TM225

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.



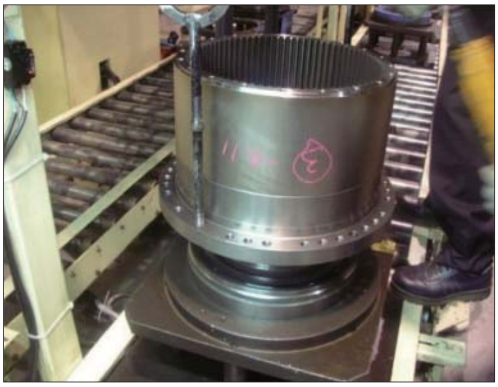
480L2TM223

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.



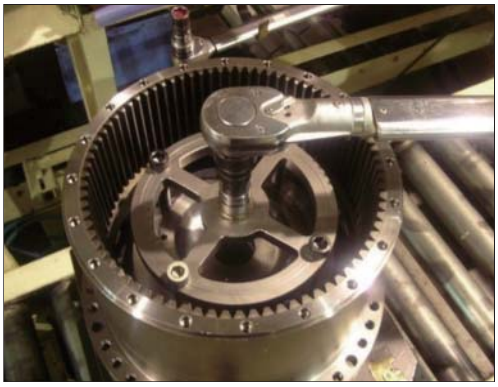
480L2TM226

9) NUT RING AND LOCK PLATE ASSEMBLY

(1) Tighten nut ring with designed torque using torque wrench.

(2) Set lock plate along with bolt hole of nut ring and assemble them.

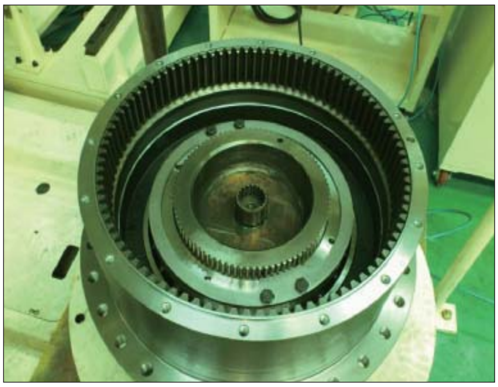
(3) Tighten hex head bolt (M12×20L) with designed torque 8.8±0.9 kgf·m (63.6±6.5 lbf·ft).



480L2TM228

10) COUPLING ASSEMBLY

Assemble coupling with motor's spline.



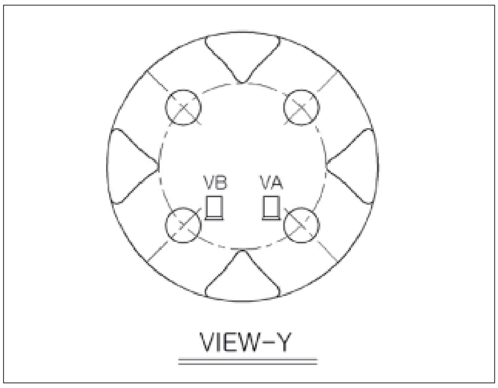
480L2TM230

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.

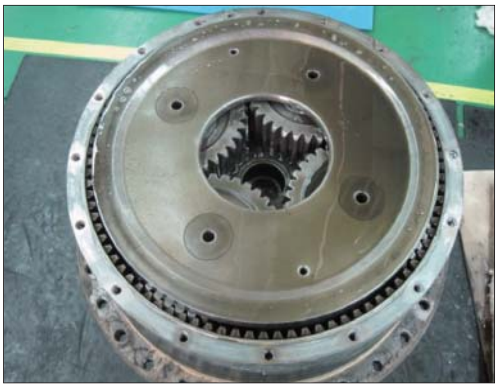
480L2TM229

※ 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.

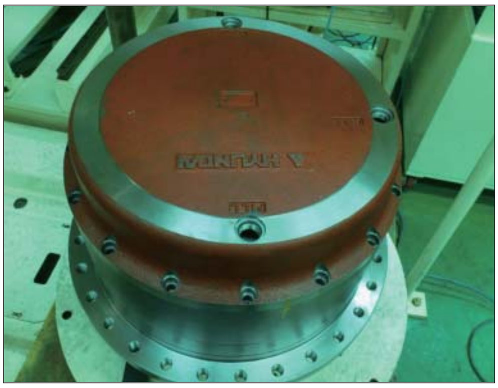
480L2TM232

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.


13031GE18

(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.

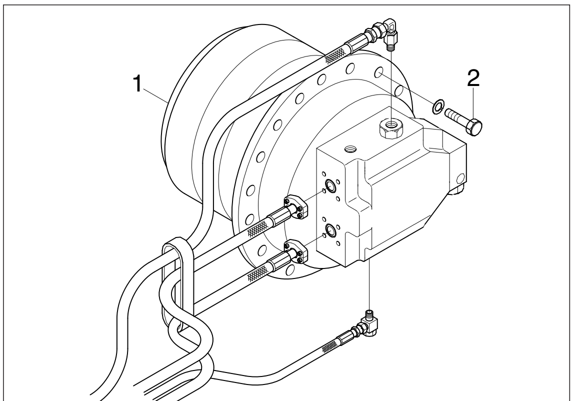
(7) Remove the bolts and the sprocket.

(8) Sling travel device assembly (1).

(9) Remove the mounting bolts (2), then remove the travel device assembly.

· Weight : 360 ㎏ (790 ㏐)

· Tightening torque : 57.9±8.7 kgf · m
(419±62.9 lbf · ft)



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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.

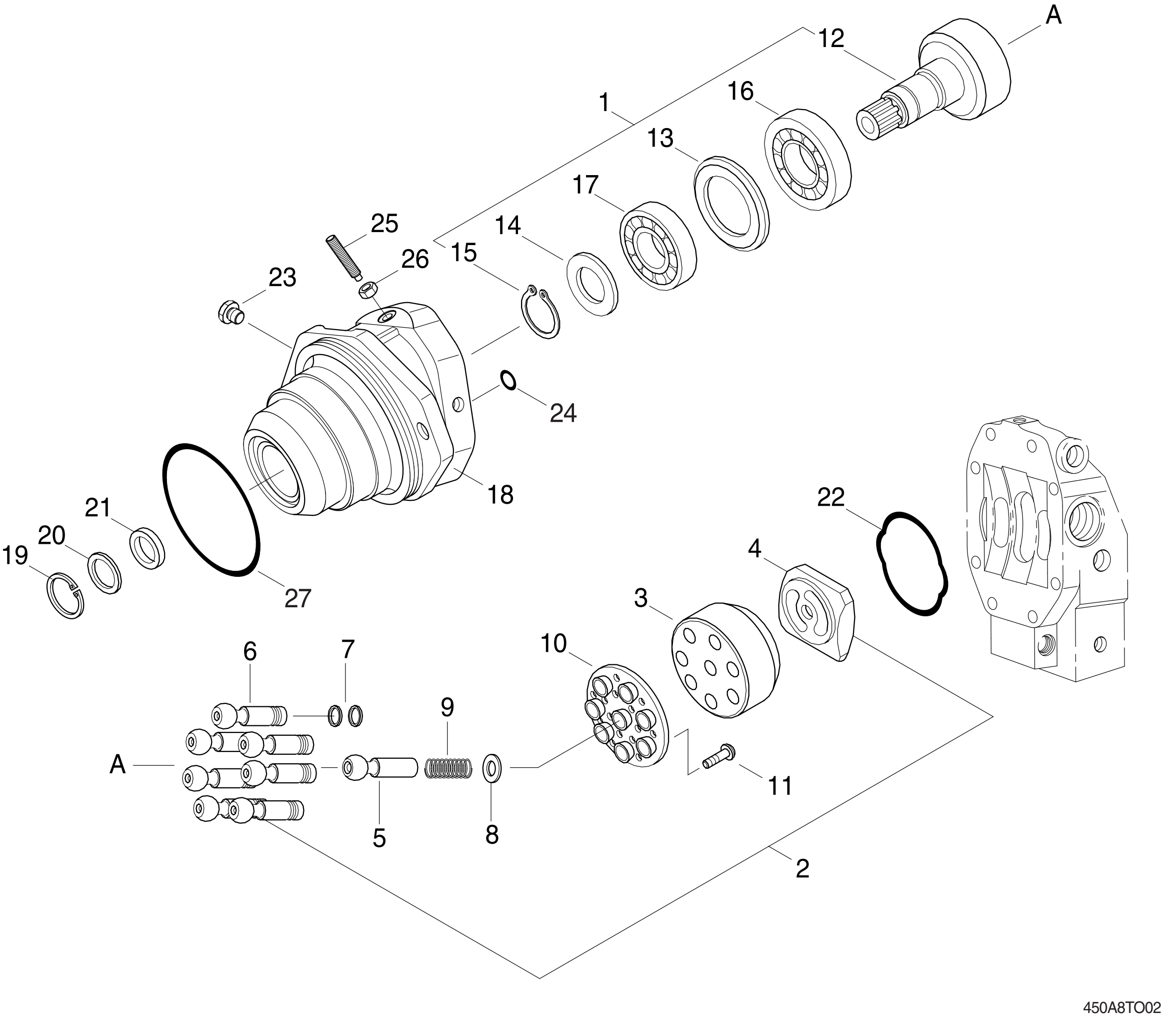
④ Start the engine, run at low idling, and check oil come out from plug.

⑤ Tighten plug fully.

(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. TRAVEL MOTOR (1/2)

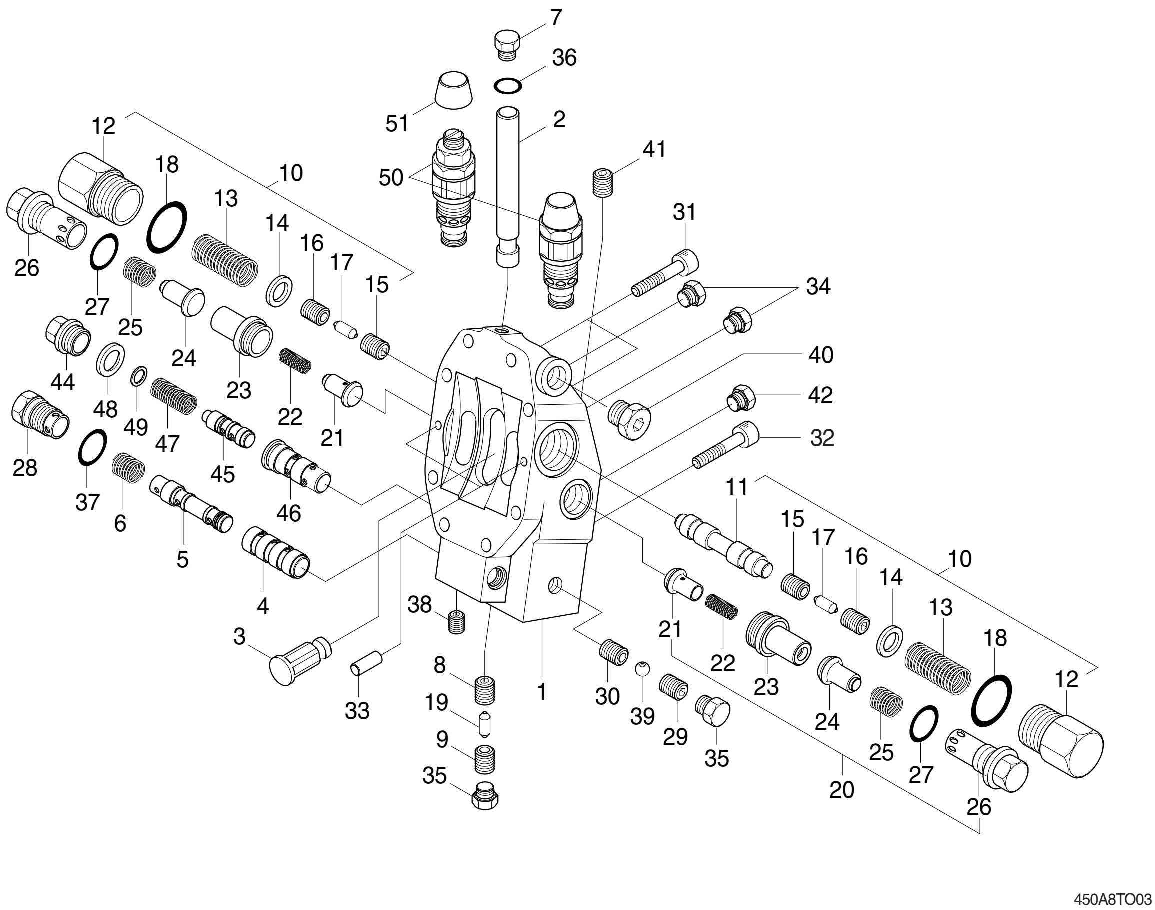
1) STRUCTURE



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)

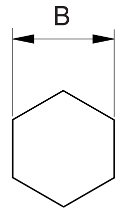
· Control part



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.

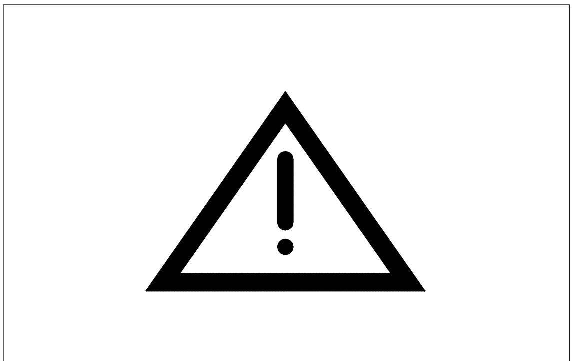
④ During disassembly, give a match mark to the mating surfaces of each part.

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.

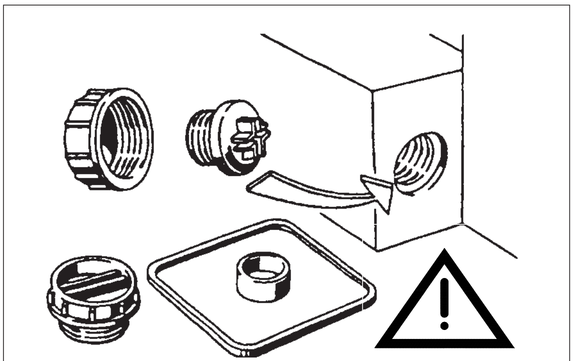
(2) Seal kit and component groups

① Attention
Observe the following notices when carrying out repair work at hydraulic aggregates!



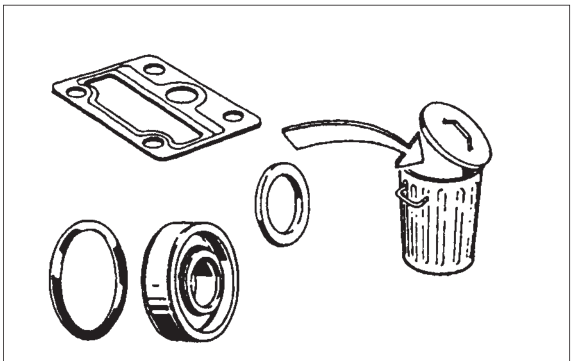
8-81(1) 450-3

② Close all ports of the hydraulic aggregates.



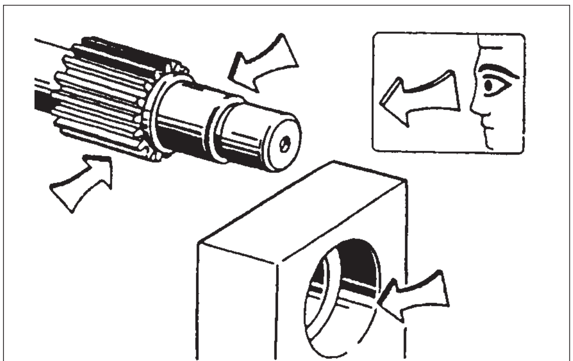
2.TIF (450-3)

③ Replace all seals.
Use only original spare parts.



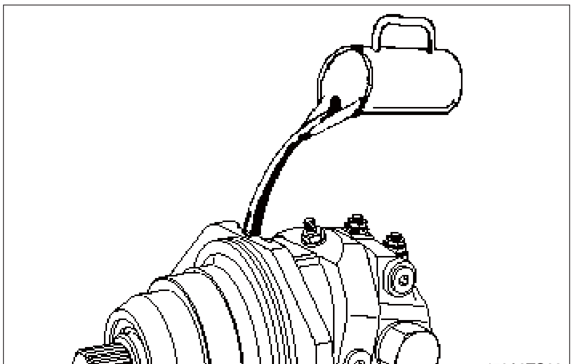
3.TIF (450-3)

④ Check all seal and sliding surfaces for wear.
Rework of sealing area for example with abrasive paper can damage surface.

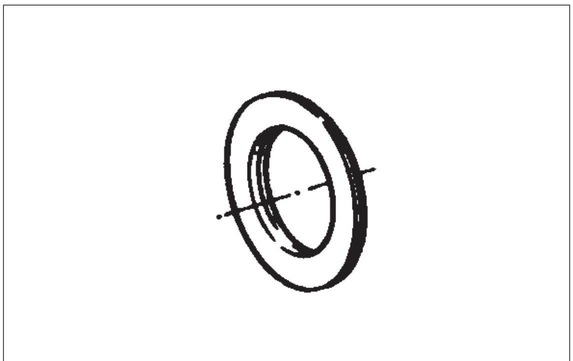


4.TIF (450-3)

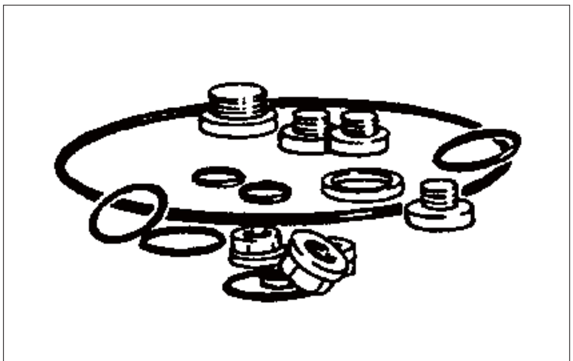
⑤ Fill up hydraulic aggregates with hydraulic oil before start-up.


450A8TO08

⑥ Seal kit for drive shaft.


6.TIF (450-3)

⑦ External seal kit.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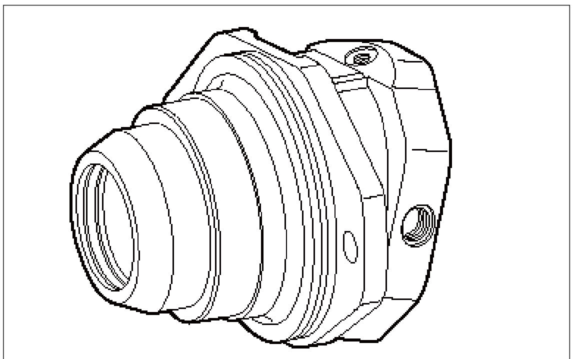
⑧ Housing.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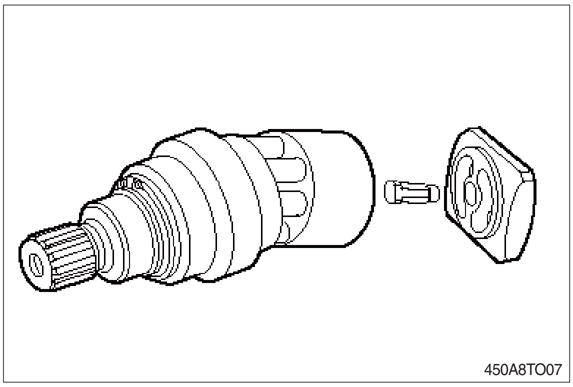
⑨ Complete rotary group.



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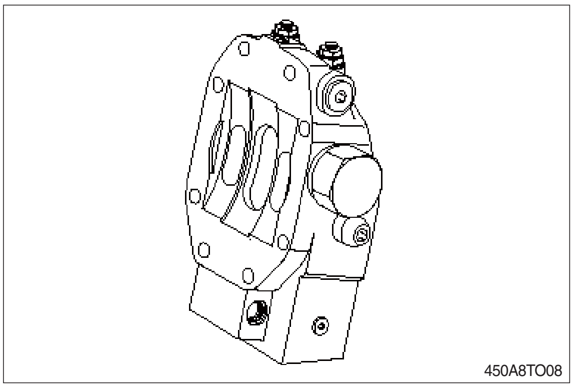
⑩ Port plate with control piston and counter-balance valve.



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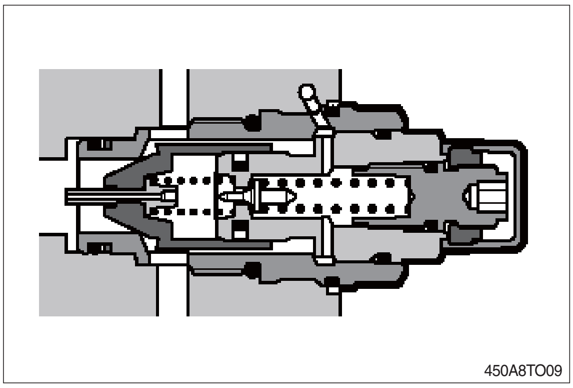
⑪ Relief valve/Make up check valve



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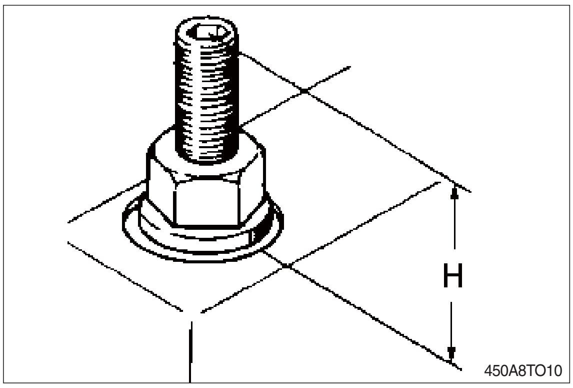
⑫ Replace seal nut.
First measure and record setting height.



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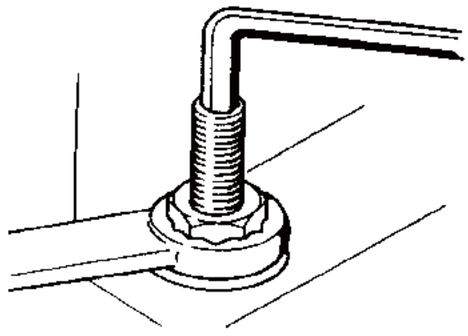
⑬ When tightening, counterhold setting screw, then check setting height.



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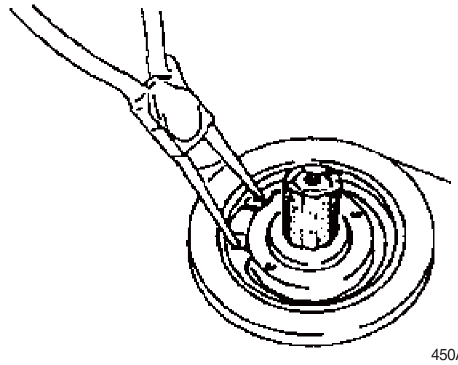
(3) Sealing the drive shaft

① Protecting the drive shaft.
Remove retaining ring and shim.



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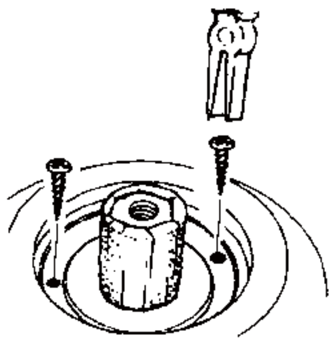
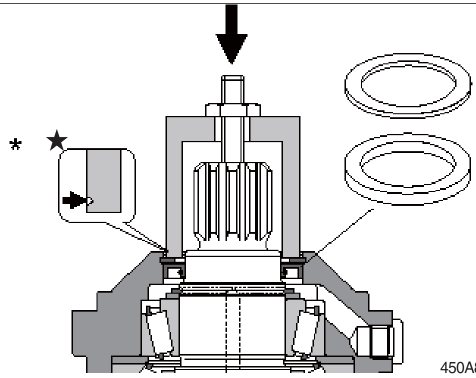
② Screw in sheet metal screw into the holes fitted with rubber.
Pull out seal with pliers.



450A8TO13

③ Press in shaft seal and shim with bush to stop.

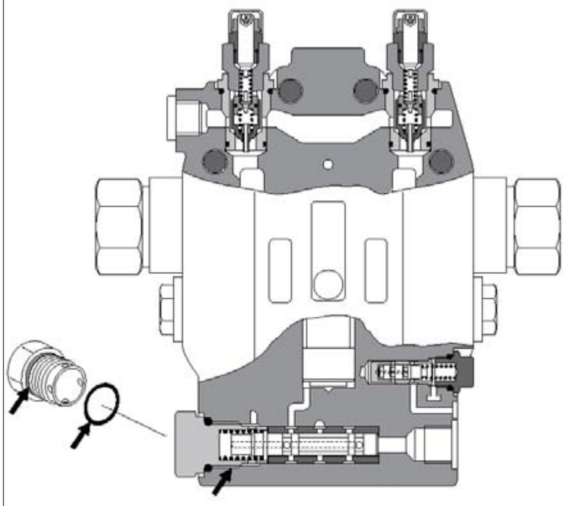
※ Pay attention to pressing depth!
★Mark for pressing depth.
Assemble retaining ring.



450A8TO14

(4) Sealing of the control parts

① HZ-Controller
※ O-ring, O-ring groove, housing.



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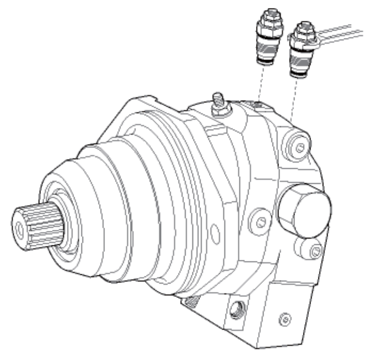
(5) Sealing of the relief valve

① Remove relief valve.



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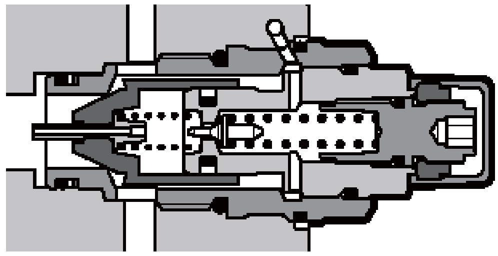
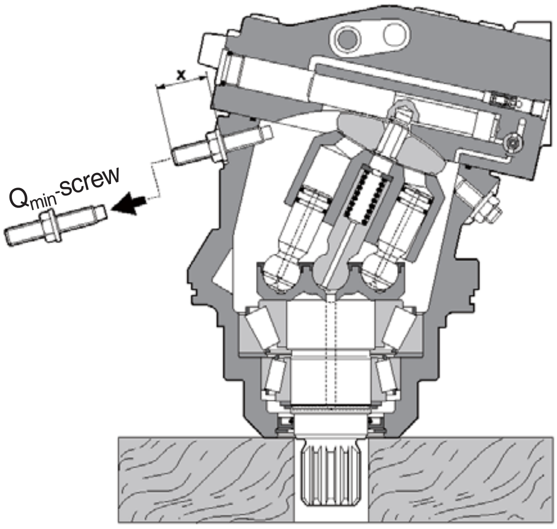
② Inspect
O-ring.



450A8TO17

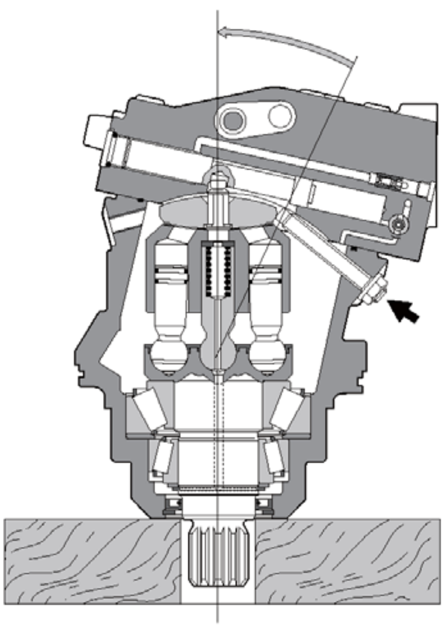
(6) Disassembly of the port plate

① Note dimension x.
Remove Q_{min}-screw.



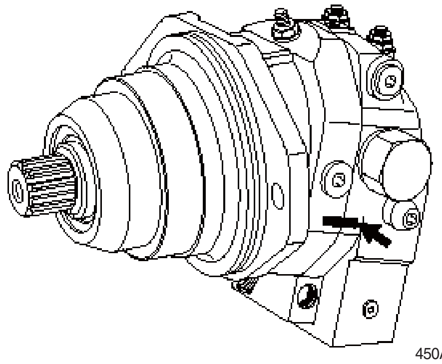
450A8TO18

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}.



450A8TO19

③ Port plate
Mark position. Loosen screws.
Removal.



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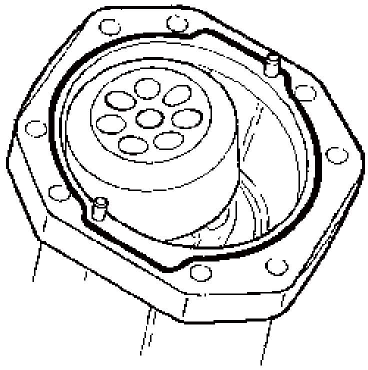
④ Check O-ring.
※ Stick new O-ring with some grease. Do not swivel rotary group. Piston rings to hang out from the cylinder boring.



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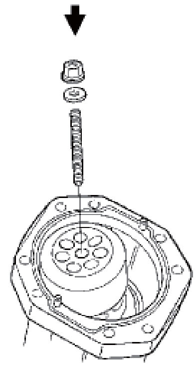
(7) Remove rotary group

① Screw in threaded pin into center pin.
Fix the cylinder with disc and lock nut.
Size : M8×105 ㎜



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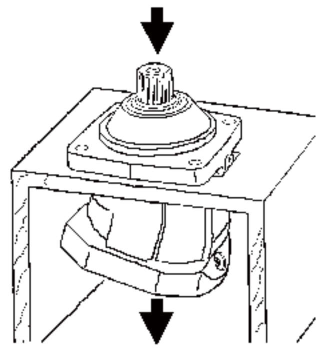
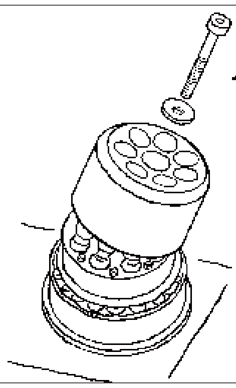
② Press out rotary group!
※ If the bearings are used again do not hit on the drive shaft.



450A8TO23

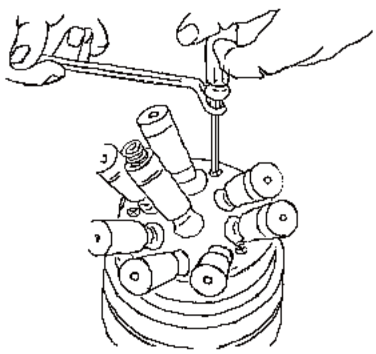
(8) Exchanging of the rotary group

① Remove fixing screw (cylinder).
Remove cylinder.



450A8TO24

② Disassemble retaining plate.
※ Screws are glued. Use Torx-tools.



450A8TO25

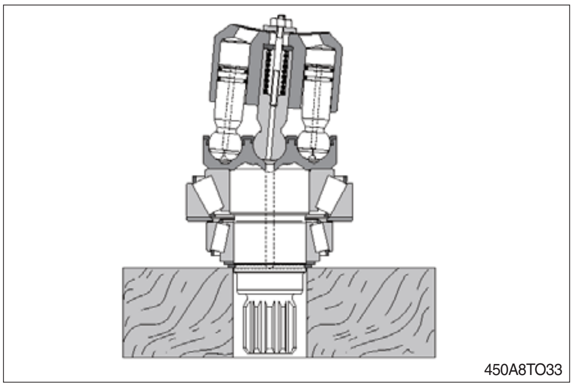
4) ASSEMBLY

(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.

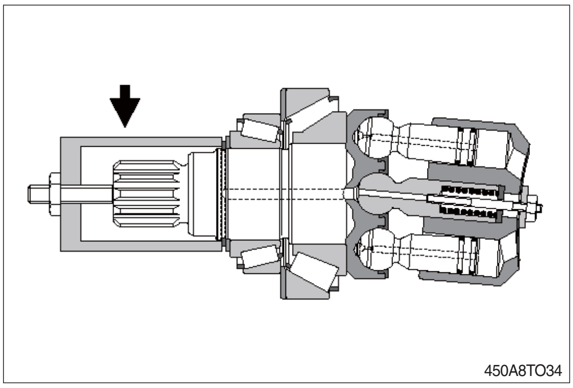
(2) Rotary group assembly

① Rotary group completely assembled ready for assembly.



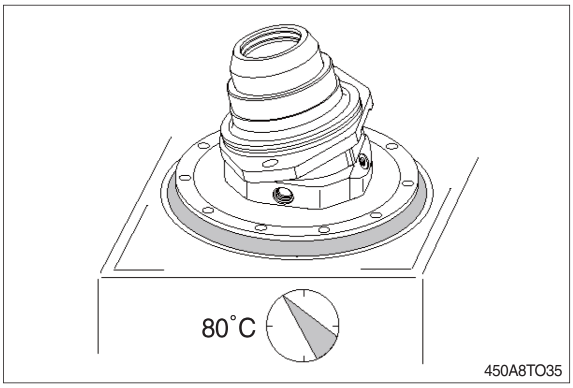
450A8TO33

② Place assembly sleeve.



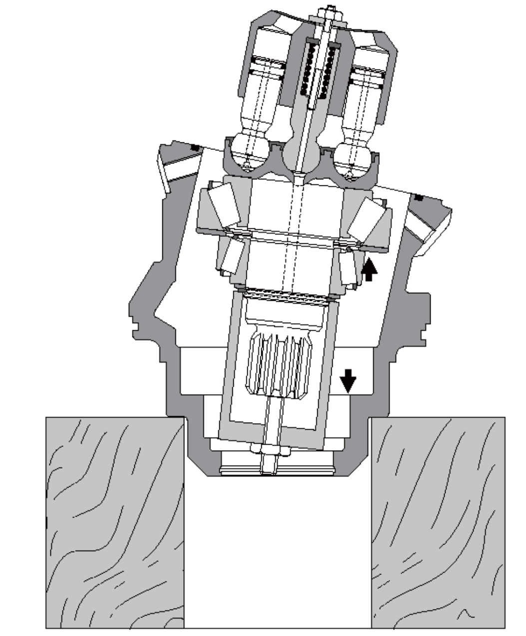
450A8TO34

③ Warm up housing to 80˚C.



450A8TO35

④ Insert rotary group into housing to seat position.

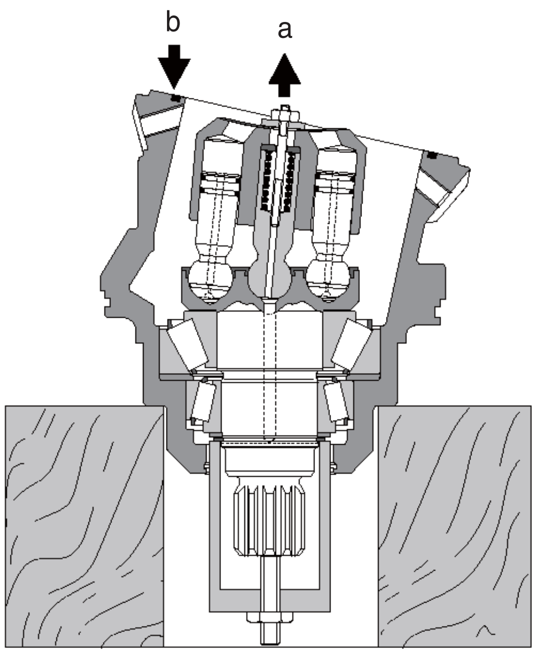


450A8TO36

⑤ Fix zero position of cylinder with Q_{max}-screw.

a. Disassemble cylinder fixing screw.

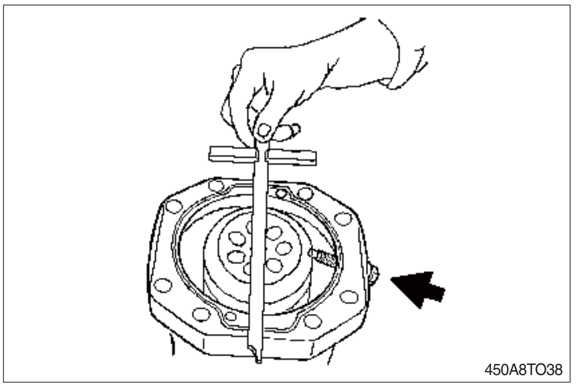
b. Insert O-ring.



450A8TO37

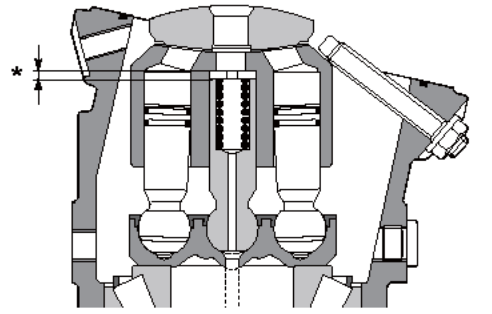
(3) Rotary group adjustment

① Determine cylinder swivel range to max angle with screw.



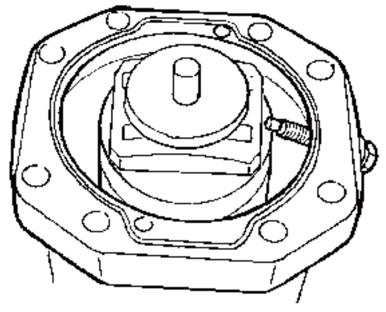
450A8TO38

② *Disc



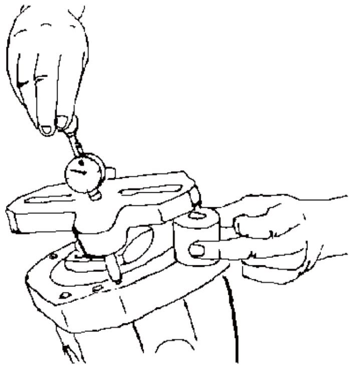
450A8TO39

③ Place centering disc.



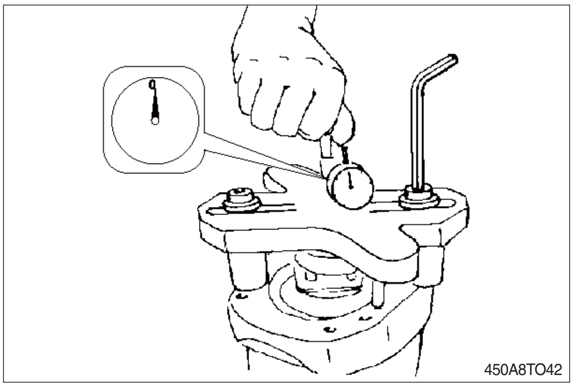
450A8TO40

④ Mount measuring device.



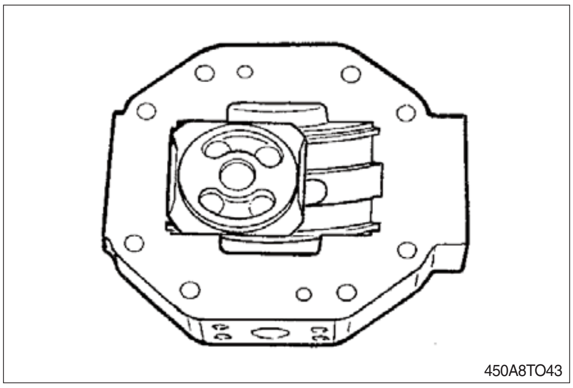
450A8TO41

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.



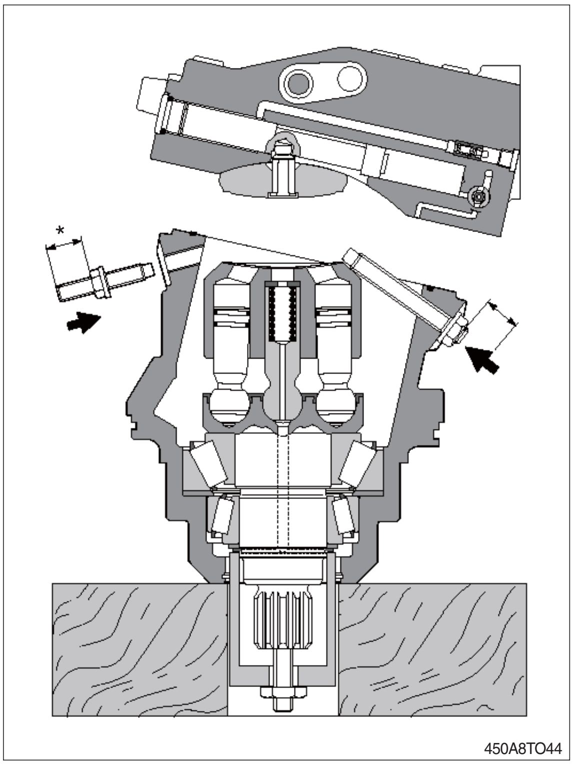
① Assembly port plate.

※ Take care of assembly design! Tighten fixing screws with torque.

a. Set Q_{min}-screw to dimension*.

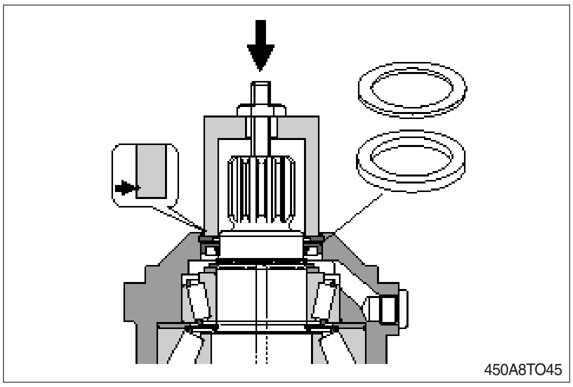
b. Assemble plug.

c. Remove assembly sleeve.



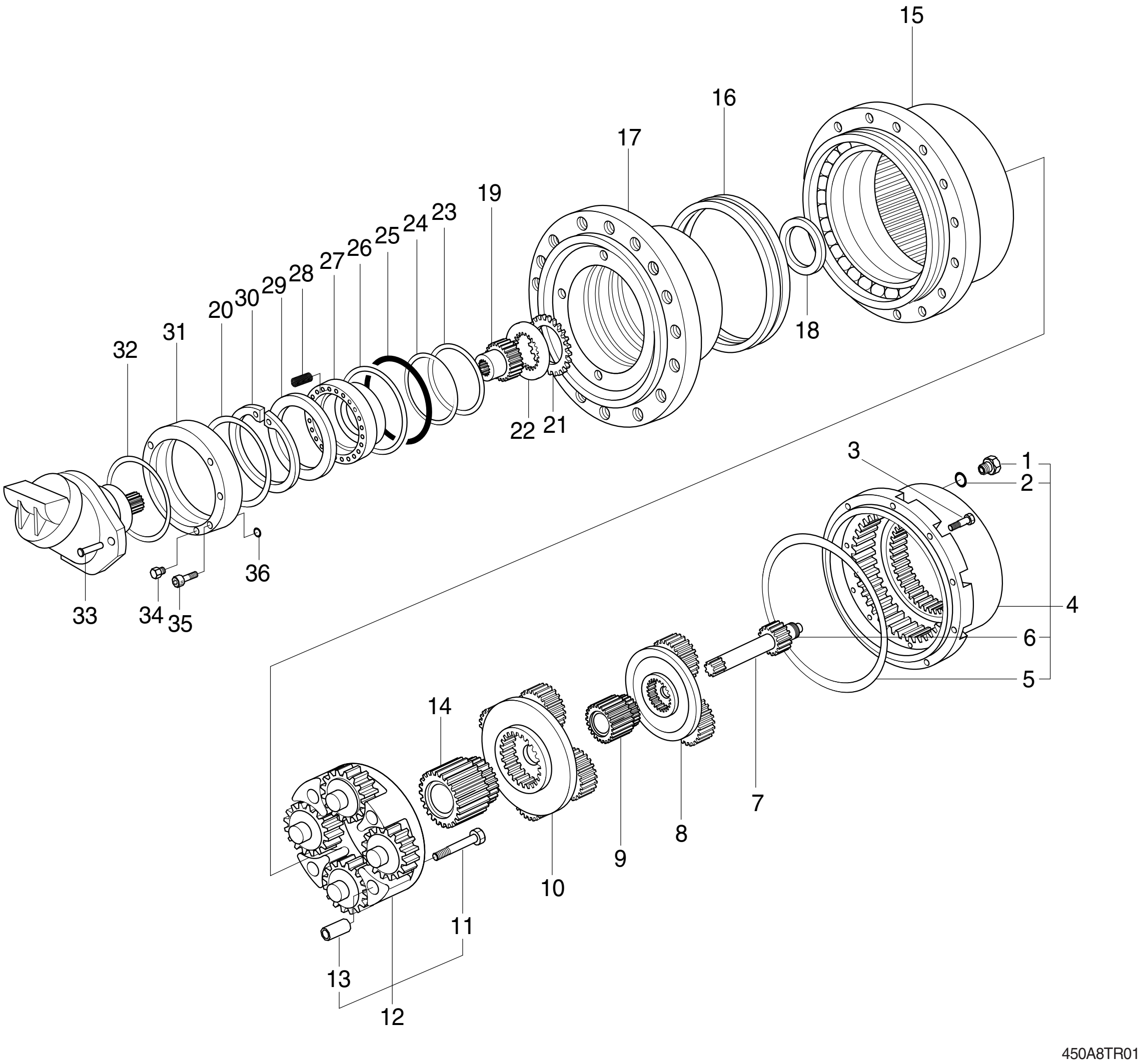
② Assemble shaft seal, disc and safety ring. Press-in with assembly sleeve.

※ Take care of press-in depth.



3. REDUCTION GEAR

1) STRUCTURE



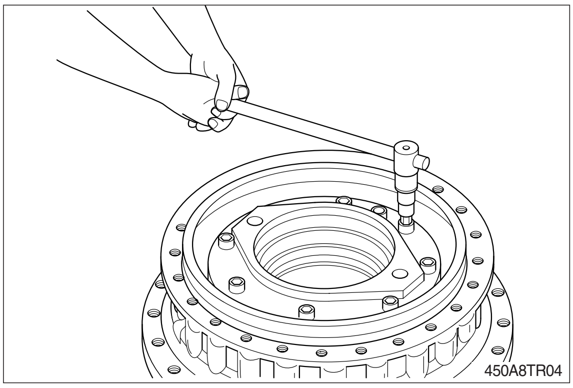
1	Washer	13	Bushing	25	O-ring
2	Breather plug	14	Sun gear	26	Spiral ring
3	Screw	15	Housing	27	Piston
4	Cover set	16	Lifetime seal	28	Spring
5	O-ring	17	Hub	29	Spacer
6	Pad	18	Spacer	30	Circlip
7	Sun gear	19	Brake shaft	31	Flange
8	Reduction assy (1st)	20	O-ring	32	O-ring
9	Sun gear	21	Brake disc	33	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.

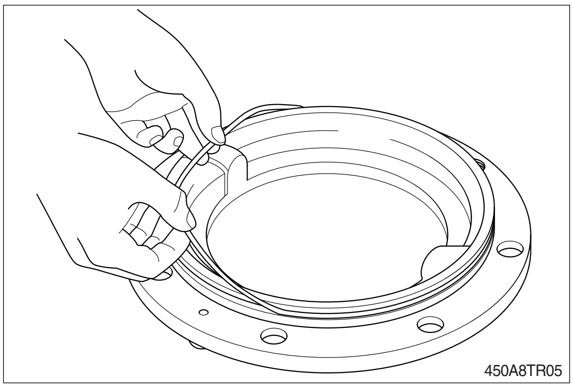
Prior to disassembling make sure that the oil is discharged, unscrew and remove the 2 screws (33), and remove the travel motor and the O-ring (32).

(1) Unscrew the 8 socket head screws (3) and remove the motor flange from the flanged hub (17).



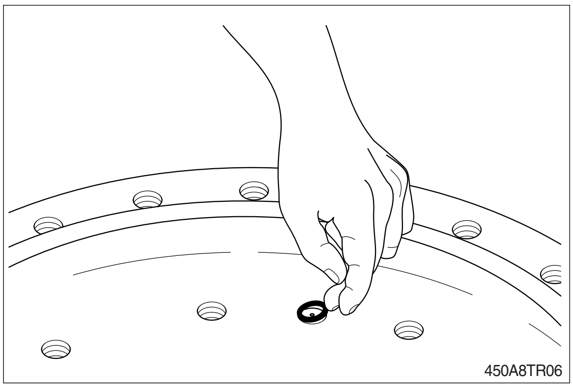
450A8TR04

(2) Remove the O-ring (20) from its grove in the motor flange (31).



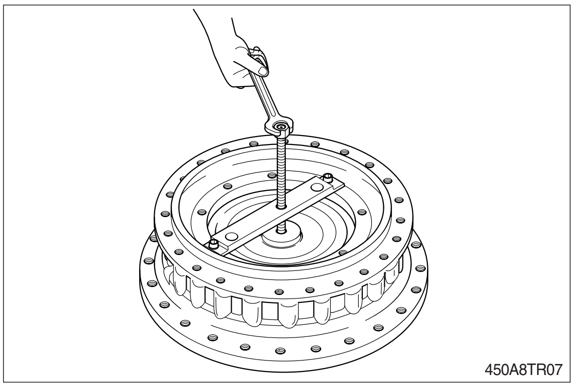
450A8TR05

(3) Remove the O-ring (36) from its grove in the flanged hub (17).

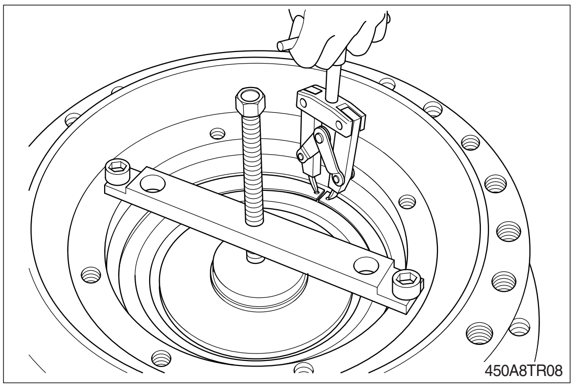


450A8TR06

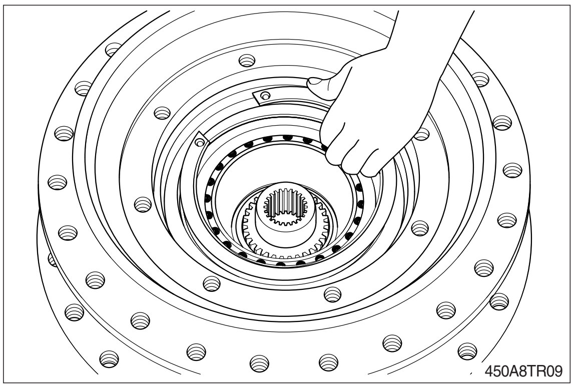
(4) After having places the disc on the spring retainer (29), fix the pusher on the flanged hub (17) as shown in the scheme by screwing the threaded bar, push the disc on the retainer, thus removing the force of the springs (28) on the circlip (30) and allowing its disassembling.


450A8TR07

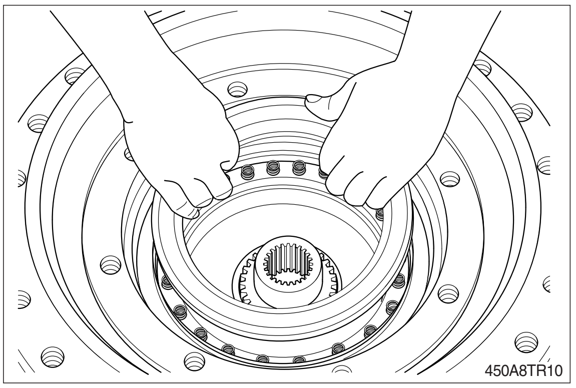
(5) Using pliers remove the circlip (30) from its grove in the flanged hub (17).


450A8TR08

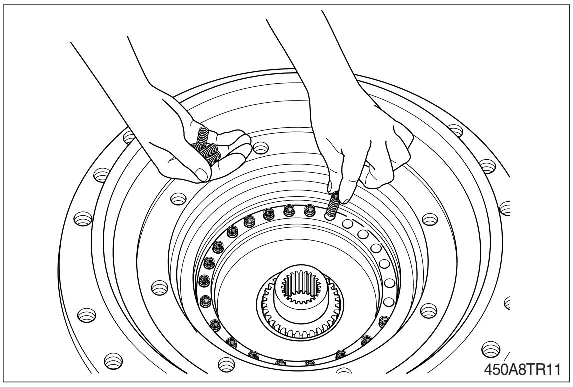
(6) Disassemble the equipment from the flanged hub (17) and remove the circlip (30).


450A8TR09

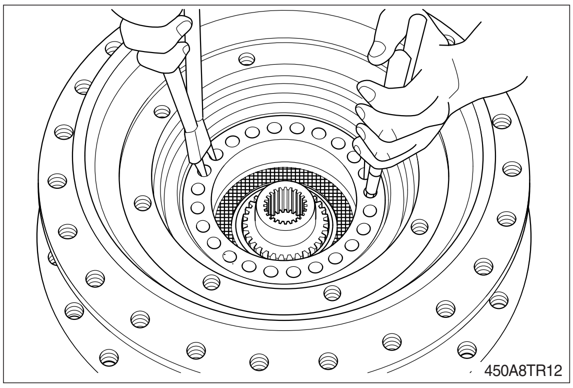
(7) Remove the springs retainer (29).


450A8TR10

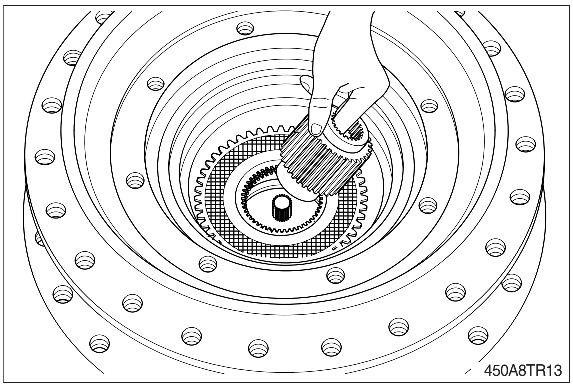
(8) Remove the springs (28) from their groves.



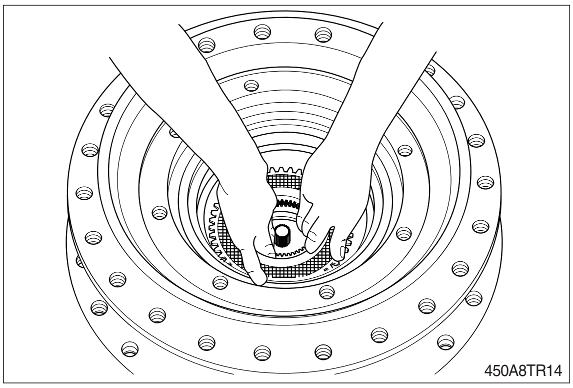
(9) Using pliers remove the brake piston (27).
※ To get it easier, pumping compressed air into the brake port hole.



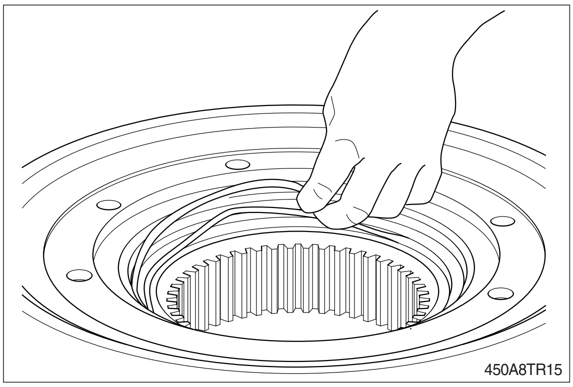
(10) Remove the brake shaft (19).



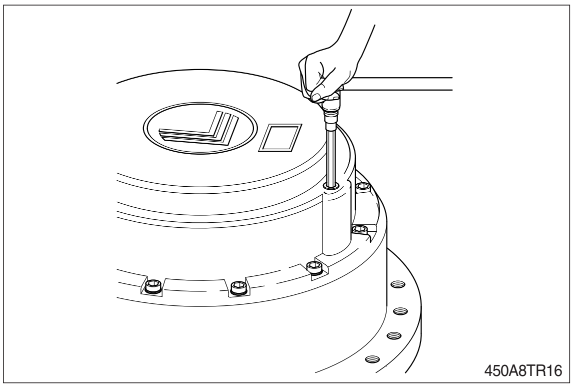
(11) Remove brake discs pack (21, 22).



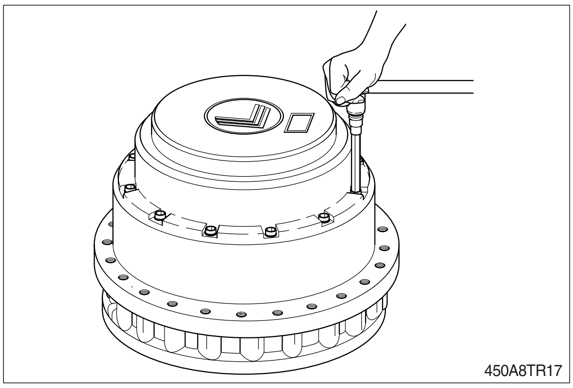
(12) Remove the O-rings (24,25) and the backup rings (23, 26) from their groves in the flanged hub (17).


450A8TR15

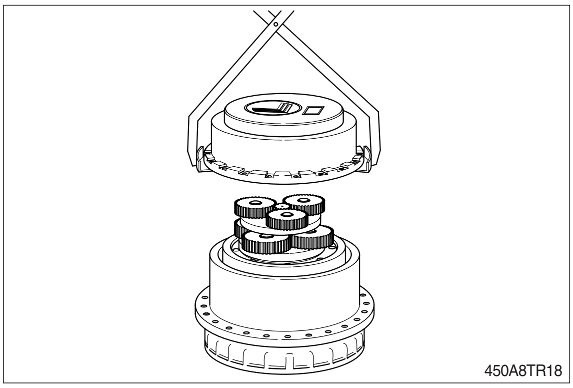
(13) Turn the gearbox around, unscrew and remove the 2 plugs (2) and the 2 washers (1) from the end cover (4).


450A8TR16

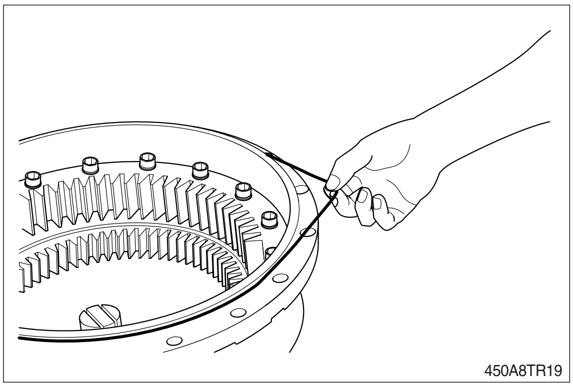
(14) Unscrew and remove the 16 socket head screws (3).


450A8TR17

(15) By means of a puller remove the end cover (4).

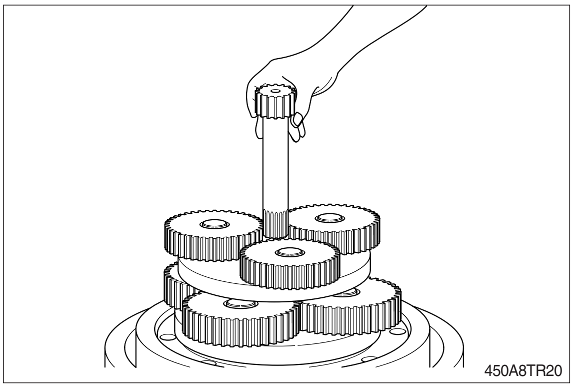

450A8TR18

(16) Remove the O-ring (5) from its grove in the end cover (4).



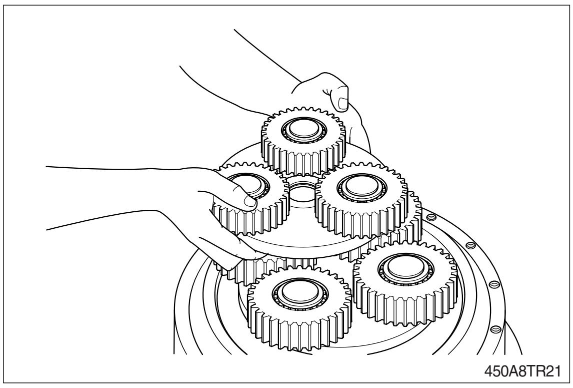
450A8TR19

(17) Remove the 1st stage sun gear (7).



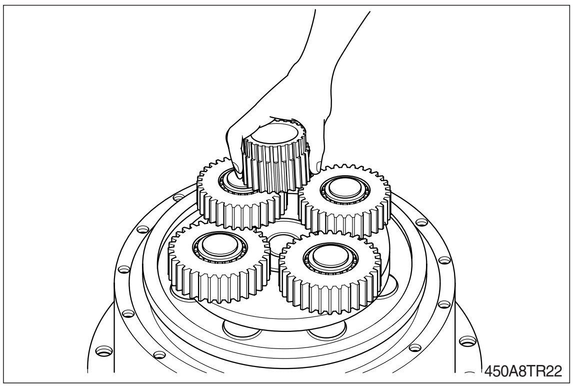
450A8TR20

(18) Remove the 1st reduction assembly (8).



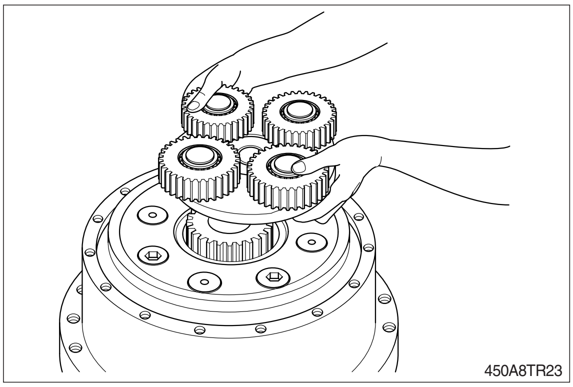
450A8TR21

(19) Remove the 2nd stage sun gear (9).

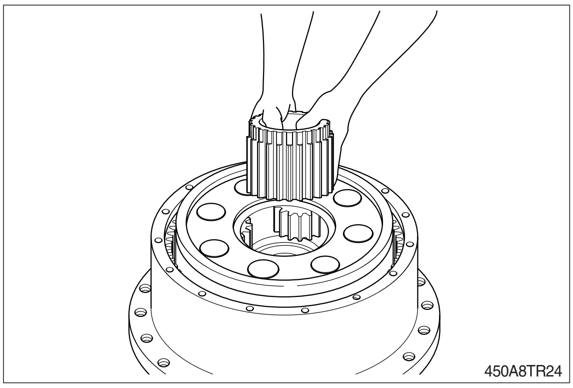


450A8TR22

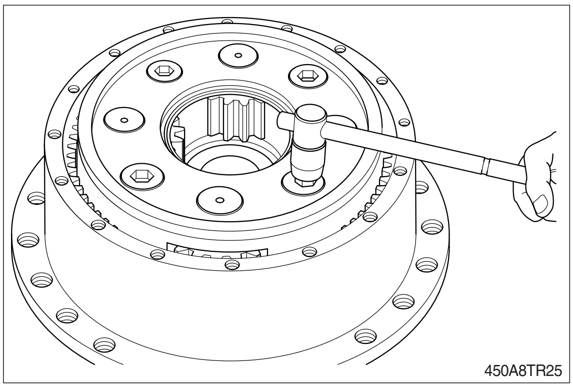
(20) Remove the 2nd reduction assembly (10).


450A8TR23

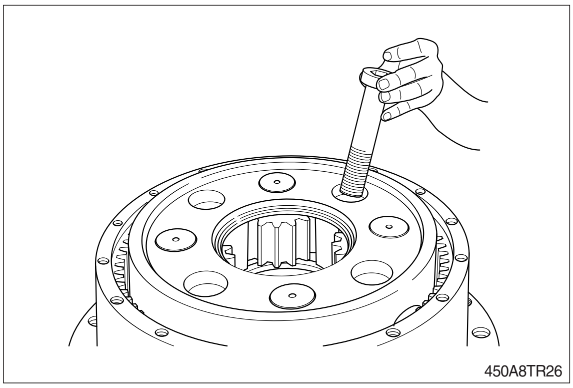
(21) Remove the 3rd stage sun gear (14).


450A8TR24

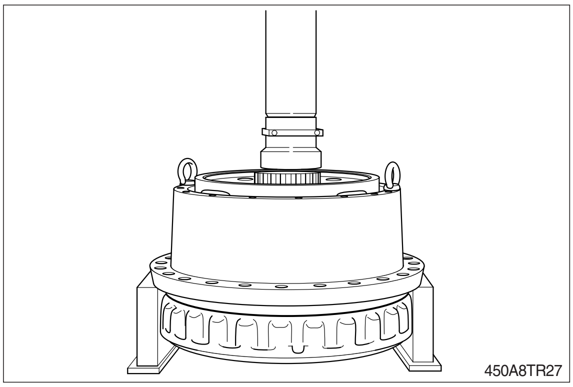
(22) Unscrew the 4 socket head screws (11), fixing the 3rd reduction assembly (12) to the flanged hub (17).


450A8TR25

(23) Remove the 4 screws (11).

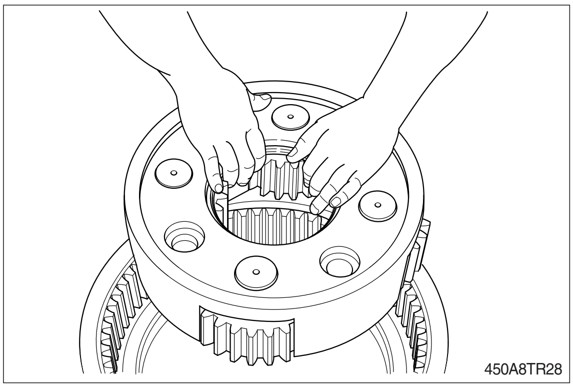

450A8TR26

(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.



450A8TR27

(25) Remove the 3rd reduction assembly (12) from the flanged hub (17).

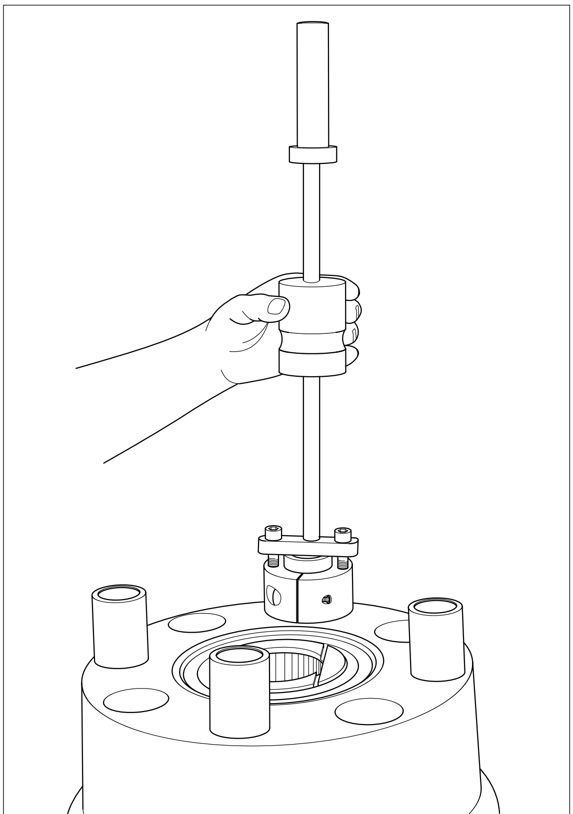


450A8TR28

(26) Using the equipment, remove bushes (13) from the flanged hub (17).

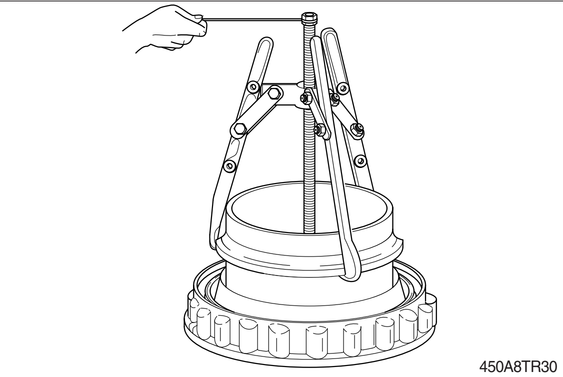
※ It is possible that the planet assemblies (see reassembly (11))remain assembled to the planet-carrier. In this case it is sufficient to push on them by means of a rubber pad or a press.

In case the planet assemblies remain assembled to the flanged hub, it is better to use the fixture (for this operation).



450A8TR29

(27) By means of an extractor, remove the inner race of the bearing and spacer kept on the flanged hub (17).



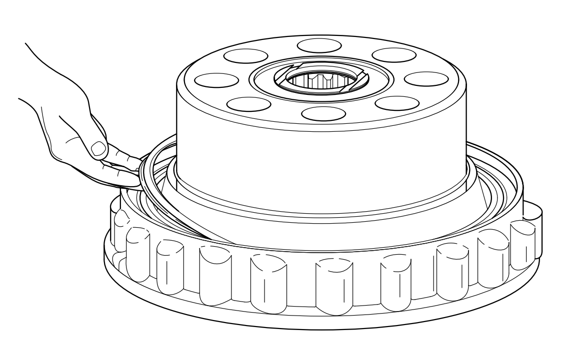
450A8TR30

(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.



450A8TR31

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.

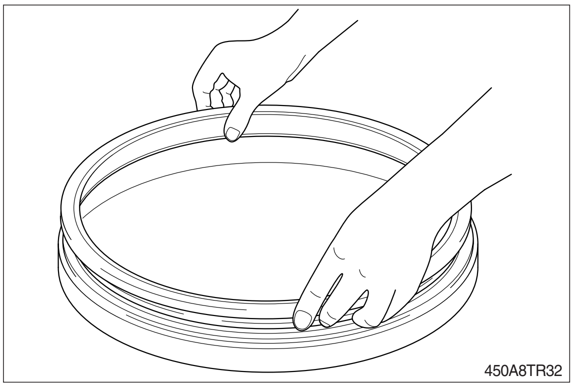
※ Before reassembling the O-ring, gaskets and the oil seals:

Concerned should be removed.

Clean with care all the housing of the seal and put some grease on the gasket before mounting.

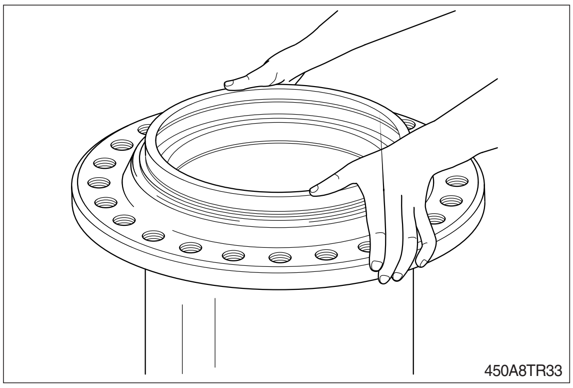
※ Never change only one part of the lifetime seal, always the two rings together.

(1) Fit the half seals (16) on the tool.



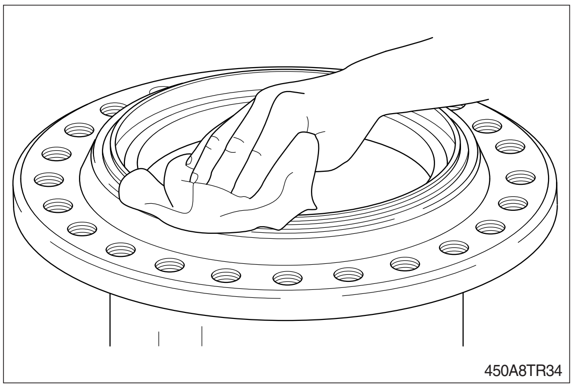
450A8TR32

(2) Fit the half seals (16) inside the gearbox housing (15).



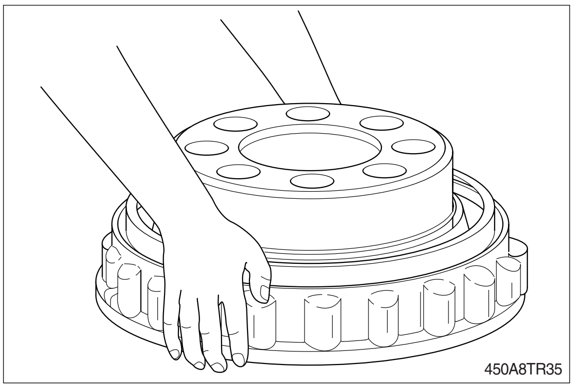
450A8TR33

(3) Clean carefully the metallic face of the half-seal.



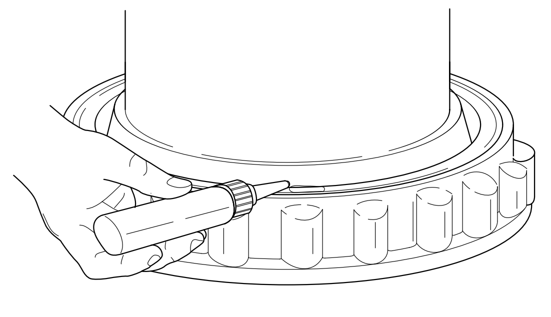
450A8TR34

(4) Assemble, by using the same tool, the half seal (16) on the flanged hub (17).

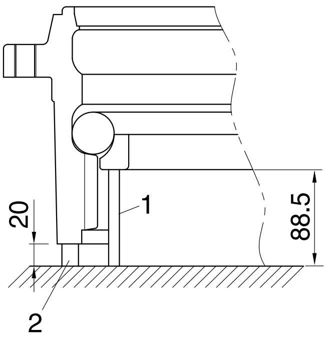


450A8TR35

(5) Lube the metallic face of the half seal with a thin oil film.

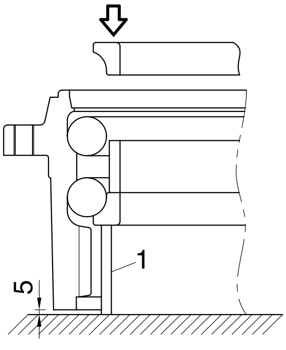

450A8TR36

(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.



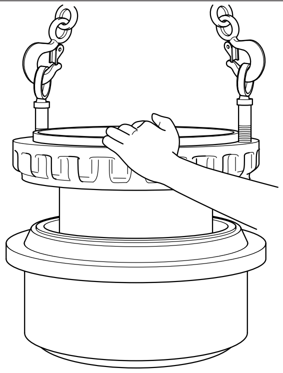
450A8TR03-1

(7) After having placed the bearing spacer fit the upper ball row.
Then place the upper inner race.

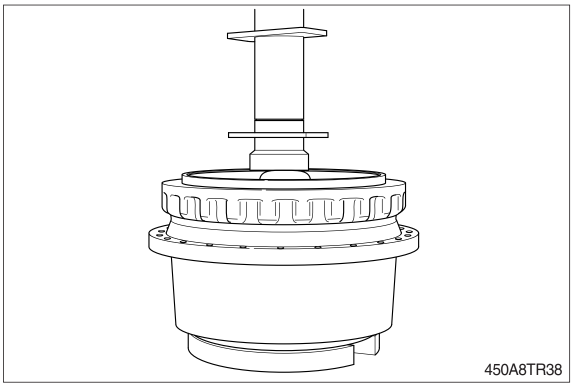


450A8TR03-2

(8) Lift the flanged hub (17) then lower it inside the gearbox housing (15).

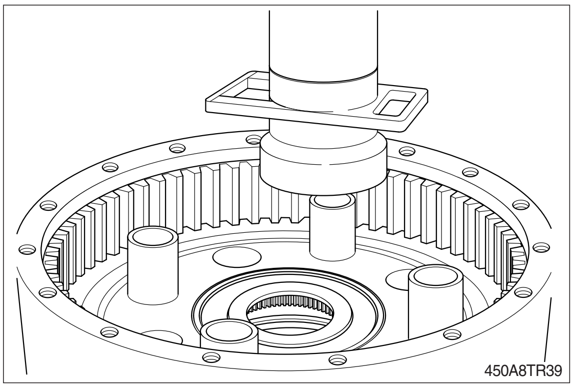

450A8TR37

(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.



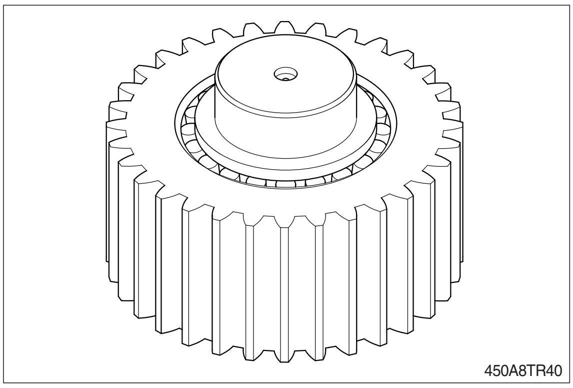
450A8TR38

(10) Using a press, place and push the 4 bush, inside their seats on the flanged hub (17).



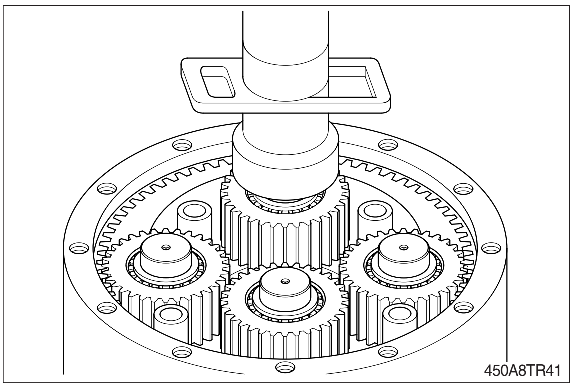
450A8TR39

(11) View of the 3rd reduction's planet assembly.



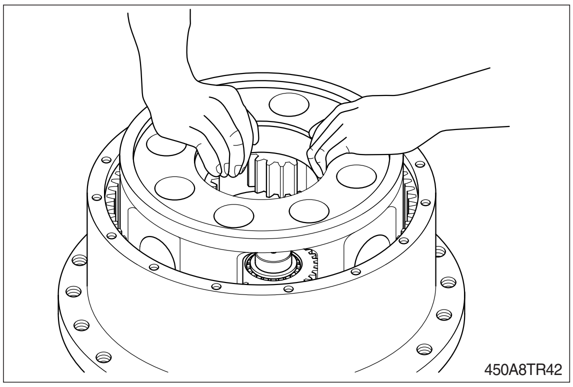
450A8TR40

(12) Using a press push the 4 planet assemblies against the shoulder on the flanged hub (17).



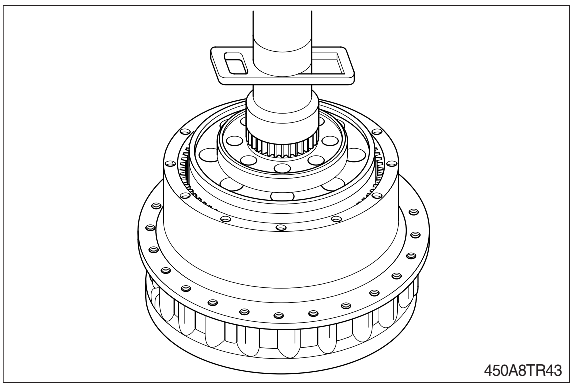
450A8TR41

(13) Place the 3rd reduction planet carrier on the hub (17).



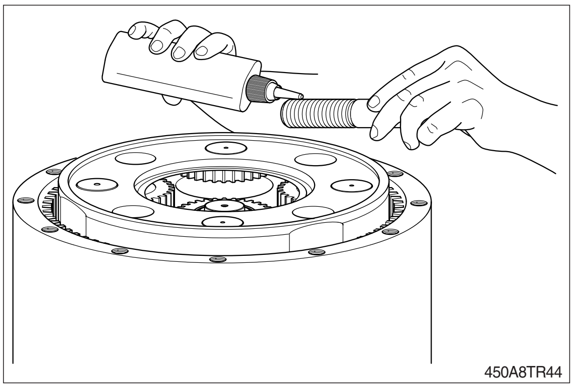
450A8TR42

(14) Using a press push the 3rd reduction planet carrier against the shoulder on the flanged hub (17) until complete assembly.



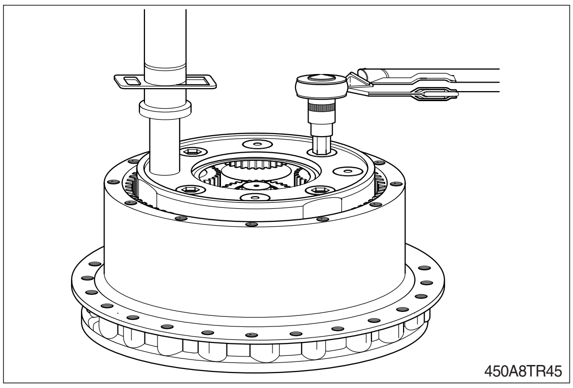
450A8TR43

(15) Apply LOCTITE type 243 on the 4 socket head screws (11), and insert them in the thread holes.



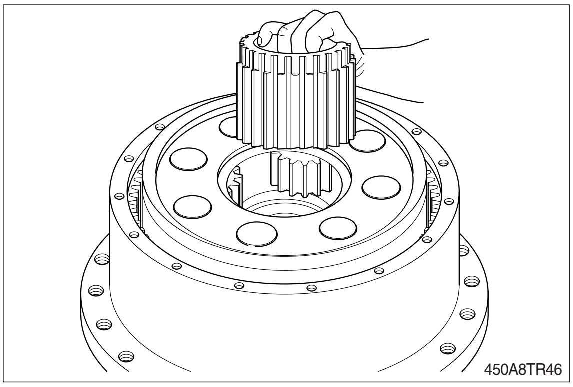
450A8TR44

(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.

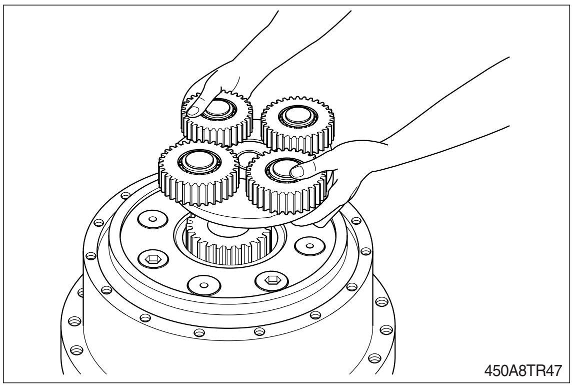


450A8TR45

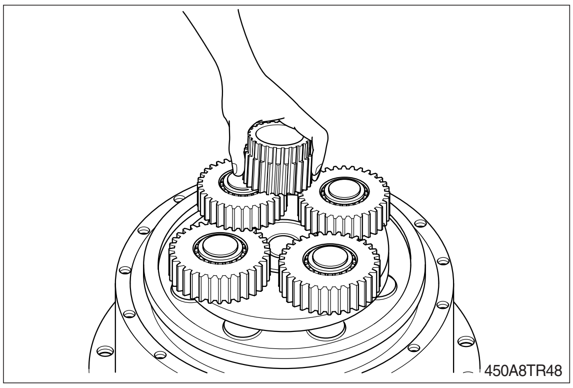
(17) Insert the 3rd stage sun gear (14).



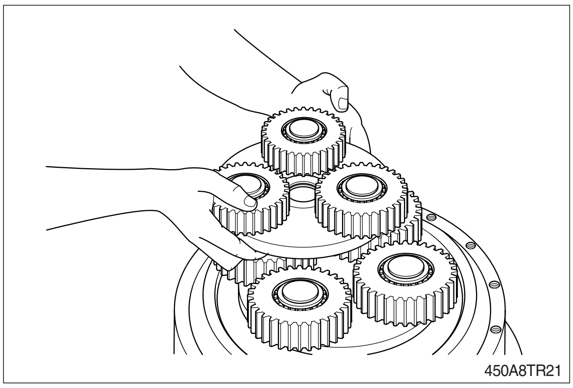
(18) Insert the 2nd reduction assembly (10).



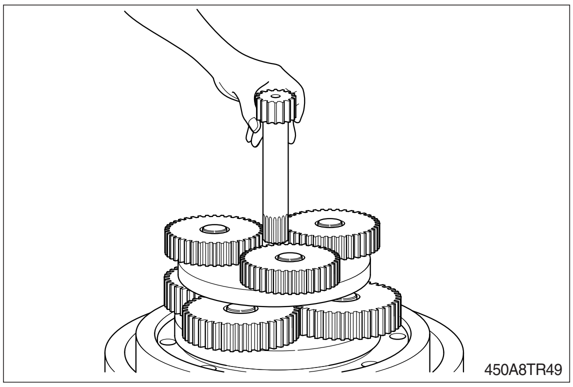
(19) Insert the 2nd stage sun gear (9).



(20) Insert the 1st reduction assembly (8).

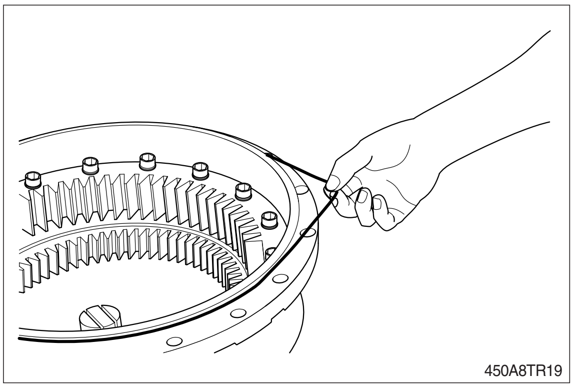


(21) Insert the 1st stage sun gear (7).



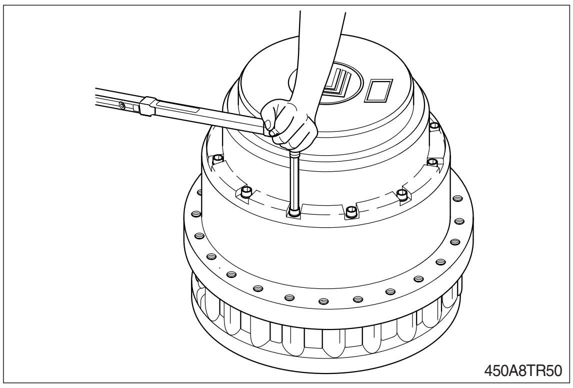
450A8TR49

(22) Fit the O-ring (5) into its grove in the end cover (4).



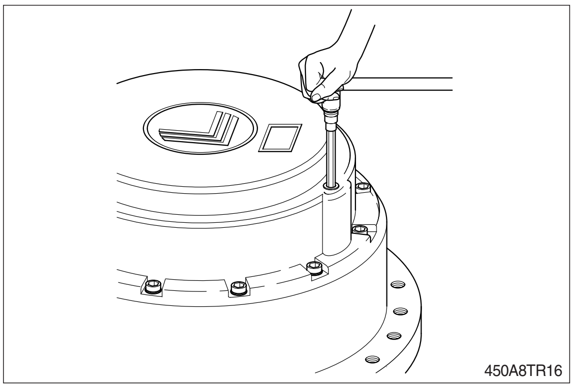
450A8TR19

(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).



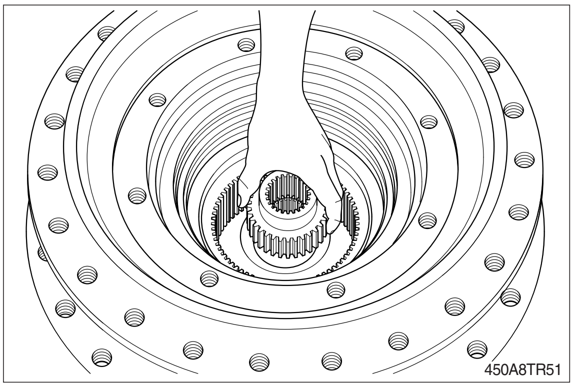
450A8TR50

(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).

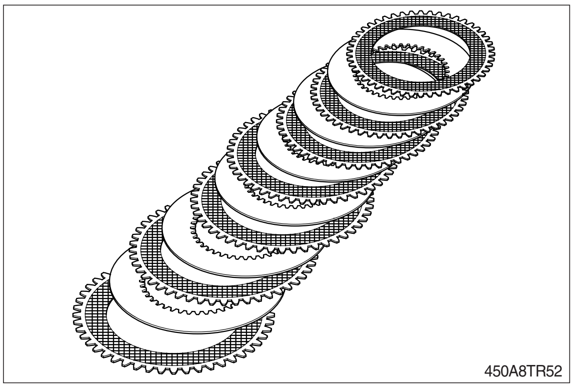


450A8TR16

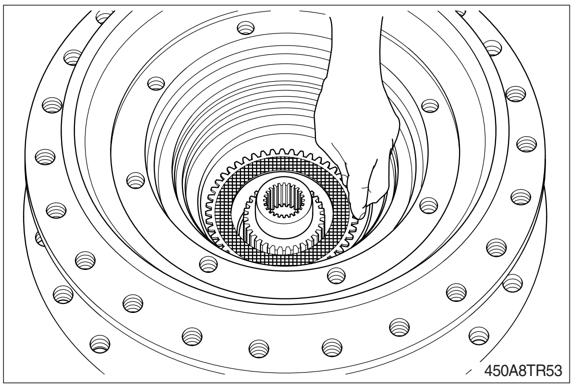
(25) Turn the gearbox around and insert the brake shaft (19).



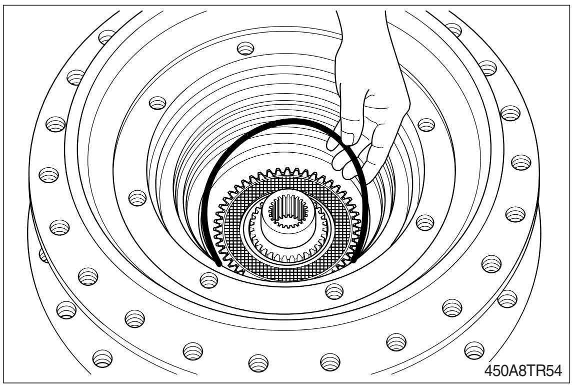
(26) View of the brake discs (21, 22).



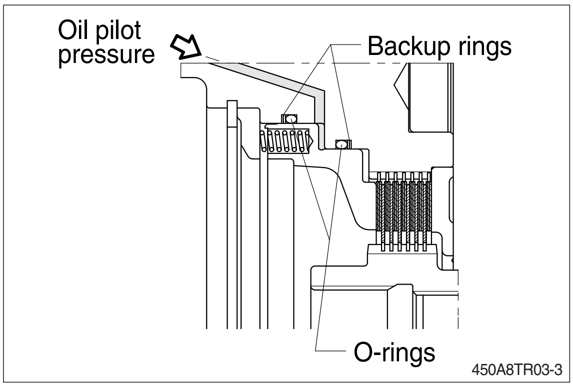
(27) Assemble the brake discs package according to the following order: Firstly insert an external toothed sintered bronze disc (21). Then insert, an internal toothed steel disc (22). Repete the operation until reaching the number of 7 bronze and 6 steel discs.



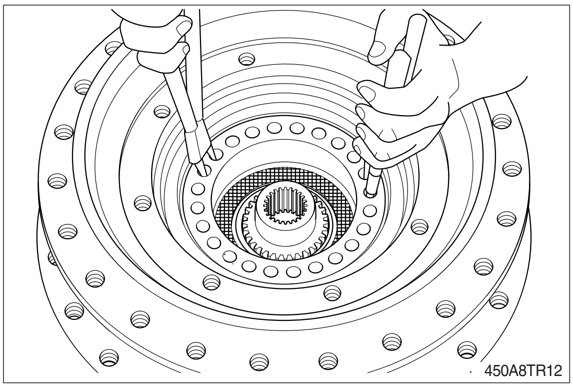
(28) Fit the backup rings (23, 26) and the O-rings (24, 25) inside the two internal groves of the flanged hub (17, see drawing).



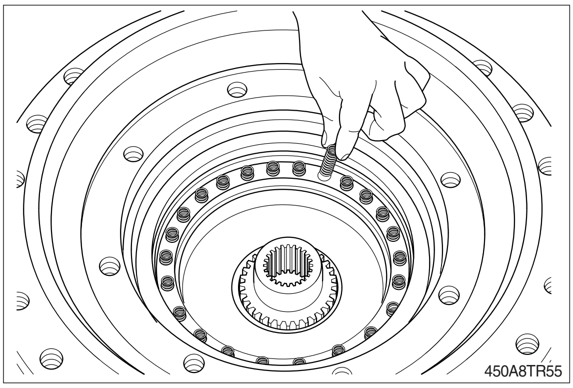
※ An O-ring and a backup ring must be fitted in the grove paying attention that the backup ring must always be beyond the O-ring against the oil flow.



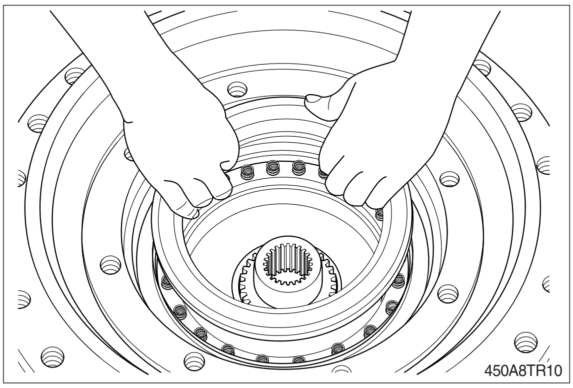
(29) Insert the brake piston (27) inside the flanged hub (17), paying attention not to damage the seals already fitted.



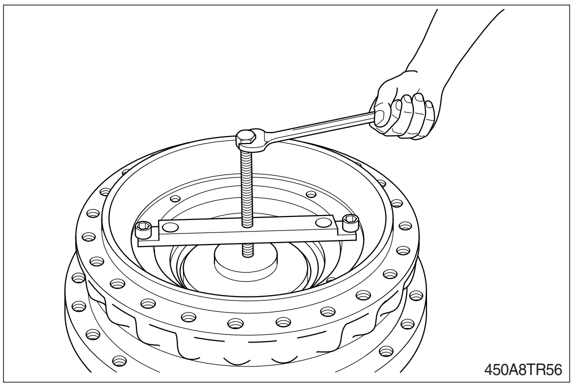
(30) Insert the springs (28) into the groves in the brake piston (27).



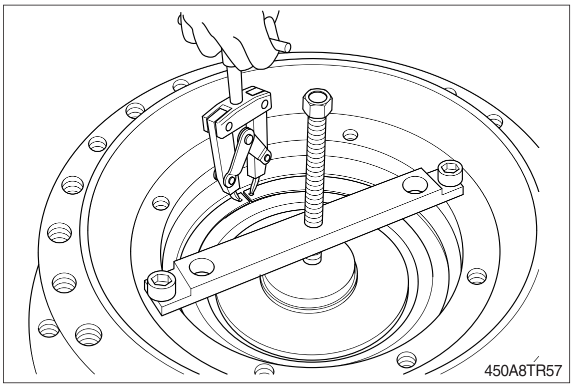
(31) Insert the retainer disc (29).



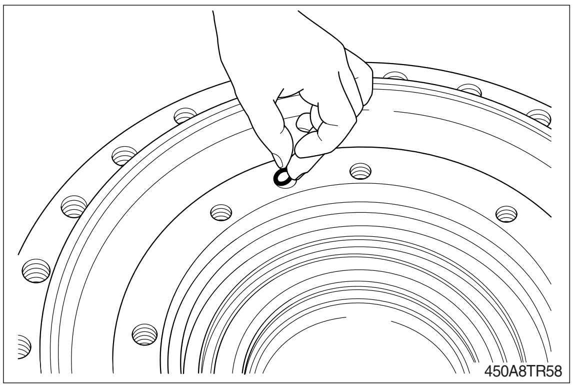
(32) Fixed the equipment to the flanged hub (17) and screw the threaded screw up the springs retainer disc (29) is lowered below the circlip seat (30).


450A8TR56

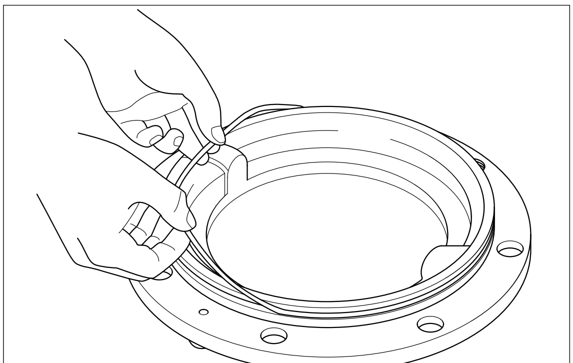
(33) By means of pliers, place the circlip (30) into its grove.


450A8TR57

(34) Fit the O-ring (36) into its grove in the flanged hub (17).

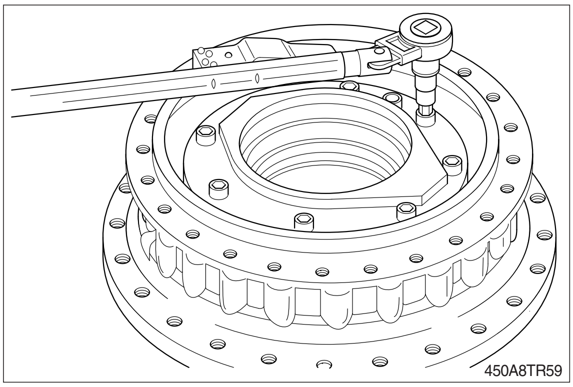

450A8TR58

(35) Fit the O-ring (20) into the grove of the motor flange (32).


450A8TR05

(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.



450A8TR59

TRAVEL DEVICE (TYPE 4)

1. REMOVAL AND INSTALL

1) REMOVAL


13031GE18

(1) Swing the work equipment 90° and lower it completely to the ground.

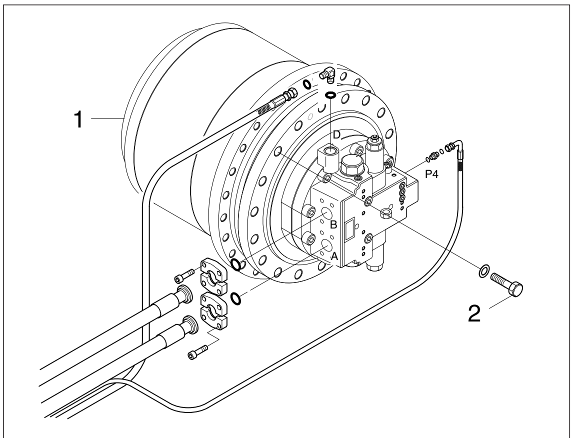
(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(4) Remove the track shoe assembly.
For details, see removal of track shoe assembly.



480A8TM01

(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.

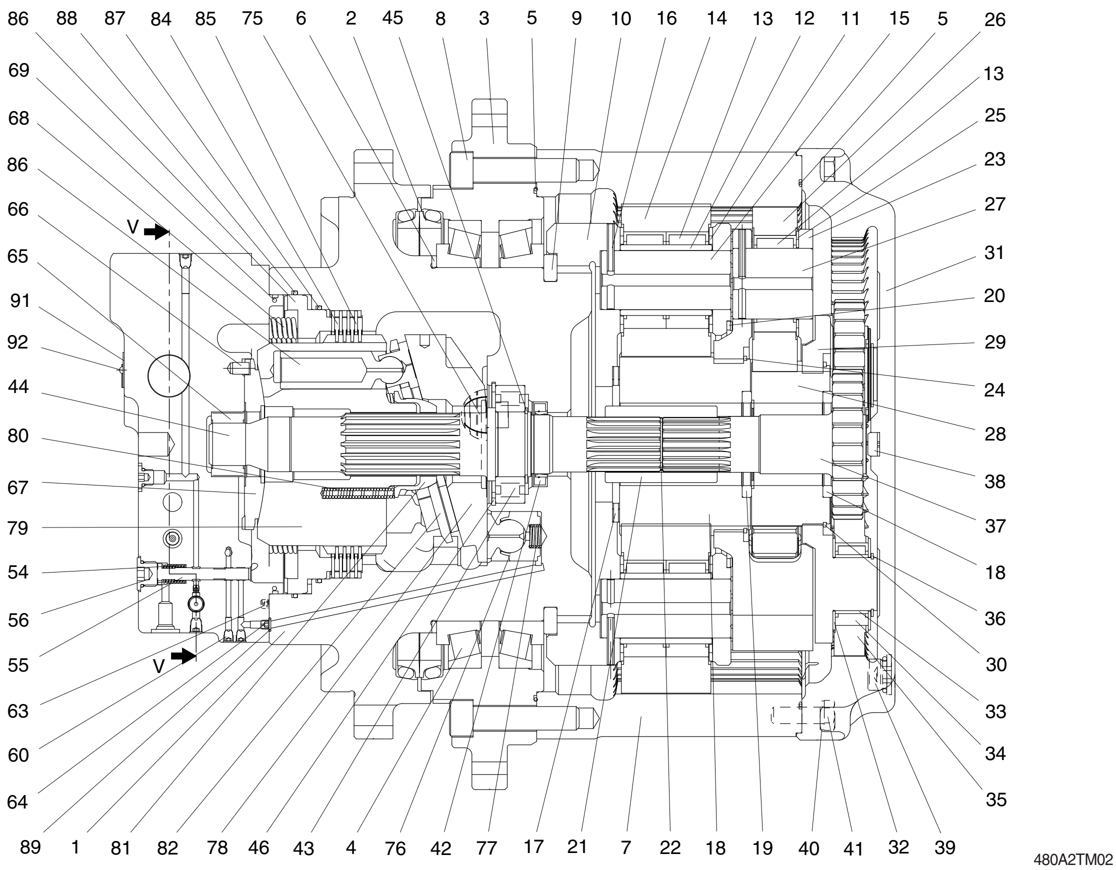
(2) Bleed the air from the travel motor.

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.

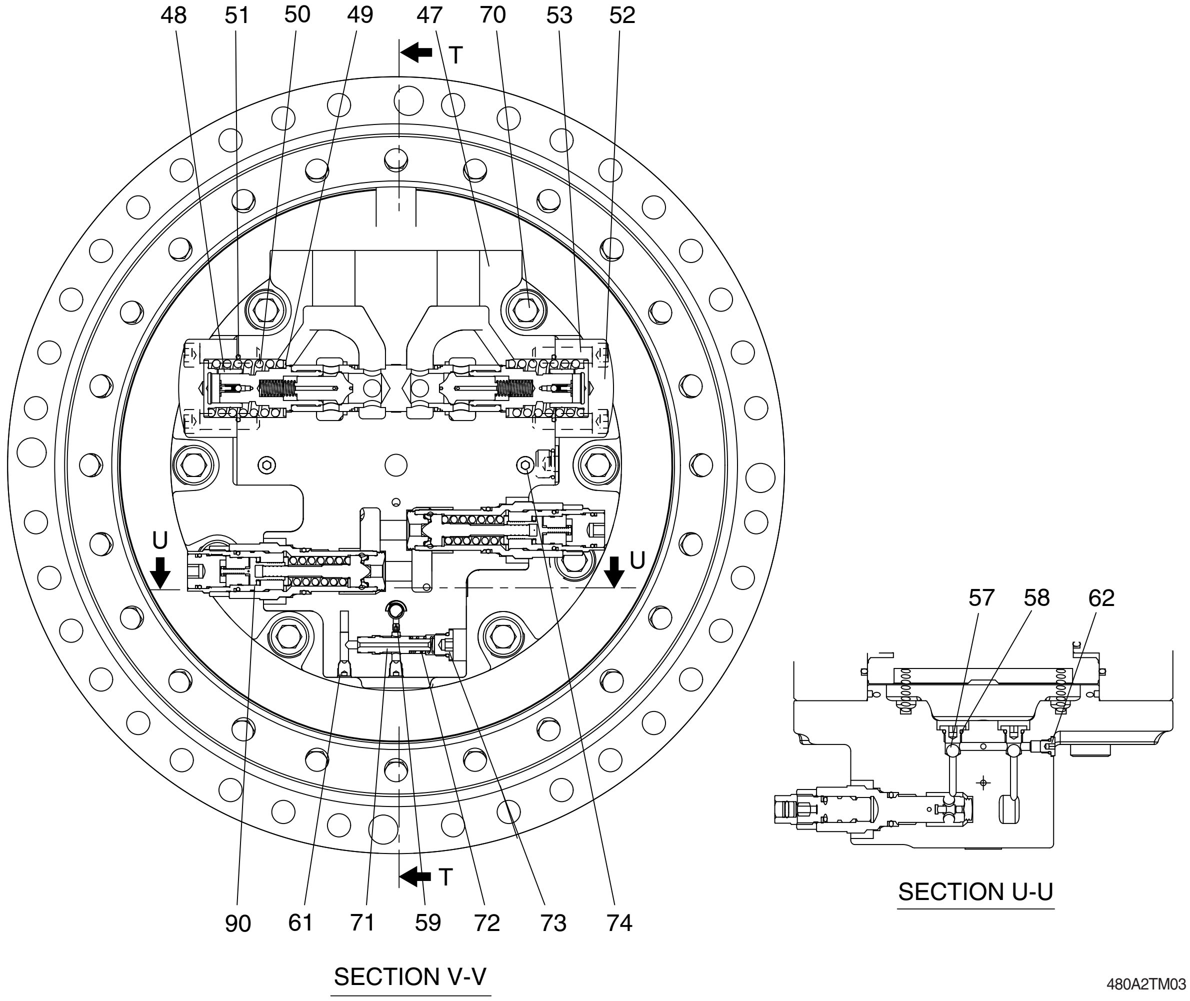
2. TRAVEL MOTOR

1) STRUCTURE (1/2)



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

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, 17mm
Hex socket	22, 41mm
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.

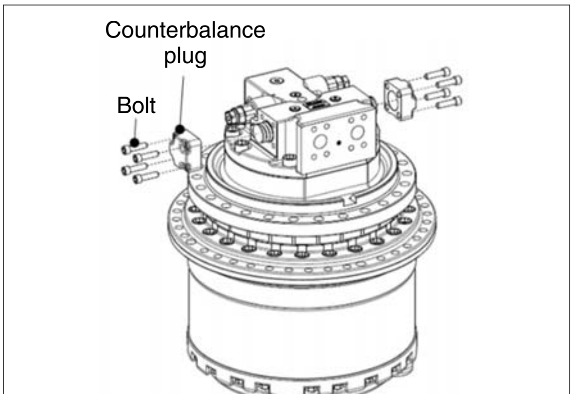
(7) eplace the floating seal, O-ring, shaft seal with a new one when disassembly.

(8) For the assembly of bearing preload/floating seal, please contact Hyundai dealer for the detailed assembly method.

2) DISASSEMBLY

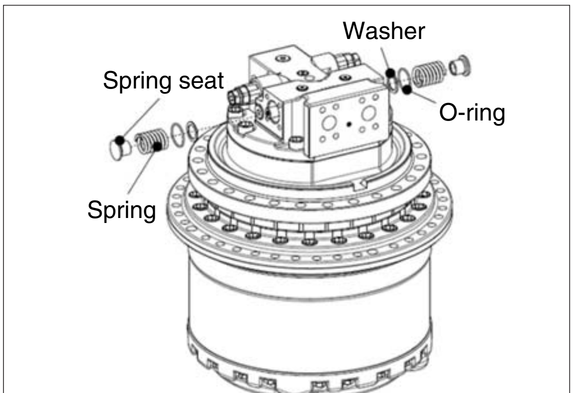
(1) Disassemble the counterbalance plug and bolt.

※ Required tools : torque wrench, hex bit 10 mm.



480A8TM10

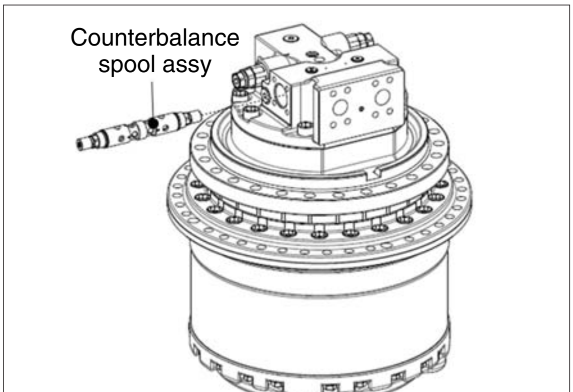
(2) Disassemble the spring, spring seat, O-ring, washer.



480A8TM11

(3) Turn the counterbalance spool assy slowly to disassemble .

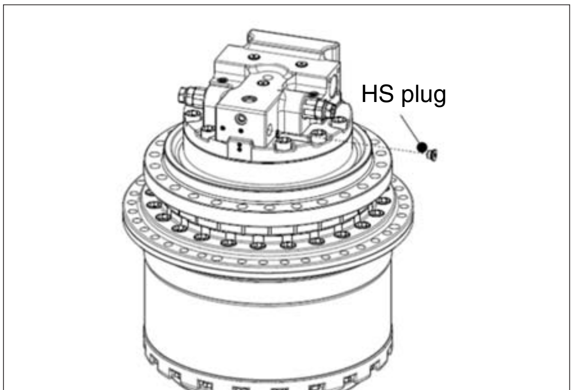
※ Damage caution of counterbalance spool surface.



480A8TM12

(4) Disassemble the HS plug.

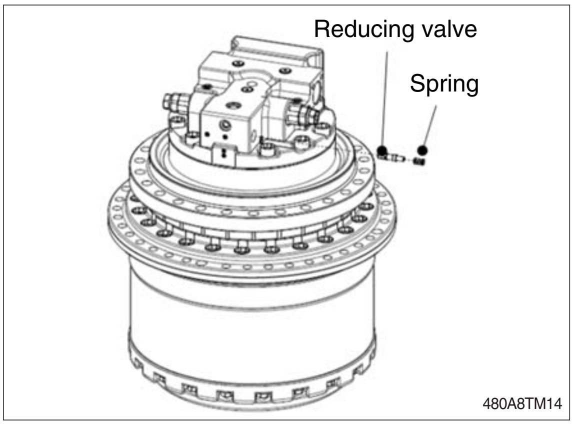
※ Required tools : torque wrench, hex bit 8 mm.



480A8TM13

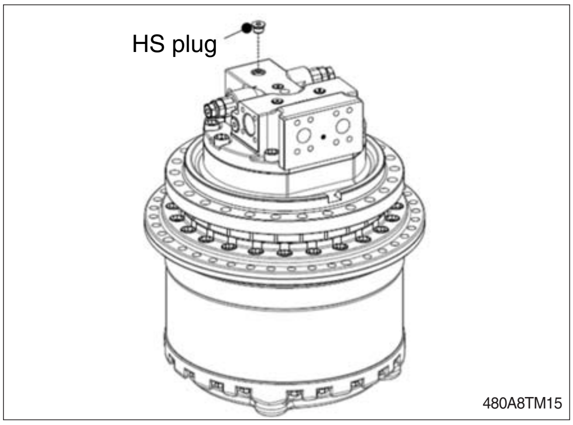
(5) Disassemble the reducing valve, spring.

※ Damage caution of reducing valve surface.



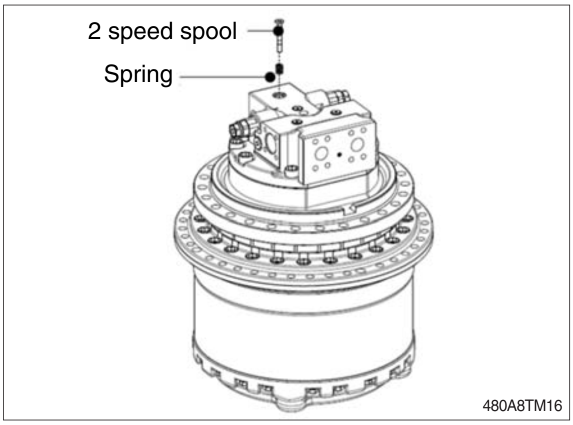
(6) Disassemble the HS plug.

※ Required tools : torque wrench, hex bit 10 mm.



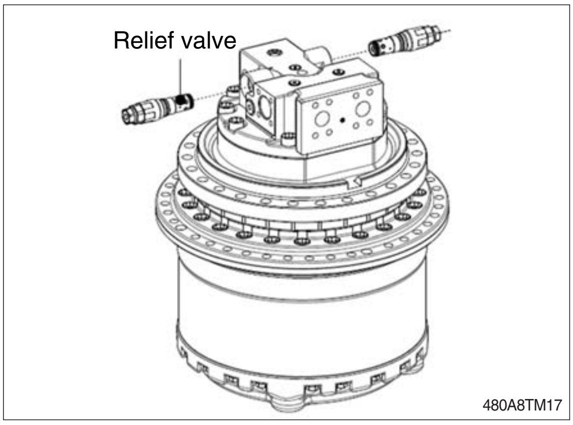
(7) Disassemble the 2 speed spool and spring.

※ Damage caution of 2 speed spool surface.

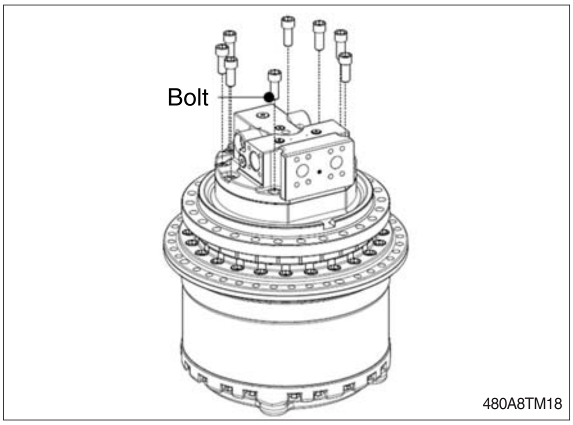


(8) Disassemble the relief valves.

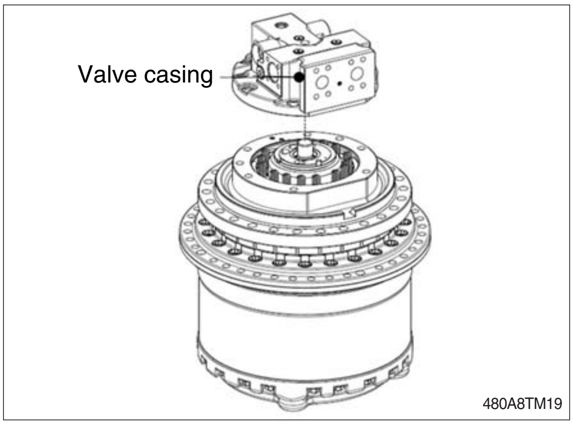
※ Required tools : torque wrench, hex socket 41 mm.



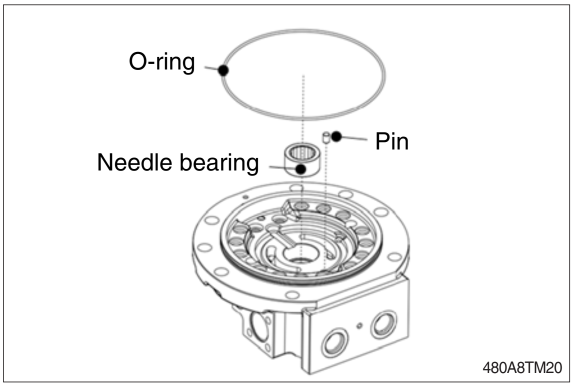
(9) Loosen each bolt evenly to disassemble.
※ Required tools : torque wrench, hex bit 17 mm.



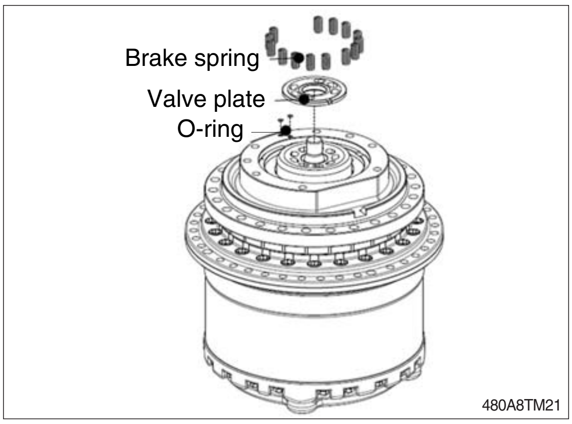
(10) Disassemble the valve casing.



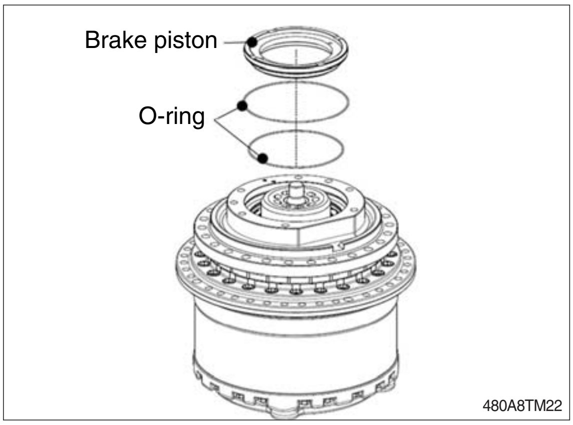
(11) Disassemble the needle bearing, O-ring, pin.



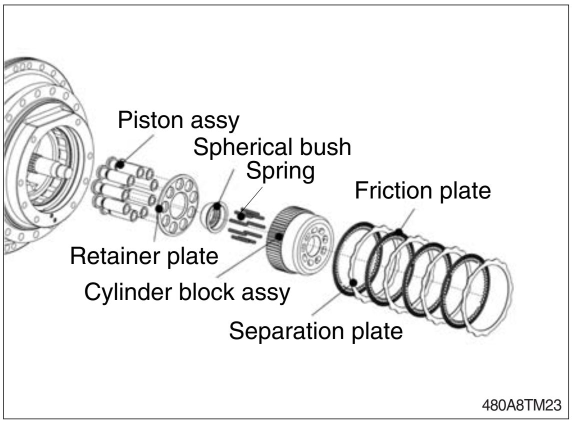
(12) Disassemble the brake spring.
※ Quantity of the brake springs could be different of each model.
Disassemble the valve plate and O-ring.



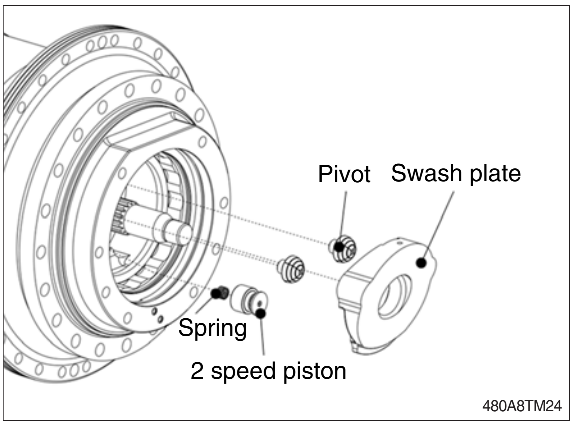
(13) Cover the top of a motor with cloths and disassembly the brake piston by blowing compressed air into the brake releasing line of the motor casing.
Disassemble the O-ring.
※ Required tools : compressed air, air gun.



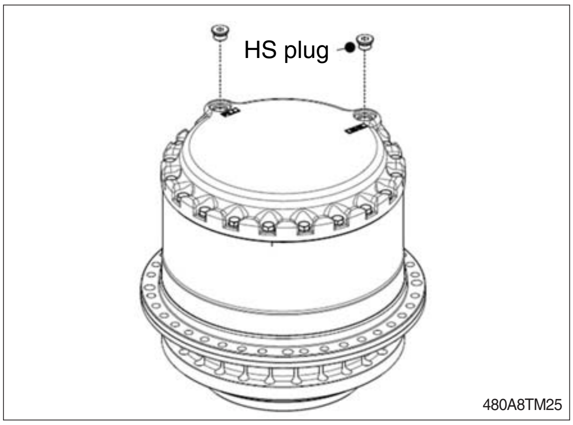
(14) Disassemble separation plate, friction plate, cylinder block assembly, spherical bush, spring, retaining plate and piston assembly.
※ Quantity of separation and friction plates could be different of each model.



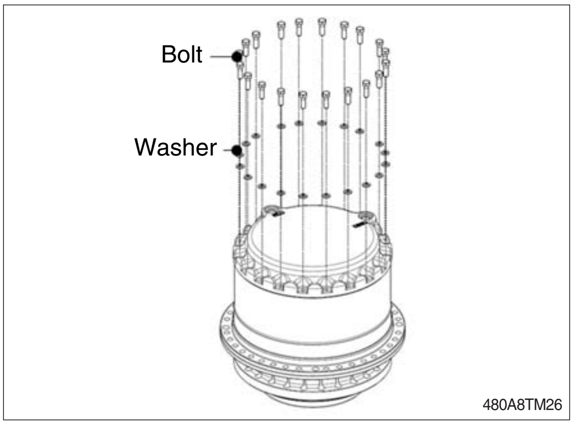
(15) Disassemble the swash plate, pivot, 2 speed piston and spring.



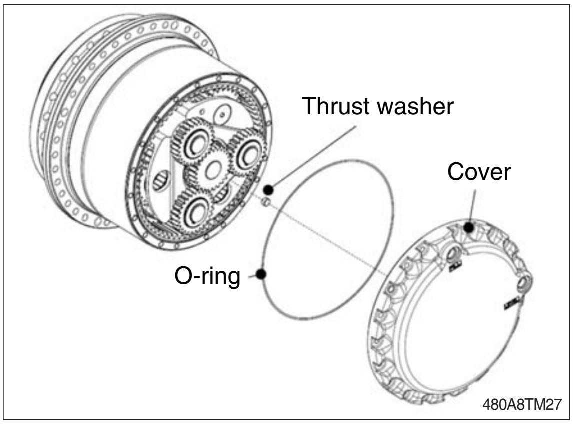
(16) Disassemble the HS plug and discharge the reduction gear oil.
※ Required tools : torque wrench, hex bit 10 mm.



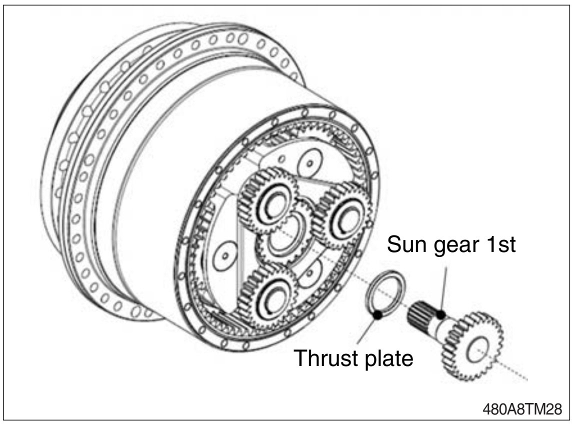
(17) Disassemble the bolt and washer.
※ Do not re-use.
※ Required tools : torque wrench, hex socket 22 mm.



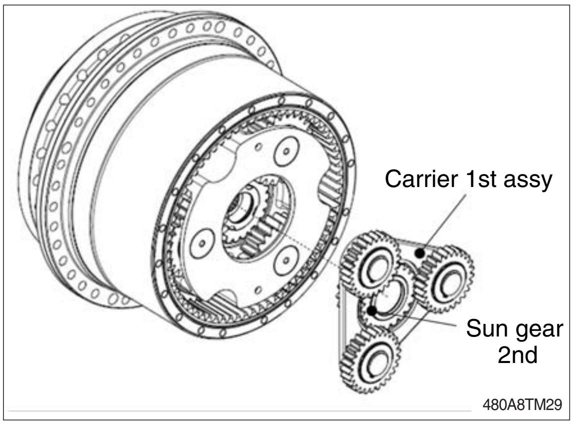
(18) Disassemble the cover, thrust washer and O-ring.



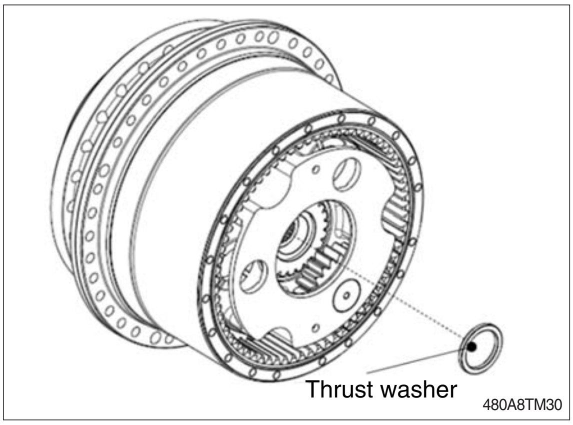
(19) Disassemble the sun gear 1st and thrust plate.



(20) Disassemble the carrier 1st assembly and sun gear 2nd.

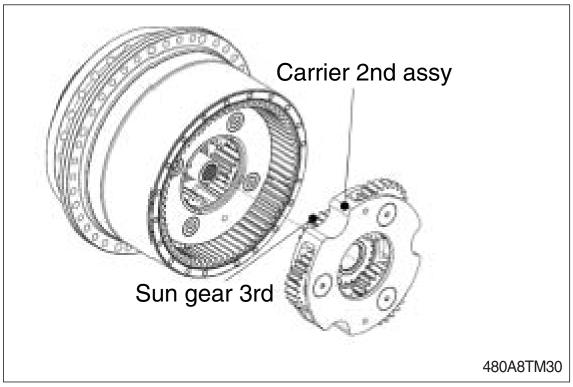


(21) Disassemble the thrust washer.

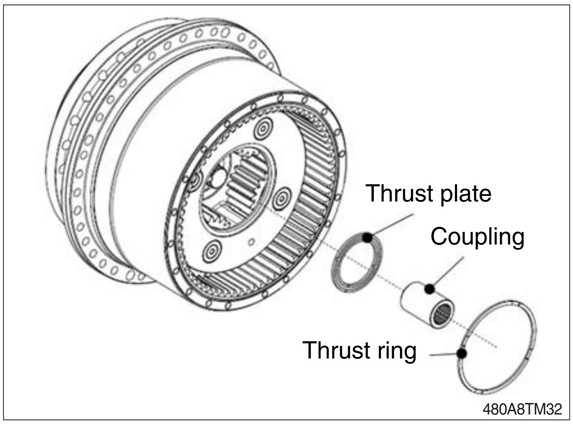


(22) Disassemble the carrier 2nd assembly and sun gear 3rd.

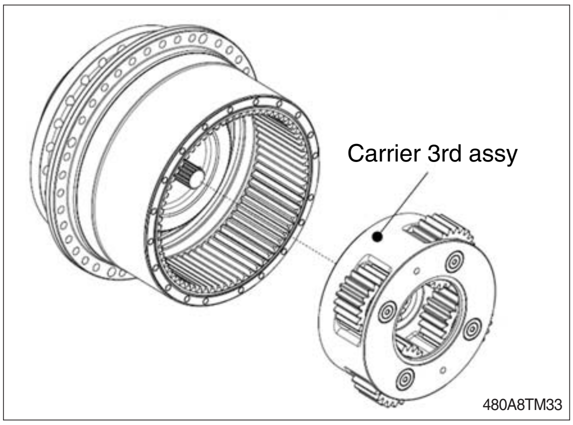
※ Required tools : eye bolt M16x2 (2ea)



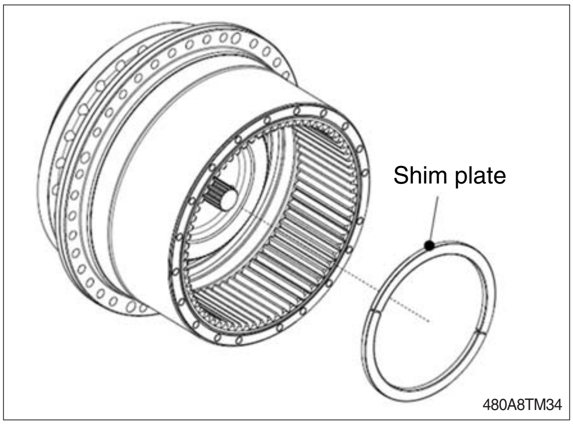
(23) Disassemble the thrust ring, coupling and thrust plate.



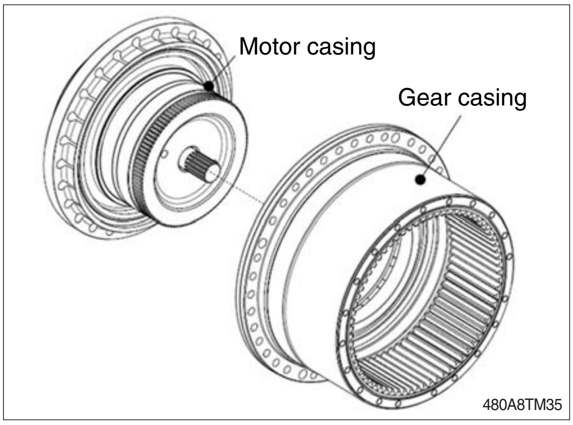
(24) Disassemble the carrier 3rd assembly.
※ Required tools : eye bolt M16x2 (2ea)



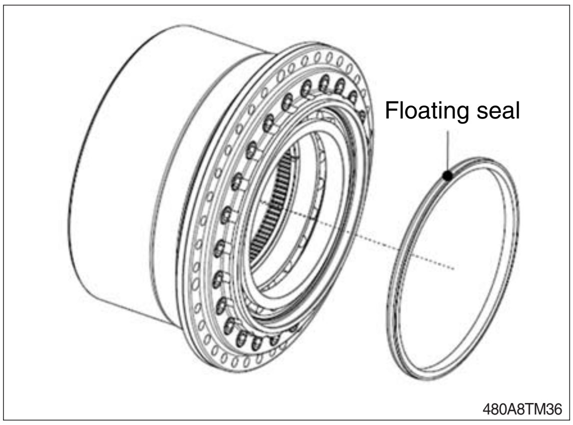
(25) Disassemble the shim plate.



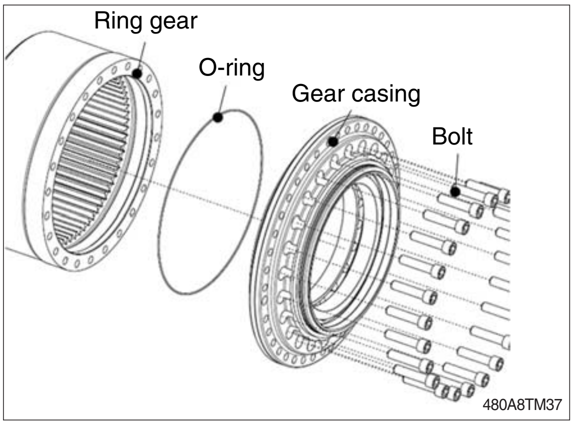
(26) Disassemble the gear casing.



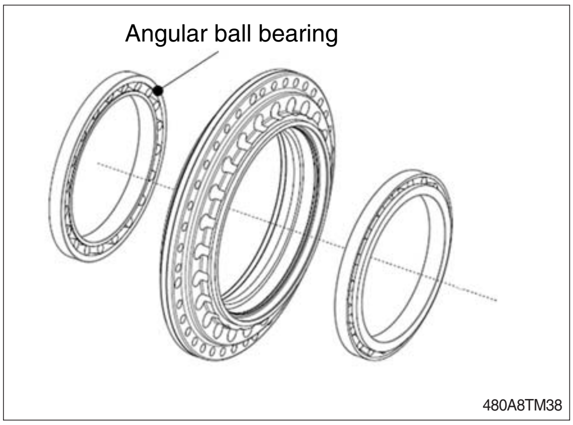
(27) Disassemble the floating seals and O-ring.
※ Damage caution of floating seal.



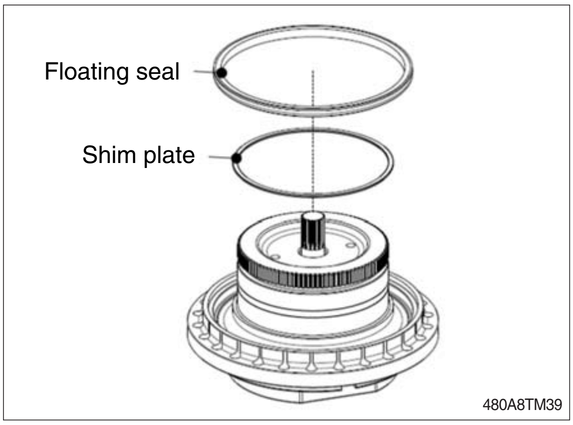
(28) Disassemble the bolt, gear casing, O-ring and ring gear.



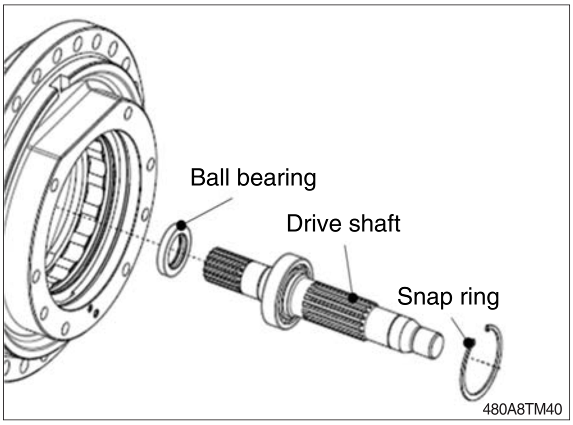
(29) Disassemble the angular ball bearing.
※ Do not disassemble if not necessary.



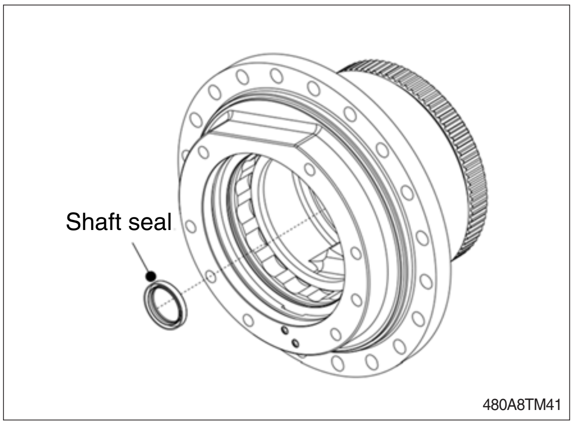
(30) Disassemble the floating seal and shim plate.
※ Damage caution of floating seal.



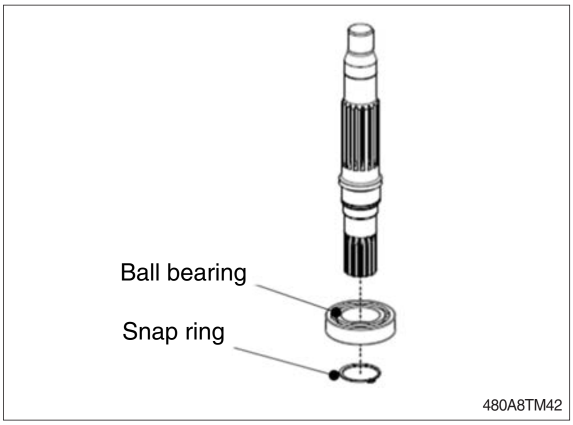
(31) Disassemble the drive shaft and ball bearing and snap ring.
※ Required tools : plier



(32) Disassemble the shaft seal.
※ Do not re-use.



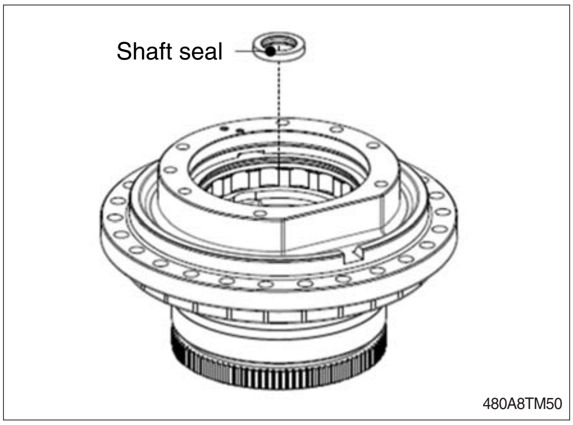
(33) Disassemble the ball bearing and snap ring.
※ Do not disassemble if not necessary.
※ Required tools : plier



3) ASSEMBLY

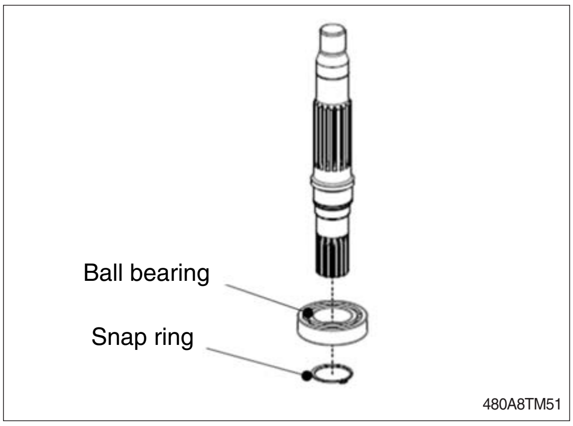
(1) Apply a small amount of hydraulic fluid to the outer diameter of the shaft seal and assemble it to the motor casing

※ Required tools : shaft seal press-fit jig



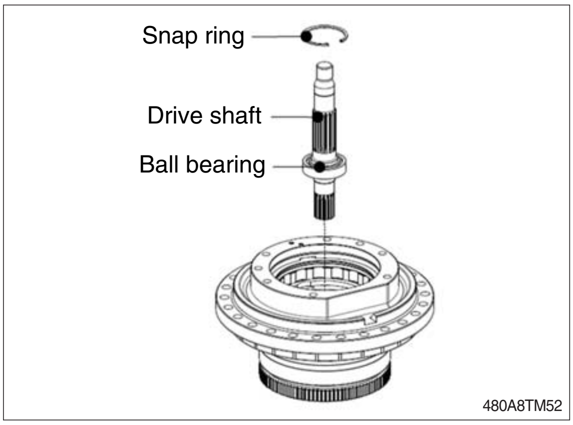
(2) Assemble the ball bearing and snap ring to the drive shaft.

※ Required tools : ball bearing assembly press-fit jig, plier.



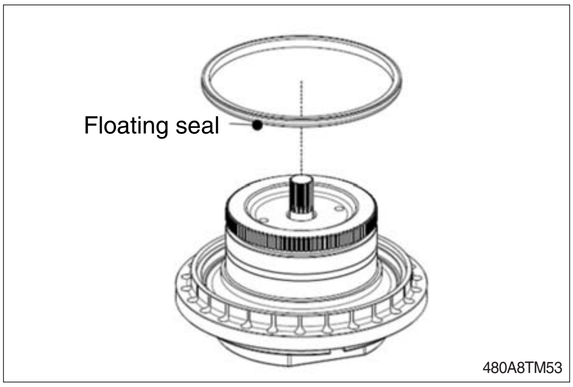
(3) Assemble the drive shaft, ball bearing and snap ring to the motor casing.

※ Required tools : plier

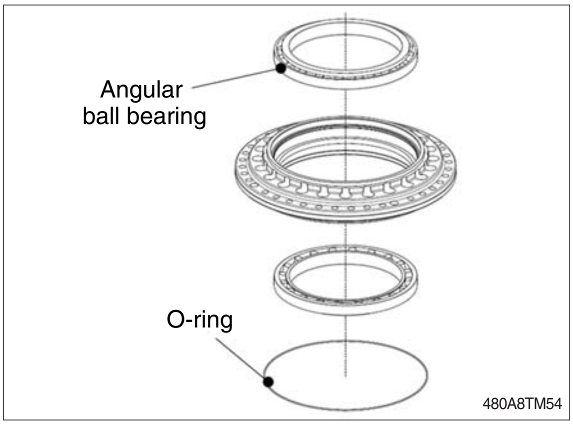


(4) Apply vaporizing lubricant to the O-ring outside of the floating seal and assemble it to the motor casing so that the parallelism can be 0.5 mm or less. After assembly, apply a small amount of hydraulic fluid to the polishing surface.

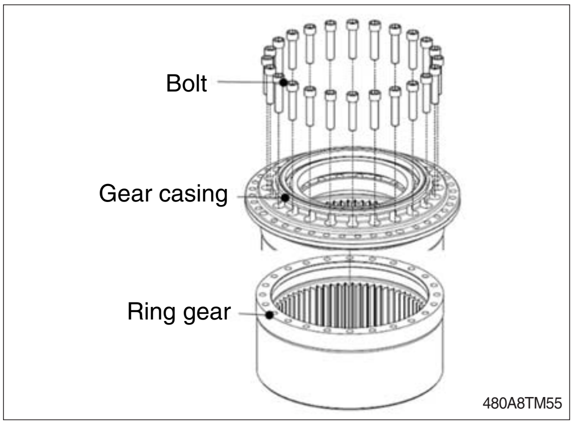
※ Required tools : floating seal assembly jig.



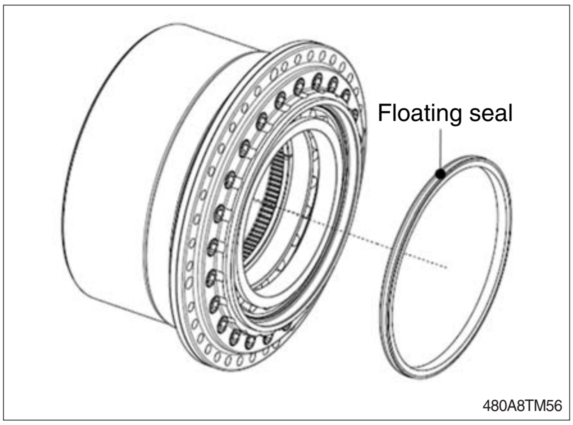
(5) Assemble the angular ball bearing into the gear casing.
Assemble the O-ring into the gear casing.
※ Required tools : angular ball bearing assembly press-fit jig.



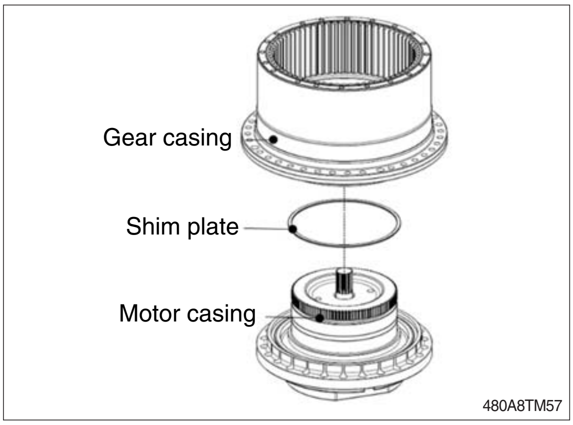
(6) Assemble the gear casing and ring gear.
Assemble the bolt after applying loctite 638.
※ Required tools : torque wrench, hex bit 17 mm.
※ Bolt size : M20x2.5
※ Tightening torque : 50.3 ± 8.0 kgf · m
(364 ± 57.9 lbf · ft)



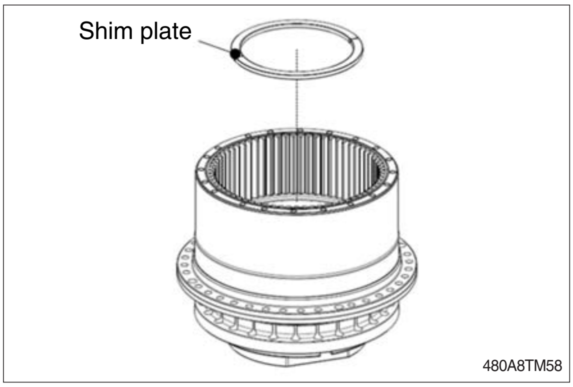
(7) Apply vaporizing lubricant to the O-ring outside of the floating seal and assemble it to the gear casing so that the parallelism can be 0.5 mm or less. After assembly, apply a small amount of hydraulic fluid to the polishing surface.
※ Required tools : floating seal assembly jig.



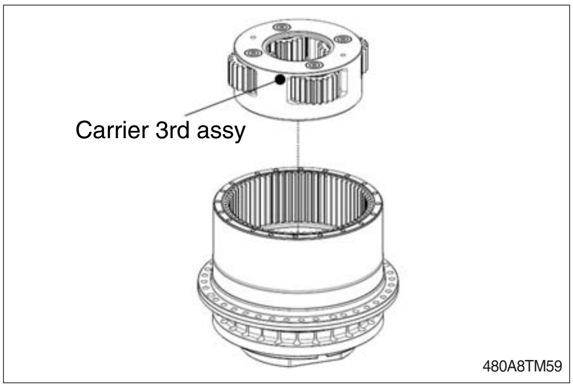
(8) Assemble the shim plate and gear casing to motor casing.
※ Damage caution of floating seal.



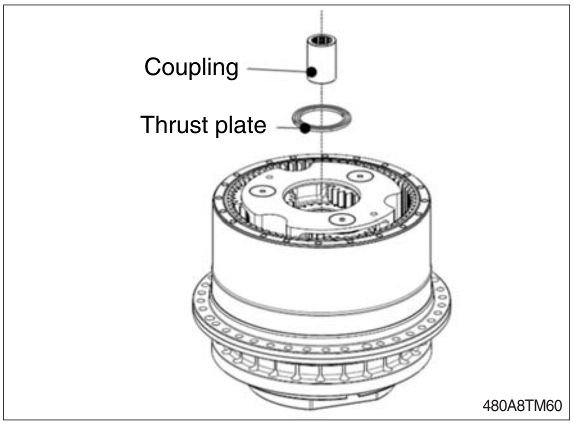
(9) Assemble the shim plate into the motor casing.



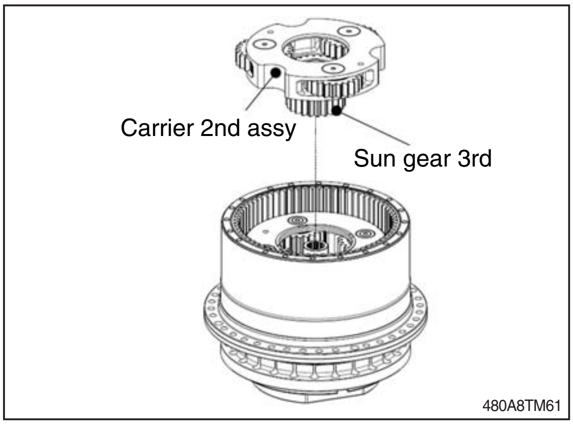
(10) Assemble the carrier 3rd assembly to gear casing.
※ Required tools : eye bolt M16x2 (2ea)



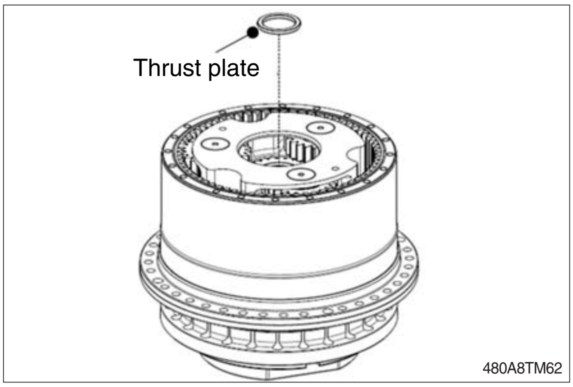
(11) Assemble the coupling and thrust plate.



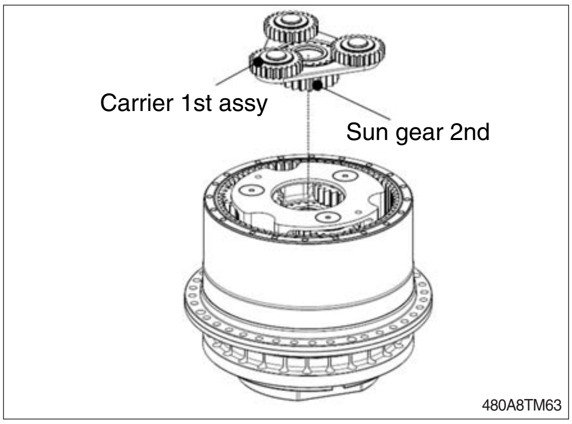
(12) Assemble the carrier 2nd assembly and sun gear 3rd to gear casing.
※ Required tools : eye bolt M16x2 (2ea)



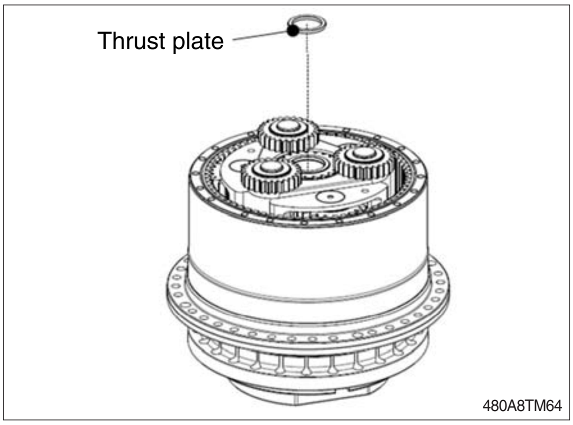
(13) Assemble the thrust plate.



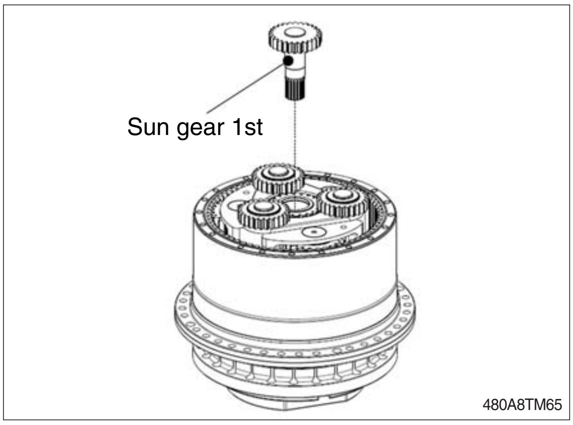
(14) Assemble the carrier no.1 assembly and sun gear 2nd.



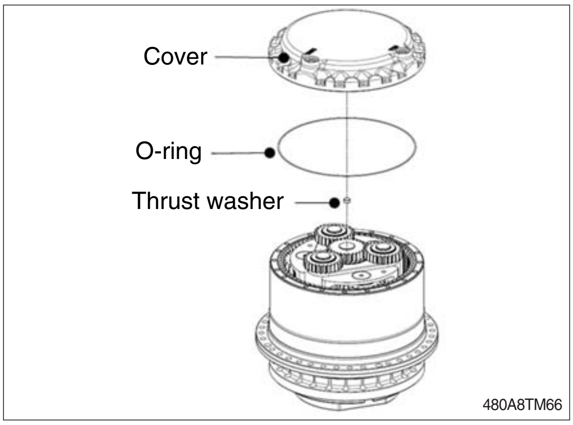
(15) Assemble the thrust plate.



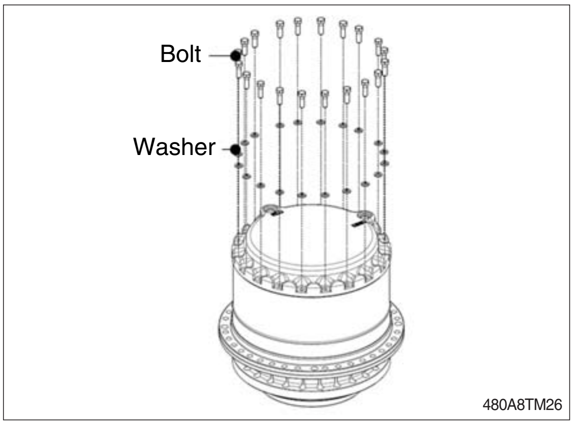
(16) Assemble the sun gear 1st.



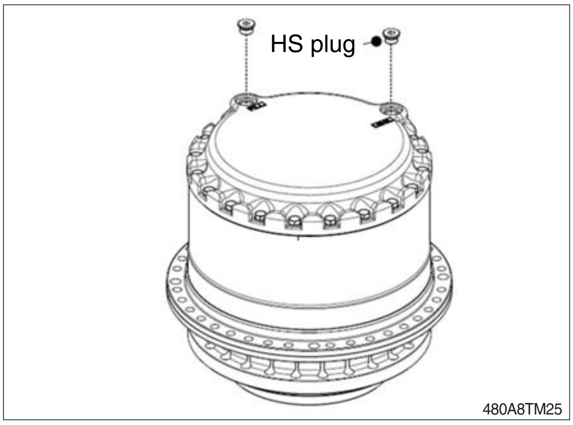
(17) Apply grease to thrust washer and assemble it to cover.
Assemble the O-ring and cover to gear casing.



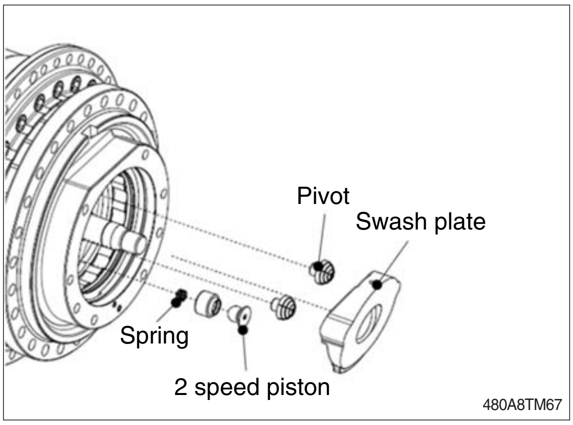
(18) Assemble the bolt and washer.
※ Required tools : torque wrench, hex socket 22 ㎜.
※ Bolt size : M14x2.0
※ Tightening torque : 17.4±2.5 kgf·m
(126±18.1 lbf·ft)



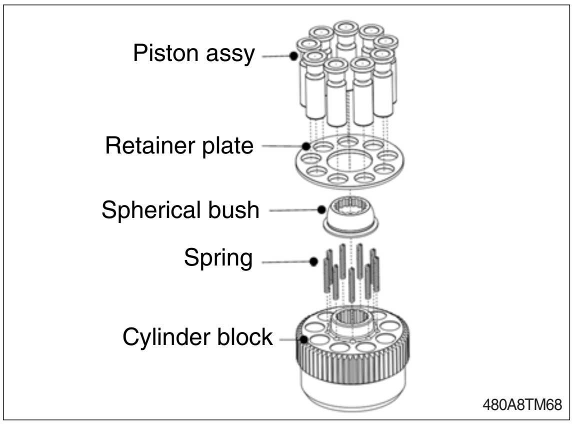
(19) Fill gear oil of 9 liter minimum and assemble HS plug to cover.
※ Required tools : torque wrench, hex bit 10 ㎜.
※ HH plug size : G 3/4
※ Tightening torque : 17.0±3.0 kgf·m
(123±21.7 lbf·ft)



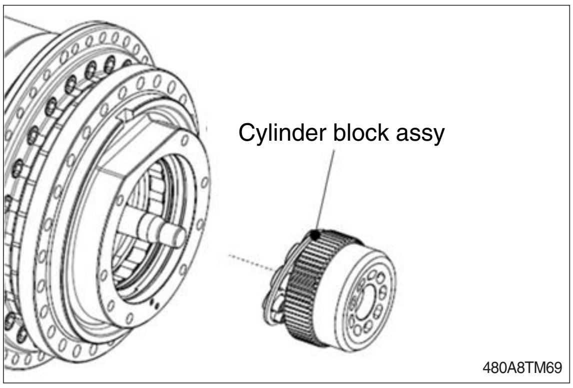
(20) Apply hydraulic fluid to the 2 speed piston outer diameter and swash plate polishing surface.
Apply grease to spring and assemble it to 2 speed piston. Assemble its to the motor casing.
※ Check whether assembled well by pushing 2 speed piston by hand.
Assemble pivot and swash plate to motor casing.
※ Check whether assembled well by pushing 2 speed piston by hand.



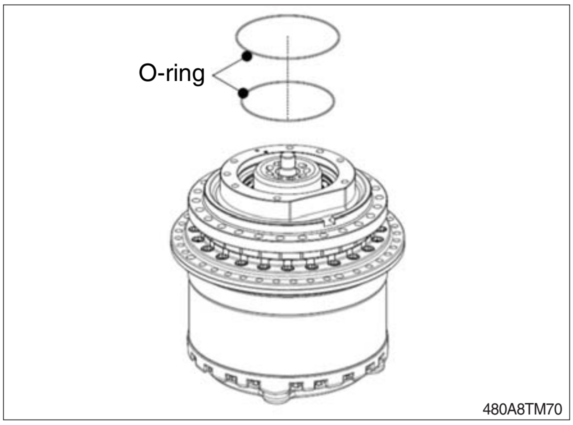
(21) Assemble the cylinder spring, cylinder block, spherical bush, retainer plate and piston assembly.



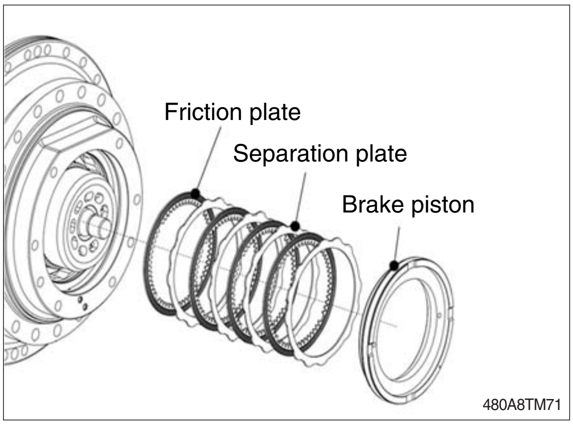
(22) Apply hydraulic fluid to the shoe.
Assemble the cylinder block assembly to drive shaft.
Apply hydraulic fluid to the cylinder block polishing surface.



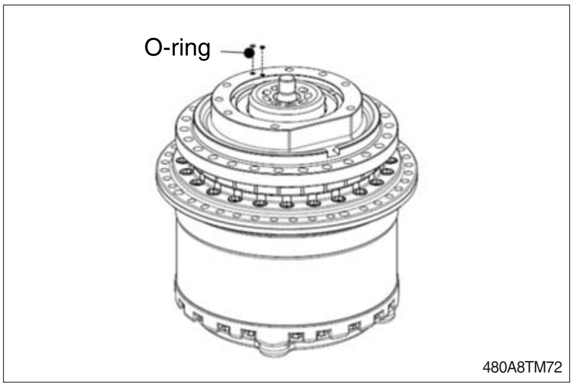
(23) Assemble the O-ring to the motor casing.



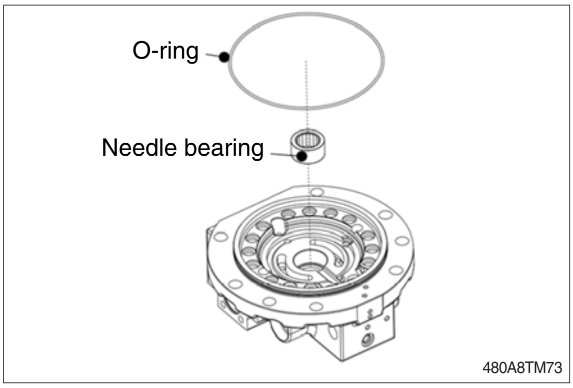
(24) Assemble the friction plate, separation plate to the motor casing in turn.
※ Be careful that the friction plate is in contact with the brake piston.
Assemble the brake piston to motor casing.
Check the brake piston is assembled completely to tap the the brake piston with a plastic hammer.
※ Quantity of friction plates and separation plates could be different of each model.



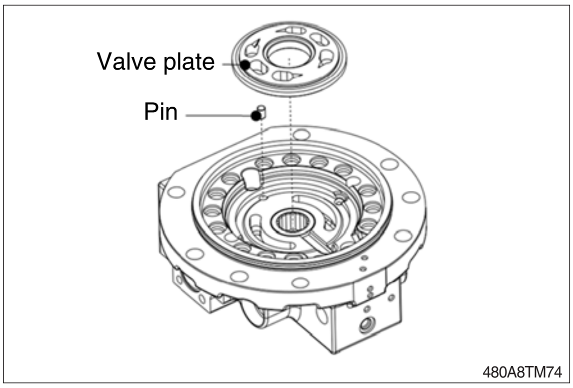
(25) Assemble the O-ring to the motor casing.



(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.

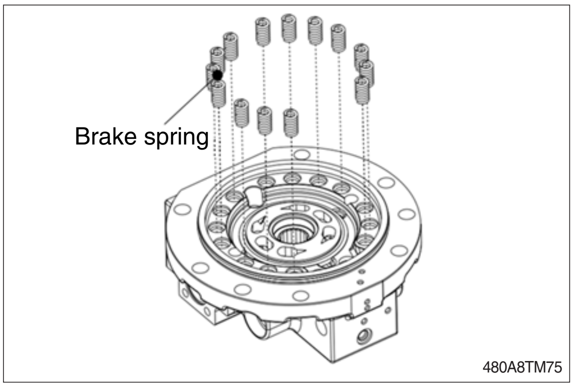


(27) Apply grease to the other side of the valve plate and assemble a valve plate and pin to valve casing.



(28) Apply grease to brake spring and assemble it to the valve casing.

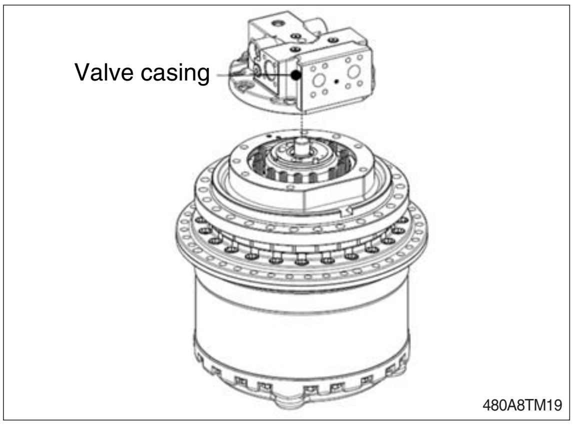
※ Quantity of brake springs could be differe-nt of each model.



(29) Assemble the valve casing to the motor casing.

※ Required tools : guide pin

※ Guide pin size : M20x2.5x45 (total length 150 mm or more)

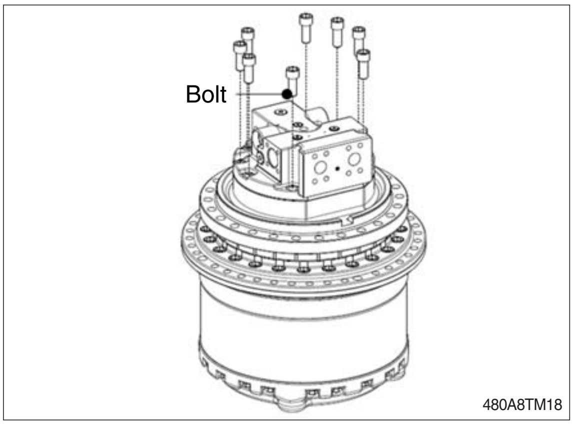


(30) Tighten each bolt evenly to assemble.

※ 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)

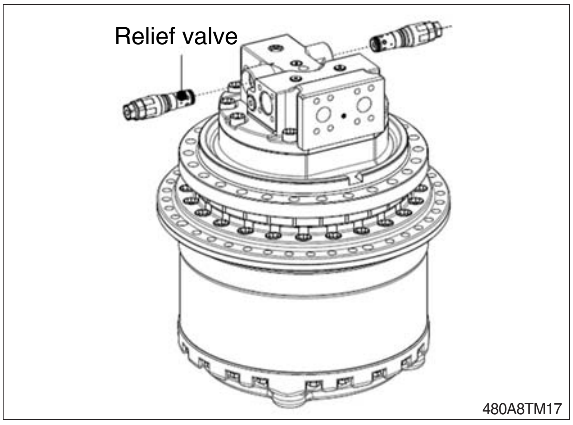


(31) Assemble the relief valve to valve casing.

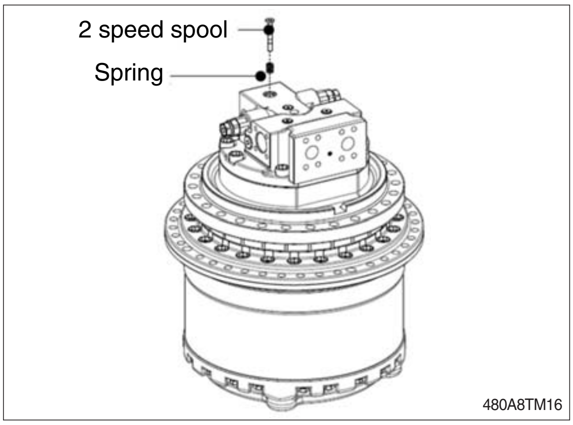
※ Required tools : torque wrench, hex socket 41 mm.

※ Tap size : M33x1.5

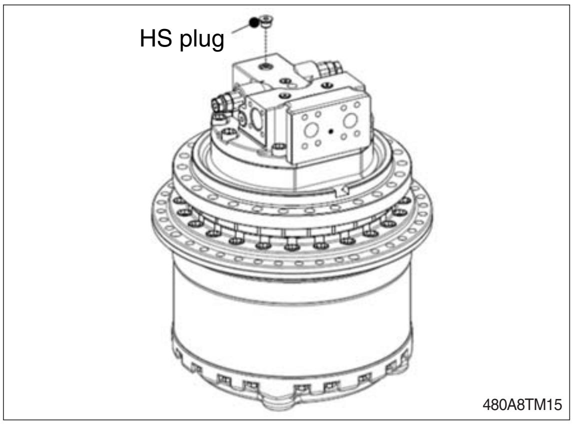
※ Tightening torque : 18.0±3.6 kgf·m
(130±26.0 lbf·ft)



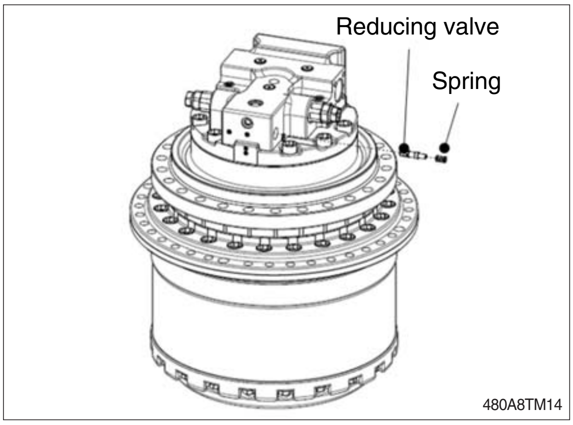
(32) Assemble the 2 speed spool, spring to valve casing.
※ Damage caution of 2 speed spool surface.



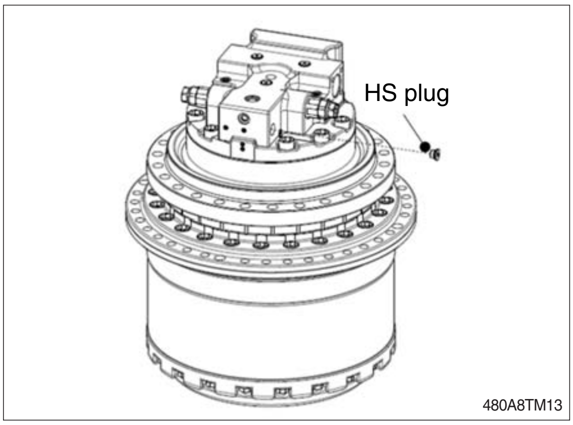
(33) Assemble the HS plug to valve casing.
※ Required tools : torque wrench, hex bit 10 mm.
※ Bolt size : G 1/2
※ Tightening torque : 10.0±2.0 kgf·m
(72.3±14.5 lbf·ft)



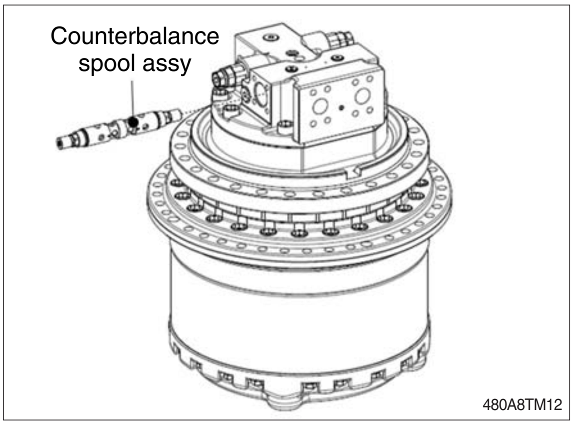
(34) Assemble the reducing valve and spring to valve casing.
※ Damage caution of reducing valve surface.



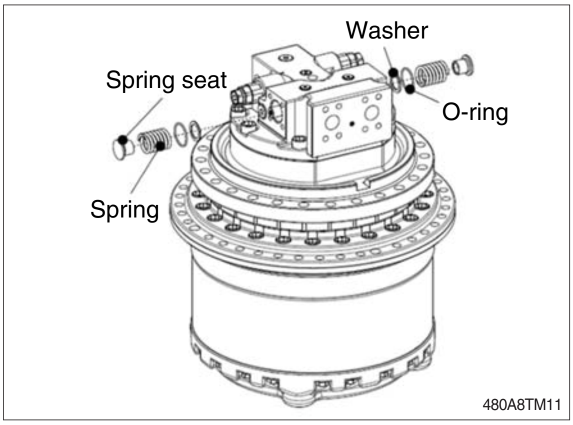
(35) Assemble the HS plug to valve casing.
※ Required tools : torque wrench, hex bit 8 mm.
※ Bolt size : G 3/8
※ Tightening torque : 6.0±1.5 kgf·m
(43.4±10.8 lbf·ft)



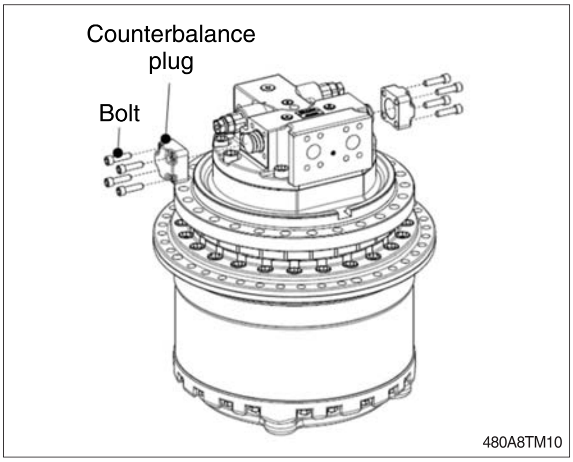
(36) Apply hydraulic fluid to counterbalance spool assy outer diameter and rotate the counterbalance spool assy slowly to assemble.
※ Damage caution of counterbalance spool surface.



(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

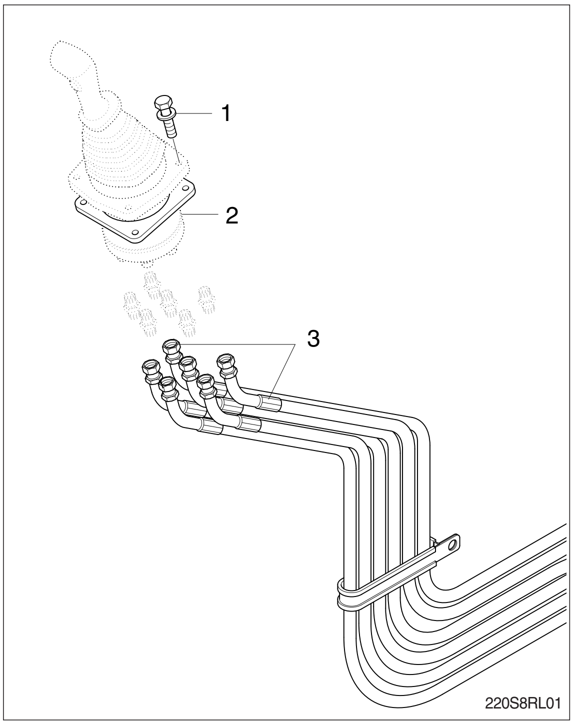
1) REMOVAL

(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.

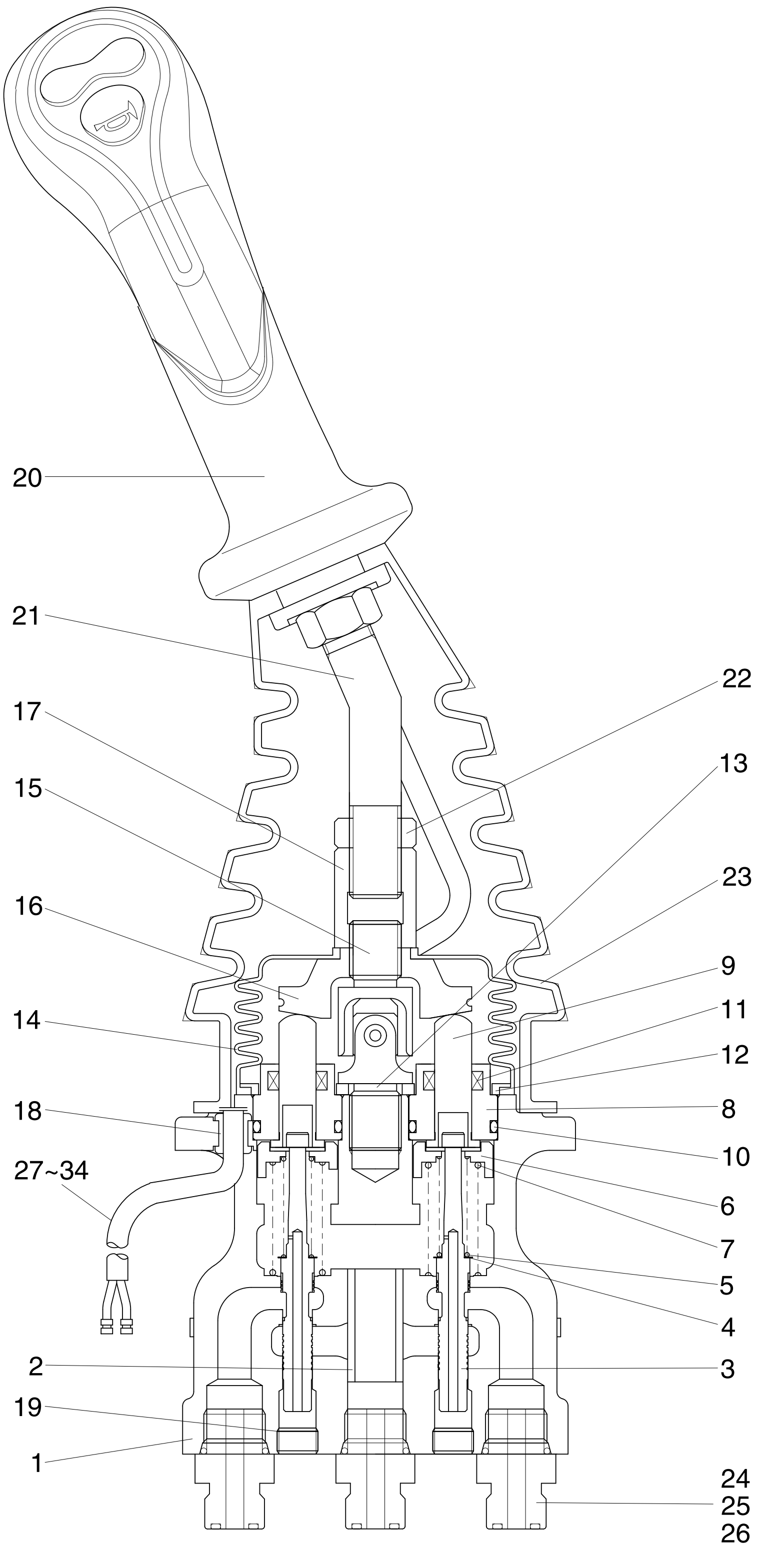
2) INSTALL

(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

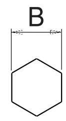


210S2RL06

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

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Allen wrench	6	
Spanne	22	
	27	
(+) Driver	Length 150	
(-) Driver	Width 4~5	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Joint	15	M14	3.8	27.5
Swash plate	16	M14	7.0±0.40	50.6±2.9
Adjusting nut	17	M14	7.0±0.40	50.6±2.9
Lock nut	22	M14	5.0±0.35	36.2±2.5

3) DISASSEMBLY

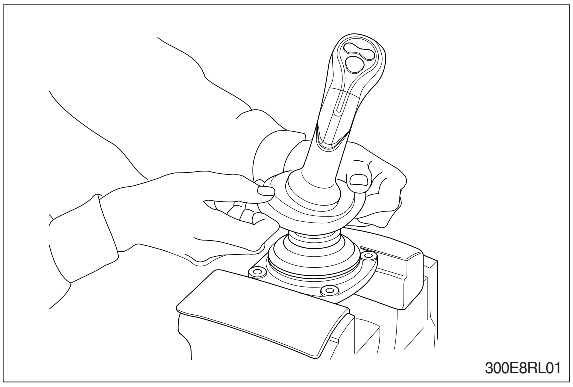
※ Procedures are based on the type M1.

(1) Clean pilot valve with kerosene.

※ Put blind plugs into all ports

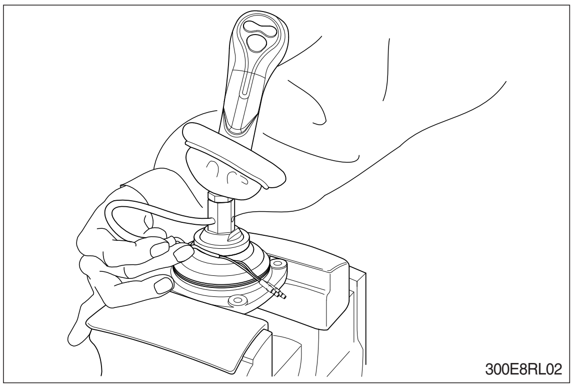
(2) Fix pilot valve in a vise with copper (or lead) sheets.

(3) Remove end of boot (23) from case (1) and take it out upwards.



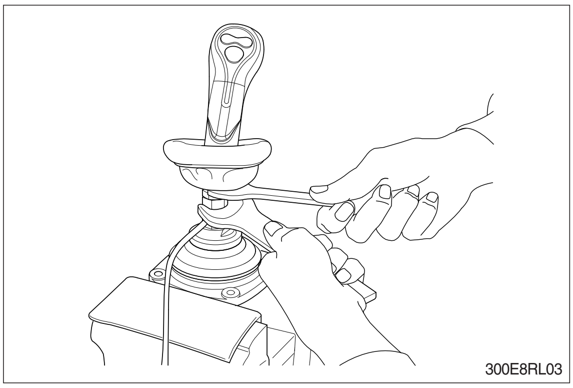
300E8RL01

※ For valve with switch, remove cord also through hole of casing.



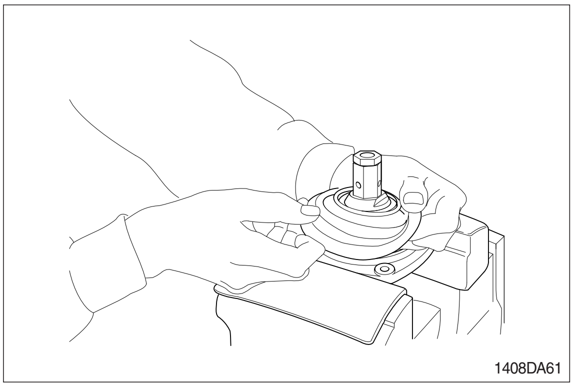
300E8RL02

(4) Loosen lock nut (22) and adjusting nut (17) with spanners on them respectively, and take out handle section as one body.



300E8RL03

(5) Remove the boot (14).



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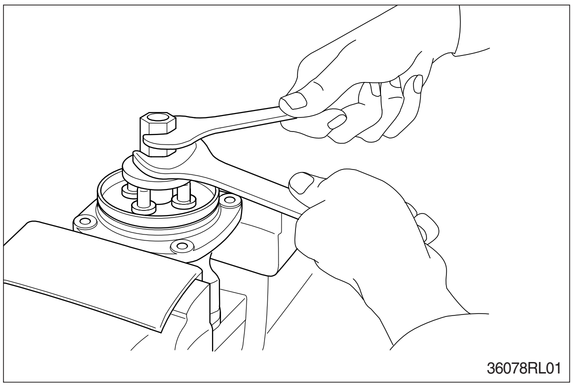
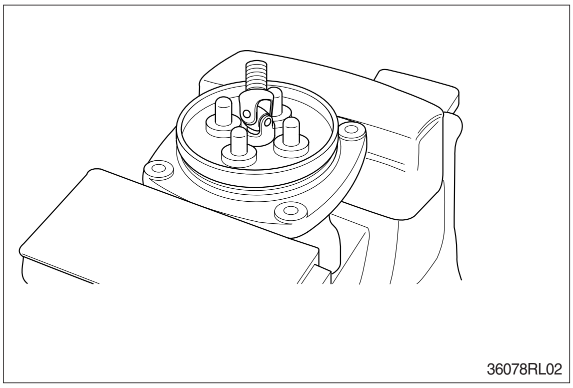
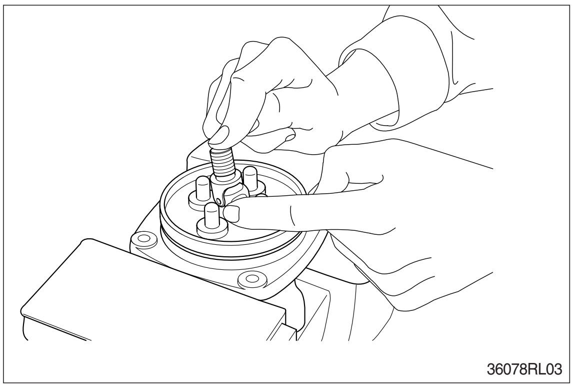
(6) Loosen adjusting nut (17) and swash plate (16) with spanners on them respectively, and remove them.

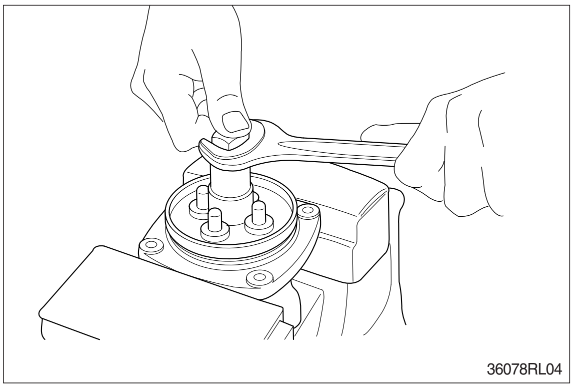

36078RL01


36078RL02

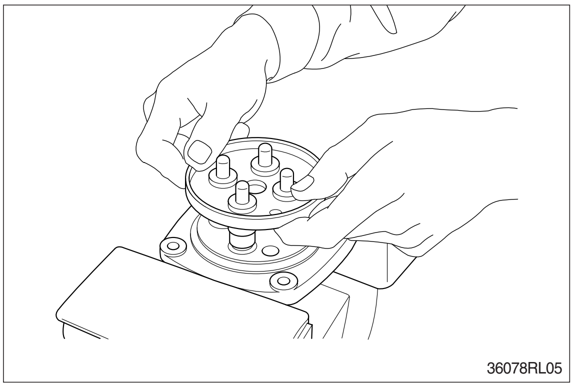
(7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).

※ When return spring (7) is strong in force, plate (12), plug (8) and push rod (9) will come up on loosening joint.
Pay attention to this.


36078RL03


36078RL04

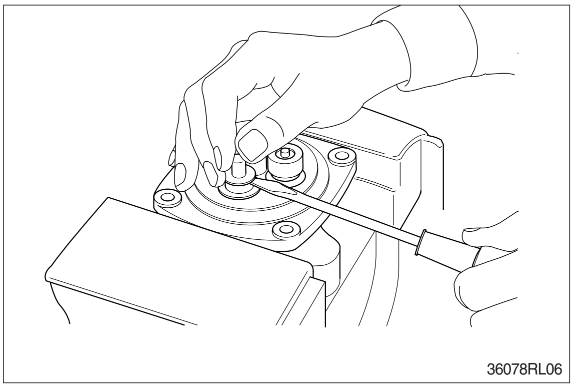
(8) Remove plate (12).



(9) When return spring (7) is weak in force, plug (8) stays in casing because of sliding resistance of O-ring.

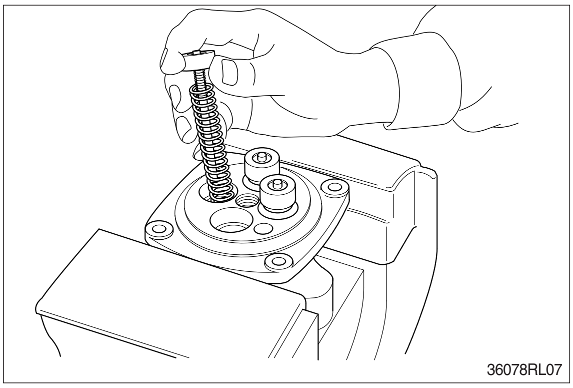
※ Take it out with minus screwdriver.
Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.

※ 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.

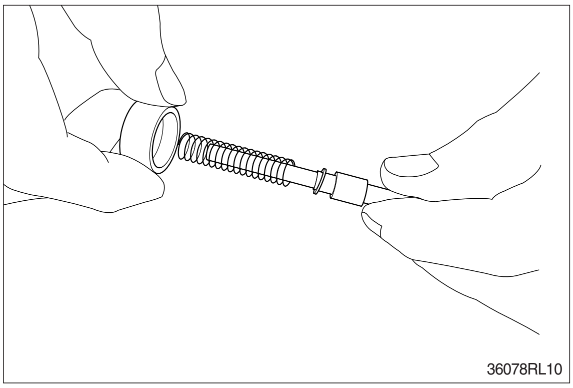


(11) Separate spool (3), spring seat (6), spring (5) and shim (4) individually.

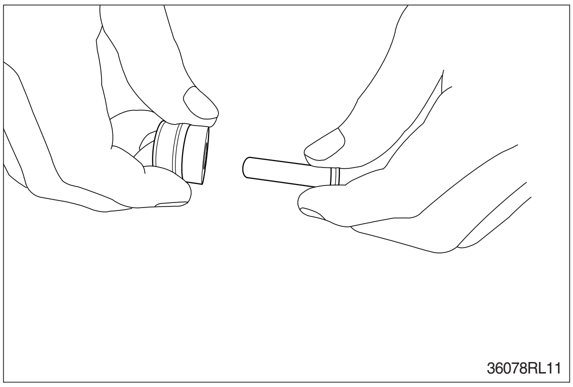
※ Pay attention not to damage spool surface.

※ Record original position of spring seat (6).

※ Until being assembled, they should be handled as one subassembly group.

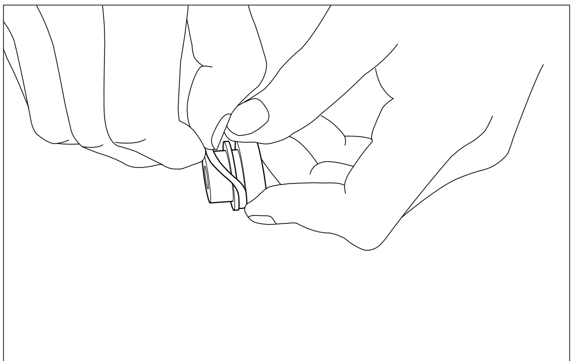


(12) Take push rod (9) out of plug (8).

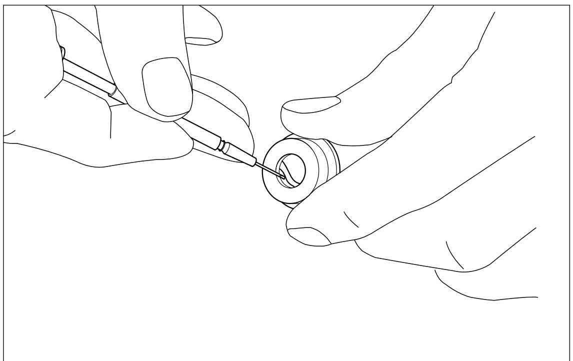


36078RL11

(13) Remove O-ring (10) and seal (11) from plug (8).
Use small minus screwdriver or so on to remove this seal.

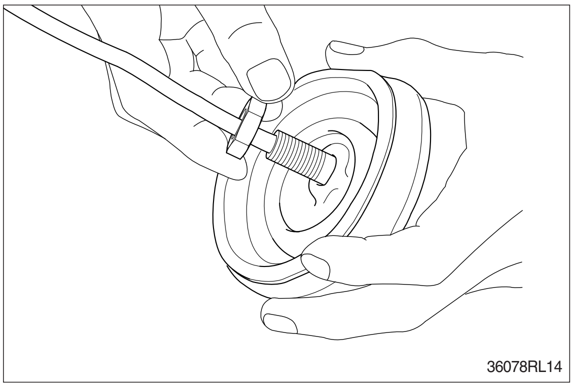


36078RL12

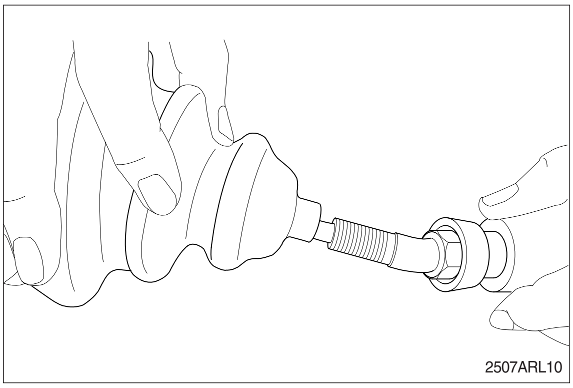


36078RL13

(14) Remove lock nut (22) and then boot (23).



36078RL14



2507ARL10

(15) Cleaning of parts

① Put all parts in rough cleaning vessel filled with kerosene and clean them (rough cleaning).

※ If dirty part is cleaned with kerosene just after putting it in vessel, it may be damaged. Leave it in kerosene for a while to loosen dust and dirty oil.

※ If this kerosene is polluted, parts will be damaged and functions of reassembled valve will be degraded.
Therefore, control cleanliness of kerosene fully.

② Put parts in final cleaning vessel filled with kerosene, turning it slowly to clean them even to their insides (finish cleaning).

※ Do not dry parts with compressed air, since they will be damaged and/or rusted by dust and moisture in air.

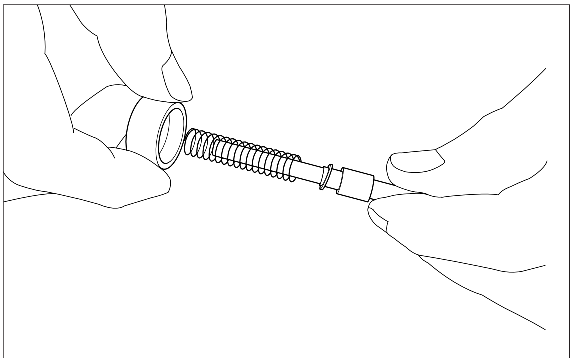
(16) Rust prevention of parts

Apply rust-preventives to all parts.

※ If left as they after being cleaned, they will be rusted and will not display their functions fully after being reassembled.

4) ASSEMBLY

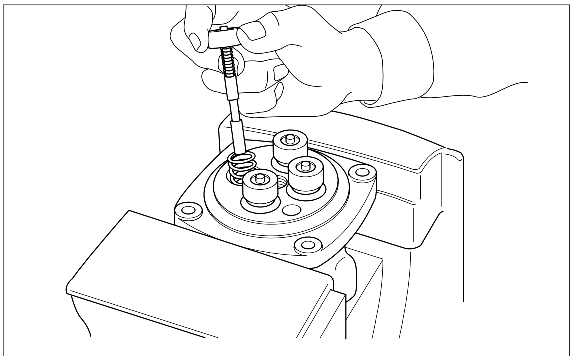
(1) Put shim (4), springs (5) and spring seat (6) onto spool (3) in this order.



36078RL16

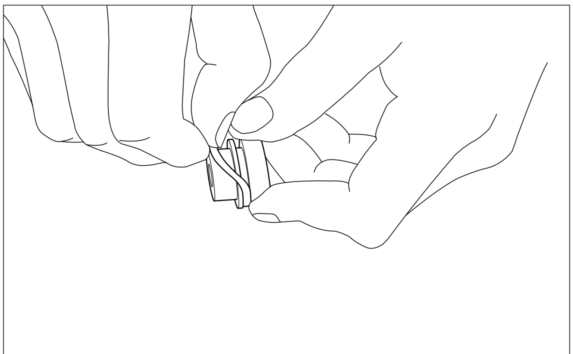
(2) Assemble spring (7) into casing (1). Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.



36078RL18

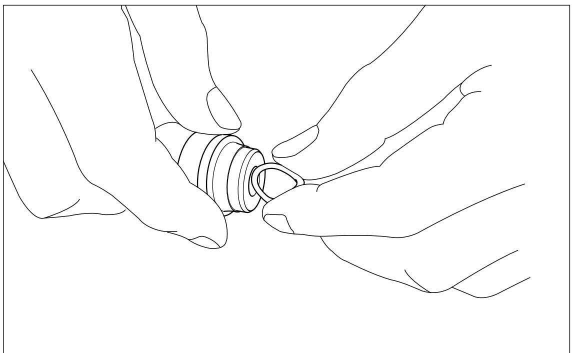
(3) Assemble O-ring (10) onto plug (8).



36078RL19

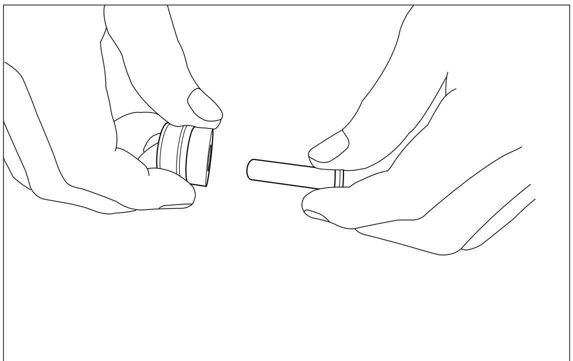
(4) Assemble seal (11) to plug (8).

※ Assemble seal in such lip direction as shown below.



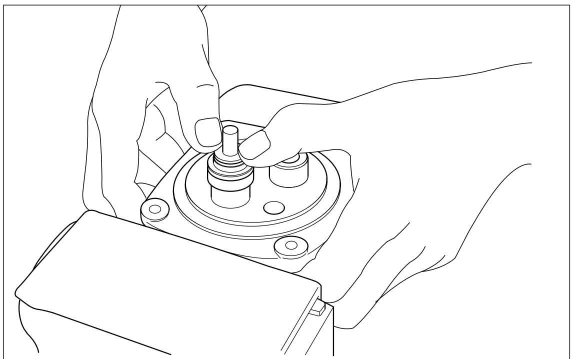
36078RL20

(5) Assemble push rod (9) to plug (8).
※ Apply working oil on push-rod surface.



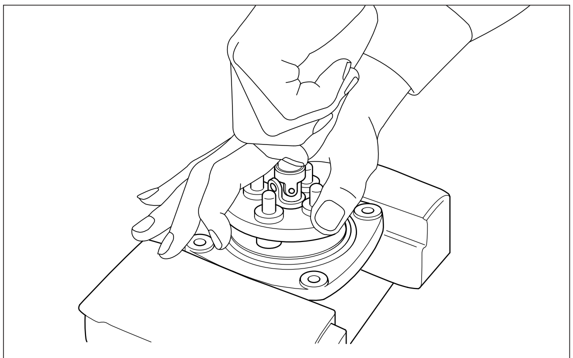
36078RL21

(6) Assemble plug subassembly to casing.
※ When return spring is weak in force, subassembly stops due to resistance of O-ring.



36078RL22

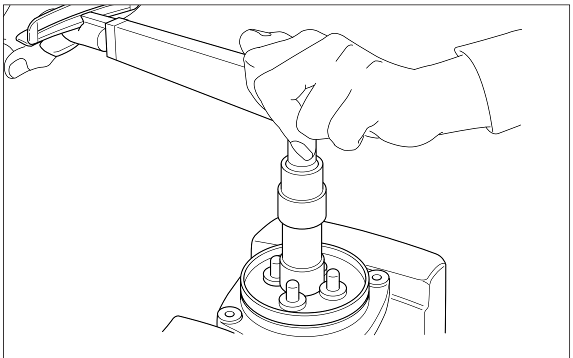
(7) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (12), and tighten joint (15) temporarily.



36078RL23

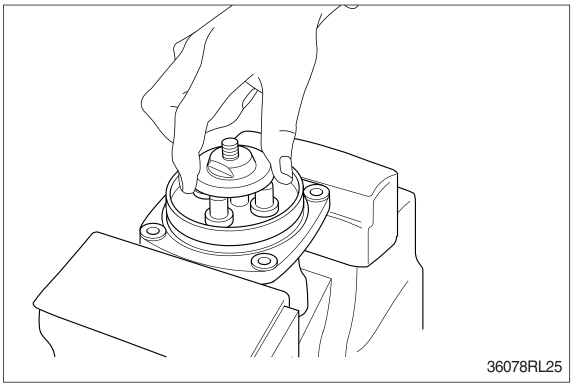
(8) Fit plate (12).

(9) Tighten joint (15) with the specified torque to casing, utilizing jig.

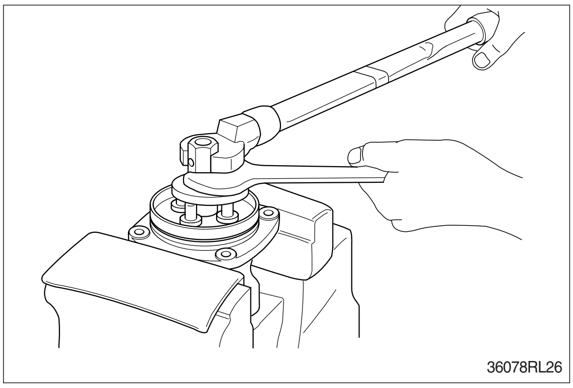


36078RL24

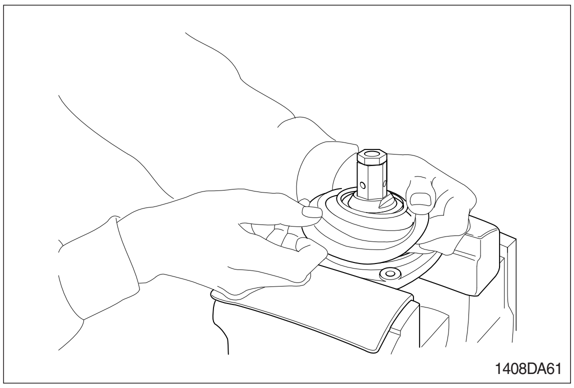
(10) Assemble swash plate (16) to joint (15).
※ Screw it to position that it contacts with 4 push rods evenly.
※ Do not screw it over.



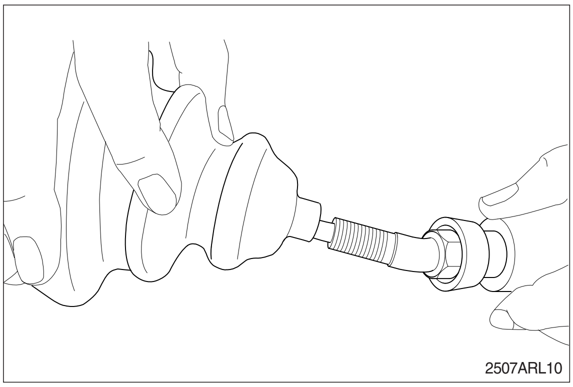
(11) Assemble adjusting nut (17), apply spanner to width across flat of plate (16) to fix it, and tighten adjusting nut to the specified torque.
※ During tightening, do not change position of disk.

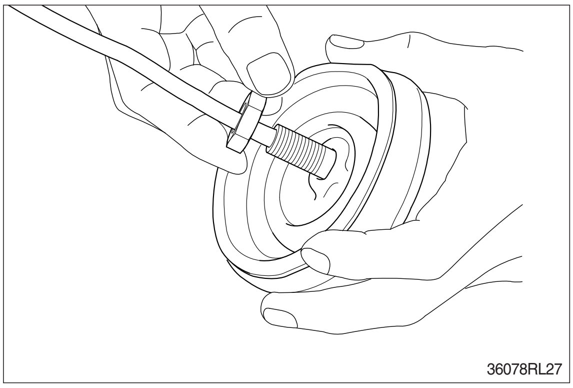


(12) Fit boot (14) to plate.

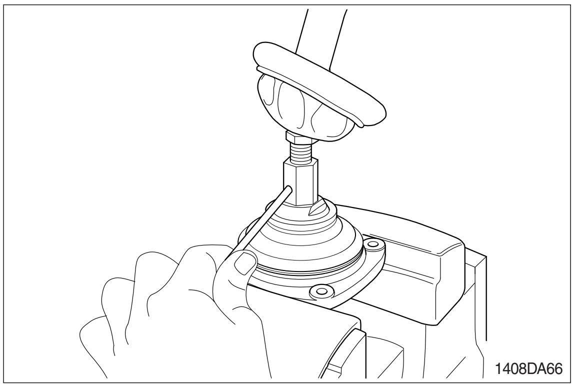


(13) Fit boot (23) and lock nut (22), and handle subassembly is assembled completely.



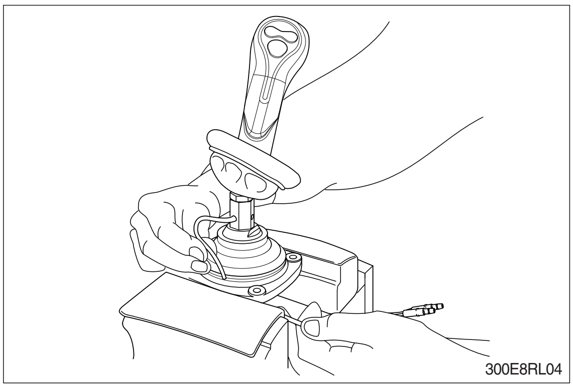


(14) Pull out cord and tube through adjusting nut hole provided in direction 60 °to 120 °from casing hole.

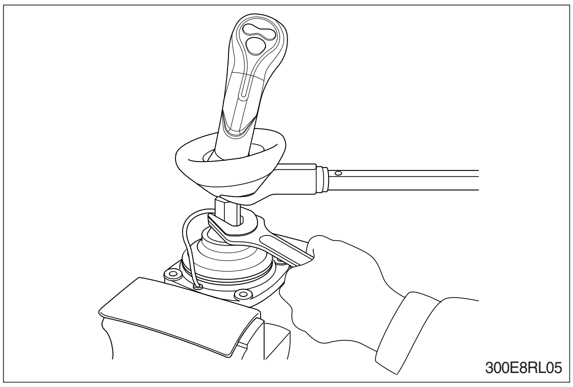


(15) Assemble bushing (18) to plate and pass cord and tube through it.

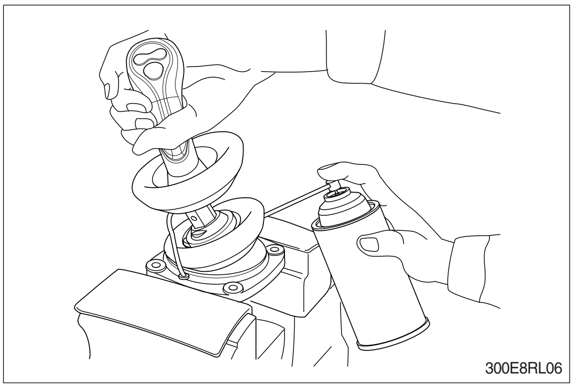
※ Provide margin necessary to operation.



(16) Determine handle direction, tighten lock nut (22) to specified torque to fix handle.

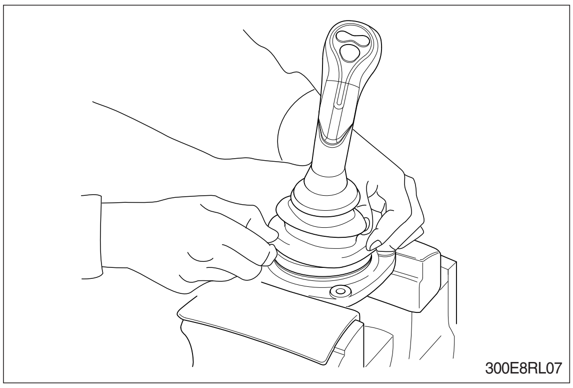

300E8RL05

(17) Apply grease to rotating section of joint and contacting faces of disk and push rod.


300E8RL06

(18) Assemble lower end of bellows to casing.

(19) Inject volatile rust-preventives through all ports and then put blind plugs in ports.


300E8RL07

GROUP 8 TURNING JOINT

1. REMOVAL AND INSTALL

1) REMOVAL

(1) Lower the work equipment to the ground and stop the engine.

(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(4) Disconnect all hoses.

(5) Sling the turning joint assembly (1) and remove the mounting bolt (2).
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.

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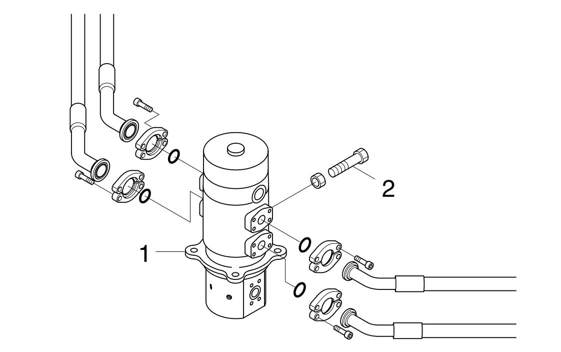
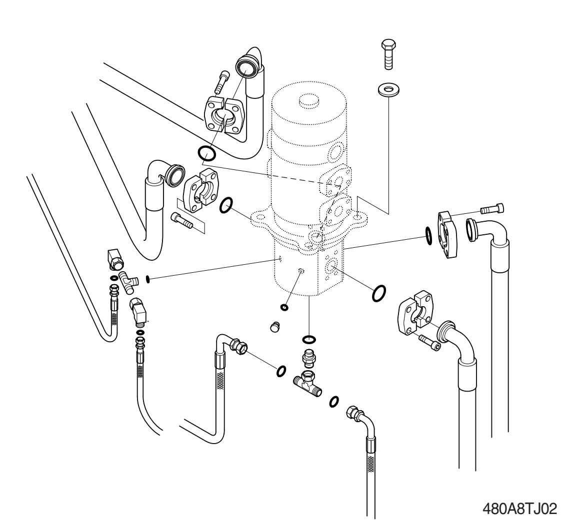


480A8TJ01



480A8TJ02

2) INSTALL

(1) Carry out installation in the reverse order to removal.

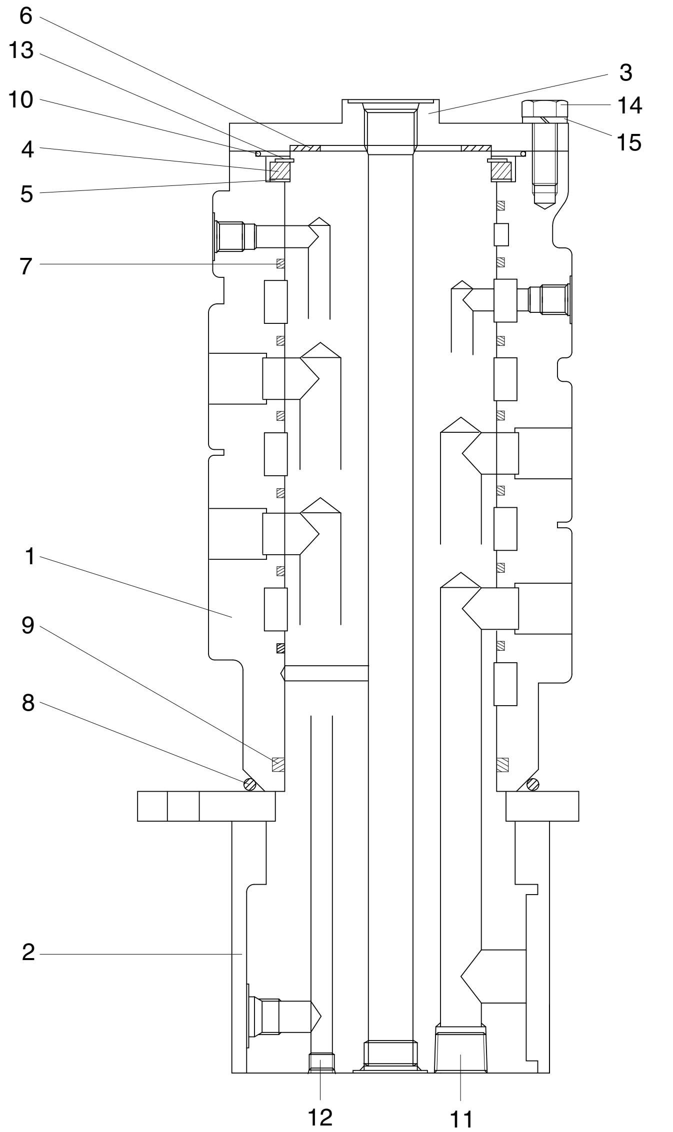
※ Take care of turning joint direction.

※ 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



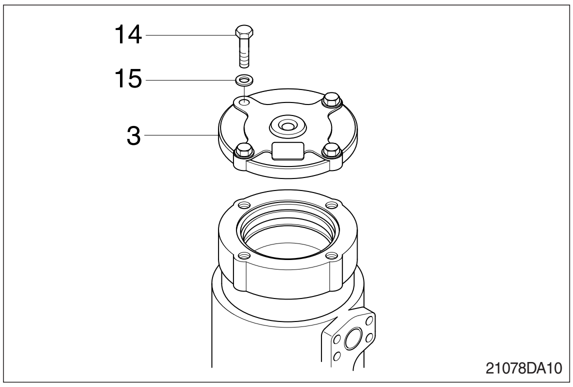
480A8TJ10

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

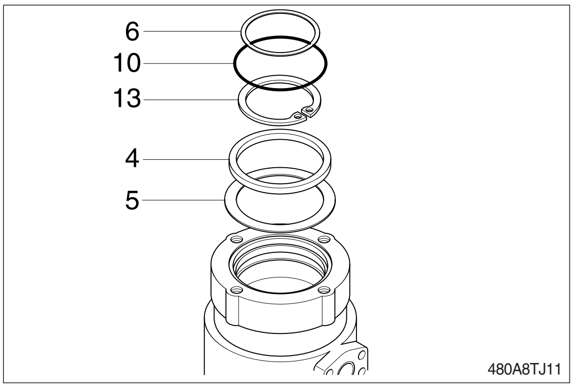
※ Before the disassembly, clean the turning joint.

(1) Remove bolts (14), washer (15) and cover (3).



(2) Remove shim (6) and O-ring (10).

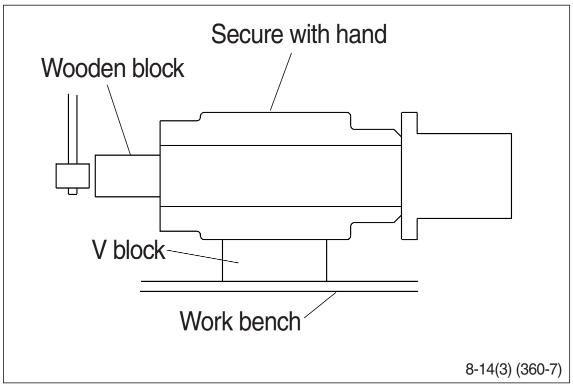
(3) Remove retainer ring (13), spacer (4) and shim (5).



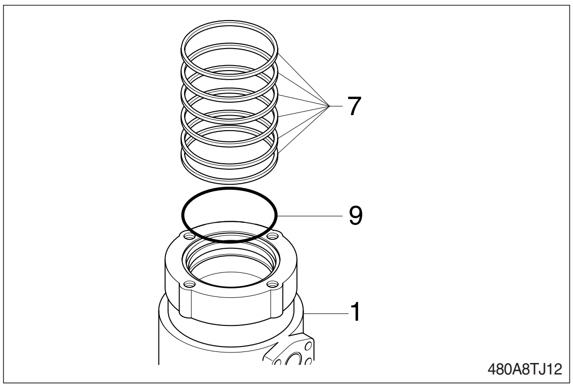
(4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

※ 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).

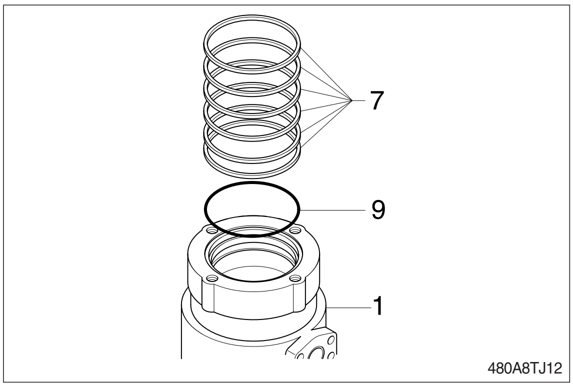


3) ASSEMBLY

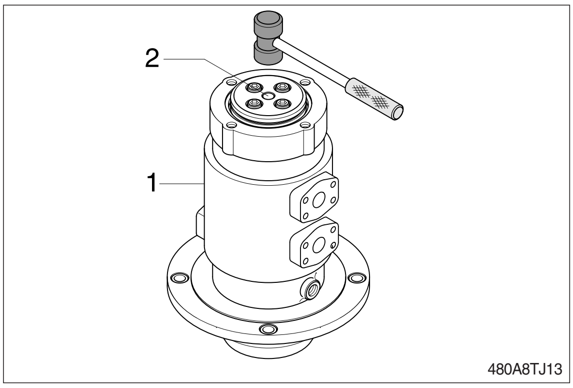
※ Clean all parts.
※ As a general rule, replace oil seals and O-ring.
※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(1) Fix seven slipper seal (7) and O-ring (9) to hub (1).

(2) Fit O-ring (8) to shaft (2).



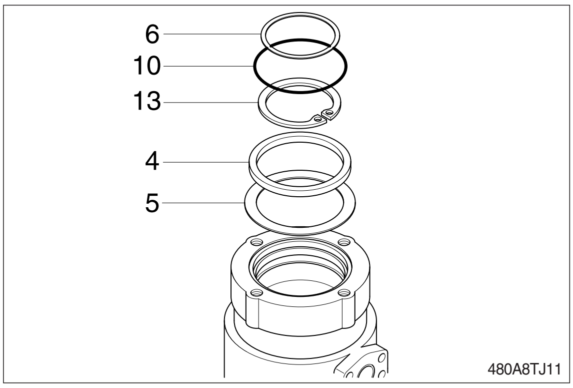
(3) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.



(4) Fit shim (5), spacer (4) and retainer ring (13) to shaft (2).

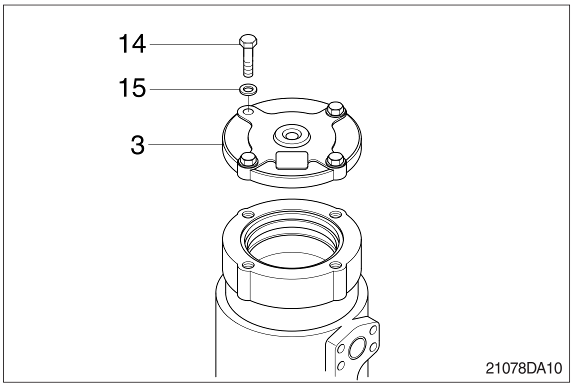
(5) Fit O-ring (10) to hub (1).

(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)



GROUP 9 BOOM, ARM AND BUCKET CYLINDER

1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

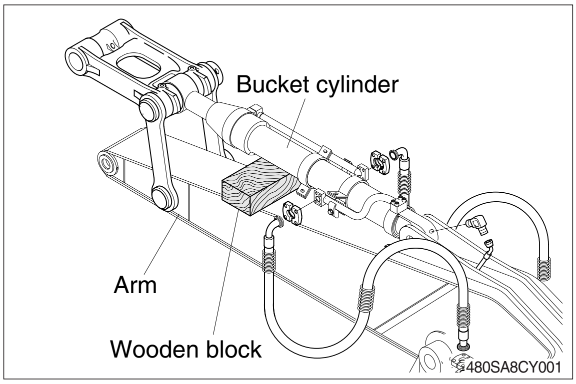
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank.

※ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

13031GE18

① Set block between bucket cylinder and arm.

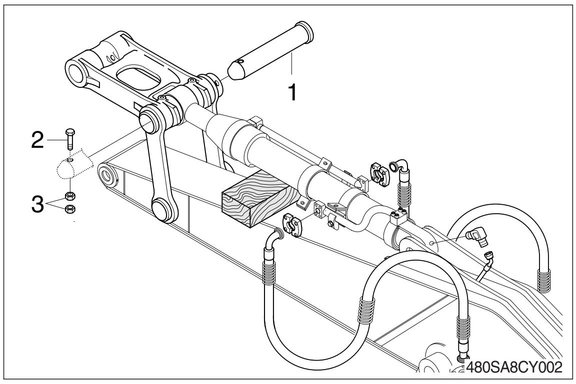


480SA8CY001

② Remove bolt (2), nut (3) and pull out pin (1).

※ Tie the rod with wire to prevent it from coming out.

· Tightening torque : 100 ± 15 kgf·m (723 ± 108 lbf·ft)



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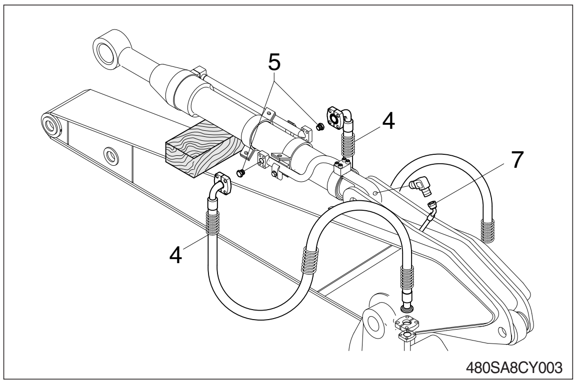
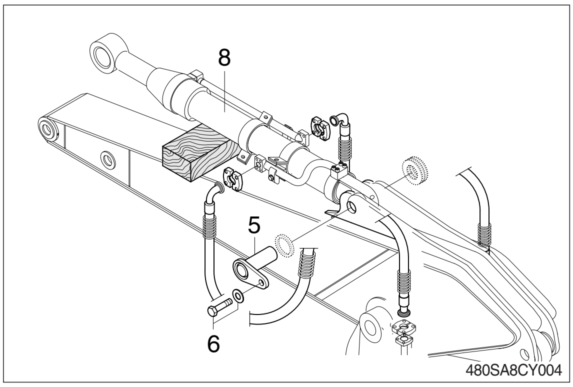
③ Disconnect bucket cylinder hoses (4), grease line hose (7) and put plugs (5) on cylinder pipe.



480SA8CY003

④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).
 · Tightening torque : 57.9 ± 8.7 kgf · m
 (419 ± 62.9 lbf · ft)

⑤ Remove bucket cylinder assembly (8).
 · Weight : 366 kg (807 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.

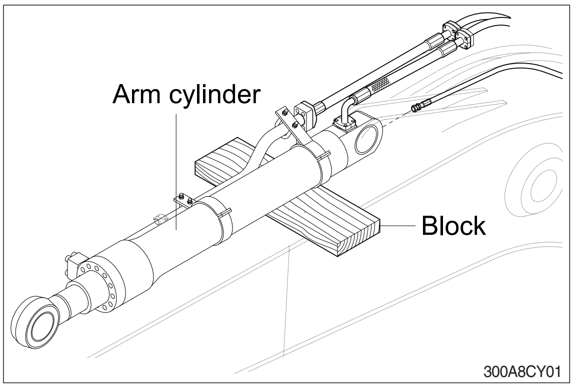
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

⚠ 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.

13031GE18



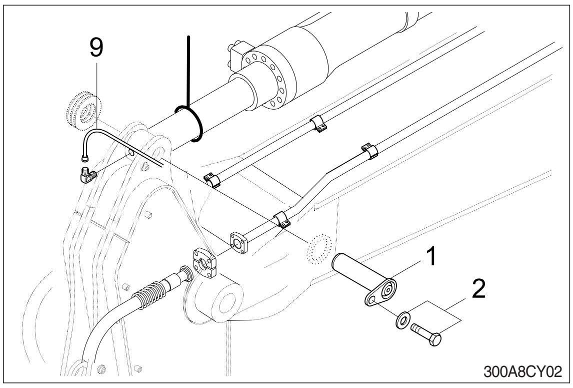
300A8CY01

② Disconnect grease line hose (9).

③ Remove bolt (2) and pull out pin (1).

※ Tie the rod with wire to prevent it from coming out.

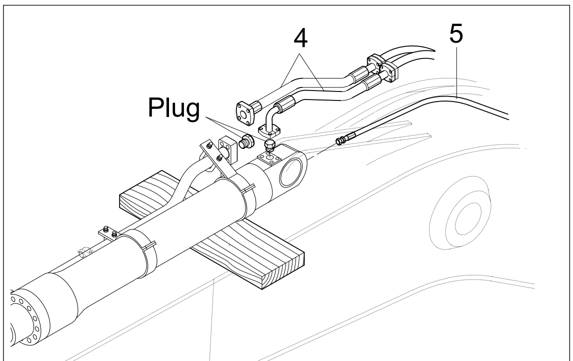
· Tightening torque : 57.9 ± 8.7 kgf·m (419 ± 62.9 lbf·ft)



300A8CY02

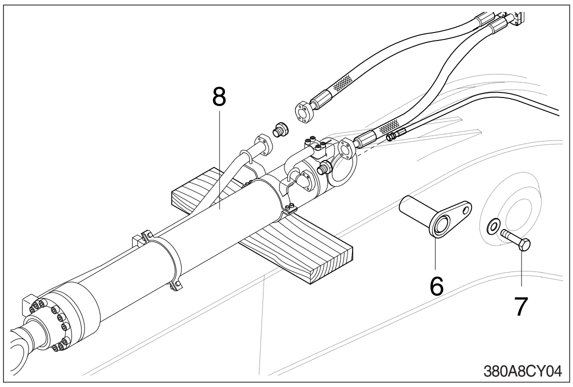
④ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

⑤ Disconnect greasing pipings (5).



300A8CY03

⑥ Sling arm assembly (8) and remove bolt (7) then pull out pin (6).
 · Tightening torque : 57.9 ± 8.7 kgf · m
 (419 ± 62.9 lbf · ft)
⑦ Remove arm cylinder assembly (8).
 · Weight : 591 kg (1303 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.

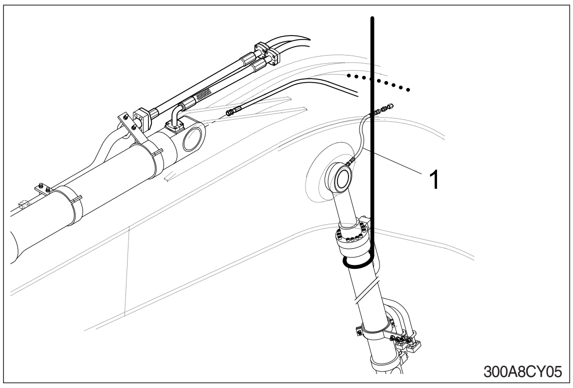
⚠ **Loosen the breather slowly to release the pressure inside the hydraulic tank.**

※ 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.

13031GE18

① Disconnect greasing hoses (1).

② Sling boom cylinder assembly.

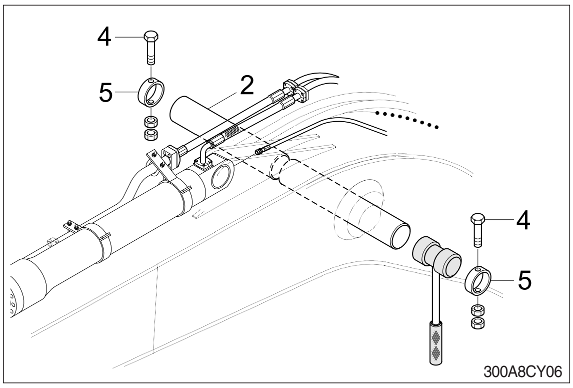


300A8CY05

③ Remove bolt (4), pin stopper (5) and pull out pin (2).

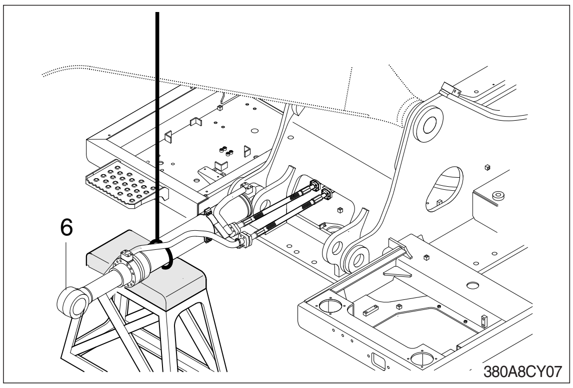
※ Tie the rod with wire to prevent it from coming out.

· Tightening torque : 100 ± 15 kgf·m (723 ± 108 lbf·ft)



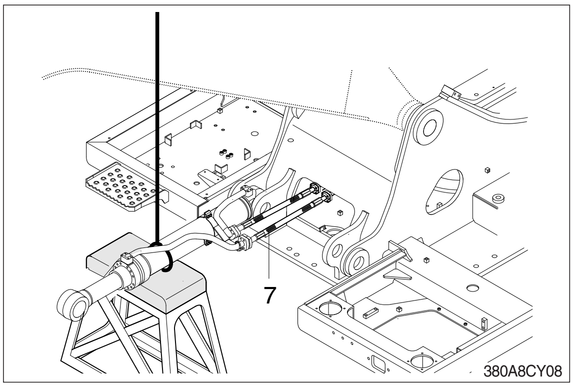
300A8CY06

④ Lower the boom cylinder assembly (6) on a stand.



380A8CY07

⑤ Disconnect boom cylinder hoses (7) and put plugs on cylinder pipe.

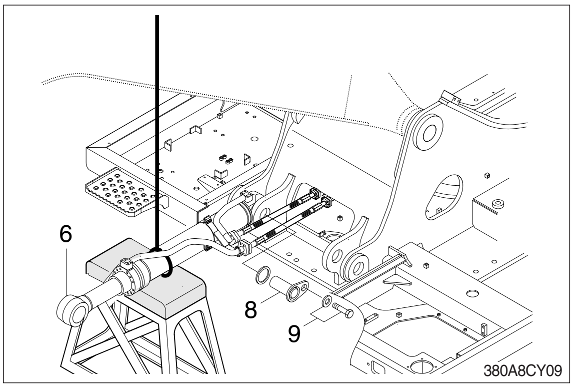


⑥ Remove bolt (9) and pull out pin (8).

· Tightening torque : 57.9 ± 8.7 kgf·m (419 ± 62.9 lbf·ft)

⑦ Remove boom cylinder assembly (6).

· Weight : 571 kg (1260 lb)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

※ Bleed the air from the boom cylinder.

※ Conformed the hydraulic oil level and check the hydraulic oil leak or not.

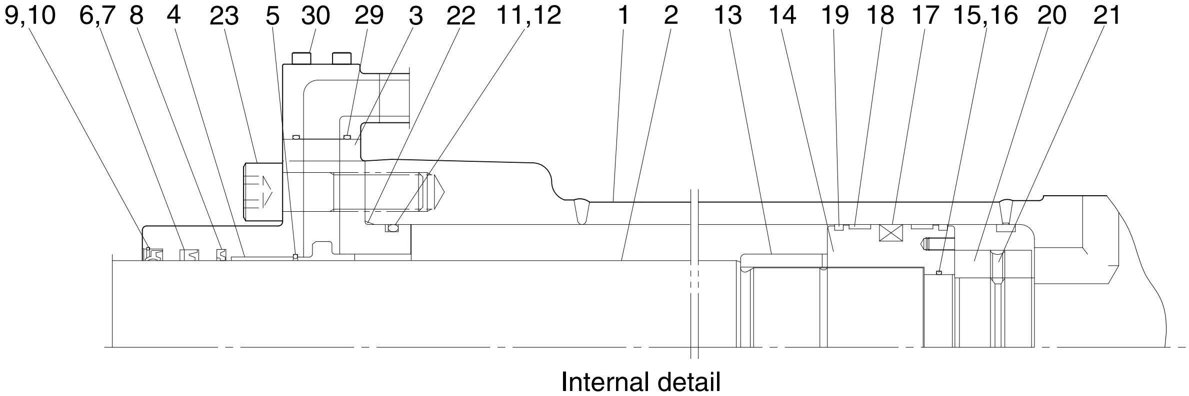
2. DISASSEMBLY AND ASSEMBLY

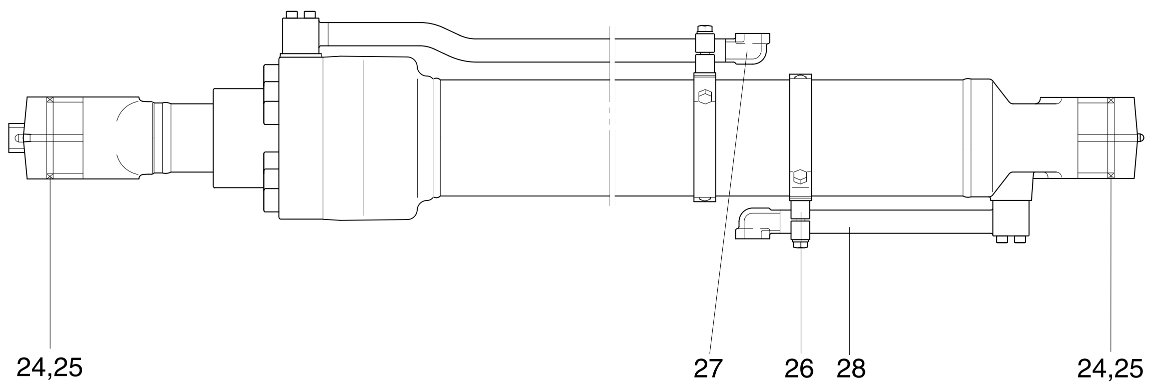
1) STRUCTURE

(1) Bucket cylinder (CHANGZHOU, type 1)

HX500LT3 : 2.55 m, 2.90 m, 3.38 m, 4.00 m arm

HX520LT3 : 6.00 m arm



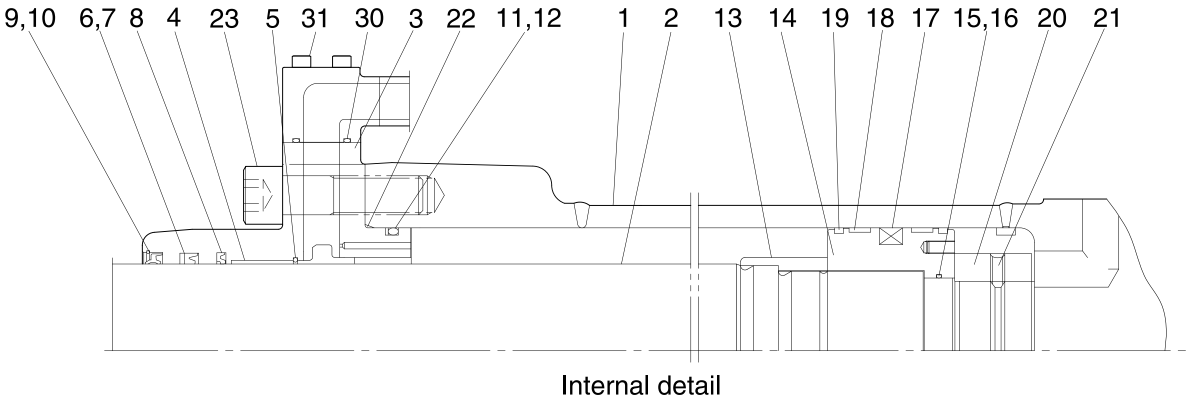


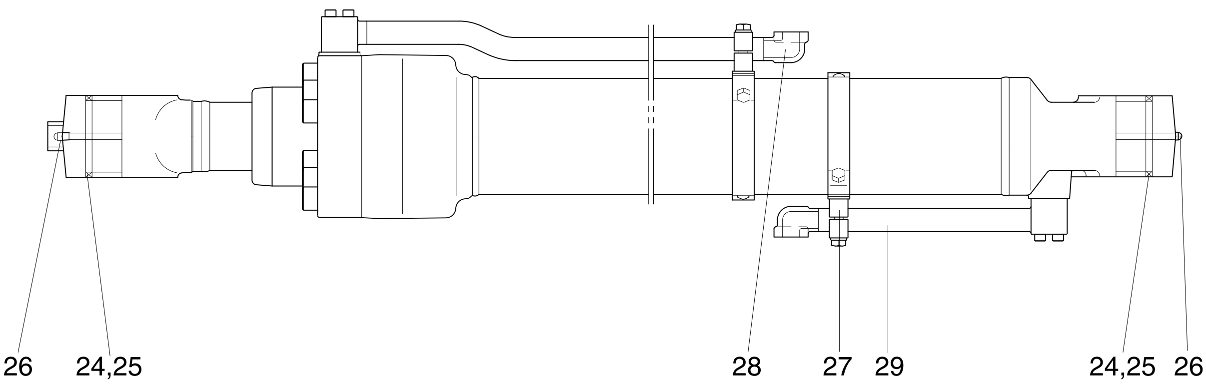
1	Tube assembly	11	O-ring	21	Hex socket headless set screw
2	Rod assembly	12	Back up ring	22	O-ring
3	Gland	13	Cushion ring	23	Hexagon socket head bolt
4	DD2 bushing	14	Piston	24	Dimple bushing
5	Snap ring	15	O-ring	25	Dust seal
6	Rod seal	16	Back up ring	26	Band assembly
7	Back up ring	17	Piston seal	27	Pipe assembly-R
8	Buffer ring	18	Wear ring	28	Pipe assembly-B
9	Dust wiper	19	Dust ring	29	O-ring
10	Snap ring	20	Lock nut	30	Hexagon socket head bolt

(2) Bucket cylinder (CHANGZHOU, type 2)

HX500LT3 : 6.00 ｍ arm

HX520LT3 : 2.55 ｍ, 2.90 m, 3.38 ｍ, 4.00 ｍ arm



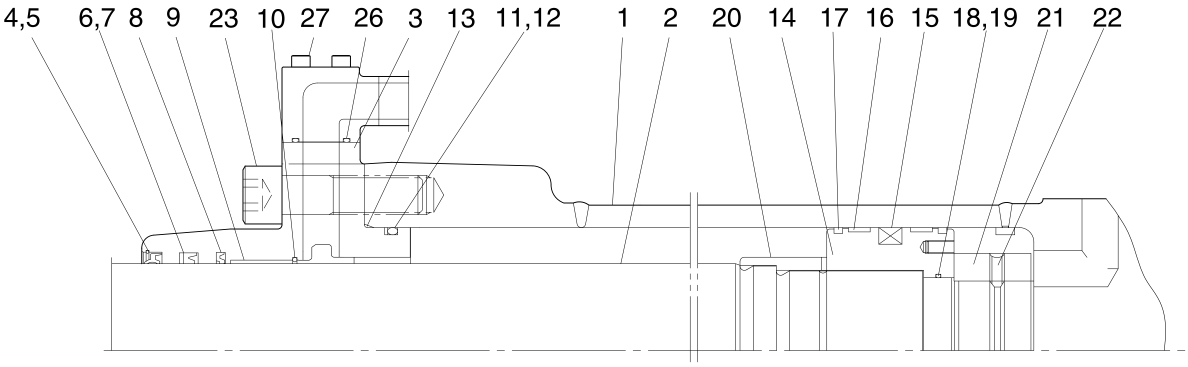


1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Dimple bushing
3	Gland	14	Piston	25	Dust seal
4	DU bushing	15	O-ring	26	Grease nipple
5	Snap ring	16	Back up ring	27	Band assembly
6	Rod seal	17	Piston seal	28	Pipe assembly-R
7	Back up ring	18	Wear ring	29	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	Hex socket headless set screw		
11	O-ring	22	O-ring		

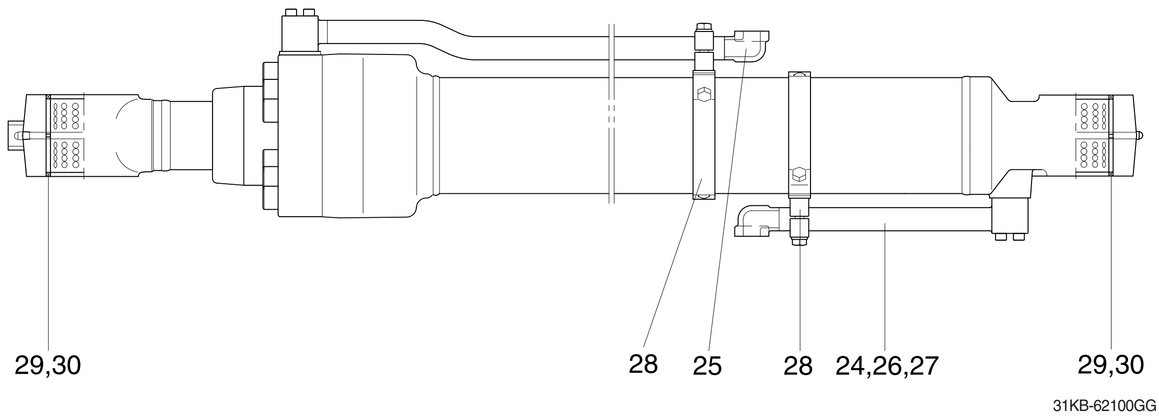
Bucket cylinder (SHPAC, type 1)

HX500LT3 : 2.55 m, 2.90 m, 3.38 m, 4.00 m arm

HX520LT3 : 6.00 m arm

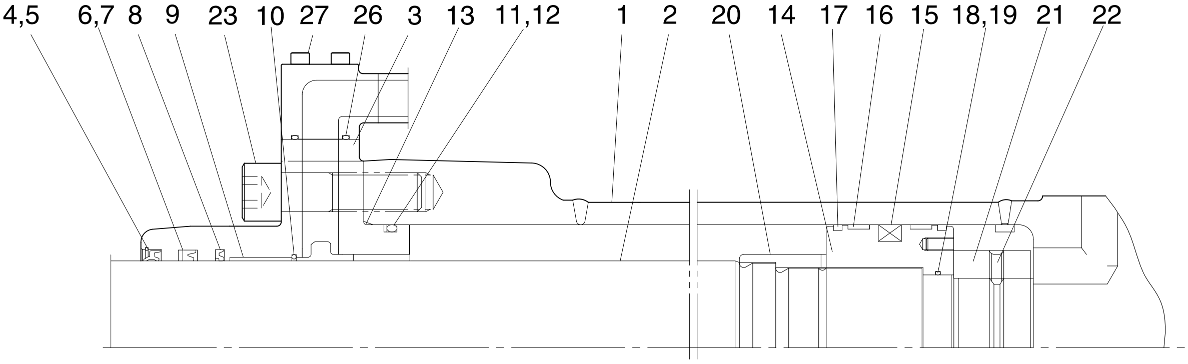


Internal detail

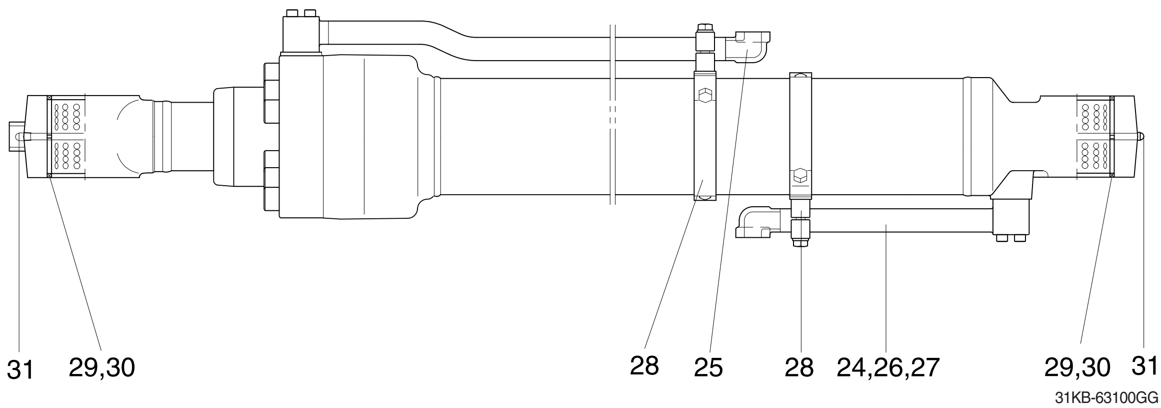


1	Tube assembly	11	O-ring	21	Lock nut
2	Rod assembly	12	Back up ring	22	Hex socket headless set screw
3	Gland	13	O-ring	23	Hexagon socket head bolt
4	Dust wiper	14	Cushion ring	24	Pipe assembly-B
5	Retaining ring	15	Piston	25	Pipe assembly-R
6	Rod seal	16	Piston seal	26	O-ring
7	Back up ring	17	Wear ring	27	Hexagon socket head bolt
8	Buffer ring	18	Dust ring	28	Band assembly
9	Dry bearing	19	O-ring	29	Dimple bushing
10	Retaining ring	20	Back up ring	30	Dust seal

Bucket cylinder (SHPAC, type 2)
HX500LT3 : 6.00 m arm
HX520LT3 : 2.55 m, 2.90 m, 3.38 m, 4.00 m arm

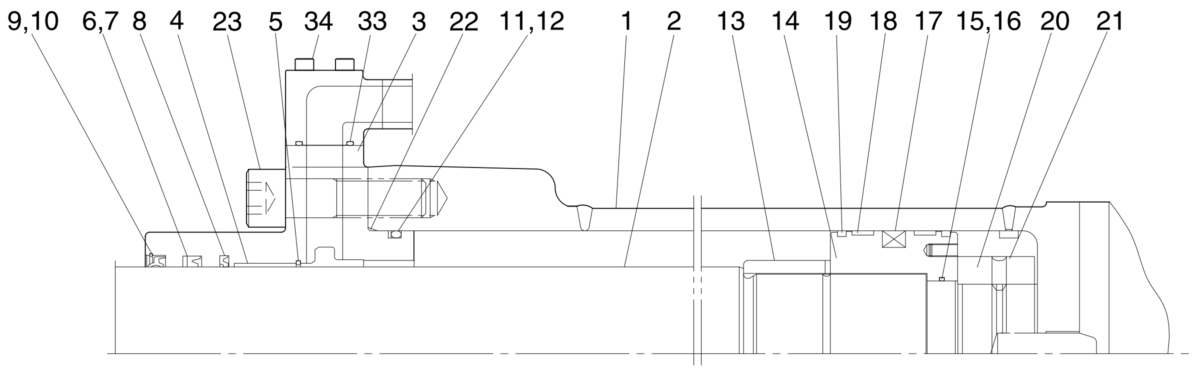


Internal detail

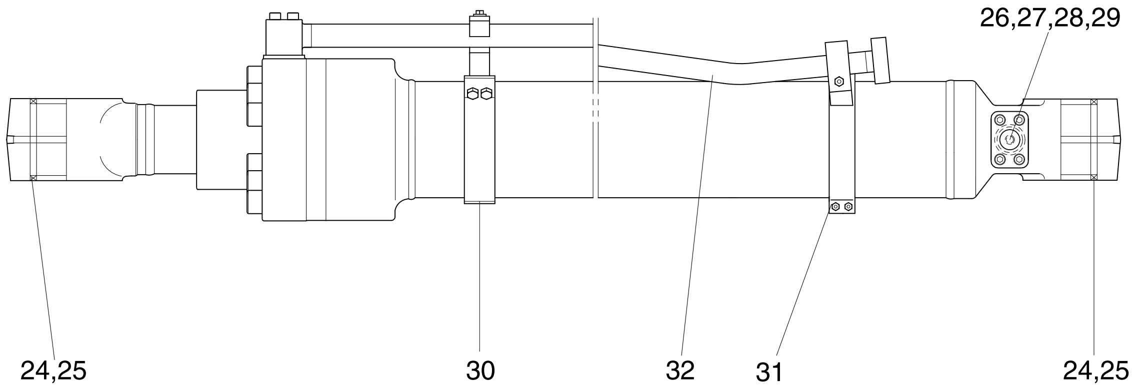


1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	O-ring	24	Pipe assembly-B
3	Gland	14	Piston	25	Pipe assembly-R
4	Dust wiper	15	Piston seal	26	O-ring
5	Retaining ring	16	Wear ring	27	Hexagon socket head bolt
6	Rod seal	17	Dust ring	28	Band assembly
7	Back up ring	18	O-ring	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	Hex socket headless set screw		

(2) Arm cylinder (CHANZHOU)



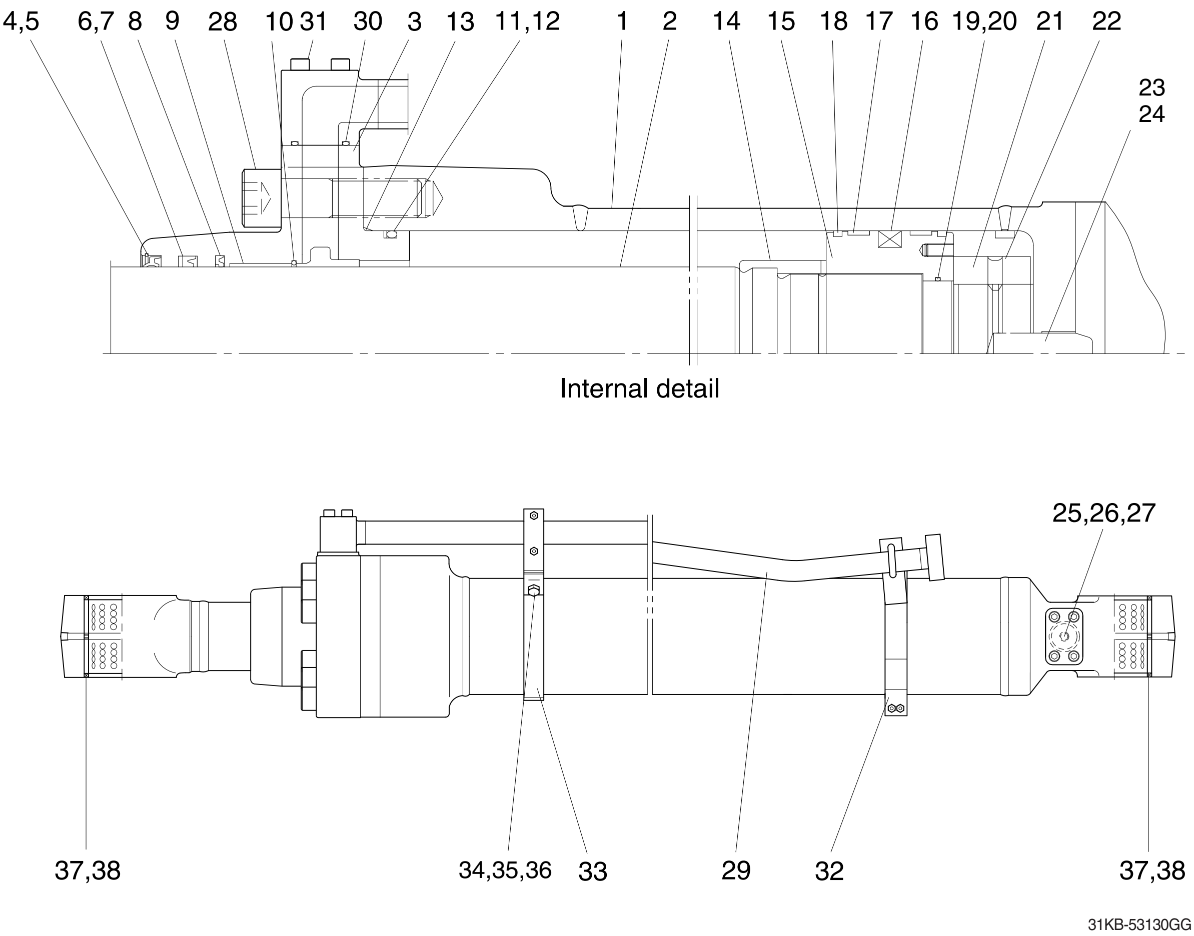
Internal detail



HCA0-50130GG

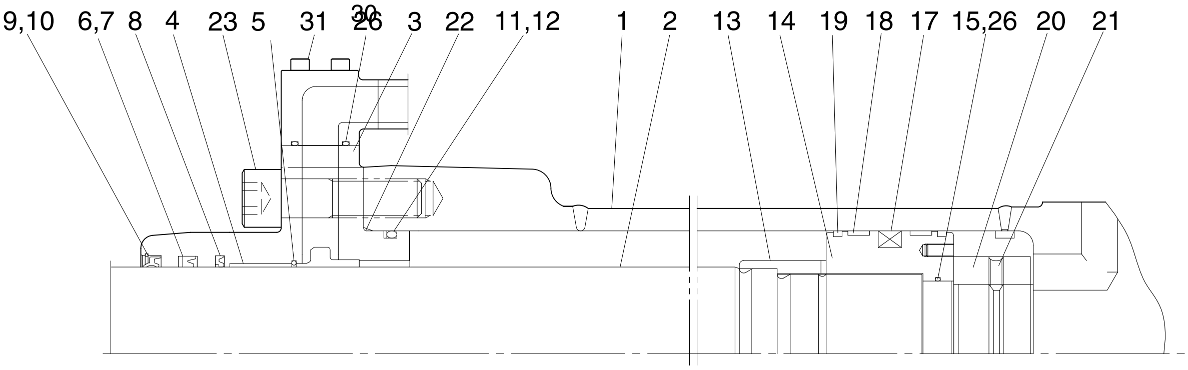
1	Tube assembly	13	Cushion ring	25	Dust seal
2	Rod assembly	14	Piston	26	Check valve
3	Gland	15	O-ring	27	Coil spring
4	DD2 bushing	16	Back up ring	28	O-ring
5	Snap ring	17	Piston seal	29	Plug
6	Rod seal	18	Wear ring	30	Band assembly-R
7	Back up ring	19	Dust ring	31	Band assembly-B
8	Buffer ring	20	Lock nut	32	Pipe assembly-R
9	Dust wiper	21	Hex socket headless set screw	33	O-ring
10	Snap ring	22	O-ring	34	Hexagon socket head bolt
11	O-ring	23	Hexagon socket head bolt		
12	Back up ring	24	Dimple bushing		

Arm cylinder (SHPAC)

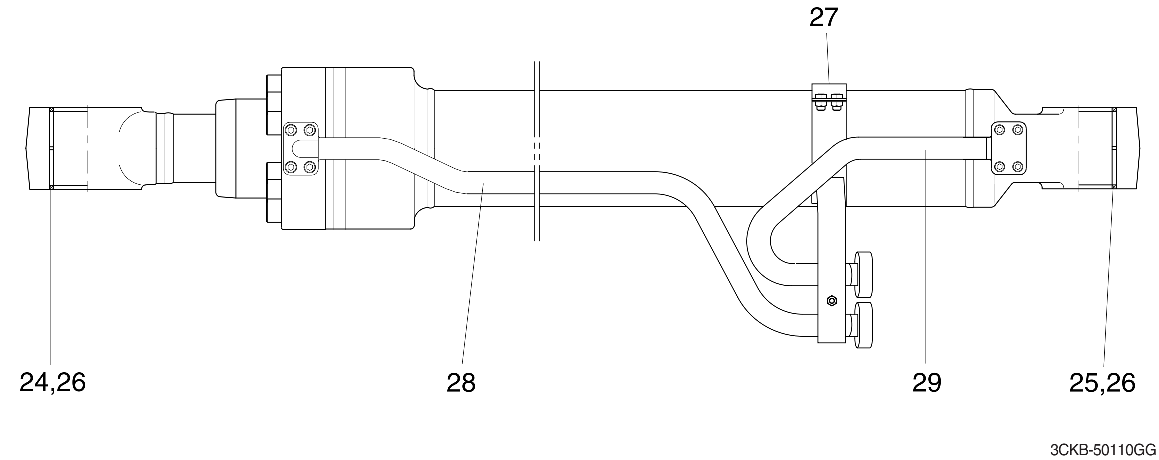


1	Tube assembly	14	Cushion ring	27	Hexagon plug
2	Rod assembly	15	Piston	28	Hexagon socket head bolt
3	Gland	16	Piston seal	29	Pipe assembly-R
4	Dust wiper	17	Wear ring	30	O-ring
5	Retaining ring	18	Dust ring	31	Hexagon socket head bolt
6	Rod seal	19	O-ring	32	Band assembly-B
7	Back up ring	20	Back up ring	33	Band assembly-R
8	Buffer ring	21	Lock nut	34	U-bolt
9	Dry bearing	22	Hex socket headless set screw	35	Hexagon nut
10	Retaining ring	23	Cushion plunger	36	Spring washer
11	O-ring	24	Stop ring	37	Dimple bushing
12	Back up ring	25	Check valve	38	Dust seal
13	O-ring	26	Coil spring		

(3) Boom cylinder (CHANZHOU)

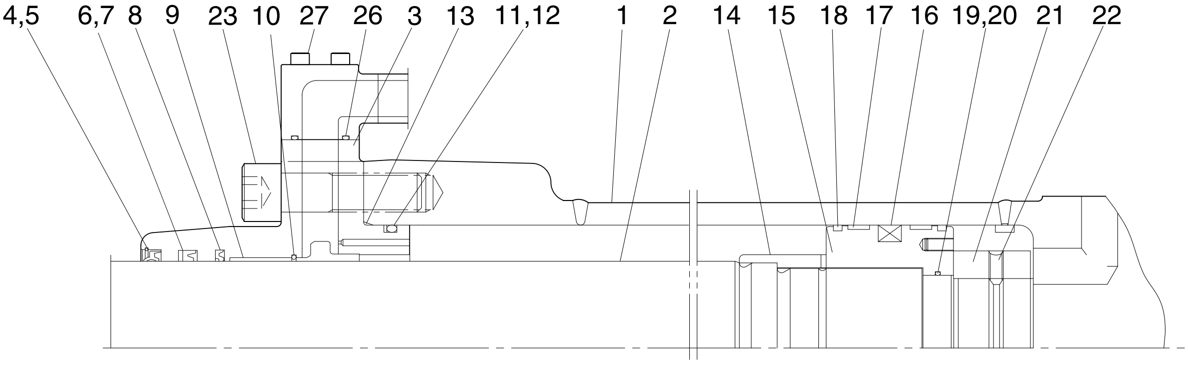


Internal detail

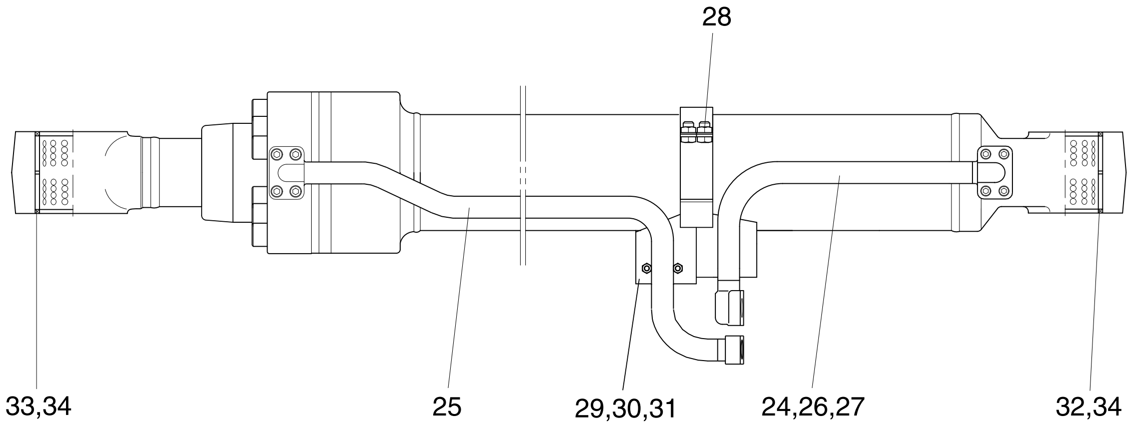


1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Dimple bushing
3	Gland	14	Piston	25	Dimple bushing
4	DU bushing	15	O-ring	26	Dust seal
5	Snap ring	16	Back up ring	27	Band assembly
6	Rod seal	17	Piston seal	28	Pipe assembly-R
7	Back up ring	18	Wear ring	29	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	Hex socket headless set screw		
11	O-ring	22	O-ring		

Boom cylinder (SHPAC)



Internal detail

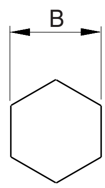


31KB-53110GG

1	Tube assembly
2	Rod assembly
3	Gland
4	Dust wiper
5	Retaining ring
6	Rod seal
7	Back up ring
8	Buffer ring
9	Dry bearing
10	Retaining ring
11	O-ring
12	Back up ring
13	O-ring
14	Cushion ring
15	Piston
16	Piston seal
17	Wear ring
18	Dust ring
19	O-ring
20	Back up ring
21	Lock nut
22	Hex socket headless set screw
23	Hexagon socket head bolt
24	Pipe assembly-B
25	Pipe assembly-R
26	O-ring
27	Hexagon socket head bolt
28	Band assembly
29	U-bolt
30	Spring washer
31	Hexagon nut
32	Pin bushing
33	Dimple bushing
34	Dust seal

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	Torque lbf · ft
Socket head bolt	Bucket cylinder	23★1★2	M22	63.0±6.0	456±45.6
		23★1★3	M22	63.0±6.0	456±45.6
		23★4	M22	69.4±6.9	502±49.9
		23★5	M22	69.4±6.9	502±49.9
		30★2	M12	9.4±1.0	68.0±7.2
		31★3	M12	9.4±1.0	68.0±7.2
		27★4	M12	11.3±1.1	81.7±8.0
		27★5	M12	11.3±1.1	81.7±8.0
	Boom cylinder	23★1★2	M22	63.0±6.0	456±45.6
		23★1★4	M22	69.4±6.9	502±49.9
		31★2	M12	9.4±1.0	68.0±7.2
		27★4	M12	11.3±1.1	81.7±8.0
	Arm cylinder	23★1★2	M24	79.0±8.0	456±43.4
		28★1★4	M24	90.2±9.0	652±65.1
		34★2	M12	9.4±1.0	68.0±7.2
		31★4	M12	11.3±1.1	81.7±8.0

★1 : Apply loctite #243 on the thread of bolt.
★2 : CHANGZHOU, type 1
★3 : CHANGZHOU, type 2
★4 : SHPAC, type 1
★5 : SHPAC, type 2

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Lock nut	Bucket cylinder	20★2 20★3 21★4 21★5	- - M85 M90	150±15.0 150±15.0 150±15.0 150±15.0	1085±108 1085±108 1085±108 1085±108
	Boom cylinder	20★2 21★4	- M85	100±10.0 100±10.0	723±72.3 723±72.3
	Arm cylinder	20★2 21★4	- M100	150±15.0 150±15.0	1085±108 1085±108
Piston	Bucket cylinder	14★2 14★3 15★4 14★5	- - M110 M105	200±20.0 200±20.0 200±20.0 200±20.0	1447±145 1447±145 1447±145 1447±145
	Boom cylinder	14★2 15★4	- M105	150±15.0 150±15.0	1085±108 1085±108
	Arm cylinder	14★2 15★4	- M120	200±20.0 200±20.0	1447±145 1447±145
Set screw	Bucket cylinder	21★2 21★3 22★4 22★5	M10 M10 M10 M10	5.4±0.5 5.4±0.5 2.5±0.3 2.5±0.25	39.1±3.6 39.1±3.6 18.1±2.2 18.1±1.8
	Boom cylinder	21★2 22★4	M10 M10	5.4±0.5 2.5±0.3	39.1±3.6 18.1±2.2
	Arm cylinder	21★2 22★4	M10 M10	5.4±0.5 2.5±0.25	39.1±3.6 18.1±1.8

★1 : Apply loctite #243 on the thread of bolt.
★2 : CHANGZHOU, type 1
★3 : CHANGZHOU, type 2
★4 : SHPAC, type 1
★5 : SHPAC, type 2

3) DISASSEMBLY

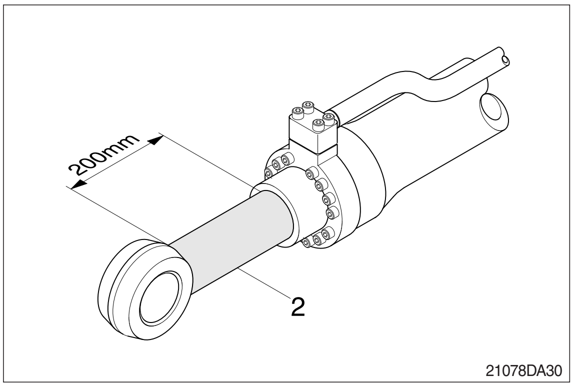
(1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder. (CHANGZHOU, type 1)

① Hold the clevis section of the tube in a vise.

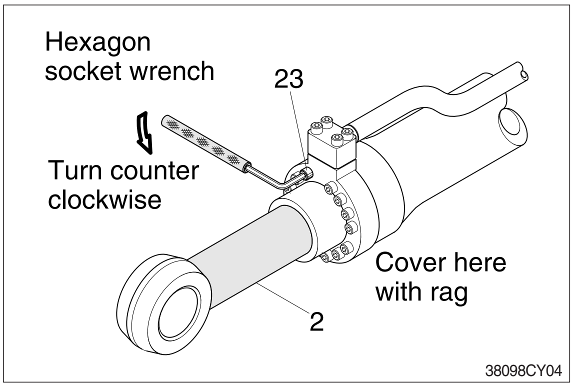
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

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.



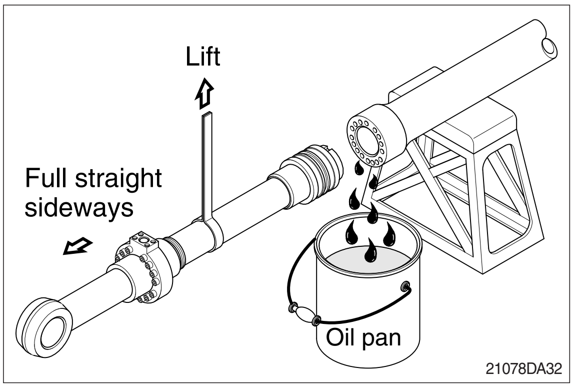
③ Loosen and remove socket bolts (23) of the gland in sequence.

※ 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).

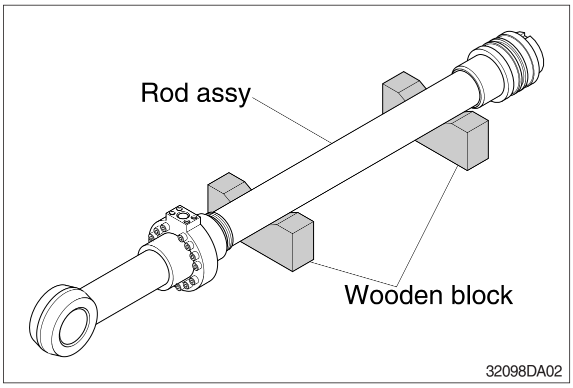
※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (2) with a crane or some means and draw it out. However, when rod assembly (2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



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.

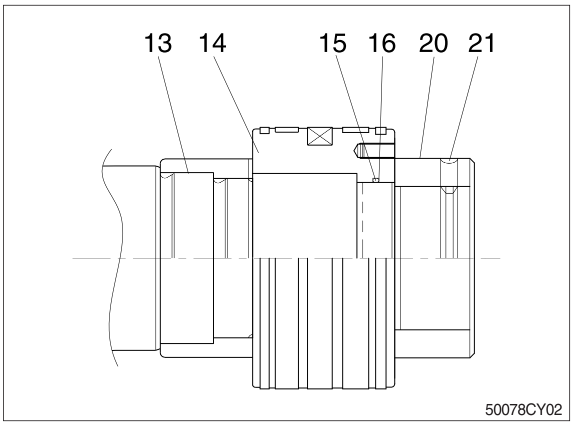


(3) Remove piston and cylinder head

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).

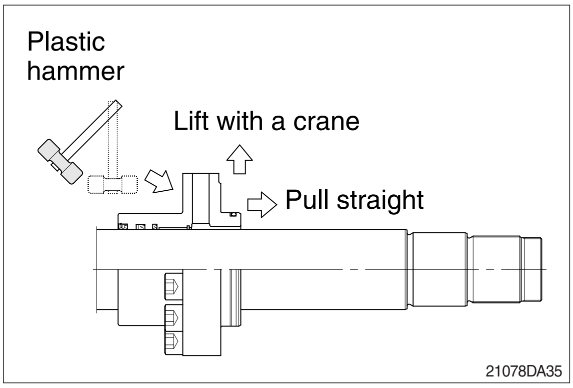


③ Remove the cylinder head assembly from rod assembly (2).

※ 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).

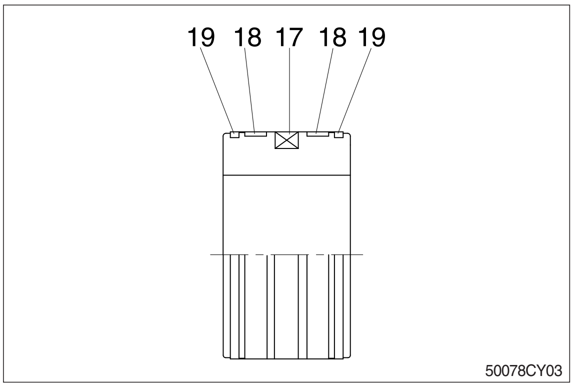


(3) Disassemble the piston assembly

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).

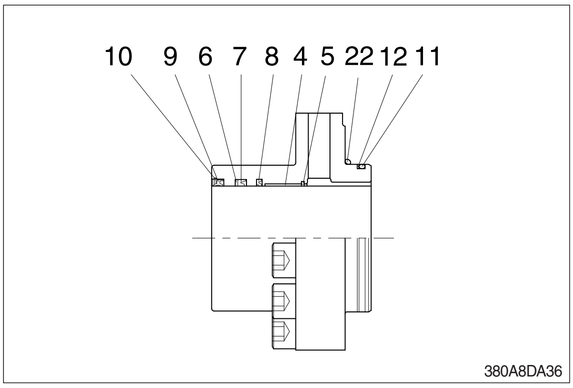
② Remove snap ring (10), dust wiper (9).

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).

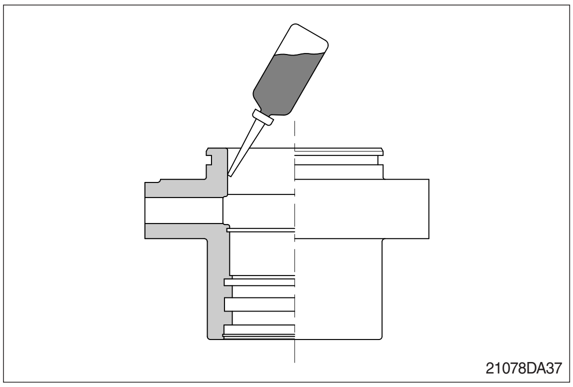


3) ASSEMBLY

(1) Assemble cylinder head assembly

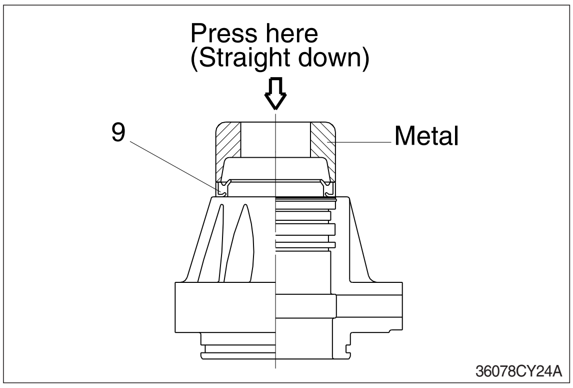
※ Check for scratches or rough surfaces if found smooth with an oil stone.

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.

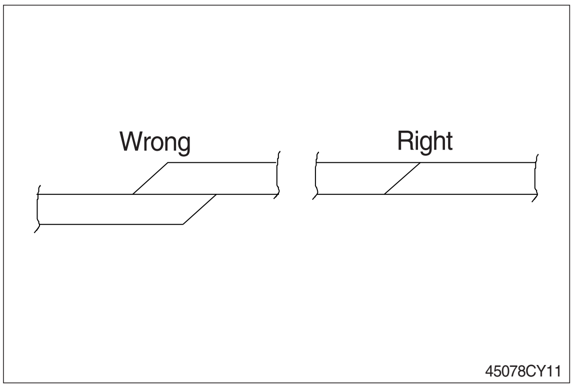
③ Fit snap ring (10) to the stop face.



④ Fit back up ring (7), rod seal (6) and buffer ring (8) to corresponding grooves, in that order.

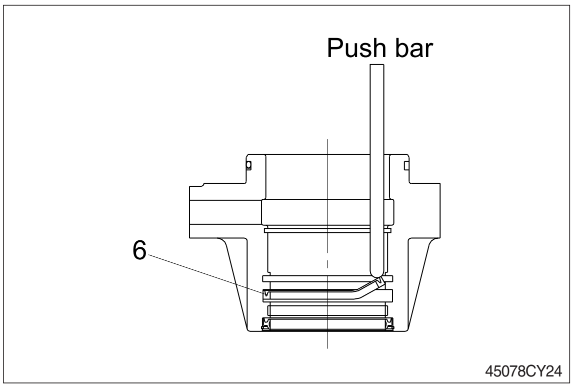
※ Coat each packing with hydraulic oil before fitting it.

※ 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.

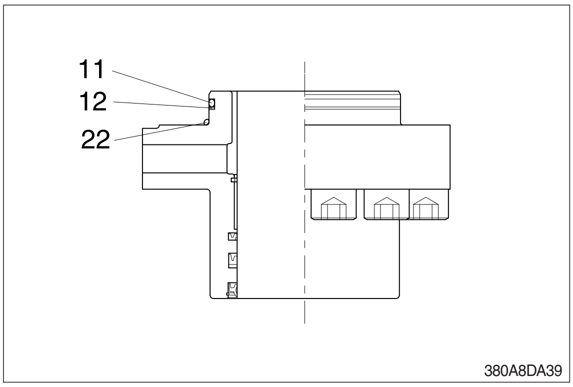
※ Fitting rod seal (6) upside down may damage its lip. Therefore check the correct direction that is shown in fig.



⑤ Fit back up ring (12) to gland (3).

※ Put the backup ring in the warm water of 30~50˚C.

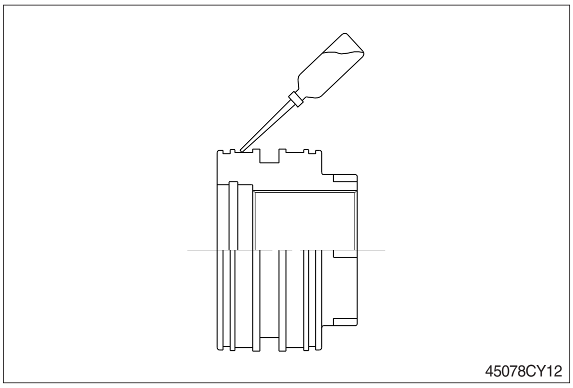
⑥ Fit O-ring (11) and O-ring (22) to gland (3).



(2) Assemble piston assembly

※ Check for scratches or rough surfaces. If found smooth with an oil stone.

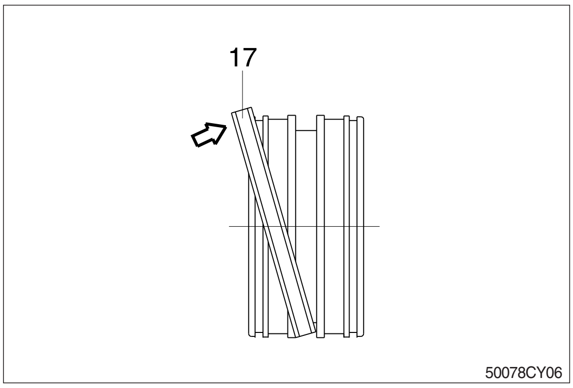
① Coat the outer face of piston (14) with hydraulic oil.



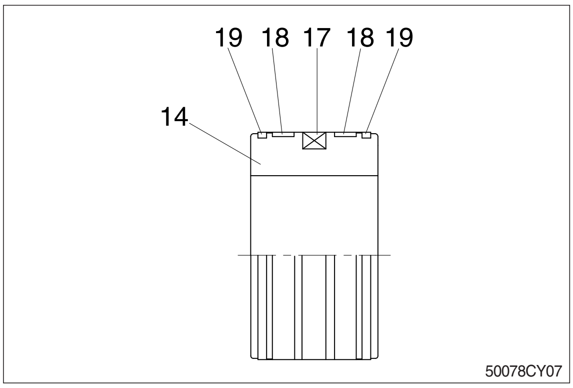
② Fit piston seal (17) to piston.

※ 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).

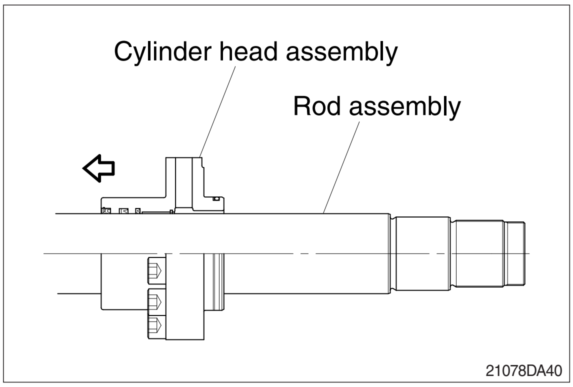


(3) Install piston and cylinder head

① Fix the rod assembly to the work bench.

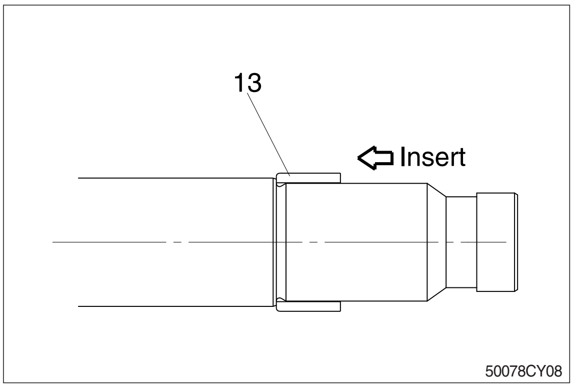
② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and cylinder head.

③ Insert cylinder head assembly to rod assembly.



④ Insert cushion ring (13) to rod assembly.

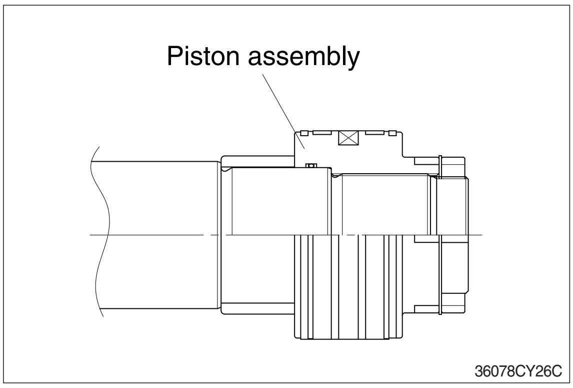
※ Note that cushion ring (13) has a direction in which it should be fitted.



⑤ Fit piston assembly to rod assembly.

· Tightening torque : 200±20 kgf · m
(1447±145 lbf · ft)

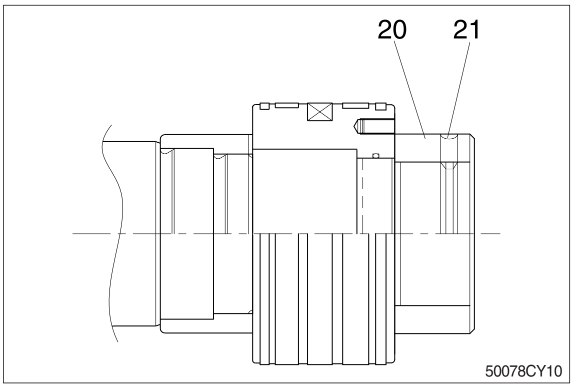
※ Refer to page 8-160.



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 8-160.



(3) Overall assemble

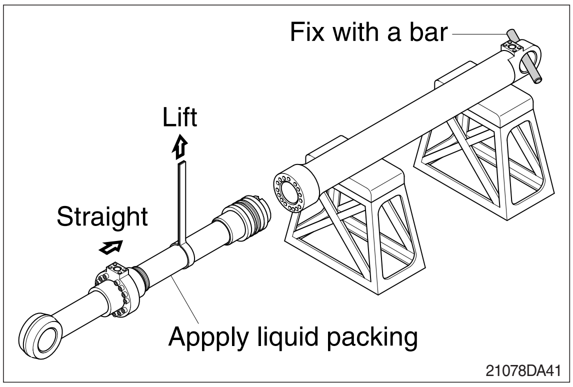
① Place a V-block on a rigid work bench. Mount the tube assembly (1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.

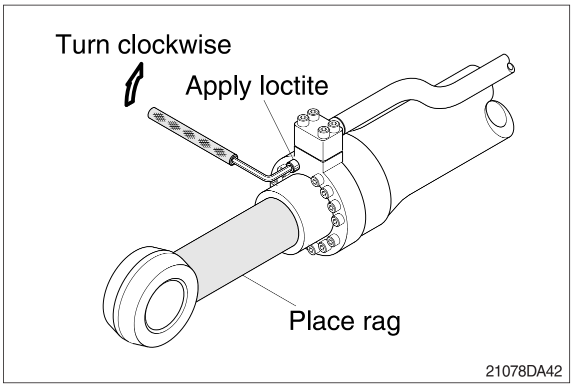
※ Be careful not to damage piston seal by thread of tube assembly.

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.



21078DA41



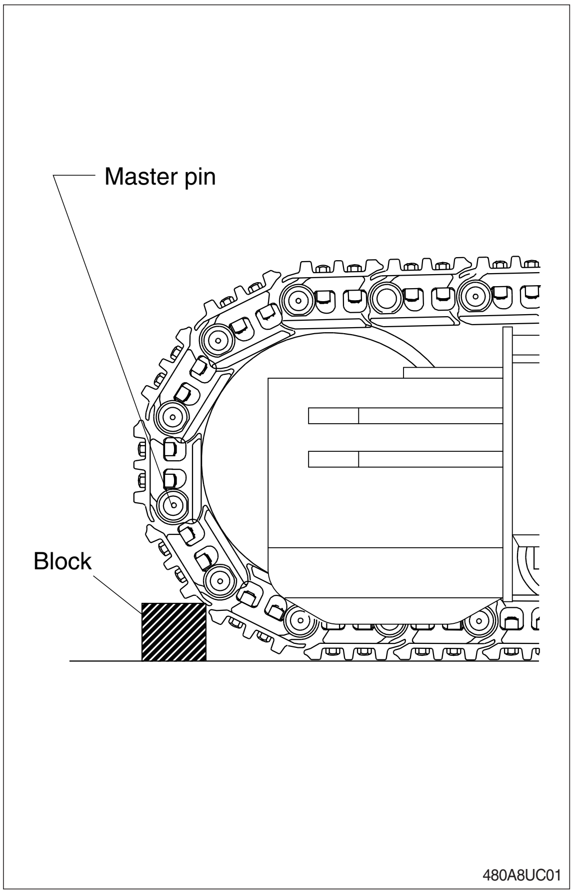
21078DA42

GROUP 10 UNDERCARRIAGE

1. TRACK LINK

1) REMOVAL

(1) Move track link until master pin is over front idler in the position put wooden block as shown.



(2) Loosen tension of the track link.

※ If track tension is not relieved when the grease valve is loosened, move the machine backwards and forwards.

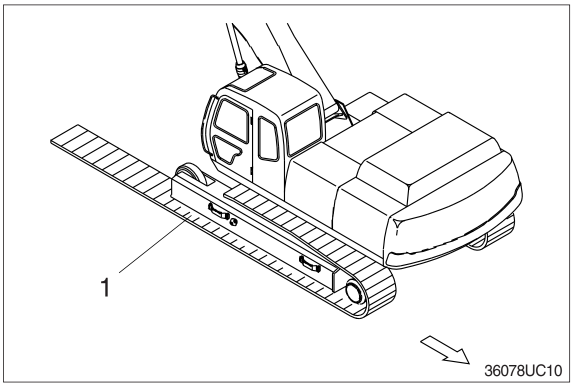
※ Unscrew the grease nipple after release the tension by pushing the poppet only when necessarily required.
Grease leaking hole is not existing. So, while unscrew the grease nipple, grease is not leaking until the grease nipple is completely coming out. If the tension is not released in advance, the grease nipple can be suddenly popped out by pressurized grease.

(3) Push out master pin by using a suitable tool.

(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.

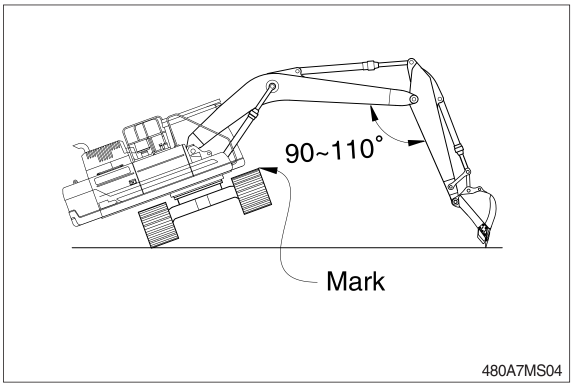
※ Don't get close to the sprocket side as the track shoe plate may fall down on your feet.



2) INSTALL

(1) Carry out installation in the reverse order to removal.

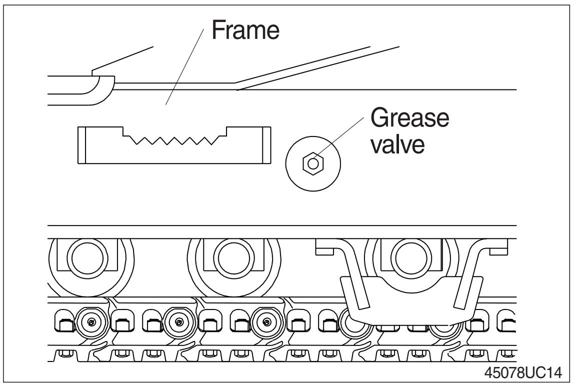
※ Adjust the tension of the track link.



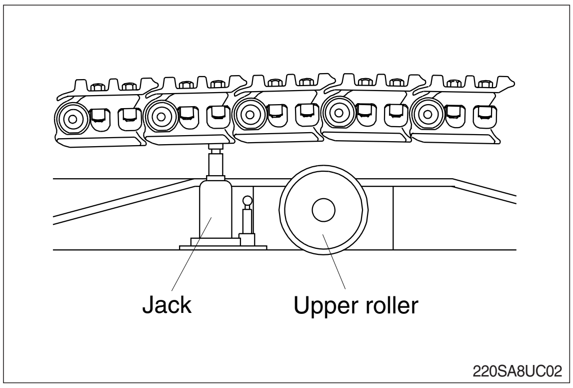
2. UPPER ROLLER

1) REMOVAL

(1) Loosen tension of the track link.



(2) Jack up the track link height enough to permit upper roller removal.

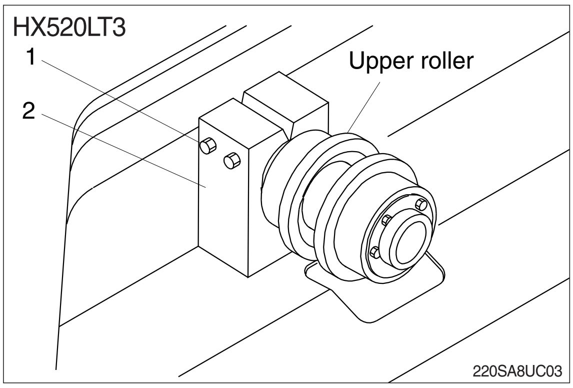


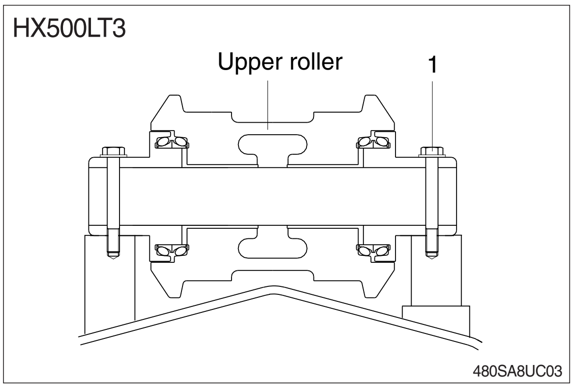
(3) Loosen the lock nut (1).

(4) Open bracket (2) with a screwdriver, push out from inside, and remove upper roller assembly.

· Weight
HX500LT3 : 88 kg (194 lb)
HX520LT3 : 41 kg (90.4 lb)

· Tightening torque
HX500LT3 : 29.7±3.0 kgf·m
(215±21.7 lbf·ft)
HX520LT3 : 100±10 kgf·m
(723±72.3 lbf·ft)





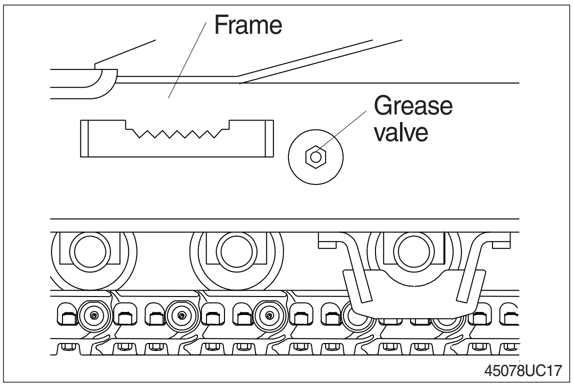
2) INSTALL

(1) Carry out installation in the reverse order to removal.

3. LOWER ROLLER

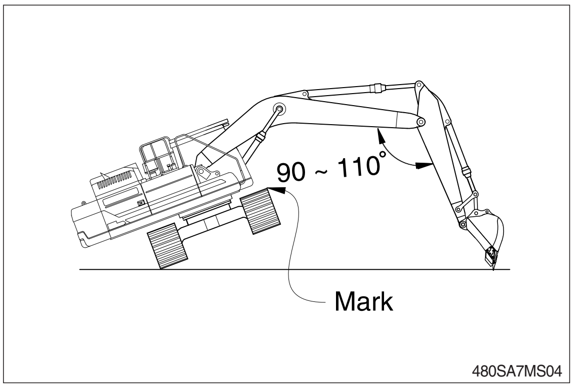
1) REMOVAL

(1) Loosen tension of the track link.



(2) Using the work equipment, push up track frame on side which is to be removed.

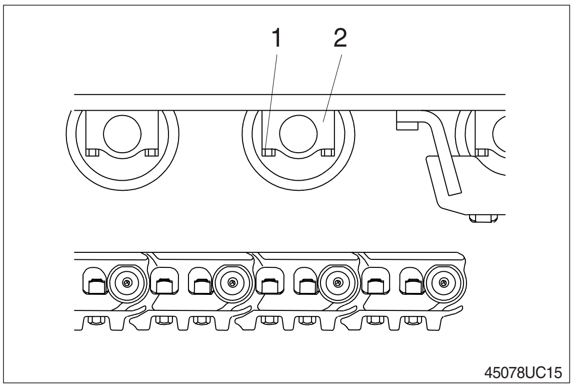
※ After jack up the machine, set a block under the unit.



(3) Remove the mounting bolt (1) and draw out the lower roller (2).

· Weight
HX500LT3 : 88 kg (194 lb)
HX520LT3 : 85 kg (187 lb)

· Tightening torque : 100±10 kgf · m
(723±72.3 lbf · ft)



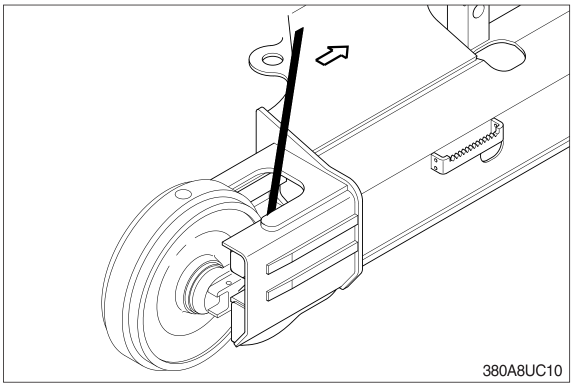
2) INSTALL

(1) Carry out installation in the reverse order to removal.

4. IDLER AND RECOIL SPRING

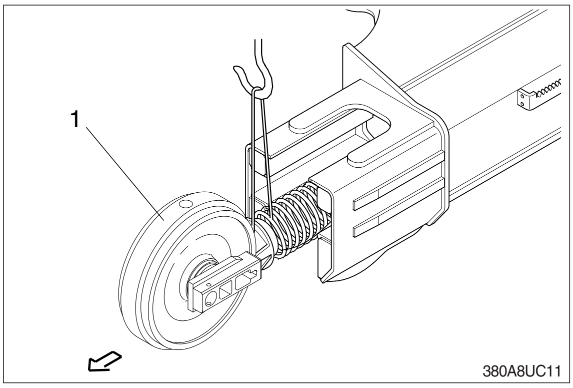
1) REMOVAL

(1) Remove the track link.
For detail, see removal of track link.



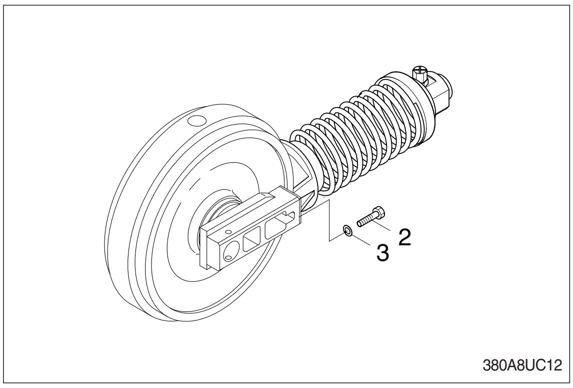
380A8UC10

(2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 653 ㎏ (1440 ℓb)



380A8UC11

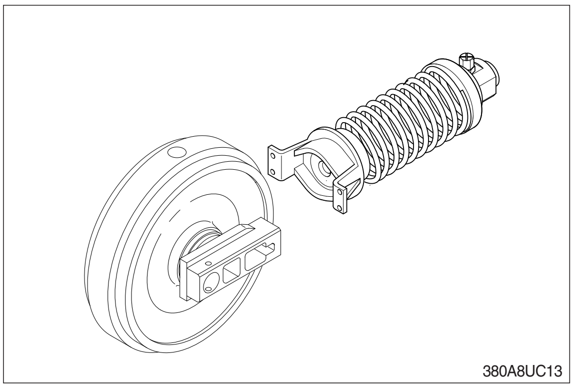
(3) Remove the bolts (2), washers (3) and separate ilder from recoil spring.
· Tightening torque (2) : 87.2±12.5 kgf·m
(631±90.4 lbf·ft)



380A8UC12

2) INSTALL

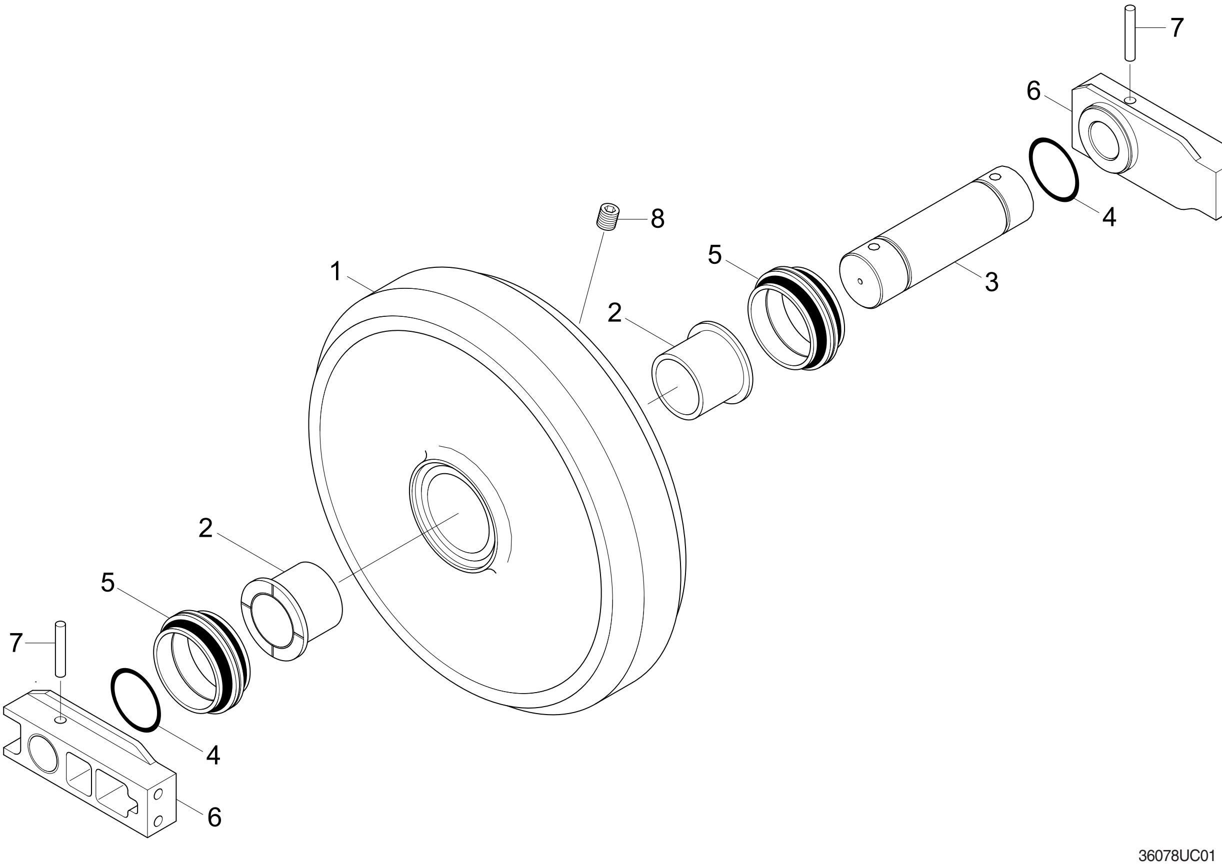
(1) Carry out installation in the reverse order to removal.
※ Make sure that the boss on the end face of the recoil cylinder rod is in the hole of the track frame.



380A8UC13

3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure

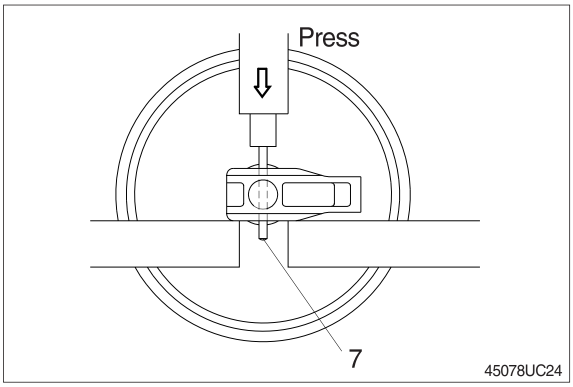


1	Shell	4	O-ring	7	Spring pin
2	Bushing	5	Seal assembly	8	Plug
3	Shaft	6	Bracket		

(2) Disassembly

① Remove plug and drain oil.

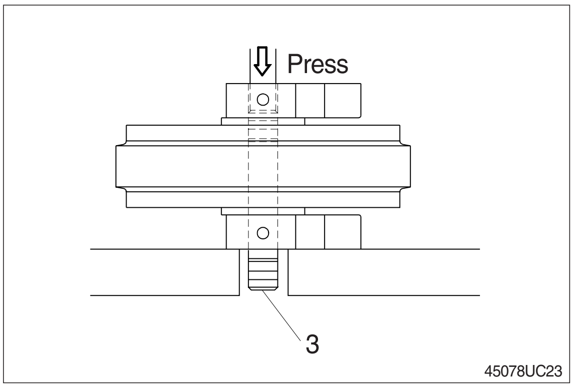
② Draw out the spring pin (7), using a press.



③ Pull out the shaft (2) with a press.

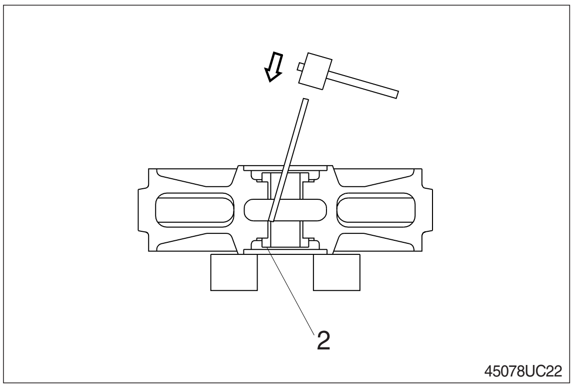
④ Remove seal (5) from shell (1) and bracket (6).

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.

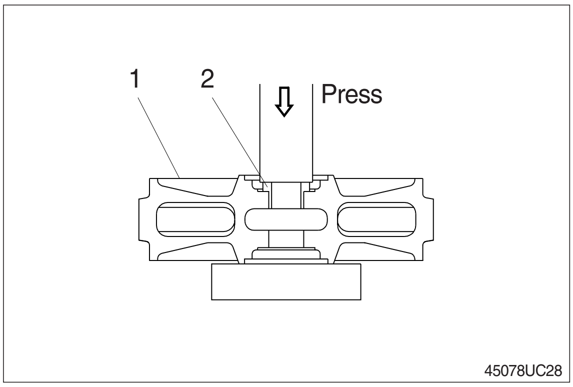


(3) Assembly

※ Before assembly, clean the parts.

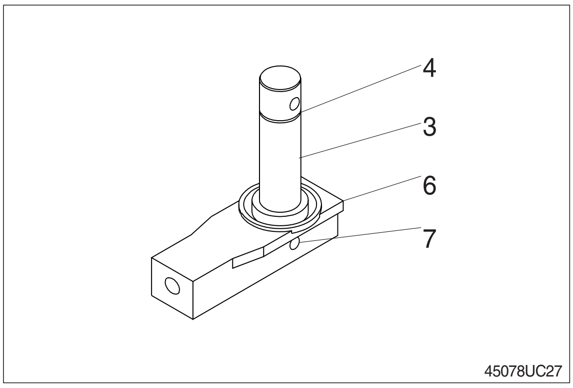
※ Coat the sliding surfaces of all parts with oil.

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.

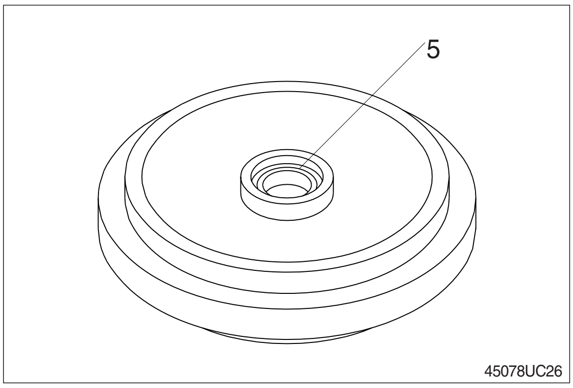


② Coat O-ring (4) with grease thinly, and install it to shaft (3).

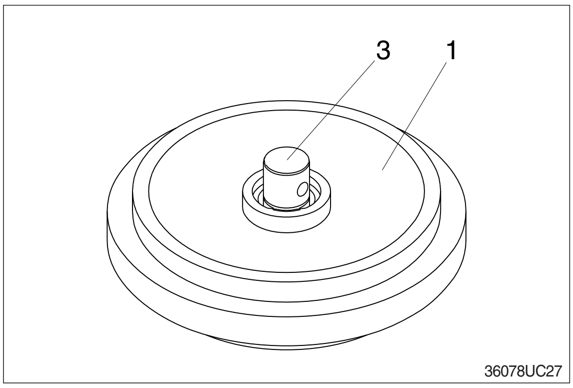
③ Insert shaft (3) into bracket (6) and drive in the spring pin (7).



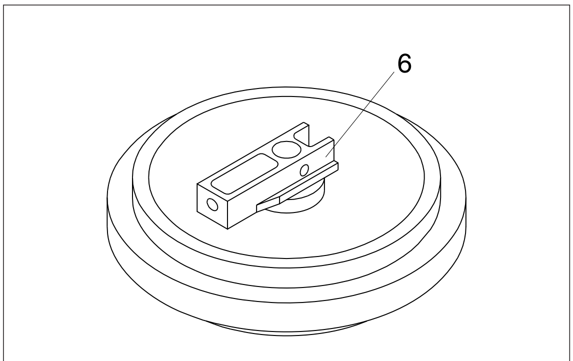
④ Install seal (5) to shell (1) and bracket (6).



⑤ Install shaft (3) to shell (1).

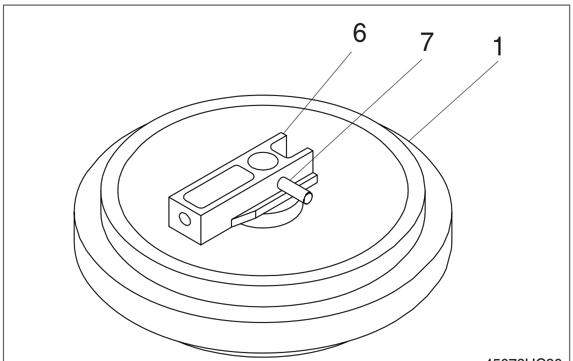


⑥ Install bracket (6) attached with seal (5).



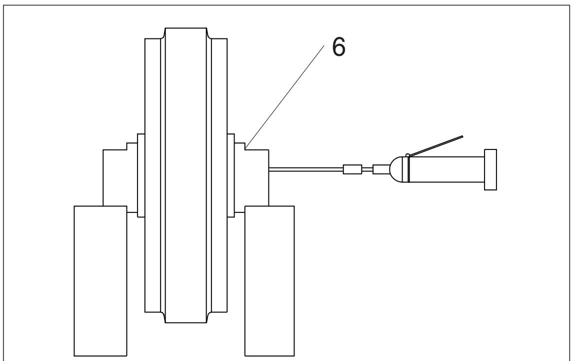
36078UC28

⑦ Knock in the spring pin (7) with a hammer.



45078UC30

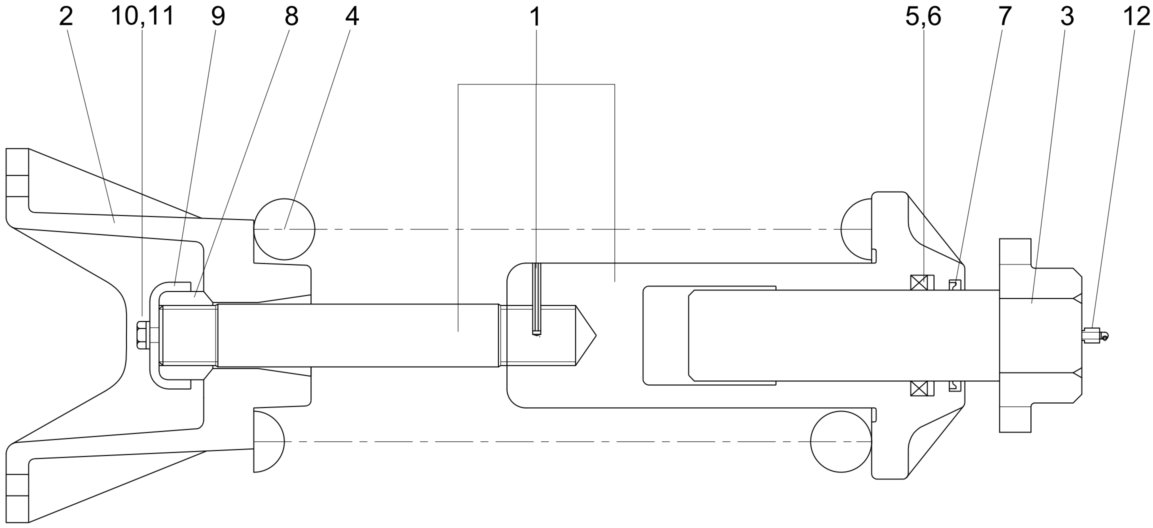
⑧ Lay bracket (6) on its side.
Supply engine oil to the specified level, and tighten plug.



45078UC29

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 ㎏ (63580 ℔)

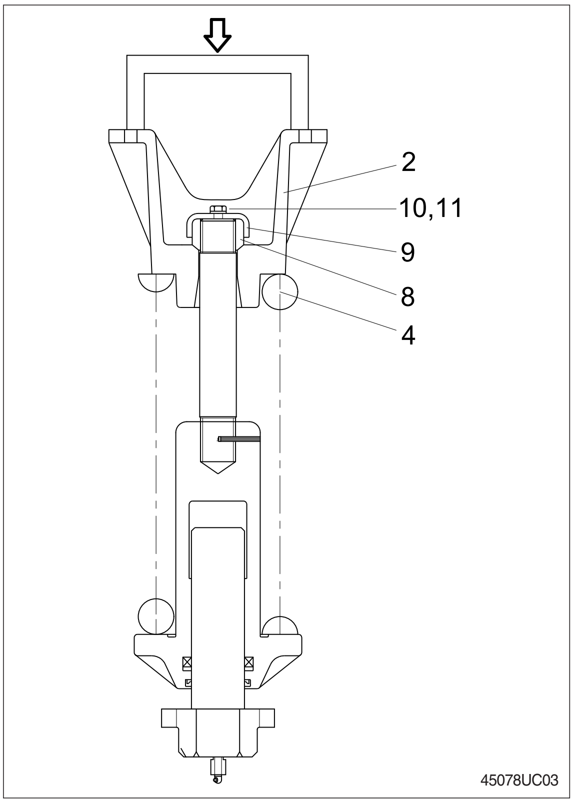
② Remove bolt (10), spring washer (11) and lock plate (9).

③ Remove lock nut (8).

Take enough notice so that the press

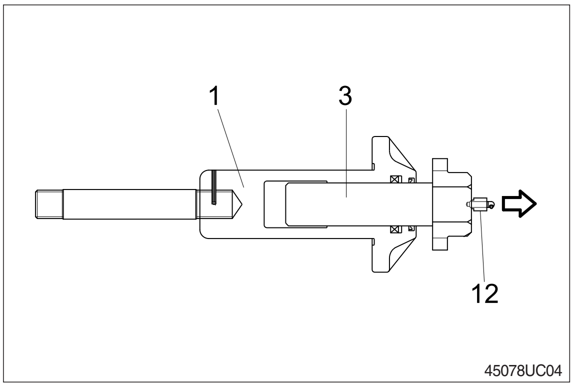
④ which pushes down the spring, should not be slipped out in its operation.

Lighten the press load slowly and remove bracket (2) and spring (4).

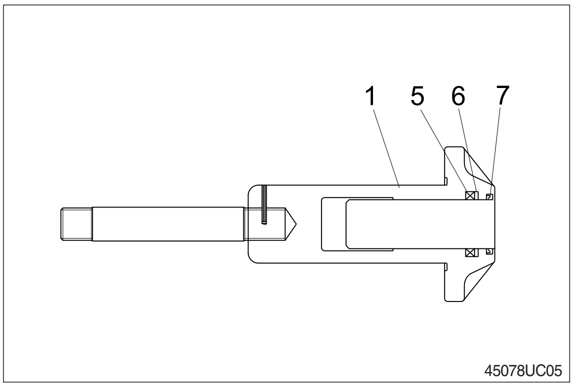


⑤ Remove rod (3) from body (1).

⑥ Remove grease valve (12) from rod (3).



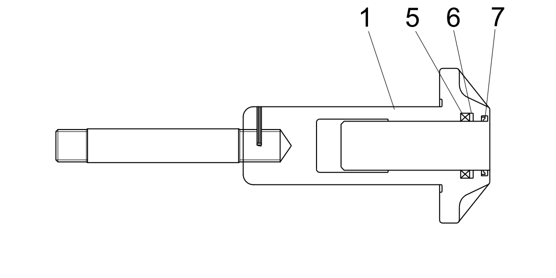
⑦ Remove rod seal (5), back up ring (6) and dust seal (11).



(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.



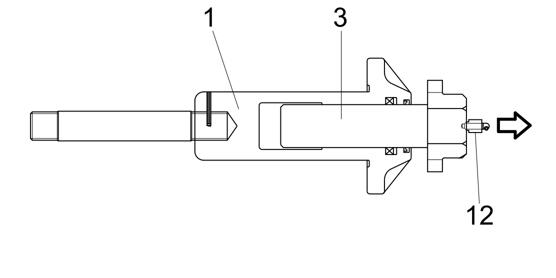
45078UC05

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)



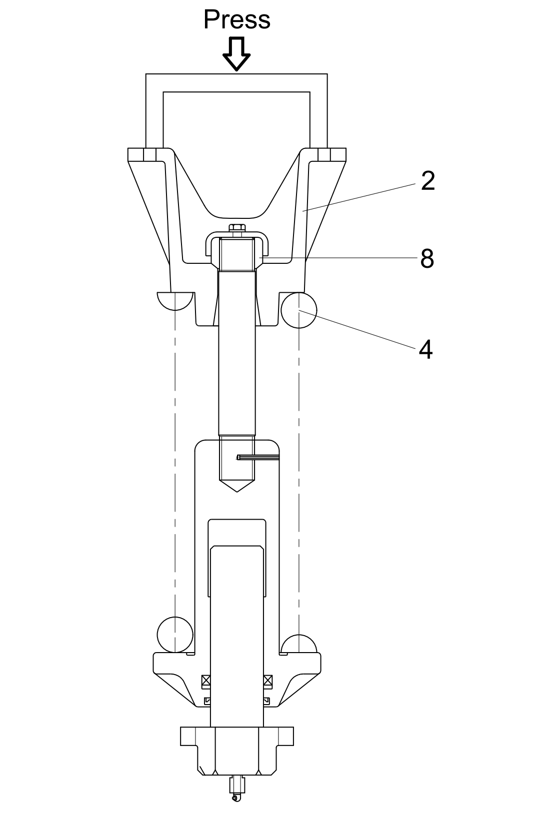
45078UC04

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.

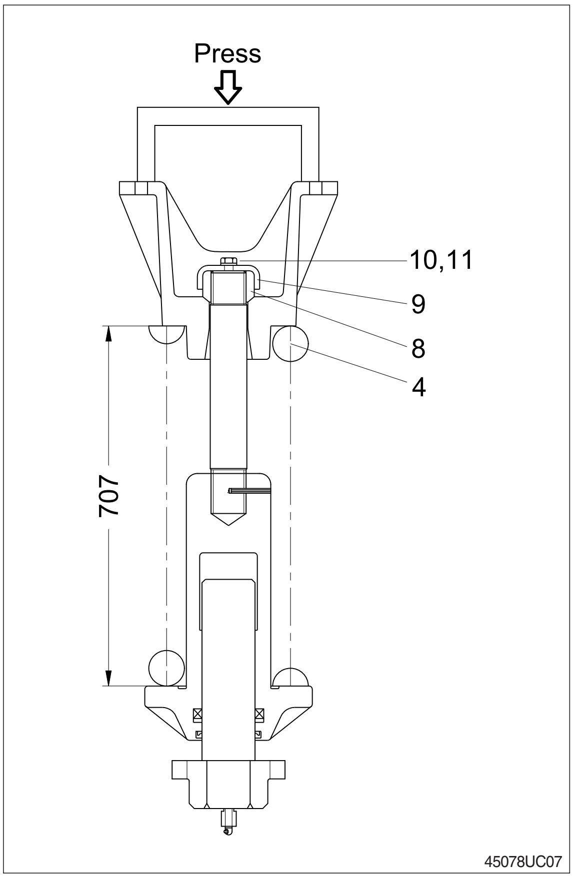
※ During the operation, pay attention specially to prevent the press from slipping out.



45078UC06

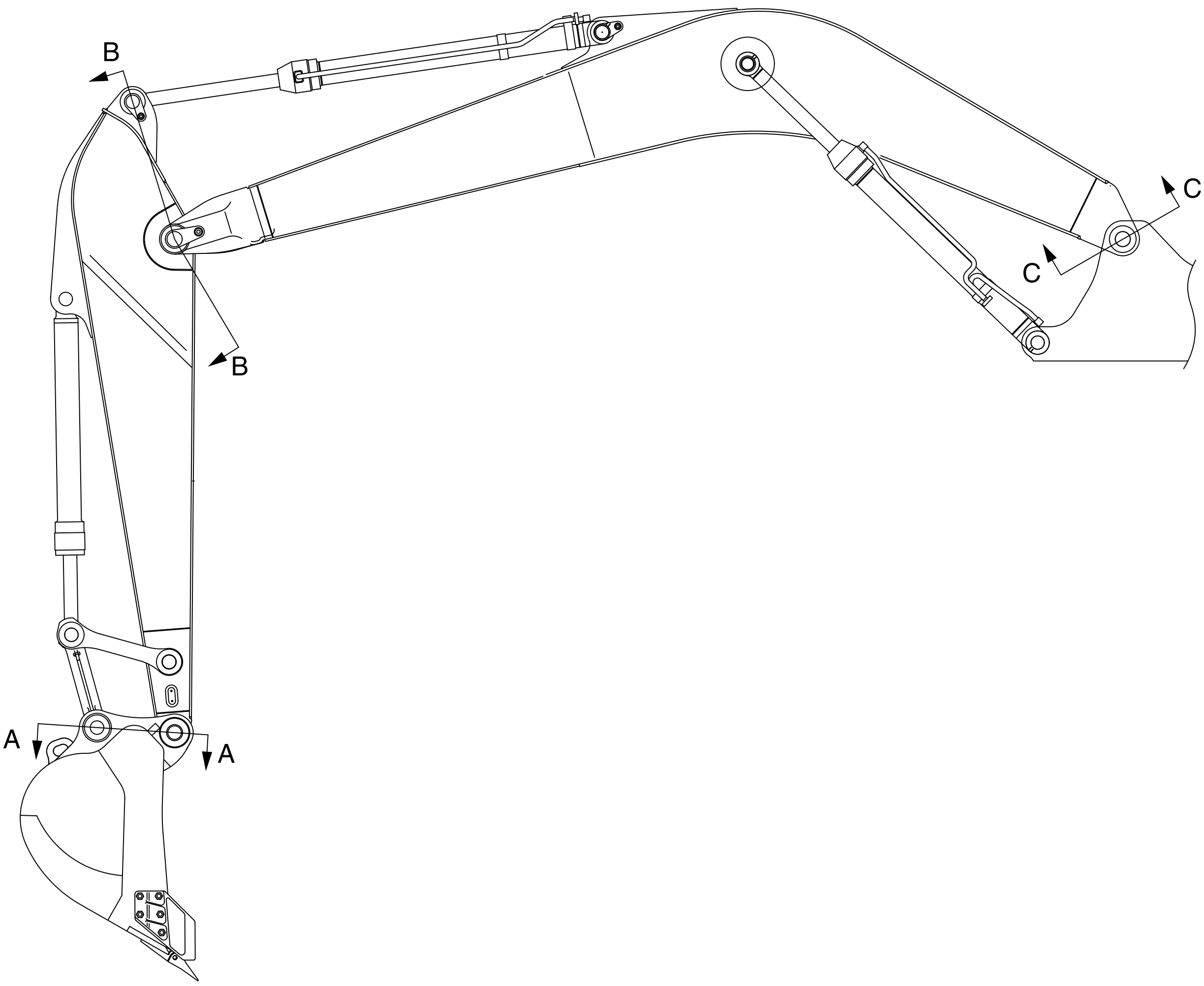
⑥ Lighten the press load and confirm the set length of spring (4).

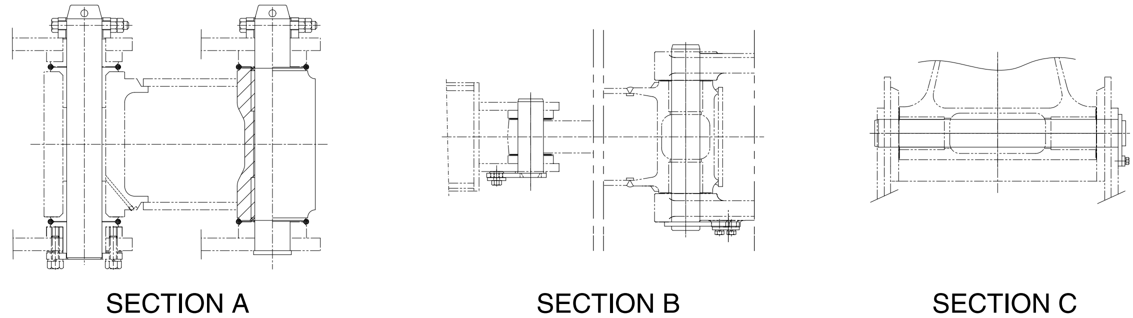
⑦ After the setting of spring (4), install lock plate (9), spring washer (11) and bolt (10).



GROUP 11 WORK EQUIPMENT

1. STRUCTURE





SECTION A SECTION B SECTION C

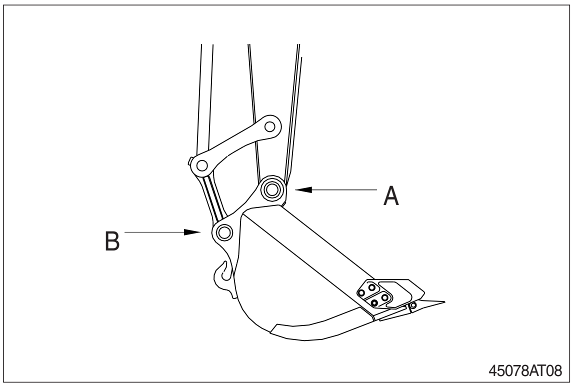
29078WE01

2. REMOVAL AND INSTALL

1) BUCKET ASSEMBLY

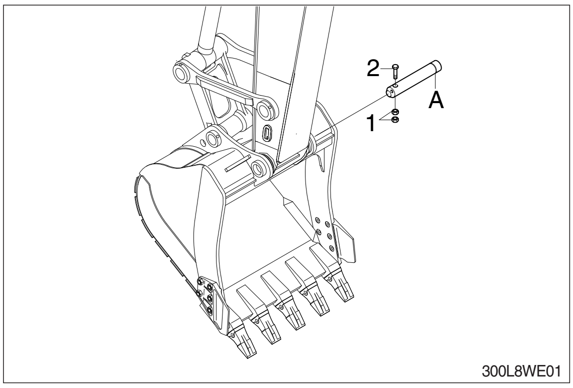
(1) Removal

① Lower the work equipment completely to ground with back of bucket facing down.



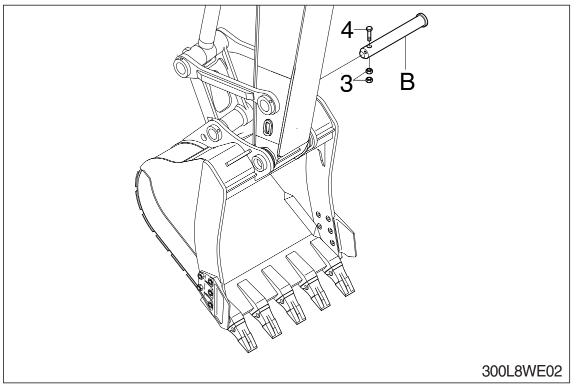
② Remove nut (1), bolt (2) and draw out the pin (A).

· 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)

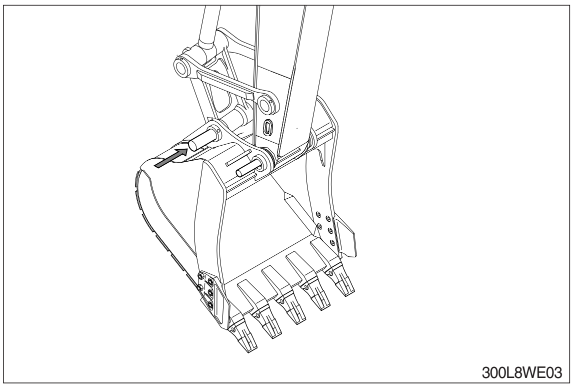


(2) Install

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**.

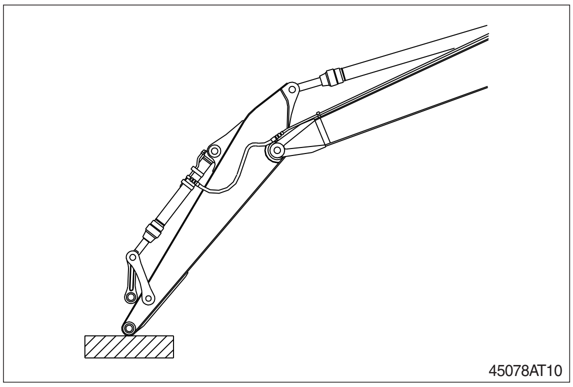


2) ARM ASSEMBLY

(1) Removal

※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

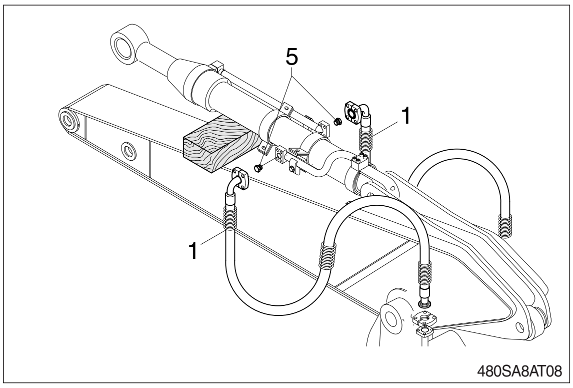
⚠ **Escaping fluid under pressure can penetrated the skin causing serious injury.**



① Remove bucket assembly.
For details, see removal of bucket assembly.

② Disconnect bucket cylinder hose (1).

⚠ **Fit blind plugs (5) in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.**



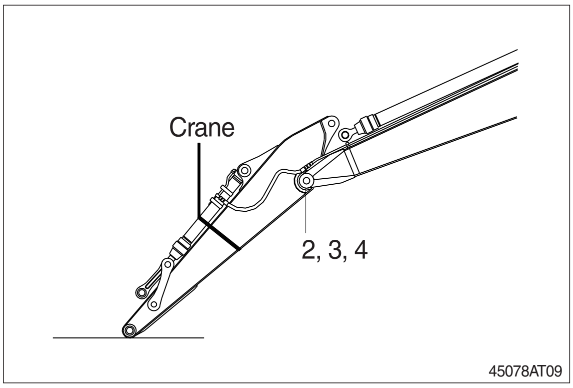
③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

※ 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 : 2430 kg (5360 lb)
- · Tightening torque : 57.9±8.7 kgf · m (419±62.9 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.**

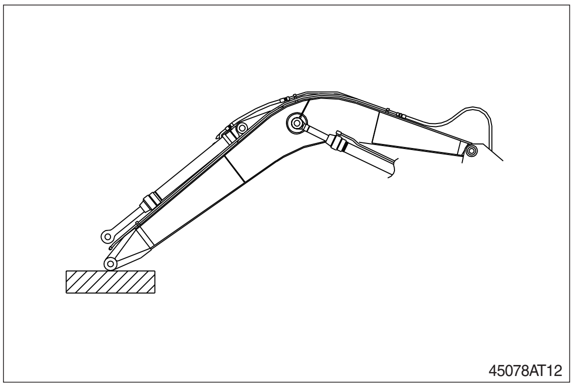
※ Bleed the air from the cylinder.

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.

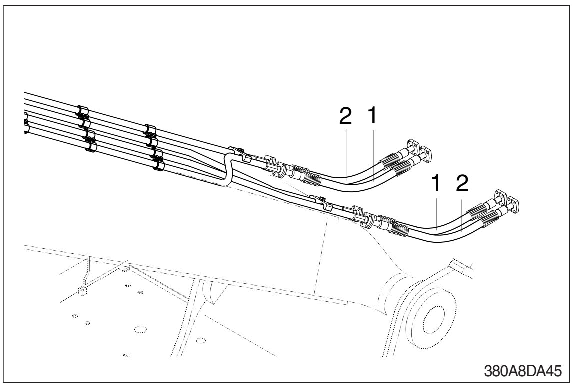


③ Disconnect head lamp wiring.

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).

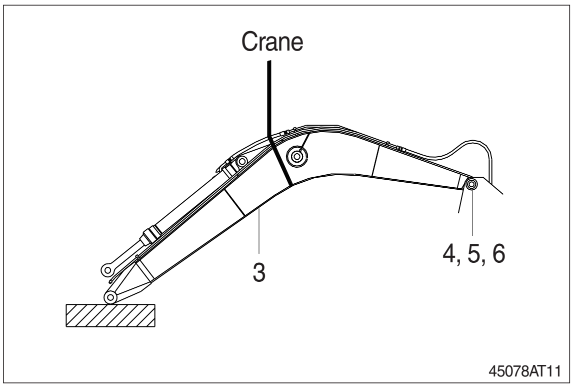


⑥ Remove bolt (4), plate (5) and pull out the pin (6) then remove boom assembly.

· Weight : 4380 kg (9660 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.