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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.

   7 - 4
   7 - 4 - 1
   7 - 4 - 2 Added pages
   7 - 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 5 in the row across the top, take this as ⓑ, then draw a perpendicular line down from ⓑ.

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

2. Convert 550 mm into inches.

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

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

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

Millimeters to inches

ⓑ

1mm = 0.03937 in

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

Millimeters to inches

1mm = 0.03937in

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

Kilogram to Pound

1kg = 2.2046lb

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

Liter to U.S. Gallon

1 ℓ = 0.2642 U.S.Gal

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

Liter to U.K. Gallon

1 ℓ = 0.21997 U.K.Gal

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

kgf · m to lbf · ft

1kgf · m = 7.233lbf · ft

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

kgf/cm² to lbf/in²

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

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

TEMPERATURE

Fahrenheit-Centigrade Conversion.
A simple way to convert a fahrenheit temperature reading into a centigrade temperature reading or vice verse is to enter the accompanying table in the center or boldface column of figures.
These figures refer to the temperature in either Fahrenheit or Centigrade degrees.
If it is desired to convert from Fahrenheit to Centigrade degrees, consider the center column as a table of Fahrenheit temperatures and read the corresponding Centigrade temperature in the column at the left.
If it is desired to convert from Centigrade to Fahrenheit degrees, consider the center column as a table of Centigrade values, and read the corresponding Fahrenheit temperature on the right.

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

SECTION 1 GENERAL

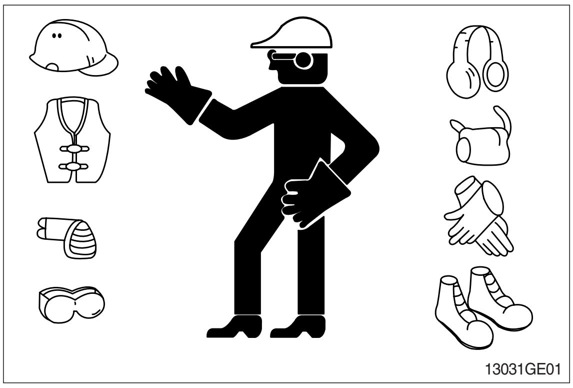
GROUP 1 SAFETY HINTS

FOLLOW SAFE PROCEDURE

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

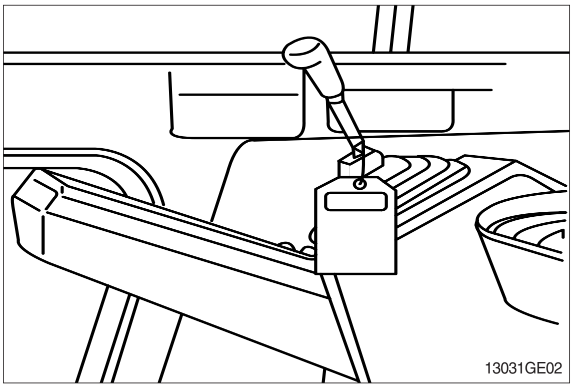
WEAR PROTECTIVE CLOTHING

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



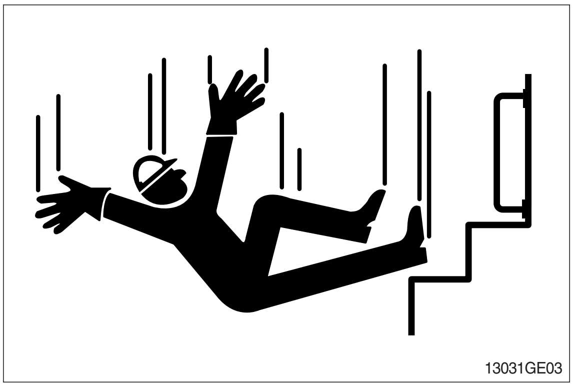
WARN OTHERS OF SERVICE WORK

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



USE HANDHOLDS AND STEPS

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

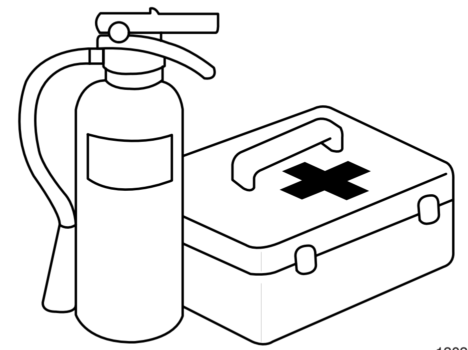


PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

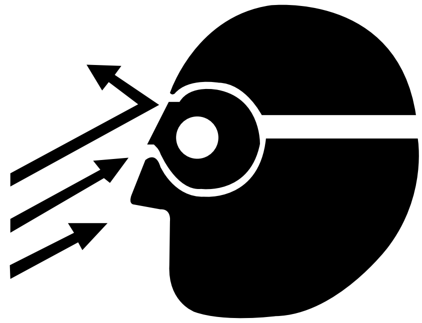
Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



13031GE04

PROTECT AGAINST FLYING DEBRIS

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



13031GE05

PROTECT AGAINST NOISE

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

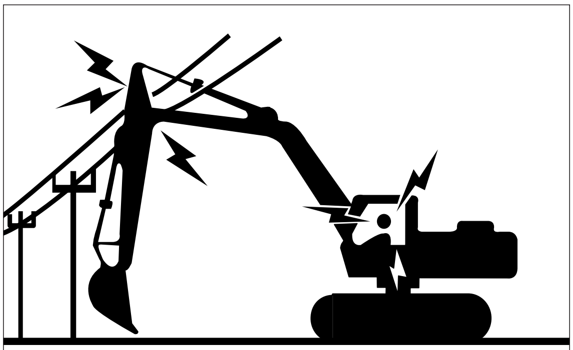
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

13031GE06

AVOID POWER LINES

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

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

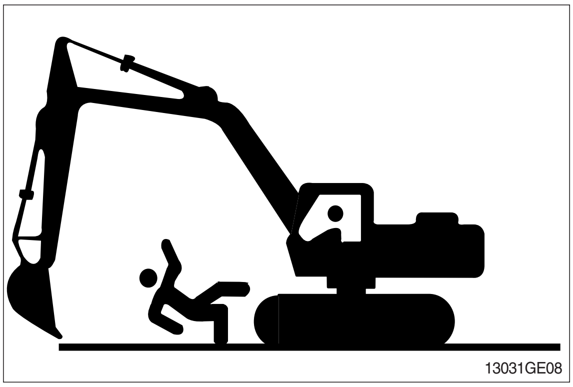


13031GE07

KEEP RIDERS OFF EXCAVATOR

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

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



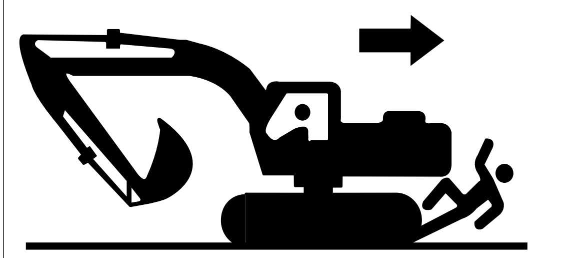
13031GE08

MOVE AND OPERATE MACHINE SAFELY

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

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

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

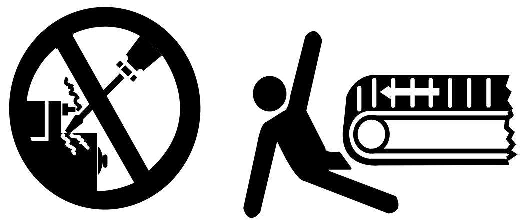


13031GE09

OPERATE ONLY FORM OPERATOR'S SEAT

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

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



13031GE26

PARK MACHINE SAFELY

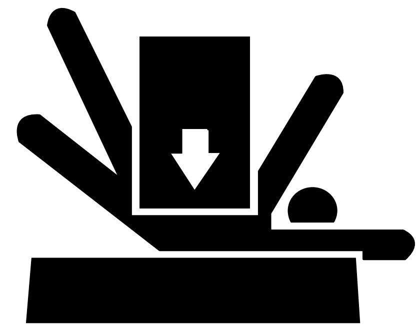
Before working on the machine:

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

SUPPORT MACHINE PROPERLY

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

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

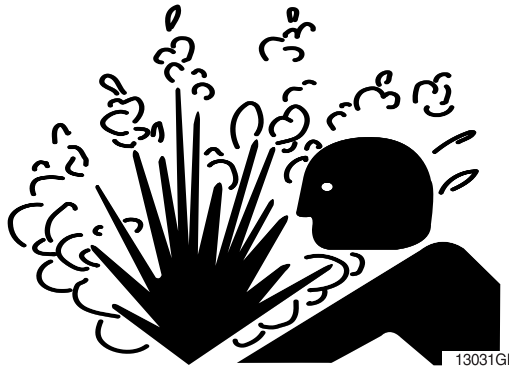


13031GE10

SERVICE COOLING SYSTEM SAFELY

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

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



13031GE11

HANDLE FLUIDS SAFELY-AVOID FIRES

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

13031GE12

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

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

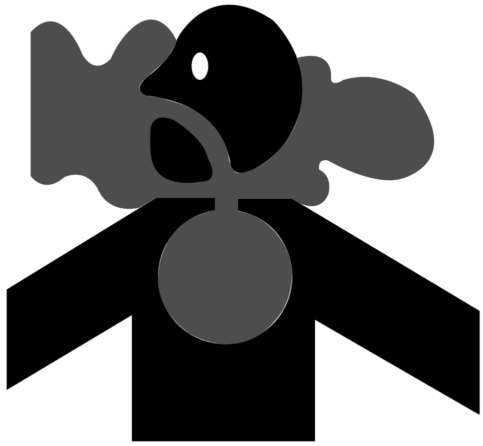
Do not store oily rags; They can ignite and burn spontaneously.

13031GE13

BEWARE OF EXHAUST FUMES

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

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



13031GE14

REMOVE PAINT BEFORE WELDING OR HEATING

Avoid potentially toxic fumes and dust.

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

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

Remove paint before welding or heating:

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

ILLUMINATE WORK AREA SAFELY

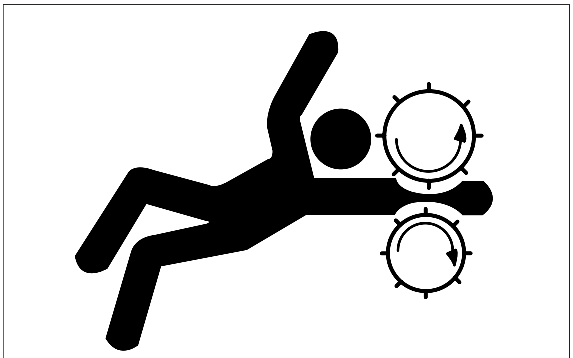
Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

13031GE15

SERVICE MACHINE SAFELY

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

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

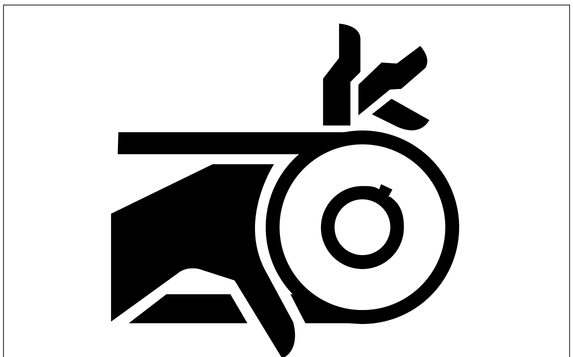


13031GE16

STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

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



13031GE17

AVOID HIGH PRESSURE FLUIDS

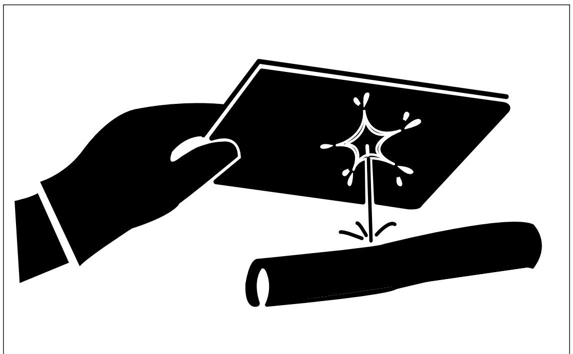
Escaping fluid under pressure can penetrate the skin causing serious injury.

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

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

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

13031GE18



13031GE19

AVOID HEATING NEAR PRESSURIZED FLUID LINES

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

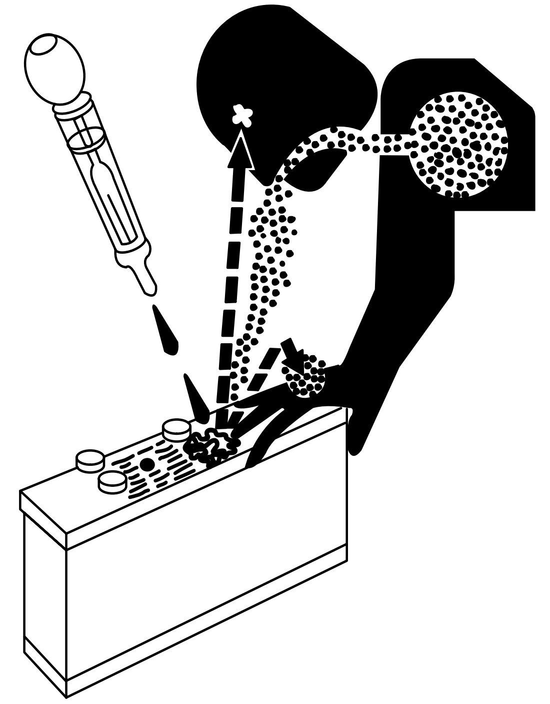
PREVENT ACID BURNS

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

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

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

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



13031GE22

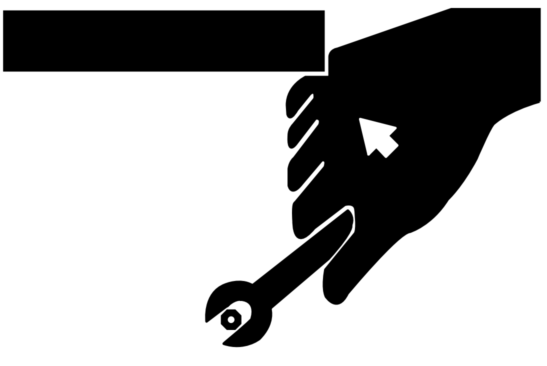
USE TOOLS PROPERLY

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

Use power tools only to loosen threaded tools and fasteners.

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

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



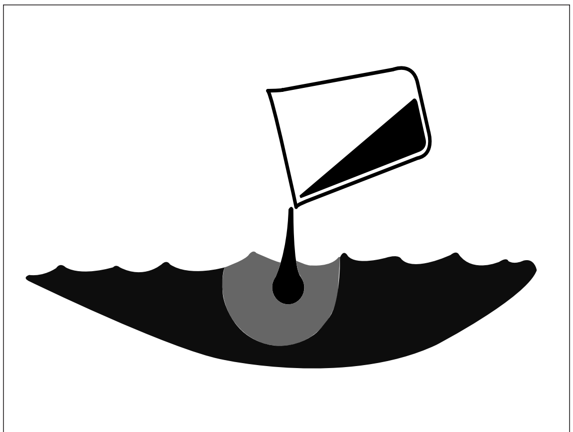
13031GE23

DISPOSE OF FLUIDS PROPERLY

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

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

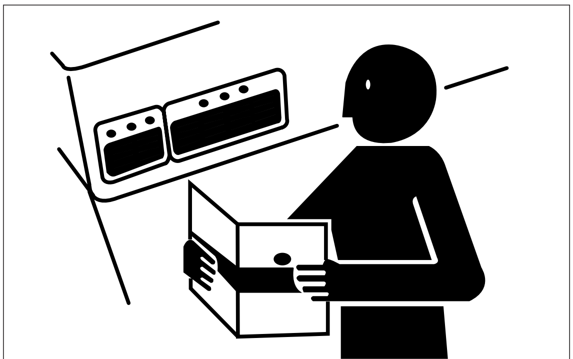
DO NOT pour oil into the ground, down a drain, or into a stream, pond, or lake. Observe relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters, batteries, and other harmful waste.



13031GE24

REPLACE SAFETY SIGNS

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



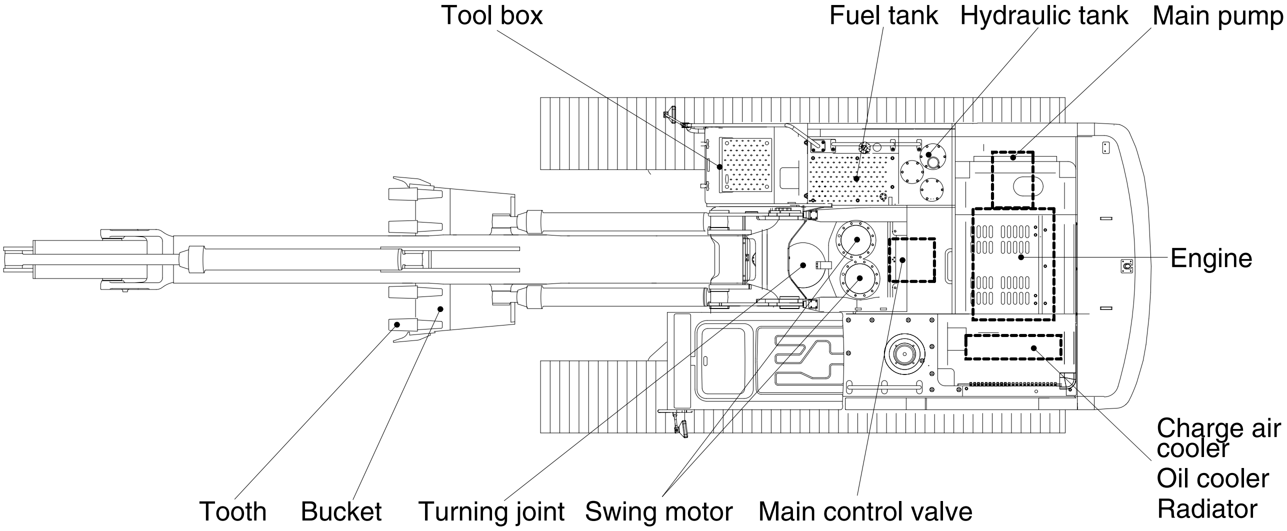
13031GE25

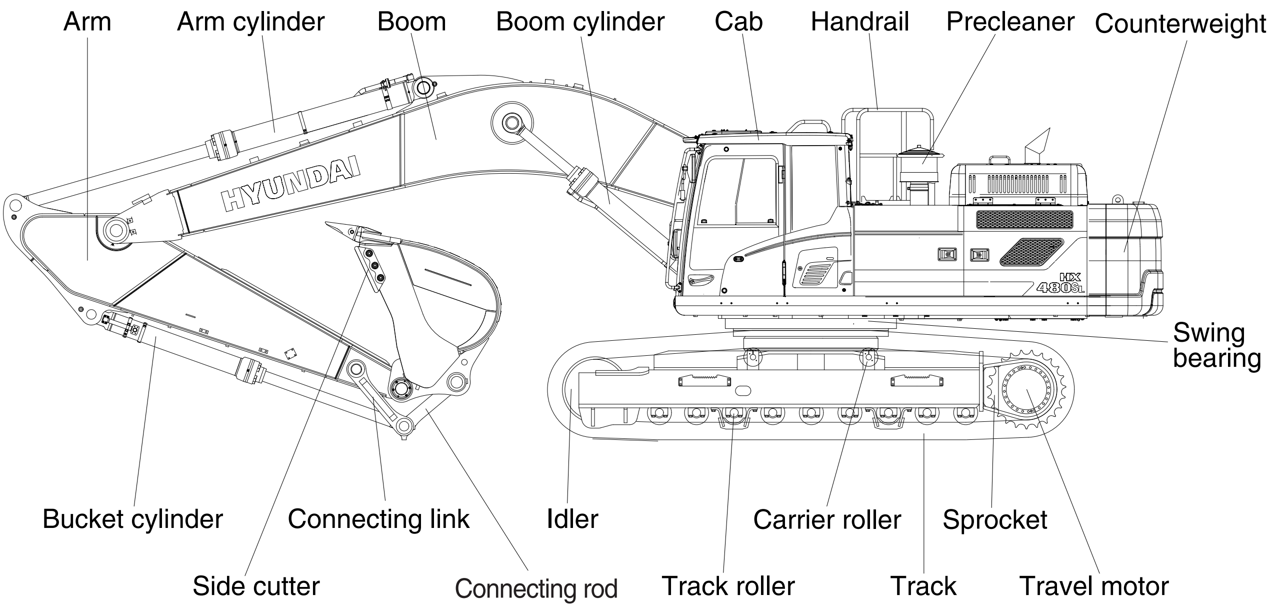
LIVE WITH SAFETY

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

GROUP 2 SPECIFICATIONS

1. MAJOR COMPONENT



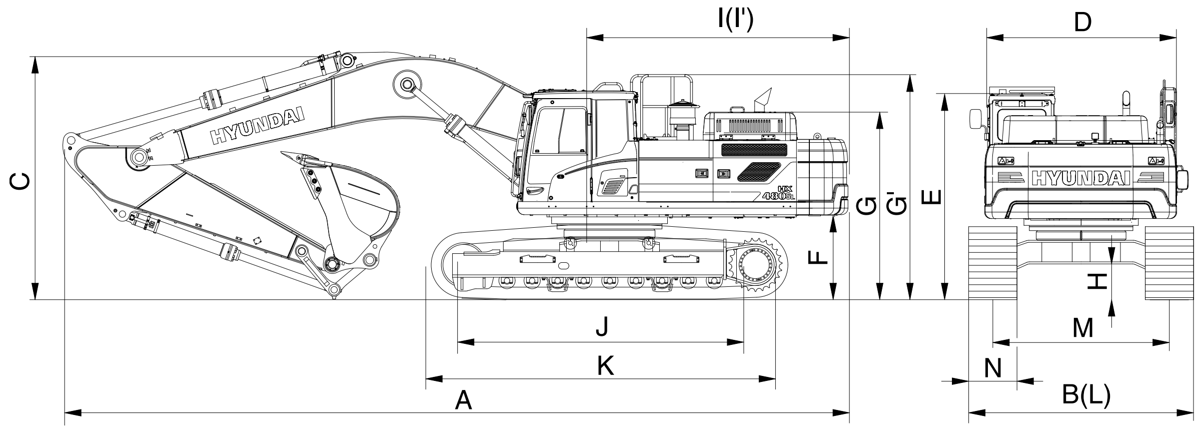


480S2SP01

2. SPECIFICATIONS

1) HX480S L

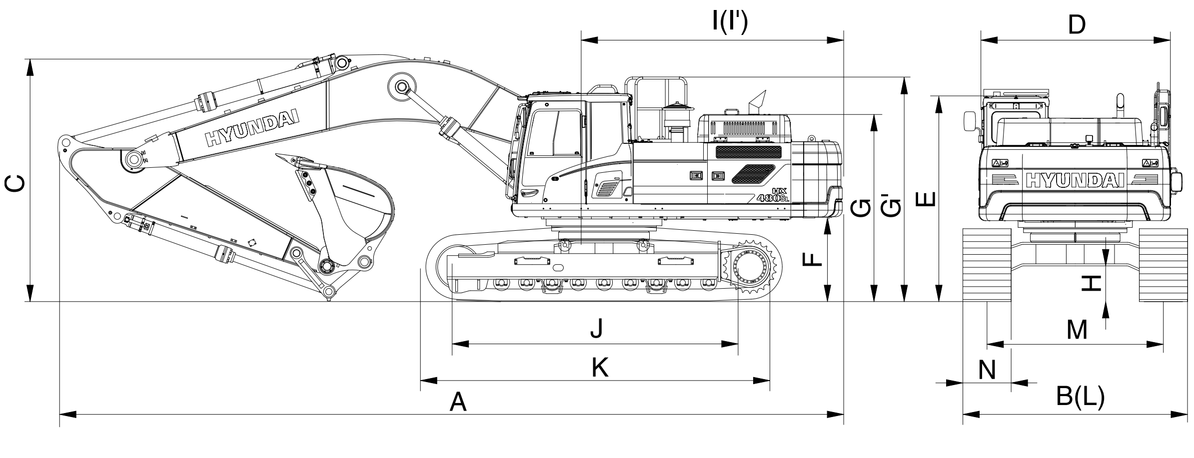
(1) 7.06 m (23' 2") boom, 3.38 m (11' 1") arm



480S2SP02

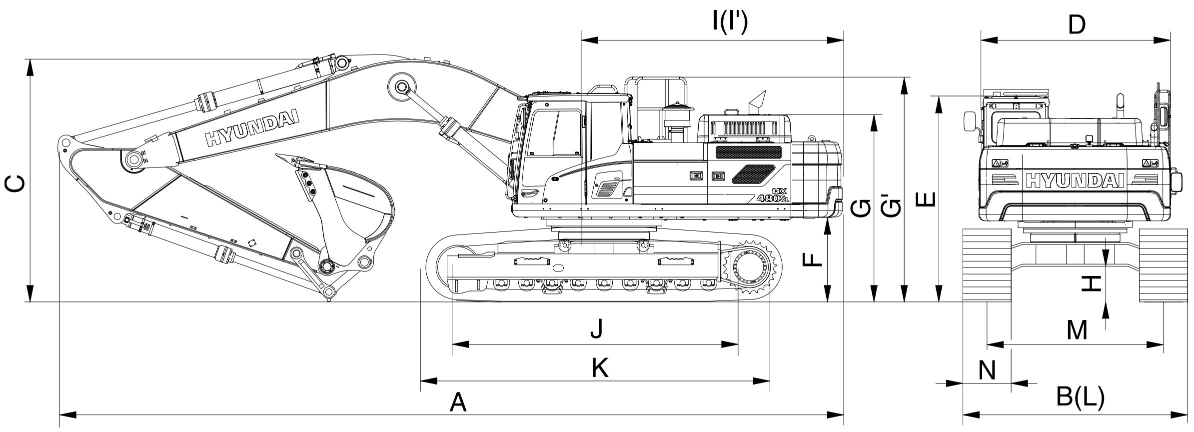
Description		Unit	Specification
Operating weight		kg (lb)	49515 (109160)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	2.20 (2.88)
Overall length	A	mm (ft-in)	12040 (39' 6")
Overall width, with 600 mm shoe	B		3340 (10' 11")
Overall height	C		3790 (12' 5")
Superstructure width	D		2980 (9' 9")
Overall height of cab	E		3220 (10' 7")
Ground clearance of counterweight	F		1295 (4' 3")
Engine cover height	G		2869 (9' 5")
Overall height of handrail	G'		3450 (11' 4")
Minimum ground clearance	H		560 (1' 10")
Rear-end distance	I		3665 (12' 0")
Rear-end swing radius	I'		3940 (12' 11")
Distance between tumblers	J		4470 (14' 8")
Undercarriage length	K		5460 (17' 11")
Undercarriage width	L		3340 (10' 11")
Track gauge	M		2740 (9' 0")
Track shoe width, standard	N		600 (24")
Travel speed (low/high)		km/hr (mph)	3.3/5.0 (2.0/3.1)
Swing speed		rpm	8.5
Gradeability		Degree (%)	35 (70)
Ground pressure (600 mm shoe)		kgf/cm^2 (psi)	0.84 (11.98)
Max traction force		kg (lb)	37300 (82230)

(2) 6.55 m (21' 6") boom, 2.40 m (7' 10") arm



Description		Unit	Specification
Operating weight		kg (lb)	49515 (109160)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	2.20 (2.88)
Overall length	A	mm (ft-in)	12040 (39' 6")
Overall width, with 600 mm shoe	B		3340 (10' 11")
Overall height	C		3790 (12' 5")
Superstructure width	D		2980 (9' 9")
Overall height of cab	E		3220 (10' 7")
Ground clearance of counterweight	F		1295 (4' 3")
Engine cover height	G		2869 (9' 5")
Overall height of handrail	G'		3450 (11' 4")
Minimum ground clearance	H		560 (1' 10")
Rear-end distance	I		3665 (12' 0")
Rear-end swing radius	I'		3940 (12' 11")
Distance between tumblers	J		4470 (14' 8")
Undercarriage length	K		5460 (17' 11")
Undercarriage width	L		3340 (10' 11")
Track gauge	M		2740 (9' 0")
Track shoe width, standard	N		600 (24")
Travel speed (low/high)		km/hr (mph)	3.3/5.0 (2.0/3.1)
Swing speed		rpm	8.5
Gradeability		Degree (%)	35 (70)
Ground pressure (600 mm shoe)		kgf/cm^2 (psi)	0.84 (11.98)
Max traction force		kg (lb)	37300 (82230)

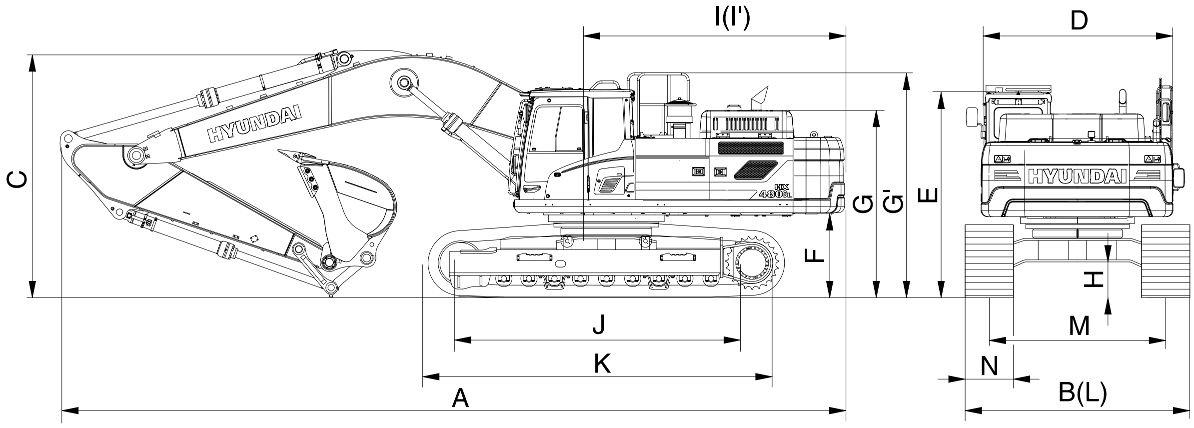
(3) 9.00 m (29' 6") boom, 6.00 m (19' 8") arm



Description		Unit	Specification
Operating weight		kg (lb)	51155 (112777)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	1.38 (1.80)
Overall length	A	mm (ft-in)	14010 (46' 0")
Overall width, with 600 mm shoe	B		3340 (10' 11")
Overall height	C		3990 (13' 1")
Superstructure width	D		2980 (9' 9")
Overall height of cab	E		3220 (10' 7")
Ground clearance of counterweight	F		1295 (4' 3")
Engine cover height	G		2689 (9' 5")
Overall height of handrail	G'		3450 (11' 4")
Minimum ground clearance	H		560 (1' 10")
Rear-end distance	I		3665 (12' 0")
Rear-end swing radius	I'		3940 (12' 11")
Distance between tumblers	J		4470 (14' 8")
Undercarriage length	K		5405 (17' 7")
Undercarriage width	L		3340 (10' 11")
Track gauge	M		2740 (9' 0")
Track shoe width, standard	N		600 (24")
Travel speed (low/high)		km/hr (mph)	3.3/5.0 (2.0/3.1)
Swing speed		rpm	8.5
Gradeability		Degree (%)	35 (70)
Ground pressure (600 mm shoe)		kgf/cm^2 (psi)	0.89 (12.64)
Max traction force		kg (lb)	37300 (82230)

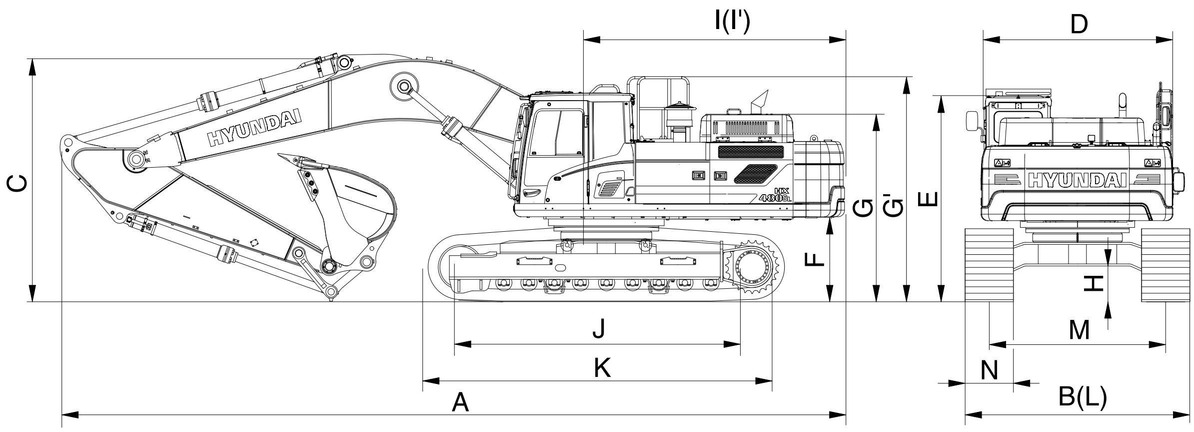
2) HX520S L

(1) 7.06 m (23' 2") boom, 3.38 m (11' 1") arm



Description		Unit	Specification
Operating weight		kg (lb)	51175 (112820)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	2.20 (2.88)
Overall length	A	mm (ft-in)	12040 (39' 6")
Overall width, with 600 mm shoe (transport position / working position)	B		2990/3540 (9' 10"/11' 7")
Overall height	C		3790 (12' 5")
Superstructure width	D		2980 (9' 9")
Overall height of cab	E		3340 (10' 11")
Ground clearance of counterweight	F		1445 (4' 9")
Engine cover height	G		3030 (9' 11")
Overall height of handrail	G'		3595 (11' 8")
Minimum ground clearance	H		770 (2' 6")
Rear-end distance	I		3665 (12' 0")
Rear-end swing radius	I'		3720 (12' 2")
Distance between tumblers	J		4470 (14' 8")
Undercarriage length	K		5460 (17' 11")
Undercarriage width (transport position / working position)	L		2990/3540 (9' 10"/11' 7")
Track gauge (transport position / working position)	M		2380/2940 (7' 10"/9' 8")
Track shoe width, standard	N		600 (24")
Travel speed (low/high)		km/hr (mph)	3.3/5.0 (2.0/3.1)
Swing speed		rpm	8.5
Gradeability		Degree (%)	35 (70)
Ground pressure (600 mm shoe)		kgf/cm^2 (psi)	0.89 (12.64)
Max traction force		kg (lb)	37300 (82230)

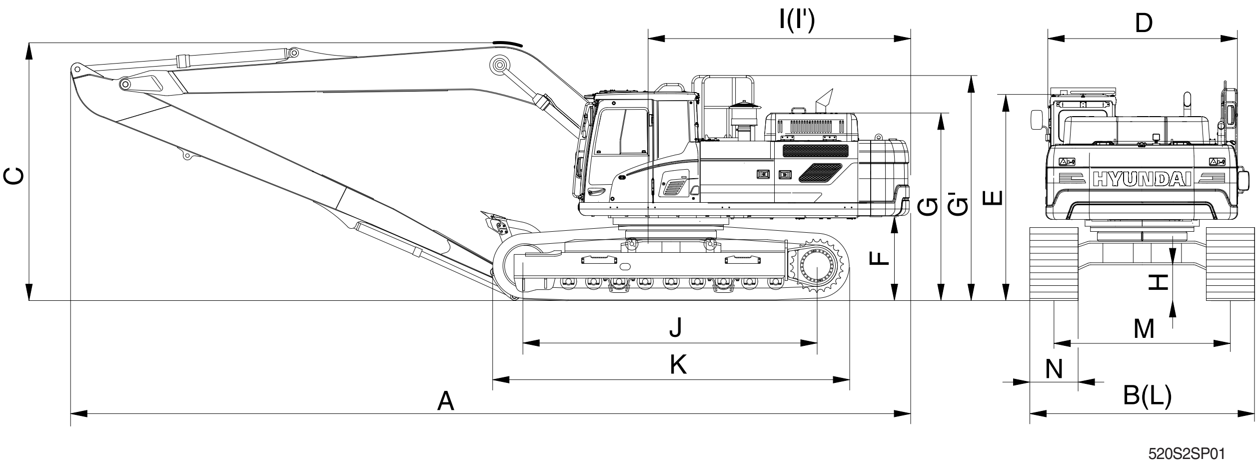
(2) 6.55 m (21' 6") boom, 2.40 m (7' 10") arm



480S2SP02

Description		Unit	Specification
Operating weight		kg (lb)	50865 (112140)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	2.20 (2.88)
Overall length	A	mm (ft-in)	11780 (38' 8")
Overall width, with 600 mm shoe (transport position / working position)	B		2990/3540 (9' 10"/11' 7")
Overall height	C		4190 (13' 9")
Superstructure width	D		2980 (9' 9")
Overall height of cab	E		3340 (10' 11")
Ground clearance of counterweight	F		1445 (4' 9")
Engine cover height	G		3030 (9' 11")
Overall height of handrail	G'		3595 (11' 8")
Minimum ground clearance	H		770 (2' 6")
Rear-end distance	I		3665 (12' 0")
Rear-end swing radius	I'		3720 (12' 2")
Distance between tumblers	J		4470 (14' 8")
Undercarriage length	K		5460 (17' 11")
Undercarriage width (transport position / working position)	L		2990/3540 (9' 10"/11' 7")
Track gauge (transport position / working position)	M		2380/2940 (7' 10"/9' 8")
Track shoe width, standard	N		600 (24")
Travel speed (low/high)		km/hr (mph)	3.3/5.0 (2.0/3.1)
Swing speed		rpm	8.5
Gradeability		Degree (%)	35 (70)
Ground pressure (600 mm shoe)		kgf/cm^2 (psi)	0.88 (12.56)
Max traction force		kg (lb)	37300 (82230)

(3) 10.00 ㎜ (32' 10") boom, 6.85 ㎜ (22' 6") arm

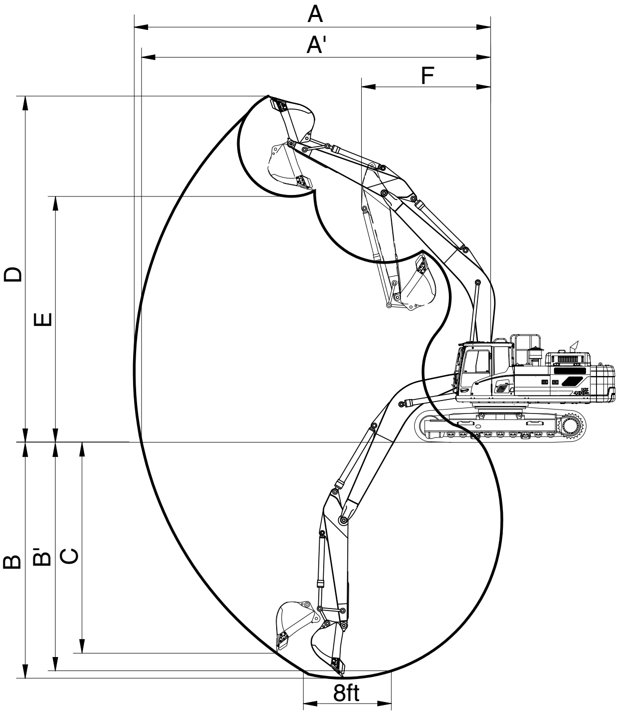


Description		Unit	Specification
Operating weight		kg (lb)	51900 (114420)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	1.00 (1.31)
Overall length	A	mm (ft-in)	10730 (35' 2")
Overall width, with 600 mm shoe (transport position / working position)	B		2990/3540 (9' 10"/11' 7")
Overall height	C		6000 (19' 8")
Superstructure width	D		2980 (9' 9")
Overall height of cab	E		3230 (10' 7")
Ground clearance of counterweight	F		1445 (4' 9")
Engine cover height	G		2870 (9' 5")
Overall height of handrail	G'		3440 (11' 3")
Minimum ground clearance	H		770 (2' 6")
Rear-end distance	I		3665 (12' 0")
Rear-end swing radius	I'		3720 (12' 2")
Distance between tumblers	J		4470 (14' 8")
Undercarriage length	K		5470 (18' 0")
Undercarriage width (transport position / working position)	L		2990/3540 (9' 10"/11' 7")
Track gauge (transport position / working position)	M		2380/2940 (7' 10"/9' 8")
Track shoe width, standard	N		600 (24")
Travel speed (low/high)		km/hr (mph)	3.3/5.0 (2.0/3.1)
Swing speed		rpm	8.5
Gradeability		Degree (%)	35 (70)
Ground pressure (600 mm shoe)		kgf/cm^2 (psi)	0.90 (12.8)
Max traction force		kg (lb)	37300 (82230)

3. WORKING RANGE

1) HX480S L

(1) 7.06 m (23' 2") boom

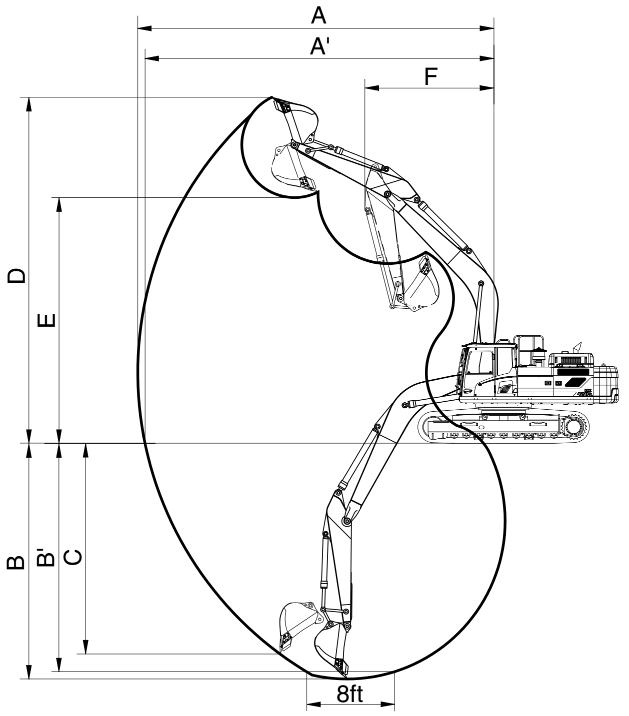


480S2SP04

Description		2.40 m (7' 10") Arm	2.90 m (9' 6") Arm	3.38 m (11' 1") Arm	4.00 m (13' 1") Arm
Max digging reach	A	11200 mm (36' 9")	11620 mm (38' 1")	12040 mm (39' 6")	12600 mm (41' 4")
Max digging reach on ground	A'	10980 mm (36' 0")	11410 mm (37' 5")	11840 mm (38'10")	12410 mm (40' 9")
Max digging depth	B	6780 mm (22' 3")	7280 mm (23'11")	7760 mm (25' 6")	8380 mm (27' 6")
Max digging depth (8ft level)	B'	6600 mm (21' 8")	7120 mm (23' 4")	7620 mm (25' 0")	8250 mm (27' 1")
Max vertical wall digging depth	C	4790 mm (15' 9")	5800 mm (19' 0")	5920 mm (19' 5")	6470 mm (21' 3")
Max digging height	D	10710 mm (35' 2")	10930 mm (35'10")	11030 mm (36' 2")	11260 mm (36'11")
Max dumping height	E	7350 mm (24' 1")	7490 mm (24' 7")	7640 mm (25' 1")	7870 mm (25'10")
Min swing radius	F	5110 mm (16' 9")	4890 mm (16' 1")	4770 mm (15' 8")	4630 mm (15' 2")
Bucket digging force	SAE	213.8 [233.2] kN	211.8 [231.0] kN	213.8 [233.2] kN	215.7 [235.4] kN
		21800 [23780] kgf	21600 [23560] kgf	21800 [23780] kgf	22000 [24000] kgf
		48060 [52430] lbf	47620 [51940] lbf	48060 [52430] lbf	48500 [52910] lbf
	ISO	248.1 [270.7] kN	246.2 [268.5] kN	248.1 [270.7] kN	250.1 [272.8] kN
		25300 [27600] kgf	25100 [27380] kgf	25300 [27600] kgf	25500 [27820] kgf
		55780 [60850] lbf	55340 [60360] lbf	55780 [60850] lbf	56220 [61330] lbf
Arm crowd force	SAE	274.6 [299.6] kN	220.7 [240.8] kN	191.2 [208.6] kN	170.6 [186.1] kN
		28000 [30550] kgf	22500 [24550] kgf	19500 [21270] kgf	17400 [18980] kgf
		61730 [67350] lbf	49600 [54120] lbf	42990 [46890] lbf	38360 [41840] lbf
	ISO	287.3 [313.4] kN	229.5 [250.4] kN	198.1 [216.1] kN	176.5 [192.6] kN
		29300 [31960] kgf	23400 [25530] kgf	20200 [22040] kgf	18000 [19640] kgf
		64600 [70460] lbf	51590 [56280] lbf	44530 [48590] lbf	39680 [43300] lbf

[ ] : Power boost

(2) 6.55 m (21' 6") boom

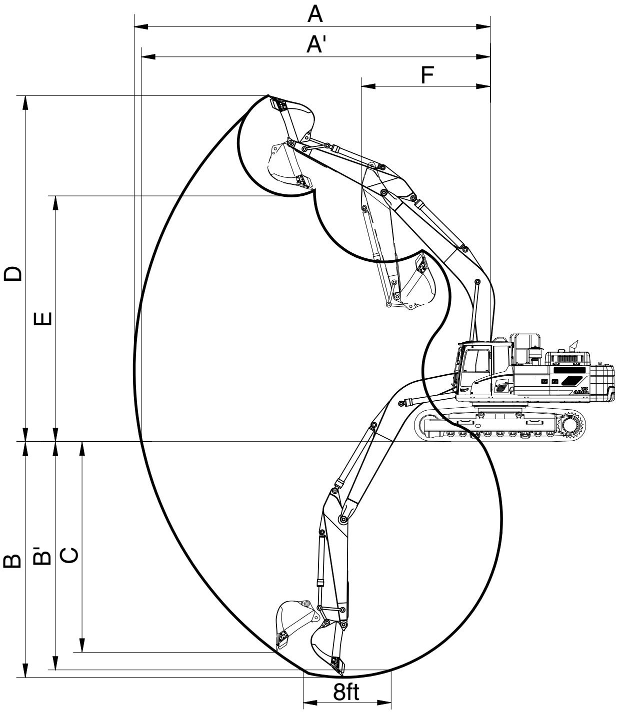


480S2SP04

Description		2.40 m (7' 10") Arm	2.90 m (9' 6") Arm
Max digging reach	A	10650 mm (34'11")	11070 mm (36' 4")
Max digging reach on ground	A'	10430 mm (34' 3")	10850 mm (35' 7")
Max digging depth	B	6420 mm (21' 1")	6920 mm (22' 8")
Max digging depth (8ft level)	B'	6240 mm (20' 6")	6760 mm (22' 2")
Max vertical wall digging depth	C	4510 mm (14'10")	5550 mm (18' 3")
Max digging height	D	10170 mm (33' 4")	10380 mm (34' 1")
Max dumping height	E	6850 mm (22' 6")	6970 mm (22'10")
Min swing radius	F	4730 mm (15' 6")	4520 mm (14'10")
Bucket digging force	SAE	241.2 [263.2] kN	211.8 [231.0] kN
		24600 [24840] kgf	21600 [23560] kgf
		54230 [59170] lbf	47620 [51940] lbf
	ISO	280.5 [306.0] kN	246.2 [268.5] kN
		28600 [31200] kgf	25100 [27380] kgf
		63050 [68780] lbf	55340 [60360] lbf
Arm crowd force	SAE	274.6 [299.6] kN	220.7 [240.8] kN
		28000 [30550] kgf	22500 [24550] kgf
		61730 [67350] lbf	49600 [54120] lbf
	ISO	287.3 [313.4] kN	229.5 [250.4] kN
		29300 [31960] kgf	23400 [25530] kgf
		64600 [70460] lbf	51590 [56280] lbf

[ ] : Power boost

(3) 9.00 m (29' 6") boom

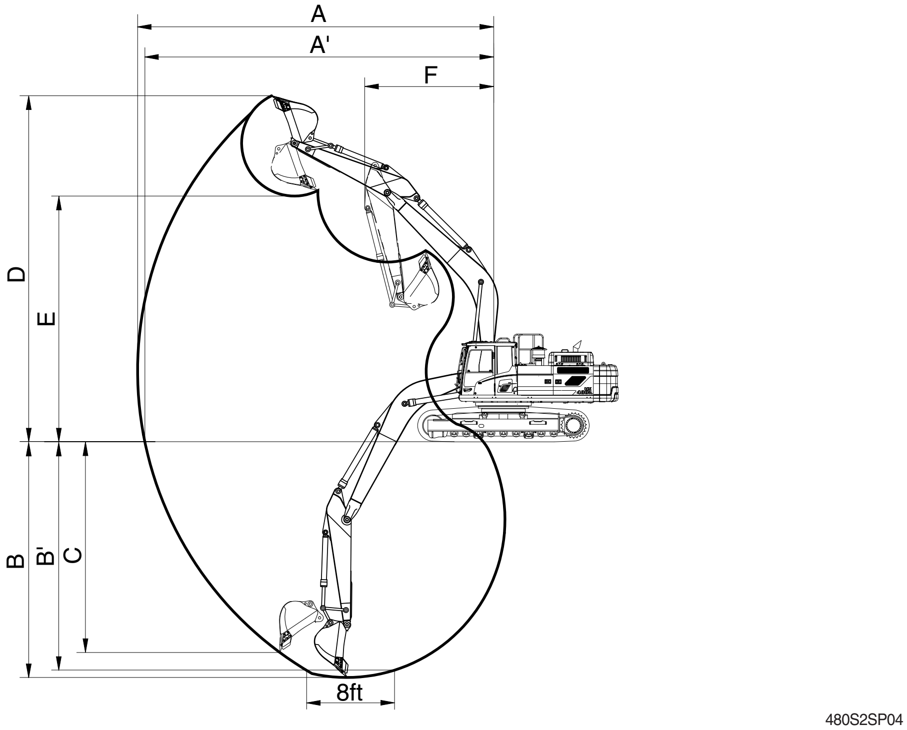


480S2SP04

Description		6.00 m (19' 8") Arm
Max digging reach	A	16180 mm (53' 1")
Max digging reach on ground	A'	16030 mm (52' 7")
Max digging depth	B	12020 mm (39' 5")
Max digging depth (8ft level)	B'	11920 mm (39' 1")
Max vertical wall digging depth	C	8510 mm (27'11")
Max digging height	D	12610 mm (41' 4")
Max dumping height	E	9410 mm (30'10")
Min swing radius	F	6040 mm (19'10")
Bucket digging force	SAE	216.7 kN
		22100 kgf
		48720 lbf
	ISO	252.0 kN
		25700 kgf
		56660 lbf
Arm crowd force	SAE	121.6 kN
		12400 kgf
		27340 lbf
	ISO	124.5 kN
		12700 kgf
		28000 lbf

2) HX520S L

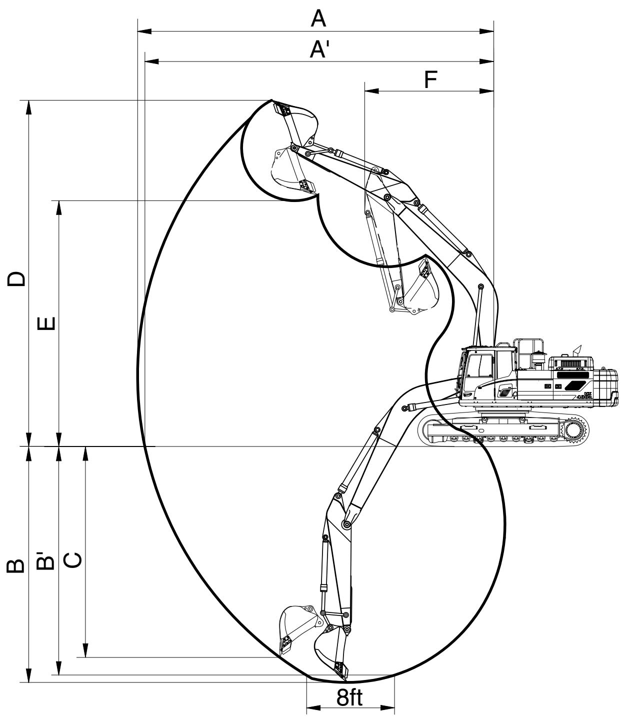
(1) 7.06 m (23' 2") boom



Description		2.40 m (7' 10") Arm	2.90 m (9' 6") Arm	3.38 m (11' 1") Arm	4.00 m (13' 1") Arm
Max digging reach	A	11200 mm (36' 9")	11620 mm (38' 1")	12040 mm (39' 6")	12600 mm (41' 4")
Max digging reach on ground	A'	10950 mm (35'11")	11380 mm (37' 4")	11810 mm (38' 9")	12380 mm (40' 7")
Max digging depth	B	6630 mm (21' 9")	7130 mm (23' 5")	7610 mm (25' 0")	8230 mm (27' 0")
Max digging depth (8ft level)	B'	6460 mm (21' 2")	6980 mm (22'11")	7470 mm (24' 6")	8110 mm (26' 7")
Max vertical wall digging depth	C	4650 mm (15' 3")	5660 mm (18' 7")	5770 mm (18'11")	6320 mm (20' 9")
Max digging height	D	10860 mm (35' 8")	11080 mm (36' 4")	11180 mm (36' 8")	11410 mm (37' 5")
Max dumping height	E	7490 mm (24' 7")	7630 mm (25' 0")	7780 mm (25' 6")	8020 mm (26' 4")
Min swing radius	F	5110 mm (16' 9")	4890 mm (16' 1")	4770 mm (15' 8")	4630 mm (15' 2")
Bucket digging force	SAE	241.2 [263.2] kN	239.3 [261.1] kN	241.2 [263.2] kN	243.2 [265.3] kN
		24600 [26840] kgf	24400 [26620] kgf	24600 [26840] kgf	24800 [27050] kgf
		54230 [59170] lbf	53790 [58690] lbf	54230 [59170] lbf	54670 [59630] lbf
	ISO	280.5 [306.0] kN	278.5 [303.8] kN	280.5 [306.0] kN	282.4 [308.1] kN
		28600 [31200] kgf	28400 [30980] kgf	28600 [31200] kgf	28800 [31420] kgf
		63050 [68780] lbf	62610 [68300] lbf	63050 [68780] lbf	63490 [69270] lbf
Arm crowd force	SAE	274.6 [299.6] kN	220.7 [240.8] kN	191.2 [208.6] kN	170.6 [186.1] kN
		28000 [30550] kgf	22500 [24550] kgf	19500 [21270] kgf	17400 [18980] kgf
		61730 [67350] lbf	49600 [54120] lbf	42990 [46890] lbf	38360 [41840] lbf
	ISO	287.3 [313.4] kN	229.5 [250.4] kN	198.1 [216.1] kN	176.5 [192.6] kN
		29300 [31960] kgf	23400 [25530] kgf	20200 [22040] kgf	18000 [19640] kgf
		64600 [70460] lbf	51590 [56280] lbf	44530 [48590] lbf	39680 [43300] lbf

[ ] : Power boost

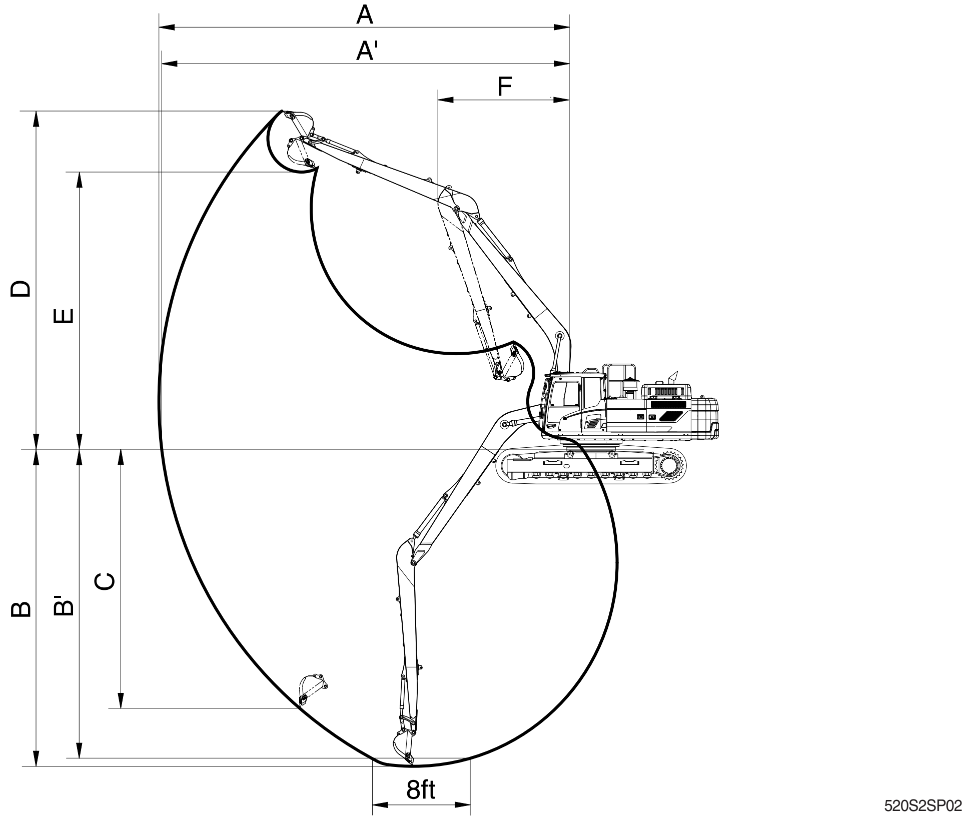
(2) 6.55 m (21' 6") boom



Description		2.40 m (7' 10") Arm	2.90 m (9' 6") Arm
Max digging reach	A	10650 mm (34'11")	11070 mm (36' 4")
Max digging reach on ground	A'	10390 mm (34' 1")	10820 mm (35' 6")
Max digging depth	B	6270 mm (20' 7")	6770 mm (22' 3")
Max digging depth (8ft level)	B'	6090 mm (20' 0")	6610 mm (21' 8")
Max vertical wall digging depth	C	4370 mm (14' 4")	5420 mm (17' 9")
Max digging height	D	10320 mm (33'10")	10530 mm (34' 7")
Max dumping height	E	7000 mm (23' 0")	7210 mm (23' 4")
Min swing radius	F	4730 mm (15' 6")	4520 mm (14'10")
Bucket digging force	SAE	241.2 [263.2] kN	239.3 [261.1] kN
		24600 [26840] kgf	24400 [26620] kgf
		54230 [59170] lbf	53790 [58690] lbf
	ISO	280.5 [306.0] kN	278.5 [303.8] kN
		28600 [31200] kgf	28400 [30980] kgf
		63050 [68780] lbf	62610 [68300] lbf
Arm crowd force	SAE	274.6 [299.6] kN	220.7 [240.8] kN
		28000 [30550] kgf	22500 [24550] kgf
		61730 [67350] lbf	49600 [54120] lbf
	ISO	287.3 [313.4] kN	229.5 [250.4] kN
		29300 [31960] kgf	23400 [25530] kgf
		64600 [70460] lbf	51590 [56280] lbf

[ ] : Power boost

(3) 10.00 m (32' 10") boom



Description		6.85 m (22' 6") Arm
Max digging reach	A	18170 mm (59' 7")
Max digging reach on ground	A'	18020 mm (59' 1")
Max digging depth	B	13080 mm (42' 11")
Max digging depth (8ft level)	B'	13000 mm (42' 8")
Max vertical wall digging depth	C	12230 mm (40' 1")
Max digging height	D	15270 mm (50' 1")
Max dumping height	E	11850 mm (38' 11")
Min swing radius	F	6280 mm (20' 7")
Bucket digging force	SAE	222.6 kN
		22700 kgf
		50045 lbf
	ISO	261.8 kN
		26700 kgf
		58863 lbf
Arm crowd force	SAE	111.8 kN
		11400 kgf
		25133 lbf
	ISO	114.7 kN
		11700 kgf
		25794 lbf

4. WEIGHT

1) HX480S L

Item		HX480S L	
		kg	lb
Upperstructure assembly		20120	44360
Main frame weld assembly		4640	10230
Engine assembly		940	2070
Main pump assembly		185	408
Main control valve assembly		421	928
Swing motor assembly		230	510
Hydraulic oil tank assembly		450	990
Fuel tank assembly		270	600
Counterweight	6.55 m, 7.06 m boom	10200	22490
	9.0 m boom	10700	23590
Cab assembly		490	1080
Lower chassis assembly		19000	41890
Track frame weld assembly		7060	15570
Swing bearing		720	1590
Travel motor assembly		440	970
Turning joint		50	110
Track recoil spring		315	694
Idler		309	681
Sprocket		95	210
Carrier roller		40	90
Track roller		87	192
Track-chain assembly (600 mm standard triple grouser shoe)		2700	5952
Front attachment assembly (7.06 m boom, 3.38 m arm, 2.20 m^3 SAE heaped bucket)		10380	22880
7.06 m boom assembly		3570	7870
6.55 m boom assembly		3560	7850
9.0 m boom assembly		4310	9500
3.38 m arm assembly		1820	4010
2.20 m^3 SAE heaped bucket		2030	4480
Boom cylinder assembly		840	1852
Arm cylinder assembly		590	1300
Bucket cylinder assembly		370	816
Bucket control linkage total		185	410

2) HX520S L

Item		HX520S L	
		kg	lb
Upperstructure assembly		21180	46690
Main frame weld assembly		4640	10230
Engine assembly		940	2070
Main pump assembly		185	408
Main control valve assembly		421	928
Swing motor assembly		230	510
Hydraulic oil tank assembly		450	990
Fuel tank assembly		270	600
Counterweight	6.55 m, 7.06 m boom	10700	23590
Cab assembly		490	1080
Lower chassis assembly		20800	45860
Lower track frame		2130	4700
Center frame support		8070	17790
Swing bearing		720	1590
Travel motor assembly		440	970
Turning joint		50	110
Track recoil spring		315	694
Idler		309	681
Sprocket		95	210
Carrier roller		40	90
Track roller		87	192
Track-chain assembly (600 mm standard triple grouser shoe)		2700	5952
Front attachment assembly (7.06 m boom, 3.38 m arm, 2.20 m^3 SAE heaped bucket)		10420	22970
7.06 m boom assembly		3570	7870
6.55 m boom assembly		3560	7850
9.0 m boom assembly		4310	9500
3.38 m arm assembly		1820	4010
2.20 m^3 SAE heaped bucket		2030	4480
Boom cylinder assembly		840	1852
Arm cylinder assembly		590	1300
Bucket cylinder assembly		400	880
Bucket control linkage total		185	410

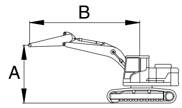
5. LIFTING CAPACITIES

1) HX480S L

Unit : mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX480S L	Mono	6550	2400	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)
7.5m	kg					*13470	*13470			*13010	12160	6.90
24.6ft	lb					*29700	*29700			*28680	26810	(22.7)
6.0m	kg					*14180	*14180	*12640	10510	*12450	9730	7.85
19.7ft	lb					*31260	*31260	*27870	23170	*27450	21450	(25.8)
4.5m	kg					*15610	14270	*13130	10220	*12220	8510	8.43
14.8ft	lb					*34410	31460	*28950	22530	*26940	18760	(27.7)
3.0m	kg					*17120	13510	*13800	9850	*12140	7900	8.71
9.8ft	lb					*37740	29780	*30420	21720	*26760	17420	(28.6)
1.5m	kg					*18030	12930	*14240	9520	*12140	7720	8.72
4.9ft	lb					*39750	28510	*31390	20990	*26760	17020	(28.6)
0.0m	kg					*17950	12640	*14120	9330	*12130	7940	8.47
0.0ft	lb					*39570	27870	*31130	20570	*26740	17500	(27.8)
-1.5m	kg			*21220	19350	*16770	12600	*13060	9310	*11970	8680	7.93
-4.9ft	lb			*46780	42660	*36970	27780	*28790	20530	*26390	19140	(26.0)
-3.0m	kg	*20040	*20040	*17740	*17740	*14140	12790			*11370	10370	7.02
-9.8ft	lb	*44180	*44180	*39110	*39110	*31170	28200			*25070	22860	(23.0)

※ Note

1. Lifting capacity are based on SAE J1097 and ISO 10567.
2. Lifting capacity of the ROBEX 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 mounting pin on the arm (without bucket).
4. *indicates load limited by hydraulic capacity.

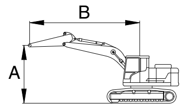
※ Lifting capacities are based upon a standard machine conditions.
Lifting capacities will vary with different work tools, ground conditions and attachments.
The difference between the weight of a work tool attachment must be subtracted.
Consult your HD Hyundai Construction Equipment dealer regarding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

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

Unit : mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX480S L	Mono	6550	2900	10200	600	-	-	-	-

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

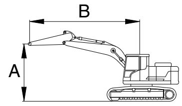


Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
7.5m	kg											*10480	*10480	7.43
24.6ft	lb											*23100	*23100	(24.4)
6.0m	kg					*13350	*13350	*11950	10630			*10270	8940	8.31
19.7ft	lb					*29430	*29430	*26350	23440			*22640	19710	(27.3)
4.5m	kg			*19260	*19260	*14860	14470	*12580	10300			*10440	7890	8.86
14.8ft	lb			*42460	*42460	*32760	31900	*27730	22710			*23020	17390	(29.1)
3.0m	kg					*16520	13650	*13380	9890	*11510	7520	*10970	7360	9.13
9.8ft	lb					*36420	30090	*29500	21800	*25380	16580	*24180	16230	(29.9)
1.5m	kg					*17700	12990	*14000	9520	*11640	7350	*11440	7180	9.14
4.9ft	lb					*39020	28640	*30860	20990	*25660	16200	*25220	15830	(30.0)
0.0m	kg			*24030	19130	*17970	12600	*14120	9270			*11510	7350	8.90
0.0ft	lb			*52980	42170	*39620	27780	*31130	20440			*25380	16200	(29.2)
-1.5m	kg	*17990	*17990	*22290	19130	*17180	12480	*13460	9190			*11500	7940	8.38
-4.9ft	lb	*39660	*39660	*49140	42170	*37880	27510	*29670	20260			*25350	17500	(27.5)
-3.0m	kg	*23650	*23650	*19260	*19260	*15110	12590	*11320	9330			*11210	9270	7.54
-9.8ft	lb	*52140	*52140	*42460	*42460	*33310	27760	*24960	20570			*24710	20440	(24.7)
-4.5m	kg			*14210	*14210	*10700	*10700					*10050	*10050	6.22
-14.8ft	lb			*31330	*31330	*23590	*23590					*22160	*22160	(20.4)

Unit : mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX480S L	Mono	7060	3380	10200	600	-	-	-	-

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

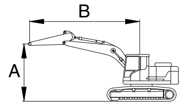


Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0m	kg											*7670	*7670	7.44
29.5ft	lb											*16910	*16910	(24.4)
7.5m	kg							*10410	*10410			*7260	*7260	8.60
24.6ft	lb							*22950	*22950			*16010	*16010	(28.2)
6.0m	kg							*10900	10640	*9960	7860	*7160	*7160	9.37
19.7ft	lb							*24030	23460	*21960	17330	*15790	*15790	(30.8)
4.5m	kg			*18500	*18500	*14060	*14060	*11750	10230	*10390	7670	*7280	6580	9.86
14.8ft	lb			*40790	*40790	*31000	*31000	*25900	22550	*22910	16910	*16050	14510	(32.4)
3.0m	kg			*22270	20290	*15870	13460	*12710	9760	*10850	7430	*7610	6180	10.10
9.8ft	lb			*49100	44730	*34990	29670	*28020	21520	*23920	16380	*16780	13620	(33.1)
1.5m	kg			*16400	*16400	*17200	12750	*13490	9340	*11220	7190	*8180	6040	10.11
4.9ft	lb			*36160	*36160	*37920	28110	*29740	20590	*24740	15850	*18030	13320	(33.2)
0.0m	kg			*18720	*18720	*17670	12320	*13840	9050	*11320	7020	*9100	6140	9.90
0.0ft	lb			*41270	*41270	*38960	27160	*30510	19950	*24960	15480	*20060	13540	(32.5)
-1.5m	kg	*13480	*13480	*22470	18690	*17220	12150	*13580	8900	*10890	6950	*10110	6530	9.44
-4.9ft	lb	*29720	*29720	*49540	41200	*37960	26790	*29940	19620	*24010	15320	*22290	14400	(31.0)
-3.0m	kg	*21440	*21440	*20150	18880	*15830	12200	*12480	8930			*10030	7350	8.69
-9.8ft	lb	*47270	*47270	*44420	41620	*34900	26900	*27510	19690			*22110	16200	(28.5)
-4.5m	kg	*20150	*20150	*16520	*16520	*13130	12450	*9780	9180			*9560	9050	7.58
-14.8ft	lb	*44420	*44420	*36420	*36420	*28950	27450	*21560	20240			*21080	19950	(24.9)

Unit : mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX480S L	Mono	7060	2400	10200	600	-	-	-	-

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

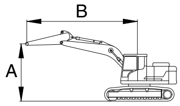


Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0m	kg											*12900	*12900	6.24
29.5ft	lb											*28440	*28440	(20.5)
7.5m	kg							*11900	10600			*11880	10380	7.59
24.6ft	lb							*26230	23370			*26190	22880	(24.9)
6.0m	kg					*13900	*13900	*12080	10430			*11450	8560	8.46
19.7ft	lb					*30640	*30640	*26630	22990			*25240	18870	(27.8)
4.5m	kg					*15490	13920	*12750	10050			*11260	7590	9.00
14.8ft	lb					*34150	30690	*28110	22160			*24820	16730	(29.5)
3.0m	kg					*17010	13100	*13500	9640	*11470	7410	*11200	7100	9.26
9.8ft	lb					*37500	28880	*29760	21250	*25290	16340	*24690	15650	(30.4)
1.5m	kg					*17790	12550	*13980	9300	*11570	7240	*11180	6950	9.27
4.9ft	lb					*39220	27670	*30820	20500	*25510	15960	*24650	15320	(30.4)
0.0m	kg					*17610	12310	*13950	9100	*11230	7160	*11160	7120	9.04
0.0ft	lb					*38820	27140	*30750	20060	*24760	15790	*24600	15700	(29.6)
-1.5m	kg					*16530	12300	*13170	9060			*11030	7700	8.53
-4.9ft	lb					*36440	27120	*29030	19970			*24320	16980	(28.0)
-3.0m	kg			*17410	*17410	*14390	12480	*11100	9240			*10570	8960	7.70
-9.8ft	lb			*38380	*38380	*31720	27510	*24470	20370			*23300	19750	(25.3)
-4.5m	kg			*12830	*12830	*10270	*10270					*9180	*9180	6.41
-14.8ft	lb			*28290	*28290	*22640	*22640					*20240	*20240	(21.0)

Unit : mm

Model	Boom Type	Boom Length	Arm Length	Counterweight Weight (kg)	Shoe Width	Dozer Front	Dozer Rear	Outrigger Front	Outrigger Rear
HX480S L	Mono	7060	2900	10200	600	-	-	-	-

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

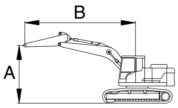


Lift-point height (A)		Lift-point radius (B) 3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		At max. reach Capacity		Reach m (ft)
9.0m	kg											*11100	*11100	6.86
29.5ft	lb											*24470	*24470	(22.5)
7.5m	kg							*11080	10750			*10430	9390	8.10
24.6ft	lb							*24430	23700			*22990	20700	(26.6)
6.0m	kg					*13100	*13100	*11450	10510			*10260	7870	8.92
19.7ft	lb					*28880	*28880	*25240	23170			*22620	17350	(29.3)
4.5m	kg					*14730	14090	*12220	10100	*10770	7610	*10430	7040	9.43
14.8ft	lb					*32470	31060	*26940	22270	*23740	16780	*22990	15520	(30.9)
3.0m	kg					*16400	13220	*13070	9650	*11130	7380	*10480	6590	9.68
9.8ft	lb					*36160	29150	*28810	21270	*24540	16270	*23100	14530	(31.8)
1.5m	kg					*17460	12560	*13700	9260	*11380	7170	*10520	6440	9.69
4.9ft	lb					*38490	27690	*30200	20410	*25090	15810	*23190	14200	(31.8)
0.0m	kg					*17610	12220	*13870	9010	*11300	7030	*10560	6570	9.47
0.0ft	lb					*38820	26940	*30580	19860	*24910	15500	*23280	14480	(31.1)
-1.5m	kg			*21410	18700	*16860	12130	*13370	8920			*10540	7040	8.99
-4.9ft	lb			*47200	41230	*37170	26740	*29480	19670			*23240	15520	(29.5)
-3.0m	kg	*21880	*21880	*18800	*18800	*15120	12250	*11890	9010			*10310	8050	8.20
-9.8ft	lb	*48240	*48240	*41450	*41450	*33330	27010	*26210	19860			*22730	17750	(26.9)
-4.5m	kg			*14730	*14730	*11850	*11850					*9480	*9480	7.01
-14.8ft	lb			*32470	*32470	*26120	*26120					*20900	*20900	(23.0)

Unit : mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX480S L	Mono	7060	4000	10200	600	-	-	-	-

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

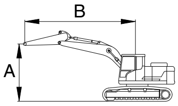


Lift-point height (A)		Lift-point radius (B)												At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		10.5 m (34.4 ft)		Capacity		Reach
																m (ft)
9.0m	kg													*6180	*6180	8.19
29.5ft	lb													*13620	*13620	(26.9)
7.5m	kg									*7290	*7290			*5890	*5890	9.26
24.6ft	lb									*16070	*16070			*12990	*12990	(30.4)
6.0m	kg							*10180	*10180	*9430	8010			*5810	*5810	9.98
19.7ft	lb							*22440	*22440	*20790	17660			*12810	*12810	(32.7)
4.5m	kg					*13090	*13090	*11110	10410	*9880	7790			*5900	*5900	10.44
14.8ft	lb					*28860	*28860	*24490	22950	*21780	17170			*13010	*13010	(34.2)
3.0m	kg			*20690	*20690	*15050	13750	*12170	9900	*10450	7510	*7550	5850	*6150	5690	10.67
9.8ft	lb			*45610	*45610	*33180	30310	*26830	21830	*23040	16560	*16640	12900	*13560	12540	(35.0)
1.5m	kg			*22110	19470	*16650	12930	*13100	9430	*10950	7230	*8270	5710	*6580	5560	10.68
4.9ft	lb			*48740	42920	*36710	28510	*28880	20790	*24140	15940	*18230	12590	*14510	12260	(35.0)
0.0m	kg			*20410	18760	*17480	12380	*13670	9070	*11230	7010			*7250	5630	10.47
0.0ft	lb			*45000	41360	*38540	27290	*30140	20000	*24760	15450			*15980	12410	(34.4)
-1.5m	kg	*13070	*13070	*23270	18560	*17430	12110	*13680	8860	*11090	6890			*8300	5930	10.04
-4.9ft	lb	*28810	*28810	*51300	40920	*38430	26700	*30160	19530	*24450	15190			*18300	13070	(32.9)
-3.0m	kg	*19110	*19110	*21440	18640	*16460	12070	*12980	8810	*10210	6890			*9550	6570	9.35
-9.8ft	lb	*42130	*42130	*47270	41090	*36290	26610	*28620	19420	*22510	15190			*21050	14480	(30.7)
-4.5m	kg	*23900	*23900	*18380	*18380	*14370	12230	*11150	8950					*9350	7820	8.32
-14.8ft	lb	*52690	*52690	*40520	*40520	*31680	26960	*24580	19730					*20610	17240	(27.3)
-6.0m	kg			*13460	*13460	*10400	*10400							*8480	*8480	6.83
-19.7ft	lb			*29670	*29670	*22930	*22930							*18700	*18700	(22.4)

Unit : mm

Model	Boom Type	Boom Length	Arm Length	Counterweight Weight (kg)	Shoe Width	Dozer Front	Dozer Rear	Outrigger Front	Outrigger Rear
HX480S L	Mono	9000	6000	10700	600	-	-	-	-

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



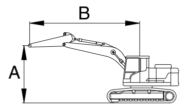
Lift-point height (A)		Lift-point radius (B)																At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		10.5 m (34.4 ft)		12.0 m (39.4 ft)		13.5 m (44.3 ft)		Capacity		Reach
																				m (ft)
10.5m	kg																	*2480	*2480	11.56
34.4ft	lb																	*5470	*5470	(37.9)
9.0m	kg													*3660	*3660			*2400	*2400	12.51
29.5ft	lb													*8070	*8070			*5290	*5290	(41.1)
7.5m	kg													*5020	*5020			*2370	*2370	13.23
24.6ft	lb													*11070	*11070			*5220	*5220	(43.4)
6.0m	kg											*6250	*6250	*5820	4910	*3180	*3180	*2400	*2400	13.74
19.7ft	lb											*13780	*13780	*12830	10820	*7010	*7010	*5290	*5290	(45.1)
4.5m	kg									*7500	*7500	*6680	6020	*6090	4710	*4290	3710	*2470	*2470	14.08
14.8ft	lb									*16530	*16530	*14730	13270	*13430	10380	*9460	8180	*5450	*5450	(46.2)
3.0m	kg			*17780	*17780	*12540	*12540	*9850	9640	*8230	7290	*7150	5680	*6380	4490	*5070	3580	*2590	*2590	14.25
9.8ft	lb			*39200	*39200	*27650	*27650	*21720	21250	*18140	16070	*15760	12520	*14070	9900	*11180	7890	*5710	*5710	(46.7)
1.5m	kg			*11650	*11650	*14170	12070	*10880	8860	*8900	6800	*7590	5350	*6670	4270	*5570	3440	*2770	*2770	14.26
4.9ft	lb			*25680	*25680	*31240	26610	*23990	19530	*19620	14990	*16730	11790	*14700	9410	*12280	7580	*6110	*6110	(46.8)
0.0m	kg			*10370	*10370	*15190	11190	*11640	8250	*9430	6380	*7950	5060	*6890	4080	*5620	3320	*3020	*3020	14.10
0.0ft	lb			*22860	*22860	*33490	24670	*25660	18190	*20790	14070	*17530	11160	*15190	8990	*12390	7320	*6660	*6660	(46.3)
-1.5m	kg	*7150	*7150	*11470	*11470	*15570	10690	*12040	7840	*9750	6060	*8170	4830	*7000	3920	*4830	3230	*3370	3120	13.79
-4.9ft	lb	*15760	*15760	*25290	*25290	*34330	23570	*26540	17280	*21500	13360	*18010	10650	*15430	8640	*10650	7120	*7430	6880	(45.2)
-3.0m	kg	*9520	*9520	*13510	*13510	*15400	10460	*12080	7600	*9810	5870	*8190	4690	*6930	3830			*3860	3270	13.29
-9.8ft	lb	*20990	*20990	*29780	*29780	*33950	23060	*26630	16760	*21630	12940	*18060	10340	*15280	8440			*8510	7210	(43.6)
-4.5m	kg	*12060	*12060	*16210	*16210	*14740	10430	*11720	7520	*9570	5790	*7940	4630	*6600	3810			*4610	3560	12.60
-14.8ft	lb	*26590	*26590	*35740	*35740	*32500	22990	*25840	16580	*21100	12760	*17500	10210	*14550	8400			*10160	7850	(41.3)
-6.0m	kg	*14890	*14890	*17360	16650	*13580	10560	*10920	7580	*8930	5820	*7310	4670					*5810	4050	11.67
-19.7ft	lb	*32830	*32830	*38270	36710	*29940	23280	*24070	16710	*19690	12830	*16120	10300					*12810	8930	(38.3)
-7.5m	kg	*18170	*18170	*14770	*14770	*11790	10840	*9550	7770	*7720	5980							*6050	4890	10.44
-24.6ft	lb	*40060	*40060	*32560	*32560	*25990	23900	*21050	17130	*17020	13180							*13340	10780	(34.3)
-9.0m	kg			*11140	*11140	*9080	*9080	*7280	*7280									*5700	*5700	8.80
-29.5ft	lb			*24560	*24560	*20020	*20020	*16050	*16050									*12570	*12570	(28.9)

2) HX520S L

Unit : mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX520S L	Mono	6550	2400	10700	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)		At max. reach Capacity		Reach m (ft)
7.5m	kg					*13500	*13500			*12940	*12940	7.02
24.6ft	lb					*29760	*29760			*28530	*28530	(23.0)
6.0m	kg					*14310	*14310	*12670	11900	*12420	10870	7.93
19.7ft	lb					*31550	*31550	*27930	26230	*27380	23960	(26.0)
4.5m	kg					*15780	*15780	*13210	11590	*12210	9610	8.47
14.8ft	lb					*34790	*34790	*29120	25550	*26920	21190	(27.8)
3.0m	kg					*17270	15400	*13870	11220	*12150	9000	8.72
9.8ft	lb					*38070	33950	*30580	24740	*26790	19840	(28.6)
1.5m	kg					*18080	14840	*14270	10900	*12150	8860	8.71
4.9ft	lb					*39860	32720	*31460	24030	*26790	19530	(28.6)
0.0m	kg					*17900	14570	*14080	10720	*12130	9180	8.43
0.0ft	lb					*39460	32120	*31040	23630	*26740	20240	(27.7)
-1.5m	kg			*20970	*20970	*16600	14550	*12880	10720	*11950	10110	7.86
-4.9ft	lb			*46230	*46230	*36600	32080	*28400	23630	*26350	22290	(25.8)
-3.0m	kg	*19550	*19550	*17320	*17320	*13780	*13780			*11270	*11270	6.91
-9.8ft	lb	*43100	*43100	*38180	*38180	*30380	*30380			*24850	*24850	(22.7)

※ Note

1. Lifting capacity are based on SAE J1097 and ISO 10567.
2. Lifting capacity of the ROBEX 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 mounting pin on the arm (without bucket).
4. *indicates load limited by hydraulic capacity.

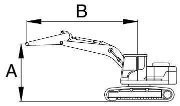
※ Lifting capacities are based upon a standard machine conditions.
Lifting capacities will vary with different work tools, ground conditions and attachments.
The difference between the weight of a work tool attachment must be subtracted.
Consult your HD Hyundai Construction Equipment dealer regarding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

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

Unit : mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX520S L	Mono	6550	2900	10700	600	-	-	-	-

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

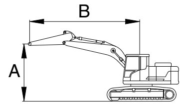


Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0m	kg											*11180	*11180	6.21
29.5ft	lb											*24650	*24650	(20.4)
7.5m	kg							*10730	*10730			*10420	*10420	7.53
24.6ft	lb							*23660	*23660			*22970	*22970	(24.7)
6.0m	kg					*13460	*13460	*11970	*11970			*10250	9990	8.38
19.7ft	lb					*29670	*29670	*26390	*26390			*22600	22020	(27.5)
4.5m	kg			*19620	*19620	*15010	*15010	*12640	11650			*10460	8910	8.90
14.8ft	lb			*43250	*43250	*33090	*33090	*27870	25680			*23060	19640	(29.2)
3.0m	kg					*16650	15510	*13440	11230	*11510	8570	*11020	8370	9.14
9.8ft	lb					*36710	34190	*29630	24760	*25380	18890	*24290	18450	(30.0)
1.5m	kg					*17750	14860	*14010	10860	*11610	8390	*11430	8230	9.13
4.9ft	lb					*39130	32760	*30890	23940	*25600	18500	*25200	18140	(29.9)
0.0m	kg			*23890	22240	*17910	14490	*14080	10620			*11490	8470	8.86
0.0ft	lb			*52670	49030	*39480	31940	*31040	23410			*25330	18670	(29.1)
-1.5m	kg	*19060	*19060	*22030	*22030	*17020	14390	*13310	10560			*11470	9220	8.32
-4.9ft	lb	*42020	*42020	*48570	*48570	*37520	31720	*29340	23280			*25290	20330	(27.3)
-3.0m	kg	*23080	*23080	*18850	*18850	*14790	14530					*11130	10860	7.43
-9.8ft	lb	*50880	*50880	*41560	*41560	*32610	32030					*24540	23940	(24.4)
-4.5m	kg			*13500	*13500	*9960	*9960					*9800	*9800	6.05
-14.8ft	lb			*29760	*29760	*21960	*21960					*21610	*21610	(19.9)

Unit : mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX520S L	Mono	7060	3380	10700	600	-	-	-	-

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

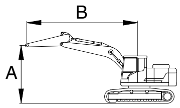


Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0m	kg							*8120	*8120			*7590	*7590	7.58
29.5ft	lb							*17900	*17900			*16730	*16730	(24.9)
7.5m	kg							*10410	*10410			*7220	*7220	8.69
24.6ft	lb							*22950	*22950			*15920	*15920	(28.5)
6.0m	kg							*10950	*10950	*10050	8920	*7140	*7140	9.43
19.7ft	lb							*24140	*24140	*22160	19670	*15740	*15740	(31.0)
4.5m	kg			*18880	*18880	*14220	*14220	*11830	11560	*10410	8720	*7280	*7280	9.90
14.8ft	lb			*41620	*41620	*31350	*31350	*26080	25490	*22950	19220	*16050	*16050	(32.5)
3.0m	kg			*22540	*22540	*16010	15310	*12780	11090	*10870	8470	*7630	7060	10.11
9.8ft	lb			*49690	*49690	*35300	33750	*28180	24450	*23960	18670	*16820	15560	(33.2)
1.5m	kg			*16320	*16320	*17260	14610	*13530	10670	*11230	8230	*8230	6950	10.10
4.9ft	lb			*35980	*35980	*38050	32210	*29830	23520	*24760	18140	*18140	15320	(33.1)
0.0m	kg			*19190	*19190	*17640	14200	*13820	10390	*11290	8060	*9200	7100	9.86
0.0ft	lb			*42310	*42310	*38890	31310	*30470	22910	*24890	17770	*20280	15650	(32.4)
-1.5m	kg	*14230	*14230	*22260	21810	*17110	14050	*13500	10260	*10780	8010	*10090	7590	9.38
-4.9ft	lb	*31370	*31370	*49070	48080	*37720	30970	*29760	22620	*23770	17660	*22240	16730	(30.8)
-3.0m	kg	*22280	*22280	*19840	*19840	*15610	14120	*12290	10300			*9990	8600	8.60
-9.8ft	lb	*49120	*49120	*43740	*43740	*34410	31130	*27090	22710			*22020	18960	(28.2)
-4.5m	kg	*19480	*19480	*16030	*16030	*12740	*12740					*9450	*9450	7.45
-14.8ft	lb	*42950	*42950	*35340	*35340	*28090	*28090					*20830	*20830	(24.4)

Unit : mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX520S L	Mono	7060	2400	10700	600	-	-	-	-

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



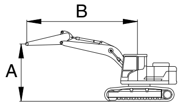
Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0m	kg											*12730	*12730	6.40
29.5ft	lb											*28060	*28060	(21.0)
7.5m	kg							*11850	*11850			*11810	11480	7.69
24.6ft	lb							*26120	*26120			*26040	25310	(25.2)
6.0m	kg					*14020	*14020	*12110	11790			*11410	9590	8.53
19.7ft	lb					*30910	*30910	*26700	25990			*25150	21140	(28.0)
4.5m	kg					*15630	*15630	*12810	11390	*11260	8640	*11230	8590	9.03
14.8ft	lb					*34460	*34460	*28240	25110	*24820	19050	*24760	18940	(29.6)
3.0m	kg					*17110	14950	*13540	10970	*11470	8460	*11180	8090	9.27
9.8ft	lb					*37720	32960	*29850	24180	*25290	18650	*24650	17840	(30.4)
1.5m	kg					*17790	14420	*13980	10630	*11540	8290	*11160	7970	9.26
4.9ft	lb					*39220	31790	*30820	23440	*25440	18280	*24600	17570	(30.4)
0.0m	kg					*17520	14210	*13880	10450			*11130	8220	9.00
0.0ft	lb					*38620	31330	*30600	23040			*24540	18120	(29.5)
-1.5m	kg					*16350	14210	*13020	10430			*10980	8940	8.46
-4.9ft	lb					*36050	31330	*28700	22990			*24210	19710	(27.8)
-3.0m	kg			*17030	*17030	*14080	*14080	*10730	10650			*10470	*10470	7.59
-9.8ft	lb			*37540	*37540	*31040	*31040	*23660	23480			*23080	*23080	(24.9)
-4.5m	kg			*12190	*12190	*9600	*9600					*8910	*8910	6.25
-14.8ft	lb			*26870	*26870	*21160	*21160					*19640	*19640	(20.5)

Unit : mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX520S L	Mono	7060	2900	10700	600	-	-	-	-

· : Rating over-front

· : Rating over-side or 360 degree

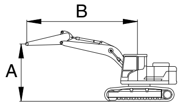


Lift-point height (A)		Lift-point radius (B)										At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		Capacity		Reach
														m (ft)
9.0m	kg											*10980	*10980	7.00
29.5ft	lb											*24210	*24210	(23.0)
7.5m	kg							*11070	*11070			*10380	*10380	8.20
24.6ft	lb							*24410	*24410			*22880	*22880	(26.9)
6.0m	kg					*13220	*13220	*11490	*11490			*10250	8840	8.98
19.7ft	lb					*29150	*29150	*25330	*25330			*22600	19490	(29.5)
4.5m	kg					*14880	*14880	*12280	11440	*10790	8650	*10440	7970	9.47
14.8ft	lb					*32800	*32800	*27070	25220	*23790	19070	*23020	17570	(31.1)
3.0m	kg					*16510	15060	*13130	10980	*11140	8420	*10460	7530	9.69
9.8ft	lb					*36400	33200	*28950	24210	*24560	18560	*23060	16600	(31.8)
1.5m	kg					*17490	14420	*13720	10600	*11370	8210	*10500	7400	9.68
4.9ft	lb					*38560	31790	*30250	23370	*25070	18100	*23150	16310	(31.8)
0.0m	kg					*17550	14110	*13830	10350	*11240	8080	*10540	7590	9.43
0.0ft	lb					*38690	31110	*30490	22820	*24780	17810	*23240	16730	(30.9)
-1.5m	kg			*21170	*21170	*16710	14040	*13250	10280			*10510	8180	8.92
-4.9ft	lb			*46670	*46670	*36840	30950	*29210	22660			*23170	18030	(29.3)
-3.0m	kg	*21490	*21490	*18450	*18450	*14850	14180	*11630	10390			*10240	9420	8.10
-9.8ft	lb	*47380	*47380	*40680	*40680	*32740	31260	*25640	22910			*22580	20770	(26.6)
-4.5m	kg			*14180	*14180	*11370	*11370					*9310	*9310	6.86
-14.8ft	lb			*31260	*31260	*25070	*25070					*20530	*20530	(22.5)

Unit : mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX520S L	Mono	7060	4000	10700	600	-	-	-	-

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

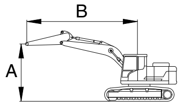


Lift-point height (A)		Lift-point radius (B)												At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		10.5 m (34.4 ft)		Capacity		Reach
																m (ft)
9.0m	kg													*6120	*6120	8.32
29.5ft	lb													*13490	*13490	(27.3)
7.5m	kg									*7640	*7640			*5850	*5850	9.34
24.6ft	lb									*16840	*16840			*12900	*12900	(30.6)
6.0m	kg							*10240	*10240	*9450	9070			*5800	*5800	10.04
19.7ft	lb							*22580	*22580	*20830	20000			*12790	*12790	(32.9)
4.5m	kg					*13260	*13260	*11190	*111 90	*9920	8830			*5900	*5900	10.47
14.8ft	lb					*29230	*29230	*24670	*24670	*21870	19470			*13010	*13010	(34.4)
3.0m	kg			*21020	*21020	*15210	*15210	*12250	11230	*10480	8540	*7660	6700	*6160	*6160	10.68
9.8ft	lb			*46340	*46340	*33530	*33530	*27010	24760	*23100	18830	*16890	14770	*13580	*13580	(35.0)
1.5m	kg			*21450	*21450	*16740	14780	*13160	10760	*10970	8270	*8230	6560	*6610	6410	10.67
4.9ft	lb			*47290	*47290	*36910	32580	*29010	23720	*24180	18230	*18140	14460	*14570	14130	(35.0)
0.0m	kg			*20600	*20600	*17490	14250	*13670	10410	*11220	8050			*7310	6520	10.44
0.0ft	lb			*45420	*45420	*38560	31420	*30140	22950	*24740	17750			*16120	14370	(34.3)
-1.5m	kg	*13610	*13610	*23120	21670	*17350	14000	*13630	10210	*11020	7940			*8410	6900	9.98
-4.9ft	lb	*30000	*30000	*50970	47770	*38250	30860	*30050	22510	*24290	17500			*18540	15210	(32.8)
-3.0m	kg	*19760	*19760	*21170	*21170	*16290	13980	*12830	10180	*10040	7960			*9520	7670	9.26
-9.8ft	lb	*43560	*43560	*46670	*46670	*35910	30820	*28290	22440	*22130	17550			*20990	16910	(30.4)
-4.5m	kg	*23280	*23280	*17970	*17970	*14060	*14060	*10850	10340					*9290	9200	8.20
-14.8ft	lb	*51320	*51320	*39620	*39620	*31000	*31000	*23920	22800					*20480	20280	(26.9)
-6.0m	kg			*12800	*12800	*9800	*9800							*8280	*8280	6.64
-19.7ft	lb			*28220	*28220	*21610	*21610							*18250	*18250	(21.8)

Unit : mm

Model	Boom	Boom	Arm	Counterweight	Shoe	Dozer		Outrigger	
	Type	Length	Length	Weight (kg)	Width	Front	Rear	Front	Rear
HX520S L	Mono	10000	6850	11700	800	-	-	-	-

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

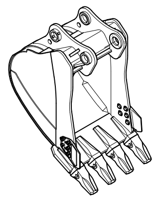
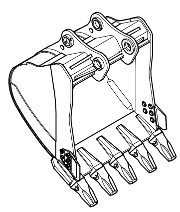
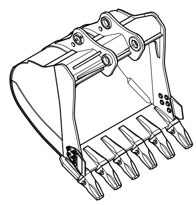


Lift-point height (A)		Lift-point radius (B)																				At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		9.0 m (29.5 ft)		10.5 m (34.4 ft)		12.0 m (39.4 ft)		13.5 m (44.3 ft)		15.0 m (49.2 ft)		Capacity		Reach m (ft)
13.5m	kg																					*3010	*3010	11.84
44.3ft	lb																					*6640	*6640	(38.8)
12.0m	kg																					*2800	*2800	13.11
39.4ft	lb																					*6170	*6170	(43.0)
10.0m	kg																	*3800	*3800			*2680	*2680	14.10
34.4ft	lb																	*8380	*8380			*5910	*5910	(46.3)
9.0m	kg																	*4500	*4500			*2610	*2610	14.88
29.5ft	lb																	*9920	*9920			*5750	*5750	(48.8)
7.5m	kg															*4870	*4870	*4600	*4600	*3670	*3670	*2590	*2590	15.47
24.6ft	lb															*10740	*10740	*10140	*10140	*8090	*8090	*5710	*5710	(50.8)
6.0m	kg													*5620	*5620	*5130	*5130	*4760	4640	*4470	3700	*2600	*2600	15.90
19.7ft	lb													*12390	*12390	*11310	*11310	*10490	10230	*9850	8160	*5730	*5730	(52.2)
4.5m	kg											*6950	*6950	*6070	*6070	*5430	*5430	*4950	4460	*4580	3590	*2660	*2660	16.17
14.8ft	lb											*15320	*15320	*13380	*13380	*11970	*11970	*10910	9830	*10100	7910	*5860	*5860	(53.1)
3.0m	kg							*12050	*12050	*9300	*9300	*7640	*7640	*6530	*6530	*5750	5270	*5160	4260	*4710	3460	*2750	*2750	16.31
9.8ft	lb							*26570	*26570	*20500	*20500	*16840	*16840	*14400	*14400	*12680	11620	*11380	9390	*10380	7630	*6060	*6060	(53.5)
1.5m	kg							*13470	*13470	*10230	10070	*8270	7780	*6970	6170	*6040	4990	*5360	4070	*4820	3330	*2880	2810	16.30
4.9ft	lb							*29700	*29700	*22550	22200	*18230	17150	*15370	13600	*13320	11000	*11820	8970	*10630	7340	*6350	6190	(53.5)
0.0m	kg							*12920	12670	*10900	9370	*8760	7290	*7320	5820	*6290	4740	*5510	3890	*4890	3220	*3070	2790	16.15
0.0ft	lb							*28480	27930	*24030	20660	*19310	16070	*16140	12830	*13870	10450	*12150	8580	*10780	7100	*6770	6150	(53.0)
-1.5m	kg					*6620	*6620	*12480	12140	*11270	8910	*9070	6920	*7550	5550	*6450	4530	*5600	3750	*4890	3130	*3320	2840	15.86
-4.9ft	lb					*14590	*14590	*27510	26760	*24850	19640	*20000	15260	*16640	12240	*14220	9990	*12350	8270	*10780	6900	*7320	6260	(52.0)
-3.0m	kg	*4750	*4750	*5780	*5780	*8370	*8370	*13630	11890	*11320	8640	*9170	6690	*7640	5360	*6490	4390	*5580	3660	*4770	3090	*3650	2960	15.42
-9.8ft	lb	*10470	*10470	*12740	*12740	*18450	*18450	*30050	26210	*24960	19050	*20220	14750	*16840	11820	*14310	9680	*12300	8070	*10520	6810	*8050	6530	(50.6)
-4.5m	kg	*6650	*6650	*7860	*7860	*10510	*10510	*13940	11850	*11070	8530	*9040	6570	*7530	5260	*6370	4320	*5400	3620			*4120	3160	14.81
-14.8ft	lb	*14660	*14660	*17330	*17330	*23170	*23170	*30730	26120	*24410	18810	*19930	14480	*16600	11600	*14040	9520	*11900	7980			*9080	6970	(48.6)
-6.0m	kg	*8670	*8670	*10150	*10150	*13100	*13100	*13060	11950	*10510	8550	*8640	6560	*7200	5250	*6030	4320	*4950	3660			*4540	3480	14.02
-19.7ft	lb	*19110	*19110	*22380	*22380	*28880	*28880	*28790	26350	*23170	18850	*19050	14460	*15870	11570	*13290	9520	*10910	8070			*10010	7670	(46.0)
-7.5m	kg	*10910	*10910	*12790	*12790	*14810	*14810	*11770	*11770	*9590	8690	*7910	6650	*6550	5330	*5340	4420					*4460	3990	13.00
-24.6ft	lb	*24050	*24050	*28200	*28200	*32650	*32650	*25950	*25950	*21140	19160	*17440	14660	*14440	11750	*11770	9740					*9830	8800	(42.7)
-9.0m	kg			*15710	*15710	*12250	*12250	*9950	*9950	*8190	*8190	*6730	*6730	*5400	*5400							*4240	*4240	11.70
-29.5ft	lb			*34630	*34630	*27010	*27010	*21940	*21940	*18060	*18060	*14840	*14840	*11900	*11900							*9350	*9350	(38.4)
-10.5m	kg					*8790	*8790	*7370	*7370	*6070	*6070	*4760	*4760									*3720	*3720	10.01
-34.4ft	lb					*19380	*19380	*16250	*16250	*13380	*13380	*10490	*10490									*8200	*8200	(32.8)

6. BUCKET SELECTION GUIDE

1) HX480S L

(1) General bucket

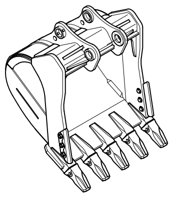
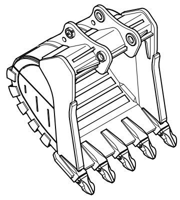
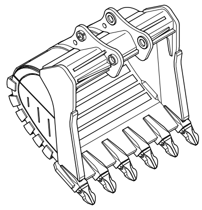
		
1.38 m³ SAE heaped bucket	2.20 m³ SAE heaped bucket	3.00 m³ SAE heaped bucket

Capacity		Width	Weight	Recommendation						
				7.06 m (23' 2") boom				6.55 m (21' 6") boom		9.00 m (29' 6") boom
SAE heaped	CECE heaped			2.4 m arm (7' 10")	2.9 m arm (9' 6")	3.38 m arm (11' 1")	4.0 m arm (13' 1")	2.4 m arm (7' 10")	2.9 m arm (9' 6")	6.00 m arm (19' 8")
1.38 m^3 (1.80 yd^3)	1.24 m^3 (1.62 yd^3)	1135 mm (45")	1670 kg (3680 lb)	●	●	●	●	●	●	▲
2.20 m^3 (2.88 yd^3)	1.93 m^3 (2.52 yd^3)	1575 mm (62")	2030 kg (4480 lb)	●	◐	◐	■	●	●	X
3.00 m^3 (3.92 yd^3)	2.70 m^3 (3.53 yd^3)	1905 mm (75")	2460 kg (5420 lb)	■	▲	▲	X	◐	■	X

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

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

(2) Heavy duty and rock-heavy duty bucket

		
◈ 2.79 m³ SAE heaped bucket	◆ 2.20 m³ SAE ◆ 2.43 m³ SAE ◆ 2.79 m³ SAE heaped bucket	◆ 3.20 m³ SAE heaped bucket

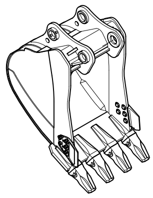
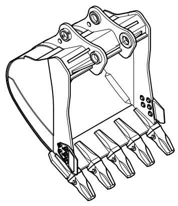
Capacity		With	Weight	Recommendation						
				7.06 m (23' 2") boom				6.55 m (21' 5") boom		9.00 m (29' 6") boom
SAE heaped	CECE heaped			2.4 m arm (7' 10")	2.9 m arm (9' 6")	3.38 m arm (11' 1")	4.0 m arm (13' 1")	2.4 m arm (7' 10")	2.9 m arm (9' 6")	6.00 m arm (19' 8")
◈ 2.79 m³ (3.65 yd³)	2.47 m³ (3.23 yd³)	1785 mm (70")	2630 kg (5800 lb)	■	▲	▲	X	◐	■	X
◆ 2.20 m³ (2.88 yd³)	1.93 m³ (2.52 yd³)	1605 mm (63")	2630 kg (5800 lb)	◐	◐	■	X	●	●	X
◆ 2.43 m³ (3.18 yd³)	2.11 m³ (2.76 yd³)	1750 mm (69")	2730 kg (6020 lb)	◐	■	▲	X	●	◐	X
◆ 2.79 m³ (3.65 yd³)	2.47 m³ (3.23 yd³)	1785 mm (70")	2950 kg (6500 lb)	■	▲	▲	X	◐	■	X
◆ 3.20 m³ (4.19 yd³)	2.82 m³ (3.69 yd³)	1995 mm (79")	3230 kg (7120 lb)	▲	X	X	X	■	▲	X

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

●	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

2) HX520S L

(1) General bucket

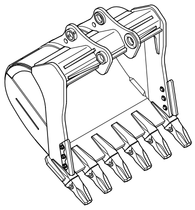
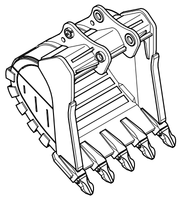
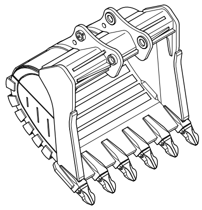
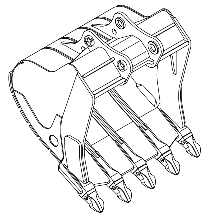
	
1.00 m³ SAE 1.38 m³ SAE heaped bucket	2.20 m³ SAE 2.79 m³ SAE heaped bucket

Capacity		Width	Weight	Recommendation							
				7.06 m (23' 2") boom				6.55 m (21' 6") boom		9.00 m (29' 6") boom	10.00 m (32' 10") boom
SAE heaped	CECE heaped			2.4 m arm (7' 10")	2.9 m arm (9' 6")	3.38 m arm (11' 1")	4.0 m arm (13' 1")	2.4 m arm (7' 10")	2.9 m arm (9' 6")	6.00 m arm (19' 8")	6.85 m arm (22' 6")
1.00 m^3 (1.31 yd^3)	0.90 m^3 (1.18 yd^3)	800 mm (31.5")	1240 kg (2730 lb)	X	X	X	X	X	X	X	▲
1.38 m^3 (1.80 yd^3)	1.24 m^3 (1.62 yd^3)	1135 mm (45")	1670 kg (3680 lb)	●	●	●	●	●	●	■	X
2.20 m^3 (2.88 yd^3)	1.93 m^3 (2.52 yd^3)	1575 mm (62")	2030 kg (4480 lb)	●	●	●	◐	●	●	X	X
2.79 m^3 (3.65 yd^3)	2.47 m^3 (3.23 yd^3)	1785 mm (70")	2300 kg (5070 lb)	●	◐	■	■	●	●	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

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

(2) Heavy duty and rock-heavy duty bucket

			
◈ 3.20 m³ SAE heaped bucket	◆ 2.20 m³ SAE ◆ 2.43 m³ SAE ◆ 2.79 m³ SAE heaped bucket	◆ 3.20 m³ SAE heaped bucket	◆ 2.70 m³ SAE ◆ 3.00 m³ SAE heaped bucket

Capacity		With	Weight	Recommendation						
				7.06 m (23' 2") boom				6.55 m (21' 5") boom		9.00 m (29' 6") boom
SAE heaped	CECE heaped			2.4 m arm (7' 10")	2.9 m arm (9' 6")	3.38 m arm (11' 1")	4.0 m arm (13' 1")	2.4 m arm (7' 10")	2.9 m arm (9' 6")	6.00 m arm (19' 8")
◈ 3.20 m³ (4.19 yd³)	2.82 m³ (3.69 yd³)	2075 mm (82")	2870 kg (6330 lb)	■	■	▲	▲	◐	◐	X
◆ 2.20 m³ (2.88 yd³)	1.93 m³ (2.52 yd³)	1605 mm (63")	2610 kg (5750 lb)	●	●	●	X	●	●	X
◆ 2.43 m³ (3.18 yd³)	2.11 m³ (2.76 yd³)	1750 mm (69")	2730 kg (6020 lb)	●	●	◐	X	●	●	X
◆ 2.70 m³ (3.53 yd³)	2.39 m³ (3.13 yd³)	1755 mm (69")	2770 kg (6110 lb)	●	◐	■	X	●	●	X
◆ 2.79 m³ (3.65 yd³)	2.47 m³ (3.23 yd³)	1785 mm (70")	2950 kg (6500 lb)	◐	■	■	X	●	◐	X
◆ 3.00 m³ (3.92 yd³)	2.76 m³ (3.61 yd³)	1950 mm (77")	3040 kg (6700 lb)	◐	■	▲	X	●	◐	X
◆ 3.20 m³ (4.19 yd³)	2.82 m³ (3.69 yd³)	1995 mm (79")	3230 kg (7120 lb)	■	■	▲	X	◐	■	X

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

● 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

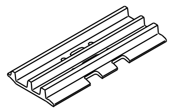
7. UNDERCARRIAGE

1) HX480S L

(1) TRACKS

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

(2) TYPES OF SHOES

Model	Shapes		Triple grouser			
						
HX480S L	Shoe width	mm (in)	600 (24)	700 (28)	800 (32)	900 (36)
	Operating weight	kg (lb)	49515 (109610)	50035 (110310)	50565 (111470)	51075 (112600)
	Ground pressure	kgf/cm^2 (psi)	0.84 (11.98)	0.74 (10.59)	0.66 (9.37)	0.59 (8.41)
	Overall width	mm (ft-in)	3340 (10' 11")	3440 (11' 3")	3540 (11' 7")	3640 (11' 11")

(3) NUMBER OF ROLLERS AND SHOES ON EACH SIDE

Item	Quantity
Carrier rollers	2 EA
Track rollers	9 EA
Track shoes	53 EA

(4) Selection of track shoe

Suitable track shoes should be selected according to operating conditions.

Method of selecting shoes

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

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

※ Table 1

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

※ Table 2

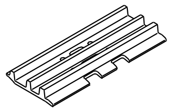
Category	Applications	Applications
A	Rocky ground, river beds, normal soil	· Travel at low speed on rough ground with large obstacles such as boulders or fallen trees or a wide range of general civil engineering work
B	Normal soil, soft ground	· These shoes cannot be used on rough ground with large obstacles 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 gound (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

2) HX520S L

(1) TRACKS

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

(2) TYPES OF SHOES

Model	Shapes		Triple grouser		
					
HX520S L	Shoe width	mm (in)	600 (24)	700 (28)	800 (32)
	Operating weight	kg (lb)	51175 (112820)	51695 (113970)	52225 (115140)
	Ground pressure	kgf/cm^2 (psi)	0.89 (12.64)	0.77 (10.95)	0.68 (9.68)
	Overall width	mm (ft-in)	★ 3540 (11' 7") ● 2990 (9' 10")	★ 3640 (11' 11") ● 3080 (10' 1")	★ 3690 (12' 1") ● 3130 (10' 3")

★ : Extended ● : Retracted

(3) NUMBER OF ROLLERS AND SHOES ON EACH SIDE

Item	Quantity
Carrier rollers	3 EA
Track rollers	9 EA
Track shoes	53 EA

(4) Selection of track shoe

Suitable track shoes should be selected according to operating conditions.

Method of selecting shoes

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

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

※ Table 1

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

※ Table 2

Category	Applications	Applications
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 gound (swampy ground)	· Use the shoes only in the conditions that the machine sinks and it is impossible to use the shoes of category A or B · These shoes cannot be used on rough ground with large obstacles such as boulders or fallen trees · Travel at high speed only on flat ground · Travel slowly at low speed if it is impossible to avoid going over obstacles

8. SPECIFICATIONS FOR MAJOR COMPONENTS

1) ENGINE

Item	Specification
Model	Cummins QSM11
Type	4-cycle turbocharged charger air cooled diesel engine
Cooling method	Water cooling
Number of cylinders and arrangement	6 cylinders, in-line
Firing order	1-5-3-6-2-4
Combustion chamber type	Direct injection type
Cylinder bore × stroke	125 × 147.1 mm (4.92" × 5.79")
Piston displacement	10800 cc (659 cu in)
Compression ratio	16.3 : 1
Rated gross horse power (SAE J1995)	335 Hp at 2000 rpm (250 kW at 2000 rpm)
Maximum torque	183 kgf · m (1320 lbf · ft) at 1400 rpm
Engine oil quantity	37.9 ℓ (10 U.S. gal)
Dry weight	942 kg (2077 lb)
Low idling speed	950 ± 50 rpm
High idling speed	1950 + 50 rpm
Rated fuel consumption	144 g/Hp · hr at 1900 rpm
Starting motor	Delco Remy 42MT (24V-7.2kW)
Alternator	Delco Remy 24V-90A
Battery	2 × 12V × 200Ah

2) MAIN PUMP

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 × 200 cc/rev
Maximum pressure	330 kgf/cm² (4690 psi) [360 kgf/cm² (5120 psi)]
Rated oil flow	2 × 380 ℓ/min (100.4 U.S. gpm / 83.6 U.K. gpm)
Rated speed	1900 rpm

[ ] : Power boost

3) GEAR PUMP

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	16 cc/rev
Maximum pressure	40 kgf/cm^2 (570 psi)
Rated oil flow	30.4 ℓ/min (8.0 U.S. gpm/6.7 U.K. gpm)

4) MAIN CONTROL VALVE

Item		Specification
		HX480/520S L
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	360 kgf/cm^2 (5120 psi)
	Arm	360 kgf/cm^2 (5120 psi)
	Bucket	360 kgf/cm^2 (5120 psi)

[ ] : Power boost

5) SWING MOTOR

Item	Specification
Type	Fixed displacement axial piston motor
Capacity	142.6 cc/rev
Relief pressure	285 kgf/cm^2 (4050 psi)
Braking system	Automatic, spring applied hydraulic released
Braking torque	63.3 kgf · m (458 lbf · ft) over
Brake release pressure	Cranking : 20.9 kgf/cm^2 (297 psi) Full stroke : 35.5 kgf/cm^2 (505 psi)
Reduction gear type	2 - stage planetary

6) TRAVEL MOTOR

Item	Specification
Type	Variable displacement axial piston motor
Relief pressure	330 kgf/cm^2 (4690 psi)
Capacity (max / min)	281.7/175.9 cc/rev
Reduction gear type	3-stage planetary
Braking system	Automatic, spring applied hydraulic released
Brake release pressure	15.7 kgf/cm^2 (114 psi) below
Braking torque	120 kgf · m (1707 lbf · ft) over

7) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Rod dia × Stroke	Ø170 × Ø115 × 1580 mm
	Cushion	Extend only
Arm cylinder	Bore dia × Rod dia × Stroke	Ø190 × Ø130 × 1820 mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia × Rod dia × Stroke	Ø160 × Ø110 × 1370 mm (HX480S L) Ø170 × Ø115 × 1370 mm (HX520S L)
	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.

8) SHOE

Item		Width	Ground pressure	Link quantity	Overall width
HX480S L	Standard	600 mm (24")	0.84 kgf/cm^2 (11.98 psi)	53	3340 mm (10' 11")
	Option	700 mm (28")	0.74 kgf/cm^2 (10.59 psi)	53	3440 mm (11' 3")
		800 mm (32")	0.66 kgf/cm^2 (9.37 psi)	53	3540 mm (11' 7")
		900 mm (36")	0.59 kgf/cm^2 (8.41 psi)	53	3640 mm (11' 11")
HX520S L	Standard	600 mm (24")	0.89 kgf/cm^2 (12.64 psi)	53	★ 3540 mm (11' 7") ● 2990 mm (9' 10")
	Option	700 mm (28")	0.77 kgf/cm^2 (10.95 psi)	53	★ 3640 mm (11' 11") ● 3080 mm (10' 1")
		800 mm (32")	0.68 kgf/cm^2 (9.68 psi)	53	★ 3690 mm (12' 1") ● 3130 mm (10' 3")

★ : Extended ● : Retracted

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 appr-oved 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	37.9 (10.0)	★SAE 5W-40 SAE 30 SAE 10W SAE 10W-30 SAE 15W-40
Swing drive	Gear oil	7.0×2 (1.8×2)	★SAE 75W-90
Final drive	Gear oil	12×2 (3.2×2)	SAE 85W-140
Hydraulic tank	Hydraulic oil	Tank : 260 (68.7) System : 486 (128.4)	★ISO VG 15 ISO VG 46 ISO VG 68
Fuel tank	Diesel fuel	660 (174.4)	★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	49 (12.9)	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

★ : 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.

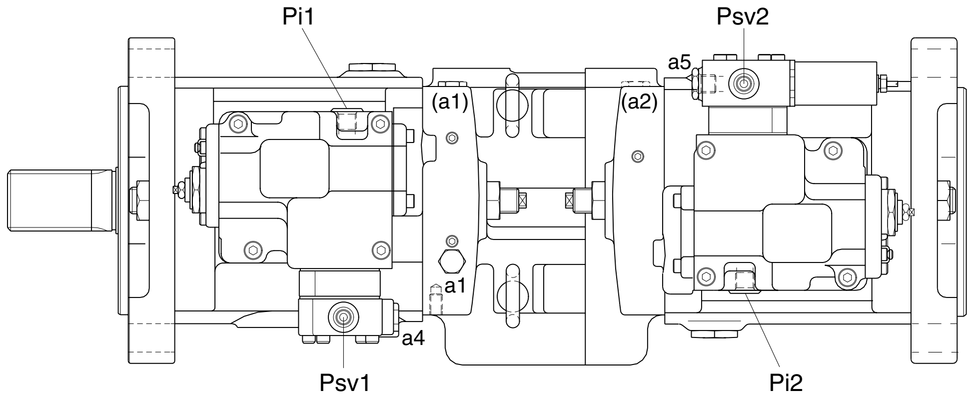
※ For HD Hyundai Construction Equipment genuine lubricating oils and grease for use in regions with extremely low temperatures, please contact HD Hyundai Construction Equipment dealers.

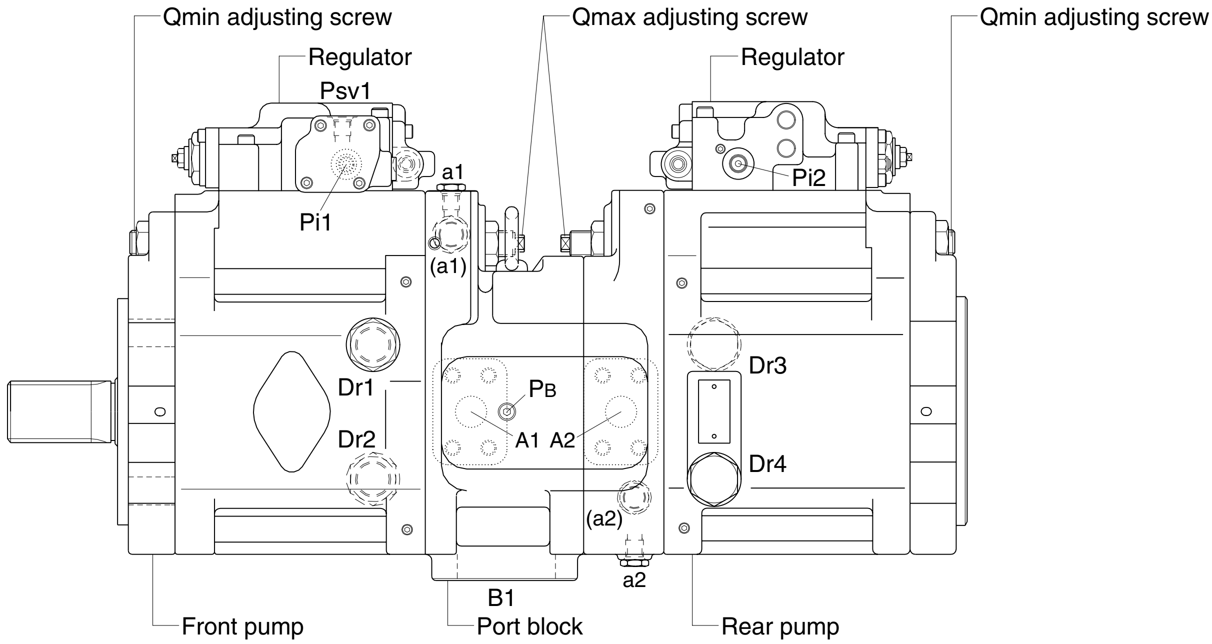
SECTION 2 STRUCTURE AND FUNCTION

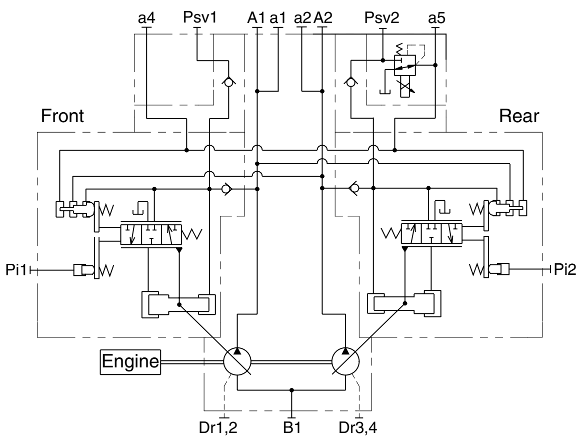
GROUP 1 PUMP DEVICE

1. STRUCTURE

The pump device consists of main pump, regulator.







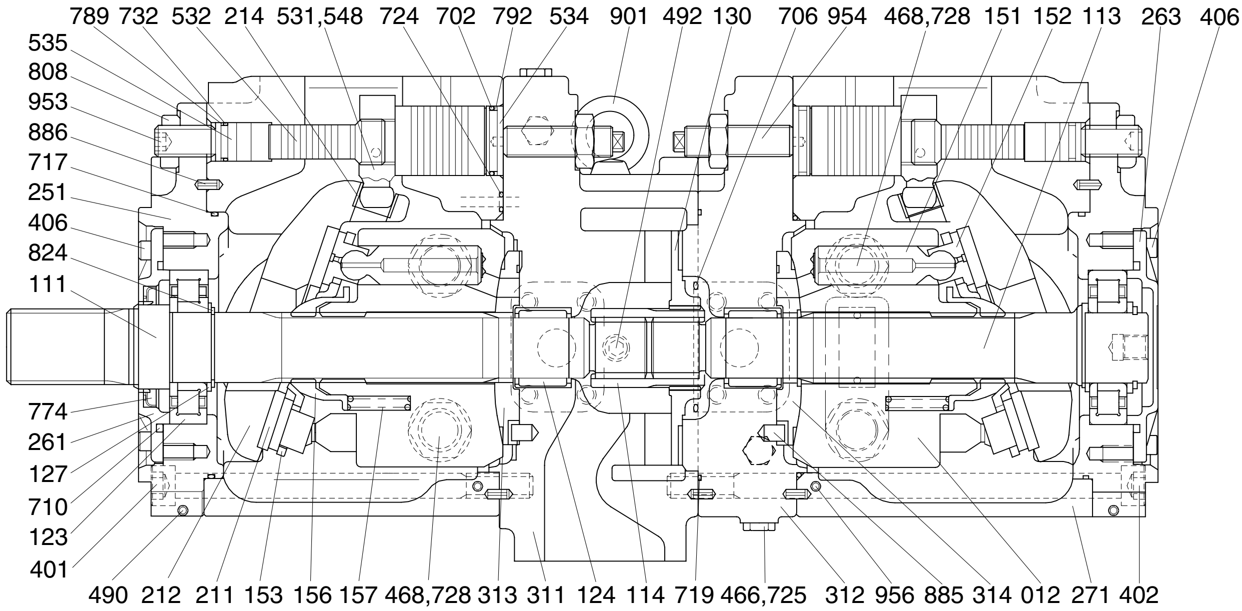
Hydraulic circuit

Port	Port name	Port size
A1,A2	Delivery port	SAE6000 psi 1"
B1	Suction port	SAE2500 psi 3"
Dr1~Dr4	Drain port	PF 3/4 - 23
Pi1,Pi2	Pilot port	PF 1/4 - 15
Psv1, Psv2	Servo assist port	PF 1/4 - 15
a1, a2, a4, a5	Gauge port	PF 1/4 - 15

480F2MP01

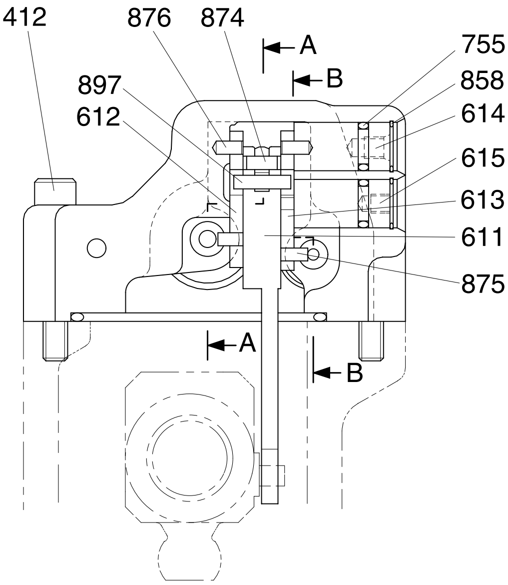
1) MAIN PUMP(1/2)

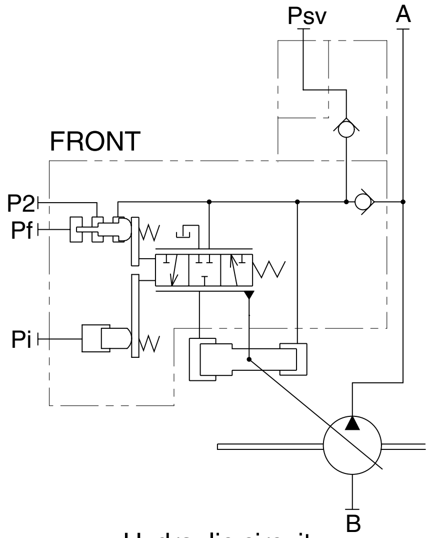
The main pump consists of two piston pumps (front & rear) and valve block.



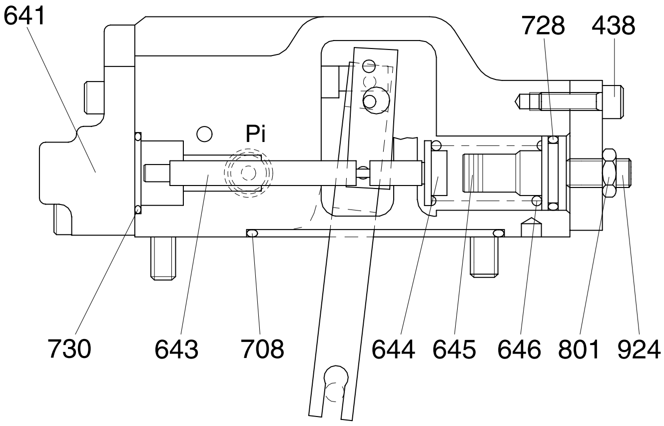
012	Cylinder block	271	Pump casing	710	O-ring
111	Drive shaft (F)	311	Valve cover (F)	717	O-ring
113	Driven shaft (R)	312	Valve cover (R)	719	O-ring
114	Coupling	313	Valve plate (R)	724	Square ring
123	Roller bearing	314	Valve plate (L)	725	O-ring
124	Needle bearing	401	Hexagon socket bolt	728	O-ring
127	Spacer	402	Hexagon socket bolt	732	O-ring
130	Booster	406	Hexagon socket bolt	774	Oil seal
151	Piston	466	VP Plug	789	Back up ring
152	Shoe	468	VP Plug	792	Back up ring
153	Set plate	490	VP Plug	808	Hexagon head nut
156	Bushing	492	VP Plug	824	Snap ring
157	Cylinder spring	531	Tilting pin	885	Valve plate pin
211	Shoe plate	532	Servo piston	886	Spring pin
212	Swash plate	534	Stopper (L)	901	Eye bolt
214	Tilting bushing	535	Stopper (S)	953	Set screw
251	Support plate	548	Feed back pin	954	Set screw
261	Seal cover (F)	702	O-ring	956	Set screw
263	Seal cover (R)	706	O-ring		

2) FRONT REGULATOR (1/2)

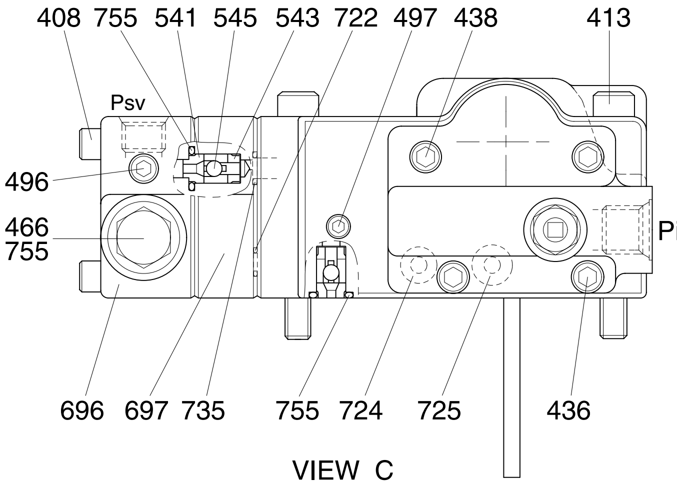




Hydraulic circuit



SECTION B-B

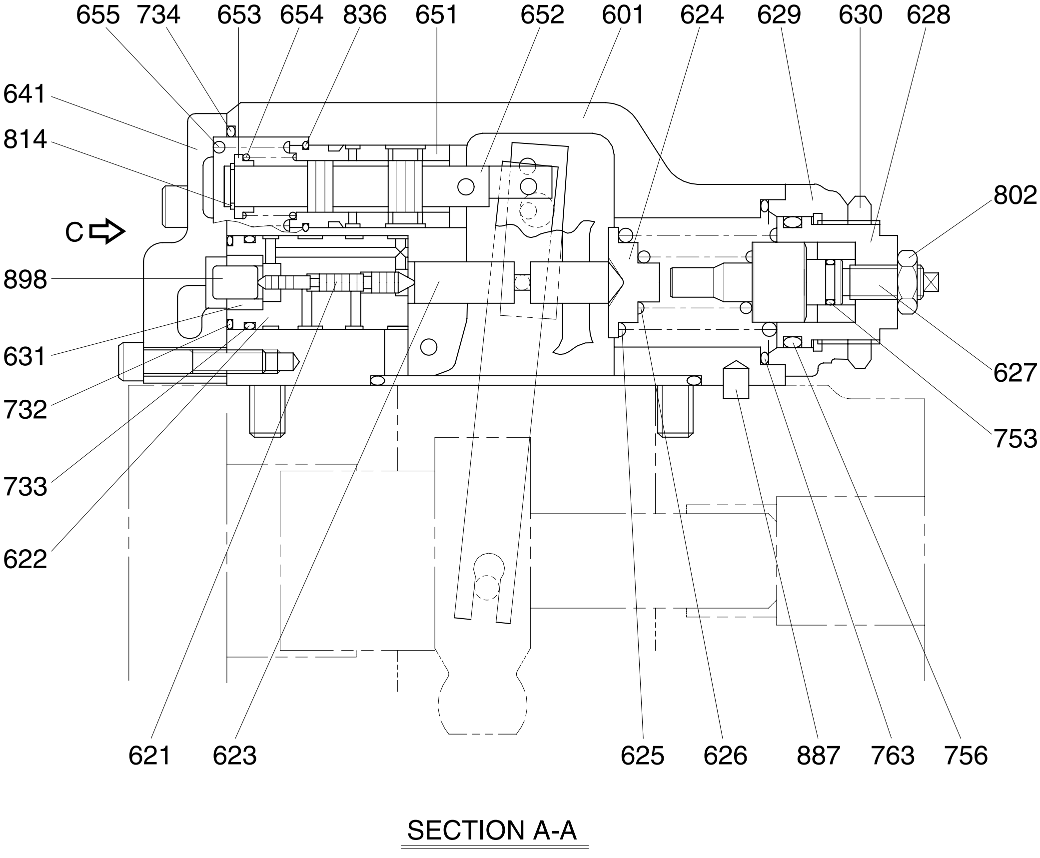


VIEW C

Port	Port name	Port size
Pi	Pilot port	PF 1/4 - 15
Psv	Servo assist port	PF 1/4 - 15
P2	Companion delivery port	-
Pf	Powershift port	-

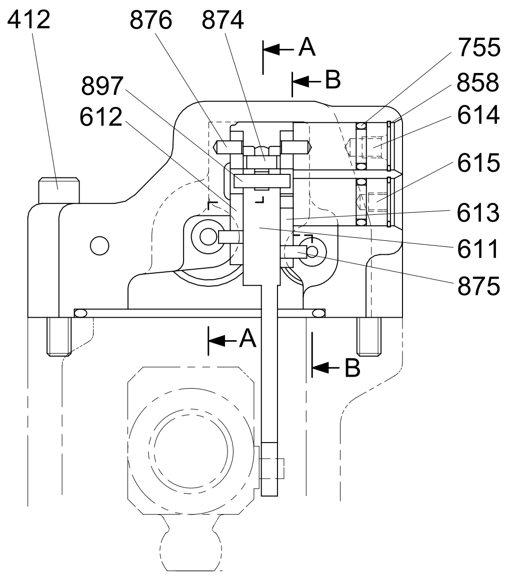
480F2RG01

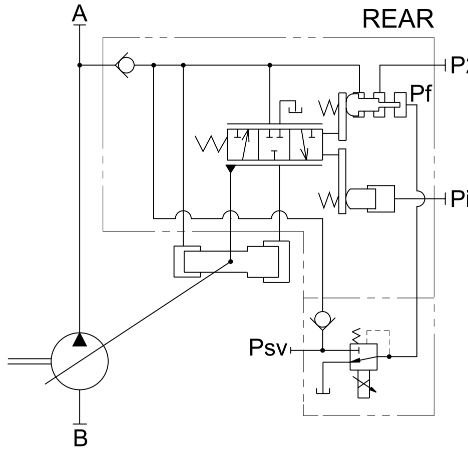
FRONT REGULATOR (2/2)



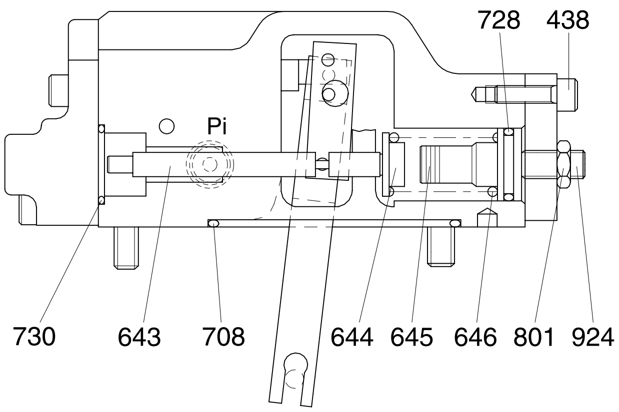
408	Hexagon socket screw	626	Inner spring	728	O-ring
412	Hexagon socket screw	627	Adjust stem (C)	730	O-ring
413	Hexagon socket screw	628	Adjust screw (C)	732	O-ring
436	Hexagon socket screw	629	Cover (C)	733	O-ring
438	Hexagon socket screw	630	Lock nut	734	O-ring
466	Plug	631	Sleeve, pf	735	O-ring
496	Plug	641	Pilot cover	753	O-ring
497	Plug	643	Pilot piston	755	O-ring
541	Seat	644	Spring seat (Q)	756	O-ring
543	Stopper	645	Adjust stem (Q)	763	O-ring
545	Steel ball	646	Pilot spring	801	Nut
601	Casing	651	Sleeve	802	Nut
611	Feed back lever	652	Spool	814	Snap ring
612	Lever (1)	653	Spring seat	836	Snap ring
613	Lever (2)	654	Return spring	858	Snap ring
614	Center plug	655	Set spring	874	Pin
615	Adjust plug	696	Port cover	875	Pin
621	Compensator piston	697	Check valve plate	876	Pin
622	Piston case	708	O-ring	887	Pin
623	Compensator rod	722	O-ring	897	Pin
624	Spring seat (C)	724	Square ring	898	Pin
625	Outer spring	725	O-ring	924	Set screw

3) REAR REGULATOR (1/2)

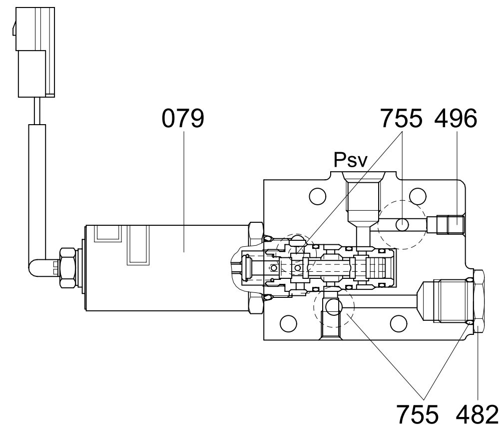




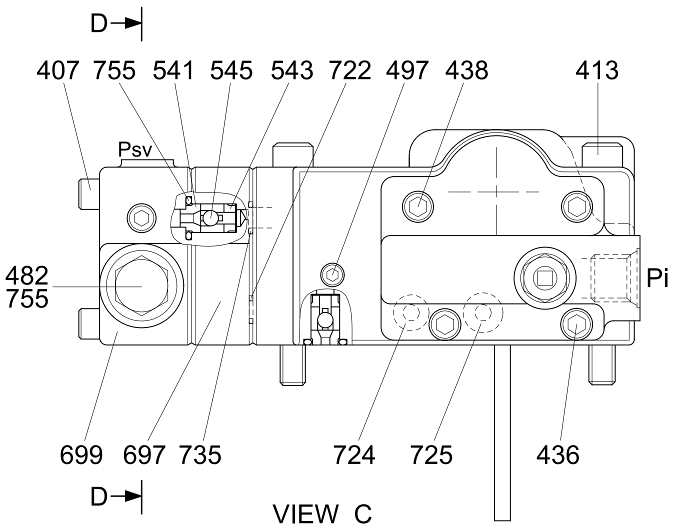
Hydraulic circuit



SECTION B-B



SECTION D-D

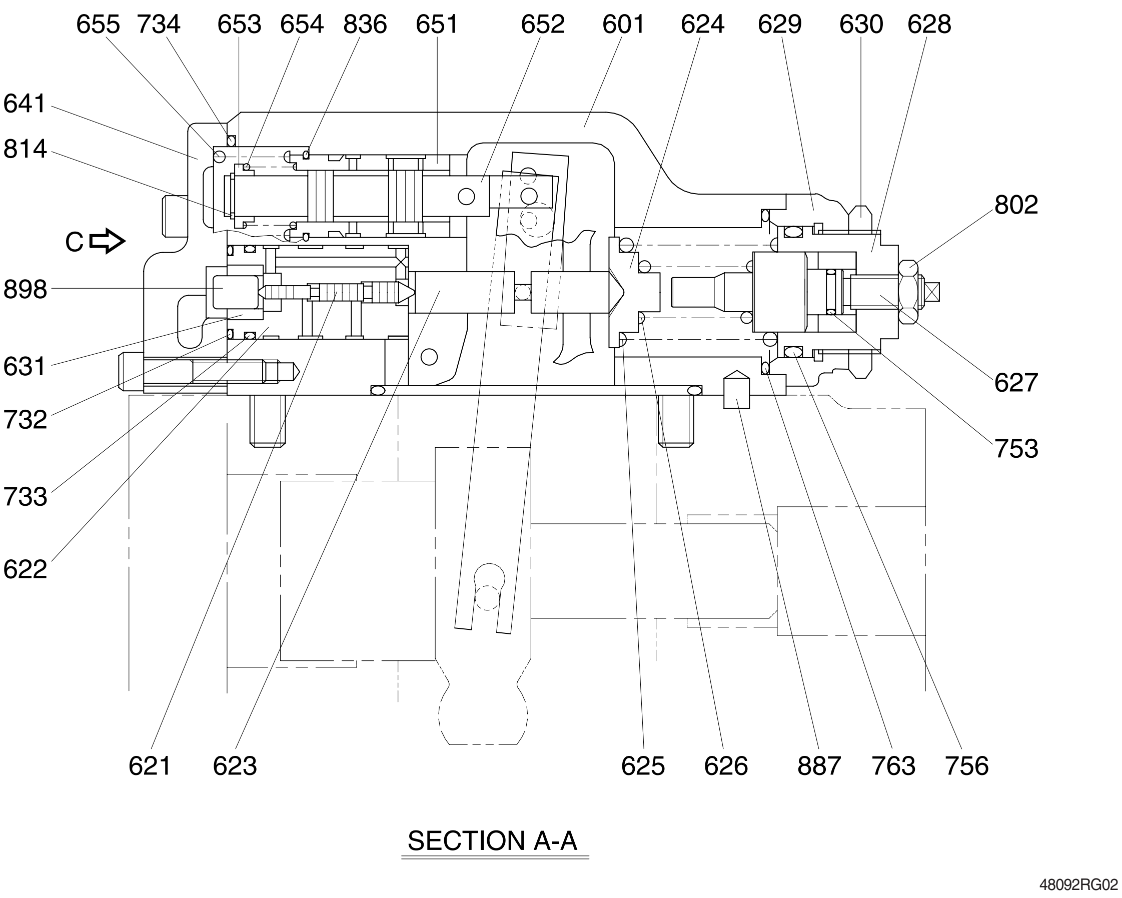


VIEW C

Port	Port name	Port size
Pi	Pilot port	PF 1/4 - 15
Psv	Servo assist port	PF 1/4 - 15
P2	Companion delivery port	-
Pf	Powershift port	-

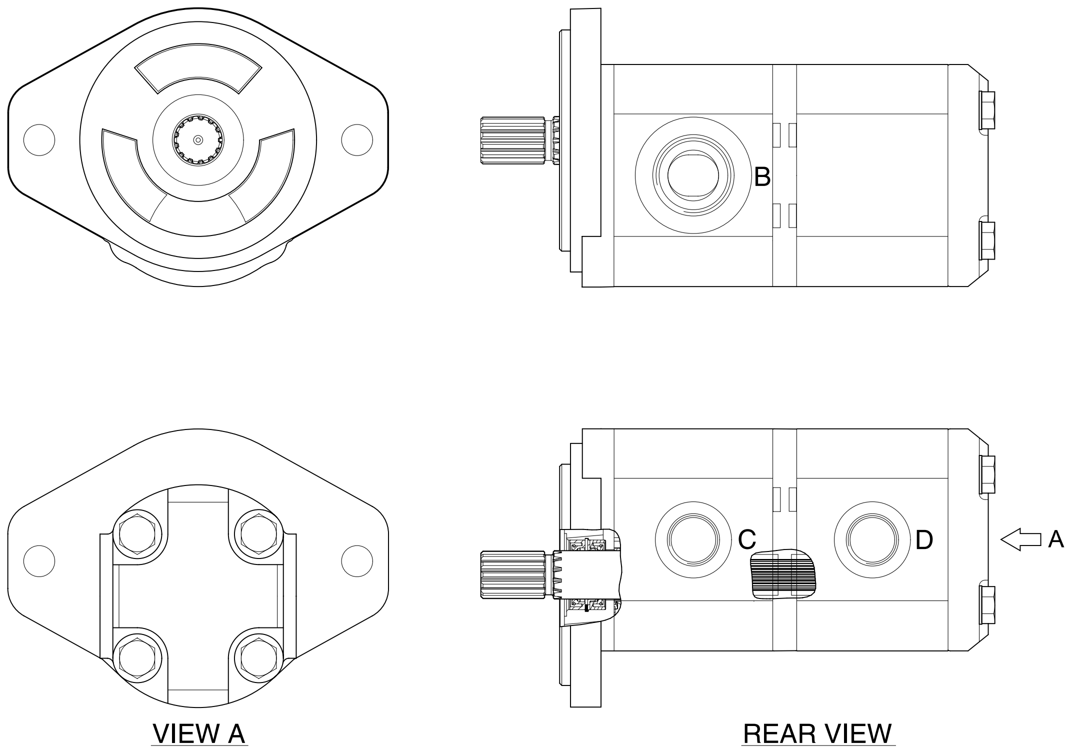
480F2RG03

REAR REGULATOR (2/2)



079	EPPR valve	626	Inner spring	728	O-ring
407	Hexagon socket screw	627	Adjust stem(C)	730	O-ring
412	Hexagon socket screw	628	Adjust screw(C)	732	O-ring
413	Hexagon socket screw	629	Cover(C)	733	O-ring
436	Hexagon socket screw	630	Lock nut	734	O-ring
438	Hexagon socket screw	631	Sleeve, pf	735	O-ring
482	Plug	641	Pilot cover	753	O-ring
496	Plug	643	Pilot piston	755	O-ring
541	Seat	644	Spring seat(Q)	756	O-ring
543	Stopper	645	Adjust stem(Q)	763	O-ring
545	Steel ball	646	Pilot spring	801	Nut
601	Casing	651	Sleeve	802	Nut
611	Feed back lever	652	Spool	814	Snap ring
612	Lever(1)	653	Spring seat	836	Snap ring
613	Lever(2)	654	Return spring	858	Snap ring
614	Center plug	655	Set spring	874	Pin
615	Adjust plug	697	Check valve plate	875	Pin
621	Compensator piston	699	Port cover	876	Pin
622	Piston case	708	O-ring	887	Pin
623	Compensator rod	722	O-ring	897	Pin
624	Spring seat(C)	724	O-ring	898	Pin
625	Outer spring	725	O-ring	924	Set screw

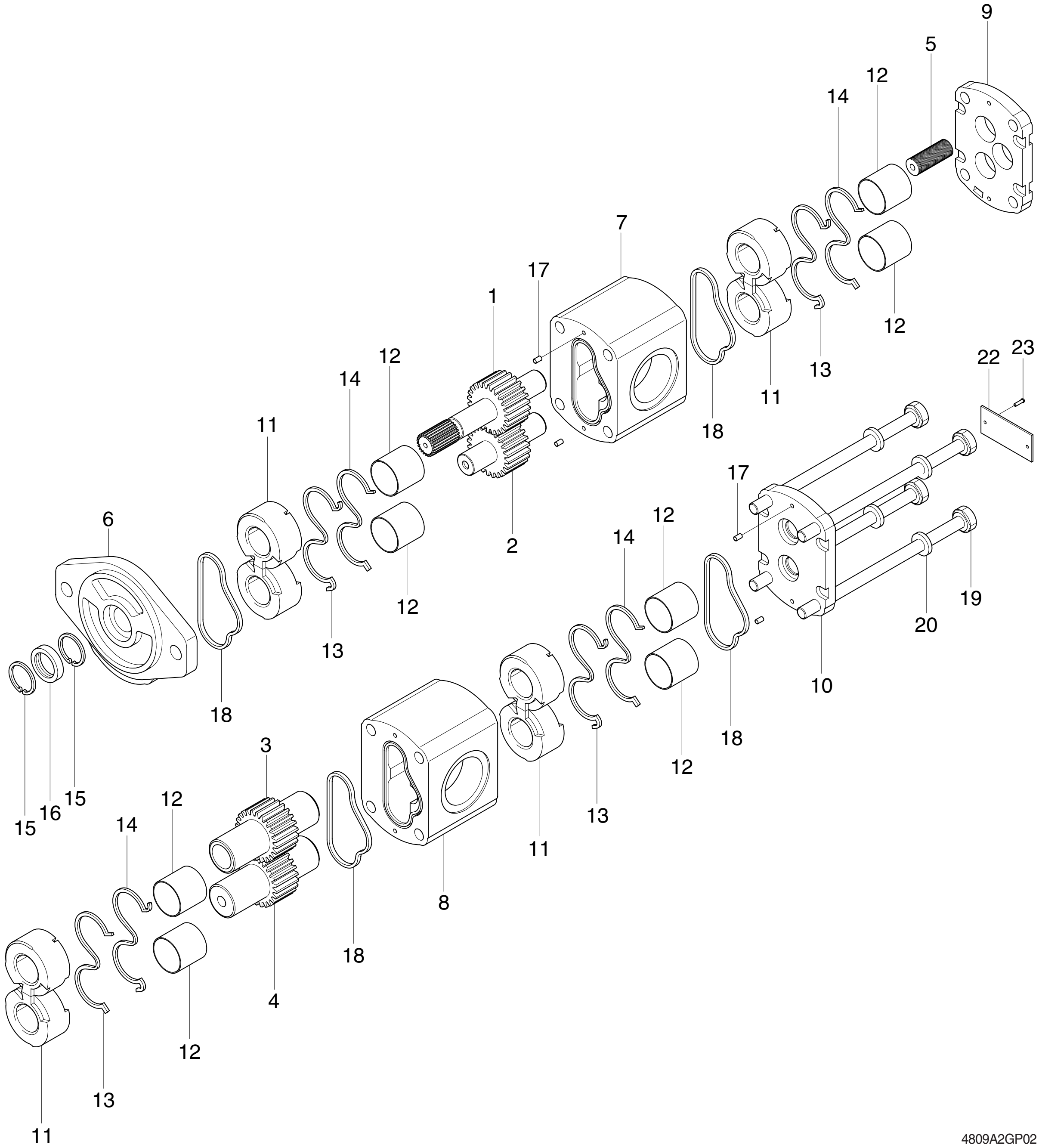
4) GEAR PUMP (1/2)



Port	Name	Size
B	Suction port	PF 1"
C	Delivery port (fan motor)	7/8"-14UNF
D	Delivery port (pilot line)	7/8"-14UNF

480F2GP01

GEAR PUMP (2/2)



1	Multi shaft gear 1	9	Multi spacer	17	Dowel pin
2	Driven gear 2	10	Rear cover	18	D-ring
3	Joint driven gear 3	11	Bushing block	19	Bolt
4	Driven gear 4	12	DU-Bushing	20	Washer
5	Connector	13	Channel seal	21	Name plate
6	Front cover	14	Back up seal	23	Rivet
7	Gear housing 1	15	Retainer seal		
8	Gear housing 2	16	Snap ring		

2. FUNCTION

1) MAIN PUMP

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

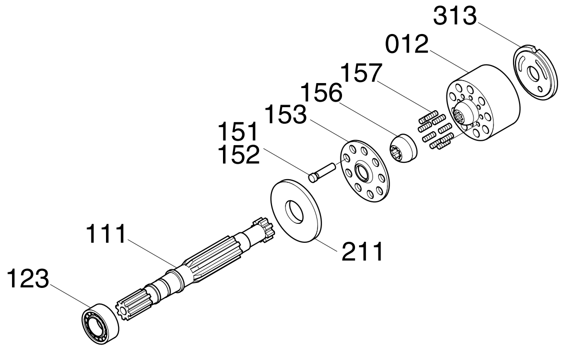
(1) Rotary group

The rotary group consists of drive shaft (F)(111), cylinder block (012), piston shoes (151,152), set plate (153), spherical bush (156), and cylinder spring (157).

The drive shaft is supported by bearing (123,124) at its both ends.

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

Similarly, the cylinder block is pressed against valve plate (313) by the action of the cylinder spring.



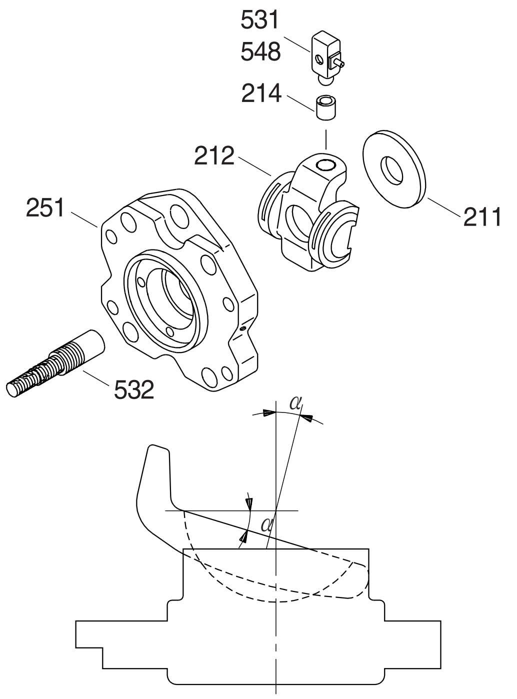
50072MP01

(2) Swash plate group

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

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

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



2-7 (210-7)

(3) Valve block group

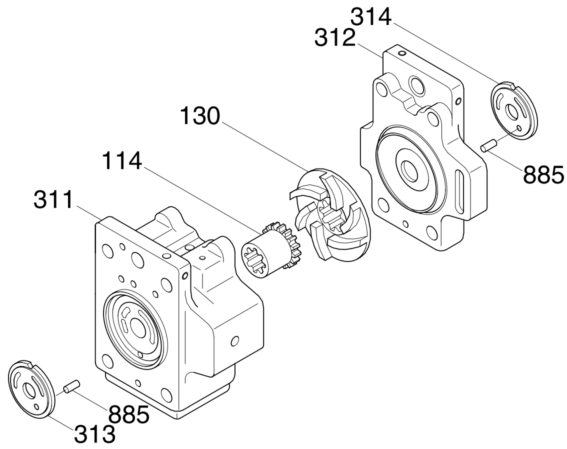
The valve cover group consists of valve cover (F, 311), valve cover (R, 312), valve plate (313, 314), spline coupling (114), booster (130) and valve plate pin (885).

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

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

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

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



36072MP03

2) REGULATOR

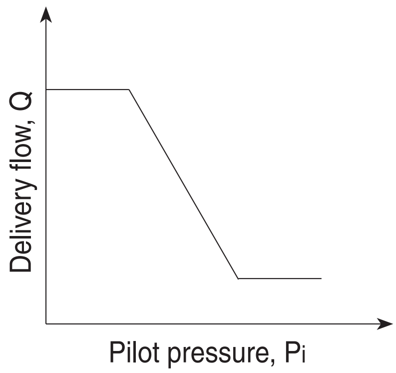
Regulator consists of the negative flow control, total horse power control and power shift control function

(1) Negative flow control

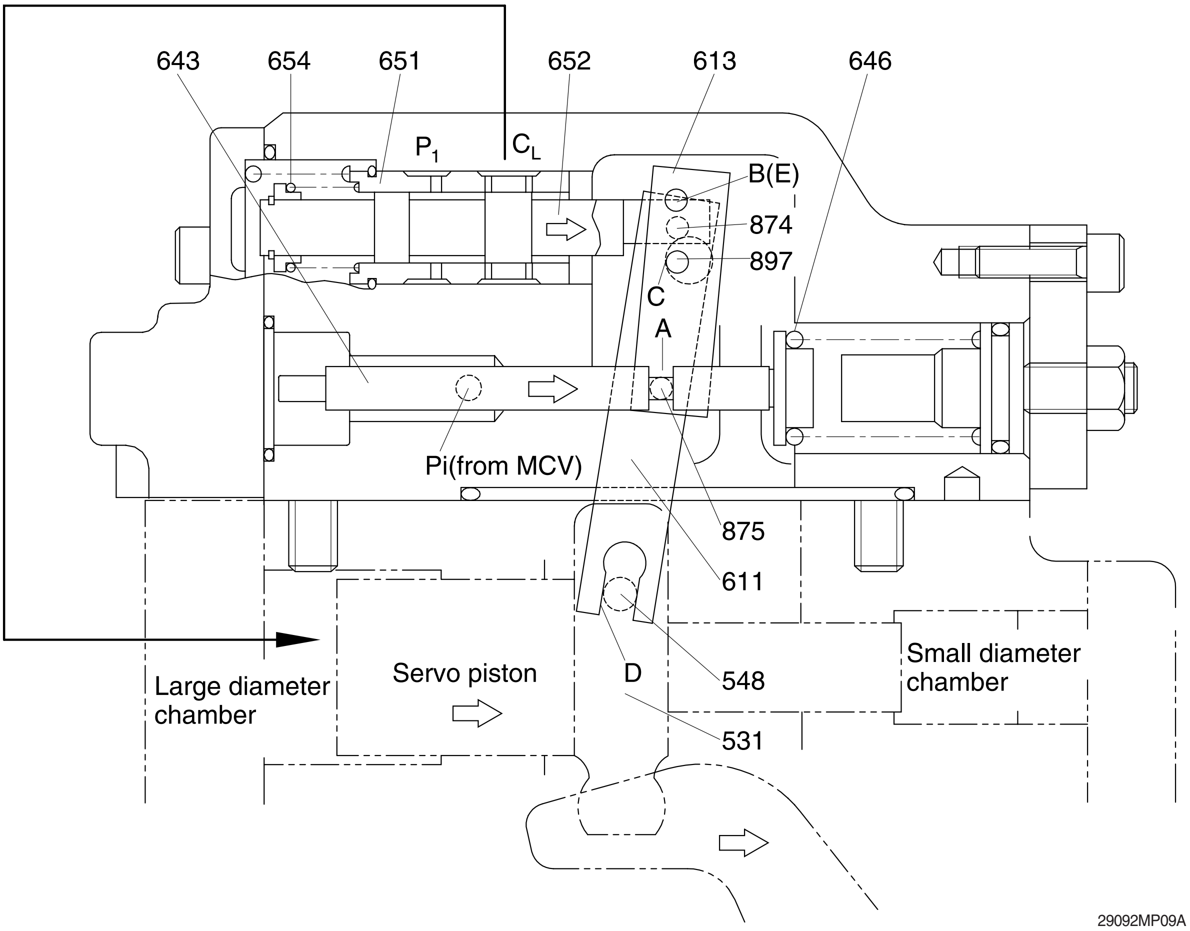
By changing the pilot pressure Pi, the pump tilting angle (delivery flow) is regulated arbitrarily, as shown in the figure.

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

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



① Flow reducing function



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

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

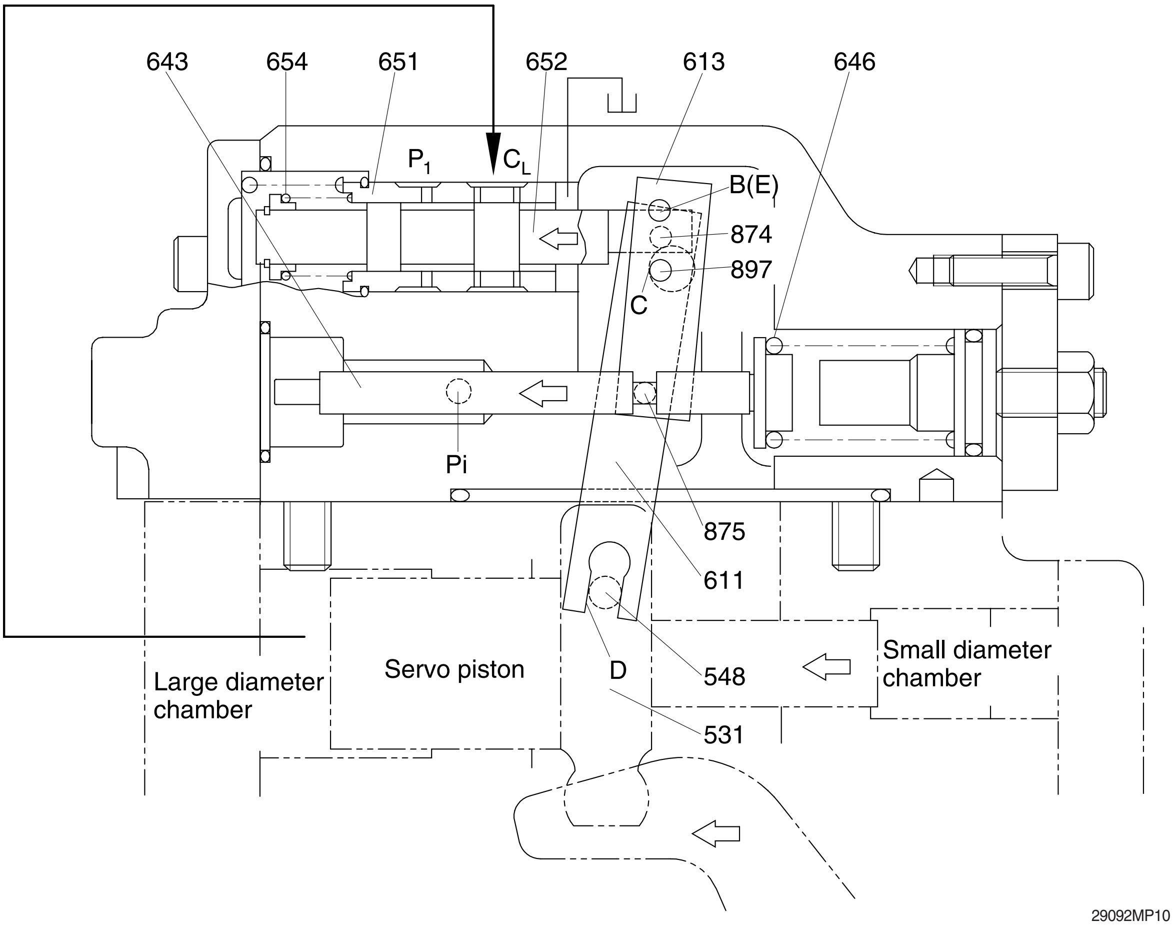
Since the feedback lever is connected with the spool (652) via the pin (874), the spool moves to the right.

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

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

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

② Flow increasing function



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

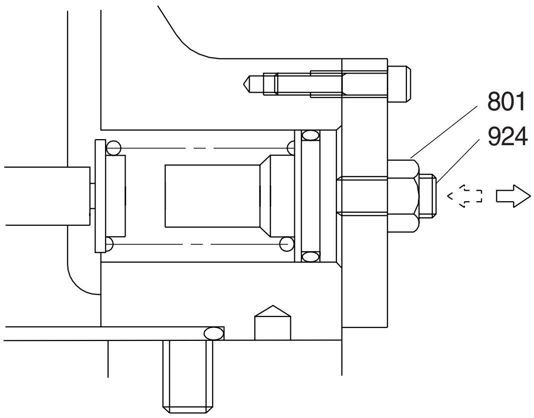
As the servo piston moves, point D also moves to the left, the feedback lever rotates around the fulcrum of point C, and the spool moves to the right till the opening between the spool and sleeve is closed.

③ Adjustment of flow control characteristic

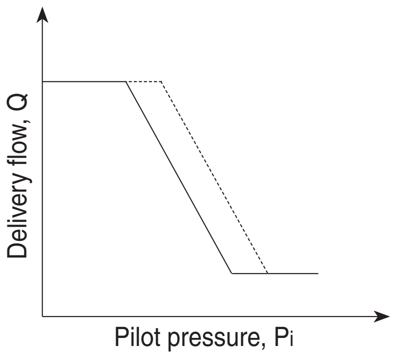
The flow control characteristic can be adjusted with the adjusting screw.
Adjust it by loosening the hexagon nut (801) and by tightening (or loosening) the hexagonal socket head screw (924).
Tightening the screw shifts the control chart to the right as shown in the figure.

※ Adjusting values are shown in table.

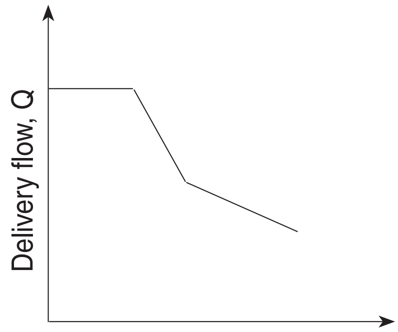
Speed	Adjustment of flow control characteristic		
	Tightening amount of adjusting screw (924)	Flow control starting pressure change amount	Flow change amount
(min^{-1})	(Turn)	(kgf/cm^2)	(ℓ/min)
1800	+1/4	+1.02	+21



2-12 (210-7)



(2) Total horsepower control



The regulator decreases the pump tilting angle (delivery flow) automatically to limit the input torque within a certain value with a rise in the delivery pressure P1 of the self pump and the delivery pressure P2 of the companion pump.

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

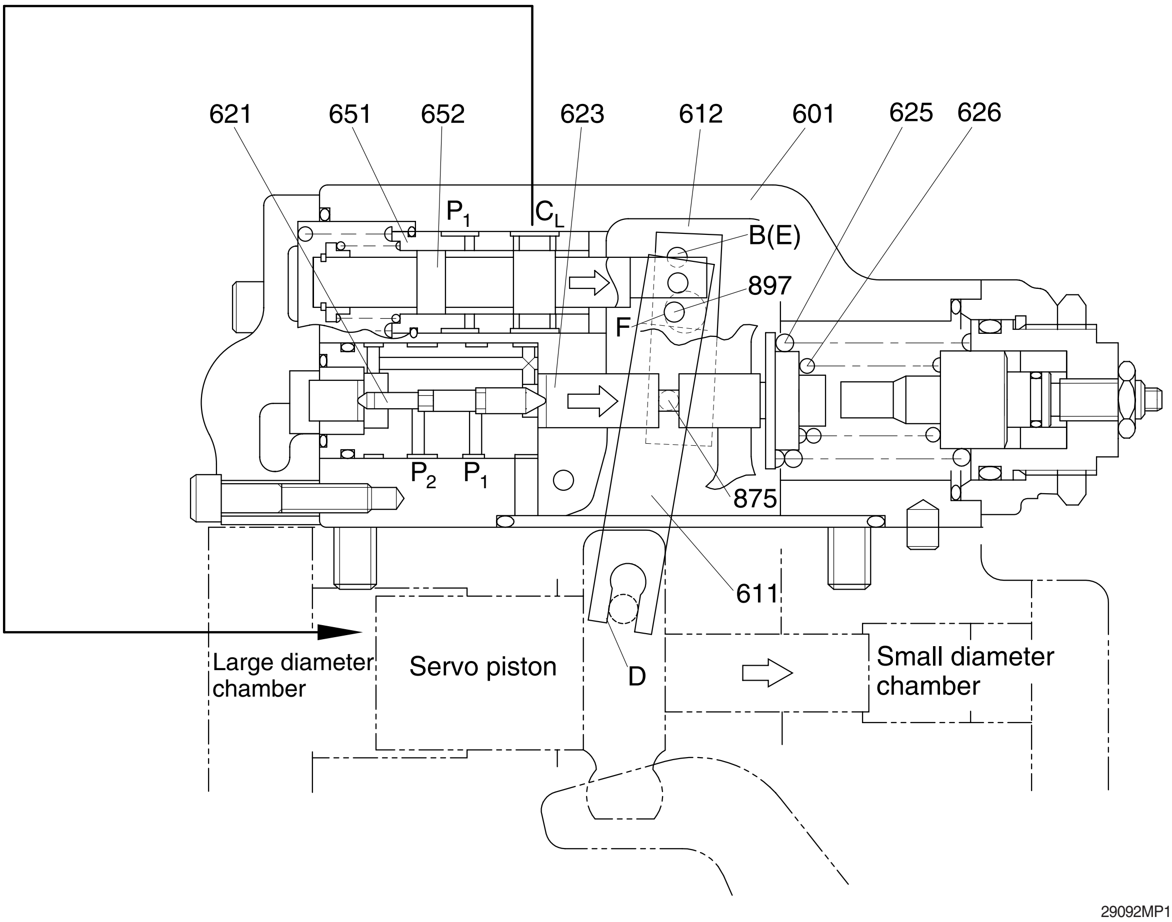
Since the regulator is of the simultaneous total horsepower type that operates by the sum of load pressures of the two pumps in the tandem double-pump system, the prime mover is automatically prevented from being overloaded, irrespective of the load condition of the two pumps, when horsepower control is under way.

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

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

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

① Overload preventive function

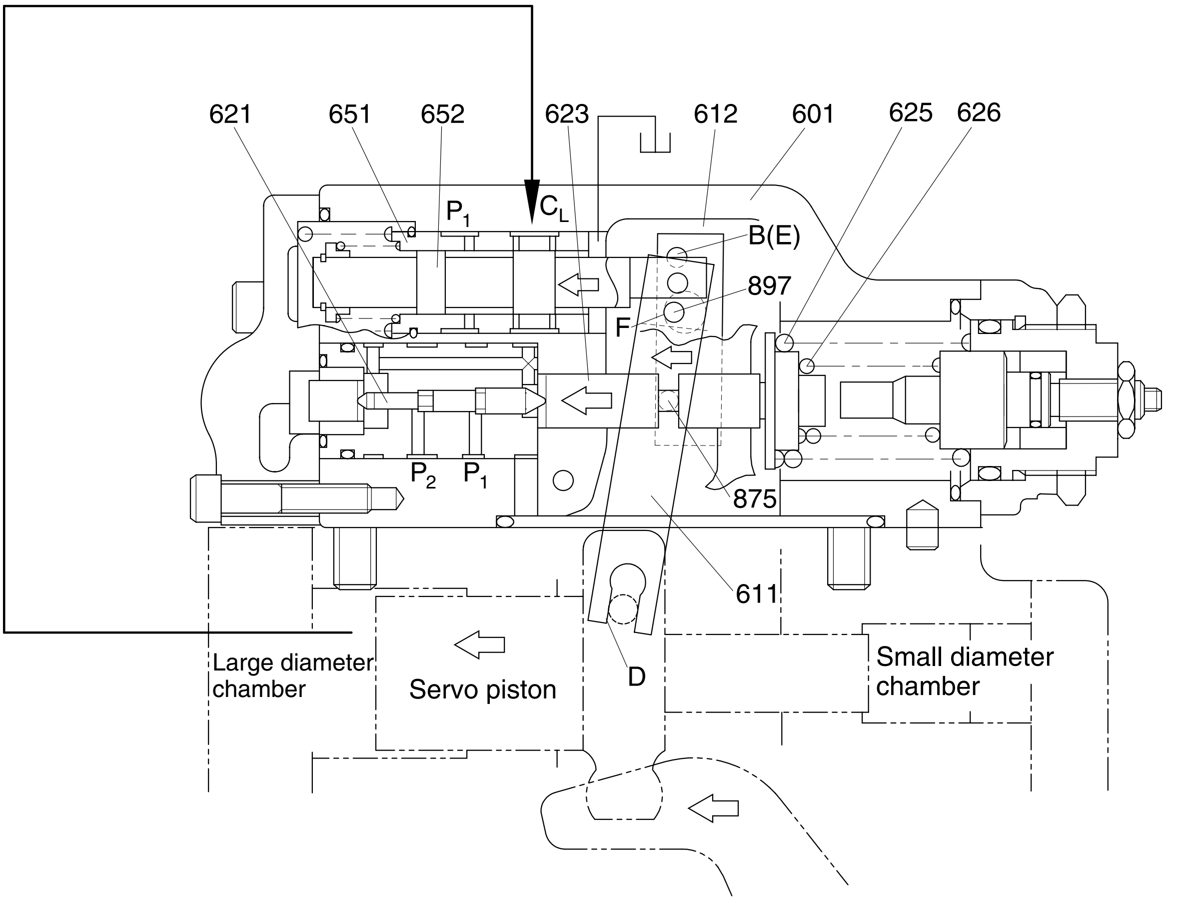


When the self pump delivery pressure P1 or the companion pump delivery pressure P2 rises, it acts on the stepped part of the compensating piston (621). It presses the compensating rod (623) to the right till the force of the outer spring (625) and inner spring (626) balances with the hydraulic force.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

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

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

② Flow reset function



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

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

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

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

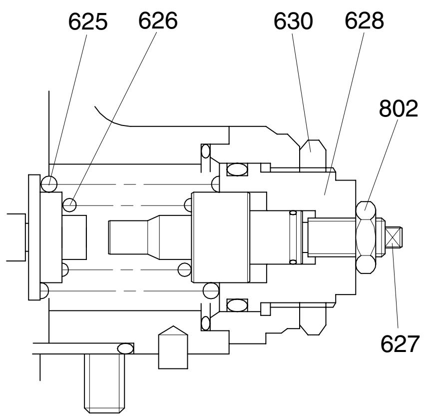
As mentioned above, flow control and horsepower control tilting angle commands are transmitted to the feedback lever and spool via the large-hole sections (C & F) of levers 1 and 2. However, since sections C and F have the pins (Ø4) protruding from the large hole (Ø8), only the lever lessening the tilting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

④ **Adjustment of input horsepower**

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

a. **Adjustment of outer spring**

Adjust it by loosening the hexagon nut (630) and by tightening (or loosening) the adjusting screw C (628). Tightening the screw shifts the control chart to the right and increases the input horsepower as shown in the figure. Since turning the adjusting screw C by N turns changes the setting of the inner spring (626), return the adjusting screw QI (627) by N×A turns at first. (A=1.85)



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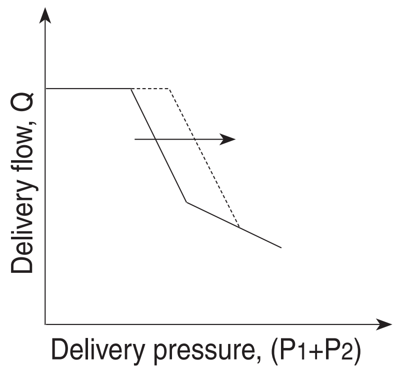
※ **Adjusting values are shown in table.**

Speed	Adjustment of outer spring		
	Tightening amount of adjusting screw (C) (628)	Compensating control starting pressure change amount	Input torque change amount
(min^{-1})	(Turn)	(kgf/cm^2)	(kgf · m)
1800	+1/4	+17.8	+9.7



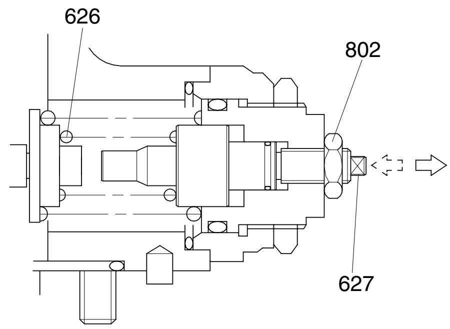
b. Adjustment of inner spring

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

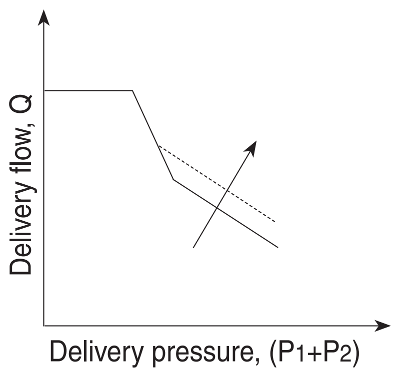
Tightening the screw increases the flow and then the input horsepower as shown in the figure.

※ Adjusting valves are shown in table.

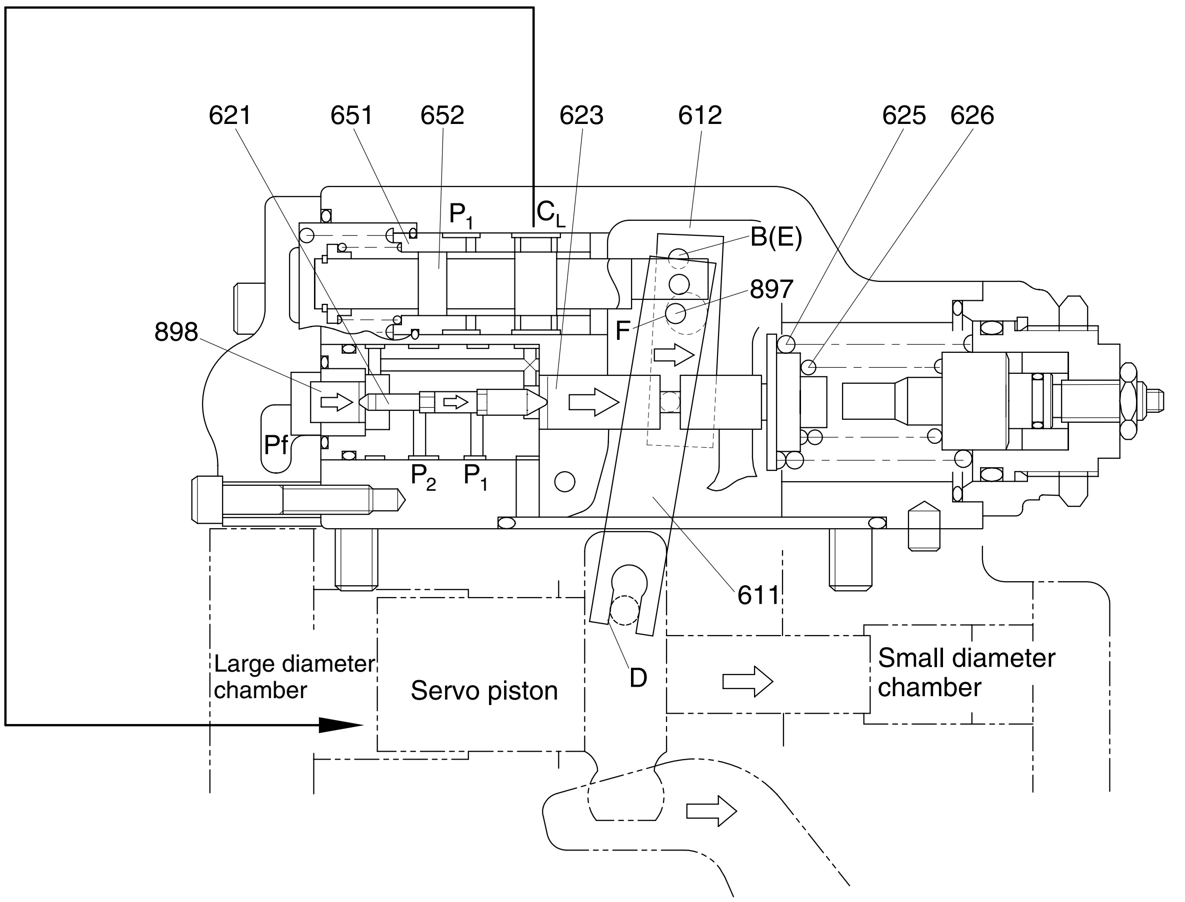
Speed	Adjustment of inner spring		
	Tightening amount of adjusting screw (QI) (627)	Flow change amount (lpm)	Input torque change amount
(min^{-1})	(Turn)	(ℓ/min)	(kgf · m)
1800	+1/4	+18.6	+10.4

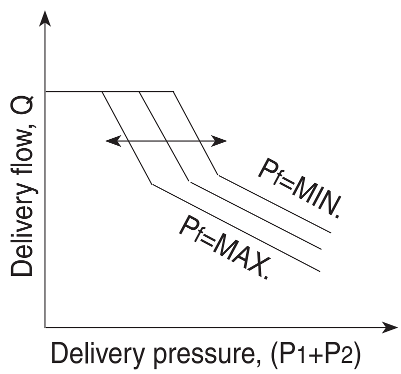


8007A2MP04



(3) Power shift control





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

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

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

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

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

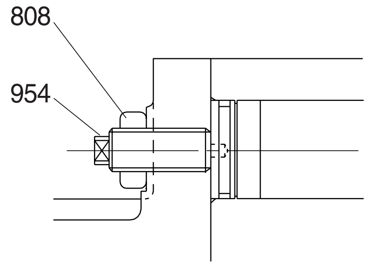
This decreases the pump tilting angle and then the set horsepower in the same way as explained in the overload preventive function of the horsepower control. On the contrary, the set horsepower rises as the power shift pressure Pf falls.

(4) Adjustment of maximum and minimum flows

① Adjustment of maximum flow

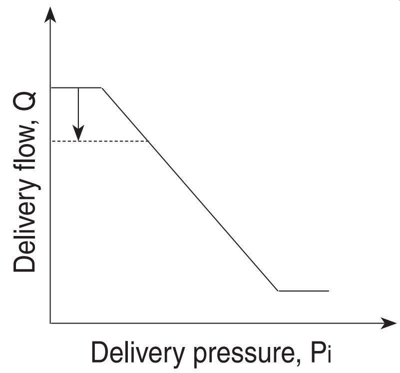
Adjust it by loosening the hexagon nut (808) and by tightening (or loosening) the set screw (954).

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



2-19 (1)

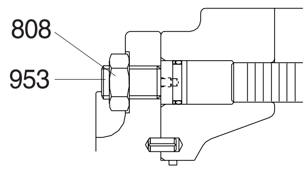
Speed	Adjustment of max flow spring	
	Tightening amount of adjusting screw (954)	Flow change amount
(min^{-1})	(Turn)	(ℓ/min)
1800	+1/4	-6.9



② Adjustment of minimum flow

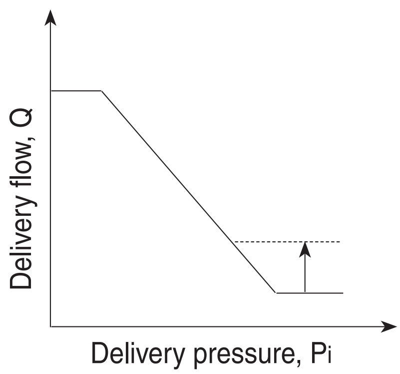
Adjust it by loosening the hexagon nut(808) and by tightening (or loosening) the hexagonal socket head set screw (953). Similarly to the adjustment of the maximum flow, other characteristics are not changed.

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

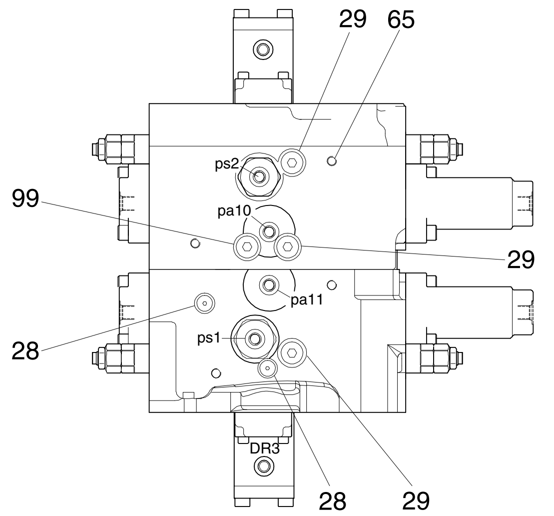


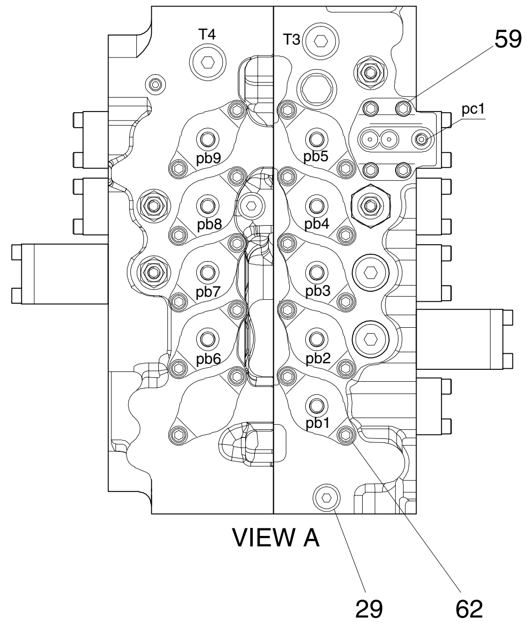
2-19 (2)

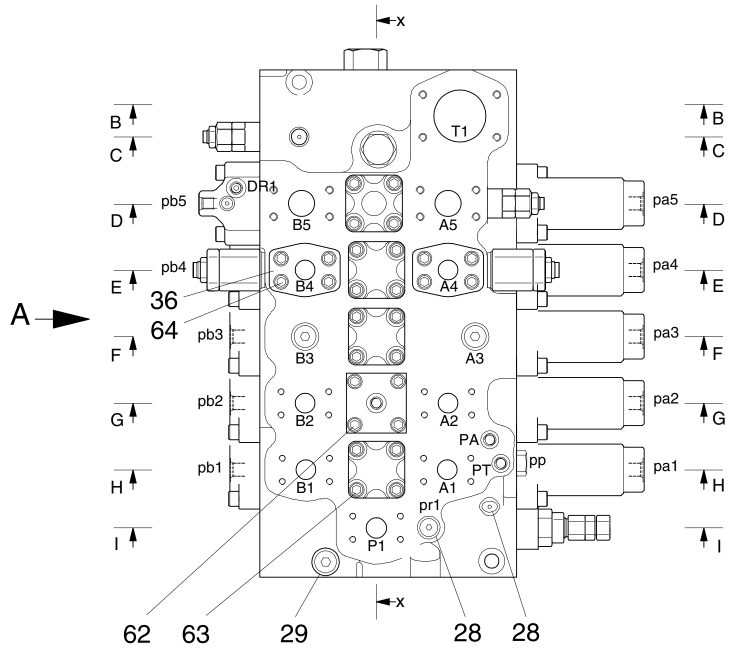
Speed	Adjustment of min flow spring	
	Tightening amount of adjusting screw (953)	Flow change amount
(min^{-1})	(Turn)	(ℓ/min)
1800	+1/4	+6.9

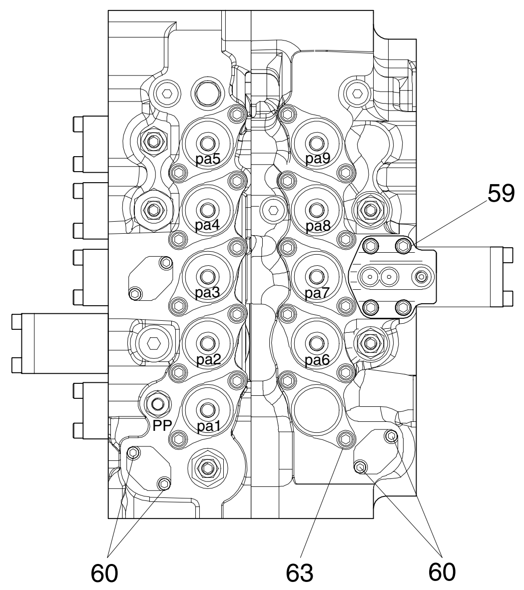


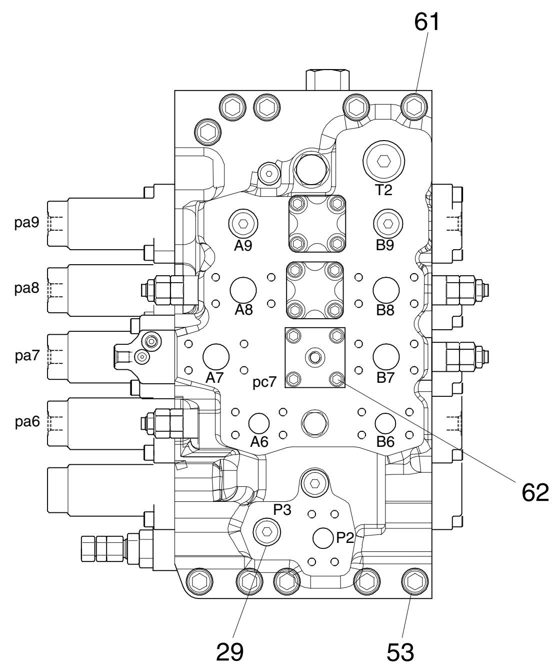
1. STRUCTURE

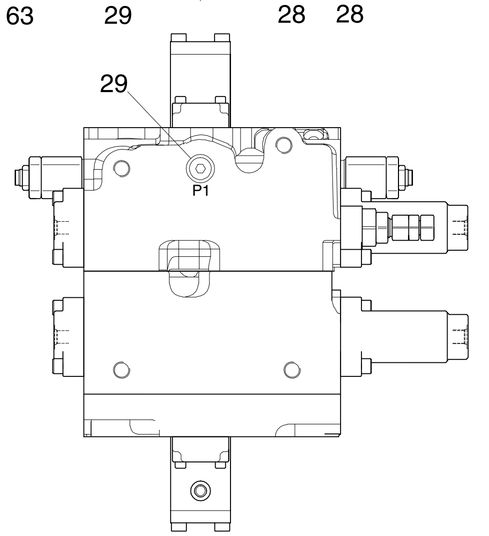










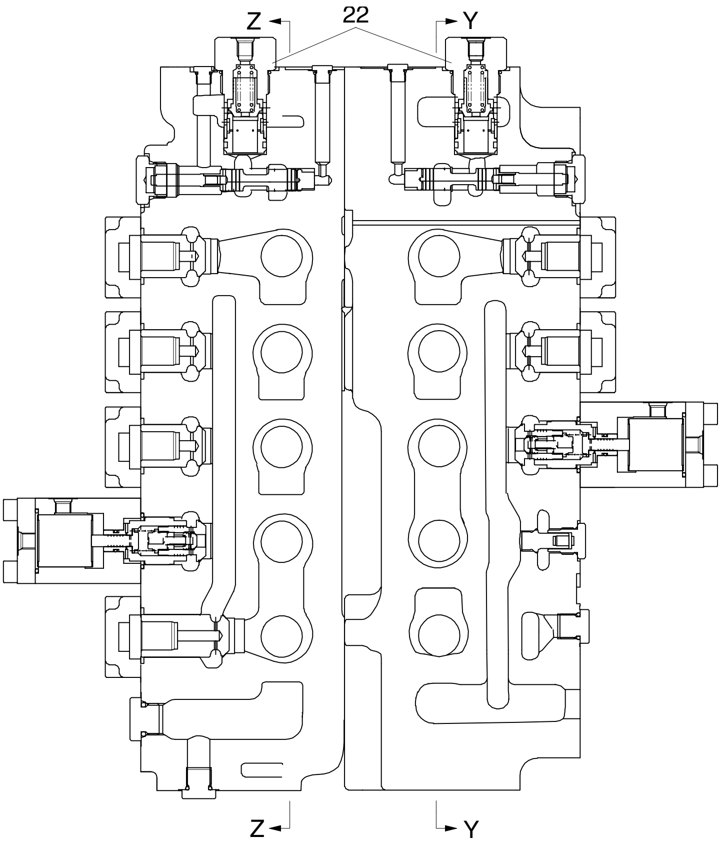


Port name	Port size	Thread depth (mm)
DR1, DR2, DR3, DR1', DR2', pr1, ps1, ps2, pc1, pc2, pc6, pa10, pa11, PA, PP, PH, PT	PF 1/4	12
pa1~pa9, pb1~pb9	PF 3/8	14
A3, A9, B3, B9, P1, P3	PF 1/2	16
T3, T4	PF 3/4	17
T2	PF 1	21

28 Plug assy (PF1/4)
29 Plug assy (PF1/2)
36 Flange (OPT)
59 Socket head bolt (M12)
60 Socket head bolt (M10)
61 Socket head bolt (M20)
62 Socket head bolt (M12)
63 Socket head bolt (M12)
64 Socket head bolt (M10)
65 Socket head bolt (M12)

480S2MC50

1) P1 AND P2 CENTER SECTION

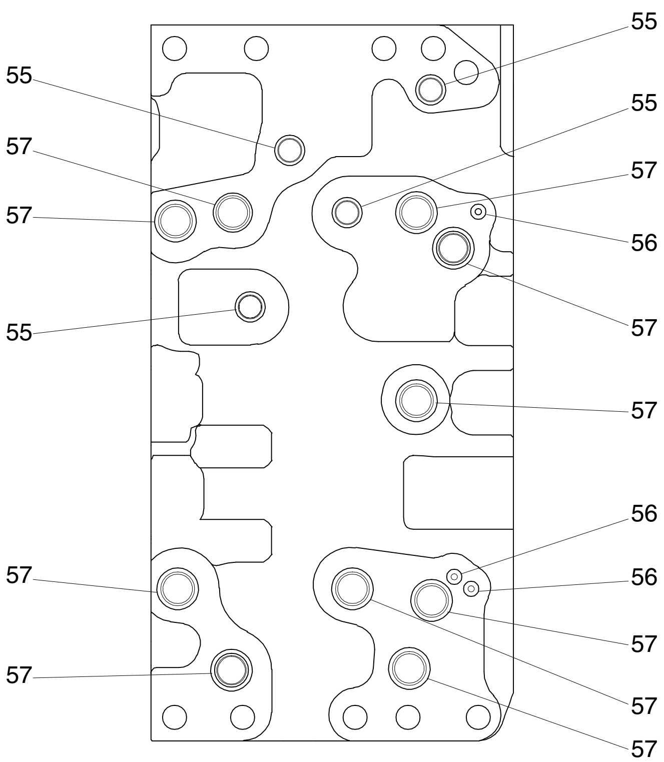


SECTION X-X

480S2MC51

22 Negacon relief valve

2) P2 HOUSING MATING SURFACE

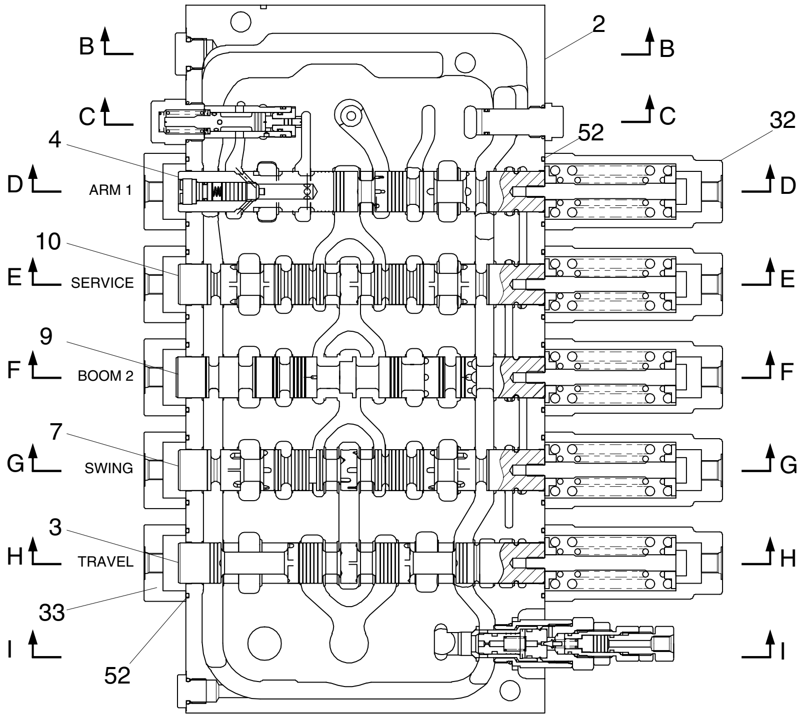


P2 VALVE HOUSING MATING SURFACE

480S2MC52

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

3) P2 HOUSING SPOOL SECTION

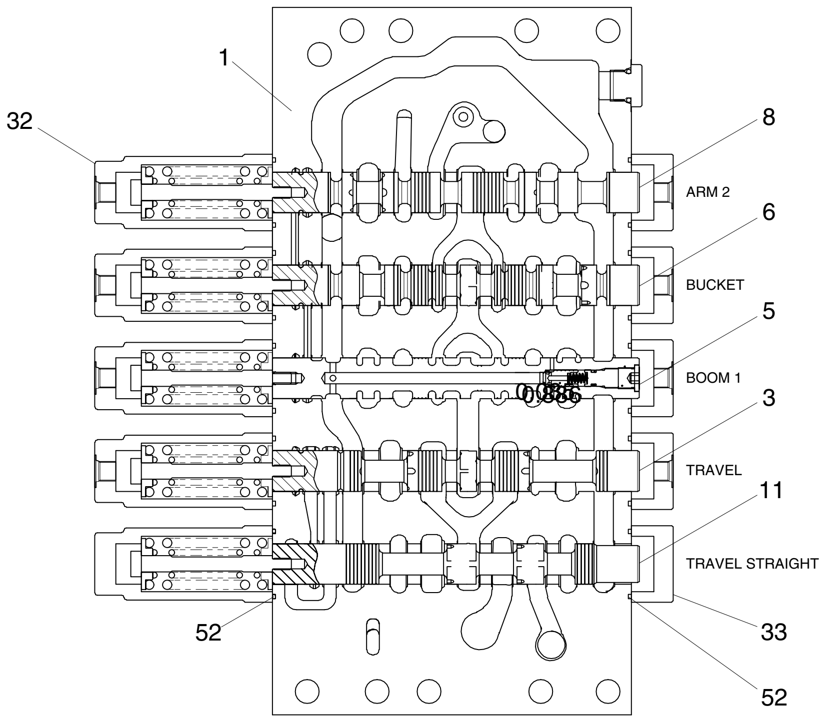


SECTION Z-Z

480S2MC53

2 P2 housing
3 Travel spool kit
4 Arm 1 spool kit
7 Swing spool kit
9 Boom 2 spool kit
10 Option spool kit
32 Large pilot cap
33 Small pilot cap
52 O-ring

4) P1 HOUSING SPOOL SECTION

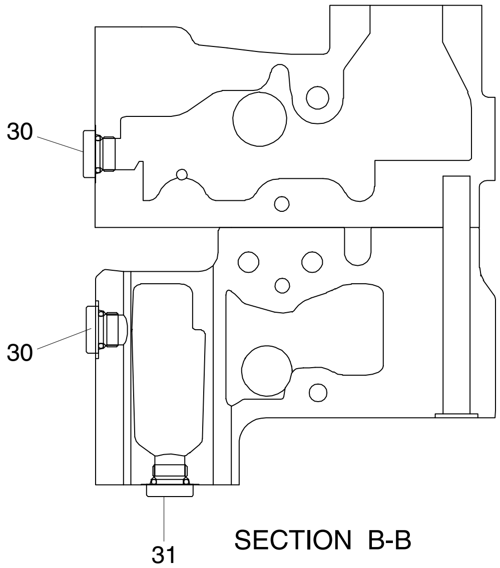


SECTION Y-Y

480S2MC54

1 P1 housing
3 Travel spool kit
5 Boom 1 spool kit
6 Bucket spool kit
8 Arm 2 spool kit
11 Travel straight spool kit
32 Large pilot cap
33 Small pilot cap
52 O-ring

5) T1 PORT SECTION

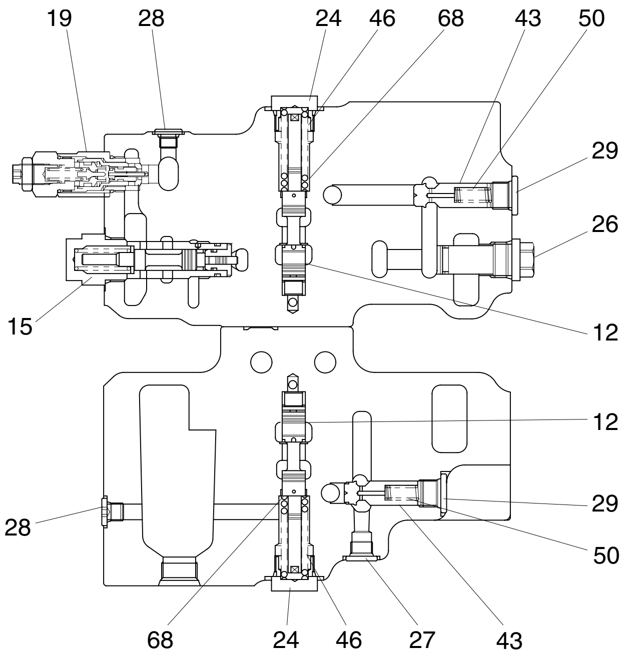


SECTION B-B

480S2MC55

30 Plug
31 Plug

6) BYPASS CUT SPOOL SECTION

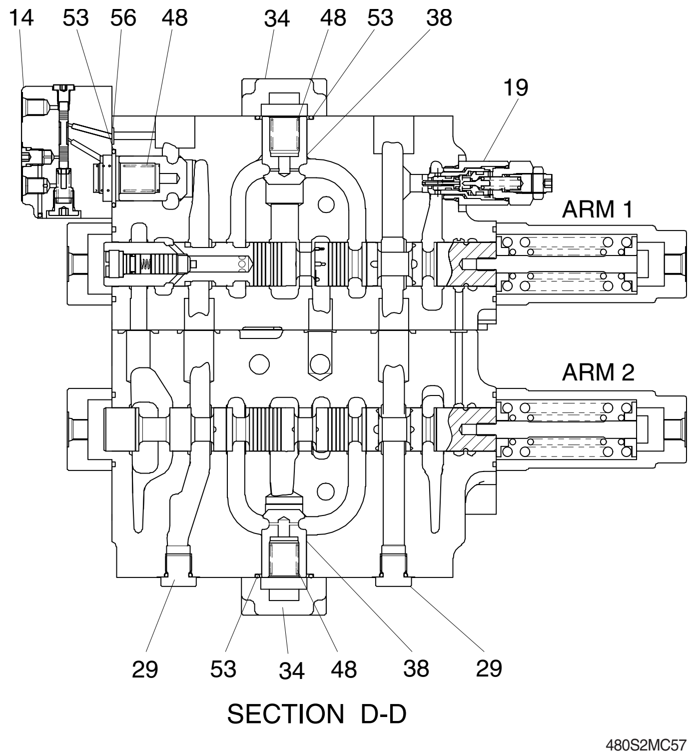


SECTION C-C

480S2MC56

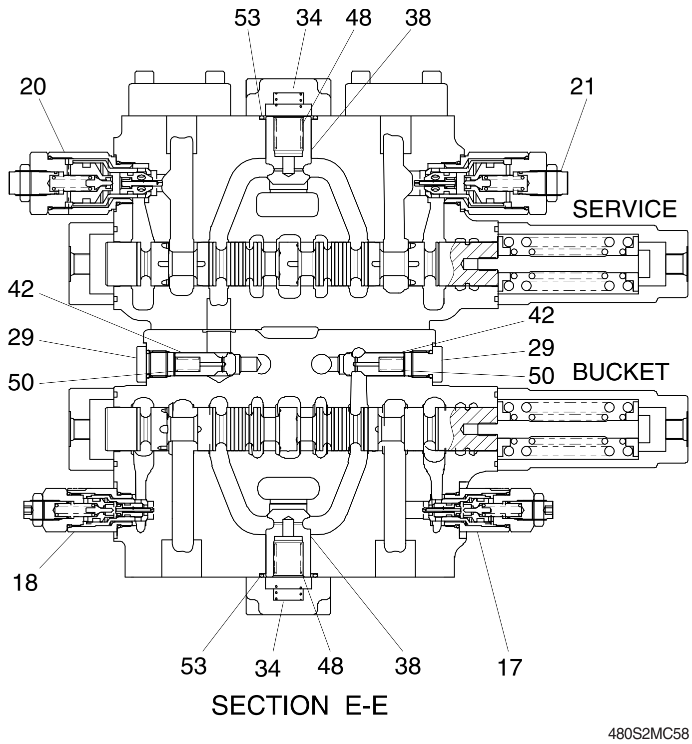
12 Bypass cut 1 spool kit
15 Arm regen cut assy
19 Port relief valve
24 Bypass plug assy
26 Plug
27 Plug
28 Plug
29 Plug
43 Poppet
46 Spring
50 Spring
68 Bypass cut spring seat

7) ARM 1 AND ARM 2 SECTION



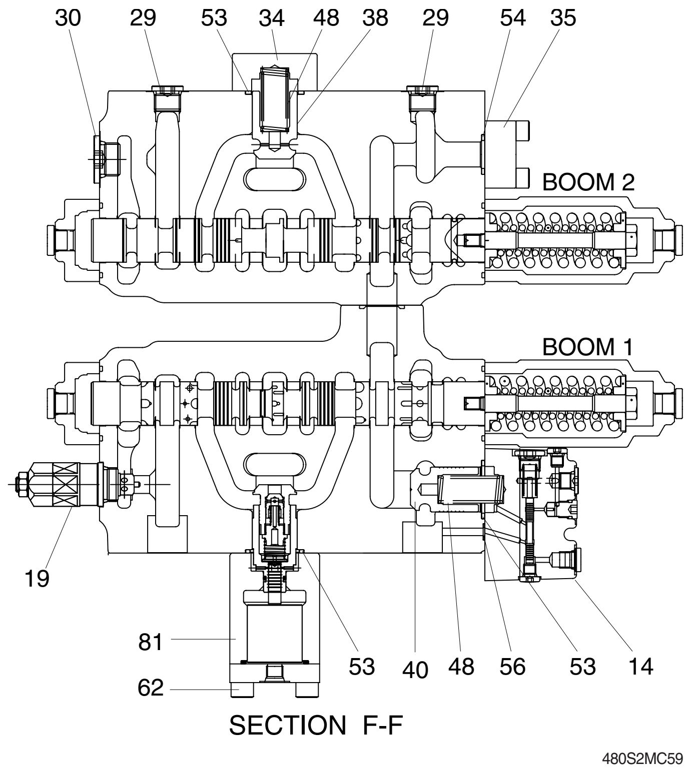
- 14 Holding valve
- 19 Port relief valve
- 29 Plug
- 34 Load check flange
- 38 Load check poppet
- 48 Load check spring
- 53 O-ring
- 56 O-ring

8) BUCKET AND OPTION SECTION



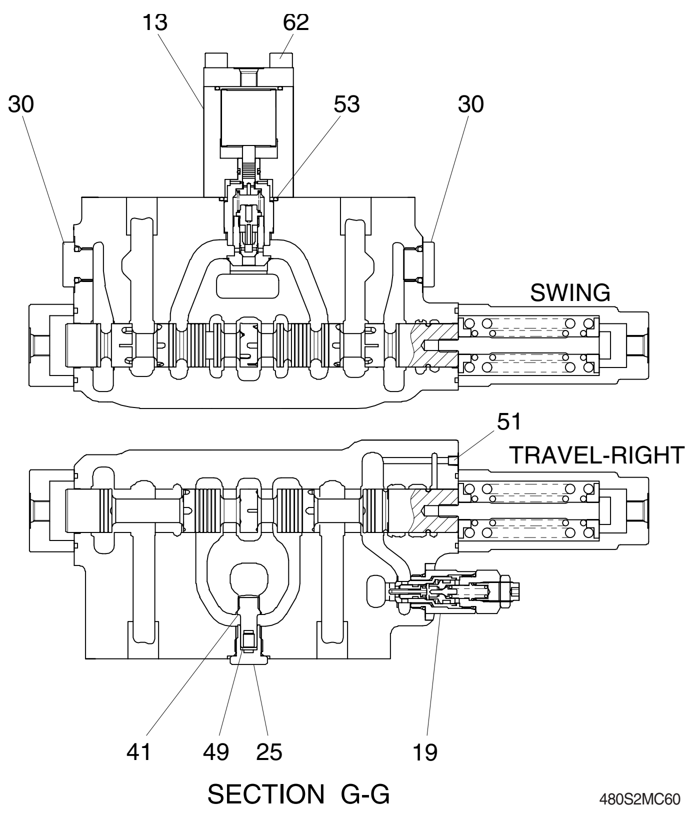
- 17 Port relief valve
- 18 Port relief valve
- 20 Port relief valve
- 29 Plug
- 34 Load check flange
- 38 Load check poppet
- 42 Poppet
- 48 Load check spring
- 50 Spring
- 53 O-ring

9) BOOM 1 AND BOOM 2 SECTION



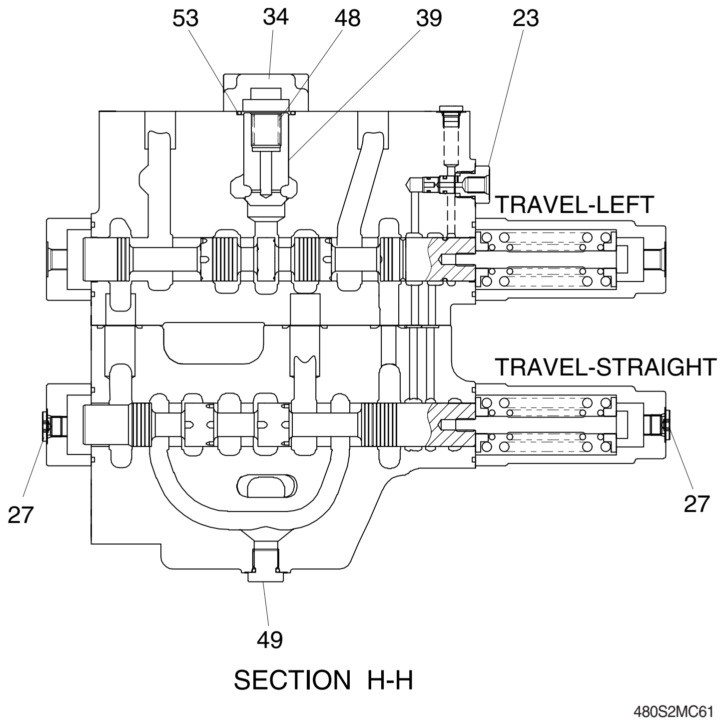
14 Holding valve
19 Port relief valve
29 Plug
30 Plug
34 Load check valve
35 Main relief valve flange
40 Main H/D poppet
48 Load check spring
53 O-ring
54 O-ring
56 O-ring
62 Socket bolt
81 Boom logic valve

10) SWING AND TRAVEL RIGHT SECTION



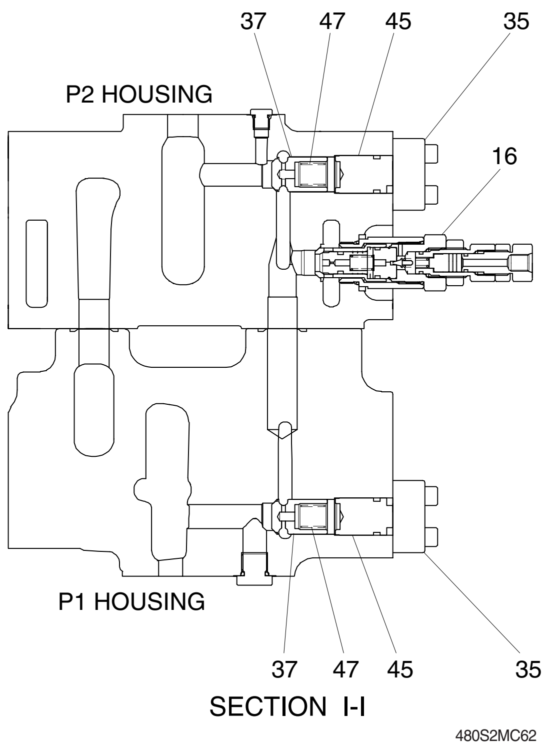
13 Swing logic valve
19 Port relief valve
25 Plug
30 Plug
41 Poppet
49 Spring
51 Plug
53 O-ring
62 Socket bolt

11) TRAVEL LEFT AND TRAVEL STRAIGHT SECTION



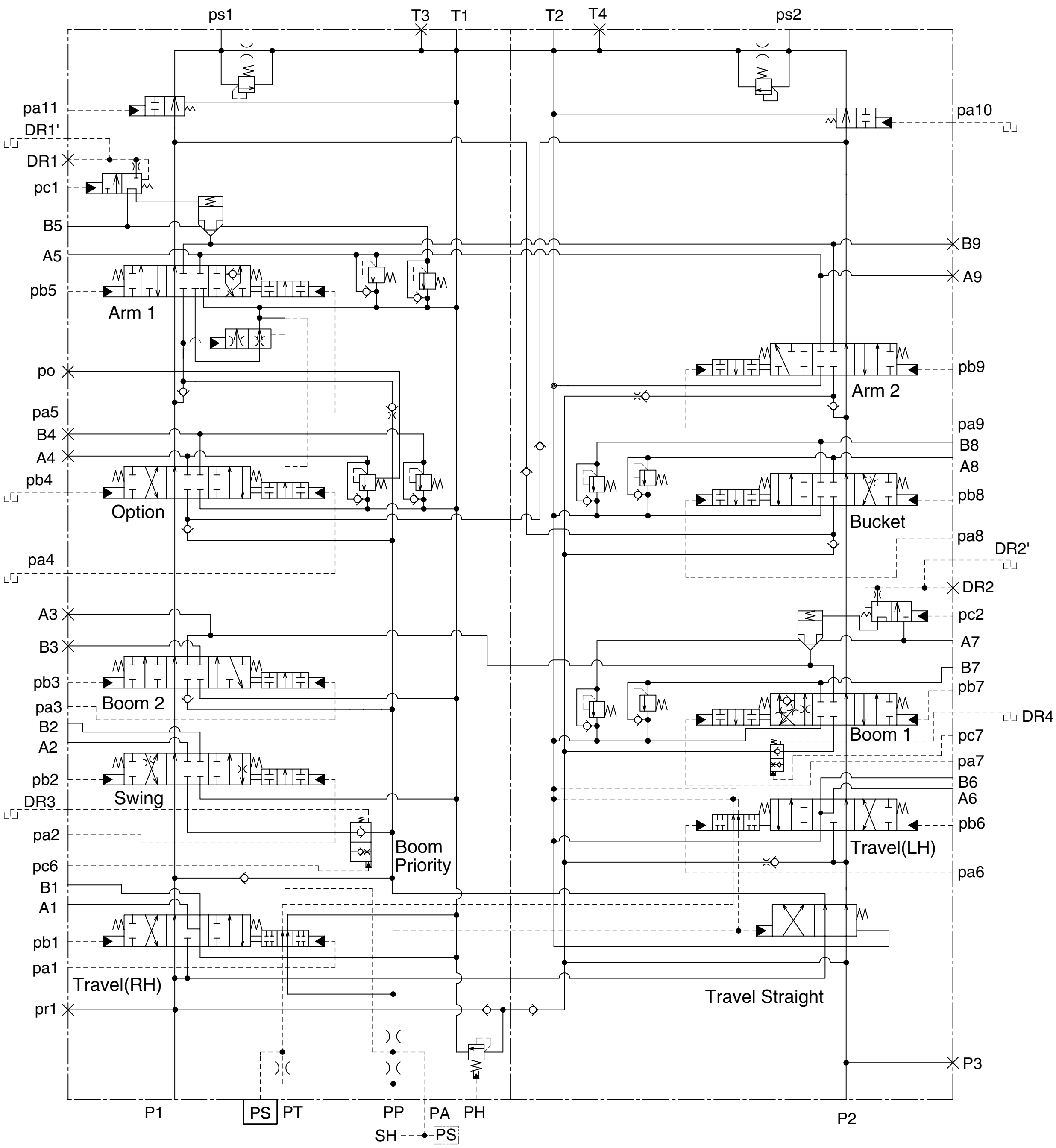
23 Signal plug assy
27 Plug
29 Plug
34 Load check flange
39 Load check poppet
48 Load check spring
53 O-ring

12) RELIEF VALVE SECTION



16 Main relief valve
35 Main relief flange
37 Main relief poppet
45 Main relief spacer assy
47 Main relief spring

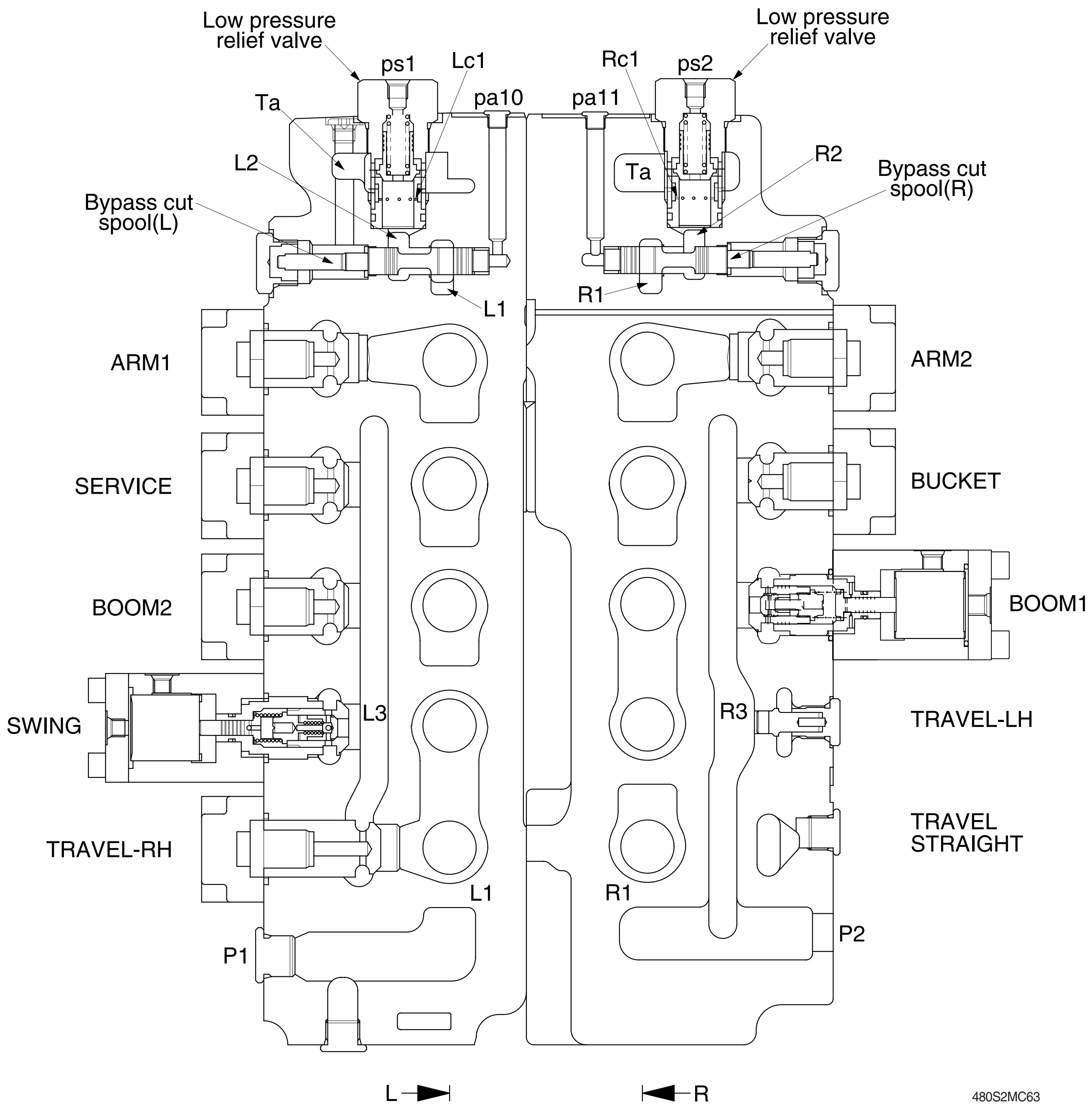
2. HYDRAULIC CIRCUIT



480S2MC06

3. OPERATION

1) ALL SPOOL NEUTRAL



(1) Neutral passage

① Oil from pump P1 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 P2 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 P1, P2.

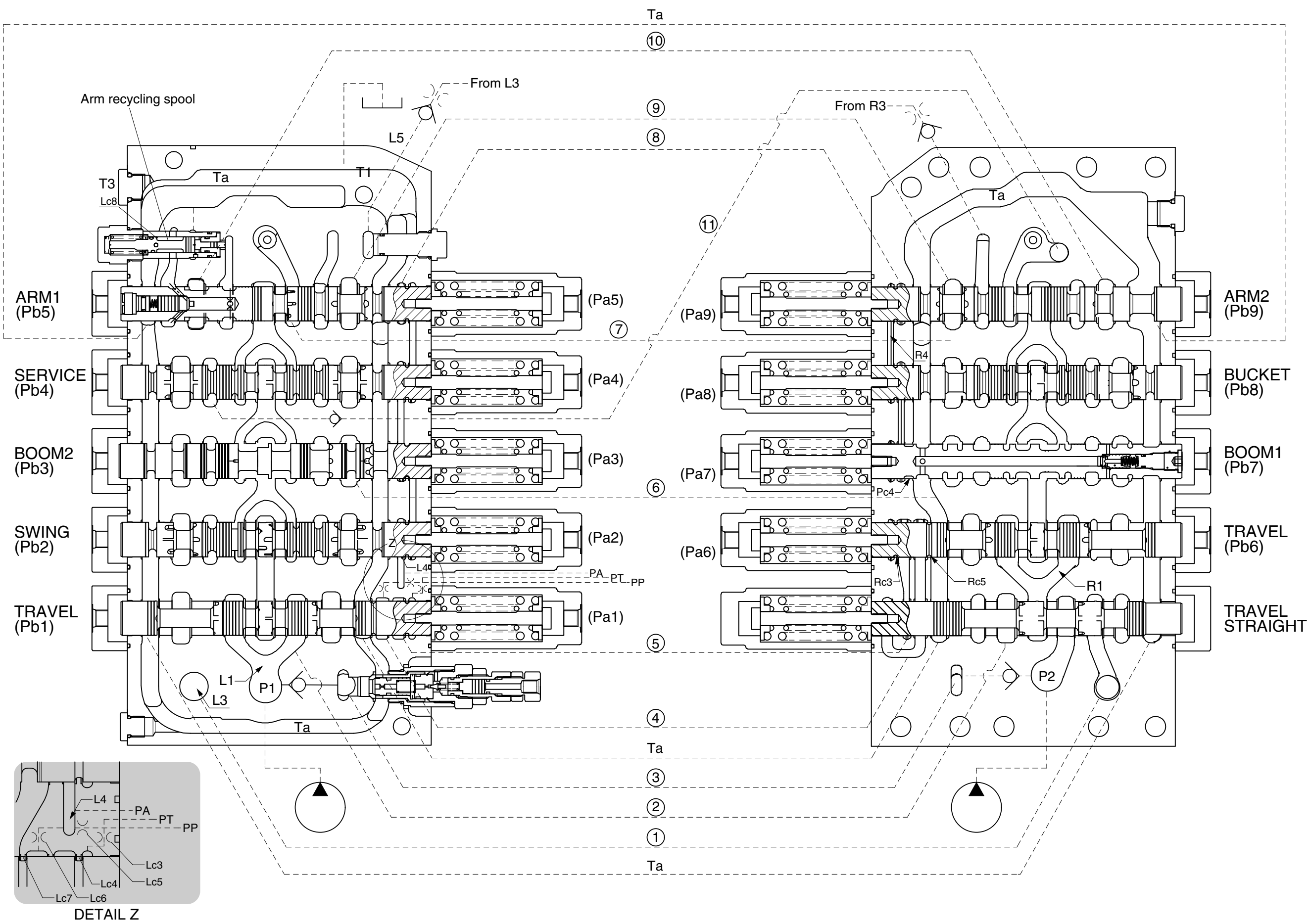
④ When a large amount of oil flows the neutral passage, the low pressure relief valves is operated. As a result, the shock pressure of port ps1, ps2 is prevented.

(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.



480S2MC67

2) SINGLE OPERATION

(1) Travel spool

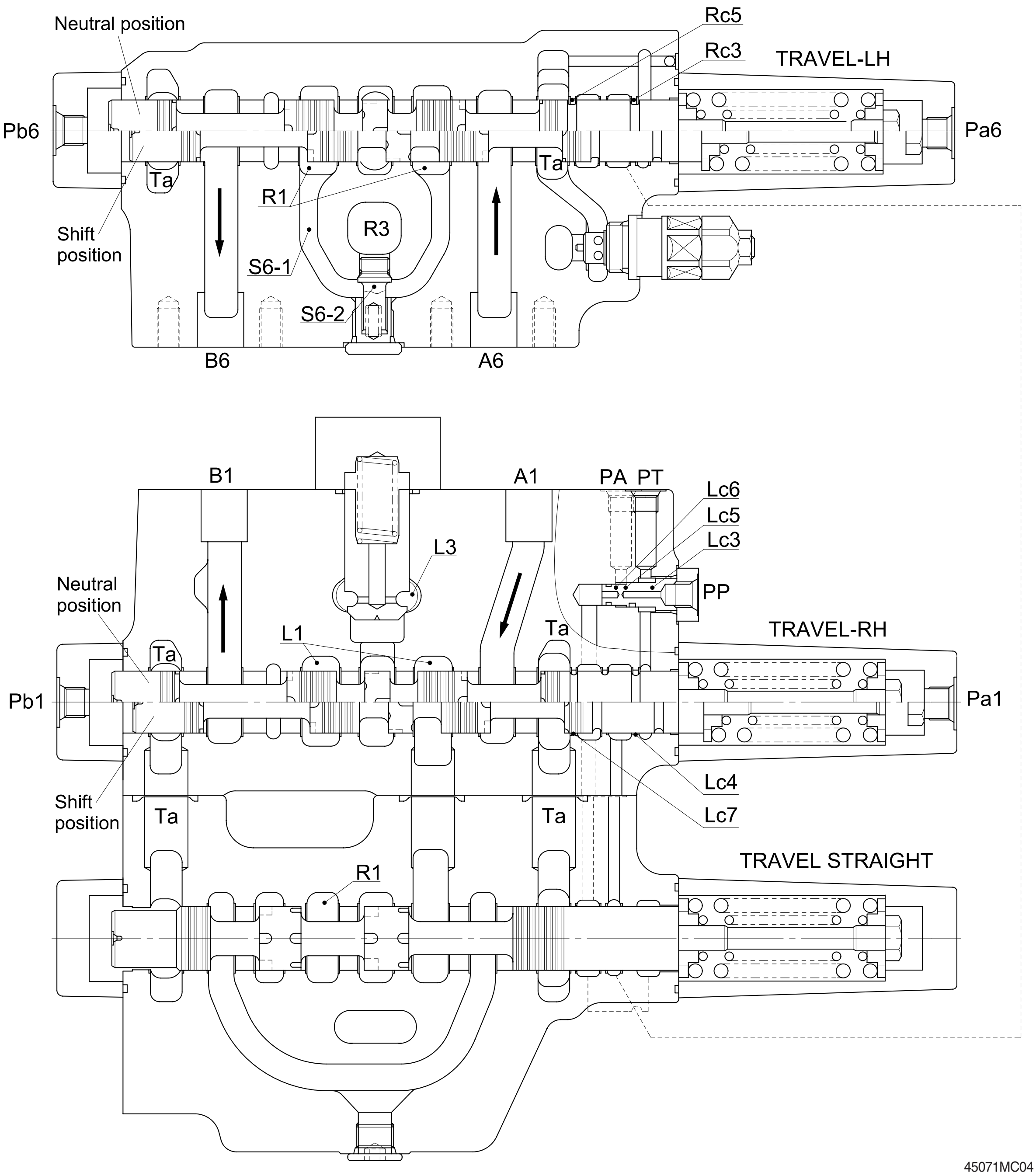
When the RH travel spool is pushed to right by the pilot pressure of port Pb1 the oil discharged from P1 port flows from the neutral passage (L1) to B1 port.

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).

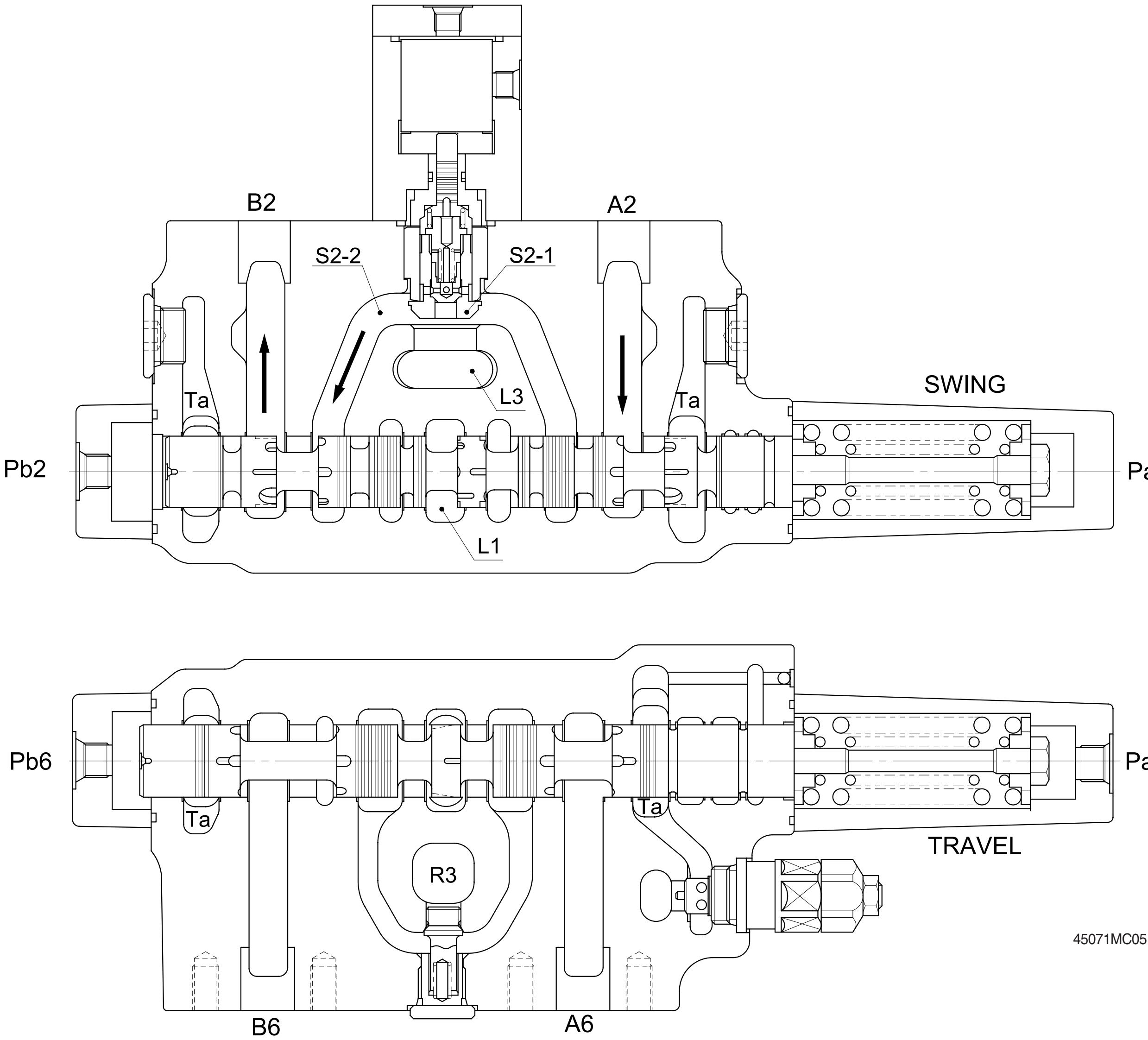
When the travel spool is pushed to the right by the pilot pressure, the land (Lc4, Rc3) is closed and the tank passage of the oil discharged from port PP is closed, and then the pressure of PT port is increased.



(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.

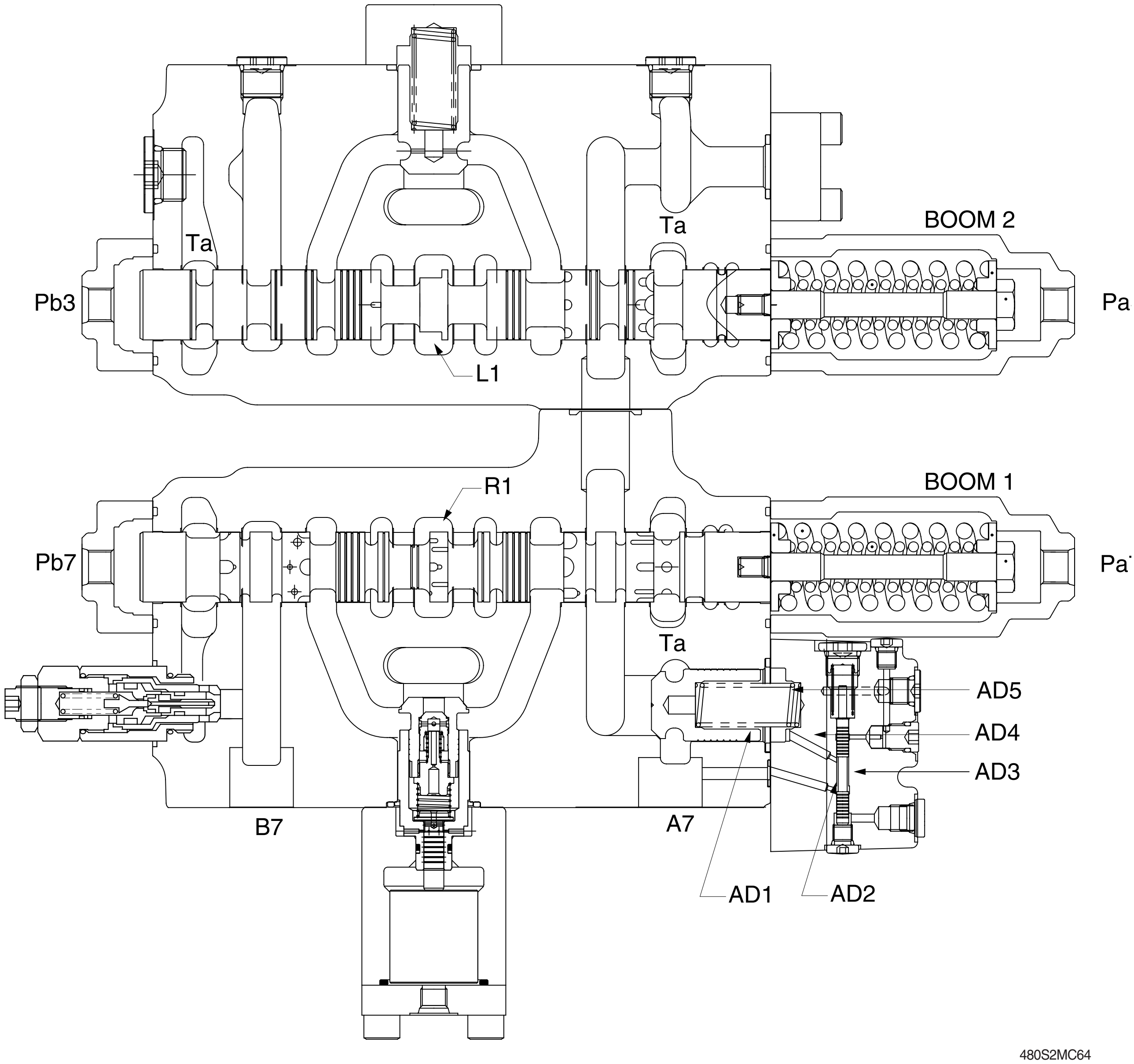
The oil from port A2 return to the tank via the tank passage (Ta).



3) BOOM SPOOL

(1) Neutral

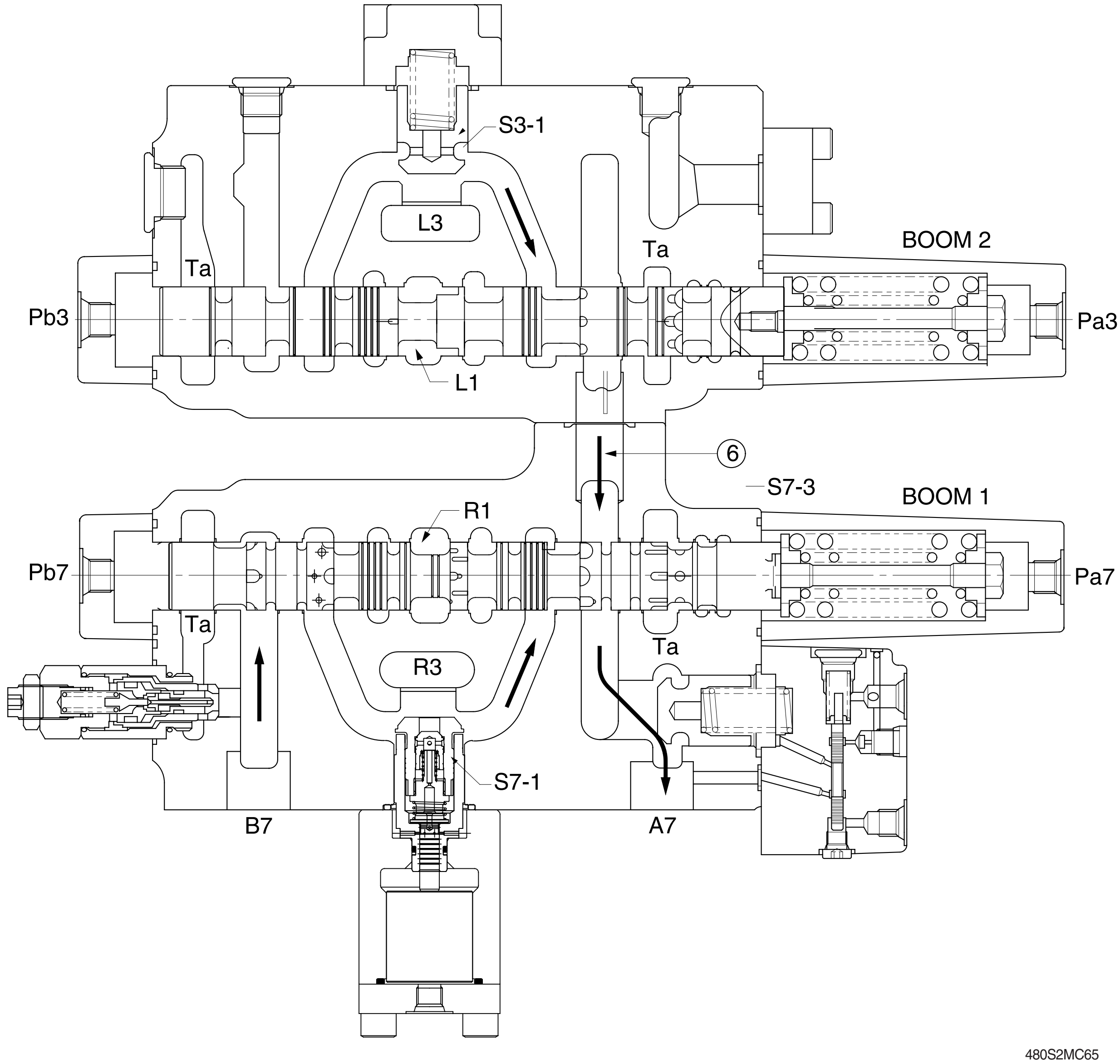
This valve is providing the anti-drift valve on the cylinder bottom side of boom 1 section. In neutral, the poppet (AD1) is seated by the pressure of spring chamber (AD5) because the oil from the port A7 is connection with spring chamber (AD5) via passage (AD2), spool (AD3) and passage(AD4).



(2) Boom up (flow summation)

When the boom 1 spool is pushed to the left by the pilot pressure of port Pb7, 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 Pb3, 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).

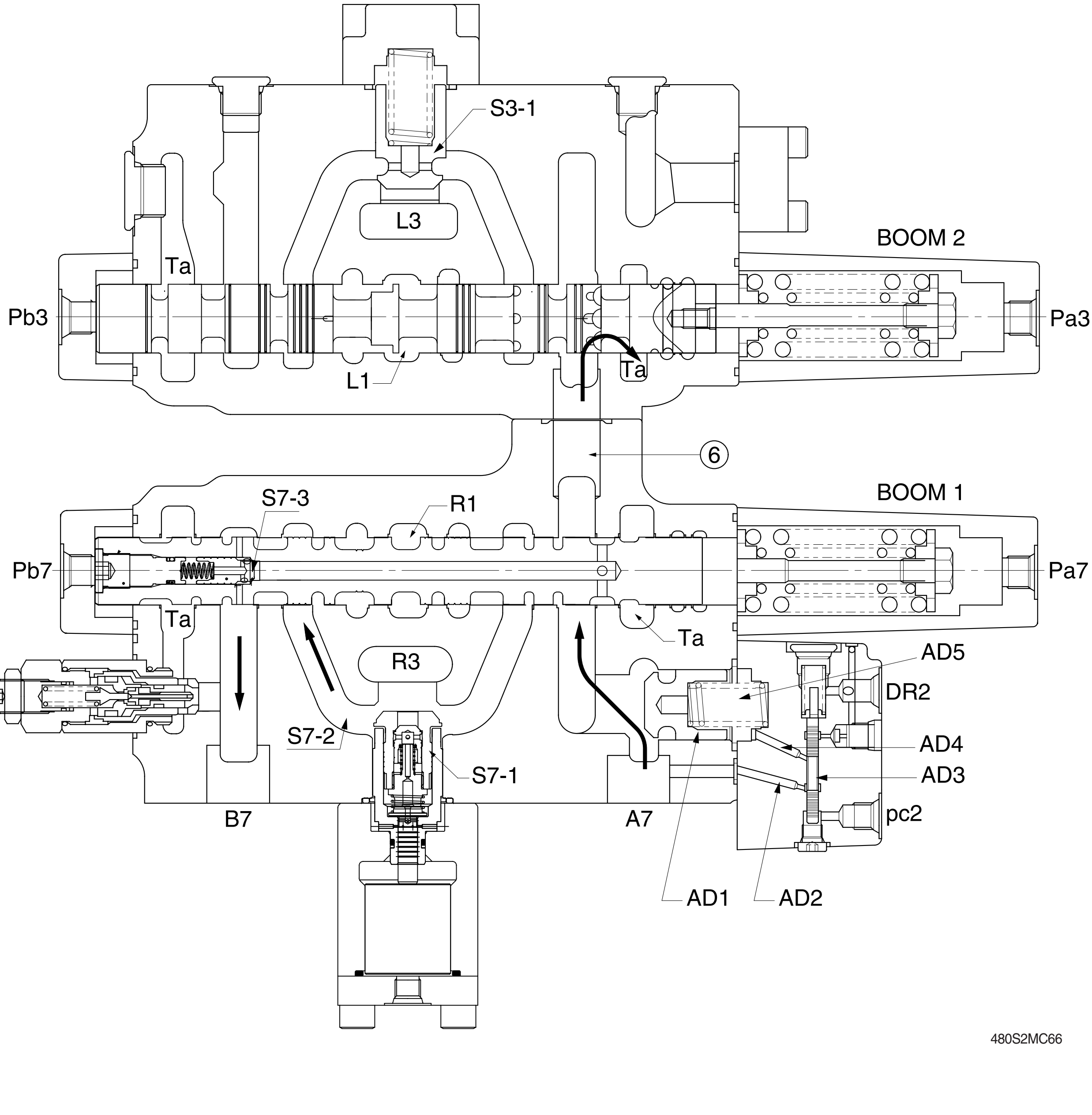


480S2MC65

(3) Boom down (recycling)

When the boom 1 spool is pushed to the right by the pilot pressure of port Pa7, 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.



480S2MC66

4) SERVICE SPOOL

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

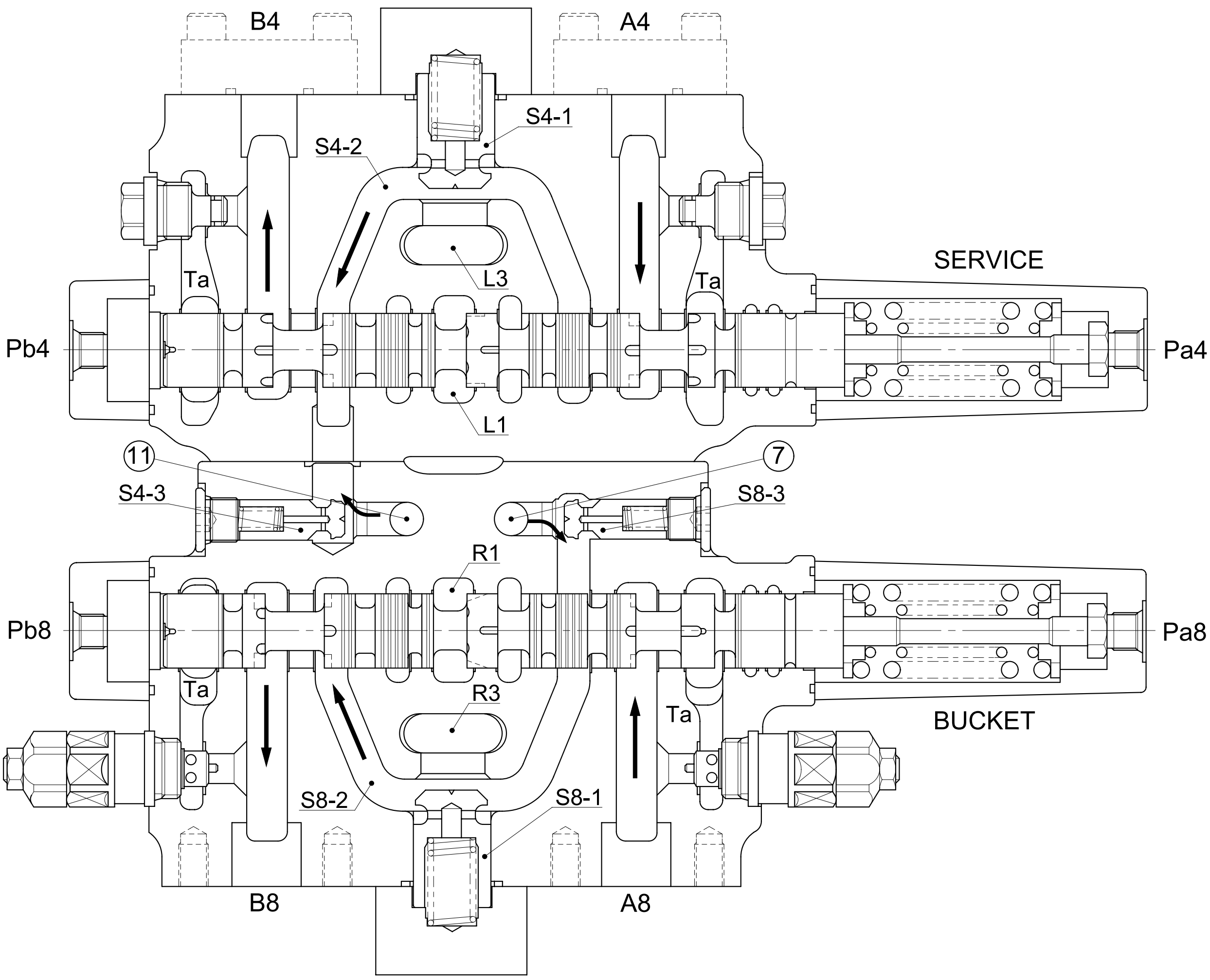
At the same time, as the port pa10 (see 2-25 page) is pressurizing and the bypass cut spool (R) is pushed, the oil discharged from pump P2 flows together into the port B7 via passage (11), poppet (S4-3). The oil returned from port A4 flows into the tank via the tank passage (Ta).

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).



45071MC09

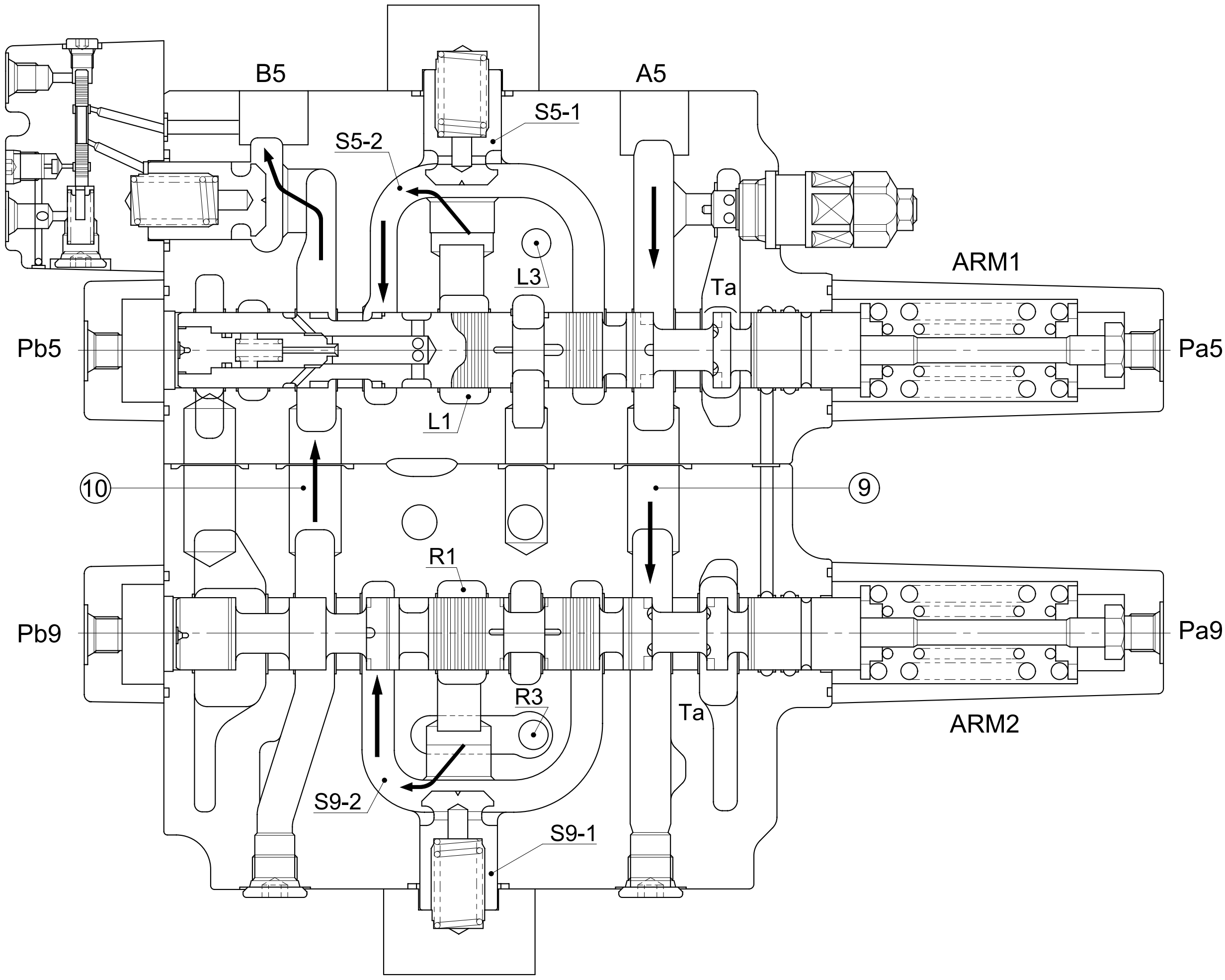
6) ARM SPOOL

(1) Arm out (flow summation)

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

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

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



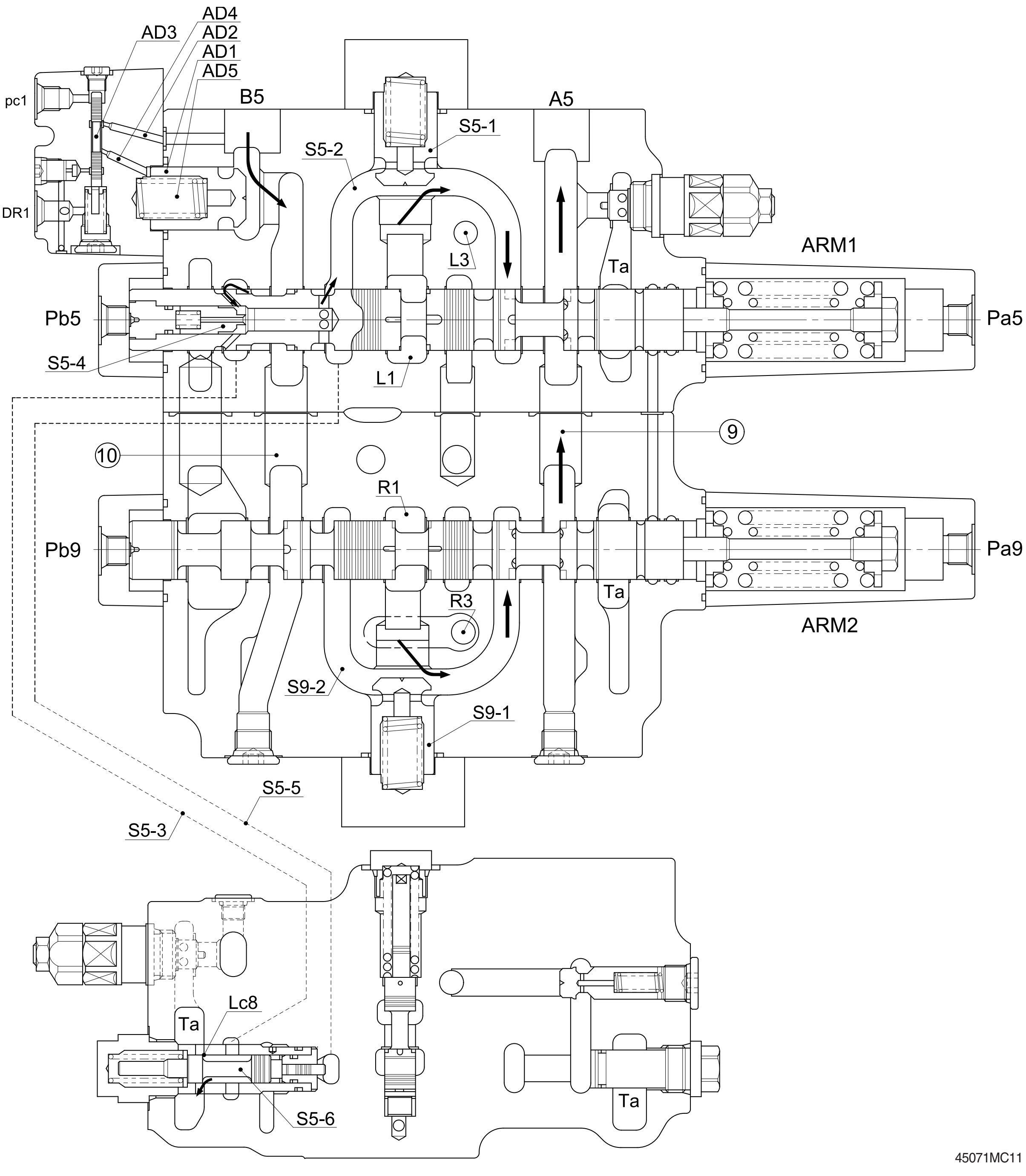
45071MC10

(2) **Arm in** (flow summation)

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

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

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

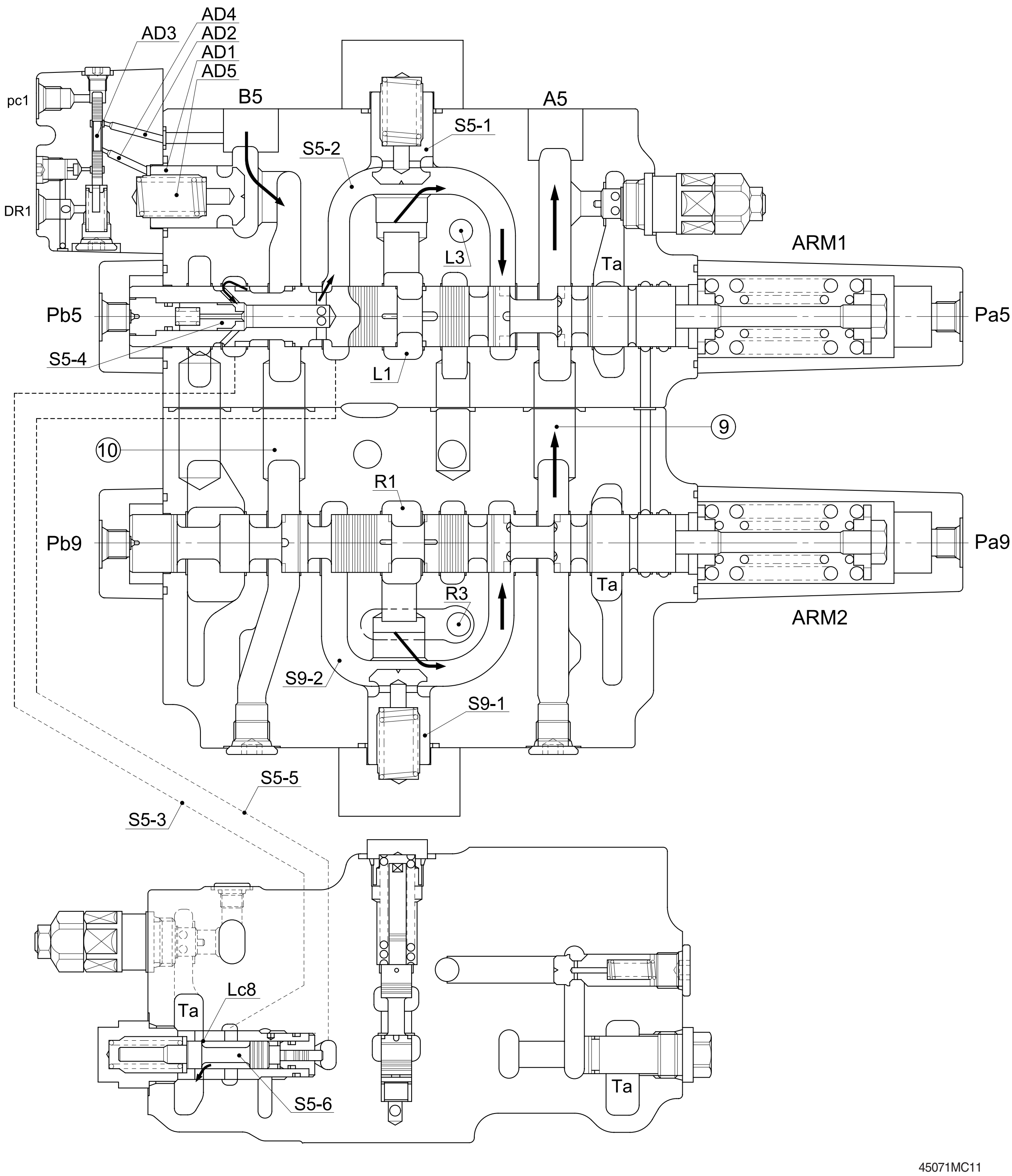


(3) **Arm recycling** (arm in)

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

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

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



7) BYPASS CUT SPOOL

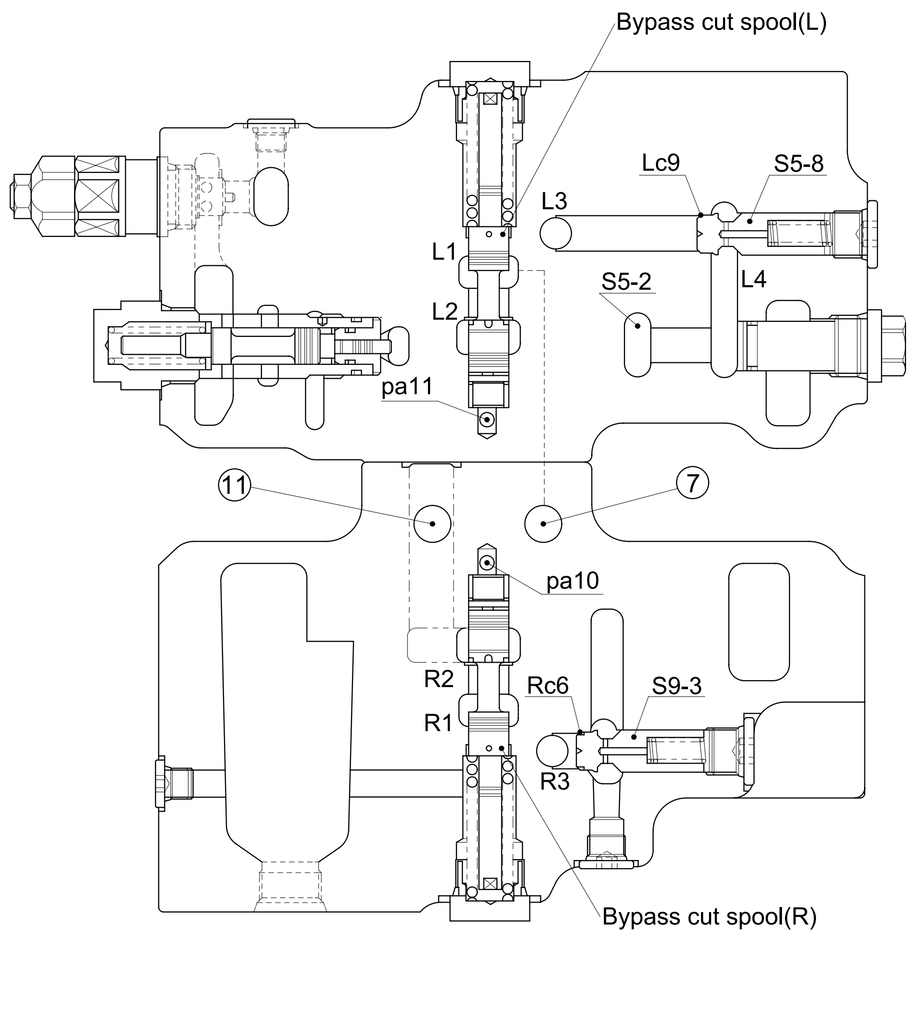
This valve is providing the bypass cut spool at the lowest stream of (upper stream of the low pressure relief valve) the neutral passage (L1, R1).

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

8) PARALLEL ORIFICE FOR ARM

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

The parallel circuit of arm 2 section is connected to the passage (S9-2, see 2-35) 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 2-35) through orifice (Lc9) in the edge of the poppet (S5-8) from the parallel passage (L3).



45071MC12

9) RELIEF VALVE

(1) Main relief valve

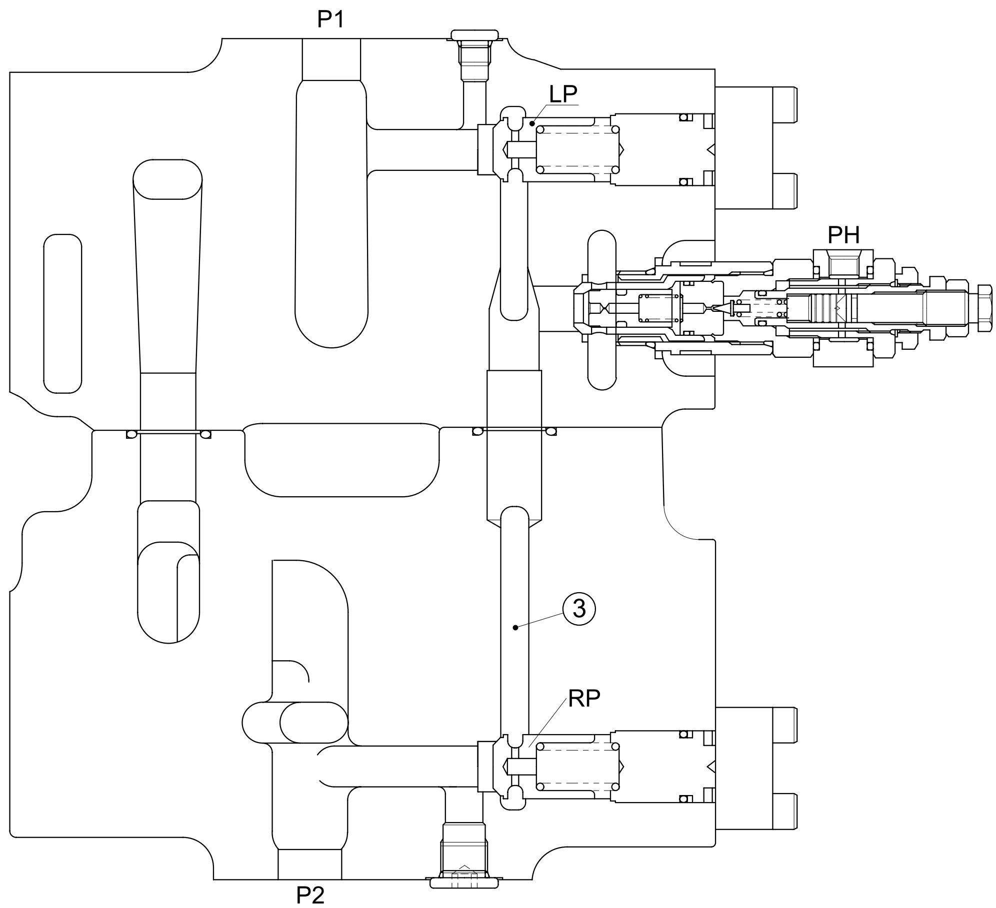
The oil discharged from P1 port via the poppet (LP) and the oil discharged from P2 port via the poppet (RP) flow into the main relief valve through the passage (3).

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

(2) Overload relief valve

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

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

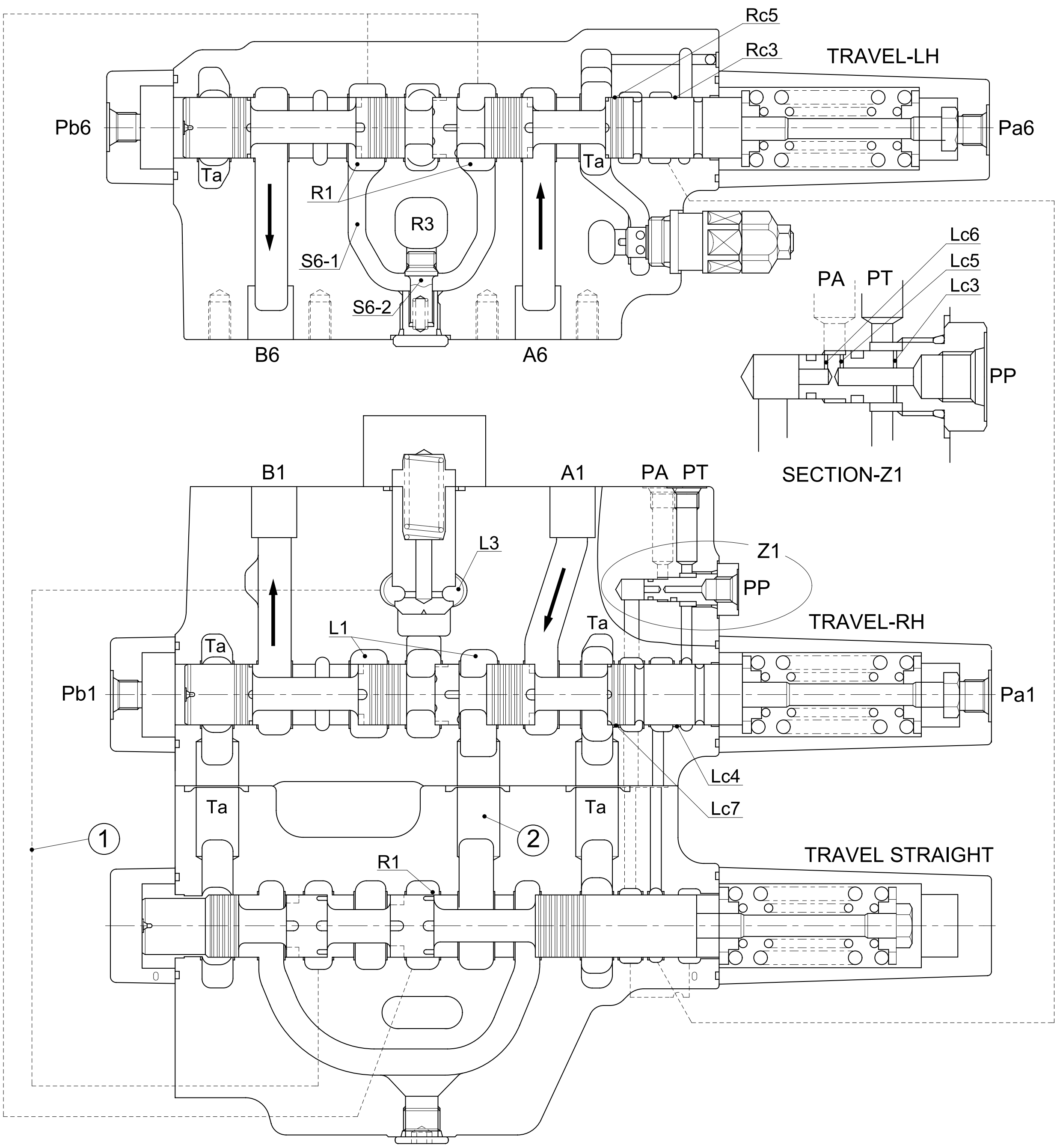


45071MC13

4. COMBINED OPERATION

1) TRAVEL COMBINED OPERATION

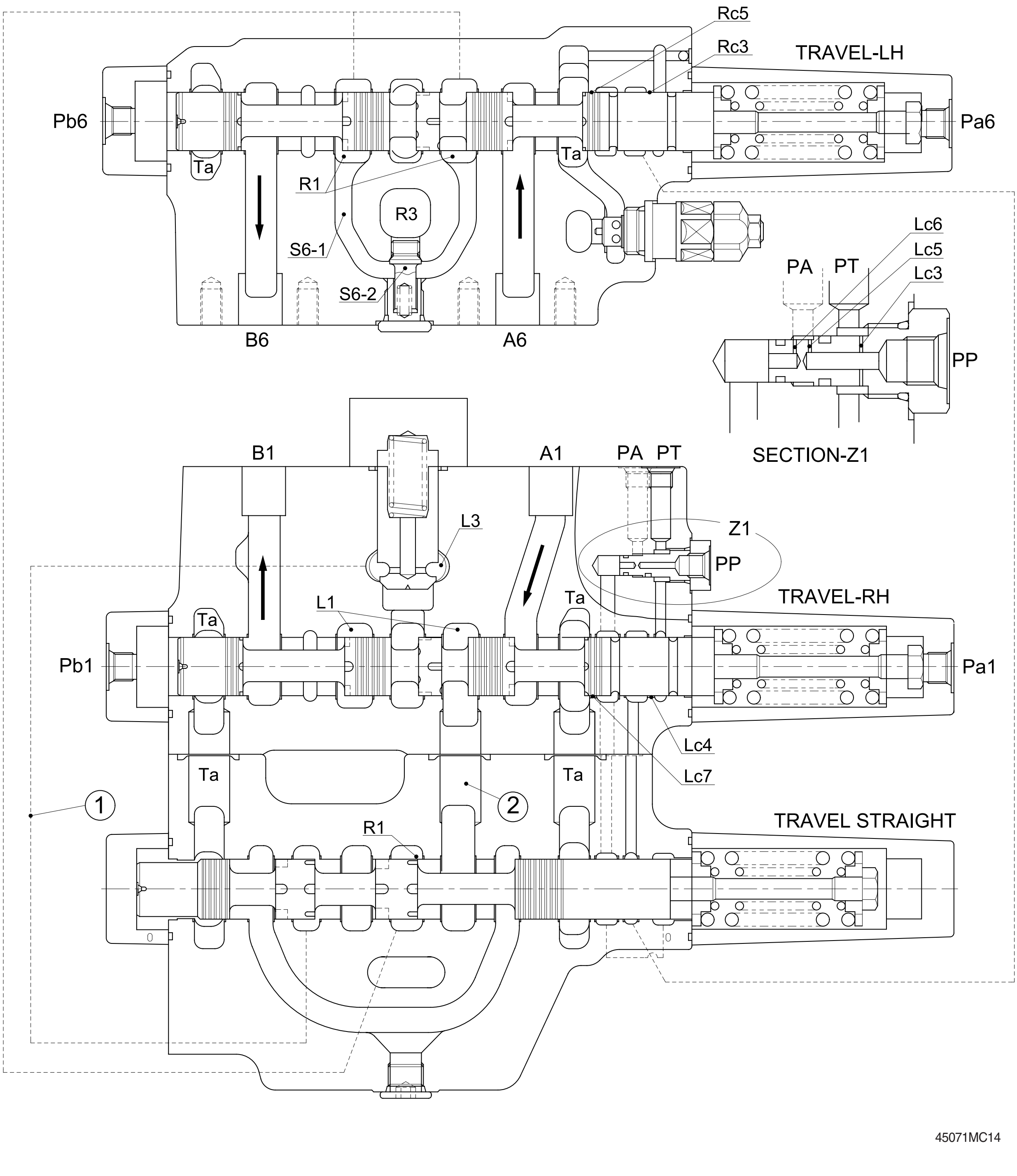
① While travel (forward, reverse and pivot turn) and front attachment (except travel section) functions are operated, the oil discharged from port PP is cut via land (Lc4, Lc7, Rc3, Rc5) and blocked from signal land except travel section to tank passage (Ta), the pressure of signal passage rises to the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



45071MC14

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).

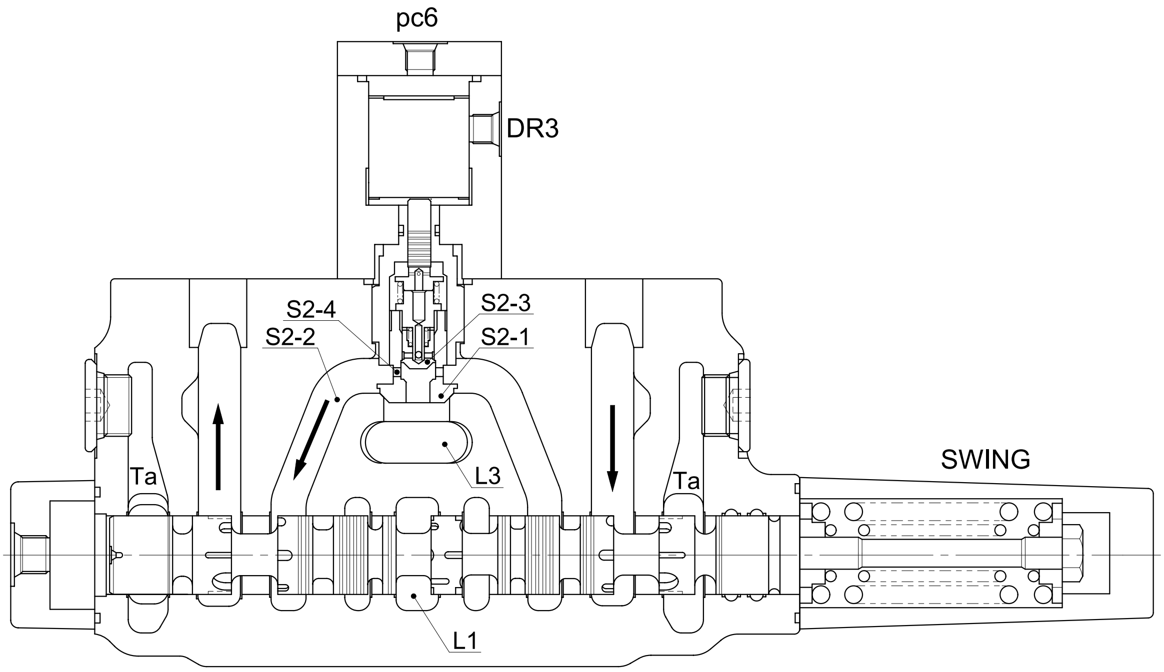
③ In case the load pressure of the section except travel is higher than that of the RH travel section, the partial oil of discharged from port P2 pushes open the poppet (S6-2) and flows together into the passage (S6-1) through the orifice at the edge of poppet. The travel (LH, RH) is operated by the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

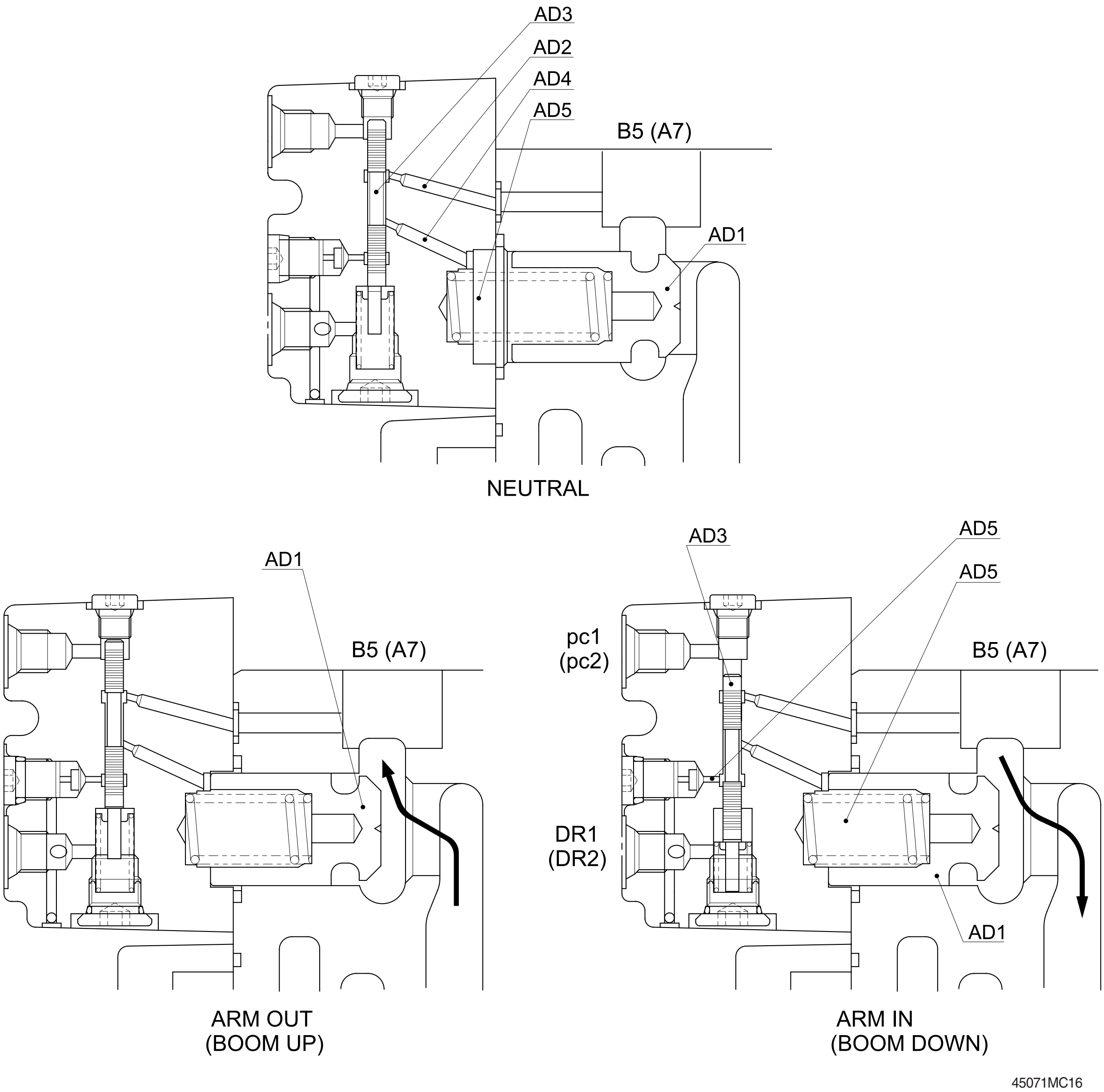
The oil from pump flows into cylinder by pushes open the poppet (AD1).

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).

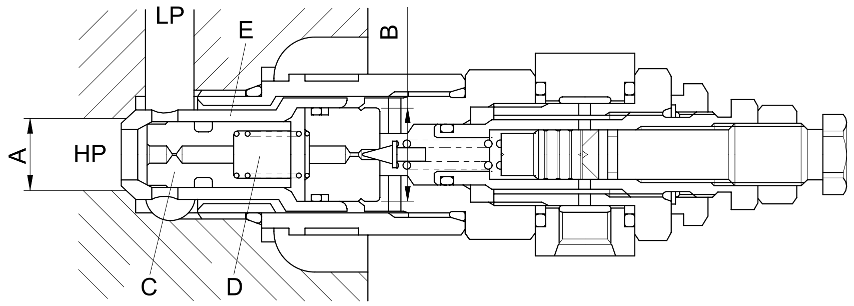
As a result, the oil from the cylinder port returns to tank passage (Ta).



6. RELIEF VALVE OPERATION

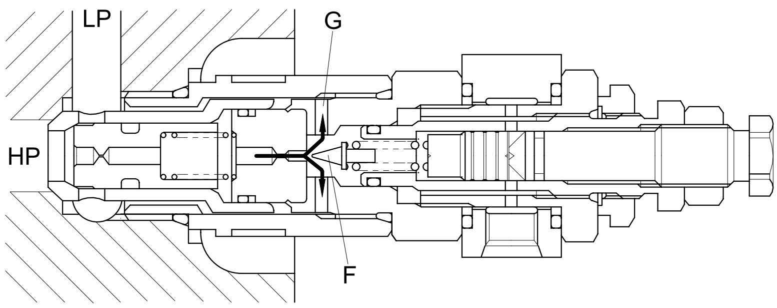
1) MAIN RELIEF VALVE

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



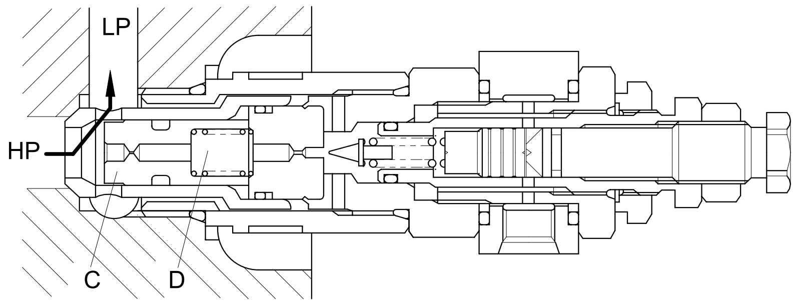
45071MC17

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



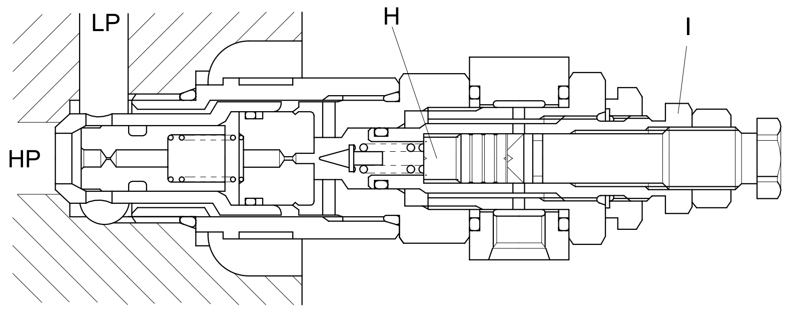
45071MC17-1

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



45071MC17-2

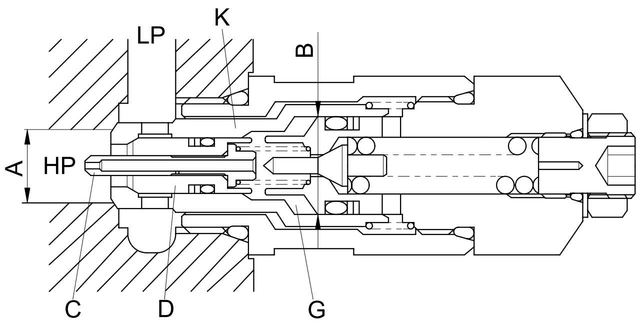
(4) High pressure setting pilot signal (Pi) : ON
The piston (H) moves to left by pilot pressure (Pi); set pressure of spring rises, making high pressure setting.



45071MC17-3

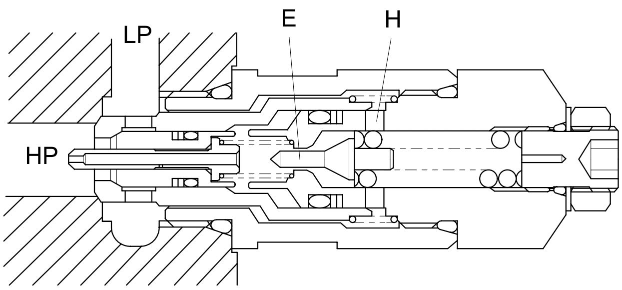
2) OVERLOAD RELIEF VALVE

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



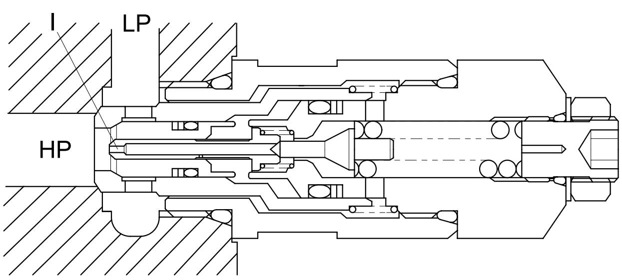
45071MC18

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



45071MC18-1

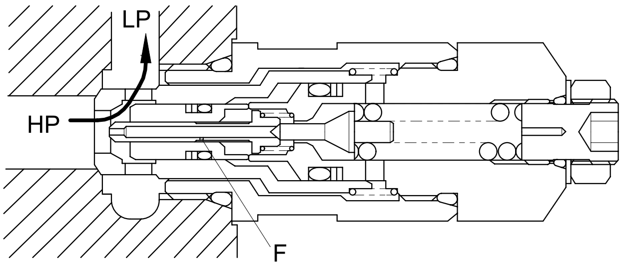
(3) When above flow is formed, the pilot poppet (E) is opened.
The pressure drops before and behind orifice (I); piston (C) moves to right and the piston (C) is seated at the tip of poppet (E).



45071MC18-2

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

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

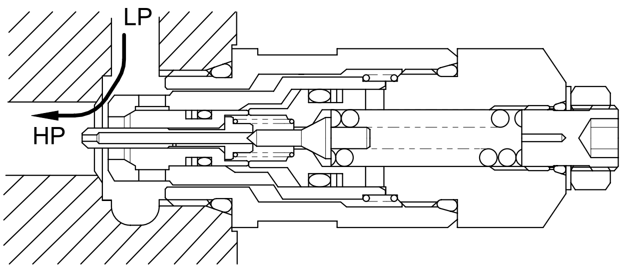


45071MC18-3

(5) Make up operation

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

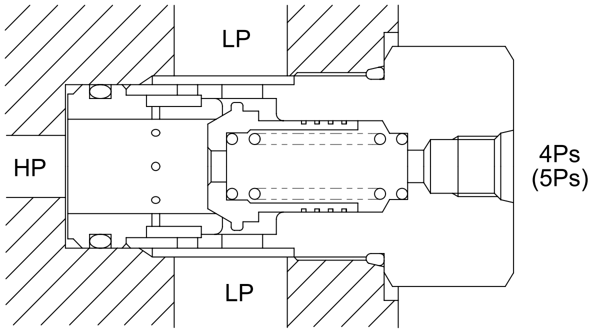
Thus the sleeve (K) and the main poppet (D) are securely seated by difference area of A and B.



45071MC18-4

3) LOW PRESSURE RELIEF VALVE

(1) When pump does not operational

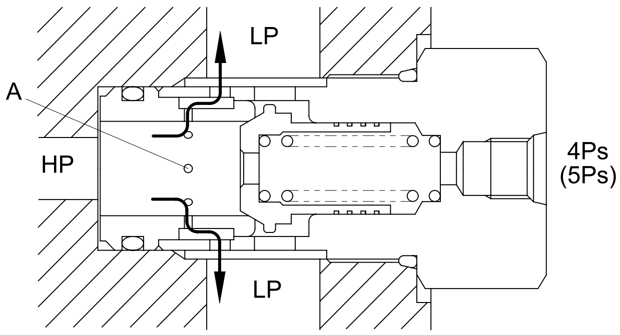


45071MC19

(2) When spool neutral

The neutral passage (HP) oil flows into the low pressure passage (LP) via signal orifice (S).

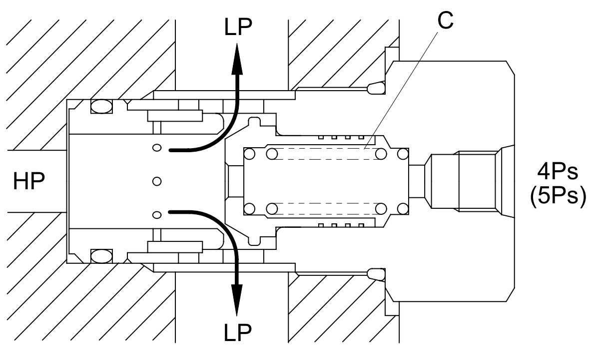
The signal port 4Ps (5Ps) pressure is raise by negative control orifice (A).



45071MC19-1

(3) Operation of low pressure relief

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



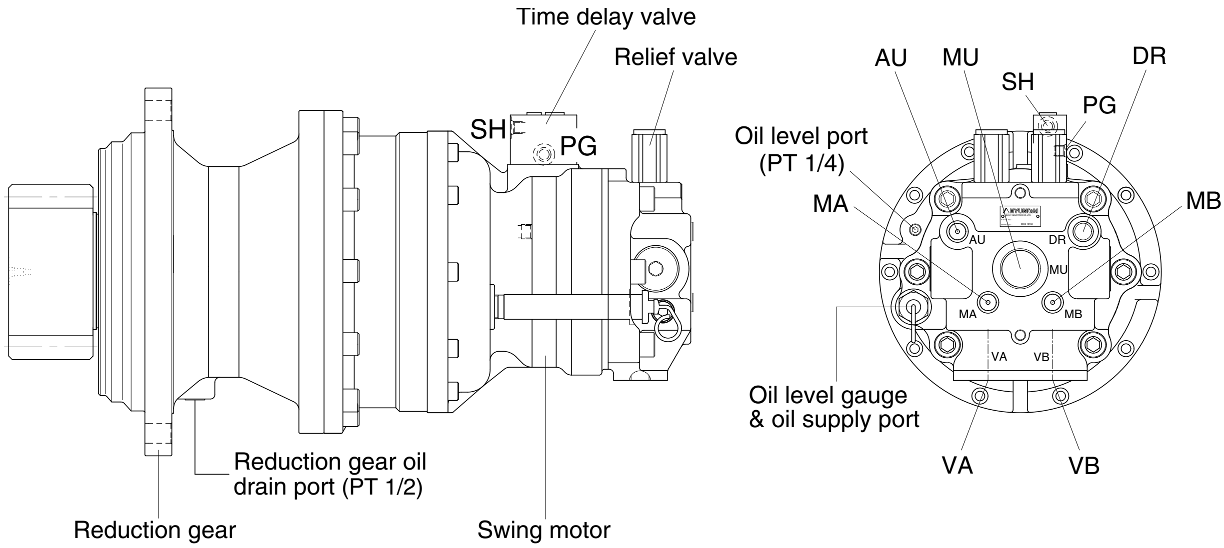
45071MC19-2

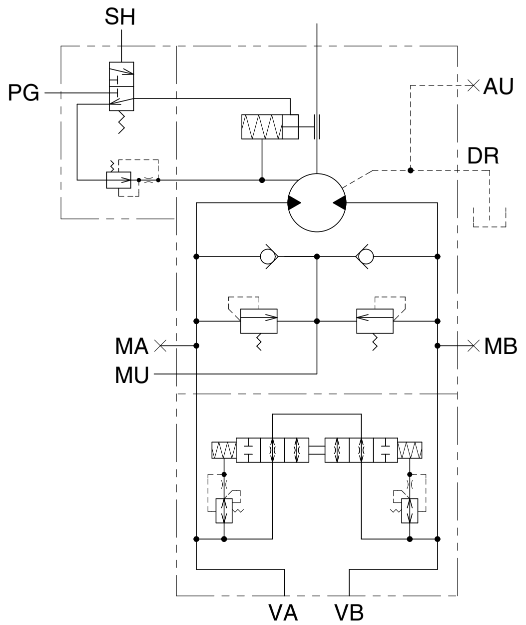
GROUP 3 SWING DEVICE

1. STRUCTURE

Swing device consists swing motor, swing reduction gear.

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



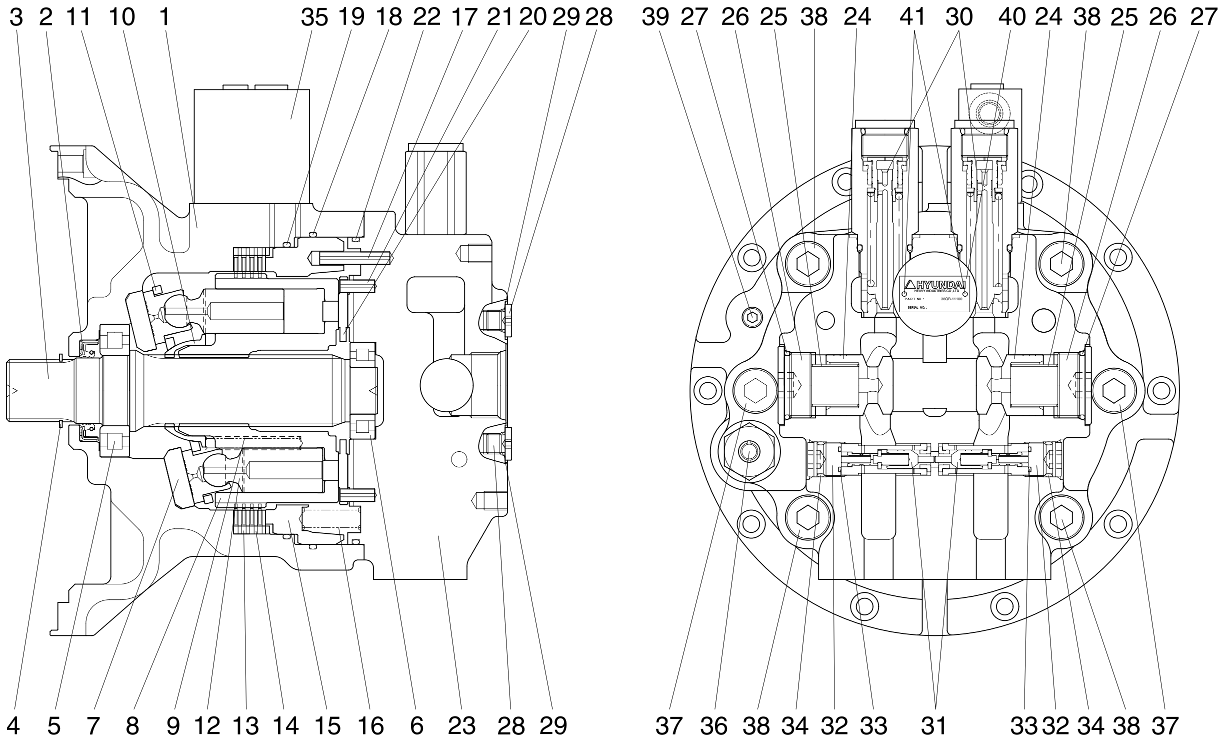


Hydraulic circuit

480S2SM01

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 stand by port	PF 1/4
SH	Brake release pilot port	PF 1/4

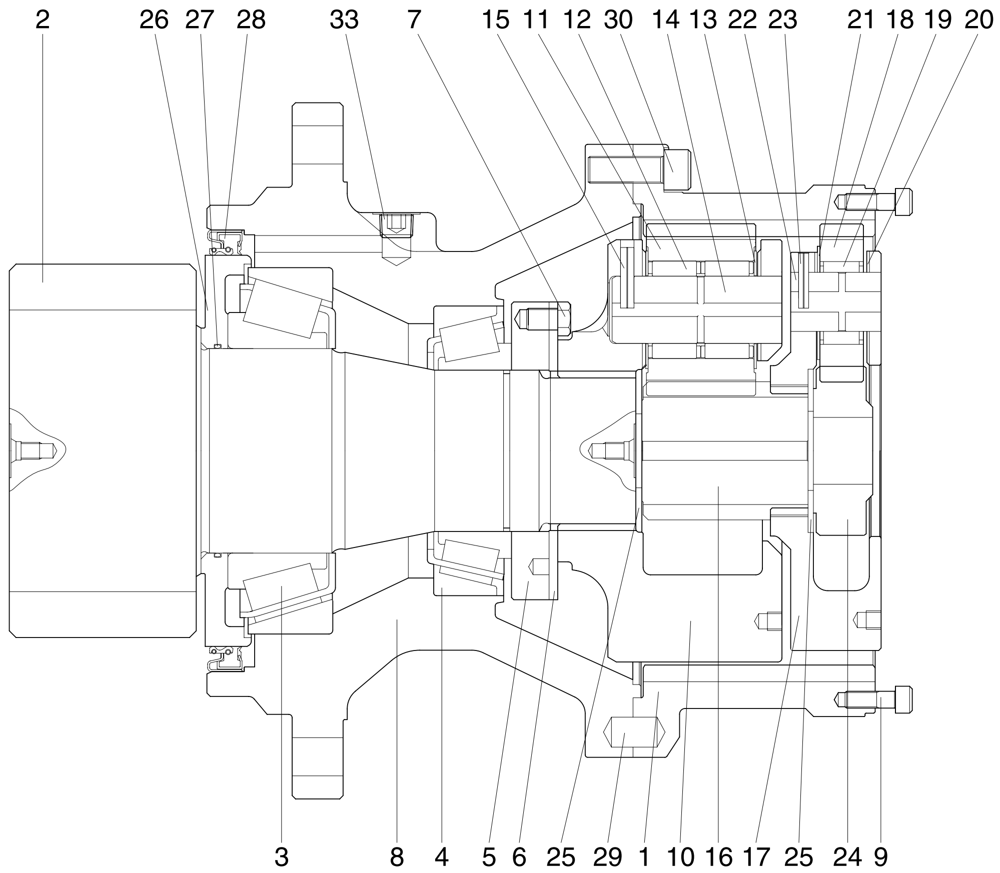
1) SWING MOTOR

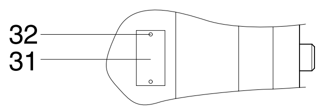


480S2SM02

1	Casing	15	Parking piston	29	O-ring
2	Oil seal	16	Brake spring	30	Relief valve assy
3	Shaft	17	Spring pin	31	Reactionless valve assy
4	Snap ring	18	O-ring	32	Plug
5	Cylinder roller bearing	19	O-ring	33	O-ring
6	Cylinder needle bearing	20	Valve plate	34	O-ring
7	Swash plate	21	Spring pin	35	Time delay valve assy
8	Cylinder block	22	O-ring	36	Level gauge 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	Check valve spring	39	Plug
12	Piston assy	26	Plug	40	Name plate
13	Friction plate	27	O-ring	41	Rivet
14	Separate plate	28	Plug		

2) REDUCTION GEAR





480F2SM03

1	Ring gear	12	Needle bearing No. 2	23	Spring pin No. 1
2	Drive shaft	13	Thrust washer No. 2	24	Sun gear No. 1
3	Taper bearing	14	Carrier pin No. 2	25	Thrust plate
4	Taper bearing	15	Spring pin No. 2	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 No. 1	30	Hexagon socket head bolt
9	Hexagon socket head bolt	20	Thrust washer No. 1-upper	31	Name plate
10	Carrier No. 2	21	Thrust washer No. 1-lower	32	Rivet
11	Planetary gear No. 2	22	Carrier pin No. 1	33	Plug

2. PRINCIPLE OF DRIVING

1) GENERATING THE TURNING FORCE

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

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

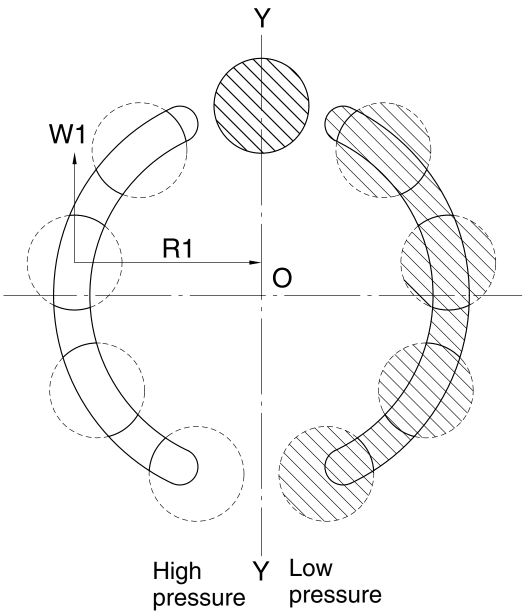
The high hydraulic can generate the force, F1=P×A (P : supplied pressure, A : water pressure area), like following pictures, working on a piston.

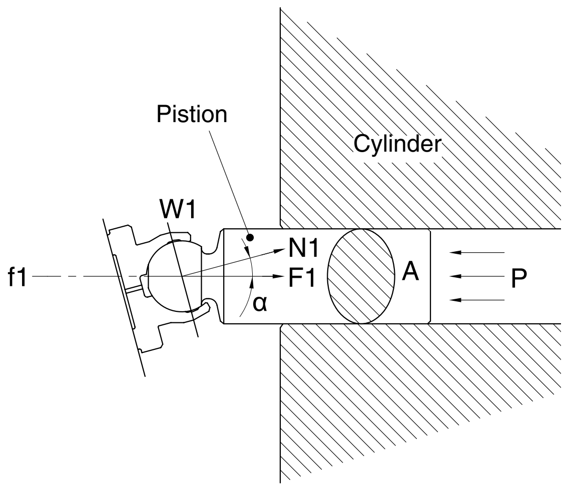
This force, F1, is divided as N1 thrust partial pressure and W1 radial partial pressure, in case of the plate of a tilt angle, α.

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

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

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





480S2SM05

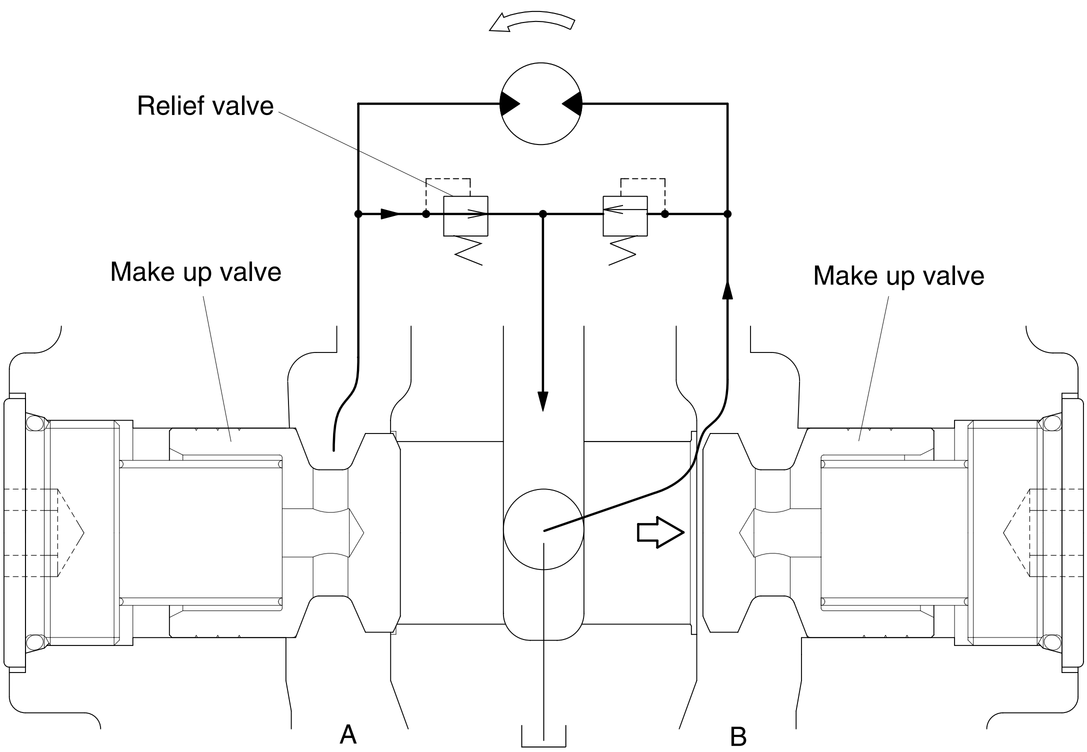
2) MAKE UP VALVE

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.

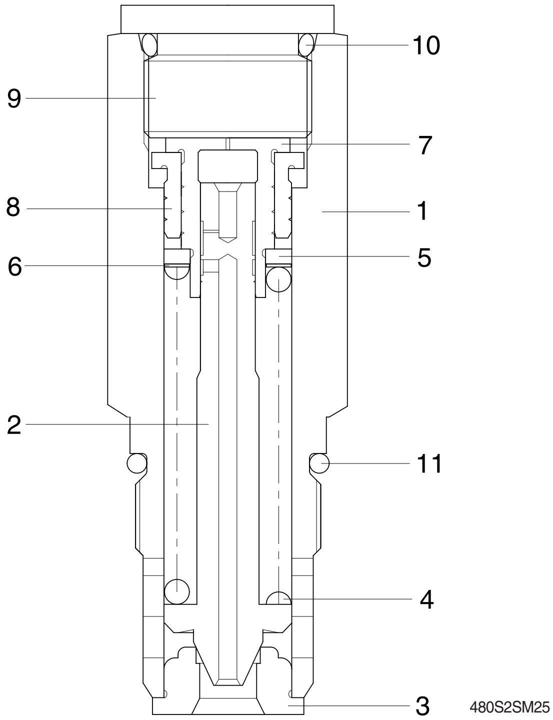
Pressurized oil into the port B, the motor rotate counterclockwise.

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.



480S2SM04

3) RELIEF VALVE



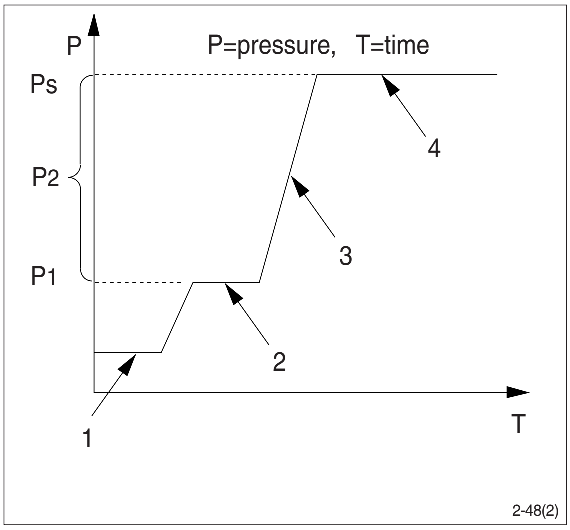
1	Sleeve
2	Poppet
3	Poppet seat
4	Spring
5	Spring seat
6	Shim
7	Piston
8	Stopper
9	Plug
10	O-ring
11	O-ring

(1) Construction of relief valve

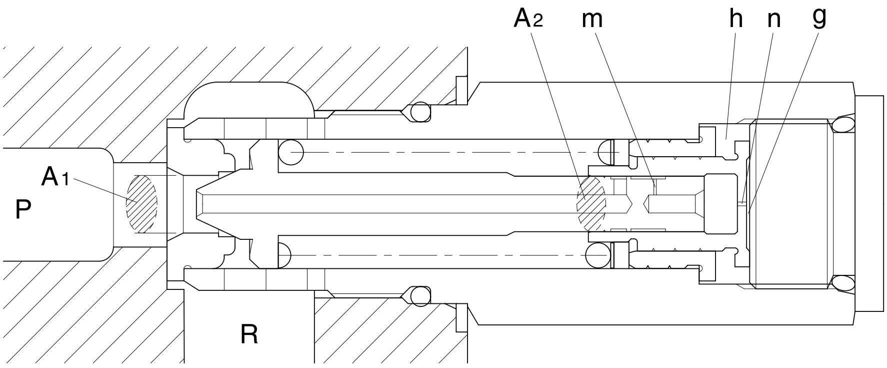
The valve casing contains two cartridge type relief valves that stop the regular and reverse rotations of the hydraulic motor. The relief valves relieve high pressure at start or at stop of swing motion and can control the relief pressure in two steps, high and low, in order to insure smooth operation.

(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.

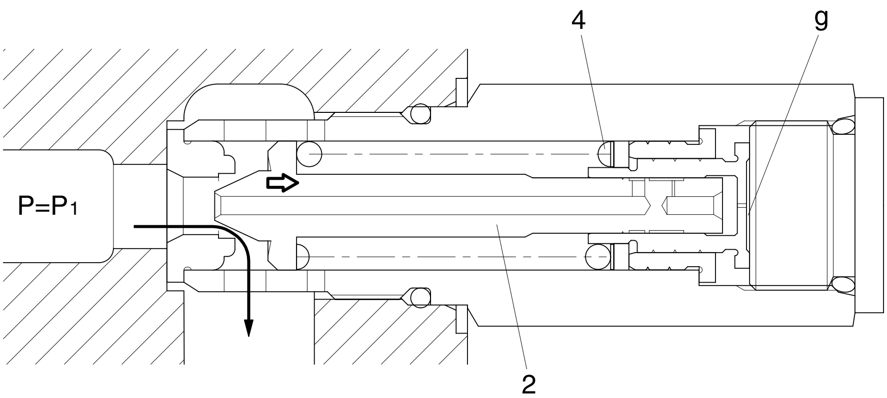


480S2SM26

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.

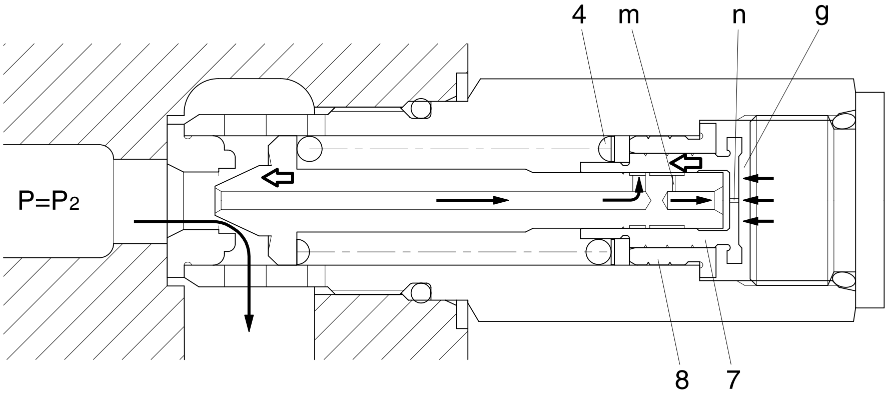
$P_1 \times A_1 = Fsp + Pg \times A_2$

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



480S2SM27

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).

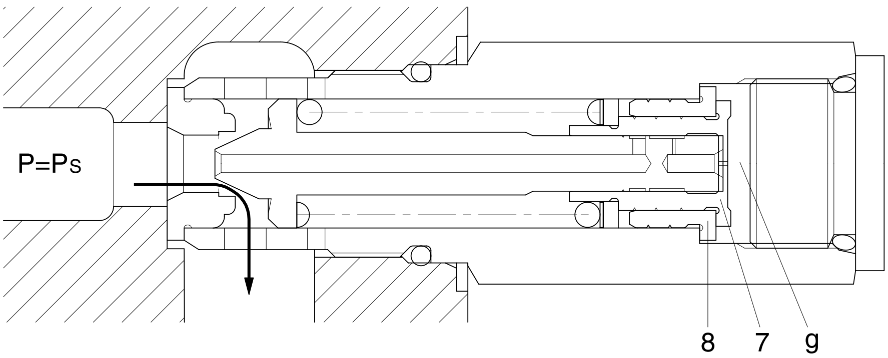


480S2SM28

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).

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

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



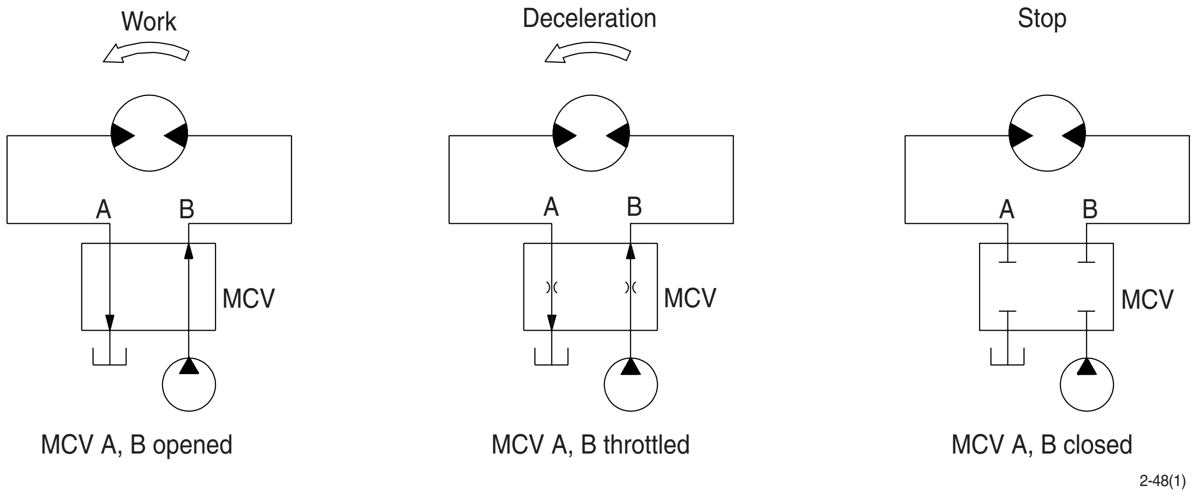
480S2SM29

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.



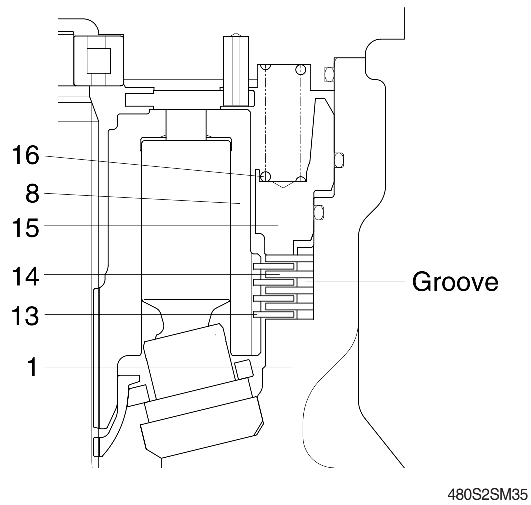
(2) Mechanical swing parking brake system

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

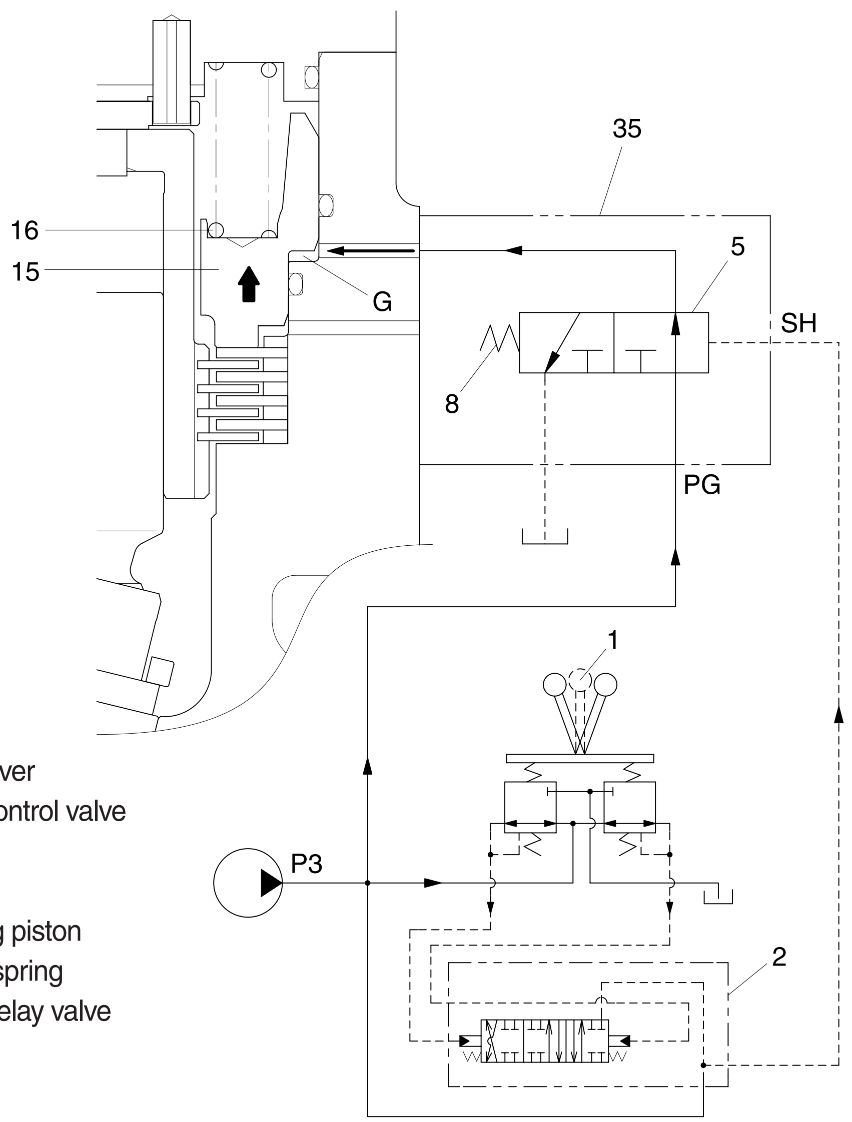
Cylinder block (8) is constrained by this friction force and brake acts, while brake releases when hydraulic force exceeds spring force.



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

② Operating principle

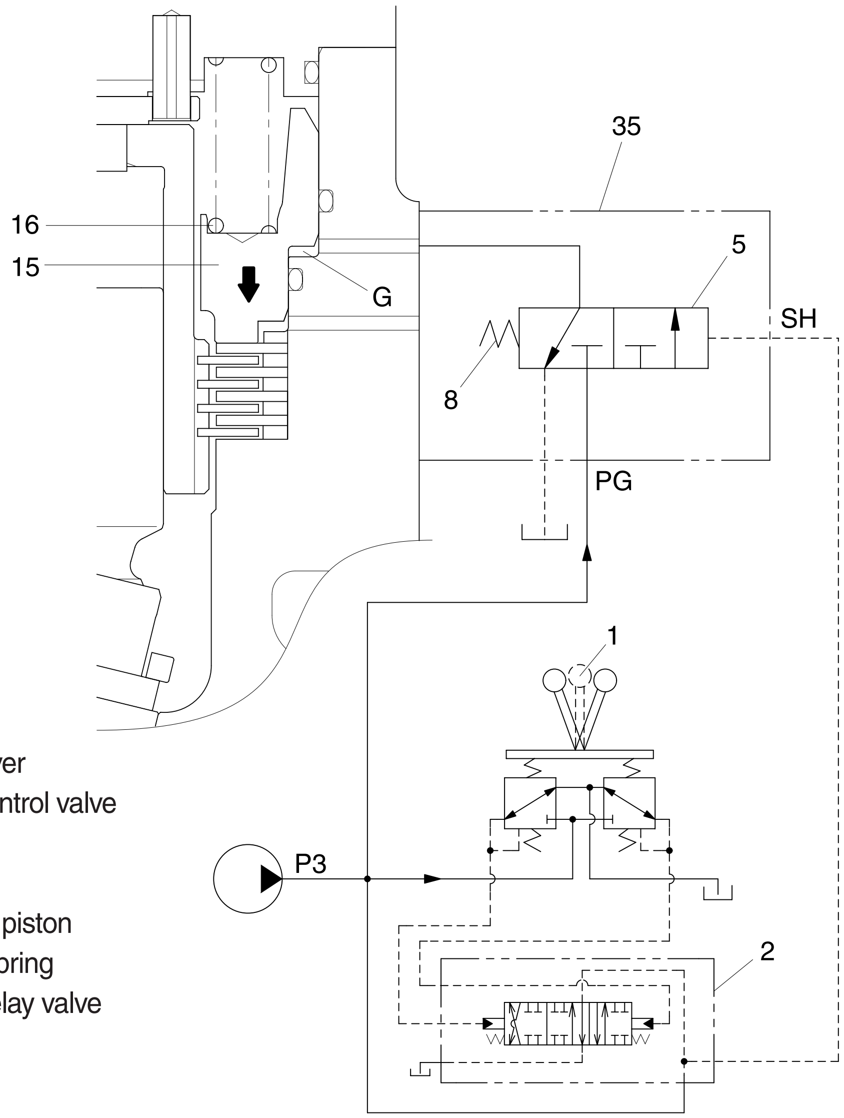
a. When one of the RCV lever (1) is set to the operation position, the each spool is shifted to left or right and the pilot oil flow is blocked. Then the pilot oil go to SH of the time delay valve (35). This pressure moves spool (5) to the leftward against the force of the spring (8), so pilot pump charged oil (P3) goes to the chamber G through port PG. This pressure is applied to move the piston (15) to the upward against the force of the brake spring (16). Thus, it releases the brake force.



1 RCV lever
2 Main control valve
5 Spool
8 Spring
15 Parking piston
16 Brake spring
35 Time delay valve

480S2SM36

b. When all of the RCV lever (1) are set the neutral position, the spool (5) returns to right.
   Then, the parking piston (15) 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
5	Spool
8	Spring
15	Parking piston
16	Brake spring
35	Time delay valve

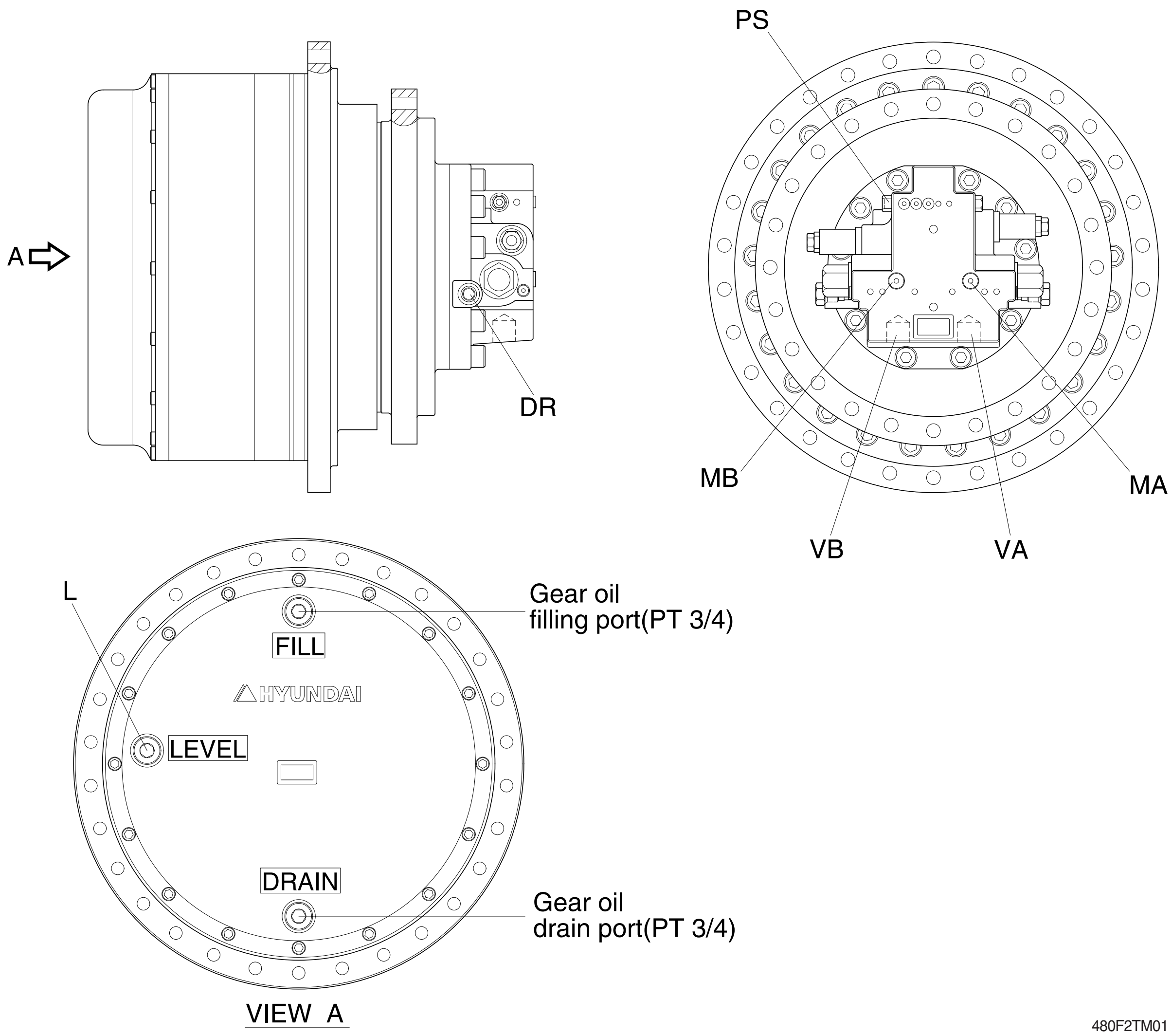
480S2SM37

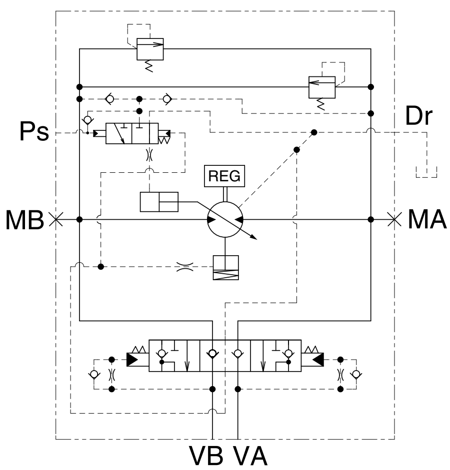
GROUP 4 TRAVEL DEVICE (TYPE 1, 2)

1. CONSTRUCTION

Travel device consists travel motor and gear box.

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



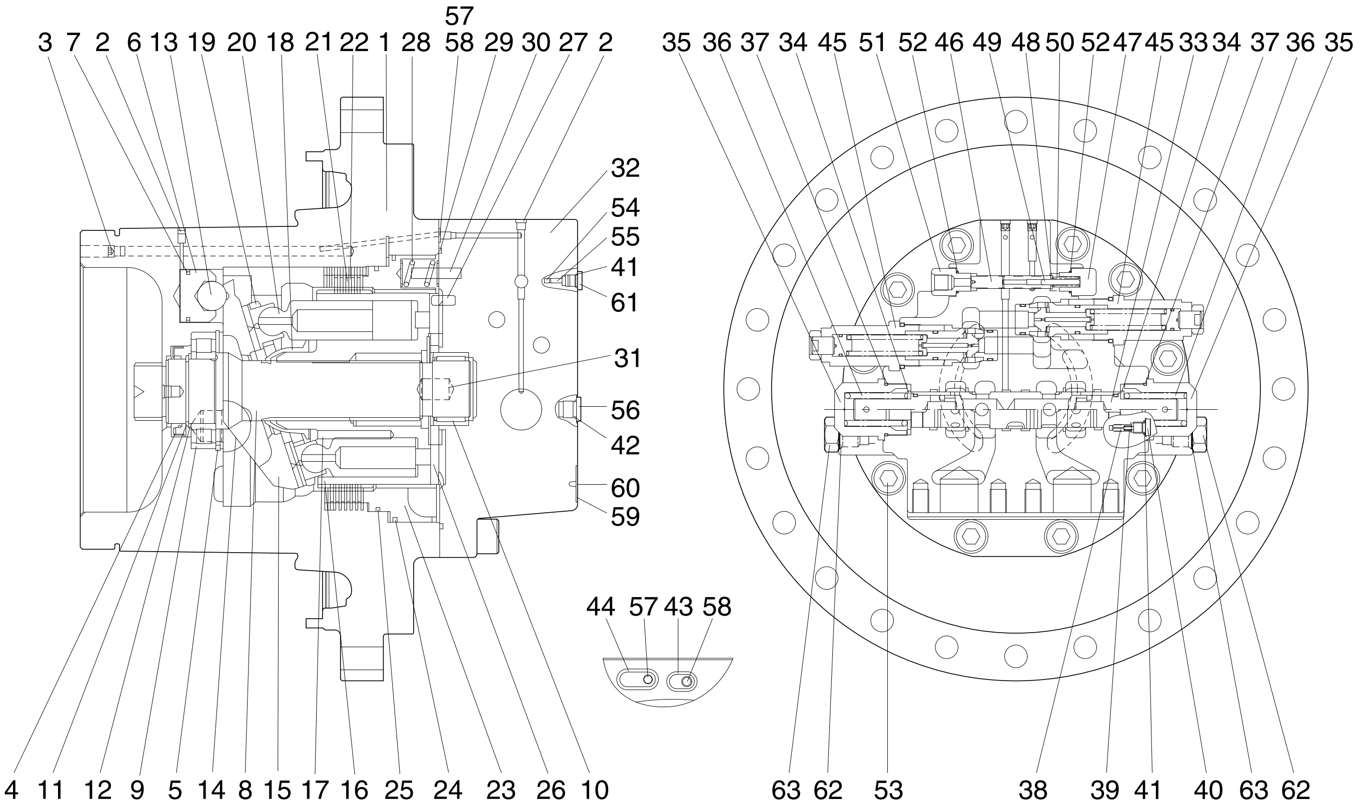


HYDRAULIC CIRCUIT

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

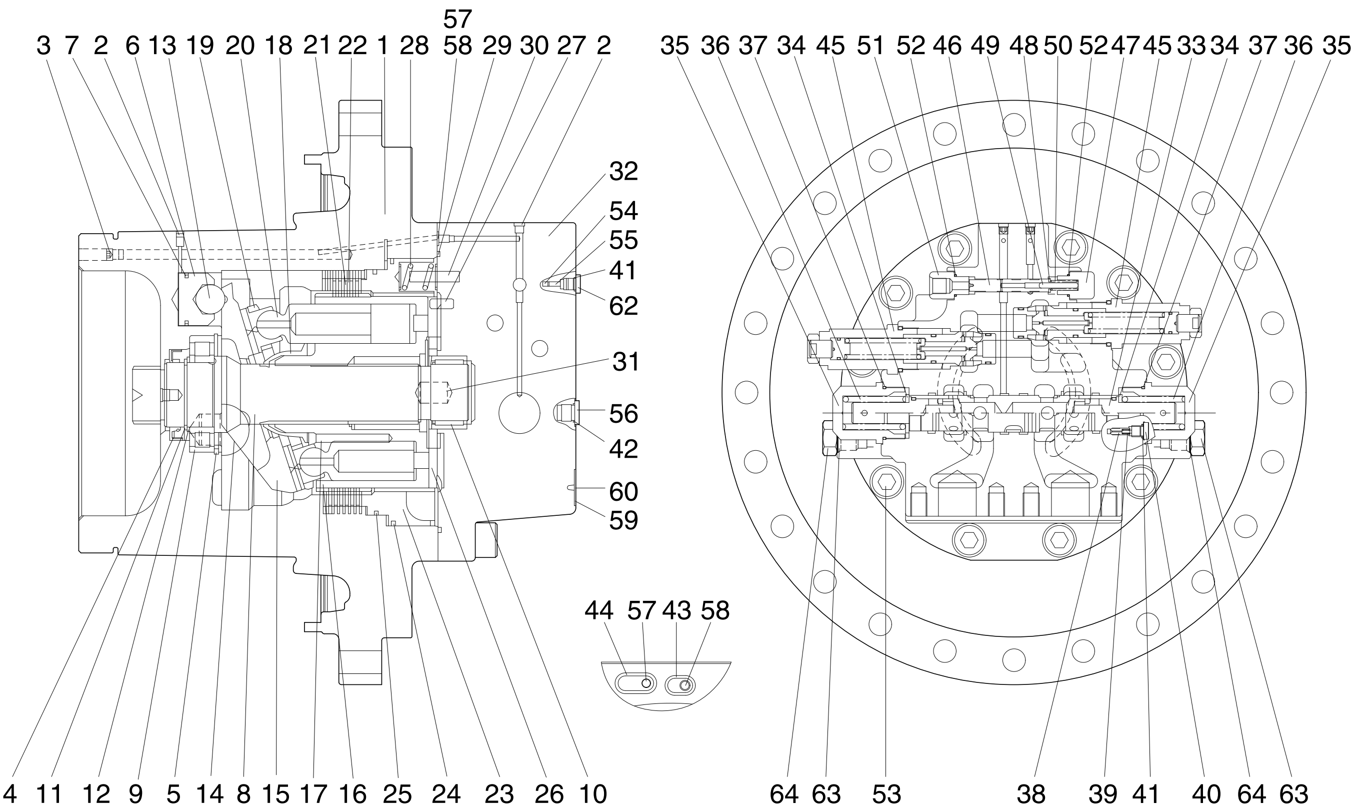
1) TRAVEL MOTOR (TYPE 1)



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

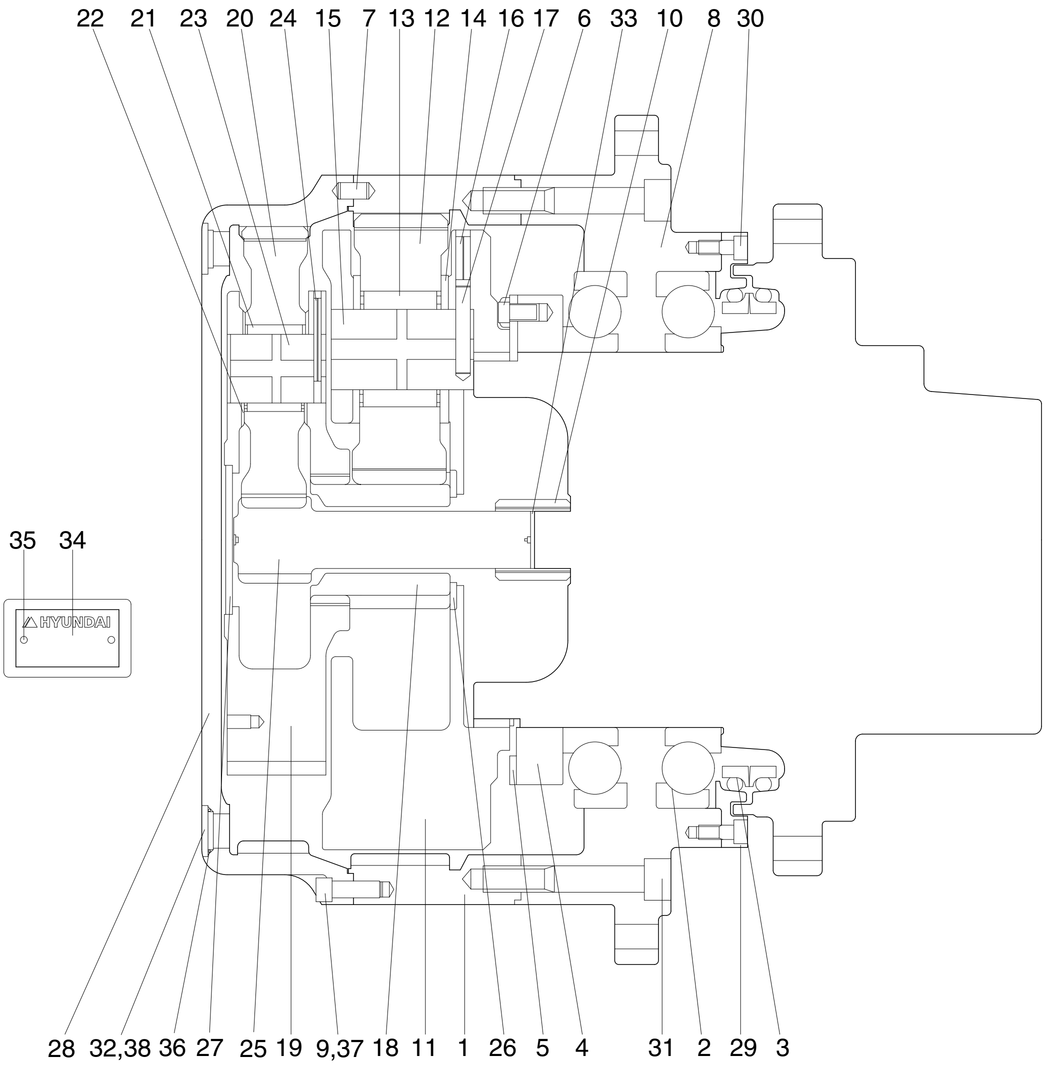
TRAVEL MOTOR (TYPE 2)



480F2TM02

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

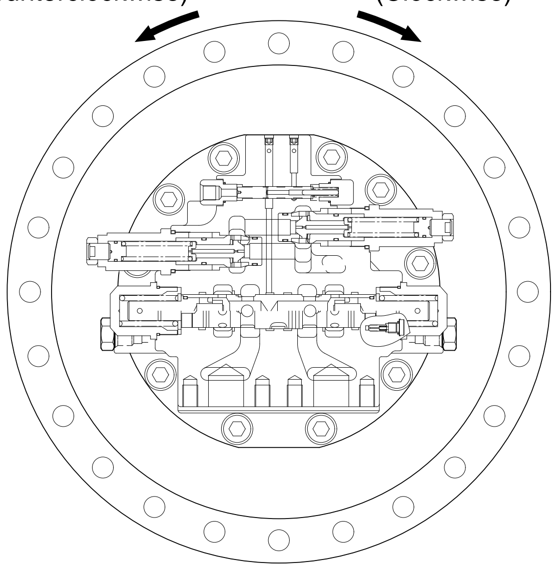


1	Ring gear	14	Thrust washer	27	Thrust plate
2	Ball bearing	15	Carrier pin No. 2	28	Cover
3	Floating seal assy	16	Spring pin	29	Cover seal
4	Ring nut	17	Solid pin No. 2	30	Hex socket head bolt
5	Lock plate	18	Sun gear No. 2	31	Hex socket head bolt
6	Hexagon head bolt	19	Carrier No. 1	32	Plug
7	Parallel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

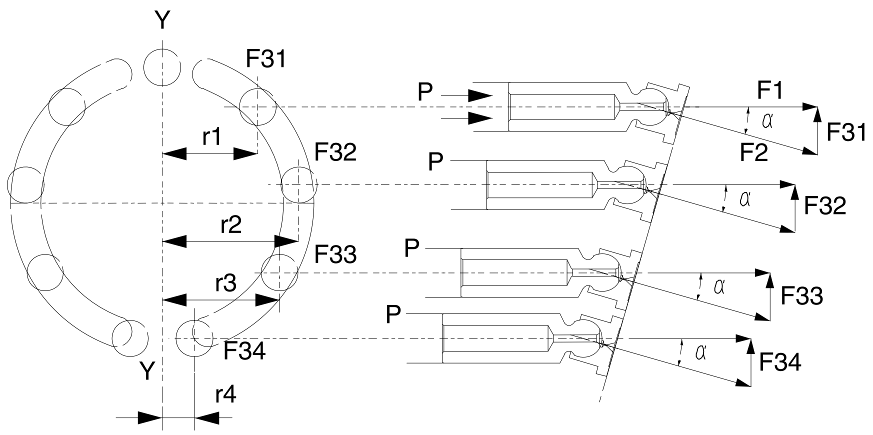
As shown in below figure, high pressure oil is supplied to the pistons which are on one side of the line Y-Y that connects upper and lower dead points and produces force F1.

F1 = P × 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).

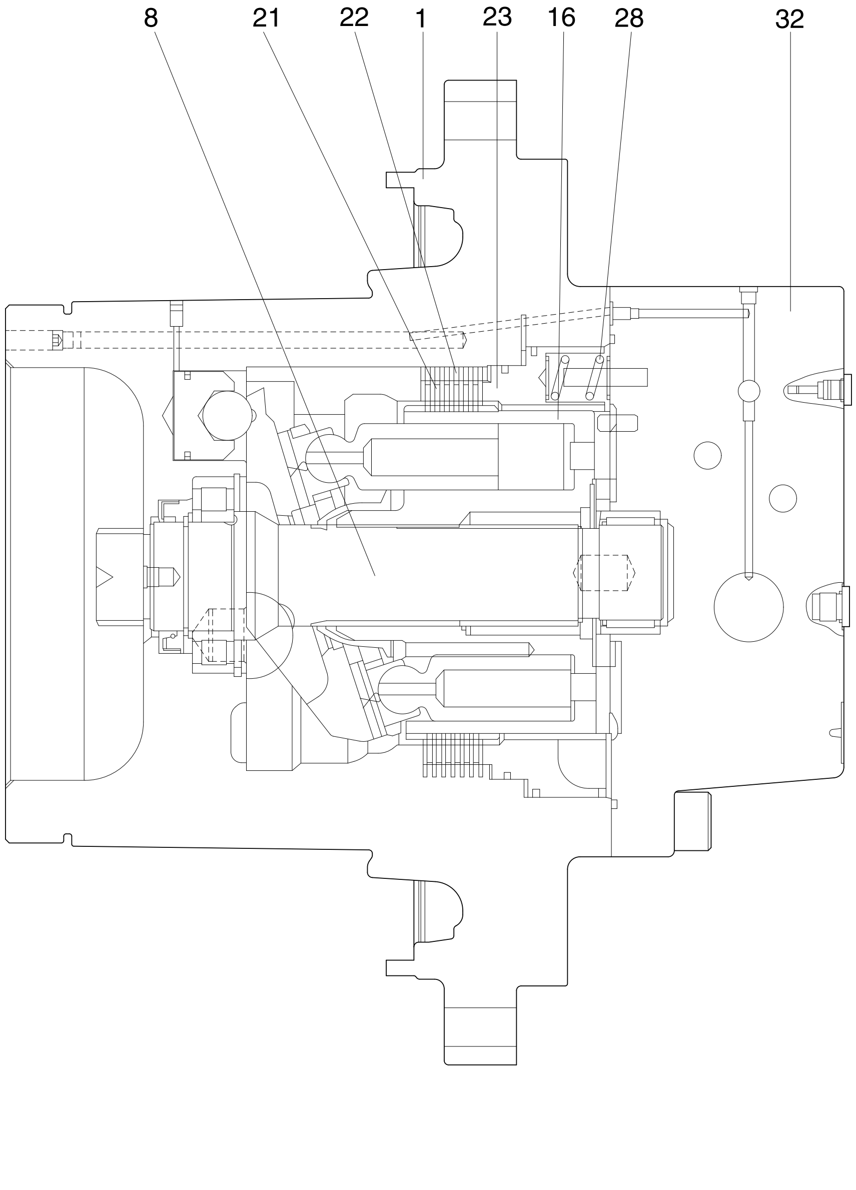


29092TM07

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.

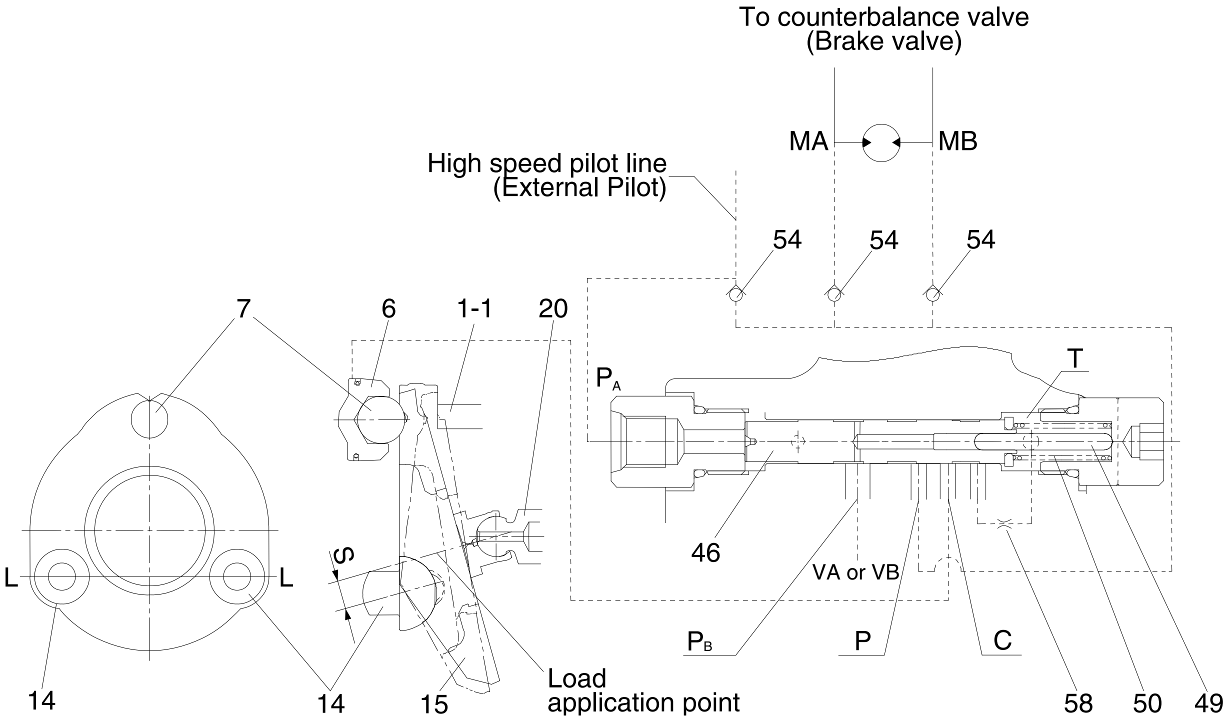
In this case, the piston stroke become shorter and motor capacity become smaller and motor rotates faster, around 1.60 times, by the same volume of oil.

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.

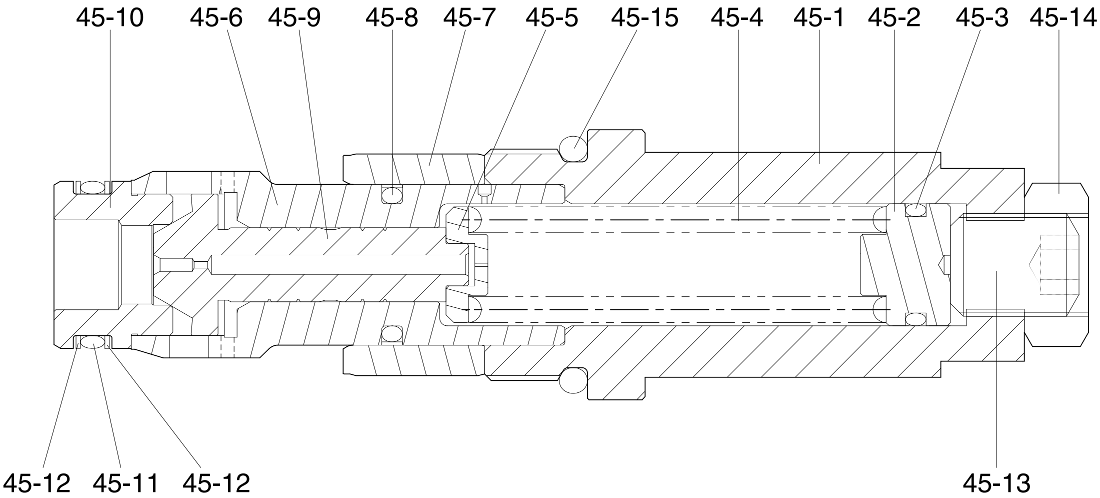


480F2TM06

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

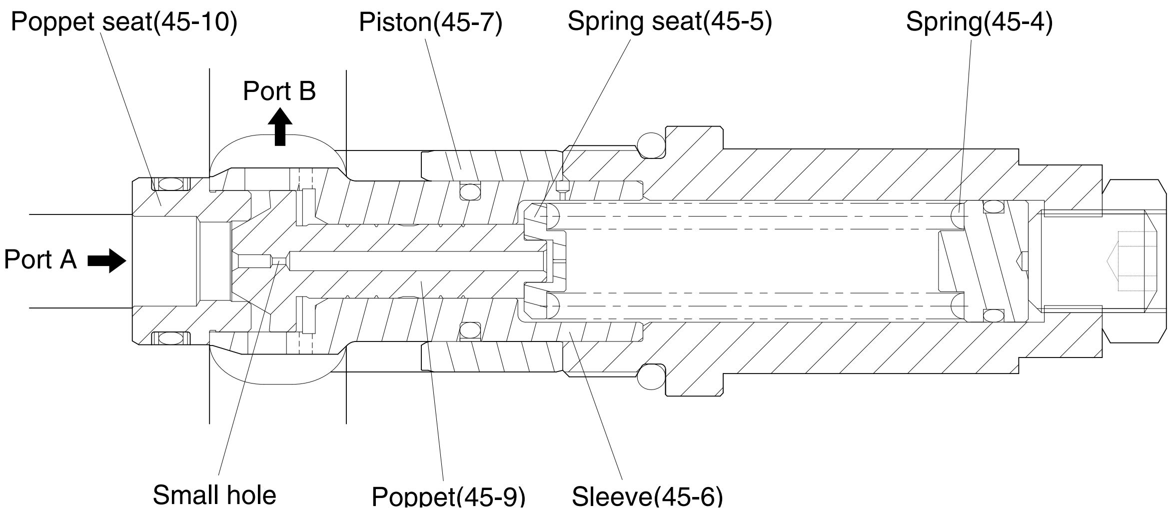
45-1	Plug	45-6	Sleeve	45-11	O-ring
45-2	Guide	45-7	Piston	45-12	Back-up ring
45-3	O-ring	45-8	Seal	45-13	Socket screw
45-4	Spring	45-9	Poppet	45-14	Hexagon nut
45-5	Spring seat	45-10	Poppet seat	45-15	O-ring

(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:

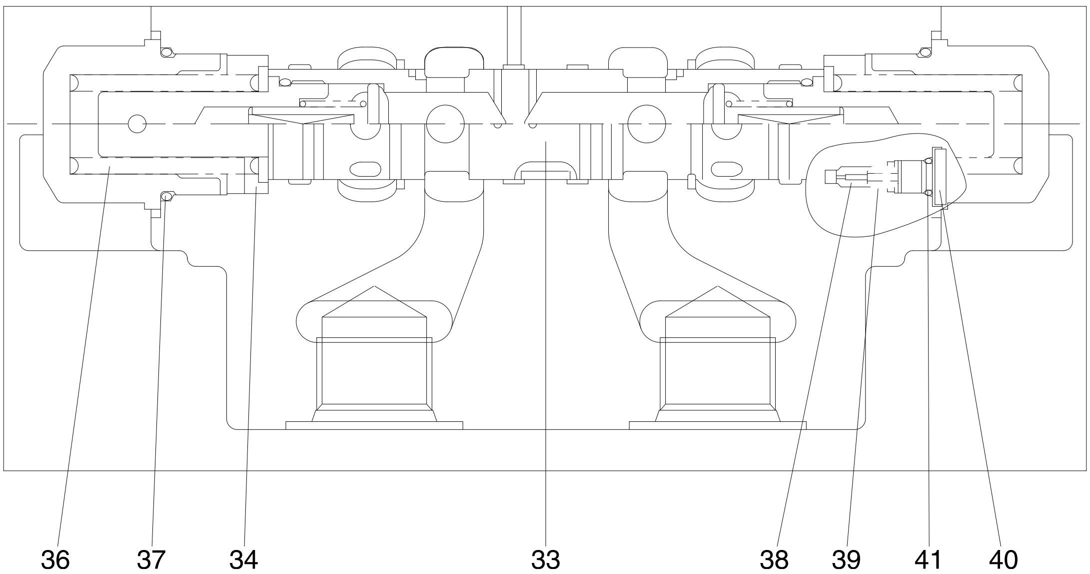
① Spool

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		

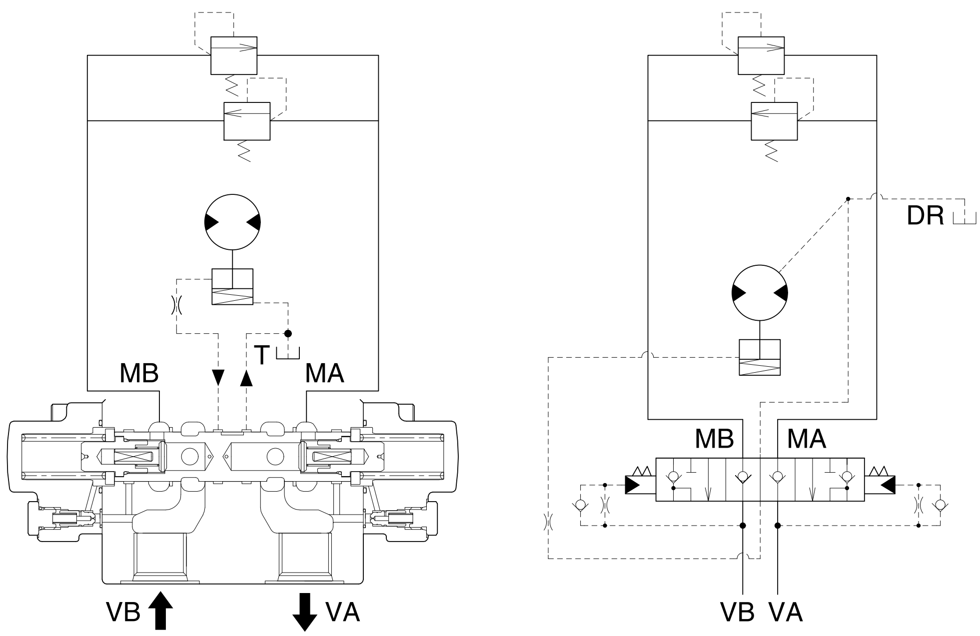
(2) Operation

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.



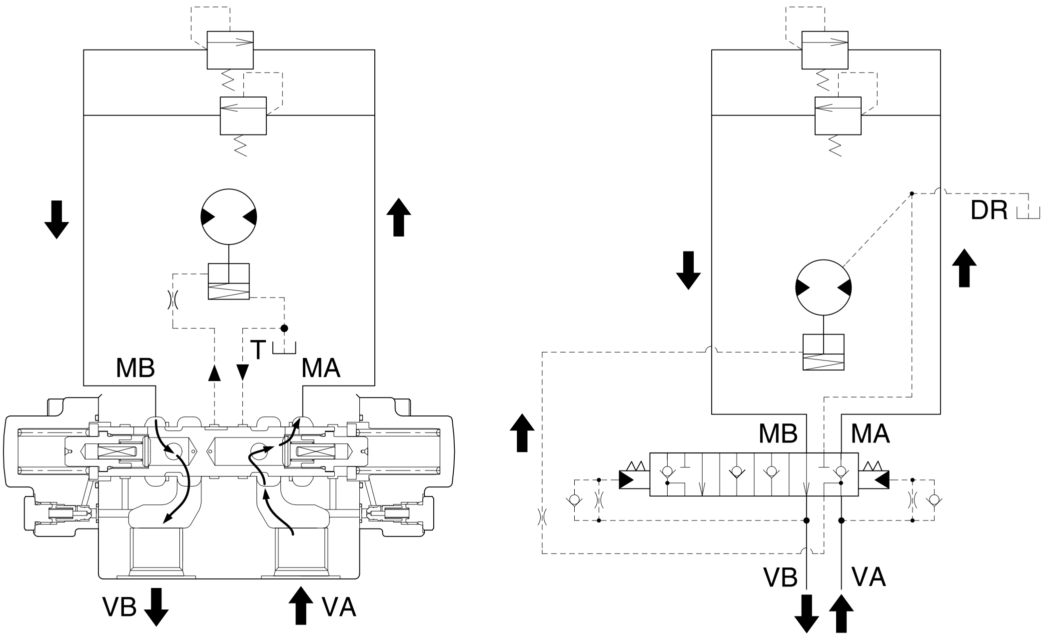
25092TM29

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.



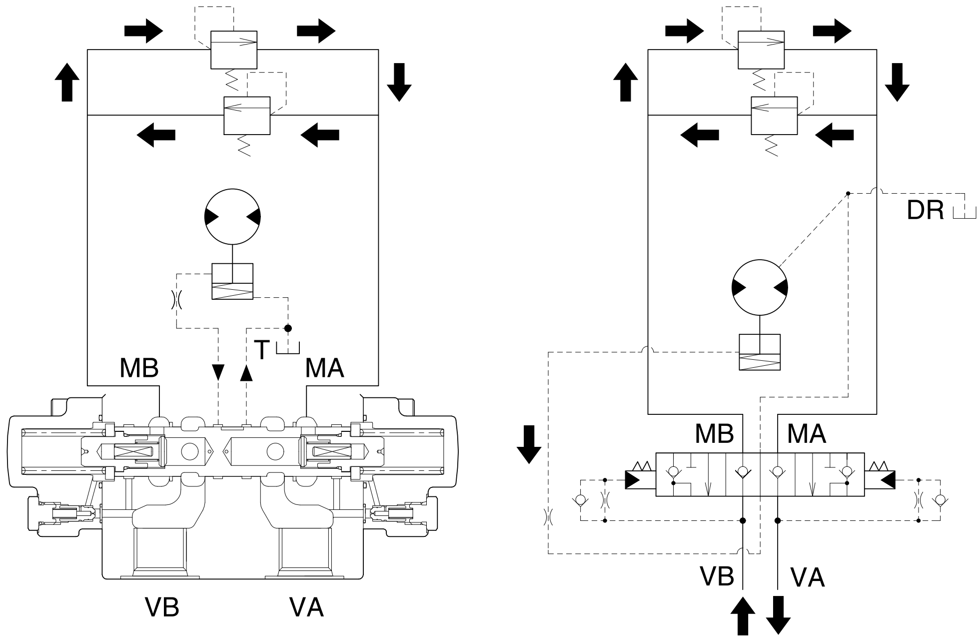
25092TM30

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.



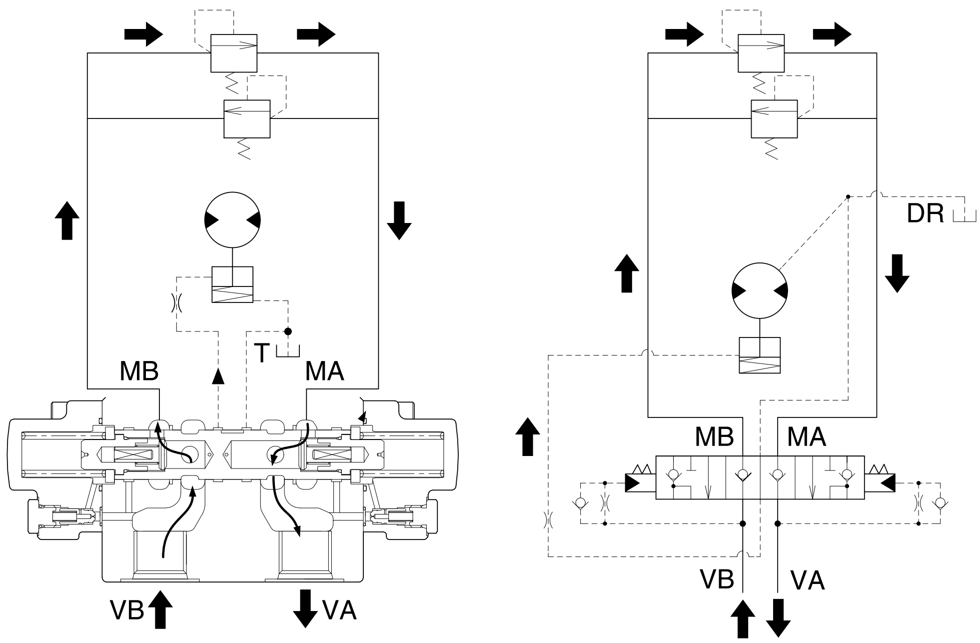
25092TM31

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.

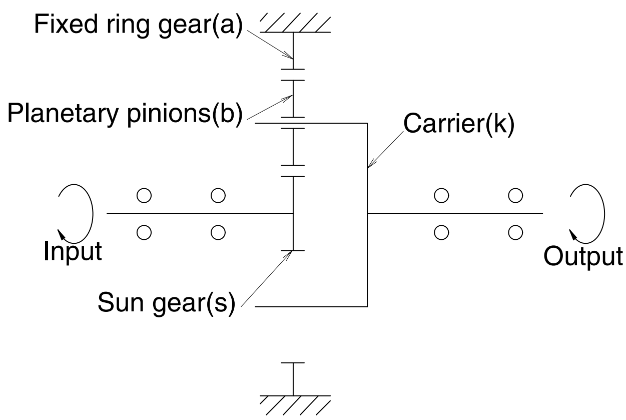
This reduction unit utilizes two stages, planetary reduction system.

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

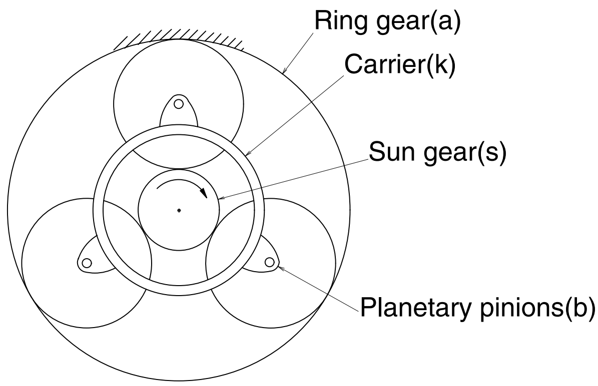
When the sun gear (s) is driven through input shaft, planetary pinions (b), rotating on their center, also move, meshing with fixed ring gear (a), around sun gear (s).

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

This mechanism is called planetary gear mechanism.



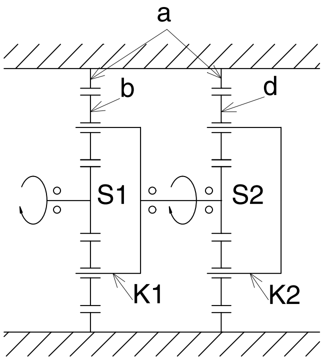
29072TM10



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.



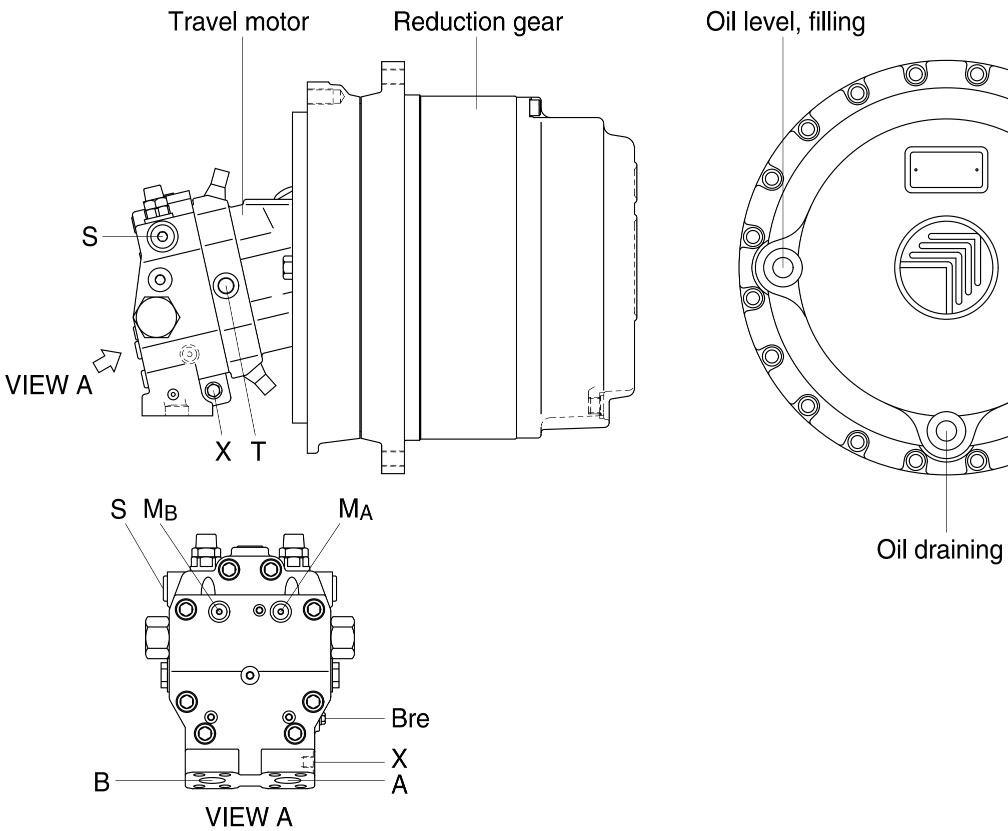
29072TM12

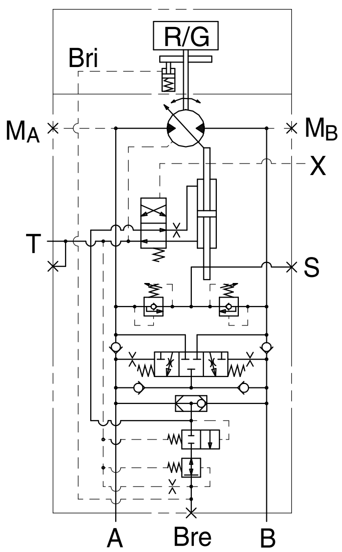
TRAVEL DEVICE (TYPE 3)

1. CONSTRUCTION

Travel device consists travel motor and gear box.

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



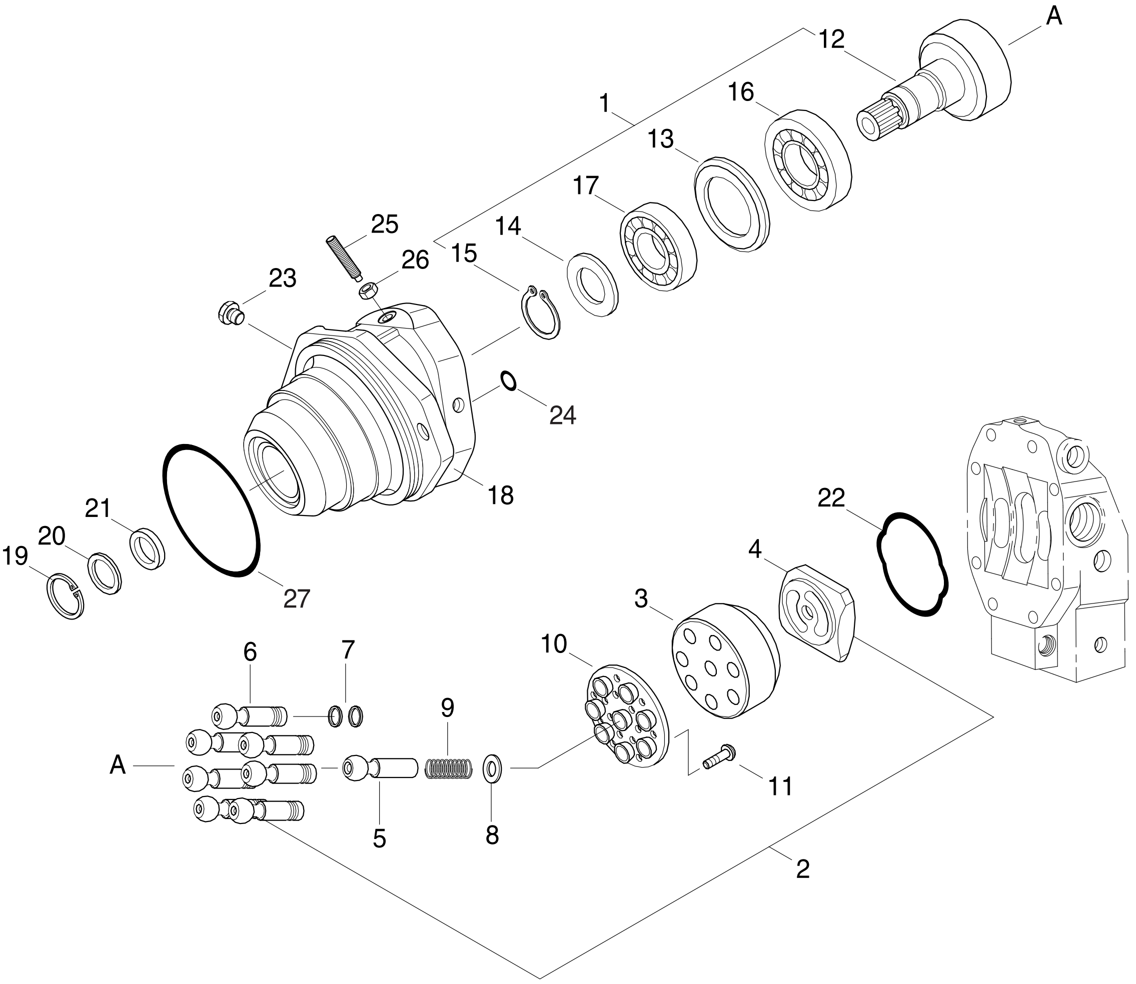


450A2TO01

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)

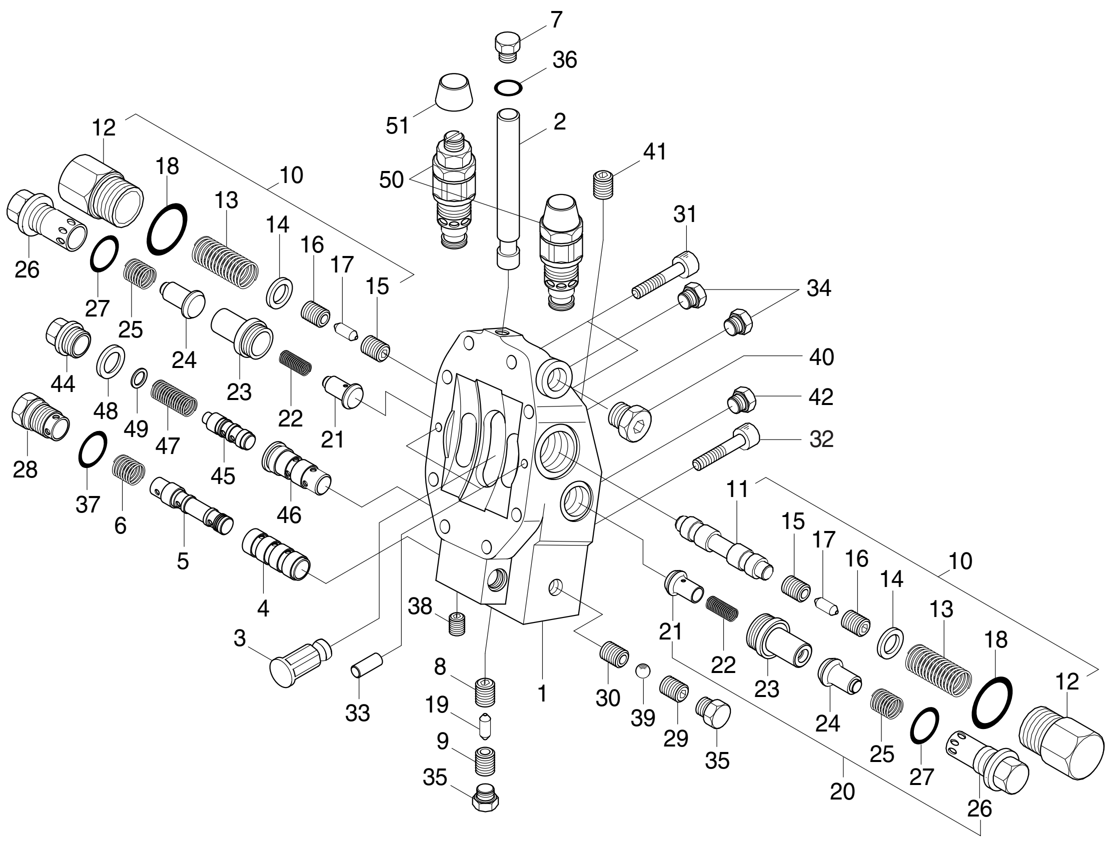


450A8TO02

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)

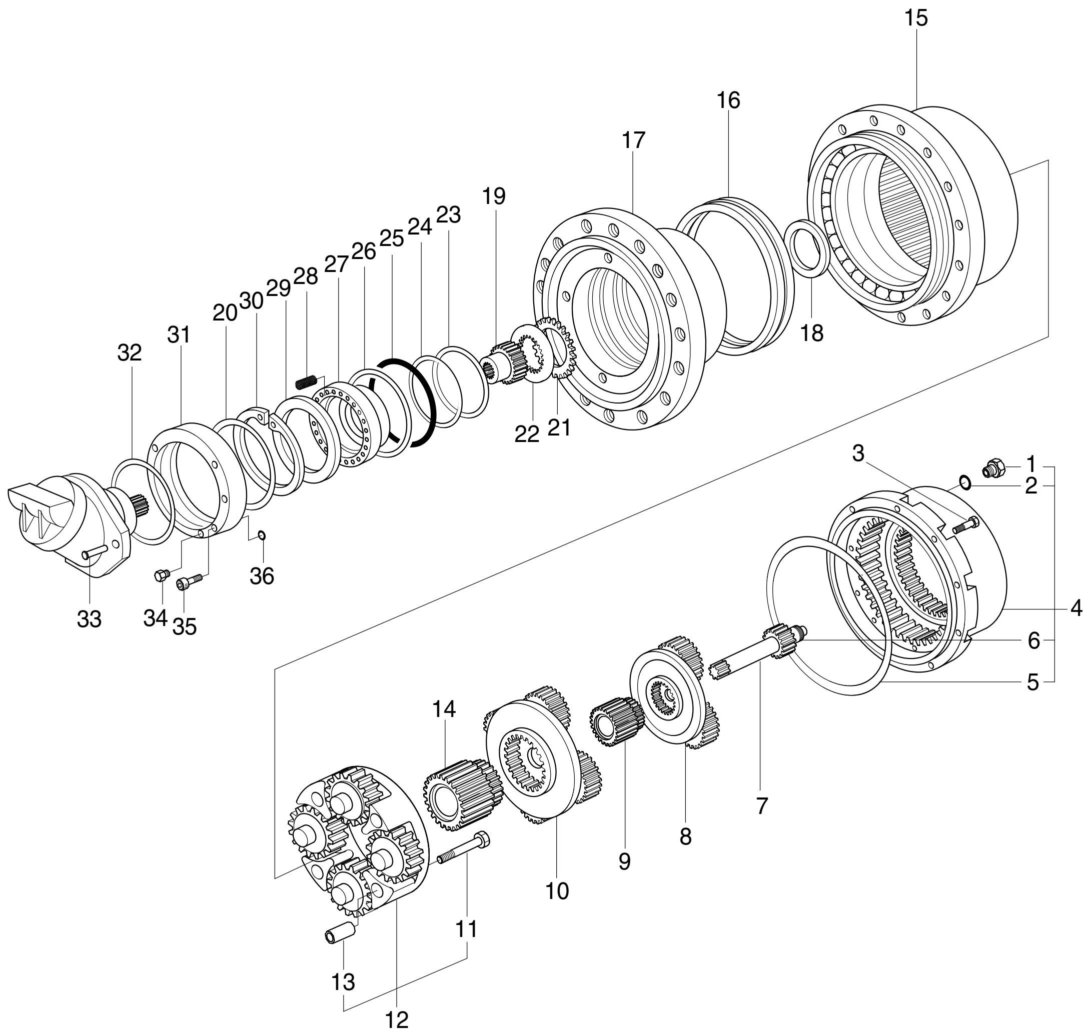
· Control part



450A8TO03

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

2) REDUCTION GEAR

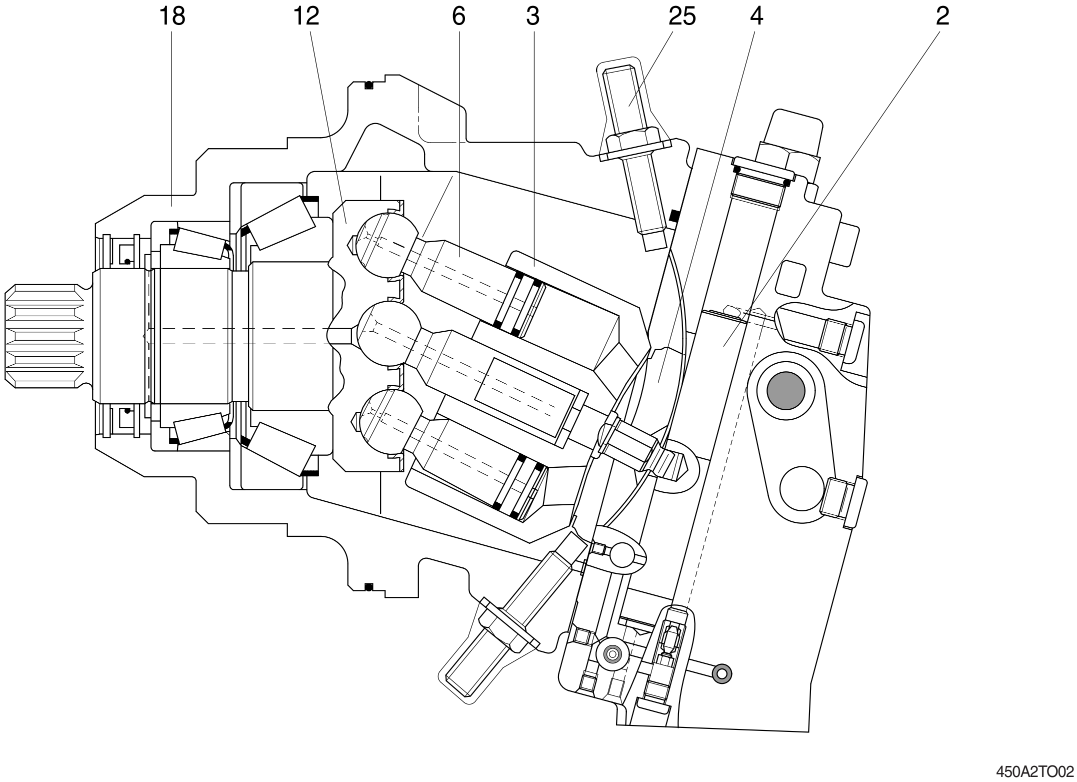


450A8TR01

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

2. FUNCTION

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



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.

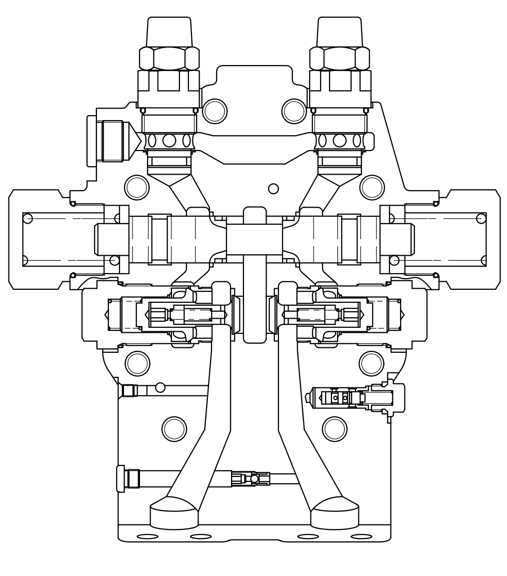
The max. swivel angle is 25˚, the min. swivel angle is 5˚.

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

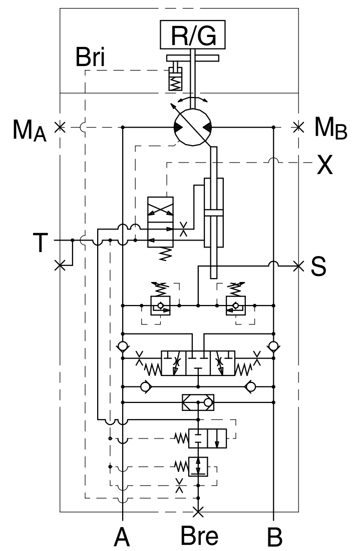
3) HYDRAULIC TWO-SPEED CONTROL

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)

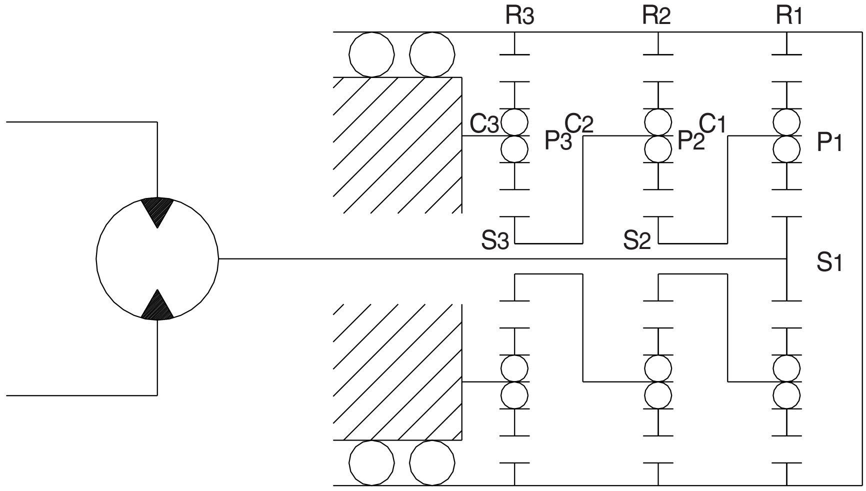
Integrated into the port plate including a brake release valve.
In case of downhill traveling or deceleration of the vehicle a counterbalance valve avoids overspeeding and cavitation of hydraulic motors.

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:

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

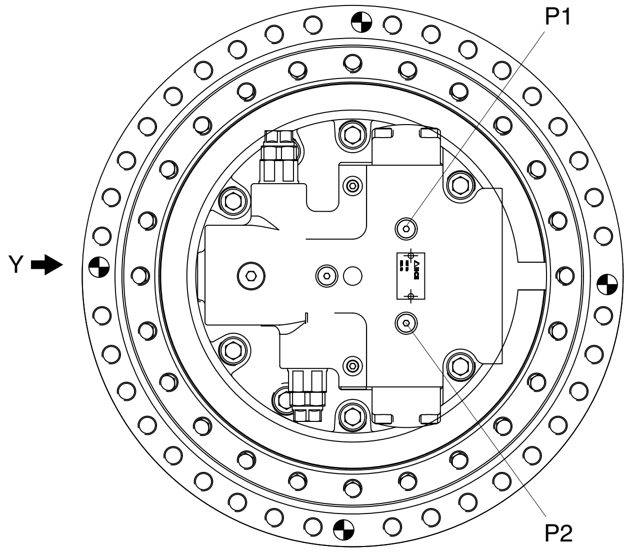
Where Z : Number of teeth of each gear
The direction of rotation is reverse to that of the input shaft.

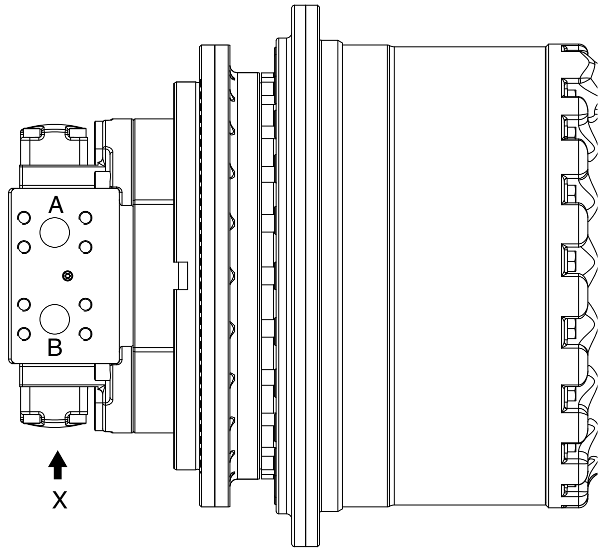
TRAVEL DEVICE (TYPE 4)

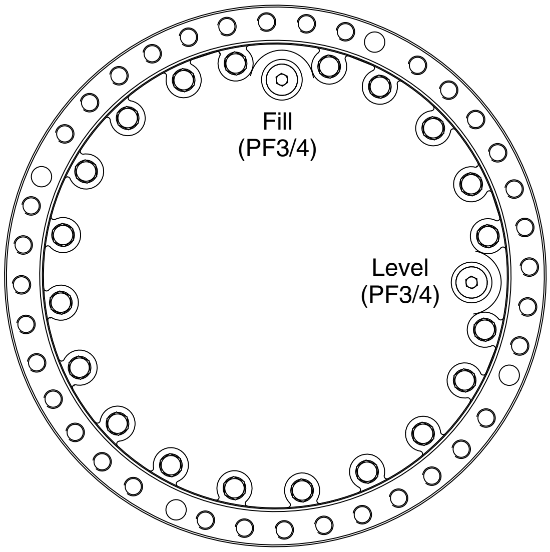
1. CONSTRUCTION

Travel device consists travel motor and gear box.

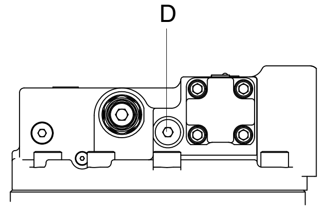
Travel motor includes brake valve, parking brake and high/low speed changeover mechanism.



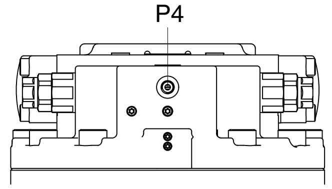




VIEW Z

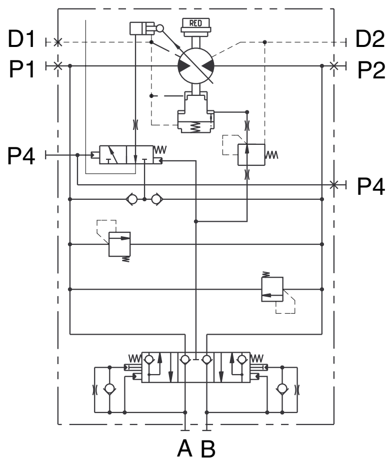


VIEW X



VIEW Y

480A2TM01

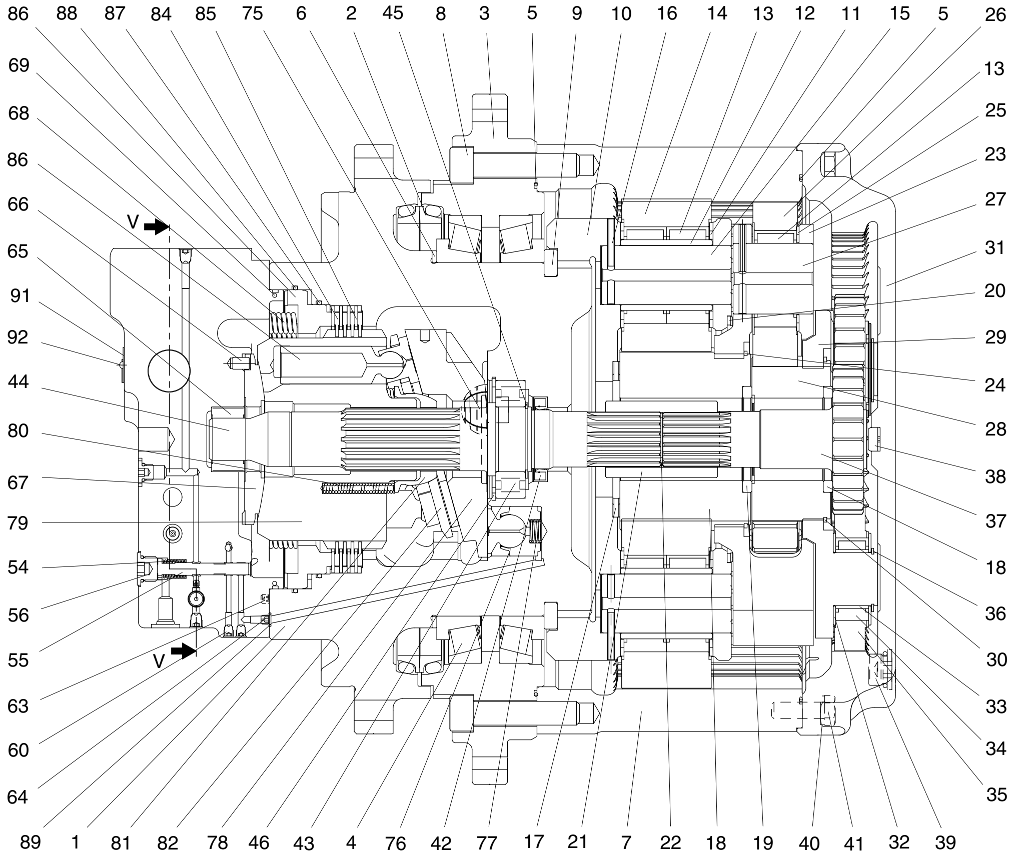


Hydraulic circuit

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

2. STRUCTURE

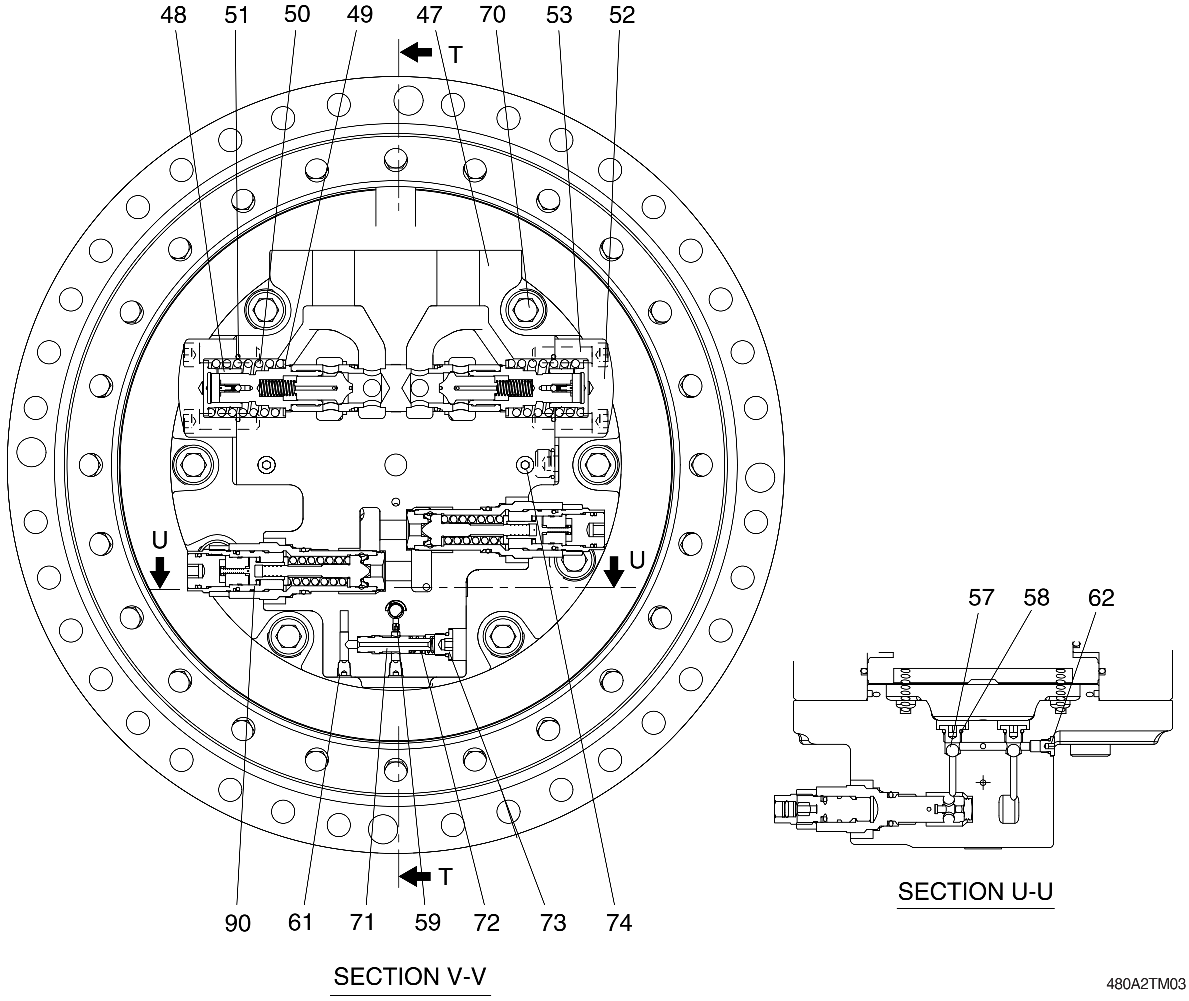
1) TRAVEL MOTOR



480A2TM02

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

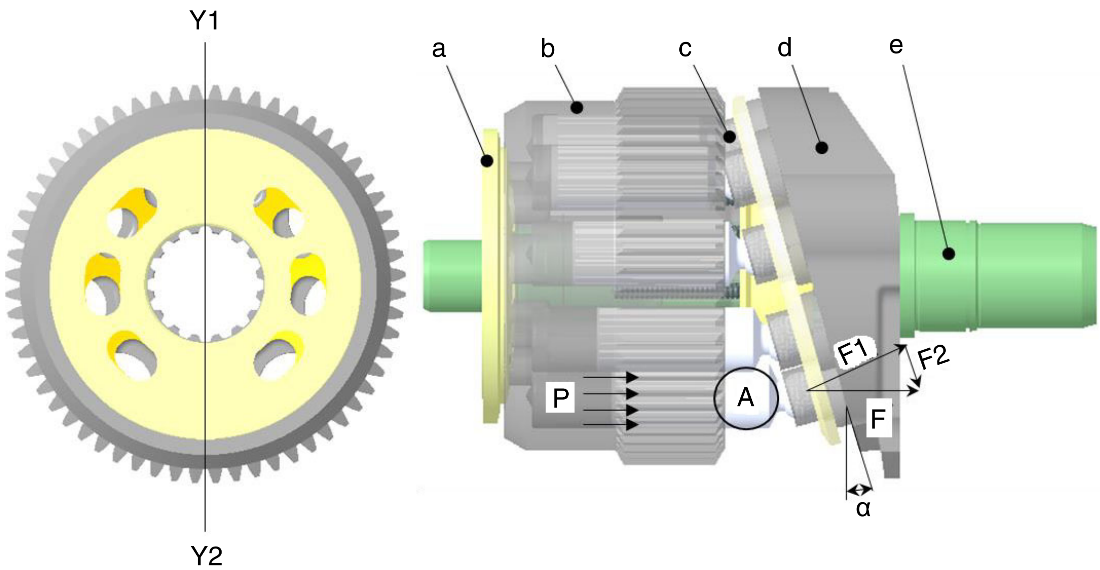
TRAVEL MOTOR



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

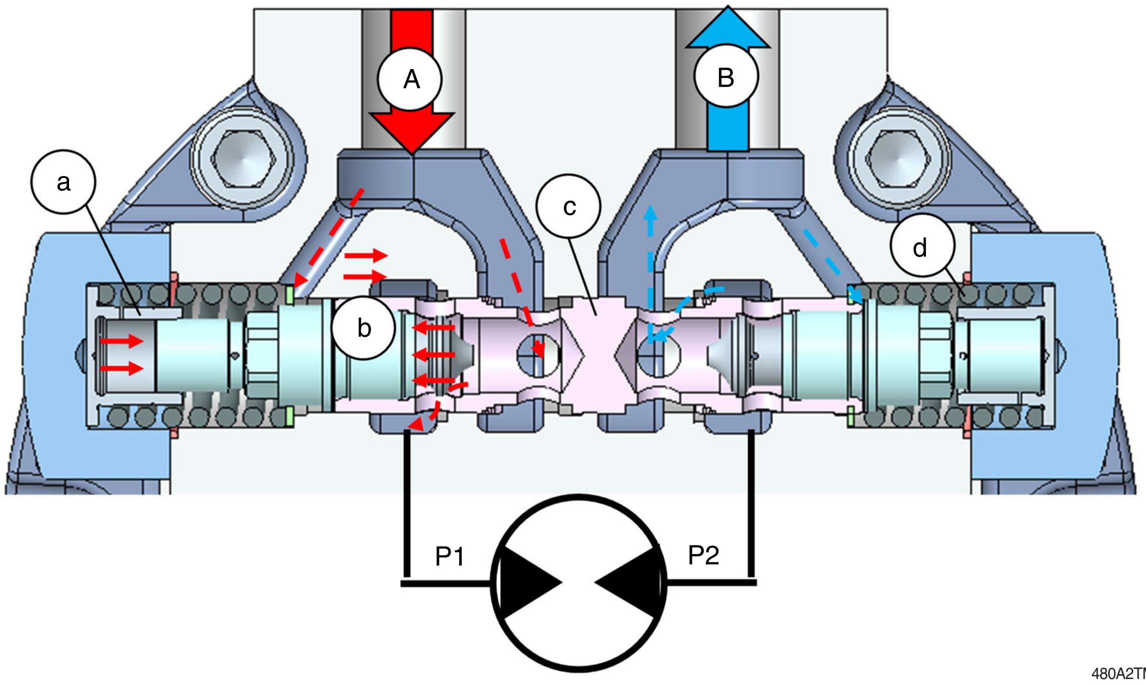
(1) The fluid supplied from the main control valve flows into the cylinder block (b) through the valve plate (a) of the hydraulic motor. This time, half of the fluid will flow in and half will flow out based on Y1-Y2 connecting the top dead center (TDC) and the bottom dead center (BDC) of the piston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

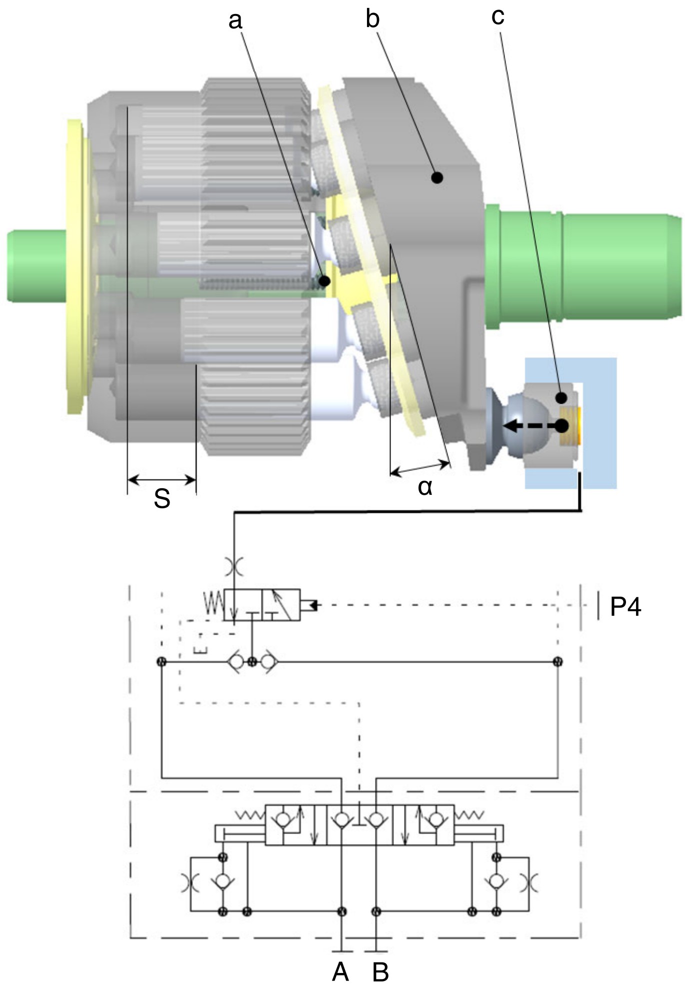
(1) If a fluid is supplied to port A rhrough the main control valve, the check valve (b) is pushed to the left to feed the inlet flow path (P1) and rotate the hydraulic motor.

(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.

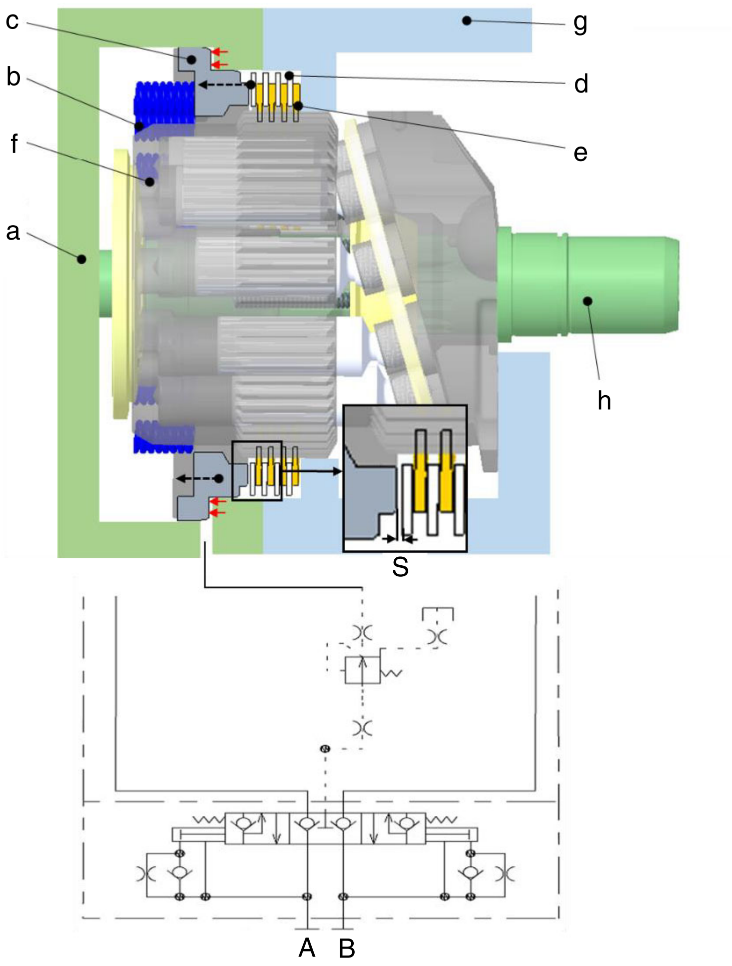
3) 2-SPEED SHIFT



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

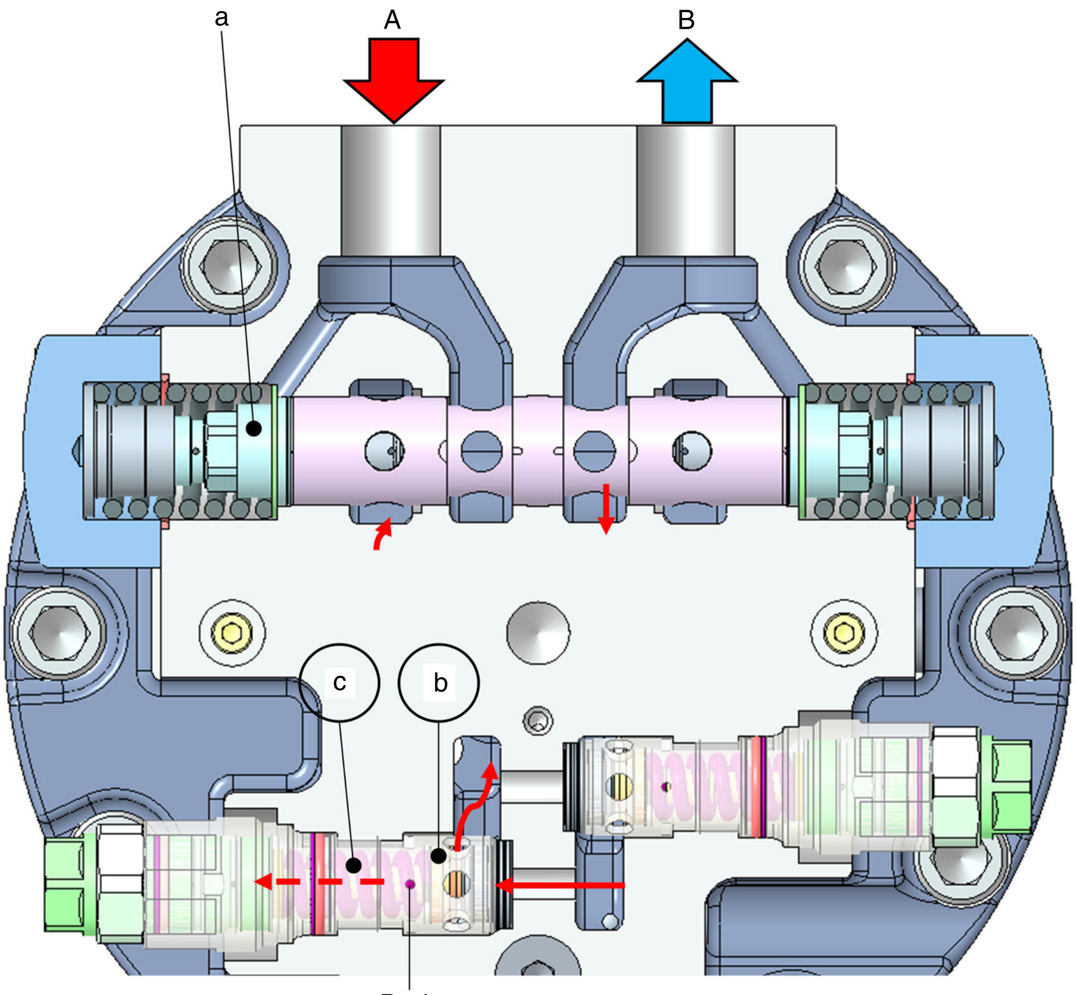


320A2TM08

(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.

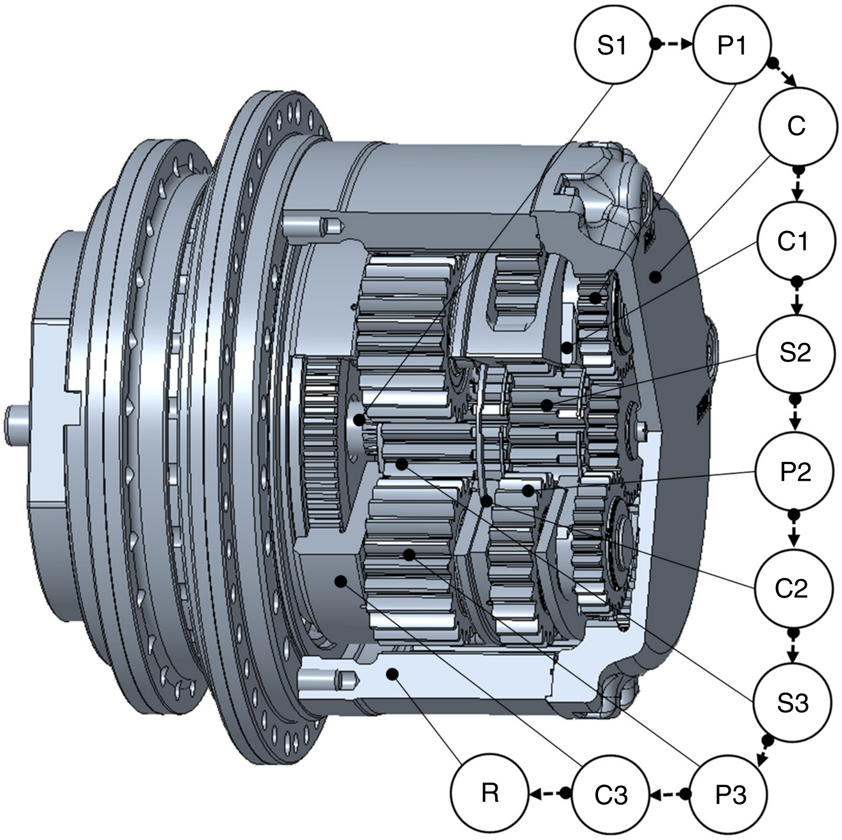
(2) If a fluid is supplied to the hydraulic motor, the fluid passing through the counterbalance spool will pass through the flow path of the motor casing (g) and force will be applied to the brake piston (c) in the opposite direction to the brake spring (b). If a fluid is supplied exceeding the specified 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



(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.

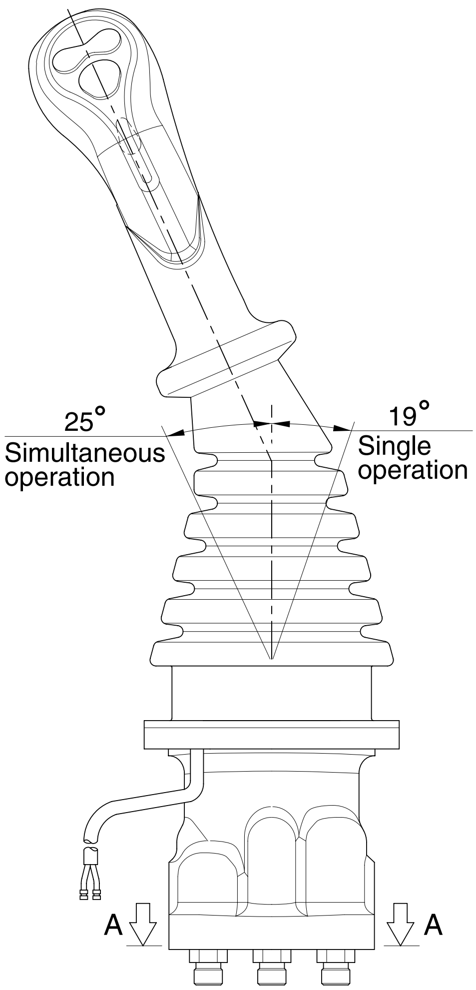
GROUP 5 RCV LEVER

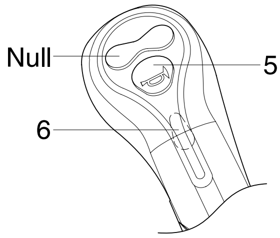
1. STRUCTURE

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 L1



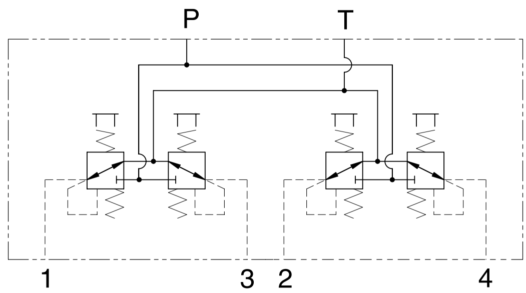


TYPE L1

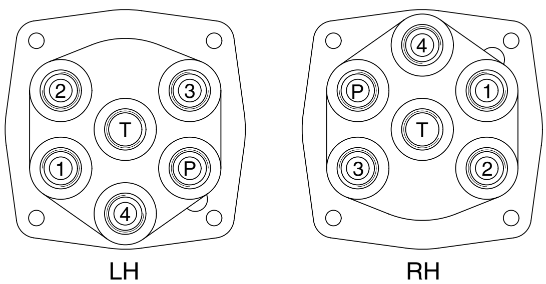
Switches

Type	No.	LH	RH
L1	5	One touch decel	Horn
	6	Power boost	Breaker

※ Number 7 and 8 : Option attachment



Hydraulic circuit



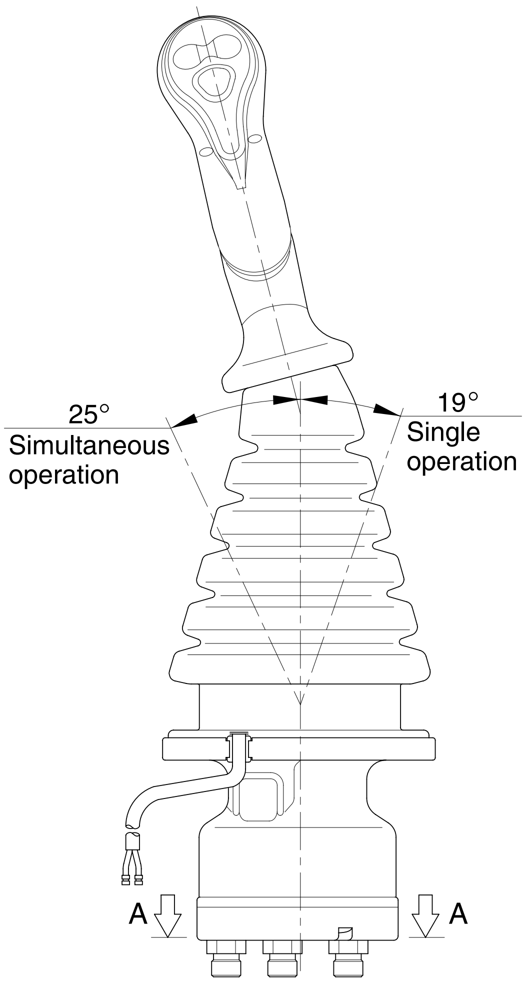
VIEW A-A

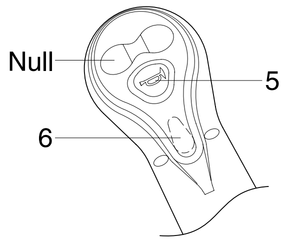
Pilot ports

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	

480S2RL01

2) TYPE L2



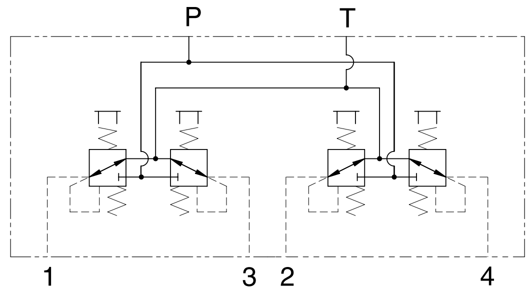


TYPE L2

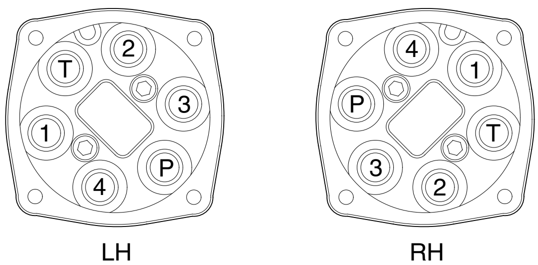
Switches

Type	No.	LH	RH
L2	5	One touch decel	Horn
	6	Power boost	Breaker

※ Number 7 and 8 : Option attachment



Hydraulic circuit



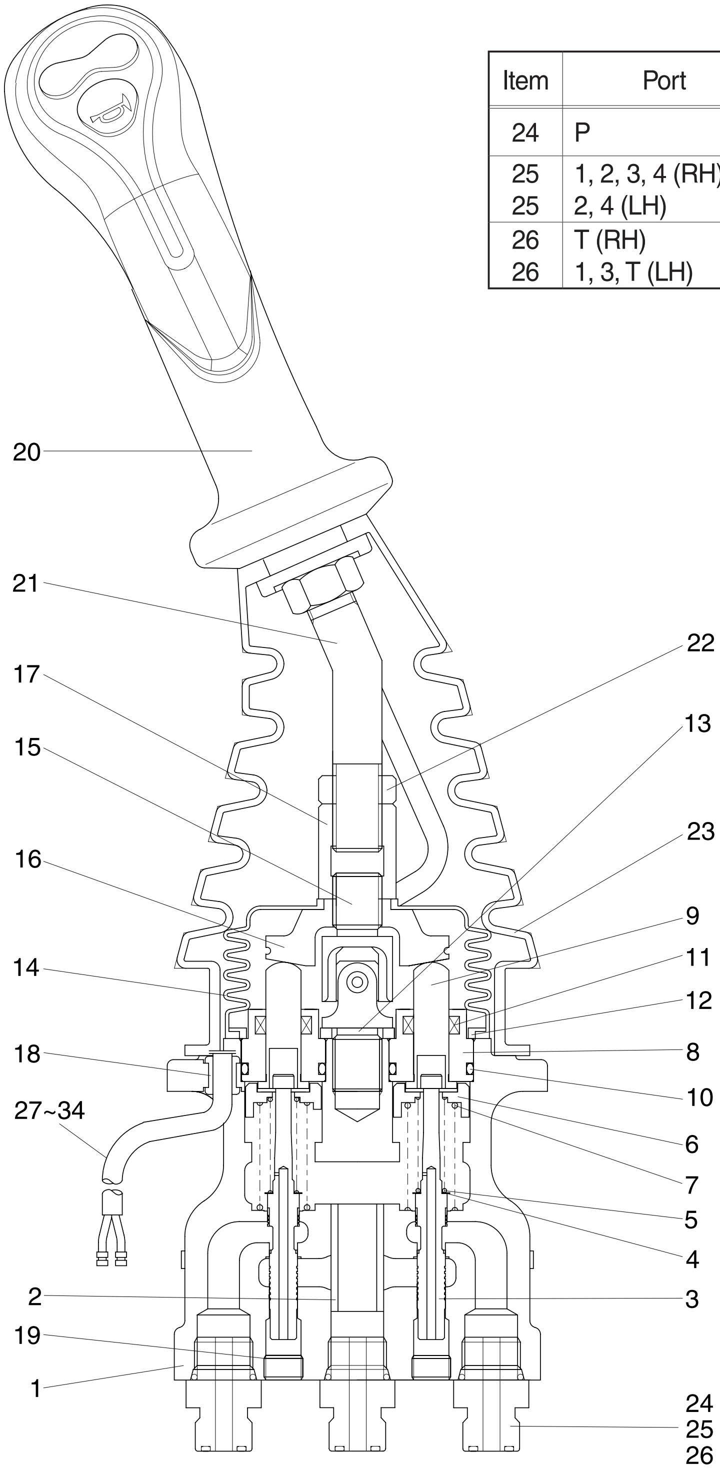
VIEW A-A

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	

480S2RL05

3) CROSS SECTION



Item	Port
24	P
25 25	1, 2, 3, 4 (RH) 2, 4 (LH)
26 26	T (RH) 1, 3, T (LH)

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

210S2RL06

Item numbers are based on the type L1.

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

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

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

2. FUNCTIONS

1) FUNDAMENTAL FUNCTIONS

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

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

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

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

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

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

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

2) FUNCTIONS OF MAJOR SECTIONS

Item numbers are based on the type L1.

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

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

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

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

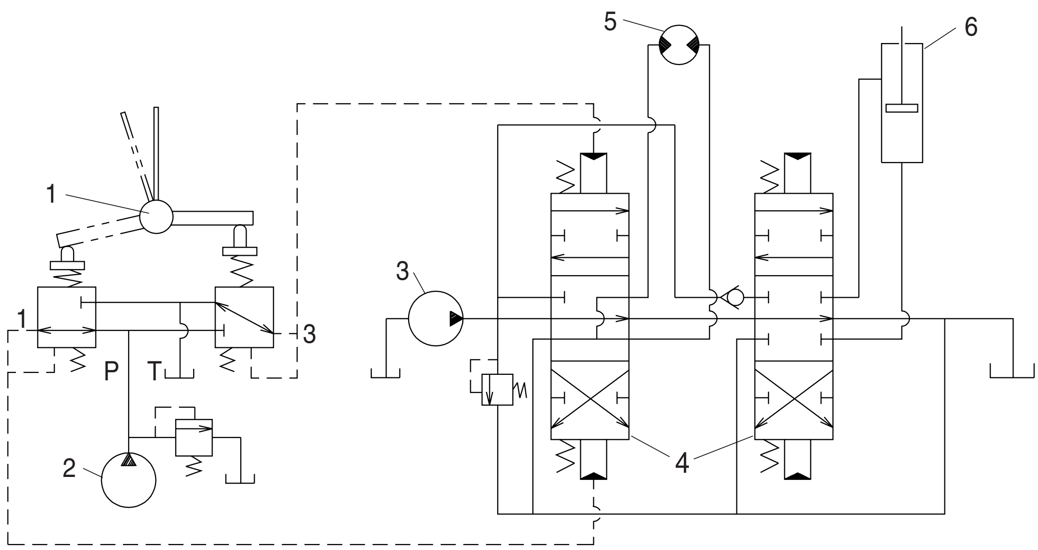
The spring (7) works on the case (1) and spring seat (6) and tries to return the push rod (9) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

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

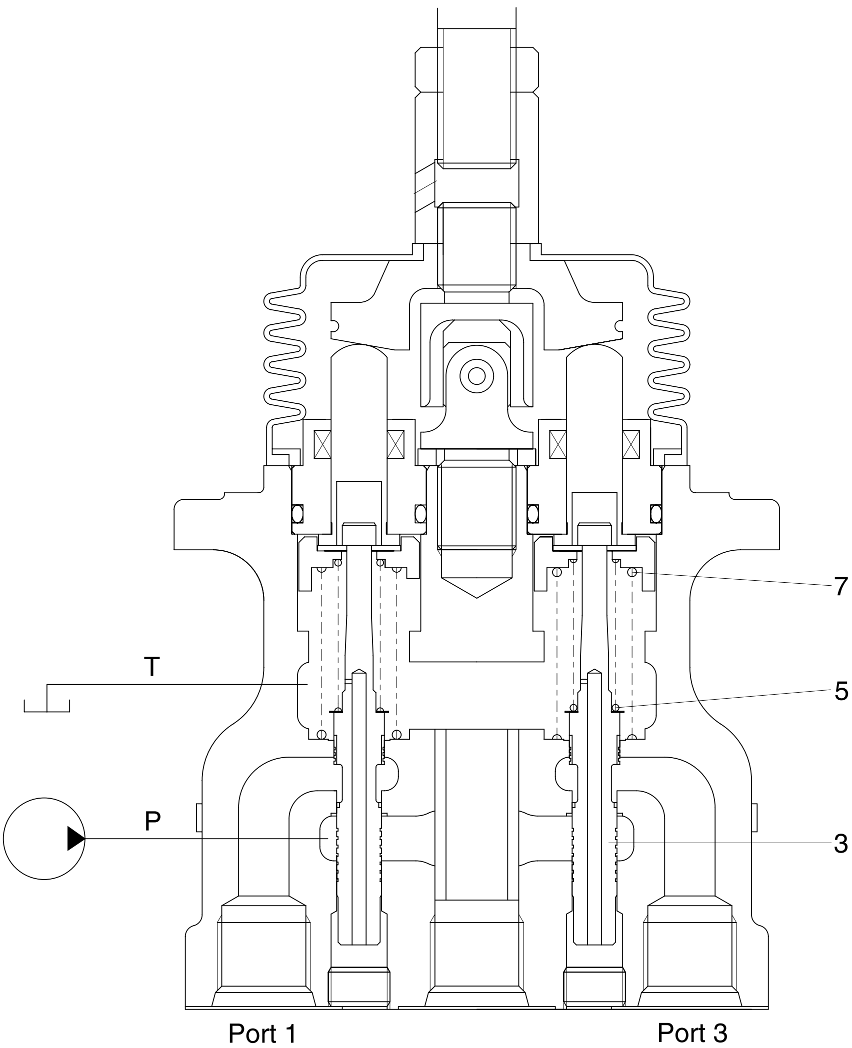
The diagram shown below is the typical application example of the pilot valve.



2-70

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

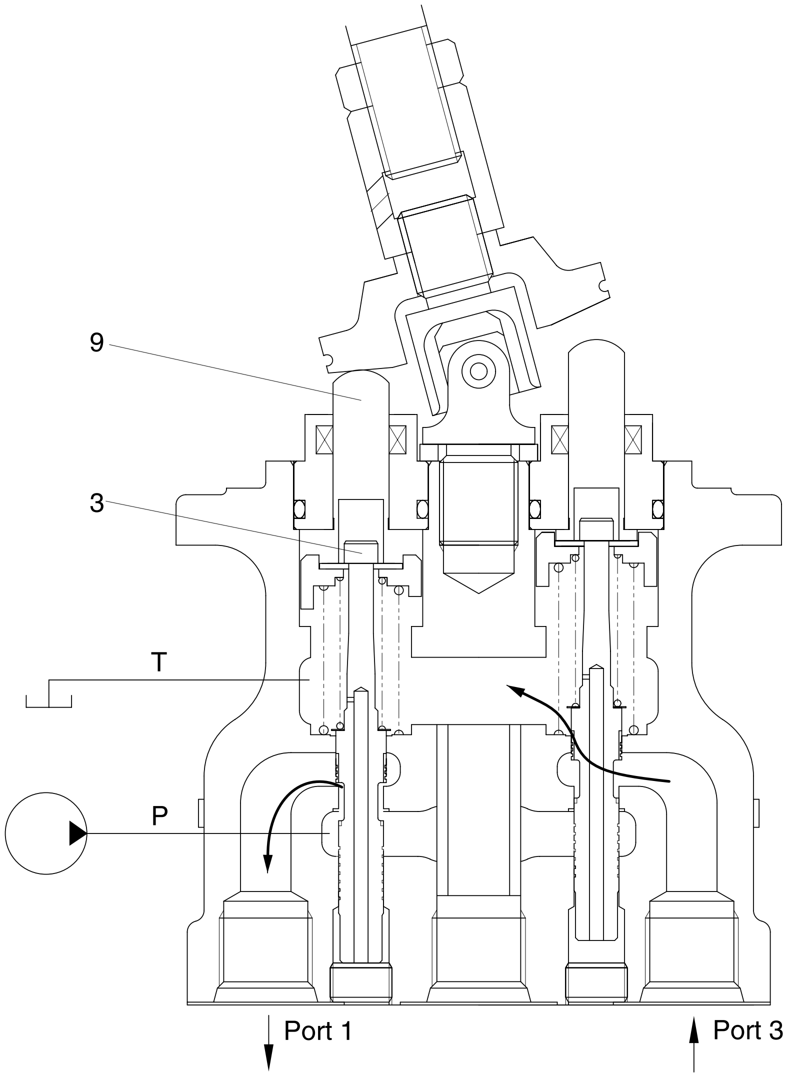
(1) Case where handle is in neutral position



300L2RL03

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

(2) Case where handle is tilted



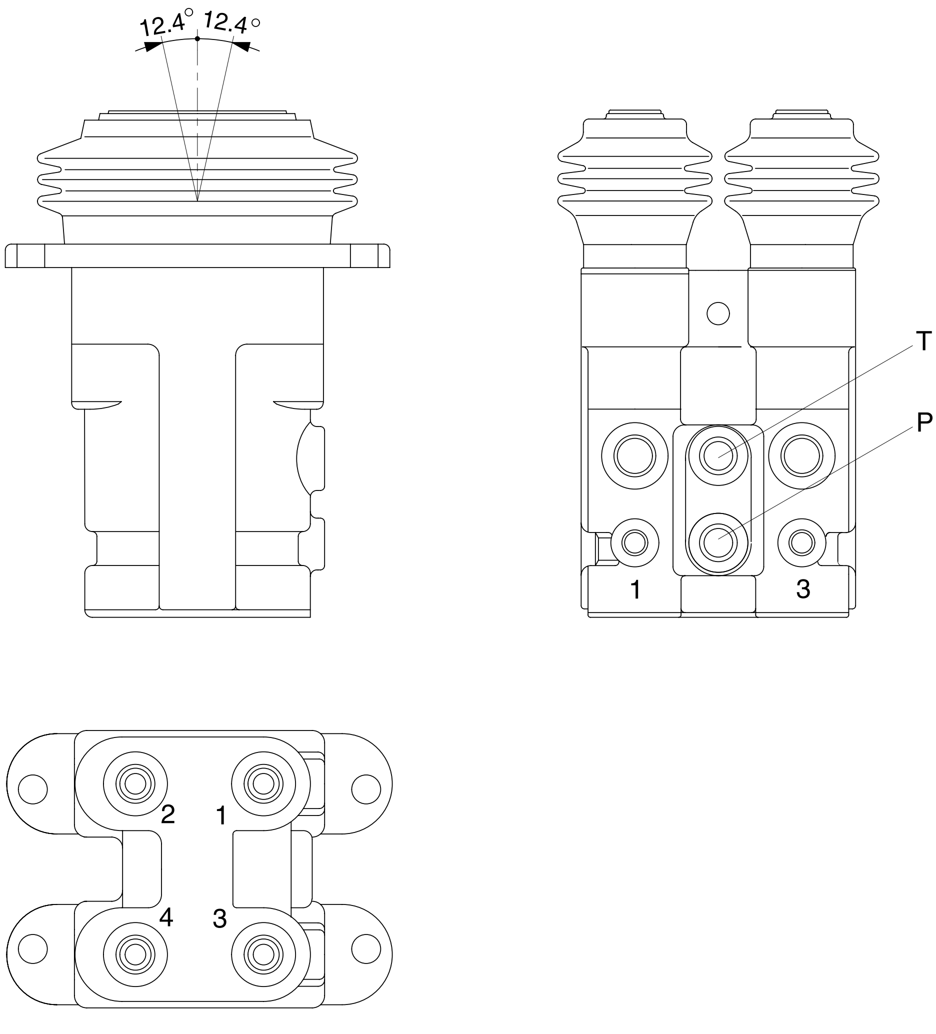
300L2RL04

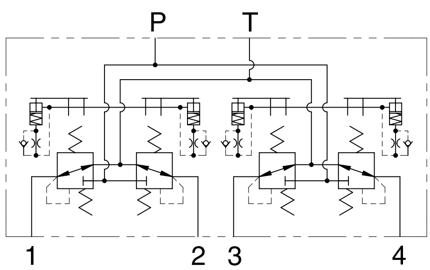
When the push rod (9) is stroked, the spool (3) moves downwards.
Then port P is connected with port (1) and the oil supplied from the pilot pump flows through port (1) to generate the pressure.
When the pressure at port (1) increases to the value corresponding to the spring force set by tilting the handle,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

GROUP 6 RCV PEDAL

1. STRUCTURE

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





Hydraulic circuit

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

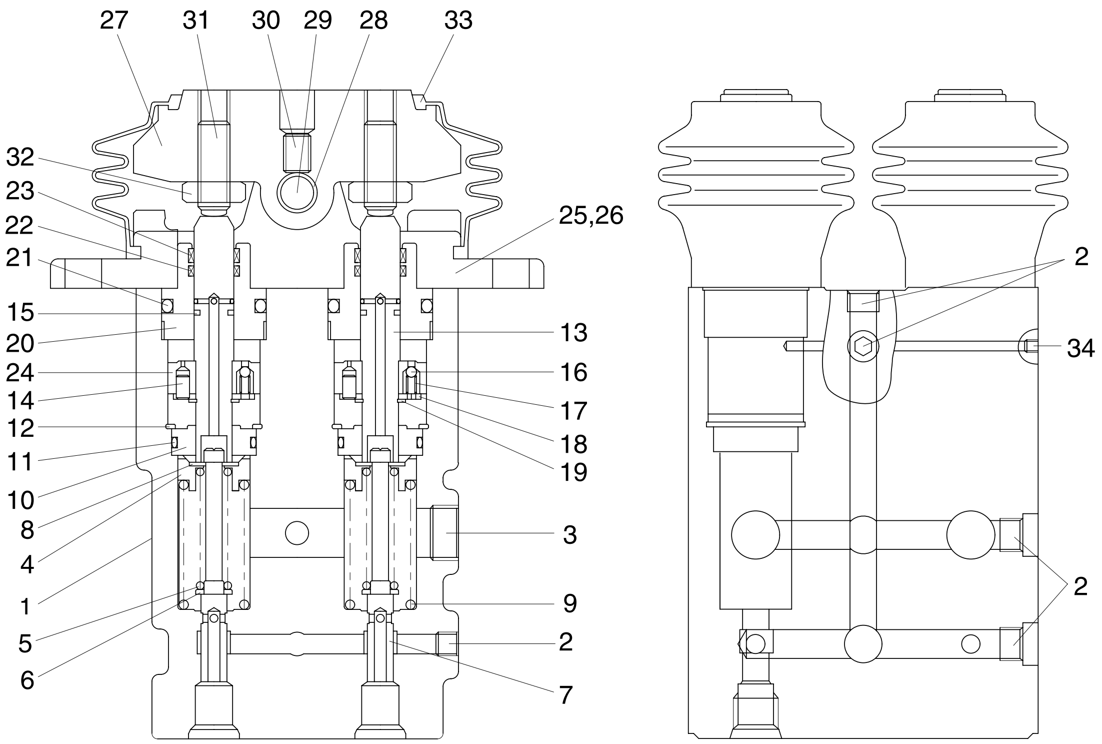
130ZF2RP01

CROSS SECTION

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

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

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



130ZF2RP02

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

2. FUNCTION

1) FUNDAMENTAL FUNCTIONS

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

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

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

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

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

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

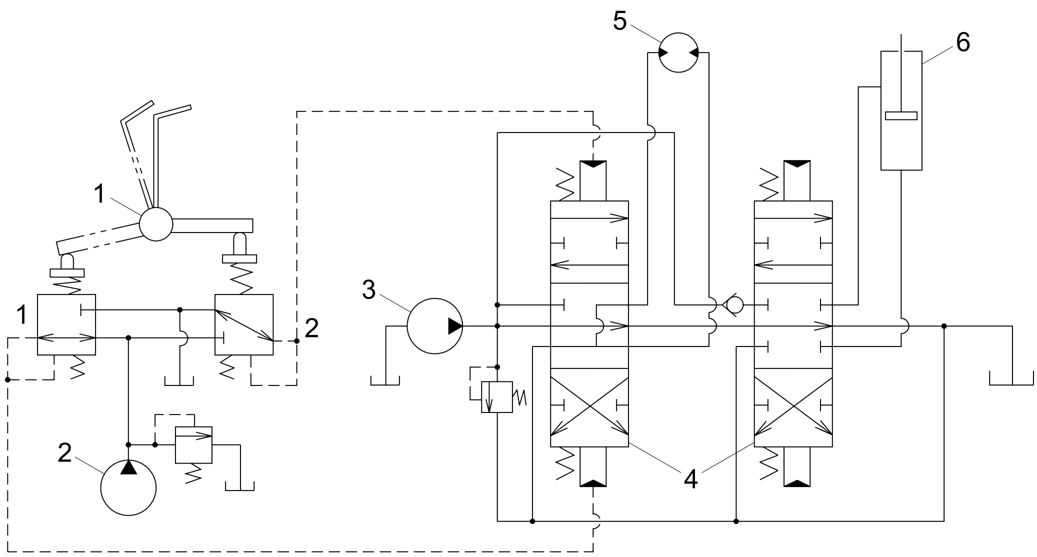
2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool (8) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output spool to determine the output pressure.
The spring (6) works on this spool to determine the output pressure.
The change the deflection of this spring, the push rod (13) is inserted and can slide in the plug (20).
For the purpose of changing th displacement of the push rod through the cam (27) and adjusting nut (32) are provided the pedal that can be tilted in any direction around the fulcrum of the cam (27) center.
The spring (9) works on the body (1) and spring seat (6) and tries to return the push rod (13) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.
This also has the effect of a reaction spring to give appropriate control feeling to the operator.

3) OPERATION

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

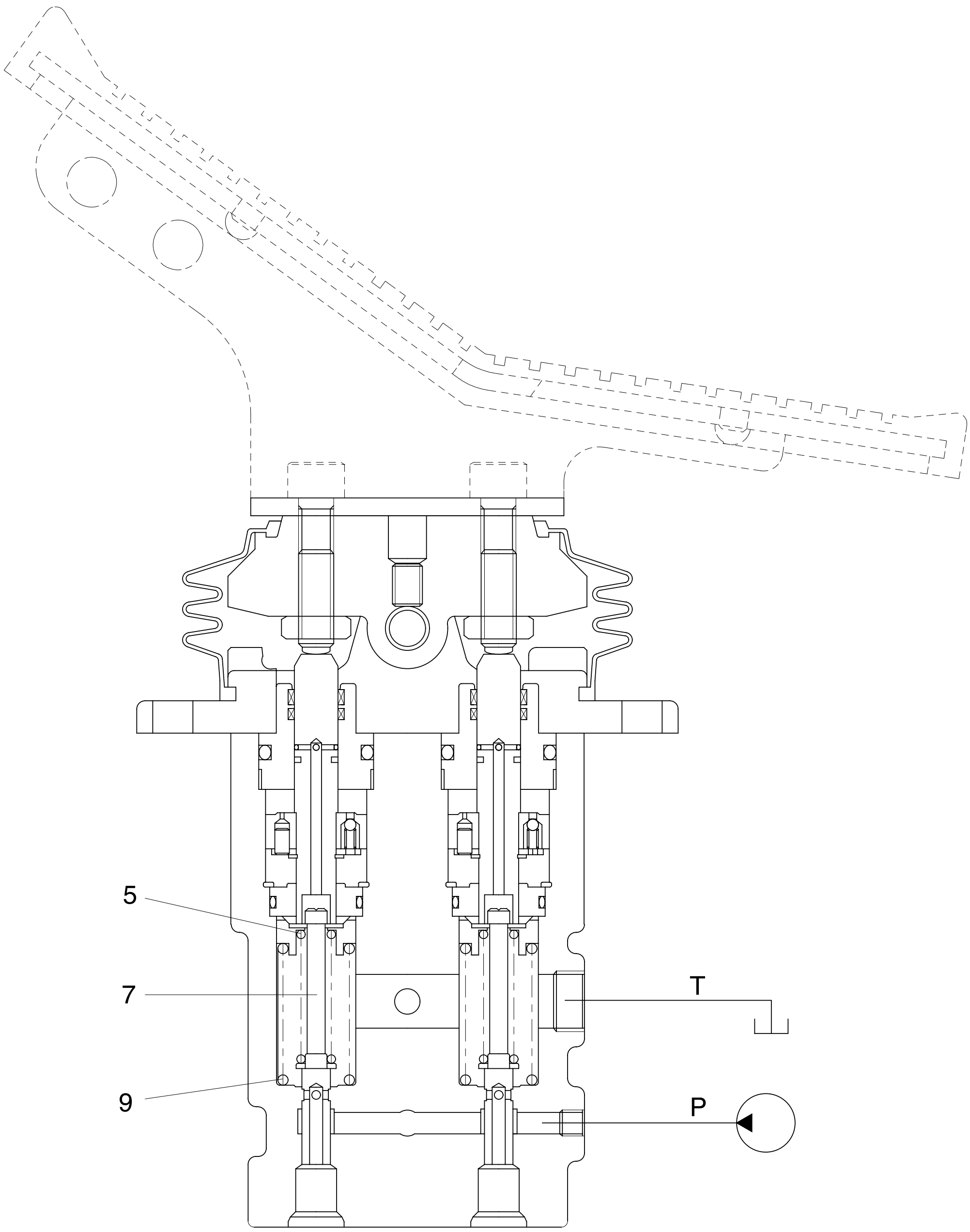
The diagram shown below is the typical application example of the pilot valve.



36072SF01

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

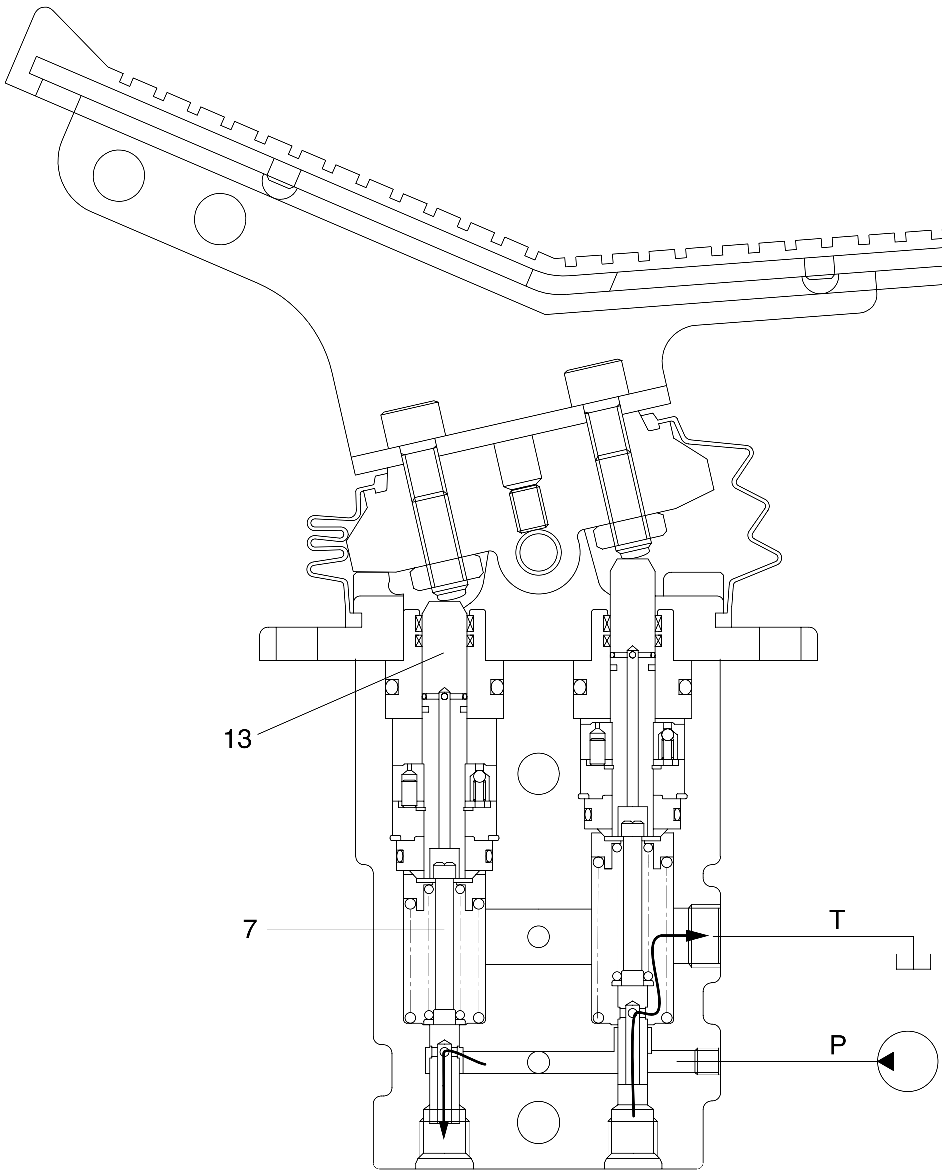
(1) Case where pedal is in neutral position



130ZF2RP03

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

(2) Case where pedal is tilted



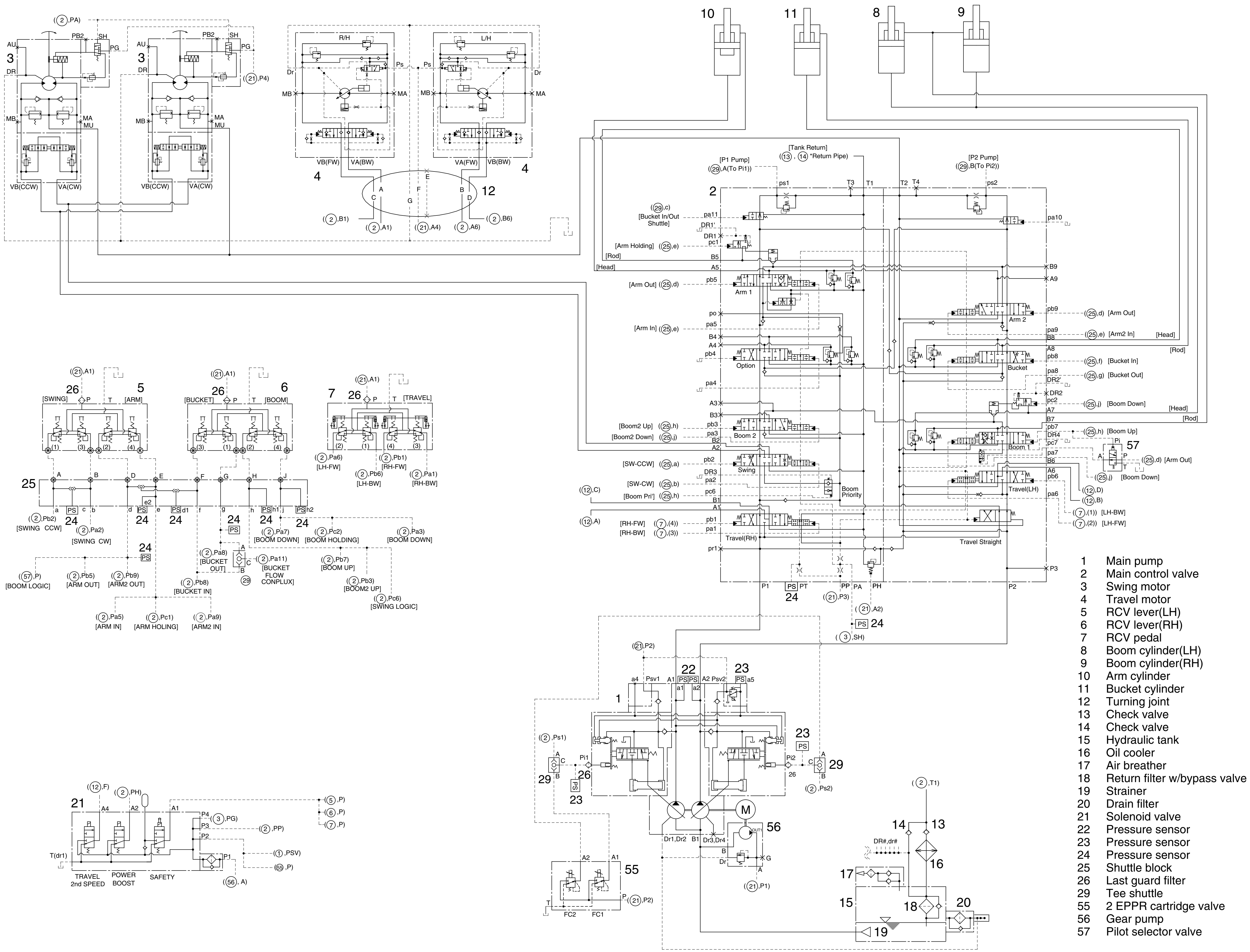
130ZF2RP04

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

SECTION 3 HYDRAULIC SYSTEM

GROUP 1 HYDRAULIC CIRCUIT

1. HYDRAULIC CIRCUIT (1/2)



1 Main pump
2 Main control valve
3 Swing motor
4 Travel motor
5 RCV lever(LH)
6 RCV lever(RH)
7 RCV pedal
8 Boom cylinder(LH)
9 Boom cylinder(RH)
10 Arm cylinder
11 Bucket cylinder
12 Turning joint
13 Check valve
14 Check valve
15 Hydraulic tank
16 Oil cooler
17 Air breather
18 Return filter w/bypass valve
19 Strainer
20 Drain filter
21 Solenoid valve
22 Pressure sensor
23 Pressure sensor
24 Pressure sensor
25 Shuttle block
26 Last guard filter
29 Tee shuttle
55 2 EPPR cartridge valve
56 Gear pump
57 Pilot selector valve

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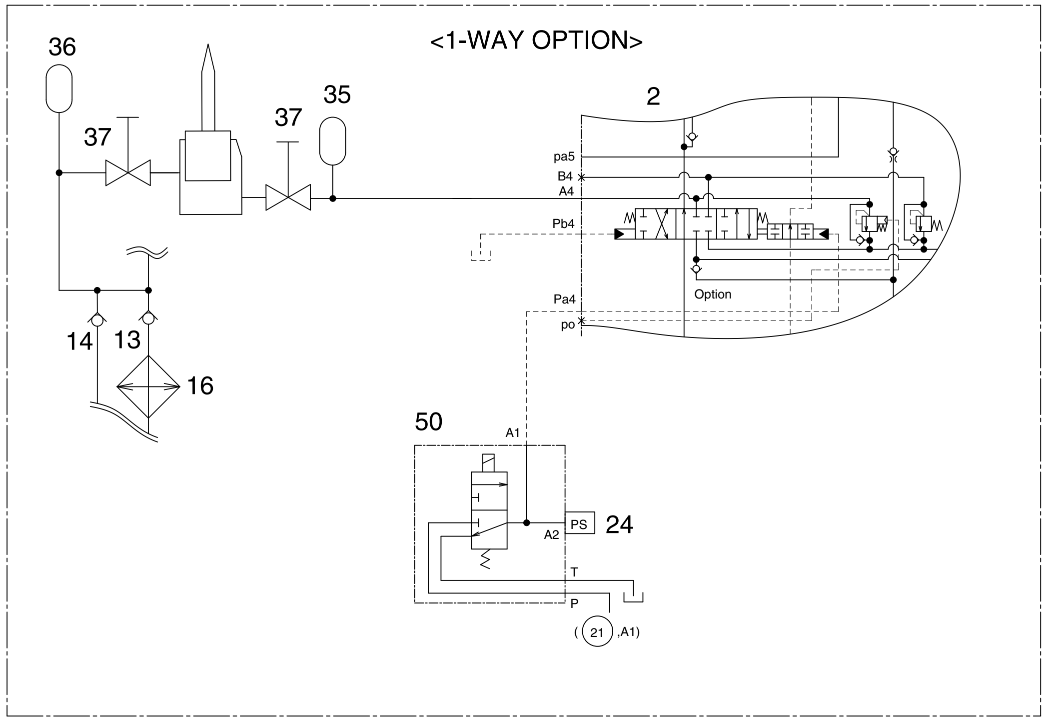
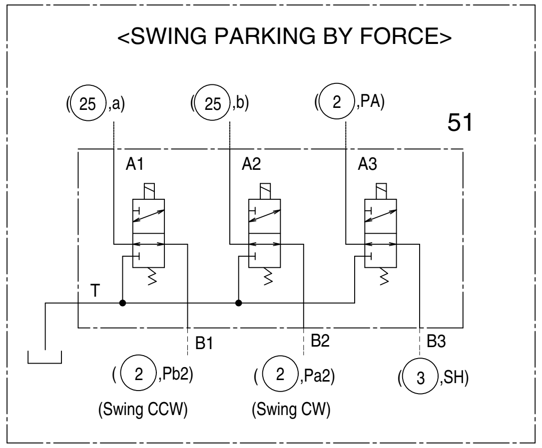
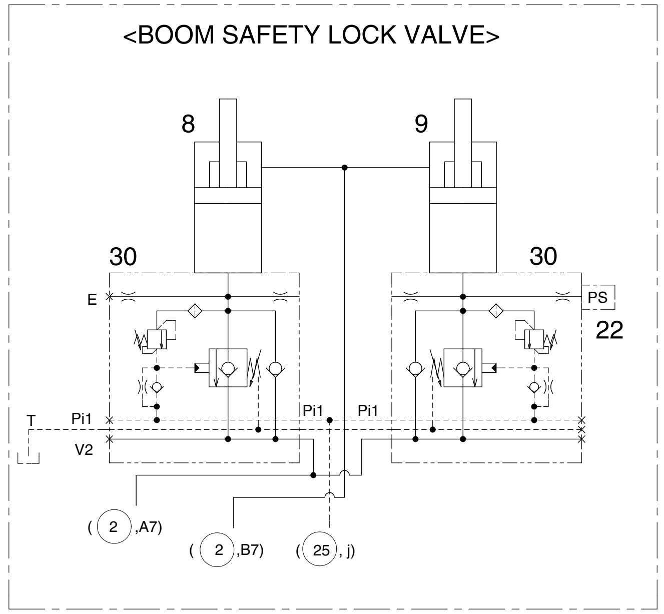
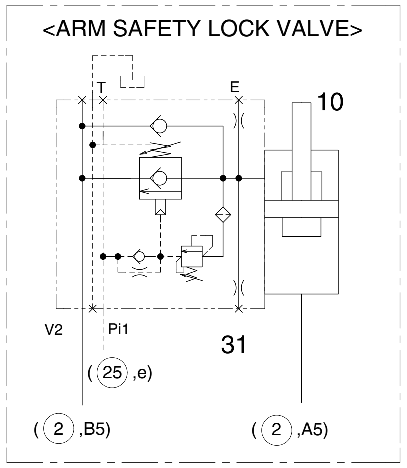
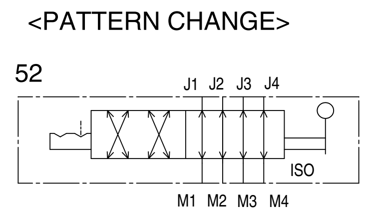
2. HYDRAULIC CIRCUIT (2/2)



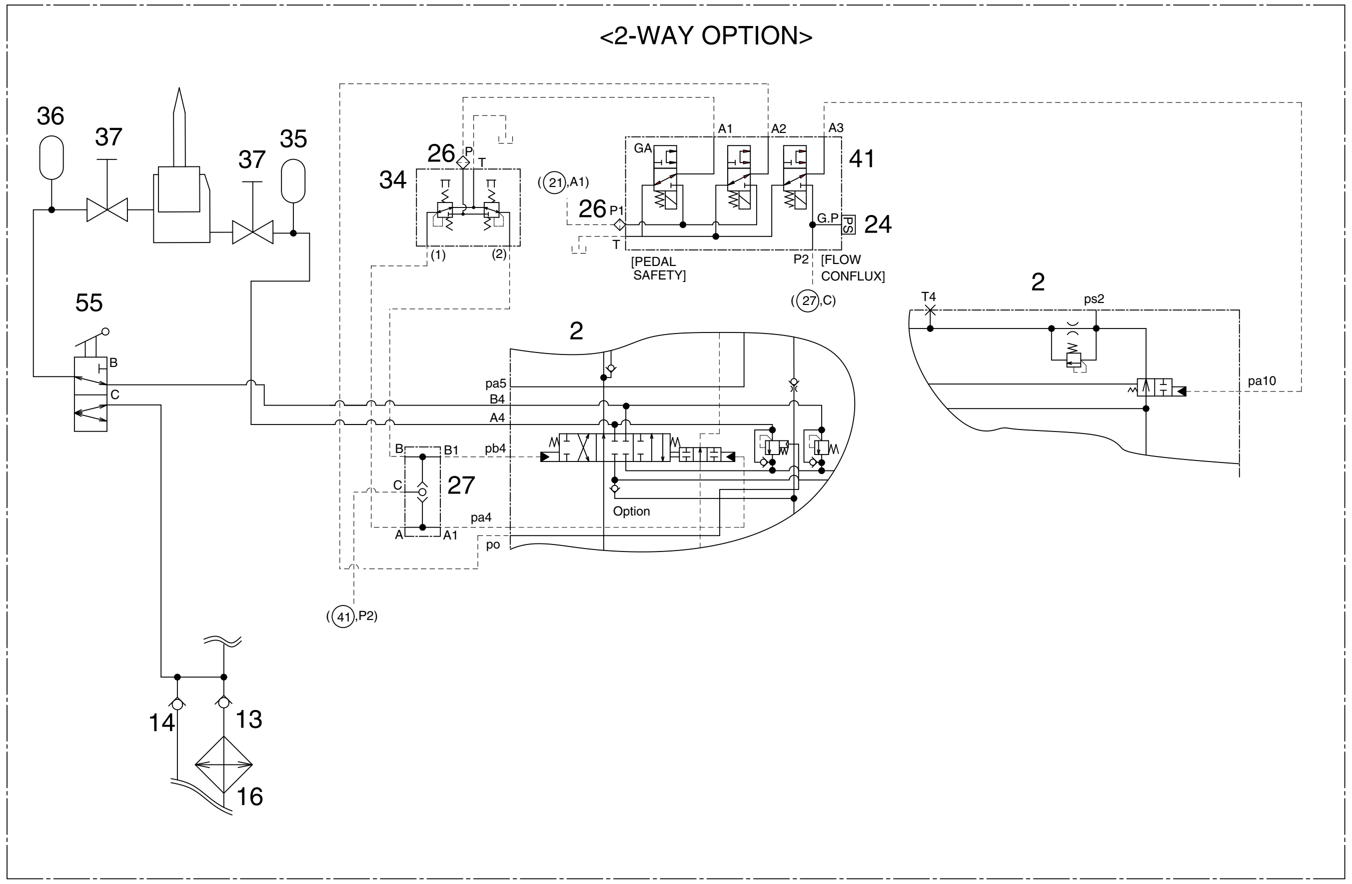


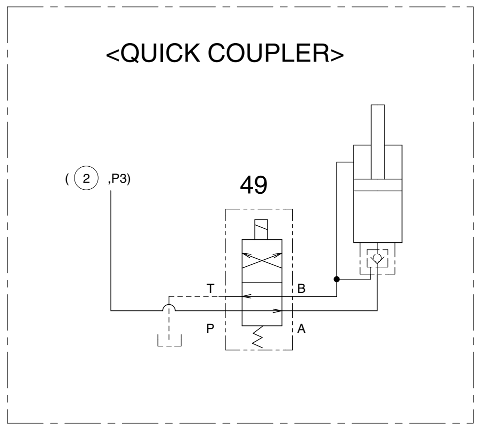






FROM		TO	
ITEM	PORT	ITEM	PORT
5	2	52	J1
	4		J3
6	2		J4
	4		J2
52	M1	25	D
	M2		J
	M3		E
	M4		H





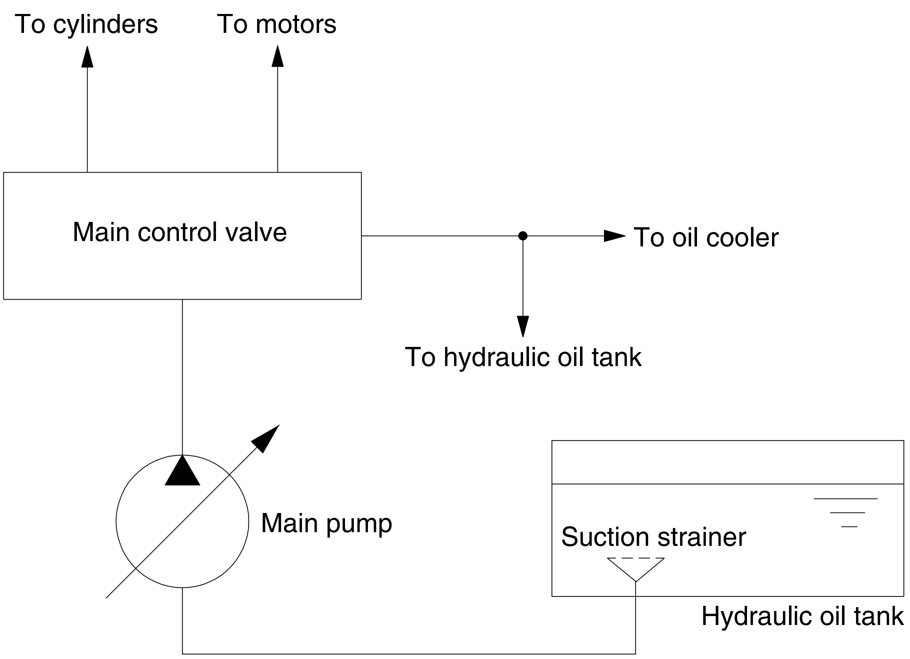
2 Main control valve
8 Boom cylinder(LH)
9 Boom cylinder(RH)
10 Arm cylinder
13 Check valve
14 Check valve
16 Oil cooler
22 Pressure sensor
24 Pressure sensor
26 Last guard filter
27 5 Shuttle assy(option)
30 Boom safety valve(option)
31 Arm safety valve(option)
34 2 Way pedal(option)
35 Accumulator(option)
36 Accumulator(option)
37 Stop valve(option)
41 Solenoid valve(option)
49 Solenoid valve(option)
50 Solenoid valve(option)
51 Solenoid valve(option)
52 Pattern change valve(option)
55 3 Way joint

30QB-47100-00 2OF2

GROUP 2 MAIN CIRCUIT

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

1. SUCTION AND DELIVERY CIRCUIT

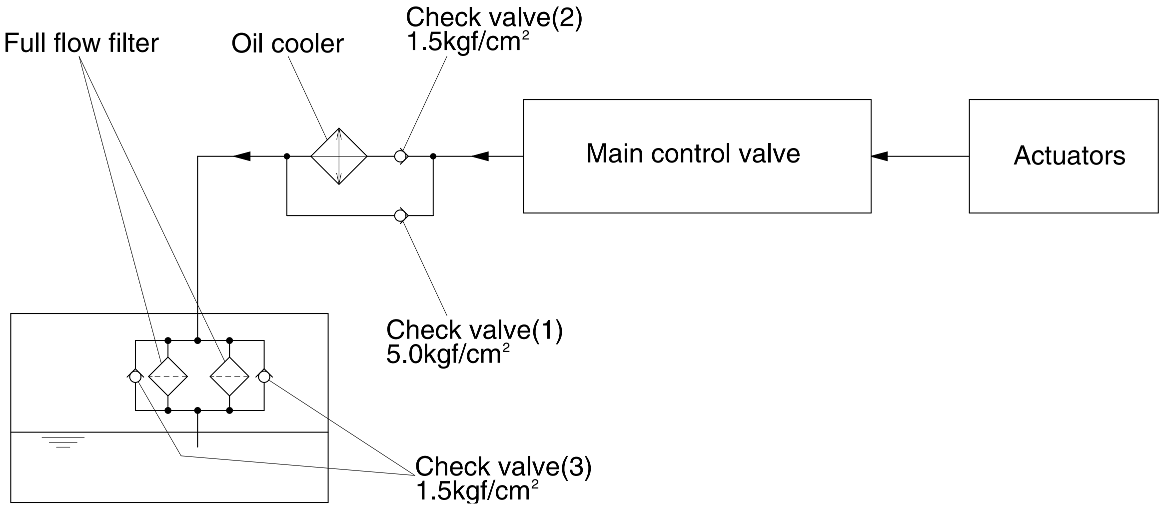


140L3CI01

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

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

2. RETURN CIRCUIT



45073CI02

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).

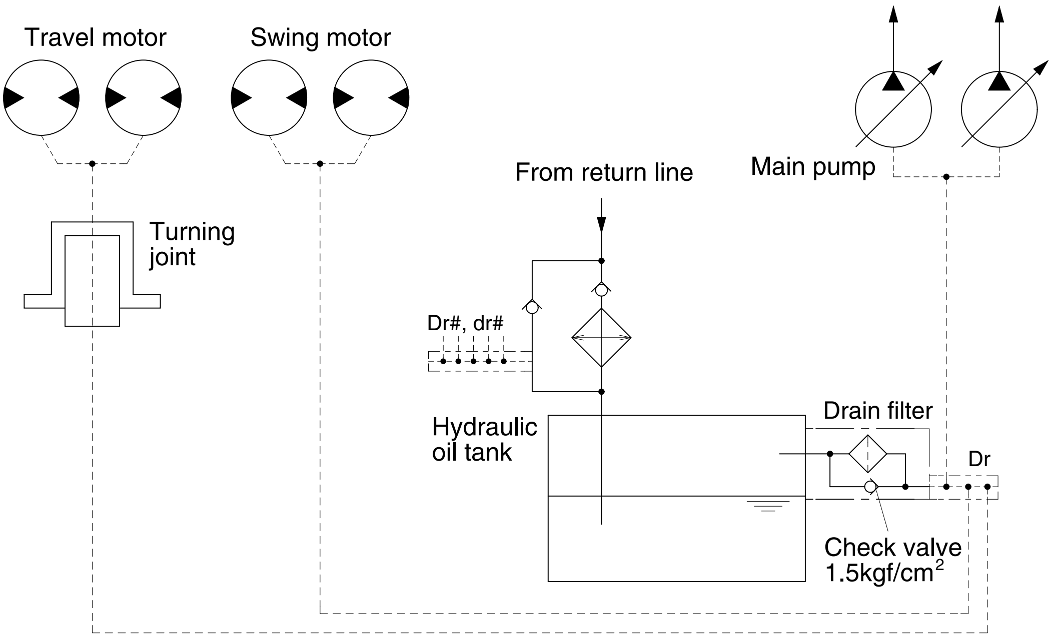
The full-flow filter and bypass relief valve are provided in the hydraulic tank.

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

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

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

3. DRAIN CIRCUIT



480S3CI02

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

1) TRAVEL MOTOR DRAIN CIRCUIT

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

2) SWING MOTOR DRAIN CIRCUIT

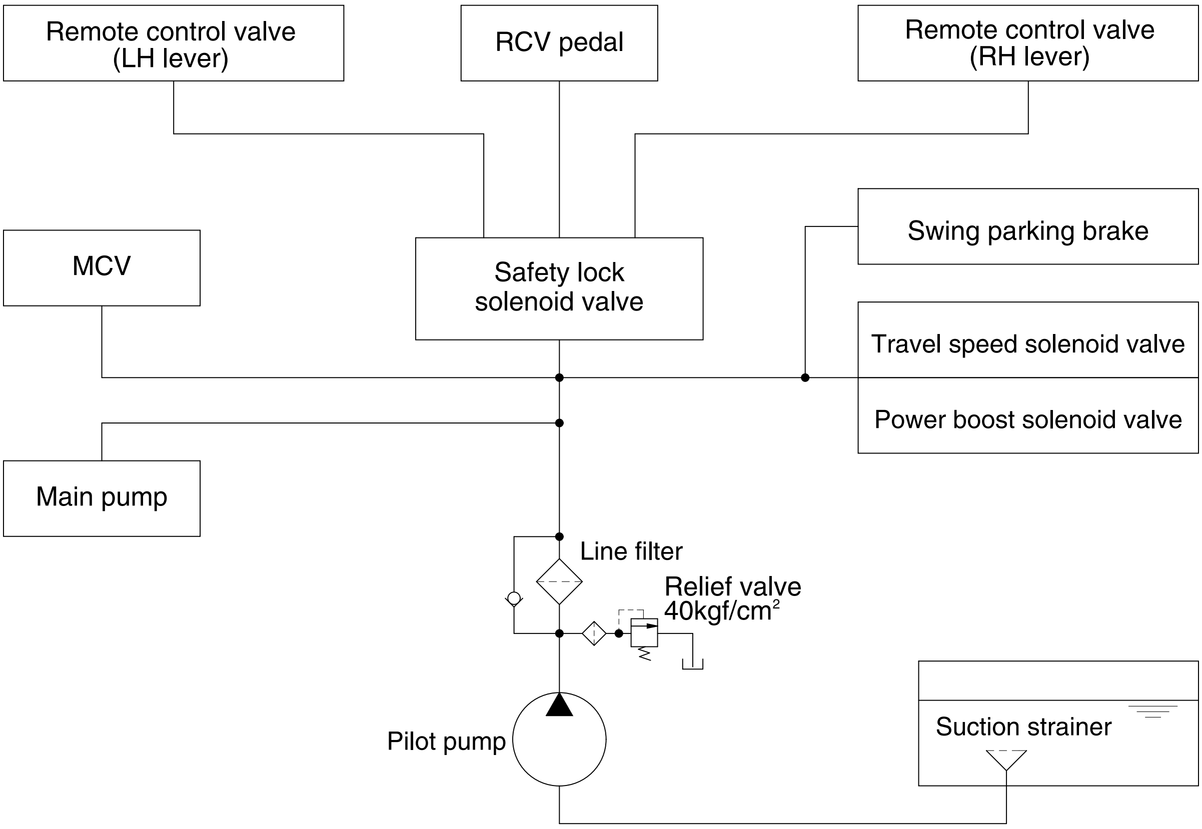
Oil leaking from the swing motors come out and return to the hydraulic tank passing through drain filter.

3) MAIN PUMP DRAIN CIRCUIT

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

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

GROUP 3 PILOT CIRCUIT



480S3CI03

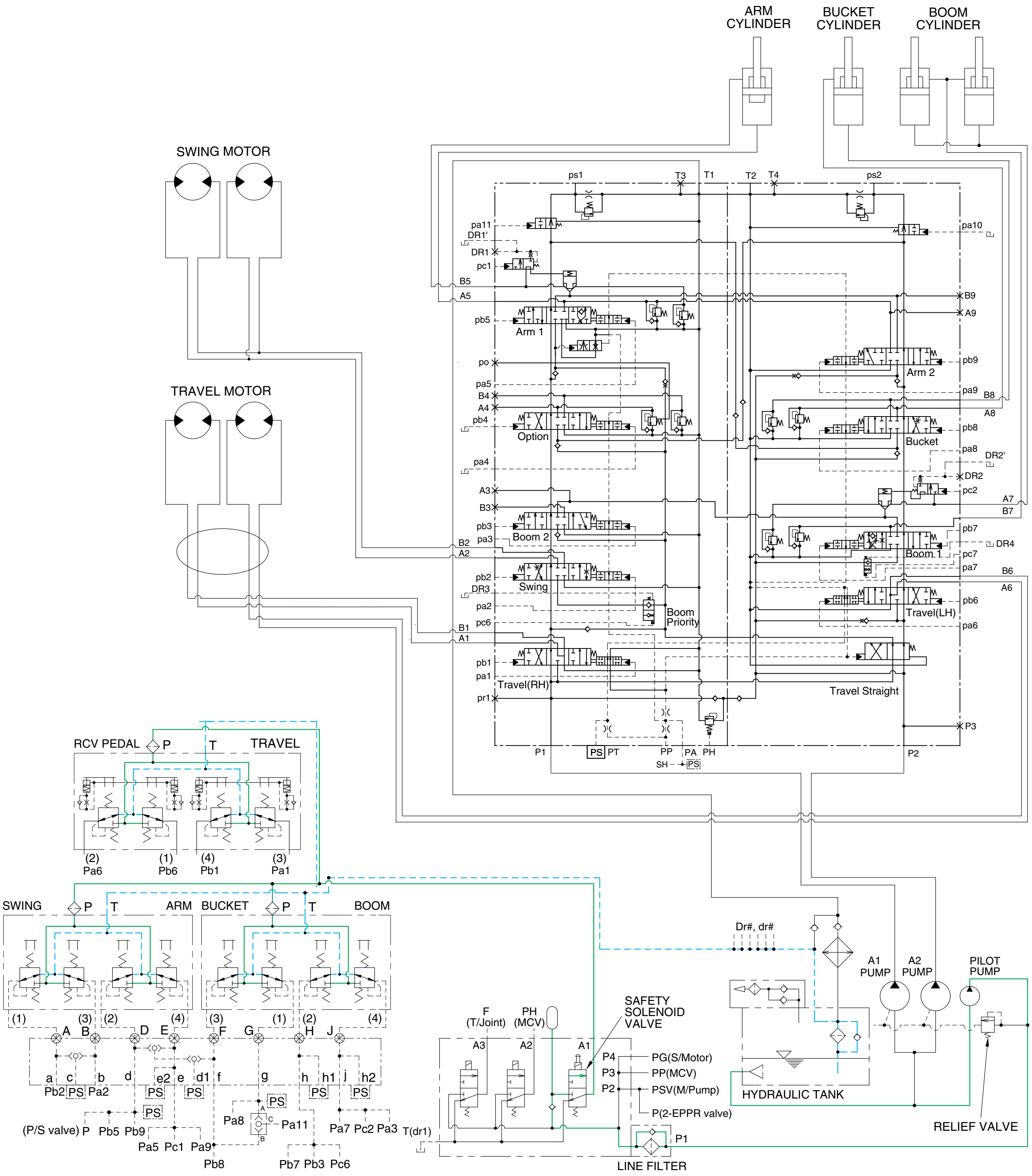
The pilot circuit consists of suction circuit, delivery circuit and return circuit.

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

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

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

1. SUCTION, DELIVERY AND RETURN CIRCUIT



480S3HC02

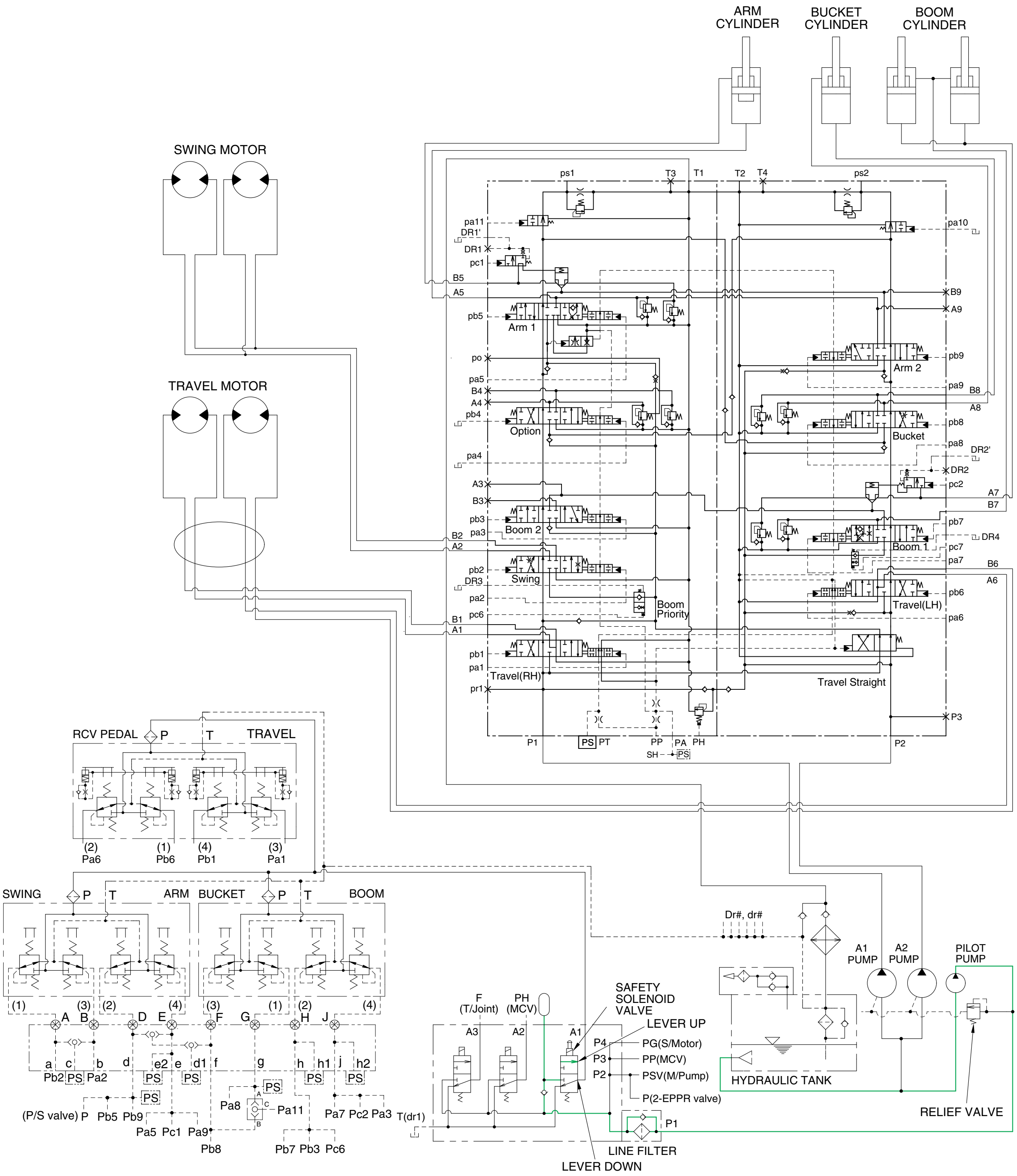
The pilot pump receive oil from the hydraulic tank. The discharged oil from the pilot pump flows to the safety solenoid valve through the line filter. The oil is filtered by the line filter. The pilot relief valve is provided in the pilot pump for limiting the pilot circuit pressure.

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

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

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

2. SAFETY SOLENOID VALVE (SAFETY LEVER)



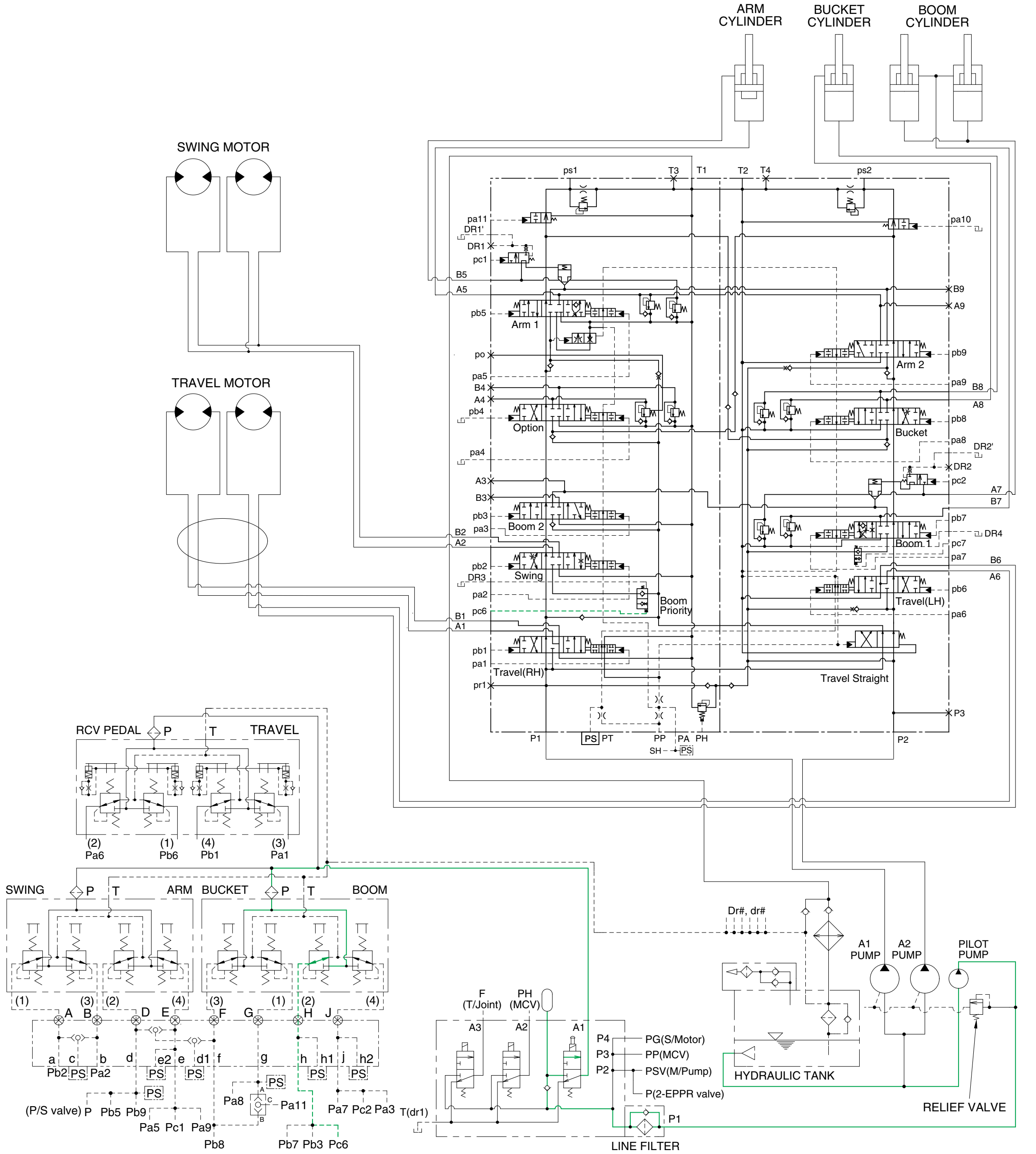
480S3HC03

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

When the lever 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



480S3HC04

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.

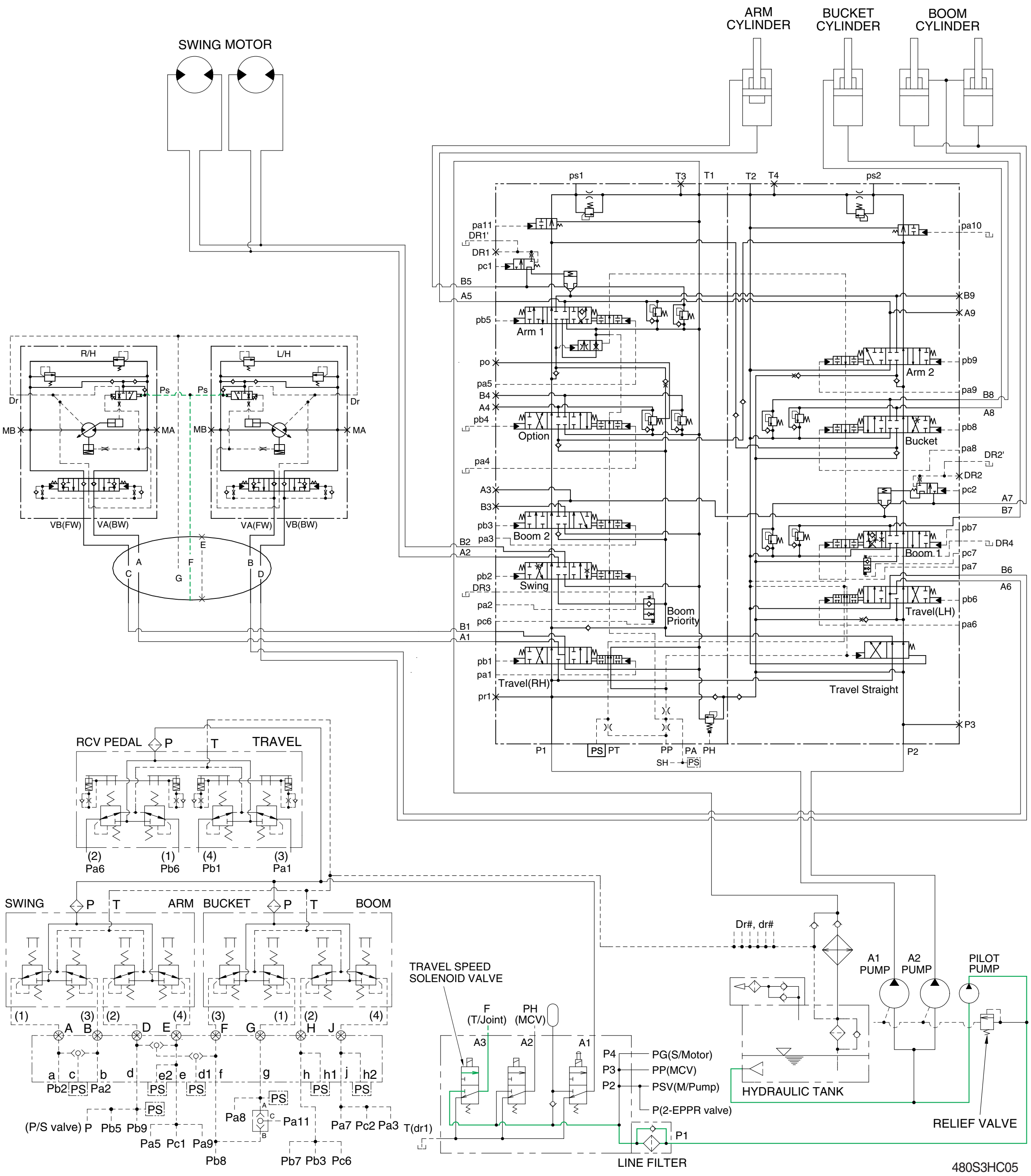
When the boom up control lever is operated, the pilot oil from the pilot oil pump flows into the Pc6 and shifts the swing logic valve in the main control valve to upper position.

Then, the oil flow rate to the swing motor is decreased and 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

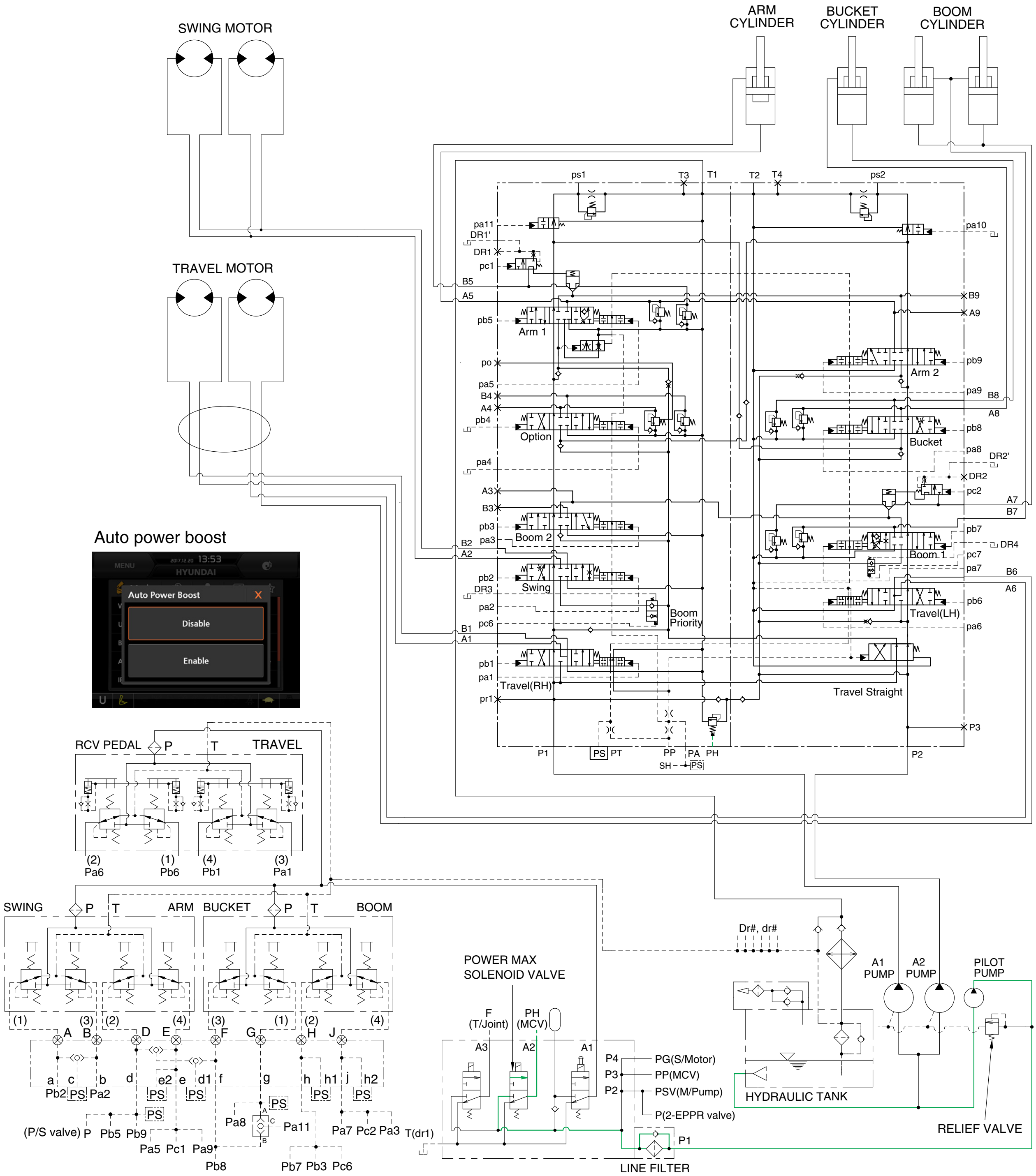


When the travel speed solenoid valve was placed in the Hi position, the pressure oil from pilot pump through line filter flows to port **Ps** of travel speed change over valve, and the control piston is pushed up, thus minimizing the displacement.

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

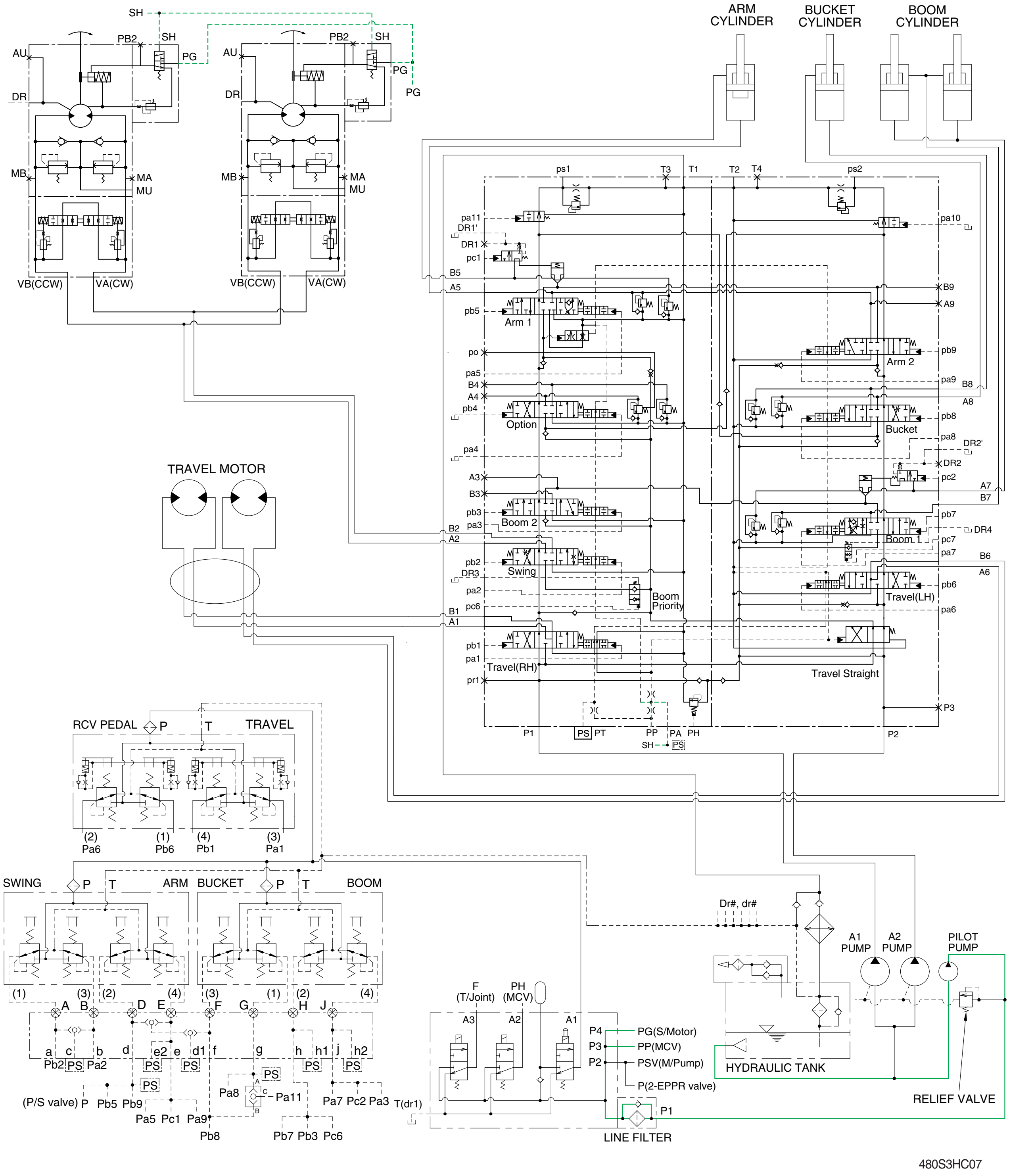


480S3HC06

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.

※ 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.

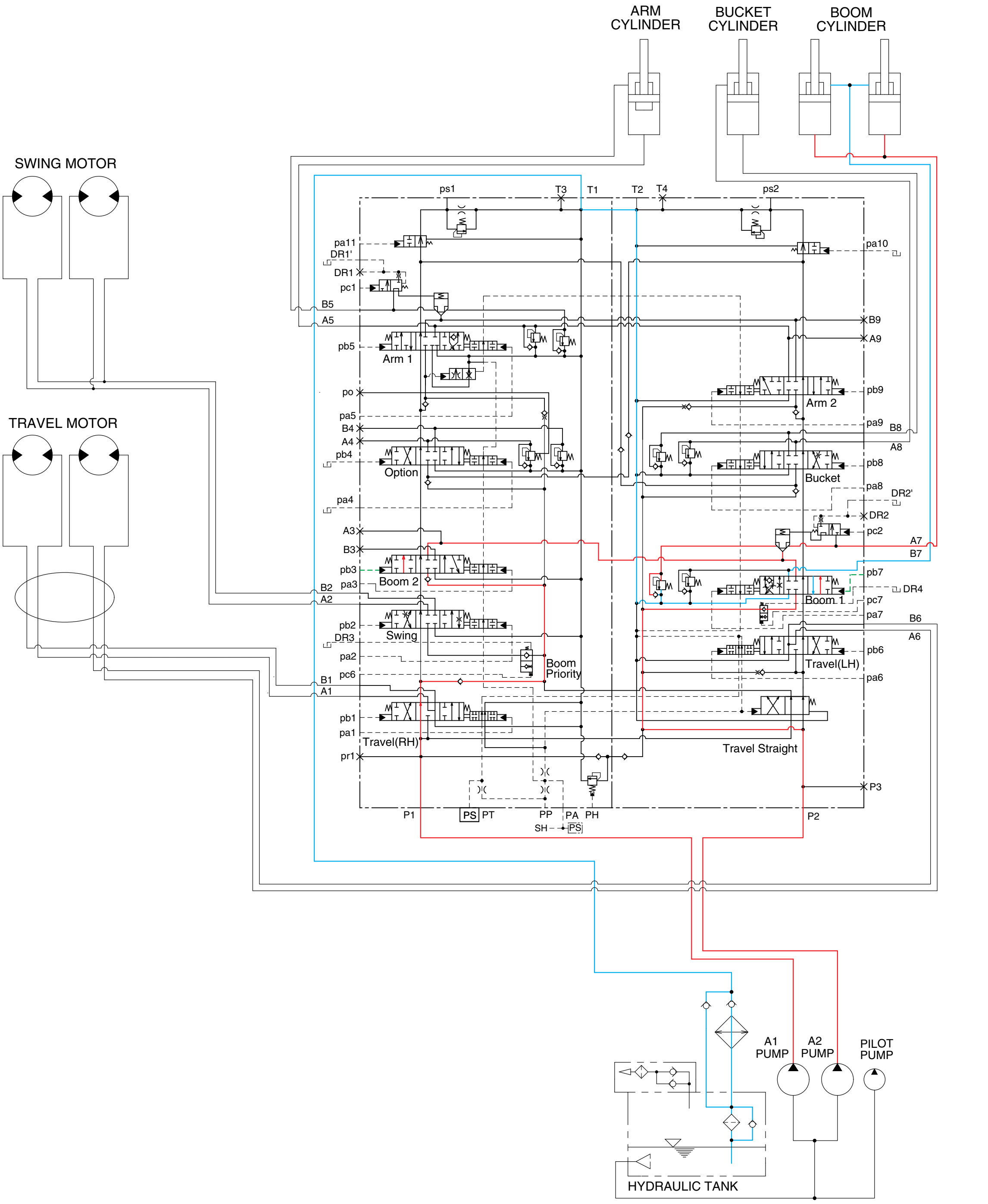
This pressure moves spool so, discharged oil from pilot valve flows to swing motor PG port.

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

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

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

1. BOOM UP OPERATION



480S3HC10A

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

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

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

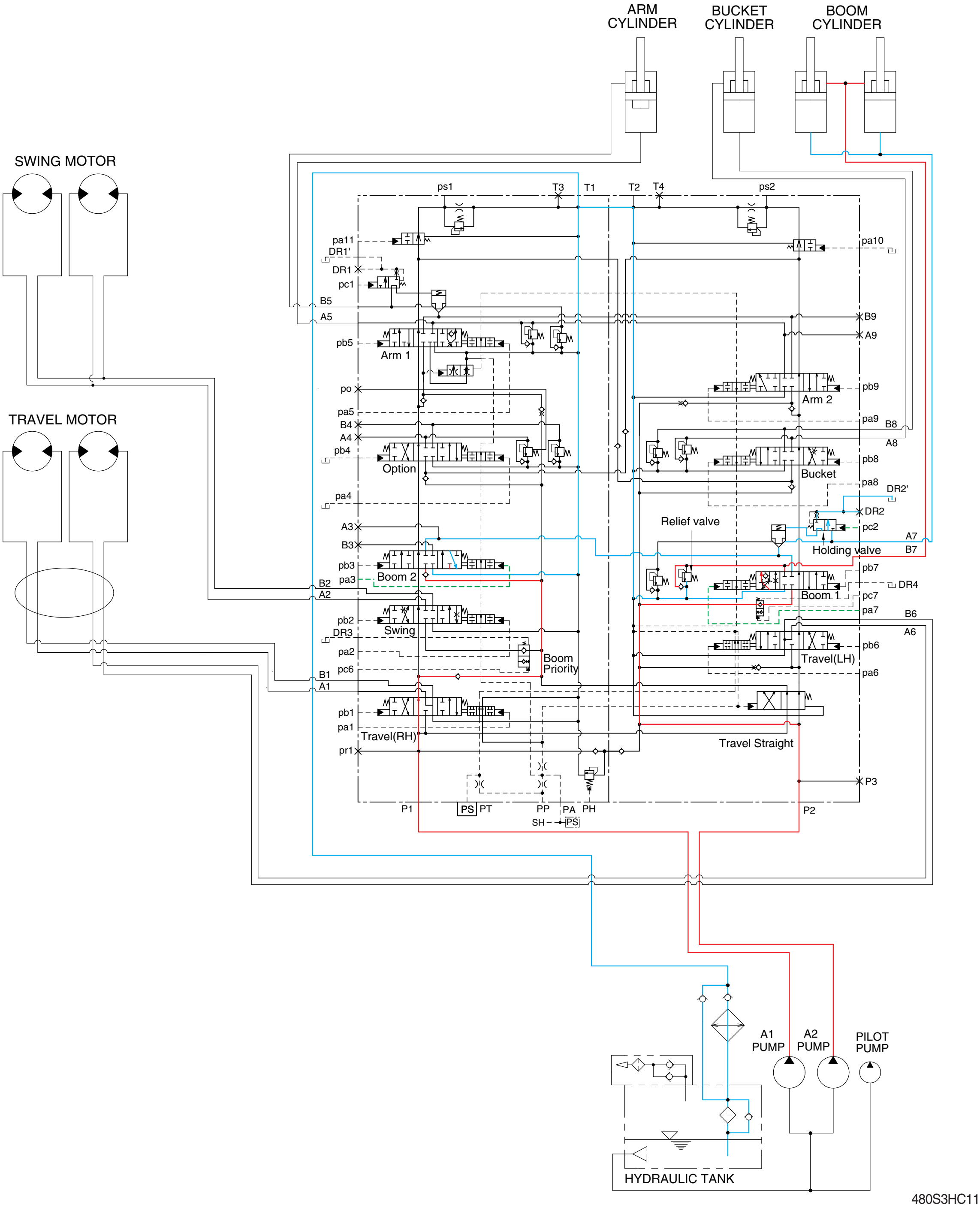
The excessive pressure in the boom cylinder bottom end circuit is prevented by relief valve.

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 boom holding valve.

This prevents the hydraulic drift of boom cylinder.

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

2. BOOM DOWN OPERATION



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

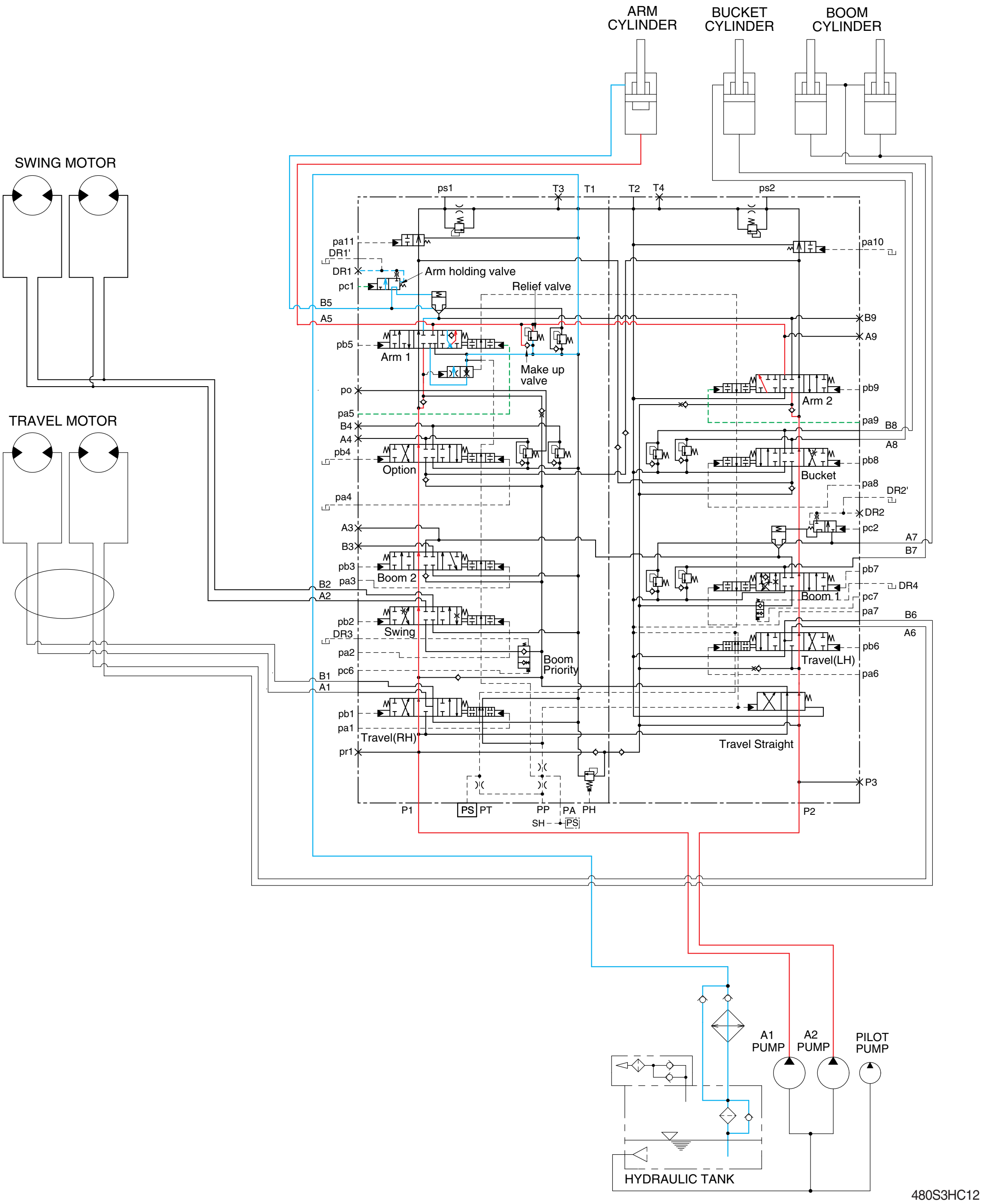
The oil from the A2 pump flows into the main control valve and then goes to the small chamber of boom cylinders. At the same time, the oil from the large chamber of boom cylinders returns to the hydraulic tank through the boom 1 and boom 2 spools in the main control valve.

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

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

※ 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 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.

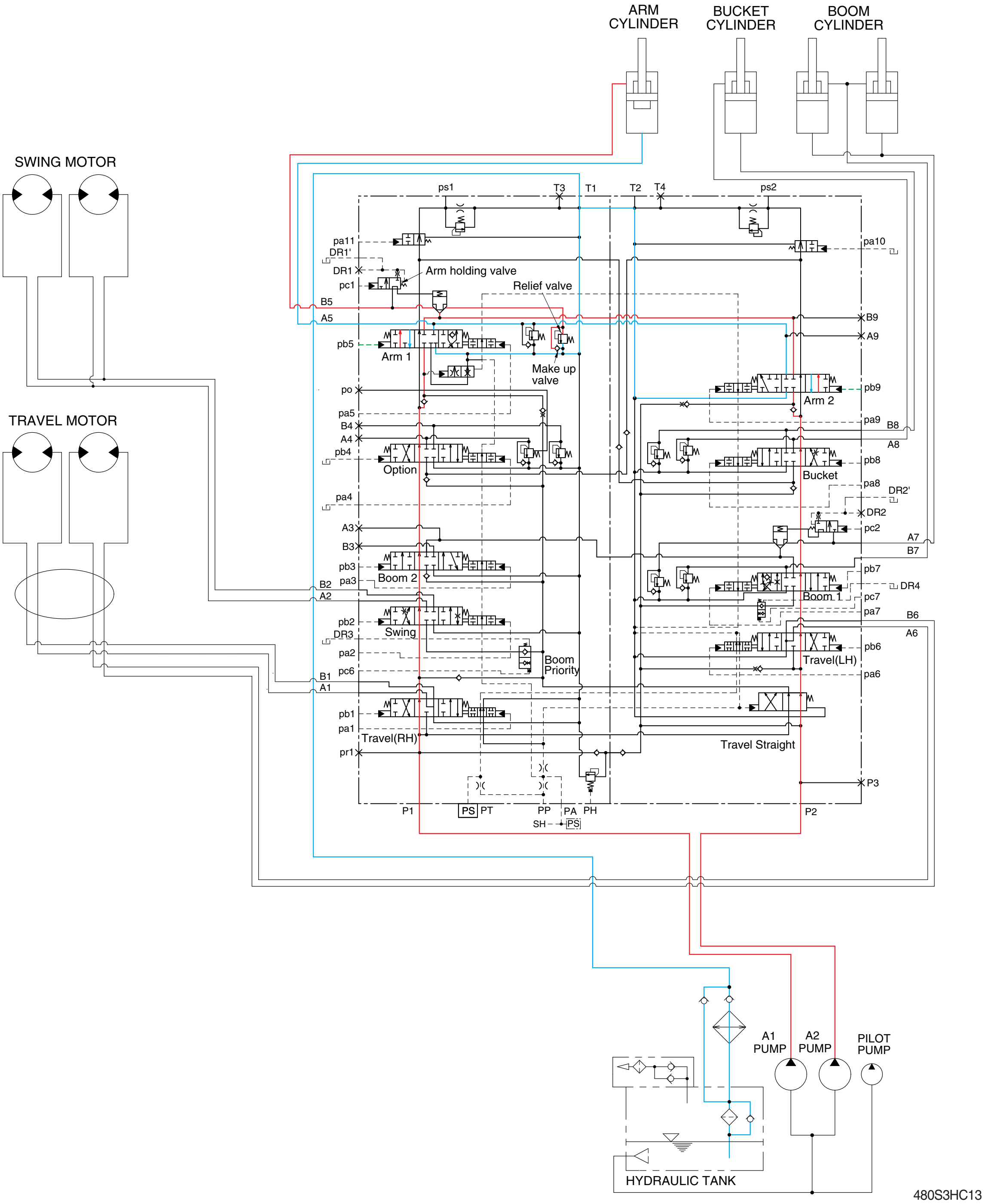
At the same time, the oil from small chamber of arm cylinder returns to the hydraulic oil tank through the Arm 1 spool in the main control valve. When this happens, the arm rolls in.

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 from the remote control valve.

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

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

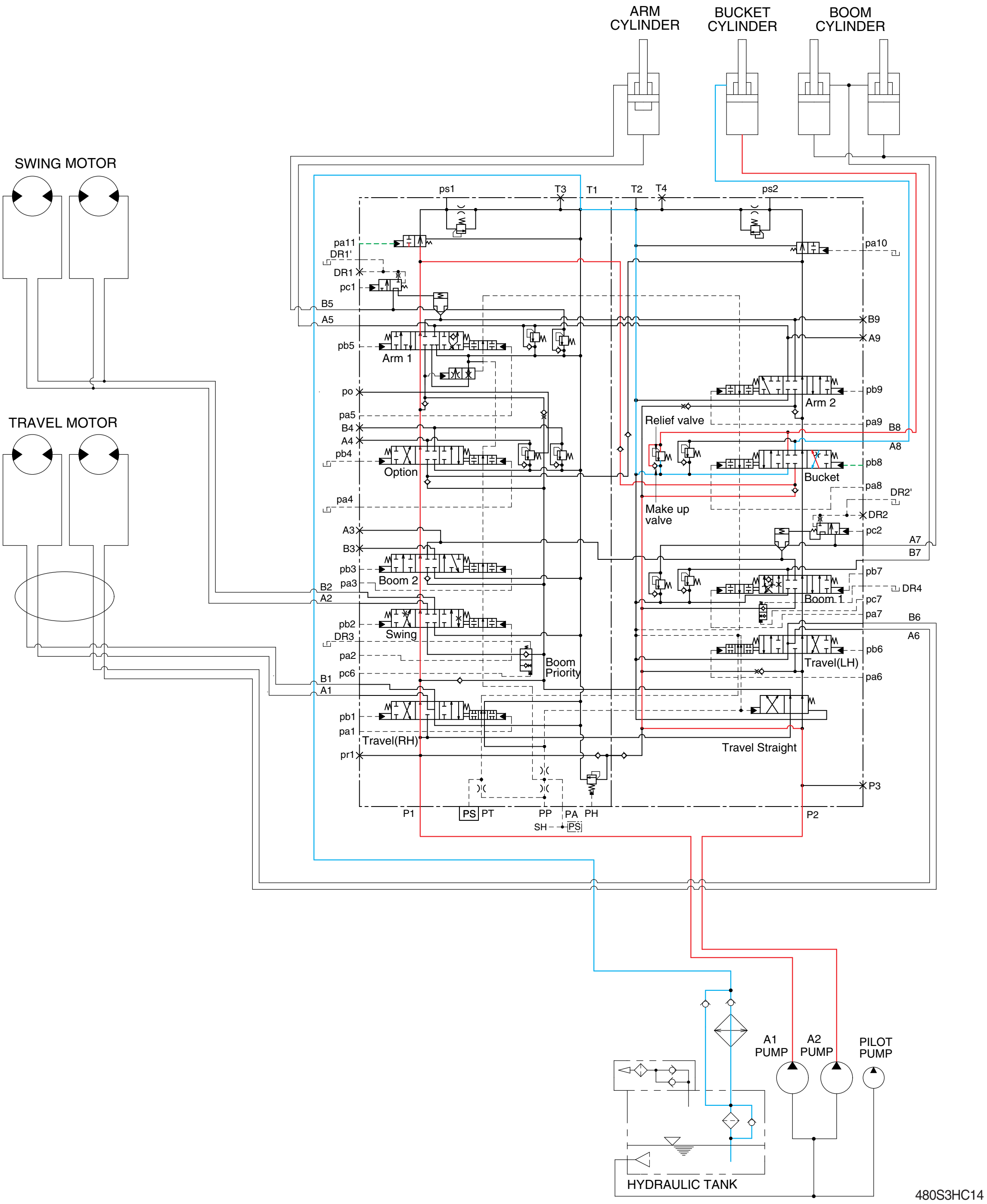
The excessive pressure in the arm cylinder rod side is prevented by relief valve.

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

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

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

5. BUCKET IN OPERATION



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 from the remote control valve.

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

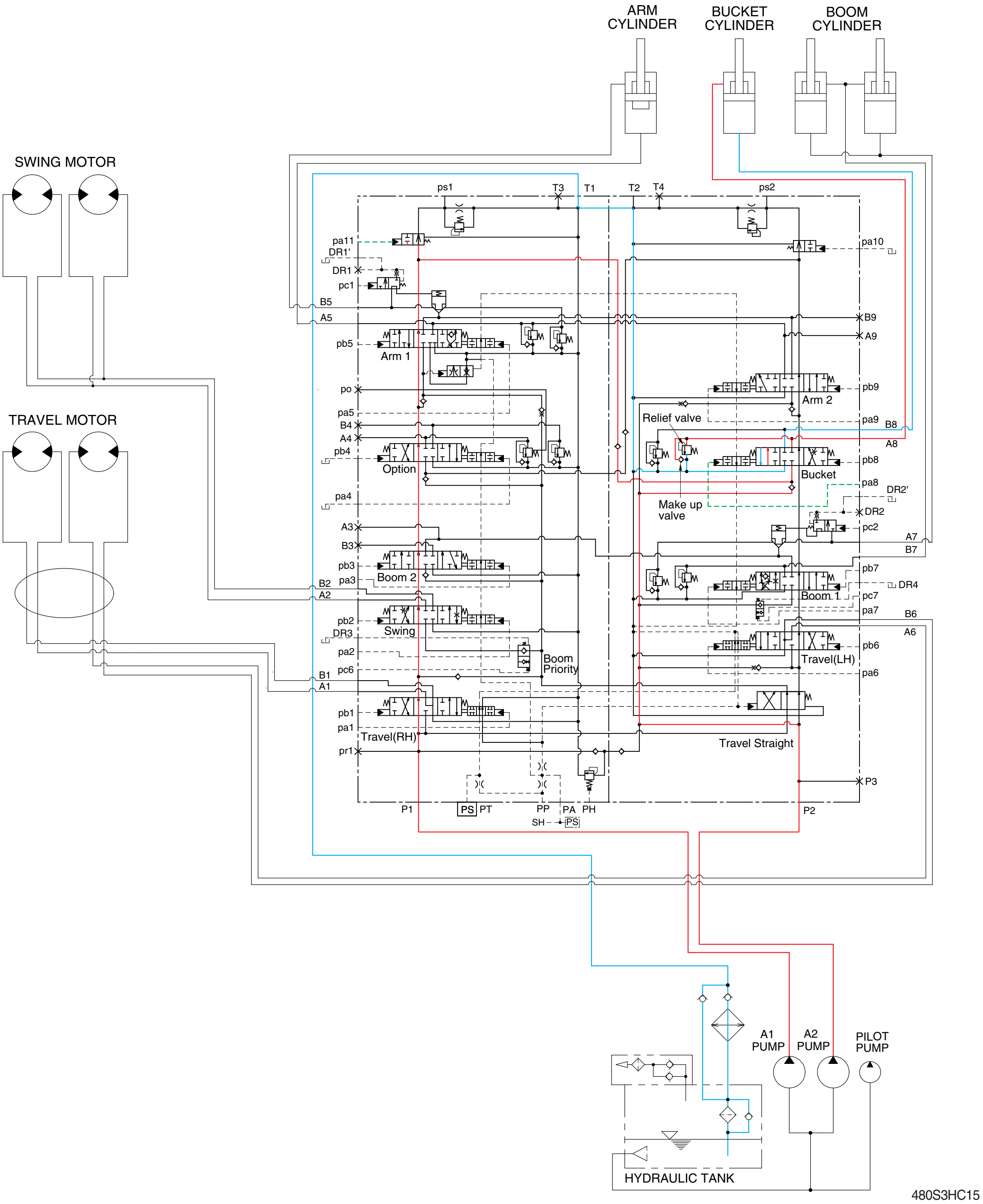
At the same time, the oil from the small chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls in.

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

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

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

6. BUCKET OUT OPERATION



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

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

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

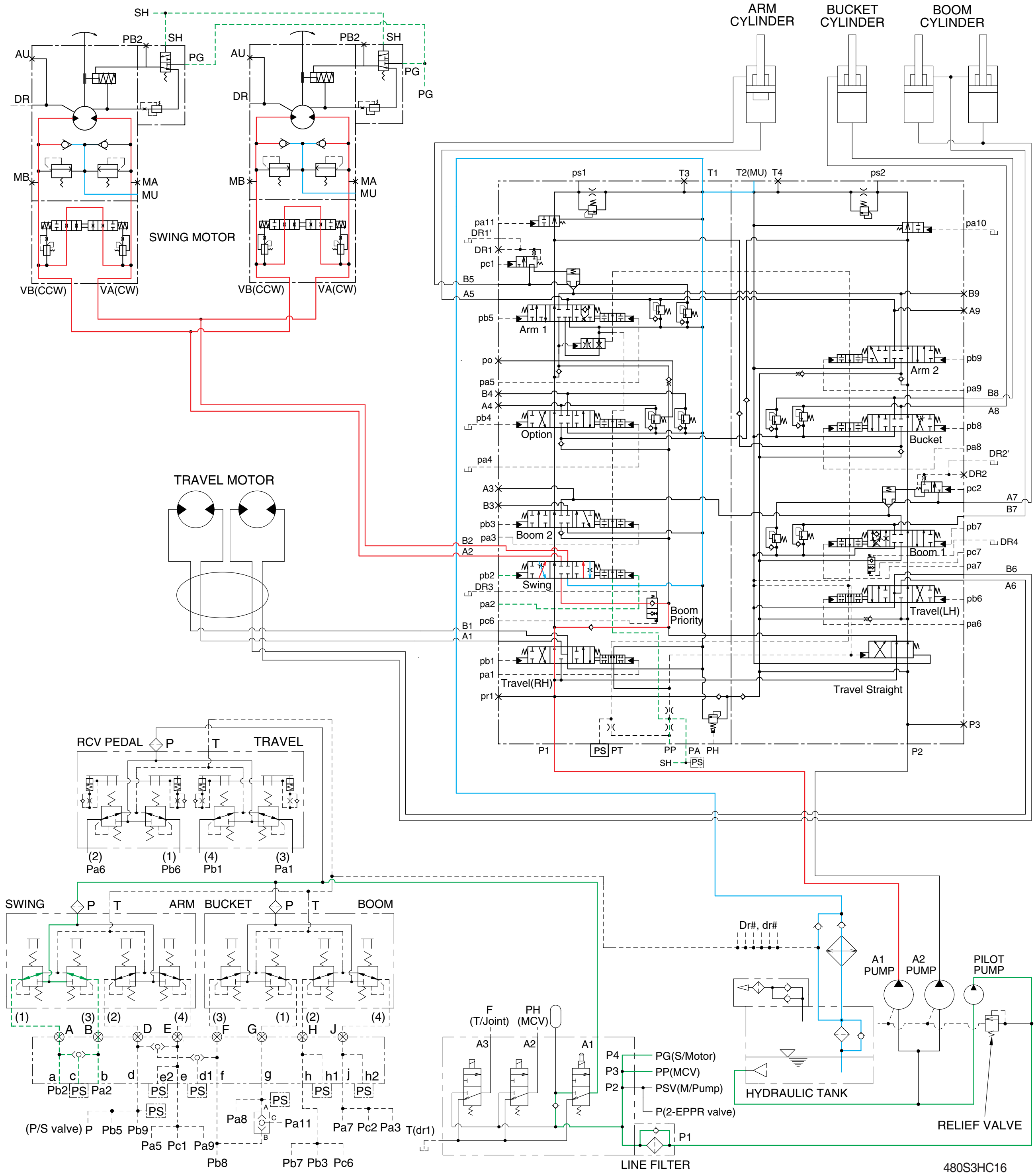
At the same time, the oil from the large chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls out.

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

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

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

7. SWING OPERATION



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

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

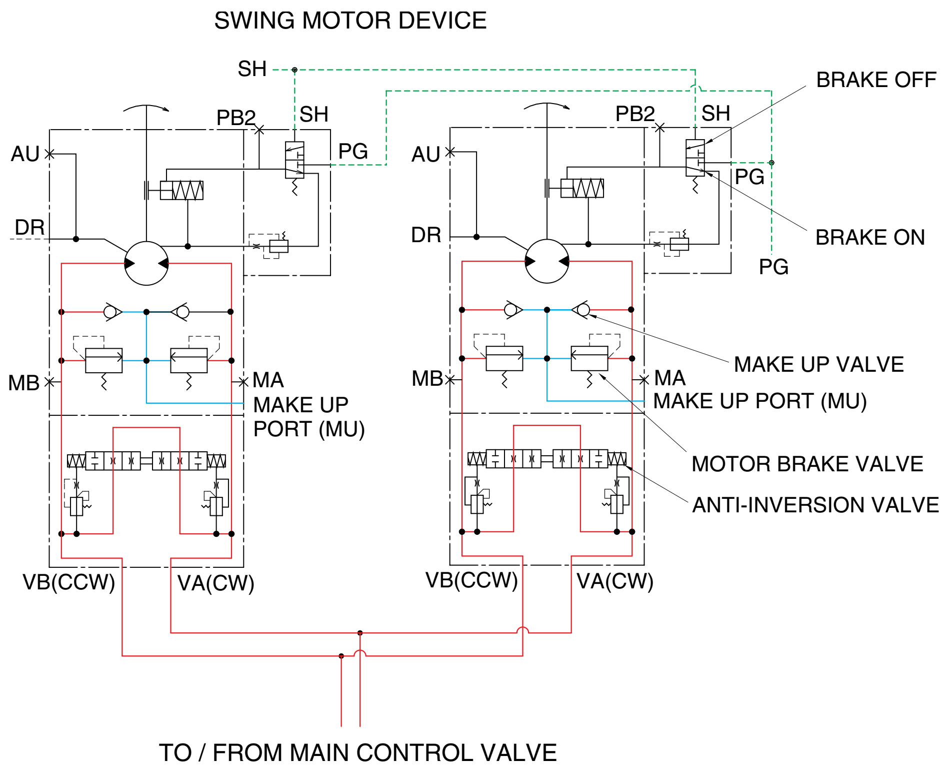
At the same time, the return oil from the swing motor returns to the hydraulic oil tank through the swing spool in the main control valve.

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



480S3HC17

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.

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

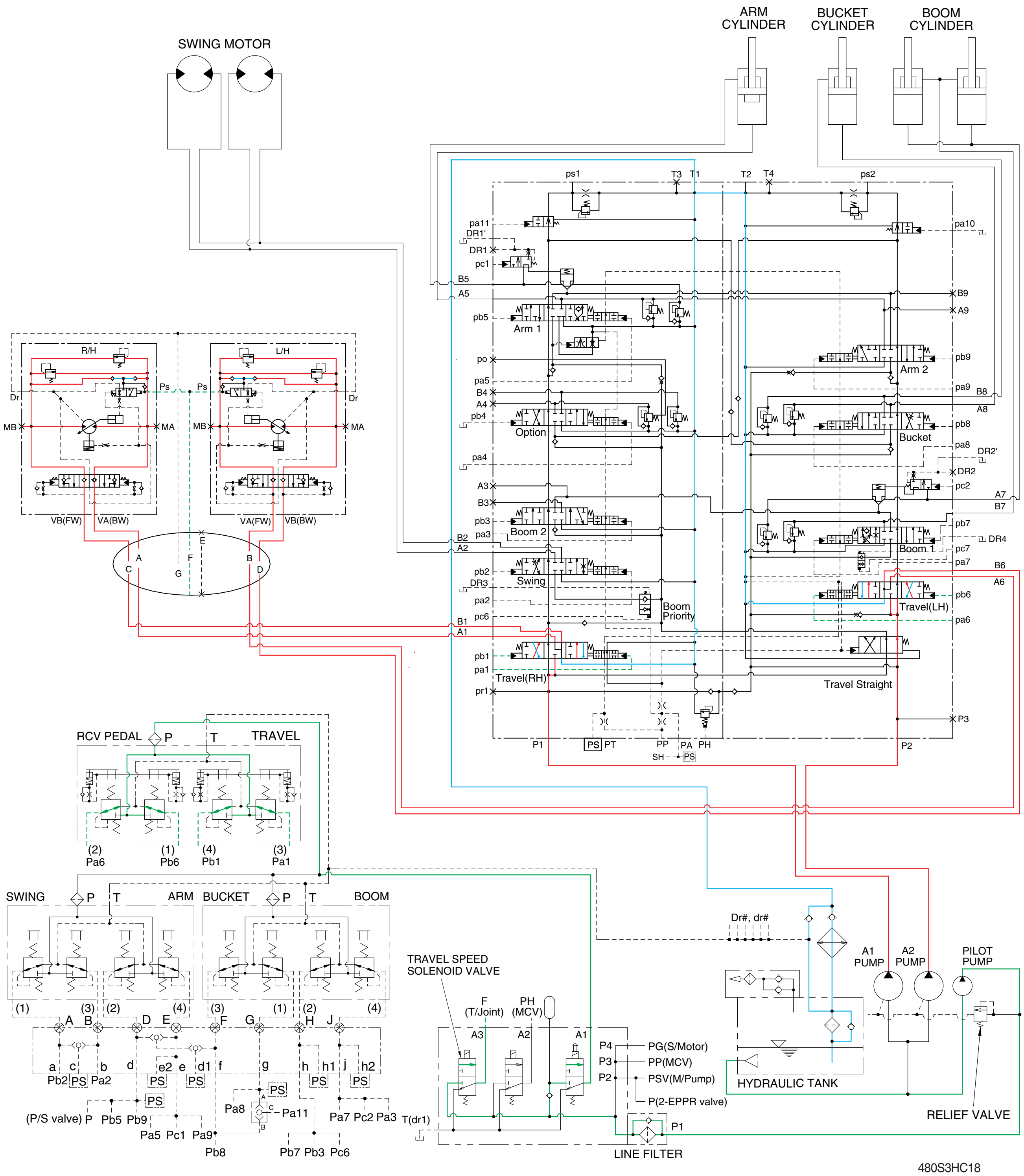
When all of the RCV lever placed in the neutral position, the pressure of the pilot oil passage down. Then the brake release valve returned to the neutral position and the oil is returned from the brake piston to the tank.   And the brake is set to 'ON".

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 from the remote control valve.

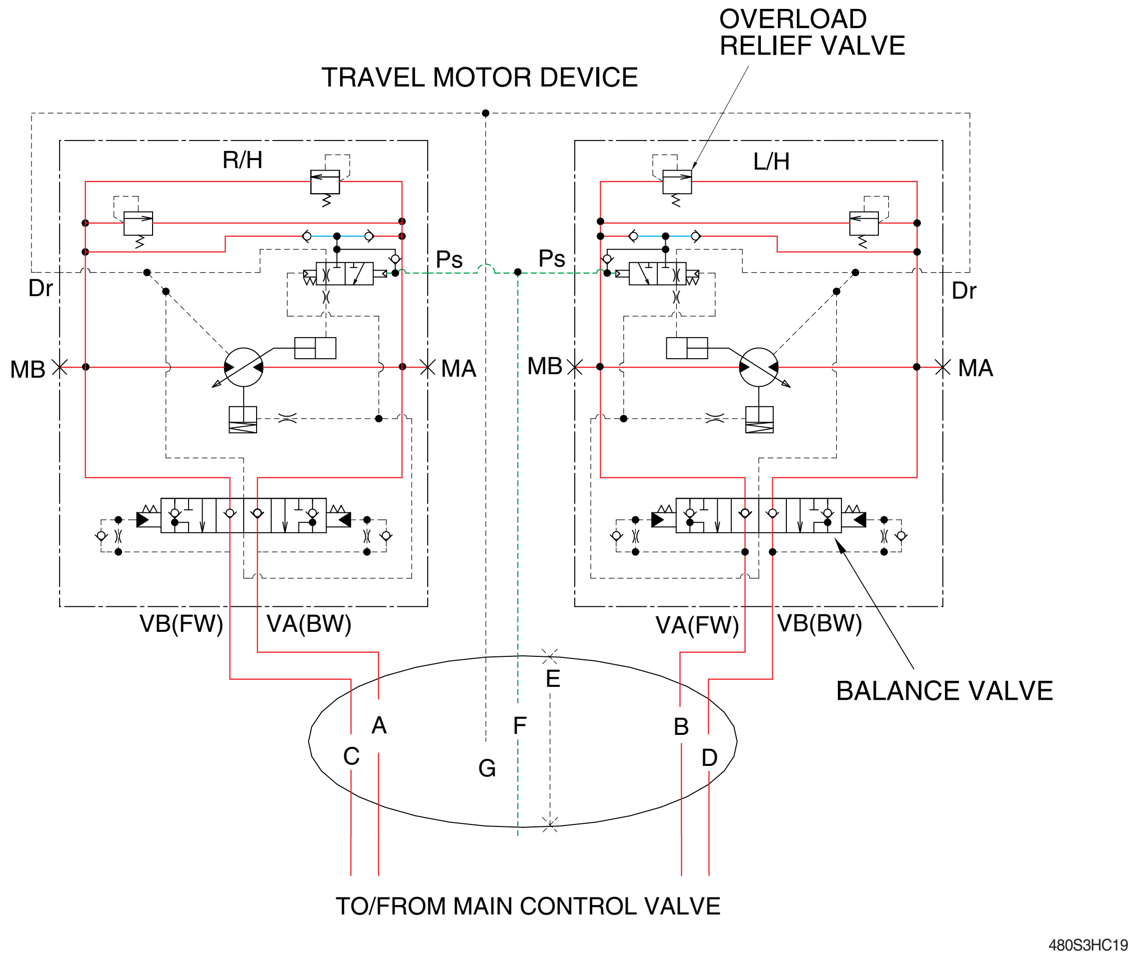
The oil from the each pump flows into the main control valve and then goes to the each travel motor through the turning joint.

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



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

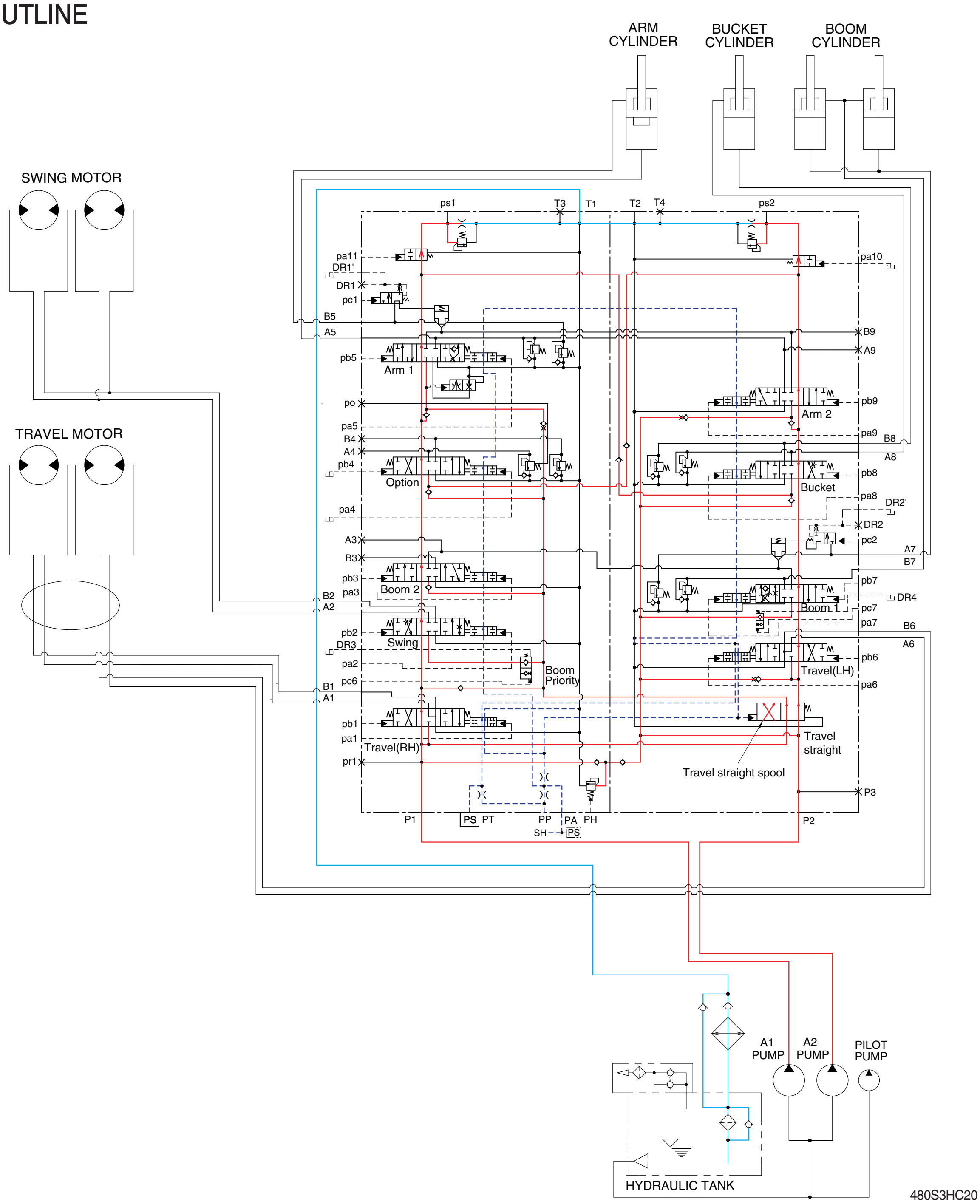
1) COUNTER BALANCE VALVE
   When stopping the motor of slope descending, this valve to prevent the motor over run.

2) OVERLOAD RELIEF VALVE
   Relief valve limit the circuit pressure below 345 kgf/cm² (4910 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

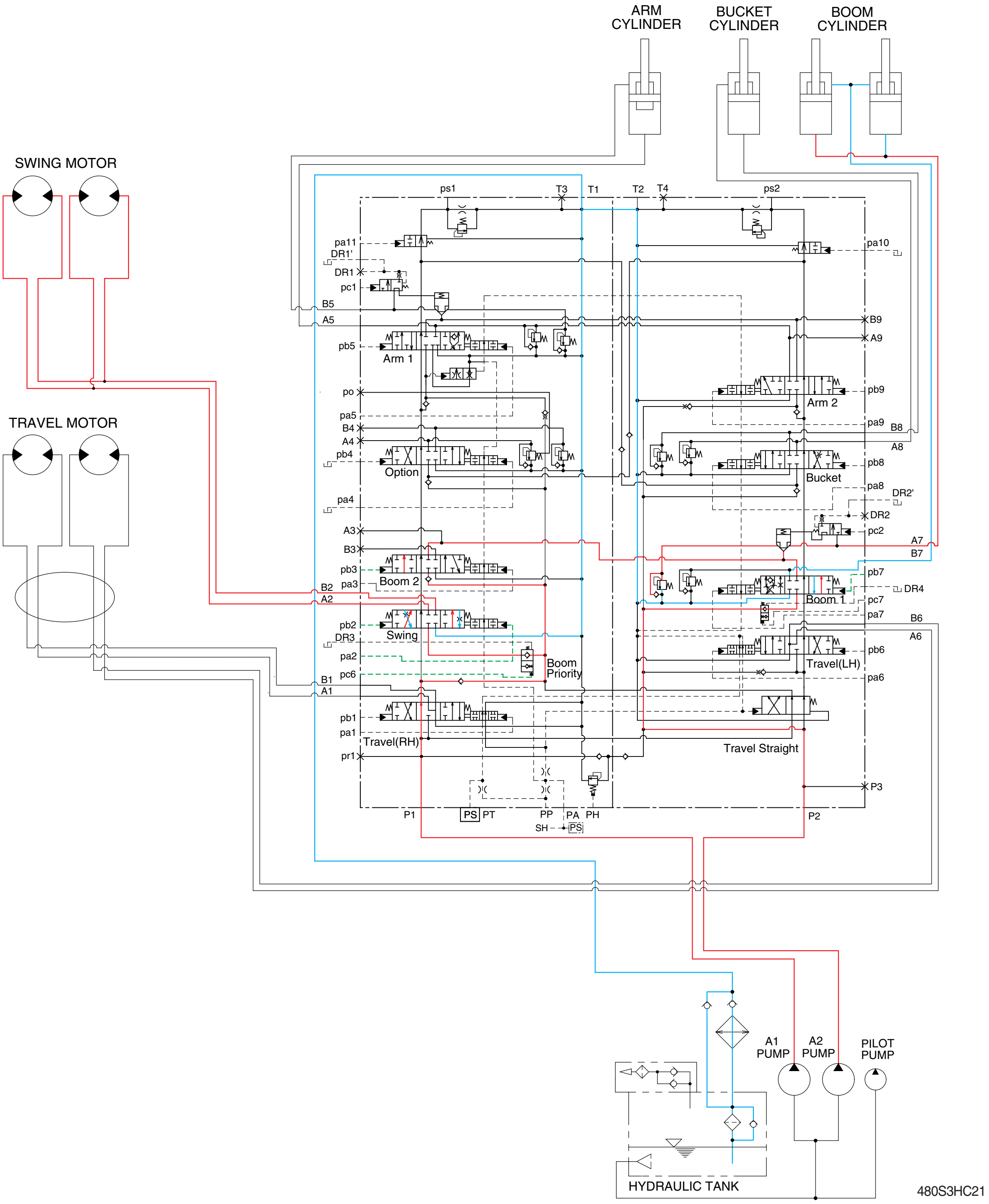
This straight travel spool is provided in the main control valve.

If any actuator is operated when traveling, the straight travel spool is pushed to the right by the pilot oil pressure 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 from the remote control valve.

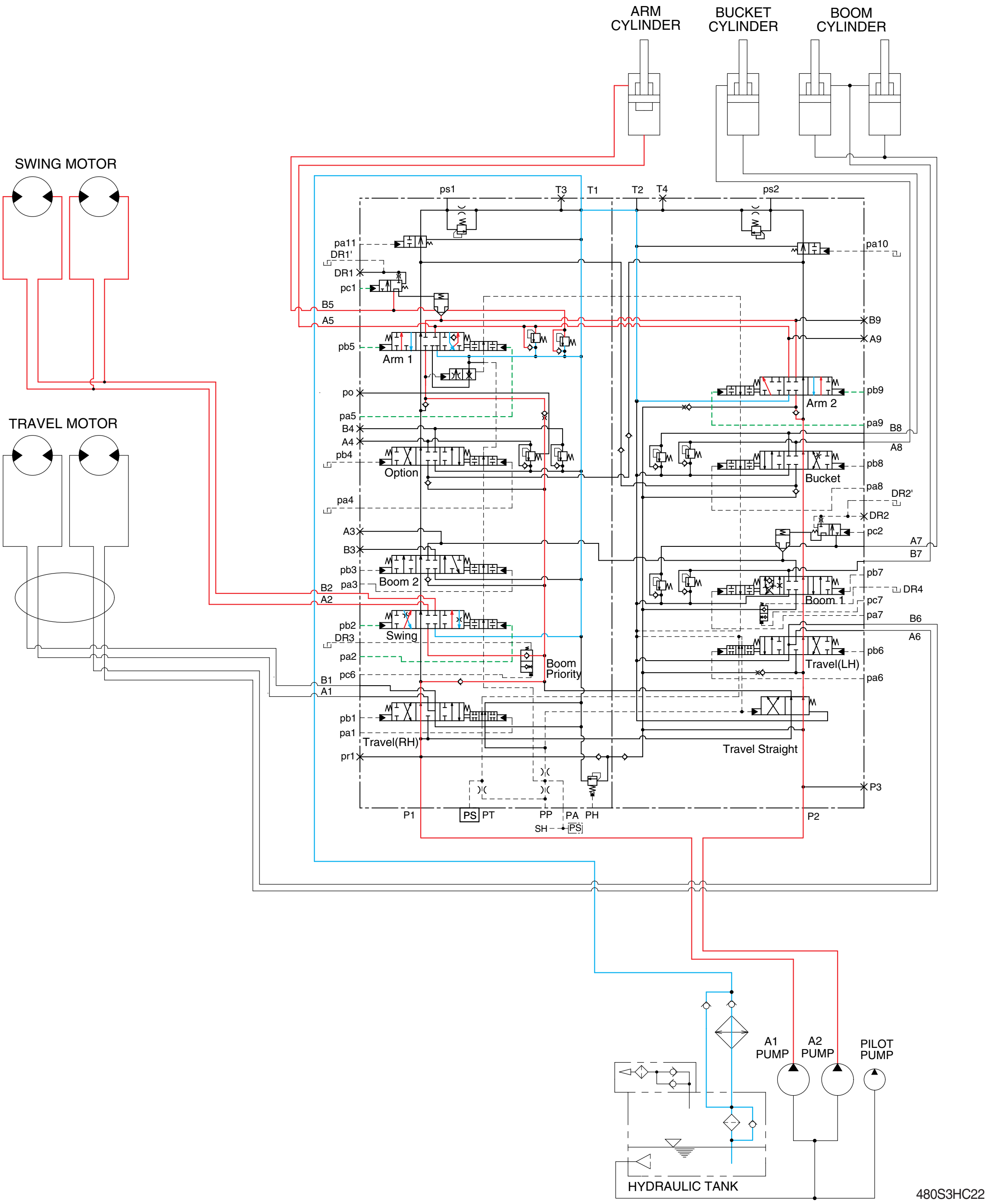
The oil from the A1 pump flows into the swing motor through swing spool and the boom cylinder through boom 2 spool.

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 3-8 for the boom priority system.

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

3. COMBINED SWING AND ARM OPERATION



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

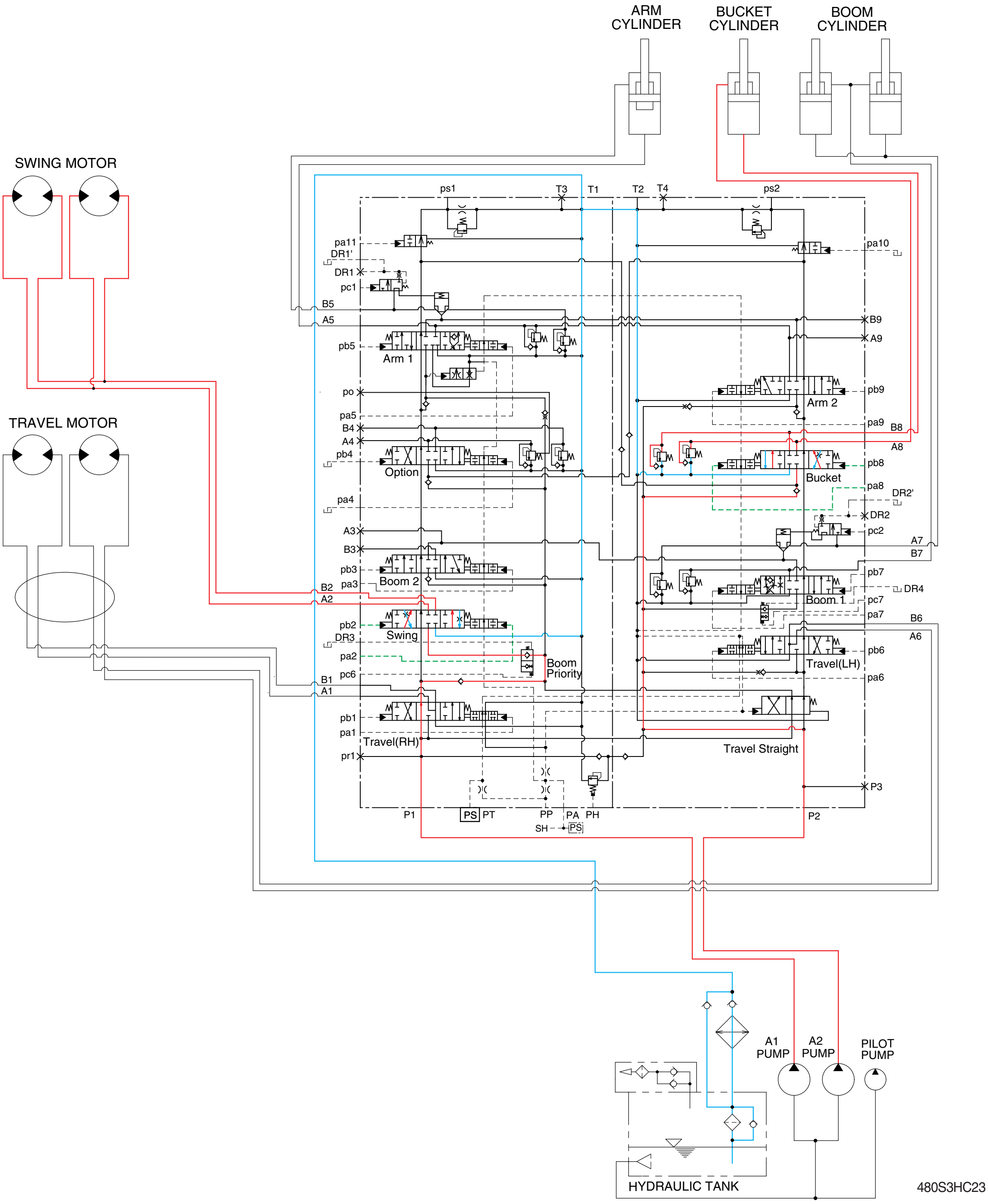
The oil from the A1 pump flows into the swing motor through swing spool and the arm cylinder through arm 1 spool.

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

Refer to page 2-35 for the swing operation preference function.

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

4. COMBINED SWING AND BUCKET OPERATION



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

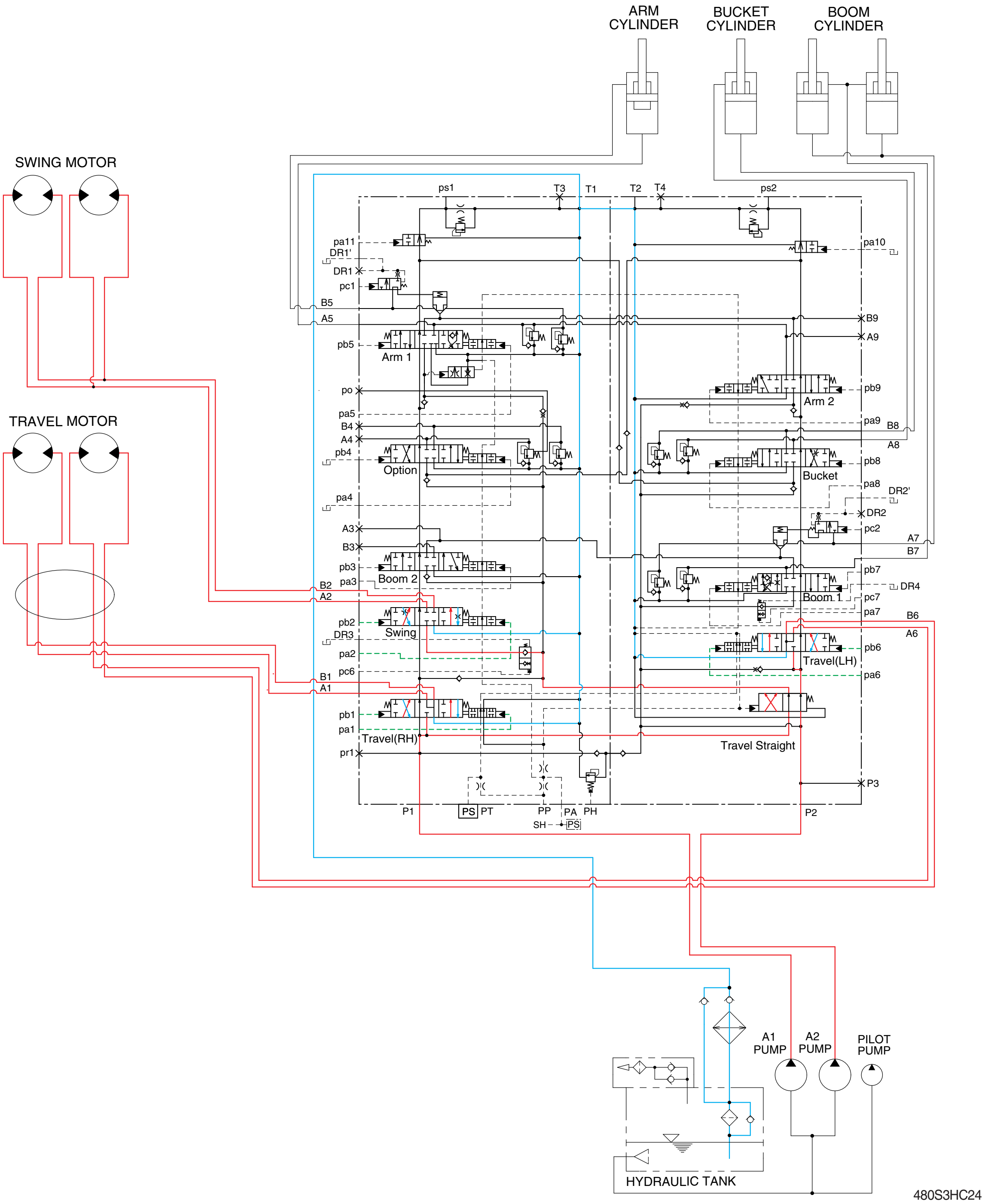
The oil from the A1 pump flows into the swing motor through the swing spool in the left control valve.

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 from the remote control valve and straight travel spool is pushed to the right by the pilot oil pressure from the pilot pump.

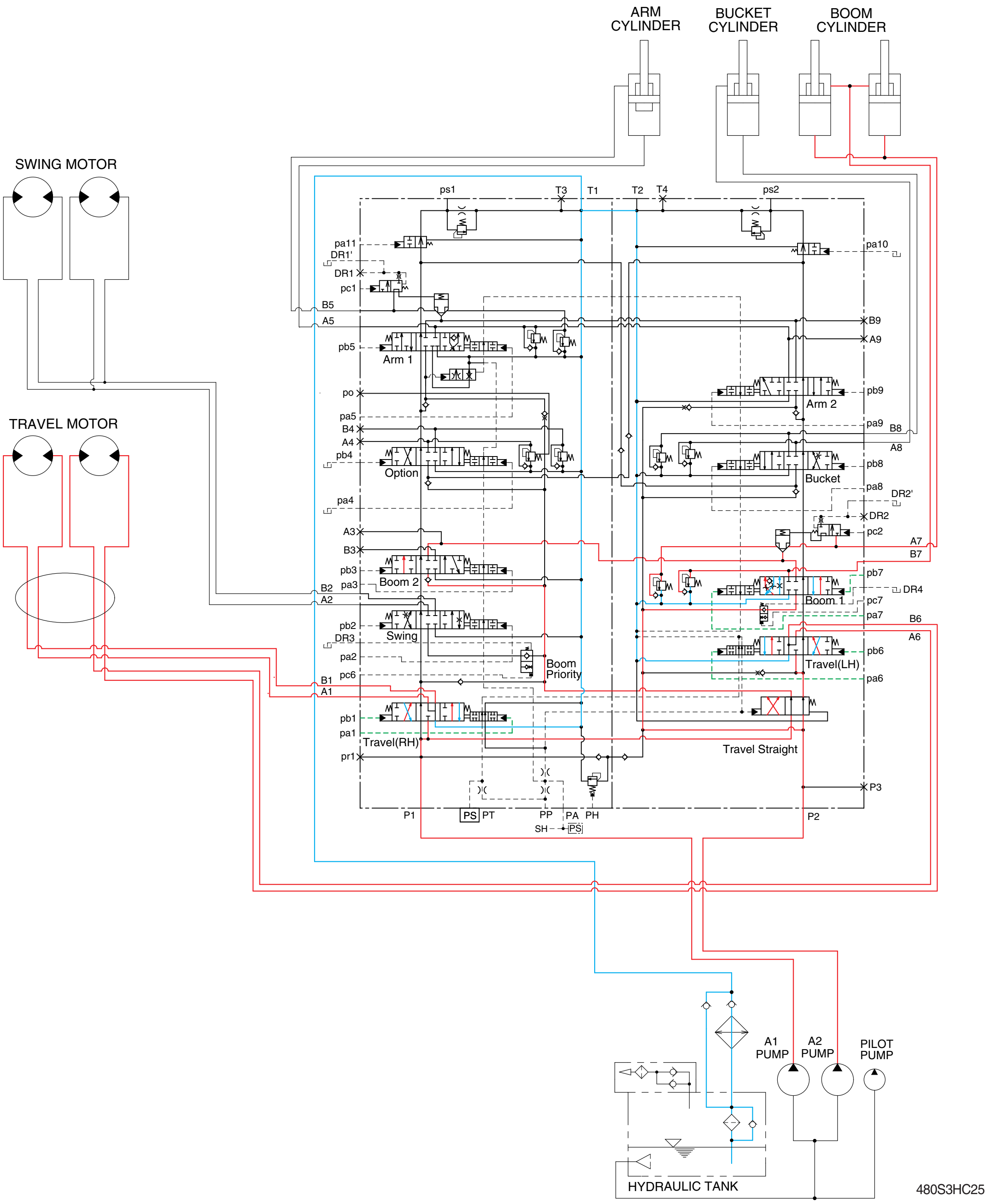
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

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 from the remote control valve and the straight travel spool is pushed to the right by the oil pressure from pilot pump.

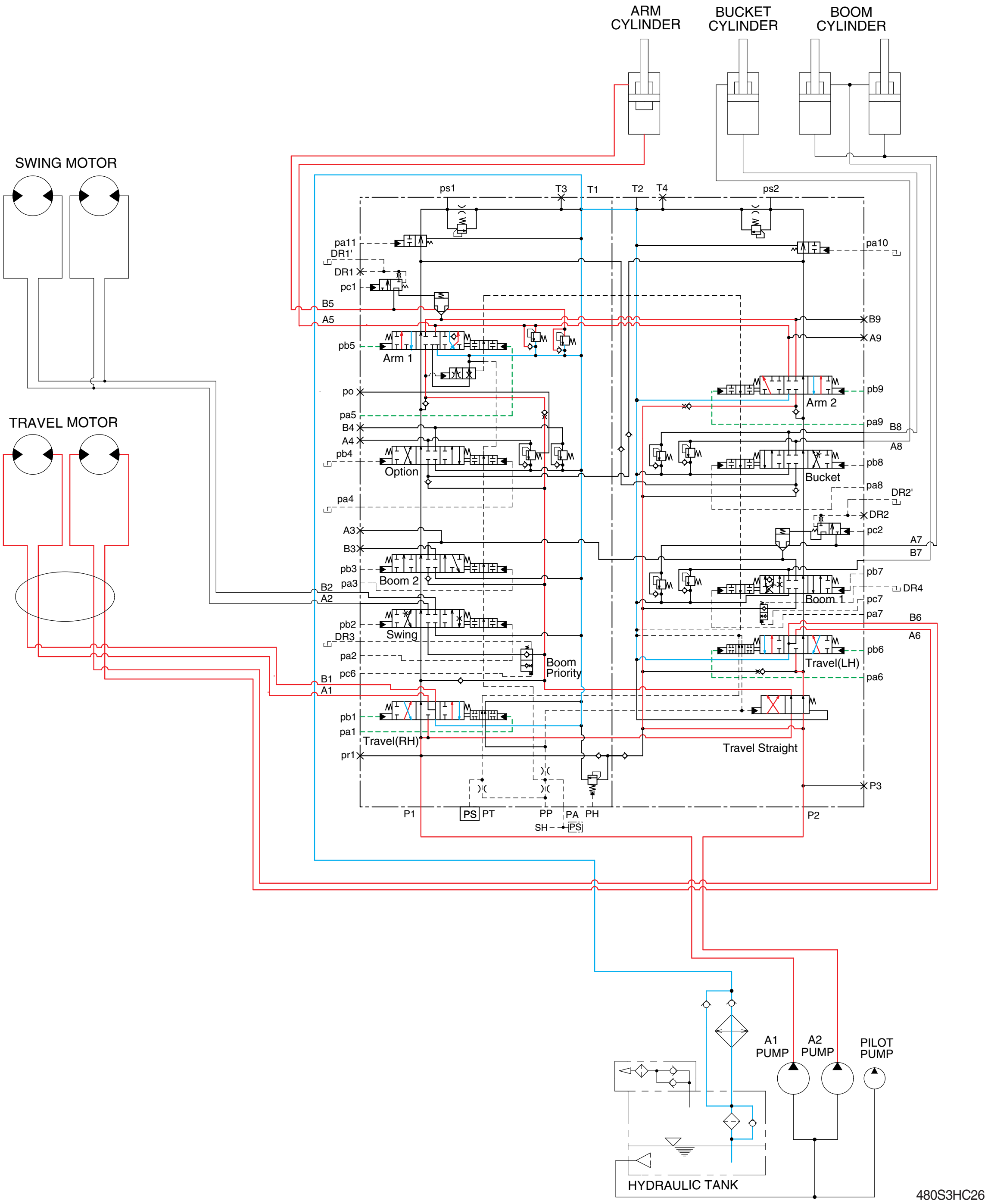
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

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 from the remote control valve and the straight travel spool is pushed to the right by the oil pressure from pilot pump.

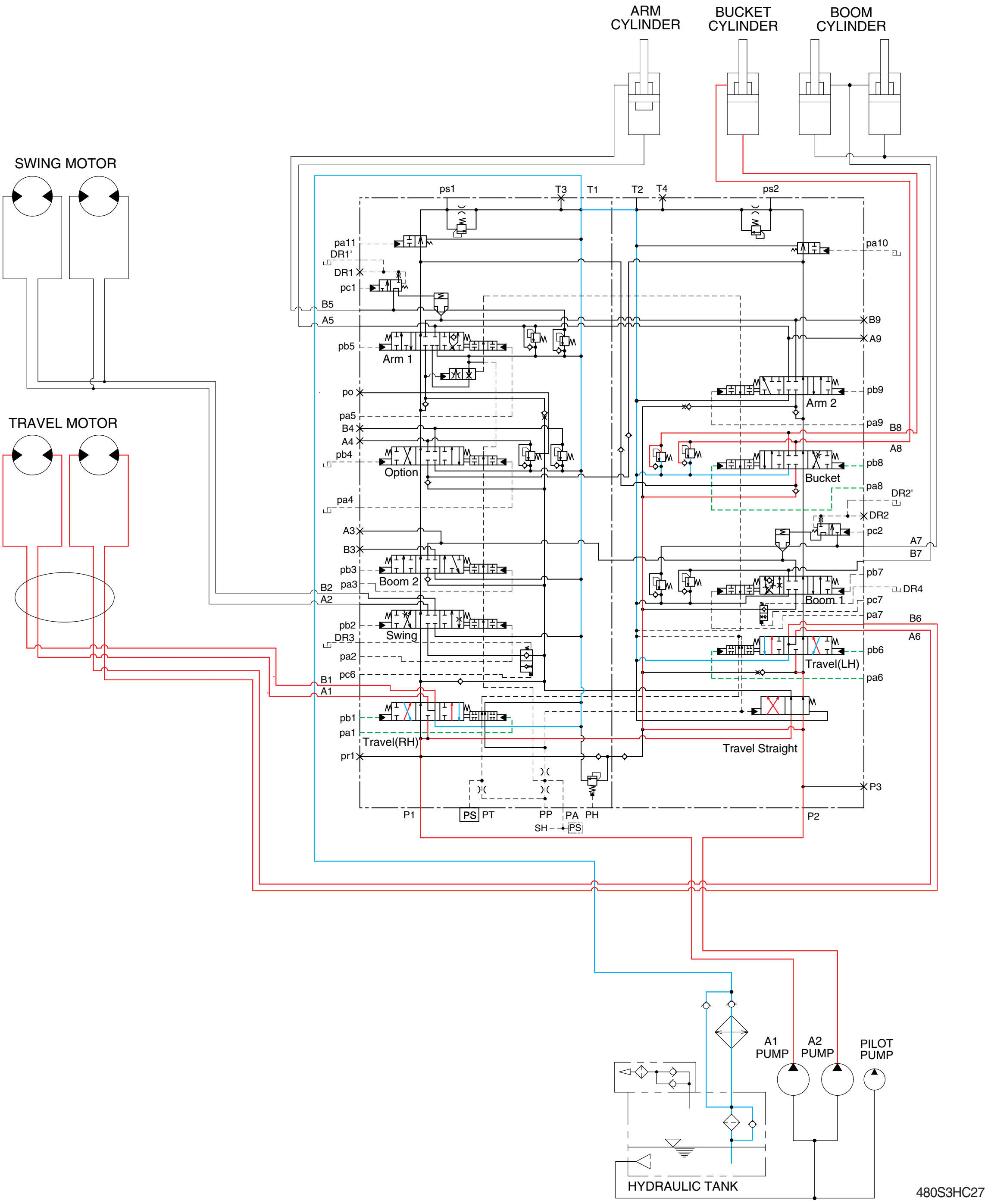
The oil from the A1 pump flows into the travel motors through the RH travel spool of the left control valve and the LH travel spool of the right control valve via the straight travel spool.

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 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.

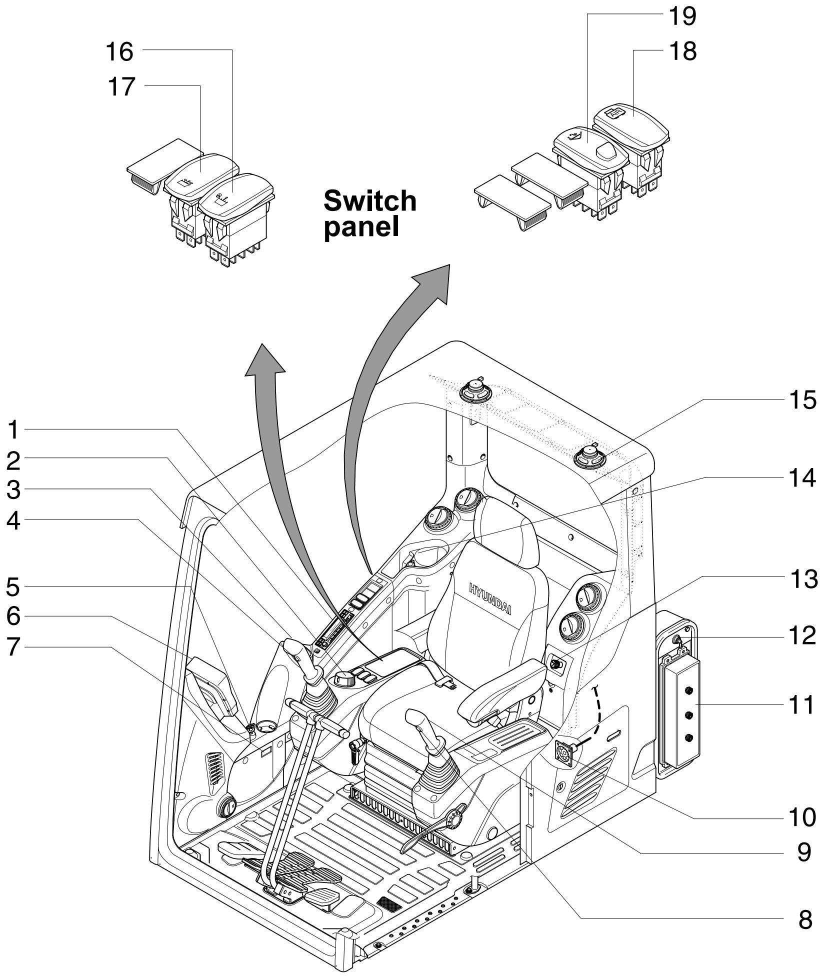
※ The circuit diagram may differ from the equipment, so please check before a repair.

SECTION 4 ELECTRICAL SYSTEM

SECTION 4 ELECTRICAL SYSTEM

GROUP 1 COMPONENT LOCATION

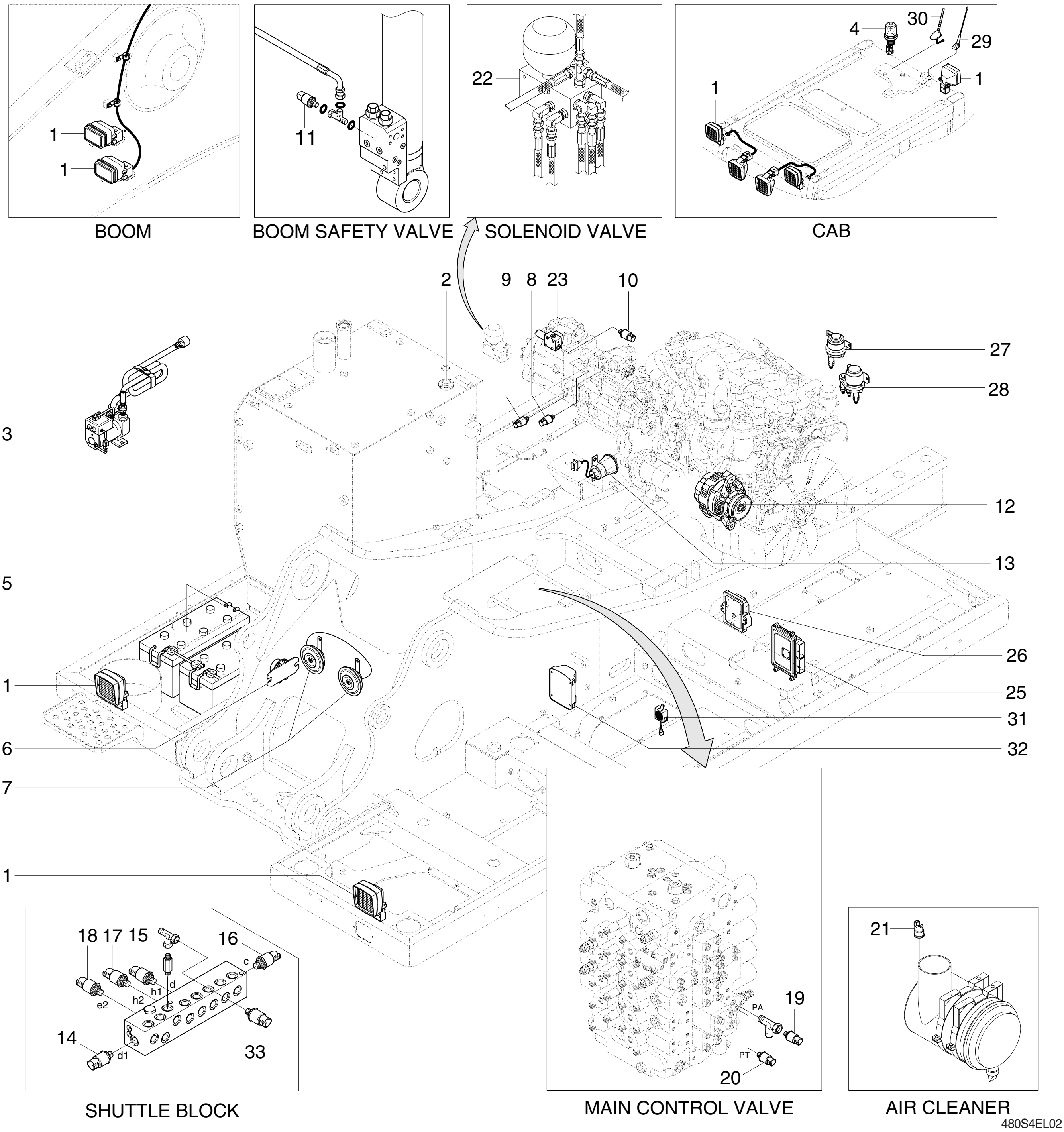
1. LOCATION 1



480S4EL01

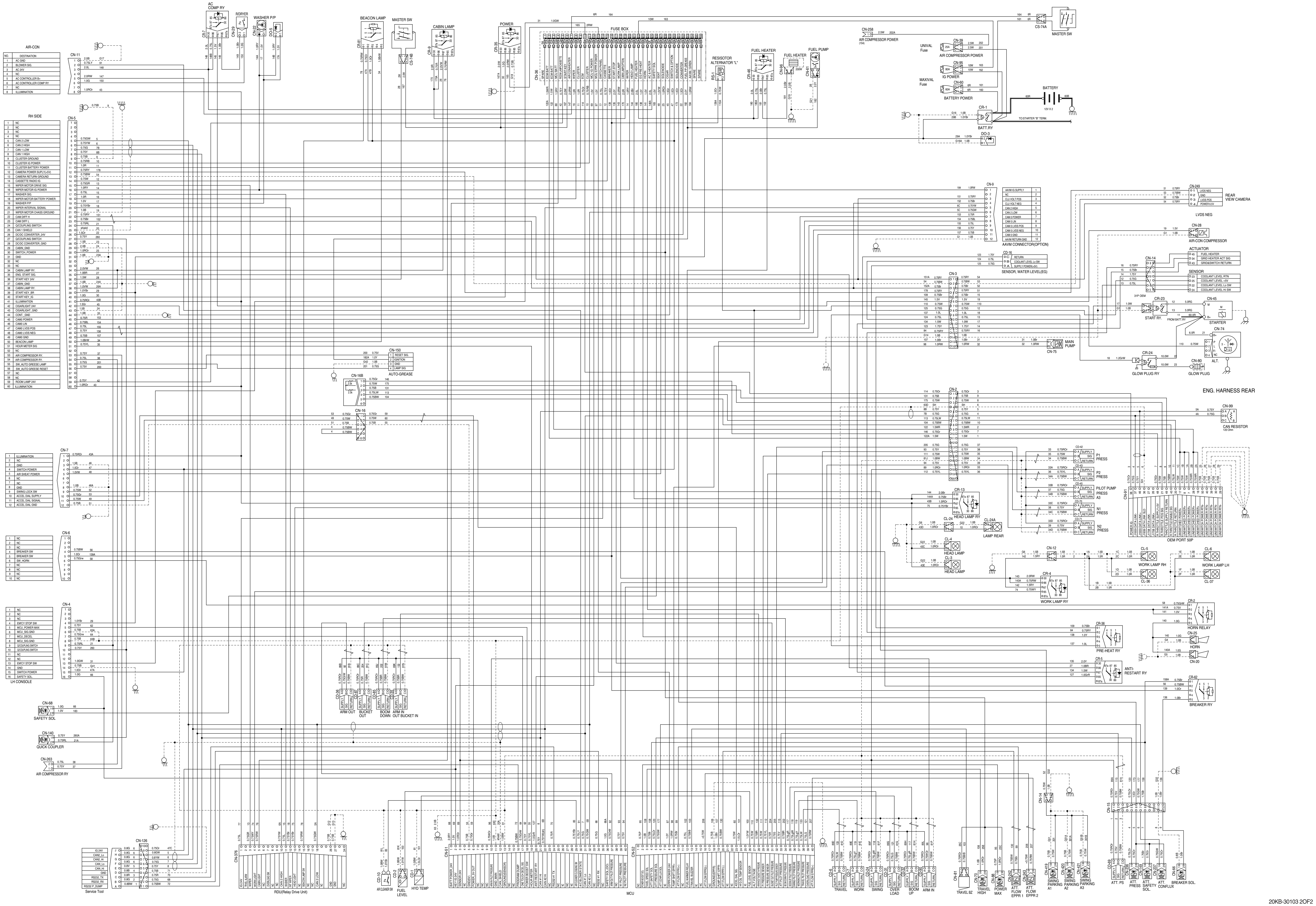
1	Radio & USB player	8	Power max switch	14	Service socket
2	Haptic controller	9	One touch decel switch	15	Speaker
3	Horn switch	10	RS232 service socket	16	Swing fine switch(opt)
4	Cluster	11	Fuse & relay box	17	Swing lock switch(opt)
5	Breaker operation switch	12	Master switch	18	Air compressor switch
6	Starting switch	13	Cigar lighter	19	Quick clamp switch
7	Service meter				

2. LOCATION 2



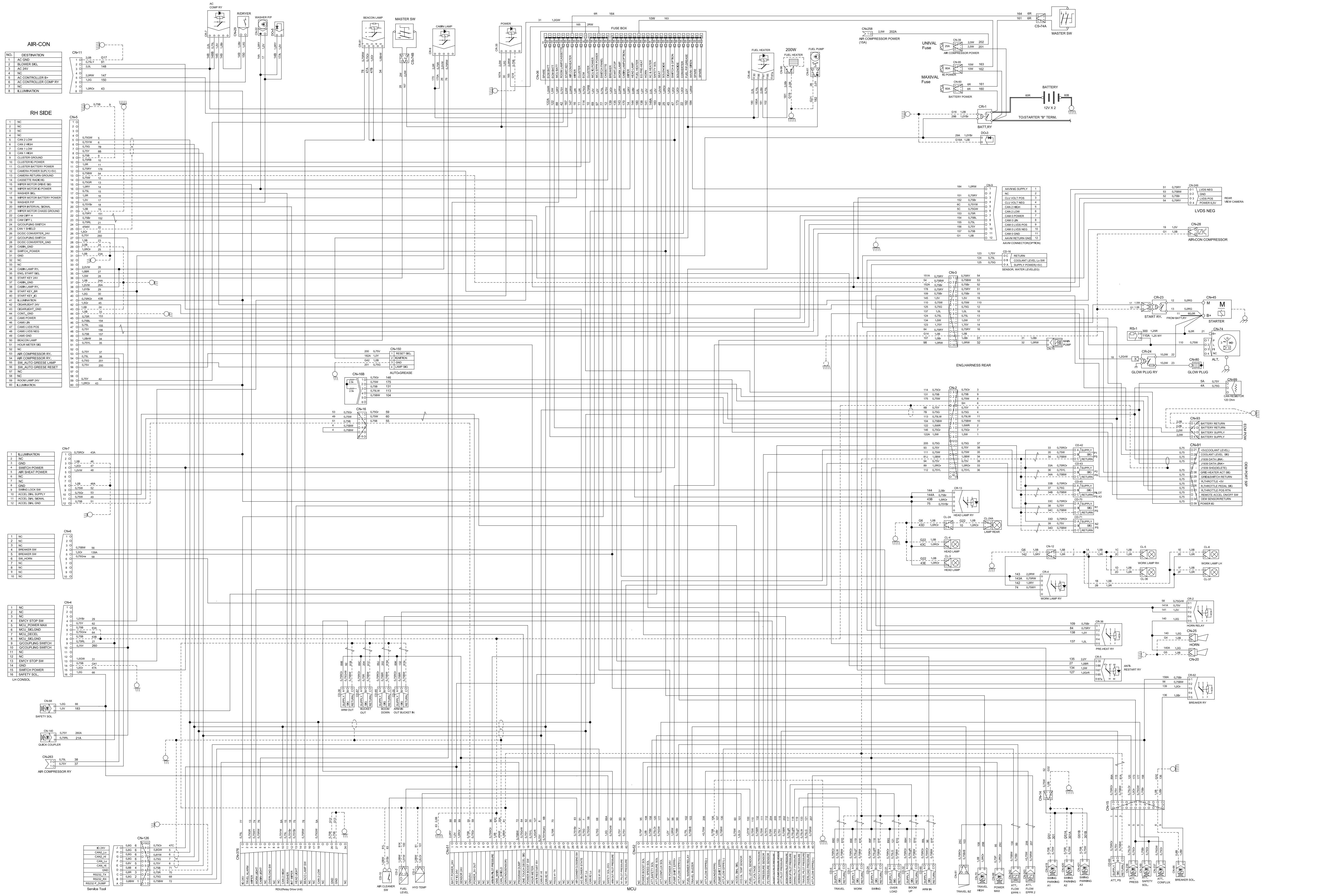
1	Lamp	12	Alternator	23	Pump EPPR valve
2	Fuel sender	13	Travel alarm buzzer	25	Around view controller
3	Fuel filler pump	14	Arm out/Bucket in pressure sensor	26	Relay drive unit
4	Beacon lamp	15	Boom up pressure sensor	27	Start relay
5	Battery	16	Swing pressure sensor	28	Heater relay
6	Battery relay	17	Boom down pressure sensor	29	Satellite antenna
7	Horn	18	Arm in pressure sensor	30	Integrated antenna
8	P1 pressure sensor	19	Attach pressure sensor	31	Remote control unit
9	P2 pressure sensor	20	Travel pressure sensor	32	Warning buzzer
10	EPPR pressure sensor	21	Air cleaner sensor	33	Arm out pressure sensor
11	Overload pressure sensor	22	Solenoid valve	34	Machine control unit

1. ELECTRICAL CIRCUIT (1/2, OLD VERSION)



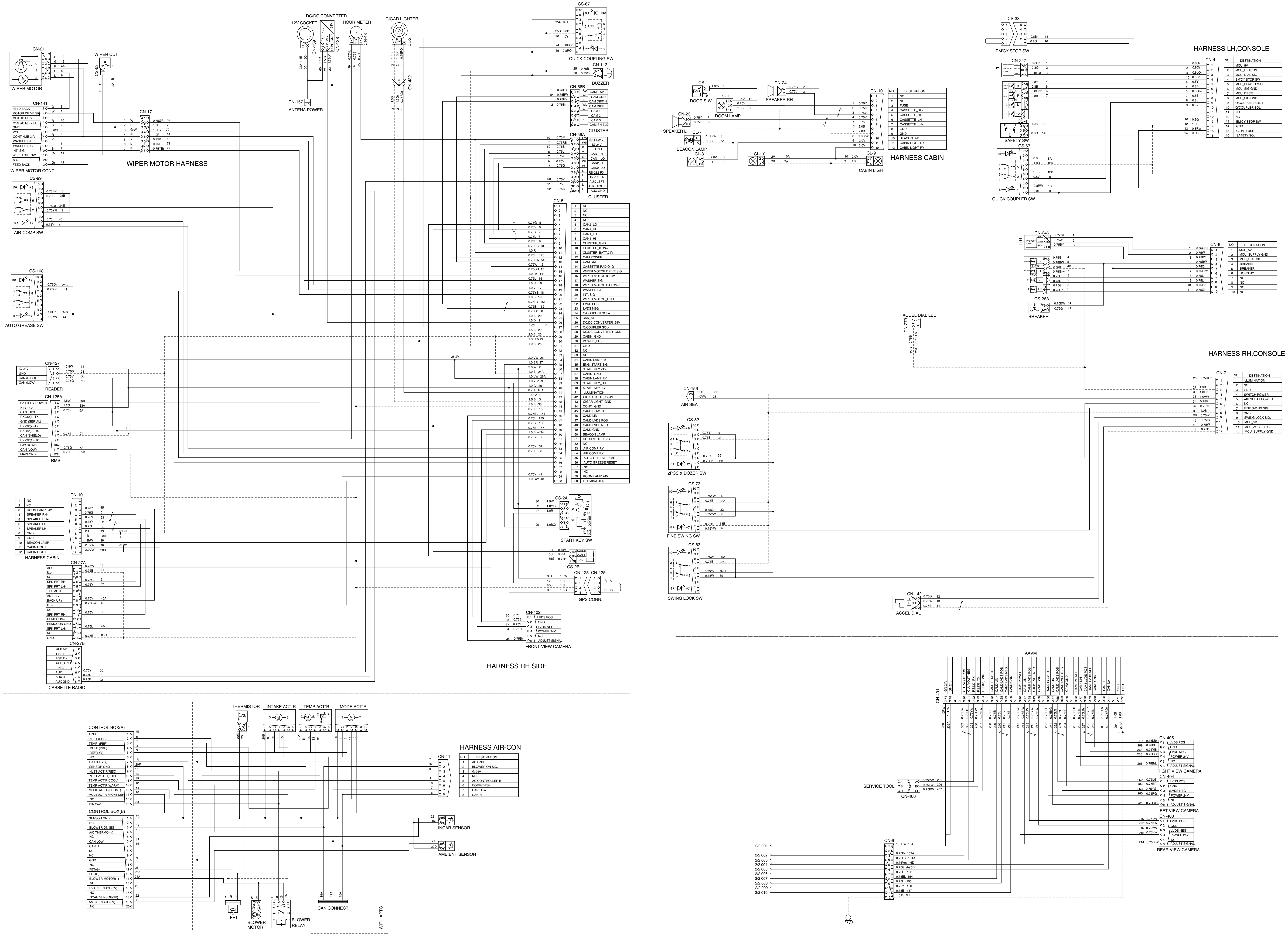
20KB-30103 2OF2

1. ELECTRICAL CIRCUIT (1/2, NEW VERSION)



20KB-30105-02

2. ELECTRICAL CIRCUIT (2/2)



20KB-30103 1OF2

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] → Bettery power fuse [CN-60] → Master switch [CS-74A]

- → Fuse box [No.2] → I/conn [CN-2 (11)] → OEM port [CN-91 (8, 7, 17)]
- → Fuse box [No.3] → I/conn [CN-2 (9)] → OEM port [CN-91 (18, 28)]
- → Fuse box [No.4] → MCU [CN-51 (1)]
- → Fuse box [No.5] → 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.6]
  - → Master switch [CS-74B] → I/conn [CN-5 (36)]
    - → Start switch [CS-2A (1)]
    - → RMS [CN-125A (1)]
    - → GPS connection [CN-125 (1)]
  - → Power relay [CR-35 (30)]
- → Fuse box [No.7] → I/conn [CN-11 (5)]
  - → AC & Heater controller box (A) (7)
  - → Blower relay (4)
- → Fuse box [No.8] → I/conn [CN-5 (18)] → I/conn [CN-17 (5)]
  - → Wiper motor controller [CN-141 (7)]
  - → Wiper motor [CN-21 (4)]
- → Fuse box [No.9] → I/conn [CN-5 (11)]
  - → Cluster [CN-56A (1)]
  - → Hour meter [CN-48 (1)]

※ I/conn : Intermediate connector

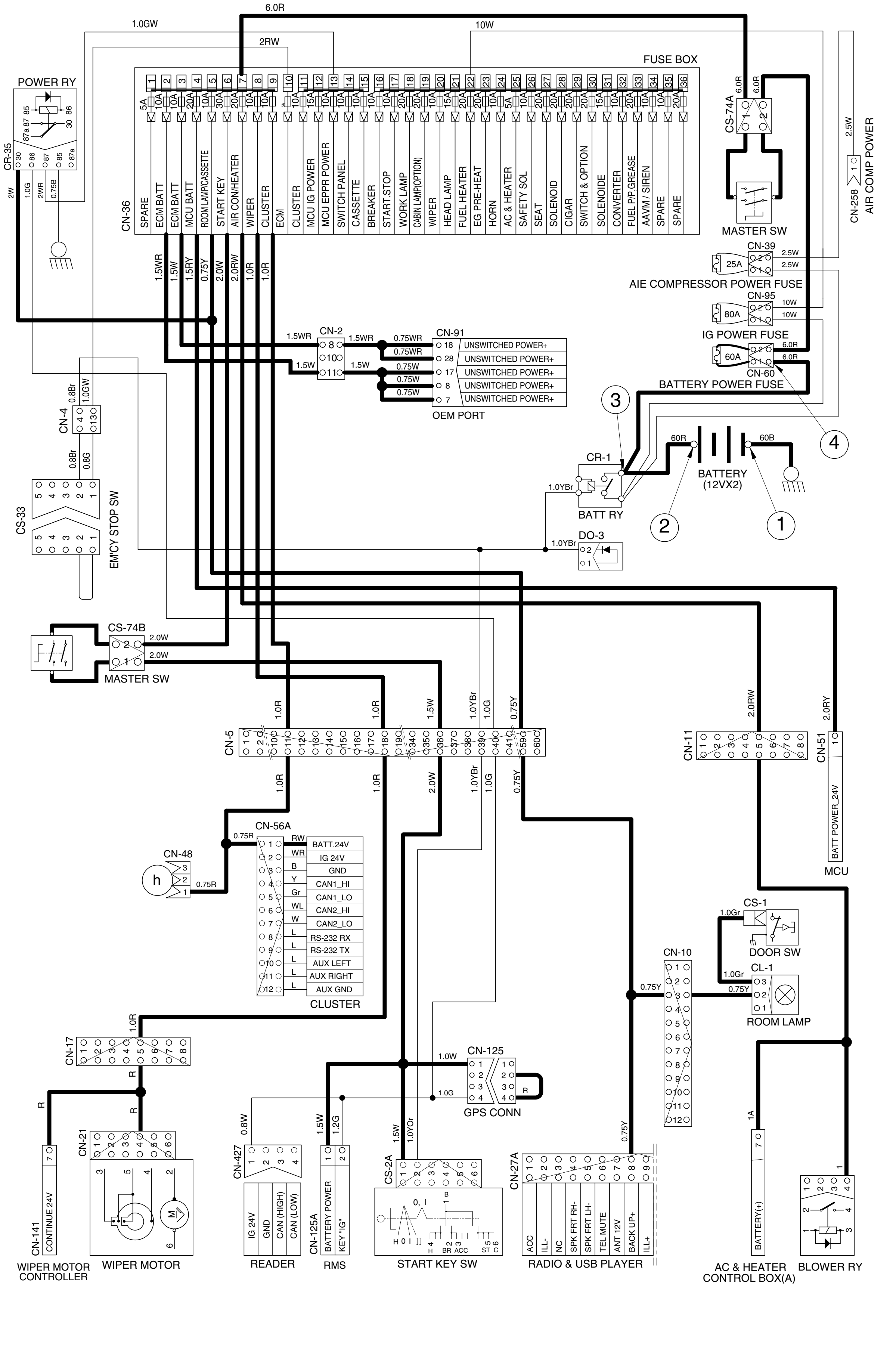
2) CHECK POINT

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 (battery power fuse)	20~25V

※ GND : Ground

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

POWER CIRCUIT



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

2. STARTING CIRCUIT

1) OPERATING FLOW

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

(1) When start key switch is in ON position

→ Start switch ON [CS-2A (2)] → I/conn [CN-5 (39)]
→ Battery relay [CR-1] → Battery relay operating (all power is supplied with the electric component)
→ Start switch ON [CS-2A (3)] → GPS conn [CN-125 (2) → (4)]
→ I/conn [CN-5 (40)] → Power relay [CR-35 (86) → (87)]
→ Fuse box [No.12] → MCU [CN-51 (2)]
→ Reader [CN-427 (1)]
→ RMS [CN-125A (2)]

(2) When start key switch is in START position

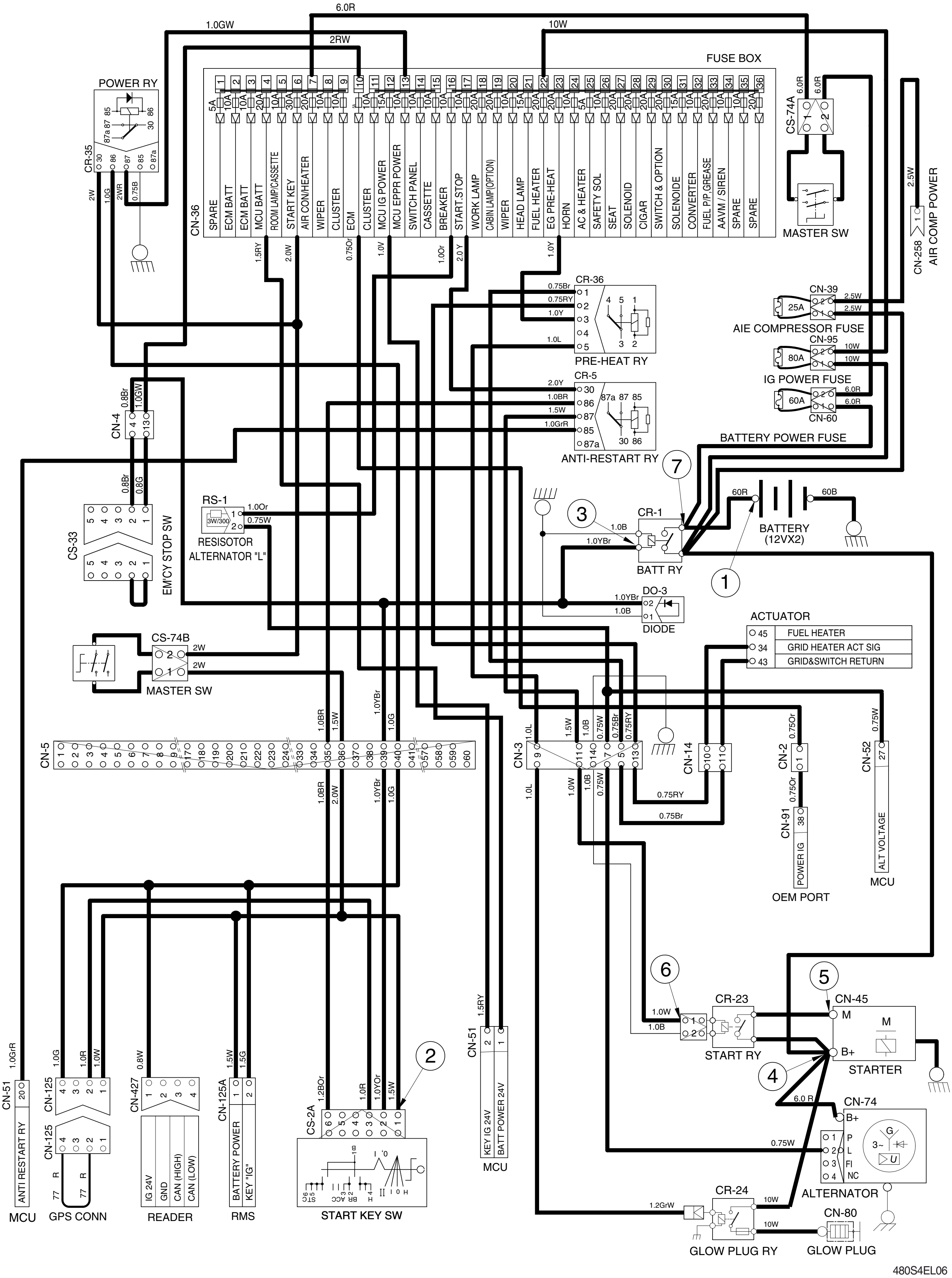
Start switch START [CS-2A (6)] → I/conn [CN-5 (35)] → Anti-restart relay [CR-5 (86) → (87)]
→ I/conn CN-3 (11) → Start relay [CR-23] → Starter motor operating

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 (2)] → I/conn [CN-1 (7)] → United MCU alternator voltage [CN-52 (27)]
→ Cluster charging warning lamp (Via CANbus interface)

(2) Charging flow

Alternator [CN-74 (B^+)] → Start motor [CN-45 (B^+)] → Battery relay (M8)
→ Battery (+) terminal
→ Battery power fuse [CN-60] → Master switch [CS-74A] → Fuse box [No.1~9]
→ IG power fuse [CN-95] → Fuse box [No.16~36]
→ Air compressor power fuse → Air compressor power [CN-258 (1)]

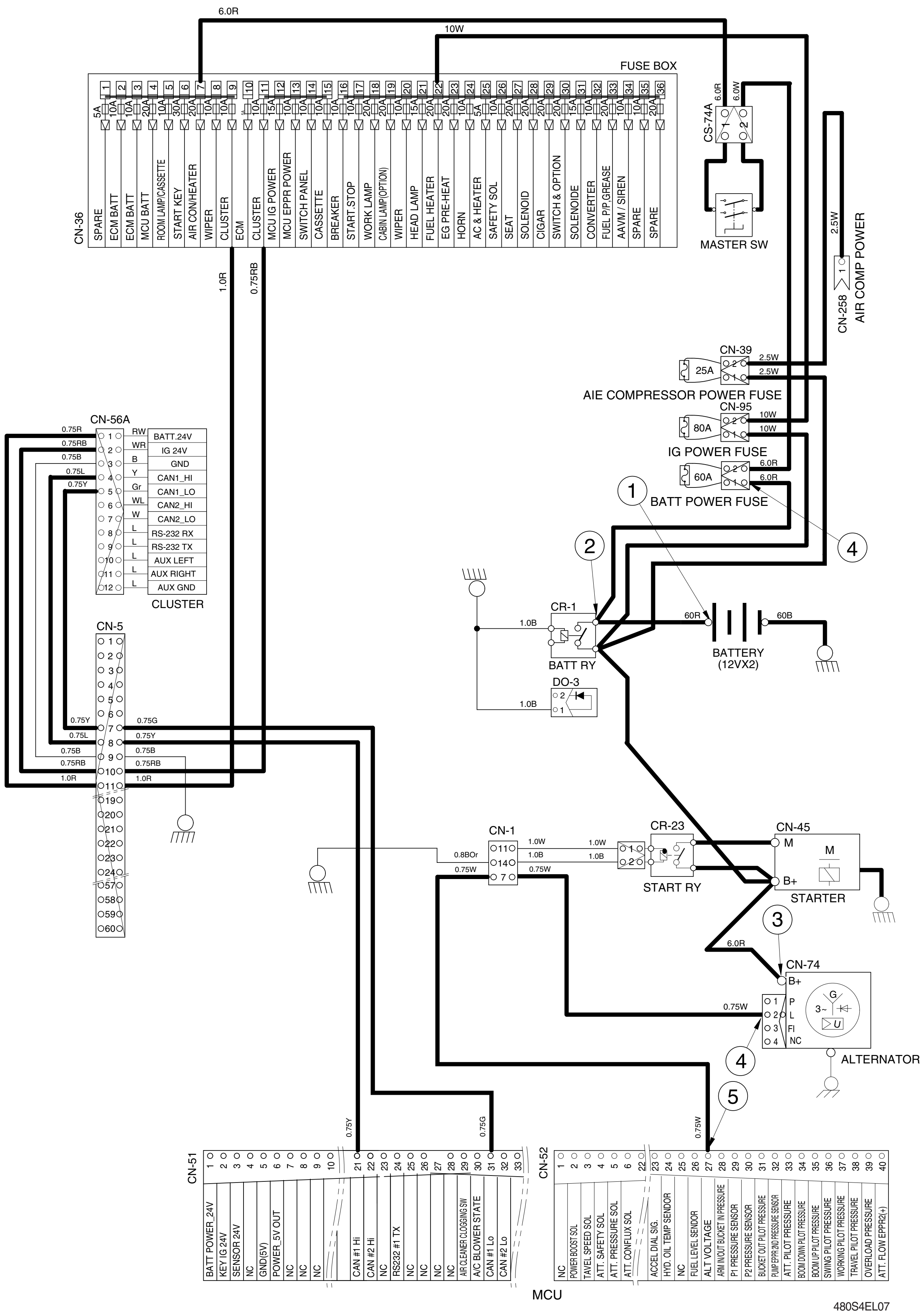
2) CHECK POINT

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.21) → Head light relay [CR-13 (30, 86)]
Fuse box (No.18) → Work light relay [CR-4 (30, 86)]
Fuse box (No.14) → Relay drive unit [CN-376 (1)]

(1) Head light switch ON

Head light switch ON [CN-376 (13)] → Head light relay [CR-13 (85) → (87)]
→ Head light ON [CL-3 (2), CL-4 (2), CL-24A (1)]
→ I/conn [CN-5 (41)] → 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-36 (2), CL-6 (2), CL-37 (2)]

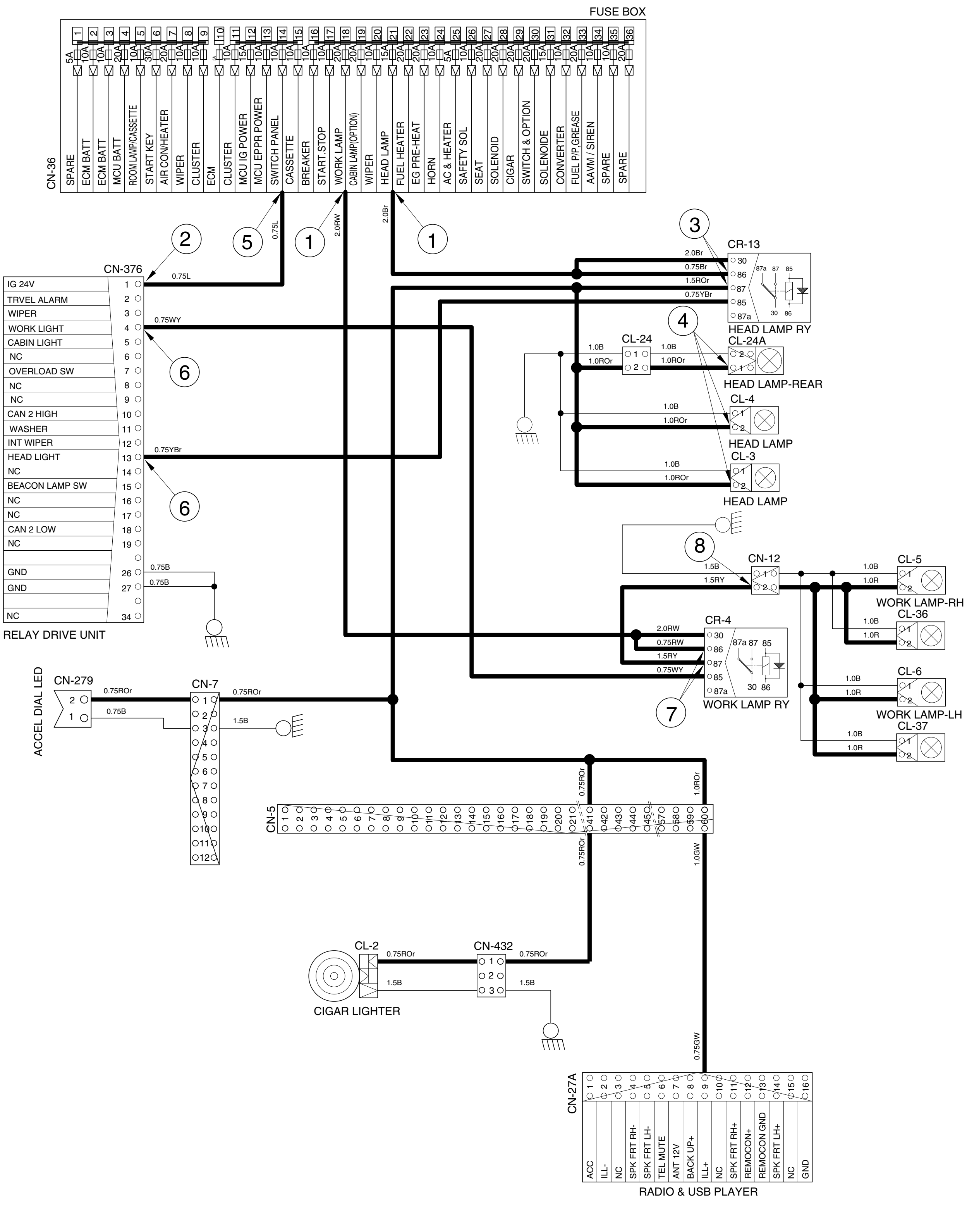
2) CHECK POINT

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 input) ⑦ - GND (work light relay) ⑧ - GND (work light)	20~25V

※ GND : Ground

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

HEAD AND WORK LIGHT CIRCUIT



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

5. BEACON LAMP AND CAB LIGHT CIRCUIT

1) OPERATING FLOW

Fuse box (No.30) → Beacon lamp relay [CR-81 (2, 3)]
Fuse box (No.19) → Cab light relay [CR-9 (30, 86)]
Fuse box (No.14) → Relay drive unit [CN-376 (1)]

(1) Beacon lamp switch ON

Beacon lamp switch ON [CN-376 (15)] → Beacon lamp relay [CR-36 (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)]

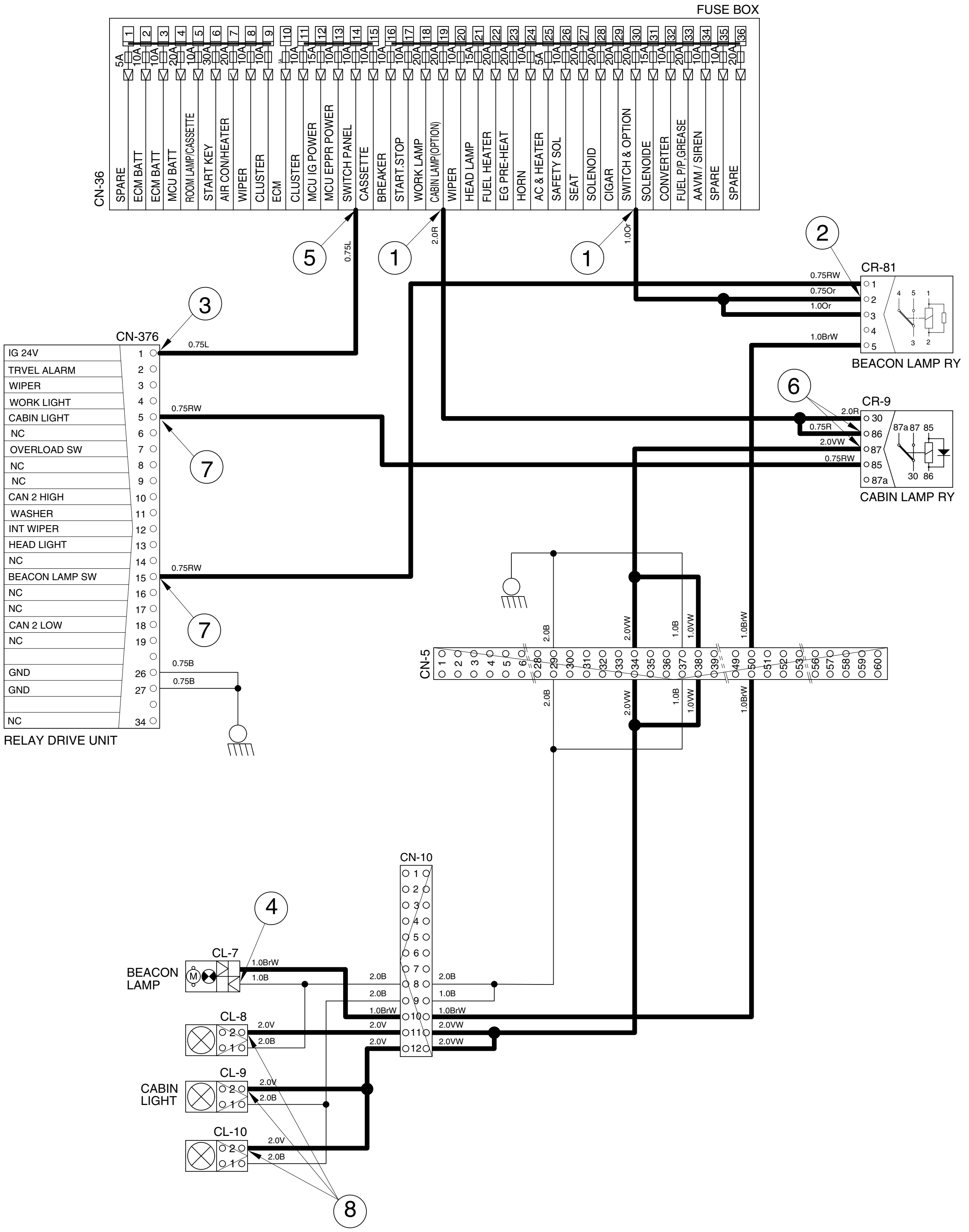
2) CHECK POINT

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 input) ⑧ - GND (cab light)	20~25V

※ GND : Ground

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

BEACON LAMP AND CAB LIGHT CIRCUIT



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

6. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

(1) Start switch ON

Fuse box (No.14) → Relay drive unit [CN-376 (1)]

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

Fuse box (No.20) → I/conn [CN-5 (16)] → I/conn [CN-17 (4)] → Wiper motor controller [CN-141 (6)]
→ Wiper 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

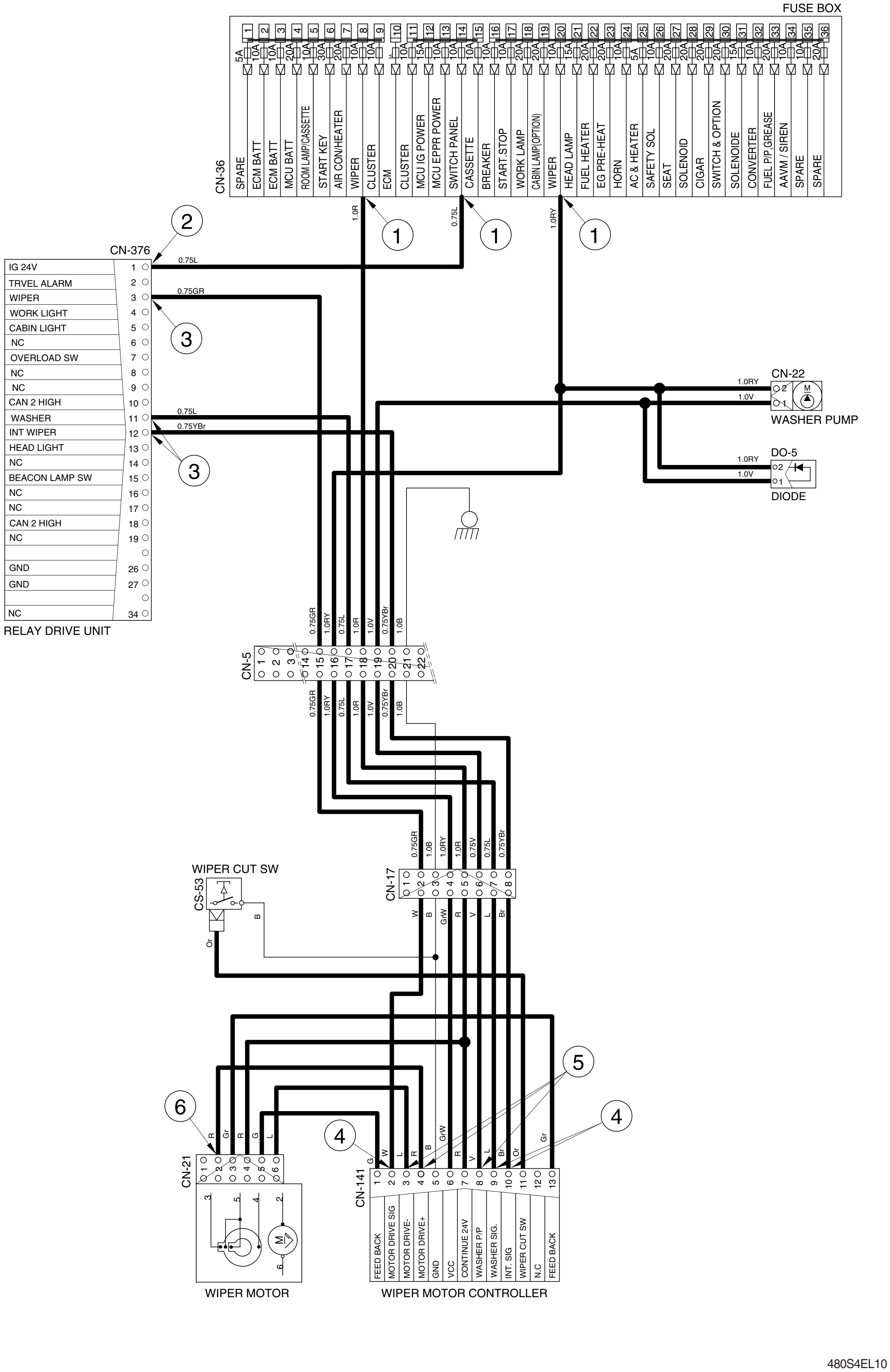
3) CHECK POINT

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

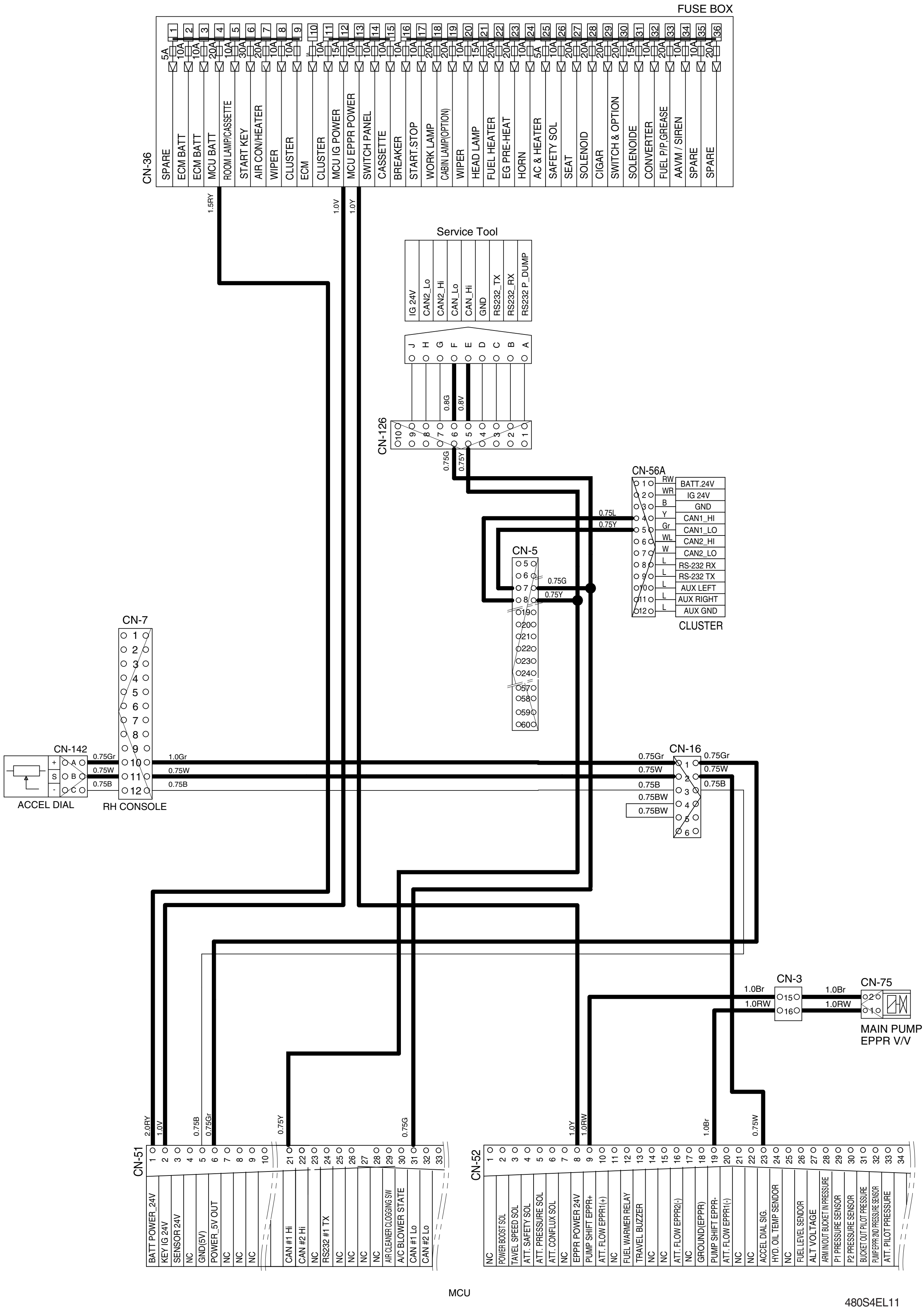
※ The circuit diagram may differ from the equipment, so please check before a repair.

WIPER AND WASHER CIRCUIT



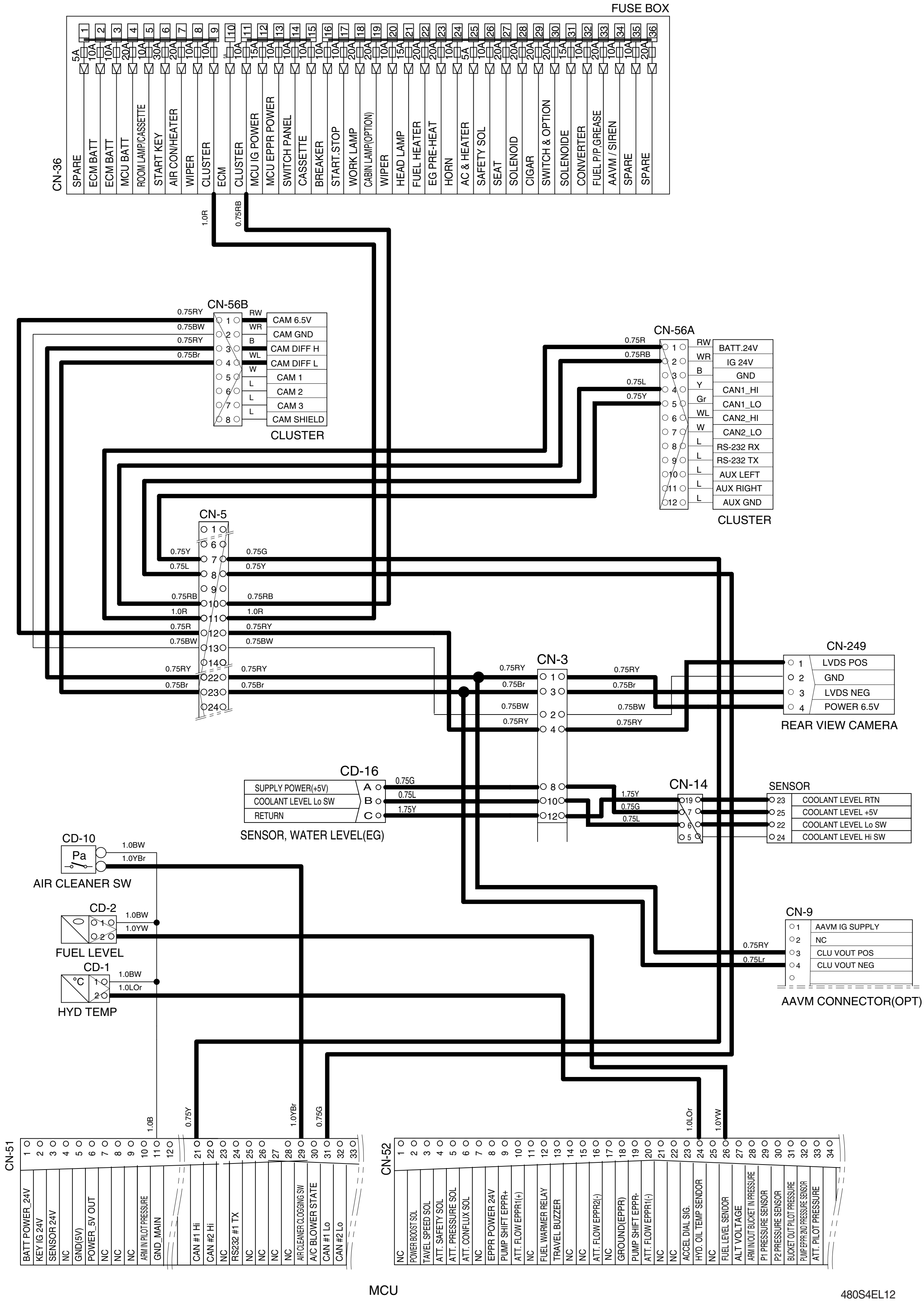
※ The circuit diagram may differ from the equipment, so please check before a repair.

CONTROLLER CIRCUIT



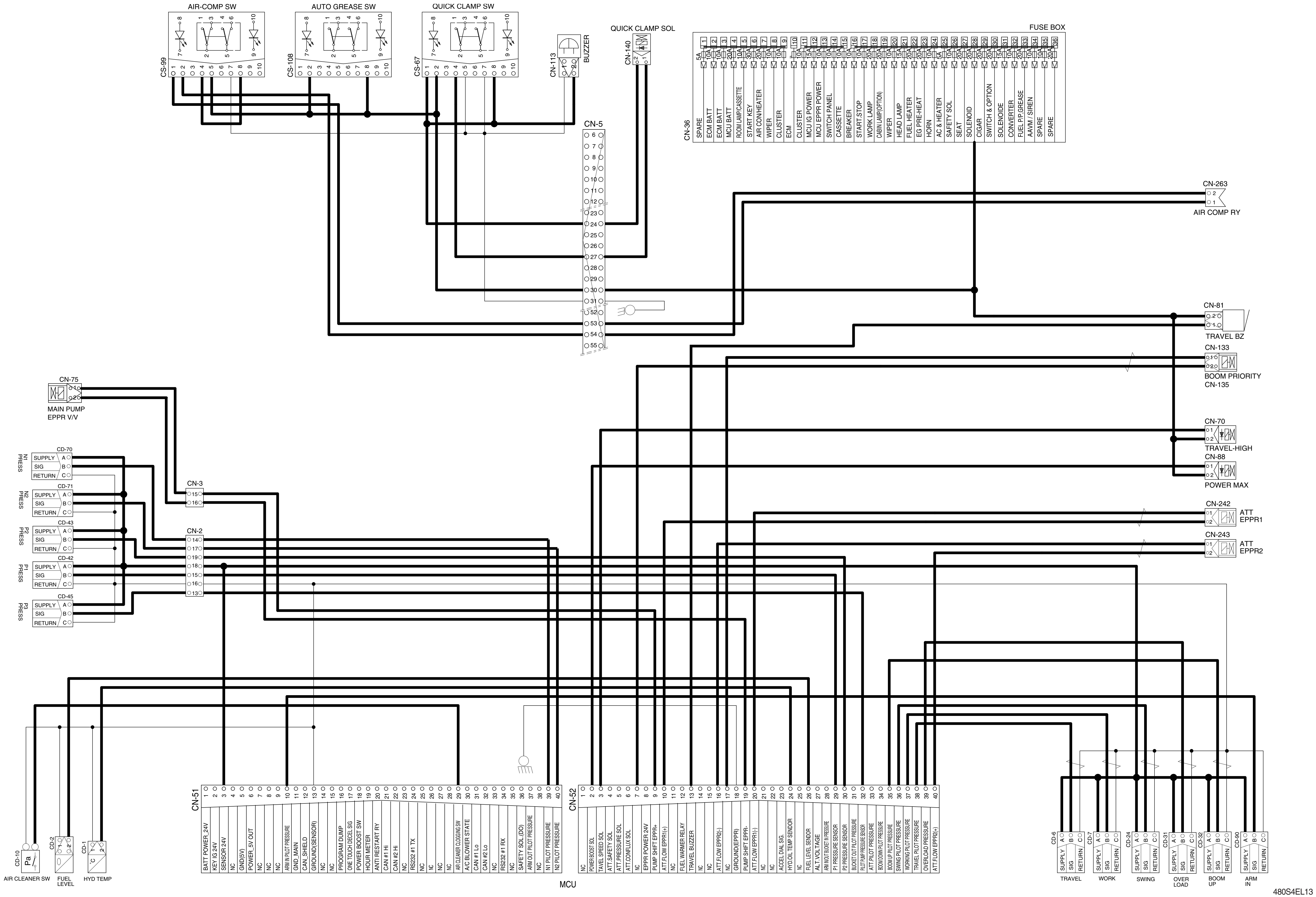
※ The circuit diagram may differ from the equipment, so please check before a repair.

MONITORING CIRCUIT



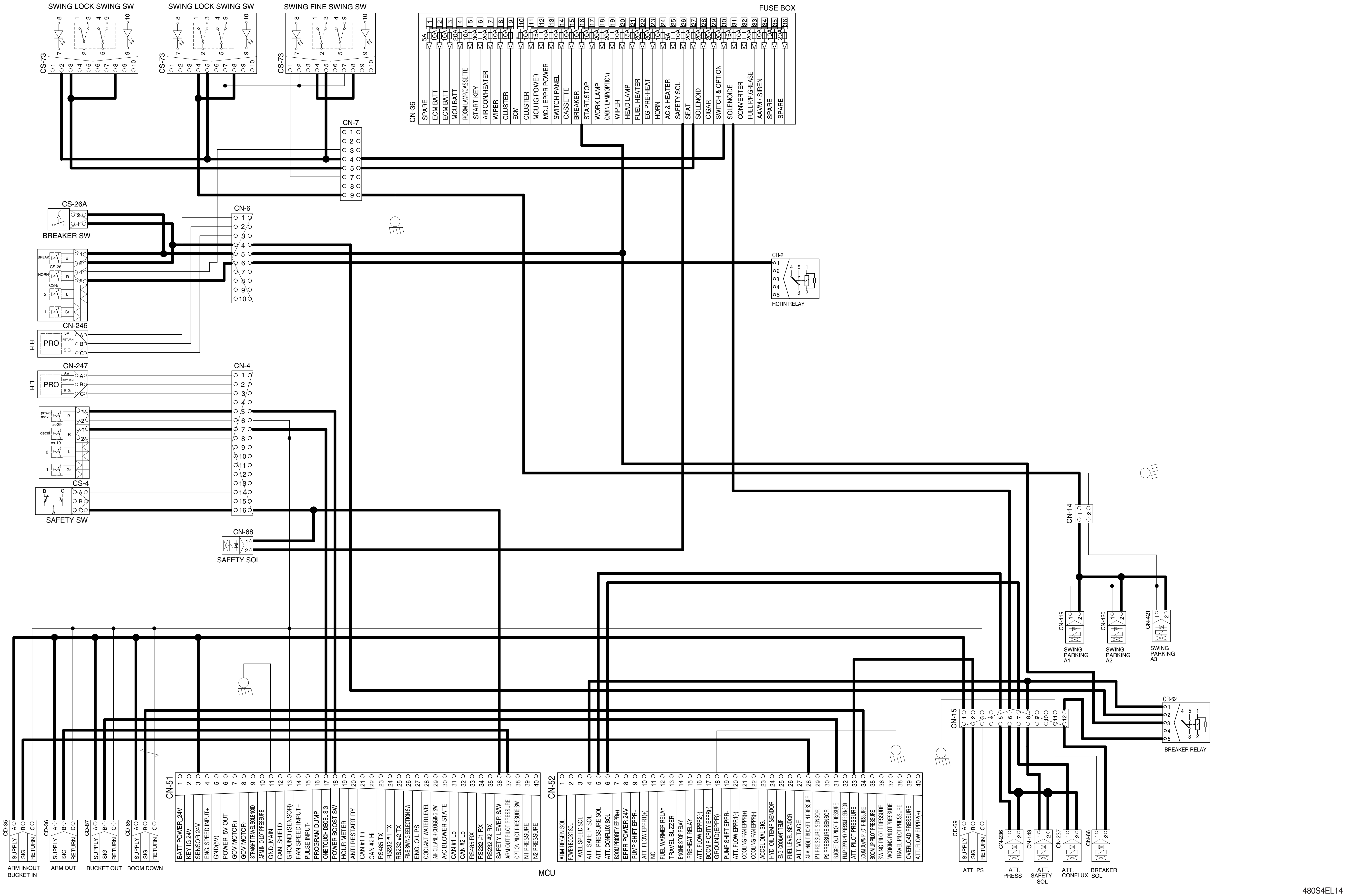
※ The circuit diagram may differ from the equipment, so please check before a repair.

ELECTRIC CIRCUIT FOR HYDRAULIC (1/2)



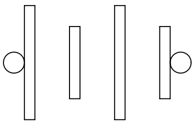
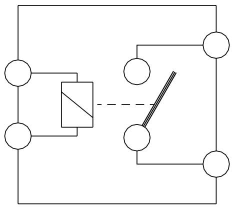
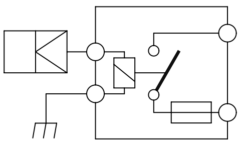
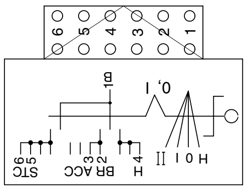
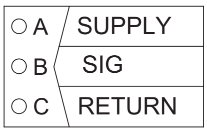
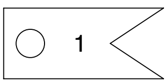
※ The circuit diagram may differ from the equipment, so please check before a repair.

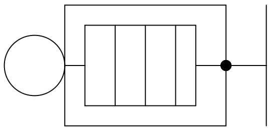
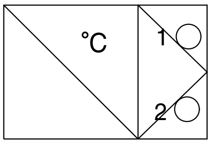
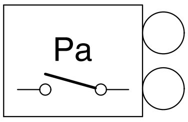
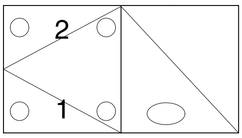
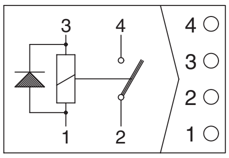
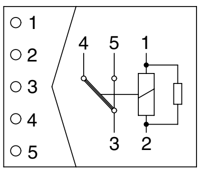
ELECTRIC CIRCUIT FOR HYDRAULIC (2/2)

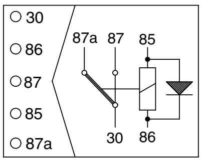
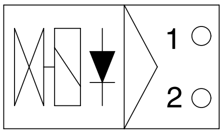
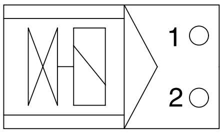
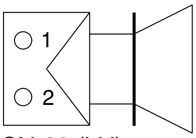
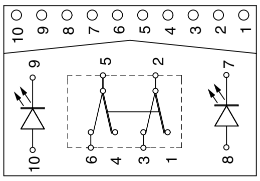
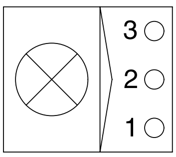


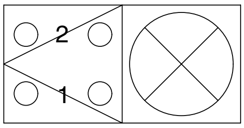
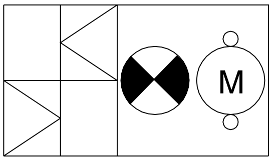
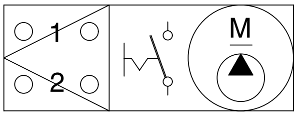
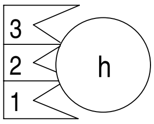
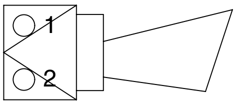
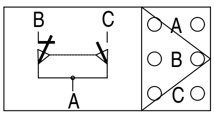
※ The circuit diagram may differ from the equipment, so please check before a repair.

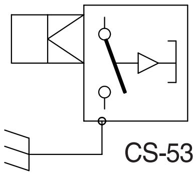
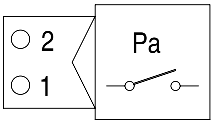
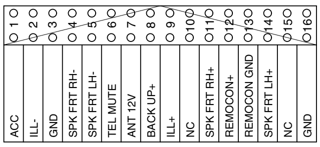
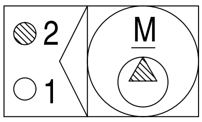
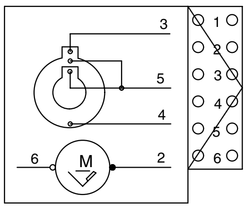
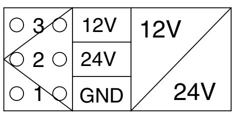
GROUP 3 ELECTRICAL COMPONENT SPECIFICATION

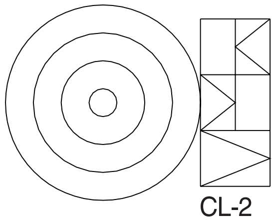
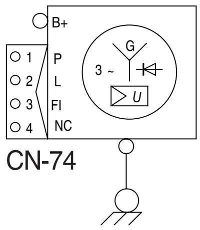
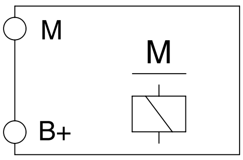
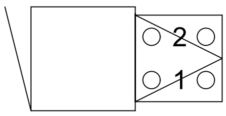
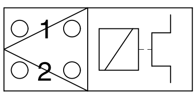
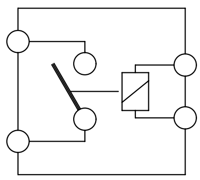
Part name	Symbol	Specifications	Check
Battery		12V × 200Ah (2EA)	※ Check specific gravity 1.280 over : Over charged 1.280 ~ 1.250 : Normal 1.250 below : Recharging
Battery relay	 CR-1	Rated load : 24V 100A (continuity) 1000A (30seconds)	※ Check coil resistance(M4 to M4) Normal : About 50Ω ※ Check contact Normal : ∞Ω
Preheat 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-45 CD-69 CD-70 CD-71 CD-85 CD-87 CD-90	8~30V	※ Check contact Normal : 0.1Ω
Air compressor power	 CN-25B	15A	

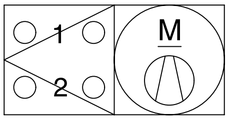
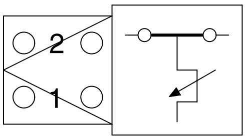
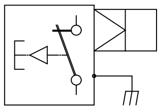
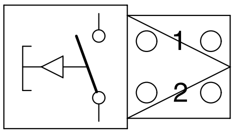
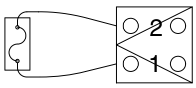
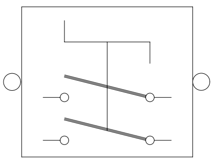
Part name	Symbol	Specifications	Check
Pre-heater	 CN-80	24V 200A	※ Check resistance 0.25~0.12Ω
Temperature sensor (hydraulic)	 CD-1 CD-8	-	※ Check resistance 50˚C : 804Ω 80˚C : 310Ω 100˚C : 180Ω
Air cleaner pressure switch	 CD-10	N.O TYPE	※ Check contact High level : ∞Ω Low level : 0Ω
Fuel level sender	 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-36 CR-62	24V 16A	※ Check resistance Normal : About 160 Ω (for terminal 1-2) 0Ω (for terminal 3-4) ∞Ω (for terminal 3-5)

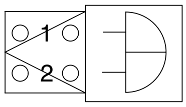
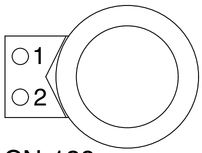
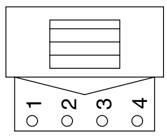
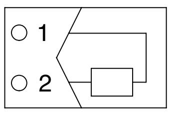
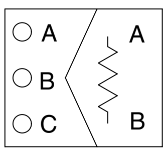
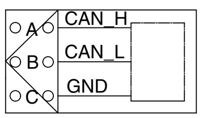
Part name	Symbol	Specifications	Check
Relay	 CR-4 CR-5 CR-7 CR-9 CR-13 CR-35 CR-46 CR-81	24V 16A	※ Check resistance Normal : About 160 Ω (for terminal 85-86) 0Ω (for terminal 30-87a) ∞ Ω (for terminal 30-87)
Solenoid valve	 CN-66 CN-68 CN-70 CN-88 CN-140 CN-149 CN-236 CN-237 CN-419 CN-420 CN-421	24V 1A	※ Check resistance Normal : 15~25Ω (for terminal 1-2)
EPPR valve	 CN-75 CN-242 CN-243	700mA	※ Check resistance Normal : 15~25Ω (for terminal 1-2)
Speaker	 CN-23 (LH) CN-24 (RH)	20W	※ Check resistance Normal : A fewΩ
Switch (locking type)	 CS-52 CS-67 CS-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)

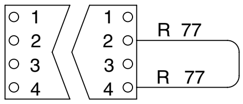
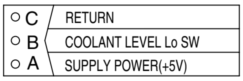
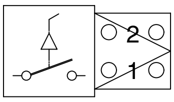
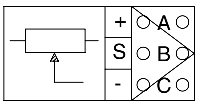
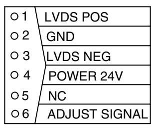
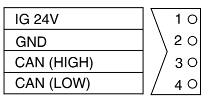
Part name	Symbol	Specifications	Check
Head lamp, Work lamp, Cab lamp	 CL-3 CL-4 CL-5 CL-6 CL-8 CL-9 CL-10 CL-24A CL-37	24V 65W (H3 Type)	※ Check disconnection Normal : 1.2Ω
Beacon lamp	 CL-7	21V 70W (H1 Type)	※ Check disconnection Normal : A fewΩ
Fuel filler pump	 CN-61	24V 10A 35 ℓ /min	※ Check resistance Normal : 1.0Ω
Hour meter	 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	Delco Remy 24V 90A	※ Check contact Normal : 0Ω (for terminal B^{+}-L) Normal : 24~27.5V
Starter	 CN-45	Delco Remy 24V 7.2W	※ 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-39 CN-60 CN-95	CN-39 : 25A CN-60 : 60A CN-95 : 80A	※ Check disconnection Normal : 0Ω (connect ring terminal and check resist between terminal 1 and 2)
Master switch	 CS-74A, CS-74B	6-36V	※ Check disconnection Normal : 0.1Ω

Part name	Symbol	Specifications	Check
Quick clamp buzzer	 CN-113	24V 200mA 107±4dB	-
Socket	 CN-139	12V 10A	-
Fuel heater	 CN-96	24V 200W	-
Resistor alternator	 RS-1	3W 300Ω	-
Resistor - CAN	 CN-99	120Ω	-
Start button	 CS-2B	-	-

Part name	Symbol	Specifications	Check
GPS connector	 CN-125	-	-
Water level sensor (EG)	 CD-16	-	-
Breaker switch	 CS-26A	-	-
Accel dial	 CN-142	-	-
Camera	 CS-402 CS-403 CS-404 CS-405	-	-
Reader	 CN-427	-	-

GROUP 4 CONNECTORS

1. CONNECTOR DESTINATION

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-2	ITT CANNON	19	I/conn (Frame harness-Engine harness)	121583-0135	121583-0119
CN-3	ITT CANNON	19	I/conn (Engine harness-Frame harness)	121583-0135	121583-0119
CN-4	AMP	16	I/conn (Console harness LH-Frame harness)	368047-1	368050-1
CN-5	DEUTSCH	60	I/conn (Side harness RH-Frame harness)	DRB16-60SAE-L018	DRB12-60P-L018
CN-6	AMP	10	I/conn (Console harness RH-Frame harness)	S816-010002	S816-110002
CN-7	AMP	12	I/conn (Console harness RH-Frame harness)	S816-012002	S816-112002
CN-8	AMP	12	I/conn (Console harness RH-Frame harness)	S816-010002	S816-112002
CN-9	DEUTSCH	12	I/conn (AAVM harness-Frame harness)	DT06-12SA-P021	DT04-12PA-P021
CN-10	DEUTSCH	12	I/conn (Cab harness-Side harness RH)	DT06-12S-EP06	DT04-12PA-P021
CN-11	DEUTSCH	8	I/conn (Frame harness-Aircon harness)	DT06-8S-EP06	-
CN-12	DEUTSCH	2	I/conn (Frame harness-Boom wire harness)	DT06-2S-EP06	DT04-2P
CN-14	DEUTSCH	2	Swing parking	DT06-2S-EP06	-
CN-14	DEUTSCH	31	OEM	HD36-24-31SE	-
CN-15	AMP	12	I/conn (Frame harness-Breaker sol)	S816-012002	S816-112002
CN-16	-	6	Emergency engine speed control	-	S816-106002
CN-16A	-	6	Emergency engine speed control	S816-006002	-
CN-16B	-	6	Emergency engine speed control	S816-006002	S816-106002
CN-17	AMP	8	I/conn (Wiper harness-Side harness RH)	S816-008002	S816-108002
CN-20	-	2	Horn	36825-0211	-
CN-21	AMP	6	Wiper motor	S810-006202	-
CN-22	KET	2	Washer pump	MG640605	-
CN-23	KET	2	Speaker-LH	MG610070	-
CN-24	KET	2	Speaker-RH	MG610070	-
CN-25	-	2	Horn	36825-0211	-
CN-27	KET	2	Washer tank	MG640795	-
CN-27A	KUM	16	Radio & USB player	PK145-16017	-
CN-27B	AMP	8	Radio & USB player	-	174984-2
CN-28	KET	2	Aircon compressor	S814-002100	-
CN-29	KET	2	Receiver dryer	MG640795	-
CN-36	-	-	Fuse & relay box	21Q7-10910	-
CN-39	-	-	Air compressor power fuse	21Q6-03270	-
CN-45	RING-TERM	-	Starter motor B^+	S820-108000	-
CN-48	KET	1	Hour meter	2-520193-2	-
CN-51	DEUTSCH	40	MCU	DRC26-40SA	-
CN-52	DEUTSCH	40	MCU	DRC26-40SB	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-56A	AMP	12	Cluster	-	174663-2
CN-56B	AMP	8	Cluster	-	174984-2
CN-60	-	2	Battery power fuse	21Q6-03270	21LM-30140
CN-61	DEUTSCH	2	Fuel filler pump	DT06-2S	DT04-2P-E005
CN-66	DEUTSCH	2	Breaker solenoid	DT06-2S-EP06	-
CN-68	DEUTSCH	2	Safety solenoid	DT06-2S-EP06	-
CN-70	DEUTSCH	2	Travel high solenoid	DT06-2S-EP06	-
CN-74	-	4	Alternator	1218 6568	-
CN-75	AMP	2	Pump EPPR	S816-002002	-
CN-81	DEUTSCH	2	Travel buzzer solenoid	DT06-2S-EP06	-
CN-88	DEUTSCH	2	Power max solenoid	DT06-2S-EP06	-
CN-91	DEUTSCH	50	ECM	DRC26-50S-01	-
CN-95	-	-	IG power fuse	21Q6-03270	21LM-03180
CN-99	DEUTSCH	3	Resistor	DT06-3S-EP06	DT04-3P-EP10
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	DEUTSCH	10	Service tool	DT06-12SA-P021	S816-110002
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
CN-141	AMP	13	Wiper motor controller	172498-1	-
CN-147	DEUTSCH	2	Fuel heater	DT06-2S-E003	-
CN-149	DEUTSCH	2	Attach safety solenoid	DT06-2S-EP06	-
CN-150	AMP	4	Auto grease	S816-004002	S816-104002
CN-156	DEUTSCH	2	Air seat	-	DT04-2P
CN-157	AMP	1	Antena power	S822-014002	-
CN-236	DEUTSCH	2	Attachment pressure sensor	DT06-3S-EP06	-
CN-237	DEUTSCH	2	Attach conflux solenoid	DT06-2S-EP06	-
CN-242	DEUTSCH	2	Attach EPPR 1	DT06-2S-EP06	-
CN-243	DEUTSCH	2	Attach EPPR 2	DT06-2S-EP06	-
CN-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	DT04-4P-E005
CN-258	KET	1	Air compressor power	MG640944-5	MG650943-5
CN-263	DEUTSCH	2	Air compressor relay	DT06-2S-EP06	-
CN-279	-	2	Accel dial LED	S816-002002	-
CN-376	AMP	34	RDU	4-1437290-1	-
CN-401	FCI	90	AAVM controller	-	-

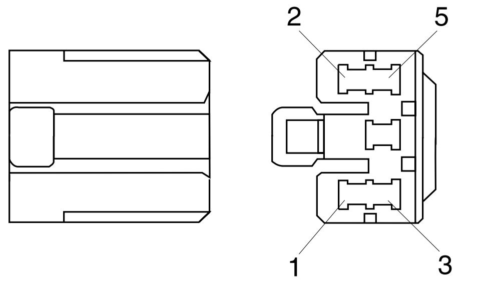
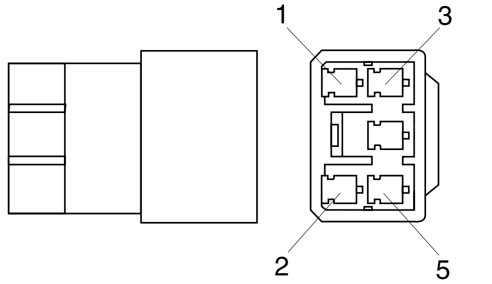
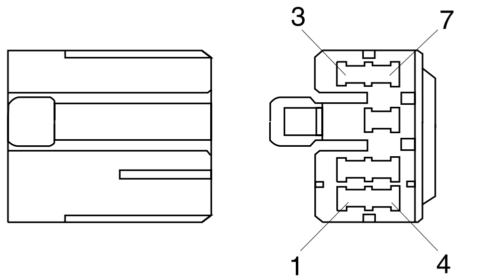
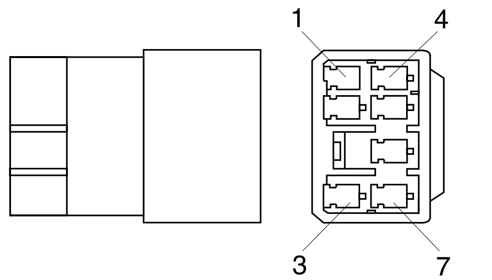
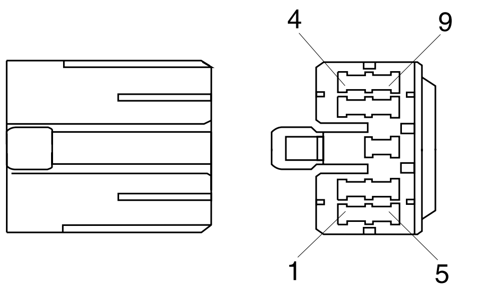
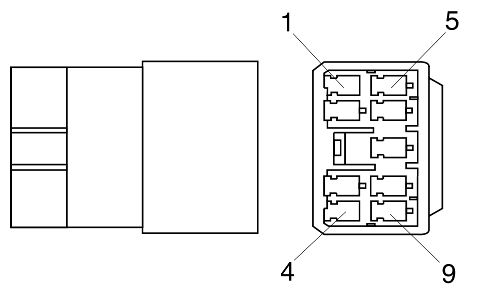
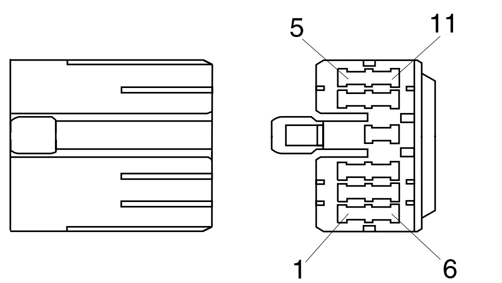
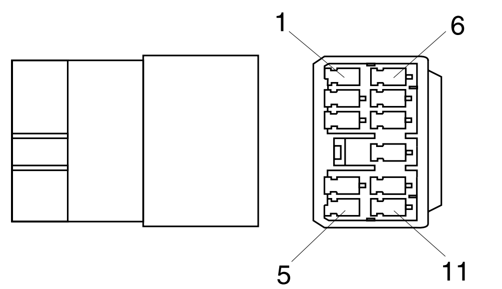
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-402	DEUTSCH	6	Front view camera	DT06-6S-PO21	DT04-6P-EP14
CN-403	DEUTSCH	6	Rear view camera	DT06-6S-EP06	DT04-6P-EP14
CN-404	DEUTSCH	6	LH view camera	DT06-6S-EP06	DT04-6P-EP14
CN-405	DEUTSCH	6	RH view camera	DT06-6S-EP06	DT04-6P-EP14
CN-406	DEUTSCH	4	RS232	DT06-4S-EP06	DT06-4P-E005
CN-427	MOLEX	4	Reader-RMS	039012040	026013096
CN-432	AMP	3	Ciger & power	174357-2	-
CN-432	AMP	3	I/conn (Side harness-RH)	-	174359-2
· Relay					
CR-1	KET	-	Battery relay	ST710289-2	-
CR-2	-	5	Horn relay	-	-
CR-4	-	5	Working lamp relay	-	-
CR-5	-	5	Anti restart relay	-	-
CR-7	-	5	Aircon compressor relay	-	-
CR-9	-	5	Cabin lamp relay	-	-
CR-13	-	5	Head lamp relay	-	-
CR-23	KET	2	Start relay	S814-002001	S814-102100
CR-24	-	1	Pre-heater relay	S822-014000	-
CR-35	-	5	Power relay	-	-
CR-36	-	5	Preheat relay	-	-
CR-46	-	5	Fuel warmer relay	-	-
CR-62	-	5	Breaker relay	-	-
CR-81	-	5	Beacon lamp relay	-	-
· Switch					
CS-1	SHUR	1	Door switch	S822-014002	S822-114002
CS-2A	WP	6	Start key switch	S814-006100	-
CS-2B	WP	3	BKCU	DT06-3S-EP06	DT04-2P-E005
CS-4	DEUTSCH	3	Safety switch	DT06-3S	-
CS-5	DEUTSCH	2	Horn switch	DT06-2S-EP06	DT04-2P
CS-19	DEUTSCH	2	One touch decel switch	DT06-2S-EP06	DT04-2P
CS-26	DEUTSCH	2	Breaker switch	DT06-2S	DT04-2P-E005
CS-26A	AMP	2	Breaker pedal switch	S816-002002	S816-102002
CS-29	DEUTSCH	2	Power max switch	DT06-2S	DT04-2P-E005
CS-33	AMP	6	Emergency engine stop switch	S816-006002	S816-106002
CS-52	CARLING	10	2 pcs & 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	Swing fine switch	VC2-01	-

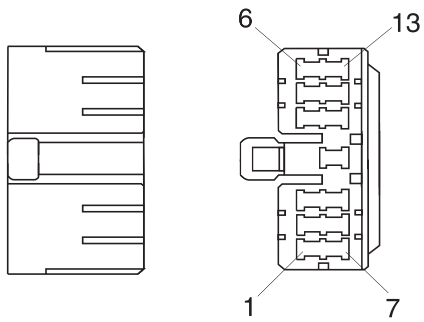
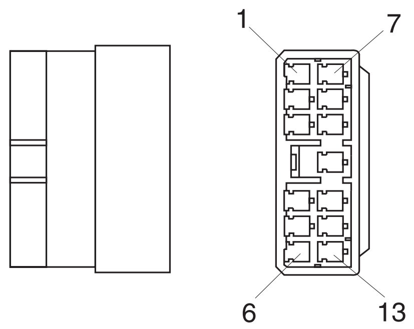
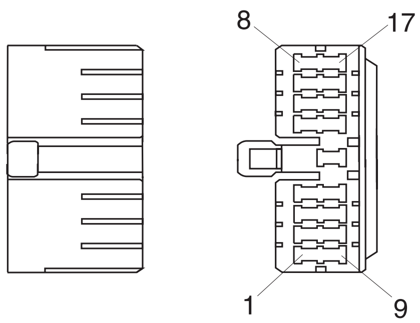
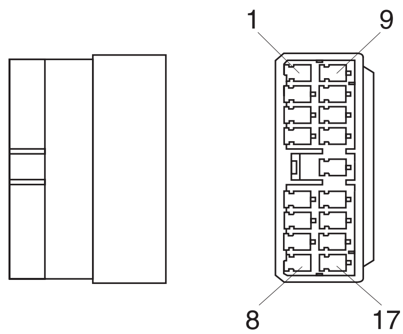
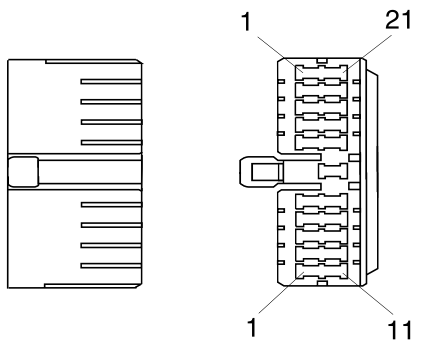
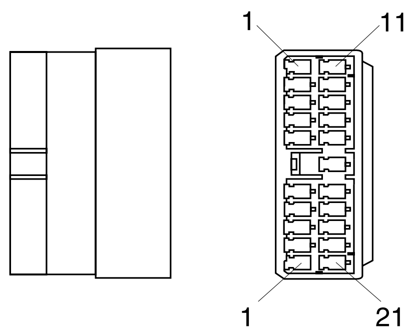
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CS-74A	KET	2	Master switch	MG610557-5	-
CS-74B	DEUTSCH	2	Master switch	DT06-2S-EP06	DT04-2P-E005
CS-83	CARLING	10	Swing lock switch	VC2-01	-
CS-99	CARLING	10	Air compressor switch	VC2-01	-
CS-108	CARLING	10	Auto grease switch	VC2-01	-
CS-142	DEUTSCH	3	Accel dial switch	DT06-3S	-
· 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	-
CL-6	DEUTSCH	2	Work lamp-RH	DT06-2S	-
CL-7	SHUR	1	Beacon lamp	S822-014002	S822-114002
CL-8	DEUTSCH	2	Cab light-LH	DT06-2S-EP06	DT04-2P
CL-9	DEUTSCH	2	Cab light-RH	DT06-2S-EP06	DT04-2P
CL-10	DEUTSCH	2	Cab light	DT06-2S-EP06	DT04-2P
CL-24	DEUTSCH	2	Head lamp-rear	DT06-2S-EP06	DT04-2P-E005
CL-36	DEUTSCH	2	Work lamp-LH	DT06-2S	DT04-2P-E005
CL-37	DEUTSCH	2	Work lamp-RH	DT06-2S	DT04-2P-E005
· Sensor, sendor					
CD-1	AMP	2	Hydraulic oil temp sender	85202-1	-
CD-2	DEUTSCH	2	Fuel sender	DT06-2S	-
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	85202-1	-
CD-16	DELPHI	3	Water level sensor	12110293	-
CD-24	DEUTSCH	3	Swing sensor	DT06-3S-EP06	-
CD-31	DEUTSCH	3	Overload sensor	DT06-3S-EP06	DT06-4P
CD-32	DEUTSCH	3	Boom up sensor	DT06-3S-EP06	S816-103002
CD-35	DEUTSCH	3	Arm & bucket in pressure sensor	DT06-3S-EP06	DT06-4P-E005
CD-36	DEUTSCH	3	Arm out pressure sensor	DT06-3S-EP06	DT06-4P-E005
CD-41	DEUTSCH	3	N1 pressure sensor	DT06-3S-EP06	DT06-4P-E005
CD-42	DEUTSCH	3	Pump pressure 1	DT06-3S-EP06	DT06-4P-E005
CD-43	DEUTSCH	3	Pump pressure 2	DT06-3S-EP06	DT06-4P-E005
CD-45	DEUTSCH	3	Pump pressure 3	DT06-3S-EP06	DT06-4P-E005
CD-69	DEUTSCH	3	Attach pressure sensor	DT06-3S-EP06	DT06-4P-E005
CD-70	DEUTSCH	3	N1 pressure sensor	DT06-3S-EP06	DT06-4P-E005

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CD-71	DEUTSCH	3	N2 pressure sensor	DT06-3S-EP06	DT06-4P-E005
CD-85	DEUTSCH	3	Boom down pressure sensor	DT06-3S-EP06	DT06-3P-E005
CD-87	DEUTSCH	3	Bucket out pressure sensor	DT06-3S-EP06	DT06-3P-E005
CD-90	DEUTSCH	3	Arm in pressure sensor	DT06-3S-EP06	DT06-3P-E005

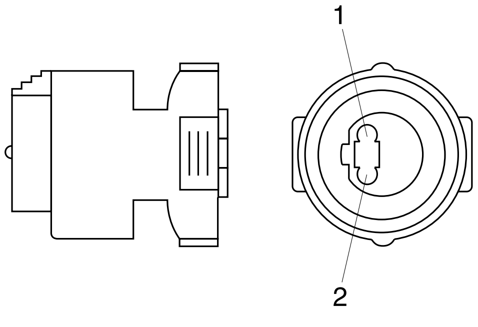
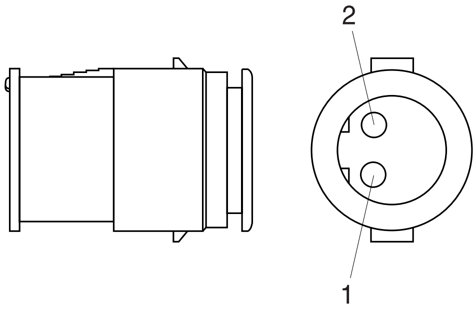
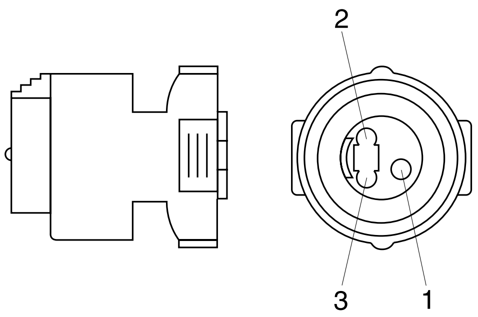
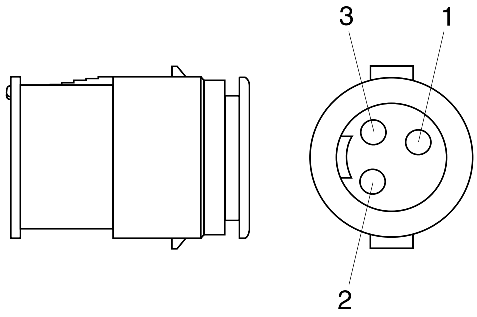
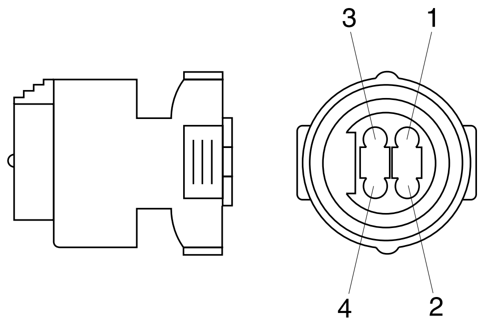
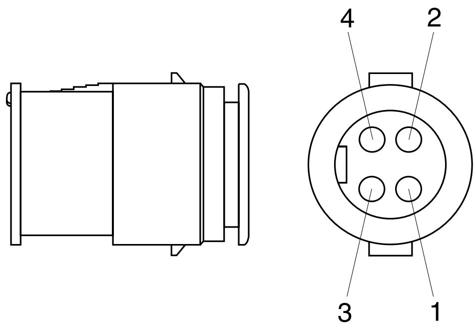
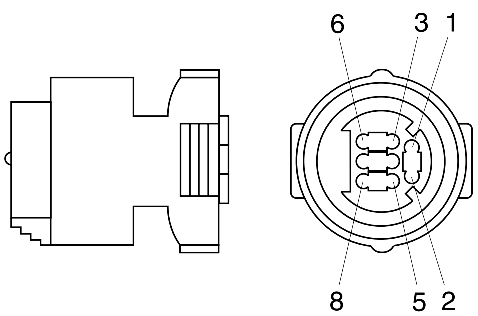
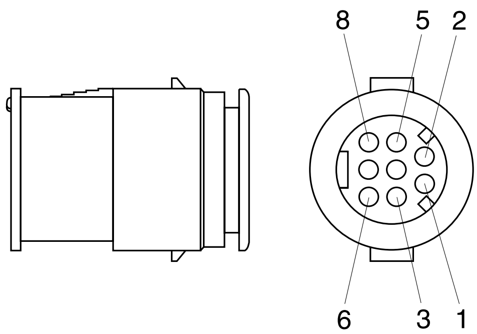
2. CONNECTION TABLE FOR CONNECTORS

1) PA TYPE CONNECTOR

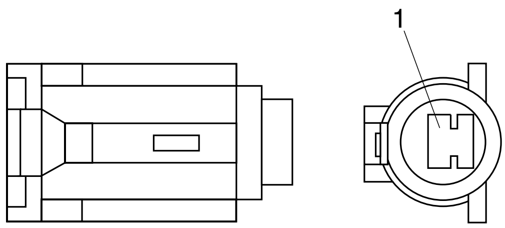
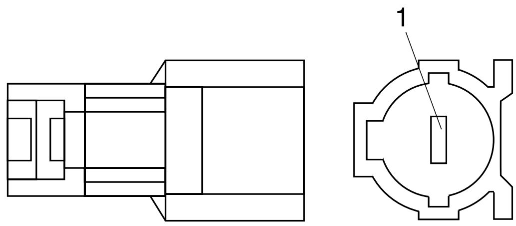
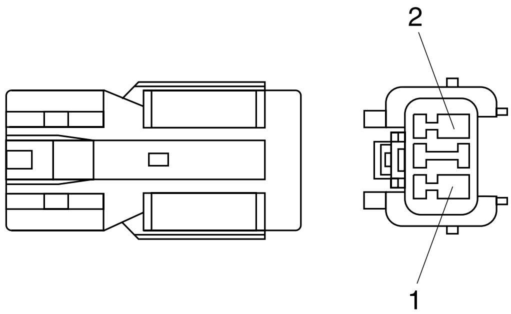
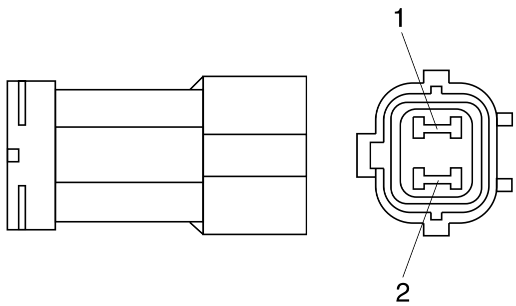
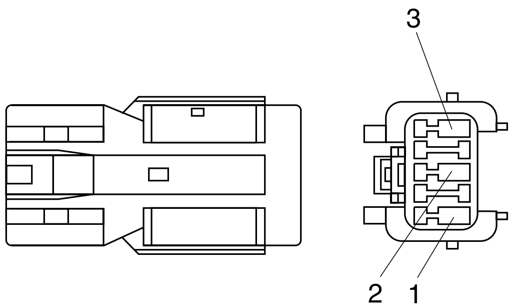
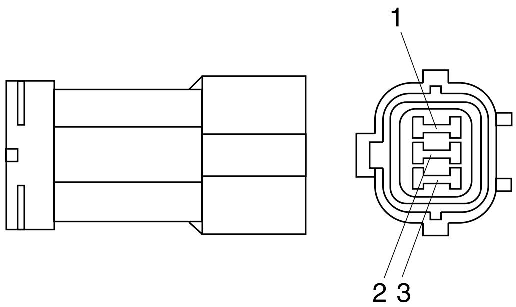
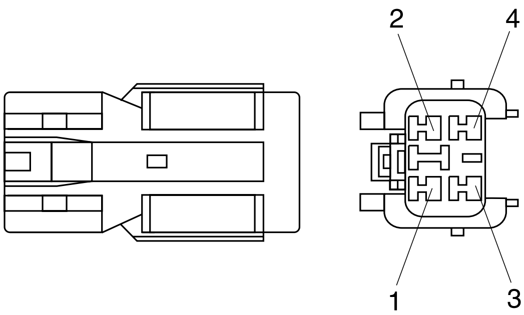
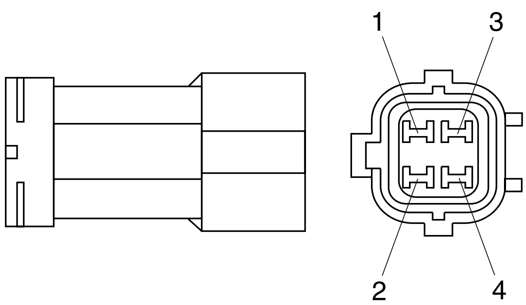
No. of pin	Receptacle connector (female)	Plug connector (male)
5	 S811-005002	 S811-105002
7	 S811-007002	 S811-107002
9	 S811-009002	 3S811-109002
11	 S811-011002	 S811-111002

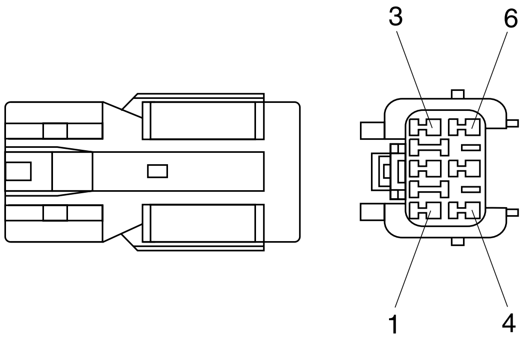
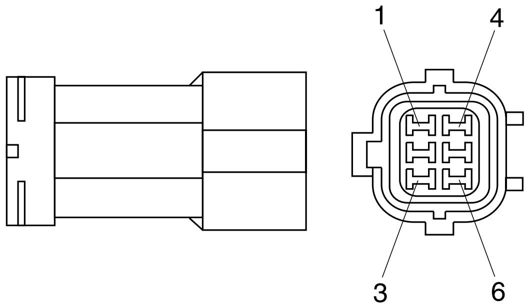
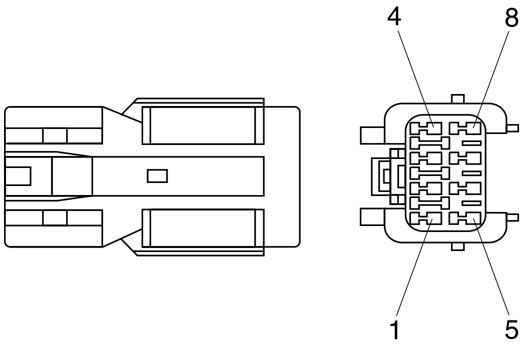
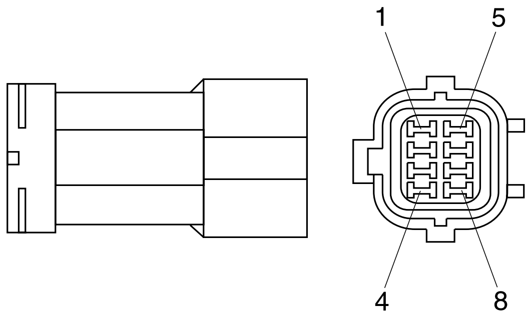
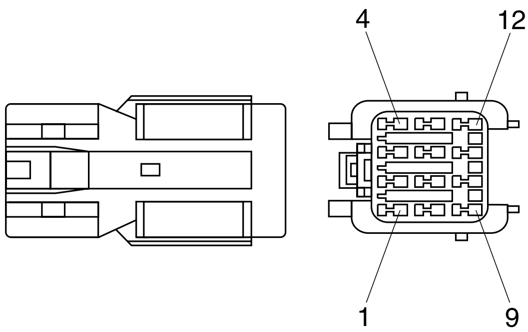
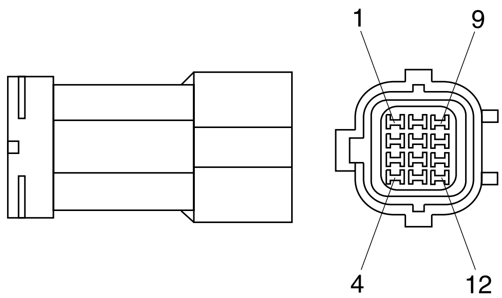
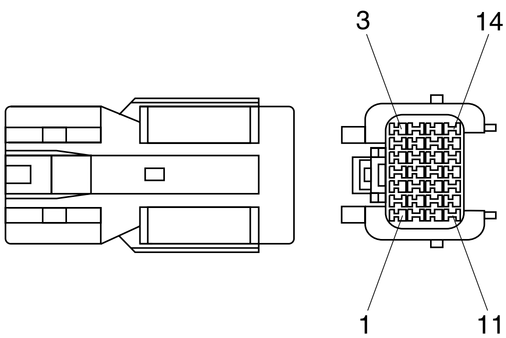
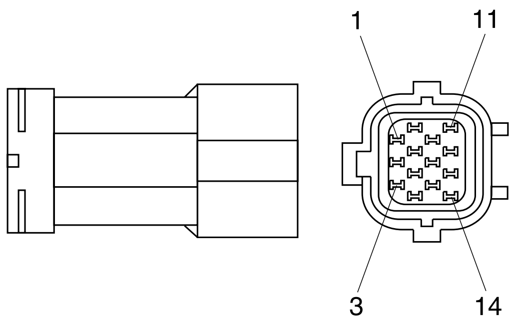
No. of pin	Receptacle connector (female)	Plug connector (male)
13	 S811-013002	 S811-113002
17	 S811-017002	 S811-117002
21	 S811-021002	 S811-121002

2) J TYPE CONNECTOR

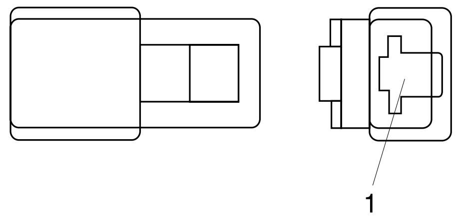
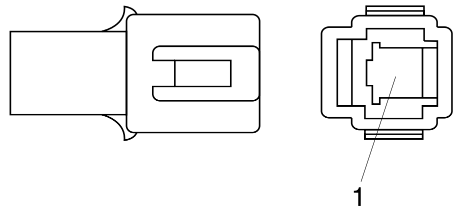
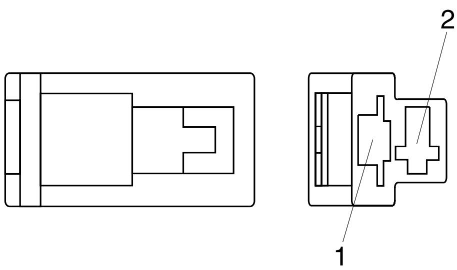
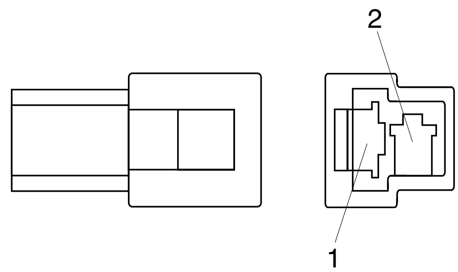
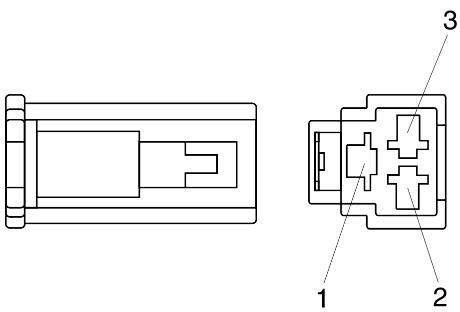
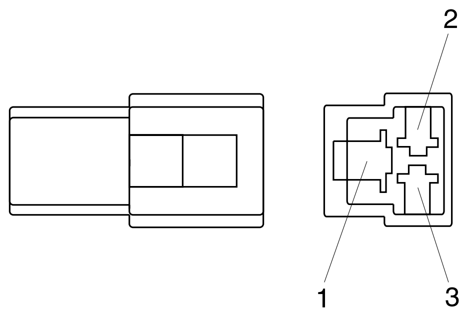
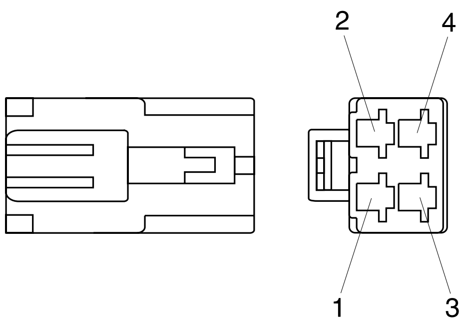
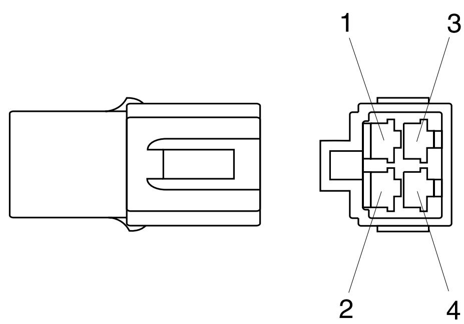
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 S816-002001	 S816-102001
3	 S816-003001	 S816-103001
4	 S816-004001	 S816-104001
8	 S816-008001	 S816-108001

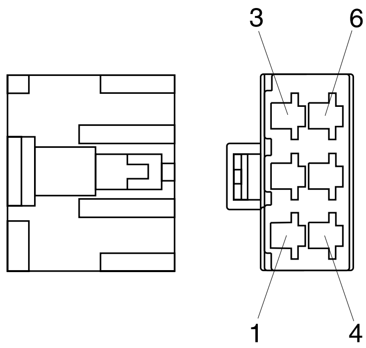
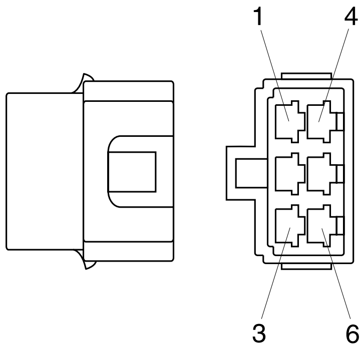
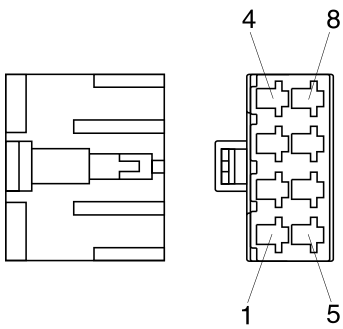
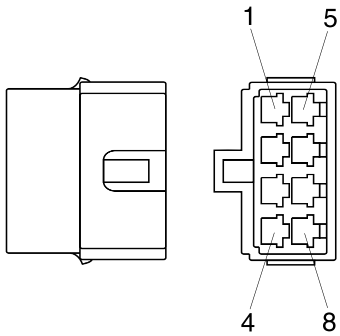
3) SWP TYPE CONNECTOR

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

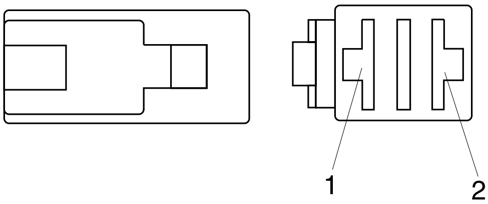
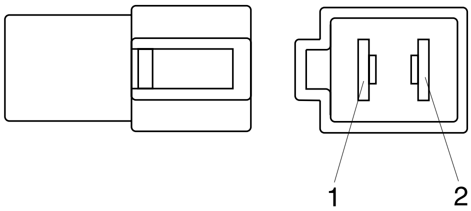
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S814-006000	 S814-106000
8	 S814-008000	 S814-108000
12	 S814-012000	 S814-112000
14	 S814-014000	 S814-114000

4) CN TYPE CONNECTOR

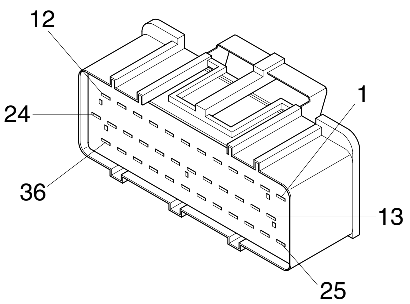
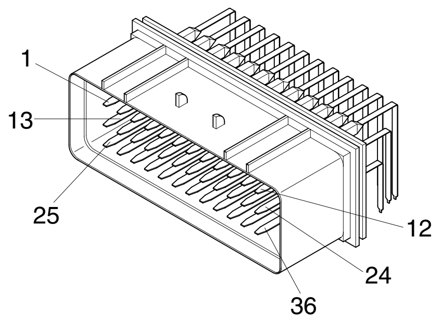
No. of pin	Receptacle connector (female)	Plug connector (male)
1	 S810-001202	 S810-101202
2	 S810-002202	 S810-102202
3	 S810-003202	 S810-103202
4	 S810-004202	 S810-104202

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

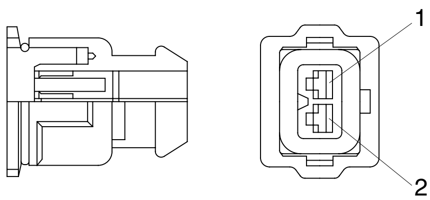
5) 375 FASTEN TYPE CONNECTOR

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

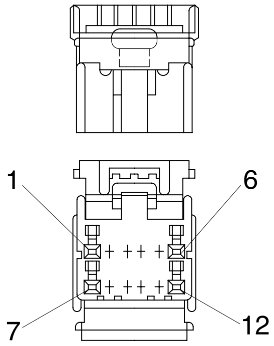
6) AMP ECONOSEAL CONNECTOR

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

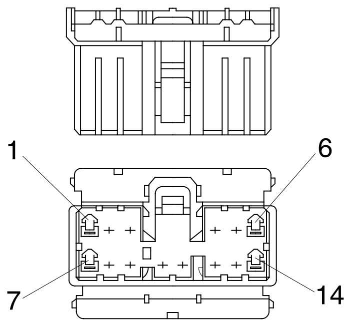
7) AMP TIMER CONNECTOR

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

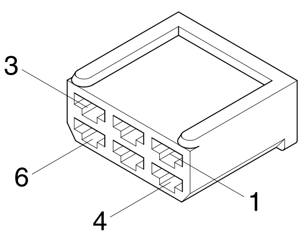
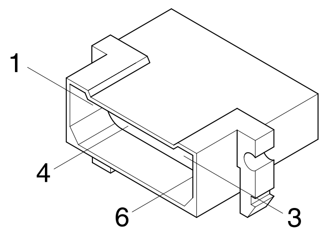
8) AMP 040 MULTILOCK CONNECTOR

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

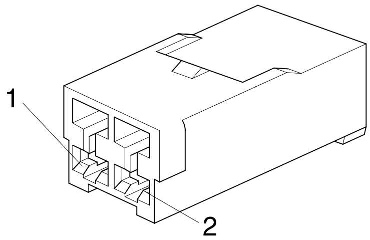
9) AMP 070 MULTILOCK CONNECTOR

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

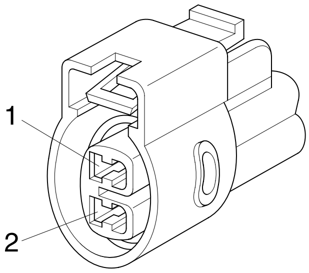
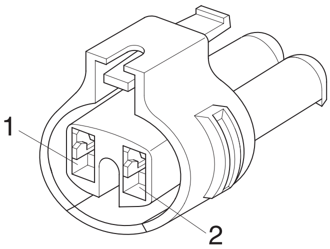
10) AMP FASTIN - FASTON CONNECTOR

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

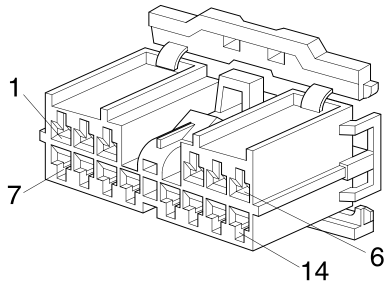
11) KET 090 CONNECTOR

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	

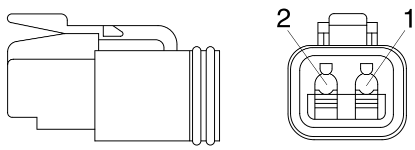
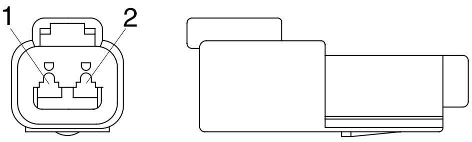
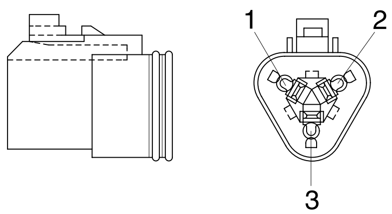
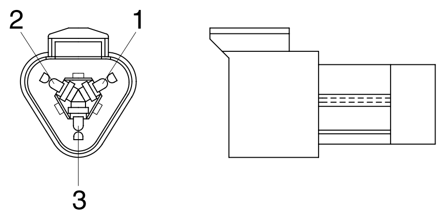
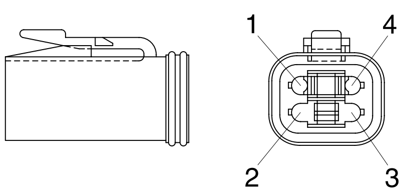
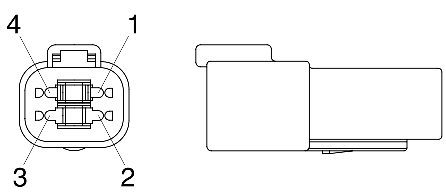
14) DEUTSCH DT CONNECTORS

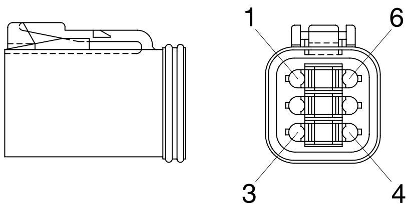
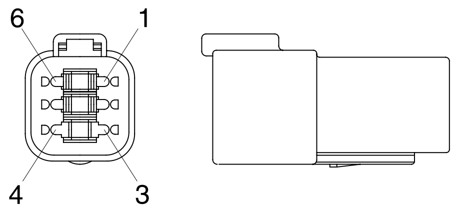
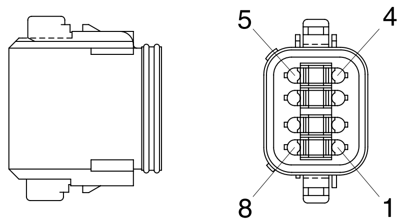
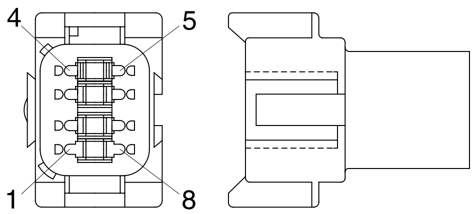
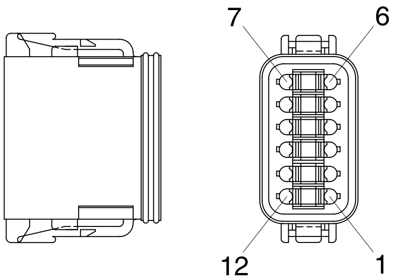
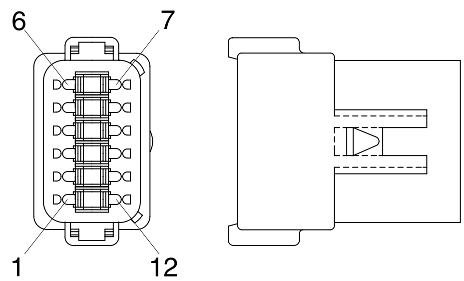
DT 06 - 3S - ★★★★

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

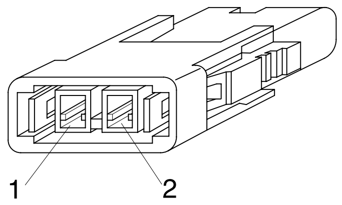
※ Modification

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

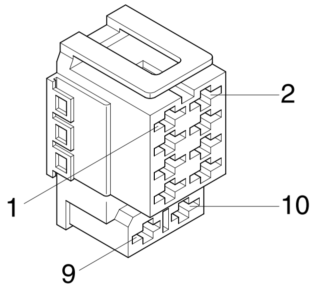
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 DT06-2S	 DT04-2P
3	 DT06-3S	 DT04-3P
4	 DT06-4S	 DT04-4P

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

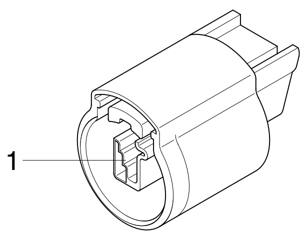
15) MOLEX 2CKTS CONNECTOR

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

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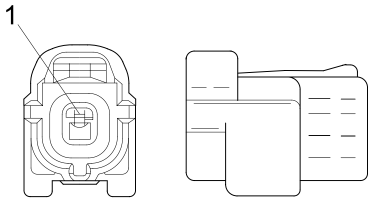
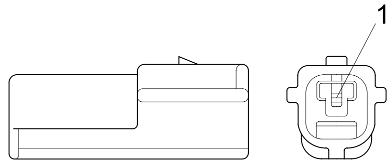
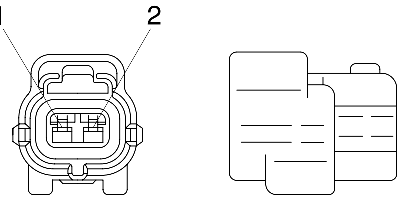
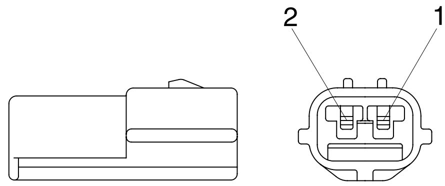
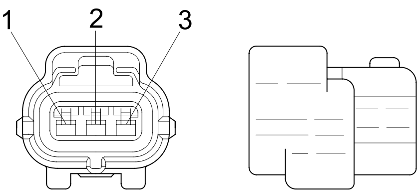
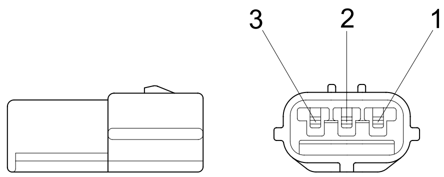
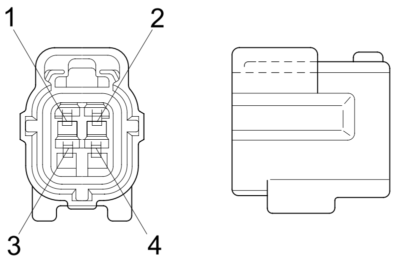
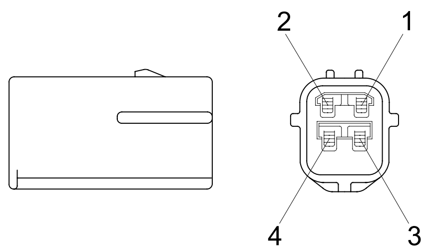
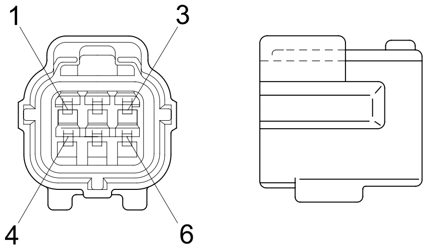
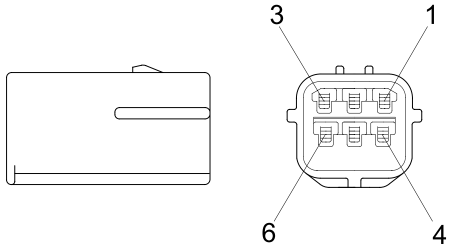
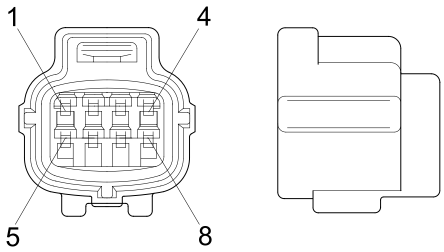
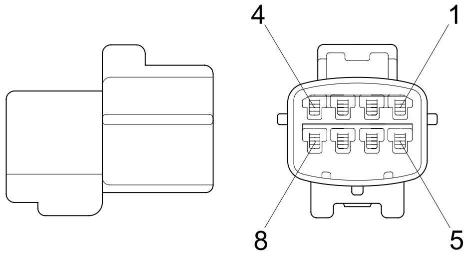
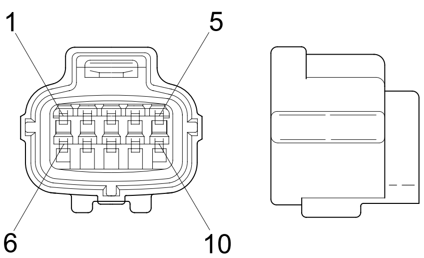
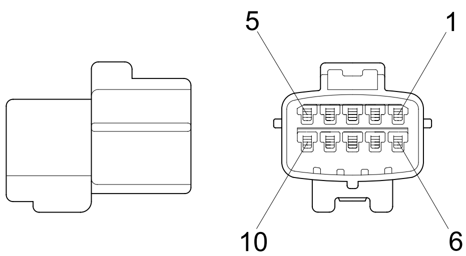
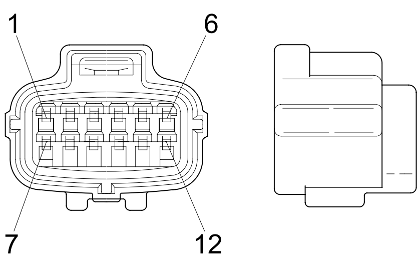
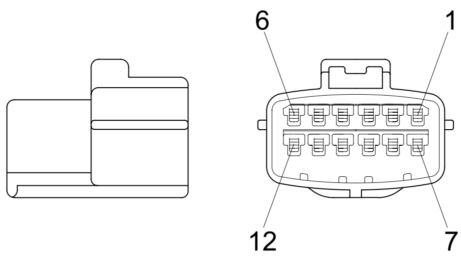
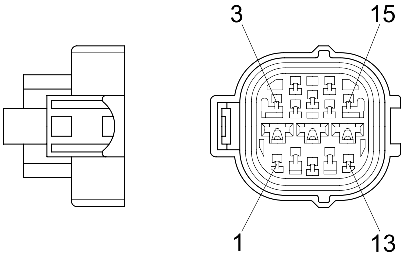
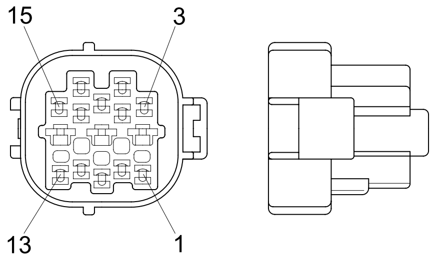
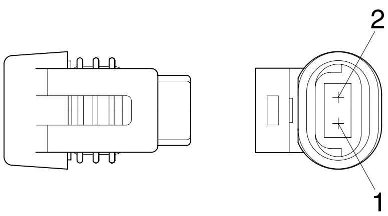
1	 S816-001002	 S816-101002
2	 S816-002002	 S816-102002
3	 S816-003002	 S816-103002
4	 S816-004002	 S816-104002

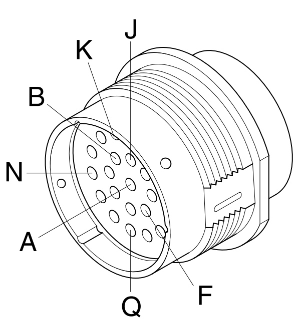
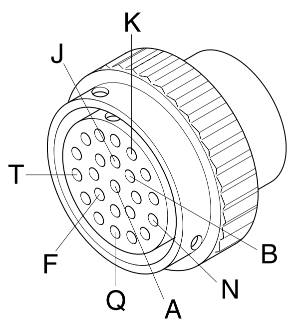
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S816-006002	 S816-106002
8	 S816-008002	 S816-108002
10	 S816-010002	 S816-110002
12	 S816-012002	 S816-112002

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

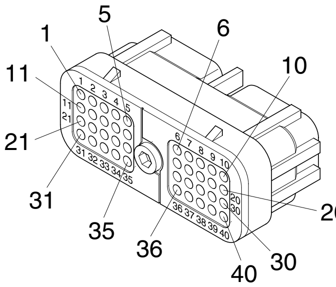
19) METRI-PACK TYPE CONNECTOR

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

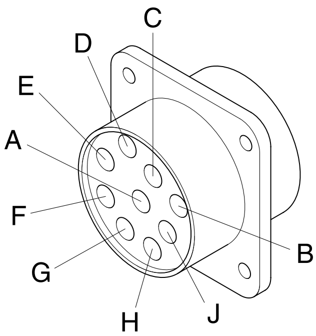
20) DEUTSCH HD30 CONNECTOR

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

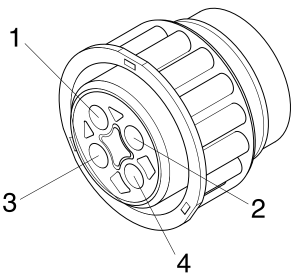
21) DEUTSCH MCU CONNECTOR

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

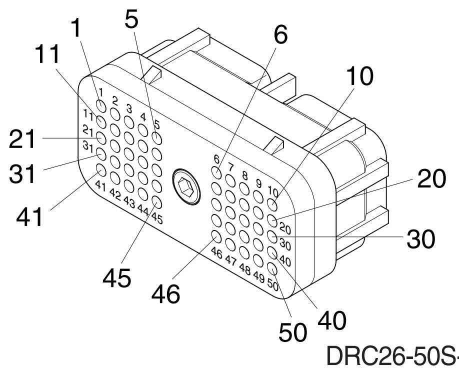
22) DEUTSCH SERVICE TOOL CONNECTOR

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

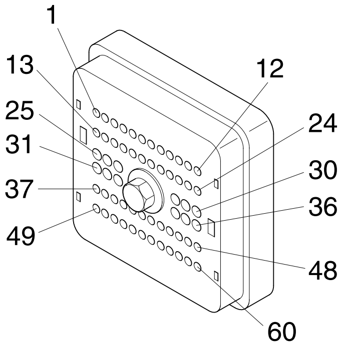
23) AMP FUEL WARMER CONNECTOR

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

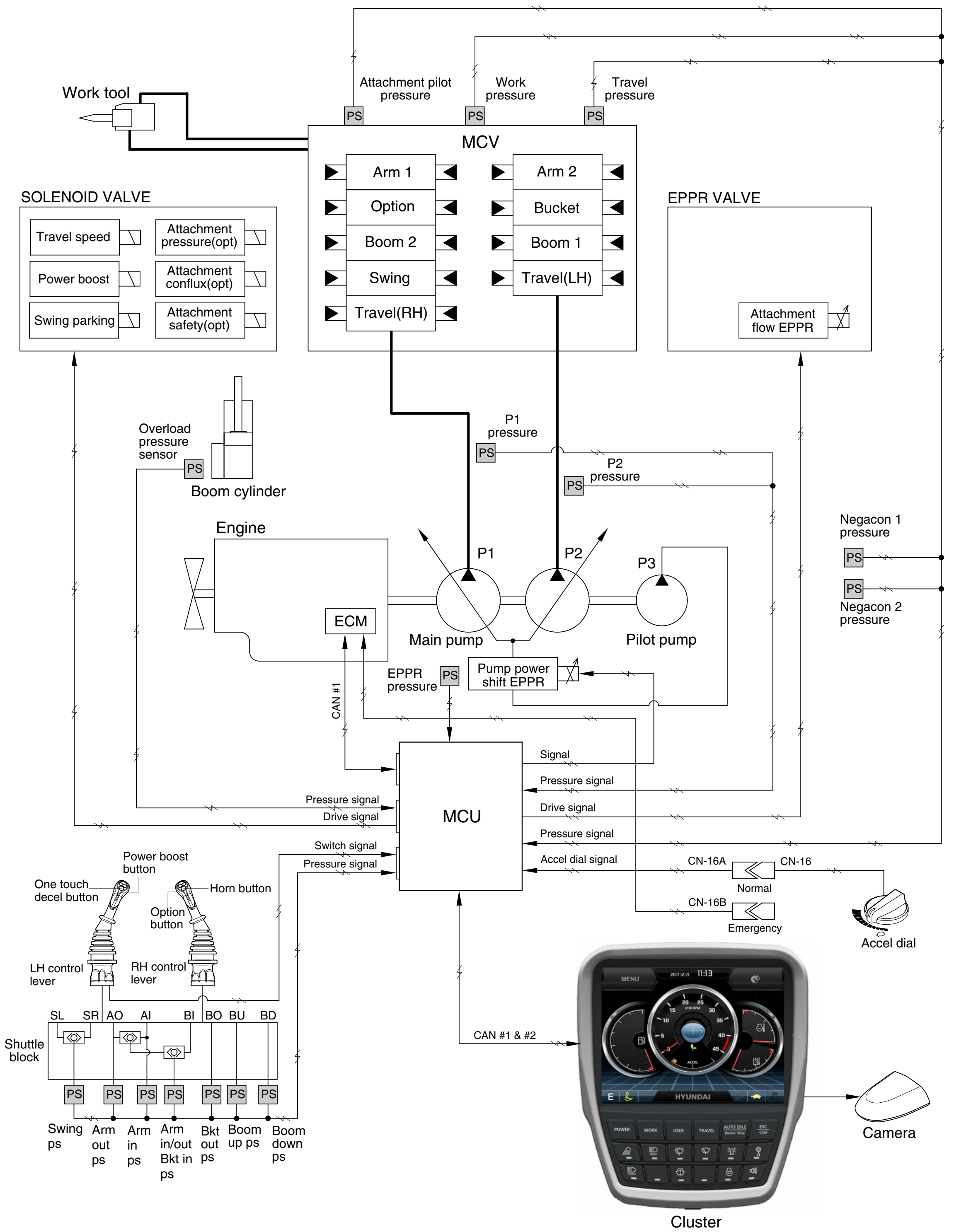
GROUP 1 OUTLINE

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
  - Power boost system
  - Travel speed control system
  - Automatic warming up system
  - Engine overheat prevention system
  - Variable power control system
  - Attachment flow control system
  - Intelligent power control system
  - Anti-restart system
  - Self-diagnostic system
    - MCU & cluster protection
    - Open-short diagnosis & error code display
    - Machine error & ECM fault code display
  - Machine monitoring system
    - Machine condition monitoring
    - Electric signal monitoring
  - One touch deceleration system

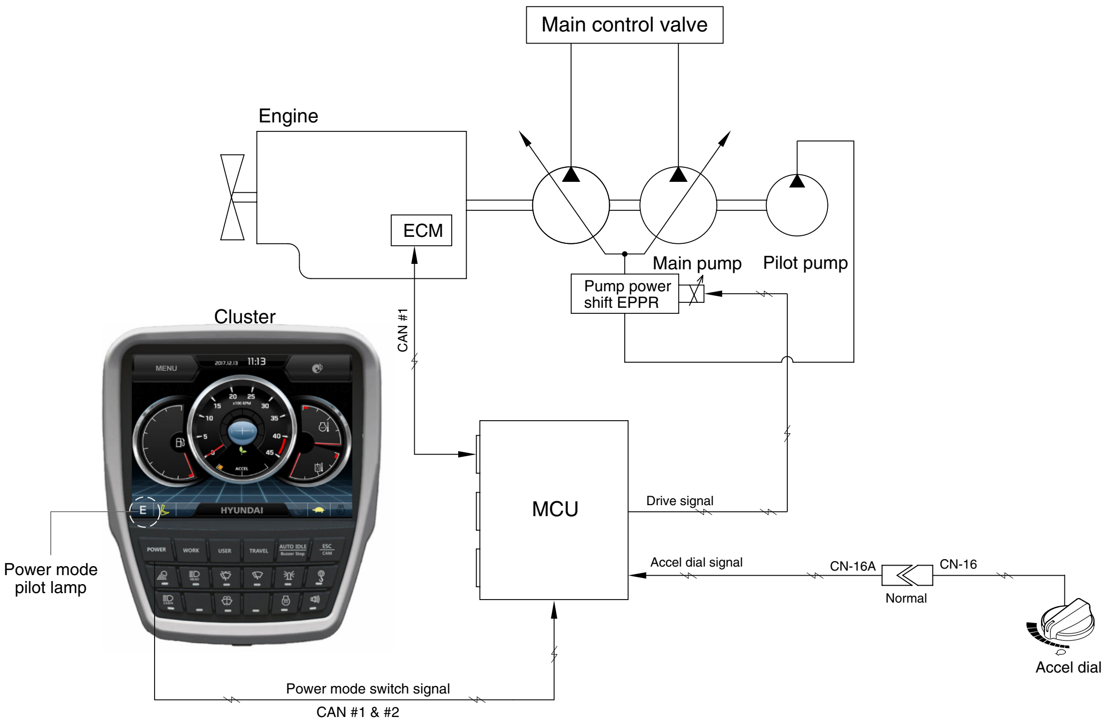
SYSTEM DIAGRAM



480S5MS01

GROUP 2 MODE SELECTION SYSTEM

1. POWER MODE SELECTION SYSTEM



480S5MS14

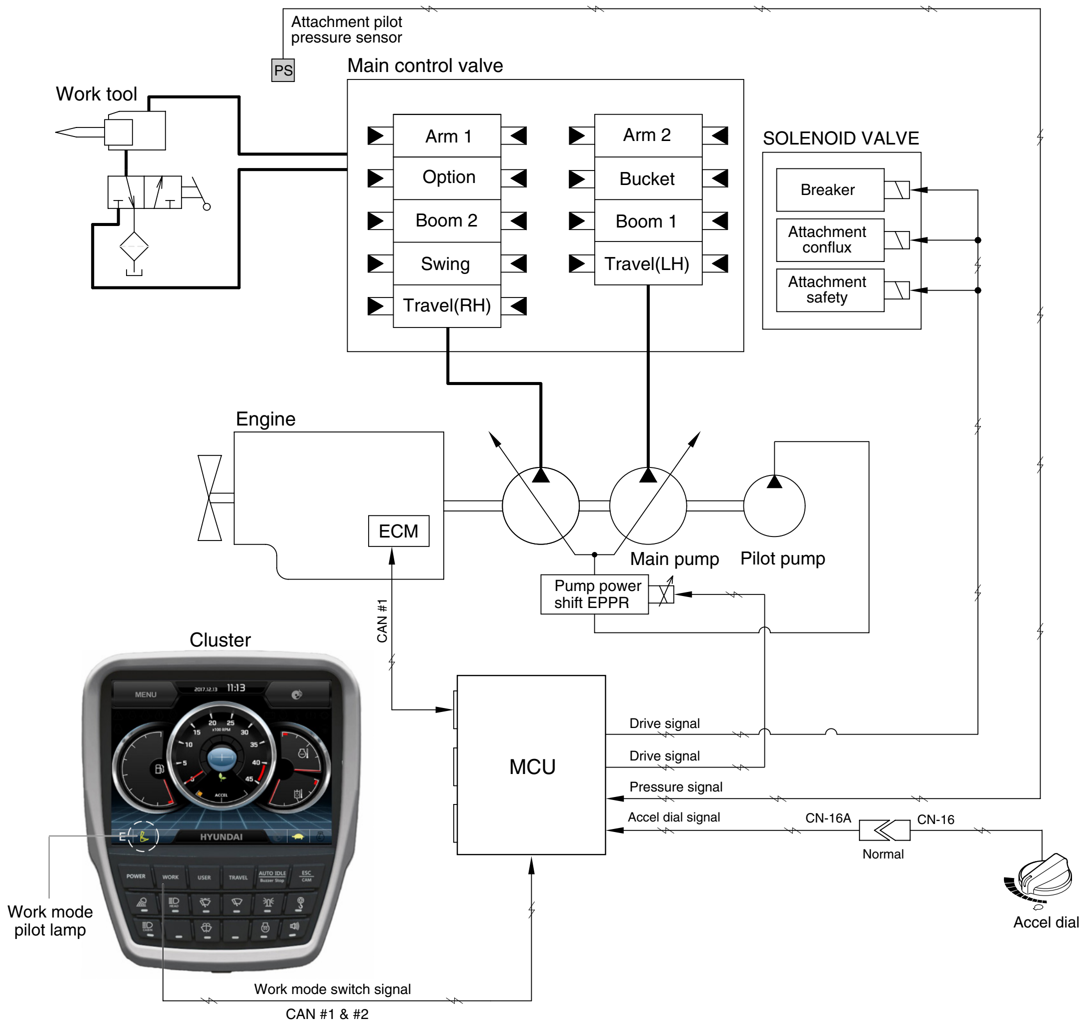
Mode selection system (micro computer based electro-hydraulic pump and engine mutual control system) optimizes the engine and pump performance.
The combination of 3 power modes (P, S, E) and acceleration mode (10 set) of haptic controller makes it possible to use the engine and pump power more effectively corresponding to the work conditions from a heavy and great power requesting work to a light and precise work.

Power mode	Application	Engine rpm				Power shift by EPPR valve			
		Standard		Option		Standard		Option	
		Unload	Load	Unload	Load	Current (mA)	Pressure (kgf/cm^2)	Current (mA)	Pressure (kgf/cm^2)
M	Heavy duty power	1900±50	1900±50	1950±50	1800±50	250±30	5	180±30	2
H	Standard power	1800±50	1800±50	1850±50	1750±50	280±30	7±3	230±30	4±3
S	Economy operation	1700±50	1700±50	1750±50	1650±50	280±30	7±3	260±30	6±3
AUTO DECEL	Engine deceleration	1100±100	-	1100±100	-	700±30	38±3	700±30	38±3
One touch decel	Engine quick deceleration	1000±100	-	1000±100	-	700±30	38±3	700±30	38±3
KEY START	Key switch start position	1000±100	-	1000±100	-	700±30	38±3	700±30	38±3

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

2. WORK MODE SELECTION SYSTEM

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



480S5MS02

1) GENERAL WORK MODE (bucket)

This mode is used to general digging work.

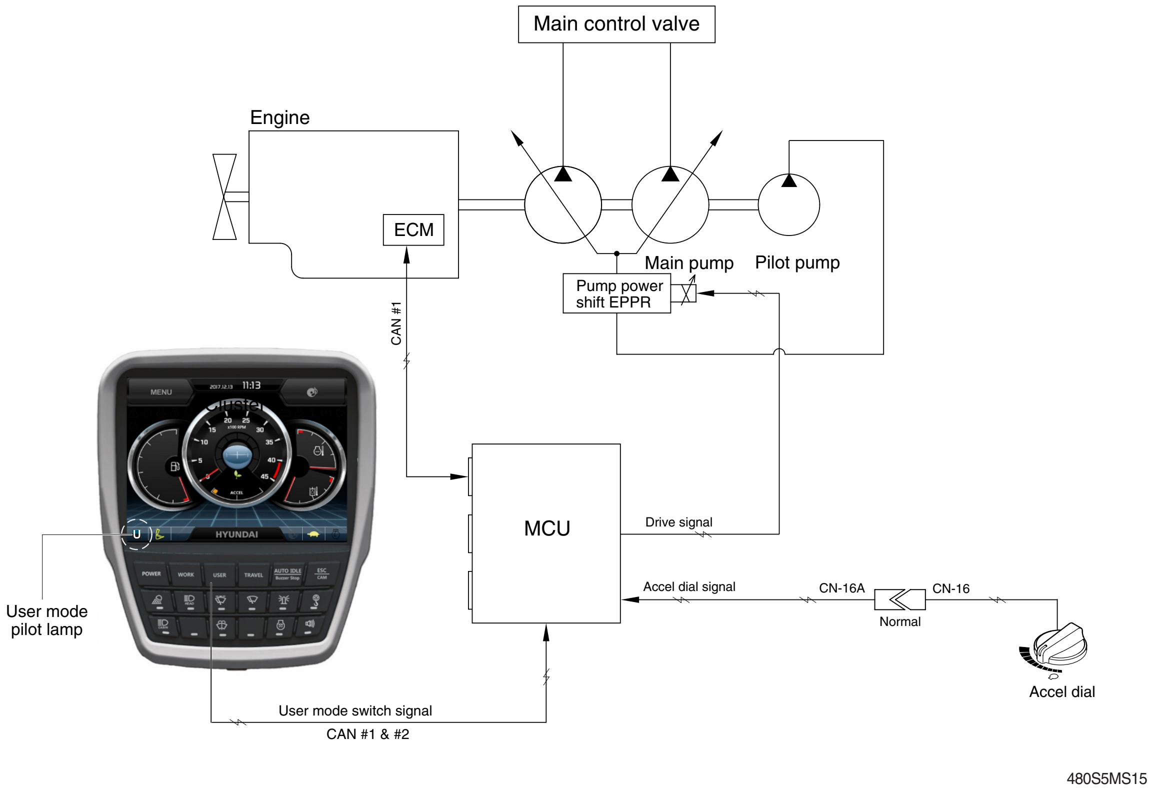
2) ATT WORK MODE (breaker, crusher)

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

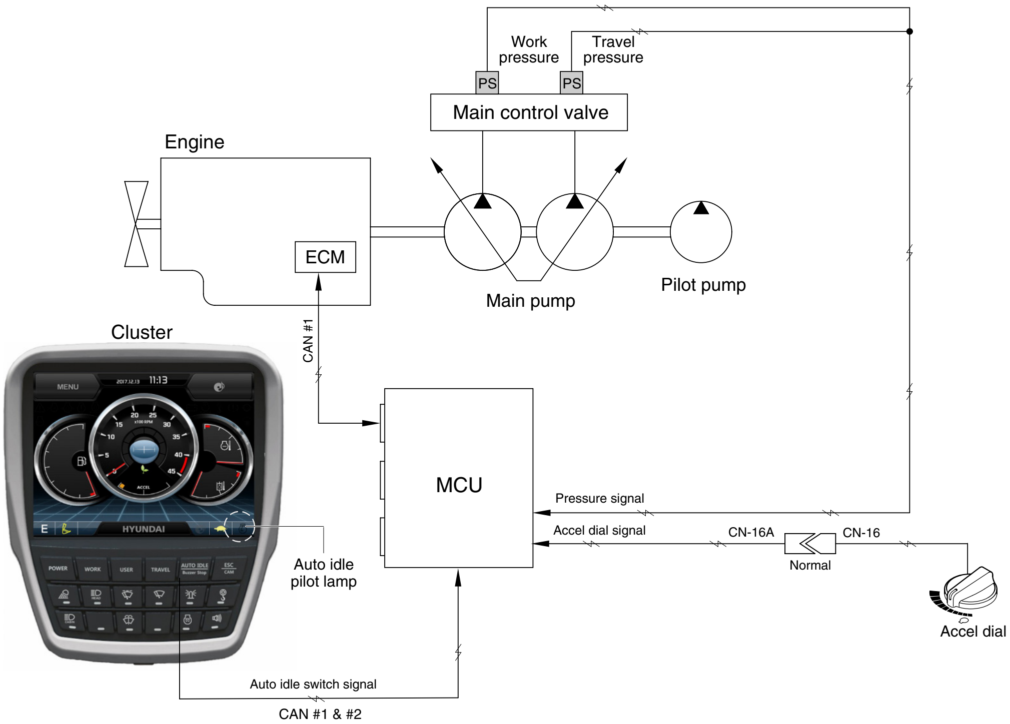


1) High idle rpm, auto idle rpm and EPPR pressure can be adjusted and memorized in the U-mode.

2) LCD segment vs parameter setting

Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1500	1000	0
2	1550	1050	3
3	1600	1100 (auto decel)	6
4	1650	1150	9
5	1700	1200	12
6	1750	1250	16
7	1800	1300	20
8	1850	1350	26
9	1900	1400	32
10	1950	1450	38

GROUP 3 AUTOMATIC DECELERATION SYSTEM

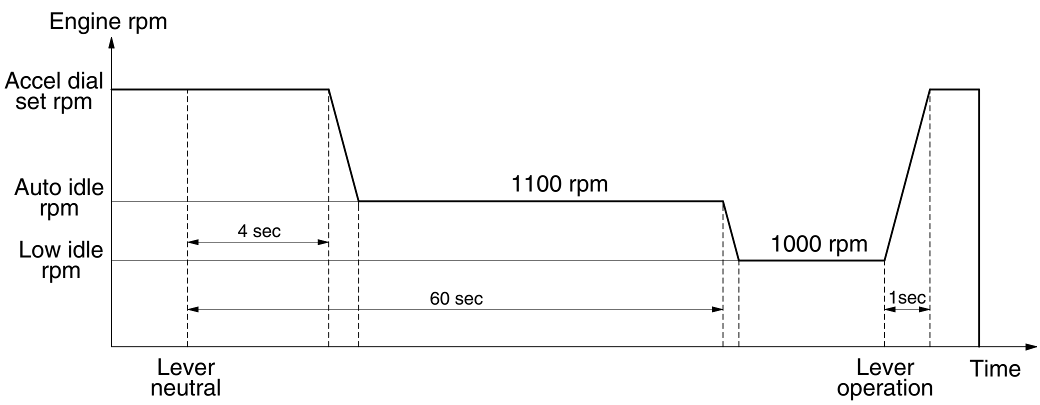


480S5MS16

1. WHEN AUTO IDLE PILOT LAMP ON

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

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



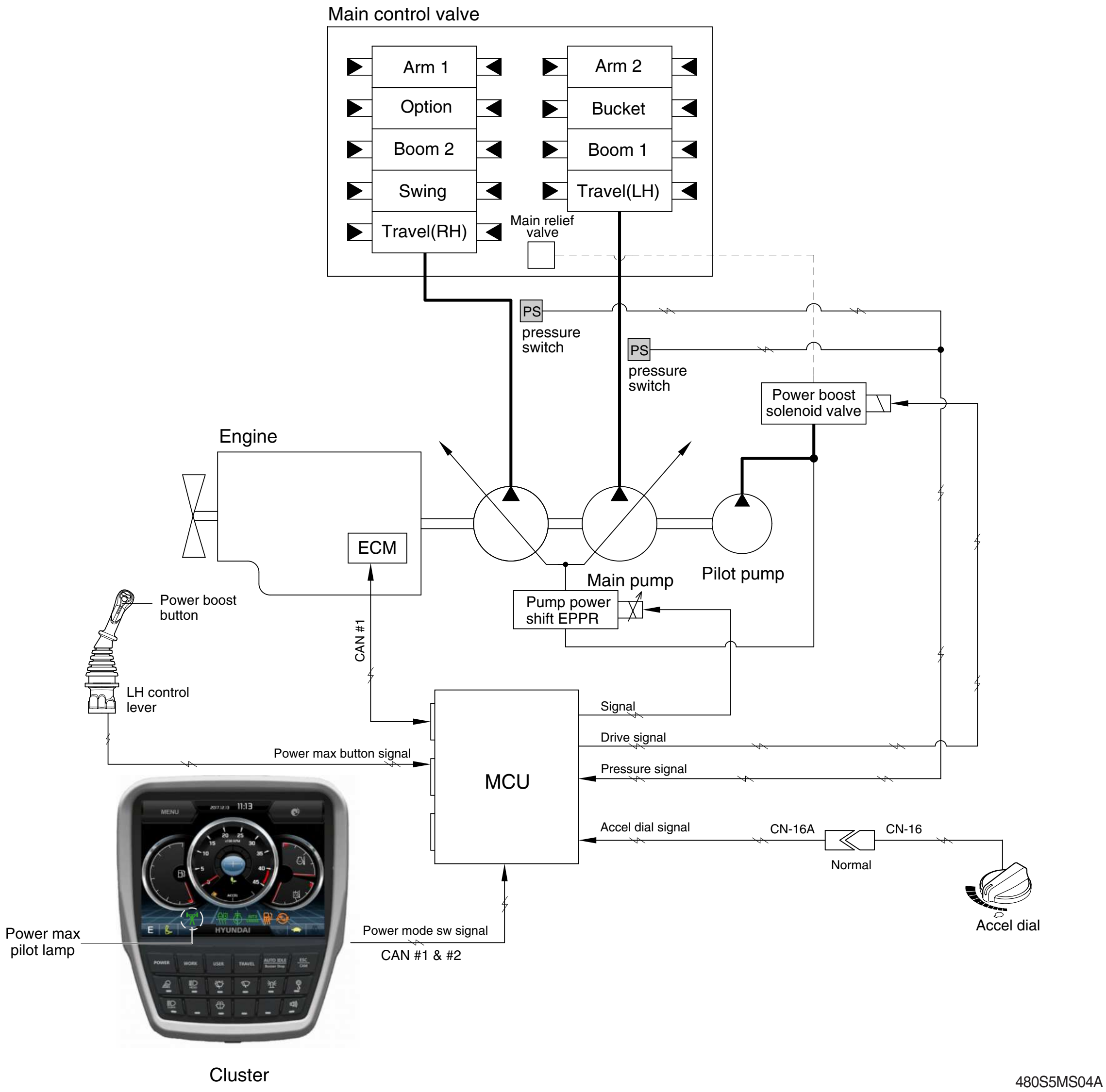
480S5MS03

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



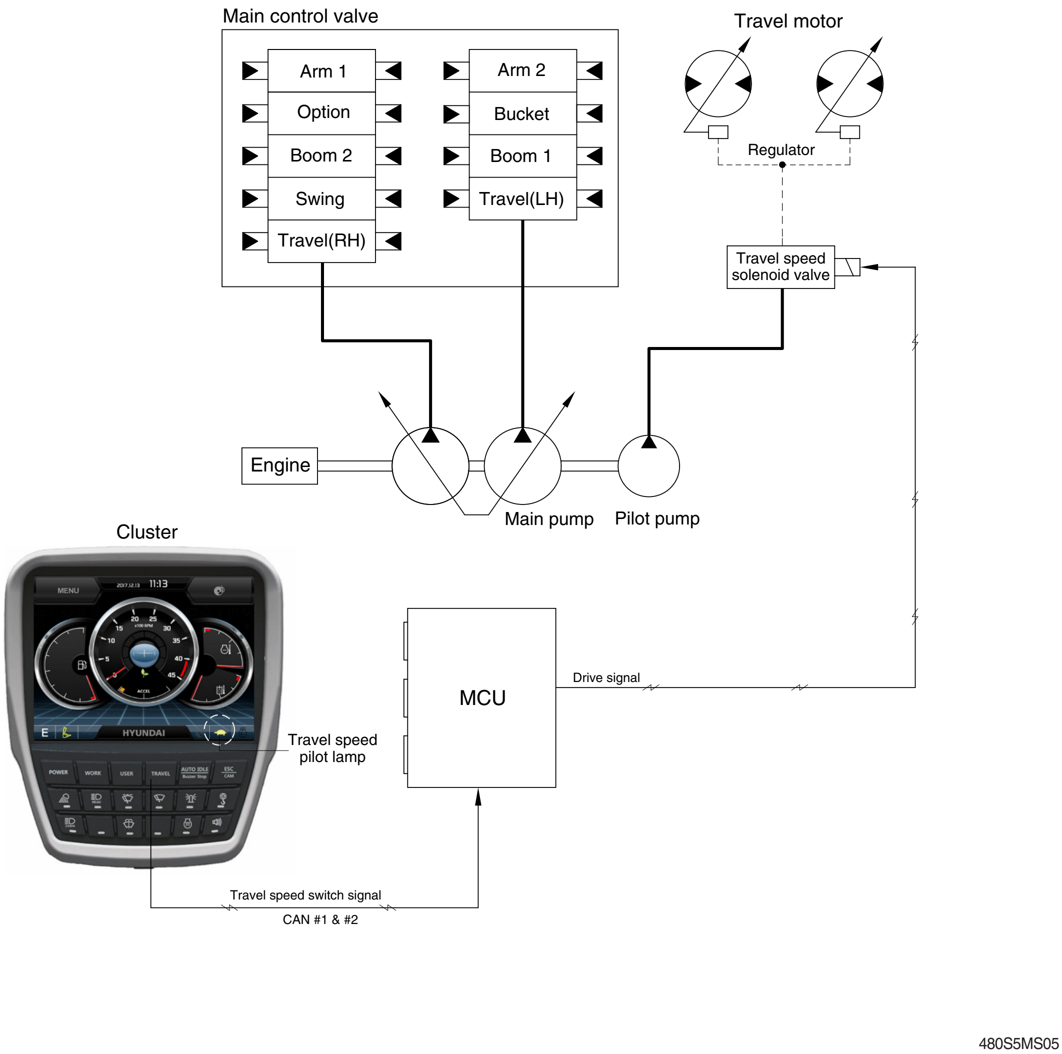
· When the power boost switch on the left control lever knob is pushed ON, the power mode is set P mode and maximum digging power is increased by 10 %.

· 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 Accel dial : over 8	- Power mode : P - Accel dial power : 9 - Power boost solenoid : ON - Power boost pilot lmap : ON - Operating time : max 8 seconds
Canceled	Power boost switch : OFF	- Pre-set power mode - Power boost solenoid : OFF - Power boost pilot lamp : OFF

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

GROUP 5 TRAVEL SPEED CONTROL SYSTEM

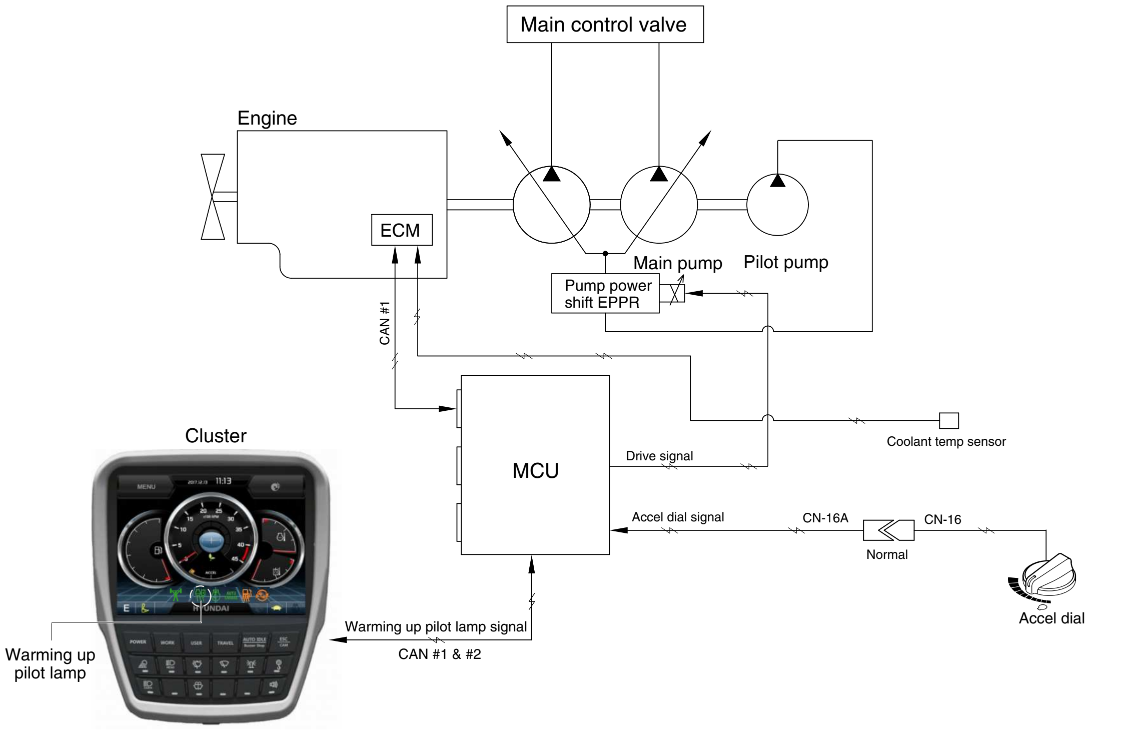


Travel speed can be switched manually by pressing the travel speed switch on the cluster.

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

※ Default : Turtle (Low)

GROUP 6 AUTOMATIC WARMING UP SYSTEM



480S5MS17A

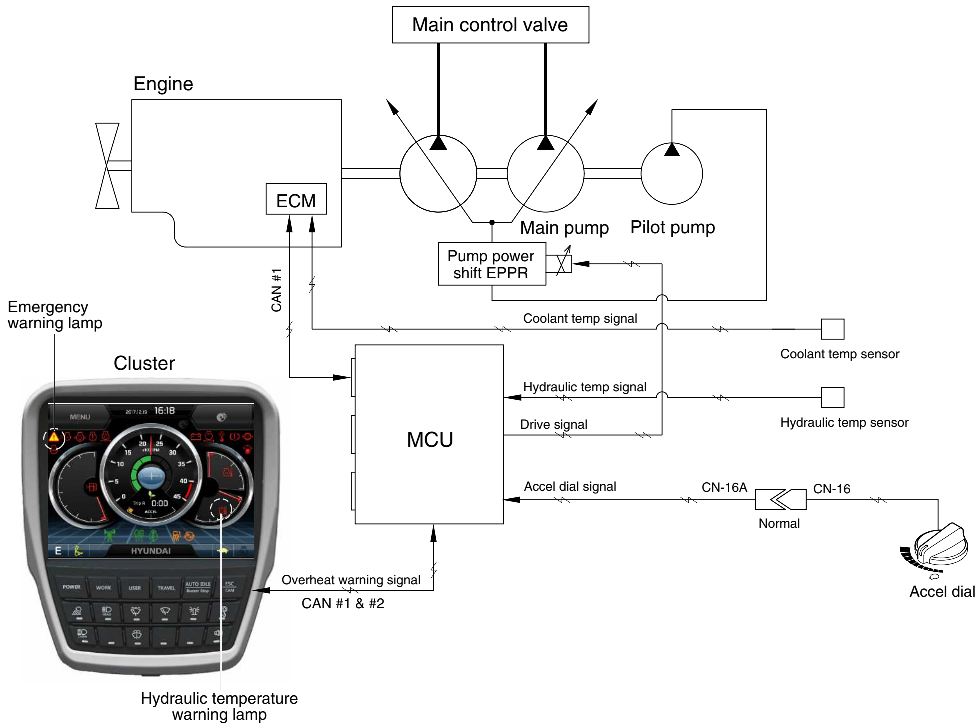
1. The MCU receives the engine coolant temperature from the ECM, and if the coolant temperature is below 30˚C, it increases the engine speed from key start rpm to 1000 rpm. At this time the mode does not change. If the coolant temperature sensor has fault, the hydraulic oil temperature signal is substituted.

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



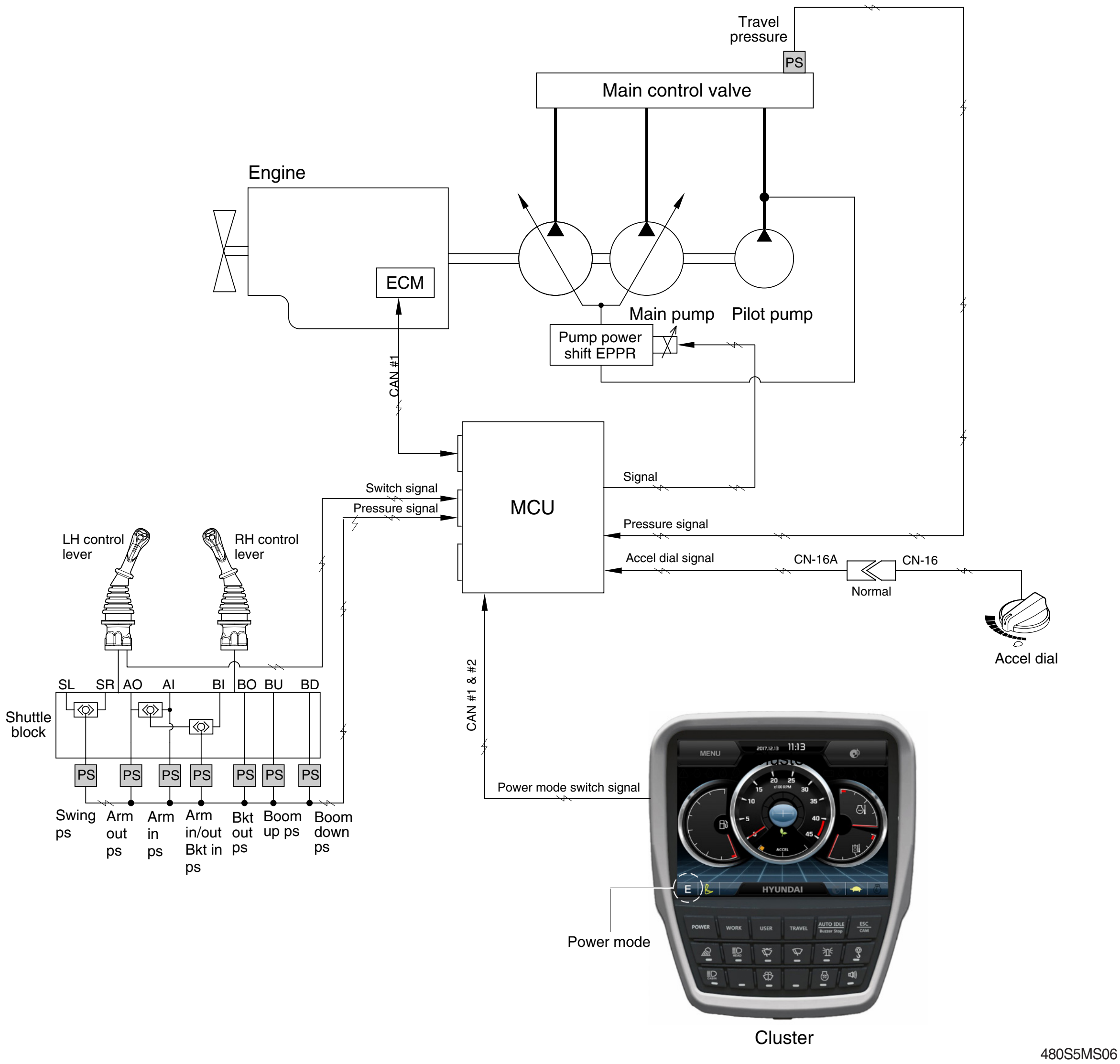
480S5MS18A

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

GROUP 8 VARIABLE POWER CONTROL SYSTEM

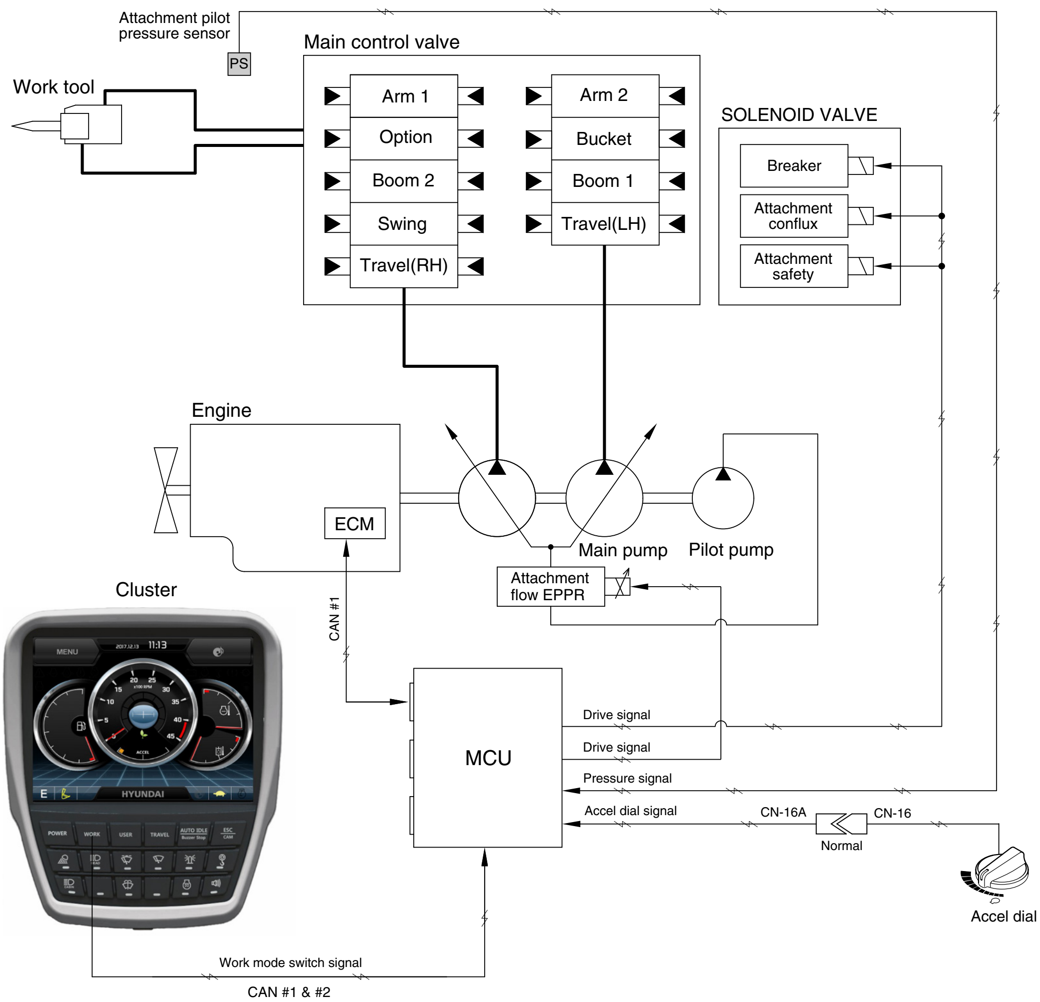


· The variable power control system controls the engine and pump mutual power according to RCV lever stroke and pump load.
It makes fuel saving and smooth control at precise work.

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

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

GROUP 9 ATTACHMENT FLOW CONTROL SYSTEM



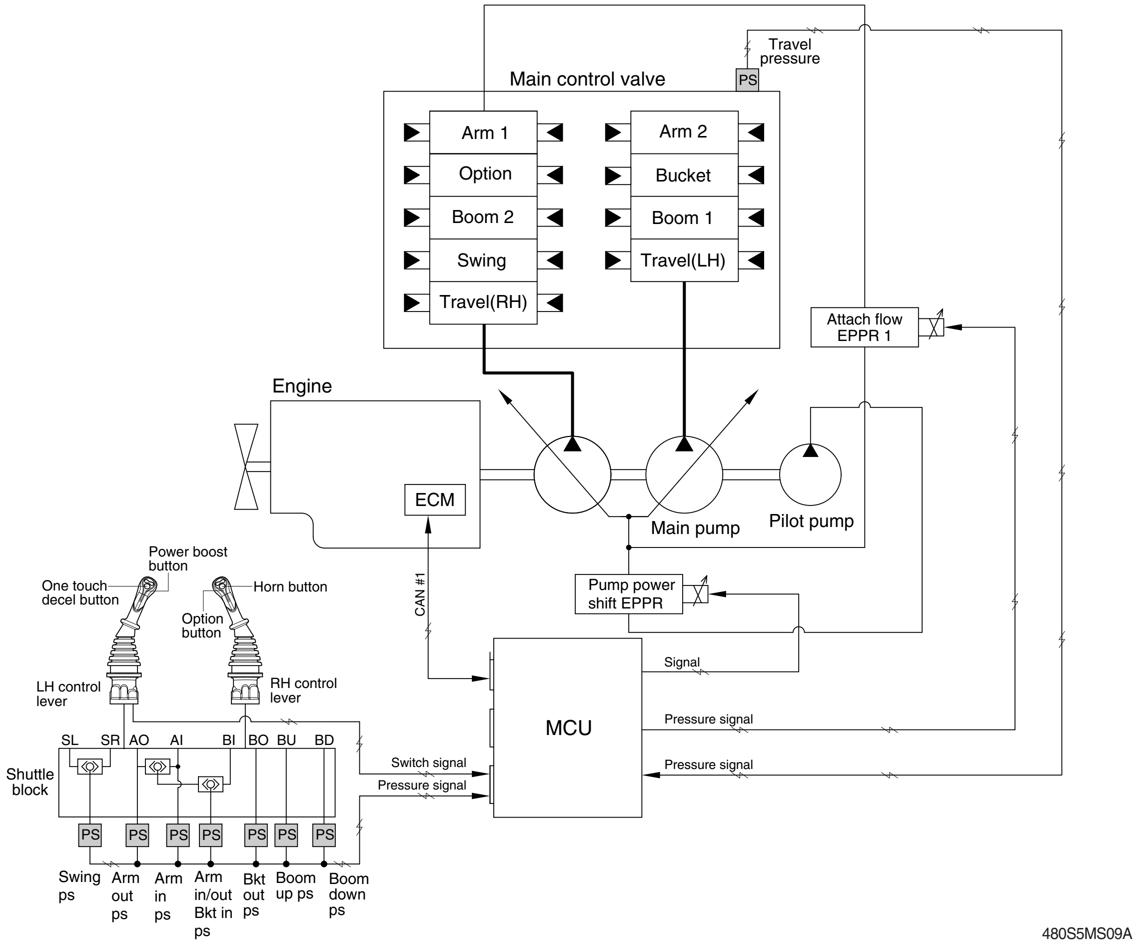
480S5MS07

· 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 ~ 320 lpm	100 ~ 760 lpm
Attach safety solenoid	-	ON
Attach conflux solenoid	-	ON/OFF
Breaker solenoid★	ON	-

※ Refer to the page 5-71 for the attachment kinds and max flow.
★ When breaker operating button is pushed.

GROUP 10 INTELLIGENT POWER CONTROL SYSTEM



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

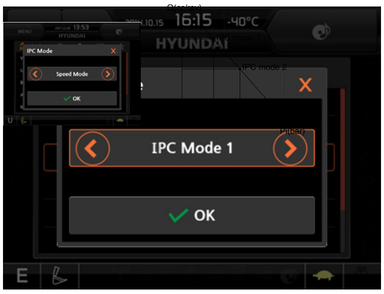
Condition★1	Function
IPC mode : ON★2 Boom up Arm in Not travel motion Not swing motion	Limitation of pump flow rate : Activated
None of upper condition	Limitation of pump flow rate : Canceled

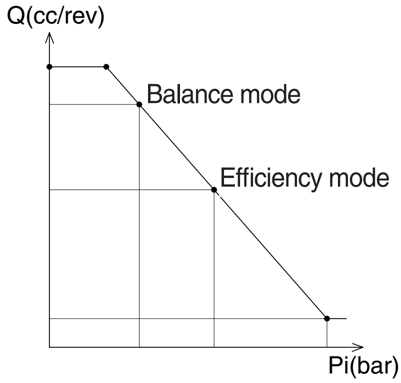
★1 AND condition

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

2. IPC MODE SELECTION

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

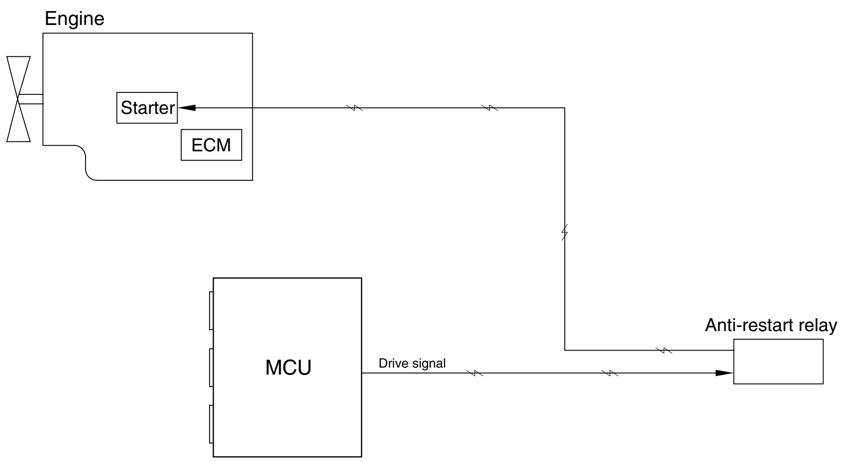




290F3CD311

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

GROUP 11 ANTI-RESTART SYSTEM



480S5MS12

1. ANTI-RESTART FUNCTION

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

GROUP 12 SELF-DIAGNOSTIC SYSTEM

1. OUTLINE

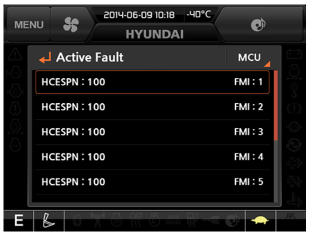
When any abnormality occurs in the ADVANCED CAPO system caused by electric parts malfunction and by open or short circuit, the MCU diagnoses the problem and sends the error codes to the cluster and also stores them in the memory.

2. MONITORING

1) Active fault

290F3CD120

290F3CD121

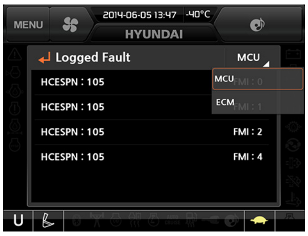


290F3CD125

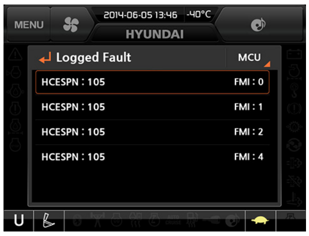
· The active faults of the MCU, engine ECM or air conditioner can be checked by this menu.

2) Logged fault

290F3CD128



290F3CD123

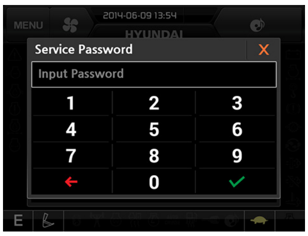


290F3CD124

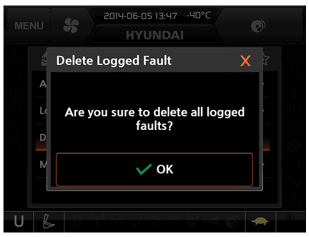
· The logged faults of the MCU, engine ECM or air conditioner can be checked by this menu.

3) Delete logged fault

290F3CD134



290F3CD126



290F3CD127

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

3. MACHINE ERROR CODES TABLE

<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 (#13) 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		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
123	0	10 seconds continuous, Negative 1 Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Negative 1 Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Negative 1 Press. Sensor Measurement Voltage < 0.3V	●		
		(Results / Symptoms) 1. Monitor – Negative 1 Press. display failure 2. Control Function – IPC operation failure, Option attachment flow control operation failure (Checking list) 1. CD-70 (#B) – CN-51 (#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

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
128	0	(when you had conditions mounting pressure sensor) 10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	(when you had conditions mounting pressure sensor) 10 seconds continuous, 0.3V≤ Boom Down Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	(when you had conditions mounting pressure sensor) 10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Boom Down Pilot Press. display failure 2. Control Function – Boom floating operation failure (Checking list) 1. CD-85 (#B) – CN-52 (#31) Checking Open/Short 2. CD-85 (#A) – CN-51 (#3) Checking Open/Short 3. CD-85 (#C) – CN-51 (#13) Checking Open/Short				
129	0	10 seconds continuous, Arm In Pilot Press. Sensor Measurement Voltage > 4.8V	●		
	1	10 seconds continuous, 0.3V≤ Arm In Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Arm In Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Arm In Pilot Press. display failure 2. Control Function – IPC operation failure (Checking list) 1. CD-90 (#B) – CN-51 (#10) Checking Open/Short 2. CD-90 (#A) – CN-51 (#3) Checking Open/Short 3. CD-90 (#C) – CN-51 (#13) Checking Open/Short				
133	0	10 seconds continuous, Arm In/Out & Bucket In Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Arm In/Out & Bucket In Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Arm In/Out & Bucket In Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Arm In/Out & Bucket In Pilot Press. display failure 2. Control Function – Engine variable horse power control operation failure (Checking list) 1. CD-35 (#B) – CN-52 (#28) Checking Open/Short 2. CD-35 (#A) – CN-51 (#3) Checking Open/Short 3. CD-35 (#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
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

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
140	5	(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	●		
	6	(Detection) 10 seconds continuous, Pump EPPR drive current > 1.0A (Cancellation) 3 seconds continuous, Pump EPPR drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Pump horse power setting specification difference (Fuel efficiency/speed specification failure) (Checking list) 1. CN-75 (#2) – CN-52 (#9) Checking Open/Short 2. CN-75 (#1) – CN-52 (#19) Checking Open/Short				
141 (NA)	5	(Model Parameter) mounting Boom Priority EPPR (Detection) (When Boom Priority EPPR Current is more than 10 mA) 10 seconds continuous, Boom Priority EPPR drive current < 0 mA (Cancellation) (When Boom Priority EPPR Current is more than 10 mA) 3 seconds continuous, Boom Priority EPPR drive current ≥ 10 mA	●		
	6	(Detection) 10 seconds continuous, Boom Priority EPPR drive current > 1.0 A (Cancellation) 3 seconds continuous, Boom Priority EPPR drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Boom first control operation failure (Checking list) 1. CN-133 (#2) – CN-52 (#34) Checking Open/Short 2. CN-133 (#1) – CN-52 (#35) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">143
(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
(NA)</td><td>5</td><td>(Model Parameter) mounting Remote Cooling Fan EPPR
(Detection)
(When Remote Cooling Fan EPPR Current is more than 10 mA)
10 seconds continuous, Remote Cooling Fan EPPR drive current = 0 mA
(Cancellation)
(When Remote Cooling Fan EPPR Current is more than 10 mA)
3 seconds continuous, Remote Cooling Fan EPPR drive current ≥ 10 mA</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Remote Cooling Fan EPPR drive current > 1.0 A
(Cancellation)
3 seconds continuous, Remote Cooling Fan EPPR drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Remote fan control operation failure
(Checking list)
1. CD-52 (#1) – CN-51 (#9) Checking Open/Short
2. CD-52 (#2) – CN-51 (#14) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General　　C : Crawler Type　　W : Wheel Type

<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 (#16) Checking Open/Short
2. CN-88 (#2) – Fuse box (#28) Checking Open/Short</td></tr>
</table>

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="4">167</td><td rowspan="2">4</td><td>(Detection)
(When Travel 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 (#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">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 (#31) 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 (#31) Checking Open/Short</td></tr>
<tr><td rowspan="3">179</td><td>4</td><td>Monitor – Selecting attachment(breaker / crusher)
(Detection)
(When Breaker Operating Solenoid is Off)
10 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage ≤ 3.0V
(Cancellation)
(When Breaker Operating Solenoid is Off)
3 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage > 3.0V</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
(When Breaker Operating Solenoid is On)
10 seconds continuous, Attachment Safety Solenoid drive current > 6.5 A
(Cancellation)
(When Breaker Operating Solenoid is On)
3 seconds continuous, Attachment Safety Solenoid drive current ≤ 6.5 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Option attachment flow control – Breaker operation failure (breaker mode)
(Checking list)
1. CN-66 (#1) – CN-15 (#11) 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 (NA)	4	(Model Parameter) mounting Reverse Cooling Fan Solenoid (Detection) (When Reverse Cooling Fan Solenoid is Off) 10 seconds continuous, Reverse Cooling Fan Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Reverse Cooling Fan Solenoid is Off) 3 seconds continuous, Reverse Cooling Fan Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Reverse Cooling Fan Solenoid is On) 10 seconds continuous, Reverse Cooling Fan Solenoid drive current > 4.5 A (Cancellation) (When Reverse Cooling Fan Solenoid is On) 3 seconds continuous, Reverse Cooling Fan Solenoid drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – Cooling Fan reverse control operation failure (not applicable)				
188	5	(Detection) (When Attachment Flow EPPR 1 current is equal or more than 300 mA) 10 seconds continuous, Attachment Flow EPPR drive current < 100 mA (Cancellation) (When Attachment Flow EPPR 1 current is equal or more than 300 mA) 3 seconds continuous, Attachment Flow EPPR drive current ≥ 100 mA	●		
	6	(Detection) 10 seconds continuous, Attachment Flow EPPR 1 drive current > 1.0 A (Cancellation) 3 seconds continuous, Attachment Flow EPPR 1 drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – IPC operation failure, Option attachment flow control operation failure (Checking list) 1. CN-242 (#2) – CN-52 (#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

<table>
<tr><th colspan="2">DTC</th><th rowspan="2">Diagnostic Criteria</th><th colspan="3">Application</th></tr>
<tr><th>HCESPN</th><th>FMI</th><th>G</th><th>C</th><th>W</th></tr>
<tr><td rowspan="3">189</td><td>5</td><td>(Detection)
(When 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</td><td>●</td><td></td><td></td></tr>
<tr><td>6</td><td>(Detection)
10 seconds continuous, Attachment Flow EPPR 2 drive current > 1.0 A
(Cancellation)
3 seconds continuous, Attachment Flow EPPR 2 drive current ≤ 1.0 A</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Option attachment flow control operation failure
(Checking list)
1. CN-243 (#2) – CN-52 (#40) Checking Open/Short
2. CN-243 (#1) – CN-52 (#16) Checking Open/Short</td></tr>
<tr><td rowspan="4">196
(NA)</td><td>0</td><td>HW145
10 seconds continuous,
Attachment flow control EPPR 1 press. Sensor Measurement Voltage > 5.2V</td><td></td><td></td><td></td></tr>
<tr><td>1</td><td>HW145
10 seconds continuous,
0.3V≤ Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.8V</td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>HW145
10 seconds continuous,
Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.3V</td><td></td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Driving second pump joining function operation failure
(Checking list)
1. CD-93 (#B) – CN-52 (#34) Checking Open/Short
2. CD-93 (#A) – CN-51 (#32) Checking Open/Short
3. CD-93 (#C) – CN-51 (#31) Checking Open/Short</td></tr>
<tr><td rowspan="4">200</td><td>0</td><td>10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage > 5.2V</td><td>●</td><td></td><td></td></tr>
<tr><td>1</td><td>10 seconds continuous, 0.3V≤ Pump EPPR Press. Sensor Measurement Voltage < 0.8V</td><td>●</td><td></td><td></td></tr>
<tr><td>4</td><td>10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage < 0.3V</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Monitor – Pump EPPR Press. display failure
2. Control Function – Pump input horse power control failure, Overload at compensation control operation failure
(Fuel efficiency/speed performance failure)
(Checking list)
1. CD-45 (#B) – CN-52 (#32) Checking Open/Short
2. CD-45 (#A) – CN-51 (#3) Checking Open/Short
3. CD-45 (#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

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

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

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 (#13) Checking Open/Short				
325	4	(Model Parameter) mounting Fuel heater Relay (Detection) (When Fuel Warmer 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 warmer operation failure (Checking list) 1. CR-46 (#85) – CN-52 (#12) Checking Open/Short 2. CR-46 (#86) – Fuse box (#22) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

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

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

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 (#30) 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 L Measurement Voltage < 18V (In case 12v goods, Alternator Node L 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 (#28) Checking Open/Short</td></tr>
<tr><td rowspan="2">831</td><td>2</td><td>(When mounting the A/C Controller)
60 seconds continuous, A/C Controller Communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – A/C Controller operation failure
(Checking list)
1. CN-11 (#8) – CN-51 (#22) Checking Open/Short
2. CN-11 (#7) – CN-51 (#32) Checking Open/Short</td></tr>
<tr><td rowspan="2">840</td><td>2</td><td>60 seconds continuous, Cluster Communication Data Error</td><td>●</td><td></td><td></td></tr>
<tr><td colspan="5">(Results / Symptoms)
1. Control Function – Cluster operation failure
(Checking list)
1. CN-56A (#7) – CN-51 (#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 (NA)	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-125 (#3) – CN-51 (#22) Checking Open/Short 2. CN-125 (#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-54 (#21) – CN-51 (#23) Checking Open/Short 2. CN-54 (#31) – CN-51 (#33) 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
866	2	(When mounting the AAVM) 60 seconds continuous, AAVM communication Data Error	●		
	(Results / Symptoms) 1. Control Function – AAVM operation failure (Checking list) 1. CN-401 (#86) – CN-51 (#22) Checking Open/Short 2. CN-401 (#87) – CN-51 (#32) Checking Open/Short				
867	2	60 seconds continuous, RDU communication Data Error	●		
	(Results / Symptoms) 1. Control Function – RDU operation failure (Checking list) 1. CN-376 (#10) – CN-51 (#22) Checking Open/Short 2. CN-376 (#18) – CN-51 (#32) Checking Open/Short				
868	2	60 seconds continuous, Switch Controller communication Data Error	●		
	(Results / Symptoms) 1. Control Function – Switch Controller operation failure (Checking list) 1. CN-56A (#7) – CN-51 (#32) Checking Open/Short 2. CN-56A (#6) – CN-51 (#22) Checking Open/Short				
869	2	(When mounting the BKCU) 60 seconds continuous, BKCU communication Data Error	●		
	(Results / Symptoms) 1. Control Function – BKCU operation failure (Checking list) 1. CS-2B (#A) – CN-51 (#22) Checking Open/Short 2. CS-2B (#B) – CN-51 (#32) Checking Open/Short 3. CS-2B (#C) – CN-5 (#44) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

4. ENGINE FAULT CODE

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
111 629 12	Error internal to the ECM related to memory hardware failures or internal ECM voltage supply circuits.	Engine will not start.
115 190 2	No engine speed signal detected at both engine position sensor circuits.	Engine will die and will not start.
121 190 10	No engine speed signal detected from one of the engine position sensor circuits.	None on performance.
122 102 3	High voltage detected on the intake manifold pressure circuit.	Derate in power output of the engine.
123 102 4	Low voltage detected on the intake manifold pressure circuit.	Derate in power output of the engine.
131 91 3	High voltage detected at the throttle position signal circuit.	Severe derate (power and speed). Limp home power only.
132 91 4	Low voltage detected at the throttle position signal circuit.	Severe derate (power and speed). Limp home power only.
133 974 3	High voltage detected at the remote throttle position signal circuit.	None on performance if remote throttle is not used.
134 974 4	Low voltage detected at the remote throttle position signal circuit.	None on performance if remote throttle is not used.
135 100 3	High voltage detected at the oil pressure circuit.	No engine protection for oil pressure.
141 100 4	Low voltage detected at the oil pressure circuit.	No engine protection for oil pressure.
143 100 18	Oil pressure signal indicates oil pressure below the low oil pressure engine protection limit.	Progressive power and speed derate with increasing time after alert. If engine protection shutdown feature is enable, engine will shut down 30 seconds after red lamp starts flashing.
144 110 3	High voltage detected at the coolant temperature circuit.	Possible white smoke. Fan will stay on if controlled by the electronic control module (ECM). No engine protection for coolant temperature.
145 110 4	Low voltage detected at the coolant temperature circuit.	Possible white smoke. Fan will stay on if controlled by electronic control module (ECM). No engine protection for coolant temperature.
147 91 8	A frequency of less then 100Hz was detected at the frequency throttle signal pin of the actuator harness connector at the ECM.	Calibration dependent power and speed derate.
148 91 8	A frequency of more than 100Hz was detected at the frequency throttle signal pin of the actuator harness connector at the ECM.	Calibration dependent power and speed derate.
151 110 0	Coolant temperature signal indicates coolant temperature above 104˚C (220˚F).	Progressive power derate with increasing time after alert. If engine protection shutdown feature is enabled, engine will shut down 30 seconds after red lamp starts flashing.

※ Some fault codes are not applied to this machine.

111Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
153 105 3	High voltage detected at the intake manifold temperature circuit.	Possible white smoke. Fan will stay on if controlled by electronic control module (ECM). No engine protection for coolant temperature.
154 105 4	Low voltage detected at the intake manifold temperature circuit.	Possible white smoke. Fan will stay on if controlled by electronic control module (ECM). No engine protection for coolant temperature.
155 105 0	Intake manifold temperature signal indicates temperature above 87.8˚C (190˚F).	Progressive power derate with increasing time after alert. If engine protection shutdown feature is enabled, engine will shut down 30 seconds after red lamp starts flashing.
187 620 4	Low voltage detected on the ECM voltage supply line to some sensors (VSEN2 supply).	Engine will run derated. No engine protection for oil pressure and coolant level.
198 612 3	High voltage detected at the ICON lamp circuit when low voltage was expected by the ECM.	The ICON system will be disabled. Only mandatory shutdown will be enabled.
199 612 4	Less than 6 VDC (low voltage) detected at the ICON lamp circuit when high voltage was expected by the ECM.	The ICON system will be disabled. Only mandatory shutdown will be enabled.
211 1484 31	Additional machine diagnostic codes have been logged. Check other ECM's for diagnostic codes.	None on engine performance.
212 175 3	High voltage detected at the oil temperature circuit.	No engine protection for oil temperature.
213 175 4	Low voltage detected at the oil temperature circuit.Low voltage detected at the oil temperature circuit.	No engine protection for oil temperature.
214 175 0	Oil temperature signal indicates oil temperate above 123.9˚C (225˚F).	Progressive power derate with increasing time after alert. If engine protection shutdown feature is enabled, engine will shut down 30sec after the red lamp starts flashing.
219 1380 17	Low oil level was detected in the CentinelTM makeup oil tank.	None on performance. CentinelTM deactivated.
221 108 3	High voltage detected at the ambient air pressure circuit.	Derate in power output of the engine.
222 108 4	Low voltage detected at the ambient air pressure circuit.	Derate in power output of the engine.
223 1265 4	Incorrect voltage detected at the CentinalTM actuator circuit by the ECM.	None on performance. CentinelTM deactivated.
227 620 3	High voltage detected on the ECM voltage supply line to some sensors (VSEN2 supply).	Engine will run derated. No engine protection for oil pressure and coolant level.
234 190 0	Engine speed signal indicates engine speed is greater than 2650 rpm.	Fuel shutoff valve is closed unit the engine speed drops. The fuel shutoff valve will open when engine speed falls below 2000 rpm.
235 111 1	Coolant level signal indicates coolant level is below the normal range.	Progressive power derate with increasing time after alert. If engine protection shutdown feature is enabled, engine will shut down 30 seconds after red lamp starts flashing.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
237 644 2	Duty cycle of the throttle input signal to the primary or secondary engine for multiple unit synchronization is less than 3 percent or more than 97 percent.	All engines(primary and secondary) are shut down with increasing time after alert if hard-coupled. Only secondary engines are shut down with increasing time after alert if soft-coupled.
241 84 2	The ECM lost the vehicle speed signal.	Engine speed limited to maximum engine speed without vehicle speed sensor parameter value Cruise Control. Gear-Down Protection and Road Speed Governor will not work (automotive only).
242 84 10	Invalid or inappropriate vehicle speed signal detected. Signal indicates an intermittent connection or VSS tampering.	Engine speed limited to maximum engine speed without vehicle speed sensor parameter value Cruise Control. Gear-Down Protection and Road Speed Governor will not work (automotive only).
245 647 4	Less than 6 VDC detected at fan clutch circuit when on. Indicates an excessive current draw from the ECM or faulty ECM output circuit.	The fan may stay on at all times.
254 647 4	Less than 6 VDC detected at FSO circuit when on. Indicates an excessive current draw from the ECM or a faulty ECM output circuit.	The ECM turns off the FSO supply voltage. The engine will shut down.
255 632 3	Externally supplied voltage detected going to the fuel shutoff solenoid supply circuit.	None on performance. Fuel shutoff valve stays open.
285 639 9	The ECM expected information from a multiplexed device but did not receive it soon enough or did not receive it at all.	At least one multiplexed device will not operate properly.
286 639 13	The ECM expected info from a multiplexed device but only received a portion of the necessary information.	At least on multiplexed device will not operate properly.
287 91 19	The machine vehicle electronic control unit (VECU) detected a fault with its throttle pedal.	The engine will only idle.
288 974 19	The machine vehicle electronic control unit (VECU) detected a fault with its remote throttle.	The engine will not respond to the remote throttle.
293 1083 3	High voltage detected at the machine temperature sensor signal pin of the 31-pin machine connector.	No engine protection for machine temperature.
294 1083 4	Low voltage detected at the machine temperature sensor signal pin of the 31-pin machine connector.	No engine protection for machine temperature.
295 108 2	An error in the ambient air pressure sensor signal was detected by the ECM.	Engine is derated to no air setting.
297 1084 3	High voltage detected at the machine pressure sensor signal pin of the 31-pin machine connector.	No engine protection for machine pressure.
298 1084 4	Low voltage detected at the machine pressure sensor signal pin of the 31-pin machine connector.	No engine protection for machine pressure.
299 1384 31	Engine shutdown by device other than key switch before proper engine cool down resulting in filtered load factor above maximum shutdown threshold.	No action taken by the ECM.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
311 651 6	Current detected at No.1 injector when voltage is turned off.	The injector for cylinder number 1 is turned off.
312 655 6	Current detected at No.5 injector when voltage is turned off.	The injector for cylinder number 5 is turned off.
313 653 6	Current detected at No.3 injector when the voltage is turned off	The injector for cylinder number 3 is turned off.
314 656 6	Current detected at No 6 injector when the voltage is turned off.	The injector for cylinder number 6 is turned off.
315 652 6	Current detected at No.2 injector when the voltage is turned off.	The injector for cylinder number 2 is turned off.
319 251 2	Real time clock lost power.	None on performance. Data in the ECM will not have accurate time and date information.
321 654 6	Current detected at No.4 injector when the voltage is turned on.	The injector for cylinder number 4 is turned off.
322 656 5	Injector solenoid driver cylinder 1 circuit-current below normal, or open circuit. Current detected at injector number 1 when voltage is turned off.	The current to the injector is shut off. The engine can possibly misfire or run rough.
323 656 5	Injector solenoid driver cylinder 5 circuit-current below normal, or open circuit. Current detected at injector number 5 when voltage is turned off.	The current to the injector is shut off. The engine can possibly misfire or run rough.
324 656 5	Injector solenoid driver cylinder 3 circuit-current below normal, or open circuit. Current detected at injector number 3 when voltage is turned off.	The current to the injector is shut off. The engine can possibly misfire or run rough.
325 656 5	Injector solenoid driver cylinder 6 circuit-current below normal, or open circuit. Current detected at injector number 6 when voltage is turned off.	The current to the injector is shut off. The engine can possibly misfire or run rough.
331 656 5	Injector solenoid driver cylinder 2 circuit-current below normal, or open circuit. Current detected at injector number 2 when voltage is turned off.	The current to the injector is shut off. The engine can possibly misfire or run rough.
332 656 5	Injector solenoid driver cylinder 4 circuit-current below normal, or open circuit. Current detected at injector number 4 when voltage is turned off.	The current to the injector is shut off. The engine can possibly misfire or run rough.
341 630 2	Severe loss of data from the ECM.	Possible no noticeable performance effects OR engine dying OR hard starting. Fault information, trip information and maintenance monitor data may be inaccurate.
343 629 12	Internal ECM error.	Possible none on performance or severe derate.
349 191 16	A frequency greater than calibrated threshold was detected at the tail shaft governor signal pin of the 31-pin machine connector.	Calibration dependent power and speed derate.
352 620 4	Low voltage detected on the ECM voltage supply line to some sensors (VSEN 1 supply).	Engine is derated to no air setting.
386 620 3	High voltage detected on the ECM voltage supply line to some sensors (VSEN 1 supply).	Engine is derated to no air setting.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
387 1043 3	High voltage detected on the ECM voltage supply line to the throttle (VTP supply)	Engine will only idle.
388 1072 11	Less than 6 VDC detected at the engine brake circuit 1 when on indicates an excessive current draw from the electronic control module (ECM) or faulty ECM output circuit.	Engine brake 1 can not be activated.
392 1073 11	Less than 6 VDC detected at the engine brake circuit 2 when on indicates an excessive current draw from the electronic control module (ECM) or faulty ECM output circuit.	Engine brake 2 can not be activated.
415 100 1	Oil pressure signal indicates oil pressure below the very low oil pressure engine protection limit.	Progressive power derate with increasing time from alert. If engine protection shutdown feature is enabled, engine will shut down 30 seconds after red lamp starts flashing.
418 097 15	Water has been detected in the fuel filter.	Possible white smoke, loss of power, or hard starting.
419 1319 2	An error in the intake manifold pressure sensor signal was detected by the ECM.	Engine is derated to no air setting.
422 111 2	Voltage detected simultaneously on both the coolant level high and low signal circuits OR no voltage detected on both circuits.	No engine protection for coolant level.
426 639 2	Communication between the ECM and the J1939 data link has been lost.	None on performance. J1939 devices may not operate.
428 97 3	High voltage detected at water-in-fuel sensor.	None on performance.
429 97 4	Low voltage detected at water-in-fuel sensor.	None on performance.
431 558 2	Voltage detected simultaneously on both the idle validation off-idle and on-idle circuits.	None on performance.
432 558 13	Voltage detected at idle validation on-idle circuit when voltage at throttle position circuit indicates the pedal is not at idle OR voltage detected at idle validation off-idle circuit when voltage at throttle position circuit indicates the pedal is at idle.	Engine will only idle.
433 102 2	Voltage signal at intake manifold pressure circuit indicates high intake manifold pressure but other engine characteristics indicate intake manifold pressure must be low.	Derate to no air setting.
434 627 2	Supply voltage to the ECM fell below 6.2 VDC for a fraction of a second OR the ECM was not allowed to power down correctly (retain battery voltage for 30 seconds after key off).	Possible no noticeable performance effects OR possibility of engine dying OR hard starting. Fault information, trip information and maintenance monitor data may be inaccurate.
435 100 2	An error in the oil pressure sensor signal was detected by the ECM.	None on performance. No engine protection for oil pressure.
441 168 18	Battery voltage below normal operating level.	Possible no noticeable performance effects OR possibility of rough idle.

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
442 168 16	Battery voltage below normal operating level.	None on performance.
443 1043 4	Low voltage detected on the ECM voltage supply line to the throttle(s) (VTP supply).	Engine will only idle.
465 1188 3	High voltage detected at the wastegate actuator number 1 circuit when no voltage was being supplied by the electronic control module (ECM).	Engine will run derated.
466 1188 4	Less than +6 VDC detected at the wastegate actuator number 1 circuit when on indicates an excessive current draw from the electronic control module (ECM) or faulty ECM output circuit.	Engine will run derated.
472 1380 2	Either high or low voltage detected on the crankcase oil level sensor circuit by the electronic control module (ECM).	None on performance. Centinel system deactivated.
474 1321 2	Either low voltage detected when +12 VDC are commanded or voltage detected when no voltafe is commanded.	Either the engine will not start or the engine will not have starter lockout protection.
475 1351 4	Low voltage was detected on the electronic air compressor circuit when high voltage was expected.	Air compressor will not shut off.
476 1351 3	High voltage or an open circuit detected at the electronic air compressor governor actuator circuit.	Air compressor runs continuously or not at all.
489 191 18	Auxiliary speed frequency on input pin indicated that the frequency is below a calibration dependent threshold.	Engine will only idle.
491 1189 3	High voltage detected at the wastegate actuator number 2 circuit when no voltage was being supplied by the electronic control module (ECM).	Engine will run derated.
492 1189 4	Less than +6 VDC detected at the wastegate actuator number 2 circuit when activated indicates an excessive current draw from the electronic control module (ECM) or faulty ECM output circuit.	Engine will run derated.
527 702 3	Less than 17.0 VDC detected at the dual output A signal pin of the 31-pin machine connector.	No action taken by the ECM.
528 093 2	Less than 17.0 VDC detected at the dual output B signal pin of the 31-pin machine connector.	No action taken by the ECM.
529 703 3	Less than 17.0 VDC detected at the dual output B signal pin at the ECM.	No action taken by the ECM.
536 718 11	Either low voltage detected on autoshift low gear actuator circuit when +12 VDC are commanded or voltage detected when no voltage is commanded.	Top 2 lockout solenoid will not function properly. Transmission will not shift properly.
537 717 11	Either low voltage detected on autoshift high gear actuator circuit when (+) 12 VDC are commanded or voltage detected when no voltage is commanded.	Top 2 shift solenoid will not function properly. Transmission will not shift properly.

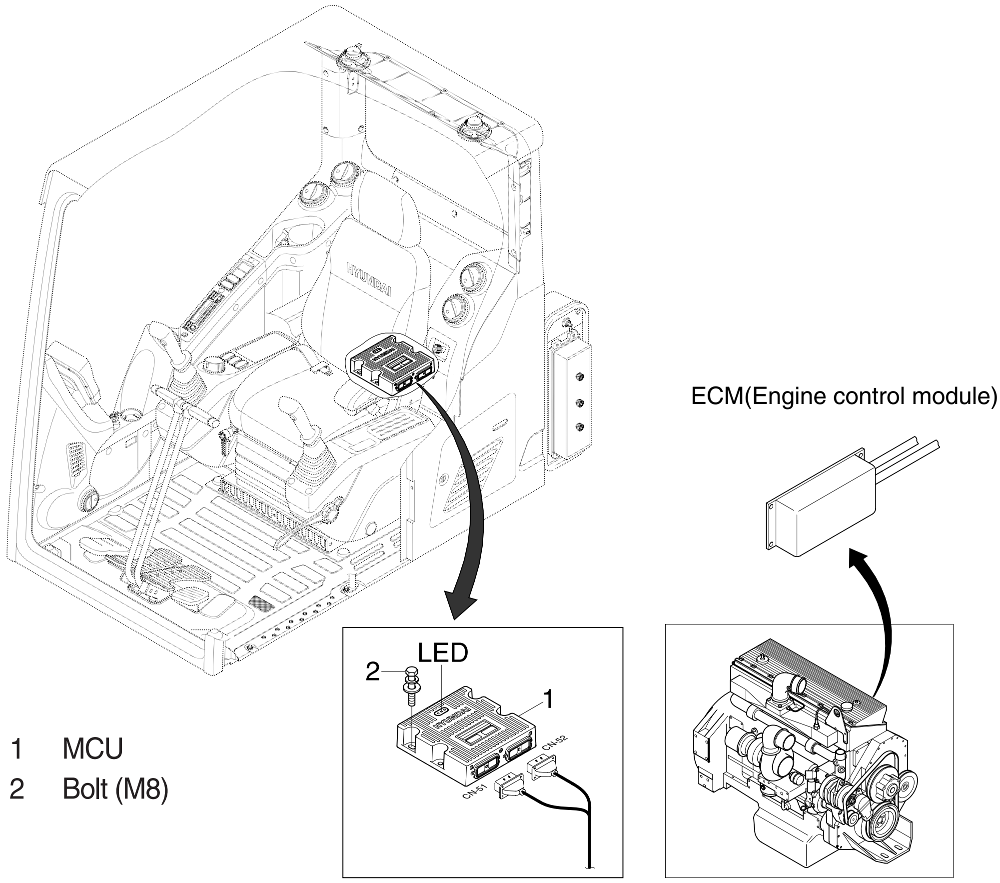
※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Reason	Effect (only when fault code is active)
538 719 11	Either low voltage detected on autoshift neutral gear actuator circuit when +12 VDC are commanded or voltage detected when no voltage is commanded.	Top 2 neutral actuator will not function properly. Transmission will not shift properly.
544 611 7	Autoshift failure ; at least three shift attempts were missed.	Top 2 transmission will not be controlled correctly. Transmission remains in manual mode.
551 558 4	No voltage detected simultaneously on both the idle validation off-idle and on-idle circuits.	Engine will only idle.
581 1381 3	High voltage detected at the fuel inlet restriction sensor signal pin.	Fuel inlet restriction monitor deactivated.
582 1381 4	Low voltage detected at the fuel inlet restriction sensor signal pin	Fuel inlet restriction monitor deactivated.
583 1381 18	Restriction has been detected at the fuel pump inlet.	Fuel inlet restriction monitor warning is set.
588 611 3	High voltage detected at the alarm circuit when low voltage was expected by the ECM.	The ICON system will be disabled. Only mandatory shutdown will be enabled. Engine can be started normally.
589 611 4	Less than +6 VDC detected at the engine start alarm circuit when high voltage was expected by the ECM.	The ICON idle control system will be disabled. Only mandatory shutdown will be enabled. Engine can be started normally.
596 167 16	High battery voltage detected by the battery voltage monitor feature.	Yellow lamp will be lit until high battery voltage condition is corrected.
597 167 16	ICONTM has restarted the engine three times within three hours due to low battery voltage (automotive only) OR low battery voltage detected by the battery voltage monitor feature.	Yellow lamp will be lit until low battery voltage condition is corrected. The ECM may increase idle speed and deactivate idle decrement switch if idle speedup is enabled. The engine will run continuously if ICONTM is active (automotive only).
598 167 1	Very low battery voltage detected by the battery voltage monitor feature.	Red lamp lit until very low battery voltage condition is corrected.
611 1383 31	Engine shutdown by operator before proper engine cool down resulting in filtered load factor above maximum shutdown threshold.	No action taken by the ECM.
951 166 2	A power imbalance between cylinders was detected by the ECM.	Engine may have rough idle or misfire.

※ Some fault codes are not applied to this machine.

GROUP 13 ENGINE CONTROL SYSTEM

1. MCU and Engine ECM (Electronic Control Module)



480S5MS10

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

Mode		Pressure		Electric current (mA)	Engine rpm (at accel dial 10)
		kgf/cm²	psi		
Standard	P	5	114	250 ± 30	1900 ± 50
	S	7 ± 3	171 ± 40	280 ± 30	1800 ± 50
	E	7 ± 3	171 ± 40	280 ± 30	1700 ± 50
Option	P	2	71	180 ± 30	1950 ± 50
	S	4 ± 3	100 ± 40	230 ± 30	1850 ± 50
	E	6 ± 3	171 ± 40	230 ± 30	1750 ± 50

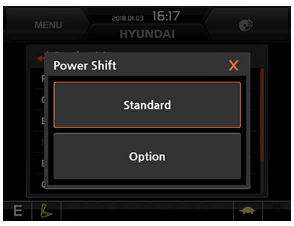
2) HOW TO SWITCH THE POWER SHIFT (STANDARD ↔ OPTION) ON THE CLUSTER

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

- Management
  · Service menu

220S3CD149

220S3CD150B

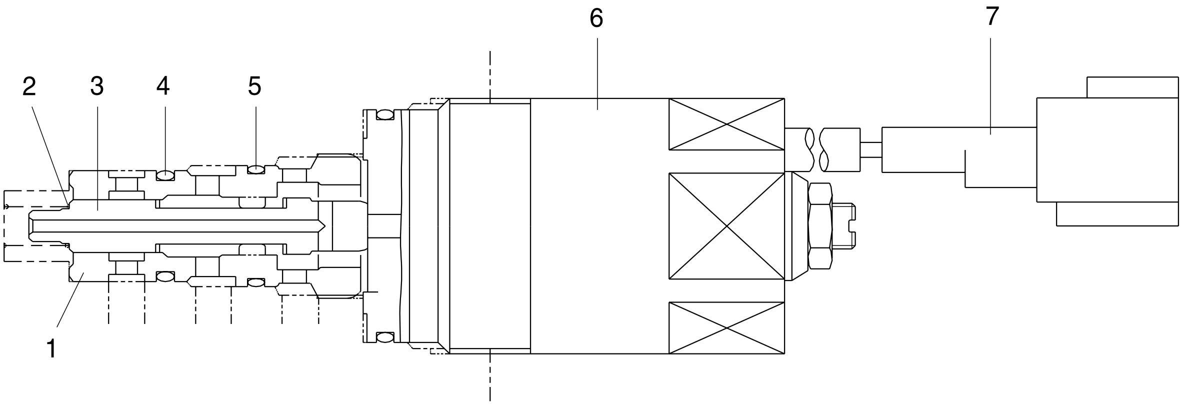


220S3CD251

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

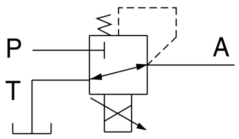
3) OPERATING PRINCIPLE (pump EPPR valve)

(1) Structure



5-22(1)

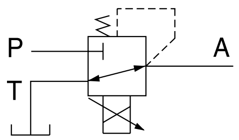
1	Sleeve	4	O-ring	6	Solenoid valve
2	Spring	5	O-ring	7	Connector
3	Spool				

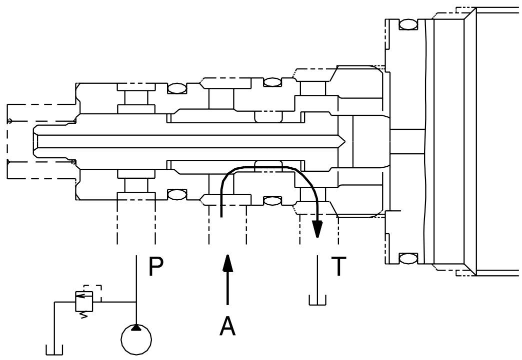


P Pilot oil supply line (pilot pressure)
T Return to tank
A Secondary pressure to flow regulator at main pump

(2) Neutral

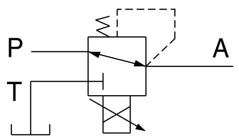
Pressure line is blocked and A oil returns to tank.

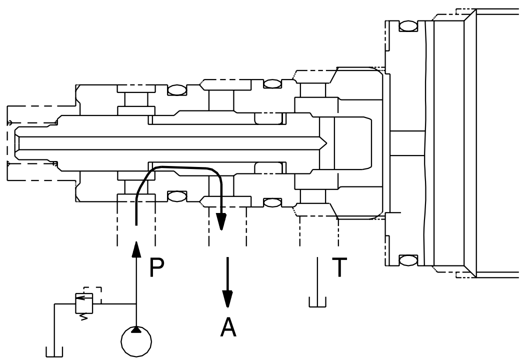




(3) Operating

Secondary pressure enters into A.





5-22(2)

4) EPPR VALVE CHECK PROCEDURE

(1) Check electric current value at EPPR valve

① Disconnect connector CN-75 from EPPR valve.

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

③ Start engine.

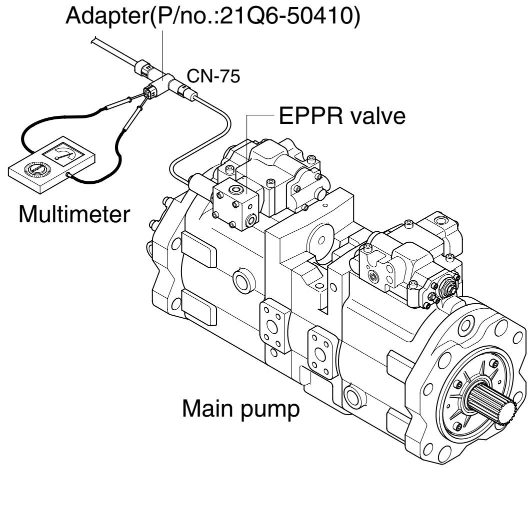
④ Set S-mode and cancel auto decel mode.

⑤ Position the accel dial at 10.

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

⑦ Check electric current at bucket circuit relief position.

Spec : 100~700 mA



480F5MS11

(2) Check pressure at EPPR valve

① Remove plug and connect pressure gauge as figure.

· Gauge capacity : 0 to 50 kgf/cm^2 (0 to 725 psi)

② Start engine.

③ Set S-mode and cancel auto decel mode.

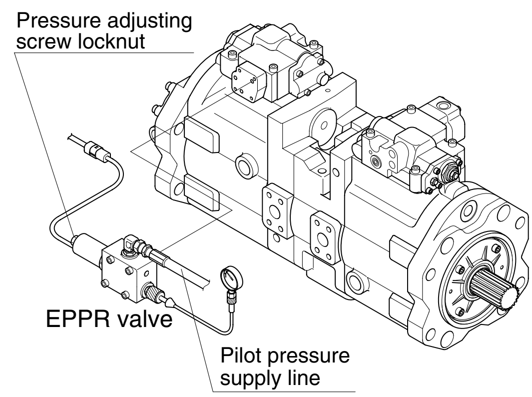
④ Position the accel dial at 10.

⑤ If tachometer show approx 1750±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.

⑥ If pressure is not correct, adjust it.

⑦ After adjust, test the machine.

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



480F5MS12

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

480S3CD501A

Premium type

480S3CD01A

※ 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 5-58 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 to1200 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.

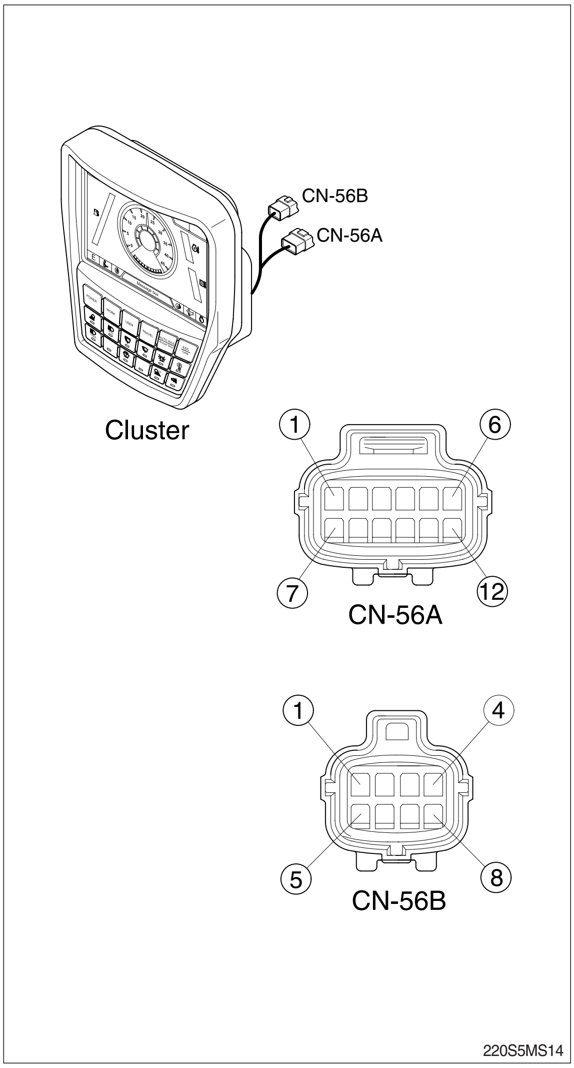
※ The pop-up warning lamp moves to the original position and blink when the buzzer stop switch is pushed. Also the buzzer stops.

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)	dc
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

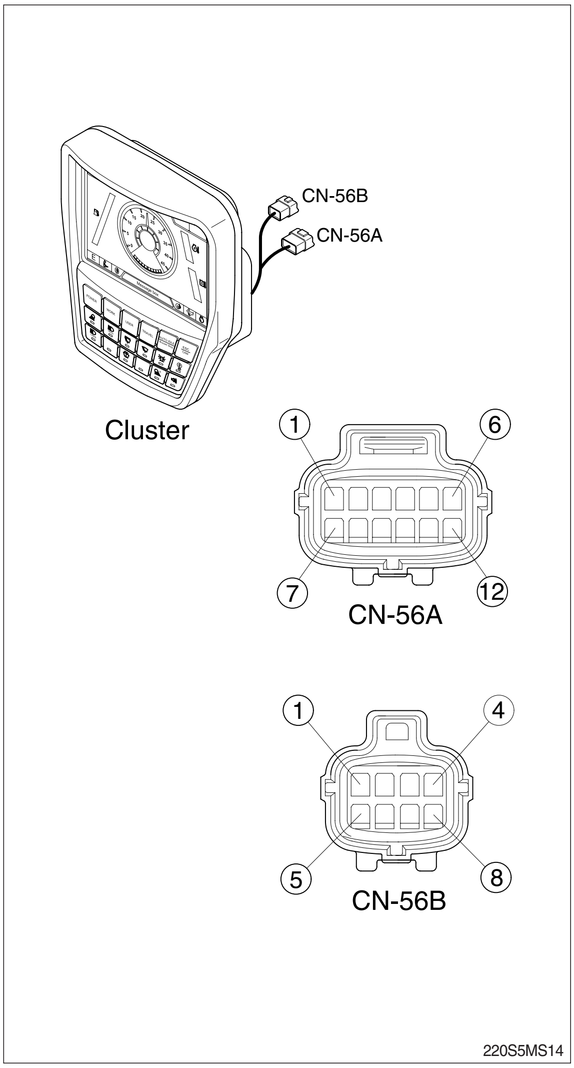
(1) CN-56A

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

(2) CN-56B

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



2) GAUGE

(1) Operation screen

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

Normal type

220S3CD551A

Premium type

Default

Option

220S3CD151

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 5-81 for details.

(2) RPM / Speed gauge

Normal type

Premium type

290F3CD549

① This display the engine speed.

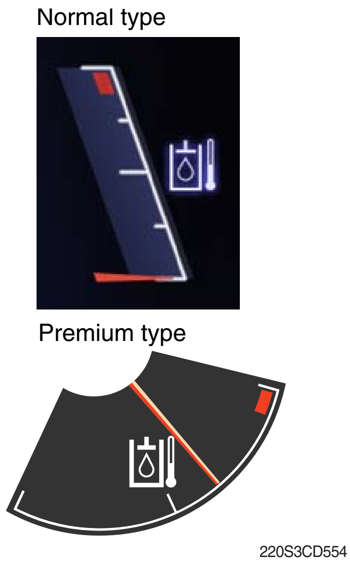
(3) Engine coolant temperature gauge

① This gauge indicates the temperature of coolant.
- 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 turn OFF the engine and check the engine cooling system.

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

(4) Hydraulic oil temperature gauge



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

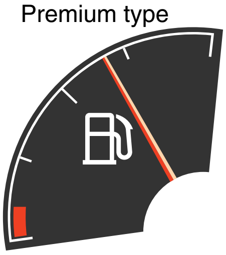
② If the indicator is in the red range or lamp pops up and the buzzer sounds reduce the load on the system. If the gauge stays in the red range, stop the machine and check the cause of the problem.

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

(5) Fuel level gauge

Normal type

Premium type



220S3CD555

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

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

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

(6) Tripmeter display

290F3CD56

① This displays the engine the tripmeter.

※ **Refer to page 5-83 for details.**

(7) Eco gauge

290F3CD58

① This gauge indicates the fuel consumption rate and machine load status. So that operators can be careful with fuel economy.

② The fuel consumption rate or machine load is higher, the number of segment is increased.

③ The color of Eco gauge indicates operation status.

· White : Idle operation

· Green : Economy operation

· Yellow : Non-economy operation at a medium level.

· Red : Non-economy operation at a high level.

(8) Accel dial gauge

290F3CD59

① This gauge indicates the level of accel dial.

3) WARNING LAMPS

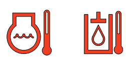
Normal type

220S3CD503A

Premium type

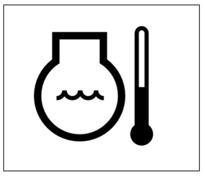
220S3CD03A

※ Warning lamps and buzzer

Warnings	When error happened	Lamps and buzzer
All warning lamps except below	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position and blinks, and the buzzer stops when ; - the buzzer stop switch AUTO IDLE Buzzer Stop is pushed - the lamp of the LCD is touched
	Warning lamp pops up on the center of the LCD and the buzzer sounds	· Cluster displays this pop-up when it has communication error with MCU. · If communication with MCU become normal state, it will disappear automatically.
	Warning lamp pops up on the center of the LCD and the buzzer sounds	※ Refer to page 5-59 for details.

※ Refer to page 5-65 for the buzzer stop switch. AUTO IDLE Buzzer Stop

(1) Engine coolant temperature warning lamp



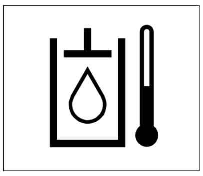
290F3CD61

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

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

③ Check the cooling system when the lamps keep blink.

(2) Hydraulic oil temperature warning lamp



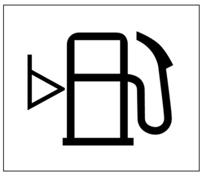
290F3CD62

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

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

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

(3) Fuel level warning lamp



290F3CD63

① This warning lamp pops up and the buzzer sounds when the level of fuel is below 61 ℓ (16.1 U.S. gal).

② Fill the fuel immediately when the lamp blinks.

(4) Emergency warning lamp

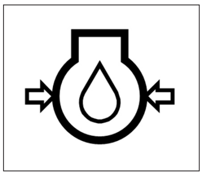
290F3CD64

① This warning lamp pops up and the buzzer sounds when each of the below warnings is happened.
- Engine coolant overheating (over 102˚C)
- Hydraulic oil overheating (over 105˚C)
- MCU input voltage abnormal
- Cluster communication data error
- Engine ECM communication data error

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

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

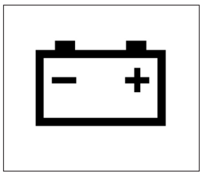
(5) Engine oil pressure warning lamp



290F3CD65

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

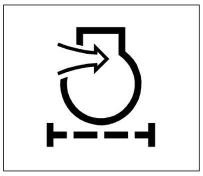
(6) Battery charging warning lamp



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.

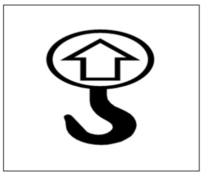
(7) Air cleaner warning lamp



290F3CD68

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

(8) Overload warning lamp (opt)



290F3CD69

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

4) PILOT LAMPS

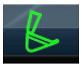
Normal type

220S3CD574A

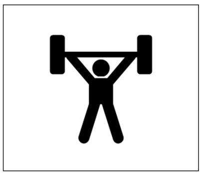
Premium type

220S3CD74A

(1) Mode pilot lamps

No	Mode	Pilot lamp	Selected mode
1	Power mode	P S E	Heavy duty power work mode Standard power mode Economy power mode
2	User mode	U	User preferable power mode
3	Work tool mode	    	General operation - IPC speed mode General operation - IPC balance mode General operation - IPC efficiency mode Breaker operation mode Crusher operation mode
4	Travel mode	 	Low speed traveling High speed traveling
5	Auto idle mode		Auto idle

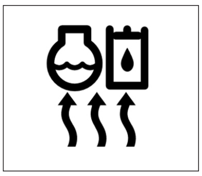
(2) Power max pilot lamp



290F3CD78

① The lamp will be ON when pushing power max switch on the LH RCV lever.
② The power max function is operated maximum 8 seconds.
※ **Refer to the operator's manual page 3-36 for power max function.**

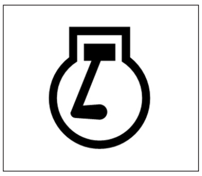
(3) Warming up pilot lamp



290F3CD80

① This lamp is turned ON when the coolant temperature is below 30˚C(86˚F).
② The automatic warming up is cancelled when the engine coolant temperature is above 30˚C, or when 10 minutes have passed since starting the engine.

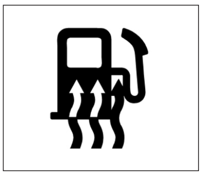
(4) Decel pilot lamp



290F3CD81

① Operating one touch decel switch on the RCV lever makes the lamp ON.
② Also, the lamp will be ON and engine speed will be lowered automatically to save fuel consumption when all levers and pedals are at neutral position, and the auto idle function is selected.
※ One touch decel is not available when the auto idle pilot lamp is turned ON.
※ Refer to the operator's manual page 3-36.

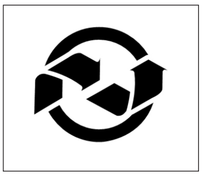
(5) Fuel warmer pilot lamp



290F3CD82

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

(6) Maintenance pilot lamp



290F3CD83

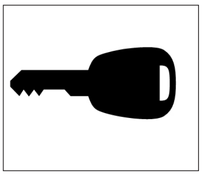
① This lamp will be ON when the consuming parts are needed to change or replace. It means that the change or replacement interval of the consuming parts remains below 30 hours.
② Check the message in maintenance information of main menu. Also, this lamp lights ON for 3 minutes when the start switch is ON position.
※ Refer to the page 5-76.

(7) Entertainment pilot lamp (premium type)

290F3CD84

① This lamp is on when audio or video files are playing.
※ Refer to the page 5-82.

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



290F3CD214

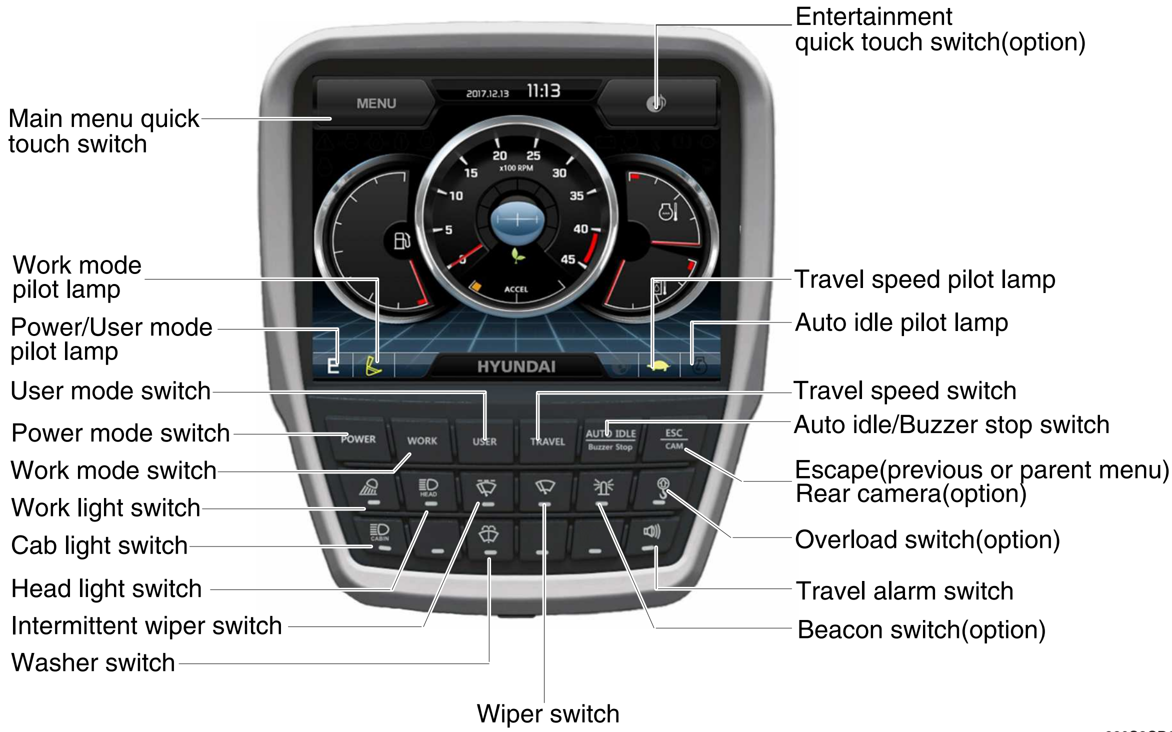
① This lamp is ON when the engine is started by the start button.
② This lamp is red when the a authentication fails, green when succeeds.
※ Refer to the page 5-77.

5) SWITCHES

Normal type

220S3CD586A

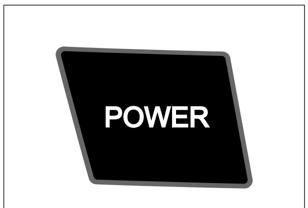
Premium type



220S3CD86A

※ When some of the switches are selected, the pilot lamps are displayed on the LCD. Refer to the page 5-61 for details.

(1) Power mode switch



290F3CD76

① This switch is to select the machine power mode and selected power mode pilot lamp is displayed on the pilot lamp position.
- · P : Heavy duty power work.
- · S : Standard power work.
- · E : Economy power work.

② The pilot lamp changes E → S → P → E in order.

(2) Work mode switch

290F3CD88

① This switch is to select the machine work mode, which shifts from general operation mode to optional attachment operation mode.
- · : General operation mode
- · : Breaker operation mode (if equipped)
- · : Crusher operation mode (if equipped)
- · Not installed : Breaker or crusher is not installed.

※ **Refer to the operator's manual page 4-7 for details.**

(3) User mode switch

290F3CD89

① This switch is used to memorize the current machine operating status in the MCU and activate the memorized user mode.
- · Memory : Push more than 2 seconds.
- · Action : Push within 2 seconds.
- · Cancel : Push this switch once more within 2 seconds.

② Refer to the page 3-19 for another set of user mode.

(4) Travel speed switch

290F3CD91

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

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

⚠ **Personal injury can result from sudden changes in machine stability.**

(5) Auto idle/ buzzer stop switch

290F3CD90

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

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

(6) Escape/Camera switch

290F3CD92

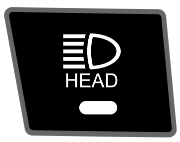
① This switch is used to return to the previous menu or parent menu.
② In the operation screen, pushing this switch will display the view of the camera on the machine (if equipped).
Please refer to page 5-83 for the camera.
③ If the camera is not installed, this switch is used only ESC function.

(7) Work light switch


290F3CD93

① This switch is used to operate the work light.
② The pilot lamp is turned ON when operating the switch.

(8) Head light switch



290F3CD94

① This switch is used to operate the head light.
② The pilot lamp is turned ON when operating the switch.

(9) Intermittent wiper switch


290F3CD95

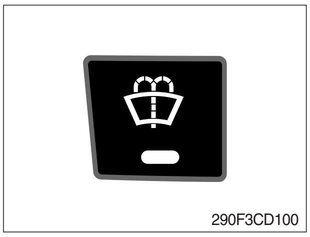
① This switch is used to wipe operates intermittently.
② The pilot lamp is turned ON when operating the switch.

(10) Wiper switch


290F3CD96

① This switch is used to operate the window wiper.
② Note that the wiper will self-park when switched off.
③ The pilot lamp is turned ON when operating the switch.
※ If the wiper does not operate with the switch in ON position, turn the switch OFF immediately. Check the cause.
If the switch remains ON, motor failure can result.

(11) Washer switch



290F3CD100

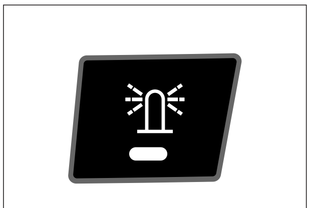
① The washer liquid is sprayed and the wiper is operated only while pressing this switch.
② The pilot lamp is turned ON when operating the switch.

(12) Cab light switch

290F3CD99

① This switch turns ON the cab light on the cab.
② The pilot lamp is turned ON when operating the switch.

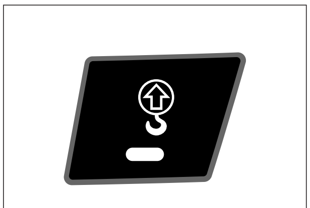
(13) Beacon switch



290F3CD97

① This switch turns ON the rotary light on the cab.
② The pilot lamp is turned ON when operating the switch.

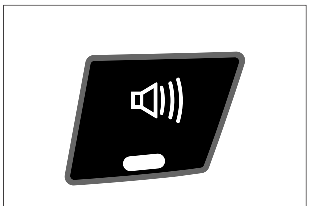
(14) Overload switch



290F3CD98

① When this switch turned ON, buzzer makes sound and overload warning lamp comes ON in case that the machine is overload.
② When it turned OFF, buzzer stops and warning lamp goes out.
⚠ **Overloading the machine could impact the machines stability which could result in tipover hazard. A tipover hazard could result in serious injury or death. Always activate the overload warning device before you handle or lift objects.**

(15) Travel alarm switch



290F3CD101

① This switch is to activate travel alarm function surrounding when the machine travels to forward and backward.
② On pressing this switch, the alarm operates only when the machine is traveling.
③ The pilot lamp is turned ON when operating the switch.

(16) Main menu quick touch switch

220S3CD217

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

※ Refer to the page 5-70.

(17) Entertainment quick touch switch (premium type, opt)

290F3CD218

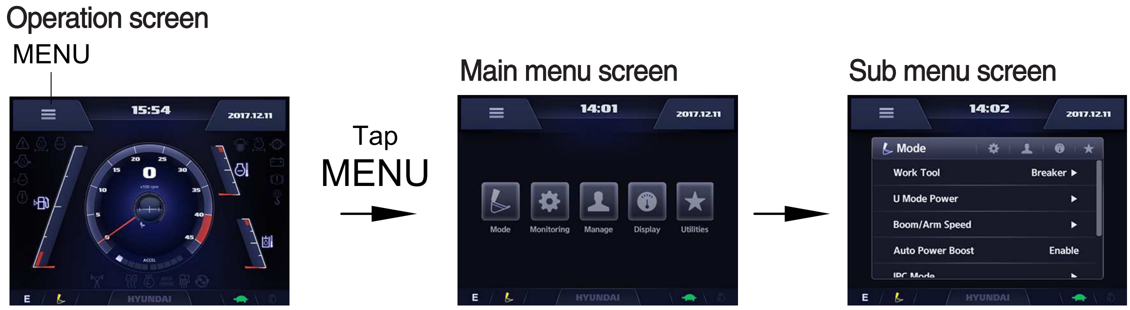
① This switch is to activate the entertainment control menu in the cluster.

※ Refer to the page 5-82.

6) MAIN MENU

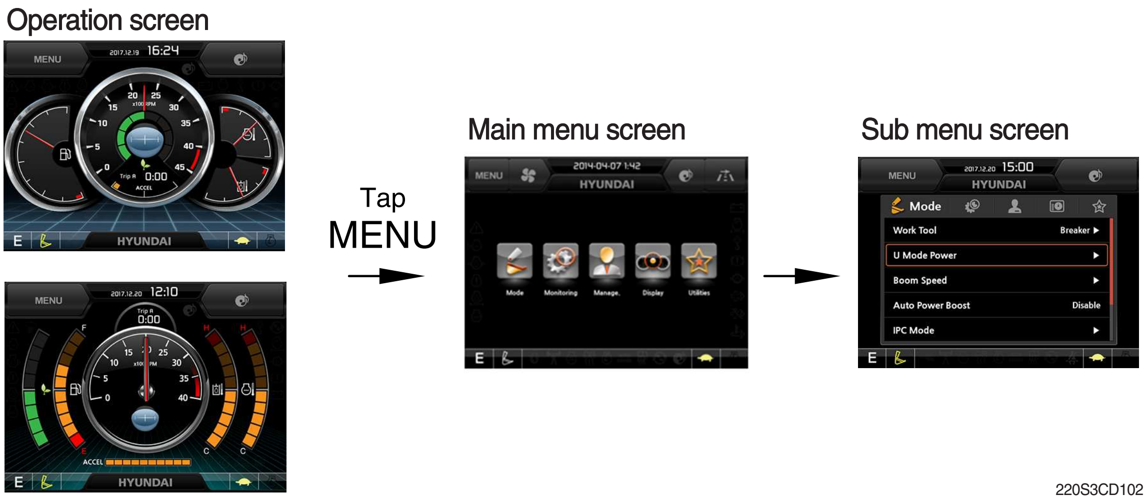
※ On the operation screen, tap MENU to access the main menu screen.
On the sub menu screen, you can tap the menu bar to access functions or applications.

Normal type



220S3CD502A

Premium type



220S3CD102

(1) Structure

No	Main menu	Sub menu	Description
1	 Mode 290S3CD103	Work tool U mode power Boom speed (null) Auto power boost IPC mode Auto engine shutdown (option) Initial 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, Accel initial mode / step Switch function
2	 Monitoring 290S3CD104	Active fault Logged fault Delete logged fault Monitoring	MCU MCU All logged fault delete, Initialization canceled Machine information, Switch status, Output status,
3	 Management 290S3CD105	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 290S3CD106	Display item Clock Brightness Unit setup Language selection Screen type	Engine speed, Tripmeter A, Tripmeter B, Tripmeter C Clock Manual, Auto Temperature, Pressure, Flow, Distance, Date format Korean, English, Chinese, ETC A type, B type★
5	 Utilities 290S3CD107	Entertainment★ Tripmeter Camera setting AUX Manual	Play Video, Audio, Smart terminal.★ 3 kinds (A, B, C) Number of active, Display order, AAVM (opt)★

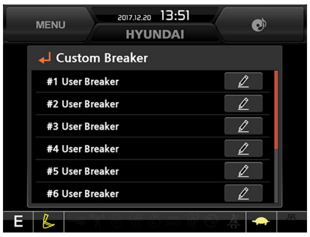
★ : premium type

(2) Mode setup

※ Illustrations are based on the premium type cluster.

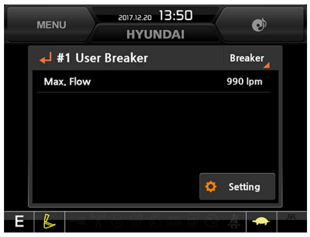
① Work tool

220S3CD108



220S3CD253

A



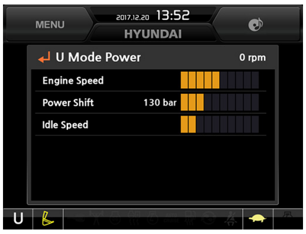
220S3CD254

B

· Select on installed optional attachment
  - A : It can set the user's attachment.
    It is available in setting #1~#10.
  - B : Max flow - Set the maximum flow for the attachment.
    Relief pressure - Set the relief pressure.

② U mode power

220S3CD111



220S3CD112

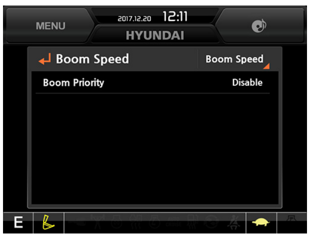
· Engine high idle rpm, auto idle rpm and pump torque (power shift) can be modulated and memorized separately in U-mode.
· U-mode can be activated by user mode switch.

Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift (bar)
1	1500	1000	0
2	1550	1050	3
3	1600	1100 (auto decel)	6
4	1650	1150	9
5	1700	1200	12
6	1750	1250	16
7	1800	1300	20
8	1850	1350	26
9	1900	1400	32
10	1950	1450	38

※ One touch decel & low idle : 1000 rpm

③ Boom speed (null)

220S3CD113



220S3CD115

· 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

220S3CD118

220S3CD117

· The power boost function can be activated or cancelled.
Enable - The digging power is automatically increased as working conditions by the MCU.
It is operated max 8 seconds.
Disable - Not operated.

⑤ IPC mode

220S3CD310

220S3CD311

220S3CD304

220S3CD312

220S3CD305

220S3CD313

220S3CD306

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

· This mode is applied only general operation mode of the work tool mode.

※ Please update the cluster programs if this mode is not displayed in the mode setup menu. Refer to the page 5-79.

⑥ Automatic engine shutdown (option)

220S3CD91

220S3CD92

220S3CD93

· 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

220S3CD122

220S3CD119

· Key on initial mode
- Selected the power mode is activated when the engine is started.

⑧ Emergency mode

220S3CD248

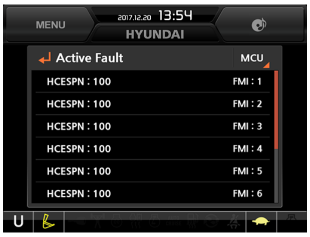
220S3CD249

· This mode can be used when the switches are abnormal on the cluster.
· The cluster switches will be selected by touched each icon.

(3) Monitoring

① Active fault

220S3CD120

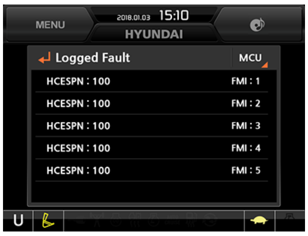


220S3CD125

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

② Logged fault

220S3CD128

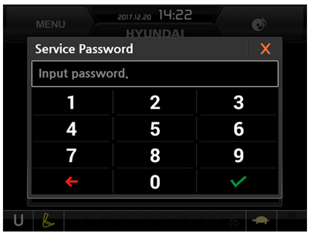


220S3CD124

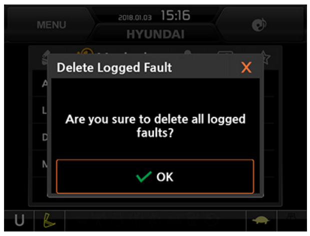
· The logged faults of the MCU can be checked by this menu.

③ Delete logged fault

220S3CD134



220S3CD126

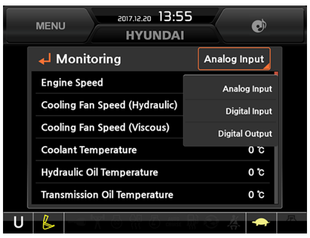


220S3CD127

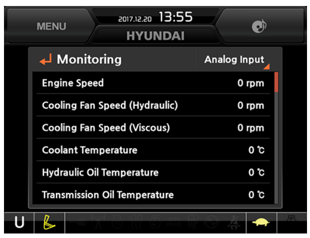
· The logged faults of the MCU can be deleted by this menu.

④ Monitoring

220S3CD172



220S3CD188



220S3CD189

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

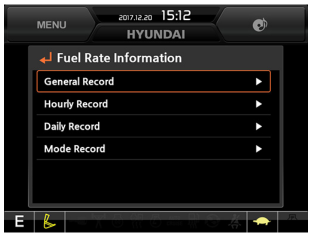
· The switch status or output status can be confirmed by this menu (Digital input & Digital output).

· The activated switch or output pilot lamps ● are light ON.

(4) Management

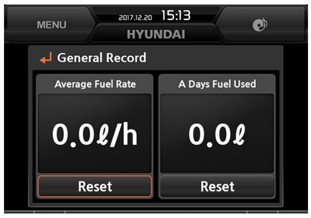
① Fuel rate information

220S3CD14



220S3CD15

A



220S3CD16

· General record (A)
- Average fuel rate (left) (from "Reset" to now)
  Fuel consumption devided by engine run time (service meter time).
- A days fuel used (right)
  Fuel consumption from 24:00 (or "Reset" time) to now (MCU real time).

B

220S3CD17

· Hourly record (B)
- Hourly fuel rates for past 12 hours (service meter time).
- No record during key-off time.
- One step shift to the right for every one hour.
- Automatic deletion for 12 hours earlier data.
- All hourly records deletion by "Reset".

C

220S3CD18

· Daily record (C)
- Daily fuel consumption for past seven days (MCU real time).
- No record during key-off time.
- One step shift to the right at 24:00 for every day.
- Automatic deletion for 7 days earlier data.
- All daily records deletion by "Reset".

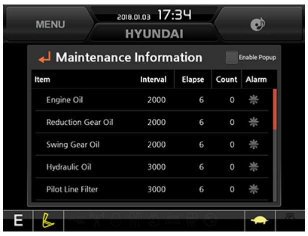
D

220S3CD19

· Mode record (D)
- Average fuel rate for each power mode/accel dial (at least 7) from "Reset" to now.
- No record during idle.
- All mode records deletion by "Reset".

② Maintenance information

220S3CD131



220S3CD132

220S3CD133

- Alarm lamp (●) is ON when oil or filter needs to be changed or replaced.
- Replacement : The elapsed time will be reset to zero (0).
- Change interval : The change or replace interval can be changed in the unit of 30 hours.
- Change or relpace interval

No	Item	Interval
1	Engine oil	500
2	Final gear oil	1000
3	Swing gear oil	1000
4	Hydraulic oil	5000
5	Pilot line filter	1000
6	Drain filter	1000
7	Hydraulic oil return filter	1000
8	Engine oil filter	500
9	Fuel filter	500
10	Pre-filter	500
11	Hydraulic tank breather	1000
12	Air cleaner (inner & outer)	2000
13	Radiator coolant	2000
14	Swing gear pinion grease	1000
15	Corrosion resistor	500

③ Machine security

220S3CD190A

220S3CD135A

220S3CD136A

· 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.

220S3CD137A

220S3CD138A

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

220S3CD190A

220S3CD140A

220S3CD135A

Enter the current password

220S3CD142A

Enter the new password

220S3CD143A

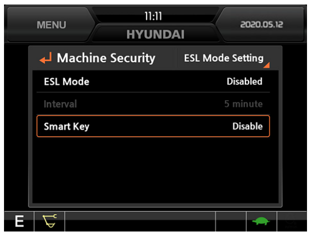
Enter the new password again

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

- Smart key

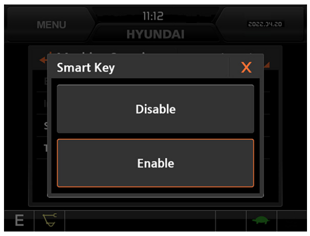
220S3CD190A

220S3CD135A



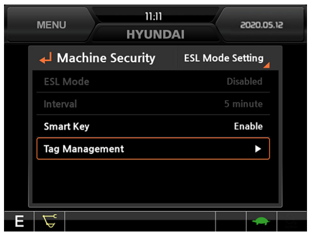
235F3CD001

- · 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.

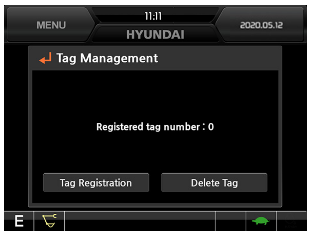


235F3CD002

- 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.

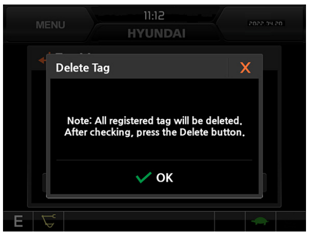


235F3CD003



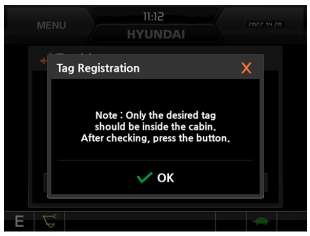
235F3CD004

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.

④ Machine Information

220S3CD144

220S3CD145

· 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)

220S3CD146

220S3CD147

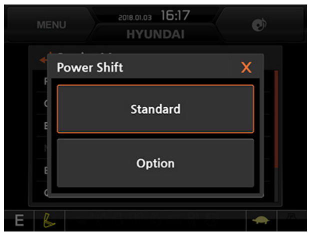
220S3CD148

Enter the new A/S phone number

⑥ Service menu

220S3CD149

220S3CD150

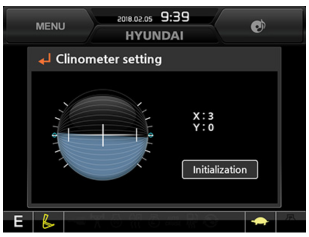


220S3CD251

· 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

220S3CD152

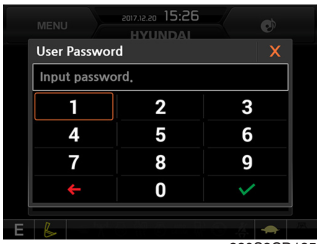


220S3CD153

· When the machine is on the flatland, if tap the "initialization", the values of X, Y reset "0".
· You can confirm tilt of machine in cluster's operating screen.

⑧ Update (cluster & ETC devices)

220S3CD67



220S3CD135

220S3CD280

- ETC devices and cluster can be updated through CAN 2 network.
- Insert USB memory stick which includes program files, start download.

220S3CD290

220S3CD281

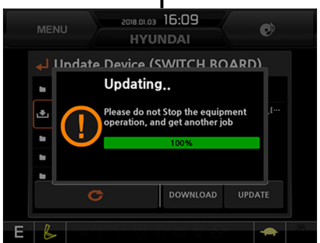
220S3CD291

220S3CD282

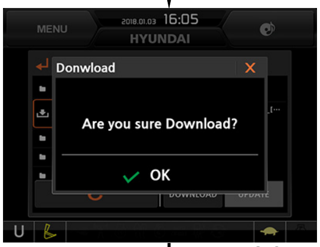
220S3CD299

220S3CD292

220S3CD283

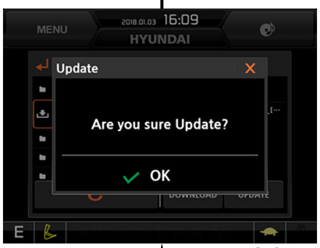


220S3CD298

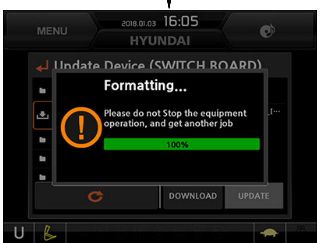


220S3CD293

220S3CD284



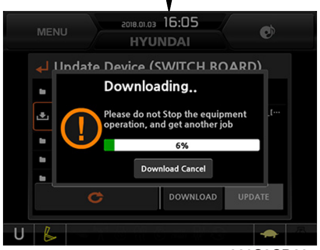
220S3CD297



220S3CD294

220S3CD285

220S3CD296



220S3CD295

(5) Display

① Display item

220S3CD154

220S3CD155

220S3CD156

· The center display type of the LCD can be selected by this menu.

· The engine speed or each of the tripmeter (A,B,C) is displayed on the center display.

② Clock

220S3CD157

220S3CD158

· The first line's three spots "**/**/****" represent Year/Month/Day each.

· The second line shows the current time. (0:00~23:59)

③ Brightness

220S3CD159

220S3CD160

220S3CD139

220S3CD141

220S3CD191

220S3CD192

· If "Auto" is chosen, brightness for day and night can be differently set up. Also by using the bar in lower side, users can define which time interval belongs to day and night.
(in bar figure, white area represents night time while orange shows day time)

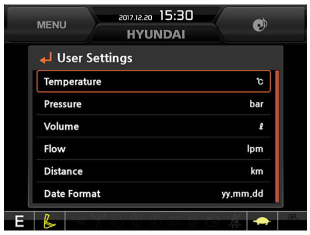
④ Unit

220S3CD161

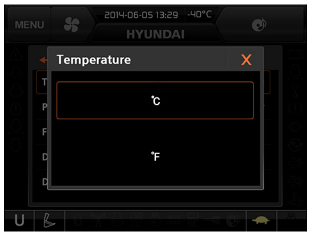
220S3CD182

220S3CD183

220S3CD186



220S3CD162



290F3CD193

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

⑤ Language

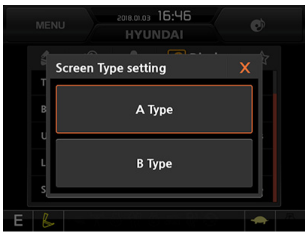
220S3CD163

220S3CD164

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

⑥ Screen type (premium type)

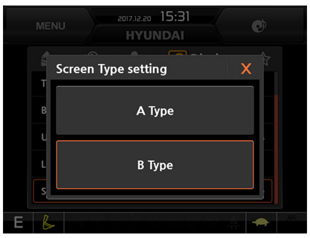
220S3CD165



A Type (Default)

220S3CD166

220S3CD156



B Type (Option)

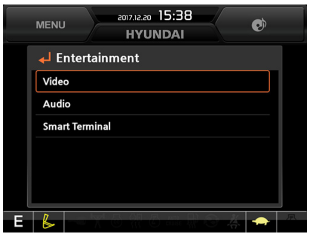
220S3CD174

220S3CD167

(6) Utilities

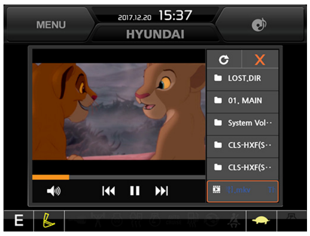
① Entertainment (premium type)

220S3CD195

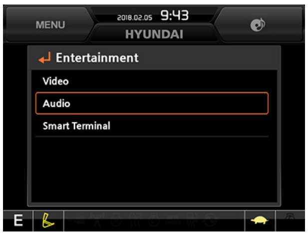


A

220S3CD196



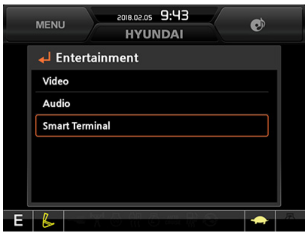
220S3CD219



B

220S3CD197

220S3CD220



C

220S3CD198

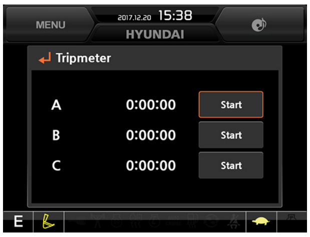
220S3CD199

220S3CD22

- Video (A) : This menu operates the video play function.
  mp4, mkv, avi files and so on.
- Audio (B) : This menu operates the play music.
  mp3, mp4 files and so on.
- Smart terminal (C) : The menu features a smartphone and operates the miracast.

② Tripmeter

220S3CD168



220S3CD169

· Maximum 3 kinds of tripmeters can be used at the same time.
· Each tripmeter can be turned on by choosing "Start" while it also can be turned off by choosing "Stop".
· If the tripmeter icon is activated in the operation screen, it can be controlled directly there.

③ Camera setting
· If the rear camera is not installed on the machine, set disable.
· If the rear camera installed on the machine, set enable.

220S3CD225

220S3CD255

220S3CD256

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

220S3CD222


290F3CD221

④ AAVM (All Around View Monitoring, premium type, opt)

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

220S3CD244

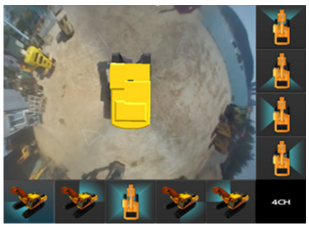
- Escape button

· It will enter into the AAVM mode from the beginning screen if the AAVM is installed.

· While in the AAVM mode, select the ESC button to return to the beginning screen.

220S3CD156

The beginning screen



AAVM mode 290F3CD222

- Buzzer stop button

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

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

290F3CD246

· When the worker or pedestrian go to the blue line (radius 5 m), an external danger area of equipping on the cluster screen, the warning buzzer sounds and it displays the blue rectangular box for the recognition of the worker and pedestrian.
At this time, the operator should stop work immediately, and stop the buzzer by pressing the buzzer stop button. And then, please work after you check whether the danger factors are solved.

290F3CD247

· When the worker or pedestrian go inside of red line (radius 3 m), an internal danger area of equipping on the cluster screen, the warning buzzer sounds and it displays the red rectangular box for the recognition of the worker and pedestrian.
At this time, the operator should stop work immediately, and stop the buzzer by pressing the buzzer stop button. And then, please work after you check whether the danger factors are solved.

※ In AAVM mode, a touch screen of the LCD is available only. The multimodal dial of the haptic controller is not available.

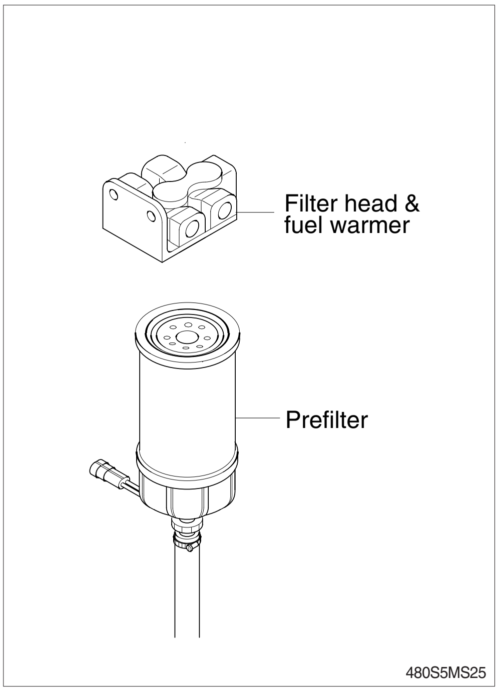
GROUP 16 FUEL WARMER SYSTEM

1. SPECIFICATION

1) Operating voltage : 24$\pm$4 V

2) Power : 350$\pm$50 W

3) Current : 15 A



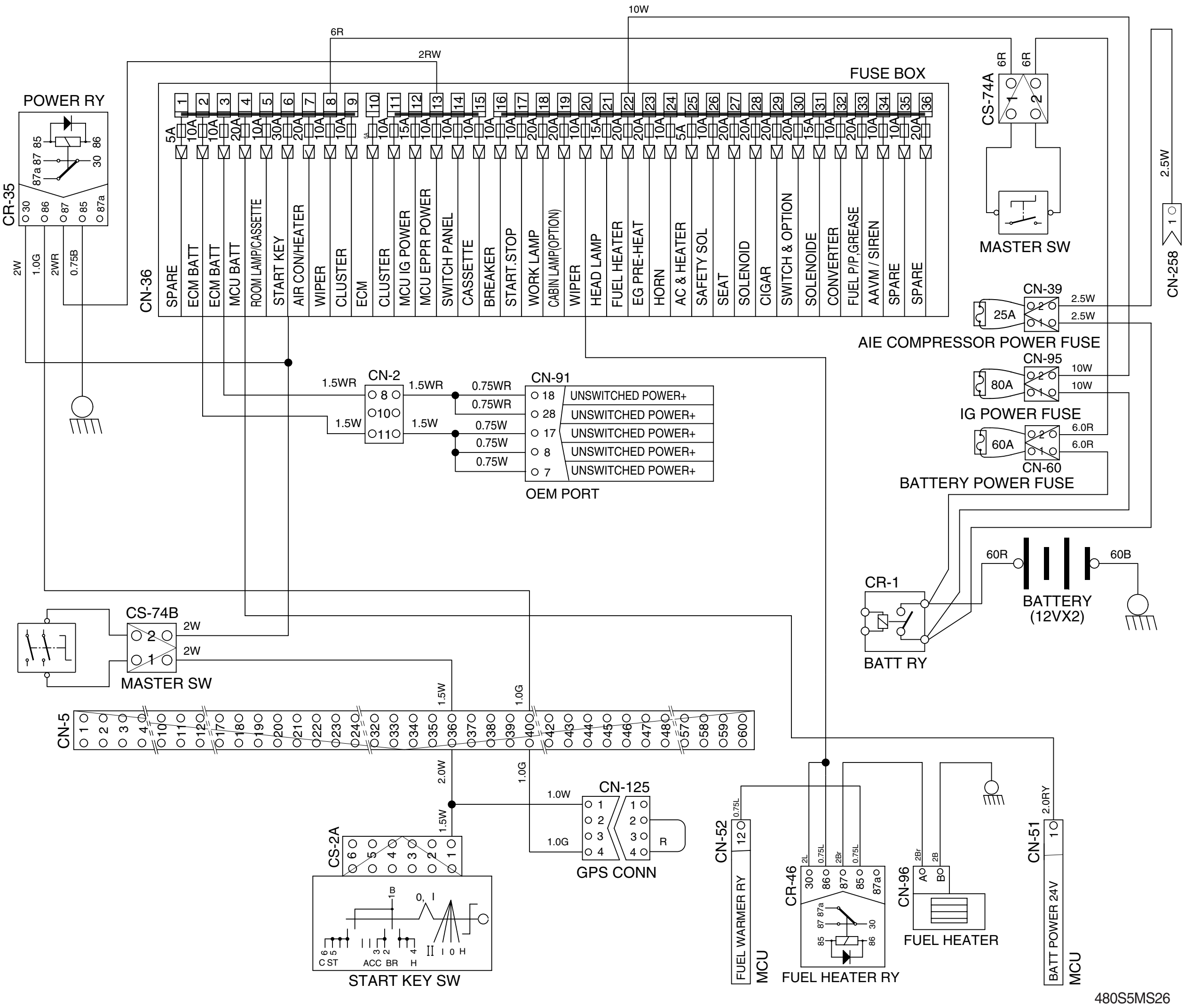
2. OPERATION

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

SECTION 6 TROUBLESHOOTING

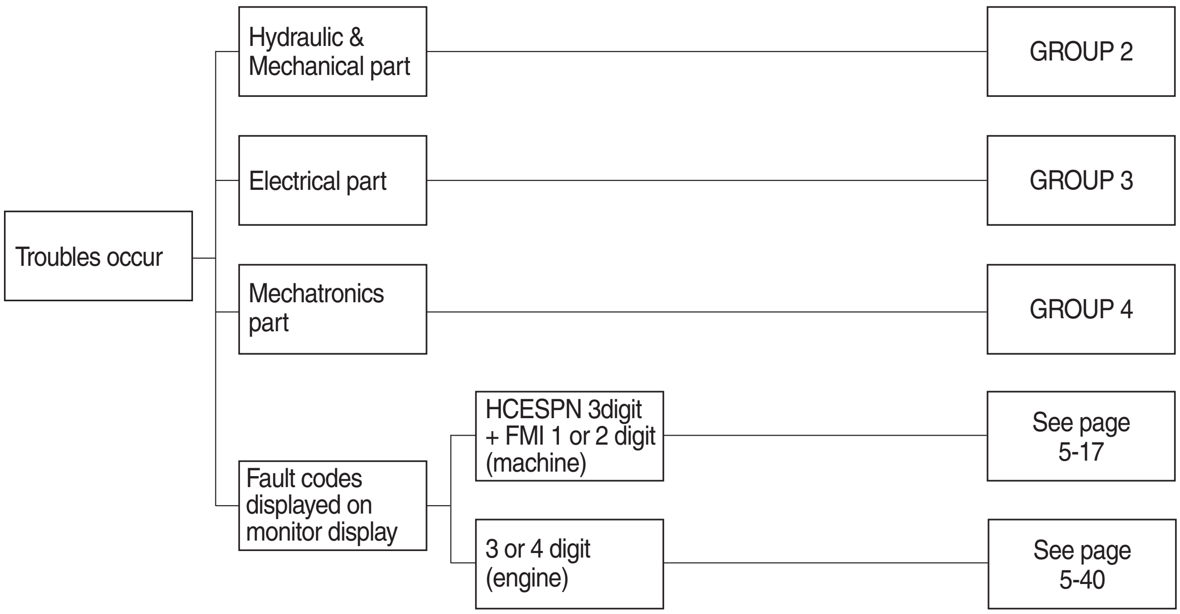
GROUP 1 BEFORE TROUBLESHOOTING

1. INTRODUCTION

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

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

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

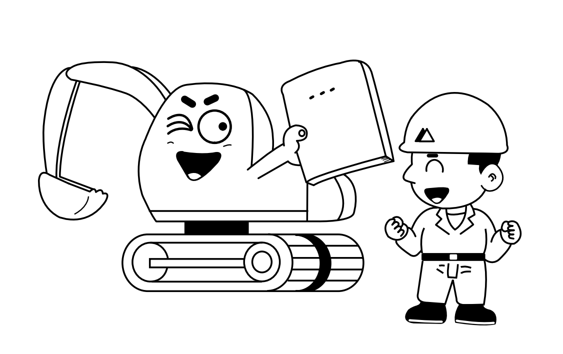


2. DIAGNOSING PROCEDURE

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

STEP 1. Study the machine system

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

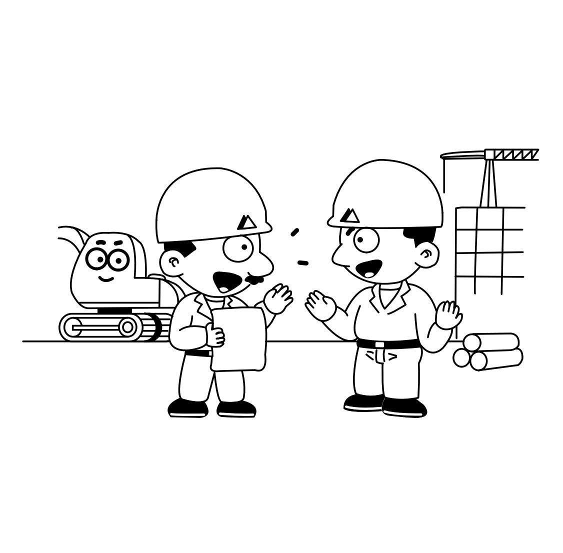


13031SH02

STEP 2. Ask the operator

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

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

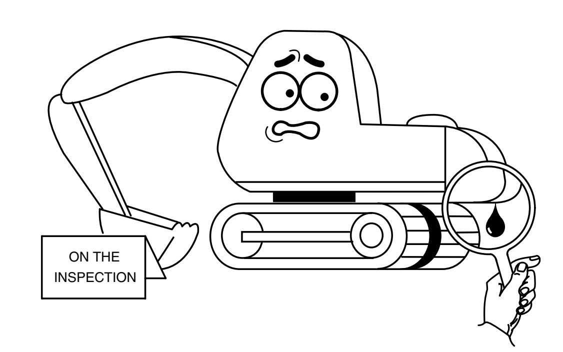


13031SH03

STEP 3. Inspect the machine

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

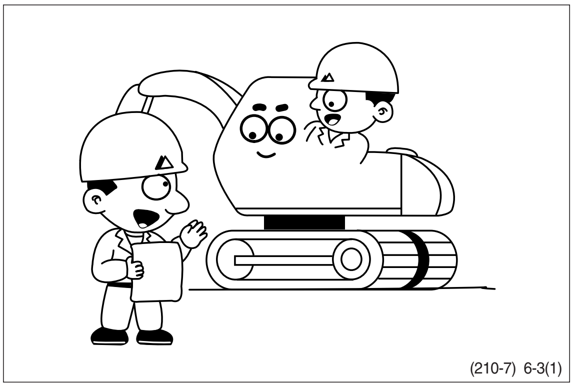
And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.



(210-7) 6-2(3)

STEP 4. Inspect the trouble actually on the machine

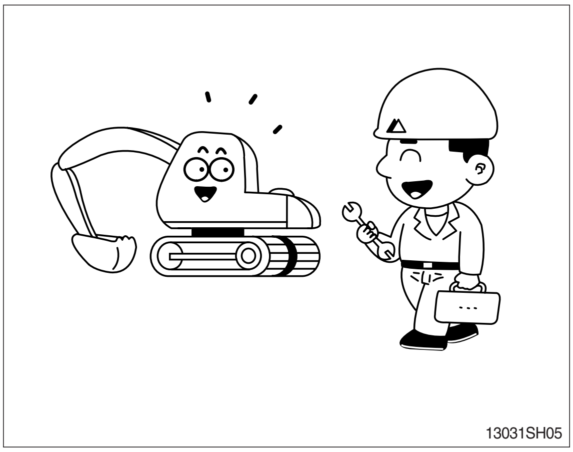
In case that some trouble cannot be confirmed, obtain the details of the malfunction from the operator.
Also, check if there are any in complete connections of the wire harnesses are or not.



(210-7) 6-3(1)

STEP 5. Perform troubleshooting

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

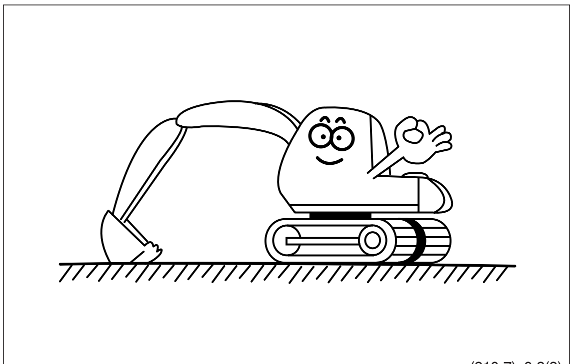


13031SH05

STEP 6. Trace a cause

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

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



(210-7) 6-3(3)

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.

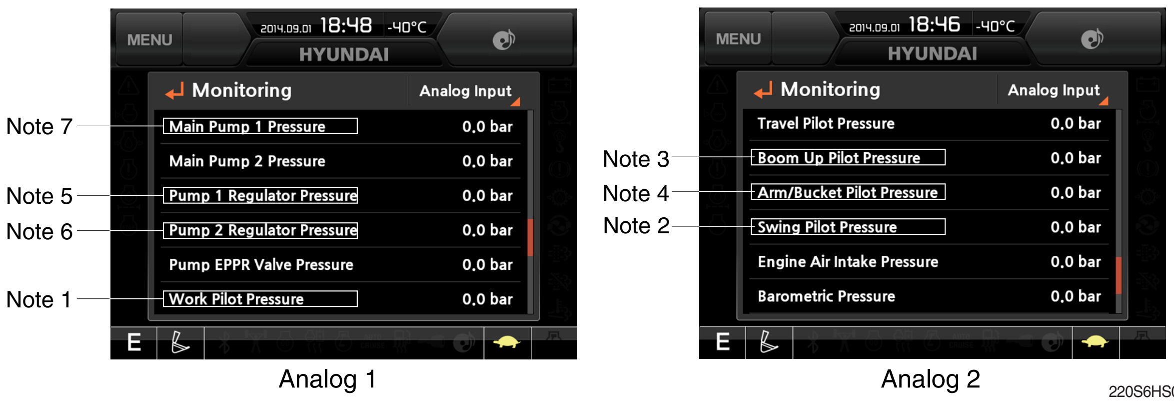
(3) When carrying out troubleshooting, do not hurry to disassemble the components.
It will become impossible to find the cause of the problem.

(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.



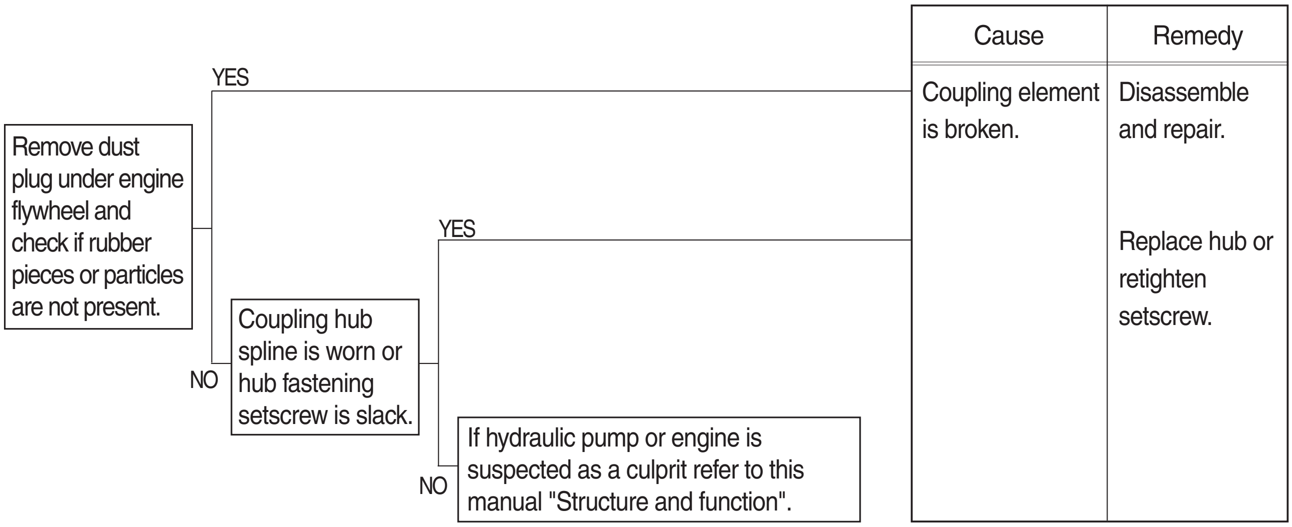
220S6HS01

(2) Specification

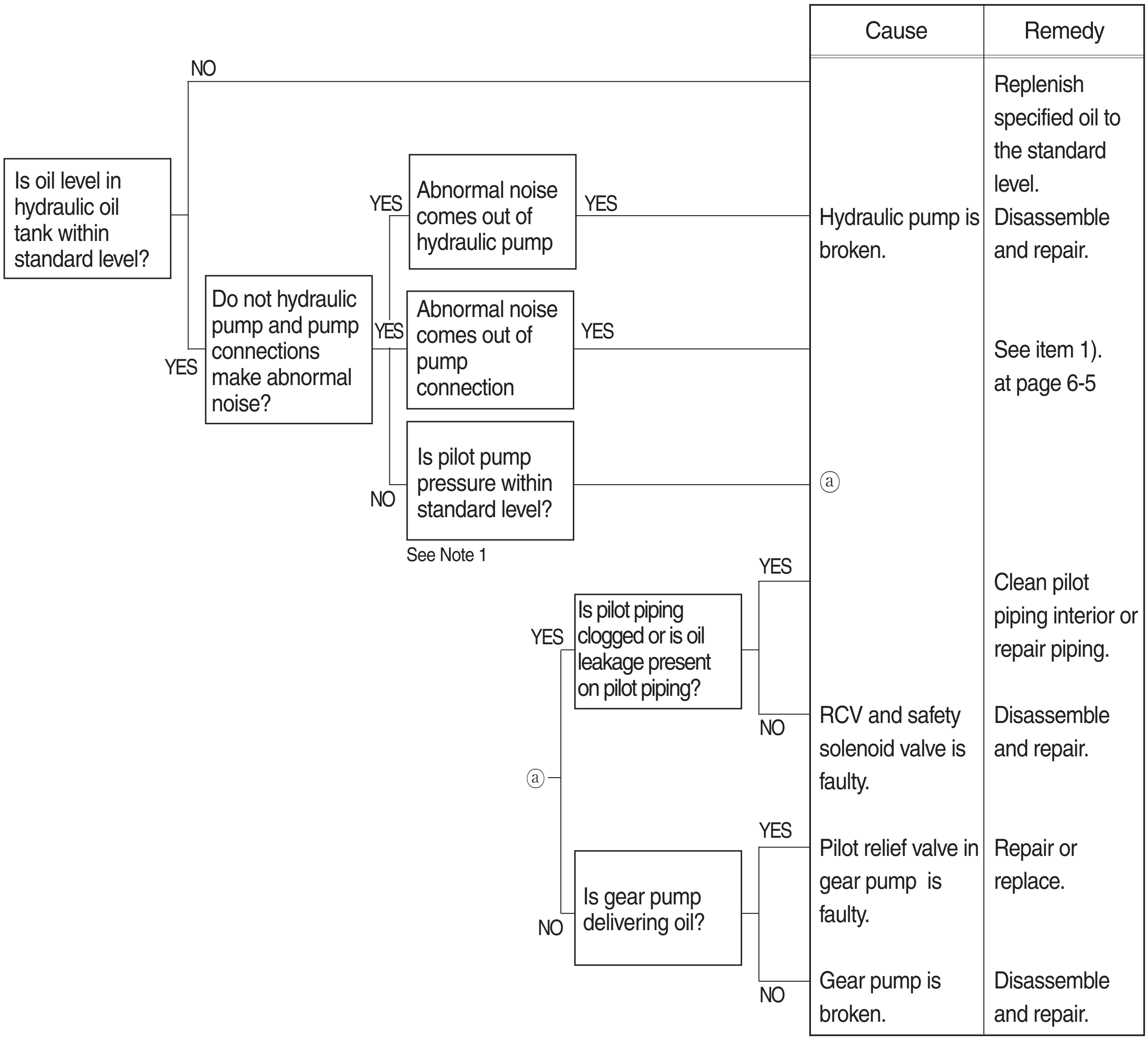
No.	Description	Specification
Note 1	Work pilot pressure	40^{+2}_{0} bar
Note 2	Swing pilot pressure	0~40 bar
Note 3	Boom up pilot pressure	0~40 bar
Note 4	Arm/bucket pilot pressure	0~40 bar
Note 5	Pump 1 regulator pressure	0~50 bar
Note 6	Pump 2 regulator pressure	0~50 bar
Note 7	Pump 1 pressure	330 bar

2. DRIVE SYSTEM

1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION

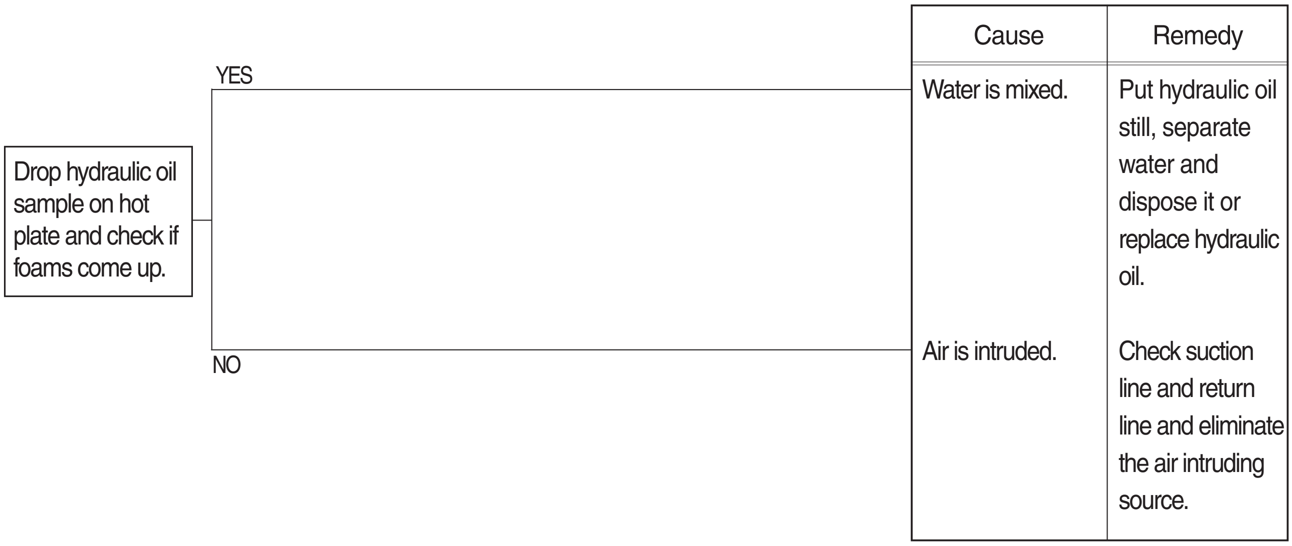


2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL

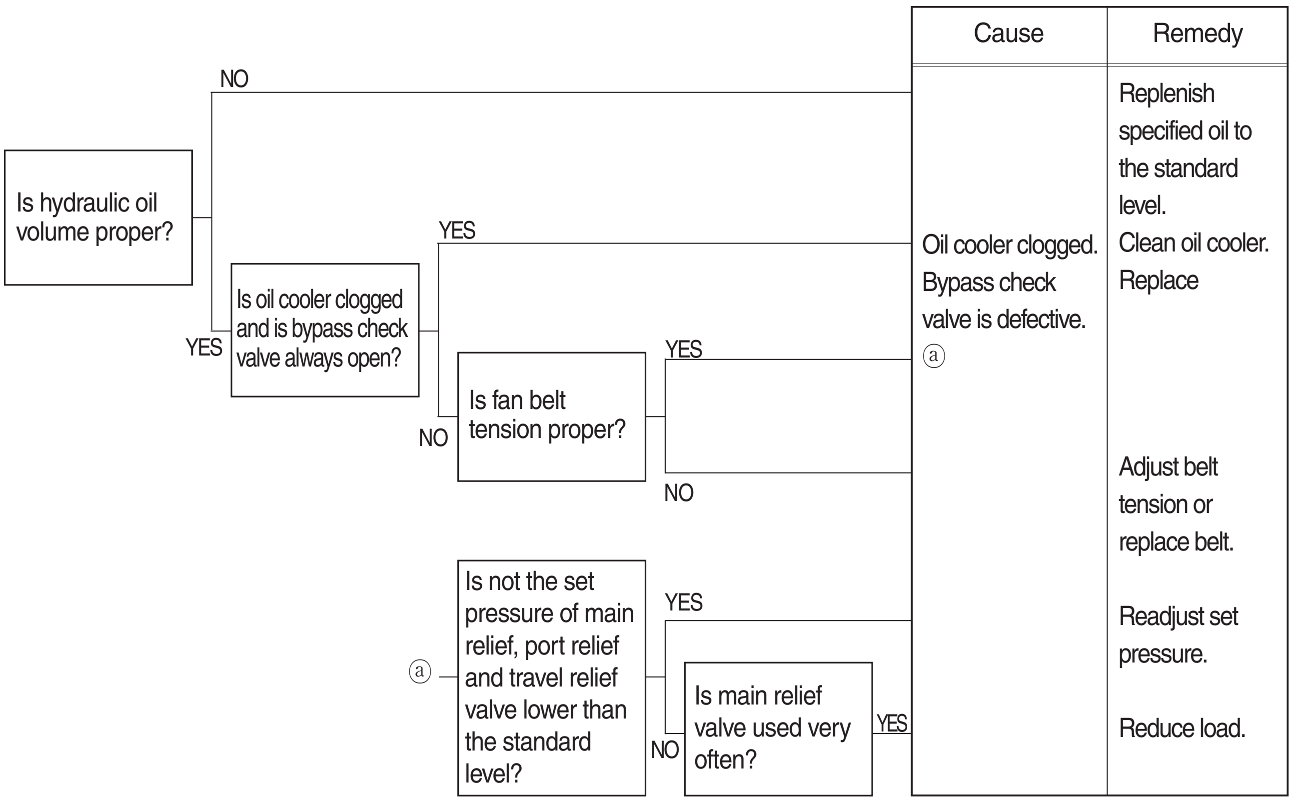


3. HYDRAULIC SYSTEM

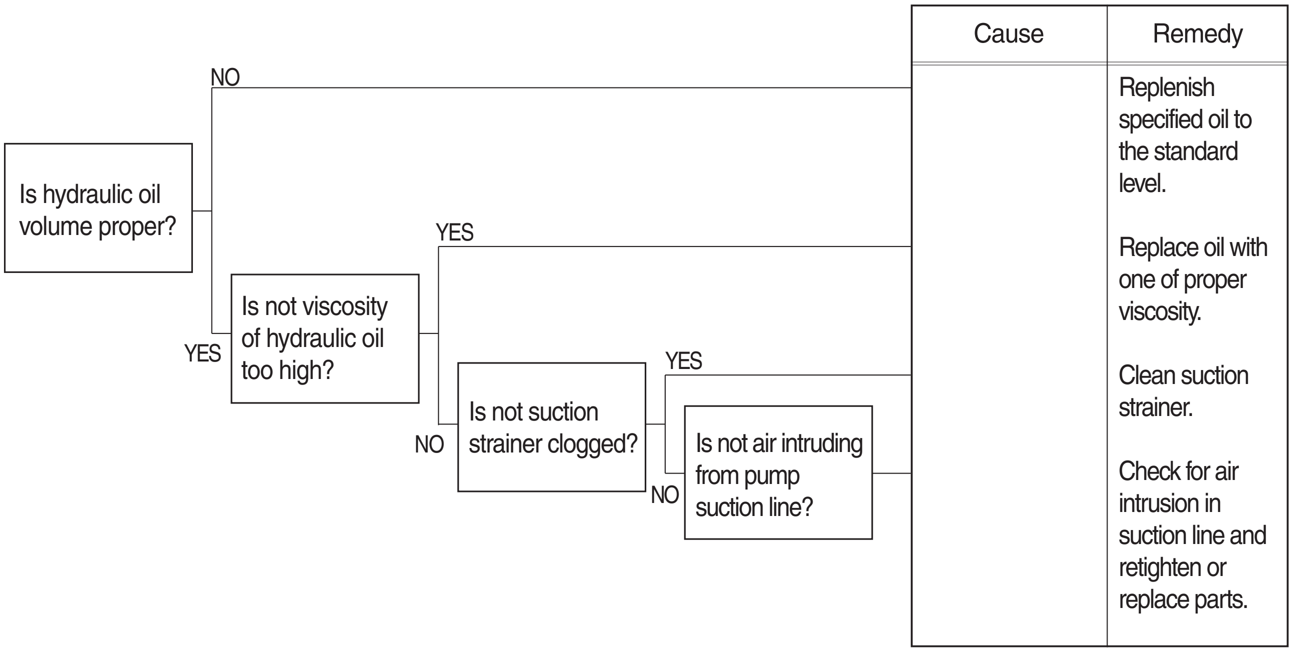
1) HYDRAULIC OIL IS CLOUDY



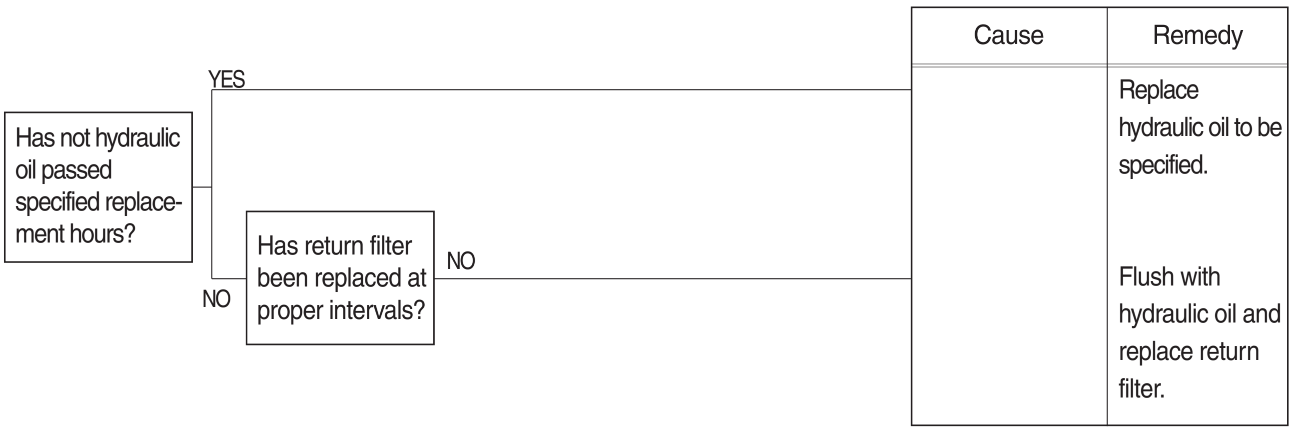
2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY



3) CAVITATION OCCURS WITH PUMP

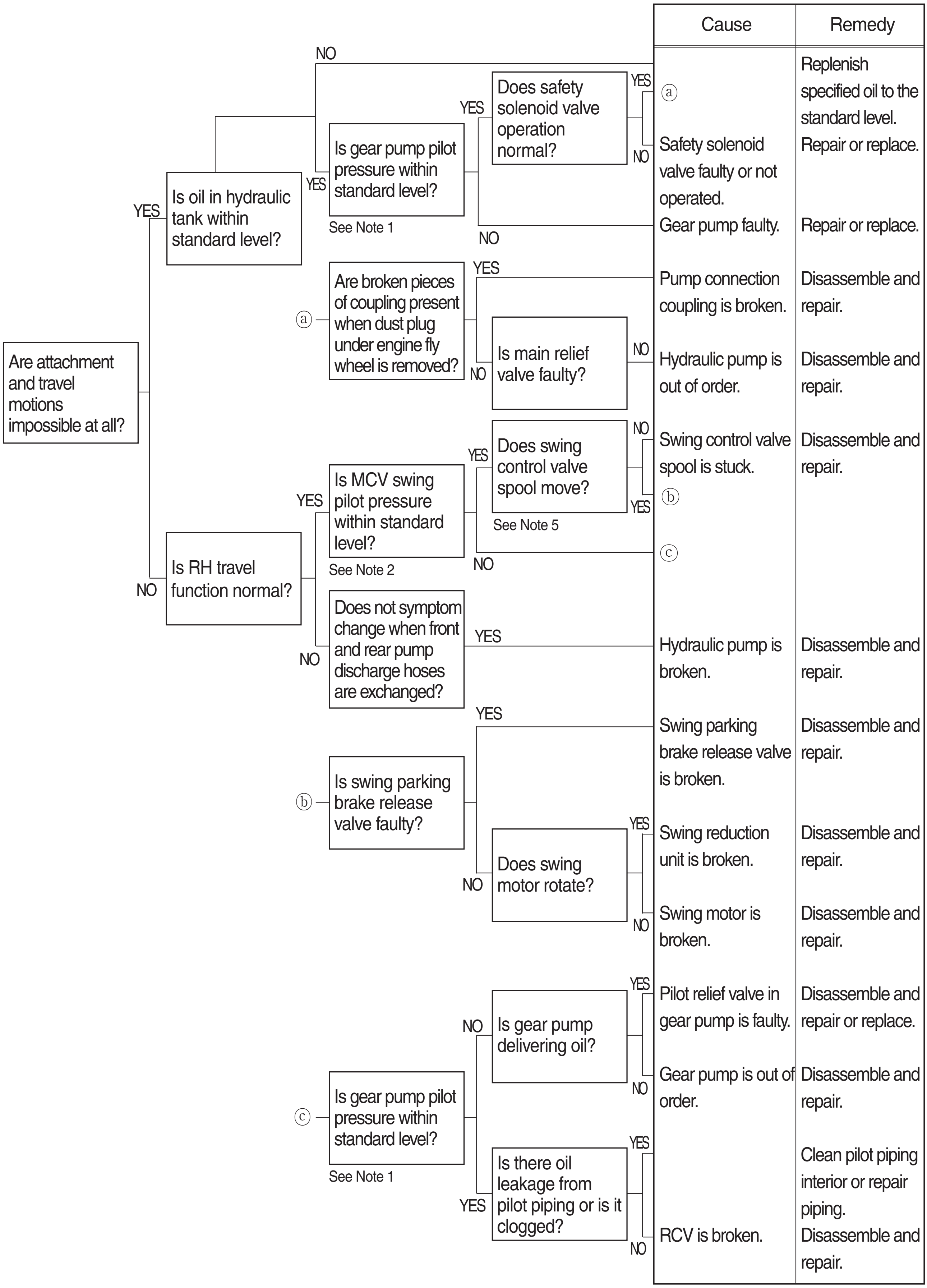


4) HYDRAULIC OIL IS CONTAMINATED

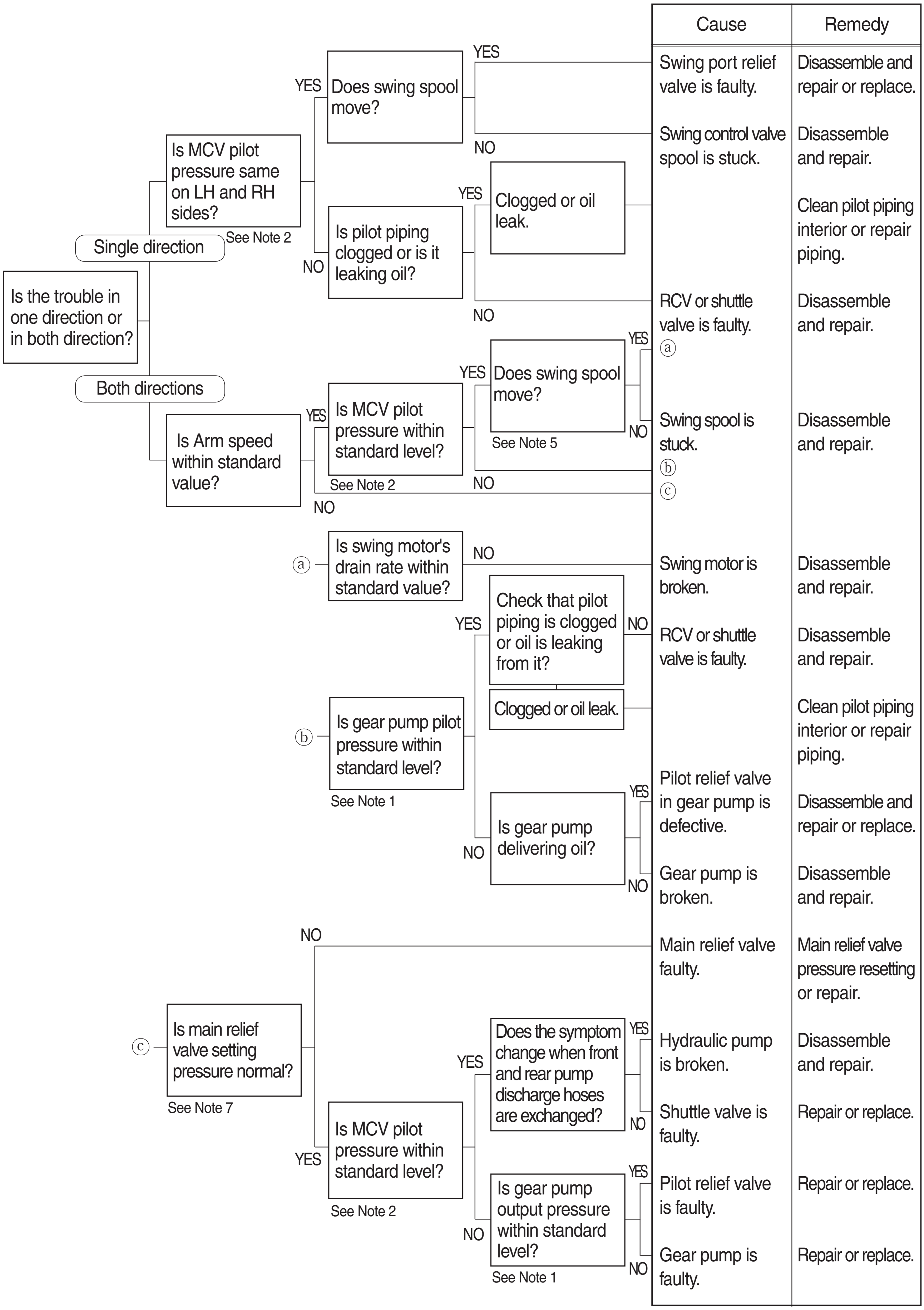


4. SWING SYSTEM

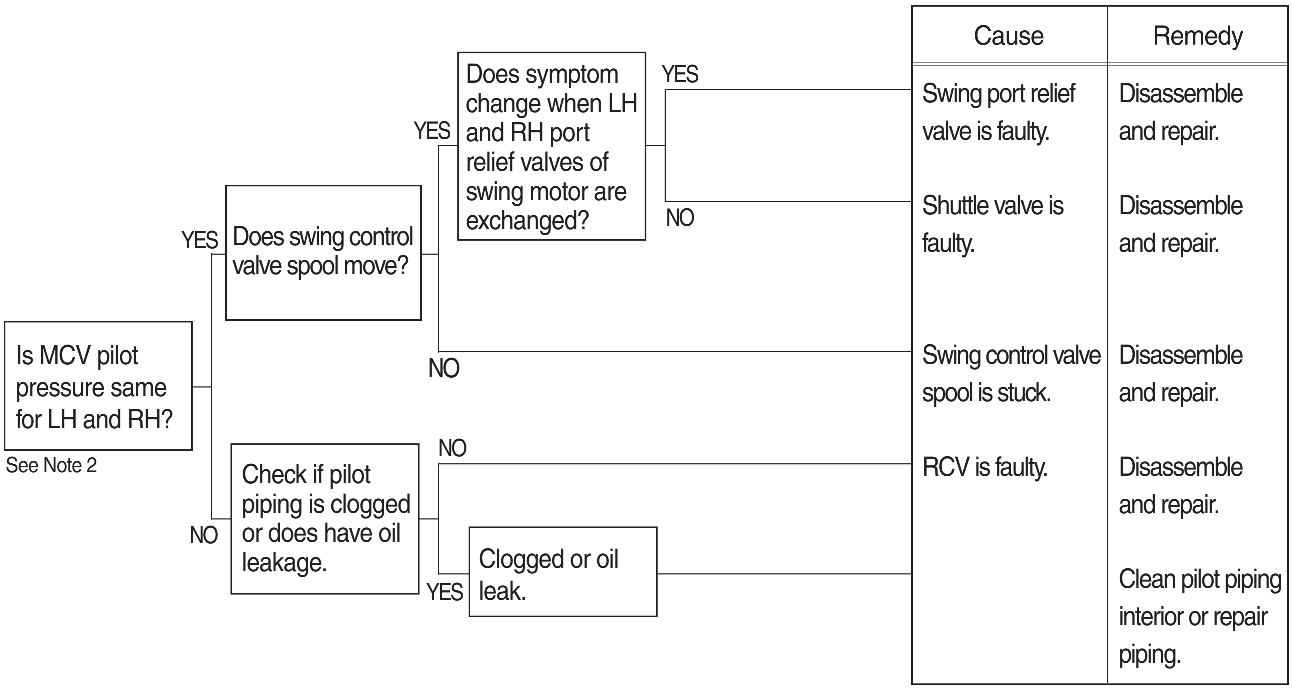
1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE



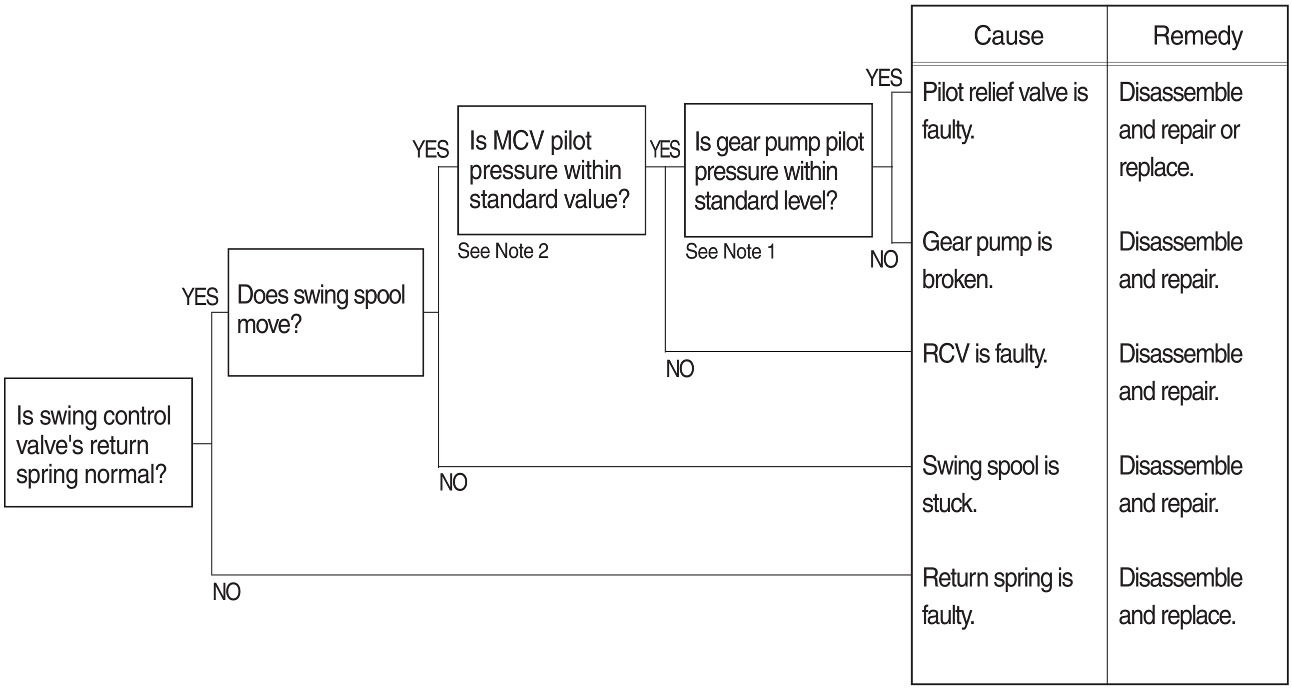
2) SWING SPEED IS LOW



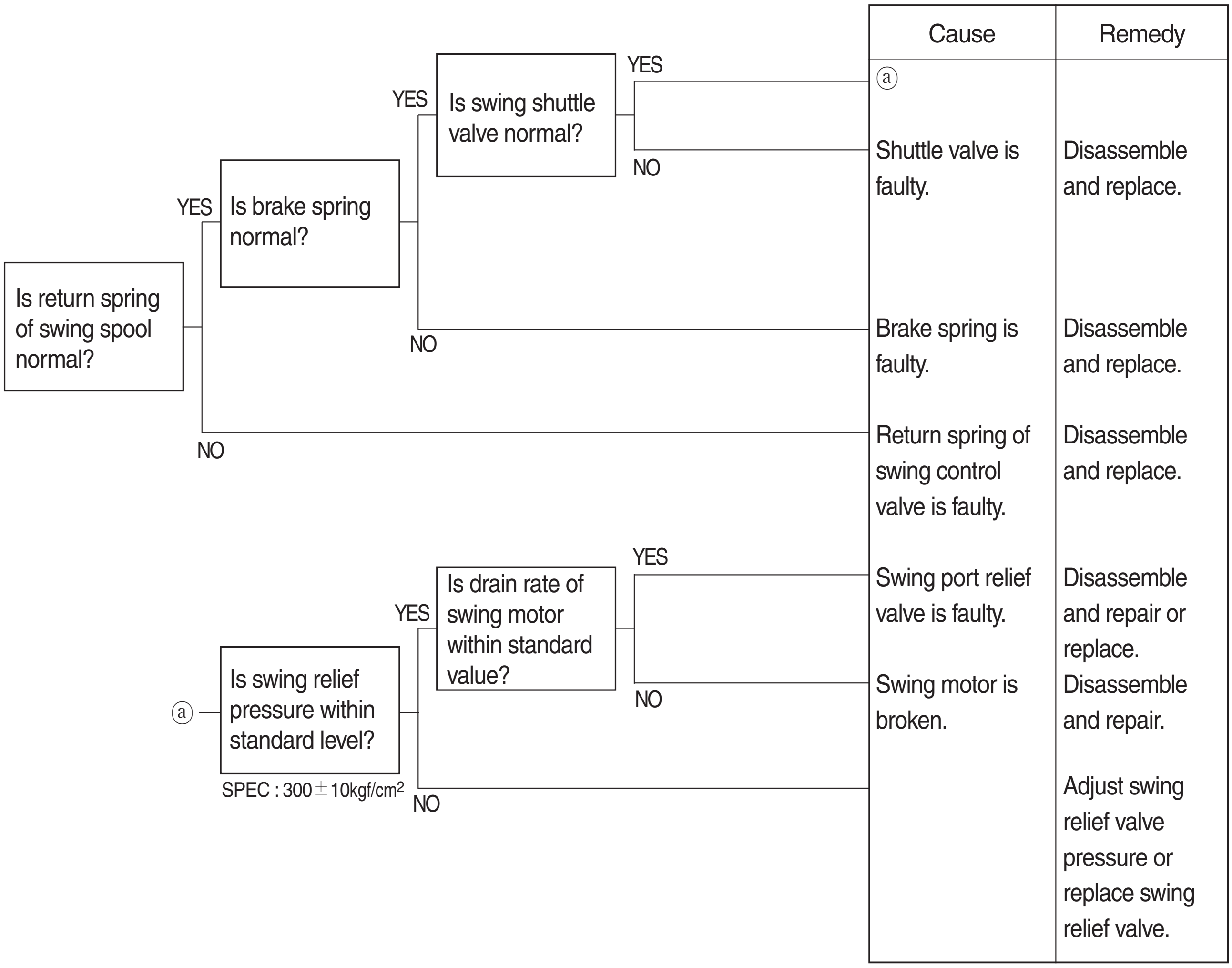
3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



4) MACHINE SWINGS BUT DOES NOT STOP

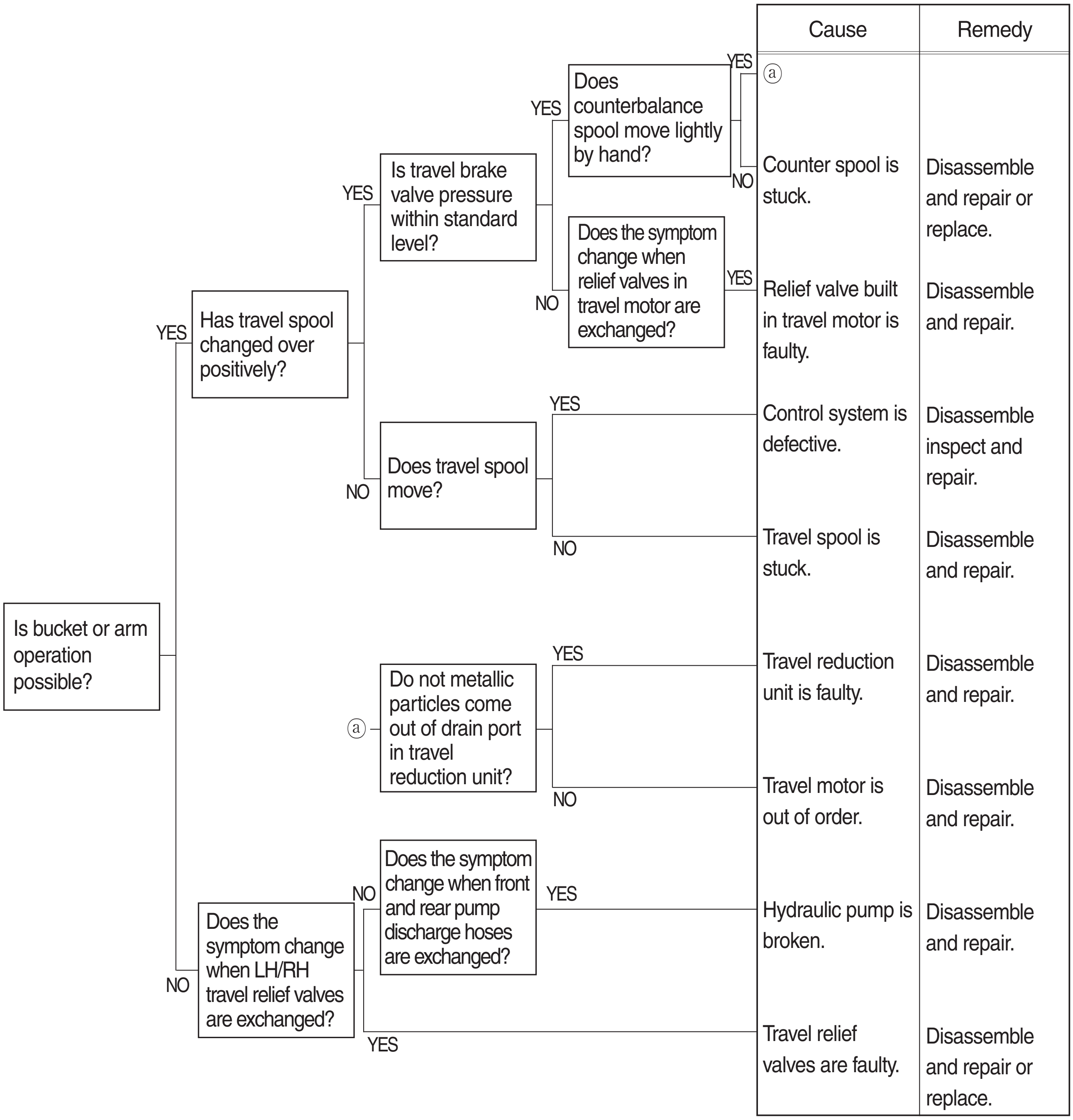


5) THE SWING UNIT DRIFTS WHEN THE MACHINE IS AT REST ON A SLOPE

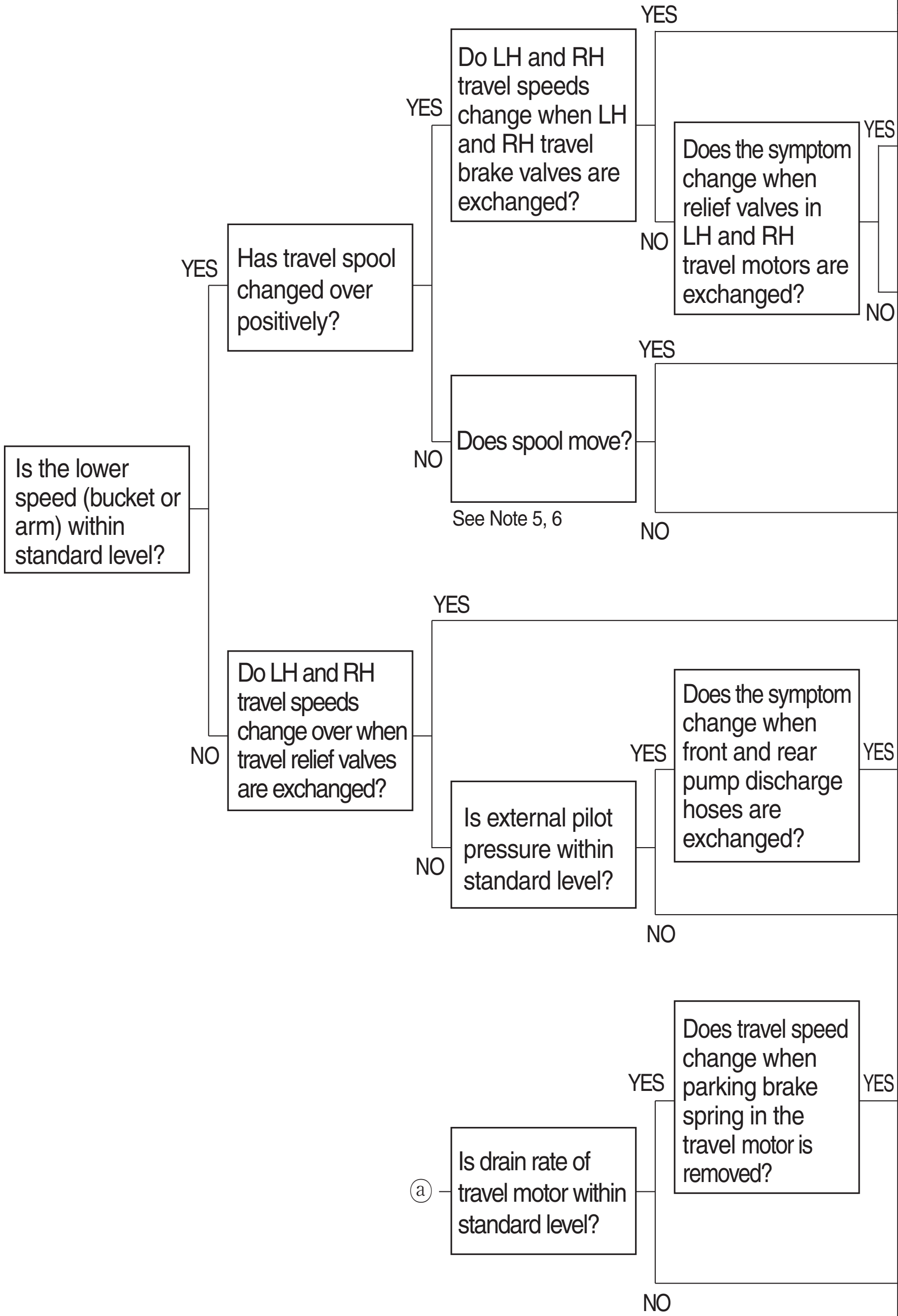


5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION AT ALL ON ONE SIDE



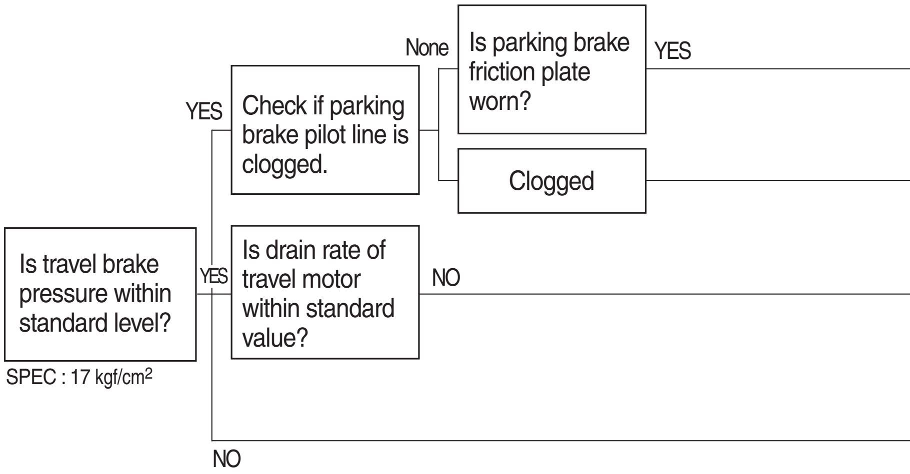
2) SPEED ON ONE SIDE FALLS AND THE MACHINE CURVES



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.

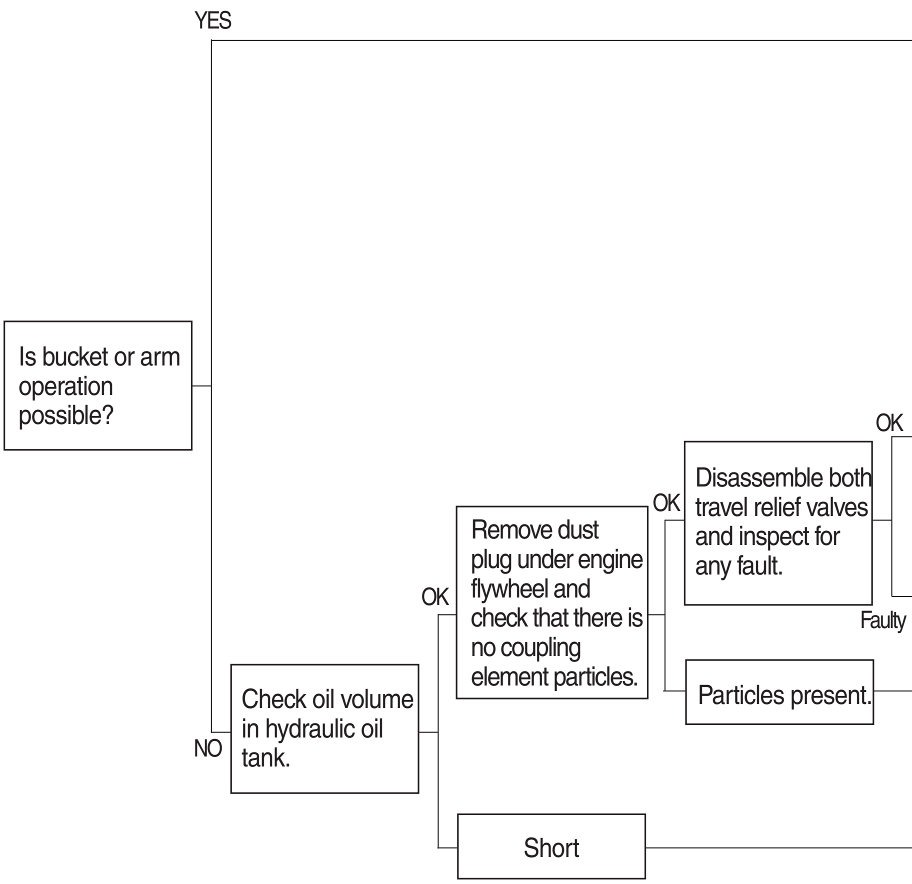
3) MACHINE DOES NOT STOP ON A SLOPE

Machine is pulled forward as sprocket rotates during digging operation.



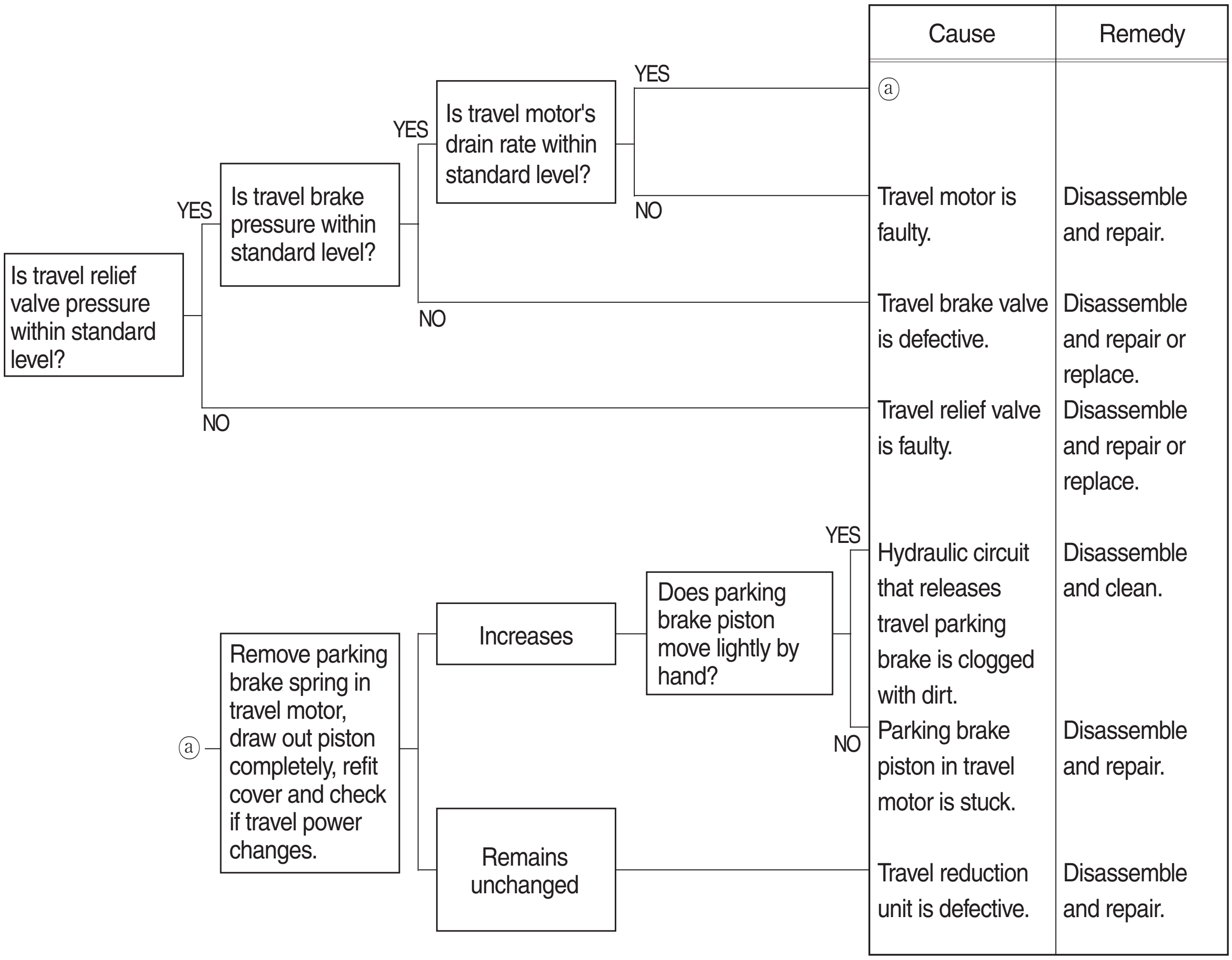
Cause	Remedy
Friction plate is faulty.	Disassemble and repair.
	Disassemble and clean pilot piping.
Travel motor is defective.	Disassemble and repair.
Brake valve is faulty.	Disassemble and repair or replace.

4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE



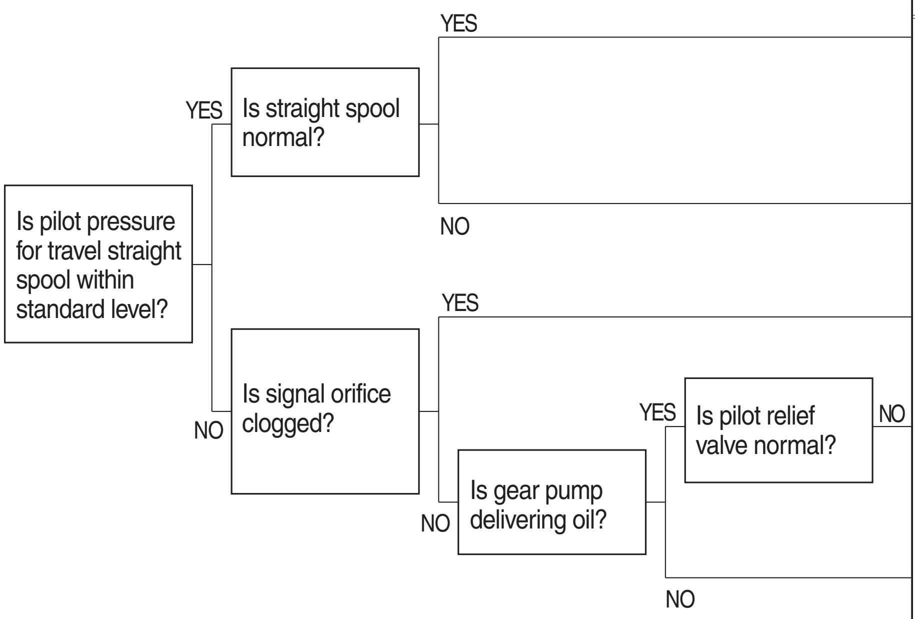
Cause	Remedy
	Inspect according to the procedure "Travel does not function at all on one side." However, a case where both LH and RH travel motions are disabled is extremely seldom statistically.
Hydraulic pump is faulty.	Disassemble and repair.
Travel relief valve is faulty.	Disassemble and repair or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

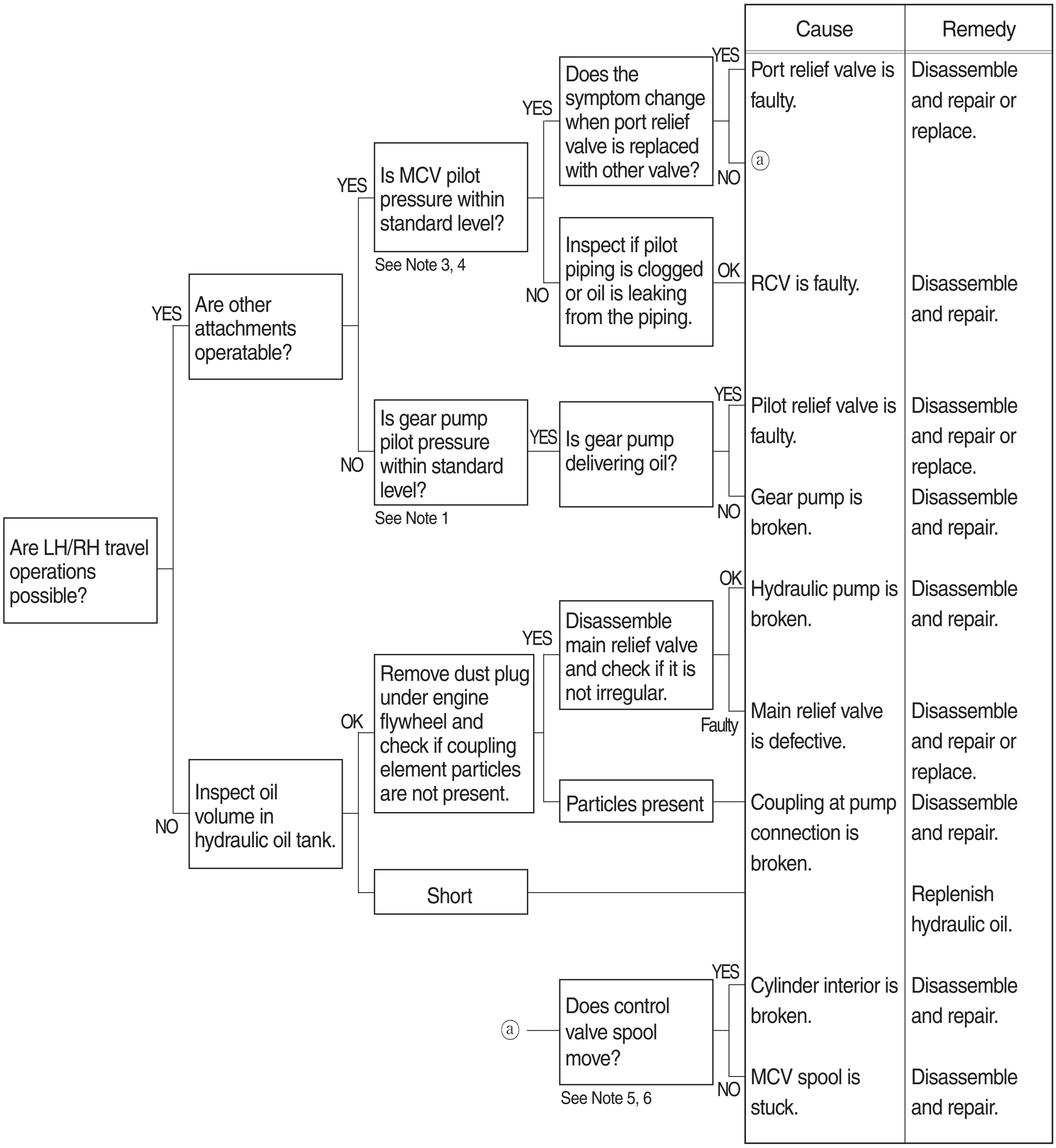
7) MACHINE MAKES A CURVED TRAVEL OR DOES NOT TRAVEL AT ALL WHEN TRAVEL AND ATTACHMENT OPERATIONS ARE EXECUTED AT THE SAME TIME



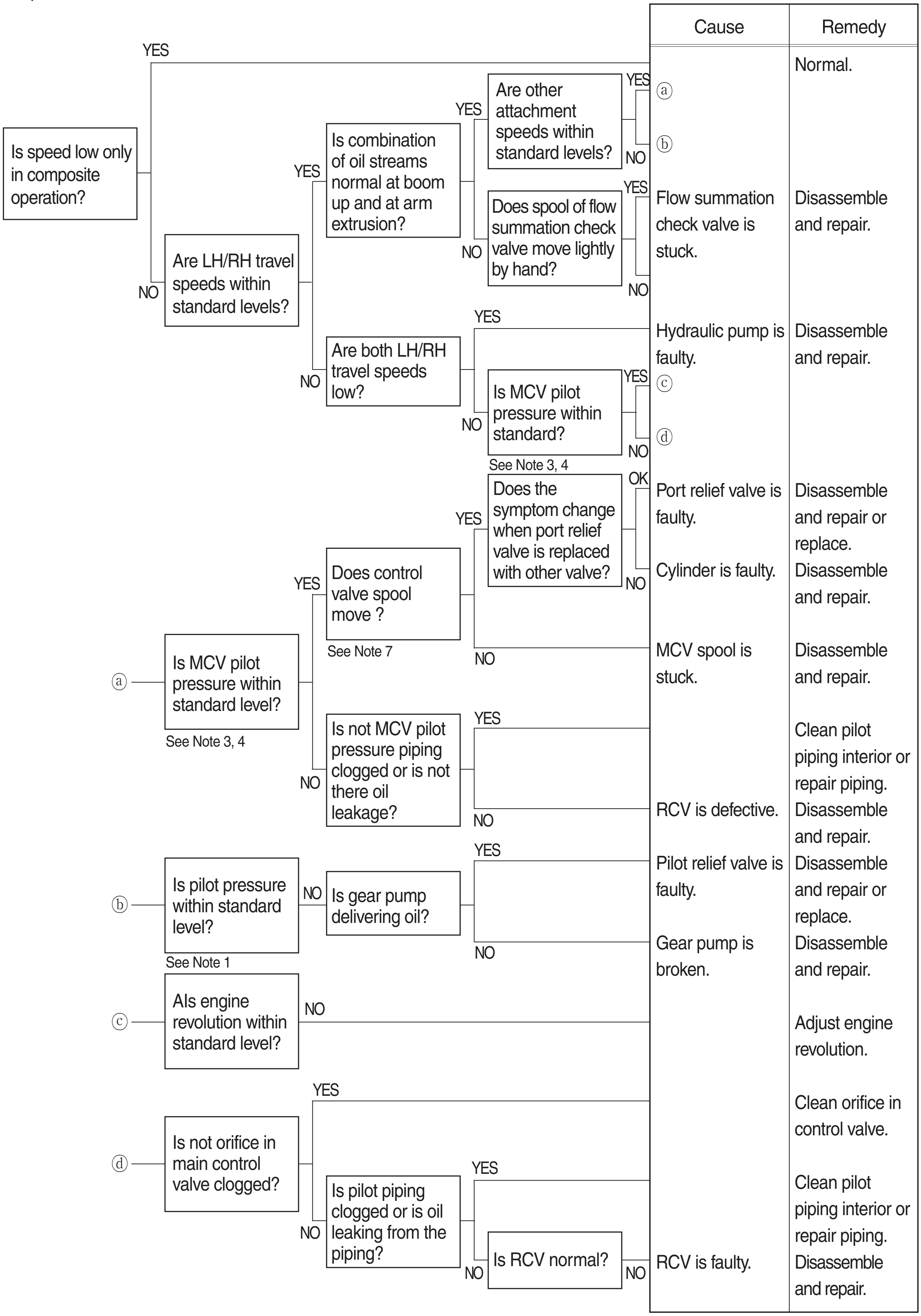
Cause	Remedy
	Normal.
Straight spool is faulty.	Repair or replace.
	Remove dirt on signal orifice.
Pilot relief valve is defective.	Disassemble and repair or replace.
Gear pump is broken.	Disassemble and repair.

6. ATTACHMENT SYSTEM

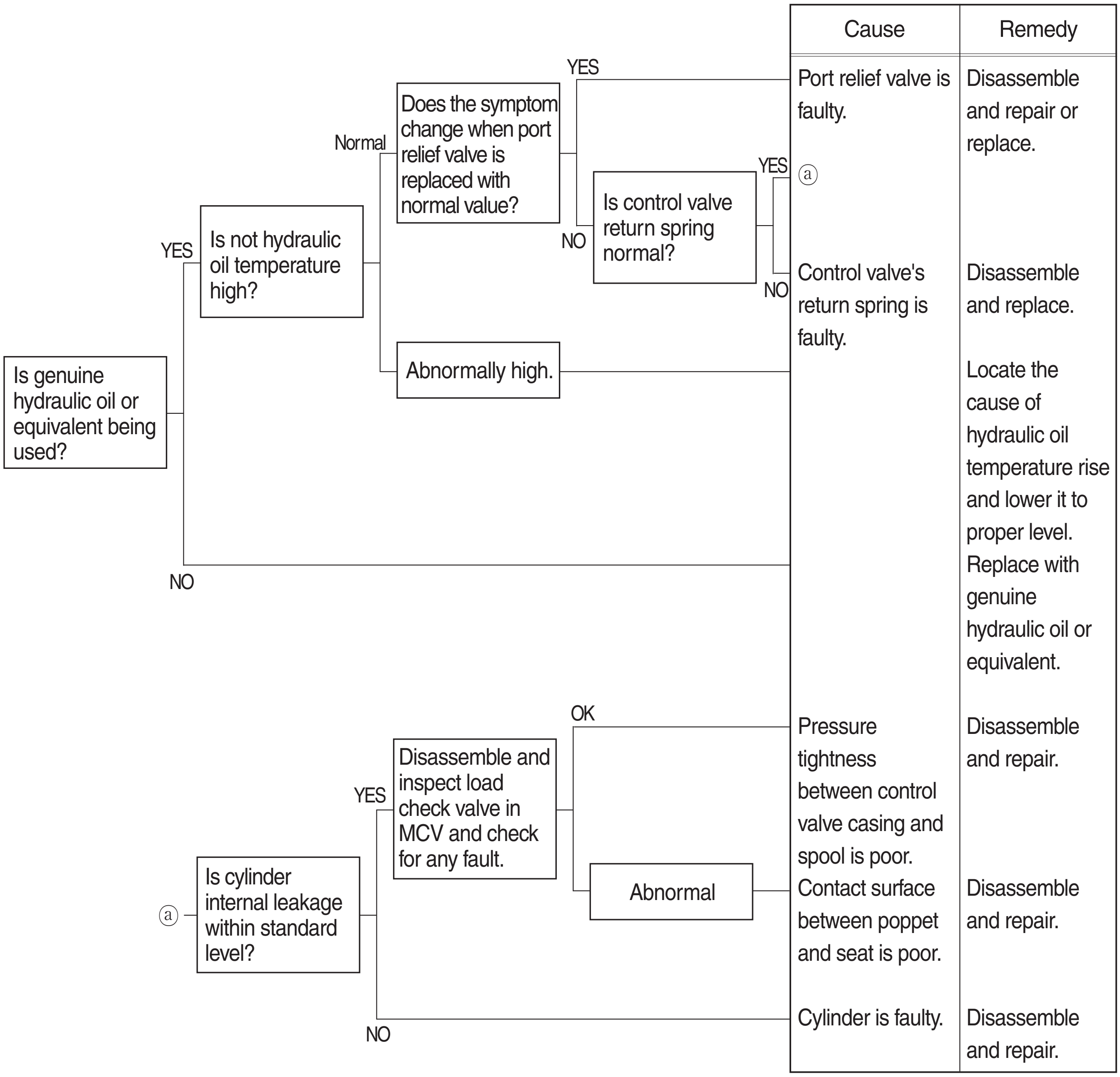
1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



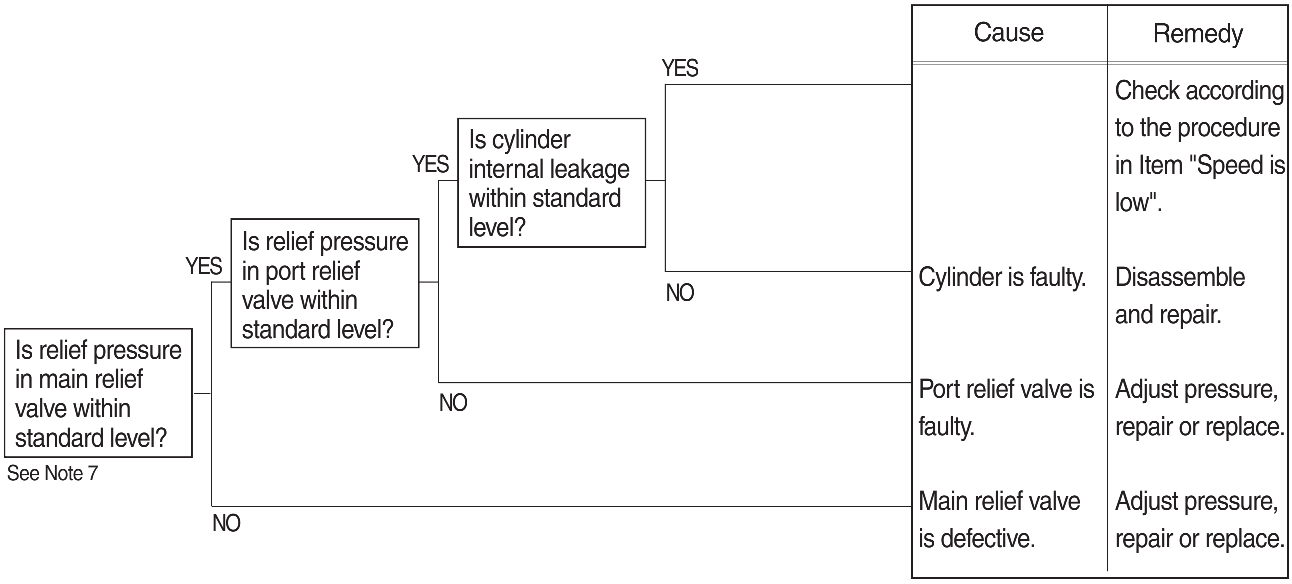
2) BOOM, ARM OR BUCKET SPEED IS LOW



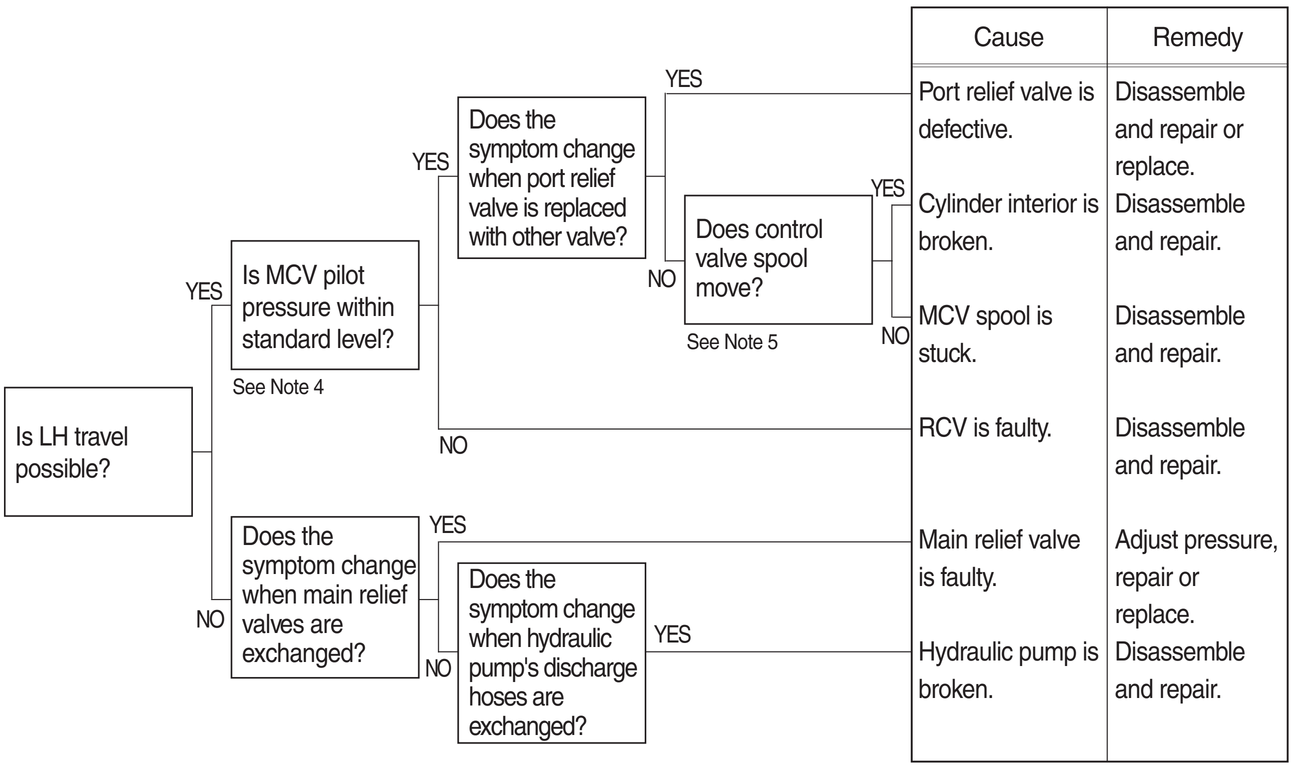
3) BOOM, ARM OR BUCKET CYLINDER EXTENDS OR CONTRACTS ITSELF AND ATTACHMENT FALLS



4) BOOM, ARM OR BUCKET POWER IS WEAK



5) ONLY BUCKET OPERATION IS TOTALLY IMPOSSIBLE



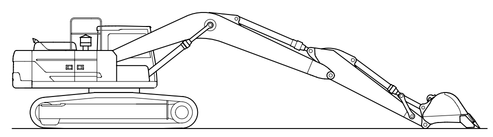
6) BOOM MAKES A SQUEAKING NOISE WHEN BOOM IS OPERATED

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.

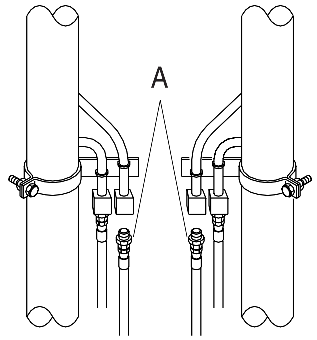
※ HOW TO CHECK INTERNAL BOOM CYLINDER LEAKAGE

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



300L6TS01

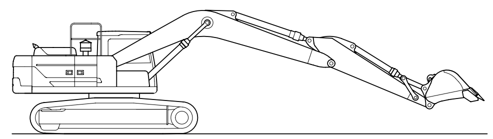
2. Disconnect hose (A) from rod side of boom cylinder and drain oil from cylinders and hose. (put cups on piping and hose ends)



(210-7) 6-20(2)

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

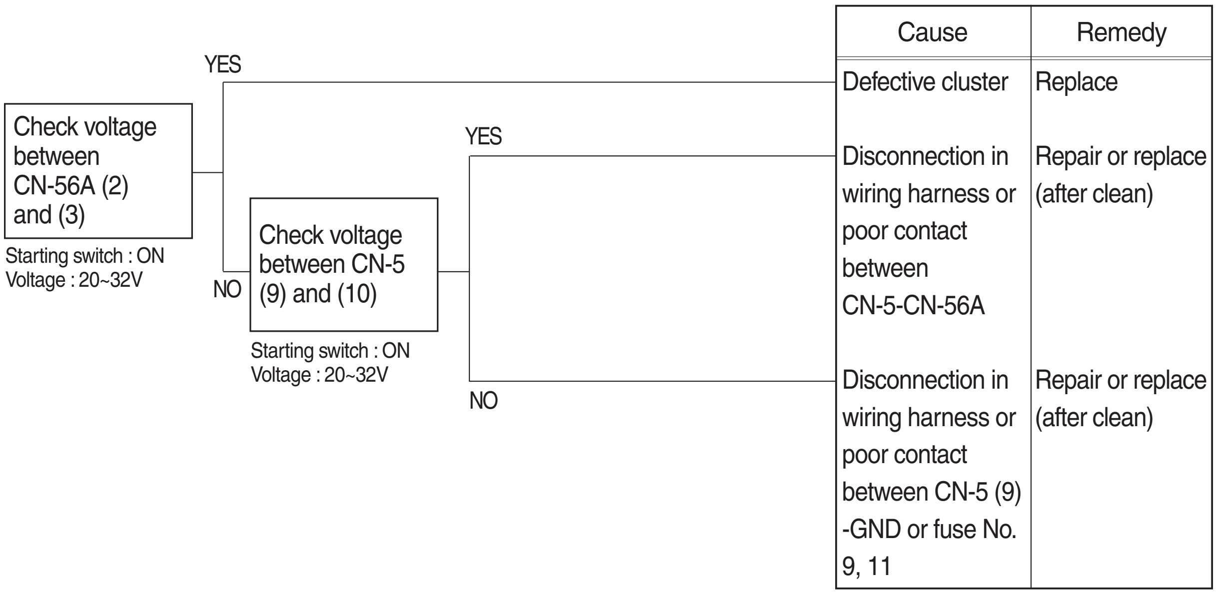
   If oil leaks from piping side and boom cylinder rod is retracted there is an internal leak in the cylinder.
   If no oil leaks from piping side and boom cylinder rod is retracted, there is an internal leak in the control valve.



300L6TS02

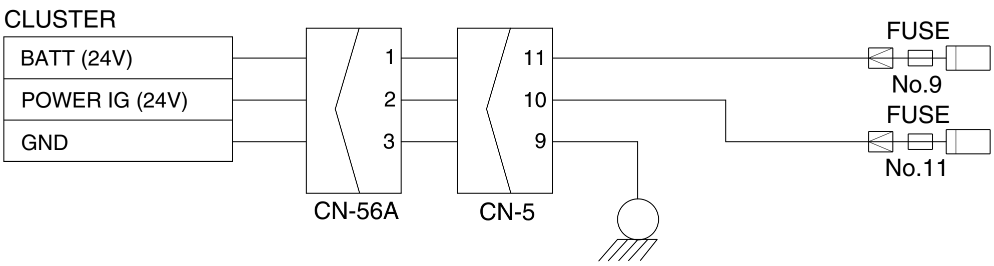
1. WHEN STARTING SWITCH IS TURNED ON, MONITOR PANEL DISPLAY DOES NOT APPEAR

· 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. 9, 11.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Check voltage

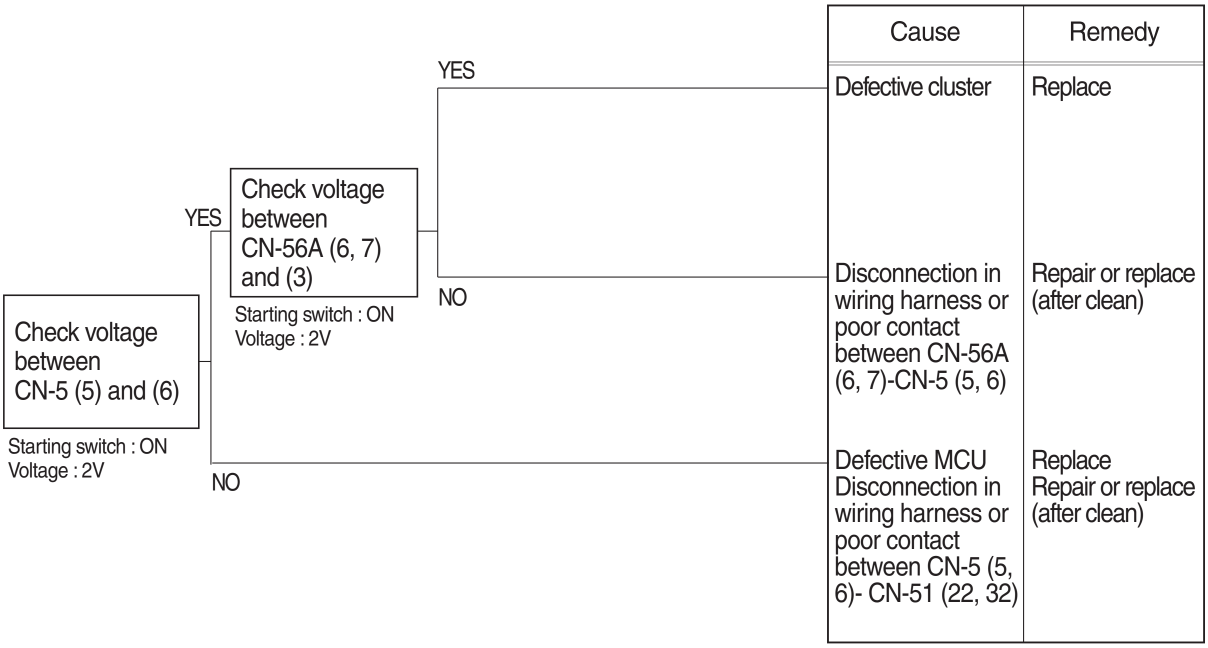
YES	20~32V
NO	0V



480S6ES01

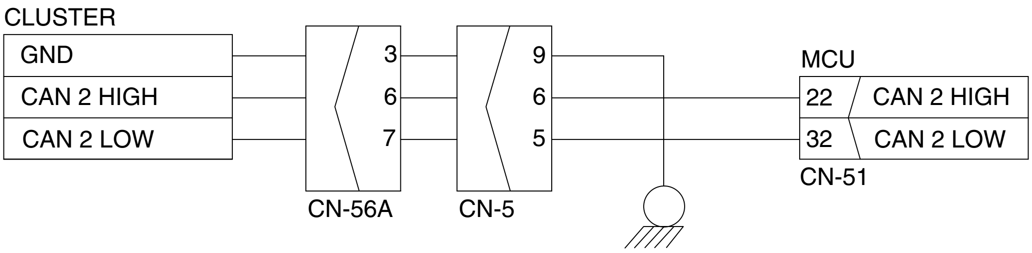
2. COMMUNICATION ERROR FLASHES ON THE CLUSTER (HCESPN 840, FMI 2)

· 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

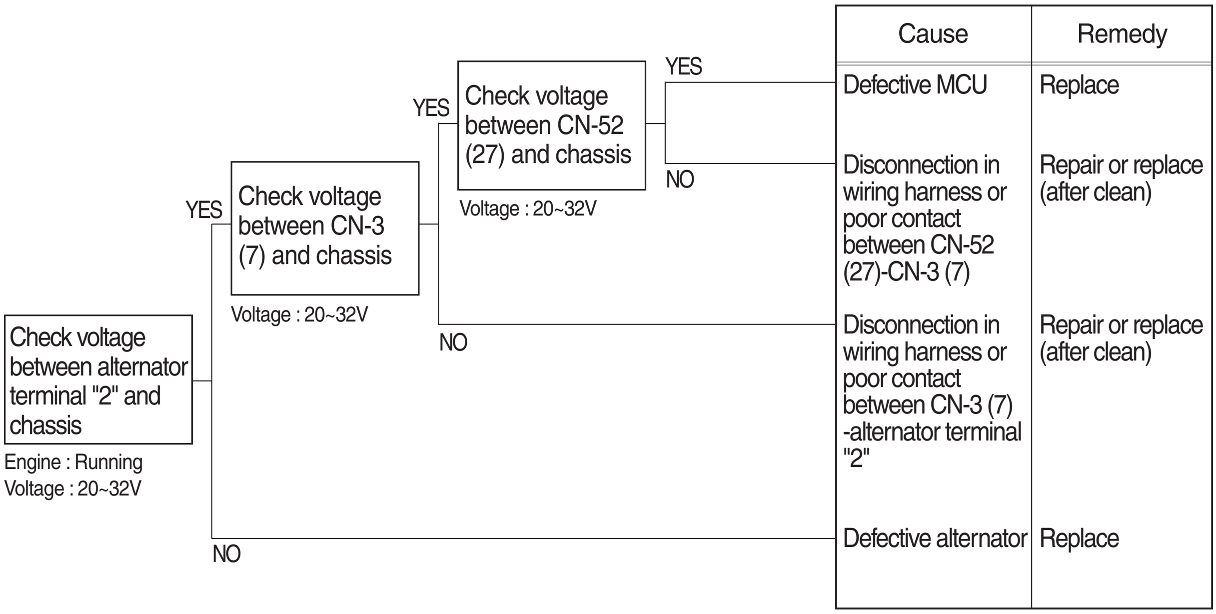
YES	2V
NO	0V



300L6ES02

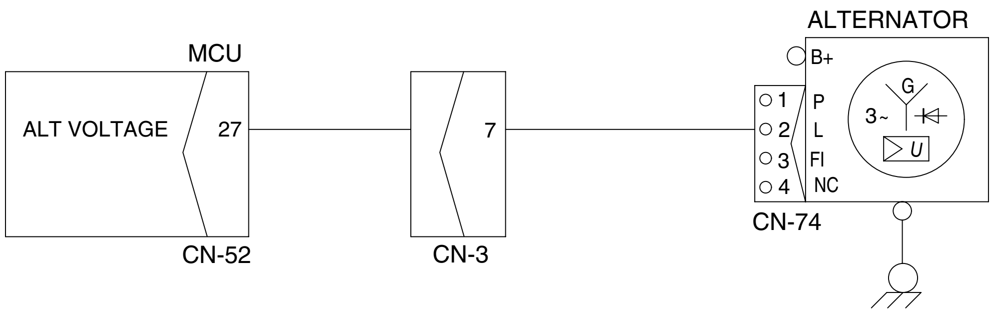
3. BATTERY CHARGING WARNING LAMP LIGHTS UP (Starting switch : ON)

· 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

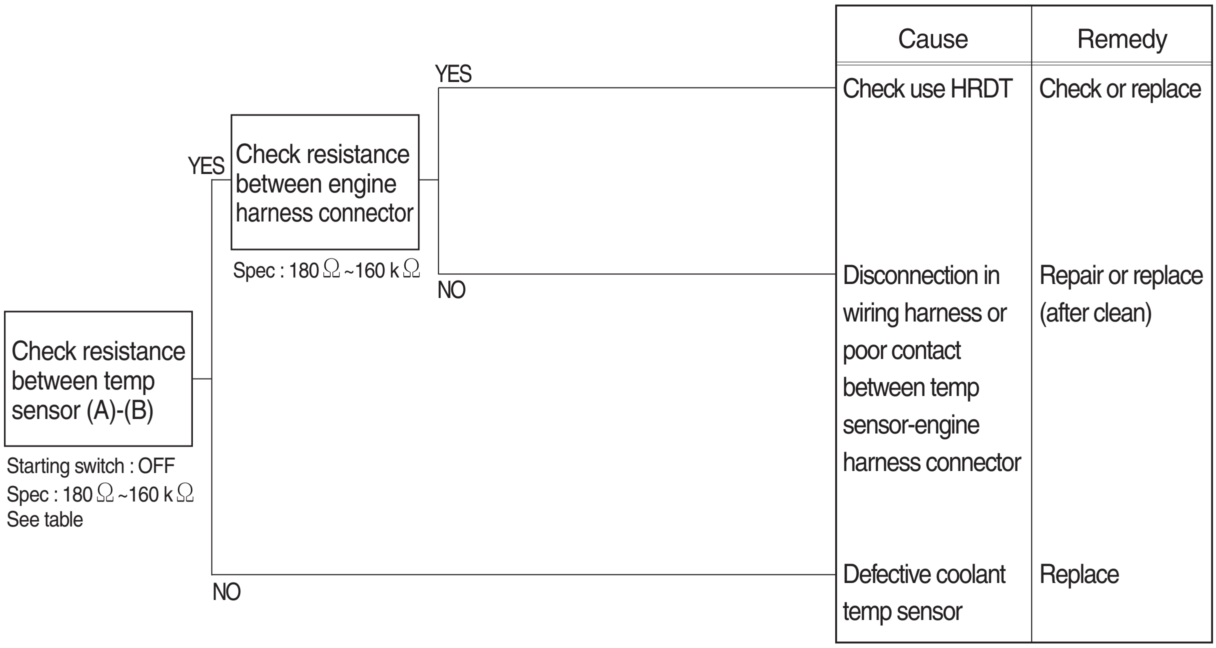
YES	20~32V
NO	0V



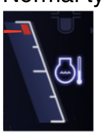
480S6ES03

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.



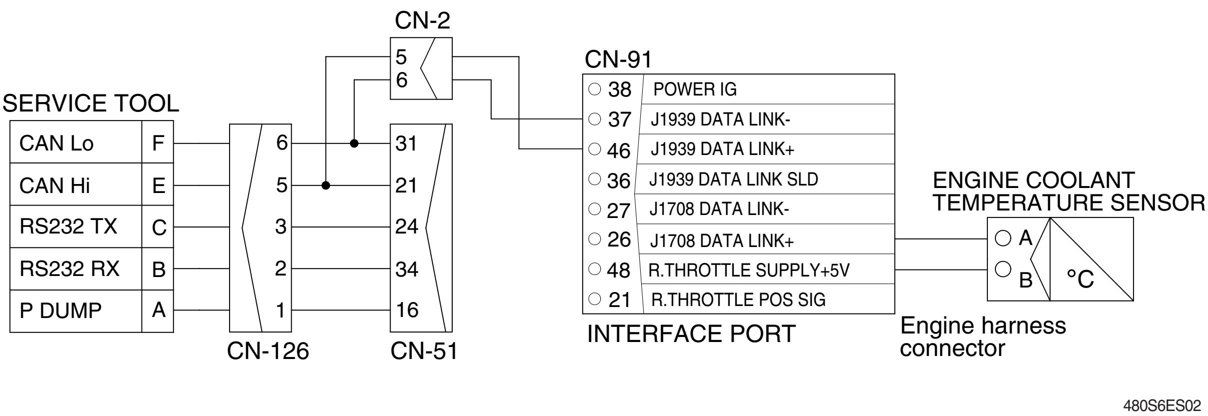
Normal type



Premium type

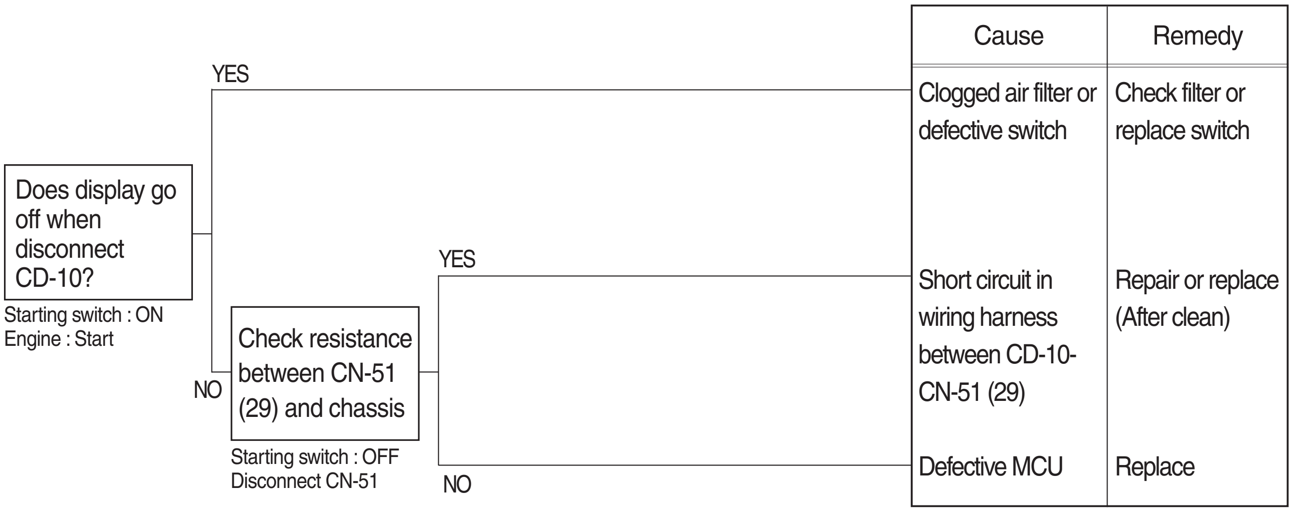
Check Table

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



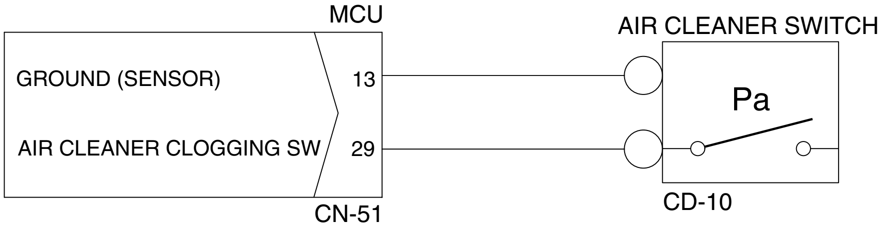
5. WHEN AIR CLEANER WARNING LAMP LIGHTS UP (engine is started)

· 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

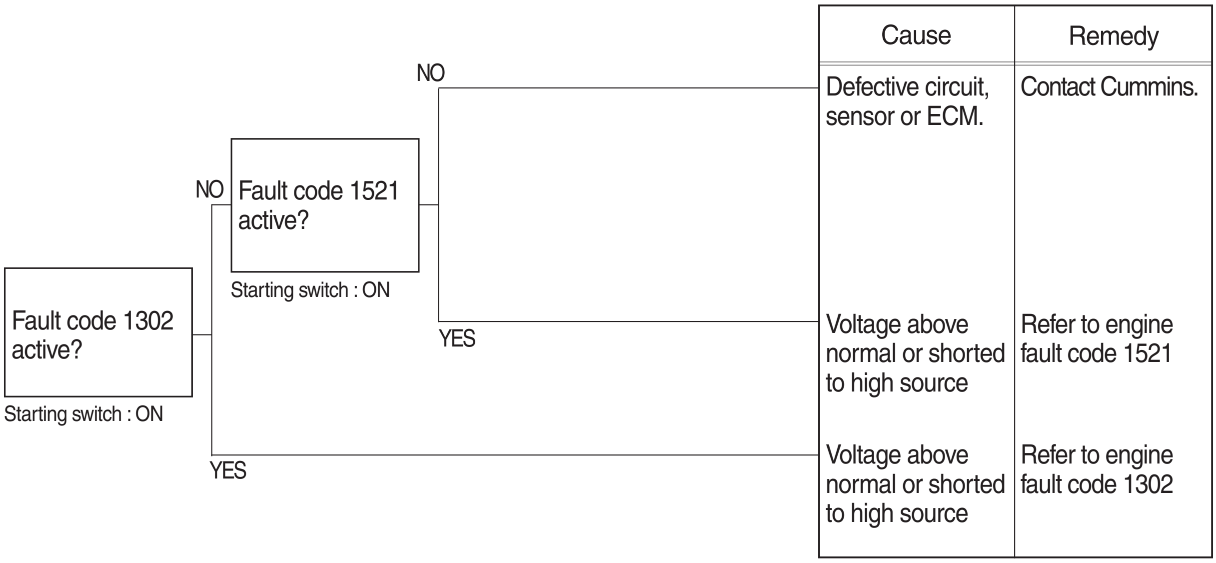
YES	MAX 1Ω
NO	MIN 1MΩ

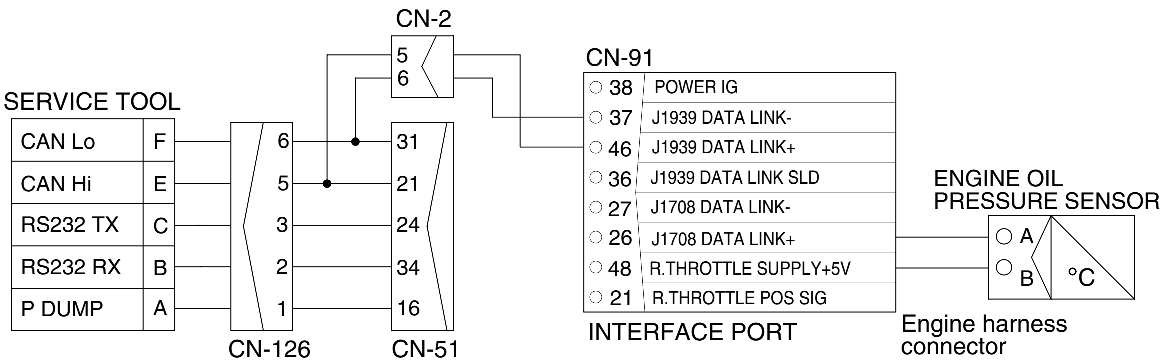


480S6ES05

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.

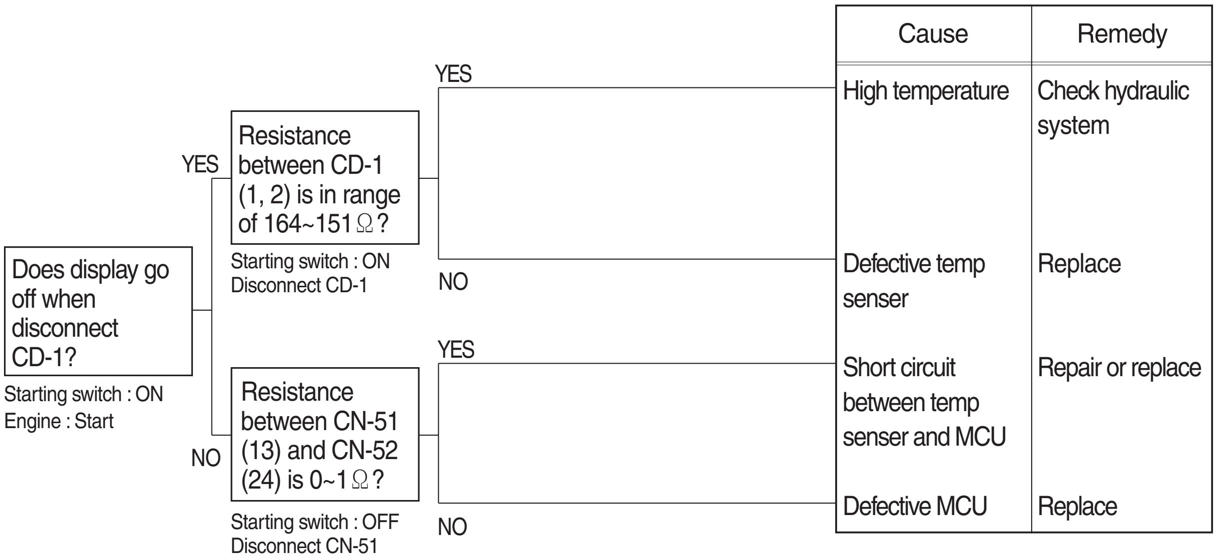




480S6ES04

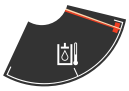
7. WHEN HYDRAULIC OIL TEMPERATURE WARNING LAMP LIGHTS UP (engine is started)

· 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.



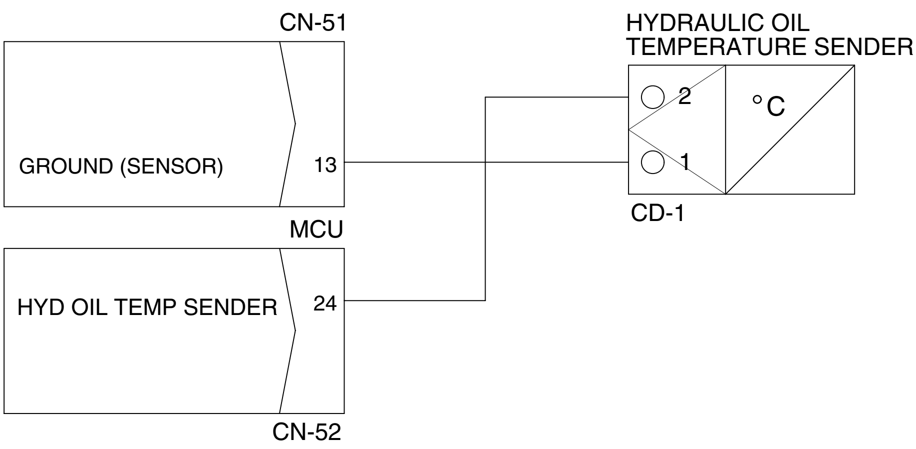
Normal type

Premium type



Check Table

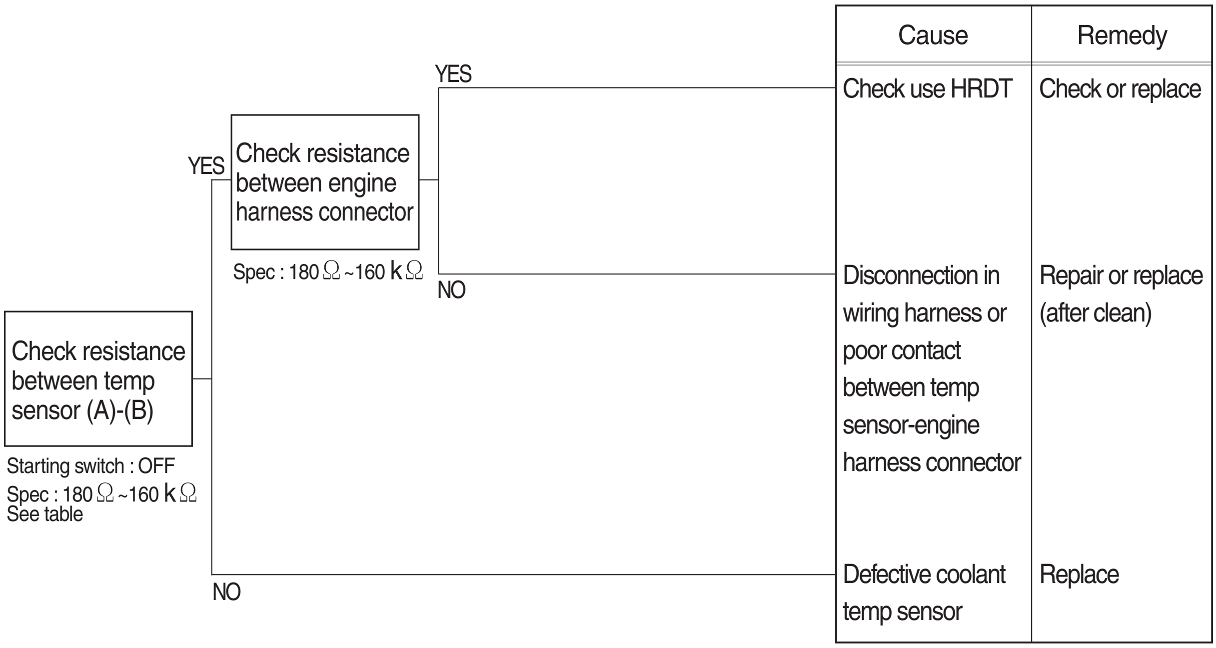
Temperature (˚C)	~ -30	~ -10	~ 0	~ 40	~ 70	~ 80	~ 90	~ 100	105~
Resistance (kΩ)	22.22 ~31.78	8.16 ~10.74	5.18 ~ 6.6	1.06 ~1.28	0.39 ~0.476	0.322 ~0.298	0.243 ~0.219	0.185 ~0.167	0.164 0.151



480S6ES08

8. WHEN COOLANT TEMPERATURE GAUGE DOES NOT OPERATE

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

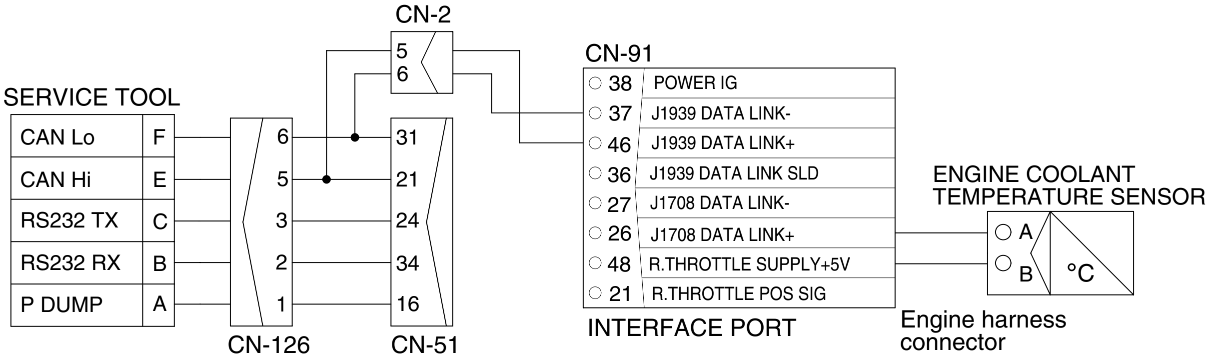


Normal type

Premium type

Check Table

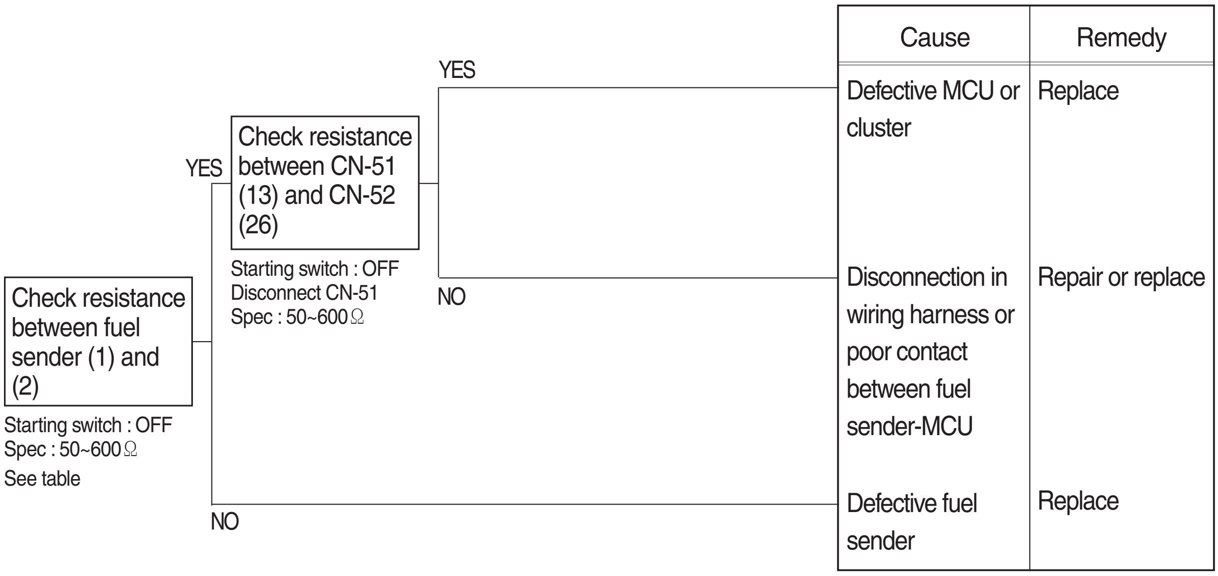
Temperature (˚C)	0	25	50	80	95
Resistance (kΩ)	30~37	9.3~10.7	3.2~3.8	1.0~1.3	0.7~0.8



480S6ES02

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.

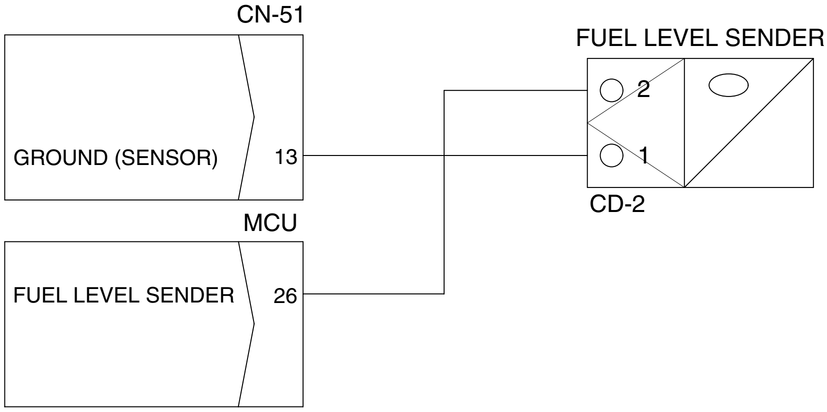


Normal type

Premium type

Check Table

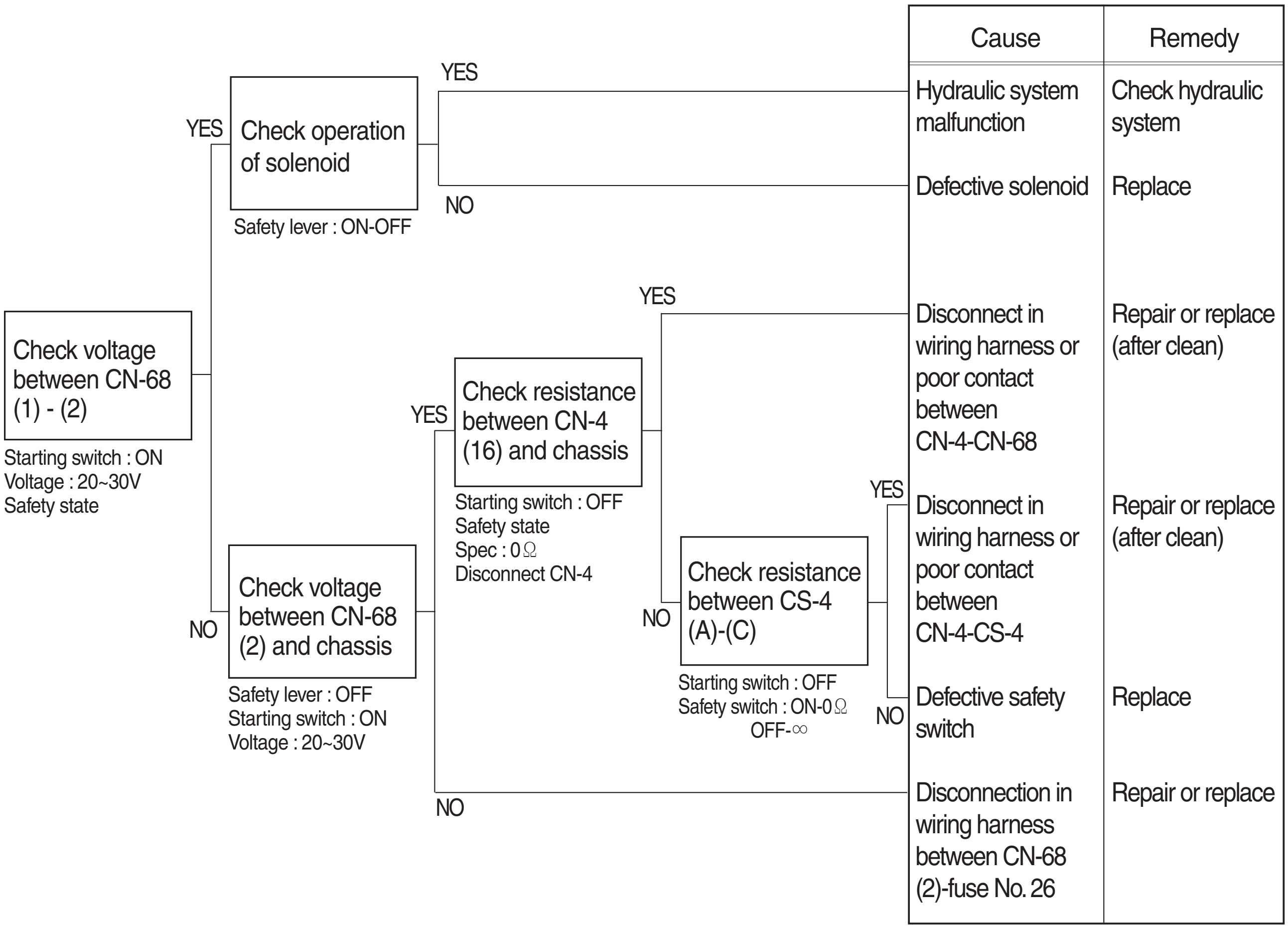
Range	Resistance (Ω)	Range	Resistance (Ω)
Full	50	5/12	400
11/12	100	4/12	450
10/12	150	3/12	500
9/12	200	2/12	550
8/12	250	1/12	600
7/12	300	Empty warning	700
6/12	350	-	-

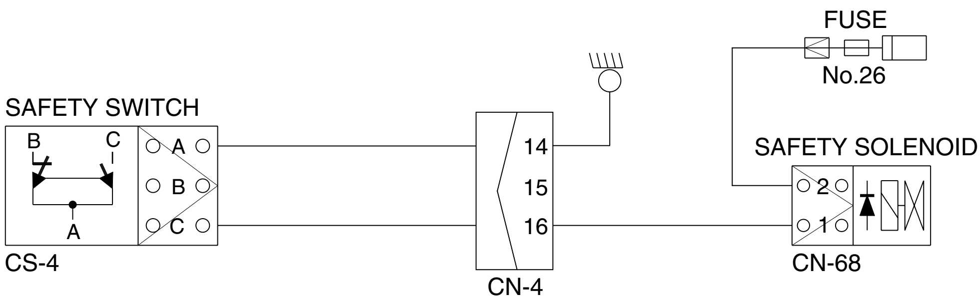


480S6ES10

10. WHEN SAFETY SOLENOID DOES NOT OPERATE

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 26.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

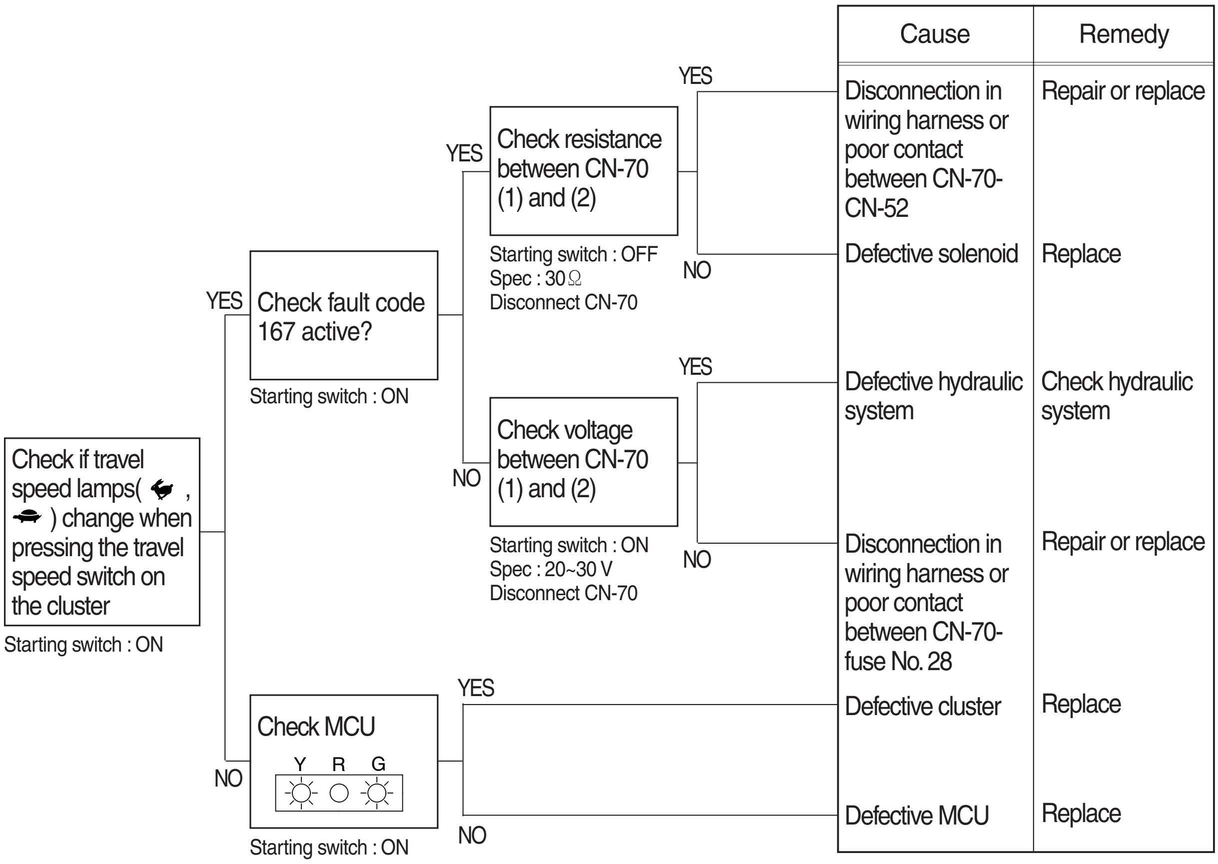


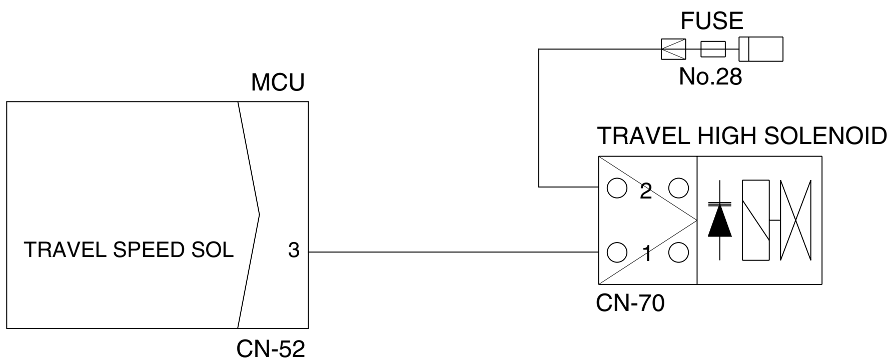


480S6ES12

11. WHEN TRAVEL SPEED 1, 2 DOES NOT OPERATE (HCESPN 167, FMI 4 or 6)

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 28.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.

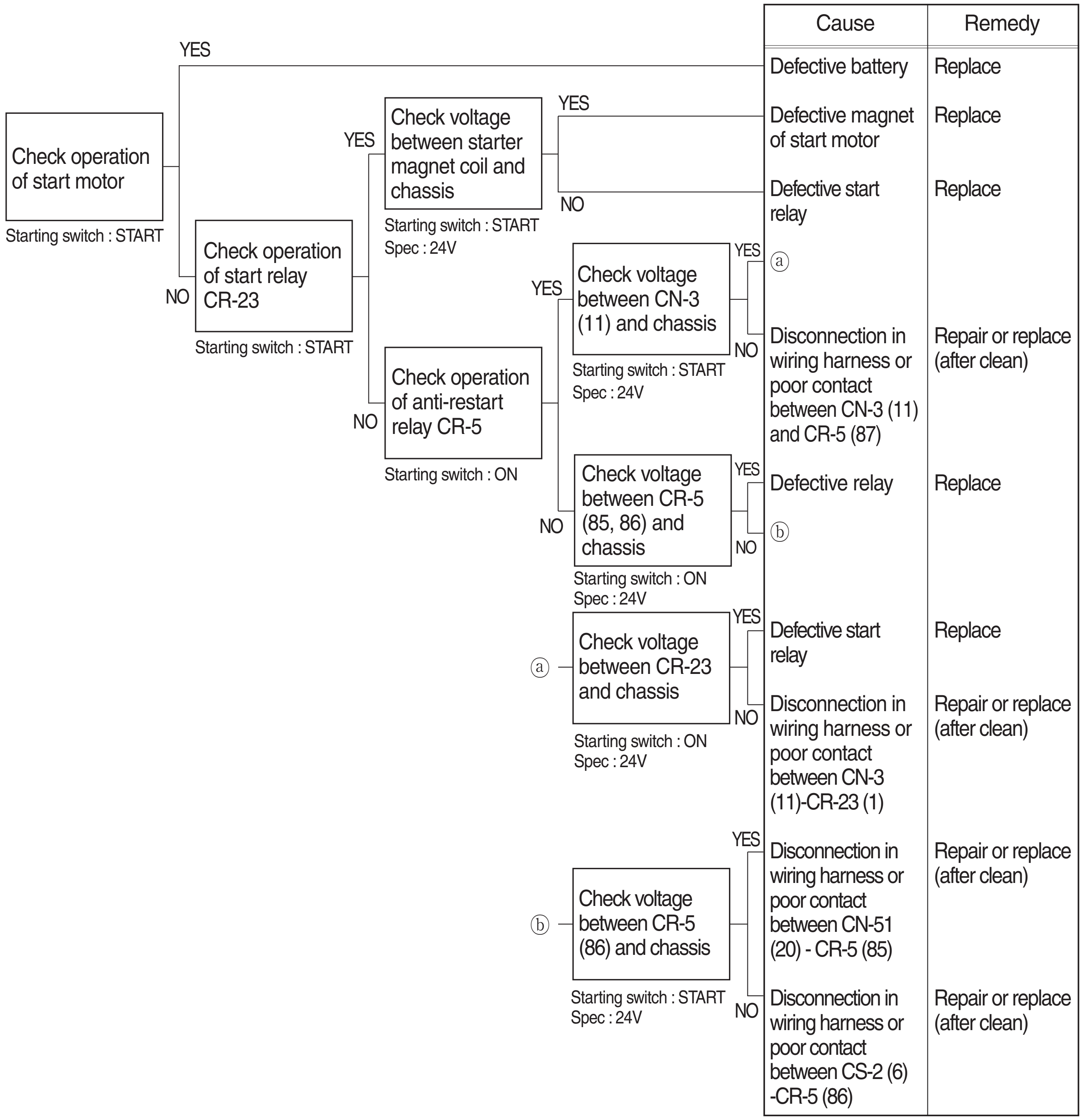


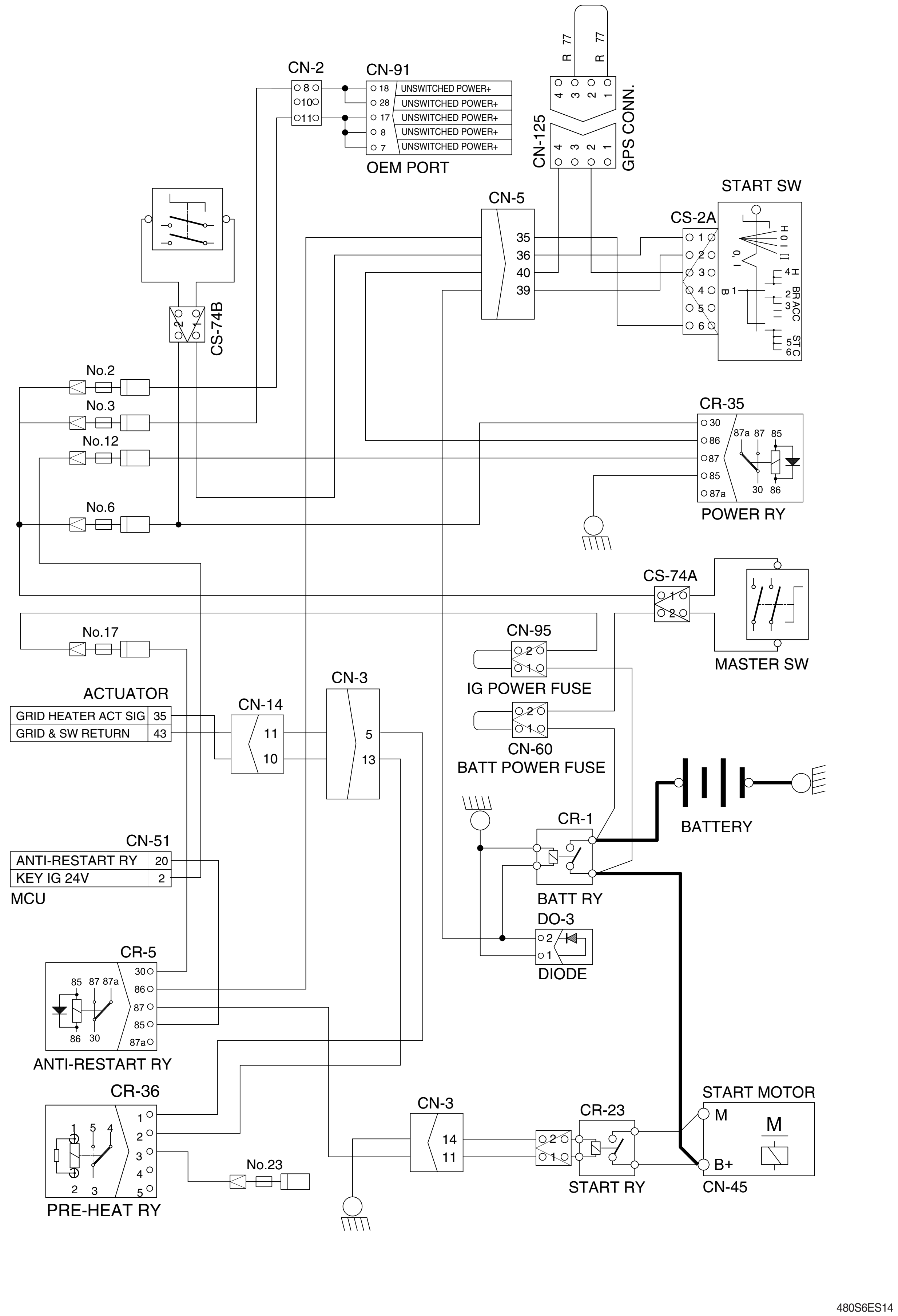


480S6ES13

12. WHEN ENGINE DOES NOT START ([- +] lights up condition)

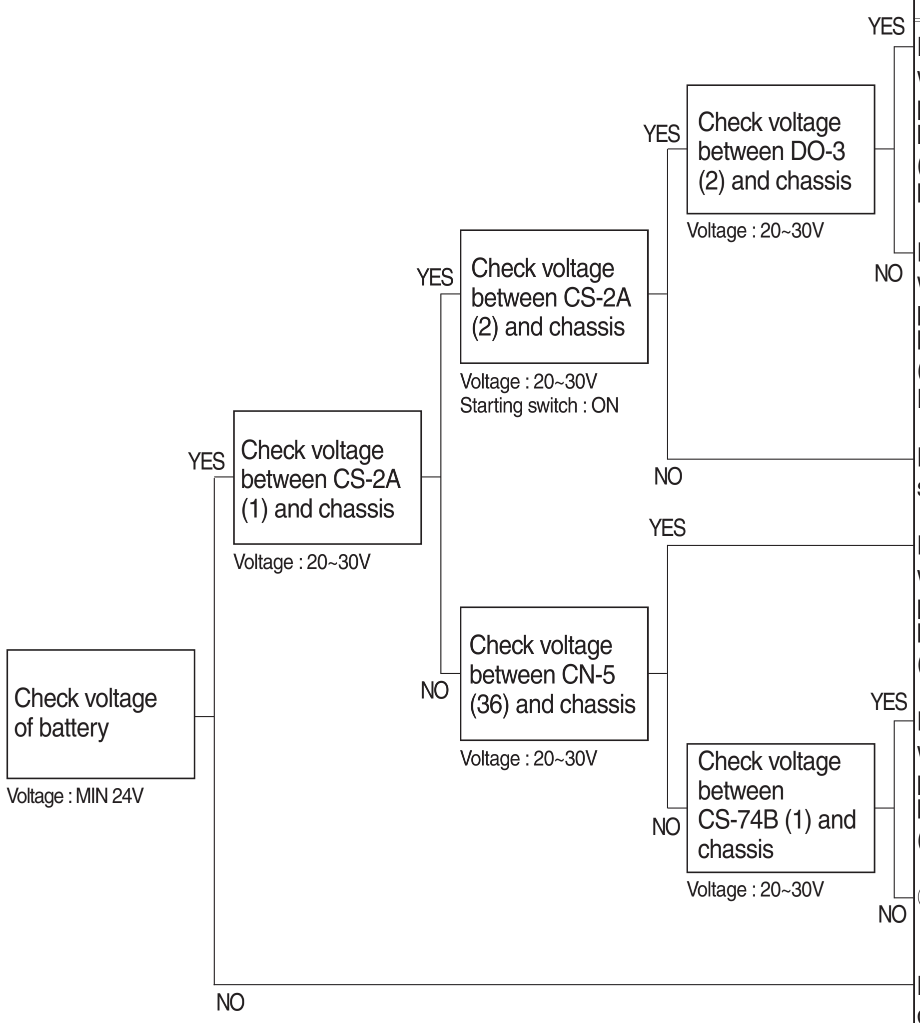
- Check supply of the power at engine stop solenoid while starting switch is ON.
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and fuse No. 2, 3, 6, 12 and 23 burnt out.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



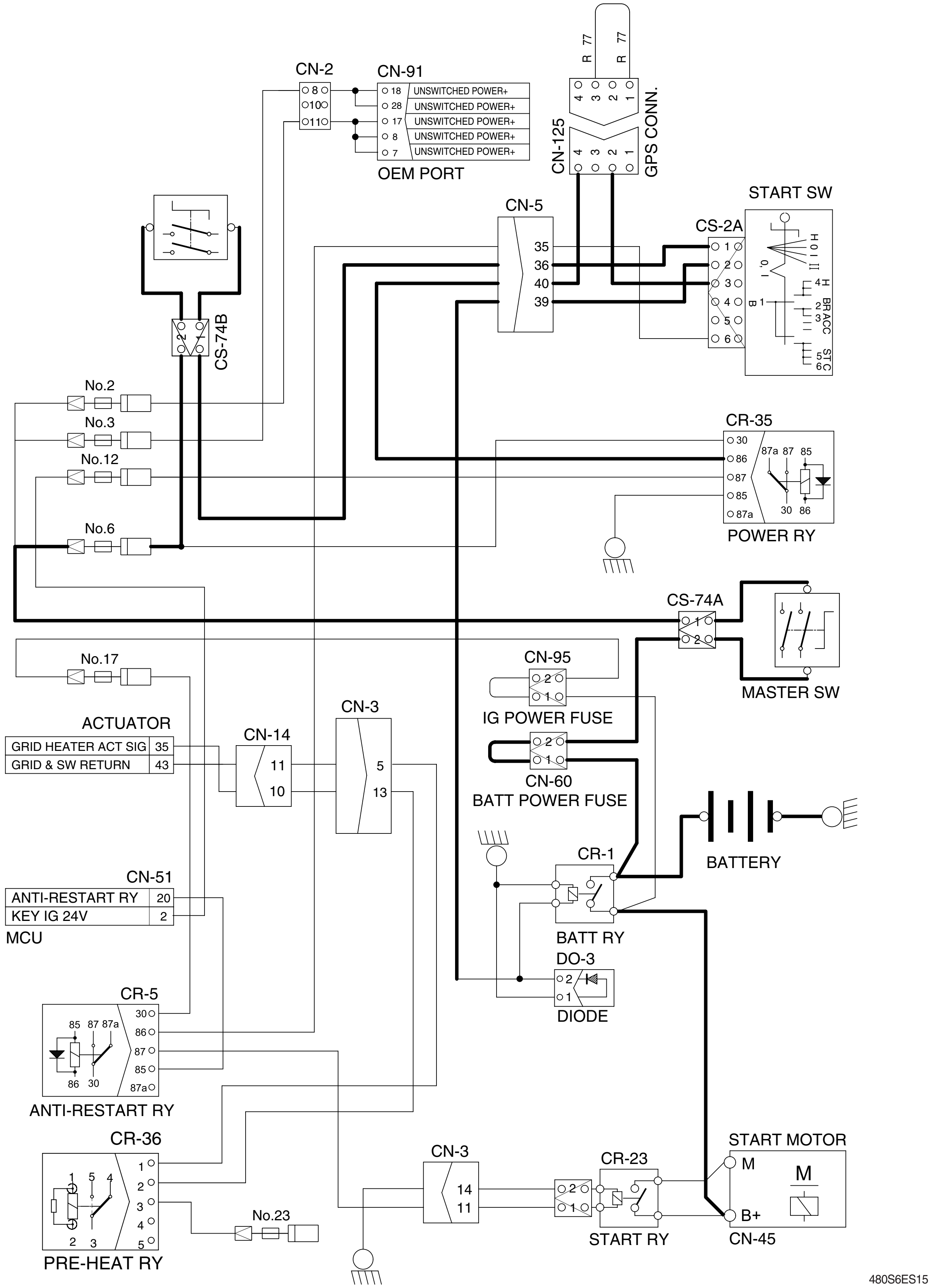


13. WHEN STARTING SWITCH ON DOES NOT OPERATE

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted, master switch ON and check open circuit of battery power fuse (CN-60).
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

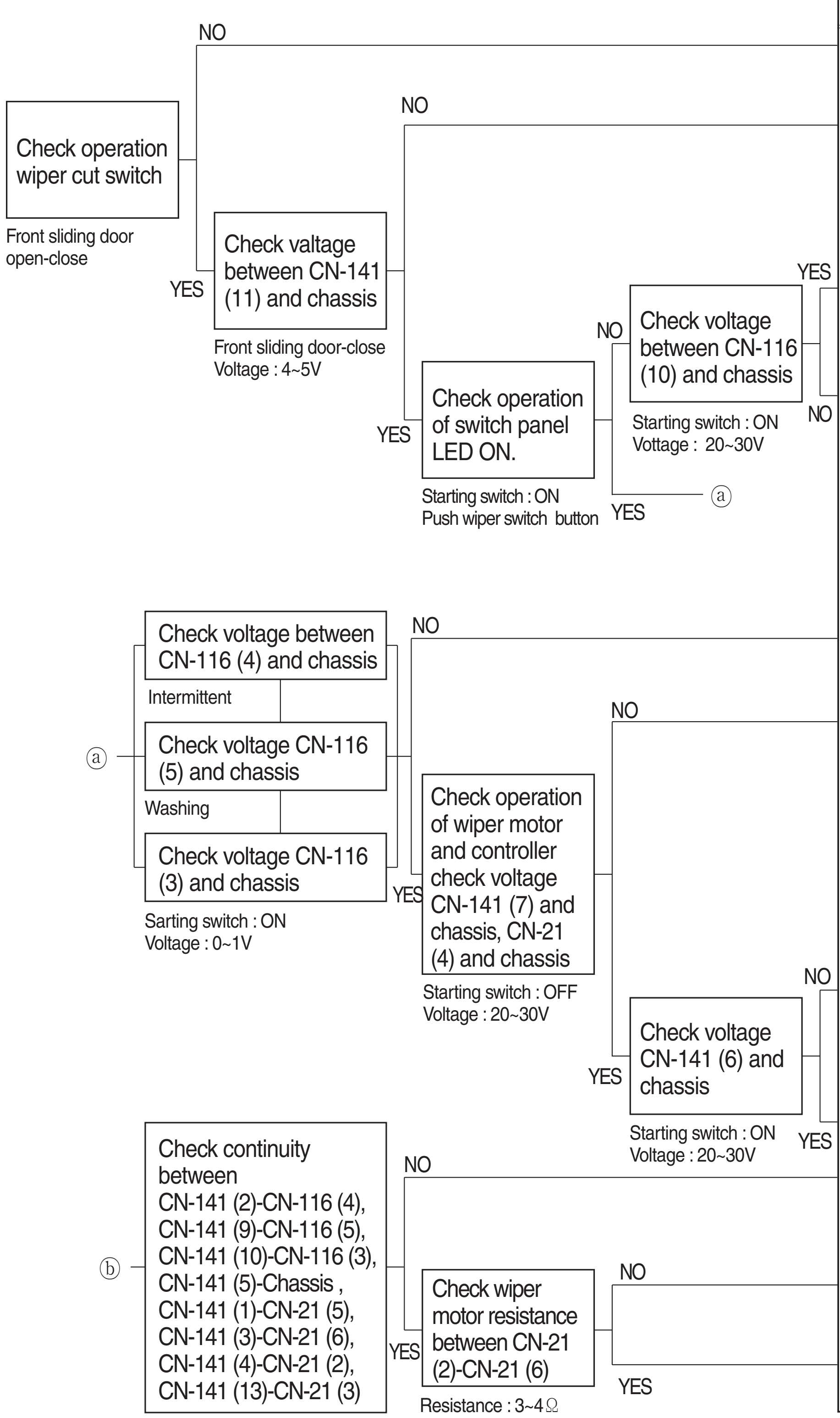


Cause	Remedy
Disconnection in wiring harness or poor contact between DO-3 (2)-CR-1 or defective battery relay	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CS-2A (2)-CN-5 (39)-DO-3 (2)	Repair or replace (after clean)
Defective start key switch	Replace
Disconnection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

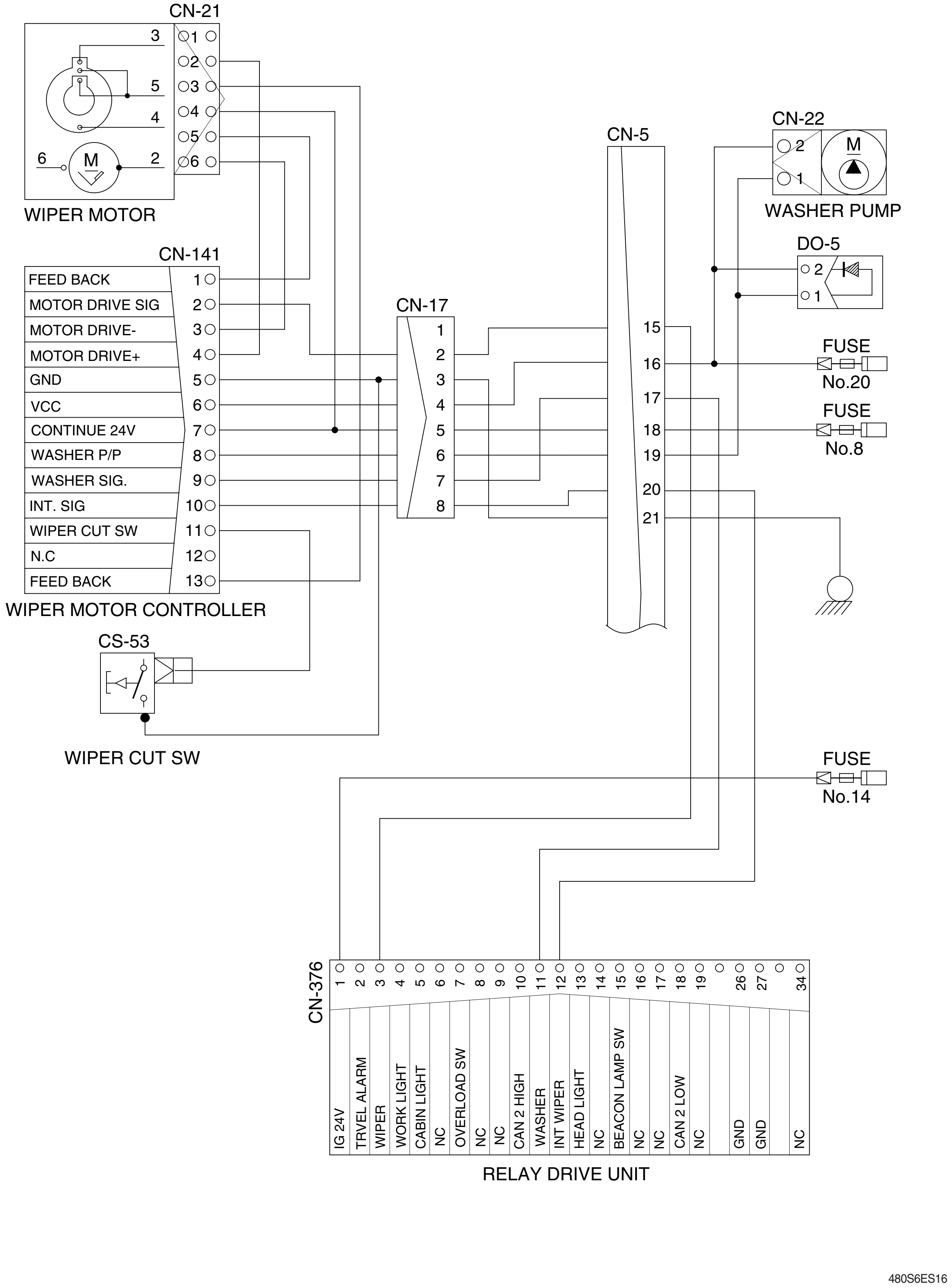


14. WHEN STARTING SWITCH IS TURNED ON, WIPER MOTOR DOES NOT OPERATE

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and fuse No. 8, 14 and 20 is not blown out.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

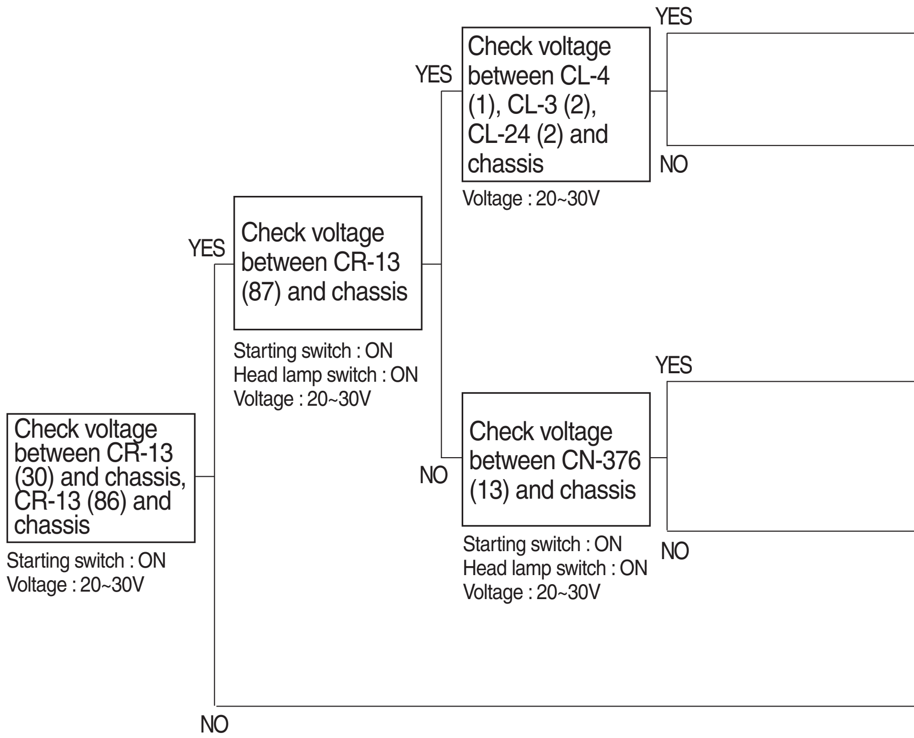


Cause	Remedy
Defective wiper cut switch	Replace
Short circuit in wiring harness or poor contact between CN-141 (11)- CS-53	Repair or replace (after clean)
Defective relay drive unit	Replace
1)Recheck fuse No.14 2)Disconnection in wiring harness or poor contact between CN-376 (1)-Fuse No.14	Replace Repair or replace (after clean)
Defective relay drive unit	Replace
1) Recheck fuse No.8 2) Disconnection in wiring harness or poor contact between CN-141 (7)-Fuse No.8, CN-21 (4)-Fuse No.8	Replace Repair or replace (after clean)
1) Recheck fuse No.20 2) Disconnection CN-141(6)-Fuse No.20	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

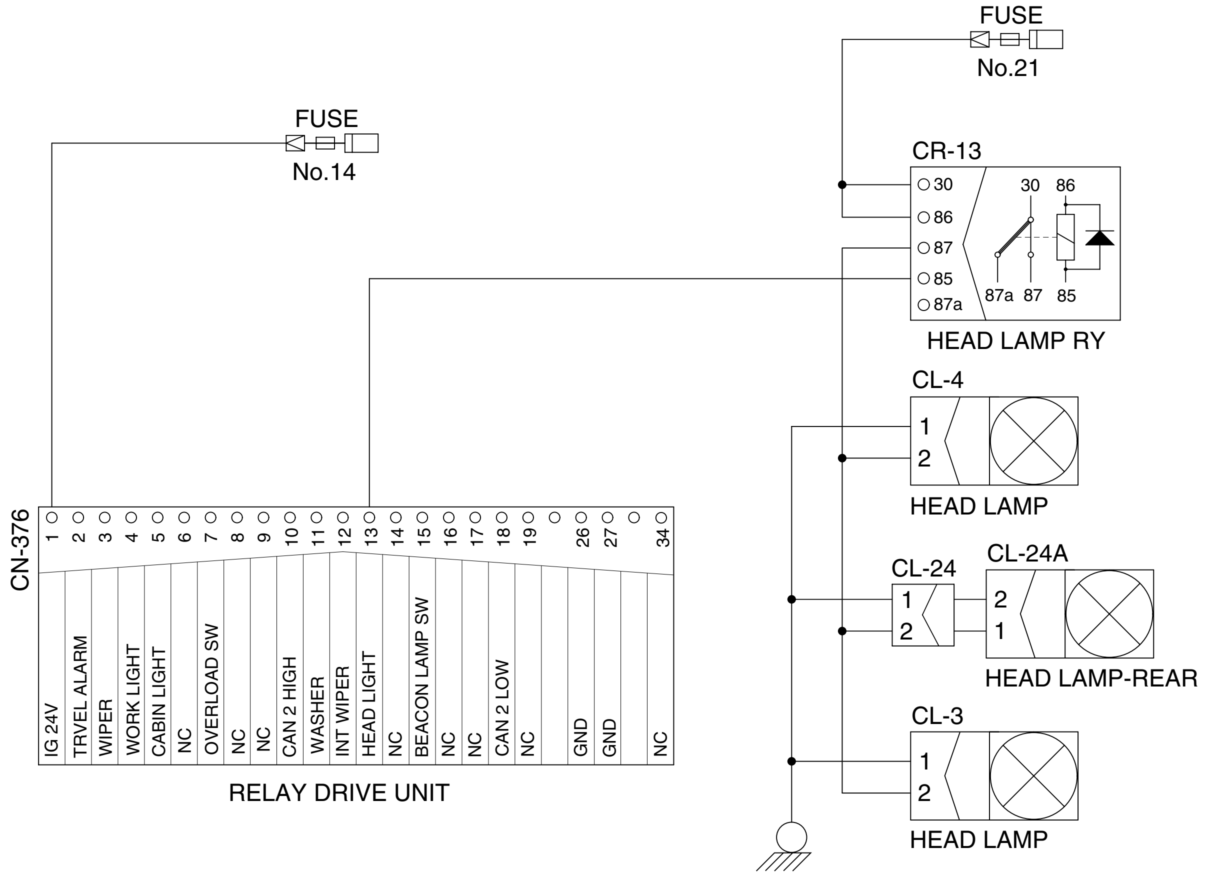


15. WHEN STARTING SWITCH IS TURNED ON, HEAD LAMP DOES NOT LIGHTS UP

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.13 and 20.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



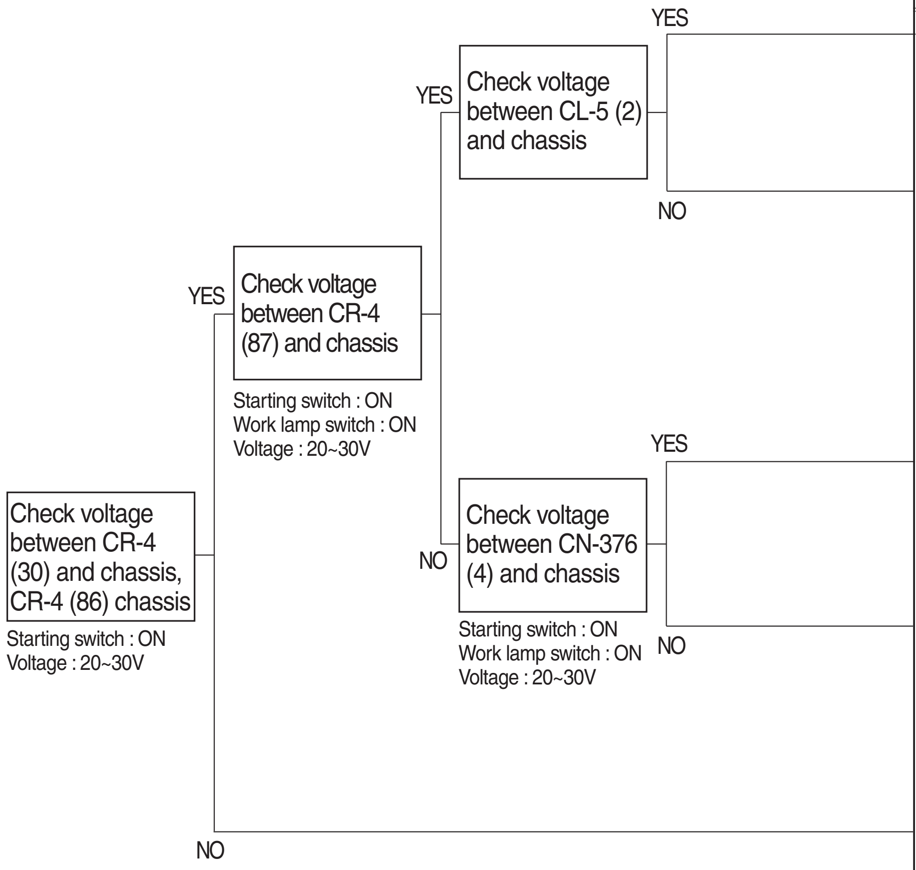
Cause	Remedy
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CR-13 (87)-CL-4 (1) or CR-13 (87)-CL-3 (2)	Repair or replace (after clean)
Defective relay drive unit	Replace
Disconnection in wiring harness or poor contact between CN-376 (13)-CR-13 (85)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CR-13 (30) and fuse No.21 or CR-13 (86) - fuse No.21	Repair or replace (after clean)
Recheck fuse No. 21	Replace



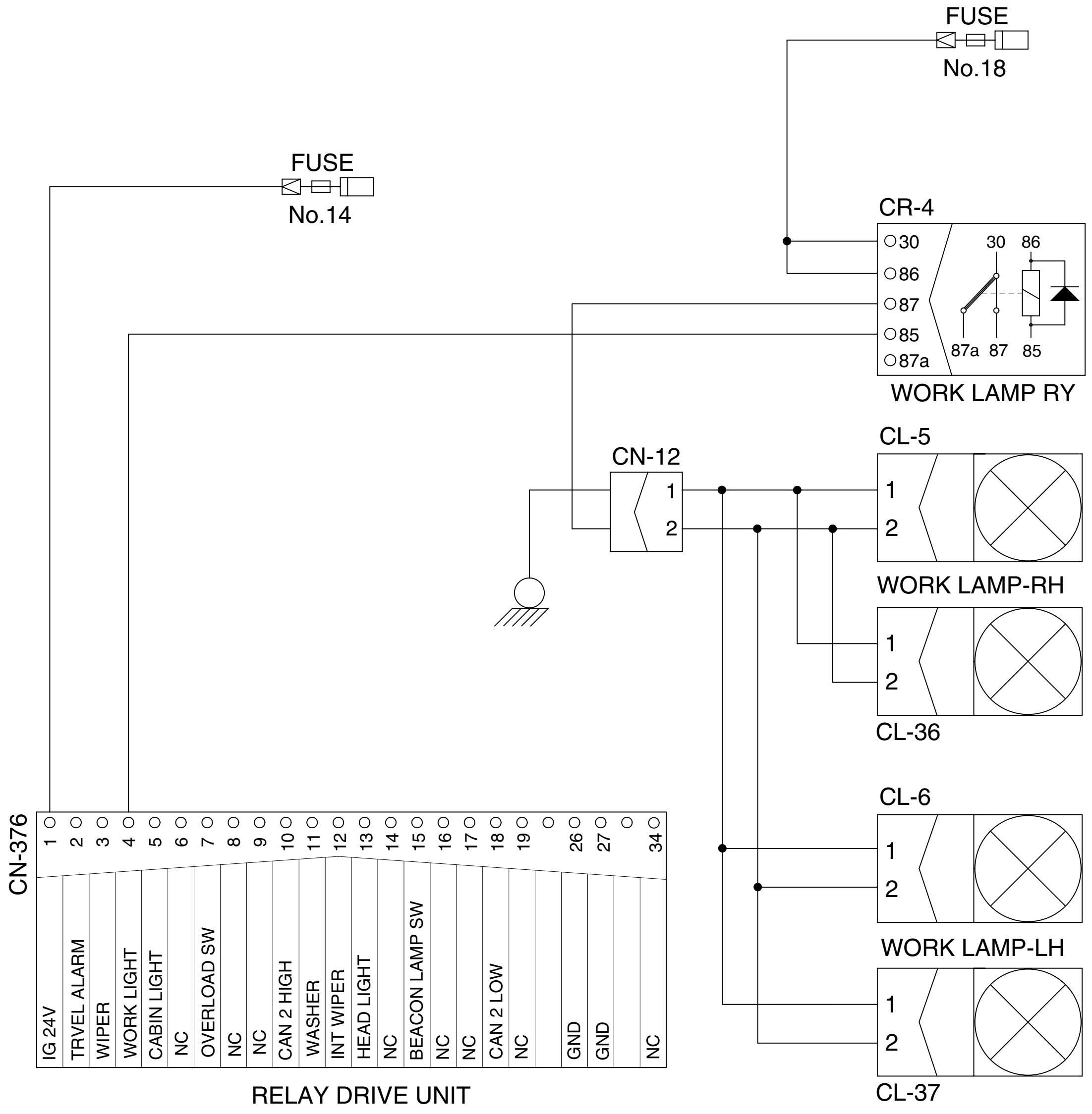
480S6ES17

16. WHEN STARTING SWITCH IS TURNED ON, WORK LAMP DOES NOT LIGHTS UP

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse 14 and 18.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CR-4 (87)-CL-5 (2), CL-6 (2), CL-36 (2), CL-37 (2)	Repair or replace (after clean)
Defective relay drive unit	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.18 or CR-4 (86) and fuse No.18	Repair or replace (after clean)
Recheck fuse No.18	Replace



480S6ES18

GROUP 4 MECHATRONICS SYSTEM

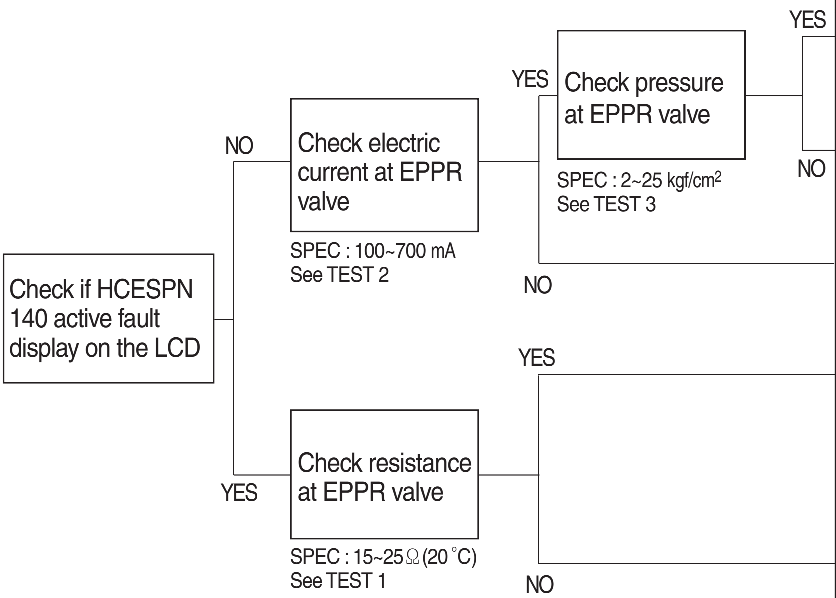
1. ALL ACTUATORS SPEED ARE SLOW

※ Boom, Arm, Bucket, Swing and travel speed are slow, but engine speed is good.

※ Spec : P-mode 1900 ± 50 rpm S -mode 1800 ± 50 rpm E-mode 1700 ± 50 rpm

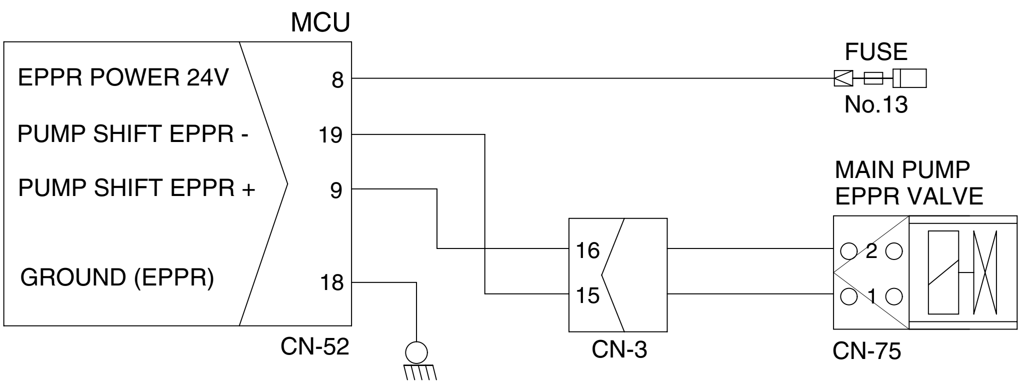
※ Before carrying out below procedure, check all the related connectors are properly inserted and fault code on the cluster.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective hydraulic system	
Defective EPPR valve	Replace
Defective MCU	Replace
Short circuit or poor connection between CN-52 -CN-75	Check & repair wire harness or between CN-52 -CN-75
Defective EPPR valve	Replace

Wiring diagram



480S6MS01

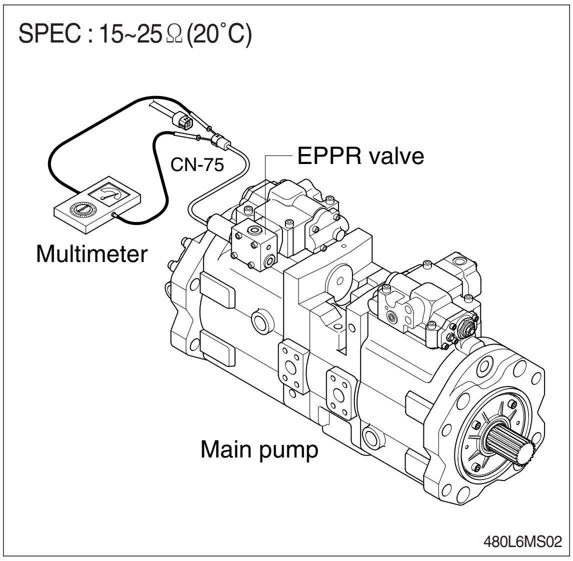
2) TEST PROCEDURE

(1) Test 1 : Check resistance at connector CN-75.

① Starting key OFF.

② Disconnect connector CN-75 from EPPR valve at main hydraulic pump.

③ Check resistance between 2 lines as figure.



(2) Test 2 : Check electric current at EPPR valve.

① Disconnect connector CN-75 from EPPR valve.

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

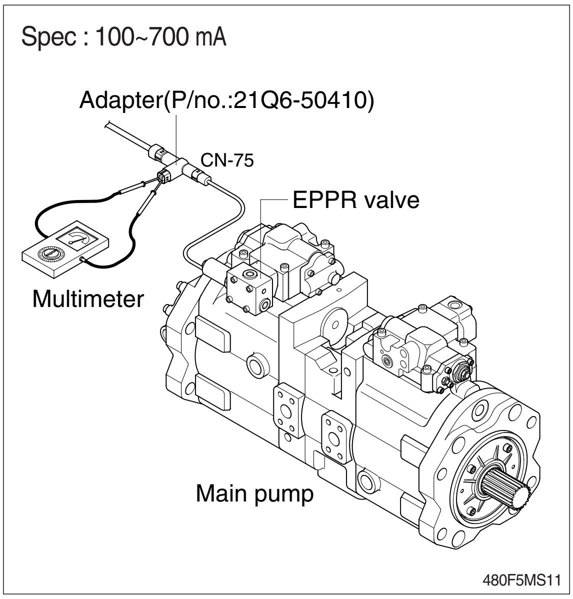
③ Start engine.

④ Set S-mode and cancel auto decel mode.

⑤ Position the accel dial at 10.

⑥ If tachometer show approx 1800±50 rpm disconnect one wire harness from EPPR valve.

⑦ Check electric current at bucket circuit relief position.



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

① Remove plug and connect pressure gauge as figure.

· Gauge capacity : 0 to 50 kgf/cm2 (0 to 725 psi)

② Start engine.

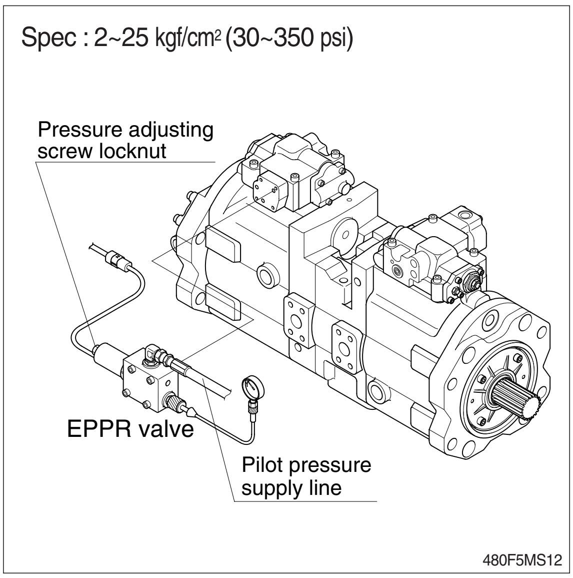
③ Set S-mode and cancel auto decel mode.

④ Position the accel dial at 10.

⑤ If tachometer show approx 1800±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.

⑥ If pressure is not correct, adjust it.

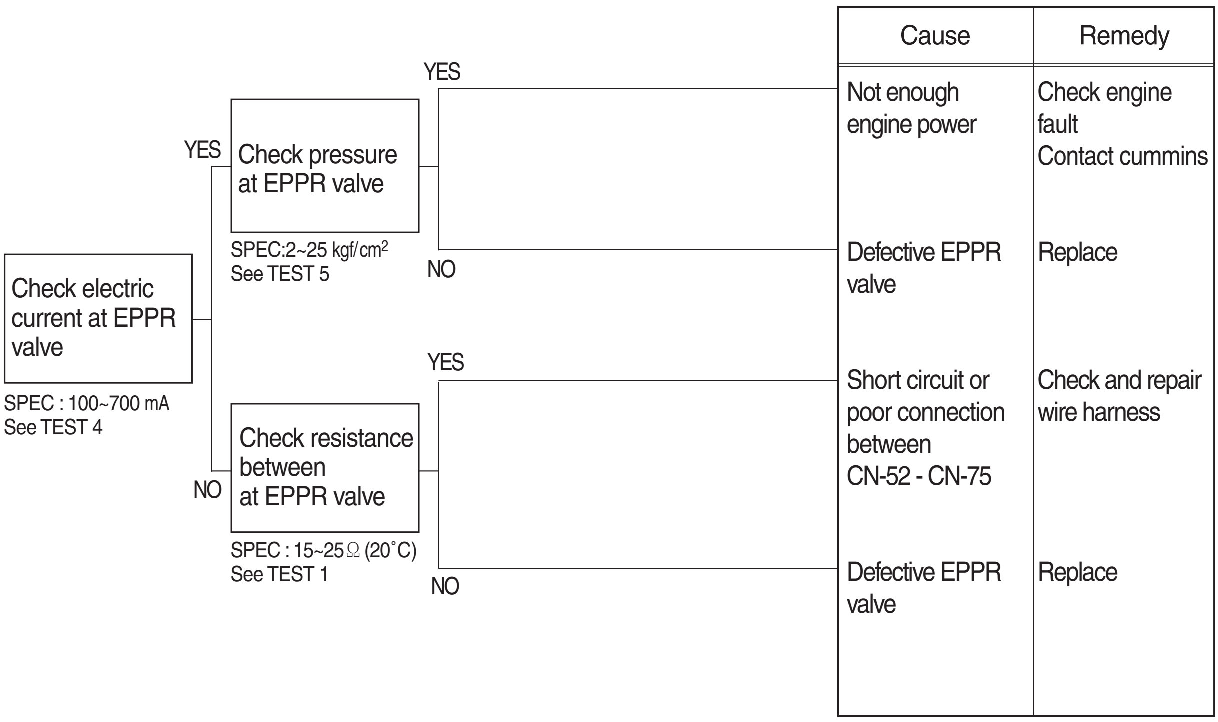
⑦ After adjust, test the machine.



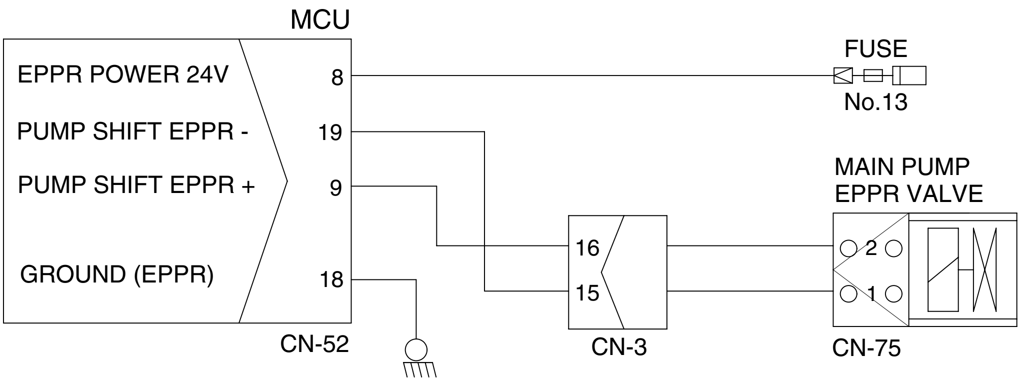
2. ENGINE STALL

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

1) INSPECTION PROCEDURE



Wiring diagram

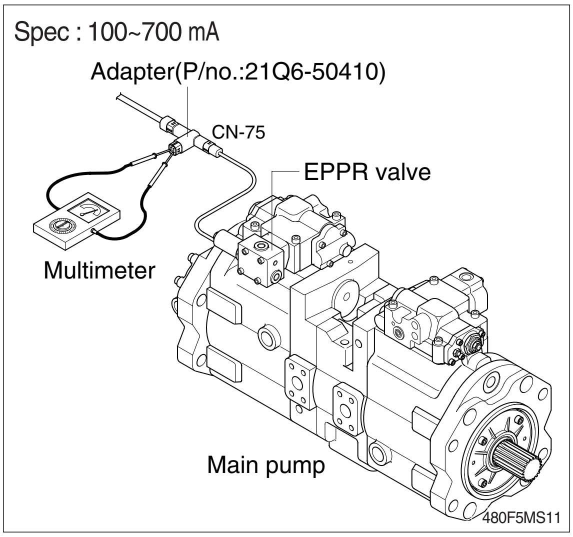


480S6MS01

2) TEST PROCEDURE

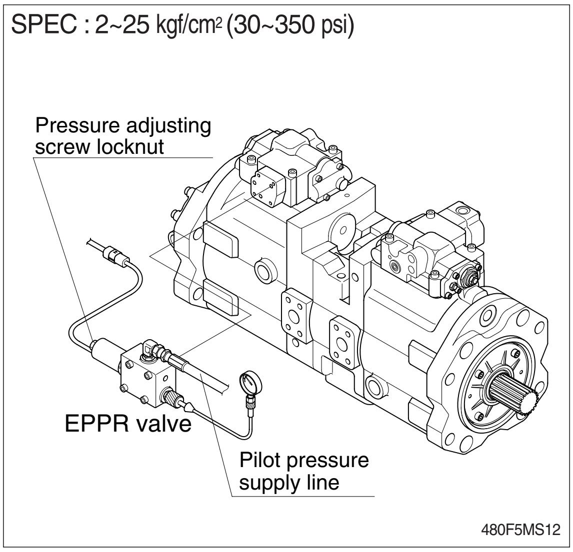
(1) Test 4 : Check electric current at EPPR valve.

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 1800±50 rpm disconnect one wire harness from EPPR valve.
⑦ Check electric current at bucket circuit relief position.



(2) Test 5 : Check pressure at EPPR valve.

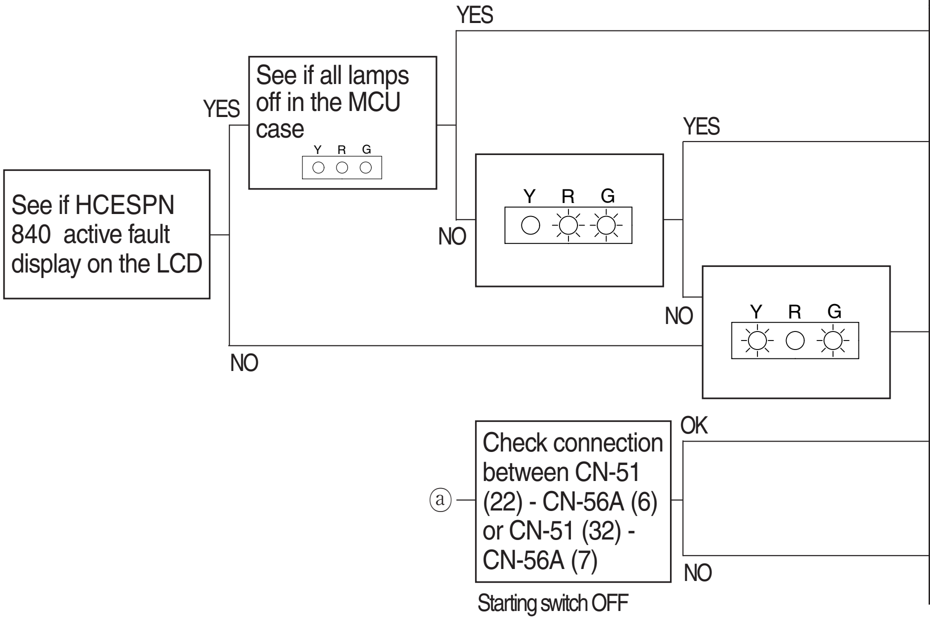
① Remove plug and connect pressure gauge as figure.
 · Gauge capacity : 0 to 50 kgf/cm^2 (0 to 725 psi)
② Start engine.
③ Set S-mode and cancel auto decel mode.
④ Position the accel dial at 10.
⑤ If rpm show approx 1800±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.
⑥ If pressure is not correct, adjust it.
⑦ After adjust, test the machine.



3. MALFUNCTION OF CLUSTER OR MODE SELECTION SYSTEM

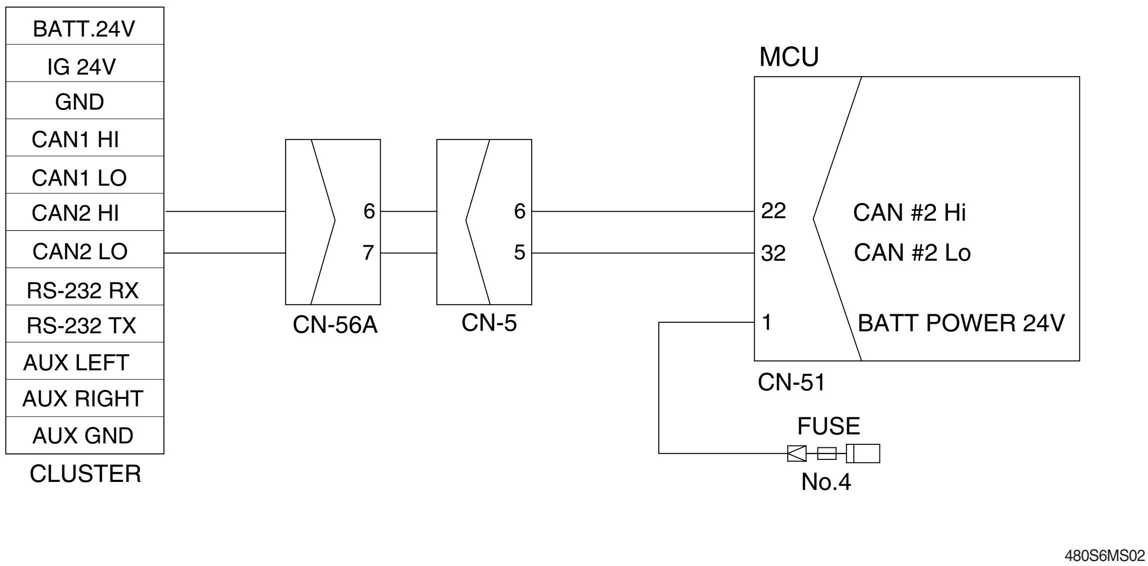
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
No power supply to the MCU	Check fuse No.4
MCU failure	Replace
ⓐ	
Cluster failure	Replace
No connection	Check and repair

Wiring diagram

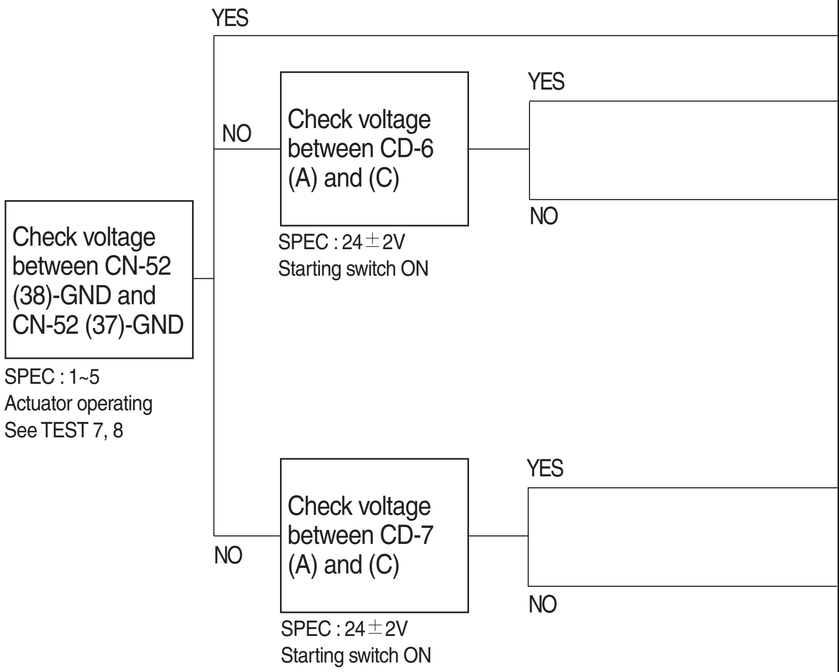


4. AUTO DECEL SYSTEM DOES NOT WORK

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

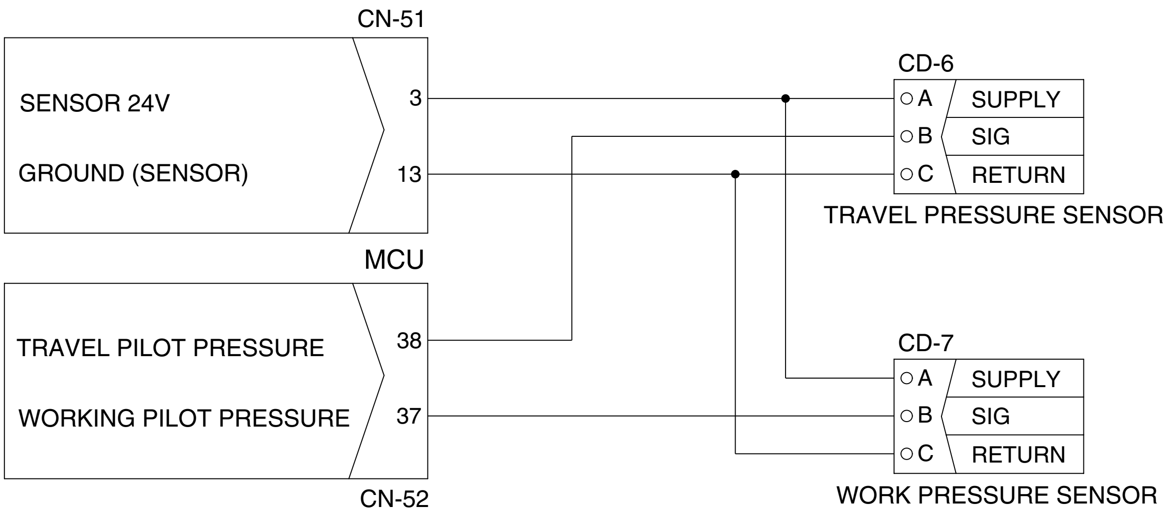
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Defective travel pressure switch	Replace
Short circuit or poor connection between CN-51 (3)-CD-6 (A) and / or CN-51 (13)-CD-6 (C) (fault code 108 displayed)	Replace or repair
Defective work pressure sensor	Replace
Short circuit or poor connection between CN-51 (3)-CD-7 (A) and / or CN-51 (13)-CD-7 (C) (fault code 105 displayed)	Replace or repair

Wiring diagram



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.

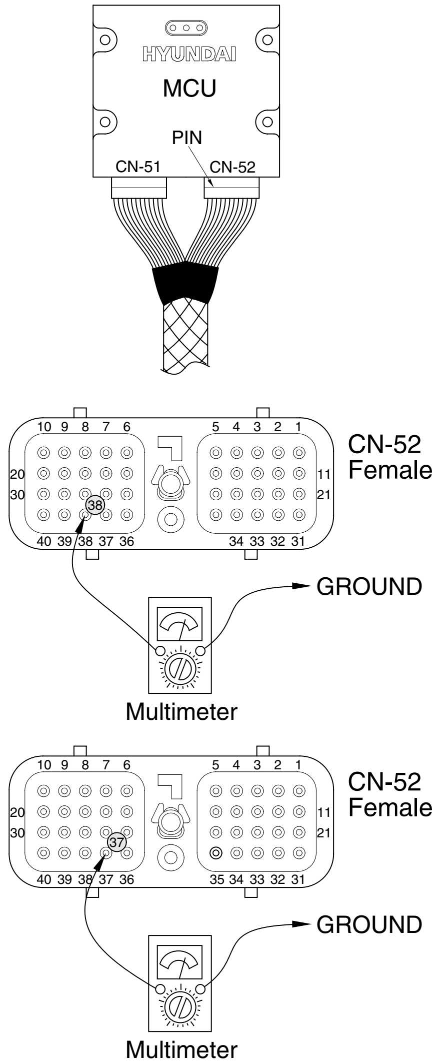
① Prepare 1 piece of thin sharp pin, steel or copper

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



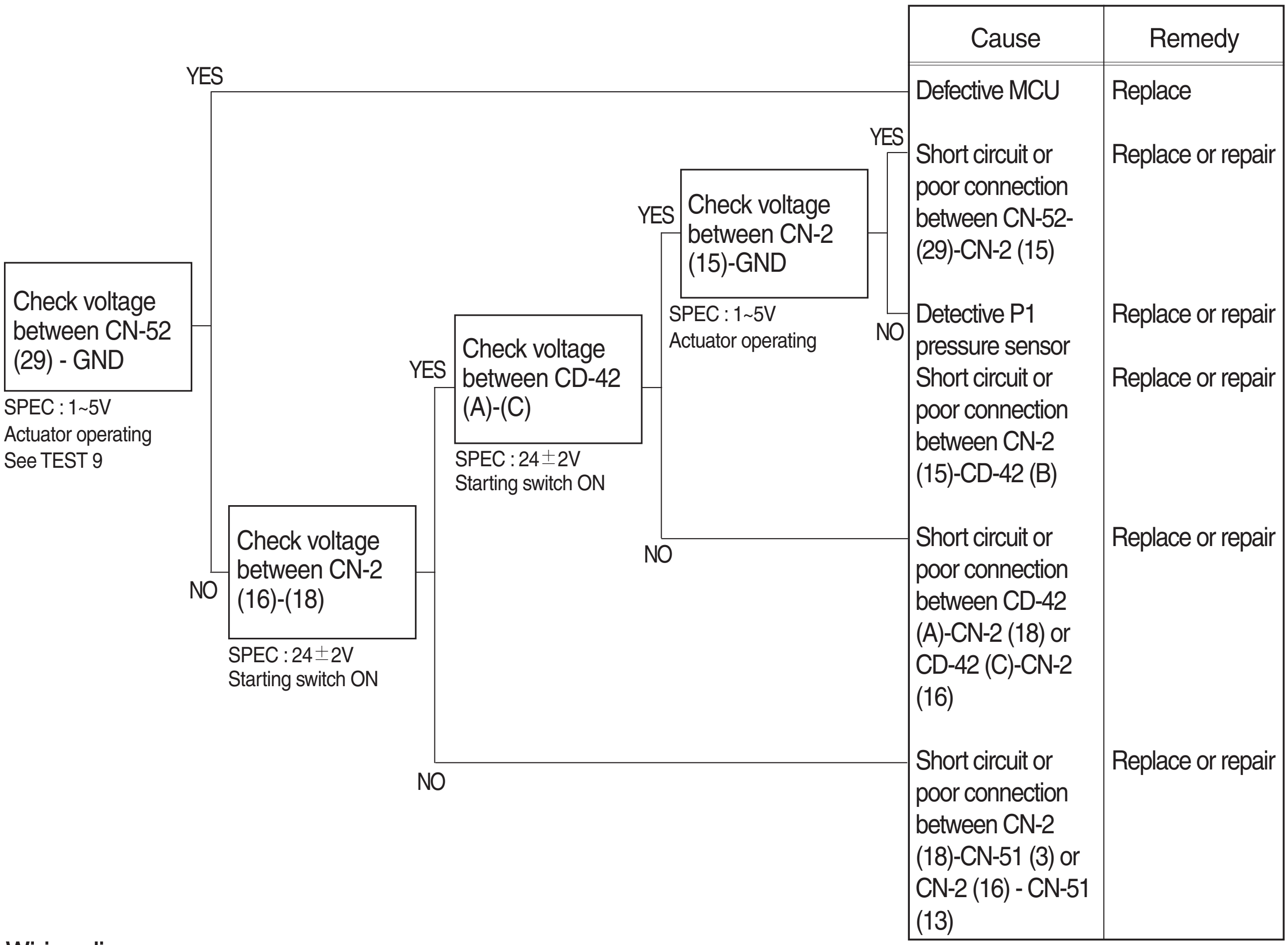
300L6MS04

5. MALFUNCTION OF PUMP 1 PRESSURE SENSOR

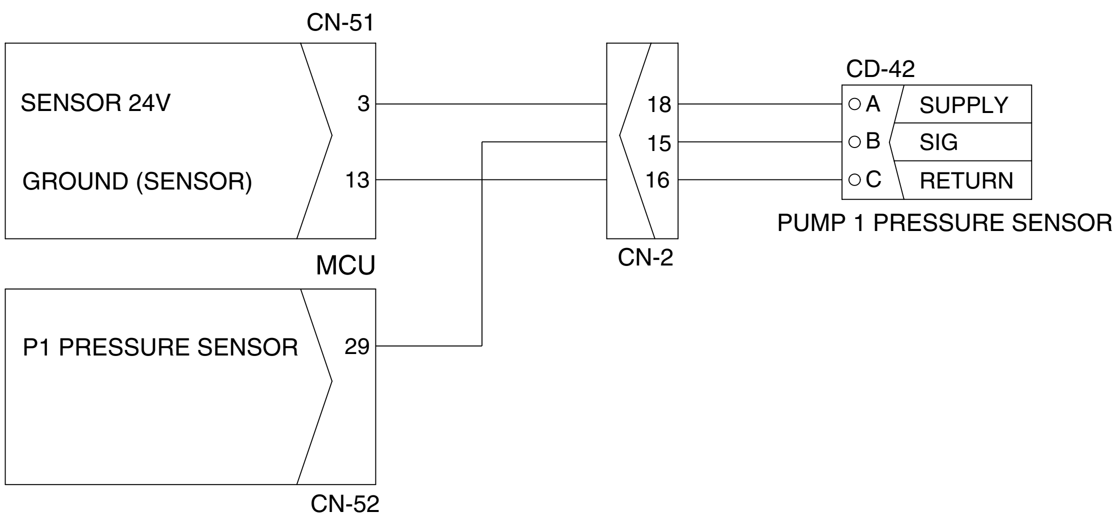
· Fault code : HCESPN 120, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



480S6MS05

2) TEST PROCEDURE

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

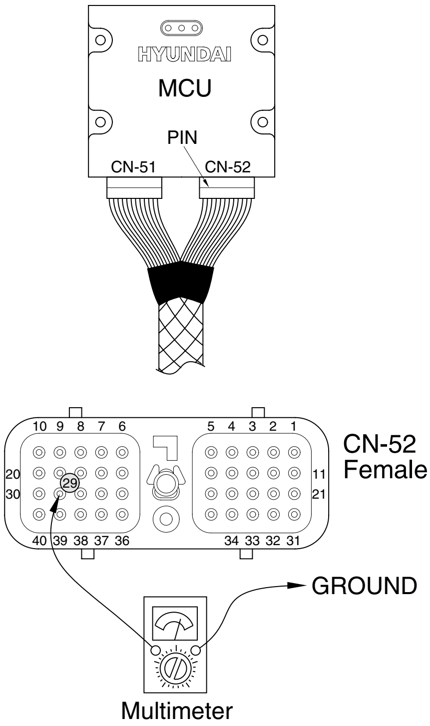
① Prepare 1 piece of thin sharp pin, steel or copper.

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



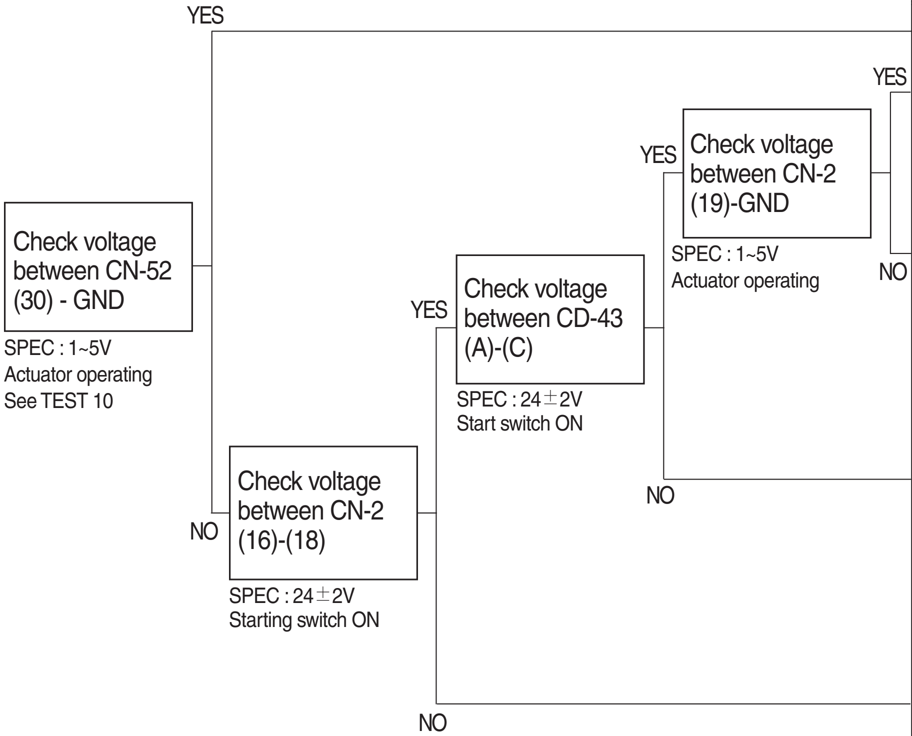
300L6MS06

6. MALFUNCTION OF PUMP 2 PRESSURE SENSOR

· Fault code : HCESPN 121, FMI 0~4

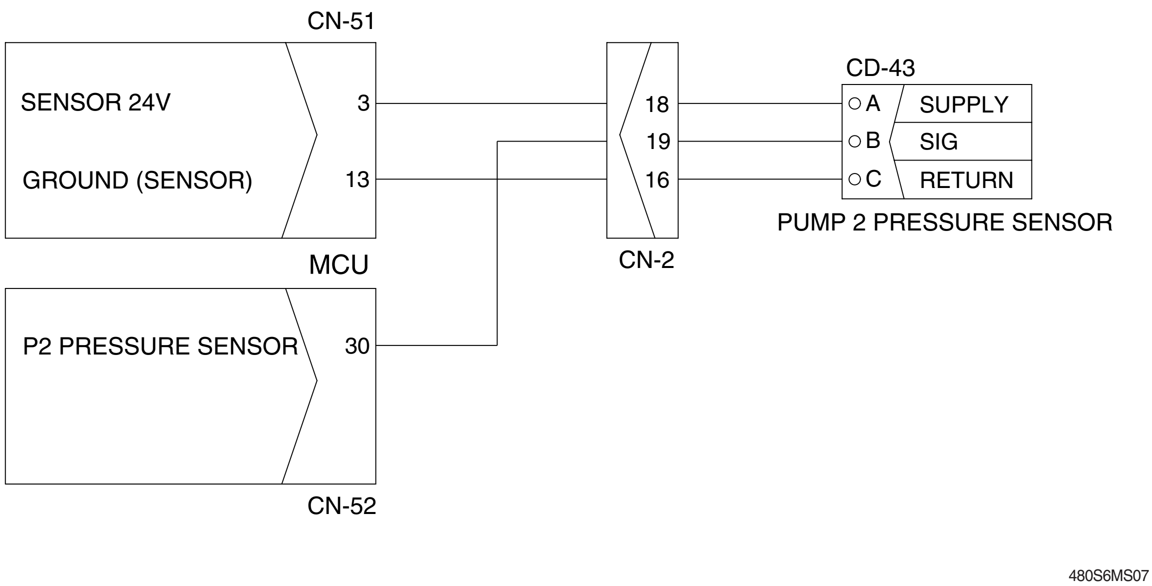
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Short circuit or poor connection between CN-52-(30)-CN-2 (19)	Replace or repair
Detective P2 pressure sensor	Replace or repair
Short circuit or poor connection between CN-2 (19)-CD-43 (B)	Replace or repair
Short circuit or poor connection between CD-43 (A)-CN-2 (18) or CD-43 (C)-CN-2 (16)	Replace or repair
Short circuit or poor connection between CN-2 (18)-CN-51 (3) or CN-2 (16) - CN-51 (13)	Replace or repair

Wiring diagram



2) TEST PROCEDURE

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

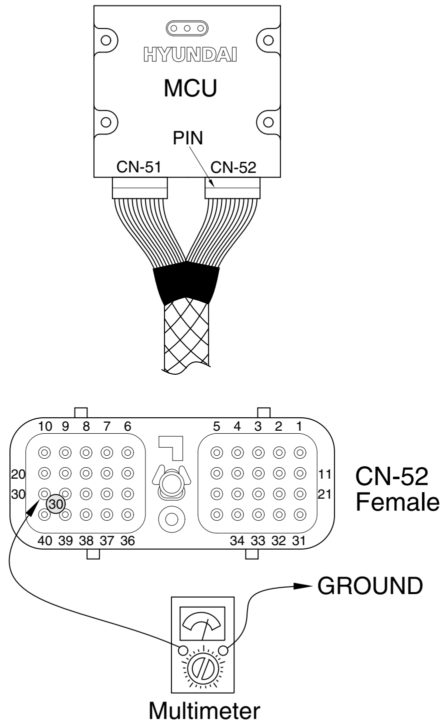
① Prepare 1 piece of thin sharp pin, steel or copper.

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



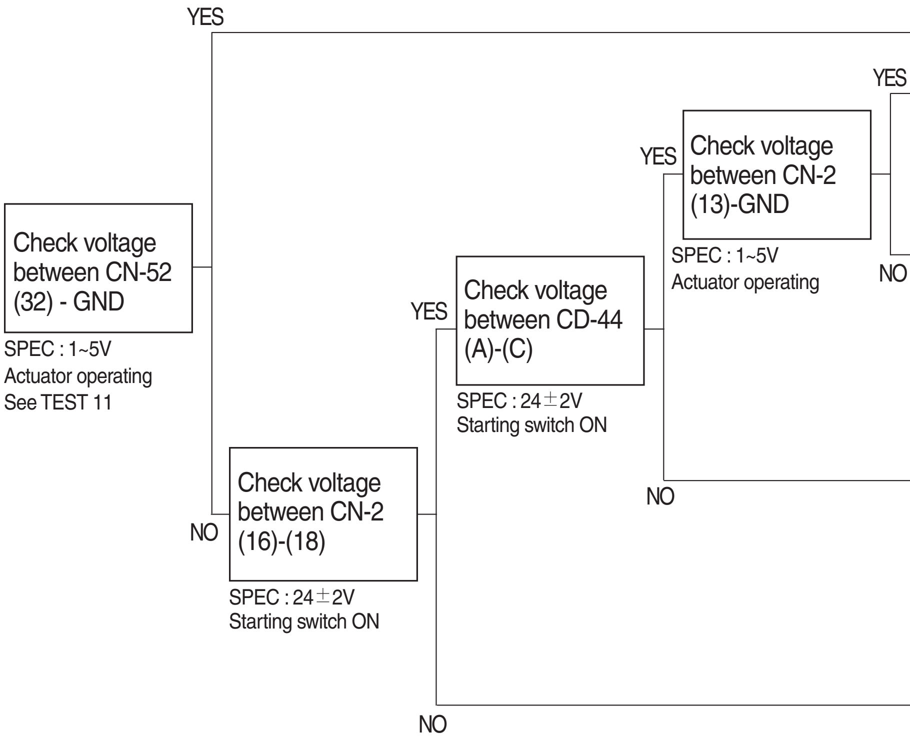
220S6MS08

7. MALFUNCTION OF PUMP 3 PRESSURE SENSOR

· Fault code : HCESPN 125, FMI 0~4

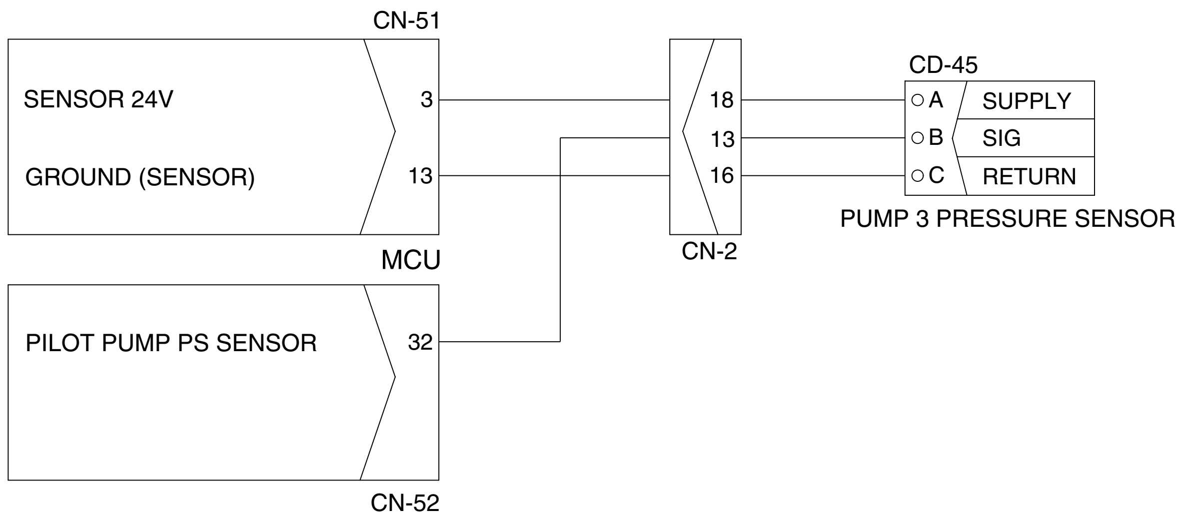
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Short circuit or poor connection between CN-52-(32)-CN-2 (13)	Replace or repair
Detective P3 pressure sensor	Replace or repair
Short circuit or poor connection between CN-2 (13)-CD-44 (B)	Replace or repair
Short circuit or poor connection between CD-44 (A)-CN-2 (18) or CD-44 (C)-CN-2 (16)	Replace or repair
Short circuit or poor connection between CN-2 (18)-CN-51 (3) or CN-2 (16) - CN-51 (13)	Replace or repair

Wiring diagram



480S6MS09

2) TEST PROCEDURE

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

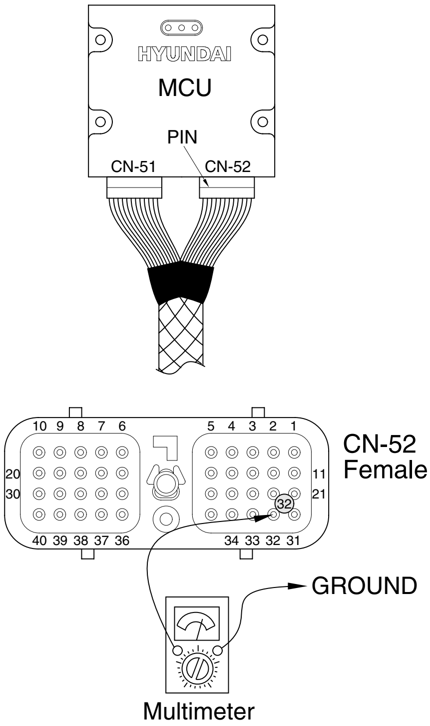
① Prepare 1 piece of thin sharp pin, steel or copper.

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



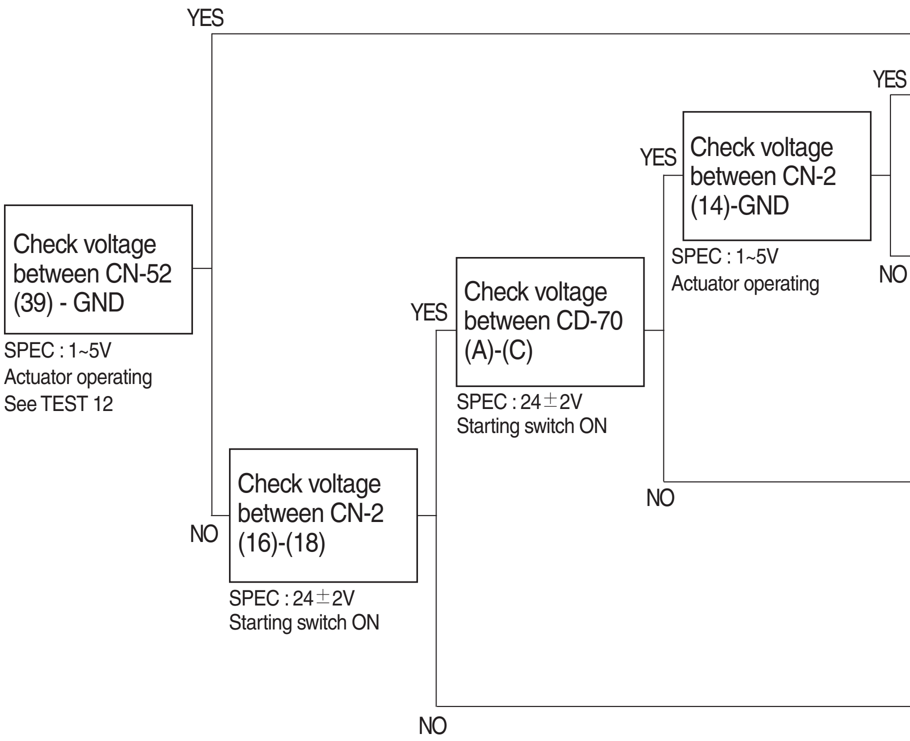
300L6MS10

8. MALFUNCTION OF NEGATIVE 1 PRESSURE SENSOR

· Fault code : HCESPN 123, FMI 0~4

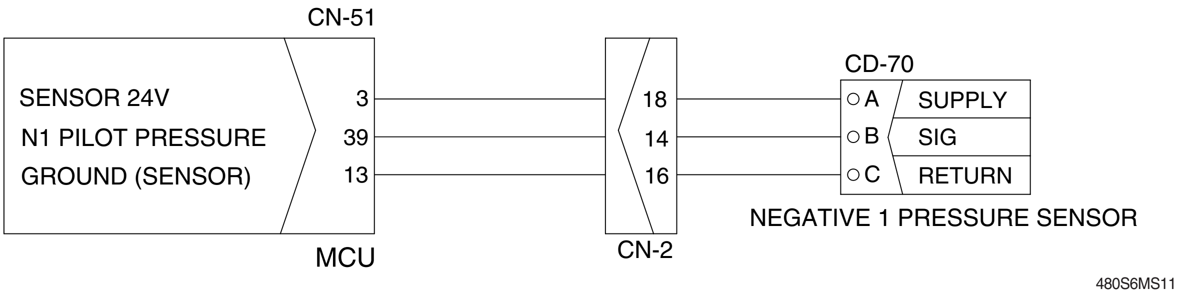
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Short circuit or poor connection between CN-52-(39)-CN-2 (14)	Replace or repair
Detective N1 pressure sensor	Replace or repair
Short circuit or poor connection between CN-2 (14)-CD-70 (B)	Replace or repair
Short circuit or poor connection between CD-70 (A)-CN-2 (18) or CD-70 (C)-CN-2 (16)	Replace or repair
Short circuit or poor connection between CN-2 (18)-CN-51 (3) or CN-2 (16) - CN-51 (13)	Replace or repair

Wiring diagram



2) TEST PROCEDURE

(1) Test 12 : Check voltage at CN-52 (39) and ground.

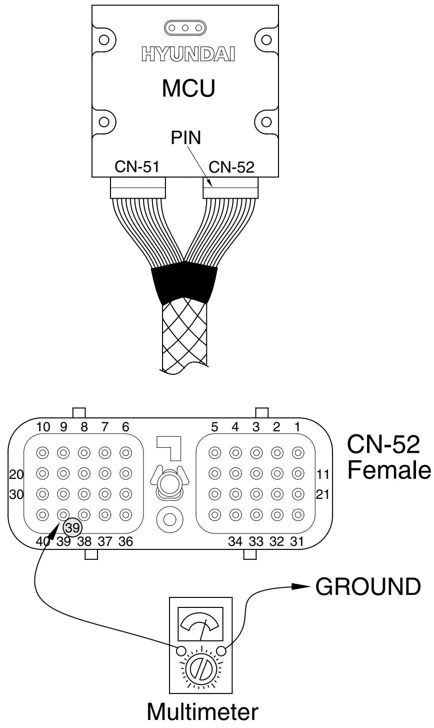
① Prepare 1 piece of thin sharp pin, steel or copper.

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



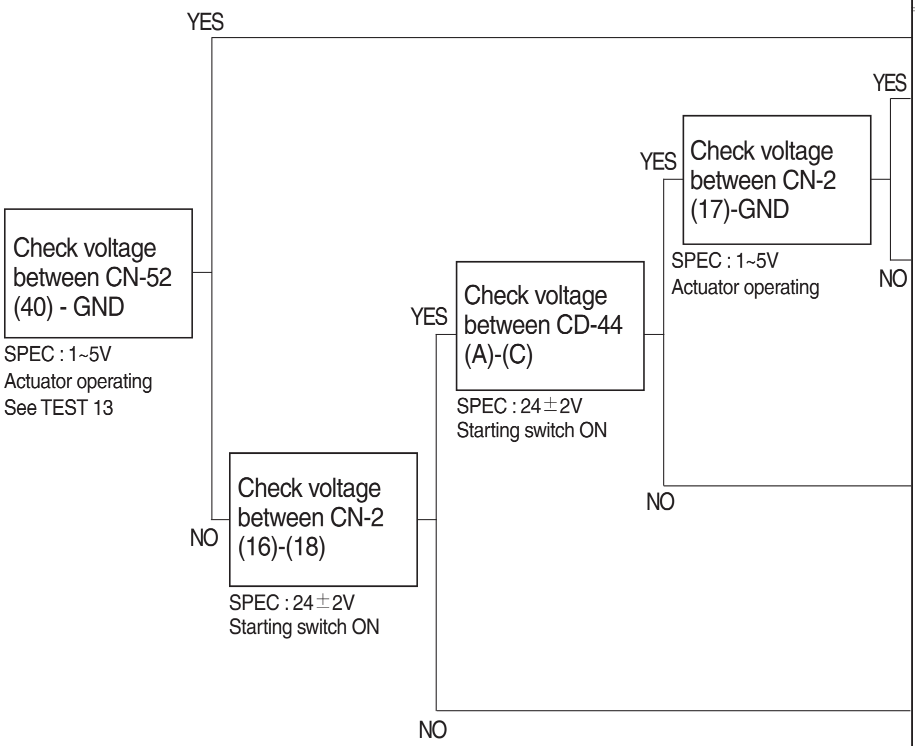
220S6MS12

9. MALFUNCTION OF NEGATIVE 2 PRESSURE SENSOR

· Fault code : HCESPN 124, FMI 0~4

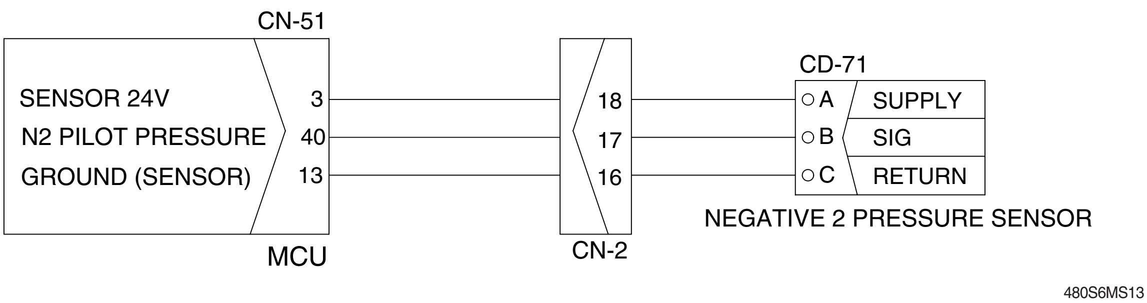
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Short circuit or poor connection between CN-52-(40)-CN-2 (17)	Replace or repair
Detective N2 pressure sensor	Replace or repair
Short circuit or poor connection between CN-2 (17)-CD-44 (B)	Replace or repair
Short circuit or poor connection between CD-44 (A)-CN-2 (18) or CD-44 (C)-CN-2 (16)	Replace or repair
Short circuit or poor connection between CN-2 (18)-CN-51 (3) or CN-2 (16) - CN-51 (13)	Replace or repair

Wiring diagram

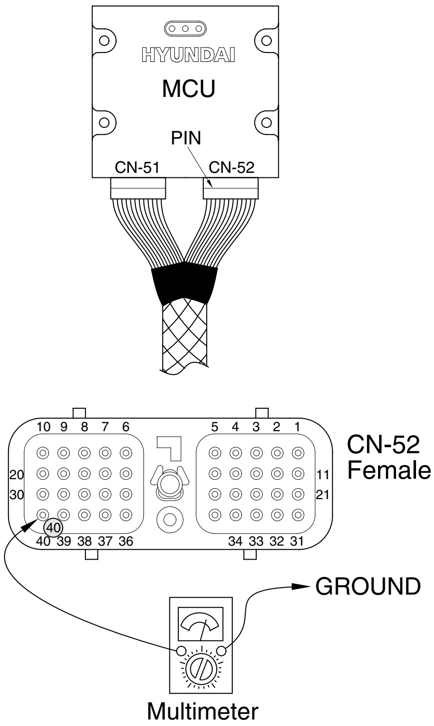


2) TEST PROCEDURE

(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



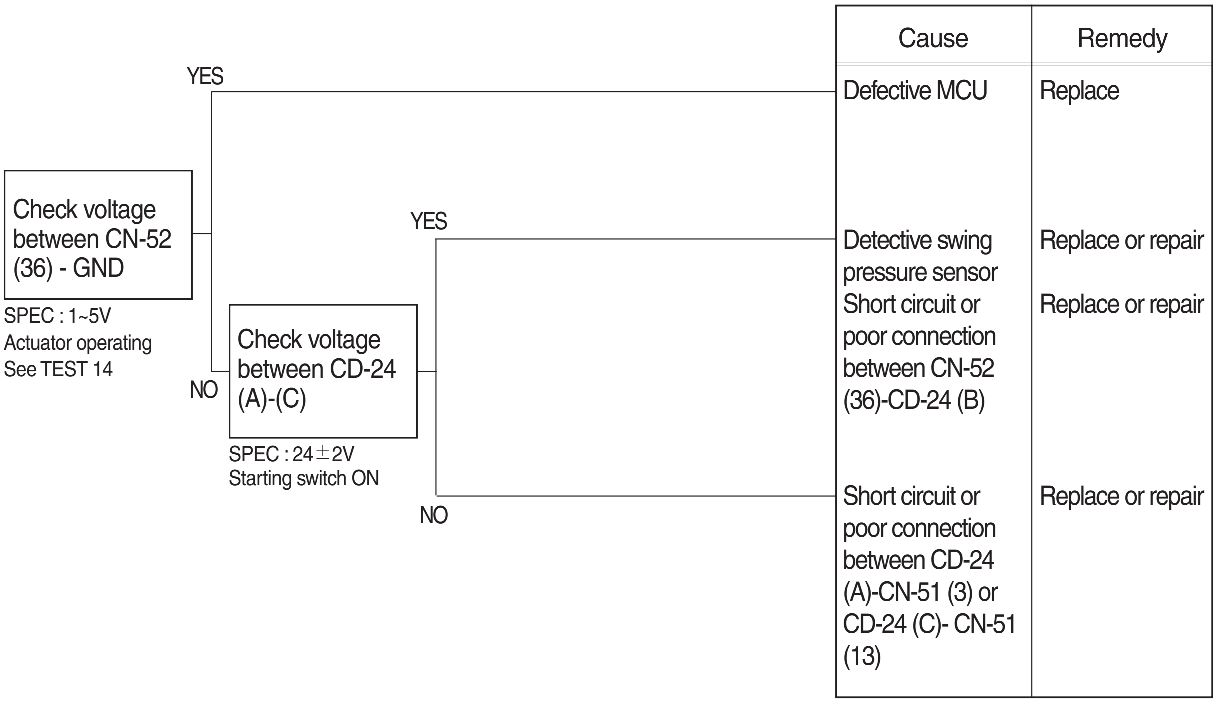
220S6MS14

10. MALFUNCTION OF SWING PRESSURE SENSOR

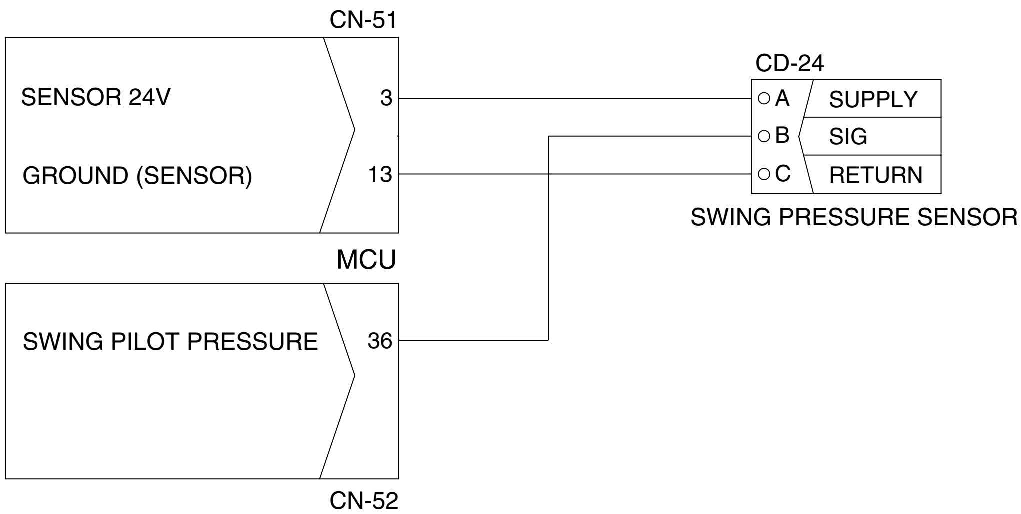
· Fault code : HCESPN 135, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram



220S6MS15

2) TEST PROCEDURE

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

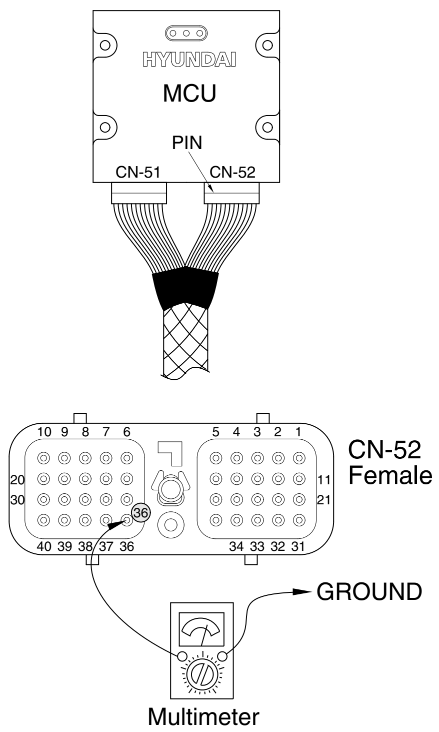
① Prepare 1 piece of thin sharp pin, steel or copper.

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



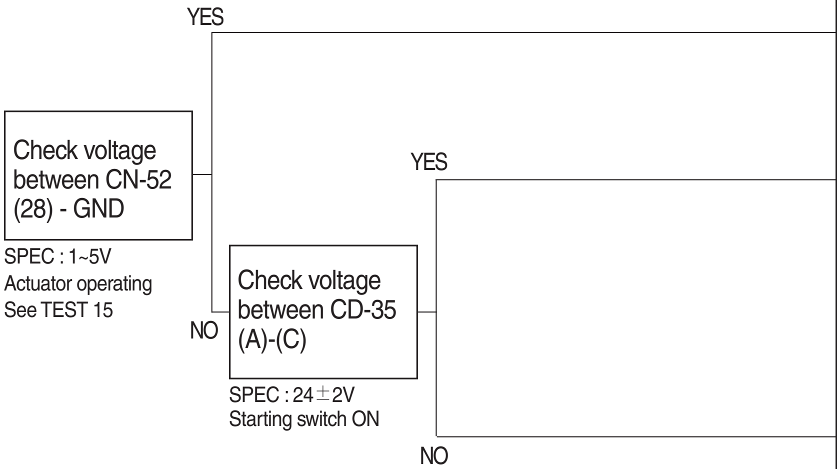
300L6MS16

11. MALFUNCTION OF ARM IN/OUT & BUCKET IN PRESSURE SENSOR

· Fault code : HCESPN 133, FMI 0~4

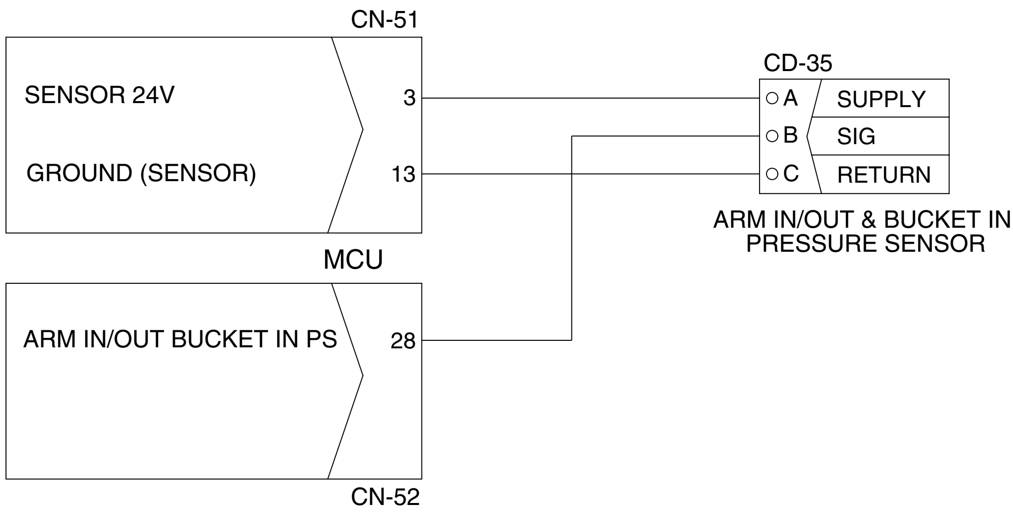
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective MCU	Replace
Detective arm in/out & bucket in pressure sensor	Replace or repair
Short circuit or poor connection between CN-52 (35)-CD-35 (B)	Replace or repair
Short circuit or poor connection between CD-35 (A)-CN-51 (3) or CD-35 (C)- CN-51 (13)	Replace or repair

Wiring diagram



220S6MS17

2) TEST PROCEDURE

(1) Test 15 : Check voltage at CN-52 (28) and ground.

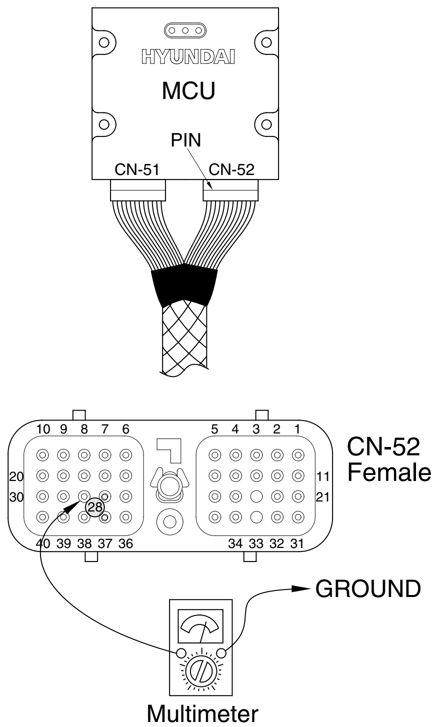
① Prepare 1 piece of thin sharp pin, steel or copper.

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



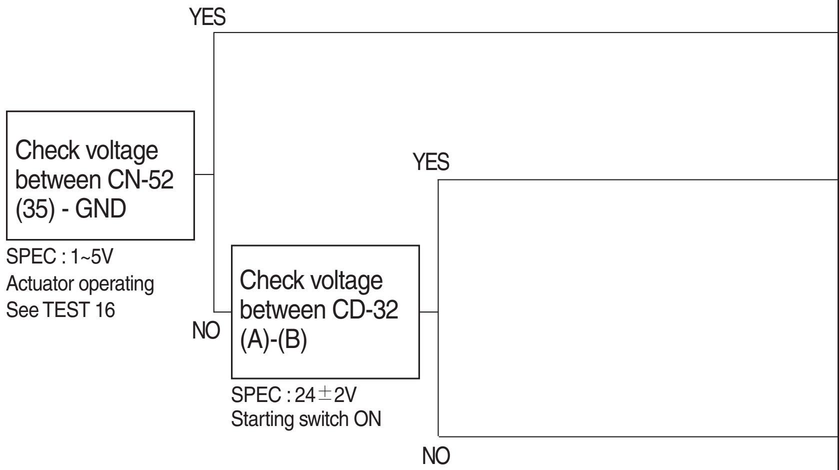
220S6MS18

12. MALFUNCTION OF BOOM UP PRESSURE SENSOR

· Fault code : HCESPN 127, FMI 0~4

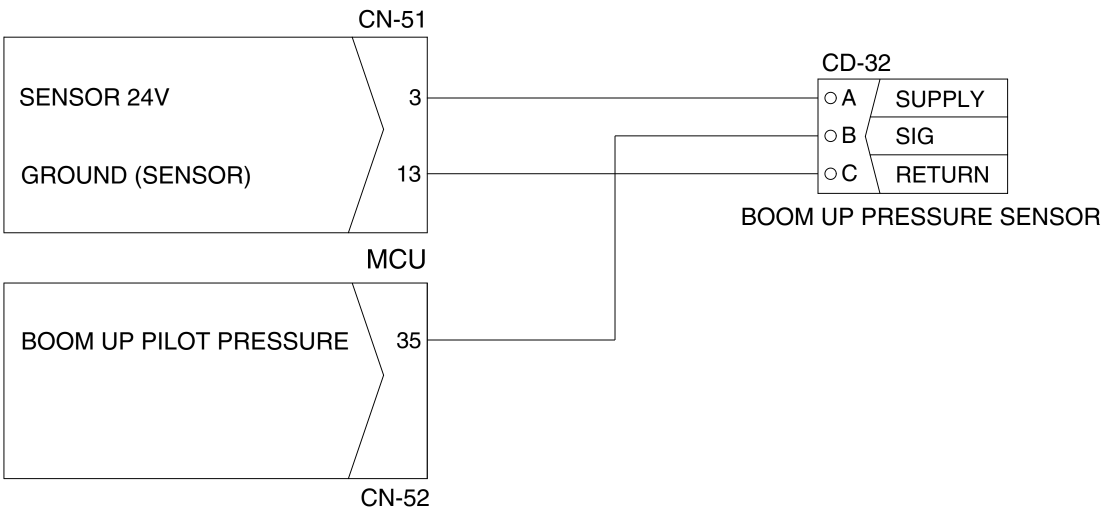
※ Before carrying out below procedure, check all the related connectors are properly inserted.

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.

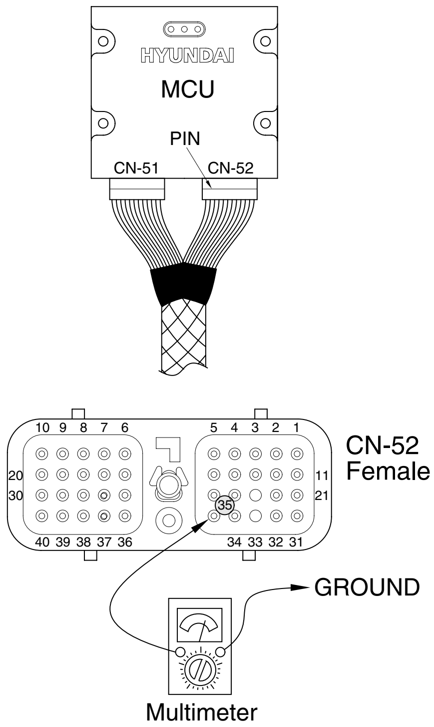
① Prepare 1 piece of thin sharp pin, steel or copper.

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



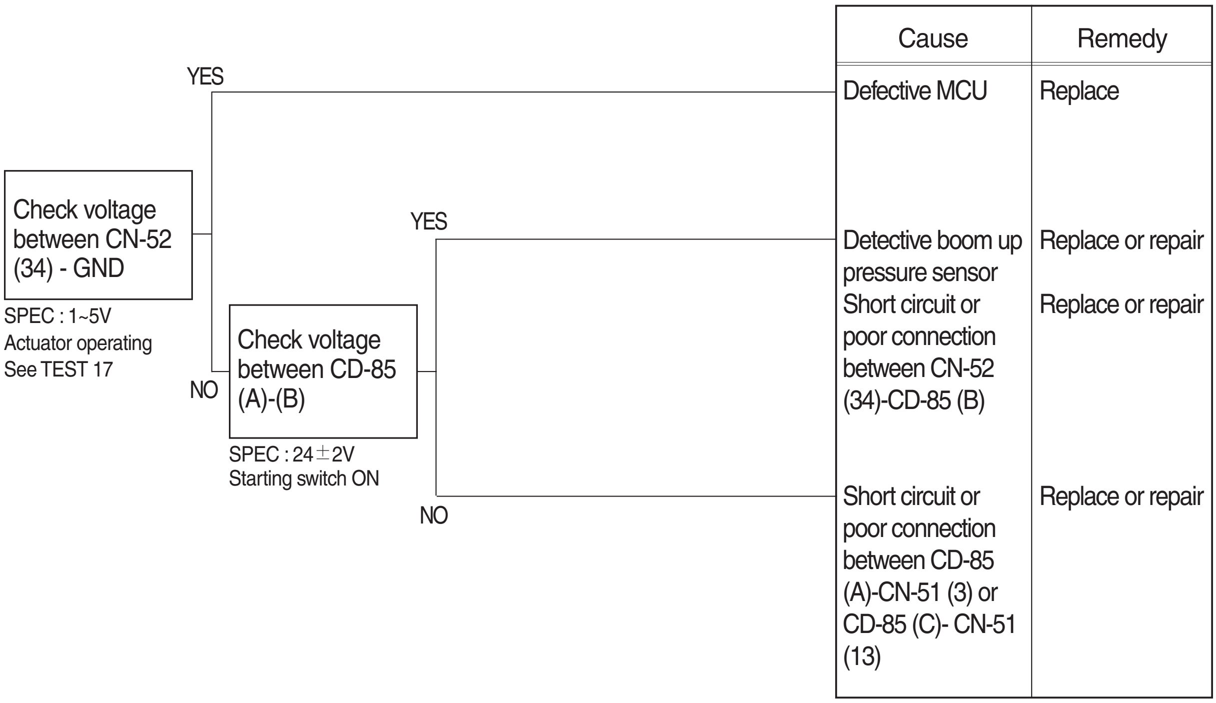
220S6MS20

13. MALFUNCTION OF BOOM DOWN PRESSURE SENSOR

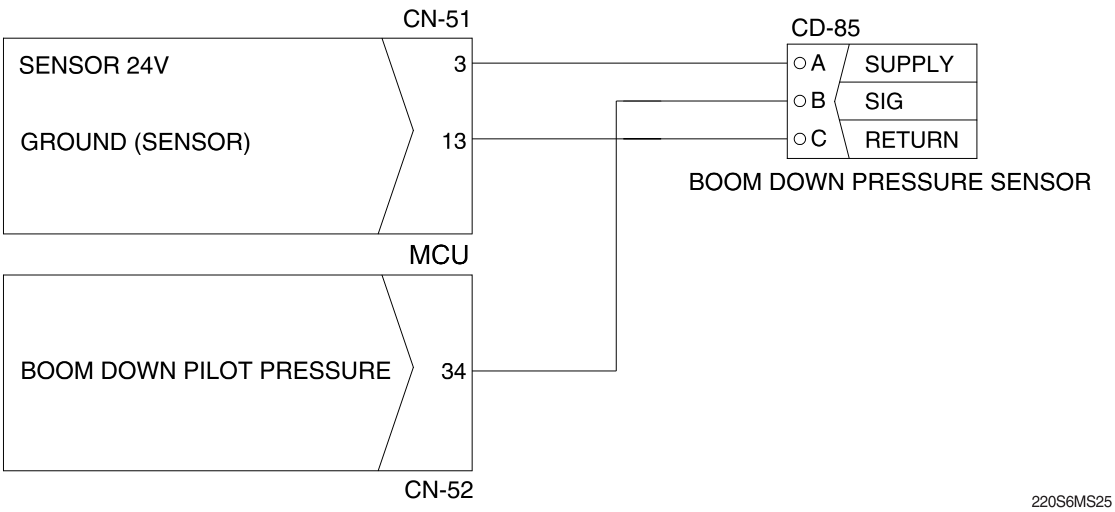
· Fault code : HCESPN 128, FMI 0~4

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

1) INSPECTION PROCEDURE



Wiring diagram

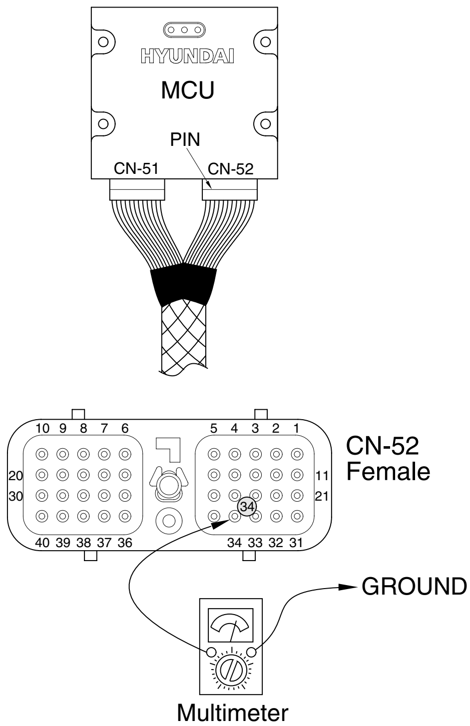


2) TEST PROCEDURE

(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



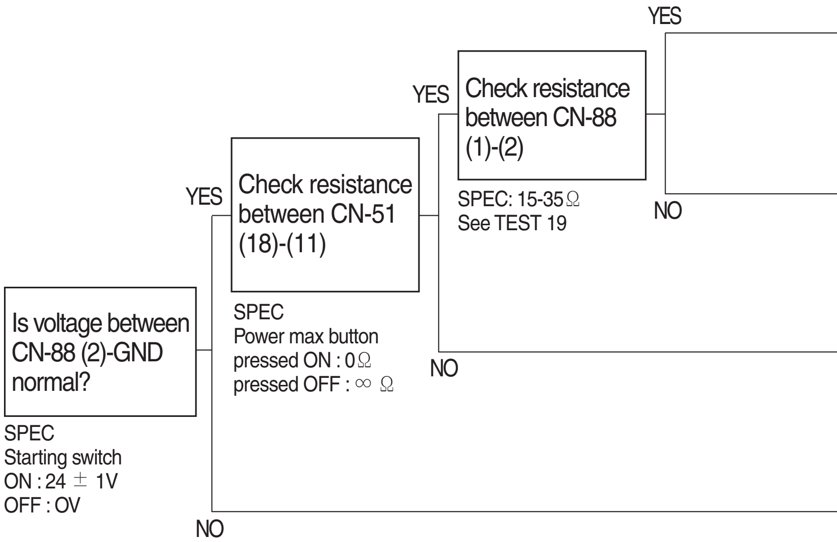
220S6MS26

14. MALFUNCTION OF POWER MAX

- Fault code : HCESPN 166, FMI 4 or 6

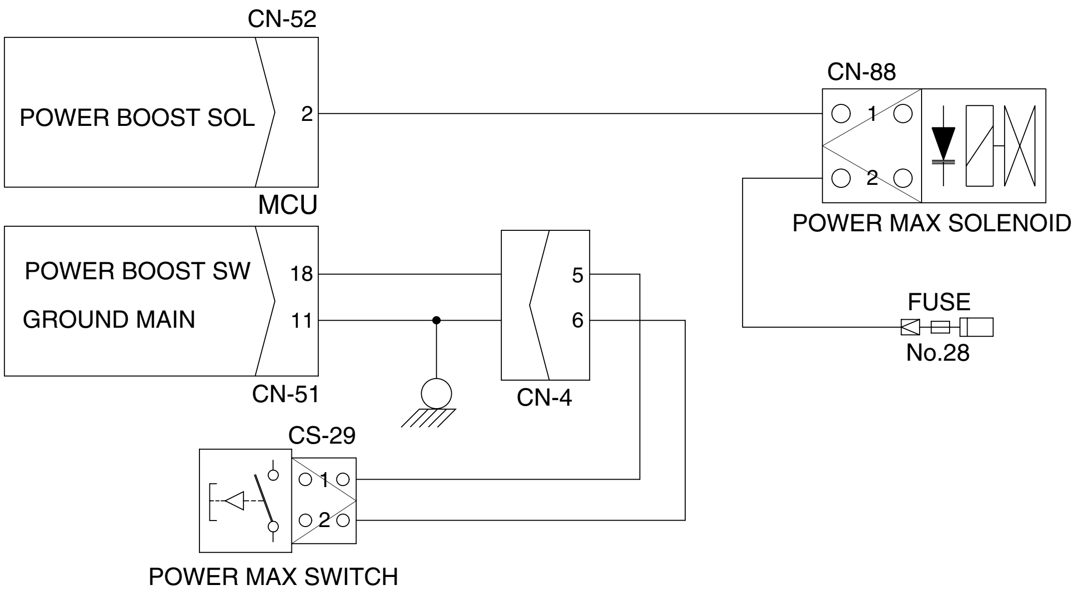
※ Before carrying out below procedure, check all the related connectors are properly inserted.

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. 28	Repair or replace

Wiring diagram



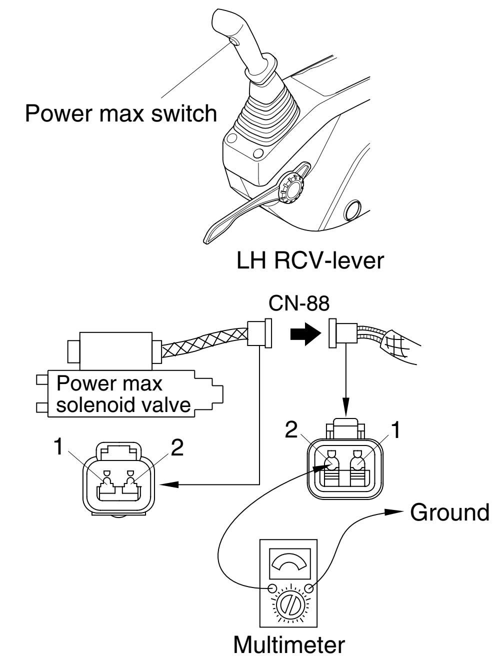
480S6MS21

2) TEST PROCEDURE

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

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

SPEC : Starting switch ON : 24±1V
Starting switch OFF : 0V

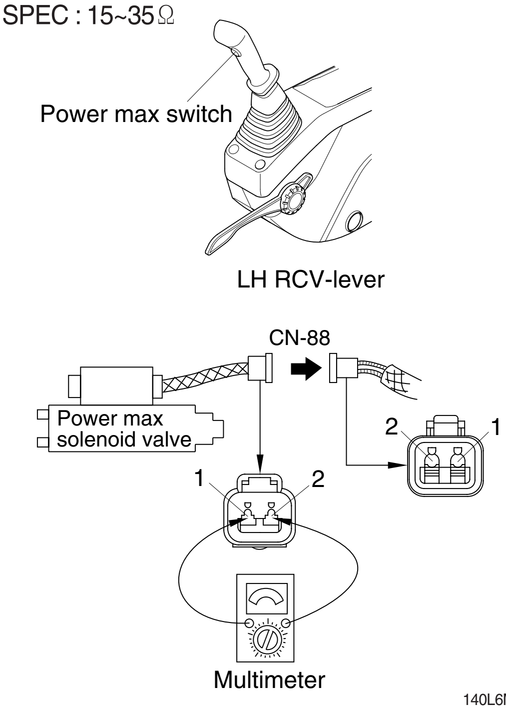


140L6MS123

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

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

SPEC : 15~35Ω



140L6MS124

SECTION 7 MAINTENANCE STANDARD

SECTION 7 MAINTENANCE STANDARD

GROUP 1 OPERATIONAL PERFORMANCE TEST

1. PURPOSE

Performance tests are used to check :

1) OPERATIONAL PERFORMANCE OF A NEW MACHINE

Whenever a new machine is delivered in parts and reassembled at a customer's site, it must be tested to confirm that the operational performance of the machine meets HD Hyundai Construction Equipment spec.

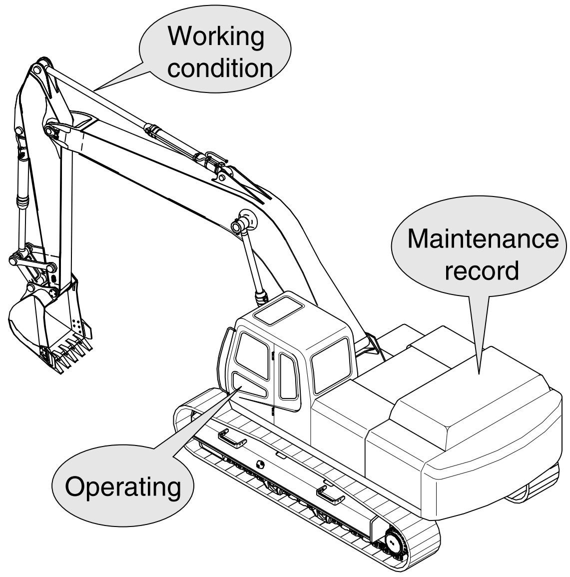
2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

With the passage of time, the machine's operational performance deteriorates, so that the machine needs to be serviced periodically to restore it to its original performance level.

Before servicing the machine, conduct performance tests to check the extent of deterioration, and to decide what kind of service needs to be done(by referring to the "Service Limits" in this manual).

3) OPERATIONAL PERFORMANCE OF A REPAIRED MACHINE

After the machine is repaired or serviced, it must be tested to confirm that its operational performance was restored by the repair and/or service work done.

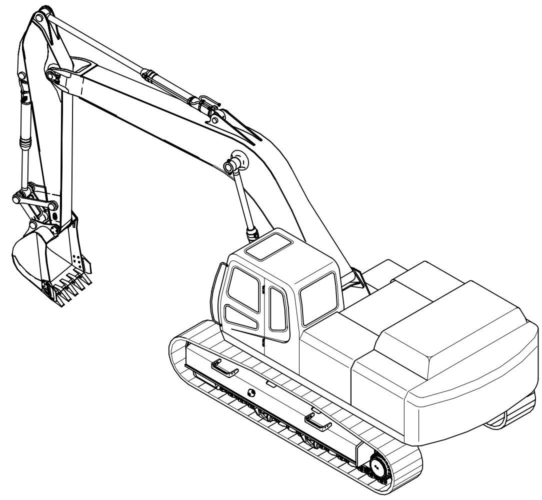


21077MS01

2. TERMINOLOGY

1) STANDARD

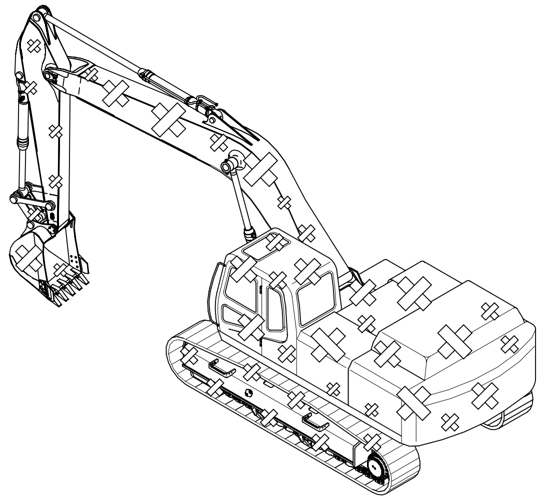
Specifications applied to the brand-new machine, components and parts.



21077MS02

2) SERVICE LIMIT

The lowest acceptable performance level. When the performance level of the machine falls below this level, the machine must be removed from work and repaired. Necessary parts and components must be replaced.



21077MS03

3. OPERATION FOR PERFORMANCE TESTS

1) Observe the following rules in order to carry out performance tests accurately and safely.

(1) The machine

Repair any defects and damage found, such as oil or water leaks, loose bolts, cracks and so on, before starting to test.

(2) Test area

① Select a hard, flat surface.

② Secure enough space to allow the machine to run straight more than 20 m, and to make a full swing with the front attachment extended.

③ If required, rope off the test area and provide signboards to keep unauthorized personnel away.

(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.

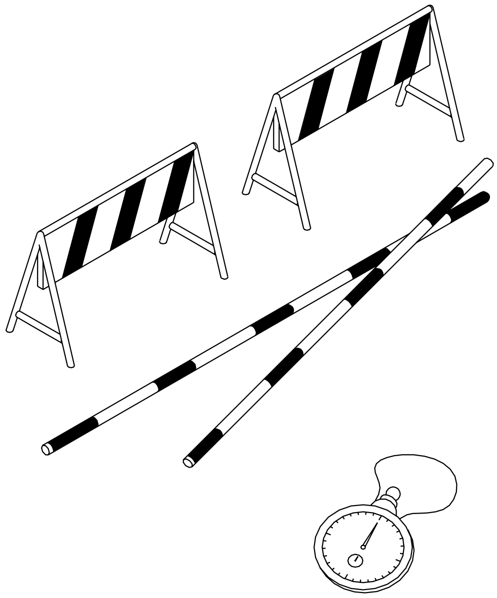
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

(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.

480S7MS01

(4) Evaluation

The measured speeds should meet the following specifications.

Unit : rpm

Model	Engine speed	Standard	Remarks
HX480S L HX520S L	Start idle	1000±100	
	P mode	1900±50	
	S mode	1800±50	
	E mode	1700±50	
	Auto decel	1100±100	
	One touch decel	1000±100	

Condition : Set the accel dial at 10 (Max) position.

3) TRAVEL SPEED

(1) Measure the time required for the excavator to travel a 20 ㎙ test track.

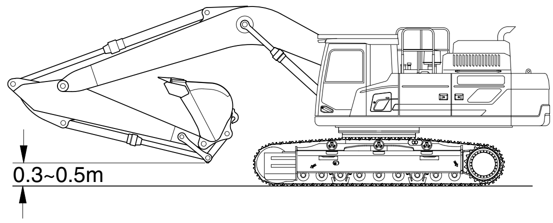
(2) Preparation

① Adjust the tension of both tracks to be equal.

② Prepare a flat and solid test track 20㎙ in length, with extra length of 3 to 5 ㎙ on both ends for machine acceleration and deceleration.

③ Hold the bucket 0.3 to 0.5 ㎙ above the ground with the arm and bucket rolled in.

④ Keep the hydraulic oil temperature at 50±5˚C.



480A7MS02

(3) Measurement

① Measure both the low and high speeds of the machine.

② Before starting either the low or high speed tests, adjust the travel mode switch to the speed to be tested, then select the following switch positions.

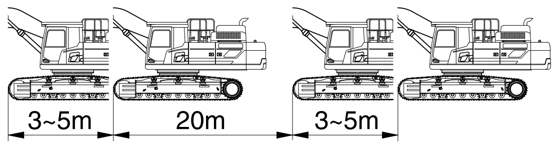
· Power mode switch : P mode

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

④ Measure the time required to travel 20 m.

⑤ After measuring the forward travel speed, turn the upperstructure 180˚ and measure the reverse travel speed.

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



480A7MS03

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds / 20 ㎙

Model	Travel speed	Standard	Maximum allowable	Remarks
HX480S L HX520S L	1 Speed	22.6±2.0	29.6	
	2 Speed	14.5±1.0	20.0	

4) TRACK REVOLUTION SPEED

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

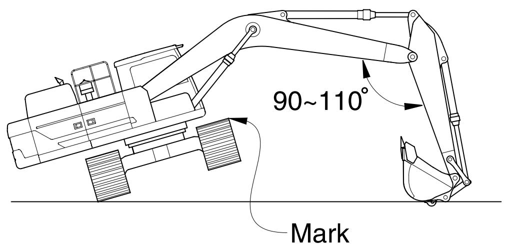
(2) Preparation

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.



480L7MS04

(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
HX480S L HX520S L	1 Speed	39.2±2.0	52.7
	2 Speed	24.9±1.0	33.8

5) TRAVEL DEVIATION

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

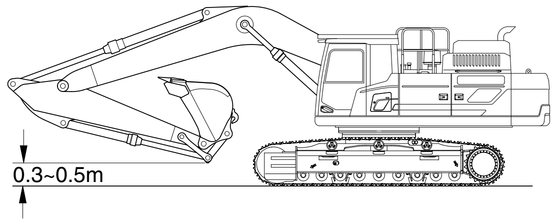
(2) Preparation

① Adjust the tension of both tracks to be equal.

② Provide a flat, solid test yard 20 m in length, with extra length of 3 to 5 m on both ends for machine acceleration and deceleration.

③ Hold the bucket 0.3 to 0.5 m above the ground with the arm and bucket rolled in.

④ Keep the hydraulic oil temperature at 50±5˚C.



480A7MS02

(3) Measurement

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

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

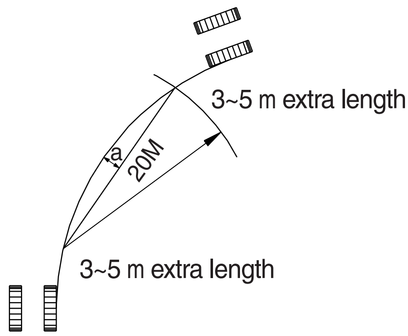
· Power mode switch : P mode

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

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

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

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



(210-7) 7-7(2)

(4) Evaluation

Mistrack should be within the following specifications.

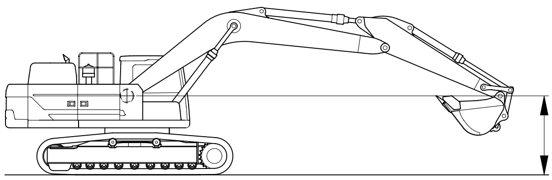
Unit : mm / 20 m

Model	Standard	Maximum allowable	Remarks
HX480S L HX520S L	200 below	250	-

6) SWING SPEED

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

(2) Preparation
① Check the lubrication of the swing gear and swing bearing.
② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.
③ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. The bucket must be empty.
④ Keep the hydraulic oil temperature at 50±5˚C.



480L7MS05

(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

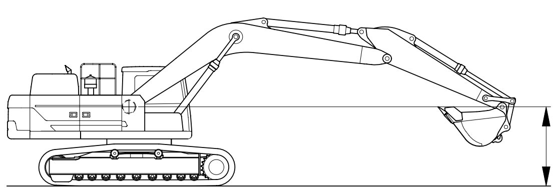
Model	Power mode switch	Standard	Maximum allowable
HX480S L HX520S L	P mode	21.2±1.5	28.0

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

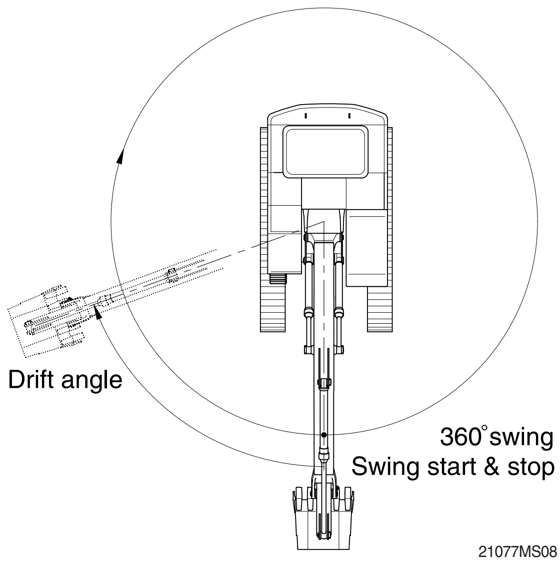
① Check the lubrication of the swing gear and swing bearing.
② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.
③ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. 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.



480L7MS05

(3) Measurement

① Conduct this test in the M mode.
② Select the following switch positions.
· Power mode switch : P mode
③ Operate the swing control lever fully and return it to the neutral position when the mark on the upperstructure aligns with that on track frame after swinging 360 ˚
④ Measure the distance between the two marks.
⑤ Align the marks again, swing 360 ˚, then test the opposite direction.
⑥ Repeat steps ④ and ⑤ three times each and calculate the average values.



21077MS08

(4) Evaluation

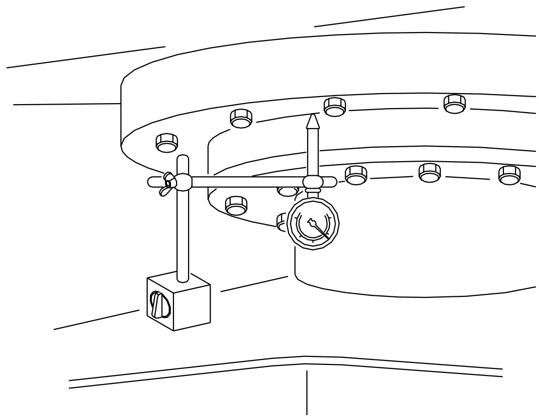
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Power mode switch	Standard	Maximum allowable	Remarks
HX480S L HX520S L	P mode	90 below	112.5	

8) SWING BEARING PLAY

(1) Measure the swing bearing play using a dial gauge to check the wear of bearing races and balls.



(210-7) 7-10(1)

(2) Preparation

① Check swing bearing mounting cap screws for loosening.

② Check the lubrication of the swing bearing. Confirm that bearing rotation is smooth and without noise.

③ Install a dial gauge on the track frame as shown, using a magnetic base.

④ Position the upperstructure so that the boom aligns with the tracks facing towards the front idlers.

⑤ Position the dial gauge so that its needle point comes into contact with the bottom face of the bearing outer race.

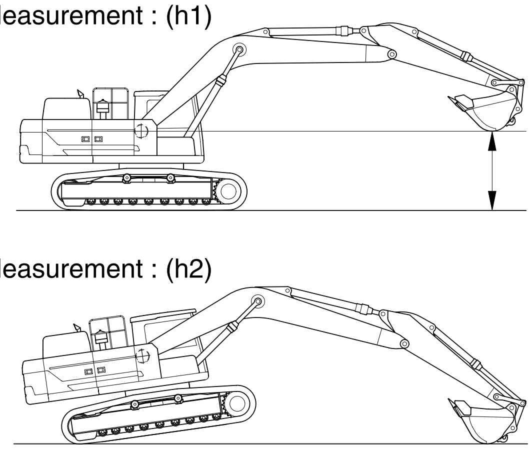
⑥ Bucket should be empty.

(3) Measurement

① With the arm rolled out and bucket rolled in, hold the bottom face of the bucket to the same height of the boom foot pin.
Record the dial gauge reading (h1).

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

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



480L7MS06

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Standard	Maximum allowable	Remarks
HX480S L HX520S L	0.5 ~ 1.5	3.0	

9) HYDRAULIC CYLINDER CYCLE TIME

(1) Measure the cycle time of the boom, standard arm, and standard bucket cylinders.

(2) Preparation

① To measure the cycle time of the boom cylinders:
With the arm rolled out and the empty bucket rolled out, lower the bucket to the ground, as shown.

② To measure the cycle time of the arm cylinder.
With the empty bucket rolled in, position the arm so that it is vertical to the ground. Lower the boom until the bucket is 0.5 m above the ground.

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

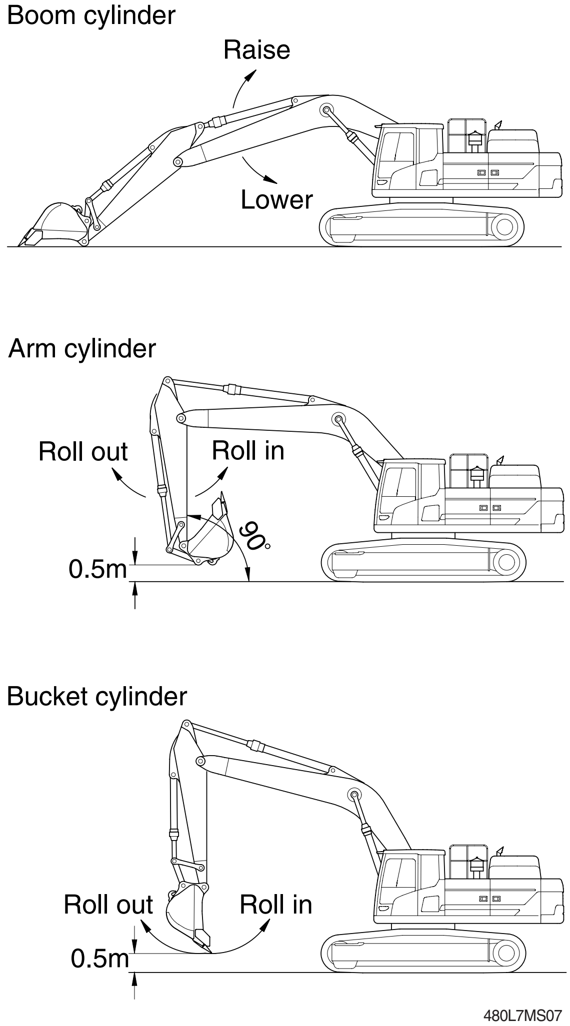
④ Keep the hydraulic oil temperature at 50±5˚C.

(3) Measurement

① Select the following switch positions.
· Power mode switch : P mode

② To measure cylinder cycle times.

- Boom cylinders.
  Measure the time it takes to raise the boom, and the time it takes to lower the boom. To do so, position the boom at one stroke end then move the control lever to the other stroke end as quickly as possible.
- Arm cylinder.
  Measure the time it takes to roll in the arm, and the time it takes to roll out the arm. To do so, position the bucket at one stroke end, then move the control lever to the other stroke end as quickly as possible.



- Bucket cylinders
  Measure the time it takes to roll in the bucket, and the time it takes to roll out the bucket. To do so, position the bucket at one stroke end, then move the control lever to the other stroke end as quickly as possible.
- Repeat each measurement 3 times and calculate the average values.

(4) Evaluation

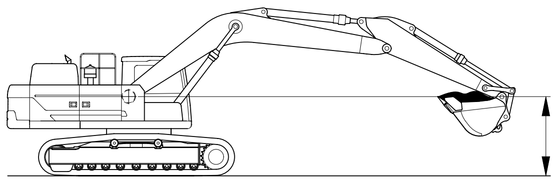
The average measured time should meet the following specifications.

Unit : Seconds

Model	Function	Standard	Maximum allowable	Remarks
HX480S L	Boom raise	4.4±0.4	5.3	
	Boom lower	2.2±0.4	2.9	
	Arm in	3.2±0.4	4.3	
	Arm out	3.4±0.4	4.0	
	Bucket load	2.9±0.4	3.6	
	Bucket dump	2.3±0.4	3.0	
HX520S L	Boom raise	4.9±0.4	5.6	
	Boom lower	2.7±0.4	3.6	
	Arm in	3.4±0.4	4.3	
	Arm out	3.4±0.4	4.2	
	Bucket load	3.1±0.4	3.6	
	Bucket dump	2.3±0.4	3.0	

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.



480L7MS08

(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.

(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
HX480S L HX520S L	Boom cylinder	10 below	15	
	Arm cylinder	10 below	15	
	Bucket cylinder	40 below	50	

11) CONTROL LEVER OPERATING FORCE

(1) Use a spring scale to measure the maximum resistance of each control lever at the middle of the grip.

(2) Preparation

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

(3) Measurement

① Start the engine.

② Select the following switch positions.

· Power mode switch : P mode

③ Operate each boom, arm, bucket and swing lever at full stroke and measure the maximum operating force for each.

④ Lower the bucket to the ground to raise one track off the ground. Operate the travel lever at full stroke and measure the maximum operating force required. When finished, lower the track and then jack-up the other track.

⑤ Repeat steps ③ and ④ three times and calculate the average values.

(4) Evaluation

The measured operating force should be within the following specifications.

Unit : kgf

Model	Kind of lever	Standard	Maximum allowable	Remarks
HX480S L HX520S L	Boom lever	1.4 or below	1.8	
	Arm lever	1.4 or below	1.8	
	Bucket lever	1.4 or below	1.8	
	Swing lever	1.4 or below	1.8	
	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
HX480S L HX520S L	Boom lever	80±10	110	
	Arm lever	80±10	110	
	Bucket lever	80±10	110	
	Swing lever	80±10	110	
	Travel lever	139±10	178	

13) PILOT PRIMARY PRESSURE

(1) Preparation

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

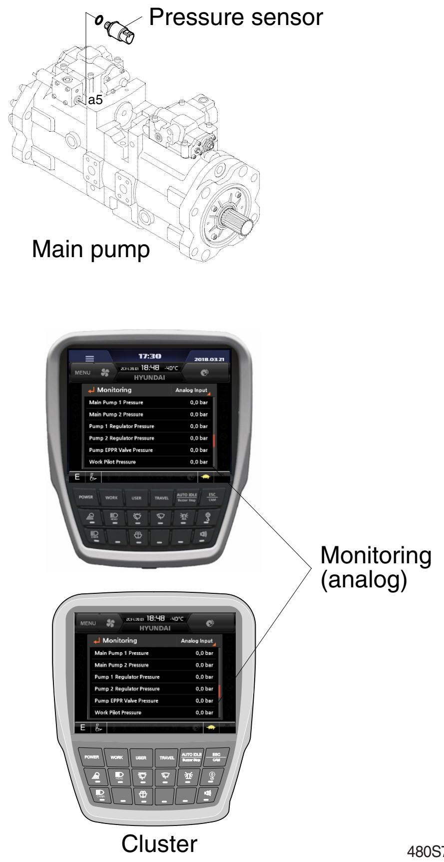
(2) Measurement

① Select the following switch positions.

· Power mode switch : P mode

· Auto decel switch : OFF

② Measure the primary pilot pressure by the monitoring menu of the cluster.



480S7MS09

(3) Evaluation

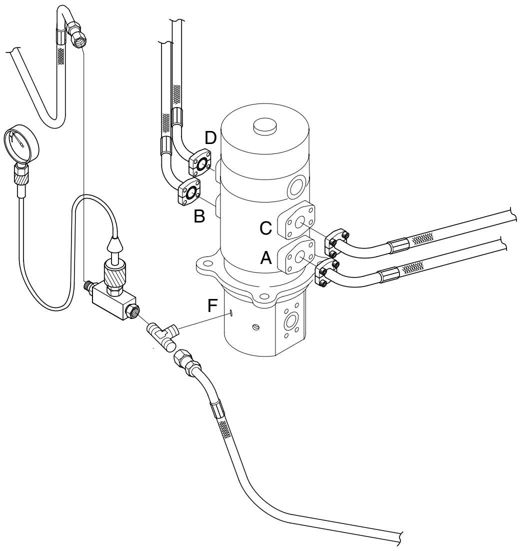
The average measured pressure should meet the following specifications:

Unit : kgf / cm^2

Model	Engine speed	Standard	Allowable limits	Remarks
HX480S L HX520S L	P mode	40^{+2}_{0}	-	

14) FOR TRAVEL SPEED SELECTING PRESSURE:

(1) Preparation



480S7MS13

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.

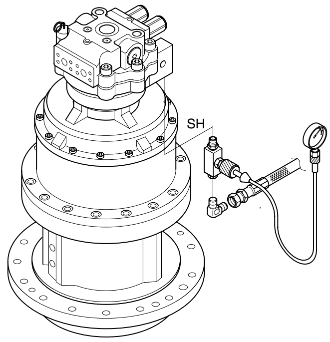
Unit : kgf / cm^2

Model	Travel speed mode	Standard	Maximum allowable	Remarks
HX480S L HX520S L	1 Speed	0	-	
	2 Speed	40±5	-	

15) SWING PARKING BRAKE RELEASING PRESSURE

(1) Preparation

① Stop the engine.
② Loosen the cap and relieve the pressure in the tank by pushing the top of the air breather.
③ The pressure release L wrench to bleed air.
④ Install a connector and pressure gauge assembly to swing motor SH port, as shown.
⑤ Start the engine and check for oil leakage from the adapter.
⑥ Keep the hydraulic oil temperature at 50±5˚C.



480L7MS10

(2) Measurement

① Select the following switch positions.
· Power mode switch : P mode
② Operate the swing function or arm roll in function and measure the swing brake control pressure with the brake disengaged. Release the control lever to return to neutral and measure the control pressure when the brake is applied.
Repeat step ② three times and calculate the average values.

(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm^2

Model	Description	Standard	Allowable limits	Remarks
HX480S L HX520S L	Brake disengaged	40	35.5~50	
	Brake applied	0	-	

16) MAIN PUMP DELIVERY PRESSURE

(1) Preparation

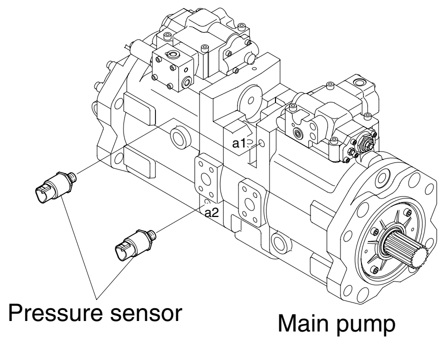
① Keep the hydraulic oil temperature at 50±5˚C.

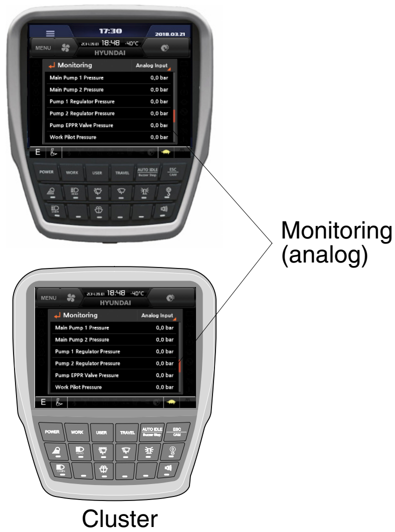
(2) Measurement

① Select the following switch positions.

· Power mode switch : P mode

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





480S7MS11

(3) Evaluation

The average measured pressure should meet the following specifications.

Unit : kgf / cm^2

Model	Engine speed	Standard	Allowable limits	Remarks
HX480S L HX520S L	High idle	40±5	-	

17) SYSTEM PRESSURE REGULATOR RELIEF SETTING

(1) Preparation

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

(2) Measurement

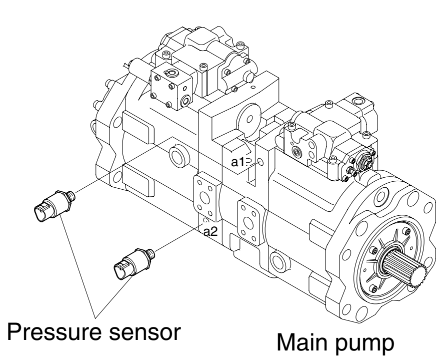
① Select the following switch positions.

· Power mode switch : P mode

② Slowly operate each control lever of boom, arm and bucket functions at full stroke over relief and measure the pressure.

③ In the swing function, place bucket against an immovable object and measure the relief pressure.

④ In the travel function, lock undercarriage with an immovable object and measure the relief pressure.



480S7MS11

(3) Evaluation

The average measured pressure should be within the following specifications.

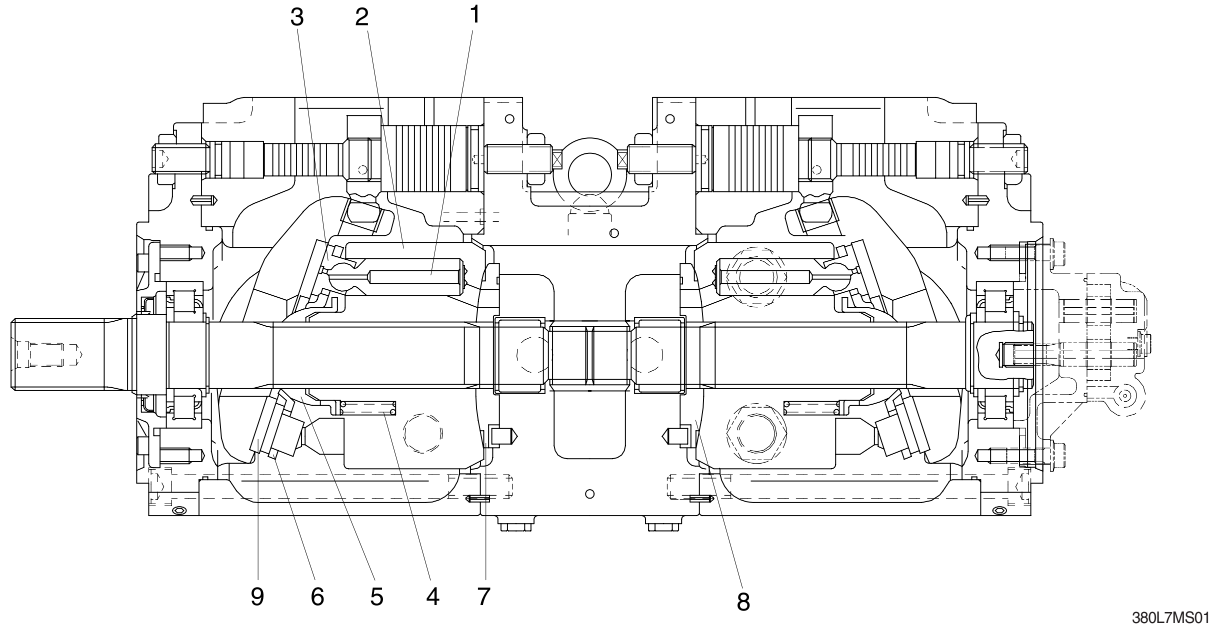
Unit : kgf / cm²

Model	Function to be tested	Standard	Port relief setting
HX480S L HX520S L	Boom	330 (360)±10	360
	Arm	330 (360)±10	360
	Bucket	330 (360)±10	360
	Travel	360±10	380
	Swing	285±10	285

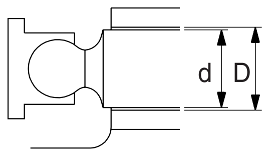
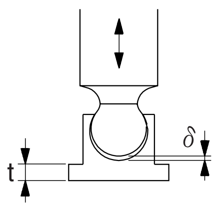
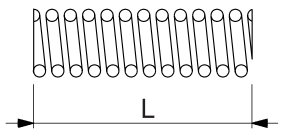
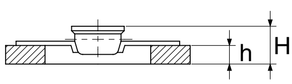
(   ) : Power boost

GROUP 2 MAJOR COMPONENT

1. MAIN PUMP



380L7MS01

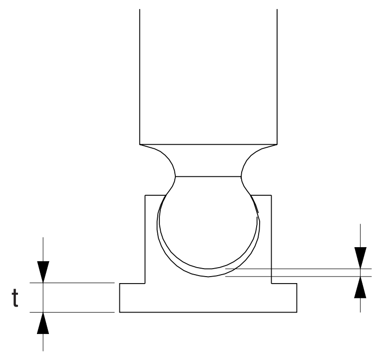
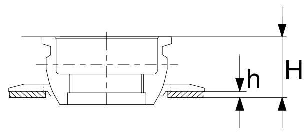
Part name & inspection item		Standard dimension	Recommended replacement value	Counter measures
Clearance between piston(1) & cylinder bore(2) (D-d)		0.043	0.070	Replace piston or cylinder.
Play between piston(1) & shoe caulking section(3) (δ)		0-0.1	0.3	Replace assembly of piston & shoe.
Thickness of shoe (t)		5.4	5.0	
Free height of cylinder spring(4) (L)		47.9	47.1	Replace cylinder spring.
Combined height of set plate(5) & spherical bushing(6) (H-h)		23.8	22.8	Replace retainer or set plate.
Surface roughness for valve plate (sliding face) (7,8), swash plate (shoe plate area) (9), & cylinder(2) (sliding face)	Surface roughness necessary to be corrected	3z		Lapping
	Standard surface roughness (corrected value)	0.4z or lower		

2. MAIN CONTROL VALVE

Part name	Inspection item	Criteria & measure
Casing	· Existence of scratches, rust or corrosion.	· In case of damage in following section, replace casing. - Sliding sections of casing hole and spool, especially land sections applied with held pressure. - Seal pocket section where spool is inserted. - Sealing section of port where O-ring contacts. - Sealing section of each relief valve for main and port. - Sealing section of plug. - Other damages that may damage normal function.
Spool	· Existence of scratch, gnawing, rusting or corrosion. · O-ring seal sections at both ends. · Insert spool into casing hole, rotate and reciprocate it.	· Replacement when its outside sliding section has scratch (especially on seals-contacting section). · Replacement when its sliding section has scratch. · Correction or replacement when O-ring is damaged or when spool does not move smoothly.
Poppet	· Damage of spring · Damage of poppet · Insert poppet into casing and function it.	· Replacement. · Correction or replacement when sealing is incomplete. · Normal when it can function lightly and smoothly without sticking.
Spring and related parts	· Rusting, corrosion, deformation or breakage of spring, spring seat, plug or cover.	· Replacement for significant damage.
Around seal for spool	· External oil leakage. · Rusting, corrosion or deformation of seal plate.	· Correction or replacement. · Correction or replacement.
Main relief valve, port relief valve & negative control valve	· External rusting or damage. · Contacting face of valve seat. · Contacting face of poppet. · O-rings and back up rings.	· Replacement. · Replacement when damaged. · Replacement when damaged. · Replacement in principle.

3. SWING DEVICE

1) WEARING PARTS

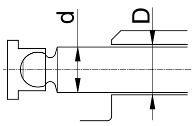
Inspection item	Standard dimension	Recommended replacement value	Counter measures
Clearance between piston and cylinder block bore	0.041	0.060	Replace piston or cylinder block
Thickness of valve plate	6	5.88	Replace
Play between piston and shoe caulking section (δ)	0.025	0.1	Replace assembly of piston and shoe
Thickness of shoe (t)	6.6	6.5	Replace assembly of piston and shoe
Combined height of retainer plate and spherical bushing (H-h)	17.6	17.3	Replace set of retainer plate and sperical bushing
Thickness of friction plate	2.94	2.7	Replace
 140W77MS12	 2609A7MS01		

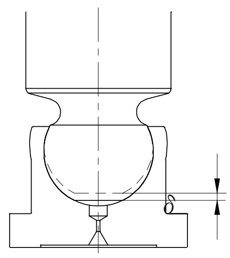
2) SLIDING PARTS

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

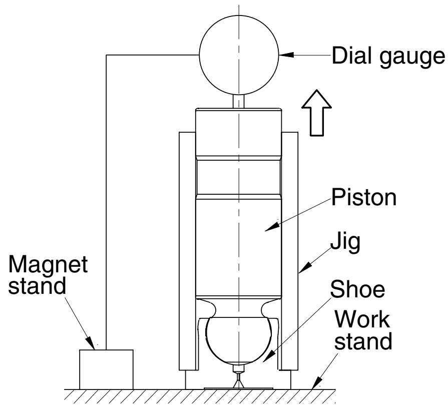
4. TRAVEL MOTOR

The followings are the general maintenance standards. However, it is the most important to determine which parts should be replaced, depending on the characteristics before disassembling, damages and discoloration of exterior view, the purpose of disassembling, the expected remaining service life. etc..

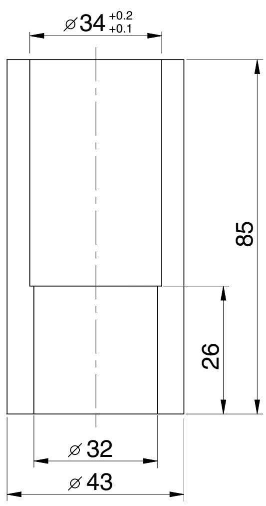
Check item		Measuring method	Criteria	Allowable	Remedy
Sliding surface of cylinder block, valve plate and swash plate	Surface roughness of cylinder block, valve plate and swas plate	Measure the surface roughness by roughness tester	Below 0.4 Z μ	Below 3.0 Z μ	Replace or repair ※ Lap together the surfaces of both cylinder block and valve plate to remedy their roughness (# 1200 power)
	Swash plate - hardness of sliding surface	Measure the surface hardness of swash plate by hardness tester	Over HS78	HS74	Replace
Clearance between piston and cylinder block  Measurement position	Outer dia of piston d max - d min	Measure outer dia of piston and bore of cylinder block at least 3 places in the longitudinal direction with micrometer and obtain : max outer dia = d max min outer dia = d min max inner dia = D max min inner dia = D min	0.01 mm	0.05 mm	Replace piston or cylinder block ※ In exchanging pistons, replace all of nine pistons at the same time
	Inner dia of cylinder bore D max - D min		0.01 mm	0.022 mm	
	Clearance D-d		0.037~ 0.047 mm	0.065 mm	
Play between piston and shoe	Play between calked piston and shoe (δ)	With the jig, hold down the shoe on work stand and pull up the piston vertical direction to measure the play between piston and shoe	0~0.1 mm	0.3 mm	Replace piston



Play



Method



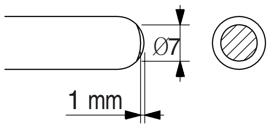
Jig for measuring play

29097MS10

Check item	Measuring method	Criteria	Allowable	Remedy
Parking brake torque	After completion of assembly, set the torque wrench on the shaft end, and measure the braking torque generated when the shaft starts to rotate	92.6 kgf · m (670 lbf · ft)	82.8 kgf · m (599 lbf · ft)	Replace all of separator, friction plates and springs
Standard of replacing friction and separating plate. When measuring parking brake torque, it needs to disassemble traveling unit to motor and reduction gear portion, and it's so hard. The right allowable value is a standard of replacing friction and separating plate. If it is impossible to disassemble traveling unit, refer to the right value.	Measure the total thickness of 4 pieces of friction plate and 5 pieces of separating plate.	22.76 mm	Thickness : 21.3 mm	Replace all separating and friction plates and springs.

Check item	Measuring method	Judging criteria and remedy
Shaft	Measure the wear at contacting surface of oil seal (3) with the surface roughness tester	If the depth of shaft wear is less than 0.05 mm, the shaft is reusable. ※ In case of replacing the shaft (9), replace oil seal (3) at the same time.
Bearings	Replace bearings (10, 51) after decided hours	Replace bearings (10, 51) before hour meter of host machine indicates 10,000 hours. ※ In case replacing the bearings (10, 51), replace both inner and outer races at the same time. ※ Also the bearing shims (52) must be readjusted when replaced shaft (9) and/or bearings (10, 51). Contact dealers for jigs and tools required.
Splines	Replace if the wear of splines exceeds the allowable value	If the wear of splines is less than 0.3 mm, the spline is reusable.
Overload relief valve	Do not try to adjust the valve, since special hydraulic test bench is required for inspecting and adjusting the pressure	Replace relief valve part as an assembly each time the host machine works for 10,000 hours.

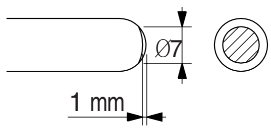
5. RCV LEVER

Maintenance check item	Criteria	Remark
Leakage	The valve is to be replaced when the leakage becomes more than 1000 cc/m at neutral handle position, or more than 2000 cc/m during operation.	Conditions : Primary pressure : 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.

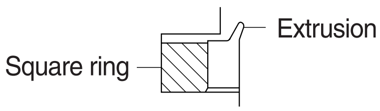
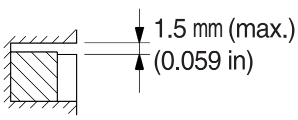
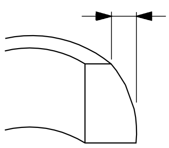
2. When loosening the hexagon socket head cap screw (125), replace the seal washers (121) without fail.

6. RCV PEDAL

Maintenance check item	Criteria	Remark
Leakage	The valve is to be replaced when the leakage effect to the system. For example, the primary pressure drop.	Conditions : Primary pressure : 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.

7. TURNING JOINT

Part name		Maintenance standards	Remedy
Body, Stem	Sliding surface with sealing sections.	Plating worn or peeled due to seizure or contamination.	Replace
	Sliding surface between body and stem other than sealing section.	· Worn abnormality or damaged more than 0.1 mm (0.0039 in) in depth due to seizure contamination.	Replace
		· Damaged more than 0.1 mm (0.0039 in) in depth.	Smooth with oilstone.
	Sliding surface with thrust plate.	· Worn more than 0.5 mm (0.02 in) or abnormality.	Replace
		· Worn less than 0.5 mm (0.02 in).	Smooth
		· Damage due to seizure or contamination remediable within wear limit (0.5 mm) (0.02 in).	Smooth
Cover	Sliding surface with thrust plate.	· Worn more than 0.5 mm (0.02 in) or abnormality.	Replace
		· Worn less than 0.5 mm (0.02 in).	Smooth
		· Damage due to seizure or contamination remediable within wear limit (0.5 mm) (0.02 in).	Replace
Seal set	-	· Extruded excessively from seal groove square ring.  	Replace
	-	· Slipper ring 1.5 mm (0.059 in) narrower than seal groove, or narrower than back ring.  	Replace
	-	· Worn more than 0.5 mm (0.02 in) ~ 1.5 mm (MAX.) (0.059 in) 	Replace

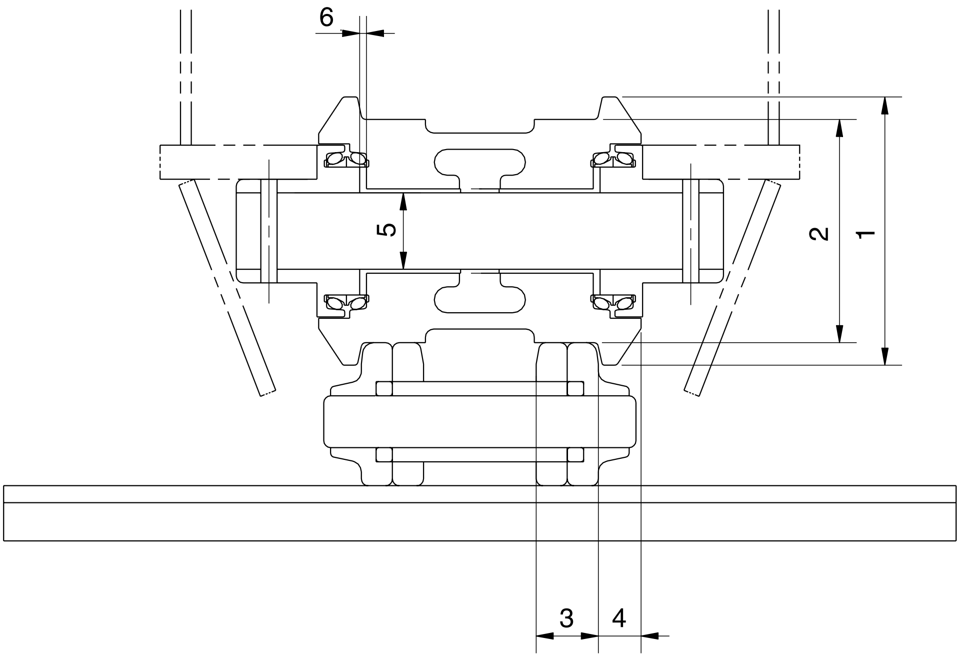
8. CYLINDER

Part name	Inspecting section	Inspection item	Remedy
Piston rod	· Neck of rod pin	· Presence of crack	· Replace
	· Weld on rod hub	· Presence of crack	· Replace
	· Stepped part to which piston is attached.	· Presence of crack	· Replace
	· Threads	· Presence of crack	· Recondition or replace
	· Plated surface	· Plating is not worn off to base metal.	· Replace or replate
		· Rust is not present on plating.	· Replace or replate
		· Scratches are not present.	· Recondition, replate or replace
	· Rod	· Wear of O.D.	· Recondition, replate or replace
	· Bushing at mounting part	· Wear of I.D.	· Replace
Cylinder tube	· Weld on bottom	· Presence of crack	· Replace
	· Weld on head	· Presence of crack	· Replace
	· Weld on hub	· Presence of crack	· Replace
	· Tube interior	· Presence of faults	· Replace if oil leak is seen
	· Bushing at mounting part	· Wear on inner surface	· Replace
Gland	· Bushing	· Flaw on inner surface	· Replace if flaw is deeper than coating

GROUP 3 TRACK AND WORK EQUIPMENT

1. TRACK

1) TRACK ROLLER

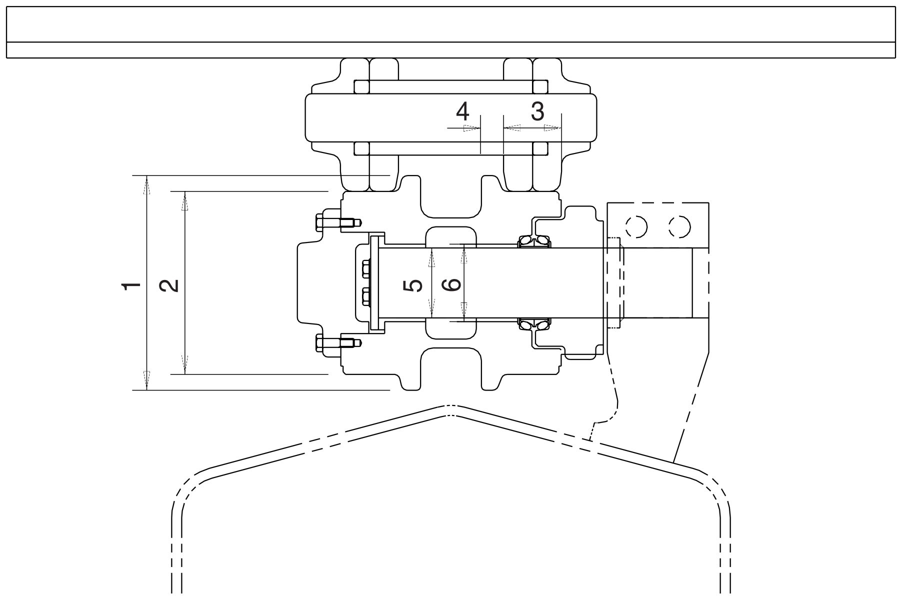


21037MS01

Unit : mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="4">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outside diameter of flange</td><td colspan="2">Standard size</td><td colspan="2">Repair limit</td><td rowspan="4">Rebuild or replace</td></tr>
<tr><td colspan="2">Ø216</td><td colspan="2">–</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="2">Ø180</td><td colspan="2">Ø168</td></tr>
<tr><td>3</td><td>Width of tread</td><td colspan="2">50</td><td colspan="2">56</td></tr>
<tr><td>4</td><td>Width of flange</td><td colspan="2">57</td><td colspan="2">21</td><td></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>Ø75 $^{0}_{-0.03}$</td><td>Ø75.35 $^{+0.05}_{0}$</td><td>0.35 to 0.40</td><td>2.0</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Side clearance of roller (both side)</td><td colspan="2">Standard clearance</td><td colspan="2">Clearance limit</td><td rowspan="2">Replace</td></tr>
<tr><td colspan="2">0.16~1.24</td><td colspan="2">2.0</td></tr>
</table>

2) CARRIER ROLLER

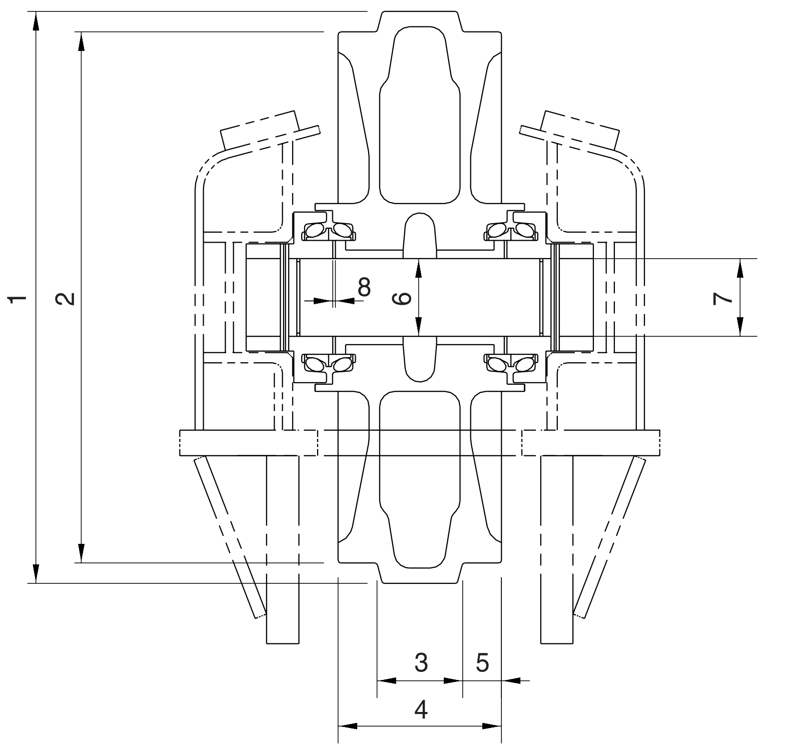


32037MA37

Unit : ㎜

<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">$\varnothing 200$</td><td colspan="2">–</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="2">$\varnothing 168$</td><td colspan="2">$\varnothing 158$</td></tr>
<tr><td>3</td><td>Width of tread</td><td colspan="2">54</td><td colspan="2">59</td></tr>
<tr><td>4</td><td>Width of flange</td><td colspan="2">19</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>$\varnothing 55^{+0.085}_{+0.066}$</td><td>$\varnothing 55^{+0.37}_{+0.33}$</td><td>0.245 to 0.304</td><td>2.0</td></tr>
<tr><td>6</td><td>Clearance between shaft and support</td><td>$\varnothing 58^{\ 0}_{-0.1}$</td><td>$\varnothing 58^{+0.5}_{+0.3}$</td><td>0.3 to 0.6</td><td>1.2</td><td>Replace</td></tr>
</table>

3) IDLER

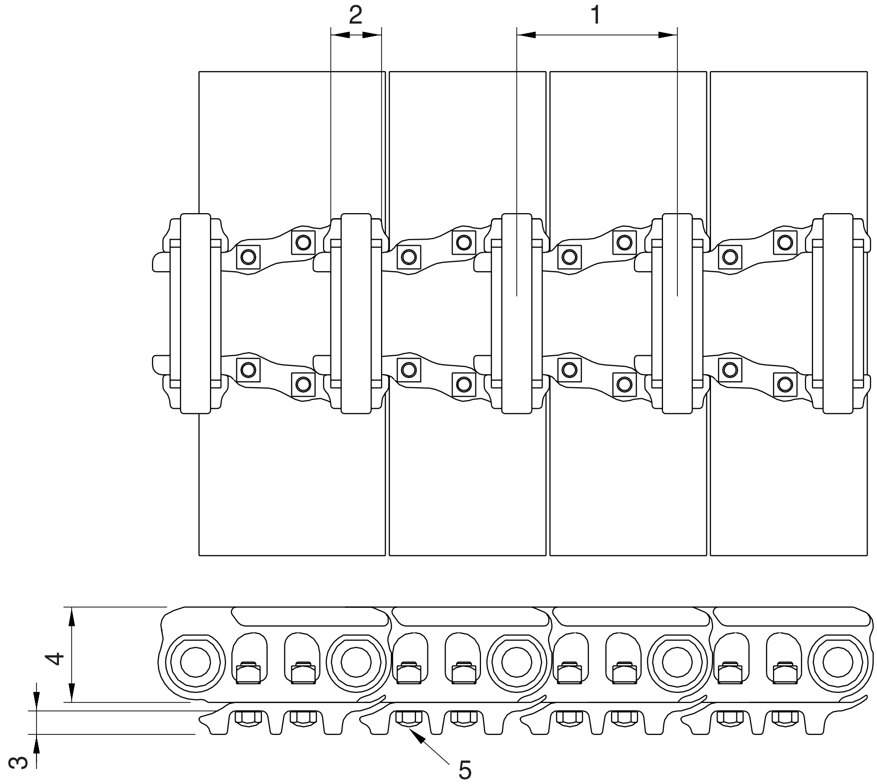


21037MS03

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 protrusion</td><td colspan="2">Standard size</td><td colspan="2">Repair limit</td><td rowspan="6">Rebuild or replace</td></tr>
<tr><td colspan="2">Ø646</td><td colspan="2">–</td></tr>
<tr><td>2</td><td>Outside diameter of tread</td><td colspan="2">Ø594</td><td colspan="2">Ø588</td></tr>
<tr><td>3</td><td>Width of protrusion</td><td colspan="2">102</td><td colspan="2">–</td></tr>
<tr><td>4</td><td>Total width</td><td colspan="2">203</td><td colspan="2">–</td></tr>
<tr><td>5</td><td>Width of tread</td><td colspan="2">50.5</td><td colspan="2">56.5</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Clearance between shaft and bushing</td><td colspan="2">Standard size & tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td><td rowspan="3">Replace bushing</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>Ø90 $^{0}_{-0.035}$</td><td>Ø90.35 $^{+0.05}_{0}$</td><td>0.35 to 0.435</td><td>2.0</td></tr>
<tr><td>7</td><td>Clearance between shaft and support</td><td>Ø90 $^{0}_{-0.035}$</td><td>Ø90 $^{+0.09}_{+0.036}$</td><td>0.036 to 0.125</td><td>1.2</td><td>Replace</td></tr>
<tr><td>8</td><td>Side clearance of idler (both side)</td><td colspan="2">Standard clearance
0.4 to 1.2</td><td colspan="2">Clearance limit
2.0</td><td>Replace</td></tr>
</table>

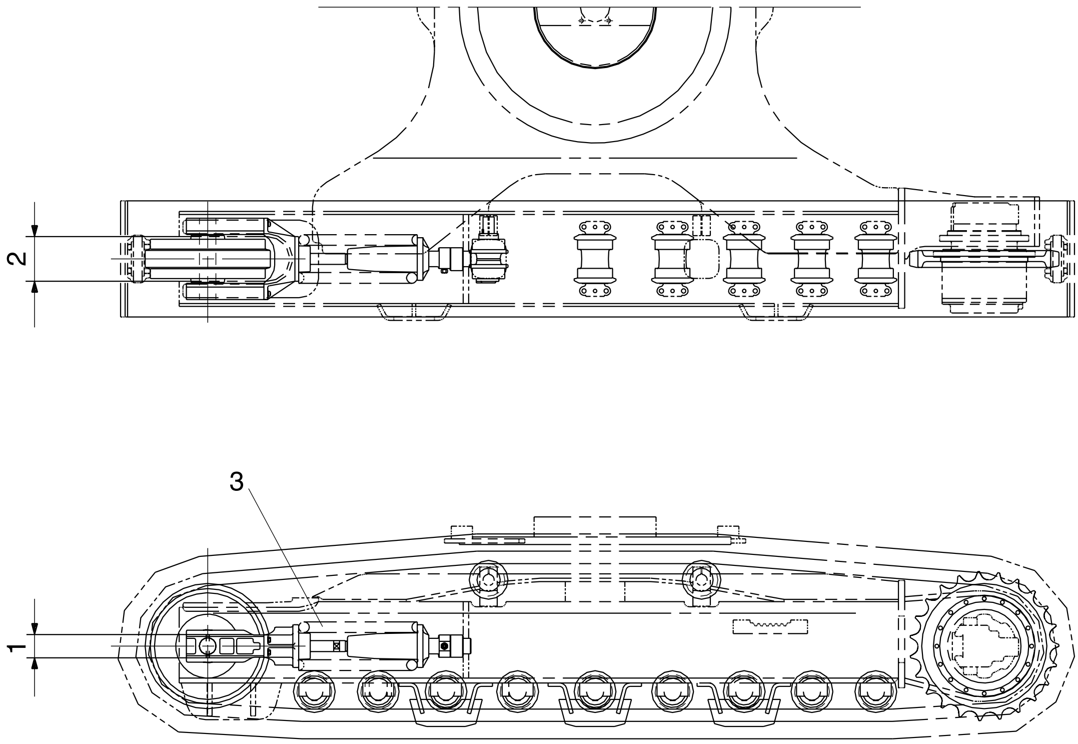
4) TRACK



Unit : mm

No.	Check item	Criteria		Remedy
1	Link pitch	Standard size	Repair limit	Turn or replace
		216	221	
2	Outside diameter of bushing	Ø66.5	Ø60.9	Rebuild or replace
3	Height of grouser	30	23	
4	Height of link	116	111	
5	Tightening torque	Initial tightening torque : 115±5 kgf · m		Retighten

5) TRACK FRAME AND RECOIL SPRING

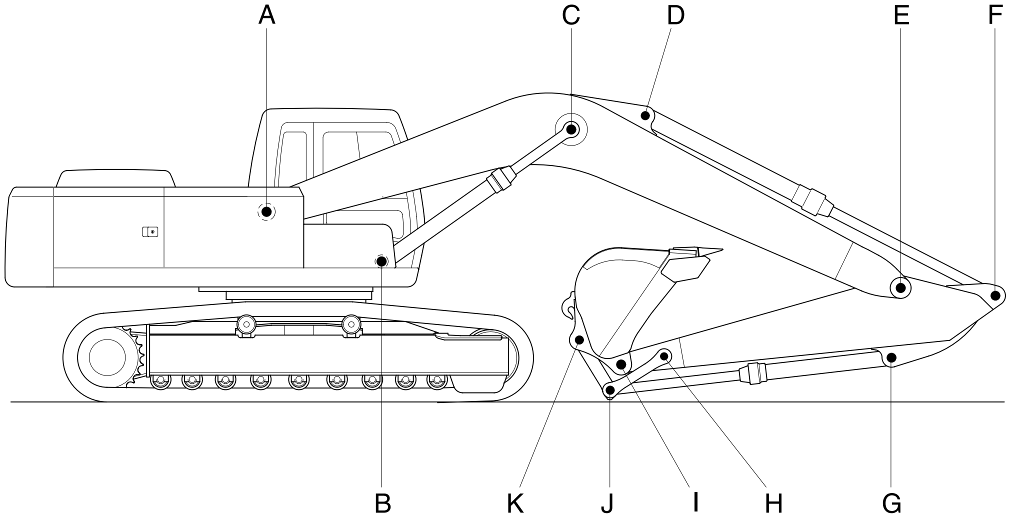


21037MS05

Unit : ㎜

No.	Check item	Criteria					Remedy
1	Vertical width of idler guide		Standard size	Tolerance	Repair limit		Rebuild or replace
		Track frame	132	+2 0	136		
		Idler support	130	0 - 1.5	126		
2	Horizontal width of idler guide	Track frame	292	+2 0	297		
		Idler support	290	-	288		
3	Recoil spring	Standard size			Repair limit		Replace
		Free length	Installation length	Installation load	Free length	Installation load	
		Ø253×710	580	19012 ㎏	–	15210 ㎏	

2. WORK EQUIPMENT



21077MS20

Unit : ㎜

Mark	Measuring point (Pin and Bushing)	Normal value	Pin		Bushing		Remedy & Remark
			Recomm. service limit	Limit of use	Recomm. service limit	Limit of use	
A	Boom Rear	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 (HX480S L)	100	99	98.5	100.5	101	
	Bucket Cylinder Head (HX520S L)	110	109	108.5	110.5	111	
H	Arm Link	100	99	98.5	100.5	101	
I	Bucket and Arm Link (HX480S L)	100	99	98.5	100.5	101	
	Bucket and Arm Link (HX520S L)	120	119	118.5	120.5	121	
J	Bucket Cylinder Rod (HX480S L)	100	99	98.5	100.5	101	
	Bucket Cylinder Rod (HX520S L)	110	109	108.5	110.5	111	
K	Bucket Link (HX480S L)	100	99	98.5	100.5	101	
	Bucket Link (HX520S L)	120	119	118.5	120.5	121	

SECTION 8 DISASSEMBLY AND ASSEMBLY

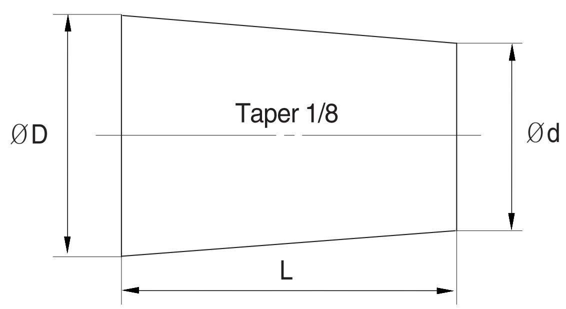
SECTION 8 DISASSEMBLY AND ASSEMBLY

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

· HX480S L

No.	Descriptions		Bolt size	Torque	
				kgf · m	lbf · ft
1	Engine	Engine mounting bolt (FR, bracket)	M20 × 2.5	57.9 ± 8.0	419 ± 62.9
2		Engine mounting bolt (RR, bracket)	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
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 housing mounting bolt	M10 × 1.5	6.7 ± 1.0	48.7 ± 7.2
7	Hydraulic system	Main pump mounting bolt	M20 × 2.5	44 ± 6.6	318 ± 47.7
8		Main control valve mounting nut	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
9		Fuel tank mounting bolt	M20 × 2.5	46 ± 5.1	333 ± 36.9
10		Hydraulic oil tank mounting bolt	M20 × 2.5	57.9 ± 8.0	419 ± 57.9
11		Turning joint mounting bolt, nut	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
12	Power train system	Swing motor mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
13		Swing bearing upper part mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
14		Swing bearing lower part mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
15		Travel motor mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
16		Sprocket mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 43.4
17	Under carriage	Carrier roller mounting bolt, nut	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
18		Track 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

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

· HX520S L

No.	Descriptions		Bolt size	Torque	
				kgf · m	lbf · ft
1	Engine	Engine mounting bolt (FR, bracket)	M20 × 2.5	57.9 ± 8.0	419 ± 62.9
2		Engine mounting bolt (RR, bracket)	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
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 housing mounting bolt	M10 × 1.5	6.7 ± 1.0	48.7 ± 7.2
7	Hydraulic system	Main pump mounting bolt	M20 × 2.5	44 ± 6.6	318 ± 47.7
8		Main control valve mounting nut	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
9		Fuel tank mounting bolt	M20 × 2.5	46 ± 5.1	333 ± 36.9
10		Hydraulic oil tank mounting bolt	M20 × 2.5	57.9 ± 8.0	419 ± 57.9
11		Turning joint mounting bolt, nut	M16 × 2.0	29.7 ± 4.5	215 ± 32.5
12	Power train system	Swing motor mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
13		Swing bearing upper part mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
14		Swing bearing lower part mounting bolt	M24 × 3.0	100 ± 10	723 ± 72.3
15		Travel motor mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 62.9
16		Sprocket mounting bolt	M20 × 2.5	57.9 ± 6.0	419 ± 43.4
17	Under carriage	Carrier roller mounting bolt, nut	M16 × 2.0	29.7 ± 3.0	215 ± 21.7
18		Track 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

※ 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.

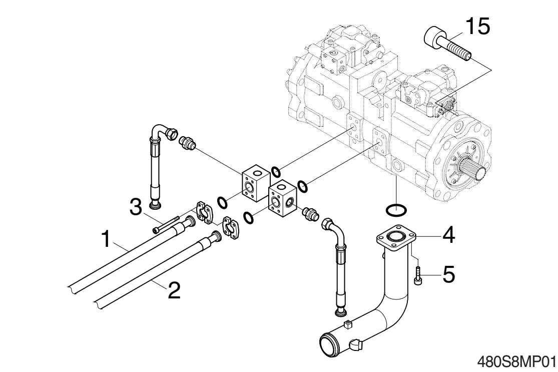
⚠ **Escaping fluid under pressure can penetrate the skin causing serious injury.**

13031GE18

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

- Hydraulic tank quantity : 250 ℓ

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

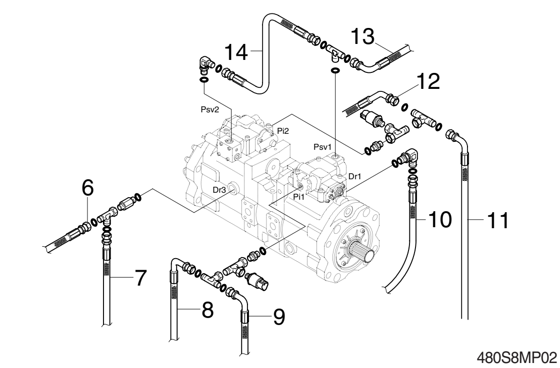


480S8MP01

(6) Disconnect pilot line hoses (6, 7, 8, 9, 10, 11, 12, 13, 14).

(7) Remove socket bolts (5) and disconnect pump suction tube (4).

※ When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.



480S8MP02

(8) Sling the pump assembly and remove the pump mounting bolts (15).

- Weight : 190 kg (420 lb)
- Tightening torque : 69.5 ± 10.4 kgf · m (503 ± 75.2 lbf · ft)

※ Pull out the pump assembly from housing. When removing the pump assembly, check that all the hoses have been disconnected.

2) INSTALL

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

(2) Remove the suction strainer and clean it.

(3) Replace return filter with new one.

(4) Remove breather and clean it.

(5) After adding oil to the hydraulic tank to the specified level.

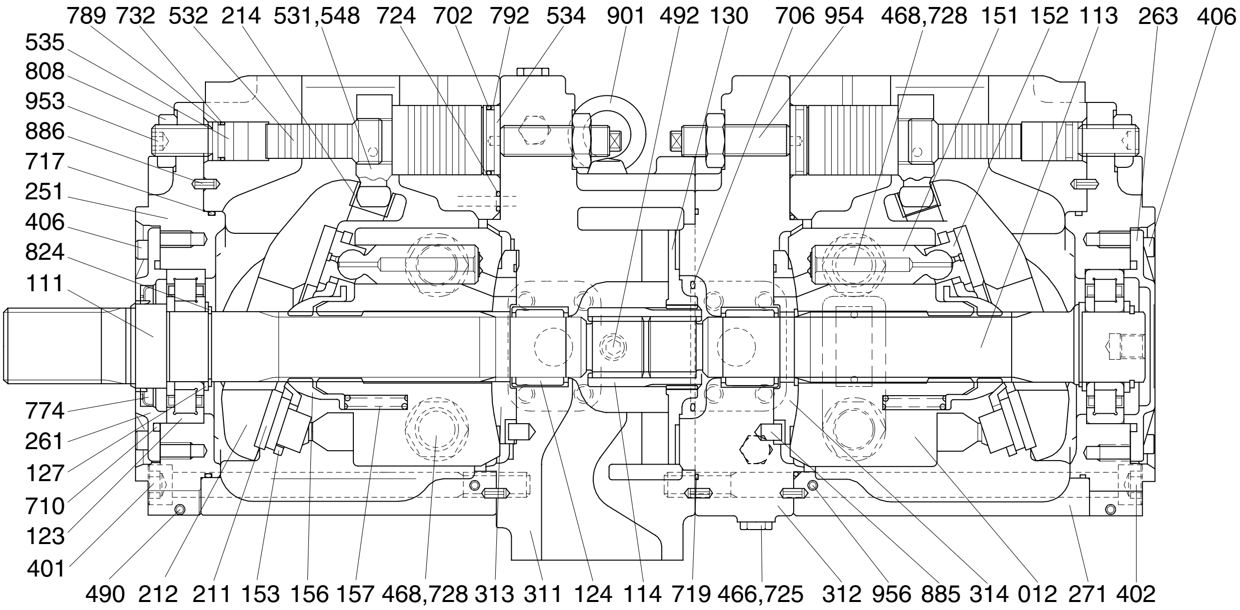
(6) Bleed the air from the hydraulic pump.
① Remove the air vent plug (2EA).
② Tighten plug lightly.
③ Start the engine, run at low idling, and check oil come out from plug.
④ Tighten plug.

(7) Start the engine, run at low idling (3~5 minutes) to circulate the oil through the system.

(8) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. MAIN PUMP (1/2)

1) STRUCTURE



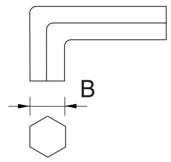
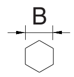
480F2MP02

012 Cylinder block
111 Drive shaft (F)
113 Driven shaft (R)
114 Coupling
123 Roller bearing
124 Needle bearing
127 Spacer
130 Booster
151 Piston
152 Shoe
153 Set plate
156 Bushing
157 Cylinder spring
211 Shoe plate
212 Swash plate
214 Tilting bearing
251 Support plate
261 Seal cover (F)
263 Seal cover (R)
271 Pump casing
311 Valve cover (F)
312 Valve cover (R)
313 Valve plate (R)
314 Valve plate (L)
401 Hexagon socket bolt
402 Hexagon socket bolt
406 Hexagon socket bolt
466 VP Plug
468 VP Plug
490 VP Plug
492 VP Plug
531 Tilting pin
532 Servo piston
534 Stopper (L)
535 Stopper (S)
548 Feed back pin
702 O-ring
706 O-ring
710 O-ring
717 O-ring
719 O-ring
724 Square ring
725 O-ring
728 O-ring
732 O-ring
774 Oil seal
789 Back up ring
792 Back up ring
808 Hexagon head nut
824 Snap ring
885 Valve plate pin
886 Spring pin
901 Eye bolt
953 Set screw
954 Set screw
956 Set screw

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the follow list.

<table>
<tr><th colspan="2">Tool name & size</th><th colspan="4">Part name</th></tr>
<tr><td rowspan="6">Allen wrench
</td><td>B</td><td>Hexagon socket head bolt</td><td>PT plug (PT thread)</td><td>PO plug (PF thread)</td><td>Hexagon socket head setscrew</td></tr>
<tr><td>4</td><td>M 5</td><td>BP-1/16</td><td>-</td><td>M 8</td></tr>
<tr><td>5</td><td>M 6</td><td>BP1/ 8</td><td>-</td><td>M10</td></tr>
<tr><td>6</td><td>M 8</td><td>BP-1/ 4</td><td>PO-1/4</td><td>M12, M14</td></tr>
<tr><td>8</td><td>M10</td><td>BP-3/ 8</td><td>PO-3/8</td><td>M16, M18</td></tr>
<tr><td>17</td><td>M20, M22</td><td>BP-1</td><td>PO-1, 1 1/4, 1 1/2</td><td>-</td></tr>
<tr><td rowspan="6">Double ring spanner, socket wrench, double (single) open end spanner
</td><td>-</td><td>Hexagon head bolt</td><td>Hexagon head bolt</td><td colspan="2">VP plug (PF thread)</td></tr>
<tr><td>19</td><td>M12</td><td>M12</td><td colspan="2">VP-1/4</td></tr>
<tr><td>24</td><td>M16</td><td>M16</td><td colspan="2">-</td></tr>
<tr><td>27</td><td>M18</td><td>M18</td><td colspan="2">VP-1/2</td></tr>
<tr><td>30</td><td>M20</td><td>M20</td><td colspan="2">-</td></tr>
<tr><td>36</td><td>-</td><td>-</td><td colspan="2">VP-3/4</td></tr>
<tr><td colspan="2">Adjustable angle wrench</td><td colspan="4">Medium size, 1 set</td></tr>
<tr><td colspan="2">Screw driver</td><td colspan="4">Minus type screw driver, Medium size, 2 sets</td></tr>
<tr><td colspan="2">Hammer</td><td colspan="4">Plastic hammer, 1 set</td></tr>
<tr><td colspan="2">Pliers</td><td colspan="4">For snap ring, TSR-160</td></tr>
<tr><td colspan="2">Steel bar</td><td colspan="4">Steel bar of key material approx. 10×8×200</td></tr>
<tr><td colspan="2">Torque wrench</td><td colspan="4">Capable of tightening with the specified torques</td></tr>
</table>

(2) Tightening torque

Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt (material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.0	116	0.47	12
	M16	24.0	174	0.55	14
	M18	34.0	246	0.55	14
	M20	44.0	318	0.67	17
PT plug (material : S45C) ※ Wind a seal tape 1 1/2 to 2 turns round the plug	PT1/16	0.7	5.1	0.16	4
	PT 1/8	1.05	7.59	0.20	5
	PT 1/4	1.75	12.7	0.24	6
	PT 3/8	3.5	25.3	0.31	8
	PT 1/2	5.0	36.2	0.39	10
PF plug (material : S45C)	PF 1/4	3.0	21.7	0.24	6
	PF 1/2	10.0	72.3	0.39	10
	PF 3/4	15.0	109	0.55	14
	PF 1	19.0	137	0.67	17
	PF 1 1/4	27.0	195	0.67	17
	PF 1 1/2	28.0	203	0.67	17

3) DISASSEMBLY

(1) Select place suitable to disassembling.

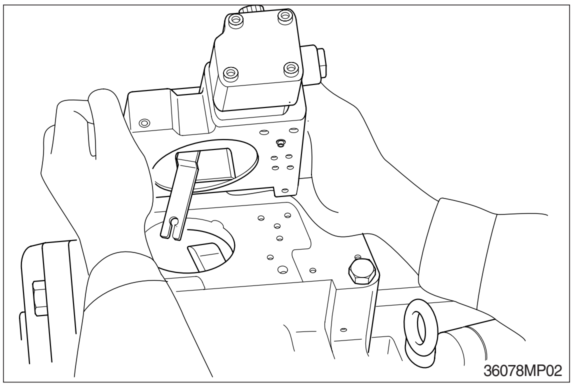
※ Select clean place.

※ Spread rubber sheet, cloth or so on on overhaul workbench top to prevent parts from being damaged.

(2) Remove dust, rust, etc, from pump surfaces with cleaning oil or so on.

(3) Remove drain port plug (468) and let oil out of pump casing (front and rear pump).

(4) Remove hexagon socket head bolts (412, 413) and remove regulator.



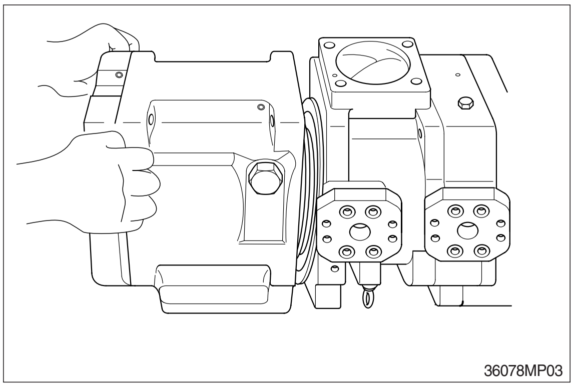
(5) Loosen hexagon socket head bolts (401) which tighten swash plate support (251), pump casing (271) and valve cover (F, 311).

※ If gear pump and so on are fitted to rear face of pump, remove them before starting this work.

(6) Loosen hexagon socket head bolts (402) which tighten swash plate support (251), pump casing (271) and valve cover (R, 312).

(7) Place pump horizontally on workbench with its regulator-fitting surface down, and separate pump casing (271) from valve cover (F, 311).

※ Before bringing this surface down, spread rubber sheet on workbench without fail to prevent this surface from being damaged.

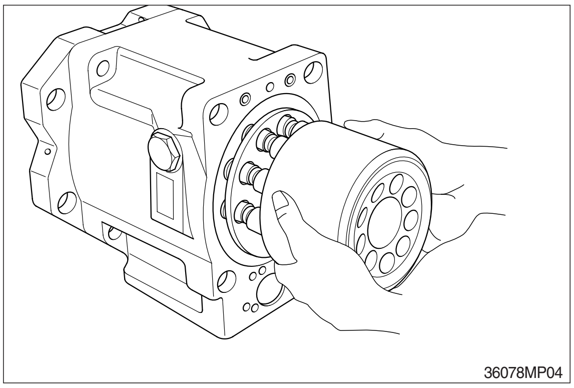


36078MP03

(8) Separate valve cover (F, 311) from valve cover (R, 312) and pull out booster (130), spline coupling (114).

(9) Separate valve cover (R, 312) from pump casing and then pull out the cylinder block (012) of pump casing (271) straightly over drive shaft (R, 113). Pull out also pistons (151), set plate (153), spherical bush (156) and cylinder springs (157) simultaneously.

※ Take care not to damage sliding surfaces of cylinder, spherical bushing, shoes, swash plate, etc.

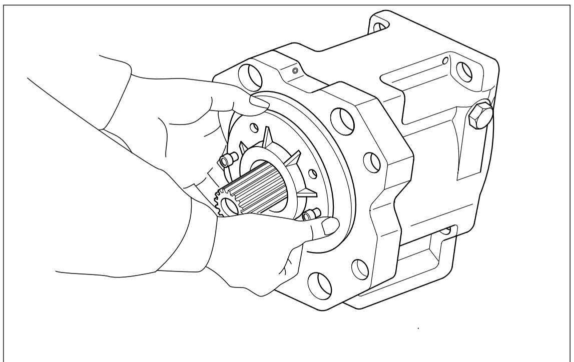


36078MP04

(10) Remove hexagon socket head bolts (406) and then seal cover (F, 261).

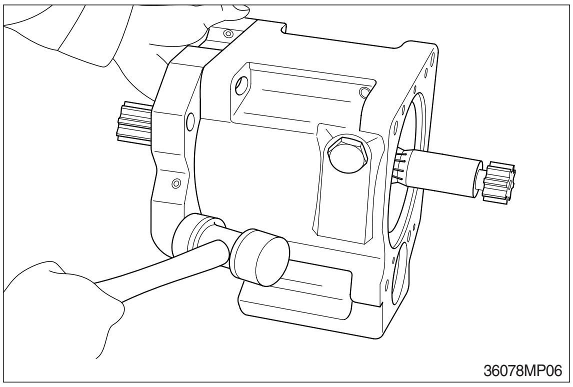
※ Fit bolt into pulling-out tapped hole of seal cover (F), and cover can be removed easily.

※ Since oil seal is fitted on seal cover (F), take care not to damage it when removing cover.



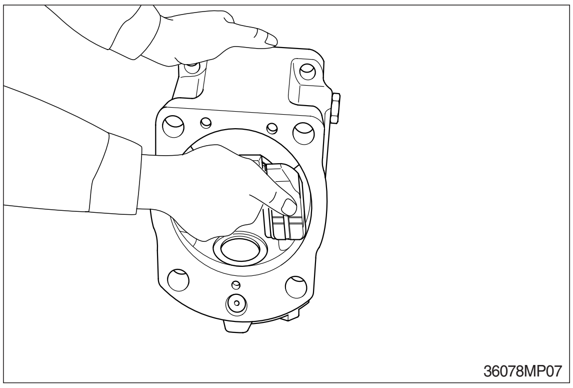
36078MP05

(11) Tapping lightly fitting flange section of swash plate support (251) on its pump casing side, separate swash plate support from pump casing.



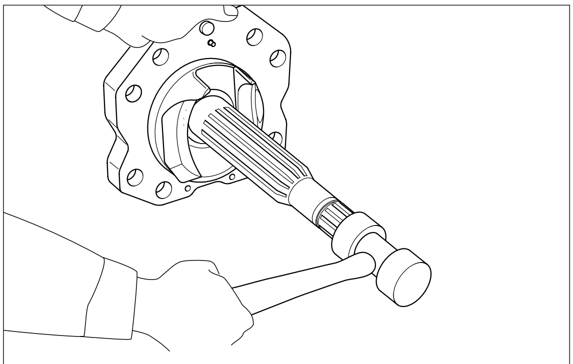
36078MP06

(12) Remove shoe plate (211) and swash plate (212) from pump casing (271).



36078MP07

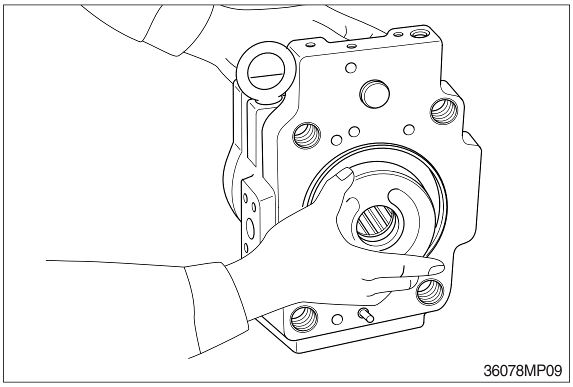
(13) Tapping lightly shaft ends of drive shafts (111, 113) with plastic hammer, take out drive shafts from swash plate supports.



36078MP08

(14) Remove valve plates (313, 314) from valve cover (311, 312).

※ These may be removed in work 7, 9.



(15) If necessary, remove stopper (L, 534), stopper (S, 535), servo piston (532) and tilting pin(531) from pump casing (271), and needle bearing (124) from valve cover (311, 312).

※ In removing tilting pin, use a protector to prevent pin head from being damaged.

※ Since loctite is applied to fitting areas of tilting pin and servo piston, take care not to damage servo piston.

※ Do not remove needle bearing as far as possible, except when it is considered to be out of its life span.

※ Do not loosen hexagon nuts of valve cover and swash plate support.
If loosened, flow setting will be changed.

(16) This is the end of disassembling procedures.

4) ASSEMBLY

(1) For reassembling reverse the disassembling procedures, paying attention to the following items.

① Do not fail to repair the parts damaged during disassembling, and prepare replacement parts in advance.

② Clean each part fully with cleaning oil and dry it with compressed air.

③ Do not fail to apply clean working oil to sliding sections, bearings, etc. before assembling them.

④ In principle, replace seal parts, such as O-rings, oil seals, etc.

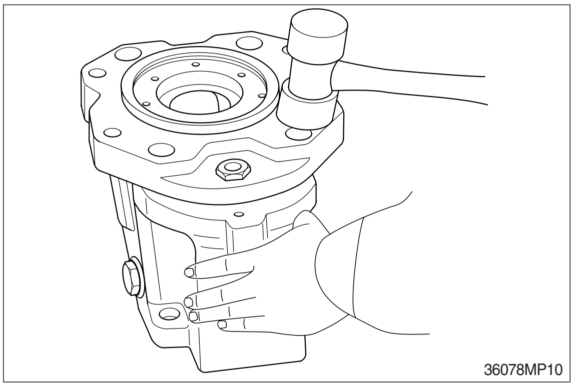
⑤ For fitting bolts, plug, etc., prepare a torque wrench or so on, and tighten them with torques shown in page 8-11, 12.

⑥ For the double-pump, take care not to mix up parts of the front pump with those of the rear pump.

(2) Fit swash plate support (251) to pump casing (271), tapping the former lightly with a hammer.

※ After servo piston, tilting pin, stopper (L) and stopper (S) are removed, fit them soon to pump casing in advance for reassembling.

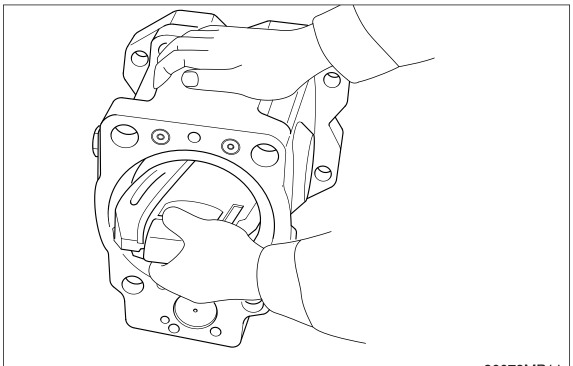
※ In tightening servo piston and tilting pin, use a protector to prevent tilting pin head and feedback pin from being damaged. In addition, apply loctite (medium strength) to their threaded sections.


36078MP10

(3) Place pump casing with its regulator fitting surface down, fit tilting bush of swash plate to tilting pin (531) and fit swash plate (212) to swash plate support (251) correctly.

※ Confirm with fingers of both hands that swash plate can be removed smoothly.

※ Apply grease to sliding sections of swash plate and swash plate support, and drive shaft can be fitted easily.



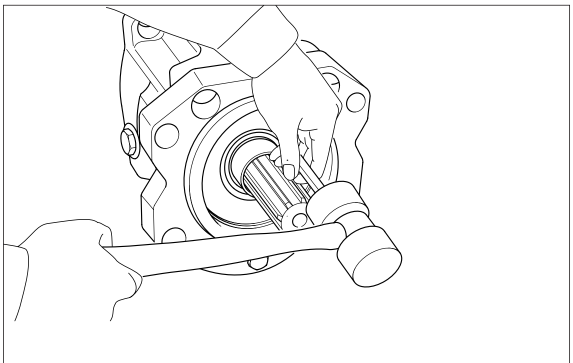
36078MP11

(4) To swash plate support (251), fit drive shaft (111) set with bearing (123), bearing spacer (127) and snap ring (824).

※ Do not tap drive shaft with hammer or so on.

※ Assemble them into support, tapping outer race of bearing lightly with plastic hammer.

Fit them fully, using steel bar or so on.



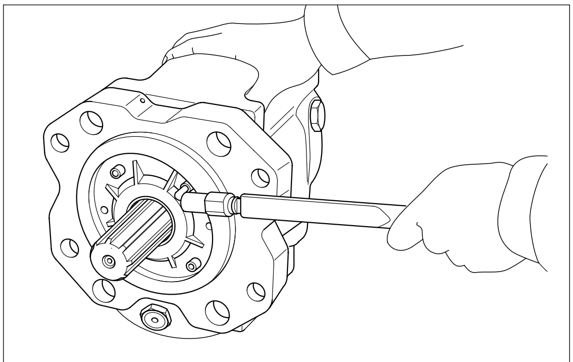
36078MP12

(5) Assemble seal cover (F, 261) to pump casing (271) and fix it with hexagon socket head bolts (406).

※ Apply grease lightly to oil seal in seal cover (F).

※ Assemble oil seal, taking full care not to damage it.

※ For tandem type pump, fit rear cover (263) and seal cover (262) similarly.

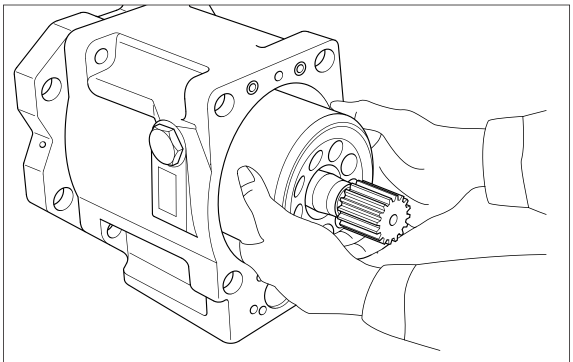


36078MP13

(6) Assemble piston cylinder subassembly [cylinder block (012), piston subassembly (151, 152), set plate (153), spherical bushing (156) and cylinder spring (157)].

Fit spline phases of retainer and cylinder.

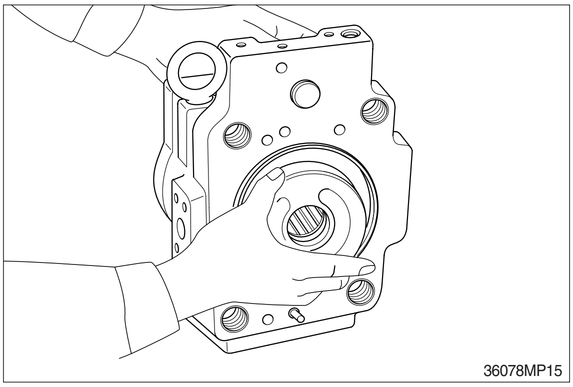
Then, insert piston cylinder subassembly into pump casing (271).



36078MP14

(7) Fit valve plate (313) to valve cover (F, 311), and fit valve plate (314) to valve cover (R, 312), entering pin into pin hole.

※ Take care not to mistake suction / delivery directions of valve plate.

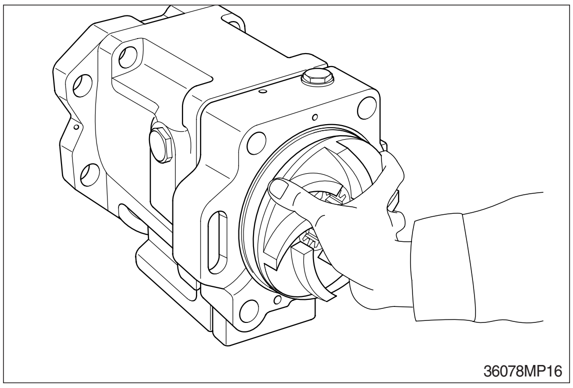


36078MP15

(8) Fit valve block (R, 312) to pump casing (271) and fit spline coupling (114) and booster (130) to shaft (R, 113).

※ Take care not to mistake direction of valve cover.
Fit valve cover with regulator up and with delivery flange left, viewed from front side.

※ Take care not to mistake direction of booster (130).
(refer to the sectional drawing)

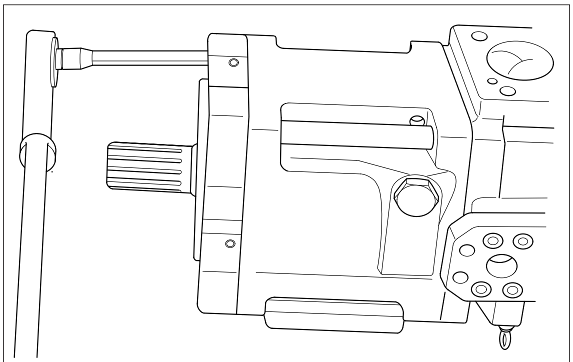


36078MP16

(9) Fit valve cover (F, 311) to valve cover (R) and tighten hexagon socket head bolts (402).

(10) Fit pump casing (271) with shaft (F, 111) to valve cover (F, 311) and tighten hexagon socket head bolts (401).

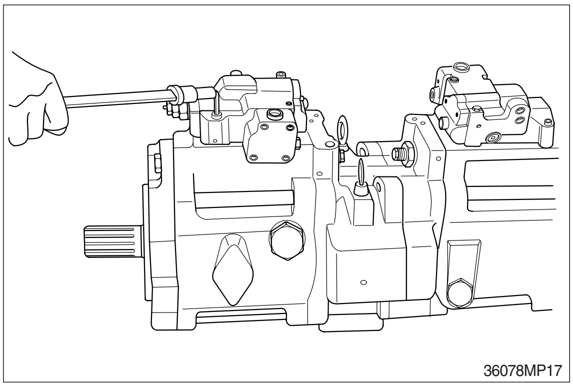
※ Mate spline phases of shaft (F) and spline coupling, with shaft (F) been rotating.



36078MP18

(11) Putting feedback pin of tilting pin into feedback lever of regulator, fit regulator and tighten hexagon socket head bolts (412,413).

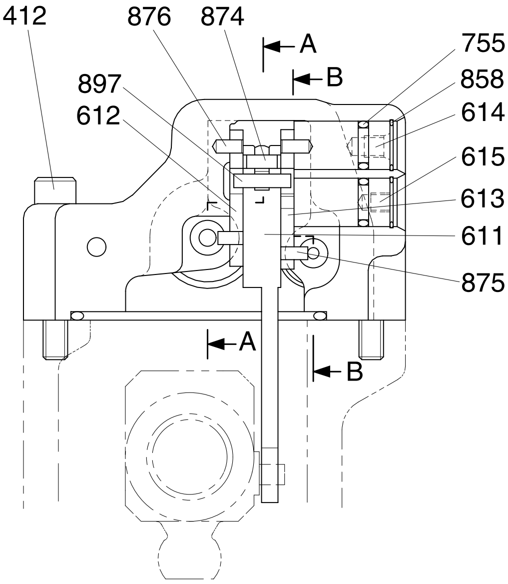
※ Take care not to mistake regulator of front pump for that of rear pump.

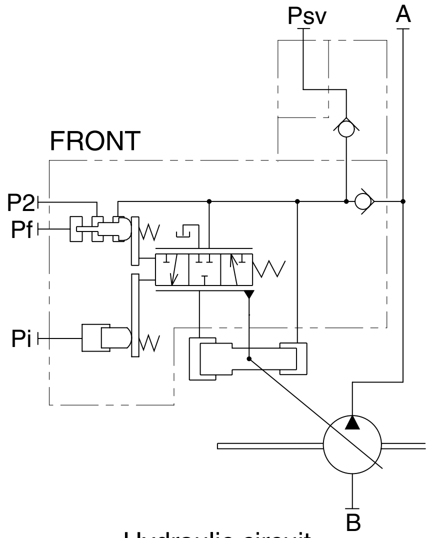

36078MP17

(12) Fit drain port plug (468).

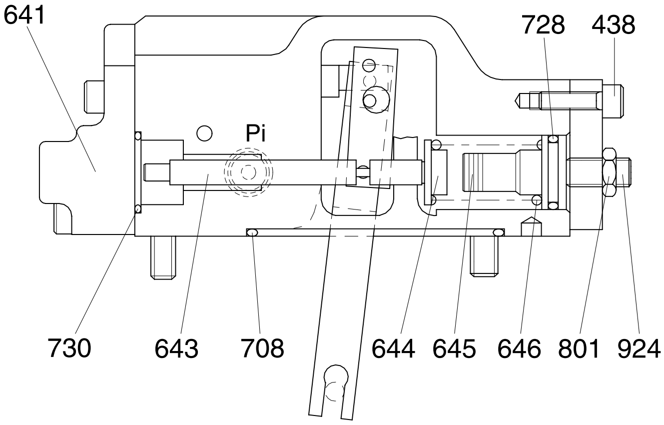
This is the end of reassembling procedures.

5) REGULATOR (1/2)

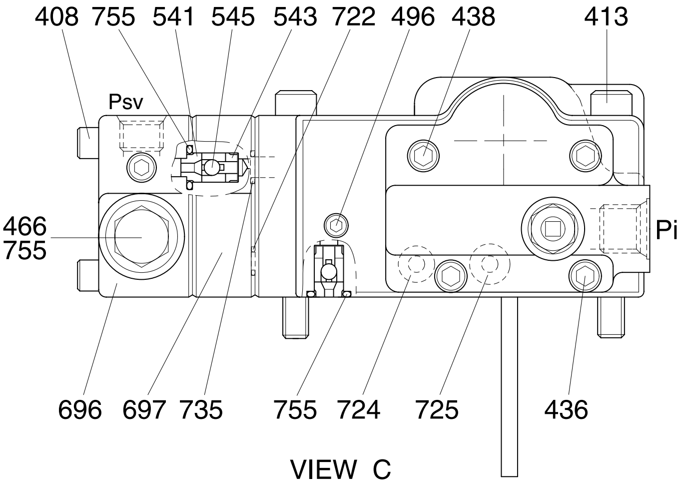




Hydraulic circuit



SECTION B-B

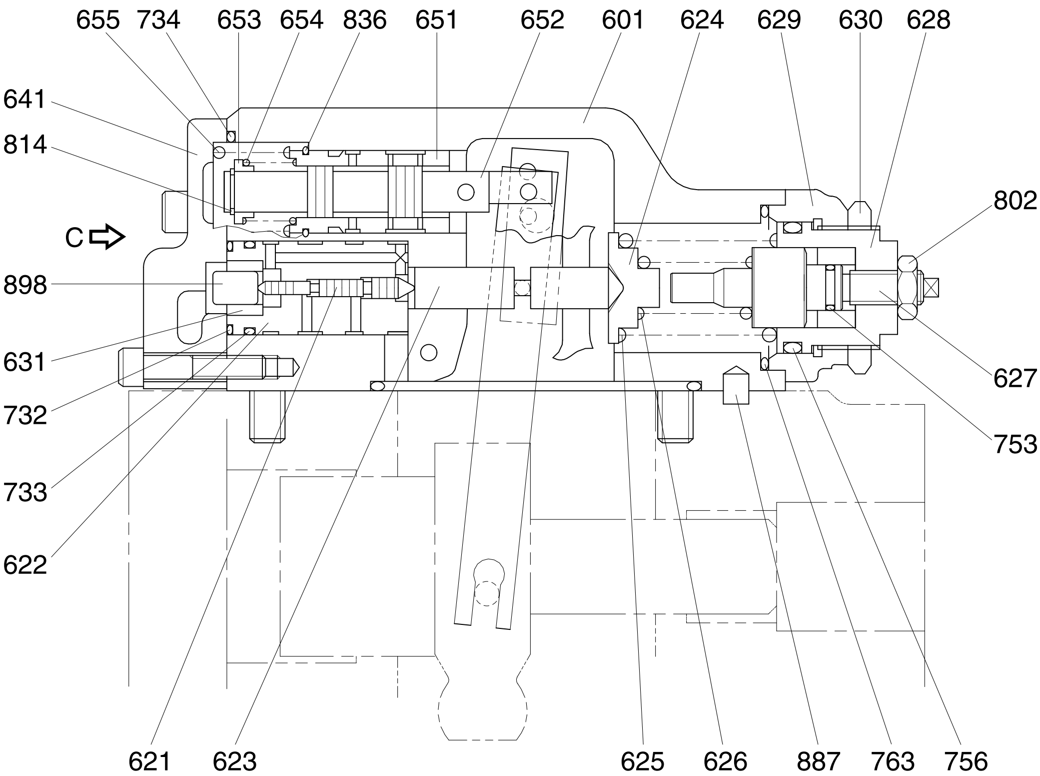


VIEW C

Port	Port name	Port size
Pi	Pilot port	PF 1/4 - 15
Psv	Servo assist port	PF 1/4 - 15
P2	Companion delivery port	-
Pf	Powershift port	-

48092RG01

REGULATOR(2/2)



SECTION A-A

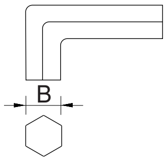
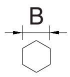
48092RG02

408	Hexagon socket screw	626	Inner spring	728	O-ring
412	Hexagon socket screw	627	Adjust stem (C)	730	O-ring
413	Hexagon socket screw	628	Adjust screw (C)	732	O-ring
436	Hexagon socket screw	629	Cover (C)	733	O-ring
438	Hexagon socket screw	630	Lock nut	734	O-ring
466	Plug	631	Sleeve, pf	735	O-ring
496	Plug	641	Pilot cover	753	O-ring
497	Plug	643	Pilot piston	755	O-ring
541	Seat	644	Spring seat (Q)	756	O-ring
543	Stopper	645	Adjust stem (Q)	763	O-ring
545	Steel ball	646	Pilot spring	801	Nut
601	Casing	651	Sleeve	802	Nut
611	Feed back lever	652	Spool	814	Snap ring
612	Lever (1)	653	Spring seat	836	Snap ring
613	Lever (2)	654	Return spring	858	Snap ring
614	Center plug	655	Set spring	874	Pin
615	Adjust plug	696	Port cover	875	Pin
621	Compensator piston	697	Check valve plate	876	Pin
622	Piston case	708	O-ring	887	Pin
623	Compensator rod	722	O-ring	897	Pin
624	Spring seat (C)	724	Square ring	898	Pin
625	Outer spring	725	O-ring	924	Set screw

6) TOOLS AND TIGHTENING TORQUE

(1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the follow list.

<table>
<tr><th colspan="2">Tool name & size</th><th colspan="12">Part name</th></tr>
<tr><td>Name</td><td>B</td><td colspan="3">Hexagon socket head bolt</td><td colspan="3">PT plug (PT thread)</td><td colspan="3">PO plug (PF thread)</td><td colspan="3">Hexagon socket head setscrew</td></tr>
<tr><td rowspan="3">Allen wrench </td><td>4</td><td colspan="3">M 5</td><td colspan="3">BP-1/16</td><td colspan="3">-</td><td colspan="3">M 8</td></tr>
<tr><td>5</td><td colspan="3">M 6</td><td colspan="3">BP1/ 8</td><td colspan="3">-</td><td colspan="3">M10</td></tr>
<tr><td>6</td><td colspan="3">M 8</td><td colspan="3">BP-1/ 4</td><td colspan="3">PO-1/4</td><td colspan="3">M12, M14</td></tr>
<tr><td rowspan="2">Double ring spanner, socket wrench, double (single) open end spanner </td><td>-</td><td colspan="4">Hexagon head bolt</td><td colspan="4">Hexagon nut</td><td colspan="4">VP plug (PF thread)</td></tr>
<tr><td>6</td><td colspan="4">M 8</td><td colspan="4">M 8</td><td colspan="4">-</td></tr>
<tr><td colspan="2">Adjustable angle wrench</td><td colspan="12">Small size, Max 36 mm</td></tr>
<tr><td colspan="2">Screw driver</td><td colspan="12">Minus type screw driver, Medium size, 2 sets</td></tr>
<tr><td colspan="2">Hammer</td><td colspan="12">Plastic hammer, 1 set</td></tr>
<tr><td colspan="2">Pliers</td><td colspan="12">For snap ring, TSR-160</td></tr>
<tr><td colspan="2">Steel bar</td><td colspan="12">4×100 mm</td></tr>
<tr><td colspan="2">Torque wrench</td><td colspan="12">Capable of tightening with the specified torques</td></tr>
<tr><td colspan="2">Pincers</td><td colspan="12">-</td></tr>
<tr><td colspan="2">Bolt</td><td colspan="12">M4, Length : 50 mm</td></tr>
</table>

(2) Tightening torque

Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt Material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.0	116	0.47	12
	M16	24.0	174	0.55	14
	M18	34.0	246	0.55	14
	M20	44.0	318	0.67	17
PT Plut(Materal : S45C) ※Wind a seal tape 1 1/2 to 2 turns round the plug	PT1/16	0.7	5.1	0.16	4
	PT 1/8	1.05	7.59	0.20	5
	PT 1/4	1.75	12.7	0.24	6
	PT 3/8	3.5	25.3	0.31	8
	PT 1/2	5.0	36.2	0.39	10
PF Plut(Materal : S35C)	PF 1/4	3.0	21.7	0.24	6
	PF 1/2	10.0	72.3	0.39	10
	PF 3/4	15.0	109	0.55	14
	PF 1	19.0	137	0.67	17
	PF 1 1/4	27.0	195	0.67	17
	PF 1 1/2	28.0	203	0.67	17

3) DISASSEMBLY

Since the regulator consists of small precision finished parts, disassembly and assembly are rather complicated.

For this reason, replacement of a regulator assembly is recommended, unless there is a special reason, but in case disassembly is necessary for an unavoidable reason, read through this manual to the end before starting disassembly.

(1) Choose a place for disassembly.

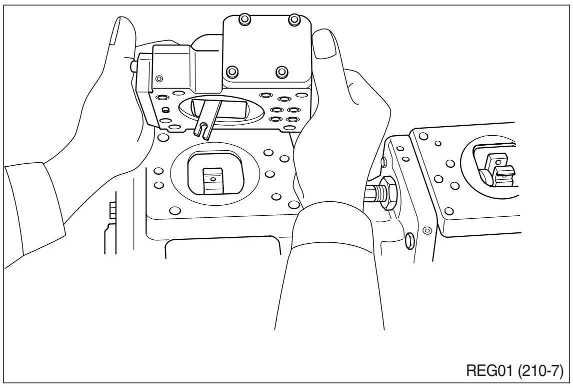
※ Choose a clean place.

※ Spread rubber sheet, cloth, or so on on top of work-bench to prevent parts from being damaged.

(2) Remove dust, rust, etc. from surfaces of regulator with clean oil.

(3) Remove hexagon socket head screw (412, 413) and remove regulator main body from pump main body.

※ Take care not to lose O-ring.



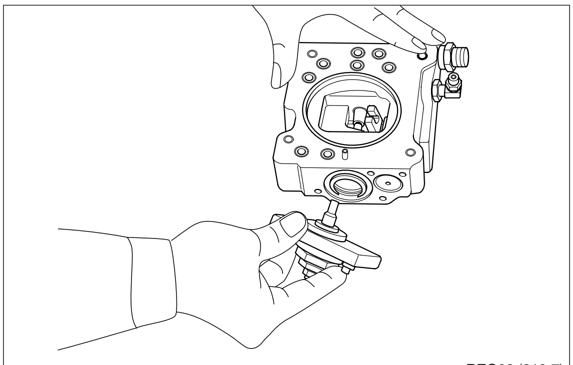
REG01 (210-7)

(4) Remove hexagon socket head screw (438) and remove cover (C,629)

※ Cover (C) is fitted with adjusting screw (C,QI) (628), adjusting ring (C, 627), lock nut (630), hexagon nut (801) and adjusting screw (924).

Do not loosen these screws and nuts.

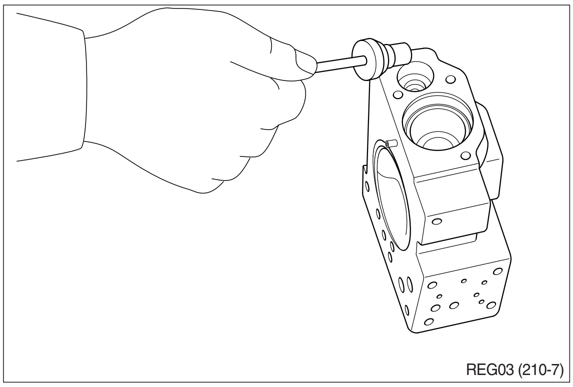
If they are loosened, adjusted pressure-flow setting will vary.



REG02 (210-7)

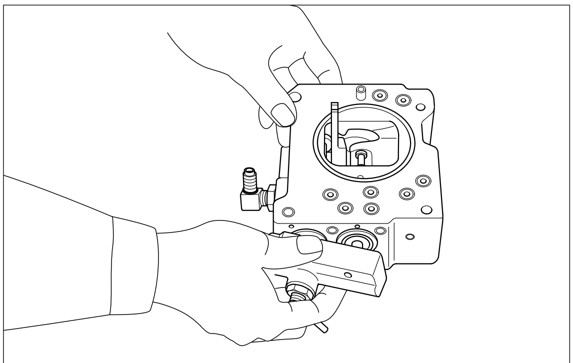
(5) After removing cover (C, 629) subassembly, take out outer spring (625), inner spring (626) and spring seat (C, 624) from compensating section.
Then draw out adjusting ring (Q, 645), pilot spring (646) and spring seat (644) from pilot section.

※ **Adjusting ring (Q,645) can easily be drawn out with M4 bolt.**



REG03 (210-7)

(6) Remove hexagon socket head screws (436, 438) and remove pilot cover (641).
After removing pilot cover, take out set spring (655) from pilot section.

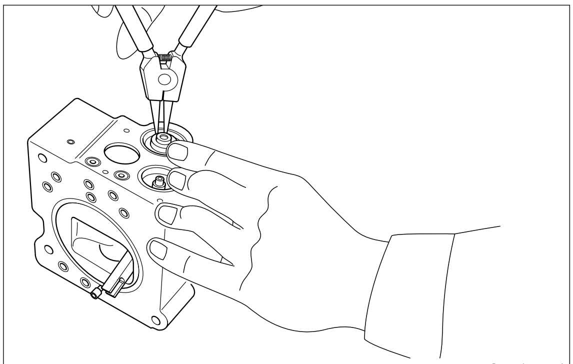


REG04 (210-7)

(7) Remove snap ring (814) and take out spring seat (653), return spring (654) and sleeve (651).

※ **Sleeve (651) is fitted with snap ring (836).**

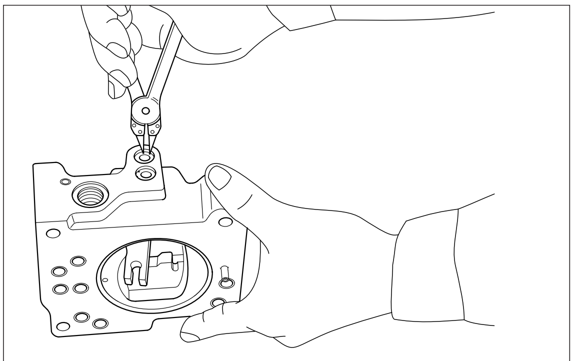
※ **When removing snap ring (814), return spring (654) may pop out.
Take care not to lose it.**



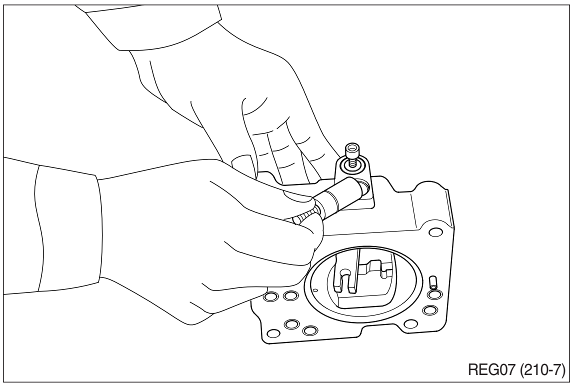
REG05 (210-7)

(8) Remove locking ring (858) and take out fulcrum plug (614) and adjusting plug (615).

※ **Fulcrum plug (614) and adjusting plug (615) can easily be taken out with M6 bolt.**

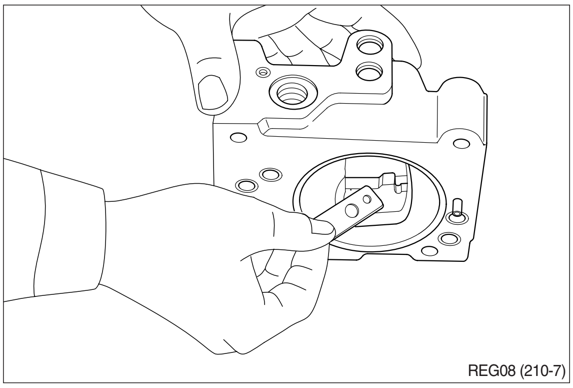


REG06 (210-7)


REG07 (210-7)

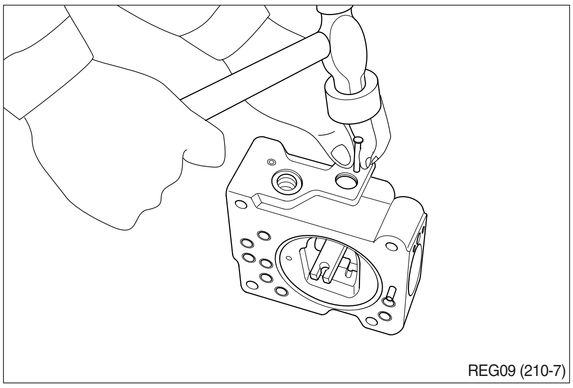
(9) Remove lever 2 (613). Do not draw out pin (875).

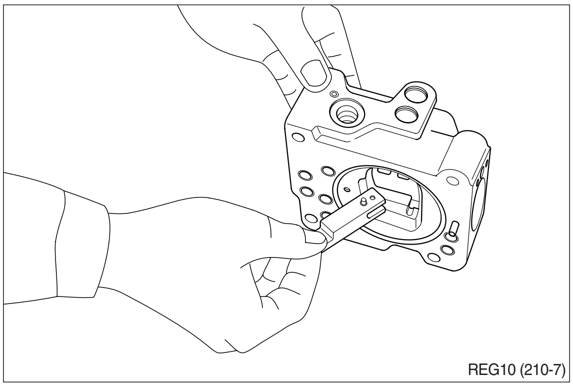
※ Work will be promoted by using pincers or so on.


REG08 (210-7)

(10) Draw out pin (874) and remove feedback lever (611).

Push out pin (874, 4 mm in dia.) from above with slender steel bar so that it may not interfere with lever 1 (612).


REG09 (210-7)


REG10 (210-7)

(11) Remove lever (1, 612). Do not draw out pin (875).

(12) Draw out pilot piston (643) and spool (652).

(13) Draw out piston case (622), compensating piston (621) and compensating rod (623).

※ Piston case (622) can be taken out by pushing compensating rod (623) at opposite side of piston case.

This completes disassembly.

4) ASSEMBLY

(1) For assembly, reverse disassembly procedures, but pay attention to the following items.

① Always repair parts that were scored at disassembly.

② Get replacement parts ready beforehand.
Mixing of foreign matter will cause malfunction.
Therefore, wash parts well with cleaning oil, let them dry with jet air and handle them in clean place.

③ Always tighten bolts, plugs, etc. to their specified torques.

④ Do not fail to coat sliding surfaces with clean hydraulic oil before assembly.

⑤ Replace seals such as O-ring with new ones as a rule.

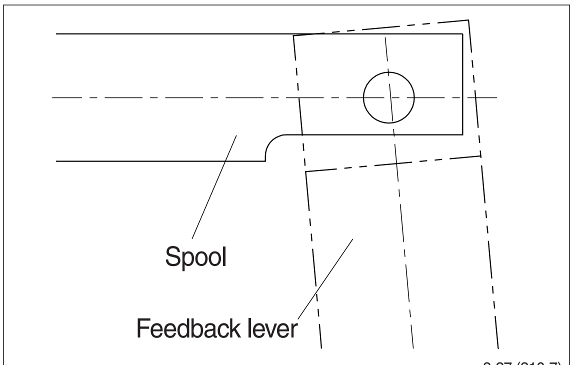
(2) Put compensating rod (623) into compensating hole of casing (601).

(3) Put pin force-fitted in lever 1 (612) into groove of compensating rod and fit lever 1 to pin force-fitted in casing.

(4) Fit spool (652) and sleeve (651) into hole in spool of casing.

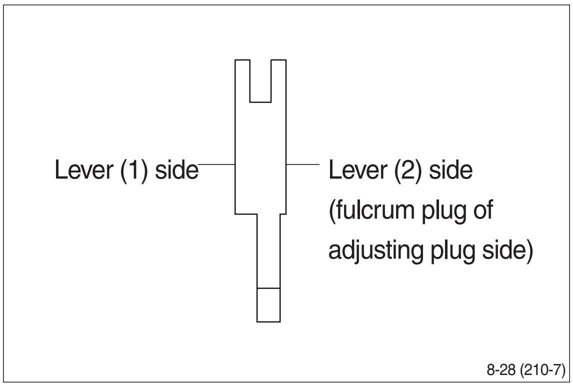
※ Confirm that spool and sleeve slide smoothly in casing without binding.

※ Pay attention to orientation of spool.



8-27 (210-7)

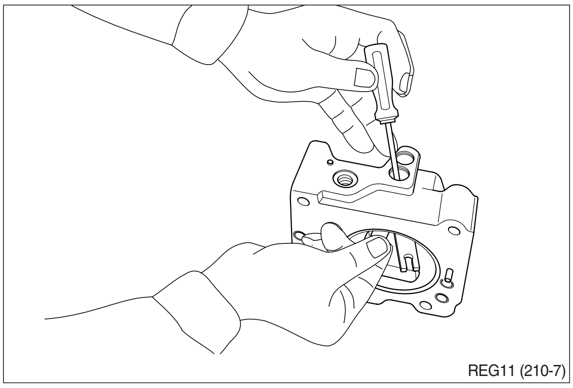
(5) Fit feedback lever (611), matching its pin hole with pin hole in spool.
Then insert pin (874).
※ Insert pin in feedback lever a little to ease operation.
※ Take care not to mistake direction of feedback lever.



8-28 (210-7)

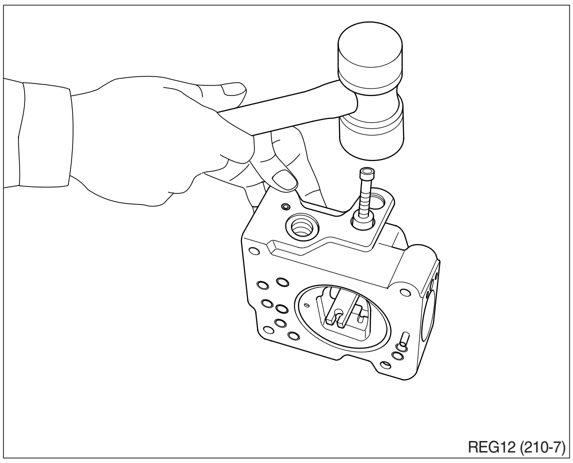
(6) Put pilot piston (643) into pilot hole of casing.
※ Confirm that pilot piston slides smoothly without binding.

(7) Put pin force-fitted in lever 2 (613) into groove of pilot piston.
Then fix lever (2).

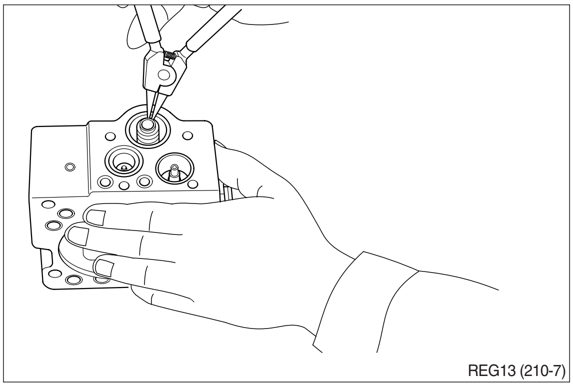

REG11 (210-7)

(8) Fit fulcrum plug (614) so that pin force-fitted in fulcrum plug (614) can be put into pin hole of lever 2.
Then fix locking ring (858).

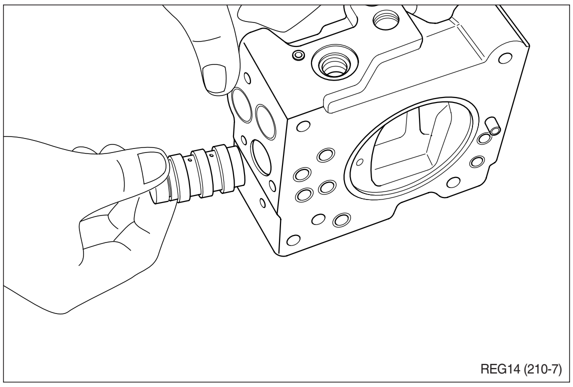
(9) Insert adjusting plug (615) and fit locking ring.
※ Take care not to mistake inserting holes for fulcrum plug and adjusting plug.
At this point in time move feedback lever to confirm that it has no large play and is free from binding.


REG12 (210-7)

(10) Fit return spring (654) and spring seat (653) into spool hole and attach snap ring (814).

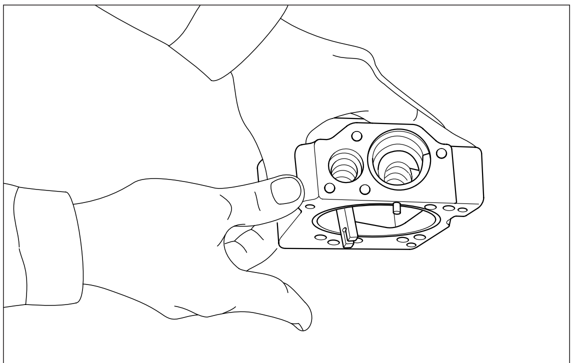

REG13 (210-7)

(11) Fit set spring (655) to spool hole and put compensating piston (621) and piston case (622) into compensating hole.
Fit pilot cover (641) and tighten it with hexagonal socket head screws (436, 438).



REG14 (210-7)

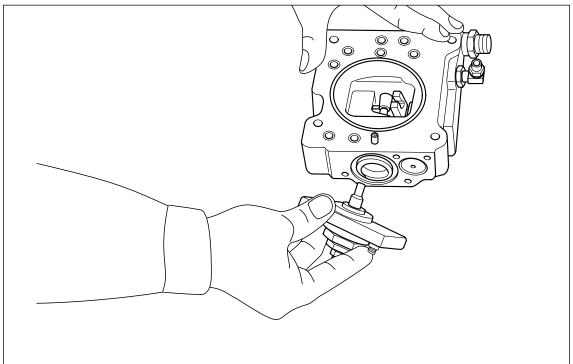
(12) Put spring seat (644), pilot spring (646) and adjusting ring (Q, 645) into pilot hole.
Then fix spring seat (624), inner spring (626) and outer spring (625) into compensating hole.
※ When fitting spring seat, take care not to mistake direction of spring seat.



REG15 (210-7)

(13) Install cover (C, 629) fitted with adjusting screws (628, 925), adjusting ring (C, 627), lock nut (630), hexagon nut (802) and adjusting screw (924).
Then tighten them with hexagonal socket head screws (438).

This completes assembly.



REG16 (210-7)

GROUP 4 MAIN CONTROL VALVE

1. REMOVAL AND INSTALL

1) REMOVAL


13031GE18

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

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

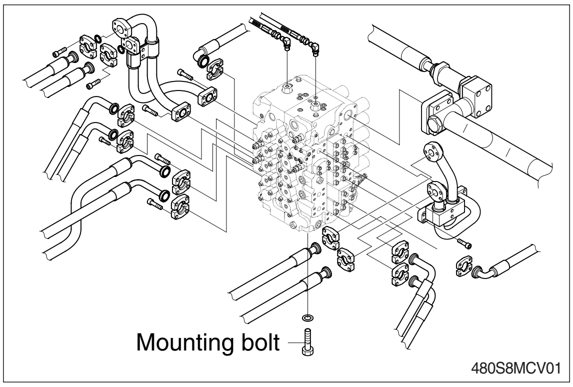
(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

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

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

(5) Remove bolts and disconnect pipe.



480S8MCV01

(6) Disconnect pilot line hoses.

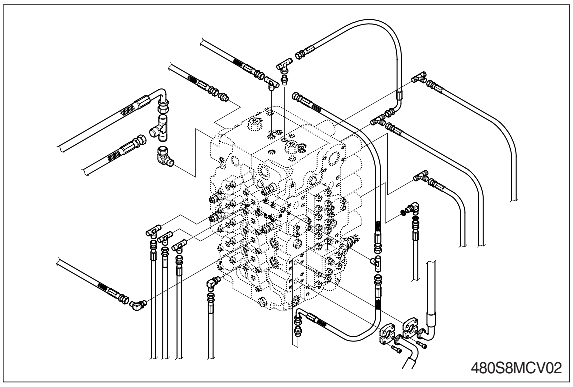
(7) Disconnect pilot piping.

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

· Weight : 420 kg (930 lb)

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

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


480S8MCV02

2) INSTALL

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

(2) Bleed the air from below items.

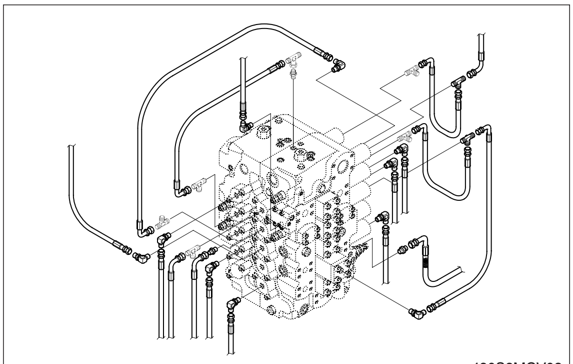
① Cylinder (boom, arm, bucket)

② Swing motor

③ Travel motor

※ See each item removal and install.

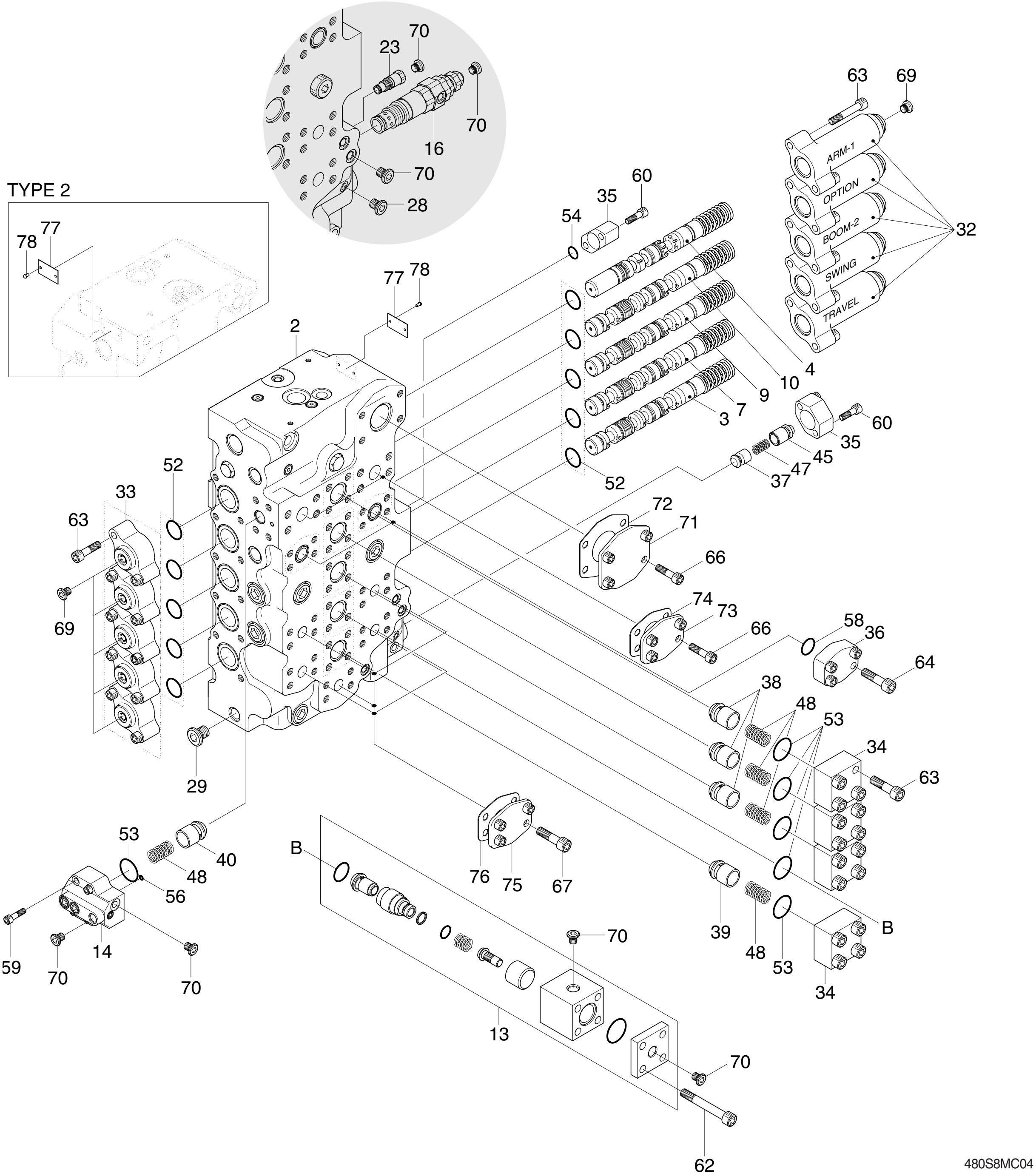
(3) Confirm the hydraulic oil level and recheck the hydraulic oil leak or not.


480S8MCV03

2. STRUCTURE (1/3)

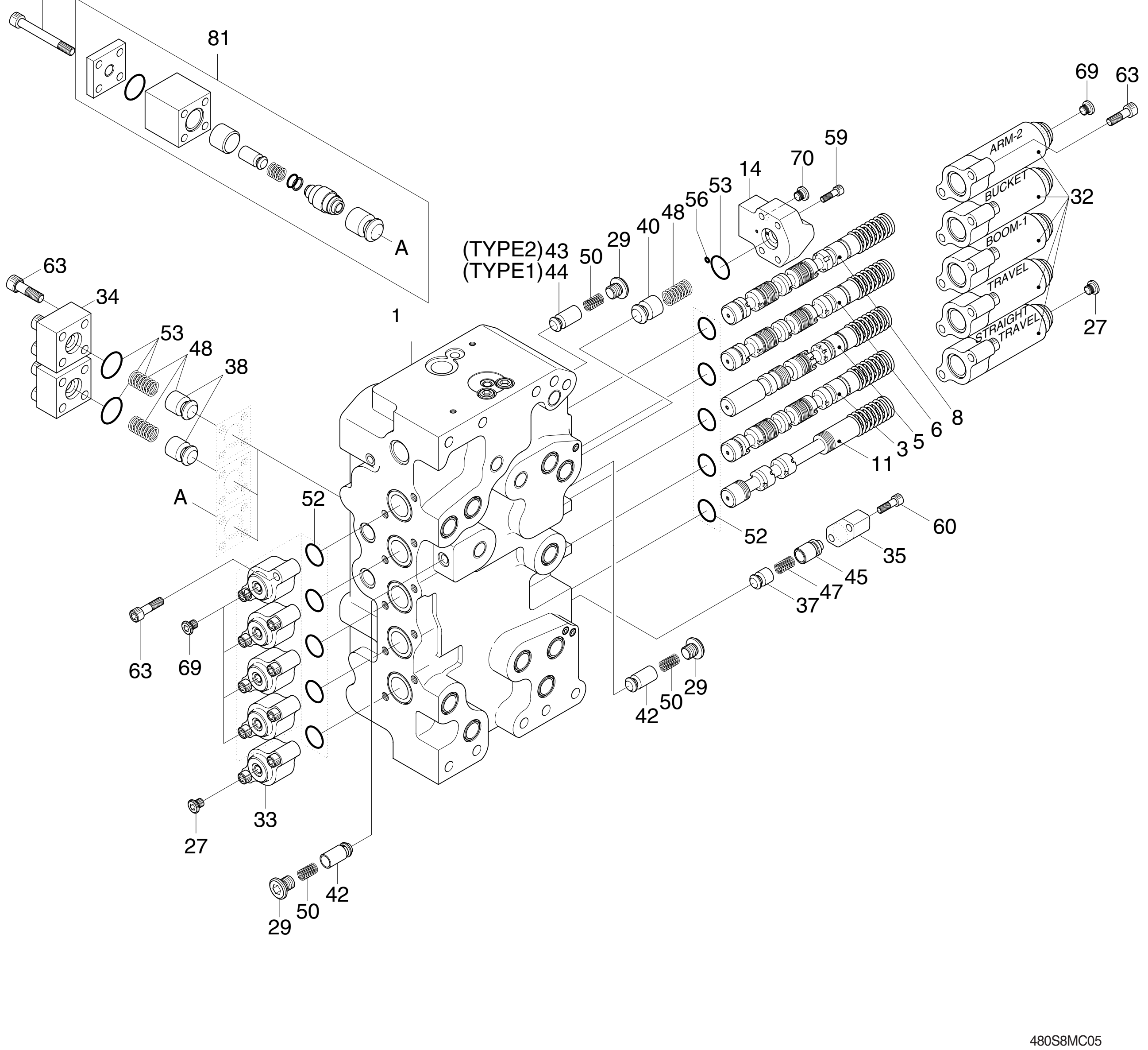
12	Bypass cut 1 spool kit	28	Plug	57	O-ring
15	Arm regen cut assy	29	Plug	61	Socket bolt
17	Port relief valve	30	Plug	65	Socket bolt
18	Port relief valve	31	Plug	66	Socket bolt
19	Port relief valve	41	Poppet	67	Socket bolt
20	Port relief valve	43	Poppet	68	Bypass cut spring seat
21	Port relief valve	46	Spring	70	Dust cap
22	Negacon relief valve	49	Spring	73	Cover
24	Bypass plug assy	50	Spring	74	Gasket
25	Plug	51	Plug	75	Cover
26	Plug	55	O-ring	76	Gasket
27	Plug	56	O-ring		

STRUCTURE (2/3)



2	P2 housing	35	Main relief flange	60	Socket bolt
3	Travel spool kit	36	Option flange	62	Socket bolt
4	Arm 1 spool kit	37	Main relief poppet	63	Socket bolt
7	Swing spool kit	38	Load check poppet	64	Socket bolt
9	Boom 2 spool kit	39	Load check poppet	66	Socket bolt
10	Option spool kit	40	Main holding poppet	67	Socket bolt
13	Swing logic valve	45	Main relief spacer assy	69	Dust cap
14	Holding valve	47	Main relief spring	70	Dust cap
16	Main relief valve	48	Load check spring	71	Cover
23	Signal plug assy	52	O-ring	72	Gasket
28	Plug	53	O-ring	73	Cover
29	Plug	54	O-ring	74	Gasket
32	Pilot cap-large	56	O-ring	75	Cover
33	Pilot cap-small	58	O-ring	76	Gasket
34	Load lock flange	59	Socket bolt	77	Name plate
				78	Rivet

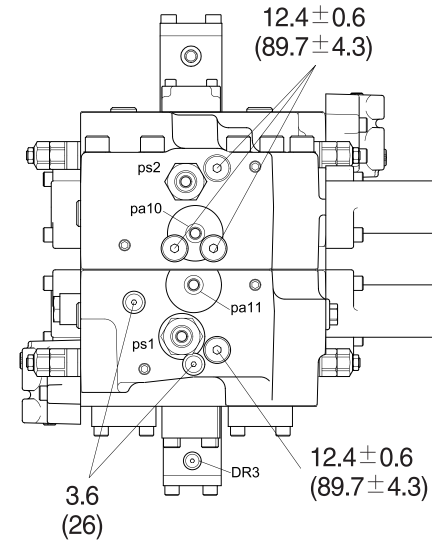
STRUCTURE (3/3)

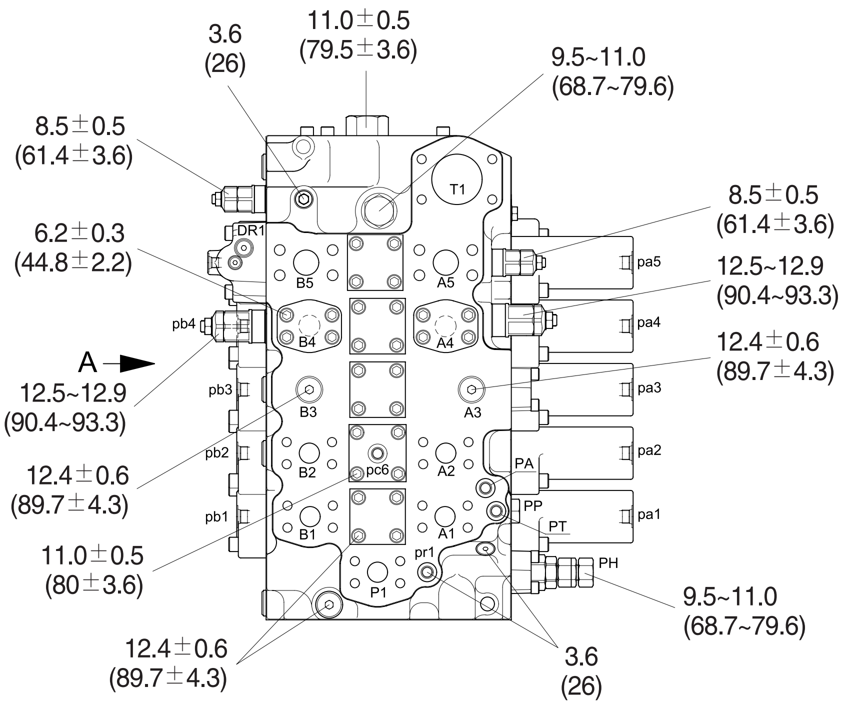


1	P1 housing	34	Load check flange	50	Spring
3	Travel spool kit	35	Main relief flange	52	O-ring
5	Boom 1 spool kit	37	Main relief poppet	53	O-ring
6	Bucket spool kit	38	Load check poppet	56	O-ring
8	Arm 2 spool kit	40	Main H/D poppet	59	Socket bolt
11	Straight travel spool kit	42	Poppet	60	Socket bolt
14	Holding valve	43	Poppet	62	Socket bolt
27	Plug	44	Poppet	63	Socket bolt
29	Plug	45	Main relief spacer assy	69	Dust cap
32	Pilot cap-large	47	Main relief spring	70	Dust cap
33	Pilot cap-small	48	Load check spring	81	Boom logic valve

3. TIGHTENING TORQUE (1/2)

※ Unit : kgf · m (lbf · ft)

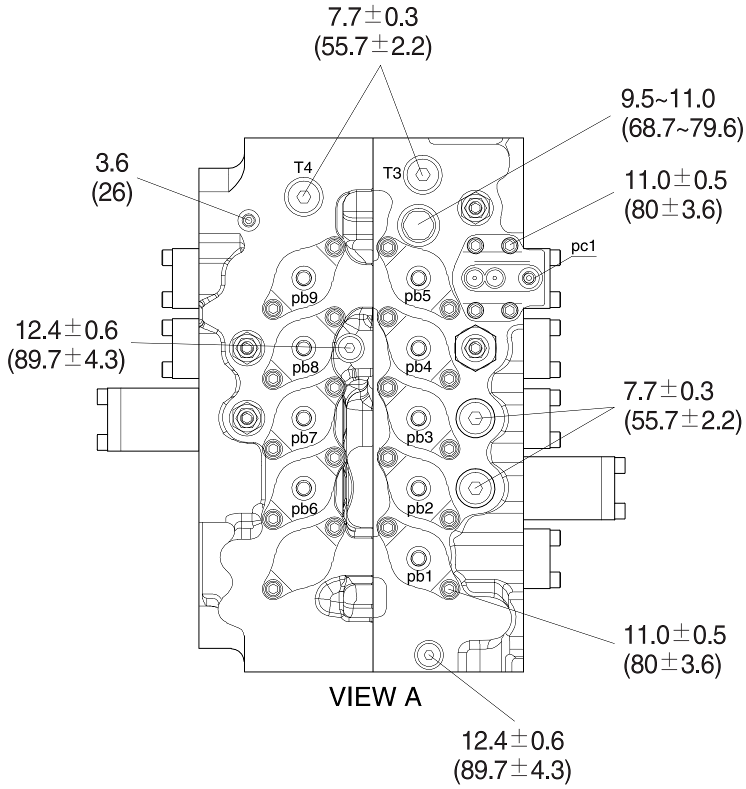




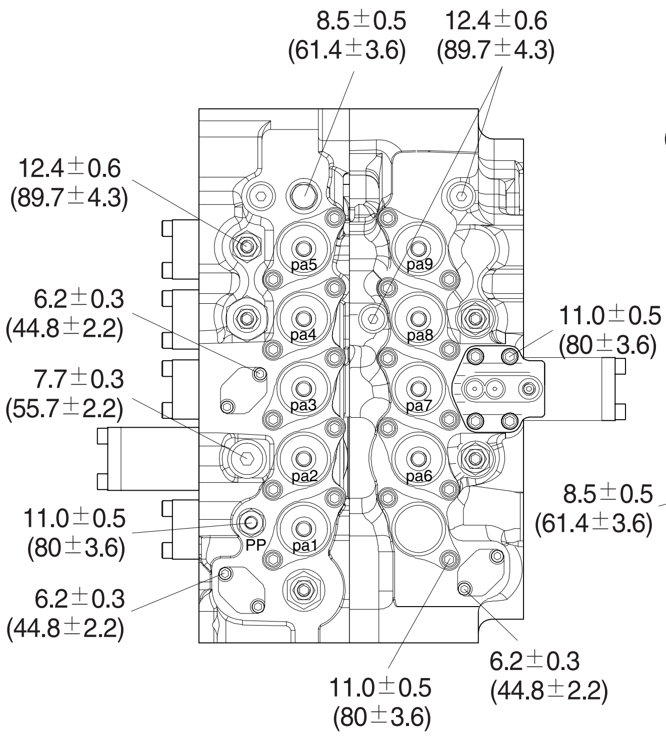
480S8MV07

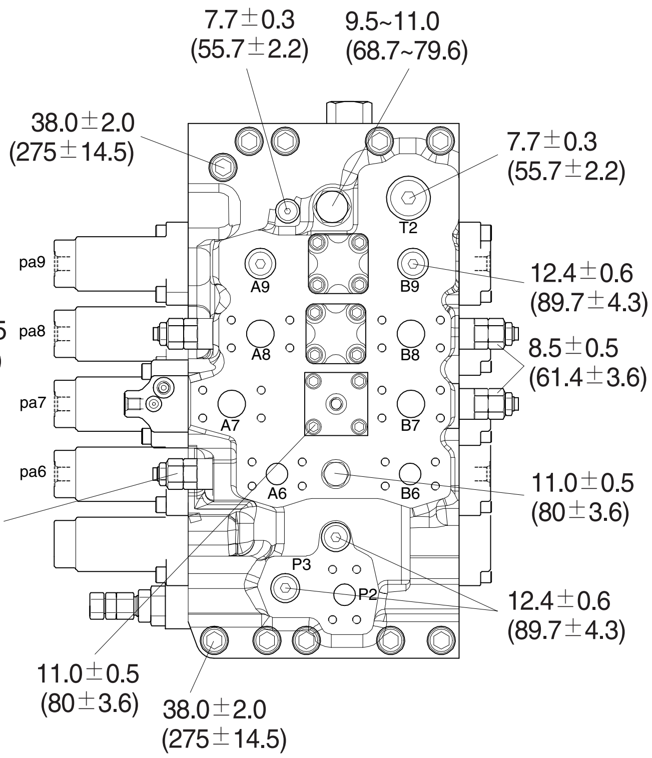
TIGHTENING TORQUE (2/2)

※ Unit : kgf · m (lbf · ft)



VIEW A





480S8MV08

4. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

(1) All hydraulic components are manufactured to a high precision. Consequently, before disassembling and assembling them, it is essential to select an especially clean place.

(2) In handling a control valve, pay full attention to prevent dust, sand, etc. from entering into it.

(3) When a control valve is to be remove from the machine, apply caps and masking seals to all ports. Before disassembling the valve, recheck that these caps and masking seals are fitted completely, and then clean the outside of the assembly. Use a proper bench for working. Spread paper or a rubber mat on the bench, and disassemble the valve on it.

(4) Support the body section carefully when carrying or transferring the control valve. Do not lift by the exposed spool, end cover section etc.

(5) After disassembling and assembling of the component it is desired to carry out various tests (for the relief characteristics, leakage, flow resistance, etc.), but the hydraulic test equipment is necessary for these tests. Therefore, even when its disassembling can be carried out technically, do not disassemble such components that cannot be tested, adjusted, and so on. Additionally one should always prepare clean cleaning oil, hydraulic oil, grease, etc. beforehand.

2) DISASSEMBLY

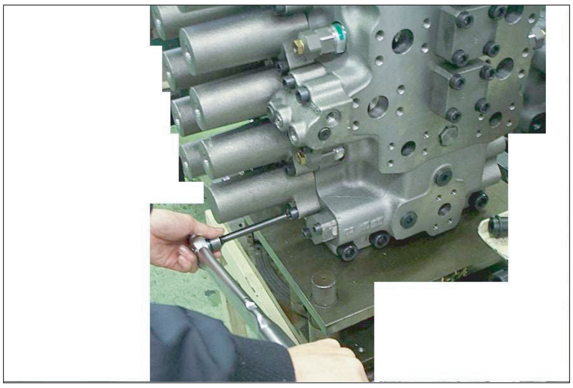
The figure in ( ) shown after the part name in explanation sentence shows its number in the construction figures.

(1) Place control valve on working bench

※ Disassemble the valve in a clean and dry environment and pay careful attention not to damage the sealing flange faces.

(2) Main spool

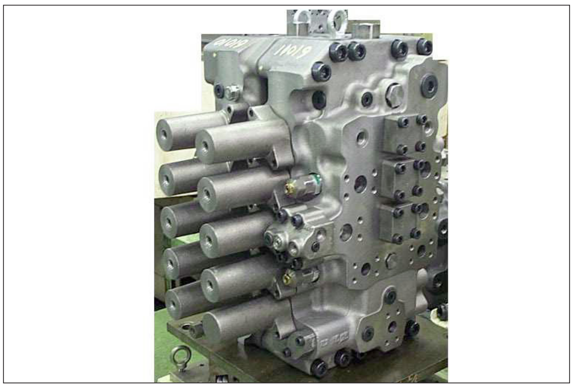
① Loosen socket head bolts (63) and remove the pilot cap (32).
Pull out O-ring (52) from valve housing.



45078MC07

② Remove all spool (3~11) of subassembly itself from valve housing.

※ Be careful not to be damaged while pulling out spools. Identify them with a tag to prevent from being mistaken at disassembly.



45078MC08

③ Spools sub assy (3, 4, 5, 6, 7, 8, 9, 10, 11).

45078MC10

④ Spool sub assy (5).

45078MC11

⑤ Spool sub assy (4).

※ When disassemble the spool assembly, fix the spool with vise. On this occasion attach wood between vise blades to prevent the spool from damaging.

※ Heat the outer race of spool with industrial drier and then loosen easily. (Temperature : 200~250˚C)

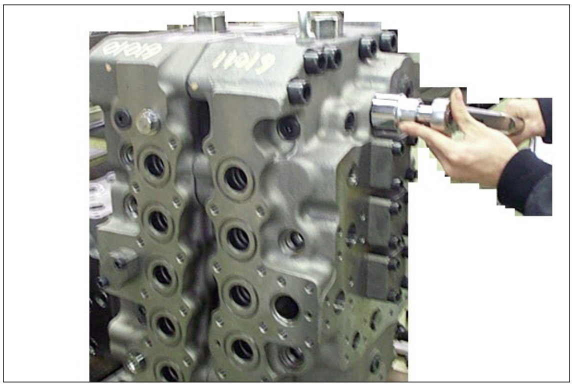
45078MC12

⑥ Loosen the socket head bolt (63) and remove the small pilot cap (33). Pull out O-ring (14) from valve housing.

45078MC09

(3) Center bypass cut spool assy (12)

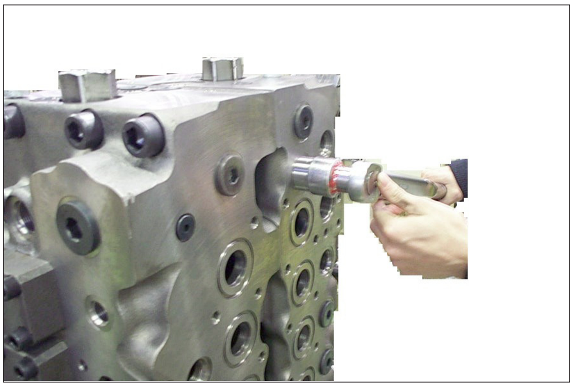
① Loosen the plug (24) and remove spring (46), spring seat (68) and the spool (12).



45078MC13

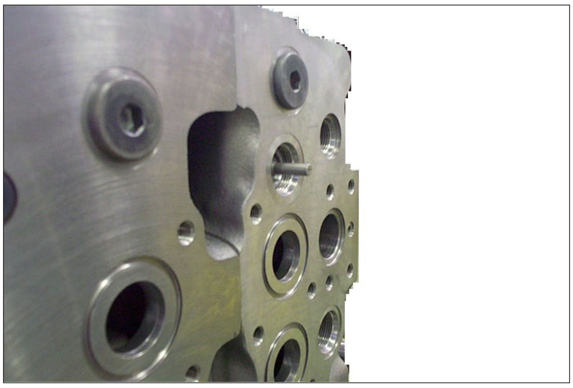
(4) Arm1 regeneration spool assy (15)

① Loosen the plug and pull out O-ring.



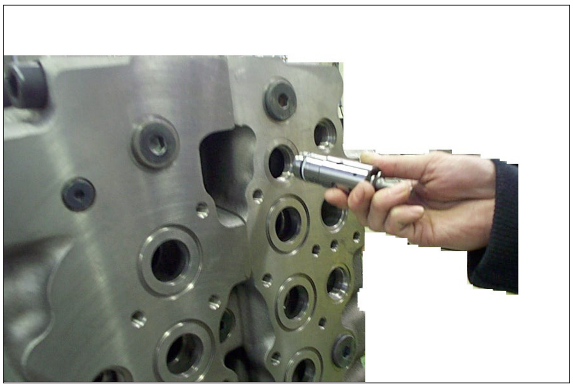
45078MC15

② Disassemble spring, spring seat and spool.



45078MC16

③ Pull out sleeve of hole inside at same time, disassemble sleeve and piston.



45078MC18

(5) General precautions

Clean all disassembled parts with clean mineral oil fully, and dry them with compressed air. Then, place them on clean papers or cloths for inspection.

① Control valve

a. Check whole surfaces of all parts for burrs, scratches, notches and other defects.

b. Confirm that seal groove faces of casing and block are smooth and free of dust, dent, rust etc.

c. Correct dents and damages and check seat faces within the casing, if any, by lapping.

※ Pay careful attention not to leave any lapping agent within the casing.

d. Confirm that all sliding and fitting parts can be moved manually and that all grooves and paths are free from foreign matter.

e. If any spring is broken or deformed, replace it with new one.

f. When a relief valve does not function properly, repair it, following the prescribed disassembly and assembly procedures.

g. Replace all seals and O-rings with new ones.

② Relief valve

a. Confirm that all seat faces at ends of all poppets and seats are free of defects and show uniform and consistent contact faces.

b. Confirm manually that main poppet and seat can slide lightly and smoothly.

c. Confirm that outside face of main poppet and inside face of seat are free from scratches and so on.

d. Confirm that springs are free from breakage, deformation, and wear.

e. Confirm that orifices of main poppet and seat section are not clogged with foreign matter.

f. Replace all O-rings with new ones.

g. When any light damage is found in above inspections, correct it by lapping.

h. When any abnormal part is found, replace it with a completely new relief valve assembly.

3) ASSEMBLY

(1) General comments

① In this assembly section, explanation only is shown.
For further understanding, please refer to the figures and photographs shown in the previous disassembly section.

② Figure in ( ) shown after the part name in the explanation refers to the reference identity number shown on the construction figure shown in the spares section.

③ Cautions in assembling seal

a. Pay close attention to keeping all seals free from handling damage and inspect carefully for damage before using them.

b. Apply clean grease or hydraulic oil to the seal so as to ensure it is fully lubricated before assembly.

c. Do not stretch seals so much as to deform them permanently.

d. In fitting O-rings, pay close attention not to roll them into their final position in addition, a twisted O-ring cannot easily untwist itself naturally and could thereby cause inadequate sealing and thereby both internal and external oil leakage.

e. Tighten fitting bolts for all sections with a torque wrench adjusted to the respective tightening torque as shown on the corss section drawings of the spares section.

(2) Main spool

① Apply loctite to thread of spools (3, 4, 5, 6, 7, 8, 9, 10, 11) and assemble spring seat, spring and spool end. Assemble spool end to spool after fixing spool with a vise attached wood.

※ Be careful not to applying loctite too much.

· Tightening torque : 2.5 ~ 2.7 kgf · m (18.1 ~ 19.5 lbf · ft)

Fit O-ring into housing and assemble spools (3, 4, 5, 6, 7, 8, 9, 10, 11) into housing.

Assemble lock cap on housing and tighten hex socket bolt.

· Tightening torque : 11±0.5 kgf · m (79.7±3.7 lbf · ft)

② Insert poppet, spring into spool (5) and then apply loctite to thread of spool.

Fit O-ring and backup ring on the plug and then tighten plug.

Assemble spring seat, spring, and spool end and then assemble spool end sub assy to spool after fixing spool with a vise attached wood.

· Tightening torque : 2.5 ~ 2.7 kgf · m (18.1 ~ 19.5 lbf · ft)

Fit O-ring into housing and assemble spool (5) into housing.

Assemble lock cap on housing and tighten hex socket bolt.

· Tightening torque : 11±0.5 kgf · m (79.7±3.7 lbf · ft)

③ Insert poppet, spring into spool (4) and then apply loctite to thread for spool.

Fit O-ring and backup ring on the plug and then tighten plug.

Assemble spring seat, spring, and spool end and then assemble spool end sub assy to spool after fixing spool with a vise attached wood.

· Tightening torque : 2.5 ~ 2.7 kgf · m (18.1 ~ 19.5 lbf · ft)

Fit O-ring into housing and assemble spool (4) into housing.

Assemble lock cap on housing and tighten hex socket bolt.

· Tightening torque : 2.5±2.7 kgf · m (18.1±19.5 lbf · ft)

④ Assemble short cap on housing and tighten hex socket bolt.

· Tightening torque : 11±0.5 kgf · m (79.7±3.7 lbf · ft)

(3) Center bypass cut spool assy (12)

① Apply loctite to thread of spool, assemble spool end to spool.

※ Be careful not to appling loctite too much.

② Assemble spool assy, spring seat, spring and tighten plug with O-ring.

· Tightening torque : 9.5 ~ 11.0 kgf · m (68.6 ~ 79.7 lbf · ft)

(4) Arm1 regeneration spool assy (15)

① Assemble backup rings and O-rings to sleeve respectively.

② Assemble piston to sleeve which seal is assemble, and insert spool into sleeve.

③ Assemble spool assy, spring seat, spring and tighten plug with O-ring.

· Tightening torque : 9.5 ~ 11.0 kgf · m (68.6 ~ 79.7 lbf · ft)

GROUP 5 SWING DEVICE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

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

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

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

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

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

13031GE18

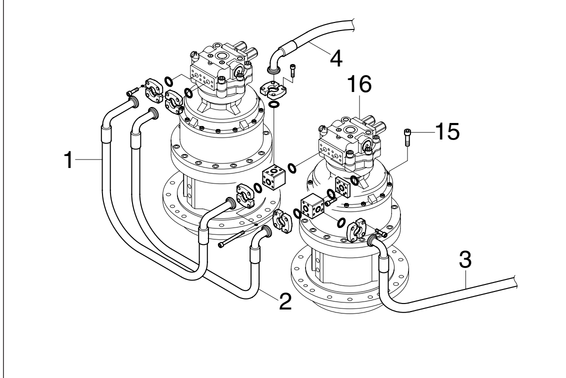
(4) Disconnect hose assembly (1, 2, 3, 4).

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

(6) Sling the swing motor assembly (16) and remove the swing motor mounting socket bolts (15).

· Motor device weight : 61 kg (135 lb)

· Tightening torque : 8.27 ± 1.7 kgf · m (59.8 ± 12.3lbf · ft)



480S8SM01

(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.

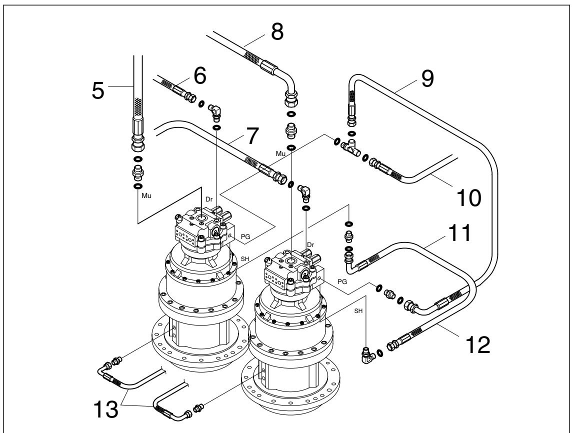
② Pour in hydraulic oil until it overflows from the port.

③ Tighten plug lightly.

④ Start the engine, run at low idling and check oil come out from plug.

⑤ Tighten plug fully.

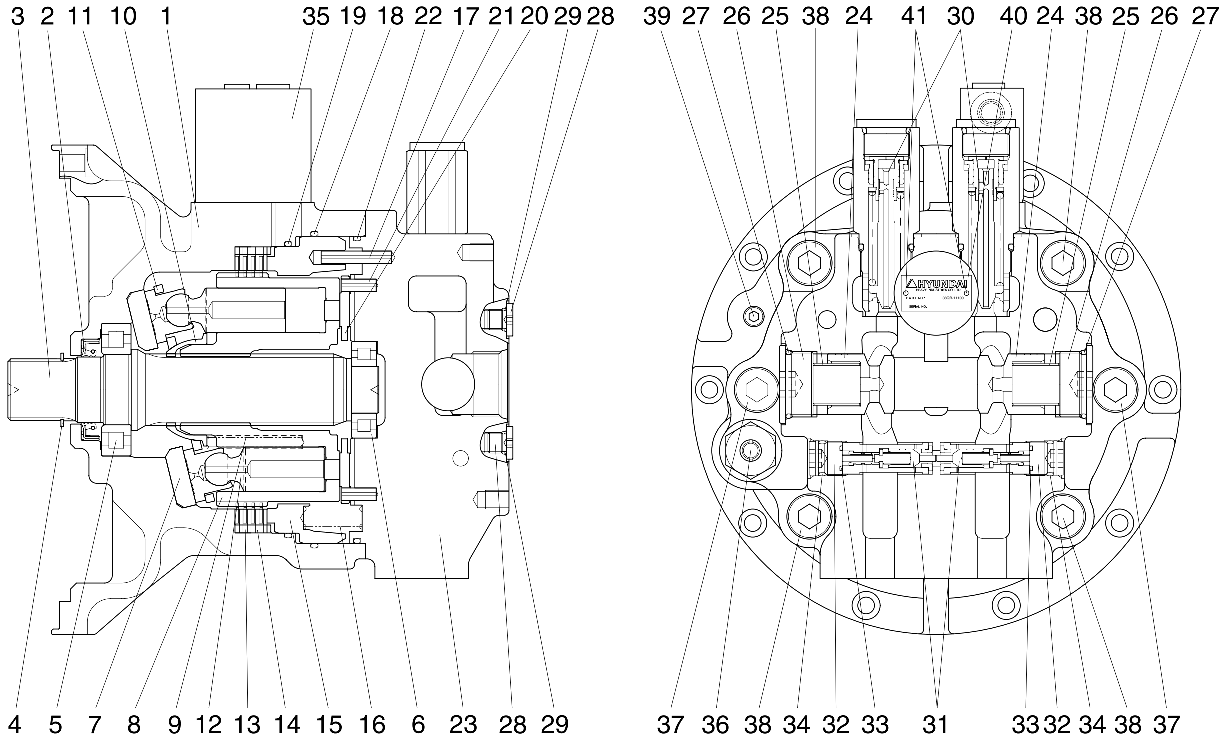
(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.



480S8SM02

2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



480S2SM02

1	Casing	15	Parking piston	29	O-ring
2	Oil seal	16	Brake spring	30	Relief valve assy
3	Shaft	17	Spring pin	31	Reactionless valve assy
4	Snap ring	18	O-ring	32	Plug
5	Cylinder roller bearing	19	O-ring	33	O-ring
6	Cylinder needle bearing	20	Valve plate	34	O-ring
7	Swash plate	21	Spring pin	35	Time delay valve assy
8	Cylinder block	22	O-ring	36	Level gauge 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	Check valve spring	39	Plug
12	Piston assy	26	Plug	40	Name plate
13	Friction plate	27	O-ring	41	Rivet
14	Separate plate	28	Plug		

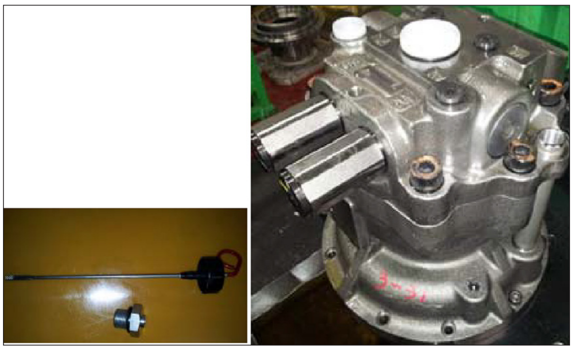
2) DISASSEMBLING

(1) Disassembly the sub of a turning axis

① Unloosing wrench bolt and disassemble time delay valve assy (35) from casing (1).

480L2SM10

② Disassemble level gauge (36) from casing (1).



480L2SM11

③ Hang buckles on valve casing (23) and unloose the bolt-hex (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

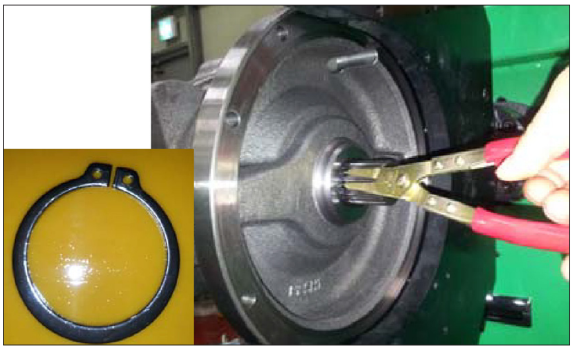
⑤ Take cylinder block sub assy (8), friction plates (13), seperated plates (14) out of casing (1) in order.

480L2SM14

⑥ Disassemble swash plate (7) from casing (1).

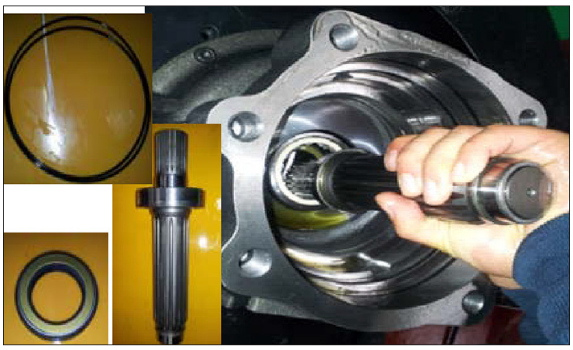
480L2SM15

⑦ Using a pair of pliers, take snap-ring out of casing (1).



480L2SM16

⑧ Disassemble shaft sub assy (3), oil seal (2), O-rings (18, 22) from casing (1).



480L2SM17

(2) Disassemble cylinder block assy

① Disassemble pistion assy (12) from cylinder block assy (8).

480L2SM18

② Disassemble ball guide (10) and springs (9) (cylinder block) from cylinder block assy (8).

· Ball guide × 1EA

· Spring × 9EA

480L2SM19

(3) Disassemble valve casing assy

① Take pin spring (17, 21), valve plate (20), O-ring (22) out of valve casing (23) in order.

480L2SM20

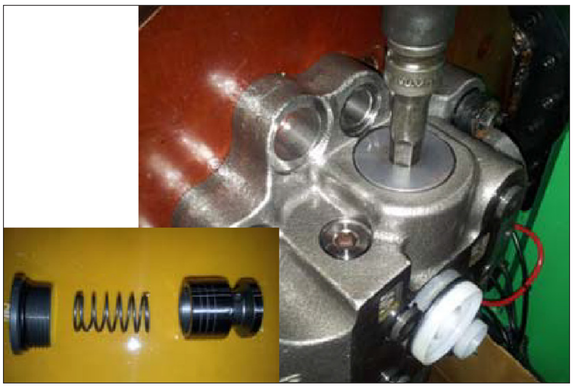
② Using a torque wrench, disassemble relief valve (30) from valve casing (23).

480L2SM21

③ Disassemble plug (32), O-rings (33, 34) and reactionless 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 is assembled on shaft with pressure.

480L2SM26

(2) Assemble the sub of cylinder block assy

① Put springs (9, cylinder block) on holes of cylinder block.

· Spring × 9EA

480L2SM27

② Put ball guide (10) on cylinder block (8).

· Ball guide × 1EA

480L2SM28

③ Assemble piston assy (12) with retainer plate (11).
· Piston assy × 9EA
· Retainer plate × 1EA

480L2SM29

④ Put ② and ③ together as one.

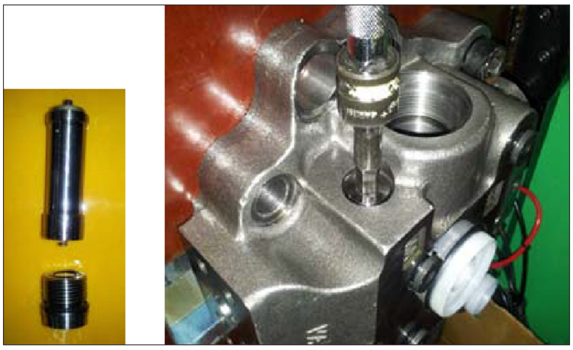
480L2SM30

(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 reactionless valve assy.
Assemble reactionless valve (31), O-ring (33, 34), and plug (32) into valve casing (23) in order.
· Reactionless valve assy (31) × 2EA
· Plug (32) × 2EA
· O-ring (33, 34) × 2EA



480L2SM32

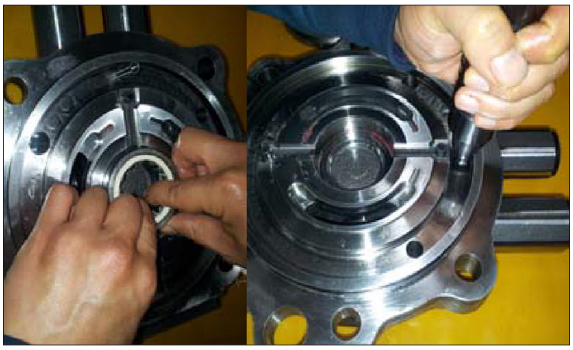
③ Assemble relief valve assy (30) 2set into valve casing (23) with torque wrench (bilateral symmetry assembling).
· Relief valve assy (30)×2EA

480L2SM33

④ Assemble plug (28) and O-ring (23) into valve casing with a torque wrench.
· Plug (28)×3EA
· O-ring (27)×3EA

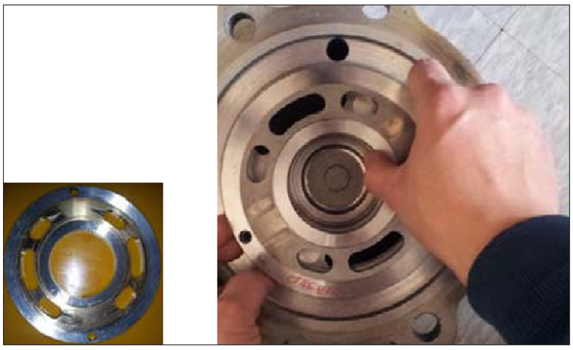
480L2SM34

⑤ After assembling needle bearing (6) into valve casing, assemble pin spring (17, 21).
· Needle bearing (6) ×1EA
· Pin spring (17, 21) ×1EA



480L2SM35

⑥ After applying grease on valve plate (20), attach it to valve casing (23).
· Valve plate (20) ×1EA



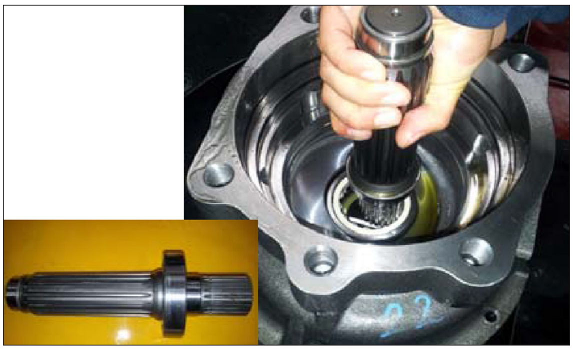
480L2SM36

(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

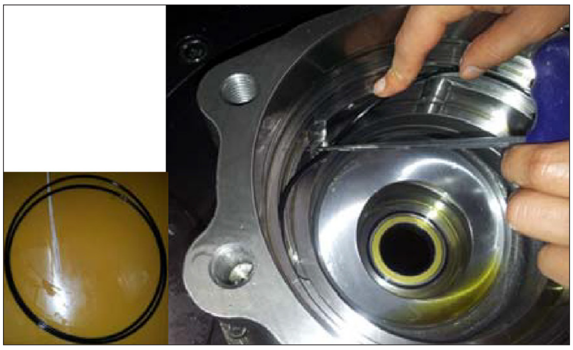
③ Fix snap ring (4) to shaft with a pair of plier jig.
 · Snap ring × 1EA

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 a casing.
· O-ring (18)×1EA
· O-ring (19)×1EA



480L2SM41

⑥ Insert cylinder block assy (8) into casing (1).

480L2SM42

⑦ After assemble 4 set of seperated plates (14), friction plate (13) step by step into casing, put parking piston (15) with compressing tool.
· Seperated 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 bolt (37, 38) tightly.

480L2SM45

⑩ Assemble level gauge assy (36) and plug (39) into casing (1).

480L2SM46

⑪ After assembling time delay valve assy (35) into valve casing (23), tighten hex bolt (42).

· Time delay valve assy × 1EA
· Hex bolt × 3EA

480L2SM47

⑫ Air leak test

After putting assembled swing motor into test tank, excute the air leak test for 2 min at 2k.

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.

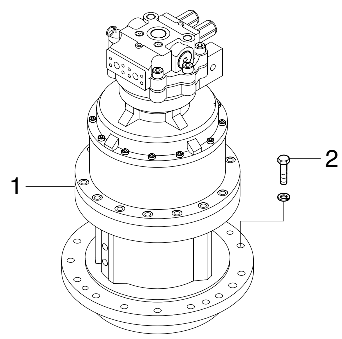
(2) Sling reduction gear assembly (1) and remove mounting bolts (2).

(3) Remove the reduction gear assembly.
· Reduction gear device weight : 180 kgf · m
(396 lbf · ft)

13031GE18

2) INSTALL

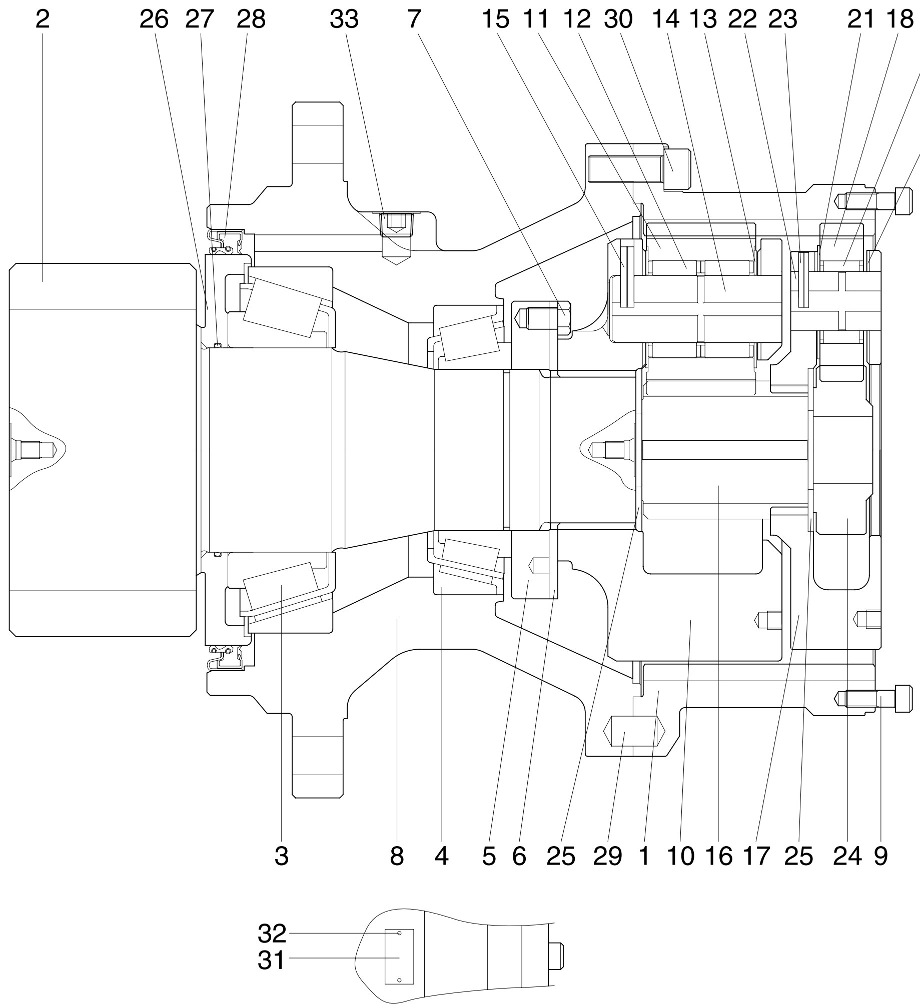
(1) Carry out installation in the reverse order to removal.
· Tightening torque : 57.9±8.7 kgf · m
(419±62.9 lbf · ft)



480S8SM03

4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE



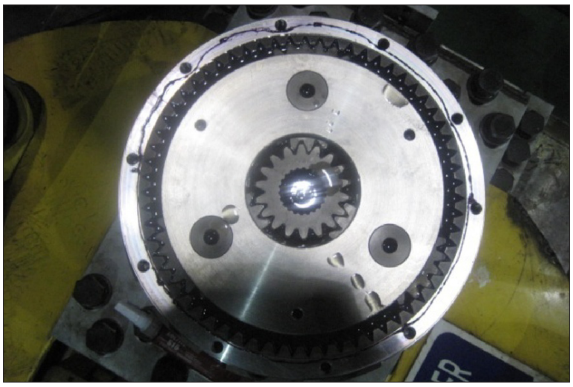
480F2SM03

1	Ring gear	12	Needle bearing No. 2	23	Spring pin No. 1
2	Drive shaft	13	Thrust washer No. 2	24	Sun gear No. 1
3	Taper bearing	14	Carrier pin No. 2	25	Thrust plate
4	Taper bearing	15	Spring pin No. 2	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 No. 1	30	Hexagon socket head bolt
9	Hexagon socket head bolt	20	Thrust washer No. 1-upper	31	Name plate
10	Carrier No. 2	21	Thrust washer No. 1-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.

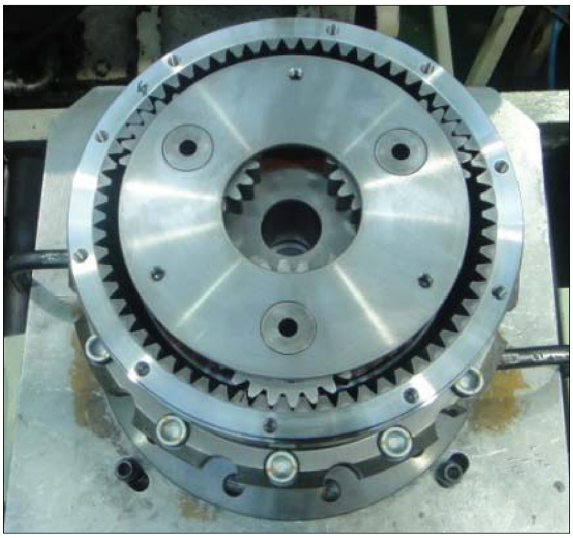
⚠ Take great care not to pinch your hand between parts while disassembling not left fall parts on your foot while lifting them.



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 No.1 pin spring. If No.1 pin spring
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 No.2 pin spring. If No.2 pin spring has problem, change whole No.2 carrier sub assy.

480L2SM55

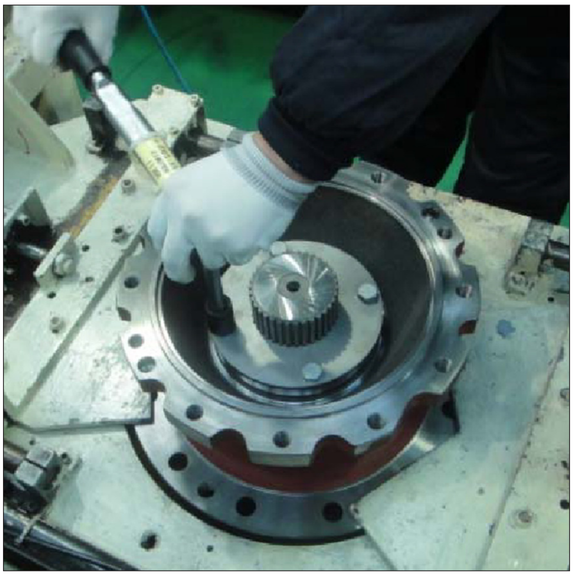
(3) Removing ring gear

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

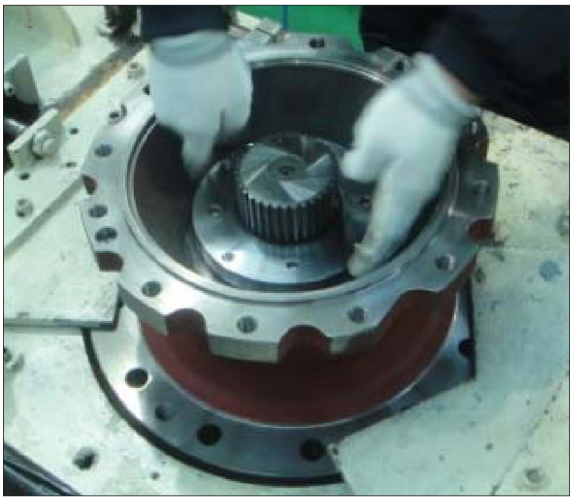
(4) Removing drive shaft sub assy

① Unscrew every hex head bolt (M12) to remove lock plate.



480L2SM57

② Rolling nut ring for removing them from drive shaft sub assy.
(Use special tool to roll nut ring 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 & bearing taper (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.

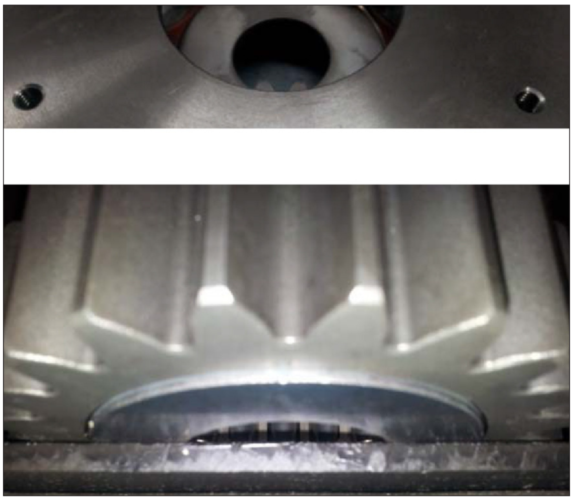
⑩ Bearing

- Rotate it by hands to check such noise or uneven rotation.

(2) Assembling No.1 carrier sub assy

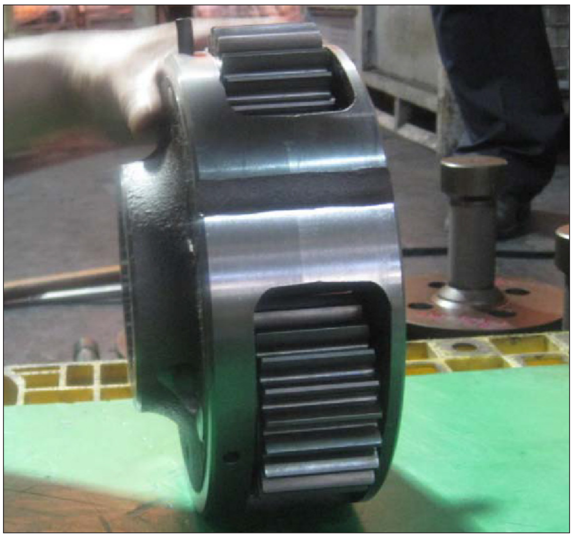
① Put thrust plate firmly in No.1 carrier.

② After assembling No.1 needle bearing to No.1 planetary gear, put a pair of No.1 thrust washer on both sides of bearing and install them to No.1 carrier.



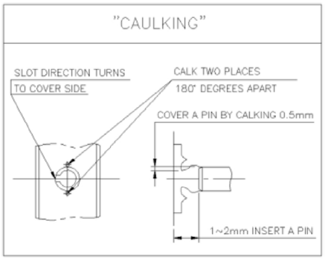
480L2SM62

③ Make No.1 pin spring pin hole and No.1 carrier's spring pin hole in line, press No.1 pin spring into the holes.
(Make No.1 pin spring hole head for No.1 planetary gear.)



480L2SM63

④ Caulk carrier holes to make No.1 pin spring settle down stably.
(Caution : Refer to “caulking details”)
※ Use paint marker for marking after caulking.



480L2SM64

480L2SM65

(3) Assembling No.2 carrier sub assy

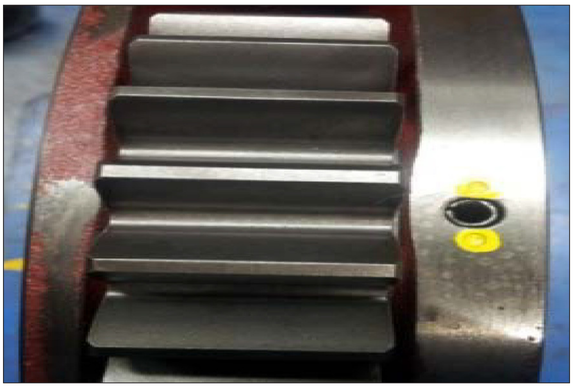
① Put thrust plate in firmly No.2 carrier.

480L2SM66

② After assembling No.2 needle bearing to No.2 planetary gear, put 2 pieces of No.2 thrust washer on both sides of bearing and install them to No.2 carrier.

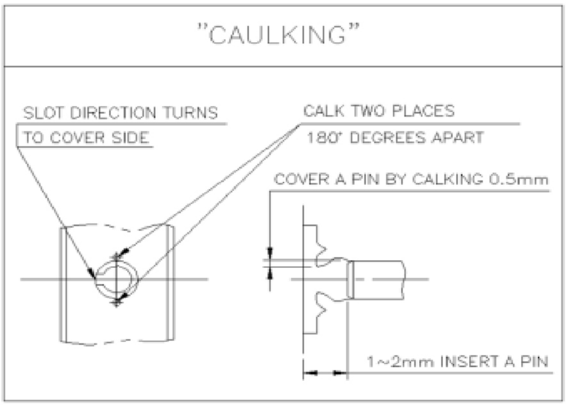
480L2SM67

③ Align No.2 pin spring hole and No.2 carrier spring pin hole, put No.2 pin spring into the holes.
(Make No.2 pin spring cutting line face to No.2 planetary gear.)



480L2SM68

④ Caulk carrier holes to make No.2 pin spring settle down stably.
(Caution : Refer to “caulking details”)
※ Use paint marker for marking after caulking.



480L2SM69

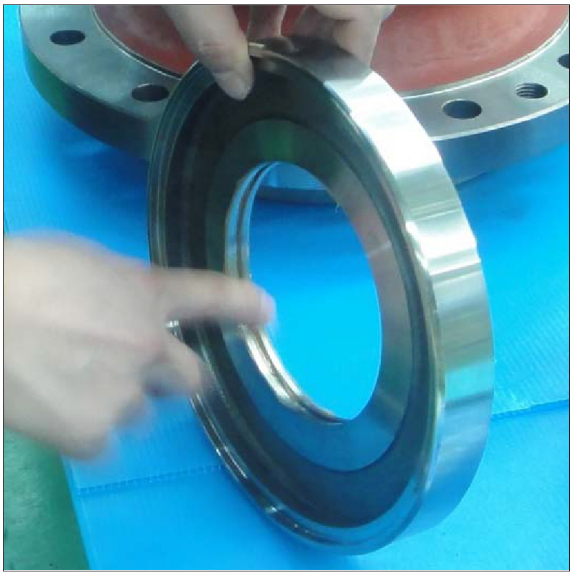
(4) Assembling pinion gear sub assy

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 bearing taper and sleeve into drive shaft using press jig.
(Use special jig for pressing. Leave no space between sleeve and bearing taper.)

480L2SM72

480L2SM73

(5) Assembling bearing cup & oil seal

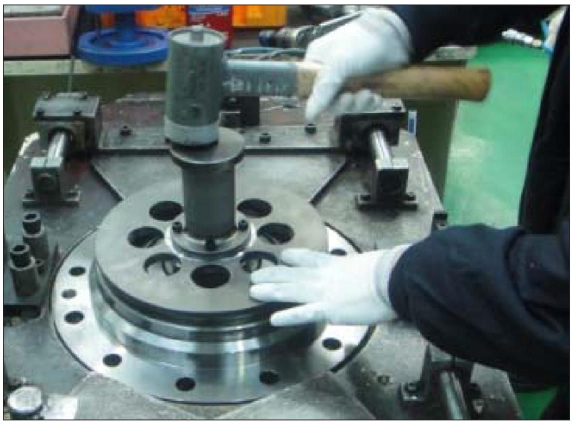
① Put top, bottom bearing cup into casing. (Use special jig for pressing. Pay attention to foreign materials while assembling bearing cup.)

※ Flip over casing to assemble oil seal.

480L2SM74

480L2SM75

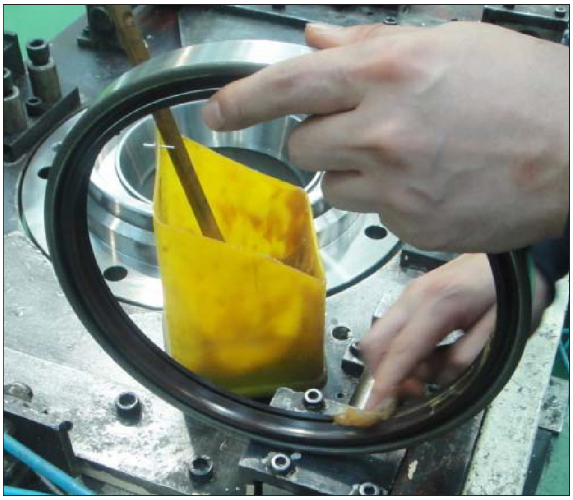
② Assemble oil seal to casing.
(Use special jig for pressing. Pay attention to direction of dust seal and dent.)



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.)

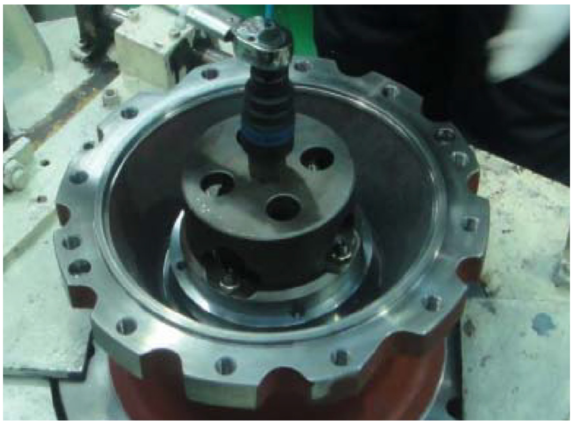
480L2SM79

③ Put bearing taper into it.
(Rotate bearing by hands for checking after assembly.)

480L2SM80

④ Put nut ring 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



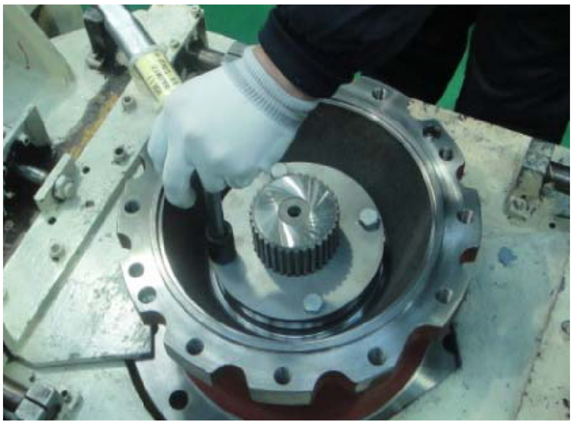
480L2SM82

⑤ Align nut ring's bolt screw with lock plate's hole.
(In case of misalign between nut ring's bolt screw and lock plate's hole, put lock plate's hole as near as possible to nut ring's bolt screw and make it in line by increasing tightening torque.)


480L2SM83


480L2SM84

⑥ Screw 4 bolts (M12×16) to connect nut ring and lock plate by using torque wrench.
· 4-M12 / bolt = 12.9T
· The tightening torque :
8.8±0.9 kgf · m (63.7±6.5 lbf · ft)
※ Apply enough loctite #242 before screwing bolts.

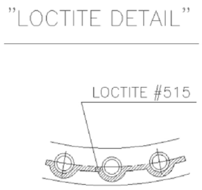

480L2SM85

⑦ Use paint marker for checking surplus parts after assembling.


480L2SM86

(7) Assembling ring gear

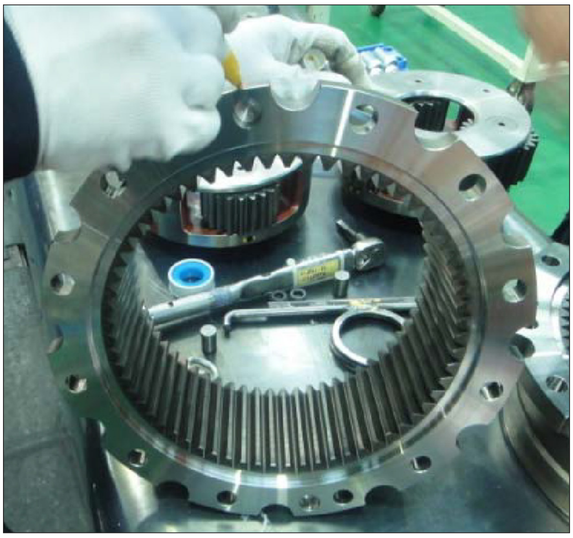
① Apply loctite #515 bottom of casing sub assy contacting with ring gear without disconnection. (Refer to loctite detail)



480L2SM87

480L2SM88

② Put pin parallel into casing sub assy hole. (Mark pin parallel position using paint marker.)



480L2SM89

③ Align ring gear with pin parallel 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 (01) 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.

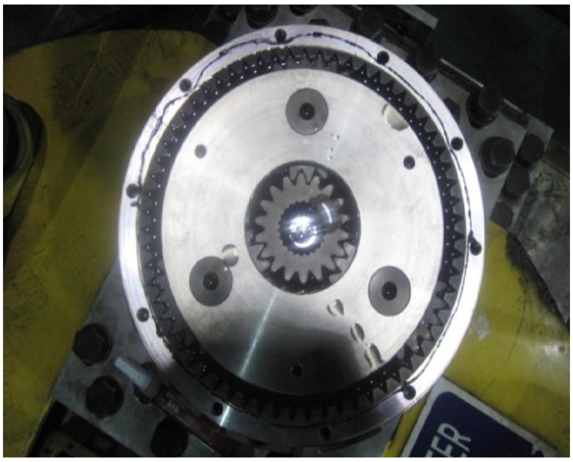
480L2SM94

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

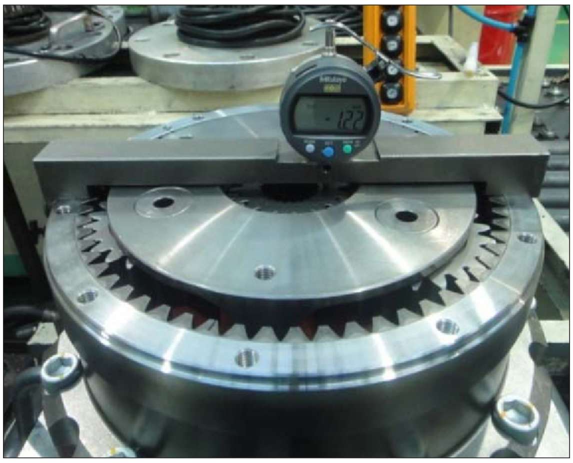
④ Put No.1 sun gear into No.1 carrier sub assy.
(Be sure to maintain it vertical with ground. And align with No.1 planetary gear spline.)

⑤ Rotate No.1 carrier sub assy by hands to check noise.


480L2SM96

(9) Measuring clearance & assembling name plate

① Check the clearance between ring gear and No.1 sun gear using a tool with dial gauge.
(Check the clearance / Dial gauge = -0.3 ~ +2.95)


480L2SM97

GROUP 6 TRAVEL DEVICE (TYPE 1, 2)

1. REMOVAL AND INSTALL

1) REMOVAL


13031GE18

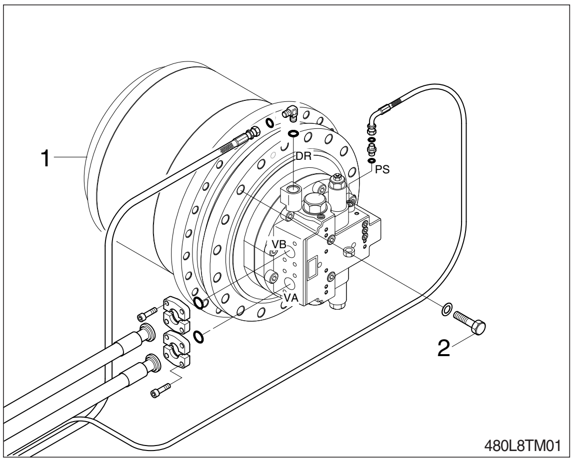
(1) Swing the work equipment 90 °and lower it completely to the ground.

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

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

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

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



480L8TM01

(4) Remove the track shoe assembly.
For details, see removal of track shoe assembly.

(5) Remove the cover.

(6) Remove the hoses.

※ Fit blind plugs to the disconnected hoses.

(7) Remove the bolts and the sprocket.

(8) Sling travel device assembly (1).

(9) Remove the mounting bolts (2), then remove the travel device assembly.

· Weight : 632 kg (1393 lb)

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

2) INSTALL

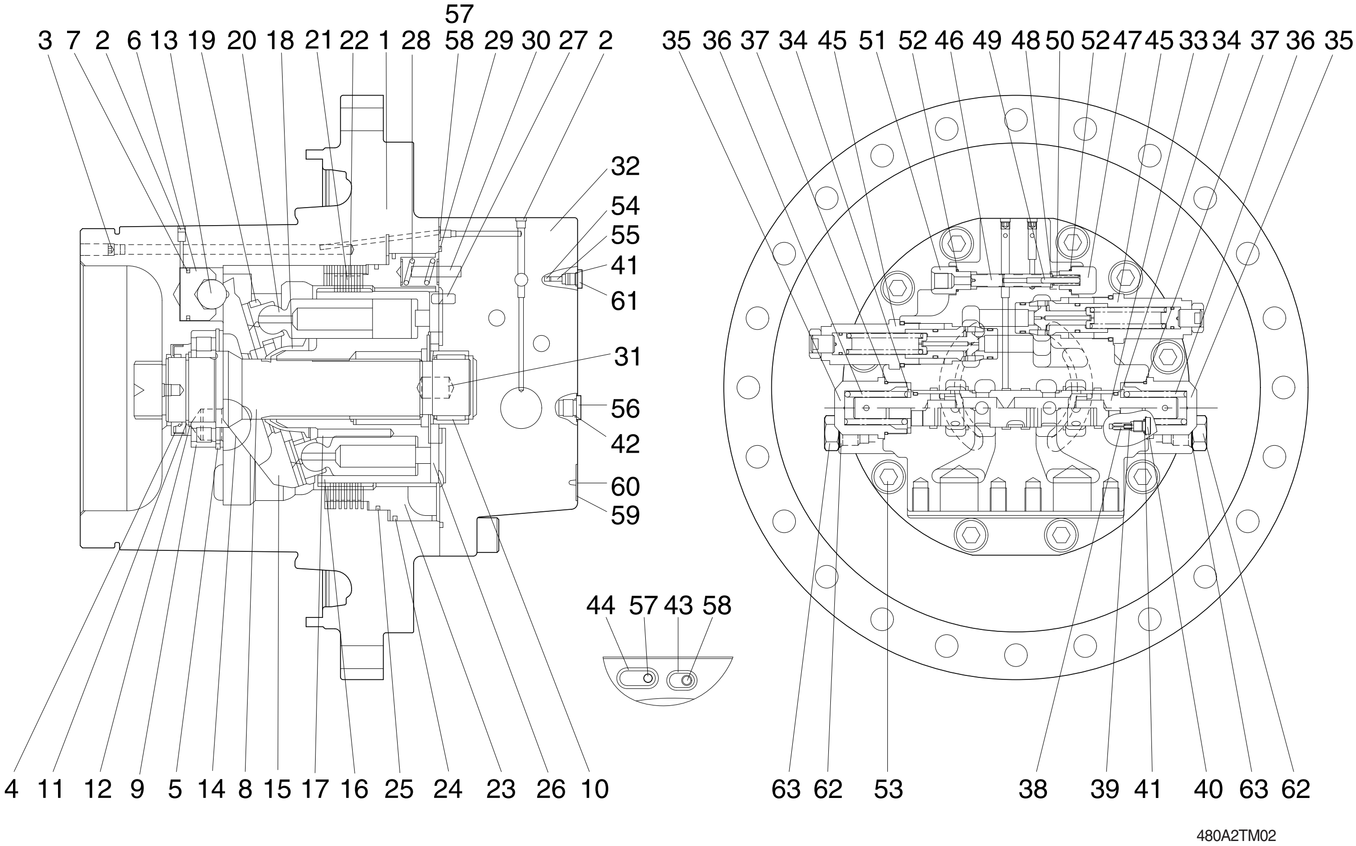
(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from the travel motor.
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling, and check oil come out from plug.
⑤ Tighten plug fully.

(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

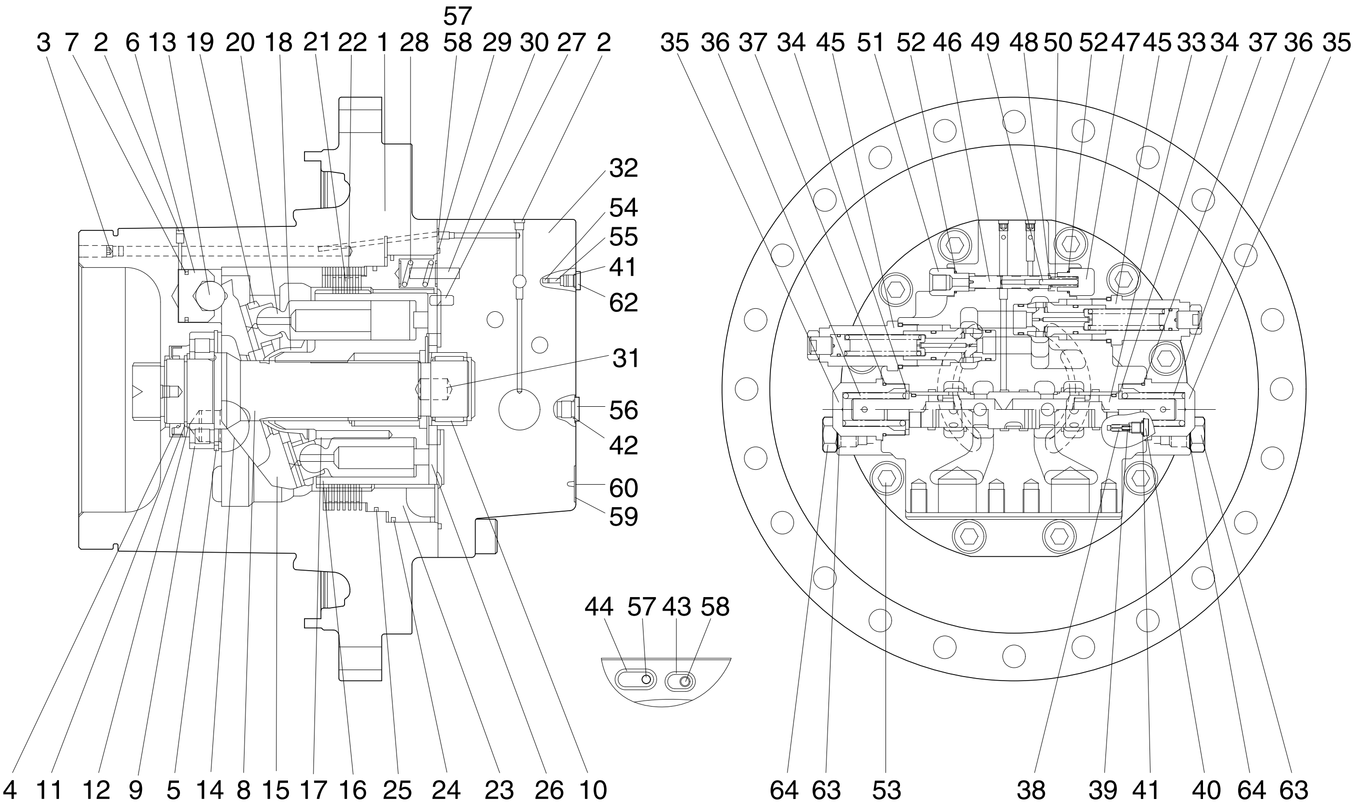
2. TRAVEL MOTOR

1) STRUCTURE (TYPE 1)



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

STRUCTURE (TYPE 2)



480F2TM02

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

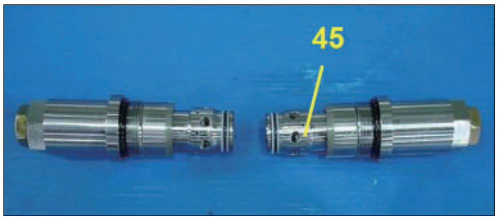
(2) This motor can be disassembled even in a state on the reduction gear.
However, in that case, pay full attention to preventing mud, dust, etc. from entering in it.

(3) The numerical in parentheses following each part name indicates its part number shown in the attached **assembly drawings.**

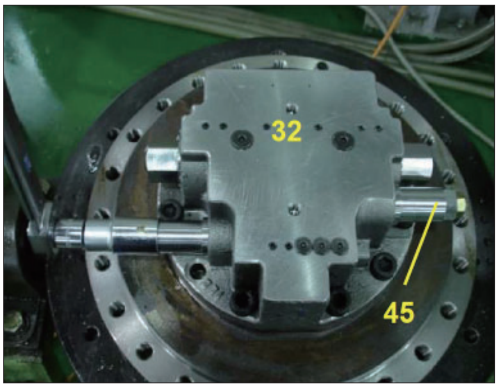
(4) The piping side of the motor is referred to as the rear side, and the output side as the front side.

2) DISASSEMBLY OF REDUCTION GEAR

(1) Disassemble relief valve assy (45) from rear cover (32) using spanner and torque wrench.

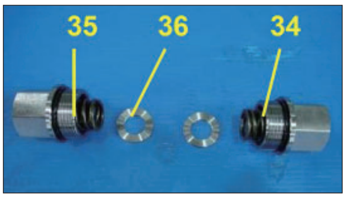


480L2TM11

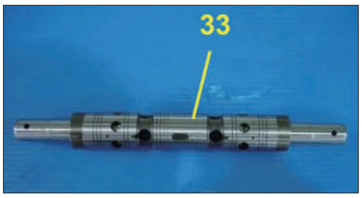


480L2TM12

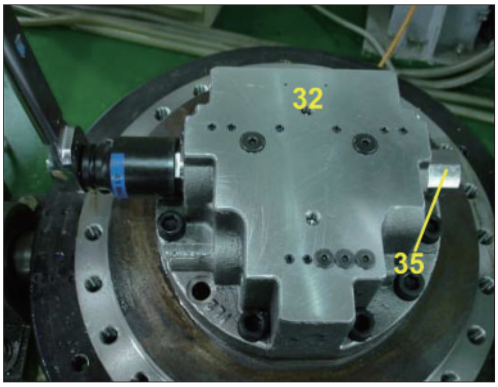
(2) Disassemble plug (35) from rear cover (32) and then disassemble spring (36), spring seat (34), main spool kit (33) in regular sequence.



480L2TM13

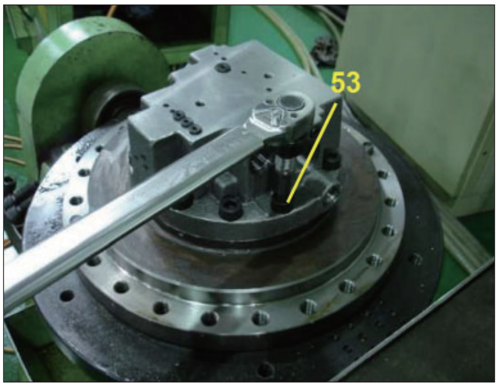


480L2TM14



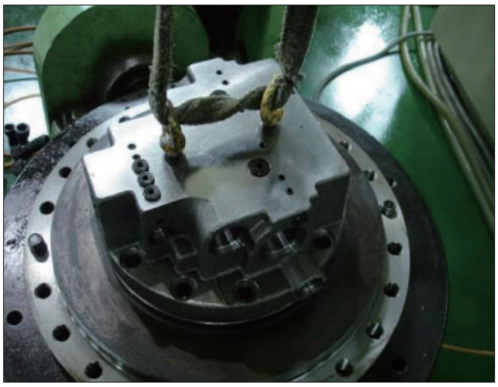
480L2TM15

(3) Disassemble socket bolt (53)-10EA using torque wrench.



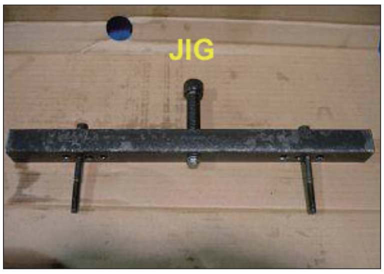
480L2TM16

(4) Take out rear cover (32) from casing (1).

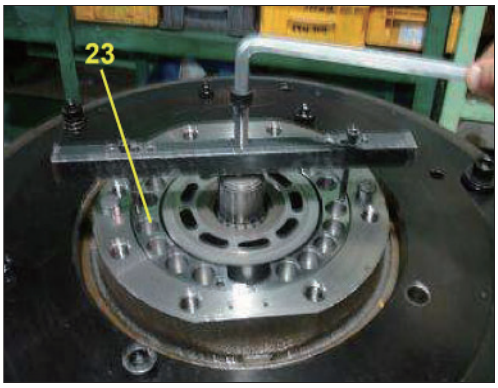


480L2TM17

(5) Disassemble parking piston (23) using jig.

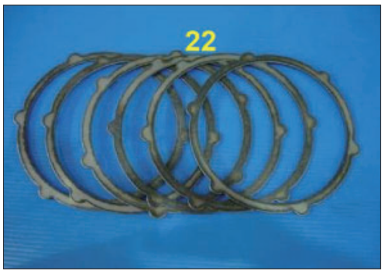


480L2TM18

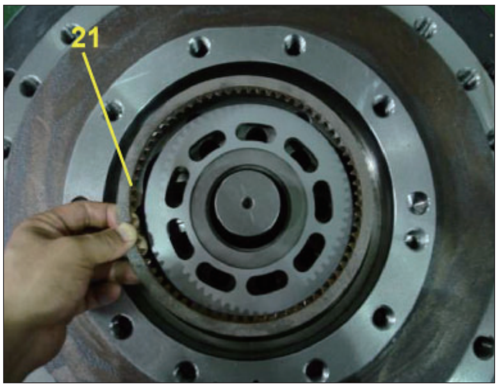


480L2TM19

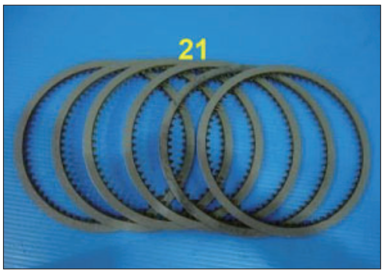
(6) Disassemble separate plate (22)-7EA, friction plate (21)-6EA



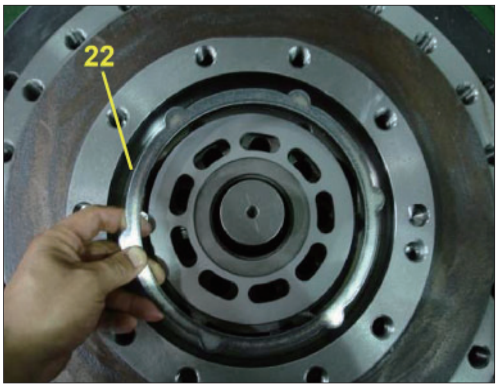
480L2TM20



480L2TM21

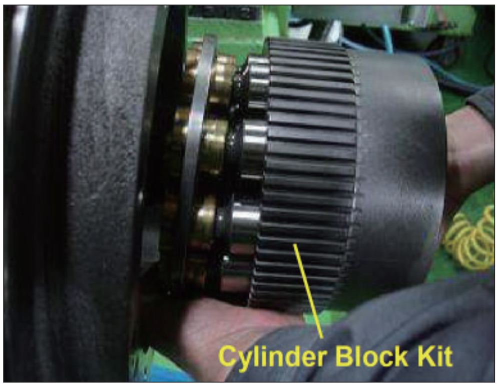


480L2TM22



480L2TM23

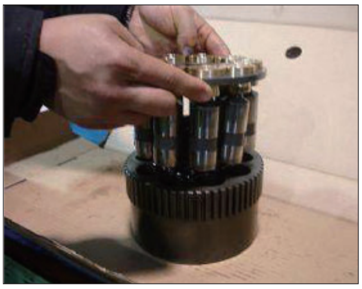
(7) Remove rotary block kit.
It is easier to work by placing the casing (1) horizontal.

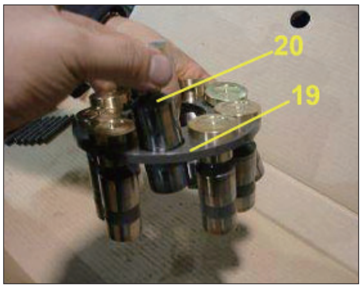


480L2TM24

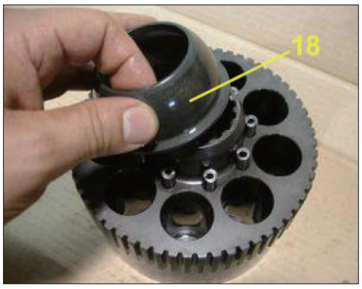
(8) Disassemble rotary block (16), retaner plate (19), piston and shoe (20), ball guide (18), spring (17) from rotary block kit.


480L2TM25

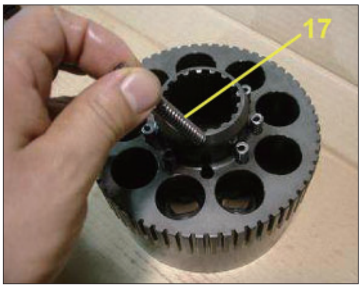

480L2TM26



480L2TM27



480L2TM28



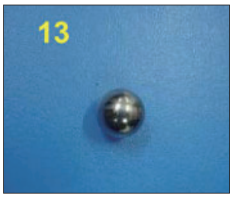
480L2TM29

(9) Disassemble swash plate (15) from shaft casing (1).

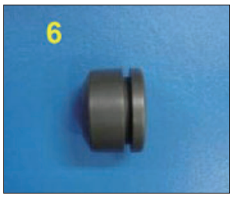
480L2TM30


480L2TM31

(10) Disassemble steel ball (13), swash piston (6)
Hole in the casing (1) of two speed line is decomposed by injecting oil.



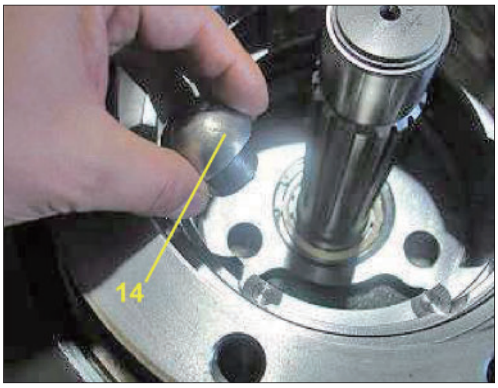
480L2TM32



480L2TM33

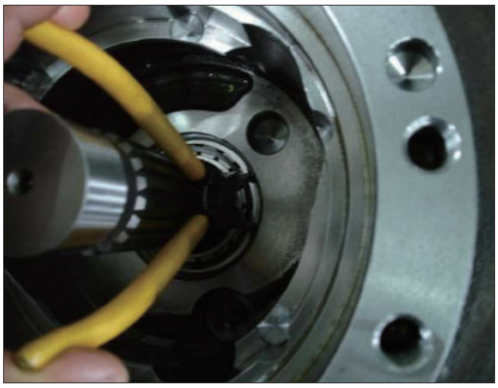

480L2TM34

(11) Disassemble pivot (14)-2EA from casing (1).

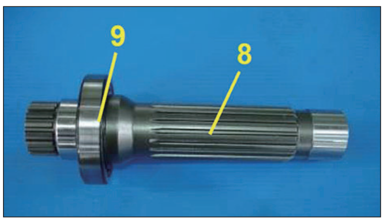


480L2TM35

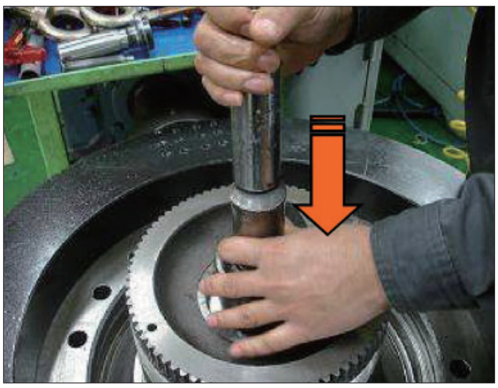
(12) Disassemble retainer ring (5) using pliers.


480L2TM36

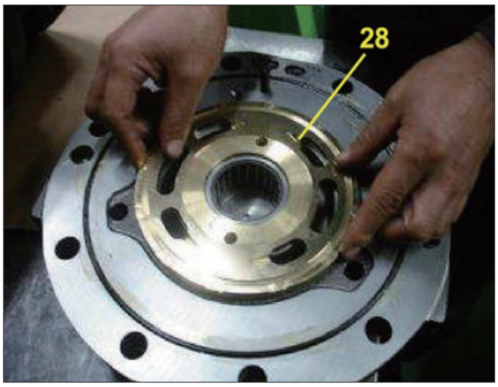
(13) In the casing (1), the arrow part of the shaft (8) using a rubber mallet taps and then disassemble the shaft (8) and roller bearing (9) to the other side.



480L2TM37

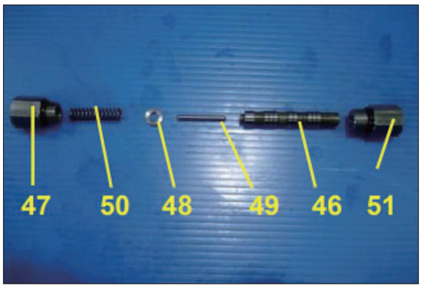

480L2TM38

(14) Disassemble valve plate (36) from rear cover (32).

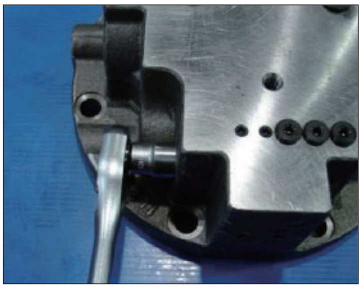


480L2TM39

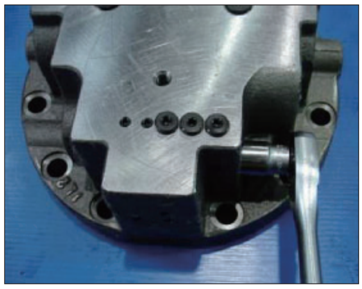
(15) Disassemble plug (47), connector (51) from rear cover (32) and then disassemble spring (50), spring seat (48), parallel pin (49), spool (46) in regular sequence.



480L2TM40

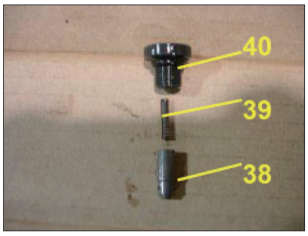


480L2TM41

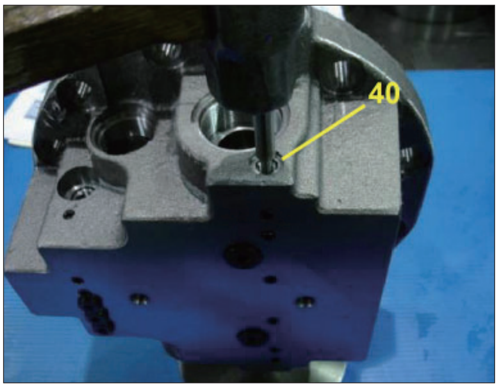


480L2TM42

(16) Disassemble plug (40) from rear cover (32) and then disassemble spring (39), restictor (38) from rear cover (34) in regular sequence.

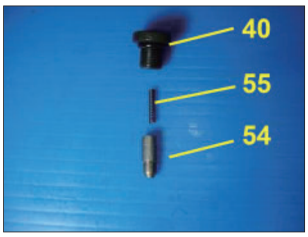


480L2TM43

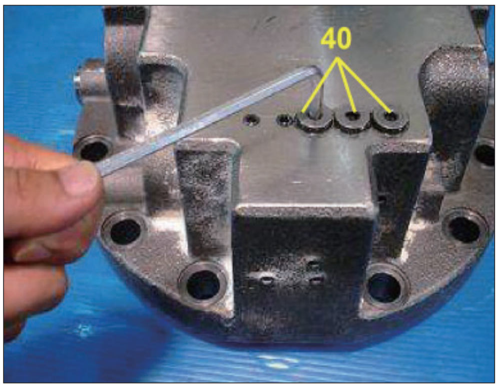


480L2TM44

(17) Disassemble plug (40) from rear cover (32) and then disassemble spring (55), check valve (54) from rear cover (32) in regular sequence.

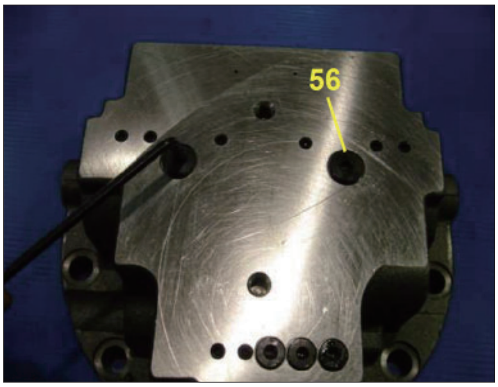


480L2TM45



480L2TM46

(18) Disassemble plug (56) from rear cover (32).

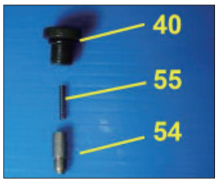


480L2TM47

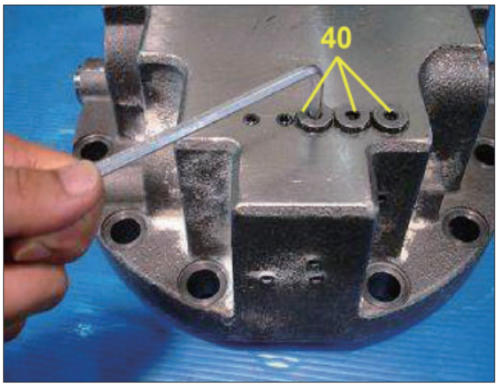
2) ASSEMBLY OF MOTOR

(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)



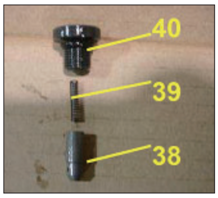
480L2TM48



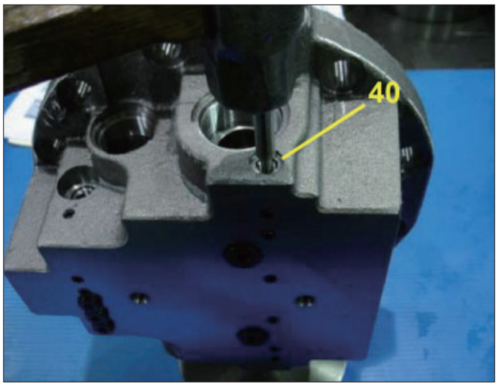
480L2TM49

(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)

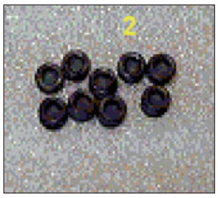


480L2TM50

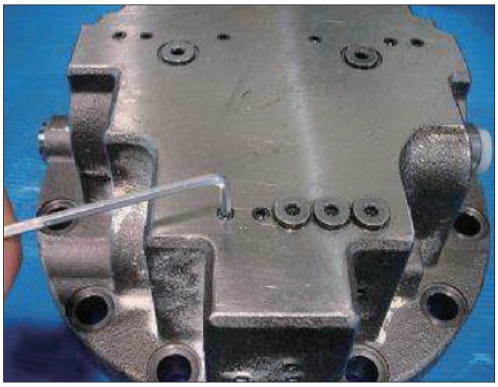


480L2TM51

(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).



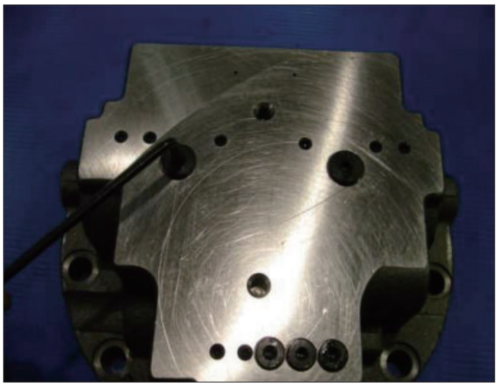
480L2TM52



480L2TM53

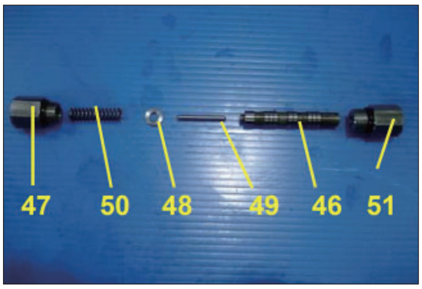
(4) Assemble 2-PF1/4 plug (56, 61) using torque-wrench.

· Tightening torque : 4.5±0.5 kgf·m (32.5±3.6 lbf·ft)

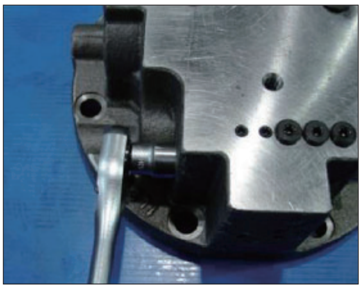


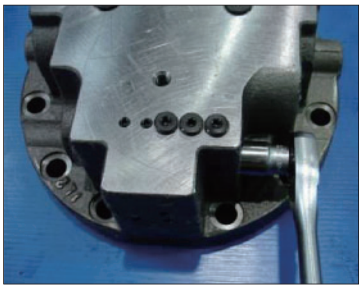
480L2TM54

(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)

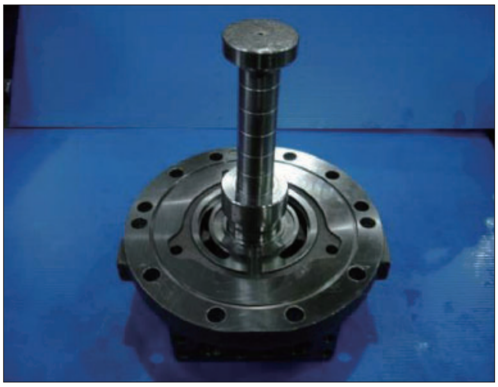


480L2TM55

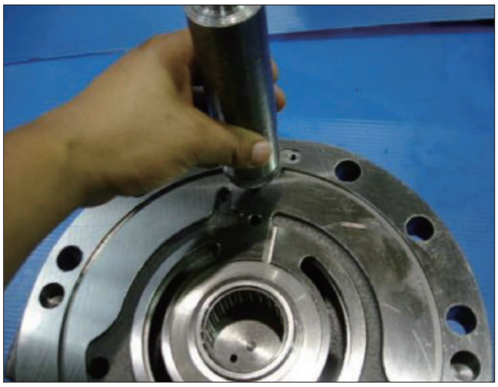

480L2TM56


480L2TM57

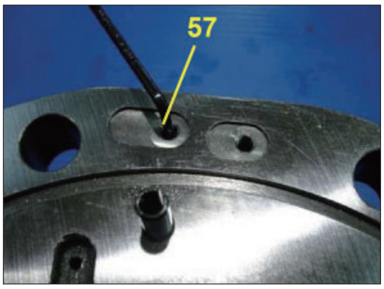
(6) Press needle bearing (10) into rear cover (32) using jig.


480L2TM58

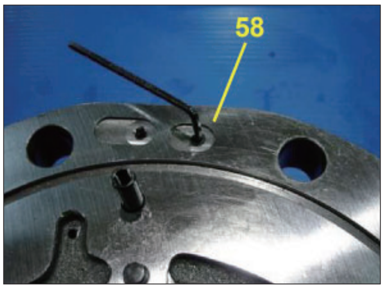
(7) Assemble spring pin (30), parallel pin (27) using small hammer.


480L2TM59

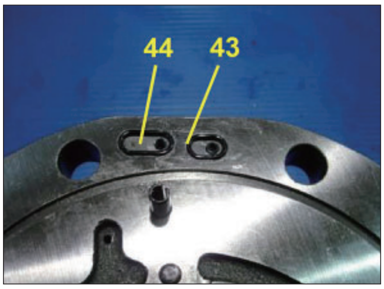
(8) Apply loctitle #242 on the restrictor (57, 58) and then assemble restrictor (57, 58), O-ring (43, 44) into rear cover (32).



480L2TM60

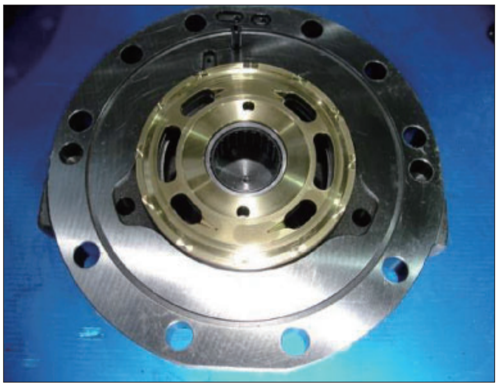


480L2TM61

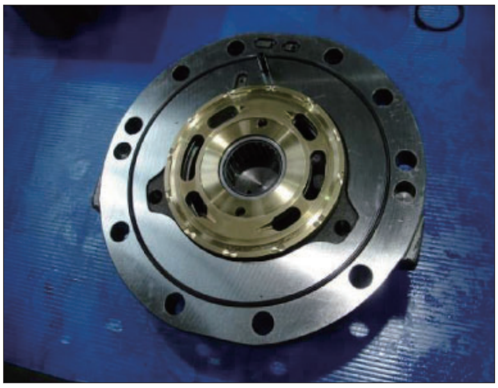


480L2TM62

(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

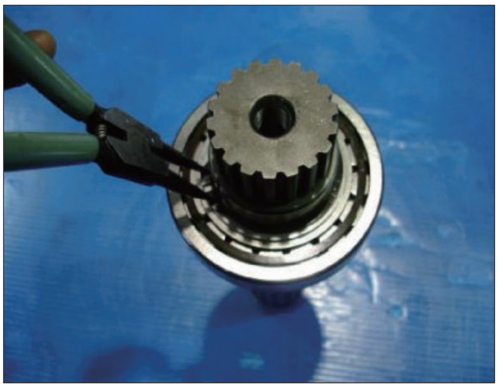
(10) Apply grease to the O-ring (29), and then assemble O-ring into rear cover (32).


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.

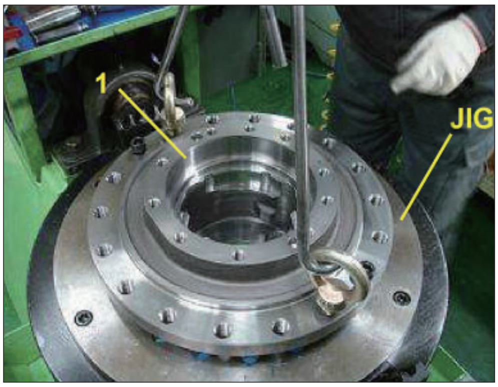

480L2TM65


480L2TM66


480L2TM67

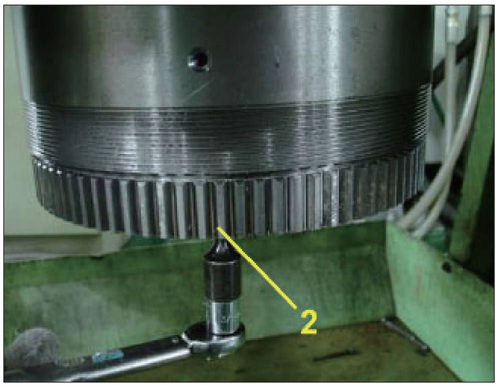

480L2TM68

(12) Install casing (1) into assembling jig.

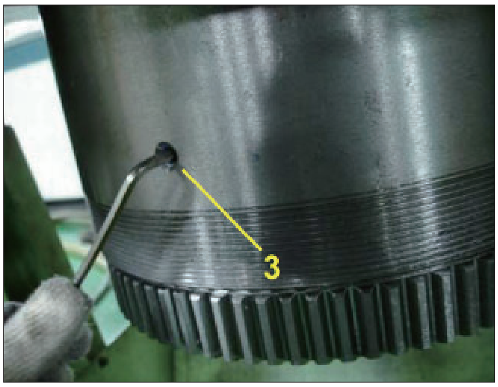


480L2TM69

(13) Assemble plug (2), (3) into casing (1).

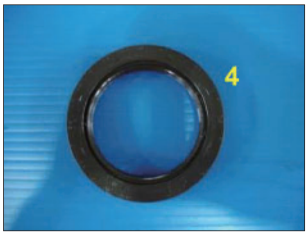


480L2TM70

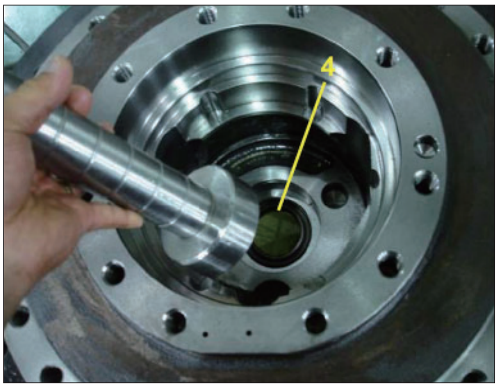


480L2TM71

(14) Assemble oil seal (4) into casing (1) with assembling jig.

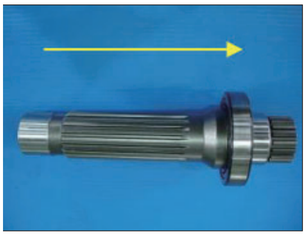


480L2TM72



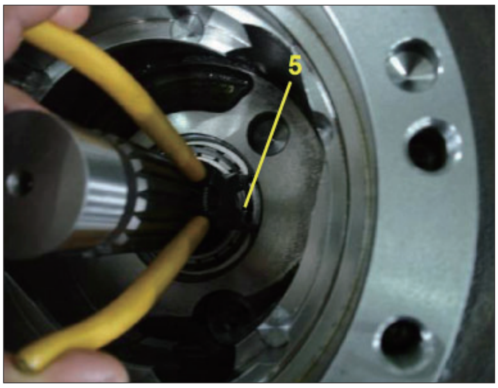
480L2TM73

(15) Insert assembled shaft assy in the direction of the arrow into casing (1) using a rubber mallet.



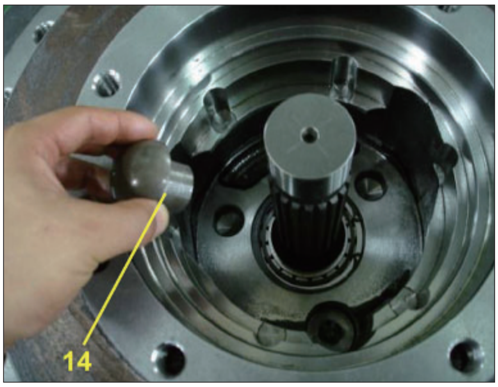
480L2TM74

480L2TM75



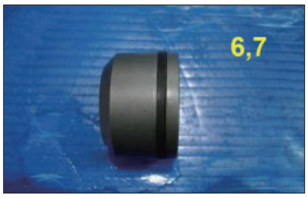
480L2TM76

(16) Apply the grease to pivot (14)-2EA and then assemble pivot (14) into casing (1).

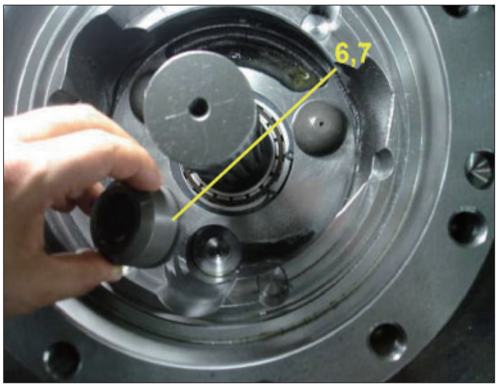


480L2TM77

(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).



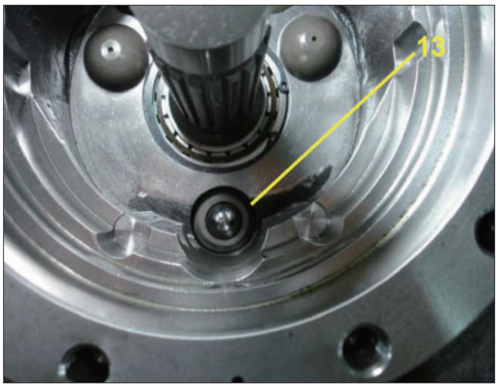
480L2TM78



480L2TM79

(18) Apply the grease to steel ball (13) and then assemble steel ball (13) into casing (1).

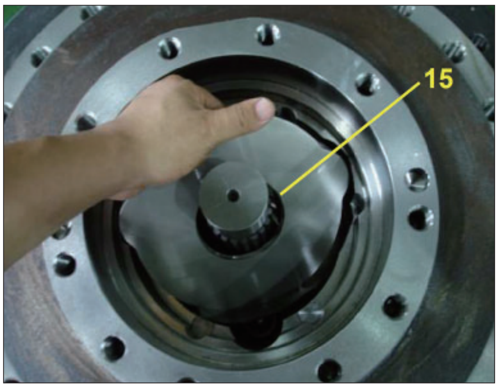
480L2TM80



480L2TM81

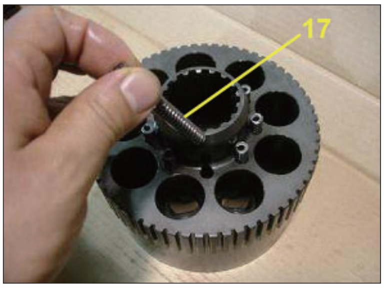
(19) Apply the grease to swash plate (15) and then assemble swash plate (15) into casing (1).

480L2TM82

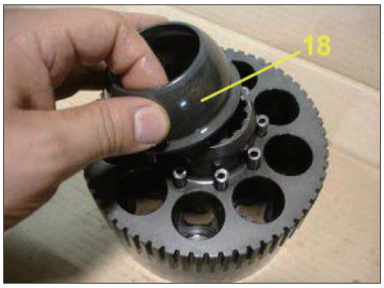


480L2TM83

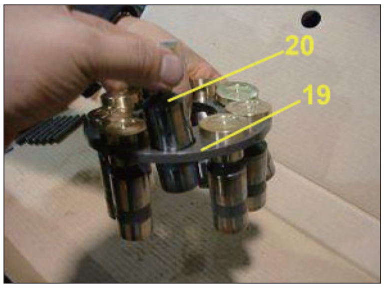
(20) Assemble spring (17), ball guide (18), retainer plate (19), piston and shoe (20) into rotary block (16) in regular sequence.



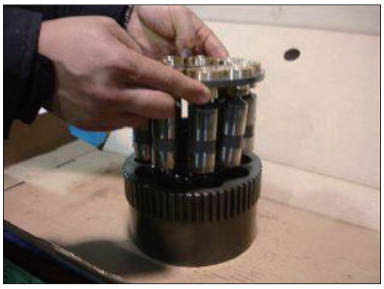
480L2TM84



480L2TM85

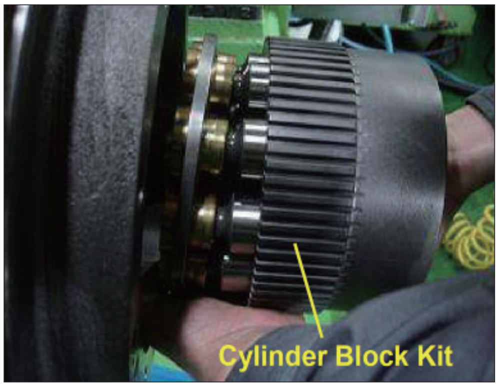


480L2TM86


480L2TM87

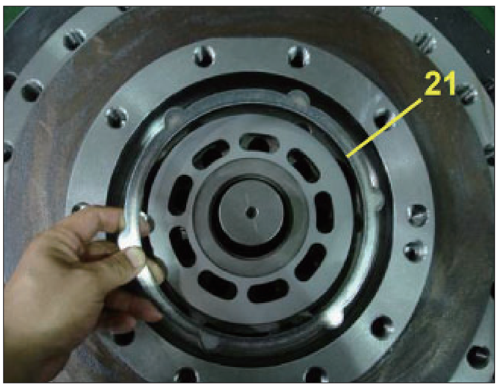

480L2TM88

(21) Assemble rotary block kit into casing (1).

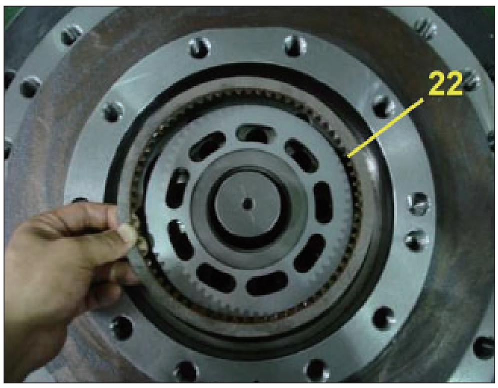


480L2TM89

(22) Assemble separate plate (22), friction plate (21) into rotary block in regular sequence.
Friction plate : 6 EA
Separate plate : 7 EA



480L2TM90

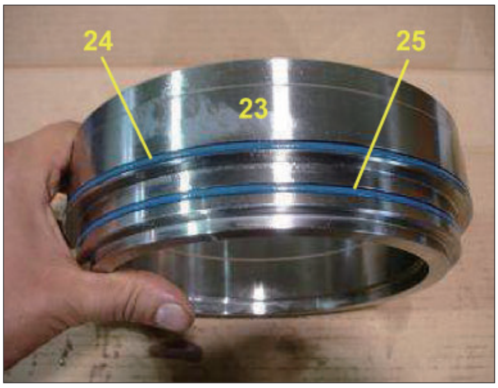


480L2TM91

(23) Assemble parallel pin (31) into casing (1).

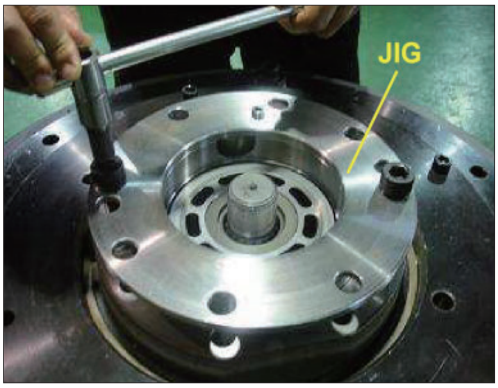
480L2TM92

(24) Apply the grease to D-ring (24,25) and then assemble D-ring (24, 25) into parking piston (23)



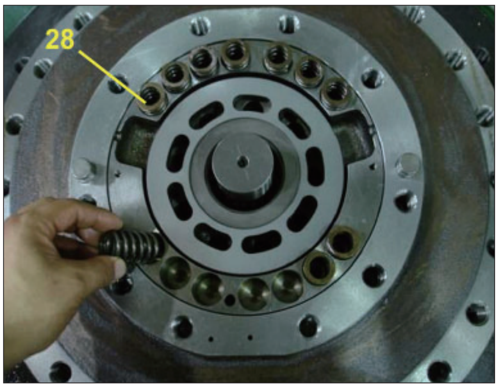
480L2TM93

(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

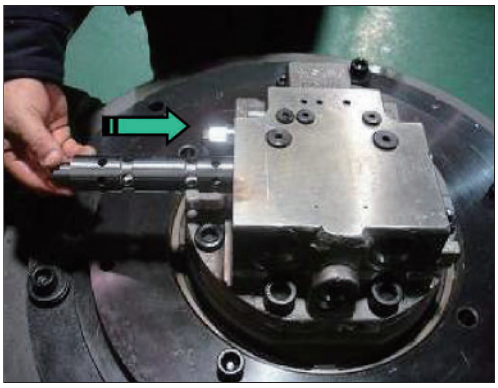
(28) Assemble rear cover (32) into casing (1) and then tighten the socket bolt (53) using torque wrench.

· 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

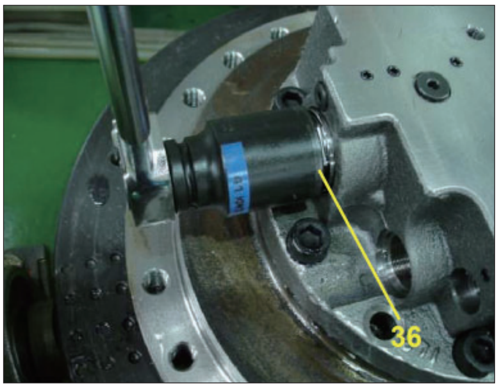

480L2TM100

(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

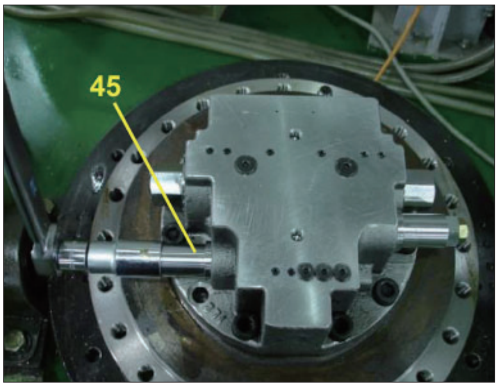

480L2TM102



480L2TM103

(31) Assemble relief valve assy (45) using torque wrench.

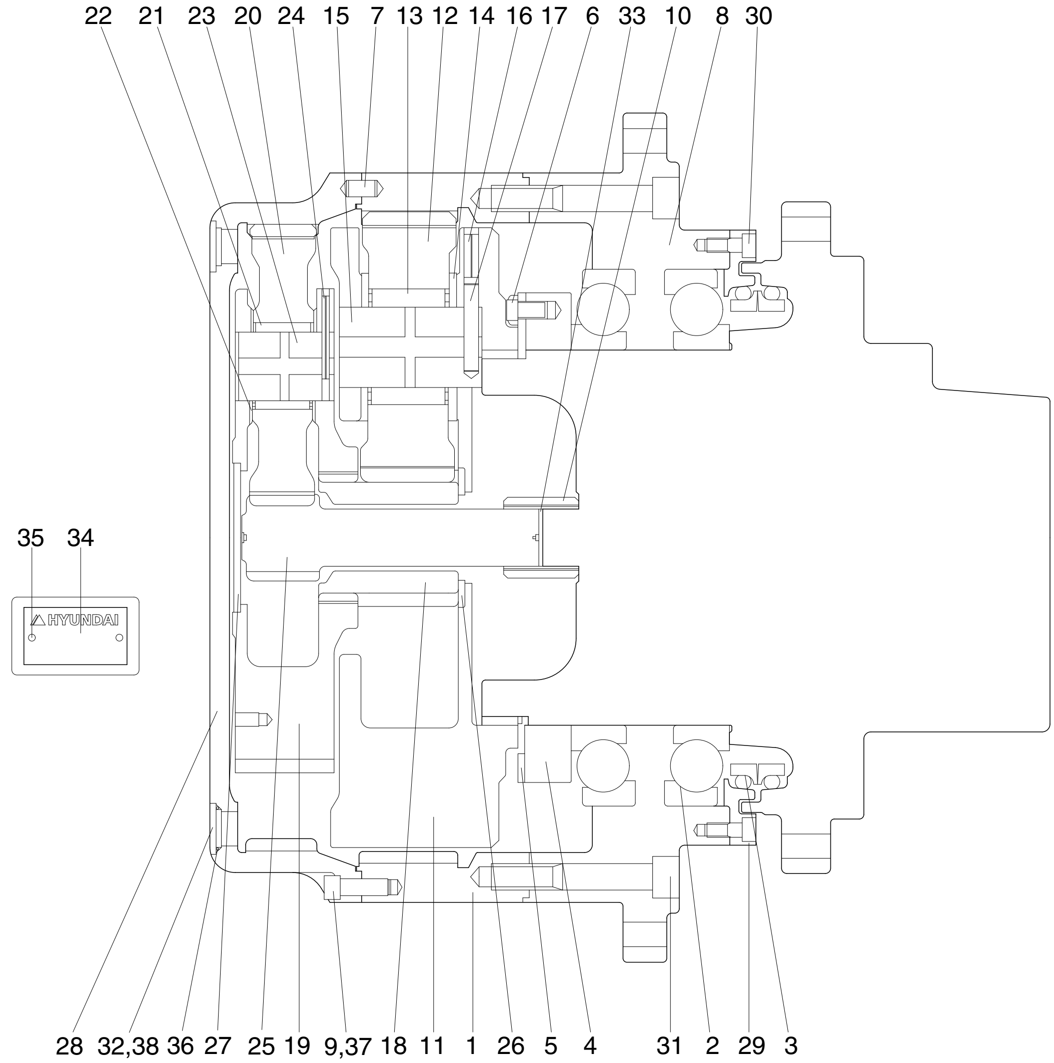
· Tightening torque : 26±2.6 kgf · m
(188±18.8 lbf · ft)



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

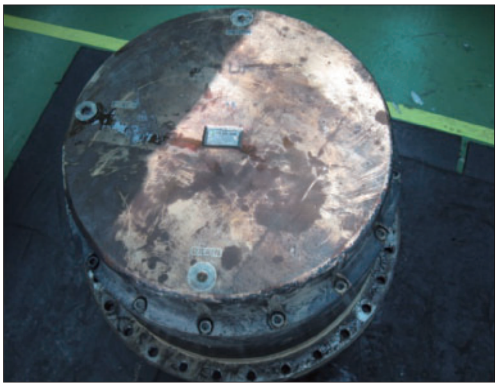
(1) Reduction gear removed from machine usually covered with dirt, so clean it with cleaning liquid and dry it.

(2) Put reduction gear on stable place with drain port down side and remove oil plug (PF3/4) to pull-out gear oil through drain port.

※ When the oil is hot, there are high chance to blow out hot oil because of the pressure difference between container and out side.

(3) Set reduction gear on work table.

(4) Mark surface of cover, ring gear and housing for proper reassembly.

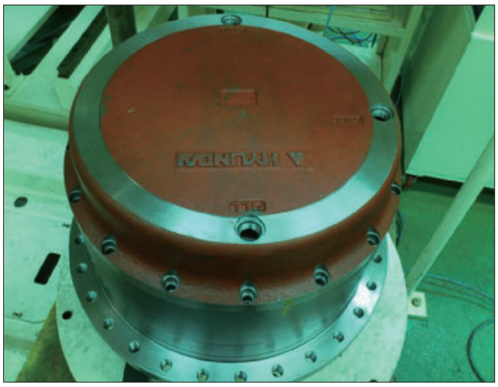


480L2TM201

2) PUT REDUCTION GEAR ON WORK TABLE TO DISASSEMBLE

(1) Set eye bolt (M20) into M20 tap hole on housing flange. Make reduction gear cover upper direction using hoist machine.

⚠ Be aware of safety. There are some chances of accidents when put down the reduction gear. Do not place the part pall on your foot.

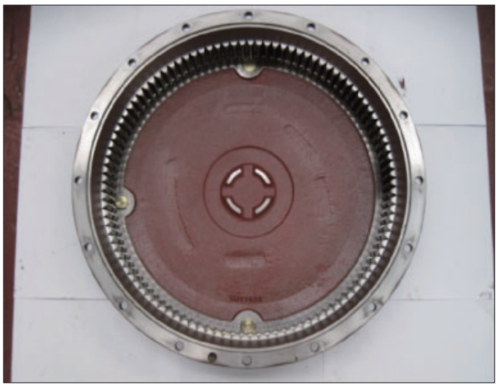


480L2TM202

3) COVER REMOVE

(1) Remove 16 of bolt-hex. socket head (M12X35L) connecting cover and ring gear using torque wrench.

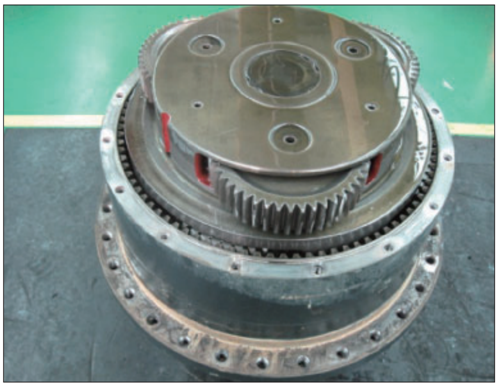
(2) Using sharp tools to separate cover and ring gear. Put sharp tools into the gap between ring gear and cover and tap the tool tenderly.



480L2TM203

4) REMOVE THRUST PLATE AND NO.1 CARRIER SUB

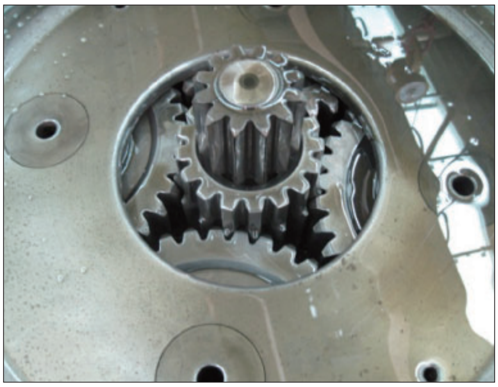
(1) Remove thrust plate first, set eye bolt (M10) in No.1 carrier tap hole. After these, pull-up No.1 carrier assy slowly.



480L2TM204

(2) Remove No.1 sun gear from reduction gear slowly.

※ When disassemble No.1 sun gear, be sure to keep vertical against ground with No.1 sun gear.

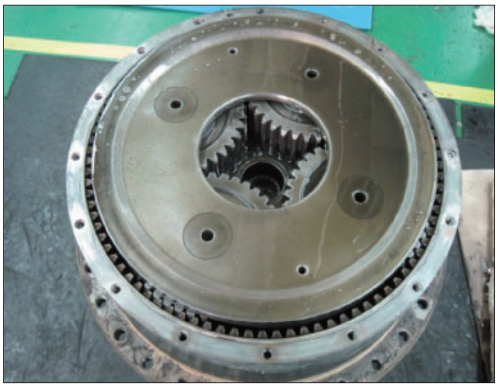


480L2TM205

5) REMOVE NO.2 CARRIER SUB

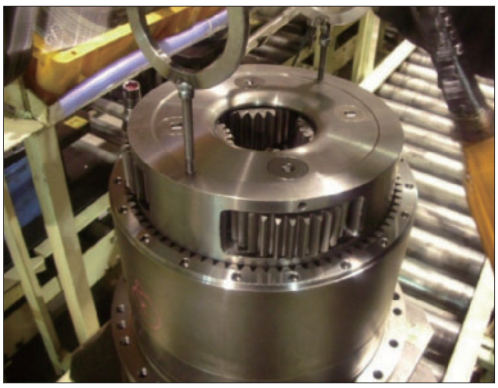
(1) Remove No.2 sun gear slowly.

※ When disassemble No.2 sun gear, be sure to keep vertical against ground with No.2 sun gear.



480L2TM206

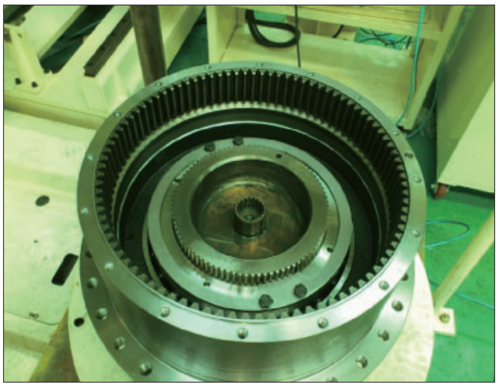
(2) Set eye bolt (M10) in No.2 carrier assy, pull-up slowly.



480L2TM207

6) REMOVE COUPLING

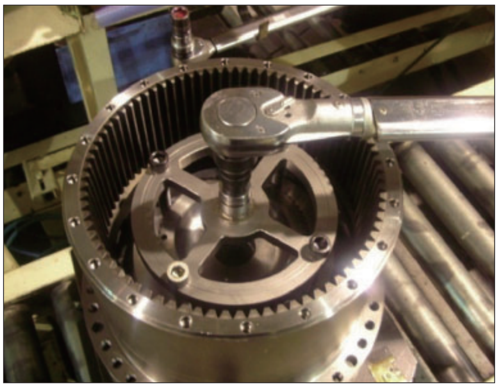
(1) Remove coupling on motor spline.



480L2TM208

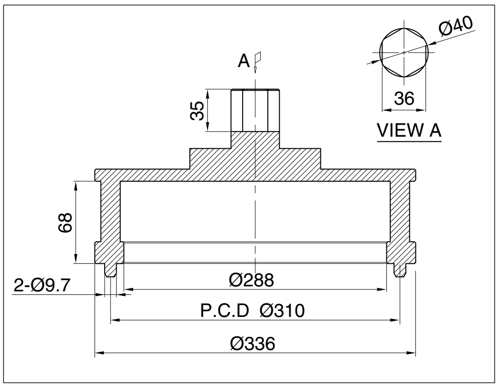
7) REMOVE RING NUT AND LOCK PLATE

(1) Remove hex head bolt (M12×20L) using torque wrench which is connecting ring nut and lock plate.
(2) Remove lock plate from motor casing spline.



480L2TM209

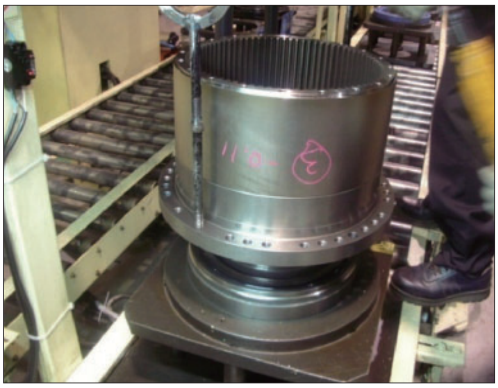
(3) Remove ring nut using designed tools.



480L8TM03

8) DISASSEMBLE RING GEAR AND HOUSING

(1) Set eye bolt (M20) in flange of housing, pulling ring gear and housing from motor.



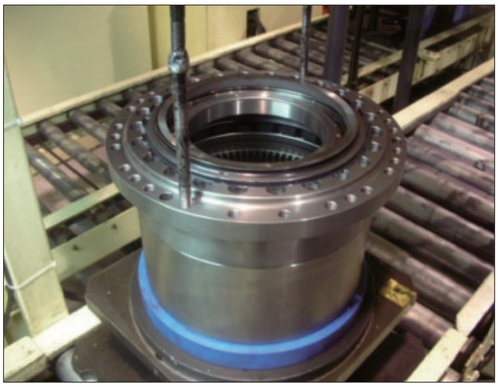
480L2TM210

(2) Put disassembled ring gear and housing on work table. Be sure to set floating seal upper side, and remove floating seal.

※ Do not re-use floating seal.

(3) Remove hex socket head bolt (M20×120L) connecting housing and ring gear using torque wrench.

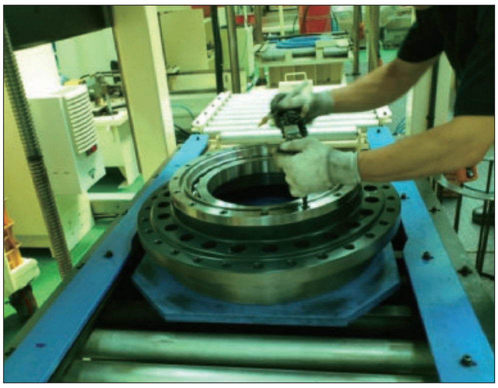
(4) Put sharp tool into gap between ring gear and housing and tap it tenderly to separate gear and housing.



480L2TM212

9) DISASSEMBLE HOUSING COMPONENTS

Hex socket head bolt (M10×25L) connecting housing and seal cover using torque wrench, and remove seal cover.

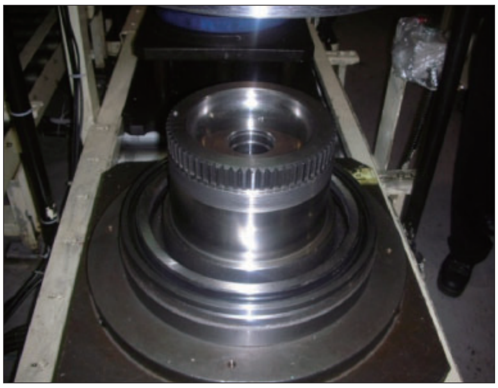


480L2TM213

10) SEPARATE MOTOR CASING AND FLOATING SEAL

Pull floating seal in motor casing slowly and remove floating seal from motor casing.

※ Do not re-use floacting seal.



480L2TM211

11) NO.1 CARRIER ASS'Y DISASSEMBLE

(1) Put spring pin into spring pin hole using specially designed tool.

480L2TM214

(2) Disassemble No.1 planetary gear, thrust washer, spring pin, needle bearing form No.1 carrier.

※ Do not re-use spring pin.

480L2TM215

12) NO.2 CARRIER ASS'Y DISASSEMBLE

(1) Cut No.2 solid pin by pressing spring pin using press machine.

⚠ **Be aware of scattering of components when operator use press machine.**

(2) Disassemble No.2 planetary gear, thrust washer, spring pin, needle bearing from No.2 carrier.

※ Do not re-use spring pin.

480L2TM216

3. ASSEMBLY OF REDUCTION GEAR

1) GENERAL PRECAUTIONS

(1) Clean all components with kerosene and dry them in shade. Remove all loctite with solvent.
Check the components.
Apply loctite #262 on thread of bolt-hex.socket head.
Be aware of dropping of parts on foot and safety accident.
Check the quantity of all parts in advance.

(2) Check the abnormality of thrust washer like twist or wear.

(3) Check the surface of every gear. Whether there is pitting or crack on them.

(4) Rolling the bearing and check the rolling condition and the noise.

(5) Check the surface of floating seal and crack of O-ring.

2) NO.1 CARRIER ASSEMBLY

(1) Set No.1 carrier on stable and even place.

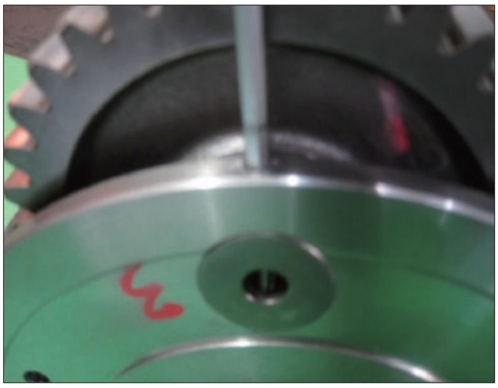
(2) Put needle bearing in No.1 planetary gear and place thrust washer 2 pcs on both side of gear. Assemble gear in carrier.

480L2TM217

(3) Align spring pin with No.1 carrier spring pin hole and assemble spring pin accordingly.

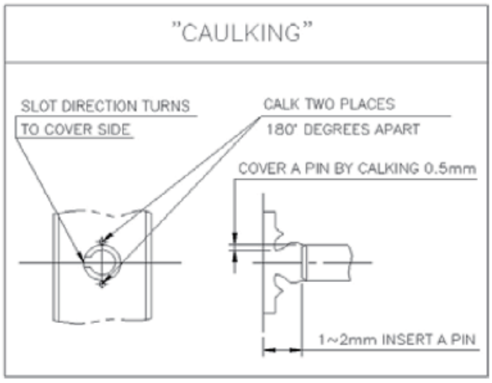
480L2TM218

(4) Put spring pin into No.1 carrier using jig with force.



480L2TM221

(5) Caulking both side of pressed spring pin 180˚ using caulking jig.



480L2TM219

3) NO.2 CARRIER ASSEMBLY

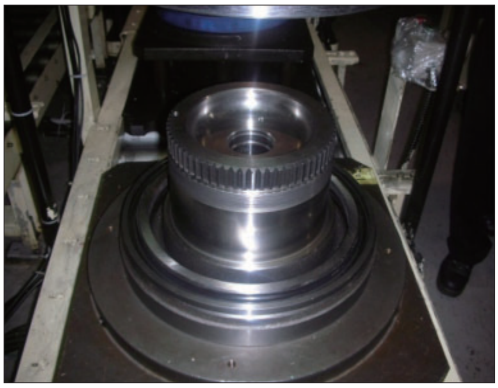
(1) Set No.2 carrier on stable and even place.
(2) Put needle bearing in No.2 planetary gear and place thrust washer 2 pcs on both side of gear. Assemble gear in carrier.
(3) Align solid pin hole of spring pin and No.2 carrier spring pin hole. and assemble spring pin accordingly.
(4) After assembly solid pin, put spring pin with force.
(5) Caulking both sides of pressed spring pin 180˚ using caulking jig.

480L2TM220

4) FLOATING SEAL ASSEMBLY

Wipe O-ring side of floating seal and contact surface of floating seal of motor casing with oil applied lint free towel, and press fitting floating seal into motor casing with special jig.

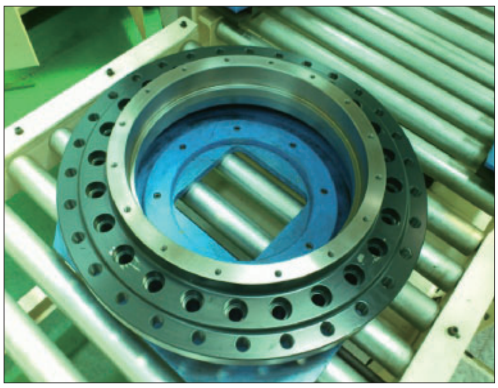
※ Keep the floating seal vertical against ground.



480L2TM222

5) HOUSING & MAIN BEARING ASSEMBLY

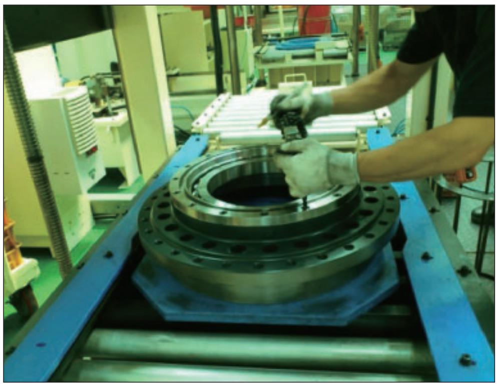
(1) Heating and cleaning housing with 60~70˚C temperature.
(2) Set the housing on working table safely, press fitting main bearing into both side of housing.



480L2TM224

6) SEAL COVER ASSEMBLY

Apply three bond #1194 on contact surface of housing and seal cover, tighten hex socket head bolt (M10×25L) with designed torque 6.3±0.6 kgf · m (45.6±4.3 lbf · ft) using torque wrench.

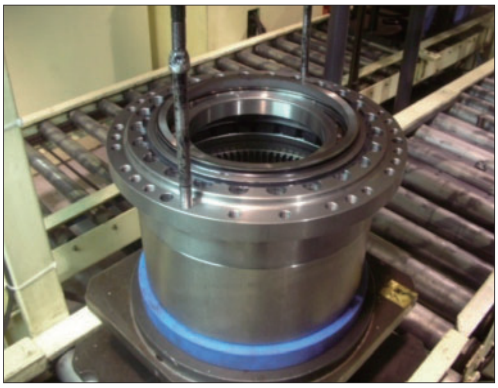


480L2TM225

7) HOUSING COMPONENTS AND RING GEAR ASSEMBLY

(1) Apply three bond #1194 on the surface of ring gear and housing contact surface, tighten hex socket head bolt (M20×120L) with designed torque 53±5.3 kgf · m (383±38.3 lbf · ft) using torque wrench.

(2) Wipe O-ring side of floating seal and contact surface of floating seal of seal cover with oil applied lint free towel, and press fitting floating seal into seal cover.



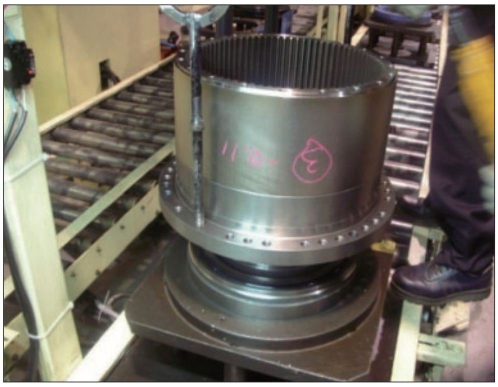
480L2TM223

8) MOTOR & ASSEMBLED HOUSING COMPONENTS ASSEMBLY

(1) Set eye bolt (M20) in housing flange tap hole.

(2) Assemble assembled housing components on motor using hoist.

※ Be sure set eye bolt firmly to keep operator safe.



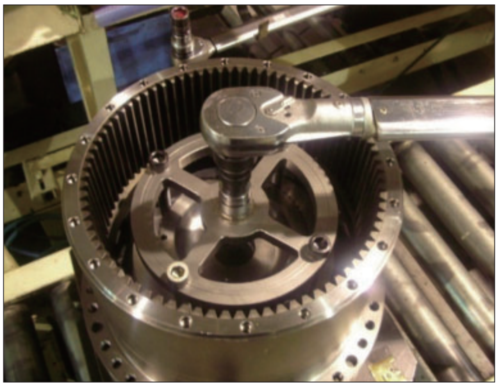
480L2TM226

9) NUT RING AND LOCK PLATE ASSEMBLY

(1) Tighten nut ring with designed torque using torque wrench.

(2) Set lock plate along with bolt hole of nut ring and assemble them.

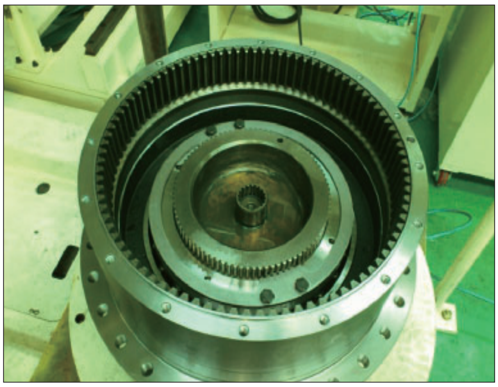
(3) Tighten hex head bolt (M12×20L) with designed torque 8.8±0.9 kgf · m (63.6±6.5 lbf · ft).



480L2TM228

10) COUPLING ASSEMBLY

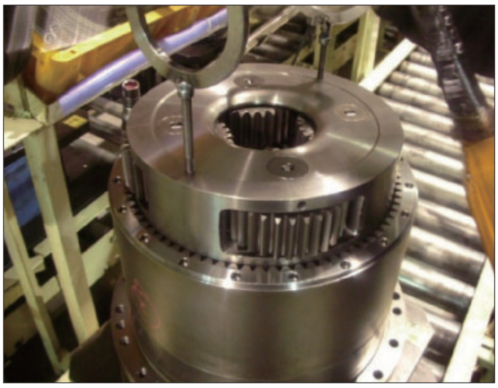
Assemble coupling with motor's spline.



480L2TM230

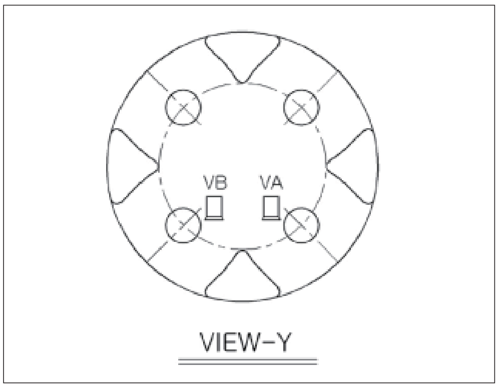
11) NO.2 CARRIER SUB ASSEMBLY

(1) Set eye bolt (M10) in No.2 carrier assy, lift them using hoist and set down No.2 carrier assy into motor.



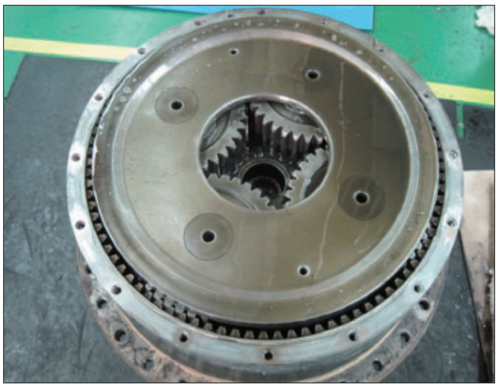
480L2TM229

※ To set the align valve ports, refer to right drawing.



480L2TM231

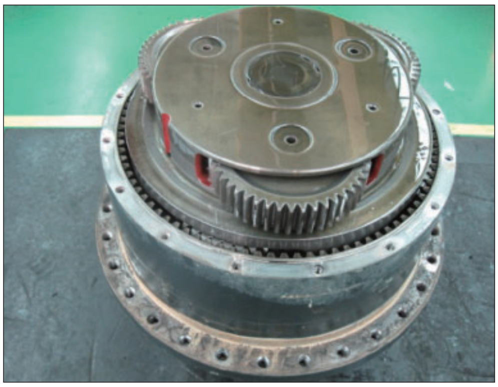
(2) Assemble No.2 sun gear into No.2 carrier assy.



480L2TM227

12) NO.1 CARRIER SUB ASSEMBLY

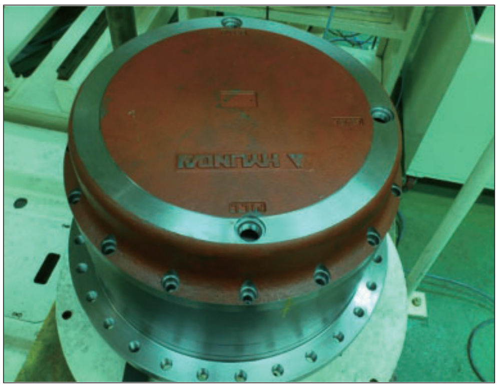
(1) Set eye bolt (M10) in No.1 carrier tap hole and set down No.1 carrier assy slowly.
(2) Assemble No.1 sun gear and No.1 carrier assy.
(3) Assemble thrust plate and carrier.



480L2TM232

13) COVER ASSEMBLY

(1) Put parallel pin (Ø13×20L) into parallel pin hole of ring gear with rubber hammer.
(2) Apply three bond #1194 on cover contacting surface of ring gear and assemble cover.
(3) Tighten 16 of hex socket head bolt (M12×35L) with designed torque 14.3±1.4 kgf · m (103±10.1 lbf · ft) using torque wrench.



480L2TM233

14) PUTTING GEAR OIL

(1) Put gear oil 12±0.5L through drain port and check the level gage.
(2) Tighten oil plug with torque 10±1.0 kgf · m (72.3±7.2 lbf · ft).

TRAVEL DEVICE (TYPE 3)

1. REMOVAL AND INSTALL

1) REMOVAL

(1) Swing the work equipment 90˚and lower it completely to the ground.

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

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

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

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

(4) Remove the track shoe assembly.
For details, see removal of track shoe assembly.

(5) Remove the cover.

(6) Remove the hose.

※ Fit blind plugs to the disconnected hoses.

(7) Remove the bolts and the sprocket.

(8) Sling travel device assembly (1).

(9) Remove the mounting bolts (2), then remove the travel device assembly.

- Weight : 360 ㎏ (790 ℔)
- Tightening torque : 57.9±8.7 kgf · m (419±62.9 lbf · ft)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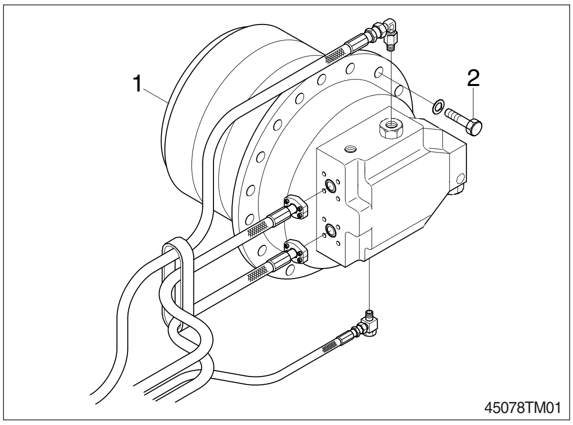


45078TM01

2) INSTALL

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

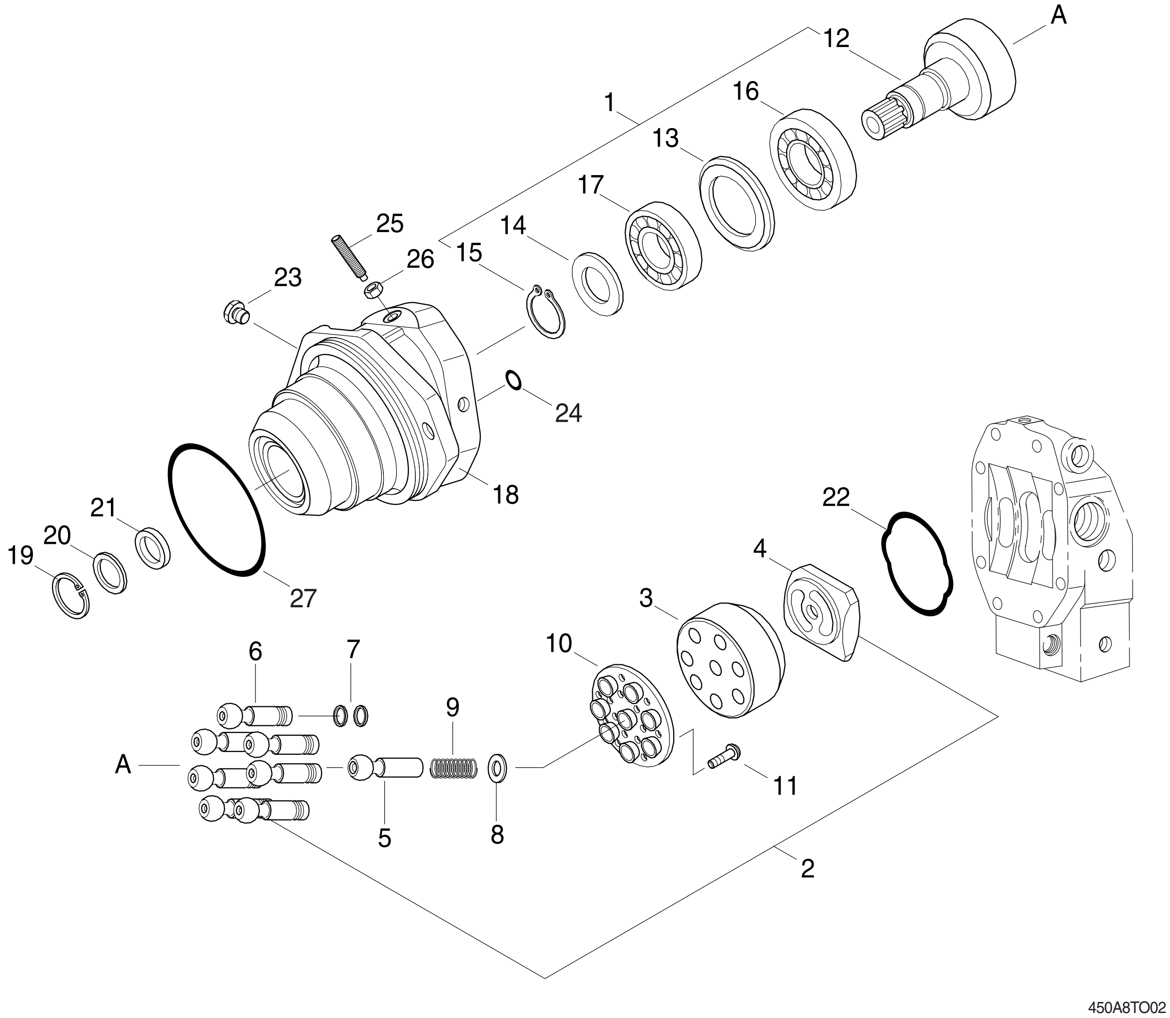
(2) Bleed the air from the travel motor.

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)

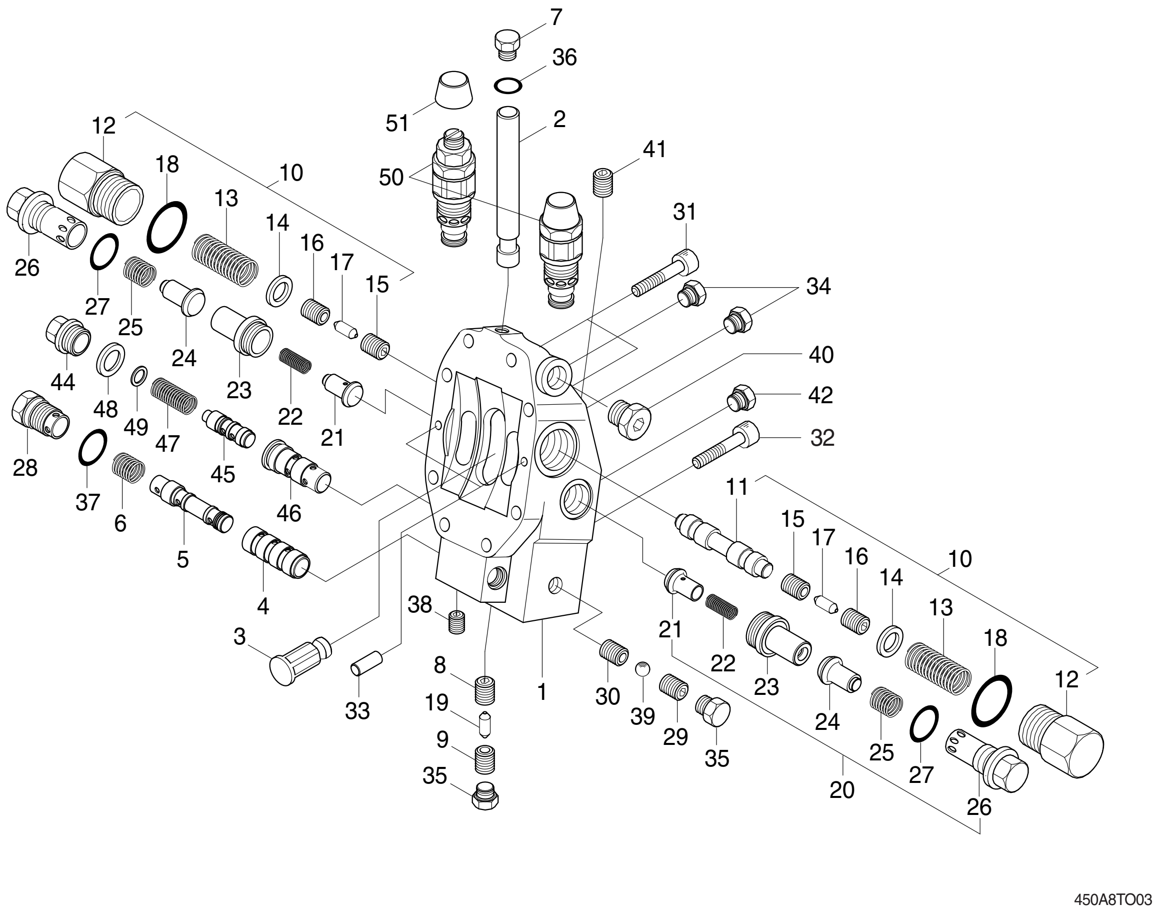
1) STRUCTURE



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)

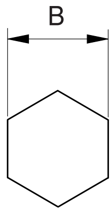
· Control part



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.

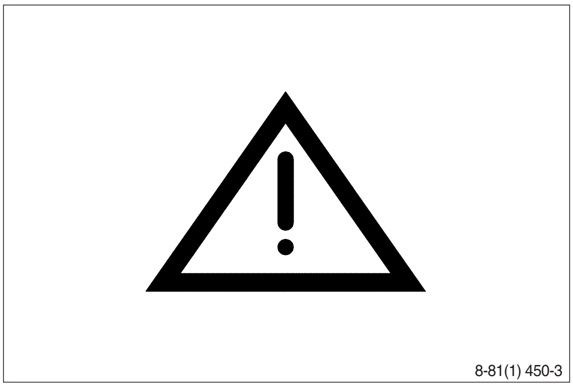
④ During disassembly, give a match mark to the mating surfaces of each part.

⑤ Arrange removed parts in order so that they will not become damaged or missing during disassembly.

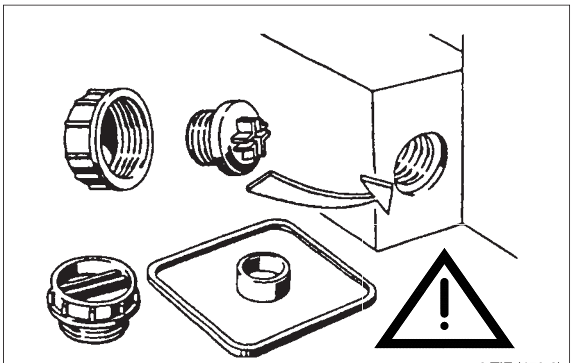
⑥ Once seals have been disassembled, they should be replaced even if damage is not observed. Have replacement seals ready on hand before starting your disassembling job.

(2) Seal kit and component groups

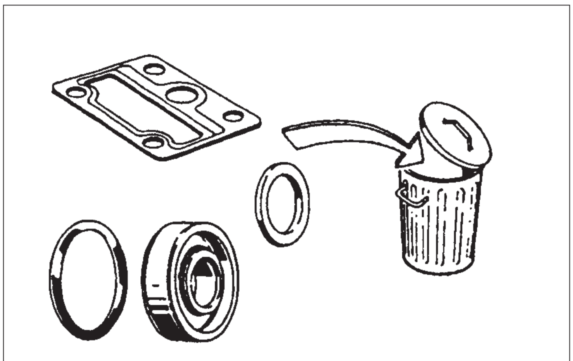
① Attention
Observe the following notices when carrying out repair work at hydraulic aggregates!


8-81(1) 450-3

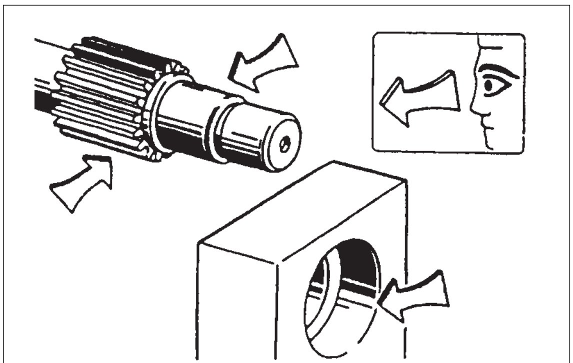
② Close all ports of the hydraulic aggregates.


2.TIF (450-3)

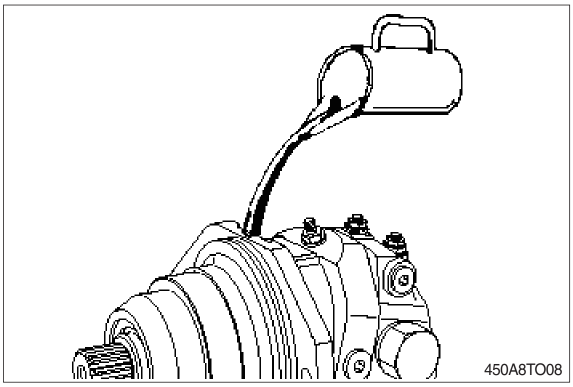
③ Replace all seals.
Use only original spare parts.


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.

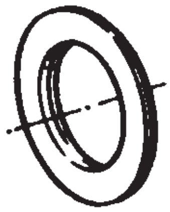

4.TIF (450-3)

⑤ Fill up hydraulic aggregates with hydraulic oil before start-up.



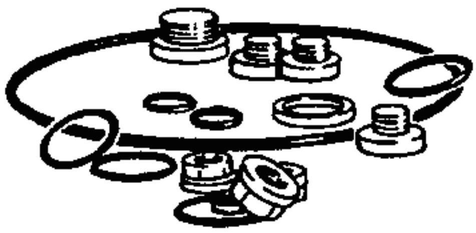
450A8TO08

⑥ Seal kit for drive shaft.



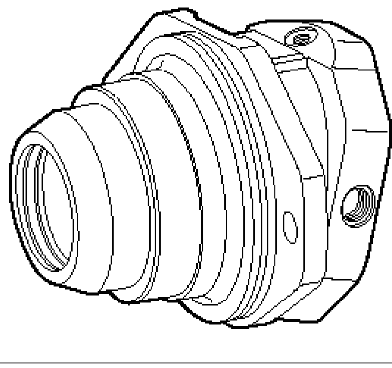
6.TIF (450-3)

⑦ External seal kit.



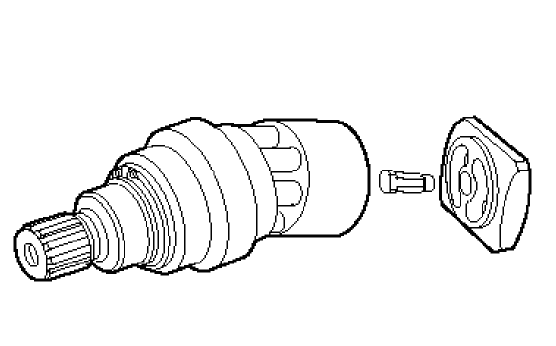
450A8TO05

⑧ Housing.

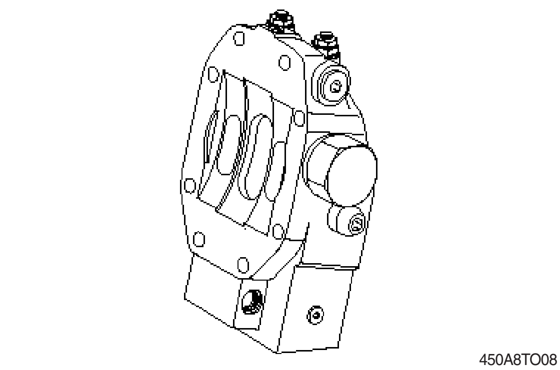


450A8TO06

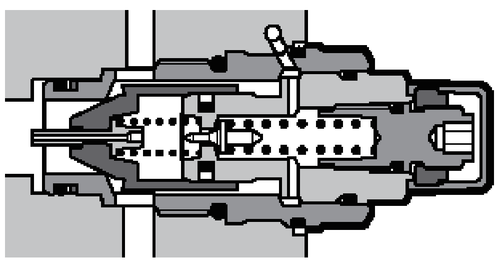
⑨ Complete rotary group.


450A8TO07

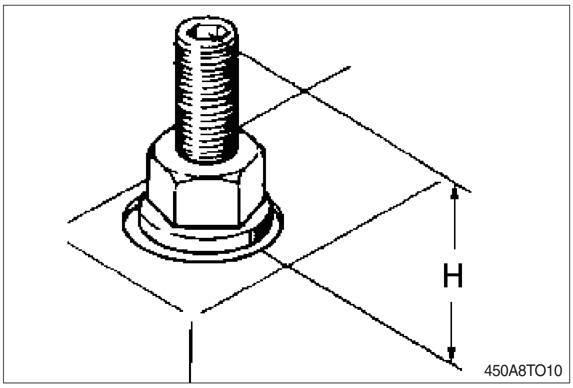
⑩ Port plate with control piston and counter-balance valve.


450A8TO08

⑪ Relief valve/Make up check valve

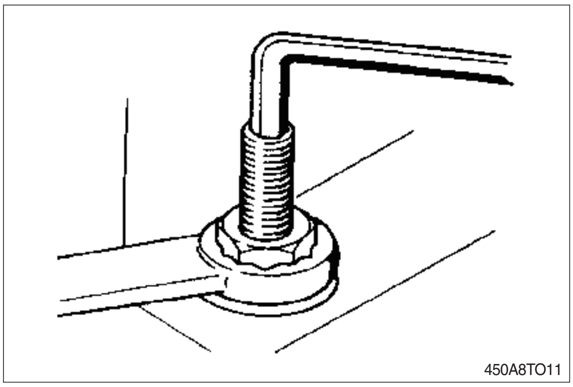

450A8TO09

⑫ Replace seal nut.
First measure and record setting height.



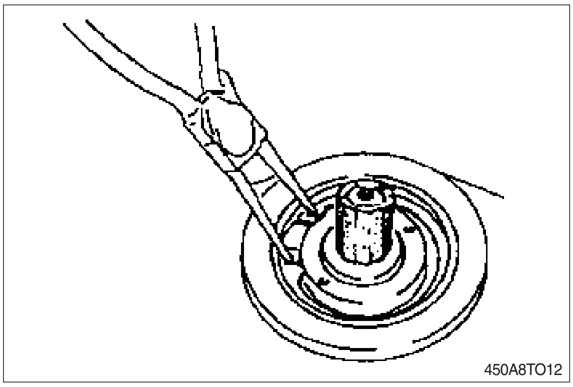
450A8TO10

⑬ When tightening, counterhold setting screw, then check setting height.

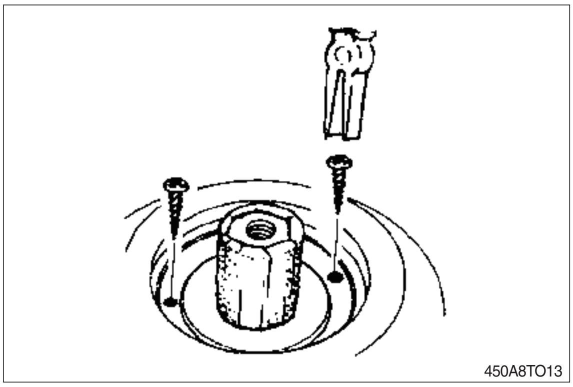

450A8TO11

(3) Sealing the drive shaft

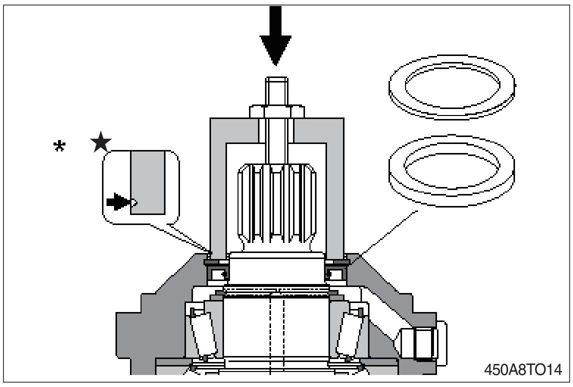
① Protecting the drive shaft.
Remove retaining ring and shim.


450A8TO12

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.

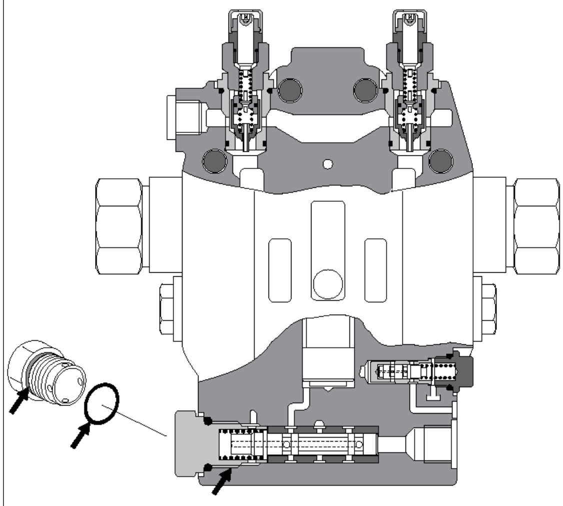


450A8TO14

(4) Sealing of the control parts

① HZ-Controller

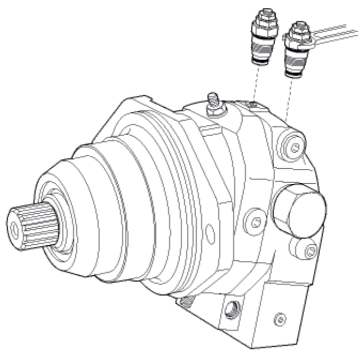
※ O-ring, O-ring groove, housing.



450A8TO15

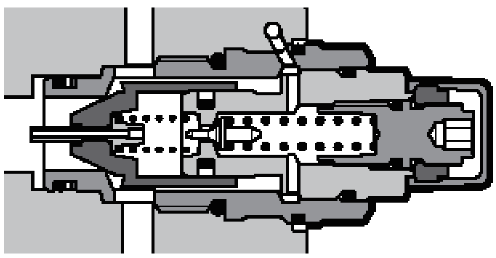
(5) Sealing of the relief valve

① Remove relief valve.



450A8TO16

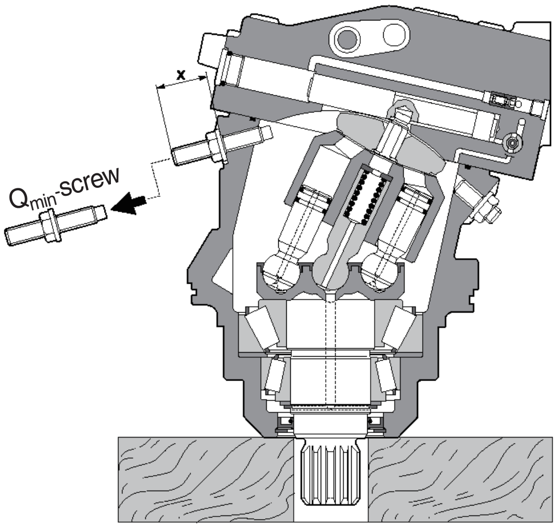
② Inspect
O-ring.



450A8TO17

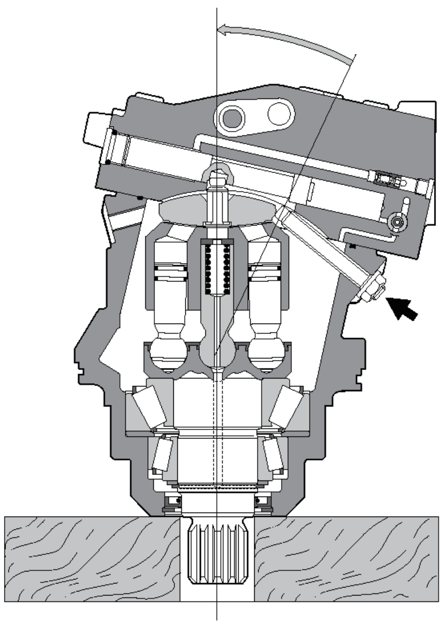
(6) Disassembly of the port plate

① Note dimension x.
Remove Q_{min}-screw.



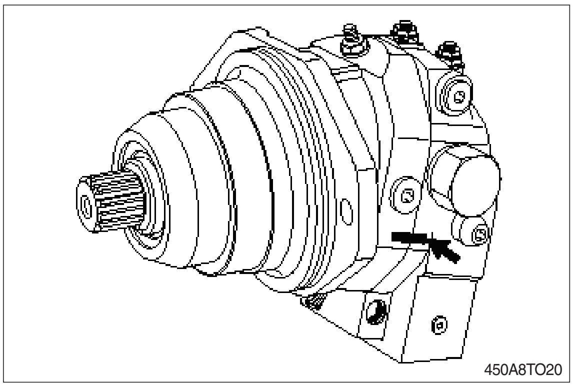
450A8TO18

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}.



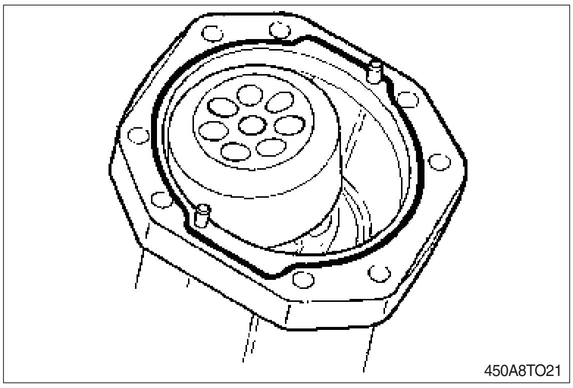
450A8TO19

③ Port plate
Mark position. Loosen screws.
Removal.



450A8TO20

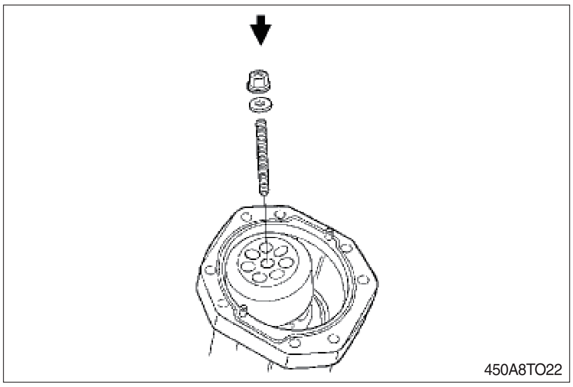
④ Check O-ring.
※ Stick new O-ring with some grease. Do not swivel rotary group. Piston rings to hang out from the cylinder boring.



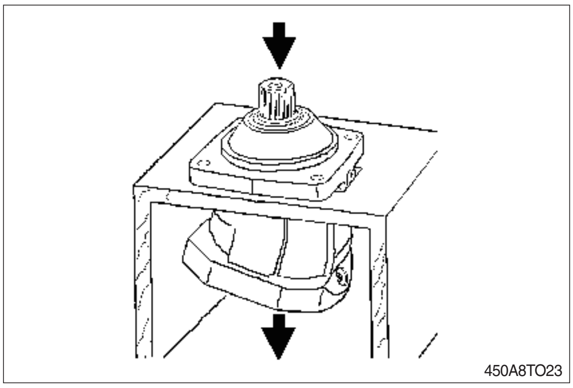
450A8TO21

(7) Remove rotary group

① Screw in threaded pin into center pin.
Fix the cylinder with disc and lock nut.
Size : M8×105 mm

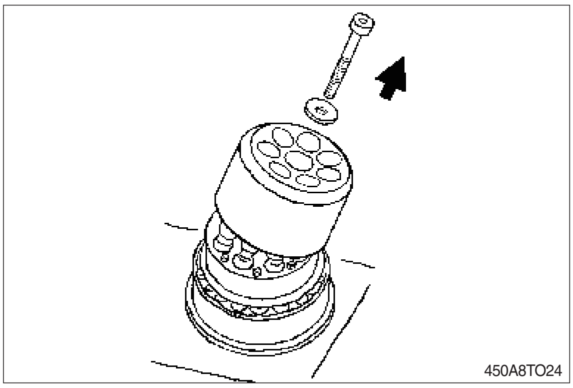

450A8TO22

② Press out rotary group!
※ If the bearings are used again do not hit on the drive shaft.

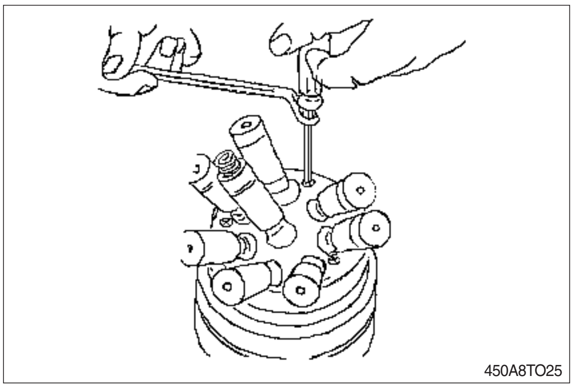

450A8TO23

(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

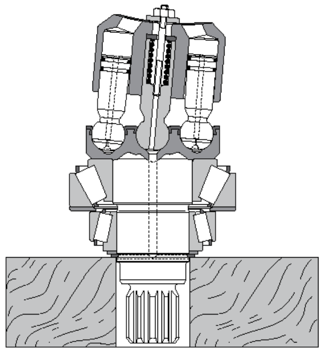
4) ASSEMBLY

(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.

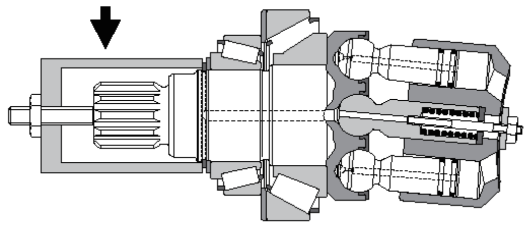
(2) Rotary group assembly

① Rotary group completely assembled ready for assembly.



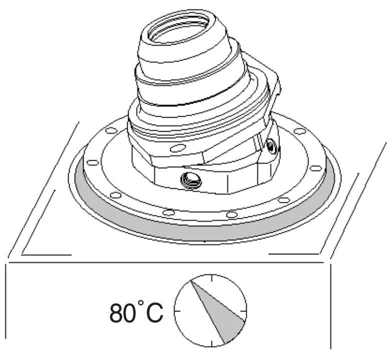
450A8TO33

② Place assembly sleeve.



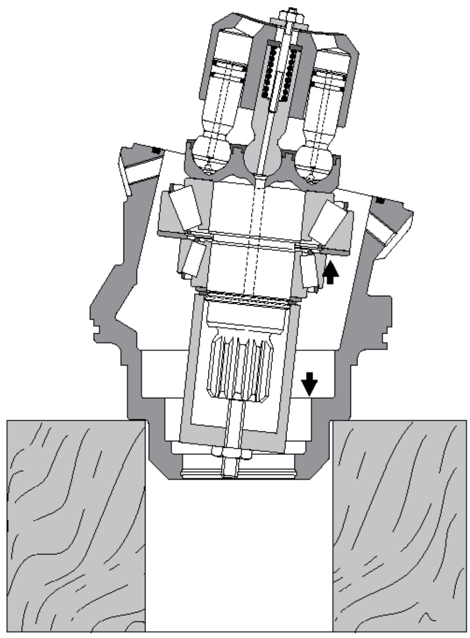
450A8TO34

③ Warm up housing to 80˚C.



450A8TO35

④ Insert rotary group into housing to seat position.

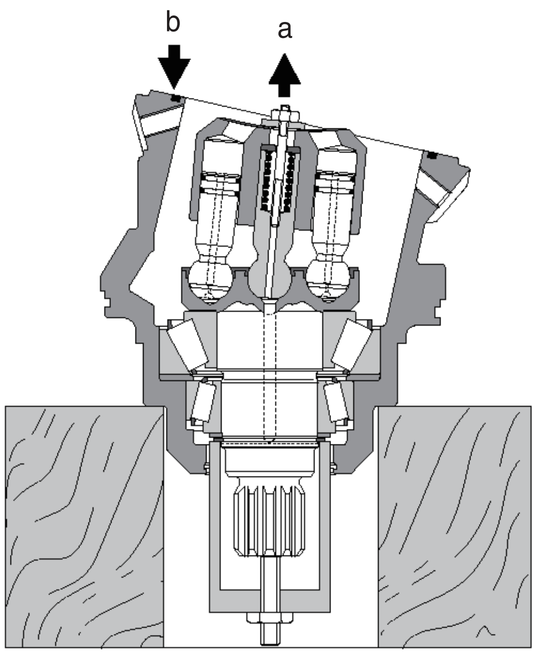


450A8TO36

⑤ Fix zero position of cylinder with Q_{max}-screw.

a. Disassemble cylinder fixing screw.

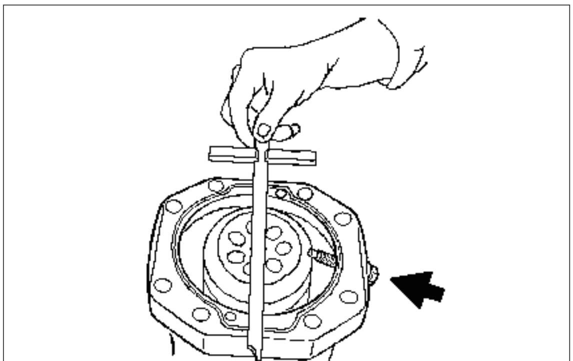
b. Insert O-ring.



450A8TO37

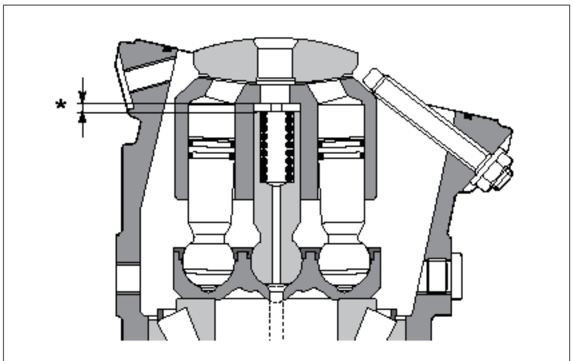
(3) Rotary group adjustment

① Determine cylinder swivel range to max angle with screw.



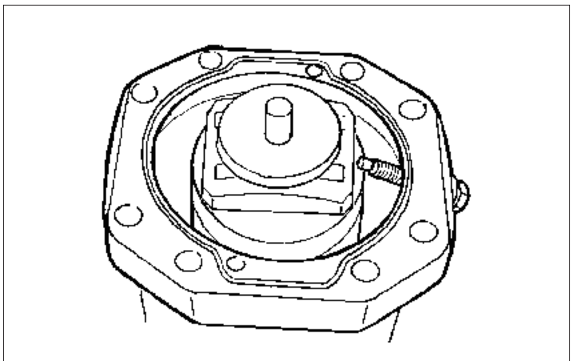
450A8TO38

② *Disc



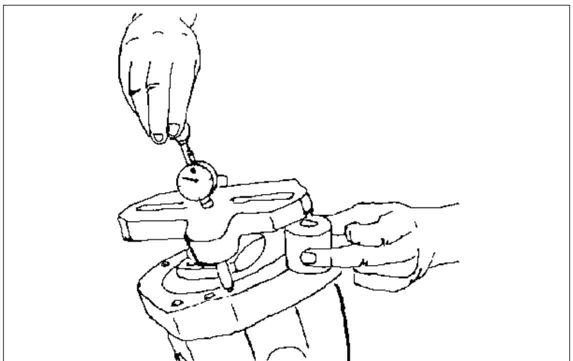
450A8TO39

③ Place centering disc.



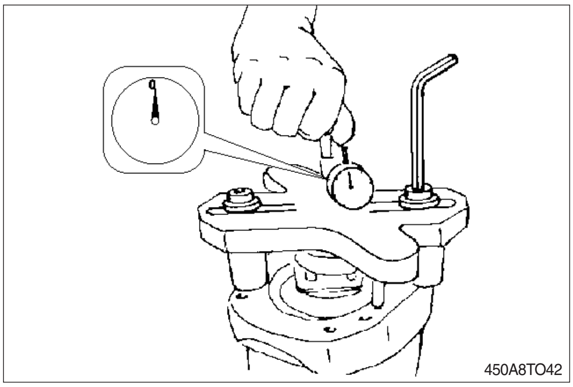
450A8TO40

④ Mount measuring device.



450A8TO41

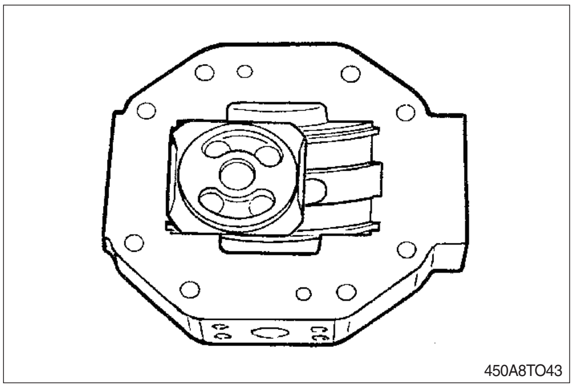
⑤ Check dimension X.



450A8TO42

(4) Assembly of the port plate

※ Stick centrol lens in sliding surface with grease. Assembly in reversal order. Mount port plate.



450A8TO43

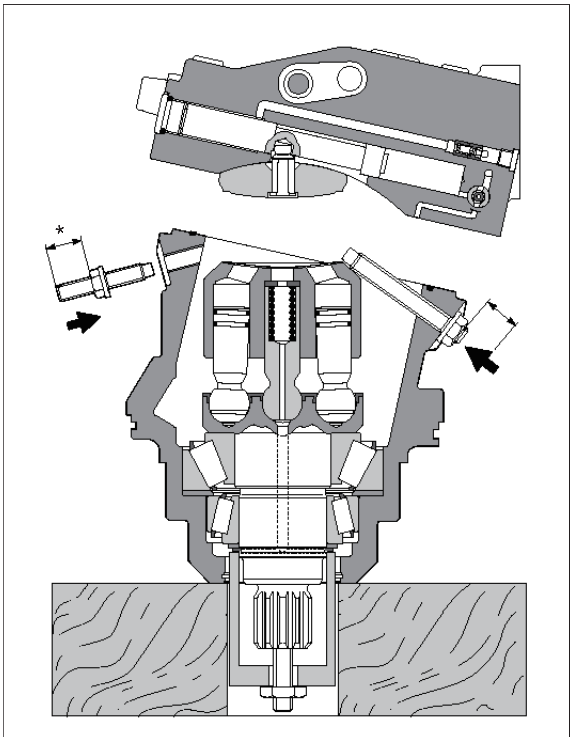
① Assembly port plate.

※ Take care of assembly design! Tighten fixing screws with torque.

a. Set Q_{min}-screw to dimension*.

b. Assemble plug.

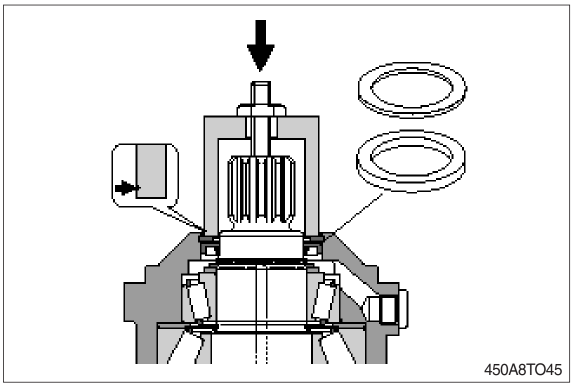
c. Remove assembly sleeve.



450A8TO44

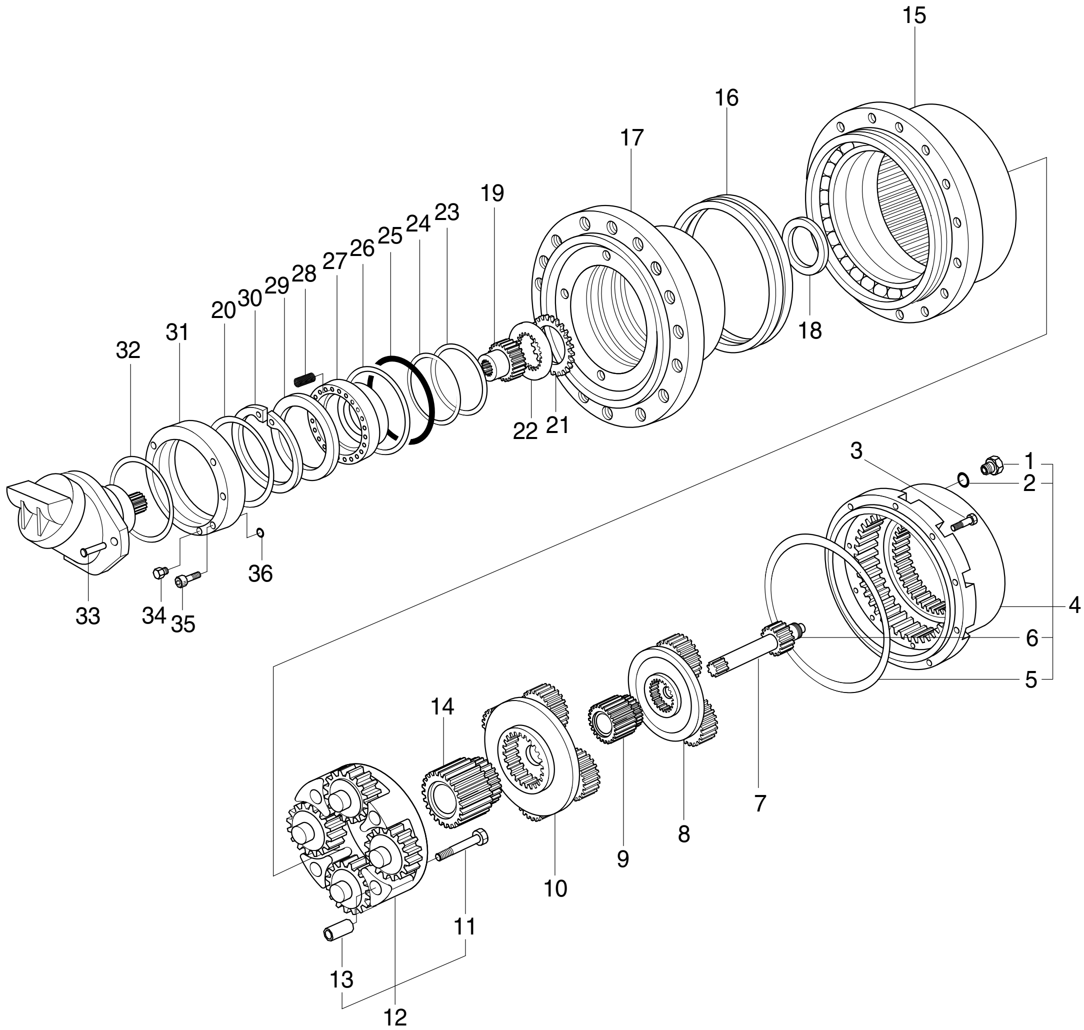
② Assemble shaft seal, disc and safety ring. Press-in with assembly sleeve.

※ Take care of press-in depth.



3. REDUCTION GEAR

1) STRUCTURE



450A8TR01

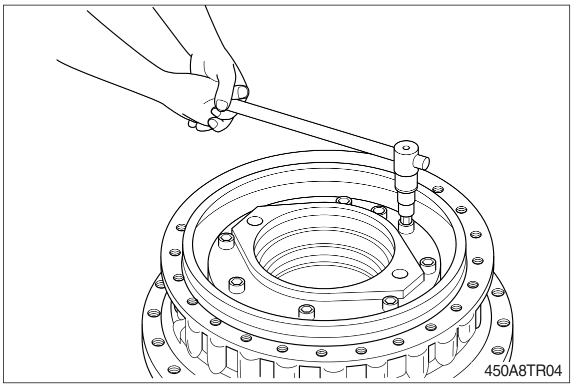
1	Washer	13	Bushing	25	O-ring
2	Breather plug	14	Sun gear	26	Spiral ring
3	Screw	15	Housing	27	Piston
4	Cover set	16	Lifetime seal	28	Spring
5	O-ring	17	Hub	29	Spacer
6	Pad	18	Spacer	30	Circlip
7	Sun gear	19	Brake shaft	31	Flange
8	Reduction assy (1st)	20	O-ring	32	O-ring
9	Sun gear	21	Brake disc	33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

2) DISASSEMBLING

Initial inspection of the gears and the travel motor, can be made without disassembling the track and the gearmotor from the machine.

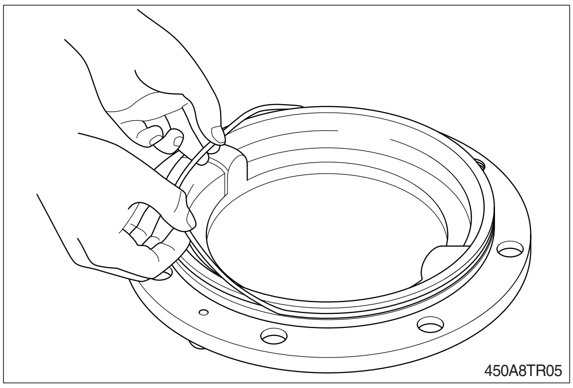
Prior to disassembling make sure that the oil is discharged, unscrew and remove the 2 screws (33), and remove the travel motor and the O-ring (32).

(1) Unscrew the 8 socket head screws (3) and remove the motor flange from the flanged hub (17).



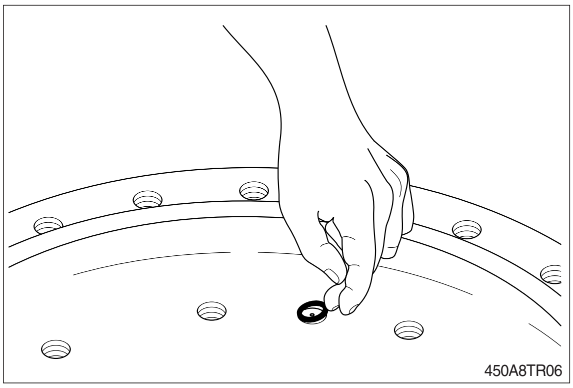
450A8TR04

(2) Remove the O-ring (20) from its grove in the motor flange (31).



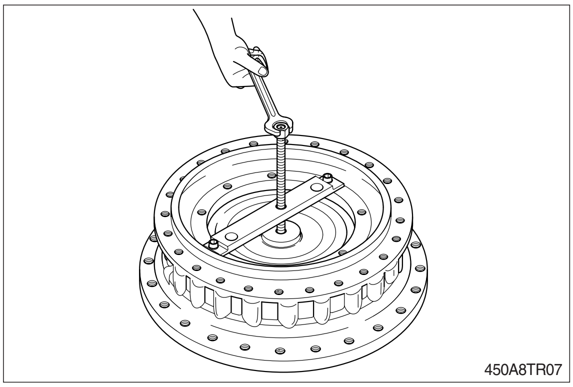
450A8TR05

(3) Remove the O-ring (36) from its grove in the flanged hub (17).

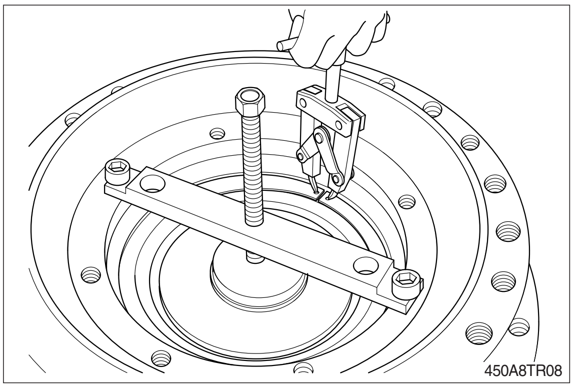


450A8TR06

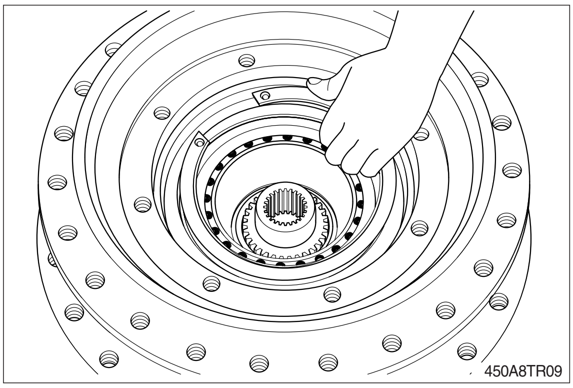
(4) After having places the disc on the spring retainer (29), fix the pusher on the flanged hub (17) as shown in the scheme by screwing the threaded bar, push the disc on the retainer, thus removing the force of the springs (28) on the circlip (30) and allowing its disassembling.



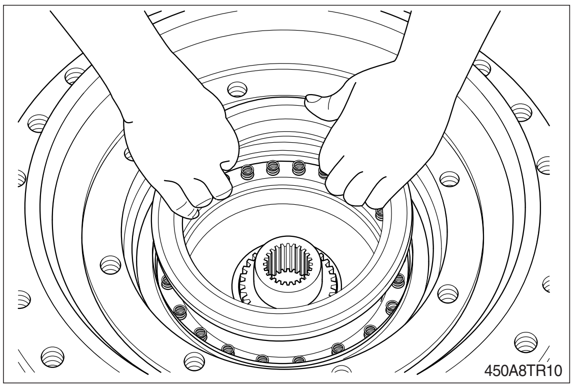
(5) Using pliers remove the circlip (30) from its grove in the flanged hub (17).



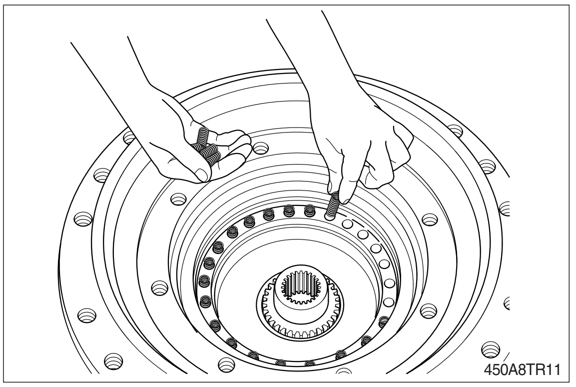
(6) Disassemble the equipment from the flanged hub (17) and remove the circlip (30).



(7) Remove the springs retainer (29).

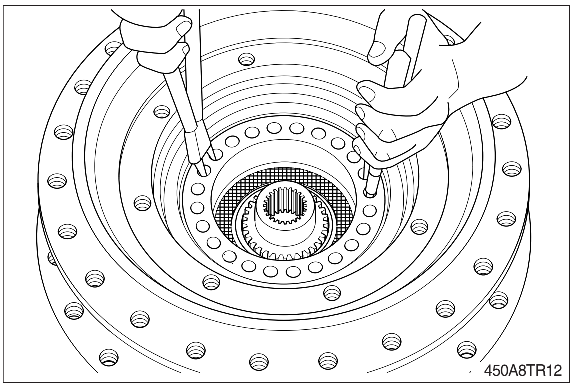


(8) Remove the springs (28) from their groves.

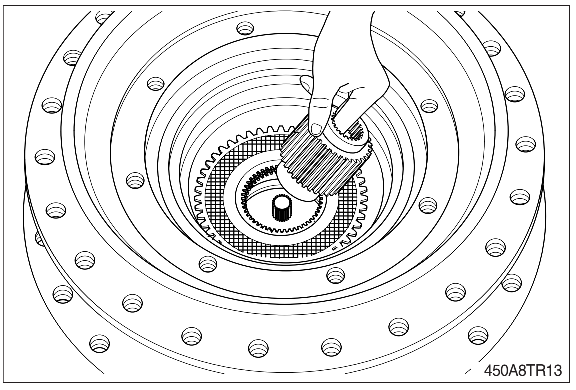


(9) Using pliers remove the brake piston (27).

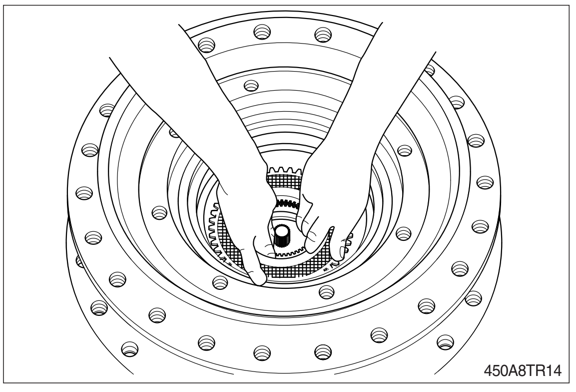
※ To get it easier, pumping compressed air into the brake port hole.



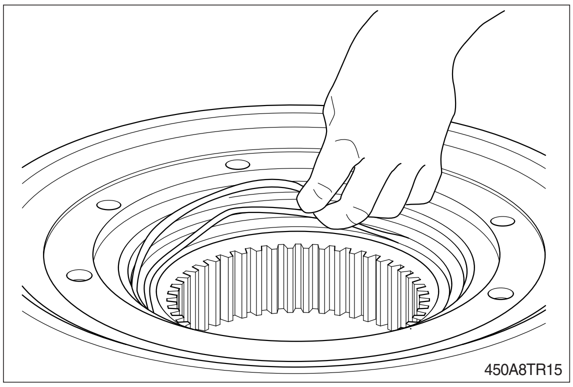
(10) Remove the brake shaft (19).



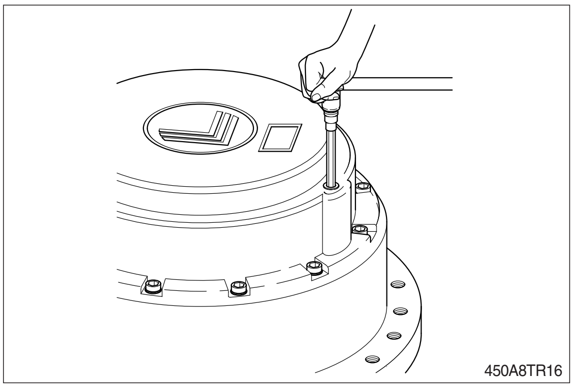
(11) Remove brake discs pack (21, 22).



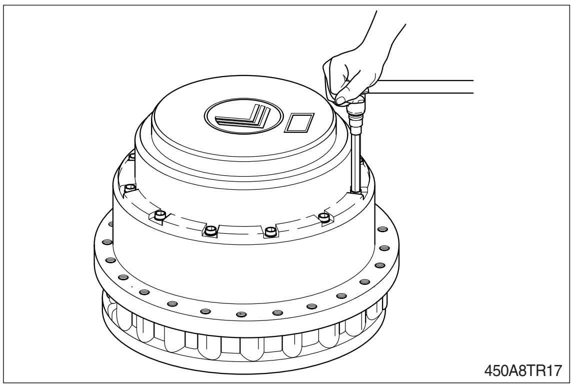
(12) Remove the O-rings (24,25) and the backup rings (23, 26) from their groves in the flanged hub (17).



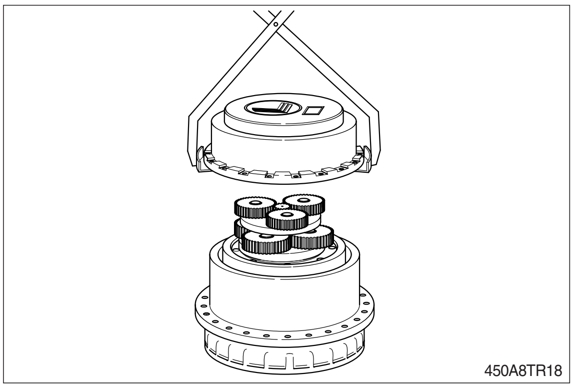
(13) Turn the gearbox around, unscrew and remove the 2 plugs (2) and the 2 washers (1) from the end cover (4).



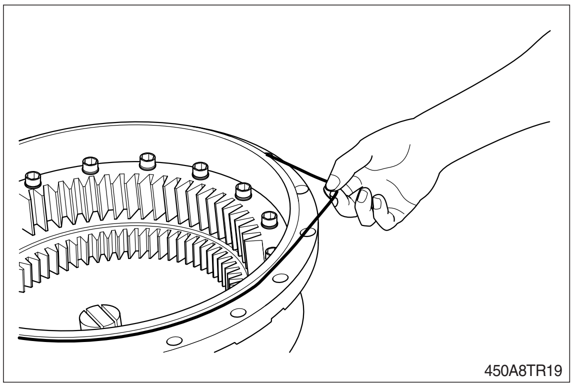
(14) Unscrew and remove the 16 socket head screws (3).



(15) By means of a puller remove the end cover (4).

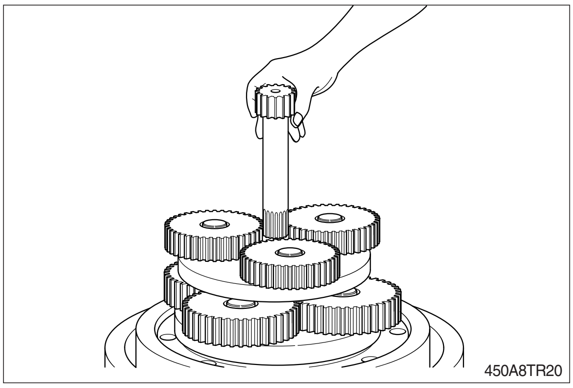


(16) Remove the O-ring (5) from its grove in the end cover (4).



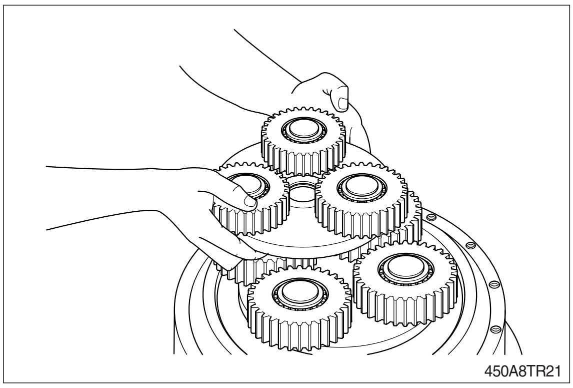
450A8TR19

(17) Remove the 1st stage sun gear (7).



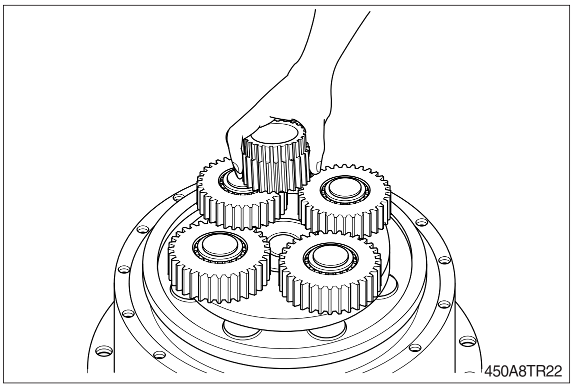
450A8TR20

(18) Remove the 1st reduction assembly (8).



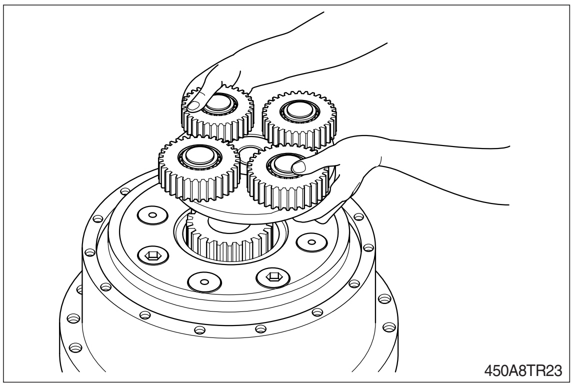
450A8TR21

(19) Remove the 2nd stage sun gear (9).

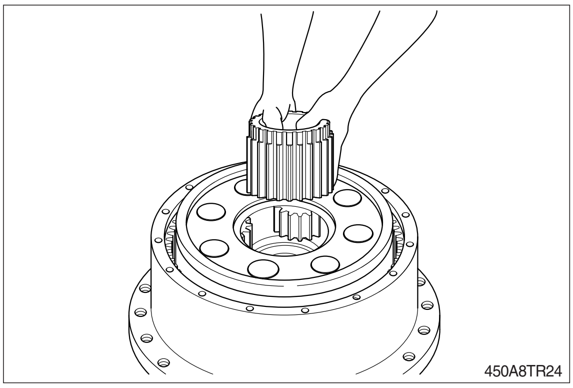


450A8TR22

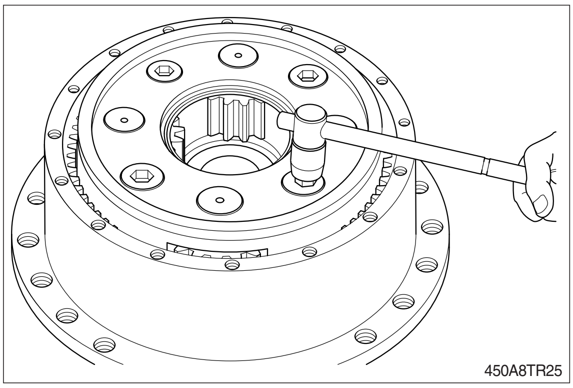
(20) Remove the 2nd reduction assembly (10).



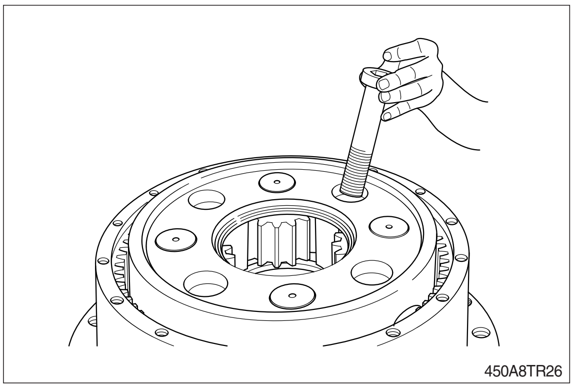
(21) Remove the 3rd stage sun gear (14).



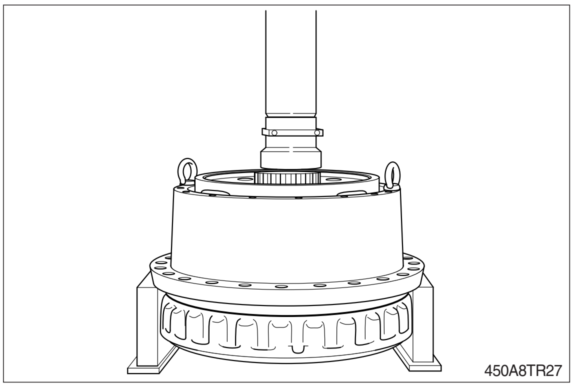
(22) Unscrew the 4 socket head screws (11), fixing the 3rd reduction assembly (12) to the flanged hub (17).



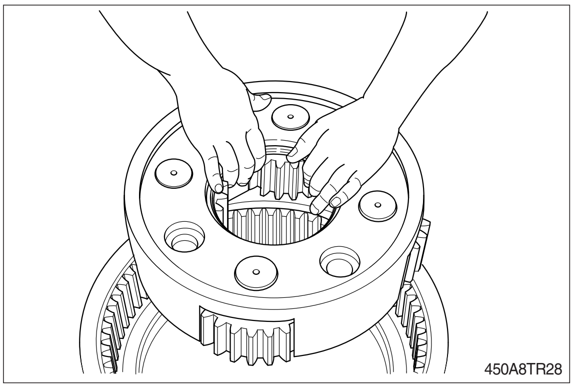
(23) Remove the 4 screws (11).



(24) Using a press and a metal stopper, remove the flanged hub (17) from the gearbox housing (14), paying attention to the eventual falling down of the main bearing's balls.



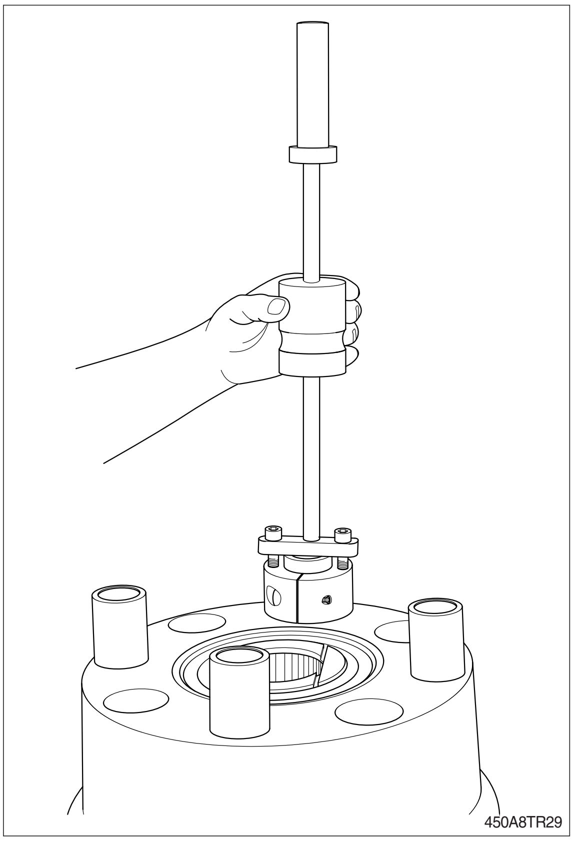
(25) Remove the 3rd reduction assembly (12) from the flanged hub (17).



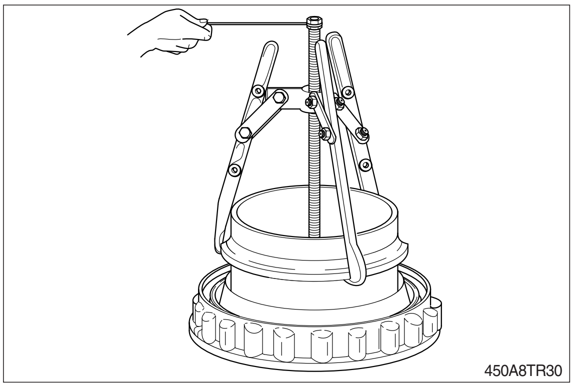
(26) Using the equipment, remove bushes (13) from the flanged hub (17).

※ It is possible that the planet assemblies (see reassembly (11))remain assembled to the planet-carrier. In this case it is sufficient to push on them by means of a rubber pad or a press.

In case the planet assemblies remain assembled to the flanged hub, it is better to use the fixture (for this operation).



(27) By means of an extractor, remove the inner race of the bearing and spacer kept on the flanged hub (17).

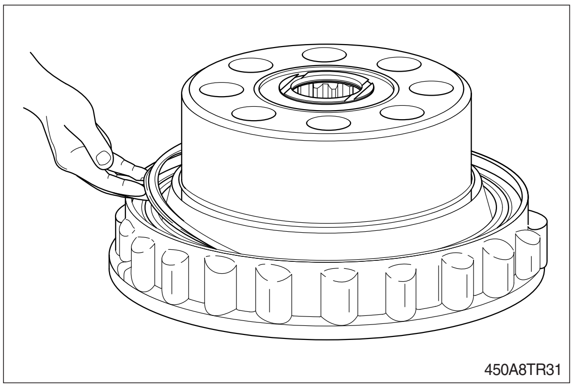


450A8TR30

(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

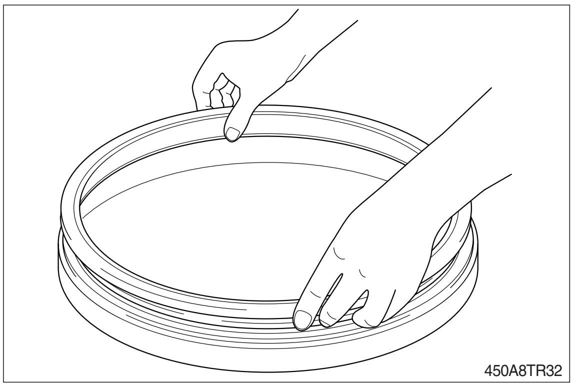
3) REASSEMBLY

※ 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.

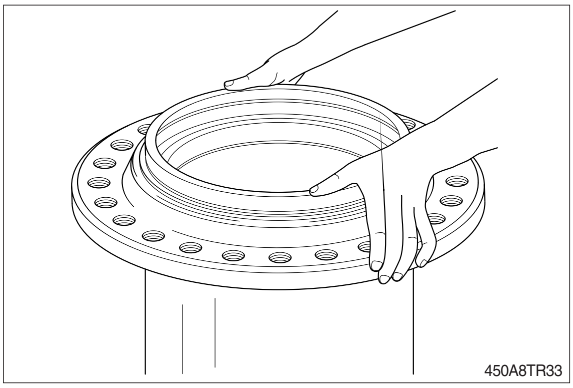
※ Before reassembling the O-ring, gaskets and the oil seals:
Concerned should be removed.
Clean with care all the housing of the seal and put some grease on the gasket before mounting.

※ Never change only one part of the lifetime seal, always the two rings together.

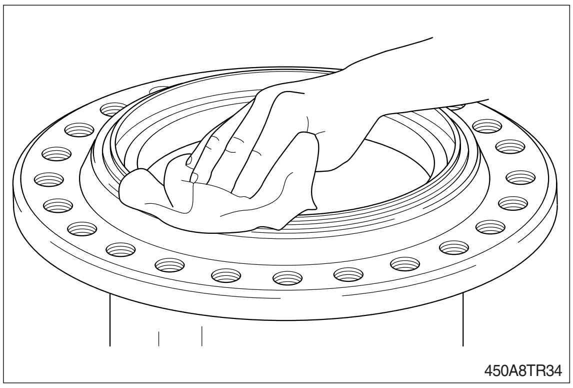
(1) Fit the half seals (16) on the tool.



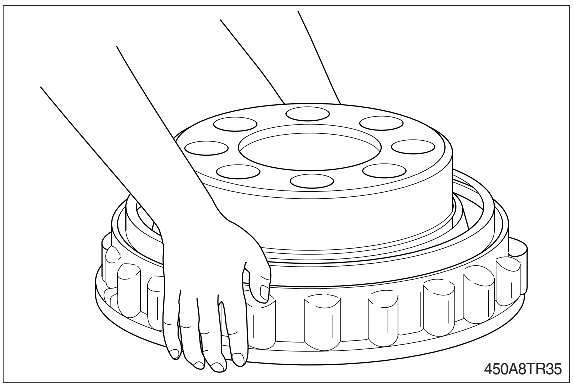
(2) Fit the half seals (16) inside the gearbox housing (15).



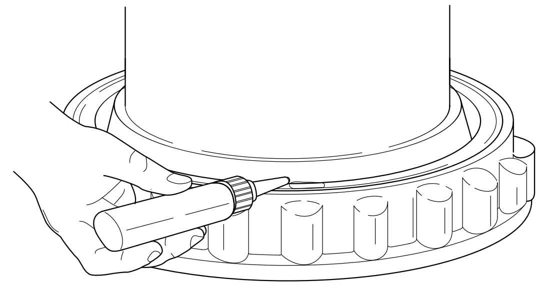
(3) Clean carefully the metallic face of the half-seal.



(4) Assemble, by using the same tool, the half seal (16) on the flanged hub (17).

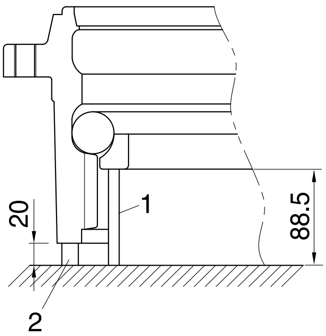


(5) Lube the metallic face of the half seal with a thin oil film.



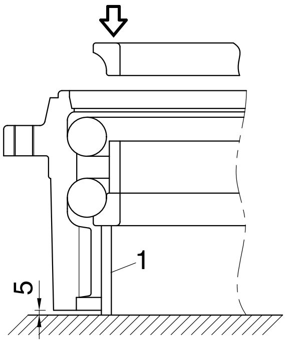
450A8TR36

(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.



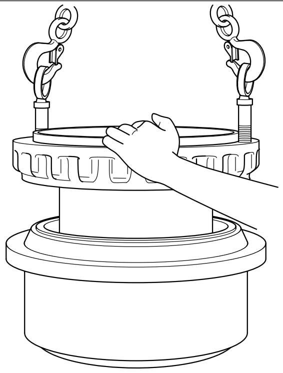
450A8TR03-1

(7) After having placed the bearing spacer fit the upper ball row.
Then place the upper inner race.



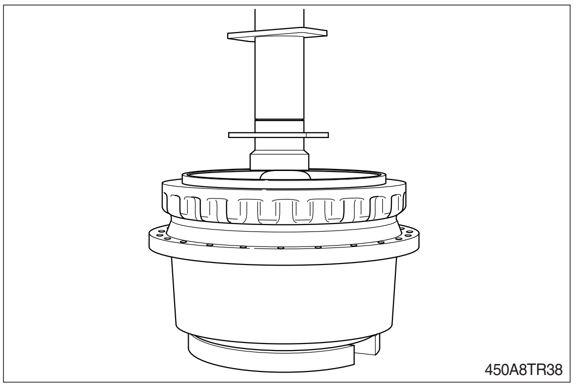
450A8TR03-2

(8) Lift the flanged hub (17) then lower it inside the gearbox housing (15).

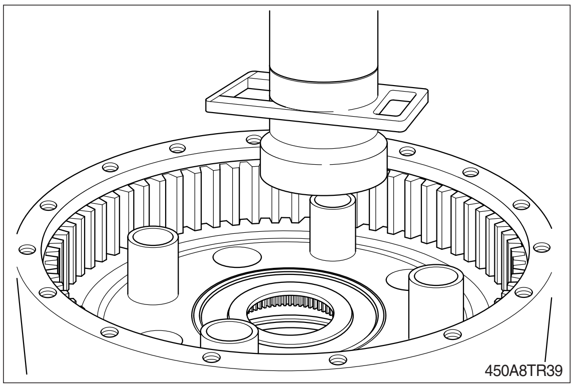


450A8TR37

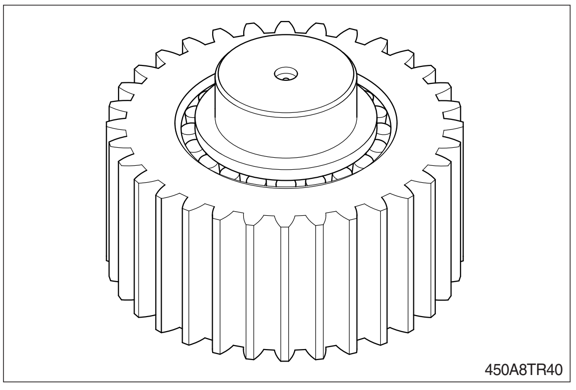
(9) Using a press and a metal stopper, push the flanged hub (17) against the shoulder on the gearbox housing (15) until assembling is complete.



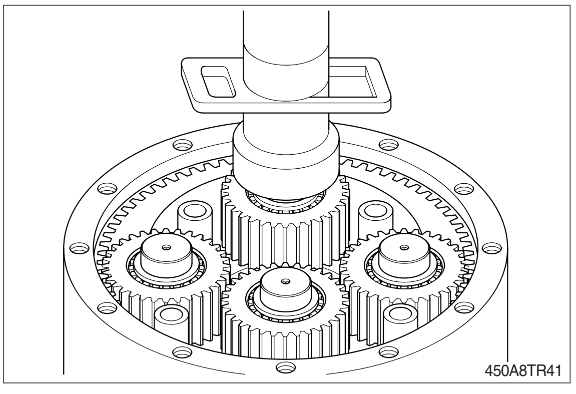
(10) Using a press, place and push the 4 bush, inside their seats on the flanged hub (17).



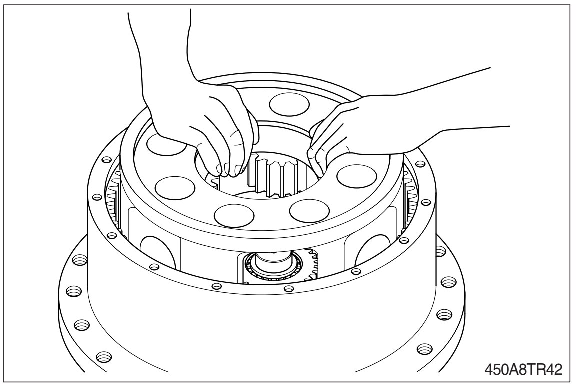
(11) View of the 3rd reduction's planet assembly.



(12) Using a press push the 4 planet assemblies against the shoulder on the flanged hub (17).

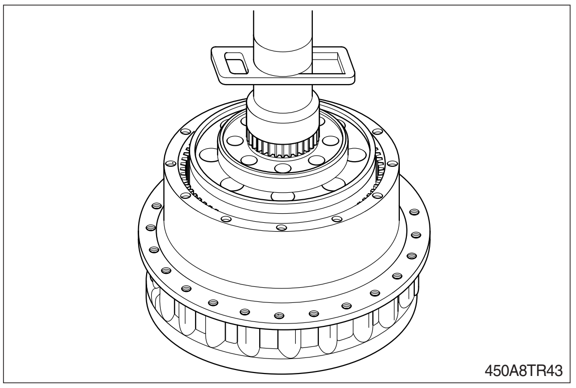


(13) Place the 3rd reduction planet carrier on the hub (17).



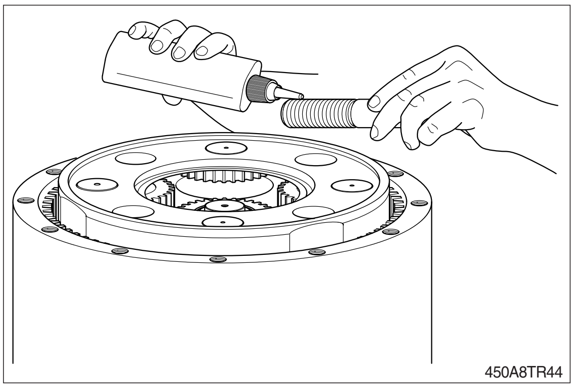
450A8TR42

(14) Using a press push the 3rd reduction planet carrier against the shoulder on the flanged hub (17) until complete assembly.



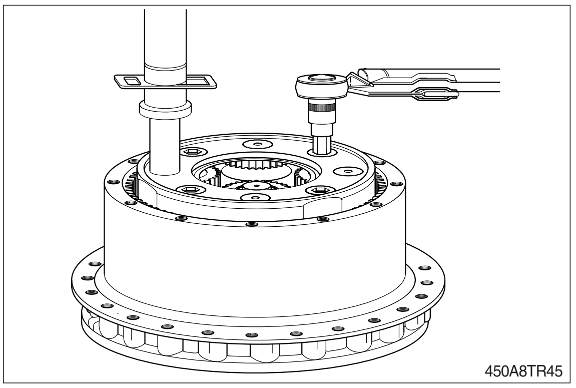
450A8TR43

(15) Apply LOCTITE type 243 on the 4 socket head screws (11), and insert them in the thread holes.



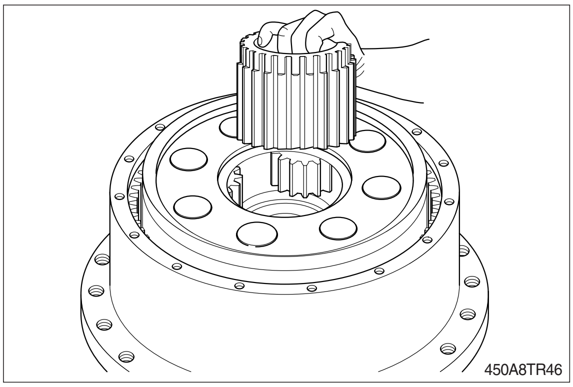
450A8TR44

(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.

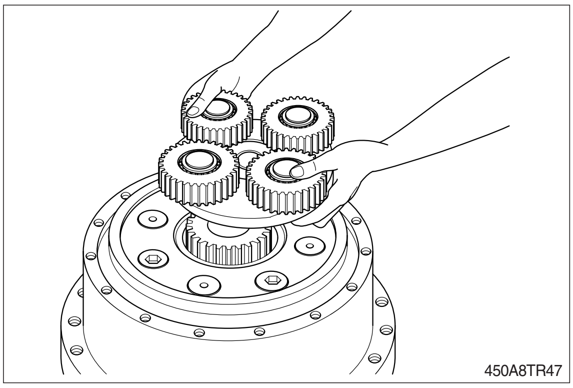


450A8TR45

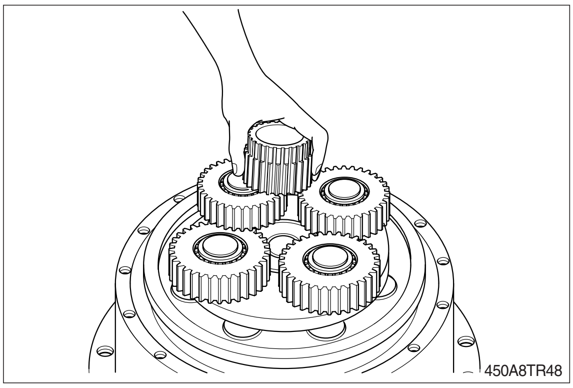
(17) Insert the 3rd stage sun gear (14).



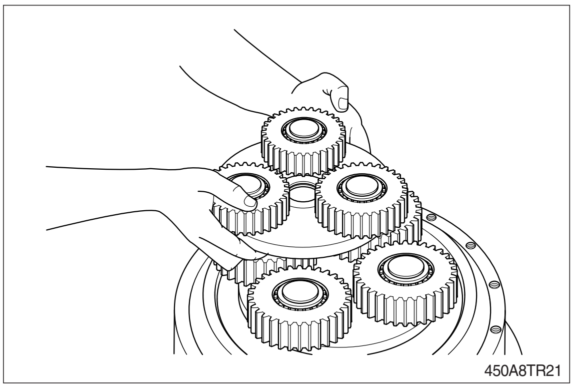
(18) Insert the 2nd reduction assembly (10).



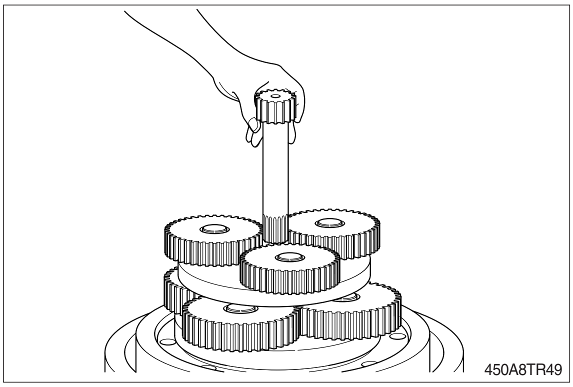
(19) Insert the 2nd stage sun gear (9).



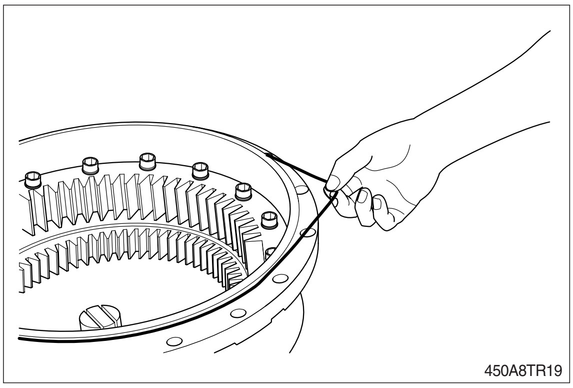
(20) Insert the 1st reduction assembly (8).



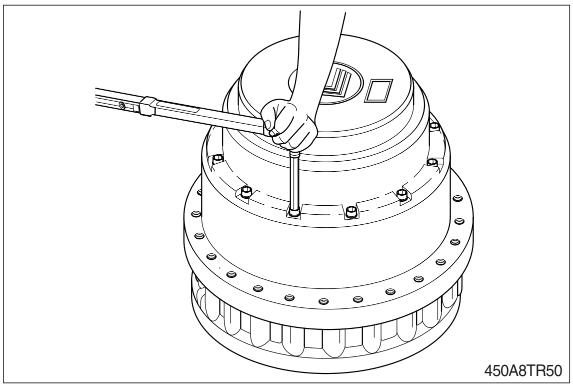
(21) Insert the 1st stage sun gear (7).


450A8TR49

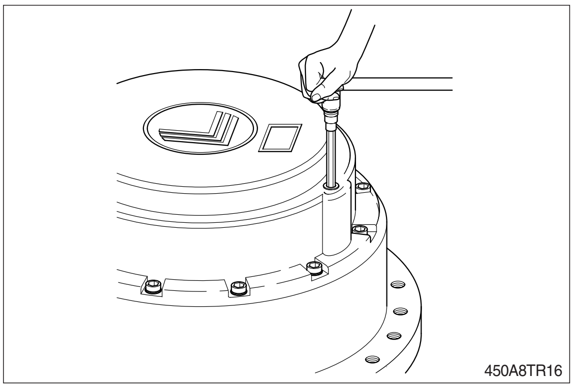
(22) Fit the O-ring (5) into its grove in the end cover (4).


450A8TR19

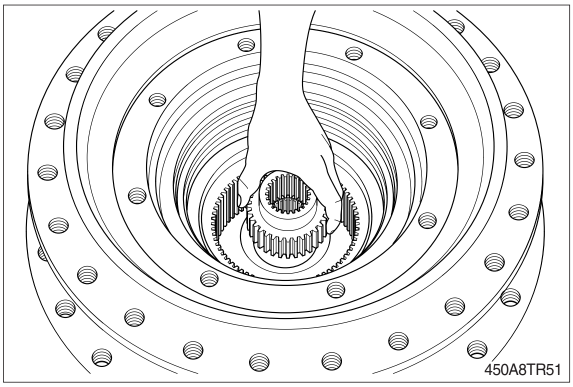
(23) Place the end cover (4) on the gearbox housing (15).
Apply LOCTITE type 243 on the 16 socket head screws (3), and tighten them by a torque wrench at a torque of 19.4 kgf · m (140 lbf · ft).


450A8TR50

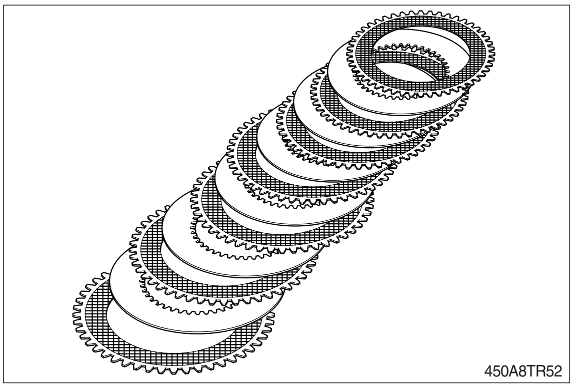
(24) Place the 2 washer (1) in their groves and tighten the 2 plugs at a torque of 6.1~8.2 kgf · m (44.1~59.3 lbf · ft).


450A8TR16

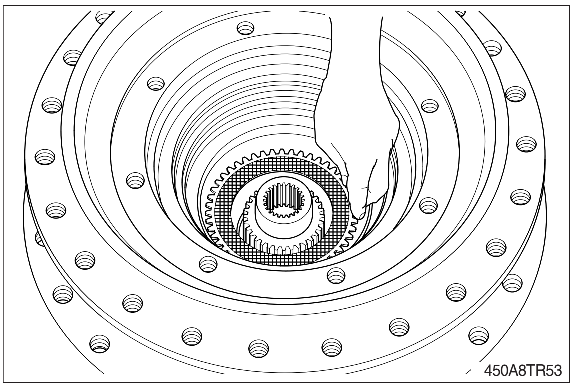
(25) Turn the gearbox around and insert the brake shaft (19).



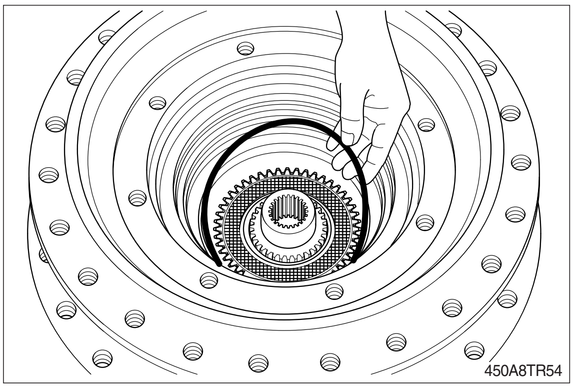
(26) View of the brake discs (21, 22).



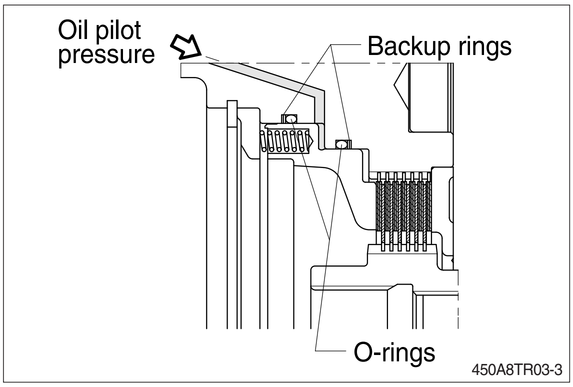
(27) Assemble the brake discs package according to the following order: Firstly insert an external toothed sintered bronze disc (21). Then insert, an internal toothed steel disc (22). Repete the operation until reaching the number of 7 bronze and 6 steel discs.



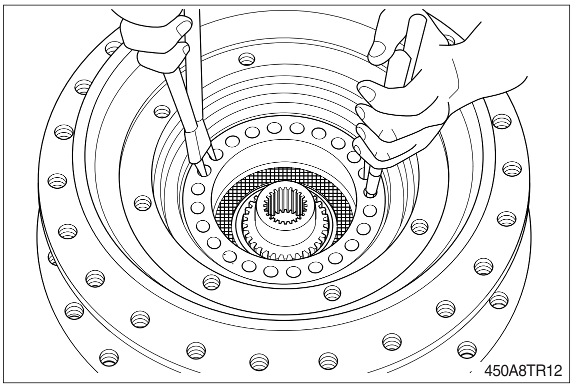
(28) Fit the backup rings (23, 26) and the O-rings (24, 25) inside the two internal groves of the flanged hub (17, see drawing).



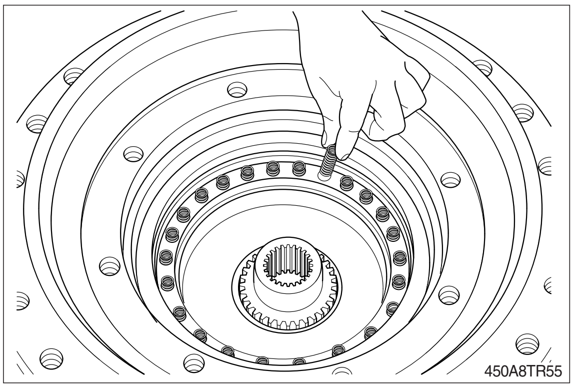
※ An O-ring and a backup ring must be fitted in the grove paying attention that the backup ring must always be beyond the O-ring against the oil flow.



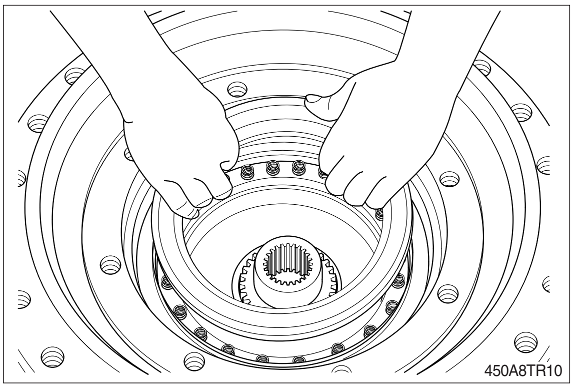
(29) Insert the brake piston (27) inside the flanged hub (17), paying attention not to damage the seals already fitted.



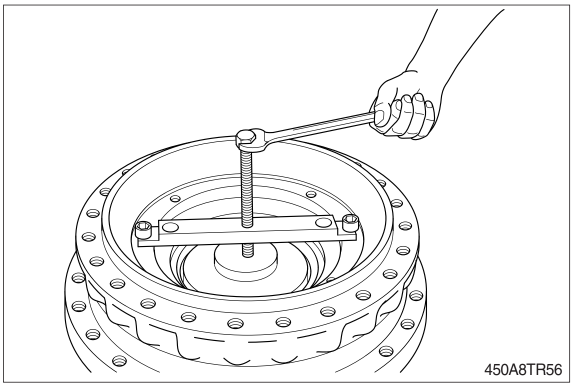
(30) Insert the springs (28) into the groves in the brake piston (27).



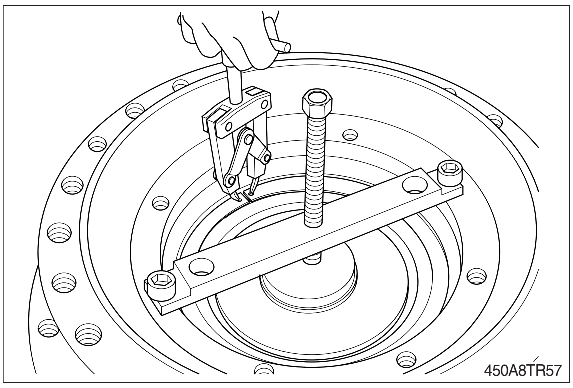
(31) Insert the retainer disc (29).



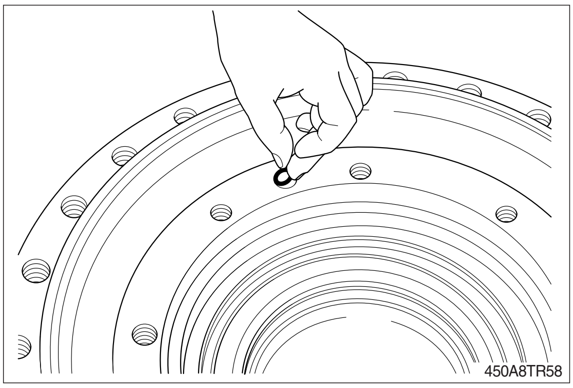
(32) Fixed the equipment to the flanged hub (17) and screw the threaded screw up the springs retainer disc (29) is lowered below the circlip seat (30).



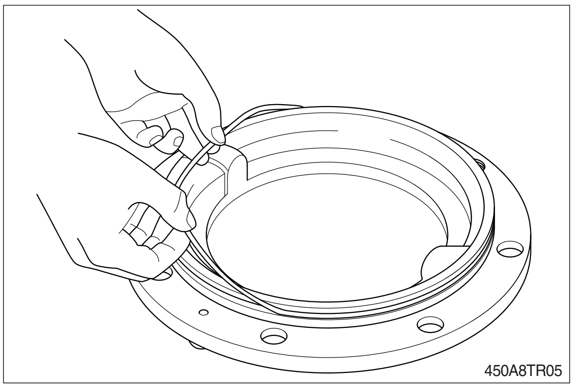
(33) By means of pliers, place the circlip (30) into its grove.



(34) Fit the O-ring (36) into its grove in the flanged hub (17).

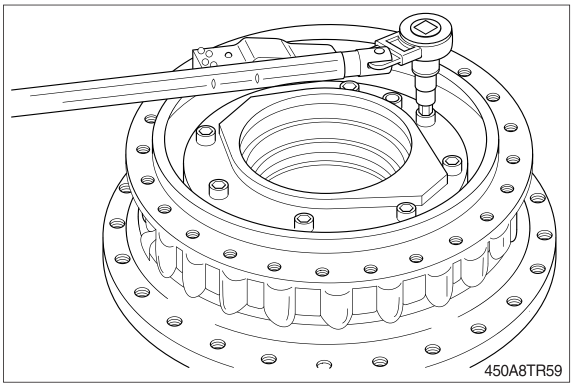


(35) Fit the O-ring (20) into the grove of the motor flange (32).



(36) Place and fix the motor flange (32) to the flanged hub (17) through 8 screws (35) tightened by a torque wrench at a torque of 21.9 kgf · m (158.4 lbf · ft).

※ After having reassembled the gearbox, fit the travel motor (taking care to include the O-ring(32), by means of 2 fixing screws(33), tightened at 42.3kgf · m (306.0lbf · ft). Fill the gearbox with the lubricant oil.



450A8TR59

TRAVEL DEVICE (TYPE 4)

1. REMOVAL AND INSTALL

1) REMOVAL

(1) Swing the work equipment 90° and lower it completely to the ground.

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

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

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

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

(4) Remove the track shoe assembly.
For details, see removal of track shoe assembly.

(5) Remove the cover.

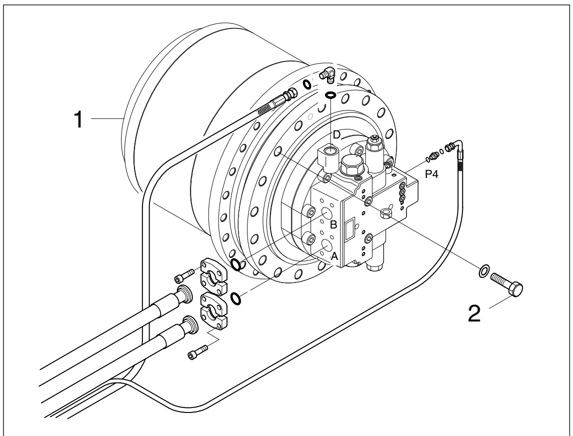
(6) Remove the hoses.
※ Fit blind plugs to the disconnected hoses.

(7) Remove the bolts and the sprocket.

(8) Sling travel device assembly (1).

(9) Remove the mounting bolts (2), then remove the travel device assembly.
· Weight : 632 kg (1393 lb)
· Tightening torque : 57.9±8.7 kgf · m (419±62.9 lbf · ft)

13031GE18



480A8TM01

2) INSTALL

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

(2) Bleed the air from the travel motor.

① Remove the air vent plug.

② Pour in hydraulic oil until it overflows from the port.

③ Tighten plug lightly.

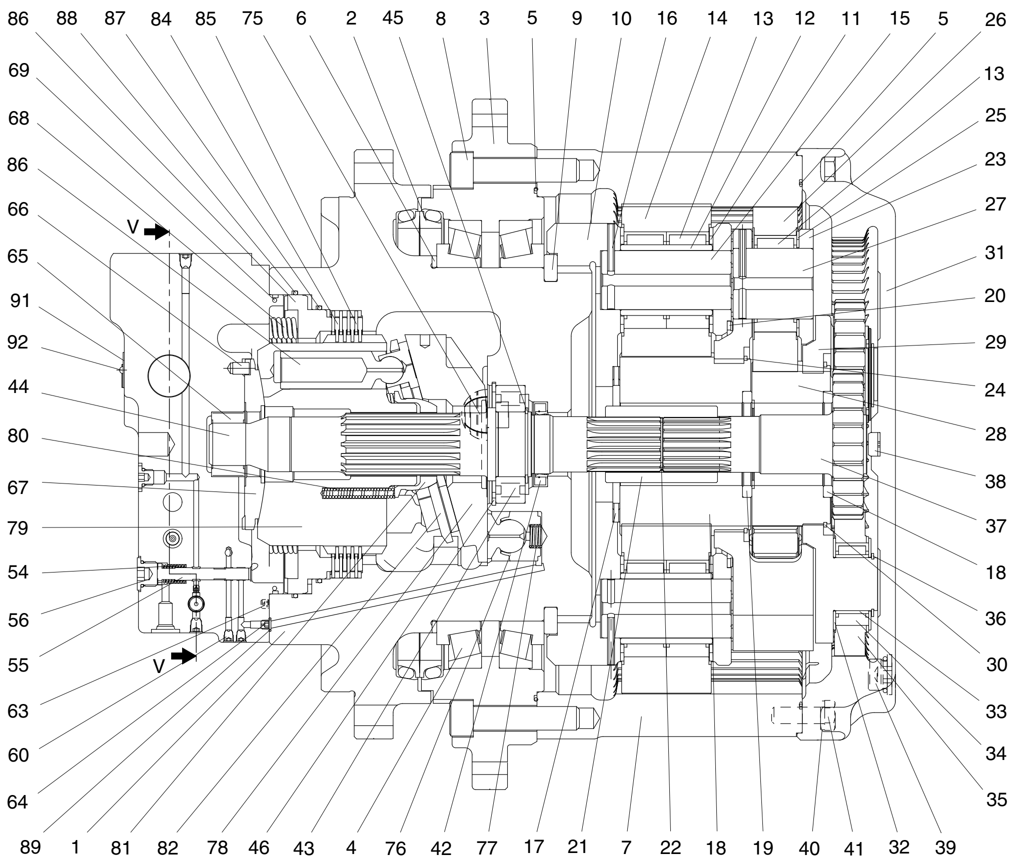
④ Start the engine, run at low idling, and check oil come out from plug.

⑤ Tighten plug fully.

(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. TRAVEL MOTOR

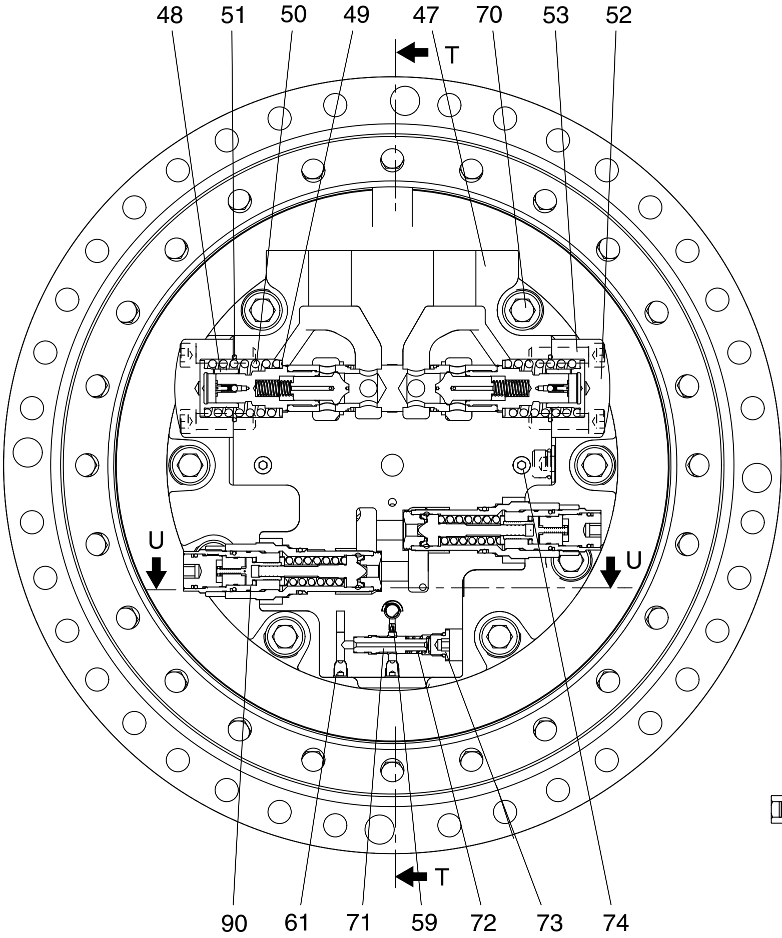
1) STRUCTURE (1/2)



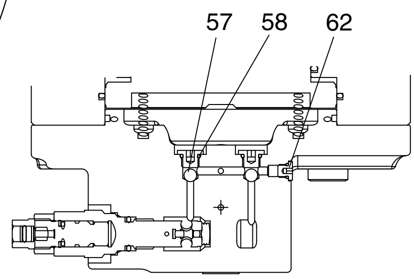
480A2TM02

1 Casing
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)



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

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.

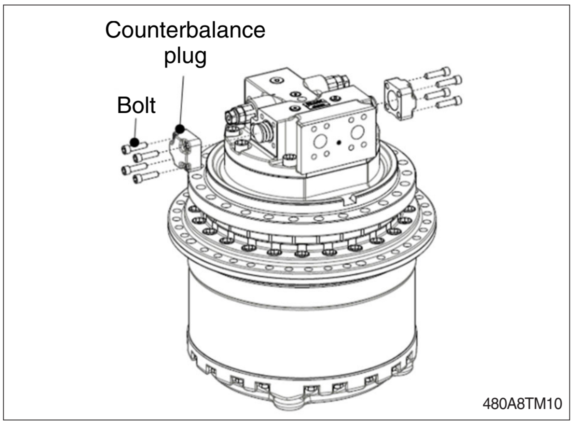
(7) eplace the floating seal, O-ring, shaft seal with a new one when disassembly.

(8) For the assembly of bearing preload/floating seal, please contact HD Hyundai Construction Equipment dealer for the detailed assembly method.

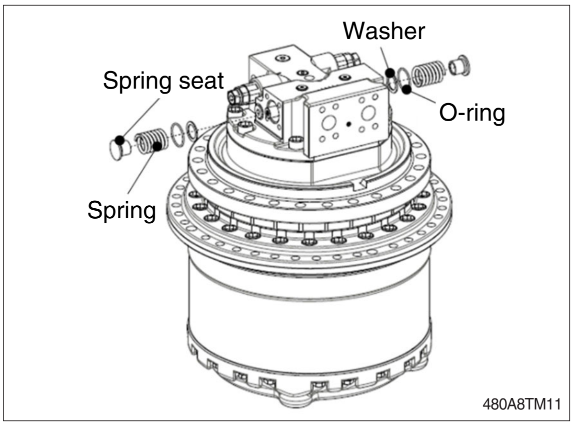
2) DISASSEMBLY

(1) Disassemble the counterbalance plug and bolt.

※ Required tools : torque wrench, hex bit 10 mm.

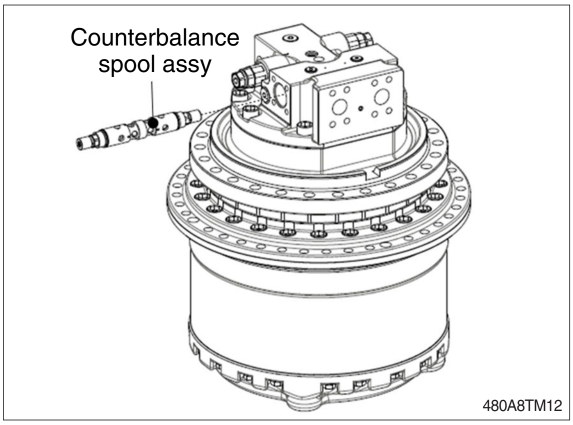


(2) Disassemble the spring, spring seat, O-ring, washer.



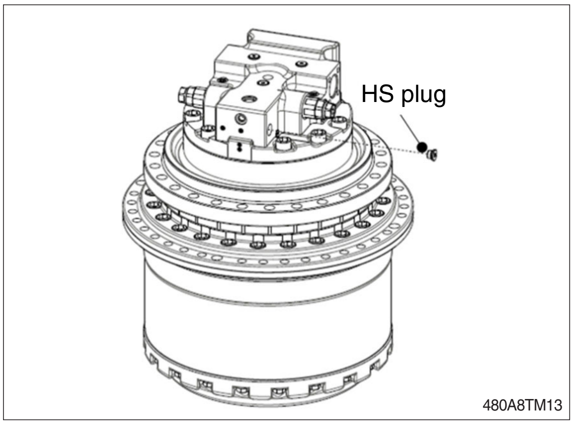
(3) Turn the counterbalance spool assy slowly to disassemble .

※ Damage caution of counterbalance spool surface.



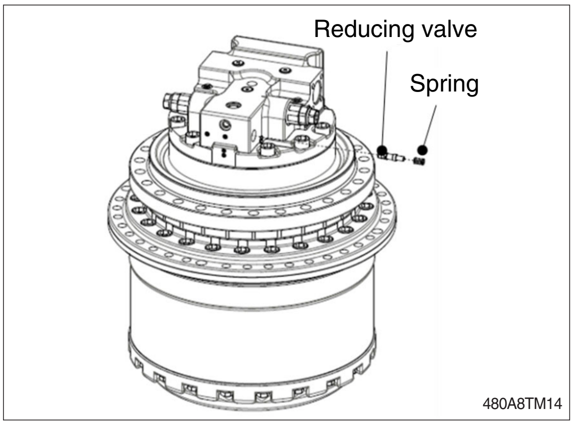
(4) Disassemble the HS plug.

※ Required tools : torque wrench, hex bit 8 mm.



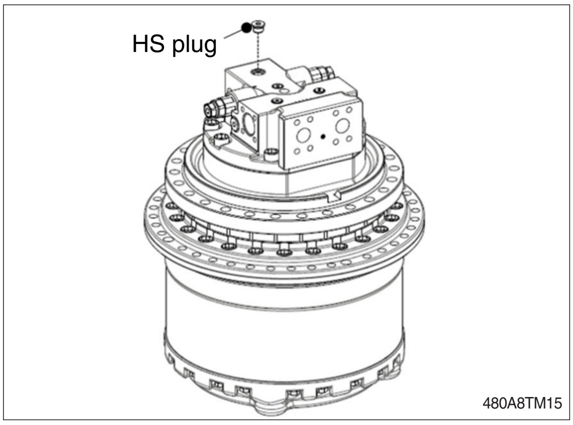
(5) Disassemble the reducing valve, spring.

※ Damage caution of reducing valve surface.



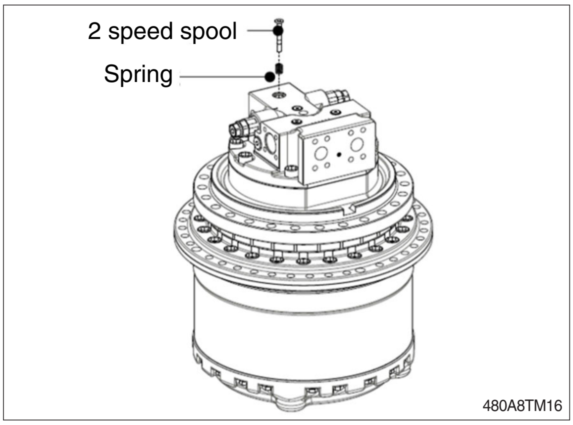
(6) Disassemble the HS plug.

※ Required tools : torque wrench, hex bit 10 mm.



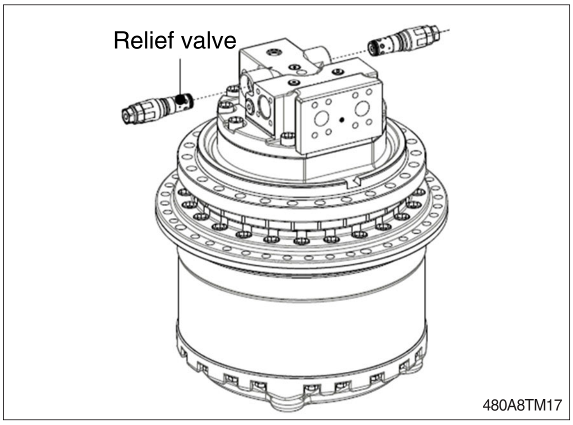
(7) Disassemble the 2 speed spool and spring.

※ Damage caution of 2 speed spool surface.

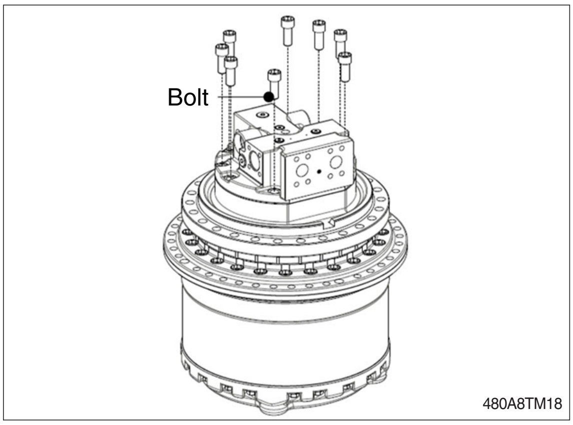


(8) Disassemble the relief valves.

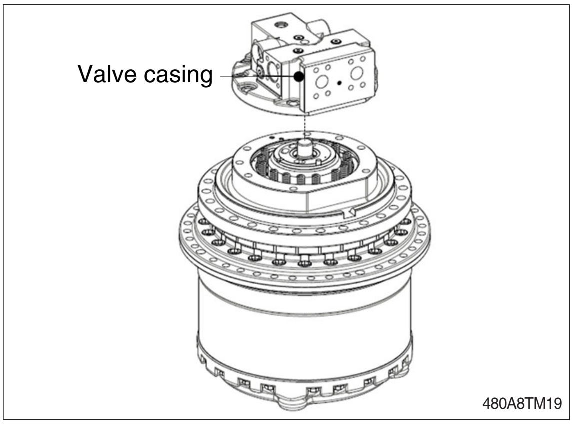
※ Required tools : torque wrench, hex socket 41 mm.



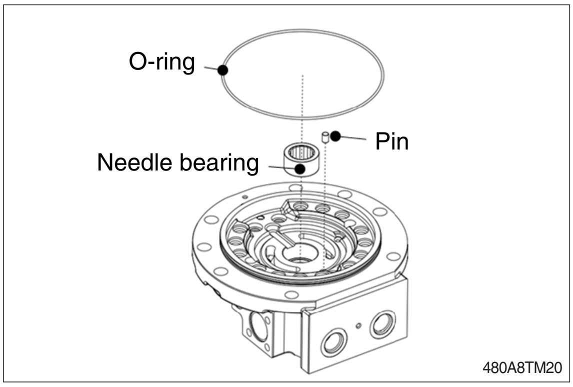
(9) Loosen each bolt evenly to disassemble.
※ Required tools : torque wrench, hex bit 17 mm.



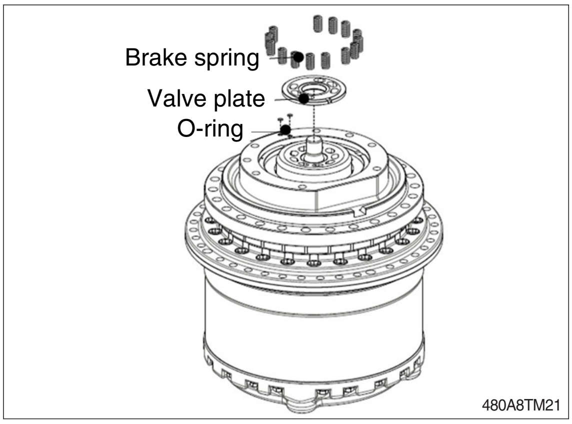
(10) Disassemble the valve casing.



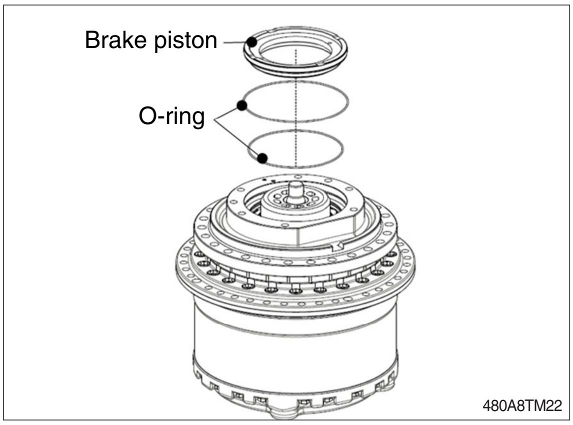
(11) Disassemble the needle bearing, O-ring, pin.



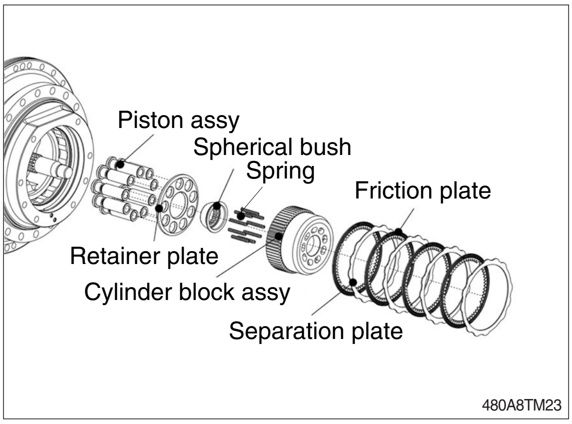
(12) Disassemble the brake spring.
※ Quantity of the brake springs could be different of each model.
Disassemble the valve plate and O-ring.



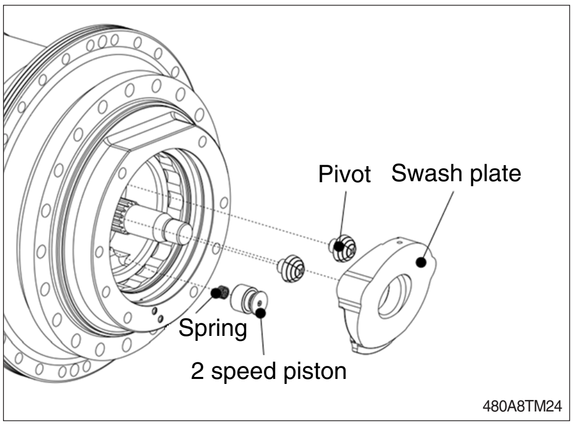
(13) Cover the top of a motor with cloths and disassembly the brake piston by blowing compressed air into the brake releasing line of the motor casing.
Disassemble the O-ring.
※ Required tools : compressed air, air gun.



(14) Disassemble separation plate, friction plate, cylinder block assembly, spherical bush, spring, retaining plate and piston assembly.
※ Quantity of separation and friction plates could be different of each model.

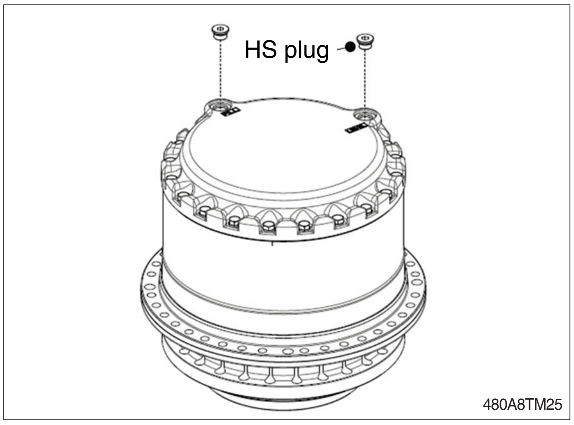


(15) Disassemble the swash plate, pivot, 2 speed piston and spring.



(16) Disassemble the HS plug and discharge the reduction gear oil.

※ Required tools : torque wrench, hex bit 10 mm.

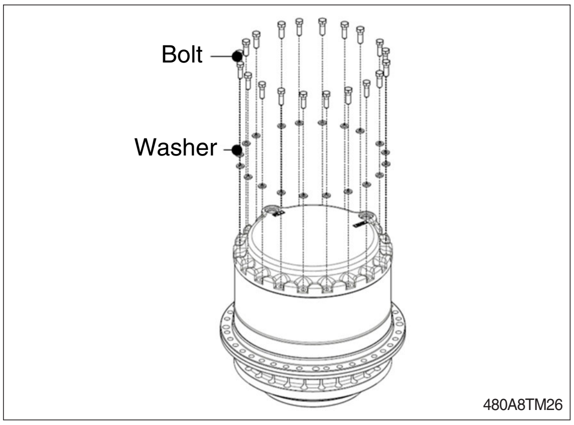


480A8TM25

(17) Disassemble the bolt and washer.

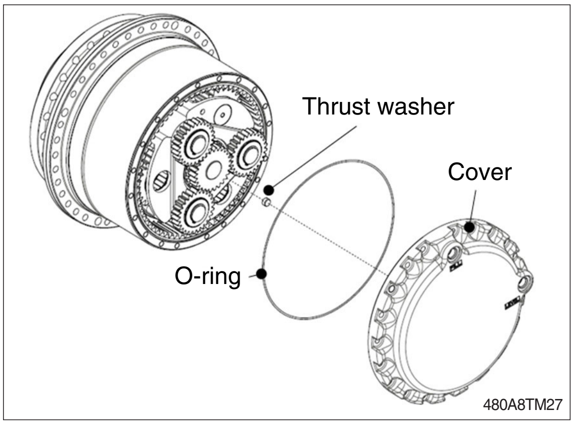
※ Do not re-use.

※ Required tools : torque wrench, hex socket 22 mm.



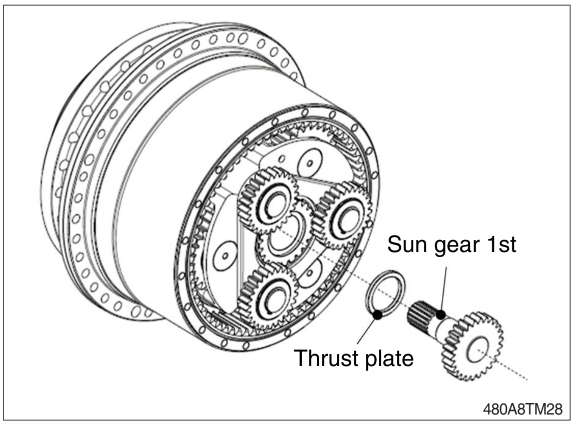
480A8TM26

(18) Disassemble the cover, thrust washer and O-ring.



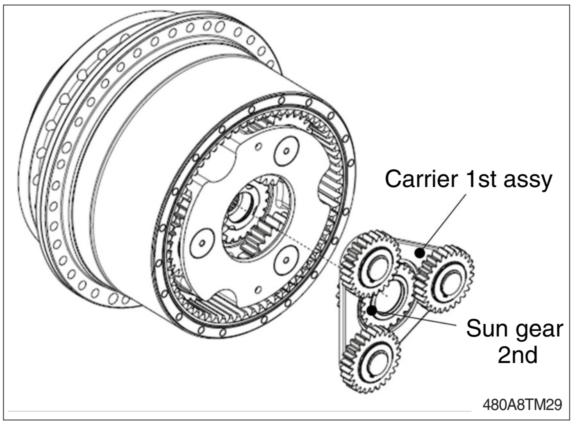
480A8TM27

(19) Disassemble the sun gear 1st and thrust plate.

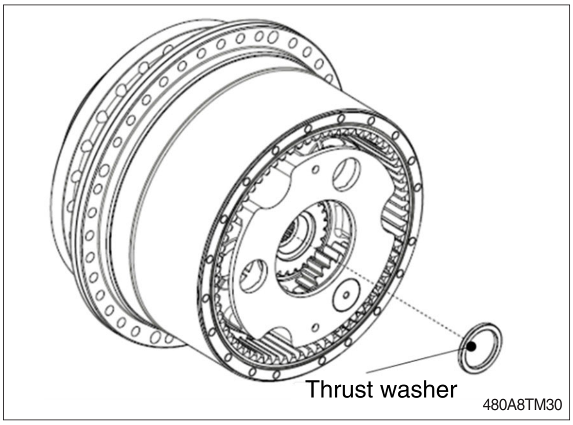


480A8TM28

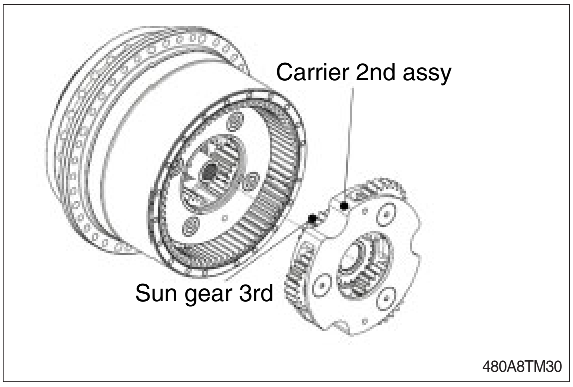
(20) Disassemble the carrier 1st assembly and sun gear 2nd.



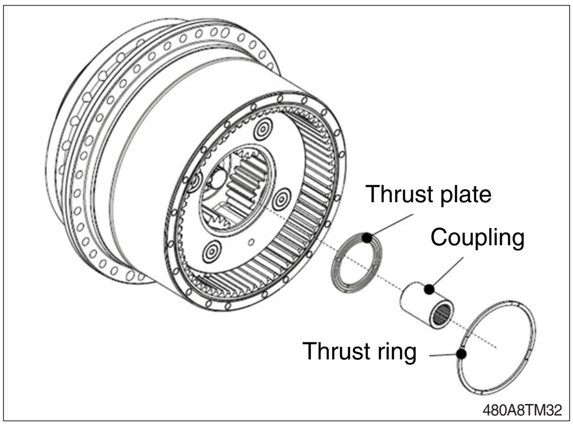
(21) Disassemble the thrust washer.



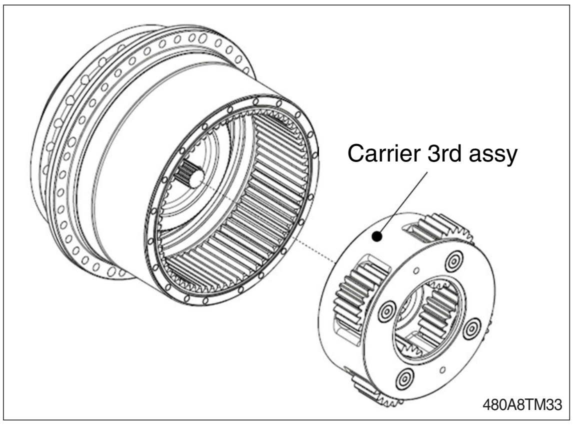
(22) Disassemble the carrier 2nd assembly and sun gear 3rd.
※ Required tools : eye bolt M16x2 (2ea)



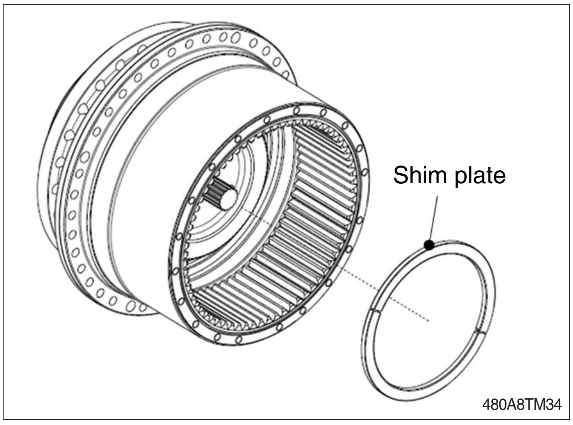
(23) Disassemble the thrust ring, coupling and thrust plate.



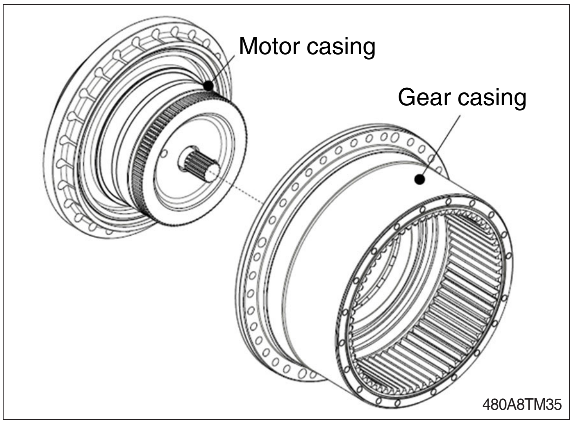
(24) Disassemble the carrier 3rd assembly.
※ Required tools : eye bolt M16x2 (2ea)



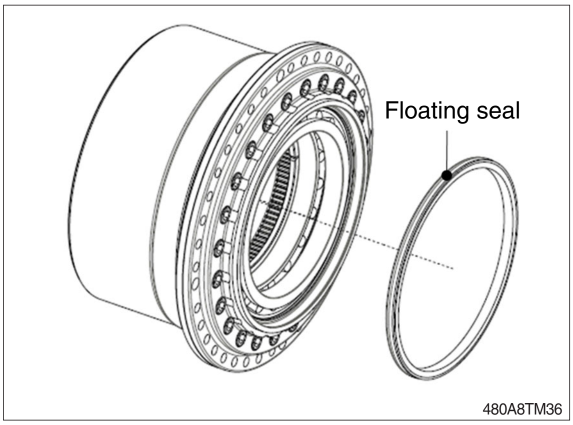
(25) Disassemble the shim plate.



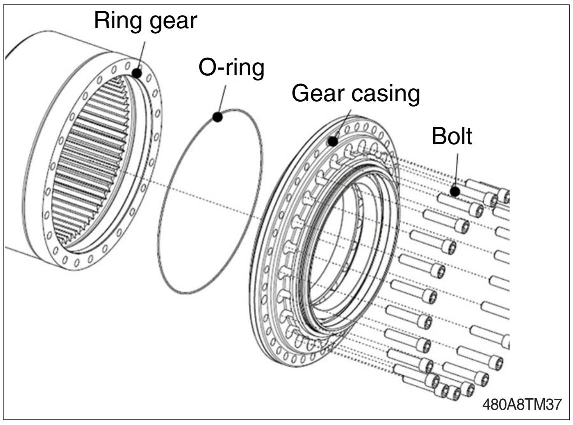
(26) Disassemble the gear casing.



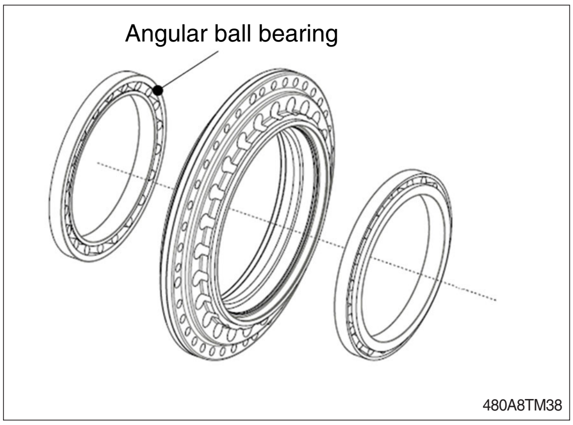
(27) Disassemble the floating seals and O-ring.
※ Damage caution of floating seal.



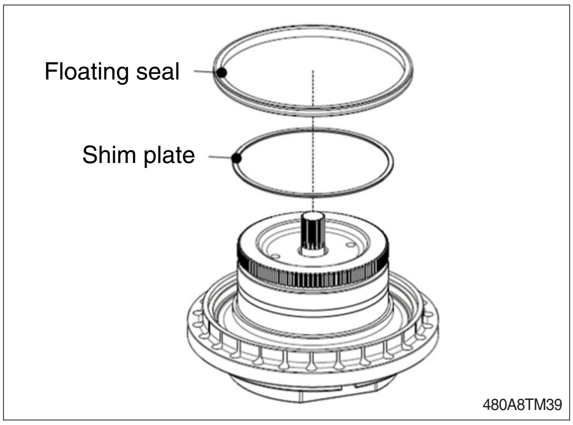
(28) Disassemble the bolt, gear casing, O-ring and ring gear.



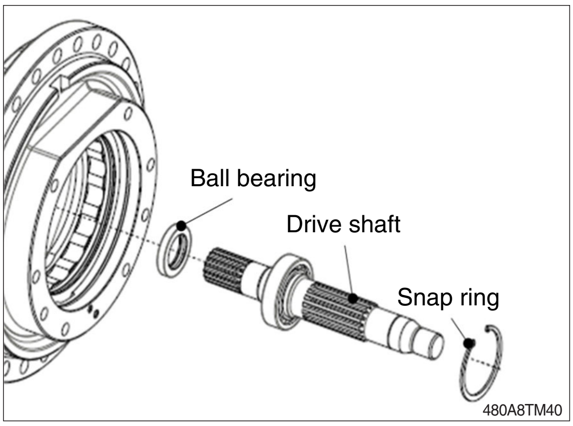
(29) Disassemble the angular ball bearing.
※ Do not disassemble if not necessary.



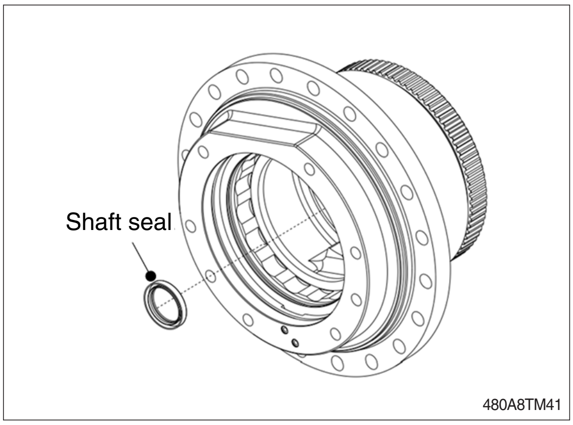
(30) Disassemble the floating seal and shim plate.
※ Damage caution of floating seal.



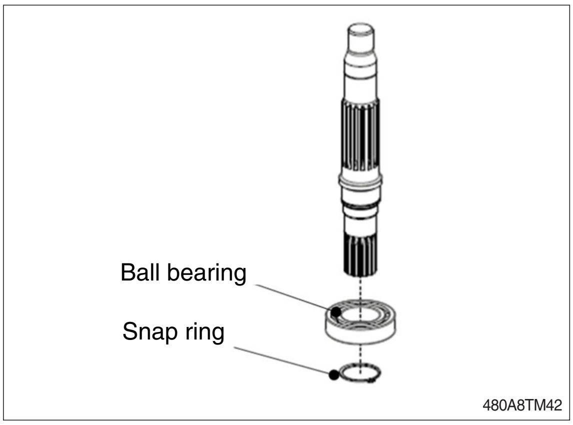
(31) Disassemble the drive shaft and ball bearing and snap ring.
※ Required tools : plier



(32) Disassemble the shaft seal.
※ Do not re-use.



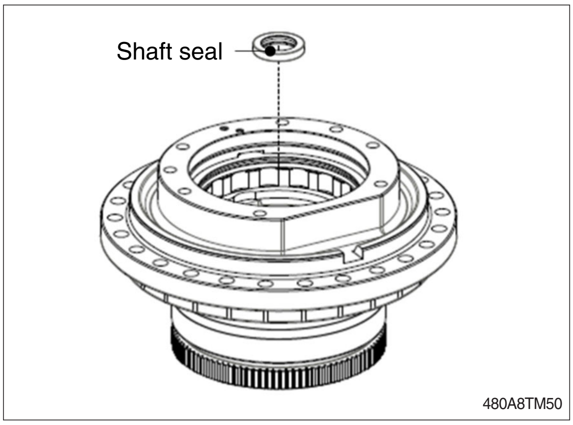
(33) Disassemble the ball bearing and snap ring.
※ Do not disassemble if not necessary.
※ Required tools : plier



3) ASSEMBLY

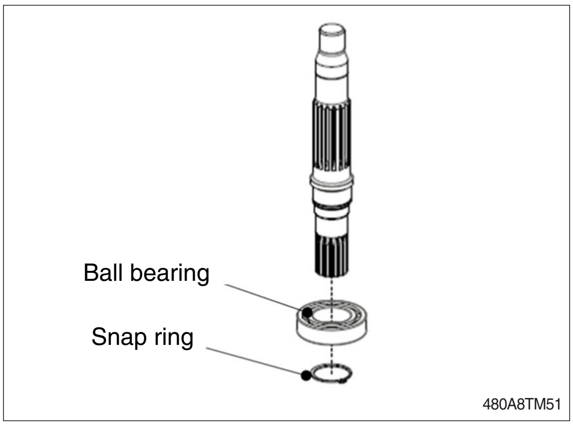
(1) Apply a small amount of hydraulic fluid to the outer diameter of the shaft seal and assemble it to the motor casing

※ Required tools : shaft seal press-fit jig



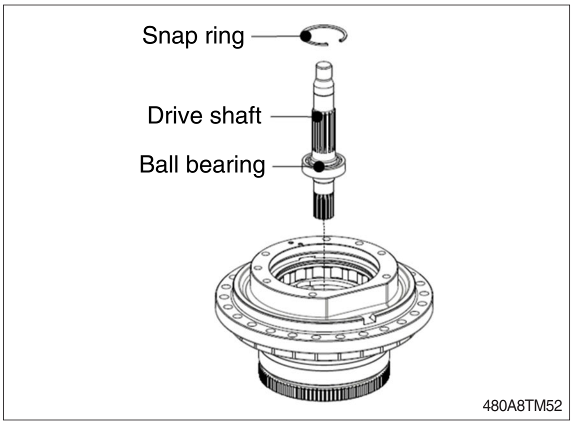
(2) Assemble the ball bearing and snap ring to the drive shaft.

※ Required tools : ball bearing assembly press-fit jig, plier.



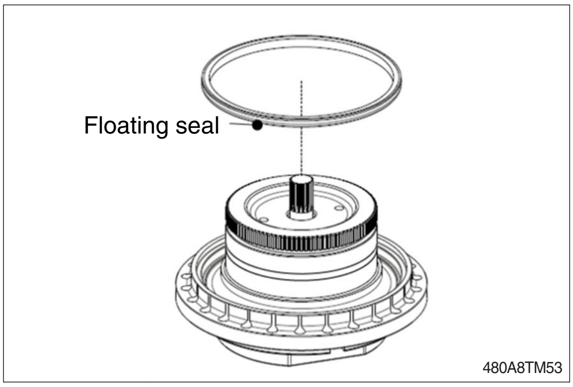
(3) Assemble the drive shaft, ball bearing and snap ring to the motor casing.

※ Required tools : plier

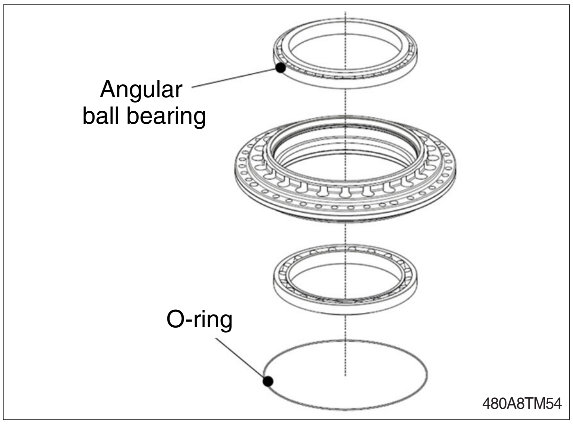


(4) Apply vaporizing lubricant to the O-ring outside of the floating seal and assemble it to the motor casing so that the parallelism can be 0.5 mm or less. After assembly, apply a small amount of hydraulic fluid to the polishing surface.

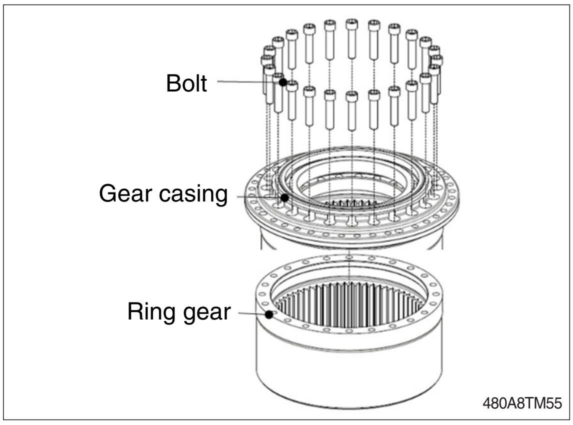
※ Required tools : floating seal assembly jig.



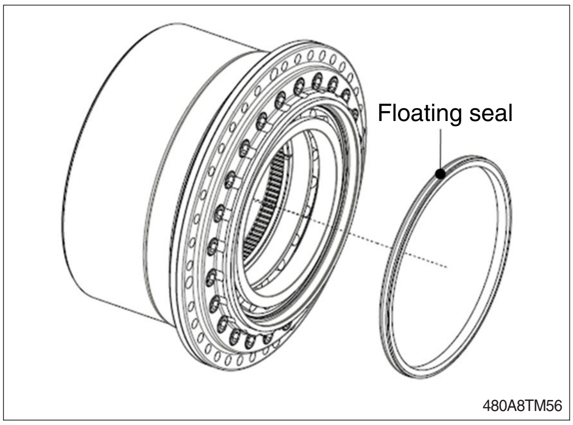
(5) Assemble the angular ball bearing into the gear casing.
Assemble the O-ring into the gear casing.
※ Required tools : angular ball bearing assembly press-fit jig.



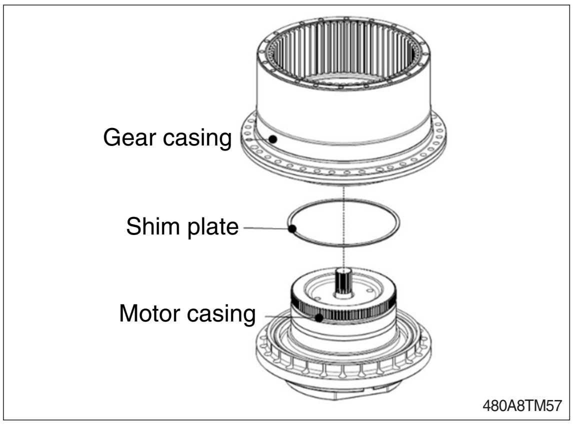
(6) Assemble the gear casing and ring gear.
Assemble the bolt after applying loctite 638.
※ Required tools : torque wrench, hex bit 17 mm.
※ Bolt size : M20x2.5
※ Tightening torque : 50.3±8.0 kgf·m
(364±57.9 lbf·ft)



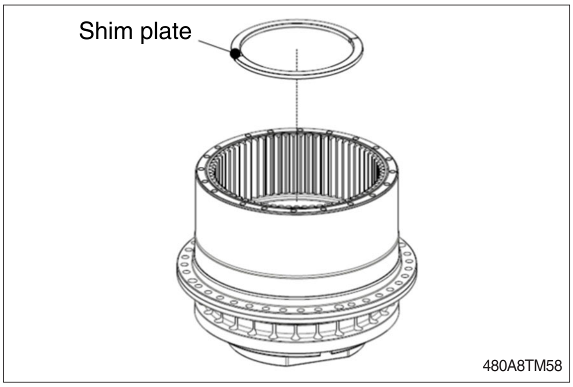
(7) Apply vaporizing lubricant to the O-ring outside of the floating seal and assemble it to the gear casing so that the parallelism can be 0.5 mm or less. After assembly, apply a small amount of hydraulic fluid to the polishing surface.
※ Required tools : floating seal assembly jig.



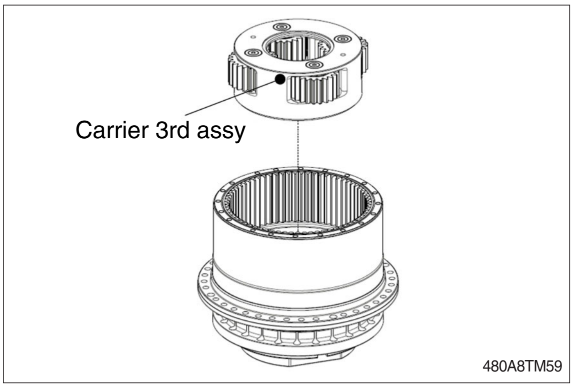
(8) Assemble the shim plate and gear casing to motor casing.
※ Damage caution of floating seal.



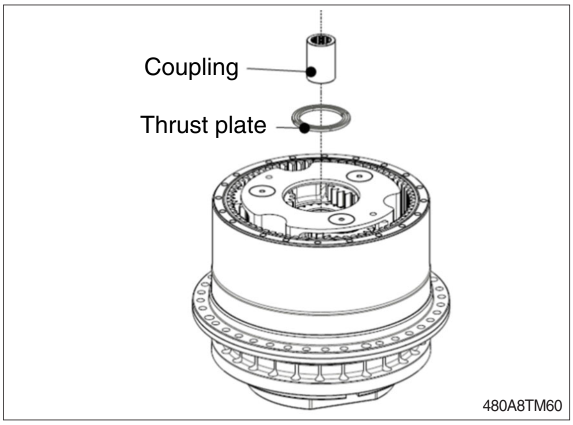
(9) Assemble the shim plate into the motor casing.



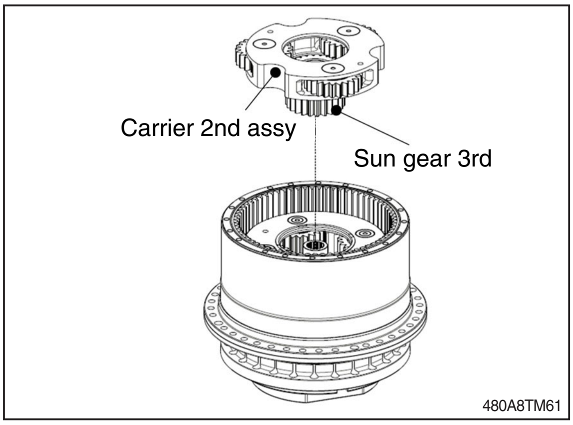
(10) Assemble the carrier 3rd assembly to gear casing.
※ Required tools : eye bolt M16x2 (2ea)



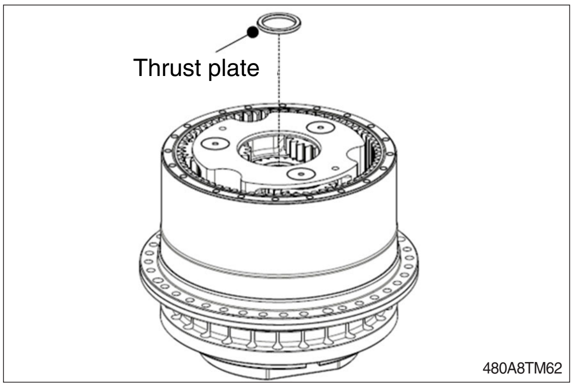
(11) Assemble the coupling and thrust plate.



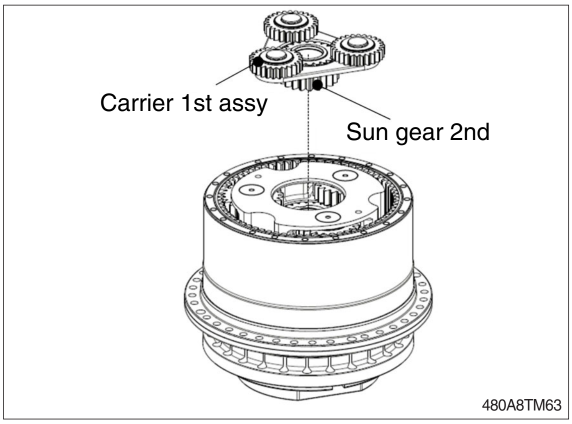
(12) Assemble the carrier 2nd assembly and sun gear 3rd to gear casing.
※ Required tools : eye bolt M16x2 (2ea)



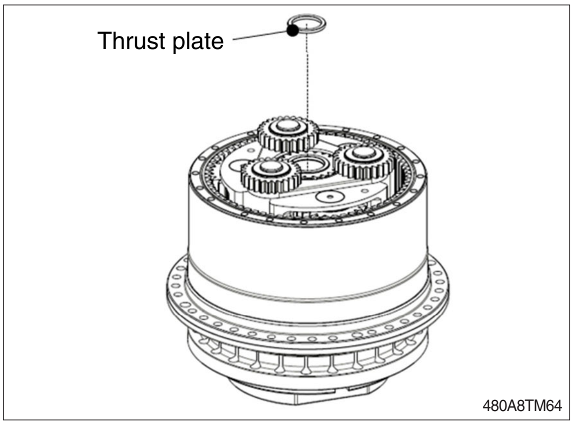
(13) Assemble the thrust plate.



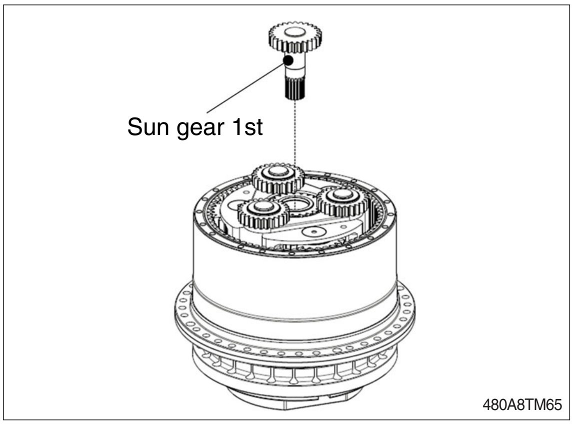
(14) Assemble the carrier no.1 assembly and sun gear 2nd.



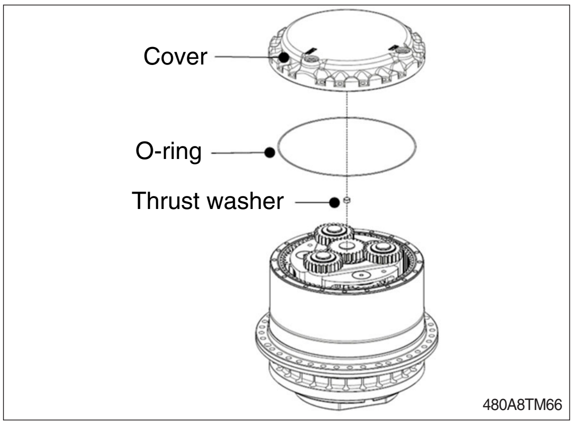
(15) Assemble the thrust plate.



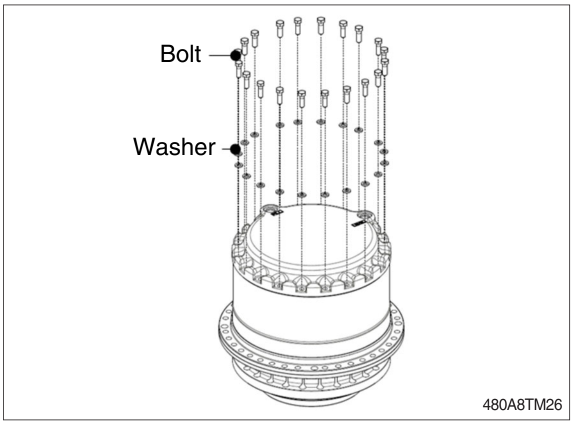
(16) Assemble the sun gear 1st.



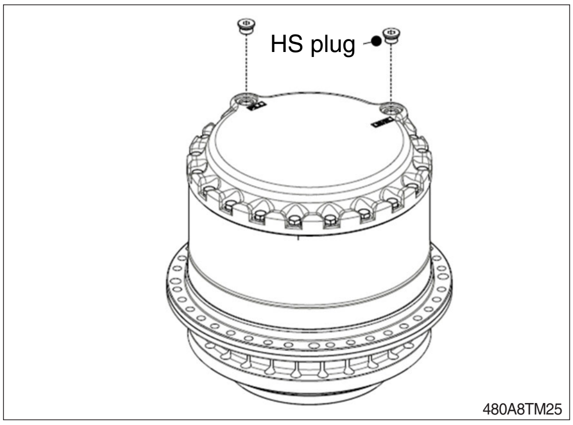
(17) Apply grease to thrust washer and assemble it to cover.
Assemble the O-ring and cover to gear casing.



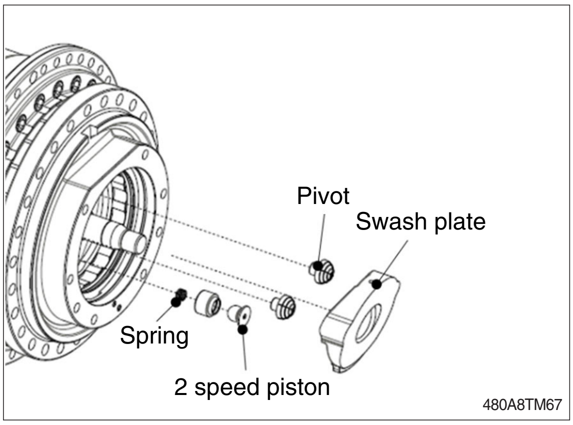
(18) Assemble the bolt and washer.
※ Required tools : torque wrench, hex socket 22 mm.
※ Bolt size : M14x2.0
※ Tightening torque : 17.4±2.5 kgf·m
(126±18.1 lbf·ft)



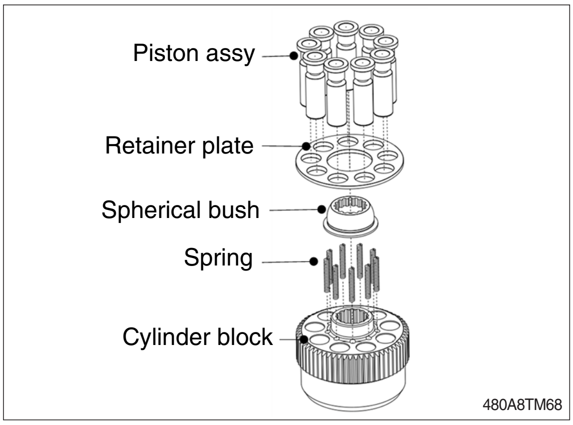
(19) Fill gear oil of 9 liter minimum and assemble HS plug to cover.
※ Required tools : torque wrench, hex bit 10 mm.
※ HH plug size : G 3/4
※ Tightening torque : 17.0±3.0 kgf·m
(123±21.7 lbf·ft)



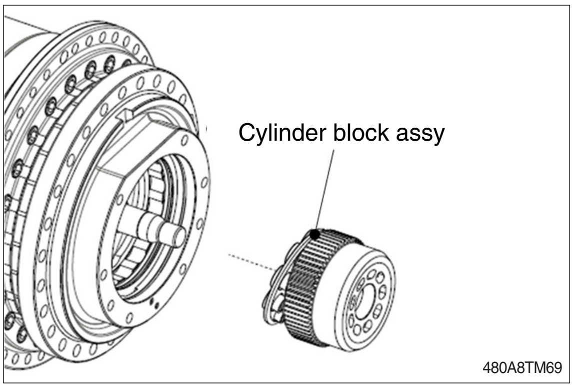
(20) Apply hydraulic fluid to the 2 speed piston outer diameter and swash plate polishing surface.
Apply grease to spring and assemble it to 2 speed piston. Assemble its to the motor casing.
※ Check whether assembled well by pushing 2 speed piston by hand.
Assemble pivot and swash plate to motor casing.
※ Check whether assembled well by pushing 2 speed piston by hand.



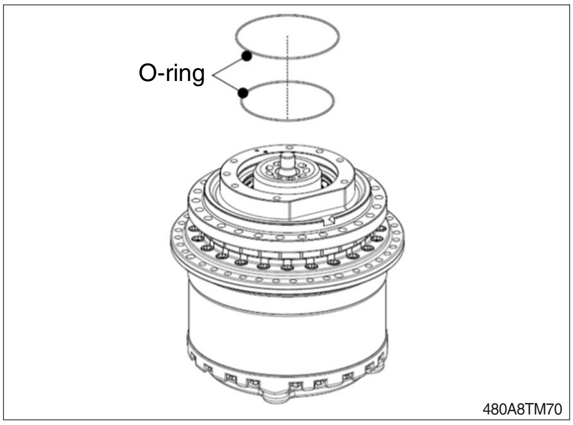
(21) Assemble the cylinder spring, cylinder block, spherical bush, retainer plate and piston assembly.



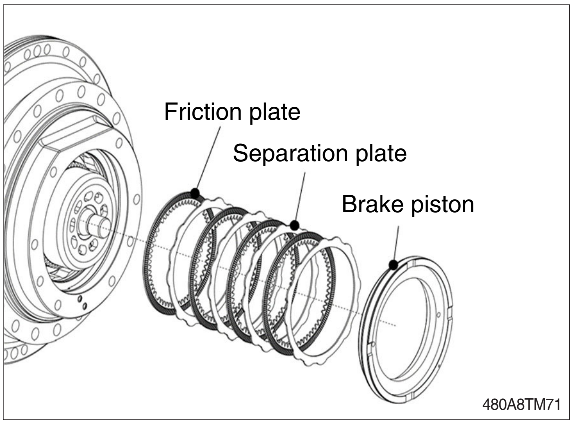
(22) Apply hydraulic fluid to the shoe.
Assemble the cylinder block assembly to drive shaft.
Apply hydraulic fluid to the cylinder block polishing surface.



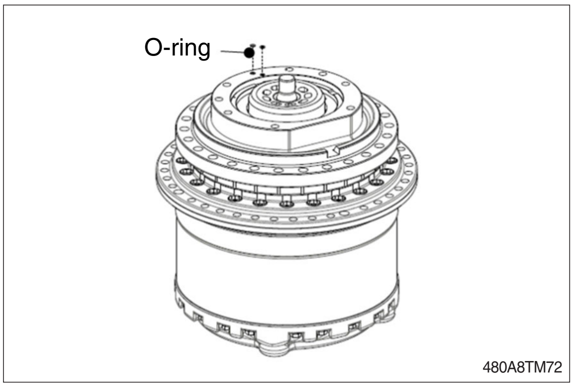
(23) Assemble the O-ring to the motor casing.



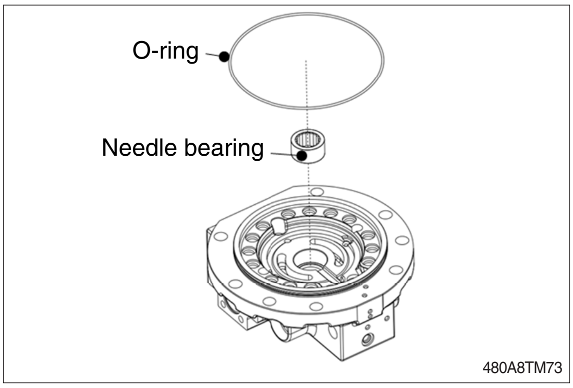
(24) Assemble the friction plate, separation plate to the motor casing in turn.
※ Be careful that the friction plate is in contact with the brake piston.
Assemble the brake piston to motor casing.
Check the brake piston is assembled completely to tap the the brake piston with a plastic hammer.
※ Quantity of friction plates and separation plates could be different of each model.



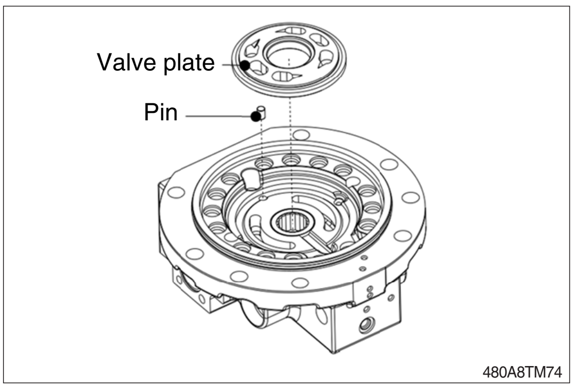
(25) Assemble the O-ring to the motor casing.



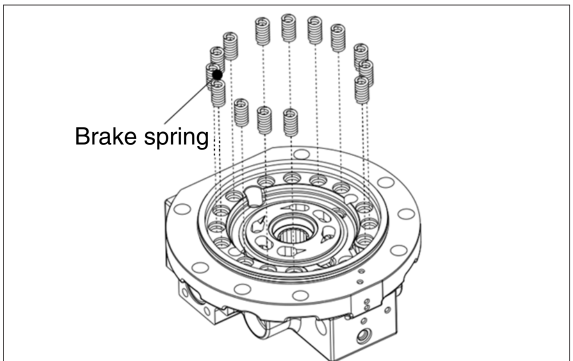
(26) Assemble the needle bearing to the valve casing.
Apply grease to the inner race of ball bearing.
Assemble the O-ring to the valve casing.



(27) Apply grease to the other side of the valve plate and assemble a valve plate and pin to valve casing.

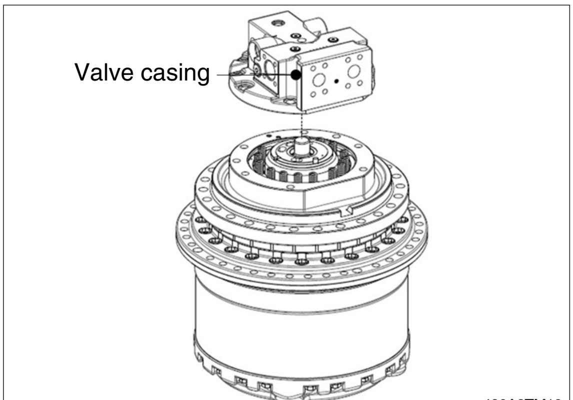


(28) Apply grease to brake spring and assemble it to the valve casing.
※ Quantity of brake springs could be different of each model.



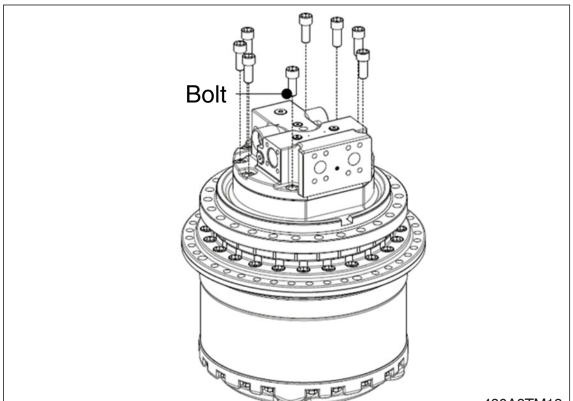
480A8TM75

(29) Assemble the valve casing to the motor casing.
※ Required tools : guide pin
※ Guide pin size : M20x2.5x45
(total length 150 mm or more)



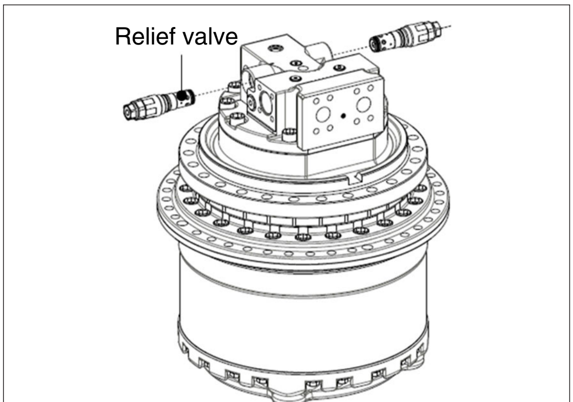
480A8TM19

(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)



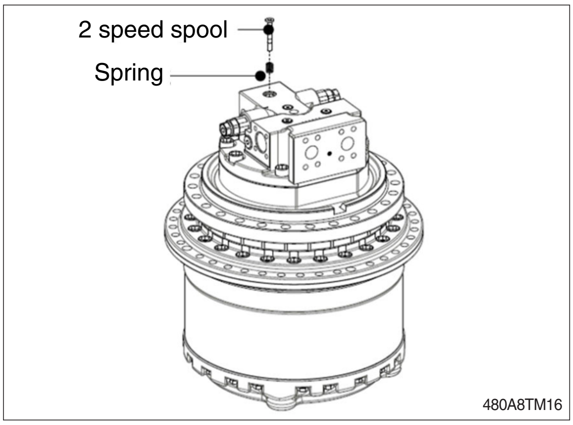
480A8TM18

(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)

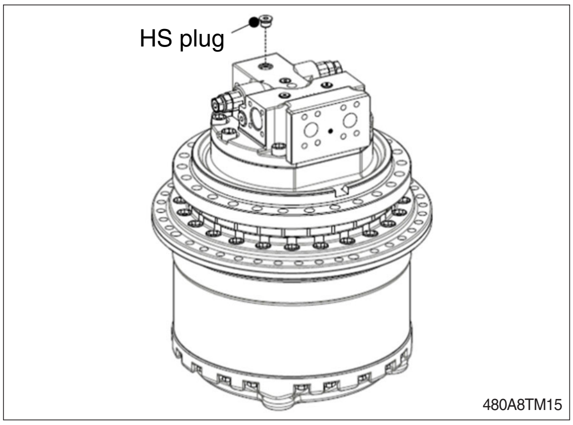


480A8TM17

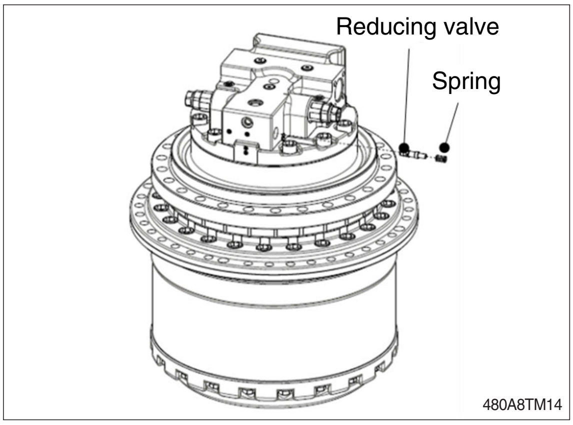
(32) Assemble the 2 speed spool, spring to valve casing.
※ Damage caution of 2 speed spool surface.



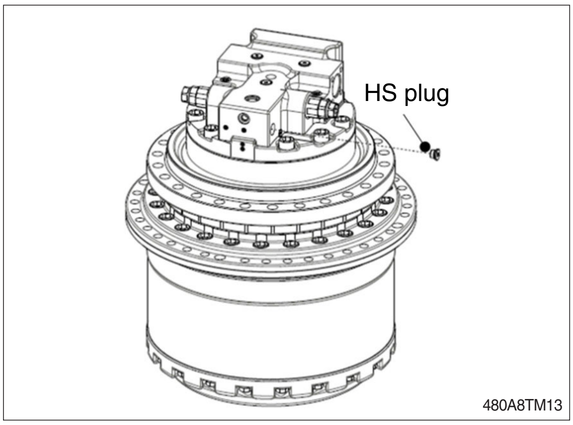
(33) Assemble the HS plug to valve casing.
※ Required tools : torque wrench, hex bit 10 mm.
※ Bolt size : G 1/2
※ Tightening torque : 10.0±2.0 kgf·m
(72.3±14.5 lbf·ft)



(34) Assemble the reducing valve and spring to valve casing.
※ Damage caution of reducing valve surface.

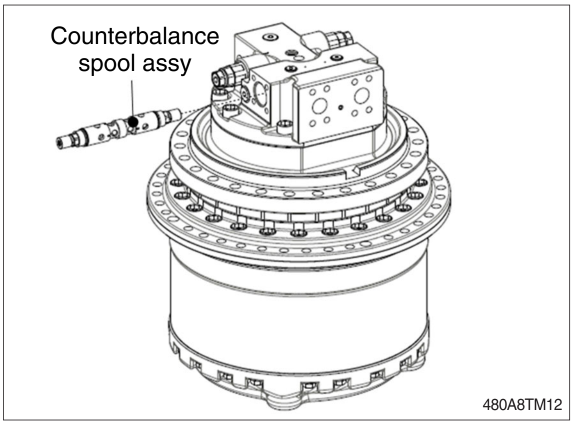


(35) Assemble the HS plug to valve casing.
※ Required tools : torque wrench, hex bit 8 mm.
※ Bolt size : G 3/8
※ Tightening torque : 6.0±1.5 kgf·m
(43.4±10.8 lbf·ft)



(36) Apply hydraulic fluid to counterbalance spool assy outer diameter and rotate the counterbalance spool assy slowly to assemble.

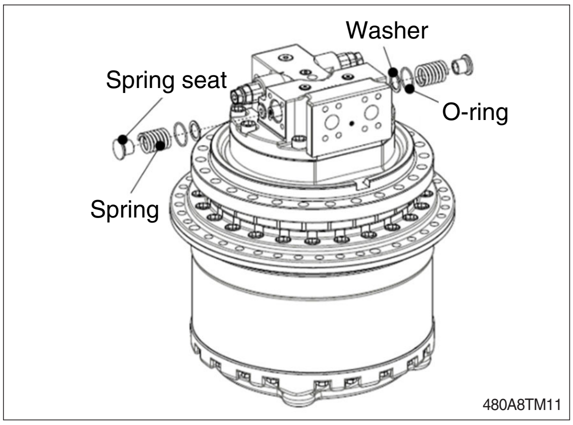
※ Damage caution of counterbalance spool surface.



480A8TM12

(37) Assemble the spring, spring seat, O-ring and washer to the valve casing.

※ Assemble the counterbalance plug and bolt to valve casing.



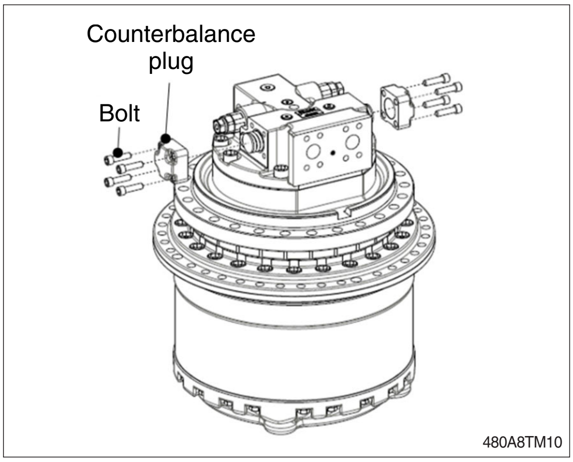
480A8TM11

(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)



480A8TM10

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


13031GE18

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

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

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

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

(4) Loosen the socket bolt (1).

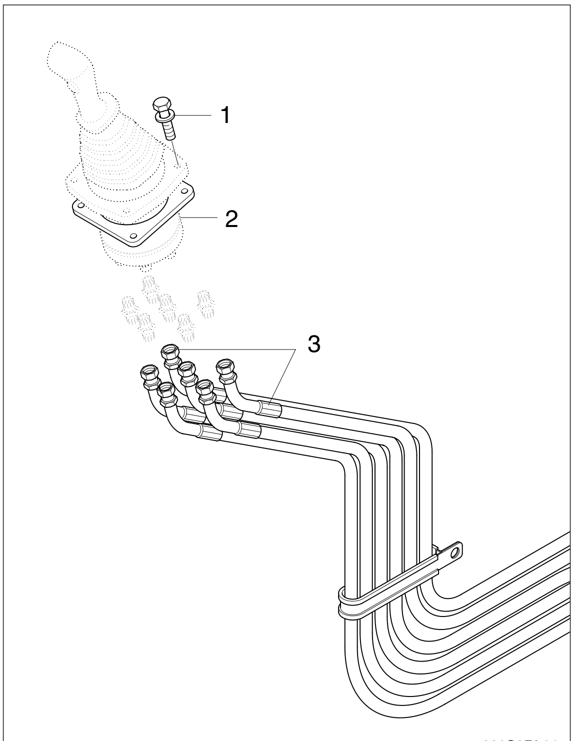
· Tightening torque : 1.05 ± 0.2 kgf · m (7.6 ± 1.45 lbf · ft)

(5) Remove the cover of the console box.

(6) Disconnect pilot line hoses (3).

(7) Remove the pilot valve assembly (2).

※ When removing the pilot valve assembly, check that all the hoses have been disconnected.



220S8RL01

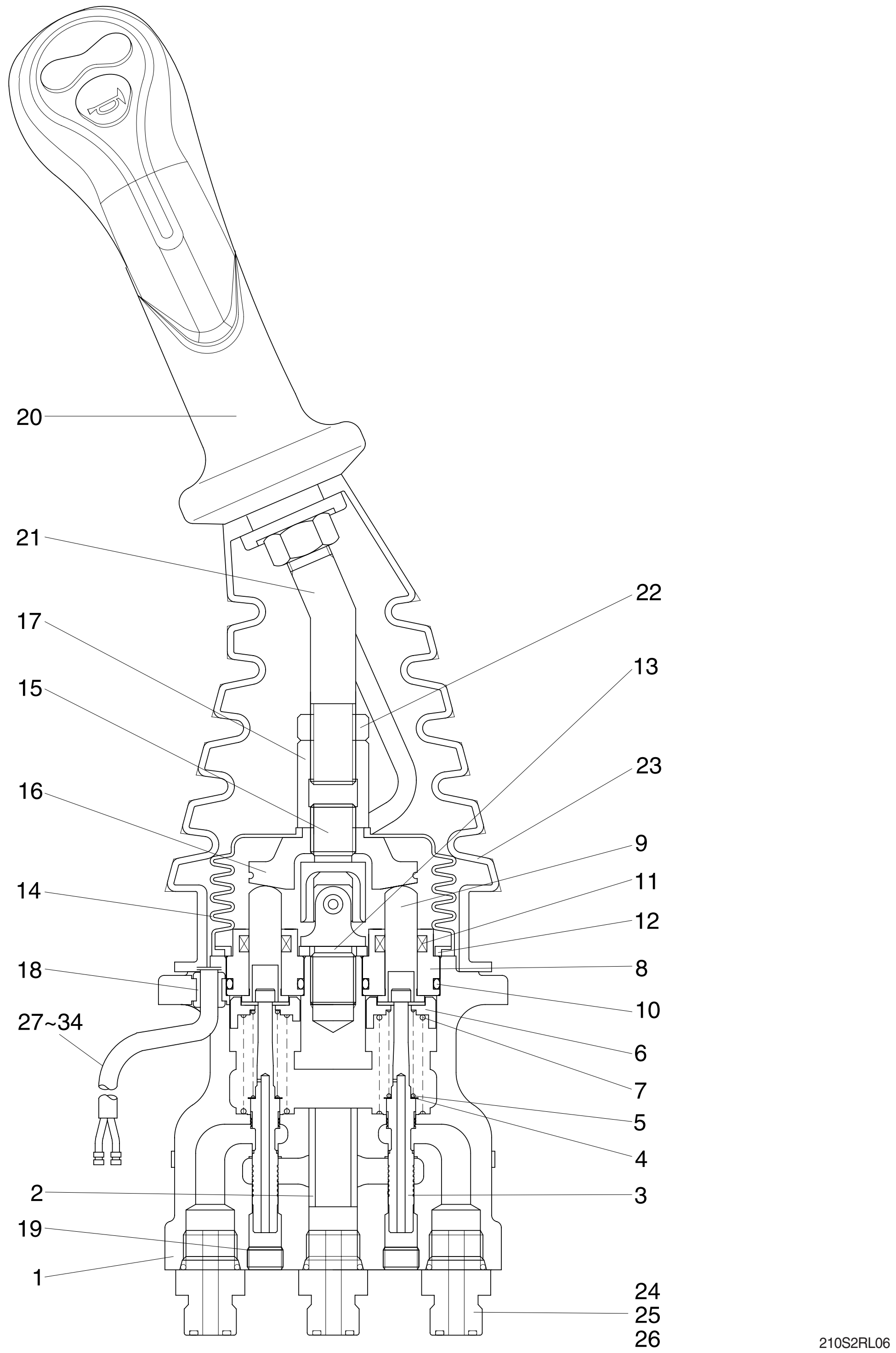
2) INSTALL

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

(2) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

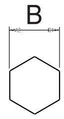
1) STRUCTURE



1	Case	10	O-ring	19	Plug	28	Connector
2	Bushing	11	Rod seal	20	Handle assembly	29	Connector
3	Spool	12	Plate	21	Handle bar	30	Connector
4	Shim	13	Spacer	22	Nut	31	Small guide
5	Spring	14	Boot	23	Boot	32	Connector
6	Spring seat	15	Joint assembly	24	Last guard filter	33	Big guide
7	Spring	16	Swash plate	25	Connector	34	Connector
8	Plug	17	Adjusting nut	26	Connector		
9	Push rod	18	Bushing	27	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	3.5	25.3
Swash plate	16	M14	5.0±0.35	36.2±2.5
Adjusting nut	17	M14	5.0±0.35	36.2±2.5
Lock nut	22	M14	5.0±0.35	36.2±2.5

3) DISASSEMBLY

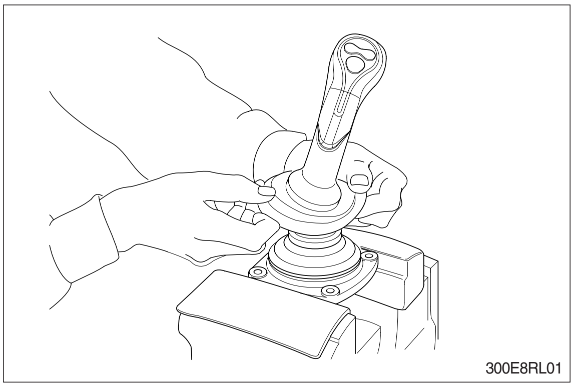
※ Procedures are based on the type L1.

(1) Clean pilot valve with kerosene.

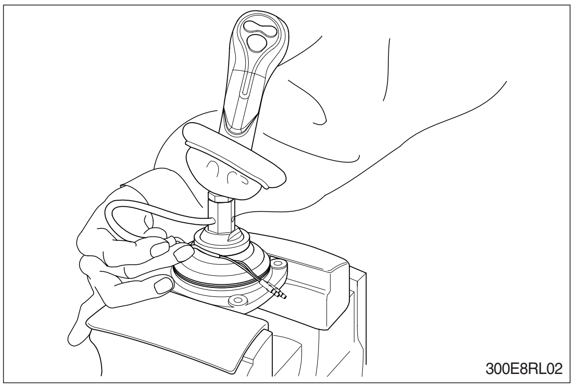
※ Put blind plugs into all ports

(2) Fix pilot valve in a vise with copper (or lead) sheets.

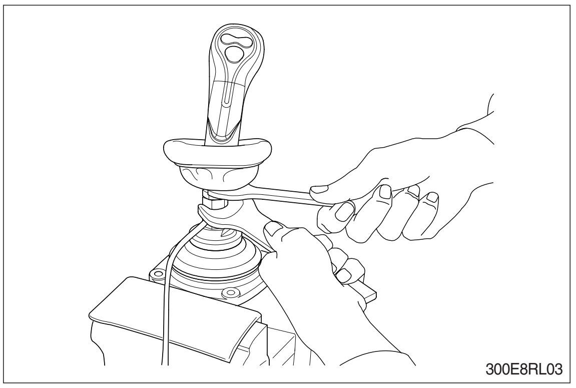
(3) Remove end of boot (23) from case (1) and take it out upwards.



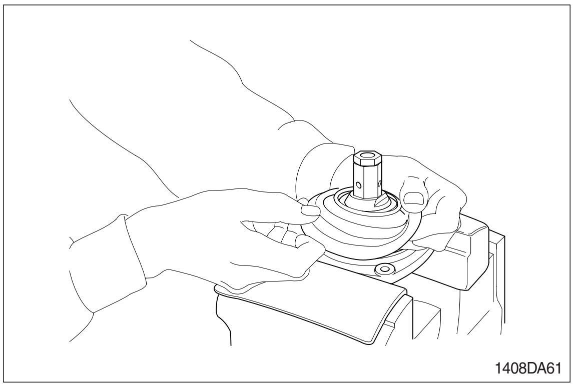
※ For valve with switch, remove cord also through hole of casing.



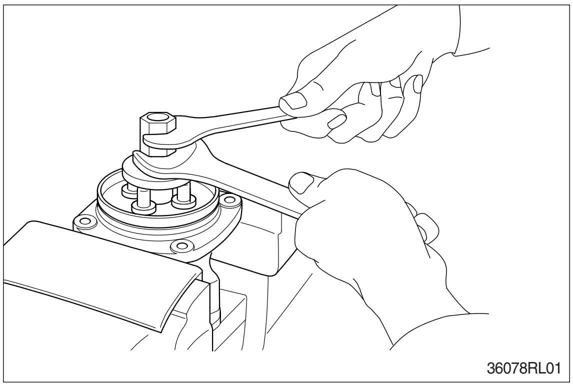
(4) Loosen lock nut (22) and adjusting nut (17) with spanners on them respectively, and take out handle section as one body.



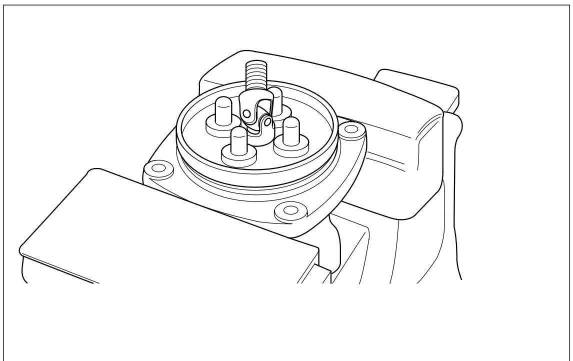
(5) Remove the boot (14).



(6) Loosen adjusting nut (17) and swash plate (16) with spanners on them respectively, and remove them.



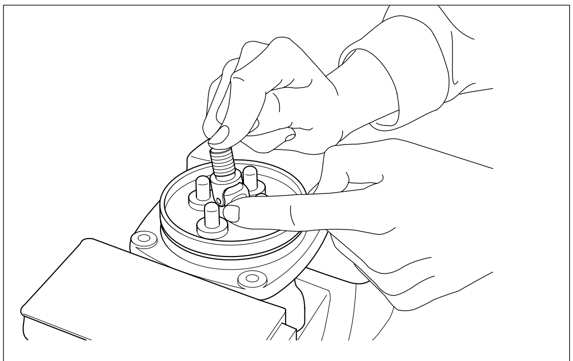
36078RL01



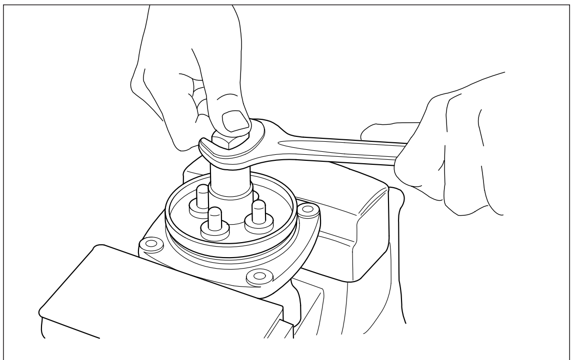
36078RL02

(7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).

※ When return spring (7) is strong in force, plate (12), plug (8) and push rod (9) will come up on loosening joint.
Pay attention to this.

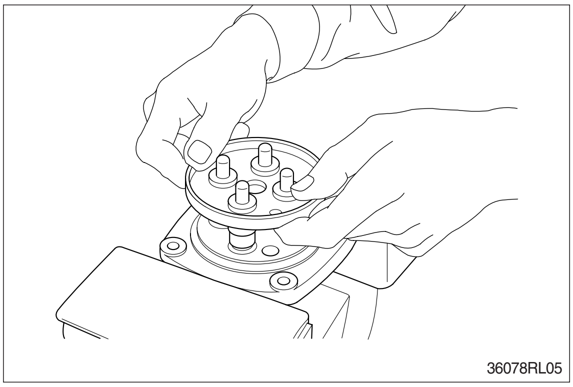


36078RL03



36078RL04

(8) Remove plate (12).

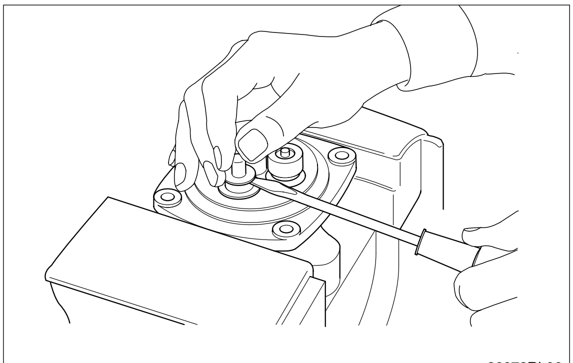


36078RL05

(9) When return spring (7) is weak in force, plug (8) stays in casing because of sliding resistance of O-ring.

※ Take it out with minus screwdriver.
Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.

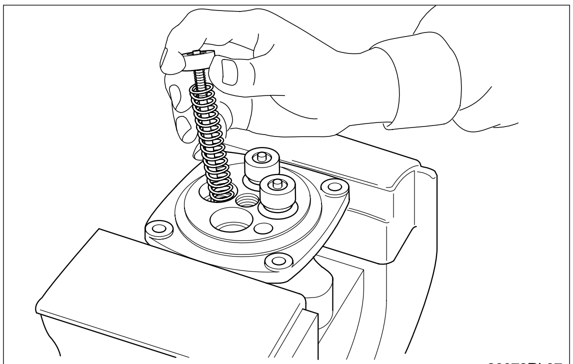
※ During taking out, plug may jump up due to return spring (7) force.
Pay attention to this.



36078RL06

(10) Remove reducing valve subassembly and return spring (7) out of casing.

※ Record relative position of reducing valve subassembly and return springs.



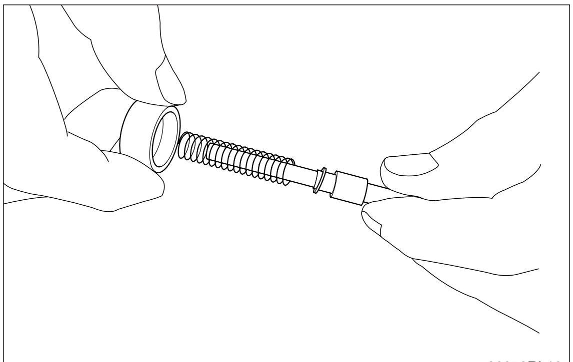
36078RL07

(11) Separate spool (3), spring seat (6), spring (5) and shim (4) individually.

※ Pay attention not to damage spool surface.

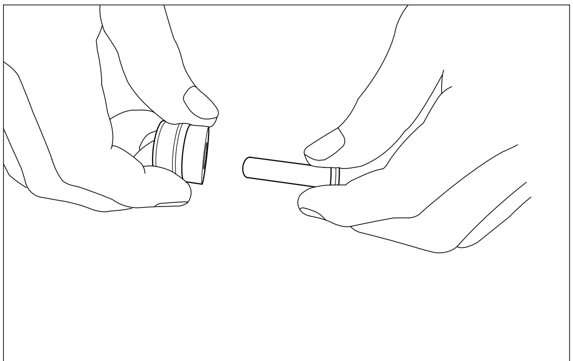
※ Record original position of spring seat (6).

※ Until being assembled, they should be handled as one subassembly group.



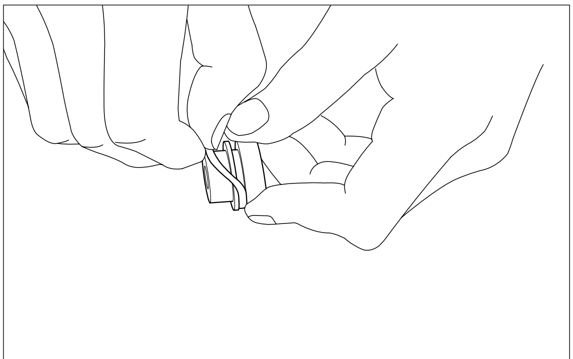
36078RL10

(12) Take push rod (9) out of plug (8).

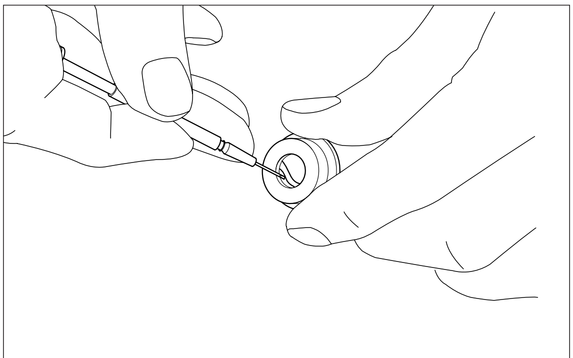


36078RL11

(13) Remove O-ring (10) and seal (11) from plug (8).
Use small minus screwdriver or so on to remove this seal.

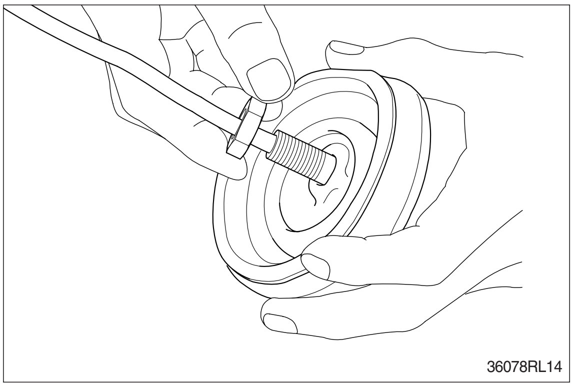


36078RL12

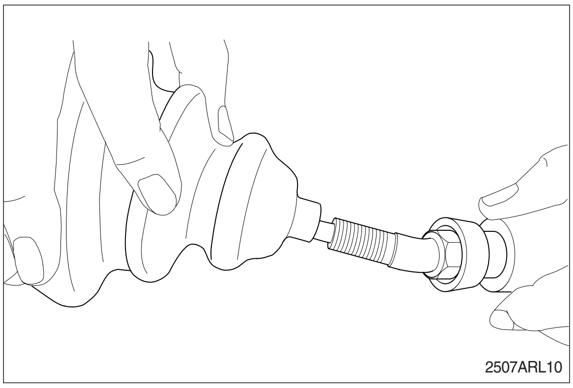


36078RL13

(14) Remove lock nut (22) and then boot (23).



36078RL14



2507ARL10

(15) Cleaning of parts

① Put all parts in rough cleaning vessel filled with kerosene and clean them (rough cleaning).

※ If dirty part is cleaned with kerosene just after putting it in vessel, it may be damaged. Leave it in kerosene for a while to loosen dust and dirty oil.

※ If this kerosene is polluted, parts will be damaged and functions of reassembled valve will be degraded.
Therefore, control cleanliness of kerosene fully.

② Put parts in final cleaning vessel filled with kerosene, turning it slowly to clean them even to their insides (finish cleaning).

※ Do not dry parts with compressed air, since they will be damaged and/or rusted by dust and moisture in air.

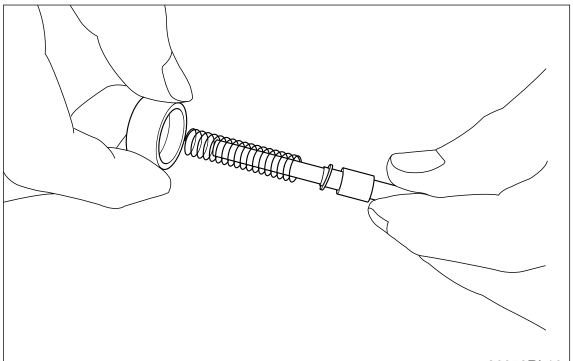
(16) Rust prevention of parts

Apply rust-preventives to all parts.

※ If left as they after being cleaned, they will be rusted and will not display their functions fully after being reassembled.

4) ASSEMBLY

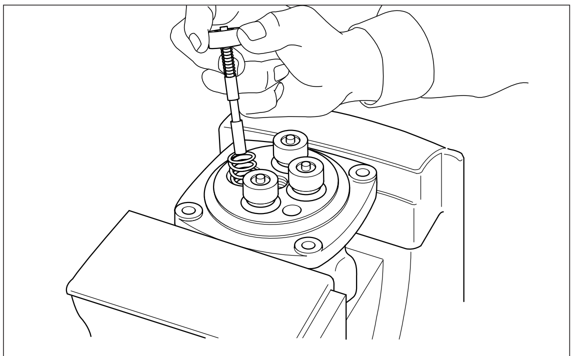
(1) Put shim (4), springs (5) and spring seat (6) onto spool (3) in this order.



36078RL16

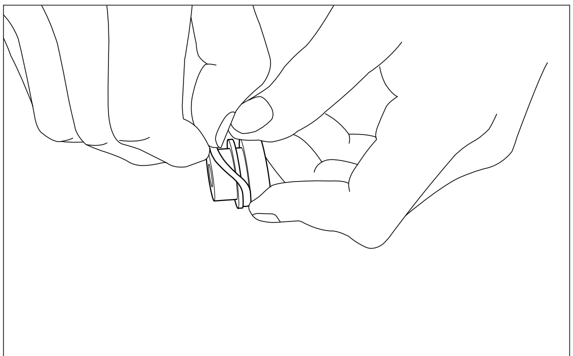
(2) Assemble spring (7) into casing (1).
Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.



36078RL18

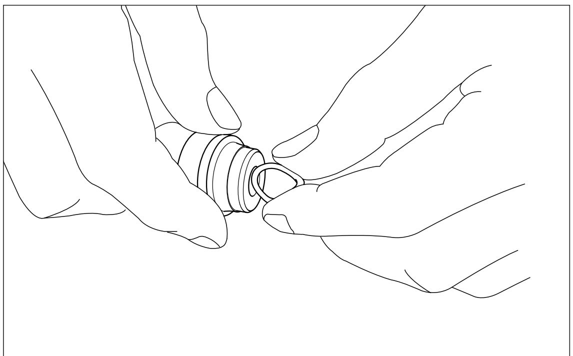
(3) Assemble O-ring (10) onto plug (8).



36078RL19

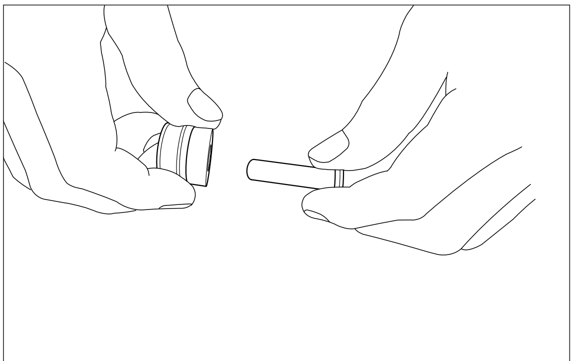
(4) Assemble seal (11) to plug (8).

※ Assemble seal in such lip direction as shown below.

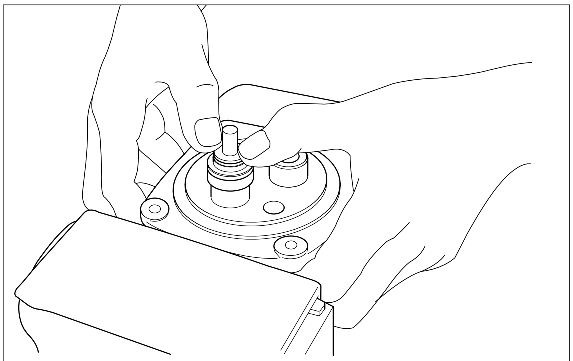


36078RL20

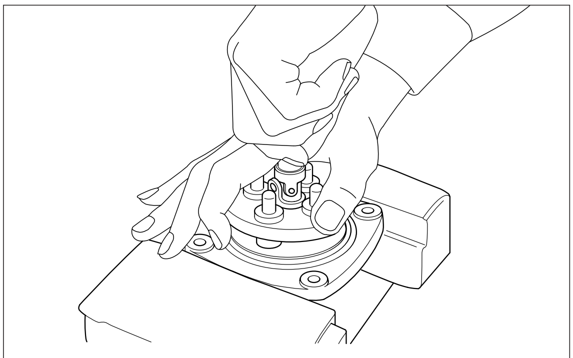
(5) Assemble push rod (9) to plug (8).
※ Apply working oil on push-rod surface.


36078RL21

(6) Assemble plug subassembly to casing.
※ When return spring is weak in force, subassembly stops due to resistance of O-ring.

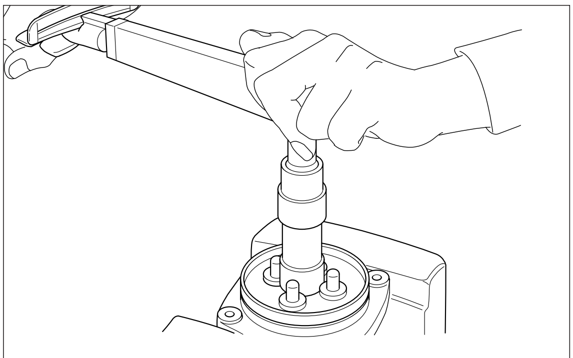

36078RL22

(7) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (12), and tighten joint (15) temporarily.


36078RL23

(8) Fit plate (12).

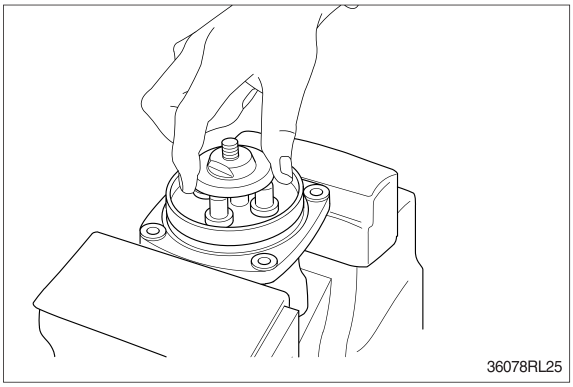
(9) Tighten joint (15) with the specified torque to casing, utilizing jig.


36078RL24

(10) Assemble swash plate (16) to joint (15).

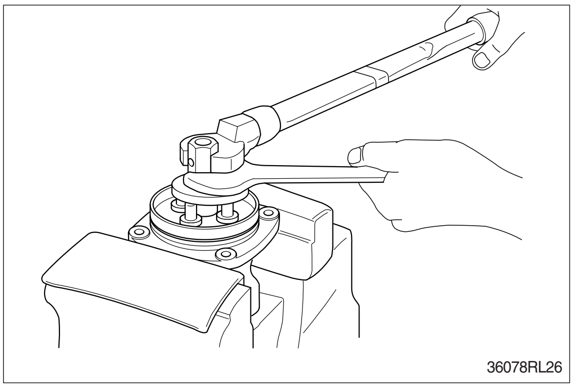
※ Screw it to position that it contacts with 4 push rods evenly.

※ Do not screw it over.

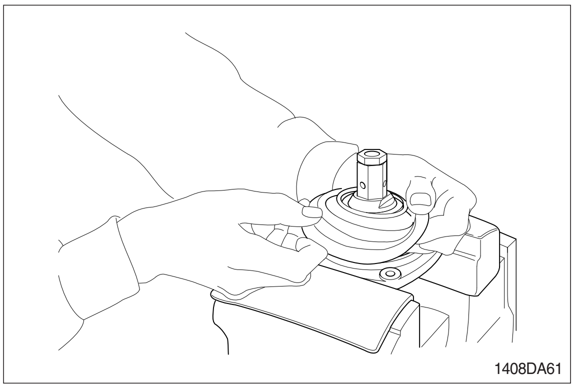


(11) Assemble adjusting nut (17), apply spanner to width across flat of plate (16) to fix it, and tighten adjusting nut to the specified torque.

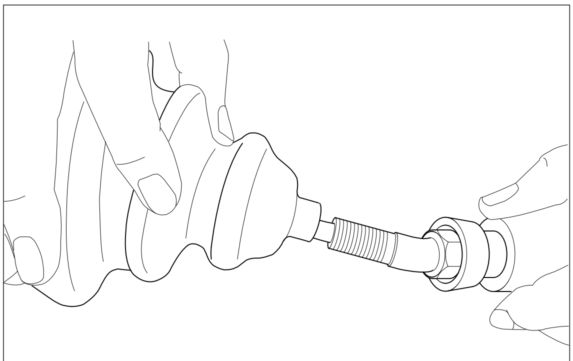
※ During tightening, do not change position of disk.



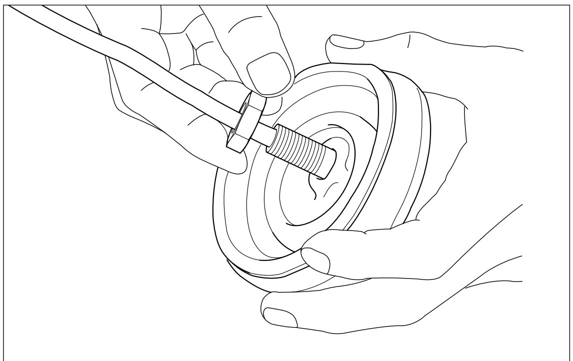
(12) Fit boot (14) to plate.



(13) Fit boot (23) and lock nut (22), and handle subassembly is assembled completely.

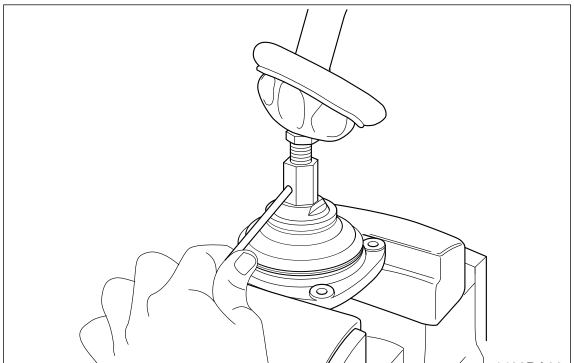


2507ARL10



36078RL27

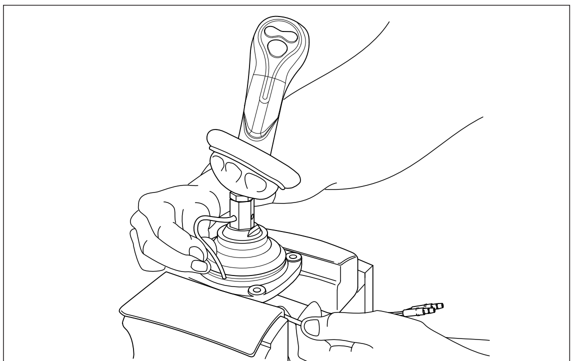
(14) Pull out cord and tube through adjusting nut hole provided in direction 60° to 120° from casing hole.



1408DA66

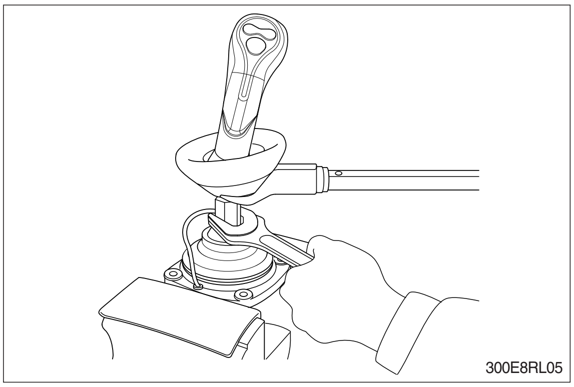
(15) Assemble bushing (18) to plate and pass cord and tube through it.

※ Provide margin necessary to operation.

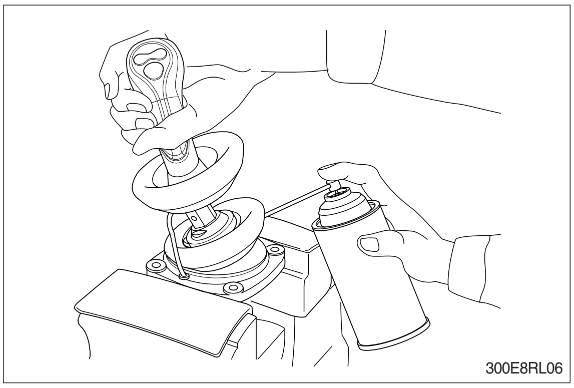


300E8RL04

(16) Determine handle direction, tighten lock nut (22) to specified torque to fix handle.

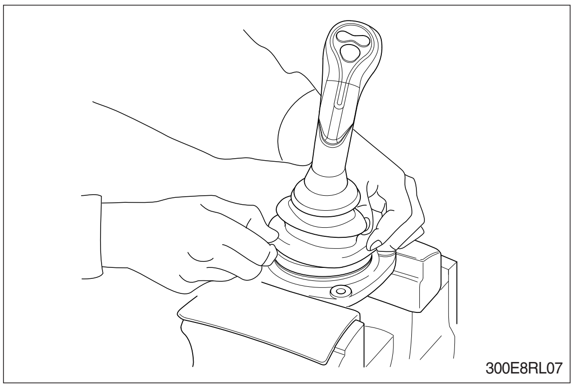

300E8RL05

(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


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.

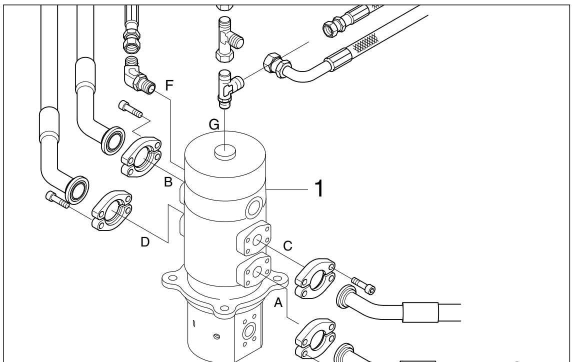
(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ **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.

(4) Disconnect all hoses.

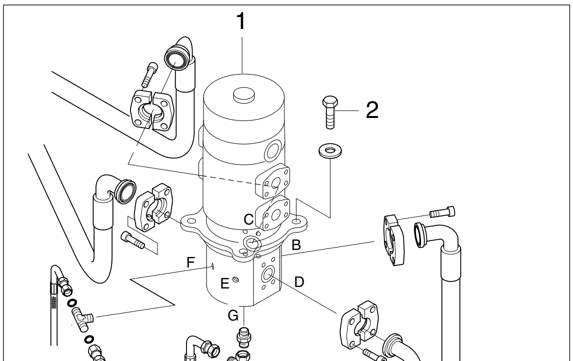
(5) Sling the turning joint assembly (1) and remove the mounting bolt (2).
Weight : 55 kg (120 lb)
Tightening torque : 29.7±4.5 kgf · m
(215±32.5 lbf · ft)



480S8TJ01

(6) Remove the turning joint assembly.

※ When removing the turning joint, check that all the hoses have been disconnected.



480S8TJ02

2) INSTALL

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

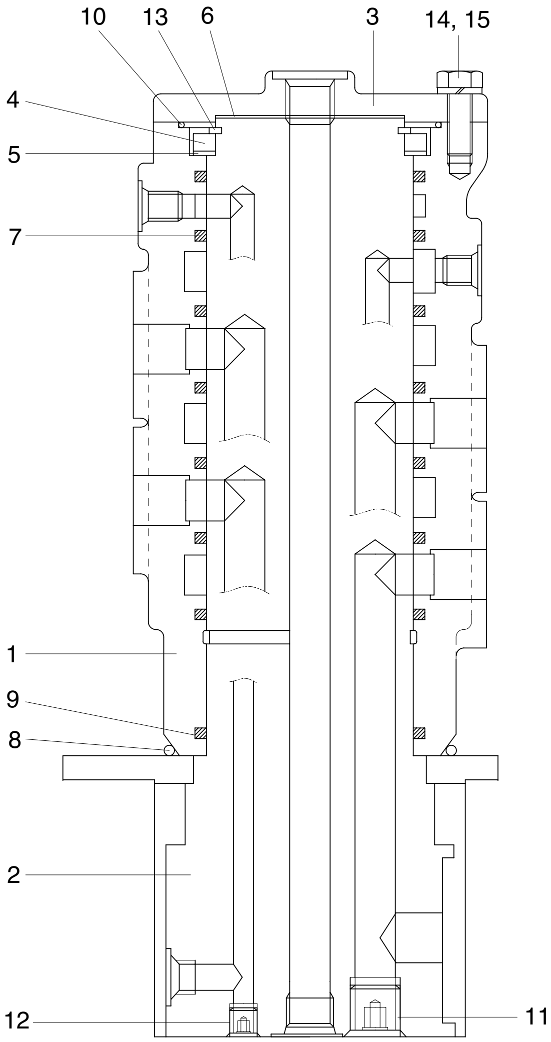
※ Take care of turning joint direction.

※ 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



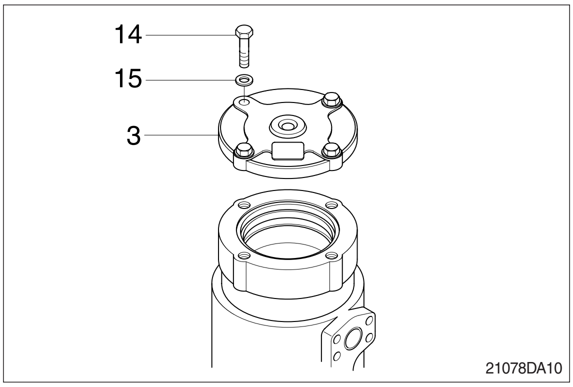
480S8TJ10

1	Hub	6	Shim	11	Plug
2	Shaft assy	7	Slipper seal	12	Plug
3	Cover	8	O-ring	13	Retaining ring
4	Spacer	9	O-ring	14	Hexagon bolt
5	Shim	10	O-ring	15	Spring washer

2) DISASSEMBLY

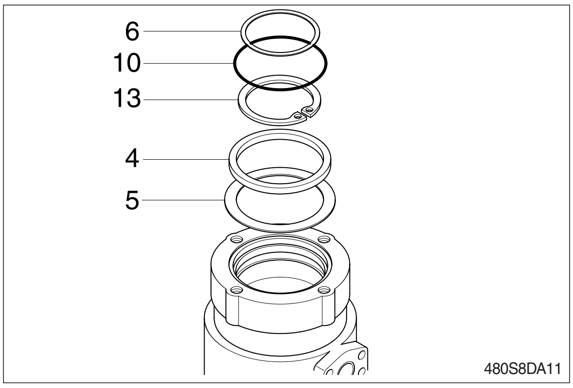
※ Before the disassembly, clean the turning joint.

(1) Remove bolts (14), washer (15) and cover (3).



(2) Remove shim (6) and O-ring (10).

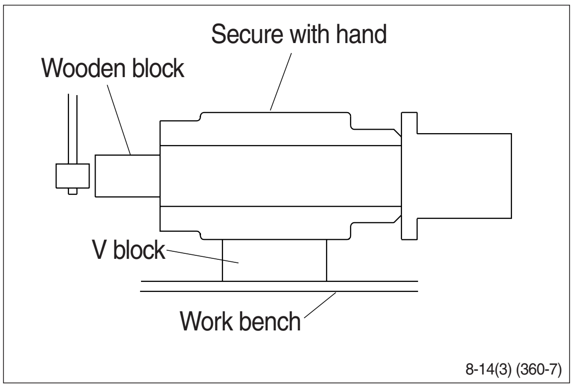
(3) Remove retainer ring (13), spacer (4) and shim (5).



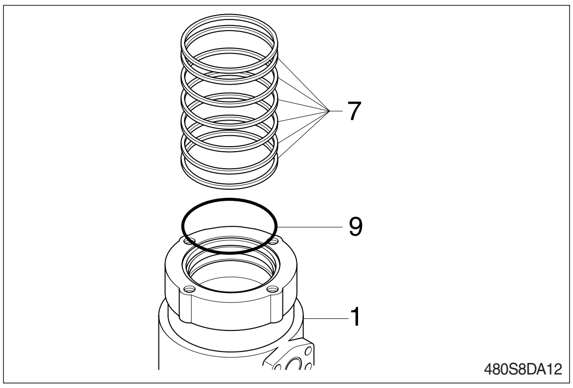
(4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

※ 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 seven slipper seals (7) and O-ring (9) from hub (1).



3) ASSEMBLY

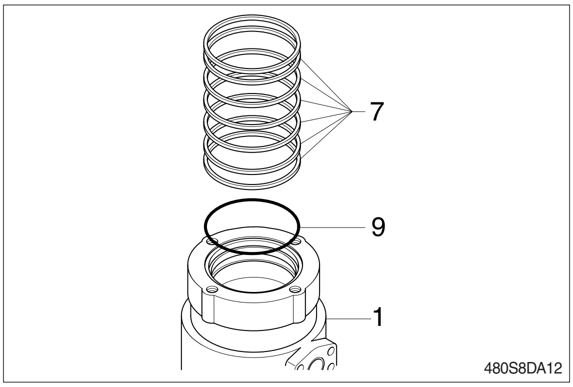
※ Clean all parts.

※ As a general rule, replace oil seals and O-ring.

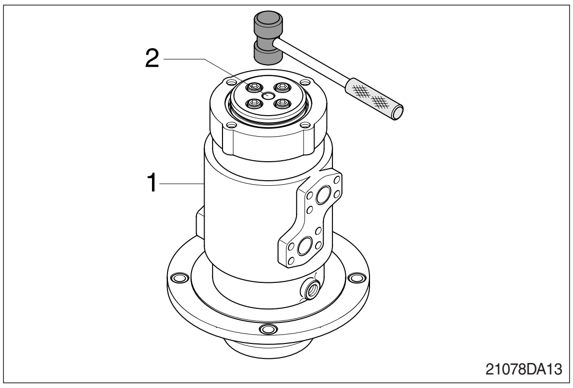
※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(1) Fix seven slipper seal (7) and O-ring (9) to hub (1).

(2) Fit O-ring (8) to shaft (2).



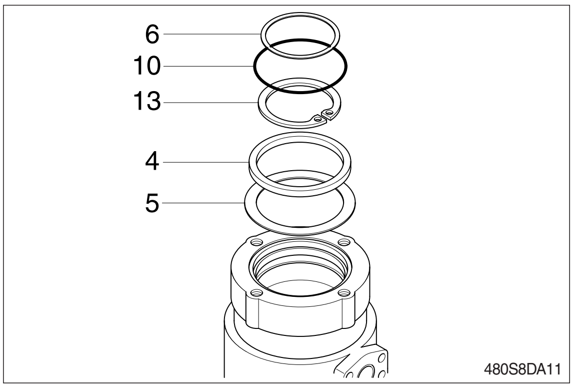
(3) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.



(4) Fit shim (5), spacer (4) and retainer ring (13) to shaft (2).

(5) Fit O-ring (10) to hub (1).

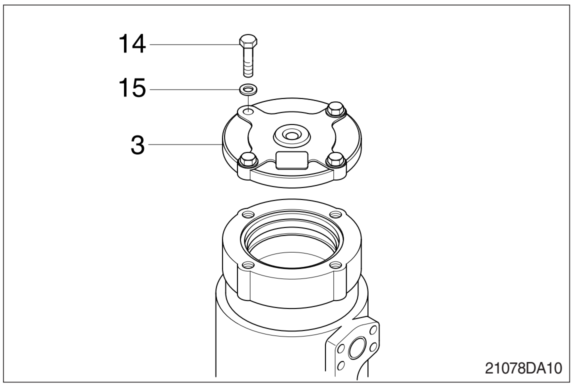
(6) Fit shim (6) to shaft (2).



(7) Install cover (3) to body (1) and tighten bolts (14).

Torque : 10~12.5 kgf · m

(72.3~90.4 lbf · ft)



GROUP 9 BOOM, ARM AND BUCKET CYLINDER

1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

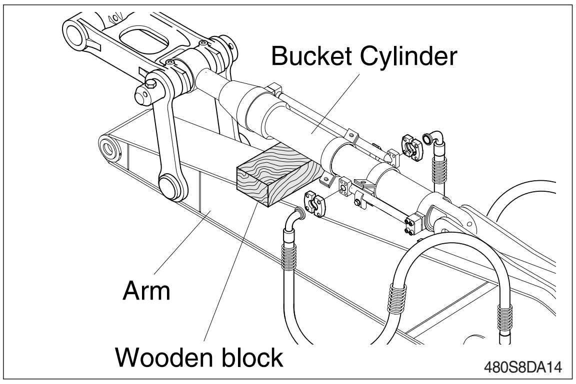
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

⚠ **Loosen the breather slowly to release the pressure inside the hydraulic tank.**

※ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.


13031GE18

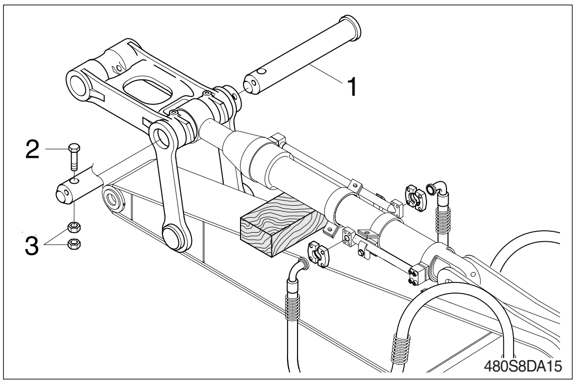
① Set block between bucket cylinder and arm.



480S8DA14

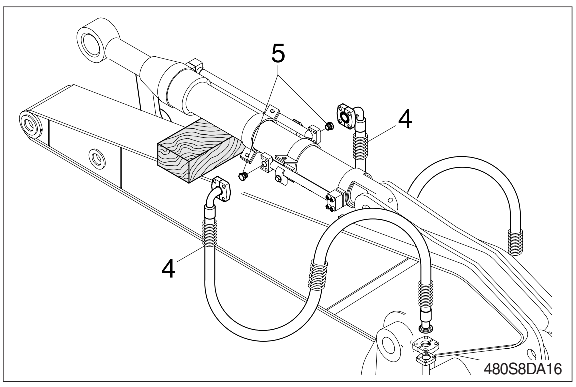
② Remove bolt (2), nut (3) and pull out pin (1).

※ Tie the rod with wire to prevent it from coming out.



480S8DA15

③ Disconnect bucket cylinder hoses (4) and put plugs (5) on cylinder pipe.

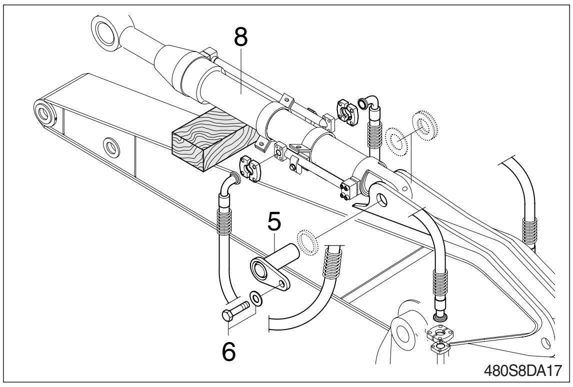


480S8DA16

④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).

⑤ Remove bucket cylinder assembly (8).

· Weight : HX480S L : 370 kg (816 lb)
HX520S L : 400 kg (880 lb)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

※ Bleed the air from the bucket cylinder.

※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2) ARM CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

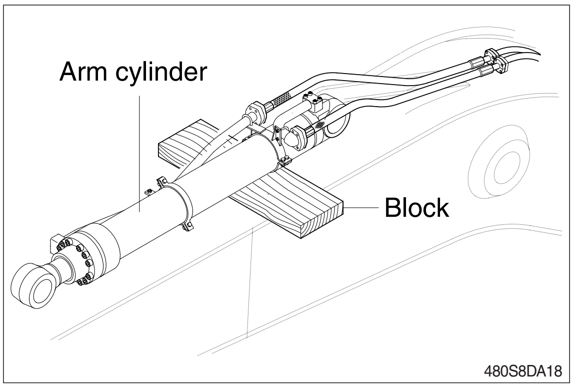
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

⚠ **Loosen the breather slowly to release the pressure inside the hydraulic tank.**

※ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.


13031GE18

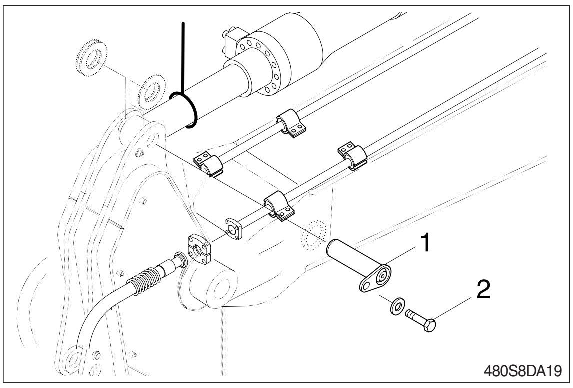
① Set block between arm cylinder and boom.



480S8DA18

② Remove bolt (2) and pull out pin (1).

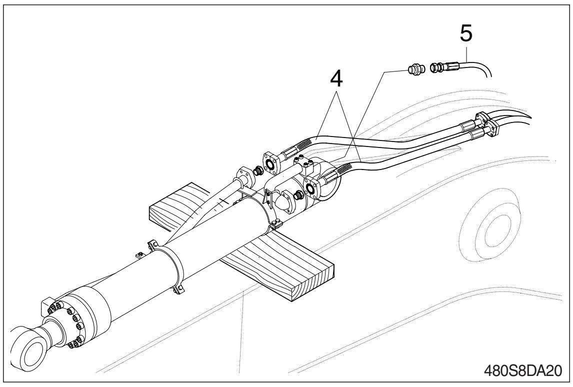
※ Tie the rod with wire to prevent it from coming out.



480S8DA19

③ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

④ Disconnect greasing pipings (5).

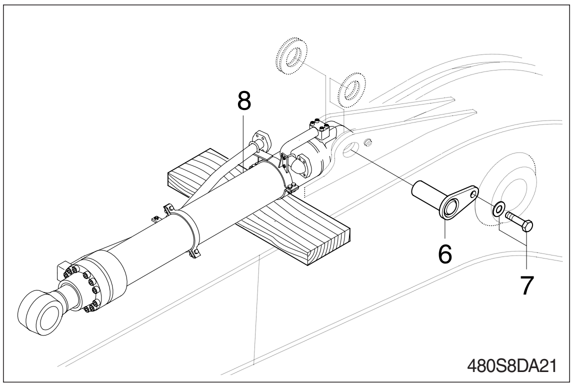


480S8DA20

⑤ Sling arm assembly (8) and remove bolt (7) then pull out pin (6).

⑥ Remove arm cylinder assembly (8).

  · Weight : 600 ㎏ (1320 ㏌)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

※ Bleed the air from the arm cylinder.

※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

3) BOOM CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

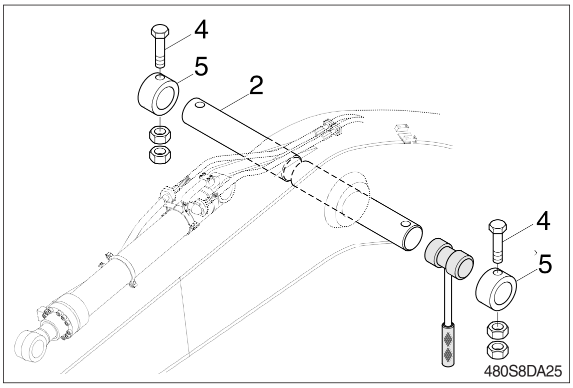
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

⚠ **Loosen the breather slowly to release the pressure inside the hydraulic tank.**

※ Escaping fluid under pressure can penetrate the skin causing serious injury. Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

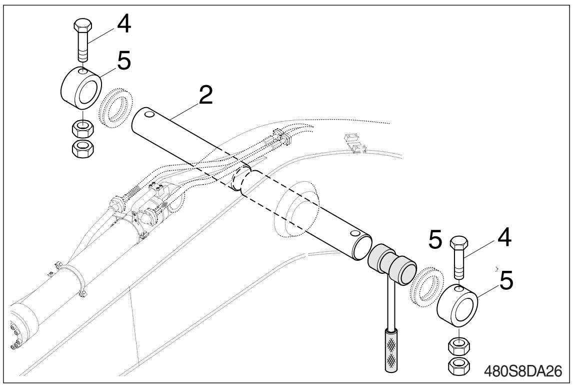
① Disconnect greasing hoses (1).

② Sling boom cylinder assembly.

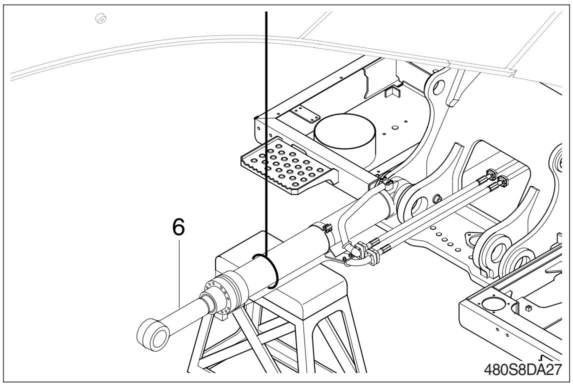


③ Remove bolt (4), pin stopper (5) and pull out pin (2).

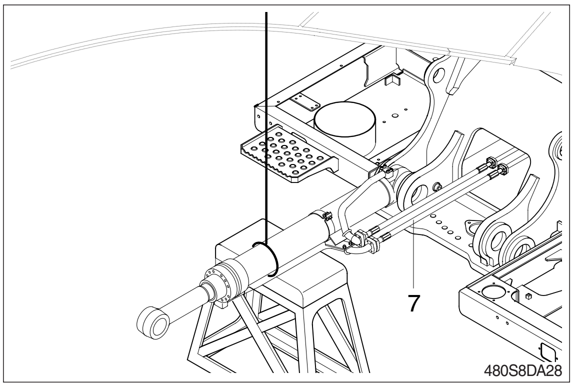
※ Tie the rod with wire to prevent it from coming out.



④ Lower the boom cylinder assembly (6) on a stand.



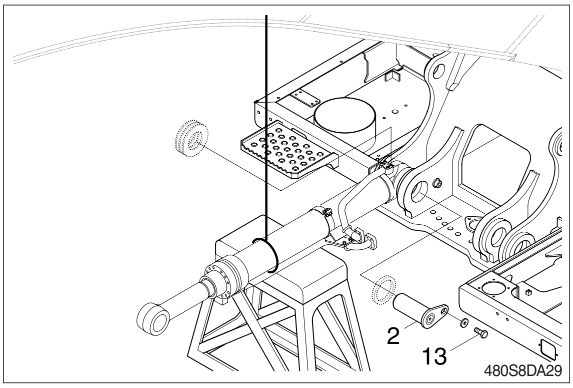
⑤ Disconnect boom cylinder hoses (7) and put plugs on cylinder pipe.



⑥ Remove bolt (9) and pull out pin (8).

⑦ Remove boom cylinder assembly (6).

· Weight : 435 ㎏ (960 ℔)



(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.

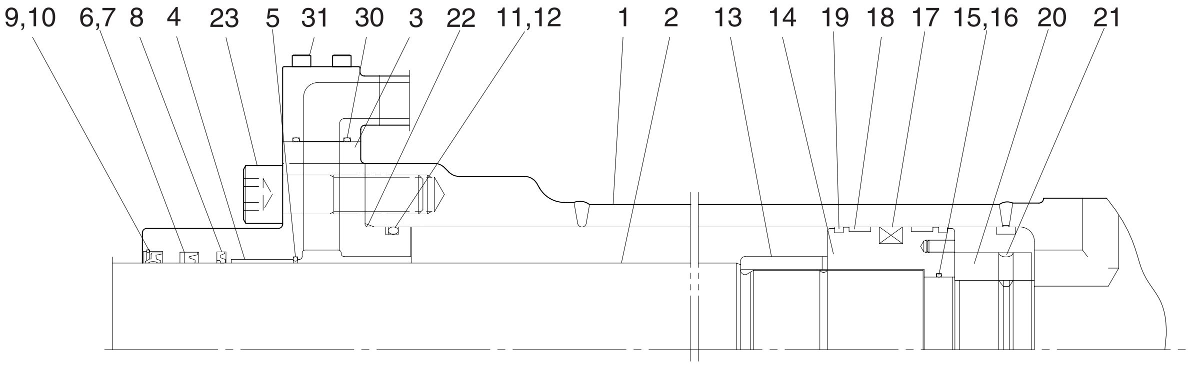
※ Bleed the air from the boom cylinder.

※ Conformed the hydraulic oil level and check the hydraulic oil leak or not.

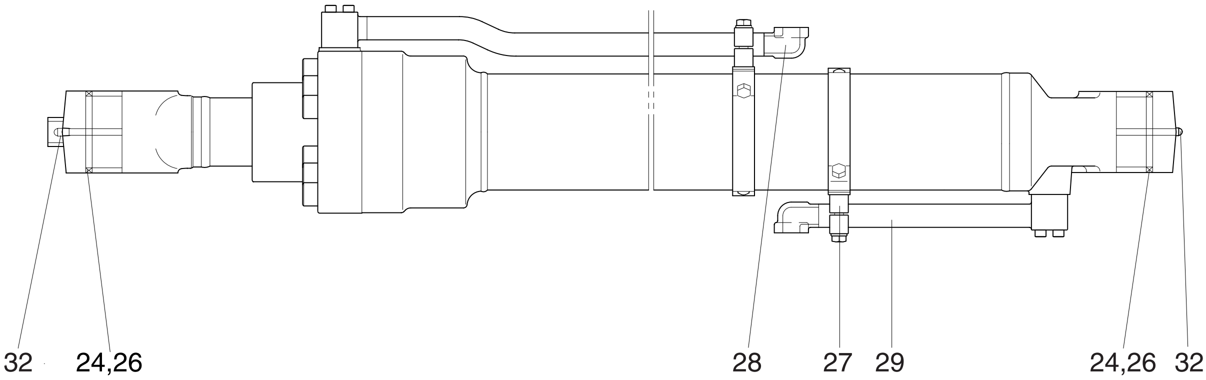
2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

(1) Bucket cylinder (HX480S L)



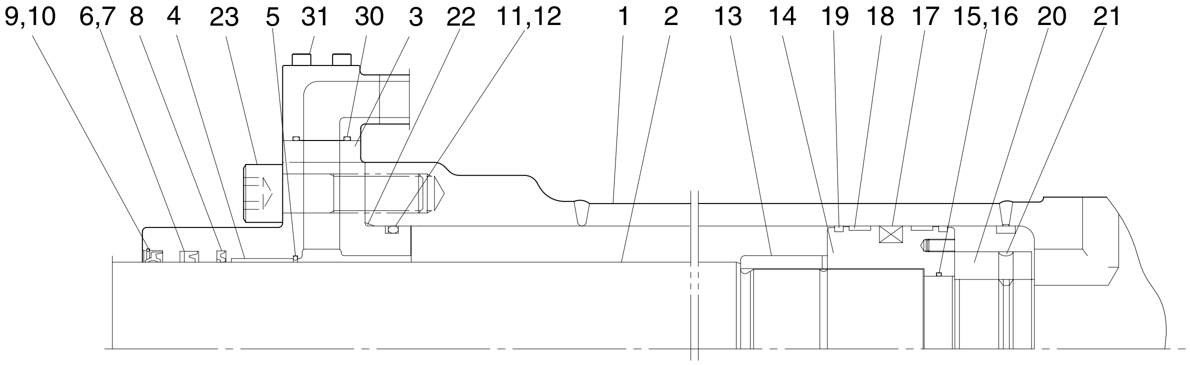
Internal detail



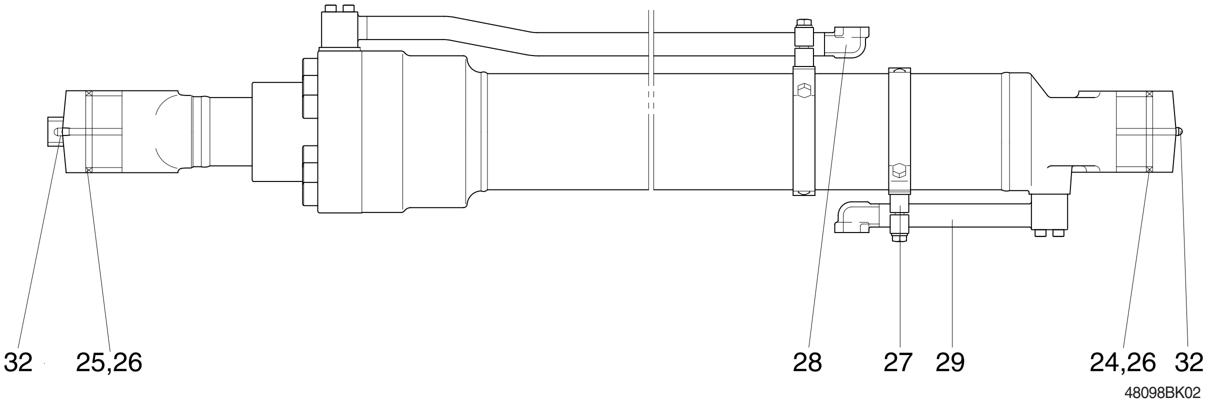
48098BK01

1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Pin bushing
3	Gland	14	Piston	26	Dust seal
4	DD2 bushing	15	O-ring	27	Band assembly
5	Snap ring	16	Back up ring	28	Pipe assembly
6	Rod seal	17	Piston seal	29	Pipe assembly
7	Back up ring	18	Wear ring	30	O-ring
8	Buffer ring	19	Dust ring	31	Hexagon socket head bolt
9	Dust wiper	20	Lock nut	32	Grease nipple
10	Snap ring	21	Hexagon socket head bolt		
11	O-ring	22	O-ring		

(2) Bucket cylinder (HX520S L)

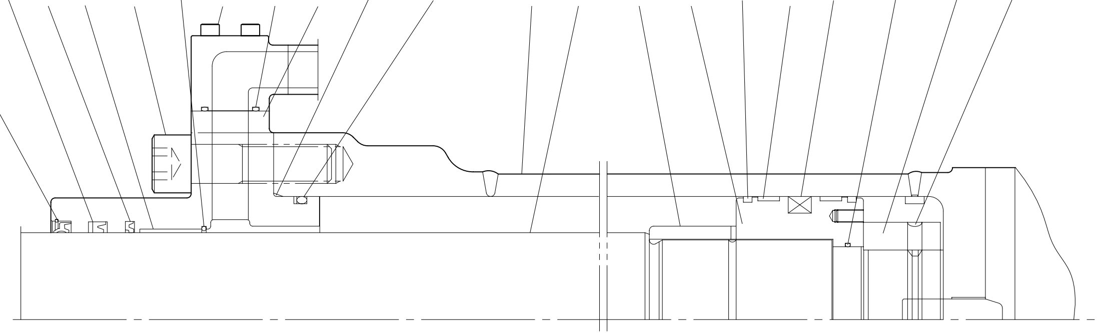


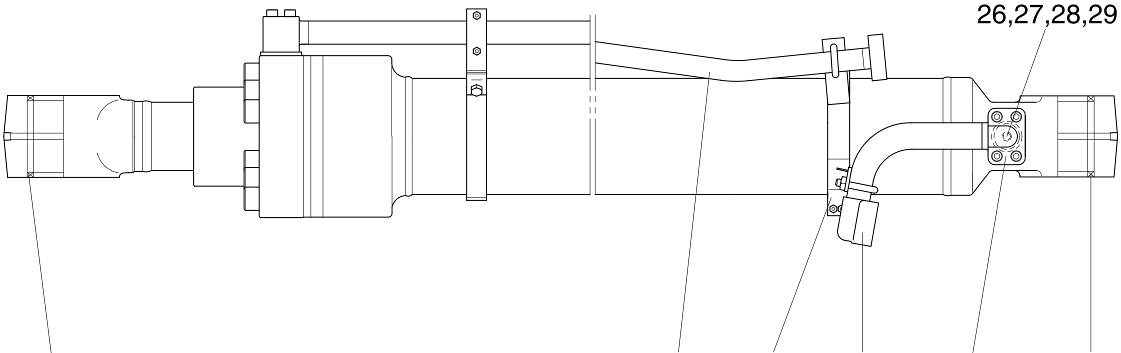
Internal detail



1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Pin bushing
3	Gland	14	Piston	25	Pin bushing
4	DD2 bushing	15	O-ring	26	Dust seal
5	Snap ring	16	Back up ring	27	Band assembly
6	Rod seal	17	Piston seal	28	Pipe assembly
7	Back up ring	18	Wear ring	29	Pipe assembly
8	Buffer ring	19	Dust ring	30	O-ring
9	Dust wiper	20	Lock nut	31	Hexagon socket head bolt
10	Snap ring	21	Hexagon socket head bolt	32	Grease nipple
11	O-ring	22	O-ring		

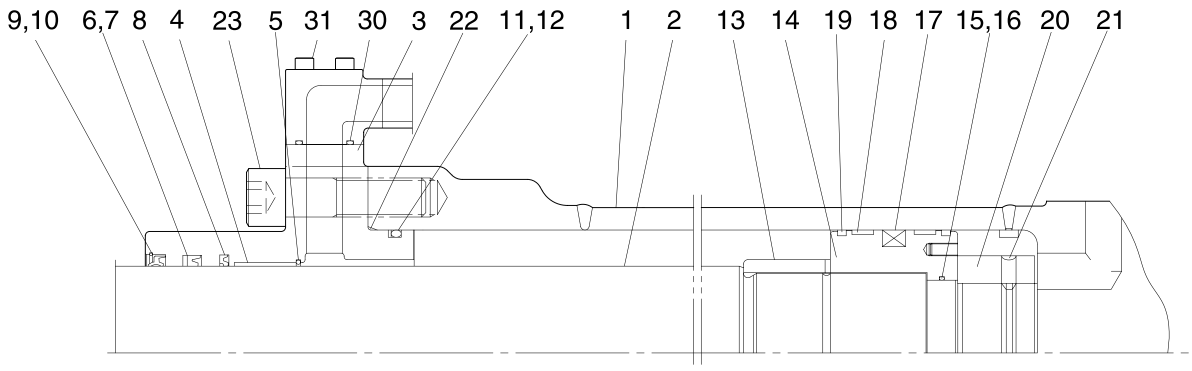
(3) Arm cylinder



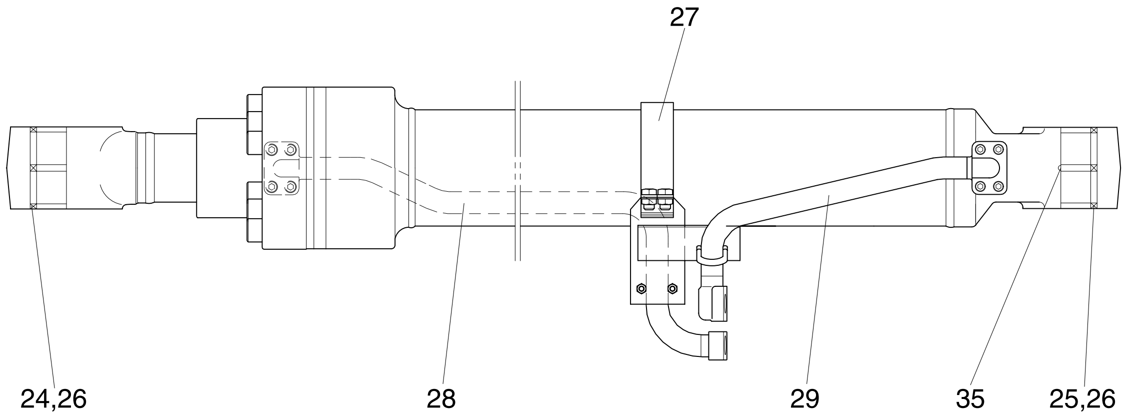


1	Tube assembly	14	Piston	27	Coil spring
2	Rod assembly	15	O-ring	28	O-ring
3	Gland	16	Back up ring	29	Plug
4	DD2 bushing	17	Piston seal	30	Band assembly
5	Snap ring	18	Wear ring	31	Band assembly
6	Rod seal	19	Dust ring	32	Pipe assembly
7	Back up ring	20	Lock nut	33	Pipe assembly
8	Buffer ring	21	Hexagon socket set screw	34	O-ring
9	Dust wiper	22	O-ring	35	O-ring
10	Snap ring	23	Hexagon socket head bolt	36	Hexagon socket head bolt
11	O-ring	24	Pin bushing	37	Hexagon socket head bolt
12	Back up ring	25	Dust seal		
13	Cushion ring	26	Check valve		

(4) Boom cylinder



Internal detail

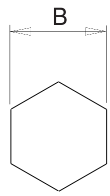


48098BO01

1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Pin bushing
3	Gland	14	Piston	25	Pin bushing
4	DD2 bushing	15	O-ring	26	Dust seal
5	Snap ring	16	Back up ring	27	Band assembly
6	Rod seal	17	Piston seal	28	Pipe assembly
7	Back up ring	18	Wear ring	29	Pipe assembly
8	Buffer ring	19	Dust ring	30	O-ring
9	Dust wiper	20	Lock nut	31	Hexagon socket head bolt
10	Snap ring	21	Hexagon socket set screw	35	Grease nipple
11	O-ring	22	O-ring		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Allen wrench	10	
	14	
	18	
	24	
	30	
(-) Driver	Small and large sizes	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Piston	Bucket cylinder	14	-	200±20	1447±145
	Boom cylinder	14	-	150±15	1085±108
	Arm cylinder	14	-	200±20	1447±145
Piston lock nut	Bucket cylinder	20	-	150±15	1085±108
	Boom cylinder	20	-	100±10	723±72
	Arm cylinder	20	-	150±15	1085±108
Socket head bolt	Bucket cylinder	23	M22	63.0±6.0	456±43
		31	M12	9.4±1.0	67.9±7.2
	Boom cylinder	23	M22	63.0±6.0	456±43
		31	M12	9.4±1.0	67.9±7.2
	Arm cylinder	23	M24	79.0±8.0	571±58
		36	M12	9.4±1.0	67.9±7.2
Socket set screw	Bucket cylinder	21	M10	5.4±0.5	39.1±3.6
	Boom cylinder	21	M10	5.4±0.5	39.1±3.6
	Arm cylinder	21	M10	5.4±0.5	39.1±3.6

3) DISASSEMBLY

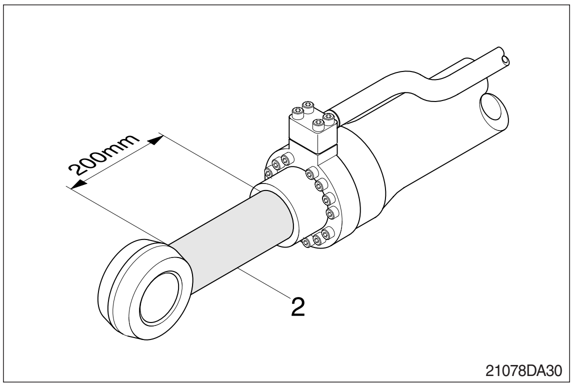
(1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder.

① Hold the clevis section of the tube in a vise.

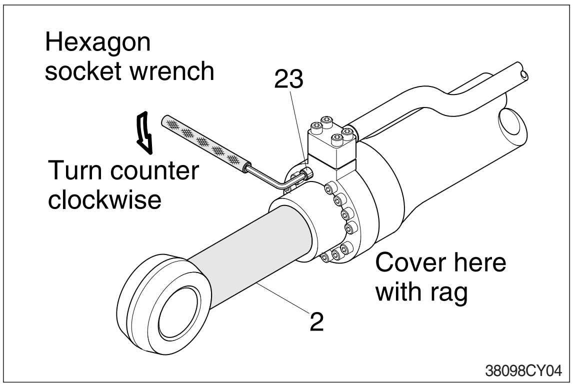
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

② Pull out rod assembly (2) about 200 mm (7.1in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



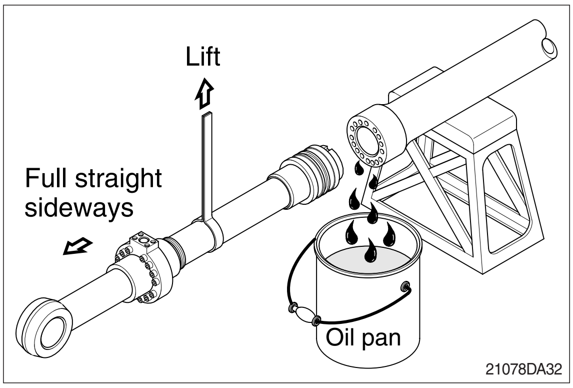
③ Loosen and remove socket bolts (23) of the gland in sequence.

※ 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).

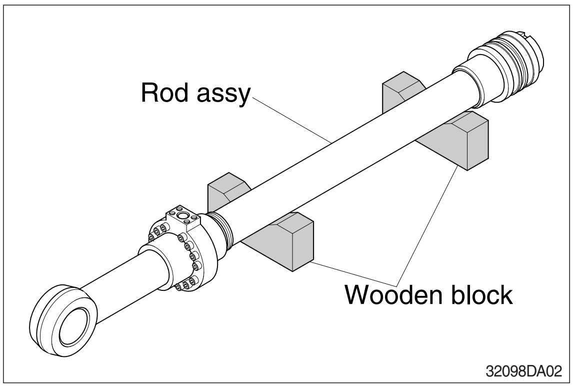
※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (2) with a crane or some means and draw it out. However, when rod assembly (2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



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.

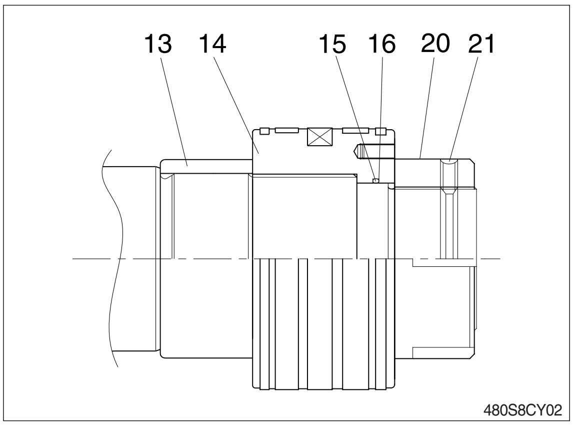


(3) Remove piston and cylinder head

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).

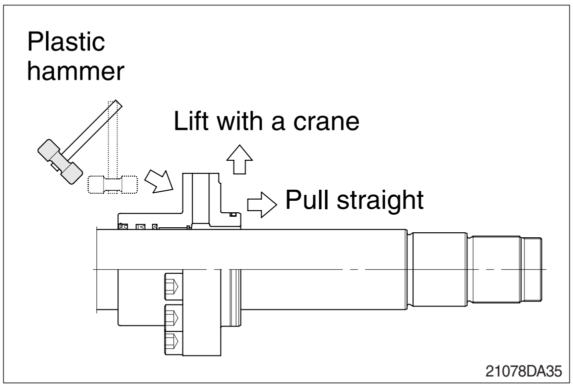


③ Remove the cylinder head assembly from rod assembly (2).

※ 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).



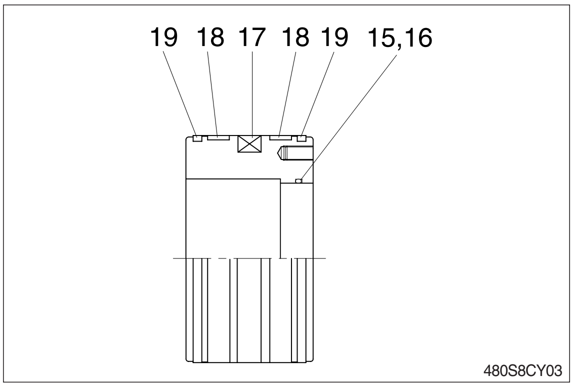
(3) Disassemble the piston assembly

① Remove wear ring (18).

② Remove dust ring (19) and piston seal (17).

※ Exercise care in this operation not to damage the grooves.

③ Remove back up ring (16) and O-ring (15).



(4) Disassemble cylinder head assembly

① Remove back up ring (12), O-ring (11) and O-ring (22).

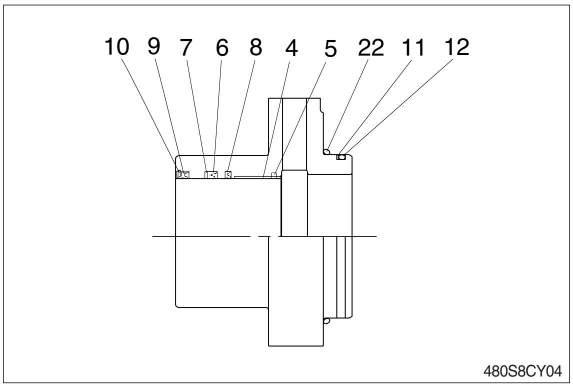
② Remove snap ring (10), dust wiper (9).

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).

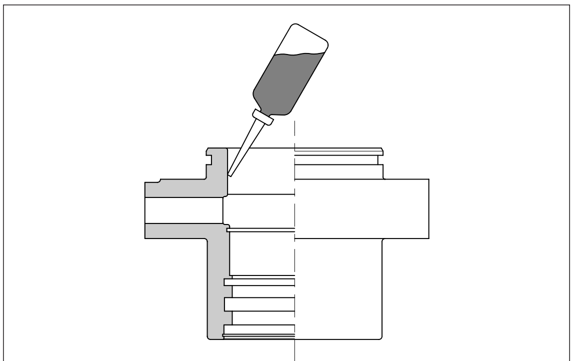


3) ASSEMBLY

(1) Assemble cylinder head assembly

※ Check for scratches or rough surfaces if found smooth with an oil stone.

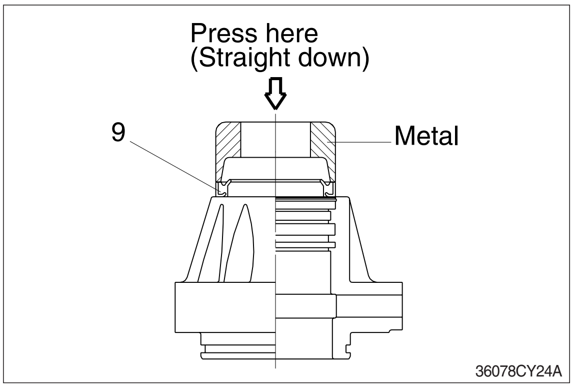
① Coat the inner face of gland (3) with hydraulic oil.



21078DA37

② Coat dust wiper (9) with grease and fit dust wiper (9) to the bottom of the hole of dust seal.
At this time, press a pad metal to the metal ring of dust seal.

③ Fit snap ring (10) to the stop face.

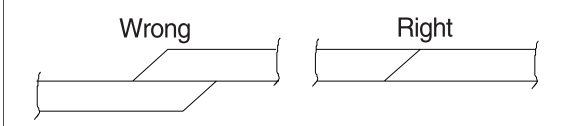


36078CY24A

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.

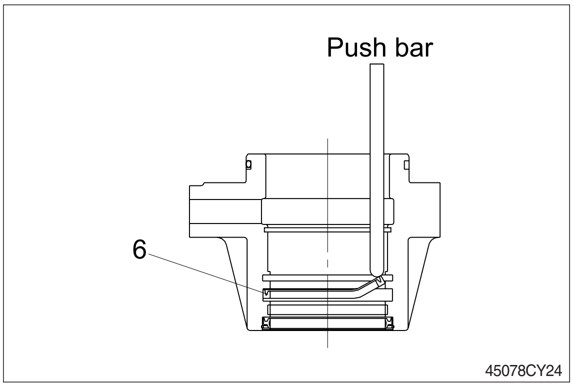
※ Insert the backup ring until one side of it is inserted into groove.



45078CY11

※ 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.

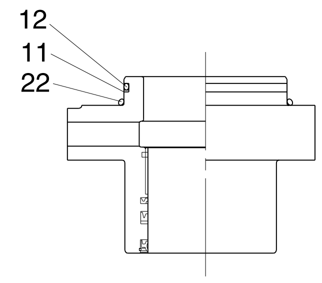


45078CY24

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).

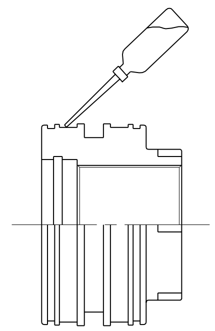


480S8CY05

(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.

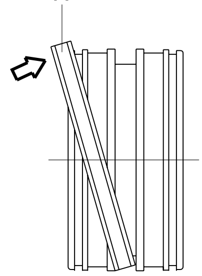


45078CY12

② Fit piston seal (17) to piston.

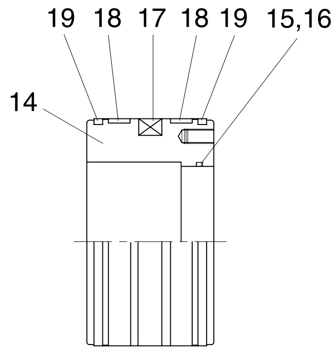
※ Put the piston seal in the warm water of 60~100˚C for more than 5 minutes.

※ After assembling the piston seal, press its outer diameter to fit in.



50078CY06

③ Fit wear ring (18) and dust ring (19) to piston (14).



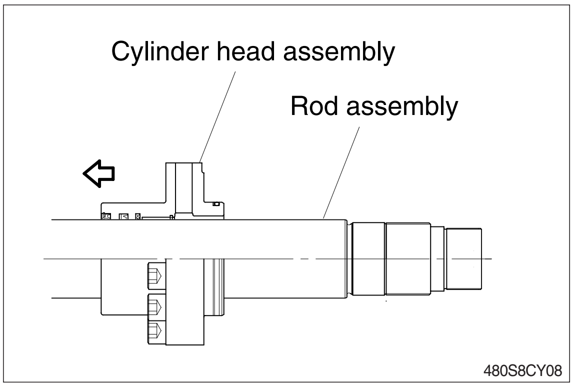
480S8CY07

(3) Install piston and cylinder head

① Fix the rod assembly to the work bench.

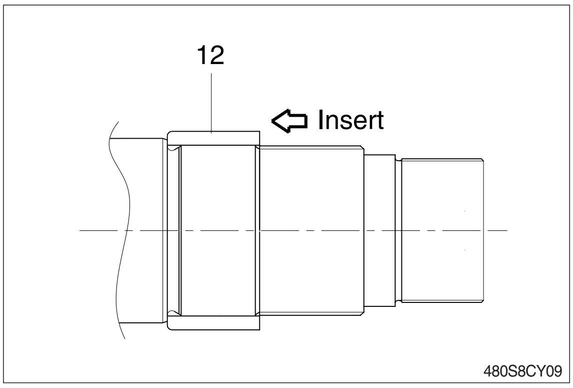
② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and cylinder head.

③ Insert cylinder head assembly to rod assembly.



④ Insert cushion ring (13) to rod assembly.

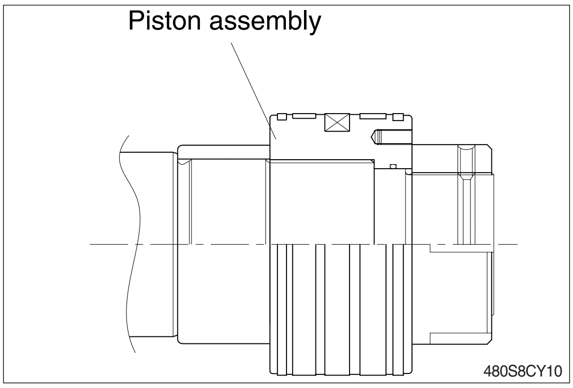
※ Note that cushion ring (13) has a direction in which it should be fitted.



⑤ Fit piston assembly to rod assembly.

· Tightening torque

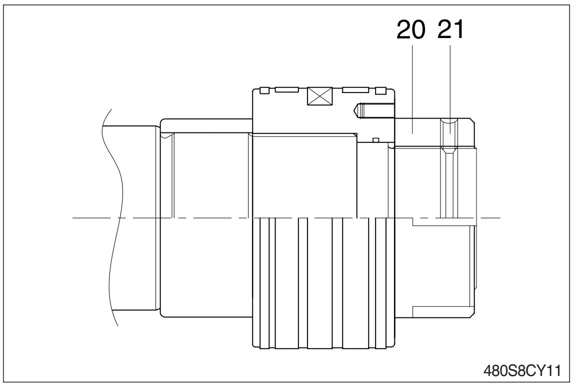
Item		kgf · m	lbf · ft
14	Bucket	200±20	1447±145
14	Boom	150±15	1085±108
14	Arm	200±20	1447±145



⑥ Fit lock nut (20) and tighten the set screw (21).

· Tightening torque :

Item		kgf · m	lbf · ft
Bucket	20	150±15	1085±108
	21	5.4±0.5	39.1±3.6
Boom	20	100±10	723±72
	21	5.4±0.5	39.1±3.6
Arm	20	150±15	1085±108
	21	5.4±0.5	39.1±3.6



480S8CY11

(3) Overall assemble

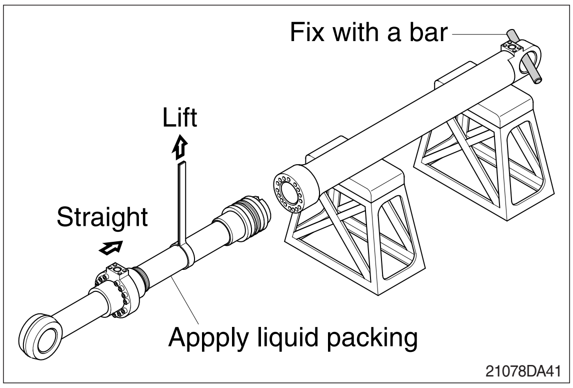
① Place a V-block on a rigid work bench. Mount the tube assembly (1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

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.



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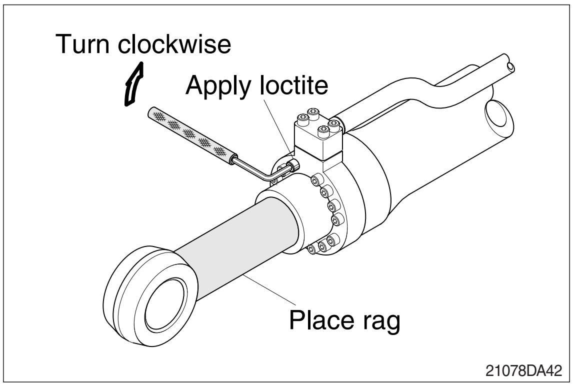


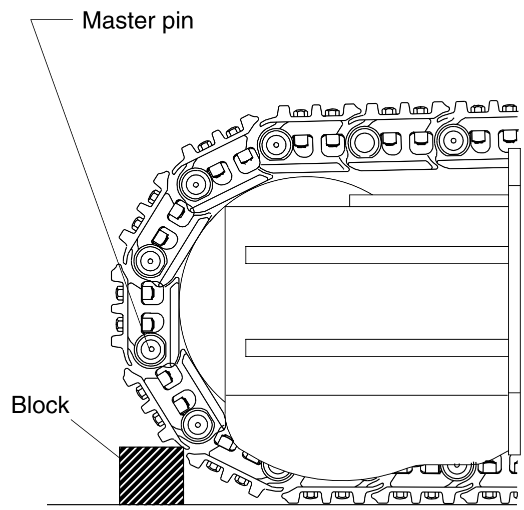
21078DA42

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.



4800S8UC01

(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.

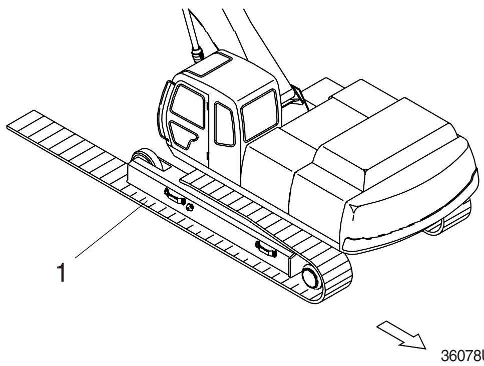
※ Unscrew the grease nipple after release the tension by pushing the poppet only when necessarily required.
Grease leaking hole is not existing. So, while unscrew the grease nipple, grease is not leaking until the grease nipple is completely coming out. If the tension is not released in advance, the 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.

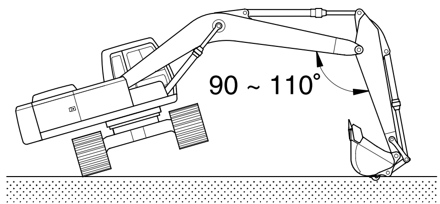


36078UC10

2) INSTALL

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

※ Adjust the tension of the track link.

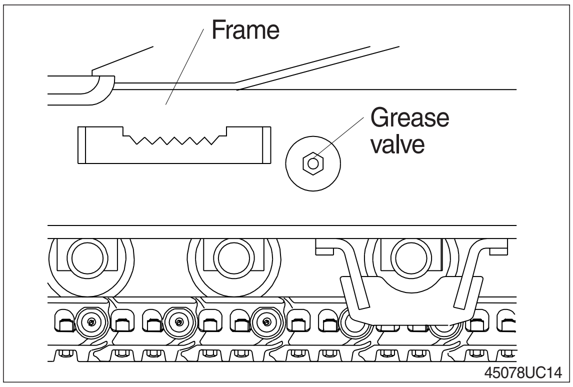


21074OP14

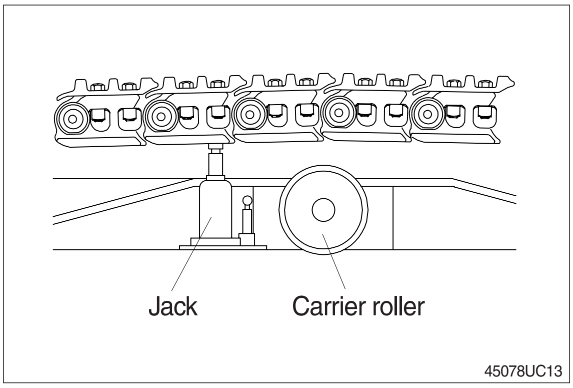
2. CARRIER ROLLER

1) REMOVAL

(1) Loosen tension of the track link.



(2) Jack up the track link height enough to permit carrier roller removal.

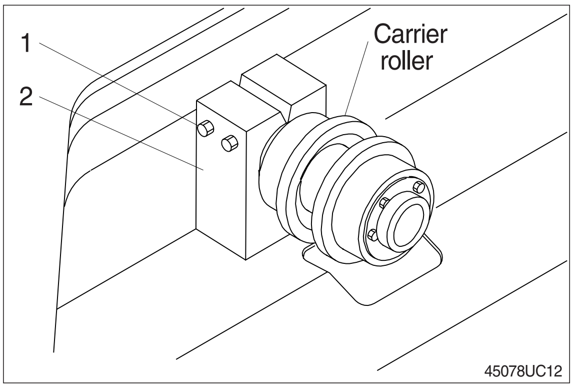


(3) Loosen the lock nut (1).

(4) Open bracket (2) with a screwdriver, push out from inside, and remove carrier roller assembly.

· Weight : 40 kg (90 lb)

· Tightening torque : 29.7±4.5 kgf · m (215±32.5 lbf · ft)



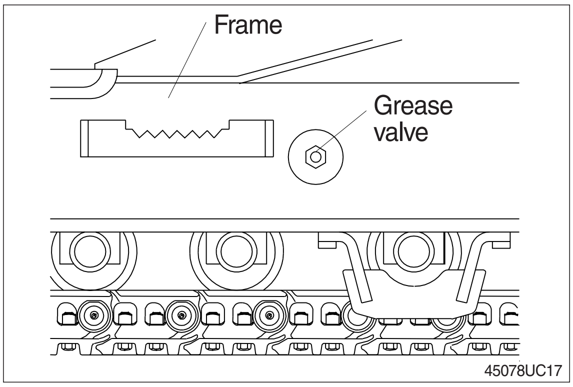
2) INSTALL

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

3. TRACK ROLLER

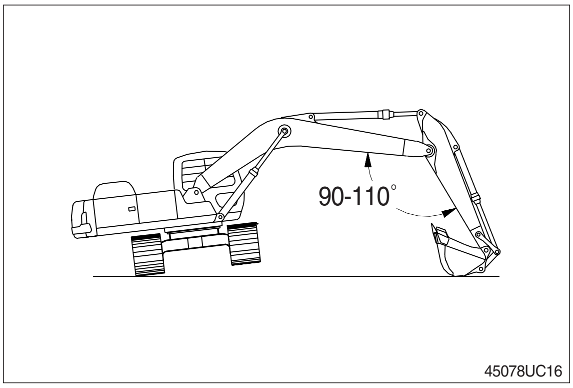
1) REMOVAL

(1) Loosen tension of the track link.



(2) Using the work equipment, push up track frame on side which is to be removed.

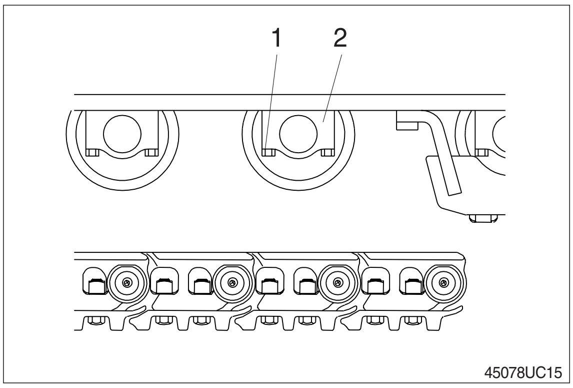
※ After jack up the machine, set a block under the unit.



(3) Remove the mounting bolt (1) and draw out the track roller (2).

· Weight : 87 kg (190 lb)

· Tightening torque : 100±15 kgf · m (723±109 lbf · ft)



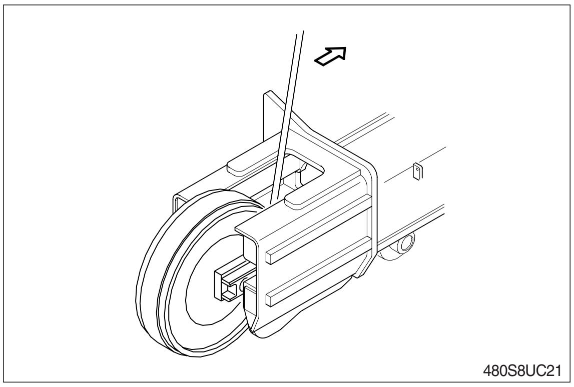
2) INSTALL

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

4. IDLER AND RECOIL SPRING

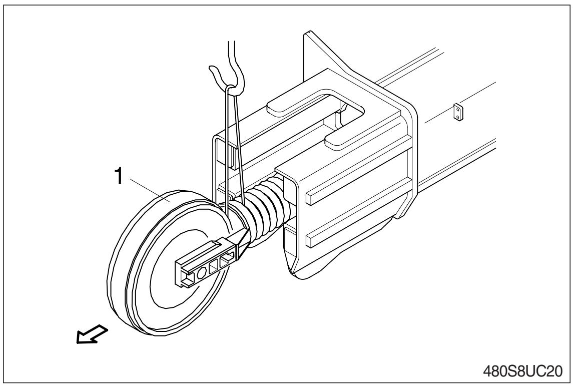
1) REMOVAL

(1) Remove the track link.
For detail, see removal of track link.



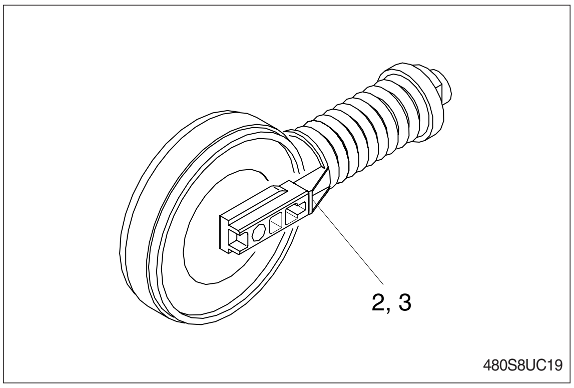
480S8UC21

(2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 550 kg (1210 lb)



480S8UC20

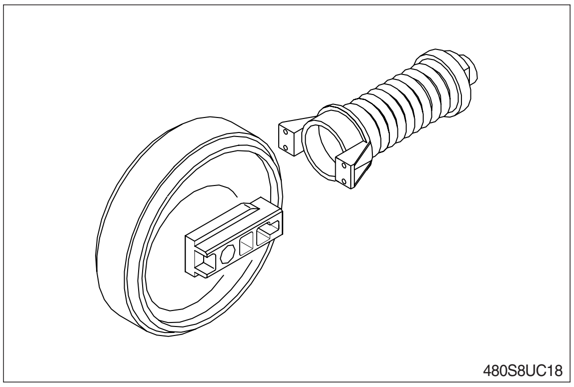
(3) Remove the bolts (2), washers (3) and separate ilder from recoil spring.
· Tightening torque : 83.2±12.5 kgf · m (602±90.4 lbf · ft)



480S8UC19

2) INSTALL

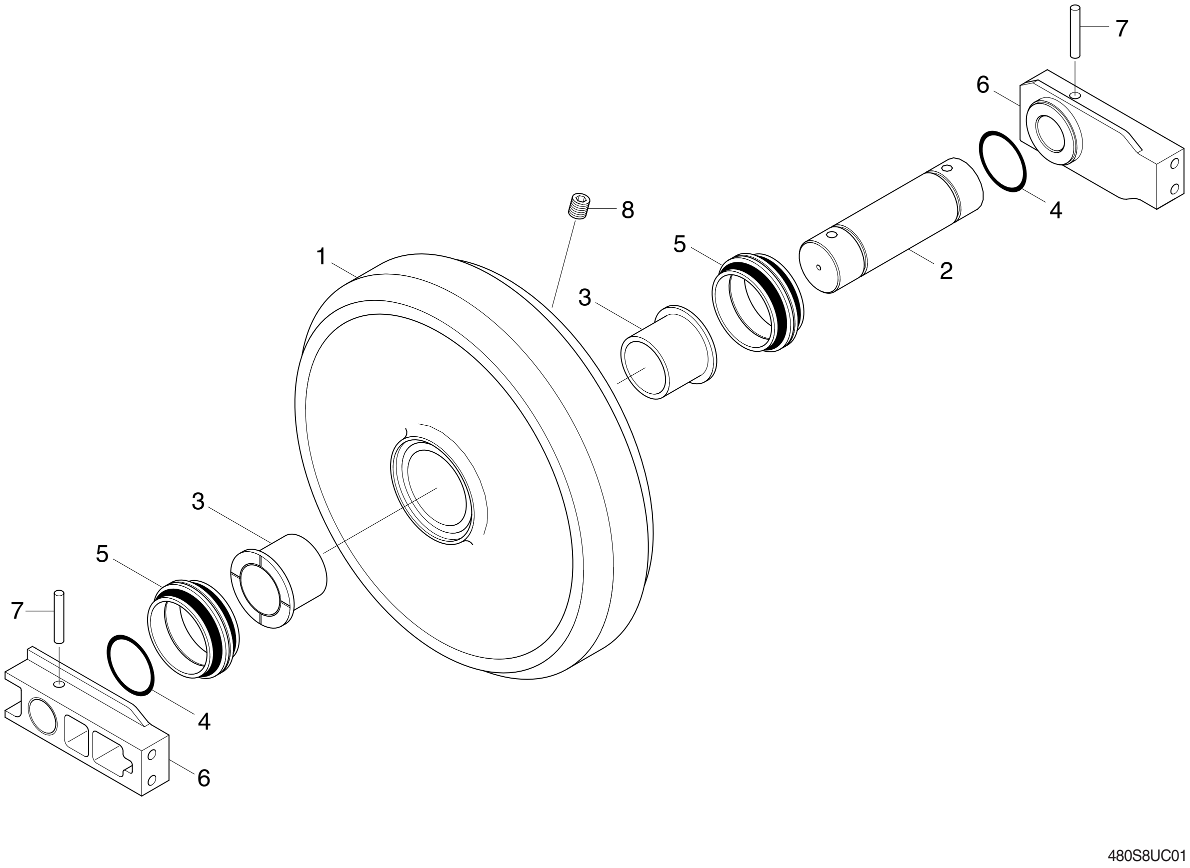
(1) Carry out installation in the reverse order to removal.
※ Make sure that the boss on the end face of the recoil cylinder rod is in the hole of the track frame.



480S8UC18

3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure

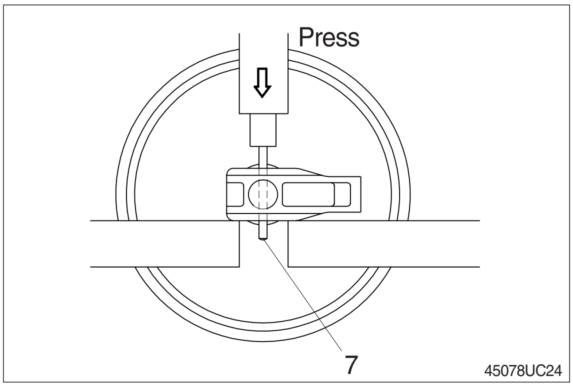


1	Shell	4	O-ring	7	Spring pin
2	Shaft	5	Seal assembly	8	Plug
3	Bushing	6	Bracket		

(2) Disassembly

① Remove plug and drain oil.

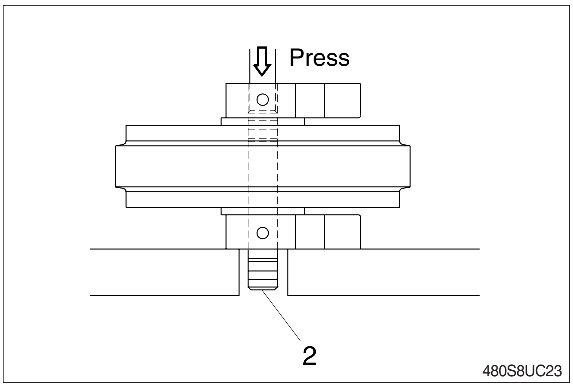
② Draw out the spring pin (7), using a press.



③ Pull out the shaft (2) with a press.

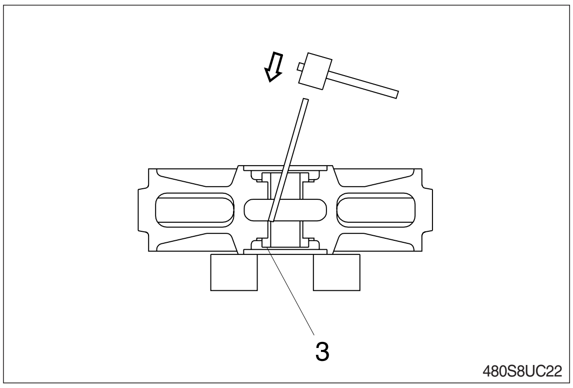
④ Remove seal (5) from shell (1) and bracket (6).

⑤ Remove O-ring (4) from shaft.



⑥ Remove the bushing (3) from idler, using a special tool.

※ Only remove bushing if replacement is necessity.

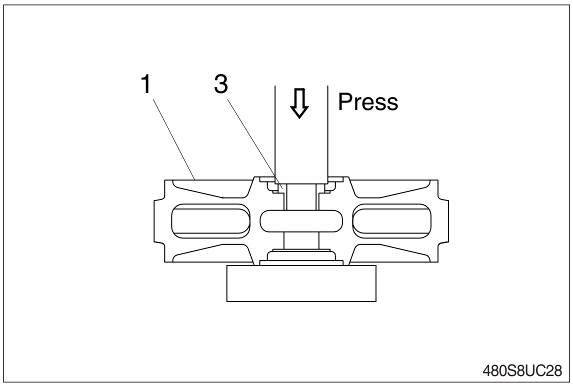


(3) Assembly

※ Before assembly, clean the parts.

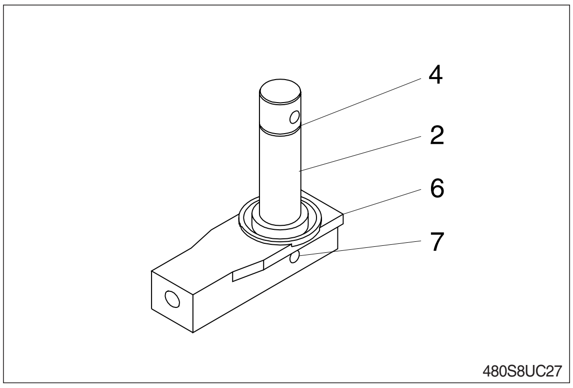
※ Coat the sliding surfaces of all parts with oil.

① Cool up bushing (3) 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.

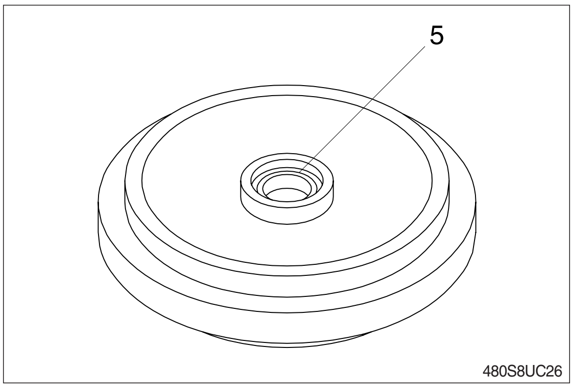


② Coat O-ring (4) with grease thinly, and install it to shaft (2).

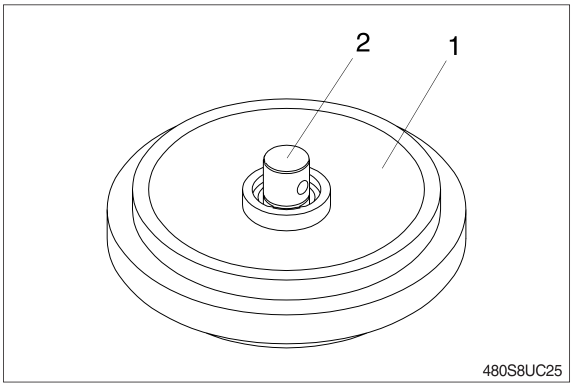
③ Insert shaft (3) into bracket (6) and drive in the spring pin (7).



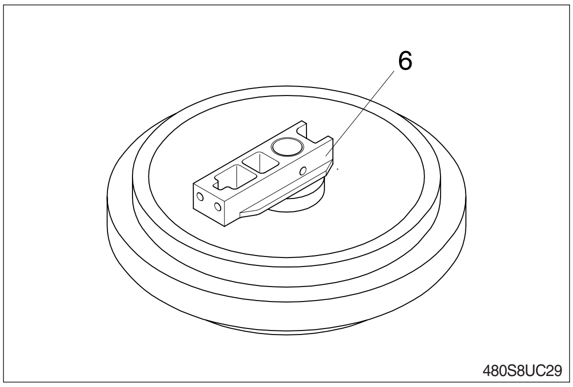
④ Install seal (5) to shell (1) and bracket (6).



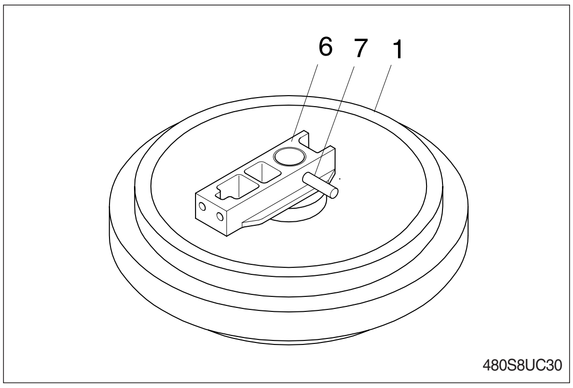
⑤ Install shaft (2) to shell (1).



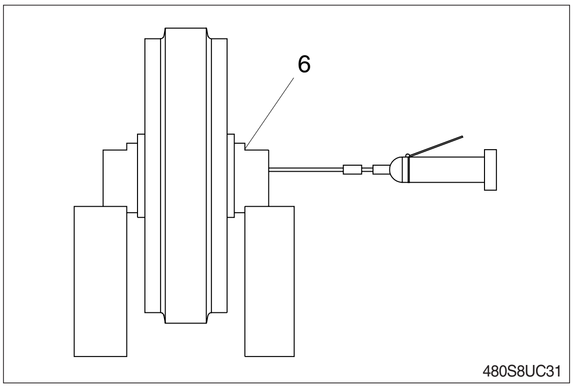
⑥ Install bracket (6) attached with seal (5).



⑦ Knock in the spring pin (7) with a hammer.

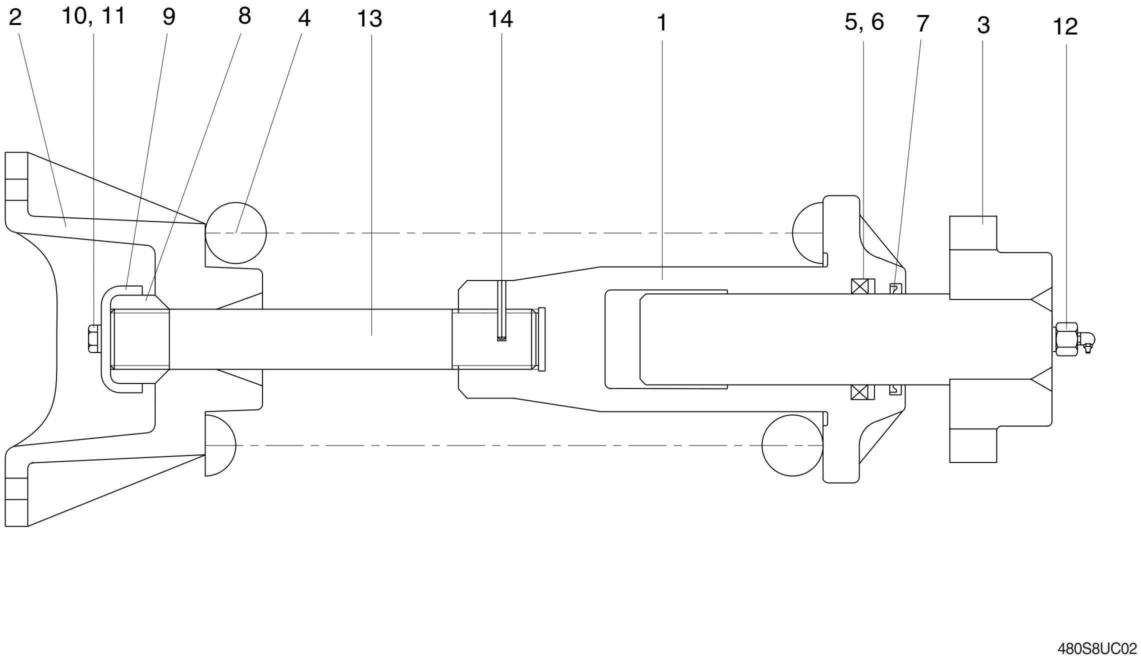


⑧ Lay bracket (6) on its side.
Supply engine oil to the specified level, and tighten plug.



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure



1	Body	6	Back up ring	11	Spring washer
2	Bracket	7	Dust seal	12	Grease valve
3	Rod assembly	8	Lock nut	13	Tie bar
4	Spring	9	Lock plate	14	Spring pin
5	Rod seal	10	Hex bolt		

(2) Disassembly

① Apply pressure on spring (4) with a press.

※ The spring is under a large installed load. This is dangerous, so be sure to set properly.

· Spring set load : 28840 kg (63580 lb)

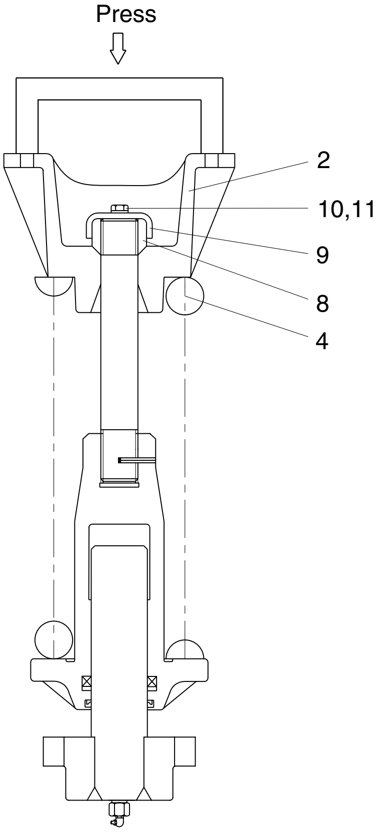
② Remove bolt (10), spring washer (11) and lock plate (9).

③ Remove lock nut (8).

Take enough notice so that the press

④ which pushes down the spring, should not be slipped out in its operation.

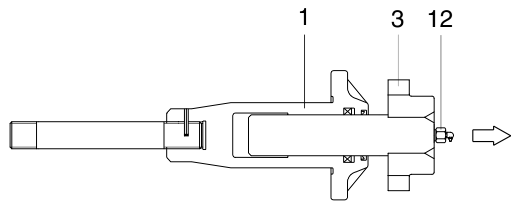
Lighten the press load slowly and remove bracket (2) and spring (4).



480S8UC03

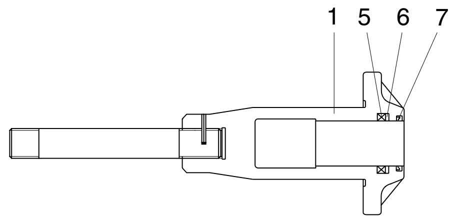
⑤ Remove rod (3) from body (1).

⑥ Remove grease valve (12) from rod (3).



480S8UC04

⑦ Remove rod seal (5), back up ring (6) and dust seal (11).

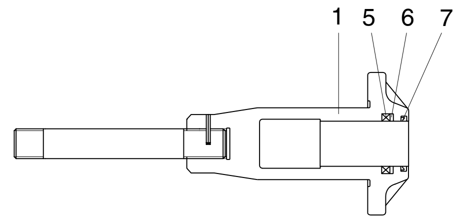


480S8UC05

(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.



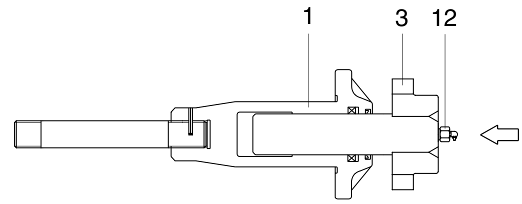
480S8UC05

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)



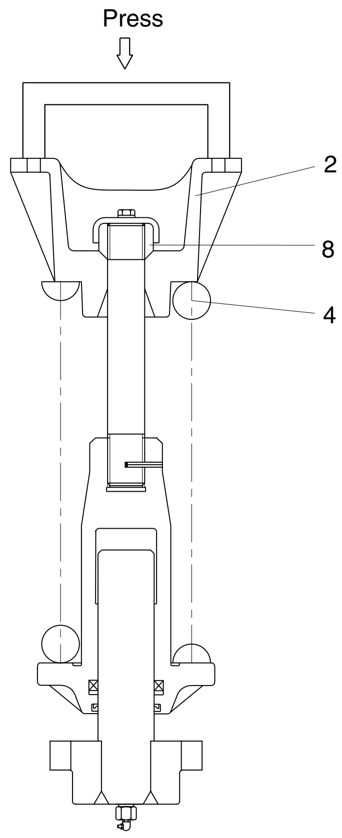
480S8UC06

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.

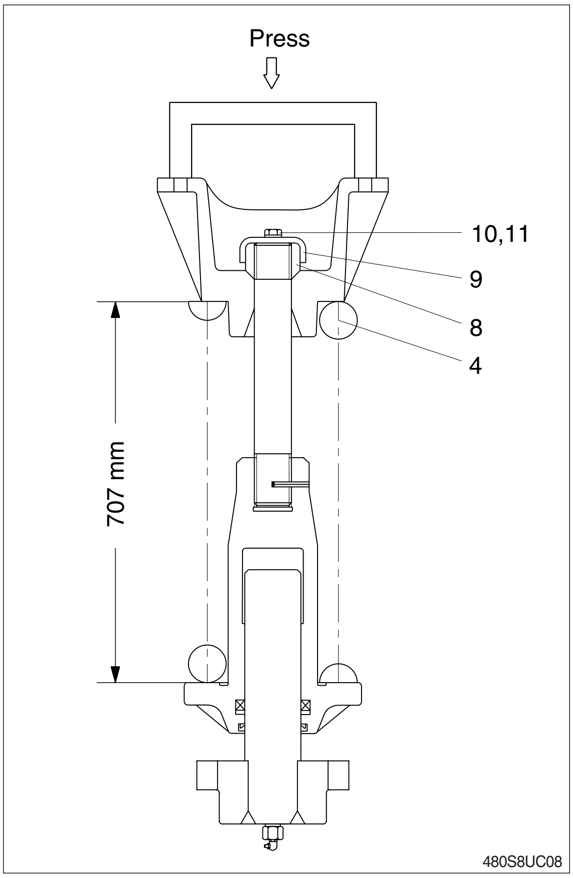


480S8UC07

⑥ Lighten the press load and confirm the set length of spring (4).

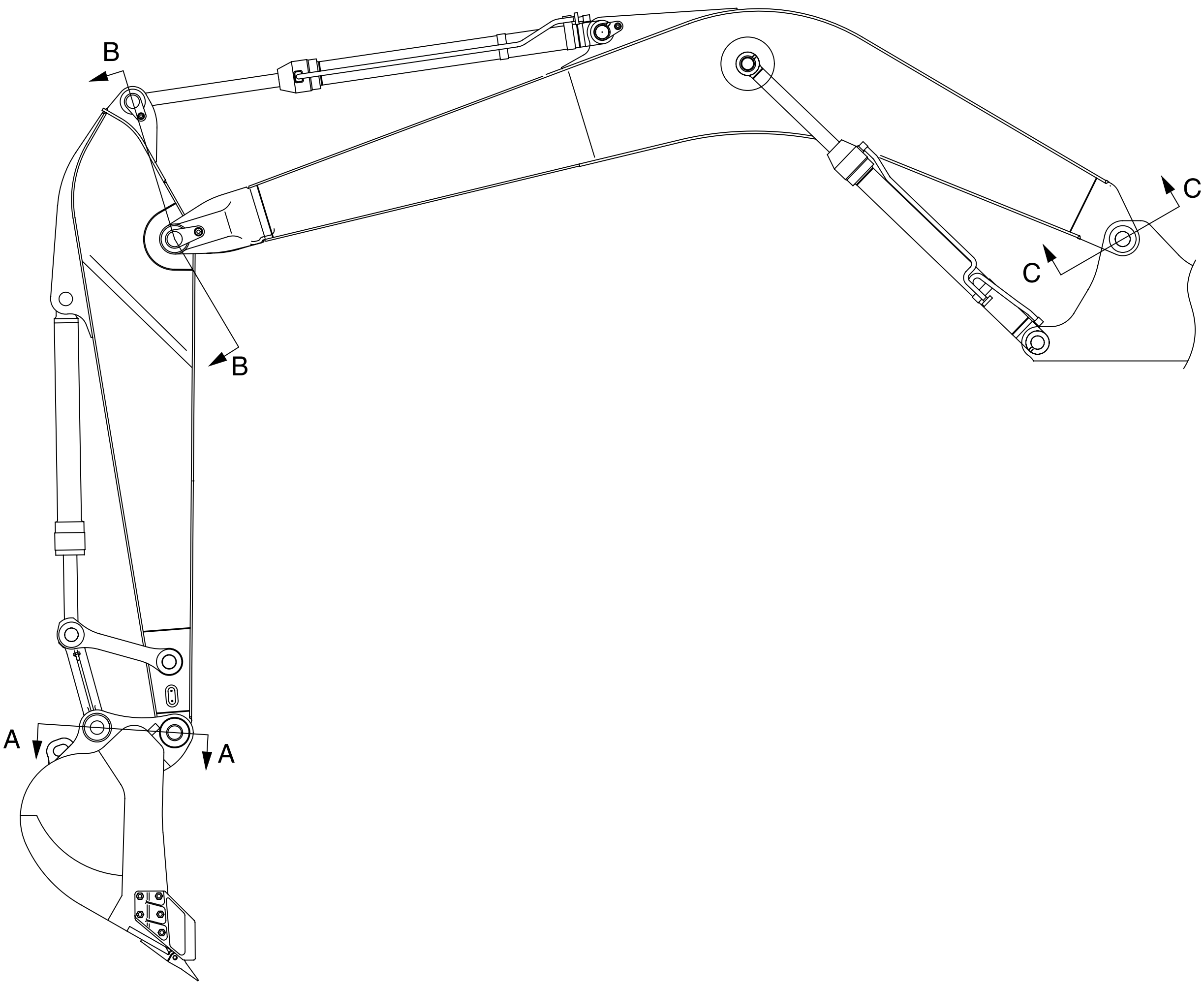
⑦ After the setting of spring (4), install lock plate (9), spring washer (11) and bolt (10).

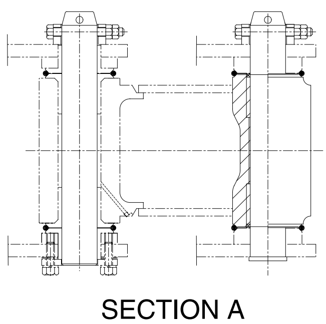
· Tightening torque : 21.3±3.1 kgf · m (152±22.4lbf · ft)



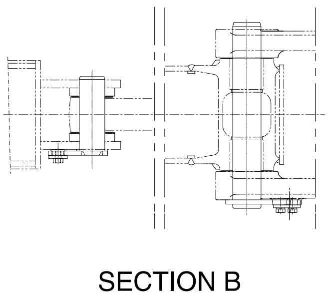
GROUP 11 WORK EQUIPMENT

1. STRUCTURE

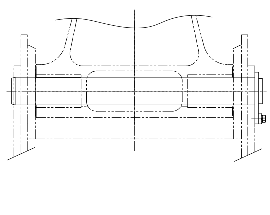




SECTION A



SECTION B



SECTION C

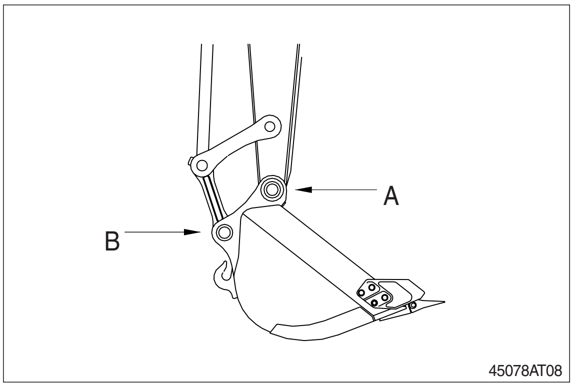
29078WE01

2. REMOVAL AND INSTALL

1) BUCKET ASSEMBLY

(1) Removal

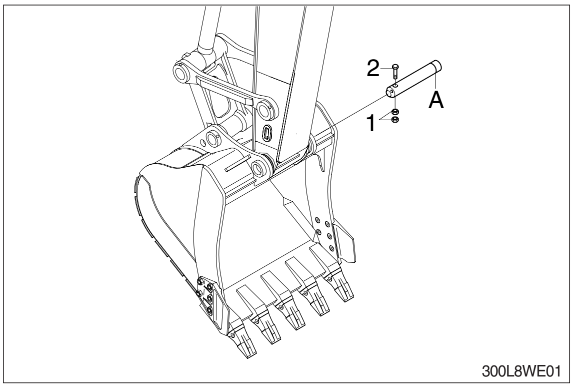
① Lower the work equipment completely to ground with back of bucket facing down.



45078AT08

② Remove nut (1), bolt (2) and draw out the pin (A).

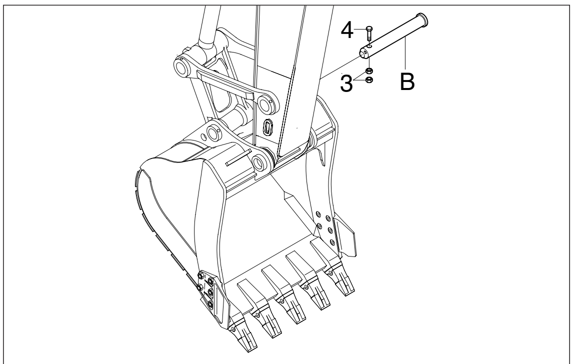
· Tightening torque (1) : 100±15 kgf · m (723±109lbf · ft)



300L8WE01

③ Remove nut (3), bolt (4) and draw out the pin (B).

· Tightening torque (3) : 100±15 kgf · m (723±109lbf · ft)



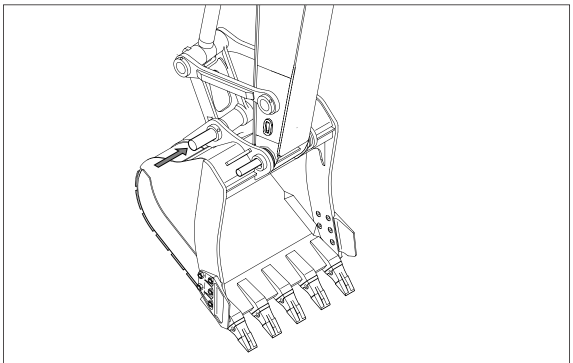
300L8WE02

(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

※ Adjust the bucket clearance.
For detail, see **operation manual**.



300L8WE03

2) ARM ASSEMBLY

(1) Removal

※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

① Remove bucket assembly.
For details, see removal of bucket assembly.

② Disconnect bucket cylinder hose (1).

⚠ Fit blind plugs in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.

③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

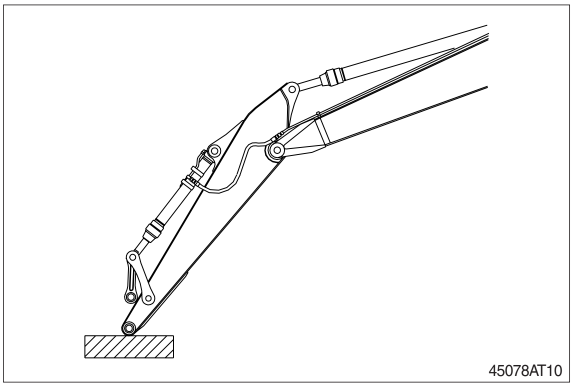
※ Tie the rod with wire to prevent it from coming out.

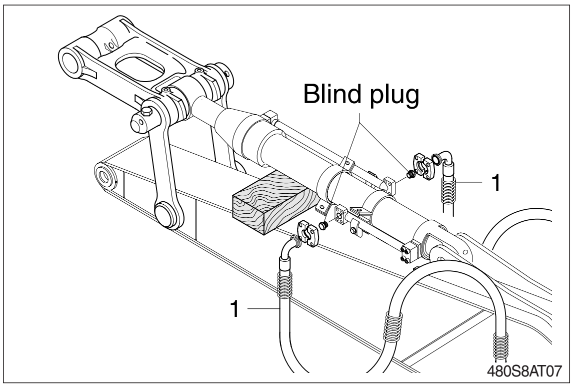
④ For details, see removal of arm cylinder assembly.
Place a wooden block under the cylinder and bring the cylinder down to it.

⑤ Remove bolt (2), plate (3) and pull out the pin (4) then remove the arm assembly.

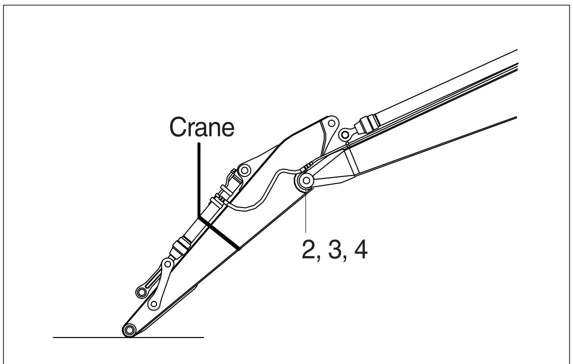
- · Weight : 1820 kg (4010 lb)
- · Tightening torque (2) : 29.7±45 kgf · m (215±32.5 lbf · ft)

※ When lifting the arm assembly, always lift the center of gravity.


45078AT10



480S8AT07



45078AT09

(2) Install

① Carry out installation in the reverse order to removal.

⚠ When lifting the arm assembly, always lift the center of gravity.

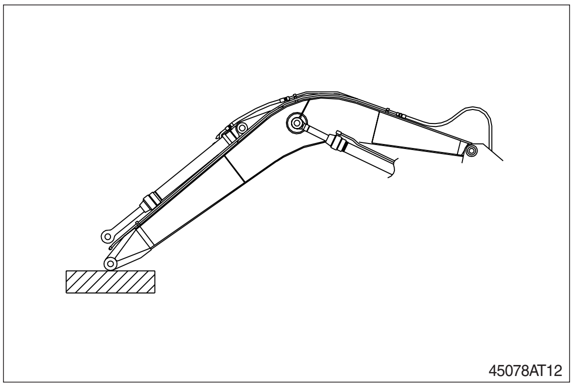
※ Bleed the air from the cylinder.

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.

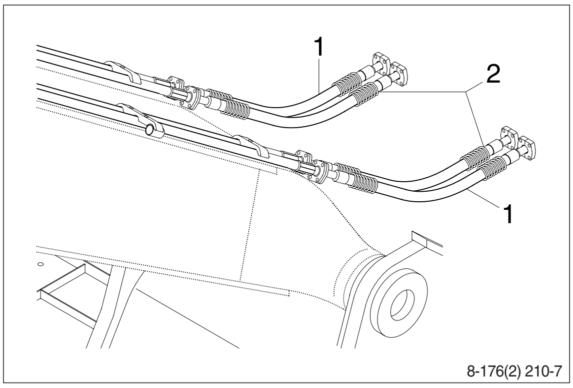


③ Disconnect head lamp wiring.

④ Disconnect bucket cylinder hose (2) and arm cylinder hose (1).

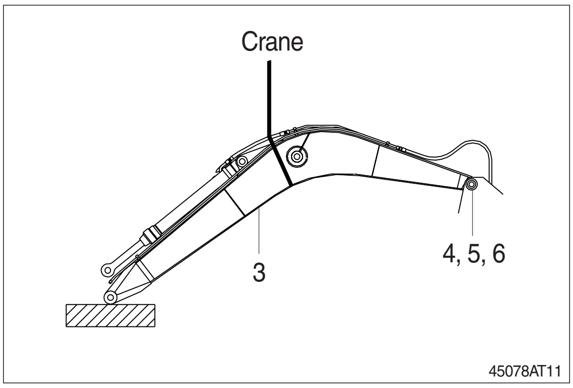
※ When the hose are disconnected, oil may spurt out.

⑤ Sling boom assembly (3).



⑥ Remove bolt (4), plate (5) and pull out the pin (6) then remove boom assembly.
· Weight : 3570 ㎏ (7870 ㏶)
· Tightening torque (4) : 59.7±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.