CONTENTS

SECTION 1 GENERAL

SECTION 2 STRUCTURE AND FUNCTION

SECTION 3 HYDRAULIC SYSTEM

SECTION 4 ELECTRICAL SYSTEM

SECTION 5 TROUBLESHOOTING

SECTION 6 MAINTENANCE STANDARD

SECTION 7 DISASSEMBLY AND ASSEMBLY

SECTION 8 COMPONENT MOUNTING TORQUE

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.

SECTION 9 COMPONENT MOUNTING TORQUE

This section shows bolt specifications and standard torque values needed when mounting components to the machine.

The specifications contained in this shop manual are subject to change at any time and without any advance notice. Contact your HYUNDAI 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 HYUNDAI 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.

   10 - 4
   10 - 4 - 1 ⎤ Added pages
   10 - 4 - 2 ⎦
   10 - 5

Revised edition mark(①②③…)

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

Revisions

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

Symbols

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

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

3. CONVERSION TABLE

Method of using the Conversion Table

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

Example

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

   Convert 55mm into inches.

   (1) Locate the number 50in the vertical column at the left side, take this as ⓐ, then draw a horizontal line from ⓐ.

   (2) Locate the number 5in the row across the top, take this as ⓑ, then draw a perpendicular line down from ⓑ.

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

2. Convert 550mm 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 55mm.

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

   (3) The original value(550mm) 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 550mm = 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

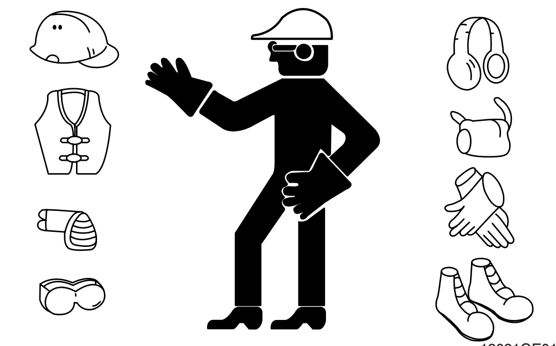
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

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

WEAR PROTECTIVE CLOTHING

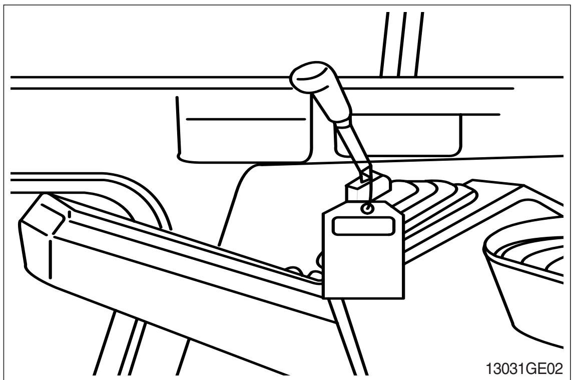
Wear close fitting clothing and safety equipment appropriate to the job.



13031GE01

WARN OTHERS OF SERVICE WORK

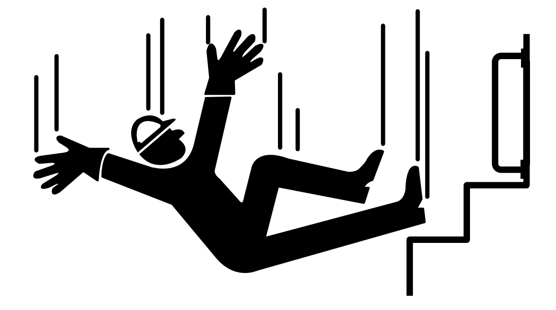
Unexpected machine movement can cause serious injury.
Before performing any work on the excavator, attach a 「Do Not Operate」 tag on the right side control lever.



13031GE02

USE HANDHOLDS AND STEPS

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



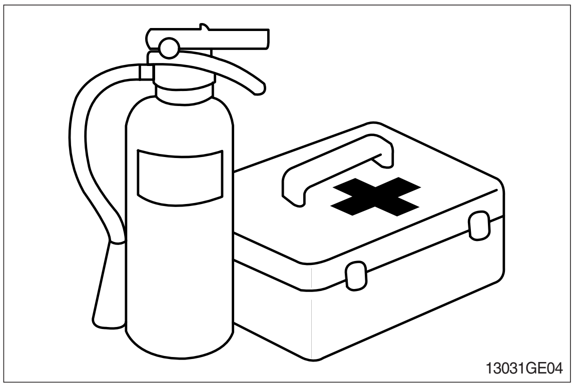
13031GE03

PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

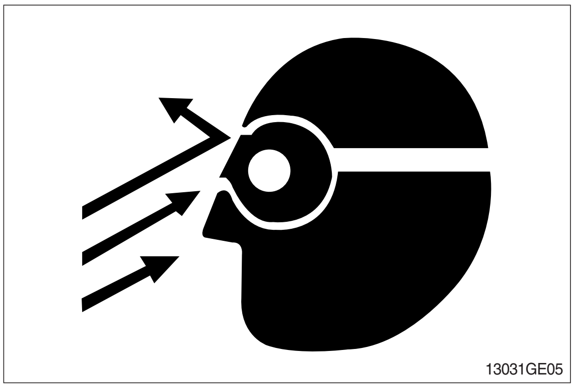
Keep a first aid kit and fire extinguisher handy.

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



PROTECT AGAINST FLYING DEBRIS

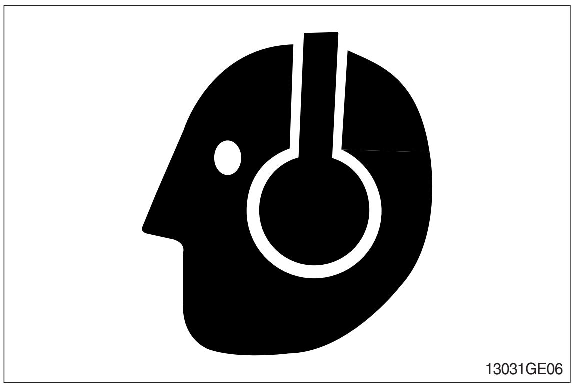
Guard against injury from flying pieces of metal or debris; Wear goggles or safety glasses.



PROTECT AGAINST NOISE

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

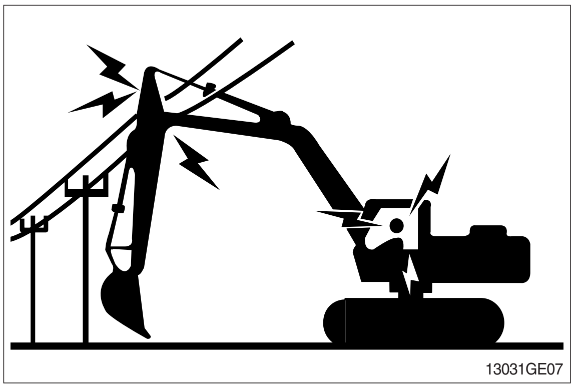
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.



AVOID POWER LINES

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

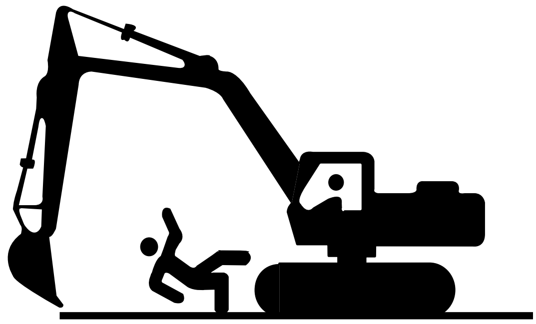
Never move any part of the machine or load closer to electric line than 3m(10ft) plus twice the line insulator length.



KEEP RIDERS OFF EXCAVATOR

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

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



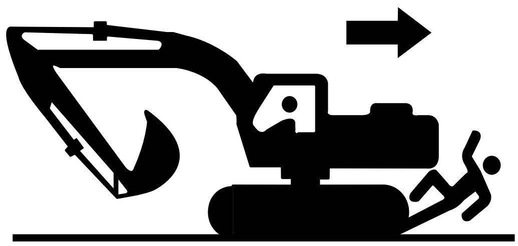
13031GE08

MOVE AND OPERATE MACHINE SAFELY

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

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

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

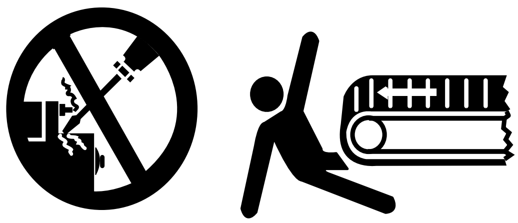


13031GE09

OPERATE ONLY FORM OPERATOR'S SEAT

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

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



13031GE26

PARK MACHINE SAFELY

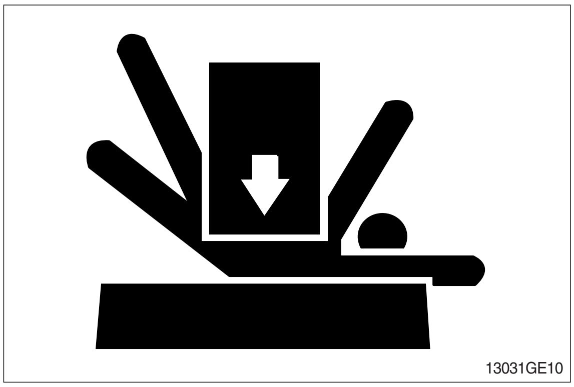
Before working on the machine:

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

SUPPORT MACHINE PROPERLY

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

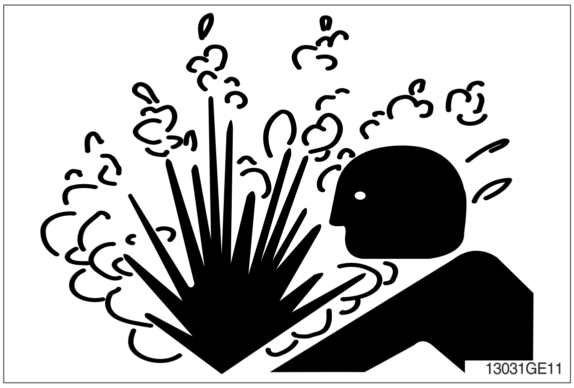
Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load.
Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.



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.



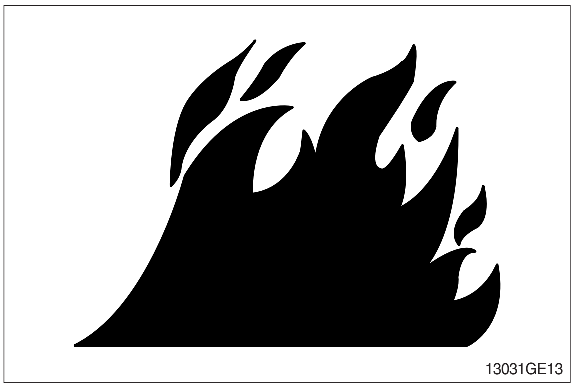
HANDLE FLUIDS SAFELY-AVOID FIRES

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.

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

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

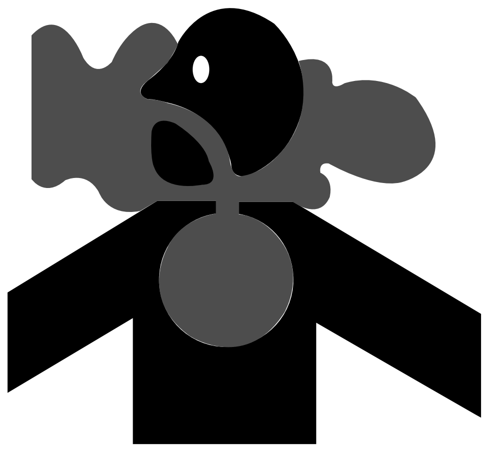
Do not store oily rags; They can ignite and burn spontaneously.



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

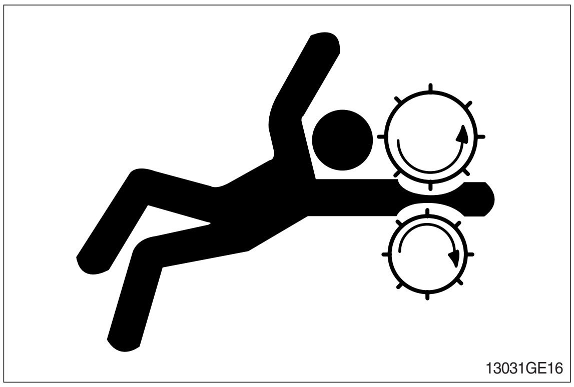
Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

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.

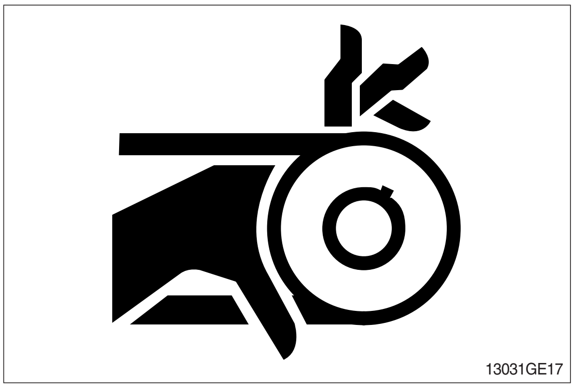


13031GE16

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

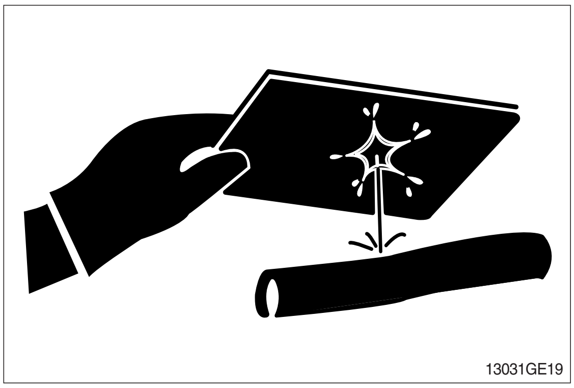
Escaping fluid under pressure can penetrate the skin causing serious injury.

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

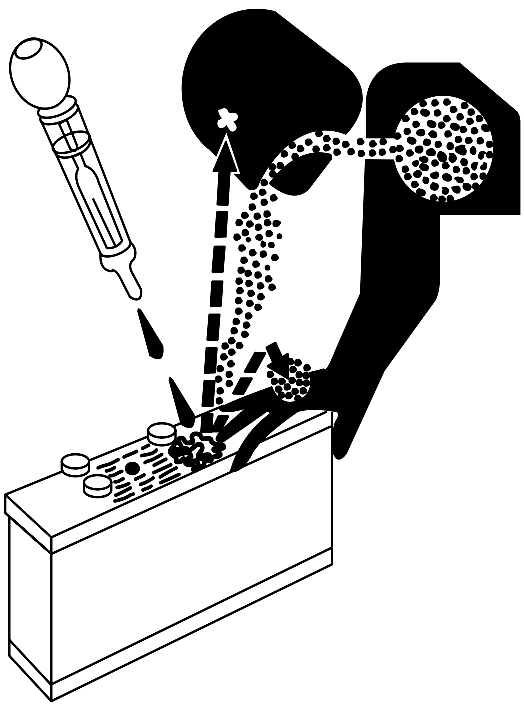
PREVENT ACID BURNS

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

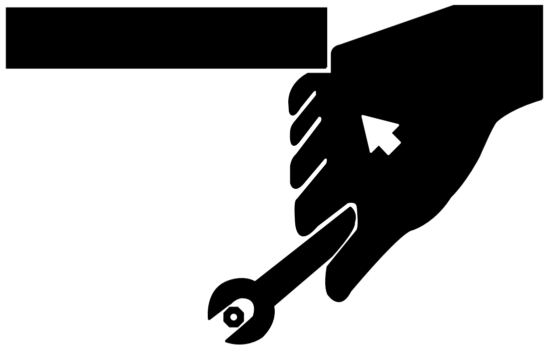
USE TOOLS PROPERLY

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.(aee Parts catalogue.)



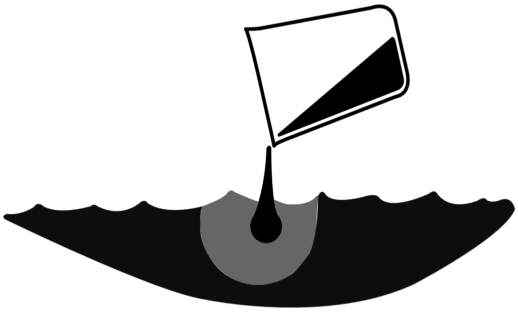
13031GE23

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.

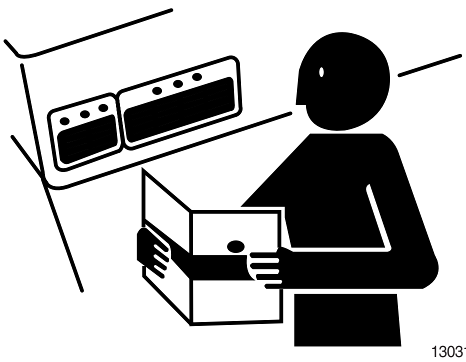
DO NOT pour oil into the ground, down a drain, or into a stream, pond, or lake. Observe relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters, batteries, and other harmful waste.



13031GE24

REPLACE SAFETY SIGNS

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



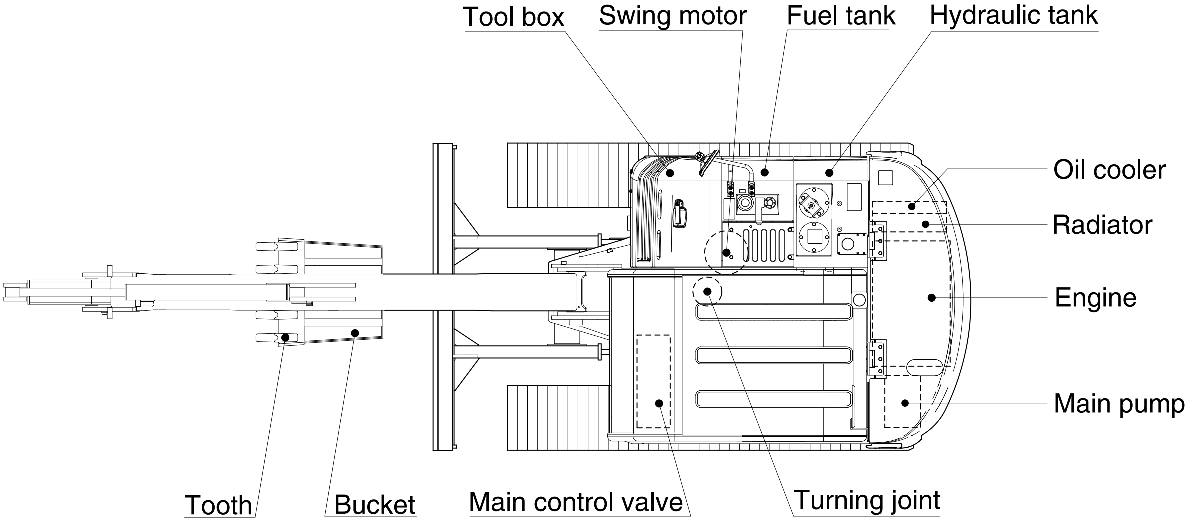
13031GE25

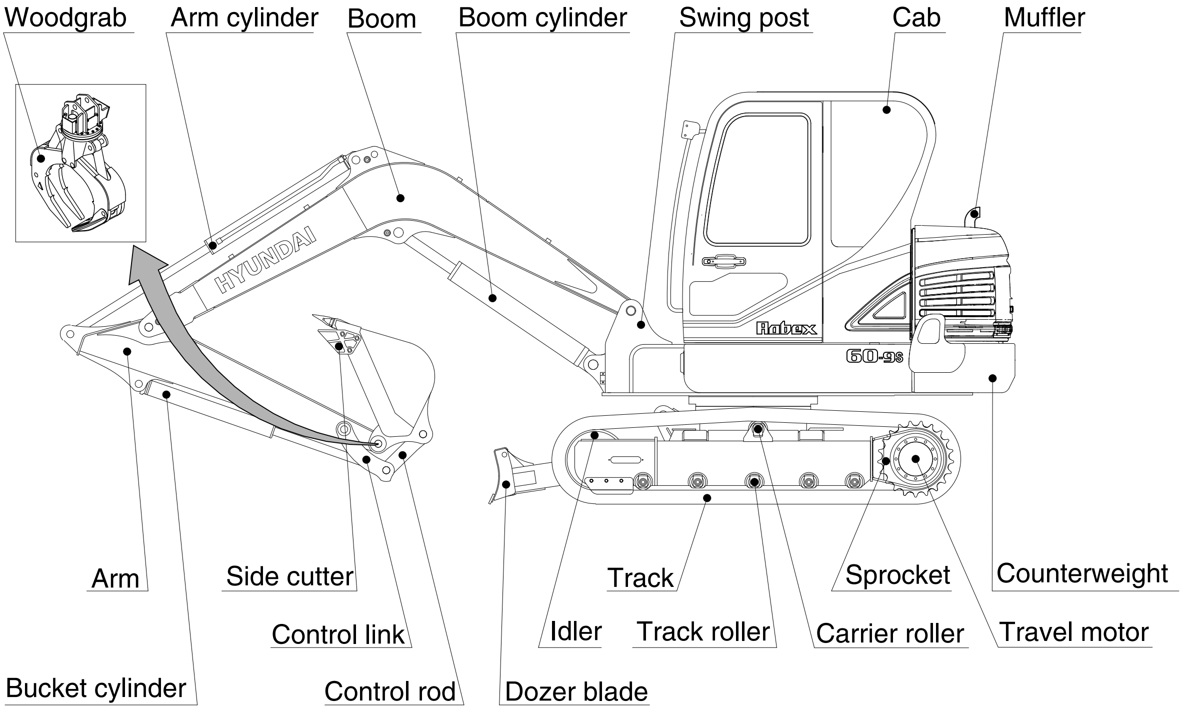
LIVE WITH SAFETY

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

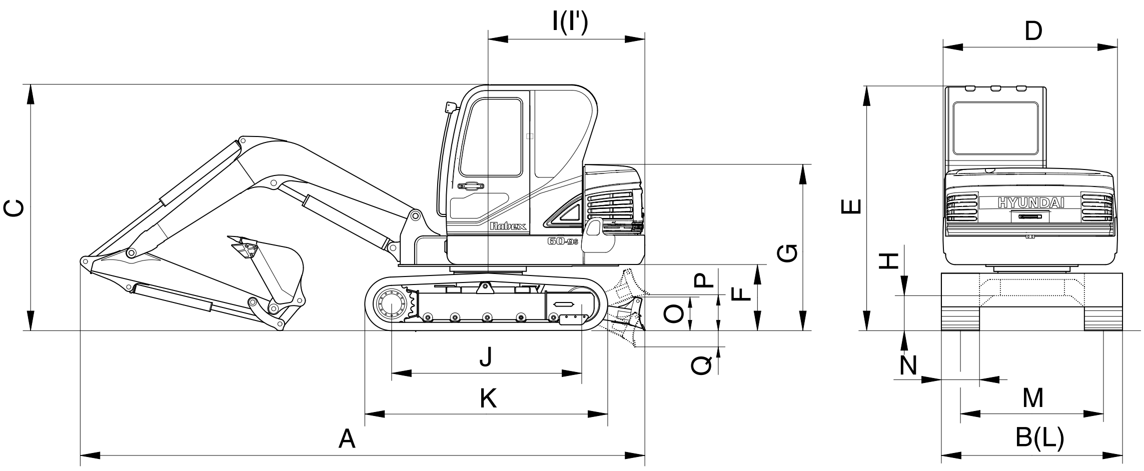




559S2SP01

2. SPECIFICATIONS

1) 3.0 m (9' 10") MONO BOOM, 1.6 m (5' 3") ARM, WITH BOOM SWING SYSTEM

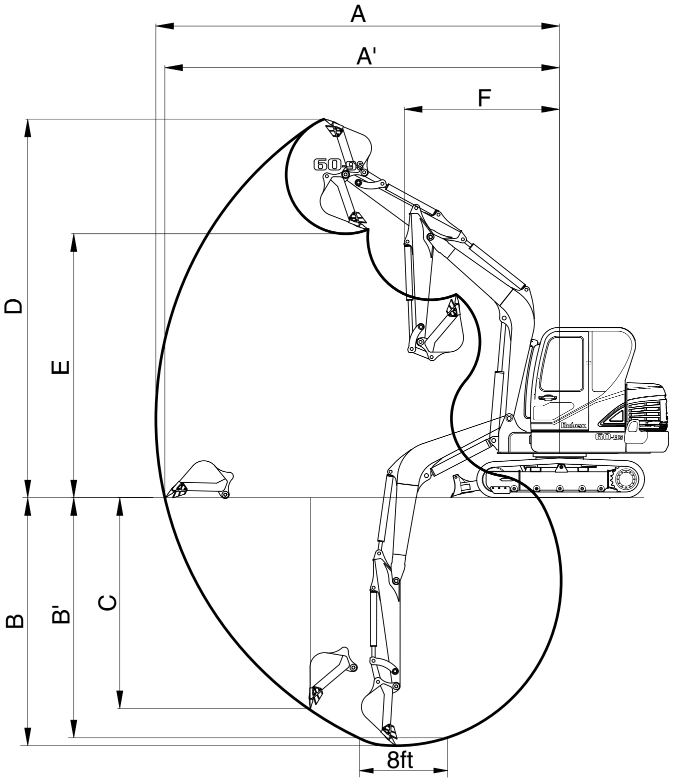


559S2SP02

Description		Unit	Specification
Operating weight		kg (lb)	5650 (12460)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	0.18 (0.24)
Overall length	A	mm (ft-in)	5900 (19' 4")
Overall width, with 380 mm shoe	B		1920 (6' 4")
Overall height	C		2550 (8' 4")
Superstructure width	D		1850 (6' 1")
Overall height of cab	E		2550 (8' 4")
Ground clearance of counterweight	F		690 (2' 3")
Engine cover height	G		1690 (5' 7")
Minimum ground clearance	H		380 (1' 3")
Rear-end distance	I		1650 (5' 5")
Rear-end swing radius	I'		1650 (5' 5")
Distance between tumblers	J		1990 (6' 6")
Undercarriage length	K		2530 (8' 4")
Undercarriage width	L		1880 (6' 2")
Track gauge	M		1500 (4' 11")
Track shoe width, standard	N		380 (15")
Height of blade	O		350 (1' 2")
Ground clearance of blade up	P		390 (1' 3")
Depth of blade down	Q		590 (1' 11")
Travel speed (low/high)		km/hr (mph)	2.2/4.0 (1.4/2.5)
Swing speed		rpm	9.3
Gradeability		Degree (%)	35 (70)
Ground pressure (380 mm shoe)		kgf/cm^2(psi)	0.34 (4.83)
Max traction force		kg (lb)	5300 (11680)

3. WORKING RANGE

1) 3.0 m (9' 10") MONO BOOM WITH BOOM SWING SYSTEM



Description		1.6 m (5' 3") Arm
Max digging reach	A	6150 mm (25' 5")
Max digging reach on ground	A'	6010 mm (24'11")
Max digging depth	B	3820 mm (16' 2")
Max digging depth (8ft level)	B'	3420 mm (15' 4")
Max vertical wall digging depth	C	3200 mm (15' 3")
Max digging height	D	5780 mm (26' 7")
Max dumping height	E	4050 mm (18' 7")
Min swing radius	F	2350 mm (8' 8")
Boom swing radius (left/right)		80˚/50˚
Bucket digging force	SAE	37.7 kN
		3850 kgf
		8490 lbf
	ISO	42.4 kN
		4330 kgf
		9550 lbf
Arm crowd force	SAE	28.4 kN
		2900 kgf
		6390 lbf
	ISO	31.9 kN
		3260 kgf
		7190 lbf

4. WEIGHT

Item	kg	lb
Upperstructure assembly	2710	5970
Main frame weld assembly	600	1320
Engine assembly	280	620
Main pump assembly	30	70
Main control valve assembly	40	90
Swing motor assembly	80	180
Hydraulic oil tank assembly	90	200
Fuel tank assembly	60	130
Boom swing post	110	240
Counterweight	235	520
Cab assembly	350	770
Lower chassis assembly	2150	4740
Track frame weld assembly	700	1540
Swing bearing	94	210
Travel motor assembly	80	180
Turning joint	28	62
Track recoil spring	17	37
Idler & tension body	56	120
Carrier roller	12	26
Track roller	12	26
Sprocket	17	37
Track-chain assembly (380 mm standard triple grouser shoe)	325	720
Dozer blade assembly	210	460
Front attachment assembly (3.0 m boom,1.6 m arm, 0.18 m^3 SAE heaped bucket)	790	1740
3.0 m boom assembly	240	530
1.6 m arm assembly	130	290
0.18 m^3 SAE heaped bucket	170	370
Boom cylinder assembly	70	155
Arm cylinder assembly	60	130
Bucket cylinder assembly	35	80
Bucket control link assembly	40	90
Dozer cylinder assembly	40	90
Boom swing cylinder assembly	40	90

5. LIFTING CAPACITIES

1) 3.0 m (9' 10") boom, 1.6 m (5' 3") arm equipped with 0.18 m^3 (SAE heaped) bucket and 380 mm (15") triple grouser shoe, the dozer blade down.

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

Load point height		Load radius								At max. reach		
		2.0 m (7 ft)		3.0 m (10 ft)		4.0 m (13 ft)		5.0 m (16 ft)		Capacity		Reach
												m (ft)
5.0 m	kg									*950	*950	4.12
(16 ft)	lb									*2090	*2090	(13.5)
4.0 m	kg					*1020	*1020			*980	780	5.08
(13 ft)	lb					*2250	*2250			*2160	1720	(16.7)
3.0 m	kg					*1090	*1090			*1010	650	5.60
(10 ft)	lb					*2400	*2400			*2230	1430	(18.4)
2.0 m	kg	*3050	*3050	*1690	*1690	*1320	1100	*1170	760	*1050	590	5.84
(7 ft)	lb	*6720	*6720	*3730	*3730	*2910	2430	*2580	1680	*2310	1300	(19.2)
1.0 m	kg			*2360	1610	*1600	1040	*1280	740	*1100	580	5.85
(3 ft)	lb			*5200	3550	*3530	2290	*2820	1630	*2430	1280	(19.2)
Ground	kg	*2350	*2350	*2700	1540	*1790	1000	*1350	720	*1140	610	5.63
Line	lb	*5180	*5180	*5950	3400	*3950	2200	*2980	1590	*2510	1340	(18.5)
-1.0 m	kg	*3600	3020	*2670	1530	*1800	990			*1180	700	5.13
(-3 ft)	lb	*7940	6660	*5890	3370	*3970	2180			*2600	1540	(16.8)
-2.0 m	kg	*3770	3060	*2300	1540					*1140	960	4.23
(-7 ft)	lb	*8310	6750	*5070	3400					*2510	2120	(13.9)
-3.0 m	kg	*2040	*2040									
(-10 ft)	lb	*4500	*4500									

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 load point is a hook located on the back of the bucket.
4. *indicates load limited by hydraulic capacity.

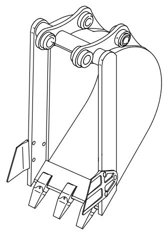
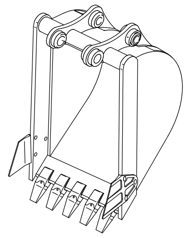
2) 3.0 m (9'10") boom, 1.6 m (5' 3") arm equipped with 0.18 m³ (SAE heaped) bucket and 380 mm (15") triple grouser shoe, the dozer blade up.

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

Load point height		Load radius								At max. reach		
		2.0 m (7 ft)		3.0 m (10 ft)		4.0 m (13 ft)		5.0 m (16 ft)		Capacity		Reach
												m (ft)
5.0 m	kg									*950	*950	4.12
(16 ft)	lb									*2090	*2090	(13.5)
4.0 m	kg					*1020	*1020			*980	740	5.08
(13 ft)	lb					*2250	*2250			*2160	1630	(16.7)
3.0 m	kg					*1090	1080			890	610	5.60
(10 ft)	lb					*2400	2380			1960	1340	(18.4)
2.0 m	kg	*3050	*3050	*1690	1630	*1320	1030	1040	710	810	550	5.84
(7 ft)	lb	*6720	*6720	*3730	3590	*2910	2270	2290	1570	1790	1210	(19.2)
1.0 m	kg			2250	1510	1430	980	1010	690	800	540	5.85
(3 ft)	lb			4960	3330	3150	2160	2230	1520	1760	1190	(19.2)
Ground	kg	*2350	*2350	2170	1440	1390	940	990	670	840	570	5.63
Line	lb	*5180	*5180	4780	3170	3060	2070	2180	1480	1850	1260	(18.5)
-1.0 m	kg	*3600	2780	2150	1420	1370	930			970	660	5.13
(-3 ft)	lb	*7940	6130	4740	3130	3020	2050			2140	1460	(16.8)
-2.0 m	kg	*3770	2830	2170	1440					*1140	900	4.23
(-7 ft)	lb	*8310	6240	4780	3170					*2510	1980	(13.9)
-3.0 m	kg	*2040	*2040									
(-10 ft)	lb	*4500	*4500									

6. BUCKET SELECTION GUIDE

1) GENERAL BUCKET

	
$0.07 m^3$ SAE heaped bucket	$0.18 m^3$ SAE heaped bucket

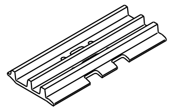
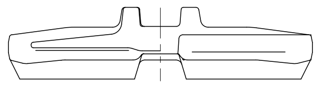
Capacity		Width		Weight	Recommendation
					3.0 m (9' 10") boom
SAE heaped	CECE heaped	Without side cutter	With side cutter		1.6 m (5' 3") arm
$0.07 m^3$ ($0.09 yd^3$)	$0.06 m^3$ ($0.08 yd^3$)	315 mm (12.4")	360 mm (14.2")	115 kg (255 lb)	Applicable for materials with density of 1600 kgf/m^3 (2700 lb/yd^3) or less
$0.18 m^3$ ($0.24 yd^3$)	$0.15 m^3$ ($0.20 yd^3$)	670 mm (26.4")	740 mm (29.1")	170 kg (375 lb)	

7. UNDERCARRIAGE

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		Steel track	Rubber track
				
R60-9S	Shoe width	mm (in)	380 (15)	400 (16)
	Operating weight	kg (lb)	5650 (12460)	5670 (12500)
	Ground pressure	kgf/cm^2 (psi)	0.34 (4.83)	0.33 (4.69)
	Overall width	mm (ft-in)	1880 (6' 2")	1900 (6' 3")

3) NUMBER OF ROLLERS AND SHOES ON EACH SIDE

Item	Quantity
Carrier rollers	1 EA
Track rollers	5 EA
Track shoes	40 EA

8. SPECIFICATIONS FOR MAJOR COMPONENTS

1) ENGINE

Item	Specification
Model	Yanmar 4TNV94L-XHYB2
Type	4-cycle diesel engine, low emission
Cooling method	Water cooling
Number of cylinders and arrangement	4 cylinders, in-line
Firing order	1-3-4-2
Combustion chamber type	Direct injection type
Cylinder bore×stroke	94×110 mm (3.7"×4.33")
Piston displacement	3054 cc (186 cu in)
Compression ratio	19 : 1
Rated gross horse power (SAE J1995)	53 Hp at 2200 rpm (52 Hp/40 kW at 2200 rpm)
Maximum torque at 1400 rpm	20.6 kgf · m (149 lbf · ft)
Engine oil quantity	11.6 l (3.1 U.S. gal)
Dry weight	280 kg (617 lb)
High idling speed	2200±50 rpm
Low idling speed	1000±100 rpm
Rated fuel consumption	172.6 g/Hp · hr at 2200 rpm
Starting motor	12 V-3.0 kW
Alternator	12 V-100 A
Battery	1×12 V×100 Ah

2) MAIN PUMP

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 × 27.5 cc/rev
Maximum pressure	220 kgf/cm^2 (3130 psi)
Rated oil flow	2 × 55 l /min (14.5 U.S. gpm / 12.1 U.K. gpm)
Rated speed	2200 rpm

3) GEAR PUMP

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	18.3+4.5 cc/rev
Maximum pressure	220/30 kgf/cm^2 (3130/430 psi)
Rated oil flow	36.6/9.0 l /min (9.7/2.4 U.S. gpm / 8.0/2.0 U.K. gpm)

4) MAIN CONTROL VALVE

Item	Specification
Type	Sectional, 9 spools+1 option
Operating method	Hydraulic pilot system
Main relief valve pressure	220 kgf/cm^2 (3130 psi)
Overload relief valve pressure	240 kgf/cm^2 (3410 psi)

[ ] : Power boost

5) SWING MOTOR

Item	Specification
Type	Fixed displacement axial piston motor
Capacity	32.3 cc/rev
Relief pressure	220 kgf/cm^2 (3130 psi)
Braking system	Automatic, spring applied hydraulic released
Braking torque	14 kgf · m (101 lbf · ft)
Brake release pressure	20~40 kgf/cm^2 (284~570 psi)
Reduction gear type	2 - stage planetary

6) TRAVEL MOTOR

Item	Specification
Type	Variable displacement axial piston motor
Relief pressure	220 kgf/cm^2 (3130 psi)
Reduction gear type	2-stage planetary
Braking system	Automatic, spring applied hydraulic released
Brake release pressure	9 kgf/cm^2 (128 psi)
Braking torque	8.4 kgf · m (61 lbf · ft)

7) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Rod dia × Stroke	ø 110 × ø 60 × 715 mm
	Cushion	Extend only
Arm cylinder	Bore dia × Rod dia × Stroke	ø 90 × ø 55 × 850 mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia × Rod dia × Stroke	ø 80 × ø 50 × 660 mm
Dozer blade cylinder	Bore dia × Rod dia × Stroke	ø 110 × ø 60 × 224 mm
Boom swing cylinder	Bore dia × Rod dia × Stroke	ø 95 × ø 50 × 527 mm

※ 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
R60-9S	380 mm (15")	0.34 kgf/cm^2 (4.83 psi)	40	1880 mm (6' 2")

9) BUCKET

Item		Capacity		Tooth quantity	Width	
		SAE heaped	CECE heaped		Without side cutter	With side cutter
R60-9S	STD	0.18 m^3 (0.24 yd^3)	0.15 m^3 (0.20 yd^3)	5	670 mm (26.4")	740 mm (29.1")
	OPT	0.07 m^3 (0.09 yd^3)	0.06 m^3 (0.08 yd^3)	3	315 mm (12.4")	360 mm (14.2")

9. RECOMMENDED OILS

Use only oils listed below. Do not mix different brand oil.
Please use HYUNDAI genuine oil and grease.

Service point	Kind of fluid	Capacity l (U.S. gal)	Ambient temperature °C (°F): -20 (-4), -10 (14), 0 (32), 10 (50), 20 (68), 30 (86), 40 (104)
Engine oil pan	Engine oil	11.6 (3.1)	SAE 30 SAE 10W SAE 10W-30 SAE 15W-40
Swing drive	Grease	0.2 (0.05)	NLGI NO.1 NLGI NO.2
	Gear oil	1.5 (0.4)	SAE 80W-90
Final drive	Gear oil	1.2×2 (0.3×2)	
Hydraulic tank	Hydraulic oil	Tank : 70 (18.5) System : 120 (31.7)	ISO VG 32 ISO VG 46 ISO VG 68
Fuel tank	Diesel fuel	120 (31.7)	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 water 50 : 50	9.5 (2.5)	Ethylene glycol base permanent type

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

SECTION 2 STRUCTURE AND FUNCTION

SECTION 2 STRUCTURE AND FUNCTION

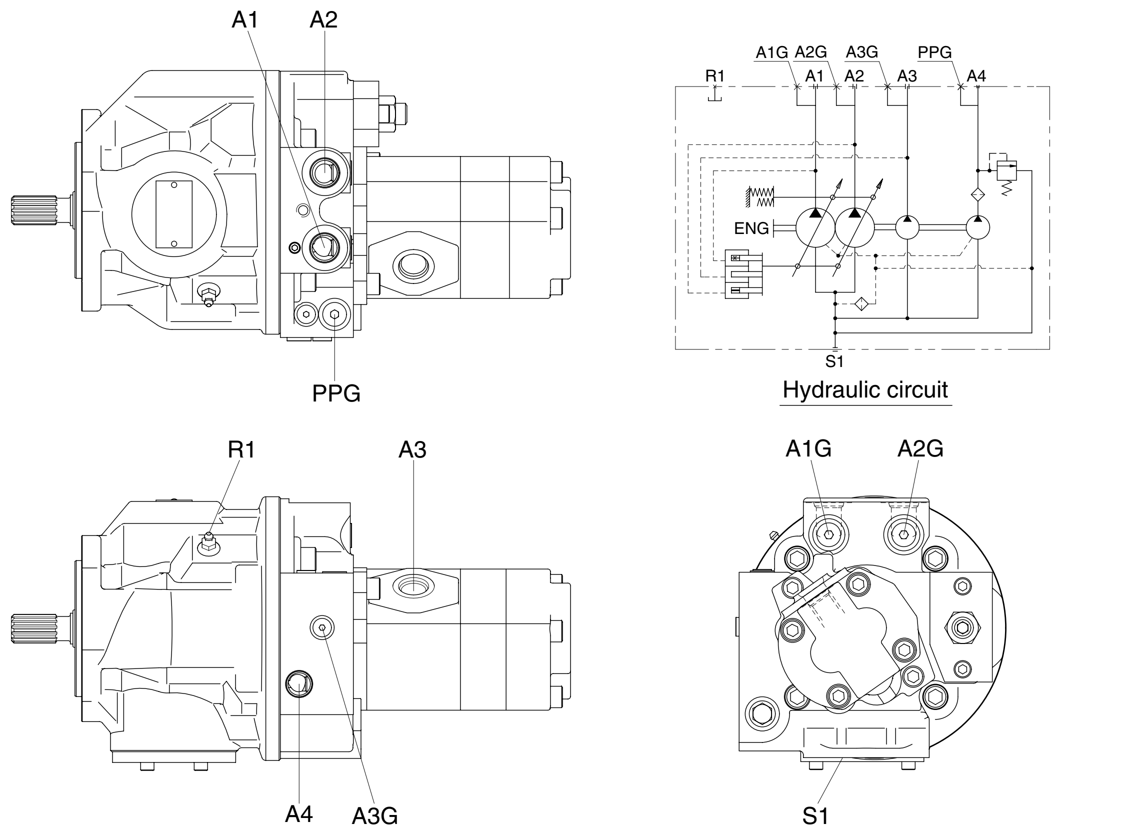
GROUP 1 HYDRAULIC PUMP

1. GENERAL

This is a variable displacement double-piston pump for discharge with equal displacements from one cylinder block. This pump is so compact as to appear a single pump though this is actually a double pump.

Because this pump has one swash plate, the tilting angle is the same for two pumps. Tilting of the pump changes in response to the total pressure of P1 + P2. Namely, the output is controlled to the constant value so that the relationship between the discharge pressure and flow rate Q becomes constant, $(P1 + P2) \times Q$ =Constant.

The third pump and pilot pump can be connected to the same shaft via a coupling.



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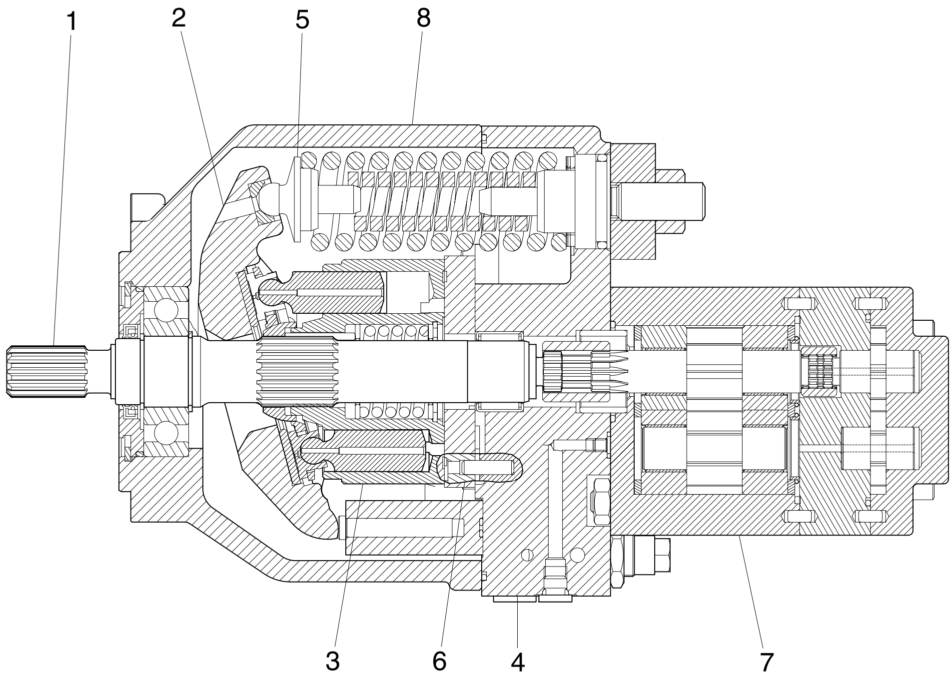
Description of the ports

Port	Name	Bore
S1	Suction port	SAE 1 1/2 (standard)
A1, A2	Discharge port	PF 1/2
A3	Discharge port	PF 1/2
A4	Discharge port	PF 1/4
A1G, A2G	Gauge port	PF 1/4 (with quick coupler)
A3G	Gauge port	PF 1/8 (with quick coupler)
A4G	Gauge port	PF 1/4 (with quick coupler)
R1	Air bleeder port	M10×1.0 (with bleeder valve)

2. PRINCIPAL COMPONENTS AND FUNCTIONS



1	Drive shaft	5	Control spring
2	Hanger	6	Control piston
3	Rotary group	7	Gear pump
4	Cover	8	Housing

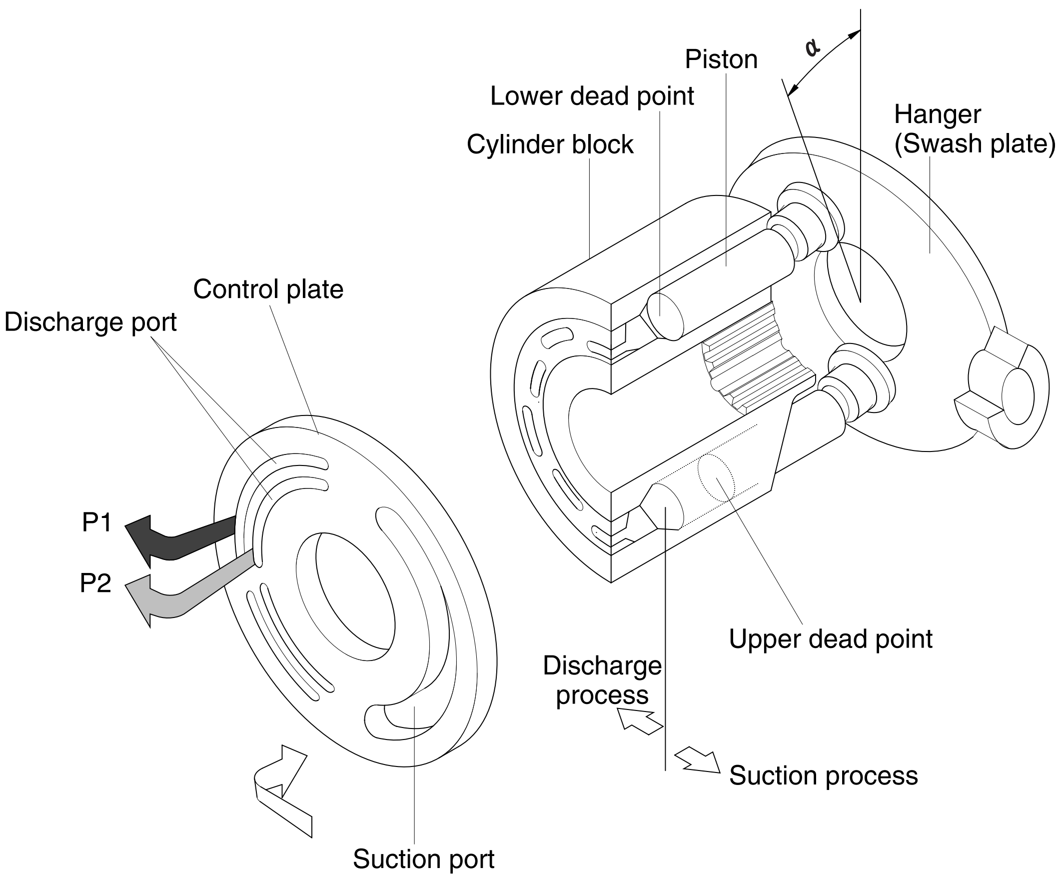
SPECIFICATIONS

- Capacity : $2\times27.5+18.3+4.5$ cc/rev
- Rated oil flow : $2\times55+36.6+9.0$ l /min
- Rated pressure : $3\times220+30$ kgf/cm^2

This is a variable displacement double-piston pump for discharge with two equal displacements from one cylinder block. Because this is one rotary group, there is only one suction port.
The oil is divided into two equal flows by the control plate in the cover and directed to two discharge ports provided in the cover.
The discharge pressure directed to the control piston tilts the hanger by overcoming the spring force.
Since the piston stroke changes according to the tilting angle of the hanger, the flow can be changed.
The simultaneous tilting angle constant-output control method is employed.
The third pump and pilot pump can be connected to the same shaft via a coupling.

1) PRINCIPLE OF OPERATION

(1) Function of pump



R5572SF03

The cylinder block is connected via spline and can rotate together with the drive shaft.

The piston assembled into the cylinder block performs reciprocal operation while following the swash plate on the hanger.

The piston moves in a direction to increase the displacement during a stroke from the lower to the upper dead points. The oil flows from the suction port via a port plate into the cylinder block (suction process).

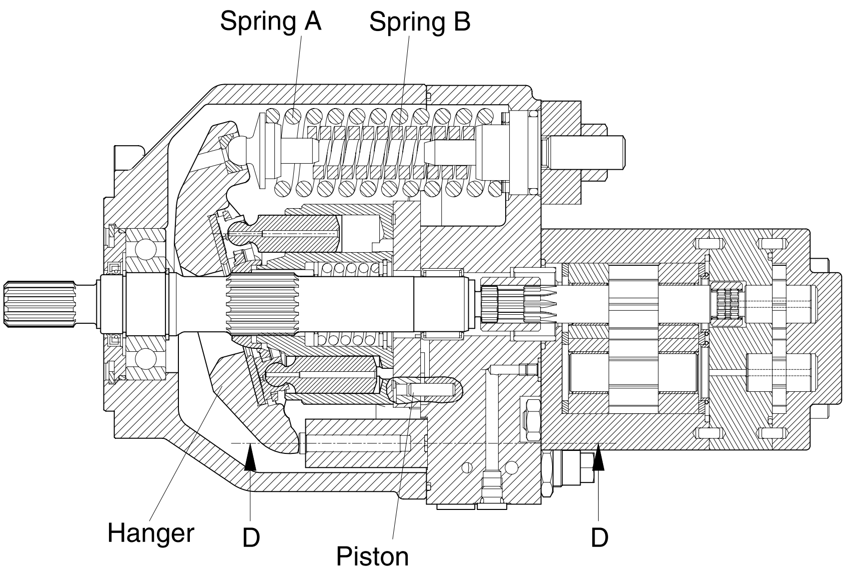
During a stroke from the upper to the lower dead points, the piston moves in a direction to decrease the displacement. The oil is discharged to the discharge port (discharge process).

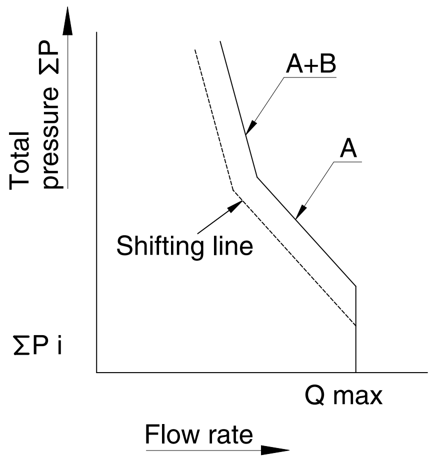
The displacement can be changed by changing the tilting of the hanger (swash plate).

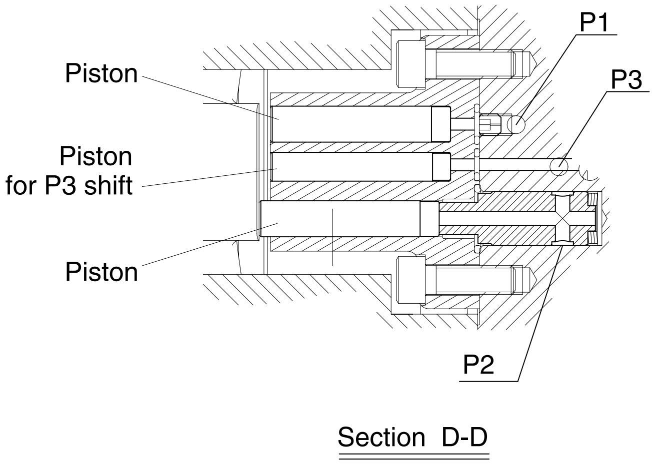
The oil sucked through the port in the cylinder block is discharged from the discharge port in the port plate.

The oil sucked through the port on the outside of the cylinder block is discharged from the discharge port on the outside of the port plate.

2) CONTROL FUNCTIONS







R5572SF04

The discharge pressures P1 and P2 are directed to the pistons of equal area act on the hanger. The spring is provided to act against the discharge pressure. When the oil pressure acting on the piston is less than the installation load of the spring A (outer spring), the hanger is fixed to the maximum tilting position. When the oil, pressure acting on the piston exceeds the installation load of the spring A the hanger is tilted and kept tilted at a position where the oil pressure is balanced with the spring force. (region A in the middle of the figure above)

When the oil pressure acting on the piston rises further to reduce the tilting angle, the spring B which has been inactive up to now becomes active.

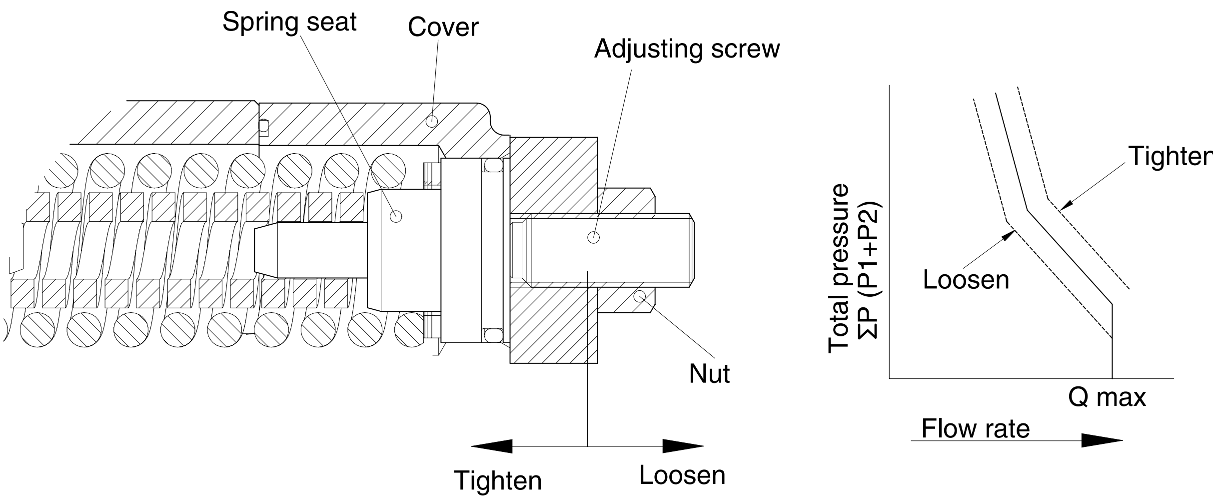
To overcome the spring force of two springs, the oil pressure must be higher and the shifting line becomes more steep. (regions A + B in the middle of the figure above)

When the P3 oil pressure acts on the shift piston, the control shifting line is shifted.

3) CONTROL / ADJUSTMENT PROCEDURE

(1) Loosen the hexagonal nut.

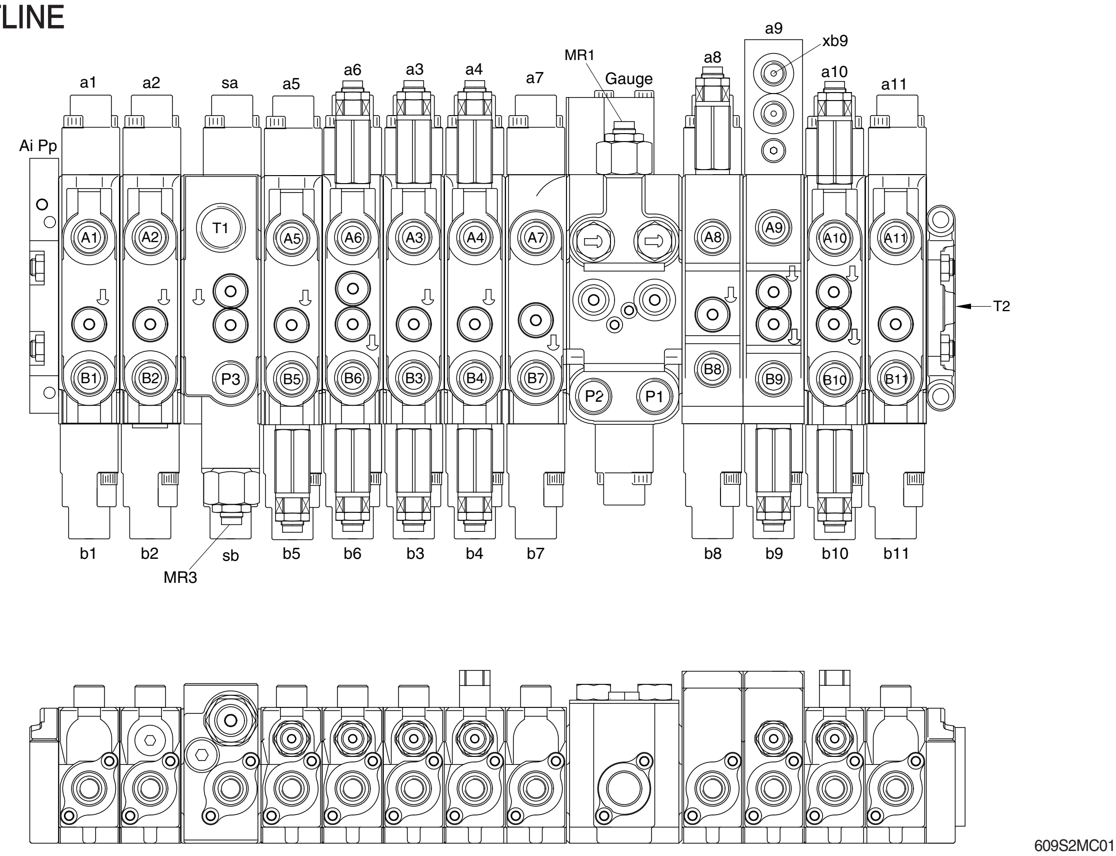
(2) Tighten or loosen the adjusting screw to set the power shifting line.



R5572SF05

GROUP 2 MAIN CONTROL VALVE

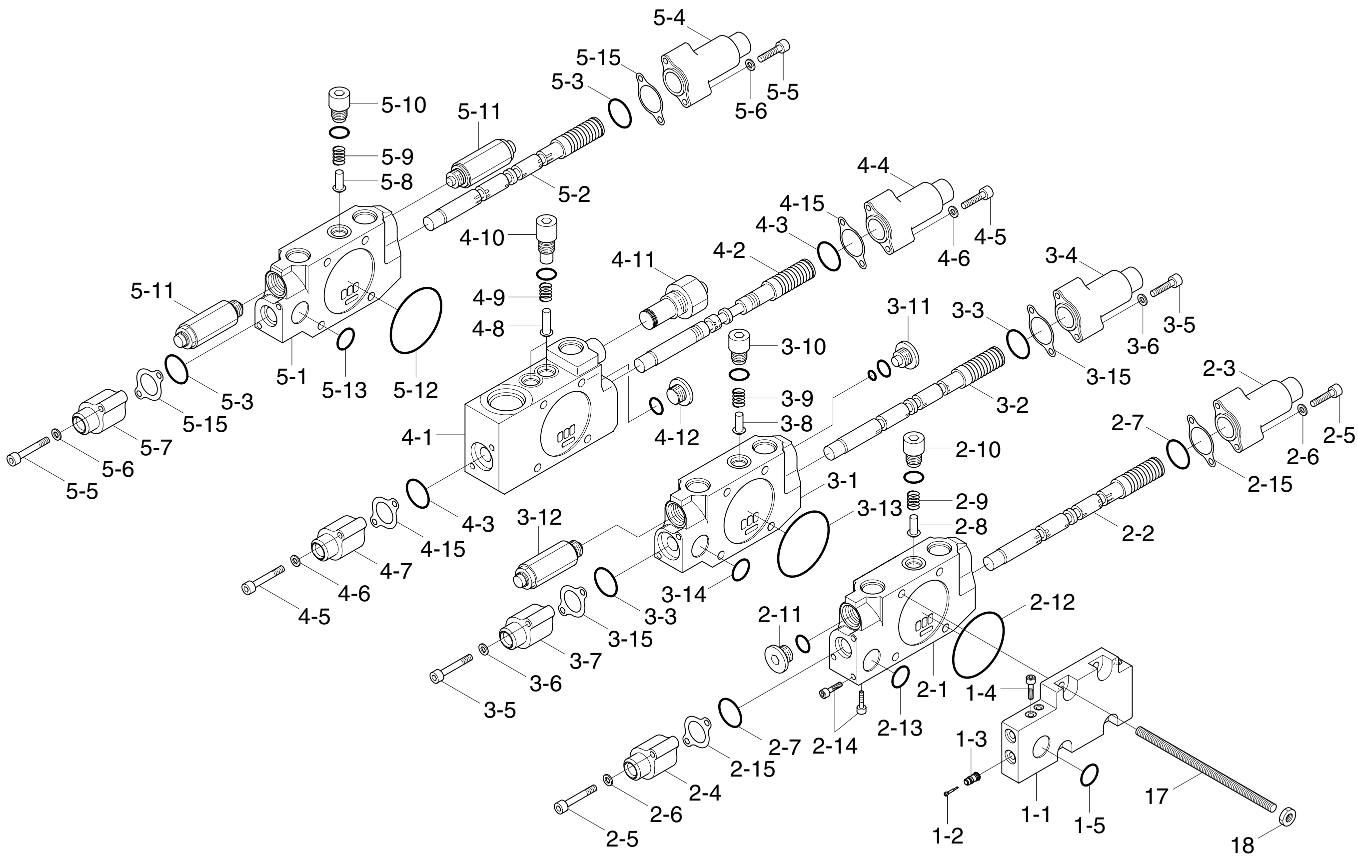
1. OUTLINE



Mark	Port name	Port size	Tightening torque
P1	P1 pump port	PF 1/2	6.0~7.0 kgf · m
P2	P2 pump port		
P3	P3 pump port		
A1	Swing port (LH)		
B1	Swing port (RH)		
A2	Dozer down port		
B2	Dozer up port		
A3	Woodgrab rotate port (LH)		
B3	Woodgrab rotate port (RH)		
A4	Woodgrab close port		
B4	Woodgrab open port		
A5	Boom 2 port		
B5	Breaker port		
A6	Arm out port		
B6	Arm in port		
A7	Travel port [LH/FW]		
B7	Travel port [LH/RR]		
A8	Travel port [RH/FW]		
B8	Travel port [RH/RR]		
A9	Boom up port		
B9	Boom down port		
A10	Bucket out port		
MR1 MR3	Main relief valve	-	

Mark	Port name	Port size	Tightening torque
B10	Bucket in port	PF 1/2	6.0~7.0 kgf · m
B11	Arm 2 port		
T2	Tank return port	PF 3/4	8.0~9.0 kgf · m
T1	Tank return port	PF1	10~12 kgf · m
a1	Swing pilot port (LH)	PF 1/4	2.5~3.0 kgf · m
b1	Swing pilot port (RH)		
a2	Dozer down pilot port		
b2	Dozer up pilot port		
a3	Woodgrab rotate pilot port (LH)		
b3	Woodgrab rotate pilot port (RH)		
a4	Woodgrab open pilot port		
b4	Woodgrab close pilot port		
a5	Boom 2 pilot port		
b5	Breaker pilot port		
a6	Arm out pilot port		
b6	Arm in pilot port		
a9	Boom up pilot port		
b9	Boom down pilot port		
a10	Bucket out pilot port		
b10	Bucket in pilot port		
a11	Arm 2 pilot port		
b11	Arm 2 pilot port		
Ai	Auto idle signal port		
Pp	Pilot supply port		

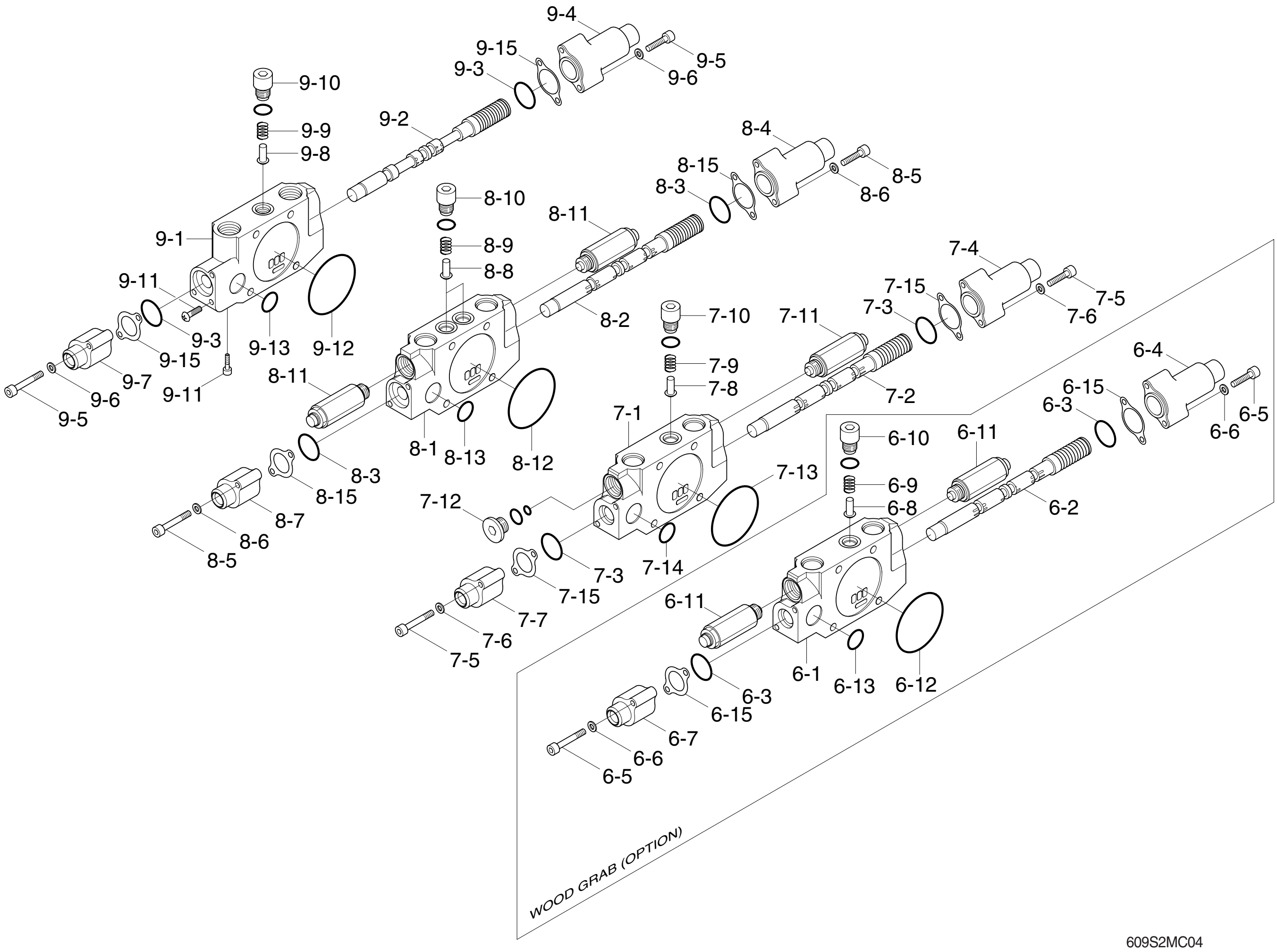
2. STRUCTURE (1/4)



609S2MC03

1	Auto idle cover	3-1	Work block	4-8	Check poppet
1-1	Cover	3-2	Spool assy	4-9	Check spring
1-2	Orifice	3-3	O-ring	4-10	Plug
1-3	Filter	3-4	Pilot cap (A)	4-11	Main relief valve
1-4	Taper plug	3-5	Socket bolt	4-12	Cap assy
1-5	O-ring	3-6	Plain washer	4-15	Gasket
2	Swing section assy	3-7	Pilot cap (B1)	5	Rotator section assy (woodgrab)
2-1	Work block	3-8	Check poppet	5-1	Work block
2-2	Spool assy	3-9	Check spring	5-2	Spool assy
2-3	Pilot cap (A)	3-10	Plug	5-3	O-ring
2-4	Pilot cap (B1)	3-11	Plug	5-4	Pilot cap (A)
2-5	Wrench bolt	3-12	Overload relief valve	5-5	Wrench bolt
2-6	Plain washer	3-13	O-ring	5-6	Plain washer
2-7	O-ring	3-14	O-ring	5-7	Pilot cap (B1)
2-8	Check poppet	3-15	Gasket	5-8	Check poppet
2-9	Check spring	4	Inlet (P3) section assy	5-9	Check spring
2-10	Plug	4-1	Work block	5-10	Plug
2-11	Plug	4-2	Spool assy	5-11	Overload relief valve
2-12	O-ring	4-3	O-ring	5-12	O-ring
2-13	O-ring	4-4	Pilot cap (A)	5-13	O-ring
2-14	Taper plug	4-5	Wrench bolt	5-15	Gasket
2-15	Gasket	4-6	Plain washer	17	Tie bolt
3	Dozer section assy	4-7	Pilot cap (B1)	18	Nut

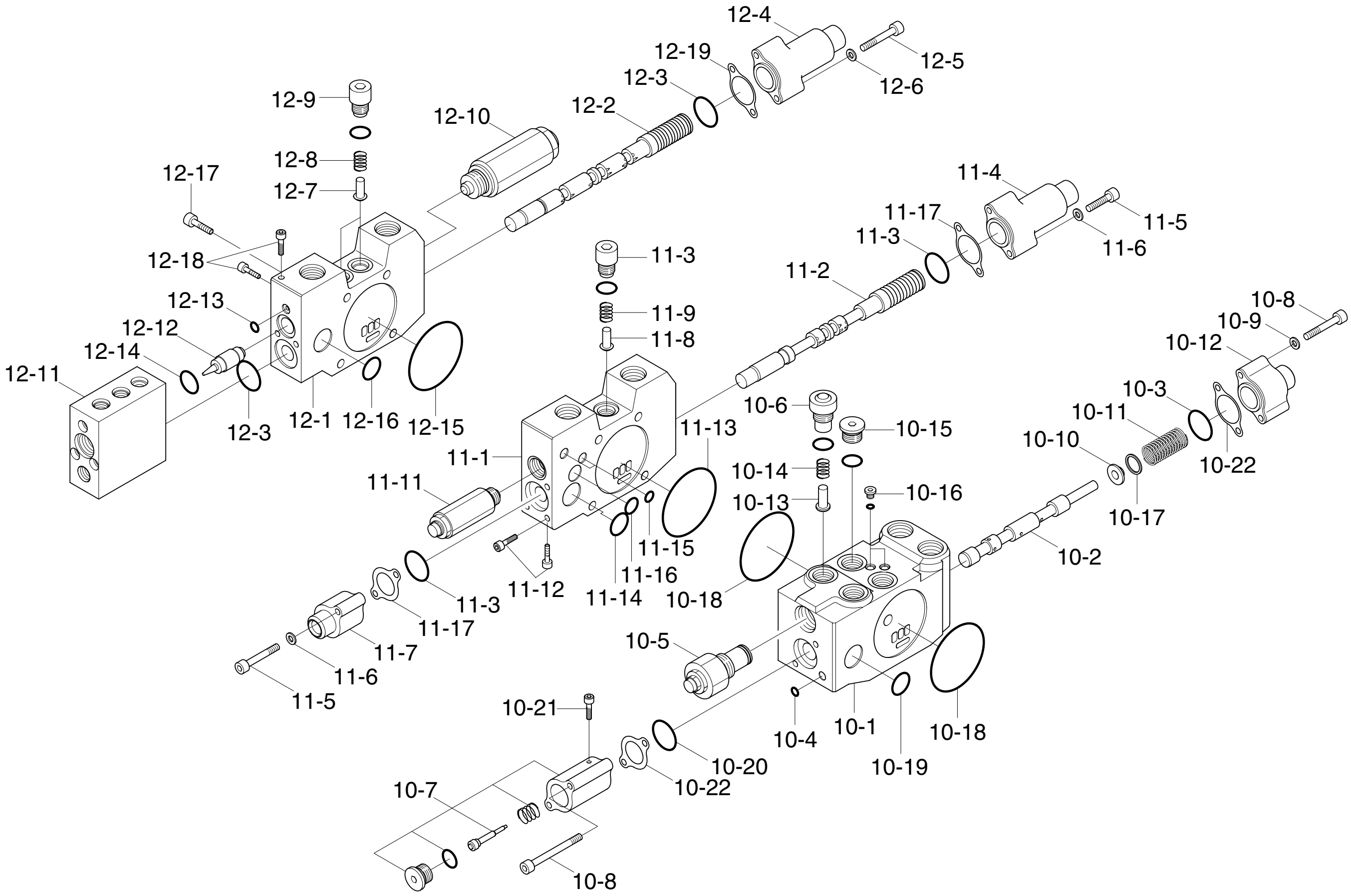
STRUCTURE (2/4)



609S2MC04

6 Woodgrab section assy
6-1 Work block
6-2 Spool assy
6-3 O-ring
6-4 Pilot cap (A)
6-5 Wrench bolt
6-6 Plain washer
6-7 Pilot cap (B1)
6-8 Check poppet
6-9 Check spring
6-10 Plug
6-11 Overload relief valve
6-12 O-ring
6-13 O-ring
6-15 Gasket
7 Boom 2 / Breaker section
7-1 Work block
7-2 Spool assy
7-3 O-ring
7-4 Pilot cap (A)
7-5 Wrench bolt
7-6 Plain washer
7-7 Pilot cap (B1)
7-8 Check poppet
7-9 Check spring
7-10 Plug
7-11 Overload relief valve
7-12 Plug
7-13 O-ring
7-14 O-ring
7-15 Gasket
8 Arm 1 section assy
8-1 Work block
8-2 Spool assy
8-3 O-ring
8-4 Pilot cap (A)
8-5 Socket bolt
8-6 Plain washer
8-7 Pilot cap (B1)
8-8 Check poppet
8-9 Check spring
8-10 Plug
8-11 Overload relief valve
8-12 O-ring
8-13 O-ring
8-15 Gasket
9 Travel (L) section assy
9-1 Work block
9-2 Spool assy
9-3 O-ring
9-4 Pilot cap (A)
9-5 Wrench bolt
9-6 Plain washer
9-7 Pilot cap (B1)
9-8 Check poppet
9-9 Check spring
9-10 Plug
9-11 Taper plug
9-12 O-ring
9-13 O-ring
9-15 Gasket

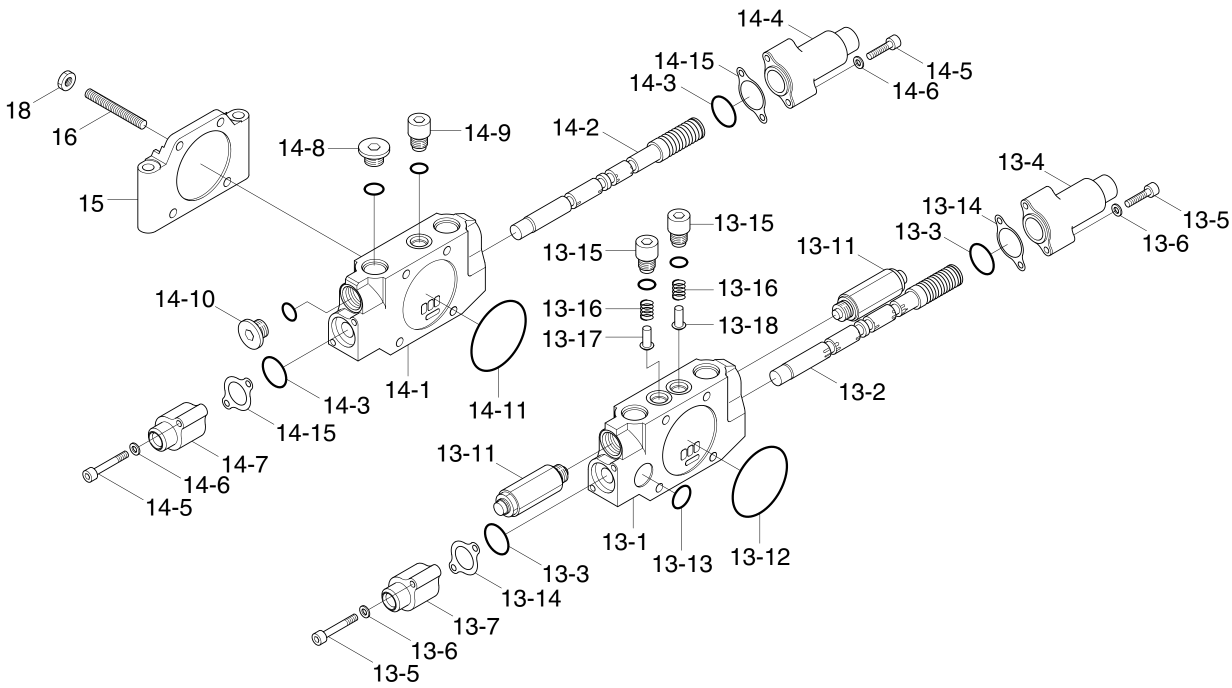
STRUCTURE (3/4)



609S2MC05

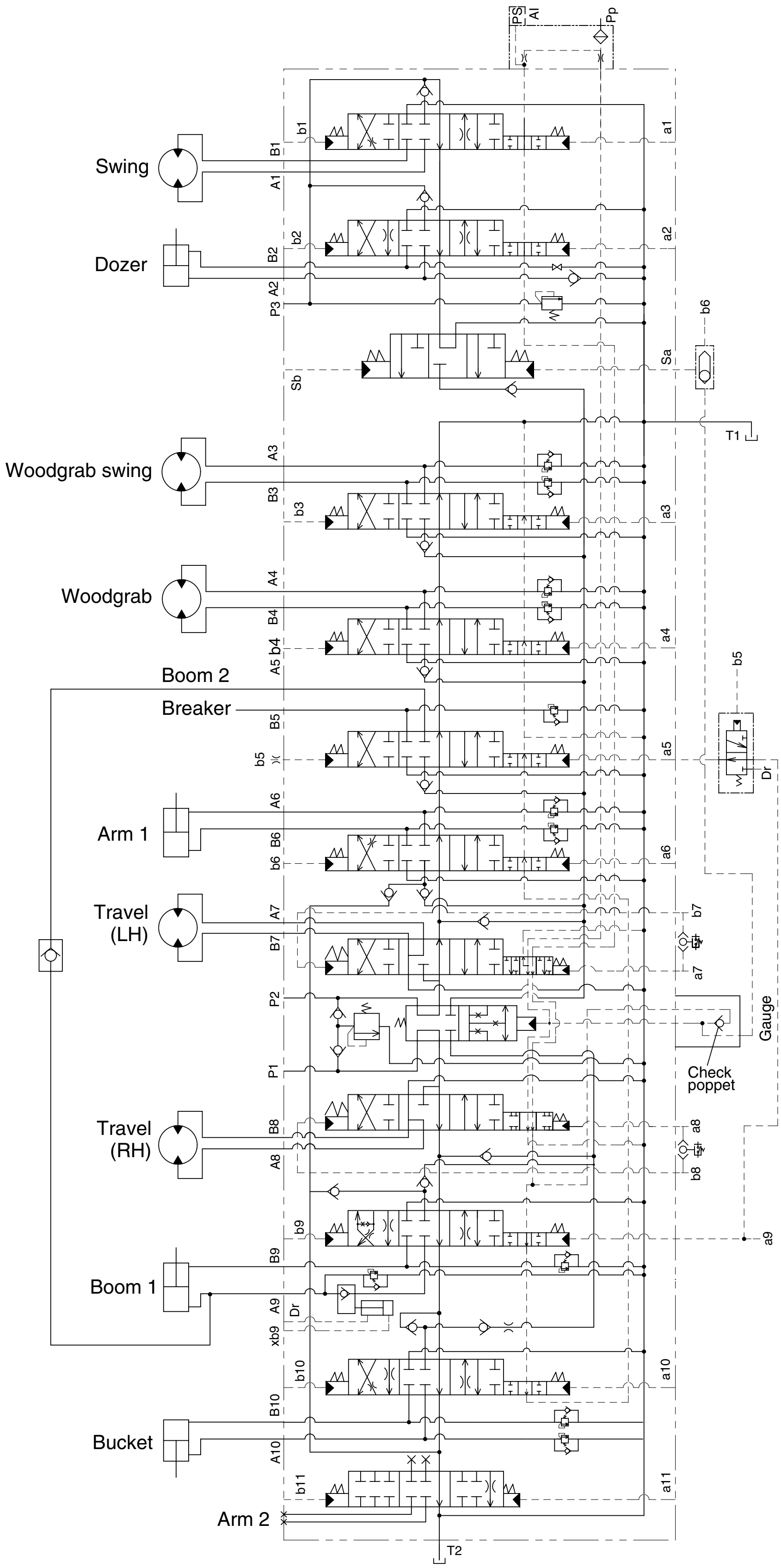
10	Inlet (P1, P2) section assy
10-1	Work block
10-2	Spool assy
10-3	O-ring
10-4	O-ring
10-5	Main relief valve
10-6	Plug
10-7	Check cap assy (TS)
10-8	Wrench bolt
10-9	Plain washer
10-10	Spring seat
10-11	Pilot spring
10-12	Pilot cap
10-13	Check poppet
10-14	Check spring
10-15	Plug
10-16	Plug
10-17	Spring shim
10-18	O-ring
10-19	O-ring
10-20	O-ring
10-21	Taper plug
10-22	Gasket
11	Travel (R) section assy
11-1	Work block
11-2	Spool assy
11-3	O-ring
11-4	Pilot cap (A)
11-5	Wrench bolt
11-6	Plain washer
11-7	Pilot cap (B1)
11-8	Check poppet
11-9	Check spring
11-10	Plug
11-11	Overload relief valve
11-12	Taper plug
11-13	O-ring
11-14	O-ring
11-15	O-ring
11-16	O-ring
11-17	Gasket
12	Boom 1 block
12-1	Work block
12-2	Spool assy
12-3	O-ring
12-4	Pilot cap (A)
12-5	Wrench bolt
12-6	Plain washer
12-7	Check poppet
12-8	Check spring
12-9	Plug
12-10	Overload relief valve
12-11	Holding valve assy (A)
12-12	Holding valve assy (B)
12-13	O-ring
12-14	O-ring
12-15	O-ring
12-16	O-ring
12-17	Wrench bolt
12-18	Taper plug
12-19	Gasket

STRUCTURE (4/4)



13	Bucket block assy	13-14	Gasket	14-6	Plain washer
13-1	Work block	13-15	Plug	14-7	Pilot cap (B1)
13-2	Spool assy	13-16	Check spring	14-8	Plug
13-3	O-ring	13-17	Check poppet	14-9	Plug
13-4	Pilot cap (A)	13-18	Check poppet	14-10	Plug
13-5	Wrench bolt	14	Arm 2 section assy	14-11	O-ring
13-6	Plain washer	14-1	Work block	14-15	Gasket
13-7	Pilot cap (B1)	14-2	Spool assy	15	End cover
13-11	Overload relief valve	14-3	O-ring	16	Tie bolt
13-12	O-ring	14-4	Pilot cap (A)	18	Nut
13-13	O-ring	14-5	Wrench bolt		

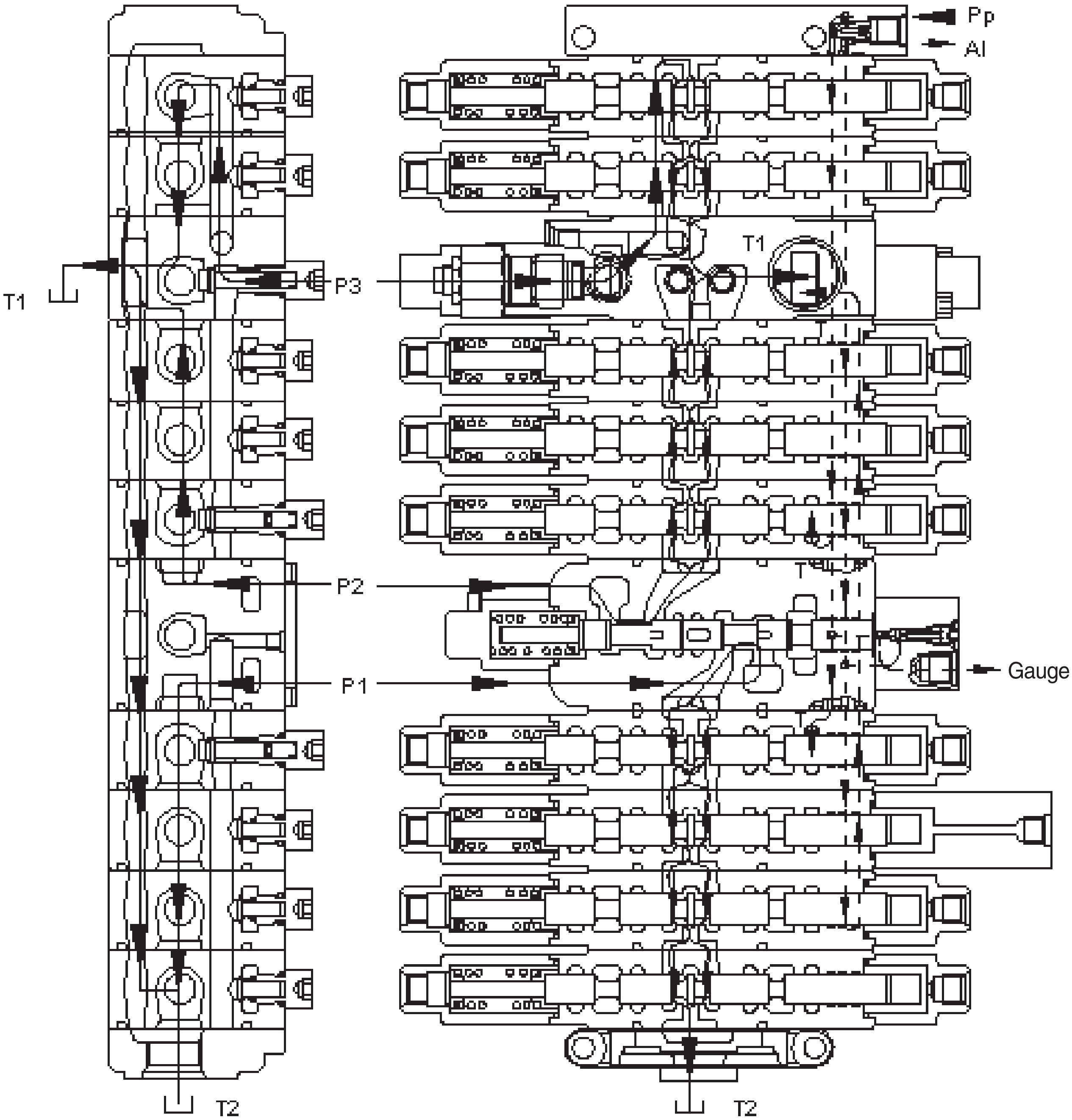
3. HYDRAULIC CIRCUIT



609S2MC02

4. FUNCTION

1) CONTROL IN NEUTRAL FUNCTION



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In neutral, spring sets the spool at the neutral position, the hydraulic oil from pumps flows to the tank through the center bypass.

(1) P1

The oil discharged from the hydraulic pump flows into control valve P1 port, and then flows the right side travel valve through the travel straight valve. In neutral, the oil flows through the center bypass passage in the direction of right travel → boom 1 → bucket → arm 2 spool, and then flows from the center bypass passage to the tank port T1 and T2.

(2) P2

The oil discharged from the hydraulic pump flows into control valve P2 port, and then flows the left side travel valve through the travel straight valve. In neutral, the oil flows through the center bypass passage in the direction of left travel → arm 1 → boom 2/breaker spool, and then flows from the center bypass passage to the tank port T1 and T2.

(3) P3

The oil discharged from the hydraulic pump flows into control valve P3.
In neutral, the oil flows through the center bypass passage in the direction of swing → dozer spool, and then flows from the center bypass passage to the tank port T1 and T2.

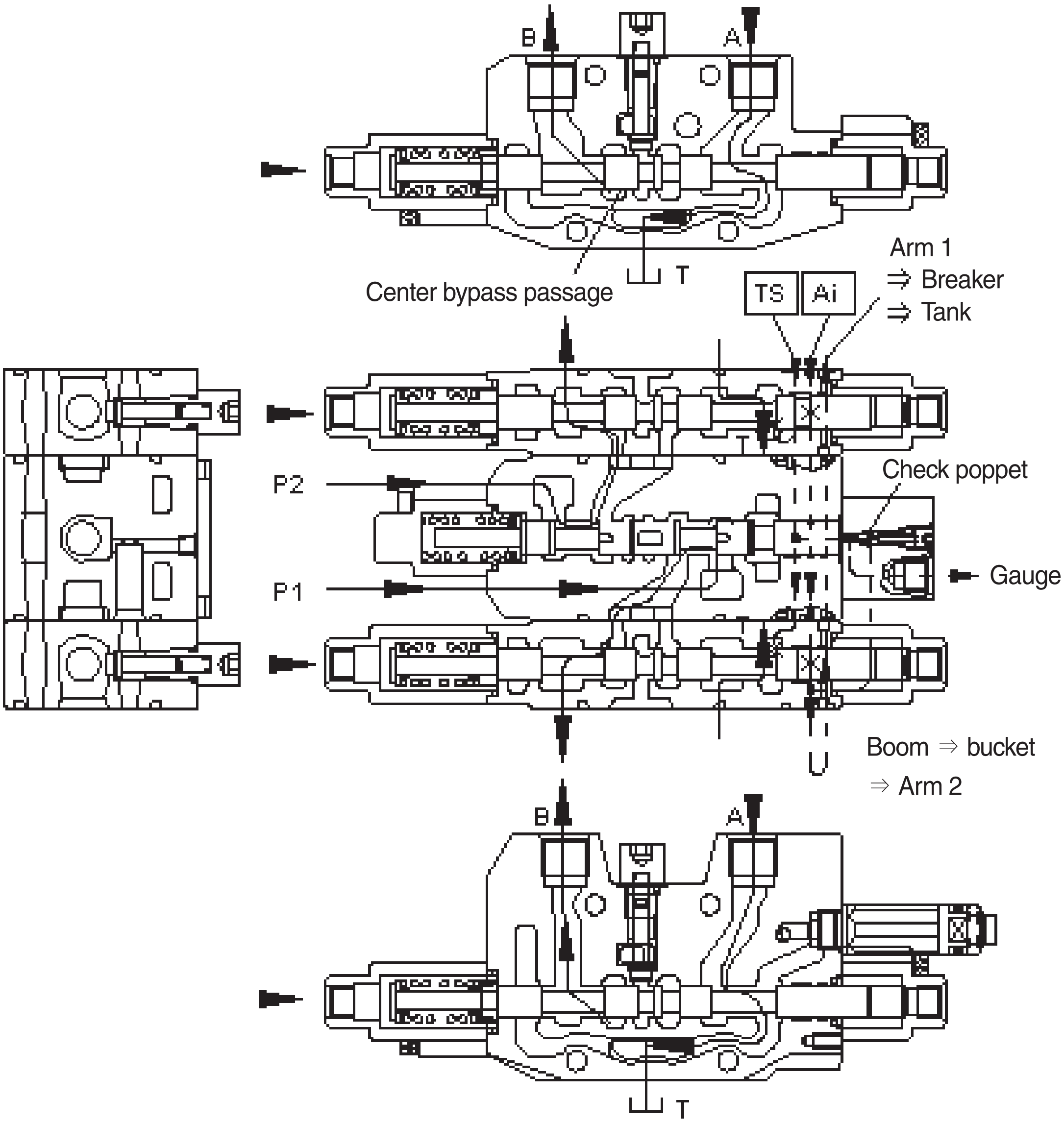
(4) Pp

When Pp port is applied with pilot pressure, the oil flows into the swing block through TS signal passage and Ai signal passage independently via an orifice.

With the spool in neutral, the oil flows into the tank passage through the all section of the control valve(except arm 2 section). As a result, the TS valve is not shifted and the auto idle signal pressure is not raised.

2) EACH SPOOL OPERATION

(1) Travel operation (forward / backward)

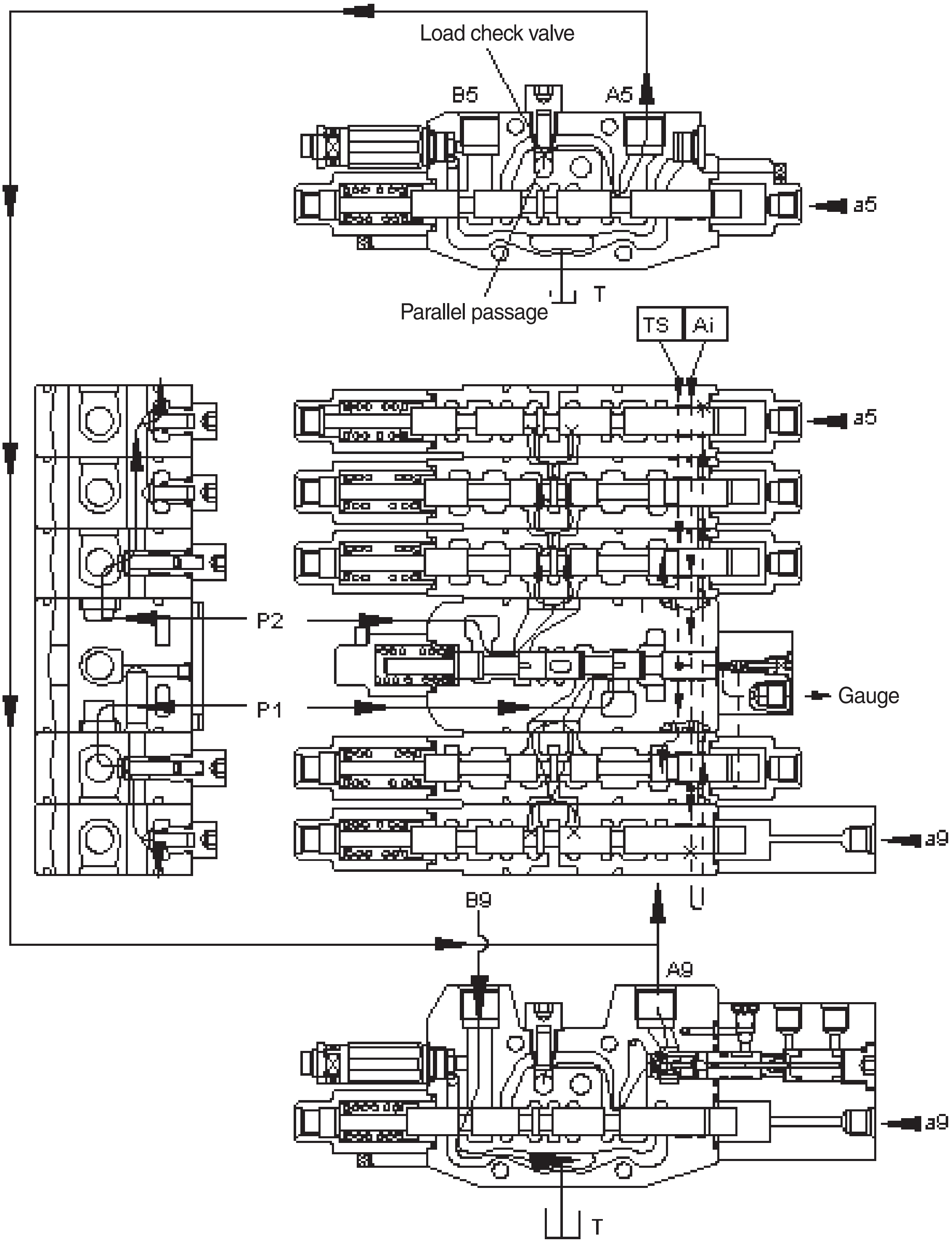


555C92MC08

- During travel (forward/backward) operation, the pilot pressure from RCV is supplied into the travel pilot port and shift the travel spool in the right direction.
- The hydraulic oil fluid from pump is entered center bypass passage of inlet block (P1, P2) and then flows into the port of travel motor.
- The oil from the port A of travel motor flows into the main control valve and return to the hydraulic oil tank through the tank passage.
- The TS signal passage is shut off by shifting of the travel spool, but it is connected with Ai signal passage and drain to the hydraulic oil tank. As a result, the travel straight spool is not shifted.
- The Ai signal passage is connected with travel block through swing and dozer block and it is shut off by shifting of the travel spool and then signal pressure of auto idle is raised.

(2) Boom operation

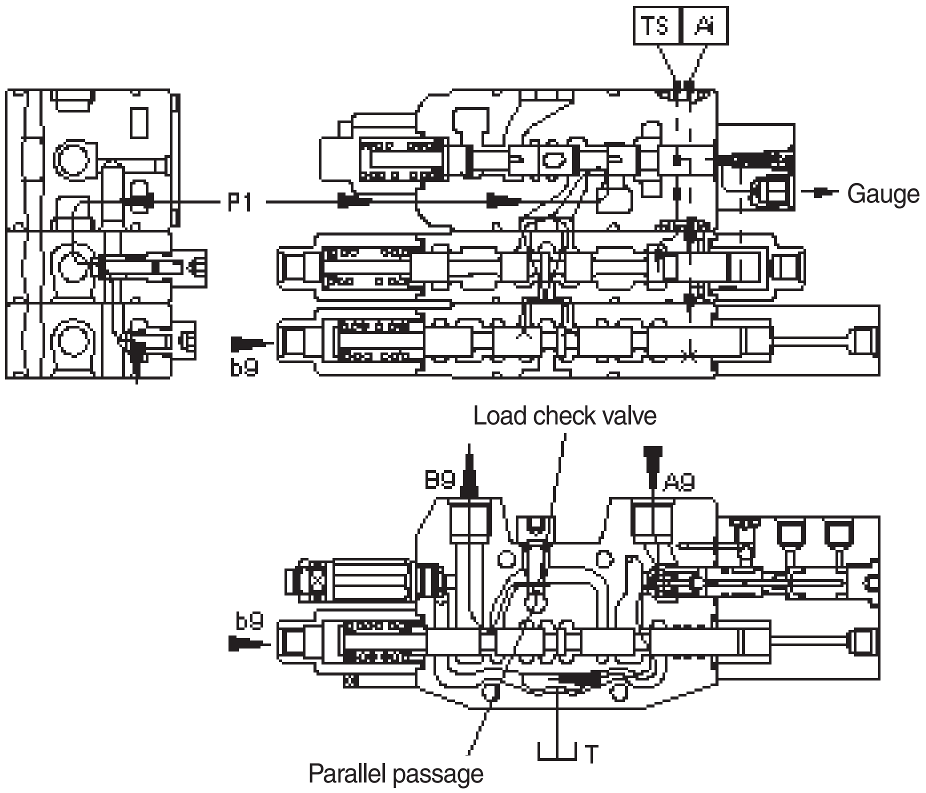
① Boom up operation (P1 and P2 summation)



555C92MC09

· During boom up operation, the pilot pressure from RCV is supplied into the port a9 and shift the boom 1 spool in the left direction. The hydraulic oil fluid from pump P1 is entered P1 parallel passage and then passes through the load check valve then flows into the port A9.
  Following this, it flows into the head side of the boom cylinder.
  At the same time the pilot pressure through the port a5 shifts the boom 2 spool. The hydraulic oil fluid from pump P2 is entered P2 parallel passage and then passes through the load check valve then flows into the port A5. The flows combine in hydraulic hoses and are directed to the cylinder head side of boom cylinder.
  The flow from rod side of the boom cylinder return to the boom 1 spool through the port B9. There after it is directed to the hydraulic oil tank through the tank passage.
· The TS signal passage oil from the Pp port is drain to the hydraulic oil tank through the left/right travel valve and the signal pressure is not raised.
· The Ai signal passage oil from the Pp port is shut off by shifting of the boom 1 spool and then signal pressure of auto idle is raised.

② Boom down operation

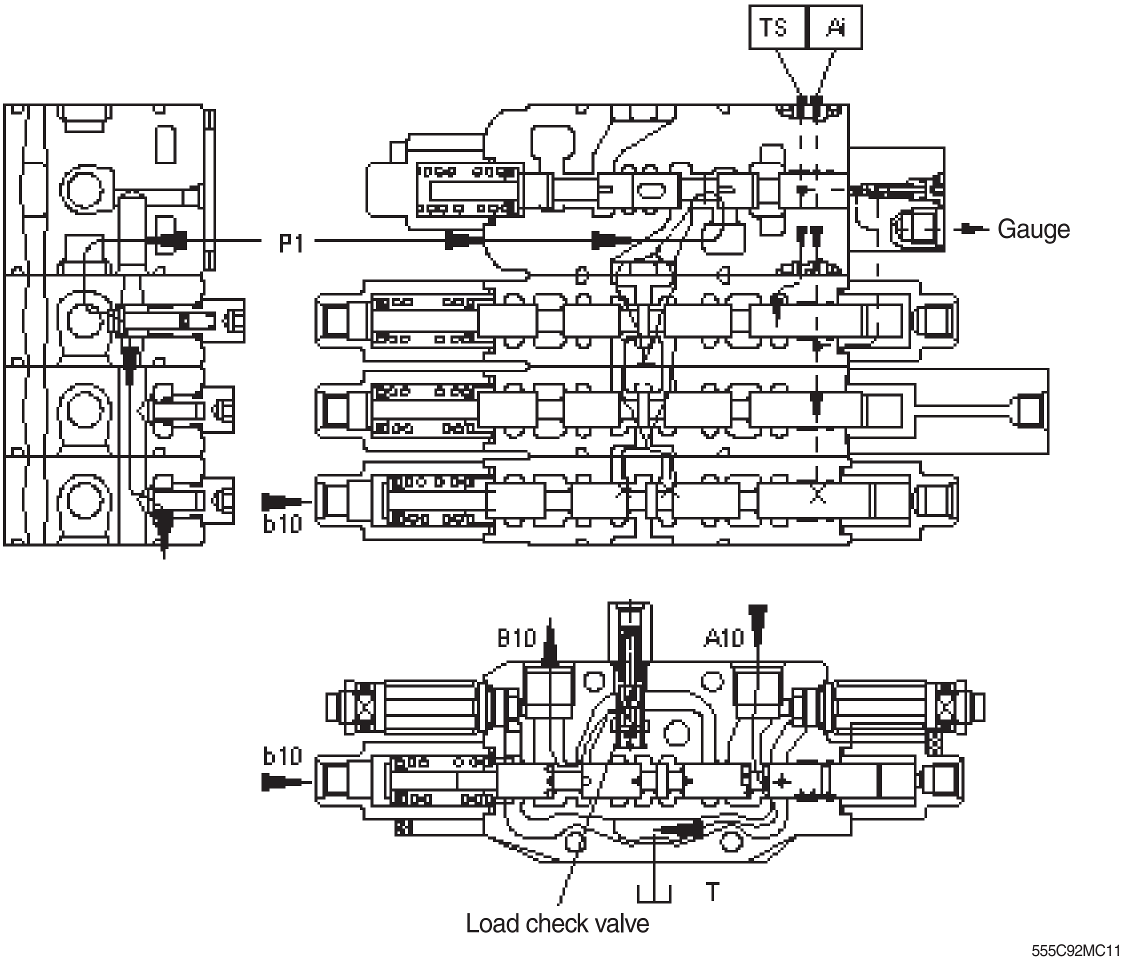


555C92MC10

- During the boom lowing operation, the pilot pressure from RCV is supplied to the port b9 and shift the boom 1 spool in the right direction.
  The hydraulic fluid from the pump P1 enters the parallel passage and is directed to the port B9 through the load check valve. Following this, it flows into the rod side of the boom cylinder.
  The return flow from the head side of the boom cylinder returns to the boom 1 spool through the port A9. Thereafter it is directed to the hydraulic oil tank through tank passage.
- The hydraulic oil flow from the Pp port is same as the boom up operation.

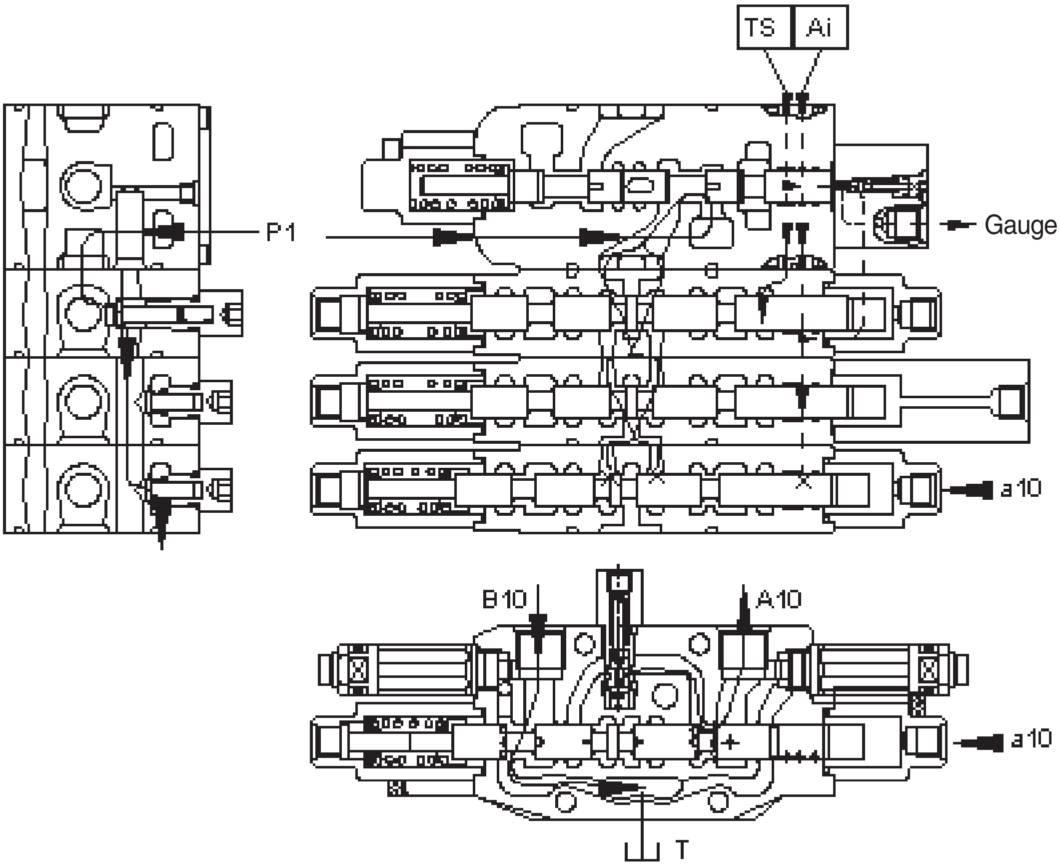
(3) Bucket operation

① Bucket roll in operation



- During the bucket roll in operation, the pilot pressure from RCV is supplied to port b10 and shift the bucket spool in the right direction.
  The hydraulic fluid from pump P1 entered P1 parallel passage and is directed to the port B10 through the load check valve.
  Following this, it flows into the head side of the bucket cylinder.
  The return flow from the rod side of the bucket cylinder returns to the bucket spool through the port A10. Thereafter it is directed to the hydraulic oil tank through the tank passage.
- The TS signal passage oil from the Pp port is drain to the hydraulic oil tank through the left/right travel valve and the signal pressure is not raised.
- The Ai signal passage oil from the Pp port is shut off by shifting of the bucket spool and then signal pressure of auto idle is raised.

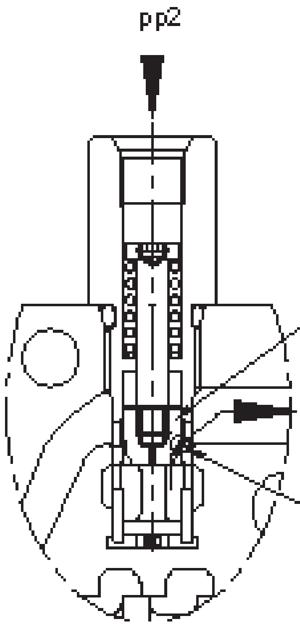
② Bucket roll out operation



555C92MC12

· In case of the bucket roll out operation, the operation is similar.
· The hydraulic oil flow from the Pp port is same as the bucket in operation.

③ Bucket load check valve operation

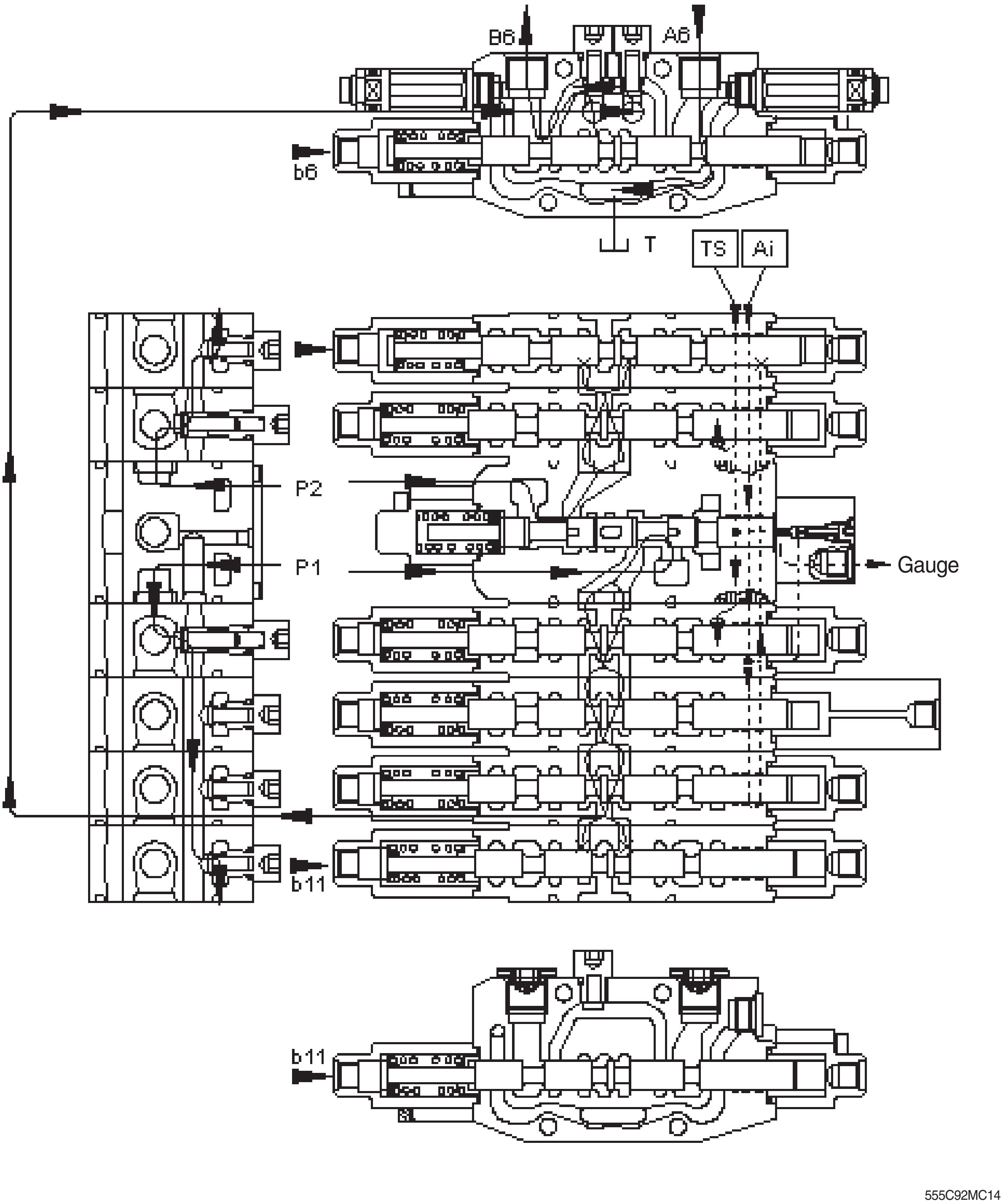


555C92MC13

- This function is used to speed up of the boom or arm by reducing the bucket speed when bucket operation with boom or arm operation simultaneously.
- When the signal pressure flows into port pp2, the plunger is shifted and orifice is made.
- The hydraulic oil from the port P1 flow into bucket cylinder via the orifice and then the speed of bucket cylinder is slow down.
  Accordingly, the much fluid from the port P1 is supplied other cylinder than the bucket cylinder.

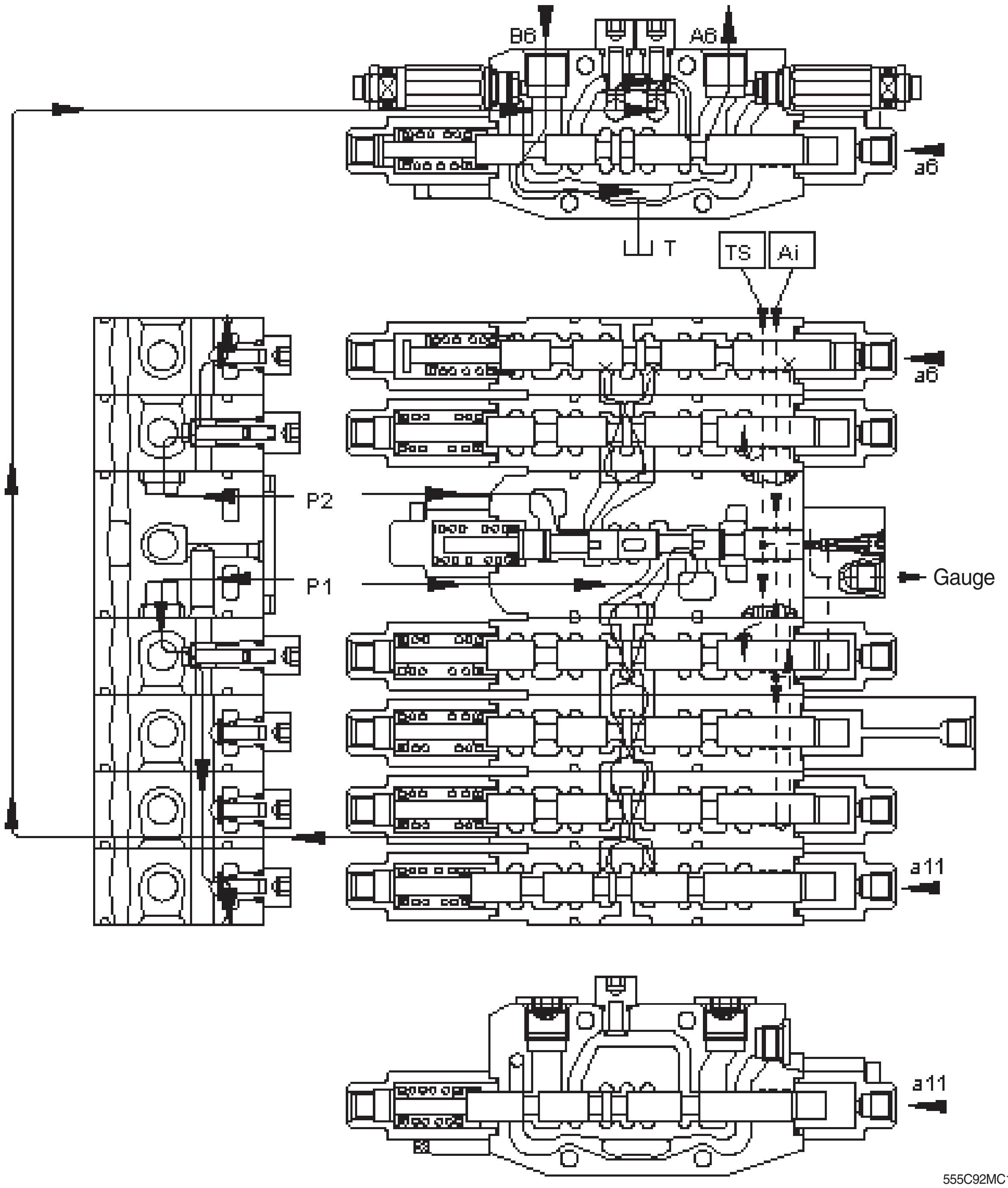
(4) Arm operation

① **Arm roll in operation** (P1 and P2 summation)



- During arm roll in operation the pilot pressure from the RCV is supplied to the port b6 and b11 and shifts arm 1 spool and arm 2 spool in the direction.
  The hydraulic oil from the pump P2 flows into the arm cylinder head side through P2 parallel passage, the load check valve and the port B6.
  At same time, the hydraulic fluid from the pump P1 flows into the arm summation passage in arm 1 spool through the arm 2 spool. Then it entered the arm cylinder head side with hydraulic fluid from arm 1 spool.
- The TS signal passage oil from the Pp port is drain to the hydraulic oil tank through the left/right travel valve and the signal pressure is not raised.
- The Ai signal passage oil from the Pp port is shut off by shifting of the arm spool and then signal pressure of auto idle is raised.

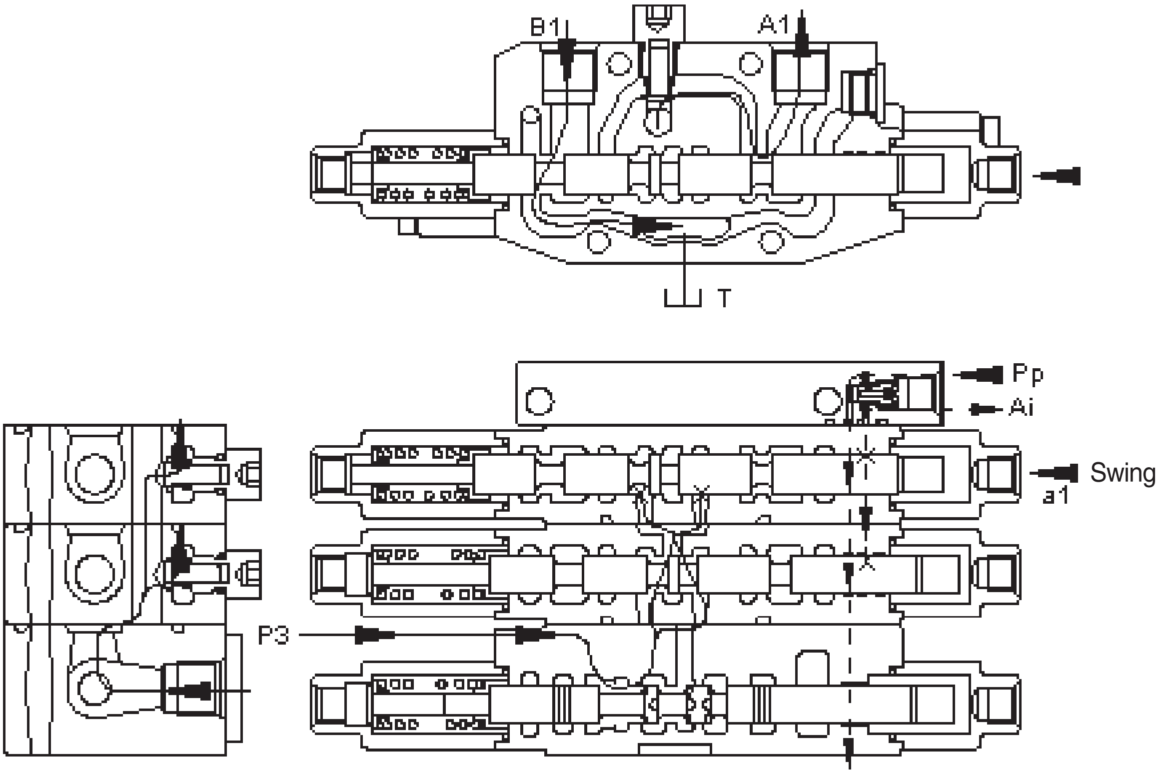
② Arm roll out operation



555C92MC15

- During arm roll out operation the pilot pressure from RCV is supplied to the port a6 and the a11 and shifts arm 1 spool and arm 2 spool in the left direction.
  The hydraulic fluid from pump P2 flows into arm 1 spool through the parallel passage. Then it enters into the arm cylinder rod side through the load check valve and the port A6.
  At same time, the hydraulic oil from the pump P1 flows into the arm summation passage in arm 1 spool through the arm 2 spool.
  The return flow from the arm cylinder head side returns to the hydraulic tank through the port B6 the arm1 spool and tank passage.
- The hydraulic oil flow from the Pp port is same as the arm roll in operation.

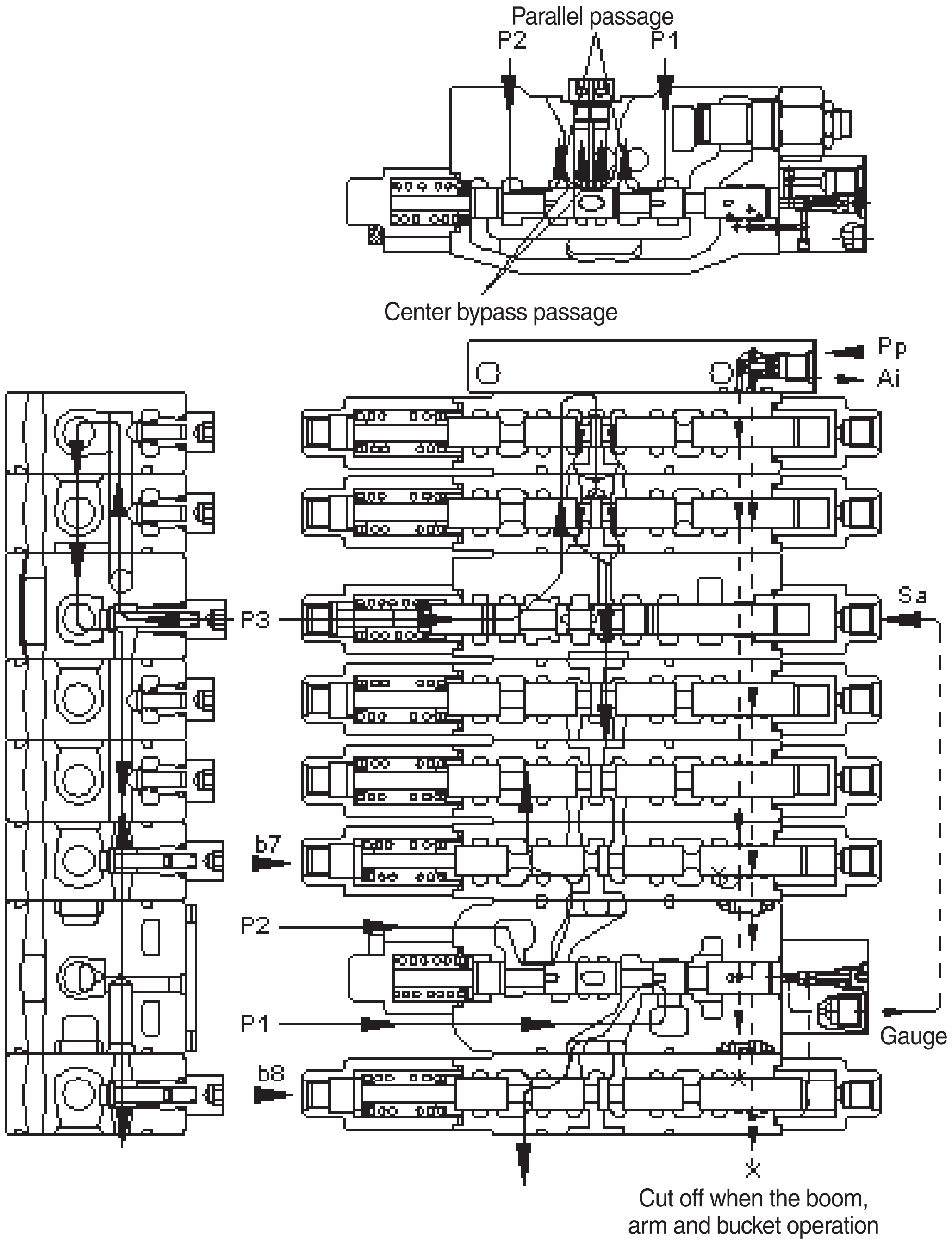
(5) Swing operation



555C92MC16

- The pilot pressure from the RCV is supplied to the a1 and shift the swing spool in left direction. The hydraulic fluid from pump P3 flows into swing spool through the parallel passage. Then it is directed to swing motor through the port A1. As a result, swing motor turns and flow from the swing motor returns to the hydraulic oil tank through the port B1, swing spool and the tank passage.
  In case of swing left operation, the operation is similar.
- The TS signal passage oil from the Pp port is drain to the hydraulic oil tank through the left/right travel valve and the signal pressure is not raised.
- The Ai signal passage oil from the Pp port is shut off by shifting of the swing spool and then signal pressure of auto idle is raised.

(6) Travel straight function



555C92MC17

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

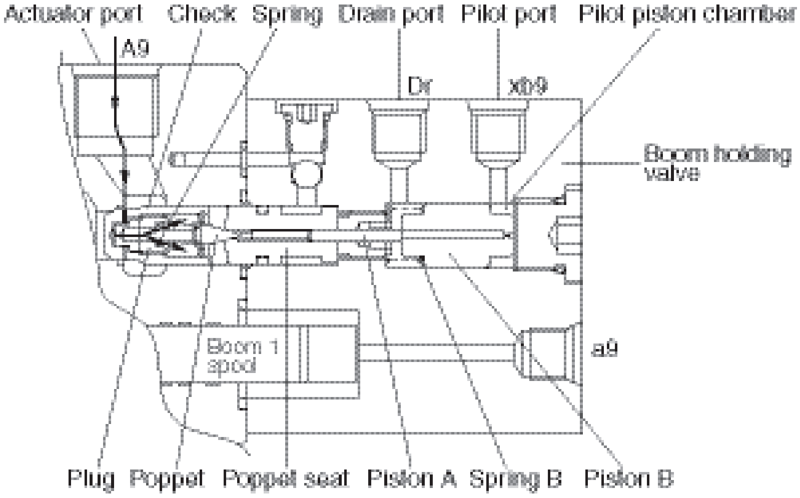
① During travel only :
The hydraulic fluid of the pump P1 is supplied to the travel motor and the pump P2 is supplied to the other motor.
Thus, the machine keep travel straight.

② The other actuator operation during straight travel operation.
When the other actuator spool(s) is selected under straight travel operation, the straight travel spool is moved.
Some of hydraulic fluid from pump P1 and P2 is supplied to the travel motors through parallel passage and the other hydraulic fluid is supplied to the actuator(s) through center bypass passage via orifice passage.
Thus, the machine keeps straight travel.

· The fluid flows into P3 pilot port Sa through the gauge port and the spool is shifted. As a result, the fluid of P3 pump is combined with the boom, arm and bucket and then the actuators speed up.

(7) Holding valve operation

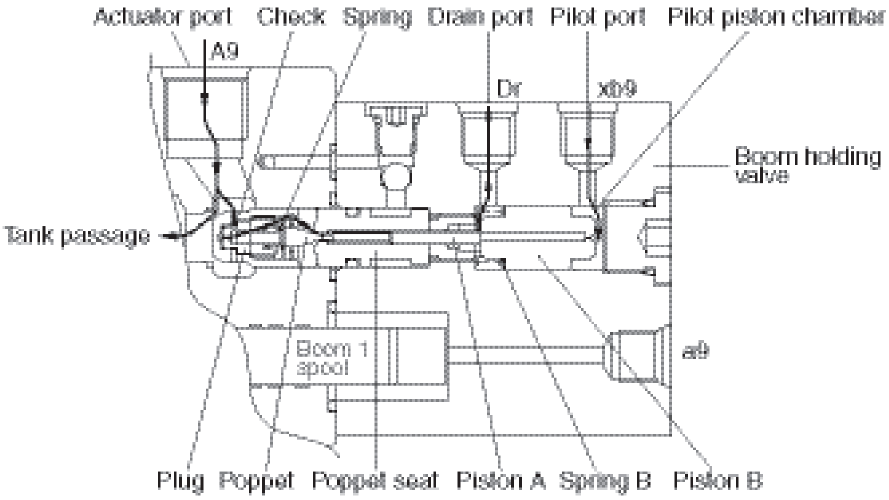
① Holding operation



55W72MC16

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

② Release holding operation



55W72MC17

The pilot pressure is supplied to the pilot port for release holding valve and shifts the piston "B" in the left direction against the spring "B", and shifts the poppet in the left direction through piston "B" and piston "A" against spring "B" and shifts the spool in the left side.
At same time, the return fluid from actuator returns to the drain port through the periphery hole of check, crevice of the check and the plug, the periphery hole of the plug, in side of holding valve, crevice of the poppet and the poppet seat, the periphery hole of the poppet seat, crevice of socket and spool and internal passage of spool.
When the poppet is opened, pressure of inside of holding valve is decreased and the return fluid from actuator returns to the tank passage through the notch of spool.

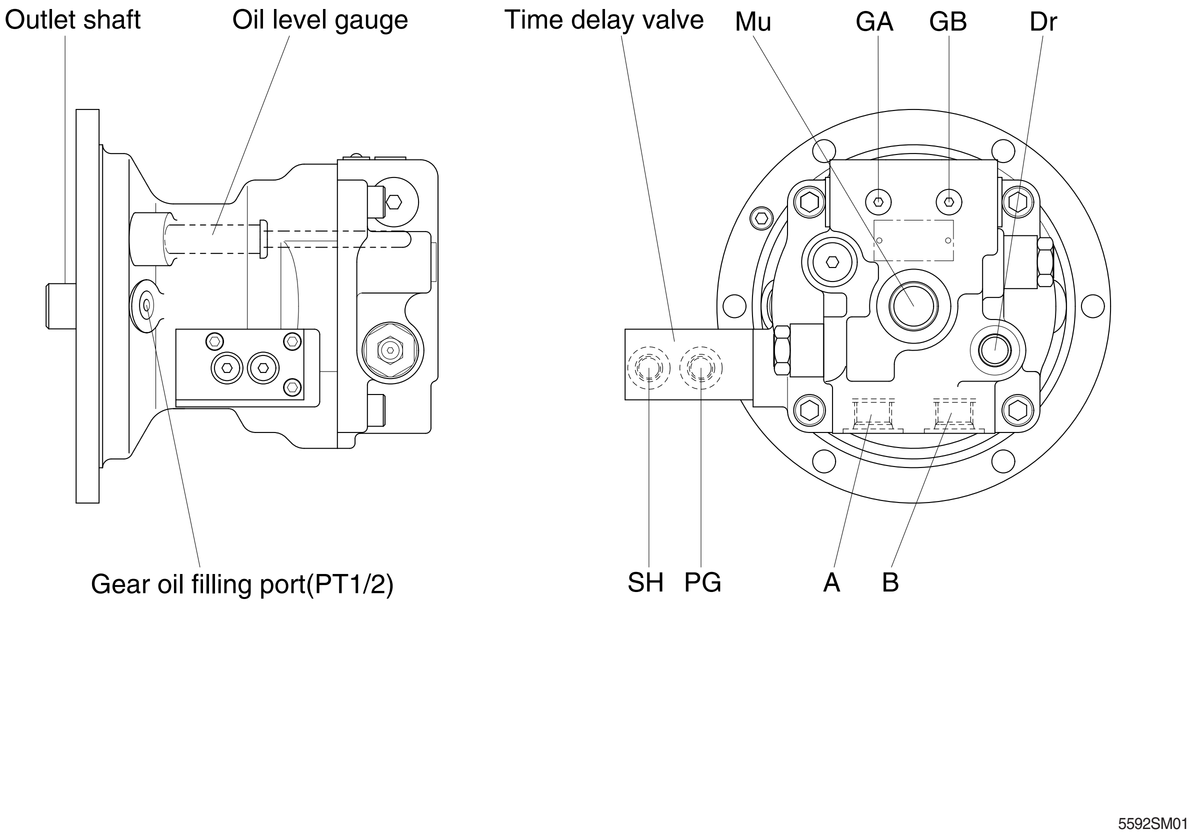
GROUP 3 SWING DEVICE

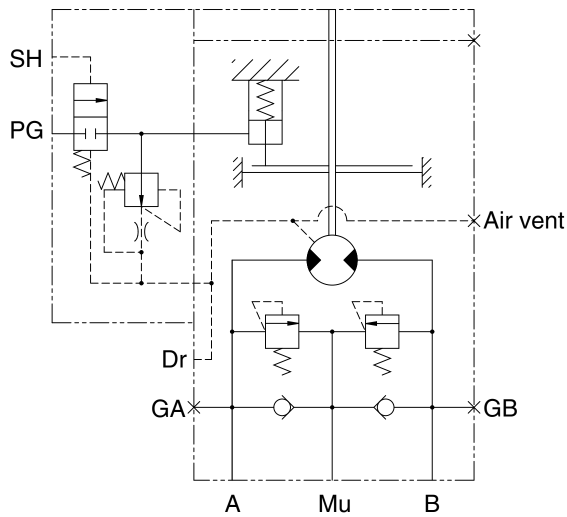
1. STRUCTURE

Swing device consists swing motor, swing reduction gear.

1) SWING MOTOR

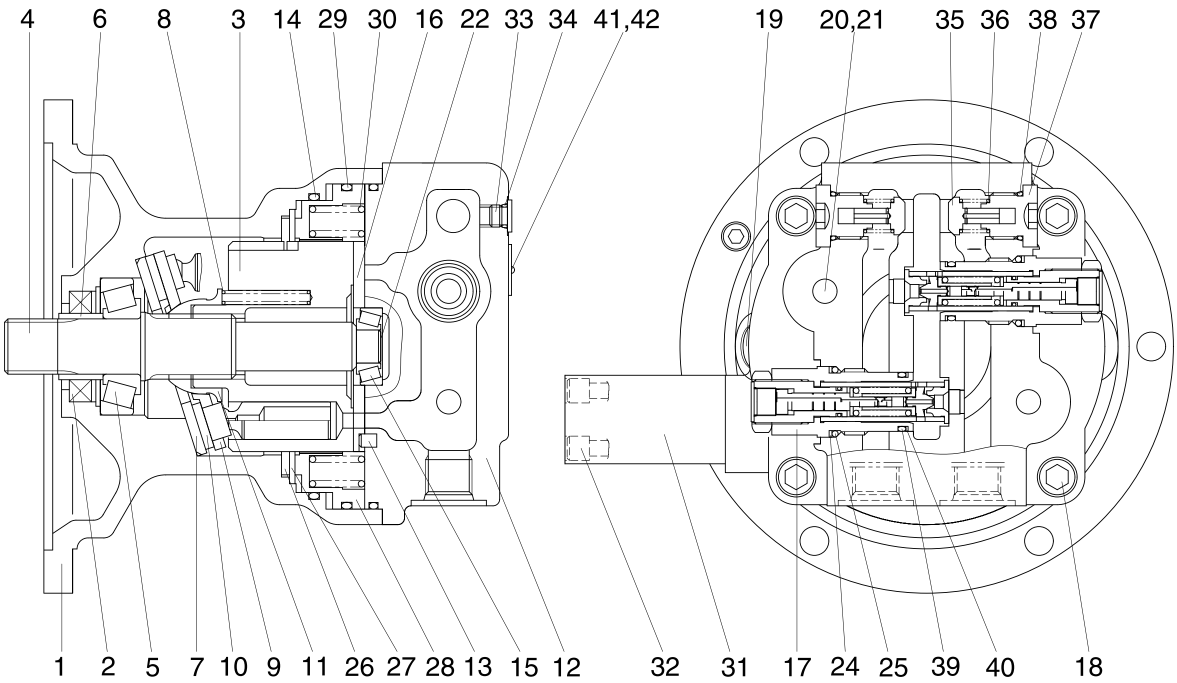
Swing motor include mechanical parking valve, relief valve, make up valve and time delay valve.





Hydraulic circuit

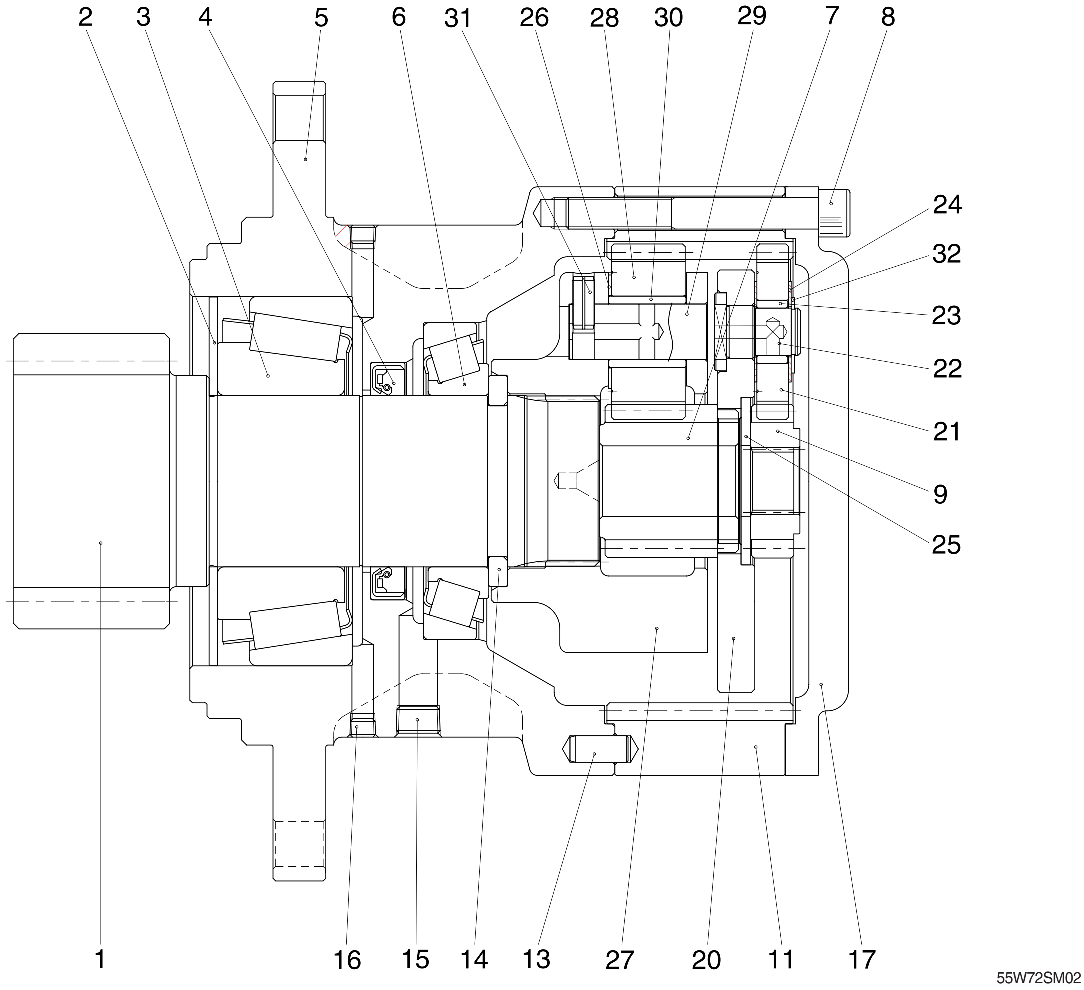
Port	Port name	Port size
A	Main port	SAE PF 1/2
B	Main port	SAE PF 1/2
Dr	Drain port	PF 3/8
Mu	Make up port	PF 3/4
PG	Brake release stand by port	PF 1/4
SH	Brake release pilot port	PF 1/4
GA,GB	Gauge port	PF 1/4



555K2SM03

1	Body	15	Taper bearing	29	O-ring
2	Oil seal	16	Valve plate	30	Spring
3	Cylinder block	17	Relief valve assy	31	Time delay valve
4	Shaft	18	Socket bolt	32	Socket bolt
5	Taper bearing	19	Plug	33	Plug
6	Bushing	20	Plug	34	O-ring
7	Shoe plate	21	O-ring	35	Valve
8	Spring	22	Shim	36	Spring
9	Set plate	23	Plug	37	Plug
10	Piston shoe assy	24	Back up ring	38	O-ring
11	Ball guide	25	O-ring	39	O-ring
12	Rear cover	26	Friction plate	40	Back up ring
13	Pin	27	Plate	41	Name plate
14	O-ring	28	Parking piston	42	Rivet

2) REDUCTION GEAR



1	Shaft	12	Carrier assy 2	23	Bushing 1
2	Bearing cover	13	Dowel pin	24	Thrust washer 1
3	Taper roller bearing	14	Collar	25	Thrust washer 3
4	Case	15	Plug	26	Thrust washer 2
5	Oil seal	16	Plug	27	Carrier assy 2
6	Taper roller bearing	17	Cover	28	Planet gear 2
7	Sun gear 2	18	Pipe	29	Pin 2
8	Socket bolt	19	Level gauge	30	Bushing 2
9	Sun gear 1	20	Carrier assy 1	31	Spring pin
10	Carrier assy 1	21	Planet gear 1	32	Snap ring
11	Ring gear	22	Pin 1	33	Thrust washer 4

2. FUNCTION

1) ROTARY PART

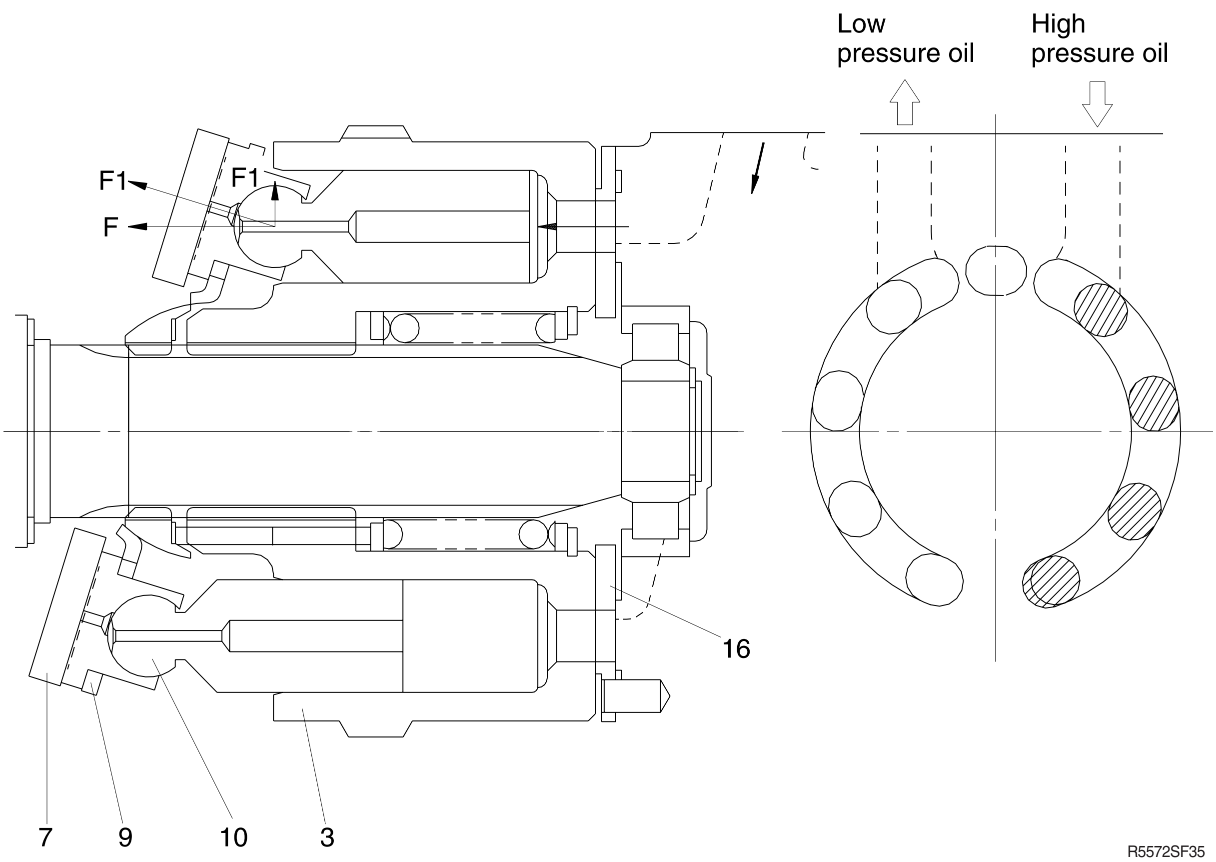
When high pressurized oil enters a cylinder through port(a), which is the inlet of balance plate(16), hydraulic pressure acting on the piston causes axial force F. The pressure force F works via the piston(10) upon the return plate(9) which acts upon the swash plate(7) via an hydrostatic bearing. Force F1 perpendicular to swash plate(7) and force F2 perpendicular to cylinder center.

Being transferred to the cylinder block(3) through piston, force F2 causes rotational moment at surroundings of cylinder.

Since cylinder block has 9 equidistantly arrayed pistons, rotational torque is transmitted to cylinder shaft in order by several pistons connected to the inlet port of high pressurized oil. When the direction of oil flow is reversed, rotational direction of cylinder is also reversed. Output torque is given by the equation.

$$T = \frac{p \times q}{2\pi}, \; q = Z \cdot A \cdot PCD \cdot \tan\theta, \; F1 = \frac{F}{COS\theta}, \; F_2 = F\tan\theta, \; S = PCD \times \tan\theta$$

Where p : Effective difference of pressure (kgf/cm^2)
q : Displacement (cc/rev)
T : Output torque (kgf · cm)
Z : Piston number (9EA)
A : Piston area (cm^2)
θ : Tilting angle of swash plate (degree)
S : Piston stroke (cm)



2) MAKE UP VALVE

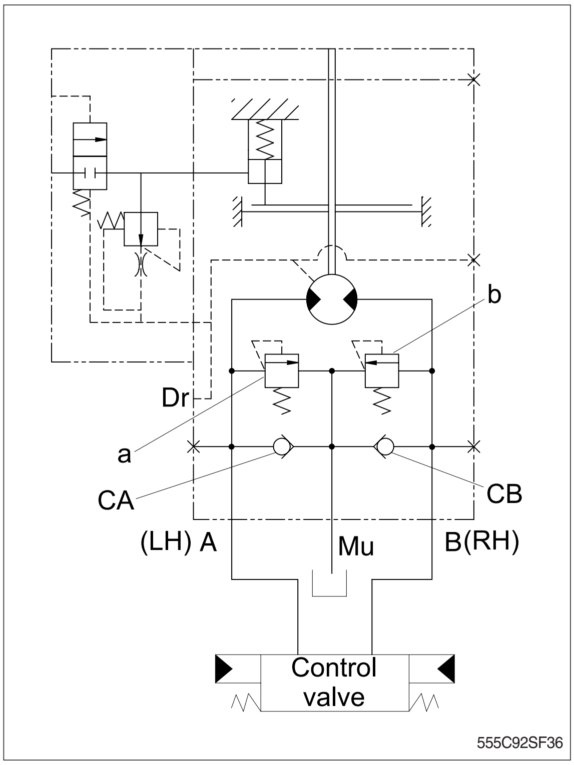
(1) Outline

The safety valve portion consists of a check valve and safety valve.

(2) Function

When the swing is stopped, the output circuit of the motor continues to rotate because of inertia. For this reason, the pressure at the output side of the motor becomes abnormality high, and this will damage the motor. To prevent this, the oil causing the abnormal hydraulic pressure is allowed to escape from the outlet port (high-pressure side) of the motor to port Mu, thereby preventing damage to the motor.

Compared with a counterbalance valve, there is no closed-in pressure generated at the outlet port side when slowing down the swing speed. This means that there is no vibration when slowing down, so the ease of swing control is improved.



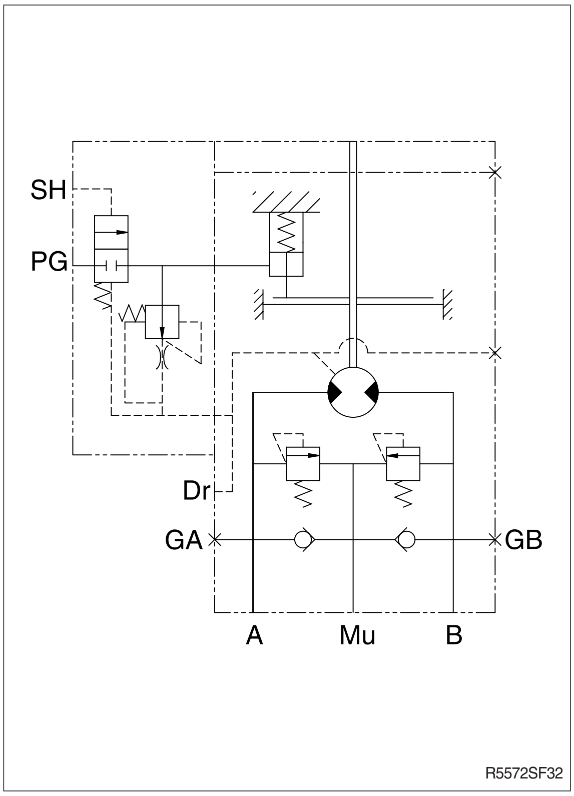
(3) Operation

① When starting swing

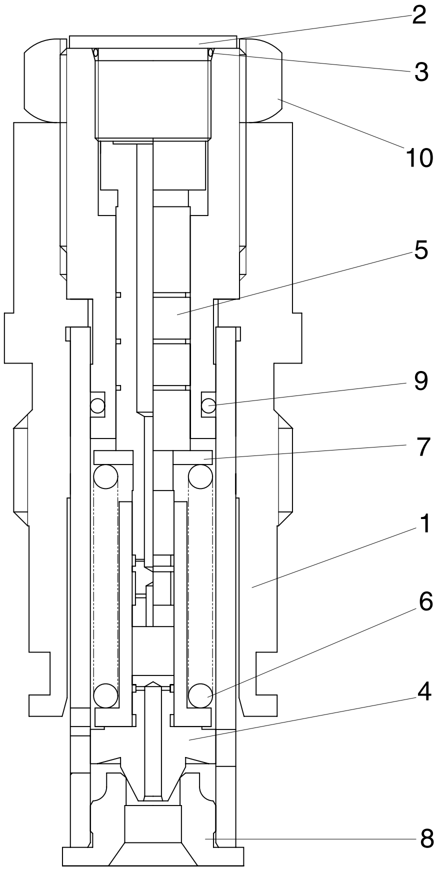
When the swing control lever is operated to left swing, the pressurized oil from the pump passes through the control valves and is supplied to port B. Because of this, the pressure at port B rises, staring torque is generated in the motor, and the motor starts to rotate. The oil from the outlet port of the motor passes from port A through the control valve and returns to the tank.

② When stopping swing

- When the swing control lever is returned to neutral, no pressurized oil is supplied from the pump to port B.
  The return circuit to the tank is closed by the control valve. So the oil from the outlet port of the motor increases in pressure at port A. Resistance to the rotation of the motor is created, and the brake starts to act.
- The pressure at port A rises to the set pressure of make up valve a, and in this way, a high brake torque acts on the motor, and the motor stops.
- When make up valve a is being actuated, the relief oil from make up valve a and the oil from port Mu pass through check valve CB and are supplied to port B. This prevents cavitation from forming at port B.



3) RELIEF VALVE



555C92SF37

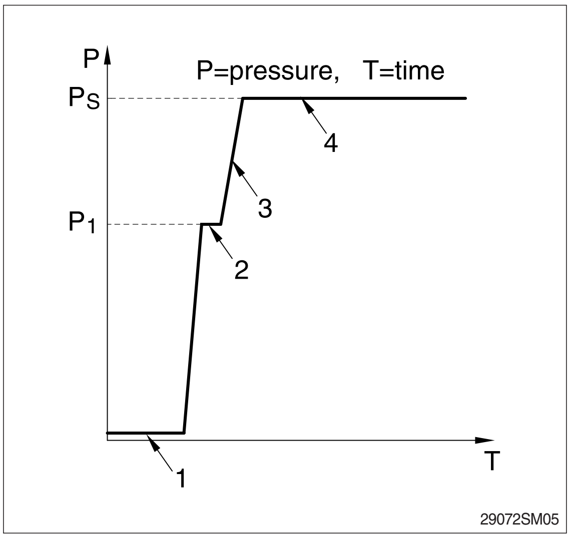
1	Body
2	Plug
3	O-ring
4	Plunger
5	Piston
6	Spring
7	Spring seat
8	Seat
9	O-ring
10	Nut

(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.



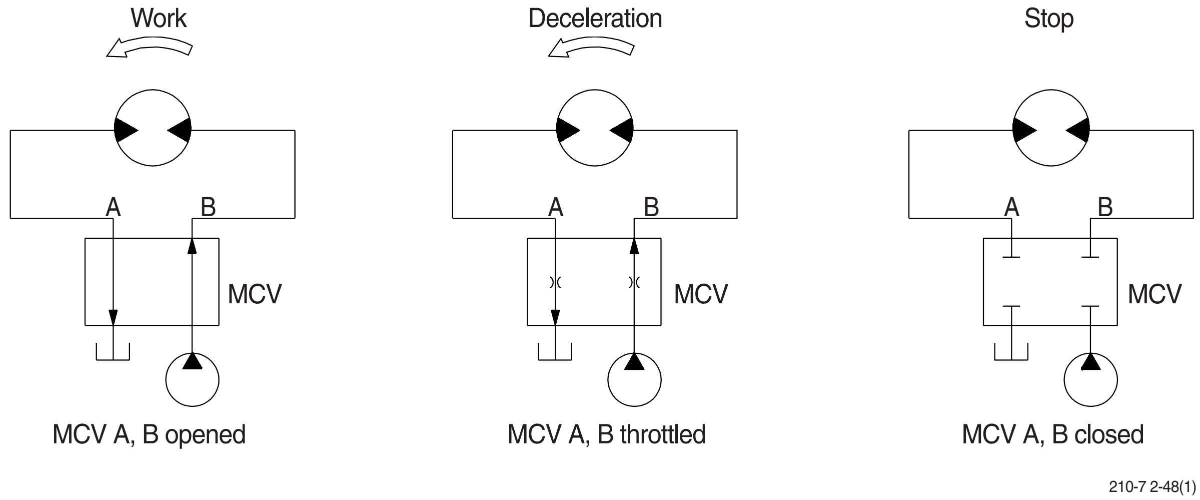
29072SM05

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.



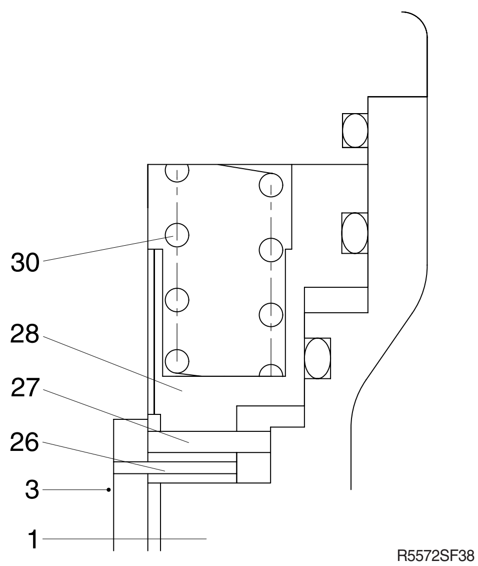
(2) Mechanical swing parking brake system

The mechanical swing parking brake system is installed to prevent the upper structure from swinging downhill because of its own weight when the excavator is parked on a slope since it completely eliminates the hydraulic drift of swing motion while the excavator is on a slop, work can be done more easily and safely.

① Brake assembly

Circumferential rotation of separate plate (27) is constrained by the groove located at casing (1). When housing is pressed down by brake spring (30) through friction plate (26), separate plate (27) and brake piston (28), friction force occurs there.

Cylinder (3) is constrained by this friction force and brake acts, while brake releases when hydraulic force exceeds spring force.

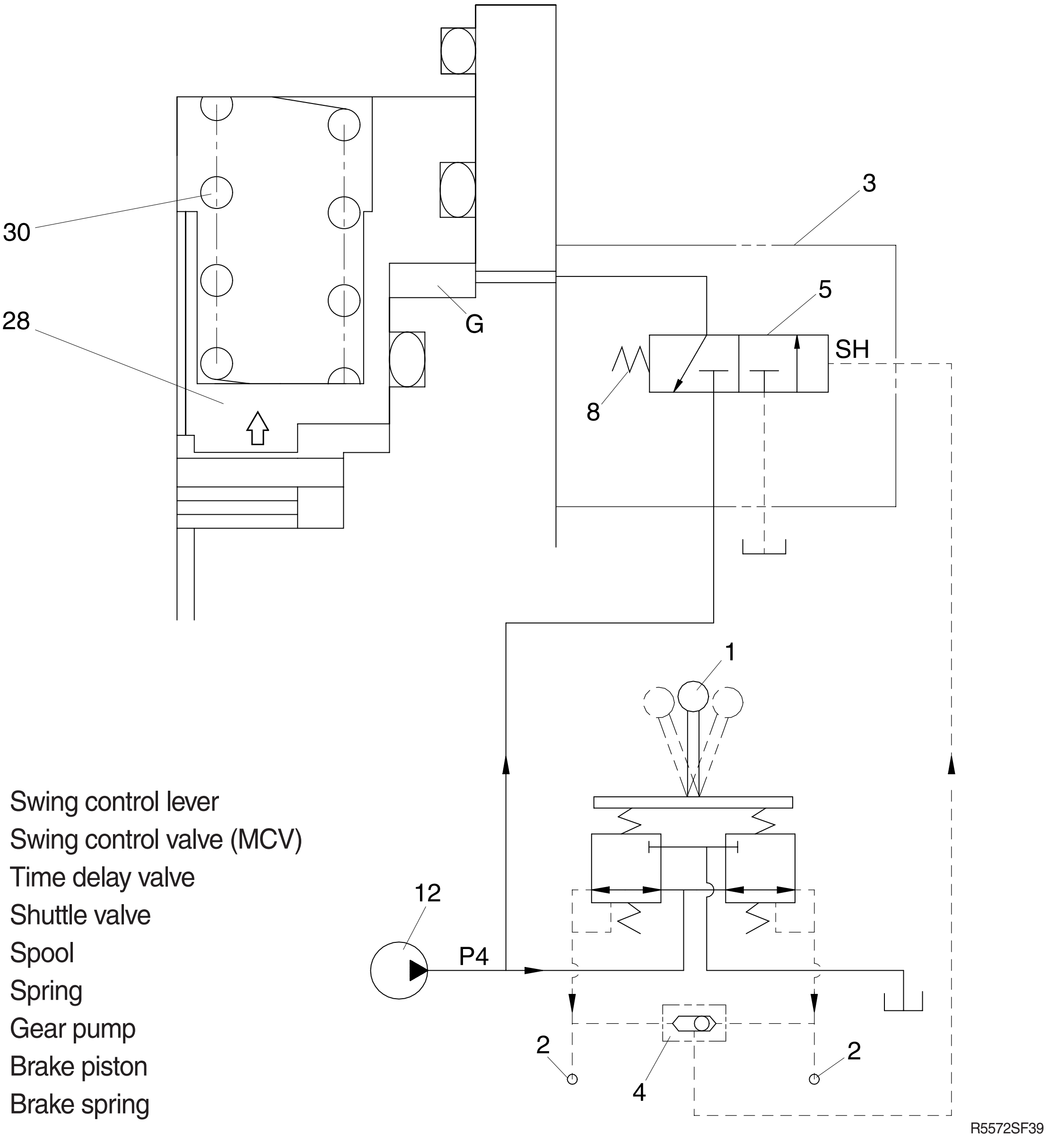


1	Casing	27	Separate plate
3	Cylinder	28	Brake piston
26	Friction plate	30	Brake spring

② Operating principle

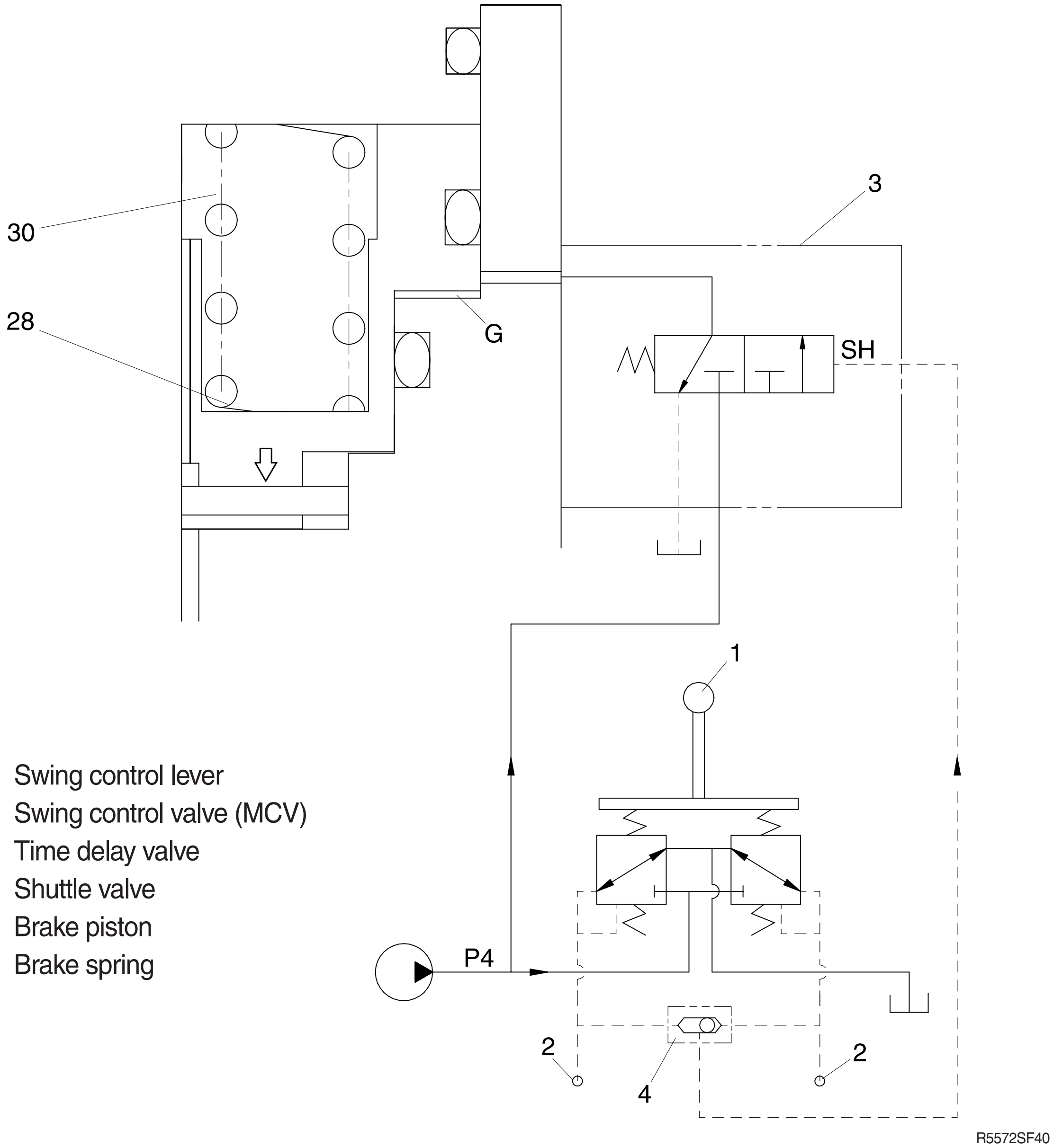
a. When the swing control lever (1) is set to the swing position, the pilot oil go to the swing control valve (2) and to SH of the time delay valve (3) via the shuttle valve (4), this pressure move spool (5) to the leftward against the force of the spring (8), so pilot pump charged oil (P4) goes to the chamber G.

This pressure is applied to move the piston (28) to the upward against the force of the spring (30). Thus, it releases the brake force.



1 Swing control lever
2 Swing control valve (MCV)
3 Time delay valve
4 Shuttle valve
5 Spool
8 Spring
12 Gear pump
28 Brake piston
30 Brake spring

b. When the swing control lever (1) is set the neutral position, the time delay valve (3) shifts the neutral position and the pilot oil blocked chamber G.
Then, the piston (28) is moved lower by spring (30) force and the return oil from the chamber G is drain.



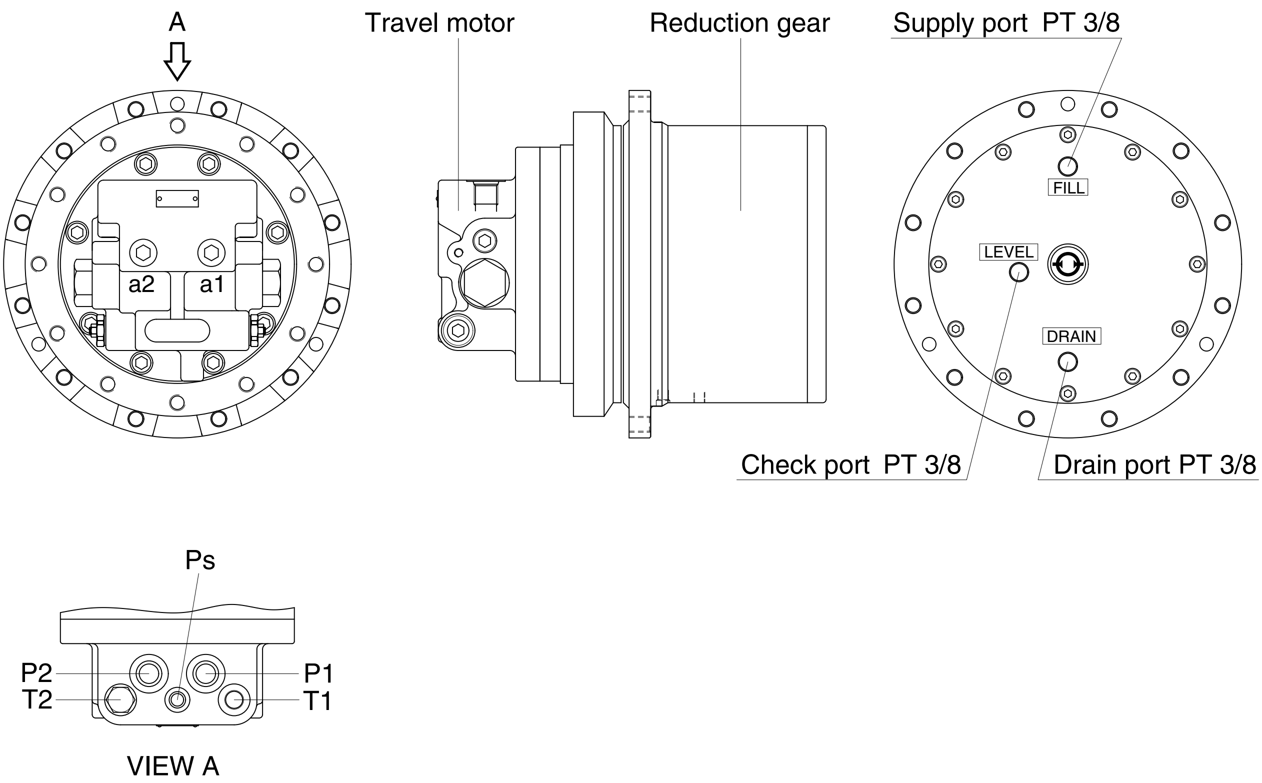
1	Swing control lever
2	Swing control valve (MCV)
3	Time delay valve
4	Shuttle valve
28	Brake piston
30	Brake spring

GROUP 4 TRAVEL DEVICE (TYPE 1)

1. CONSTRUCTION

Travel device consists travel motor and gear box.

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



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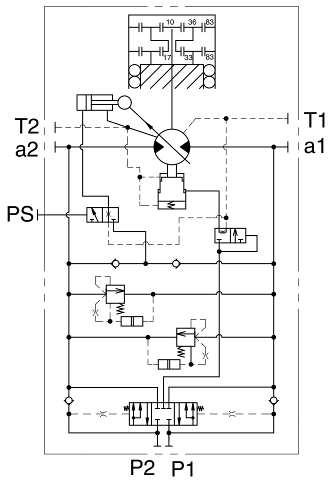
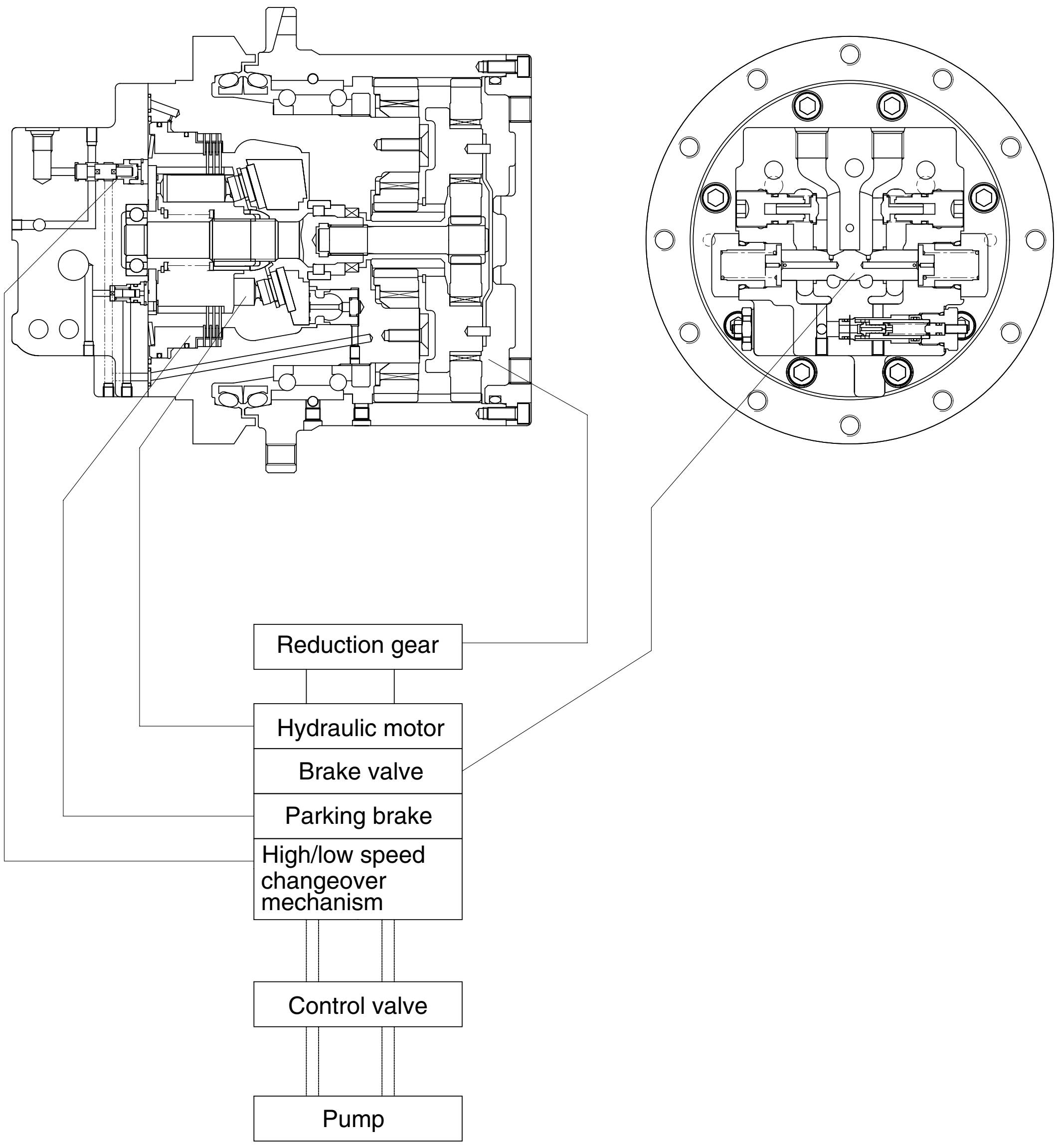


Hydraulic circuit

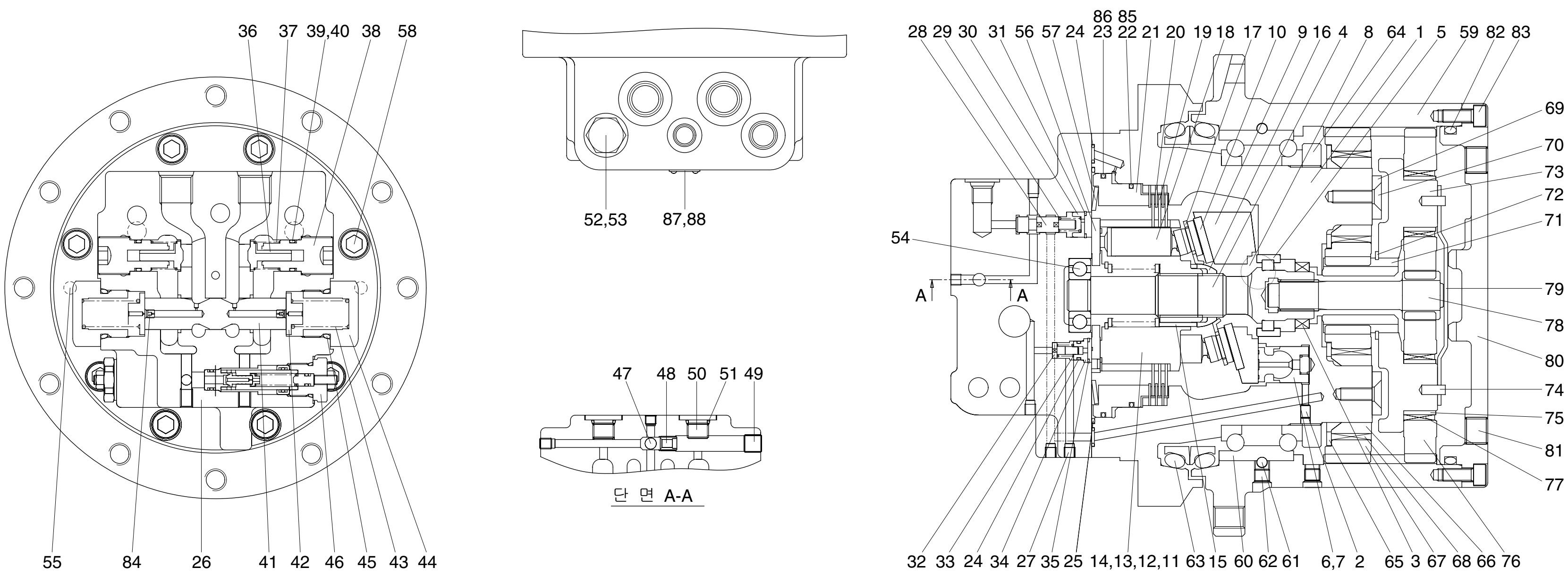
Port	Port name	Port size
P1	Main port	PF 1/2
P2	Main port	PF 1/2
a1,a2	Gauge port	PT 1/4
T1,T2	Drain port	PF 3/8
Ps	2 speed control port	PF 1/4

1) BASIC STRUCTURE



5592TM02

2) STRUCTURE



555K2TM03

1	Shaft casing	16	Ball guide	31	Snap ring	46	Relief valve assy	61	Steel ball	76	Planetary gear
2	Expand	17	Set plate	32	Check	47	Steel ball	62	Plug	77	Needle bearing
3	Oil seal	18	Piston kit	33	Spring	48	Check seat	63	Floating seal	78	Drive gear
4	Shaft	19	Friction plate	34	Seat	49	Plug	64	Nut	79	Thrust plate
5	Bearing	20	Parking plate	35	Snap ring	50	Plug	65	Washer	80	Ring gear cover
6	Swash piston kit	21	Parking piston	36	Check	51	O-ring	66	Collar	81	Plug
7	Spring	22	O-ring	37	Spring	52	Plug	67	Planetary gear	82	O-ring
8	Swash steel ball	23	O-ring	38	Plug	53	O-ring	68	Needle bearing	83	Wrench bolt
9	Swash plate	24	O-ring	39	O-ring	54	Ball bearing	69	Plate	84	Orifice
10	Shoe plate	25	O-ring	40	Back up ring	55	Pin	70	Bolt	85	Back up ring
11	Cylinder block	26	Rear cover	41	Main spool kit	56	Valve plate	71	Sun gear	86	Back up ring
12	Spring seat	27	Plug	42	Spring seat	57	Spring plate	72	Snap ring	87	Name plate
13	Spring	28	Spool	43	Spring	58	Wrench bolt	73	Carrier	88	Rivet
14	Snap ring	29	Spring	44	Plug	59	Ring gear	74	Spring pin		
15	Pin	30	Stopper	45	O-ring	60	Angular bearing	75	Collar		

2. PRINCIPLE OF DRIVING

1) GENERATING THE TURNING FORCE

The high hydraulic supplied from a hydraulic pump flows into a cylinder (11) through valve casing of motor (26), and valve plate (56).

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

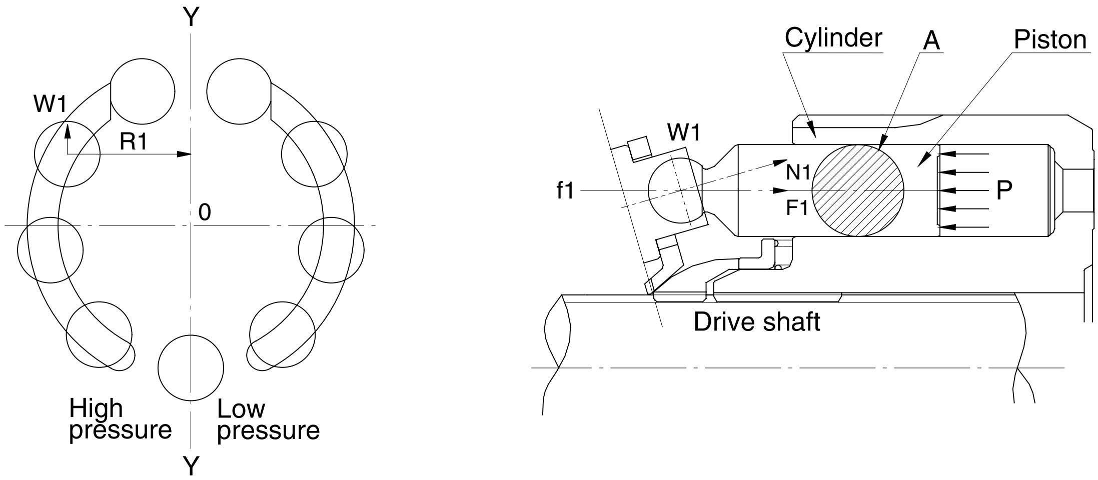
The high hydraulic can generate the force, $F1 = P \times A$ (P : Supplied pressure, A : water pressure area), like following pictures, working on a piston.

This force, F1, is divided as N1 thrust partial pressure and W1 radial partial pressure, in case of the swash plate (9) of a tilt angle, α .

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

The sum of torque ($\Sigma W1 \times R1$), generated from each piston (4~5pieces) on the side of a high hydraulic, generates the turning force.

This torque transfers the turning force to a cylinder (11) through a piston; because a cylinder is combined with a turning axis and spline, a turning axis rotates and a turning force is sent.



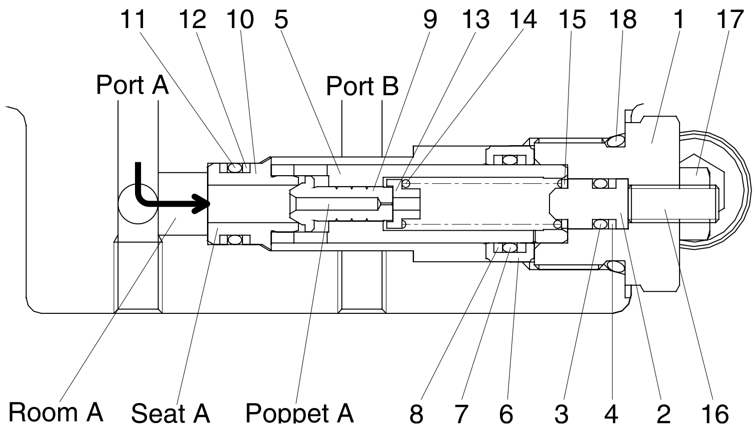
5592TM03

2) WORKING OF RELIEF VALVE

Relief valve carries on two functions of followings.

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

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



5592TM04

3) WORKING OF BRAKE

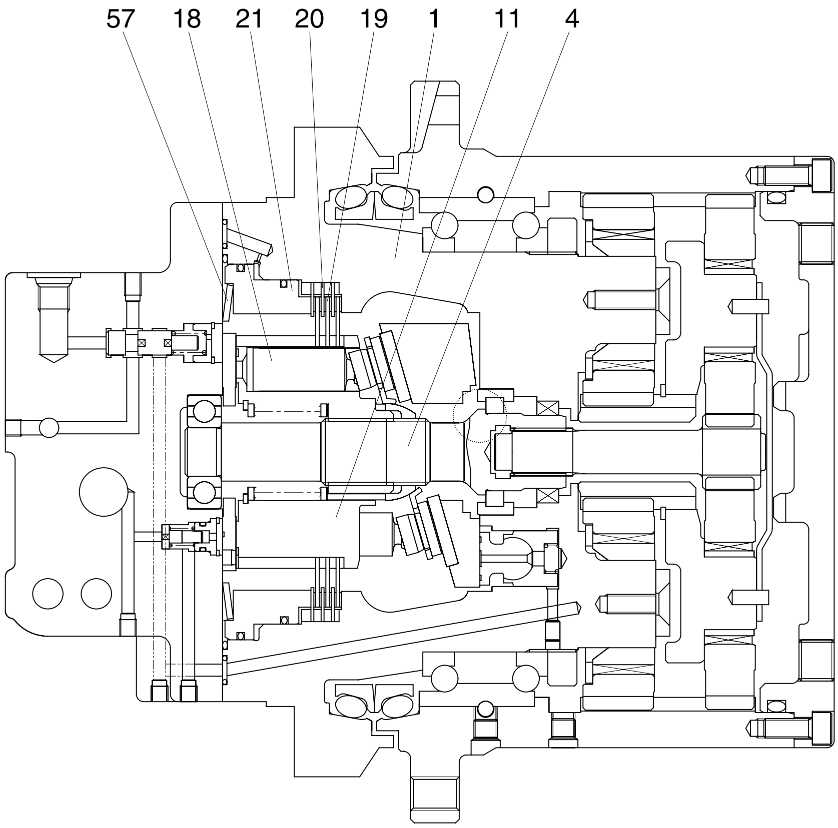
Brake operates the pressure supplied through SPOOL (simultaneous peripheral operation online) installed in valve casing (26) to the part of parking piston (21) and releases a brake.

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

The force of a brake is generated by the frictional force among a plate (20), brake piston (21) and a cylinder block (11) that is connected through spline which are fixed by shaft casing (1) with friction plate (19).

When a pressure does not work on the part of piston, brake spring presses brake piston; oil in a brake room flows into the drain of a motor through an orifice; in that time, brake piston compresses a frictional plate (19) and a detached plate in the middle of shaft casing and brake piston according to the force plate springs (57); finally, it makes a frictional force.

This frictional force helps the brake fixing a turning axis (3) connected by a cylinder and spline operated.



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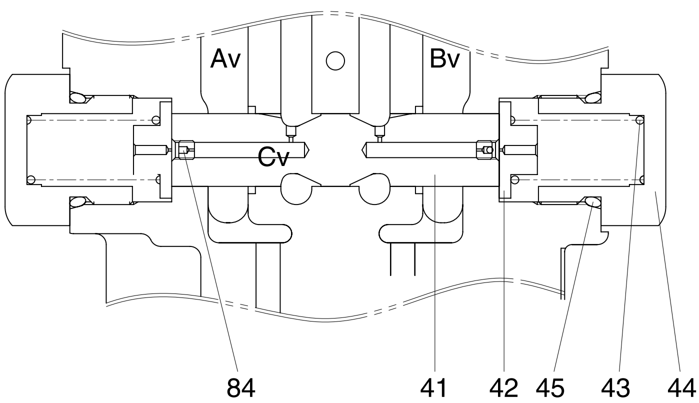
4) COUNTERBALANCE VALVE

Av port is connected into a hydraulic pump and Bv port is into a tank. Hydraulic pump supplying oil is come into Av → Cv room. In accordance with spring force (43) that is working on the spool's side it moves to the spool (41) on the right side which is medium position and that time motor is turning.

When the spool (41) is come back to the medium position that time hydraulic motor is stopped.

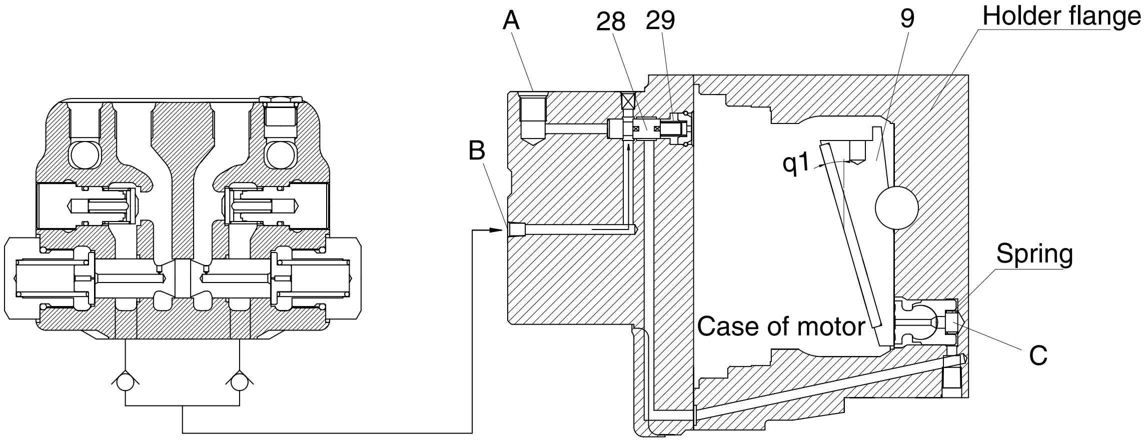
In accordance with spool's returning speed and shape control the working oil that is returning from hydraulic motor smoothly stopping the motor.



555K2TM07

4) HIGH/LOW SPEED CHANGEOVER MECHANISM

(1) At low speed-at pilot pressure of less than 10 kgf/cm^2 (0.98 Mpa)

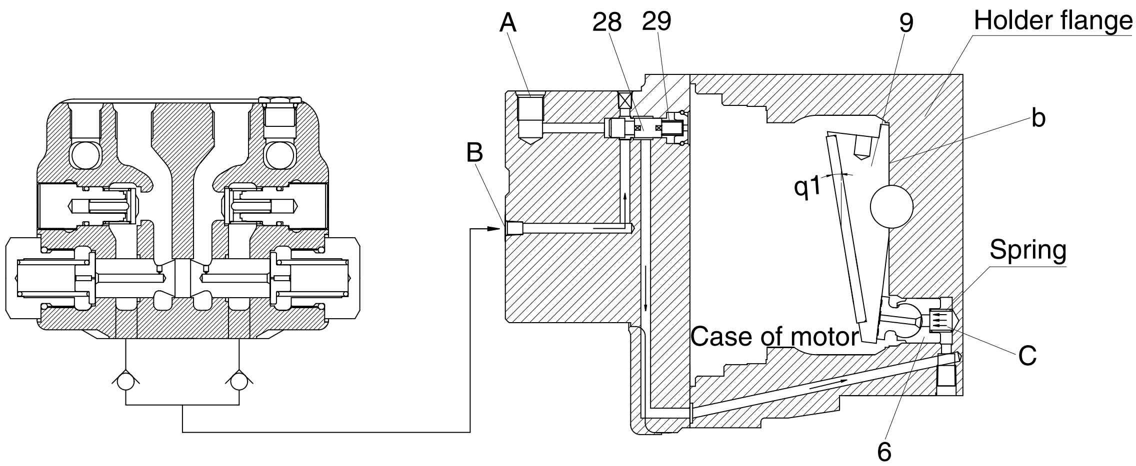


5592TM05

When no pilot pressure is supplied from port (A) at a pressure of 10 kgf/cm^2 (0.98 Mpa) or less, spool (28) is pressed toward the left by the force of spring (29), the pressurized oil supply port B is shut off, and oil in chamber (C) is released into the motor case via spool (28).

Consequently, swash plate (9) is tilted at a maximum angle (θ 1°) and the piston displacement of hydraulic motor becomes maximum, thus leading to low-speed rotation.

(2) At high speed-at pilot pressure of 10 kgf/cm^2 (0.98 Mpa) or more



5592TM06

When a pilot pressure is supplied from port (A) at a pressure of 10 kgf/cm^2 (0.98 Mpa) or more, the pressure overcomes the force of spring (29) and spool (28) is pressed toward the right. The pressurized oil at supply port (B) is then introduced into chamber (C) via spool (28).

Piston (6) pushes up swash plate (9) until it touches side (b) of the holder flange.

At this time, swash plate (9) is tilted at a minimum angle (θ 2°) and the piston displacement of hydraulic motor becomes maximum, thus leading to high-speed rotation.

2. REDUCTION GEAR

1) FUNCTION

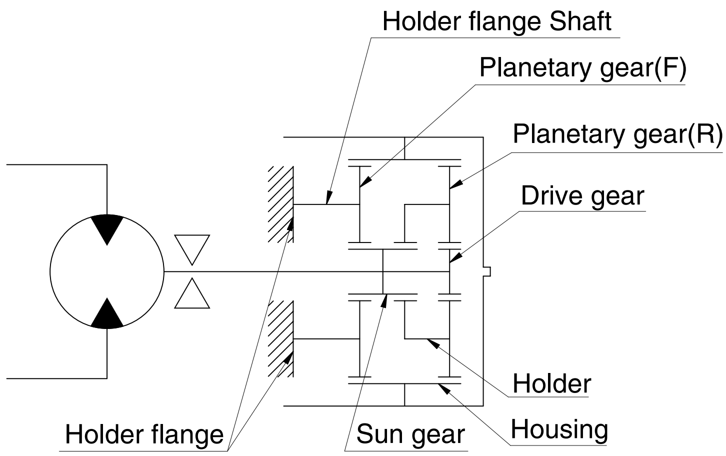
The reduction gear unit consists of a combination of simple planetaly gear mechanism.

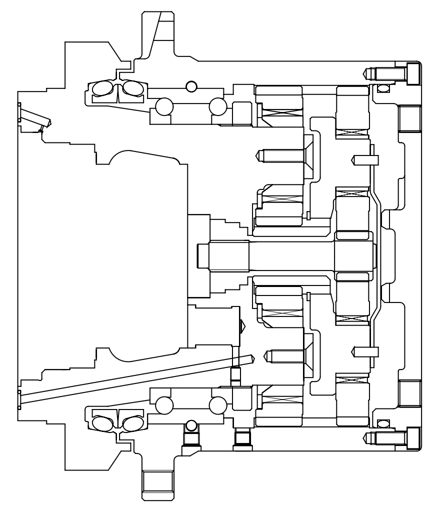
This mechanism reduce the high speed rotation from the hydraulic motor and convert it into low speed, high torque to rotate the hub (or case), which in turn rotates the sprocket.

2) OPERATING PRINCIPLE

Shaft → Drive gear → Planetary Gear R → Housing

→ Holder → Sun gear → Planetary Gear F →Rotation of Housing





5592TM07

Reduction ratio = (Housing Teeth/Drive Gear Teeth + 1)

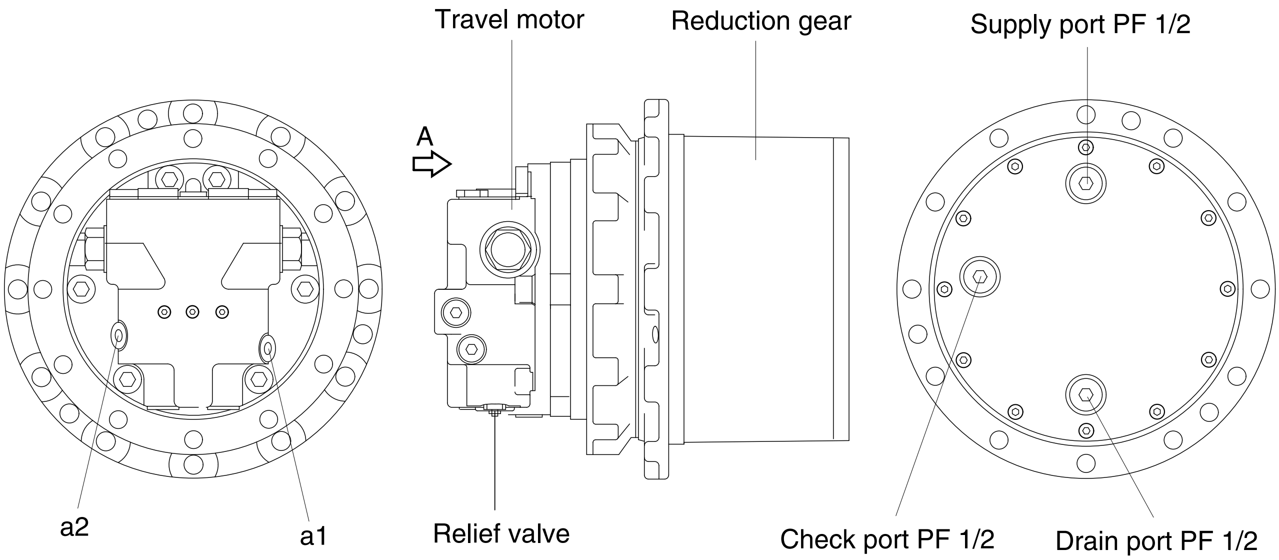
×(Housing Teeth/Sun Gear Teeth + 1) - 1.

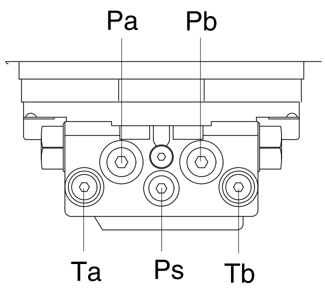
TRAVEL DEVICE (TYPE 2, MACHINE SERIAL NO. : #5982-)

1. CONSTRUCTION

Travel device consists travel motor and gear box.

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

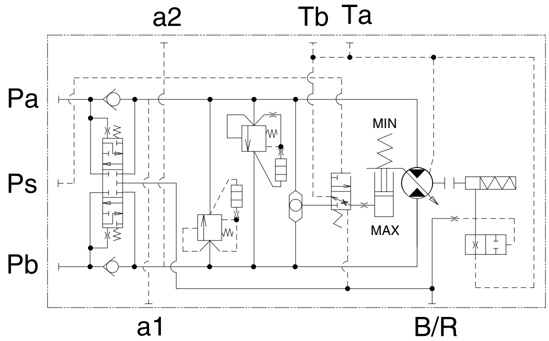




VIEW A

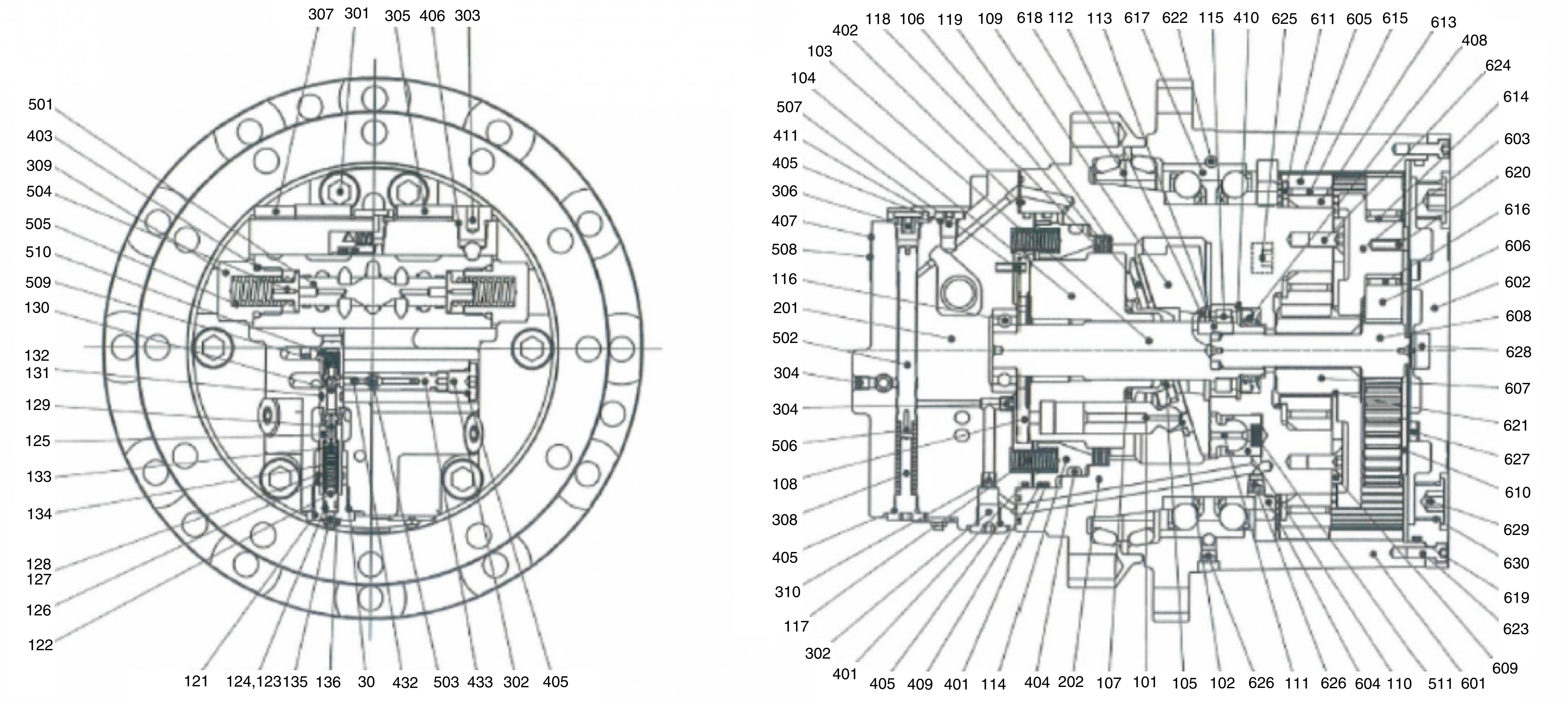
HX60A2TM50E

Port	Port name	Port size
Pa	Main port	PF 1/2
Pb	Main port	PF 1/2
a1,a2	Gauge port	PT 1/4
Ta,Tb	Drain port	PF 3/8
Ps	2 speed control port	PF 1/4



Hydraulic circuit

2) STRUCTURE



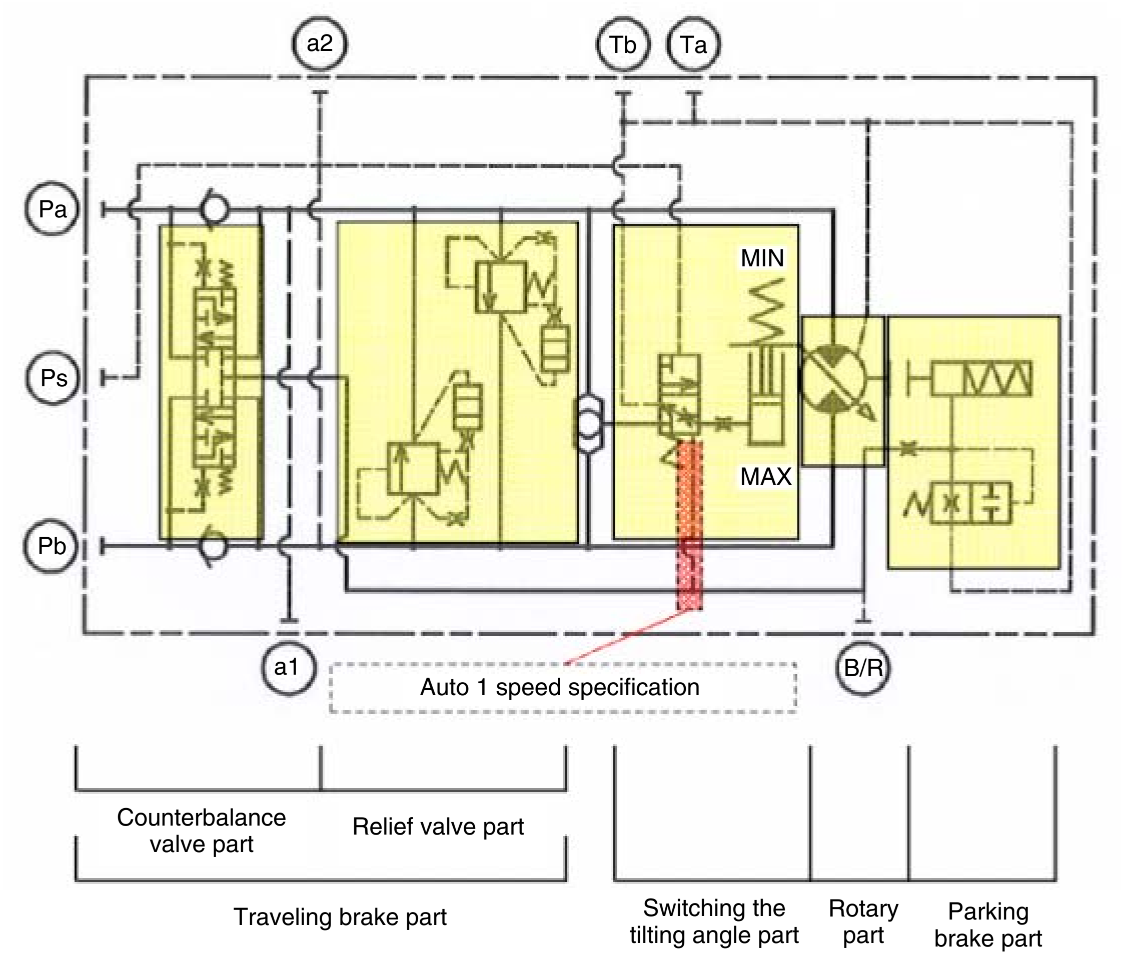
HX60A2TM51

30 Relief valve assy
101 Piston
102 Shoe
103 Drive shaft
104 Cylinder block
105 Spherical bushing
106 Set plate
107 Cylinder spring
108 Valve plate
109 Swash plate
110 Swash piston
111 Swash shoe
112 Pivot
113 Pivot pin
114 Brake piston
115 Roller bearing
116 Ball bearing
117 Brake spring
118 Friction plate
119 Separator plate
121 Plug
122 Guide
123 O-ring
124 Back up ring
125 Sleeve
126 Piston
127 O-ring
128 Back up ring
129 Poppet
130 Poppet seat
131 O-ring
132 Back up ring
133 Spring seat
134 Spring
135 Adjust screw
136 Hex nut
137 O-ring
201 Valve casing
202 Casing
301 Socket bolt
302 Plug
303 Drain plug
304 NPTF plug
305 Dust plug
306 Dust plug
307 Dust plug
308 2 speed plug
309 Set plug
310 Restrictor
311 Plug
401 O-ring
402 O-ring
403 O-ring
404 O-ring
405 O-ring
406 O-ring
407 Name plate
408 Oil seal
409 Back up ring
410 Snap ring
411 O-ring
432 Seat
433 Seat casing
501 Main spool
502 2 speed spool
503 Steel ball
504 Plunger
505 Main spool spring
506 2 speed spool spring
507 Spring pin
508 Pin
509 Spring cap
510 Cap
511 Swash piston spring
601 Housing
602 Cover
603 Holder
604 Ring nut
605 Planetary gear F
606 Planetary gear R
607 Sun gear
608 Ring nut
609 Thrust plate F
610 Thrust plate R
611 Thrust washer
613 Collar
614 Inner race
615 Needle bearing
616 Needle bearing
617 Angular bearing
618 Floating seal kit
619 O-ring
620 Spring pin
621 Snap ring
622 Steel ball
623 Socket bolt
624 Bolt
625 Plug
626 Plug
627 Side plate A
628 Side plate B
629 Plug
630 O-ring

2) MAJOR COMPONENT

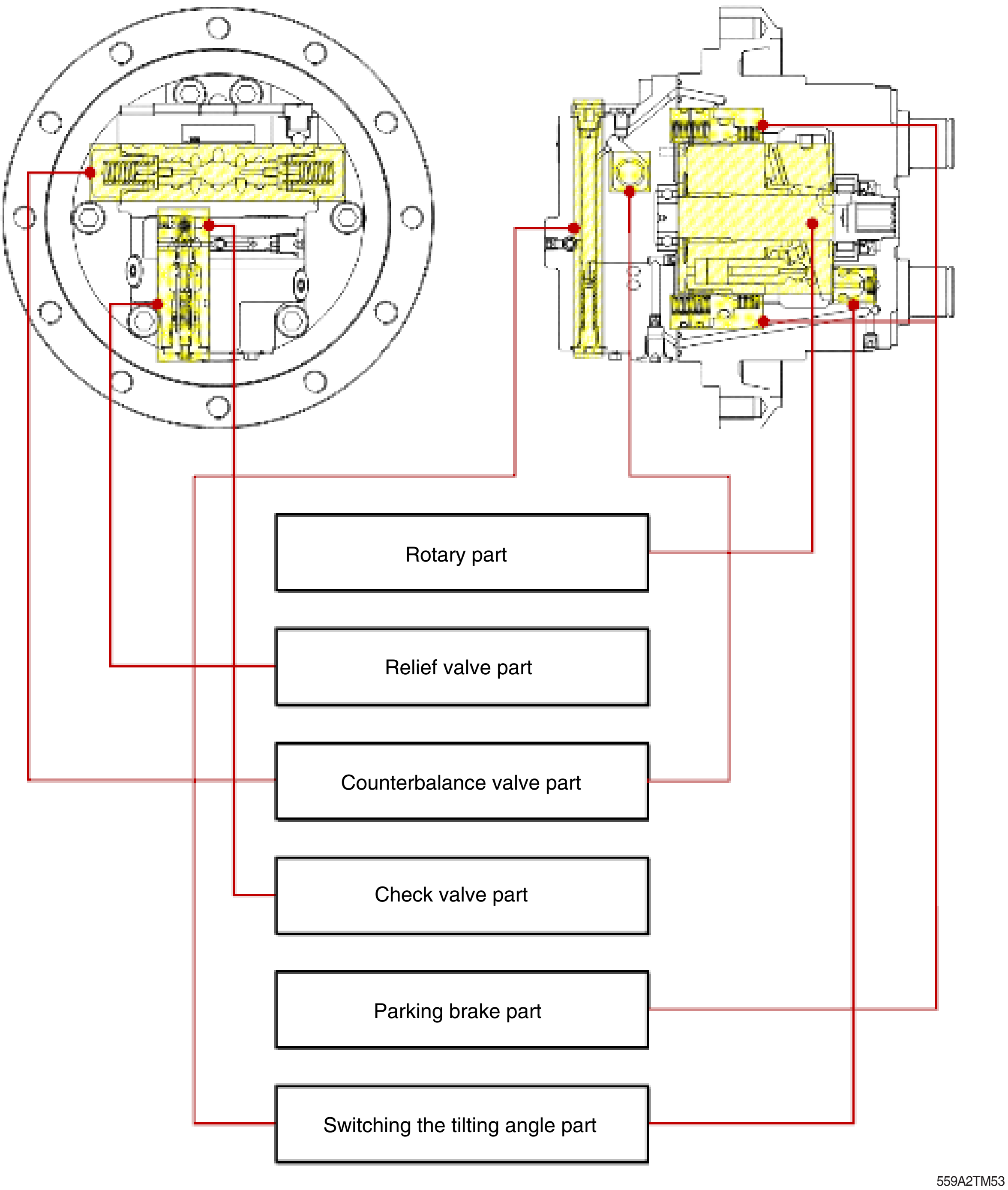
This product is only composed of hydraulic motor. Reduction parts are not composed.
This hydraulic motor is variable swash plate axial piston motor. It is composed of 4 parts.

- Rotary part which makes rotatory power
- Traveling brake valve part
- Parking brake part
- Switching the tilting angle part (auto 1/2 speed control part)



559A2TM52

3) BASIC STRUCTURE



2. WORKING PRINCIPLE

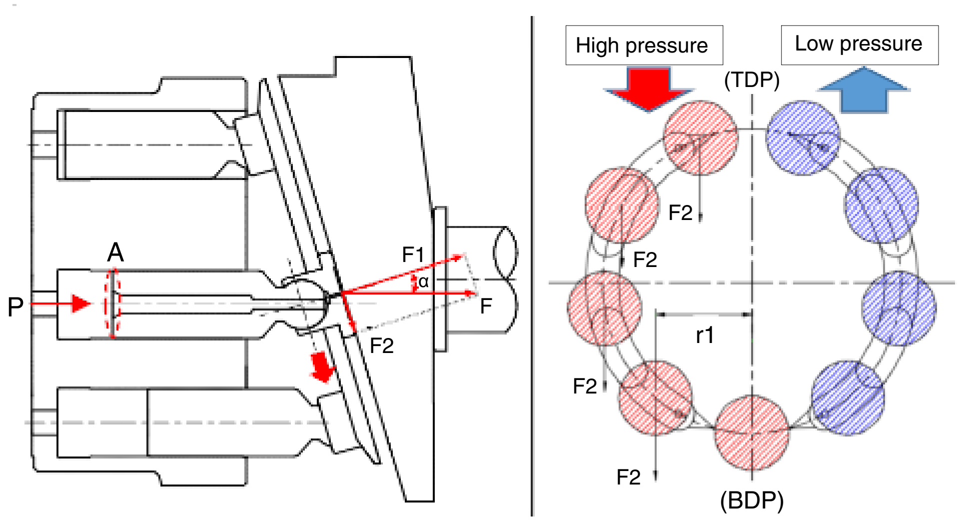
1) HYDRAULIC MOTOR SECTION

When high pressure oil passes from pump through the inlet port of the valve plate(108) and flows into the cylinder (104) as shown in figure, the oil pressure acts upon the piston (101) to generate the axial force "F". The force "F" acts on the swash (109) plane in the axial direction.

F = P×A (P : Pressure, A : Area)

The swash plate (109) is fixed with an inclination angle of α to the axis of the drive shaft (103). Therefore, this force is divided into two vector forces through the shoe (102) : namely, the force F1 vertical to the swash plate (109) and the force F2 perpendicular to the drive shaft (103).
Because of the force "F2", piston (101) slides along with shoe (102) in the direction of the arrow in Figure. This force "F2" is transmitted to the cylinder block (104) via the piston (101) and generates a couple of forces which turn the output drive shaft (103).
In the cylinder block (104) nine pistons are equispaced and the pistons connected to the high pressure oil inlet ports give their rotating torque to the output shaft sequentially.
When the oil inflow/outflow direction are reversed, the rotating direction of the output shaft is reversed.
The theoretical output torque "T [N/m]" is given by the flowing.

$T = \dfrac{P \times q}{2\pi}$ P : Effective pressure difference (Mpa), q : Displacement per revolution (cm³)



559A2TM54

2) TRAVELING BRAKE VALVE

Traveling brake valve is composed of relief valve, counterbalance valve and check port A is connected with hydraulic pump and port B is connected with tank.

(1) In case of traveling

When the compressed oil, which is supplied along the inlet port, exceeds certain pressure, it pushes cap (509). And, it is supplied to one side of the casing (202).

It is trying to rotate the hydraulic motor.

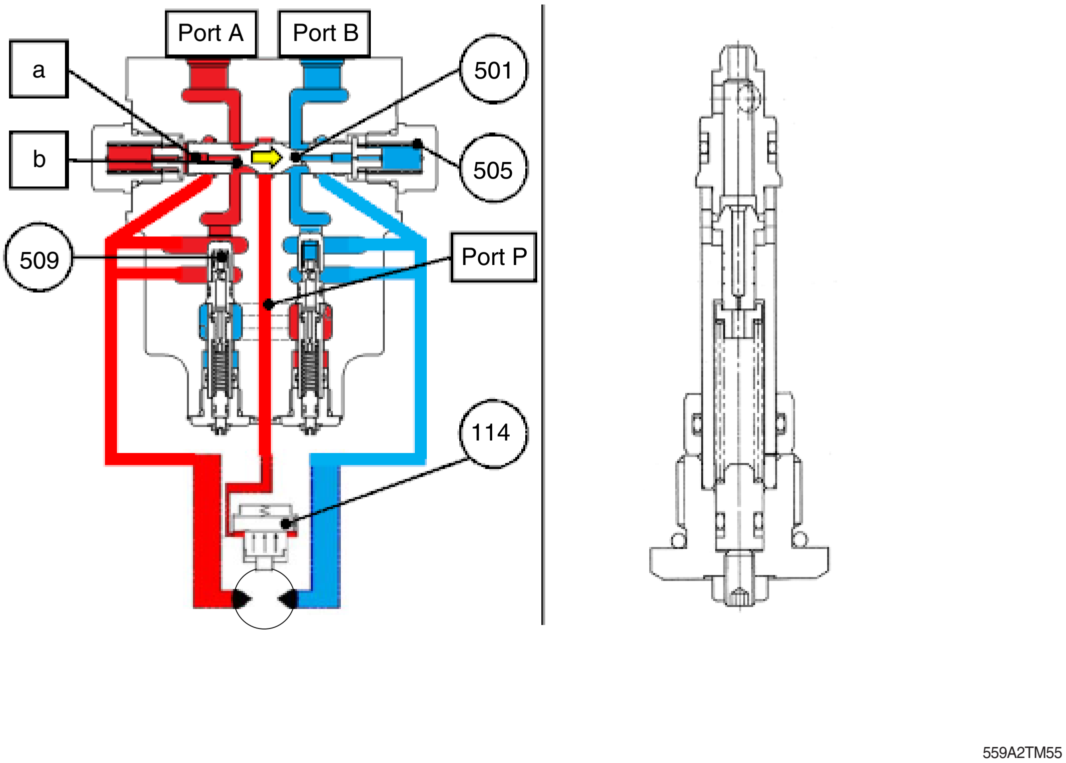
At the same time, the compressed oil enters the chamber {a} along small hole {b} of main spool (501) and acts on the face of main spool (501). After increasing pressure of oil, when this pressure exceeds the spring elasticity force of main spool spring (505), main spool (501), which is held in neutral by the spring elasticity force, moves to the right.

The inlet side and outlet side that was blocked by main spool (501) during stop connect with each other. So, return oil returns to the oil tank, so the hydraulic motor rotates.

Furthermore as main spool (501) moves, the path of parking brake (port P) is connected.

When compressed pressure, which enter to (port P) , becomes brake release pressure, it operates brake piston (114) and parking brake is released.

If the direction of oil inlet is reversed, main spool (501) and check valve motion is reversed. Output rotation direction is also reversed.



(2) In case of stop

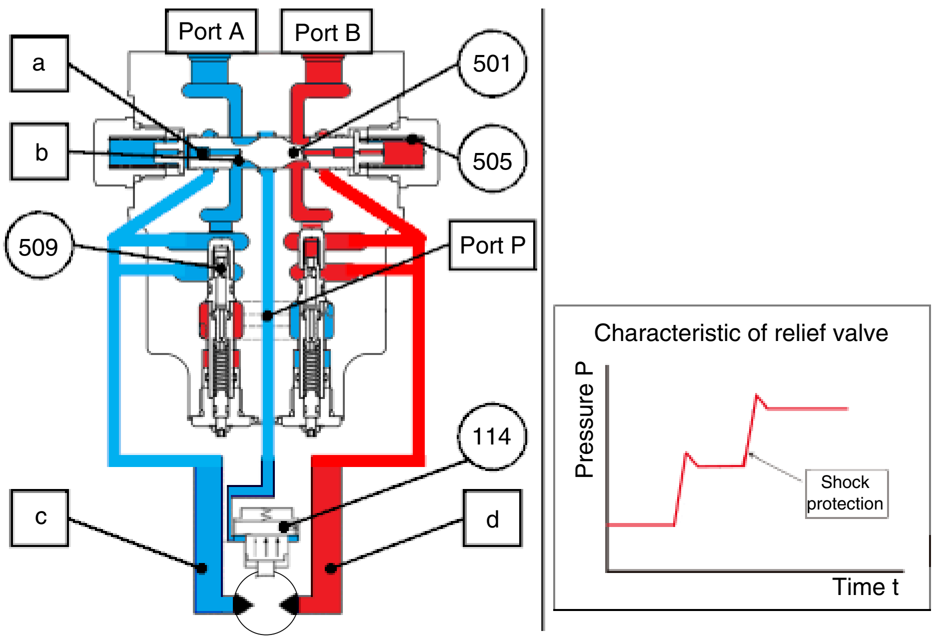
If the pressure supplied along the port to the inlet breaks while traveling, the pressure applied to the section of the main spool (501) is removed. Therefore, the main spool (501), which was pushed to the right, returns to neutral due to the spring elasticity force of the main spool spring (505).

The rotary part continues to rotate under inertia even if pressure is lost from the inlet side. As the main spool (501) returns to neutral, the connected inlet and outlet sides of the flow path are blocked. Since there is no escape location for the returned oil, the pressure of the exit side (D) is raised.

The returned oil with increased pressure enters the relief valve (30). if it exceeds the set pressure of the relief valve (30), operates the relief valve (30). The flow path from the outlet side {D} to the inlet side {C} is connected. And it controls the pressure on the outlet side.

At the same time it prevents cavitation on the inlet side.

It also relieves the shock during stop while controlling pressure on the outlet side with relief valve (30) in two stages, and apply soft braking to the hydraulic motor by applying an orifice and notch on the main spool (501).



559A2TM56

(2) In case of stop

If the pressure supplied along the port to the inlet breaks while traveling, the pressure applied to the section of the main spool (501) is removed. Therefore, the main spool (501), which was pushed to the right, returns to neutral due to the spring elasticity force of the main spool spring (505).

The rotary part continues to rotate under inertia even if pressure is lost from the inlet side. As the main spool (501) returns to neutral, the connected inlet and outlet sides of the flow path are blocked. Since there is no escape location for the returned oil, the pressure of the exit side (D) is raised.

The returned oil with increased pressure enters the relief valve (30). if it exceeds the set pressure of the relief valve (30), operates the relief valve (30). The flow path from the outlet side {D} to the inlet side {C} is connected. And it controls the pressure on the outlet side.

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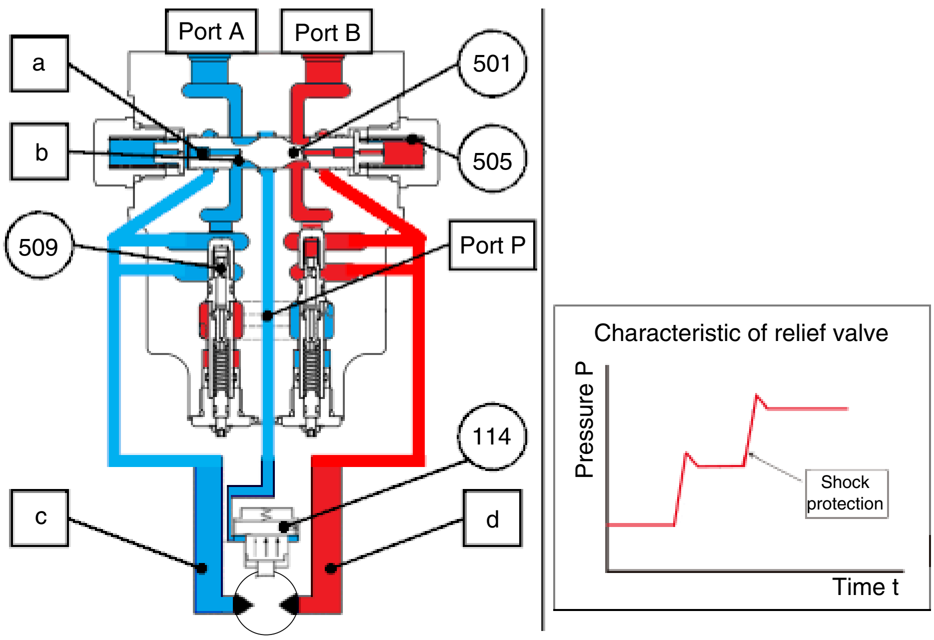


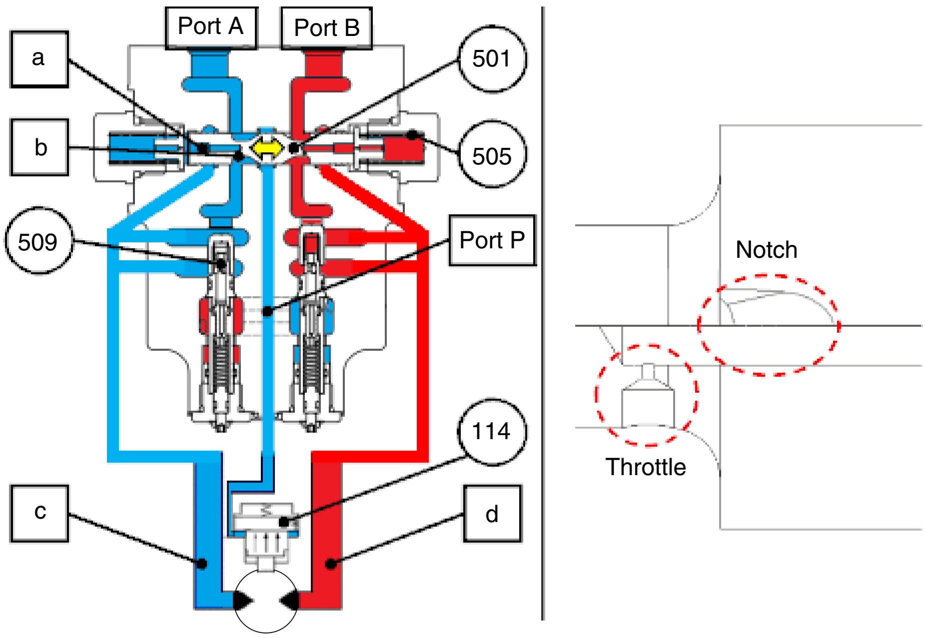
559A2TM56

(3) In case of overrun

Overrun is when the excavator's speed is increased by the it's gravity (inertia), such as when an excavator is going downhill, causing the hydraulic motor to rotate above the supply flow of the hydraulic pump.

In the case of overrun, the compressed oil on the inlet side is entered into the rotary and the pressure on the inlet side is reduced. Therefore, due to the spring elasticity force of the main spool spring (505), main spool (501) returns to neutral, as it stops.

At the same time, back pressure is generated due to the throttle (notch of main spool) between the outlet side (D) and the outlet port (port B) passage. The back pressure controls the return speed of the main spool (501) and hydraulic motor, which is about to be rotated by inertia forces, is decelerated. The operation of main spool (501) is controlled by the notch of main spool (501) and throttle. So motor smoothly moves according to the supply flow rate.



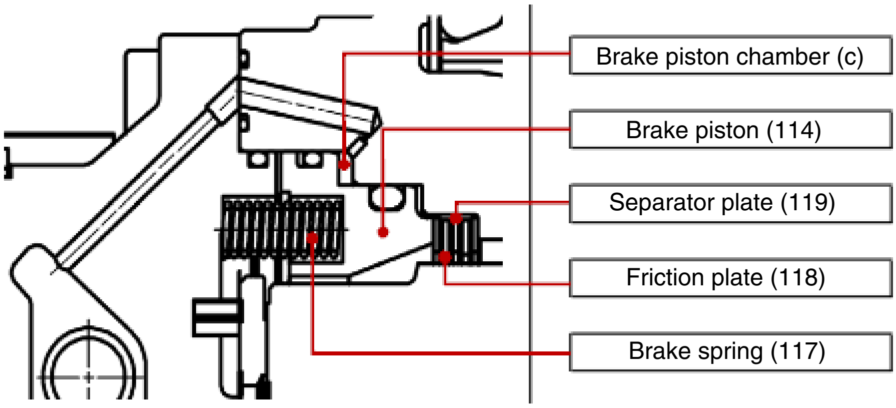
559A2TM57

3) PARKING BRAKE

The parking brake is wet-type multiple disk brakes. It is a negative brake system which is released when the brake release pressure enters the brake piston chamber.

The internal structure of parking brake is shown in figure. Friction plate (118) and separator plate (119) are alternately stacked, and acting on springs to produce brake torque with friction forces.

It prevents not only the braking of excavators but also overrun or slip during traveling and stopping on the slip.



559A2TM58

(1) In case traveling

The cylinder block (104) is connected to the drive shaft (103) with spline. In addition, the separator plate (119) is restrained from circumferentially-rotating by an arc groove cut on the casing (202).

The friction plate (118) which is connected to the arc groove cut on cylinder block (104), can be rotated along the cylinder block (104).

When pressurized oil is supplied from the inlet side during traveling operation, the blocked flow path is opened. so pressurized oil is supplied to the brake piston chamber (c) that is comprised inside brake piston (114) and casing (202).

If the hydraulic force F4 of the brake piston chamber (c) is greater than the spring elasticity force F3 of the brake spring (117), then brake piston (114) move to valve casing. (above brake release pressure)

F3 = k x n , k : Spring constant, x : Spring stroke, n : Number of spring brake

F4 = P × (A1 - A2), P : Main pressure of input, (A1 - A2) : Area difference of brake piston

The force that friction plate (118) and separator plate (119) pressurize the casing (202) disappears and the brake releases.

So, the hydraulic motor can rotate.

(2) In case of stop

If the pressurized oil supplied by the inlet is cut off during stop, the pressurized oil supplied to the brake piston chamber (c) will also be blocked. (below brake release pressure)

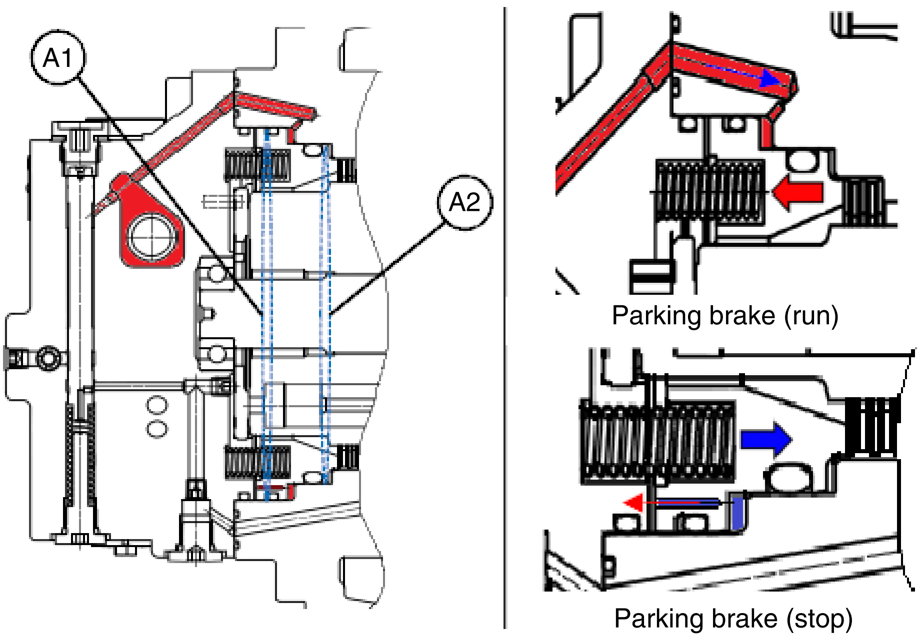
If the spring elasticity force F3 of the brake spring (117) is greater than the hydraulic force F4 of the brake piston chamber (c), then brake piston (114) move to casing by spring elasticity force. The hydraulic oil of the brake piston (114) is drained through the throttle. Therefore brake piston (114) smoothly operates.

F3 < F4

F3 = k x n , k : Spring constant, x : Spring stroke, n : Number of spring brake

F4 = P × (A1 - A2), P : Main pressure of input, (A1 - A2) : Area difference of brake piston

When the brake piston (114) pushes casing (202) by the brake spring (117), the frictional force appears between friction plate (118), casing (202), separator plate (119) and brake piston (114). parking brake appears by friction force and spring elasticity of the brake spring (117), the drive shaft (103) is constrained.



559A2TM59

4) 1/2 SPEED SWITCHING OPERATION (AUTOMATIC 1/2 SPEED CONTROL PART)

(1) Low speed traveling

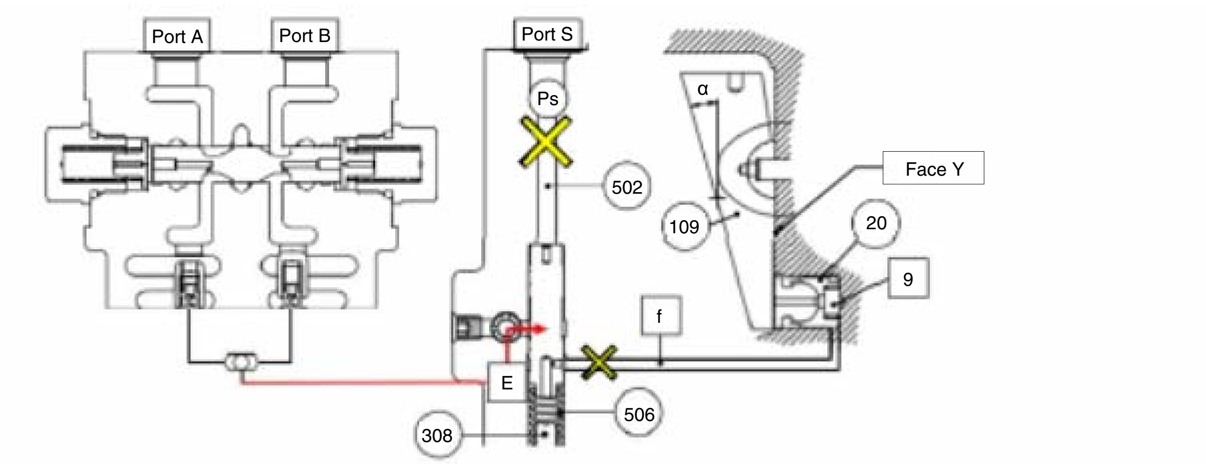
If pilot pressure is not supplied on pilot port (port S), 2 speed spool (502) is pushed in the direction of the port S by spring elasticity of 2 speed spool spring (506).

As a result, the compressed oil from the high pressure selection check valve (E) is not connected to the swash piston chamber (g).

The compressed oil of swash piston chamber{g} is drained through the flow path of 2 speed spool chamber (f).

So, the compressed oil from the high pressure selection check valve (E) is not connected to the swash piston chamber {g}. As a result, the swash plate (109) will be the maximum angle α and the stroke of the piston (101) will be long. So, a large amount of oil will be required for rotating the motor once.

Therefore the displacement of the hydraulic motor is maximized and rotated at low speed.



559A2TM60

(2) High speed traveling

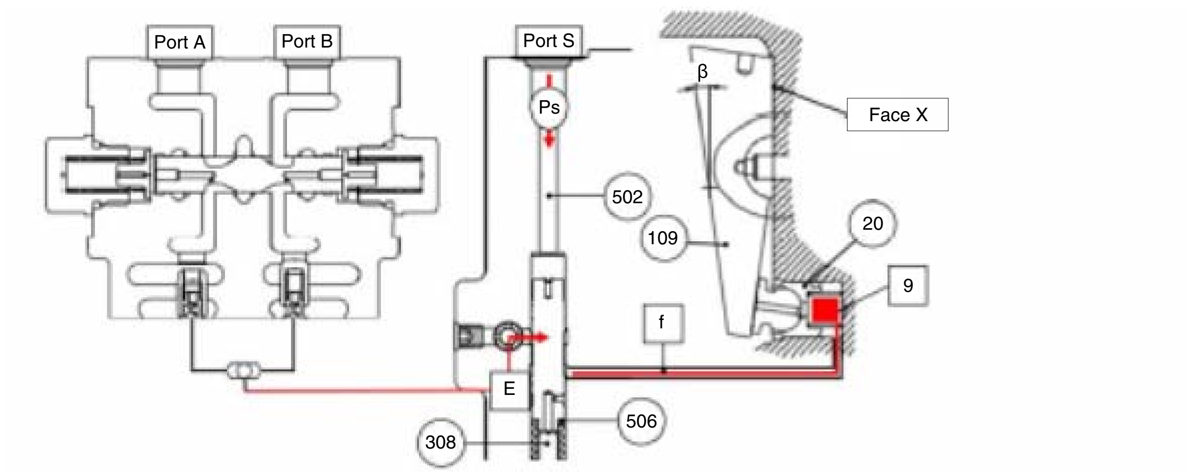
If the pilot pressure (20~50 kgf/cm^2) is supplied to the port (port S), the pilot pressure overcomes the oil pressure in the main port and the spring elasticity force of the 2 speed spool spring (506). and it pushes the 2 speed spool (502) to the 2 speed plug (308) direction.

This is why the pressure from the high pressure selection check valve (E) is connected to the flow path (f).

The pressurized oil flows into the {g} chamber along the flow path {f} and pushes swash piston (20) to contact the face 'X' of swash plate (109) with the wall of the casing (202).

As a result, the swash plate (109) is the minimum angle β. Because stroke of piston (101) is shortened, a small amount of oil is used for one revolution.

Therefore, the displacement of the hydraulic motor is minimized and is rotated at high speed.



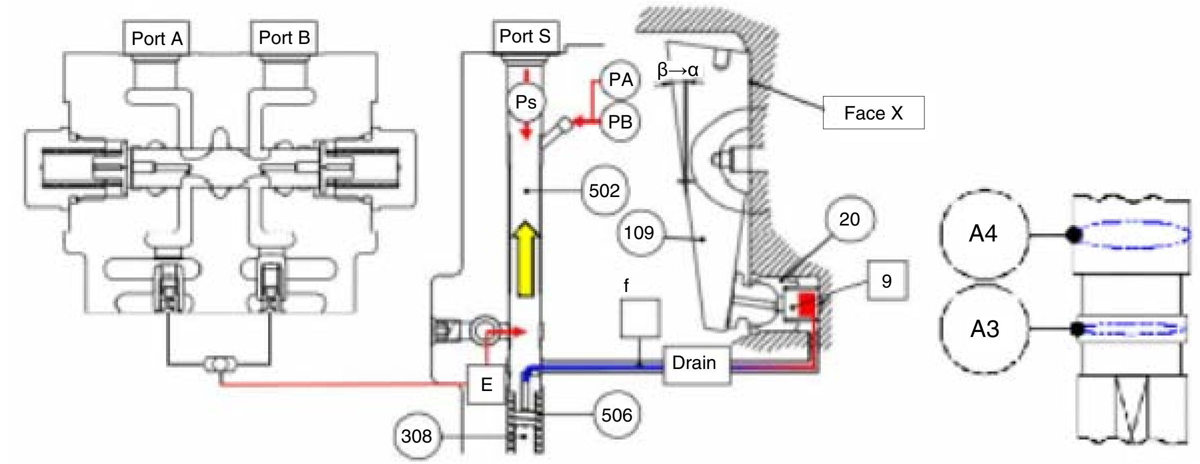
559A2TM61

(3) Automatic 1/2 speed control part

If the load is increased during the 2-speed driving, the hydraulic pressure on the main port is increased. The pressure (△P) of main port and spring elasticity force of 2 speed spool spring (506) will overcome the pressure of pilot, 2 speed spool (502) is pushed in port S direction.

F5 < [{F6 × (A4 - A3)} + (Fspring)]
F5 = PS × A3, PS : Pilot pressure, A3 : 2 speed spool area
F6 = (PA or PB) × (A4 - A3), (PA or PB) : Main pressure difference between inlet side and outlet side
Fspring = K x X ; K : Spring constant of 2 speed spool spring, X : Spring stroke

Therefore, flow path from the high pressure selection check valve (E) to (f) is blocked.
And the pressure of (g) is slowly drained to 2 speed spool chamber (f) through throttle and a notch of 2 speed spool.
The angle of swash plate (109) transfers from β to α, and the motor automatically switches from 2 speed to 1 speed to rotate at low speed.



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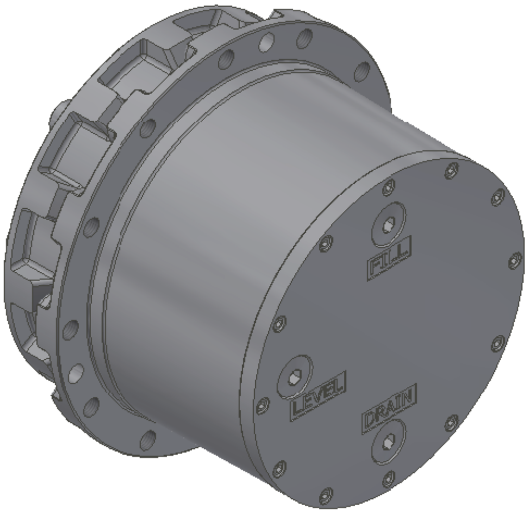
5) REDUCTION GEAR



559A2TM63

(1) Refer to the section drawing for the basic construction.

(2) The reduction gear consists of two stage planetary gears.

(3) The reduction ratio is determined by the number of teeth of the gear, and the reduction ratio is 42.439.
In other words, the number of revolutions of the hydraulic motor is transmitted to the output shaft at 1 / reduction ratio.

(4) The direction of rotation of the input and output shafts is opposite.

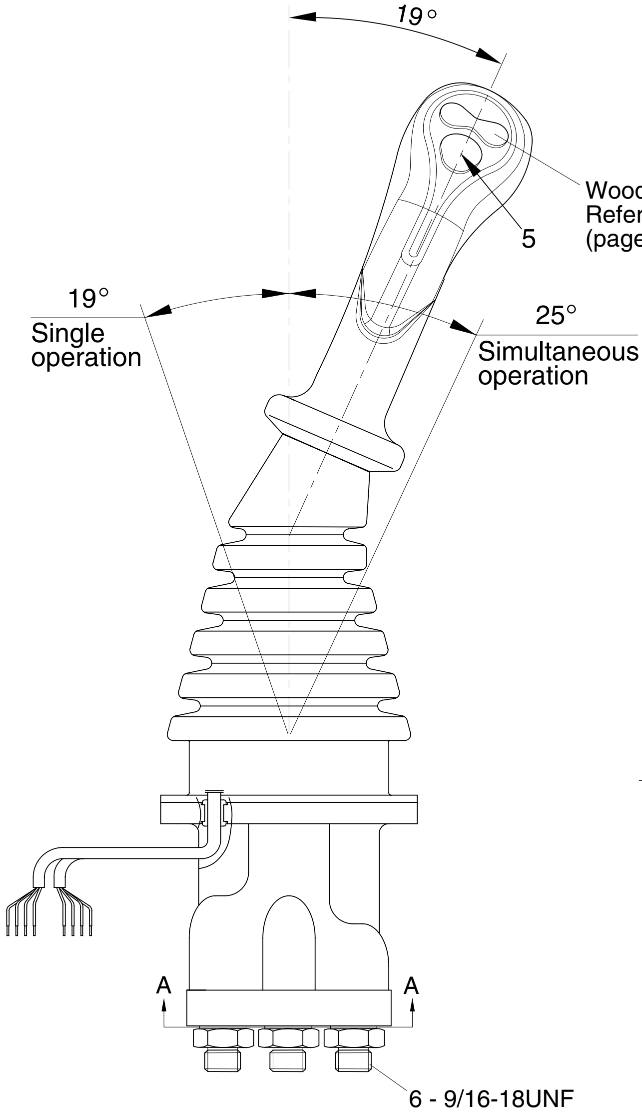
GROUP 5 RCV LEVER

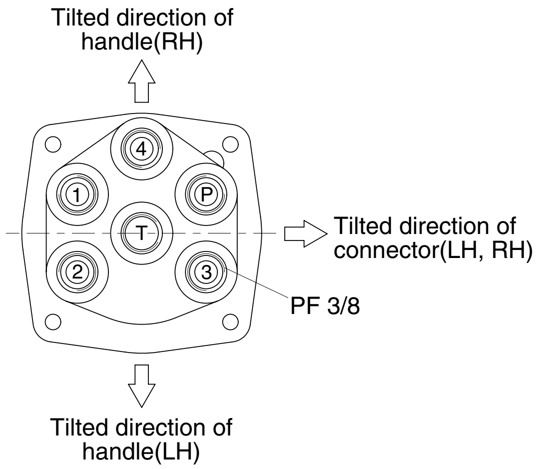
1. STRUCTURE

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.

Switches

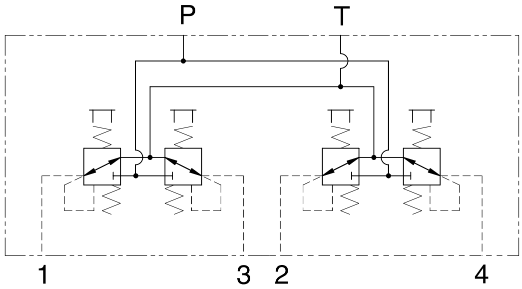
No.	LH	RH
5	Horn	Breaker





VIEW A

60W9S2RL01



Hydraulic circuit

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 in port	Boom down port	
3	Right swing port	Bucket in port	
4	Arm out port	Boom up port	

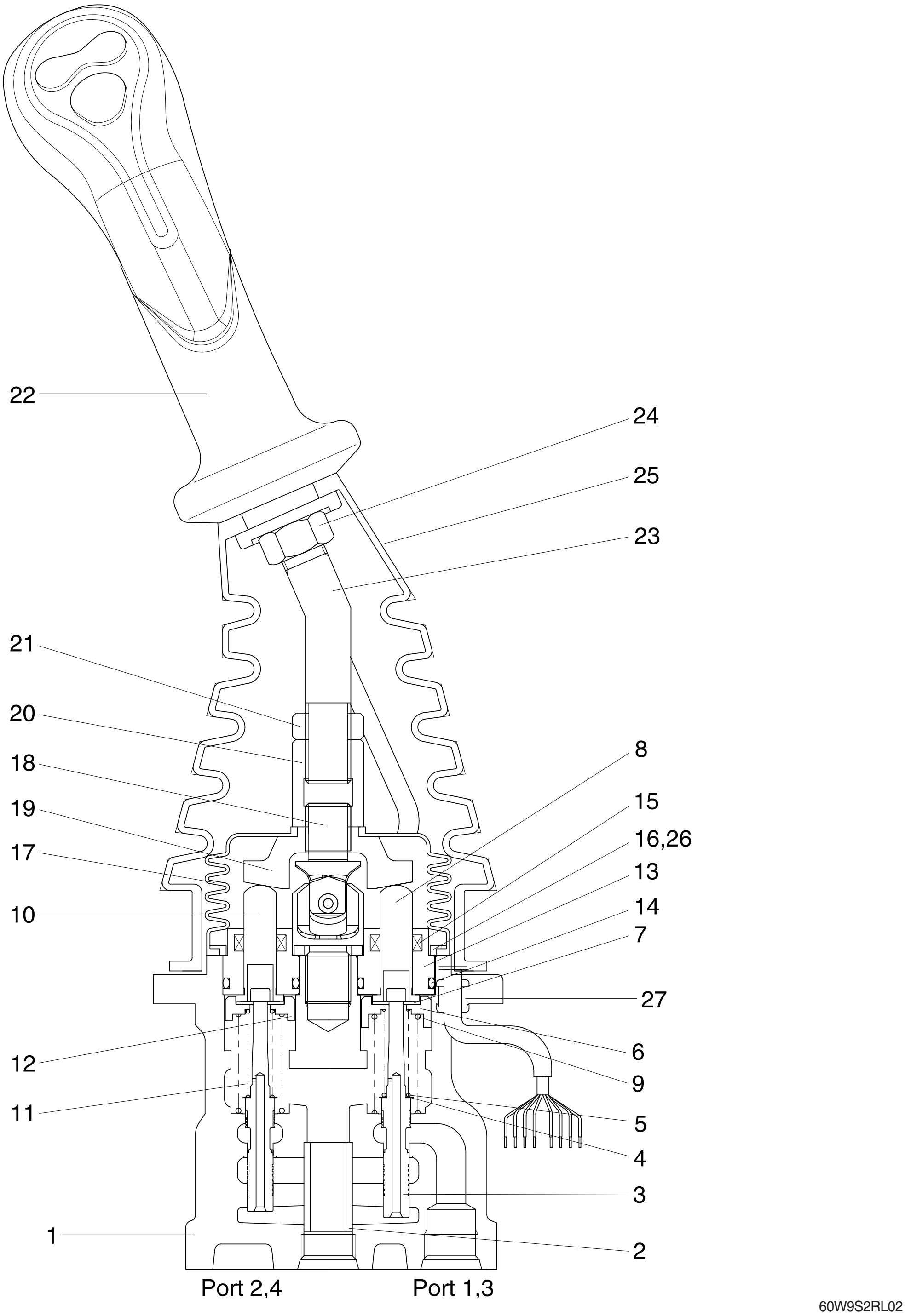
CROSS SECTION

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, spring (9), stopper (7), spring seat (6, 12) 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 (8, 10) 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.

CROSS SECTION



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

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

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 (8,10) is inserted and can slide in the plug (13).

For the purpose of changing the displacement of the push rod through the swash plate (19) and adjusting nut (20) are provided the handle (22) that can be tilted in any direction around the fulcrum of the universal joint (18) center.

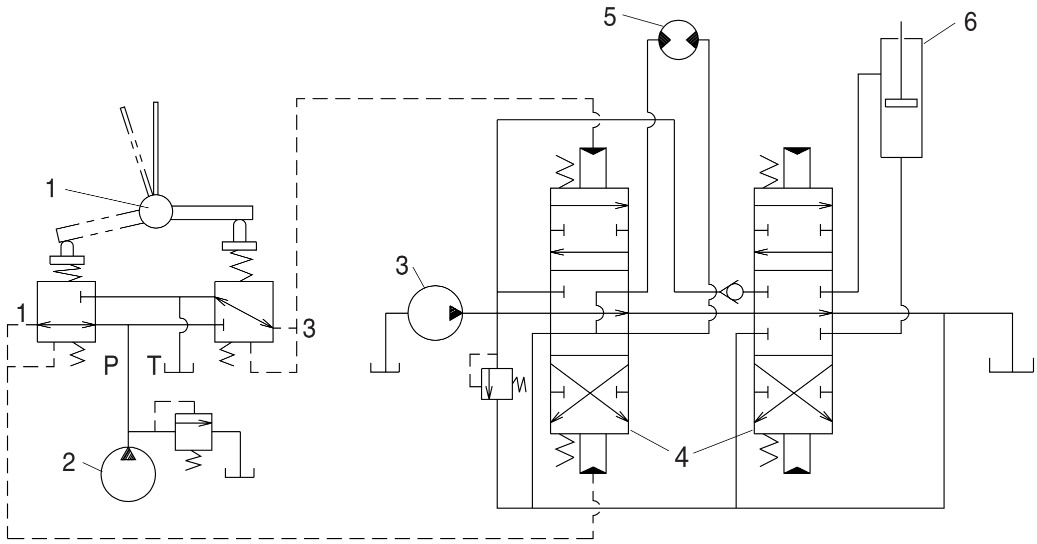
The spring (9) works on the case (1) and spring seat (6, 12) and tries to return the push rod (8,10) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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.

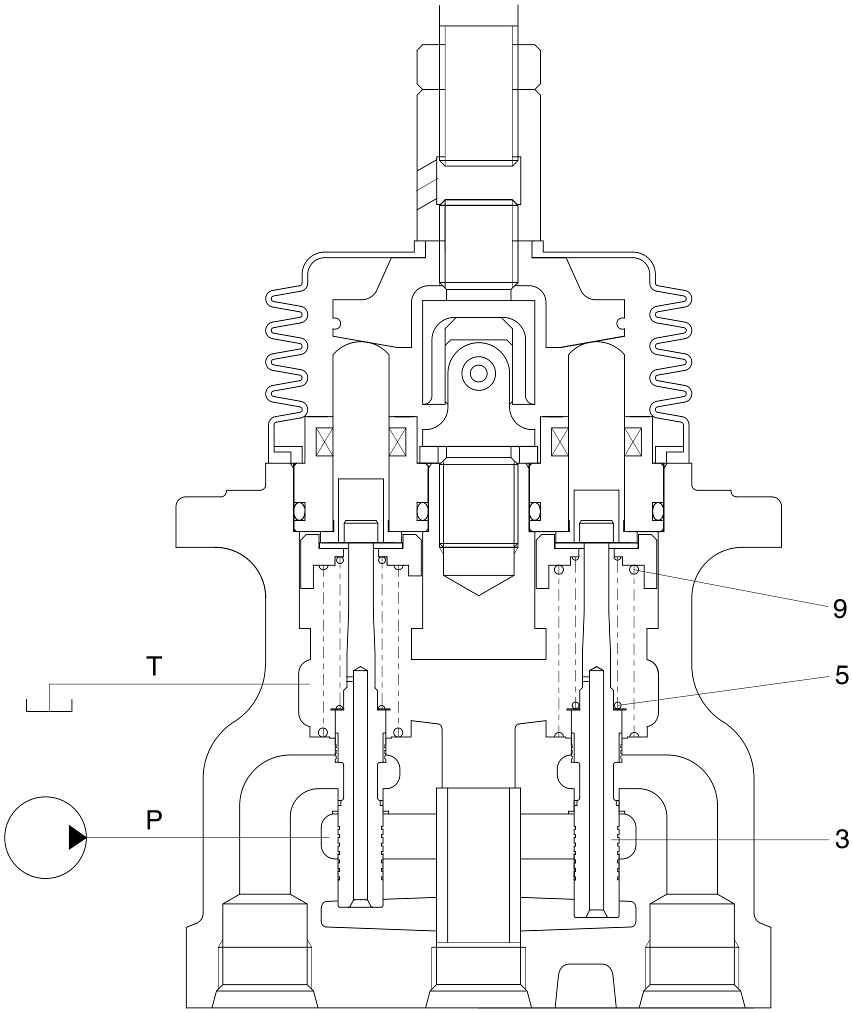
The diagram shown below is the typical application example of the pilot valve.



2-70

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

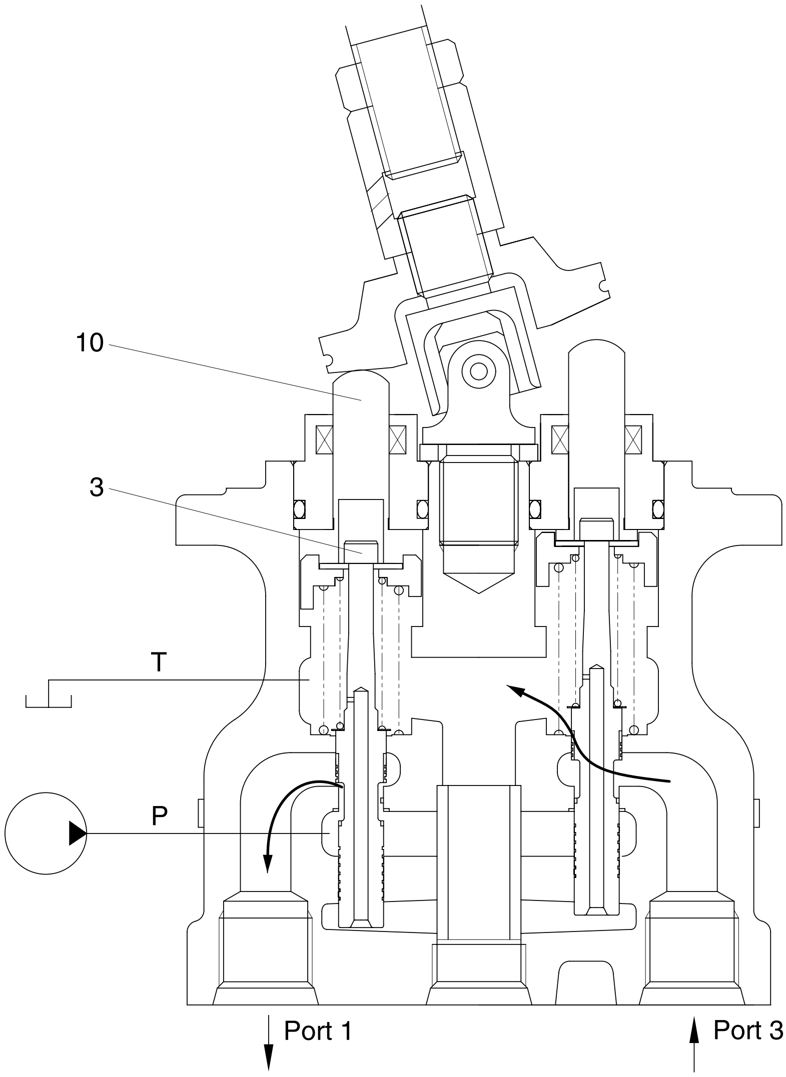
(1) Case where handle is in neutral position



60W9S2RL03

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 (9) 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



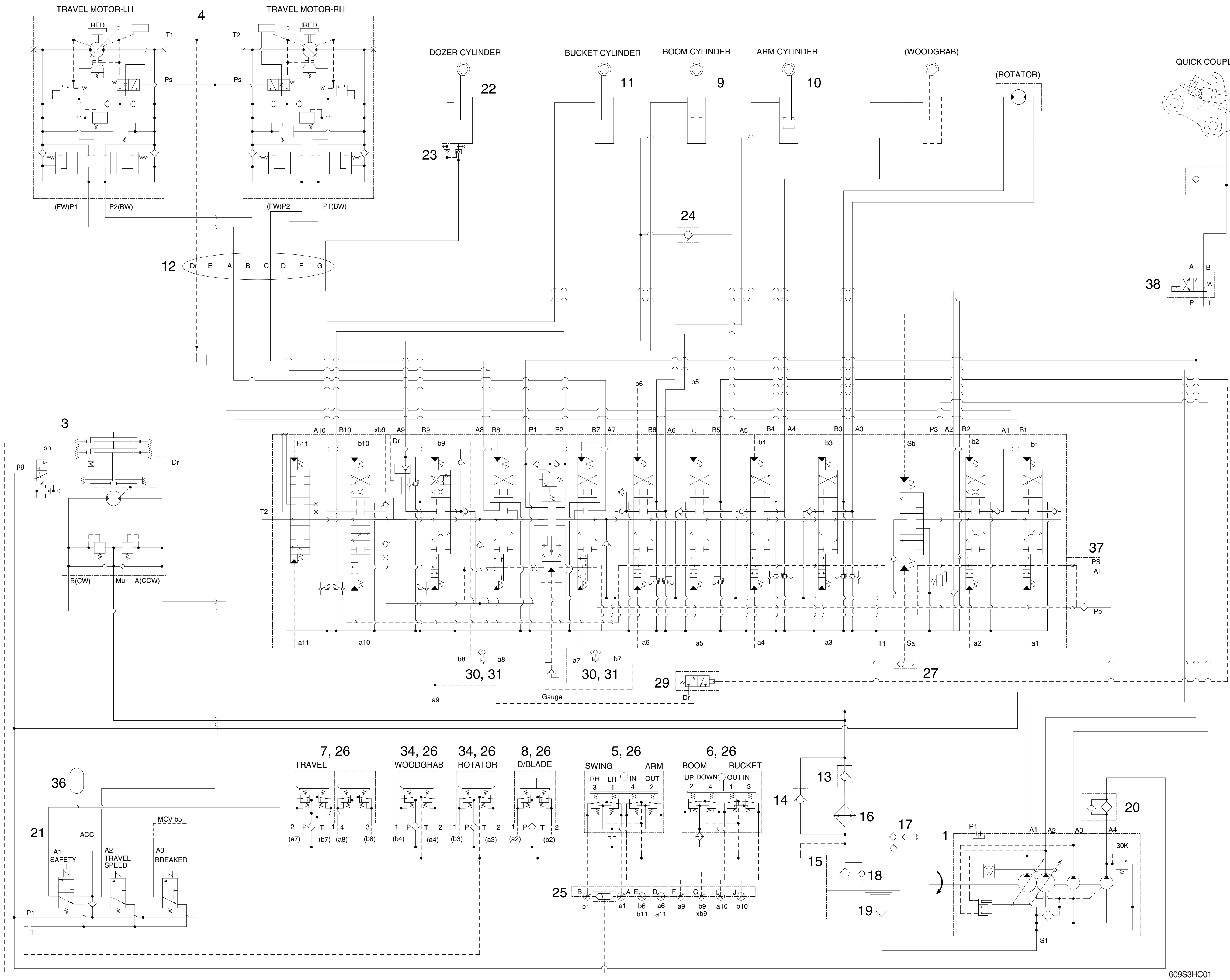
60W9S2RL04

When the push rod (10) 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.

SECTION 3 HYDRAULIC SYSTEM

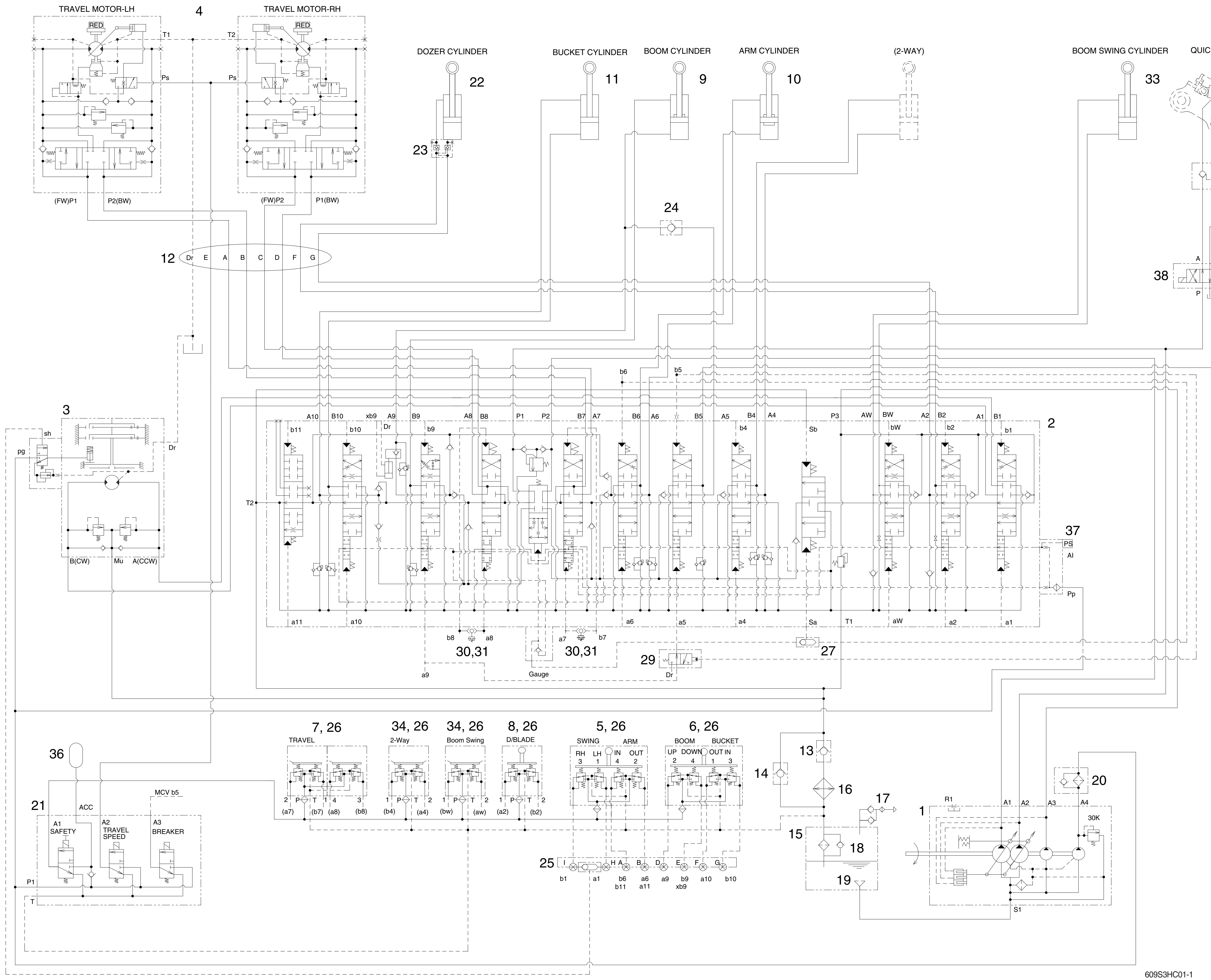
GROUP 1 HYDRAULIC CIRCUIT

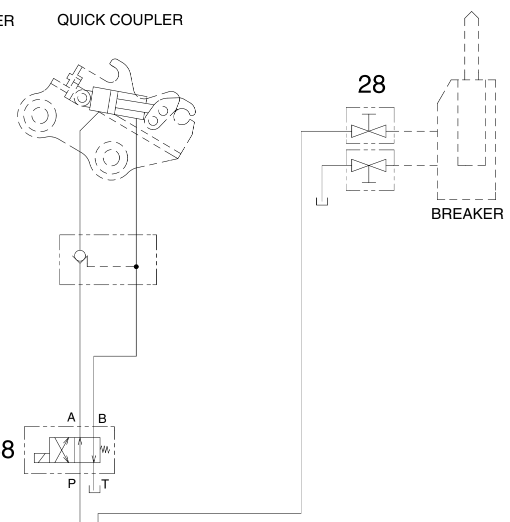
1. FIXED BOOM, WOOD GRAB



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 RCV dozer
9 Boom cylinder
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 Bypass valve & return element
19 Suction strainer
20 Pilot filter
21 Solenoid valve
22 Dozer cylinder
23 Check valve
24 Check valve
25 Terminal
26 Last guard filter
27 Shuttle valve
28 Stop valve
29 Selector valve
30 Pressure switch
31 Shuttle valve
34 RCV pedal (woodgrab & rotator)
36 Accumulator
37 Pressure sensor
38 Solenoid valve

2. BOOM SWING, 2-WAY



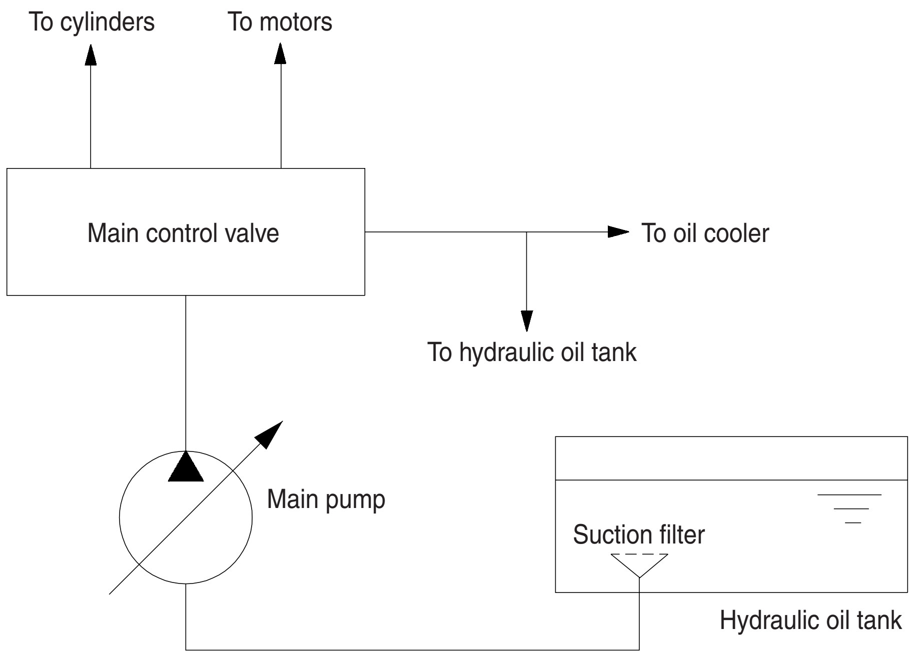


1 Main pump
2 Main control valve
3 Swing motor
4 Travel motor
5 RCV lever(LH)
6 RCV lever(RH)
7 RCV pedal
8 RCV dozer
9 Boom cylinder
10 Arm cylinder
11 Bucket cylinder
12 Turning joint
13 Check valve
14 Check valve
15 Hydraulic tank
16 Oil cooler
17 Air breather
18 Bypass valve &return element
19 Suction strainer
20 Pilot filter
21 Solenoid valve
22 Dozer cylinder
23 Check valve
24 Check valve
25 Terminal
26 Last guard filter
27 Shuttle valve
28 Stop valve
29 Selector valve
30 Pressure switch
31 Shuttle valve
33 Boom swing cylinder
34 RCV pedal (2-way & boom swing)
36 Accumulator
37 Pressure sensor
38 Solenoid valve

GROUP 2 MAIN CIRCUIT

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

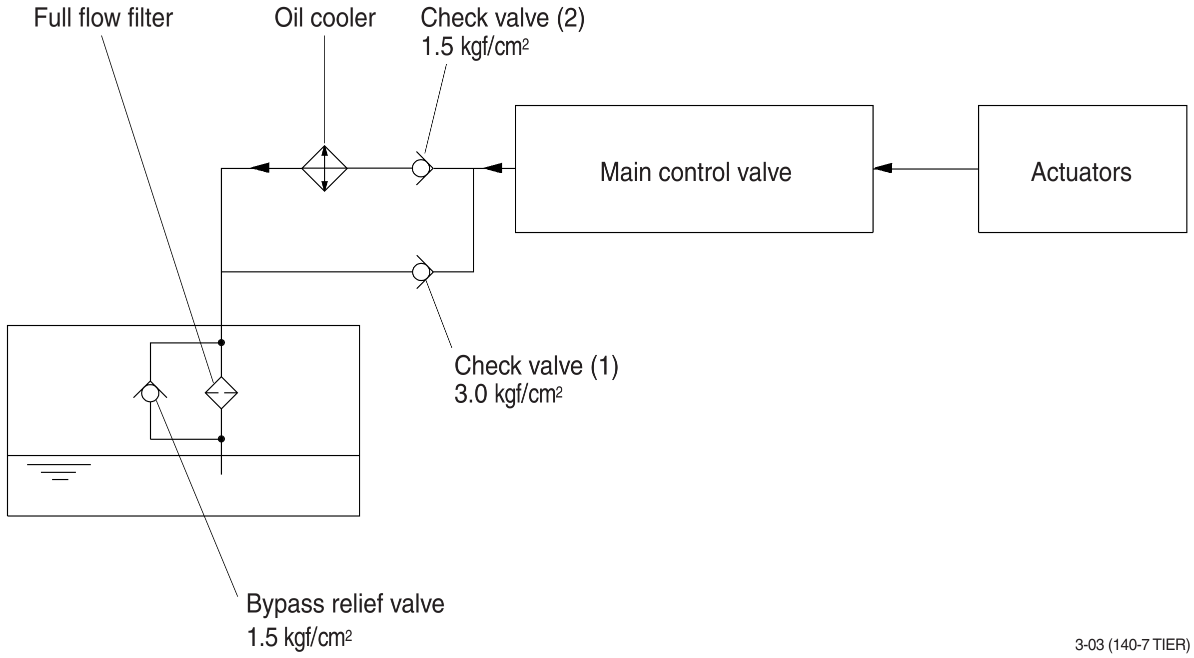
1. SUCTION AND DELIVERY CIRCUIT



3-02 (140-7 TIER)

The pumps receive oil from the hydraulic tank through a suction filter. 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.

2. RETURN CIRCUIT



All oil returned 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 3.0 kgf/cm^2 (43 psi). Usually, oil returns to the hydraulic tank from the left side of control valve through oil cooler.

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

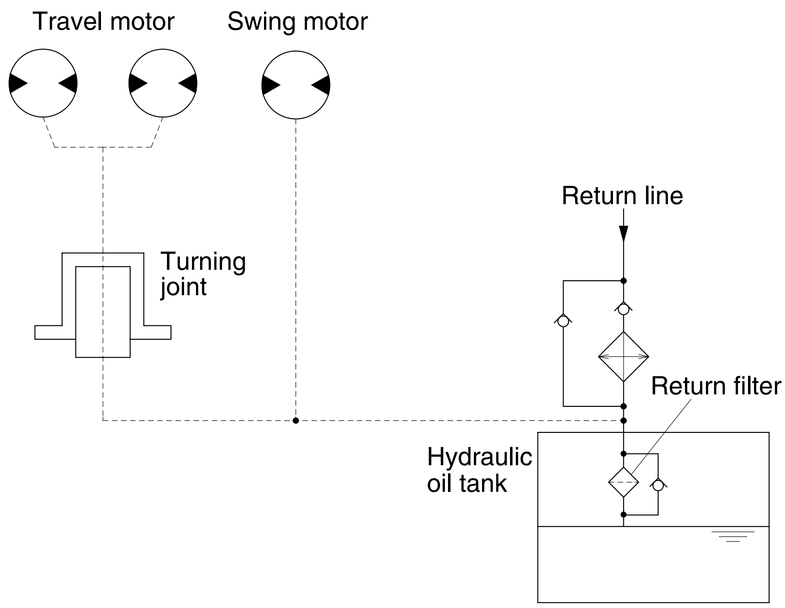
When the oil cooler is clogged, the oil returns directly to the hydraulic tank through bypass check valve (1).

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

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

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

3. DRAIN CIRCUIT



R5573CI02

Besides internal leaks from the motors and main pump, the oil for lubrication circulates.

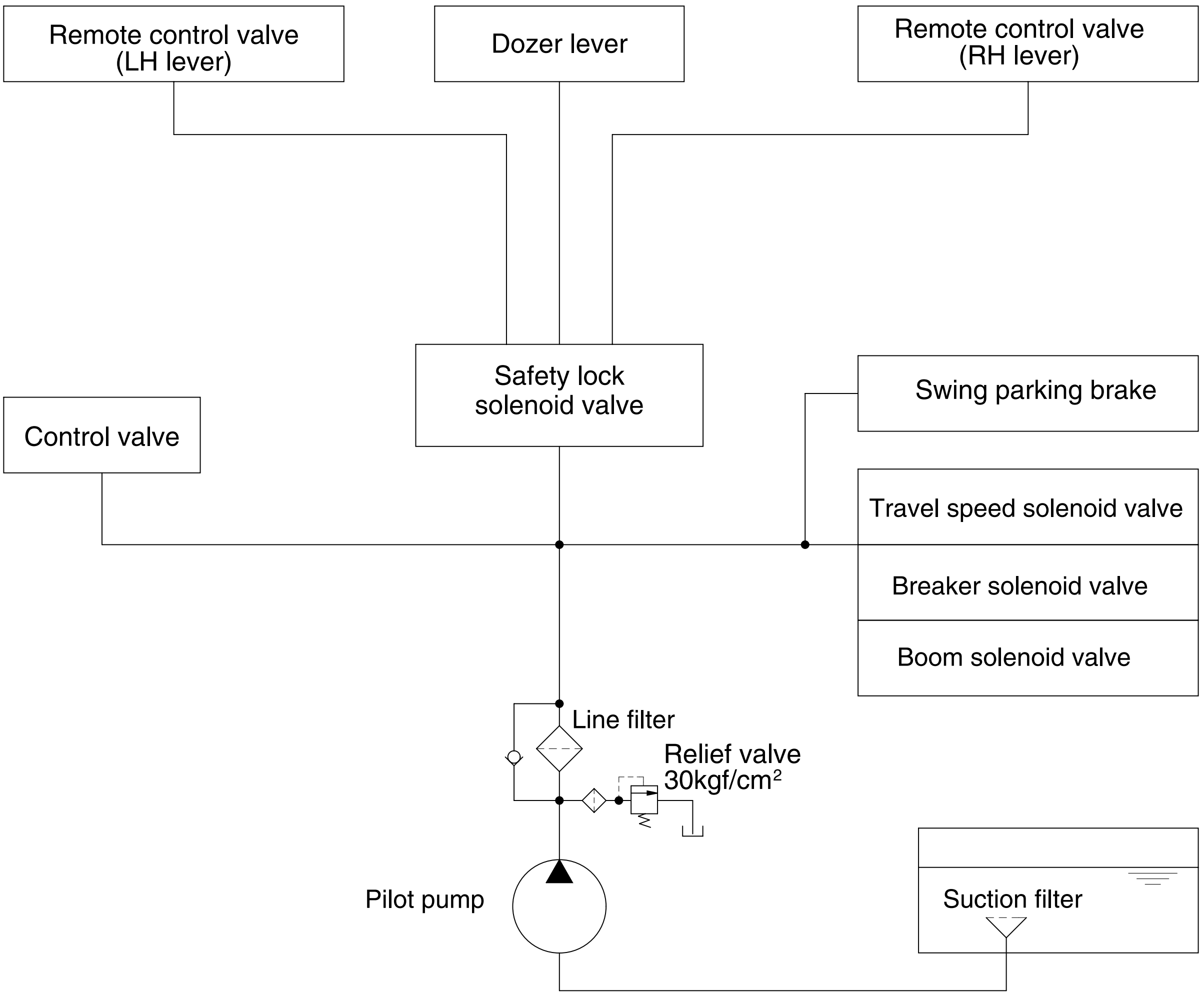
1) TRAVEL MOTOR DRAIN CIRCUIT

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

2) SWING MOTOR DRAIN CIRCUIT

Oil leaked from the swing motor returns to the hydraulic tank passing through a return filter with oil drained from the travel circuit .

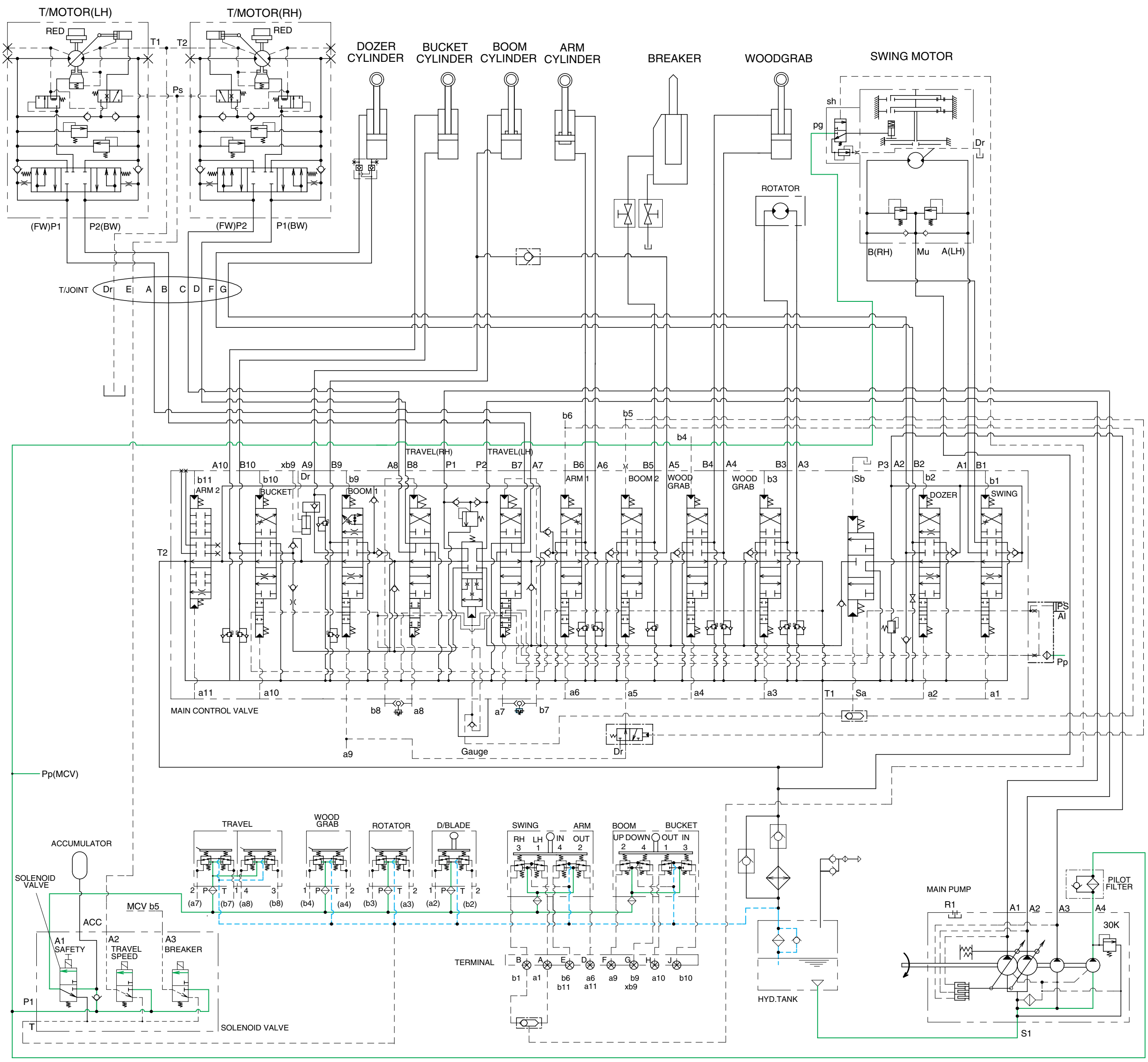
GROUP 3 PILOT CIRCUIT



R5573CI03

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

1. SUCTION, DELIVERY AND RETURN CIRCUIT



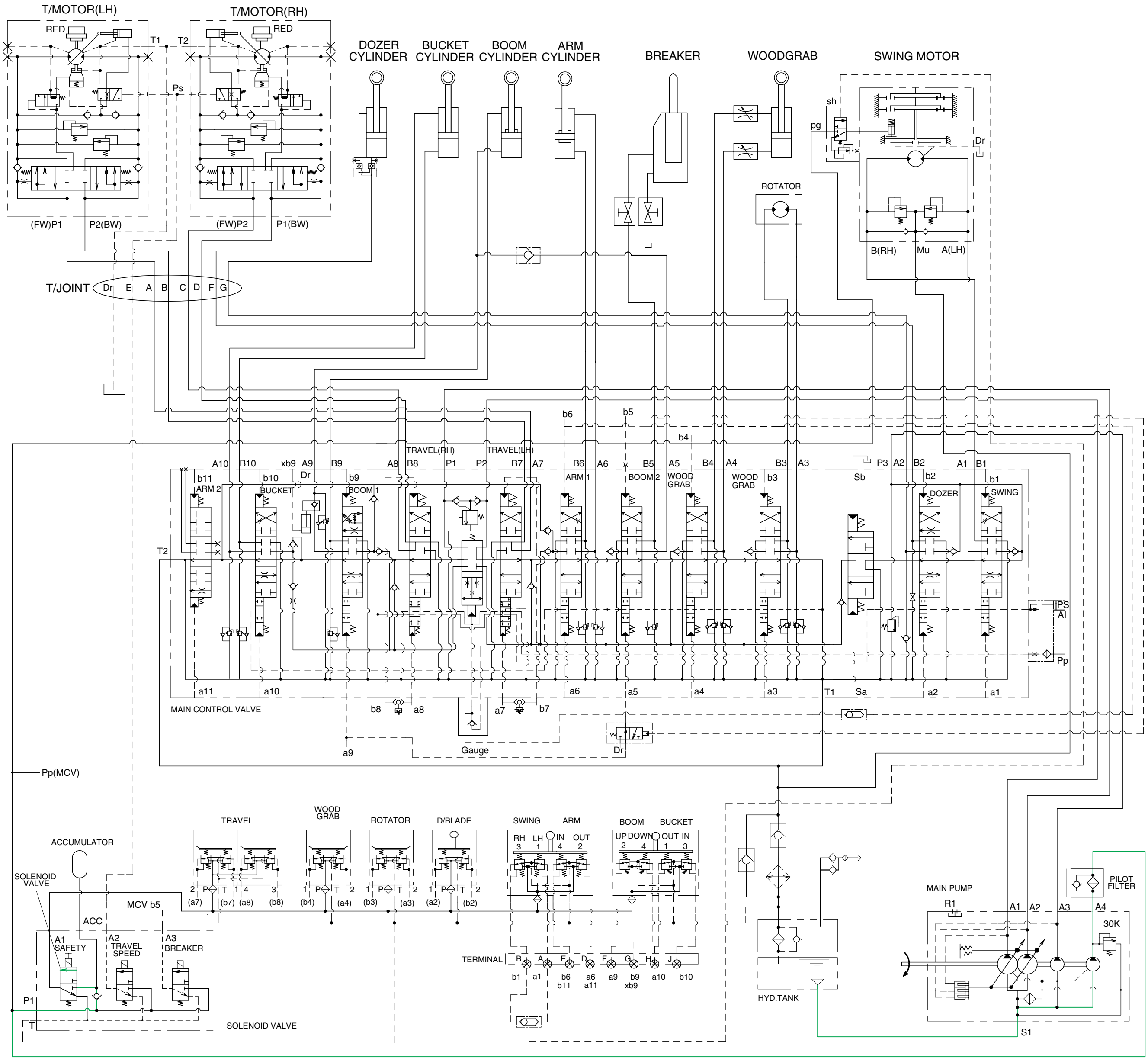
609S3HC02

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 flow into the hydraulic tank.

2. SAFETY VALVE (SAFETY LEVER)

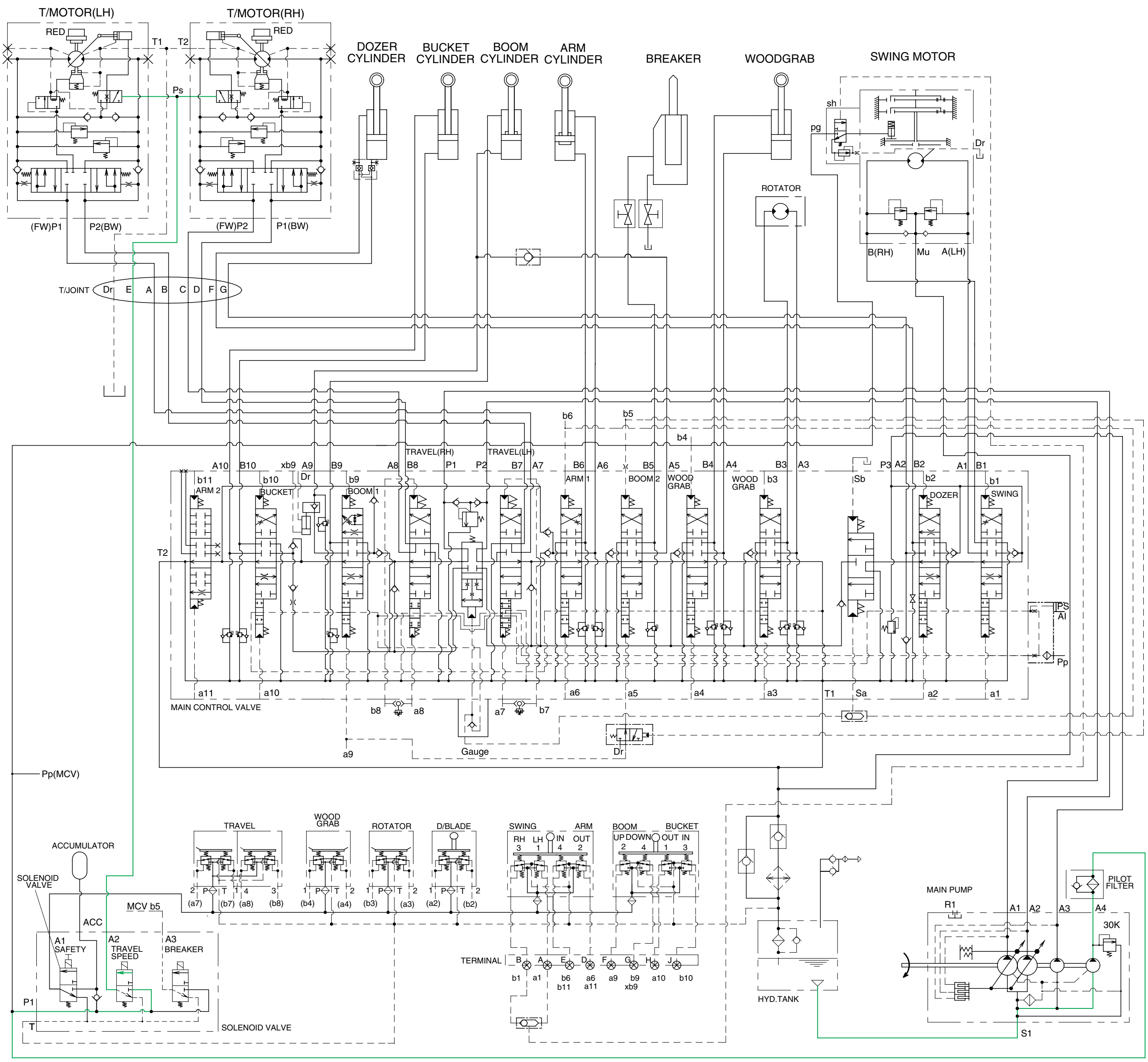


609S3HC03

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 is moved upward, oil does not flow into the remote control valve, because of the blocked port.

3. TRAVEL SPEED CONTROL SYSTEM



609S3HC04

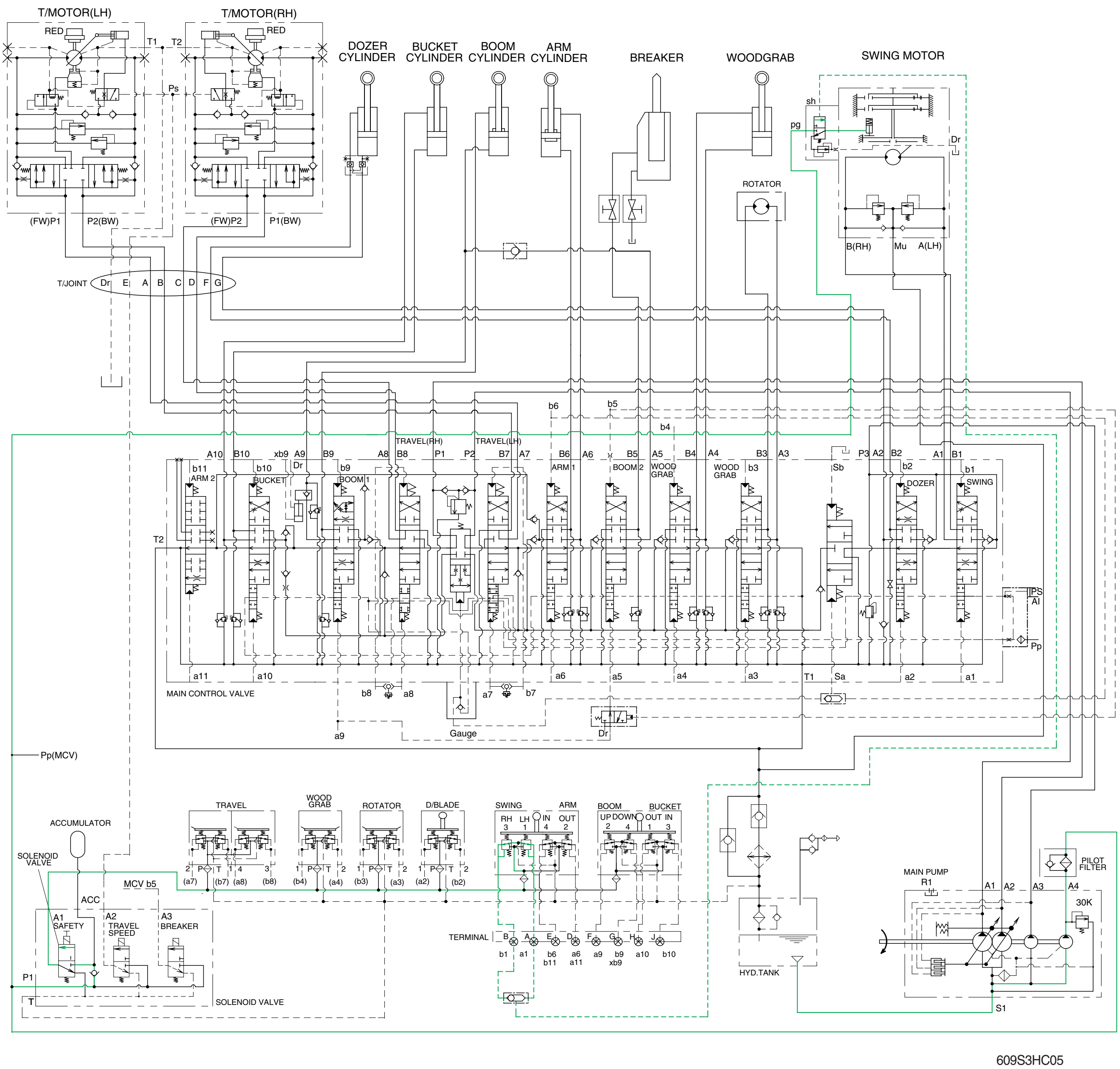
When the travel speed switch is pushed, the travel speed solenoid valve is actuated and the discharged oil from the pilot pump flows to the Ps port of pilot valve in the travel motors.

As a result, the control piston is pushed by the main oil flow, thus the displacement is minimized.

When the travel speed switch is pushed once more, the travel speed solenoid valve is return to original position by the force of spring, the hydraulic oil of Ps port returns to the hydraulic tank.

As a result, the control piston is returned by the main oil flow, thus the displacement is maximized.

4. SWING PARKING BRAKE RELEASE



609S3HC05

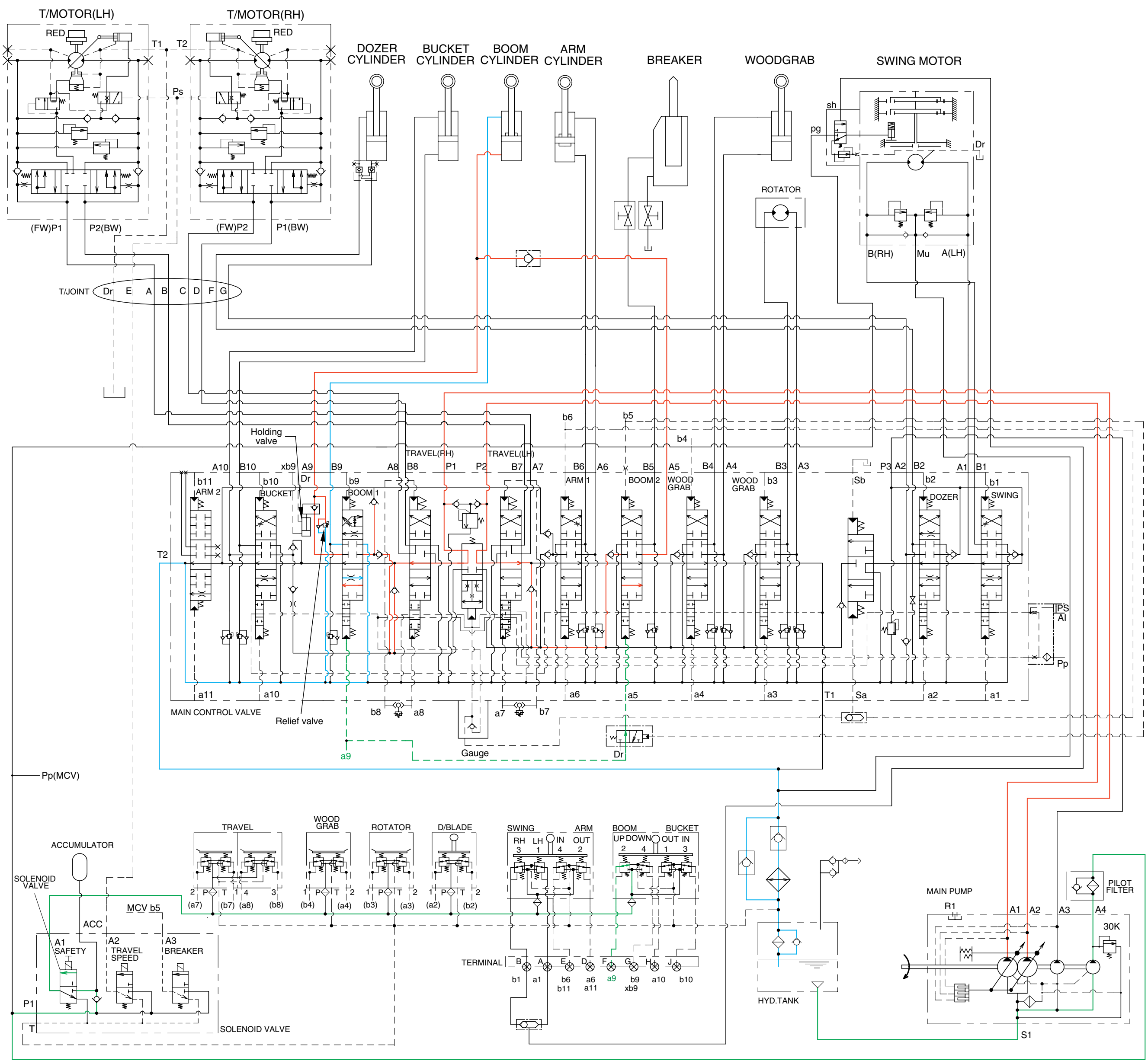
When the swing control lever is tilted, the pilot oil flow into SH port of shuttle valve, this pressure move spool so, discharged oil from pilot valve flow into PG port.

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

When the swing control lever is set in the neutral position, oil in the swing motor disc cylinder is drained, thus the brake is applied.

GROUP 4 SINGLE OPERATION

1. BOOM UP OPERATION

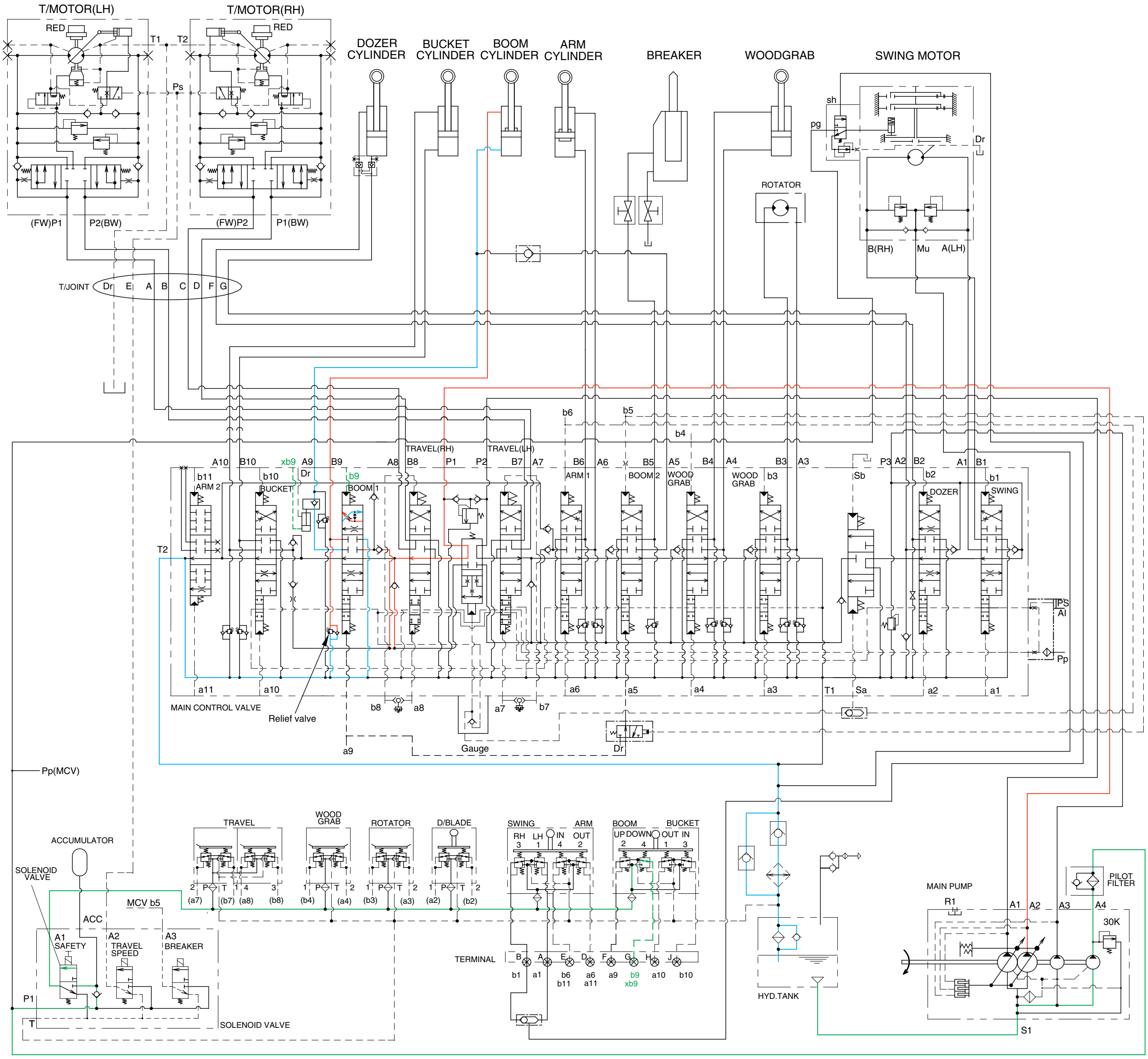


609S3HC06

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

2. BOOM DOWN OPERATION



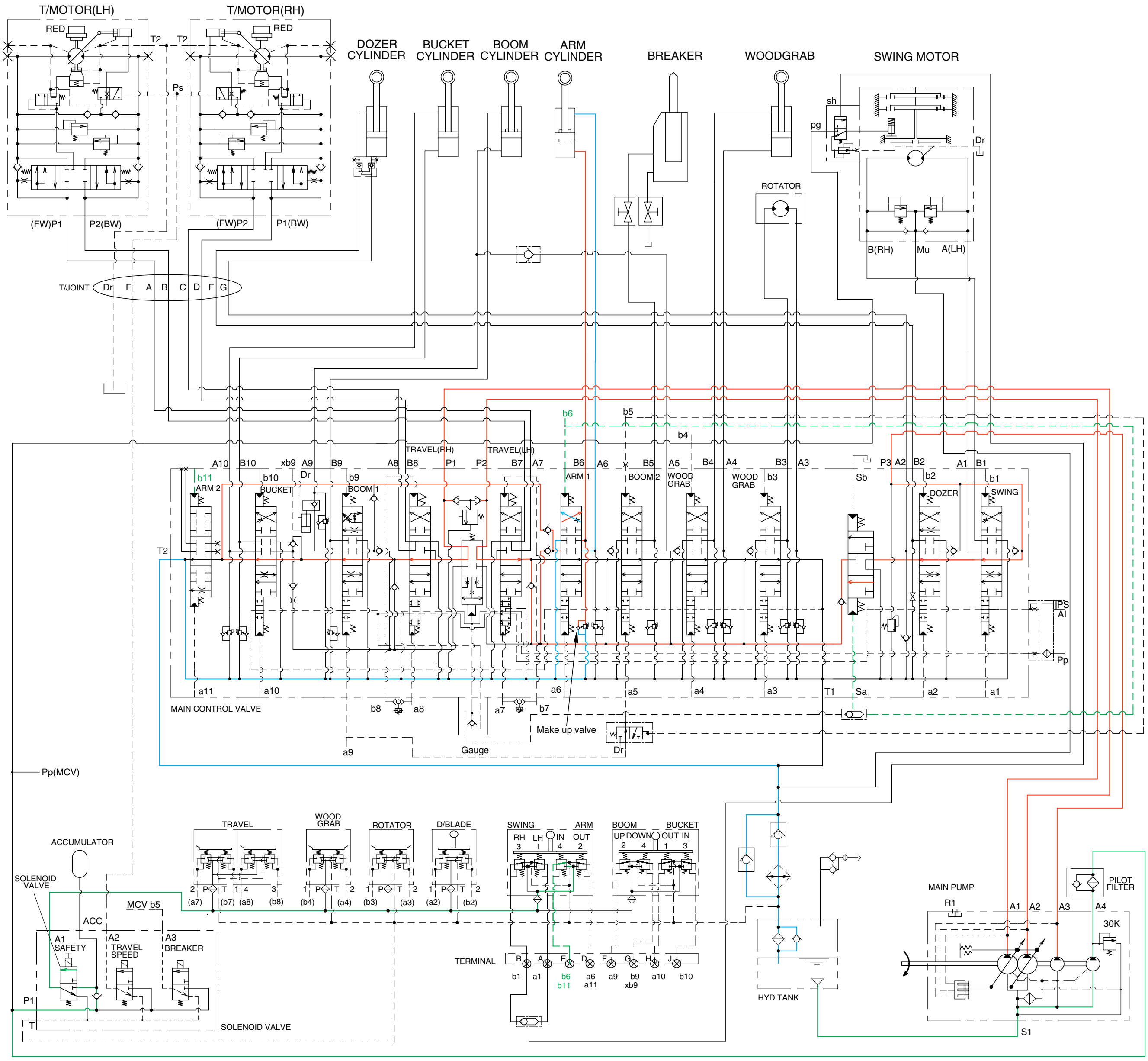
609S3HC07

When the right 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 spool in the main control valve.

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

3. ARM ROLL IN OPERATION



609S3HC08

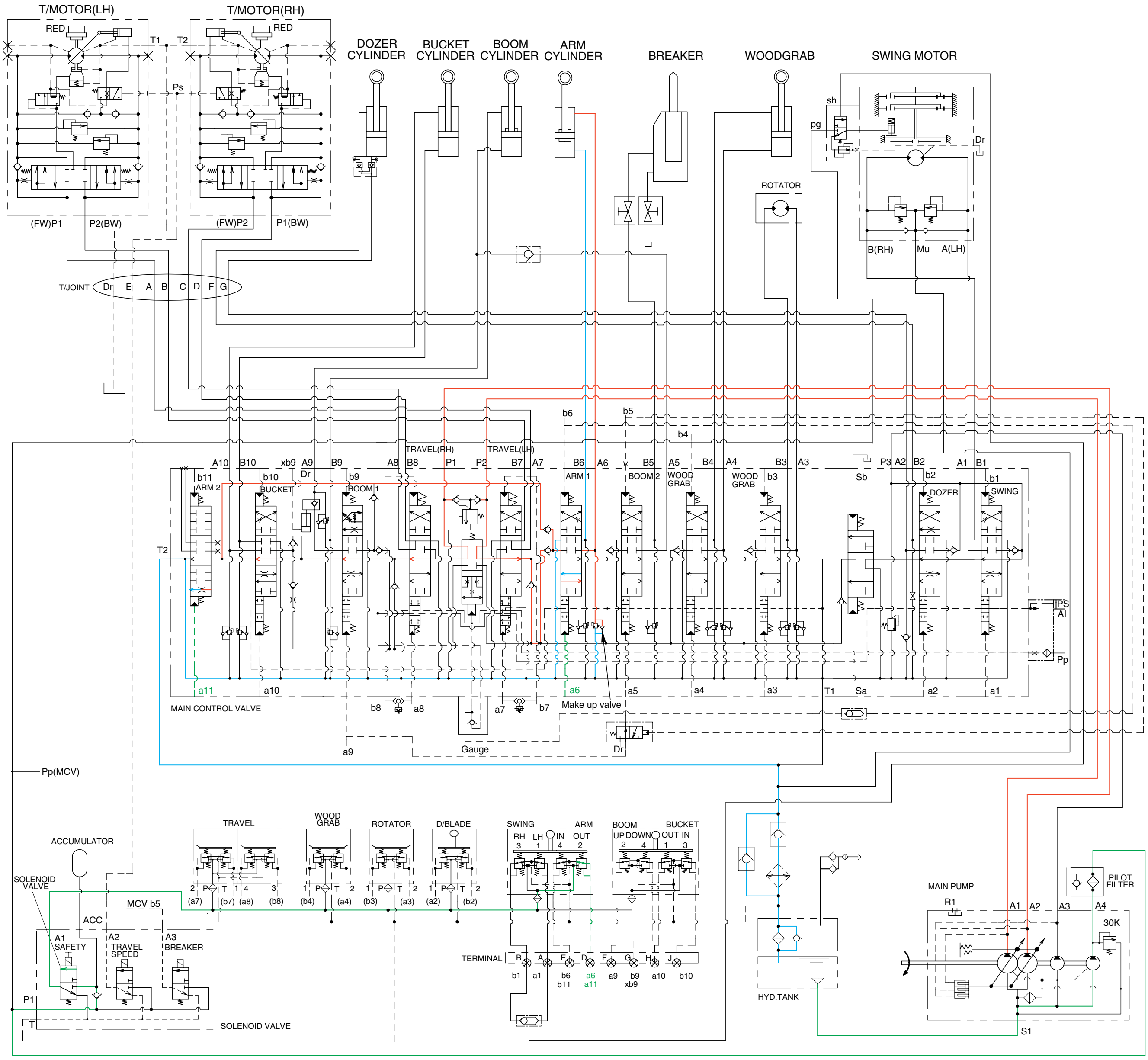
When the left control lever is pulled back, the arm spools in the main control valve are moved the to roll in position by the pilot oil pressure from the remote control valve.

The oil from the A1, A2 and A3 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 spool in the main control valve. When this happens, the arm rolls in.

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

4. ARM ROLL OUT OPERATION



609S3HC09

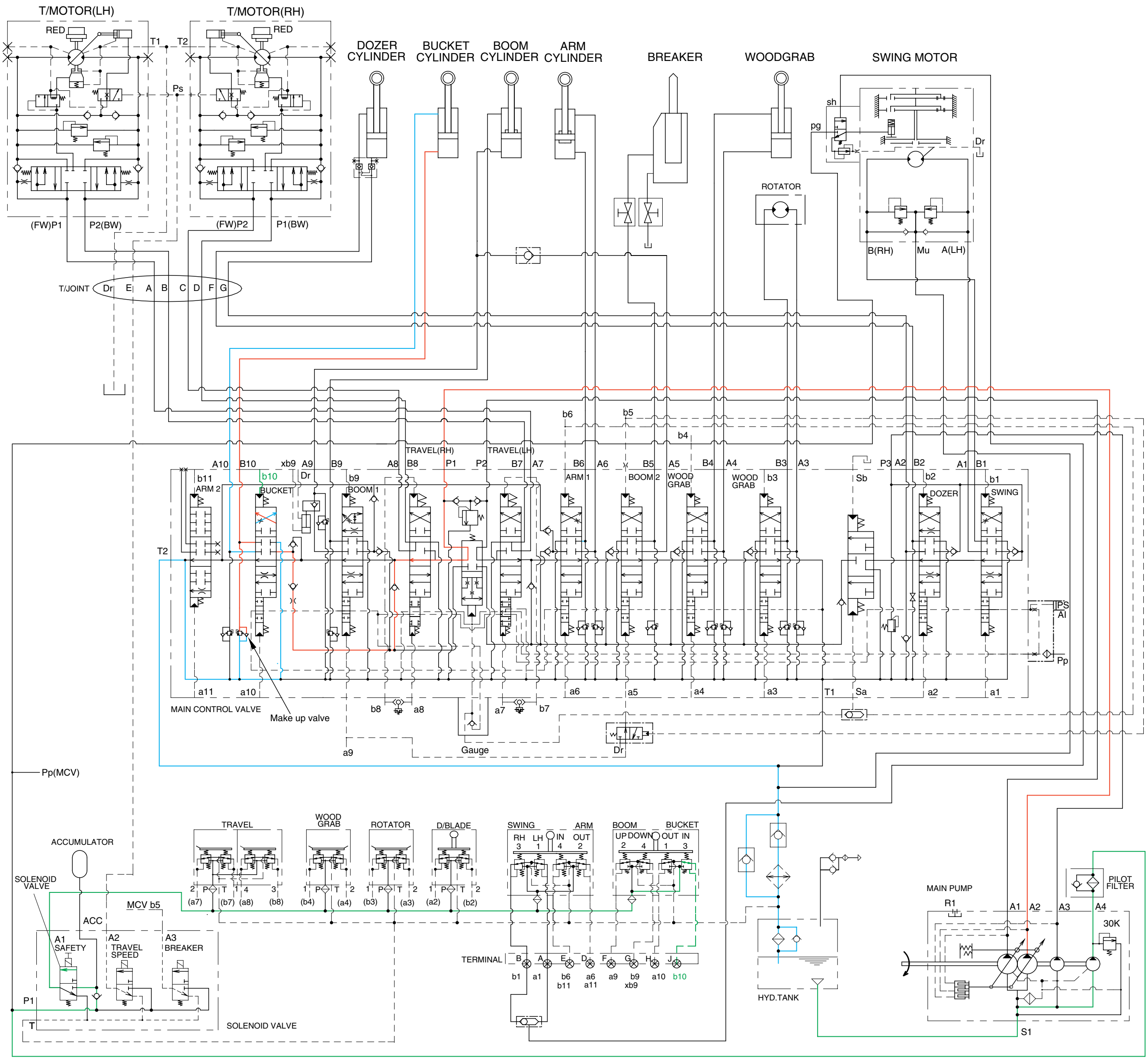
When the left control lever is pushed forward, the arm spool in the main control valve are moved to the roll out position by the pilot oil pressure from the remote control valve.

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 spool in the main control valve. When this happens, the arm rolls out.

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

5. BUCKET ROLL IN OPERATION



609S3HC10

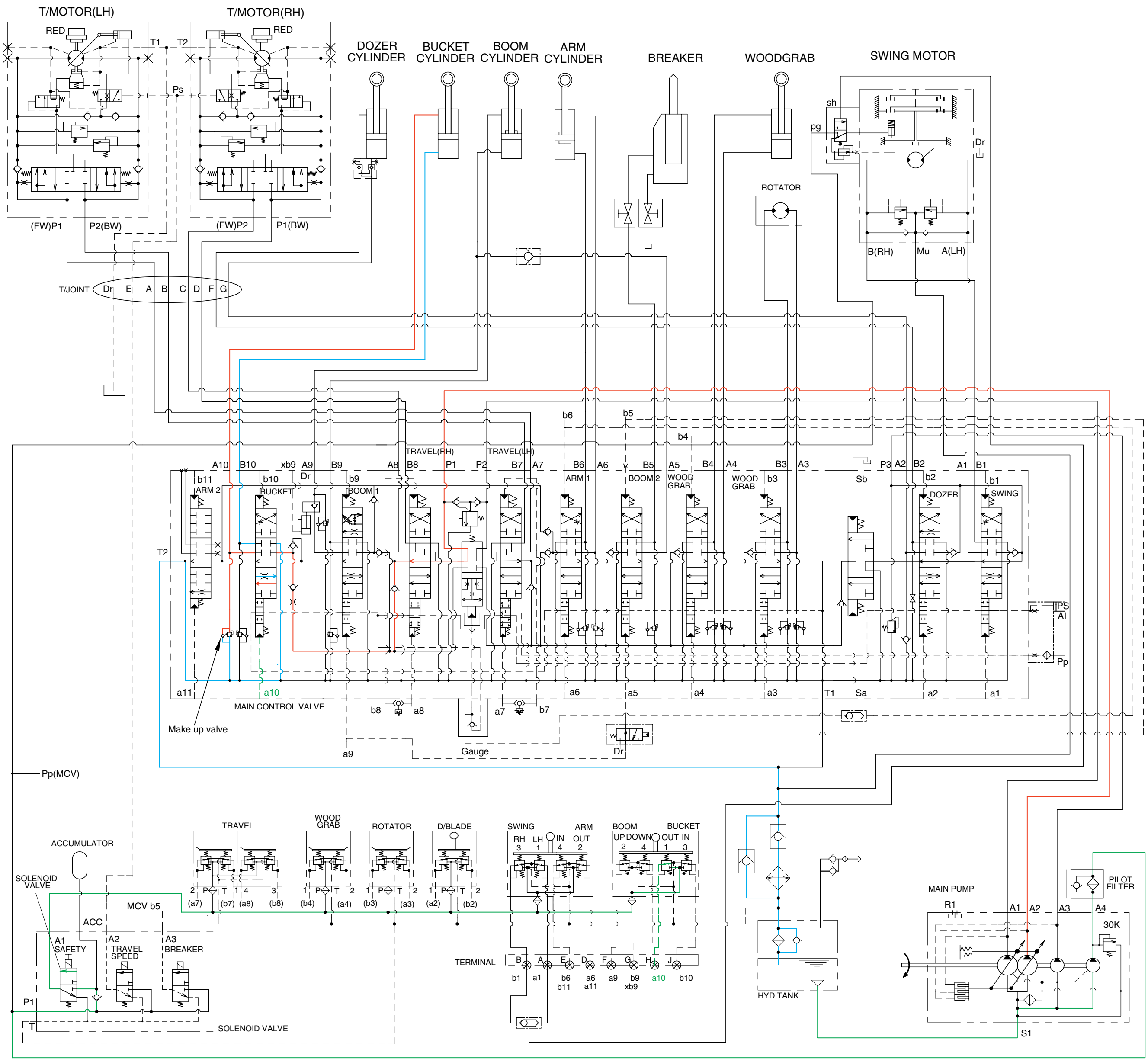
When the right control lever is pulled left, the bucket spool in the main control valve is moved to the roll in position by the pilot oil pressure from the remote control valve.

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

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

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

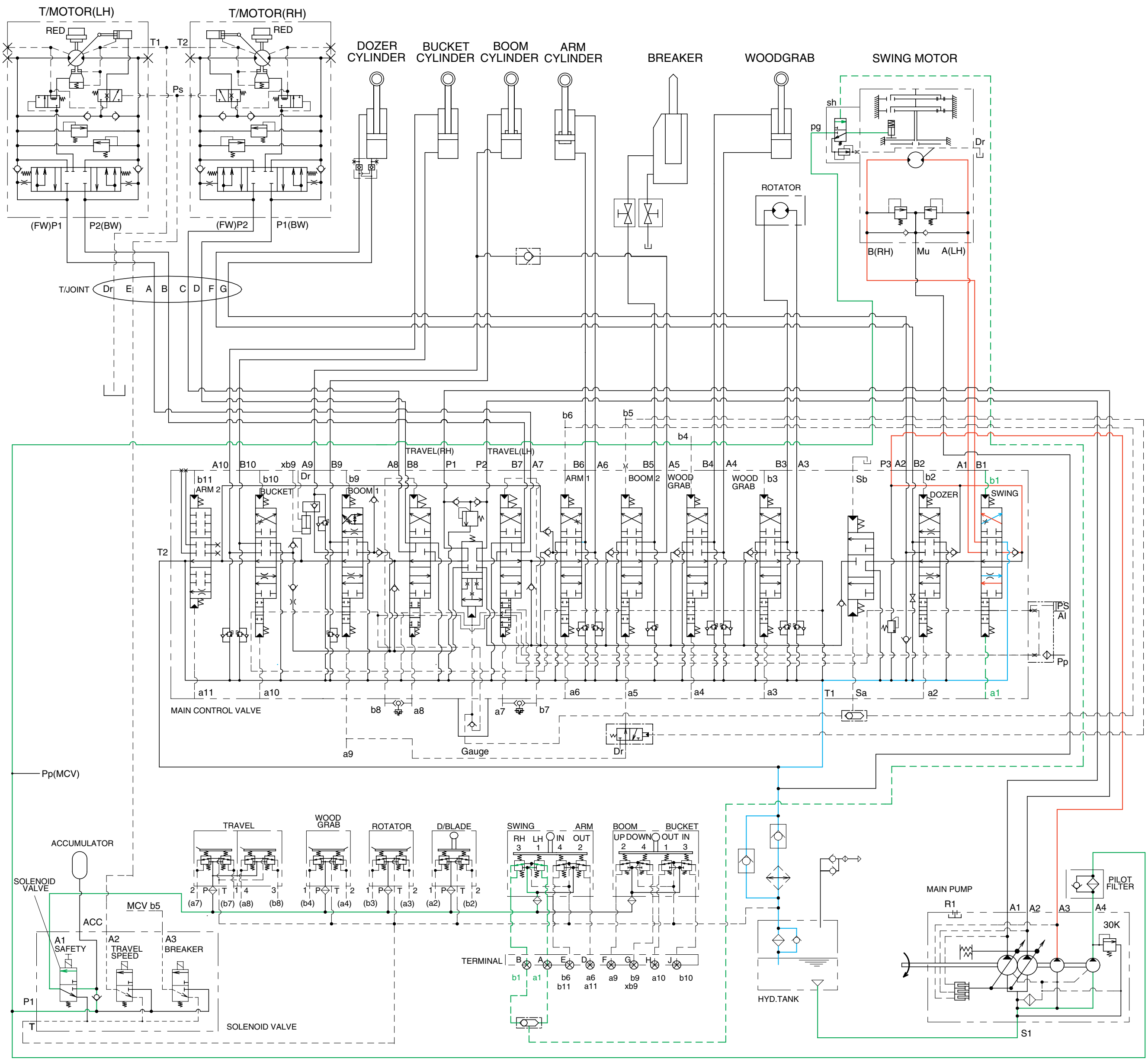
6. BUCKET ROLL OUT OPERATION



609S3HC11

When the right control lever is pushed right, the bucket spool in the main control valve is moved to the roll out position by the pilot oil pressure from the remote control valve.
The oil from the A2 pump flows into the main control valve and then goes to the small chamber of bucket cylinder.
At the same time, the oil from the large chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls out.
The cavitation which will happen to the rod of the bucket cylinder is also prevented by the make-up valve in the main control valve.

7. SWING OPERATION



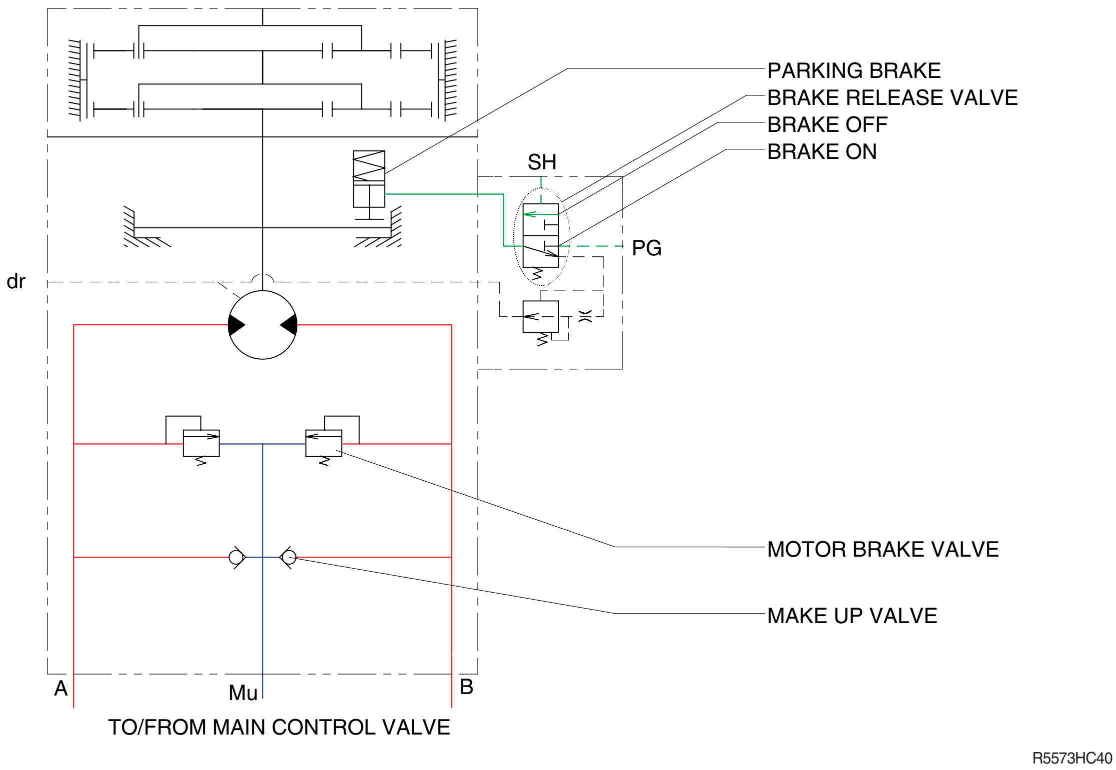
609S3HC12

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

The oil from the A3 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 superstructure swings to the left or right. The swing parking brake, make up valve and the overload relief valve are provided in the swing motors. The cavitation which will happen to the swing motor is also prevented by the make up valve in the swing motor itself.

SWING CIRCUIT OPERATION



1) MOTOR BRAKE VALVE

Motor brake valve for the swing motor limits to cushion the starting and stopping pressure of swing operation.

2) MAKE UP VALVE

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

3) PARKING BRAKE

In case that the parking, of the machine at slope is required during operation, there is the danger of involuntary swing caused by the self weight of the machine. The brake is connected to prevent this involuntary swing.

PARKING BRAKE "OFF" OPERATION

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

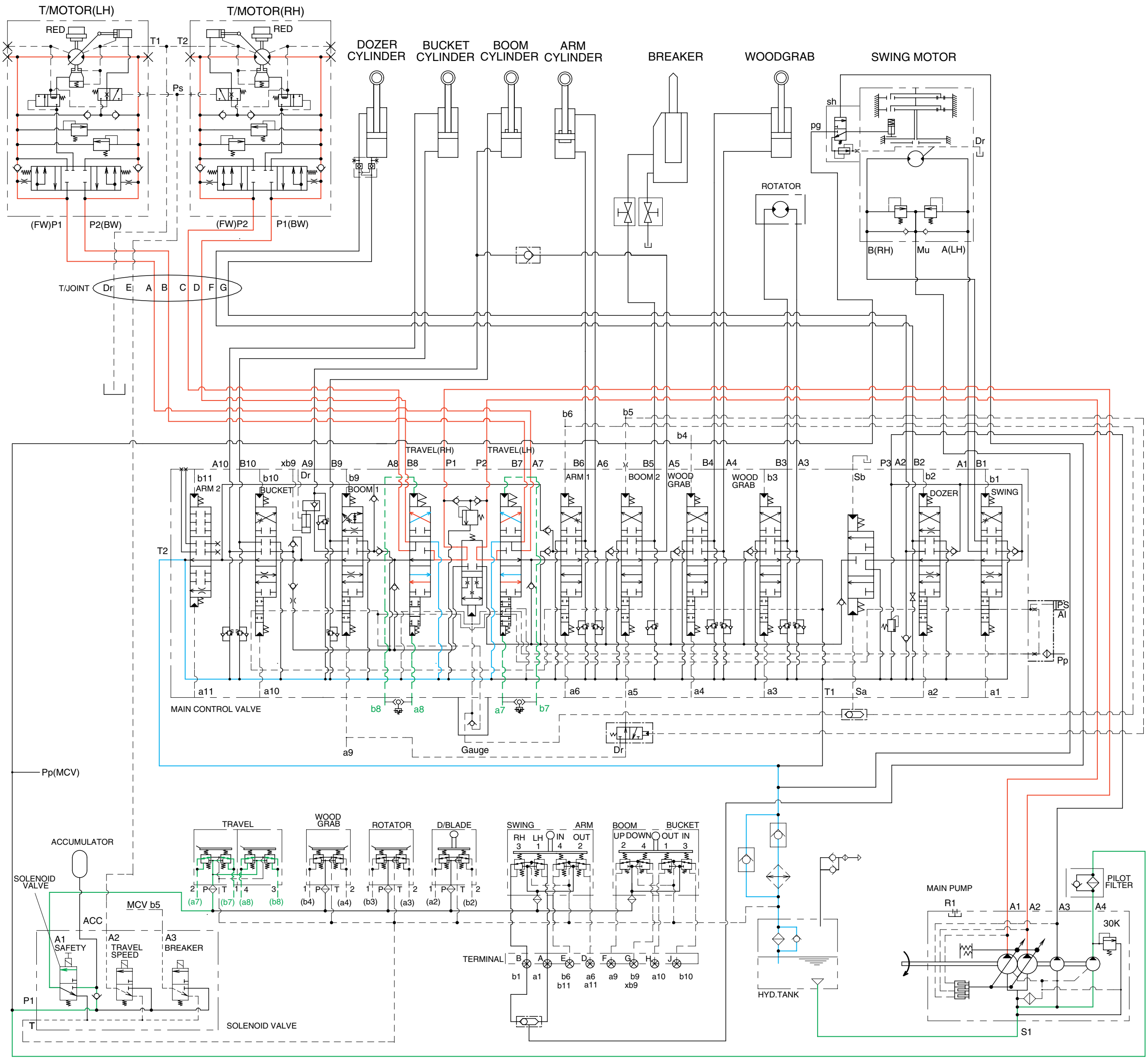
When the left control lever placed in the swing position, the pilot pressure at the shuttle valve is transferred to the brake release valve and the brake release valve is change over. Then the pilot pressure lift the brake piston and release the parking brake.

PARKING BRAKE "ON" OPERATION

When the control 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".

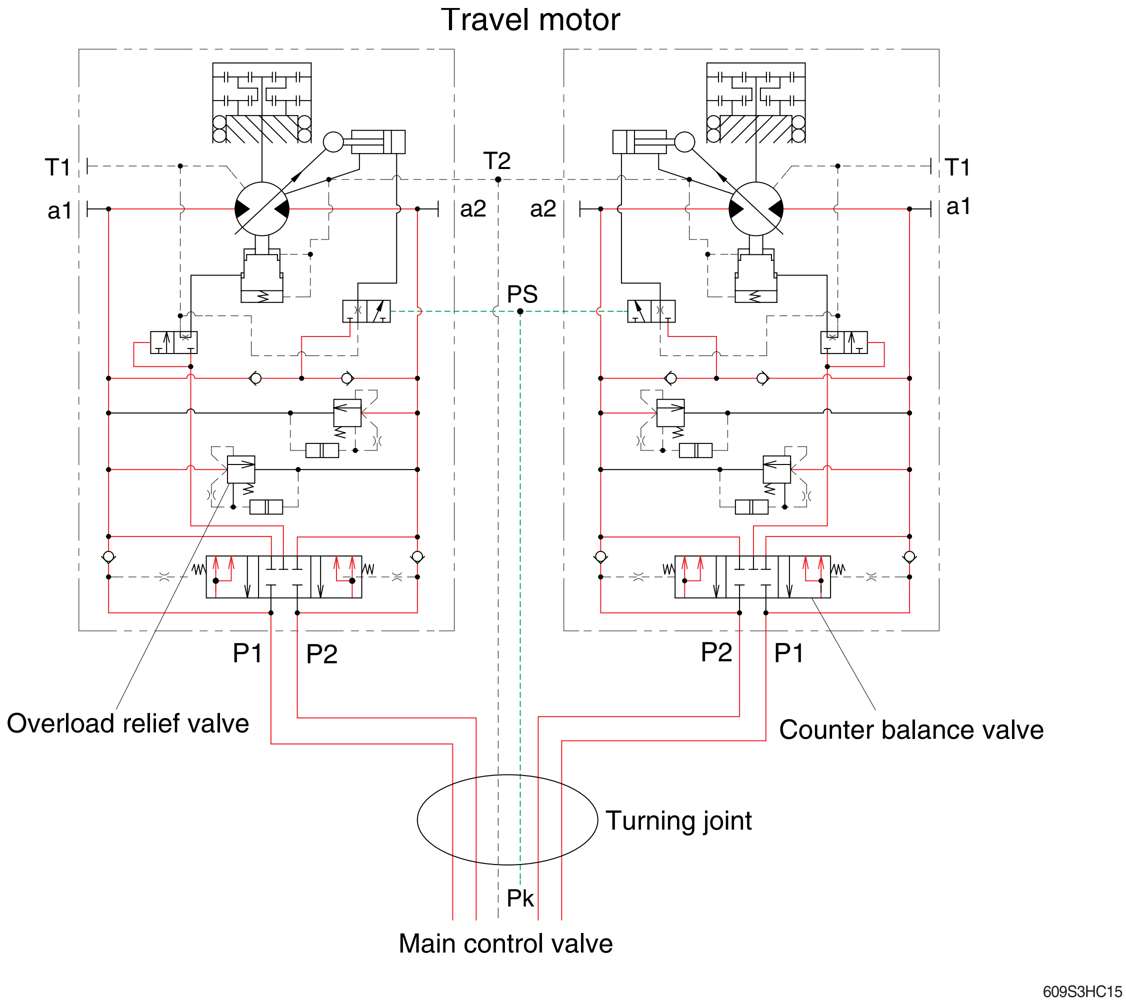
8. TRAVEL FORWARD AND REVERSE OPERATION



609S3HC14

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 link. The oil from the both pumps (A1, A2) flows into the main control valve and then goes to the both travel motors 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.

TRAVEL CIRCUIT OPERATION



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

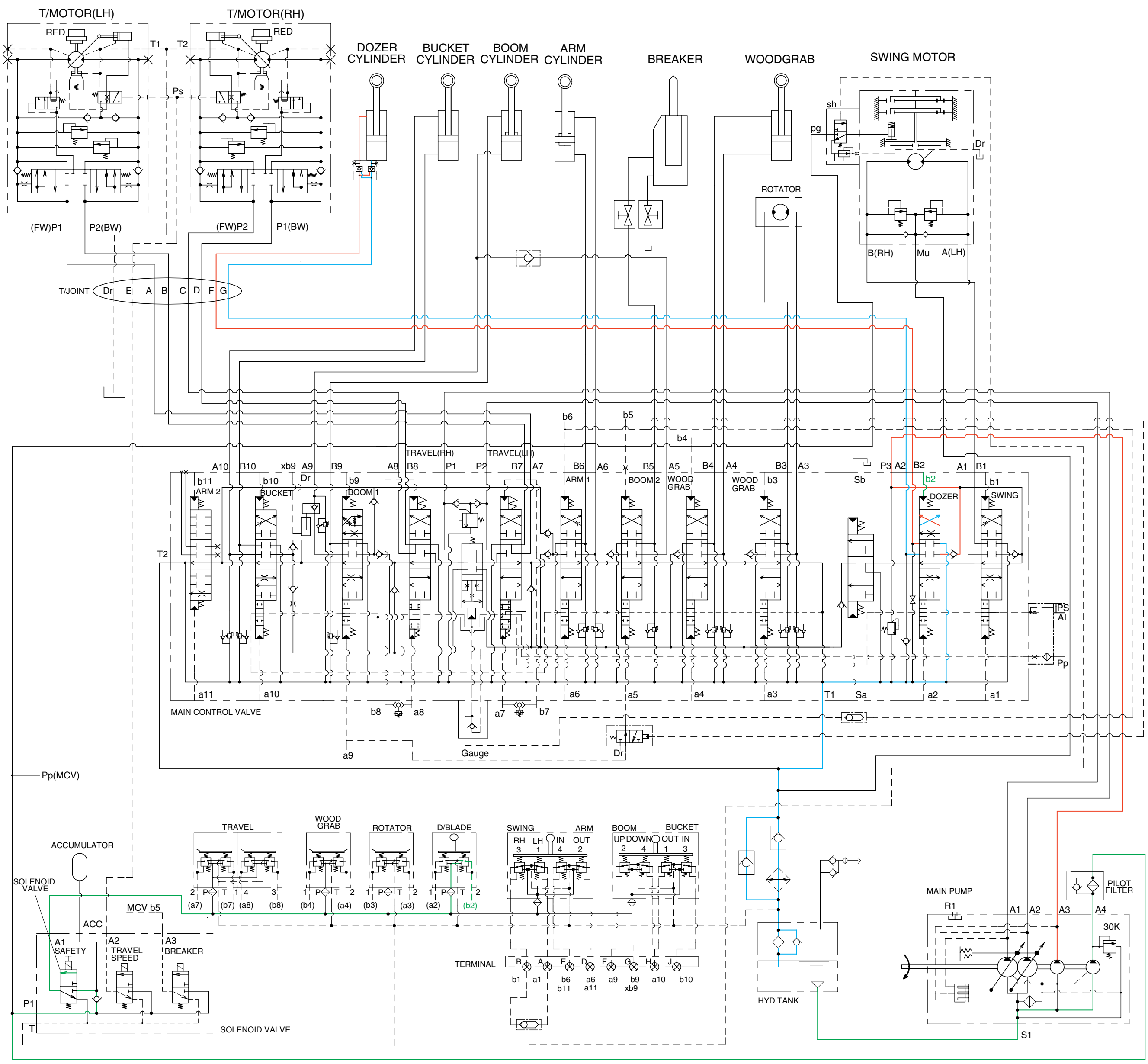
1) COUNTER BALANCE VALVE

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 220 kgf/cm^2 to prevent high pressure generated at at 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.

9. DOZER UP OPERATION



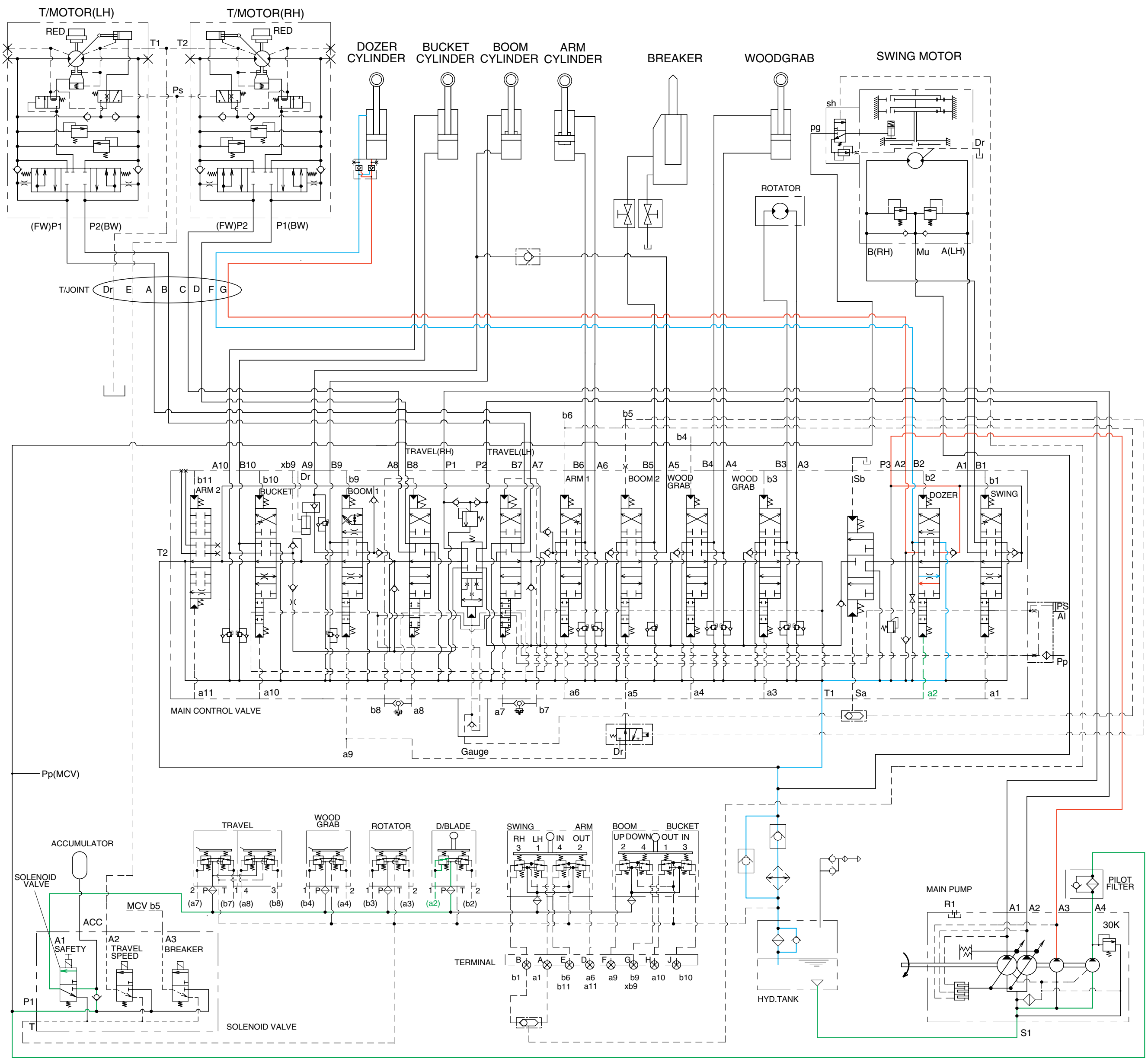
609S3HC16

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

The oil from the A3 pump flows into the main control valve and then goes to the small chamber of dozer cylinders.

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

10. DOZER DOWN OPERATION



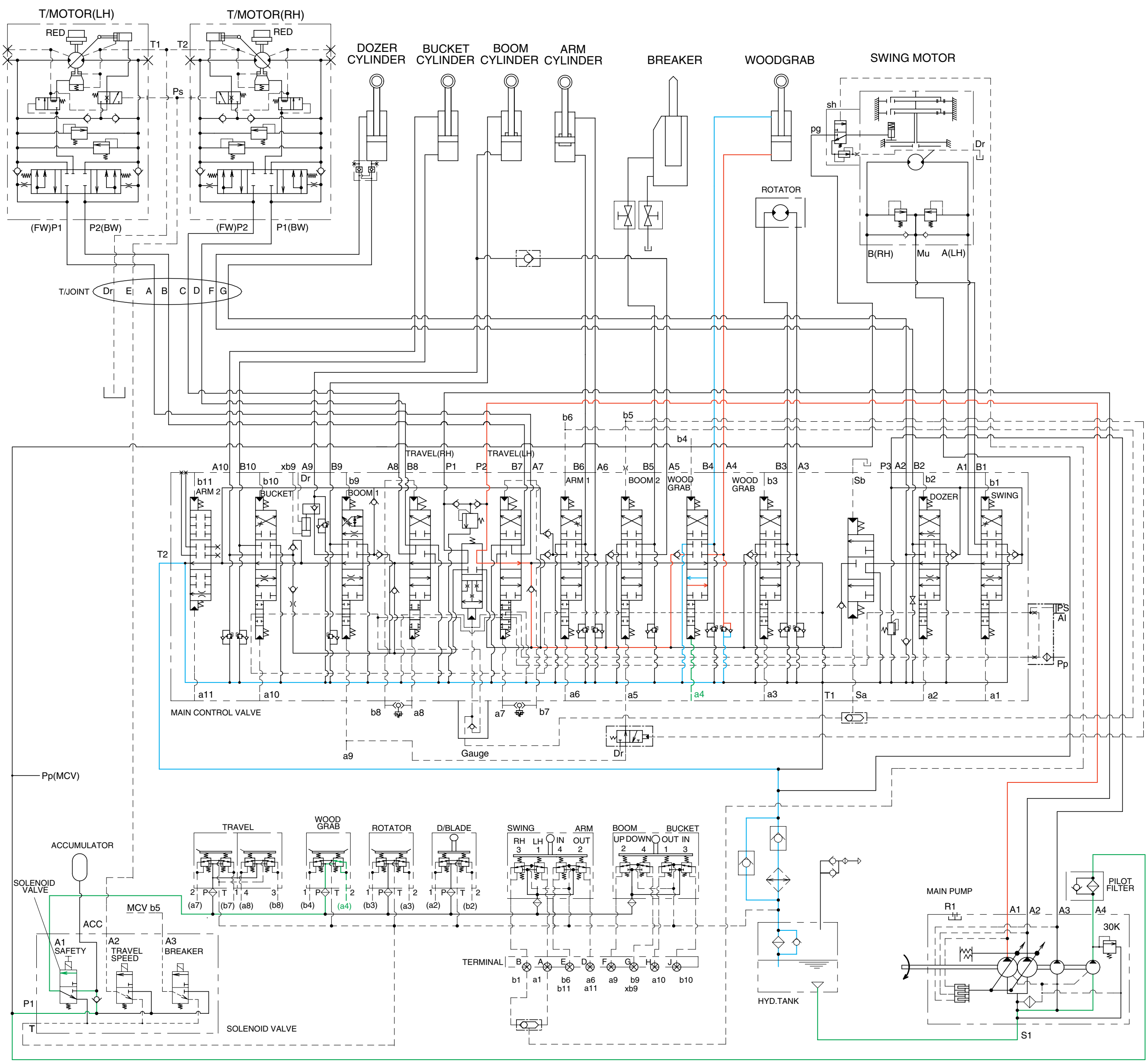
609S3HC17

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

The oil from the A3 pump flows into the main control valve and then goes to the large chamber of dozer cylinders.

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

11. WOODGRAB CLOSE



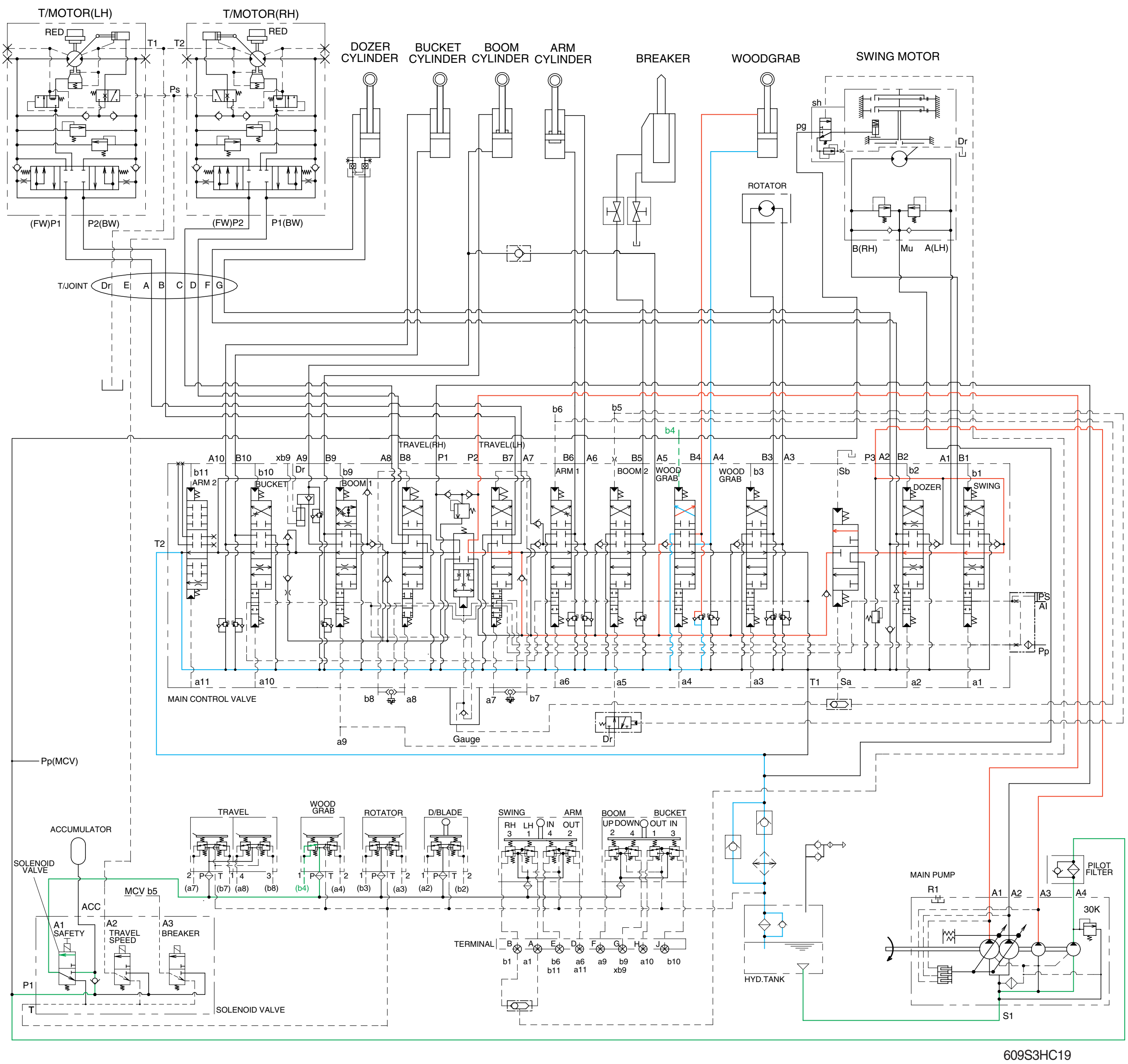
609S3HC18

When the left control pedal (OPT) pushed forward, the woodgrab spool in the main control valve is moved to the woodgrab close 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 large chamber of woodgrab cylinder.

At the same time, the oil from the small chamber of woodgrab cylinder returns to the hydraulic oil tank through the woodgrab spool in the main control valve.

When this happens the woodgrab close. The cavitation which will happen to the large chamber of woodgrab cylinder is also prevented by the make-up valve in the main control valve.

12. WOODGRAB OPEN

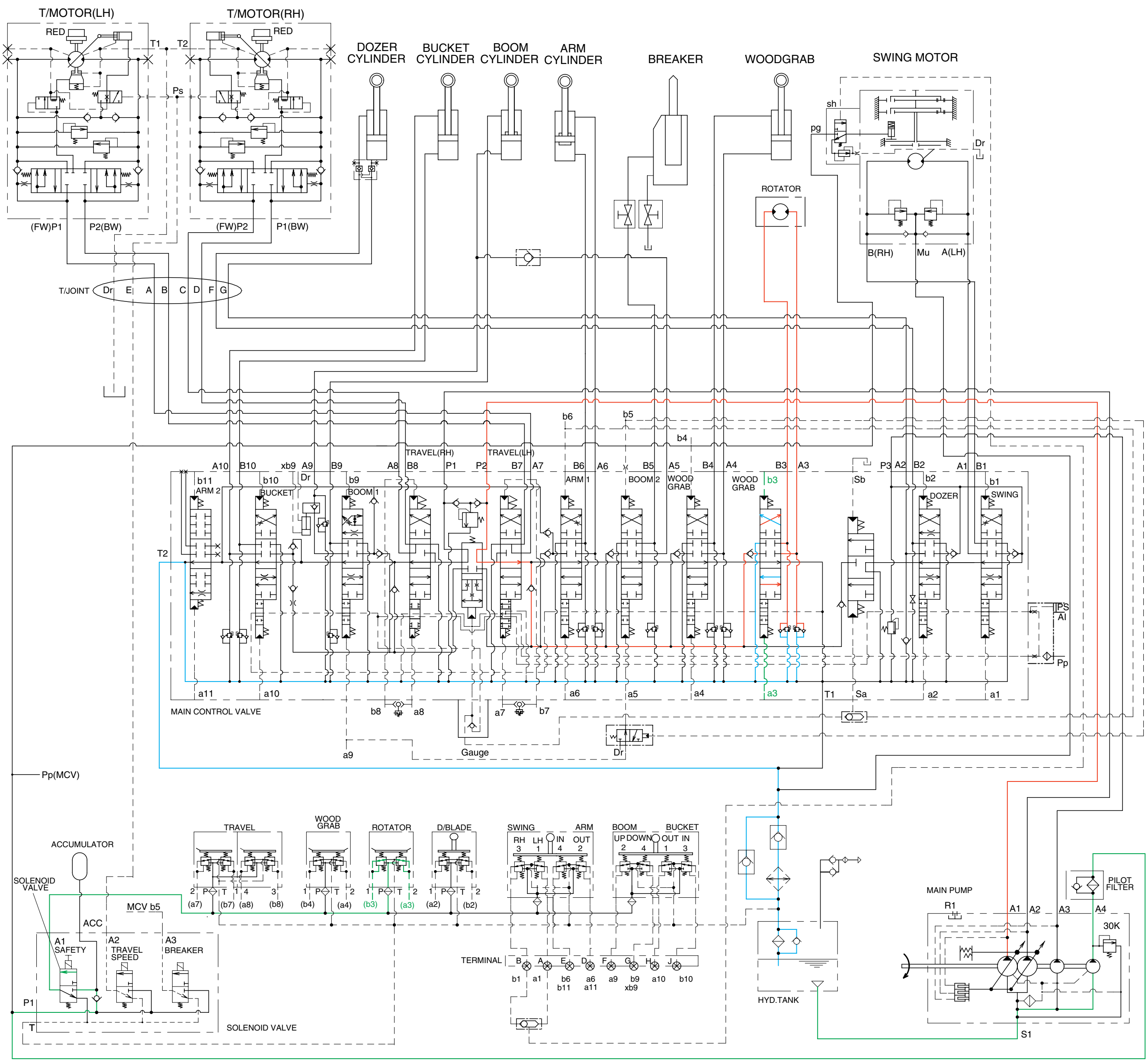


When the left control pedal (OPT) pushed backward, the woodgrab spool in the main control valve is moved to the woodgrab open position by the pilot oil pressure from the remote control valve. The oil from the A1 pump flows into the main control valve and then goes to the small chamber of woodgrab cylinder.

At the same time, the oil from the large chamber of woodgrab cylinder returns to the hydraulic oil tank through the woodgrab spool in the main control valve.

When this happens the woodgrab open. The cavitation which will happen to the small chamber of woodgrab cylinder is also prevented by the make-up valve in the main control valve.

13. WOODGRAB ROTATE OPERATION



609S3HC20

When the right control pedal (OPT) pushed forward or backward, the woodgrab rotate spool in the main control valve is moved to the woodgrab rotate position by the pilot oil pressure from the remote control valve.

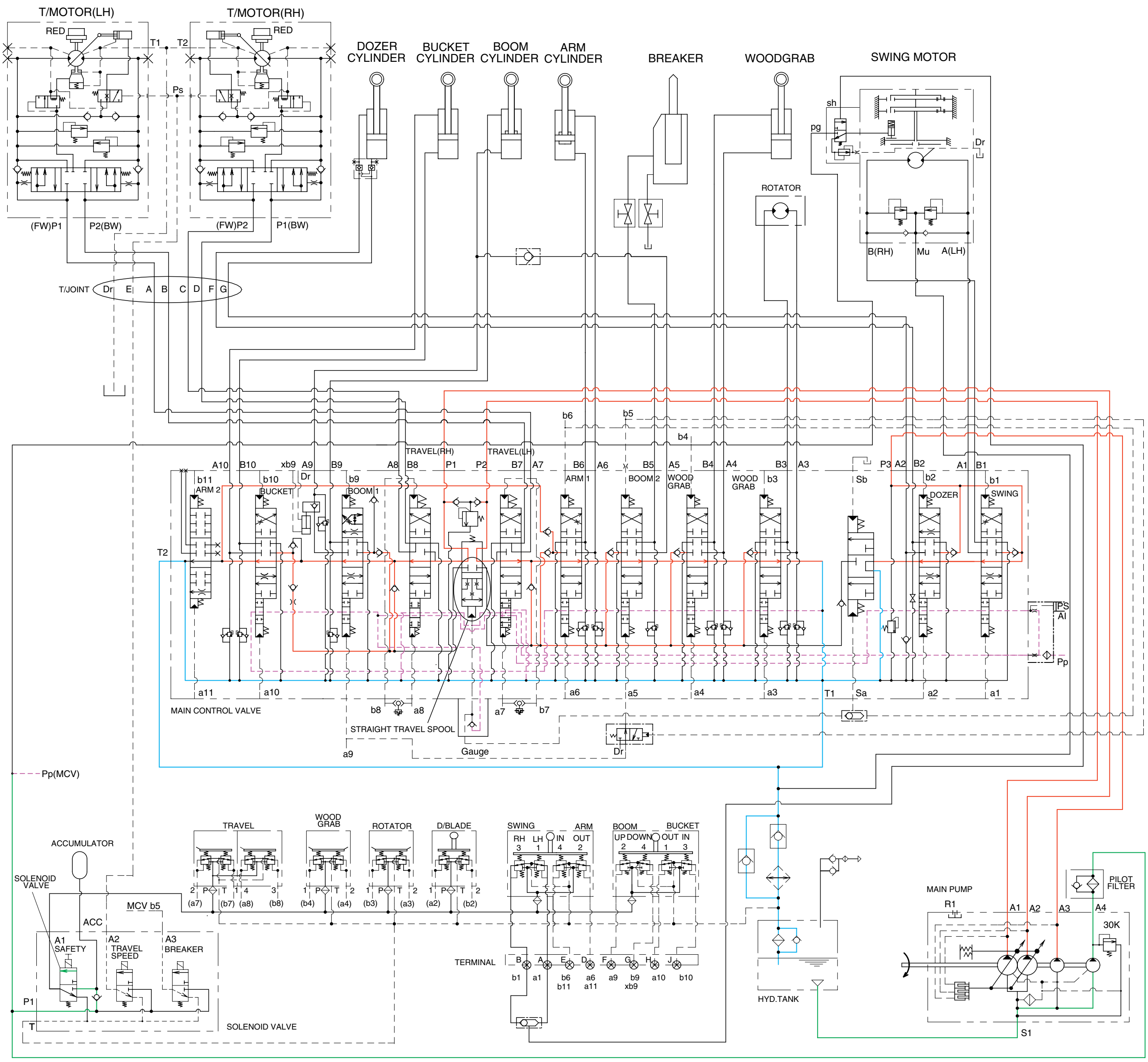
The oil from the A1 pump flows into the main control valve and the goes to the rotator.

At the same time, the oil from rotator returns to the hydraulic tank through to the woodgrab rotate spool in the main control valve. When this happens, the woodgrab rotates counterclockwise or clockwise.

The cavitation which will happen to the rotator is also prevented by the make-up valve in the main control valve.

GROUP 5 COMBINED OPERATION

1. OUTLINE



609S3HC21

The oil from the A1, A2, A3 pump flows through the neutral oil passage, bypass oil passage and confluence oil passage in the main control valve. Then the oil goes to each actuator and operates them. Check valves and orifices are located on these oil passage in the main control valve. These control the oil from the main pumps so as to correspond to the operation of each actuator and smooth the combined operation.

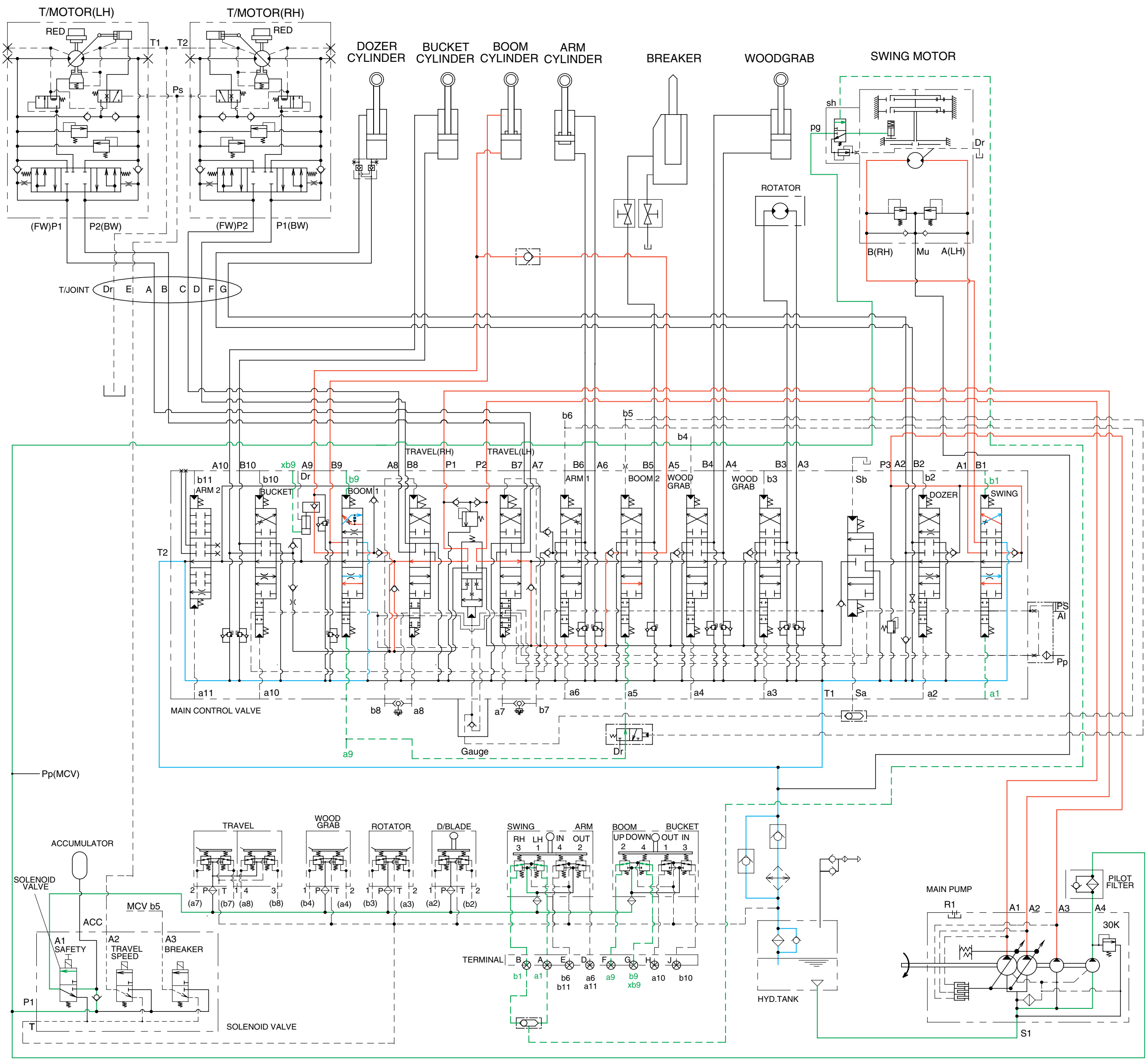
STRAIGHT TRAVEL SPOOL

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

If any actuator is operated when traveling, the straight travel spool is pushed to the up by the pilot oil pressure.

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.

2. COMBINED SWING AND BOOM OPERATION



609S3HC22

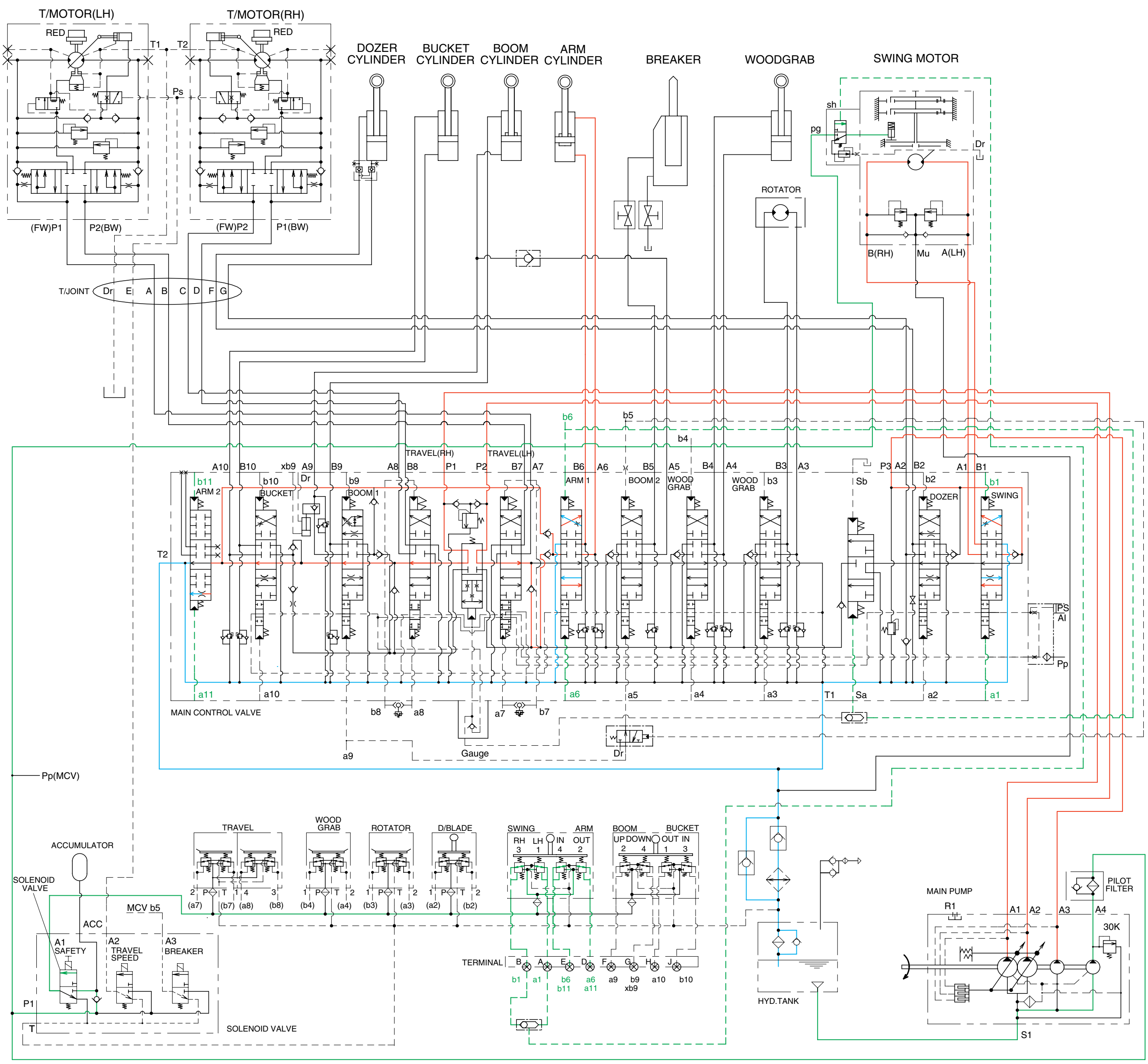
When the swing and boom functions are operated, simultaneously the swing spool and boom spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the A1 and A2 pump flows into the boom cylinder through boom and boom 2 spool.

The oil from the A3 pump flows into the swing motor through the swing spool.

The superstructure swings and the boom is operated.

3. COMBINED SWING AND ARM OPERATION



609S3HC23

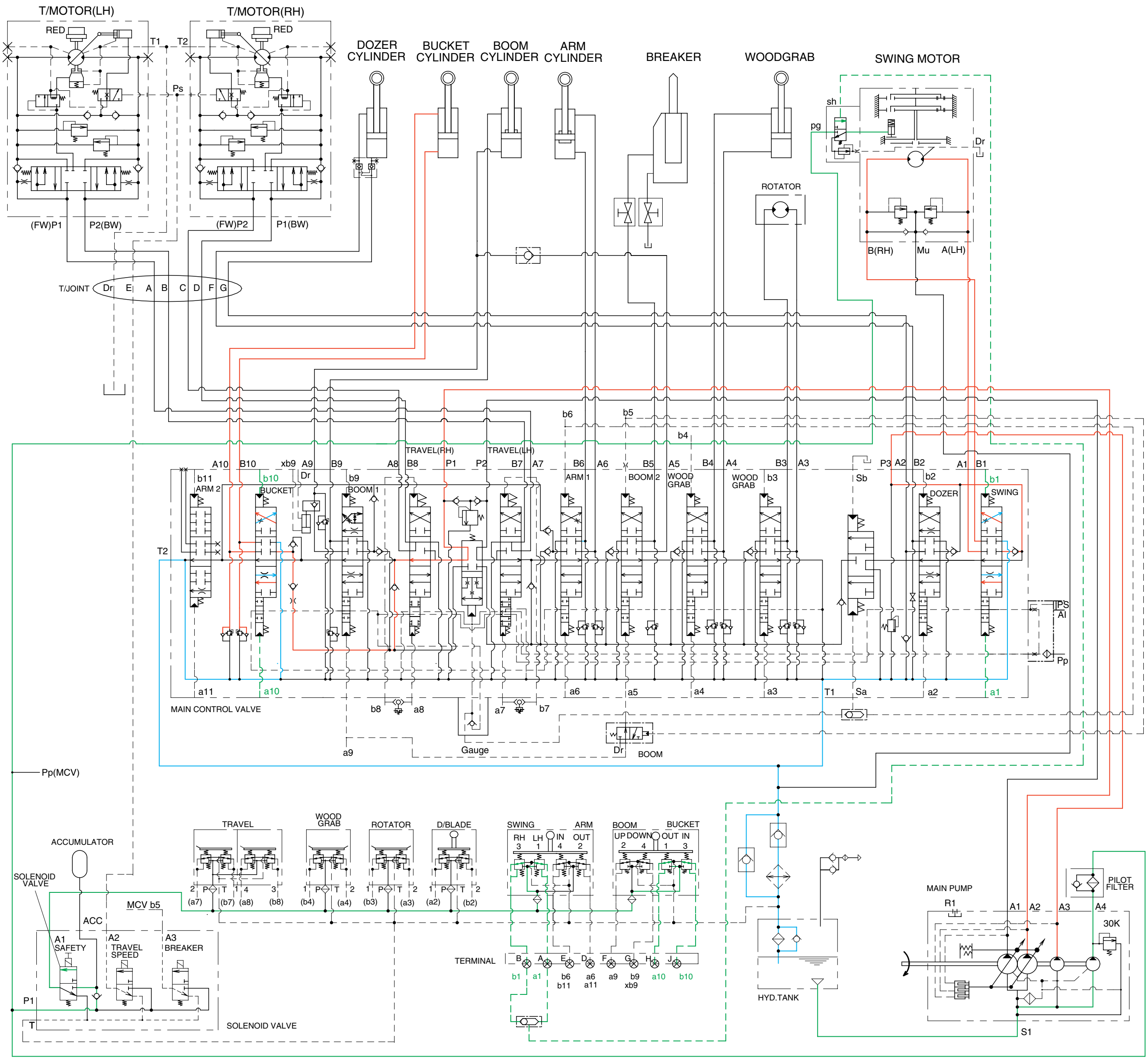
When the swing and arm functions are operated, simultaneously the swing spool and arm spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the A3 pump flows into the swing motor through swing spool.

The oil from the A1 and A2 pump flows into the arm cylinder through the arm and arm 2 spool.

The superstructure swings and the arm is operated.

4. COMBINED SWING AND BUCKET OPERATION



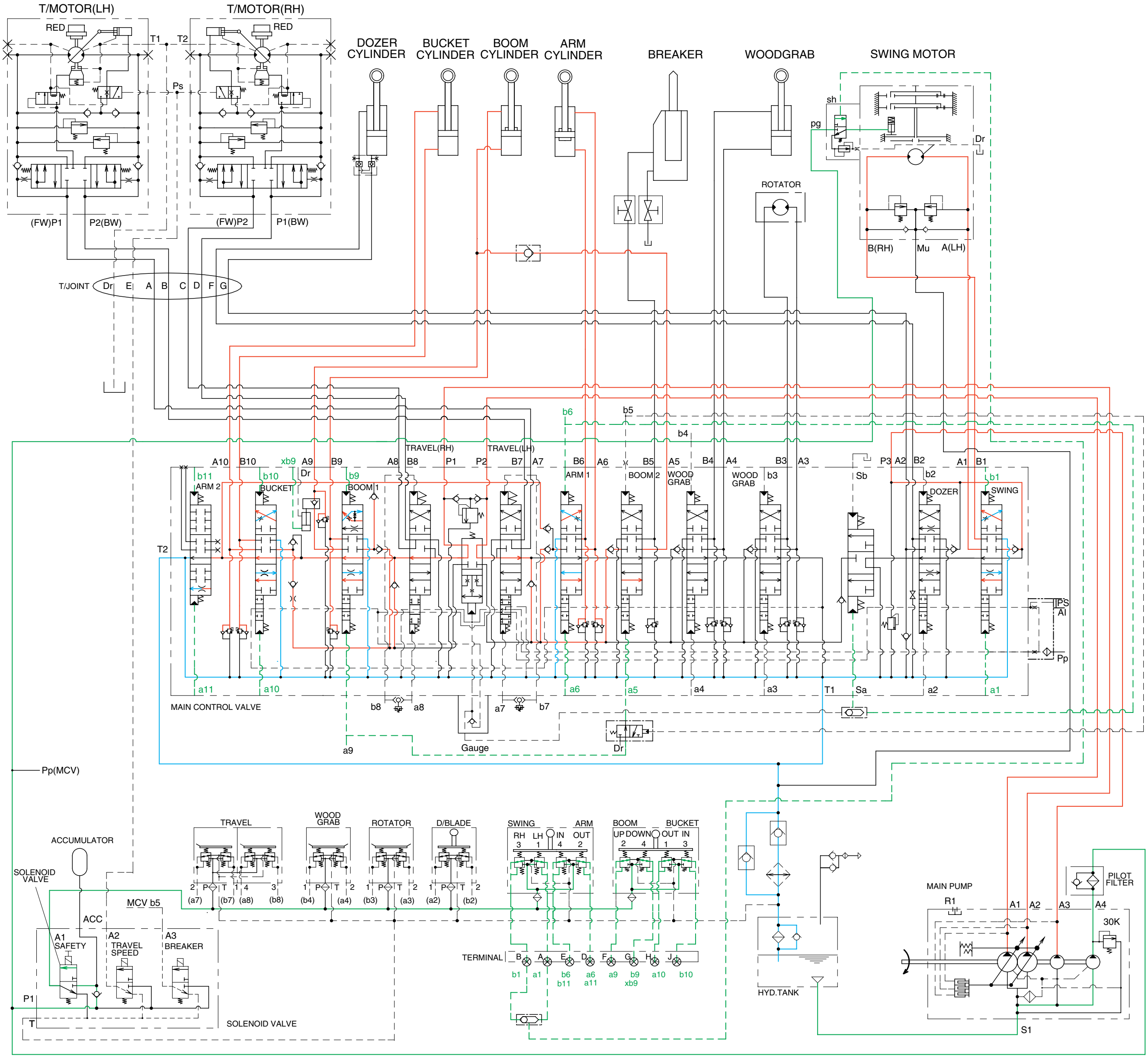
609S3HC24

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 A3 pump flows into the swing motor through the swing spool.

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

5. COMBINED SWING, BOOM, ARM AND BUCKET OPERATION



609S3HC25

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

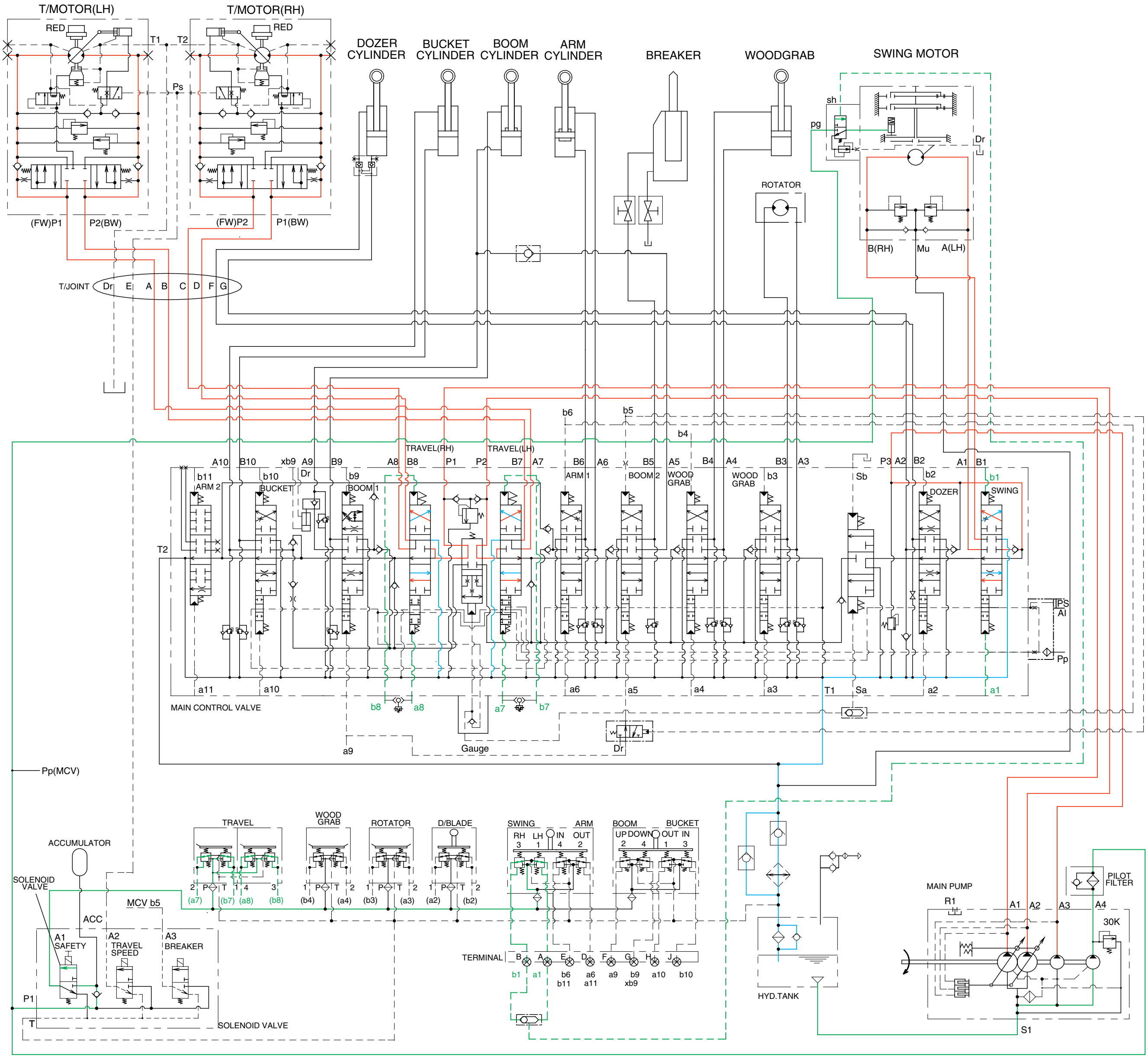
The oil from the A1 pump flows into the boom cylinders and arm cylinder through boom 2 spool, arm spool.

The oil from the A2 pump flows into the boom cylinders, arm cylinder and bucket cylinder through the boom spool, arm 2 spool, bucket spool.

The oil from the A3 pump flows into the swing motor through the swing spool.

The superstructure swings and the boom, arm and bucket are operated.

6. COMBINED SWING AND TRAVEL OPERATION



609S3HC26

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 the travel levers.

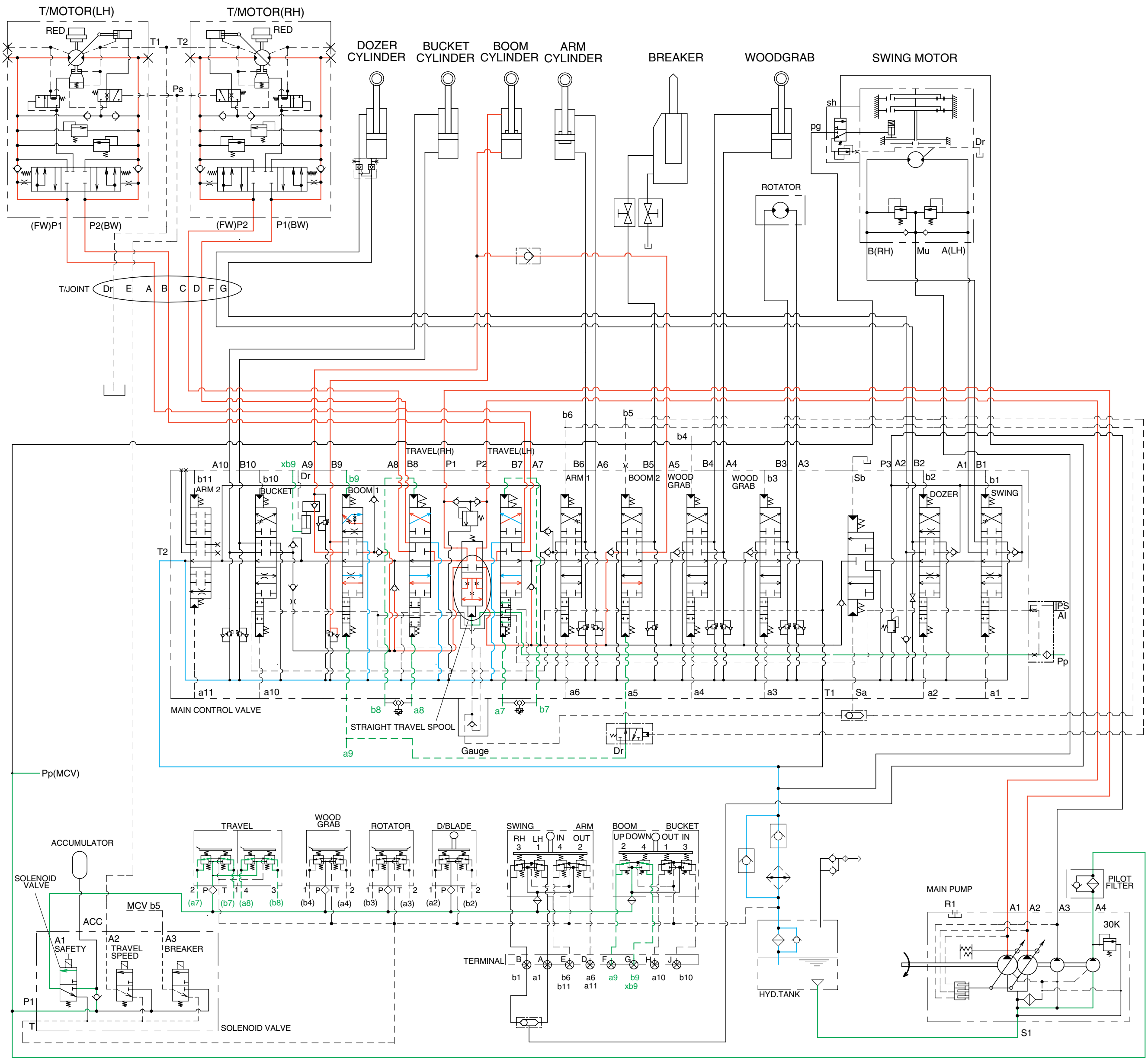
The oil from the A3 pump flows into the swing motor through the swing spool.

The oil from the A1 pump flows into the travel motor through the LH travel spool.

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

The superstructure swings and the machine travels straight.

7. COMBINED BOOM AND TRAVEL OPERATION



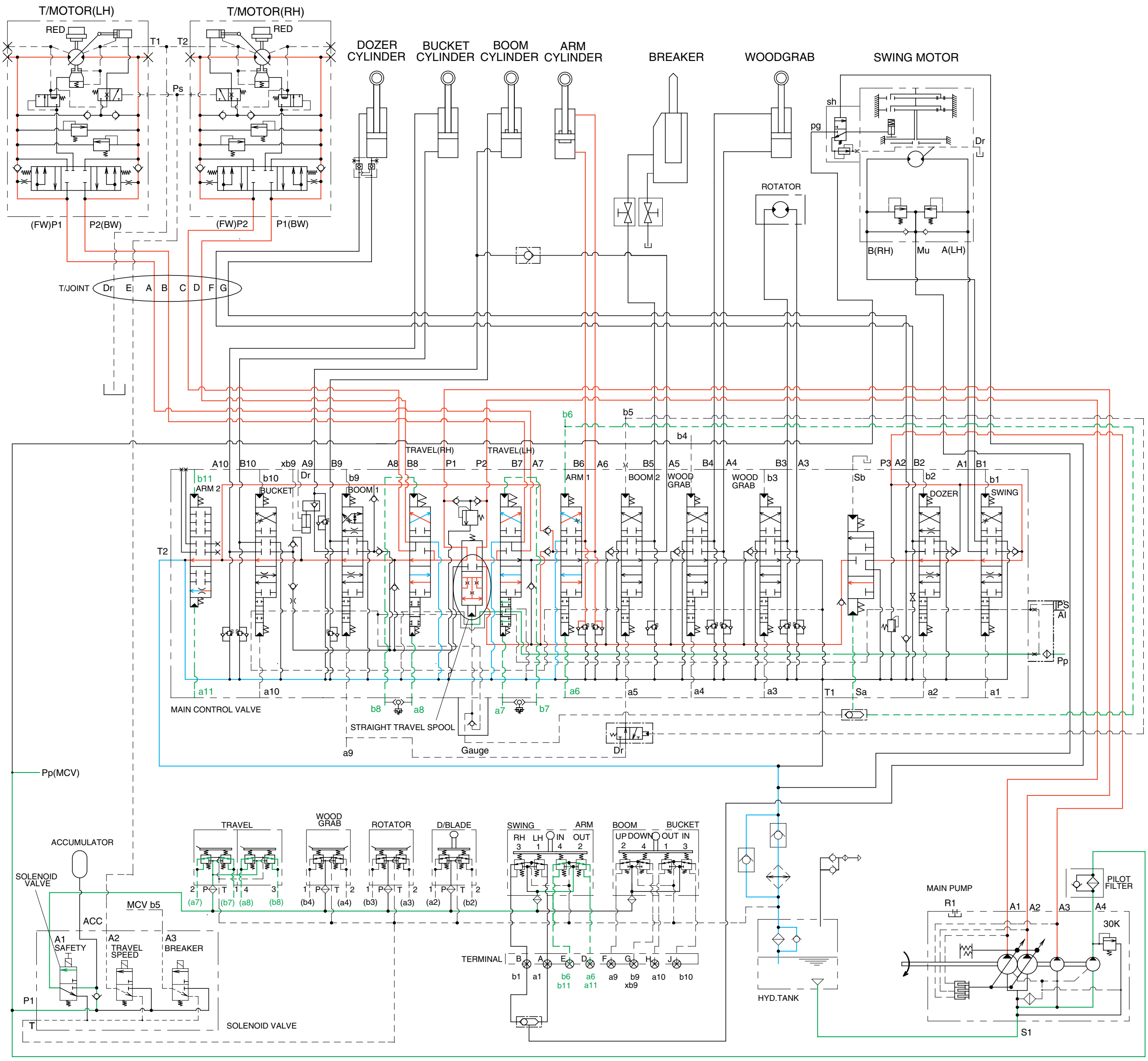
609S3HC27

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 up by the oil pressure from pilot pump.

The oil from the A1 and A2 pumps flows into the boom cylinders and the travel motors through boom 1, boom 2, travel LH and travel RH spools via the straight travel spool.

The boom is operated and the machine travels straight.

8. COMBINED ARM AND TRAVEL OPERATION



609S3HC28

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 up by the oil pressure from pilot pump.

The oil from the A1 and A2 pumps flows into the travel motors and the arm cylinder through travel spools and arm spools via the straight travel spool.

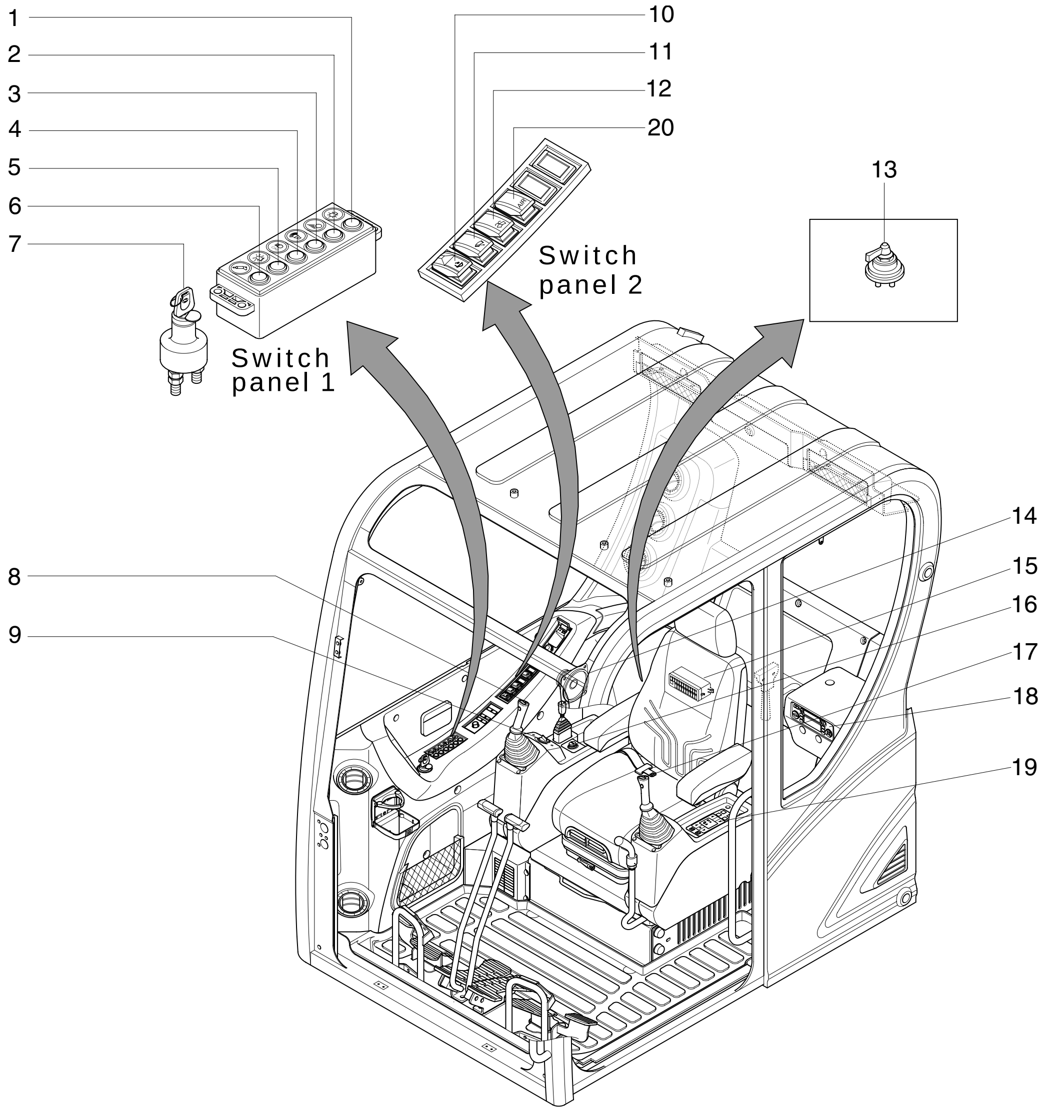
At the same time, the oil from the A3 pump flows into the arm cylinder through the arm 1 spool via the selector valve.

The arm is operated and the machine travels straight.

SECTION 4 ELECTRICAL SYSTEM

GROUP 1 COMPONENT LOCATION

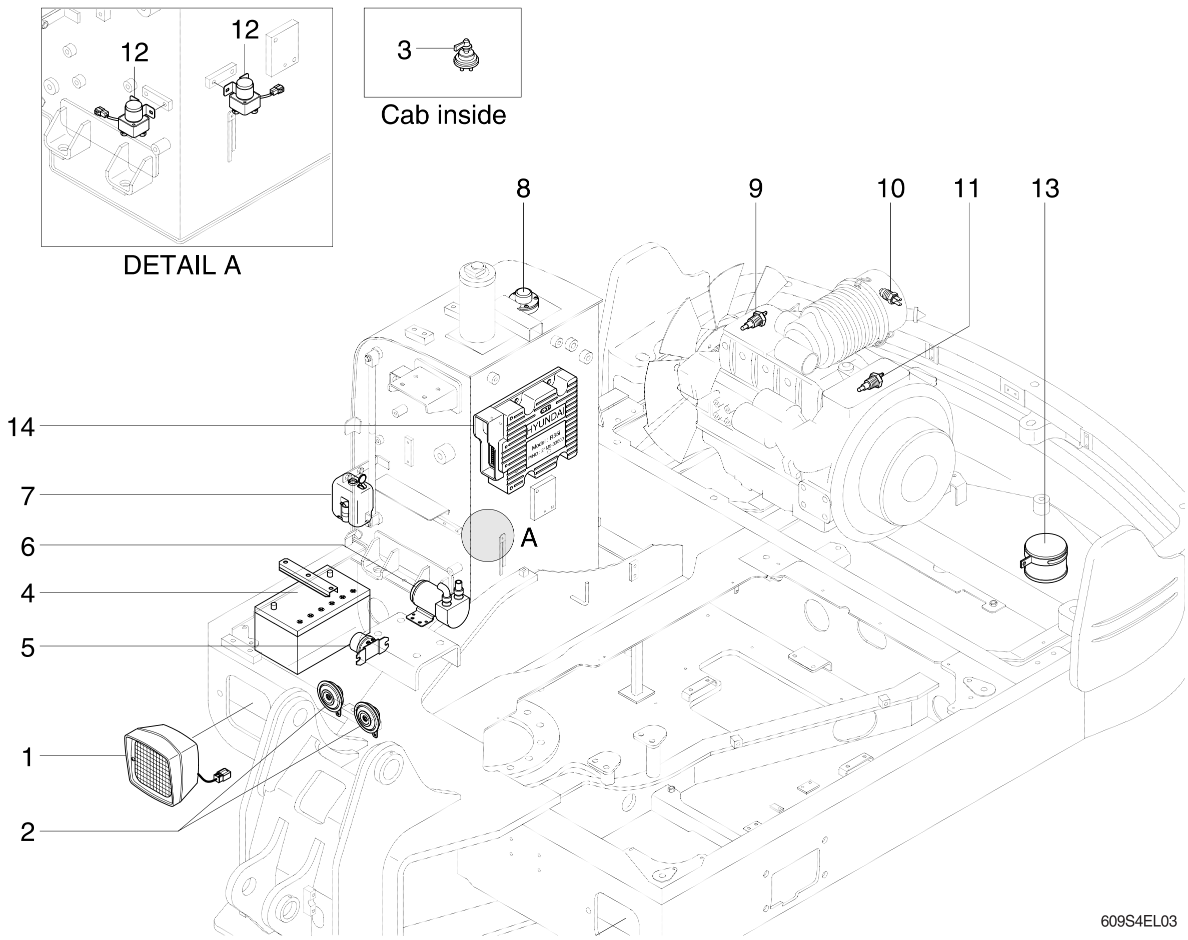
1. LOCATION 1



609S4EL02

1 Head light switch
2 Work light switch
3 Travel alarm switch
4 Cab light switch
5 Beacon switch
6 Breaker selection switch
7 Start switch
8 Breaker operation switch
 Woodgrab control switch
 (RH, option)
9 Accel dial switch
10 Quick clamp switch
11 Wiper switch
12 Washer switch
13 Master switch
14 Speaker
15 Fuse box
16 Cigar lighter
17 Horn switch
 Woodgrab control switch
 (LH, option))
18 Radio & USB player
19 Aircon & heater controller
20 Air compressor switch

2. LOCATION 2



1	Lamp	6	Fuel filler pump	11	Engine oil pressure switch
2	Horn	7	Washer pump	12	Relays
3	Master switch	8	Fuel sender	13	Travel alarm buzzer
4	Battery	9	Coolant temp sender	14	MCU
5	Battery relay	10	Air cleaner switch		

GROUP 2 MONITORING SYSTEM

1. OUTLINE

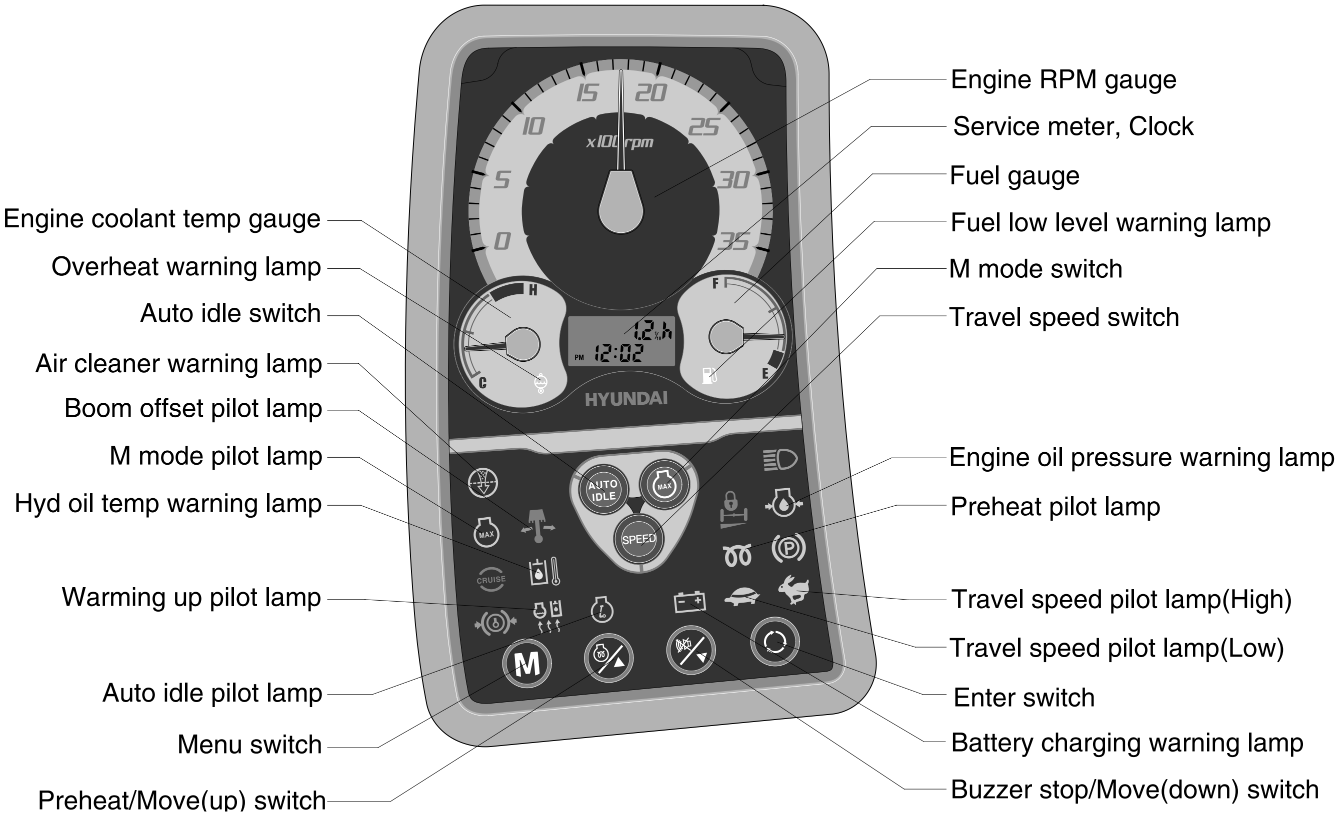
Monitoring system consists of the monitor part and switch part.

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

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

2. CLUSTER

1) MONITOR PANEL



559S3CD02

2) CLUSTER CHECK PROCEDURE

(1) Start key : ON

① Check monitor initial 6 seconds

a. All lamps light up.

b. Buzzer sound.

② Check monitor after 3 seconds : Indicate machine condition

a. Tachometer : 0 rpm

b. Fuel gauge : Pointed at appropriate level

c. Engine coolant temperature gauge : Pointed at appropriate level

d. Warning lamp

※ During start key ON the engine oil pressure lamp and battery charging lamp go on, but it is not abnormal.

※ When engine coolant temperature below 30˚C, the warming up lamp lights up and then operating the preheat switch.

(2) Start of engine

① Check machine condition

a. Tachometer pointed at present rpm

b. Gauge and warning lamp : Indicate at present condition.

※ When normal condition : All warning lamp OFF

c. Travel speed pilot lamp : Low (turtle)

② When abnormal condition

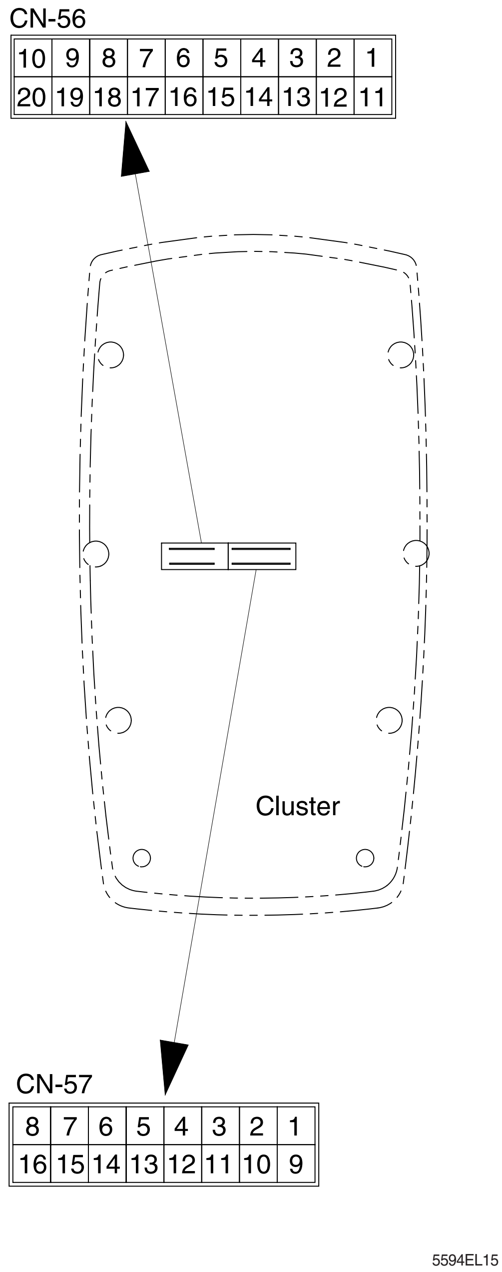
a. The lamp lights up and the buzzer sounds.

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

3. CLUSTER CONNECTOR

1) CN-56 CONNECTOR

No.	Signal	Input/ Output
1	Null	-
2	Null	-
3	Alternator signal	Input
4	Null	-
5	Tacho signal	Input
6	Anti-restart signal	Output
7	Pre-heat signal	Output
8	Travel relay	Output
9	Battery power 12V	-
10	Power IG 12V	-
11	Null	Input
12	Illumination	Input
13	Null	-
14	Null	-
15	Fuel level sender	Input
16	Hyd oil temp sendor	Input
17	Water temp sender	Input
18	GND	-
19	GND	-
20	GND	-



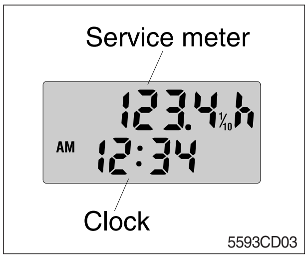
2) CN-57 CONNECTOR

No.	Signal	Input/ Output
1	Null	-
2	Engine oil pressure switch	Input
3	Air cleaner signal	Input
4	Boom swing signal	-
5	Null	-
6	Null	-
7	Null	-
8	Null	-
9	Program dump	-
10	Null	-
11	COM-GND	Input
12	RS232-RX	Input
13	RS232-TX	Output
14	RS485-RX	Input
15	RS485-TX	Output
16	Null	Input

4. CLUSTER FUNCTION

1) GAUGES AND DISPLAYS

(1) LCD display



① **Service meter** : This meter shows the total operation hours of the machine.

※ Always ensure the operating condition of the meter during the machine operation.

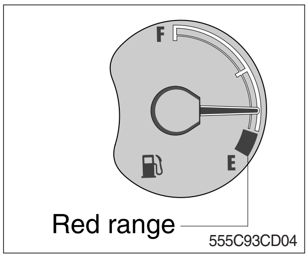
※ The last unit 4 1/10 indicates 1/10 of 4 hours.

(for example : 1 1/10 indicates 6 minutes)

② **Clock** : This displays the current time.

※ Refer to the "menu switch" for the setting time/ESL switch.

(2) Fuel gauge

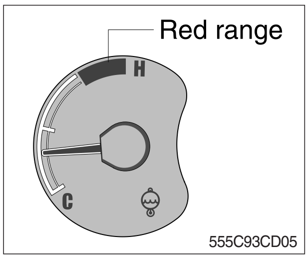


① This gauge indicates the amount of fuel in the fuel tank.

② Fill the fuel when the red range or warning lamp blinks.

※ **If the gauge indicate the red range or warning lamp ON. 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.**

(3) Engine coolant temperature gauge

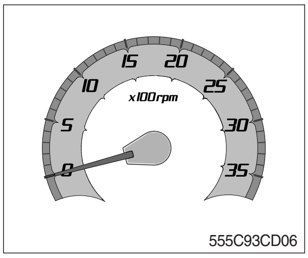


① This indicates the temperature of coolant.

② When the red range pointed or warning lamp blinks, engine do not abruptly stop but run it at medium speed to allow it to cool gradually, then stop it.
Check the radiator and engine.

※ **If the engine is stopped without cooled down running, the temperature of engine parts will rise suddenly, this could cause severe engine trouble.**

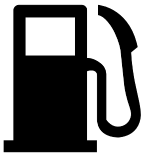
(4) Engine rpm gauge



① This gauge displays the number of engine revolutions per minute.

2) WARNING AND PILOT LAMPS

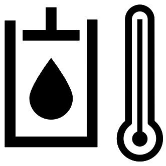
(1) Fuel low level warning lamp



R5573CD10

① This lamp blinks and the buzzer sounds when the level of fuel is below 18 ℓ (4.8 U.S. gal).
② Fill the fuel immediately when the lamp blinks.

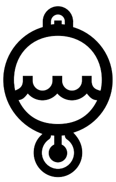
(2) Hydraulic oil temperature warning lamp



R5573CD11

① This warning lamp operates and the buzzer sounds when the temperature of hydraulic oil is over 105˚C (221˚F).
② Check the hydraulic oil level when the lamp blinks.
③ Check for debris between oil cooler and radiator.

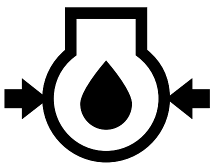
(3) Overheat warning lamp



R5573CD12

① This lamp blinks and the buzzer sounds when the temperature of coolant is over the normal temperature 110˚C (230˚F).
② Check the cooling system when the lamp blinks.

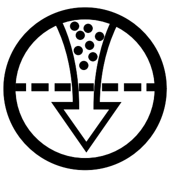
(4) Engine oil pressure warning lamp



R5573CD13

① This lamp blinks and the buzzer sounds after starting the engine because of the low oil pressure.
② If the lamp blinks during engine operation, shut OFF engine immediately. Check oil level.

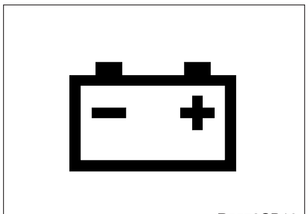
(5) Air cleaner warning lamp



R5573CD14

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

(6) Battery charging warning lamp

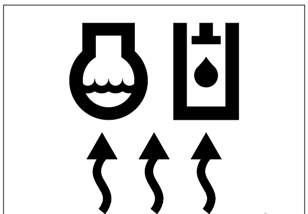


R5573CD16

① This lamp blinks and the buzzer sounds when the starting switch is ON, it is turned OFF after starting the engine.

② Check the battery charging circuit when this lamp blinks during engine operation.

(7) Warming up pilot lamp

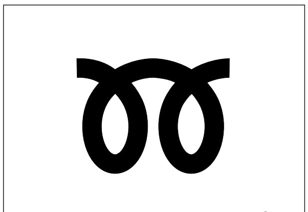


R5573CD18

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.

(8) Preheat pilot lamp

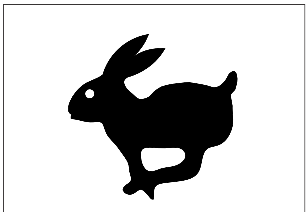


R5573CD19

① When engine preheating switch is turned ON, pilot lamp cames ON.

② Refer to the preheating switch for details.

(9) Travel speed pilot lamp (high)

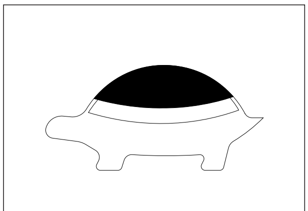


R5573CD20

① When this lamp turned ON, the machine travel high speed.

② Refer to the travel speed select switch for details.

(10) Travel speed pilot lamp (low)

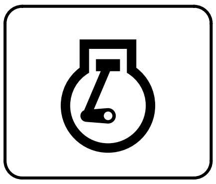


R5573CD21

① When this lamp turned ON, the machine travel low speed.

② Refer to the travel speed select switch for details.

(11) Auto idel pilot lamp



21073CD17

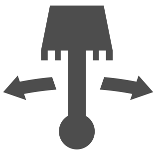
① If the control lever and pedal are not moved for several seconds with auto idle switch pressed, the indicator illuminates and engine speed is decelerated.
② If the auto idle switch is pressed once more or the control lever or pedal is moved, the indicator turns off and the number of engine revolution is turned to the previous condition.

(12) M mode pilot lamp

55W7A3CD83

① This lamp is ON when the M mode switch is pressed.
② Engine is operated with a maximum speed.

(13) Boom offset pilot lamp

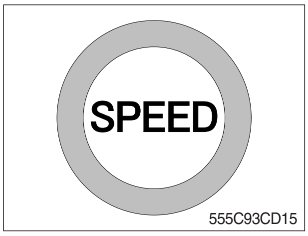


555C93CD13

① This lamp is ON when the boom swing pedal is operated.

3) SWITCHES

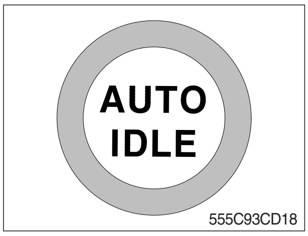
(1) Travel speed control switch



555C93CD15

① This switch is to control the travel speed which is changed to high speed (rabbit mark) by pressing the switch and low speed (turtle mark) by pressing it again.

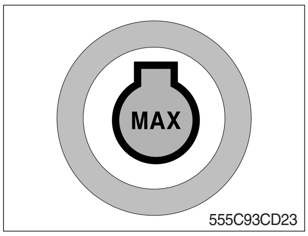
(2) Auto idle switch



555C93CD18

① This switch is used to actuate or cancel the auto idle function.
② When the switch actuated and all control levers and pedals are at neutral position, engine speed will be lowered automatically to save fuel consumption.

(3) M mode switch



555C93CD23

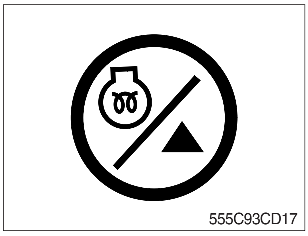
① This switch is used to maximum power.
② When this switch is pressed, the M mode pilot lamp is ON or OFF.

(4) Move (down) & buzzer stop switch


555C93CD16

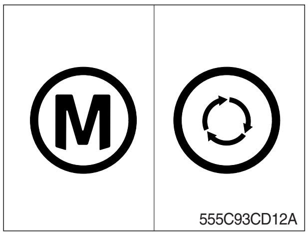
① When the starting switch is turned ON first, normally the alarm buzzer sounds for 6 seconds during lamp check operation.
② The lamp lights ON and the buzzer sounds when the machine has a problem.
In this case, press this switch and buzzer stops, but the lamp lights until the problem is cleared.
③ This switch is used to move down or decrease input value.

(5) Preheat/Move (up) switch

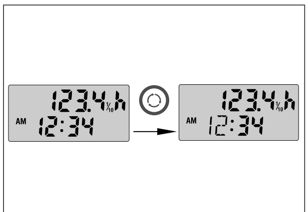

555C93CD17

① When the preheat switch is pressed, the preheating function is actuated within 15 seconds.
② After the preheat pilot lamp is turned OFF, engine start.
③ This switch is used to move up or increase input value.

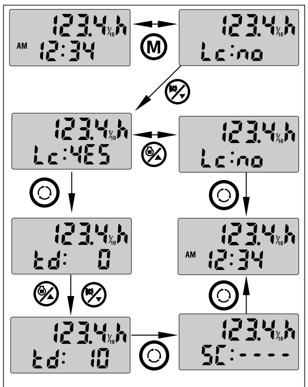
(6) Menu and enter switch


555C93CD12A

① These switches are used to set time or set ESL (Engine Start Limit) function.
- The Enter button ( ) is used to select a function.
- The Menu button ( ) is used to select a menu or return to the time display menu.


555C93CD86

② **Setting time**
- Press Enter button ( ) to set time, then the screen will be changed to a display for time setting as a following picture and time cipher will blink.
- **Set hours** : When the cipher for hour blinks, press up ( ) or down ( ) button and set the hour.
- **Set minutes**: When the cipher for minute blinks, press up ( ) or down ( ) button and set the minute.

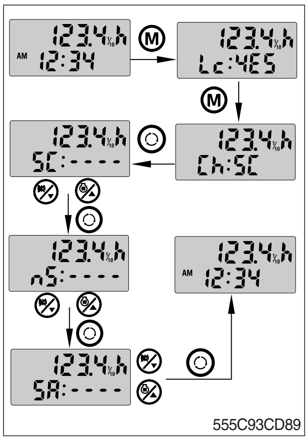


555C93CD87A

③ **Set ESL** (Engine Start Limit) **function**
- Press Menu button ( ), the display is changed from the time display menu to ESL function menu.
- Select YES or NO by Move button (,) and set the ESL function by the Enter button ( ).
  - · YES : ESL function is activated.
  - · NO : ESL function is cancelled.

④ **Set the interval time**
- Select ESL function to YES and press the Enter button ( ), then the display is changed to the interval time set menu.
- Set the interval time by move button (,) and press the Enter button ( ).
- You can finish setting the interval time by inputting the password and pressing the Enter button ( ) once more.
- Interval times : 5 kinds (0, 10, 30, 60 minutes, 1day)

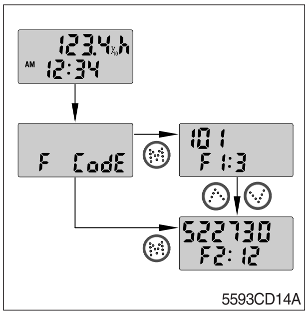
※ **If the ESL function is set to YES, the password is required when a operator starting engine first.**
But the operator can restart the engine within the interval time period without inputting the password.



⑤ Change password

- Selct ESL function to YES and press the Menu button (M), the display is shifted to the password change menu.
  - · Input a new password (Sn : - - - -) after enter the current password successfully (SC : - - - -).
  - · Push enter ( ) button for a second to finish the setting after the new password is entered once again (SA : - - - -).
  - · When the setting is done, the display will blink 3 times and return to the time display screen.

  ※ **Default password : 0000**



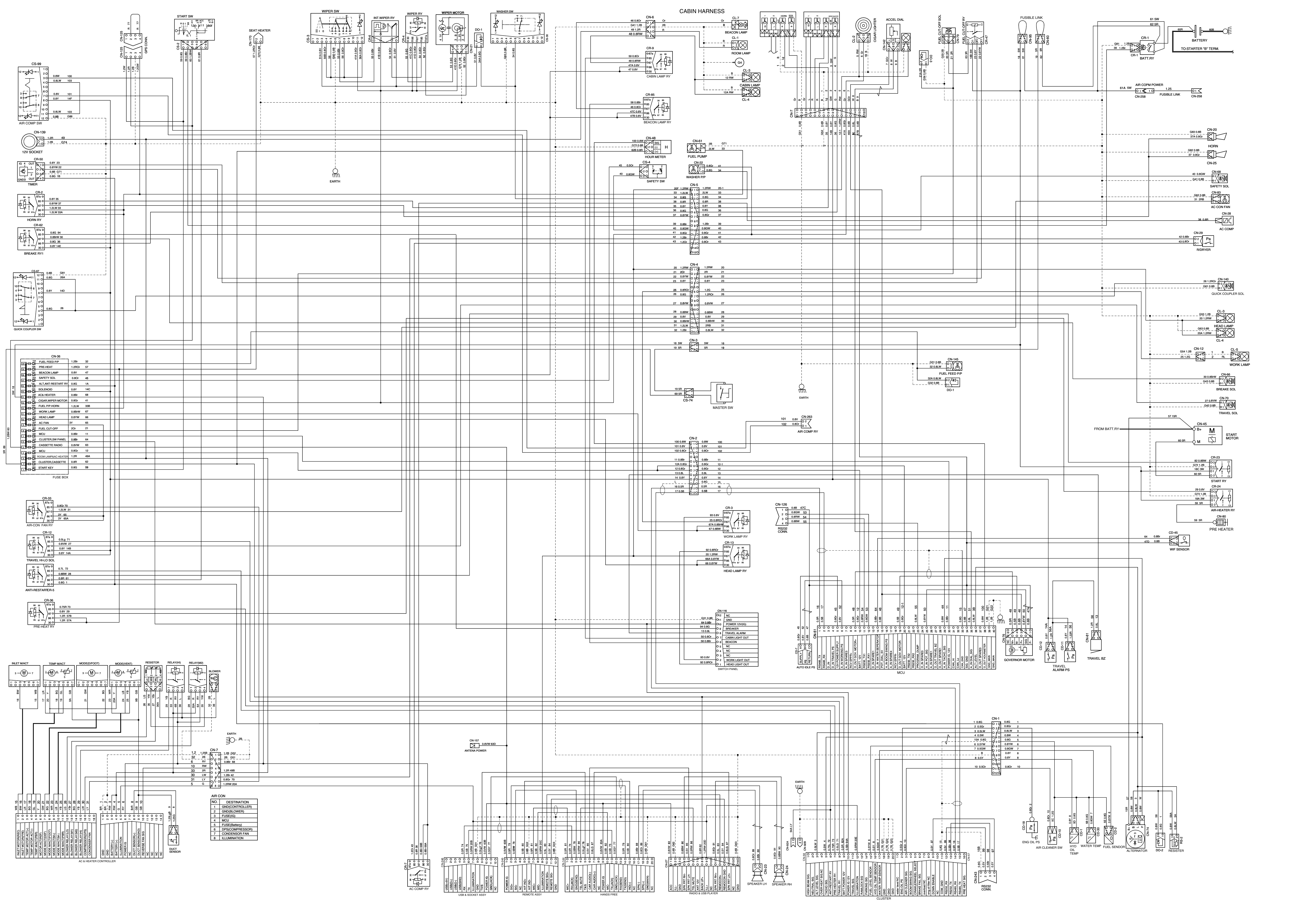
⑥ Check machine diagnostic codes

- If the F : Code is displayed on the LCD display, you can check faults of the machine.
- The machine fault code is displayed by pressing the Menu button (M).
- Other fault codes can be displayed by using the Move up / down button (,).

  ※ **Refer to the following pages for the fault codes.**

⑦ Machine fault code

Fault code		Description
HCESPN	FMI	
101	3	Hydraulic oil temperature sensor circuit - voltage above normal or shorted to high source (or open circuit)
	4	Hydraulic oil temperature sensor circuit - voltage below normal or shorted to low source
105	0	Working pressure sensor data above normal range (or open circuit)
	1	Working pressure sensor data below normal range
	2	Working pressure sensor data error
	4	Working pressure sensor circuit - voltage below normal, or shorted to low source
108	0	Travel oil pressure sensor data above normal range (or open circuit)
	1	Travel oil pressure sensor data below normal range
	2	Travel oil pressure sensor data error
	4	Travel oil pressure sensor circuit - voltage below normal or shorted to low source
122	0	Overload pressure sensor data above normal range (or open circuit)
	1	Overload pressure sensor data below normal range
	2	Overload pressure sensor data error
	3	Overload pressure sensor circuit - voltage below normal or shorted to low source
301	3	Fuel level sensor circuit - voltage above normal or shorted to high source (or open circuit)
	4	Fuel level sensor circuit - voltage below normal or shorted to low source
503	0	Brake pressure sensor data above normal range (or open circuit)
	1	Brake pressure sensor data below normal range
	2	Brake pressure sensor data error
	4	Brake pressure sensor data - voltage below normal or shorted to low source
505	0	Working brake pressure sensor data above normal range (or open circuit)
	1	Working brake pressure sensor data below normal range
	2	Working brake pressure sensor data error
	4	Working brake pressure sensor circuit - voltage below normal, or shorted to low source
530	0	Travel fwd pilot pressure sensor data above normal range (or open circuit)
	1	Travel fwd pilot pressure sensor data below normal range
	2	Travel fwd pilot pressure sensor data error
	4	Travel fwd pilot pressure sensor circuit - voltage below normal, or shorted to low source
	14	Travel fwd pilot pressure sensor circuit - special instructions
	16	Travel fwd pilot pressure sensor circuit - voltage valid but above normal operational range
701	4	Hour meter circuit - voltage below normal, or shorted to low source
705	0	MCU input voltage high
	1	MCU input voltage low
707	1	Alternator node I voltage low (or open circuit)
714	3	Acc. dial circuit - voltage above normal, or shorted to high source (or open circuit)
	4	Acc. dial circuit - voltage below normal, or shorted to low source
840	2	Cluster communication data error
841	2	ECM communication data error



609S4EL01

MEMORANDUM

1. POWER CIRCUIT

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

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 → Fusible link (CN-60) → I/conn [CN-3 (2)] → Master switch [CS-74]

- → Fuse box [No.1] → Start switch [CS-2 (1)]
- → Fuse box [No.2]
  - → Radio & USB player [CN-27 (8)]
  - → Cluster [CN-56 (9)]
- → Fuse box [No.3]
  - → I/conn [CN-7 (5)] → AC & Heater controller
  - → I/conn [CN-6 (3)] → Room lamp [CL-1 (2)]
  - → 12V socket [CN-139 (2)]
- → Fuse box [No.4]
  - → I/conn [CN-2 (7)] → MCU [CN-51 (10)]
  - → I/conn [CN-2 (6)] → MCU [CN-51 (20)]

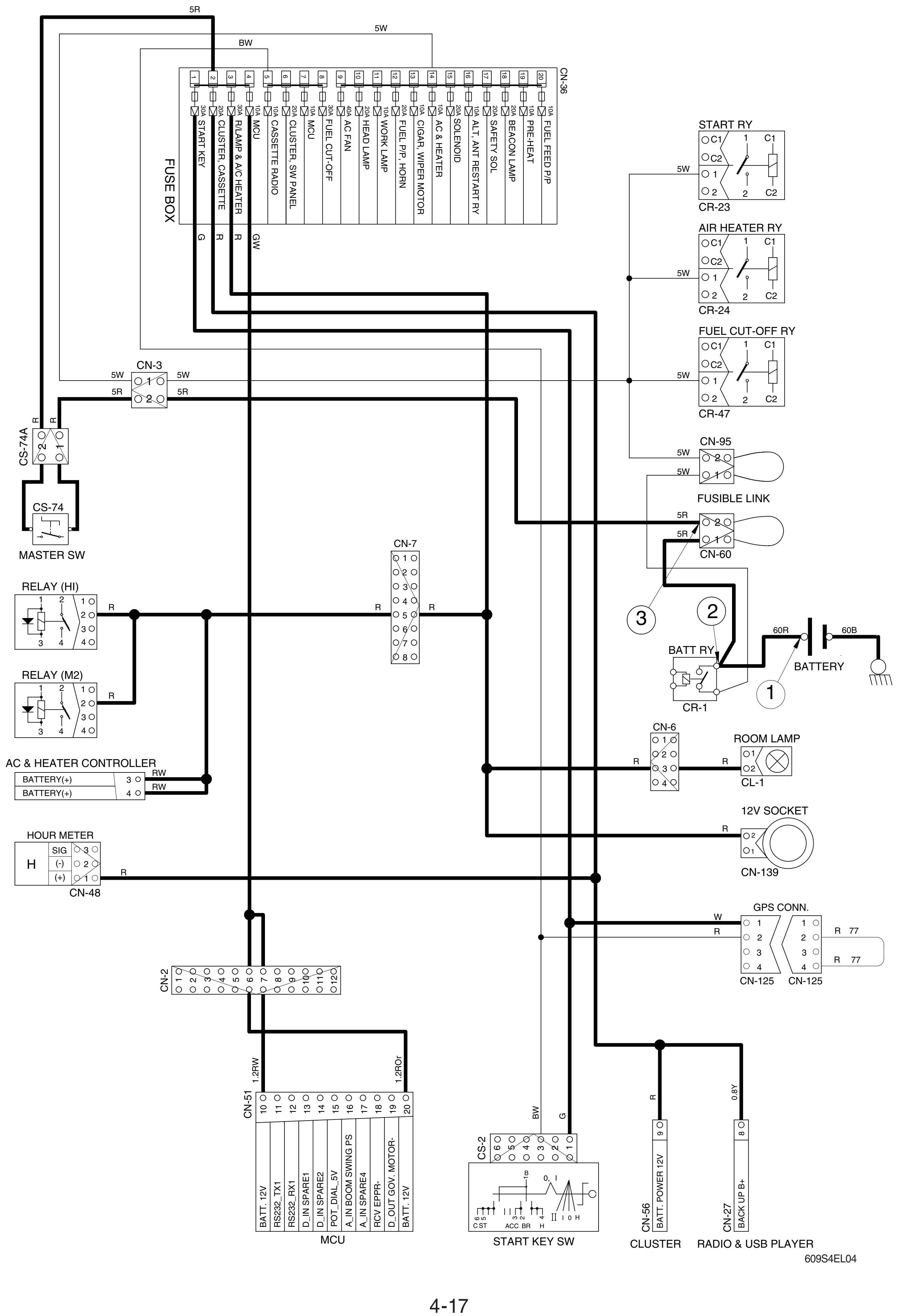
※ I/conn : Intermediate connector

2) CHECK POINT

Engine	Start switch	Check point	Voltage
OFF	OFF	① - GND (battery) ② - GND (battery relay) ③ - GND (fusible link)	10~12.5V

※ GND : Ground

POWER CIRCUIT



2. STARTING CIRCUIT

1) OPERATING FLOW

Battery (+) terminal → Battery relay [CR-1] → Fusible link [CN-60]
→ I/conn [CN-3 (2)] → Master switch [CS-74] → Fuse box No.1 → Start key [CS-2 (1)]

※ Start switch : ON

→ Start switch ON [CS-2 (2)] → I/conn [CN-5 (9)] →
Battery relay [CR-1]:Battery relay operating (all power is supplied with the electric component)
→ Start switch ON [CS-2 (3)] → Fuse box (all power is supplied with electric component)

※ Start switch : START

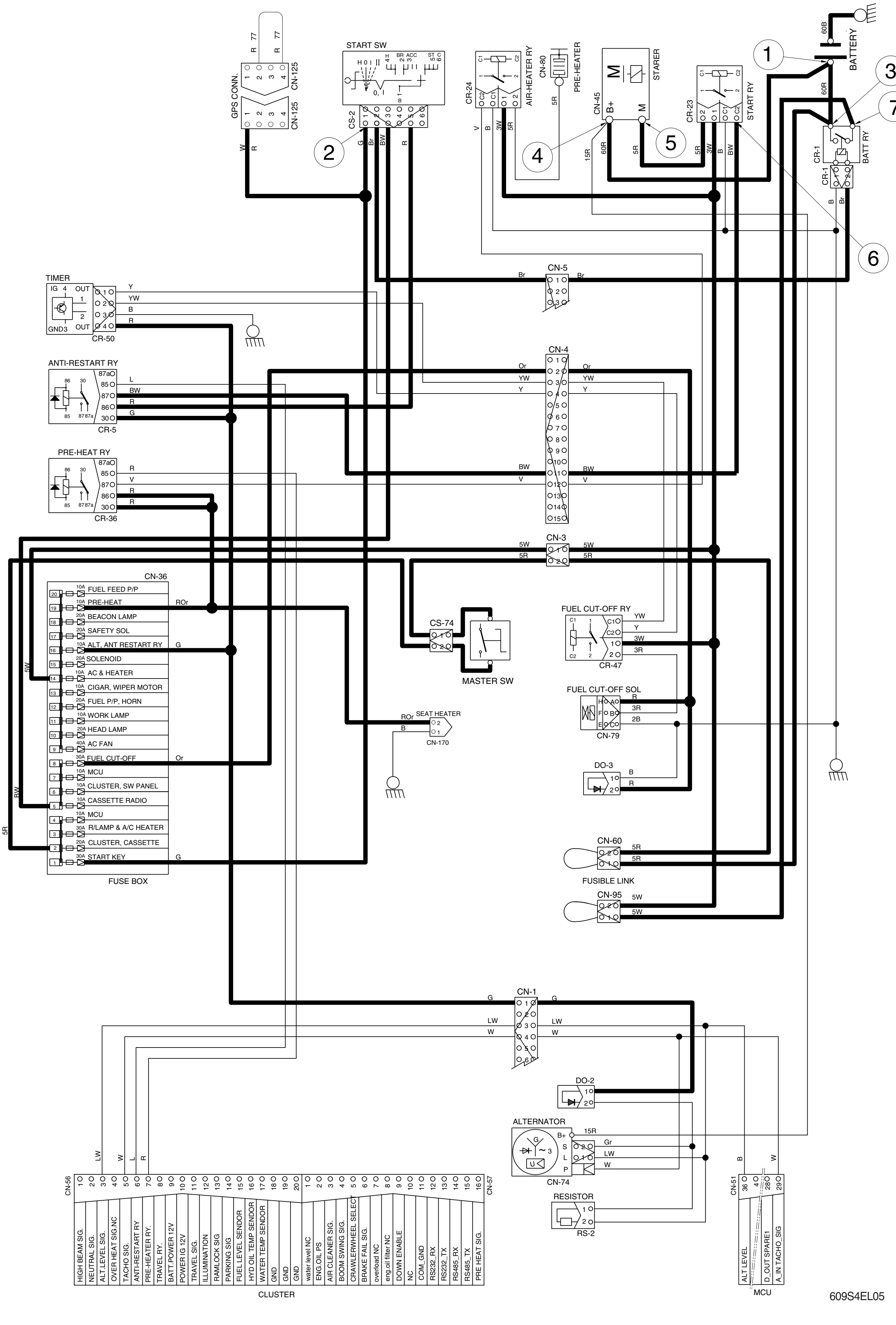
Start switch START [CS-2 (5)] → Anti-restart relay [CR-5 (86) → (87)] → I/conn [CN-4 (11)]
→ Start relay [CR-23 (C2) → (2)] → Starter motor operating

2) CHECK POINT

Engine	Start switch	Check point	Voltage
Operating	Start	① - GND (battery) ② - GND (start key) ③ - GND (battery relay M4) ④ - GND (starter B^+) ⑤ - GND (starter M) ⑥ - GND (start relay) ⑦ - GND (battery relay M8)	10~12.5V

※ GND : Ground

STARTING CIRCUIT



3. CHARGING CIRCUIT

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

Charging current generated by operating alternator flows into the battery through the Battery relay (CR-1).

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

1) OPERATING FLOW

(1) Warning flow

Alternator "L" terminal → I/conn [CN-1 (3)] → Cluster [CN-56 (3)] → Cluster warning lamp
└→ MCU [CN-51 (36)]

(2) Charging flow

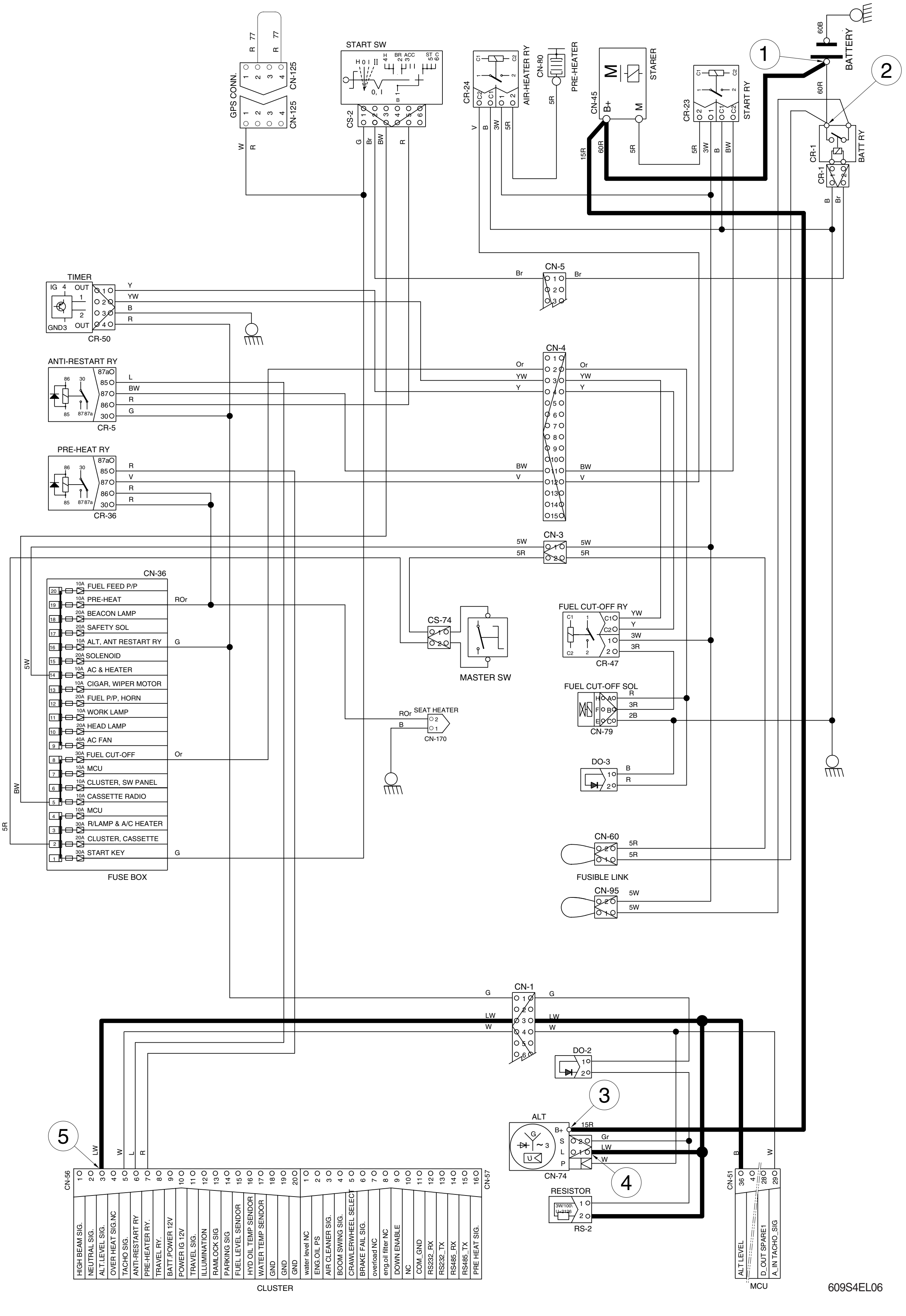
Alternator "B^+" terminal → Battery relay → Battery (+) terminal

2) CHECK POINT

Engine	Start switch	Check point	Voltage
Operating	Start	① - GND (battery voltage) ② - GND (battery relay) ③ - GND (alternator B^+ terminal) ④ - GND (alternator L terminal) ⑤ - GND (cluster)	10~12.5V

※ GND : Ground

CHARGING CIRCUIT



4. HEAD AND WORK LAMP CIRCUIT

1) OPERATING FLOW

Fuse box (No.10) → Head lamp relay [CR-13 (30, 86)]
Fuse box (No.11) → Work lamp relay [CR-3 (30, 86)]

(1) Head lamp switch ON

Head lamp switch ON [CN-116(1)] → Head lamp relay [CR-13 (85) → (87)]
- → I/conn [CN-4 (2)] → Head lamp ON [CL-3, 4 (2)]
- → I/conn [CN-5 (1)] → I/conn [CN-7 (11)] → Cigar lighter [CL-2 (1)]
- → Remote controller illumination ON [CN-245 (9)]
- → Radio & USB player illumination ON [CN-27 (9)]
- → USB & Socket illumination ON [CN-246 (7)
- → Cluster illumination ON [CN-56 (12)]
- → I/conn [CN-2 (8)] → AC/Heater controller illumination ON

(2) Work lamp switch ON

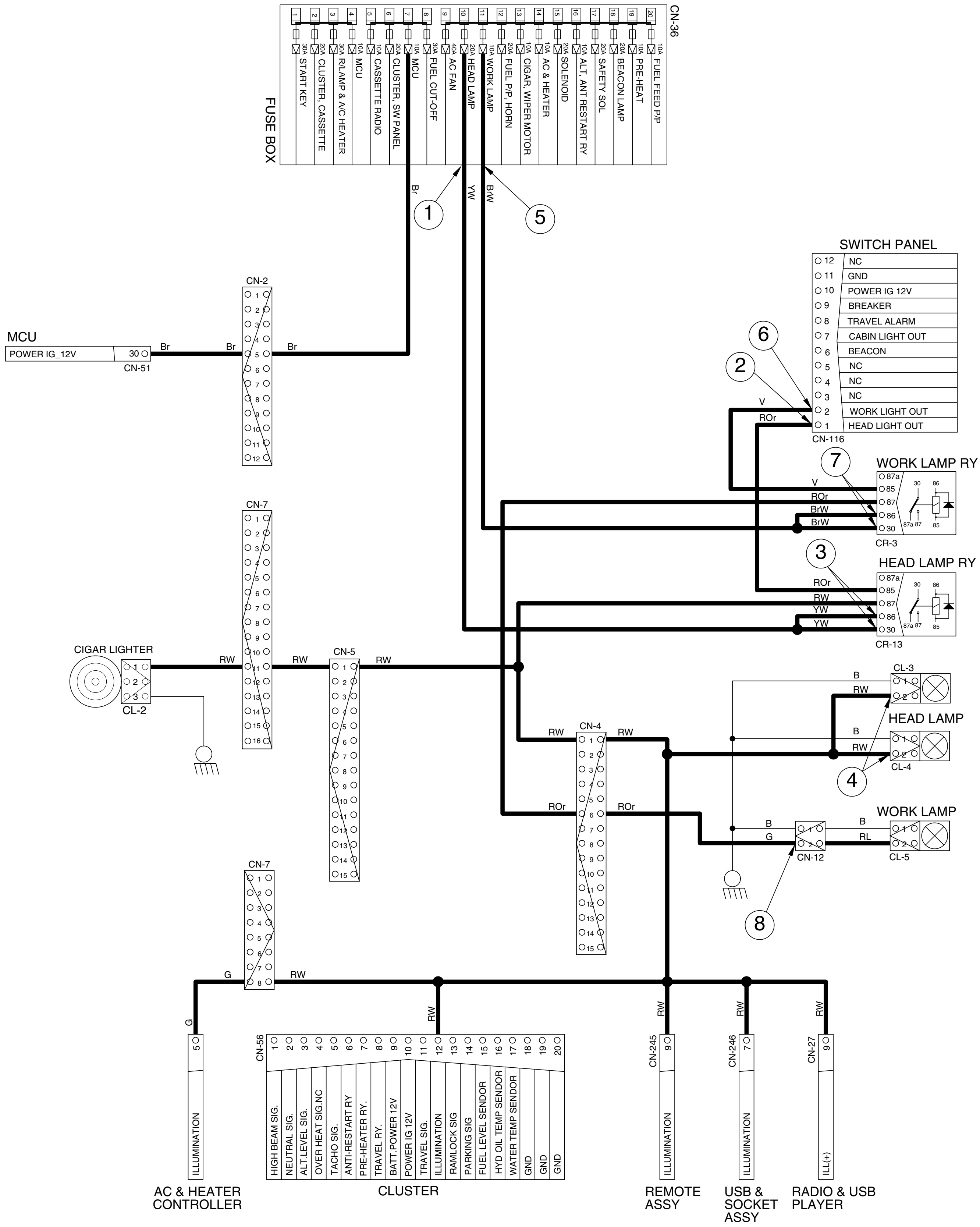
Work light switch ON [CN-116 (2)] → Work lamp [CR-3 (85) → (87)] → I/conn [CN-4 (8)]
I/conn [CN-12 (2)] → Work lamp ON [CL-5 (2)]

2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box) ② - GND (switch power input) ③ - GND (switch power output) ④ - GND (head light) ⑤ - GND (fuse box) ⑥ - GND (switch power input) ⑦ - GND (switch power output) ⑧ - GND (work light)	10~12.5V

※ GND : Ground

HEAD AND WORK LAMP CIRCUIT



609S4EL07

5. BEACON LAMP AND CAB LAMP CIRCUIT

1) OPERATING FLOW

Fuse box (No.18) ─→ Beacon lamp relay [CR-85 (30, 86)]
└→ Cab lamp relay [CR-9 (30, 86)]

(1) Beacon lamp switch ON

Beacon lamp switch ON [CN-116 (6)] → Beacon lamp relay [CR-85 (85) → (87)] → I/conn [CN-6 (1)] → Beacon lamp ON [CL-7]

(2) Cab lamp switch ON

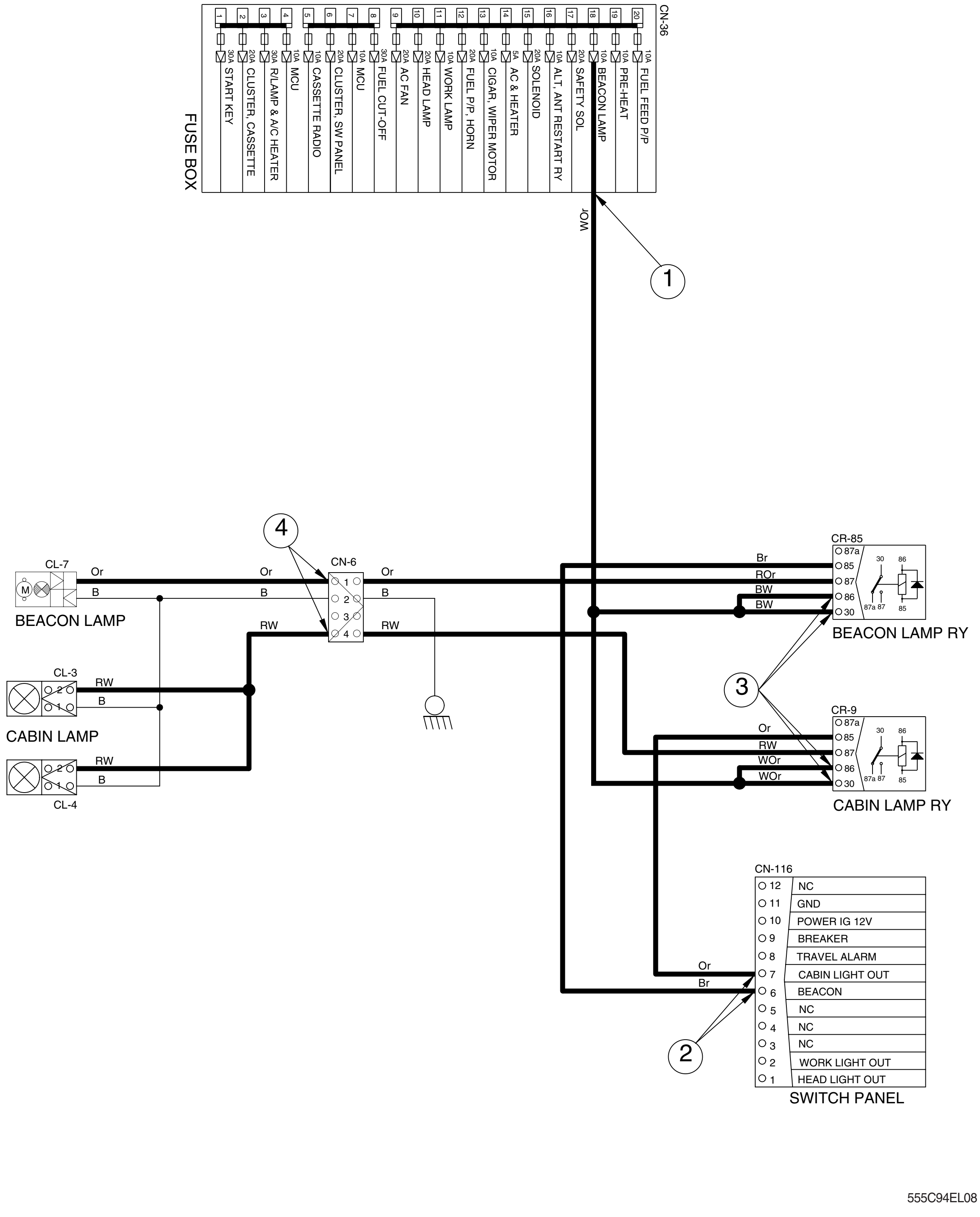
Cab lamp switch ON [CN-116 (7)] → Cab lamp relay [CR-9 (85) → (87)] → I/conn [CN-6 (4)] → Cab lamp ON [CL-3, 4]

2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box) ② - GND (switch power input) ③ - GND (switch power output) ④ - GND (beacon & cab lamp)	10~12.5V

※ GND : Ground

BEACON LAMP CIRCUIT



6. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

(1) Key switch ON

Fuse box (No.13) → Wiper relay [CR-4 (86)]
→ Int wiper relay [CR-6 (4)]
→ Wiper switch [CS-3 (11)]
→ Wiper motor [CN-21 (3)]
→ I/conn [CN-5 (11)] → Washer pump [CN-22 (2)]

(2) Wiper switch ON : 1st step

Wiper switch ON [CS-3 (9)→(7)] → Int wiper relay [CR-6 (6)→(3)] → Wiper relay [CR-4 (85)→(30)]
→ Wiper motor operating [CN-21 (4)]

Wiper switch ON [CS-3 (10)→(8)] → Wiper switch indicator lamp ON

(3) Wiper switch ON : 2nd step

Wiper switch ON [CS-3 (3)] → Int wiper relay [CR-6 (1)→(3)] → Wiper relay [CR-4 (85)→(30)]
→ Wiper motor operating [CN-21 (4)]
→ Diode [DO-1 (1)→(2)] → Wiper switch [CS-30 (6)]
→ Washer switch ON → I/conn[CN-5 (3)]
→ Washer pump operating [CN-22 (1)]

(4) Auto parking (when switch OFF)

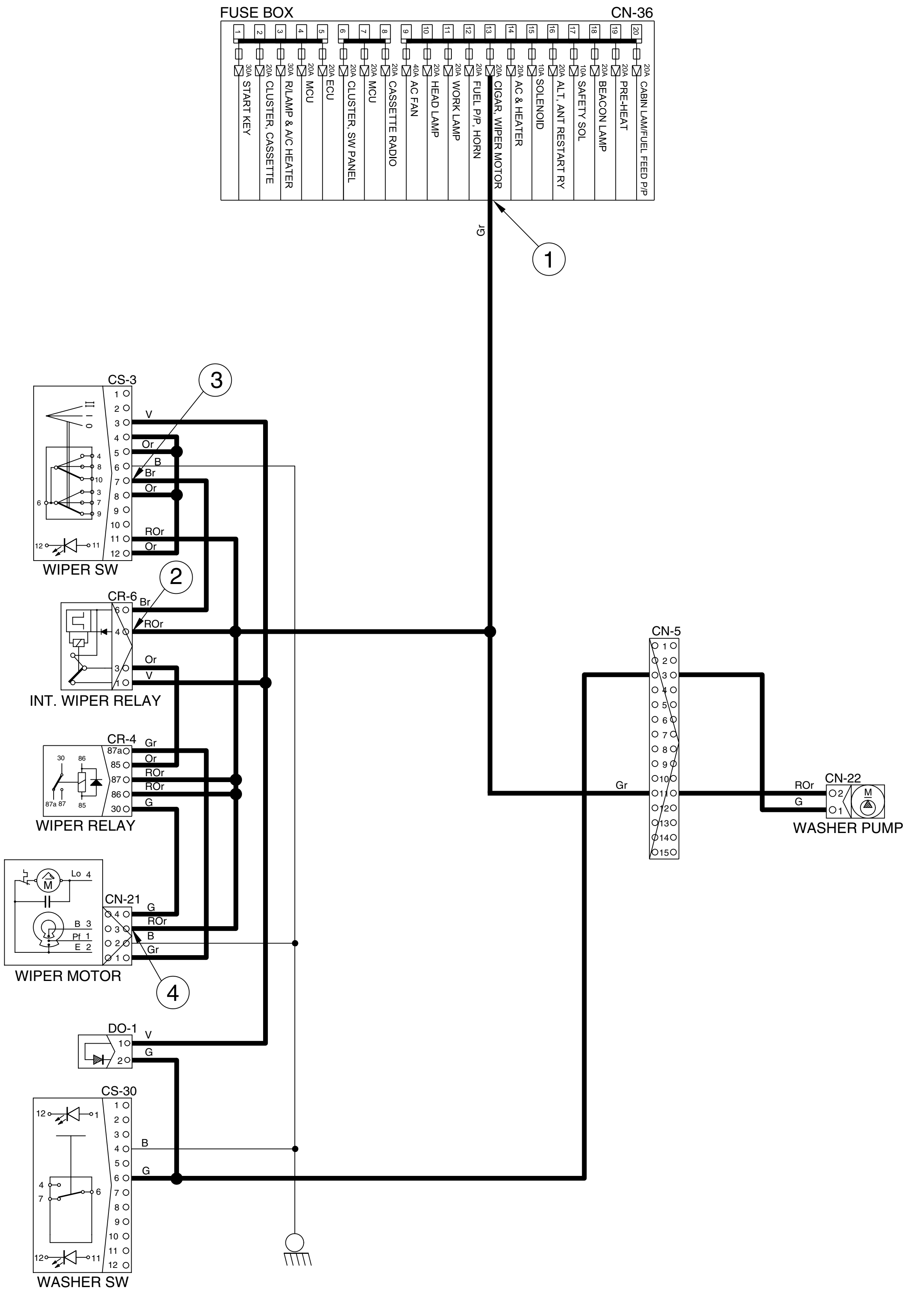
Switch OFF → Wiper relay [CR-4 (87a)] → Wiper motor [CN-21 (1)] → Wiper motor stop

2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box) ② - GND (switch power input) ③ - GND (switch power output) ④ - GND (wiper motor)	10~12.5V

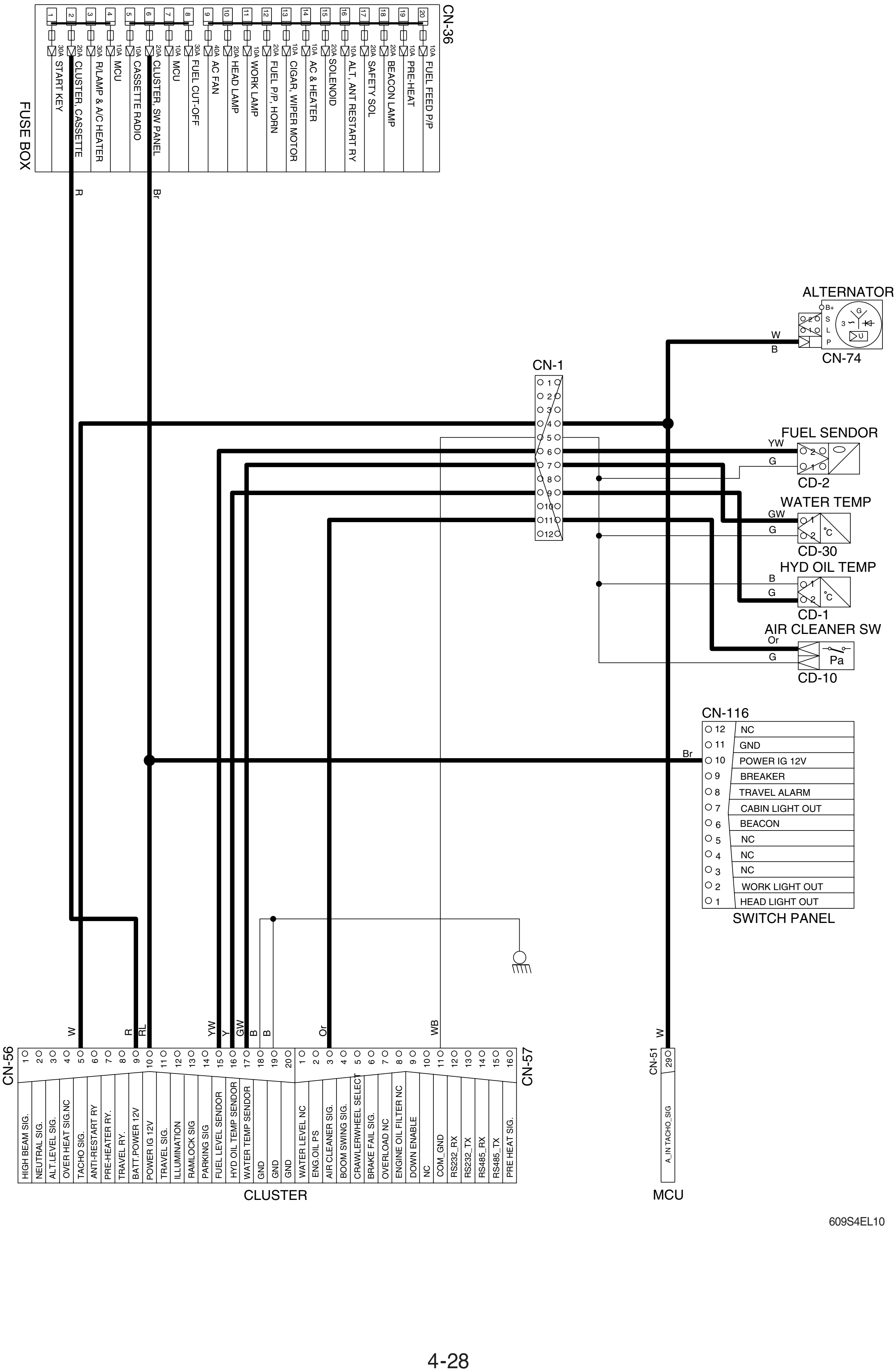
※ GND : Ground

WIPER AND WASHER CIRCUIT

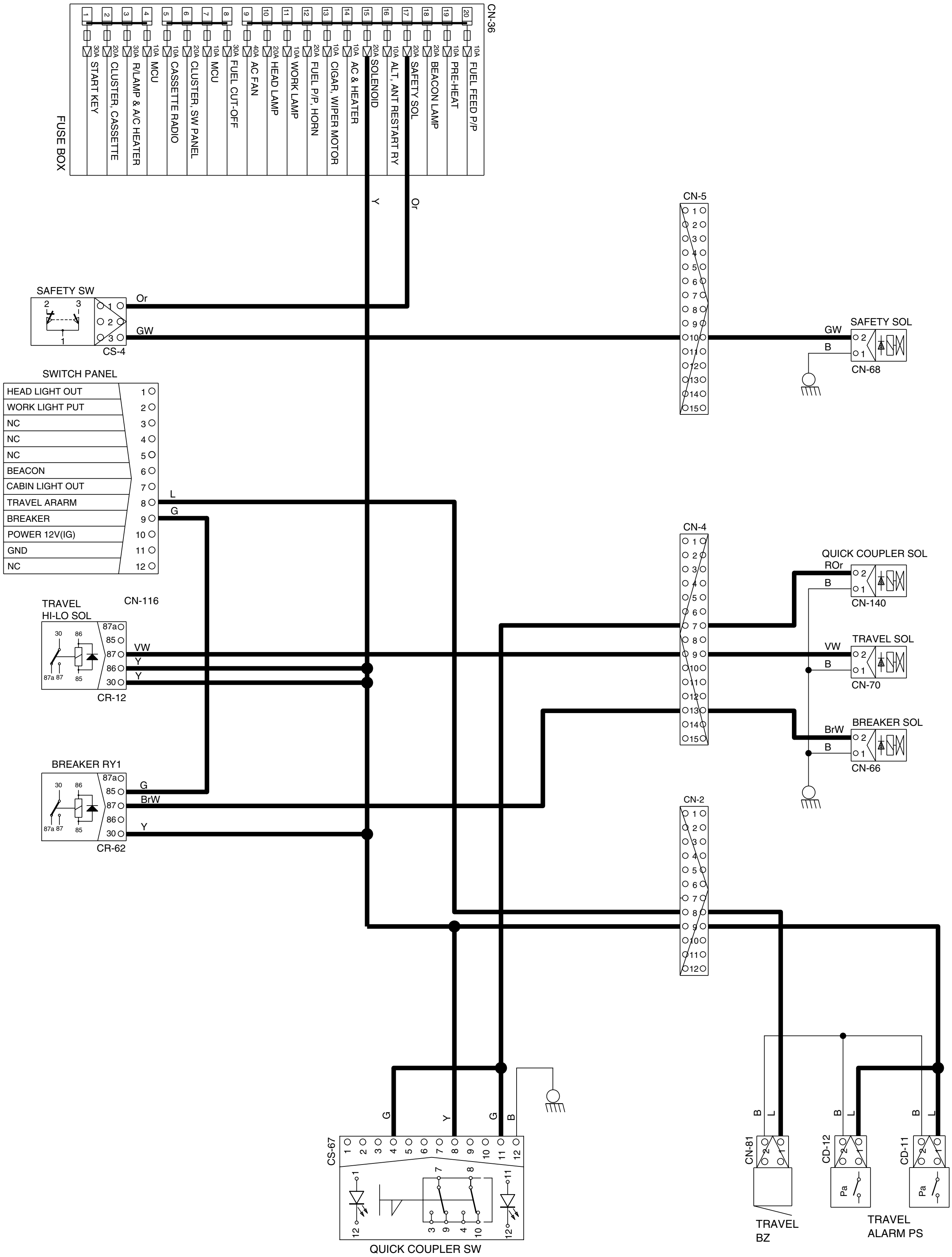


609S4EL35

MONITORING CIRCUIT

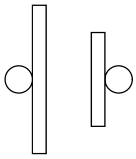
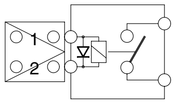
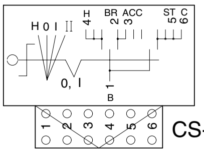
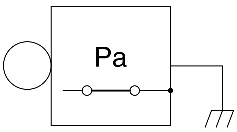
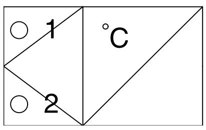


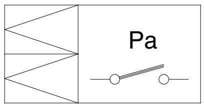
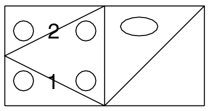
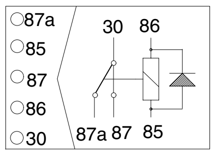
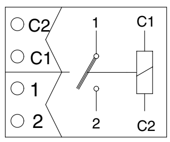
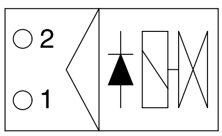
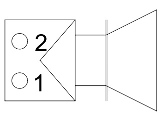
ELECTRIC CIRCUIT FOR HYDRAULIC

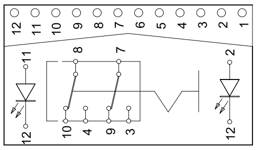
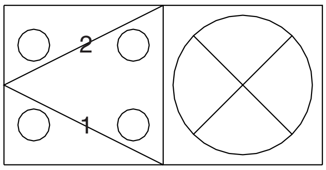
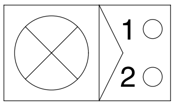
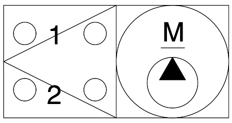
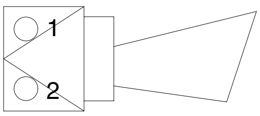


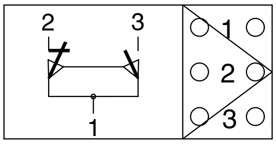
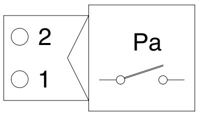
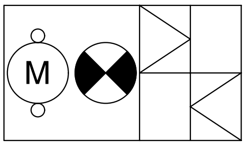
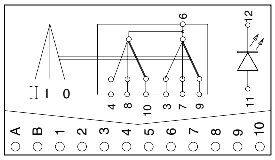
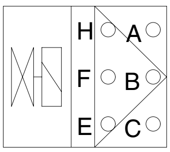
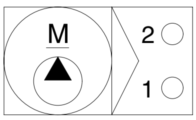
609S4EL11

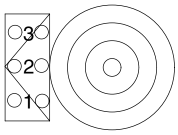
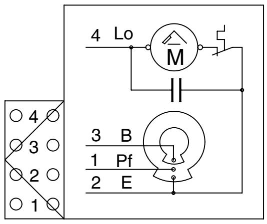
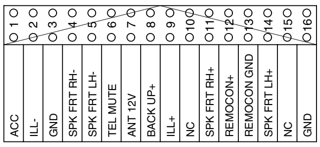
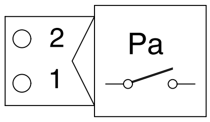
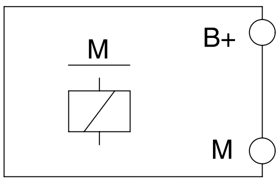
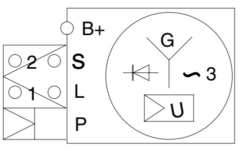
GROUP 4 ELECTRICAL COMPONENT SPECIFICATION

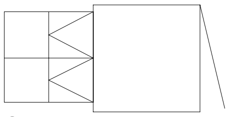
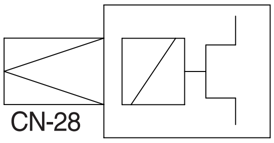
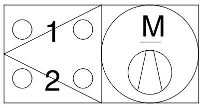
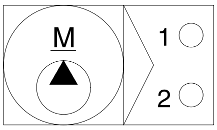
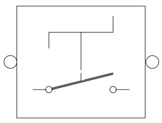
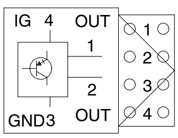
Part name	Symbol	Specification	Check
Battery		12V × 100Ah	※ Check specific gravity 1.280 over : over charged 1.280 ~ 1.250 : normal 1.250 below : recharging
Battery relay	 CR-1	Rated load : 12V 100A (continuity) 1000A (30 second)	※ Check coil resistance Normal : about 12 Ω ※ Check contact Normal : ∞ Ω
Start key	 CS-2	12V	※Check contact OFF : ∞ Ω (for each terminal) ON : 0 Ω (for terminal 1-3 and 1-2) START : 0 Ω (for terminal 1-5)
Pressure switch (for engine oil)	 CD-18	0.5 kgf/cm^2 (N.C TYPE)	※ Check resistance Normal : 0 Ω (CLOSE)
Coolant temperature sensor	 CD-8	-	※ Check resistance 50˚C : 804 Ω 80˚C : 310 Ω 100˚C : 180 Ω

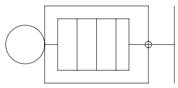
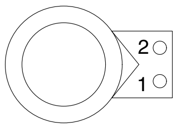
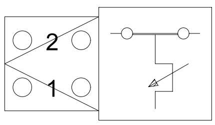
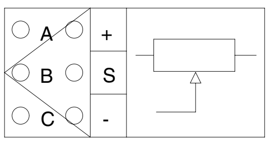
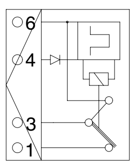
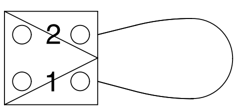
Part name	Symbol	Specification	Check
Air cleaner pressure switch	 CD-10	Pressure : 635mmH_2O (N.O TYPE)	※ Check contact Normal : ∞ Ω
Fuel sender	 CD-2	-	※ Check resistance Full : 100 Ω Low : 500 Ω Empty warning : 700 Ω
Relay	 CR-2 CR-3 CR-4 CR-5 CR-7 CR-9 CR-12 CR-13 CR-33 CR-36 CR-62 CR-85	12V 20A	※ Check resistance Normal : about 200 Ω (for terminal 85-86) : 0 Ω (for terminal 30-87a) : ∞ Ω (for terminal 30-87)
Relay	 CR-23 CR-24 CR-47	12V 60A	※ Rated coil current 1.2±0.3A
Solenoid valve	 CN-66 CN-68 CN-70 CN-140	12V 1A	※ Check resistance Normal : 15~25 Ω (for terminal 1-2)
Speaker	 CN-23(LH) CN-24(RH)	4 Ω 20W	※Check resistance Normal : 4 Ω

Part name	Symbol	Specification	Check
Quick clamp switch	 CS-67	12V 16A	※ Check contact Normal OFF - ∞ Ω (for terminal 1-5,2-6) - 0 Ω (for terminal 5-7,6-8)
Lamp	 CL-3 CL-4 CL-5	12V 55W (H3 TYPE)	※ Check disconnection Normal : 1.2 Ω
Room lamp	 CL-1	12V 10W	※ Check disconnection Normal : a few Ω
Fuel filler pump	 CN-145	12V 35 l /min	※Check operation Supply power (for terminal 1) : 12V
Horn	 CN-20 CN-25	12V	100±5dB

Part name	Symbol	Specification	Check
Safety switch	 CS-4	Micro	※ Check contact Normal : 0 Ω (for terminal A-B) : ∞ Ω (for terminal A-C) Operating : ∞ Ω (for terminal A-B) : 0 Ω (for terminal A-C)
Pressure switch	 CD-7 CD-11 CD-12	10bar (N.C type)	※ Check contact Normal : 0.1 Ω
Beacon lamp	 CL-7	12V (Strobe type)	※ Check disconnection Normal : a few Ω
Wiper switch	 CS-3	12V 16A	※Check contact Normal : ∞ Ω
Fuel cut-off solenoid	 CN-79	12V	※Check operation Rated full current : 12V 33A Rated hold current : 12V 0.8A
Washer pump	 CN-22	12V 3.8A	※Check contact Normal : 3 Ω (for terminal 1-2)

Part name	Symbol	Specification	Check
Cigar lighter	 CL-2	12V 10A 1.4W	※Check coil resistance Normal : about 1MΩ ※ Check contact Normal : ∞ Ω Operating time : 5~15sec
Wiper motor	 CN-21	12V 3A	※Check contact Normal : 6 Ω (for terminal 2-6)
Radio & USB player	 CN-27	24V 2A	※ Check voltage 20 ~ 25V (for terminal 1-3, 3-8)
Receiver dryer	 CN-29	12V	※ Check contact Normal : 0 Ω
Starter	 CN-45	12V	※ Check contact Normal : 0.1 Ω
Alternator	 CN-74	12V 55A	※ Check contact Normal : 0 Ω (for terminal B^+-1) Normal : 24 ~ 27.5V

Part name	Symbol	Specification	Check
Travel buzzer	 CN-81	12V	-
Compressor	 CN-28	12V 38W	-
Air con fan motor	 CN-83	12V 8.5A	-
Fuel feed pump	 CN-145	12V	-
Master switch		12V 1000A	-
Timer		12V	-

Part name	Symbol	Specification	Check
Preheater	 CN-80	12V 42A 500W	-
12V socket	 CN-139	12V 120W	-
Duct sensor		1˚C OFF 4˚C ON	※ Check resistance Normal : 0 Ω (for terminal 1-2) the atmosphere temp : over 4˚C
Accel dial	 CN-142	-	※ Check resistance Normal : about 5k Ω (for terminal A-C) ※ Check voltage Normal : about 5V (for terminal A-C) : 2~4.5V (for terminal C-B)
Int wiper relay	 CR-6	12V 12A	-
Fusible link	 CN-60 CN-95	12V, 30A (CN-65) 12V, 60A (CN-95)	-

GROUP 5 CONNECTORS

1. CONNECTOR DESTINATION

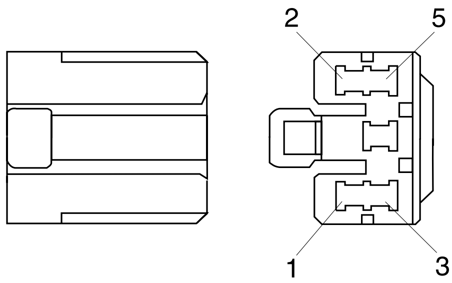
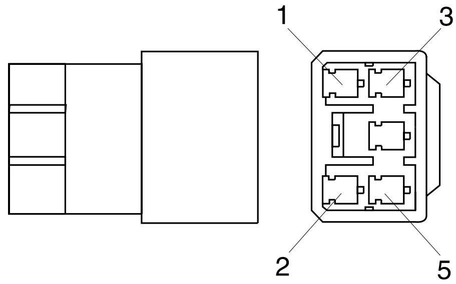
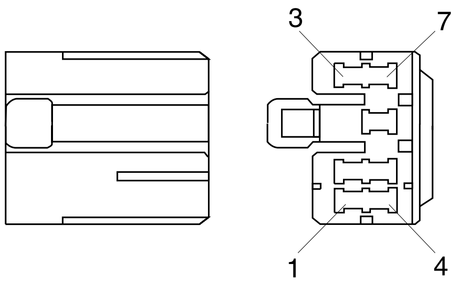
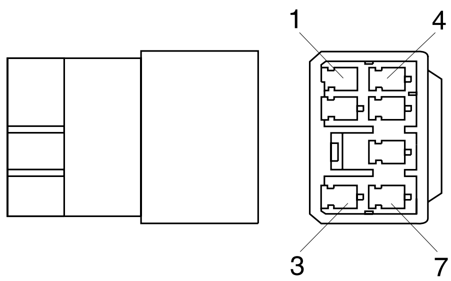
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-1	AMP	12	Cabin room harness - Main harness	S816-012002	S816-112002
CN-2	AMP	12	Aircon harness - Cabin room harness	S816-012002	S816-112002
CN-3	YAZAKI	2	Fusible link - Main harness	S813-030201	S813-130201
CN-4	AMP	15	Cabin room harness - Main harness	2-85262-1	368301-1
CN-5	AMP	15	Main harness - Cabin room harness	2-85262-1	368301-1
CN-6	DEUTSCH	4	Cabin room lamp harness - Cabin harness	DT06-4S-EP06	DT04-4P-E005
CN-7	AMP	16	Main harness - Console harness	2-85262-1	368030-1
CN-12	AMP	2	Boom harness - Main harness	S816-002002	S816-102002
CN-20	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-21	AMP	4	Wiper harness	180900-0	-
CN-22	KET	2	Washer tank	MG640605	-
CN-23	MOLEX	2	Speaker LH	MG610070	-
CN-24	MOLEX	2	Speaker RH	MG610070	-
CN-25	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-27	-	16	Radio and USB player	PK145-16017	-
CN-28	AMP	1	Air-con comp	S810-001202	-
CN-29	KET	2	Receiver dryer	MG640795	-
CN-36	-	-	Fuse box	21L7-00250	-
CN-45	KET RING TERM	1	Starter	ST710246-2 S820-408000	-
CN-48	AMP	3	Hour meter	S816-003002	S816-103002
CN-51	DEUTSCH	40	MCU	DRC26-40SA	-
CN-55	AMP	2	Travel alarm PS	S816-002002	S816-102002
CN-56	AMP	20	Cluster	175967-2	-
CN-57	AMP	16	Cluster	175966-2	-
CN-60	YAZAKI	2	Fusible link	-	7122-4125-50
CN-61	TERM	1	Fuel filler pump	S822-014000	S822-114000
CN-66	DEUTSCH	2	Breaker solenoid	DT06-2S-EP06	-
CN-68	DEUTSCH	2	Safety solenoid	DT06-2S-EP06	-
CN-70	DEUTSCH	2	Travel HI-LO solenoid	DT06-2S-EP06	-
CN-74	KET	2	Alternator	ST710285-2	-
CN-76	KET	6	DC motor	MG640515-4	-
CN-79	YAZAKI	3	Fuel cut-off solenoid	S813-060300	-
CN-80	AMP	1	Pre heater	ST710384-2	-
CN-81	DEUTSCH	2	Travel buzzer	DT06-2S-EP06	DT04-2P-E005
CN-83	AMP	2	Air-con fan	MG640188-5	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-95	YAZAKI	2	Fusible link	-	S813-130201
CN-113	AMP	2	Buzzer	S810-002202	-
CN-116	AMP	12	Switch panel	368542-1	-
CN-139	AMP	2	12V socket	S810-002202	-
CN-140	DEUTSCH	2	Quick coupler	DT06-2S-EP06	DT04-2P-E005
CN-142	DEUTSCH	3	Accel dial	DT06-3S-EP06	-
CN-144	KET	20	Handfree	MG610240	-
CN-145	KET	2	Fuel feed pump	7123-6423-30	-
CN-170	AMP	2	Seat heat switch	12162017	-
CN-245	AMP	12	Remote controller assy	368542-1	-
CN-246	AMP	12	USB & Socket assy	174045-2	-
CN-258	KET	1	Aircon comp power	MG640944-5	MG650943-5
CN-263	DEUTSCH	2	Aircon comp relay	DT06-2S-EP06	DT04-2P-E005
· LAMP					
CL-1	KET	2	Room lamp	MG610392	-
CL-2	AMP	3	Cigar light	S810-003202	-
CL-3	DEUTSCH	2	Head lamp	DT06-2S-EP06	DT04-2P-E005
CL-4	DEUTSCH	2	Head lamp	DT06-2S-EP06	DT04-2P-E005
CL-5	DEUTSCH	2	Work lamp	DT06-2S-EP06	-
CL-7	-	1	Beacon lamp	-	S822-114000
CL-9	DEUTSCH	2	Cabin lamp	DT06-2S-EP06	-
CL-10	DEUTSCH	2	Cabin lamp	DT06-2S-EP06	-
· RELAY					
CR-1	AMP	2	Battery relay	S816-002002	S816-102002
CR-2	AMP	4	Horn relay	S810-004002	-
CR-3	AMP	4	Work lamp relay	S810-004002	-
CR-4	AMP	4	Wiper relay	S810-004002	-
CR-5	AMP	4	Anti-restart relay	S810-004002	-
CR-6	AMP	6	Int wiper relay	S810-006002	-
CR-12	AMP	4	Travel relay	S810-004002	-
CR-13	AMP	4	Head lamp relay	S810-004002	-
CR-23	KET	2	Start relay	S814-002001	-
CR-24	KET	2	Air heater relay	S814-002001	-
CR-33	AMP	4	Air-con fan relay	S810-004002	-
CR-36	AMP	4	Pre-heater relay	S810-004002	-
CR-47	KET	2	Fuel cut-off relay	S814-002001	-
CR-50	KET	4	Timer relay	MG610047-5	-
CR-85	AMP	4	Beacon lamp relay	S810-004002	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
· SENDER					
CD-1	AMP	2	Hydraulic temp sender	85202-1	-
CD-2	AMP	2	Fuel sender	-	S816-102002
CD-7	DEUTSCH	3	Auto idle pressure switch	DT06-3S-EP06	-
CD-10	KET	1	Air cleaner switch	ST730057-2	-
CD-11	-	2	Travel pressure switch	MG640795	-
CD-12	-	2	Travel pressure switch	MG640795	-
CD-18	AMP	1	Engine oil pressure	ST710345-1	-
CD-30	AMP	2	Water temp	85202-1	-
CD-45	-	2	WIF sensor	-	S816-102003
DO-1	-	2	Diode	21EA-50570	-
DO-2	-	2	Diode	21EA-50570	-
DO-3	-	2	Diode	21EA-50570	-
· SWITCH					
CS-2	KET	6	Start key switch	S814-006000	-
CS-3	SWF	12	Wiper switch	589790	-
CS-4	AMP	3	Safety switch	S816-003002	-
CS-5	DEUTSCH	2	Horn-LH switch	-	DT04-2P-E005
CS-26	DEUTSCH	2	Breaker switch	-	DT04-2P-E005
CS-30	SWF	12	Wiper & washer switch	589790	-
CS-67	SWF	12	Quick coupler switch	589790	-
CS-74	YAZAKI	2	Master switch	S813-030201	-
CS-99	SWF	12	Air compressor switch	589790	-

2. CONNECTION TABLE FOR CONNECTORS

1) PA TYPE CONNECTOR

<table>
<tr><th>No. of pin</th><th>Receptacle connector (female)</th><th>Plug connector (male)</th></tr>
<tr><td>5</td><td>
S811-005002</td><td>
S811-105002</td></tr>
<tr><td>7</td><td>
S811-007002</td><td>
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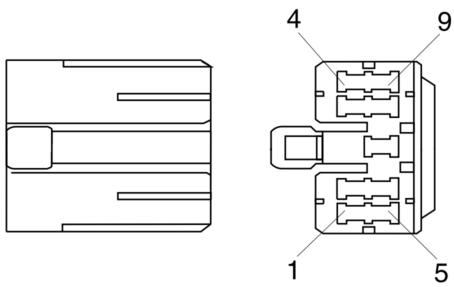
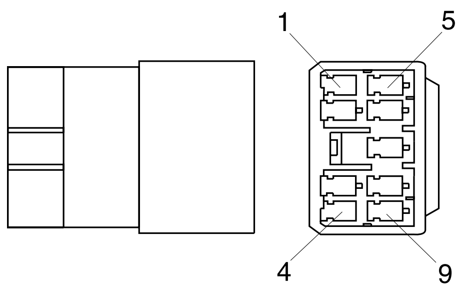
<tr><td>9</td><td>
S811-009002</td><td>
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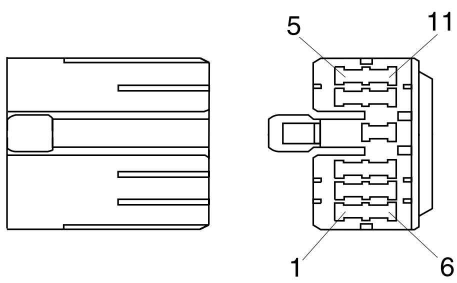
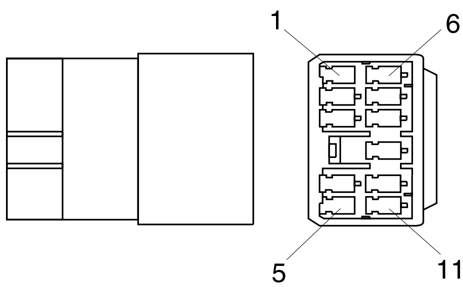
<tr><td>11</td><td>
S811-011002</td><td>
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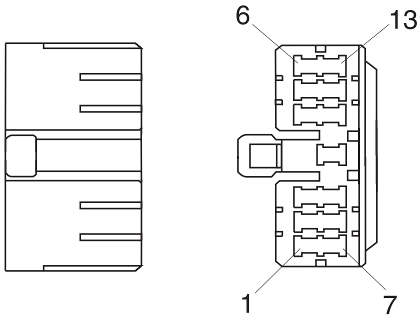
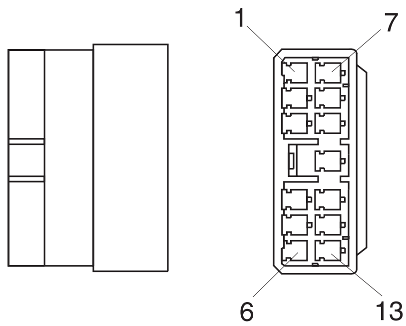
<table>
<tr><th>No. of pin</th><th>Receptacle connector (female)</th><th>Plug connector (male)</th></tr>
<tr><td>13</td><td>
S811-013002</td><td>
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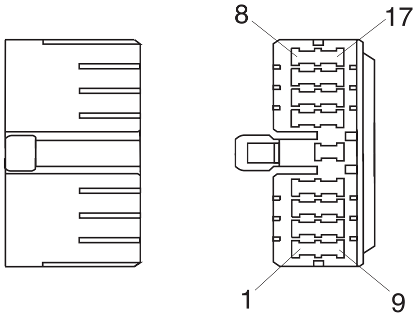
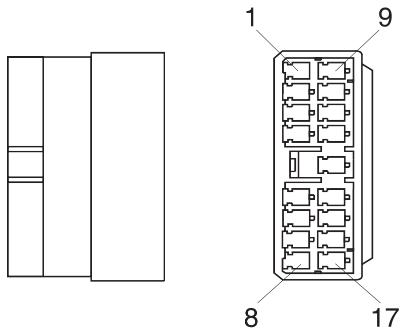
<tr><td>17</td><td>
S811-017002</td><td>
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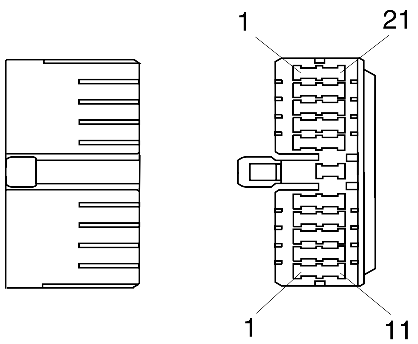
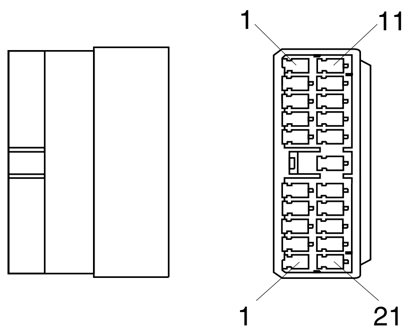
<tr><td>21</td><td>
S811-021002</td><td>
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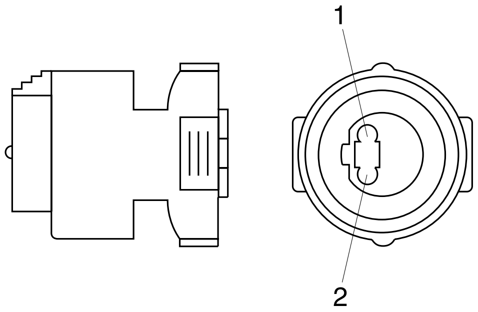
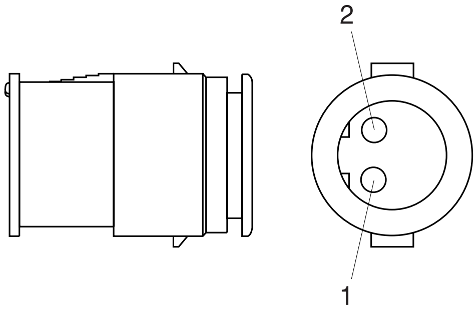
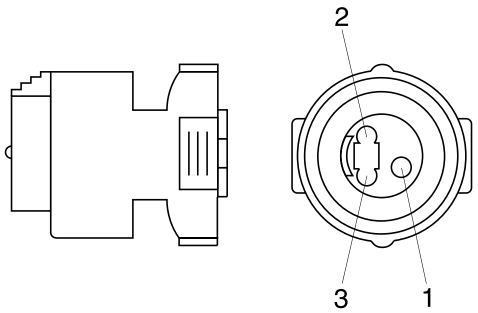
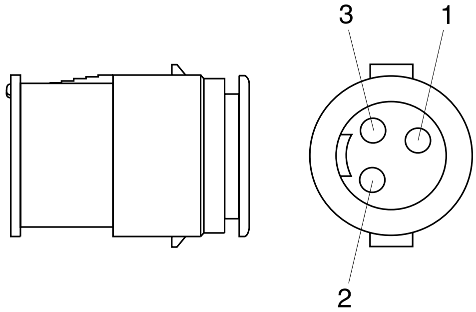
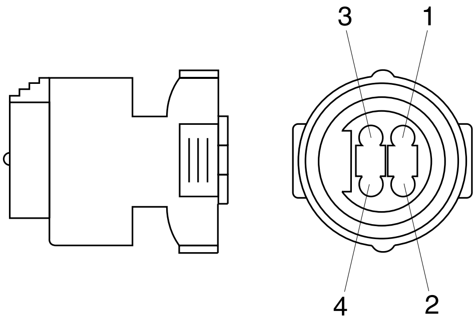
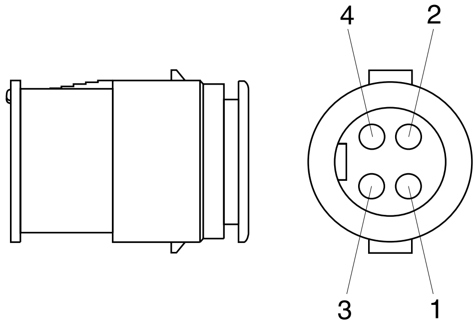
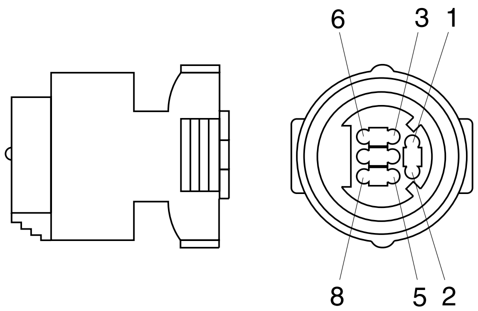
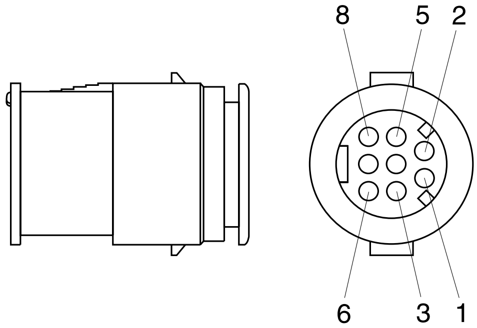
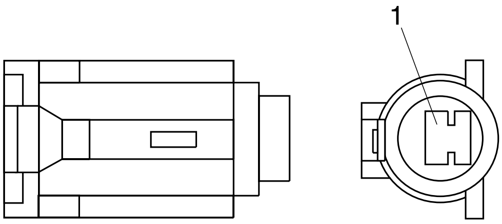
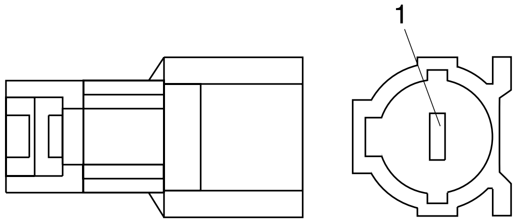
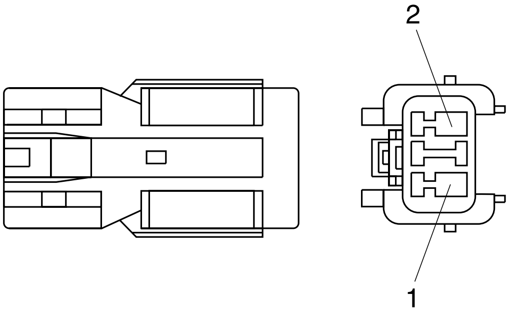
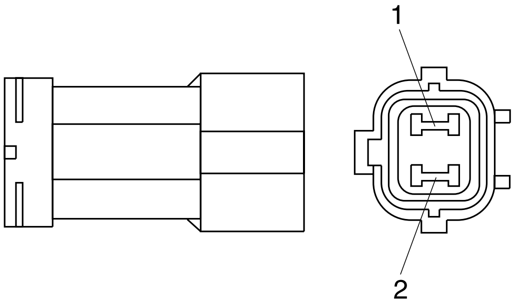
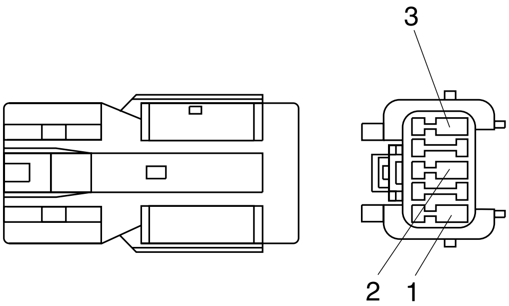
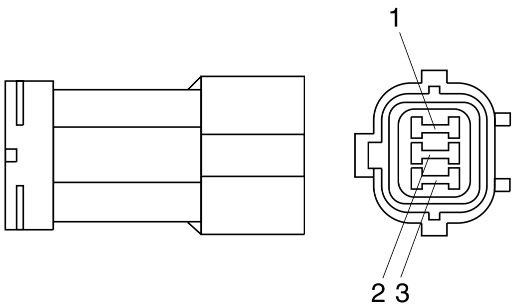
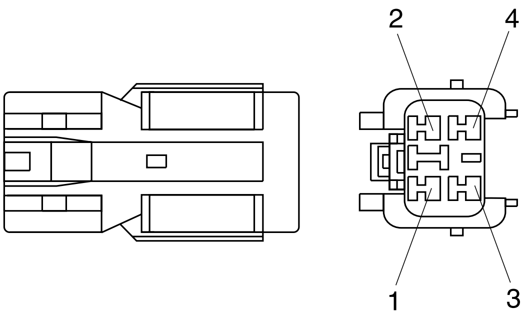
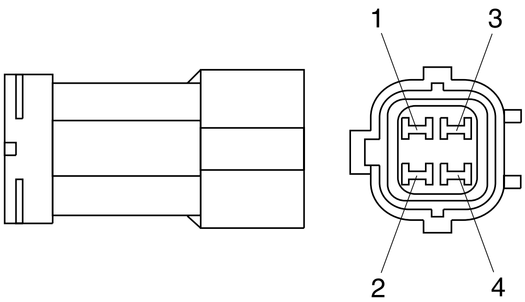
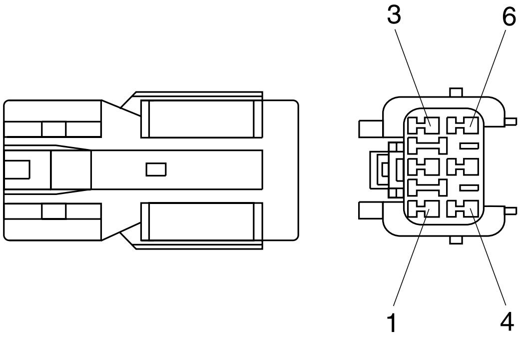
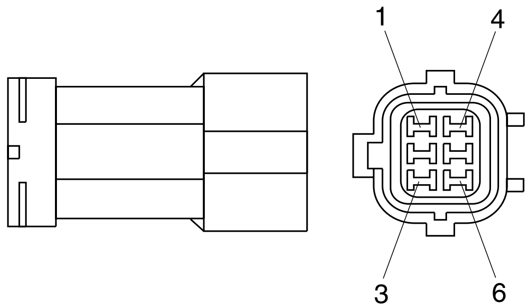
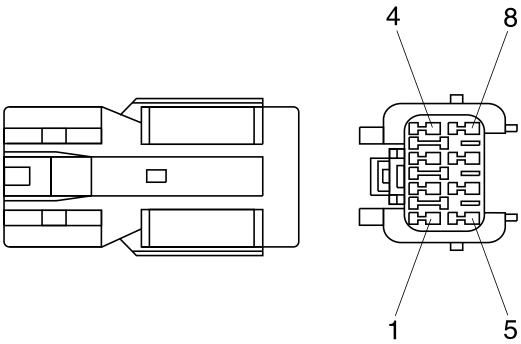
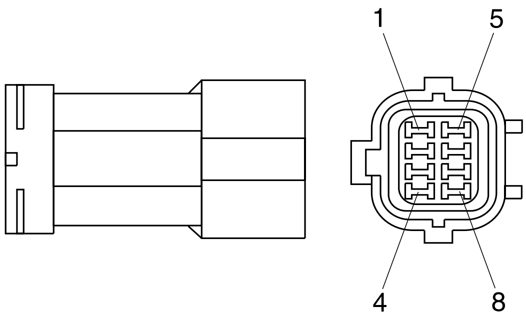
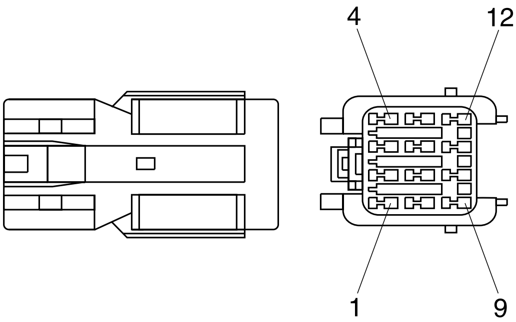
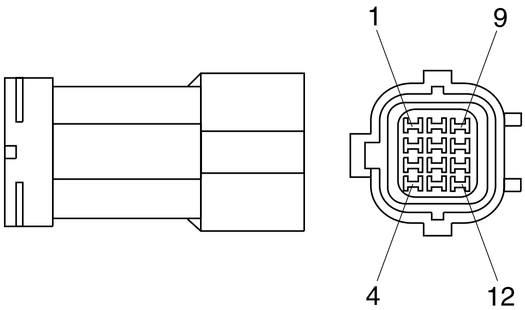
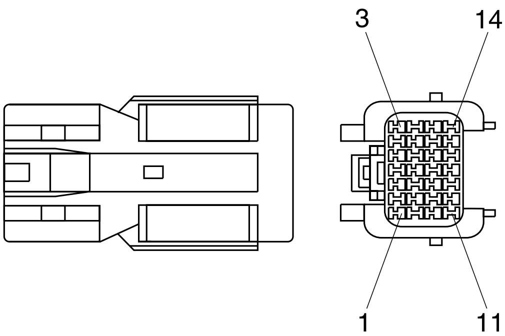
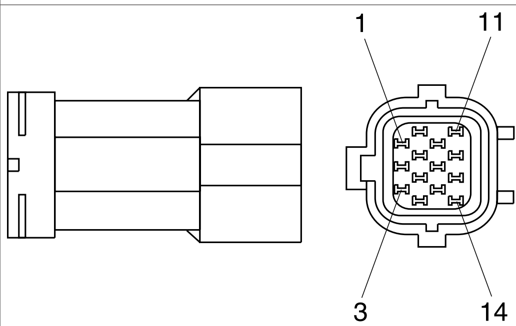
2) J TYPE CONNECTOR

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

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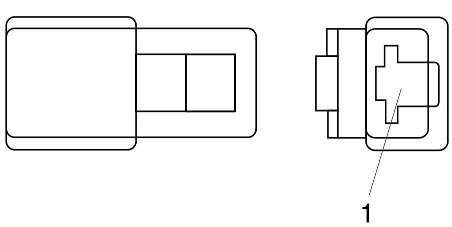
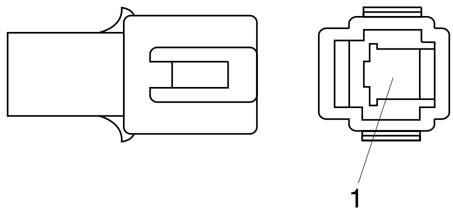
<tr><th>No. of pin</th><th>Receptacle connector (female)</th><th>Plug connector (male)</th></tr>
<tr><td>1</td><td>
S810-001202</td><td>
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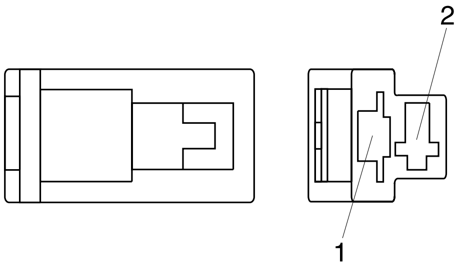
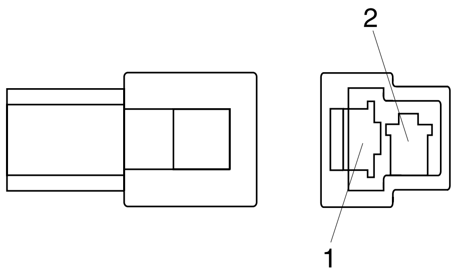
<tr><td>2</td><td>
S810-002202</td><td>
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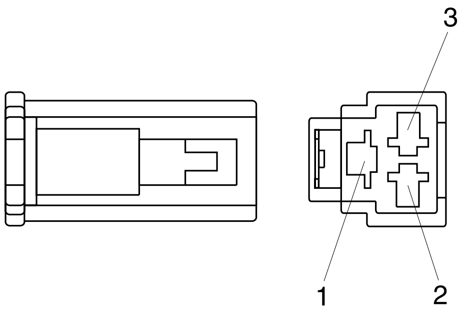
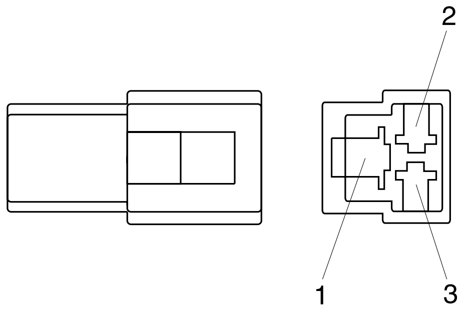
<tr><td>3</td><td>
S810-003202</td><td>
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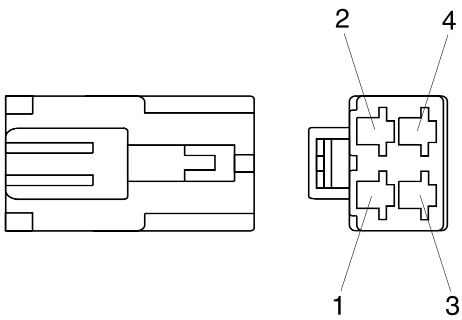
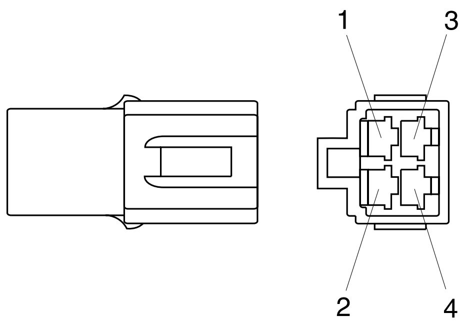
<tr><td>4</td><td>
S810-004202</td><td>
S810-104202</td></tr>
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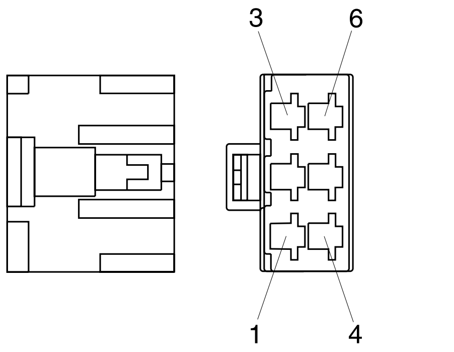
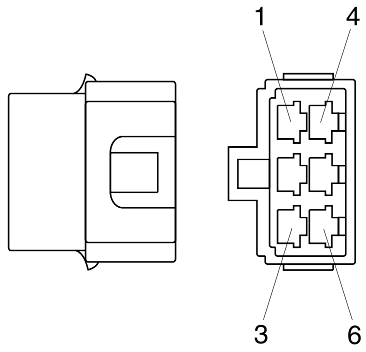
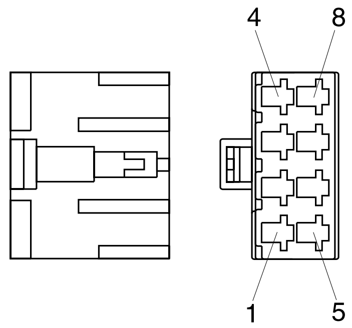
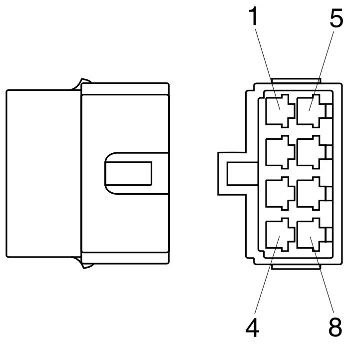
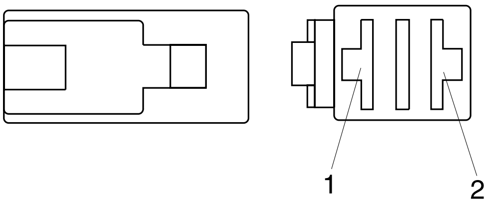
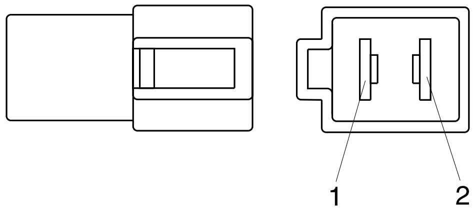
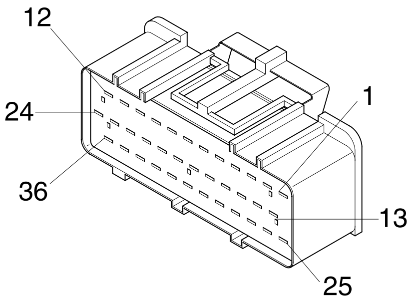
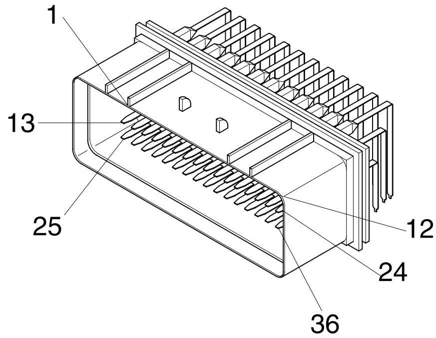
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S810-006202	 S810-106202
8	 S810-008202	 S810-108202

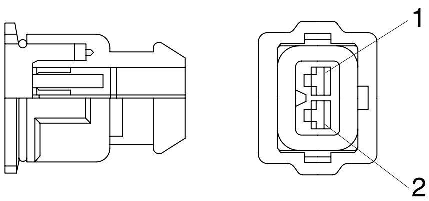
5) 375 FASTEN TYPE CONNECTOR

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

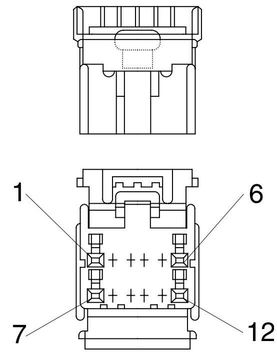
6) AMP ECONOSEAL CONNECTOR

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

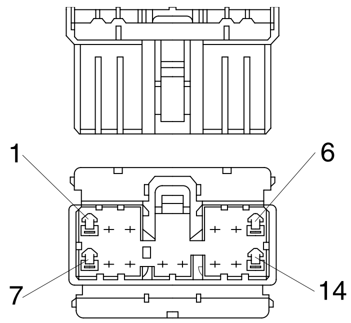
7) AMP TIMER CONNECTOR

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

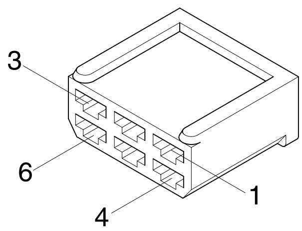
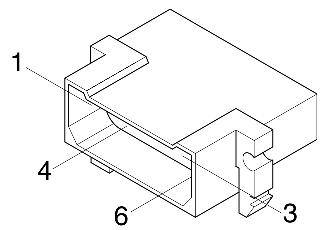
8) AMP 040 MULTILOCK CONNECTOR

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

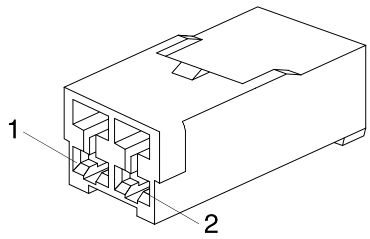
9) AMP 070 MULTILOCK CONNECTOR

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

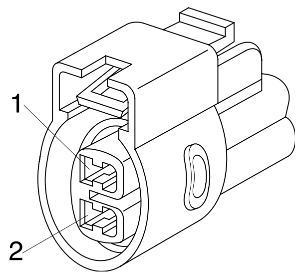
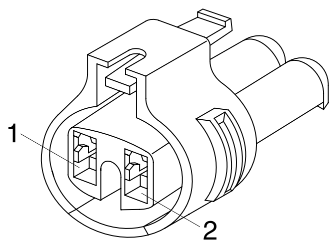
10) AMP FASTIN - FASTON CONNECTOR

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

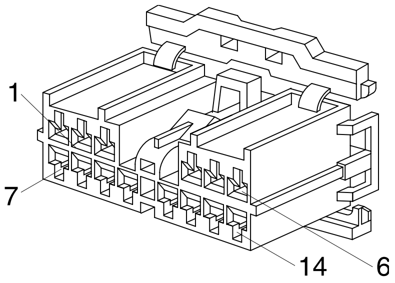
11) KET 090 CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
6	 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	

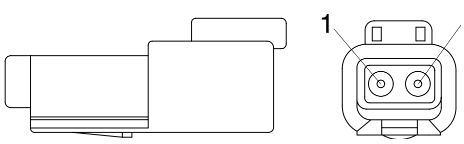
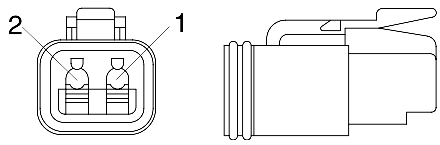
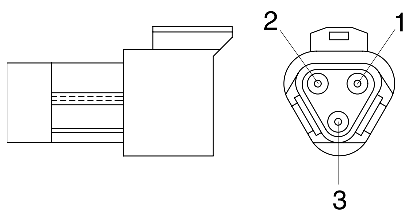
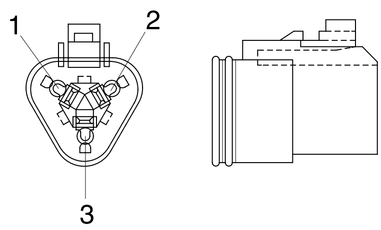
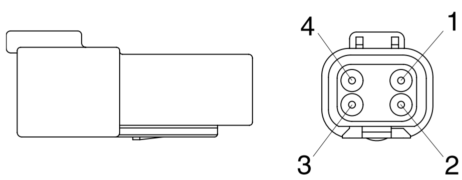
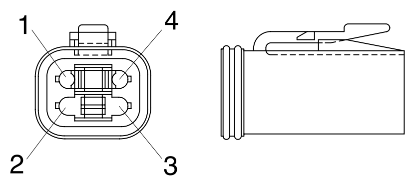
14) DEUTSCH DT CONNECTORS

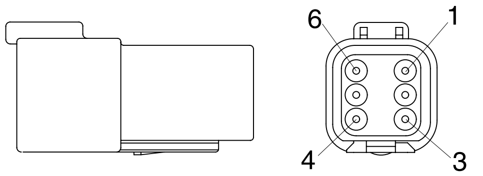
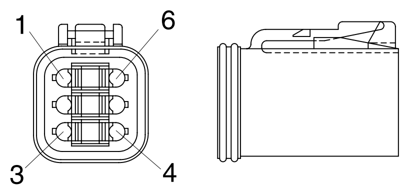
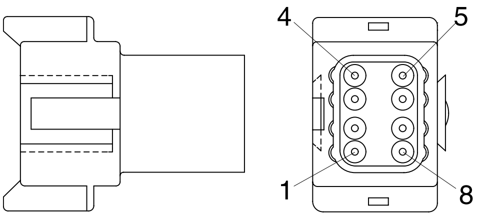
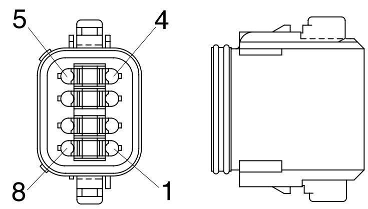
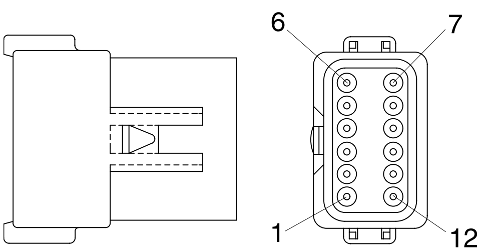
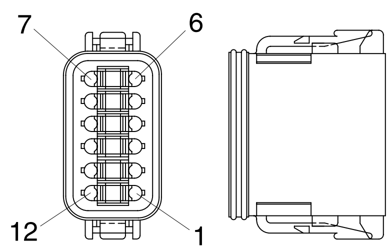
DT 06 - 3S - ★★★★

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

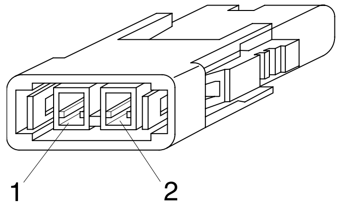
※ Modification

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

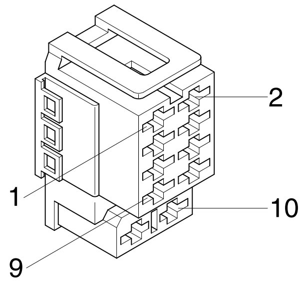
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 DT06-2S	 DT06-2P
3	 DT06-3S	 DT06-3P
4	 DT06-4S	 DT06-4P

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

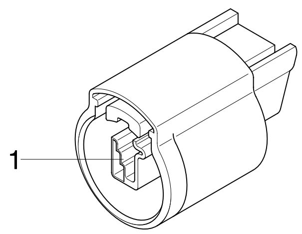
15) MOLEX 2CKTS CONNECTOR

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	

GROUP 6 FAULT CODES

1. MACHINE FAULT CODE

Fault code		Description
HCESPN	FMI	
101	3	Hydraulic oil temperature sensor circuit - voltage above normal or shorted to high source (or open circuit)
	4	Hydraulic oil temperature sensor circuit - voltage below normal or shorted to low source
105	0	Working pressure sensor data above normal range (or open circuit)
	1	Working pressure sensor data below normal range
	2	Working pressure sensor data error
	4	Working pressure sensor circuit - voltage below normal, or shorted to low source
108	0	Travel oil pressure sensor data above normal range (or open circuit)
	1	Travel oil pressure sensor data below normal range
	2	Travel oil pressure sensor data error
	4	Travel oil pressure sensor circuit - voltage below normal or shorted to low source
122	0	Overload pressure sensor data above normal range (or open circuit)
	1	Overload pressure sensor data below normal range
	2	Overload pressure sensor data error
	3	Overload pressure sensor circuit - voltage below normal or shorted to low source
301	3	Fuel level sensor circuit - voltage above normal or shorted to high source (or open circuit)
	4	Fuel level sensor circuit - voltage below normal or shorted to low source
503	0	Brake pressure sensor data above normal range (or open circuit)
	1	Brake pressure sensor data below normal range
	2	Brake pressure sensor data error
	4	Brake pressure sensor data - voltage below normal or shorted to low source
505	0	Working brake pressure sensor data above normal range (or open circuit)
	1	Working brake pressure sensor data below normal range
	2	Working brake pressure sensor data error
	4	Working brake pressure sensor circuit - voltage below normal, or shorted to low source
530	0	Travel fwd pilot pressure sensor data above normal range (or open circuit)
	1	Travel fwd pilot pressure sensor data below normal range
	2	Travel fwd pilot pressure sensor data error
	4	Travel fwd pilot pressure sensor circuit - voltage below normal, or shorted to low source
	14	Travel fwd pilot pressure sensor circuit - special instructions
	16	Travel fwd pilot pressure sensor circuit - voltage valid but above normal operational range
701	4	Hour meter circuit - voltage below normal, or shorted to low source
705	0	MCU input voltage high
	1	MCU input voltage low
707	1	Alternator node I voltage low (or open circuit)
714	3	Acc. dial circuit - voltage above normal, or shorted to high source (or open circuit)
	4	Acc. dial circuit - voltage below normal, or shorted to low source
840	2	Cluster communication data error
841	2	ECM communication data error
IDSP		Water in fuel warning
Lo bat		Low battery warning

2. ENGINE FAULT CODE

Fault code		Description	
YANMAR SPN	FMI	Area	Status
522400	2	Crankshaft speed sensor	Error (Abnormal signal)
	5		Error (No-signal)
522401	2	Camshaft speed sensor	Error (Abnormal signal)
	5		Error (No-signal)
	7		Crank angle error
91	3	Accelerator sensor 1	Error (high voltage)
	4		Error (low voltage)
51	3	Intake throttle position sensor	Error (high voltage)
	4		Error (low voltage)
3251	3	DPF differential pressure sensor	Error (high voltage)
	4		Error (low voltage)
1209	3	EGR pressure sensor (high-pressure side)	Error (high voltage)
	4		Error (low voltage)
110	3	Coolant temperature sensor	Error (high voltage)
	4		Error (low voltage)
	0	Coolant temperature	High temperature (Overheat)
105	3	Air temperature sensor	Error (high voltage)
	4		Error (low voltage)
3250	3	DPF middle temperature sensor	Error (high voltage)
	4		Error (low voltage)
3242	3	DPF inlet temperature sensor	Error (high voltage)
	4		Error (low voltage)
174	3	Fuel temperature sensor	Error (high voltage)
	4		Error (low voltage)
	0	Fuel temperature	High Temperature
157	3	Rail pressure sensor	Error (high voltage)
	4		Error (low voltage)
102	3	EGR Low-side pressure sensor	Error (high voltage)
	4		Error (low voltage)
108	3	Atmospheric pressure sensor	Error (high voltage)
	4		Error (low voltage)
3609	3	DPF Hi-side pressure sensor	Error (high voltage)
	4		Error (low voltage)
1485	7	Main relay	Stick error
	2		Power off without self-holding
522243	6	Starting aid relay	Short-circuit with ground
	5		Disconnection

Fault code		Description	
YANMAR SPN	FMI	Area	Status
2950	5	Intake throttle actuator	H-bridge circuit : No-Load
	3		H-bridge output 1 : Short-circuit with power supply
	4		H-bridge output 1 : Short-circuit with ground
2951	3		H-bridge output 2 : Short-circuit with power supply
	4		H-bridge output 2 : Short-circuit with ground
651	5	Injector 1 : Cylinder No. 4 Port : 1-2	Disconnection
	11		Failure
	3		Short-circuit
	6		Short-circuit (internal coil)
653	5	Injector 2 : Cylinder No. 2 Port : 2-1	Disconnection
	11		Failure
	3		Short-circuit
	6		Short-circuit (internal coil)
654	5	Injector 3 : Cylinder No. 1 Port : 2-2	Disconnection
	11		Failure
	3		Short-circuit
	6		Short-circuit (internal coil)
652	5	Injector 4 : Cylinder No. 3 Prot : 1-1	Disconnection
	11		Failure
	3		Short-circuit
	6		Short-circuit (internal coil)
2797	6	Injecotor (Common)	Short circuit Cylinder No. 1,4
2798	6		Short circuit Cylinder No,. 2,3
4257	12		IC error
633	5	Supply pump (MPROP)	Disconnection
	6		Hi-side : Short-circuit with ground
522571	3		Lo-side : Short-circuit with power supply
157	18	Rail pressure error	Rail pressure deviation error when actual pressure is too low
	15		Rail pressure deviation error when actual pressure is too high
	0		Fuel rail/System pressure : Too high
	16	PLV	Fuel system over pressure relief valve activated
190	16	Engine overspeed 1	
522610	19	CAN communication 1 (CAN 1)	CAN 1(for EGR) : Data length code error (received message)
	9		CAN 1(for EGR) : Time out error (received message)
522611	9		CAN 1(for exhaust throttle) : Time out error (received message)

Fault code		Description	
YANMAR SPN	FMI	Area	Status
522596	9	CAN communication 2 (CAN 2)	CAN2(TSC1) : Time out error (received message)
522599	9		CAN2(Y_ECR 1) : Time out error (received message)
522600	9		CAN2(Y_EC) : Time out error (received message)
522601	9		CAN2(Y_RSS) : Time out error (received message)
522602	9		CAN2(Y_ECM 3) for Bosch-ECU : Time out error (received message)
522603	9		CAN2(VH) : Time out error (received message)
2791	7	EGR valve	Feedback error
	12		Disconnection (Motor coil)
	12		Short circuit (Motor coil)
	12		Position sensor error
	9		CAN communication error
	12		Error (EGR valve target value)
	0		Error (high voltage)
	1		Error (low voltage)
	7		Stick error
	7		Initialize error
	1		Thermistor error (high temperature)
	1		Thermistor error (low temperature)
630	12	EEPROM	Deletion error
			Read error
			Write error
522994	12	E-ECU internal	Power supply for sensor 1 (5V) : Error
	12		Power supply for sensor 2 (5V) : Error
	12		Power supply for sensor 3 (5V) : Error
	12		Power supply for sensor (12V) : Error (high voltage)
	12		Power supply for sensor (12V) : Error (low voltage)
	12		Power supply for sensor internal : Error (high voltage)
	12		Power supply for sensor internal : Error (low voltage)
	12		Power supply for IC : Error (high voltage)
	12		Power supply for IC : Error (low voltage)
	3		Actuator relay 1 : Short-circuit with power supply
	3		Actuator relay 2 : Short-circuit with power supply
	4		Actuator relay 1 : Short-circuit with ground
	4		Actuator relay 2 : Short-circuit with ground
	12		WDA/ABE communication error
	12		CY146 SPI communication error
	12		CY320 SPI communication error
	12		R2S2 MSC communication error
	12		WDA/ABE shut off (Too low voltage)
	12		WDA/ABE shut off (Too high voltage)
	12		WDA/ABE shut off (Operation malfunction)
	11		ECU soft reset 1
	11		ECU soft reset 2
	11		ECU soft reset 3

Fault code		Description	
YANMAR SPN	FMI	Area	Status
522323	0	Air cleaner blockage alarm	
522329	0	Oily water separator alarm	
523249	5	Symptom " engine does not start "	
167	1	Charge failure	
100	4	Oil pressure switch	Disconnection
	1		Low pressure
3719	0	DPF	Over accumulation

SECTION 5 TROUBLESHOOTING

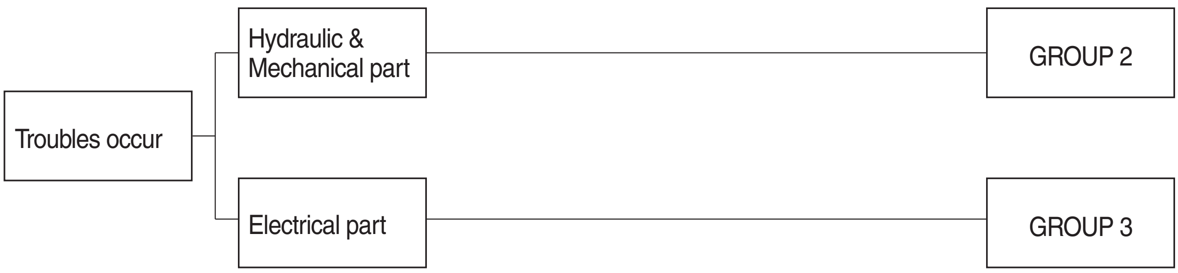
GROUP 1 BEFORE TROUBLESHOOTING

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 and Electrical system system.

At each system part, an operator can check the machine according to the troubleshooting process diagram.

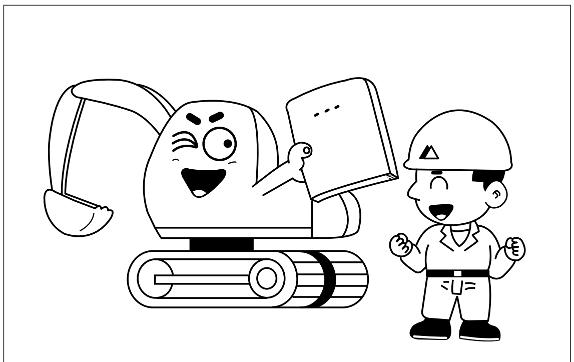


2. DIAGNOSING PROCEDURE

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.

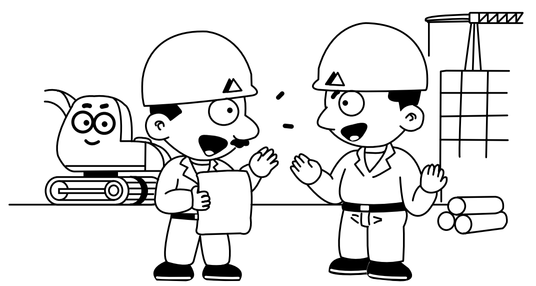


13031SH02

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.

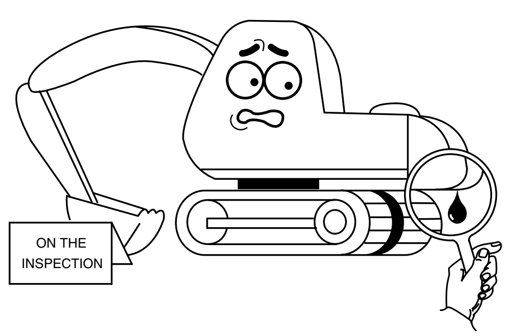


13031SH03

STEP 3. Inspect the machine

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

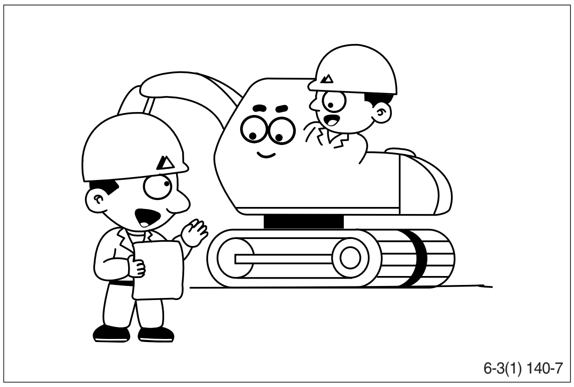
And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.



6-2(3) 140-7

STEP 4. Inspect the trouble actually on the machine

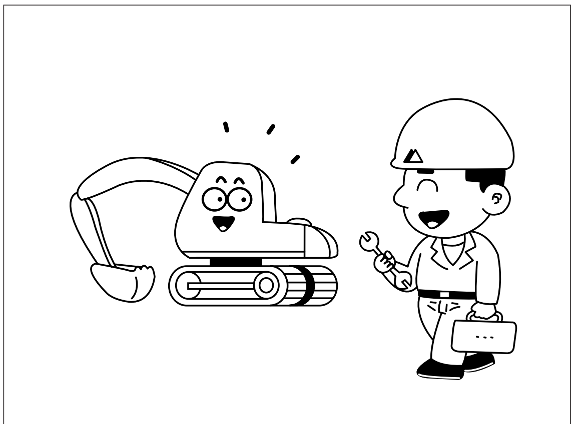
In case that some trouble cannot be confirmed, obtain the details of the malfunction from the operator.
Also, check if there are any in complete connections of the wire harnesses are or not.



6-3(1) 140-7

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.

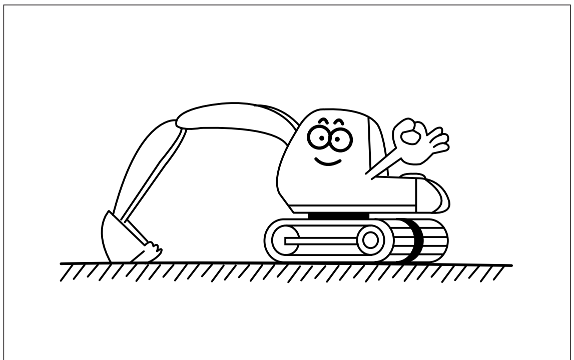


13031SH05

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.



6-3(3) 140-7

GROUP 2 HYDRAULIC AND MECHANICAL SYSTEM

1. INTRODUCTION

1) MACHINE IN GENERAL

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

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

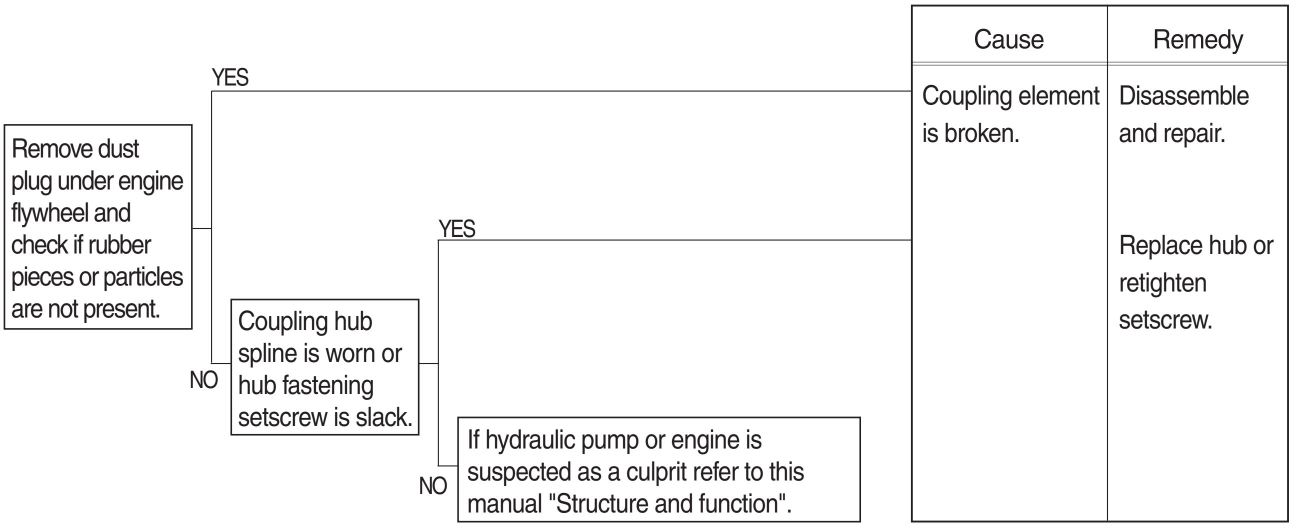
(3) When carrying out troubleshooting, do not hurry to disassemble the components.
It will become impossible to find the cause of the problem.

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

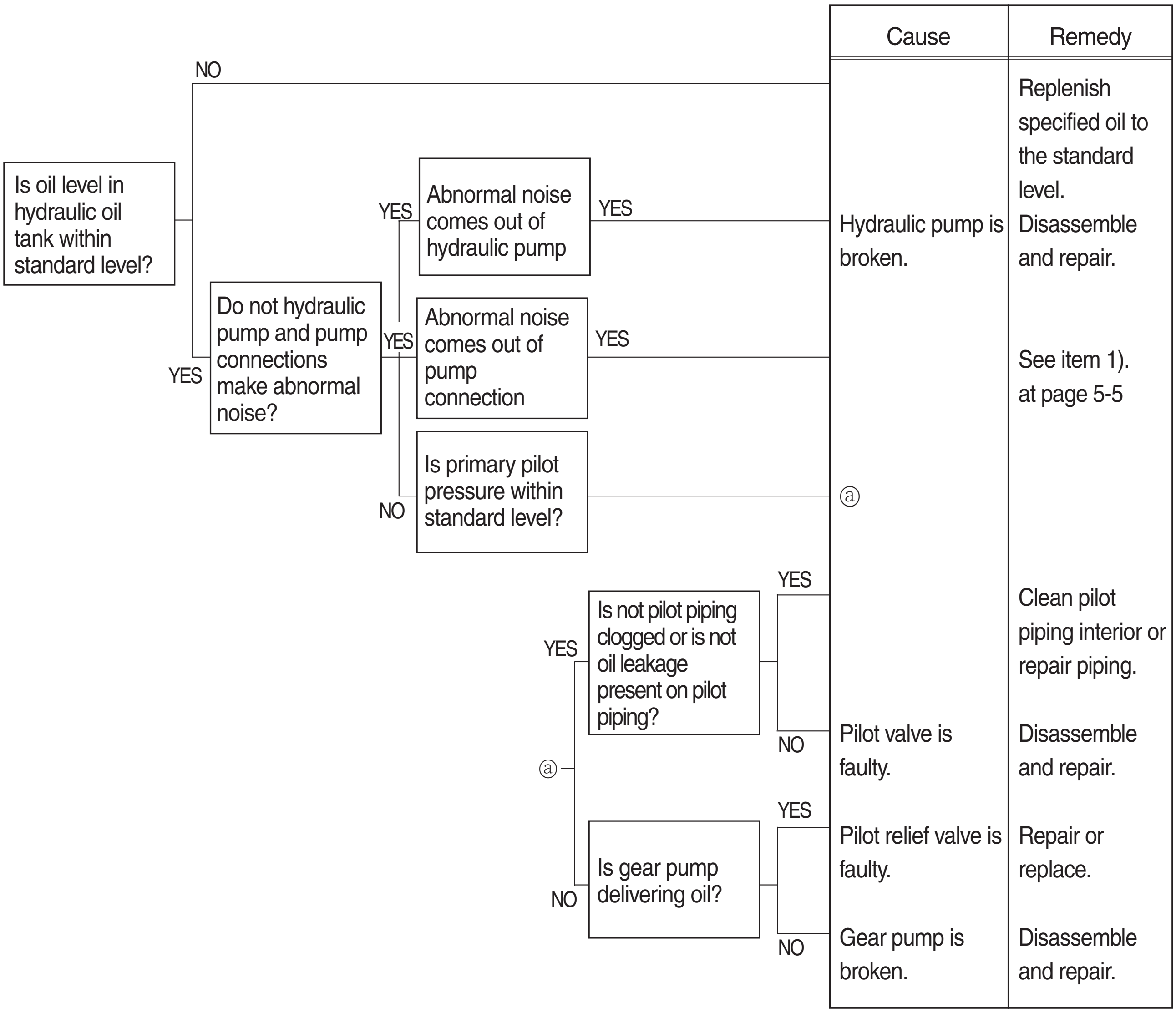
(5) Check before troubleshooting.
① Check oil and fuel level.
② Check for any external leakage of oil from components.
③ Check for loose or damage of wiring and connections.

2. DRIVE SYSTEM

1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION



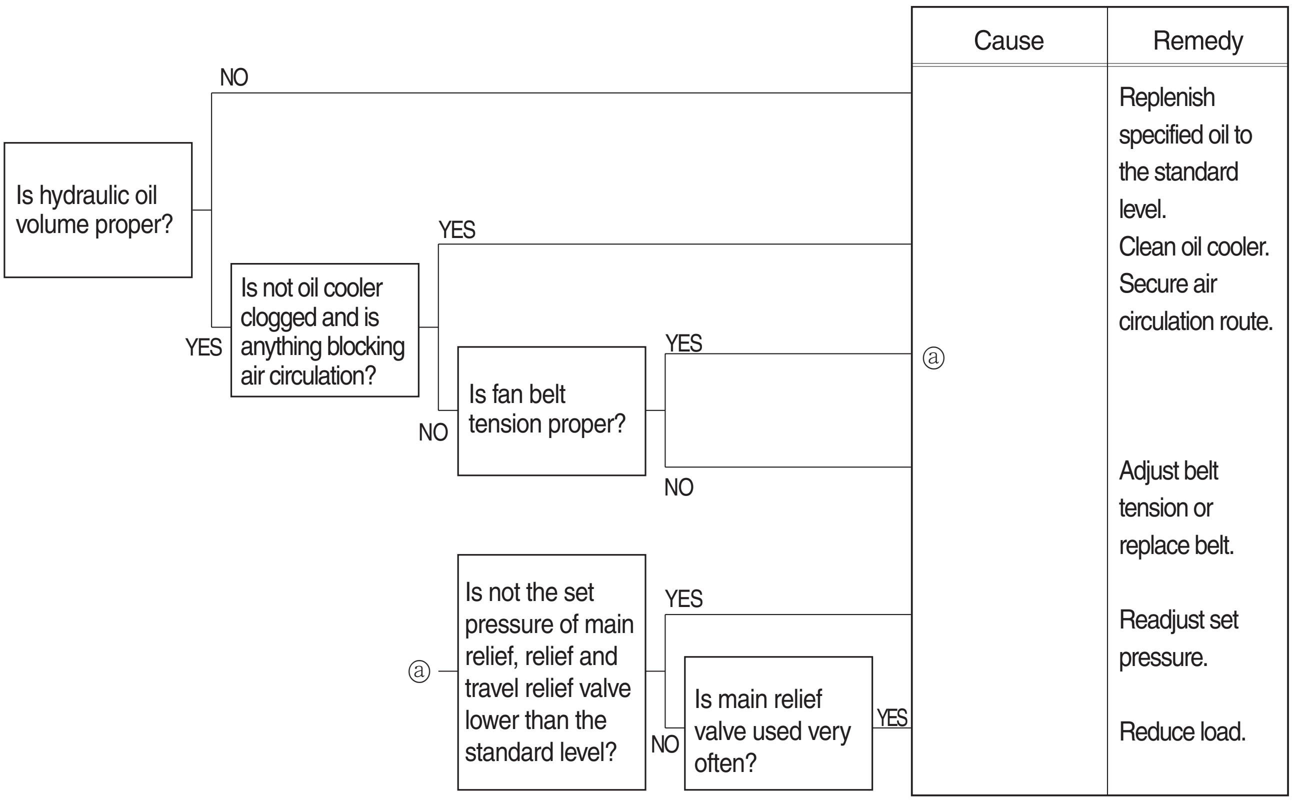
2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL



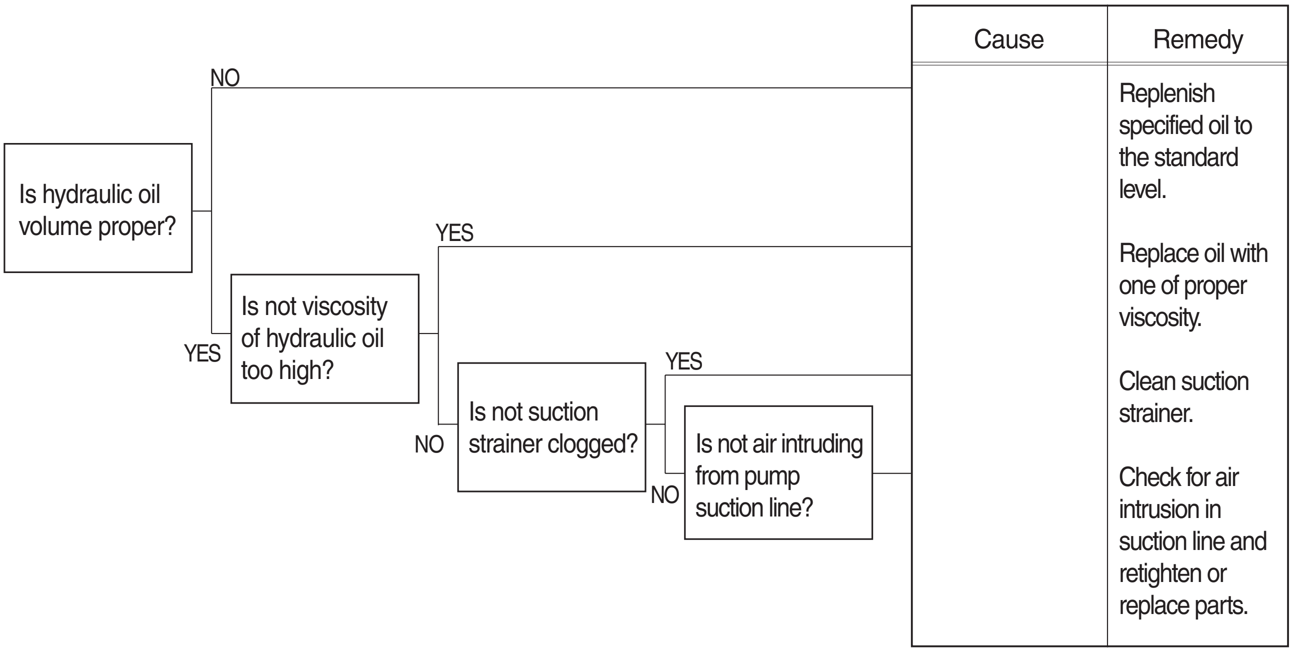
3. HYDRAULIC SYSTEM

1) HYDRAULIC OIL IS CLOUDY

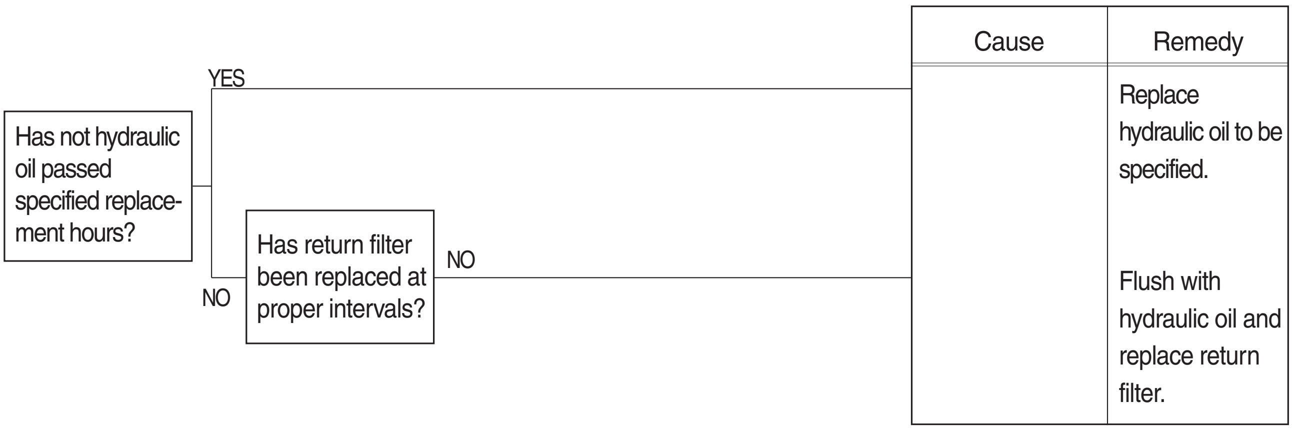
2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY



3) CAVITATION OCCURS WITH PUMP

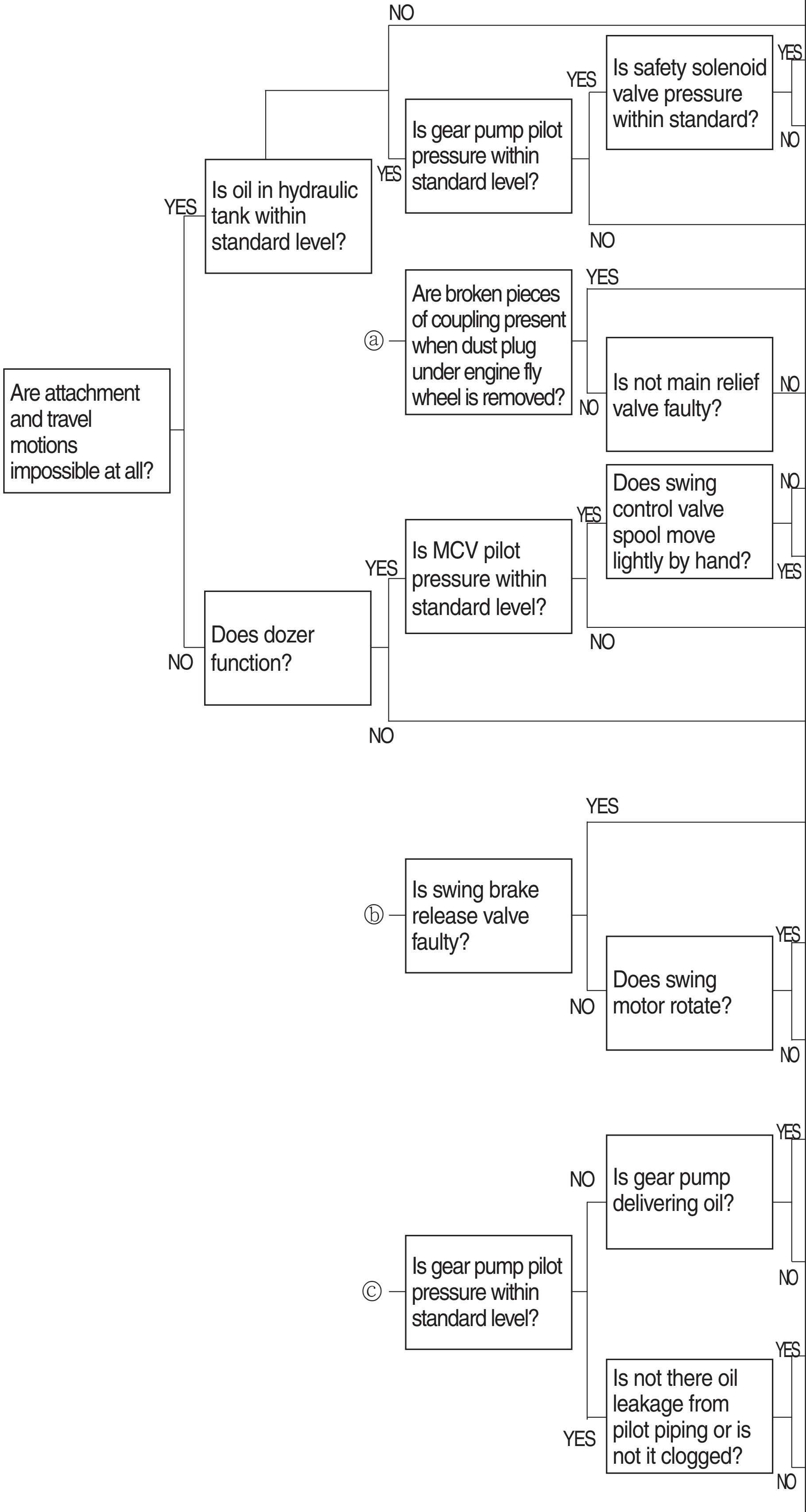


4) HYDRAULIC OIL IS CONTAMINATED



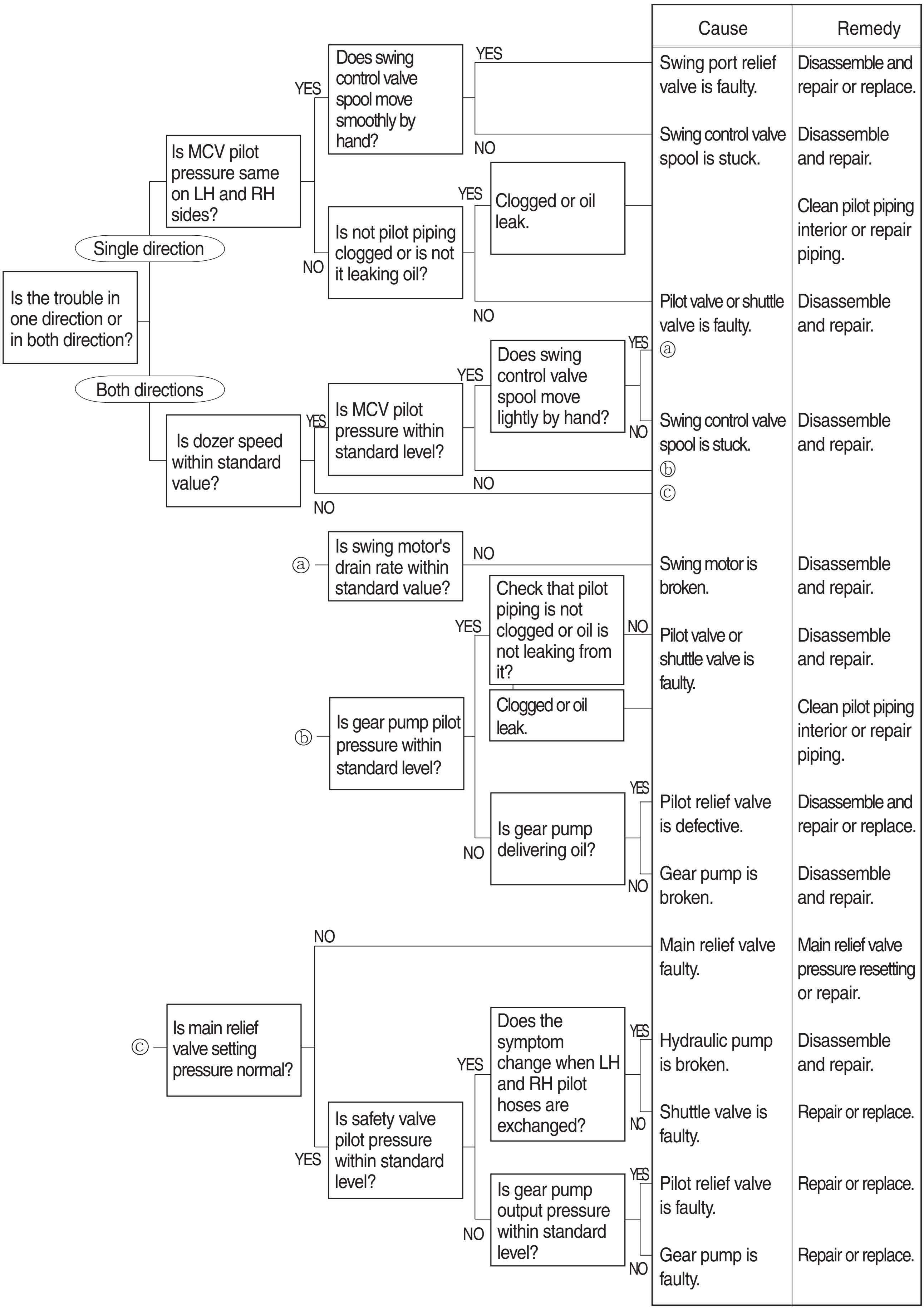
4. SWING SYSTEM

1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE

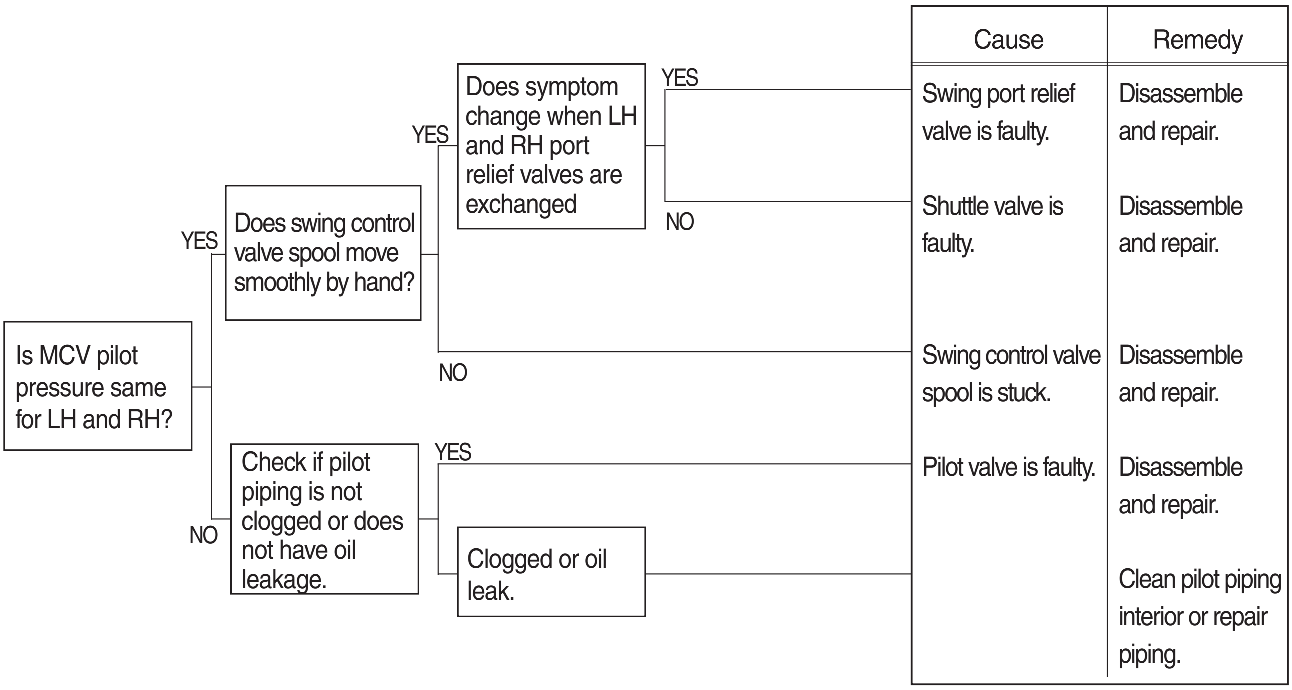


Cause	Remedy
	Replenish specified oil to the standard level.
ⓐ	
Safety valve faulty or not operated.	Repair or replace.
Gear pump faulty.	Repair or replace.
Pump connection coupling is broken.	Disassemble and repair.
Hydraulic pump is out of order.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
ⓑ	
ⓒ	
Hydraulic pump is broken.	Disassemble and repair.
Swing brake release valve is broken.	Disassemble and repair.
Swing reduction unit is broken.	Disassemble and repair.
Swing motor is broken.	Disassemble and repair.
Pilot relief valve is faulty.	Disassemble and repair or replace.
Gear pump is out of order.	Disassemble and repair.
	Clean pilot piping interior or repair piping.
Pilot valve is broken.	Disassemble and repair.

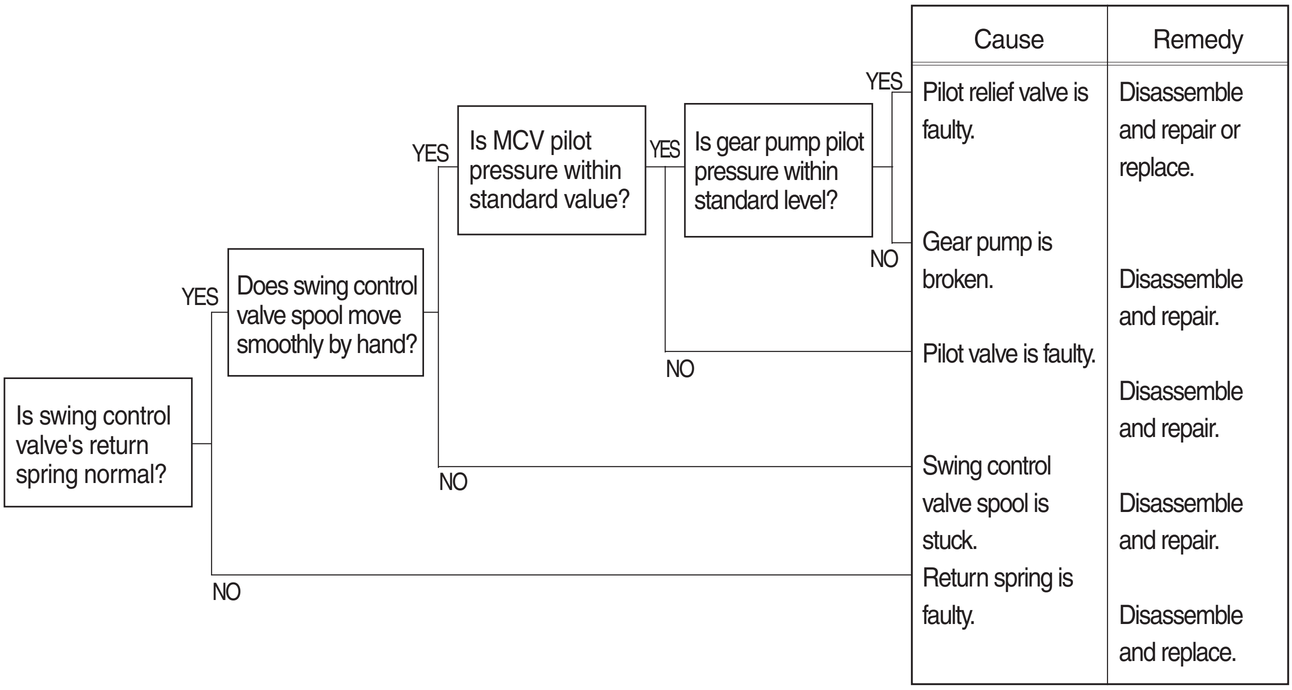
2) SWING SPEED IS LOW



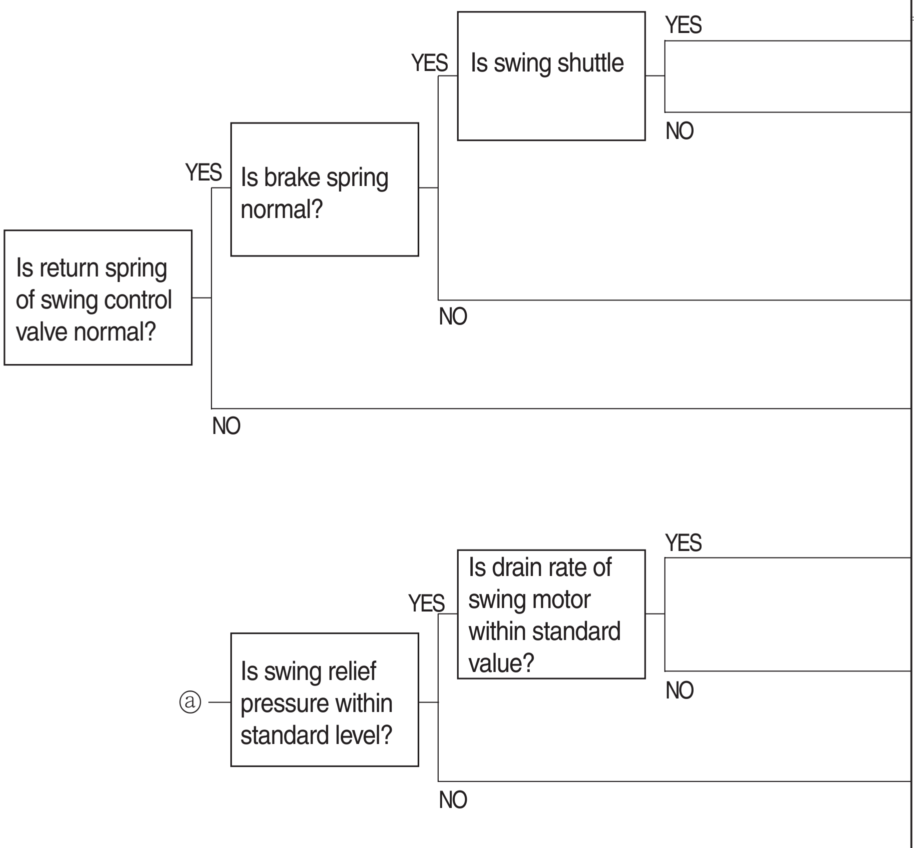
3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



4) MACHINE SWINGS BUT DOES NOT STOP



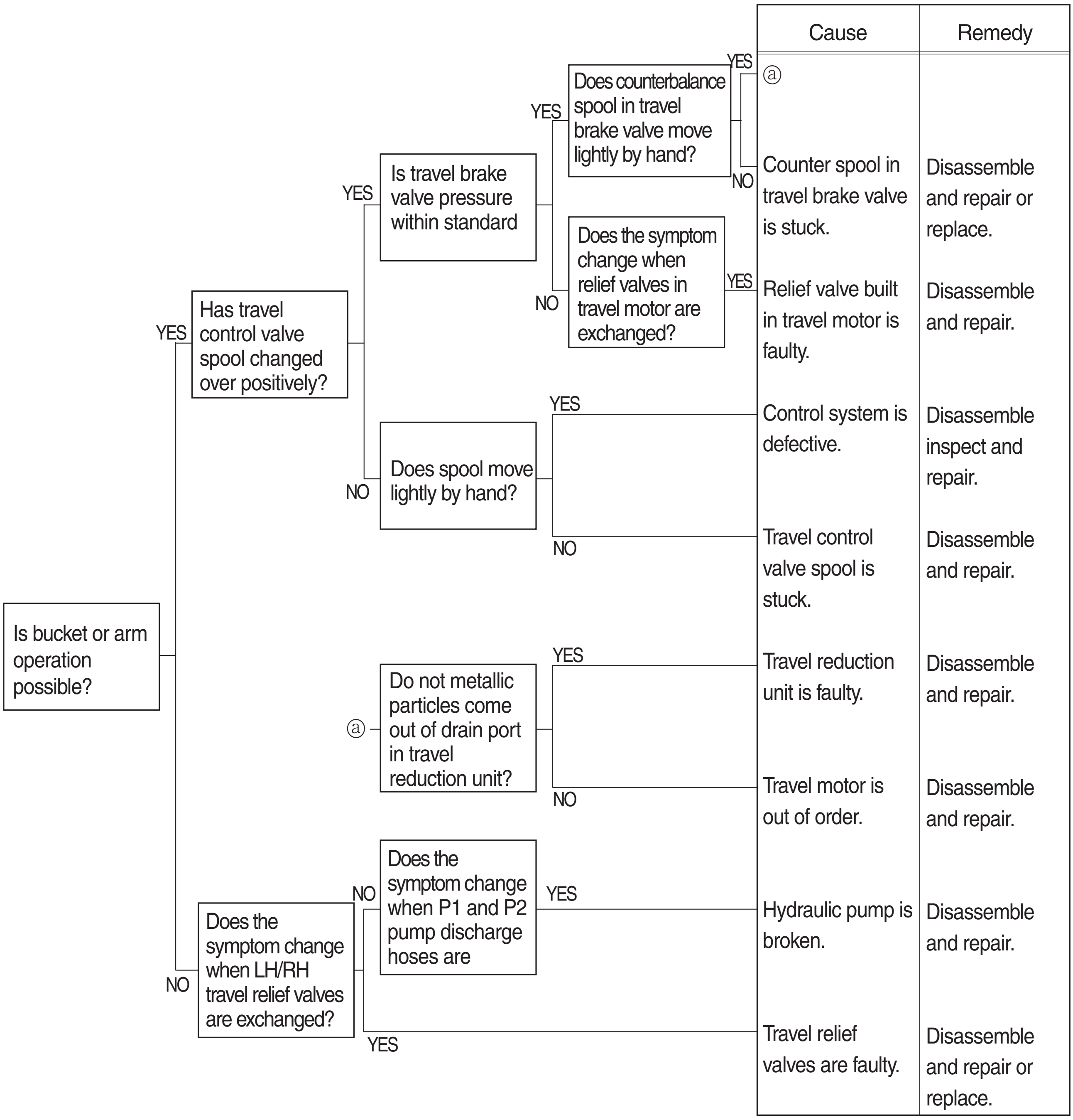
5) THE SWING UNIT DRIFTS WHEN THE MACHINE IS AT REST ON A SLOPE



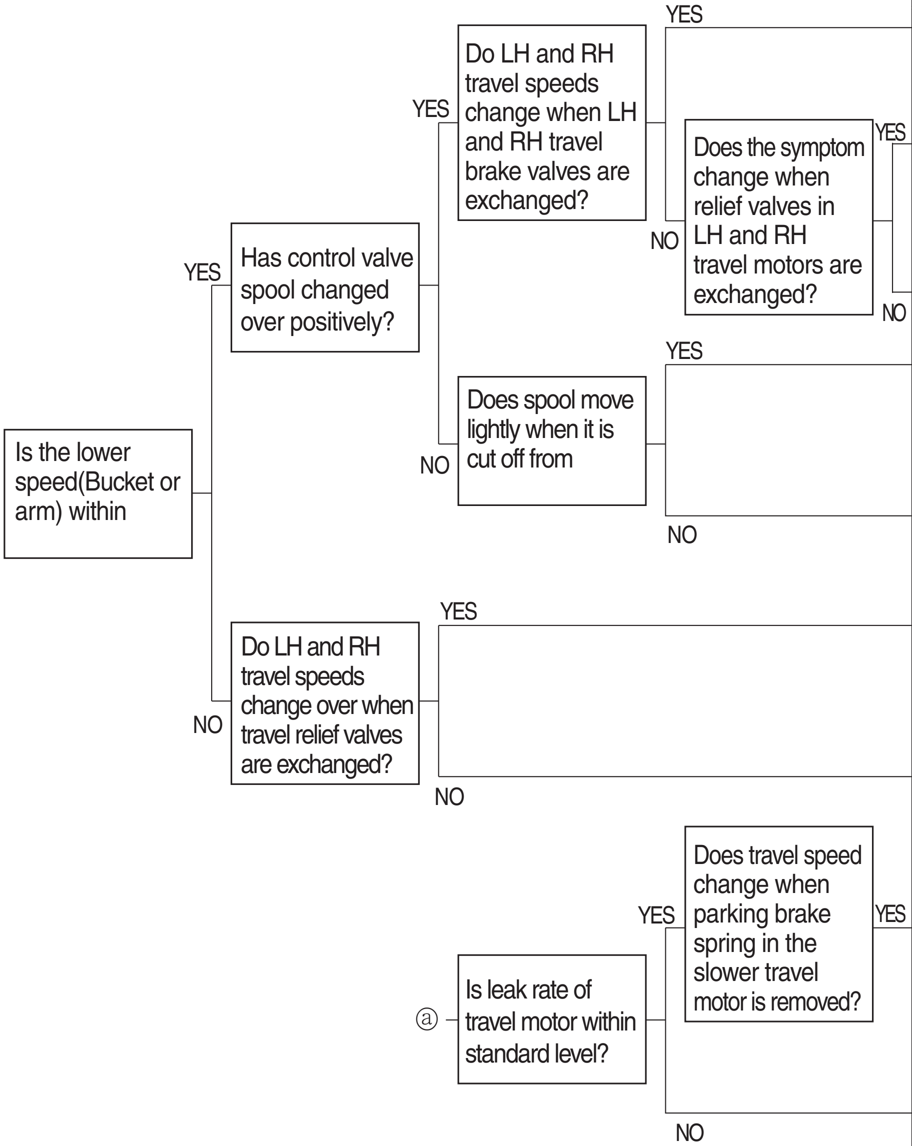
Cause	Remedy
ⓐ	
Shuttle valve is faulty.	Disassemble and replace.
Brake spring is faulty.	Disassemble and replace.
Return spring of swing control valve is faulty.	Disassemble and replace.
Swing relief valve is faulty.	Disassemble and repair or replace.
Swing motor is broken.	Disassemble and repair.
	Adjust swing relief valve pressure or replace swing relief valve.

5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION AT ALL ON ONE SIDE

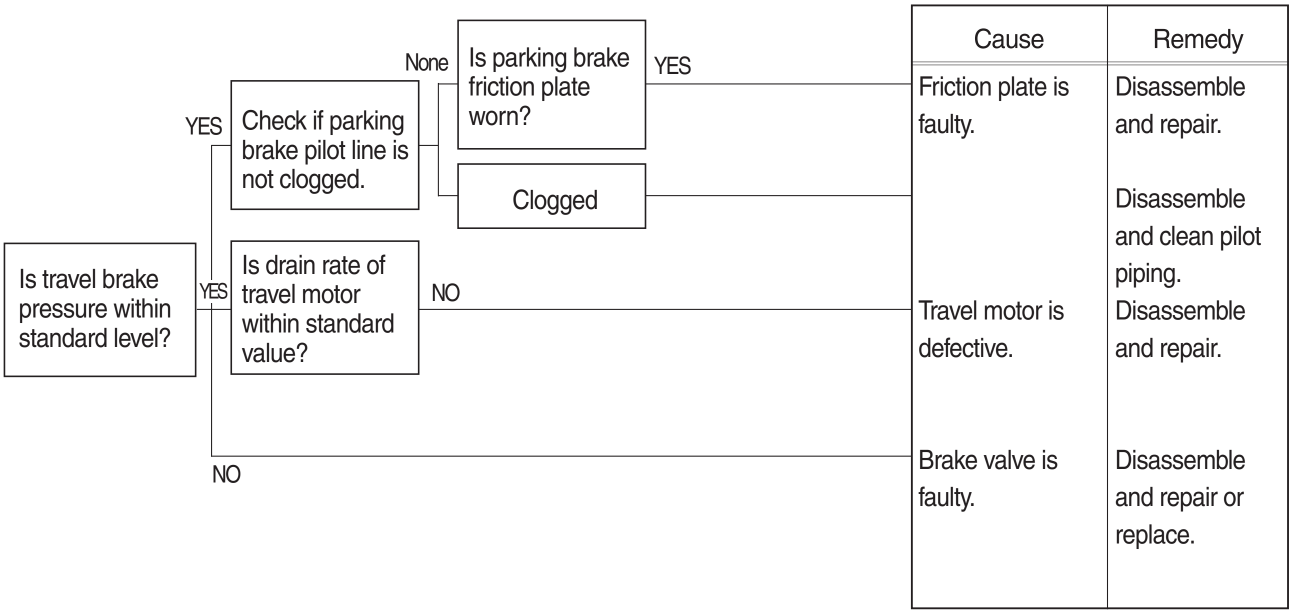


2) SPEED ON ONE SIDE FALLS AND THE MACHINE CURVES

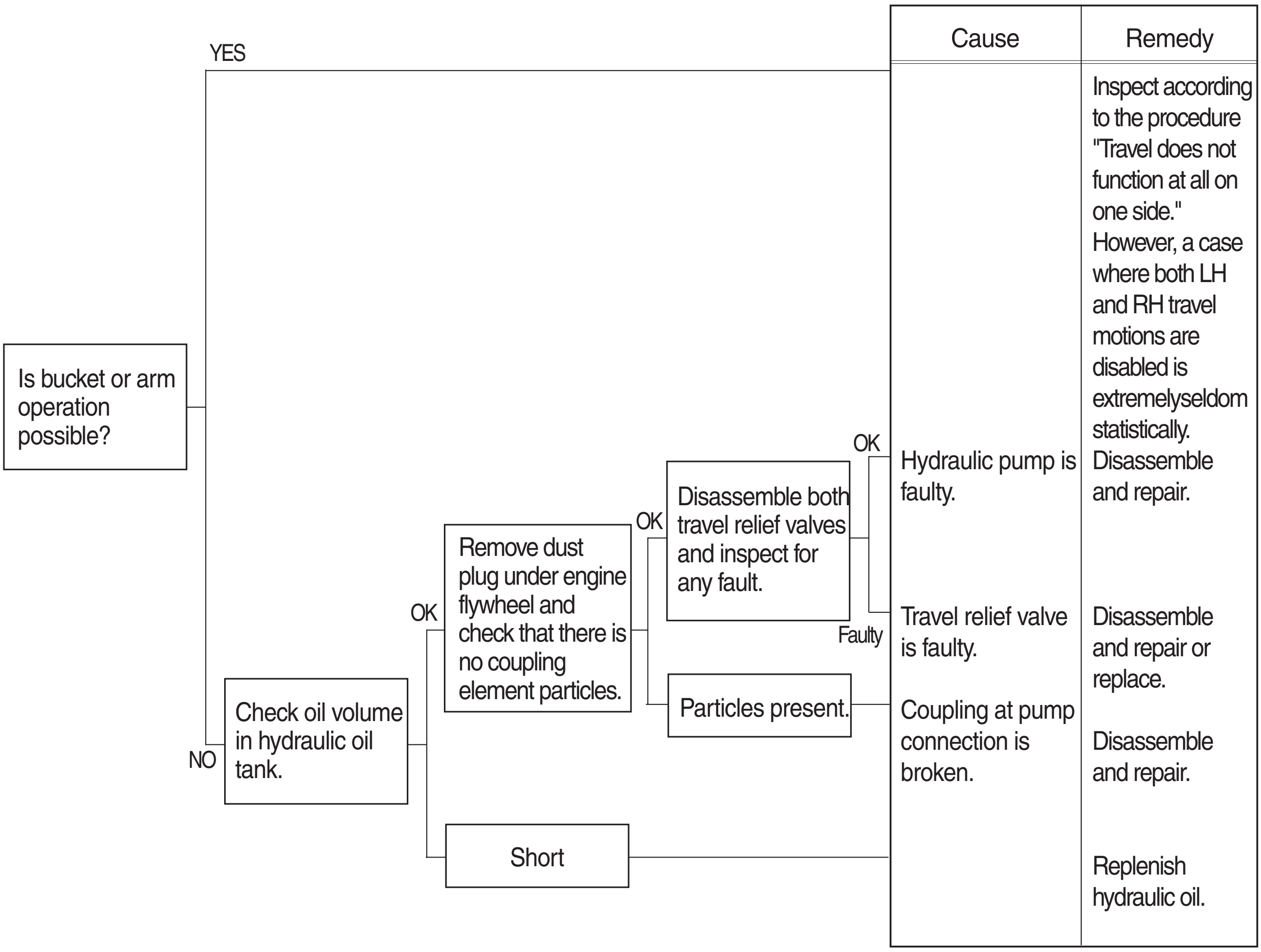


Cause	Remedy
Brake valve is defective.	Disassemble and repair or replace.
Relief valve built in travel motor is faulty.	Disassemble and repair.
ⓐ	
Control system is faulty .	Disassemble, inspect and repair.
Control valve spool is stuck.	Disassemble and repair.
Travel relief valve is faulty.	Disassemble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

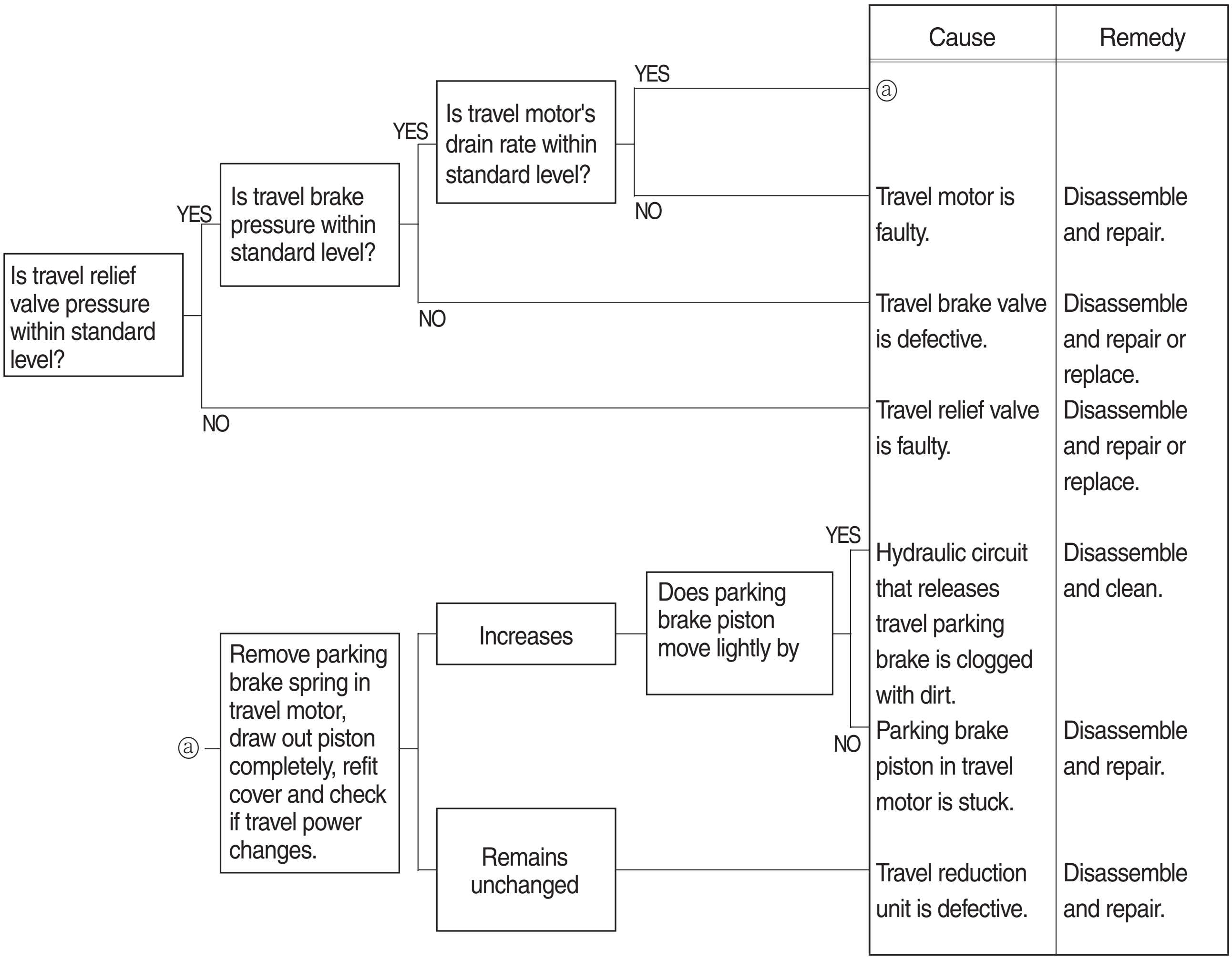
3) MACHINE DOES NOT STOP ON A SLOPE
Machine is pulled forward as sprocket rotates during digging operation.



4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE

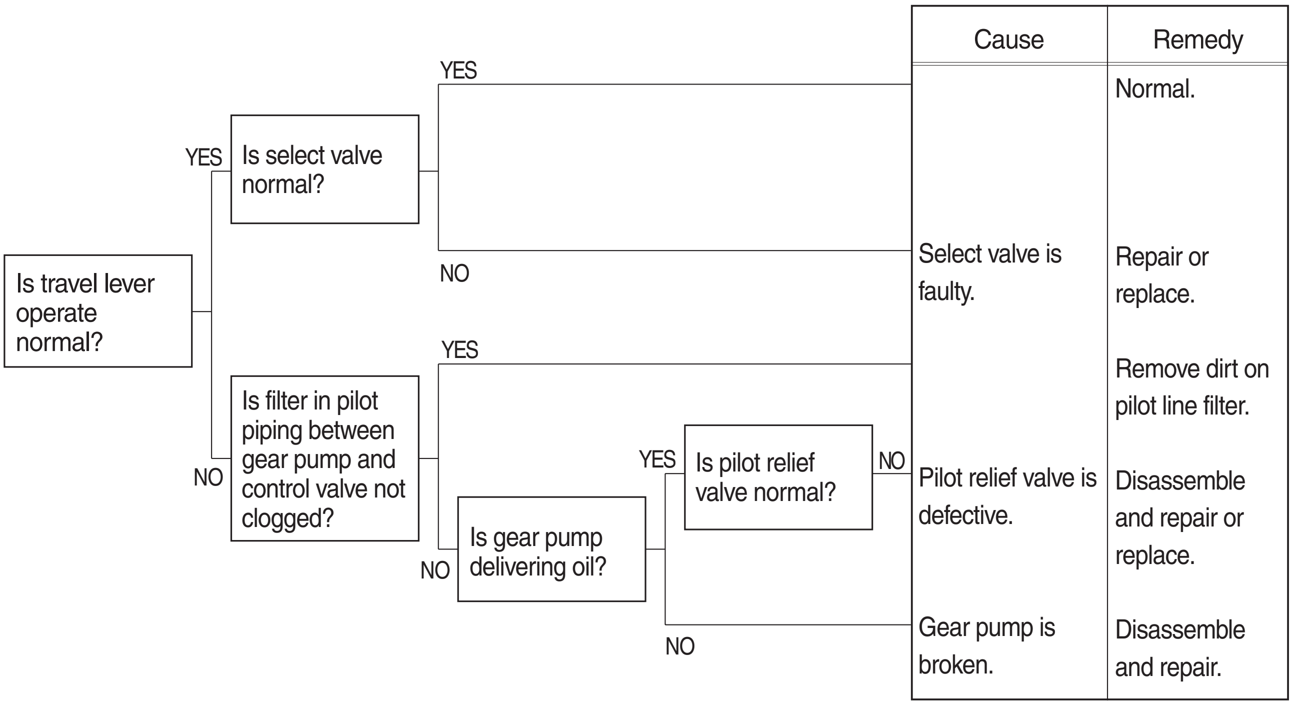


5) TRAVEL ACTION IS POWERLESS (travel only)



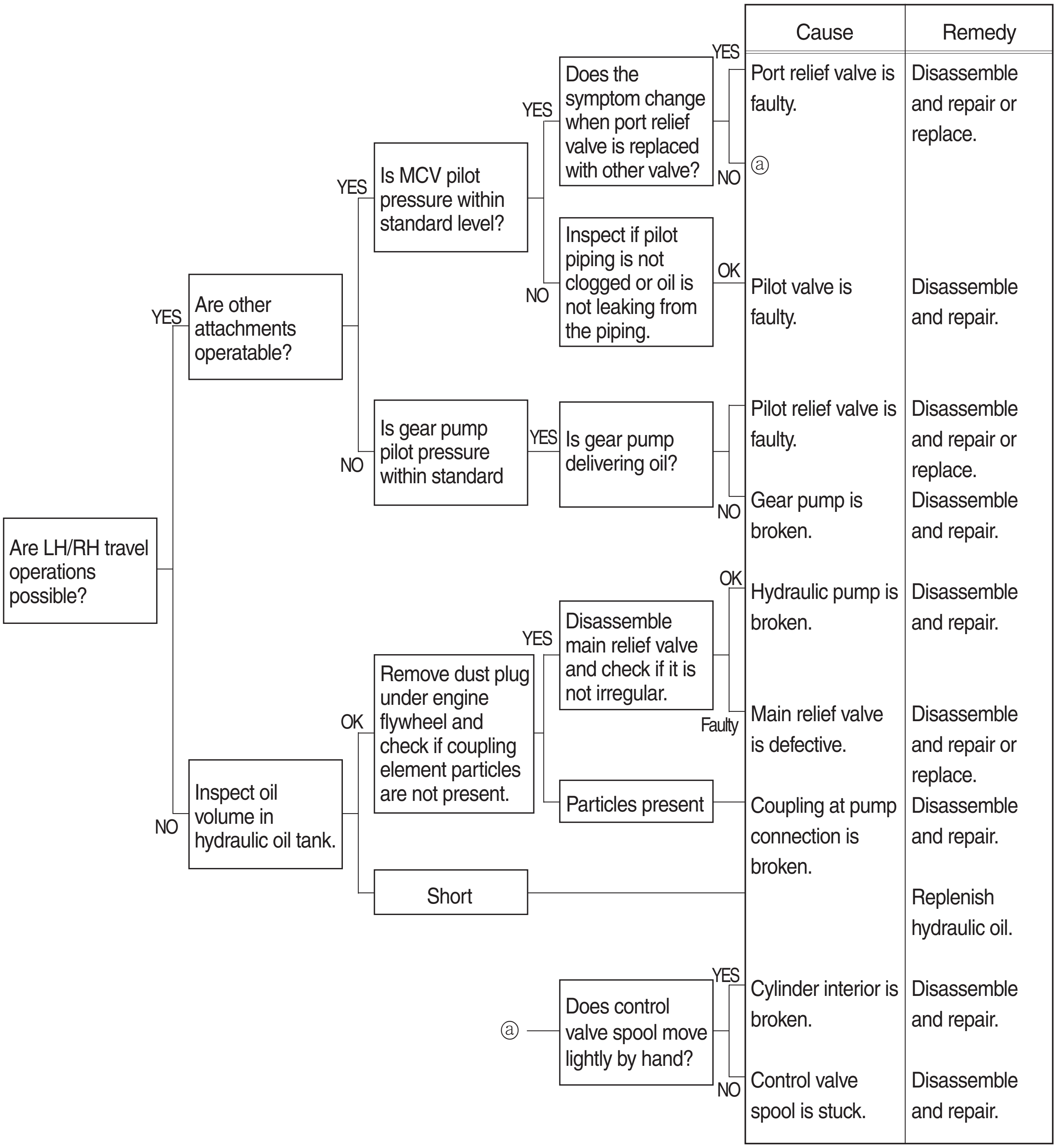
6) MACHINE RUNS RECKLESSLY ON A SLOPE

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

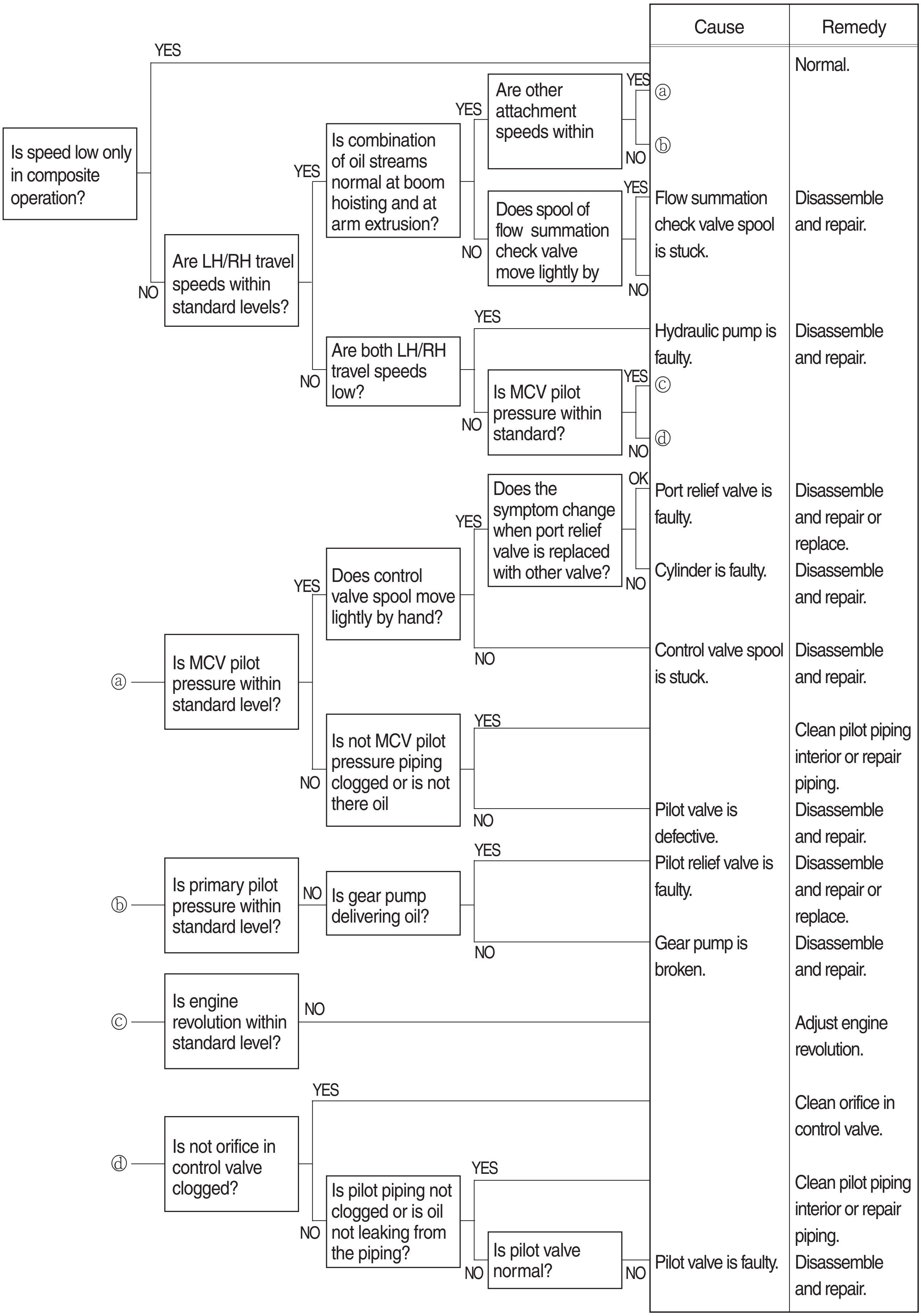


6. ATTACHMENT SYSTEM

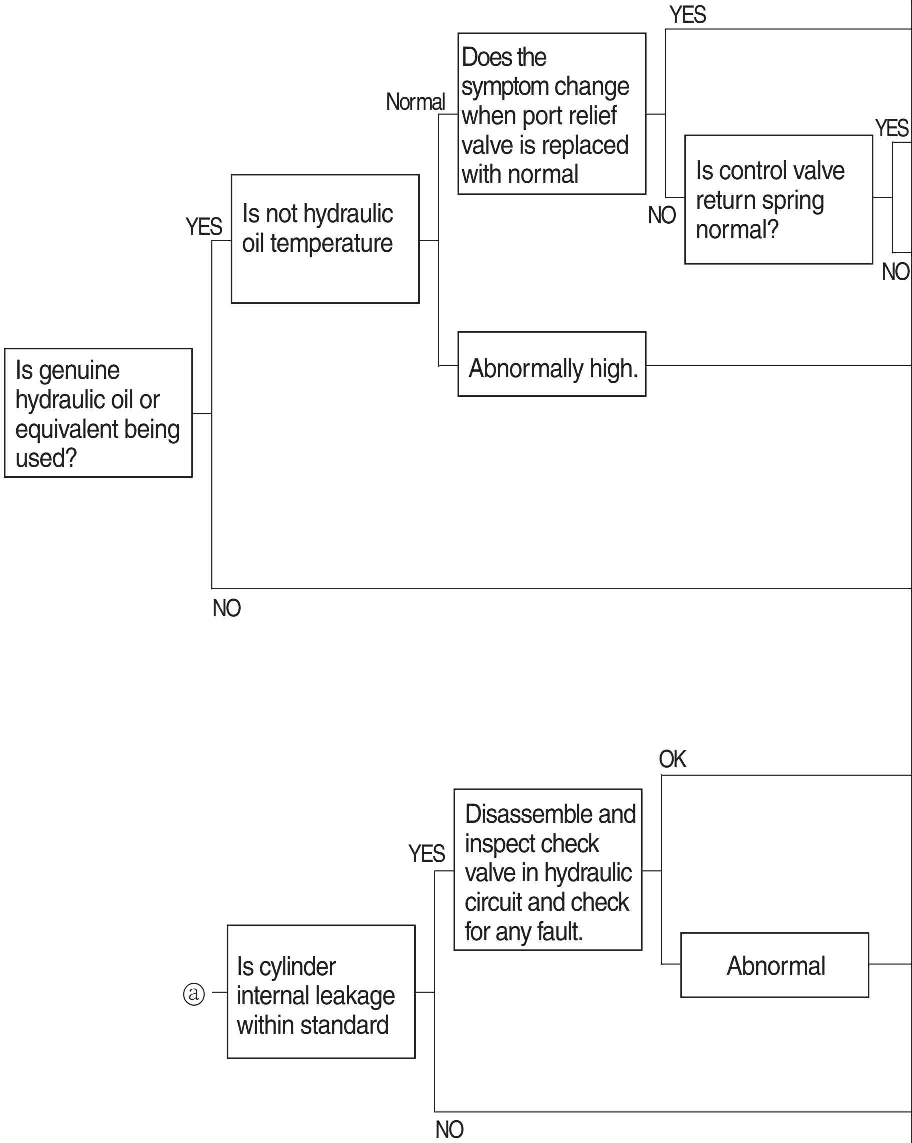
1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



2) BOOM, ARM OR BUCKET SPEED IS LOW

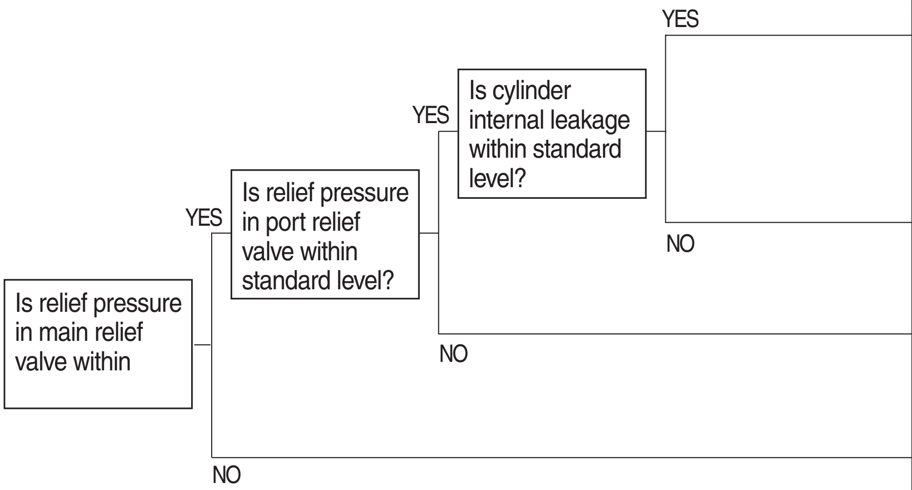


3) BOOM, ARM OR BUCKET CYLINDER EXTENDS OR CONTRACTS ITSELF AND ATTACHMENT FALLS



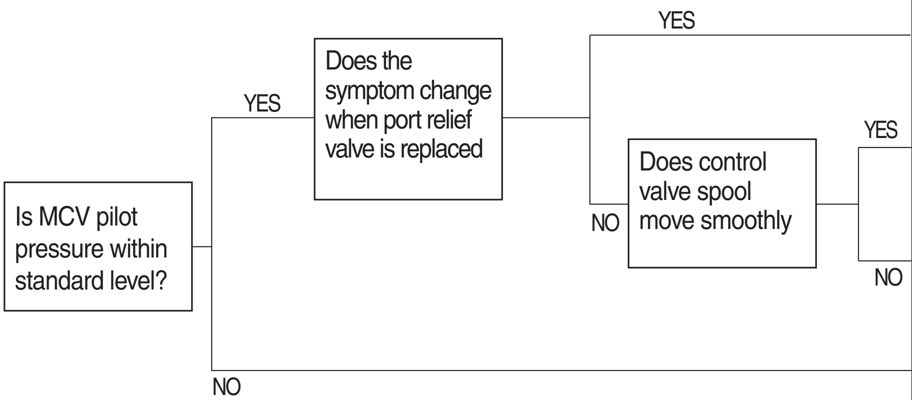
Cause	Remedy
Port relief valve is faulty.	Disassemble and repair or replace.
Control valve's return spring is faulty.	Disassemble and replace.
	Locate the cause of hydraulic oil temperature rise and lower it to proper level.
	Replace with genuine hydraulic oil or equivalent.
Pressure tightness between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

4) BOOM, ARM OR BUCKET POWER IS WEAK



Cause	Remedy
	Check according to the procedure in Item "Speed is low".
Cylinder is faulty.	Disassemble and repair.
Port relief valve is faulty.	Adjust pressure, repair or replace.
Main relief valve is defective.	Adjust pressure, repair or replace.

5) ONLY BUCKET OPERATION IS TOTALLY IMPOSSIBLE



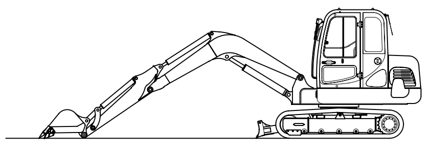
Cause	Remedy
Port relief valve is defective.	Disassemble and repair or replace.
Cylinder interior is broken.	Disassemble and repair.
Control valve spool is stuck.	Disassemble and repair.
Pilot valve is faulty.	Disassemble and repair.

6) BOOM MAKES A SQUEAKING NOISE WHEN BOOM IS OPERATED

Check	Answer	Cause	Remedy
Is boom foot pin greased sufficiently?	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.

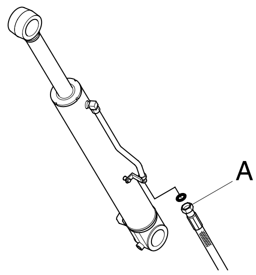
※ HOW TO CHECK INTERNAL BOOM CYLINDER LEAKAGE

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



R5575BY01

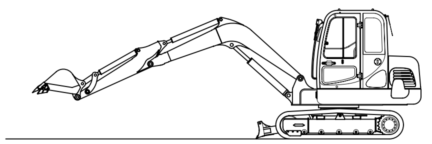
2. Disconnect hose(A) from rod side of boom cylinder and drain oil from cylinders and hose.(Put cups on piping and hose ends)



R5575BY02

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.

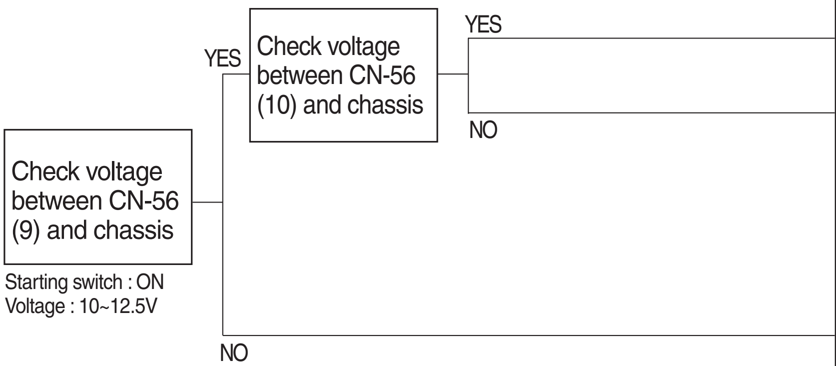


R5575BY03

GROUP 3 ELECTRICAL SYSTEM

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

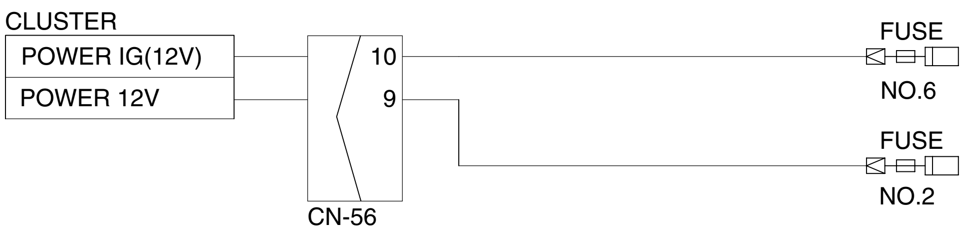
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.2 and No.5.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective cluster	Replace
Disconnection in wiring harness or poor contact between CN-56 (10) and fuse No.6.	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-56 (9) and fuse No.2	Repair or replace (after clean)

Check voltage

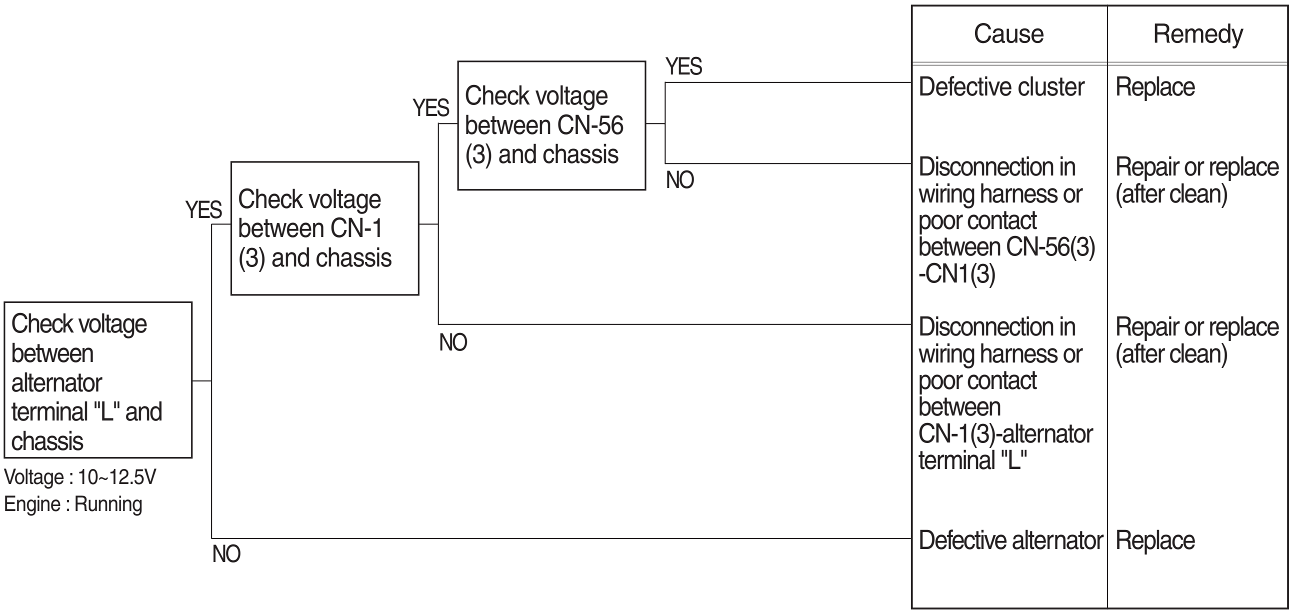
YES	10 ~ 12.5V
NO	0V



555C95TS10

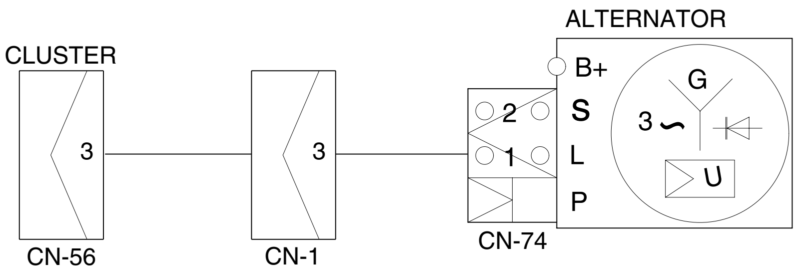
2. BATTERY CHARGING WARNING LAMP LIGHTS UP (starting switch : ON)

- 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

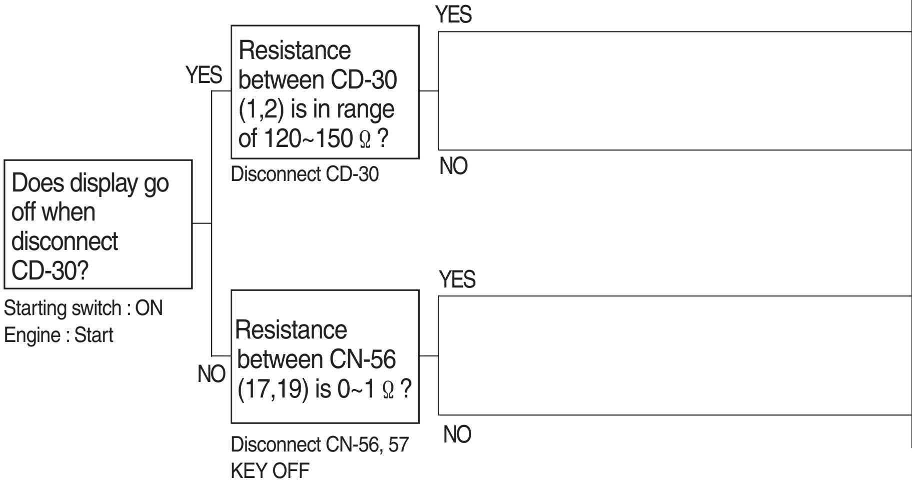
YES	10 ~ 12.5V
NO	0V



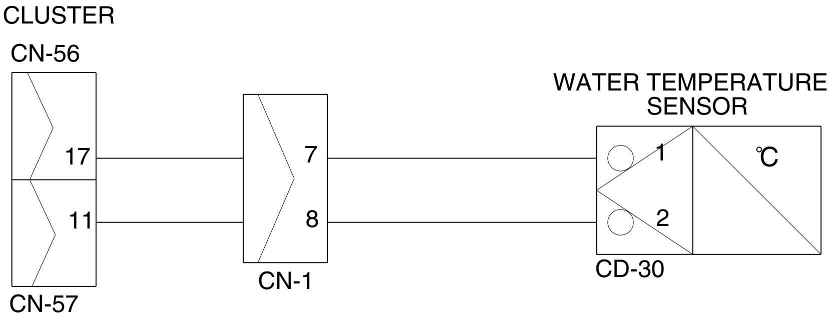
555C95TS11

3. 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.



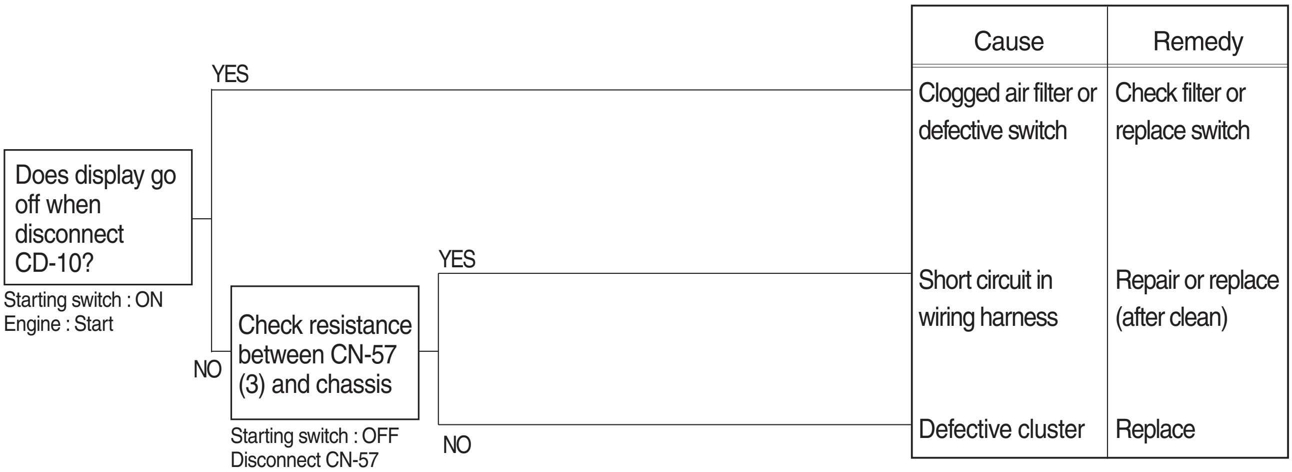
Cause	Remedy
Coolant overheat (110˚C ±2˚C)	Check engine cooling system
Defective temp sensor	Replace
Short circuit in wiring harness	Repair or replace (after clean)
Defective cluster	Replace



555C95TS12

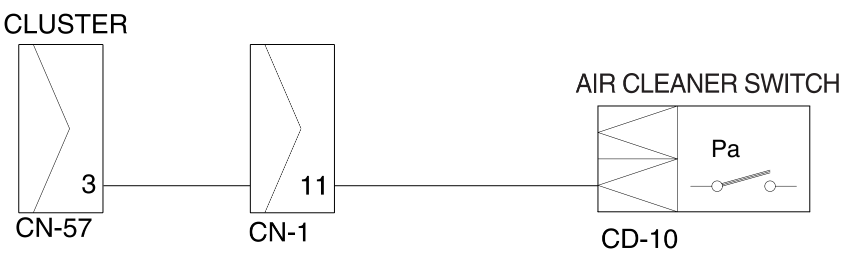
4. WHEN AIR CLEANER WARNING LAMP LIGHTS UP (engine is started)

· 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

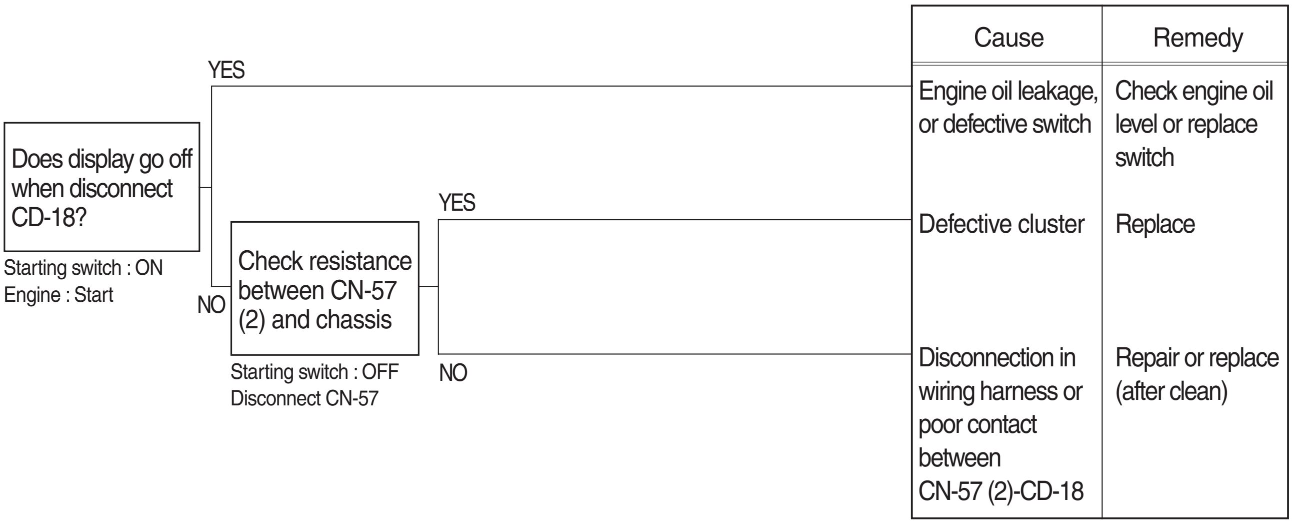
YES	MAX 1Ω
NO	MIN 1M Ω



555C95TS13

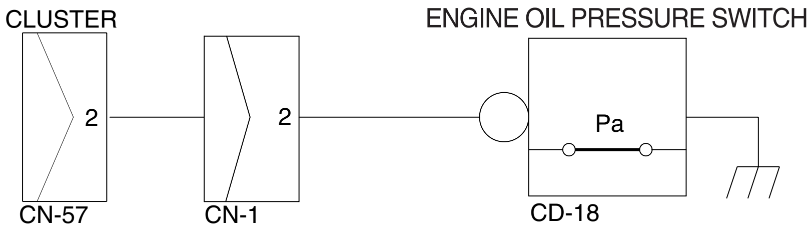
5. WHEN ENGINE OIL PRESSURE WARNING LAMP LIGHTS UP (engine is started)

· 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.



Check resistance

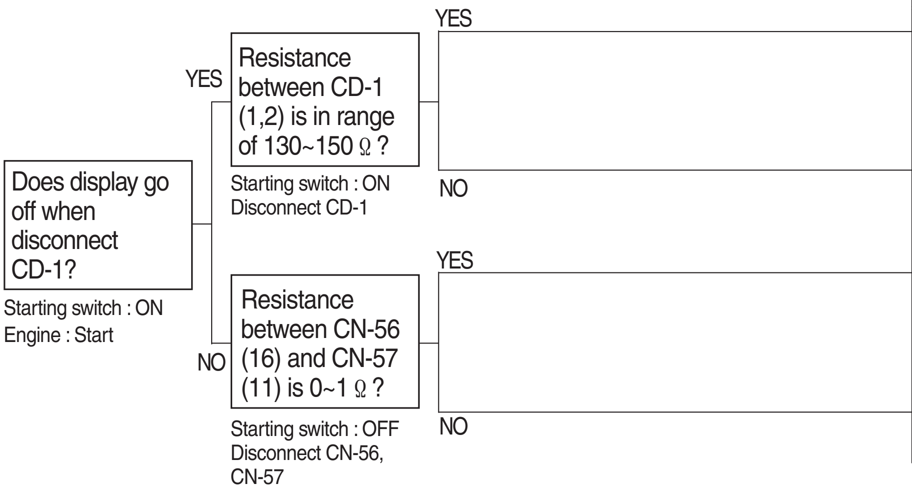
YES	MAX 1Ω
NO	MIN 1MΩ



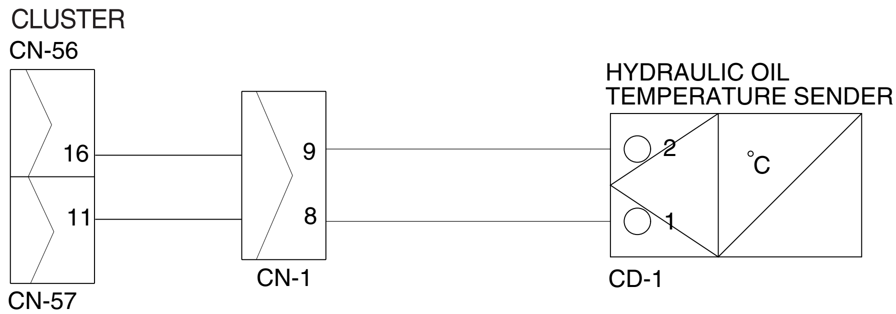
555C95TS14

6. 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.



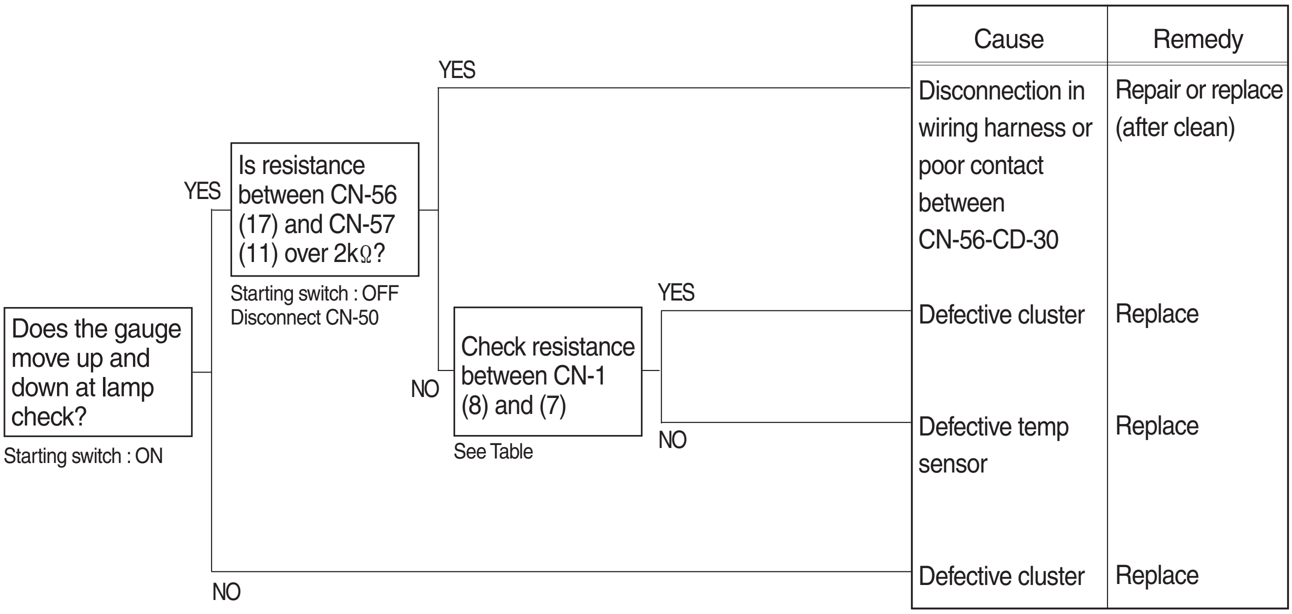
Cause	Remedy
High temperature	Check hydraulic oil temperature (100˚C ±2˚C), Replace
Defective temp sensor	Replace
Short circuit	Check and repair
Defective cluster	Replace

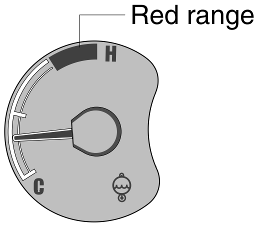


555C95TS15

7. WHEN COOLANT TEMPERATURE GAUGE DOES NOT OPERATE

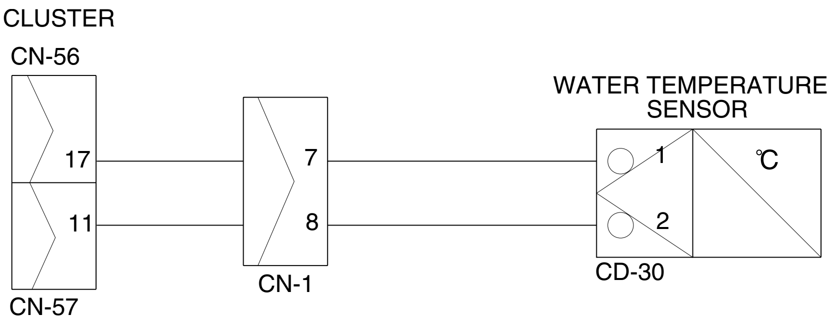
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

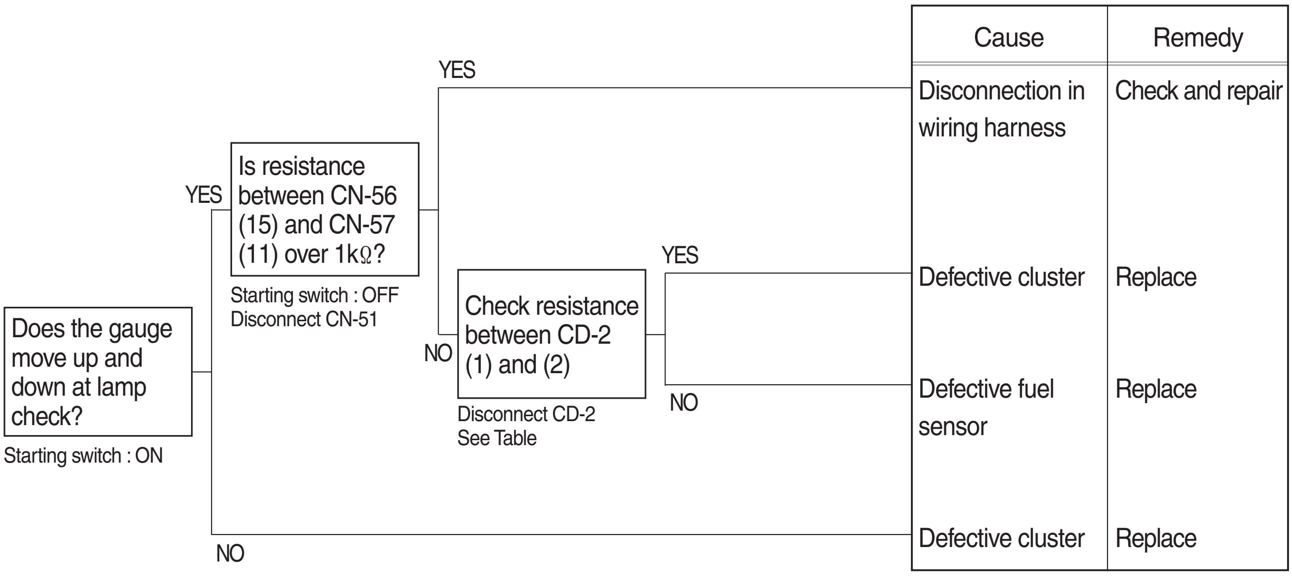
Item \ Temperature	40˚C	85~110˚C	115˚C (red range)
Unit Resistance(Ω)	1170~	270~130	~124
Tolerance(%)	±5	-8~0	±5

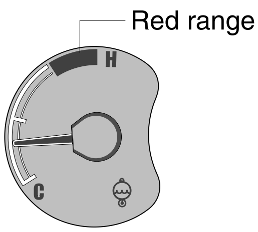


555C95TS12

8. WHEN FUEL GAUGE DOES NOT OPERATE (check warning lamp ON/OFF)

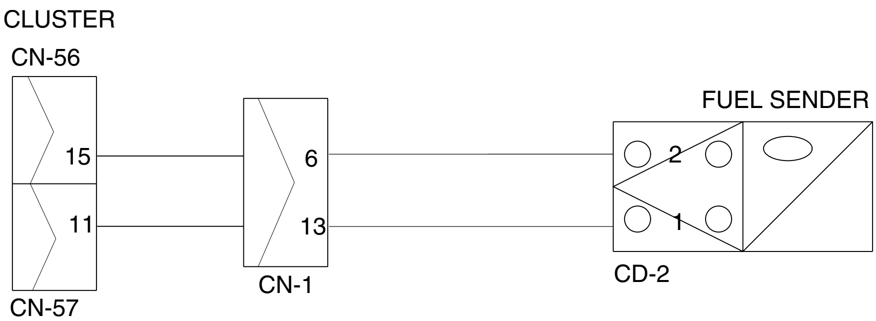
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

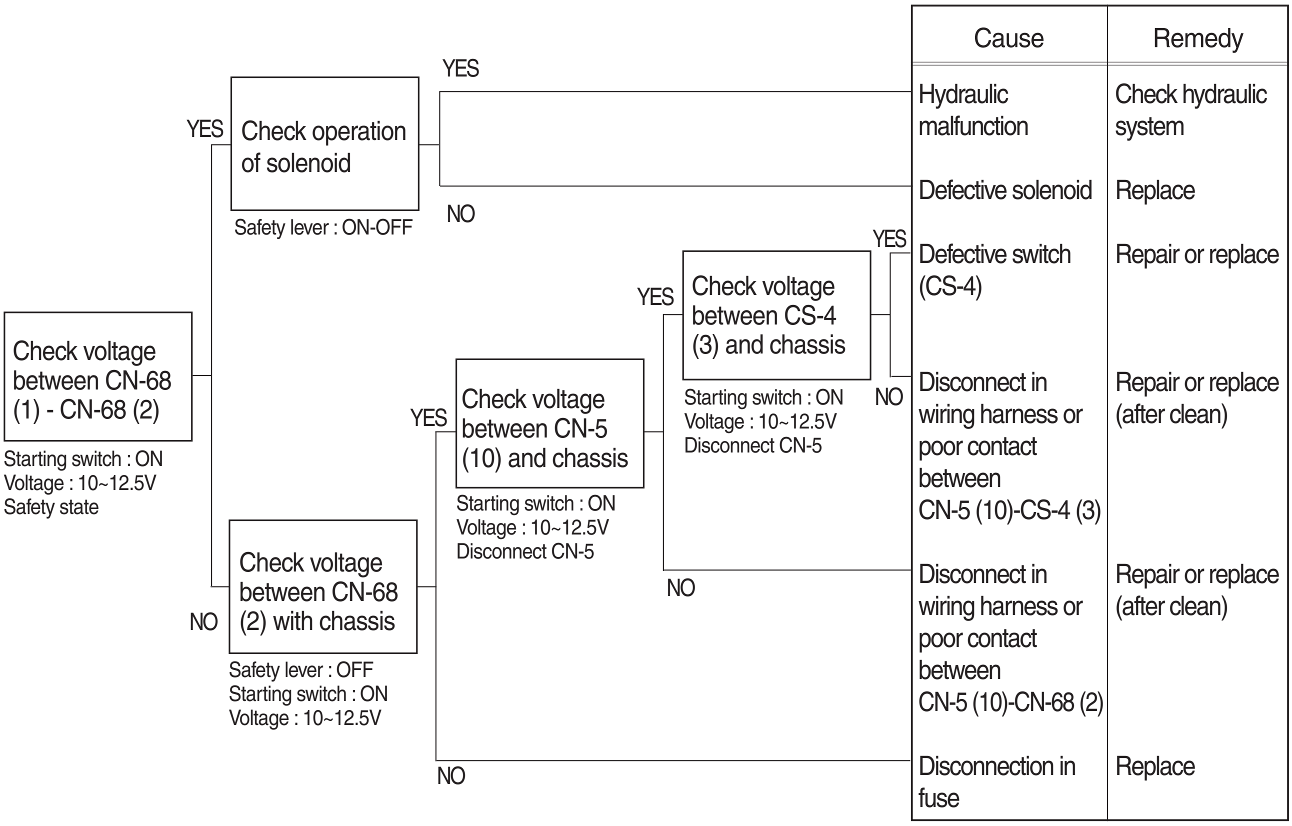
Item \ Level	Empty	1/2	Full
Unit Resistance (Ω)	700	300	~100
Tolerance (%)	±5	±8	±5

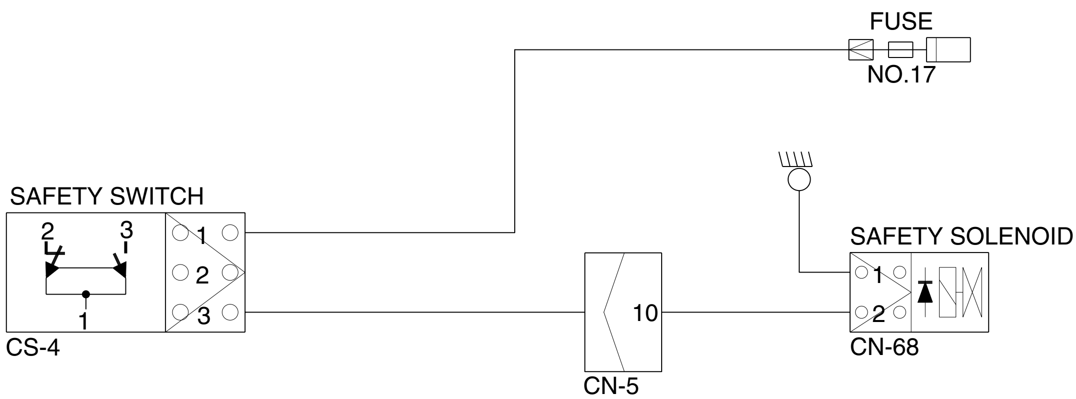


555C95TS16

9. 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.14.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.

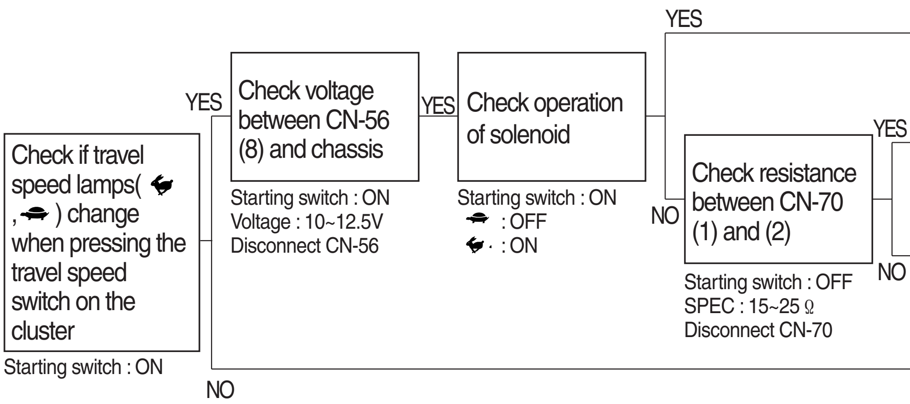




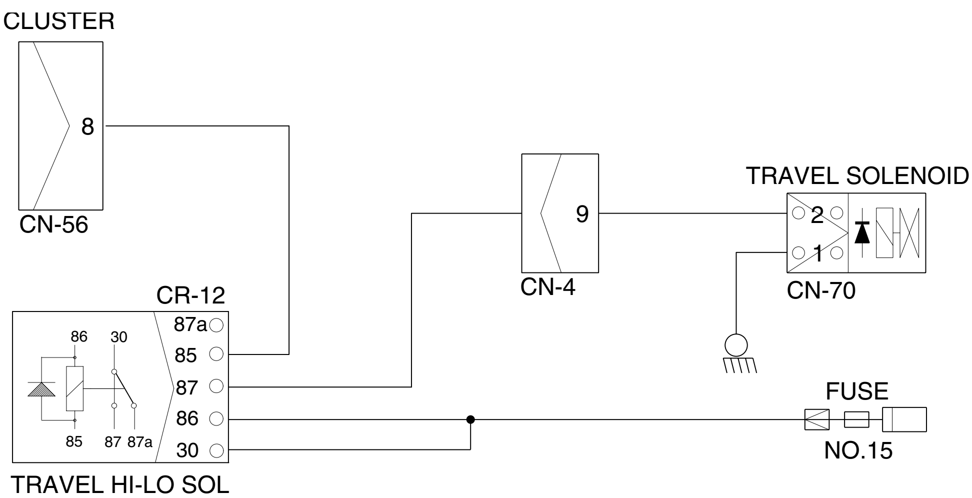
555C95TS17

10. WHEN TRAVEL SPEED 1, 2 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.15.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



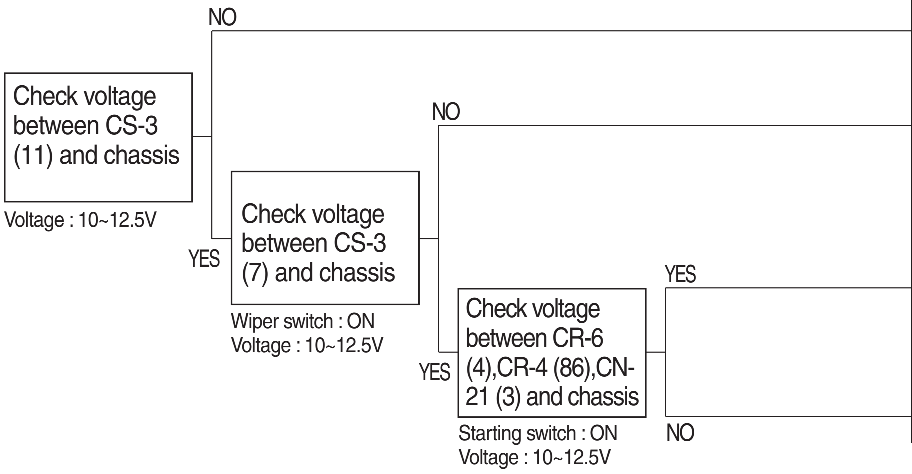
Cause	Remedy
Defective hydraulic system	Check hydraulic system
Defective cluster	Replace
Defective solenoid	Replace
Defective cluster	Replace



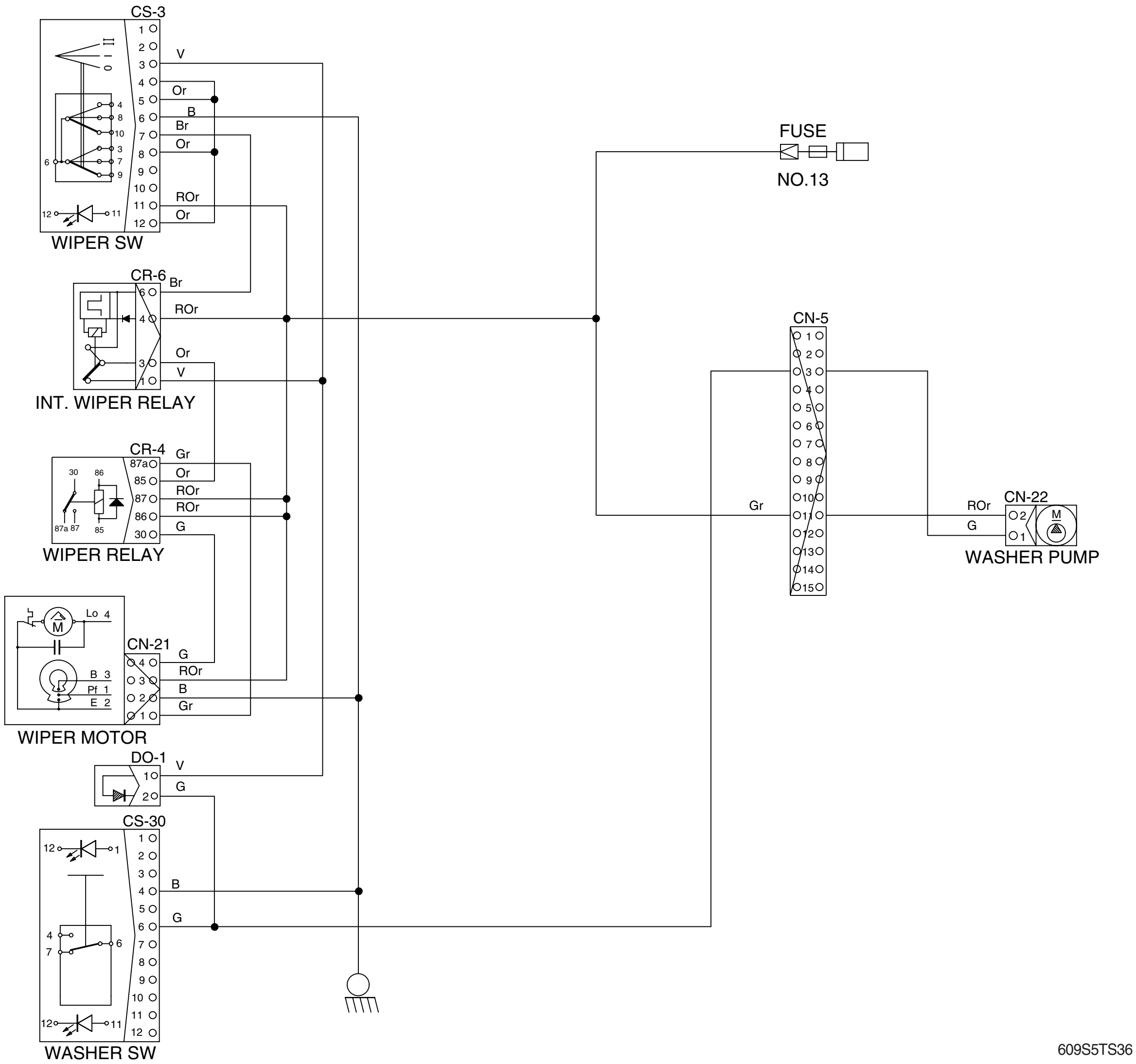
555C95TS18

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

· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and the fuse No.13 is not blown out.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



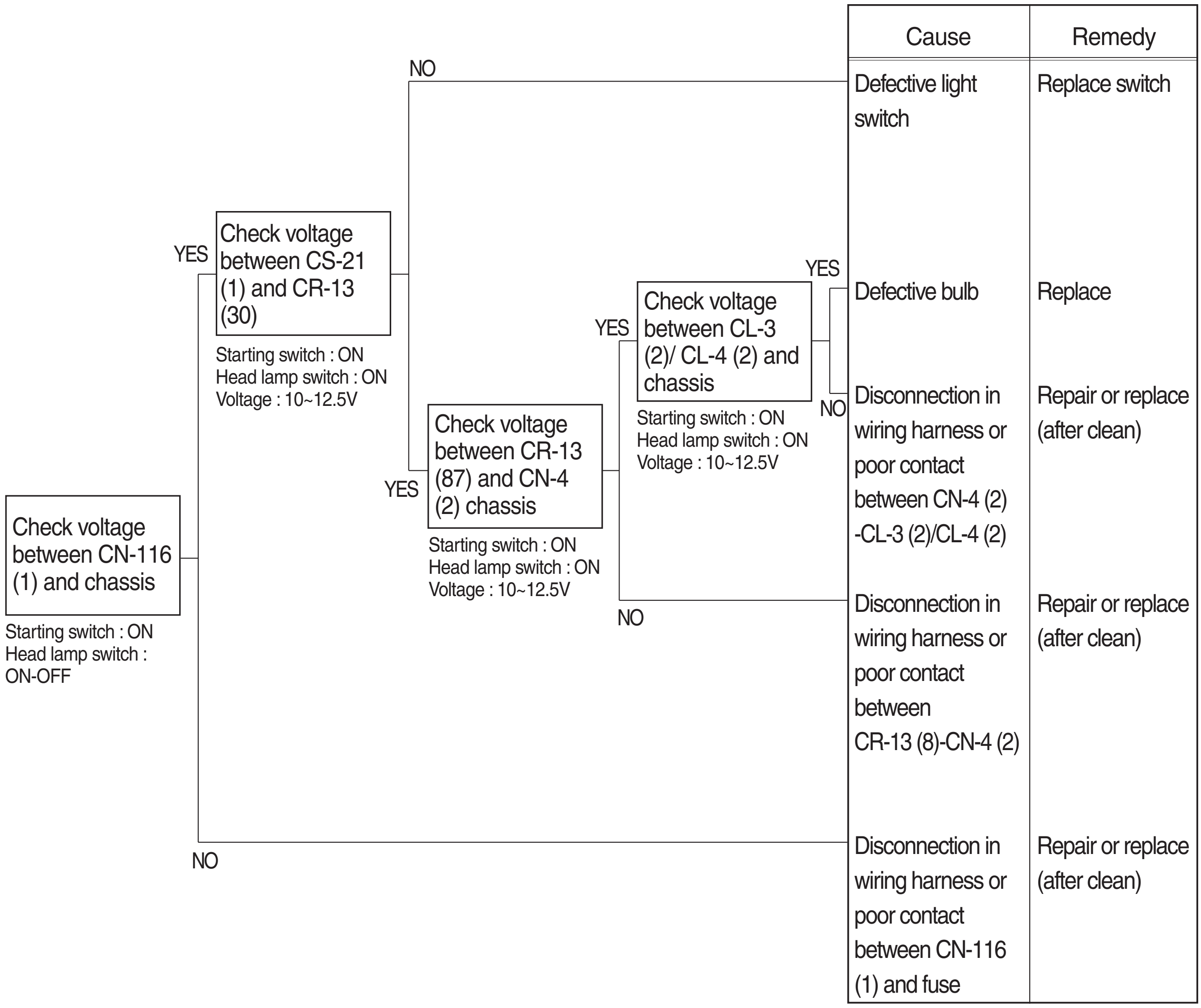
Cause	Remedy
Recheck fuse	Replace
Defective wiper switch	Replace
Defective Int wiper relay, wiper relay, wiper motor	Replace
Recheck fuse	Replace

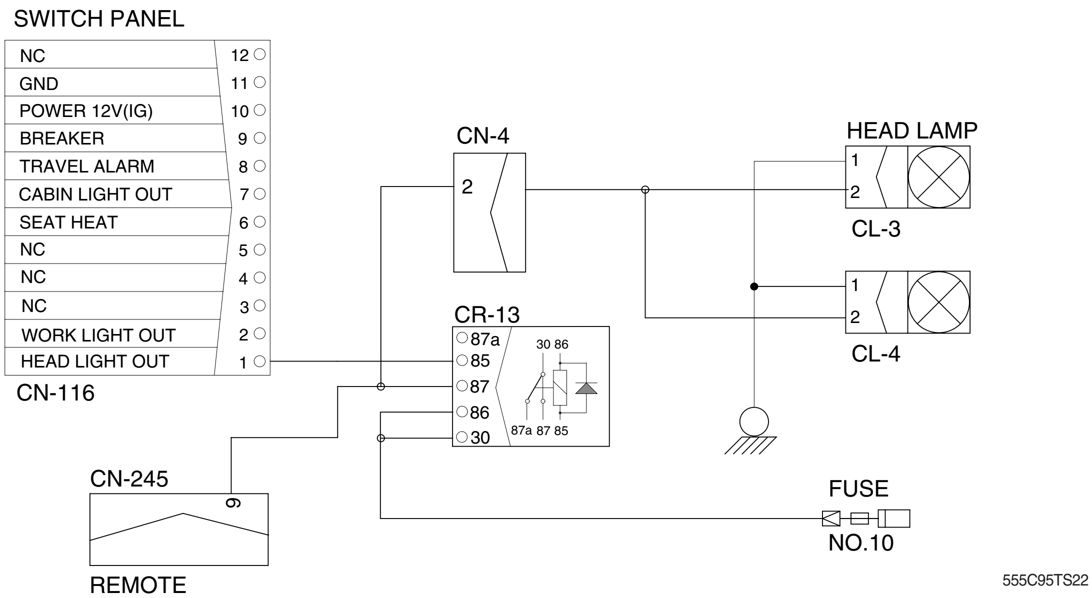


609S5TS36

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

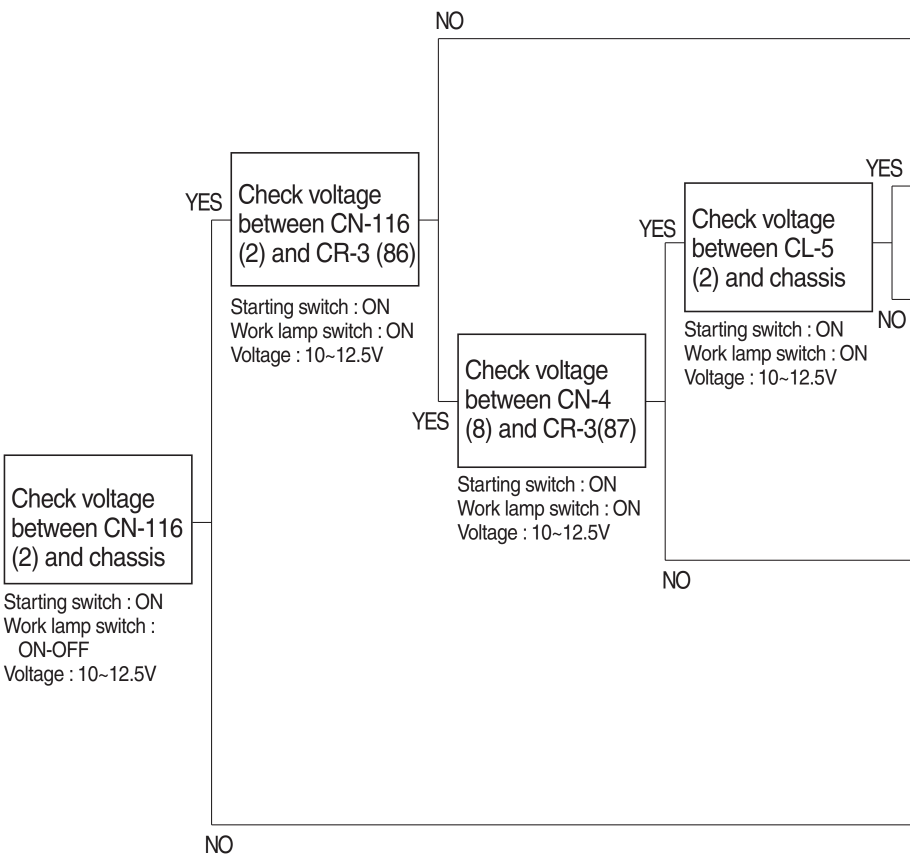
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.10.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



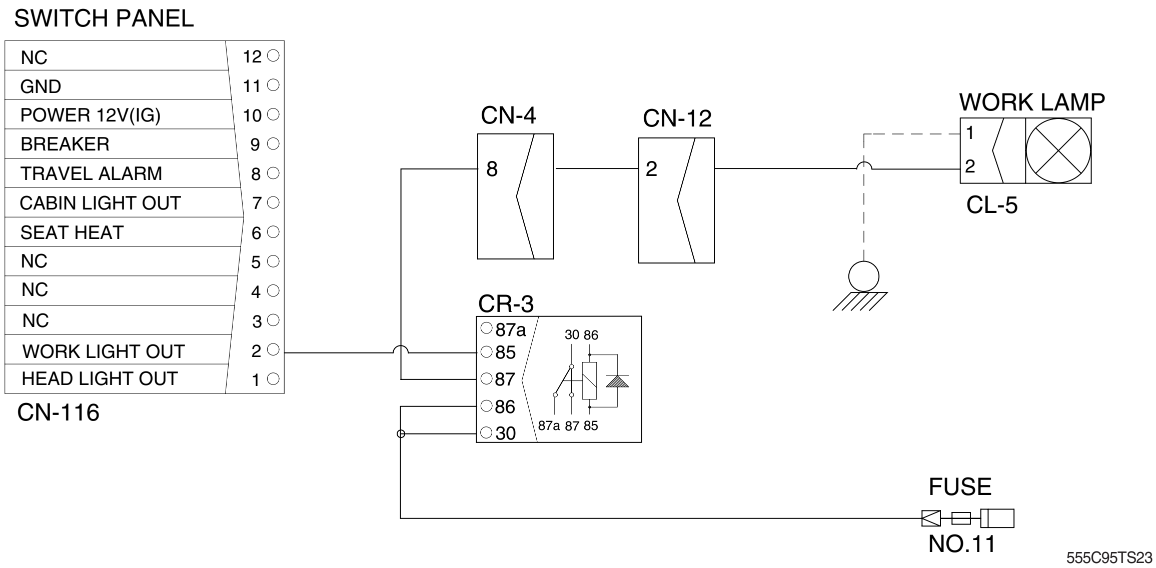


13. WHEN STARTING SWITCH IS TURNED ON, WORK LAMP DOES NOT LIGHTS UP

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.11.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.

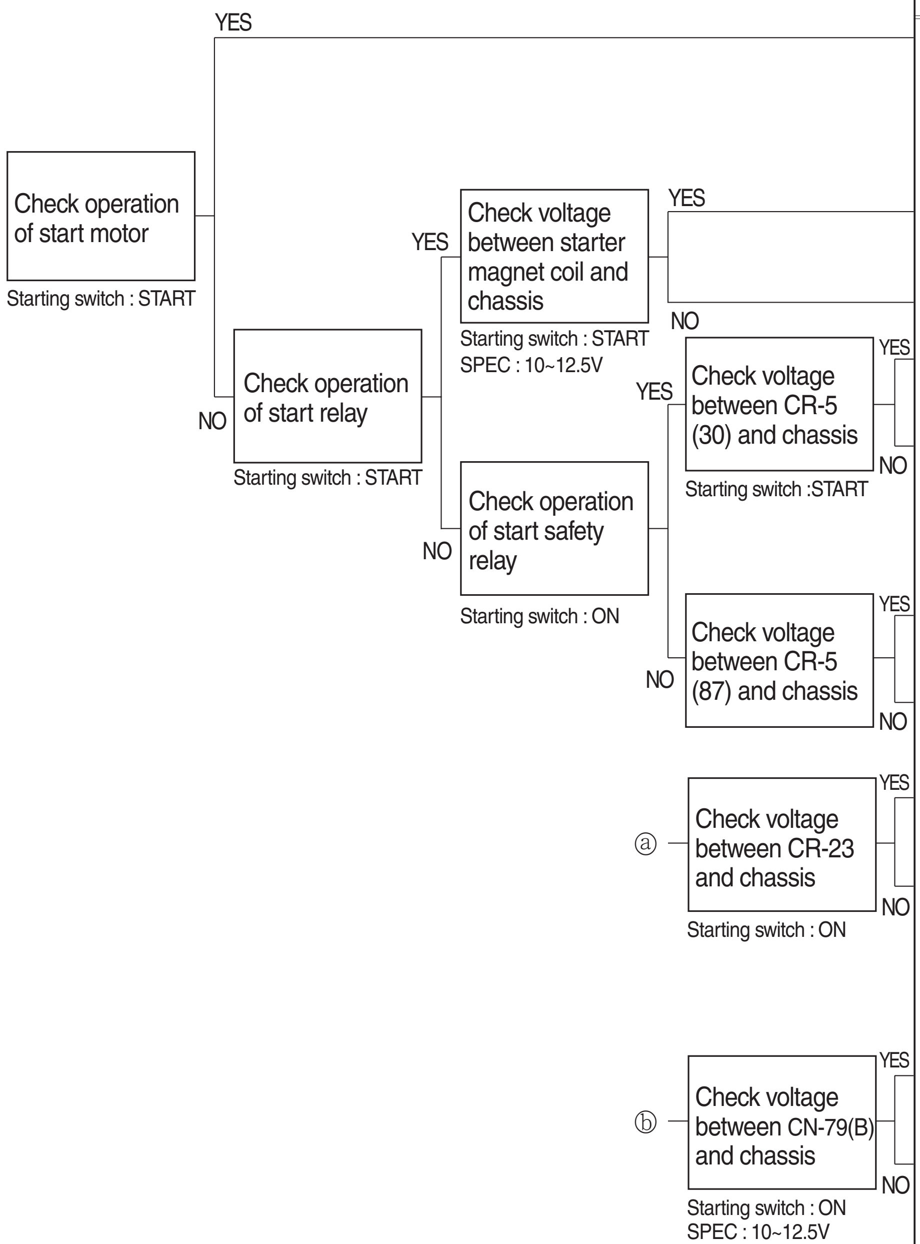


Cause	Remedy
Defective light switch	Replace switch
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CN-4 (8) and CL-5 (2)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-116 (2)-CN-4 (8)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-116 (2) and fuse	Repair or replace (after clean)

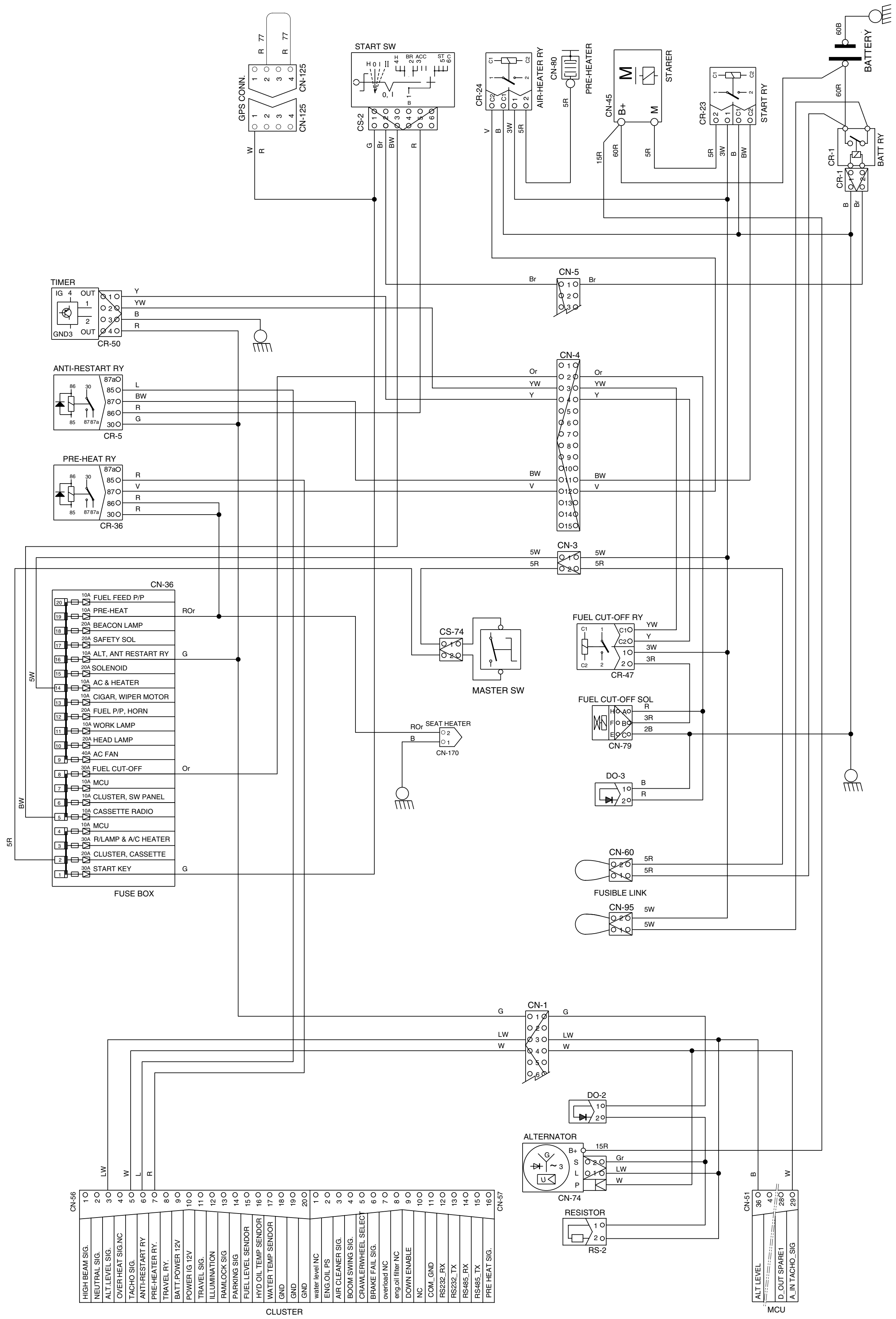


14. WHEN ENGINE DOES NOT START

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



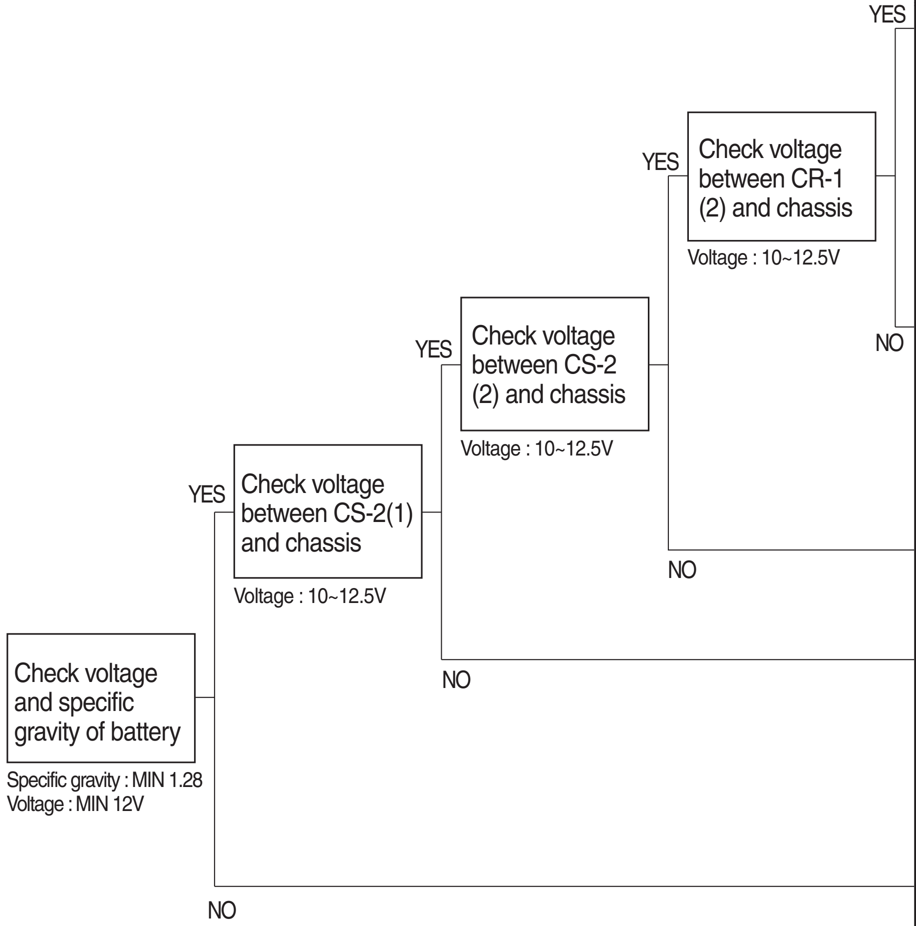
Cause	Remedy
Defective battery	Check engine system charge or replace (after checking specific gravity of battery)
Defective magnet of start motor	Replace
Defective start relay	Replace
ⓐ	
Disconnection in wiring harness or poor contact between CR-5 (87) and CN-4(11)	Repair or replace (after clean)
Defective relay	Replace
ⓑ	
Defective relay	Replace
Disconnection in wiring harness or poor contact between CR-5 (87)-CR-23 (C2)	Repair or replace (after clean)
Defective fuel cut-off solenoid	Replace
Disconnection in wiring harness or between CN-79(B)-CR-47(2)	Repair or replace (after clean)



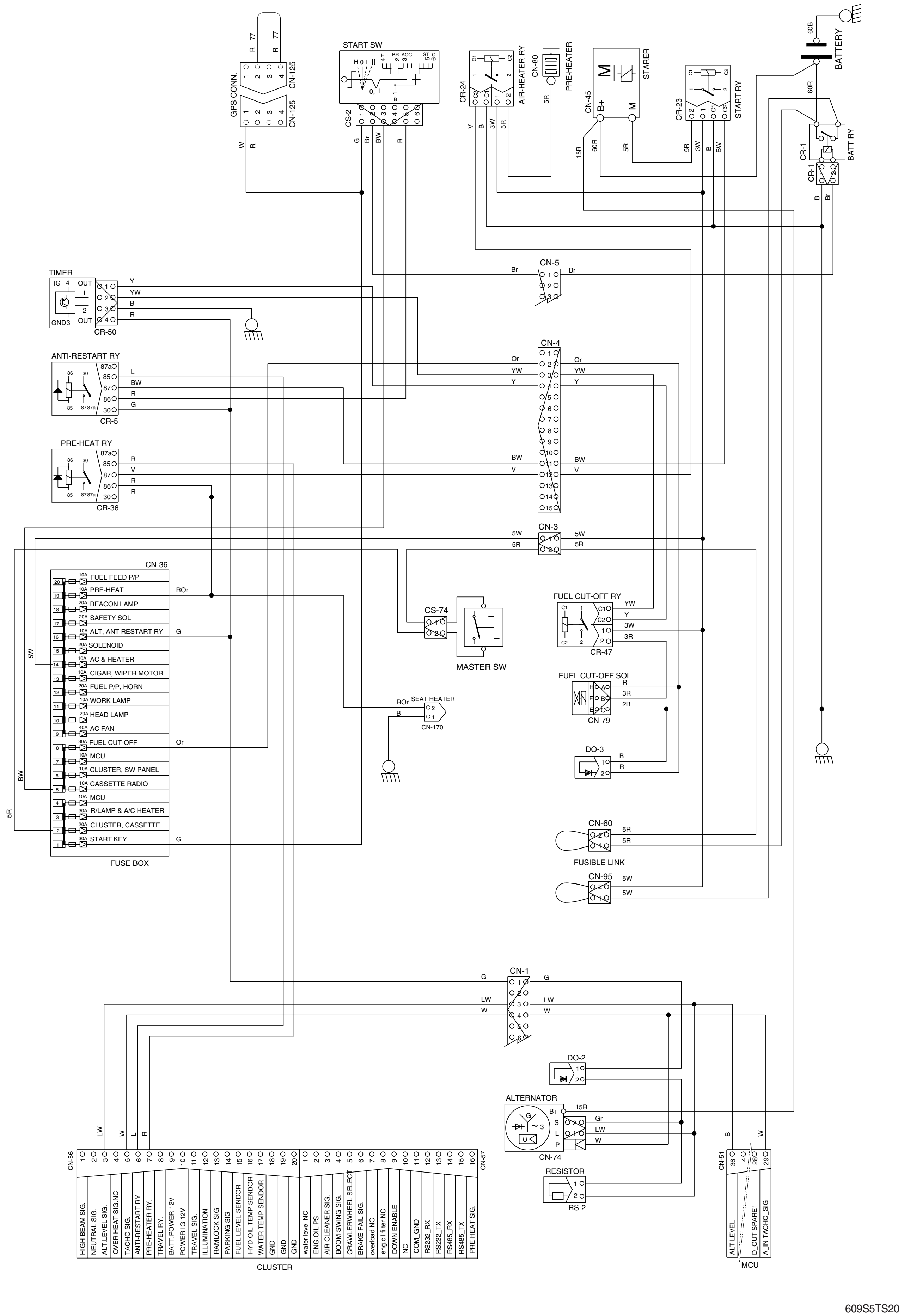
609S5TS20

15. WHEN STARTING SWITCH ON DOES NOT OPERATE

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



Cause	Remedy
Disconnection in wiring harness or poor contact between CN-5 (1)-CR-1 (2) or defective battery relay	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CS-2 (2)-CN-5 (1)	Replace
Defective start switch	Replace
Disconnection in wiring harness or poor contact between CS-2 (1)-fuse No.1	Replace
Battery capacity too low	Charge or replace (after clean)



609S5TS20

SECTION 6 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 Hyundai spec.

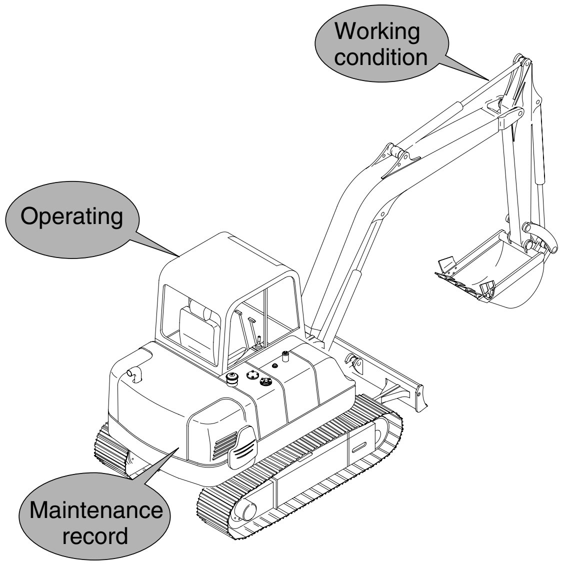
2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

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.

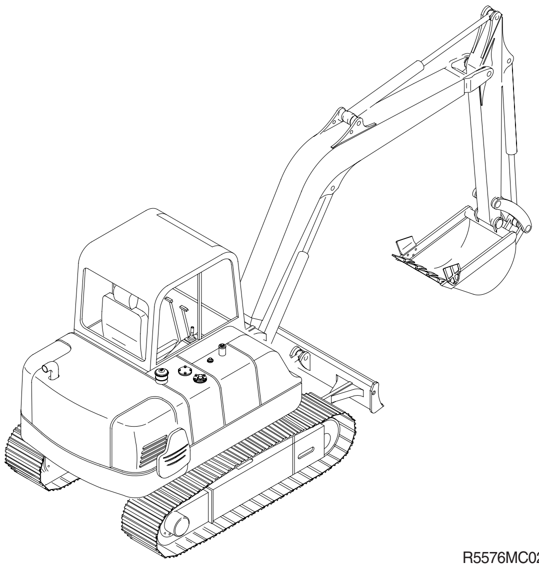


R5576MC01

2. TERMINOLOGY

1) STANDARD

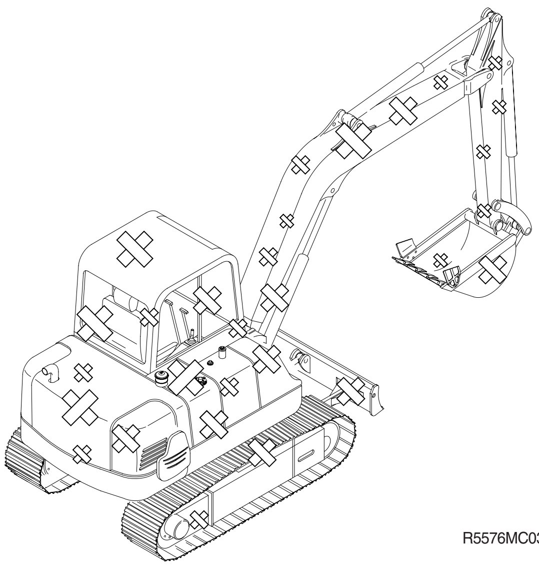
Specifications applied to the brand-new machine, components and parts.



R5576MC02

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.



R5576MC03

3. OPERATION FOR PERFORMANCE TESTS

1) Observe the following rules in order to carry out performance tests accurately and safely.

(1) The machine

Repair any defects and damage found, such as oil or water leaks, loose bolts, cracks and so on, before starting to test.

(2) Test area

① Select a hard, flat surface.

② Secure enough space to allow the machine to run straight more than 20m, and to make a full swing with the front attachment extended.

③ If required, rope off the test area and provide signboards to keep unauthorized personnel away.

(3) Precautions

① Before starting to test, agree upon the signals to be employed for communication among coworkers. Once the test is started, be sure to communicate with each other using these signals, and to follow them without fail.

② Operate the machine carefully and always give first priority to safety.

③ While testing, always take care to avoid accidents due to landslides or contact with high voltage power lines. Always confirm that there is sufficient space for full swings.

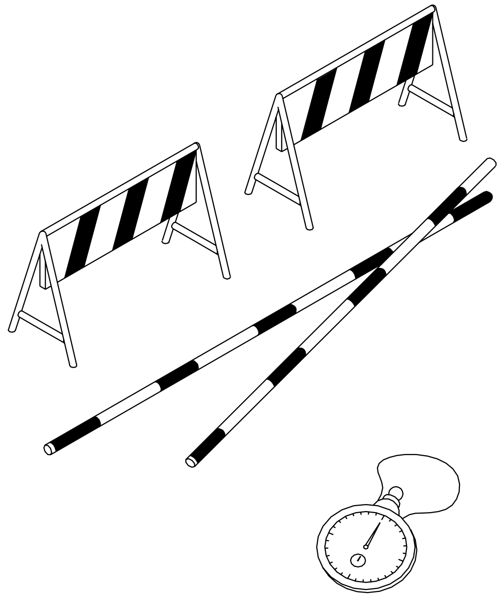
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

(4) Make precise measurements

① Accurately calibrate test instruments in advance to obtain correct data.

② Carry out tests under the exact test conditions prescribed for each test item.

③ Repeat the same test and confirm that the test data obtained can be procured repeatedly. Use mean values of measurements if necessary.



7-3 (140-7)

2) ENGINE SPEED

(1) Measure the engine speed at the maximum RPM.

※ The engine speed must meet standard RPM; if not, all other operational performance data will be unreliable. It is essential to perform this test first.

(2) Preparation and measurement

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 M mode at the cluster
③ Measure the engine RPM.

(3) Evaluation

The measured speeds should meet the following specifications.

Unit : rpm

Model	Engine speed	Standard	Remark
R60-9S	Low idle	1000±100	
	High idle	2200±50	M mode

3) TRAVEL SPEED

(1) Measure the time required for the excavator to travel a 20m test track.

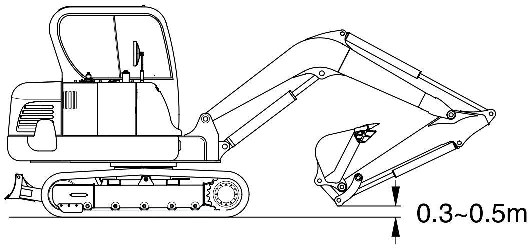
(2) Preparation

① Adjust the tension of both tracks to be equal.

② Prepare a flat and solid test track 20m in length, with extra length of 3 to 5m on both ends for machine acceleration and deceleration.

③ Hold the bucket 0.3 to 0.5m above the ground with the arm and bucket rolled in.

④ Keep the hydraulic oil temperature at 50±5˚C.



555C96MC04

(3) Measurement

① Measure both the low and high speeds of the machine.

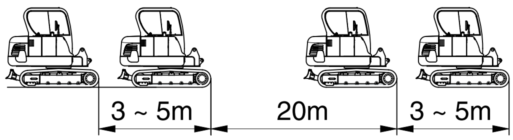
② Before starting either the low or high speed tests, adjust the travel mode switch to the speed to be tested.

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

④ Measure the time required to travel 20m.

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.



555C96MC05

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds / 20m

Model	Travel speed	Standard		Maximum allowable		Remarks
		Steel track	Rubber track	Steel track	Rubber track	
R60-9S	1 Speed	33.3±2.0	31.3±2.0	41.8	39.2	
	2 Speed	17.9±1.0	16.8±1.0	22.9	21.5	

4) TRACK REVOLUTION SPEED

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

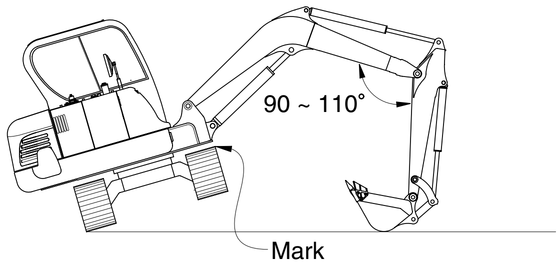
(2) Preparation

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.



555C96MC06

(3) Measurement

① Select the following switch positions.

· Travel mode switch : 1 or 2 speed

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	
		Steel track	Rubber track	Steel track	Rubber track
R60-9S	1 Speed	27.0±1.5	26.0±1.5	33.7	32.5
	2 Speed	14.5±1.5	14.0±1.5	18.2	17.5

5) TRAVEL DEVIATION

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

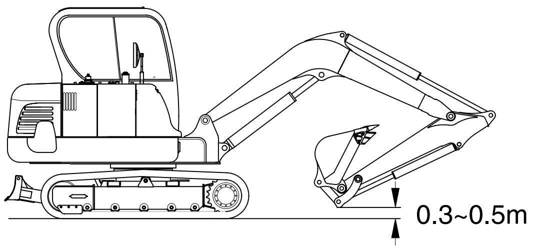
(2) Preparation

① Adjust the tension of both tracks to be equal.

② Provide a flat, solid test yard 20m in length, with extra length of 3 to 5m on both ends for machine acceleration and deceleration.

③ Hold the bucket 0.3 to 0.5m above the ground with the arm and bucket rolled in.

④ Keep the hydraulic oil temperature at 50±5˚C.



555C96MC04

(3) Measurement

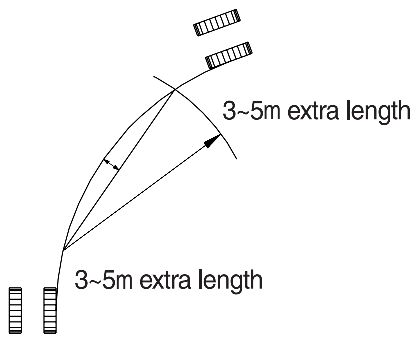
① Measure the amount of mistracking at high and low travel speeds.

② Start traveling the machine in the acceleration zone with the travel levers at full stroke.

③ Measure the distance between a straight 20m line and the track made by the machine. (dimension a)

④ After measuring the tracking in forward travel, turn the upperstructure 180˚ and measure that in reverse travel.

⑤ Repeat steps ③ and ④ three times and calculate the average values.



7-7(2) 140-7

(4) Evaluation

Mistrack should be within the following specifications.

Unit : mm / 20m

Model	Standard	Maximum allowable	Remarks
R60-9S	200 below	240	

6) SWING SPEED

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

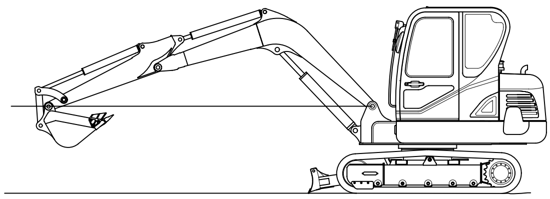
(2) Preparation

① Check the lubrication of the swing gear and swing bearing.

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

③ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. The bucket must be empty.

④ Keep the hydraulic oil temperature at 50±5˚C.



555C96MC07

(3) Measurement

① Operate swing control lever fully.

② Swing 1 turn and measure time taken to swing next 2 revolutions.

③ Repeat steps ① and ② three time and calculate the average values.

(4) Evaluation

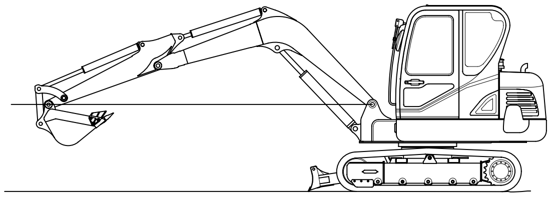
The time required for 2 swings should meet the following specifications.

Unit : Seconds / 2 revolutions

Model	Standard	Maximum allowable	Remarks
R60-9S	13.2±0.4	16.4	

7) SWING FUNCTION DRIFT CHECK

(1) Measure the swing drift on the bearing outer circumference when stopping after a 360˚ full speed swing.



555C96MC07

(2) Preparation

① Check the lubrication of the swing gear and swing bearing.

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

③ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. The bucket must be empty.

④ Make two chalk marks: one on the swing bearing and one directly below it on the track frame.

⑤ Swing the upperstructure 360˚.

⑥ Keep the hydraulic oil temperature at 50±5˚C.

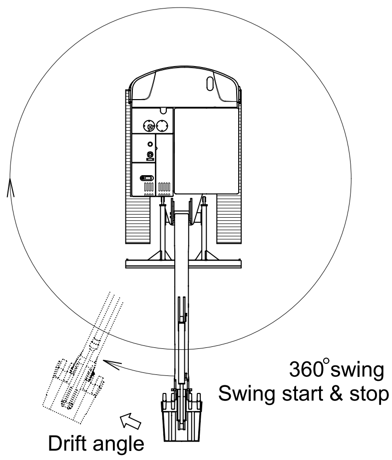
(3) Measurement

① 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˚.

② Measure the distance between the two marks.

③ Align the marks again, swing 360˚, then test the opposite direction.

④ Repeat steps ② and ③ three times each and calculate the average values.



R5576MC08

(4) Evaluation

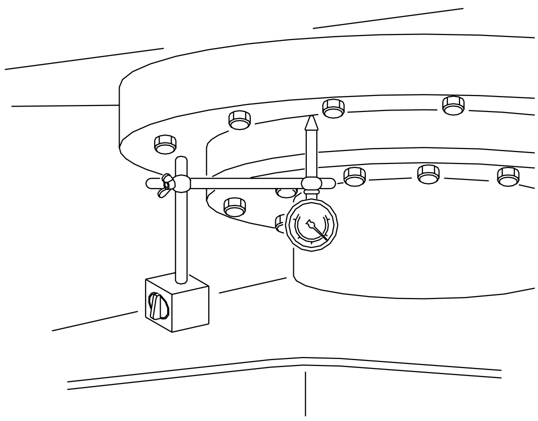
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Standard	Maximum allowable	Remarks
R60-9S	40 below	70	

8) SWING BEARING PLAY

(1) Measure the swing bearing play using a dial gauge to check the wear of bearing races and balls.



7-10(1) 140-7

(2) Preparation

① Check swing bearing mounting cap screws for loosening.

② Check the lubrication of the swing bearing. Confirm that bearing rotation is smooth and without noise.

③ Install a dial gauge on the track frame as shown, using a magnetic base.

④ Position the upperstructure so that the boom aligns with the tracks facing towards the front idlers.

⑤ Position the dial gauge so that its needle point comes into contact with the bottom face of the bearing outer race.

⑥ Bucket should be empty.

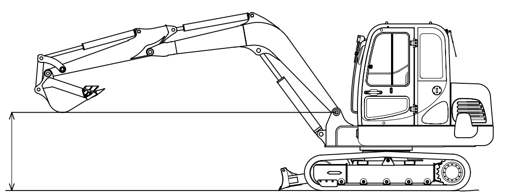
(3) Measurement

① With the arm rolled out and bucket rolled in, hold the bottom face of the bucket to the same height of the boom foot pin.
Record the dial gauge reading (h1).

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

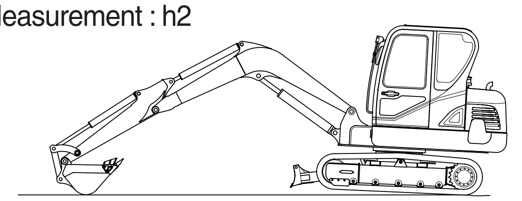
③ Calculate bearing play (H) from this data (h1 and h2) as follows.
H=h2-h1

Measurement : h1



R5576MC09

Measurement : h2



555C96MC10

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Standard	Maximum allowable	Remarks
R60-9S	0.5 ~ 1.2	2.4	

9) HYDRAULIC CYLINDER CYCLE TIME

(1) Measure the cycle time of the boom, standard arm, and standard bucket cylinders.

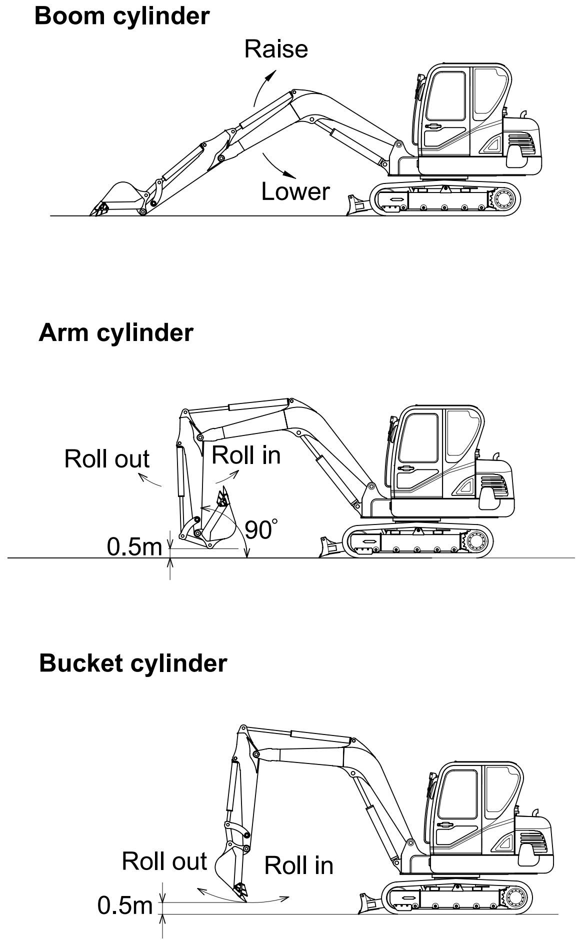
(2) Preparation

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 0.5m 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.



555C96MC11

(3) Measurement

① 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
R60-9S	Boom raise	2.5±0.4	3.0	
	Boom lower	2.4±0.4	2.9	
	Arm in	2.7±0.4	3.2	
	Arm out	2.7±0.4	3.1	
	Bucket load	3.5±0.4	4.2	
	Bucket dump	2.4±0.4	2.8	
	Boom swing (LH)	6.0±0.5	7.2	
	Boom swing (RH)	4.9±0.5	5.9	
	Dozer up (raise)	1.2±0.3	1.4	
	Dozer down (lower)	1.2±0.3	1.4	

10) DIG FUNCTION DRIFT CHECK

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

(2) Preparation

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

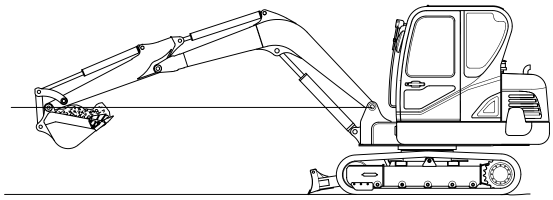
· $W = M^3 \times 1.5$
Where :
M^3 = Bucket heaped capacity (m^3)
1.5 = Soil specific gravity

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

③ Position the bucket cylinder with the rod 20 to 30mm 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.



555C96MC12

(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
R60-9S	Boom cylinder	10 below	20	
	Arm cylinder	20 below	30	
	Bucket cylinder	20 below	30	

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 Operate each boom, arm, bucket and swing lever at full stroke and measure the maximum operating force for each.

③ 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.

④ Repeat steps ② and ③ 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
R60-9S	Boom lever	1.4 or below	1.9	
	Arm lever	1.4 or below	1.9	
	Bucket lever	1.4 or below	1.9	
	Swing lever	1.4 or below	1.9	
	Travel lever	2.0 or below	2.5	

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.

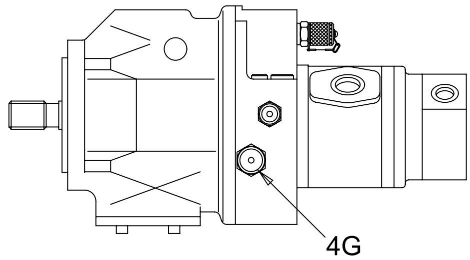
Unit : mm

Model	Kind of lever	Standard	Maximum allowable	Remarks
R60-9S	Boom lever	87±10	109	
	Arm lever	87±10	109	
	Bucket lever	87±10	109	
	Swing lever	87±10	109	
	Travel lever	86±10	105	

13) PILOT PRIMARY PRESSURE

(1) Preparation

① Stop the engine.
② Push the pressure release button to bleed air.
③ Loosen and remove plug on the pilot pump delivery port (4G) and connect pressure gauge.
④ Start the engine and check for oil leakage from the port.
⑤ Keep the hydraulic oil temperature at 50±5˚C.



R55NN7MA14

(2) Measurement

① Measure the primary pilot pressure in the M mode.

(3) Evaluation

The average measured pressure should meet the following specifications:

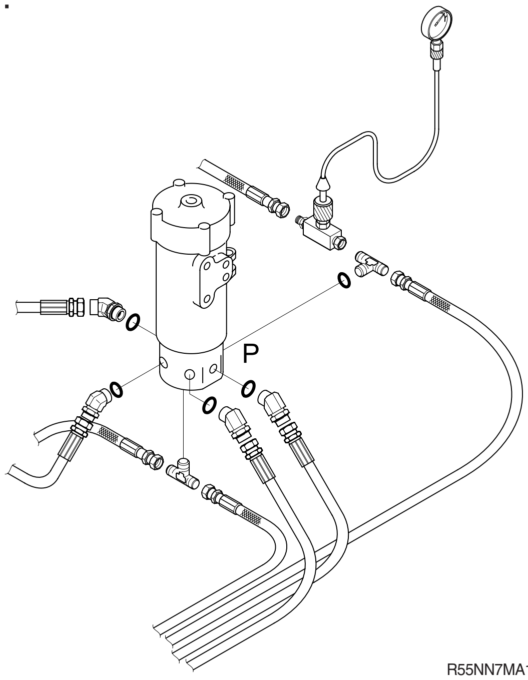
Unit : kgf / cm^2

Model	Standard	Remarks
R60-9S	30±5	

14) FOR TRAVEL SPEED SELECTING PRESSURE :

(1) Preparation

① Stop the engine.
② Push the pressure release button to bleed air.
③ To measure the speed selecting pressure: Install a connector and pressure gauge
④ assembly to turning joint P port as shown. Start the engine and check for on leakage from the adapter.
⑤ Keep the hydraulic oil temperature at $50\pm5^{\circ}C$.



R55NN7MA15

(2) Measurement

① Select the following switch positions.
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
R60-9S	1 Speed	0	-	
	2 Speed	30 ± 5	-	

15) SWING PARKING BRAKE RELEASING PRESSURE

(1) Preparation

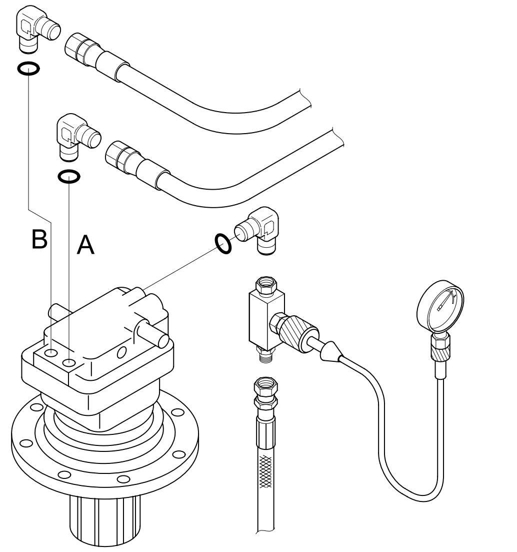
① Stop the engine.

② Push the pressure release button to bleed air.

③ Install a connector and pressure gauge assembly to swing motor SH port, as shown.

④ Start the engine and check for oil leakage from the adapter.

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



R55NN7MA16

(2) Measurement

① 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.

② Repeat three times and calculate the average values.

(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm²

Model	Description	Standard	Remarks
R60-9S	Brake disengaged	30±5	
	Brake applied	0	

16) MAIN PUMP DELIVERY PRESSURE

(1) Preparation

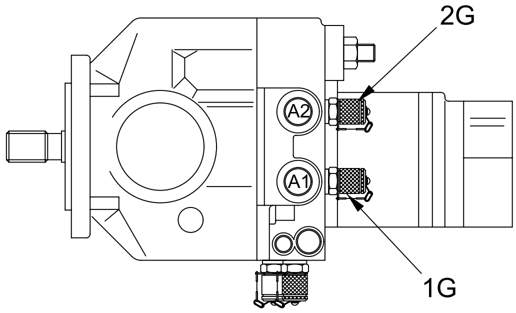
① Stop the engine.

② Push the pressure release button to bleed air.

③ To measure the main pump pressure. Install a connector and pressure gauge assembly main pump gauge port (1G, 2G) as shown.

④ Start the engine and check for oil leakage from the port.

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



R55NN7MA17

(2) Measurement

① Measure the main pump delivery pressure at high idle.

(3) Evaluation

The average measured pressure should meet the following specifications.

Unit : kgf / cm^2

Model	Engine speed	Standard	Allowable limits	Remarks
R60-9S	High idle	20±5	-	

17) SYSTEM PRESSURE REGULATOR RELIEF SETTING

(1) Preparation

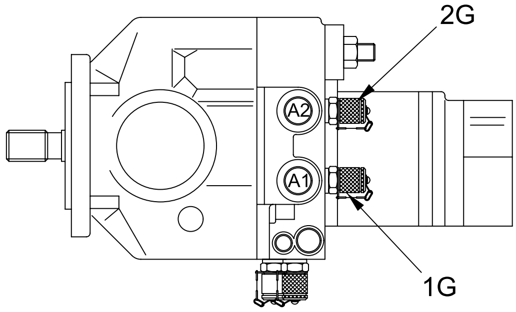
① Stop the engine.

② Push the pressure release button to bleed air.

③ To measure the system relief pressure. Install a connector and pressure gauge assembly main pump gauge port, as shown.

④ Start the engine and check for oil leakage from the port.

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



R55NN7MA17

(2) Measurement

① Slowly operate each control lever of boom, arm and bucket functions at full stroke over relief and measure the pressure.

② In the swing function, place bucket against an immovable object and measure the relief pressure.

③ In the travel function, lock undercarriage with an immovable object and measure the relief pressure.

(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm²

Model	Function to be tested	Standard
R60-9S	Boom, Arm, Bucket	220±10
	Travel	220±10
	Swing	220±10

GROUP 2 MAJOR COMPONENT

1. MAIN PUMP

Before inspection, wash the parts well and dry them completely.

Inspect the principal parts with care and replace them with new parts when any abnormal wear exceeding the allowable limit or damage considered harmful is found.

Replace the seal also when any remarkable deformation and damage are found.

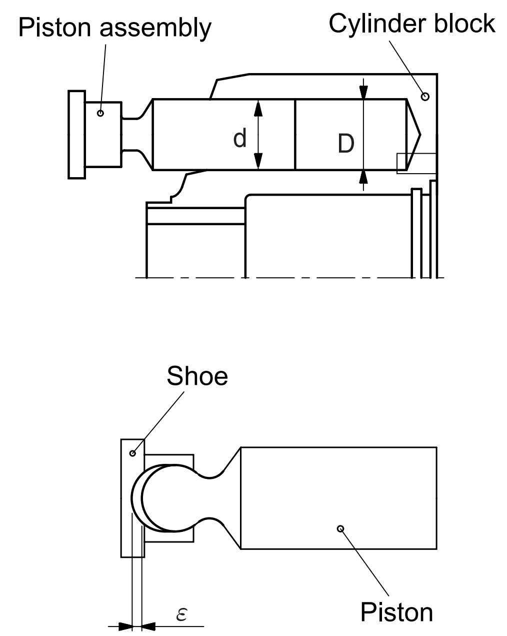
1) PISTON ASSEMBLY AND CYLINDER BLOCK

(1) Check the appearance visually.
No damage, scouring, abnormal wear (particularly, in the slide portion) should be found.

(2) Check the clearance between the piston outside dia and cylinder block inside dia.
D-d $\leq$ 0.050 mm

2) PISTON SHOE AND PISTON

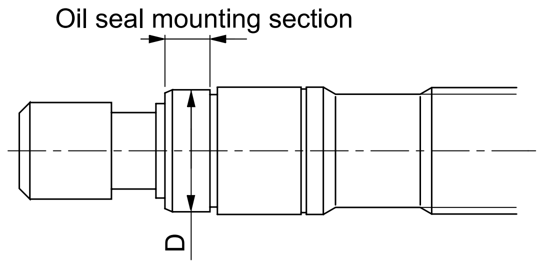
(1) Check the axial play of the piston and piston shoe.
ε $\leq$ 0.2 mm



R55NM7PH46

3) SHAFT

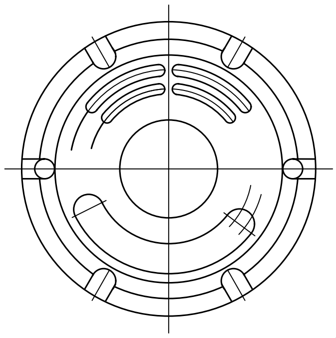
(1) Check the wear amount of the oil seal mounting section.
Wear mount $\leq$ 0.025 mm



R55NM7PH47

4) CONTROL PLATE

(1) Check the slide surface for any damage.
When the damage is large, replace the plate with new one.

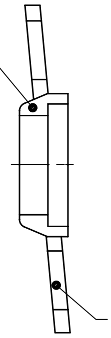


R55NM7PH48

5) GUIDE AND RETAINER

(1) Check for scouring or stepped wear.
If this can not be corrected, replace the guide and retainer with new full-set.

(2) Fine scouring or damage can be corrected with lapping.
Carry out thorough washing after lapping.



R55NM7PH49

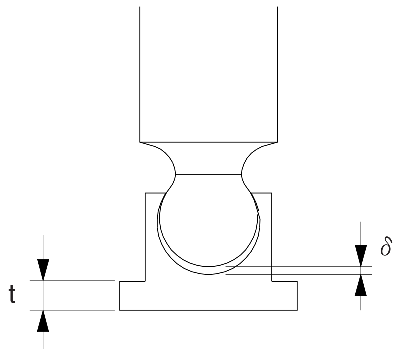
2. MAIN CONTROL VALVE

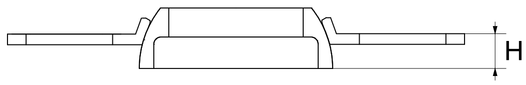
Part name	Inspection item	Criteria & measure
Block	· Existence of scratch, rusting or corrosion.	· In case of damage in following section, replace part. - Sliding sections of casing fore and spool, especially land sections applied with holded pressure. - Seal pocket section where spool is inserted. - Seal section of port where O-ring contacts. - Seal section of each relief valve for main, travel, and port. - Other damages that may damage normal functions.
Spool	· Existence of scratch, gnawing, rusting or corrosion. · O-ring seal sections at both ends. · Insert spool in casing hole, rotate and reciprocate it.	· Replacement when its outside sliding section has scratch (especially on seals-contacting section). · Replacement when its sliding section has scratch. · Correction or replacement when O-ring is damaged or when spool does not move smoothly.
Poppet	· Damage of poppet or spring · Insert poppet into casing and function it.	· Correction or replacement when sealing is incomplete. · Normal when it can function lightly without being caught.
Around spring	· Rusting, corrosion, deformation or breaking of spring, spring seat, plug or cover.	· Replacement for significant damage.
Around seal for spool	· External oil leakage. · Rusting, corrosion or deformation of seal plate.	· Correction or replacement. · Correction or replacement.
Main relief valve & port relief valve	· External rusting or damage. · Contacting face of valve seat. · Contacting face of poppet. · Abnormal spring. · O-rings, back up rings and seals.	· Replacement. · Replacement when damaged. · Replacement when damaged. · Replacement. · 100% replacement in general.

3. SWING DEVICE

1) WEARING PARTS

Inspection item	Standard dimension	Recommended replacement value	Counter measures
Clearance between piston and cylinder block bore	0.020	0.045	Replace piston or cylinder block
Play between piston and shoe caulking section (δ)	0	0.3	Replace assembly of piston and shoe
Thickness of shoe (t)	4	3.8	Replace assembly of piston and shoe
Combined height of set plate and guide (H)	17.4	17	Replace set of set plate and guide
Thickness of friction plate	3.6	3.2	Replace





2) SLIDING PARTS

Part name	Standard roughness	Remark
Shoe	0.8S	
Shoe plate	0.8S	
Cylinder block	6.3S	
Valve plate	0.8S	

5. TRAVEL DEVICE (TYPE 1)

Disassembling and inspection of the motor must be done in strict accordance with the servicing standards described here. During servicing, handle each part very carefully not to damage them, especially for their movable or sliding sections.

1) SEALS

Once the seals (o-rings, oil seals, and floating seals) have been disassembled, they must be replaced with new ones even if no damage is observed.

2) TABLE OF MAINTENANCE STANDARD

(1) Replace all parts having a seriously damaged appearance.

(2) Replace the part if any one of the states (symptoms) listed in the table below is observed.

Item No.	Part name	Situation	Standard dimension	Maximum allowable value (criteria)
2 8 17	**Spindle kit** · Spindle assembly · · Spindle · · Coupling gear · Pin	· Seriously damaged in appearance. · Galling or other forms of excessive wear are observed.	-	-
3 6 9 14 25 34	**Carrier assembly** Carrier Cluster gear Shaft Thrust collar Needle bearing Dowel pin	· The tooth surface of the cluster gear (6) is nonuniformly worn out and damaged. · The cluster gear (6) does not move smoothly.	-	-
4	Ring gear A	· The tooth surface is nonuniformly worn out and damaged.	-	-
5	Ring gear B	· The tooth surface is nonuniformly worn out and damaged.	-	-
7	Sun gear	· The tooth surface is nonuniformly worn out and damaged. · The spline section is worn.	-	-
8	Coupling gear	· Excessive wear or pitching is observed on the tooth surface.	-	-
19	Coupling	· The spline section is worn.	-	-
20	Thrust bearing	· Worn out.	Axial clearance between coupling gear (8) and cover (13) : 0.3 mm $\pm$ 0.1 mm	-

Item No.	Part name	Situation	Standard dimension	Maximum allowable value (criteria)
22	Distance piece	· The sliding surface is damaged. · The sliding surface is excessively worn out.	-	-
24	Ball bearing	· Dents are present. · Flaking develops. · Nonuniform wear is present.	-	-
101 123	**Rear flange kit** Rear flange Spool	· The movable section contacting the spool (123) is damaged. · The clearance against the spool (123) is too large. · The surface contacting the valve (127) is damaged. · The depth to the surface contacting the valve (127) is too large. · The outer surface is damaged. · The outer surface is nonuniformly worn out.	Linear clearance : 10 to 20 μ	Linear clearance : 25 μ
102	Shaft	· The surface contacting the oil seal (132) is worn out. · The spline section is worn out.	-	-
103	Swash plate	· Seizure is observed.	-	-
104	Cylinder block	· The spline section is worn out. · The bore inner surface is worn out too much. · The sliding surface that contacts the timing plate (109) is damaged or nonuniformly worn out.	-	-
 105 106	Piston assembly Piston shoe	· An axial clearance is present between the piston (105) and the shoe (106). · The shoe is excessively worn out. · The shoe is nonuniformly worn out.	Clearance : 0.05mm	Clearance : 0.15mm
107	Retainer plate	· The peripheral edge is nonuniformly worn out.	-	-

Item No.	Part name	Situation	Standard dimension	Maximum allowable value (criteria)
108 109	Thrust ball Timing plate	· The spherical sliding section that contacts the retainer plate (107) is nonuniformly worn out. · The sliding surface has the traces of seizure or nonuniformly wear.	-	-
115 116	Friction plate Mating plate	· Both edges are nonuniformly worn out. · The required torque cannot be achieved. · The traces of seizure are present.	Braking torque 40.6 kgf · m or more	Braking torque 40.6 kgf · m or less
118	Valve seat	· The seat surface is damaged.	-	-
119	Valve	· The outer surface is damaged. · The seat surface is damaged.	-	-
136 137	**Body kit** Body Spool	· The sliding section that contacts the spool (137) is damaged. · The clearance against the spool (137) is too large. · The outer surface is damaged. · The outer surface is nonuniformly worn out.	Linear clearance : 7 to 15 μ	Linear clearance : 20 μ
149 150	Roller bearing Ball bearing	· Dents are present. · Flaking develops. · Nonuniform wear is observed.	-	-
163	Valve	· The outer surface is damaged. · The seat surface is damaged.	-	-
164	Stopper	· The seat surface is damaged.		
142	Valve	· The outer surface is damaged. · The seat surface is damaged.		
172	Valve seat	· The seat surface is damaged.	-	-

TRAVEL DEVICE (TYPE 2, MACHINE SERIAL NO. : #5982-)

Disassembling and inspection of the motor must be done in strict accordance with the servicing standards described here. During servicing, handle each part very carefully not to damage them, especially for their movable or sliding sections.

1) PARTS INSPECTION TIPS AND REPLACEMENT STANDARDS

(1) **Sun gear, drive gear, planetary gear, housing.**
Pitting and breaking appear on the tooth surface.
※ **When the size of the groove or cavity in one pitting is Ø 1mm or more or the area ratio is 5% or more for the entire area.**

(2) **Oil seal**
Replace when the surface of the lip is damaged or worn.
When disassembling the oil seal from the motor for inspection.

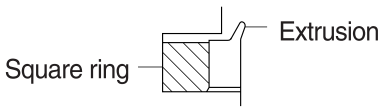
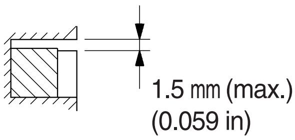
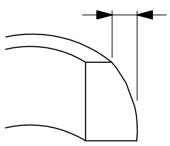
(3) **Planetary gear F of needle bearing part**
As the planetary gear F is assembled, check the boss and circumference direction clearance of the motor casing.
If it is 0.5 mm or more, replace it.

(4) **Do not disassemble in housing and check with the following tips.**
① Check the raceway surface, rollers or balls in the visible range, and make sure there are no pittings or cracks.
② Check for local corrosion and wear on the ball.
③ Please check again with the following tips.
a) Check the gear oil for excessive wear powder.
b) Make sure that there is excessive wear powder between the ball and cage.
c) When turning lightly by hand, check that it rotates smoothly.
After performing the above inspection, replace any problem.
Do not use angular bearing separated from housing again.

(5) **Side plate**
If the drive gear and sliding surfaces are markedly damaged, they must be replaced.

(6) Fitting on rotating surfaces of needle bearing and inner racefor planetary gear R, should be replaced when broken.

5. TURNING JOINT

<table>
<tr><th colspan="2">Part name</th><th>Maintenance standards</th><th>Remedy</th></tr>
<tr><td rowspan="6">Body, Stem</td><td>Sliding surface with sealing sections.</td><td>Plating worn or peeled due to seizure or contamination.</td><td>Replace</td></tr>
<tr><td rowspan="2">Sliding surface between body and stem other than sealing section.</td><td>· Worn abnormality or damaged more than 0.1 mm (0.0039 in) in depth due to seizure contamination.</td><td>Replace</td></tr>
<tr><td>· Damaged more than 0.1 mm (0.0039 in) in depth.</td><td>Smooth with oilstone.</td></tr>
<tr><td rowspan="3">Sliding surface with thrust plate.</td><td>· Worn more than 0.5 mm (0.02 in) or abnormality.</td><td>Replace</td></tr>
<tr><td>· Worn less than 0.5 mm (0.02 in).</td><td>Smooth</td></tr>
<tr><td>· Damage due to seizure or contamination remediable within wear limit (0.5 mm) (0.02 in).</td><td>Smooth</td></tr>
<tr><td rowspan="3">Cover</td><td rowspan="3">Sliding surface with thrust plate.</td><td>· Worn more than 0.5 mm (0.02 in) or abnormality.</td><td>Replace</td></tr>
<tr><td>· Worn less than 0.5 mm (0.02 in).</td><td>Smooth</td></tr>
<tr><td>· Damage due to seizure or contamination remediable within wear limit (0.5 mm) (0.02 in).</td><td>Replace</td></tr>
<tr><td rowspan="3">Seal set</td><td>-</td><td>· Extruded excessively from seal groove square ring.

</td><td>Replace</td></tr>
<tr><td>-</td><td>· Slipper ring 1.5 mm (0.059 in) narrower than seal groove, or narrower than back ring.

</td><td>Replace</td></tr>
<tr><td>-</td><td>· Worn more than 0.5 mm (0.02 in) ~ 1.5 mm (MAX.) (0.059 in)
</td><td>Replace</td></tr>
</table>

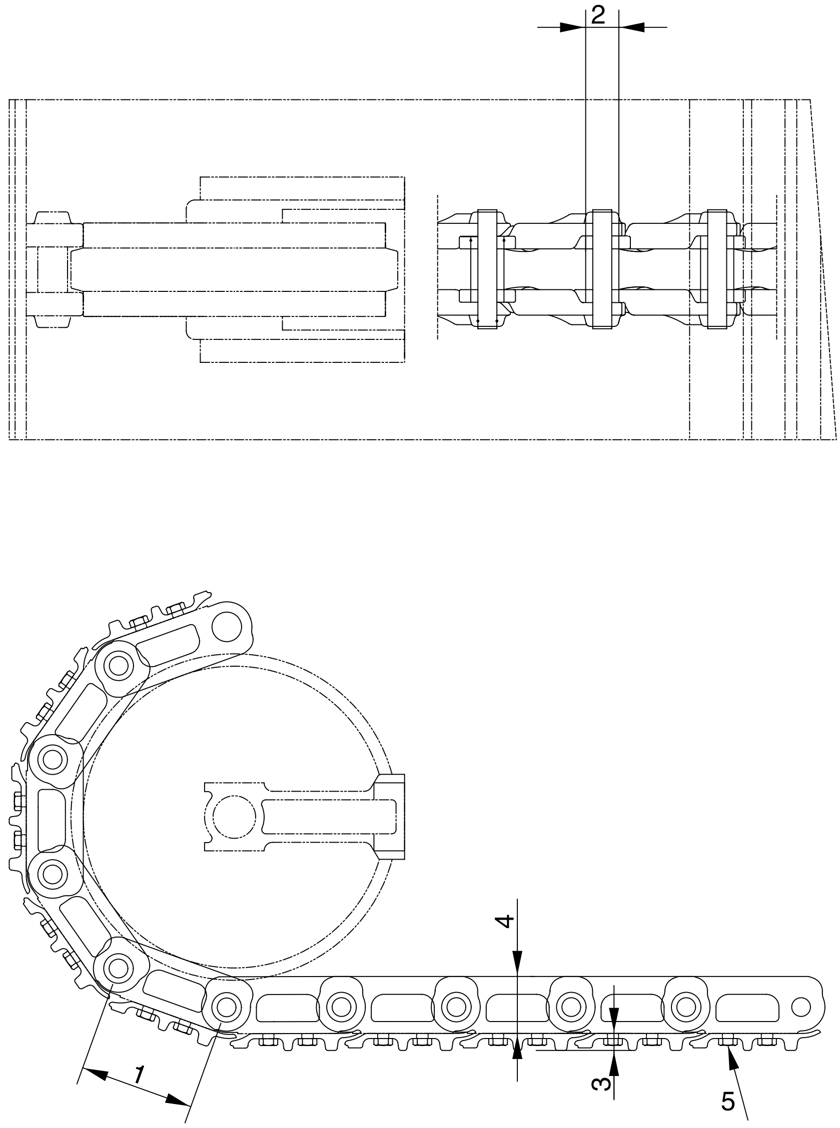
6. CYLINDER

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. · Rust is not present on plating. · Scratches are not present.	· Replace or replate · Replace or replate · 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 SHOE

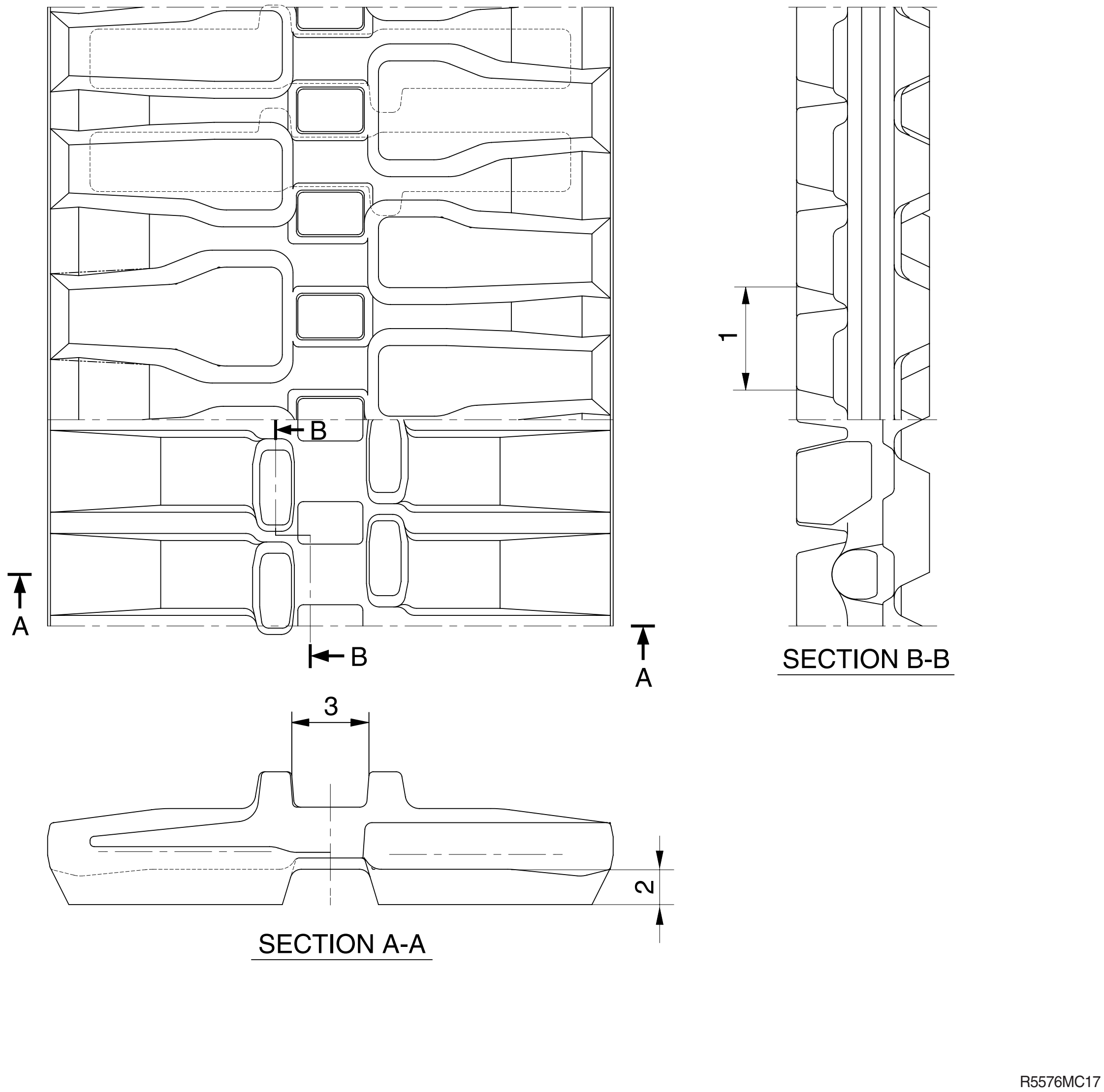
1) STEEL SHOE SPEC



Unit : mm

No	Check item	Criteria		Remedy
		Standard size	Repair limit	
1	Link pitch	135	138.6	Replace bushing and pin and link assembly
2	Outside diameter of bushing	35	31.4	
3	Height of grouser	14	11	Lug welding, rebuild or replace
4	Height of link	67	61.5	
5	Tightening torque	Initial tightening torque : 19±1.0kgf · m		Retighten

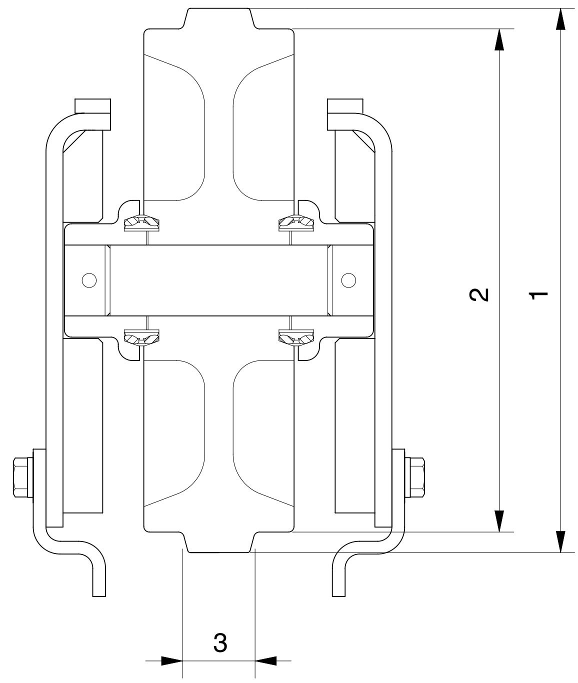
2) RUBBER SHOE SPEC



Unit : mm

No	Check item	Criteria			Remedy
		Standard size	Tolerance	Repair limit	
1	Link pitch	73	±1.0	76	Replace
2	Height of grouser	25	-	5	
5	Width of link	54	-	70	

2. IDLER

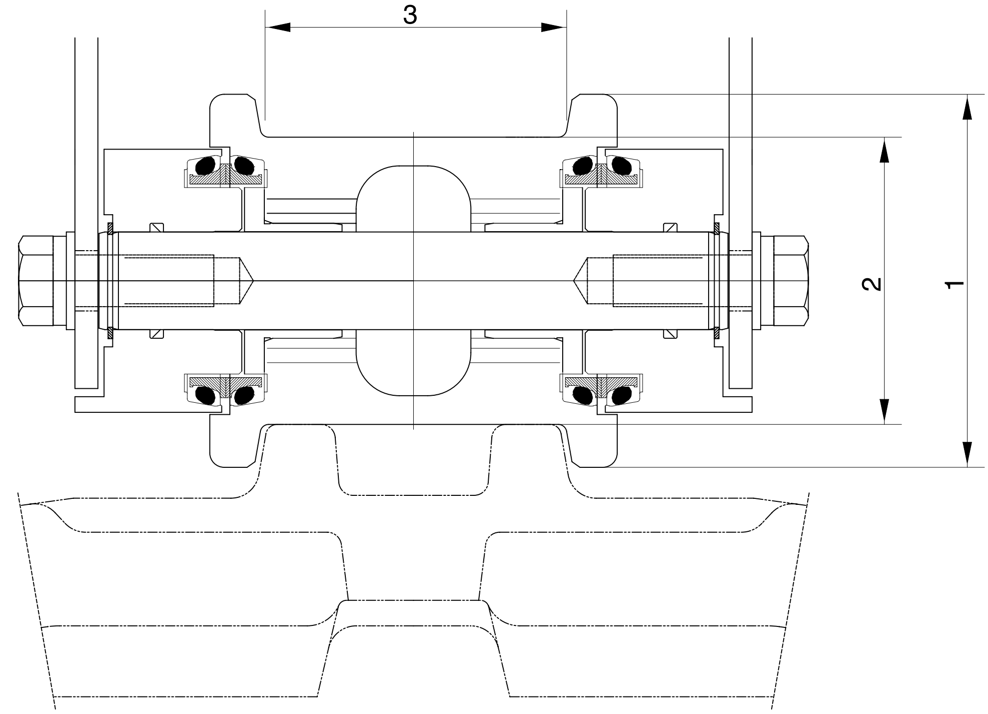


R5576MC18

Unit : mm

No	Check item		Criteria		Remedy
			Standard size	Repair limit	
1	Outside diameter of flange	Steel	384	-	Rebuild or replace
		Rubber	398	-	
2	Outside diameter of thread		355	345	
5	Width of flange		51	-	

3. TRACK/CARRIER ROLLER



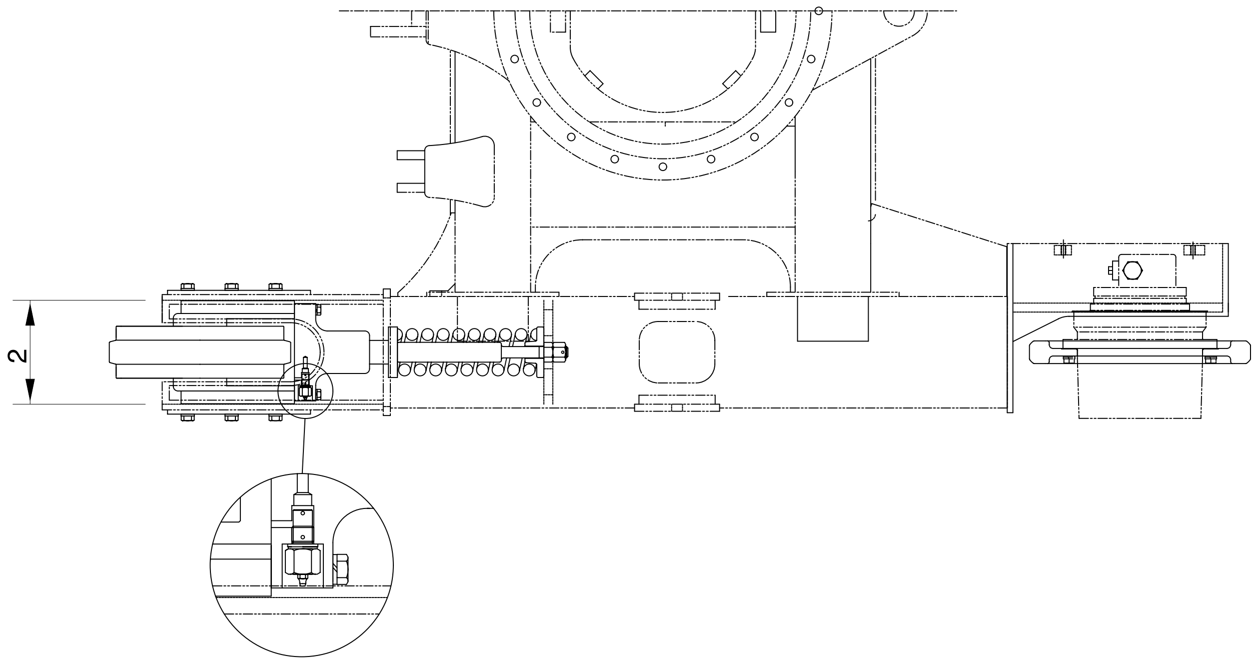
R5576MC15

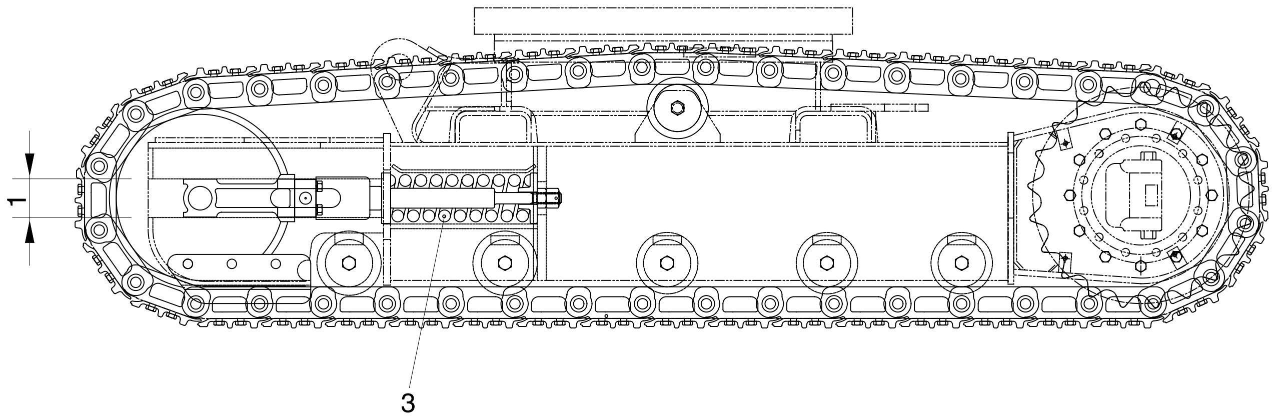
Unit : mm

No	Check item		Criteria		Remedy
			Standard size	Repair limit	
1	Outside diameter of flange	Steel	130	-	Rebuild or replace
		Rubber	135	-	
2	Outside diameter of thread		105	95	
5	Width of flange		108	114	

4. TENSION CYLINDER

1) STEEL SHOE SPEC

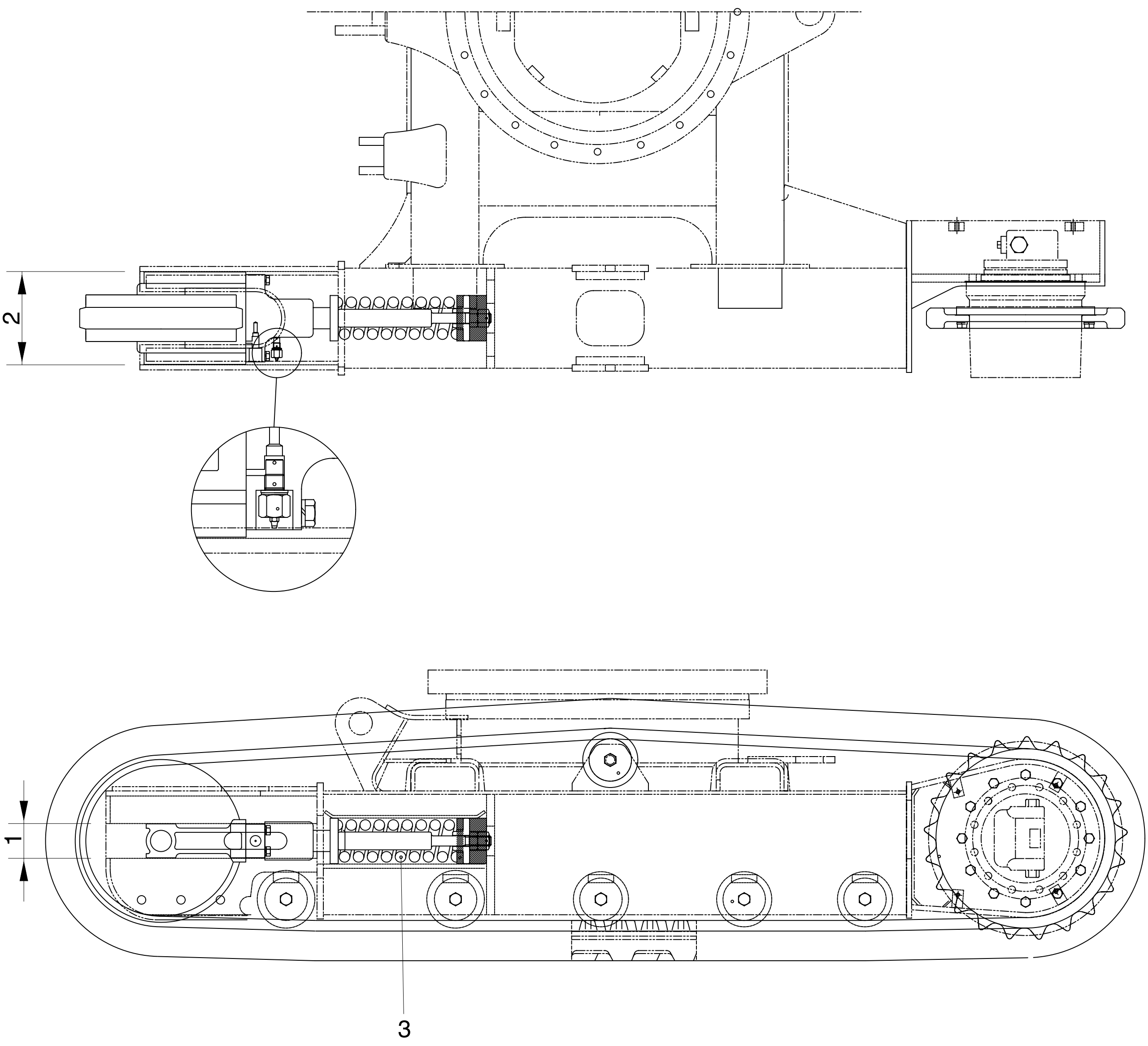




Unit : mm

<table>
<tr><th rowspan="2">No</th><th rowspan="2">Check item</th><th colspan="3">Criteria</th><th rowspan="2">Remedy</th></tr>
<tr><th></th><th>Standard size</th><th>Repair limit</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Outside diameter of flange</td><td>Track frame</td><td>82</td><td>86</td><td>Rebuild</td></tr>
<tr><td>Idler support</td><td>80</td><td>78</td><td>Rebuild or replace</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Outside diameter of thread</td><td>Track frame</td><td>220</td><td>222</td><td>Rebuild</td></tr>
<tr><td>Idler guide</td><td>218</td><td>214</td><td>Rebuild or replace</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Recoil spring</td><td colspan="3">Standard size</td><td colspan="2">Repair limit</td><td rowspan="3">Replace</td></tr>
<tr><td>Free length</td><td>Installed length</td><td>Installed load</td><td>Free length</td><td>Installed load</td></tr>
<tr><td>ø100×330</td><td>292</td><td>3,900 kg</td><td>-</td><td>3,120 kg</td></tr>
</table>

2) RUBBER SHOE SPEC

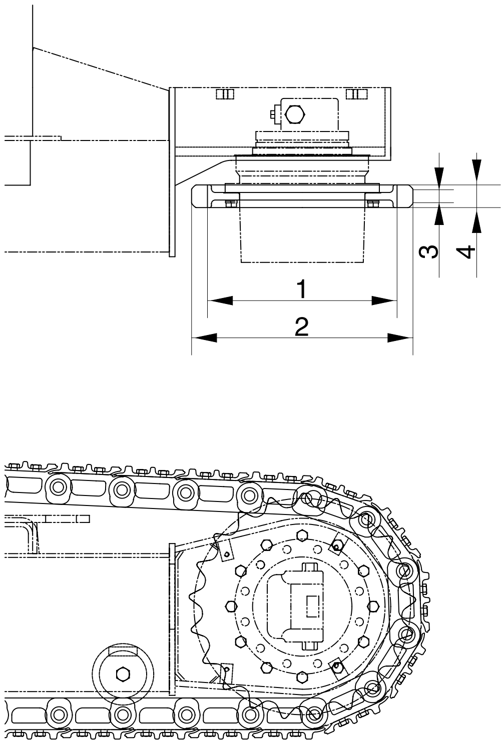


R5576MC20

Unit : mm

<table>
<tr><th rowspan="2">No</th><th rowspan="2">Check item</th><th colspan="5">Criteria</th><th rowspan="2">Remedy</th></tr>
<tr><th colspan="2"></th><th>Standard size</th><th colspan="2">Repair limit</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Vertical width of idler guide</td><td colspan="2">Track frame</td><td>82</td><td colspan="2">86</td><td rowspan="2">Rebuild</td></tr>
<tr><td colspan="2">Idler support</td><td>80</td><td colspan="2">76</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Horizontal width of idler guide</td><td colspan="2">Track frame</td><td>220</td><td colspan="2">222</td><td>Rebuild or replace</td></tr>
<tr><td colspan="2">Idler guide</td><td>218</td><td colspan="2">214</td><td>Rebuild</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Recoil spring</td><td colspan="3">Standard size</td><td colspan="2">Repair limit</td><td rowspan="2">Rebuild or replace</td></tr>
<tr><td>Free length</td><td>Installed length</td><td>Installed load</td><td>Free length</td><td>Installed load</td></tr>
<tr><td>330</td><td>280</td><td>5,140 kg</td><td>-</td><td>4,110 kg</td><td>Replace</td></tr>
</table>

5. SPROCKET

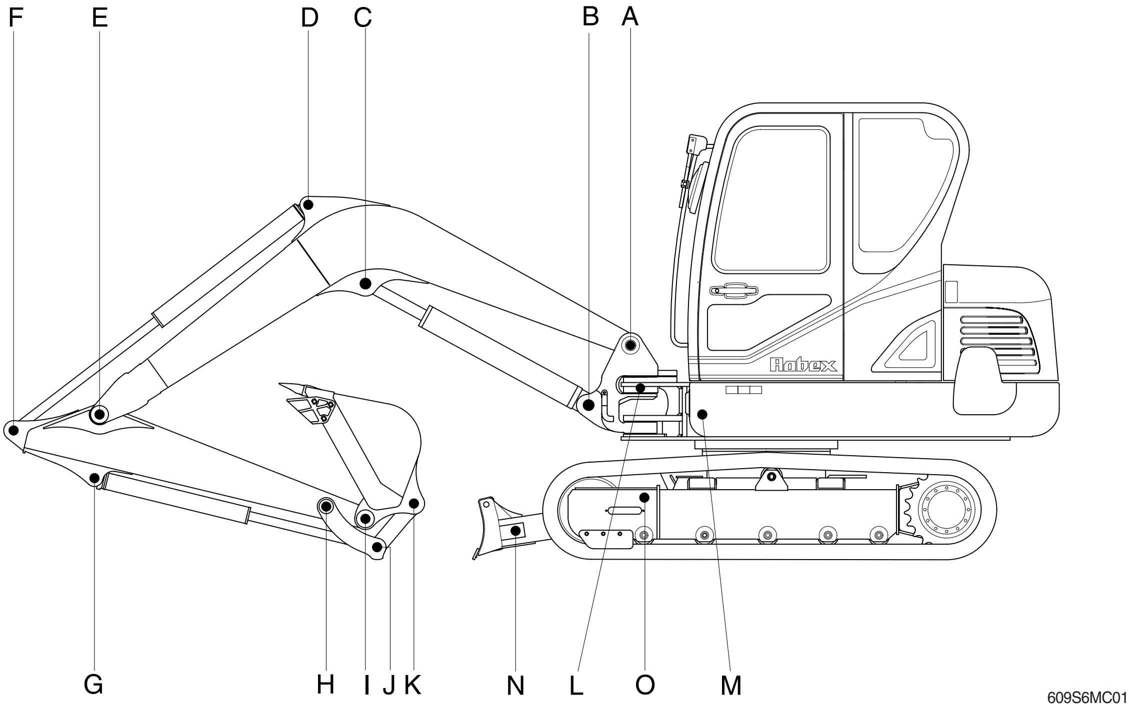


R5576MC21

Unit : mm

No	Check item	Criteria		Remedy
		Standard size	Repair limit	
1	Wear out of sprocket tooth lower side diameter	418.6	412	Repair or Replace
2	Wear out of sprocket tooth upper side diameter	476	-	
3	Wear out of sprocket tooth upper side width	33.5	-	
4	Wear out of sprocket tooth lower side width	42.5	36.5	

6. WORK EQUIPMENT



Unit : mm

Mark	Measuring point (pin and bushing)	Normal value	Pin		Bushing		Remedy & Remark
			Recomm. service limit	Limit of use	Recomm. service limit	Limit of use	
A	Boom Rear	55	54	53.5	55.5	56	Replace
B	Boom Cylinder Head	60	59	58.5	60.5	61	〃
C	Boom Cylinder Rod	60	59	58.5	60.5	61	〃
D	Arm Cylinder Head	50	49	48.5	50.5	51	〃
E	Boom Front	50	49	48.5	50.5	51	〃
F	Arm Cylinder Rod	50	49	48.5	50.5	51	〃
G	Bucket Cylinder Head	45	44	43.5	45.5	46	〃
H	Arm Link	45	44	43.5	45.5	46	〃
I	Bucket and Arm Link	45	44	43.5	45.5	46	〃
J	Bucket Cylinder Rod	45	44	43.5	45.5	46	〃
K	Bucket Link	45	44	43.5	45.5	46	〃
L	Boom swing post	110	109	108.5	110.5	111	〃
M	Boom swing cylinder	50	49	48.5	50.5	51	〃
N	Blade cylinder	55	54	53.5	55.5	56	〃
O	Blade and frame link	35	34	33.5	35.5	36	〃

SECTION 7 DISASSEMBLY AND ASSEMBLY

SECTION 7 DISASSEMBLY AND ASSEMBLY

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

1) Lower the work equipment completely to the ground.
   If the coolant contains antifreeze, dispose of it correctly.

2) After disconnecting hoses or tubes, cover them or fit blind plugs to prevent dirt or dust from entering.

3) When draining oil, prepare a container of adequate size to catch the oil.

4) Confirm the match marks showing the installation position, and make match marks in the necessary places before removal to prevent any mistake when assembling.

5) To prevent any excessive force from being applied to the wiring, always hold the connectors when disconnecting the connectors.

6) Fit wires and hoses with tags to show their installation position to prevent any mistake when installing.

7) Check the number and thickness of the shims, and keep in a safe place.

8) When raising components, be sure to use lifting equipment of ample strength.

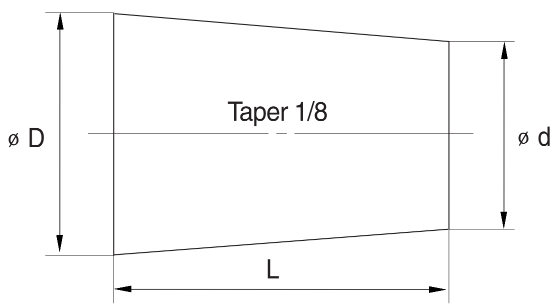
9) When using forcing screws to remove any components, tighten the forcing screws alternately.

10) Before removing any unit, clean the surrounding area and fit a cover to prevent any dust or dirt from entering after removal.

11) When removing hydraulic equipment, first release the remaining pressure inside the hydraulic tank and the hydraulic piping.

12) If the part is not under hydraulic pressure, the following corks can be used.

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



2. INSTALL WORK

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

2) Install the hoses without twisting or interference.

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

4) Bend the cotter pin or lock plate securely.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

※ If the hydraulic cylinder has been replaced, carry out this procedure before assembling the rod to the work equipment.

※ Carry out the same operation on machines that have been in storage for a long time after completion of repairs.

3. COMPLETING WORK

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

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

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

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

GROUP 2 TIGHTENING TORQUE

1. MAJOR COMPONENTS

No.	Descriptions		Bolt size	Torque	
				kgf · m	lbf · ft
1	Engine	Engine mounting bolt(Engine-Bracket)	M10 × 1.5	7.0±1.0	50.6±7.2
2		Engine mounting bolt(Bracket-Frame)	M16 × 2.0	25±2.5	181±18.1
3		Radiator mounting bolt, nut	M10 × 1.5	6.9±1.4	50±10.0
4		Coupling mounting bolt	M10 × 1.5	6.0±1.0	43.4±7.2
5	Hydraulic system	Main pump mounting bolt	M12 × 1.75	12.3±3.0	92±22.0
6		Main control valve mounting bolt	M 8 × 1.25	2.5±0.5	18±3.6
7		Fuel tank mounting bolt	M16 × 2.0	29.7±4.5	215±33
8		Hydraulic oil tank mounting bolt	M16 × 2.0	29.7±4.5	215±33
9		Turning joint mounting bolt, nut	M12 × 1.75	12.8±3.0	92±22.0
10	Power train system	Swing motor mounting bolt	M16 × 2.0	29.7±4.5	215±33.0
11		Swing bearing upper mounting bolt	M16 × 2.0	29.7±4.5	215±33.0
12		Swing bearing lower mounting bolt	M16 × 2.0	29.7±4.5	215±33.0
13		Travel motor mounting bolt	M14 × 2.0	20±2.0	145±14.0
14		Sprocket mounting bolt	M14 × 2.0	19.6±2.9	142±21.0
15	Under carriage	Carrier roller mounting bolt, nut	M16 × 2.0	29.6±3.2	214±23.1
16		Track roller mounting bolt	M18 × 2.0	41±5.0	297±36.0
17		Track tension cylinder mounting bolt	M12 × 1.75	12.8±3.0	92±22.0
18		Track shoe mounting bolt, nut	1/2-20UNF	19.5±2.0	141±14.5
19		Track guard mounting bolt	M16 × 2.0	29.6±3.2	214±23.0
20	Others	Counter weight mounting bolt	M20 × 2.5	57.8±6.4	418±46.3
21		Cab mounting bolt, nut	M12 × 1.75	12.8±3.0	92±22.0
22		Operator's seat mounting bolt	M 8 × 1.25	1.17±0.1	8.5±0.7

2. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

Bolt size	8T		10T	
	kg·m	lb·ft	kg·m	lb·ft
M 6 × 1.0	0.85 ~ 1.25	6.15 ~ 9.04	1.14 ~ 1.74	8.2 ~ 12.6
M 8 × 1.25	2.0 ~ 3.0	14.5 ~ 21.7	2.7 ~ 4.1	19.5 ~ 29.7
M10 × 1.5	4.0 ~ 6.0	28.9 ~ 43.4	5.5 ~ 8.3	39.8 ~ 60
M12 × 1.75	7.4 ~ 11.2	53.5 ~ 81.0	9.8 ~ 15.8	70.9 ~ 114
M14 × 2.0	12.2 ~ 16.6	88.2 ~ 120	16.7 ~ 22.5	121 ~ 163
M16 × 2.0	18.6 ~ 25.2	135 ~ 182	25.2 ~ 34.2	182 ~ 247
M18 × 2.5	25.8 ~ 35.0	187 ~ 253	35.1 ~ 47.5	254 ~ 344
M20 × 2.5	36.2 ~ 49.0	262 ~ 354	49.2 ~ 66.6	356 ~ 482
M22 × 2.5	48.3 ~ 63.3	349 ~ 458	65.8 ~ 98.0	476 ~ 709
M24 × 3.0	62.5 ~ 84.5	452 ~ 611	85.0 ~ 115	615 ~ 832
M30 × 3.0	124 ~ 168	898 ~ 1214	169 ~ 229	1223 ~ 1656
M36 × 4.0	174 ~ 236	1261 ~ 1704	250 ~ 310	1808 ~ 2242

(2) Fine thread

Bolt size	8T		10T	
	kg·m	lb·ft	kg·m	lb·ft
M 8 × 1.0	2.2 ~ 3.4	15.9 ~ 24.6	3.0 ~ 4.4	21.7 ~ 31.8
M10 × 1.2	4.5 ~ 6.7	32.5 ~ 48.5	5.9 ~ 8.9	42.7 ~ 64.4
M12 × 1.25	7.8 ~ 11.6	56.4 ~ 83.9	10.6 ~ 16.0	76.7 ~ 116
M14 × 1.5	13.3 ~ 18.1	96.2 ~ 131	17.9 ~ 24.1	130 ~ 174
M16 × 1.5	19.9 ~ 26.9	144 ~ 195	26.6 ~ 36.0	192 ~ 260
M18 × 1.5	28.6 ~ 43.6	207 ~ 315	38.4 ~ 52.0	278 ~ 376
M20 × 1.5	40.0 ~ 54.0	289 ~ 391	53.4 ~ 72.2	386 ~ 522
M22 × 1.5	52.7 ~ 71.3	381 ~ 516	70.7 ~ 95.7	511 ~ 692
M24 × 2.0	67.9 ~ 91.9	491 ~ 665	90.9 ~ 123	658 ~ 890
M30 × 2.0	137 ~ 185	990 ~ 1339	182 ~ 248	1314 ~ 1796
M36 × 3.0	192 ~ 260	1390 ~ 1880	262 ~ 354	1894 ~ 2562

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
1"	41	21	152
1-1/4"	50	35	253

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
1-7/16-12	41	21	152
1-11/16-12	50	35	253

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
1"	41	21	152
1-1/4"	50	35	253

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.**

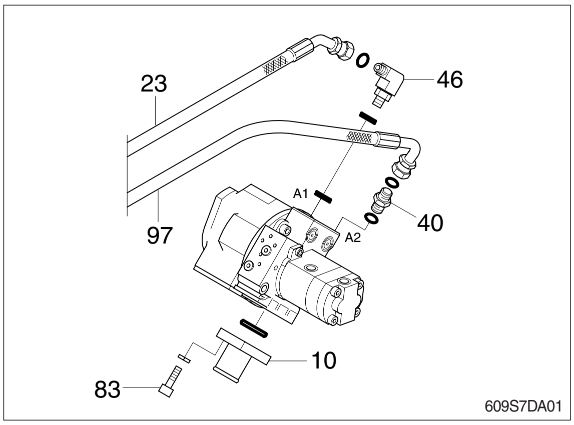
(4) Loosen the drain plug under the hydraulic tank and drain the oil from the hydraulic tank.

· Hydraulic tank quantity : 70 ℓ (18.5 U.S.gal)

(5) Disconnect hydraulic hoses (21, 22, 23, 97).

(6) Remove socket bolts (83) and disconnect pump suction pipe (10).

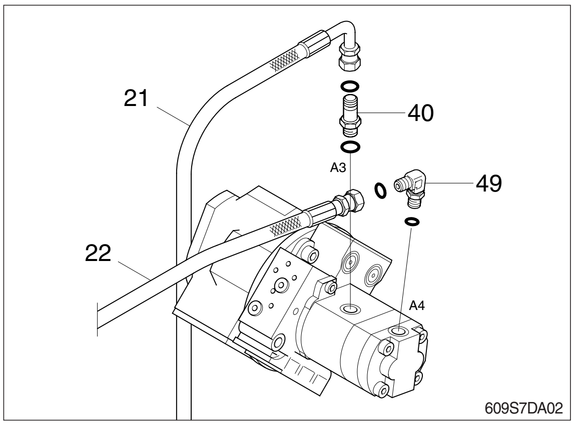
※ When pump suction pipe is disconnected, the oil inside the piping will flow out, so catch it in oil pan.



(7) Sling the pump assembly and remove the pump mounting bolts.

· Weight : 30 kg (70 lb)

※ 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.

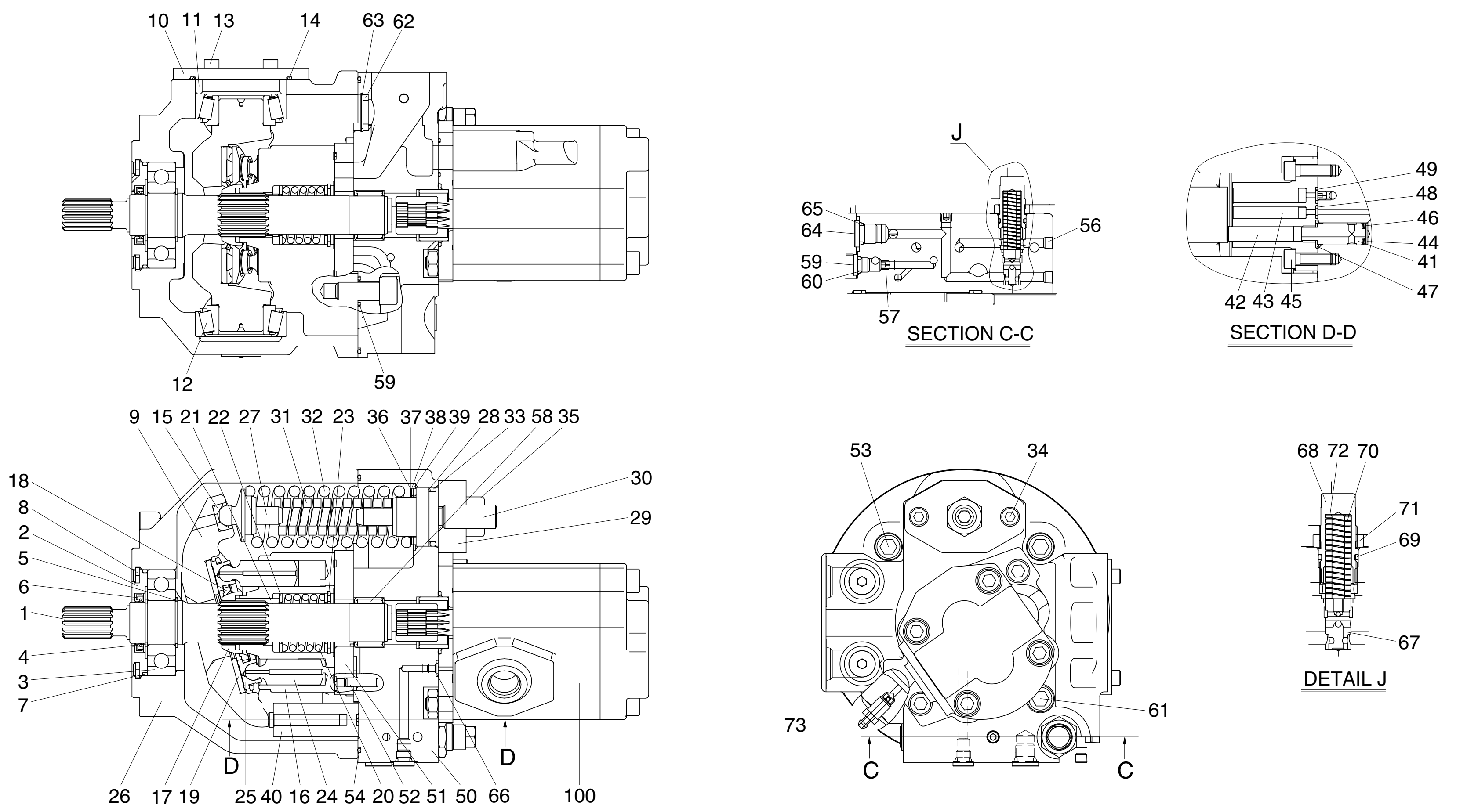
(6) Bleed the air from the hydraulic pump.
 ① Loosen the air vent plug.
 ② Start the engine, run at low idling, and check oil come out from plug.
 ③ Tighten plug.

(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) STRUCTURE



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1	Drive shaft	14	O-ring	27	Spring seat(1)	39	Shim	51	Valve plate	63	Snap ring
2	Seal cover	15	Pivot	28	Spring seat(2)	40	Control cylinder	52	Parallel pin	64	RO plug
3	Ball bearing	16	Cylinder block	29	Spring cover	41	Control piston	53	Socket bolt	65	O-ring
4	Snap ring	17	Bushing	30	Adjusting screw	42	Control push-rod(1)	54	O-ring	66	O-ring
5	Snap ring	18	Push plate	31	Spring	43	Control push-rod(2)	55	O-ring	67	Spool
6	Oil seal	19	Shoe plate	32	Spring	44	Spring seat(1)	56	Plug	68	Adjusting screw
7	O-ring	20	Spring	33	O-ring	45	Socket bolt	57	Orifice	69	O-ring
8	Snap ring	21	Parallel pin	34	Socket bolt	46	Conical spring washer	58	Needle bearing	70	Spring
9	Swash plate	22	Spring seat	35	Hex nut	47	O-ring	59	RP plug	71	Hex nut
10	Plate	23	Snap ring	36	Shim	48	O-ring	60	O-ring	72	Shim
11	Bearing spacer	24	Piston	37	Shim	49	O-ring	61	Socket bolt	73	Air breather
12	Roller bearing	25	Shoe	38	Shim	50	Valve block	62	Filter	100	Gear pump assy
13	Socket bolt	26	Pump casing								

2) TOOLS AND TIGHTENING TORQUE

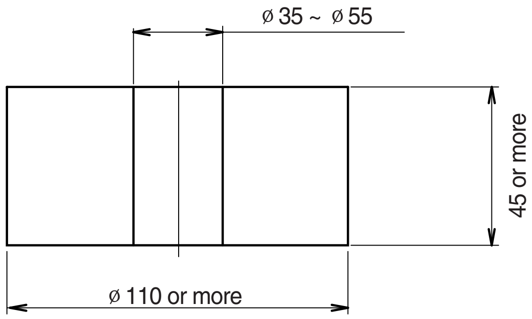
(1) Tools

The tools necessary to disassemble/reassemble the pump are shown in the follow list.

Name	Quantity	Size (nominal)
Hexagonal bar spanner	One each	5, 6, 8, 10
Spanner	1	17, 24
Plastic hammer	1	Medium size
Snap ring pilers	1	For hole (stop ring for 72)
Snap ring pilers	1	For shaft (stop rings for 28 and 30)
Standard screw-driver	2	Medium size
Torque wrench	-	Wrench which can tighten at the specified torque
Grease	Small	-
Adhesives	Small	LOCTITE #270

(2) Jigs

① Disassembling table



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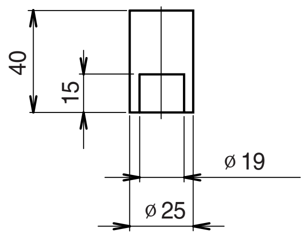
This is plate to stand the pump facing downward.
A square block may be used instead if the shaft end does not contact.

② Bearing assembling jig



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(3) Tightening torque

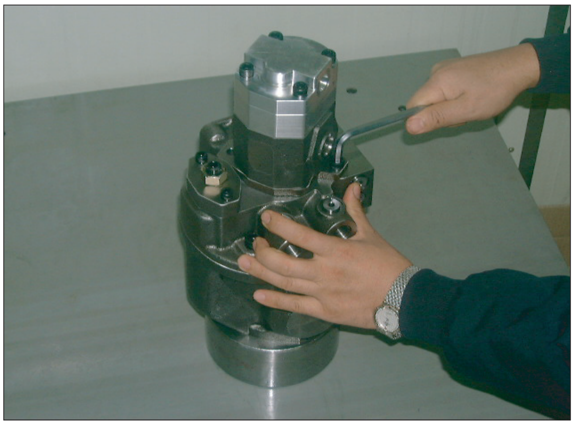
Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M12	10.0	72.3	0.39	10
	M16	24.0	174	0.55	14
	M18	34.0	246	0.55	14
PT Plug	PT 1/16	0.9	6.5	0.16	4
PF Plug	PF 1/8	1.5	10.8	0.20	5
	PF 1/4	3.0	21.7	0.24	6

3. DISASSEMBLY PROCEDURE

1) DISASSEMBLING THE GEARED PUMP

① Remove the hexagonal socket headed bolts (M10 × 25, 2 pieces).
Hexagonal bar spanner
(Hex. side distance : 8)

※ Be careful because the O-ring and filter are provided to the match surface of the geared pump.



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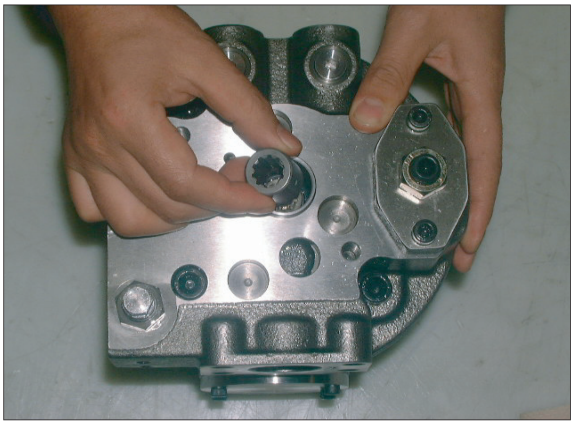
② Remove the coupling.



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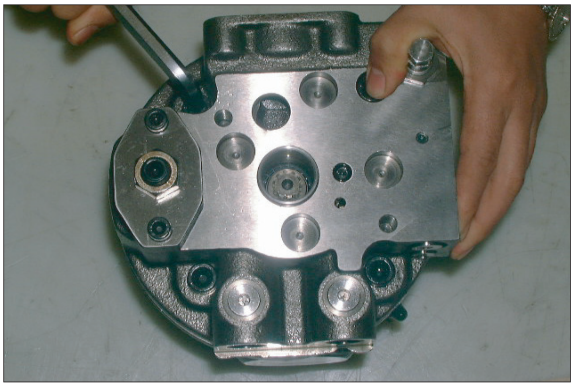
2) DISASSEMBLING THE MAIN PUMP

① Remove the cover.
Remove the hexagonal socket headed bolts. (M12 × 30, 3pieces) and (M12× 55, 1piece).
Hexagonal bar spanner
(Hex. side distance : 10)



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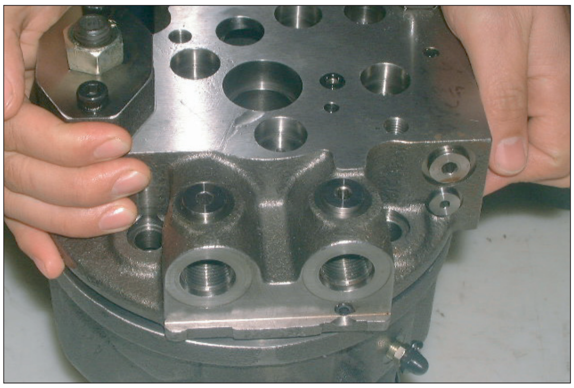
② Remove the cover in a horizontal condition.
Connect motor to work table.

※ Be careful because the control plate is provided to the backside.
When the cover is difficult to remove, knock lightly with a plastic hammer.



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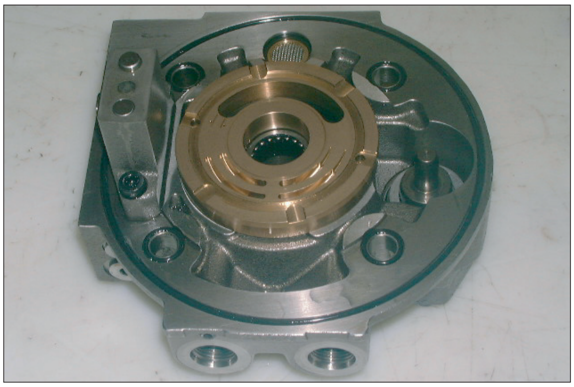
③ This photo shows the state with the cover removed.



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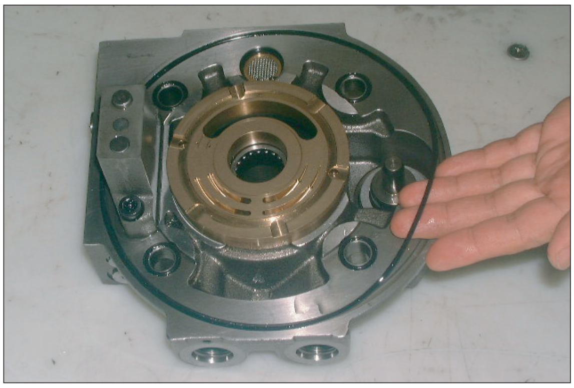
④ Remove the O-ring from the cover.



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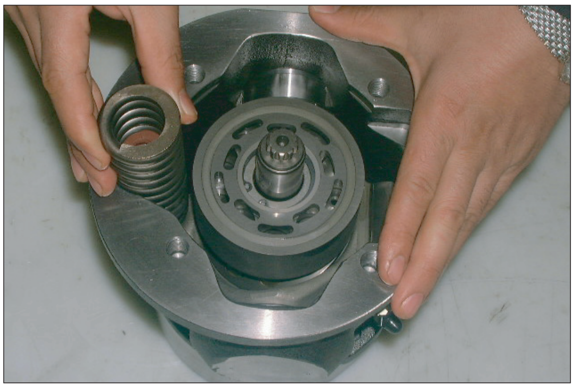
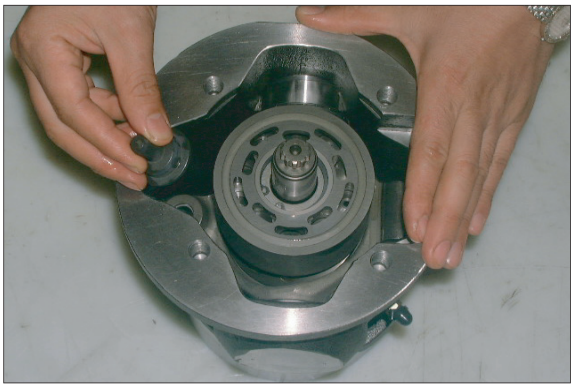
(1) The removal of the control spring

① Remove 2 springs (inner and outer).



R55NM7HP09

② Remove the spring seat.



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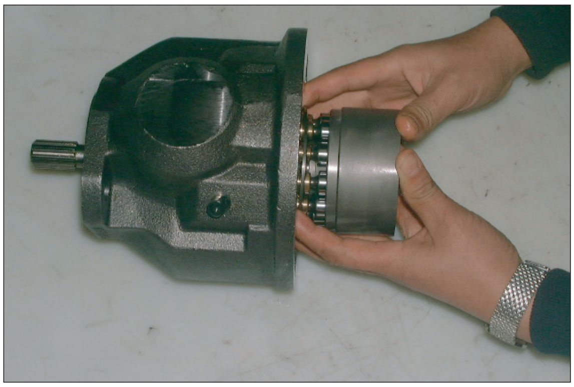
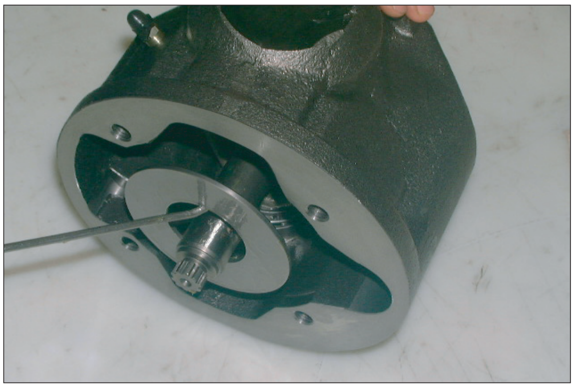
(2) The removal of rotary group

① Lay the pump on the side and take out the rotary group from the shaft.



R55NM7HP11

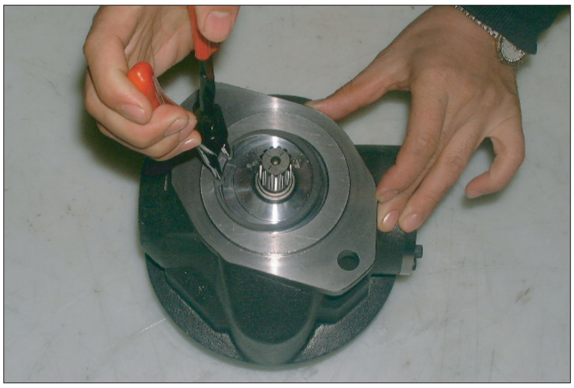
② Remove the plate.



R55NM7HP12

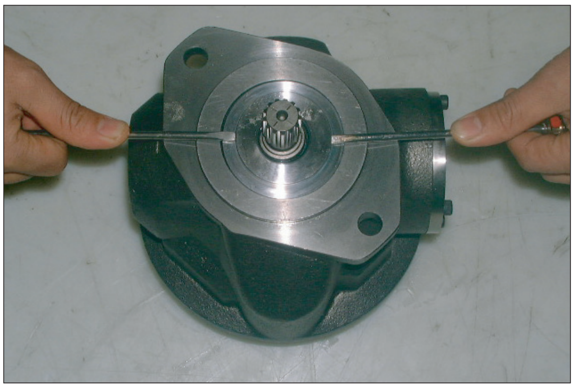
(3) The removal of the shaft

① Remove the C-type stop ring. (snap ring pliers for hole)



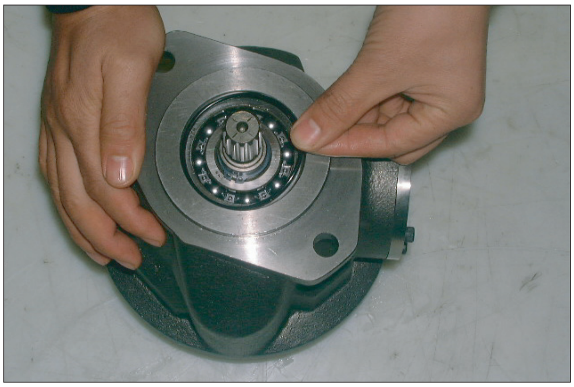
R55NM7HP13

② Use two standard screw-drivers to remove the oil seal case.



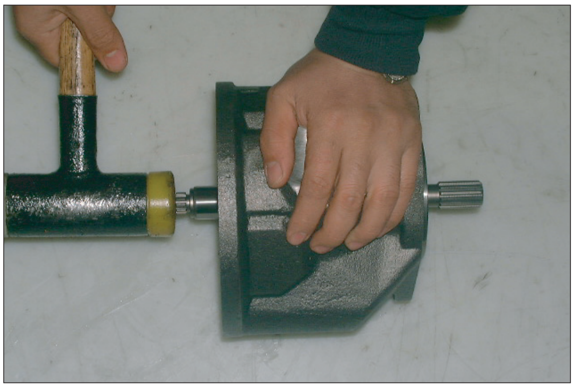
R55NM7HP14

③ Remove the O-ring.



R55NM7HP15

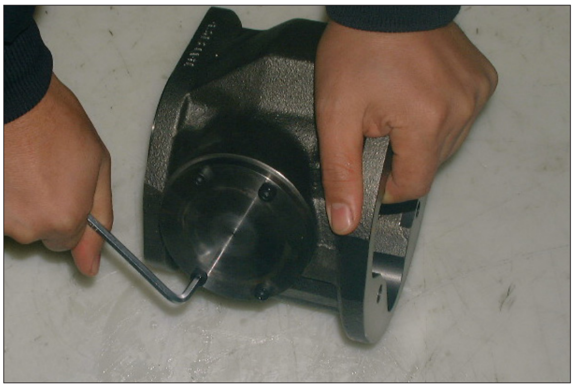
④ Remove it while knocking the shaft rear and lightly with a plastic hammer.



R55NM7HP16

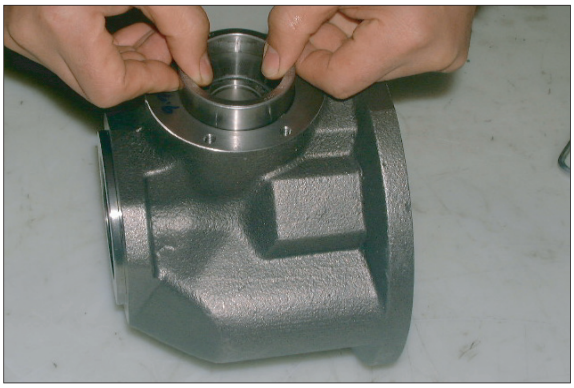
(4) The removal of the hanger

① Remove the hexagonal socket headed bolts (M6 × 16, 4pieces) and plate.
Hexagonal bar spanner
(Hex. side distance : 5)



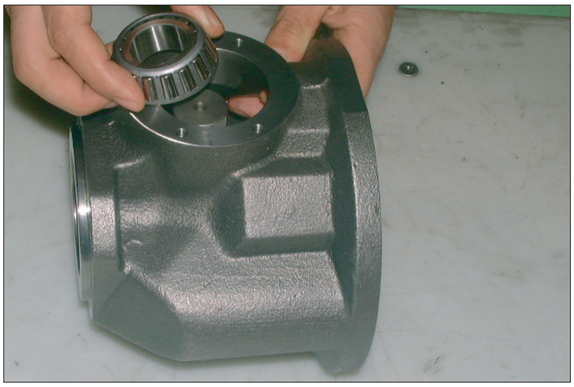
R55NM7HP17

② Remove the distance piece.



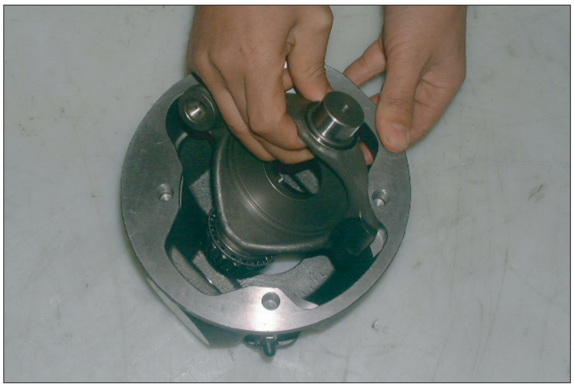
R55NM7HP18

③ Remove the bearing.



R55NM7HP19

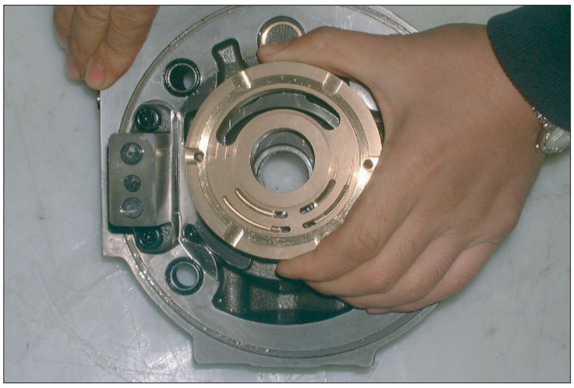
④ Remove the hanger.



R55NM7HP20

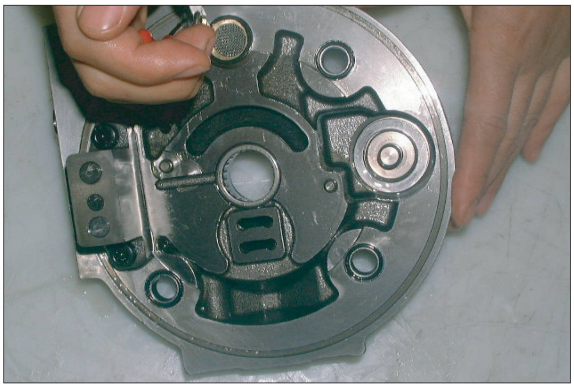
(5) The removal of the cover

① Remove the control plate.



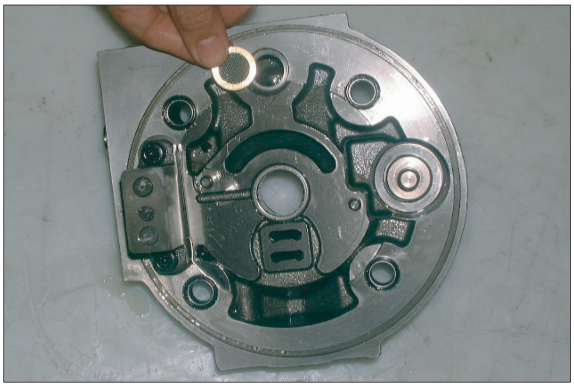
R55NM7HP21

② Remove the C-type stop ring.



R55NM7HP22

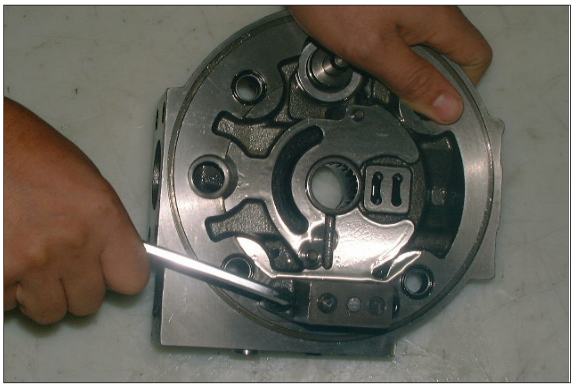
③ Remove the filter.



R55NM7HP23

(6) The removal of the control piston

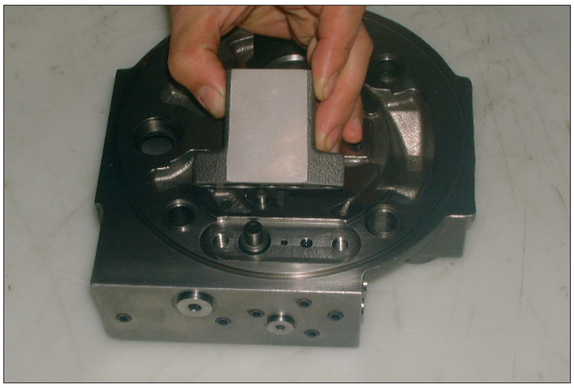
① Remove the hexagonal socket headed bolts. (M8 × 25, 2pieces)
Hexagonal bar spanner
(Hex. side distance : 6)
The threaded portion of the bolt is coated with LOCTITE #270.
This disassembly must therefore be made only when necessary.



R55NM7HP24

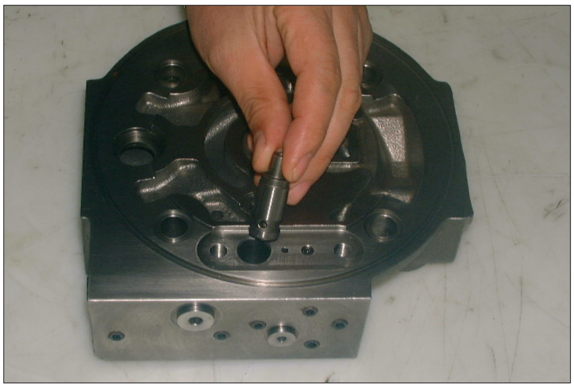
② Remove the cylinder and parallel pin.

※ Be careful because 3 O-rings are provided to the cylinder.



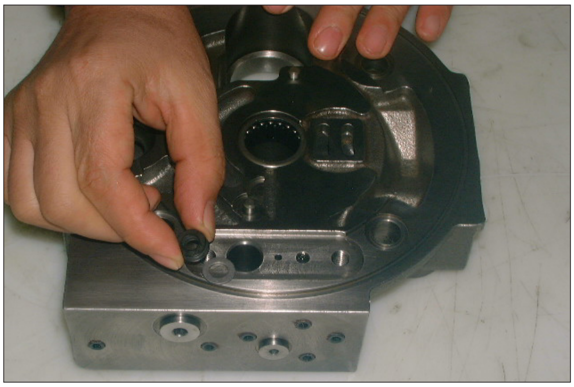
R55NM7HP25

③ Take out the piston.



R55NM7HP26

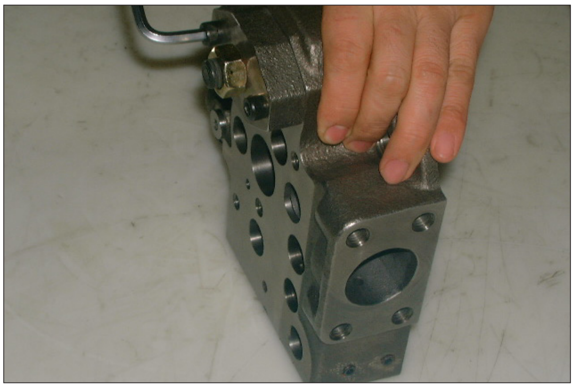
④ Take out three caned disk springs and spring seats.



R55NM7HP27

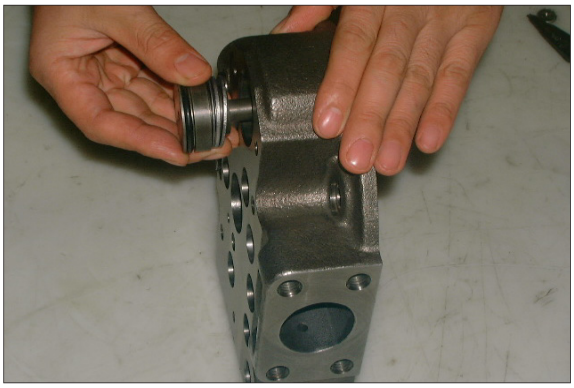
(7) The removal of the control spring

① Remove the hexagonal socket headed bolts (M8 × 30, 2pieces) and remove the cover.
Hexagonal bar spanner
(Hex. side distance : 6).



R55NM7HP28

② Remove the spring seat.

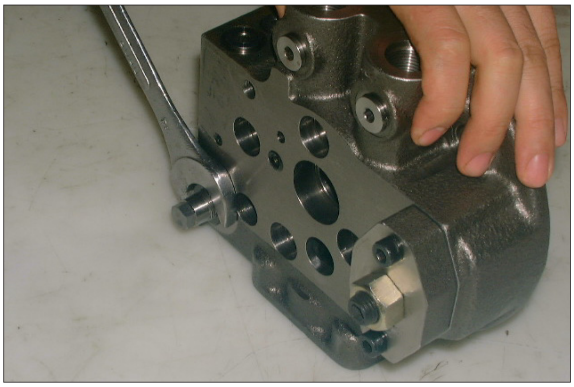


R55NM7HP29

(8) The removal of the relief valve

① Remove the hexagonal nuts.

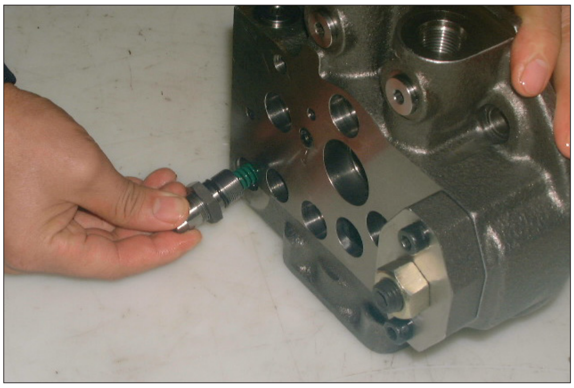
※ Since the pressure has been set, this assembly must be made only when necessary.
Spanner (Hex. side distance : 24).



R55NM7HP30

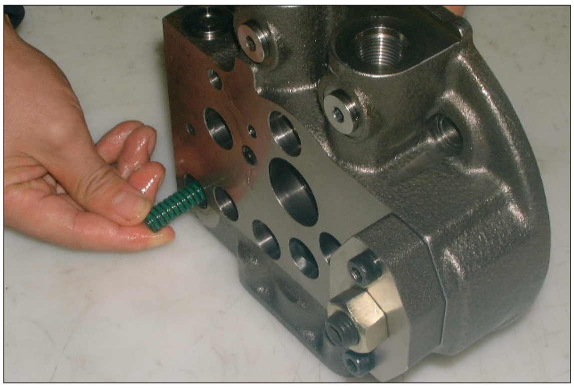
② Remove the adjusting screw.

※ Be careful because the shim is inserted.



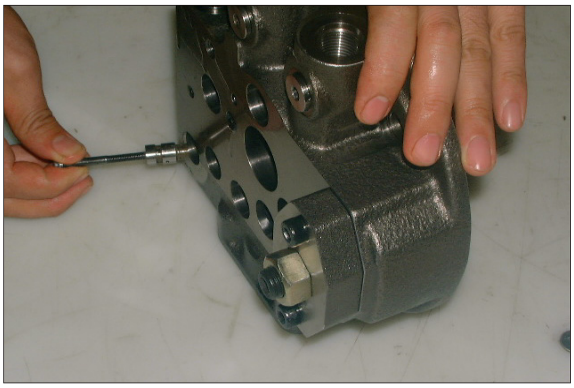
R55NM7HP31

③ Remove the spring.



R55NM7HP32

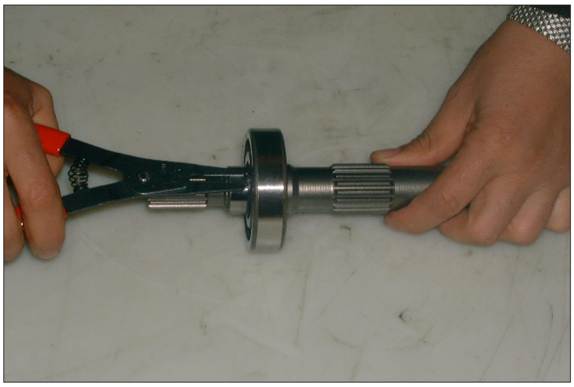
④ Remove the spool.



R55NM7HP33

(9) Disassembly of the shaft

① Remove the bearing.
Remove the C-type stop ring.
Snap ring pliers for shaft.



R55NM7HP34

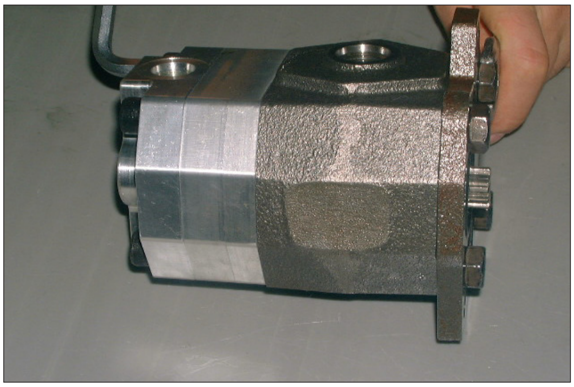
② Remove it while knocking the rear end of shaft lightly with a plastic hammer.

R55NM7HP35

3) DISASSEMBLING THE GEARED PUMP

(1) Disassembling the P3 and P4 pump

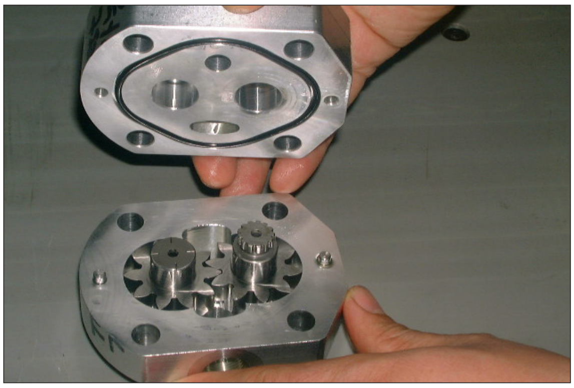
① Removed hexagonal socket head bolt and nut.
Hexagonal socket wrench (8 mm).
Hexagonal bar spanner (17 mm).



R55NM7HP209

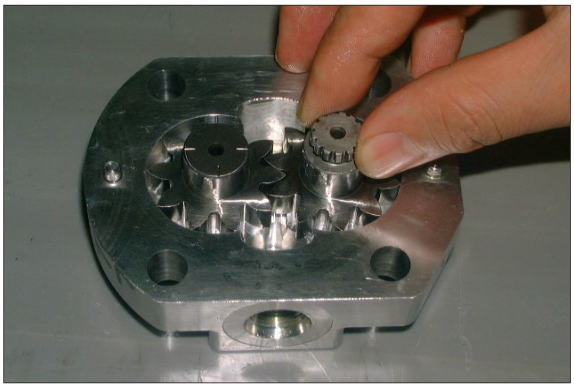
(2) Disassembling the geared pump (P4)

① Remove the geared pump (P4) from the center frame.



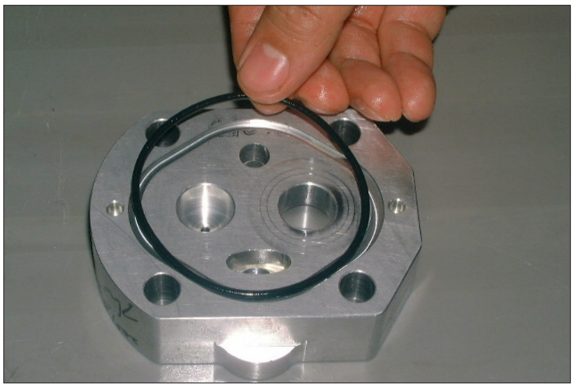
R55NM7HP208

② Pulling out the drive gear and the idle gear.



R55NM7HP207

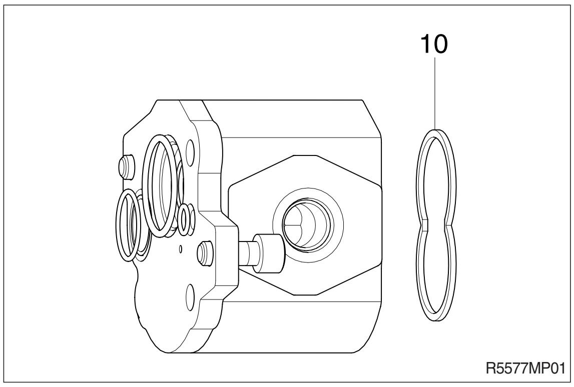
③ Remove the O-ring from the center frame.



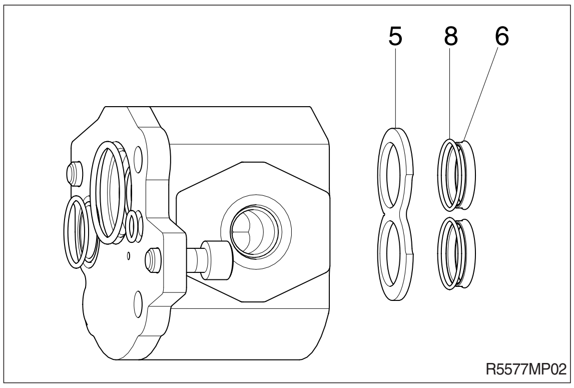
R55NM7HP206

(3) Disassembling the geared pump (P3)

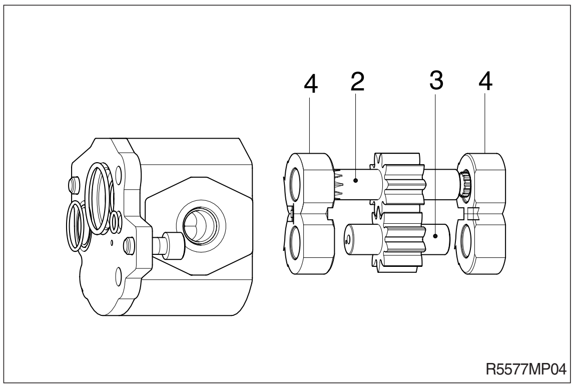
① Remove the square ring (10).



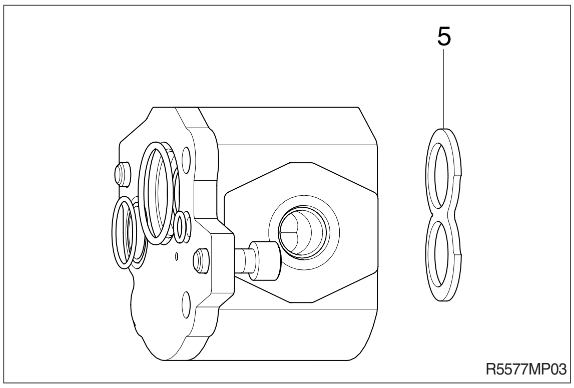
② Remove the plate (5) and the guide ring (pieces). With O-ring (6, 8).
Remove the O-ring (8) from guide ring (6).



③ Remove the drive and idle gear (2, 3) and the side plate (4) assembly.



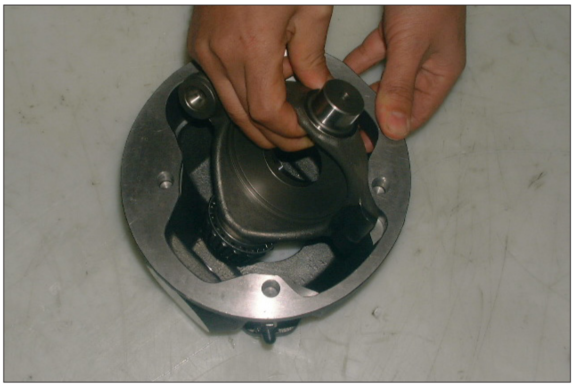
④ Remove the plate



4. ASSEMBLING PROCEDURE

1) ASSEMBLING THE MAIN PUMP

(1) Assembling the hanger.

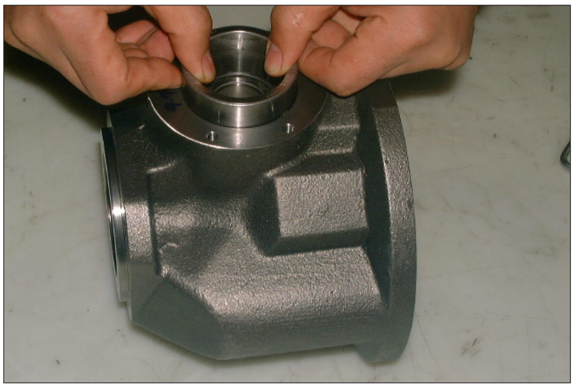


R55NM7HP50

(2) Install the bearing.

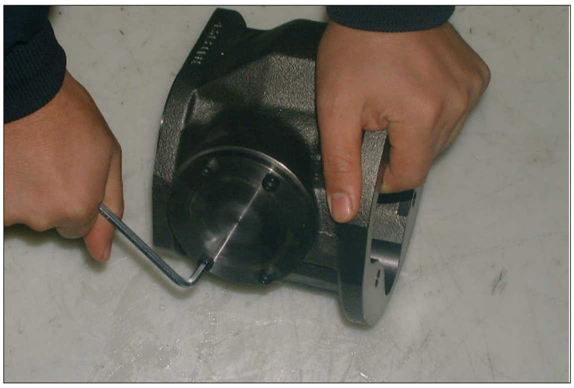
R55NM7HP50A

(3) Install the distance piece.
Confirm that pre-load is 0.1 ± 0.2.



R55NM7HP51

(4) Fix the plate with the hexagonal socket headed bolts (M6 × 16, 4pieces).
Hexagonal bar spanner
(Hex. side distance : 5)
Tightening torque : 1.2 ~ 1.5 kgf · m
(8.7 ~ 10.8 lbf · ft)



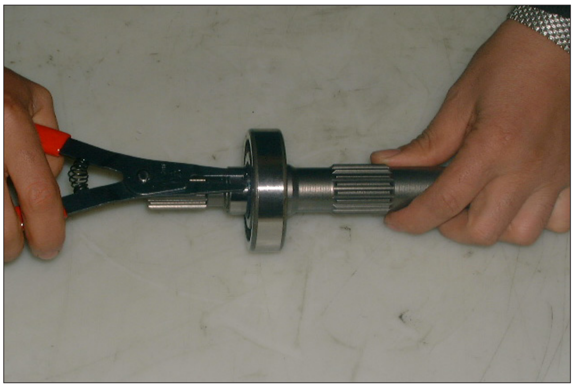
R55NM7HP52

(5) Assembling the shaft

① Fit the shaft into the bearing (with the bearing in the bottom) by using the press machine and jig. If the press is not available, use the jig in the similar manner and drive the shaft into the bearing by knocking with a plastic hammer.

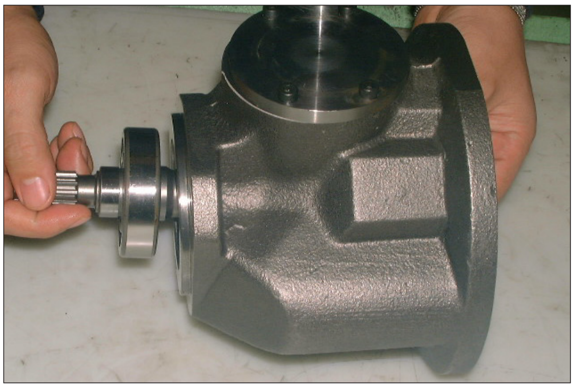
R55NM7HP53

② Install the C-type stop ring to fix the bearing.



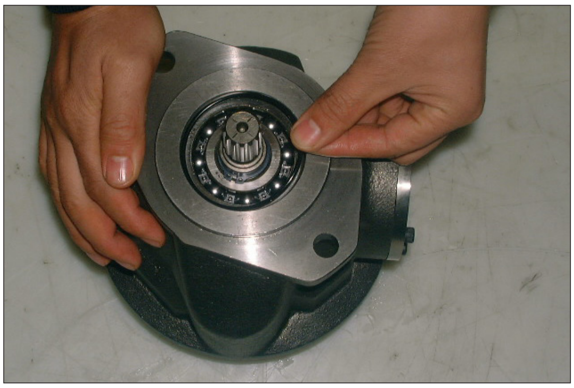
R55NM7HP54

③ Assembling the shaft.
Assemble the shaft into the housing.
Knock the spline end lightly with a plastic hammer and fix the bearing outer ring firmly into the housing hole.



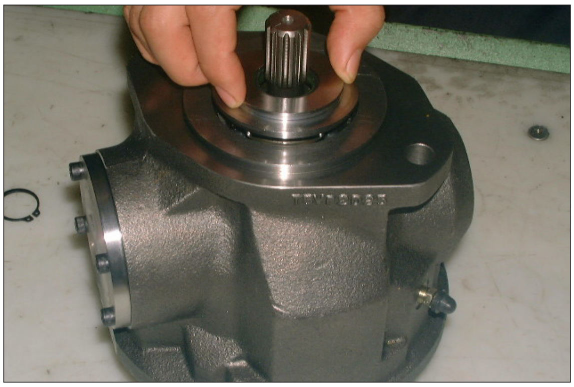
R55NM7HP55

(6) Apply grease to the O-ring for assembling.



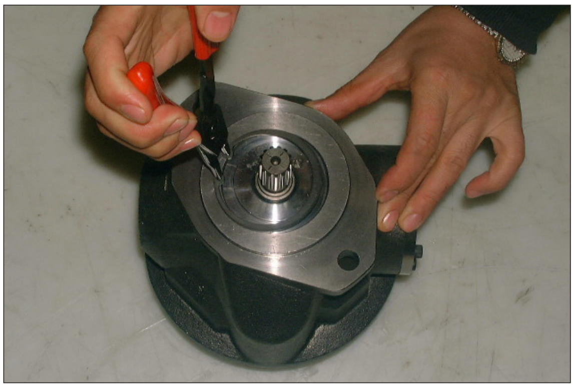
R55NM7HP56

(7) Install the case with oil seal vertically without tilting.
※ Apply grease to the oil seal lip beforehand.



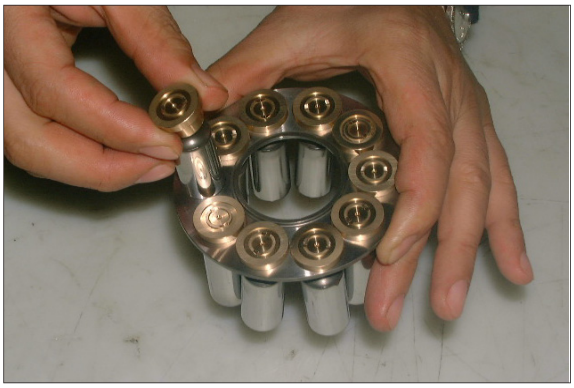
R55NM7HP57

(8) Install the C-type stop ring to fix the shaft.



R55NM7HP58

(9) Assembling the rotary group.
Install 10 (ten) pistons into the retainer.

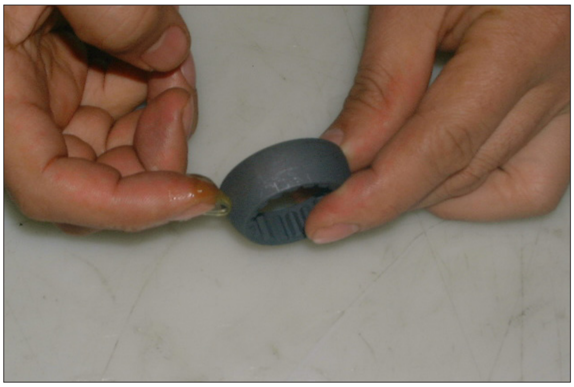


R55NM7HP59

(10) Apply grease to 3 parallel pins and assemble them to the cylinder block.

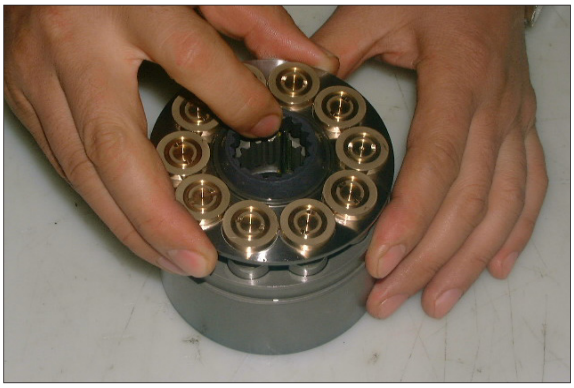
R55NM7HP60

(11) Apply grease to the spherical portion of the guide.



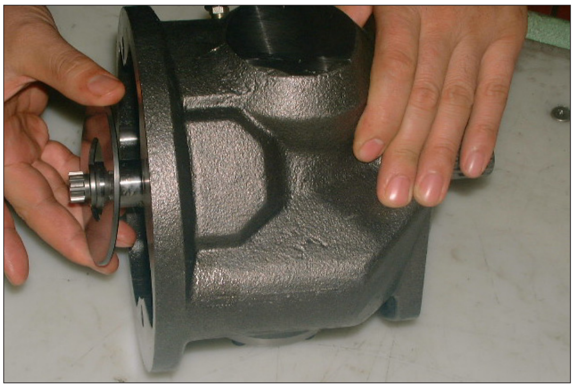
R55NM7HP61

(12) Insert the guide between the retainer and cylinder block and assemble the piston into the hole of cylinder block.



R55NM7HP62

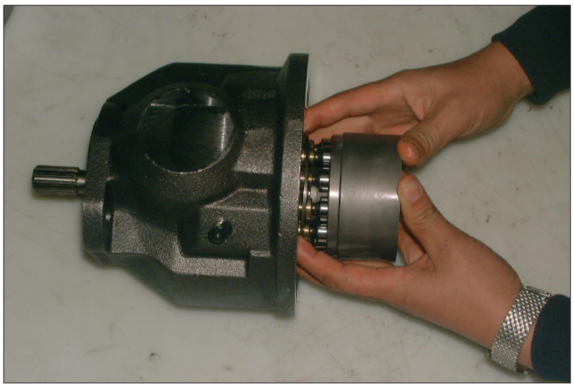
(13) Assembling the rotary group.
To prevent dislodgement, apply grease to the back side of the plate and assemble it to the hanger.



R55NM7HP63

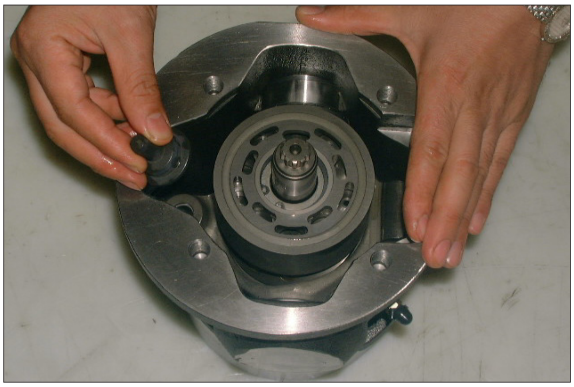
(14) Assemble the rotary group along the shaft spline.

※ During assembly, apply grease to the slide surface of piston shoe and to the slide surface of the cylinder block relative to the control plate.



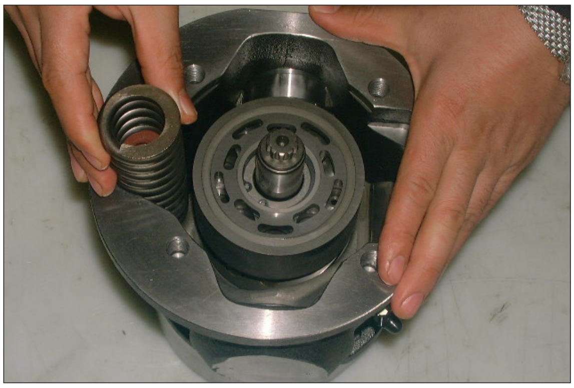
R55NM7HP64

(15) Assembling the control spring.
Apply grease to the spherical portion of the spring seat before assembling.



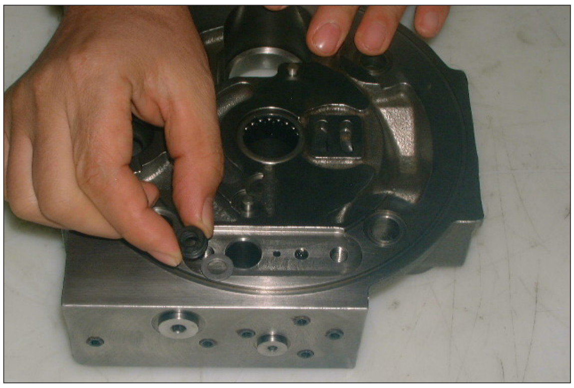
R55NM7HP65

(16) Assemble 2 springs (inner and outer).



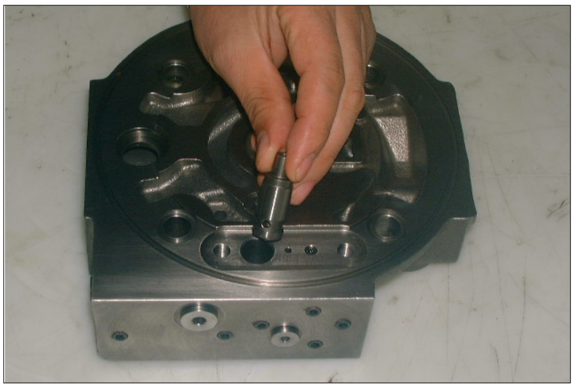
R55NM7HP66

(17) Assembling the cover.
Assemble the spring seats and coned disk springs (3 pieces).



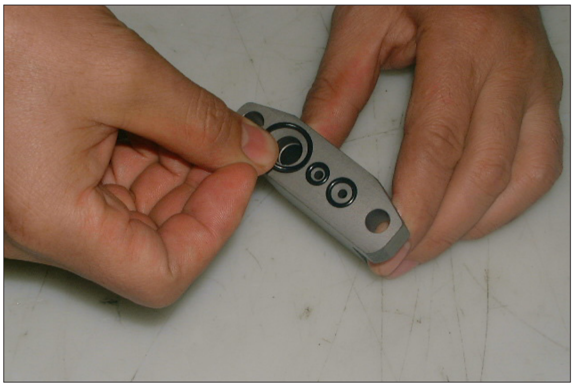
R55NM7HP67

(18) Assembling the control piston.



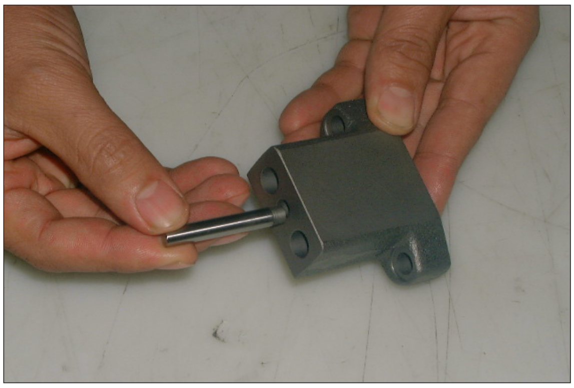
R55NM7HP68

(19) Apply grease to the O-rings (5.28×1.78, 1piece), (7.65×1.78, 1piece) and (15.6×1.78, 1piece) and assemble them to the cylinder.



R55NM7HP69

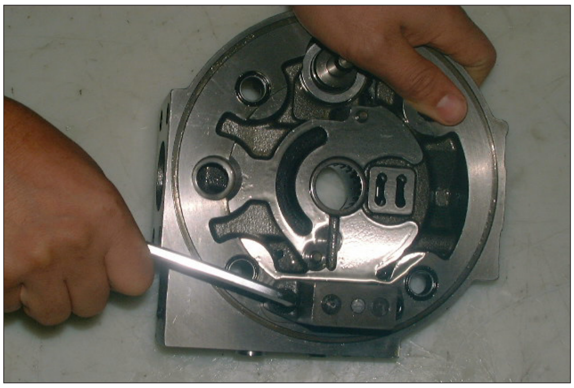
(20) Apply grease to 3 parallel pins and assemble 3 pins into the cylinder.



R55NM7HP70

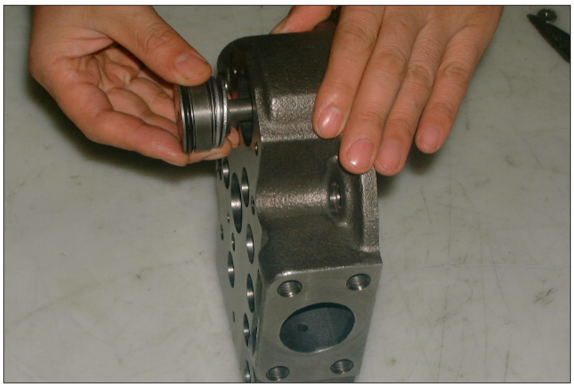
(21) Fix the cylinder with the hexagonal socket headed bolts (M8×25, 2pieces).

※ Apply LOCTITE #270 to the threaded portion of bolt.
Hexagonal bar spanner
(Hex. side distance : 6)
Tightening torque : 2.9 ~ 3.5 kgf · m
(21 ~ 25.3 lbf · ft)



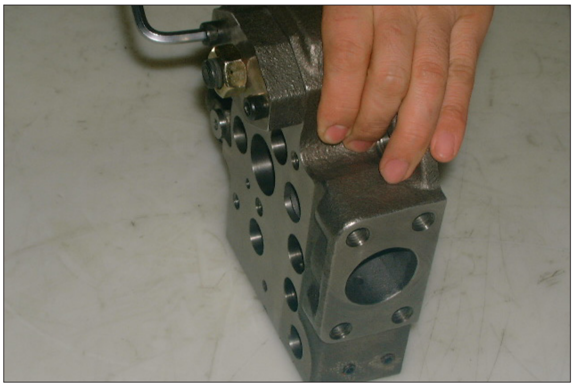
R55NM7HP71

(22) Assembling the control spring.
Install the spring seat.



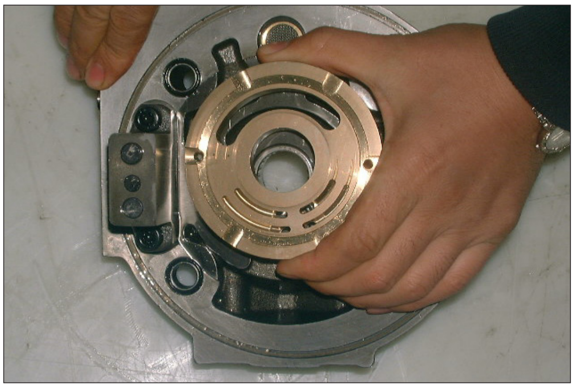
R55NM7HP72

(23) Fix the cover with the hexagonal socket headed bolts (M8 × 30, 2pieces)
Hexagonal bar spanner
(Hex. side distance : 6)
Tightening torque : 2.9 ~ 3.5 kgf · m
(21 ~ 25.3 lbf · ft)



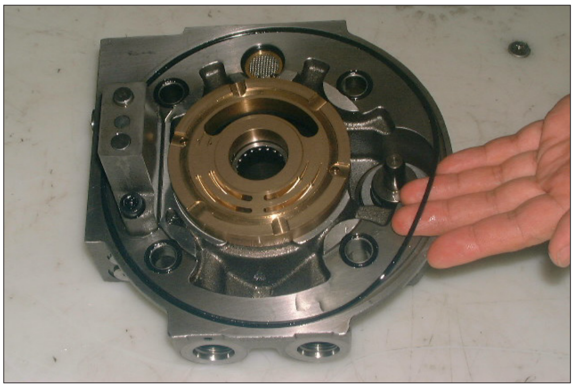
R55NM7HP73

(24) Apply grease to the back side of the control plate and assemble it to the cover while matching knock holes.



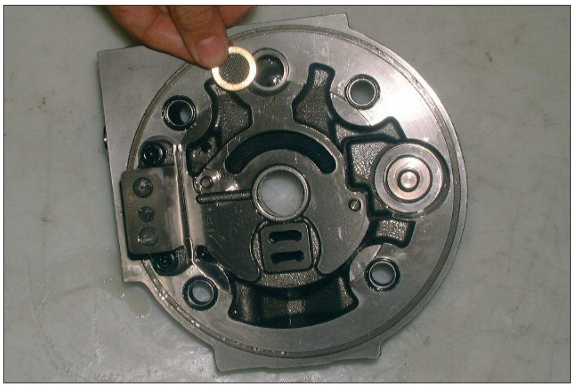
R55NM7HP74

(25) Install the O-ring.
Assemble the spring seats and coned disk springs (3pieces).



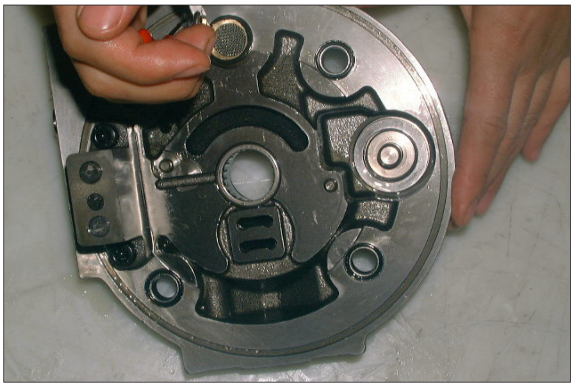
R55NM7HP75

(26) Install the filter into the cover.



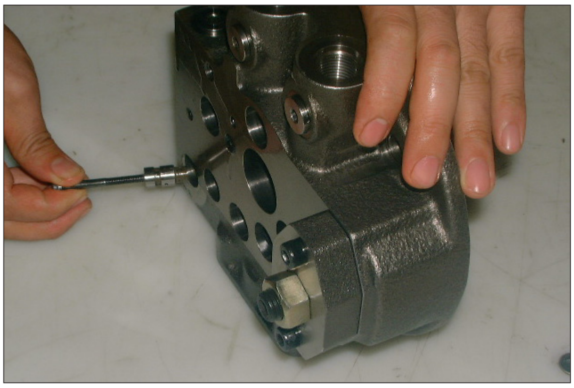
R55NM7HP76

(27) Fix the filter with the C-type stop ring.



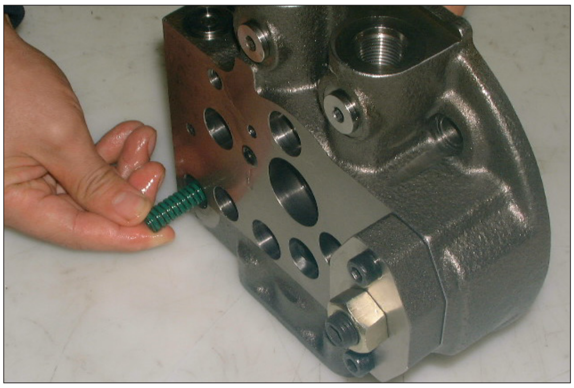
R55NM7HP77

(28) Assembling the relief valve.
Assemble the spool.



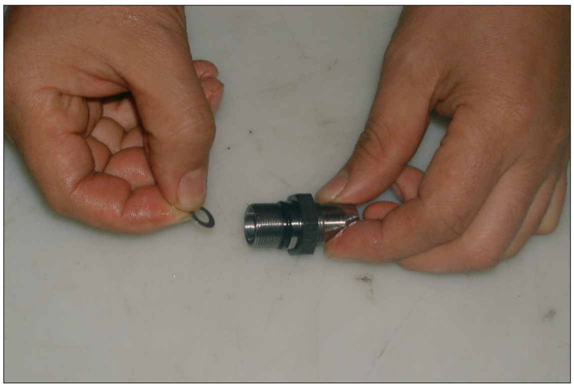
R55NM7HP78

(29) Assemble the spring.



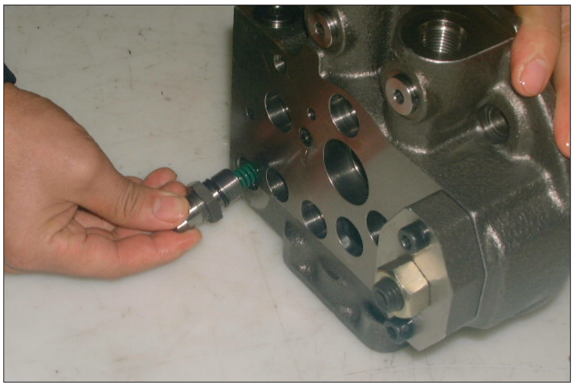
R55NM7HP79

(30) Insert the shim into the adjusting screw.



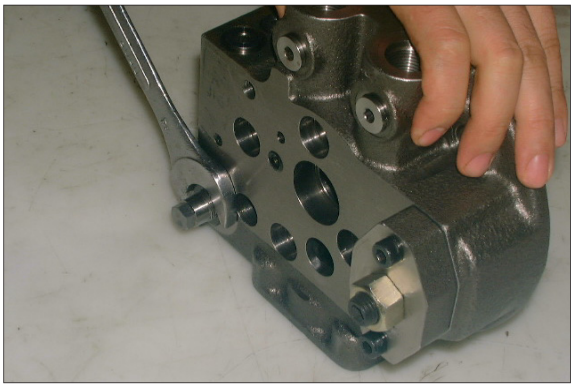
R55NM7HP80

(31) Assemble the adjusting screw.



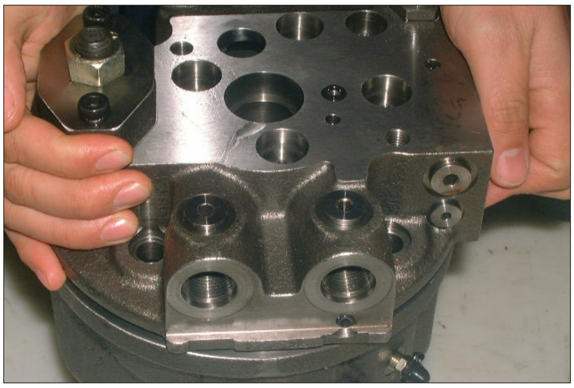
R55NM7HP81

(32) Tighten the hexagonal nuts.
After assembling, set the pressure and tighten the nuts.
1 kgf · m (7.2 lbf · ft)
Spanner (Hex. side distance : 24)



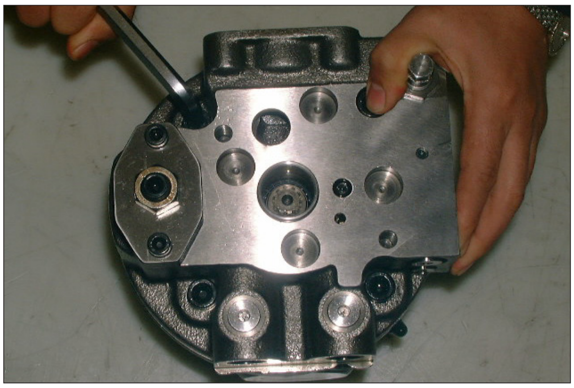
R55NM7HP82

(33) Install the cover in a parallel direction to the housing mounting surface.



R55NM7HP83

(34) Fix the cover with the hexagonal socket headed bolts (M12×30, 3pieces) and (M12×55, 1piece)
Hexagonal bar spanner
(Hex. side distance :10)
Tightening torque : 10 ~ 12.5 kgf · m
(72.3 ~ 90.4 lbf · ft)

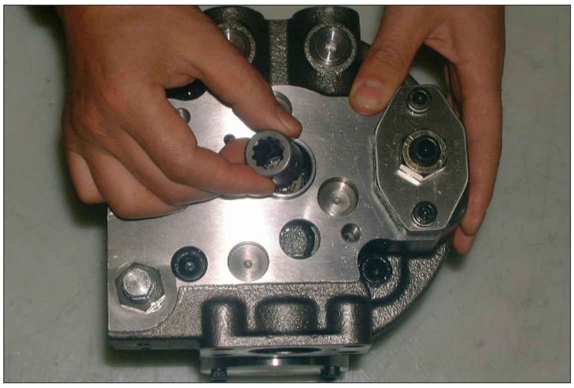


R55NM7HP84

(35) Install the O-ring into the cover.

R55NM7HP85

(36) Install the coupling to the shaft end of the main pump.

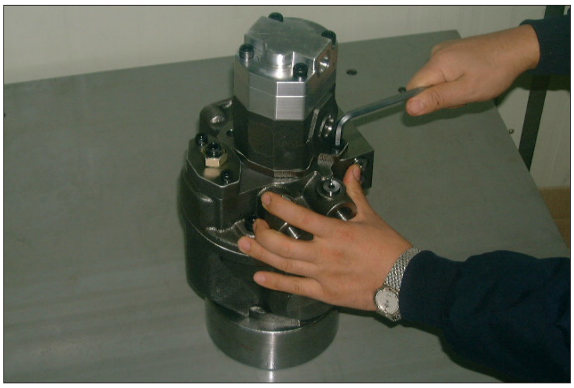


R55NM7HP86

(37) Connect the main and geared pump.

R55NM7HP87

(38) Fix the geared pump with the hexagonal socket headed bolts (M10 × 25, 2pieces).
Hexagonal bar spanner
(Hex. side distance : 8)
Tightening torque : 5.6 ~ 7.0 kgf · m
(40.5 ~ 50.6 lbf · ft)

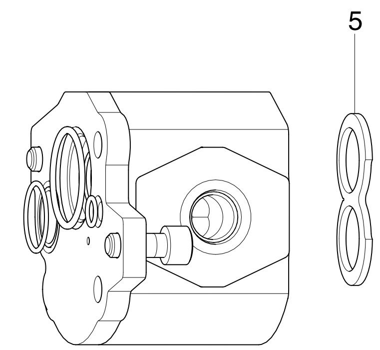


R55NM7HP88

4) REASSEMBLING THE GEARED PUMP

(1) Reassembling the geared pump (P3)

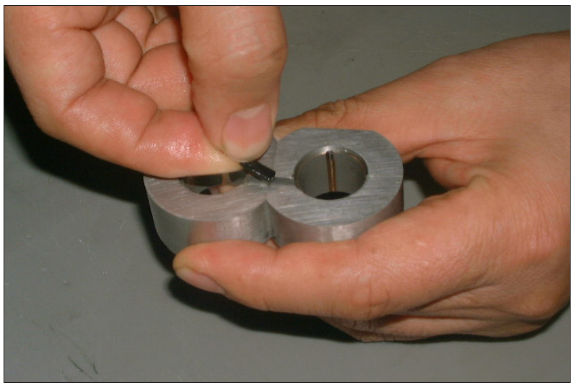
① Insert the plate (5) to the pump housing.



R5577MP03

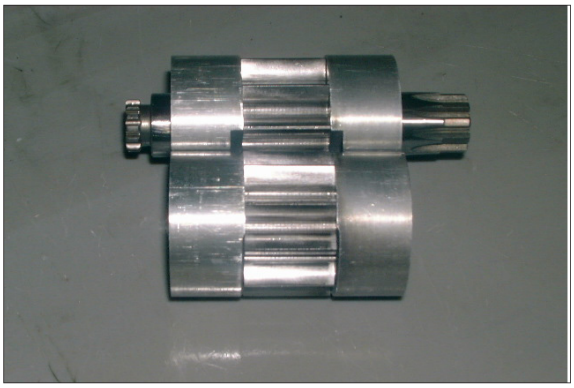
② Insert the square ring into the side plate.

※ Be careful to suction and discharge side.



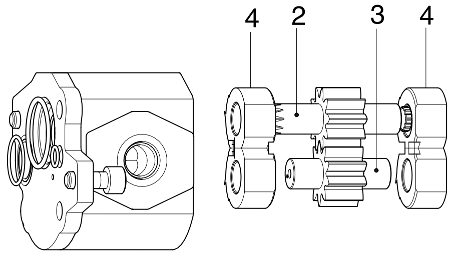
R55NM7HP210

③ Assemble the side plate to the drive and idle gear.



R55NM7HP211

④ Assemble the gear assembly into the gear casing.

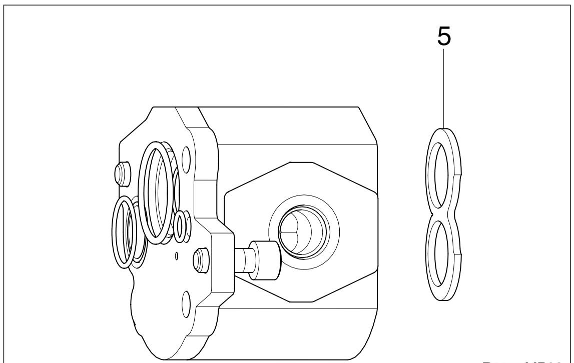


R5577MP04

⑤ Assemble the O-ring to the guide ring and assemble them to the plate.

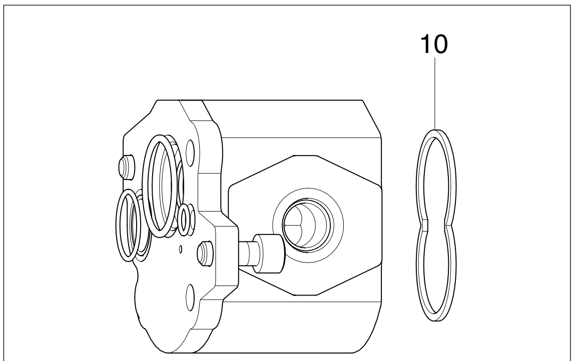
R55NM7HP213

⑥ Assemble the guide ring assembly (6, 8) and plate (5) to the gear casing.



R5577MP03

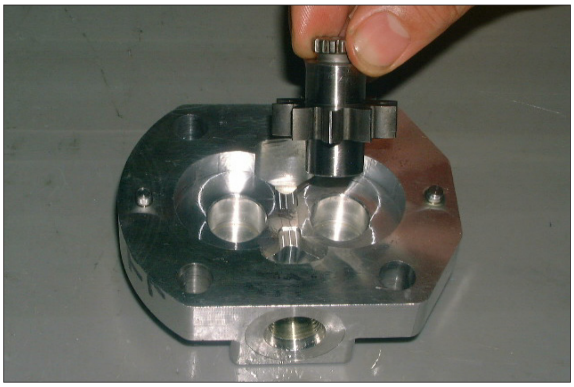
⑦ Assemble the square ring (10) to the gear casing.



R5577MP01

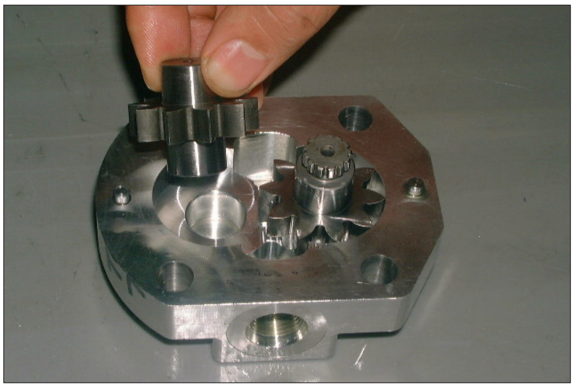
(2) Reassembling the geared pump (P4)

① Insert the drive gear into the gear casing.



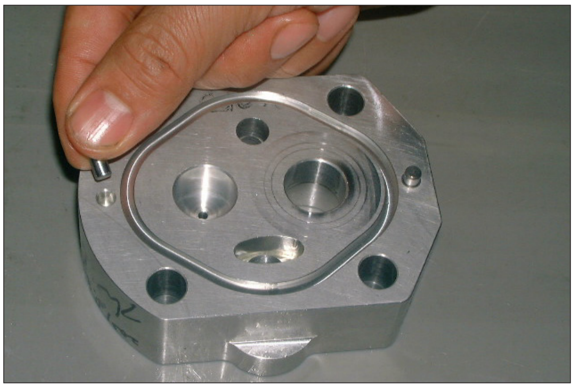
R55NM7HP219

② Insert the idle gear to into the gear casing.



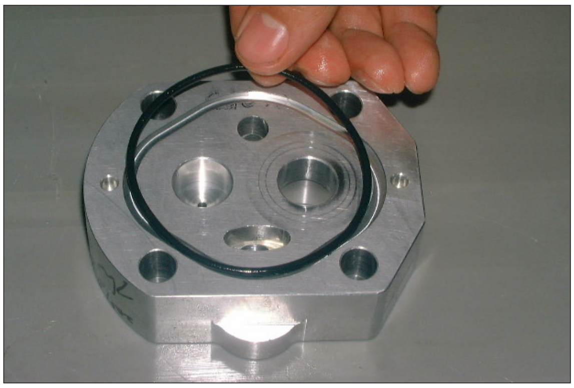
R55NM7HP220

③ Insert the pins (2-pieces) to the center frame.



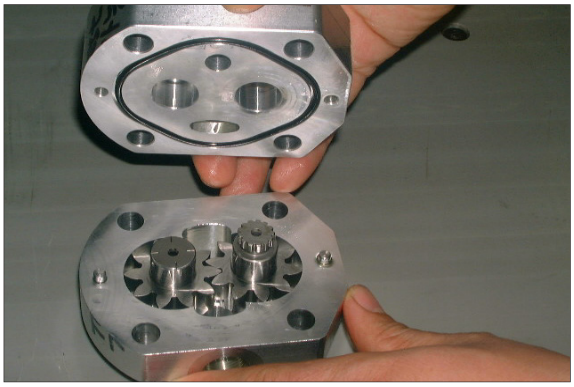
R55NM7HP221

④ Assemble the O-ring to the center frame.



R55NM7HP222

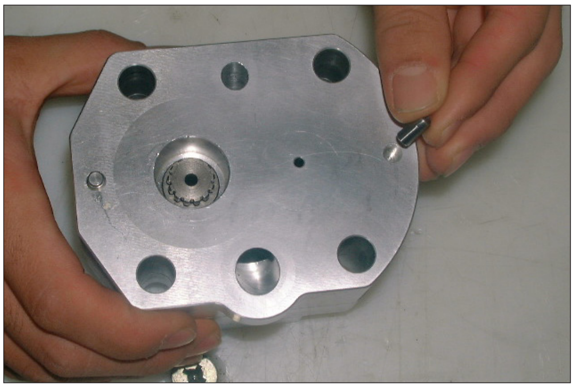
⑤ Assemble the center frame sub-assemble to the gear casing sub-assembly.



R55NM7HP223

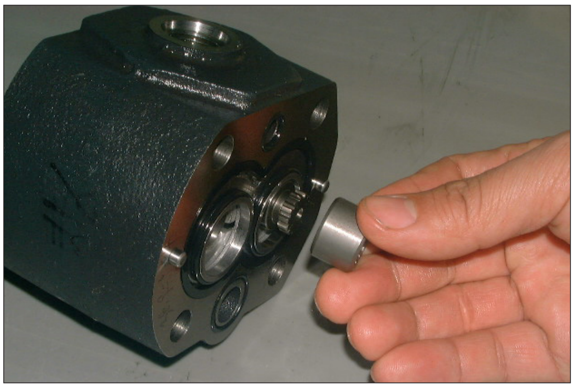
(3) Reassembling the P3 and P4 pumps

① Insert the pins (2-pieces) into the center frame.



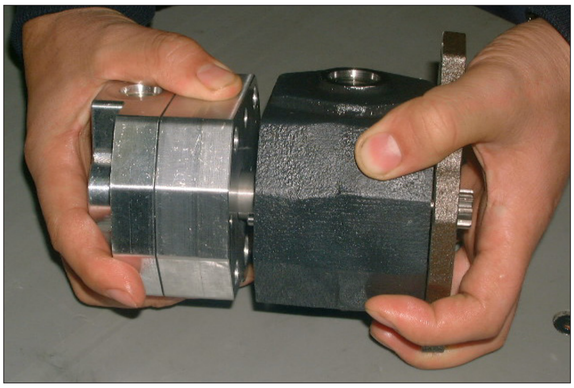
R55NM7HP224

② Insert coupling to the P3 geared pump.



R55NM7HP225

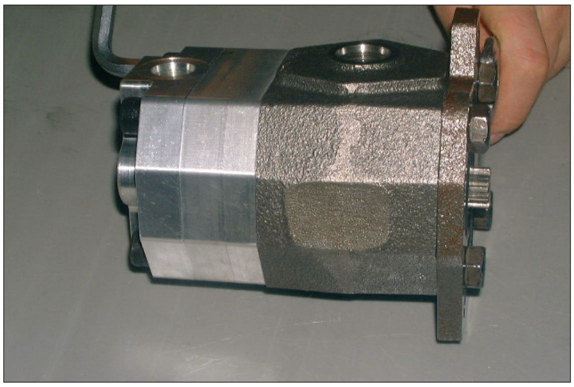
③ Assemble the P3 and P4 geared pumps.



R55NM7HP226

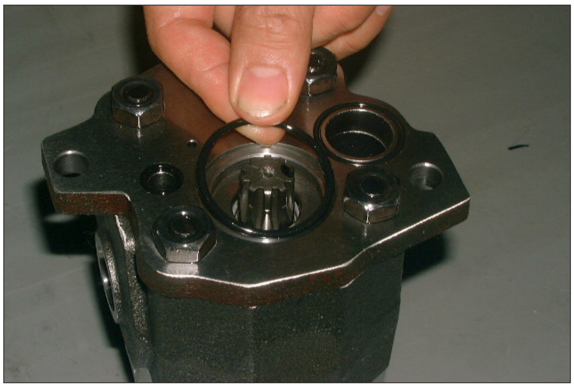
④ Assemble the hexagonal socket bolts and nuts.

· Size : M10×65L, 4pieces
· Allen wrench : 8 ㎜
· Spanner : 17 ㎜
· Tightening torque : 580 ㎏f·㎝ (56.9 N·m)



R55NM7HP227

⑤ Assemble the O-ring to the pump housing.



R55NM7HP228

GROUP 4 MAIN CONTROL VALVE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

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

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

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

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

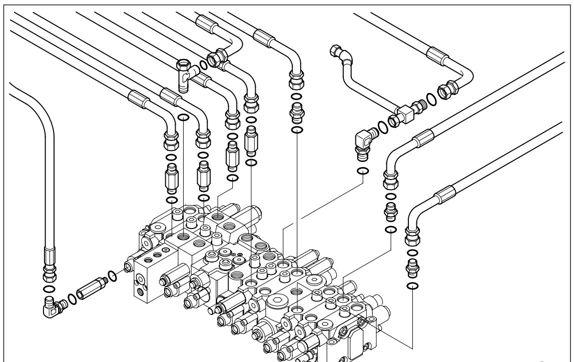
※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

13031GE18

(4) Disconnect hydraulic hose.

(5) Disconnect pilot line hoses.

(6) Remove links.

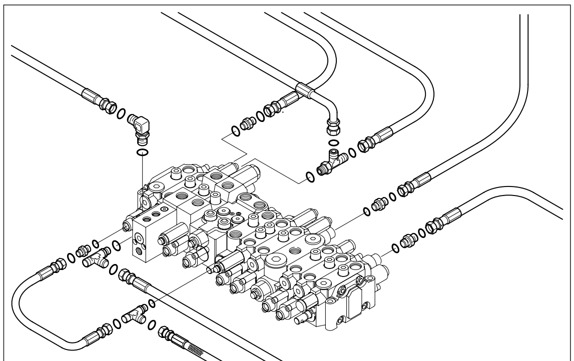


555K7MC01

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

· Weight : 40 ㎏ (90 ℔)

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



555K7MC02

2) INSTALL

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

(2) Bleed the air from below items.

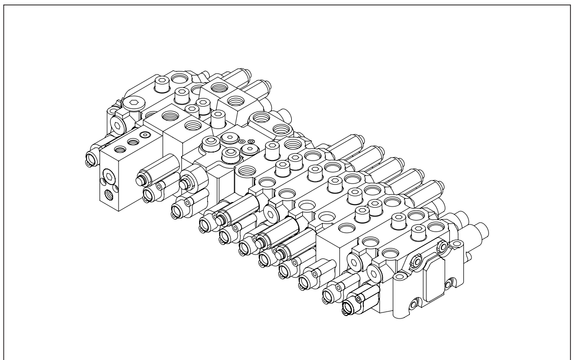
① Cylinder (boom, arm, bucket)

② Swing motor

③ Travel motor

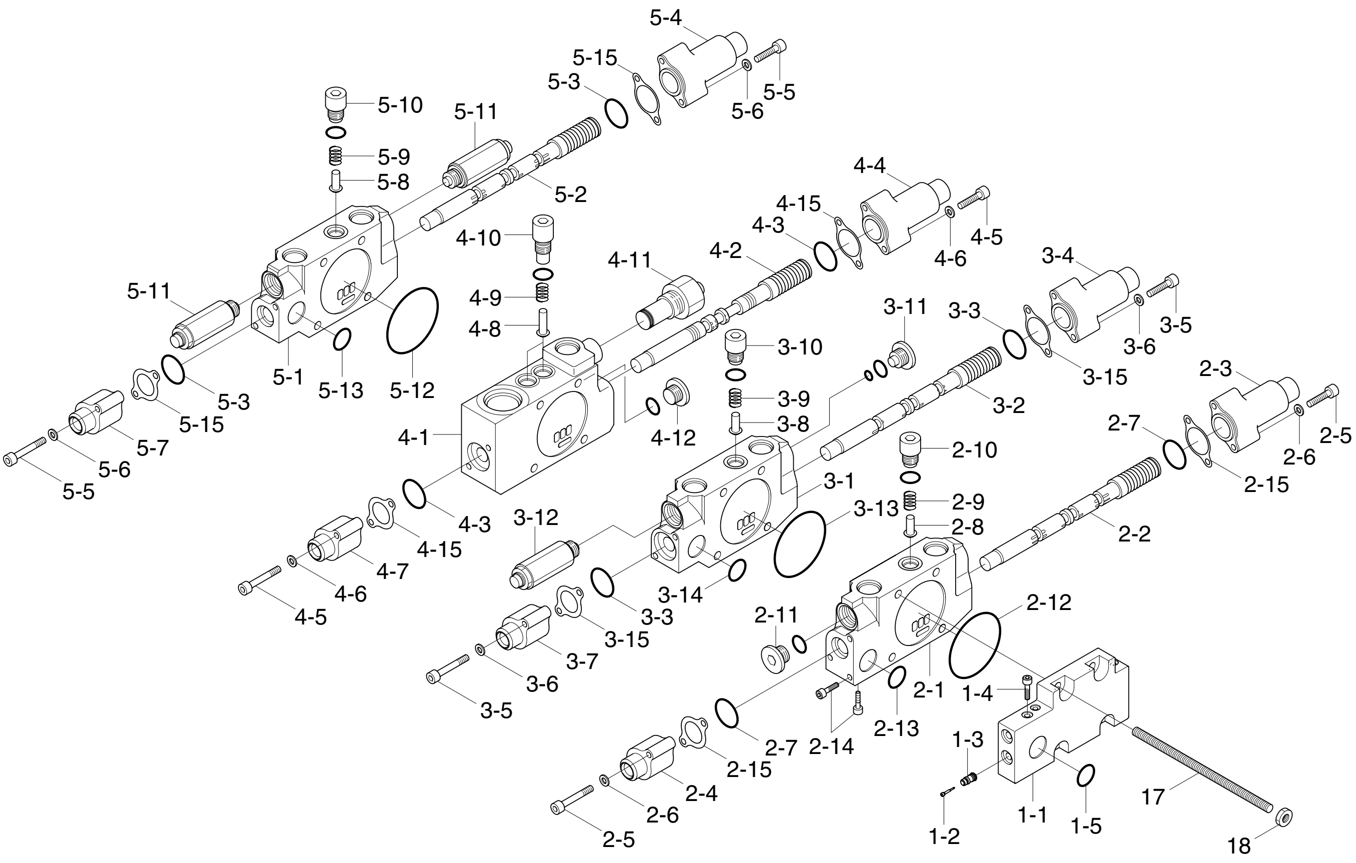
※ See each item removal and install.

(3) Confirm the hydraulic oil level and recheck the hydraulic oil leak or not.



555K7MC03

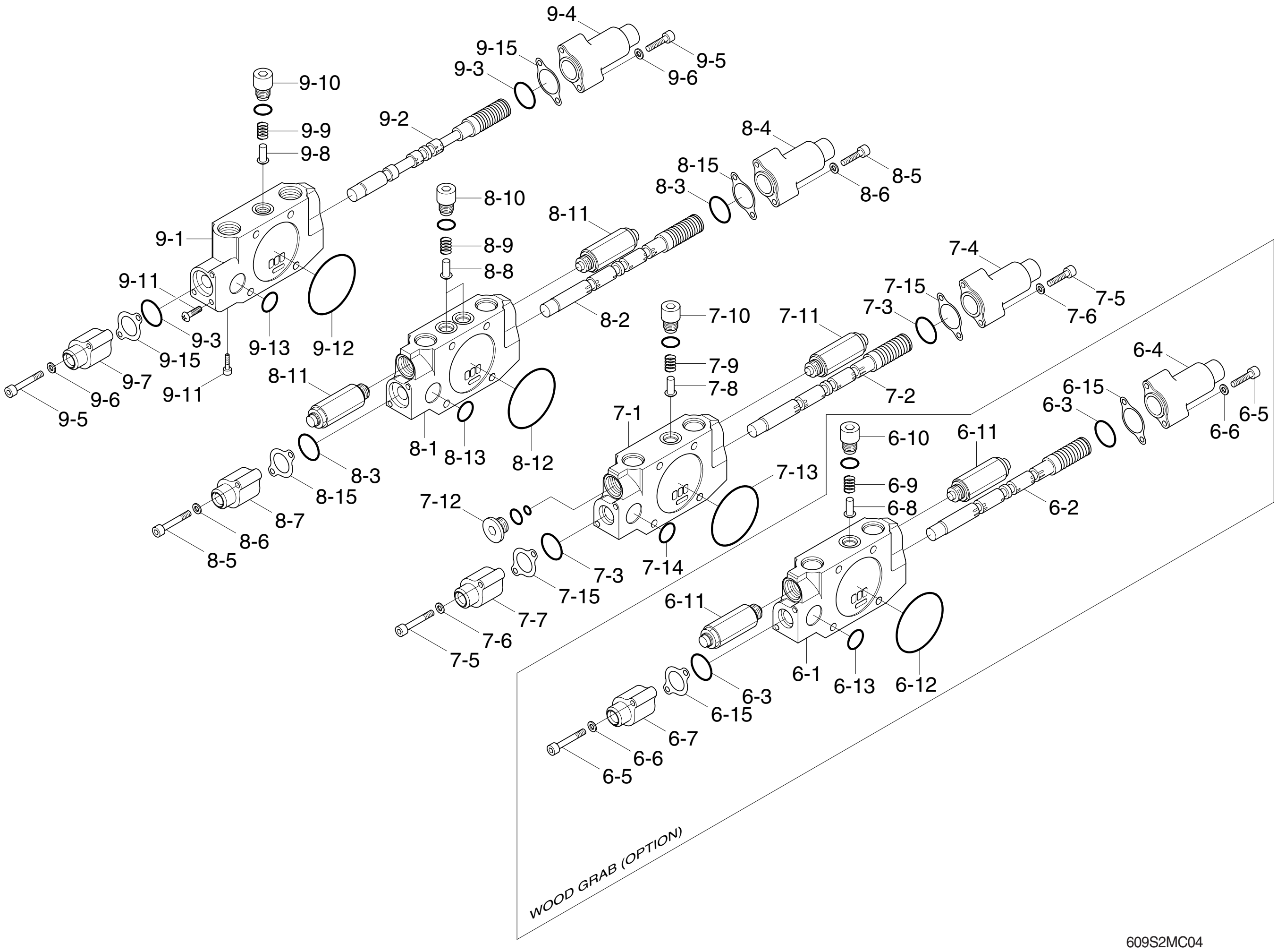
2. STRUCTURE (1/4)



609S2MC03

1	Auto idle cover
1-1	Cover
1-2	Orifice
1-3	Filter
1-4	Taper plug
1-5	O-ring
2	Swing section assy
2-1	Work block
2-2	Spool assy
2-3	Pilot cap (A)
2-4	Pilot cap (B1)
2-5	Wrench bolt
2-6	Plain washer
2-7	O-ring
2-8	Check poppet
2-9	Check spring
2-10	Plug
2-11	Plug
2-12	O-ring
2-13	O-ring
2-14	Taper plug
2-15	Gasket
3	Dozer section assy
3-1	Work block
3-2	Spool assy
3-3	O-ring
3-4	Pilot cap (A)
3-5	Socket bolt
3-6	Plain washer
3-7	Pilot cap (B1)
3-8	Check poppet
3-9	Check spring
3-10	Plug
3-11	Plug
3-12	Overload relief valve
3-13	O-ring
3-14	O-ring
3-15	Gasket
4	Inlet (P3) section assy
4-1	Work block
4-2	Spool assy
4-3	O-ring
4-4	Pilot cap (A)
4-5	Wrench bolt
4-6	Plain washer
4-7	Pilot cap (B1)
4-8	Check poppet
4-9	Check spring
4-10	Plug
4-11	Main relief valve
4-12	Cap assy
4-15	Gasket
5	Rotator section assy (woodgrab)
5-1	Work block
5-2	Spool assy
5-3	O-ring
5-4	Pilot cap (A)
5-5	Wrench bolt
5-6	Plain washer
5-7	Pilot cap (B1)
5-8	Check poppet
5-9	Check spring
5-10	Plug
5-11	Overload relief valve
5-12	O-ring
5-13	O-ring
5-15	Gasket
17	Tie bolt
18	Nut

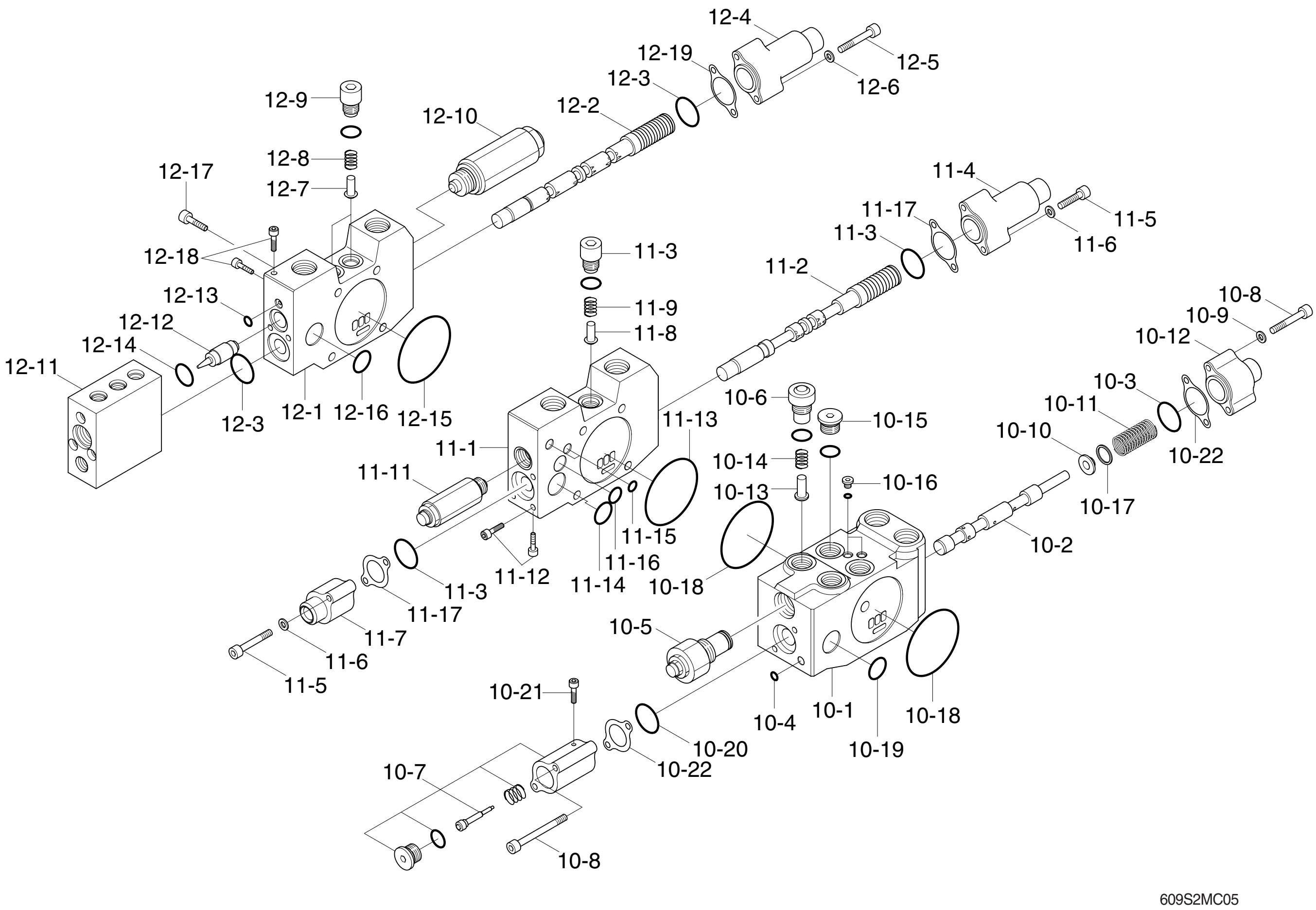
STRUCTURE (2/4)



609S2MC04

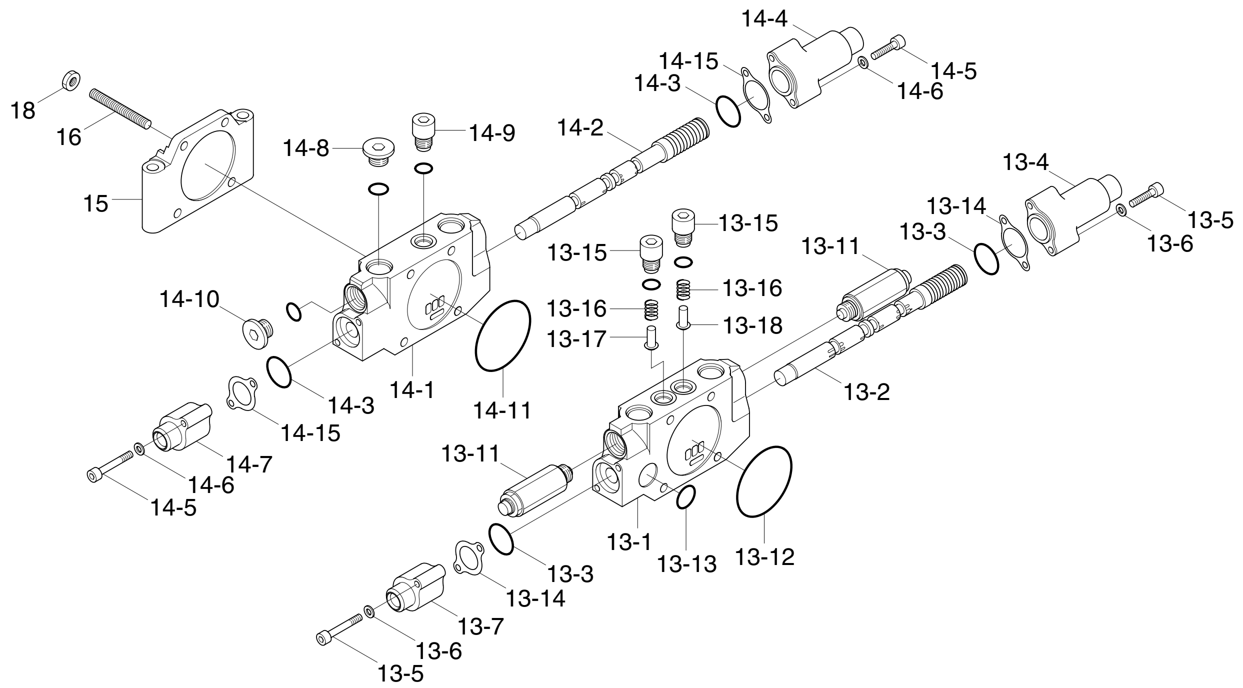
6	Woodgrab section assy
6-1	Work block
6-2	Spool assy
6-3	O-ring
6-4	Pilot cap (A)
6-5	Wrench bolt
6-6	Plain washer
6-7	Pilot cap (B1)
6-8	Check poppet
6-9	Check spring
6-10	Plug
6-11	Overload relief valve
6-12	O-ring
6-13	O-ring
6-15	Gasket
7	Boom 2 / Breaker section
7-1	Work block
7-2	Spool assy
7-3	O-ring
7-4	Pilot cap (A)
7-5	Wrench bolt
7-6	Plain washer
7-7	Pilot cap (B1)
7-8	Check poppet
7-9	Check spring
7-10	Plug
7-11	Overload relief valve
7-12	Plug
7-13	O-ring
7-14	O-ring
7-15	Gasket
8	Arm 1 section assy
8-1	Work block
8-2	Spool assy
8-3	O-ring
8-4	Pilot cap (A)
8-5	Socket bolt
8-6	Plain washer
8-7	Pilot cap (B1)
8-8	Check poppet
8-9	Check spring
8-10	Plug
8-11	Overload relief valve
8-12	O-ring
8-13	O-ring
8-15	Gasket
9	Travel (L) section assy
9-1	Work block
9-2	Spool assy
9-3	O-ring
9-4	Pilot cap (A)
9-5	Wrench bolt
9-6	Plain washer
9-7	Pilot cap (B1)
9-8	Check poppet
9-9	Check spring
9-10	Plug
9-11	Taper plug
9-12	O-ring
9-13	O-ring
9-15	Gasket

STRUCTURE (3/4)



10	Inlet (P1, P2) section assy	10-21	Taper plug	12	Boom 1 block
10-1	Work block	10-22	Gasket	12-1	Work block
10-2	Spool assy	11	Travel (R) section assy	12-2	Spool assy
10-3	O-ring	11-1	Work block	12-3	O-ring
10-4	O-ring	11-2	Spool assy	12-4	Pilot cap (A)
10-5	Main relief valve	11-3	O-ring	12-5	Wrench bolt
10-6	Plug	11-4	Pilot cap (A)	12-6	Plain washer
10-7	Check cap assy (TS)	11-5	Wrench bolt	12-7	Check poppet
10-8	Wrench bolt	11-6	Plain washer	12-8	Check spring
10-9	Plain washer	11-7	Pilot cap (B1)	12-9	Plug
10-10	Spring seat	11-8	Check poppet	12-10	Overload relief valve
10-11	Pilot spring	11-9	Check spring	12-11	Holding valve assy (A)
10-12	Pilot cap	11-10	Plug	12-12	Holding valve assy (B)
10-13	Check poppet	11-11	Overload relief valve	12-13	O-ring
10-14	Check spring	11-12	Taper plug	12-14	O-ring
10-15	Plug	11-13	O-ring	12-15	O-ring
10-16	Plug	11-14	O-ring	12-16	O-ring
10-17	Spring shim	11-15	O-ring	12-17	Wrench bolt
10-18	O-ring	11-16	O-ring	12-18	Taper plug
10-19	O-ring	11-17	Gasket	12-19	Gasket
10-20	O-ring				

STRUCTURE (4/4)



609S2MC06

13	Bucket block assy	13-14	Gasket	14-6	Plain washer
13-1	Bucket block	13-15	Plug	14-7	Pilot cap (B1)
13-2	Bucket spool assy	13-16	Check spring	14-8	Plug (Pf 1/2)
13-3	O-ring	13-17	Check poppet	14-9	Plug
13-4	Pilot cap (A)	13-18	Check poppet	14-10	Plug
13-5	Wrench bolt	14	Arm 2 section assy	14-11	O-ring
13-6	Plain washer	14-1	Work block (Ae)	14-15	Gasket
13-7	Pilot cap (B1)	14-2	Arm 2 spool assy	15	End cover
13-11	Overload relief valve	14-3	O-ring	16	Tie bolt
13-12	O-ring	14-4	Pilot cap (A)	18	Nut
13-13	O-ring	14-5	Wrench bolt		

3. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

(1) All hydraulic components are manufactured to a high precision. Consequently, before disassembling and assembling them, it is essential to select an especially clean place.

(2) In handling a control valve, pay full attention to prevent dust, sand, etc. from entering into it.

(3) When a control valve is to be remove from the machine, apply caps and masking seals to all ports. Before disassembling the valve, recheck that these caps and masking seals are fitted completely, and then clean the outside of the assembly. Use a proper bench for working. Spread paper or a rubber mat on the bench, and disassemble the valve on it.

(4) Support the body section carefully when carrying or transferring the control valve. Do not lift by the exposed spool, end cover section etc.

(5) After disassembling and assembling of the component it is desired to carry out various tests (for the relief characteristics, leakage, flow resistance, etc.), but hydraulic test equipment is necessary for these tests. Therefore, even when its disassembling can be carried out technically, do not disassemble such components that cannot be tested, adjusted, and so on. Additionally one should always prepare clean cleaning oil, hydraulic oil, grease, etc. beforehand.

2) TOOLS

Before disassembling the control valve, prepare the following tools beforehand.

Name of tool	Quantity	Size (mm)
Vice mounted on bench (soft jaws)	1 unit	
Hexagon wrench	Each 1 piece	5, 6, 10, 12 and 14
Socket wrench	Each 1 piece	5 and 6
Spanner	Each 1 piece	13, 21 and 30
Rod	1 piece	Less than 10 × 250

3) DISASSEMBLY

(1) Disassembly of spools (pilot type)

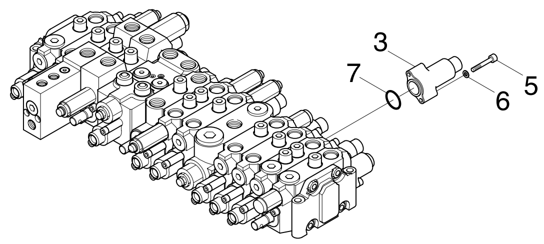
① Loosen hexagon socket head bolts (5) with washer (6).
(Hexagon wrench : 5 mm)

② Remove the pilot cover (3).

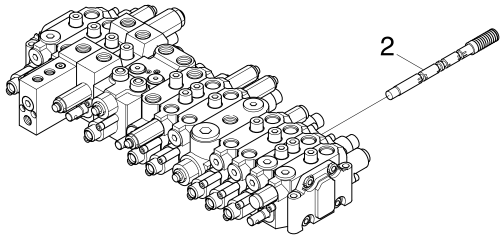
※ Pay attention not to lose the O-ring (7) under the pilot cover.

③ Remove the spool assembly (2) from the body by hand slightly.

※ When extracting each spool from its body, pay attention not to damage the body.
※ When extracting each spool assembly, it must be extracted from spring side only.
※ When any abnormal parts are found, replace it with completely new spool assembly.
※ When disassembled, tag the components for identification so that they can be reassembled correctly.



R5577MCV04



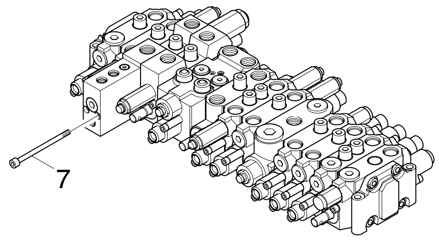
R5577MCV05

(2) Disassembly of holding valve (boom 1)

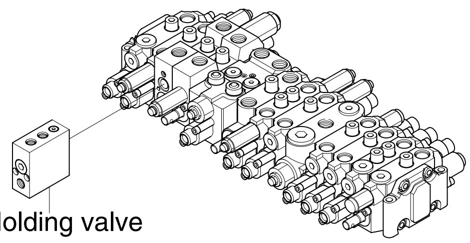
① Loosen hexagon socket head bolts (7).
(Hexagon wrench : 5 mm)

② Remove the holding valve.

※ Pay attention not to lose the O-ring and the poppet under the pilot cover.
※ Pay attention not to damage the "piston A" under pilot cover.
※ When any abnormal parts are found, replace it with completely new holding valve assembly.
※ When disassembled, tag the components for identification so that they can be reassembled correctly.



R5577MCV13



R5577MCV14

(3) Disassembly of the load check valve and the negative relief valve

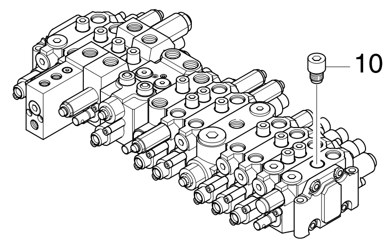
① The load check valve

a. Fix the body to suitable work bench.

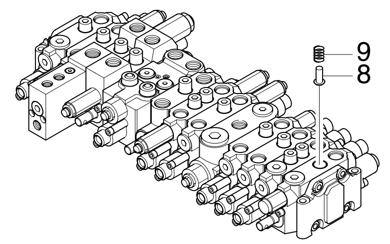
※ Pay attention not to damage the body.

b. Loosen the plug (10)
(Hexagon wrench : 10 mm).

c. Remove the spring (9) and the load check valve (8) with pincers or magnet.



R5577MCV11



R5577MCV12

(4) Disassembly of the main and overload relief valve

① Fix the body to suitable work bench.

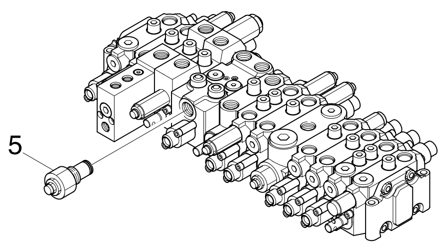
② Remove the main relief valve (5).
(Spanner : 30 mm)

③ Remove the overload relief valve (12).
(Spanner : 22 mm)

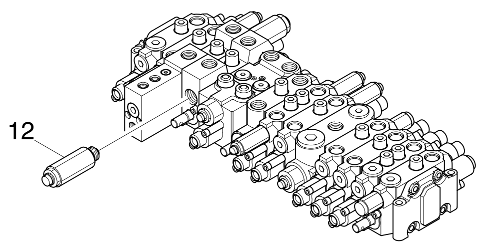
※ When disassembled, tag the relief valve for identification so that they can be reassembled correctly.

※ Pay attention not to damage seat face.

※ When any abnormal parts are found, replace it with completely new relief valve assembly.



R5577MCV09



R5577MCV10

(5) Disassembly of the block assembly

① Fix the body to suitable work bench.

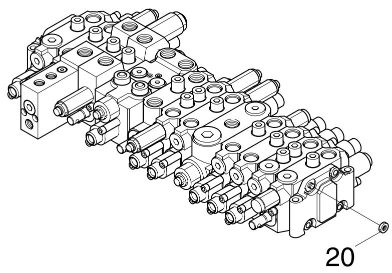
② Remove the nut (20).
(Spanner : 13 ㎜)

※ The work block is assembled by two sets of tie-bolts.

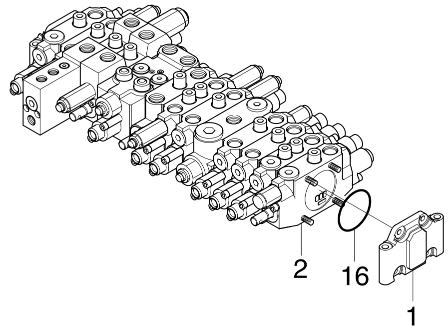
③ Remove the end cover (1) and the work blocks.

※ Do not removed the tie bolt.

※ Pay attention not to lose the O-ring (16).



R5577MCV15



R5577MCV16

(6) Inspection after disassembly

Clean all disassembled parts with clean mineral oil fully, and dry them with compressed air. Then, place them on clean papers or cloths for inspection.

① Control valve

a. Check whole surfaces of all parts for burrs, scratches, notches and other defects.
b. Confirm that seal groove faces of body and block are smooth and free of dust, dent, rust etc.
c. Correct dents and damages and check seat faces within the body, if any, by lapping.
※ Pay careful attention not to leave any lapping agent within the body.
d. Confirm that all sliding and fitting parts can be moved manually and that all grooves and path's are free foreign matter.
e. If any spring is broken or deformed, replace it with new one.
f. When a relief valve does not function properly, repair it, following it's the prescribed disassembly and assembly procedures.
g. Replace all seals and O-rings with new ones.

② Relief valve

a. Confirm that all seat faces at ends of all poppets and seats are free of defects and show uniform and consistent contact faces.
b. Confirm manually that main poppet and seat can slide lightly and smoothly.
c. Confirm that outside face of main poppet and inside face of seat are free from scratches and so on.
d. Confirm that springs are free from breakage, deformation, and wear.
e. Confirm that orifices of main poppet and seat section are not clogged with foreign matter.
f. Replace all O-rings with new ones.
g. When any light damage is found in above inspections, correct it by lapping.
h. When any abnormal part is found, replace it with a completely new relief valve assembly.

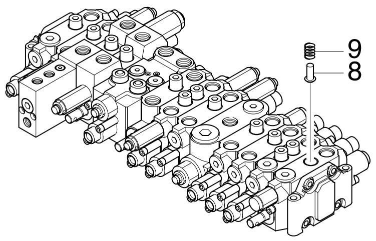
4) ASSEMBLY

(1) General precaution

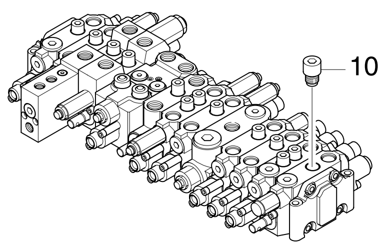
① In this assembly section, explanation only is shown.
For further understanding, please refer to the figures shown in the previous structure & disassembly section.
② Pay close attention to keeping all seals free from handling damage and inspect carefully for damage before using them.
③ Apply clean grease or hydraulic oil to the seal so as to ensure it is fully lubricated before assembly.
④ Do not stretch seals so much as to deform them permanently.
⑤ 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.
⑥ Tighten fitting bolts for all sections with a torque wrench adjusted to the respective tightening torque.
⑦ Do not reuse removed O-rings and seals.

(2) Load check valve

① Assemble the load check valve (8) and spring (9).
② Put O-rings on to plug (10).
③ Tighten plug to the specified torque.
· Hexagon wrench : 8 mm
· Tightening torque : 3.7 kgf · m
(26.7 lbf · ft)



R5577MCV12

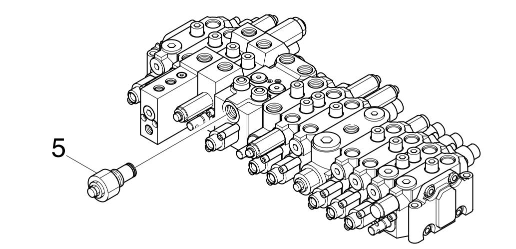


R5577MCV11

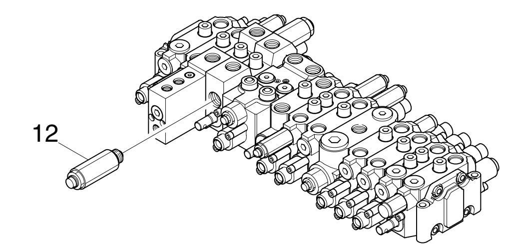
(3) Main relief, port relief valves

① Install the main relief valve (5).
  · Spanner : 30 mm
  · Tightening torque : 6 kgf · m (43.4 lbf · ft)

② Install the over load relief valve (12).
  · Spanner : 22 mm
  · Tightening torque : 4 kgf · m (28.9 lbf · ft)



R5577MCV09

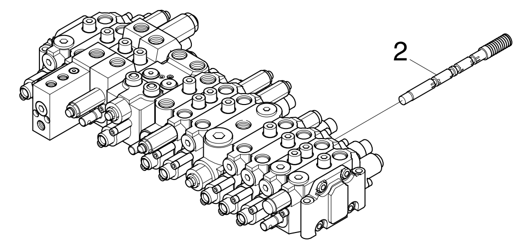


R5577MCV10

(4) Main spools

① Carefully insert the previously assembled spool assemblies into their respective bores within of body.

※ Fit spool assemblies into body carefully and slowly. Do not under any circumstances push them forcibly in.

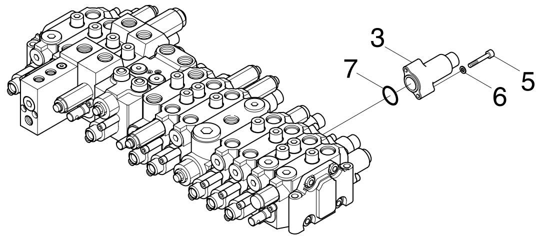


R5577MCV05

(5) Covers of pilot type

① Fit spool covers (3) tighten the hexagonal socket head bolts (5) to the specified torque.
  · Hexagon wrench : 5 mm
  · Tightening torque : 1~1.1 kgf · m (7.2~7.9 lbf · ft)

※ Confirm that O-rings (7) have been fitted.



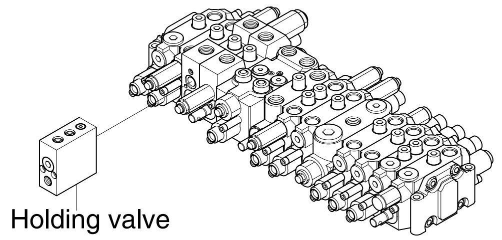
R5577MCV04

(6) Holding valve

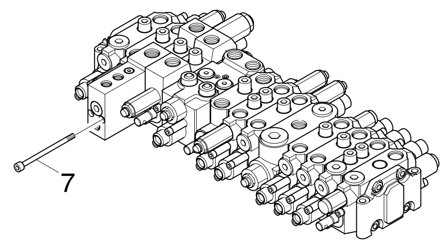
① Fit the holding valve to the body and tighten hexagon socket head bolt (7) to specified torque.

· Hexagon wrench : 5 ㎜

· Tightening torque : 1.1 kgf · m(7.9 lbf · ft)



R5577MCV14



R5577MCV13

GROUP 5 SWING DEVICE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

13031GE18

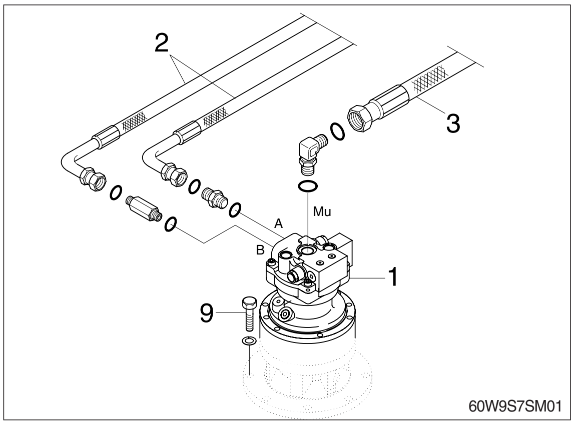
(1) Lower the work equipment to the ground and stop the engine.

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

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

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

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



60W9S7SM01

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

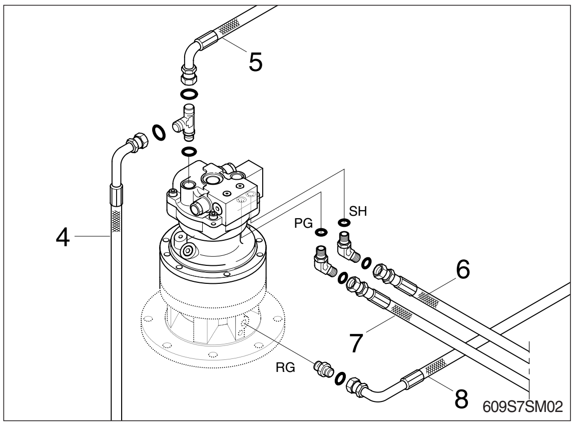
(5) Disconnect pilot line hoses (4, 5, 6, 7, 8).

(6) Sling the swing motor assembly (1) and remove the swing motor mounting bolts (9).

※ Motor device weight : 23 kg (51 lb)

(7) Remove the swing motor assembly.

※ When removing the swing motor assembly, check that all the piping have been disconnected.



609S7SM02

2) INSTALL

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

(2) Bleed the air from the swing motor.

① Remove the air vent plug.

② Pour in hydraulic oil until it overflows from the port.

③ Tighten plug lightly.

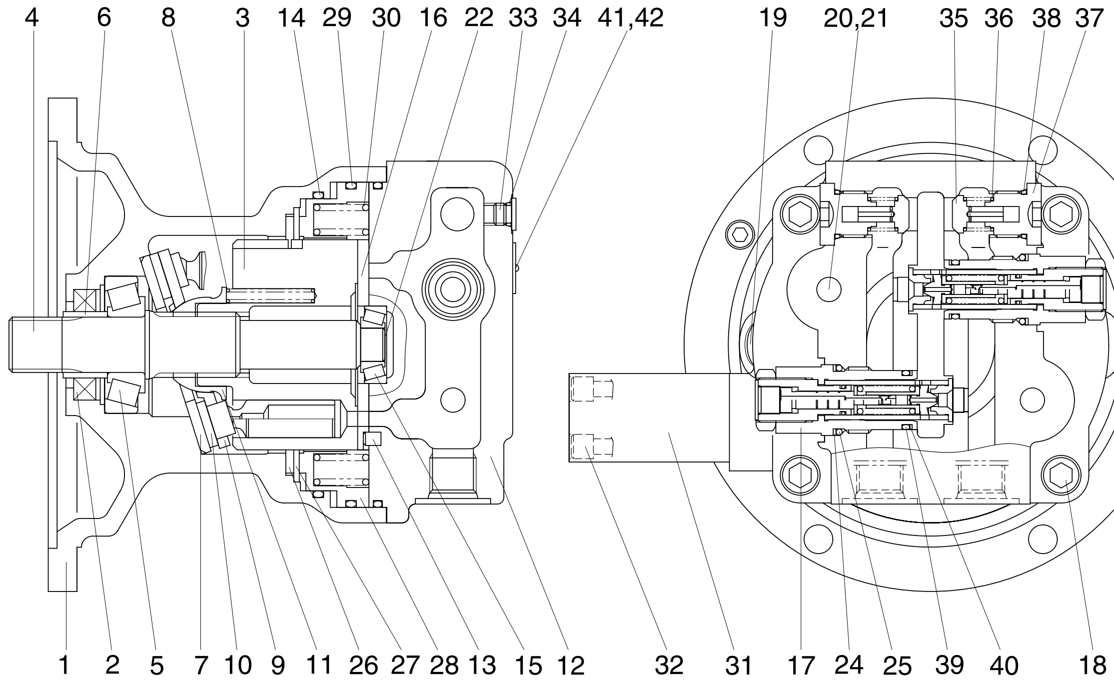
④ Start the engine, run at low idling and check oil come out from plug.

⑤ Tighten plug fully.

(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



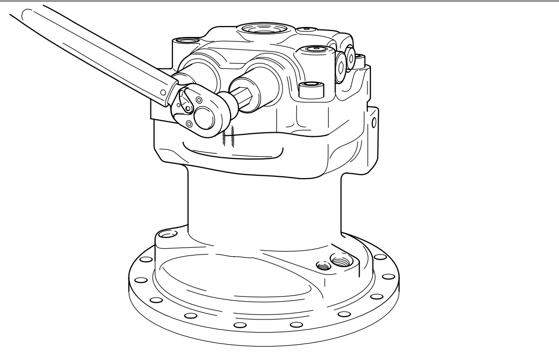
555K2SM03

1	Body	15	Taper bearing	29	O-ring
2	Oil seal	16	Valve plate	30	Spring
3	Cylinder block	17	Relief valve assy	31	Time delay valve
4	Shaft	18	Socket bolt	32	Socket bolt
5	Taper bearing	19	Plug	33	Plug
6	Bushing	20	Plug	34	O-ring
7	Shoe plate	21	O-ring	35	Valve
8	Spring	22	Shim	36	Spring
9	Set plate	23	Plug	37	Plug
10	Piston shoe assy	24	Back up ring	38	O-ring
11	Ball guide	25	O-ring	39	O-ring
12	Rear cover	26	Friction plate	40	Back up ring
13	Pin	27	Plate	41	Name plate
14	O-ring	28	Parking piston	42	Rivet

2) DISASSEMBLY

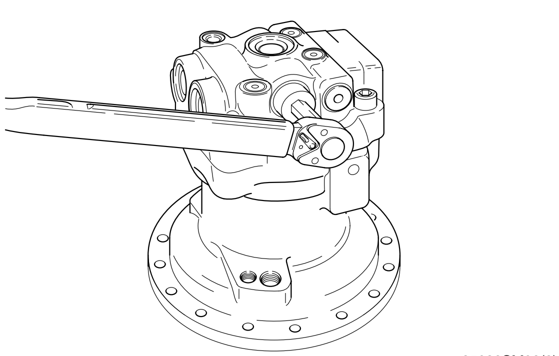
(1) Removal of relief valve assembly
Remove cap of relief valve assembly (17) with 14 mm hexagonal wrench.

※ Assemble removed relief valve assembly (17) to original state when reassembling.



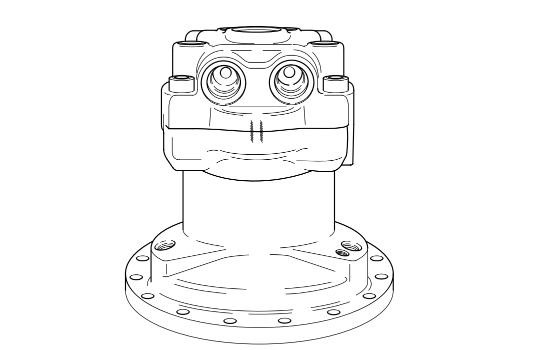
25038SM02(1)

(2) Removal of make up valve and bypass valve assembly
Loosen plug (37) with 14 mm hexagonal wrench, and remove check valve (35) and spring (36).



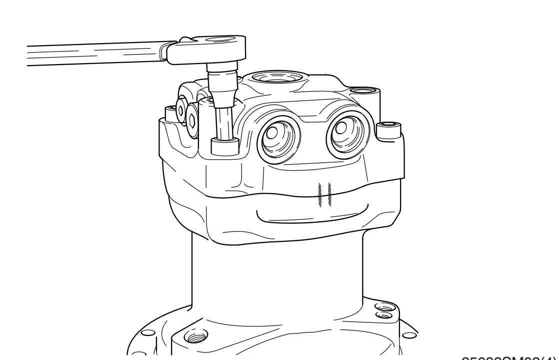
25038SM02(2)

(3) Marking at swing motor
Before disassembling motor, make a matching mark between cover (12) and housing (1) for easy reassembling.



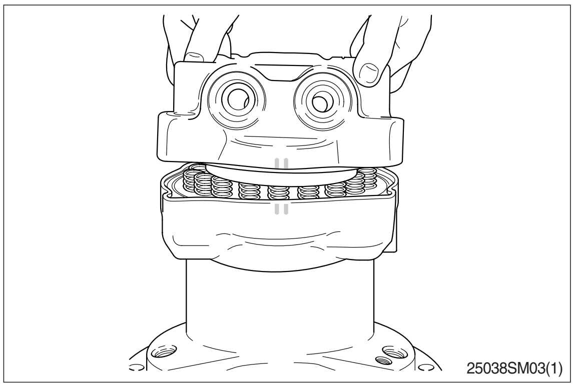
25038SM02(3)

(4) Remove mounting bolts of cover
Loosen hexagon socket bolt (18) with 12 mm hexagonal wrench.



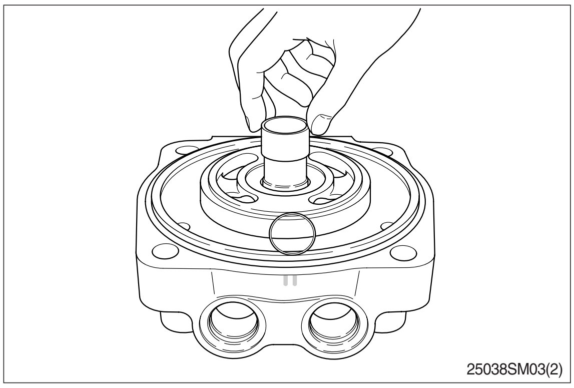
25038SM02(4)

(5) Removal of cover assembly
Place shaft of motor assembly to downward and take cover (12) out.



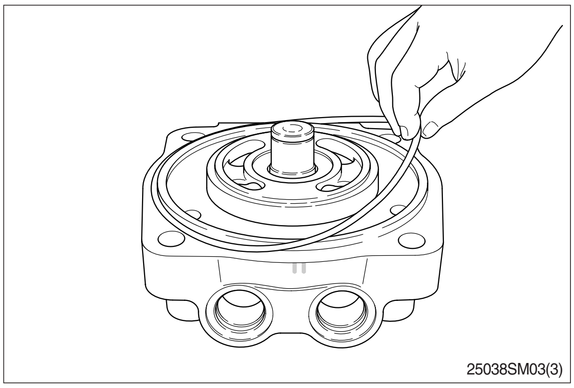
25038SM03(1)

(6) Remove shim (22) remove inner race of needle bearing (15) by bearing puller.



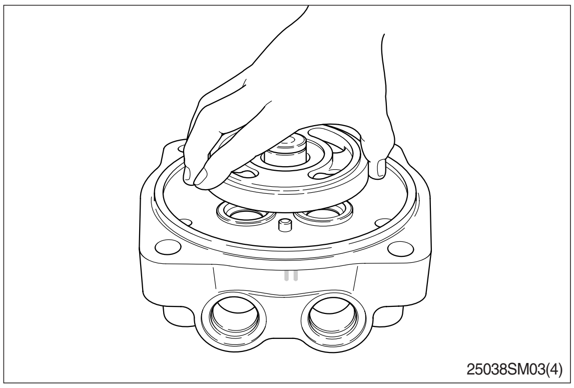
25038SM03(2)

(7) Remove O-ring (29) from cover.



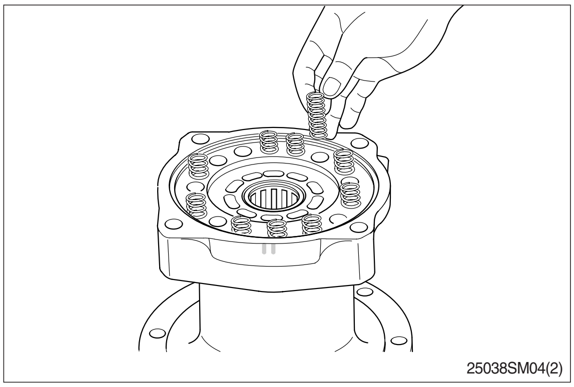
25038SM03(3)

(8) Remove balance plate
Valve plate (16) is adhered on end surface of cylinder (3) by oil viscosity. Take off balance plate (16) with hands.
Assembling method of balance plate (16) depends on cover (12).
(Band groove and round groove of high · low pressure transmission area)
Before removing, check and record location of balance plate (16) to prevent misassembling.

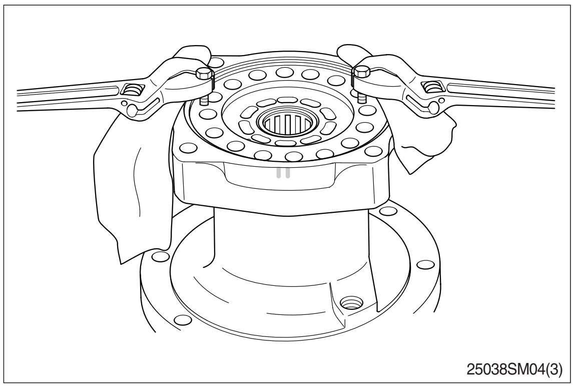


25038SM03(4)

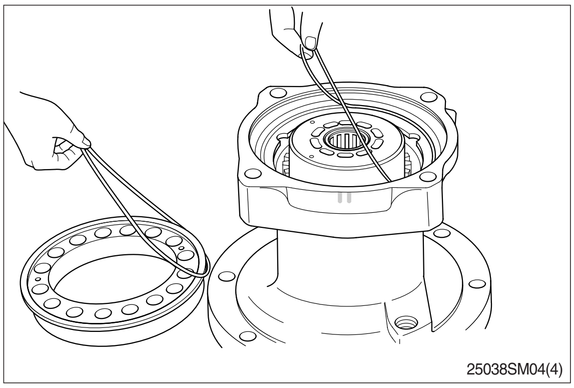
(9) Removal of spring (30, brake area)
Remove spring (30) from piston (28).
Check and record original position of each spring (30) for correct assembling.


25038SM04(2)

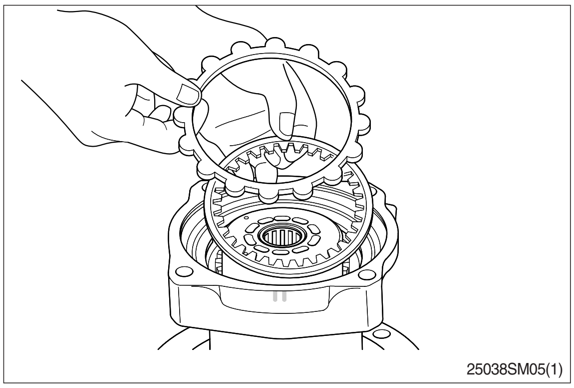
(10) Removal of brake piston
When removing piston (28) from housing (1), there is a sliding resistance against tightening of O-rings (14,29). Use tap hole on piston (28) as shown in the picture.


25038SM04(3)

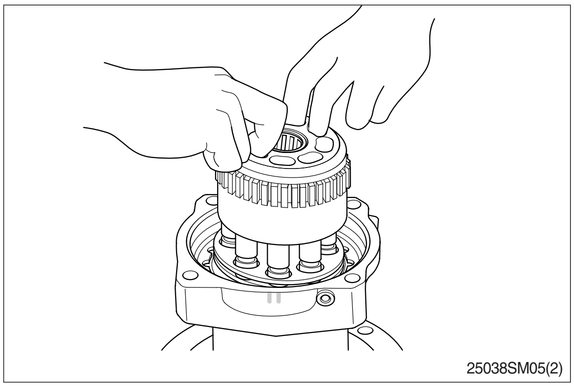
(11) Remove O-rings (14, 29) from piston (28) and housing (1).


25038SM04(4)

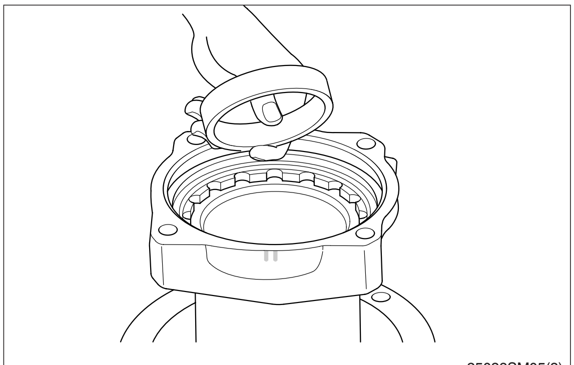
(12) Remove friction plate (26) and lining plate (27) from housing (1).


25038SM05(1)

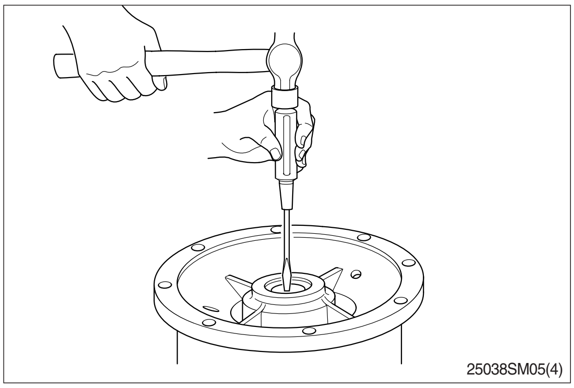
(13) Removal of cylinder assembly
Holding end of cylinder assembly (3) with hand, draw out cylinder assembly from housing.
※ Oil seal (2) and outer race of taper roller bearing (15) are left inside of housing.
※ End surface of cylinder (3) is sliding face . So, protect the surface with a scrap of cloth against damage.
※ Make a matching mark on piston hole of cylinder (3) and piston assembly (10) to fit piston into the same hole when reassembling.


25038SM05(2)

(14) Separate outer race of taper roller bearing (5) from housing.

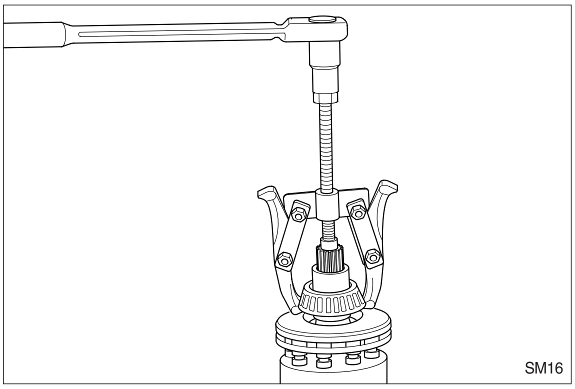

25038SM05(3)

(15) Removal of oil seal
Remove oil seal (2) from housing (1) with driver and hammer.
※ Do not reuse oil seal after removal.

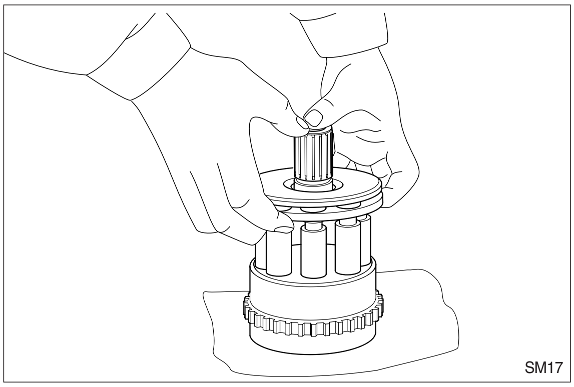

25038SM05(4)

(16) Disassembly of cylinder assembly

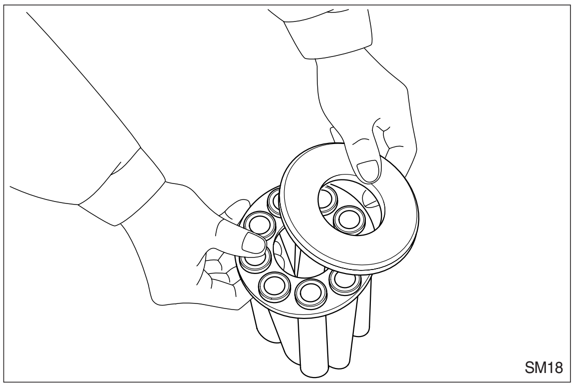
① Removal of inner race of taper roller bearing (5).
Lift out cylinder block (3) with 2 inner race of roller bearing (5) by applying gear puller at the end of spline in the cylinder.


SM16

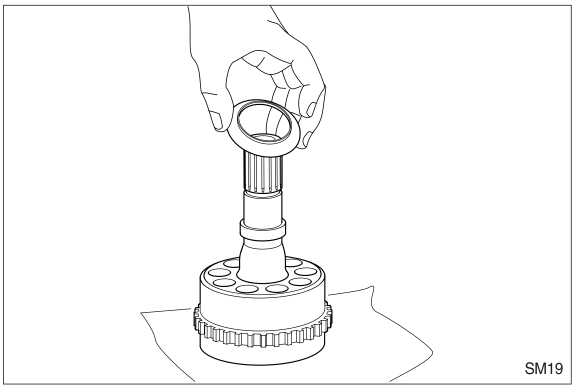
② Separate shoe plate (7), piston assembly (10), set plate (9) from cylinder block (3).


SM17

③ Get shoe plate (7) slide on sliding face of piston assembly (10) and remove it.
※ Be cautious not to damage on sliding face of cam plate.


SM18

④ Remove ball guide (11) from cylinder block (3).


SM19

This completes disassembly.

3) ASSEMBLY

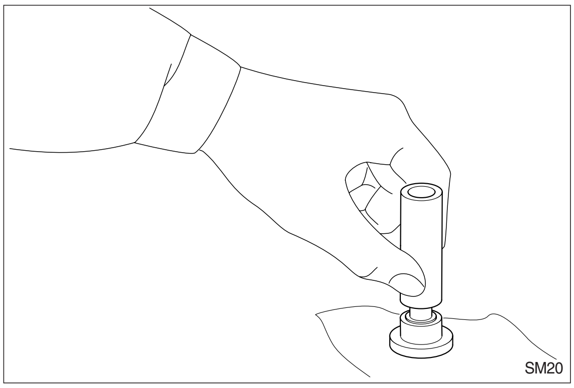
(1) Preparation

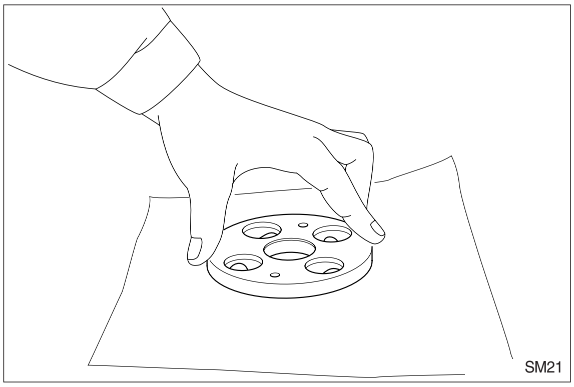
Before reassembling, perform below procedure.

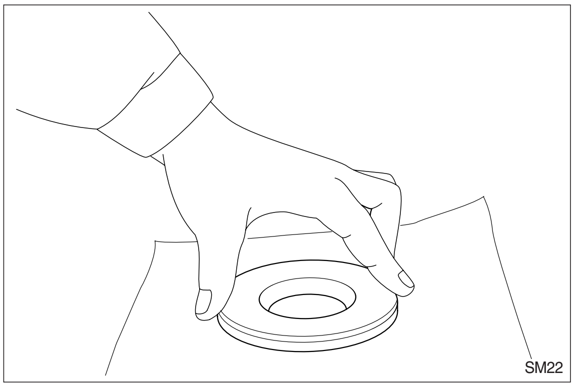
① Check each part for damage caused by using or disassembling. If damaged, eliminate damage by grinding with proper sandpaper, wash them with cleaning oil and dry with compressed air.

② Replace seal with new one.

③ Grind sliding face of piston assembly (10), balance plate (16) and shoe plate (7) with sandpaper #2000.





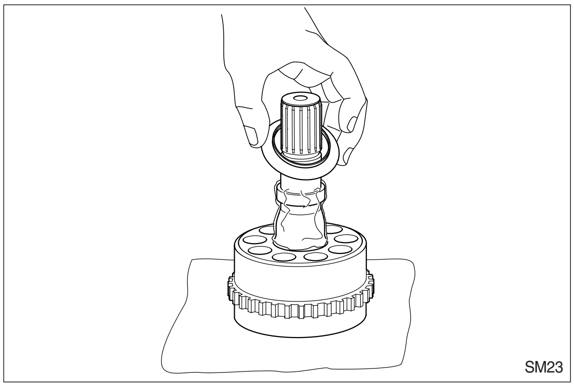


④ When assembling, lubricate with specified clean hydraulic oil.

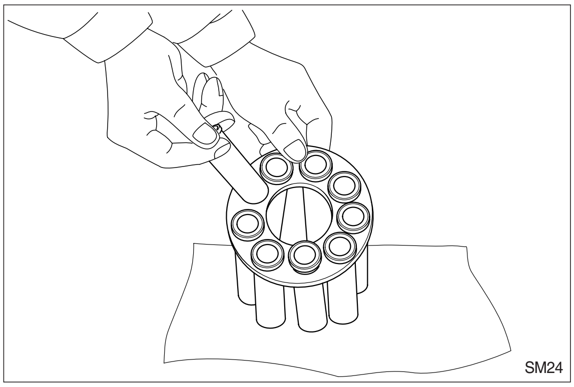
⑤ When assembling piston assembly (10) to piston hole of cylinder block (3), check matching mark between them.

(2) Cylinder assembly

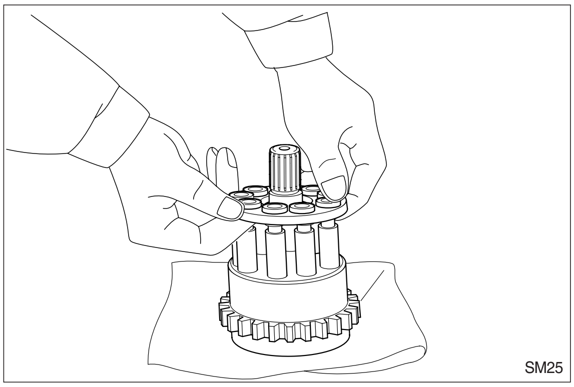
① Lubricate grease on round area (Contacting area withball guide (11)) of cylinder block (3) and assemble spring (4).



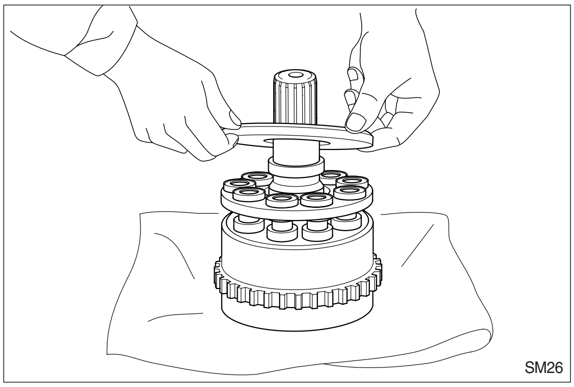
② Insert piston assembly (10) in hole of set plate (9).



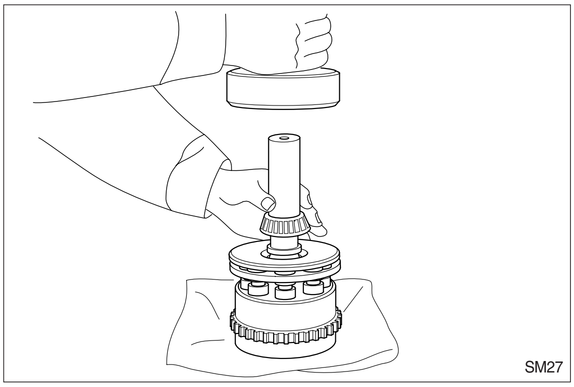
③ Assemble piston assembly (10) and set plate (9) to cylinder block (3). When assembling, check matching mark between them. Before assembling, lubricate specified hydraulic oil in piston hole of cylinder block (3).



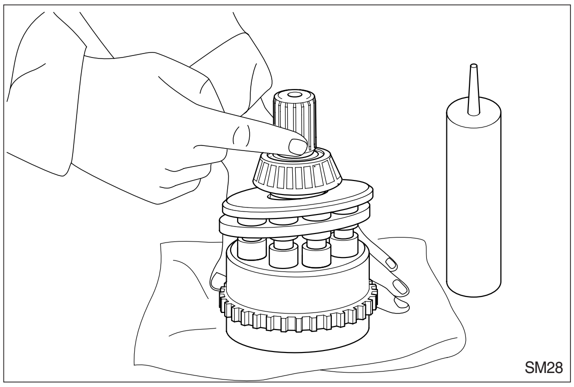
④ Lubricate specified hydraulic oil on shoe sliding face of piston assembly (10) and assemble shoe plate (7).



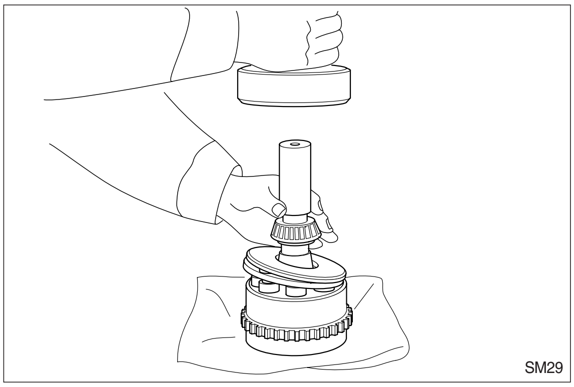
⑤ Assemble inner race of taper roller bearing (5) to cylinder block (3).



⑥ Apply loctite to bearing mounting area of inner race of cylinder block (3) lightly.



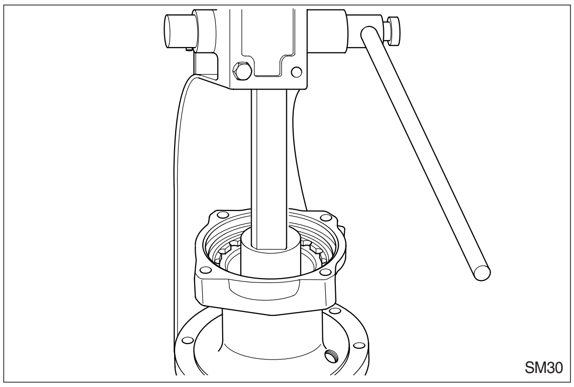
⑦ Assemble bushing (6) to cylinder block (3).



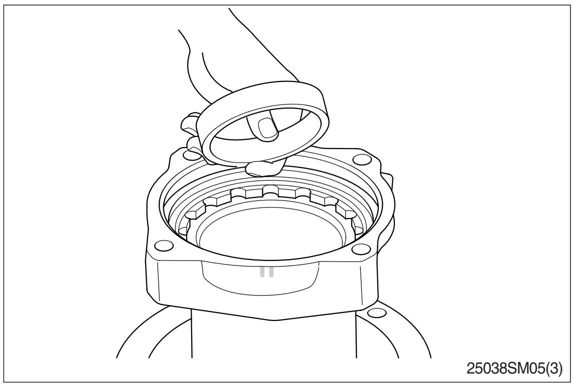
(3) Oil seal

Apply three bond of white color on outer surface of oil seal (2) and assemble and insert it.

※ Before assembling, lubricate lip of oil seal with grease.



(4) Assemble outer race of taper roller bearing (5) to motor housing (1).

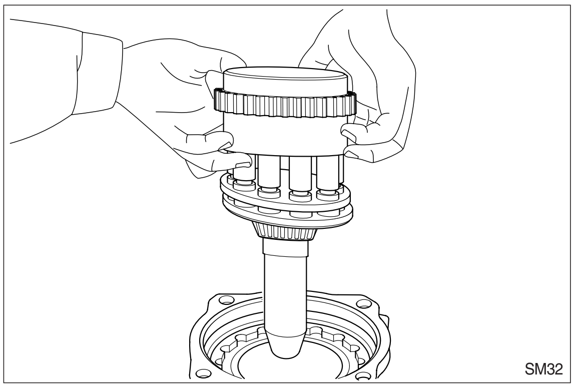


25038SM05(3)

(5) Cylinder assembly

Hold end of cylinder assembly(3) with hands and assemble cylinder assembly to housing(1). Be careful to prevent damage of seal by spline of shaft.

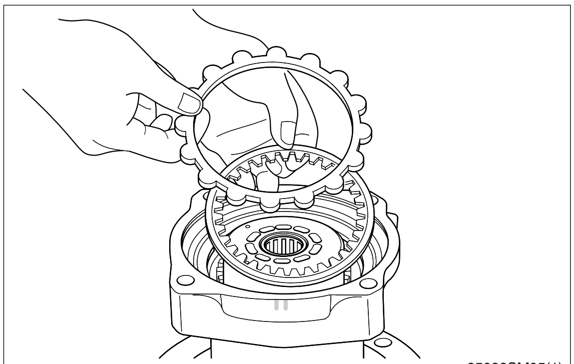
※ When assemble cylinder assembly, spline shaft of cylinder is protruded from end of housing, therefore put pads with length 30~50mm under bottom of housing.



SM32

(6) Assemble friction plate (26) and lining plate (27).

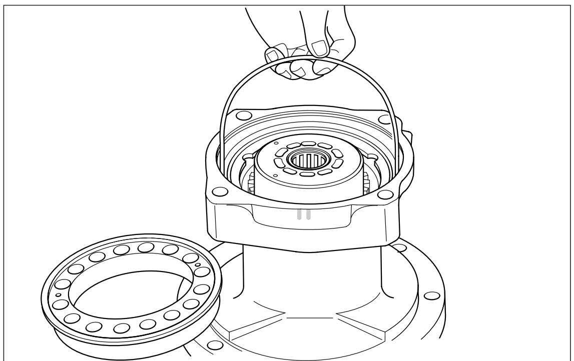
※ Lubricate specified hydraulic oil on each side.



25038SM05(1)

(7) Insert O-rings (14,29) into housing (1) and piston (28).

※ Lubricate O-ring with grease.

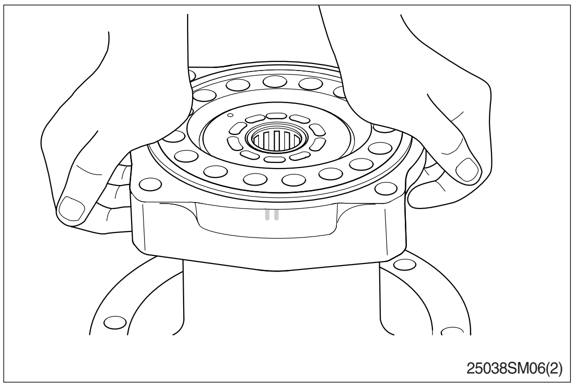


25038SM06(1)

(8) Brake piston

Lubricate specified hydraulic oil on outer sliding face of piston (28) and assemble brake piston to housing (1).

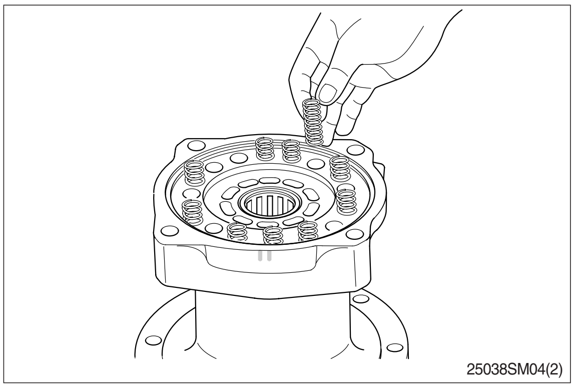
※ It is too tight to assemble piston (10) because O-rings (14,29) are fitted, therefore it is recommended to push piston (28) horizontally by hands at once.



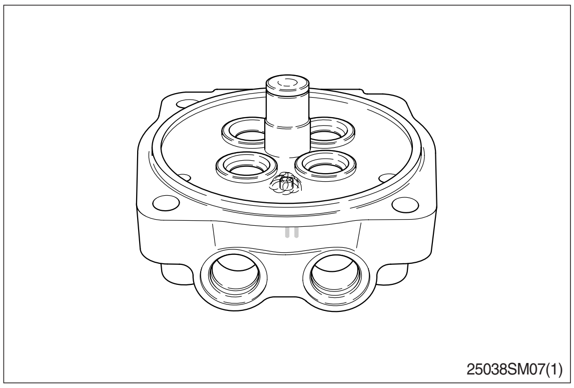
(9) Spring (30, brake unit)

Assemble spring (30) to piston (28) of brake unit.

※ Insert spring (30) into original position.



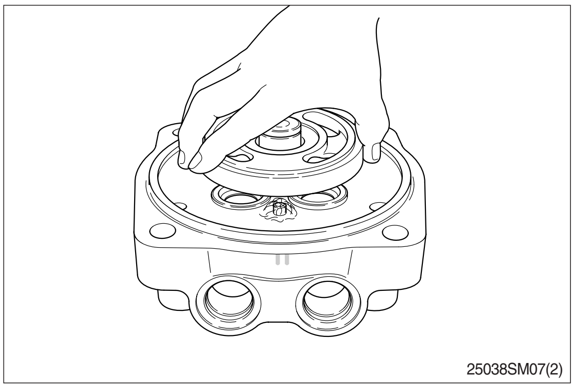
(10) Lubricate locating pin for antirotation of valve plate (16) of cover (12) with grease sufficiently and install locating pin to housing.



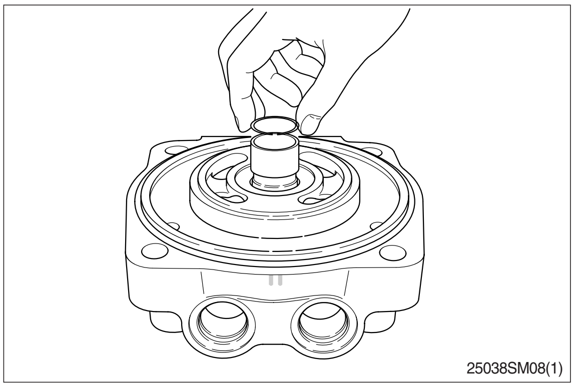
(11) Balance plate

Assemble valve plate (16) to cover (12).

※ Be cautious of assembling direction.

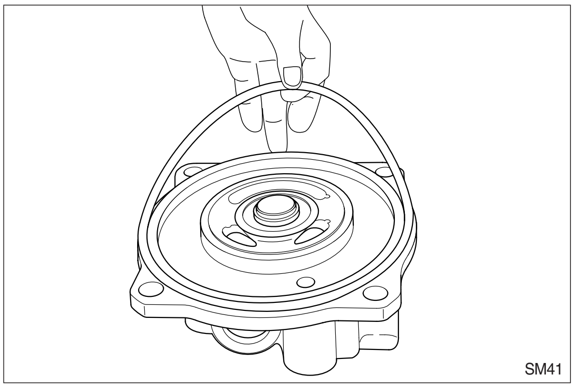


(12) Assemble inner race of needle bearing (15) and shim (22) to cover (12).

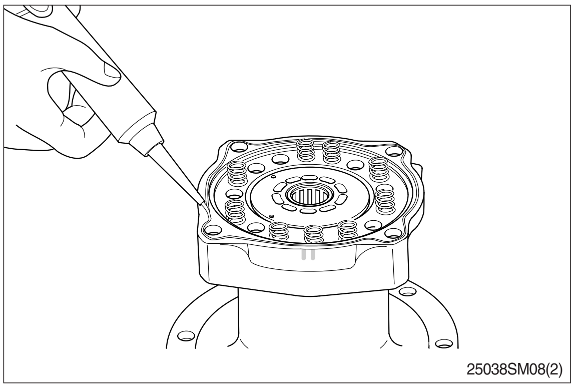


(13) Assemble O-ring (29) to cover (12).

※ Lubricate O-ring with grease.



(14) Apply three bond of white color to distinguish oil leakage from remaining oil in bolt hole of cover (12).

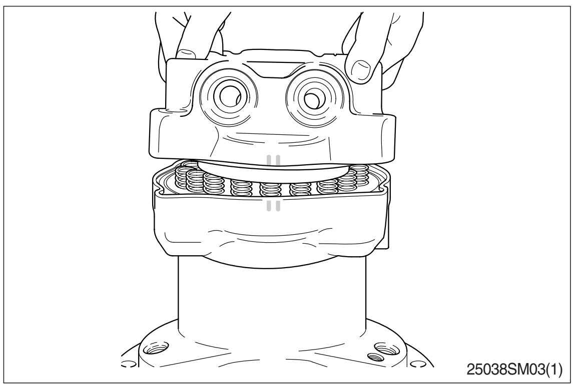


(15) Cover

Assemble cover (12) and valve plate (16) to housing (1) lightly, holding them up with hands.

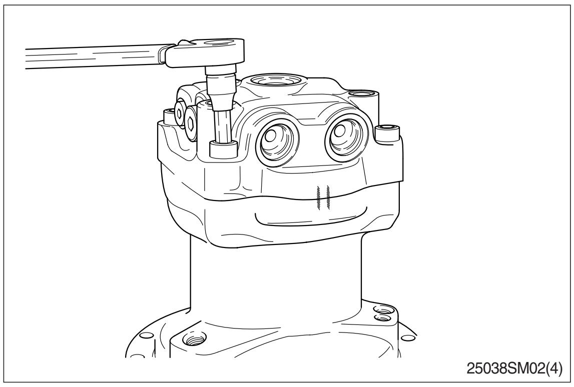
※ When assembling, be careful not to detach valve plate (16) and bushing (6) from cover (12).

※ Fit matching marks on housing (1) and cover (12) made before disassembling.



(16) Tighten cover (12) and housing (1) with 12 mm hexagonal socket bolt (18).

- Tightening torque : 16 kgf · m (116 lbf · ft)

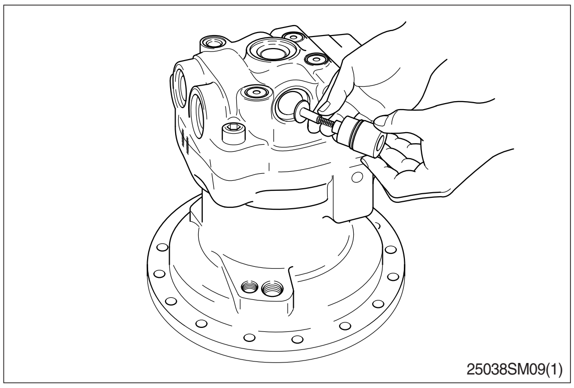


25038SM02(4)

(17) Make up valve

Assemble check(35) and spring(36) to cover(12) and tighten plug(37) with 14 mm hexagonal socket bolt.

- Tightening torque : 14 kgf · m (101 lbf · ft)



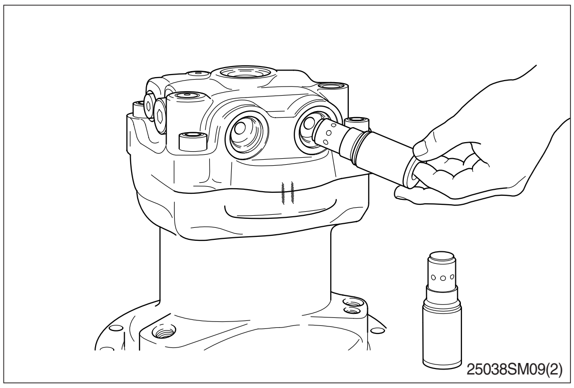
25038SM09(1)

(18) Relief assembly

Assemble relief valve assembly(17) to cover(12) with 14mm hexagonal socket bolt.

- Tightening torque : 8 kgf · m (58 lbf · ft)

※ Be cautious of assembling method.



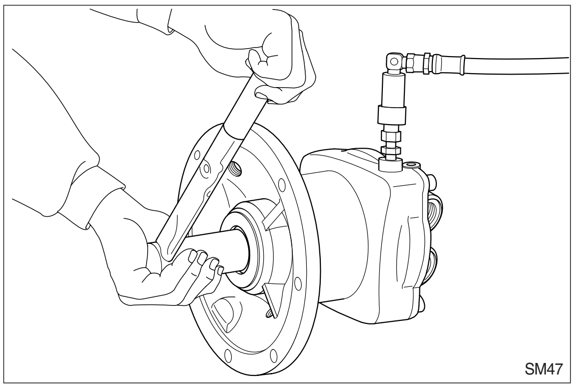
25038SM09(2)

(19) Check of assembly

Load pilot pressure of 20 kgf/cm^2 to brake release port after opening inlet and outlet port.

Check if output shaft is rotated smoothly around torque of 0.5~1 kgf · m.

If not rotated, disassemble and check.



SM47

This completes assembly.

3. REMOVAL AND INSTALL OF REDUCTION GEAR

1) REMOVAL

(1) Remove the swing motor assembly.
For details, see removal of swing motor assembly.

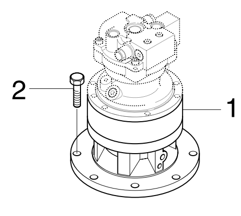
(2) Sling reduction gear assembly (1) and remove mounting bolts (2).

(3) Remove the reduction gear assembly.
· Reduction gear device weight : 45 kg (99 lb)

13031GE18

2) INSTALL

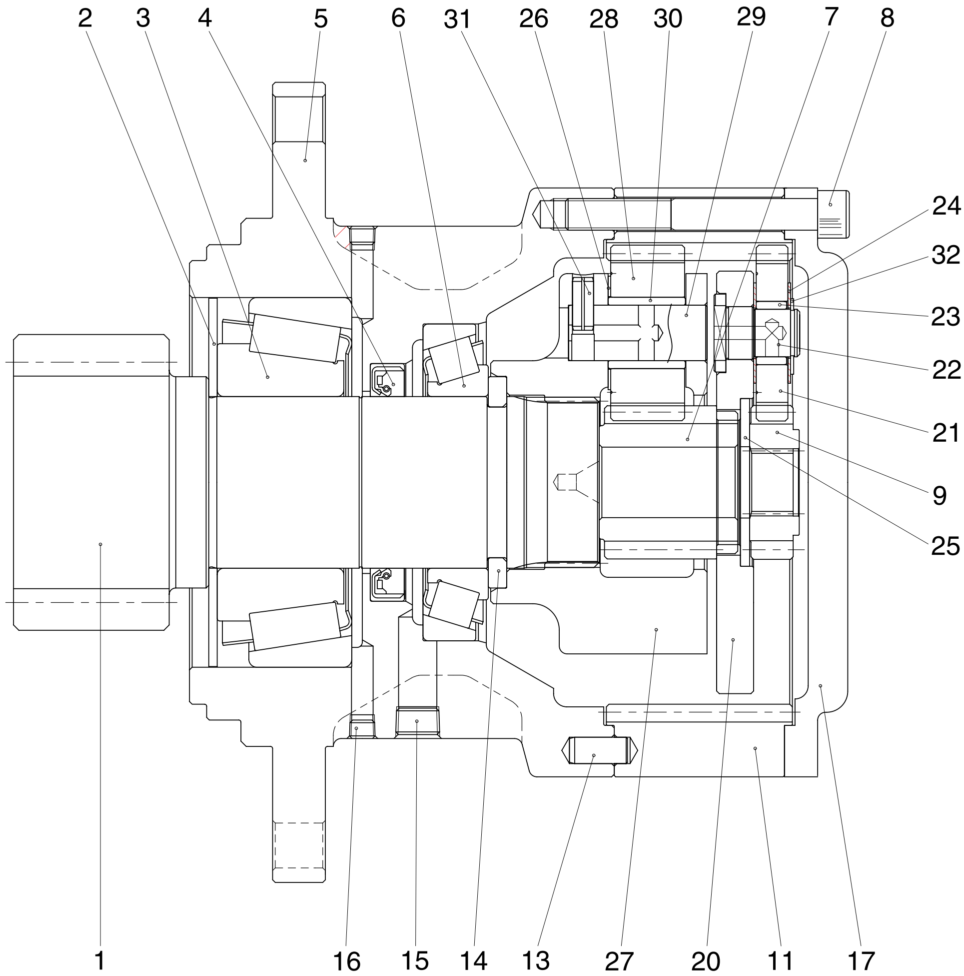
(1) Carry out installation in the reverse order to removal.
· Tightening torque : 10.5 kgf · m (76 lbf · ft)



R5577SM03

4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE

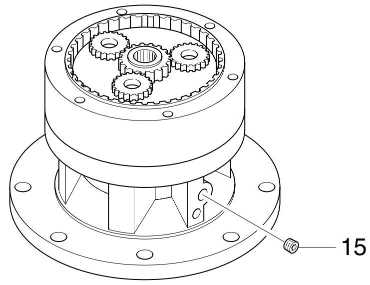


55W72SM02

1	Shaft	12	Carrier assy 2	23	Bushing 1
2	Bearing cover	13	Dowel pin	24	Thrust washer 1
3	Taper roller bearing	14	Collar	25	Thrust washer 3
4	Case	15	Plug	26	Thrust washer 2
5	Oil seal	16	Plug	27	Carrier assy 2
6	Taper roller bearing	17	Cover	28	Planet gear 2
7	Sun gear 2	18	Pipe	29	Pin 2
8	Socket bolt	19	Level gauge	30	Bushing 2
9	Sun gear 1	20	Carrier assy 1	31	Spring pin
10	Carrier assy 1	21	Planet gear 1	32	Snap ring
11	Ring gear	22	Pin 1	33	Thrust washer 4

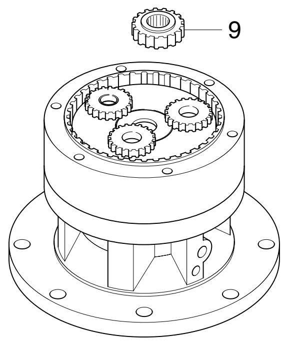
2) DISASSEMBLY

(1) Remove the plug (15) and drain out gear oil.



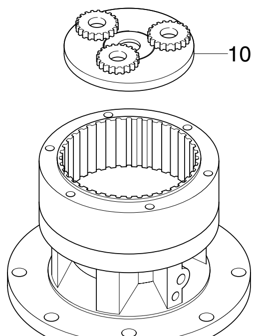
R5577SM04

(2) Remove the No.1 sun gear (9).



R5577SM05

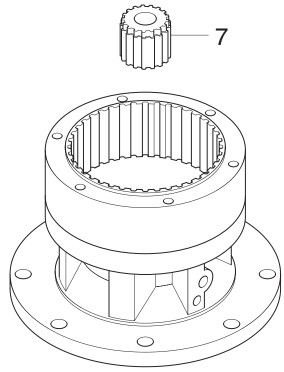
(3) Remove the No.1 carrier sub-assembly (10) using the jig.



R5577SM06

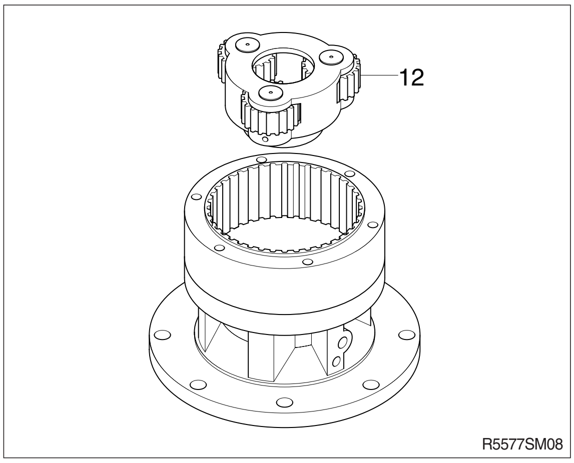
(4) Remove the No.2 sun gear (7).

※ Pay attention to ensure the gear is not damaged during disassembling.

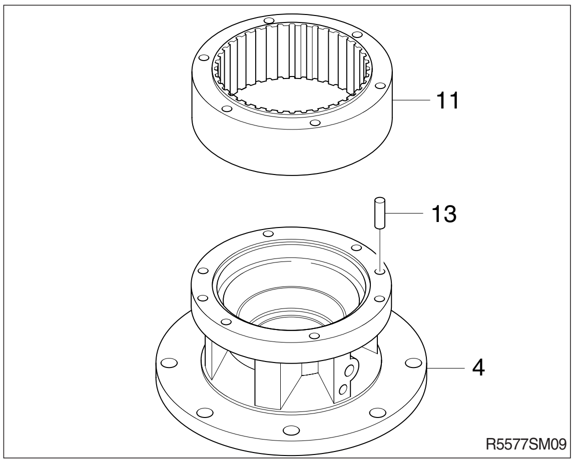


R5577SM07

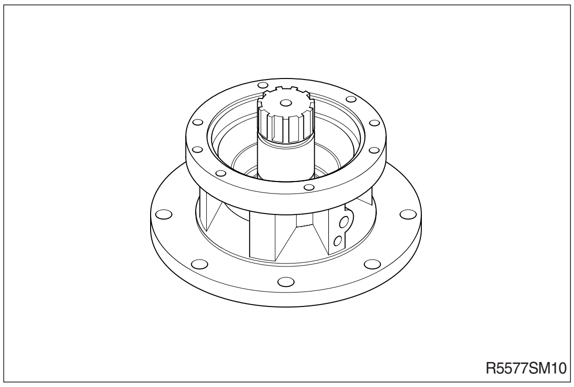
(5) Remove the No.2 carrier sub assembly (12).



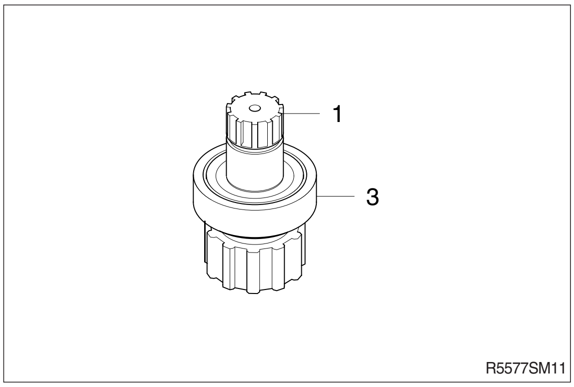
(6) Remove the ring gear by the removal groove between the ring gear (11) and casing (4) by using jig.
Full out the knock pin (13).
Do not need to remove the knock pin (13) if it is not worn or damaged.



(7) Put it on the working table with the drive shaft up.

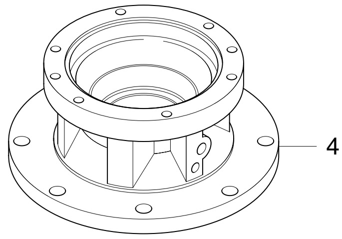


(8) Disassemble the drive shaft (1) with bearing (3) by using jig.



3) ASSEMBLING SWING REDUCTION GEAR

(1) Place the case (4) on the reversing machine having the flange side of the case up.

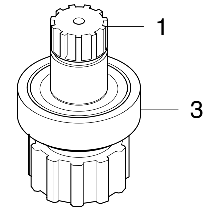


R5577SM12

(2) Install shaft assembly (1) into case (4).

※ Be sure to clean the case before install, using washing machine with the temperature of 80˚C

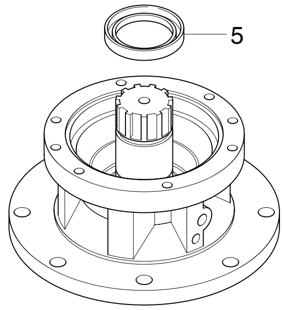
※ Do not install shaft assembly by force.



R5577SM11

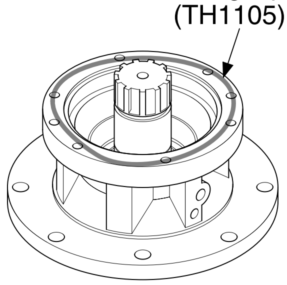
(3) Reverse case and press to insert oil seal (5) by using pressing jig after spreading grease oil around the outside ring of the seal and bearing.
Coat grease oil slightly on the lip surface to prevent any scratch when installing.

※ Be sure to check by eye that the oil seal is seated completely after being installed.



R5577SM13

(4) Clean the assembling surface of case and spread packing liquid (TH1105) as shown in figure.

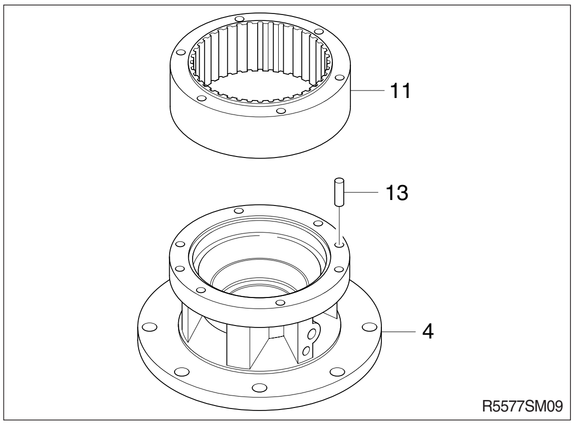


R5577SM14

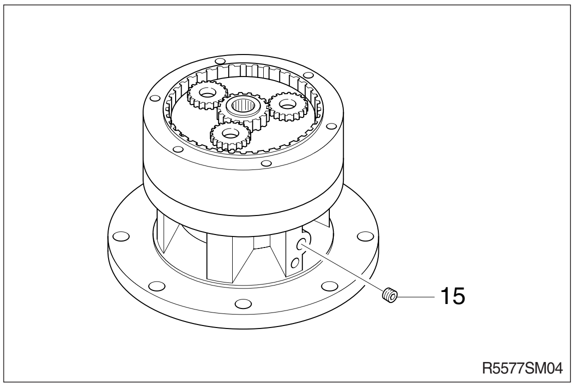
(5) Place ring gear (11) on the case by matching it with knock pin (13) hole.

(6) Insert 2 knock pins (13) by using jig.

※ Be sure to check the hole location of oil gage before inserting.

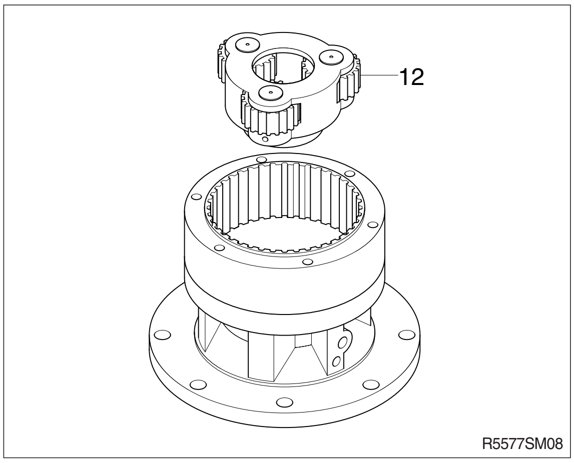


(7) Screw drain plug into drain plug (15) after winding sealing tape.



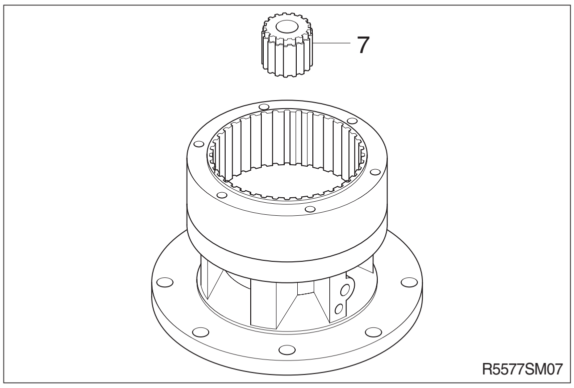
(8) Mount No.2 carrier assembly (12) in the case sub assembly and install bolts into 2 TAP holes (M6) as shown in figure.

※ Turn the carrier slowly by hand to adjust the matching holes when assembling.



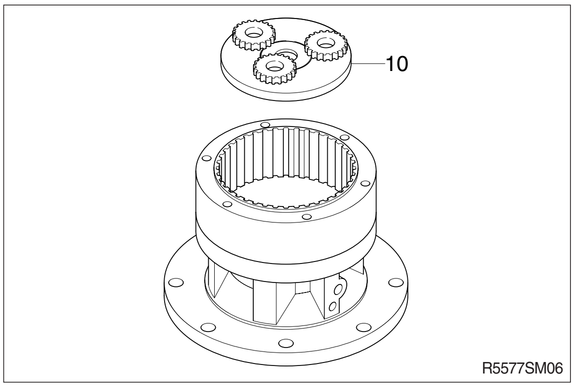
(9) Install No.2 sun gear (7).

※ Be sure to check the direction of sun gear (7) when assembling.

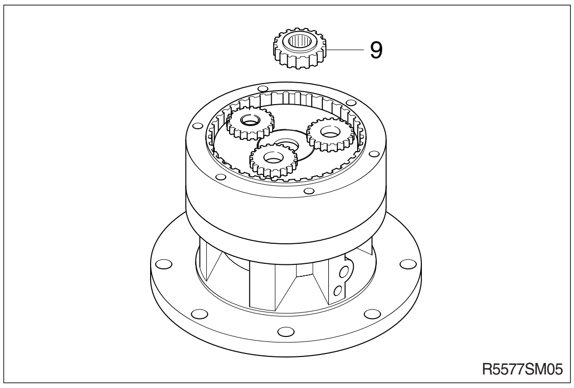


(10) Mount No.1 carrier assembly (10) in the case sub assembly and install bolts into 2 TAP holes (M6) as shown in figure.

※ Turn the carrier slowly by hand to adjust the matching holes when assembling.



(11) Assemble No.1 sun gear (9).



GROUP 6 TRAVEL DEVICE (TYPE 1)

1. REMOVAL AND INSTALL

1) REMOVAL

(1) Swing the work equipment 90˚ and lower it completely to the ground.

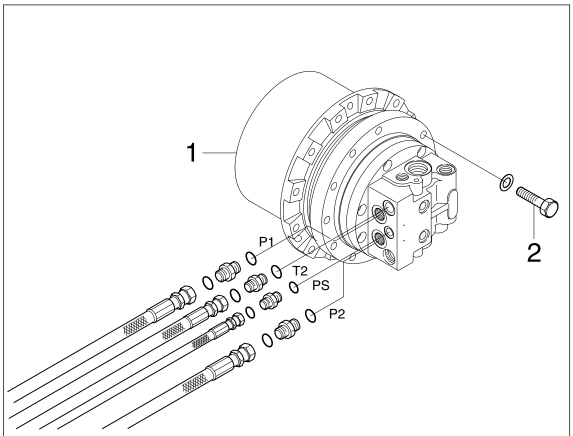
(2) Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

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

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

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

13031GE18



555K7TM01

(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 : 80 kg (180 lb)

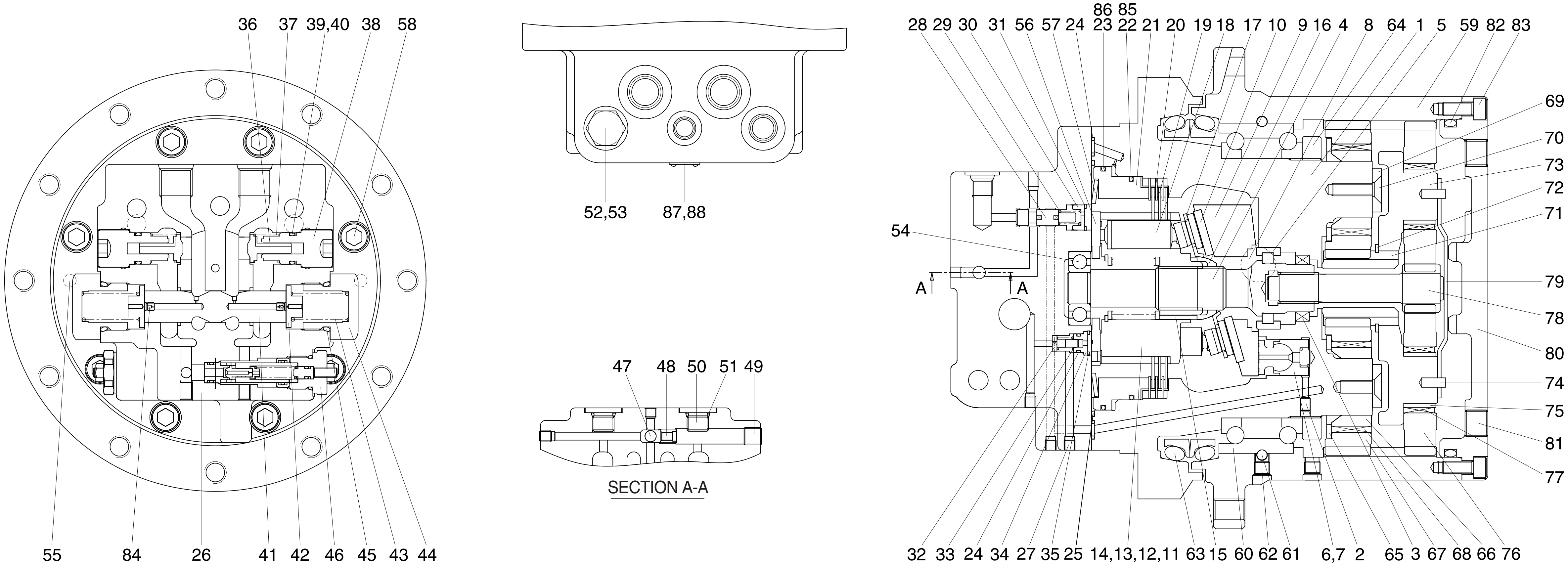
2) INSTALL

(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) STRUCTURE



R5572TM10

1 Shaft casing
2 Expand
3 Oil seal
4 Shaft
5 Bearing
6 Swash piston
7 Spring
8 Swash steel ball
9 Swash plate
10 Shoe plate
11 Cylinder block
12 Spring seat
13 Spring
14 Snap ring
15 Pin
16 Ball guide
17 Set plate
18 Piston
19 Friction plate
20 Parking plate
21 Parking piston
22 O-ring
23 O-ring
24 O-ring
25 O-ring
26 Valve casing
27 Plug
28 Spool
29 Spring
30 Stopper
31 Snap ring
32 Check
33 Spring
34 Seat
35 Snap ring
36 Check
37 Spring
38 Plug
39 O-ring
40 Back up ring
41 Main spool
42 Spring seat
43 Spring
44 Plug
45 O-ring
46 Relief valve assembly
47 Steel ball
48 Check seat
49 Plug
50 Plug
51 O-ring
52 Plug
53 O-ring
54 Ball bearing
55 Pin
56 Valve plate
57 Spring
58 Wrench bolt
59 Ring gear
60 Angular bearing
61 Steel ball
62 Plug
63 Floating seal
64 Nut
65 Washer
66 Collar
67 Planetary gear (A)
68 Needle bearing
69 Plate
70 Flat head bolt
71 Sun gear
72 Snap ring
73 Carrier
74 Spring pin
75 Collar
76 Planetary gear (B)
77 Needle bearing
78 Drive gear
79 Thrust plate
80 Ring gear cover
81 Plug
82 O-ring
83 Wrench bolt
84 Orifice
85 Back up ring
86 Back up ring
87 Name plate
88 Rivet

2. DISASSEMBLY

1) GENERAL PRECAUTIONS

(1) Before disassembling the travel motors, 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 as followings 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) TOOLS AND TIGHTENING TORQUE

(1) Tools

Name of tools	Size	Name of applied parts
Hexagonal L-wrench	2.5	Orifice (84)
	4	Plug (27)
	6	Plug (49), wrench bolt (70, 83)
	8	Plug (81)
	-	Plug (38, 52, 50)
Socket wrench / spanner	27	Plug (44), Relief valve assembly (46)
Snap-ring plier (for holes, axis)		Snap ring (14, 31, 35, 72)
Solder hammer		Bearing (5), Pin (55, 74), Oil seal (3)
Torque wrench		Size : 500, 3000
Jig for assembling oil seal		Oil seal (3)
Induction heating apparatus for bearing		Bearing (5)

(2) Tightening torque

No.	Name	Size	Torque
			kgf · m
27	Plug	NPT 1/16	0.7~1.1
38	Plug	M24	5
46	Orifice	M27	17~19
49	Plug	PT 1/4	5
58	Wrench bolt	M12×35L	10
81	Plug	PT 3/8	8.5
70, 83	Wrench bolt	M8×20L	10
84	Orifice	M5	0.7

3. DISASSEMBLY

1) GENERAL PRECAUTIONS

(1) Select a clean place for disassembling.
Spread a rubber plate on a working table in order to prohibit the damage of parts.

(2) Clean a reduction gear and a motor part, washing out dirt and unnecessary substances.

(3) Without any damage of O-ring, oil seal, the adhered surface of other seals, a gear, a pin, the adhered surface of other bearings, and the surface of moisturized copper, treat each parts.

(4) Numbers written in the parenthesis ( ), next to the name of a part represent the item numbers of a previous page.

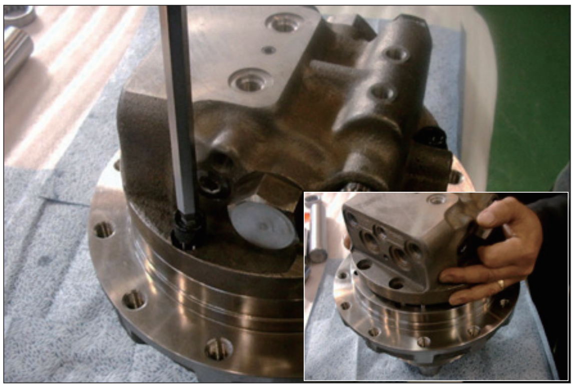
(5) The side of a pipe in a motor can be written as a rear side ; the side of out-put as a front side.

(6) In case of bonding bolts, combine a standard torque by torque wrench after spraying loctite #262 on the tap parts.

2) DISASSEMBLING

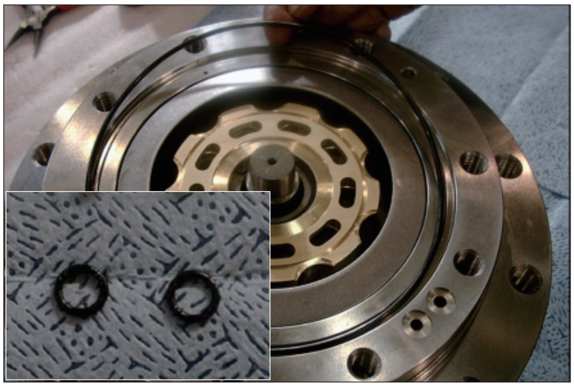
(1) Motor unit

① Put the motor assembly on the assemble table.
Using L-Wrench, disassemble 8 wrench bolt (58) and so respectively disassemble shaft casing assembly and rear cover assembly.



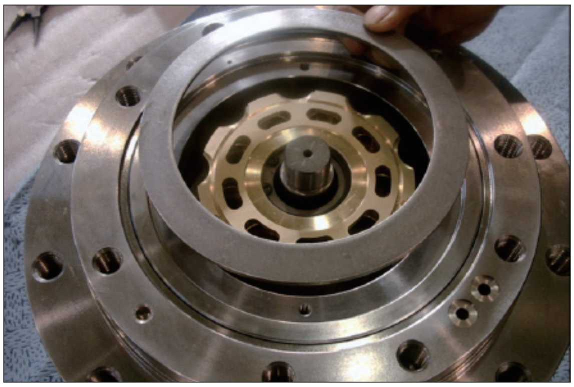
7078TM01/01A

② Disassemble O-ring (24) and O-ring (25) in that order from shaft casing (1).



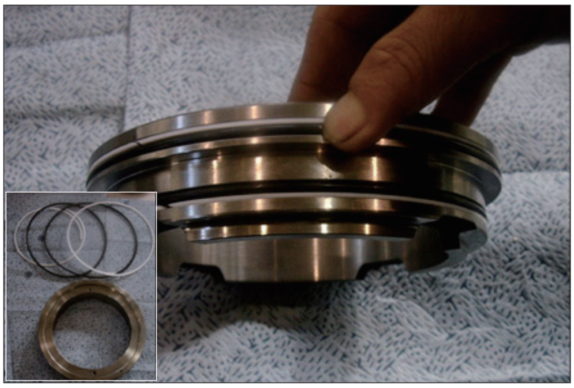
555K7TM02/02A

③ Dissemble plate spring (57) from shaft casing (1).



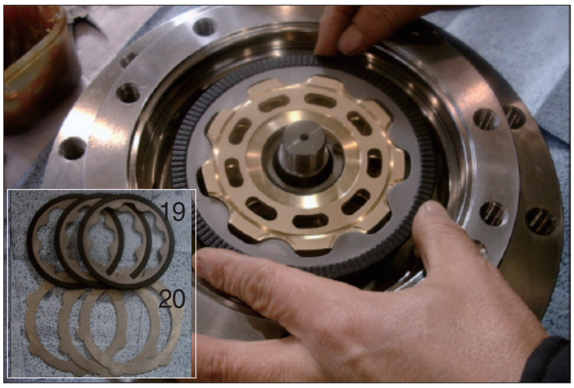
555K7TM03

④ Using compression air, disassemble parking piston (21) from shaft casing (1) and dissemble O-ring (23), O-ring (22) and back up ring (85) in that order.



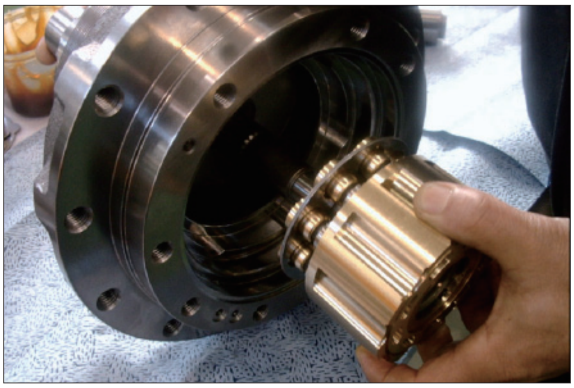
7078TM04/04A

⑤ Disassemble respectively 3 set of friction plate (19), parking plate (20) from shaft casing (1).



555K7TM05

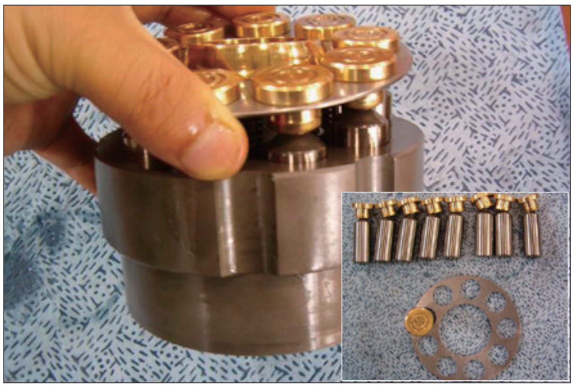
⑥ Disassemble cylinder block assembly (11) from shaft casing (1).



555K7TM06

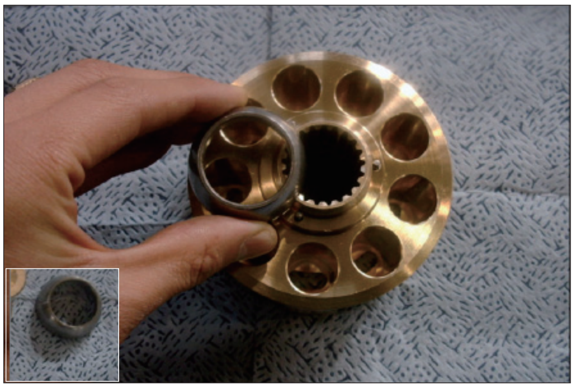
(2) Cylinder block

① Disassemble set plate (17), piston assembly (18) from cylinder block assembly (11).



7078TM07/07A

② Disassemble cylinder block (11), ball guide (16) and pin (15) in that order.

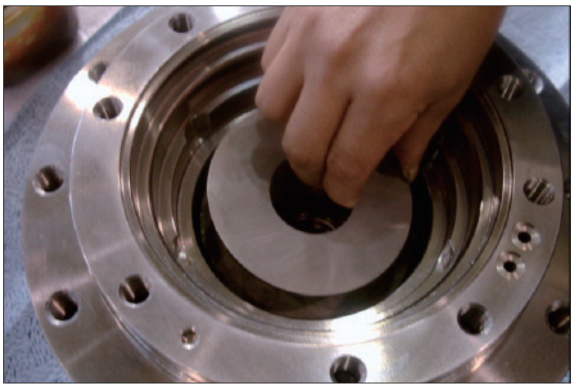


555K7TM08/08A

③ Put the cylinder block (11) on the air assembling jig and dissemble snap ring (14) by using a plier.
Dissemble spring seat (12), spring (13) and spring seat (12) in that order.

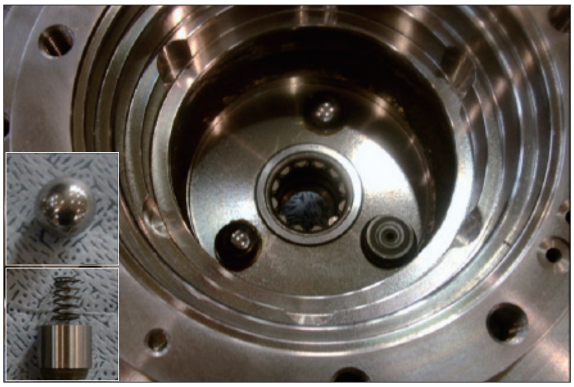
555K7TM09/09A

④ Disassemble shoe plate (10) from shaft casing (1).



555K7TM10

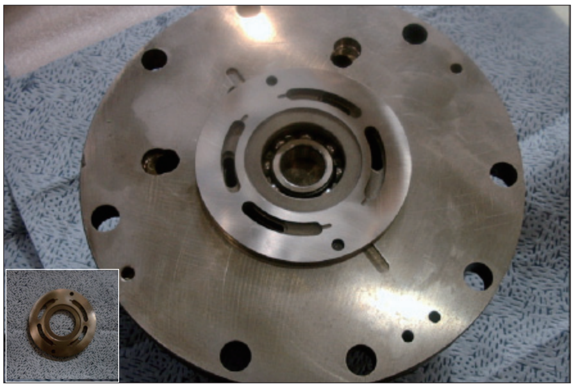
⑤ Disassemble steel ball (8) and swash plate (6) from shaft casing (1).



555K7TM11/11A/11B

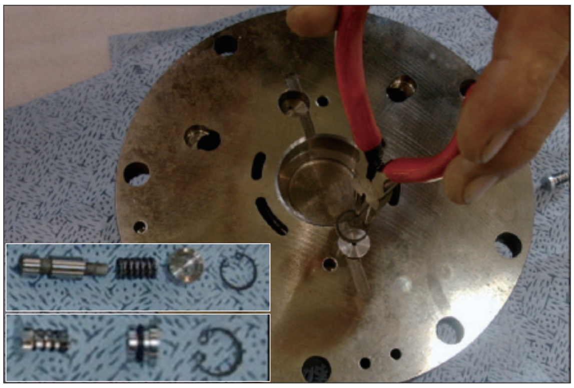
(3) Rear cover

① Disassemble valve plate (56) from rear cover (26).



555K7TM12/12A

② Using plier jig, disassemble snap ring (35), seat (34), O-ring (24), spring (33), check (32) from rear cover (26) and then disassemble snap ring (31), stopper (30), spring (29) and spool (28) same procedure.

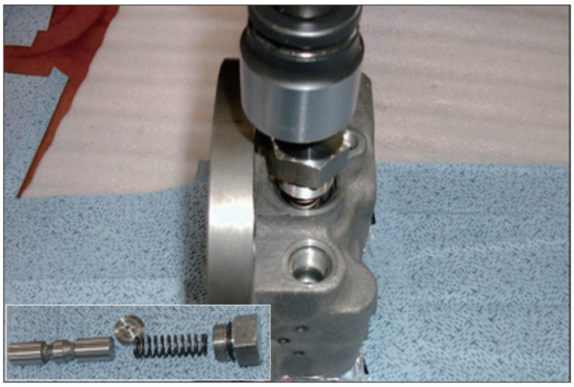


7078TM13

③ Using torque wrench, disassemble relief valve assembly (46) from rear cover (26) (left, right is symmetry).

555K7TM14/14A

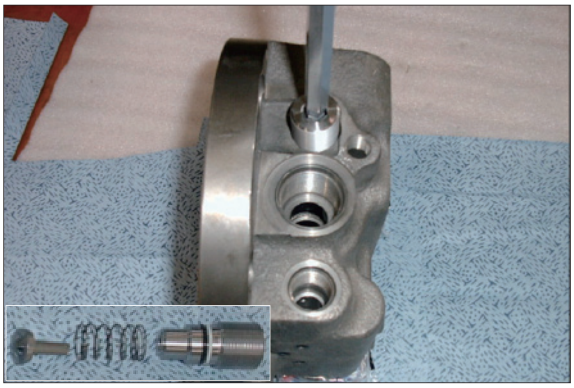
④ Using torque wrench, disassemble plug (44) and O-ring (45), spring (43), spring seat (42) and main spool (41) in that order.



7078TM15/15A

⑤ Disassembly make up valve

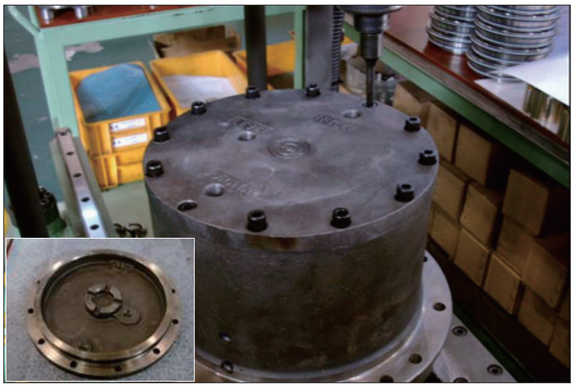
Using L-wrench, disassemble plug (38) and dissemble O-ring (36), back up ring (40) and spring (37) and then check (36) and spring (37) in that order.



555K7TM15/15A

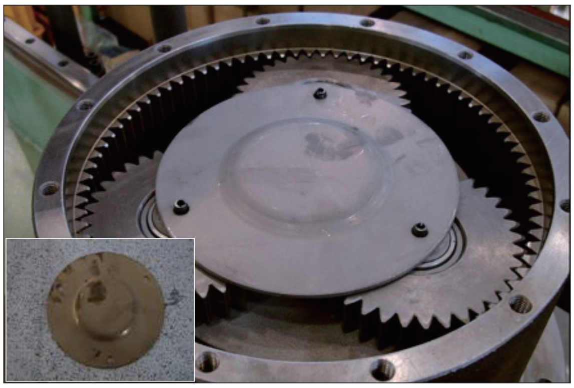
(4) Reduction gear

① Using L-wrench, disassemble wrench bolt (83) and then ring gear cover (80), O-ring (82) from ring gear (59).



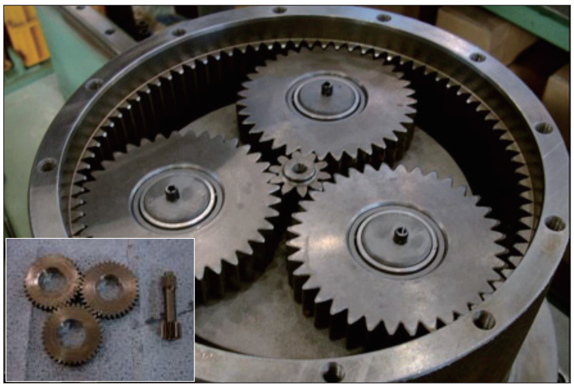
7078TM17/17A

② Disassemble thrust plate (79) from ring gear (59).



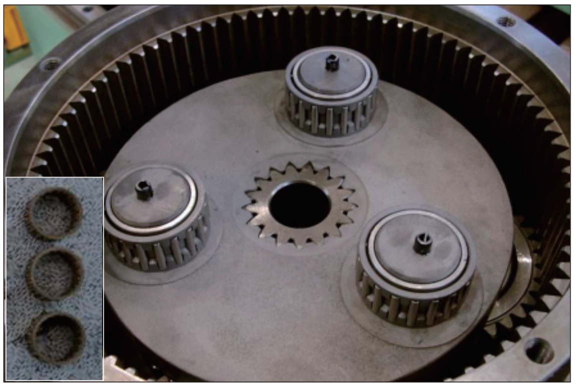
7078TM18/18A

③ Disassemble planetary gear (76), drive gear (78) in that order from ring gear (59).



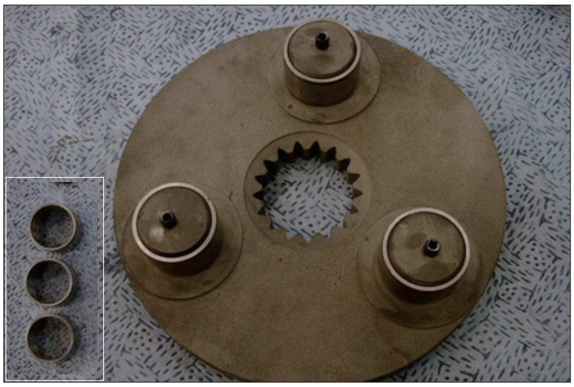
7078TM19/19A

④ Disassemble 3 needle bearing (77) from ring gear (59).



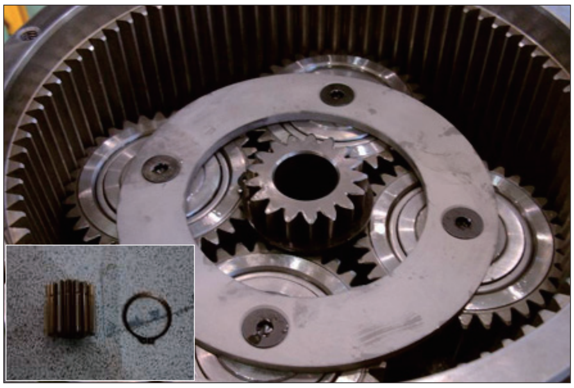
7078TM20/20A

⑤ Disassemble in order collar (75), carrier (73) from ring gear (59).



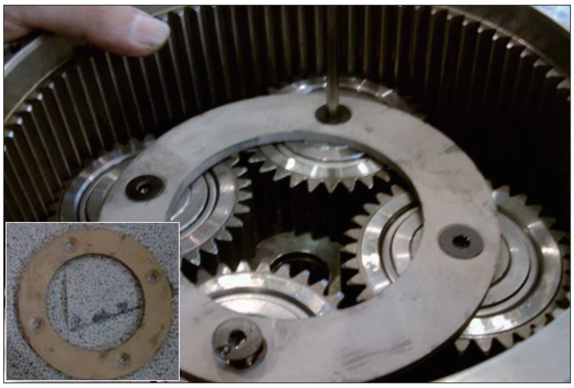
7078TM21/21A

⑥ Disassemble sun gear (71) from ring gear (59) and then disassemble snap ring (72) with a plier jig.



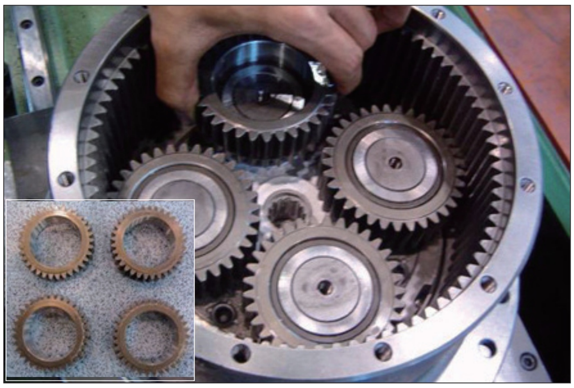
7078TM22/22A

⑦ Using a L-wrench, disassemble plate head bolt (70)-4EA from ring gear (59) and then disassemble plate (69).



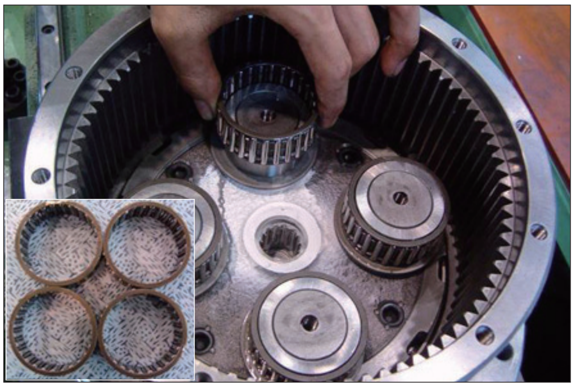
7078TM23/23A

⑧ Disassemble planetary gear (67)-4EA from ring gear (59).



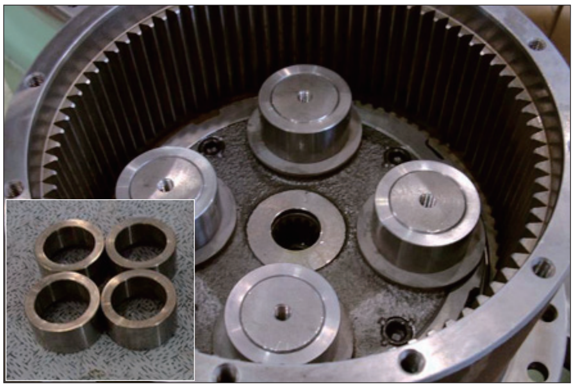
7078TM24/24A

⑨ Disassemble needle bearing (68)-4EA from ring gear (59).



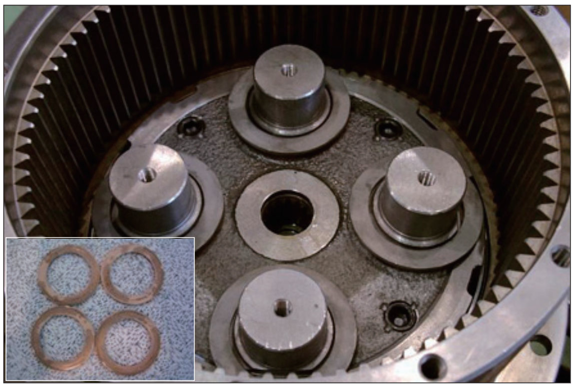
7078TM25/25A

⑩ Disassemble collar (66)-4EA from ring gear (59).



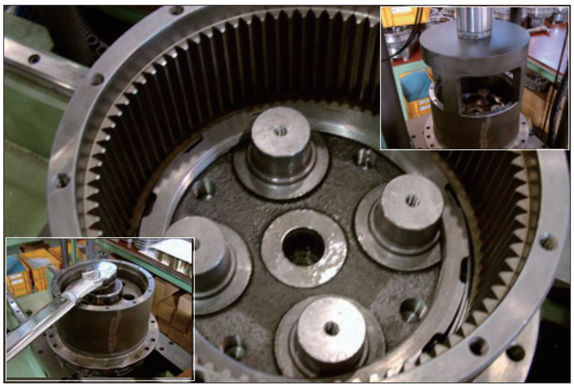
7078TM26/26A

⑪ Disassemble washer (65)-4EA from ring gear (59).



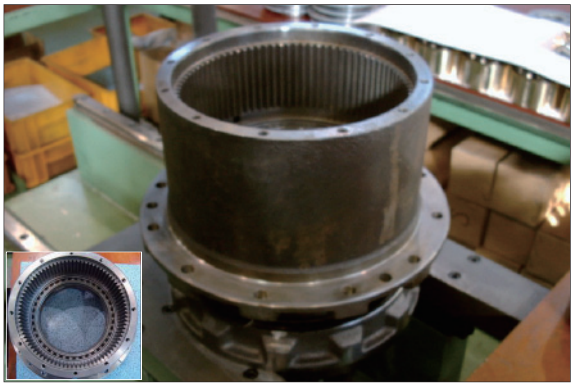
7078TM27/27A

⑫ Using jig, disassemble nut (64) when inner pressed state with a L-wrench bolt from ring gear (59).



78078TM29

⑬ Put the reduction gear on the assembling jig and then disassemble ring gear (59).



555K7TM17

4. ASSEMBLY

1) GENERAL SUGGESTIONS

(1) After washing each parts cleanly, dry it with compressed air.
Provided that you do not wash friction plate with treated oil.

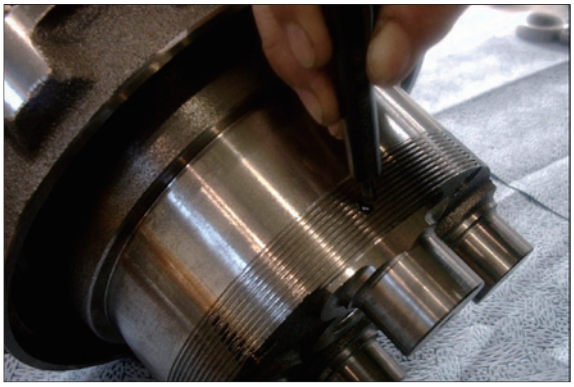
(2) In bonding each part, fasten bond torque.

(3) When using a hammer, do not forget to use a plastic hammer.

2) ASSEMBLING

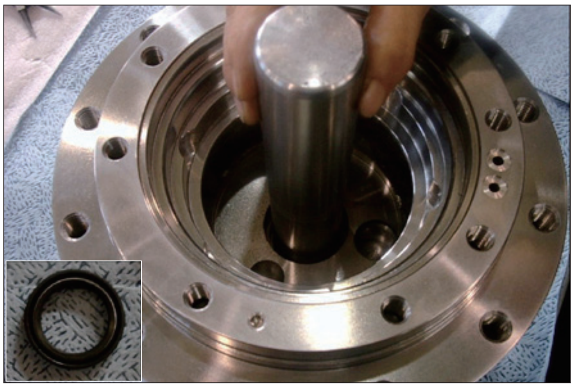
(1) Sub of turning axis and valve casing

① Using a jig, insert the steel ball (61) to the shaft casing (1) and then assemble plug (62).



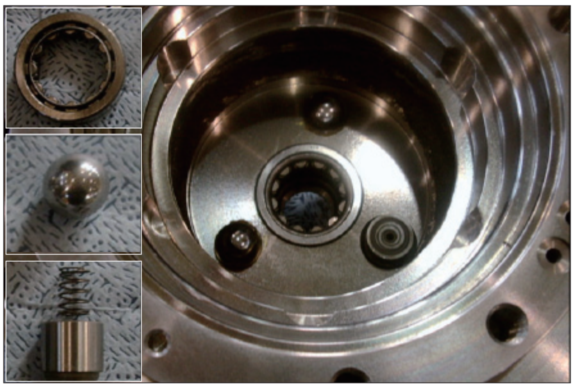
7078TM51

② Using a jig, assemble oil seal (3) to the shaft casing (1) and then insert with solid hammer.



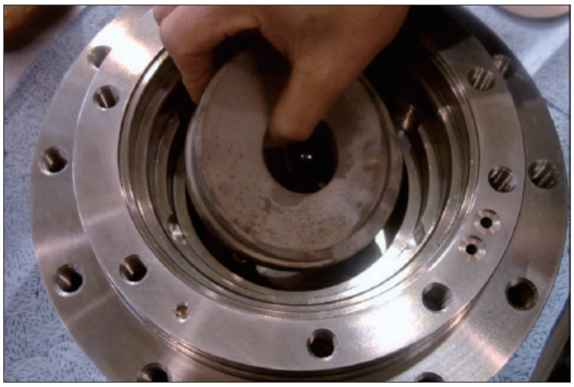
7078TM52

③ Assemble bearing (5) to the shaft casing (1) and then assemble steel ball (8) with grease and swash piston (6).



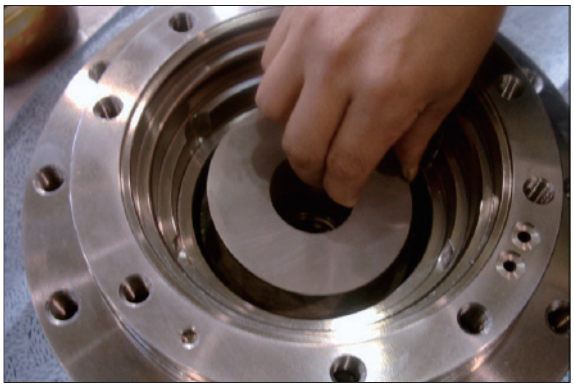
555K7TM19/19A/19B/19C

④ Assemble swash plate (9) to the shaft casing (1).



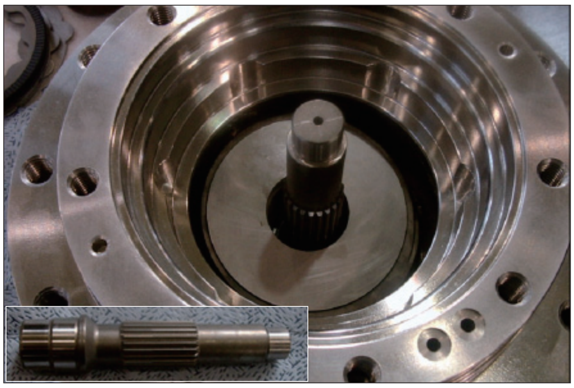
555K7TM20

⑤ Assemble shoe plate (10) to the shaft casing (1).



555K7TM21

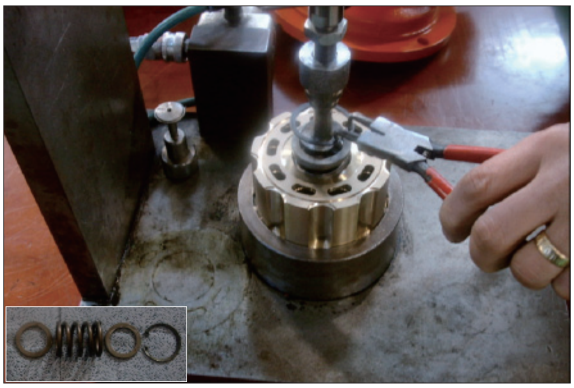
⑥ Assemble shaft (4) to the shaft casing (1).



555K7TM22/22A

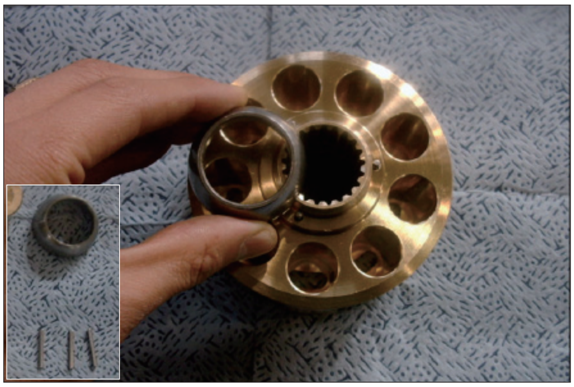
(2) Cylinder block sub assembly

① Put cylinder block (11) on the air jig, assemble spring seat (12), spring (13) in that order and then assemble the snap ring (14) with a plier.



555K7TM09A

② Assemble pin (15), ball guide (16) in that order to the cylinder block (11).



555K7TM08/08A

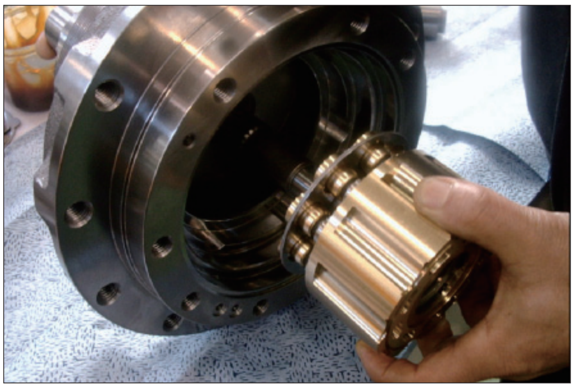
③ Assemble piston (18) to the set plate (17, 9 set).

555K7TM23

④ Assemble sub-assembled piston (17, 18) to the cylinder block (9).

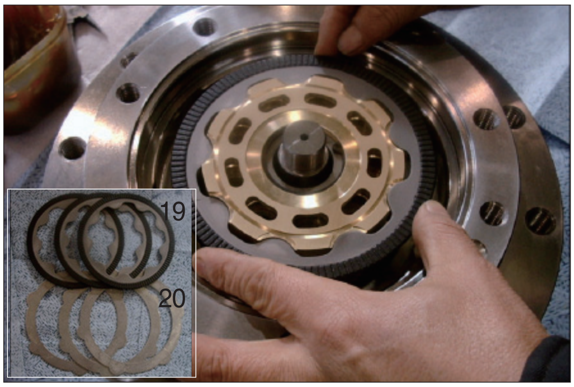
7078TM60

⑤ Assemble sub-assembled cylinder block (11) to the shaft casing (1).



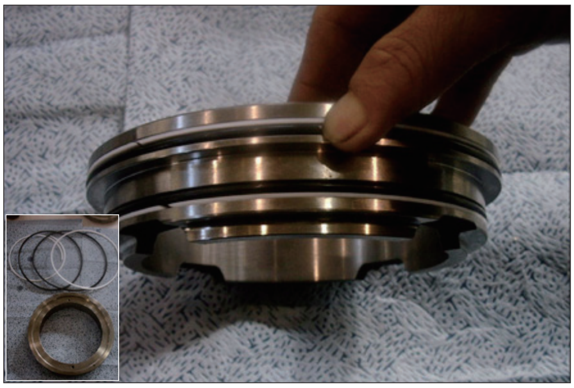
555K7TM06

⑥ Assemble friction plate (19), parking plate (20) (respectively 3 EA) to the shaft casing (1).

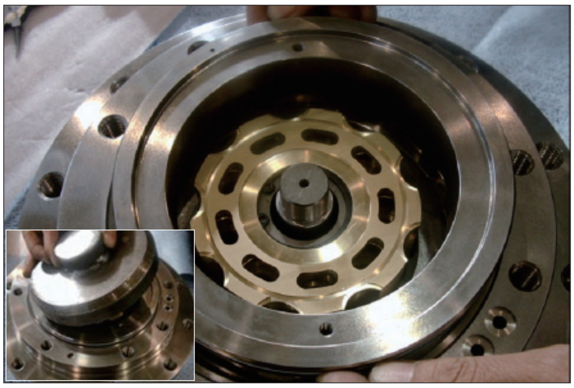


555K7TM05

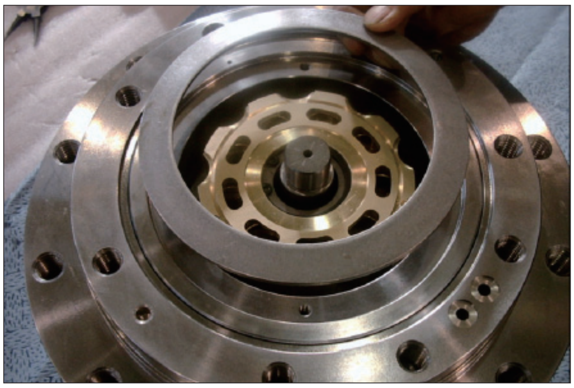
⑦ Assemble back up ring (86), O-ring (23, 22), back up ring (85) in that order to the parking piston (21).


7078TM04/04A

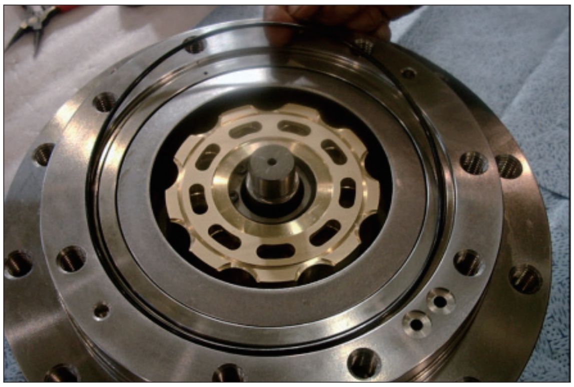
⑧ Using a jig, insert the parking piston to the shaft casing (1) and assemble.


555K7TM24

⑨ Assemble spring (57) to the shaft casing (1).

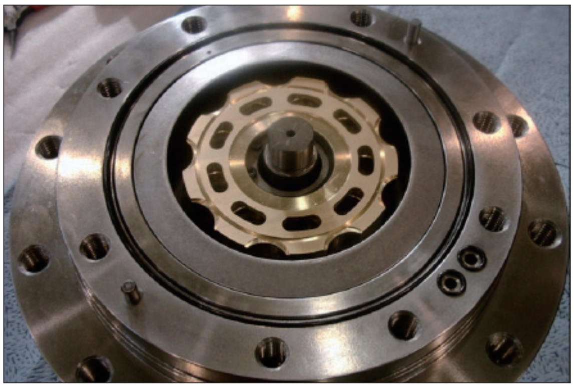

555KTM03

⑩ Assemble O-ring (25) to the shaft casing (1).



555K7TM02

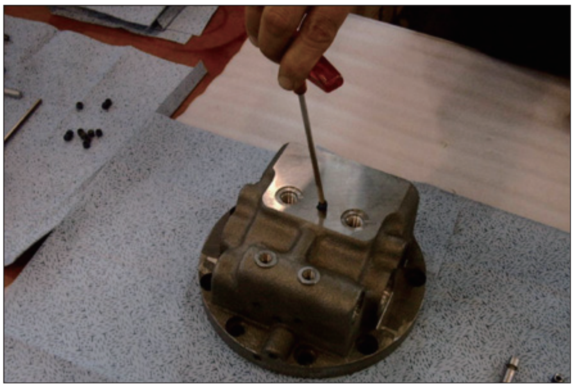
⑪ Assemble pin (55), O-ring (24) in that order to the shaft casing (1).



555K7TM25

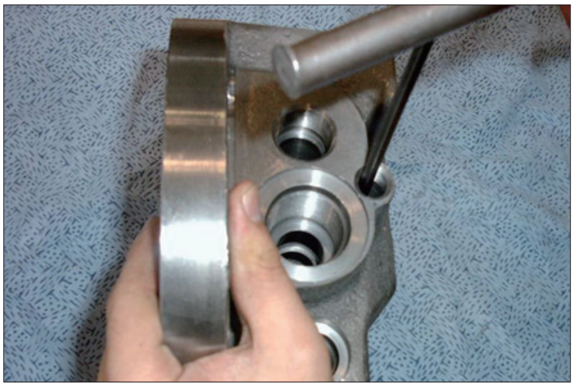
(3) Rear cover assembly

① Using a L-wrench, assemble plug (27)-9EA to the rear cover (26).



7078TM66

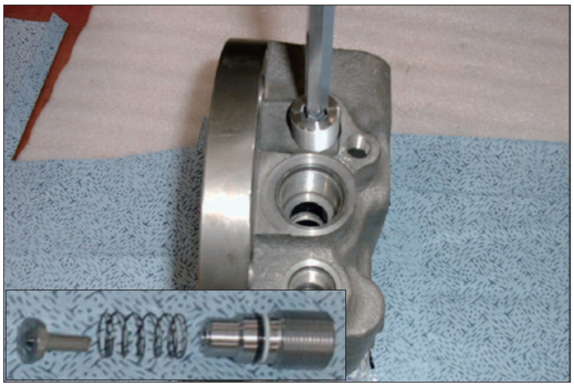
② Contact steel ball (47) to the rear cover (26) by using jig and assemble plug (49) with a L-wrench.



7078TM67

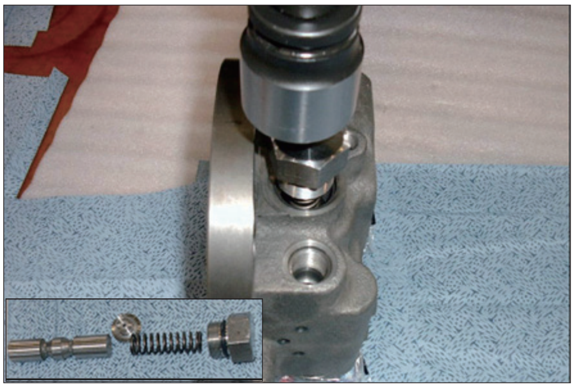
③ **Assemble the make up check valve**

Assemble check (36), spring (37) to rear cover (26) and assemble plug (38) with back up ring (40) and O-ring (39) to rear cover (26) by using a L-wrench.



7078TM16/16A

④ Fit orifice (84) to main spool (41) symmetry and assemble it to rear cover (26) and then assemble spring seat (42), spring (43), O-ring (45) and plug (44) in that order by using a torque wrench.

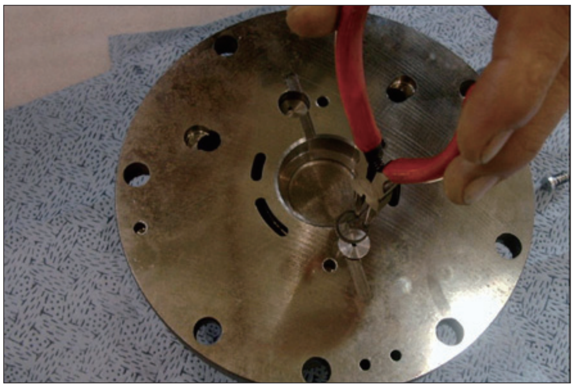


7078TM15/15A

⑤ Assemble relief valve assembly (46) (with left-right symmetry) to the rear cover (26) and then tighten with a torque-wrench.

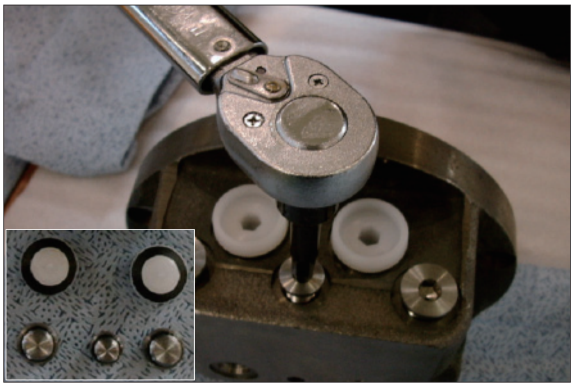
7078TM71

⑥ Using plier, Assemble spool (28), spring (29), stopper (30) and snap ring (31) in that order to the Ø16 hole on the underneath of the rear cover (26) and assemble check (32), spring (33), O-ring (24),seat (34) and snap ring (35) in that order to the Ø15 hole of the rear cover (26).



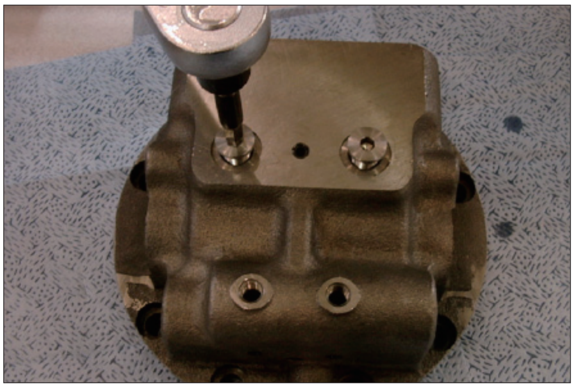
7078TM13

⑦ Fit O-ring (51) to plug (49) and O-ring (53) to plug (52) and then assemble them to rear cover (26) by a torque wrench.



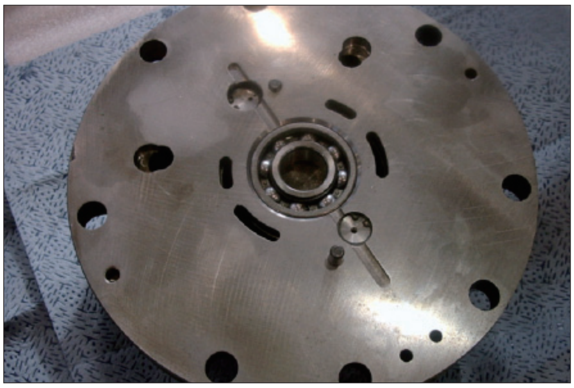
555K7TM26/26A

⑧ Assemble 2 plug (50) to rear cover (26) by a torque wrench.



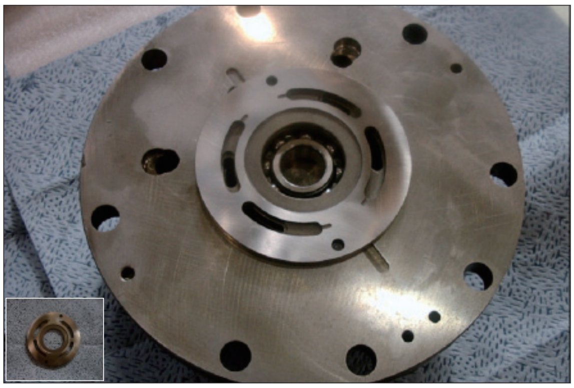
555K7TM27

⑨ Assemble ball bearing (54) with grease to rear cover (26) and insert 2 pin (55) by using hammer.



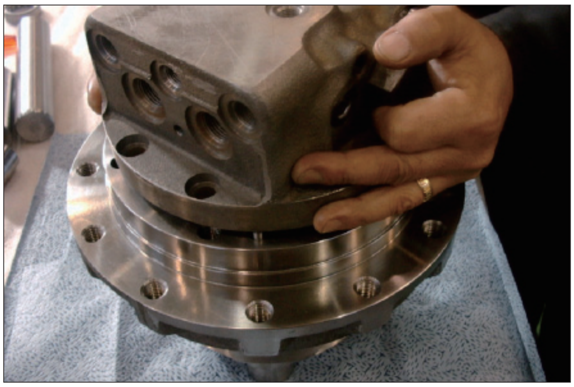
555K7TM28

⑩ Assemble valve plate (56) with grease to rear cover (26).



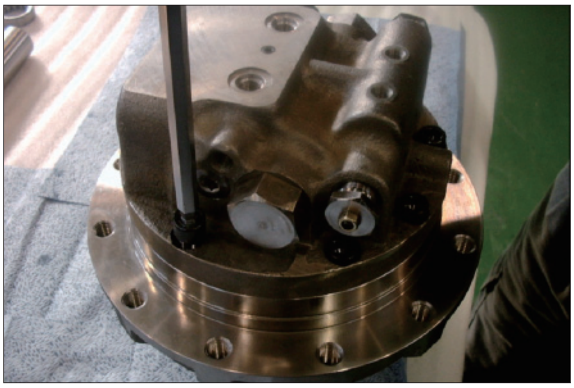
555K7TM12/12A

⑪ Assemble rear cover (26) to shaft casing (1).



555K7TM29

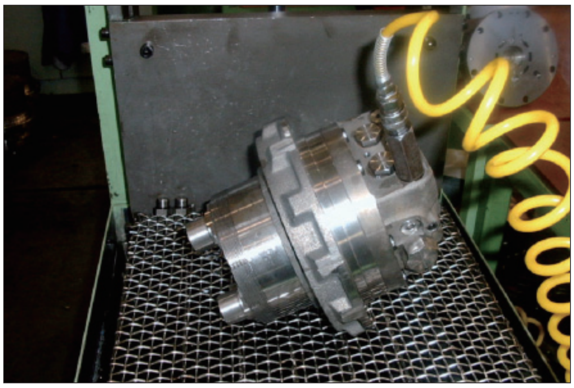
⑫ Combine rear cover assembly and shaft casing assembly with 8 bolt (58).



555K7TM30

⑬ Motor pressure test

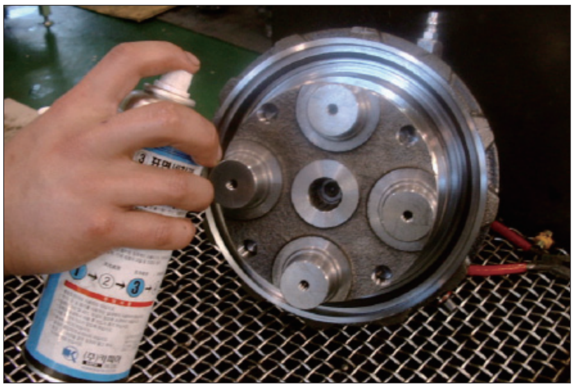
- Check the oil leak for one minute by appearance test at air pressure 5 kgf/cm^2 (43 psi).



555K7TM31

⑭ Leakage test

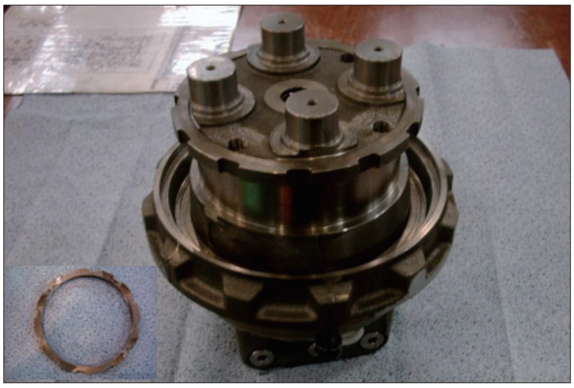
- Clean the unit by #1 color checker and spray #3 checker.
  Check leakage from oil seal and body.



555K7TM32

(4) Travel reduction gear

① Before assemble nut (64) to the motor. Remove burr and alien substances ready for assembling.



7078TM77/28A

② Insert ring gear (59) to the spray washing machine and heat up 69~70 ˚C for one minute.

7078TM78

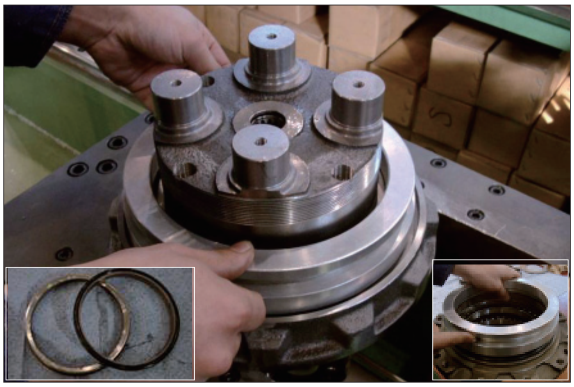
③ Assemble angular bearing (60) to the ring gear (59).

7078TM79/79A

④ Insert 10 steel ball (61) to the ring gear (59) with a jig and assemble 2 plug (62) with a L-wrench.

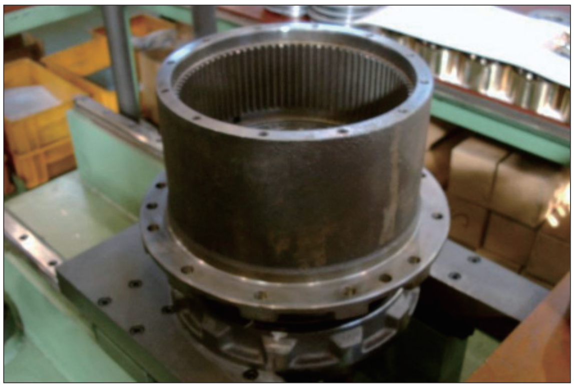
7078TM80/80A

⑤ Assemble floating seal (63) to ring gear (59) and motor part with a jig.



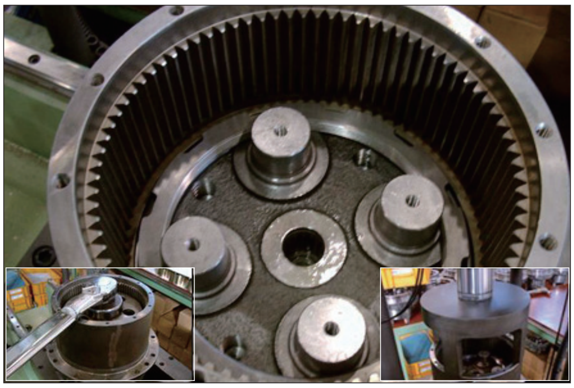
7078TM81/81A/82

⑥ Upset the ring gear (59) and assemble with motor.



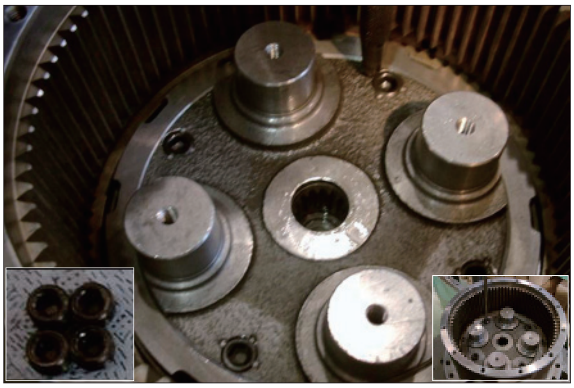
7078TM83

⑦ Combine nut (64) to the ring gear (59) and pressing use a jig and then assemble with a torque-wrench.



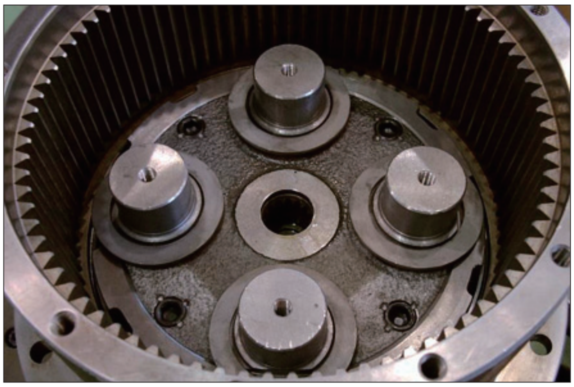
7078TM28/28B/28C

⑧ Using a L-wrench, assemble plug-4EA to the ring gear (59) and then cocking by a jig.



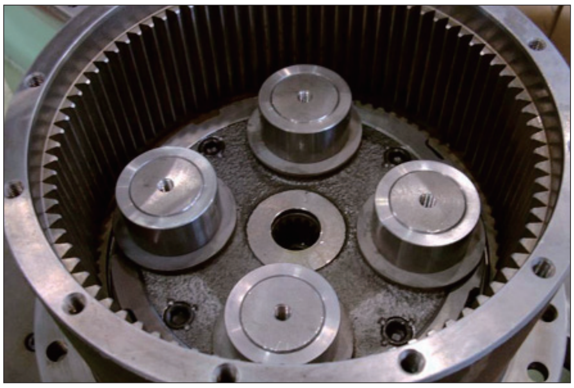
7078TM84/84A/85

⑨ Assemble washer (65)-4EA to the ring gear (59).



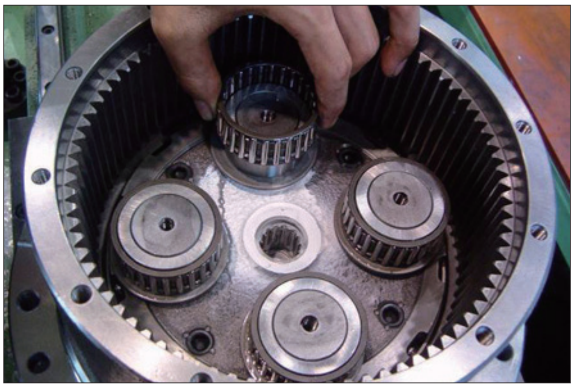
7078TM27

⑩ Assemble collar (66)-4EA to the ring gear (59).



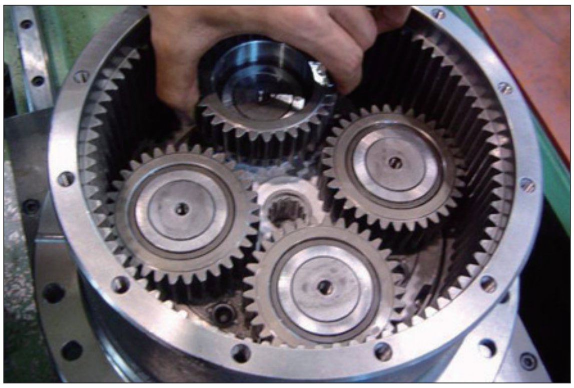
7078TM26

⑪ Assemble needle bearing (68)-4EA to the ring gear (59).



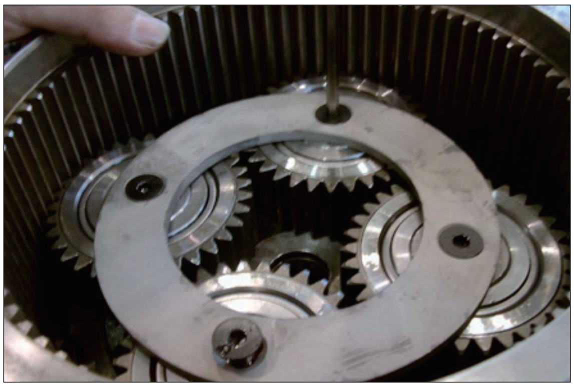
7078TM25

⑫ Assemble planetary gear (67)-4EA to the ring gear (59).



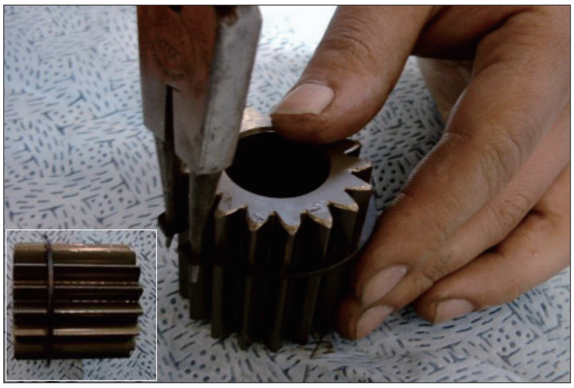
7078TM24

⑬ Assemble plate (69)-1EA to the ring gear (59) and then tighten flat head bolt (70)-4EA with a L-wrench.
(after paste loctite and then tighten the flat head bolt).



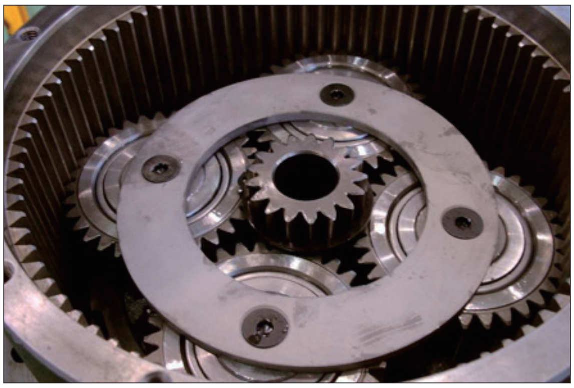
7078TM23

⑭ Assemble snap ring (72) to the sun gear (71) with a plier jig.



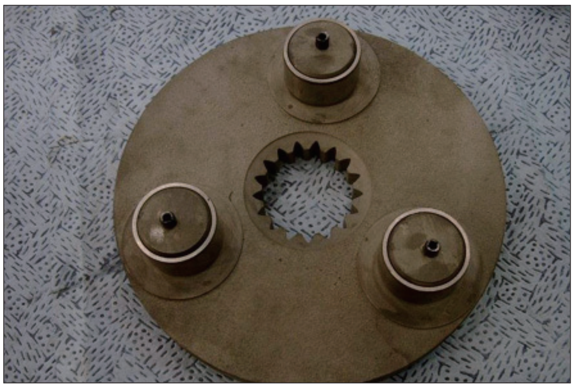
7078TM86/86A

⑮ Assemble sun gear with snap ring assembly to the ring gear (59).



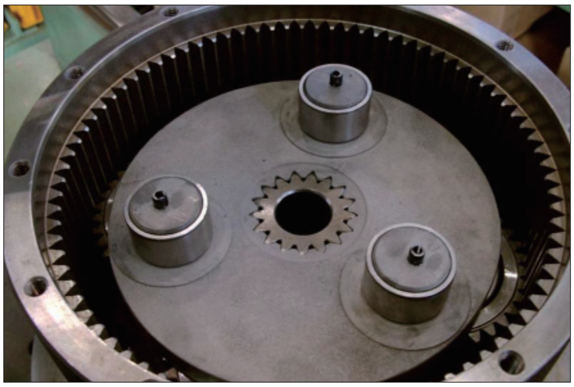
7078TM22

⑯ Assemble in that order collar (75), spring pin (74) to the carrier (73).



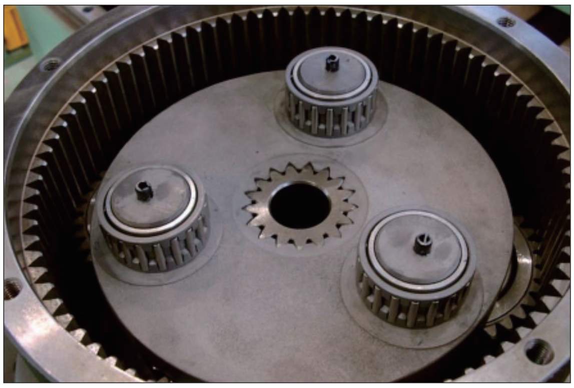
7078TM21

⑰ Assemble carrier sub assembly to the ring gear (59).



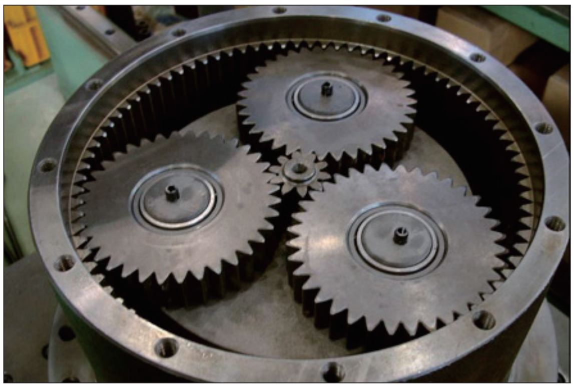
7078TM87

⑱ Assemble needle bearing (77)-3EA to the ring gear (59).



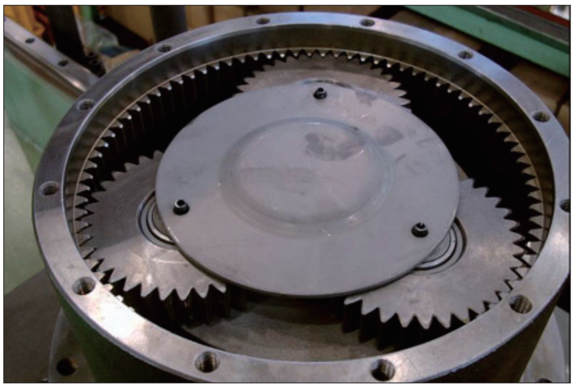
7078TM20

⑲ Assemble in order planetary gear (76), drive gear (78) to the ring gear (59).



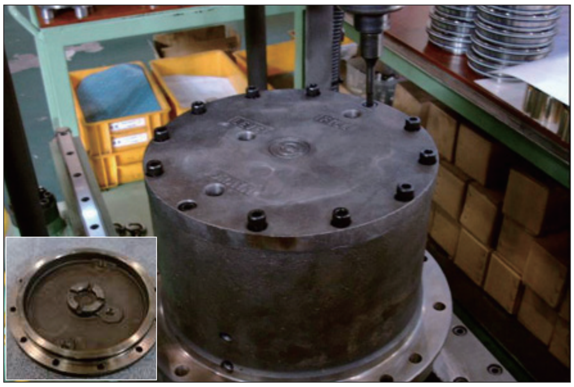
7078TM19

⑳ Assemble thrust plate (79) to the ring gear (59).



7078TM18

㉑ Assemble in order ring gear cover (80) with O-ring (82) and then assemble wrench bolt (83) with a torque-wrench.



7078TM17/17A

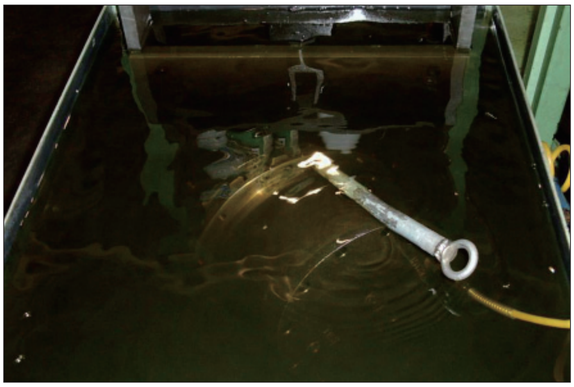
㉒ Roll the teflon tape to the ring gear (59) and then combine with a L-wrench (after test of drain part water pressure and capacity and then assemble plug PT3/8).

7078TM88

(5) Test

① Motor pressure test

- Check the oil leak for one minute by appearance test at air pressure 5 kgf/cm^2 (71 psi).



7078TM89

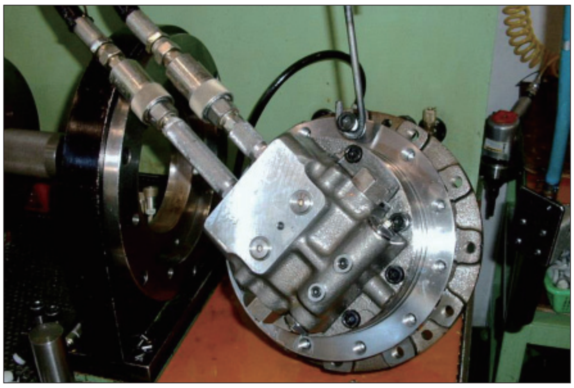
② Performance test

- Pour the gear oil (85W-140) by beaker at the reduction gear.

7078TM90

③ Test bench mounting

- Partially performance test by mounting the motor test bench.



7078TM91

TRAVEL DEVICE (TYPE 2, MACHINE SERIAL NO. : #5982-)

1. REMOVAL AND INSTALL

1) REMOVAL

(1) Swing the work equipment 90° and lower it completely to the ground.

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

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

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

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

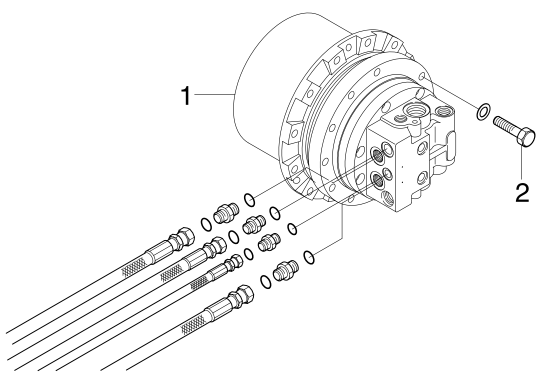
13031GE18

(4) Remove the track shoe assembly.
For details, see removal of track shoe assembly.

(5) Remove the cover.

(6) Remove the hose.

※ **Fit blind plugs to the disconnected hoses.**



HX607TM01

(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 : 80 kg (180 lb)
· Tightening torque : 20±2.0 kgf·m (145±14.5 lbf·ft)

2) INSTALL

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

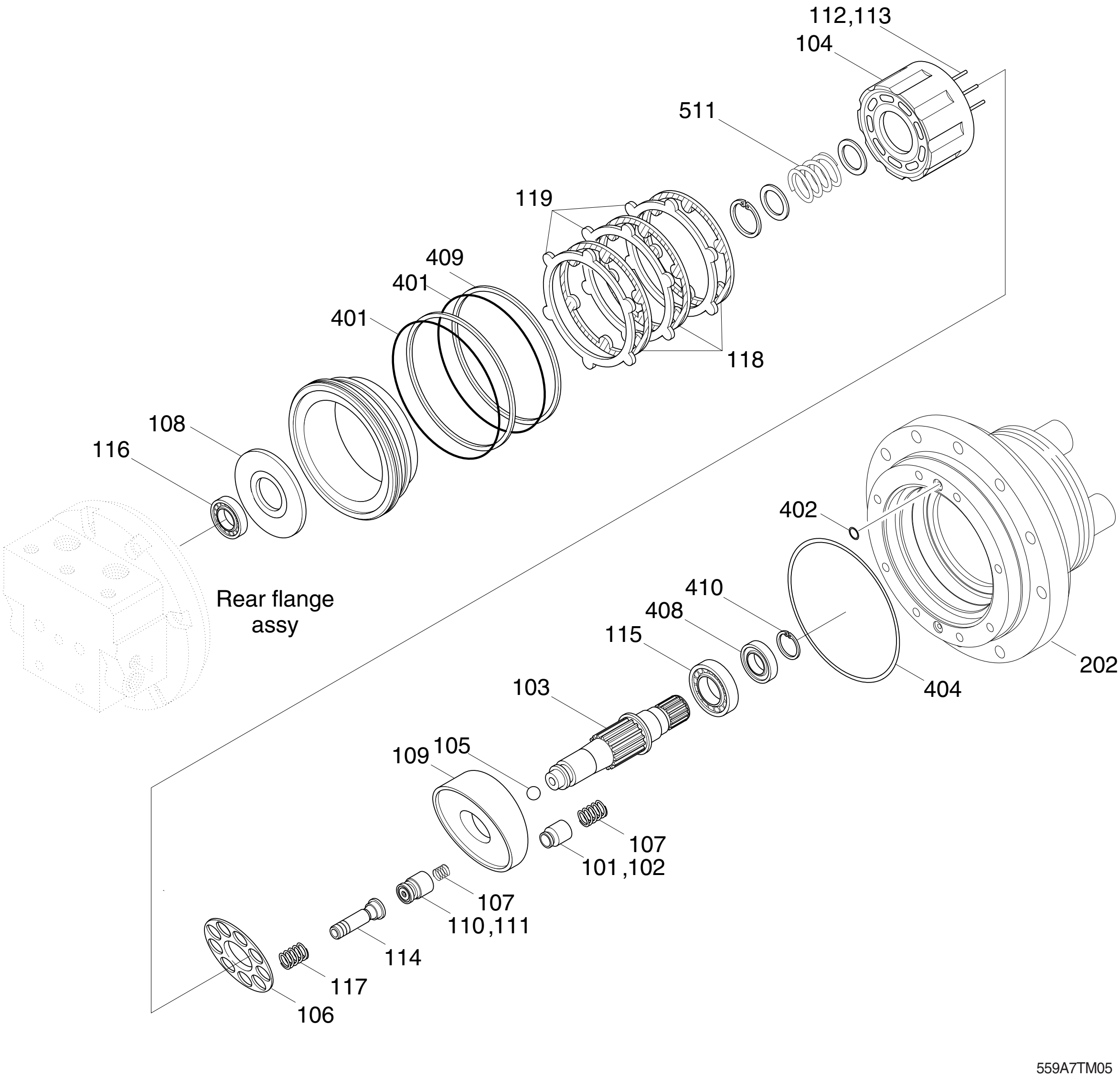
(2) Bleed the air from the travel motor.

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.

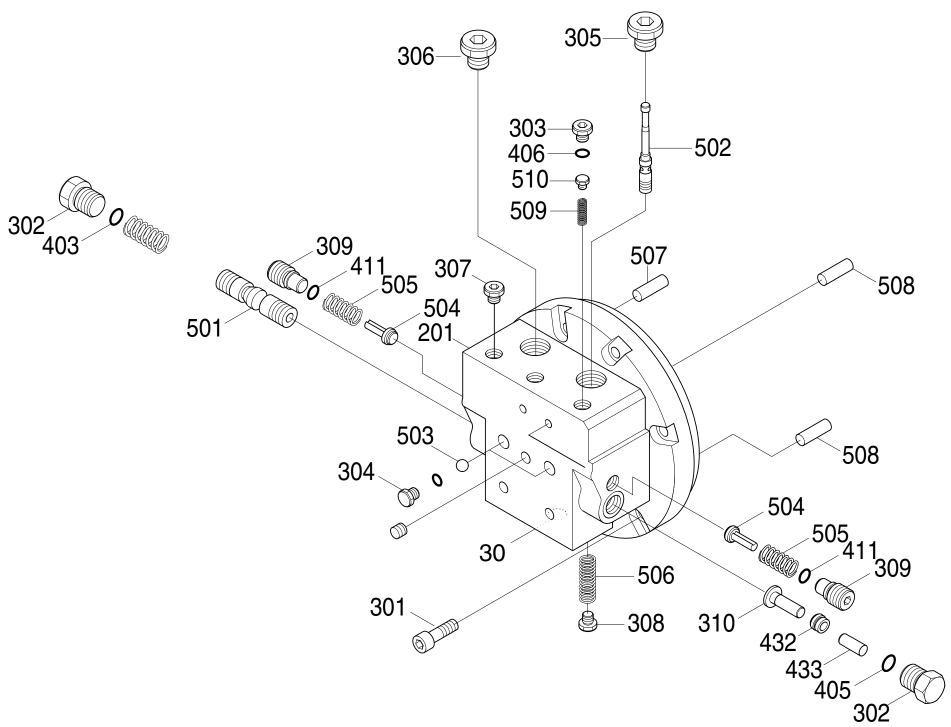
2. DISASSEMBLY AND ASSEMBLY OF MOTOR UNIT

1) PARTS LIST (1/2)



101	Piston	110	Swash piston	119	Separator plate
102	Shoe	111	Swash shoe	202	Reducer casing
103	Drive shaft	112	Pivot	401	O-ring
104	Cylinder block	113	Pivot pin	402	O-ring
105	Spherical bushing	114	Brake piston	404	O-ring
106	Set plate	115	Roller bearing	408	Oil seal
107	Cylinder spring	116	Ball bearing	409	Back up ring
108	Valve plate	117	Brake spring	410	Snap ring
109	Swash plate	118	Friction plate	511	Swash piston spring

PARTS LIST (2/2)



559A7TM06

30	Relief valve assy	309	Set plug	503	Steel ball
201	Valve casing	310	Restrictor	504	Plunger
301	Socket bolt	403	O-ring	505	Main spool spring
302	Plug	405	O-ring	506	2 speed spool spring
303	Drain plug	406	O-ring	507	Spring pin
304	NPTF plug	411	O-ring	508	Pin
305	Dust plug	432	Seat	509	Spring cap
306	Dust plug	433	Seat casing	510	Cap
307	Dust plug	501	Main spool		
308	2 speed plug	502	2 speed spool		

2) TOOLS AND TIGHTENING TORQUE

(1) Tightening torque

This table shows the typical screw sizes and tightening torques used in the motor

Item	Part name	Size	Tightening torque	
			kgf · m	lbf · ft
30	Relief valve assy	G 1/2	11.2	81.0
301	Socket bolt	M14	16.3	118
302	ROH plug	G 1/4	3.6	26.0
303	Drain plug	G 3/8	7.5	54.2
304	NPTF plug	NPTF 1/16	1.1	8.0
308	2 speed plug	G 1/4	3.6	26.0
309	Set plug	G 3/4	17.3	125
310	Restrictor	NPTF 1/16	1.1	8.0
626	Pipe plug	RC 1/8	1.2	8.7
632	ROH plug	G 1/8	1.5	10.8

(2) Tools

① Hexagon and socket wrench

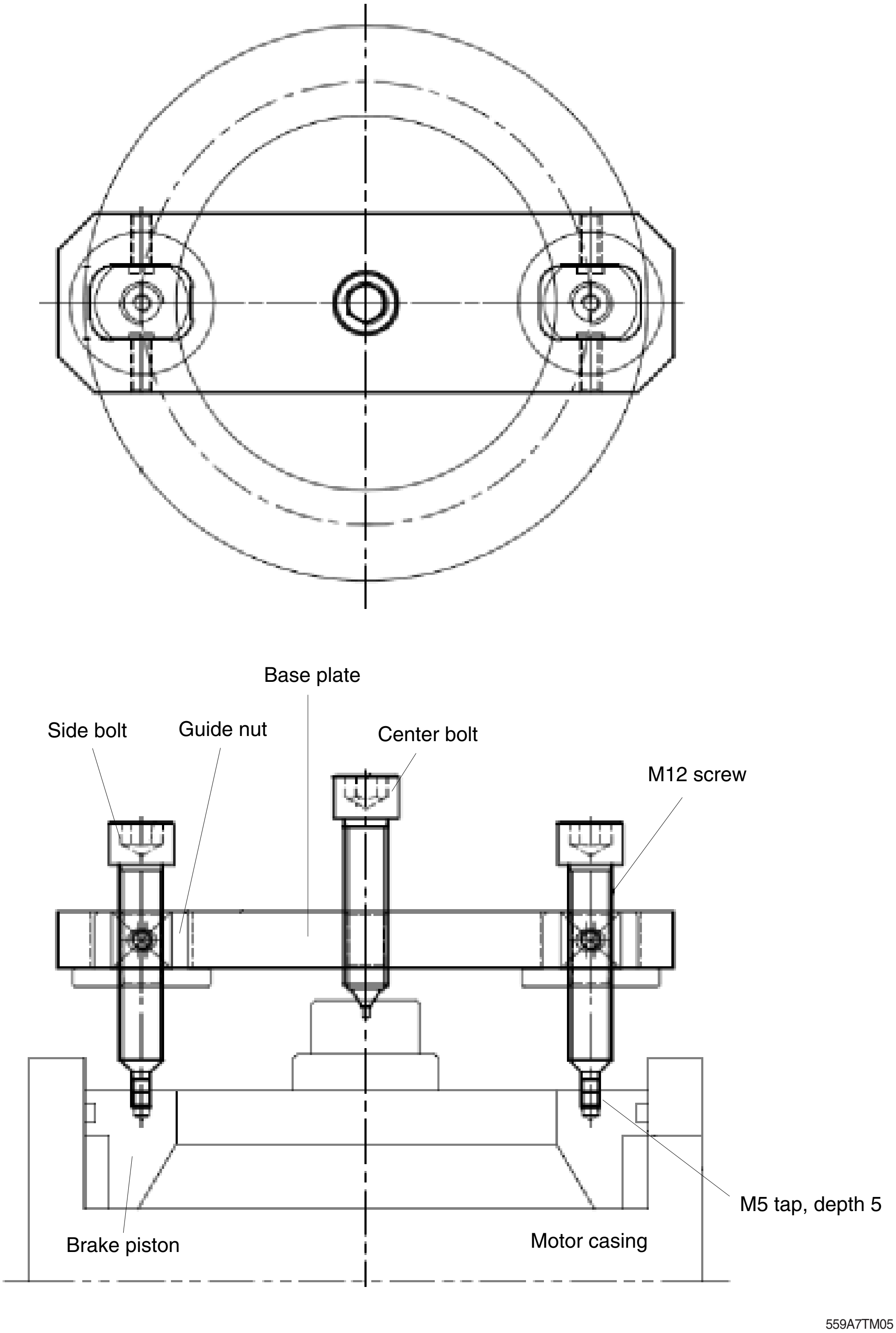
Tools	Item	Part name	B size	Screw size
Hexagon wrench	304, 310	NPTF plug, Restrictor	4	R 1/16
	626, 632	Pipe plug, ROH plug	5	R 1/8
	302, 308	ROH plug, 2 speed plug	6	G 1/4
	301	Socket bolt	12	M14
Socket wrench	303	Drain plug	22	G 3/8
	30	Relief valve assy	27	G 1/2
	309	Set plug	30	G 3/4
	30	Relief valve assy	8	M5

② Others

Tools	Specification
Driver	Screw driver (small, medium)
Hammer	Rubber or plastic hammer, iron hammer
	Round bar : about Ø45 mm x 150 mm
Bearing press jig	Round bar : about Ø60 mm x 150 mm
Torque wrench	Torque adjustment range
	- For 4~20 Nm
	- For 20~100 Nm
	- For 40~200 Nm
Slide hammer bearing puller	-
Brake piston disassembly jig	-
Brake piston press jig	-
Snap ring plier	Inner diameter

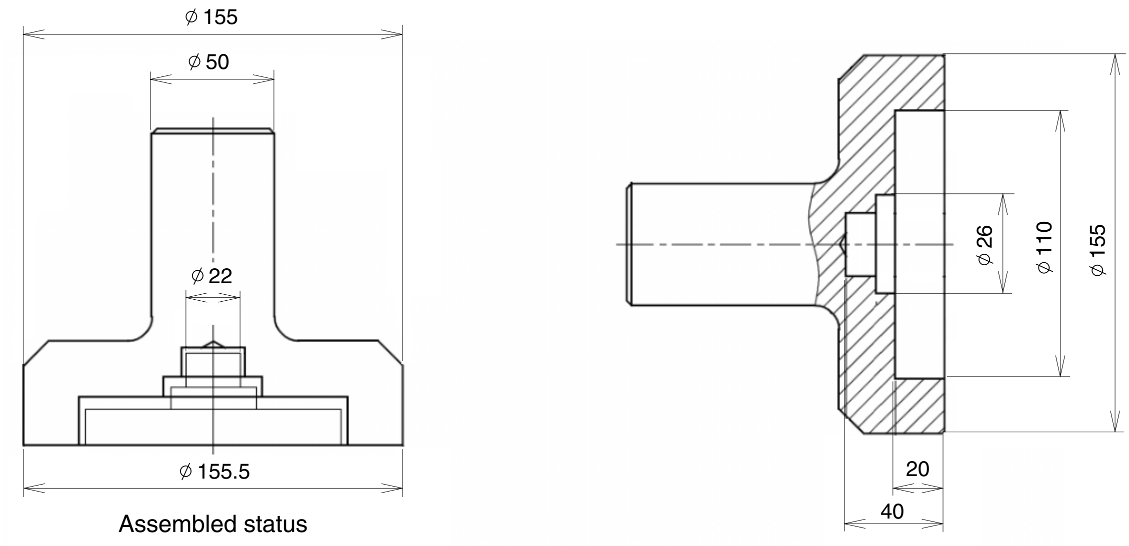
(3) Special tools

① Brake piston disassembly jig



② Brake piston press jig

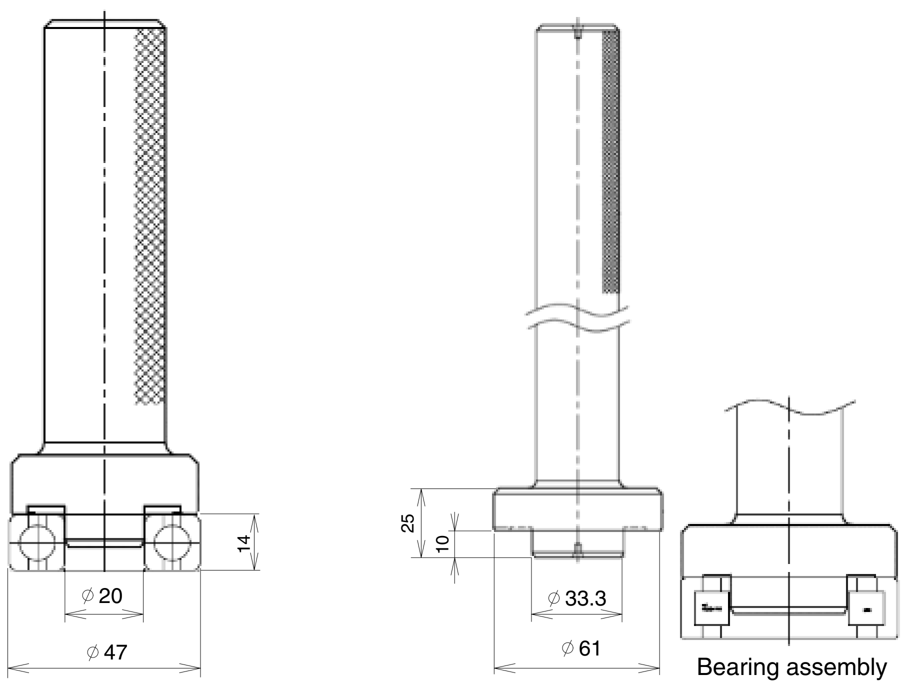
The below dimensions are the reference dimensions.



559A7TM10

③ Bearing press jig

The below dimensions are the reference dimensions.



Bearing pressing jig for valve casing

Roller bearing pressing jig for casing

559A7TM11

3) DISASSEMBLY

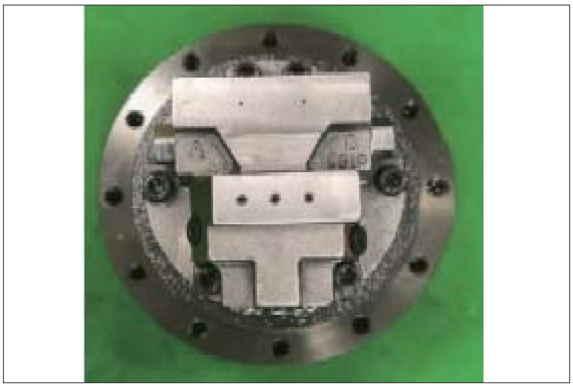
When disassembling the motor, disassemble in the order shown below. The number in brackets after part name means item number of section drawing.

(1) Wrap a wire rope around the outer periphery of the motor, lift it with a crane, and wash it with white kerosene. After washing, dry with compressed air.

※ The motor can be disassembled into an mounted state on the excavator. In this case, disassemble not to be got foreign materials: dust, mud, etc.

(2) Remove the oil in the casing (202) from the drain plug.

※ In the case of automatic 1-speed specification, 2 speed spool (502) may drop out during operation. Block pilot port with dust plug (306).



559A7TM12

(3) Disassembly is easily fixed to the workstation.
Place the shaft end of the drive shaft (103) facing down.
Mark the joint mark at the junction point of casing (202) and valve casing (201).

※ Choose a clean place.
Spread a rubber plate or cloth on the workbench to prevent friction and damage of the parts.

■ Disassembly of valve casing kit

(4) Loosen the relief valve assy (30) and remove it from the valve casing (201).

559A7TM13

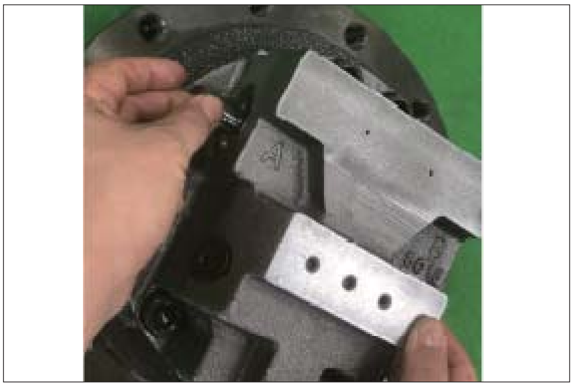
(5) Disassemble the spring cap (510) → cap (509).


559A7TM14

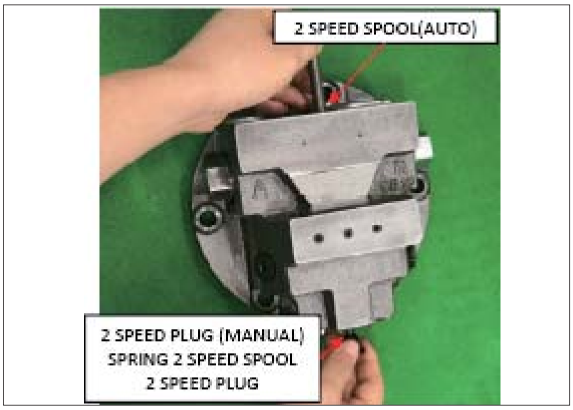
(6) Loosen the set plug (309), remove the plunger (504) and the main spool spring (505).
Then take out the main spool (501).

※ Main spool is disassembled in the horizontal direction with the hole. Be careful not to scratch the sliding surface of the main spool.


559A7TM15


559A7TM16

(7) Loosen the 2 speed plug (308), take out the 2 speed plug spring (506) and the 2 speed spool (502).

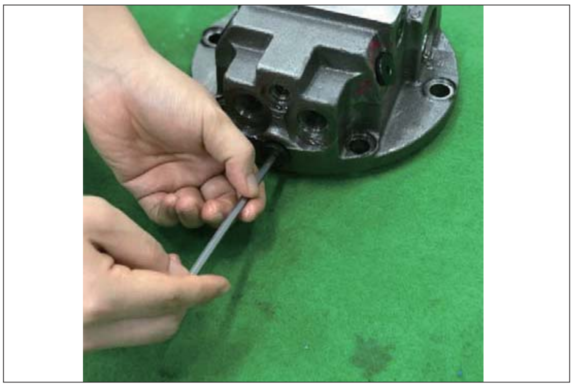


559A7TM17

(8) The following operations should be carried out if necessary.

① Loosen the ROH plug (302) and remove the restrictor (310).

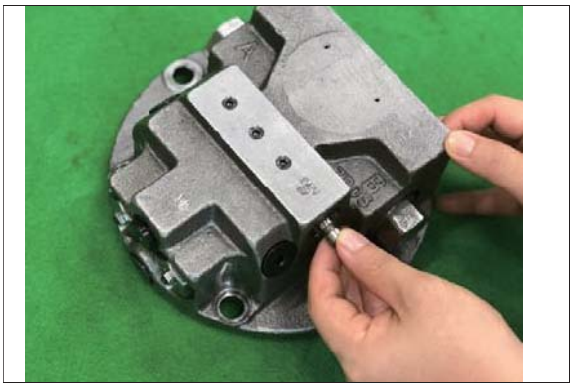
※ If there is no problem with the 1st / 2nd speed switching, no special disassembly is required.



559A7TM18

② Release ROH plug (302) and disassemble in the following order: Seat casing (433) → steel ball (503) → seat (432).

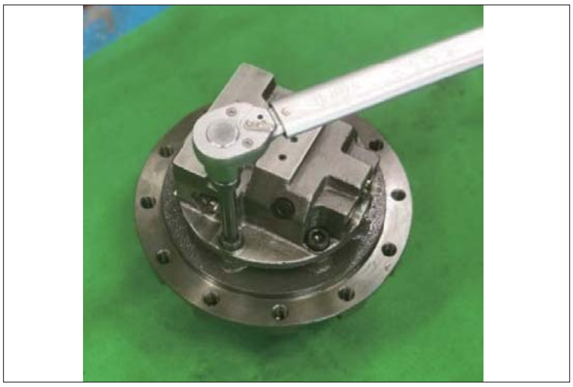
※ If there is no problem with the 1st / 2nd speed switching, no special disassembly is required. Please be careful about the loss of the steel ball. Please be careful not to damage the inner diameter of the seat casing and seat.



559A7TM19

(9) Loosen socket bolt (301) and remove valve casing (201) from casing (202).

※ (Due to the force of the brake spring E (117), when the socket bolt (301) is unscrewed, the valve casing (201) is raised from the casing (202). Further, remove the valve plate (108) from the valve casing (201).

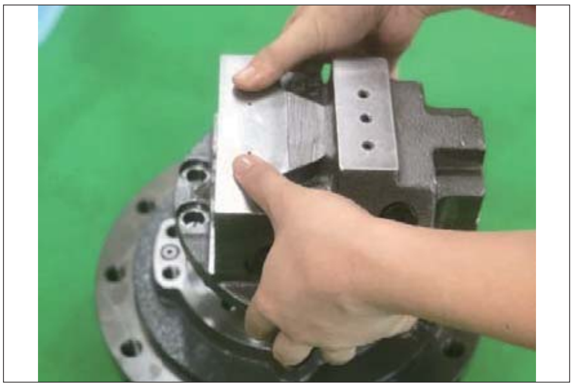


559A7TM20

Carefully work so that the valve plate does not fall off the valve casing.

※ In some cases, the valve plate is attached to the cylinder block.

Be careful not to scratch the sliding surface and mating surface when you disassemble the mating surface with a screwdriver or the like.



559A7TM21

559A7TM22

■ DISASSEMBLY OF MOTOR BODY

(10) Remove the brake spring (117) from the brake piston (114).

559A7TM25

(11) Using the jig, remove the brake piston (114) from the casing (202). No.16

※ If you need to disassemble without jig, Fill the brake flow path hole with compressed air.
If you blow compressed air suddenly brake piston can jump out of casing.
There is a risk of damage or injury to the part;
Please follow the directions below.

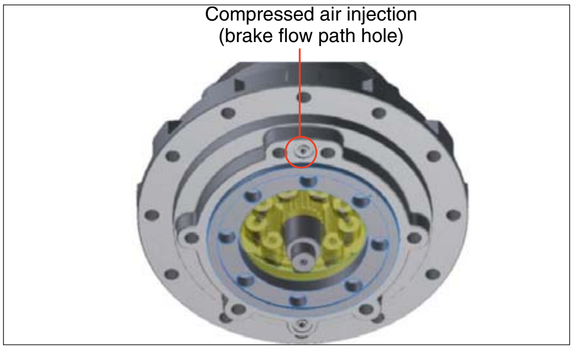
① Cover the casing with a clean cloth.

② Press the cloth lightly with your hand to prevent the brake piston from jumping out.

③ Fill the brake flow path hole with compressed air.

559A7TM26

※ Both ends of the jig are hooked to the groove of the brake piston. The center of the jig is hooked to the center of the drive shaft and makes the jig and brake piston parallel.



559A7TM40

(12) Put the motor horizontally.
Disassemble cylinder block (104) from drive shaft (103).
Also, disassemble piston assy (10), set plate (106), spherical bush (105), cylinder spring (107).

559A7TM31

※ Mark each cylinder block bore, piston assy, and set plate bore in the assembled position so that the assembled position does not change.
Be careful not to scratch the sliding surface of cylinder block, piston, shoe, etc.

559A7TM32

559A7TM33

559A7TM34

(13) Disassemble friction plate (118) and separator plate (119) in casing (202).

559A7TM35

(14) Disassemble the drive shaft (103) and swash plate (109).

559A7TM37

(15) Disassemble swash piston assy (20), swash piston spring (511), pivot (112), pivot pin (113).

559A7TM38

(16) Do not disassemble any further unless there is a specific problem. At this state, check bearing according to the following inspection instructions.

① Check the raceway surface, rollers or balls in the visible range, and make sure there are no pittings or cracks.

② Check for local corrosion and wear on the ball or roller.

③ Make sure that there is excessive wear powder between the ball or roller and cage.

④ When turning lightly by hand, check that it rotates smoothly.

If there is no problem after checking in this step, the following disassembly is not necessary.

559A7TM41

(17) The following operations should be carried out if necessary.
From the casing (202), the outer ring of the cylindrical roller bearing (115) is tapped lightly from the housing part side of the oil seal (408) via the steel bar and is pulled out.

※ Do not reuse the removed roller bearing.

(18) Disassemble the snap ring (410) using a snap ring plier (inner diameter) in casing (202).

(19) From the casing (202), the gently tap out the housing side of the oil sea (408) is tapped lightly from the rear of the casing (202) via the steel bar and is pulled out.

※ Do not reuse the removed oil seal.

(20) Remove the cylindrical ball bearing (116) from the valve casing (201) using the slide hammer bearing puller.

※ Do not reuse the removed ball bearing.

※ The disassembly operation is finished. Please check that there is no problem in each part.

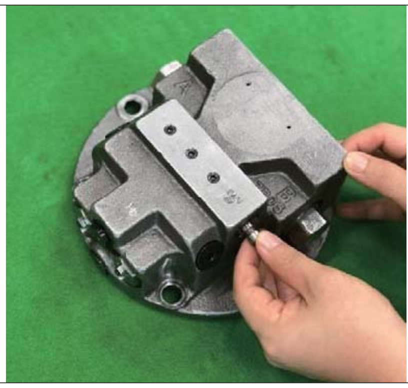
4) ASSEMBLY

(1) The assembly way is the reverse of the disassembly way, but be careful of the following items.
① Be sure to repair damaged parts during disassembly. Please prepare replacement parts in advance.
② Wash each part thoroughly with wash liquid and dry with compressed air.
③ Be sure to coating clean hydraulic oil to sliding parts, bearings, etc. and assemble them.
④ In principle, should replace seal parts such as O ring and oil seal.
⑤ Use the torque wrench to tighten the mounting bolts and plugs of each part, and tighten with the torque shown in page 7-99-4.

■ ASSEMBLY OF VALVE CASING KIT

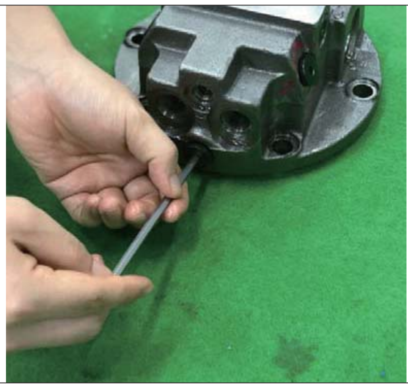
(2) This operation is necessary only when the seat assy is removed.
Assemble seat (432) → steel ball (503) → seat casing (433) → ROH plug (302) in this order.

※ Please pay attention to the assembly sequence.
Refer to section drawing.



559A7TM19

(3) This operation is necessary only when the restrictor is removed.
Apply loctite on the restrictor (310) and assemble to casing (21). And tighten ROH plug (302) with specified torque.



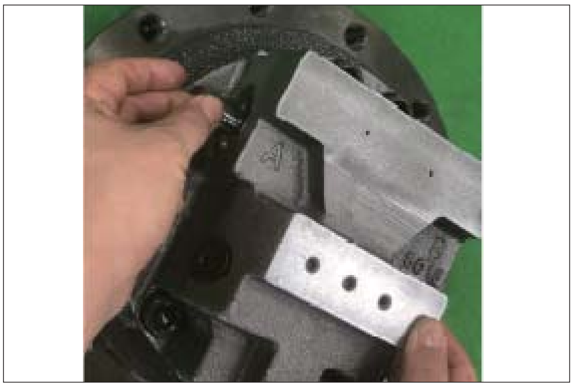
559A7TM18

(4) Assemble the 2 speed spool (502), the 2 speed spool spring (506), the 2 speed plug (308).

559A7TM17

(5) Assemble main spool (501), Plunger (504) → main spool spring (505) → O-ring (411) → Assemble set plug (309) in order.

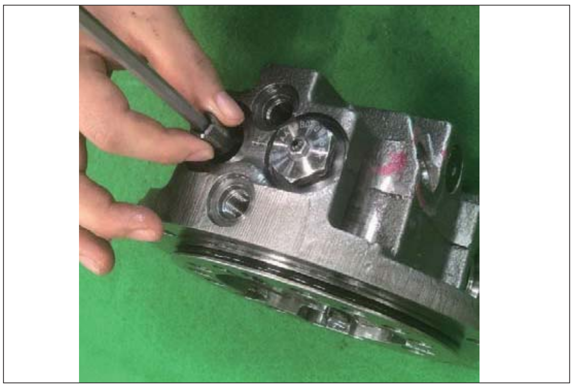
※ Make sure the main spool moves smoothly.



559A7TM16

559A7TM15

(6) Assemble the cap (509).



559A7TM14

(7) Assemble the spring cap (510) to the relief valve assy (30). Attach the relief valve to the valve casing (201).

※ It is advisable to apply grease thinly on the mating surface of spring cap to prevent falling off.

559A7TM13

■ ASSEMBLY OF MOTOR BODY

(8) Place the casing (202) on the work surface with the valve casing (201) assembly surface facing up.

(9) Insert the oil seal (408) into the casing (202) using a jig.

※ Pay attention to the direction of the oil seal. (refer to cross-section drawing) Apply grease thinly to the lip portion of the oil seal.
Hit it uniformly and be careful not to scratch the outer circumference.

(10) Assemble the snap ring (410) using the snap pliers (internal diameter) on the casing (202).

※ The snap ring "R" faces the oil seal.

(11) The outer ring of the cylindrical roller bearing (115) is tapped lightly on the casing (202) via the bearing press jig and incorporated.

559A7TM39

(12) Assemble pivot pin (113), pivot (112) to casing (202).

559A7TM38

(13) Assemble swash piston spring (511) and swash piston assy (20) to casing (202).

※ It is advisable to apply grease thinly on the mating surface of swash piston spring to prevent falling off.
When assembled normally, the pushed swash piston assy goes deeper than the casing stage.
Make sure the swash piston assy moves smoothly.

559A7TM38

(14) Place casing (202) horizontally and insert swash plate (109).

※ Make sure the swash plate moves smoothly.

559A7TM37

(15) The drive shaft (103) is attached to the casing (202).

※ Carefully insert so that the lip of the oil seal will not be scratched.
Assemble by applying oil to the oil seal assembly of drive shaft.
When assembled normally, the pushed swash piston assy goes deeper than the casing stage.
Make sure the swash piston assy moves smoothly.

559A7TM36

(16) Set the cylinder spring (107) and the spherical bush (105) into the cylinder block (107). and insert the piston assy. (10) to the bore of set plate (106).

※ Assemble the Larger outer diameter face of set plate and the sliding movement face of shoe in the same direction. (Refer to section drawing)

559A7TM34

559A7TM33

(17) The piston assy (101) set on the set plate (106) is assembled in the cylinder block (104). And the cylinder block sub assembled is inserted in accordance with the spline of the drive shaft (103) to casing (202).

※ Before assembly, apply oil to the surface of cylinder bore or piston.

※ It is easy to insert into drive shaft by matching spline of cylinder block and the spherical bush.

※ After assembly, try rotating the cylinder block lightly in the forward and reverse directions by hand.

559A7TM32

(18) Place casing (202) with the valve casing (201) assembly surface of casing (202) facing up.
Separator plate (119) and friction plate (118) are alternately assembled to casing (202).

※ Put the separator plate in arc groove of casing.

※ Please refer to the assembly drawing for the number of assembly of the separator plate and friction plate.


559A7TM30


559A7TM29

(19) Install the O-ring (118, 401) and the back up ring (409) on the brake piston (114).

※ Back up ring is installed to the valve casing direction.

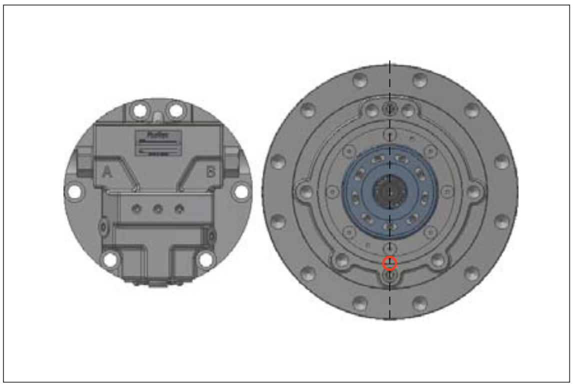
※ If the grease is lightly applied to the O-ring, it will not be cut when the brake piston is inserted.


559A7TM28

(20) The brake piston (114) is tapped lightly via the brake piston press jig and pressed into casing (202).


559A7TM27

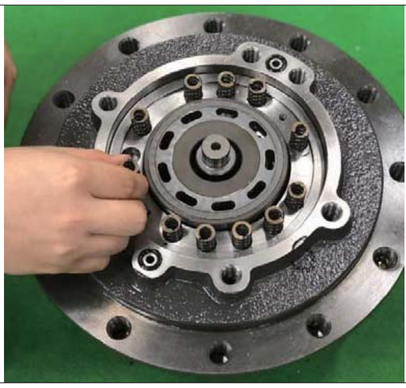
※ Pay attention to the assembly direction of the brake piston. The orifice of the brake piston is located downward on the same vertical line as the flow hole in casing.



559A7TM42

(21) Attach the brake spring (117) to the brake piston (114).

(22) Attach the O-ring (402) to the casing (202).



559A7TM25

(23) This term is necessary only when the cylindrical ball bearing (116) is removed.
The outer ring of the cylindrical ball bearing (116) is tapped lightly on the valve casing (201) via the bearing press JIG and incorporated.

559A7TM24

(24) The valve plate (108) is installed in the valve casing (202) and the O-ring (401) is mounted.

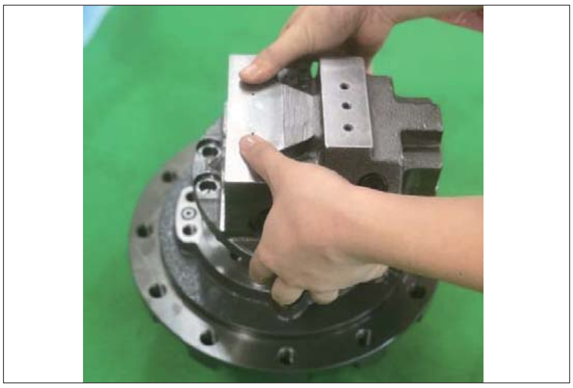
※ Apply grease thinly to the joint surface of the valve plate. (prevention of dropout)

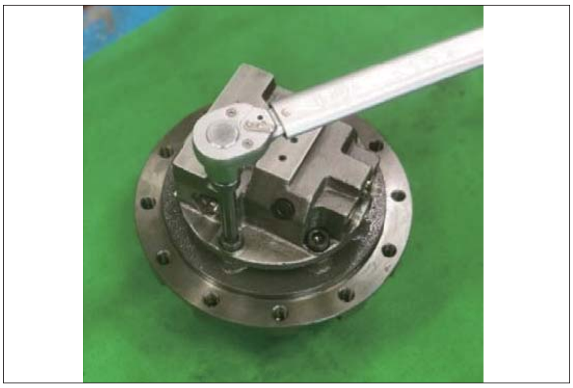

559A7TM23


559A7TM22

(25) Attach the valve casing (201) to the casing (202) and fasten it with a socket bolt (301).

※ Be careful not to remove the valve plate.
Be careful not to tilt the brake spring.
Tighten the socket bolt evenly until specified torque.

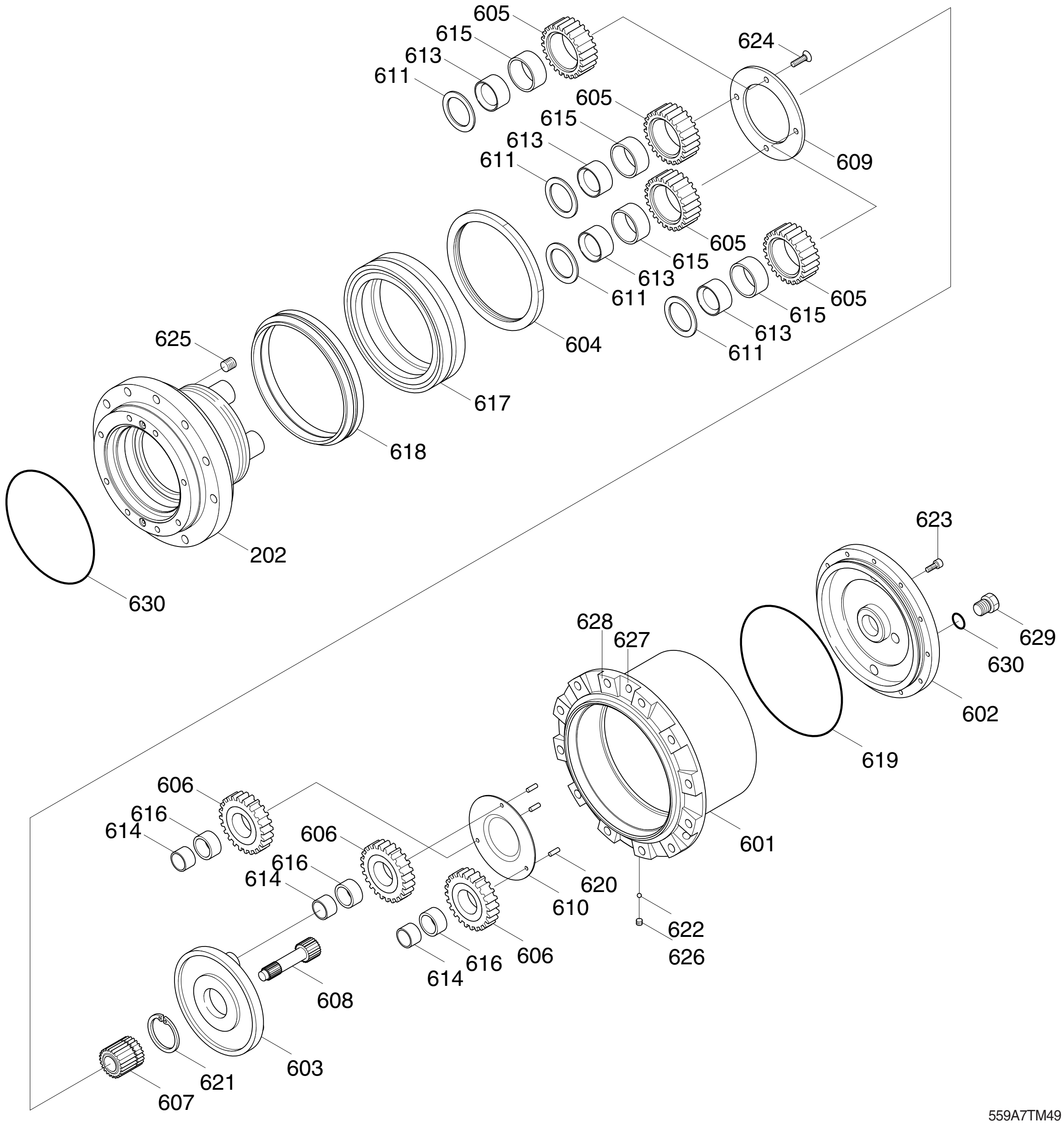

559A7TM21


559A7TM20

※ Assembly is completed with the above.

3. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) PARTS LIST



202	Reducer casing	610	Thrust plate R	621	Snap ring
601	Housing	611	Thrust washer	622	Steel ball
602	Cover	613	Collar	623	Socket bolt
603	Holder	614	Inner race	624	Bolt
604	Ring nut	615	Needle bearing	625	Plug
605	Planetary gear F	616	Needle bearing	626	Plug
606	Planetary gear R	617	Angular bearing	627	Side plate A
607	Sun gear	618	Floating seal kit	628	Side plate B
608	Ring nut	619	O-ring	629	Plug
609	Thrust plate F	620	Spring pin	630	O-ring

2) GENERAL PRECAUTIONS

This reduction gear is designed to reduce the number of parts and balance the life of the parts. Therefore, all parts can be supplied separately, but when replacing, it is often necessary to replace them both structurally and functionally.

			Parts to be replaced at the same time													
	Part number		617	618	611	613	615	605	612	609	624	603	620	614	616	606
	Name of part		Angular bearing	Floating seal	Thrust washer	Collar	Needle bearing	Planetary gear F	Thrust washer	Thrust plate F	Ext. flush bolt	Holder	Spring pin	Inner race	Needle bearing	Planetary gear R
Replace-ment parts	617	Angular bearing	—	○												
	618	Floating seal	△	—												
	611	Thrust washer			—	△	△	△	△	○	○					
	613	Collar			△	—	○	○	△	○	○					
	615	Needle bearing			△	○	—	○	△	○	○					
	605	Planetary gear F			△	△	△	—	△	○	○					
	612	Thrust washer			△	△	△	△	—	○	○					
	609	Thrust plate F			△	△	△	△	△	—	○					
	624	Ext. flush bolt			△	△	△	△	△	○	—					
	603	Holder														
	620	Spring pin											No disassembly			
	614	Inner race										Please replace the entire No.1 holder assy.				
	616	Needle bearing														
	606	Planetary gear R														

○ Indicates parts that must be replaced at the same time.
▲ Indicates parts that is desirable to be replaced at the same time.
※ Be sure to replace the bearing inner and outer rings at the same time.

2) TOOLS AND TIGHTENING TORQUE

(1) Tightening torque

This table shows the typical screw sizes and tightening torques used in the reduction gear.

Item	Part name	Size	Tightening torque	
			kgf · m	lbf · ft
604	Ring nut	M165	18	130
623	Socket bolt	M6	1.2	8.7
624	Ext flush bolt	M8	3	21.7
625	Pipe plug	RC 3/8	10	72.3
626	Pipe plug	RC 1/8	1.2	8.7
629	RO plug	G 1/2	8.4	60.8
632	ROH plug	G 1/8	1.5	10.8

(2) Tools

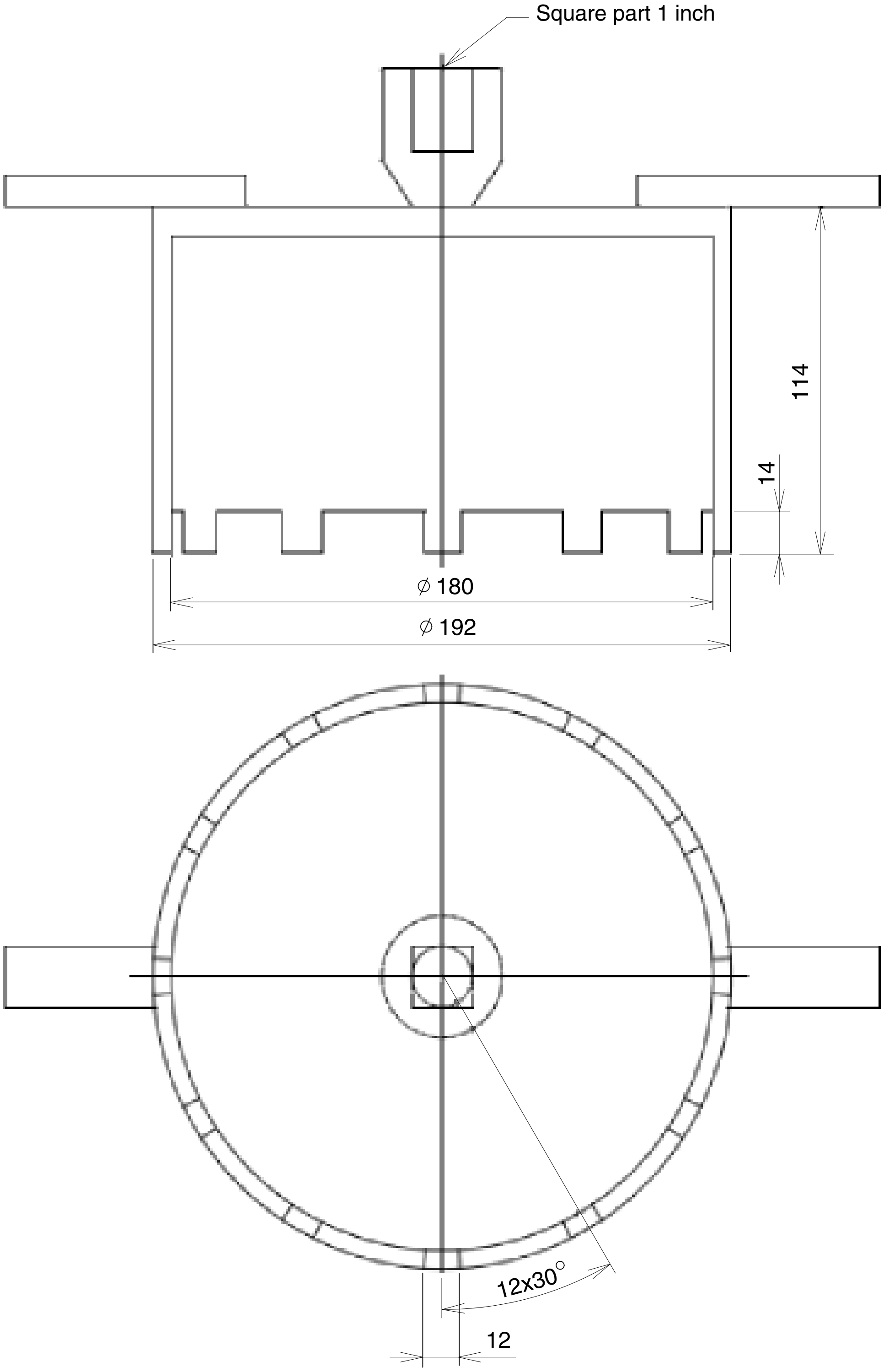
① Hexagon wrench and exclusive jig

Tools	Item	Part name	B size	Screw size
Hexagon wrench	626	Pipe plug	5	R 1/8
	625	Pipe plug	8	R 3/8
	629	RO plug	10	G 1/2
	623	Socket bolt	5	M6
	624	Ext flush bolt	6	M8
Exclusive jig	604	Nut ring	-	M165

② Others

Tools	Specification
Driver	Screw driver (small, medium)
Hammer	Rubber or plastic hammer, iron hammer
Torque wrench	Torque adjustment range
	- For 4~20 Nm
	- For 20~100 Nm
	- For 40~200 Nm
Snap ring plier	Outer diameter
Nut ring disassembly and assembly jig	-

(3) Special tools



559A7TM50

4) ASSEMBLY

(1) Disassembly and assembly tips

① When disassembling, be careful not to damage the parts.

② Wash each part with washing oil and dry it with compressed air.

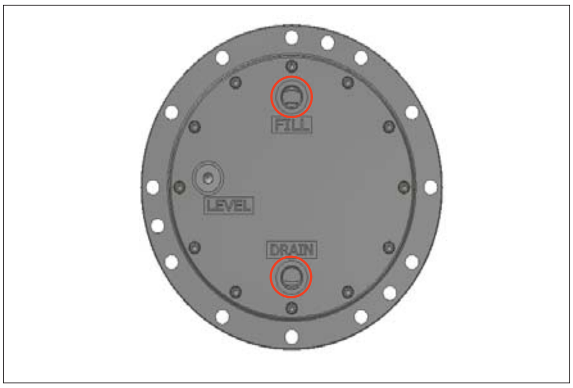
③ The numbers in parentheses after the part name represent the symbols of the cross-sectional drawing.

(2) Wrap a wire rope around the outside of the traveling device to lift it with a crane. Then wash with white kerosene. After washing, dry with compressed air.

559A7TM51

(3) Make sure that the fill plug (629) and drain plug (629) shown in the dimensional installation drawing are perpendicular to the horizontal plane.
Unplug both ports and remove the gear oil.
Place it on a suitable base.

※ Receive the gear oil in a clean container and inspect the presence and presence of wear powder.



559A7TM52

(4) Loosen the socket bolt (623) and disassemble the cover (602).

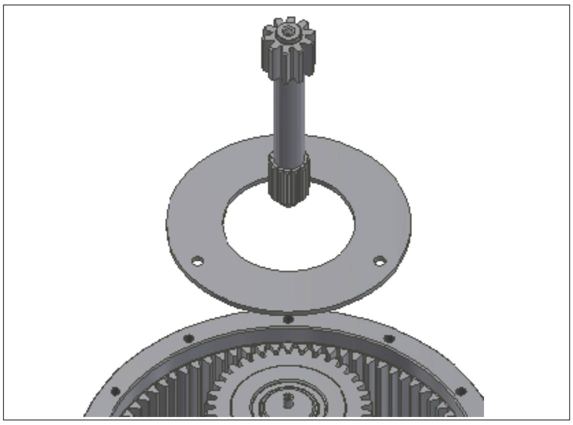
559A7TM53

※ Be careful not to damage the O-ring (619) of the cover during disassembly.

559A7TM54

(5) Disassemble thrust plate R (610), drive gear (608).

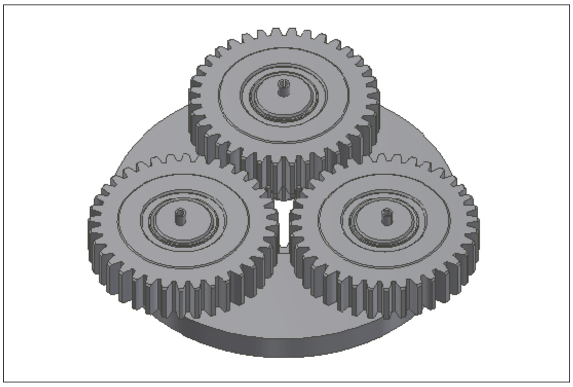
559A7TM55



559A7TM56

(6) Disassemble the No.1 holder assembly with the planetary gear R (606) attached.

※ No. 1 holder assy components are as follows.
- Holder (603)
- Spring pin (620)
- Planetary gear R (606)
- Needle bearing (616)
- Inner race (614)



559A7TM57

(7) Disassembly of No.1 holder assy

Do not disassemble the No.1 holder assy further.
In this state, check the parts according to the inspection instructions shown in section 6.
As mentioned above, it is recommended to exchange No.1 holder assy as a set as much as possible.
Please follow the instructions below when you are forced to exchange parts.

559A7TM58

① Disassemble in the order of planetary gear R (606) → Needle bearing (616) → Inner race (614).

② Unplug the spring pin.

※ Mark each planetary gear, needle bearing, and inner race in the assembled position so that each combination and assembly position does not change.

※ When disassembling the spring pin, do not reuse it.

559A7TM59

(8) Disassemble the sun gear (607).
Then, the snap ring (621) is separated from the sun gear (607) using a snap ring pliers.

559A7TM60

559A7TM61

(9) Disassemble the No.2 holder assy.

(10) Disassembly of No.2 holder assy

Do not disassemble any more No.2 holder assy unless otherwise specified.

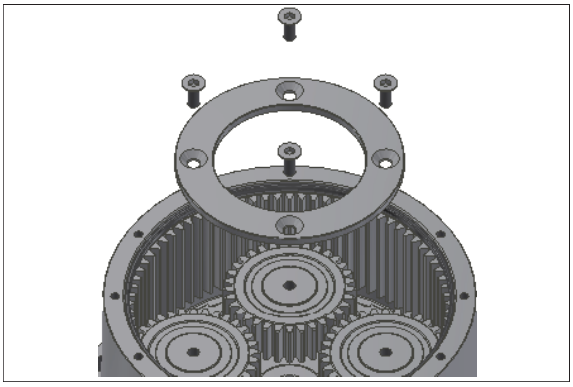
In this state, check the parts according to the inspection instructions shown in section 6.

As mentioned above, it is recommended to exchange No.2 holder assy as a set as much as possible.

Please follow the instructions below when you are forced to exchange parts.

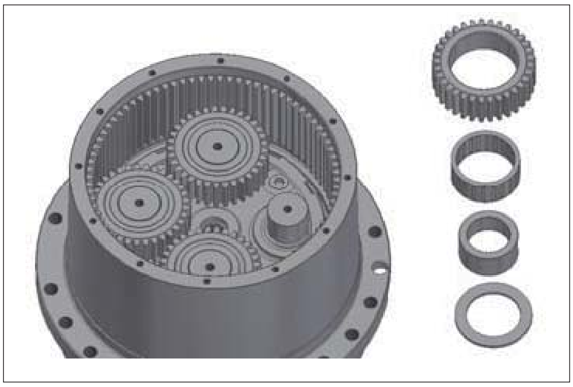
559A7TM62

① Apply enough heat to ext flush bolt(624)
② Disassemble thrust plate F (609).
③ Disassemble in the order of thrust plate F (609) → Planetary gear F (605) → Needle bearing (615) → Collar (613) → Thrust washer (611)



559A7TM63

※ Mark each planetary gear, needle bearing, and inner race in the assembled position so that each combination and assembly position does not change.



559A7TM64

(11) Do not disassemble any further unless there is a specific problem.

In this condition, check the parts according to the inspection instructions shown in Section 1-2.

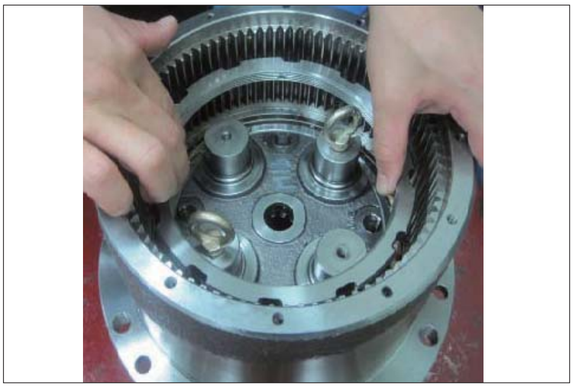
※ If there is no problem after checking in this step, the following disassembly is not necessary.

(12) Disassemble pipe plug (625).

※ When disassembling the pipe plug (625), Do not reuse.

559A7TM65

(13) Disassemble the nut ring (604).



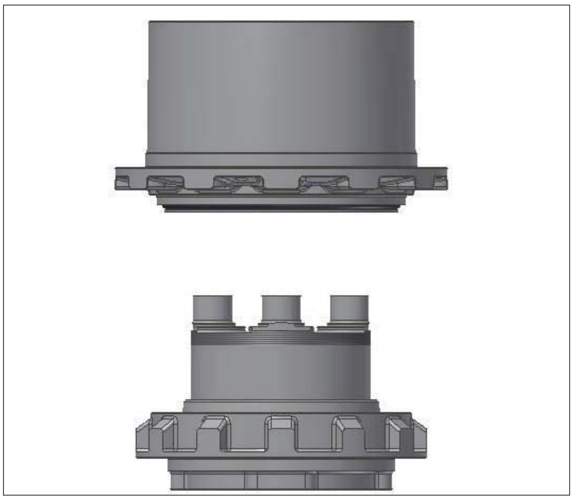
559A7TM66

※ Please disassemble the nut ring using the dedicated jig referring to the attachment.

559A7TM67

(14) Disassemble casing (202) from housing (601).

559A7TM68



559A7TM69

(15) After disassembling the pipe plug (626), remove the steel ball (622).

※ The number of steel ball is 105.
When disassembling, be sure to check the number of balls.

559A7TM70

(16) Disassemble the floating seal kit (618).

559A7TM71

(17) Disassemble angular bearing (617).

559A7TM72

※ Use a press for disassembly.

559A7TM73

※ The disassembly process is finished.

5) ASSEMBLY

(1) After placing angular bearing (617) on housing (601), press the angular bearing (617) using a press.

559A7TM72

※ Assemble the protrusion of the inner ring face down.

559A7TM73

(2) Insert 105ea steel ball (622) into housing (601) and tighten the pipe plug (626).

※ Pipe plug is assembled by wrapping Teflon tape.
After assembling the pipe plug, check if the cloud condition of the angular bearing is smooth.

(3) Assemble the floating seal kit (618) using dedicated jig for casing (202) and housing (601).

559A7TM74

※ Before assembling, check the metal surface of the floating seal for cracks, dents, and O-ring damage.
Do not apply oil to the floating seal rubber part.
After assembling the floating seal, check if there are any deviations.

559A7TM75

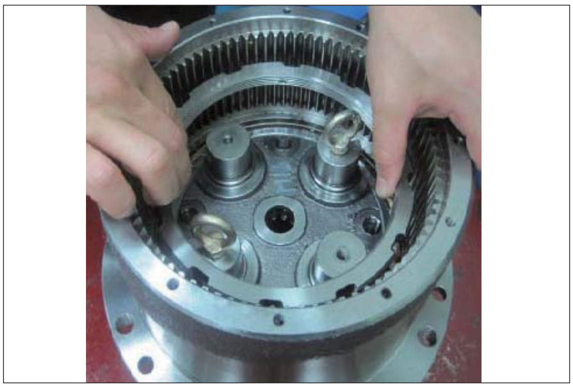
(4) Using a press, assemble the housing sub on the casing (202).

※ Floating seal are located on the same circumference.
Rotate so that the floating seal is in place.

559A7TM68

(5) Use the nut ring disassembly jig to assemble the nut ring (604).

※ After tightening, check the gap between casing and housing (0.5 ~1.5 mm) with a gauge.

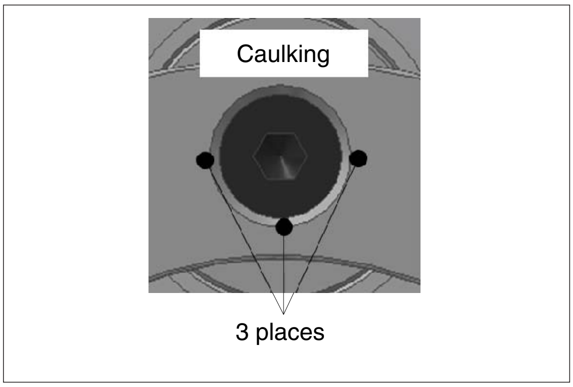


559A7TM66

(6) Tighten pipe plug (625).

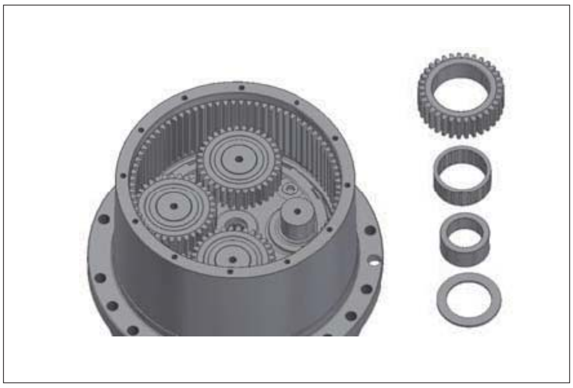
559A7TM65

※ Caulking is performed to prevent loosening around the assembly.



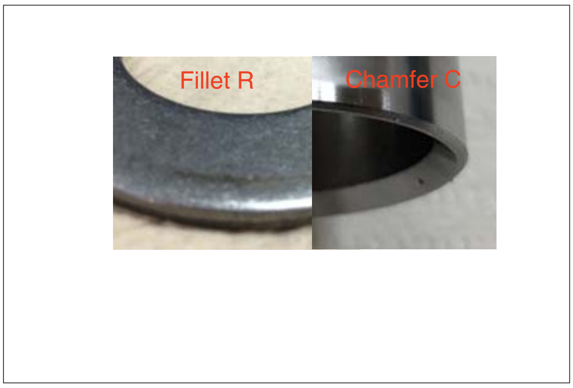
559A7TM76

(7) Assemble the No. 2 holder assy
Assemble in the order of thrust washer (611) → Collar (613) → Needle bearing (615) → Planetary gear F (605)



559A7TM64

※ The thrust washer R part is assembled in the bearing direction and the chamfered part of the collar is assembled in the casing direction.



559A7TM77

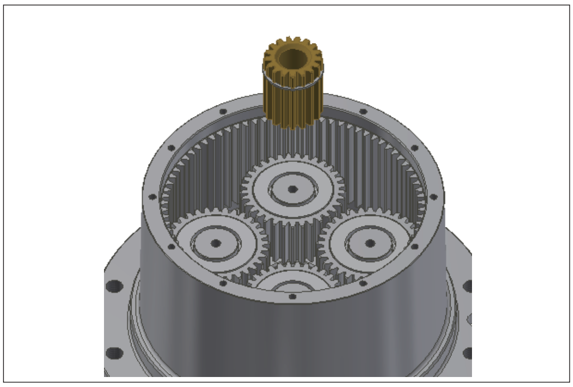
(8) Assemble the thrust plate F (609), ext flush bolt (624).

※ Assemble ext flush bolt by applying loctite in the axial direction.

559A7TM60

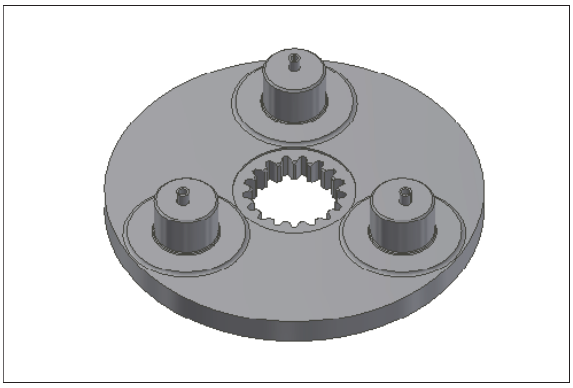
(9) Fasten snap ring (621) to sun gear (607) using snap ring pliers. And assemble in the center of planetary gear F.

※ Assemble R part of snap ring toward cover.
Sun gear is assembled with the long end facing toward casing.



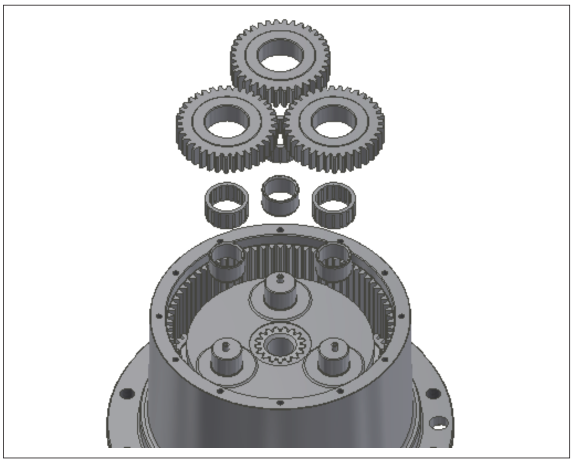
559A7TM78

(10) Assemble the No.1 holder assy.
Assemble spring pin (620) to holder (603).



559A7TM79

(11) Assemble the holder sub to the sun gear (607).
Then, assemble inner race (614) → Needle bearing (616) → planetary gear R.



559A7TM80

※ When assembling planetary gear R, assemble the convex part in the direction of thrust plate R.

※ Check the rotation status.

559A7TM81

(12) Assemble drive gear (608) and thrust plate R (610).

559A7TM55

(13) Assemble the O-ring (619), side plate A (627) and side plate B (628) on the cover (602).

※ After assembling the side plate B, remove any debris from the side.

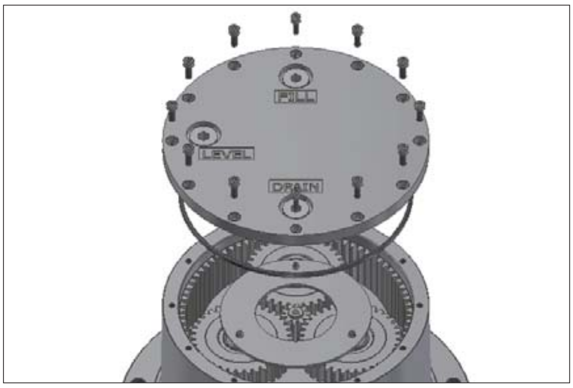
559A7TM82

(14) Assemble cover sub to housing.

559A7TM53

(15) Assemble the socket bolt (623).

※ Assemble by applying loctite in the direction of the socket bolt axis.



559A7TM54

※ The assembly process is finished.

GROUP 7 RCV LEVER

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

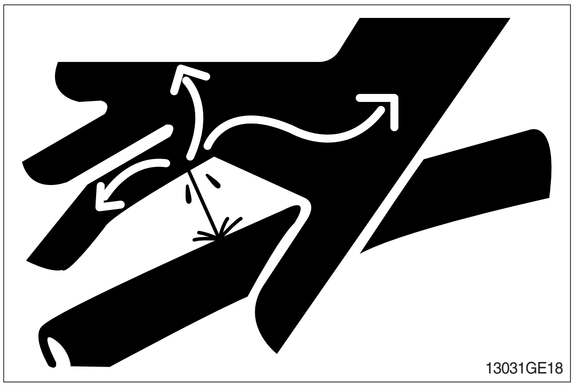
(4) Loosen the socket bolt (1).

(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.



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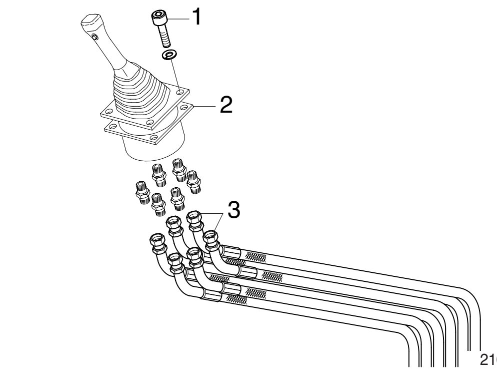

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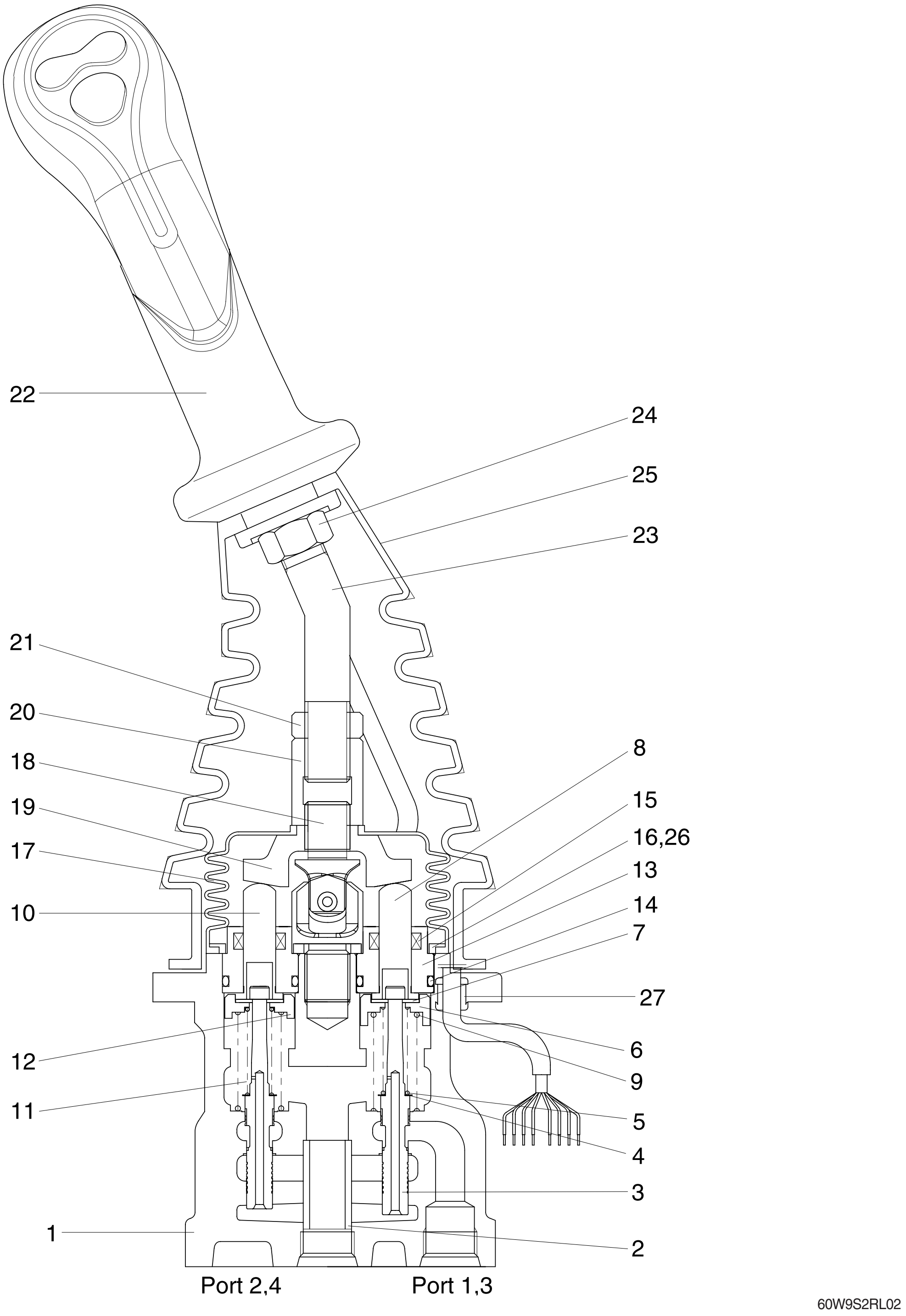
2) INSTALL

(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

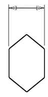
1) STRUCTURE



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

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Allen wrench	6	B 
Spanner	22	
	27	
(+) Driver	Length 150	
(-) Driver	Width 4~5	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

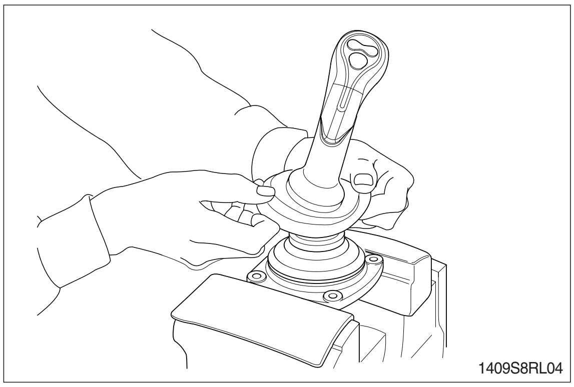
Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Joint	18	M14	3±0.2	14.5±1.4
Adjusting nut	20	M14	6±0.6	43.4±4.3
Lock nut	21	M14	6±0.6	43.4±4.3

3) DISASSEMBLY

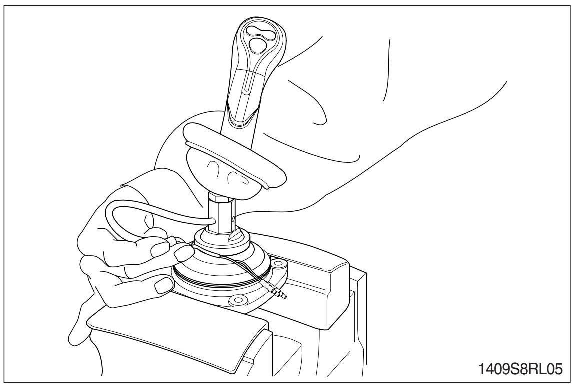
(1) Clean pilot valve with kerosene.
※ Put blind plugs into all ports

(2) Fix pilot valve in a vise with copper (or lead) sheets.

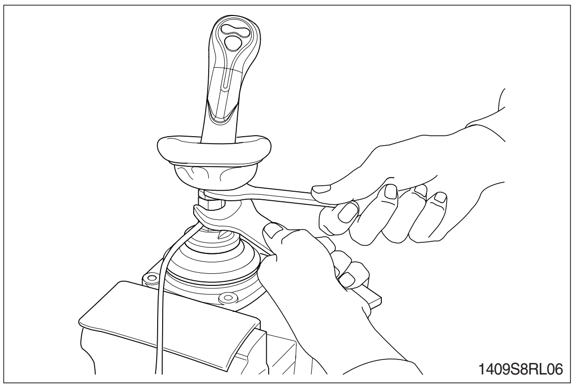
(3) Remove end of boot (25) from case (1) and take it out upwards.



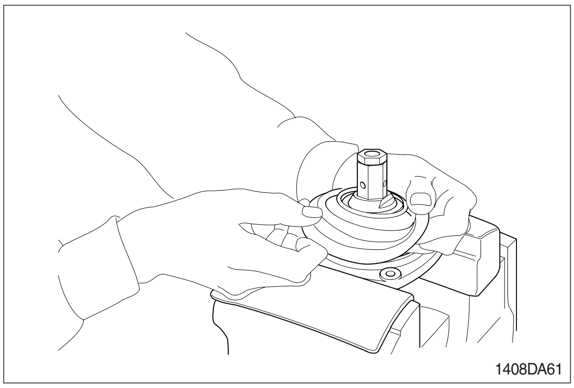
※ For valve with switch, remove cord also through hole of casing.



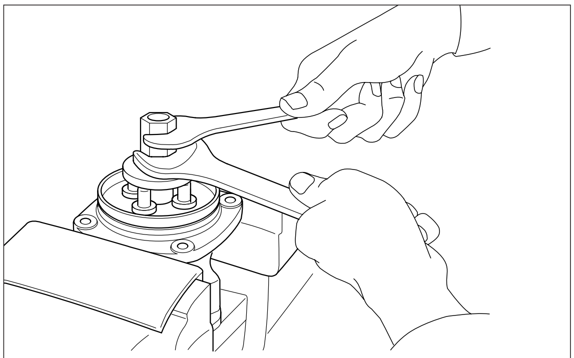
(4) Loosen lock nut (21) and adjusting nut (20) with spanners on them respectively, and take out handle section as one body.



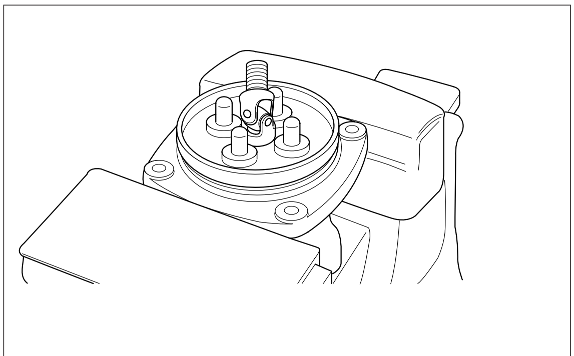
(5) Remove the boot (17).



(6) Loosen adjusting nut (20) and swash plate (19) with spanners on them respectively, and remove them.



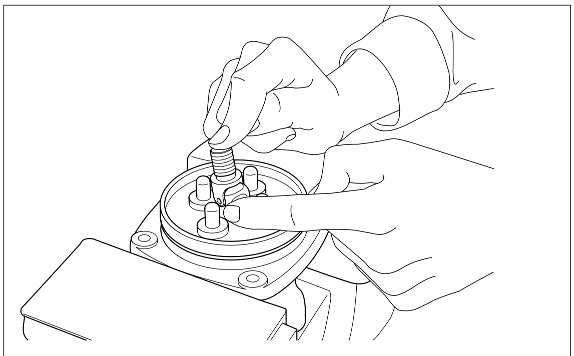
36078RL01



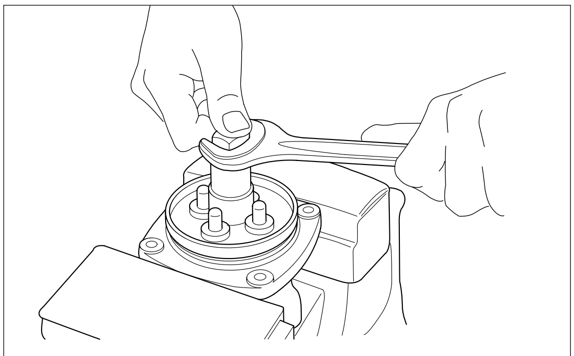
36078RL02

(7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).

※ When return spring (9) is strong in force, plate (16), plug (13) and push rod (10) will come up on loosening joint.
Pay attention to this.

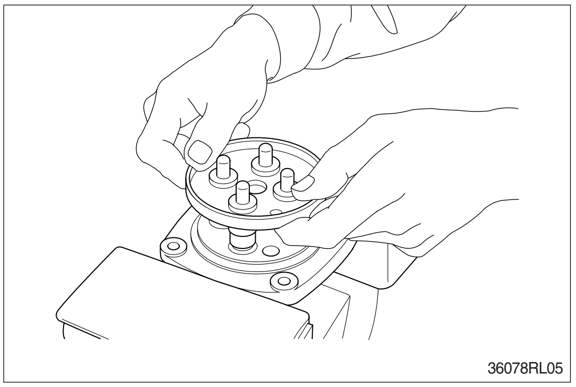


36078RL03



36078RL04

(8) Remove plate (16).

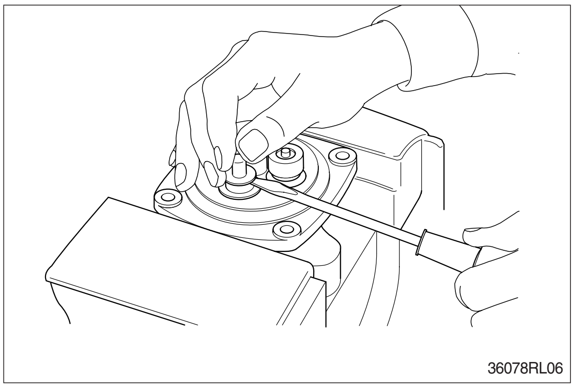


36078RL05

(9) When return spring (9) is weak in force, plug (13) 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.

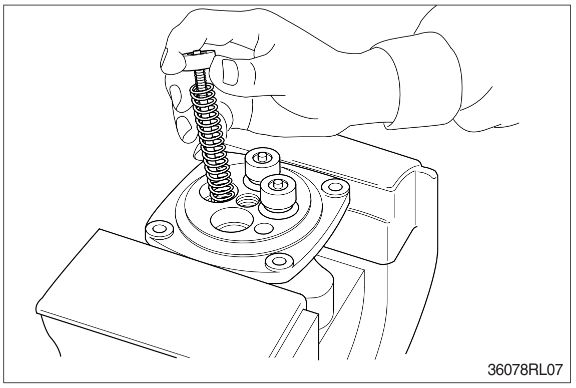
※ During taking out, plug may jump up due to return spring (9) force.
Pay attention to this.



36078RL06

(10) Remove reducing valve subassembly and return spring (9) out of casing.

※ Record relative position of reducing valve subassembly and return springs.



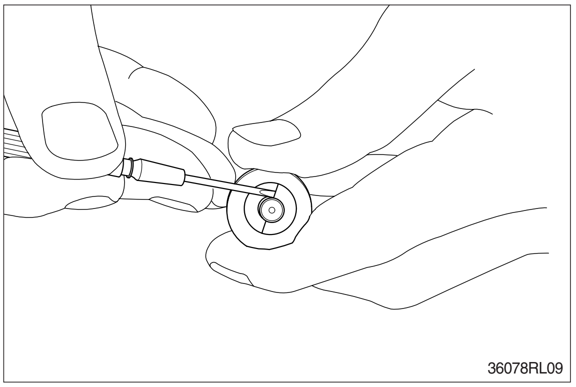
36078RL07

(11) For disassembling reducing valve section, stand it vertically with spool (3) bottom placed on flat workbench. Push down spring seat (6) and remove two pieces of semicircular stopper (7) with tip of small minus screwdriver.

※ Pay attention not to damage spool surface.

※ Record original position of spring seat (6).

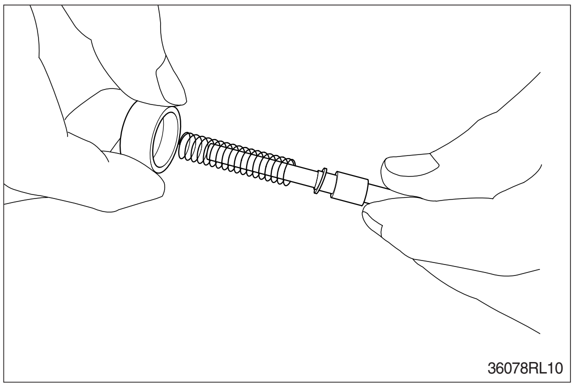
※ Do not push down spring seat more than 6 mm.



36078RL09

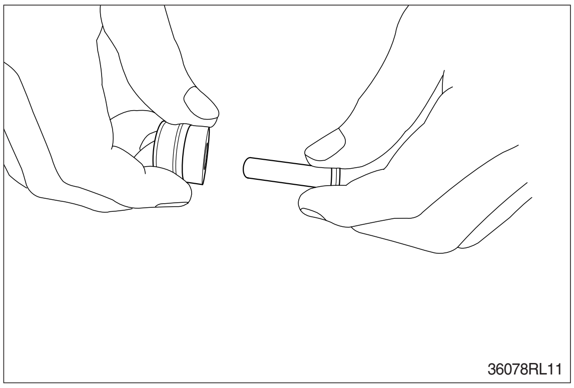
(12) Separate spool (3), spring seat (6), spring (5) and shim (4) individually.

※ Until being assembled, they should be handled as one subassembly group.



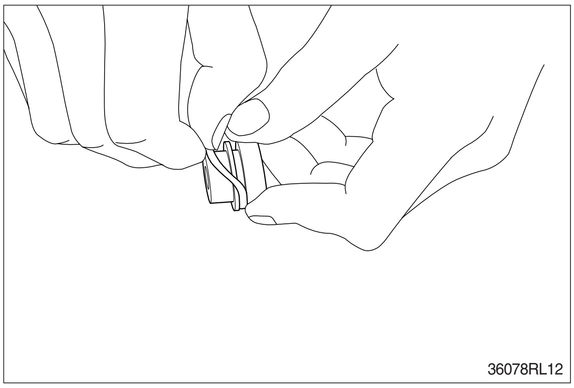
36078RL10

(13) Take push rod (10) out of plug (13).

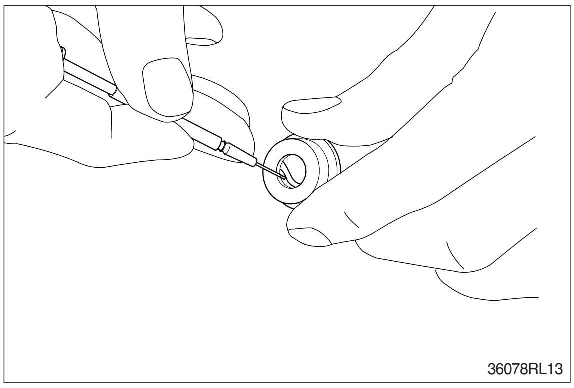


36078RL11

(14) Remove O-ring (14) and seal (15) from plug (13).
Use small minus screwdriver or so on to remove this seal.

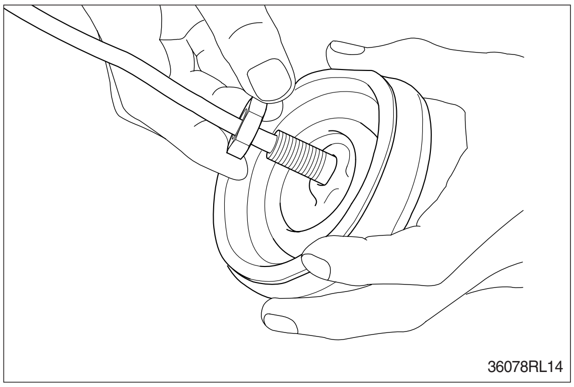


36078RL12

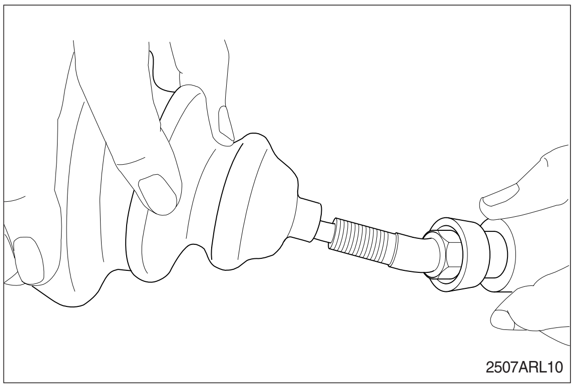


36078RL13

(15) Remove lock nut (21) and then boot (25).



36078RL14



2507ARL10

(17) 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.

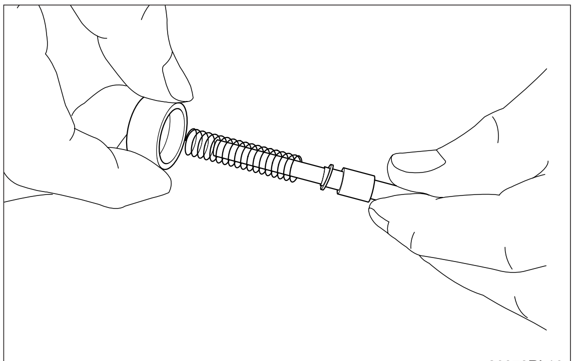
(18) Rust prevention of parts.

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

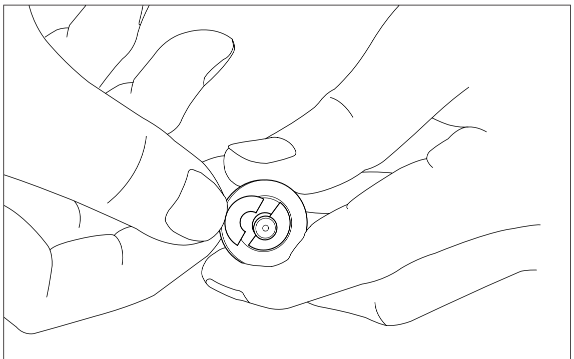
(1) Put shim (4), springs (5) and spring seat (6) onto spool (4) in this order.



36078RL16

(2) Stand spool vertically with its bottom placed on flat workbench, and with spring seat pushed down, put two pieces of semicircular stopper (7) on spring seat without piling them on.

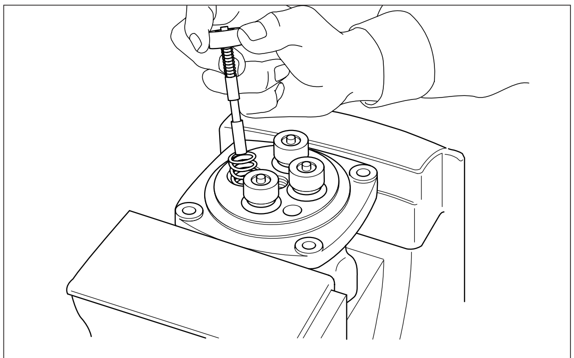
※ Assemble stopper (7) so that its sharp edge side will be caught by head of spool. Do not push down spring seat more than 6 mm.



36078RL17

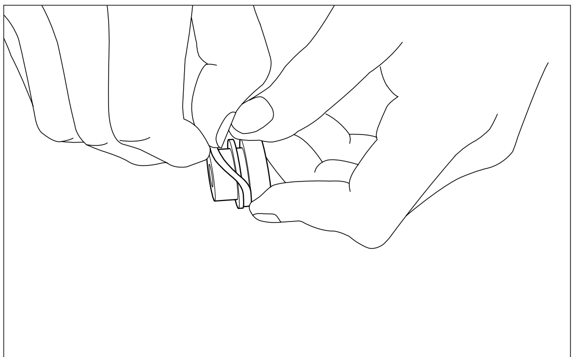
(3) Assemble spring (9) into casing (1). Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.



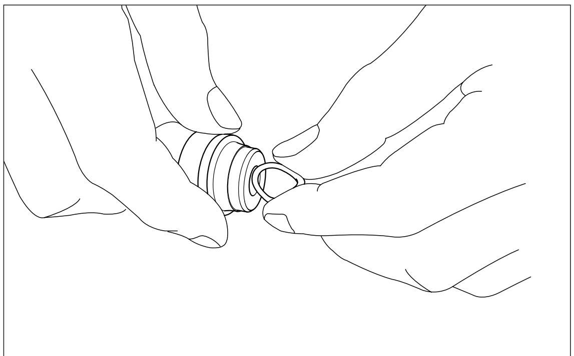
36078RL18

(4) Assemble O-ring (14) onto plug (13).



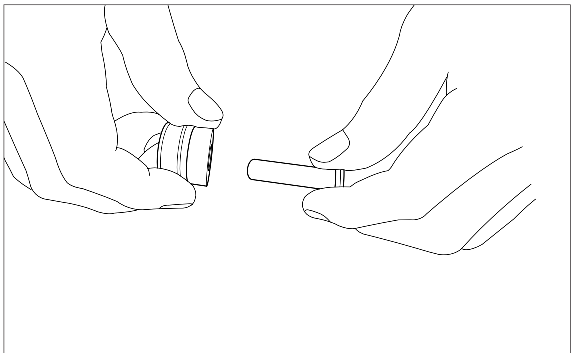
36078RL19

(5) Assemble seal (15) to plug (13).
※ Assemble seal in such lip direction as shown below.



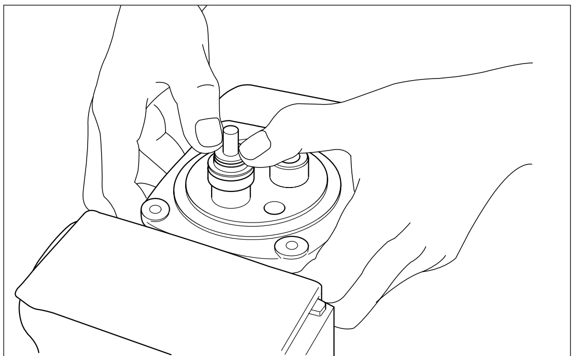
36078RL20

(6) Assemble push rod (10) to plug (13).
※ Apply working oil on push-rod surface.



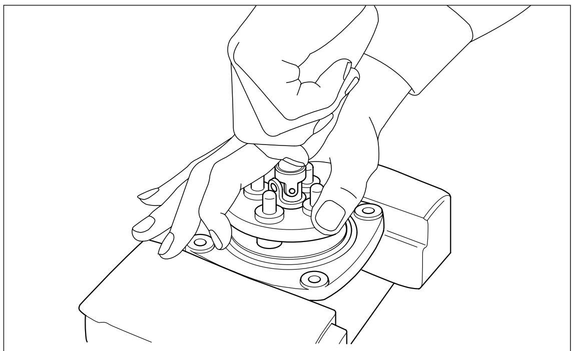
36078RL21

(7) Assemble plug subassembly to casing.
※ When return spring is weak in force, subassembly stops due to resistance of O-ring.



36078RL22

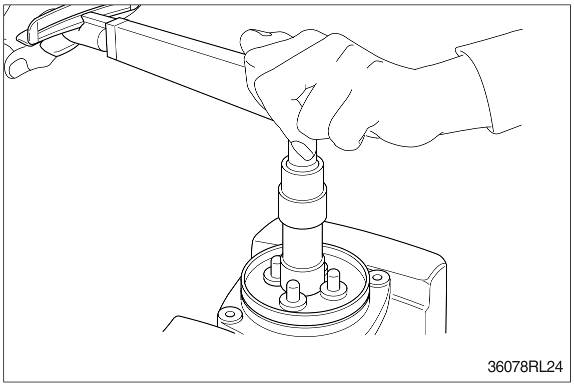
(8) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (16), and tighten joint (18) temporarily.



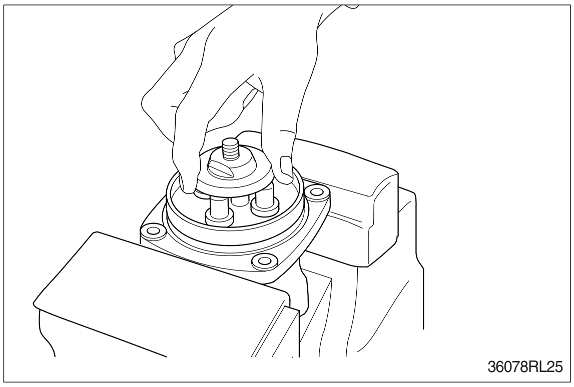
36078RL23

(9) Fit plate (16).

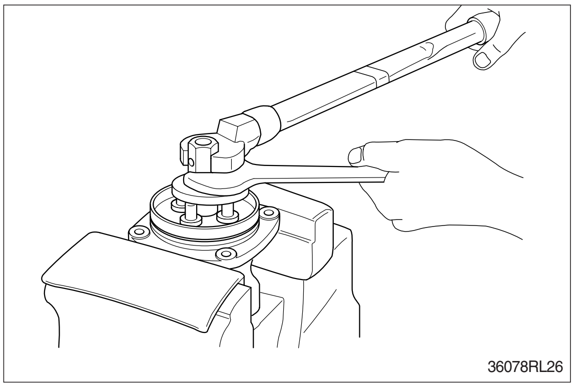
(10) Tighten joint (18) with the specified torque to casing, utilizing jig.



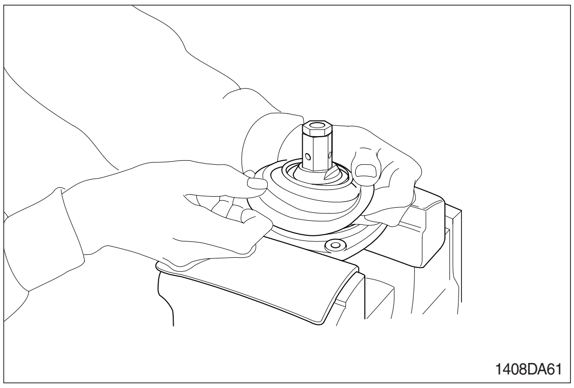
(11) Assemble swash plate (19) to joint (18).
※ Screw it to position that it contacts with 4 push rods evenly.
※ Do not screw it over.



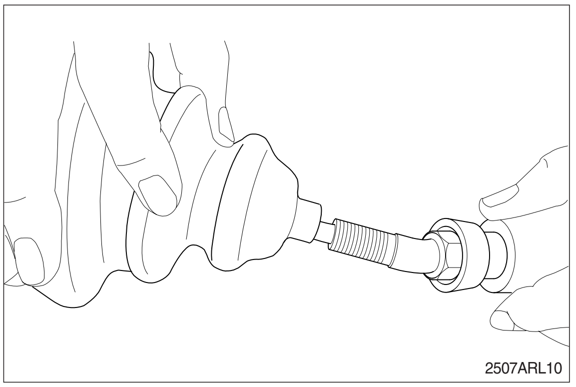
(12) Assemble adjusting nut (20), apply spanner to width across flat of plate (19) to fix it, and tighten adjusting nut to the specified torque.
※ During tightening, do not change position of disk.

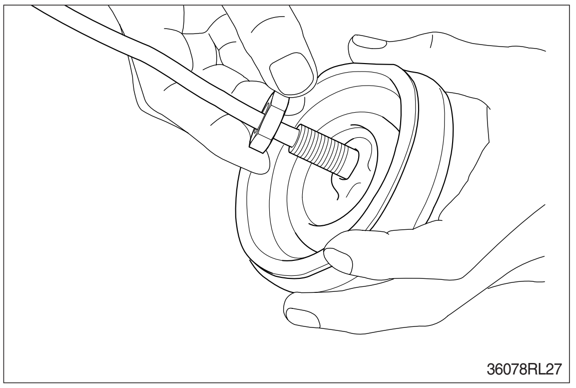


(13) Fit boot (17) to plate.

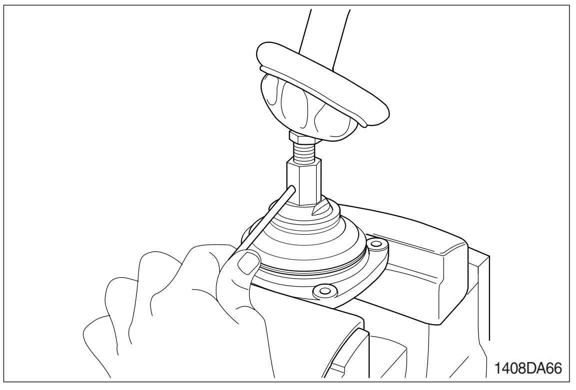


(14) Fit boot (25) and lock nut (21), and handle subassembly is assembled completely.



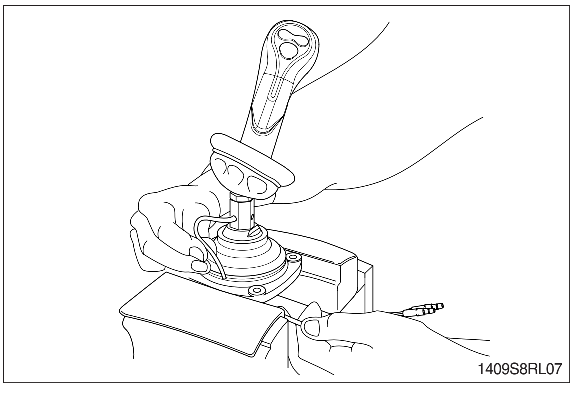


(15) Pull out cord and tube through adjusting nut hole provided in direction 60˚ to 120˚ from casing hole.

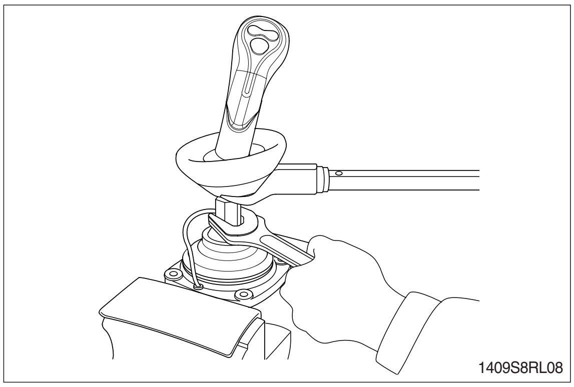


(16) Assemble bushing (27) to plate and pass cord and tube through it.

※ Provide margin necessary to operation.

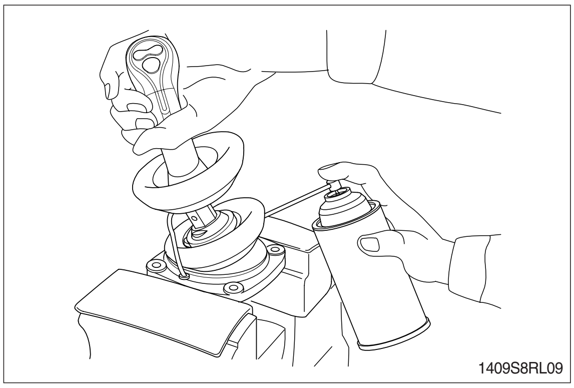


(17) Determine handle direction, tighten lock nut (21) to specified torque to fix handle.



1409S8RL08

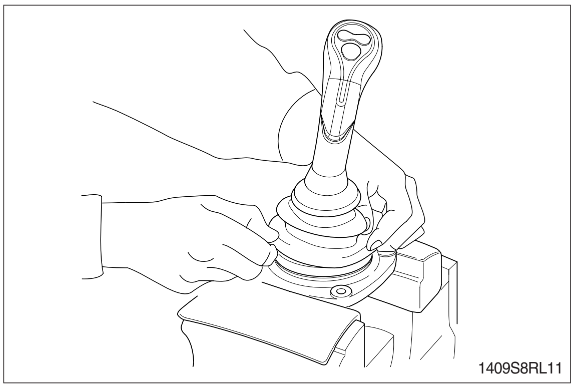
(18) Apply grease to rotating section of joint and contacting faces of disk and push rod.



1409S8RL09

(19) Assemble lower end of bellows to casing.

(20) Inject volatile rust-preventives through all ports and then put blind plugs in ports.



1409S8RL11

GROUP 8 TURNING JOINT

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

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

(4) Disconnect all hoses.

(5) Sling the turning joint assembly (1) and remove the mounting bolt (2).

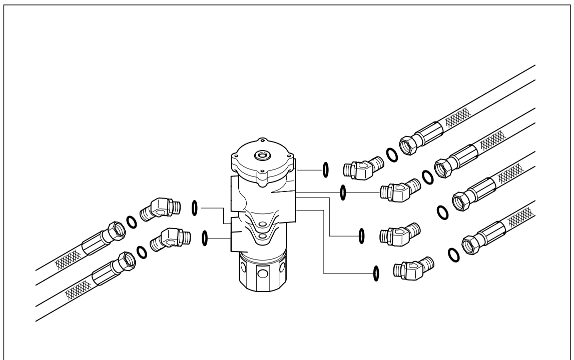
· Weight : 30 kg (70 lb)

· Tightening torque : 12.3± 1.3 kgf · m (88.9± 9.4 lbf · ft)

(6) Remove the turning joint assembly.

※ When removing the turning joint, check that all the hoses have been disconnected.

13031GE18



R5572TJ01

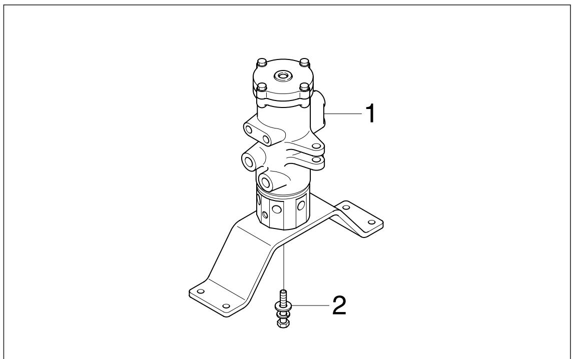
2) INSTALL

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

※ Take care of turning joint direction.

※ Assemble hoses to their original positions.

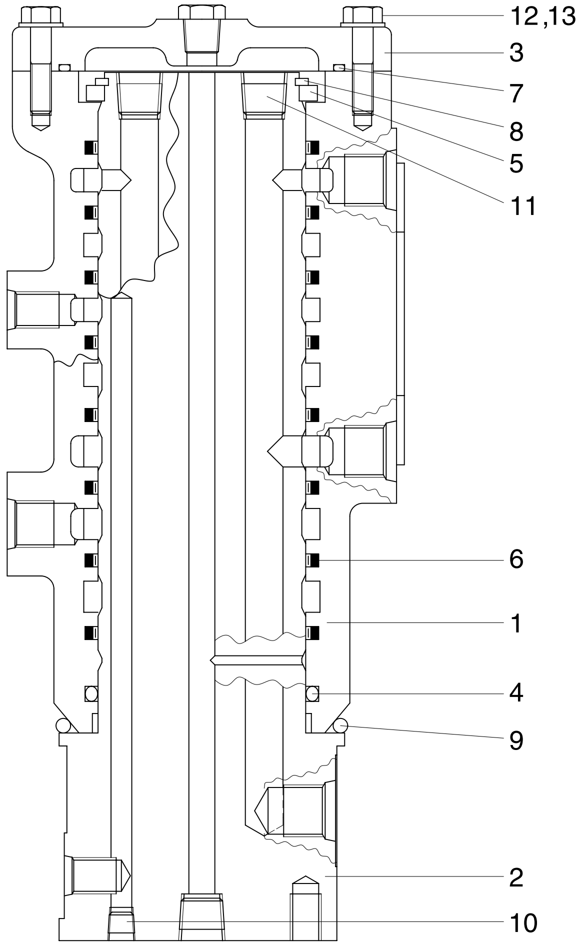
※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.



R5577TJ02

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



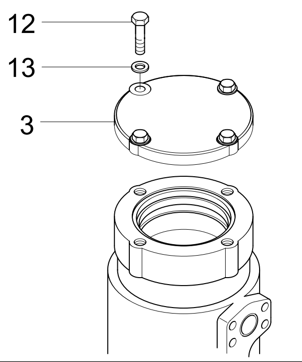
555K7TJ03

1	Hub	6	Slipper seal	10	Plug
2	Shaft	7	O-ring	11	Plug
3	Cover	8	Retainer ring	12	Hexagon bolt
4	O-ring	9	O-ring	13	Spring washer
5	Ring				

2) DISASSEMBLY

※ Before the disassembly, clean the turning joint.

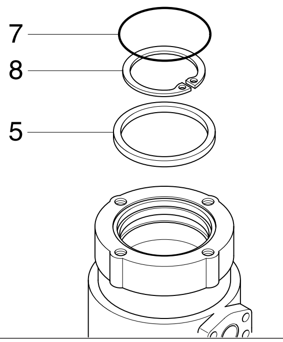
(1) Remove bolts (12), washer (13) and cover (3).



R55NM7TJ02

(2) Remove O-ring (7).

(3) Remove retainer ring (8) and ring (5).

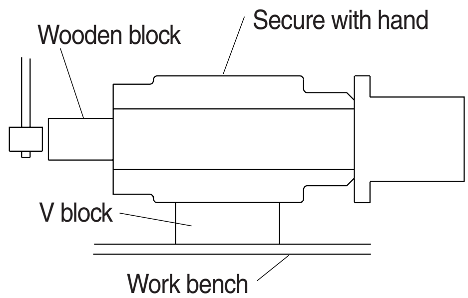


555K7TJ04

(4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

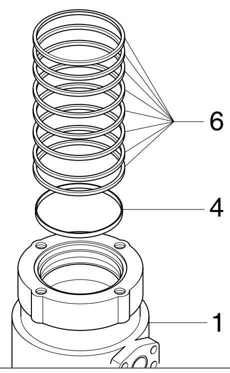
※ Take care not to damage the shaft (2) when remove hub (1) or rest it sideway.

※ Put a fitting mark on hub (1) and shaft (2).



8-141(3) 210-7

(5) Remove eight slipper seals (6) and O-ring (4) from hub (1).



555K7TJ05

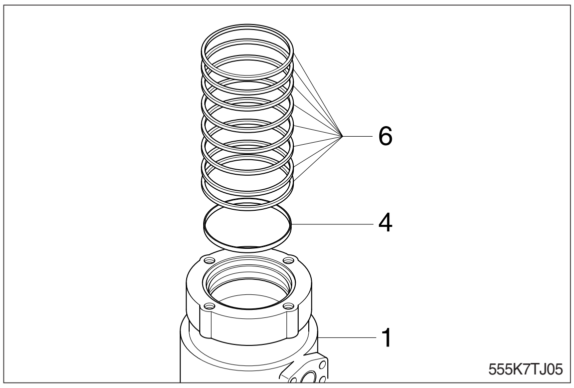
3) ASSEMBLY

※ Clean all parts.

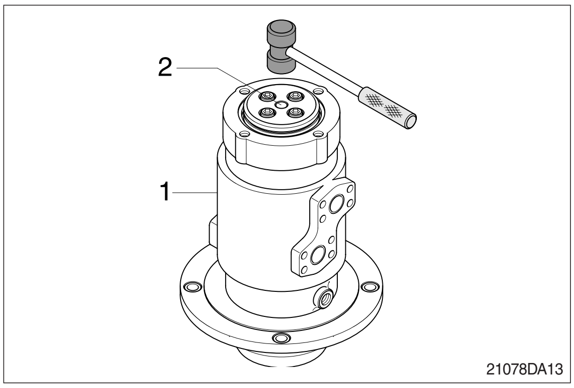
※ As a general rule, replace oil seals and O-ring.

※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(1) Fix eight slipper seal (6) and O-ring (4) to hub (1).

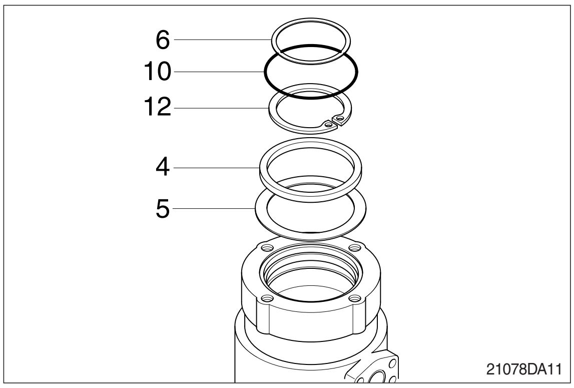


(2) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.

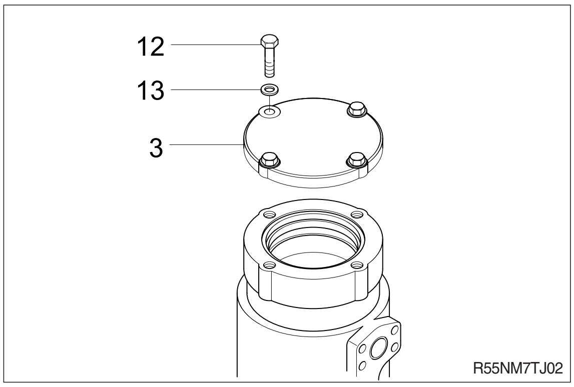


(3) Ring (5) and retainer ring (8) to shaft (2).

(4) Fit O-ring (7) to hub (1).



(5) Install cover (3) to body (1) and tighten bolts (12) with washer (13).



GROUP 9 BOOM, ARM AND BUCKET CYLINDERS

1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

(1) Removal

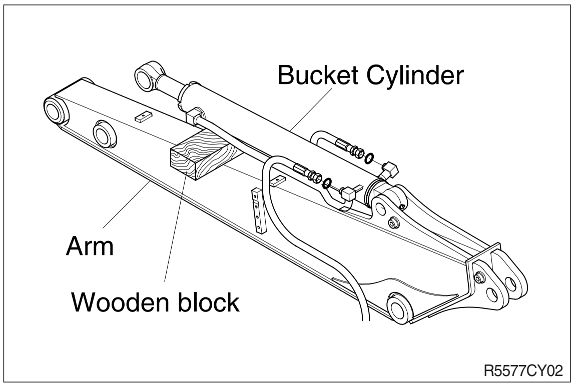
※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

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

⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank. Escaping fluid under pressure can penetrate the skin causing serious injury.

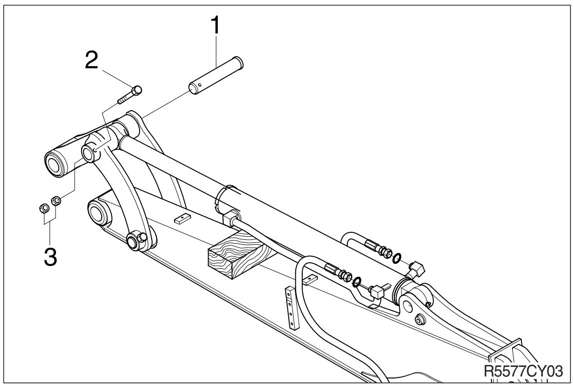
※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between bucket cylinder and arm.

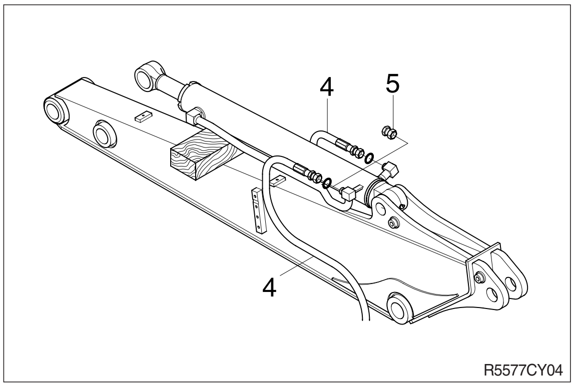


② Remove bolt (2), nut (3) and pull out pin (1).

※ Tie the rod with wire to prevent it from coming out.



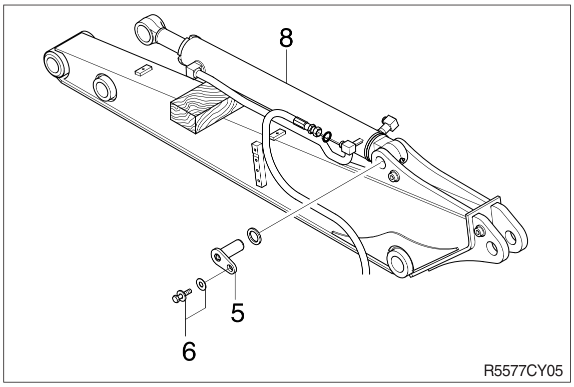
③ Disconnect bucket cylinder hoses (4) and put plugs (5) on cylinder pipe.



④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).

⑤ Remove bucket cylinder assembly (8).

  · Weight : 35 ㎏ (80 ℔)



(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.

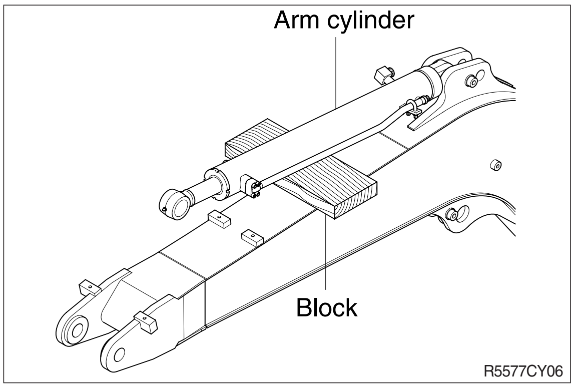
13031GE18

⚠ **Loosen the breather slowly to release the pressure inside the hydraulic tank.**

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

※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

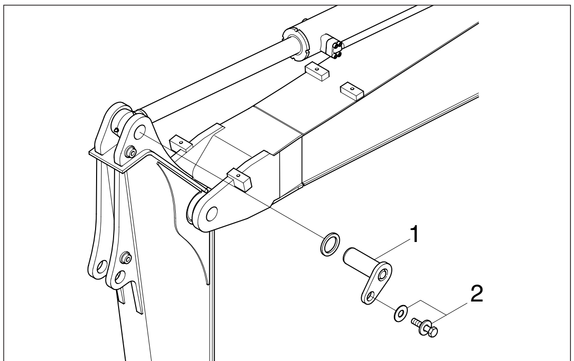
① Set block between arm cylinder and boom.



R5577CY06

② Remove bolt (2) and pull out pin (1).

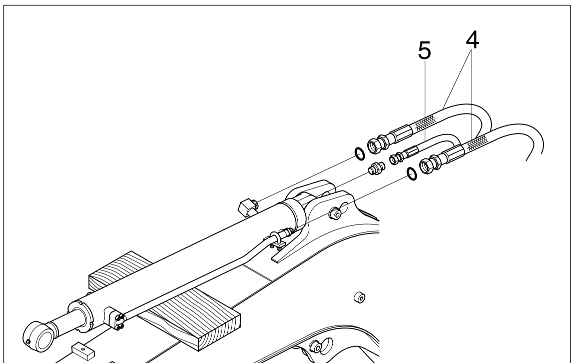
※ Tie the rod with wire to prevent it from coming out.



R5577CY07

③ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

④ Disconnect greasing pipings (5).

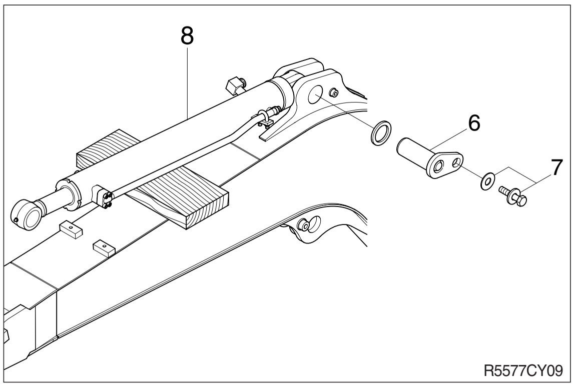


R5577CY08

⑤ Sling arm assembly (8) and remove bolt (7) then pull out pin (6).

⑥ Remove arm cylinder assembly (8).

· Weight : 60 ㎏ (130 ℔)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

※ Bleed the air from the arm cylinder.

※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

3) BOOM CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

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

13031GE18

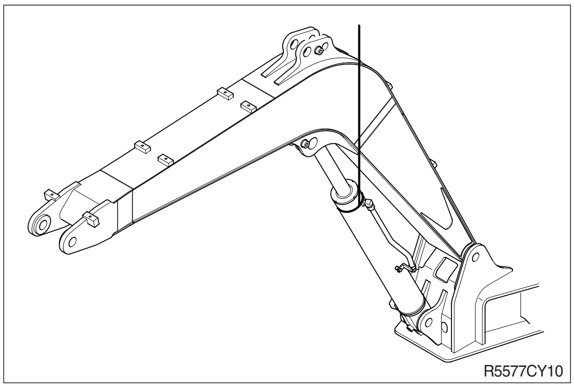
⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Disconnect greasing hoses (1).

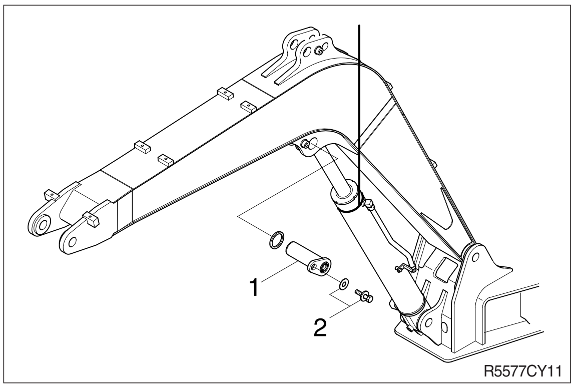
② Sling boom cylinder assembly.



R5577CY10

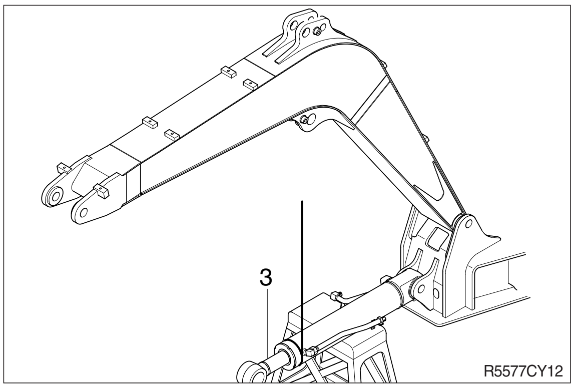
③ Remove bolt (2) and pull out pin (1).

※ Tie the rod with wire to prevent it from coming out.



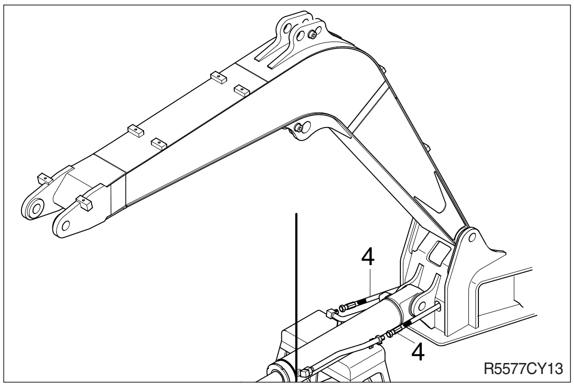
R5577CY11

④ Lower the boom cylinder assembly (3) on a stand.



R5577CY12

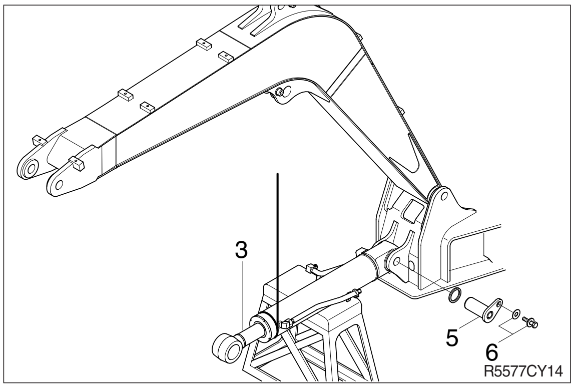
⑤ Disconnect boom cylinder hoses (4) and put plugs on cylinder pipe.



⑥ Remove bolt (6) and pull out pin (5).

⑦ Remove boom cylinder assembly (3).

· Weight : 70 ㎏ (155 ℔)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

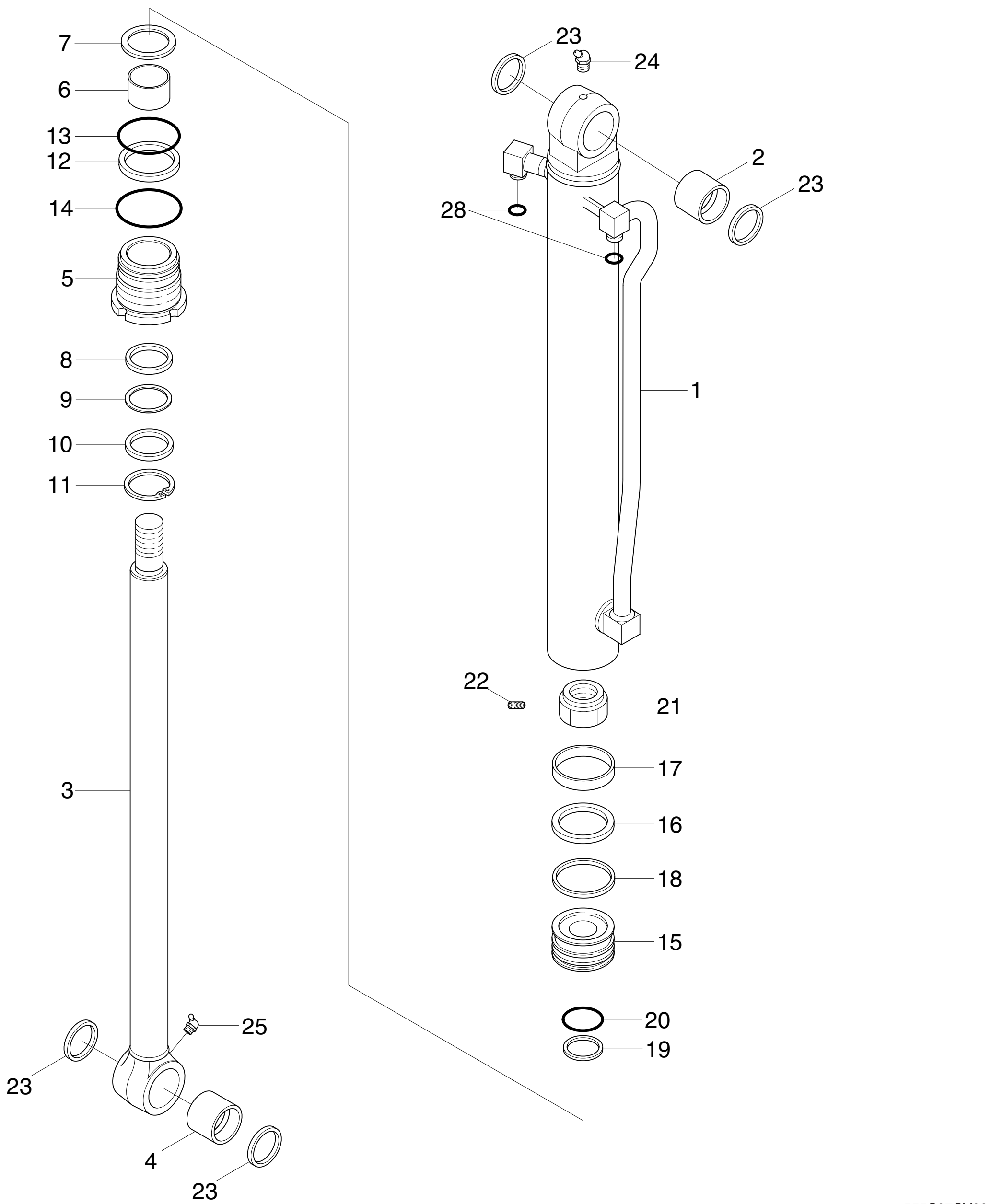
※ Bleed the air from the boom cylinder.

※ Conformed the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

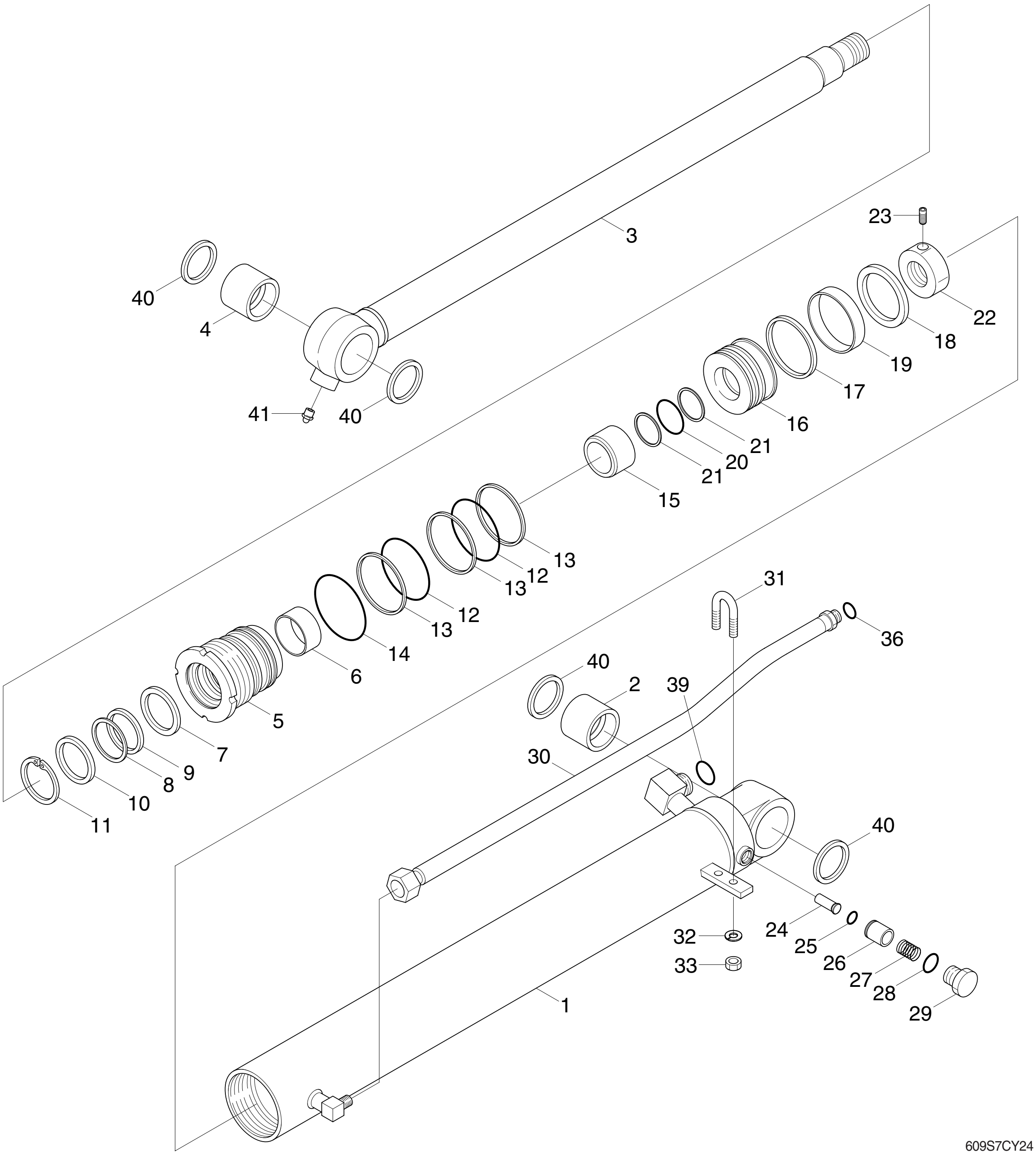
1) STRUCTURE

(1) Bucket cylinder



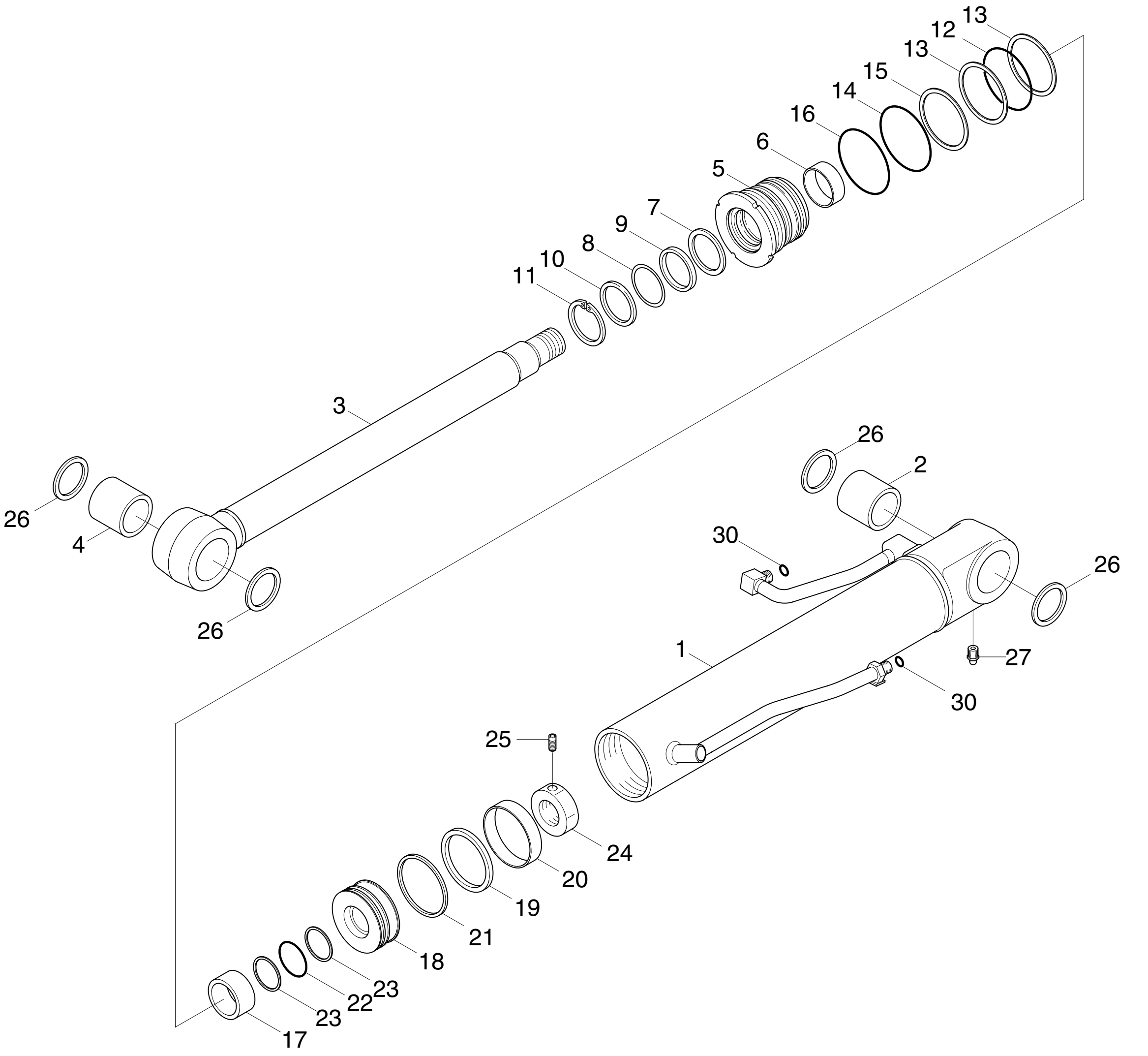
1	Tube assembly	10	Dust seal	19	Back-up ring
2	Bushing	11	Retaining ring	20	O-ring
3	Bushing	12	Back-up ring	21	Piston nut
4	Du bushing	13	O-ring	22	Set screw
5	Rod cover	14	O-ring	23	Dust seal
6	Rod bushing	15	Piston	24	Grease nipple
7	Retaining ring	16	Piston seal	25	Grease nipple
8	Buffer ring	17	Wear ring	28	O-ring
9	U-packing	18	Dust ring		

(2) Arm cylinder



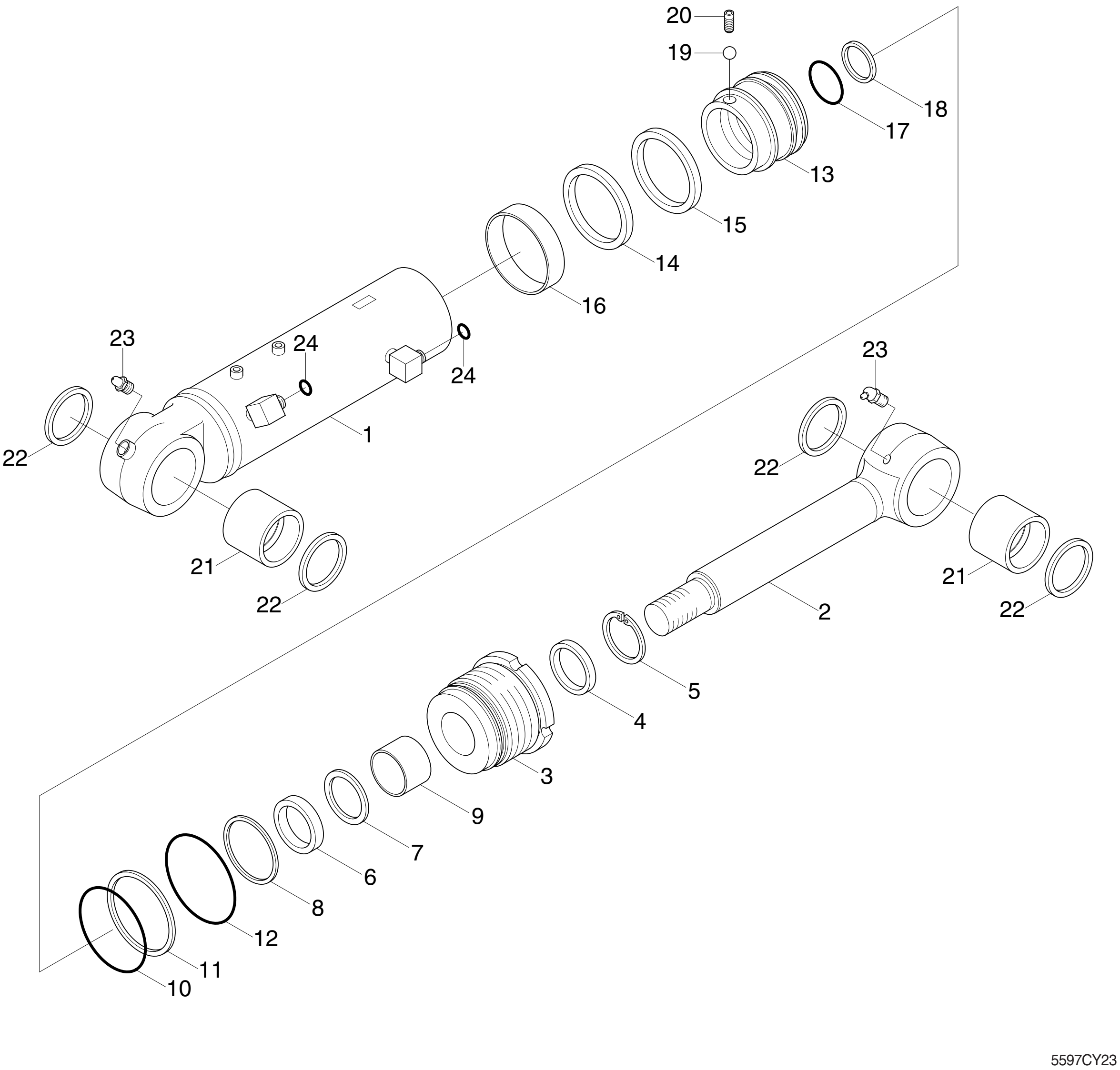
1	Tube assembly	14	O-ring	26	Check valve
2	Bushing	15	Cushion ring	27	Spring
3	Rod	16	Piston	28	Support spring
4	Pin bushing	17	Piston seal	29	Plug
5	Rod cover	18	Wear ring	30	Pipe assy
6	Rod bushing	19	Dust ring	31	U-bolt
7	Buffer seal	20	O-ring	32	Spring washer
8	U-packing	21	Back-up ring	33	Hex nut
9	Back-up ring	22	Piston nut	36	O-ring
10	Dust wiper	23	Set screw	39	O-ring
11	Retaining ring	24	Cushion plunger	40	Dust seal
12	O-ring	25	Stop ring	41	Grease nipple
13	Back-up ring				

(3) Boom cylinder



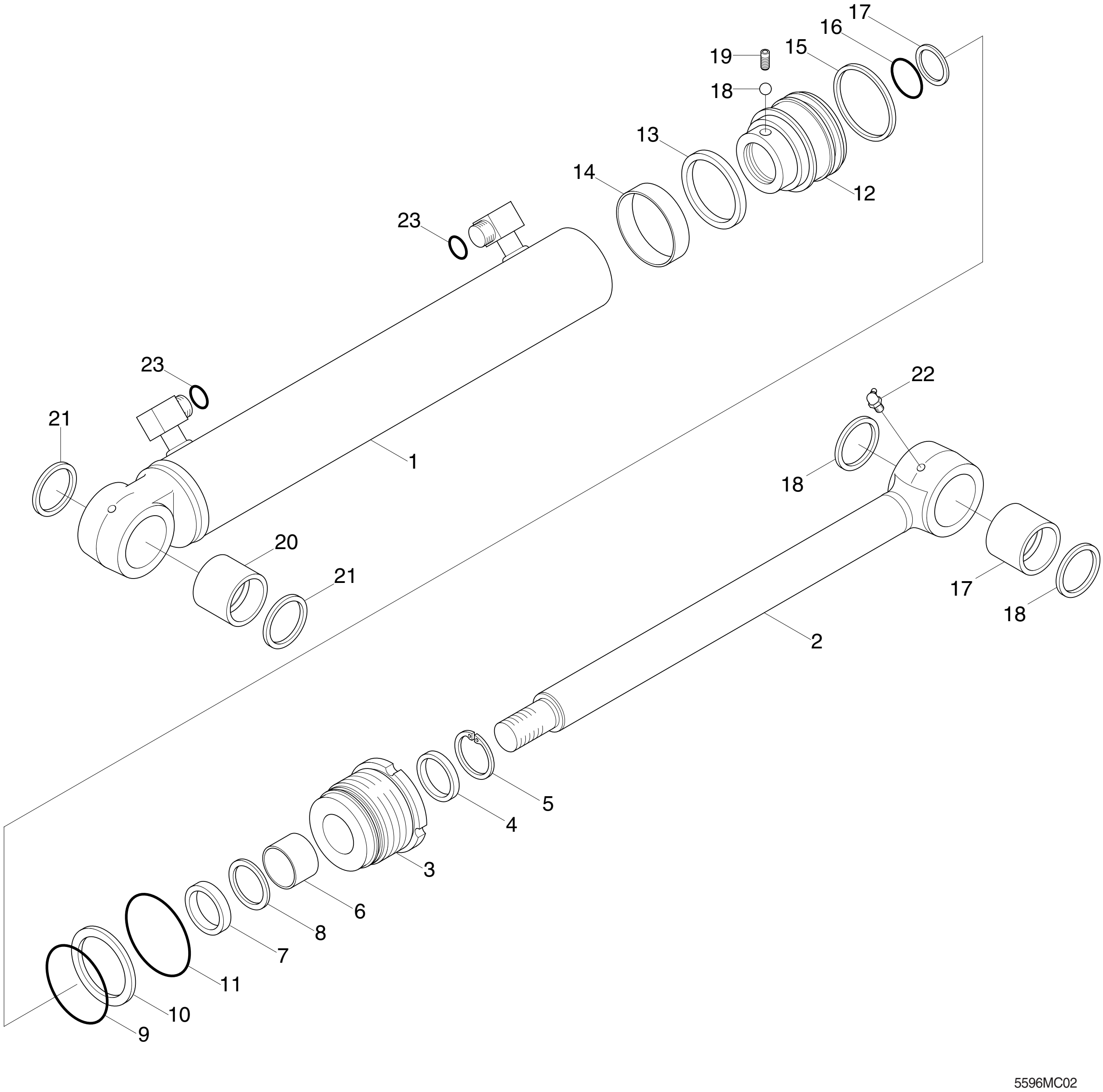
1	Tube assembly	11	Retaining ring	21	Dust ring
2	Bushing	12	O-ring	22	O-ring
3	Bushing	13	Back-up ring	23	Back-up ring
4	Du bushing	14	O-ring	24	Piston nut
5	Rod cover	15	Back-up ring	25	Set screw
6	Rod bushing	16	O-ring	26	Dust seal
7	Buffer ring	17	Cushion ring	27	Grease nipple
8	U-packing	18	Piston	30	O-ring
9	Back-up ring	19	Piston seal		
10	Dust seal	20	Wear ring		

(4) Dozer cylinder



1	Tube assembly	9	DU bushing	17	O-ring
2	Rod assembly	10	O-ring	18	Back-up ring
3	Gland	11	Back-up ring	19	Steel ball
4	Dust wiper	12	O-ring	20	Set screw
5	Retaining ring	13	Piston	21	Bushing
6	Rod seal	14	Piston seal	22	Dust seal
7	Back-up ring	15	Dust ring	23	Grease nipple
8	Buffer ring	16	Wear ring	24	O-ring

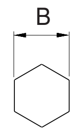
(5) Boom swing cylinder



1	Tube assembly	9	O-ring	17	Back-up ring
2	Rod assembly	10	Buck-up ring	18	Steel ball
3	Gland	11	O-ring	19	Set screw
4	Dust wiper	12	Piston	20	Pin bushing
5	Retaining ring	13	Piston seal	21	Dust seal
6	DU bushing	14	Wear ring	22	Grease nipple
7	Rod seal	15	Dust ring	23	O-ring
8	Buck-up ring	16	O-ring		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Name	Specification	
Allen wrench	8	
	10	
Spanner	M22	
Hook spanner	Suitable size	
(-) 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
Rod cover (gland)	Boom cylinder	5	M115	70±7.0	510±51
	Arm cylinder	5	M95	70±7.0	510±51
	Bucket cylinder	5	M85	75±7.5	540±54
	Dozer cylinder	3	M115	95±9.5	690±69
	Boom swing cylinder	3	M100	70±7.0	510±51
Piston nut	Boom cylinder	24	M42	75±7.5	540±54
	Arm cylinder	22	M39	75±7.5	540±54
	Bucket cylinder	21	M36	75±7.5	540±54
Piston	Boom cylinder	18	M52	50±5.0	361±36.2
	Arm cylinder	16	M39	50±5.0	361±36.2
	Bucket cylinder	15	M48	50±5.0	361±36.2
	Dozer cylinder	13	M45	113±11.3	817±81.7
	Boom swing cylinder	12	M39	97.5±9.8	705±71
Set screw	Boom cylinder	25	M8	1.5	10.8
	Arm cylinder	23	M8	1.5	10.8
	Bucket cylinder	22	M8	1.5	10.8
	Dozer cylinder	20	-	2±0.2	14.5±1.4
	Boom swing cylinder	19	M8	2±0.2	14.5±1.4

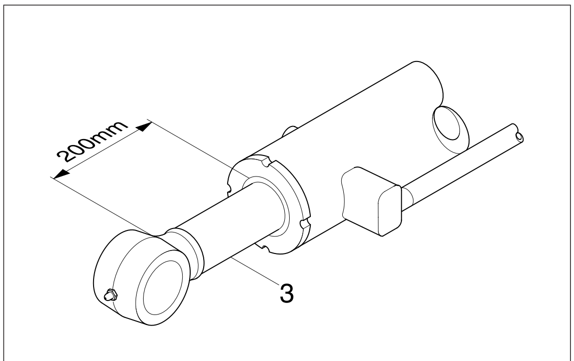
3) DISASSEMBLY

(1) Remove cylinder head and piston rod

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.

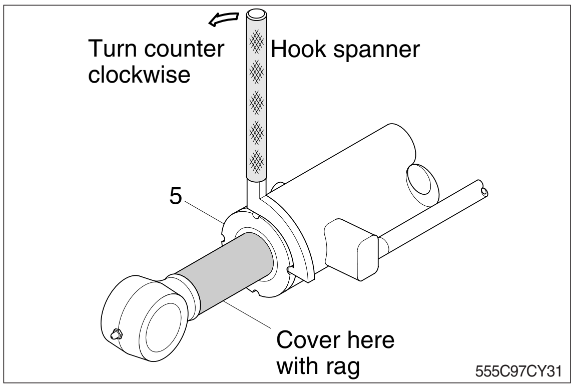
② Pull out rod assembly (3) about 200 ㎜ (7.1 in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



555C97CY30

③ Remove rod cover (5) by hook spanner.

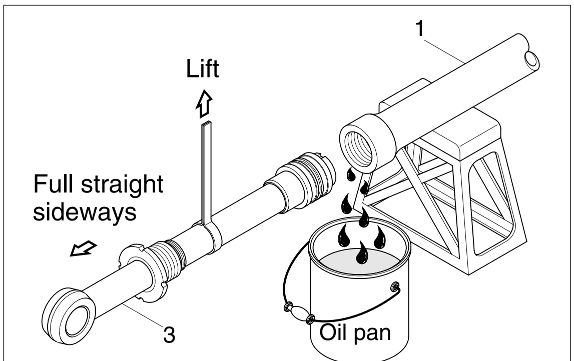
※ Cover the extracted rod assembly (3) with rag to prevent it from being accidentally damaged during operation.



555C97CY31

④ Draw out cylinder head and rod assembly (3) together from tube assembly (1).

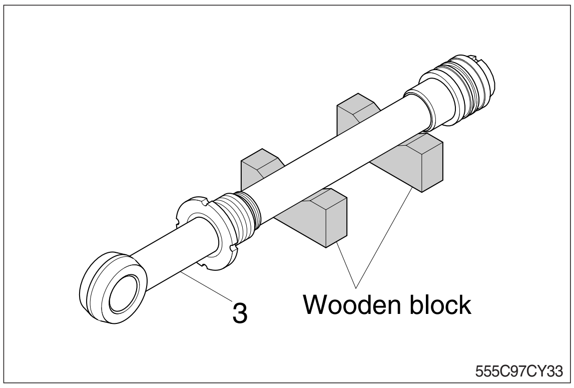
※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (3) with a crane or some means and draw it out. However, when rod assembly (3) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



555C97CY32

Note that the plated surface of rod assembly (3) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

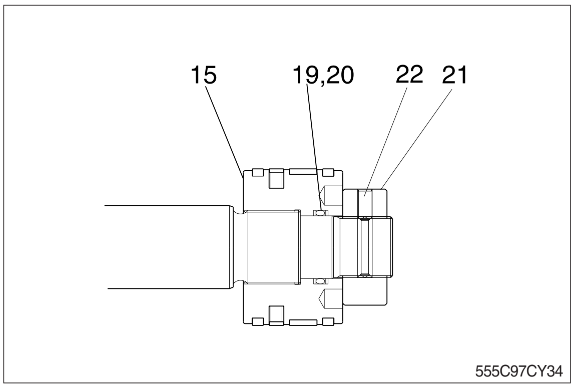
⑤ Place the removed rod assembly on a wooden V-block that is set level.
※ Cover a V-block with soft rag.



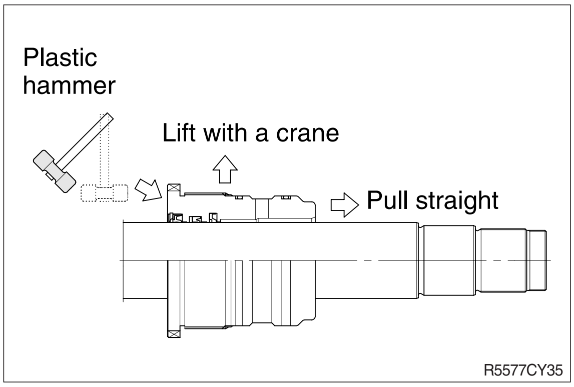
(2) Remove piston and rod cover

① Loosen set screw (22) and remove piston nut (21).
※ Since piston nut (21) is tightened to a high torque, use a hydraulic and power wrench that utilizers a hydraulic cylinder, to remove the piston nut (21).

② Remove piston assembly (15), back up ring (19), and O-ring (20).



③ Remove the rod cover from rod assembly (3).
※ If it is too heavy to move, move it by striking the flanged part of gland 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 Du bushing (6) and packing (8, 9, 10, 11, 12, 13, 14) by the threads of rod assembly (3).

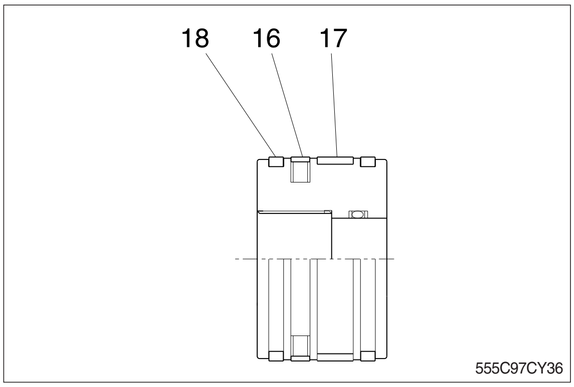


(3) Disassemble the piston assembly

① Remove wear ring (17).

② Remove dust ring (18) and piston seal (16).

※ Exercise care in this operation not to damage the grooves.



(4) Disassemble gland assembly

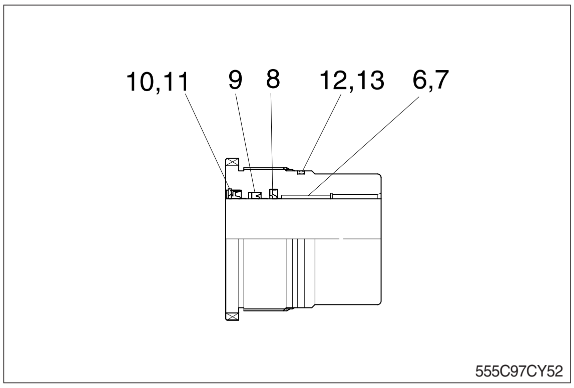
① Remove back up ring (12) and O-ring (13).

② Remove snap ring (11), dust wiper (10).

③ Remove U-packing (9) and buffer seal (8).

※ Exercise care in this operation not to damage the grooves.

※ Do not remove seal and ring, if does not damaged.

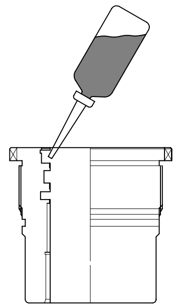


4) ASSEMBLY

(1) Assemble cylinder head assembly

※ Check for scratches or rough surfaces if found smooth with an oil stone.

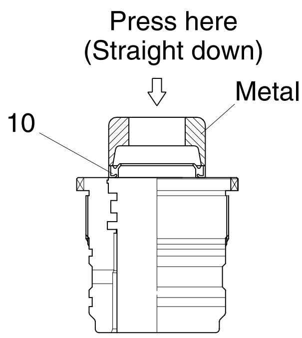
① Coat the inner face of rod cover (5) with hydraulic oil.



555C97CY38

② Coat dust wiper (10) with grease and fit dust wiper (10) 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 (11) to the stop face.

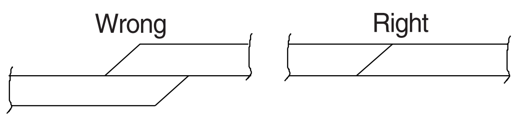


555C97CY39

④ Fit U-packing (9) and buffer seal (8) to corresponding grooves, in that order.

※ Coat each packing with hydraulic oil before fitting it.

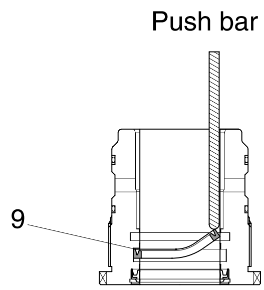
※ Insert the backup ring until one side of it is inserted into groove.



8-157(3) 210-7

※ U-packing (9) has its own fitting direction. Therefore, confirm it before fitting them.

※ Fitting U-packing (9) upside down may damage its lip. Therefore check the correct direction that is shown in fig.

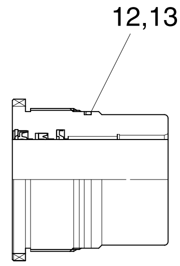


555C97CY40

⑤ Fit back up ring (12) to rod cover (5).

※ Put the backup ring in the warm water of 30~50˚C .

⑥ Fit O-ring (13) to rod cover (5).

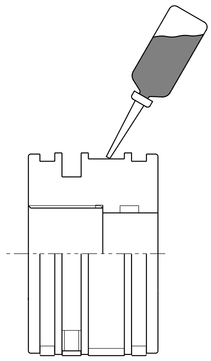


555C97CY41

(2) Assemble piston assembly

※ Check for scratches or rough surfaces. If found smooth with an oil stone.

① Coat the outer face of piston (15) with hydraulic oil.

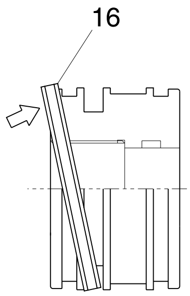


555C97CY42

② Fit piston seal (16) to piston.

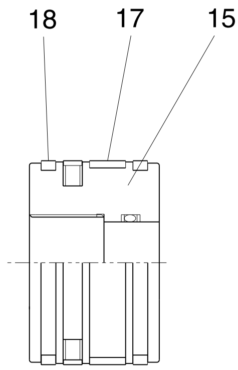
※ Put the piston seal in the warm water of 60~100˚C for more than 5 minutes.

※ After assembling the piston seal, press its outer diameter to fit in.



555C97CY43

③ Fit wear ring (17) and dust ring (18) to piston (15).



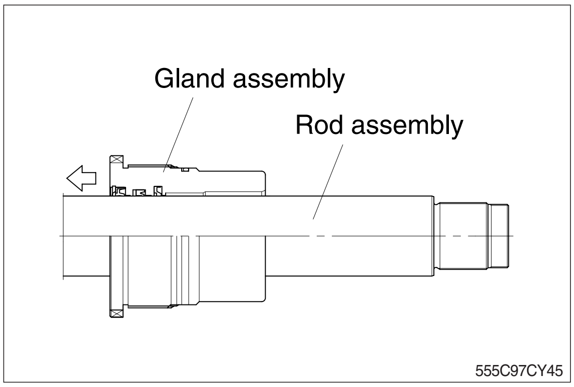
555C97CY44

(3) Install piston and cylinder head

① Fix the rod assembly to the work bench.

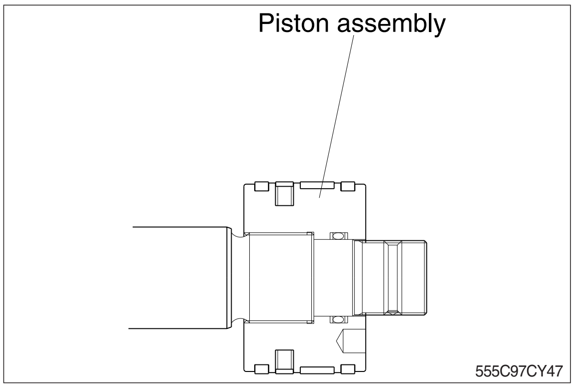
② Apply hydraulic oil to the outer surface of rod assembly (3), the inner surface of piston and cylinder head.

③ Insert cylinder head assembly to rod assembly.



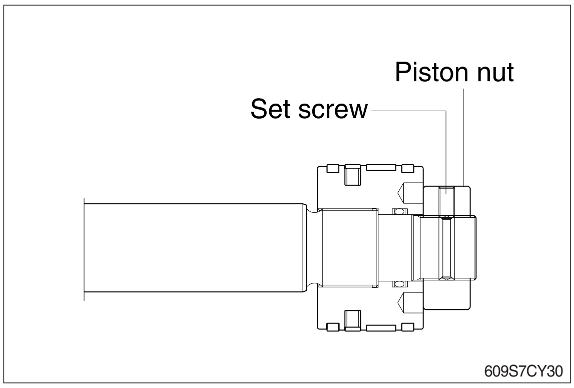
⑤ Fit piston assembly to rod assembly.

· Tightening torque : Refer to page 7-130.



⑥ Fit piston nut and tighten the set screw (22).

· Tightening torque : Refer to page 7-130.

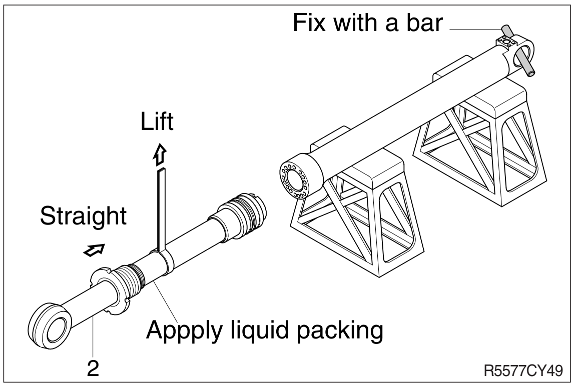


(3) Overall assemble

① Place a V-block on a rigid work bench. Mount the tube assembly (2) 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.

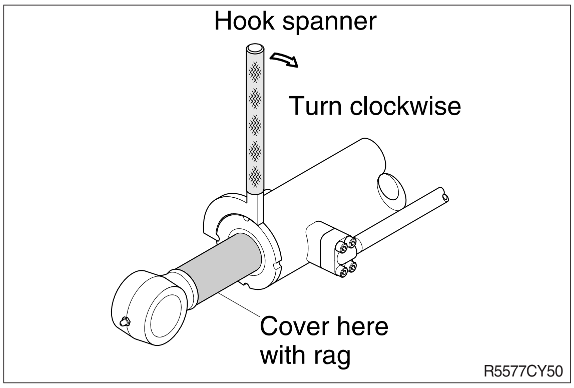
※ Be careful not to damage piston seal by thread of tube assembly.



R5577CY49

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.



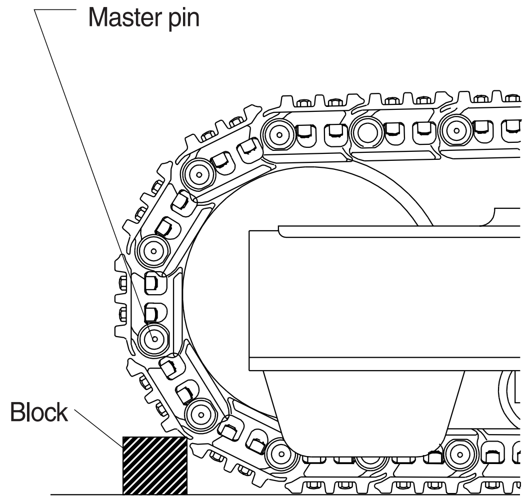
R5577CY50

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.



8-161(1) 140-7

(2) Loosen tension of the track link.

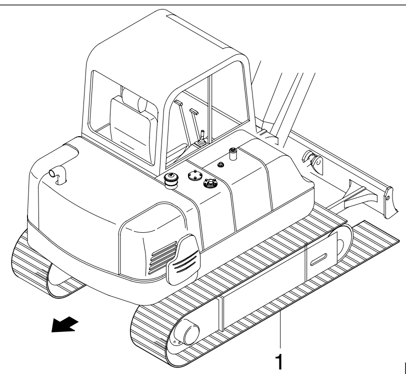
※ If track tension is not relieved when the grease valve is loosened, move the machine backwards and forwards.

(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.

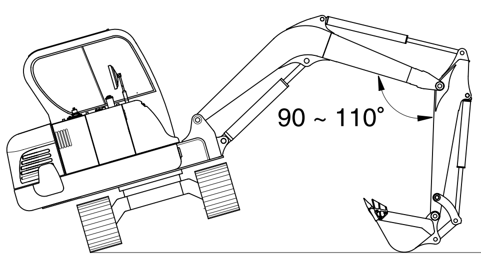


R5577TR01

2) INSTALL

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

※ Adjust the tension of the track link.

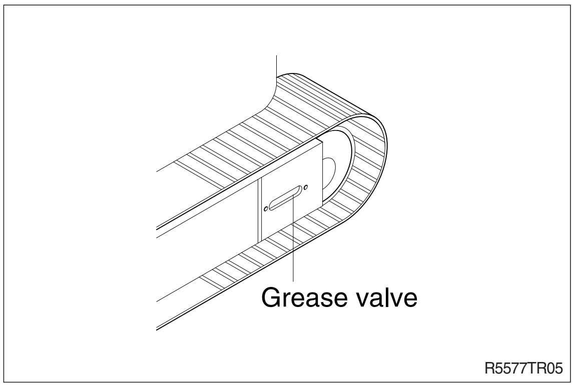


555C97TR02

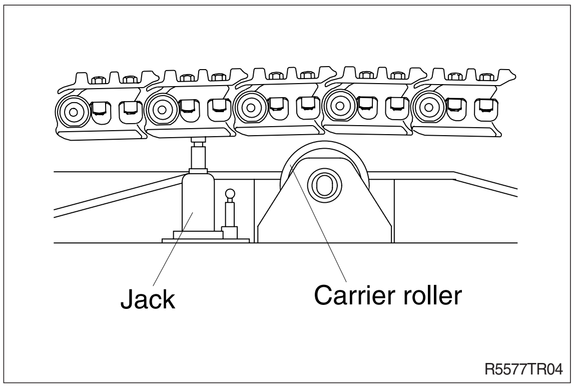
2. CARRIER ROLLER

1) REMOVAL

(1) Loosen tension of the track link.



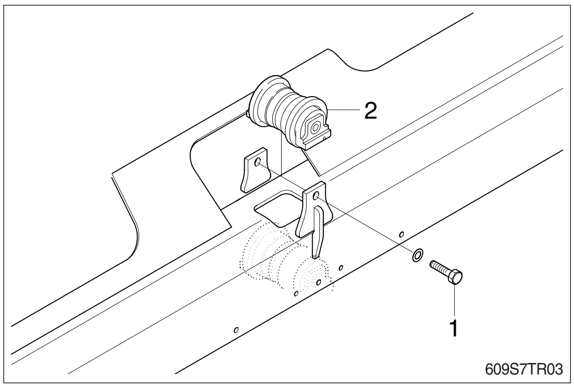
(2) Jack up the track link height enough to permit carrier roller removal.



(3) Remove bolt (1) at both side.

(4) Remove carrier roller (2).

· Weight : 12 kg (26 lb)



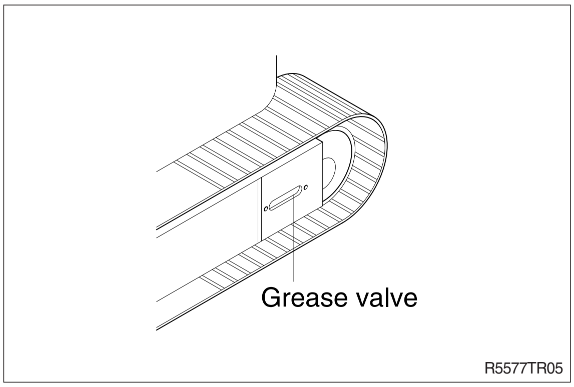
2) INSTALL

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

3. TRACK ROLLER

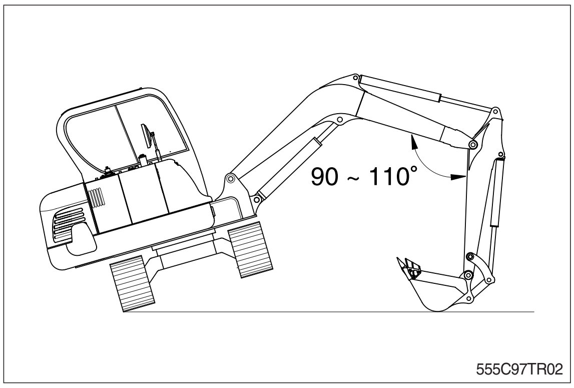
1) REMOVAL

(1) Loosen tension of the track link.



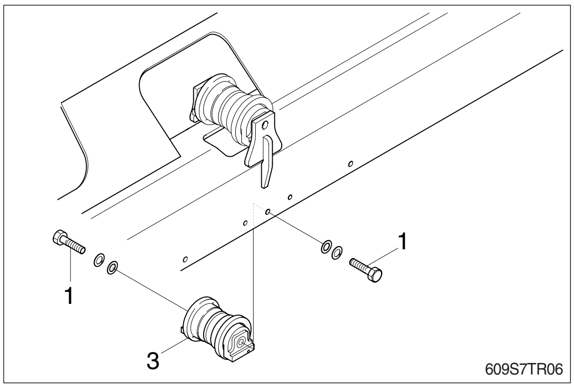
(2) Using the work equipment, push up track frame on side which is to be removed.

※ After jack up the machine, set a block under the unit.



(3) Remove the mounting bolt (1) and draw out the track roller (3).

· Weight : 12 ㎏ (26 ℔)



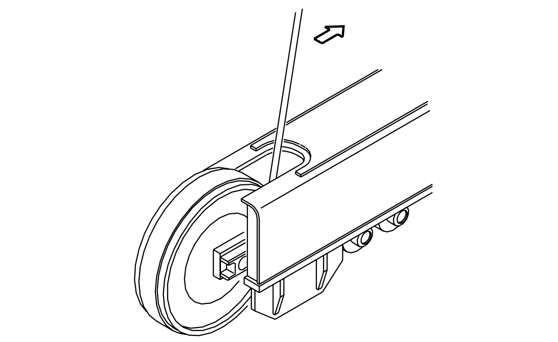
2) INSTALL

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

4. IDLER AND RECOIL SPRING

1) REMOVAL

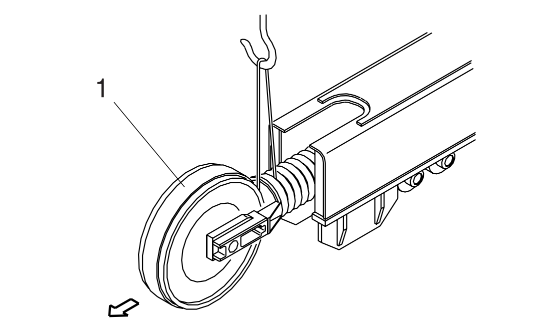
(1) Remove the track link.
For detail, see removal of track link.



8-164(1) 140-7

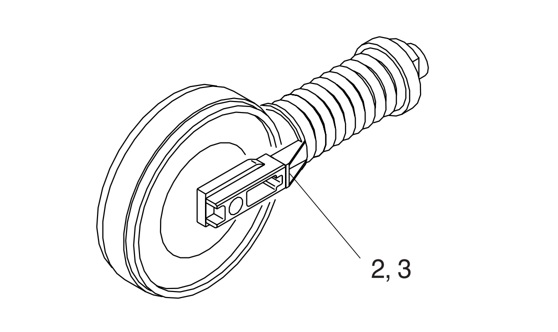
(2) Sling the recoil spring (1) and pull out idler and recoil spring assembly from track frame, using a pry.

· Weight : 100 kg (220 lb)



8-164(2) 140-7

(3) Remove the bolts (2), washers (3) and separate idler from recoil spring.

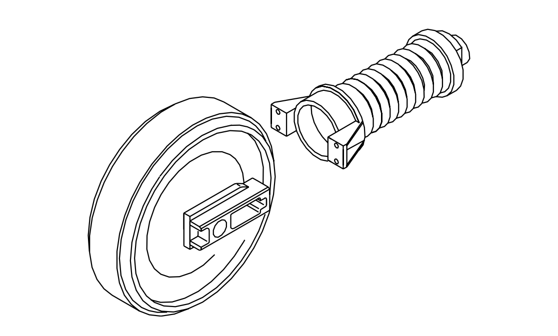


8-164(3) 140-7

2) INSTALL

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

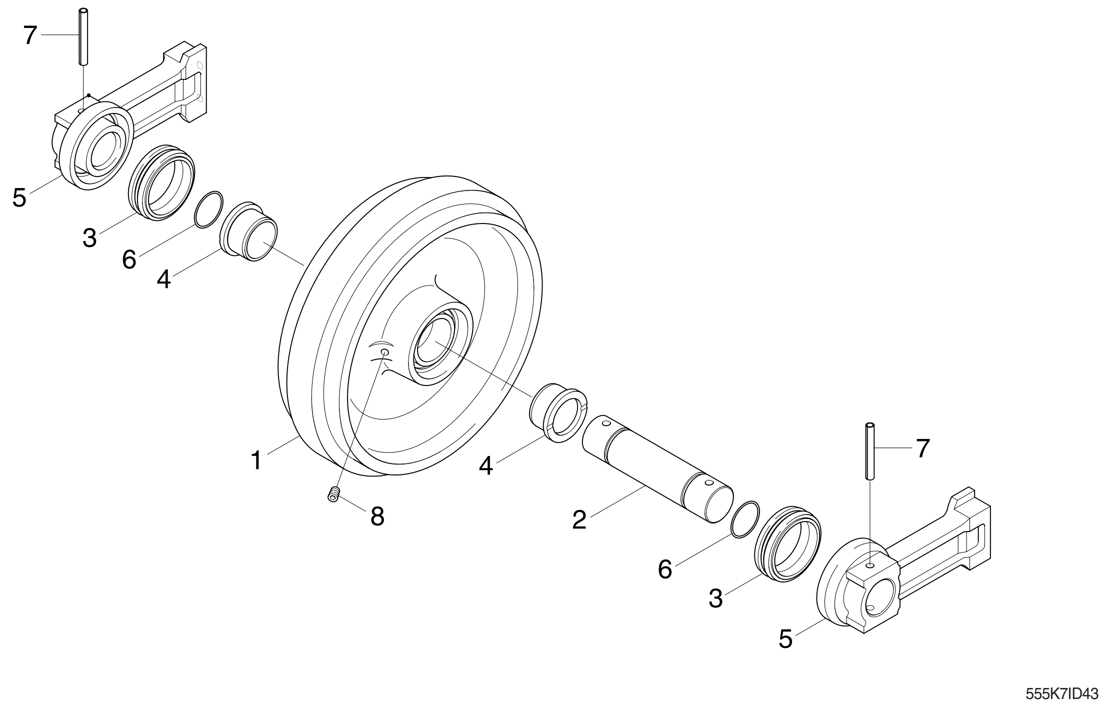
※ Make sure that the boss on the end face of the recoil cylinder rod is in the hole of the track frame.



8-164(4) 140-7

3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure

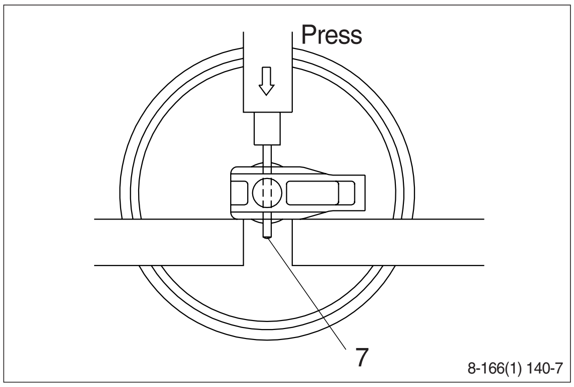


1	Shell	4	Bushing	7	Spring pin
2	Shaft	5	Bracket	8	Plug
3	Seal assembly	6	O-ring		

(2) Disassembly

① Remove plug and drain oil.

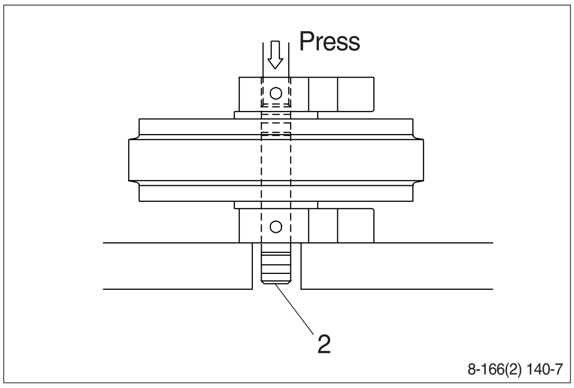
② Draw out the spring pin (7), using a press.



③ Pull out the shaft (2) with a press.

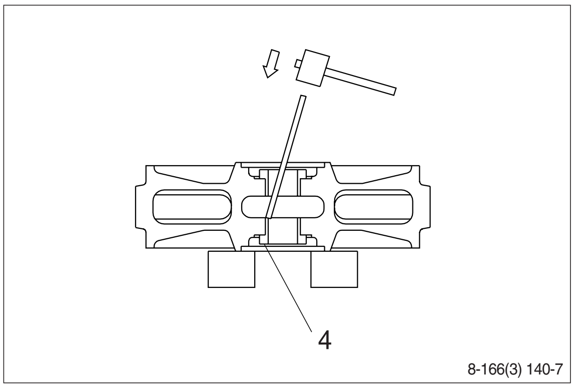
④ Remove seal (3) from idler (1) and bracket (5).

⑤ Remove O-ring (6) from shaft.



⑥ Remove the bushing (4) from idler, using a special tool.

※ Only remove bushing if replacement is necessity.

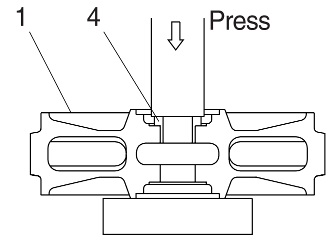


(3) Assembly

※ Before assembly, clean the parts.

※ Coat the sliding surfaces of all parts with oil.

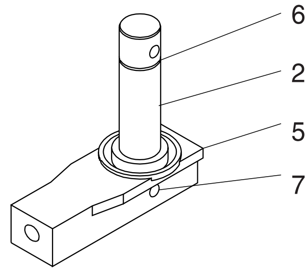
① Cool up bushing (4) fully by some dry ice and press it into shell (1).
Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.



8-167(1) 140-7

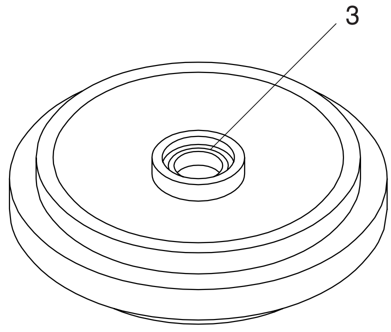
② Coat O-ring (6) with grease thinly, and install it to shaft (2).

③ Insert shaft (2) into bracket (5) and drive in the spring pin (7).



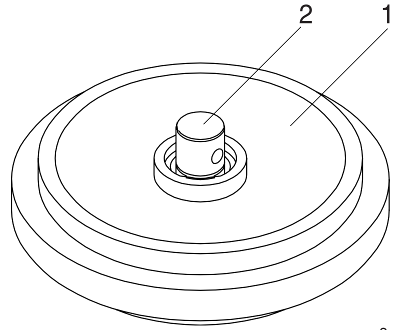
8-167(2) 140-7

④ Install seal (3) to shell (1) and bracket (5).



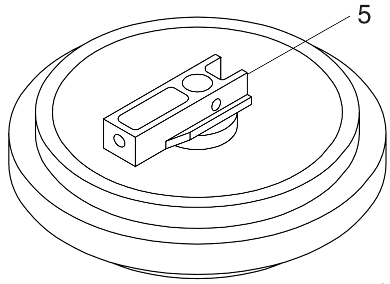
8-167(3) 140-7

⑤ Install shaft (2) to shell (1).



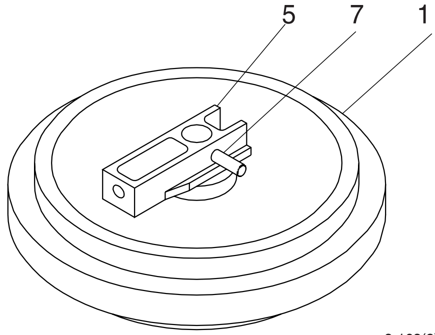
8-167(4) 140-7

⑥ Install bracket (5) attached with seal (3).



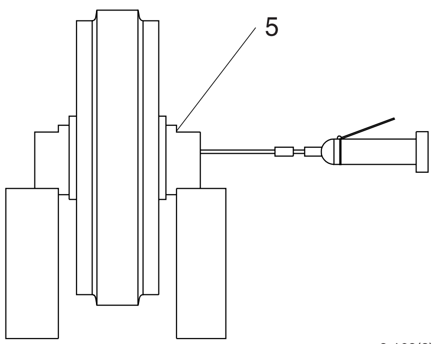
8-168(1) 140-7

⑦ Knock in the spring pin (7) with a hammer.



8-168(2) 140-7

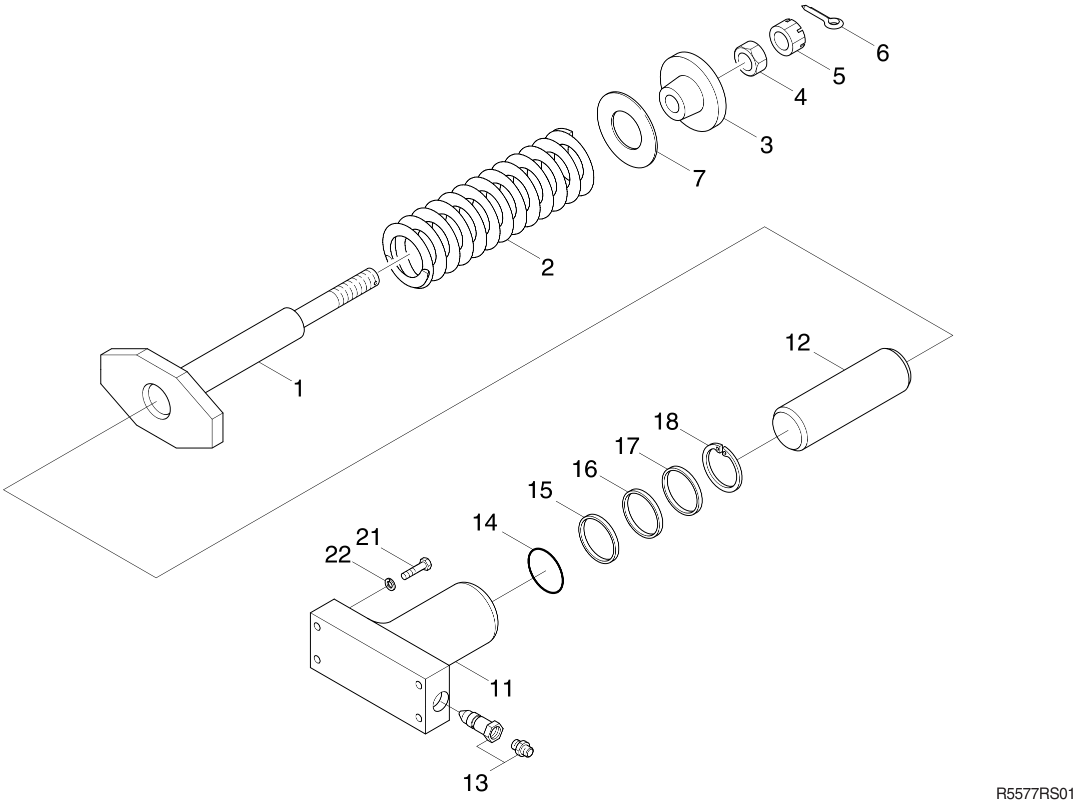
⑧ Lay bracket (5) on its side.
Supply engine oil to the specified level, and tighten plug.



8-168(3) 140-7

4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure



1	Rod	7	Spacer	16	Dust-seal
2	Spring	11	Bracket	17	Spacer
3	Lock washer	12	Piston	18	Retaining ring
4	Hex-nut	13	Grease valve	21	Bolt
5	Slotted hex-nut	14	O-ring	22	Washer
6	Split pin	15	Back-up ring		

(2) Disassembly

① Apply pressure on spring (3) with a press. The spring is under a large installed load.

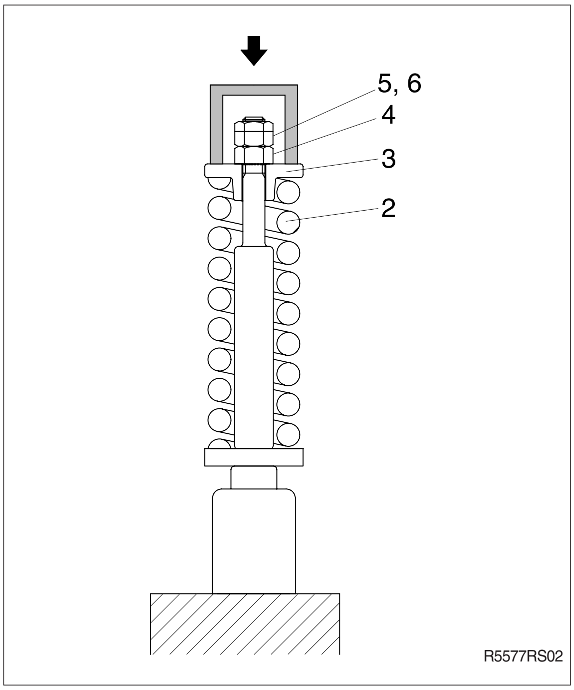
※ This is dangerous, so be sure to set properly.

· Spring set load : 3900 ㎏ (8600 ℔)

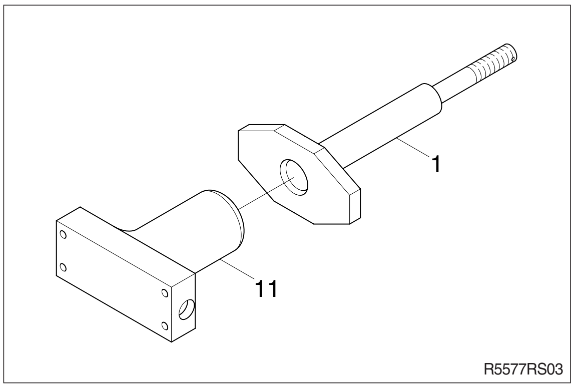
② Remove split pin (6) and nut (5).

③ Remove lock nut (4). Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.

④ Lighten the press load slowly and remove lock washer (3) and spring (2).

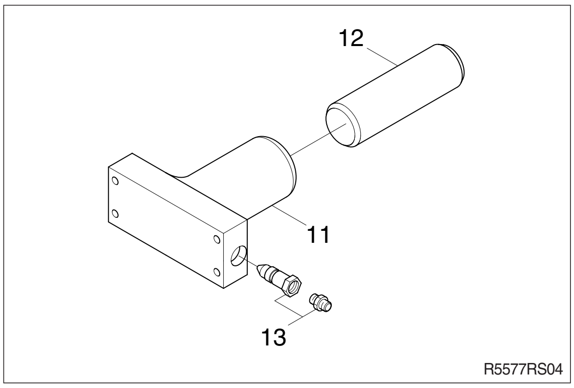


⑤ Remove rod (1) from bracket (11).

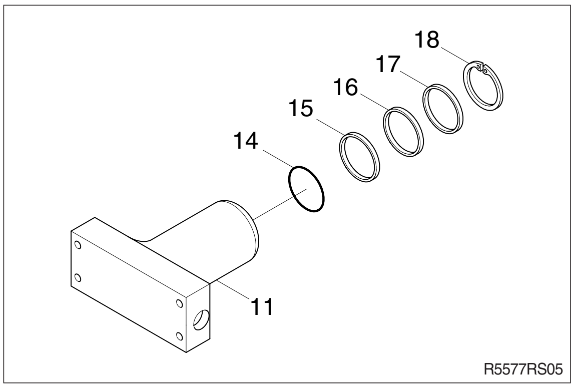


⑥ Remove grease valve (13) from bracket (11).

⑦ Remove piston (12) from bracket (11).



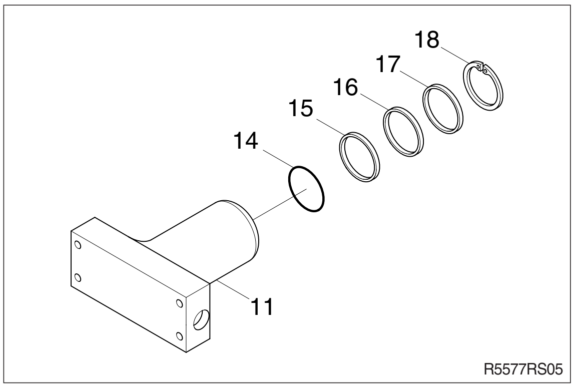
⑧ Remove retaining ring (18), spacer (17), dust seal (16), back-up ring (15) and O-ring (14).



(3) Assembly

① Install O-ring (14), back-up ring (15), dust seal (16), spacer (17) and retaining ring (18) to bracket (11).

※ When installing dust seal (16) take full care so as not to damage the lip.

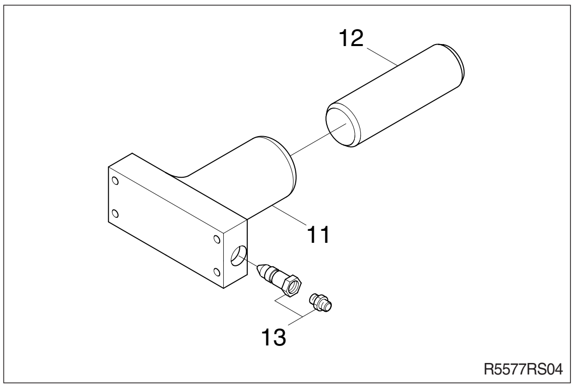


② Pour grease into bracket (11), then push in piston (12) by hand.
After take grease out of grease valve mounting hole, let air out.

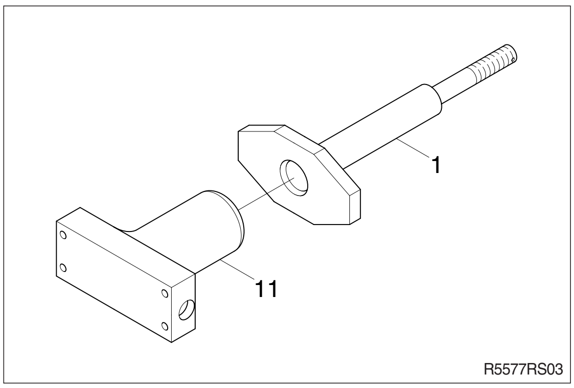
※ If air letting is not sufficient, it may be difficult to adjust the tension of crawler.

③ Fit grease valve (13) to bracket (11).

· Tightening torque : 10±0.5 kg · m (72.4±3.6 lb · ft)



④ Install rod (1) to bracket (11).



⑤ Install spring (3) and bracket (4) to body (1).

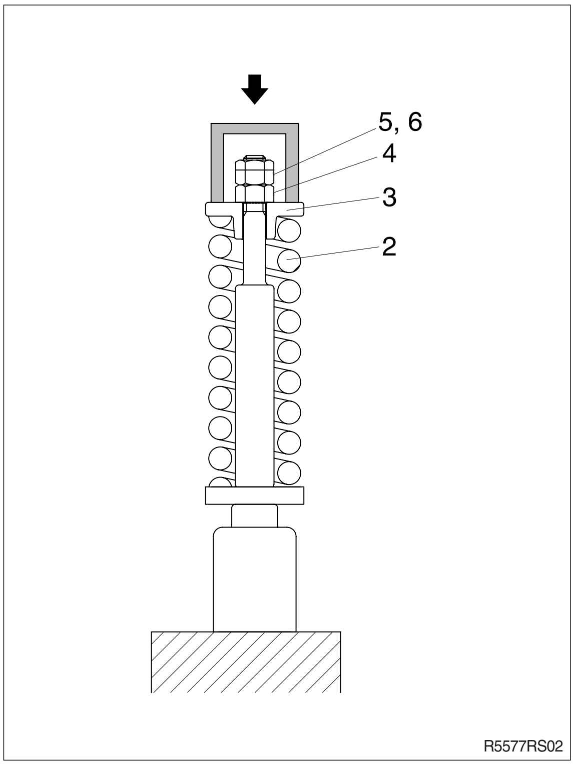
⑥ Apply pressure to spring (3) with a press and tighten nut (4).

※ Apply sealant before assembling.

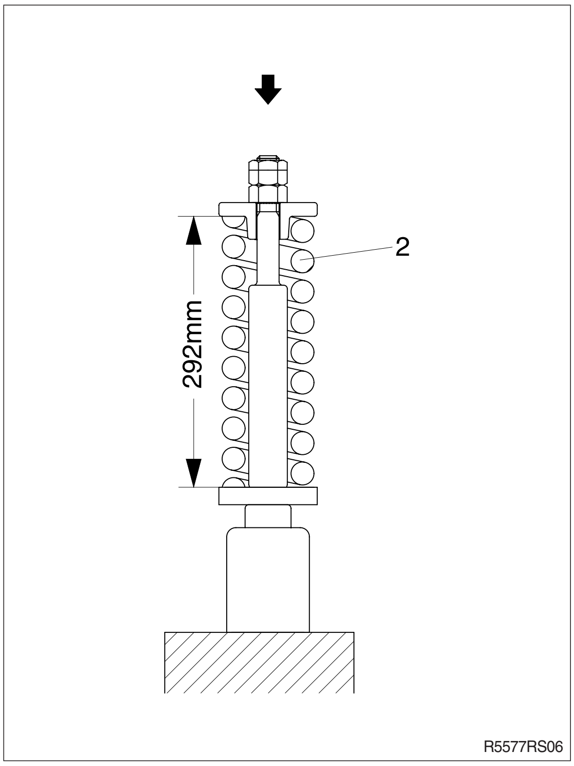
※ During the operation, pay attention specially to prevent the press from slipping out.

· Tightening torque : 30±3 kgf · m (217±21 lbf · ft)

⑦ Tighten nut (5) and insert split pin (6).

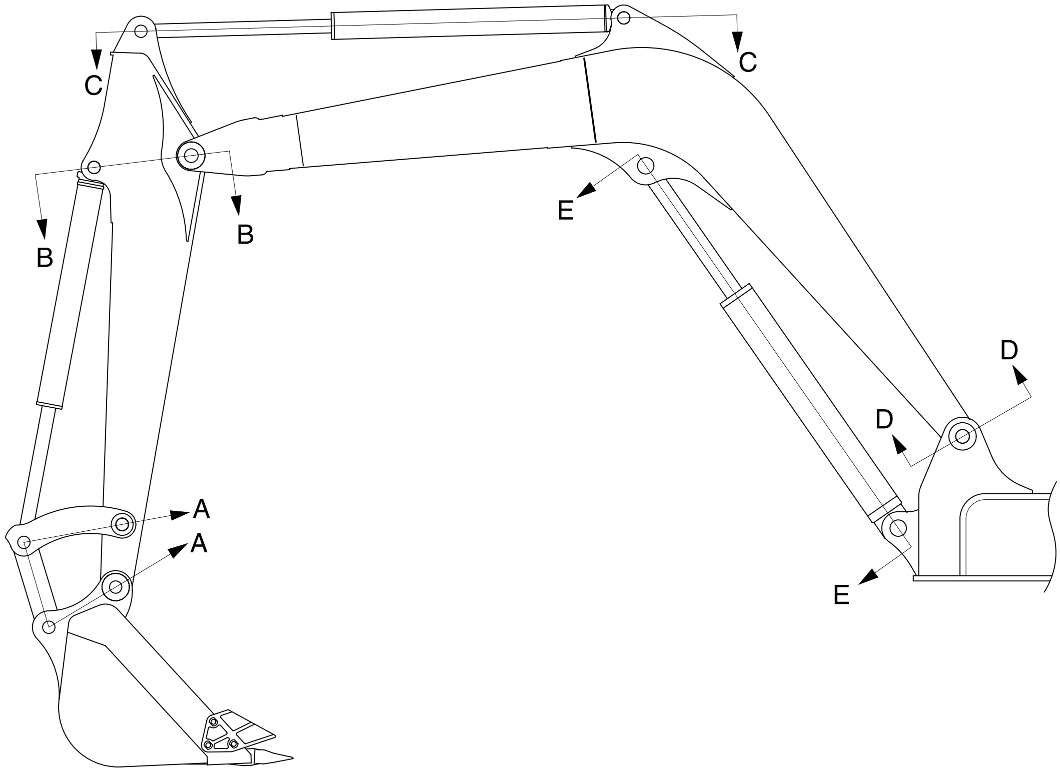


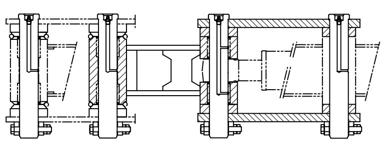
⑧ Lighten the press load and confirm the set length of spring (2).



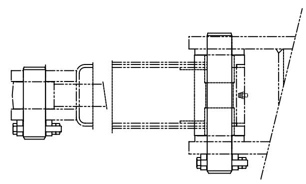
GROUP 11 WORK EQUIPMENT

1. STRUCTURE

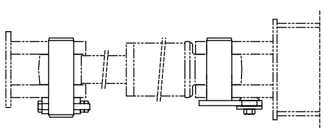




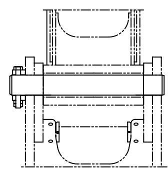
SECTION A-A



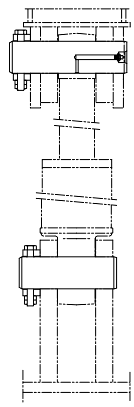
SECTION B-B



SECTION C-C



SECTION D-D



SECTION E-E

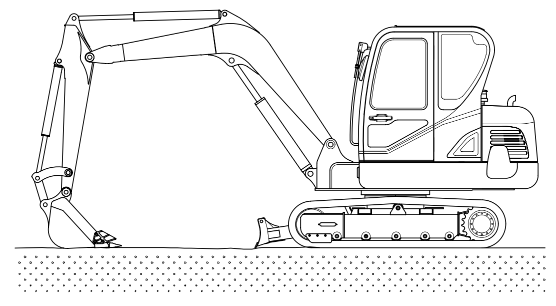
R5577AT01

2. REMOVAL AND INSTALL

1) BUCKET ASSEMBLY

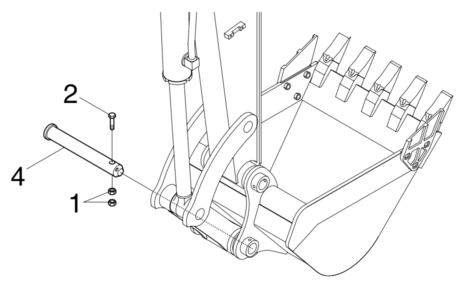
(1) Removal

① Lower the work equipment completely to ground with back of bucket facing down.



555C97AT02

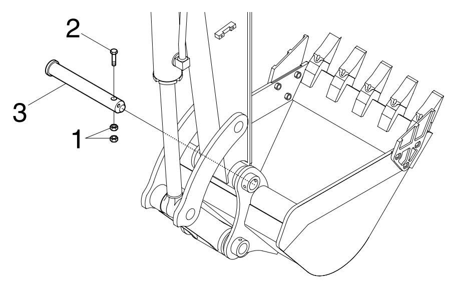
② Remove nut (1), bolt (2) and draw out the pin (4).



R5577AT13

③ Remove nut (1), bolt (2) and draw out the pin (3) then remove the bucket (0.18 m^3 SAE heaped) assembly.

· Weight : 170 ㎏ (370 ℔)



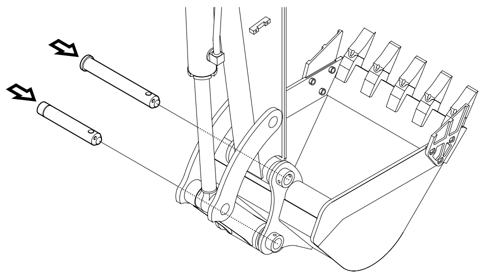
R5577AT04

(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.



R5577AT03

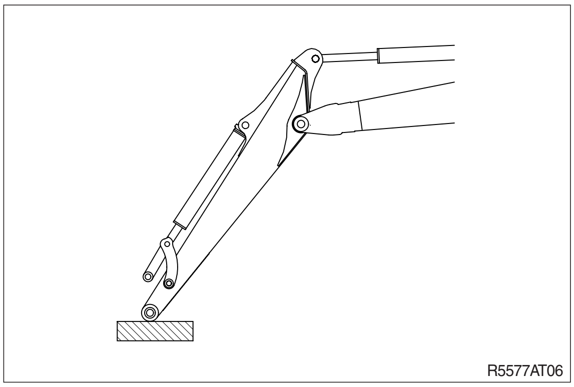
2) ARM ASSEMBLY

(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.



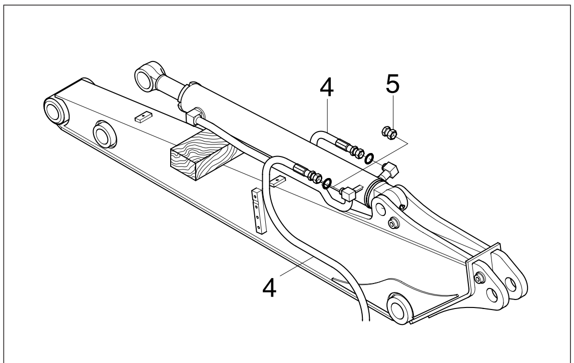
R5577AT06

② Disconnect bucket cylinder hose (4).

⚠ **Fit blind plugs (5) in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.**

③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

※ Tie the rod with wire to prevent it from coming out.

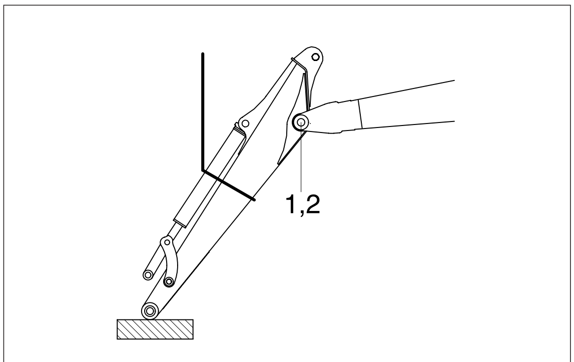


R5577CY04

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 (1) and pull out the pin (2) then remove the arm (1.6 m) assembly.
· Weight : 210 ㎏ (470 ℔)

※ When lifting the arm assembly, always lift the center of gravity.



R5577AT07

(2) Install

① Carry out installation in the reverse order to removal.

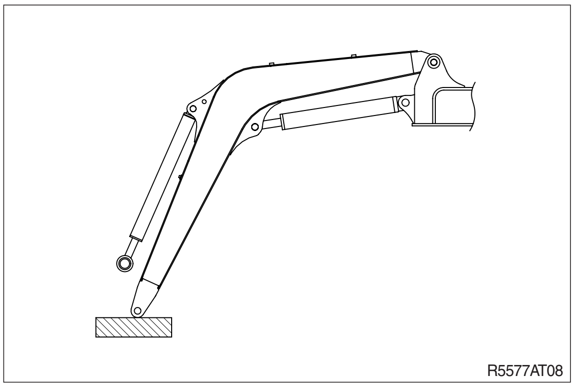
⚠ **When lifting the arm assembly, always lift the center of gravity.**

※ Bleed the air from the cylinder.

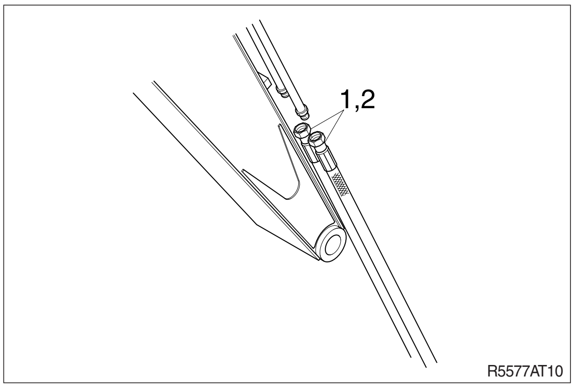
3) BOOM CYLINDER

(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 arm cylinder assembly.

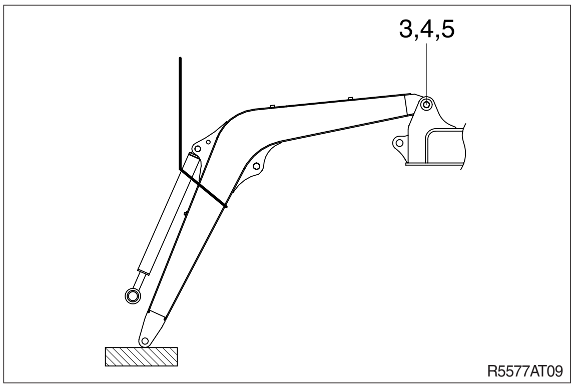

R5577AT08

③ Disconnect head lamp wiring.
④ Disconnect bucket cylinder hose (2) and arm cylinder hos e(1).
※ When the hose are disconnected, oil may spurt out.
⑤ Sling boom assembly (3).



R5577AT10

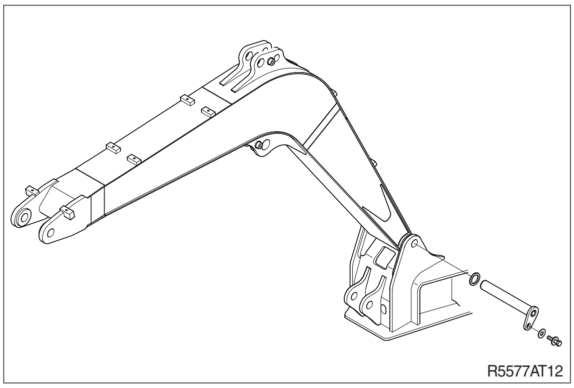
⑥ Remove bolt (3), nut (4) and pull out the pin (5) then remove boom (3.0 m) assembly.
· Weight : 310 ㎏ (680 ㏈)
※ When lifting the boom assembly always lift the center of gravity.



R5577AT09

(2) Install

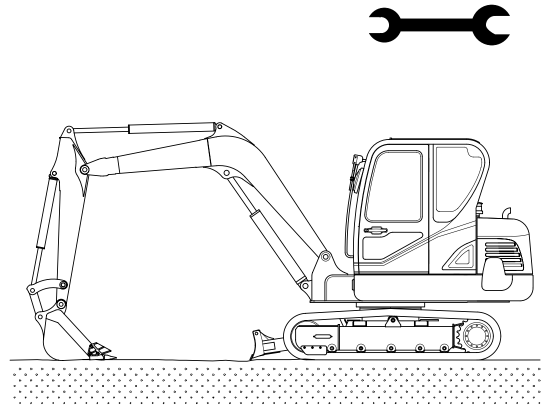
① Carry out installation in the reverse order to removal.
⚠ **When lifting the arm assembly, always lift the center of gravity.**
※ Bleed the air from the cylinder.


R5577AT12

SECTION 8 COMPONENT MOUNTING TORQUE

SECTION 8 COMPONENT MOUNTING TORQUE

GROUP 1 INTRODUCTION GUIDE


555C98CM20

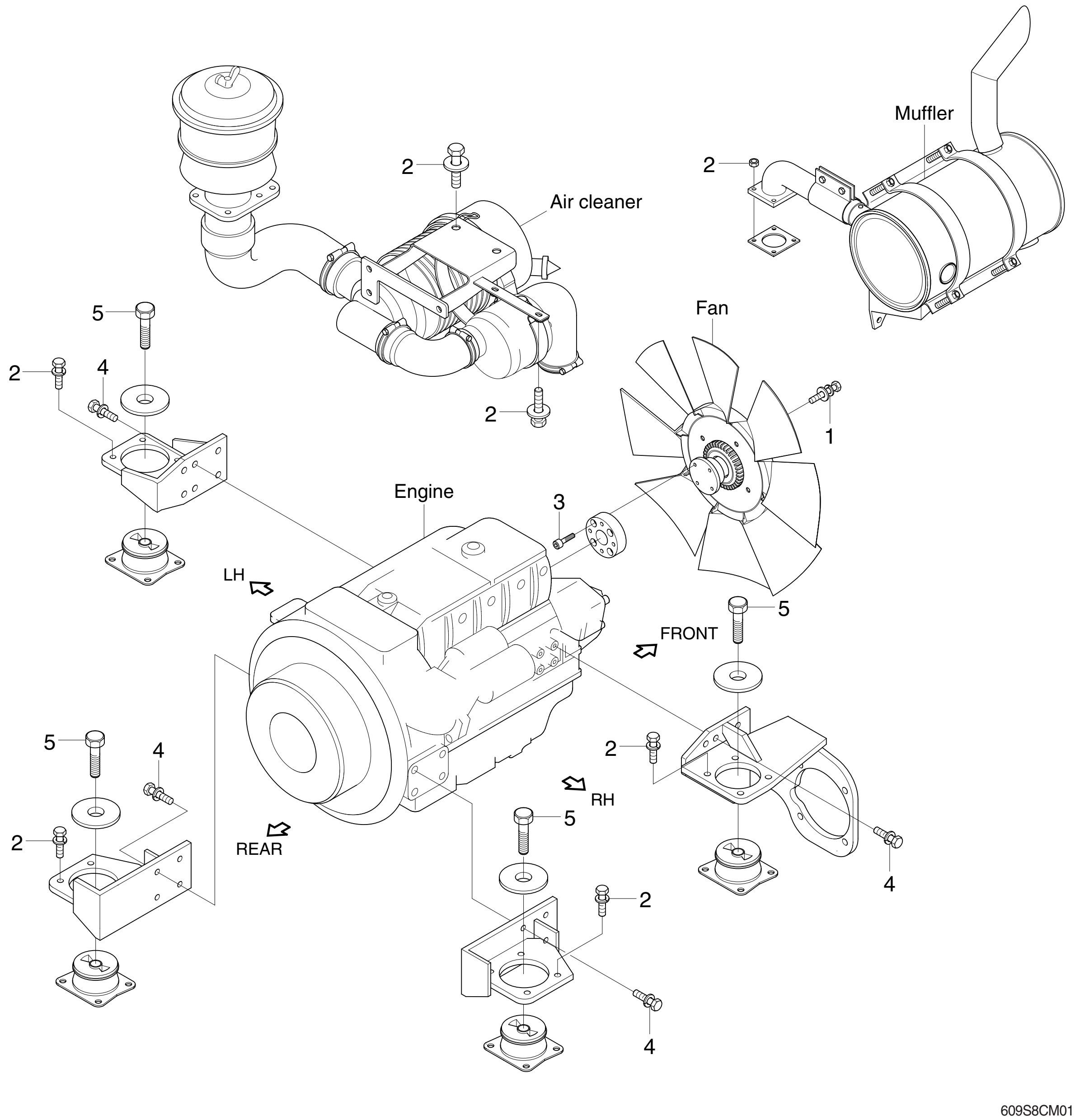
1. This section shows bolt specifications and standard torque values needed when mounting components to the machine.
2. Use genuine Hyundai spare parts.
   We expressly point out that Hyundai will not accept any responsibility for defects resulted from non-genuine parts.
   In such cases Hyundai cannot assume liability for any damage.

※ Only metric fasteners can be used and incorrect fasteners may result in machine damage or malfunction.

※ Before installation, clean all the components with a non-corrosive cleaner. Bolts and threads must not be worn or damaged.

GROUP 2 ENGINE SYSTEM

1. ENGINE AND ACCESSORIES MOUNTING

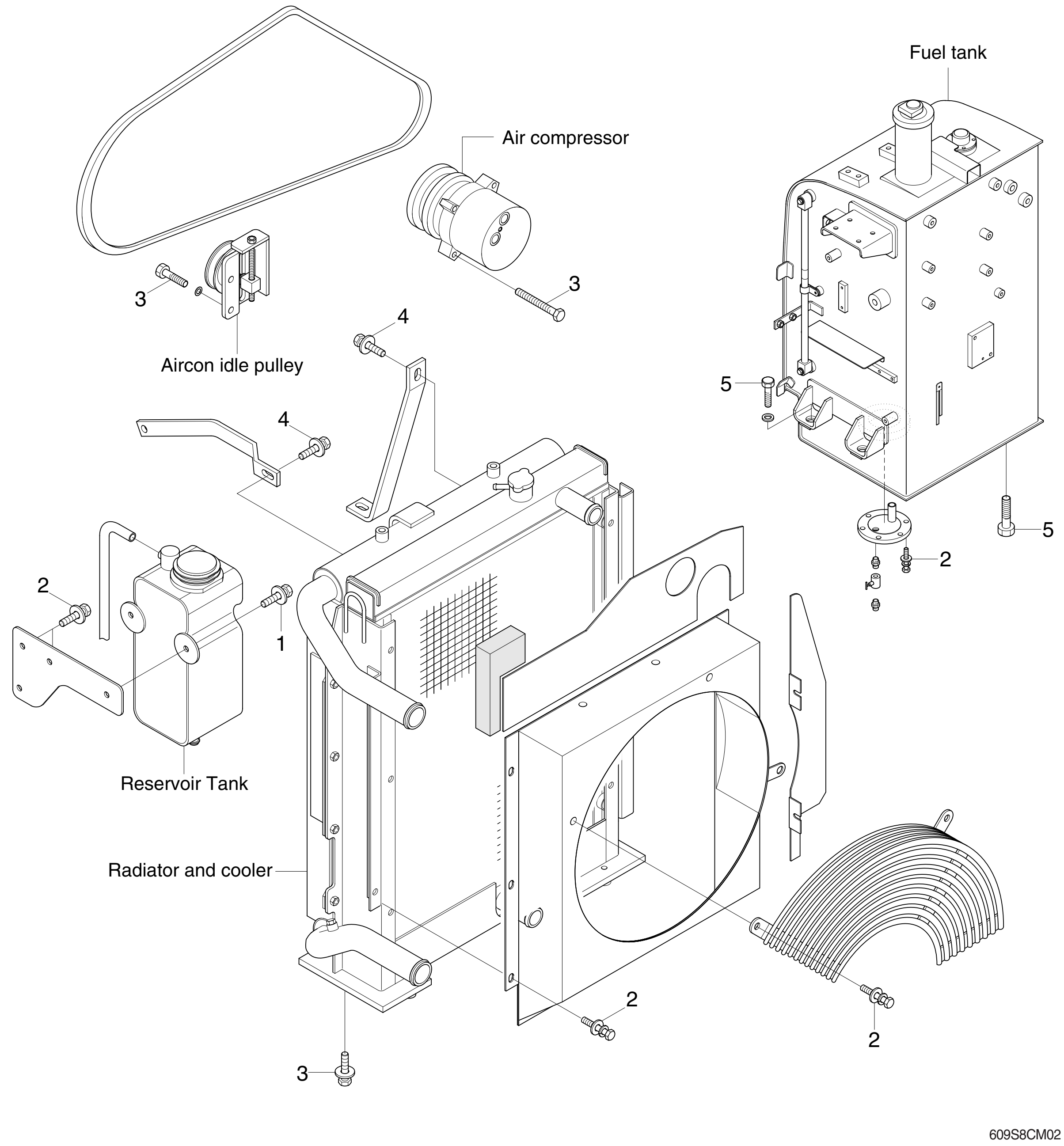


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	1.8±0.2	13.0±1.4
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M 8×1.25	3.0±0.2	21.7±1.4

Item	Size	kgf · m	lbf · ft
4	M10×1.5	6.9±1.0	49.9±7.2
5	M16×2.0	25±2.5	181±18

2. COOLING SYSTEM AND FUEL TANK MOUNTING



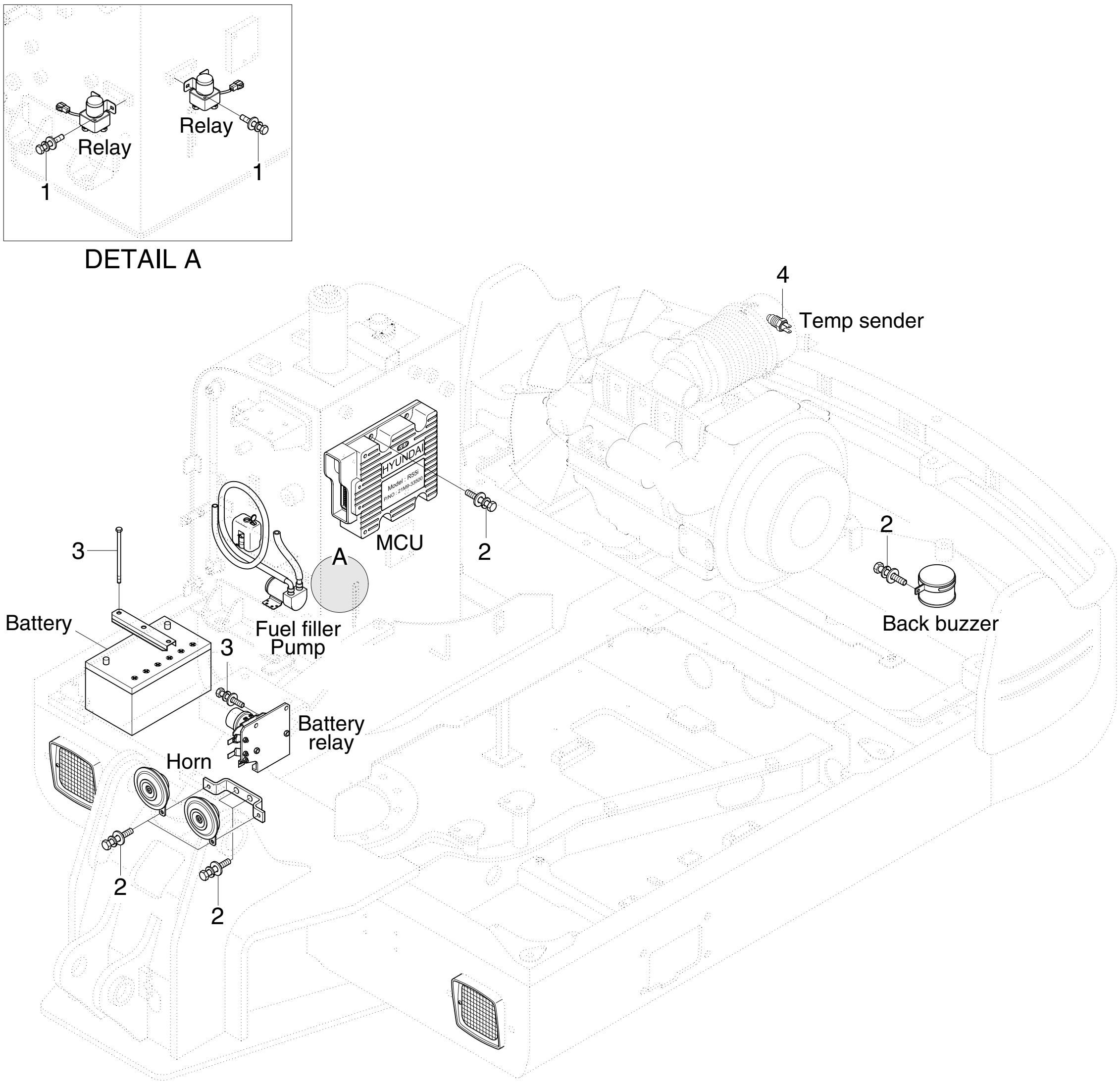
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M10×1.25	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
4	M12×1.75	12.8±3.0	92.6±21.7
5	M16×2.0	25±2.5	181±18.1

GROUP 3 ELECTRIC SYSTEM

ELECTRIC COMPONENTS MOUNTING



609S8CM03

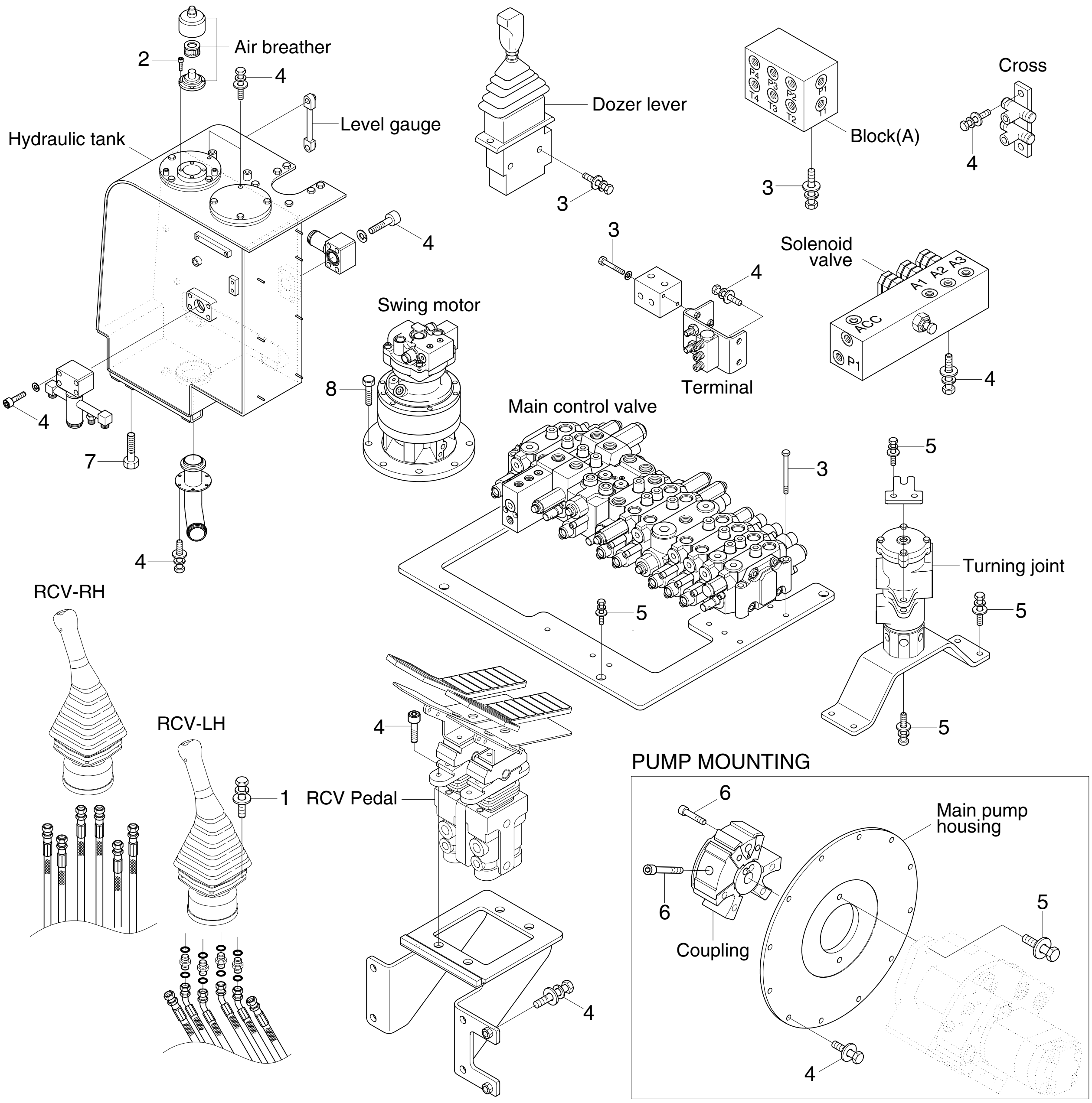
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6

Item	Size	kgf · m	lbf · ft
3	M10×1.5	6.9±1.4	49.9±10.1
4	-	2.0±0.2	14.5±1.4

GROUP 4 HYDRAULIC SYSTEM

1. HYDRAULIC COMPONENTS MOUNTING 1

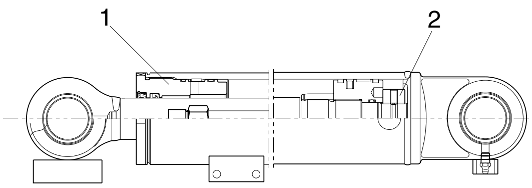


· Tightening torque

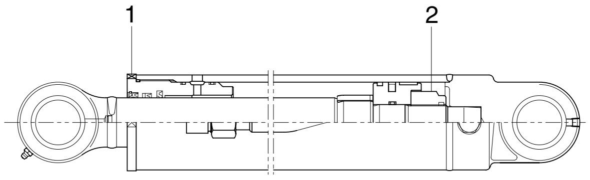
Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 6×1.0	1.44±0.3	10.4±2.2
3	M 8×1.25	2.5±0.5	18.1±3.6
4	M10×1.5	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
5	M12×1.75	12.2±1.3	88.2±9.4
6	M14×2.0	14.0±1.0	101±7.2
7	M16×2.0	25.0±2.5	118±18.1
8	M16×2.0	29.7±4.5	215±33.0

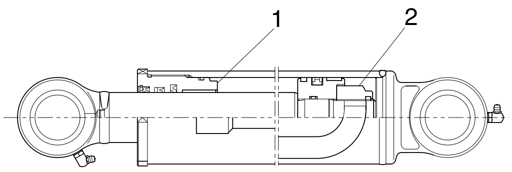
HYDRAULIC COMPONENTS MOUNTING 2



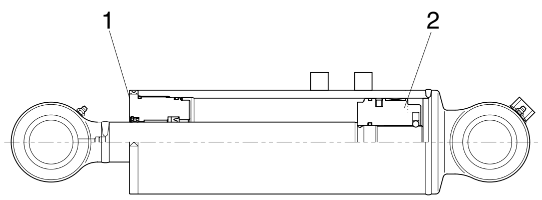
BOOM CYLINDER



ARM CYLINDER



BUCKET CYLINDER



DOZER CYLINDER

609S8CM07

· Tightening torque

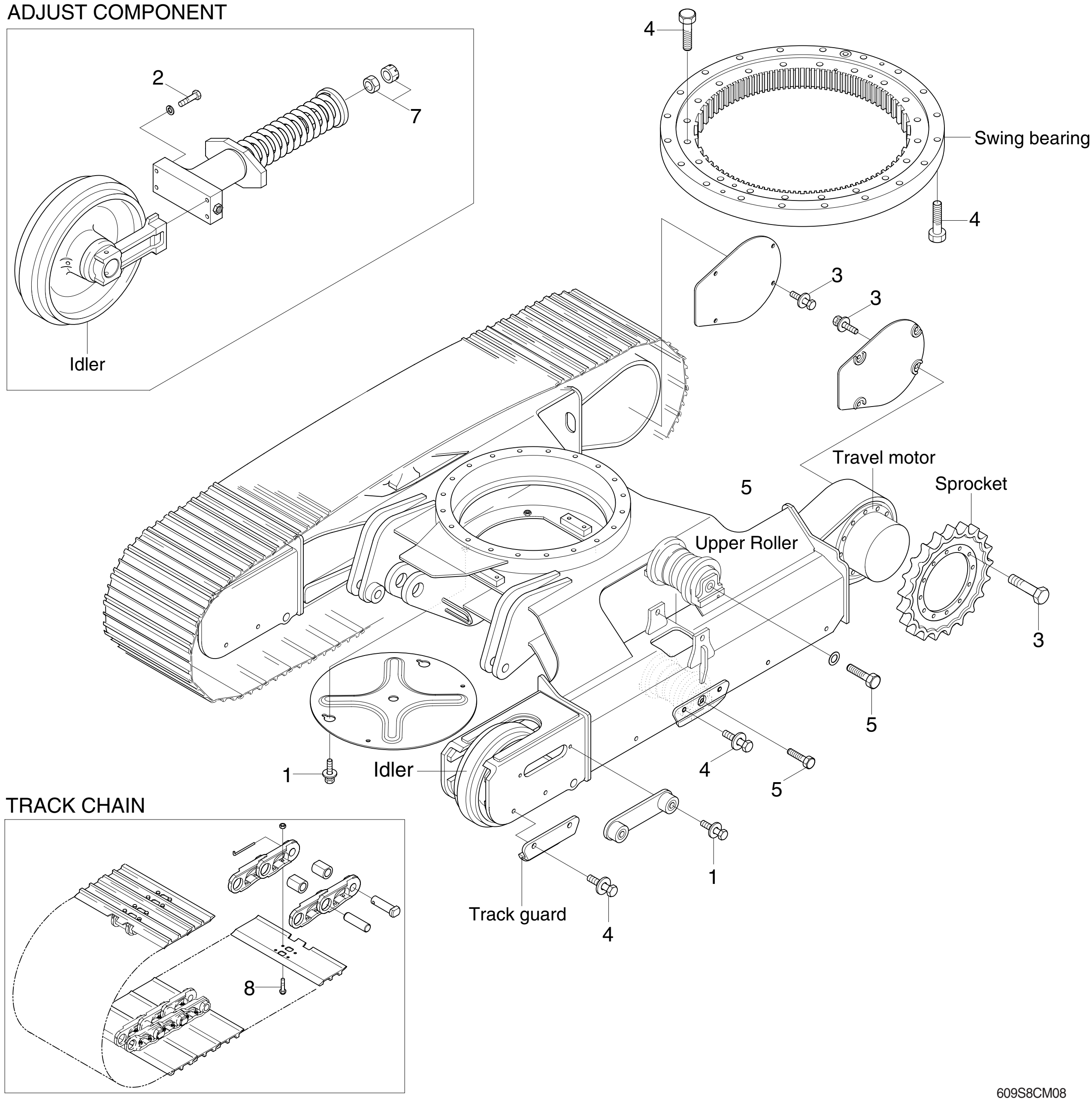
Rod cover (1)

Item	Size	kgf · m	lbf · ft
Boom cylinder	M115	70±7.0	506±51
Arm cylinder	M95	70±7.0	506±51
Bucket cylinder	M85	75±7.5	542±54
Dozer cylinder	M115	95±9.5	690±69

Piston nut (2)

Item	Size	kgf · m	lbf · ft
Boom cylinder	M42	75±7.5	542±54
Arm cylinder	M39	75±7.5	542±54
Bucket cylinder	M36	75±7.5	542±54
Dozer cylinder	M45	113±11.3	817±82

GROUP 5 UNDERCARRIAGE



609S8CM08

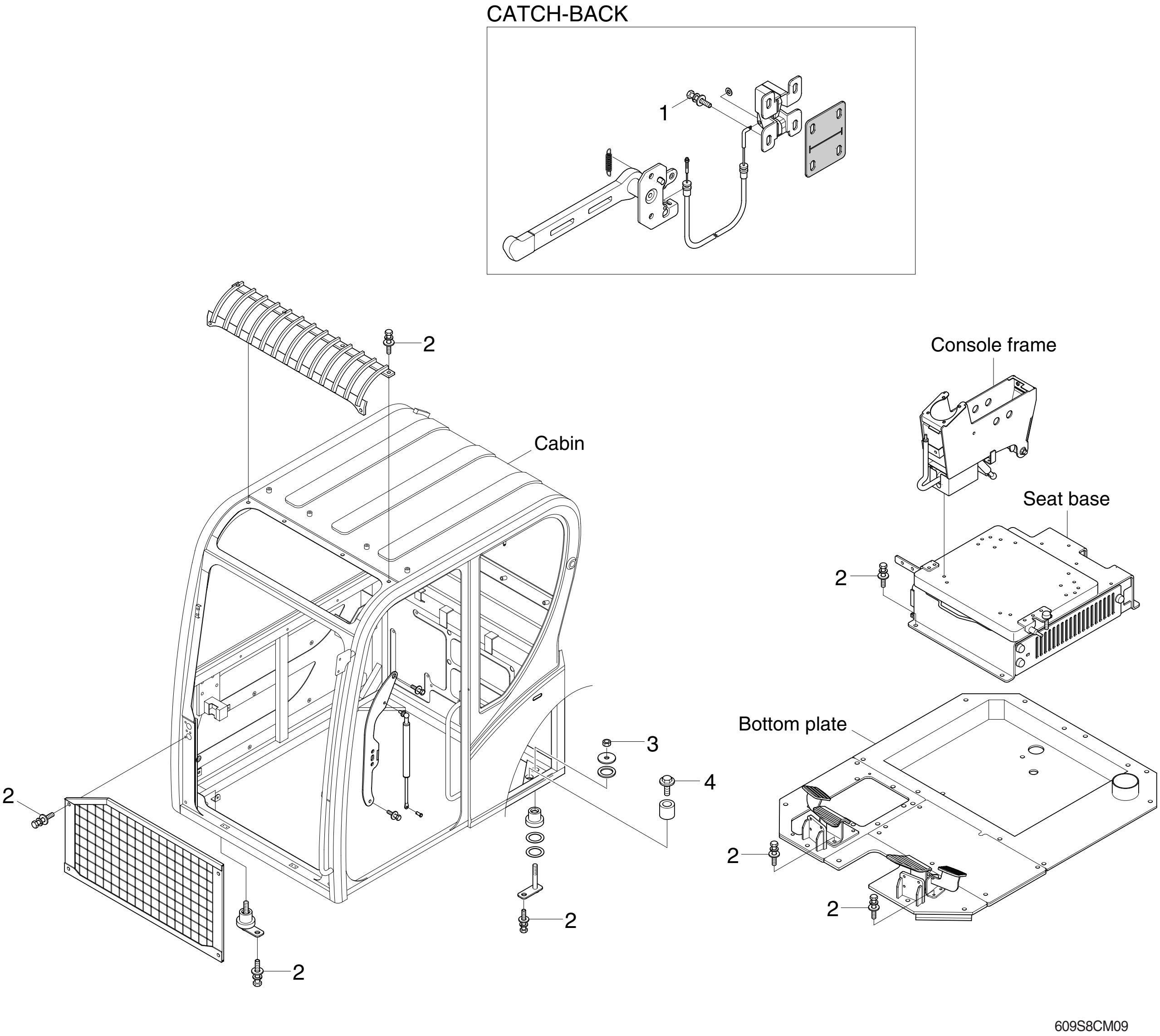
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M10×1.5	6.9±1.4	49.9±10.1
2	M12×1.75	12.8±3.0	92.6±21.7
3	M14×2.0	19.6±2.5	142±18.0
4	M16×2.0	29.7±4.5	215±32.5

Item	Size	kgf · m	lbf · ft
5	M18×2.0	41.0±5.0	297±36.0
7	M24×2.0	30.0±3.0	217±21.7
8	1/2-20UNF	19.5±2.0	141±14.5

GROUP 6 STRUCTURE

1. CAB AND ACCESSORIES MOUNTING

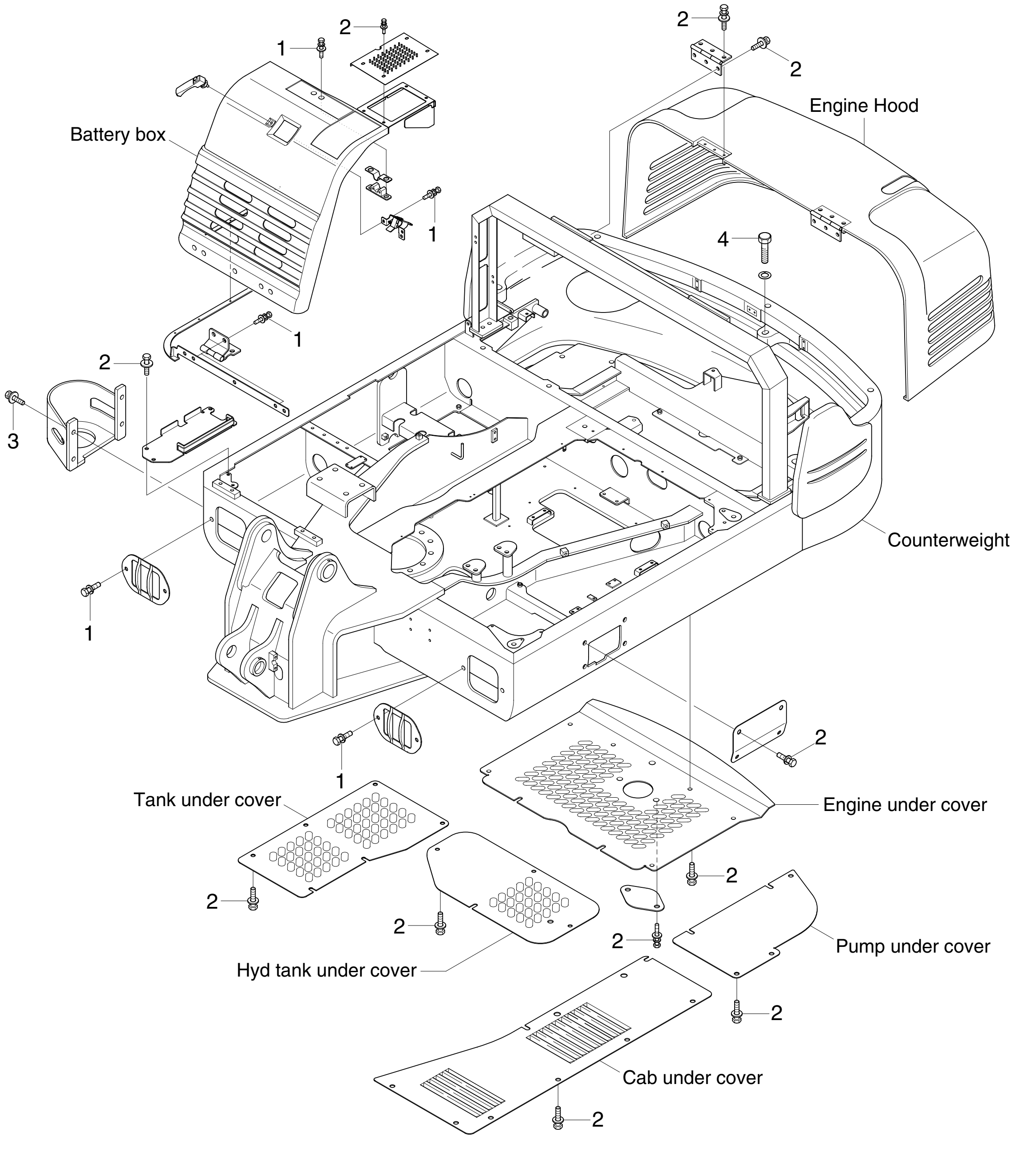


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	2.5±0.5	18.1±3.6
2	M10×1.5	4.7±0.9	34.0±6.5

Item	Size	kgf · m	lbf · ft
3	M12×1.75	12.8±3.0	92.6±21.7
4	M16×2.0	29.7±4.5	215±32.5

2. COWLING MOUNTING

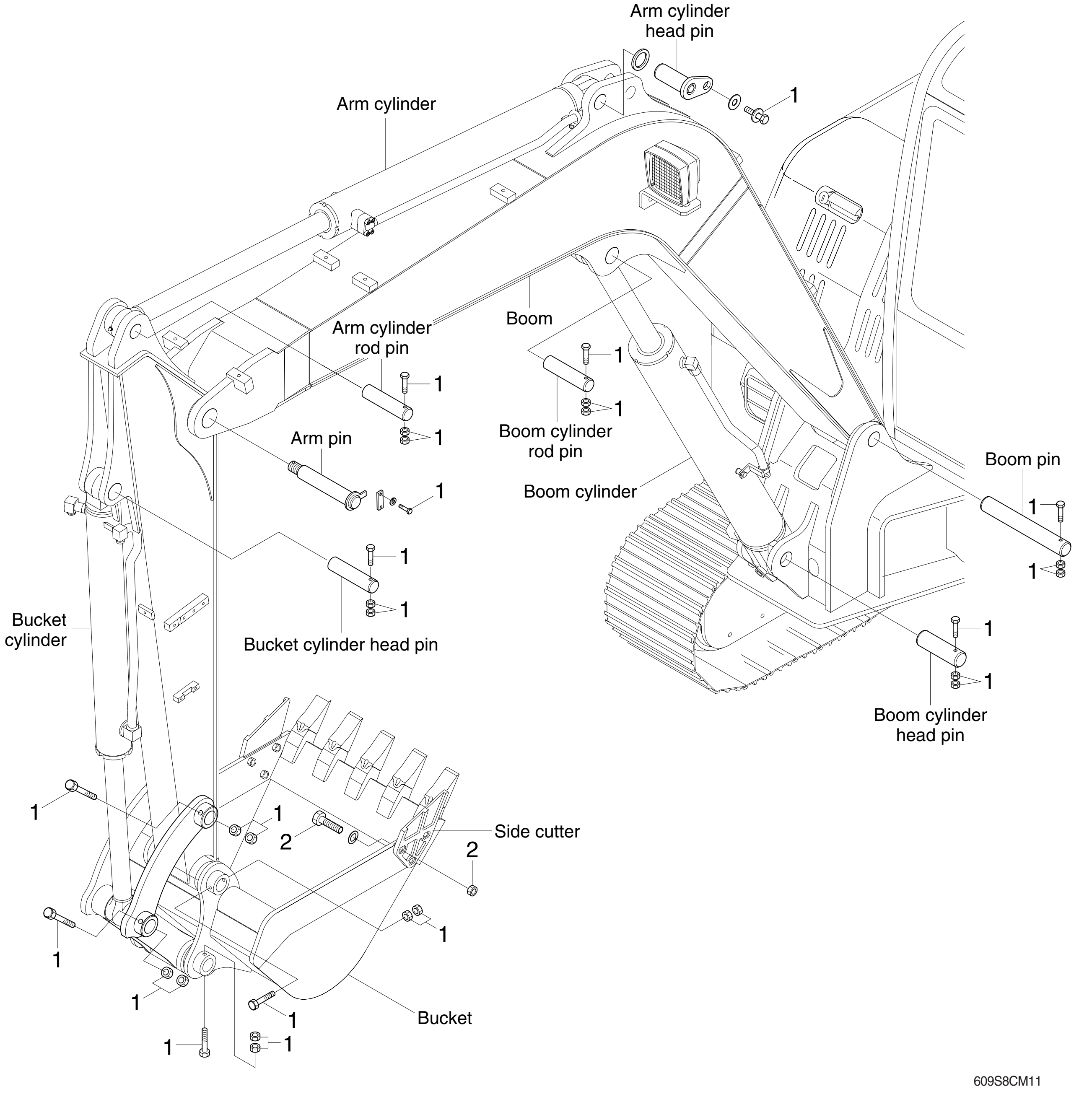


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	2.5±0.5	18.1±3.6
2	M10×1.5	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
3	M12×1.75	12.8±3.0	92.6±21.7
4	M20×2.5	57.8±6.4	418±46.3

GROUP 7 WORK EQUIPMENT



· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M12×1.75	12.8±3.0	92.6±21.7

Item	Size	kgf · m	lbf · ft
2	M16×2.0	29.7±4.5	215±32.5