CONTENTS

SECTION 6 DISASSEMBLY AND ASSEMBLY

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 AND ELECTRICALSYSTEM

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

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 4 TROUBLESHOOTING

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

SECTION 5 MAINTENANCE STANDARD

This section gives the judgement standards when inspecting disassembled parts.

SECTION 6 DISASSEMBLY AND ASSEMBLY

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

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

2. HOW TO READ THE SERVICE MANUAL

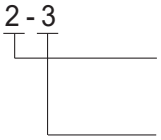
Distribution and updating

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



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.

3- 4
3 - 4 - 1
3 - 4 - 2 ┐ Added pages
3 - 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
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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 / cm² = 14.2233lbf / in²

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

TEMPERATURE

Fahrenheit-Centigrade Conversion.

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

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

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

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

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

SECTION 1 GENERAL

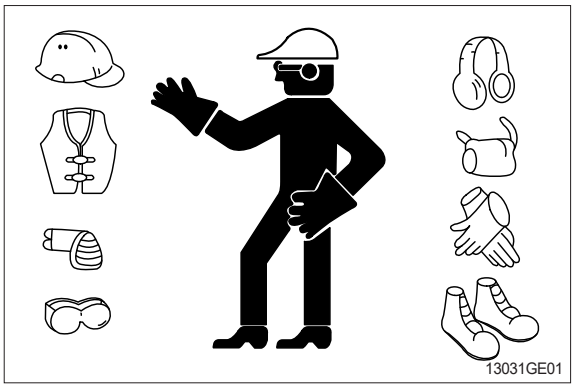
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

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

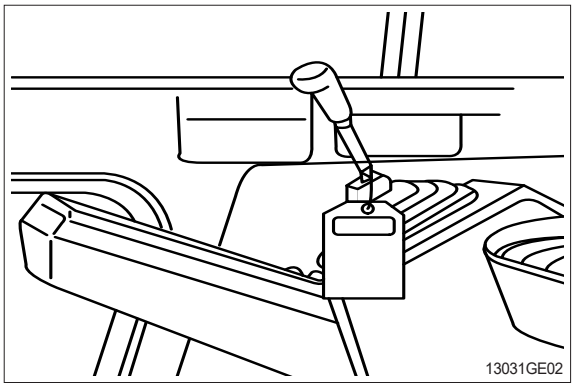
WEAR PROTECTIVE CLOTHING

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



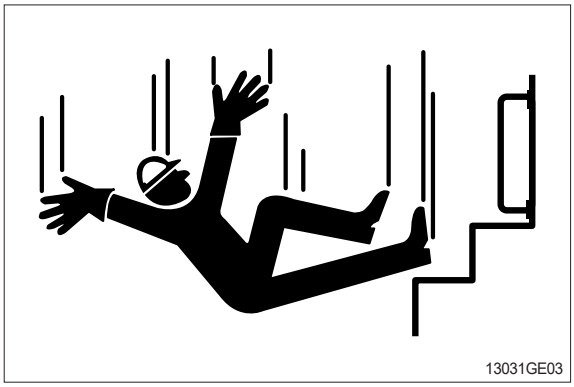
WARN OTHERS OF SERVICE WORK

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



USE HANDHOLDS AND STEPS

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

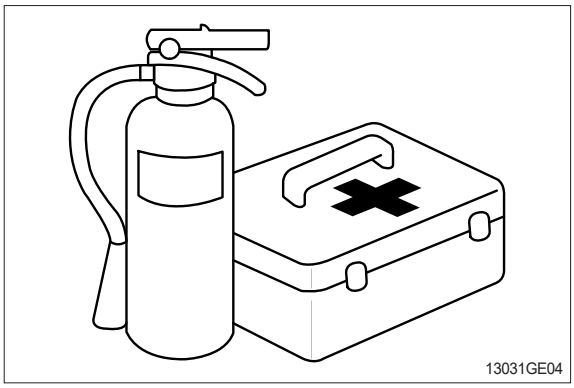


PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

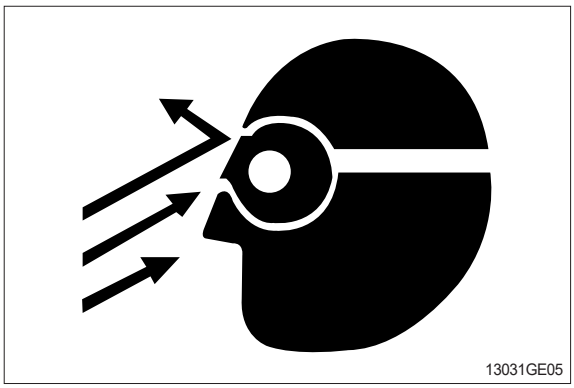
Keep a first aid kit and fire extinguisher handy.

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



PROTECT AGAINST FLYING DEBRIS

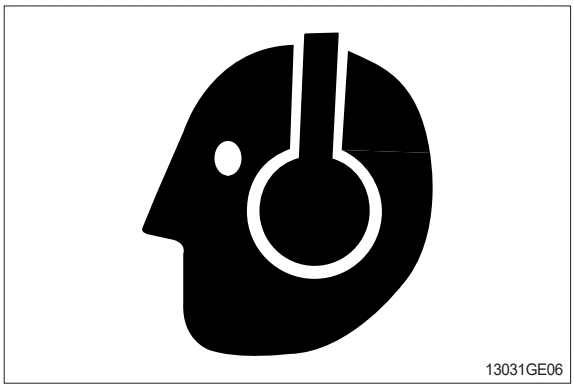
Guard against injury from flying pieces of metal or debris; Wear goggles or safety glasses.



PROTECT AGAINST NOISE

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

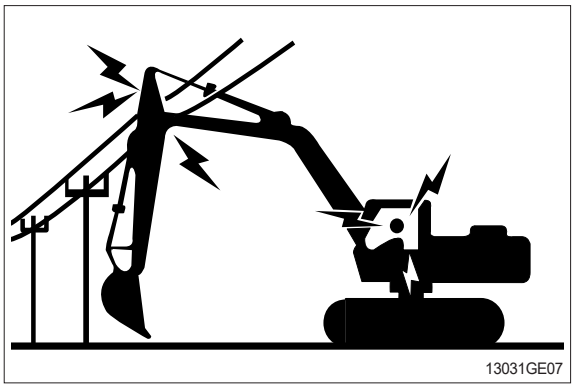
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.



AVOID POWER LINES

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

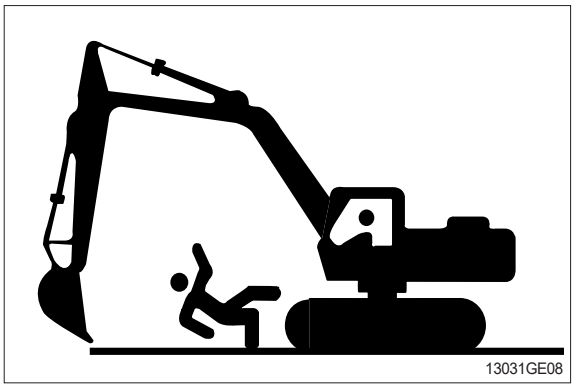
Never move any part of the machine or load closer to electric line than 3m(10ft) plus twice the line insulator length.



KEEP RIDERS OFF EXCAVATOR

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

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

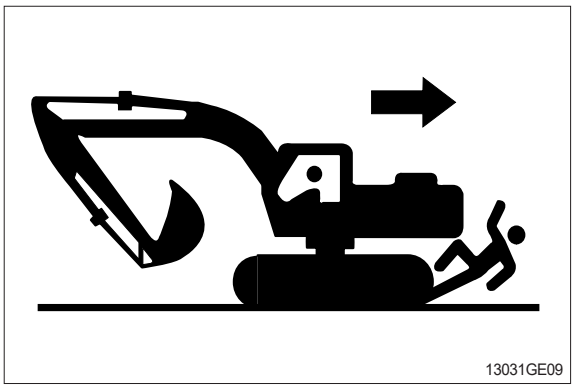


MOVE AND OPERATE MACHINE SAFELY

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.



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.

PARK MACHINE SAFELY

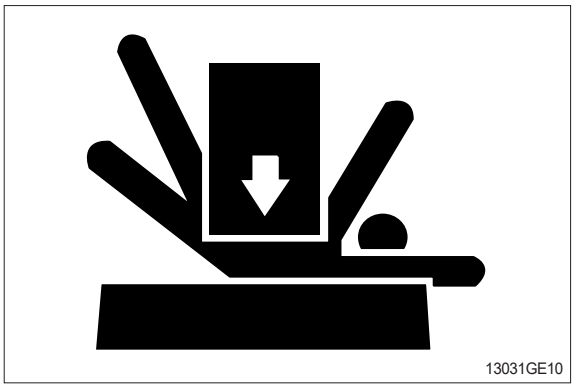
Before working on the machine:

- 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.

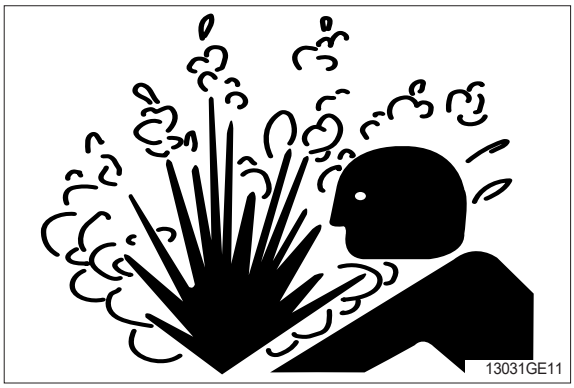
Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load.
Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.



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.



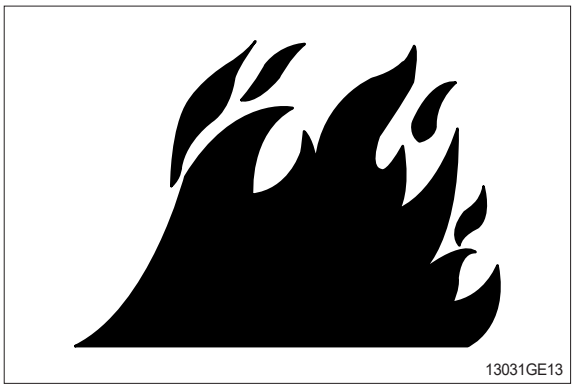
HANDLE FLUIDS SAFELY-AVOID FIRES

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.

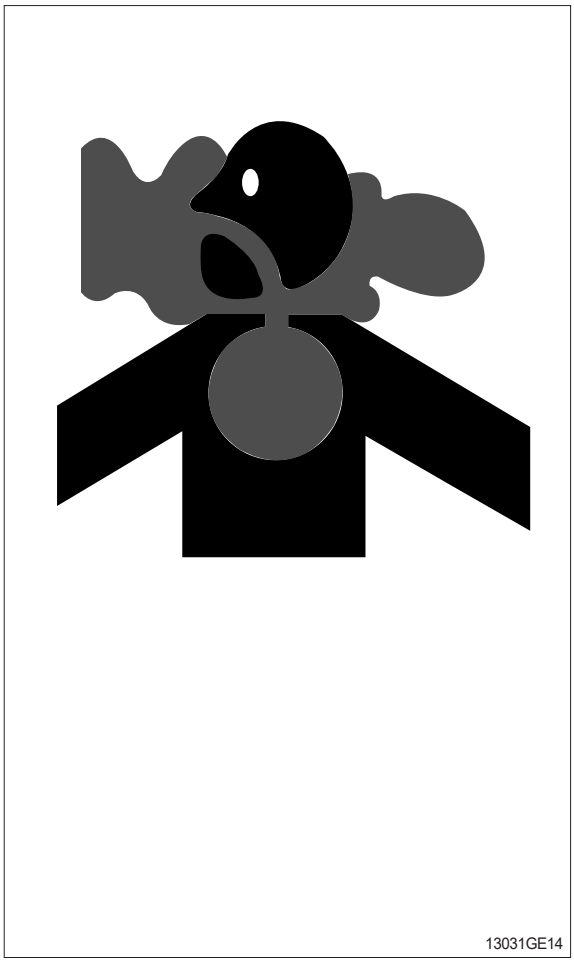
Do not store oily rags; They can ignite and burn spontaneously.



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.



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.

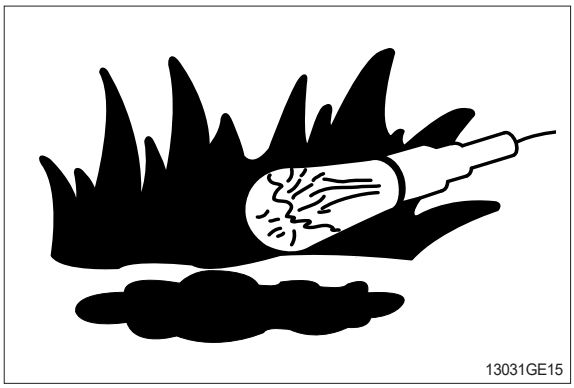
Do all work outside or in a well ventilated area. Dispose of paint and solvent properly.

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

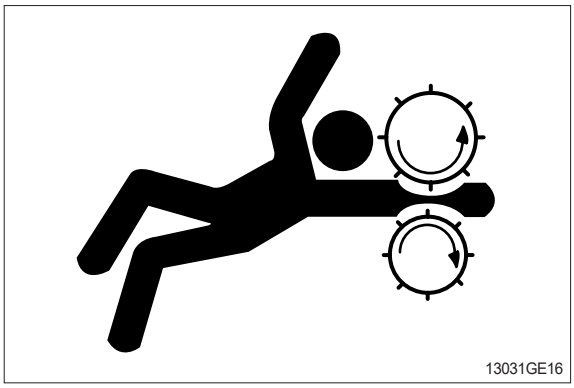
Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.



SERVICE MACHINE SAFELY

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

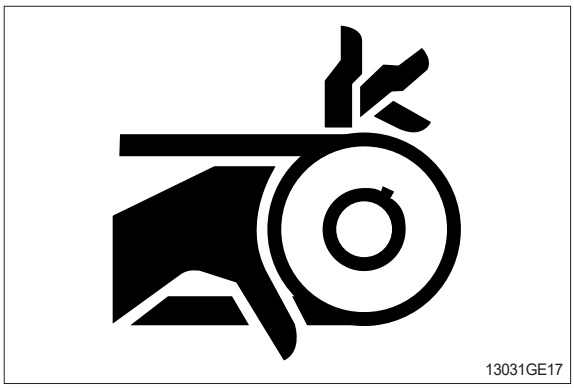
Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

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



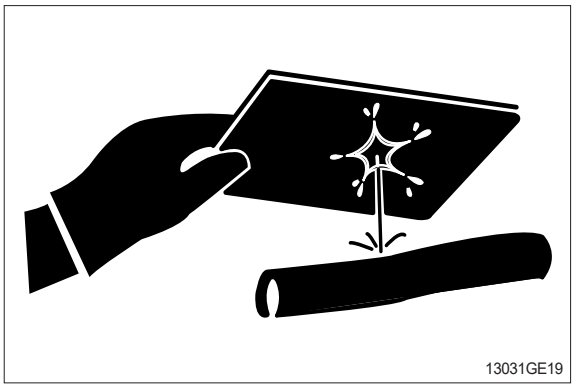
AVOID HIGH PRESSURE FLUIDS

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

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

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

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



AVOID HEATING NEAR PRESSURIZED FLUID LINES

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

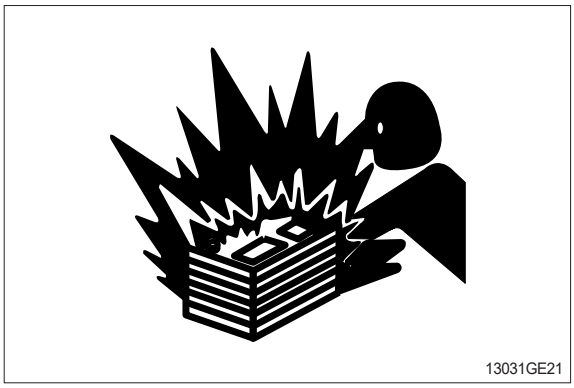
Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area. Install fire resisting guards to protect hoses or other materials.

PREVENT BATTERY EXPLOSIONS

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

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

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



PREVENT ACID BURNS

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

Avoid the hazard by:

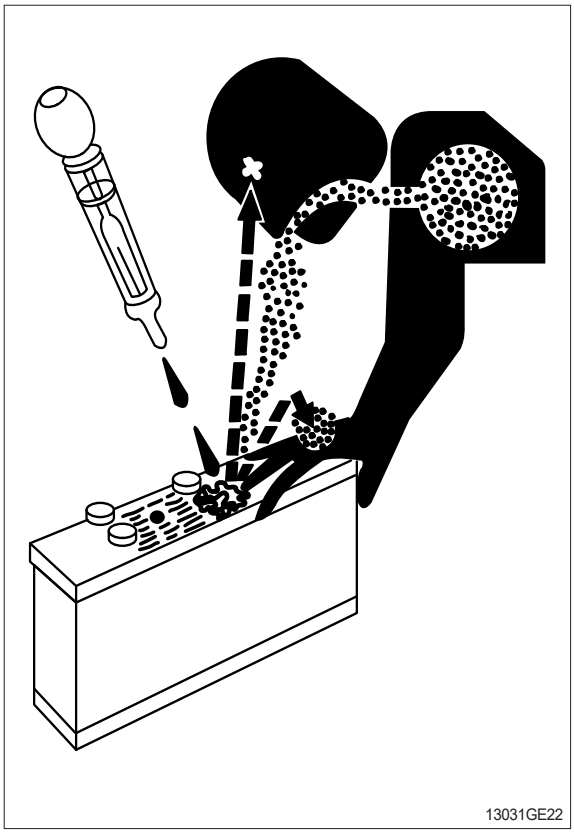
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling of dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

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

If acid is swallowed:

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



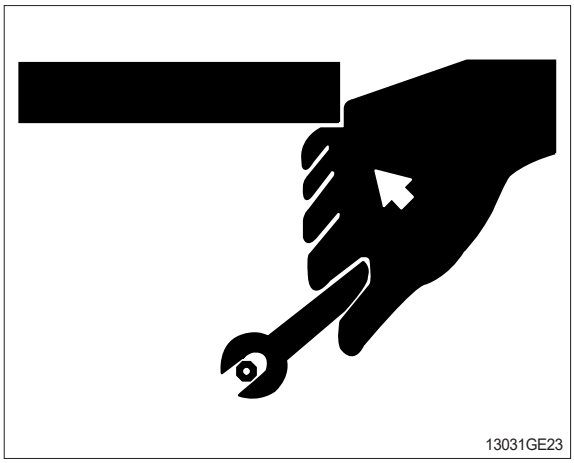
USE TOOLS PROPERLY

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

Use power tools only to loosen threaded tools and fasteners.

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

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

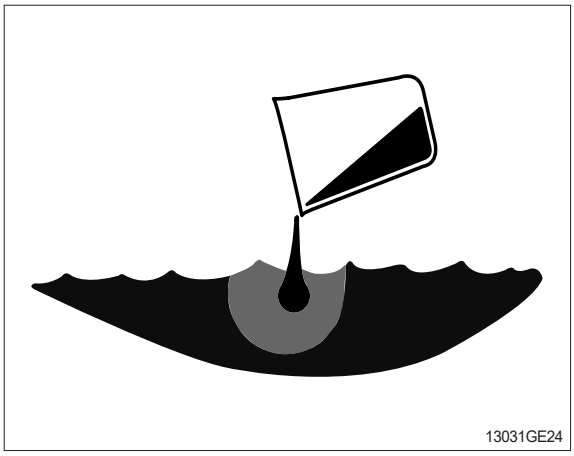


DISPOSE OF FLUIDS PROPERLY

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

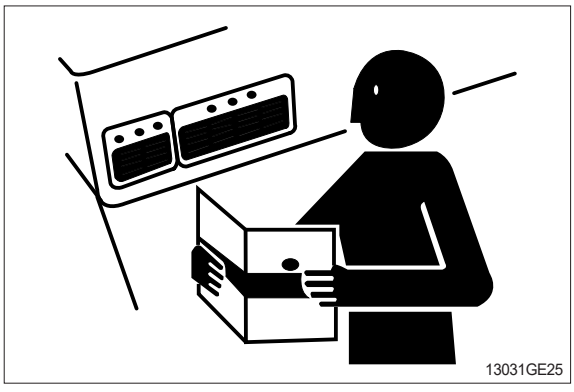
Use proper containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

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



REPLACE SAFETY SIGNS

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

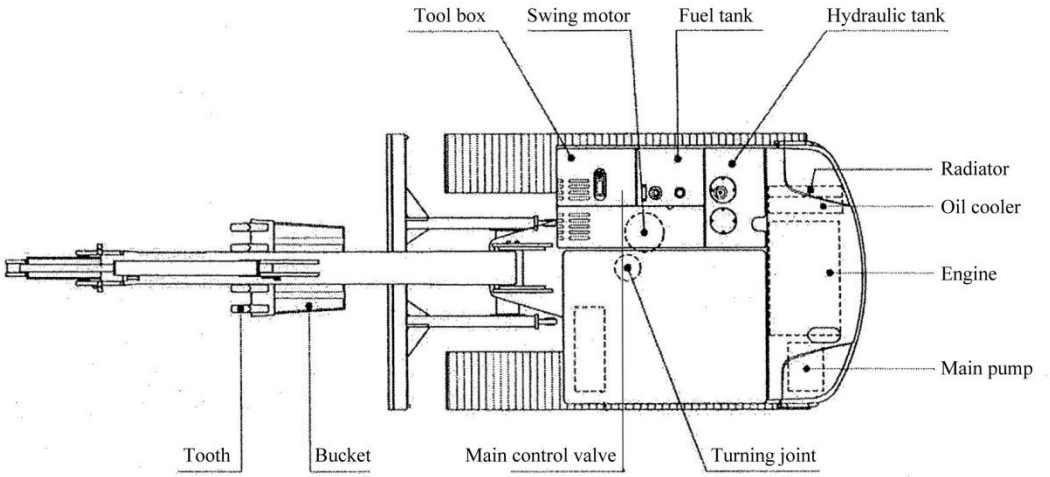


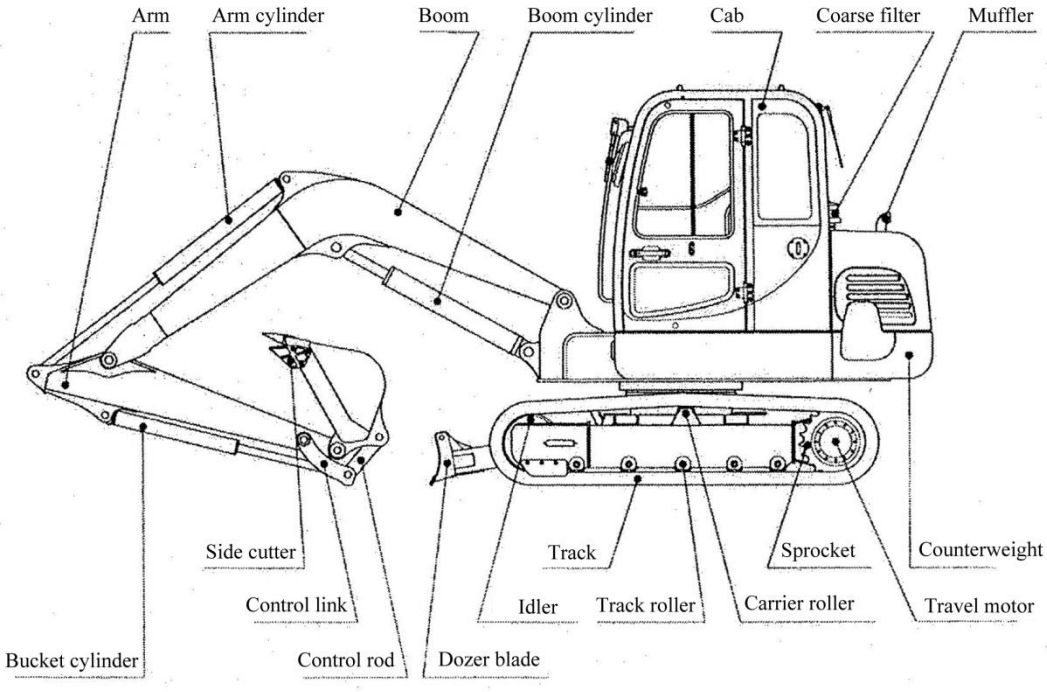
LIVE WITH SAFETY

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

GROUP 2 SPECIFICATIONS

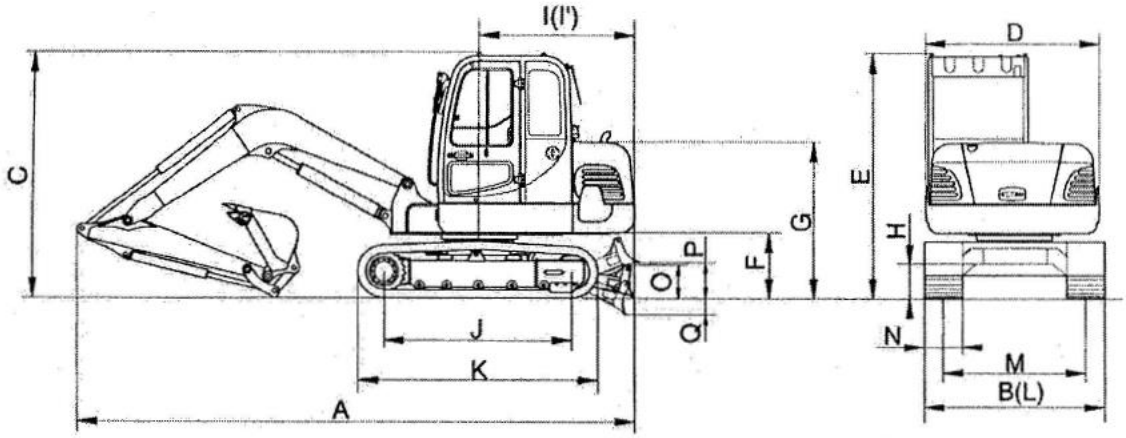
1. MAJOR COMPONENT





2. SPECIFICATIONS

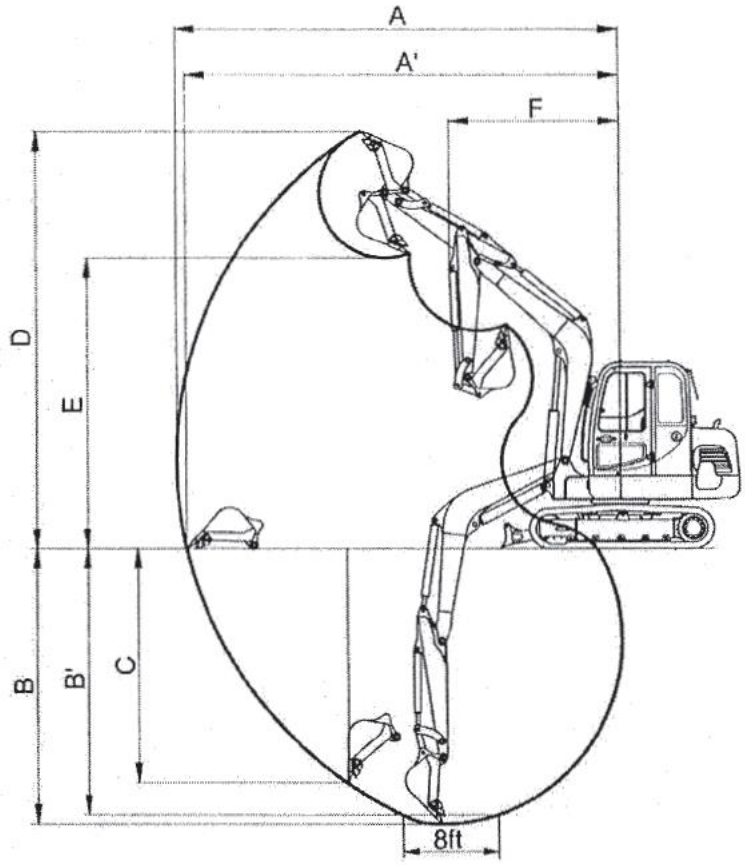
1) 3.7m (12’2”) mono boom, 1.6 7m (5’6”)



Description		Unit	Specification
Operating weight		kg	6,980
Bucket capacity (SAE heaped), standard		m^3	0.32
Overall length	A	mm	6,080
Overall width (400 mm track)	B		2,260
Overall height	C		2,690
Superstructure width	D		2,250
Overall height of cab	E		2,550
Ground clearance of counterweight	F		755
Engine cover height	G		1,755
Minimum ground clearance	H		360
Rear-end distance	I		1,730
Rear-end swing radius	I’		1,750
Distance between tumblers	J		2,130
Undercarriage length	K		2,725
Undercarriage width	L		2,200
Track gauge	M		1,750
Track shoe width, standard	N		450
Height of blade	O		460
Ground clearance of blade up	P		400
Depth of blade down	Q		280
Travel speed (low/high)		km/h	2.9/4.7
Swing speed		rpm	16.4
Gradeability		Degree (%)	35
Ground pressure (400 mm shoe)		kgf/cm^2	0.35

3. WORKING RANGE

1) 3.7 m (12’2”) mono boom



Description		1.6 7m Arm
Max digging reach	A	6,335 mm
Max digging reach on ground	A’	6,185mm
Max digging depth	B	4,015 mm
Max digging depth (8’ level)	B’	3,625 mm
Max vertical digging depth	C	3,210 mm
Max digging height	D	7,175 mm
Max dumping height	E	5,080 mm
Min swing radius	F	1,750 mm
Bucket digging force	ISO	4,874 kgf
Arm digging force	ISO	3,697 kgf

4. WEIGHT

Item	HX75S
	kg
Upperstructure assembly	3,430
Main frame weld assembly	737
Engine assembly	234
Main pump assembly	50
Main control valve assembly	60
Swing motor assembly	80
Hydraulic oil tank assembly	100
Fuel tank assembly	73
Counterweight	390
Cab assembly	450
Lower undercarriage assembly	2,780
Track frame weld assembly	900
Swing bearing	140
Travel motor assembly	87
Turning joint	27
Tension body	110
Idler	65
Carrier roller	8
Track roller	10
Sprocket	20
Track-chain assembly (450 mm standard triple grouser shoe)	810
Dozer blade assembly	315
Working device assembly (3.0 m boom, 1.6 m arm, 0.21 m^3 SAE heaped bucket)	1,185
3.7 m boom assembly	481
1.6 7m arm assembly	192
0.32 m^3 SAE heaped bucket	250
Boom cylinder assembly	120
Arm cylinder assembly	80
Bucket cylinder assembly	50
Bucket control link assembly	60
Dozer cylinder assembly	50

5. LIFTING CAPACITIES

3.7 m (12’2”) boom, 1.67 m (5’6”) arm equipped with 0.32 m^3 (SAE heaped) bucket and 450 mm triple grouser shoe, the dozer blade down.
The parameters of HX75D are the same as those in the table below.

Table of Lifting Capacities

HX75S

Boom: 3.7 m (12’2”)

Arm: 1.6 7m (5’6”)

Bucket: 0.32m^3 (SAE heaped)

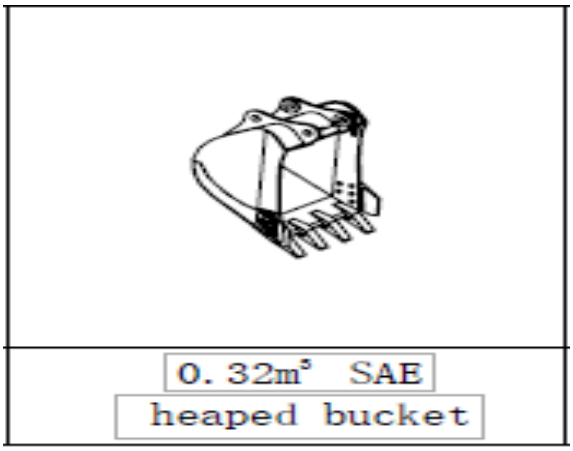
 Rating over-front

 Rating over-side or 360 degree

Load point height (m/ft)		Load radius						At max. reach		
		1.5 m (5 ft)		3.0 m (10 ft)		4.5m (15 ft)		Capacity		Reach
										m (ft)
4.5 m	kg			*1800	*1800			*1680	1090	5.06
15 ft	lb			*3970	*3970			*3700	2400	(16.6)
3.0 m	kg	*3890	*3890	*2370	*2370	*1930	1300	*1710	820	5.75
10 ft	lb	*8580	*8580	*5220	*5220	*4250	2870	*3770	1810	(18.9)
1.5 m	kg			*3340	2350	*2230	1210	*1760	740	5.95
5 ft	lb			*7340	5180	*4920	2670	*3880	1630	(19.5)
Ground line	kg			*3820	2160	*2430	1140	*1810	770	5.70
	lb			*8420	4760	*5360	2510	*3990	1700	(18.7)
-1.5 m	kg	*4810	*4810	1700	2130	*2230	1120	*1790	990	4.93
-5 ft	lb	*10600	*10600	3750	4700	*4920	2470	*3950	2180	(16.2)
-3.0 m	kg	*4000	*4000	1720	2220					
-10 ft	lb	*8820	*8820	3790	4890					

- The ratings of lifting capacities are based on SAE J1097 and ISO 10567.
- The load point is a hook located on the back of the bucket (standard).
- * Indicate the load limited by hydraulic capacity.
- If you want to install a non-recommended working device, refer to the service manual.
- Install the working device to prevent the boom from falling during lifting.
- The aforesaid lifting capacity include the sling weight.
- Read the operator’s manual before operation and observe it during operation.

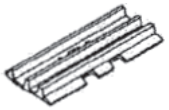
6. BUCKET SELECTION GUIDE



Capacity		Width		Weight	Recommendation
SAE heaped	CECE heaped	Without side cutter	With side cutter		3.7m boom
					1.67m arm
0.32m^3	0.28 m^3	760 mm	840 mm	250 kg	Applicable for materials with density of 2000 kgf/m^3 (3370 lb/yd^3) or less

7. UNDERCARRIAGE

1) Track

Model	Category		Triple grouser shoe
			
HX75S	Shoe width	mm	450
	Operating weight	kg	6,800
	Ground pressure	kgf/cm^2	0.35
	Overall width	mm	2,260

2) Number of rollers and shoes on each side

Item	Quantity
Carrier rollers	1EA
Track rollers	5EA
Track shoes	38EA

8. SPECIFICATIONS FOR MAJOR COMPONENTS

1) Engine

Item	Specification
Model	XSNSRE/4TNV98-ZCV
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	98 ×110 mm
Piston displacement	3,318cc
Compression ratio	18.5:1
Rated gross horse power (SAE J1995)	44.4/2,100 (KW/rpm)
Maximum torque at 1,575 rpm	240.1N•m
Engine oil quantity	12.0L
Net weight of engine	234kg
High idling speed	2,200+50 rpm
Low idling speed	1,050 ±50 rpm
Starting motor	12 V-3.0 kW
Alternator	12 V-80 A
Battery	1 ×12 V ×100 Ah

2) Main pump

Item	Specification
Type	Variable-displacement axial piston pump
Capacity	72 cc/rev
Maximum pressure	275 kgf/cm^2
Rated oil flow	158.4 L/min
Rated speed	2,200 rpm

3) Gear pump

Item	Specification
Type	Single stage quantitative gear pump
Capacity	8cc/rev
Main relief valve pressure	35kgf/cm^2
Rated oil flow	17.6 /min

4) Main control valve

Item	Specification
Type	Sectional, 8 spools (one optional)
Operating method	Hydraulic pilot system
Main relief valve pressure	275 kgf/cm^2
Overload relief valve pressure	

5) Swing motor

Item	Specification
Type	Fixed-displacement axial piston motor
Capacity	43cc/rev
Relief pressure	210 kgf/cm^2
Braking system	Automatic, spring applied hydraulic release
Braking torque	14 kgf•m (101 lbf•ft)
Brake release pressure	20-40 kgf/cm^2 (284-569 psi)
Reduction gear type	2-stage planetary
Swing speed	16.4 rpm

6) Travel motor

Item	Specification
Type	Variable-displacement axial piston motor
Relief pressure	300kgf/cm^2
Reduction gear type	2-stage planetary
Braking system	Automatic, spring applied hydraulic release

7**) Remote control valve**

Item		Specification
Type		Proportional pressure reduction
Operating pressure	Min.	5kgf/cm^2
	Max.	20.5kgf/cm^2
One-way operating stroke	Handle	6.5/8.5 mm (0.26/0.33 in)

8) Cylinder

Item		Specification
Boom cylinder	Bore dia ×Rod dia ×Stroke	Φ115 × Φ70 ×980mm
	Cushion	Extend only
Arm cylinder	Bore dia ×Rod dia ×Stroke	Φ95 × Φ60 × 860 mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia ×Rod dia ×Stroke	Φ90 × Φ55× 665 mm
	Cushion	
Dozer cylinder	Bore dia ×Rod dia ×Stroke	Φ110× Φ65 × 152 mm

※ Discoloration may occur to the cylinder rod due to surface friction during operation.

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

9) Shoe

Item	Width	Ground pressure	Link quantity	Overall width
HX75S	450 mm (16'')	0.35 kgf/cm^2	38	2260 mm (7'5')

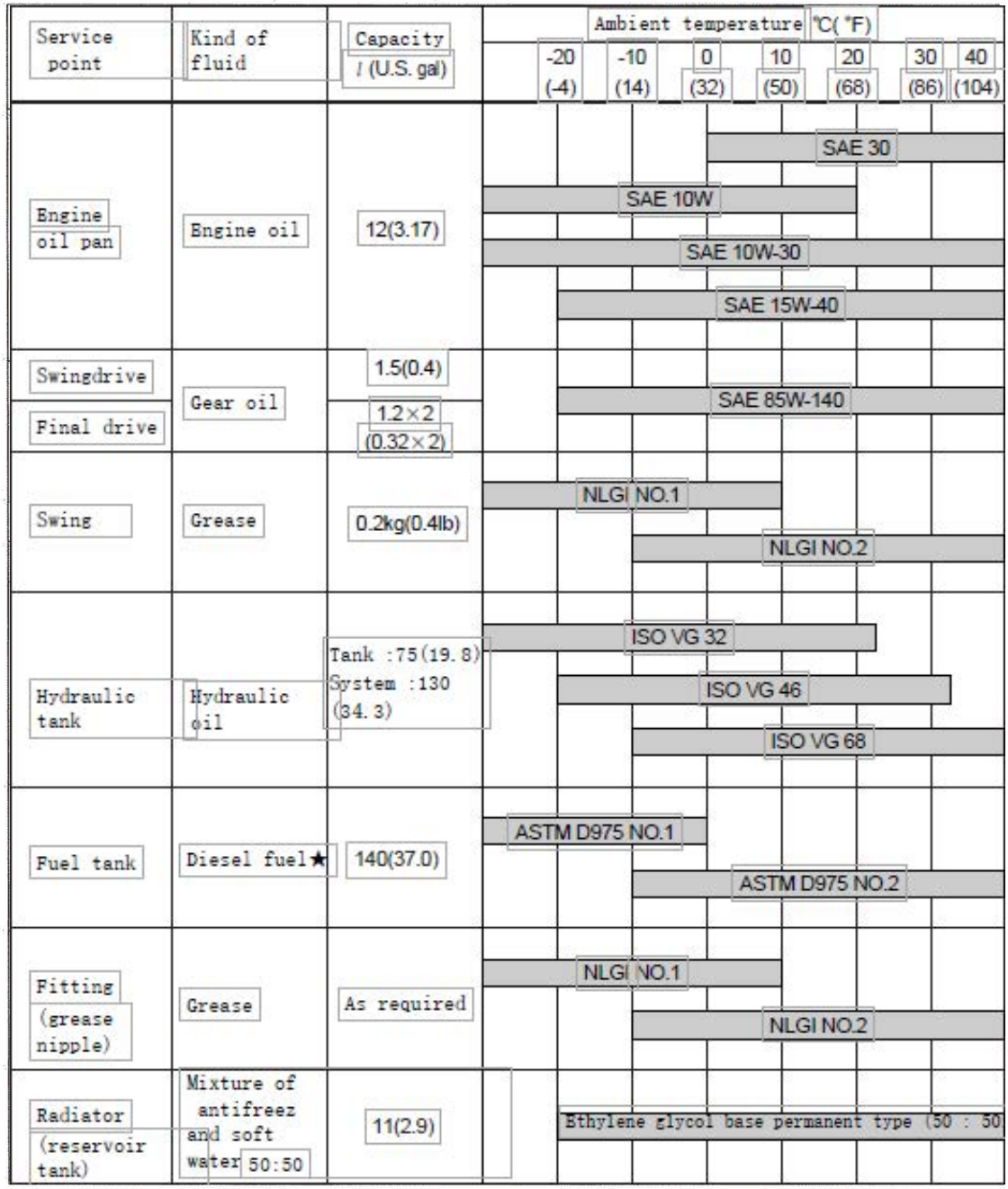
10) Bucket

Item		Capacity		Tooth quantity	Width	
		SAE heaped	CECE heaped		Without side cutter	With side cutter
HX75S	Standard	0.32 m^3	0.28 m^3	5	760mm	840mm

9. RECOMMENDED OILS

Use the oils listed below or those of the same grade or above.

Do not mix oils of different grades.



SAE: Society of Automotive Engineers

API: American Petroleum Institute

ISO: International Organization for Standardization

NLGI: National Lubricating Grease Institute

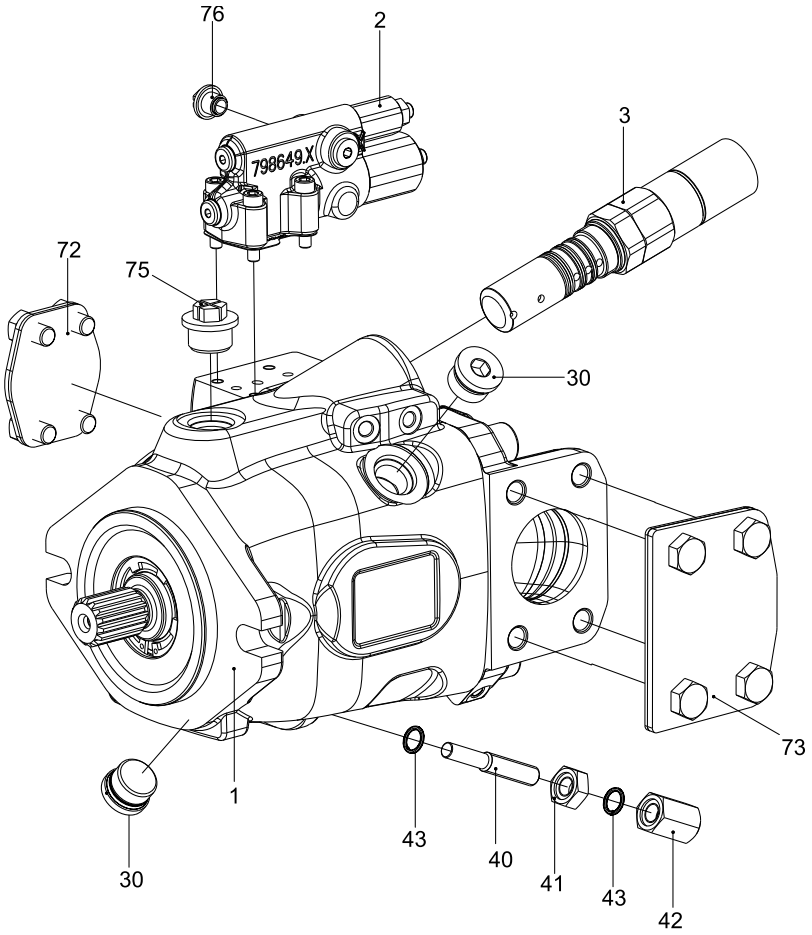
ASTM: American Society of Testing and Material

SECTION 2 STRUCTURE AND FUNCTION

SECTION 2 STRUCTURE AND FUNCTION

GROUP 1 HYDRAULIC PUMP

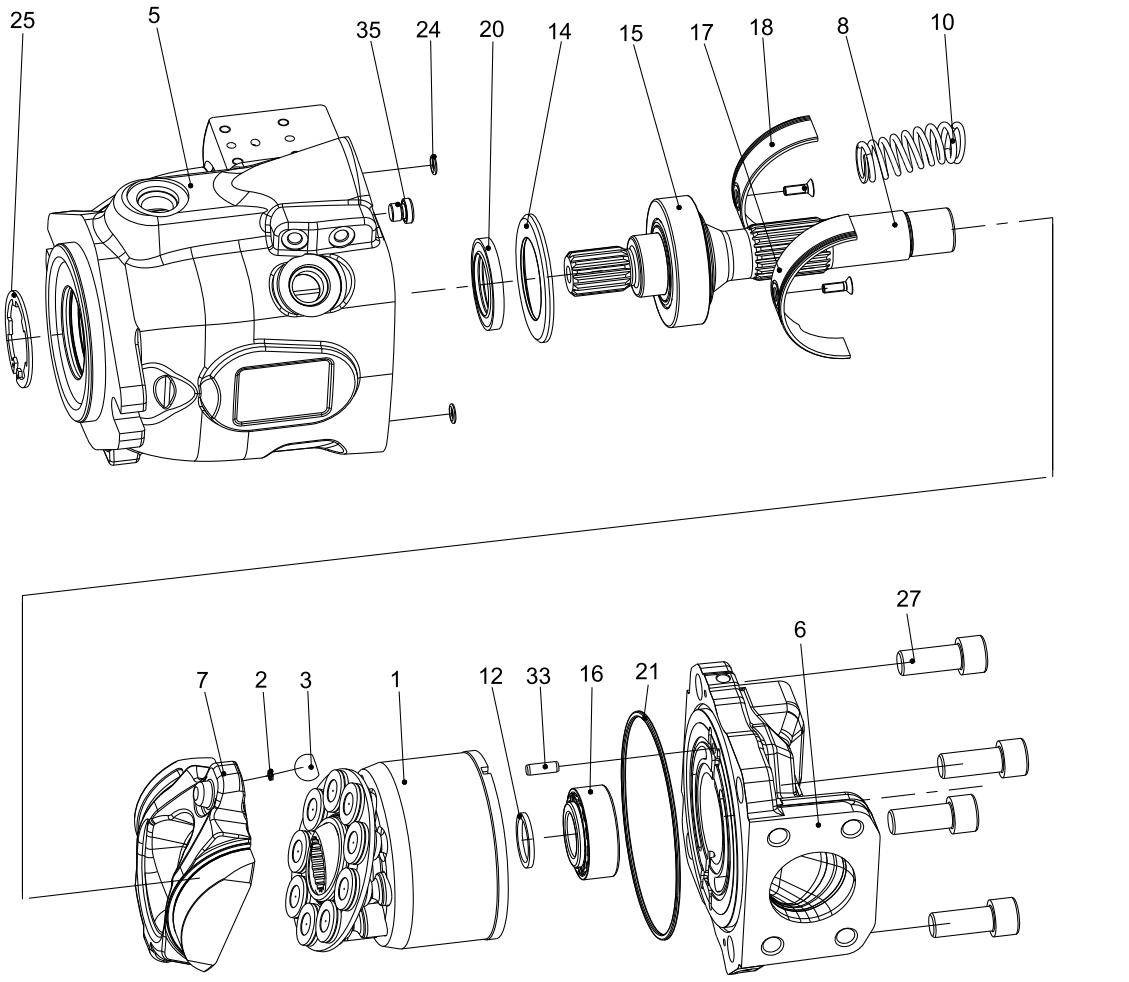
1. STRUCTURE (1/2)



60S2MP05

1	Main pump	43	O-ring
2	Control valve	72	Cover
3	Control valve	73	Cover
30	Locking screw	75	Screw
40	Stop screw	76	Screw
41	Nut		
42	Cap		

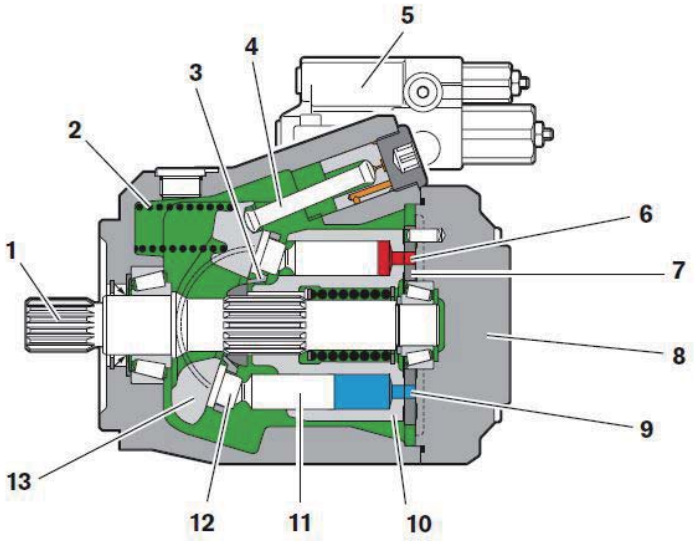
STRUCTURE (2/2)



60S2MP05

1	Rotary Assy	16	Taper roller bearing
2	Spring	17	Liner bearing
3	Stopper	18	Liner bearing
5	Pump housing	20	Seal ring
6	Port plate	21	O-ring
7	Swash plate	24	Seal ring
8	Drive shaft	25	Retainer ring
10	Spring	27	Socket screw
12	Adjust shim	33	Cylinder pin
14	Stop ring	35	Screw
15	Taper roller bearing		

2. PUMP FUNCTIONS

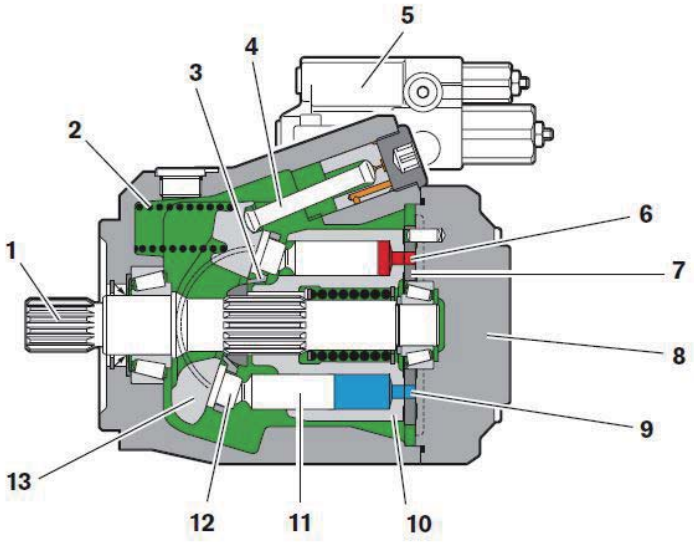


HX60S2MP01

1	Drive shaft	8	Port plate
2	Spring	9	Suction side
3	Retaining plate	10	Cylinder
4	Stroke piston	11	Piston
5	Control valve	12	Slipper pad
6	High-pressure side	13	Swashplate
7	Control plate		

Torque and rotational speed are applied to the drive shaft (1) by an engine. The drive shaft is connected by splines to the cylinder (10) to set this in motion. With every revolution, the pistons (11) in the cylinder bores execute one stroke whose magnitude depends on the setting of the swashplate (13). The pistons hold the slipper pads (12) onto the glide surface of the swashplate with the retaining plate (3) and guide them along. The swashplate setting during a rotation causes each piston to move over the bottom and top dead centers and back to its initial position. Here, hydraulic fluid is fed in and drained out through the two control slots in the control plate (7) according to the stroke displacement. On the suction side (9) hydraulic fluid flows into the piston chamber as the piston recedes. At the same time, on the high-pressure side (6) the fluid is pushed out of the cylinder chamber into the hydraulic system by the pistons.

3. CONTROL FUNCTIONS



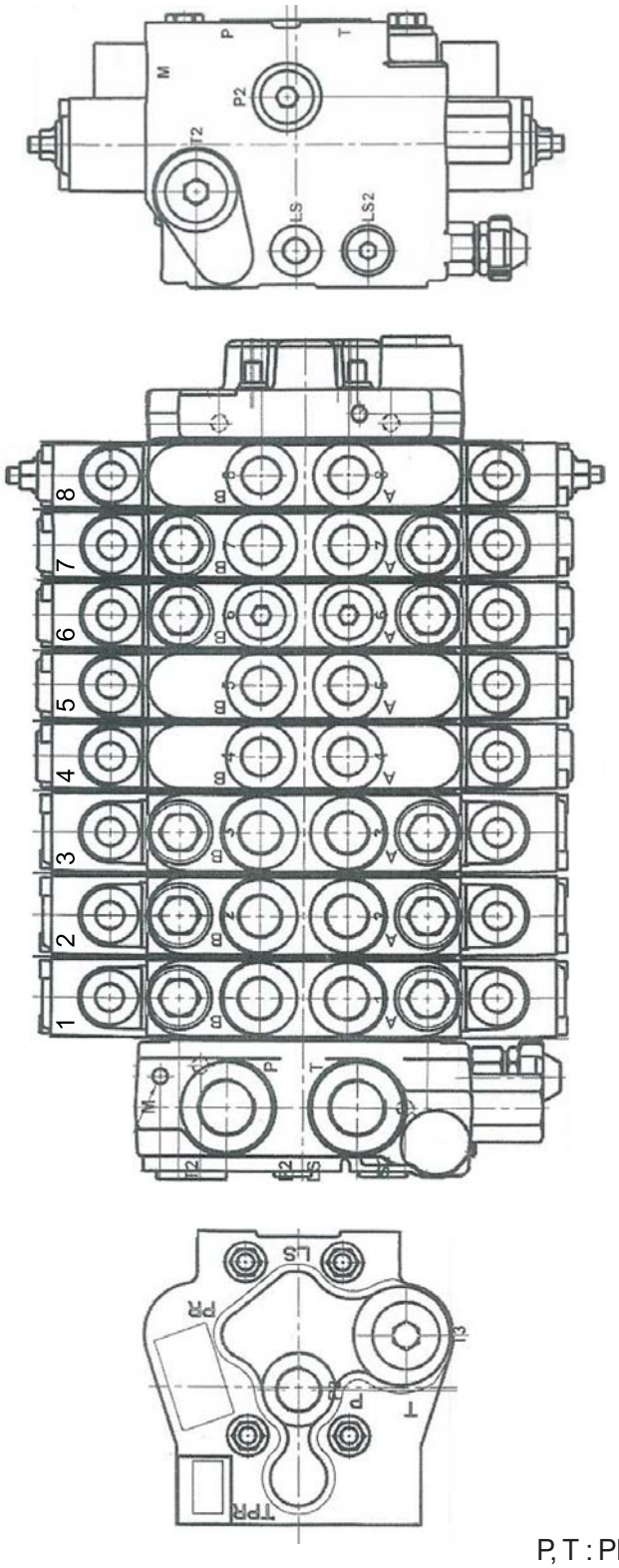
HX60S2MP01

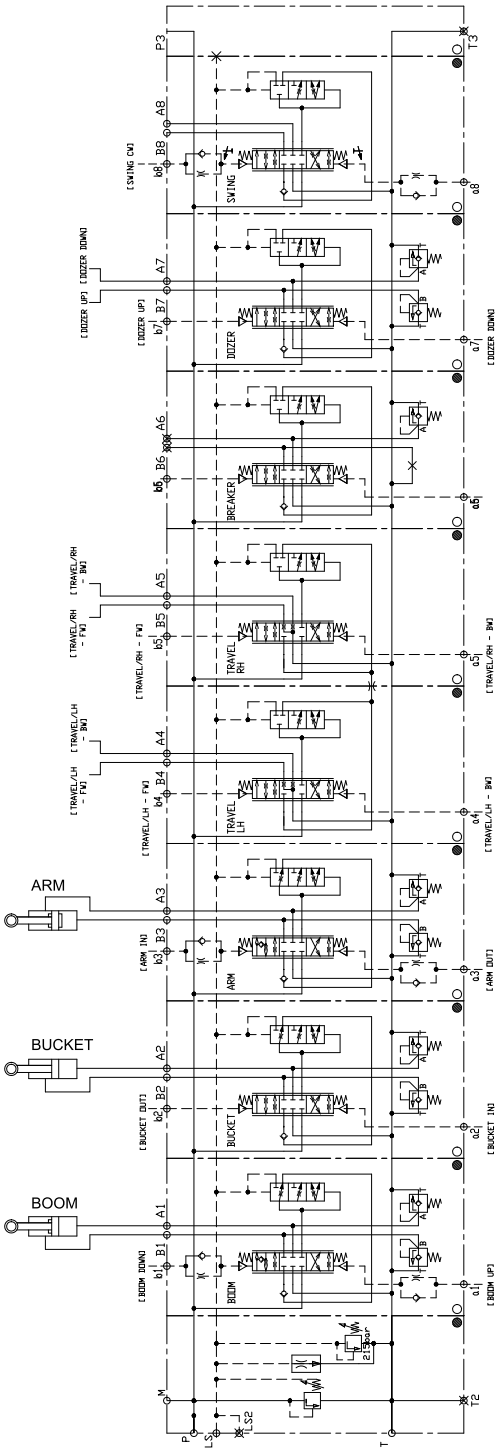
1	Drive shaft	8	Port plate
2	Spring	9	Suction side
3	Retaining plate	10	Cylinder
4	Stroke piston	11	Piston
5	Control valve	12	Slipper pad
6	High-pressure side	13	Swashplate
7	Control plate		

The swivel angle of the swashplate (13) is steplessly variable. Controlling the swivel angle of the swashplate changes the piston stroke and therefore the displacement. The swivel angle is changed hydraulically by means of the stroke piston. The swashplate is mounted in swivel bearings for easy motion and it is kept in balance by a spring (2). Increasing the swivel angle increases the displacement; reducing the angle results in a corresponding reduction in displacement.

GROUP 2 MAIN CONTROL VALVE

1. OUTLINE

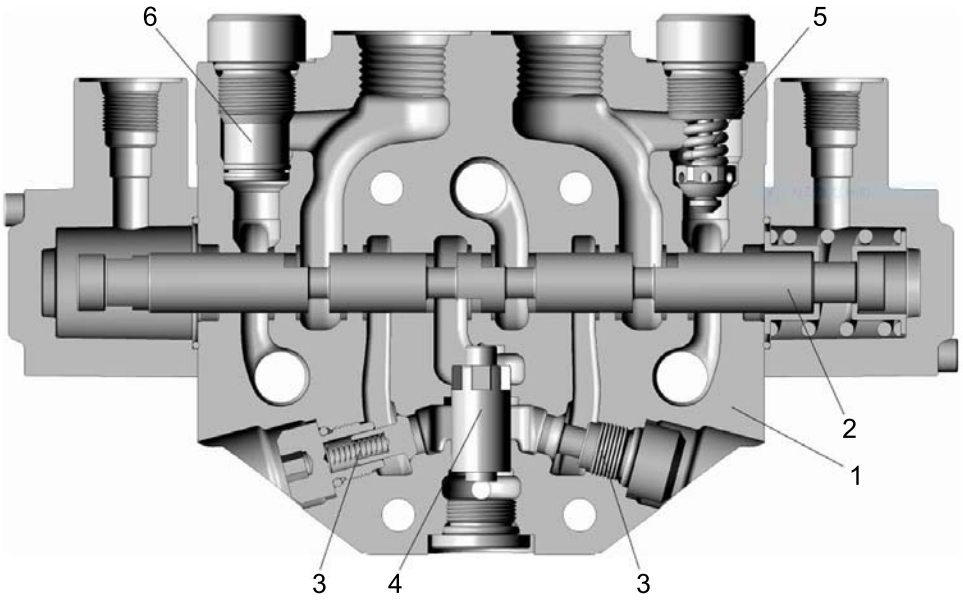




P, T : PF 3/4
LS, M, a, b : PF 1/4
A, B : PF 3/8

60S2MC01

2. SECTION FUNCTIONAL DESCRIPTION



1	Housing	4	Pressure compensator
2	Main spool	5	Secondary valve
3	Load holding valves	6	Plug screw

60S2MC02

· The control block consists of an inlet plate, elements and an end plate. The inlet plate has two mounting points as well as the line connections P, T, LS and M. The inlet plate moreover comprises all components neces-sary for the system function: One flow control valve for the controlled unloading of the LS line and one LS pressure relief valve to limit the maximum system pressure.

· Every directional valve element of the control block con-sists of the housing (1), one main spool (2), two load hold-ing valves (3), one pressure compensator (4), installation bores for direct operated pressure relief valves with feed function (5) as well as feed valves or plug screws (6).
The end plate has two mounting points.

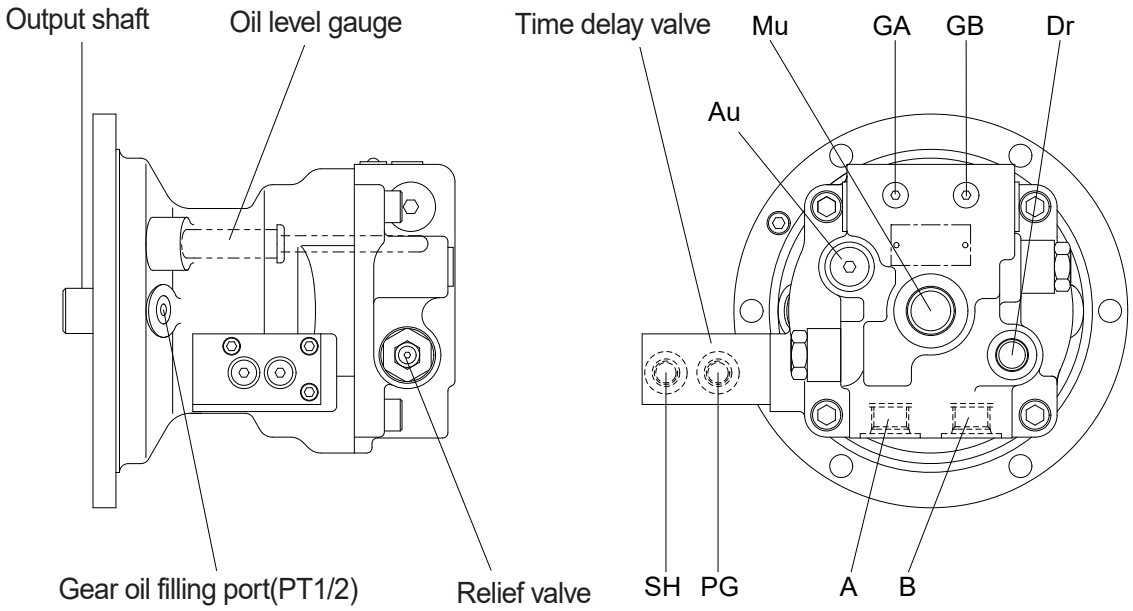
GROUP 3 SWING DEVICE

1. STRUCTURE

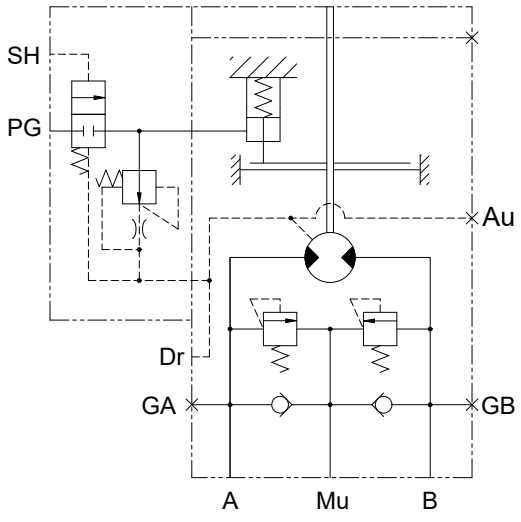
Swing device consists swing motor, swing reduction gear.

1) SWING MOTOR

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

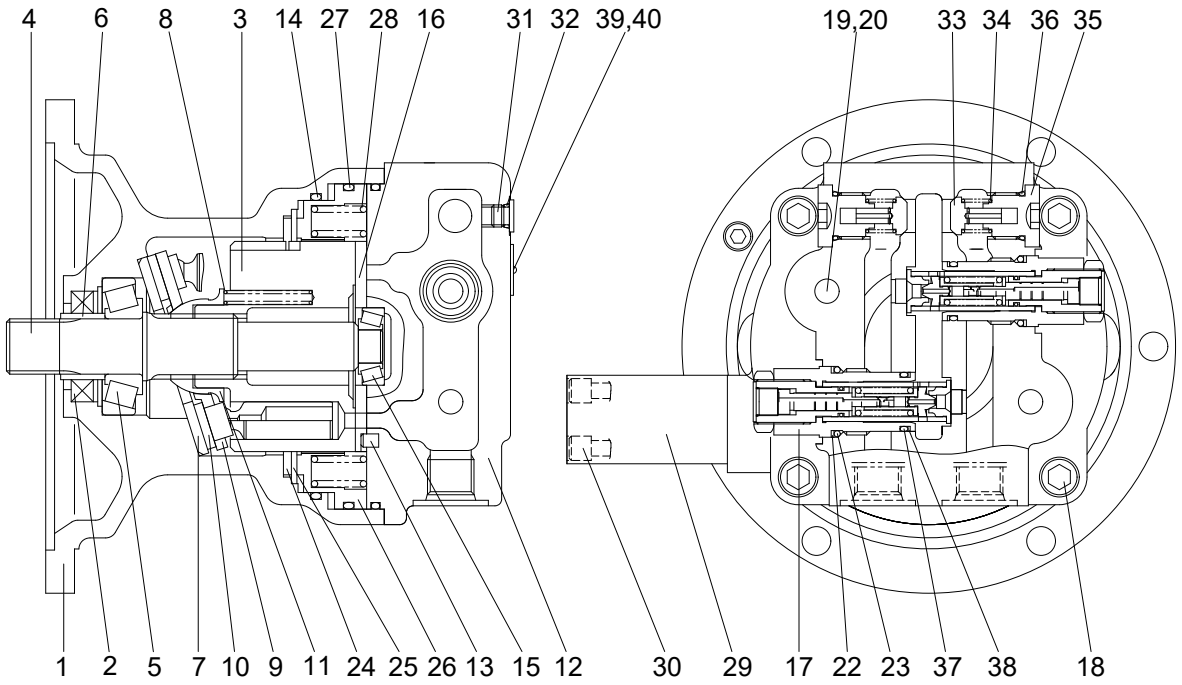


HX60A2SM01



Hydraulic circuit

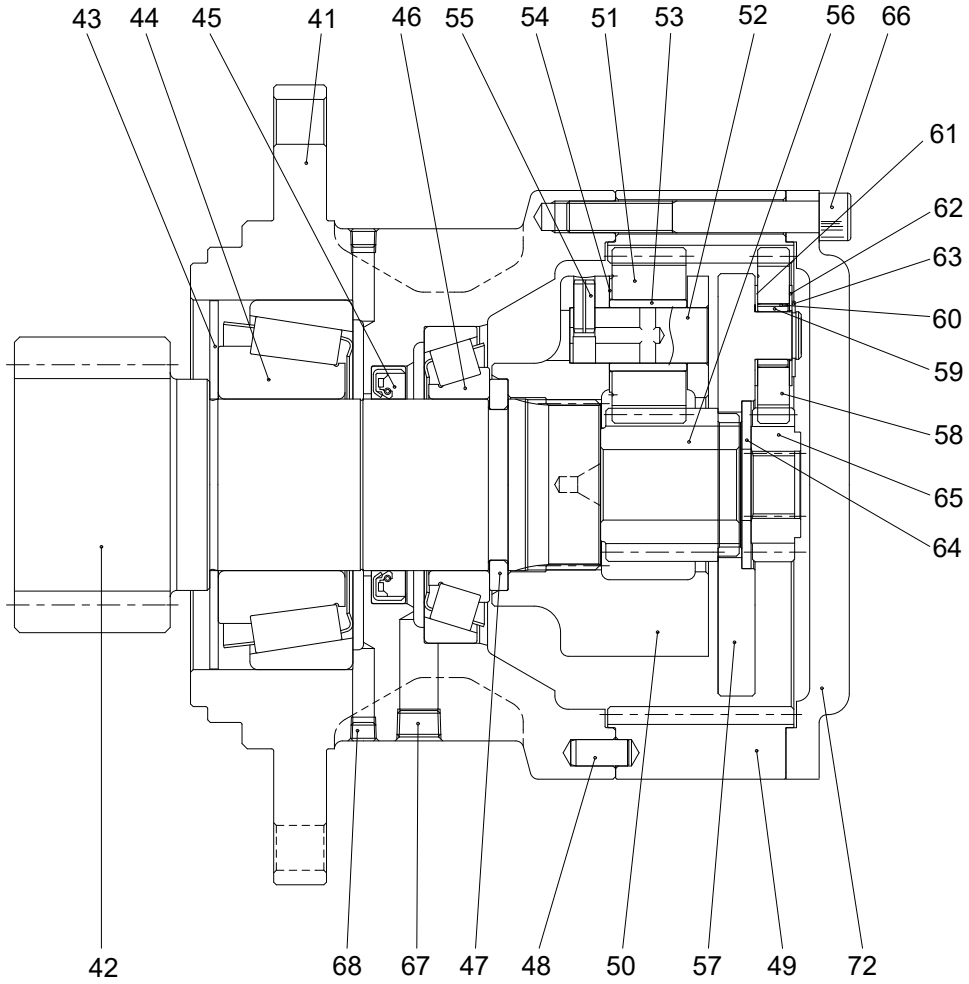
Port	Port name	Port size
A	Main port	PF 1/2
B	Main port	PF 1/2
Dr	Drain port	PF 3/8
Mu	Make up port	PF 3/4
PG	Brake release stand by port	PF 1/4
SH	Brake release pilot port	PF 1/4
AU	Air vent port	PF 3/8
GA,GB	Gauge port	PF 1/4



HX60A2SM03

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

2) REDUCTION GEAR



HX60A2SM02

41	Case	52	Pin 2	63	Snap ring
42	Pinion gear	53	Needle roller bearing	64	Side plate
43	Bearing cover	54	Thrust washer 2	65	Sun gear 1
44	Taper roller bearing	55	Spring pin	66	Bolt
45	Oil seal	56	Sun gear 2	67	Plug
46	Taper roller bearing	57	Carrier assy 1	68	Plug
47	Lock collar	58	Planet gear 1	69	Level bar
48	Knock pin	59	Needle roller bearing	70	Level pipe
49	Ring gear	60	Collar	71	Air breather
50	Carrier assy 2	61	Thrust washer 1	72	Cover
51	Planet gear 2	62	Thrust washer 2		

2. FUNCTION

1) ROTARY PART

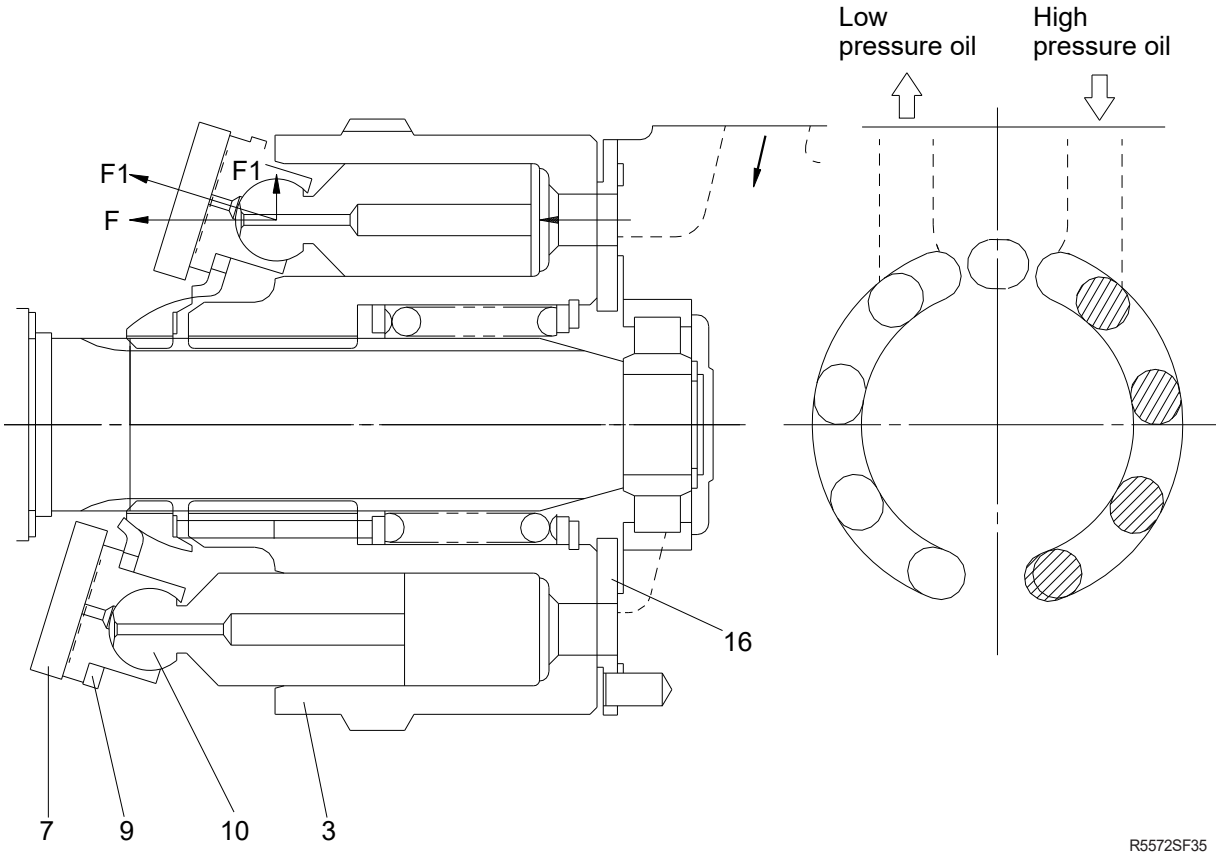
When high pressurized oil enters a cylinder through port(a), which is the inlet of balance plate(16), hydraulic pressure acting on the piston causes axial force F. The pressure force F works via the piston(10) upon the return plate(9) which acts upon the swash plate(7) via an hydrostatic bearing. Force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

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

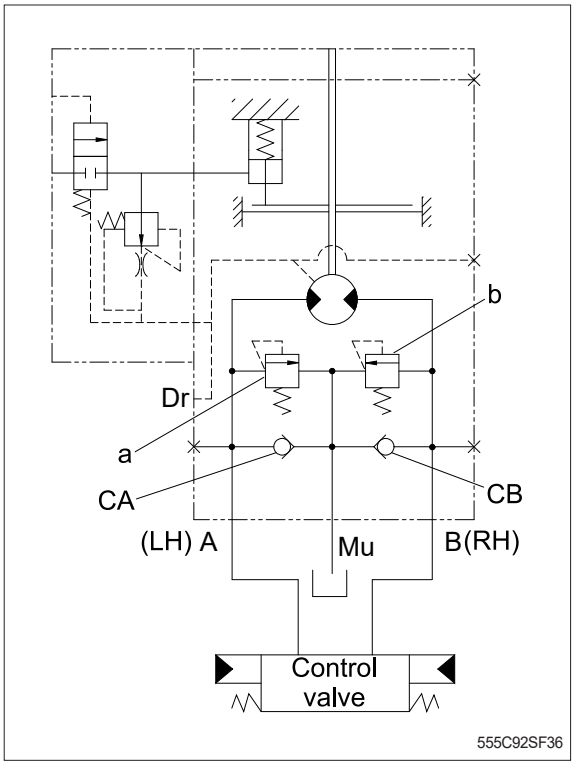
Where p : Effective difference of pressure (kgf/cm^2)
q : Displacement (cc/rev)
T : Output torque ($kgf \cdot cm$)
Z : Piston number (9EA)
A : Piston area (cm^2)
θ : Tilting angle of swash plate (degree)
S : Piston stroke (cm)



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

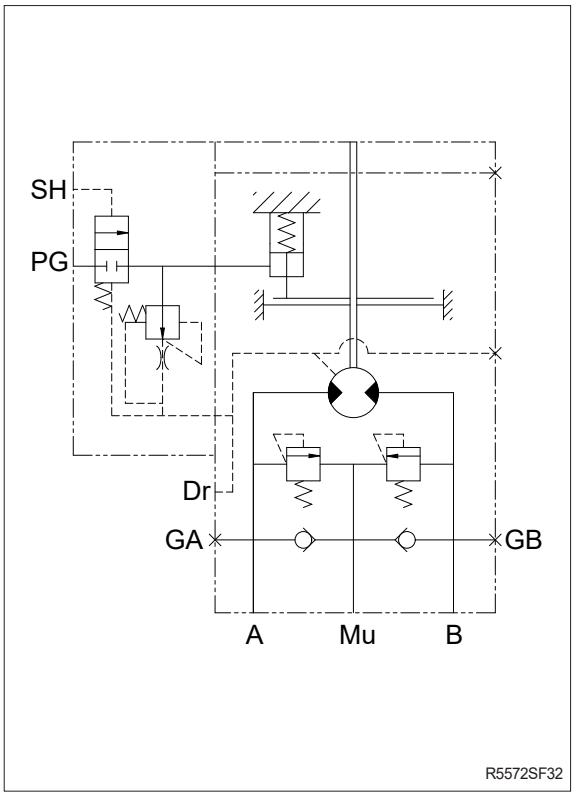
When the swing control lever is operated to left swing, the pressurized oil from the pump passes through the control valves and is supplied to port B. Because of this, the pressure at port B rises, staring torque is generated in the motor, and the motor starts to rotate. The oil from the outlet port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

② When stopping swing

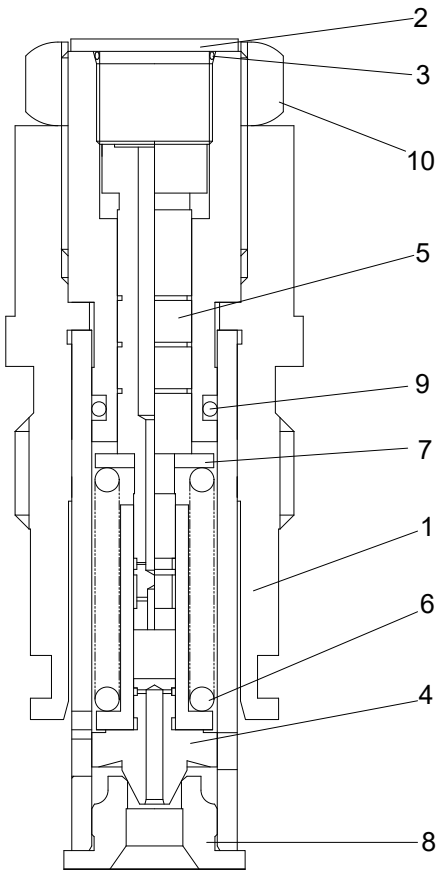
· When the swing control lever is returned to neutral, no pressurized oil is supplied from the pump to port B.
  The return circuit to the tank is closed by the control valve. So the oil from the outlet port of the motor increases in pressure at port A. Resistance to the rotation of the motor is created, 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



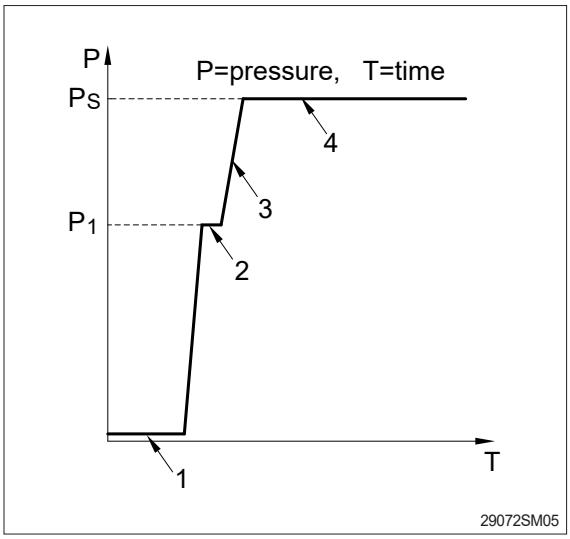
1 Body
2 Plug
3 O-ring
4 Plunger
5 Piston
6 Spring
7 Spring seat
8 Seat
9 O-ring
10 Nut

(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.

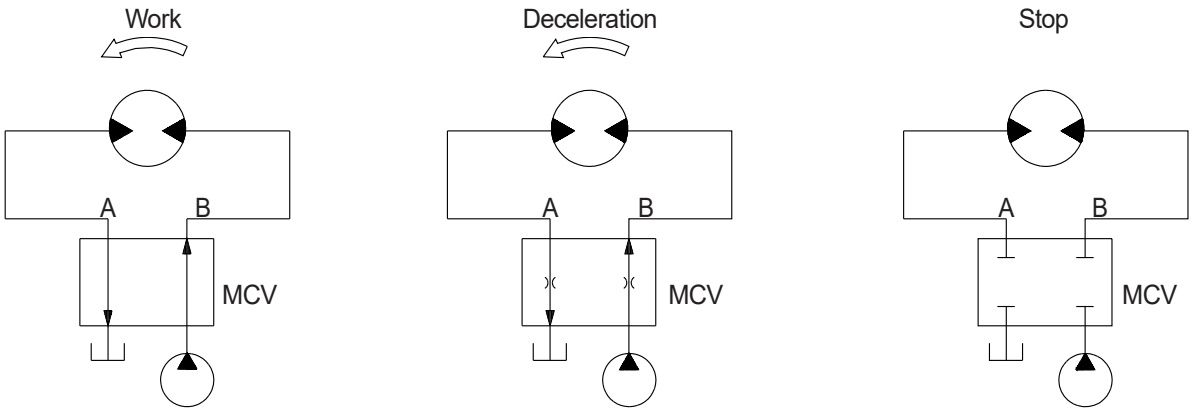


4) BRAKE SYSTEM

(1) Control valve swing brake system

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

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



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

210-7 2-48(1)

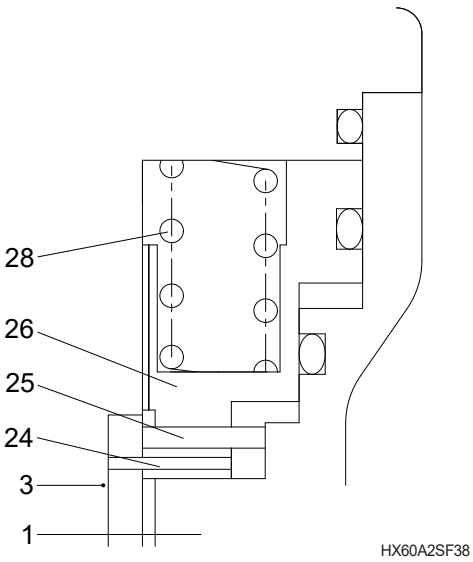
(2) Mechanical swing parking brake system

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 (25) is constrained by the groove located at body (1). When housing is pressed down by brake spring (28) through friction plate (24), separate plate (25) and parking piston (26), friction force occurs there.

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



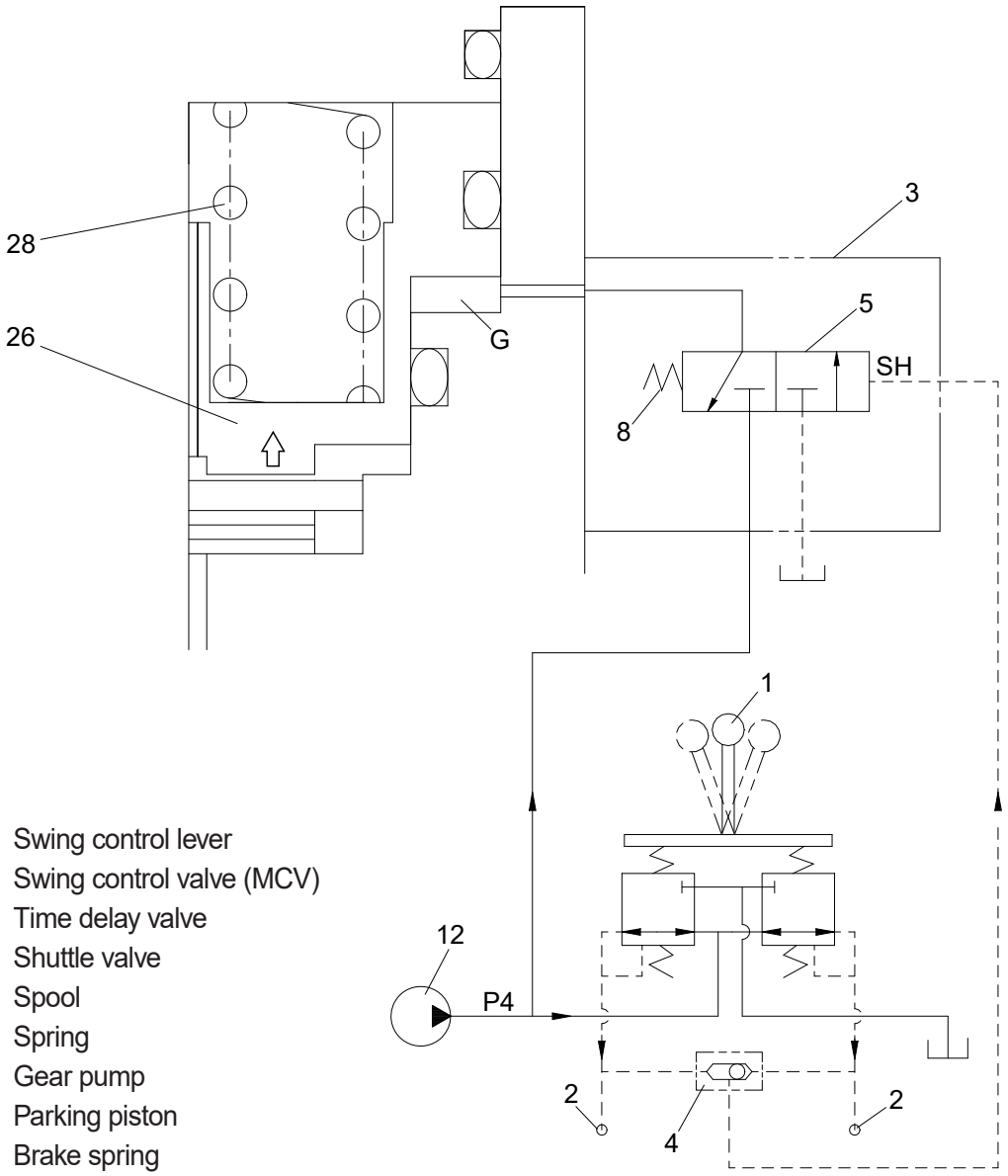
HX60A2SF38

1	Body	25	Separate plate
3	Cylinder block	26	Parking piston
24	Friction plate	28	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.

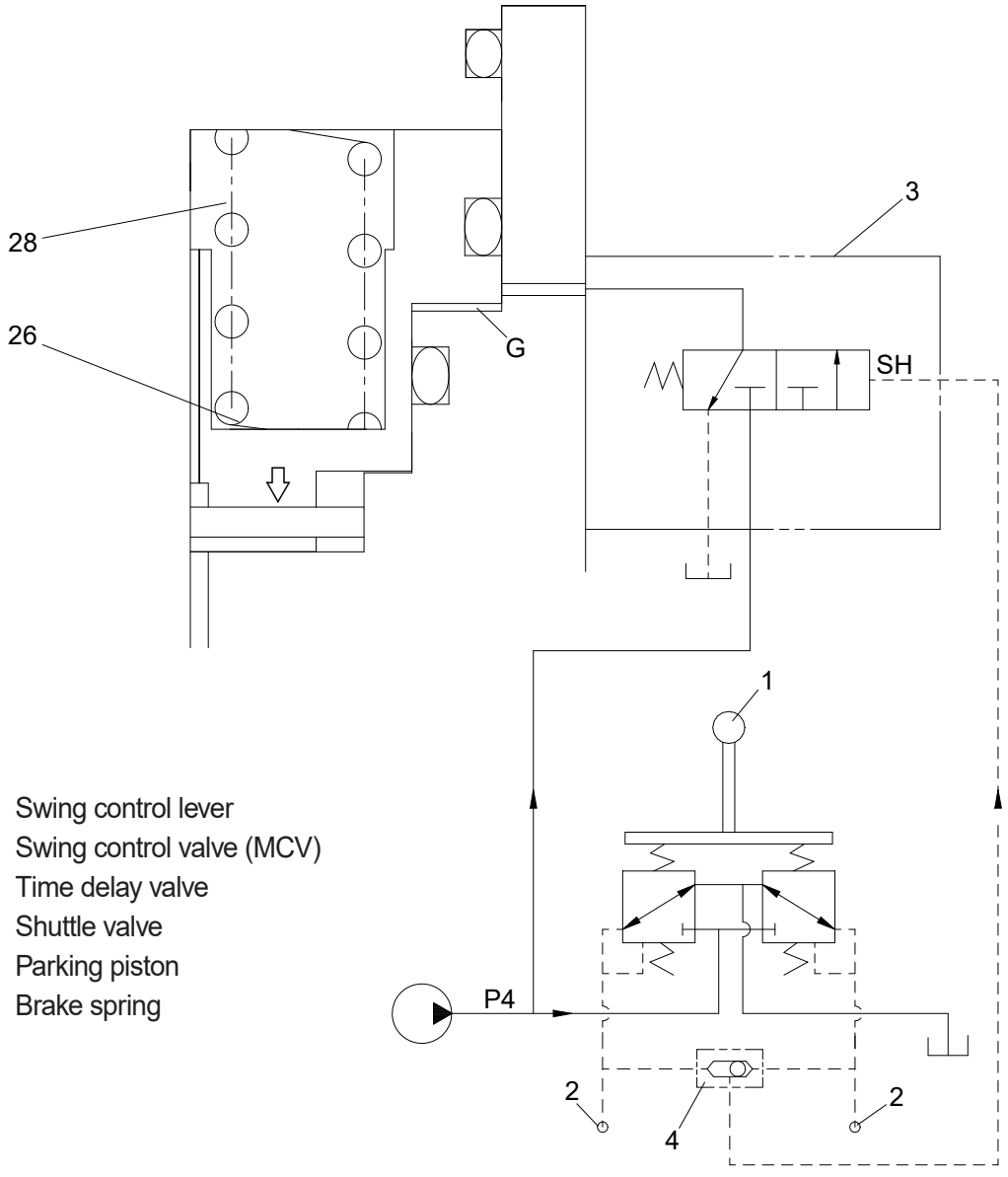
This pressure is applied to move the piston (26) to the upward against the force of the spring (28). Thus, it releases the brake force.



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

HX60A2SF39

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 (26) is moved lower by spring (28) force and the return oil from the chamber G is drain.



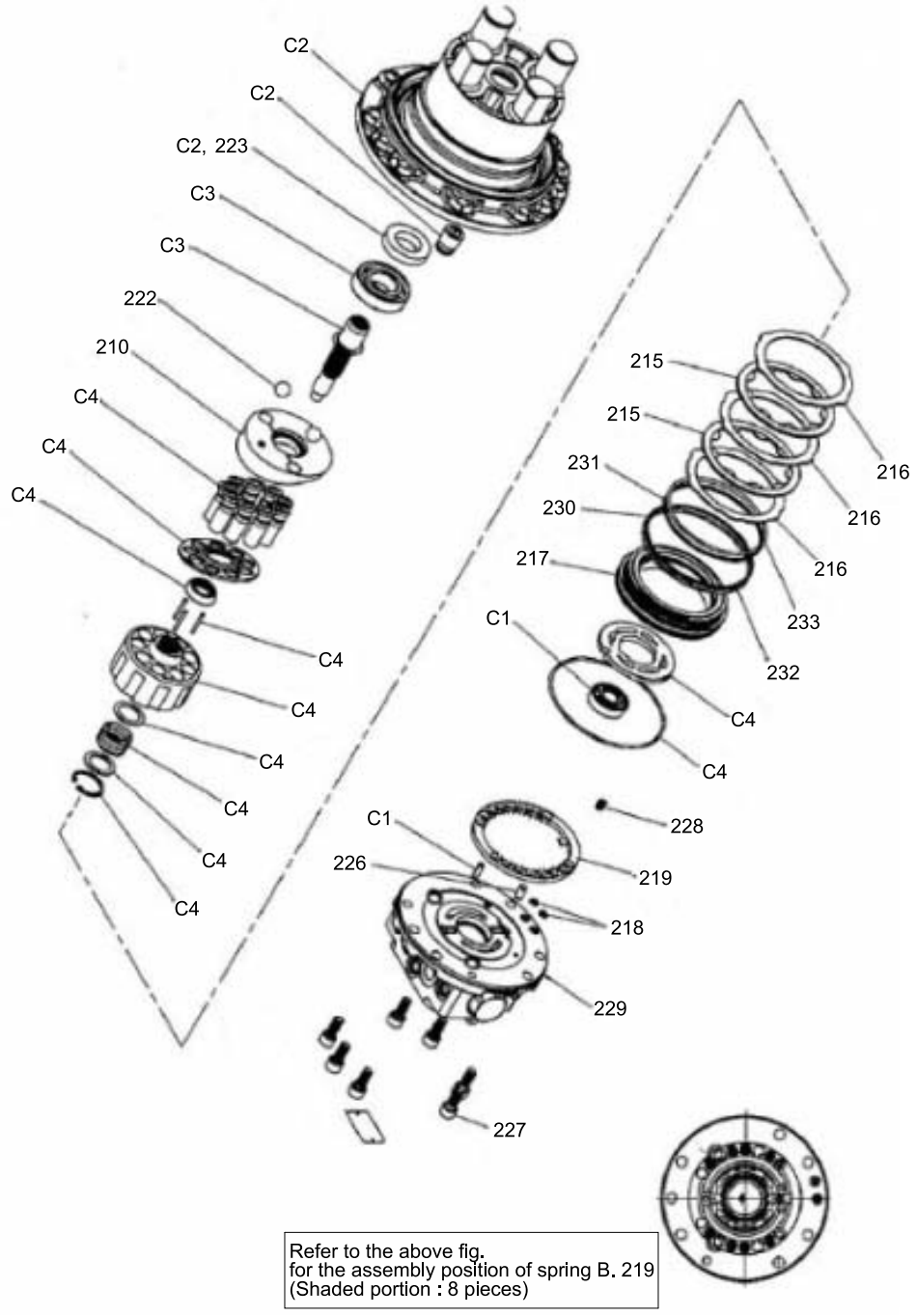
1 Swing control lever
2 Swing control valve (MCV)
3 Time delay valve
4 Shuttle valve
26 Parking piston
28 Brake spring

HX60A2SF40

GROUP 4 TRAVEL DEVICE

1. STRUCTURE

1) TRAVEL MOTOR (1/4)

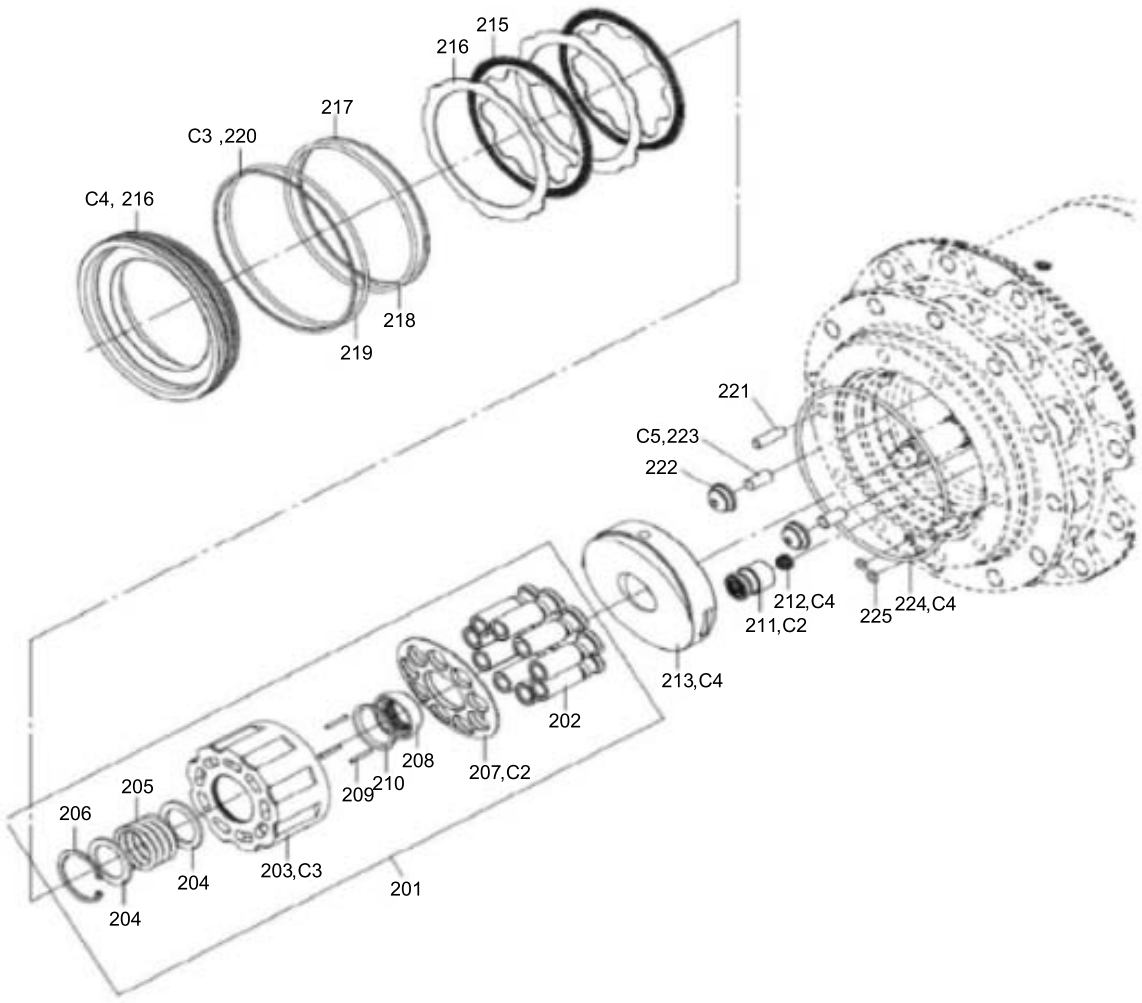


Refer to the above fig.
for the assembly position of spring B. 219
(Shaded portion : 8 pieces)

60S2TM20

210	Swash plate	226	Pin	C1	Body
215	Disk	227	Screw	C2	Body
216	Steel plate	228	O-ring	C3	Shaft
217	Brake piston	229	O-ring	C4	Cylinder barrel
218	Retainer	230	O-ring		
219	Spring	231	O-ring		
222	Ball	232	Back-up ring		
223	Oil seal	233	Back-up ring		

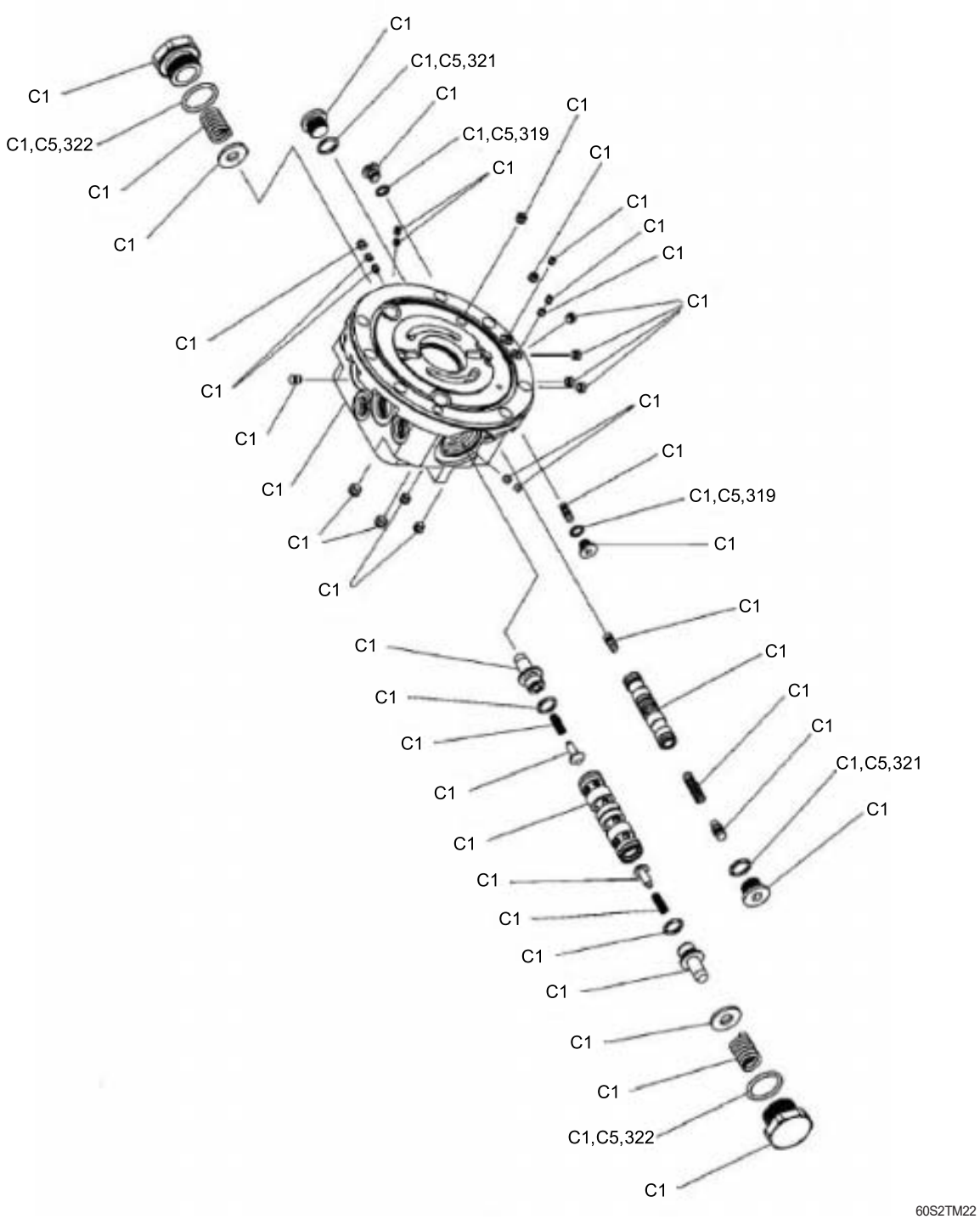
TRAVEL MOTOR (2/4)



60S2TM21

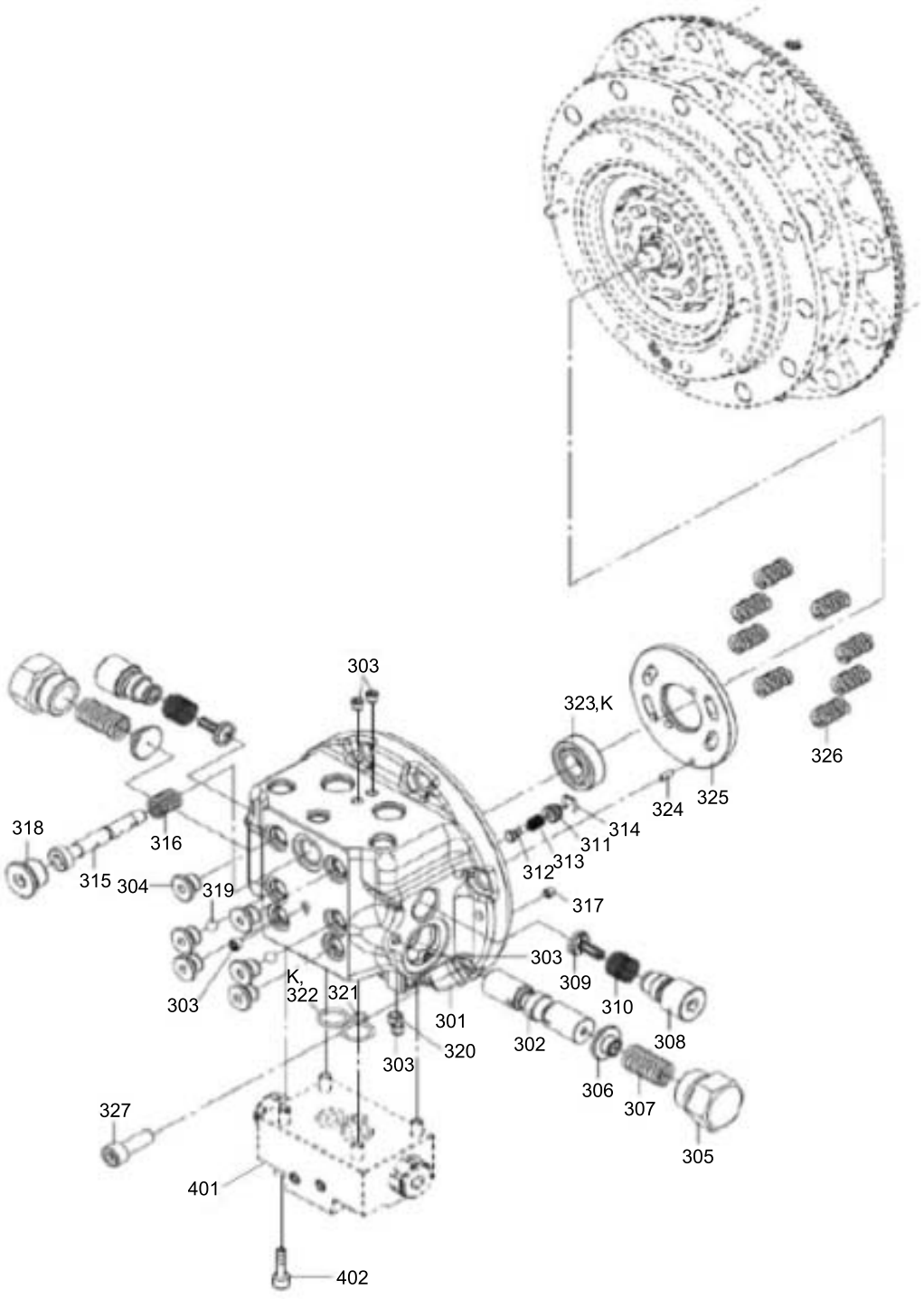
201	Block & piston kit	211	Piston assy	221	Parallel pin
202	Piston assy	212	Spring	222	Pivot
203	Rotary block	213	Swash plate	223	Pin
204	Washer	214	Piston	224	O-ring
205	Spring	215	Friction plate	225	O-ring
206	Snap ring	216	Separation plate	C2	Body
207	Retainer plate	217	Back up ring	C3	Shaft
208	Bushing	218	O-ring	C4	Cylinder barrel
209	Roller	219	O-ring	C5	Seal kit
210	Collar washer	220	Back up ring		

TRAVEL MOTOR (3/4)



319	O-ring	C1	Body	C4	Cylinder barrel
321	O-ring	C2	Body	C5	Seal kit
322	O-ring	C3	Shaft		

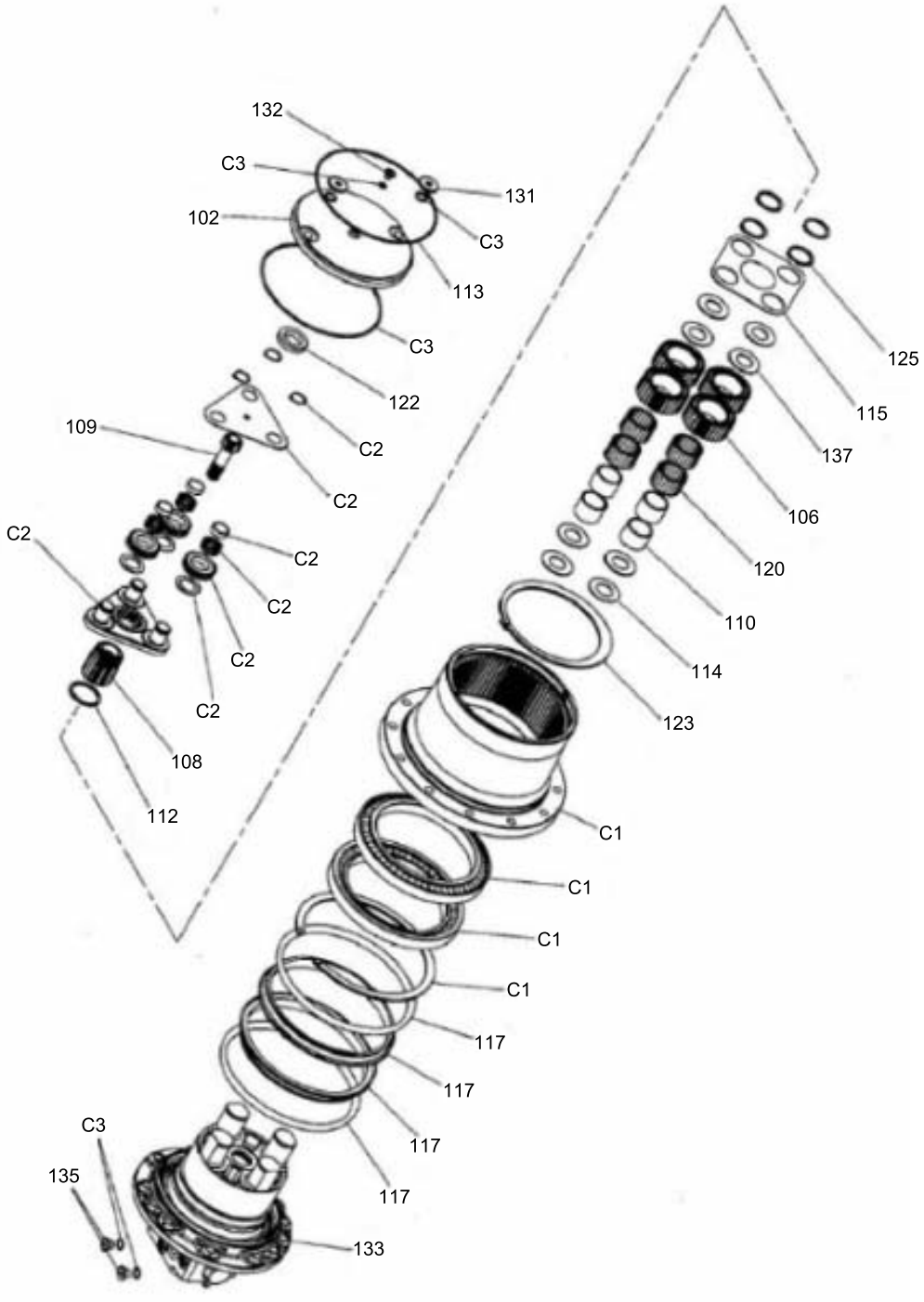
TRAVEL MOTOR (4/4)



60S2TM23

301	Rear plange	309	Check valve	317	Orifice	325	Timing plate
302	Main spool	310	Spring	318	Plug assy	326	Spring
303	Plug	311	Valve sheet	319	Steel ball	327	Socket bolt
304	Plug assy	312	T type valve	320	Plug	401	Relief valve assy
305	Plug assy	313	Spring	321	O-ring	402	Bolt
306	Spring retainer	314	Ring	322	O-ring		
307	Main spring	315	2-speed spool	323	Bearing		
308	Check plug	316	Spring	324	Pin		

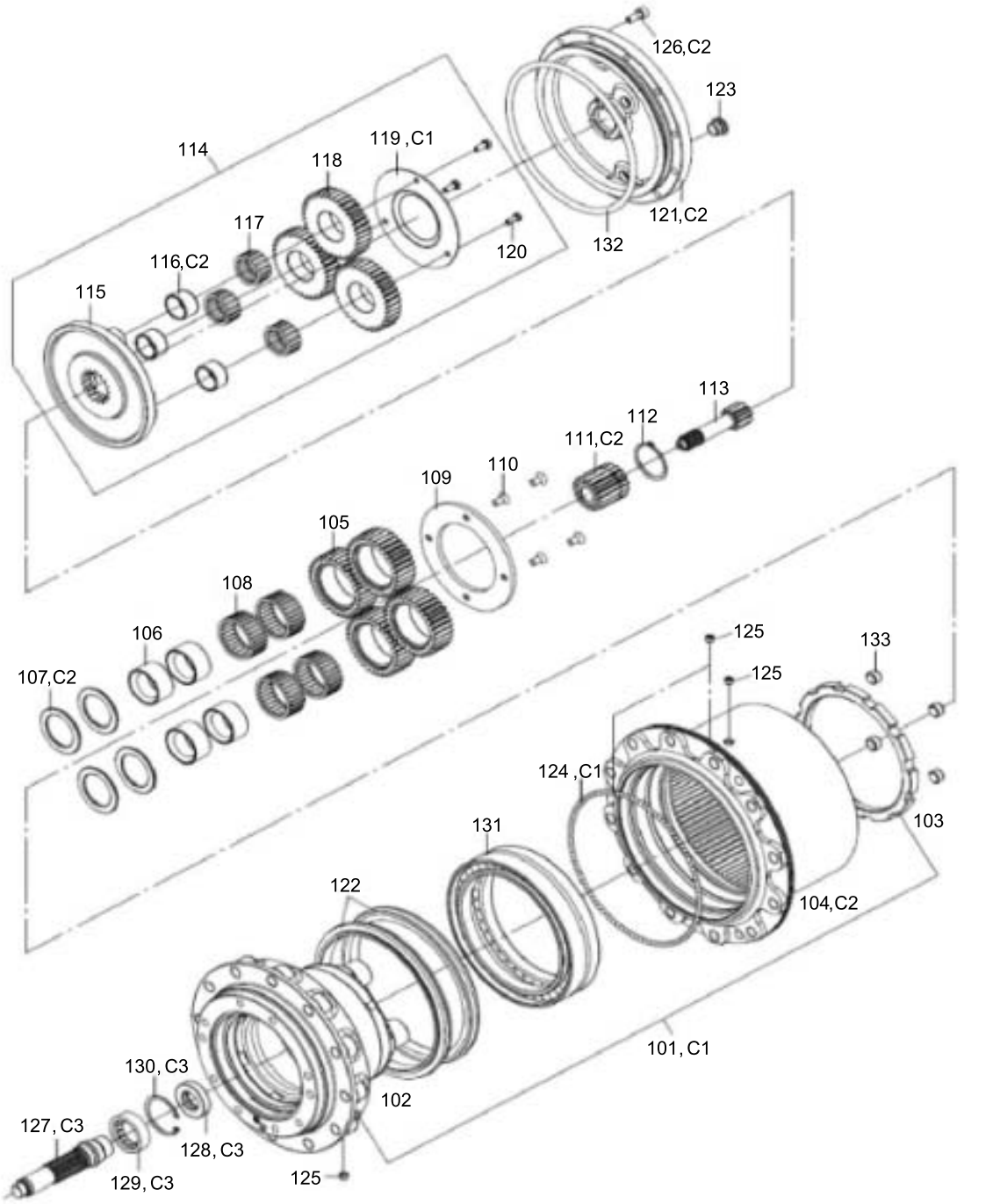
REDUCTION GEAR (1/2)



60S2TM24

102	Cover	115	Thrust plate	133	Motor
106	Gear B1	117	Floating seat & O-ring	135	Plug
108	Gear S1	120	Needle	137	Thrust washer
109	Gear S2	122	Ring	C1	Body
110	O-ring	123	Snap ring	C2	Carrier
112	Thrust washer	125	Snap ring	C3	Seal kit
113	Snap ring	131	Plug		
114	Thrust washer	132	Plug		

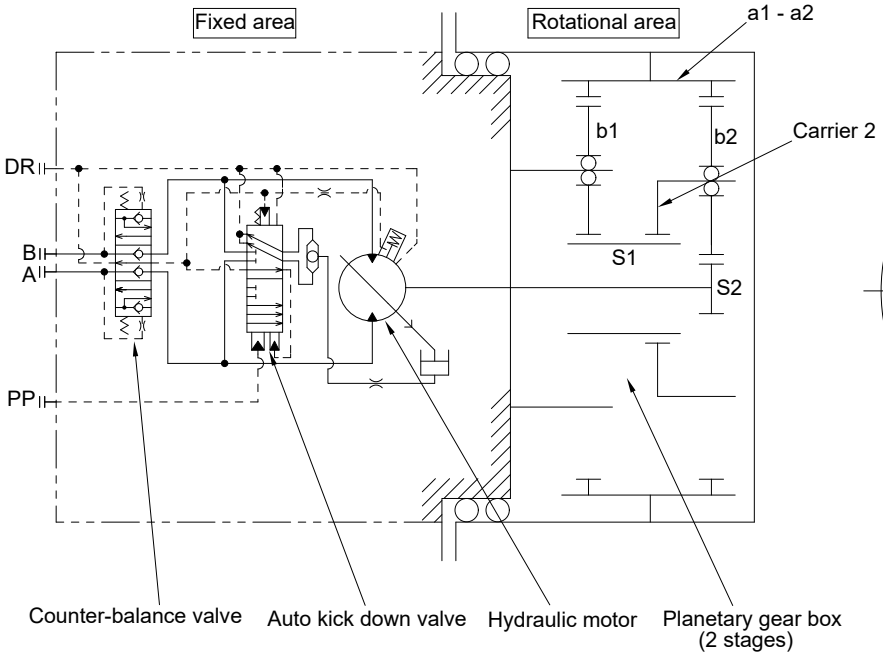
REDUCTION GEAR (2/2)

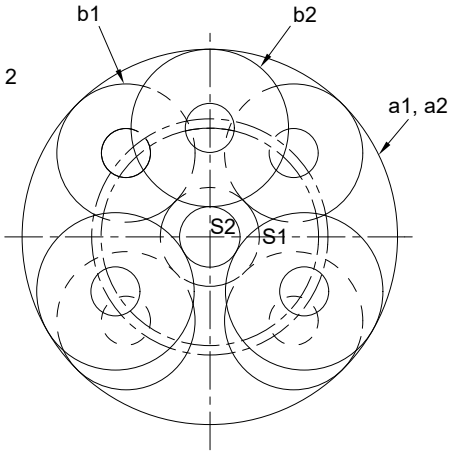


60S2TM25

101	Holder	110	Screw	119	Thrust plate	128	Oil seal
102	Holder	111	Sun gear	120	Bolt	129	Roaller bearing
103	Ring nut	112	Snap ring	121	Cover	130	Snap ring
104	Housing	113	Drive gear	122	Floating seal	131	Ball bearing
105	Gear	114	Holder assy	123	Plug assy	132	O-ring
106	Color	115	Holder	124	Ball	133	Plug
107	Thrust washer	116	Inner race	125	Plug	C1	Body
108	Niddle bearing	117	Niddle bearing	126	Socket bolt	C2	Carrier
109	Plate	118	Gear	127	Drive shaft	C3	Seal kit

2. DRAWING OF OPERATIONAL PRINCIPLE





※Note
b1 gear=4pcs, b3 gear=3pcs

60S2TM03

3. OPERATION

Travel motor consists of a hydraulic motor "Fixed parts" and a planetary gear speed reducer "Rotating parts".

1) REDUCTION GEAR SECTION

(1) Function

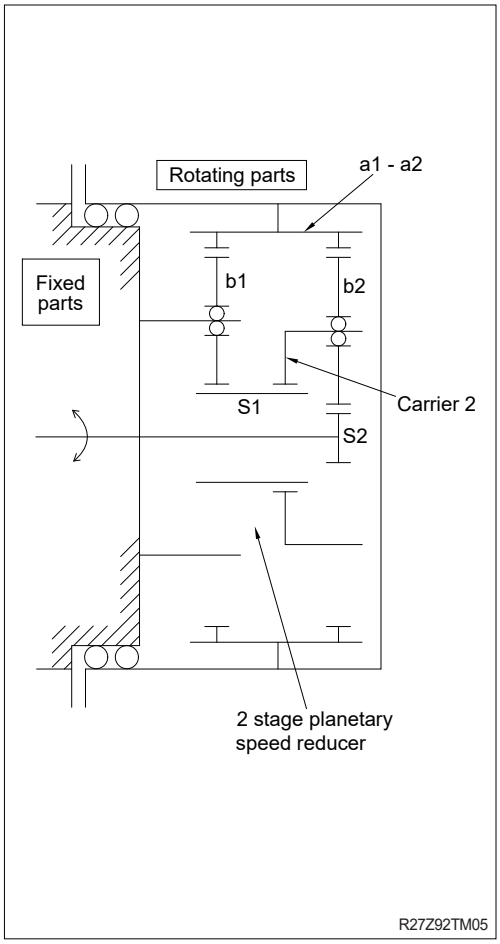
The speed reducer of travel motor is a simple planetary gear type with two stages. The high output speed of the hydraulic motor is reduced to low speed with high torque.

(2) Operation

The S2 gear is attached to the hydraulic motor shaft and the S2 output speed is reduced between the gears (s2, b2, a2) as a first stage speed reducer.

The reduced output speed of this first stage is reduced again between the gears (s1, b1, a1) which are connected to the carrier 2 with the spline.

This reduced output speed of the second stage is transmitted to the body case "rotating parts" through the inner gears (a1, a2) and drives the machine.



The gear ratio of 2 stage simple planetary speed reducer is calculated using the following formula.

$$R = \frac{Zs1}{Zs1+Za1} \times \frac{Zs2}{Zs2+Za2}$$

※ Z_{**} : Number of teeth

With the travel motor, the body case rotating, so the gear ratio is ;

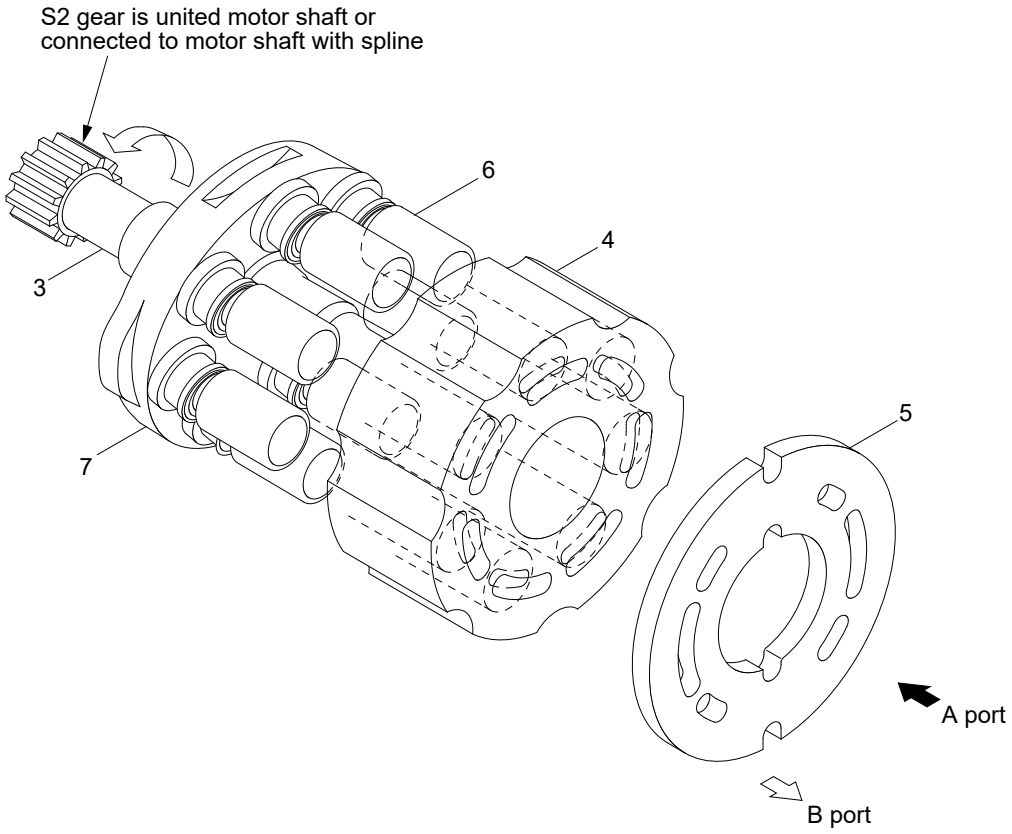
$$R' = \frac{1}{1-1/R}$$

2) HYDRAULIC MOTOR SECTION

(1) Function

This hydraulic motor is an axial piston type, and changes the hydraulic energy supplied from the pump to the rotary motion.

(2) Structure



R27Z92TM06

Through a hydraulic valve, the pressurized oil is supplied to the valve plate (5).
When the pressurized oil is supplied to the A port, this pressurized oil pushes the piston (6) in the clylinder barrel (4). This pushing force is changed to the rotational power by the swash plate (7) and transmitted to the shaft (3) which is connected to the cylinder barrel (4) with the spline. The return flow from the cylinder port is going out through the B port of the valve plate (5). To reverse rotation, pressurized oil is supplied to the B port and returning oil exits through the A port.

(3) 2 Speed motor operation

The swash plate, which has surface Ⅰ and Ⅱ in the opposite side to the shoe sliding surface, is supported by the 2 balls which are fixed to the body 2.

Since the balls are located in the eccentric position, in the low speed range, the surface Ⅰ is faced to the body 2 by the oil pressure in the piston and the spring force in the cylinder barrel. The swash plate angle is α (Max. capacity).

When the pressurized oil is supplied to the (PP) port, the two-speed spool moves to the high position.

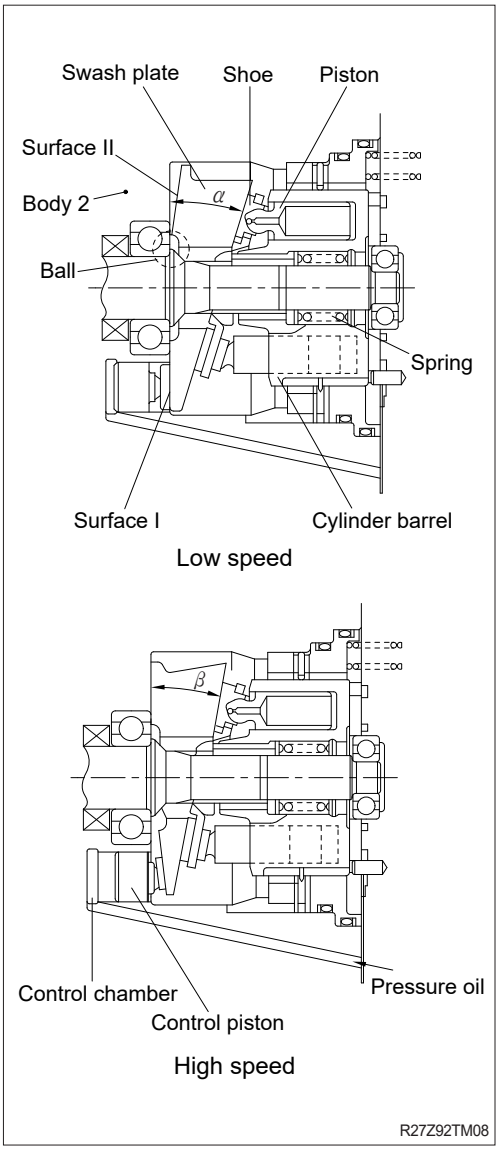
And the pressurized oil of inlet is led to the control chamber through the two-speed spool.

The control piston moves forward until the surface Ⅱ of the swash plate is in contact with the body 2, and the swash plate angle becomes β.

The capacity of the hydraulic motor is made small.

The pressurized oil of the (PP) port is shut off (or the engine is stopped), the two-speed spool moves to the low position.

And the control chamber is led to the tank port through the two-speed spool and the swash plate position comes to the low speed by the spring force.



(4) Auto kick down valve

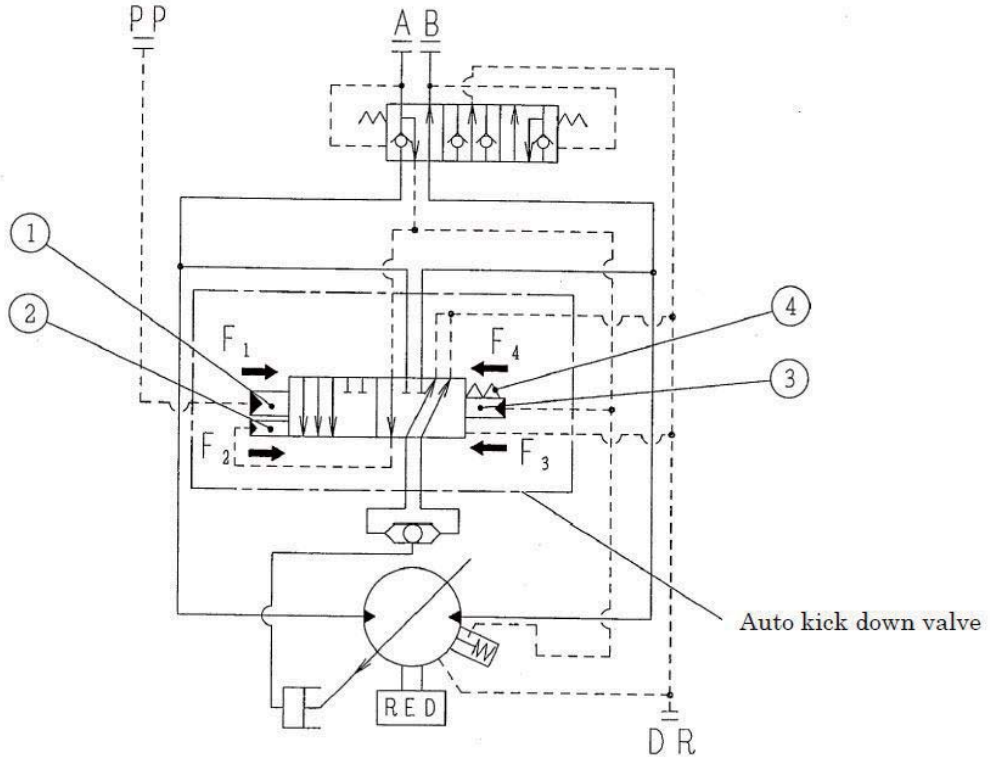
When the pilot switch for Hi speed mode is turned on, the pilot pressure for Hi speed mode comes from PP port to the hydraulic pilot (1), then the force F1 occurs, The auto kick down valve moves to the right direction because the F1 is larger than F4, which is by spring (4). Then the speed of track motor is changed to the Hi speed mode.

On the other hand, the operating pressure comes from A or B port to the hydraulic pilot (2) and (3), then the force F2 and F3 occur. The F3 larger than F2 because the area of (3) is wider than the area of (2). Therefore, if the operating pressure increased, the difference between F2 and F3 also increases.

When the operating pressure is larger than the setting pressure of Hi speed to Lo speed, the right direction resultant of F1 and F2 is smaller than the left direction resultant of F3 and F4.

Therefore the auto kick down valve moves to the left direction, then the speed of track motor is changed to the Lo speed mode. When the operating pressure is smaller than the larger than the left direction resultant of F3 and F4.

Therefore the auto kick down valve moves to the right direction, then the speed of track motor is changed to the Hi speed mode.



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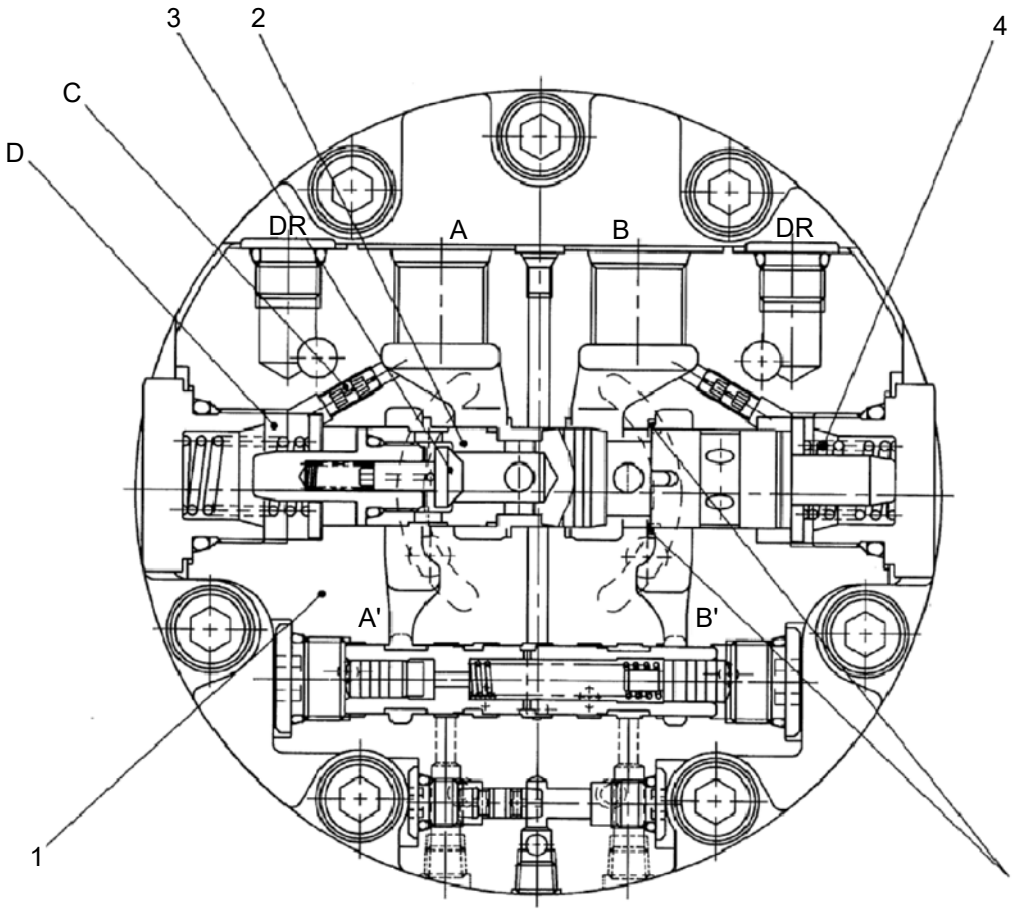
3) HYDRAULIC VALVE SECTION

(1) Counter-balance valve

When the pressurized oil is supplied from the A port, the pressurized oil opens the check valve (3) and flows into the hydraulic motor inlet A' port. At the same time, the pressurized oil goes through the orifice C into the chamber D, pushes the spring (4) and moves the spool (2) to right. Then the returned oil from the hydraulic motor flows into the B port, goes through area E and drives the hydraulic motor. When the pressurized oil is supplied from the B port, the hydraulic motor rotates in reverse.

Even the pressurized oil of the A port is shut off, the hydraulic motor tries to rotate by inertia force. When the pressurized oil from the A port is shut off, the spool (2) tries to return to left by the spring (4) force. At this time, the oil in the chamber D tries to go out to the A port through the orifice C, but due to the throttle effect of orifice C, the spool (2) speed is reduced. With the orifice and notches on the spool, the returned oil is controlled gradually and the hydraulic motor stops smoothly.



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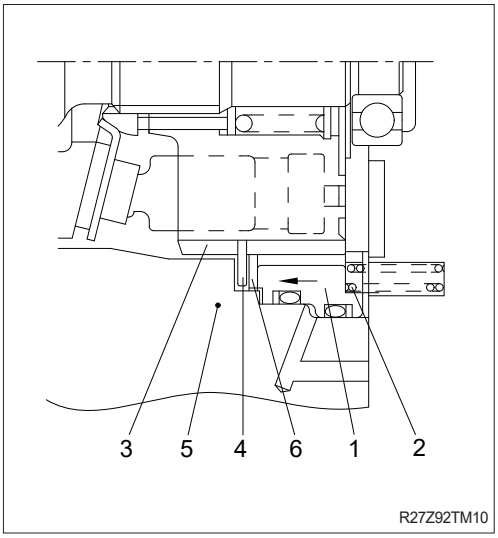
4) PARKING BRAKE SECTION

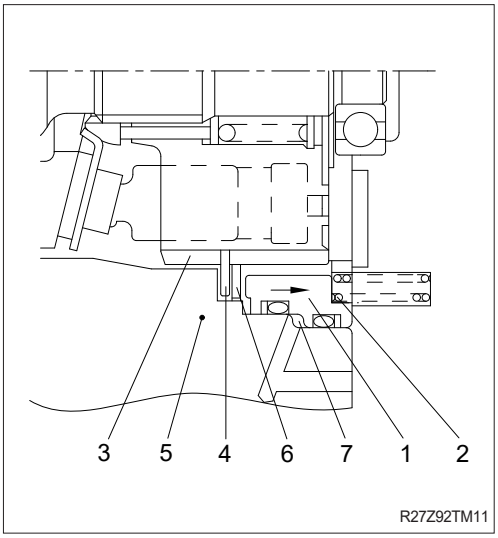
(1) Structure

The parking brake fixes the output shaft of hydraulic motor mechanically while the travel motor is stopped. And it is applied automatically in the following fashion.

When A and B ports are not pressurized, the brake piston (1) is pressed in the direction (shown as arrow) by the spring (2). Then the disk plate (4) which is fixed to the cylinder barrel (3) is held between the steel plate (6) which are fixed to the body 2 (5) and the body 2 (5). As a result, with the friction of these plates, the cylinder barrel (3) and the hydraulic motor are unable to rotate.

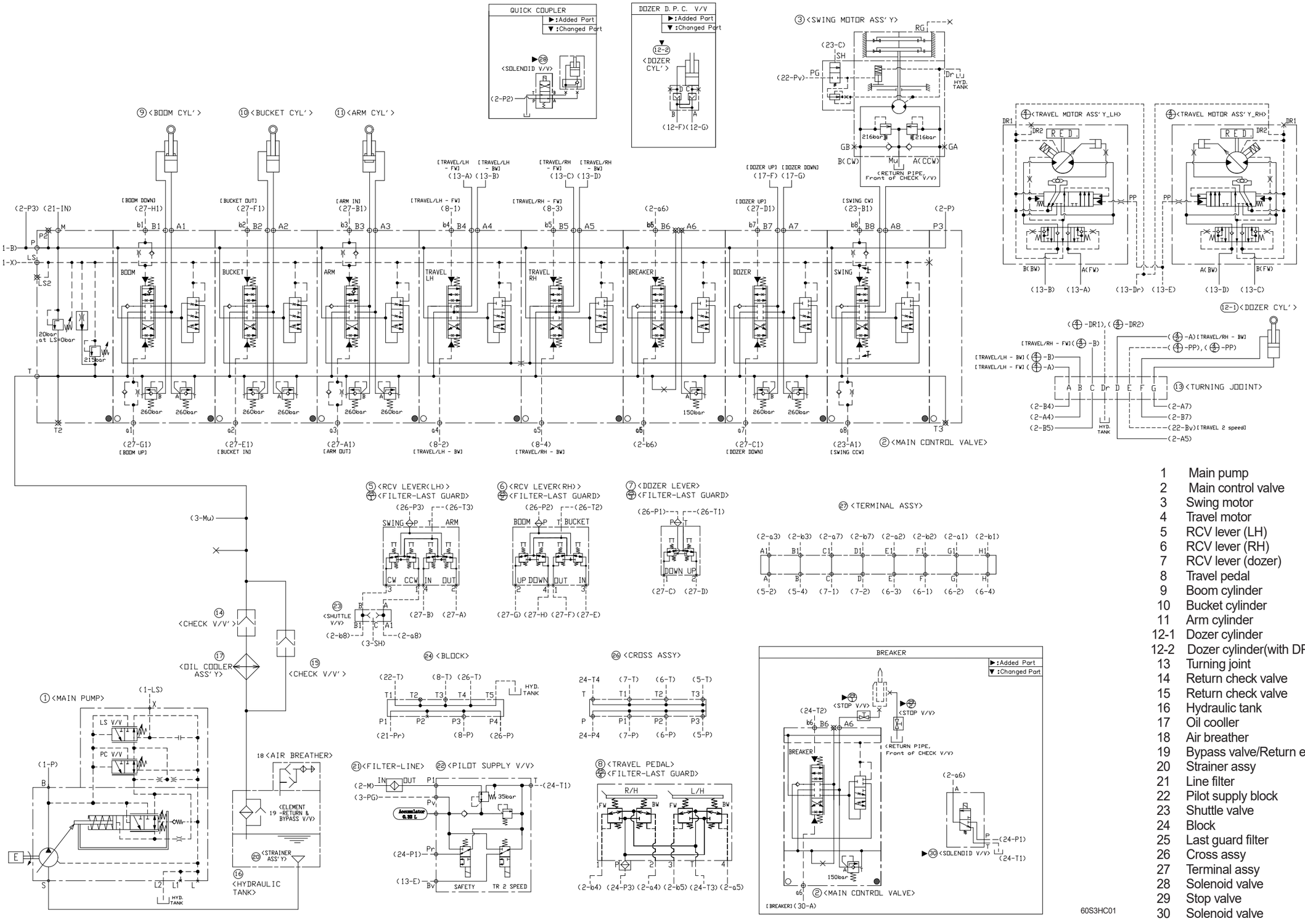


When A or B ports are pressurized, the oil is lead to chamber (7). Then the brake piston (1) is moved to the direction (shown as arrow) against the force of spring (2). As a result, the disk plate (4) is released from the steel plate (6) and the body 2 (5), and the cylinder barrel (3) can be rotated.



SECTION 3 HYDRAULIC AND ELECTRICAL SYSTEM

GROUP 1 HYDRAULIC CIRCUIT



1 Main pump
2 Main control valve
3 Swing motor
4 Travel motor
5 RCV lever (LH)
6 RCV lever (RH)
7 RCV lever (dozer)
8 Travel pedal
9 Boom cylinder
10 Bucket cylinder
11 Arm cylinder
12-1 Dozer cylinder
12-2 Dozer cylinder(with DPC valve)
13 Turning joint
14 Return check valve
15 Return check valve
16 Hydraulic tank
17 Oil cooler
18 Air breather
19 Bypass valve/Return element
20 Strainer assy
21 Line filter
22 Pilot supply block
23 Shuttle valve
24 Block
25 Last guard filter
26 Cross assy
27 Terminal assy
28 Solenoid valve
29 Stop valve
30 Solenoid valve

GROUP 2 MONITORING SYSTEM

1. Overview

The cluster consists of the LCD and switches, as shown below. The LCD is to warn the operator in case of abnormal machine operation or conditions for the appropriate operation and inspection. It is also to set and display modes, monitoring and functions.

※ If a device malfunctions, the indicator will be ON and an alarm will be sent. Turn off the buzzer to cancel the alarm. If the indicator is still ON after the buzzer is turned off, take appropriate measures.

2. Cluster

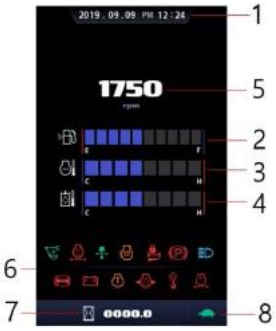
1) Structure

2) Gauge

(1) Operation screen

Default (A type)

Option (B type)

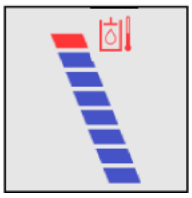


1. Clock 2. Fuel level gauge 3. Engine coolant temperature gauge
4. Hydraulic oil temperature gauge 5. Engine rpm 6. Warning lamp/indicator
7. Working hour gauge 8. Travel speed indicator

(2) Fuel level gauge

① This gauge indicates the amount of fuel in the fuel tank.
② Fill the fuel when the pointer is within the stage 1 or the red lamp is ON.
※ If this gauge indicates the red range or the warning lamp is ON, check the electrical device for poor contact and sensor for malfunction.

(3) Hydraulic oil temperature gauge



① This gauge indicates the temperature of hydraulic oil at 8 stages.

- Stage 0: 44 ℃ and below
- Stages 1-7: 45 ℃ to 104 ℃
- Stage 8: 105 ℃ and above

② The pointer normally indicates the stages 2-6 during driving.

③ The machine runs at the stages 2-6 during low-speed idling after startup.

④ Reduce the load when the pointer indicates the stages 7-8. If the pointer still indicates the stages 7-8 after load reduction, stop the machine and check it.

(4) Engine coolant temperature gauge

① This gauge indicates the temperature of hydraulic oil at 8 stages.

- Stage 0: 44 ℃ and below
- Stages 1-7: 45 ℃ to 114 ℃
- Stage 8: 115 ℃ and above

② The engine must not be shut down if the red warning lamp is ON. Instead, the engine should be shut down after cooling at an intermediate speed.

※ If the engine is shut down without adequate cooling its temperature will rise rapidly, which may cause damage to internal parts.

(5) Current time

① Indicate the current time.

(6) Working hour gauge

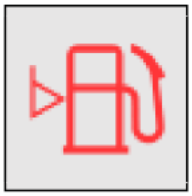
① Indicate the total working hours of the machine.

(7) Engine rpm

① Indicate the engine speed in rpm.

3) Warning lamps

(1) Fuel level warning lamp



① Indicate the amount of fuel in the fuel tank.
② Fill fuel immediately if this lamp flickers.

(2) Hydraulic oil temperature warning lamp

① The lamp is ON and the buzzer sounds when the hydraulic oil temperature is over the reference temperature (105 ℃).
② When this lamp is ON, check the oil cooling system.
③ Check the oil cooler and radiator.

(3) Cooling water temperature warning lamp

④ The lamp is ON and the buzzer sounds when the cooling water temperature is over the reference temperature (115 ℃).
① Check the cooling water level if this warning lamp is ON.

(4) Engine oil pressure warning lamp

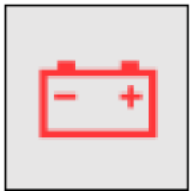
① The lamp is ON and the buzzer sounds due to low oil pressure before engine startup. The alarm will be canceled after startup.
② If the engine warning lamp is ON, reduce the engine speed or immediately shut down the engine, and check the engine oil level.

(5) Air cleaner warning lamp

① This lamp is ON and the buzzer sounds when the filter of the air cleaner is clogged.

② If this lamp is ON, check the filter and clean or replace it.

(6) Battery charging warning lamp



① Check whether the charging indicator is ON before starting the engine. If the warning lamp is ON and the buzzer sounds, ignition must not be performed.

② If the starting switch is made ON, the warning lamp will be ON and the buzzer will sound. After the engine is started, the warning lamp will be OFF. Check the battery charging line if the warning lamp is ON during engine operation.

(7) Engine check

① If the communication between the MCU and engine ECM is abnormal and the engine ECM sends a fault code to the cluster.

② Check the communication line. If communication is in good conditions, check the fault code on the cluster.

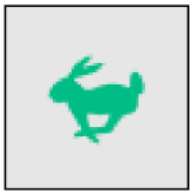
4) Pilot lamps

(1) Engine preheat pilot lamp

① When preheating is enabled automatically or manually, this lamp will be ON.

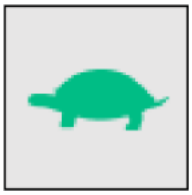
② Start the engine after this lamp is OFF.

(2) Travel speed pilot lamp (high speed)



① If this lamp is ON, the machine is running at a high speed.

(3) Travel speed pilot lamp (low speed)



① If this lamp is ON, the machine is running at a low speed.

5) Switches

(1) Travel speed switch

① Press the travel speed switch on the right side once to enable the high speed mode and again to enable the low speed mode.

(2) Buzzer stop switch

① When the starting switch is turned on, the alarm buzzer sound for 6 seconds under normal circumstances.
② If the machine fails, the red pilot lamp will be ON, and the buzzer will wound. In this case, press this switch to shut down the buzzer. Then the LED on this switch will be ON. Wait until it is OFF.

(3) ESC switch

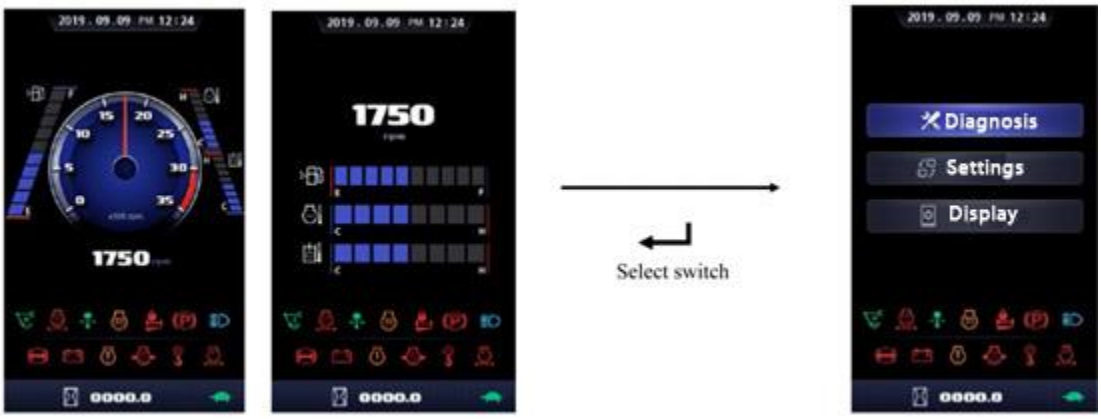
① Go back to the previous menu.

(4) Select switch

① Go back to the menu or use it after changing the input value.

3. Functions

1) Menu

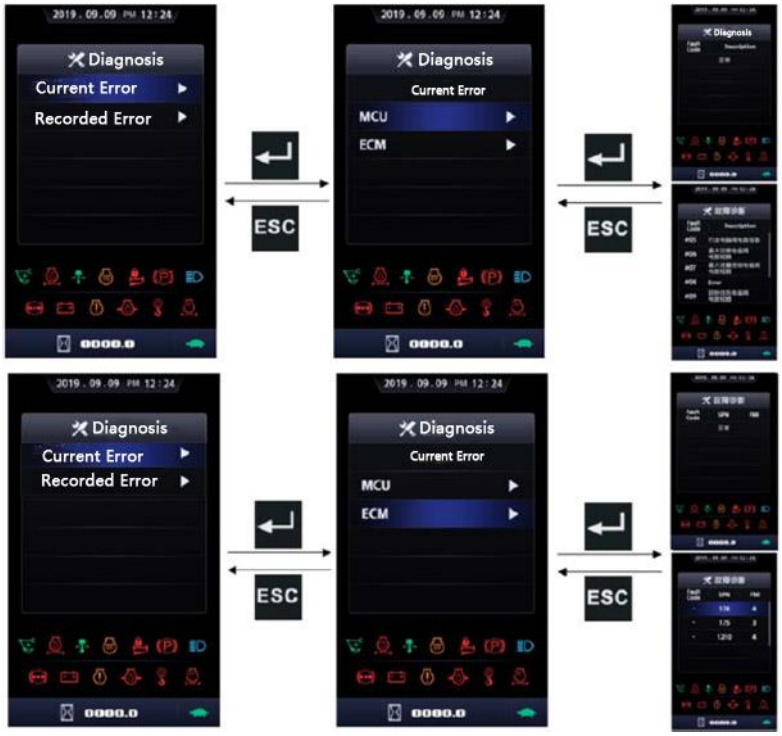


2) Structure

No	Main menu	Sub-menu	Description
1	Fault diagnosis	Active fault diagnosis Logged fault diagnosis	Confirmation and deletion of faults recorded in MCU and engine ECM
2	Change setting	Time setting Start limit	Time setting Start limit and password change
3	Screen setting	Operation screen Screen brightness Language Version Info	Working mode selection Brightness setting Language setting Device information confirmation

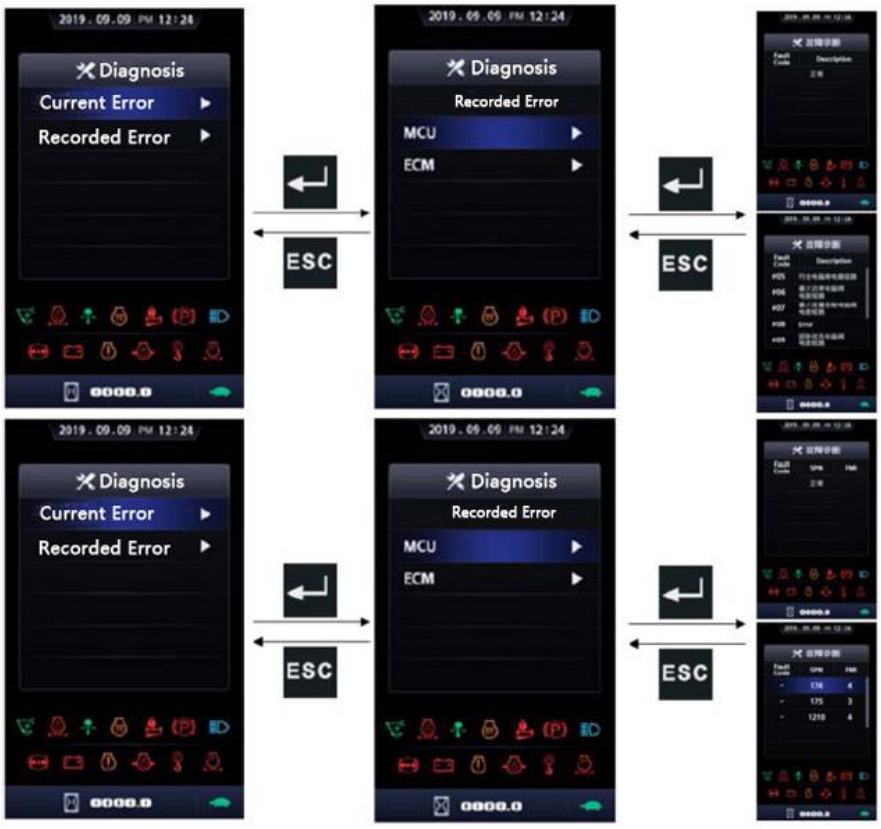
3) Fault diagnosis

(1) Active fault diagnosis



① The active fault of the MCU or engine ECM can be checked.

(2) Logged fault diagnosis



① The logged fault of the MCU or engine ECM can be checked.

4) Change setting

(1) Time setting

① The year, month, day, hour and minute can be set.

(2) Start limit

a. Start limit setting

① This is designed against stealing and for the device that is not permitted to work.

② If the starting switch is ON during the start limit setting, it is required to enter the password.

- This function is disabled when not used.
- The operator needs to enter the password each time before startup.
- To set the start delay, it is required to enter the password after the first startup, but not required to restart the machine during the delay period. The maximum delay period is 7 days.

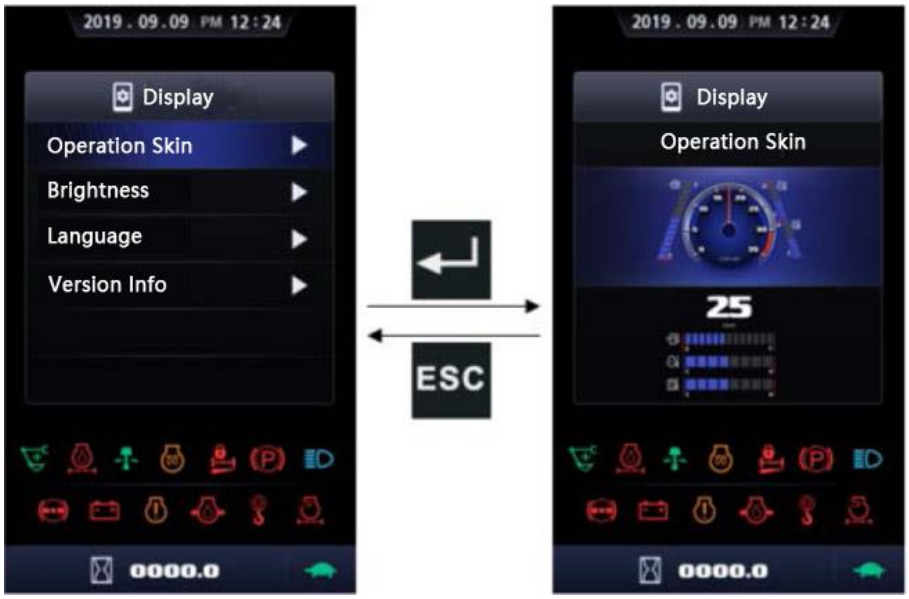
b. Change password

① The password consists of 4 digits. Press "↵" after entering the password.

② The initial password is "0000".

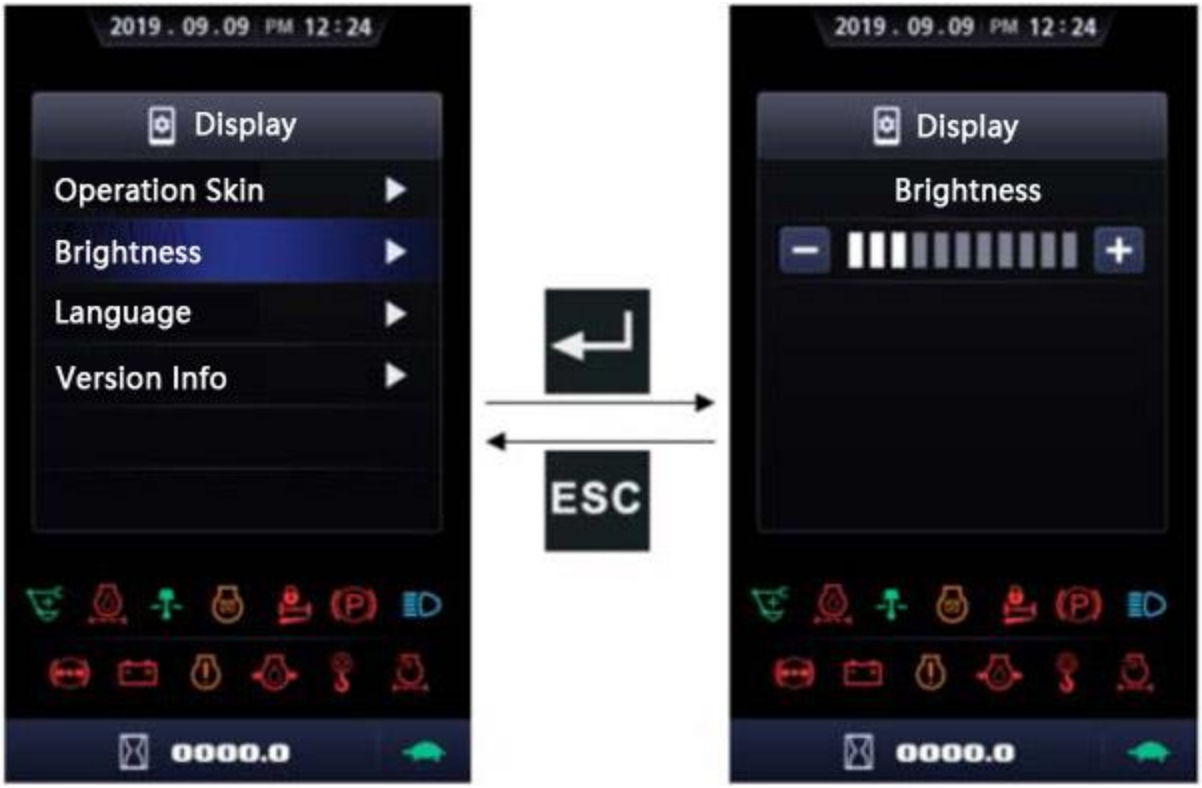
5) Screen setting

(1) Operation screen



① The type of the operation screen can be set: analog/digital.

(2) Screen brightness



① The screen brightness can be set.

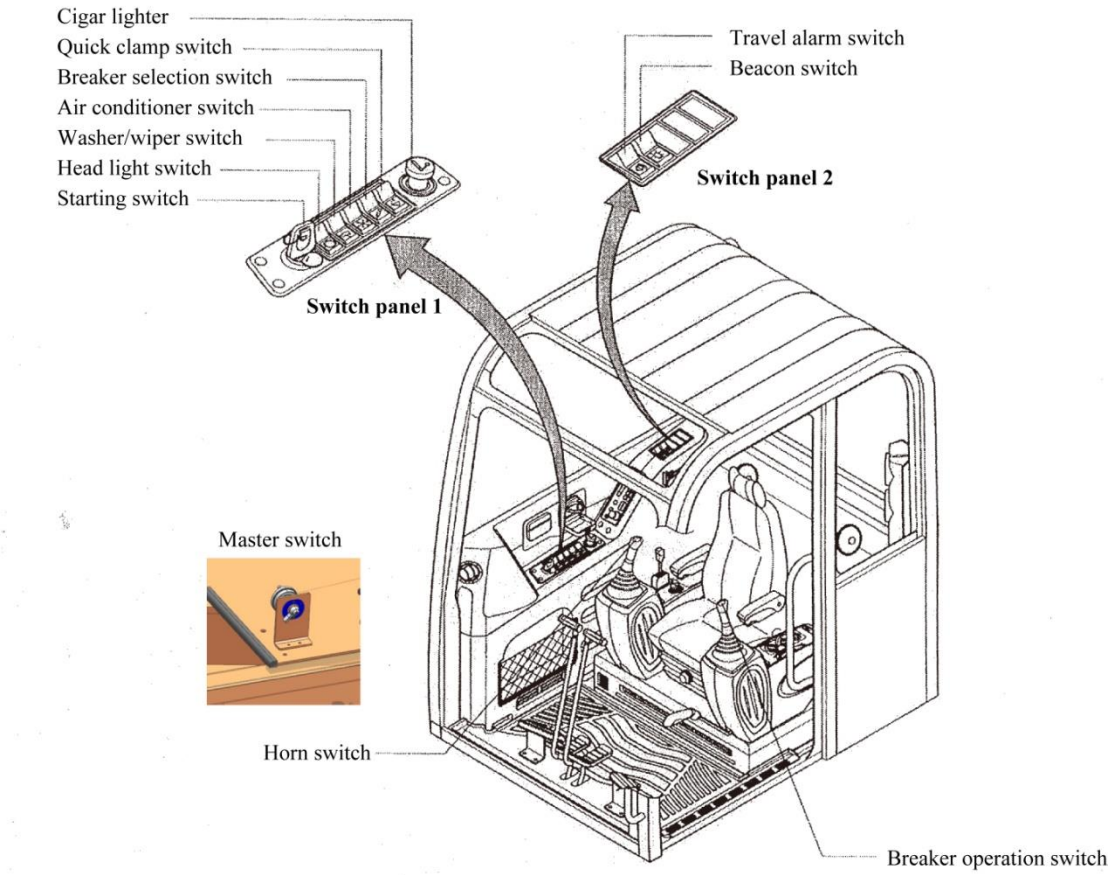
(3) Language

① The desired language can be selected. The screen will show the selected language.

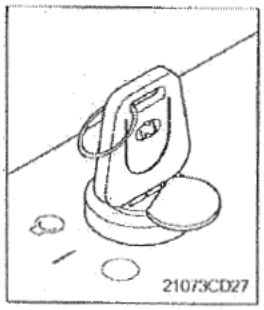
(4) Version information

① The F/W, Image, GPS version and model of the device can be confirmed.

2. Switches



1) Starting switch



(1) There are three positions: OFF, ON and START.

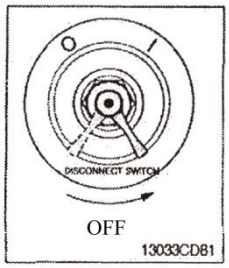
(2) ○ (OFF): None of electrical systems activate.

(3) | (ON): All the systems operate.

(4) (START): Use when starting the engine. Release the key immediately after starting.

※ The key must be in the ON position with engine running to maintain electrical and hydraulic functions and prevent serious machine damage.

2) Master switch



(1) This switch is used to shut off the entire electrical system.

(2) I: The battery remains connected to the electrical system.

O: The battery is disconnected to the electrical system.

※ Never turn the master switch to O (OFF) with the engine running. It could result in engine and electrical system damage.

3) Main light switch

(1) This switch has two modes for operation of the head light and work light.

● Mode 1: The beacons of the head light and instrument are ON.

● Mode 2: The work light and the beacon below it are ON.

4) Wiper and washer switch

(1) This switch has two modes for operation of the wiper and washer.

● Mode 1: the wiper can be operated.

● Mode 2: If this switch is turned to the mode 2, washing fluid will be sprayed and the wiper will work. If this switch is released, the mode 1 will be enabled.

5) Travel alarm switch (optional)

(1) This switch is used to alarm surroundings when the machine travels to forward and backward.

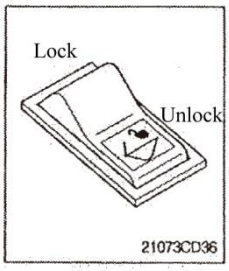
(2) On pressing this switch, the alarm operates only when the machine is traveling.

6) Air conditioner switch

(1) This switch is used to operate the air conditioner.

(2) See the air conditioner and heater instructions for details.

7) Quick clamp switch (optional)



(1) This switch is used to engage or disengage the hook on the quick clamp.

(2) See the "Quick Clamp" for details.

※ The quick clamp must be operated with the quick clamp switch in the lock position and the safety pin assembled.

8) Breaker selection switch (optional)

(1) This switch is used to control the breaker.

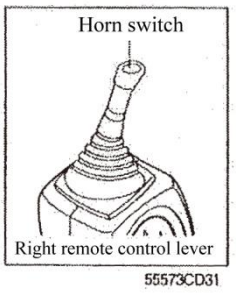
(2) On pressing this switch, the breaker will operate.

9) Swing beacon switch (optional)

(1) This switch is used to turn on the swing beacon in the cab.

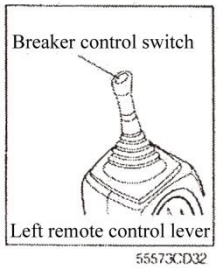
(2) On pressing this switch, the beacon below will be ON.

10) Horn switch



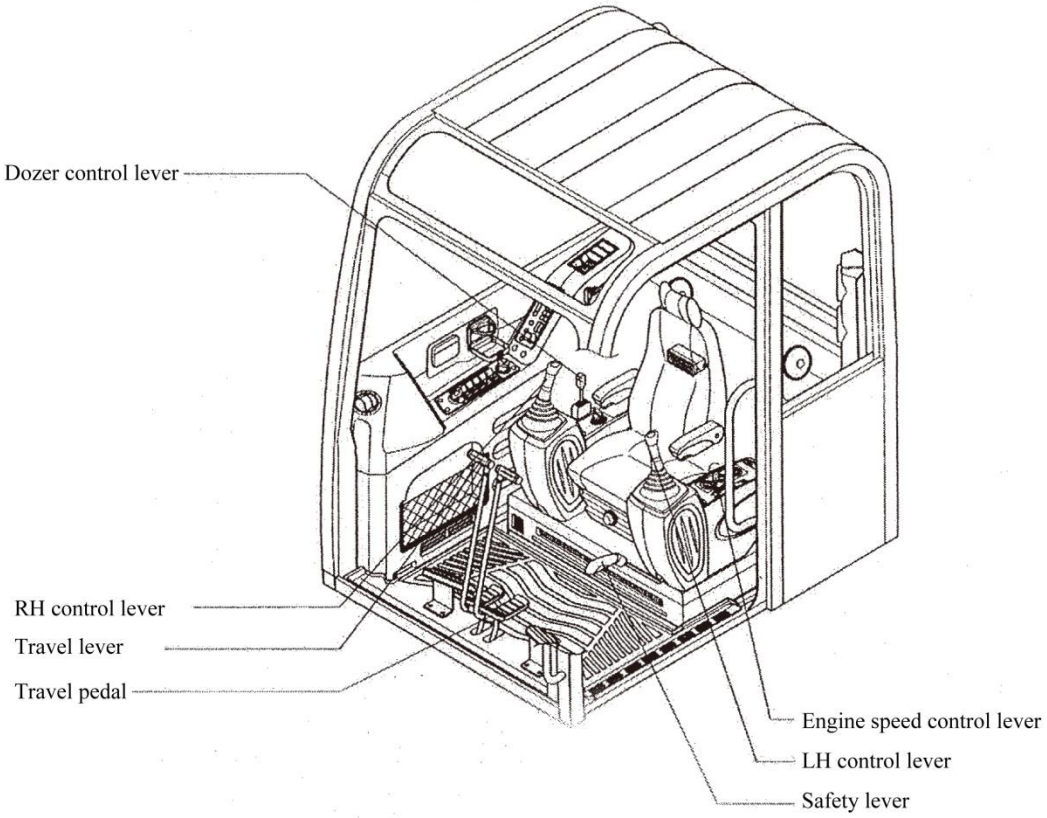
(1) This switch is at the top of left side control lever. On pressing, the horn sounds.

11) Breaker operation switch

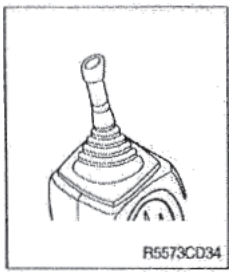


(1) On pressing this switch, the breaker operates only when the breaker selection switch on the switch panel is selected.

4. Levers and Pedals



1) LH control lever

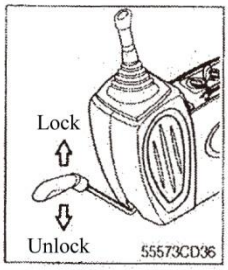


(1) This joystick is used to control the swing and arm.
(2) Refer to the operation of working devices in Chapter 4 for details.

2) RH control lever

(1) This joystick is used to control the boom and bucket.
(2) Refer to the operation of working devices in Chapter 4 for details.

3) Safety lever



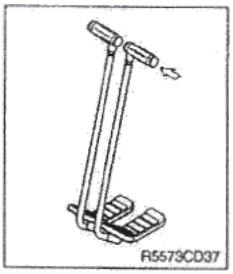
(1) When this lever is in the LOCK position, the console box will be raised, the pilot oil line will be cut off, and the working device and swing will not work.

※ Be sure to raise the lever to the LOCK position when leaving from operator's seat.

(2) By pushing the lever to UNLOCK position, the machine is operational.

※ Do not use the safety lever as a handle when getting on or off the machine.

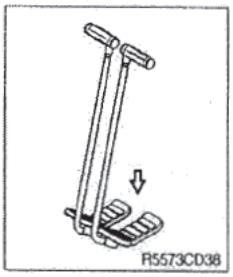
4) Travel lever



(1) This lever is mounted on the travel pedal and used for traveling by hand. The operation principle is same as that of the travel pedal.

(2) Refer to the "Traveling of Machine" for details.

5) Travel pedal

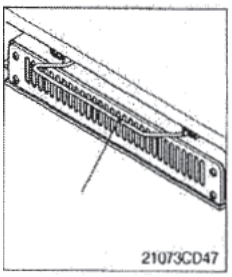


(1) This pedal is used to move the machine forward or backward.

(2) If the left side pedal is pressed, the left track will move. If the right side pedal is pressed, the right track will move.

(3) Refer to the "Traveling of Machine" for details.

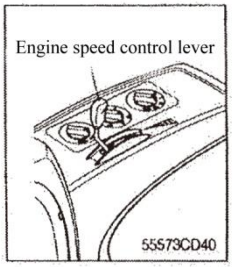
6) Seat and console box adjust lever



(1) This lever is used to move the seat and console box to fit the contours of the operator's body.

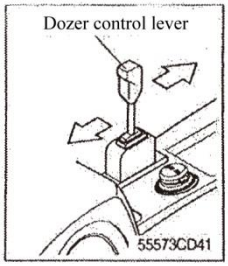
(2) Pull the lever to adjust forward or backward over 90 mm (3.5").

7) Engine speed control lever

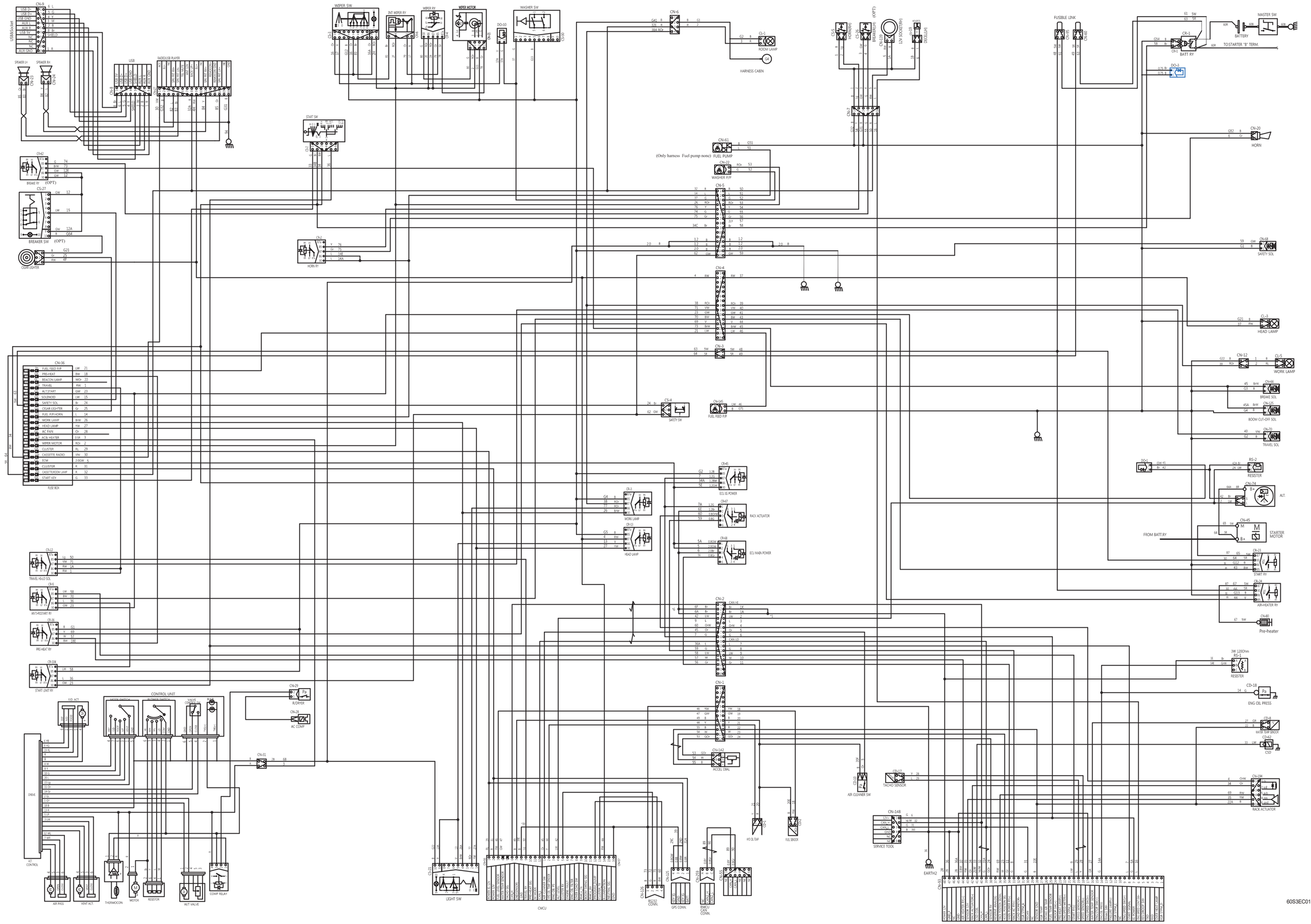


(1) This control lever is to increase or decrease the engine speed.
(2) Move this control lever backward to increase the engine speed and forward to decrease the engine speed.
(3) To stop the engine, move the engine speed control lever forward to the maximum, and turn the key to the OFF position.

8) Dozer control lever



(1) This lever is used to operate the dozer blade.
(2) If the lever is pushed forward, the dozer blade will be going down. If the lever is pulled back, the dozer blade will be going up.


WIPER SW
INT WIPER RY
WIPER RY
WIPER MOTOR
WASHER SW
START SW
HORN RY
HORN
HARNESS CABIN
ROOM LAMP
FUSIBLE LINK
MASTER SW
BATTERY
TO STARTER "B" TERM.
BATT RY
HORN
FUEL PUMP
(Only harness Fuel pump none)
WASHER P/P
BRAKE RY (OPT)
BREAKER SW (OPT)
CIGAR LIGHTER
SAFETY SOL
HEAD LAMP
WORK LAMP
BREAKE SOL
BOOM CUT-OFF SOL
TRAVEL SOL
RESISTER
ALT.
STARTER MOTOR
START RY
AIR+HEATER RY
Pre-heater
SAFETY SW
FUEL FEED P/P
AIR CLEANER SW
TACHO SENSOR
SERVICE TOOL
ENG OIL PRESS
WATER TEMP.SENSOR
CSD
RACK ACTUATOR
FUSE BOX
TRAVEL HI-LO SOL
ANTI-RESTART RY
PRE-HEAT RY
START LIMIT RY
I/O ACT.
CONTROL UNIT
MODE SWITCH
POWER SWITCH
A/CRYER
AC COMP
ACT CONTROL
AIR PRES
VENT ACT.
THERMOCON
MOTOR
RESISTOR
WIT VALVE
COMP RELAY
LIGHT SW
CMCU
RS232 CONN.
GPS CONN.
EMCU CAN CONN.
ECU
EARTH2
HYD OIL TEMP
FUEL SENSOR
60S3EC01

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)]

- → Fuse box [No.1] → Start switch [CS-2 (1)]
- → Fuse box [No.2]
  - → MP3 & Radio player [CN-27 (8)]
  - → Room lamp [CL-1 (1)] / 12V socket [CN-139 (2)]
- → Fuse box [No.3]
  - → Cluster [CN-56 (2)]
  - → GPS connector [CN-125 (1)]
- → Fuse box [No.4]
  - → ECU main power relay [CR-68 (1,2)]
  - → ECU IG power relay [CR-45 (30)]

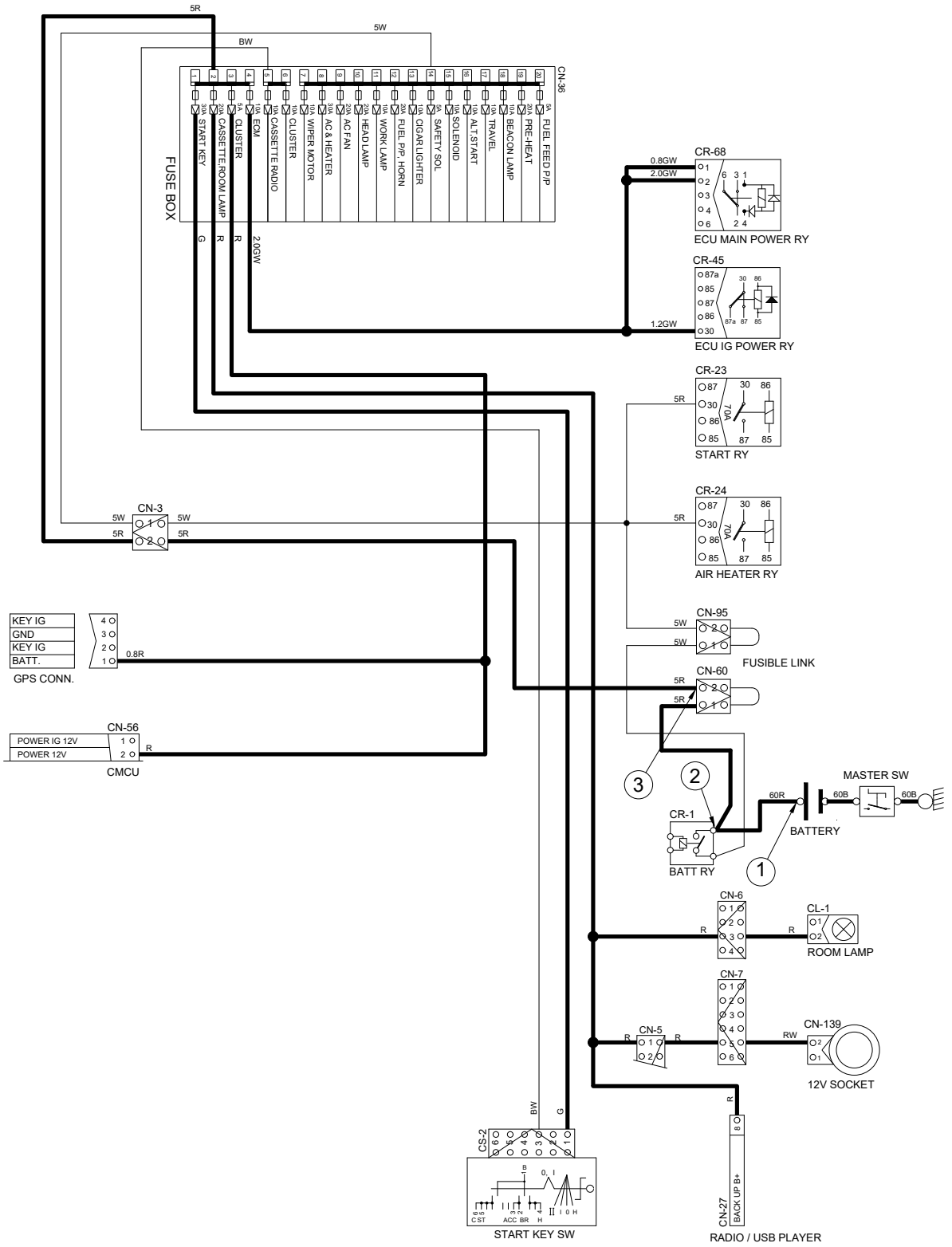
※ I/conn : Intermediate connector

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



60S4EL04

2. STARTING CIRCUIT

1) OPERATING FLOW

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

※ Start switch : ON

- Start switch ON [CS-2 (2)] → ECU IG power relay [CR-45 (86)]
  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

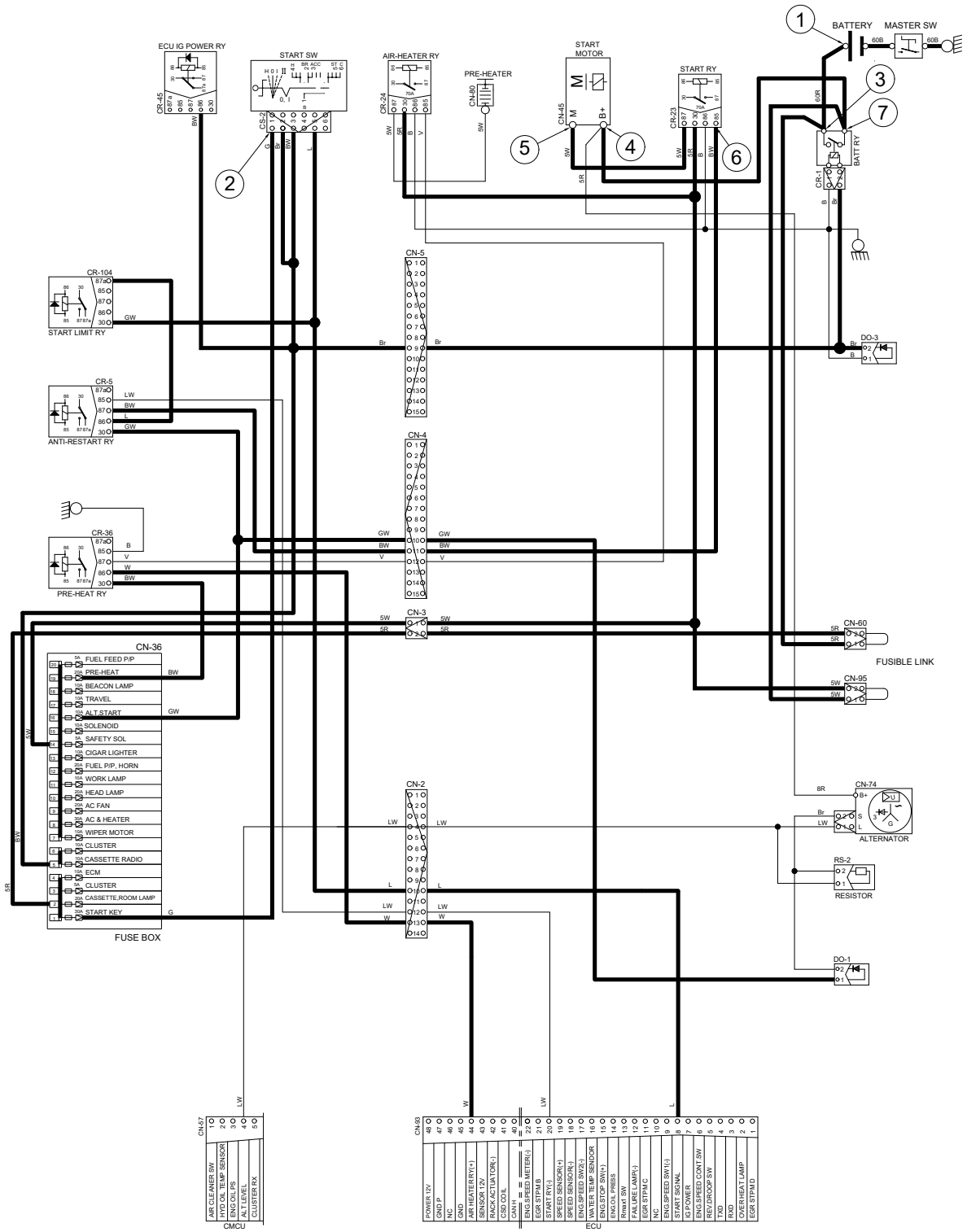
Start switch START [CS-2 (5)] → Anti-restart relay [CR-5 (86) → (87)] → I/conn [CN-4 (11)]
→ Start relay [CR-23 (C2) → (2)] → Starter motor operating
I/conn [CN-2 (10)] → ECU [CN-93 (8)]

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



60S4EL05

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-2 (4)] → Cluster [CN-57 (4)] → Cluster warning lamp

(2) Charging flow

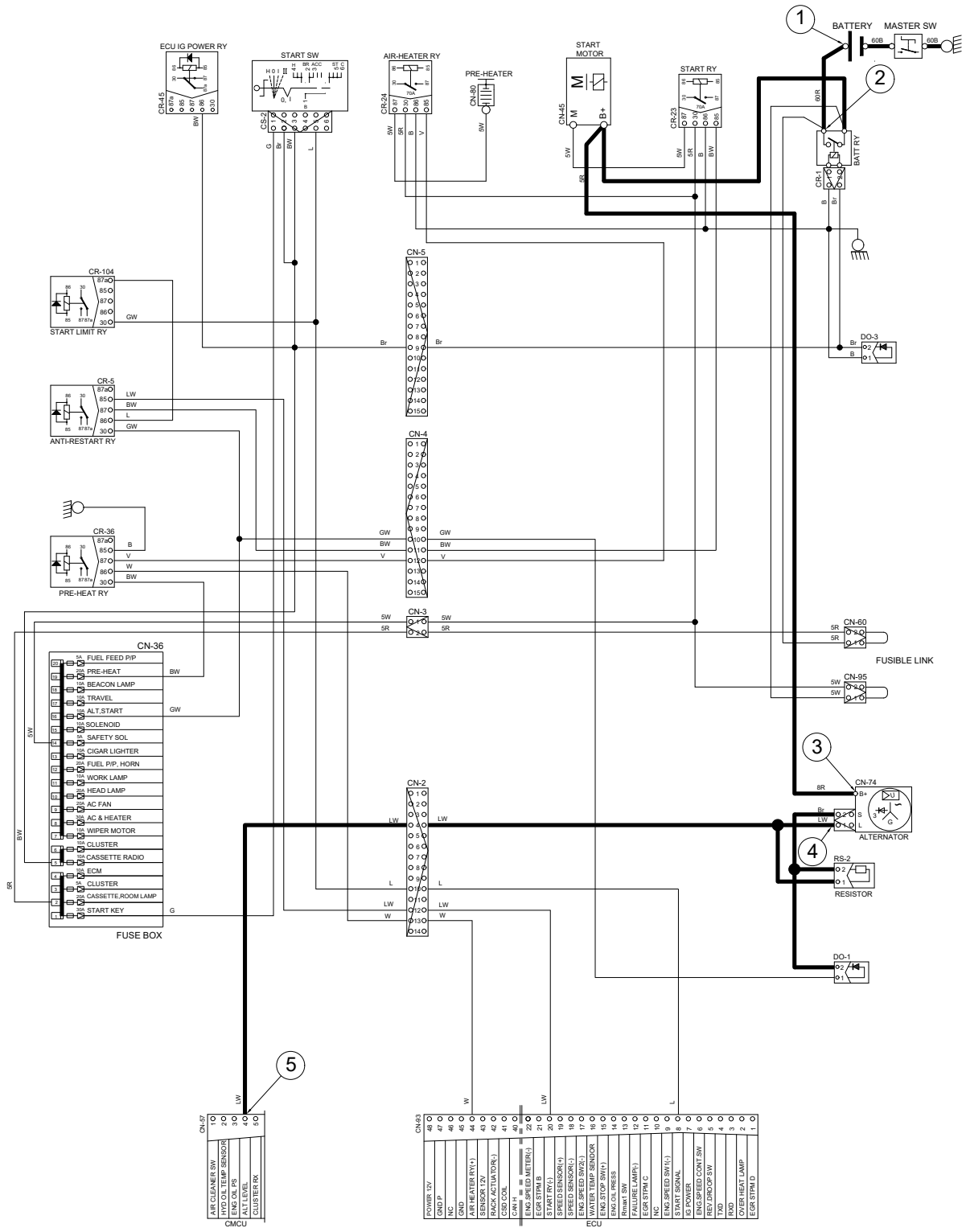
Alternator "B^+" terminal → Battery relay → Battery (+) terminal

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



60S4EL06

4. HEAD AND WORK LAMP CIRCUIT

1) OPERATING FLOW

Fuse box (No.10) → Head lamp relay [CR-13 (30) → (86)] → Switch [CS-21 (5)]
Fuse box (No.11) → Work lamp relay [CR-3 (30) → (86)] → Switch [CS-21 (2)]

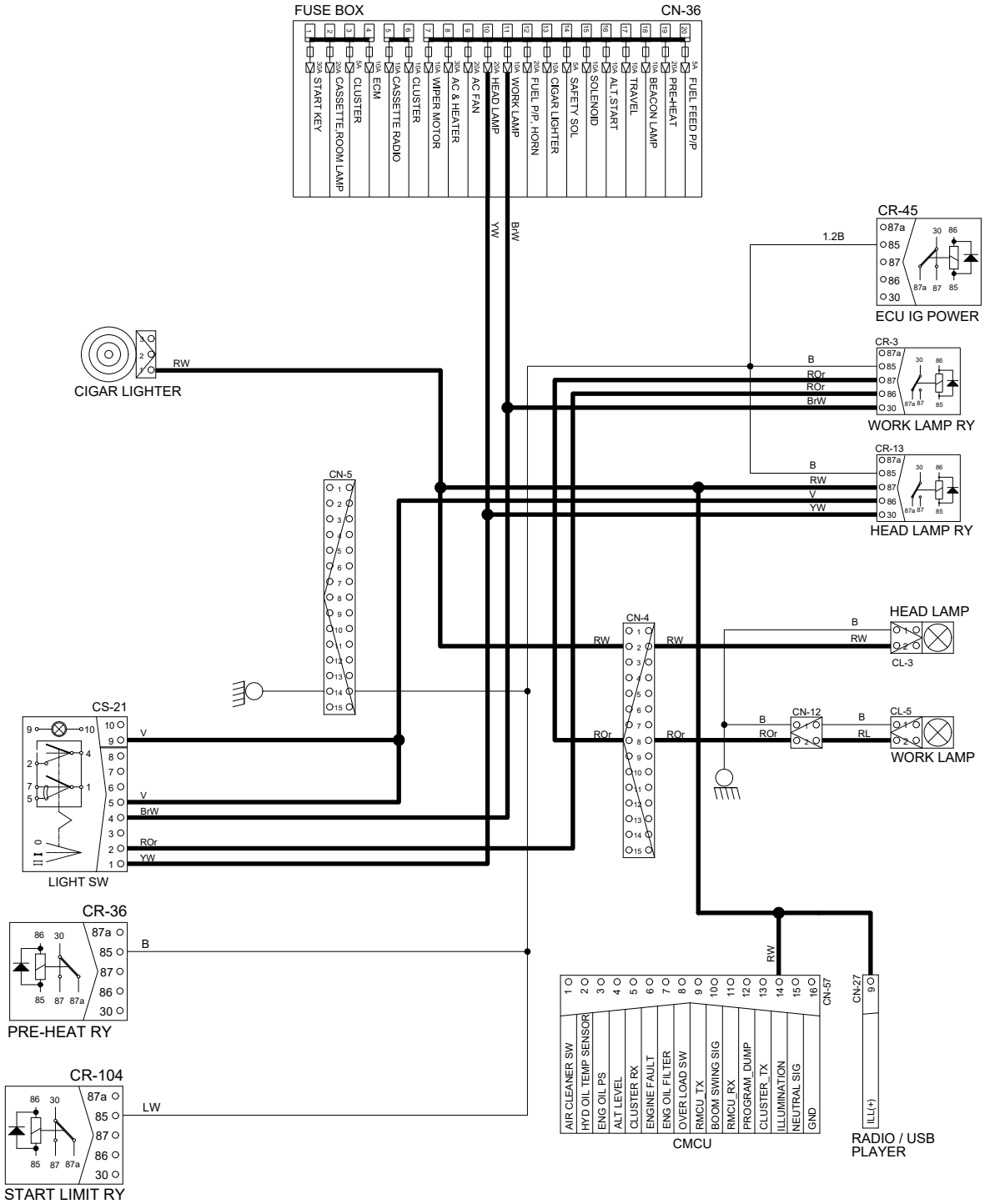
(1) Head lamp switch ON

Head lamp switch ON [CS-21 (5)] → Head lamp relay [CR-13 (86) → (87)]
- → I/conn [CN-4 (2)] → Head lamp ON [CL-3 (2)]
- → Cigar lighter [CL-2 (1)]
- → MP3 & Radio player illumination ON [CN-27 (9)]
- → Cluster illumination ON [CN-57 (14)]

(2) Work lamp switch ON

Work lamp switch ON [CS-21 (2)] → Work lamp [CR-3 (30) → (87)] → I/conn [CN-4 (8)]
I/conn [CN-12 (2)] → Work lamp ON [CL-5 (2)]

HEAD AND WORK LAMP CIRCUIT



60S4EL07

5. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

(1) Key switch ON

Fuse box (No.7) → Wiper relay [CR-4 (86)]
→ Int wiper relay [CR-6 (4)]
→ Wiper switch [CS-3 (10)]
→ Wiper motor [CN-21 (3)]
→ I/conn [CN-5 (4)] → Washer pump [CN-22 (2)]

(2) Wipe switch ON : 1st step (low speed)

Wiper switch ON [CS-3 (5)→(6)] → Int wiper relay [CR-6 (6)→(3)] → Wiper relay [CR-4 (85)→(30)]
→ Washer motor operating [CN-21 (4)]

(3) Wiper switch ON : 2nd step (washer)

Wiper switch ON [CS-3 (2)] → Int wiper relay [CR-6 (1)] → Washer switch [CS-30 (1)]
→ Wiper relay [CR-4 (85)→(30)]
→ Wiper motor operating[CN-21(1)]

Washer switch ON [CS-30 (1)] → I/conn [CN-5 (3)] → Washer pump operating [CN-22 (1)]

(4) Auto parking (when switch OFF)

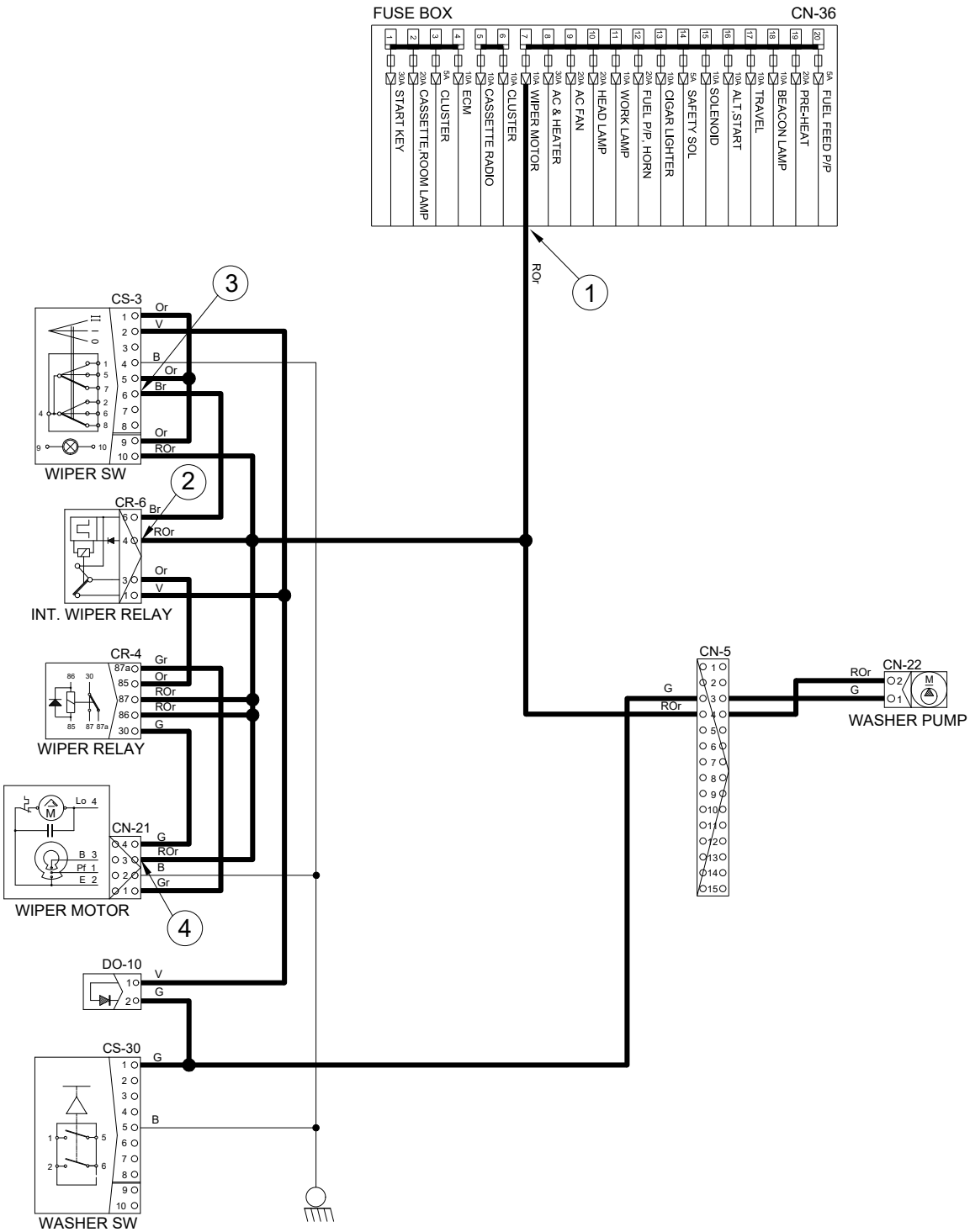
Switch OFF → Wiper motor [CN-21 (1)] → Wiper switch [CS-3 (5)→(6)] → Int wiper relay [CR-6 (6)→(3)]
→ Wiper relay [CR-4 (85)→(30)] → Wiper motor [CN-21 (4)]
→ Wiper motor parking position by wiper motor controller

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

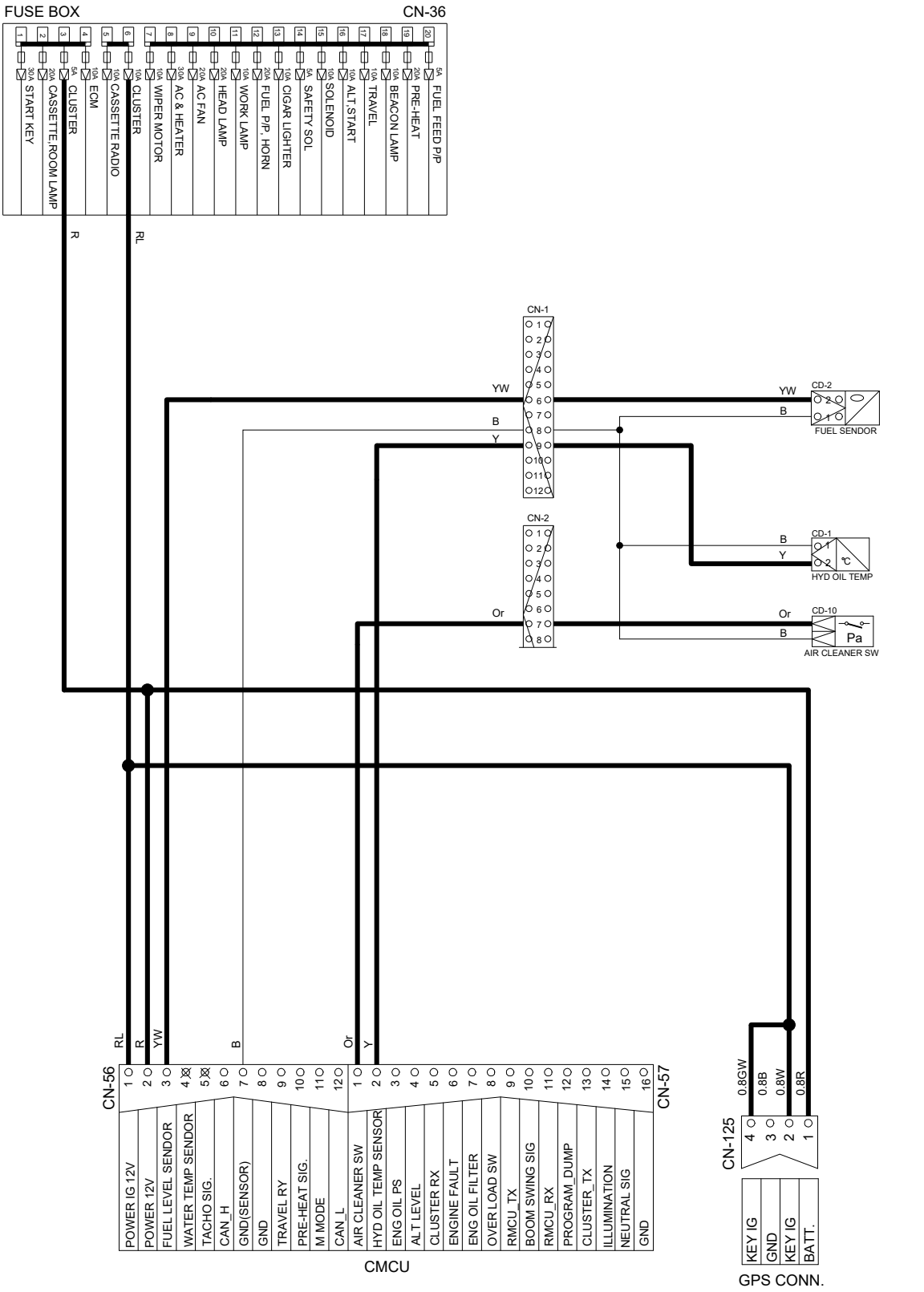
※ GND : Ground

WIPER AND WASHER CIRCUIT

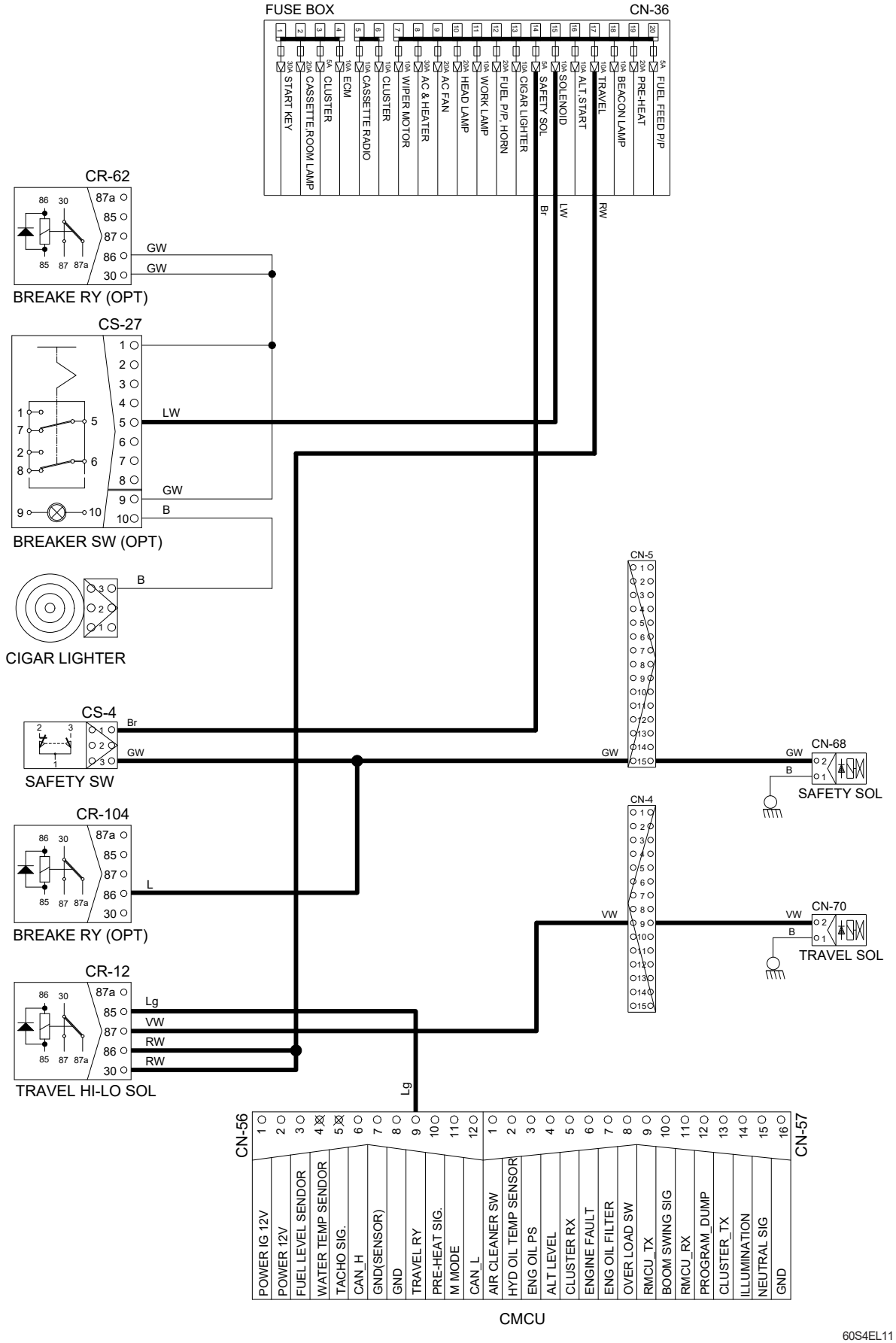


60S4EL09

MONITORING CIRCUIT



ELECTRIC CIRCUIT FOR HYDRAULIC



SECTION 4 TROUBLESHOOTING

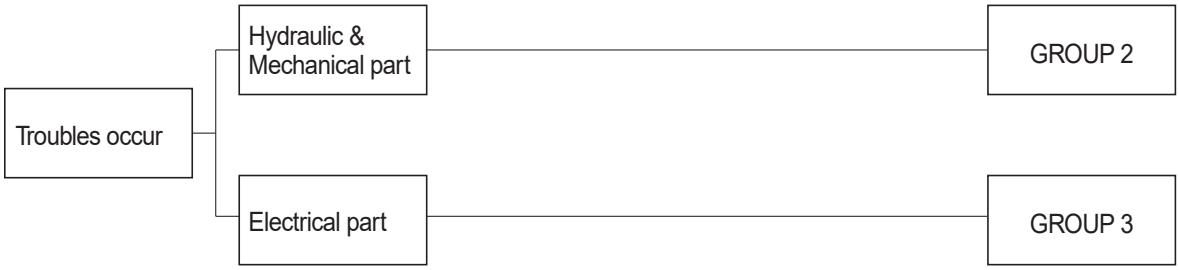
GROUP 1 BEFORE TROUBLESHOOTING

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.

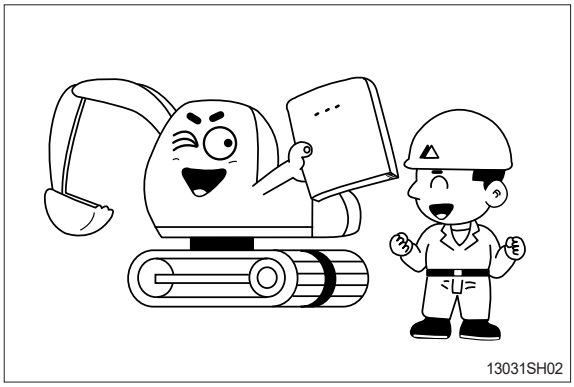


2. DIAGNOSING PROCEDURE

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

STEP 1. Study the machine system

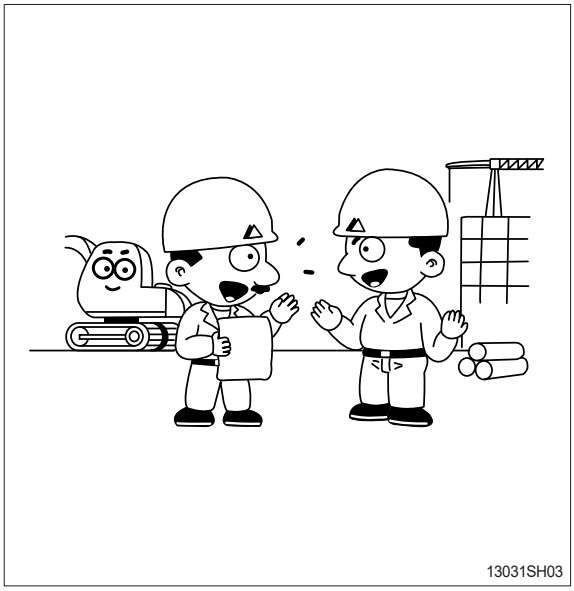
Study and know how the machine is operating, how the system is composing, what kinds of function are installed in the machine and what are specifications of the system components by the machine service manual.
Especially, deepen the knowledge for the related parts of the trouble.


13031SH02

STEP 2. Ask the operator

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

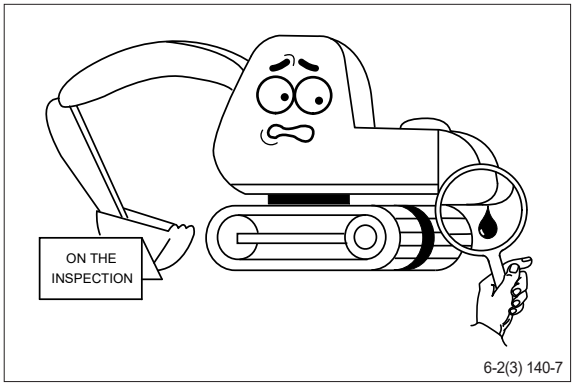
1) How the machine is used and when it is serviced?
2) When the trouble was noticed and what work the machine was doing at that time?
3) What is the phenomenon of the trouble? Was the trouble getting worse, or did it come out suddenly for the first time?
4) Did the machine have any troubles previously?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

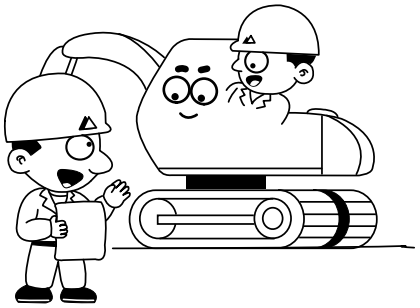
And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.



6-2(3) 140-7

STEP 4. Inspect the trouble actually on the machine

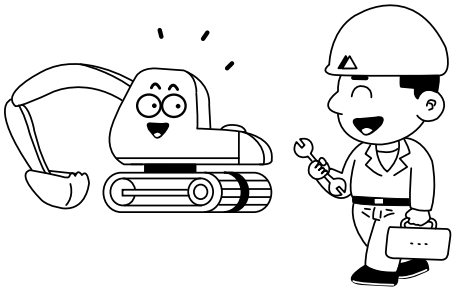
In case that some trouble cannot be confirmed, obtain the details of the malfunction from the operator.
Also, check if there are any in complete connections of the wire harnesses are or not.



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.

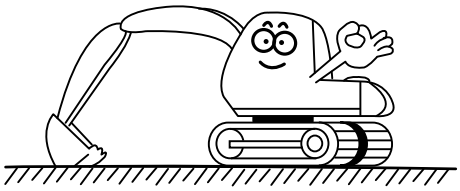


13031SH05

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.

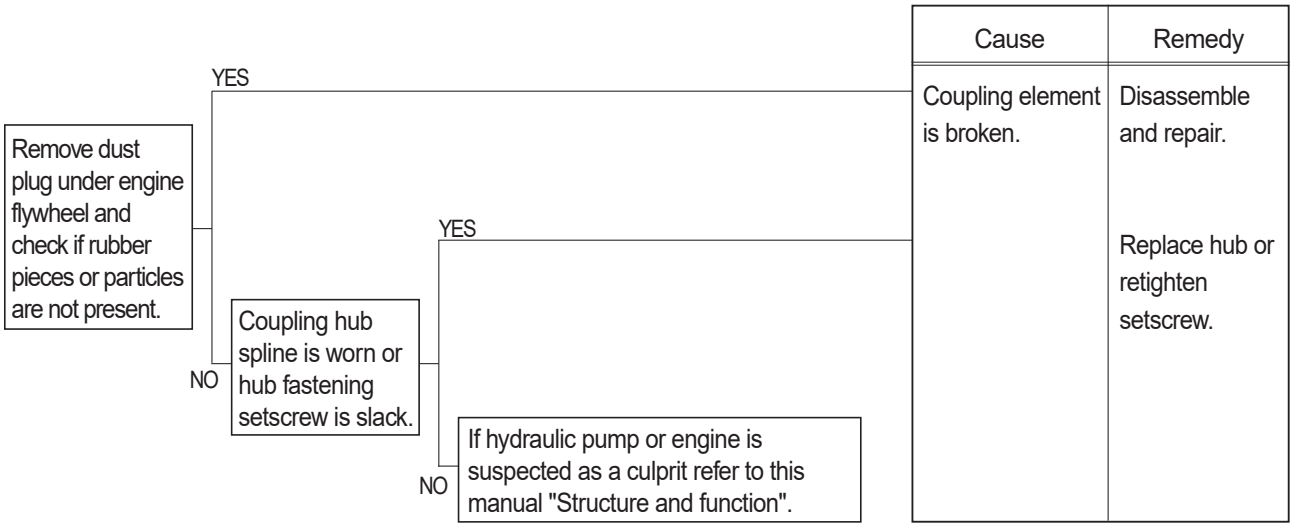
(3) When carrying out troubleshooting, do not hurry to disassemble the components.
It will become impossible to find the cause of the problem.

(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.

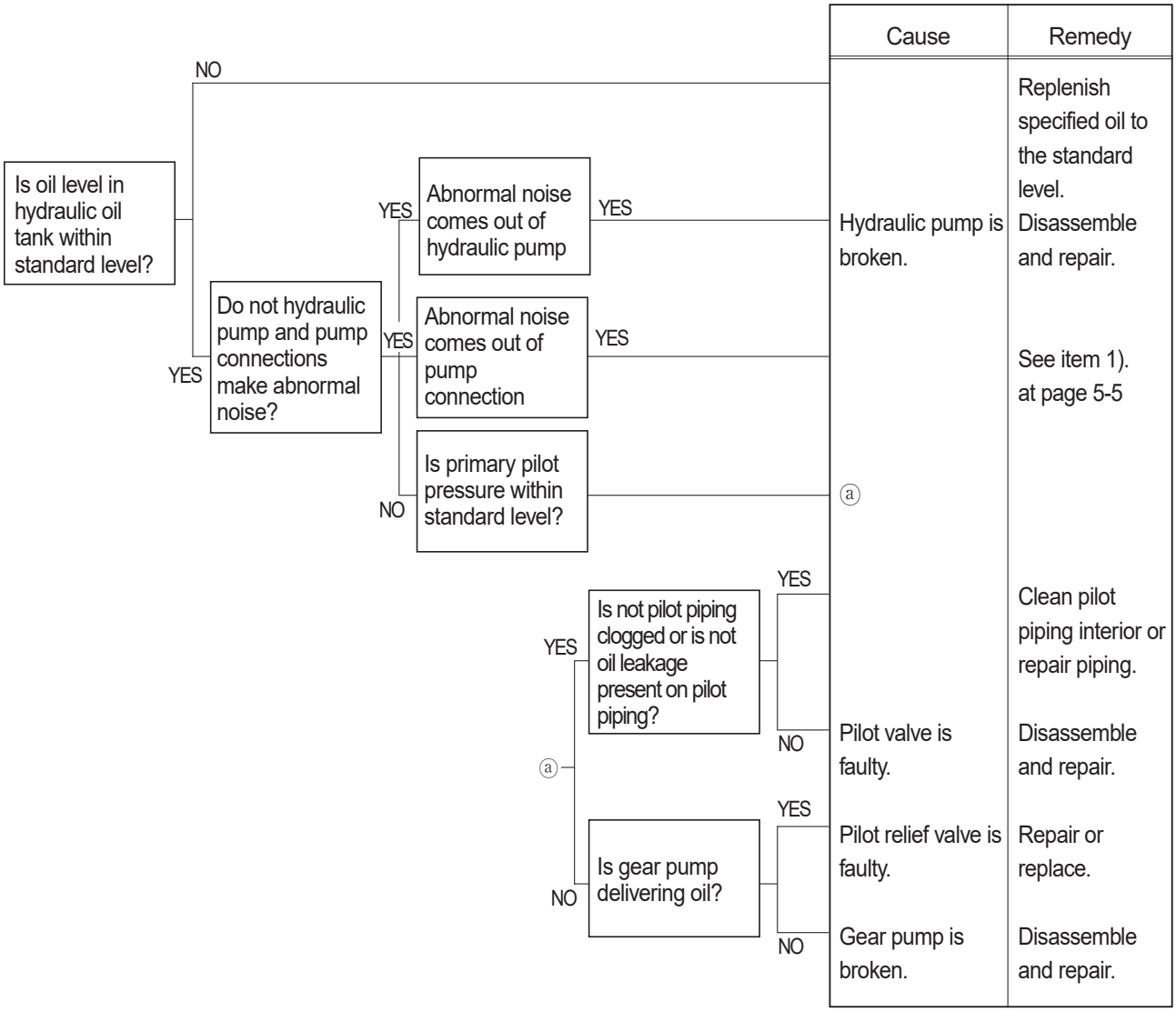
2. DRIVE SYSTEM

1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION



Cause	Remedy
Coupling element is broken.	Disassemble and repair.
	Replace hub or retighten setscrew.

2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL



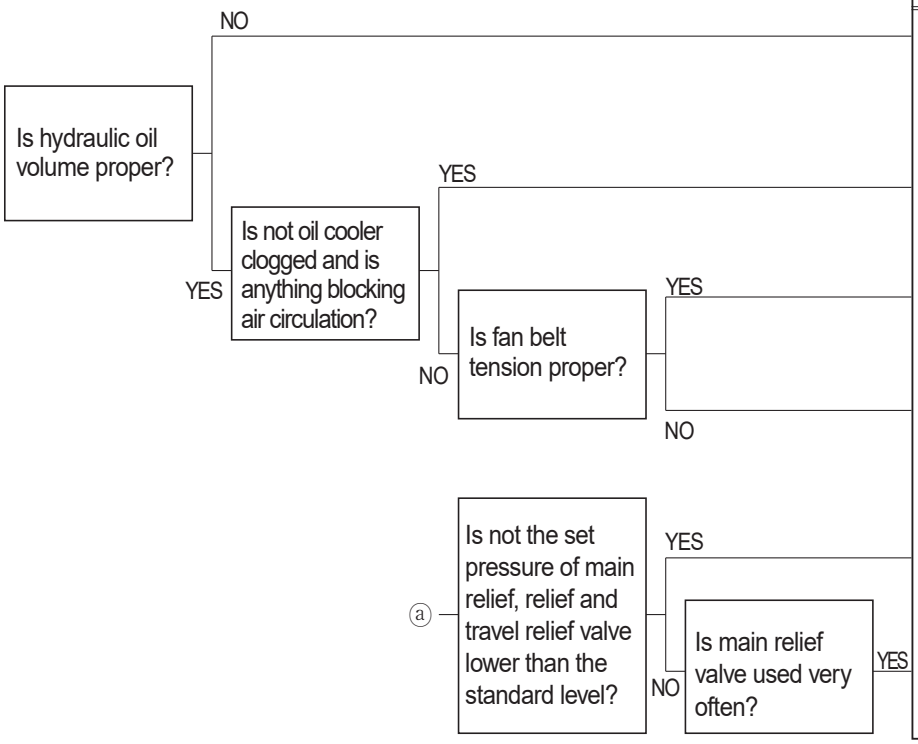
Cause	Remedy
	Replenish specified oil to the standard level.
Hydraulic pump is broken.	Disassemble and repair.
	See item 1). at page 5-5
ⓐ	
	Clean pilot piping interior or repair piping.
Pilot valve is faulty.	Disassemble and repair.
Pilot relief valve is faulty.	Repair or replace.
Gear pump is broken.	Disassemble and repair.

3. HYDRAULIC SYSTEM

1) HYDRAULIC OIL IS CLOUDY

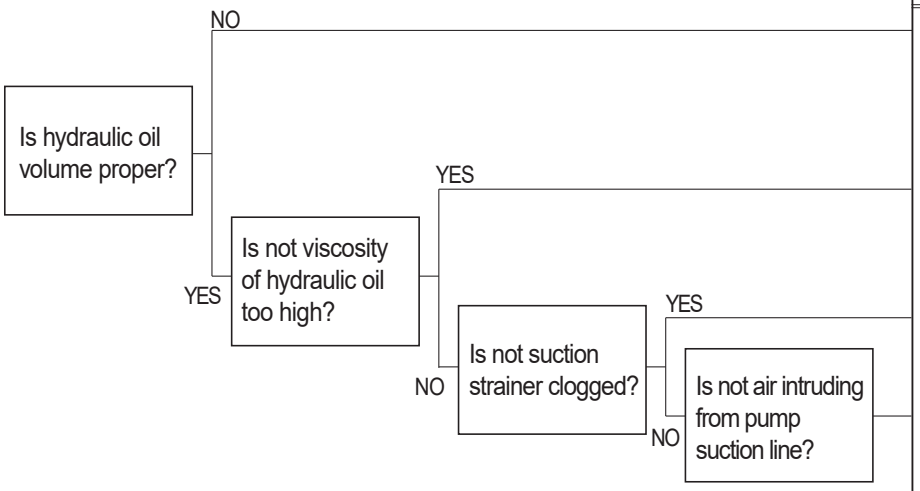
Cause	Remedy
Water is mixed.	Put hydraulic oil still, separate water and dispose it or replace hydraulic oil.
Air is intruded.	Check suction line and return line and eliminate the air intruding source.

2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY



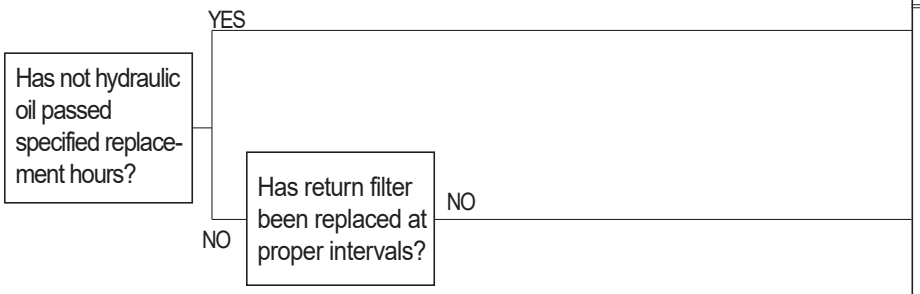
Cause	Remedy
ⓐ	Replenish specified oil to the standard level. Clean oil cooler. Secure air circulation route. Adjust belt tension or replace belt. Readjust set pressure. Reduce load.

3) CAVITATION OCCURS WITH PUMP



Cause	Remedy
	Replenish specified oil to the standard level. Replace oil with one of proper viscosity. Clean suction strainer. Check for air intrusion in suction line and retighten or replace parts.

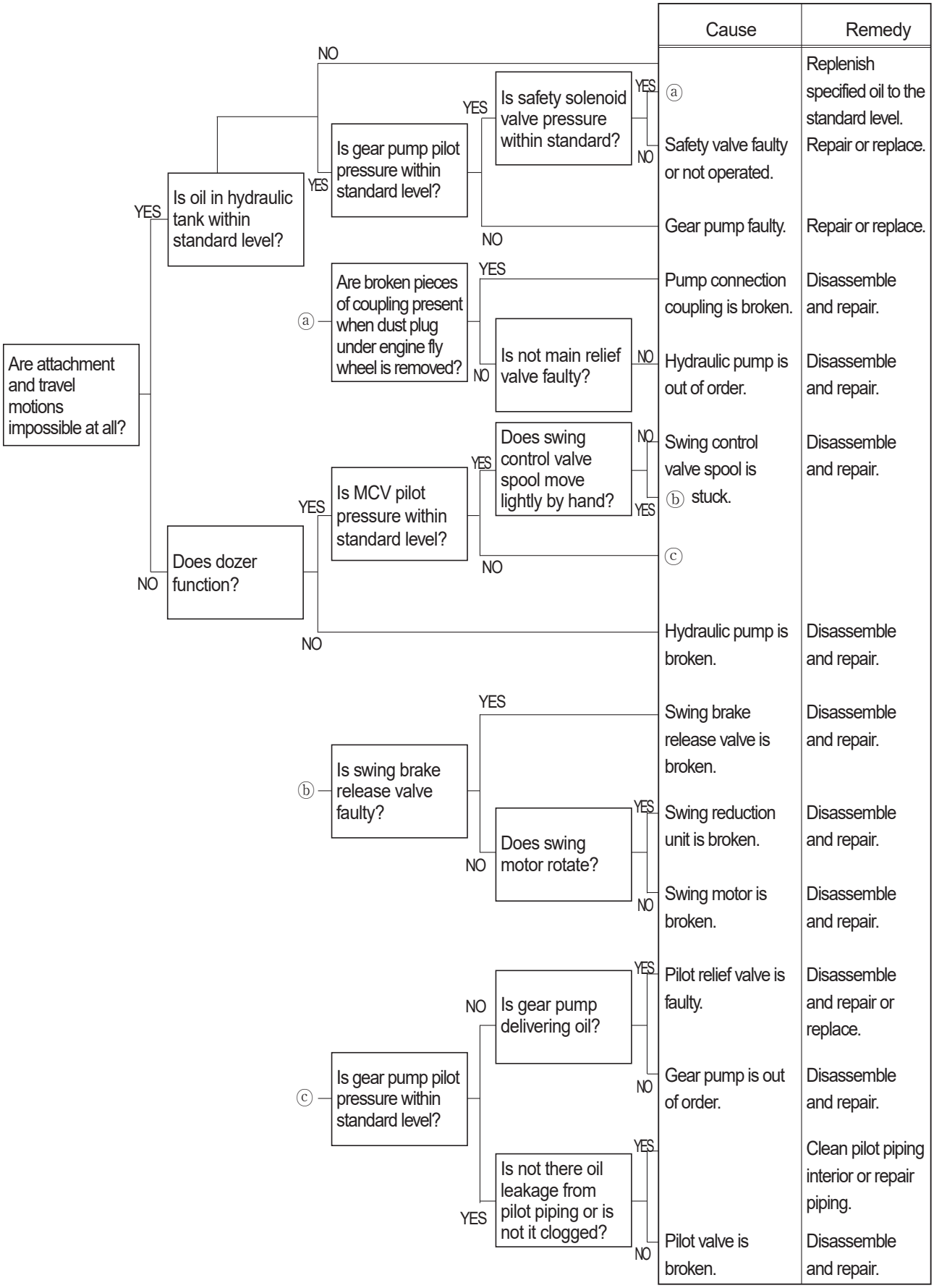
4) HYDRAULIC OIL IS CONTAMINATED



Cause	Remedy
	Replace hydraulic oil to be specified. Flush with hydraulic oil and replace return filter.

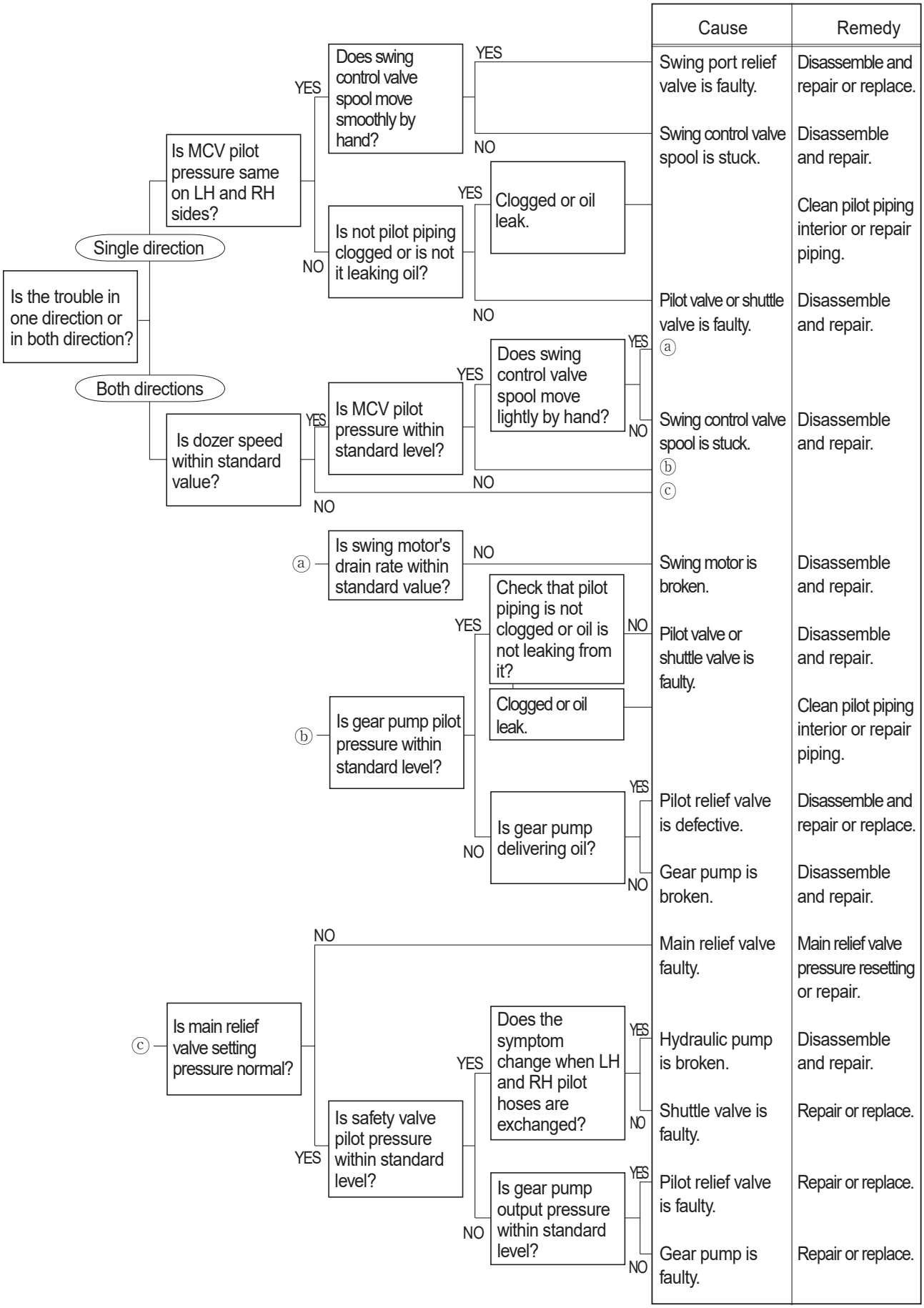
4. SWING SYSTEM

1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE

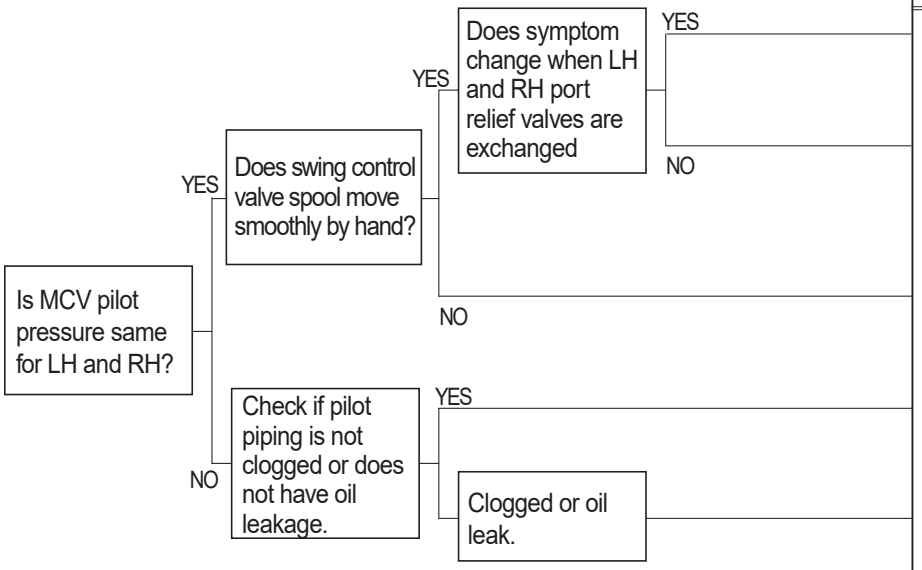


Cause	Remedy
ⓐ Safety valve faulty or not operated.	Replenish specified oil to the standard level. Repair or replace.
Gear pump faulty.	Repair or replace.
Pump connection coupling is broken.	Disassemble and repair.
Hydraulic pump is out of order.	Disassemble and repair.
Swing control valve spool is ⓑ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

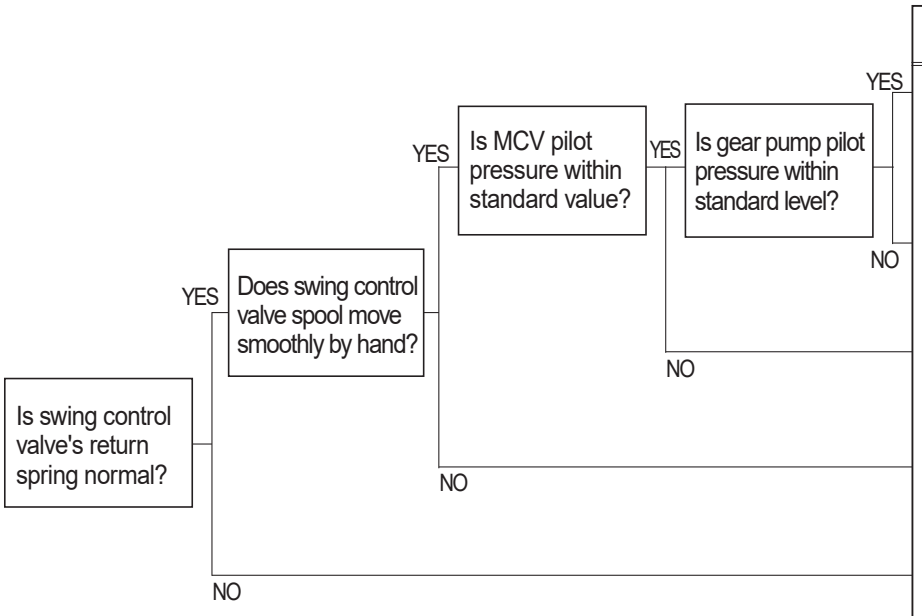


3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



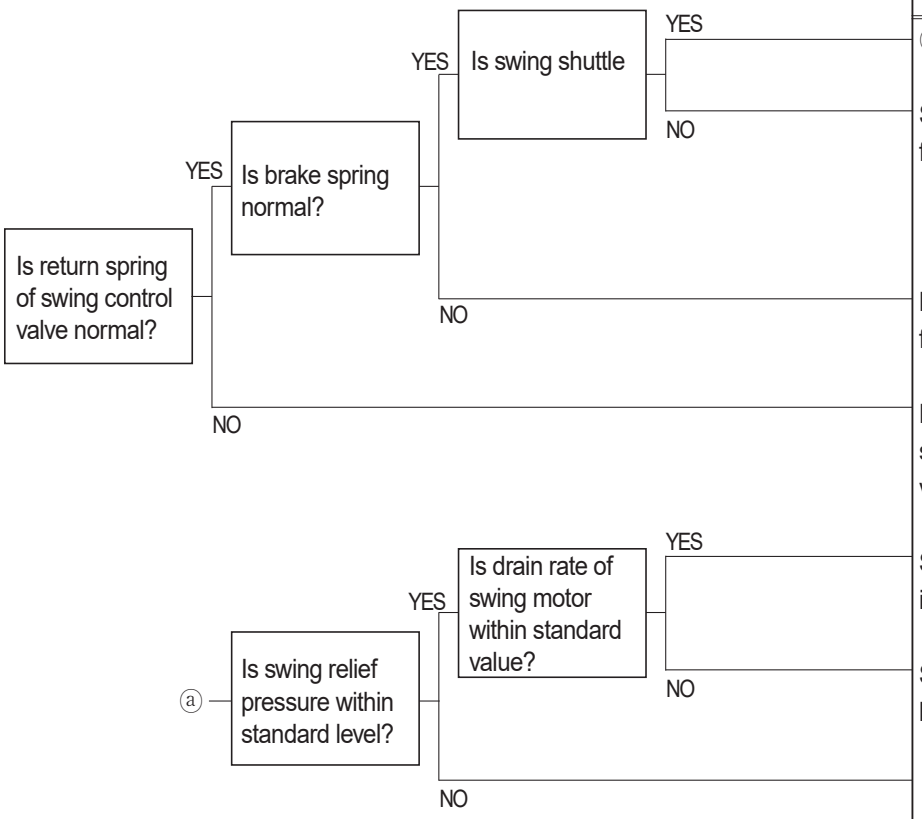
Cause	Remedy
Swing port relief valve is faulty.	Disassemble and repair.
Shuttle valve is faulty.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
Pilot valve is faulty.	Disassemble and repair.
	Clean pilot piping interior or repair piping.

4) MACHINE SWINGS BUT DOES NOT STOP



Cause	Remedy
Pilot relief valve is faulty.	Disassemble and repair or replace.
Gear pump is broken.	Disassemble and repair.
Pilot valve is faulty.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
Return spring is faulty.	Disassemble and replace.

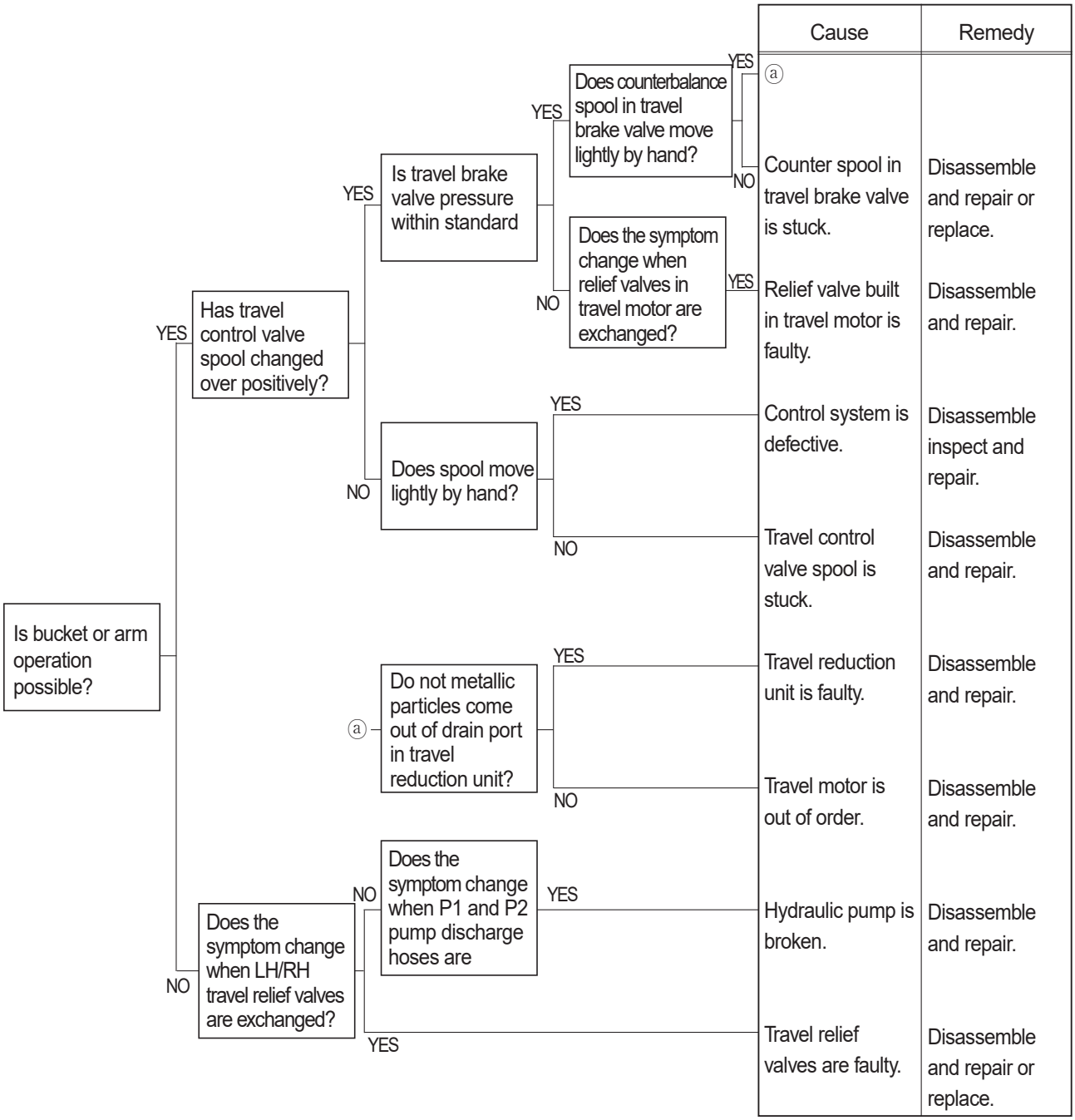
5) THE SWING UNIT DRIFTS WHEN THE MACHINE IS AT REST ON A SLOPE



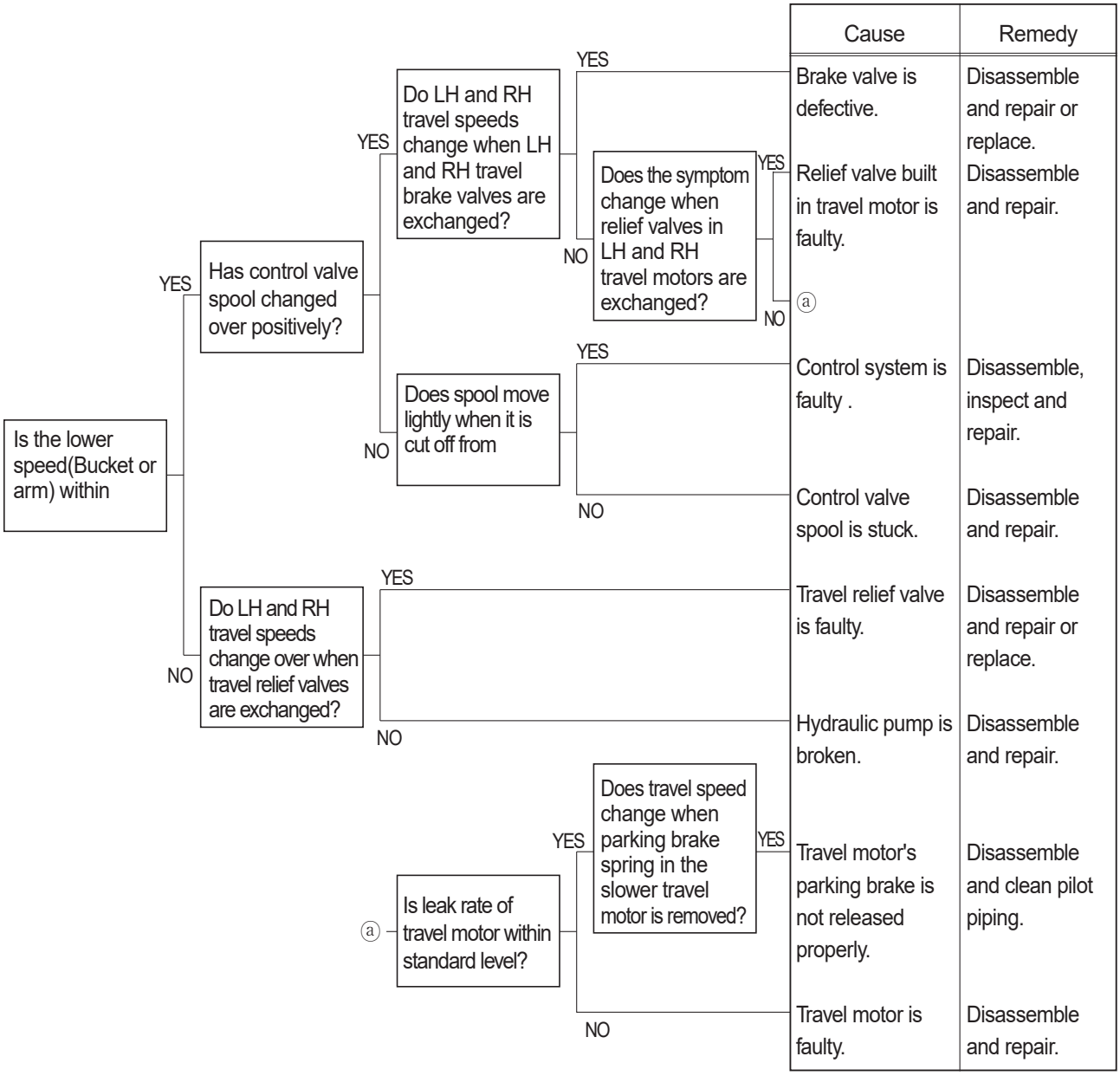
Cause	Remedy
ⓐ	
Shuttle valve is faulty.	Disassemble and replace.
Brake spring is faulty.	Disassemble and replace.
Return spring of swing control valve is faulty.	Disassemble and replace.
Swing relief valve is faulty.	Disassemble and repair or replace.
Swing motor is broken.	Disassemble and repair.
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

5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION AT ALL ON ONE SIDE

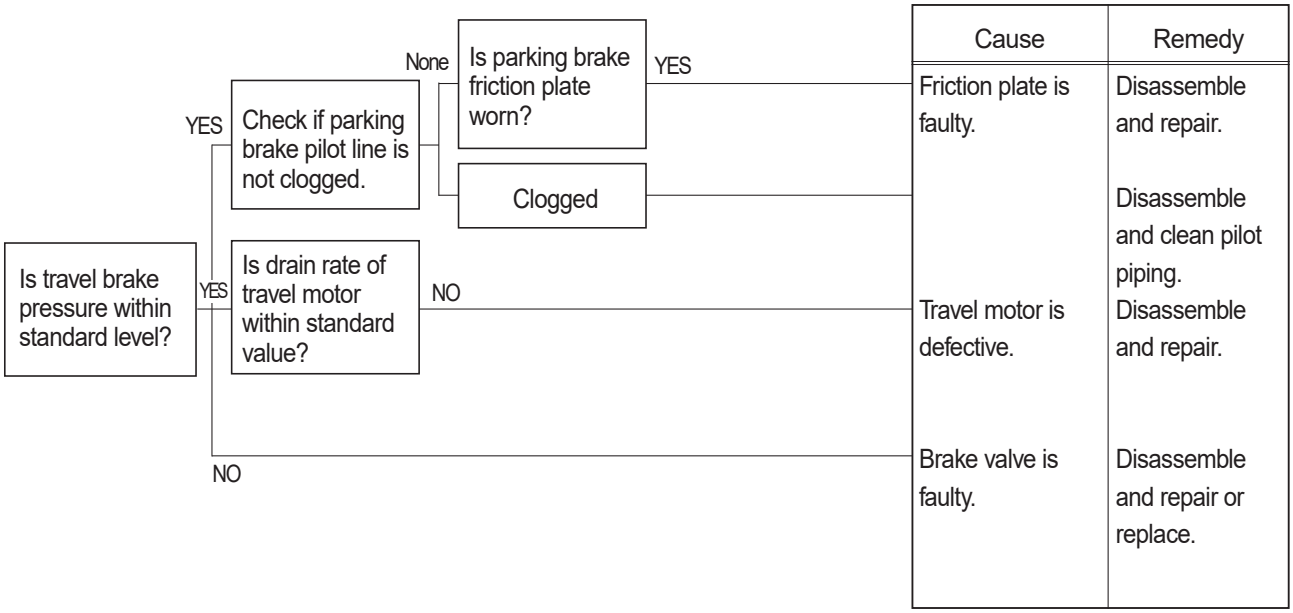


2) SPEED ON ONE SIDE FALLS AND THE MACHINE CURVES



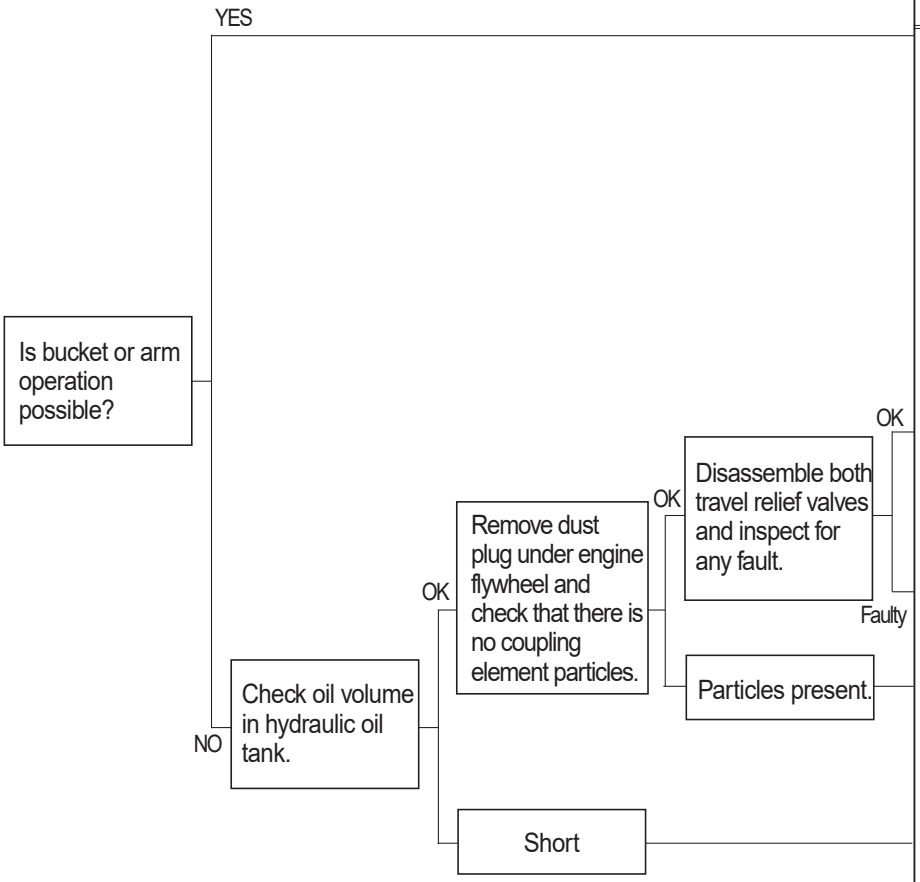
3) MACHINE DOES NOT STOP ON A SLOPE

Machine is pulled forward as sprocket rotates during digging operation.



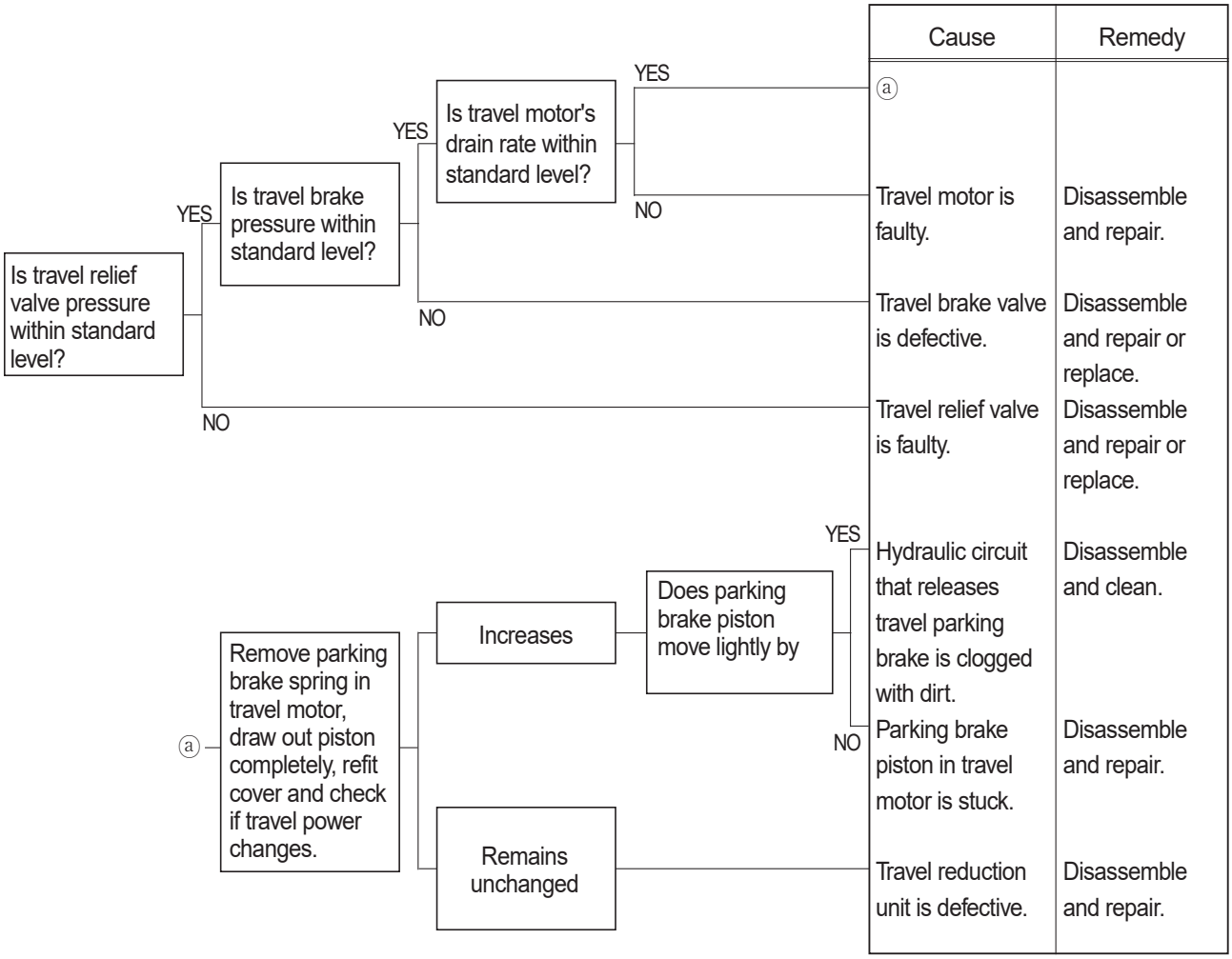
Cause	Remedy
Friction plate is faulty.	Disassemble and repair.
Clogged	Disassemble and clean pilot piping.
Travel motor is defective.	Disassemble and repair.
Brake valve is faulty.	Disassemble and repair or replace.

4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE



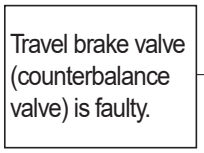
Cause	Remedy
	Inspect according to the procedure "Travel does not function at all on one side." However, a case where both LH and RH travel motions are disabled is extremelyseldom statistically.
Hydraulic pump is faulty.	Disassemble and repair.
Travel relief valve is faulty.	Disassemble and repair or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

5) TRAVEL ACTION IS POWERLESS (travel only)



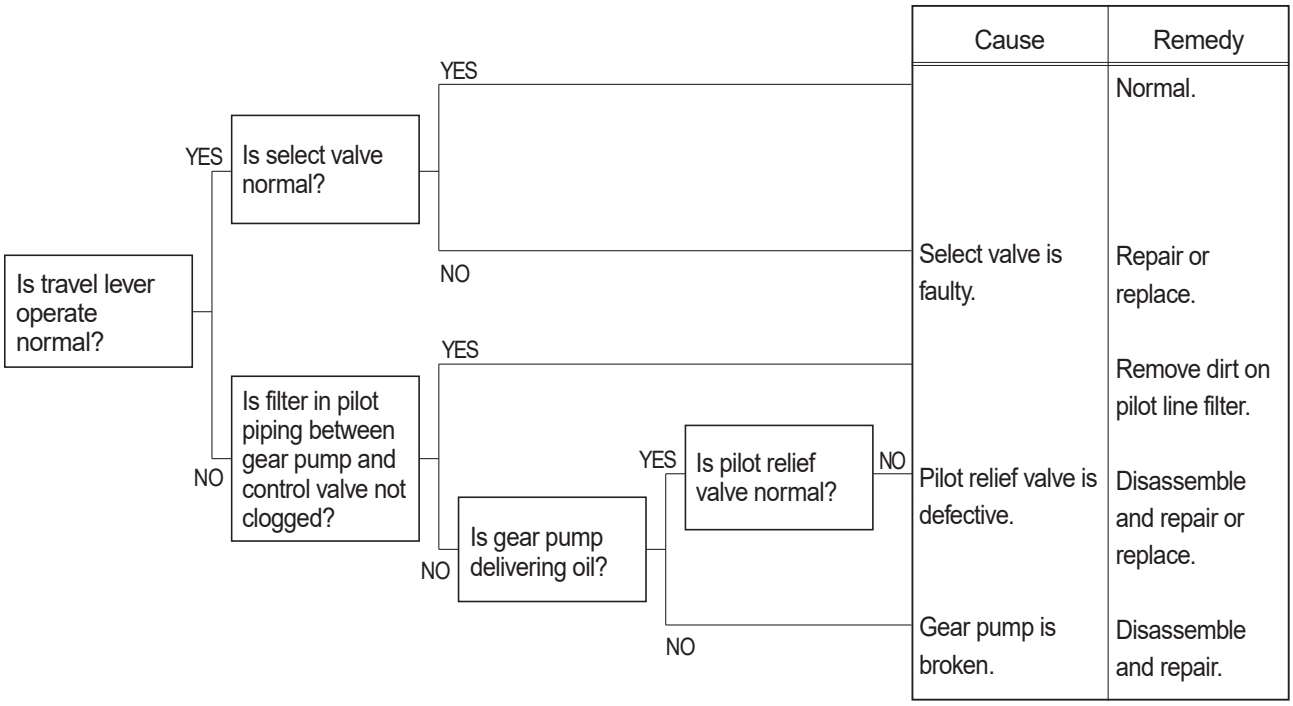
Cause	Remedy
ⓐ	
Travel motor is faulty.	Disassemble and repair.
Travel brake valve is defective.	Disassemble and repair or replace.
Travel relief valve is faulty.	Disassemble and repair or replace.
Hydraulic circuit that releases travel parking brake is clogged with dirt.	Disassemble and clean.
Parking brake piston in travel motor is stuck.	Disassemble and repair.
Travel reduction unit is defective.	Disassemble and repair.

6) MACHINE RUNS RECKLESSLY ON A SLOPE



Cause	Remedy
	Disassemble and repair or replace.

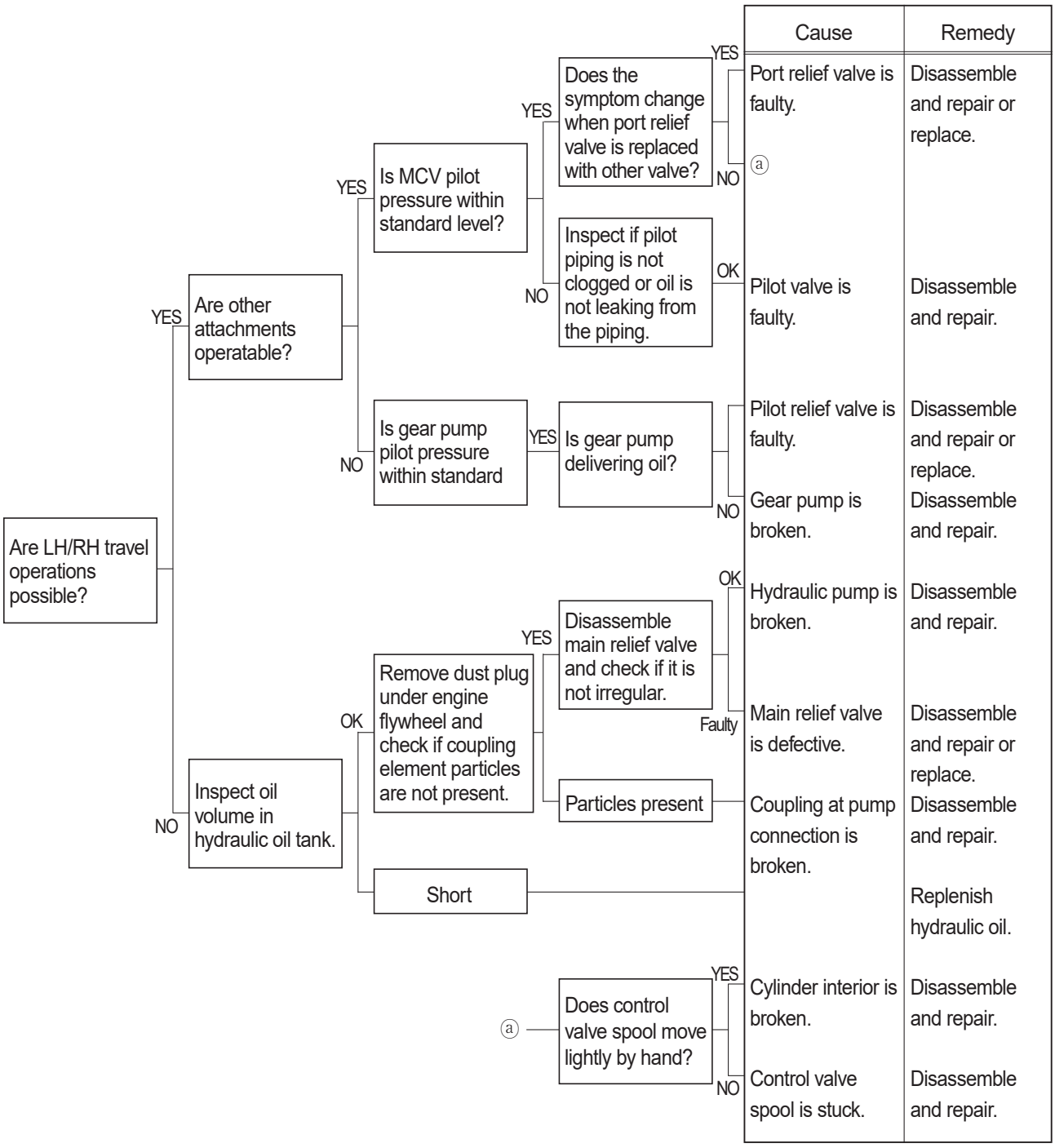
7) MACHINE MAKES A CURVED TRAVEL OR DOES NOT TRAVEL AT ALL WHEN TRAVEL AND ATTACHMENT OPERATIONS ARE EXECUTED AT THE SAME TIME



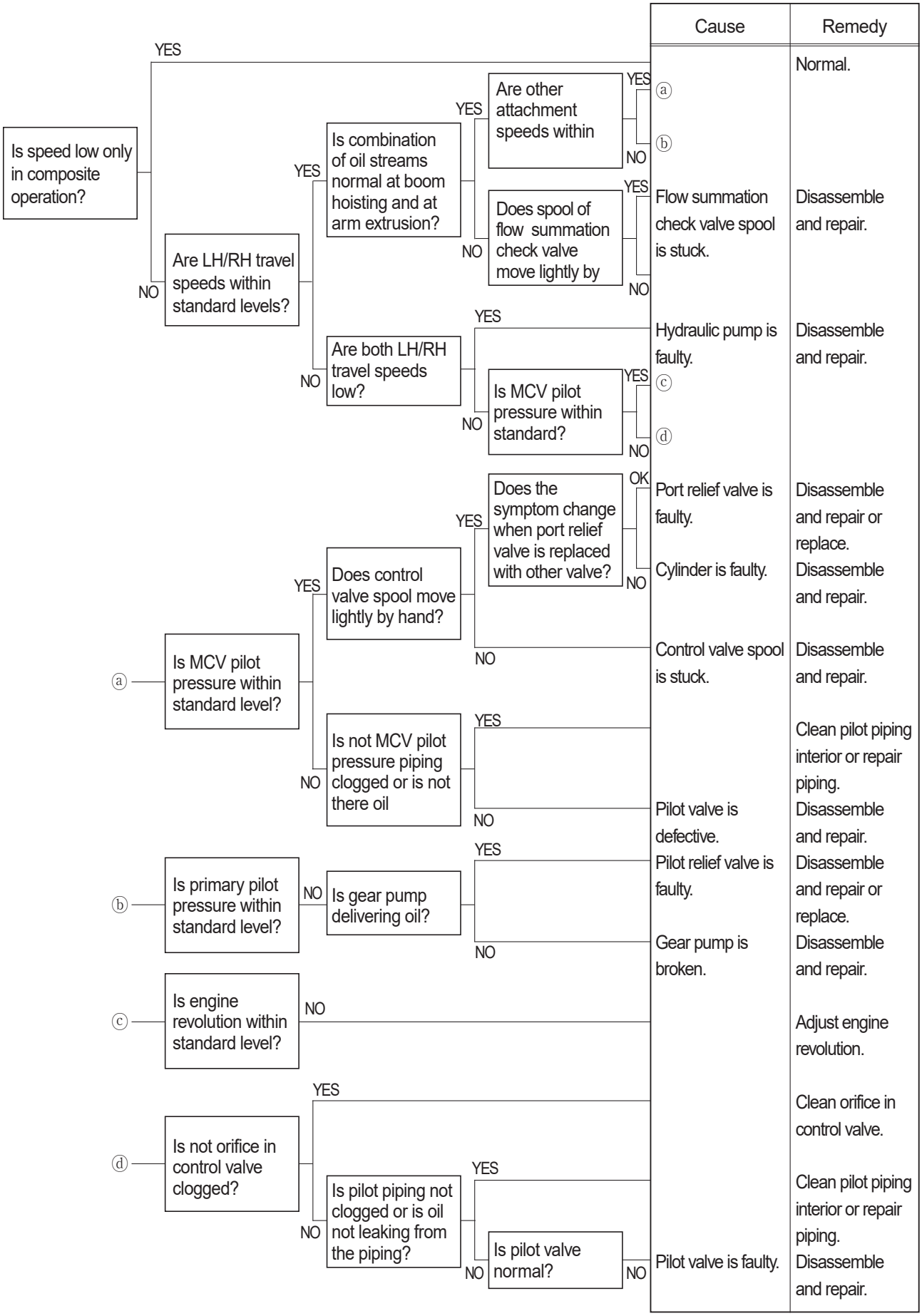
Cause	Remedy
	Normal.
Select valve is faulty.	Repair or replace.
	Remove dirt on pilot line filter.
Pilot relief valve is defective.	Disassemble and repair or replace.
Gear pump is broken.	Disassemble and repair.

6. ATTACHMENT SYSTEM

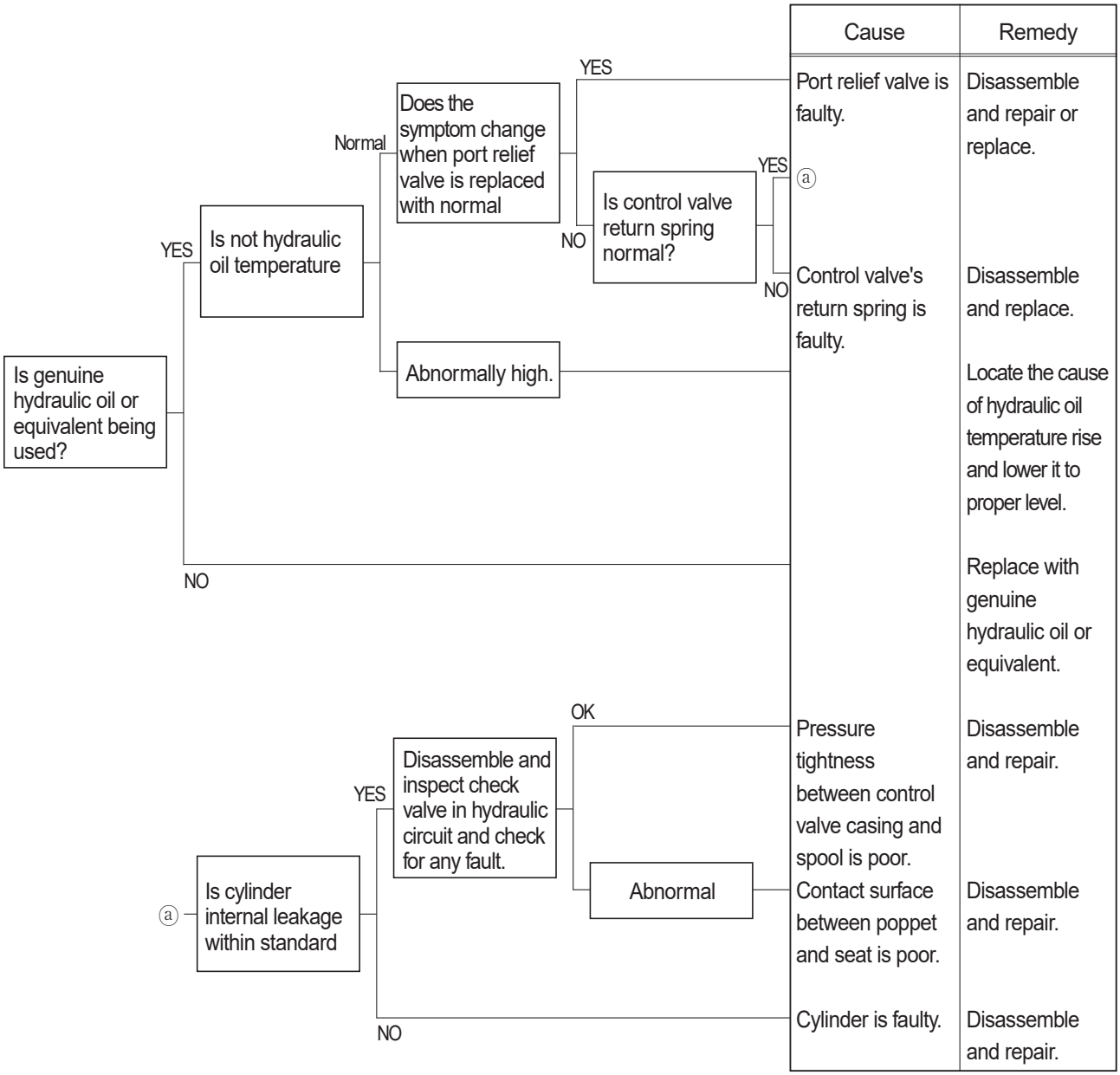
1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



2) BOOM, ARM OR BUCKET SPEED IS LOW

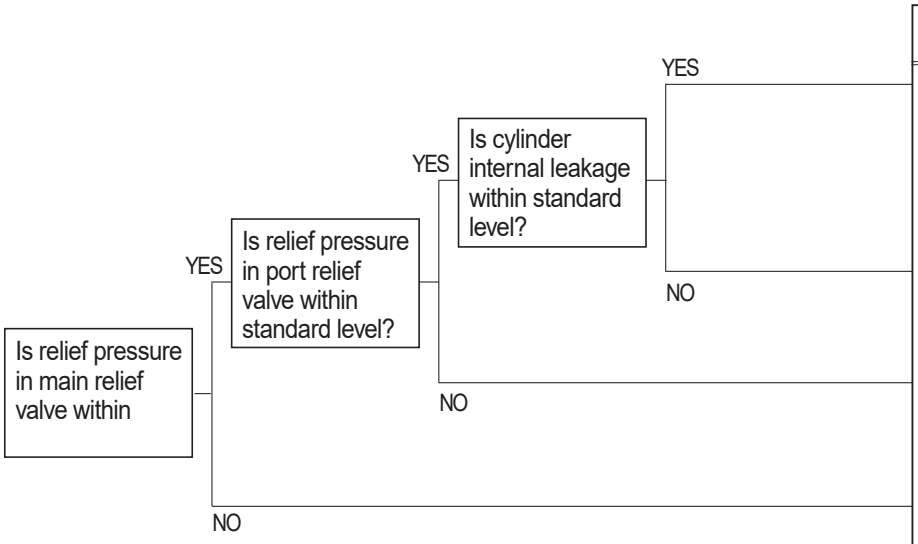


3) BOOM, ARM OR BUCKET CYLINDER EXTENDS OR CONTRACTS ITSELF AND ATTACHMENT FALLS



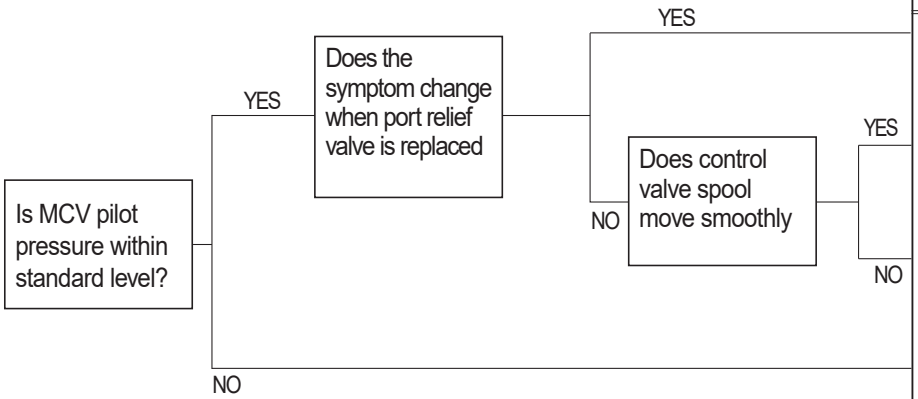
Cause	Remedy
Port relief valve is faulty.	Disassemble and repair or replace.
ⓐ	
Control valve's return spring is faulty.	Disassemble and replace.
	Locate the cause of hydraulic oil temperature rise and lower it to proper level.
	Replace with genuine hydraulic oil or equivalent.
Pressure tightness between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

4) BOOM, ARM OR BUCKET POWER IS WEAK



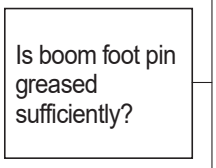
Cause	Remedy
	Check according to the procedure in Item "Speed is low".
Cylinder is faulty.	Disassemble and repair.
Port relief valve is faulty.	Adjust pressure, repair or replace.
Main relief valve is defective.	Adjust pressure, repair or replace.

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



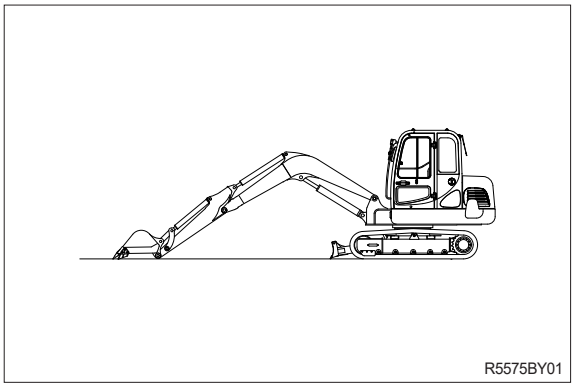
YES

NO

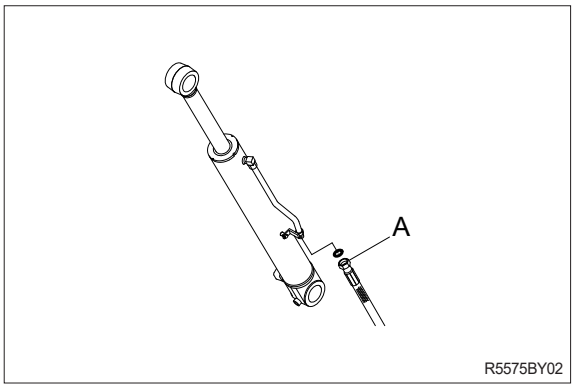
Cause	Remedy
	Frictional noise occurs between the sliding faces of boom cylinder's oil seal and boom proper. ※ Frictional noise will disappear if they are kept used.
Boom foot pin has run out of grease.	Supply grease to it. ※ If seizure is in an initial stage, supply sufficient grease. If seizure is in a grown state, correct it by paper lapping or with an oil stone.

※ HOW TO CHECK INTERNAL BOOM CYLINDER LEAKAGE

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

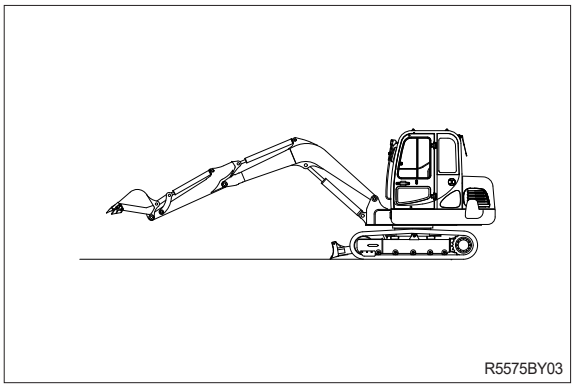


2. Disconnect hose(A) from rod side of boom cylinder and drain oil from cylinders and hose.(Put cups on piping and hose ends)



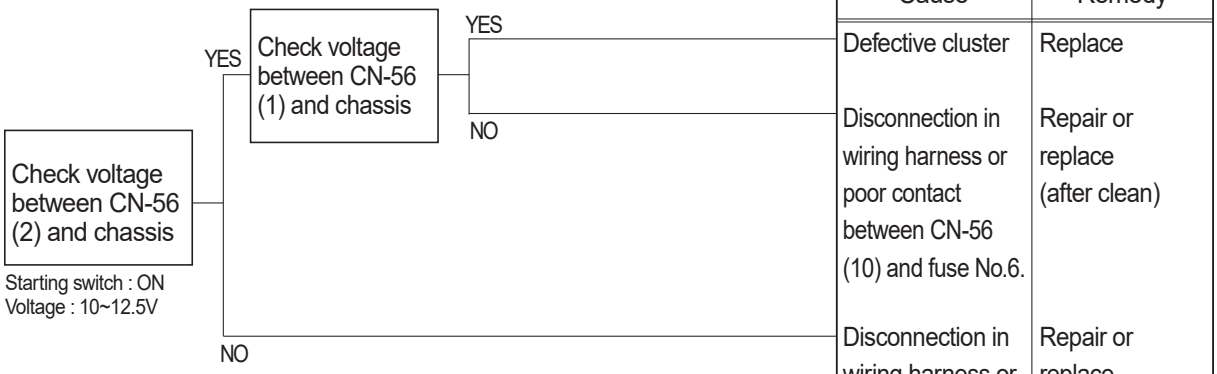
3. Raise bucket OFF the ground by retracting the arm cylinder rod.

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



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

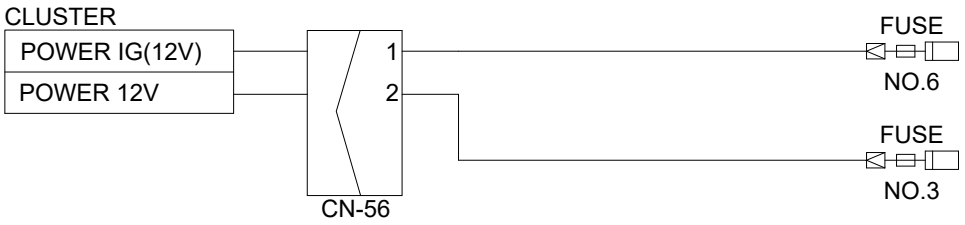
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.3 and No.6.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



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.3	Repair or replace (after clean)

Check voltage

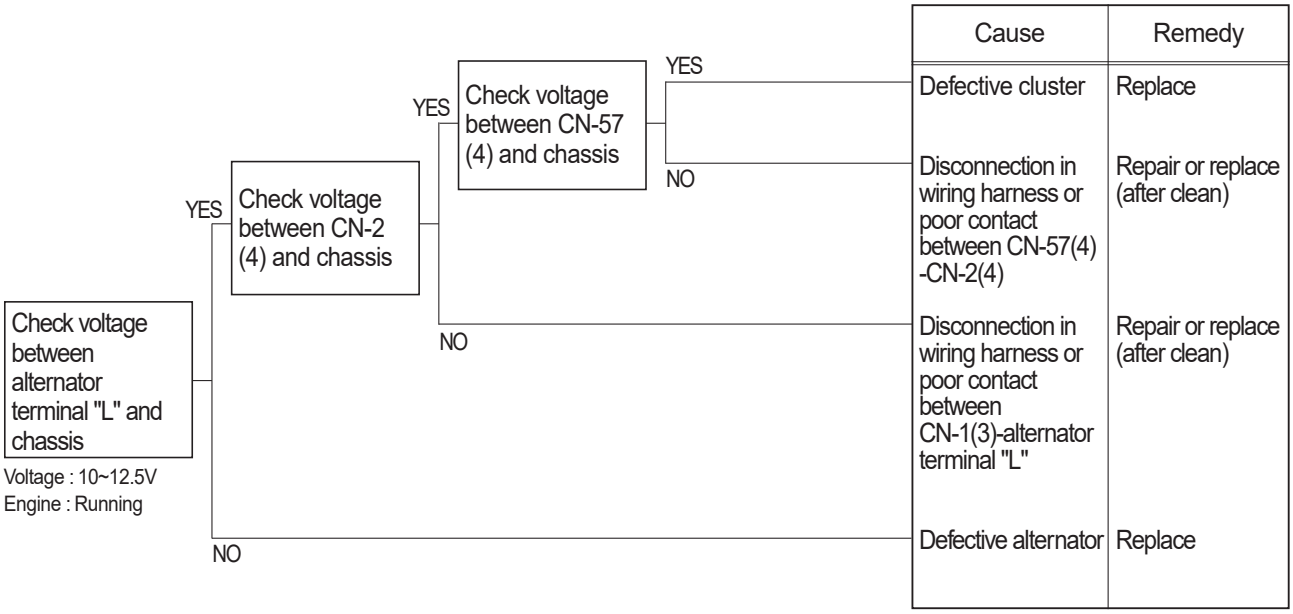
YES	10 ~ 12.5V
NO	0V



60S5TS01

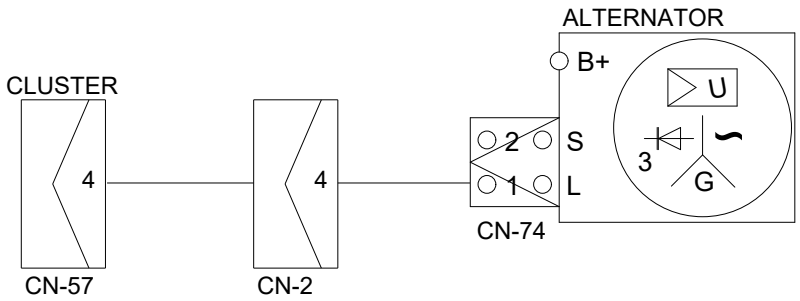
2. BATTERY CHARGING WARNING LAMP LIGHTS UP (starting switch : ON)

· 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

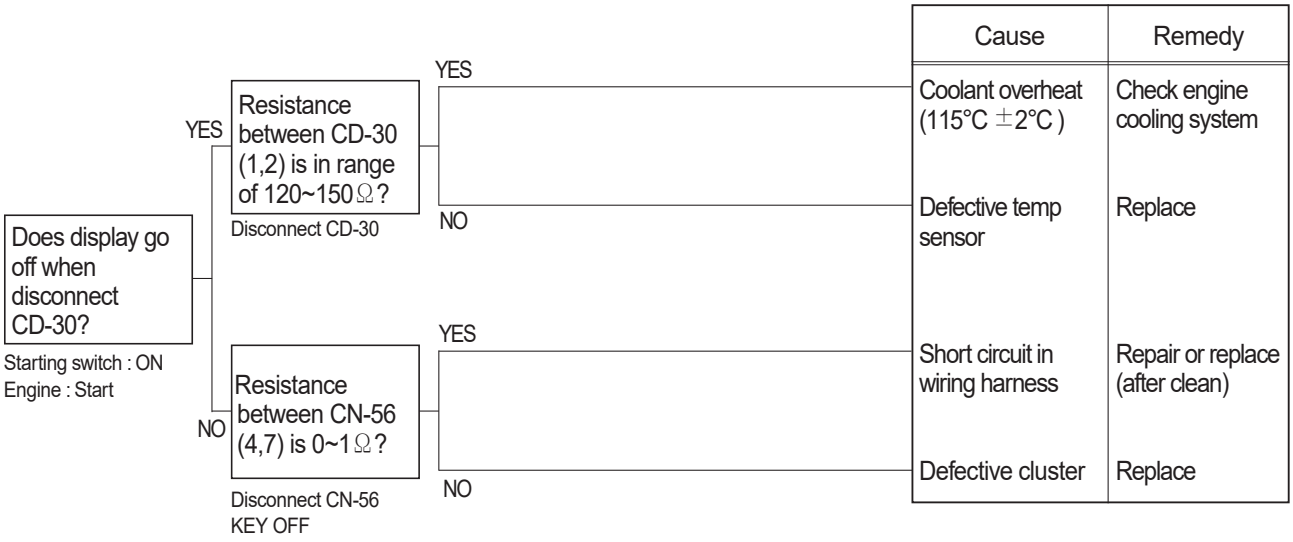
YES	10 ~ 12.5V
NO	0V

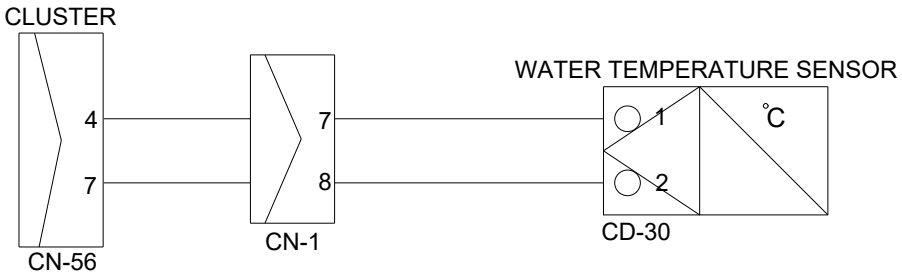


60S5TS02

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.

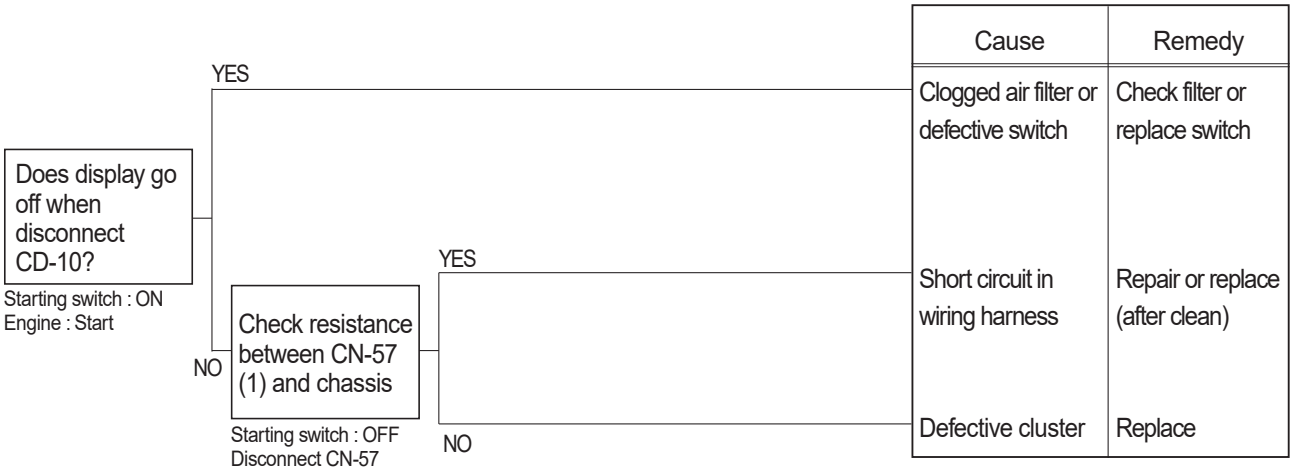




60s5TS03

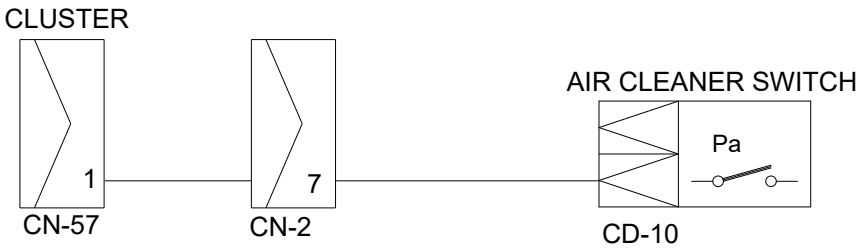
4. WHEN AIR CLEANER WARNING LAMP LIGHTS UP (engine is started)

· 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

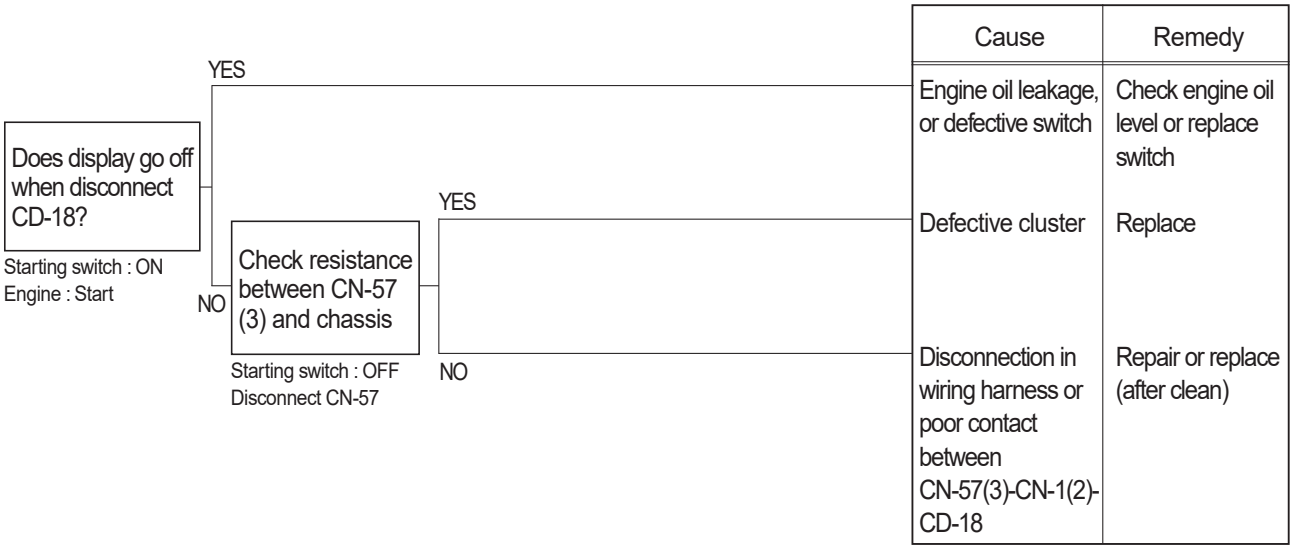
YES	MAX 1Ω
NO	MIN 1MΩ



60S5TS04

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

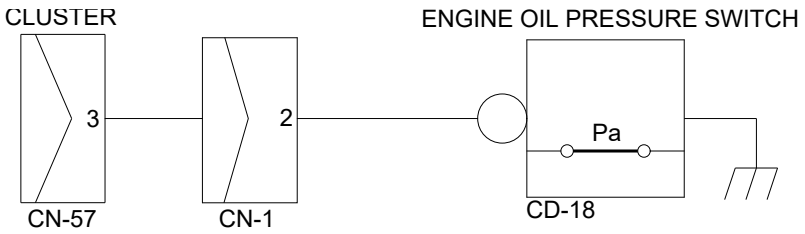
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Engine oil leakage, or defective switch	Check engine oil level or replace switch
Defective cluster	Replace
Disconnection in wiring harness or poor contact between CN-57(3)-CN-1(2)-CD-18	Repair or replace (after clean)

Check resistance

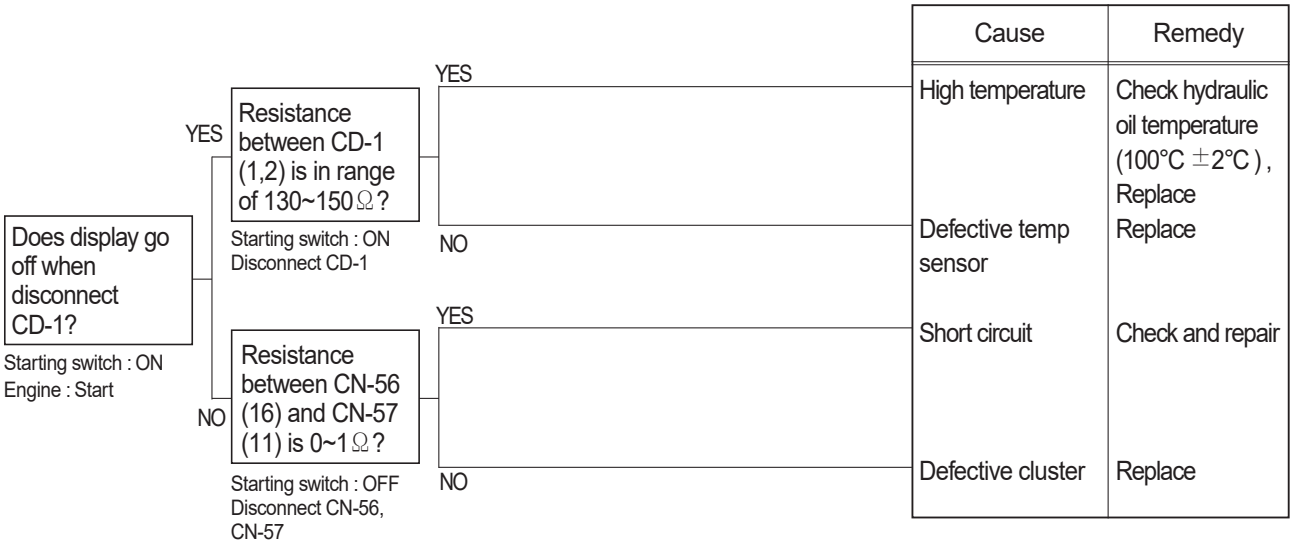
YES	MAX 1Ω
NO	MIN 1MΩ

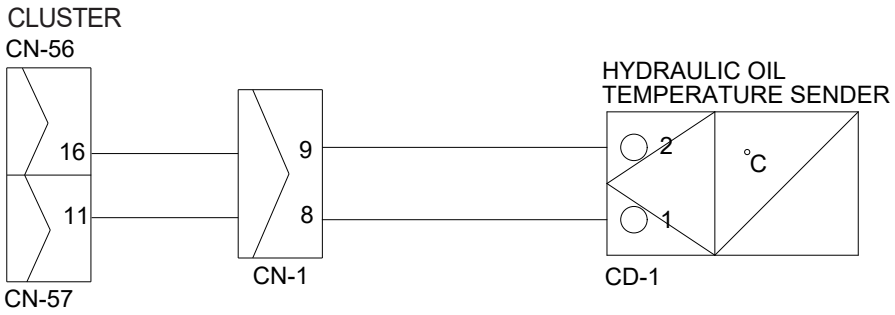


60S5TS05

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.

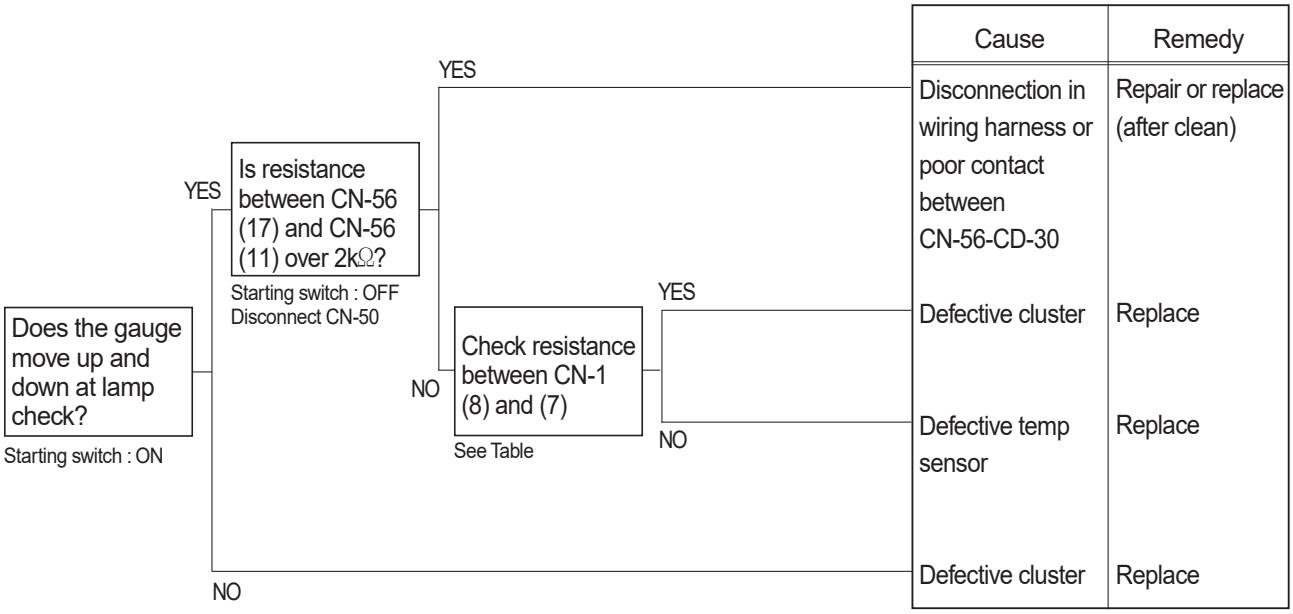




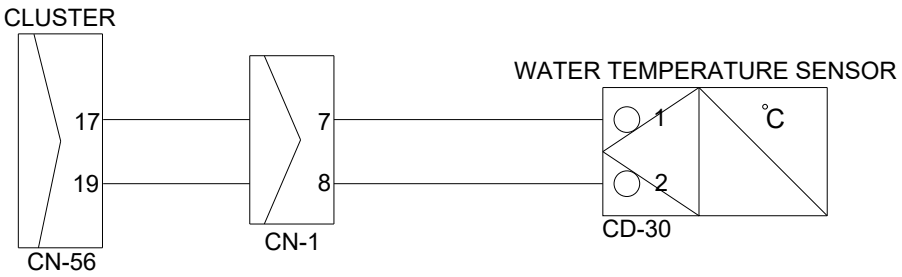
555C95TS15

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.



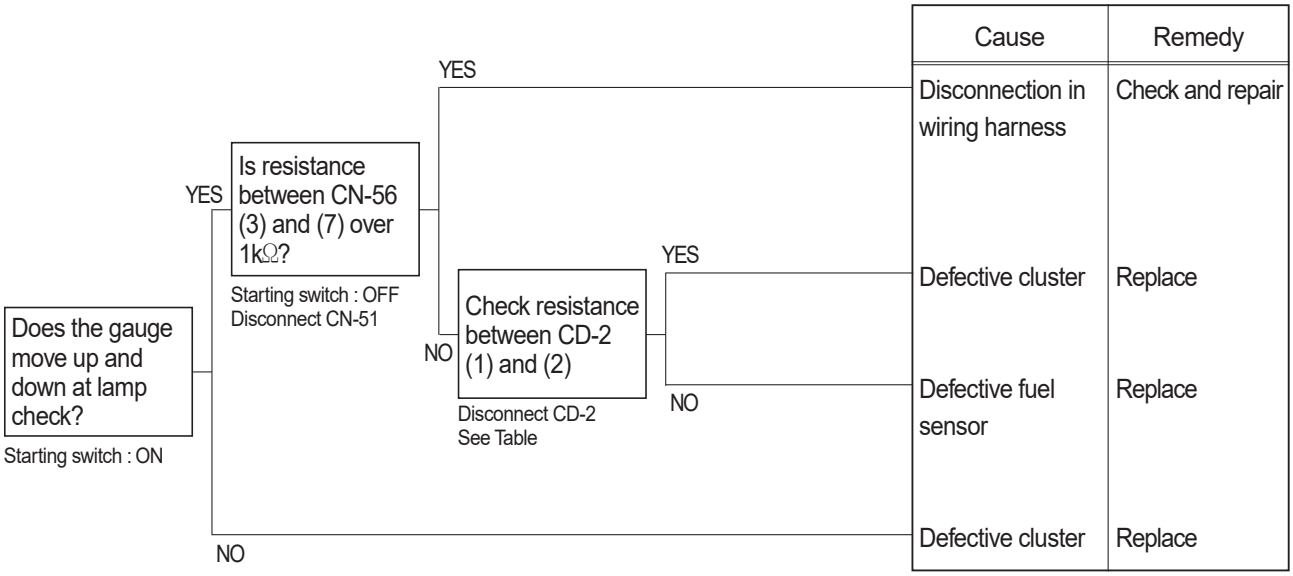
Cause	Remedy
Disconnection in wiring harness or poor contact between CN-56-CD-30	Repair or replace (after clean)
Defective cluster	Replace
Defective temp sensor	Replace
Defective cluster	Replace

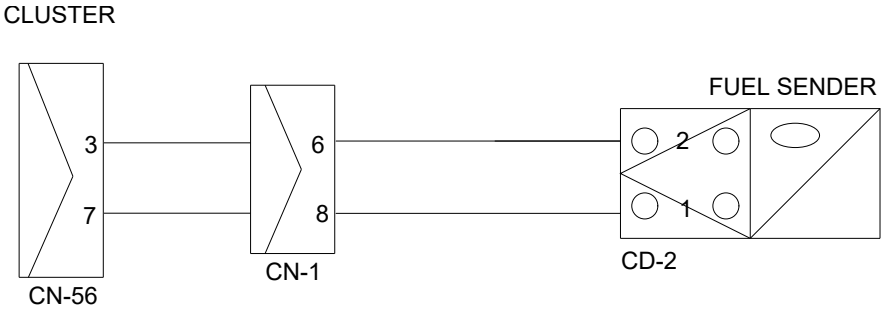


5595TS03

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.

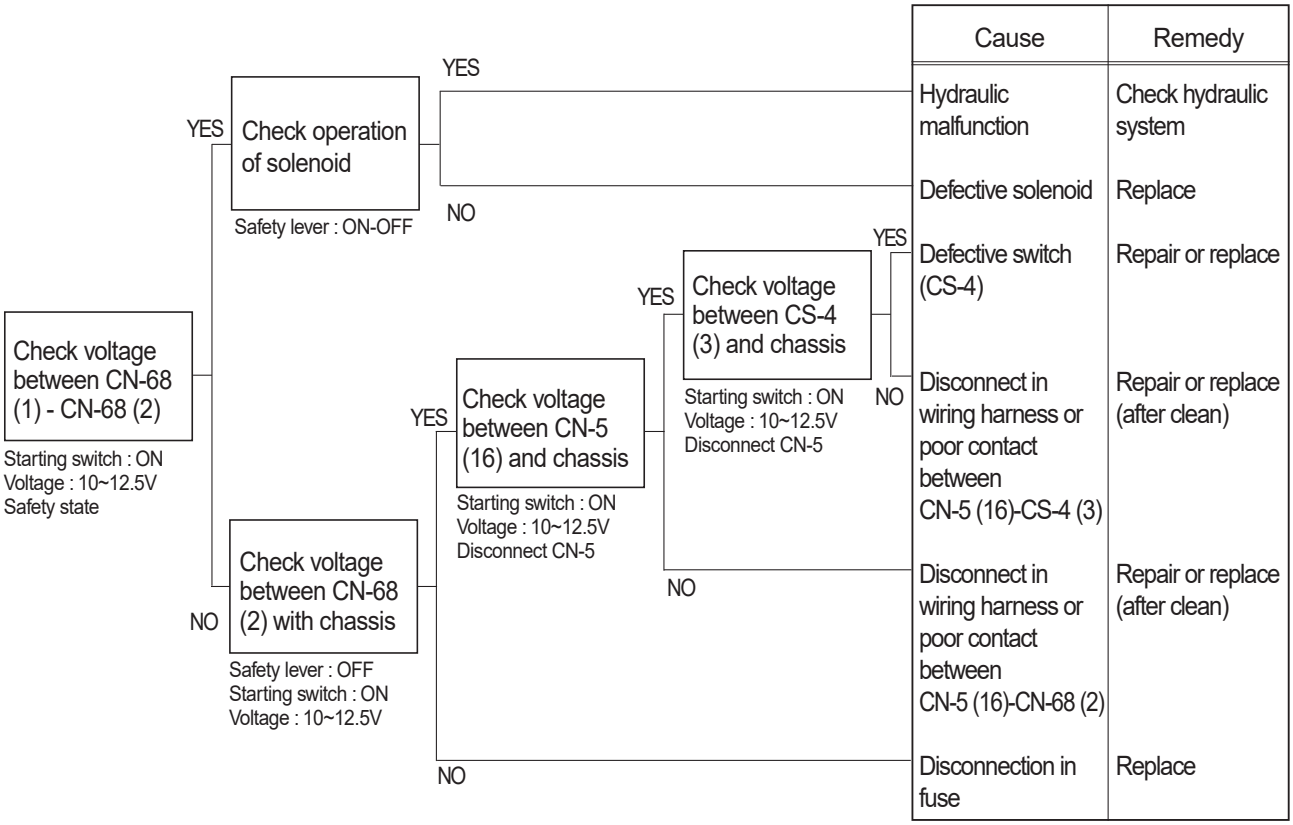


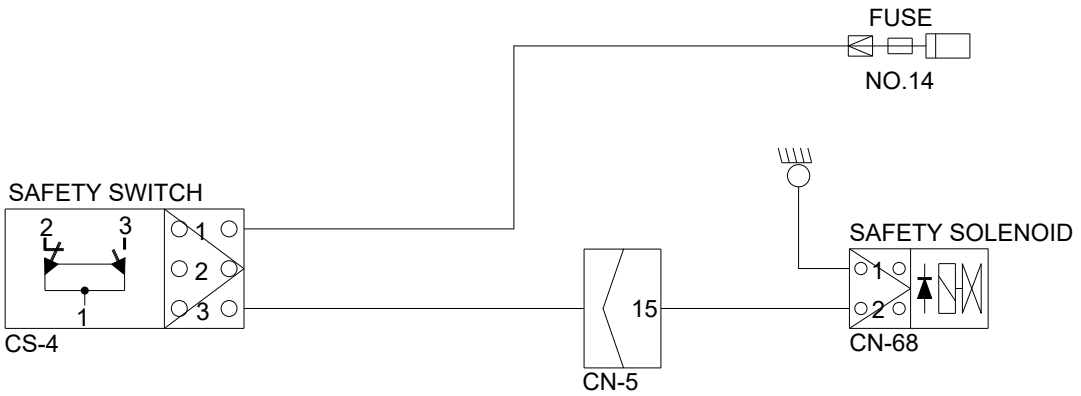


60S5TS06

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.

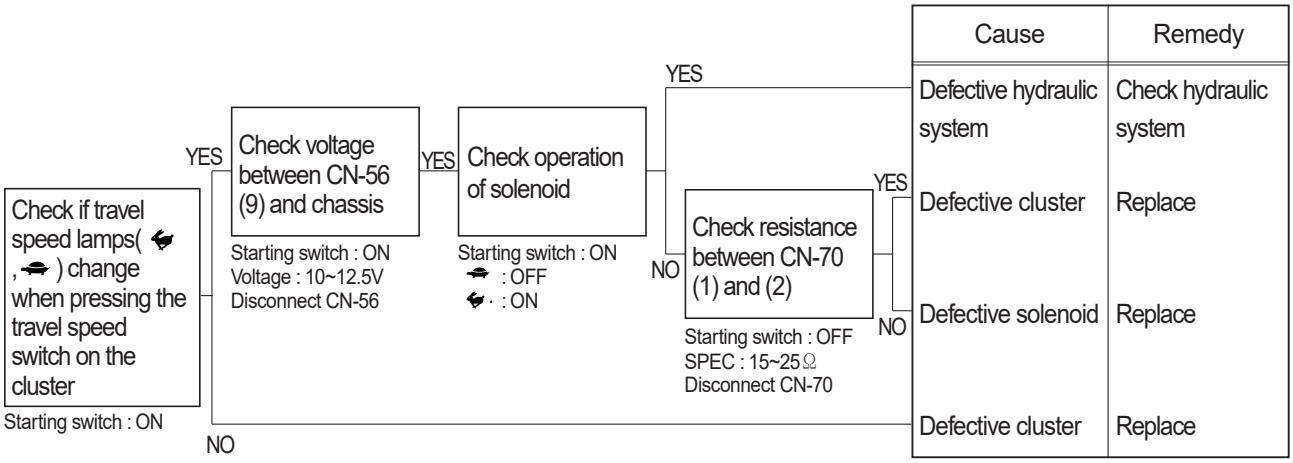


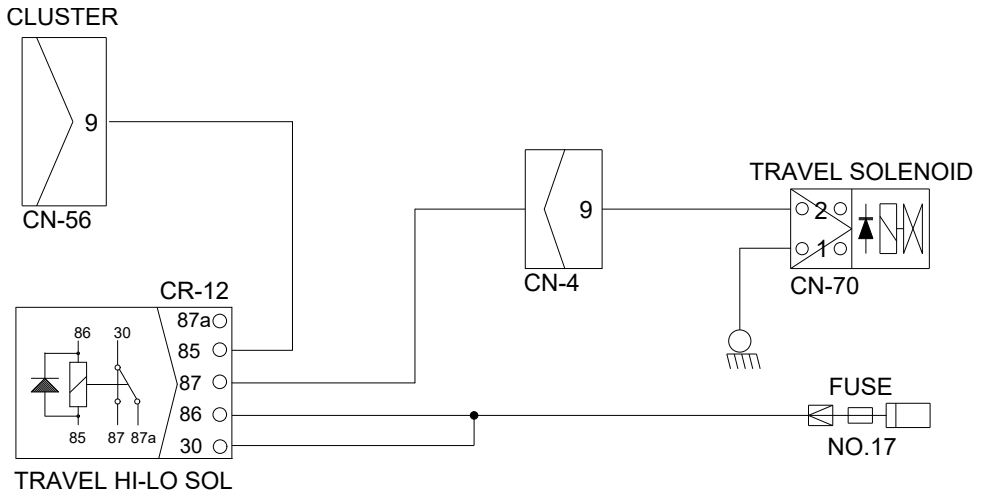


60S5TS07

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.17.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

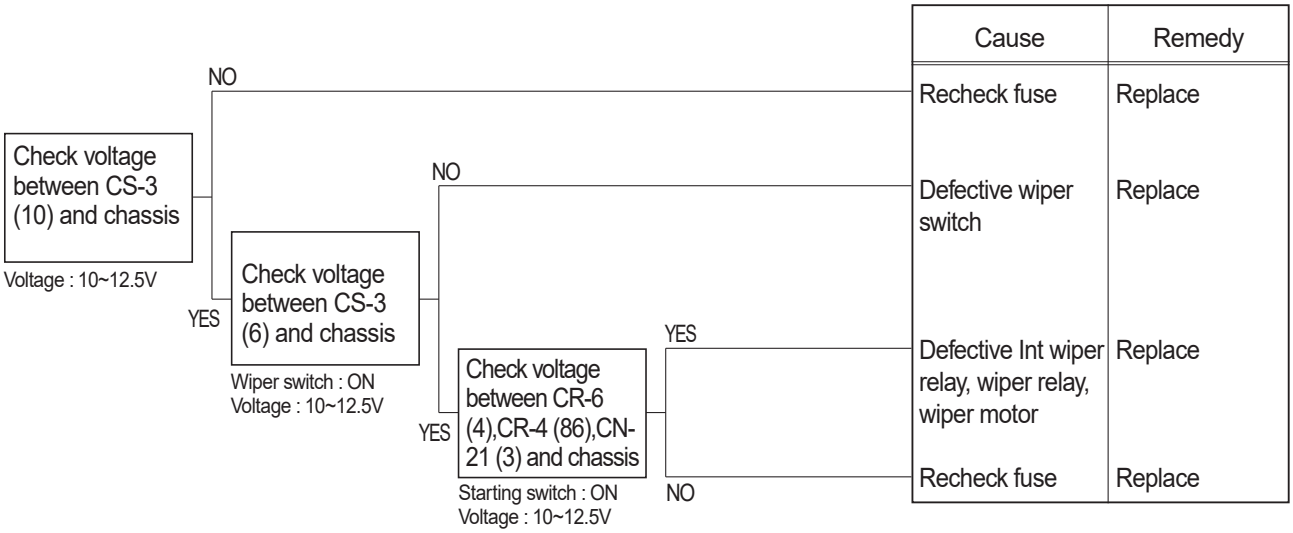


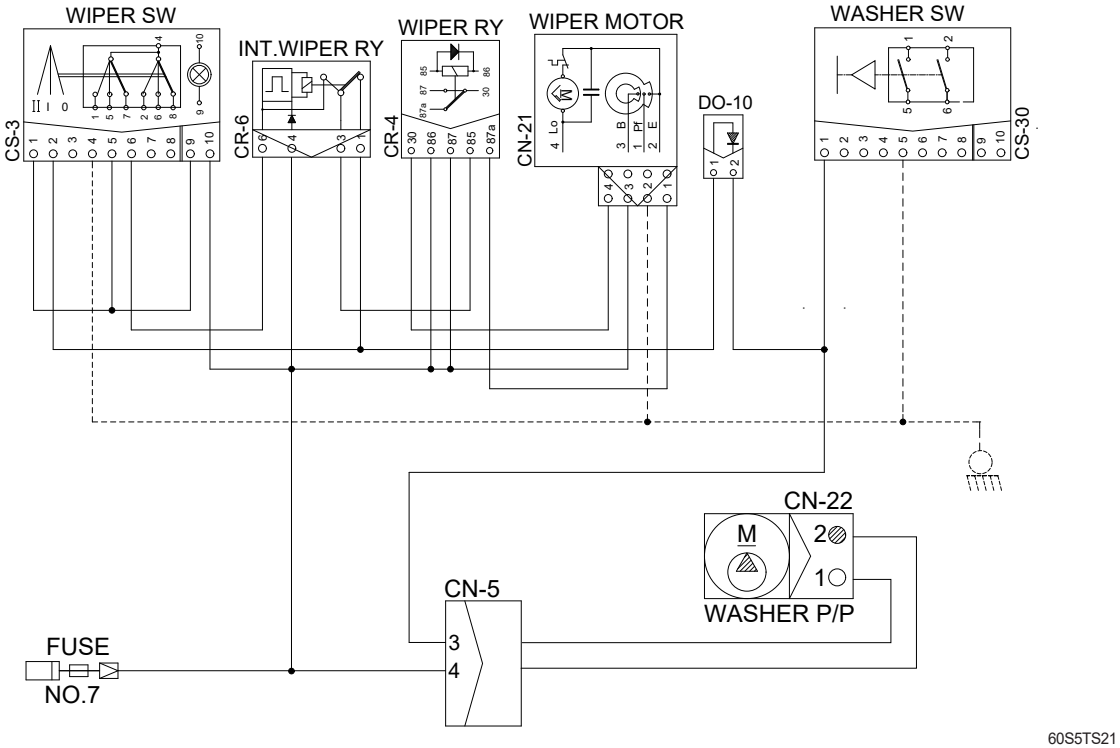


60S5TS08

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

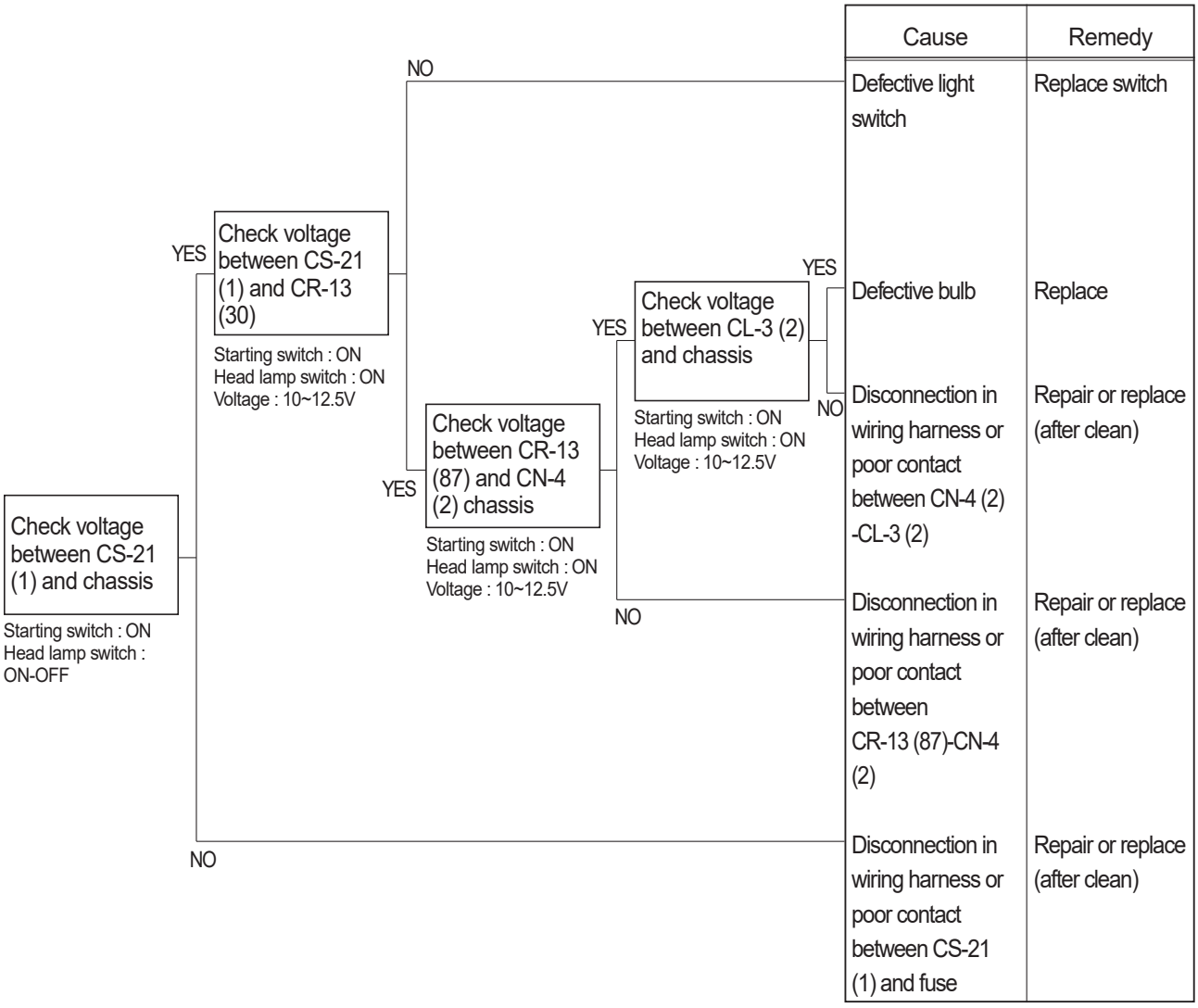
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and the fuse No.13 is not blown out.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.

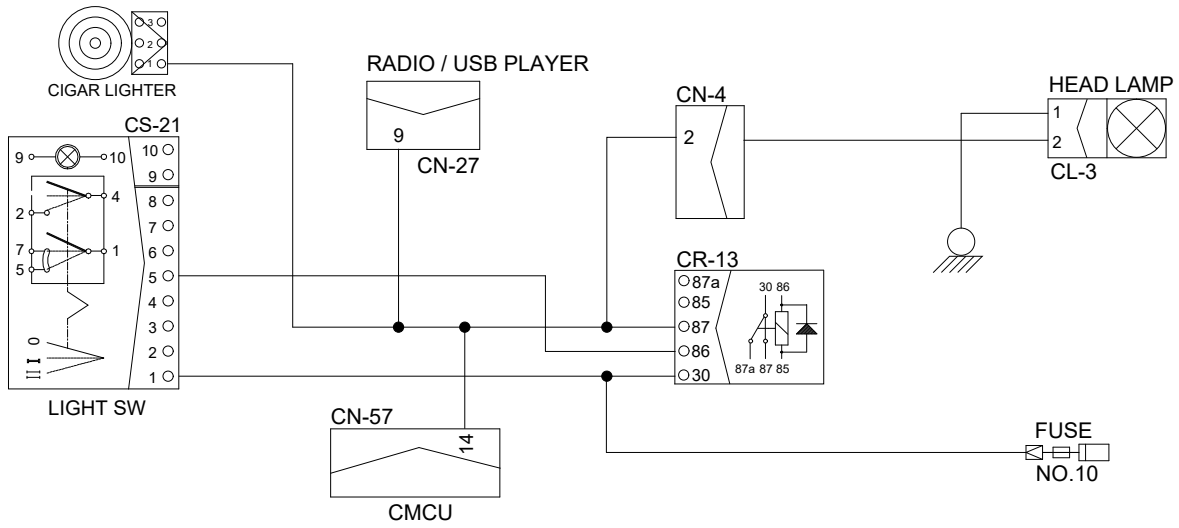




12. WHEN STARTING SWITCH IS TURNED ON, HEAD LAMP DOES NOT LIGHTS UP

· 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.

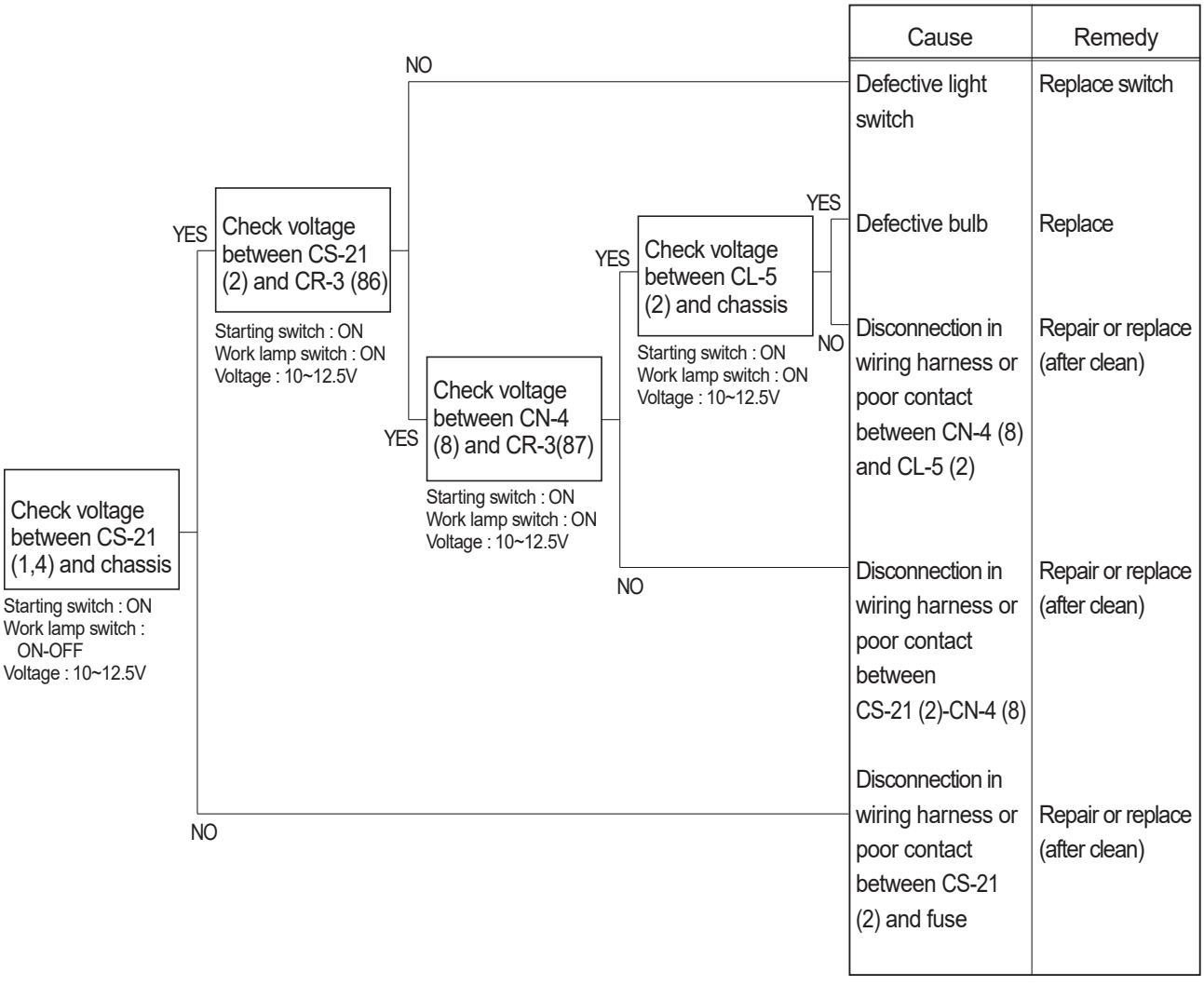


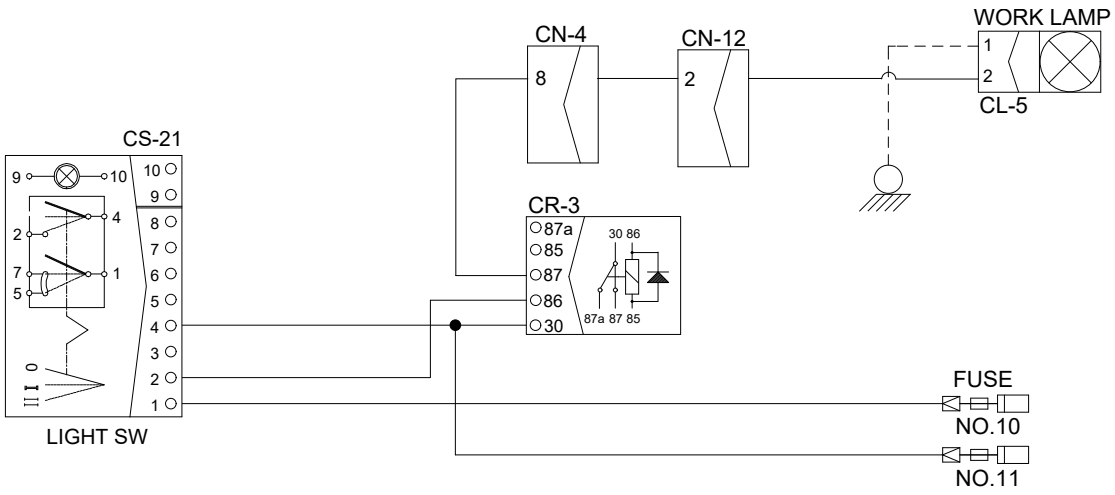


60S5TS22

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

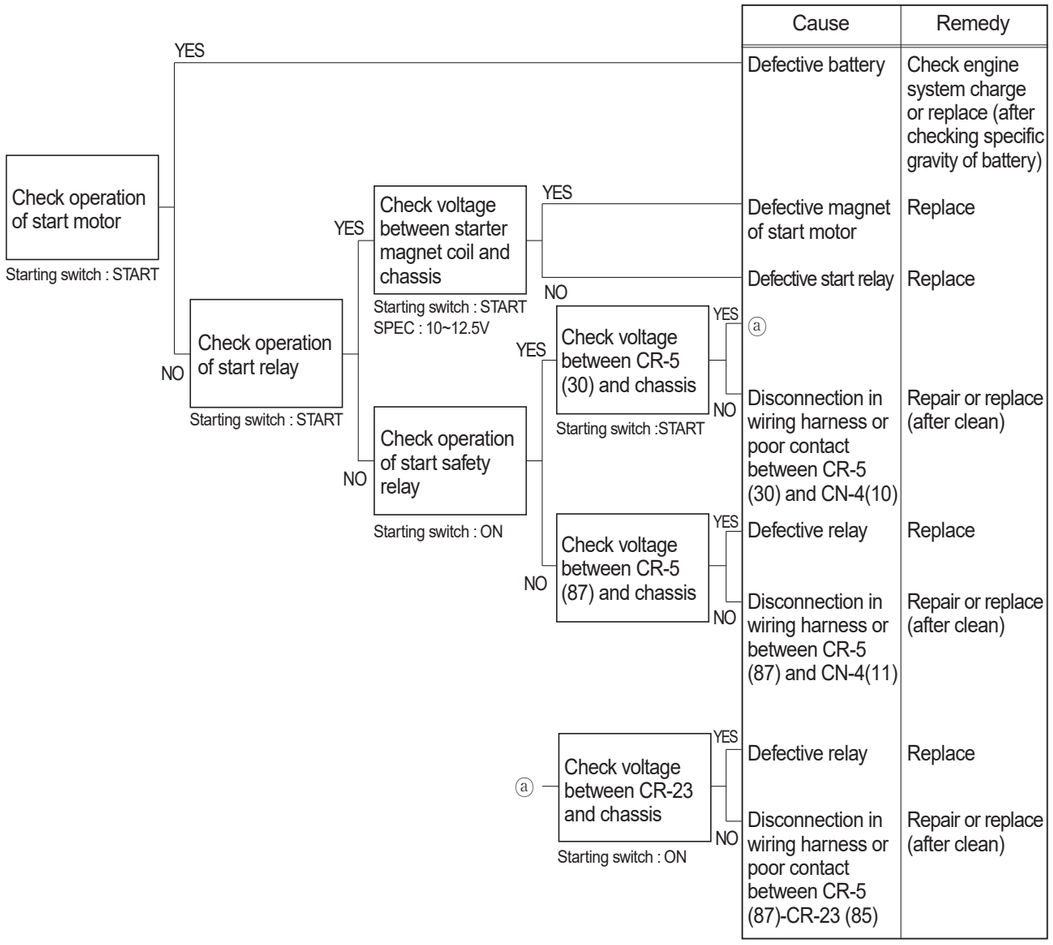


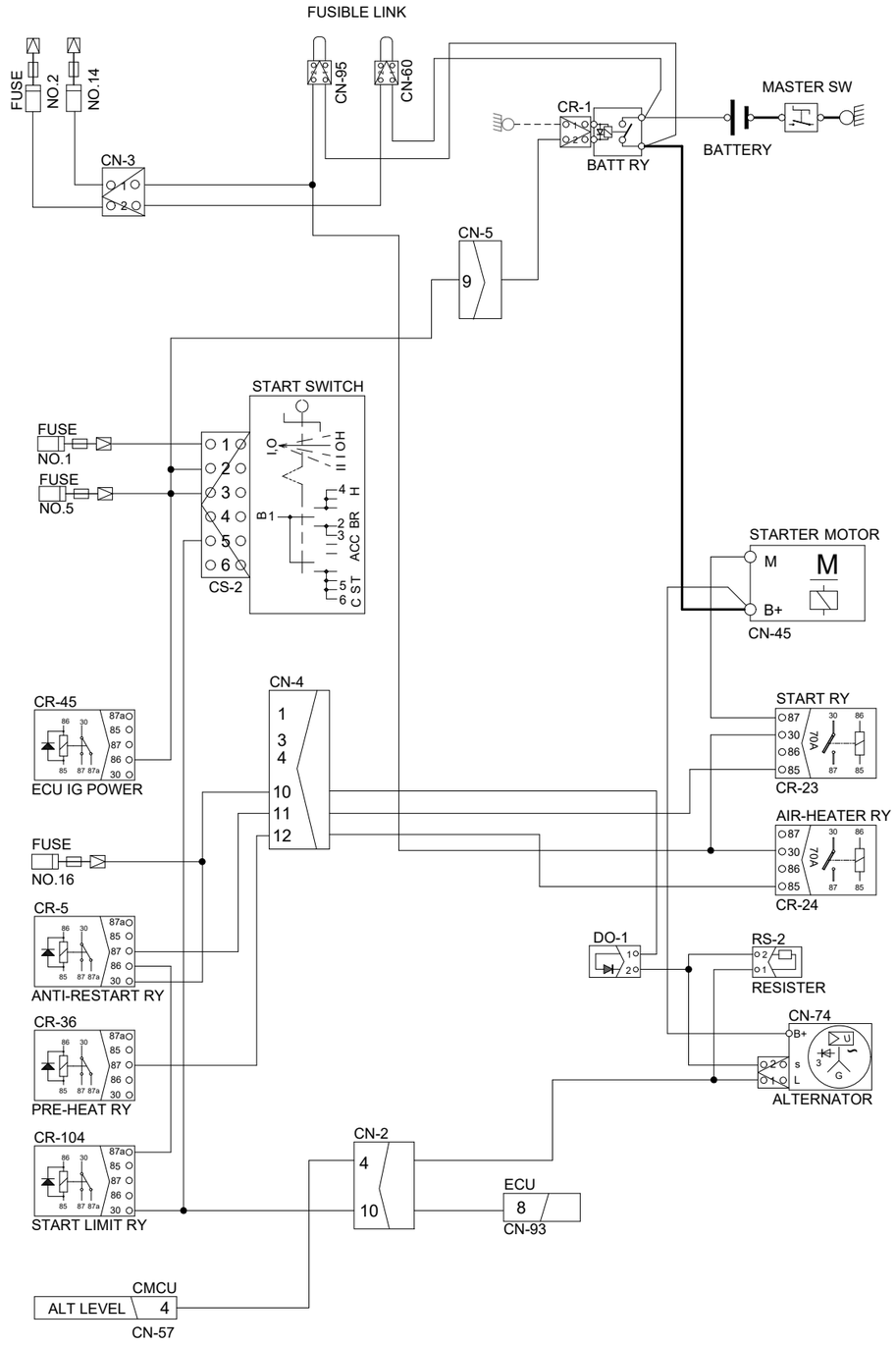


555C95TS23

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.

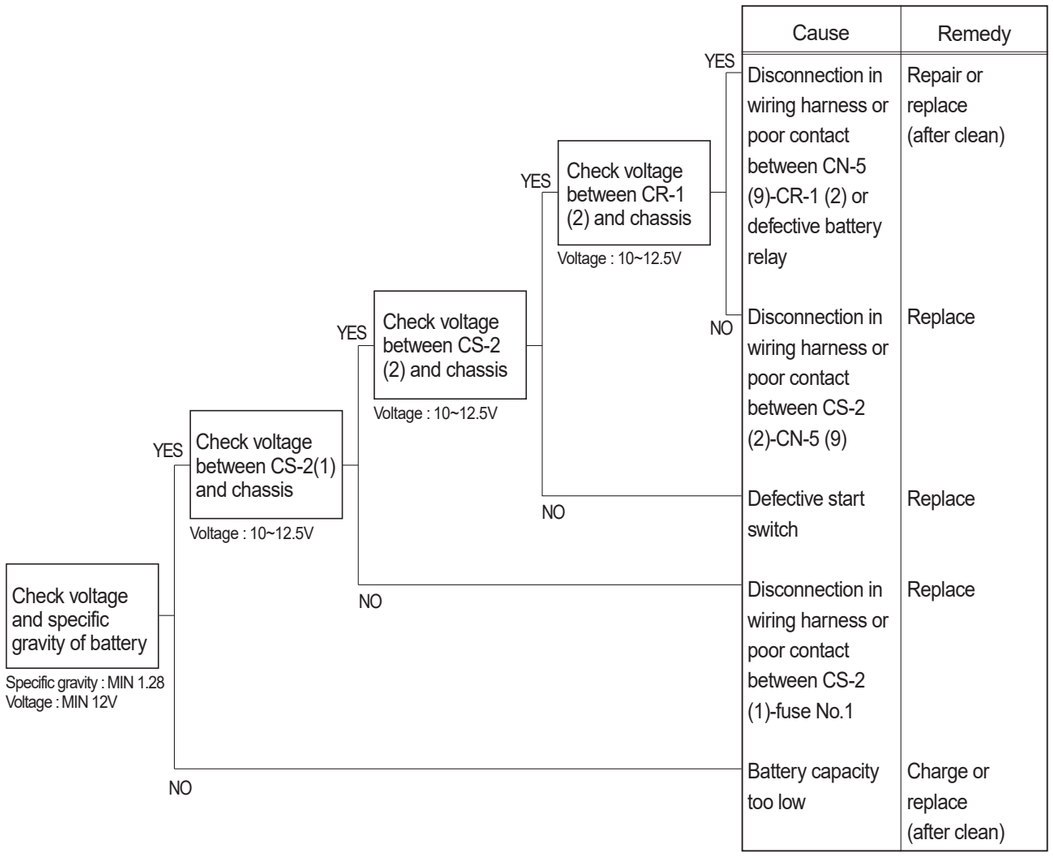




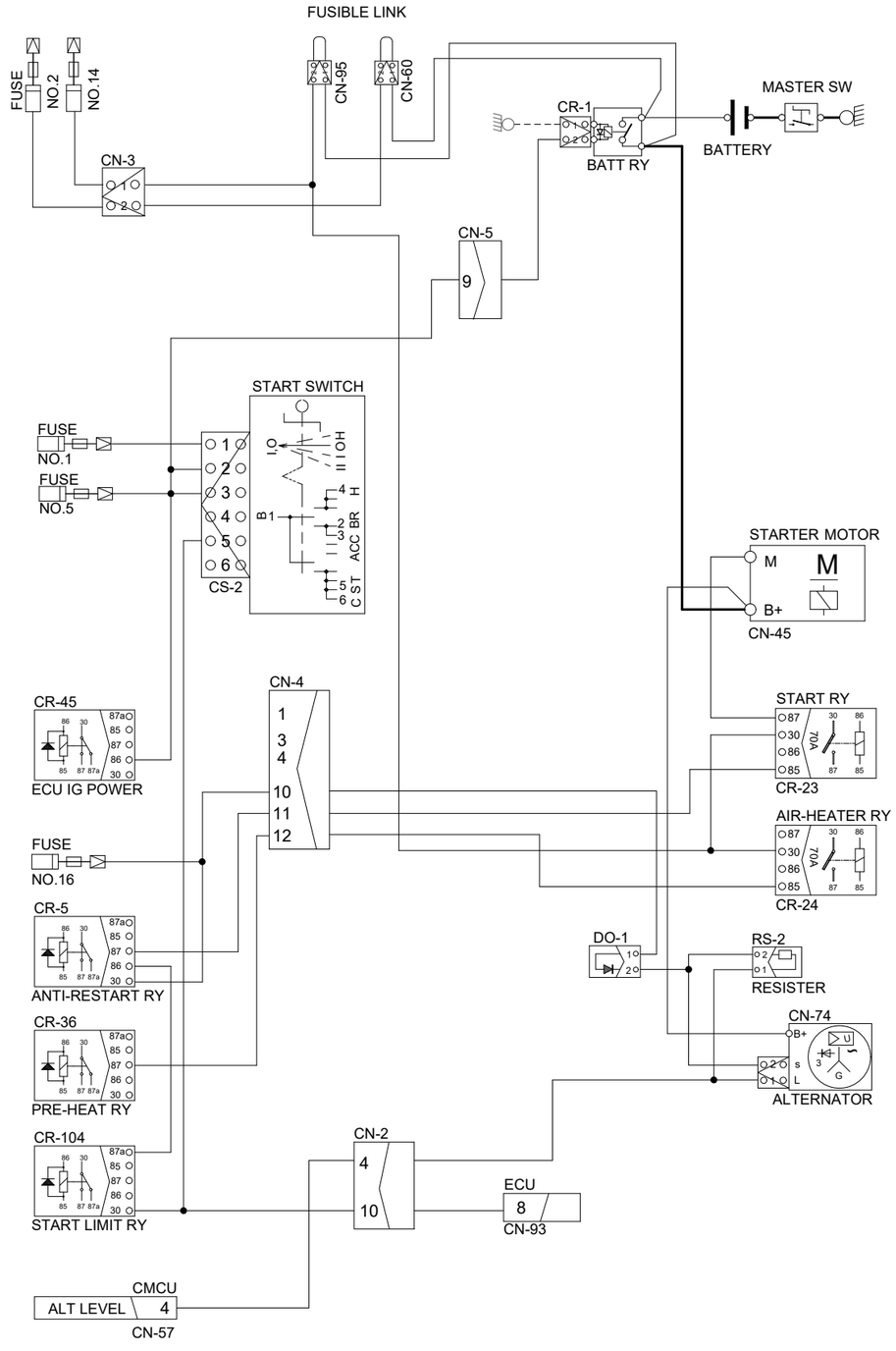
60S5TS20

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 (9)-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 (9)	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)



60S5TS20

SECTION 5 MAINTENANCE STANDARD

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.

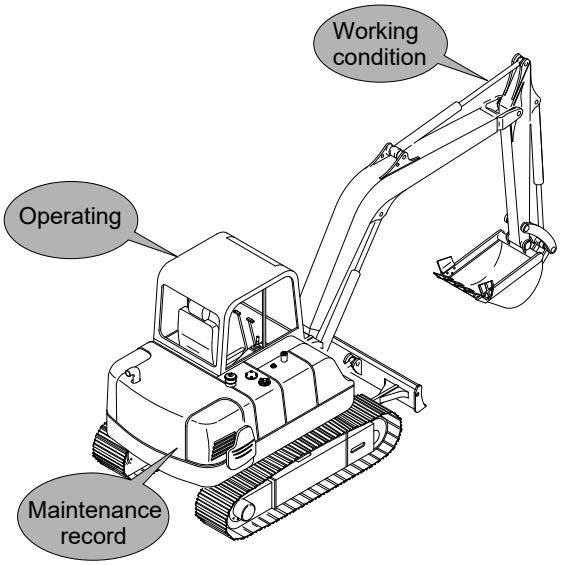
2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

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.

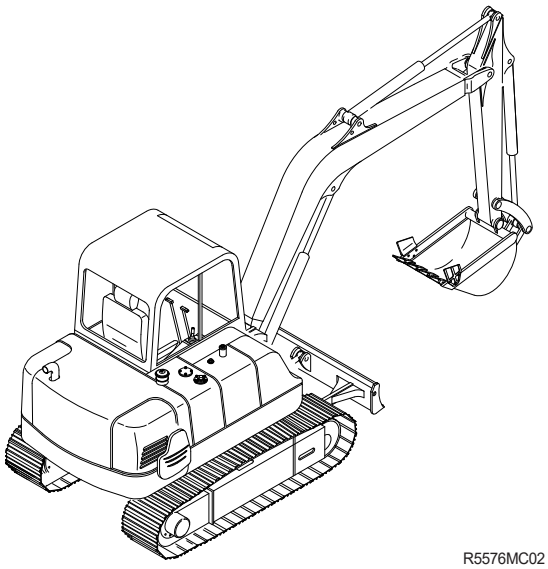


R5576MC01

2. TERMINOLOGY

1) STANDARD

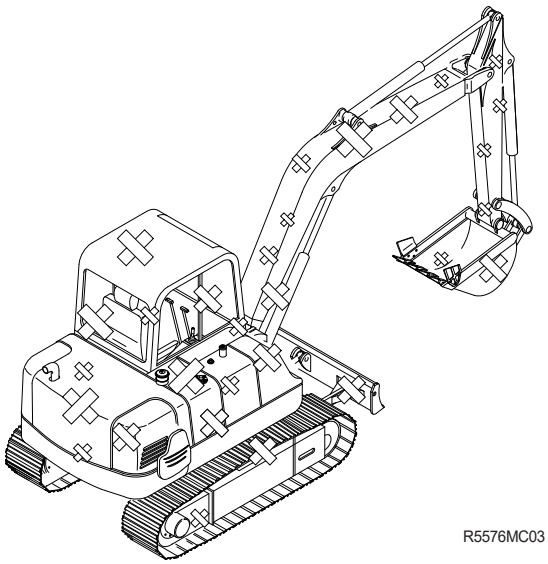
Specifications applied to the brand-new machine, components and parts.



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.

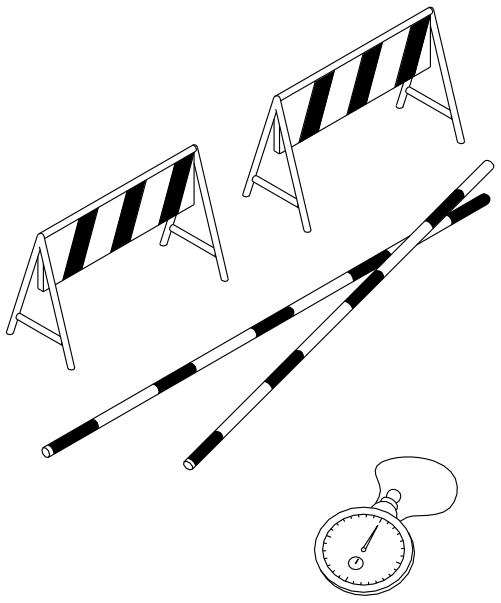
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

(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 : t / rpm

Model	Engine speed	Standard	Remark
HX75S	Low idle	1050±50	
	High idle	2200±50	

3) TRAVEL SPEED

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

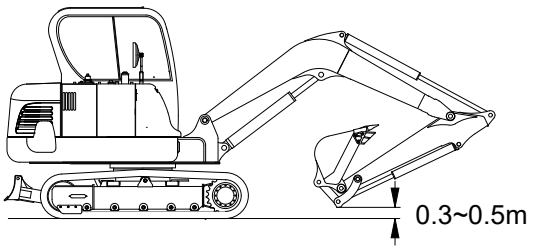
(2) Preparation

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.

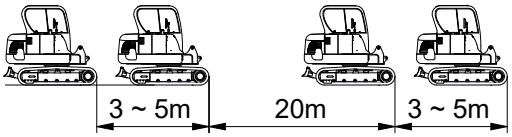
② Before starting either the low or high speed tests, adjust the travel mode switch to the speed to be tested.

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
HX75S	1 Speed	31.6±1.5	41	
	2 Speed	19.1±1.5	23	

4) TRACK REVOLUTION SPEED

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

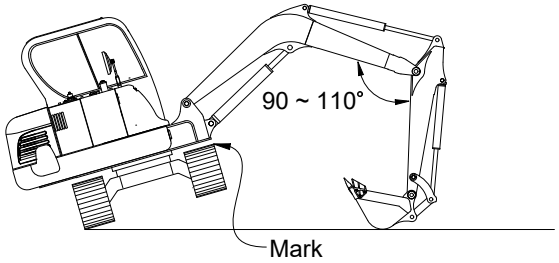
(2) Preparation

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
HX75S	1 Speed	25±2	30
	2 Speed	15±2	20

5) TRAVEL DEVIATION

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

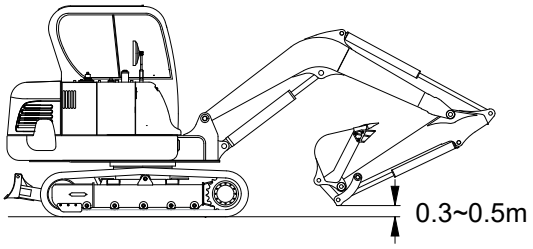
(2) Preparation

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

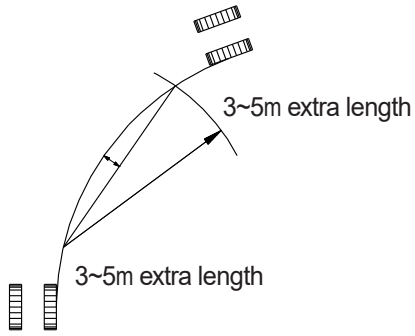
① Measure the amount of mistracking at high and low travel speeds.

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
HX75S	200 below	240	

6) SWING SPEED

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

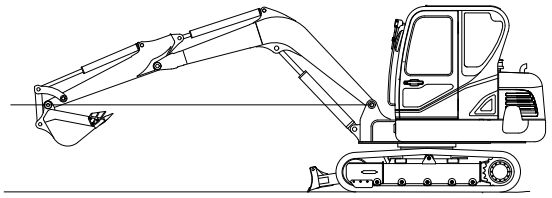
(2) Preparation

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

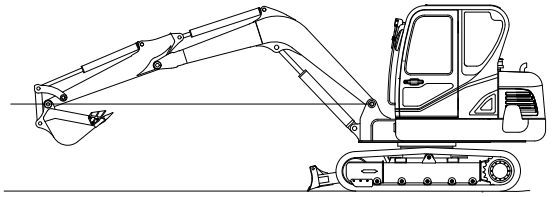
The time required for 2 swings should meet the following specifications.

Unit : Seconds / 2 revolutions

Model	Standard	Maximum allowable	Remarks
HX75S	16.4±0.8	20	

7) SWING FUNCTION DRIFT CHECK

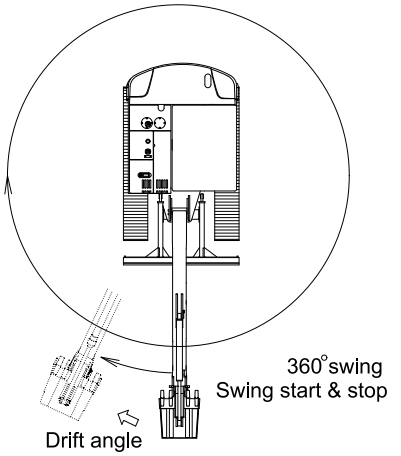
(1) Measure the swing drift on the bearing outer circumference when stopping after a 360° full speed swing.



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.



R5576MC08

(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.

(4) Evaluation

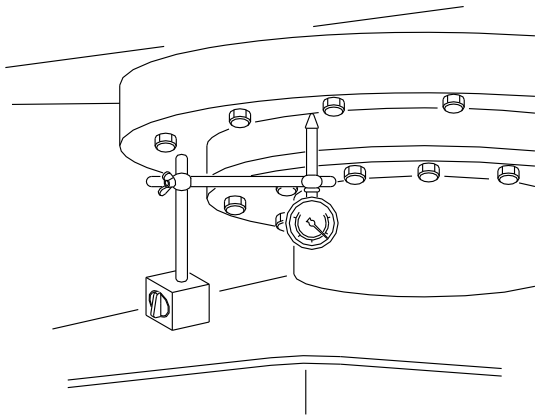
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Standard	Maximum allowable	Remarks
HX75S	40 below	90	

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

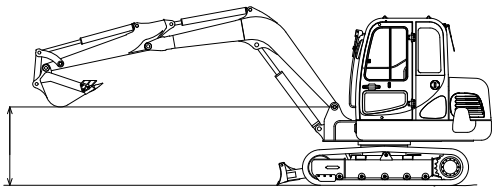
(2) Preparation

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

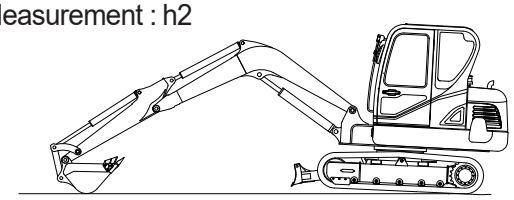
① With the arm rolled out and bucket rolled in, hold the bottom face of the bucket to the same height of the boom foot pin.
Record the dial gauge reading (h1).
② Lower the bucket to the ground and use it to raise the front idler 50 ㎝.
Record the dial gauge reading (h2).
③ Calculate bearing play (H) from 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
HX75S	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.

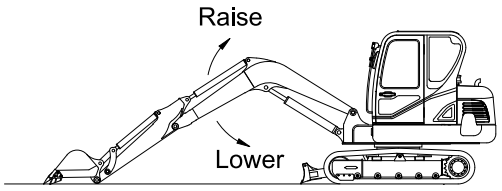
④ Keep the hydraulic oil temperature at 50±5°C.

(3) Measurement

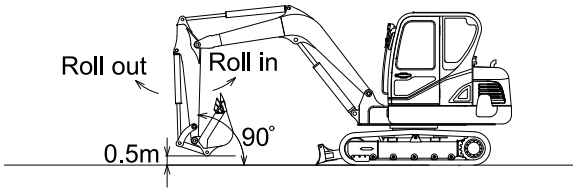
① To measure cylinder cycle times.

- 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.

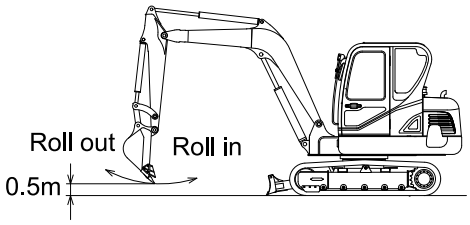
Boom cylinder



Arm cylinder



Bucket cylinder



555C96MC11

- 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
HX75S	Boom raise	2.6±0.3	3.2	
	Boom lower	2.2±0.3	2.8	
	Arm in	2.2±0.3	2.8	
	Arm out	2.1±0.3	2.7	
	Bucket load	2.1±0.3	2.7	
	Bucket dump	1.9±0.3	2.5	
	Dozer up (raise)	2.0±0.3	2.3	
	Dozer down (lower)	2.4±0.3	2.7	

10) DIG FUNCTION DRIFT CHECK

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

(2) Preparation

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

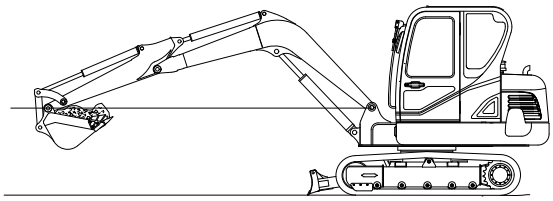
· $W = M^3 \times 1.5$
Where :
M^3 = Bucket heaped capacity (m^3)
1.5 = Soil specific gravity

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

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

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

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



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
HX75S	Boom cylinder	10below	20	
	Arm cylinder	10below	20	
	Bucket cylinder	40below	60	

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
HX75S	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.

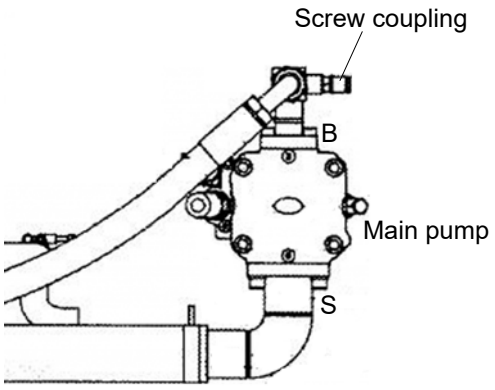
Unit : mm

Model	Kind of lever	Standard	Maximum allowable	Remarks
HX75S	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 the screw coupling on the pilot pump delivery port (B) 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.



60S7MA14

(2) Measurement

① Measure the primary pilot pressure.

(3) Evaluation

The average measured pressure should meet the following specifications:

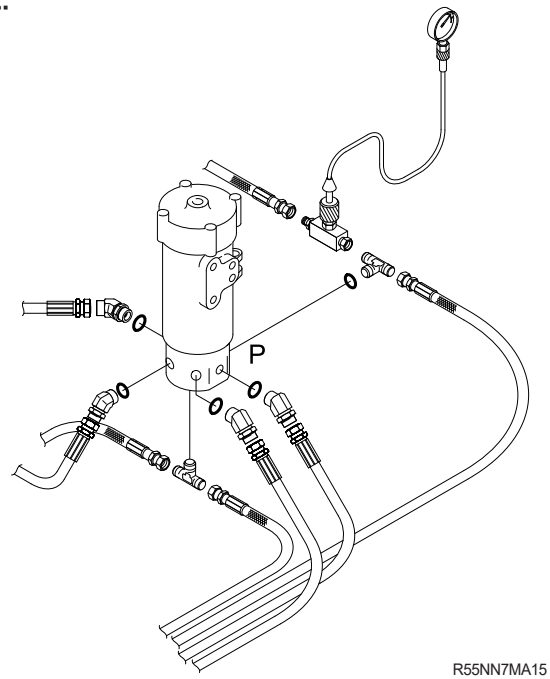
Unit : kgf / cm²

Model	Standard	Remarks
HX75S	35±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±5°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.

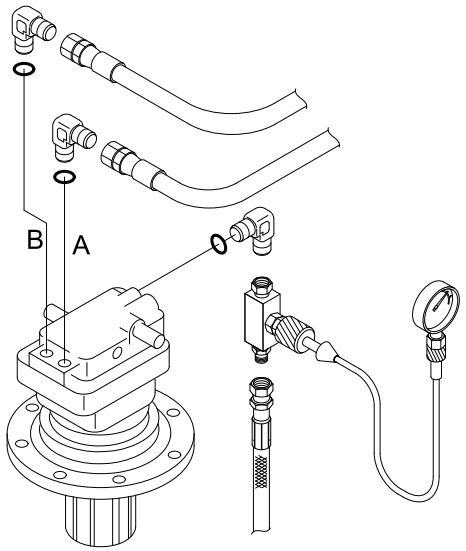
Unit : kgf / cm^2

Model	Travel speed mode	Standard	Maximum allowable	Remarks
HX75S	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.



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(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.

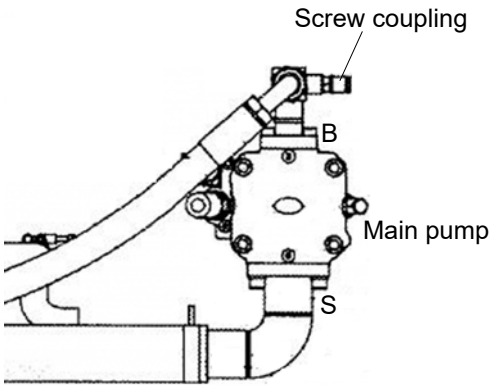
Unit : kgf / cm^2

Model	Description	Standard	Remarks
HX75S	Brake disengaged	20~40	
	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, loosen the screw coupling on the pilot pump delivery port (B) 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.



60S7MA14

(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 / cm²

Model	Engine speed	Standard	Allowable limits	Remarks
HX75S	High idle	20±5	-	

17) SYSTEM PRESSURE REGULATOR RELIEF SETTING

(1) Preparation

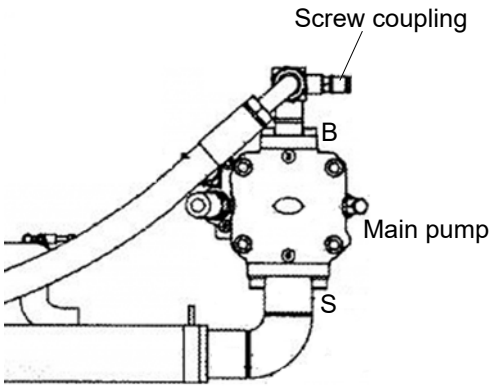
① Stop the engine.

② Push the pressure release button to bleed air.

③ To measure the system relief pressure, install pressure gauge assembly on main pump gauge port (B).

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

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



60S7MA14

(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
HX75S	Boom, Arm, Bucket	300±10
	Travel	275±10
	Swing	210±10

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.

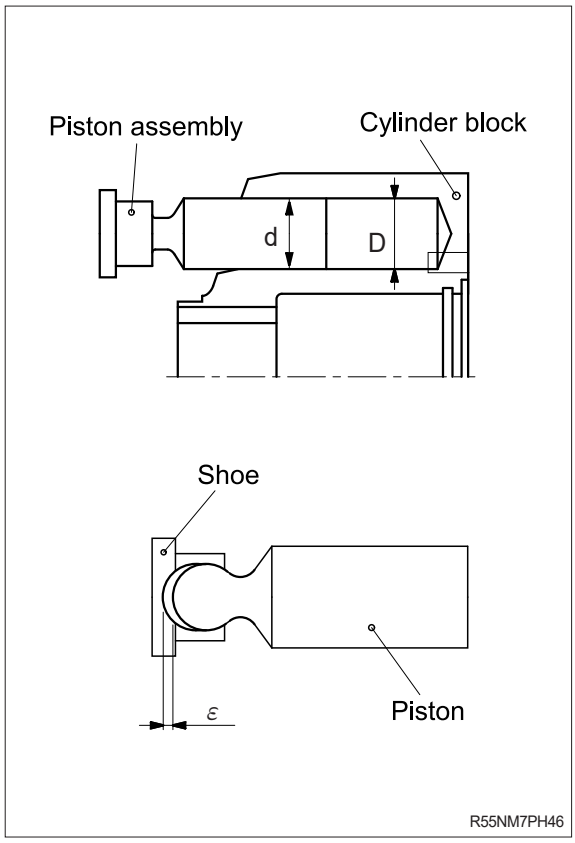
1) PISTON ASSEMBLY AND CYLINDER BLOCK

(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

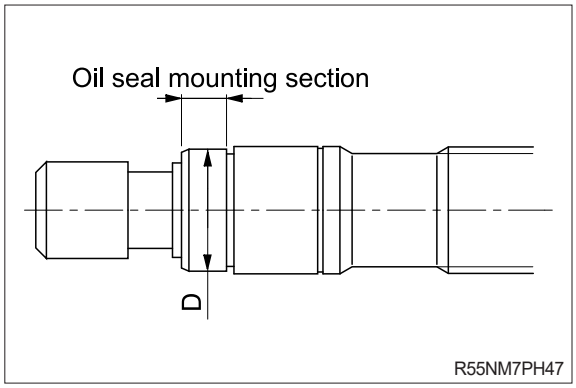
2) PISTON SHOE AND PISTON

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



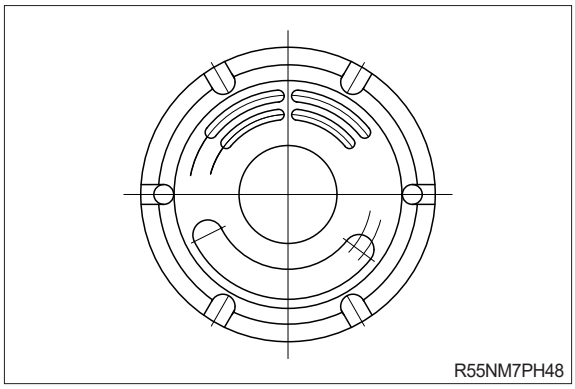
3) SHAFT

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



4) CONTROL PLATE

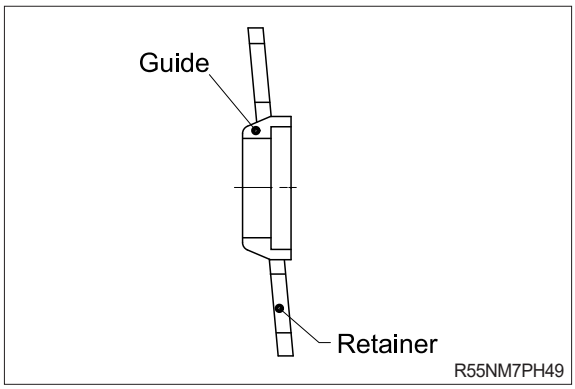
(1) Check the slide surface for any damage. When the damage is large, replace the plate with new one.



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.

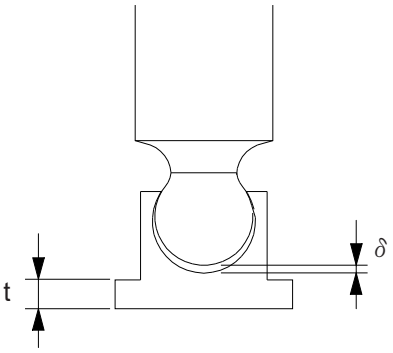
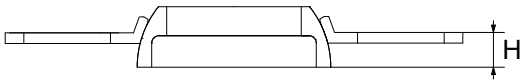


2. MAIN CONTROL VALVE

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	

4. TRAVEL MOTOR

1) MAINTENANCE STANDARD FOR TRAVEL MOTOR

Travel motors basically don't require maintenance except changing the reducer lubricant. Don't disassemble the motor unless there are problem with it. Refer to the following standards for parts (kits) replacement.

(1) Reducer

No.	Part name	Point to be checked	Standard	Action
1	Body (internal gear)	Engaging tooth surface with B1 and B2 gears	No pitching with 5% or greater (ratio of engaging area to tooth surface) No abnormal damage	Replace
2	Carrier 2	Spline tooth surface	No abnormal damage, wear	Replace whole carrier 2 kit
		Loose of B2 pins	No loose by hand	
3	B1 gears	Tooth surface	No pitching with 5% or greater (ratio of engaging area to tooth surface) No abnormal damage	Replace
		Needle rolling contact surface	No flaking and pitching	
4	B2 gears	Tooth surface	No pitching with 5% or greater (ratio of engaging area to tooth surface) No abnormal damage	Replace whole carrier 2 kit
		Needle rolling contact surface	No flaking and pitching	
5	S1 gear	Tooth surface	No pitching with 5% or greater (ratio of engaging area to tooth surface) No abnormal damage	Replace whole carrier 2 kit
6	S2 gear	Engaging tooth surface with B2 gears	No pitching with 5% or greater (ratio of engaging area to tooth surface) No abnormal damage	Replace
		Spline tooth surface	No abnormal damage, wear	
7	B2 pins	Needle rolling contact surface	No flaking and pitching	Replace whole carrier 2 kit
8	Floating seals	Seat surface	No abnormal damage, wear	Replace
		O-ring surface	No damage, deformation, and hardening	
9	Angular ball bearings	Rolling contact surface	No abnormal damage, flaking	Replace
10	Needles	Rolling contact surface	No flaking and pitching	Replace whole carrier 2 kit
11	O-rings	Surface, hardness	No damage, deformation, and hardening	Replace

(2) Hydraulic valve and motor

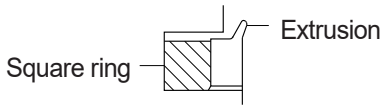
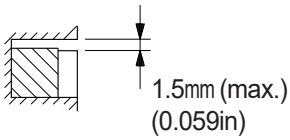
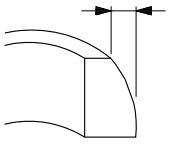
No.	Part name	Point to be checked	Standard	Action
12	Body 1	Spool sliding contact surface	No abnormal damage, wear	Relpace whole body 1 kit
13	Counter valve spool Two-speed spool Shuttle spool	Body 1 sliding contact surface	No abnormal damage, wear	Relpace whole body 1 kit
14	Body 2	Spline tooth surface	No abnormal damage, wear	Replace whole body 2 kit
		Control piston sliding contact surface	No abnormal damage, wear Clearance between piston and body 2 is 0.023 mm or smaller	
		Swash plate installaion surface	No abnormal damage, wear	
		Ball sliding contact surface	No abnormal damage, wear	
15	Shaft	Spline tooth surface	No abnormal damage, wear	Replace shaft kit
		Oil seal sliding contact surface	No abnormal damage, wear (0.025 mm or greater)	
16	Cylinder barrel	Piston sliding contact surface	No abnormal damage, wear Clearance between piston and cylinder barrel is 0.030 mm or smaller	Replace cylinder barrel kit
		Valve place sliding contact surface	No abnormal damage, wear (0.020 mm or greater)	Lap or replace cylicder barrel kit
17	Valve plate	Cylinder barrel sliding contact surface	No abnormal damage, wear (0.020 mm or greater)	Lap or replace cylicder barrel kit
18	Pistons Shoes	Cylinder barrel sliding contact surface	No abnormal damage, wear (0.020 mm or greater)	Replace cylinder barrel kit
		Swash plate sliding contact surface	No abnormal damage, wear (0.020 mm or greater)	Lap or replace cylicder barrel kit
		Loose of shoe calking part	Loose is smaller than 0.3 mm	Replace cylinder barrel kit
19	Shoe holder	Barrel holder sliding contact surface	No abnormal damage, wear	Replace cylinder barrel kit
20	Barrel holder	Spline tooth surface	No abnormal damage, wear	Replace cylinder barrel kit
		Shoe holder sliding contact surface	No abnormal damage, wear	
21	Swash plate	Shoe sliding contact surface	No abnormal damage, wear (0.020 mm or greater)	Lap or replace
		Ball sliding contact surface	No abnormal damage, wear	Replace
22	Control piston	Body 2 sliding contact surface	Clearance between piston and body 2 is 0.023 mm or smaller	Replace body 2 kit
23	Oil seal	Lip surface	No abnormal damage, wear and deformation	Replace
24	Ball bearing	Rolling contact surface	No abnormal damage, flaking	Replace
25	Springs	Surface	No crack	Replace
26	O-rings	Surface and hardness	No damage, deformation, and hardening	Replace

2) FAILURE DIAGNOSIS OF TRAVEL MOTOR

Failure detail	Major causes	Countermeasure
Doesn't start	Operating defect in hydraulic equipment except travel motors	Inspect and repair or replace each equipment. Check that normal working pressure is supplied to the motor inlet port.
	Defect in reducer - Damage of inner parts	Replace the damaged part (kit).
	Defect in hydraulic motor - Oil leakage due to abnormal wear of the sliding parts	Replace the worn part (kit).
	- Damage of inner parts	Replace the damaged part (kit).
	Defect in hydraulic valve - Spool doesn't move Foreign object is caught in the spool sliding part.	Remove the foreign object. In case of much leakage, replace the body 1 kit.
	Choke is clogged	Remove the foreign object.
Doesn't stop or stop slowly	Defect in hydraulic valve - Spool doesn't return Foreign object is caught in the spool sliding part.	Remove the foreign object. In case of much leakage, replace the body 1 kit.
	Choke is clogged.	Remove the foreign object.
	Spring is damaged.	Replace the body 1 kit.
	- Check valve doesn't close due to foreign object being caught on the seat.	Remove the foreign object. In case of much leakage, replace the body 1 kit.
Rotating speed is slow	Prescribed flow rate is not supplied to the motor due to operating defect in the pump.	Inspect and repair or replace the pump.
	Volumetric efficiency declines due to defect in the motor. - Abnormal wear of sliding parts	Replace the worn part (kit).
	Volumetric efficiency declines due to defect in the hydraulic valve. - Abnormal wear of main spool and two speed spool sliding part	Replace body 1 kit.

Failure detail	Major causes	Countermeasure
Doesn't change to two speed	Operating defect in hydraulic equipment except travel motors	Inspect and repair or replace each equipment. Check that normal pressure is supplied to the pilot port.
	Defect in the hydraulic valve	
	- Two speed spool doesn't move due to foreign object being caught in the spool sliding part.	Remove the foreign object. In case of much leakage, replace the body 1 kit.
	- Choke in the two speed pilot line is clogged.	Remove the foreign object.
	Defect in the hydraulic motor	
	- Control piston doesn't move.	
	Foreign object is caught in the piston sliding part.	Remove the foreign object. In case of much leakage, replace the body 2 kit.
	Oil leakage due to abnormal wear of the sliding part.	Replace the worn part (kit).
	Oil leakage due to damage of O-ring located between body 1 and body 2.	Replace the O-ring.
Doesn't change to one speed	Operating defect in hydraulic equipment except travel motors	Inspect and repair or replace each equipment. Check that normal pressure is supplied to the pilot port.
	Defect in the hydraulic valve	
	- Two speed spool doesn't move. Foreign object is caught in the spool sliding part.	Remove the foreign object. In case of much leakage, replace the body 1 kit.
	Damage of spring	Replace the body 1 kit.
	- Choke in the two speed pilot line is clogged.	Remove the foreign object.
Tracking deviation	Same as No.3, 4 and 5	-
Oil leakage	Oil leakage due to damage of O-rings.	
	- Damage of O-ring located in the reducer cover.	Replace the O-ring.
	- Damage of O-rings located between body 1 and body 2.	Replace the O-ring.
	Oil leakage from the floating seals	
	- Abnormal wear of the seat surface or damage of the O-ring.	Replace the floating seal.
	- Pressure in the reducer casing rises due to damage of the oil seal.	Replace the oil seal.

5. TURNING JOINT

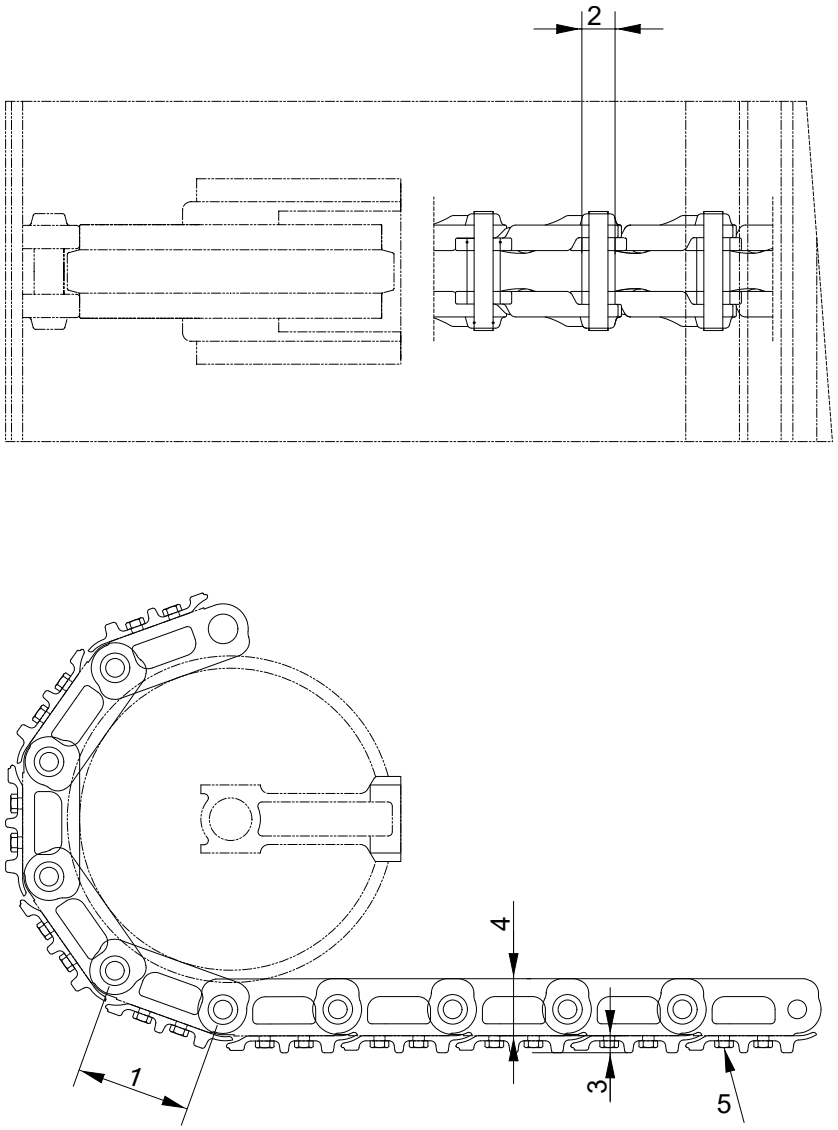
Parts Name		Check Points	Measures
Body, Stem	Sliding surface with sealing sections.	Plating worn or peeled due to seizure or contamination.	Replace
	Sliding surface between body and stem other than sealing section.	· Worn abnormality or damaged more than 0.1 mm (0.0039 in) in depth due to seizure contamination.	Replace
		· Damaged more than 0.1 mm (0.0039 in) in depth.	Smooth with oilstone.
	Sliding surface with thrust plate.	· Worn more than 0.5 mm (0.02 in) or abnormality.	Replace
		· Worn less than 0.5 mm (0.02 in).	Smooth
		· Damage due to seizure or contamination remediable within wear limit (0.5 mm) (0.02 in).	Smooth
Cover	Sliding surface with thrust plate.	· Worn more than 0.5 mm (0.02 in) or abnormality.	Replace
		· Worn less than 0.5 mm (0.02 in).	Smooth
		· Damage due to seizure or contamination remediable within wear limit (0.5 mm) (0.02 in).	Replace
Seal set	-	· Extruded excessively from seal groove square ring. 	Replace
	-	· Slipper ring 1.5 mm (0.059 in) narrower than seal groove, or narrower than back ring. 	Replace
	-	· Worn more than 0.5 mm (0.02 in) ~ 1.5 mm (MAX.) (0.059 in) 	Replace

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.	· Replace or replate
		· Rust is not present on plating.	· Replace or replate
		· Scratches are not present.	· Recondition, replate or replace
	· Rod	· Wear of O.D.	· Recondition, replate or replace
	· Bushing at mounting part	· Wear of I.D.	· Replace
Cylinder tube	· Weld on bottom	· Presence of crack	· Replace
	· Weld on head	· Presence of crack	· Replace
	· Weld on hub	· Presence of crack	· Replace
	· Tube interior	· Presence of faults	· Replace if oil leak is seen
	· Bushing at mounting part	· Wear on inner surface	· Replace
Gland	· Bushing	· Flaw on inner surface	· Replace if flaw is deeper than coating

1. TRACK SHOE

STEEL SHOE SPEC

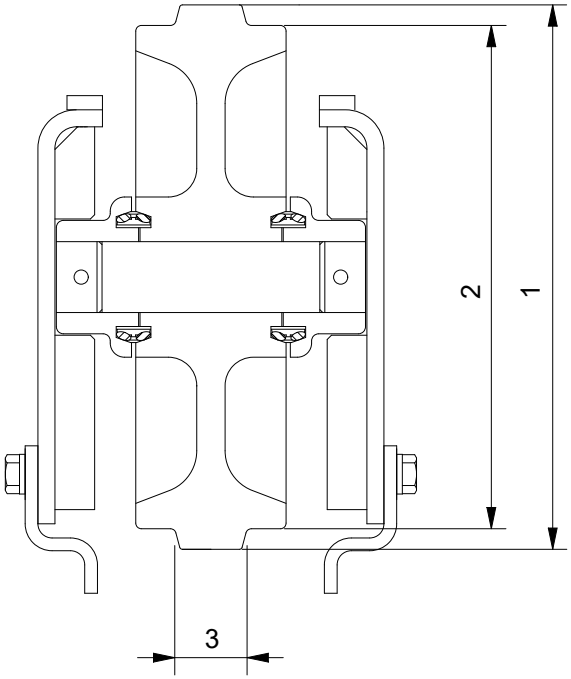


R5576MC16

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 : 17±2.0kgf · m		Retighten

2. IDLER

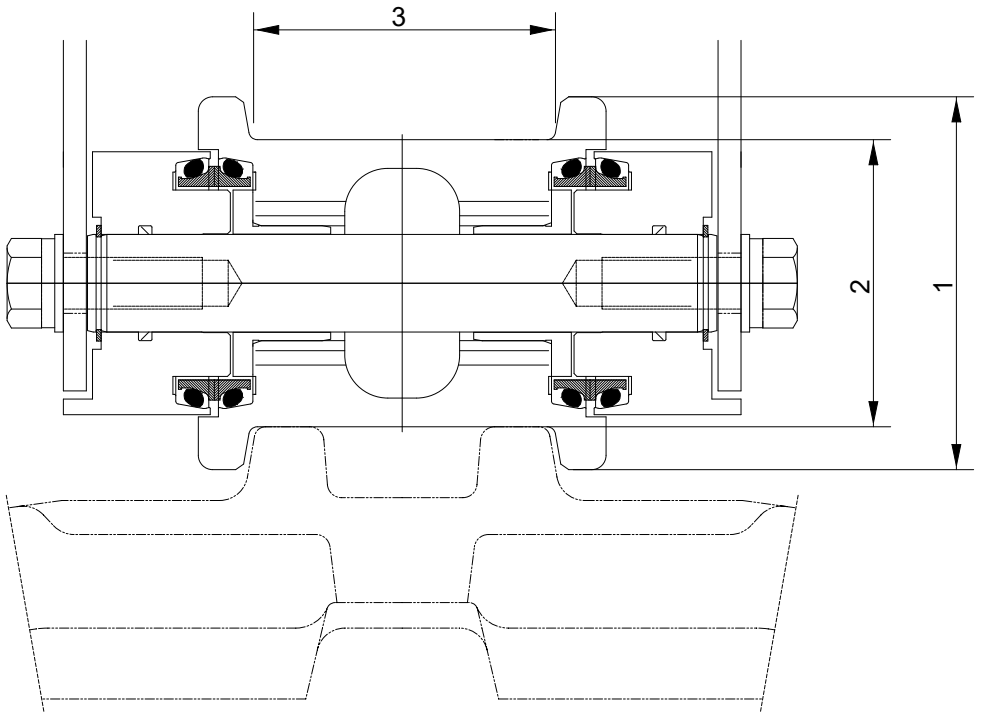


R5576MC18

Unit : mm

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

3. TRACK/CARRIER ROLLER



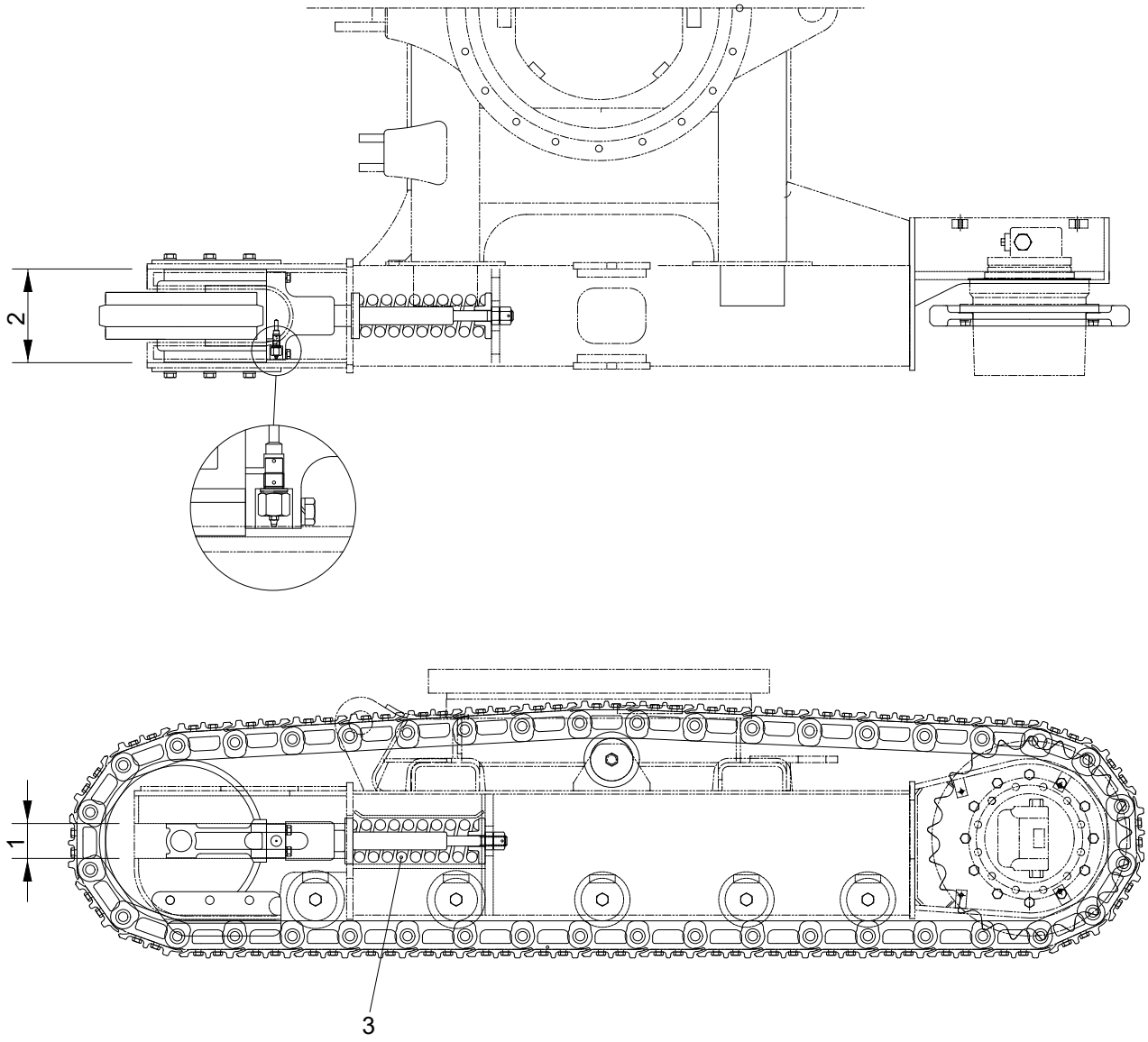
R5576MC15

Unit : mm

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

4. TENSION CYLINDER

STEEL SHOE SPEC



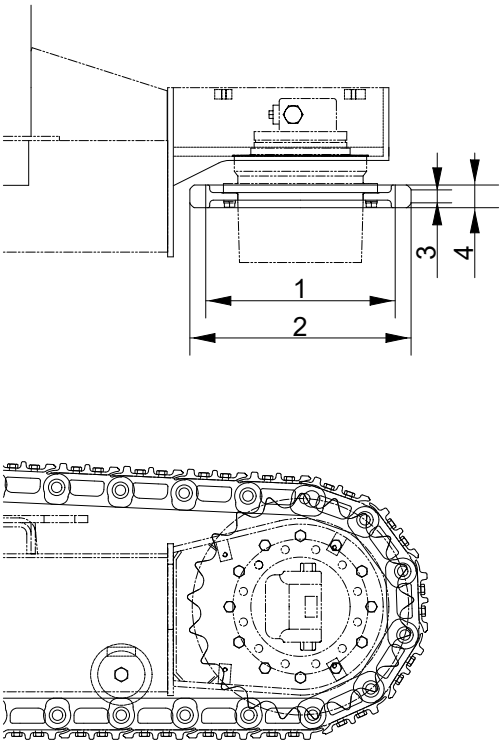
R5576MC19

Unit : mm

No	Check item	Criteria			Remedy
			Standard size	Repair limit	
1	Outside diameter of flange	Track frame	82	86	Rebuild
		Idler support	80	78	Rebuild or replace
2	Outside diameter of thread	Track frame	220	222	Rebuild
		Idler guide	218	214	Rebuild or replace

No	Check item	Standard size			Repair limit		Remedy
		Free length	Installed length	Installed load	Free length	Installed load	
3	Recoil spring	Ø100×330	292	3,900 kg	-	3,120 kg	Replace

5. SPROCKET

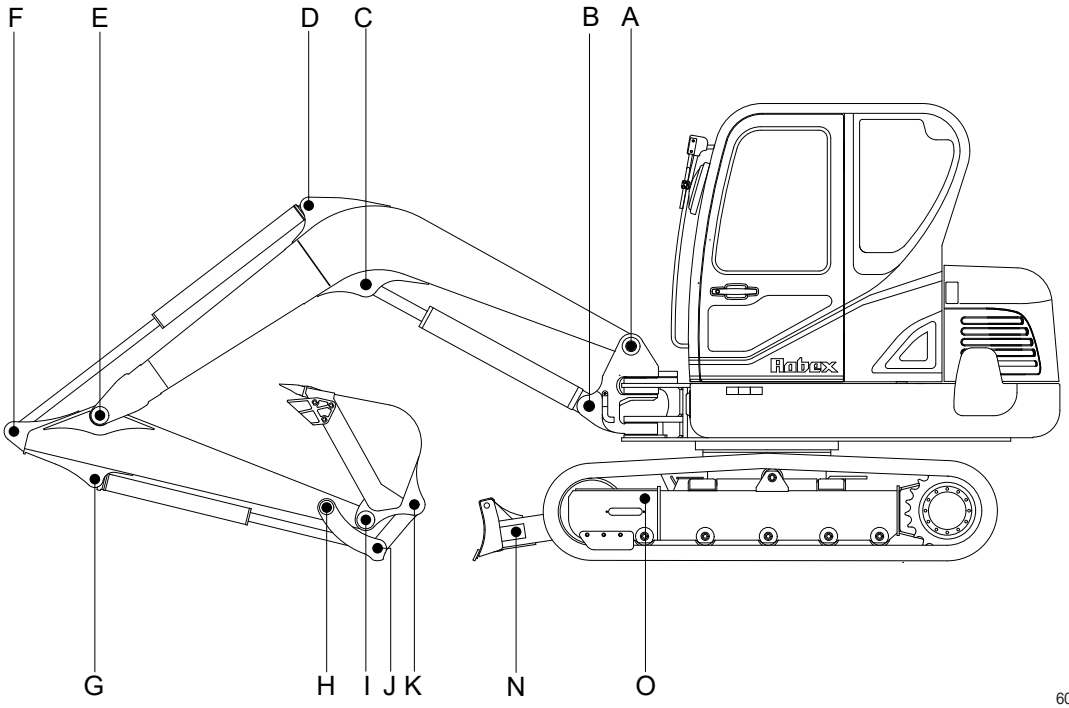


R5576MC21

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



60S6MC01

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	〃
N	Blade cylinder	55	54	53.5	55.5	56	〃
O	Blade and frame link	35	34	33.5	35.5	36	〃

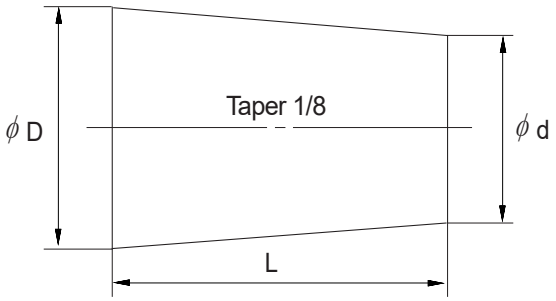
SECTION 6 DISASSEMBLY AND ASSEMBLY

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) 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 MAIN CONTROL VALVE

1. REMOVAL INSTALLATION OF THE CONTROL BLOCK

1) GENERAL RECOMMENDATIONS

※ **Property damages risk**

- Before removing the control block from the machine,the block and its surroundings must be thoroughly cleaned (Do not direct the jet of a pressure washing unit directly at the unit).
- No impurities must enter the hydraulic system.Plastic plugs are to be fitted on lines and orifices immediately following their removal.

⚠ **Oil pressure and heavy product**

- Wear protective clothing and use suitable equipment to prevent accidents, particularly concerning the hydraulic fluid.
- Use the lifting eyes and suitable handling equipment.
- Set all actuators connected to the machine in neutral position (on the ground, at lower limit ...) to avoid accidents which could result from uncontrolled movements of the equipment when the hydraulic system is disconnected.
- With the machine off, release the pressure remaining in the system by manipulating all of the distribution spools. This is performed by moving the handle in all directions.

2) REMOVAL OF THE CONTROL BLOCK

- Install a vacuum pump on the tank to limit oil leakage when connections are removed.
- After disconnecting the lines from the block, immediately fit the sealing plugs. Make sure to collect any possible oil leakage in a suitable receptacle.
- Unscrew the mounting screws and remove the control block.

3) INSTALLATION OF THE CONTROL BLOCK

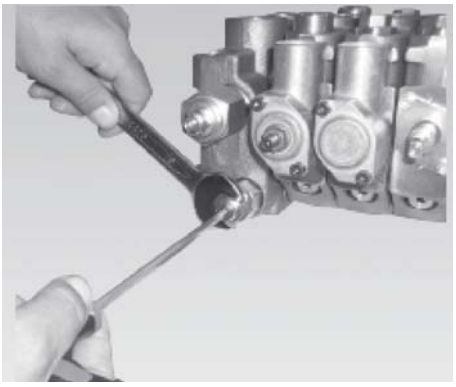
- Contact faces must be perfectly clean.
- Check the evenness of support area on the machine (Tolerance: 0.5 mm).
- Check the condition of line connector seals.
- Clean the block if it has been in storage for a long period of time.
- Correctly place and secure the control block onto the machine with the mounting screws.
- Connect the lines to the block as per the connecting diagram and tighten to the torque specification.
- Ensure that hoses are not twisted or rub.

4)STARTING, MAXIMAL PRESSURE SET UP

- Break the locking cover with a pair of pliers.
- Decalibrate the LS pressure relief valve (17 mm open end spanner on counternut ; 6 mm socket wrench) before starting the machine.
- Maintain one of the control block spool valve in action before the linked hydraulic receiver is at the end of stroke.
- On the spool valve, the value of the secondary valve pressure must be greater than that of the LS pressure relief valve to adjust.
- Adjust the maximum pressure measured in M using the LS pressure relief valve (17 mm open end spanner on counternut ; 6 mm socket wrench).
- Tighten the counternut of the adjusting screw to the torque :

  2.04 kgf · m

  Protect the setting by putting a new locking cover. Fit together two half covers.



2. INLET ELEMENT REPAIR PROCEDURE

1) LS PRESSURE RELIIEF VALVE REPLACEMENT

※ **The control block does not need to be removed from the machine to perform this operation.**

⚠ **Oil pressure**

- Place all of the machine's actuators connected to the control block in neutral position.
- **Release stored pressure by** operating all the spools.

※ Environment damages risk

- Install a vacuum pump on the tank to limit oil leakage during this operation.
- Collect possible leaks with a suitable receptacle.

Reassembly:

1) Install the LS pressure relief valve on the inlet element.
   - Torque : 4.6 kgf · m
2) Set the LS pressure relief valve to the specified value.
3) Fit a new appropriate locking cover.

2) PLUG FOR THE REGULATING UNIT REPLACEMENT

※ The control block does not need to be removed from the machine to perform this operation.

⚠ Oil pressure
Place all of the machine's actuators connected to the control block in neutral position.
Release stored pressure by operating all the spools.

Environment damages risk
Install a vacuum pump on the tank to limit oil leakage during this operation.
Collect possible leaks with a suitable receptacle.

Unscrew the plug (27 mm socket wrench or open end spanner).

Reassembly :

- Install the plug on the inlet element.
- Torque : 10.5 ± 10% kg.m

3) FLOW REGULATOR REPLACEMENT

※ The control block does not need to be removed from the machine to perform this operation.

⚠ Oil pressure
Place all of the machine's actuators connected to the control block in neutral position.
Release stored pressure by operating all the spools.

Environment damages risk
Install a vacuum pump on the tank to limit oil leakage during this operation.
Collect possible leaks with a suitable receptacle.

Unscrew the flow regulator (6 mm socket wrench).

Reassembly :
- Install the plug on the inlet element.
- Torque : 2.3 ± 10% kg.m

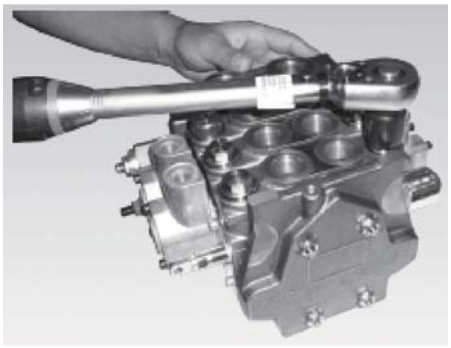
3. DISTRIBUTION ELEMENT REPAIR PROCEDURE

1) SECONDARY VALVES REPLACEMENT

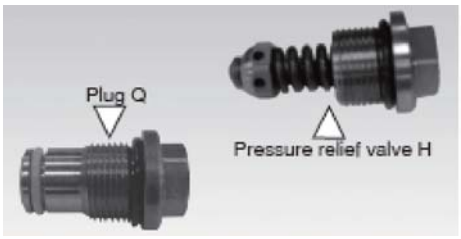
※ The control block does not need to be removed from the machine to perform this operation.

Pressure relief valve

On the distribution element in question, unscrew the relief valve or the plug (17 mm ring wrench).



Reassembly :
Install the plug on the inlet element.
Torque : 6.6 ± 10% kg.m



2) PRESSURE COMPENSATOR REPLACEMENT

※ The control block does not need to be removed from the machine to perform this operation.

Below the distribution element in question, unscrew the compensator plug (8 mm socket wrench).

Remove the compensator piston using a magnet to extract it from its bore.

※ Risk of contamination when using magnetic tool.

Clean parts to remove any attracted metal particle.

Do not use magnet for reassembly.

Reassembly :

Install the plug on the inlet element.

Torque : 5.1 ± 10% kg.m

3) CHECK VALVE REPLACEMENT

※ The control block does not need to be removed from the machine to perform this operation.

Below the distribution element in question, unscrew one of the check valves. (6 mm socket wrench).

Reassembly :

Install the check valve on the distribution element.

Torque: 4.08 ± 10% kg.m

4. REMOVAL OF A SPOOL

※ The control block does not need to be removed from the machine to perform this operation.

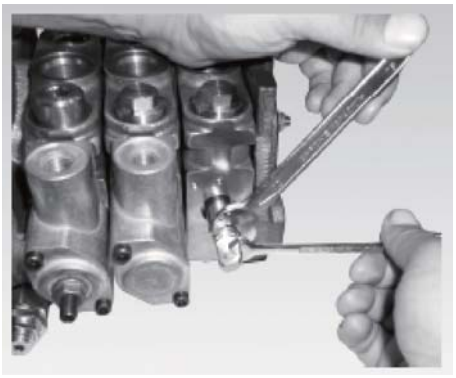
Tonguw Z1 side

On the distribution element in question, unscrew the mounting screws on the plate (4 mm socket wrench).

Remove :

- The 2 mounting screws (L = 8 mm).
- The plate.
- The wiper ring and the o-ring. (Push & Pull the spool in order to disengage rings from the body

Tongue replacement (if necessary) : hold the end of the spool with a 12 mm open end spanner and unscrew the tongue with a 6 mm open end spanner.



Reassembly:

- Change the wiper ring and the o-ring,

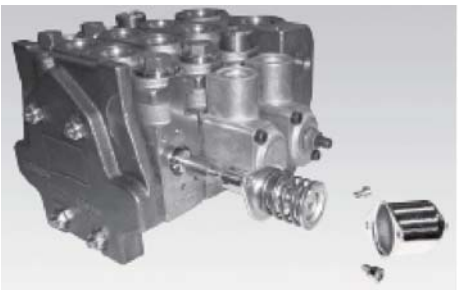
※ Position the lip part of the wiper ring on the outside. Lip must fit under the plate.

- Reassemble parts in reverse order.
- Torque for the 2 mounting screws : 0.36 ± 10% kg.m
- Torque for the tongue : 0.92 ± 10% kg.m

Cover side A2
On the distribution element in question, unscrew the 2 mounting screws (L = 8 mm) on the cover (4 mm socket wrench).

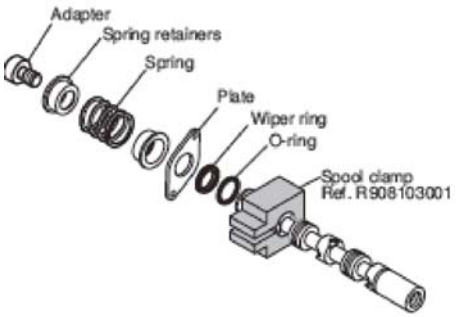
Remove the cover.

Remove the spool from the distribution element.



Use the spool clamp and a vuce to secure the spool.

※ In order to avoid damaging the spool, place it approximately 30 mm from the end of the spool (Never on center).



Remove the adapter (4mm socket wrench).

Remove
- The 2 spring retainers.
- The spring.
- The plate.
- The o-ring and the wiper ring.

Reassembly:

- Change the wiper ring and the o-ring.

※ Seals must be fitted on the end of the spool so that they are not damaged on the spool. Grooves and their tightness property does not deteriorate.

※ Position the lip part of the wiper ring on the outside. Lip must fit under the plate.

- Reassemble parts in reverse order.
- Torque for the adapter : 0.92 ± 10% kg.m
- Mount the spool inside the distribution element.
- Torque for the 2 cover screws : 0.36 ± 10% kg.m

5. REMOVAL OF A HYDRAULIC OPERATION

Removal of the hydraulic cover

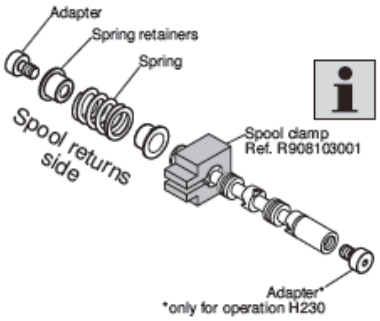
Remove the 2 mounting screws (4 mm socket wrench).

Remove
- The cover.
- The o-ring.

Reassembly:
- Replace the cover o-ring,
- Reassemble parts in reverse order,
- Torque for the 2 mounting screws :
  0.51 ± 10% kg.m

Spool return by means of spring system

※ Remove the spool from the distribution element on the spool returns side.



Use the spool clamp and a vuce to secure the spool.
In order to avoid damaging the spool.
Place it approximately 30 mm from the end of the spool (never on centre).

Unscrew the adapter (4 mm socket wrench).

※ Memorize the orientation of the spool for reassembly.

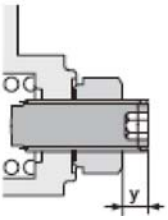
Remove:
- The 2 spring retainers.
- The spring

Reassembly:

Reassemble parts in reverse order, considering the spool orientation.
Torque for the adapter : 0.92 ± 10% kg.m

Setting of the stroke limitor

Using a vernier, measure before replacement the dimension y between the stop screw and the nut tip (see diagram below).



This value y is to be thoroughly respected when reassembling to ensure an identical flow adjustment.

Perform the adjustment on the new cover with a 13 mm open end spanner on the nut and 4 mm socket wrench on the screw.
Torque for the nut : 1.02 ± 10% kg.m

6. Complet control block disassembly / assembly

Remove the control block from the machine.
Remove the 4 nuts (13 mm ring wrench).

Remove the outlet element.
Separate the distribution elements with the seal plates from the inlet element.

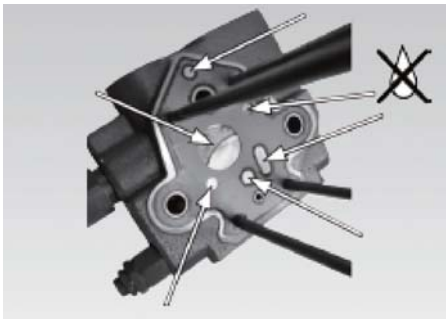
In case of inlet element replacement, remove the tie rods with a stud puller.

Reassembly:

Check the cleanliness of the element faces.
Replace the seal plates between distribution elements, the inlet element and the outlet element.

※ When reassembling, make sure the seals plates are correctly positionned so that the seals location fit with the canals.

Carefully wipe oil traces of no-opening cavities between element face and seal plate.
If the inlet element is to be replaced, torque for the 4 tie rods :
- 3.06 ± 10% kg.m



Reassemble elements in reverse order.

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

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

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

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

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

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

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

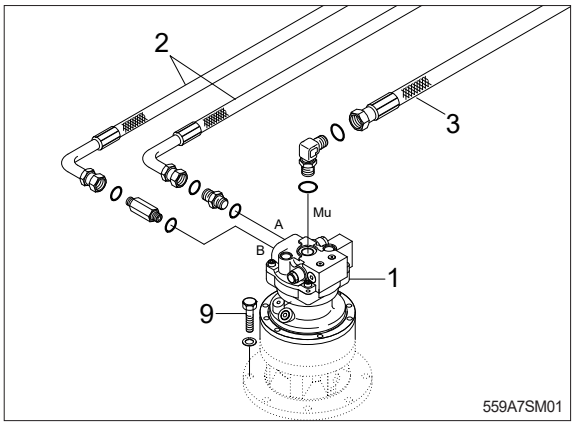
(5) Disconnect pilot line hoses (4, 5, 6, 7, 8).

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

※ Motor device weight : 23 ㎏ (51 ㏪)

(7) Remove the swing motor assembly.

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



2) INSTALL

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

(2) Bleed the air from the swing motor.

① Remove the air vent plug.

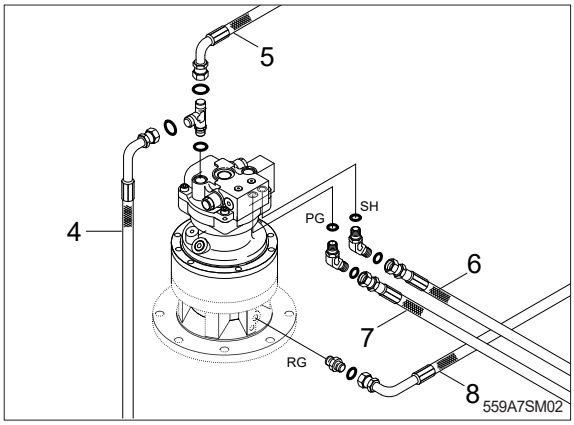
② Pour in hydraulic oil until it overflows from the port.

③ Tighten plug lightly.

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

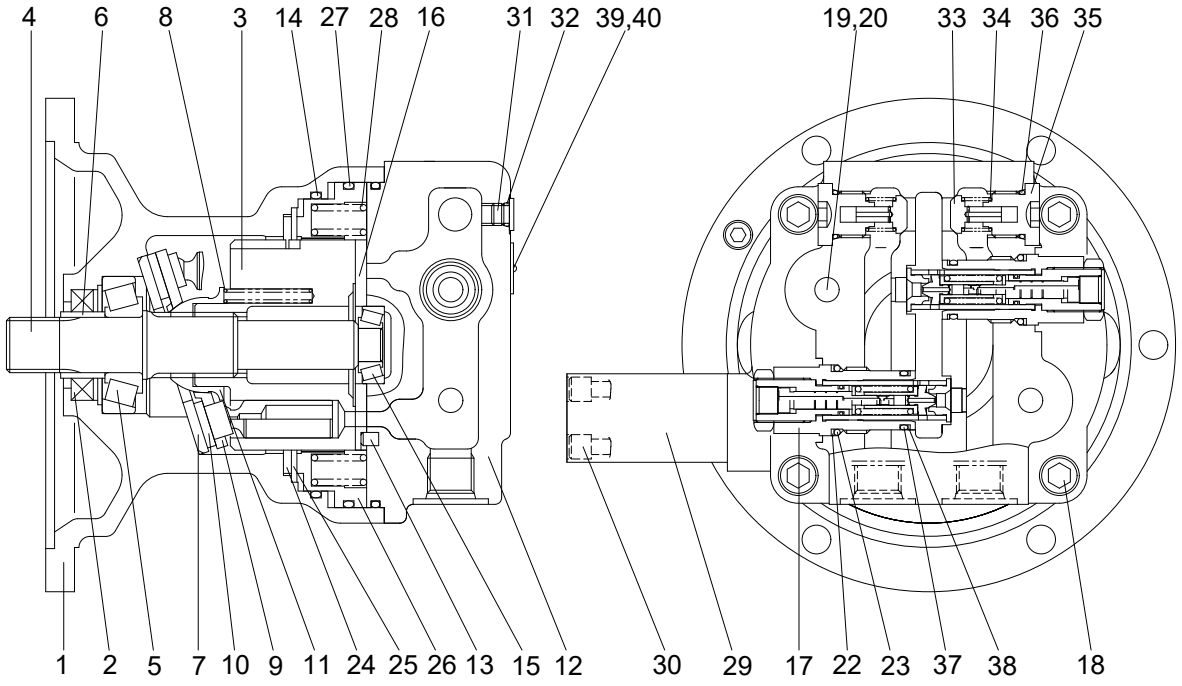
⑤ Tighten plug fully.

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



2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



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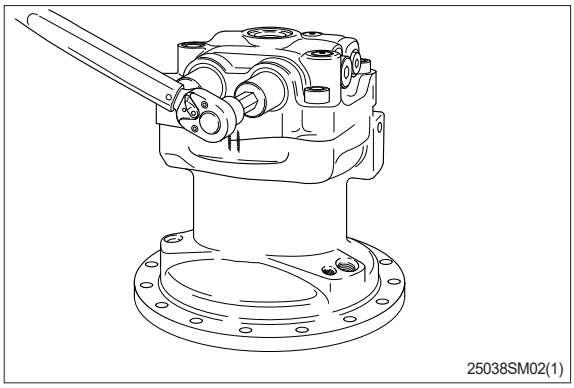
1	Body	15	Taper bearing	30	Socket bolt
2	Oil seal	16	Valve plate	31	Plug
3	Cylinder block	17	Relief valve assy	32	O-ring
4	Shaft	18	Socket bolt	33	Valve
5	Taper bearing	19	Plug	34	Spring
6	Bushing	20	O-ring	35	Plug
7	Shoe plate	22	Back up ring	36	O-ring
8	Spring	23	O-ring	37	O-ring
9	Set plate	24	Friction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

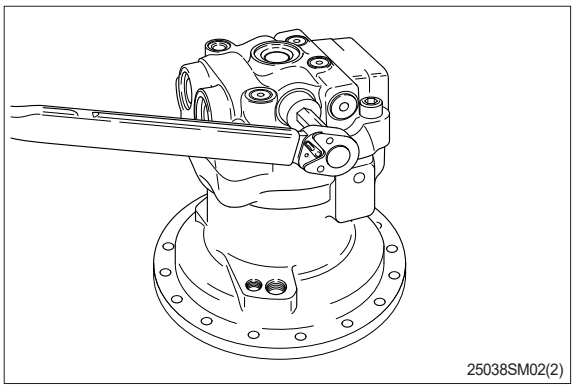
2) DISASSEMBLY

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

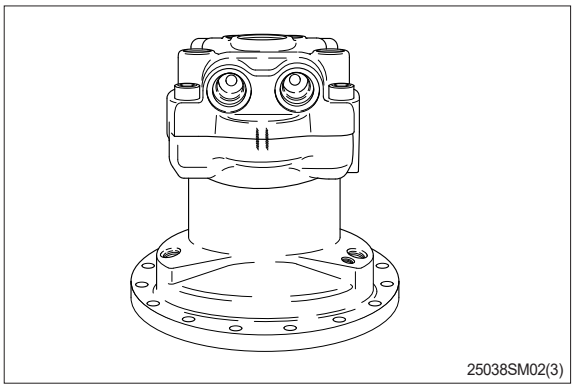
※ Assemble removed relief valve assembly (17) to original state when reassembling.


25038SM02(1)

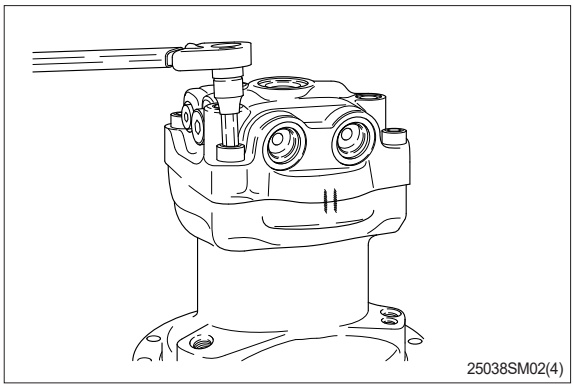
(2) Removal of make up valve and bypass valve assembly
Loosen plug (35) with 14 ㎜ hexagonal wrench, and remove check valve (33) and spring (34).


25038SM02(2)

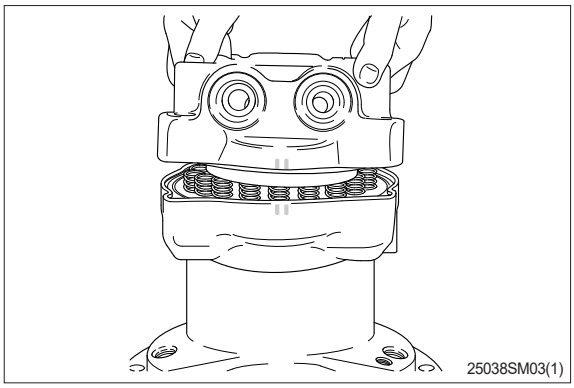
(3) Marking at swing motor
Before disassembling motor, make a matching mark between cover (12) and housing (1) for easy reassembling.


25038SM02(3)

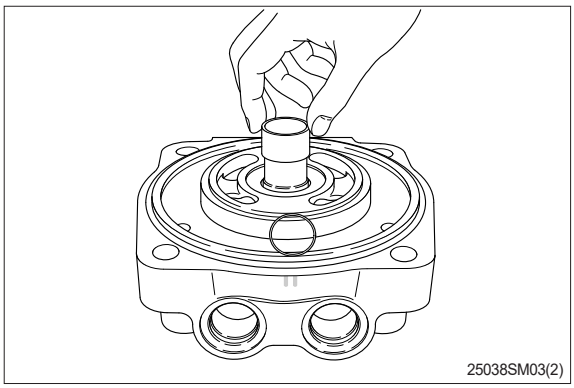
(4) Remove mounting bolts of cover
Loosen hexagon socket bolt (18) with 12 ㎜ hexagonal wrench.


25038SM02(4)

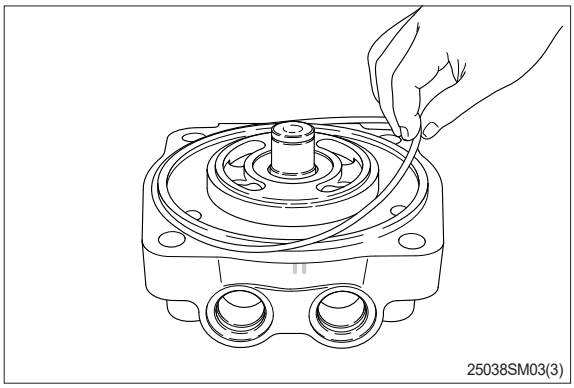
(5) Removal of cover assembly
Place shaft of motor assembly to downward and take cover (12) out.



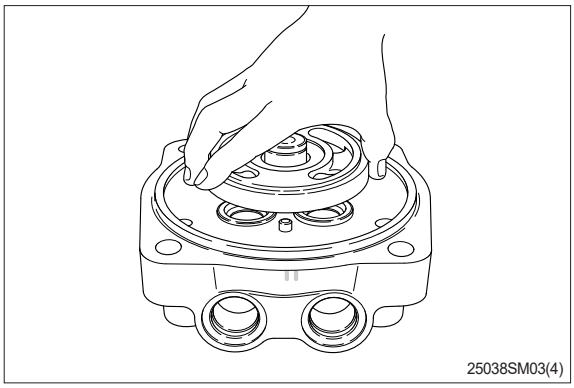
(6) Remove inner race of needle bearing (15) by bearing puller.



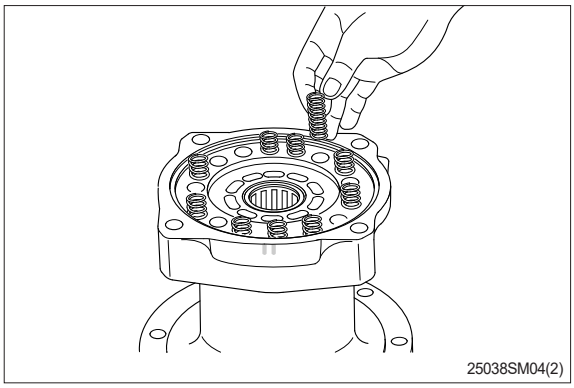
(7) Remove O-ring (27) from cover.



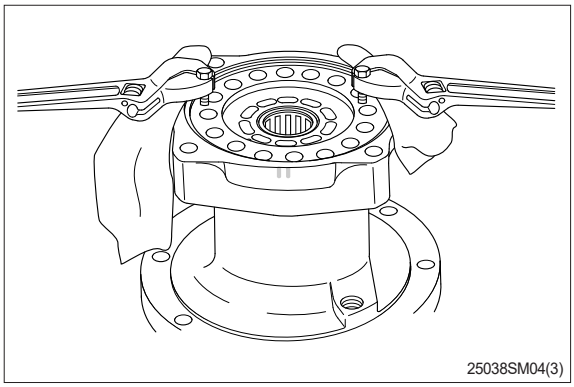
(8) Remove balance plate
Valve plate (16) is adhered on end surface of cylinder (3) by oil viscosity. Take off balance plate (16) with hands.
Assembling method of balance plate (16) depends on cover (12).
(Band groove and round groove of high · low pressure transmission area)
Before removing, check and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



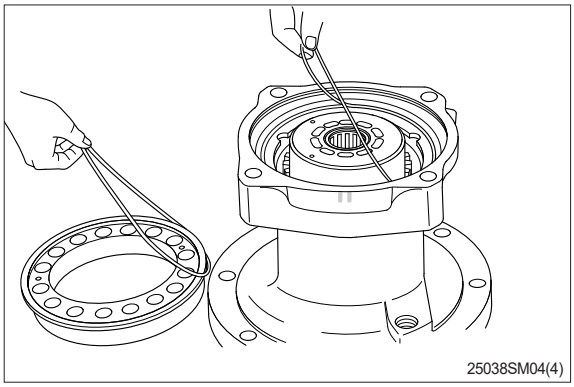
(9) Removal of spring (28, brake area)
Remove spring (28) from piston (26).
Check and record original position of each spring (28) for correct assembling.


25038SM04(2)

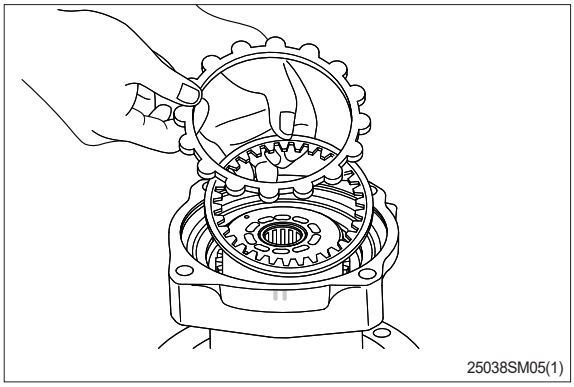
(10) Removal of brake piston
When removing piston (26) from body (1), there is a sliding resistance against tightening of O-rings (14, 27). Use tap hole on piston (26) as shown in the picture.


25038SM04(3)

(11) Remove O-rings (14, 27) from piston (26) and body (1).


25038SM04(4)

(12) Remove friction plate (24) and lining plate (25) from body (1).


25038SM05(1)

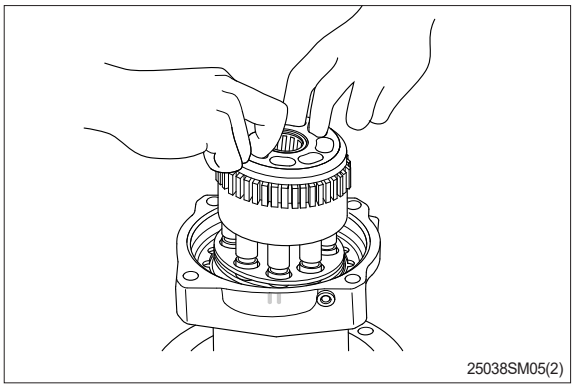
(13) Removal of cylinder assembly

Holding end of cylinder assembly (3) with hand, draw out cylinder assembly from housing.

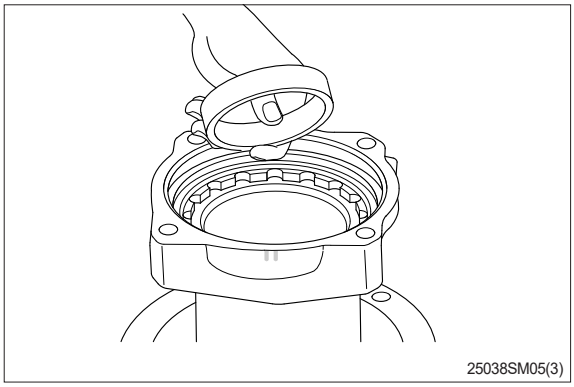
※ Oil seal (2) and outer race of taper roller bearing (15) are left inside of housing.

※ 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)

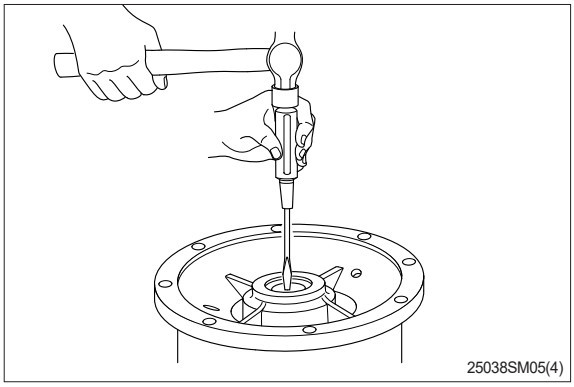
(14) Separate outer race of taper roller bearing (5) from housing.


25038SM05(3)

(15) Removal of oil seal

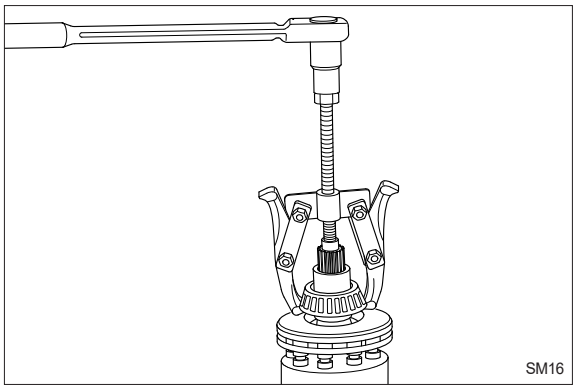
Remove oil seal (2) from body (1) with driver and hammer.

※ **Do not reuse oil seal after removal.**

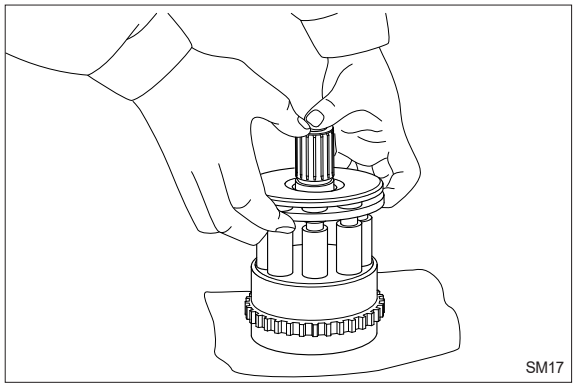

25038SM05(4)

(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.

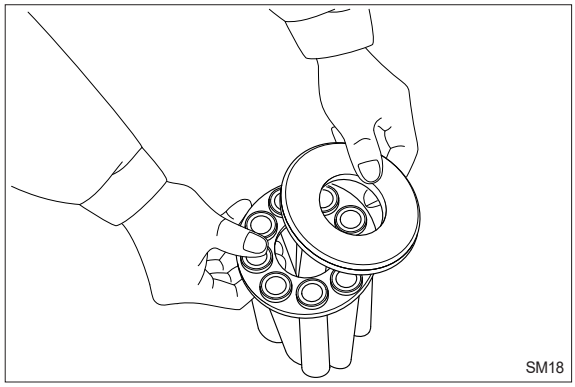

SM16

② Separate shoe plate (7), piston assembly (10), set plate (9) from cylinder block (3).

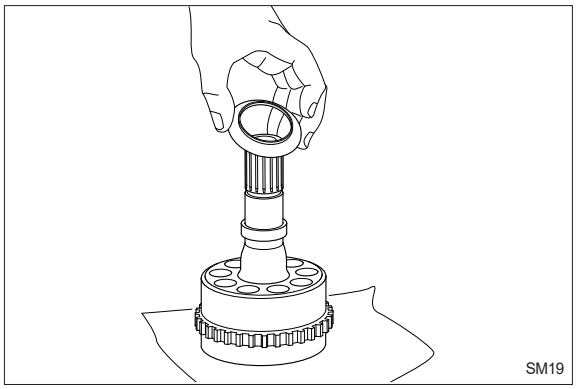

SM17

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

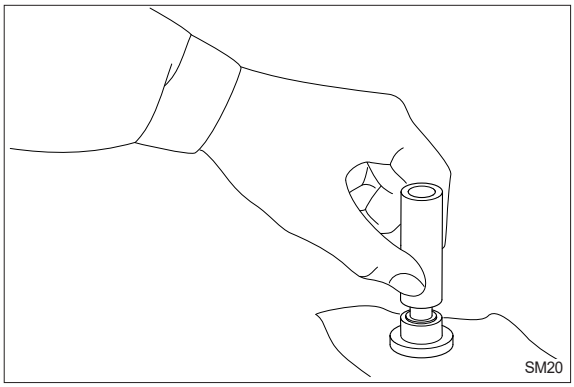
(1) Preparation

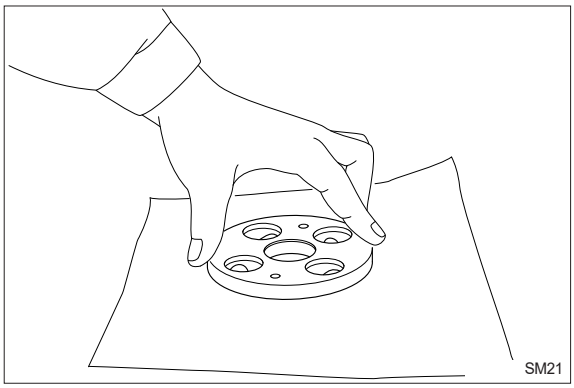
Before reassembling, perform below procedure.

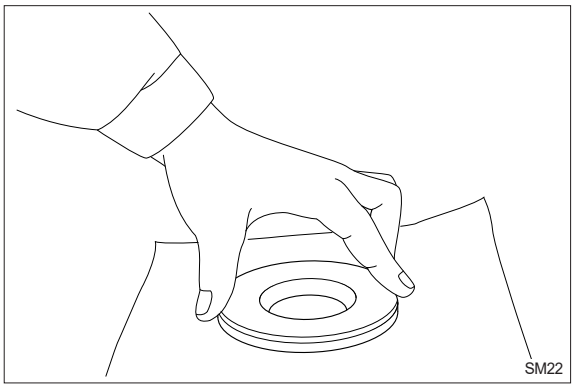
① Check each part for damage caused by using or disassembling. If damaged, eliminate damage by grinding with proper sandpaper, wash them with cleaning oil and dry with compressed air.

② Replace seal with new one.

③ Grind sliding face of piston assembly (10), valve plate (16) and shoe plate (7) with sandpaper #2000.





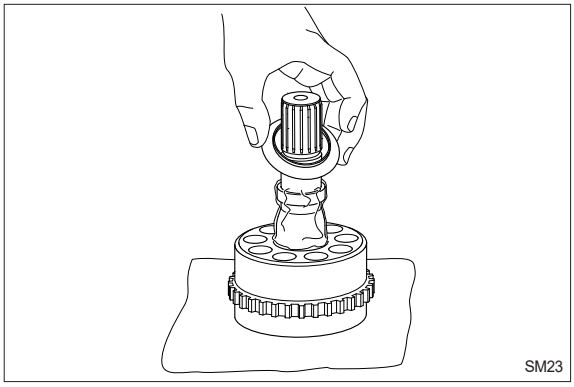


④ When assembling, lubricate with specified clean hydraulic oil.

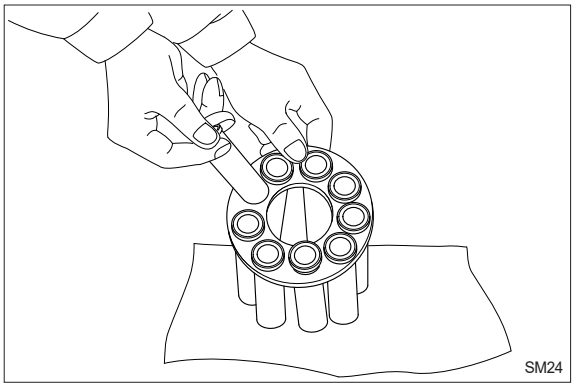
⑤ When assembling piston assembly (10) to piston hole of cylinder block (3), check matching mark between them.

(2) Cylinder assembly

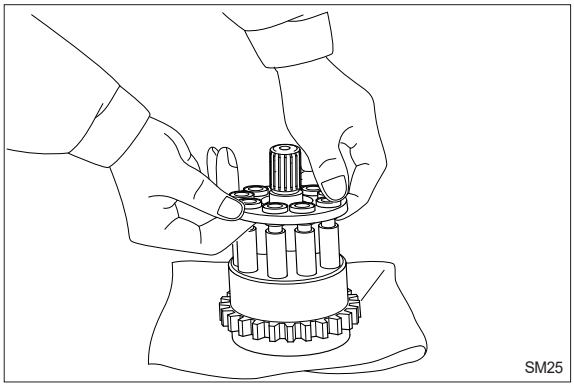
① Lubricate grease on round area (Contacting area withball guide (11)) of cylinder block (3) and assemble spring (8).



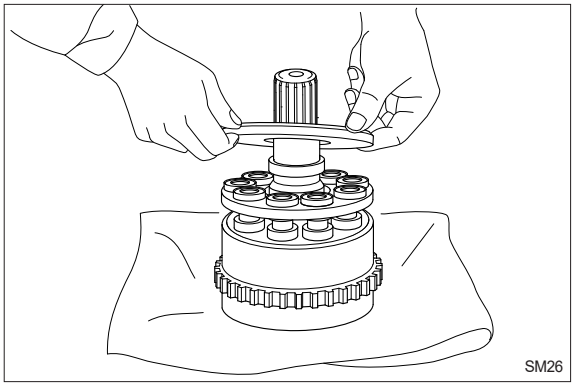
② Insert piston assembly (10) in hole of set plate (9).



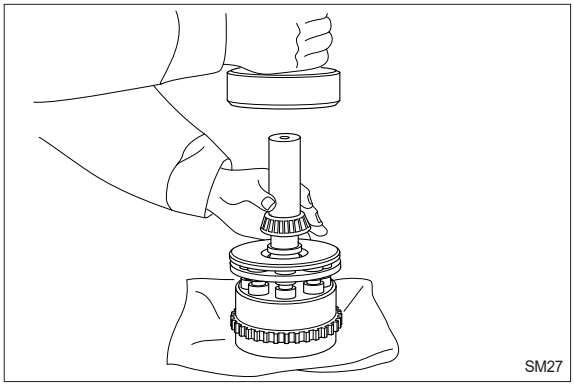
③ Assemble piston assembly (10) and set plate (9) to cylinder block (3). When assembling, check matching mark between them. Before assembling, lubricate specified hydraulic oil in piston hole of cylinder block (3).



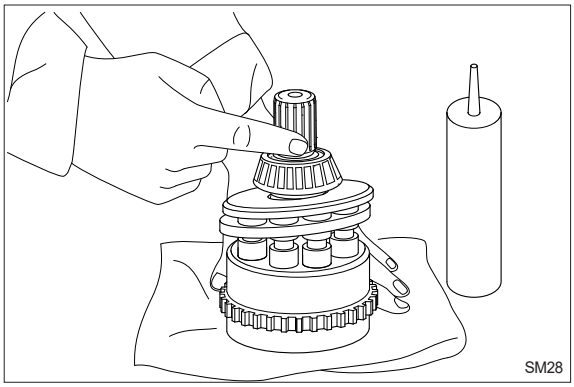
④ Lubricate specified hydraulic oil on shoe sliding face of piston assembly (10) and assemble shoe plate (7).



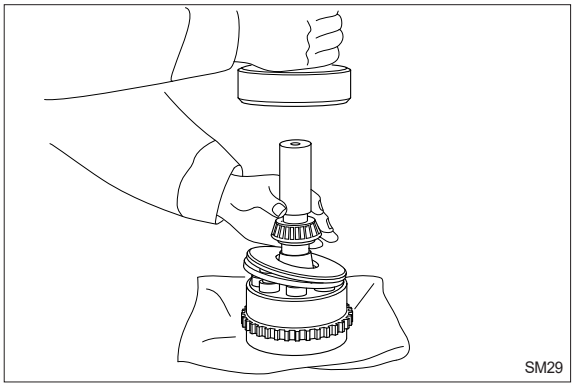
⑤ Assemble inner race of taper roller bearing (5) to cylinder block (3).



⑥ Apply loctite to bearing mounting area of inner race of cylinder block (3) lightly.



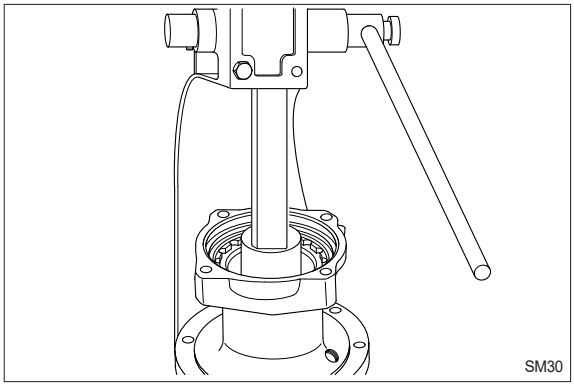
⑦ Assemble bushing (6) to cylinder block (3).



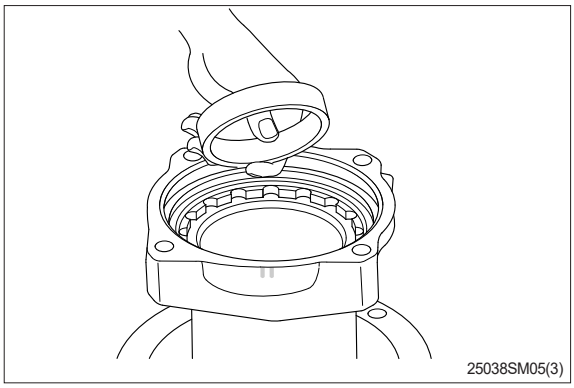
(3) Oil seal

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.



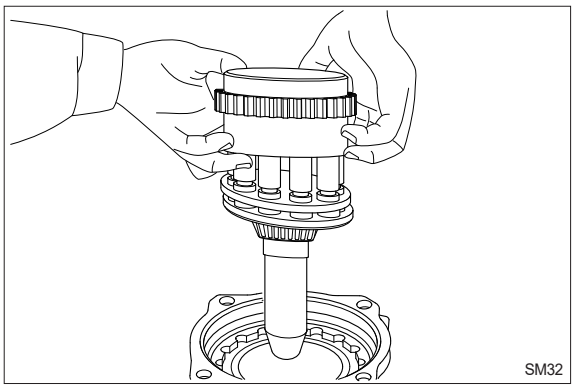
(4) Assemble outer race of taper roller bearing (5) to motor housing (1).



(5) Cylinder assembly

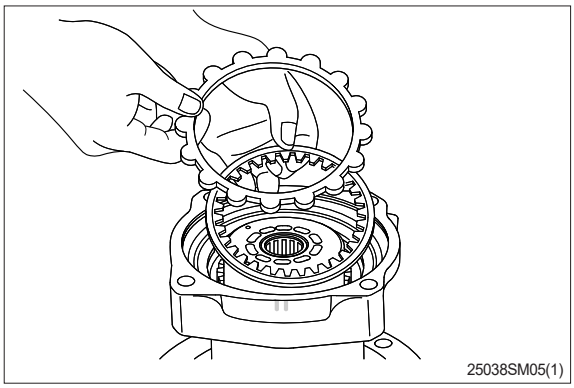
Hold end of cylinder assembly(3) with hands and assemble cylinder assembly to housing(1). Be careful to prevent damage of seal by spline of shaft.

※ When assemble cylinder assembly, spline shaft of cylinder is protruded from end of housing, therefore put pads with length 30~50㎜ under bottom of housing.



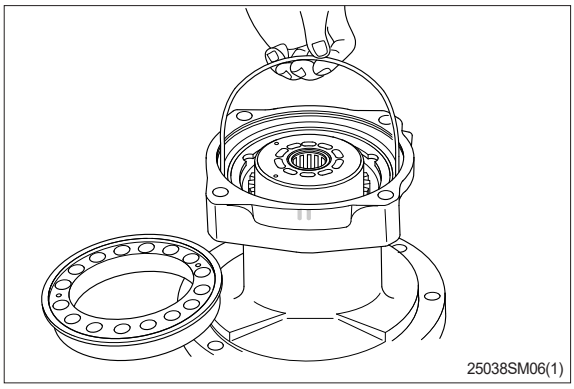
(6) Assemble friction plate (24) and lining plate (25).

※ Lubricate specified hydraulic oil on each side.



(7) Insert O-rings (14,27) into body (1) and piston (26).

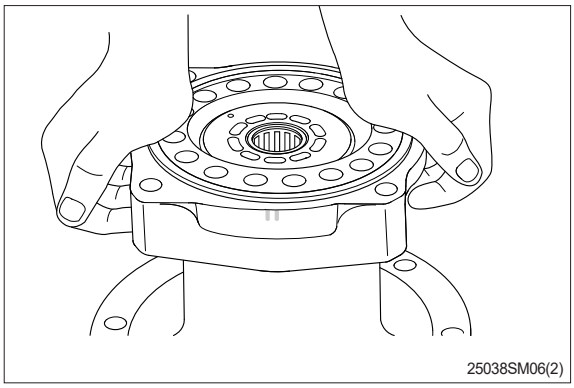
※ Lubricate O-ring with grease.



(8) Brake piston

Lubricate specified hydraulic oil on outer sliding face of piston (26) 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 (26) horizontally by hands at once.

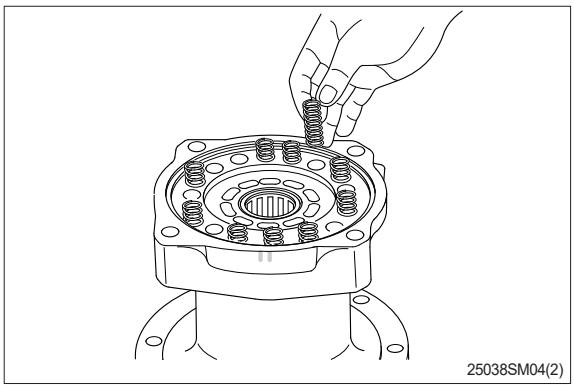


25038SM06(2)

(9) Spring (28, brake unit)

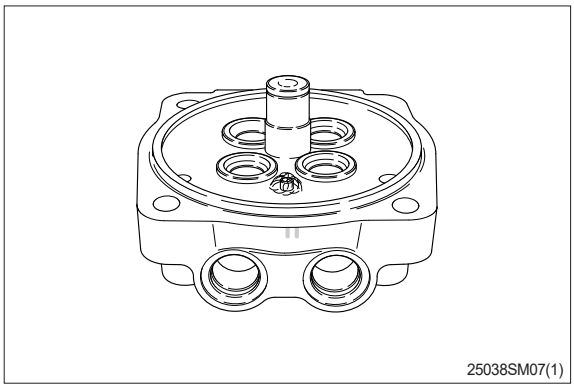
Assemble spring (28) to piston (26) of brake unit.

※ Insert spring (28) into original position.



25038SM04(2)

(10) Lubricate locating pin for antirotation of valve plate (16) of cover (12) with grease sufficiently and install locating pin to housing.

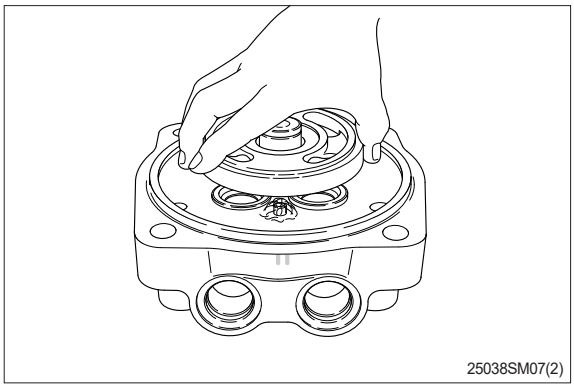


25038SM07(1)

(11) Balance plate

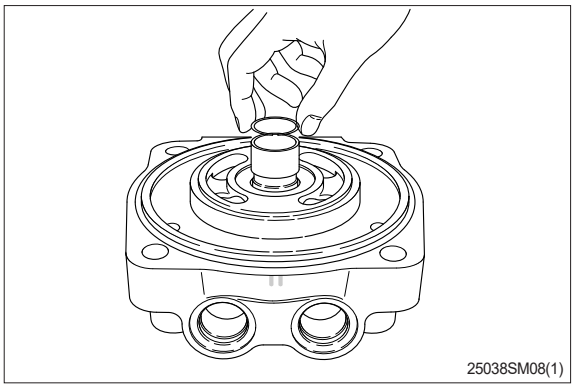
Assemble valve plate (16) to cover (12).

※ Be cautious of assembling direction.



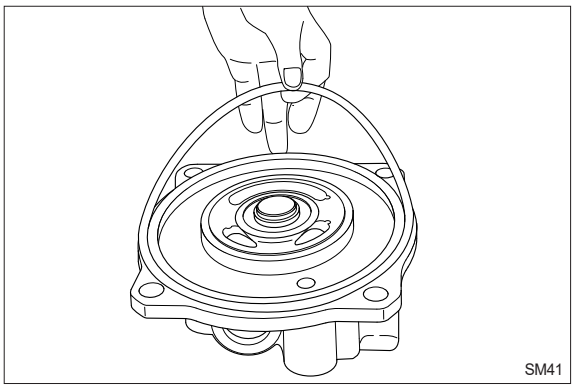
25038SM07(2)

(12) Assemble inner race of needle bearing (15) to cover (12).

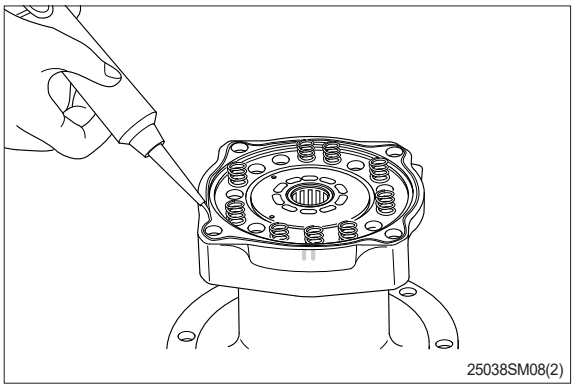


(13) Assemble O-ring (27) to cover (12).

※ 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).

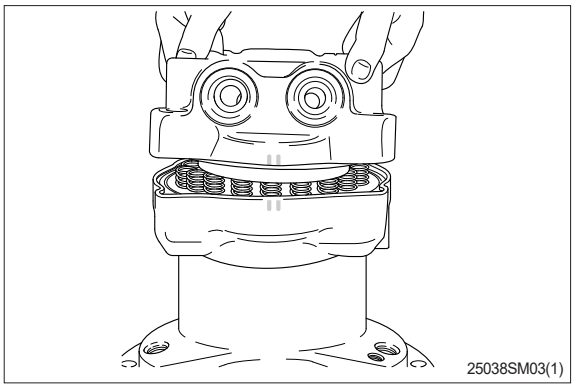


(15) Cover

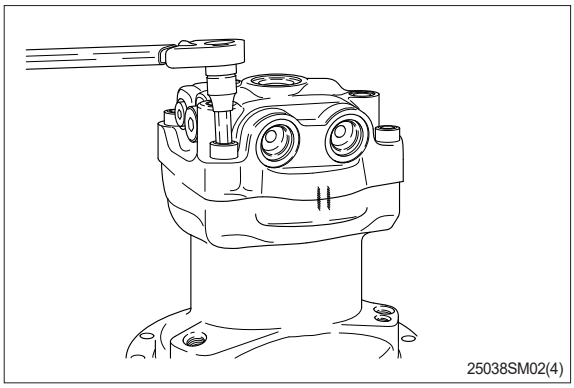
Assemble cover (12) and valve plate (16) to body (1) lightly, holding them up with hands.

※ When assembling, be careful not to detach valve plate (16) and bushing (6) from cover (12).

※ Fit matching marks on body (1) and cover (12) made before disassembling.

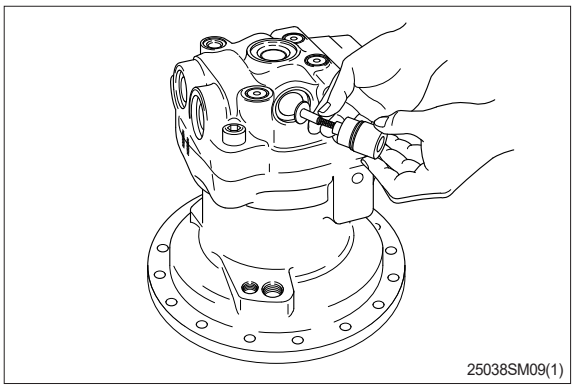


(16) Tighten cover (12) and body (1) with 12 ㎜ hexagonal socket bolt (18).
· Tightening torque : 16 kgf · m (116 lbf · ft)



(17) Make up valve

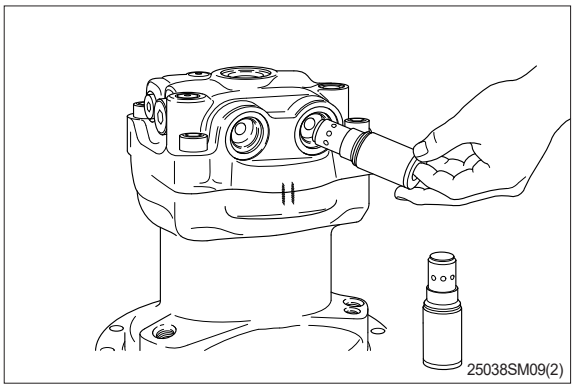
Assemble valve (33) and spring(34) to cover(12) and tighten plug (35) with 14 ㎜ hexagonal socket bolt.
· Tightening torque : 14 kgf · m (101 lbf · ft)



(18) Relief assembly

Assemble relief valve assembly (17) to cover (12) with 14㎜ hexagonal socket bolt.
· Tightening torque : 8 kgf · m (58 lbf · ft)

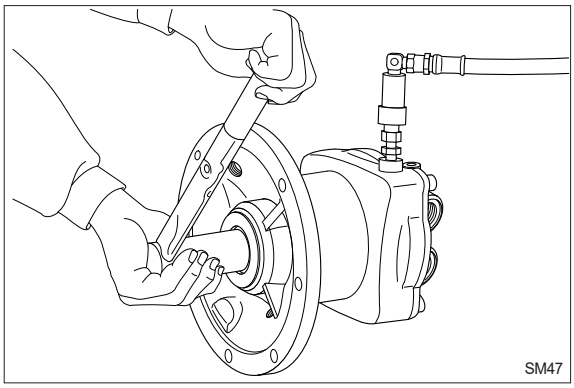
※ Be cautious of assembling method.



(19) Check of assembly

Load pilot pressure of 20 kgf/㎠ 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.

This completes assembly.



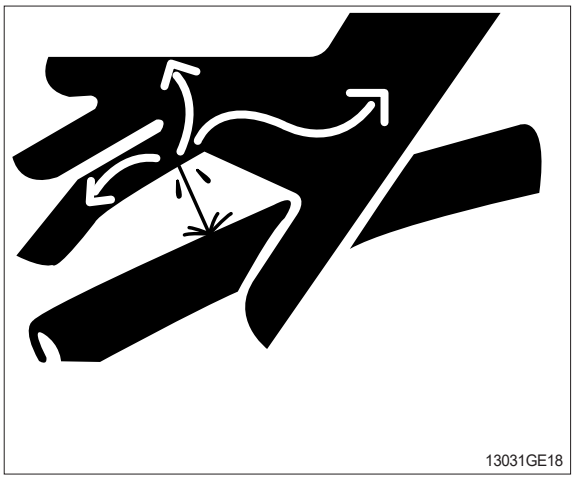
3. REMOVAL AND INSTALL OF REDUCTION GEAR

1) REMOVAL

(1) Remove the swing motor assembly.
For details, see removal of swing motor assembly.

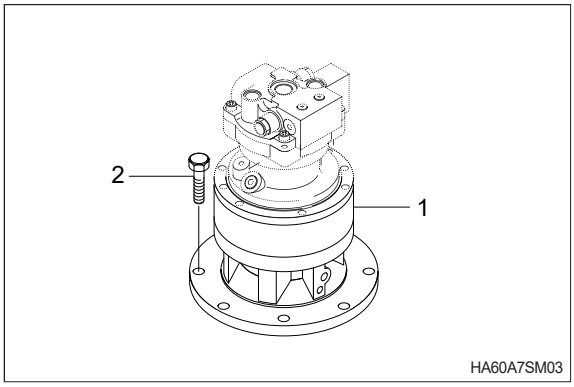
(2) Sling reduction gear assembly (1) and remove mounting bolts (2).

(3) Remove the reduction gear assembly.
· Reduction gear device weight : 45 kg (99 lb)


13031GE18

2) INSTALL

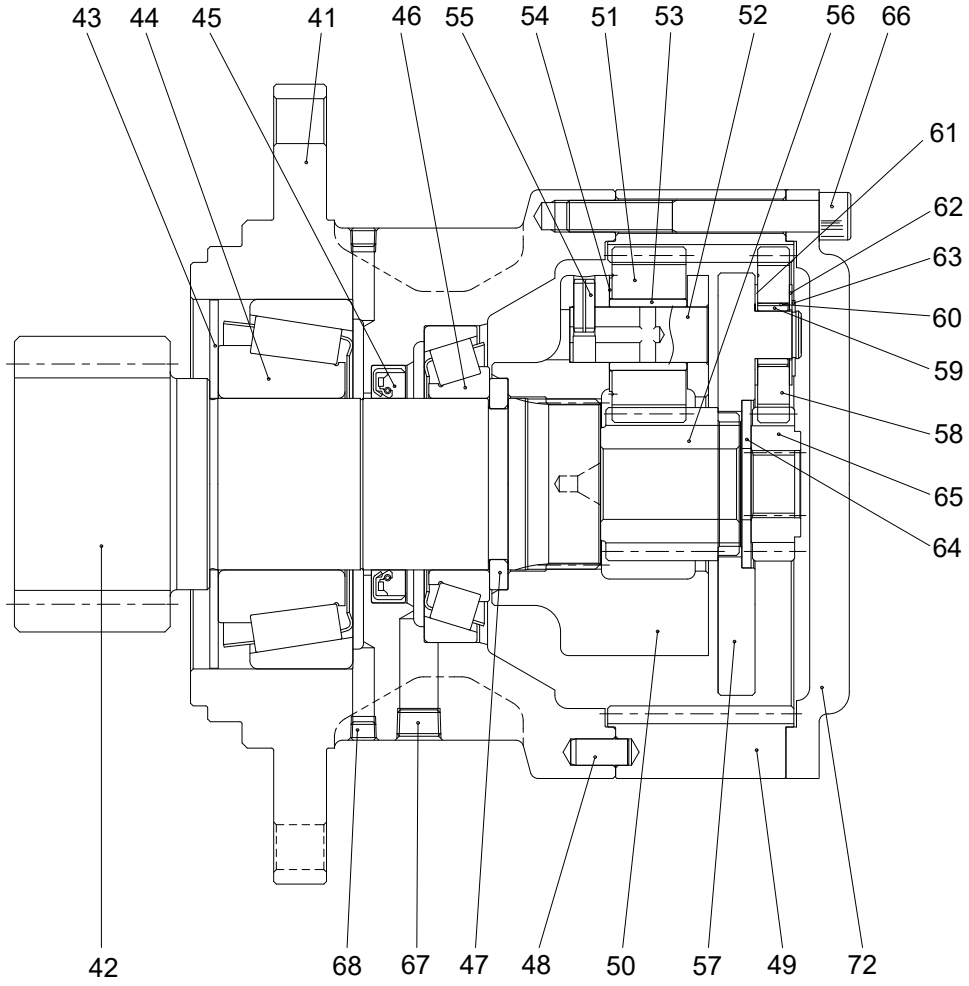
(1) Carry out installation in the reverse order to removal.
· Tightening torque :
29.7 ± 4.5 kgf · m



HA60A7SM03

4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE

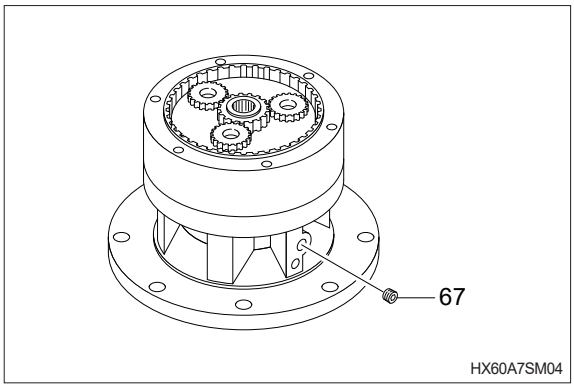


HX60A2SM02

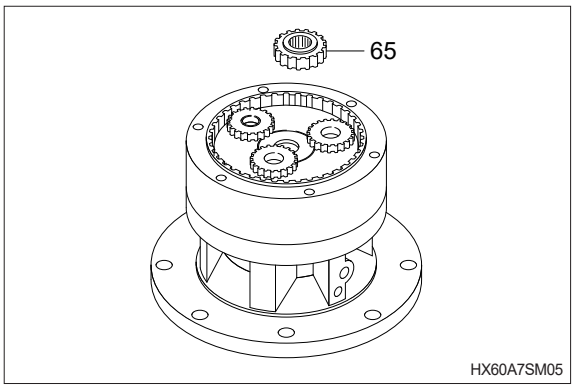
41	Case	52	Pin 2	63	Snap ring
42	Pinion gear	53	Needle roller bearing	64	Side plate
43	Bearing cover	54	Thrust washer 2	65	Sun gear 1
44	Taper roller bearing	55	Spring pin	66	Bolt
45	Oil seal	56	Sun gear 2	67	Plug
46	Taper roller bearing	57	Carrier assy 1	68	Plug
47	Lock collar	58	Planet gear 1	69	Level bar
48	Knock pin	59	Needle roller bearing	70	Level pipe
49	Ring gear	60	Collar	71	Air breather
50	Carrier assy 2	61	Thrust washer 1	72	Cover
51	Planet gear 2	62	Thrust washer 2		

2) DISASSEMBLY

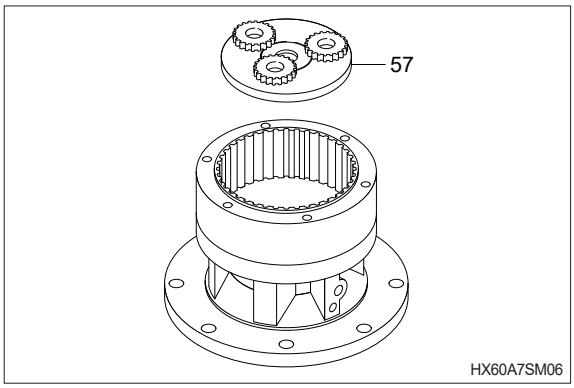
(1) Remove the plug (67) and drain out gear oil.



(2) Remove the No.1 sun gear (65).

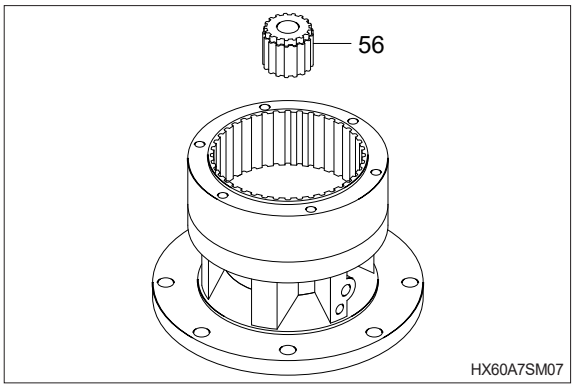


(3) Remove the No.1 carrier sub-assembly (57) using the jig.

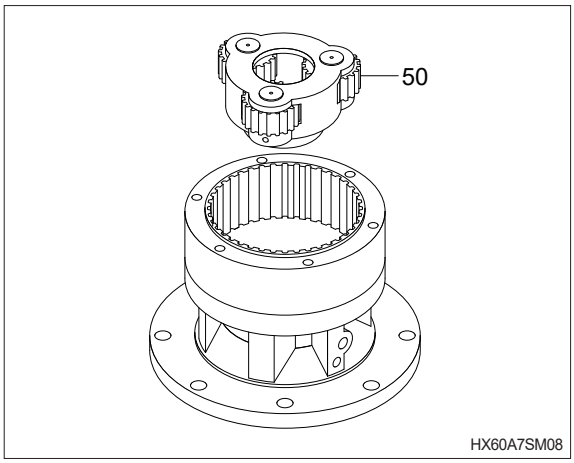


(4) Remove the No.2 sun gear (56).

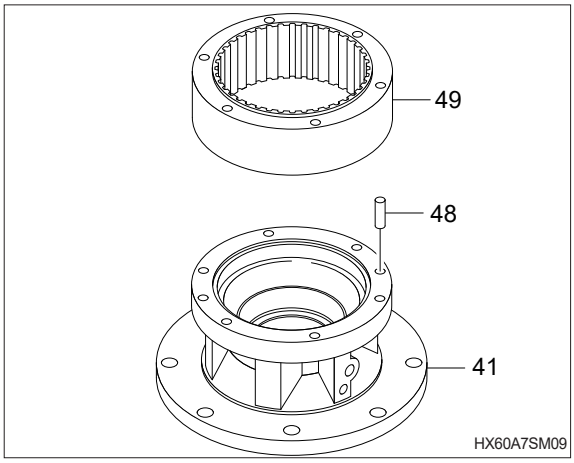
※ Pay attention to ensure the gear is not damaged during disassembling.



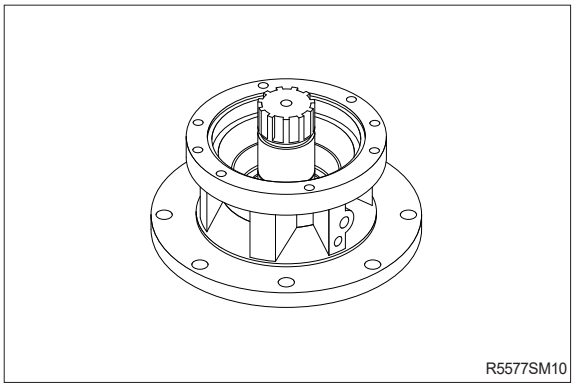
(5) Remove the No.2 carrier sub assembly (50).



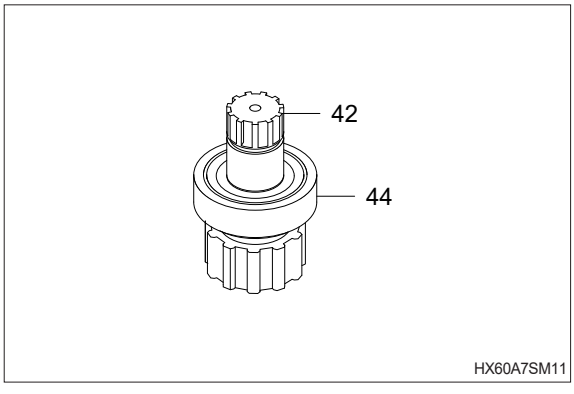
(6) Remove the ring gear by the removal groove between the ring gear (49) and casing (41) by using jig.
Full out the knock pin (48).
Do not need to remove the knock pin (48) if it is not worn or damaged.



(7) Put it on the working table with the drive shaft up.

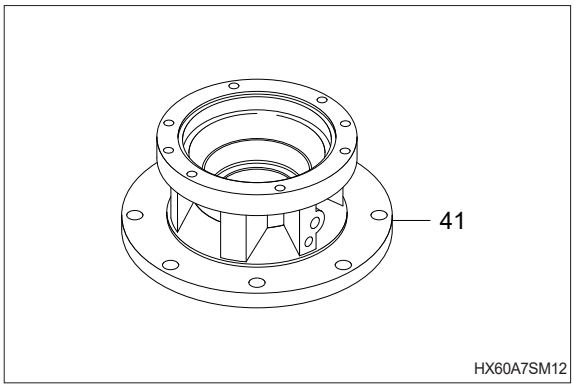


(8) Disassemble the drive shaft (42) with bearing (44) by using jig.



3) ASSEMBLING SWING REDUCTION GEAR

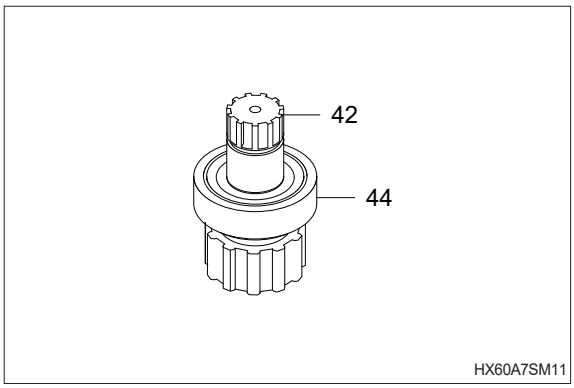
(1) Place the case (41) on the reversing machine having the flange side of the case up.



(2) Install shaft assembly (42) into case (41).

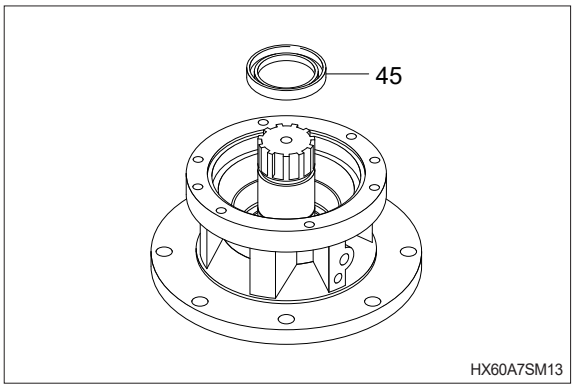
※ Be sure to clean the case before install, using washing machine with the temperature of 80°C

※ Do not install shaft assembly by force.

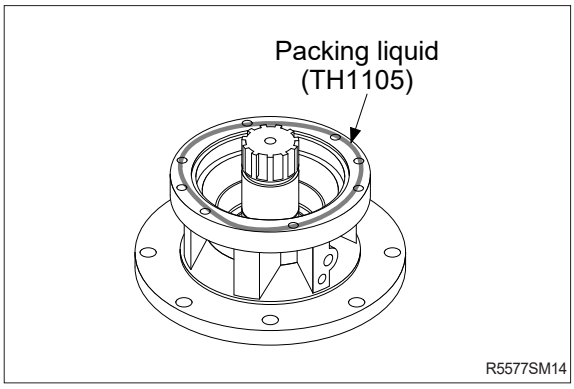


(3) Reverse case and press to insert oil seal (45) by using pressing jig after spreading grease oil around the outside ring of the seal and bearing.
Coat grease oil slightly on the lip surface to prevent any scratch when installing.

※ Be sure to check by eye that the oil seal is seated completely after being installed.



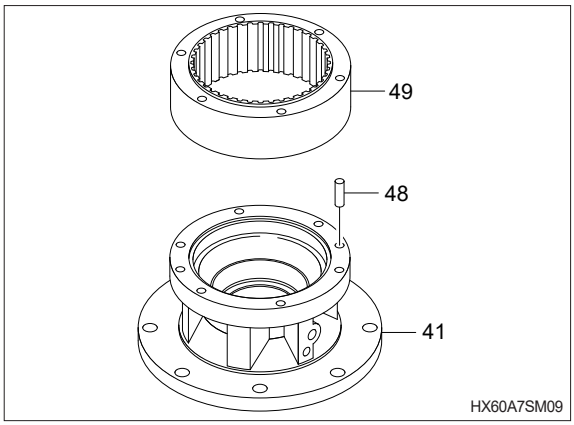
(4) Clean the assembling surface of case and spread packing liquid (TH1105) as shown in figure.



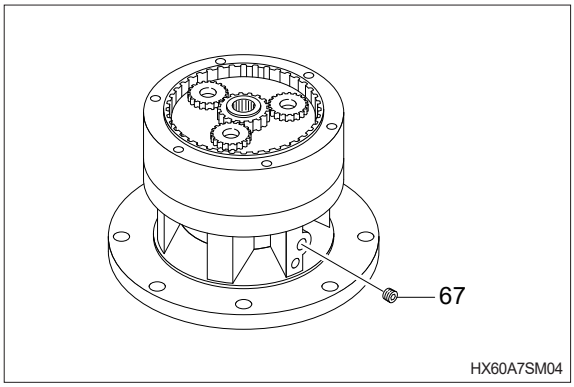
(5) Place ring gear (49) on the case by matching it with knock pin (48) hole.

(6) Insert 2 knock pins (48) by using jig.

※ Be sure to check the hole location of oil gage before inserting.

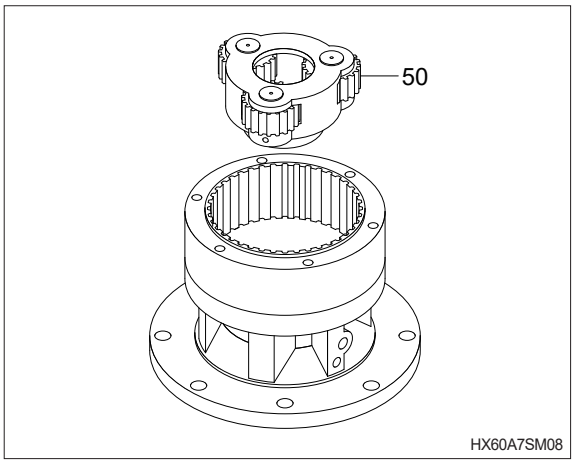


(7) Screw drain plug into drain plug (67) after winding sealing tape.



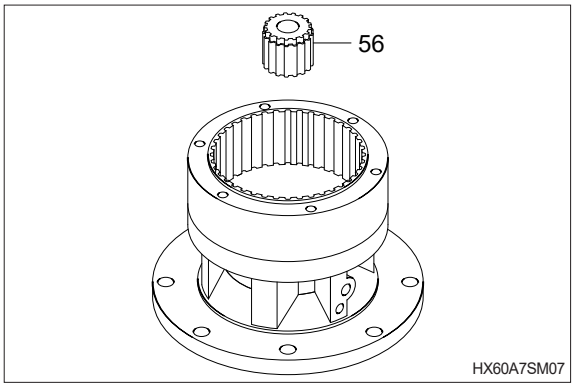
(8) Mount No.2 carrier assembly (50) in the case sub assembly and install bolts into 2 TAP holes (M6) as shown in figure.

※ Turn the carrier slowly by hand to adjust the matching holes when assembling.



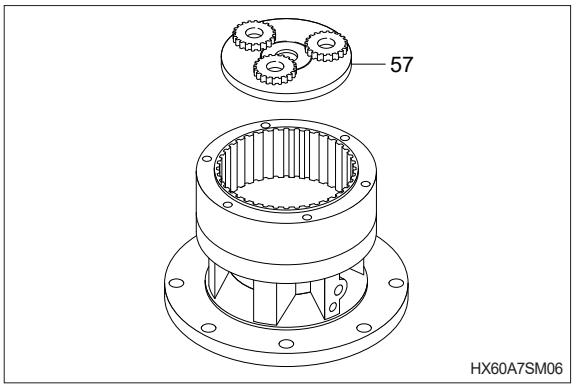
(9) Install No.2 sun gear (56).

※ Be sure to check the direction of sun gear (56) when assembling.

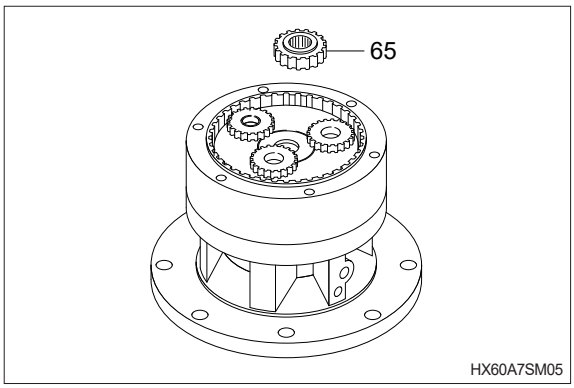


(10) Mount No.1 carrier assembly (57) in the case sub assembly and install bolts into 2 TAP holes (M6) as shown in figure.

※ Turn the carrier slowly by hand to adjust the matching holes when assembling.



(11) Assemble No.1 sun gear (65).



GROUP 5 TRAVEL DEVICE

1. GENERAL ATTENTION AT ASSEMBLING AND DISASSEMBLING

1) Pay attention to the followings at assembling and disassembling.

(1) Work at the clean area, and pay attention to clean each part from rubbish, peace of paint and water. Prepare the clean case for disassembled parts.

(2) Remove the rubbish from the outside of the wheel motor before disassembling, and remove the peace of paint by wiring brush.

(3) Put a mark on each part before disassembling for keeping the correct position at assembling of them.

(4) Handle disassembled parts with special care.

(5) Clean each part with cleaning solvents.

(6) Check disassembled parts with no damage, and removes any burrs.

(7) Use the new seal parts and snap rings.

(8) The press-fitting parts (for example, bearing and pin) can not be disassembled.

2. ASSEMBLING AND DISASSEMBLING PROCEDURE

(1) Please refer to the cross-sectional drawing and the parts list.

NECESSARY TOOL TO ASSEMBLE

No.	Necessary tool	
1	Torque wrenches	45N (J I S B4650) 90N (J I S B4650) 280N (J I S B4650)
2		
3		
4	Hexagon socket	Hexagon size 5 mm Hexagon size 8 mm
5		
6	Socket wrenches	Hexagon size 36 mm
7	Hexagon socket wrenches	Hexagon size 5 mm Hexagon size 8 mm
8		
9	Screwdrivers	Width 6~10 mm
10	Snap ring pliers	35 mm for hole 22 mm for shaft 35 mm for shaft 140 mm for shaft
11		
12		
13		
14	Plastic hammer	
15	Other	Grease Oil Sand paper C-cramps
16		
17		
18		

1. REDUCTION GEAR SECTION (DISASSEMBLING)

1) Remove the plug (G1/8).

※ Hexagon size: 5mm

7078TM03

2) Remove the 2 plugs (G3/8).

※ Hexagon size : 8 mm

7078TM04/04A

3) Remove the O-snap ring.

※ Put the screwdriver into the notch of the body. And then pull the O-ring.

7078TM05/05A

4) Remove the cover.

7078TM06

5) Remove the slide ring from the cover.

7078TM03

6) Remove the O-ring from the body.

7078TM04/04A

7) Remove the carrier~ 2 kit, s2 gear and the s1 gear from the body.

7078TM05/05A

7078TM06

8) Remove the 3 snap rings, 1 thrust plate 2, 3 b2 gears, 69 needles, 3 rings and 3 thrust washers.

※ Pay attention not to lose the each part.

7078TM03

7078TM04/04A

7078TM05/05A

9) Remove the 4 snap rings and the thrust plate 1.

7078TM03

10) Remove the 4 thrust washers.

7078TM04/04A

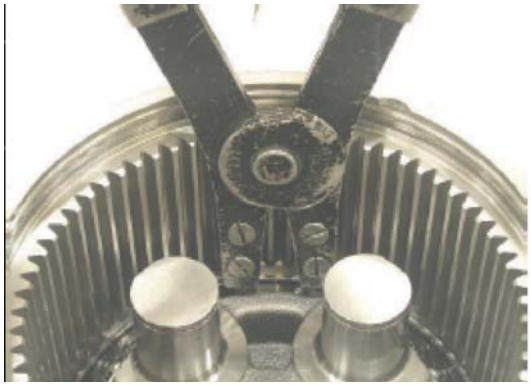
11) Remove the 4 b1 gears, 136 needles, 4 rings, 4 thrust washers.

7078TM05/05A

12) Remove the 1 thrust washer.

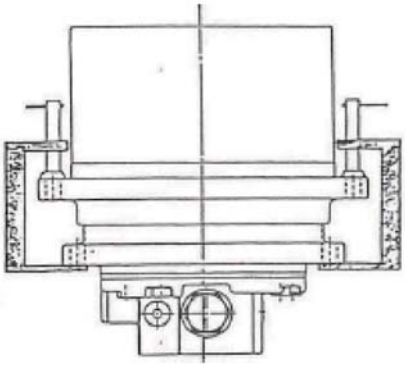
7078TM06

13) Remove the snap ring.
Tighten the speed reducer flange and the motor flange with C-cramps or a hydraulic press to make it easy (See the illustration).



7078TM03

14) Remove the Body with bearings and floating seatfrom the Hydraulic motor.



7078TM04/04A

15) Remove the floating seat with O-ring from the body.

※ The bearings are not able to disassemble, because they are press-fitted.

7078TM05/05A

16) Remove the floating seat with O-ring from the hydraulic motor.

7078TM06

2. HYDRAULIC MOTOR SECTION (DISASSEMBLING)

1) Remove the seven hexagon socket head cap bolts.

※ Hexagon sixe: 8mm

※ If you fix the motor with a vice, protect it with aluminum plates or equivalent.

7078TM03

2) Remove the body-1 from the body-2.

※ Pay attention not to come off and damage the valve plate.

7078TM04/04A

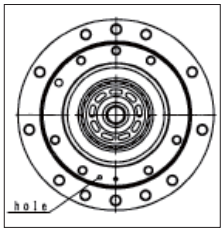
3) Remove the valve plate, spring-B and retainer.

※ The bearing and spring pin are not able to disassemble, because they are press-fitted.

7078TM05/05A

4) Remove the brake piston assembly from the body-2.

※ The brake piston removes when the air comes into the inside from the hole. Do not blow it suddenly, The brake piston assembly fly out.



7078TM06

5) Remove the 3 Steal plates and 2 Disc plates from the body-2.

7078TM03

7078TM04/04A

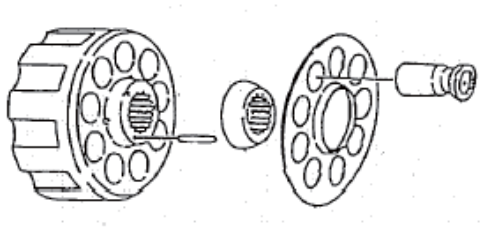
7078TM05/05A

16) Remove the cylinder barrel assembly from the body-2.

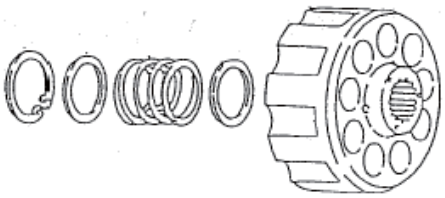
※ Pay attention not to lose the each part.

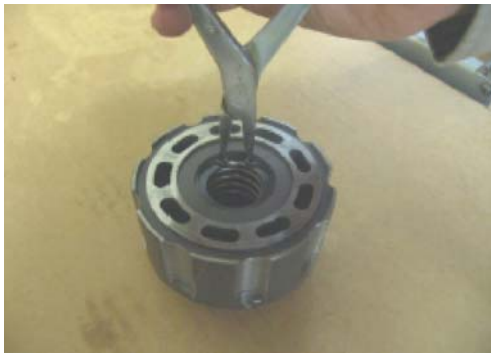
7078TM06

7) Remove the 9 piston-shoe assemblies, shoe holder, barrelholder and 3 pins.



8) Remove the snap ring, retainer, spring-C and retainer.





7078TM04/04A

9) Remove the swash plate and 2 balls from the body-2.

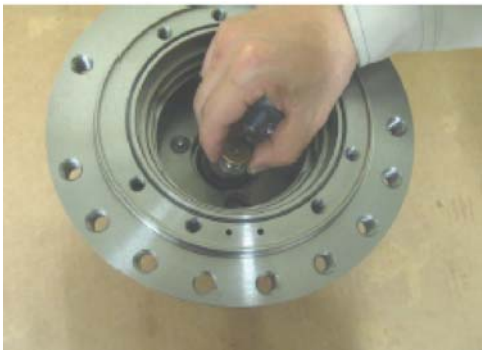
7078TM05/05A

10) Remove the shaft from the body-2.

※ The bearing is not able to disassemble, because it is press-fitted.

7078TM06

11) Remove the control piston from the body-2.



12) Remove the oil seal from the body-2.

7078TM04/04A

13) Remove the O-ring from the body-2.

7078TM05/05A

14) Remove the pin from the body-2.

7078TM06

15) Remove the 2 plugs with O-ring from the body-1.

※ Hexagon size : 36 mm

16) Remove the 2 spring-V2, 2 rings and spool assembly.

※ The spool assembly is not able to disassemble.

7078TM04/04A

7078TM05/05A

7078TM06

17) Remove the 2 plugs with O-ring from the body-1.

※ Hexagon size : 8 mm

18) Remove the two-speed spool, spool-B, spool-C andspring-V3.

※ Pay attention not to lose the each part.

7078TM04/04A

19) Remove the 2 plugs with O-ring from the body-1.

※ Hexagon size : 5 mm

7078TM05/05A

20) Remove the shuttle spool.

7078TM06

3. Hydraulic motor section (assembling)

1) Press-fit the bearing and the spring pin into the body-1.

7078TM03

2) Insert the spool assembly, 2 rings (1pc/side) and 2 springs(1pc/side) in that order into the body-1, and then screwthe 2 plugs (1pc/side) with O-ring (1pc/side).

※ The spool assembly is not able to disassemble.
※ Plugs tightening torque: 20.0 to 24.9 kg.m (Both sides)
※ Hexagon size : 36 mm

3) Insert the spring-V3, spool-B, spool-C intothe two-speed spool.
Insert its assembly into the body-1, and screwthe 2 plugs (1pc/side) with O-ring (1pc/side).

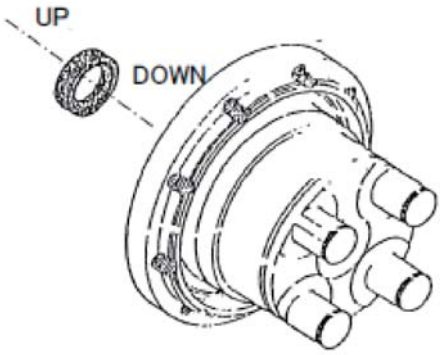
※ Plugs tightening torque : 4.7 to 5.2 kg.m (Both sides).
※ Hexagon size : 8 mm.
※ Pay attention to the direction of the spool. (See cross sectional drawing for the direction).
※ Pay attention not to lose the each part.

4) Insert the shuttle spool into the body-1, and then screwthe 2 plugs (1pc/side), with O-ring (1pc/side).

※ Plugs tightening torque: 1.22~1.84 kg.m
※ (Both sides)
Hexagon size : 5 mm.

5) Press-fit the oil seal into the body-2.

※ Apply grease to the periphery of the oil seal.
※ Pay attention to the direction of the oil seal, and do not slant it.



6) Place the pin into the Body-2.

7078TM04/04A

7) Press-fit the bearing into the shaft.

7078TM05/05A

8) Insert the control piston into the body 2.

※ Pay attention to the direction of the control piston.(See cross sectional drawing for the direction).

7078TM06

9) Place the shaft with bearing into the body-2.

※ Pay attention not to damage the oil seal with the shaft. A oil seal which damaged should be replaced.

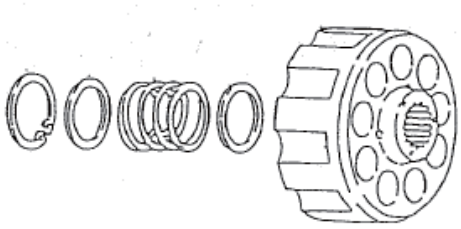
10) Place the 2 balls and the swash plate onto the body-2.

※ Apply oil to the working face of the swash plate.
※ In case the swash plate drops out, apply grease to the back of it.

7078TM04/04A

7078TM05/05A

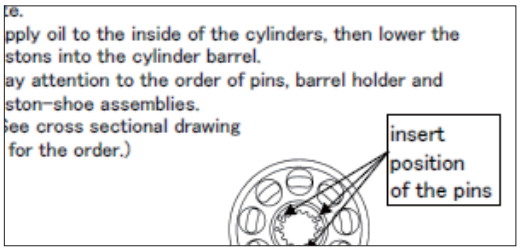
11) Place the retainer,spring and retainer in that order into thecylinder barrel, and then secure them with the snap ring.

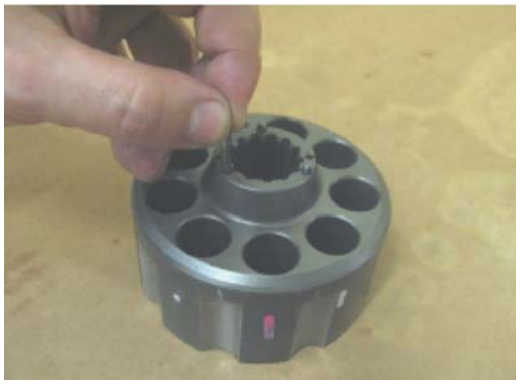


7078TM06

12) Place the piston-shoe assemblies into the shoe holder.

13) Place 3 pins,barrel holder and 9 piston-shoe assembliesin that order into the cylinder barrel.





7078TM04/04A

※ Apply oil to the inside of the cylinders, then lower the pistons into the cylinder barrel.

※ Pay attention to the order of pins, barrel holder and piston-shoe assemblies. (See cross sectional drawing for the order.)

7078TM05/05A

14) Inset the cylinder barrel assembly into the body 2 so that the shoes contact the swash plate.

※ Pay attention not to lose the each part.

7078TM06

15) Place the steel plate, disk plate, steel plate, disk plate, steelplate in that order into the body-2 along the groove.

16) Place the 2 O-rings and 2 back-up rings onto the brake piston.

※ Pay attention to the direction of O-rings and backup rings. (See cross sectional drawing for the direction.)

7078TM04/04A

17) Inset the brake piston assembly into the body-2.

※ Apply grease to the O-ring to make it easy.

7078TM05/05A

18) Fill the body-2 with hydraulic oil for lubrication.

19) Place O-ring onto the body-2.

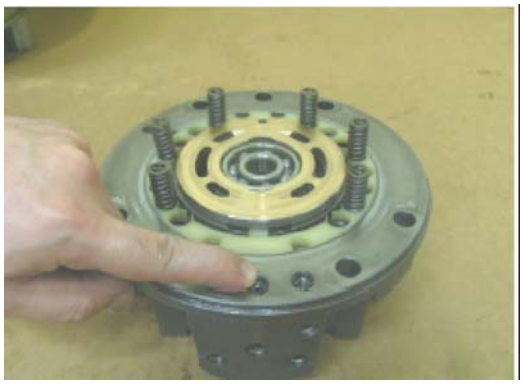
20) Place the 2 O-rings, retainer, valve plate and spring-Bonto the body-1.

※ The copper face of the valve plate should be uppermost.

※ Apply oil to the copper face of the valve plate.

※ In case the valve plate drops out, apply grease to the steel face of it.

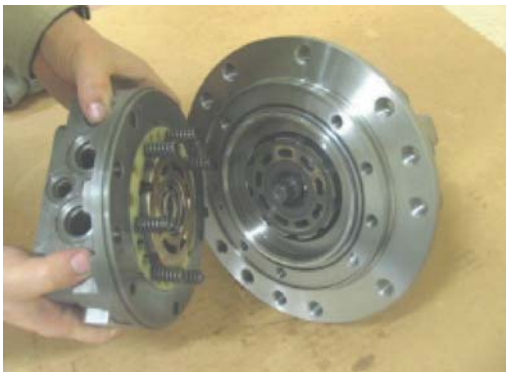
※ Please refer to the parts list for the number and the position with the spring-B.



7078TM04/04A

21) Join the body-1 to the body-2.

※ Pay attention not to lose the each part.



7078TM05/05A

22) Bolt them with seven hexagon sockets head cap bolts.

※ Bolt tightening torque : 5.2 to 6.6 kg.m

※ Hexagon size : 8 mm.

※ If you fix the motor with a vice, protect it with aluminum plates or equivalent.

7078TM06

4. REDUCTION GEAR SECTION (ASSEMBLING)

1) Place the floating seal with O-ring into the hydraulic motor.

7078TM03

2) Place the 2 bearings and snap ring into the body.

※ Pay attention to the direction of the 2 bearings.
(See cross sectional drawing for the direction.)

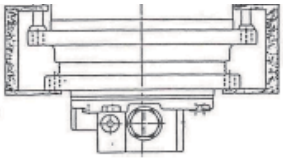
3) Put the floating seal with O-ring onto the body.

4) Join the body to the motor, and secure it with snap ring.

※ Degrease the surface of floating seal.

※ Hit around the body by the resinous hammer equally to make it easy.

※ Tighten the speed reducer flange and the motor flange with C-cramps or a hydraulic press when the snap ring is fastened.



5) Place the thrust washer onto the body-2.

6) Place the 4 thrust washers (1pc/1pin), 4 rings (1pc/1pin),4 b1 gears (1pc/1pin), 136 needles (34pcs/1pin).

※ Pay attention to the direction of the thrust washers.
(See cross sectional drawing for the direction.)

7078TM04/04A

7) Place the 4 thrust washers (1pc/1pin) and thrust plate 1 inthatorder onto the body-2, and secure it with 4 snap rings.

7078TM05/05A

8) Place the thrust plate 1 in thatorder onto the body-2, and secure it with 4 snap rings.

※ Pay attention to the direction of the snap rings and thrust plate 1. The edge side should be uppermost.

※ Pay attention not to open the snap ring too much. A snap ring which loses tension should be replaced.

7078TM06

9) Place the 3 rings(1pc/1pin), 3 thrust washers (1pc/1pin), 3 b2gears (1pc/1pin),69 needles (23pcs/1pin) and thrust plate,andsecure it with 3 snap rings.

※ Pay attention to the direction of the b2 gears.(See cross sectional drawing for the direction.)
※ Pay attention to the direction of the snap ring.The edge side should be uppermost.
※ Pay attention not to open the snap ring too much. A snap ring which loses tension should be replaced.

10) Place the S2 gear and S1 gear into the carrier-2 assembly.

11) Place the thrust washer onto the body-2.

※ Pay attention not to become scattering the carrier-2 assembly, S1 gear and S2.

※ When not assembled, please change and assemble the position of the gear.

12) Place the O-ring to the body.

※ Apply grease to the O-ring.

※ Pay attention not the rubbish in the O-ring groove.

7078TM04/04A

13) Insert the slide ring in the cover.

※ Apply grease to the slide ring to prevent it dropping out.

7078TM05/05A

14) Fill 800cm3 gear oil in the body, then insert cover in thebody.

7078TM06

15) Place the thrust washer onto the body-2.

※ Pay attention not to become scattering the carrier-2 assembly, S1 gear and S2.

※ When not assembled, please change and assemble the position of the gear.

16) Put the O-snap ring into the groove of t

※ Put the flat blade-flared tip screwdriver to the end of the snap ring, and tap it in the direction of the circumference.

17) Screw the 2 plugs (size: G3/8) with Plug.

※ Tightening torque: 4.76 to 5.2 kg.m

※ Hexagon size : 8 mm

18) Screw the plug (size : G1/8) with O-ring (1pc/plug)to the cover.

※ Plug tightening torque: 1.22 to 1.84 kg.m

※ Hexagon size : 5 mm.

GROUP 6 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.**

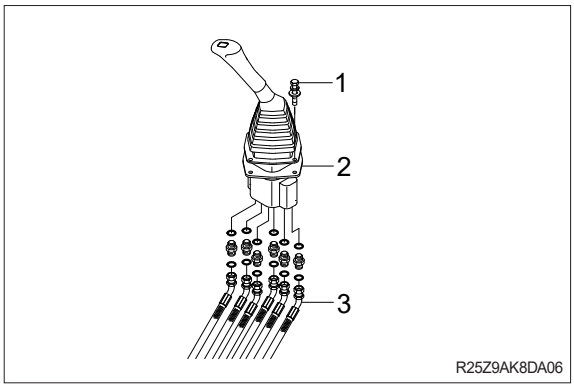
(4) Loosen the socket bolt(1).

(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.



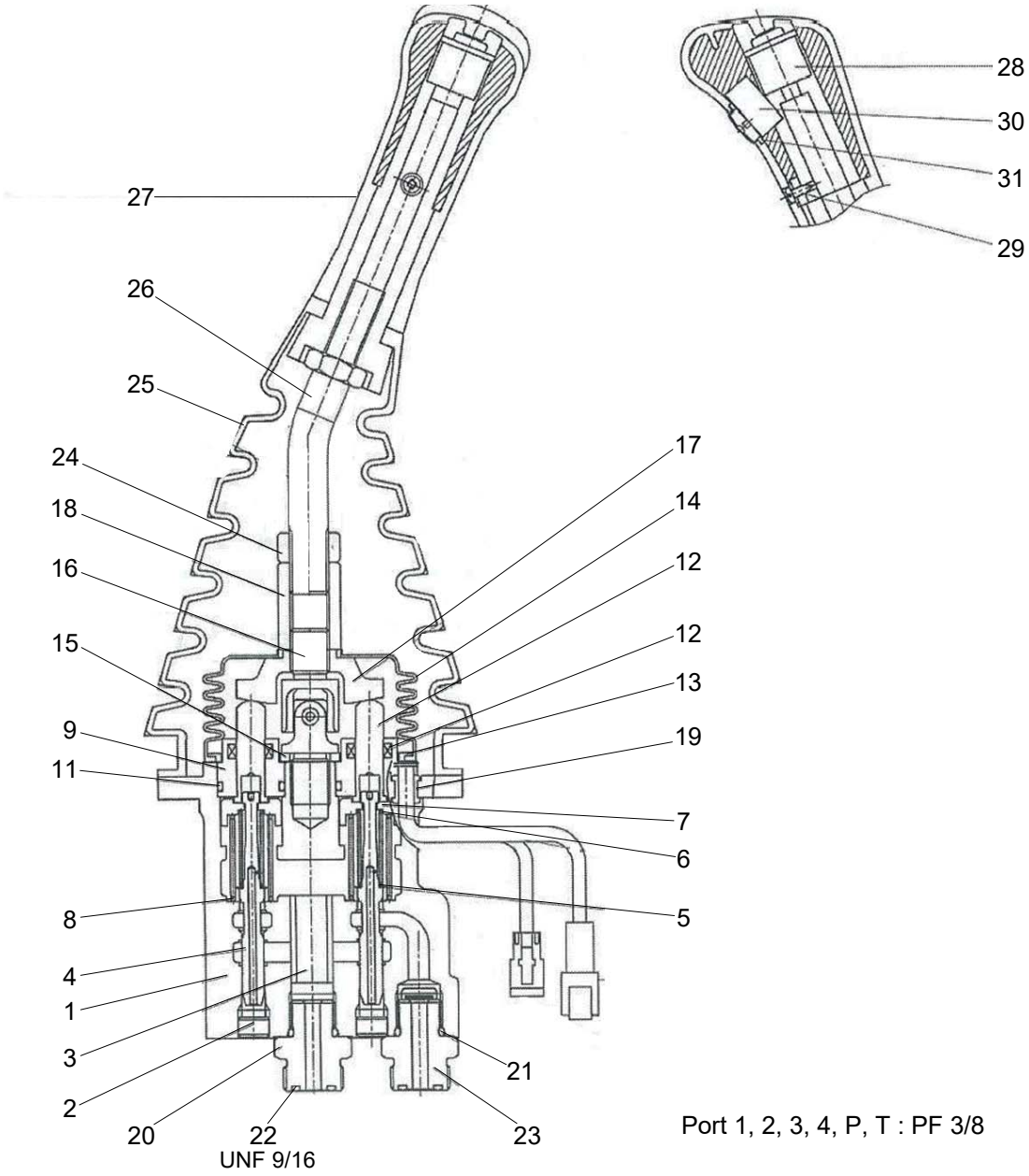
2) INSTALL

(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

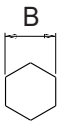


60S7RC02

1	Case	12	Rod seal	23	Last guard filter
2	Plug	13	Plate	24	Nut
3	Bushing	14	Inner boots	25	Boots
4	Spool	15	Spacer	26	Handle bar
5	Shim	16	Joint assembly	27	Handle assembly
6	Spring	17	Swash plate	28	Switch assembly
7	Spring seat	18	Nut	29	Screw
8	Spring	19	Bushing	30	Switch
9	Plug	20	Connector	31	Switch cover
10	Push rod	21	O-ring		
11	O-ring	22	O-ring		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
(L) Hexagonal wrench	10	
Spanner	22	
	27	
(+) Driver	Length 150	
(-) Driver	Width 4~5	
Torque wrench	Capable of tightening with the specified torques	

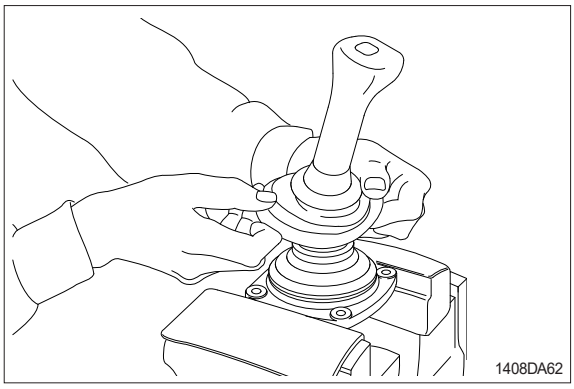
3) DISASSEMBLY

(1) Clean pilot valve with kerosene.

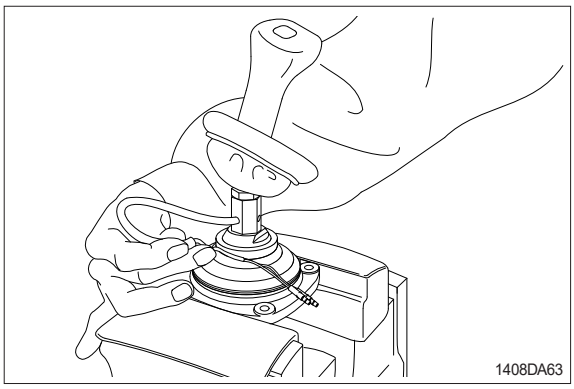
※ Put blind plugs into all ports.

(2) Fix pilot valve in a vise with copper (or lead) sheets.

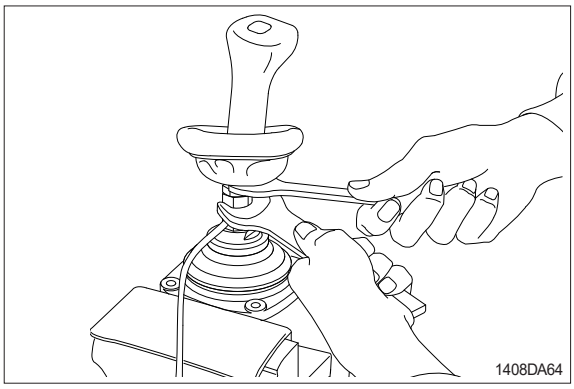
(3) Remove end of boots (25) from case (1) and take it out upwards.



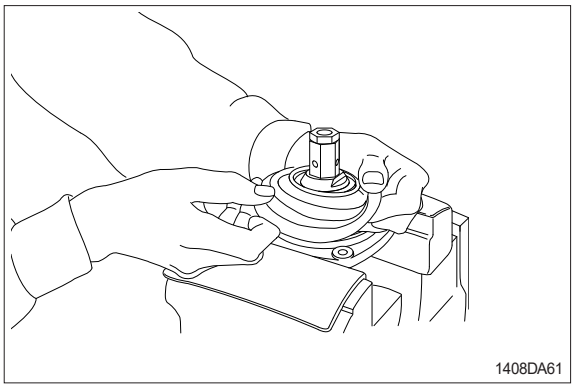
※ For valve with switch, remove cord also through hole of casing.



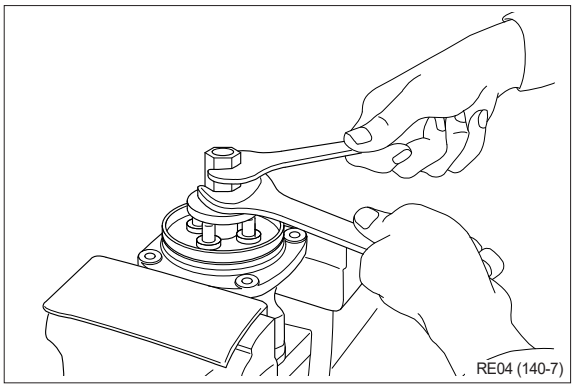
(4) Loosen lock nut (24) and adjusting nut (18) with spanners on them respectively, and take out handle section as one body.

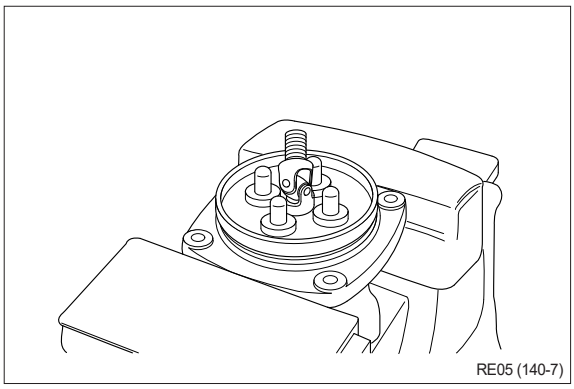


(5) Remove the boots (14).



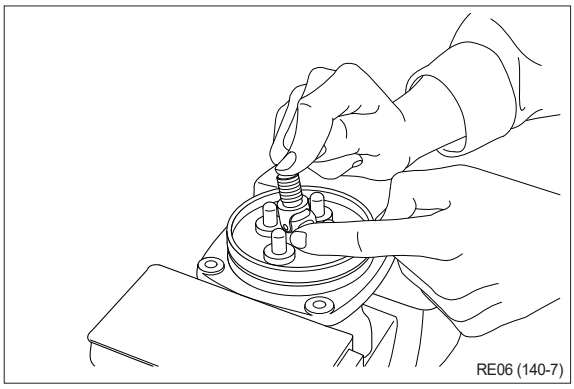
(6) Loosen adjusting nut (18) and plate (13) with spanners on them respectively, and remove them.

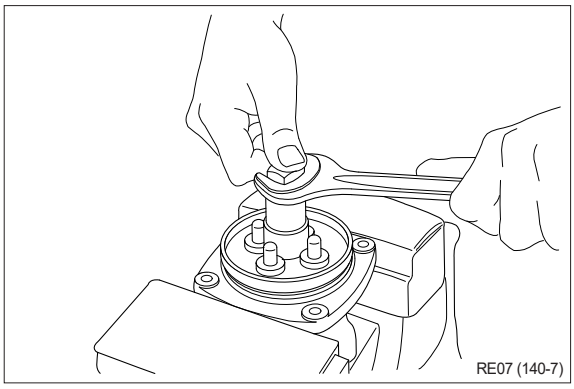

RE04 (140-7)


RE05 (140-7)

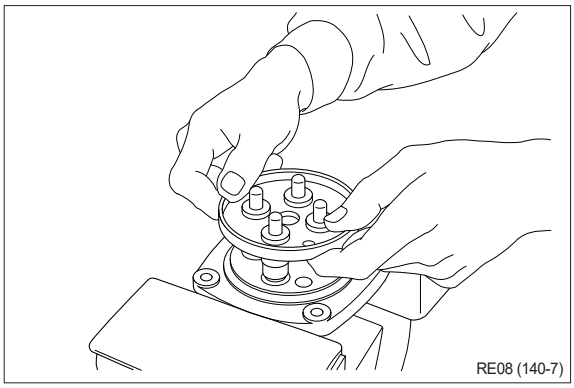
(7) Turn joint anticlockwise to loosen it, utilizing jig (special tool).

※ When return spring (6,8) is strong in force, plate (13), plug (9) and push rod (10) will come up on loosening joint. Pay attention to this.


RE06 (140-7)


RE07 (140-7)

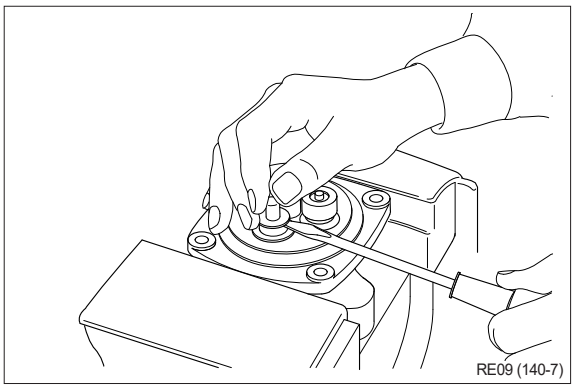
(8) Remove plate (13).


RE08 (140-7)

(9) When return spring (6, 8) is weak in force, plug (9) stays in casing because of sliding resistance of O-ring.

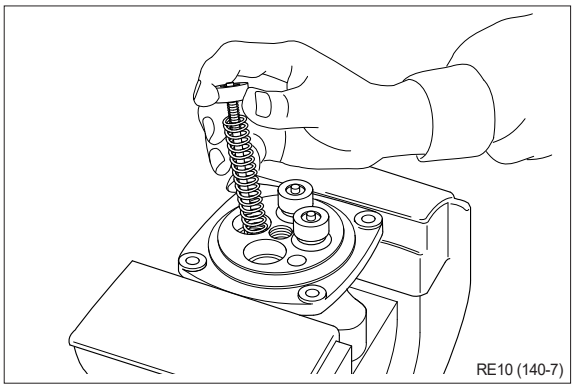
※ Take it out with minus screwdriver.
Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.

※ During taking out, plug may jump up due to return spring (6, 8) force.
Pay attention to this.

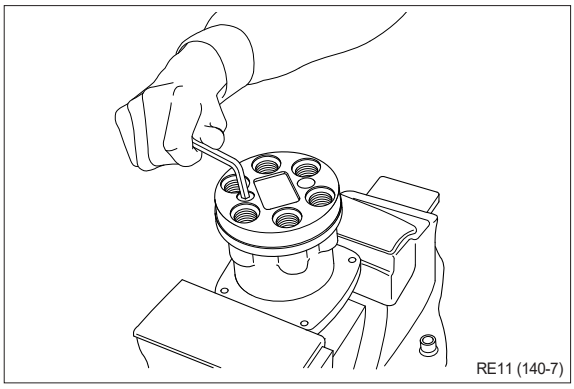

RE09 (140-7)

(10) Remove reducing valve subassembly and return spring (6, 8) out of casing.

※ Record relative position of reducing valve subassembly and return springs.


RE10 (140-7)

(11) Loosen hexagon socket head plug (2) with hexagon socket screw key.

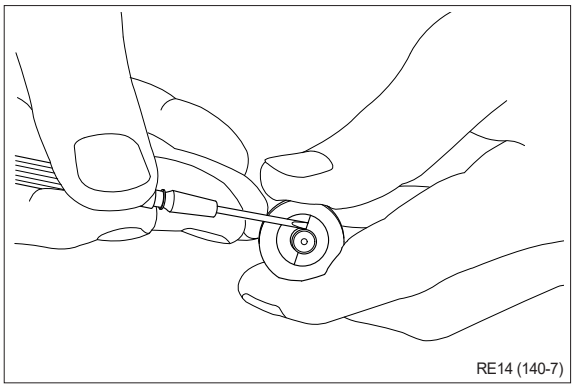

RE11 (140-7)

(12) For disassembling reducing valve section, stand it vertically with spool (4) bottom placed on flat workbench. Push down spring seat (7) and remove two pieces of semicircular stopper with tip of small minus screwdriver.

※ Pay attention not to damage spool surface.

※ Record original position of spring seat (7).

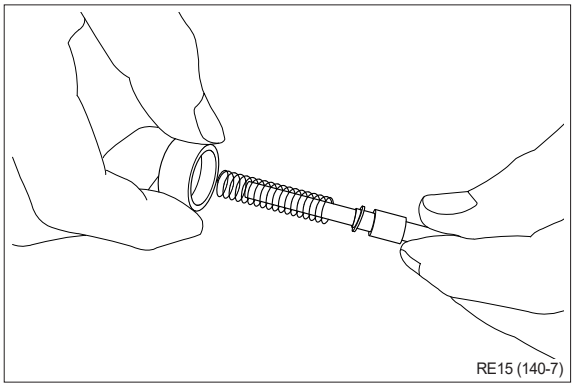
※ Do not push down spring seat more than 6 mm.



RE14 (140-7)

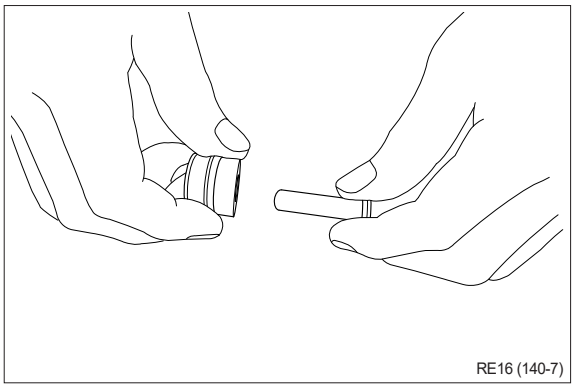
(13) Separate spool (4), spring seat (7), spring (6, 8) and shim (5) individually.
Until being assembled, they should be

※ handled as one subassembly group.



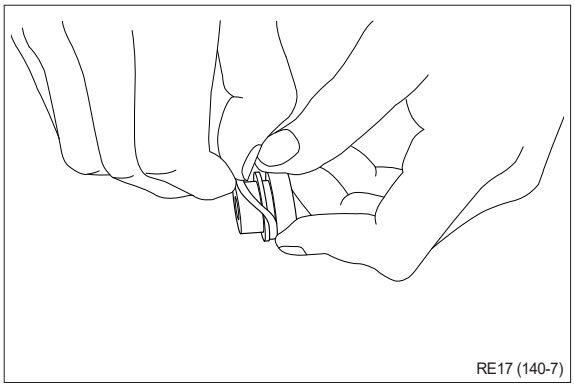
RE15 (140-7)

(14) Take push rod (10) out of plug (9).

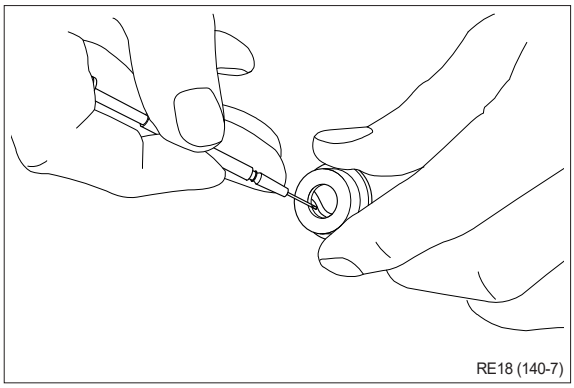


RE16 (140-7)

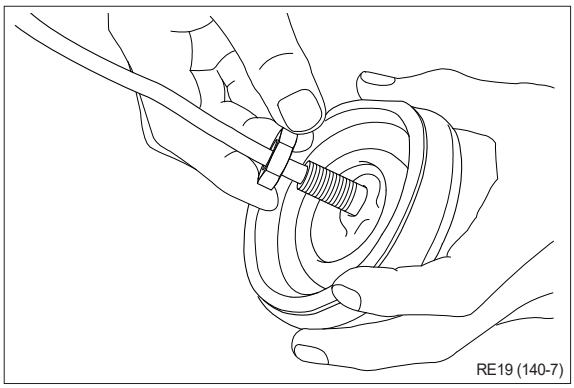
(15) Remove O-ring (11) and seal (12) from plug (9).
Use small minus screwdriver or so on to remove this seal.

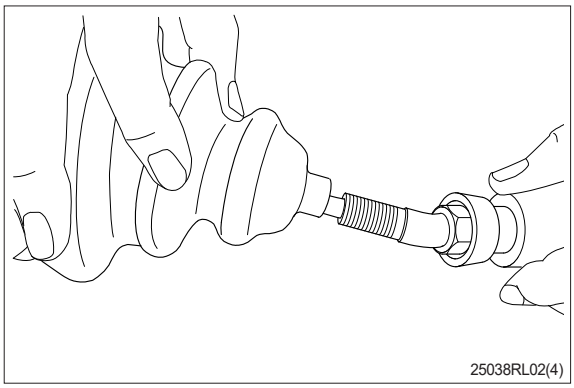


RE17 (140-7)



(16) Remove lock nut (24) and then boots (25).





(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.

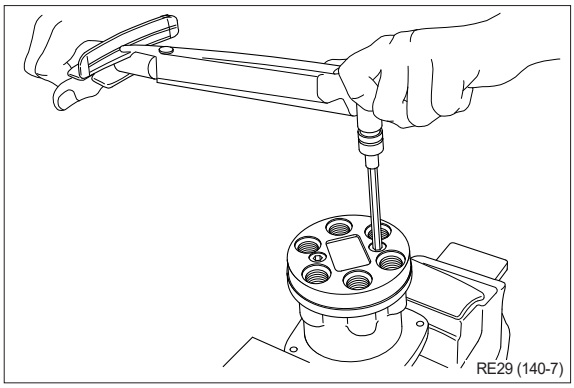
(18) Rust prevention of parts.
Apply rust-preventives to all parts.

※ If left as they after being cleaned, they will be rusted and will not display their functions fully after being reassembled.

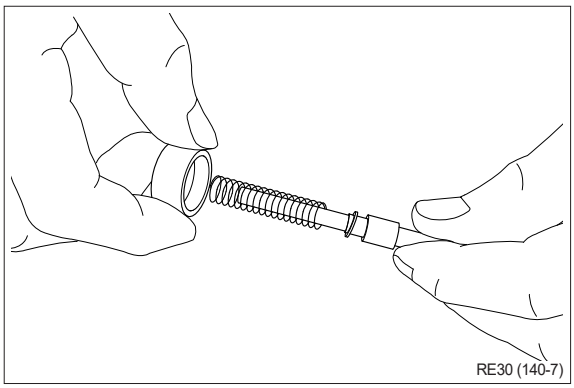
4) ASSEMBLY

(1) Tighten hexagon socket head plug (2) to the specified torque.

※ Tighten two bolts alternately and slowly.

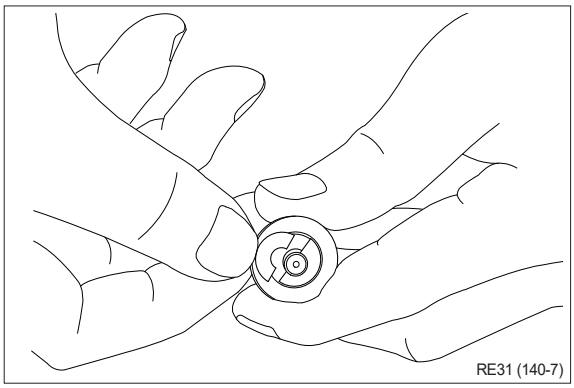

RE29 (140-7)

(2) Put spring shim (5), springs (6, 8) and spring seat (7) onto spool (4) in this order.


RE30 (140-7)

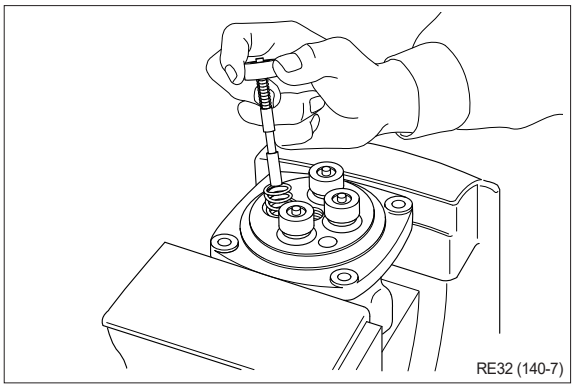
(3) Stand spool vertically with its bottom placed on flat workbench, and with spring seat pushed down, put two pieces of semicircular stopper on spring seat without piling them on.

※ Assemble stopper so that its sharp edge side will be caught by head of spool.
Do not push down spring seat more than 6 mm.

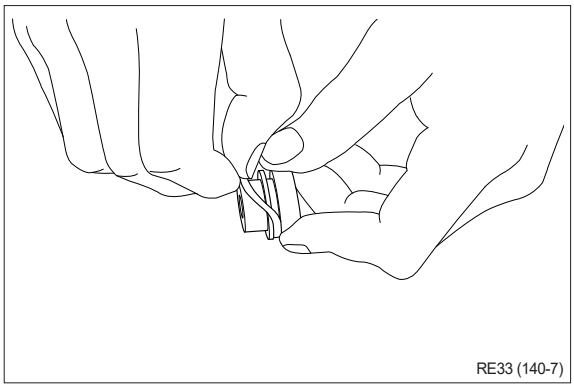

RE31 (140-7)

(4) Assemble spring (6, 8) into casing (1). Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.

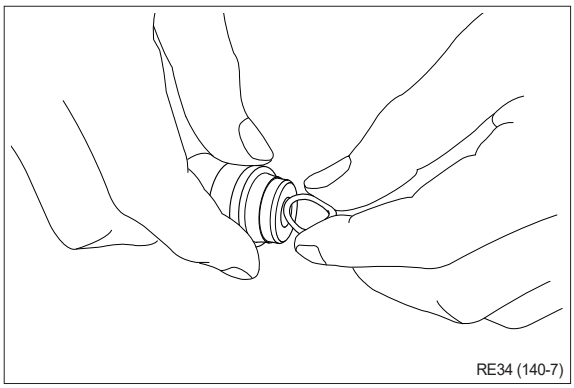

RE32 (140-7)

(5) Assemble O-ring (11) onto plug (9).


RE33 (140-7)

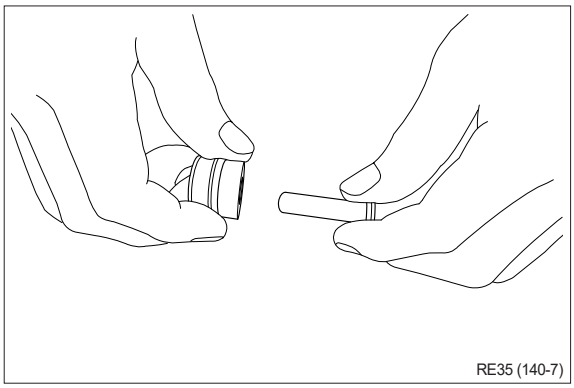
(6) Assemble seal (12) to plug (9).

※ Assemble seal in such lip direction as shown below.


RE34 (140-7)

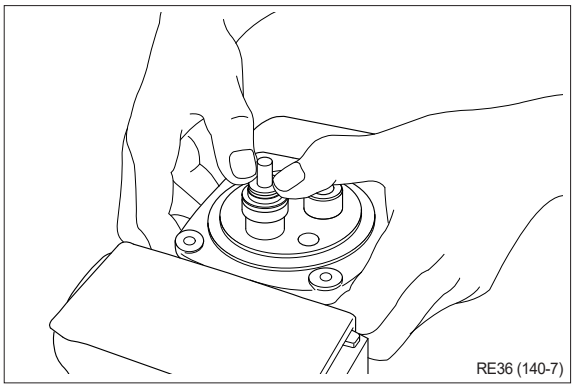
(7) Assemble push rod (10) to plug (9).

※ Apply working oil on push-rod surface.


RE35 (140-7)

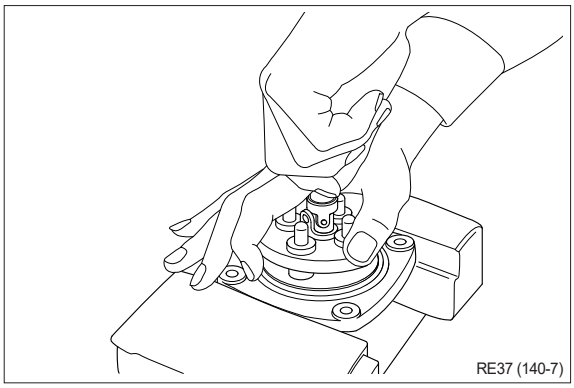
(8) Assemble plug subassembly to casing.

※ When return spring is weak in force, subassembly stops due to resistance of O-ring.

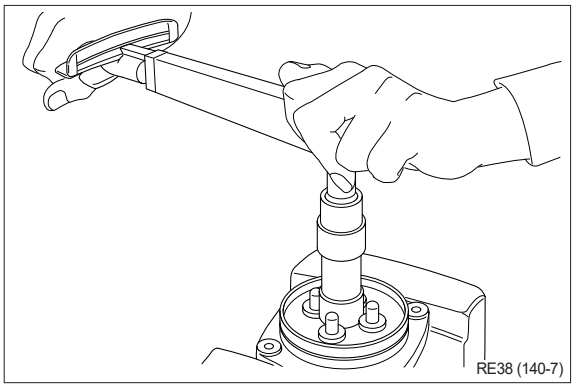

RE36 (140-7)

(9) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (13), and tighten joint (16) temporarily.

(10) Fit plate (13).


RE37 (140-7)

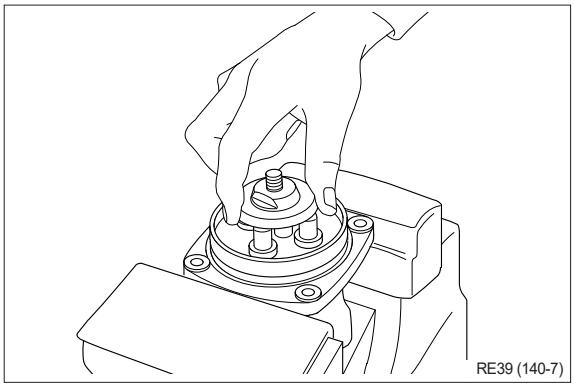
(11) Tighten joint (16) with the specified torque to casing, utilizing jig.


RE38 (140-7)

(12) Assemble spacer (15) to joint (16).

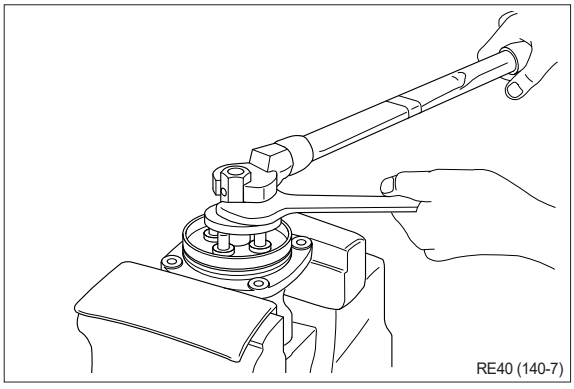
※ Screw it to position that it contacts with 4 push rods evenly.

※ Do not screw it over.

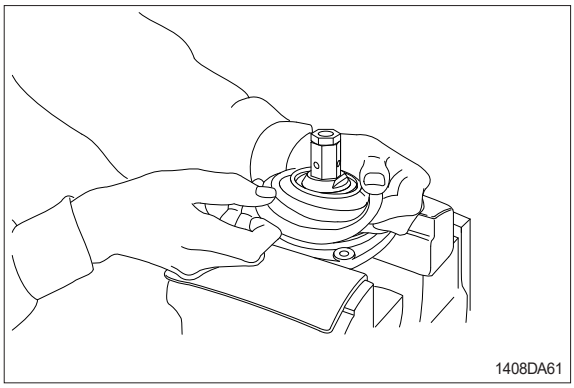

RE39 (140-7)

(13) Assemble adjusting nut (18), apply spanner to width across flat of swash plate (17) to fix it, and tighten adjusting nut to the specified torque.

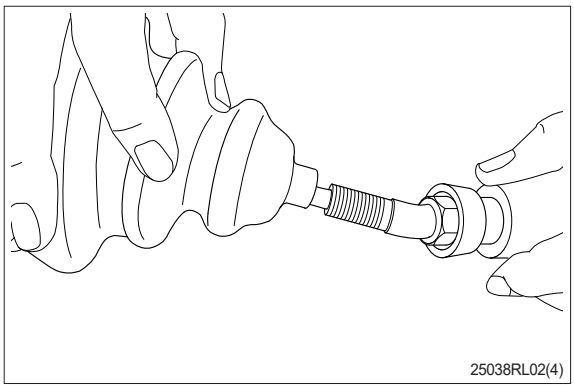
※ During tightening, do not change position of disk.

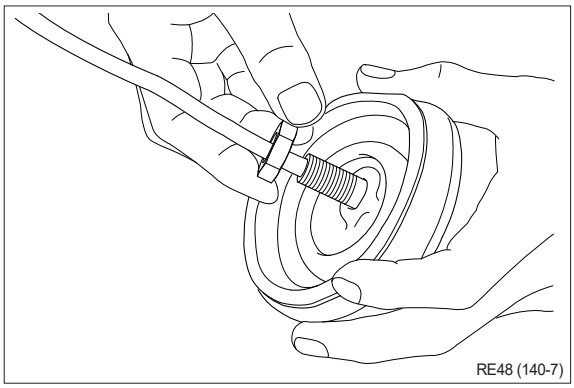

RE40 (140-7)

(14) Fit boot (14) to plate.

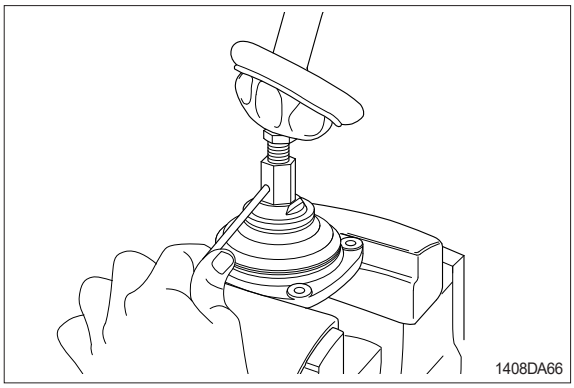


(15) Fit boot (25) and lock nut (24), and handle subassembly is assembled completely.



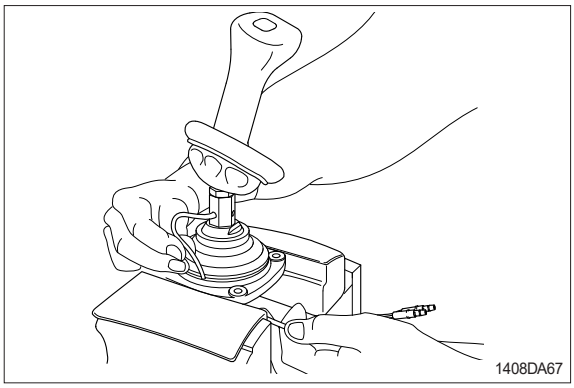


(16) Pull out cord and tube through adjusting nut hole provided in direction 60° to 120° from casing hole.

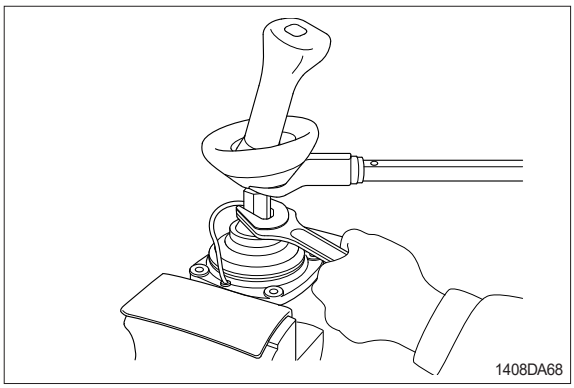


(17) Assemble bushing (19) to plate and pass cord and tube through it.

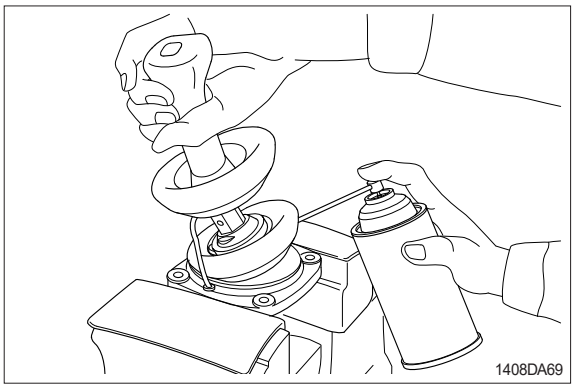
※ Provide margin necessary to operation.



(18) Determine handle direction, tighten lock nut (24) to specified torque to fix handle.

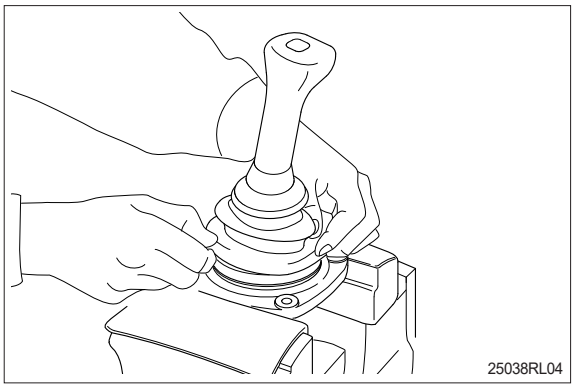


(19) Apply grease to rotating section of joint and contacting faces of disk and push rod.



(20) Assemble lower end of bellows to casing.

(21) Inject volatile rust-preventives through all ports and then put blind plugs in ports.



GROUP 7 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.**

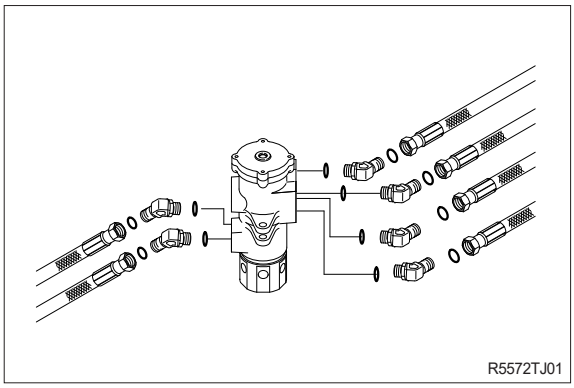
※ When pipes and hoses are disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(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.

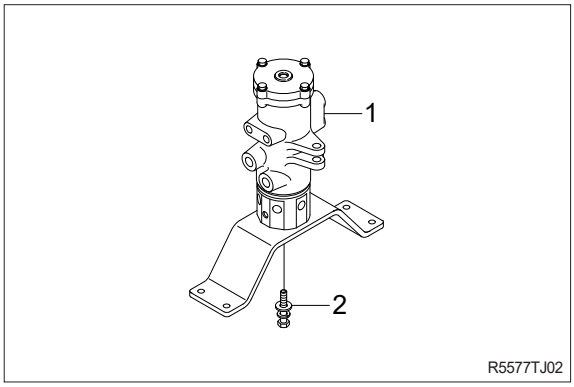
2) INSTALL

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

※ Take care of turning joint direction.

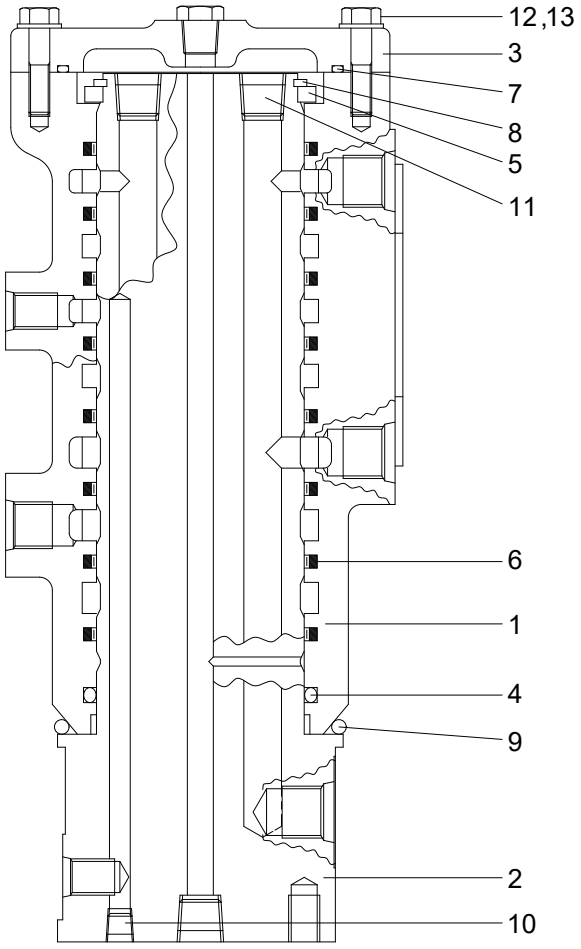
※ Assemble hoses to their original positions.

※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.



2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



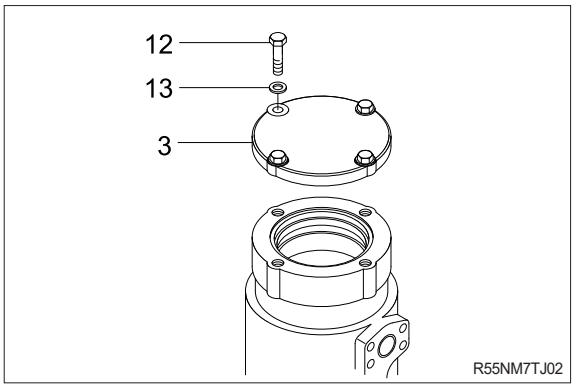
555K7TJ03

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

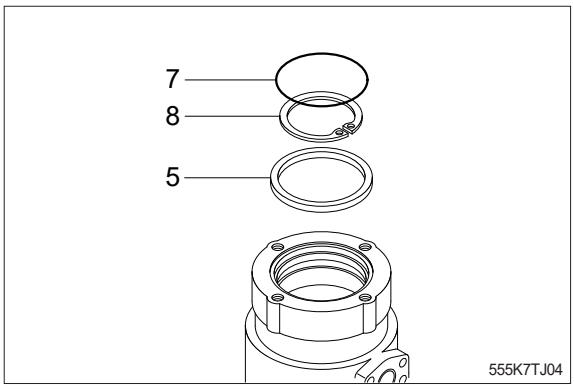
※ Before the disassembly, clean the turning joint.

(1) Remove bolts (12), washer (13) and cover (3).



(2) Remove O-ring (7).

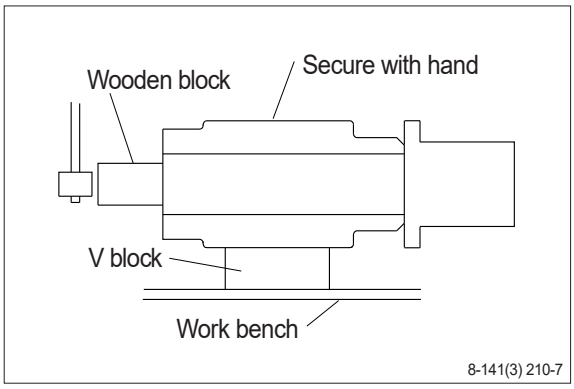
(3) Remove retainer ring (8) and ring (5).



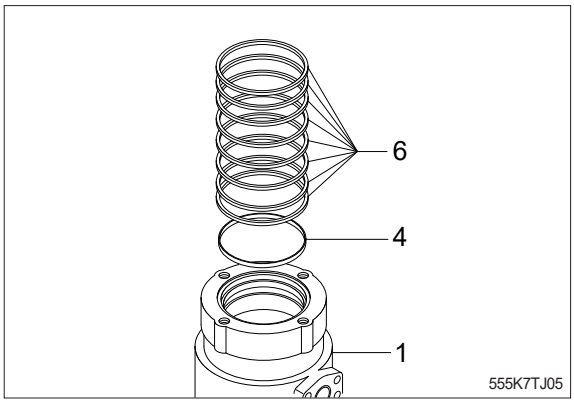
(4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

※ Take care not to damage the shaft (2) when remove hub (1) or rest it sideway.

※ Put a fitting mark on hub (1) and shaft (2).



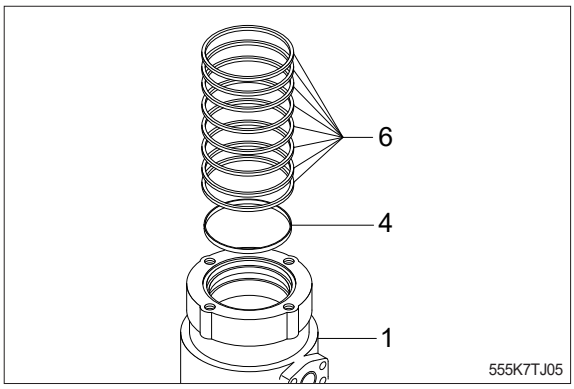
(5) Remove eight slipper seals (6) and O-ring (4) from hub (1).



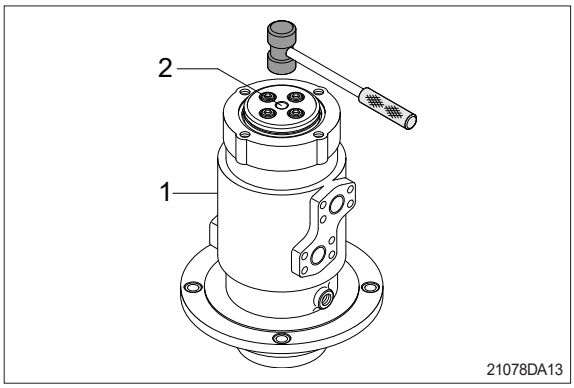
3) ASSEMBLY

※ Clean all parts.
※ As a general rule, replace oil seals and O-ring.
※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(1) Fix eight slipper seal (6) and O-ring (4) to hub (1).

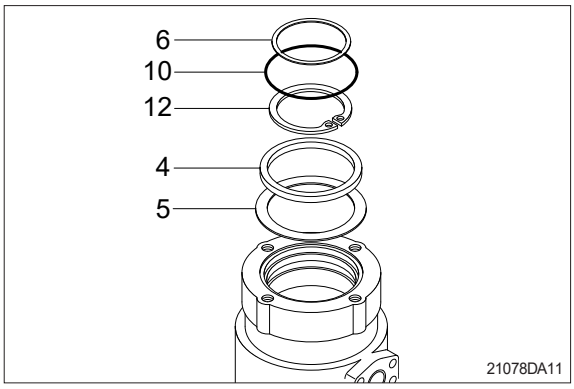


(2) Set shaft (2) on block, tap hub (1) with a plastic hammer to install.

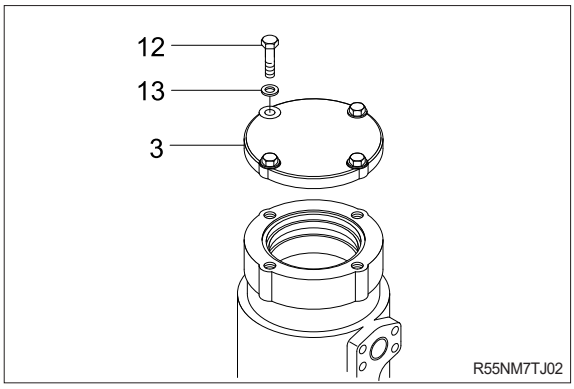


(3) Ring (5) and retainer ring (8) to shaft (2).

(4) Fit O-ring (7) to hub (1).



(5) Install cover (3) to body (1) and tighten bolts (12) with washer (13).



1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

(1) Removal

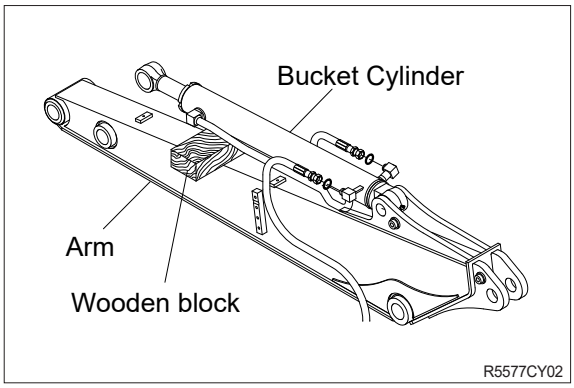
※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

※ 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.**

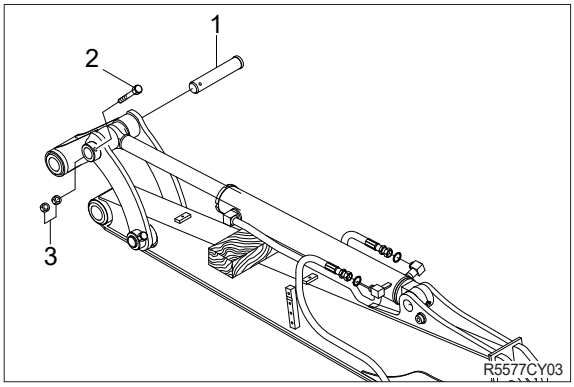
※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between bucket cylinder and arm.

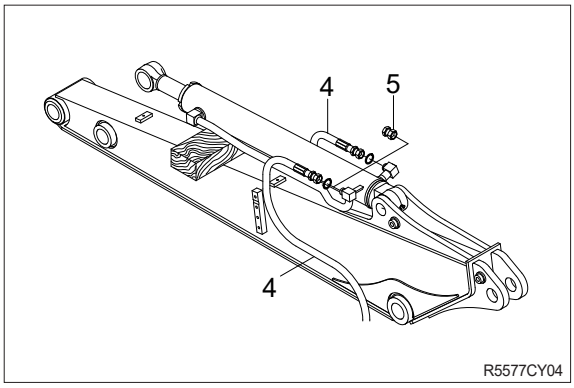


② Remove bolt (2), nut (3) and pull out pin (1).

※ Tie the rod with wire to prevent it from coming out.



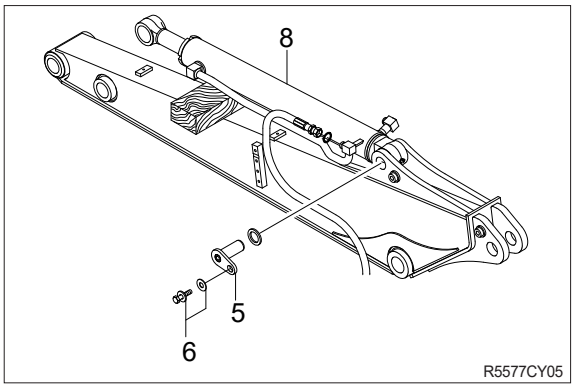
③ Disconnect bucket cylinder hoses (4) and put plugs (5) on cylinder pipe.



④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).

⑤ Remove bucket cylinder assembly (8).

· Weight : 36 kg (79 lb)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

※ Bleed the air from the bucket cylinder.

※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2) ARM CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

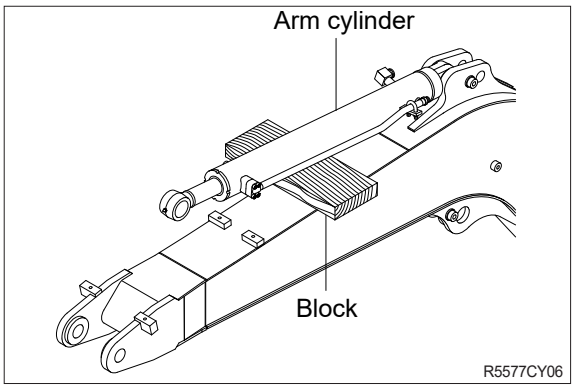
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

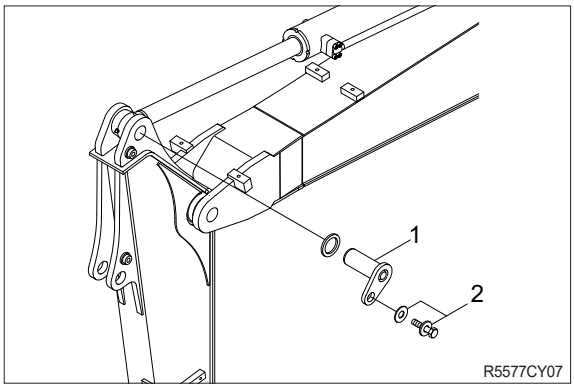
※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between arm cylinder and boom.



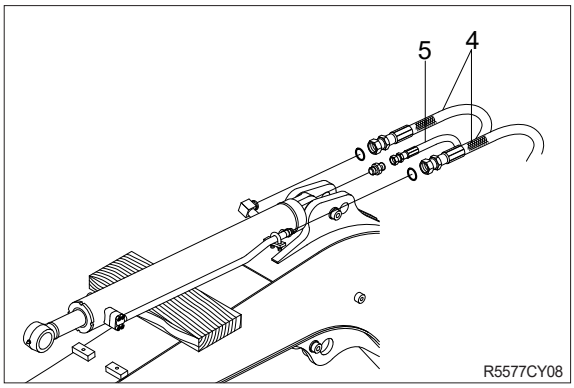
② Remove bolt (2) and pull out pin (1).

※ Tie the rod with wire to prevent it from coming out.

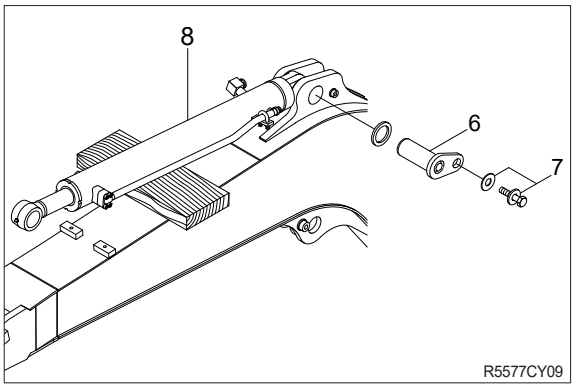


③ Disconnect arm cylinder hoses (4) and put plugs on cylinder pipe.

④ Disconnect greasing pipings (5).



⑤ Sling arm assembly (8) and remove bolt (7) then pull out pin (6).
⑥ Remove arm cylinder assembly (8).
· Weight : 54 kg (119 lb)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ When aligning the mounting position of the pin, do not insert your fingers in the pin hole.

※ Bleed the air from the arm cylinder.
※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

3) BOOM CYLINDER

(1) Removal

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

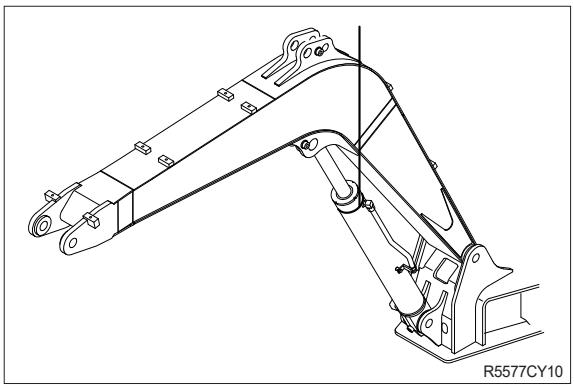
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

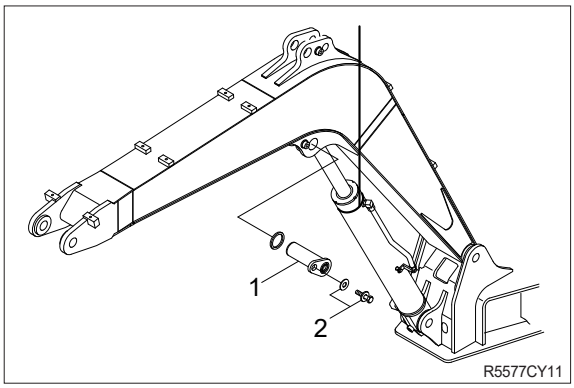
※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Disconnect greasing hoses (1).
② Sling boom cylinder assembly.

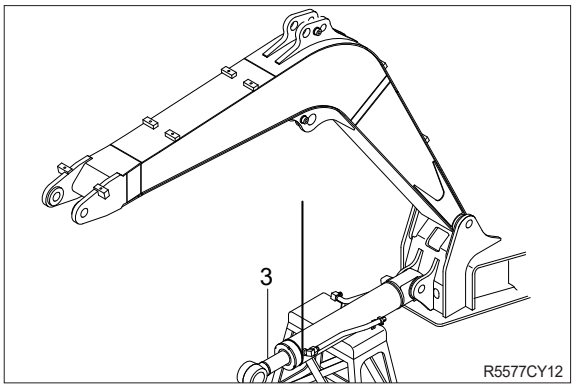


③ Remove bolt (2) and pull out pin (1).

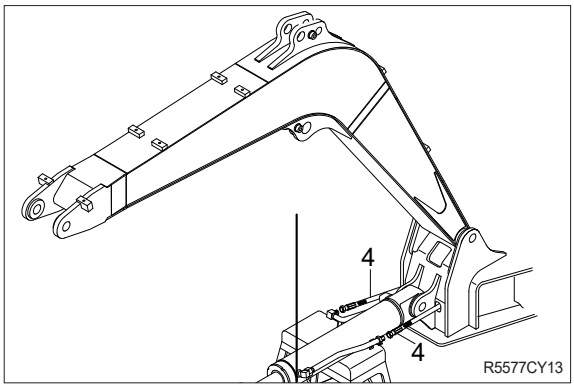
※ Tie the rod with wire to prevent it from coming out.



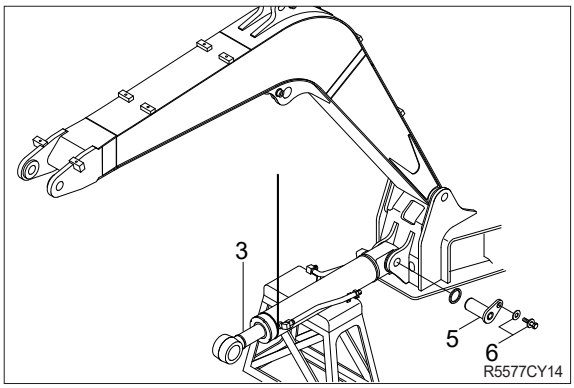
④ Lower the boom cylinder assembly (3) on a stand.



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 : 72 kg (159 lb)



(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

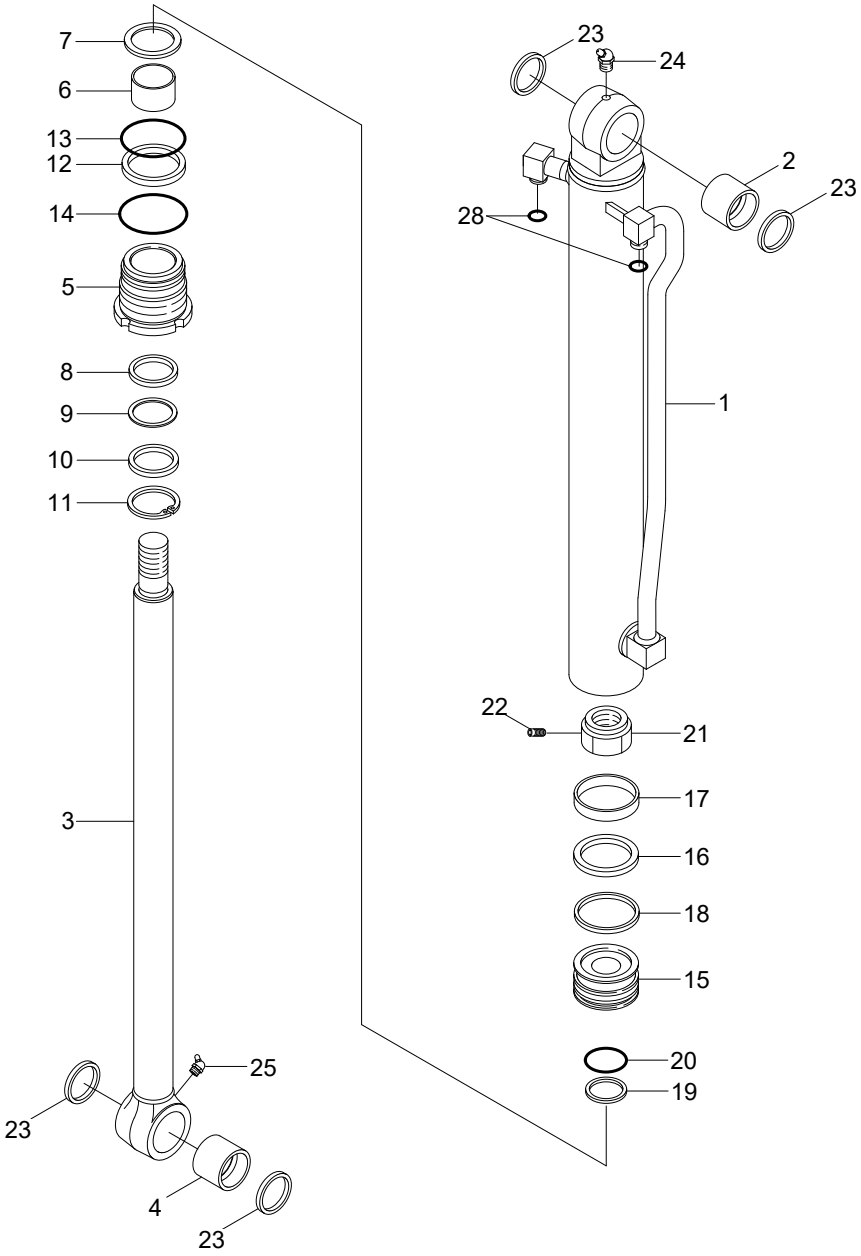
※ Bleed the air from the boom cylinder.

※ Conformed the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

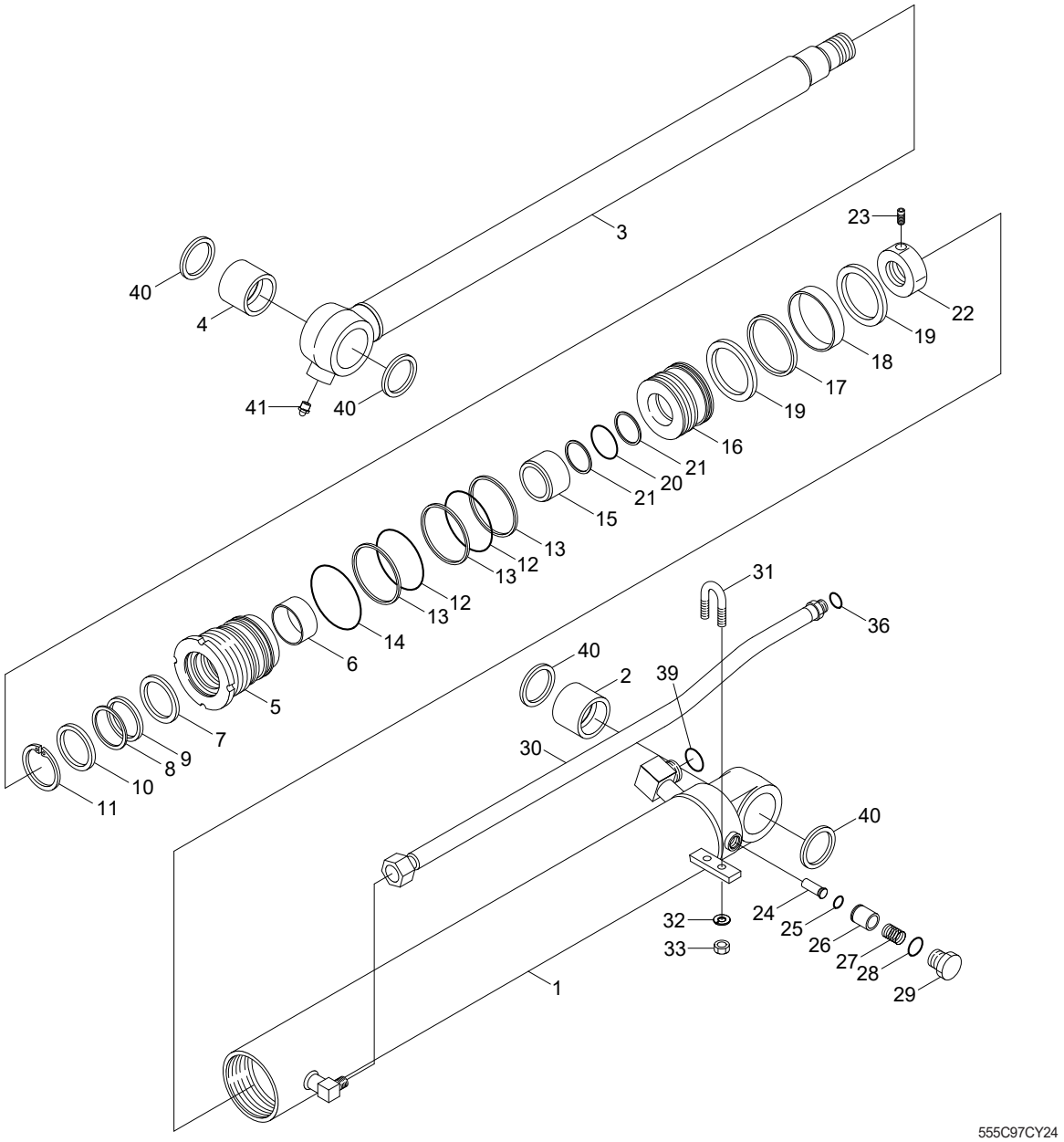
(1) Bucket cylinder



555C97CY22

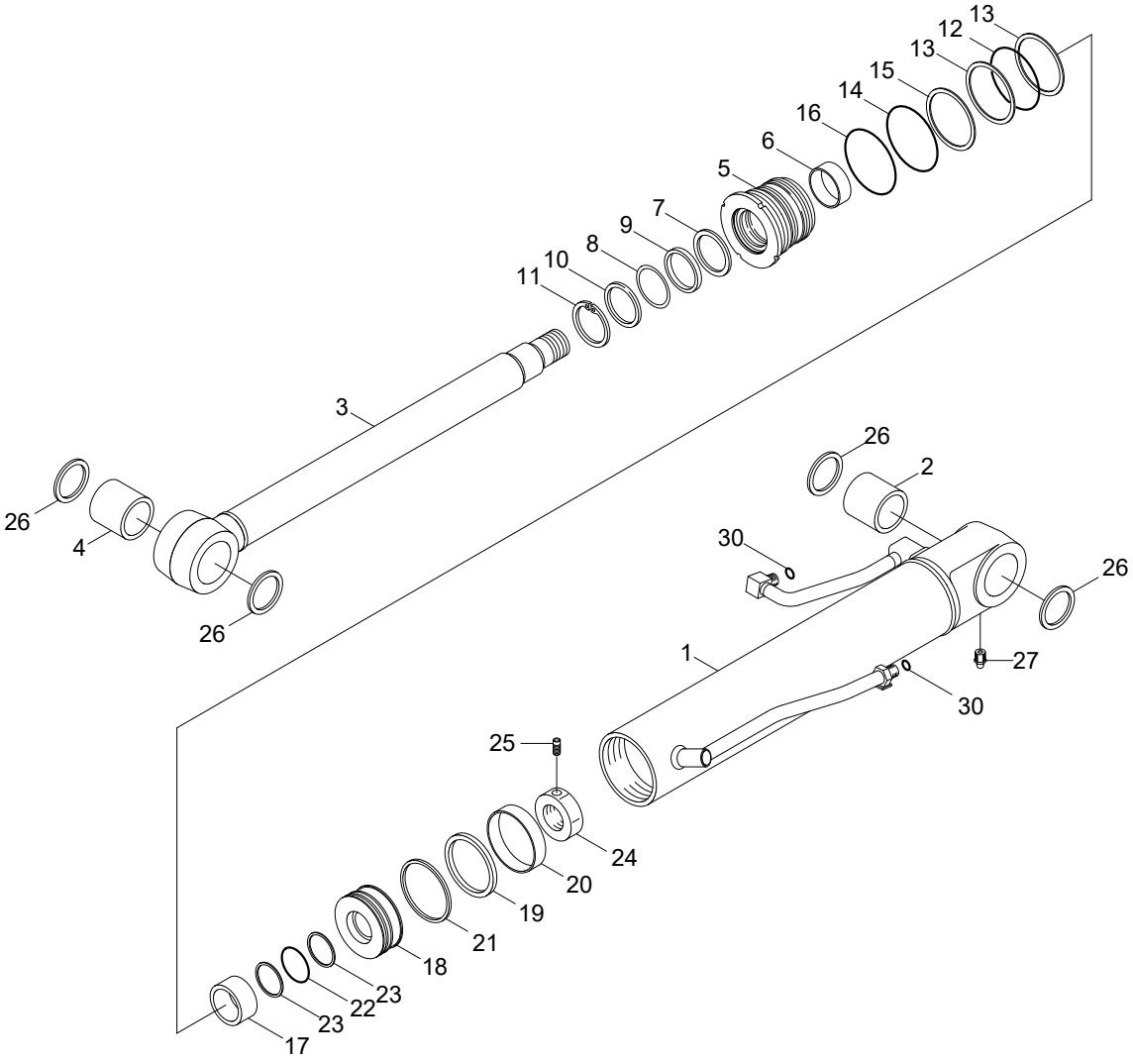
1	Tube assembly	10	Dust seal	19	Back-up ring
2	Bushing	11	Retaining ring	20	O-ring
3	Bushing	12	Back-up ring	21	Piston nut
4	Du bushing	13	O-ring	22	Set screw
5	Rod cover	14	O-ring	23	Dust seal
6	Rod bushing	15	Piston	24	Grease nipple
7	Retaining ring	16	Piston seal	25	Grease nipple
8	Buffer ring	17	Wear ring	28	O-ring
9	U-packing	18	Dust ring		

(2) Arm cylinder



1	Tube assembly	14	O-ring	27	Spring
2	Bushing	15	Cushion ring	28	Support spring
3	Rod	16	Piston	29	Socket plug
4	Bushing	17	Piston seal	30	Pipe assy
5	Rod cover	18	Wear ring	31	U-bolt
6	Rod bushing	19	Dust ring	32	Spring washer
7	Buffer seal	20	O-ring	33	Hex nut
8	U-packing	21	Back-up ring	36	O-ring
9	Back-up ring	22	Piston nut	39	O-ring
10	Dust wiper	23	Set screw	40	Dust seal
11	Retaining ring	24	Cushion plunger	41	Grease nipple
12	O-ring	25	Stop ring		
13	Back-up ring	26	Check valve		

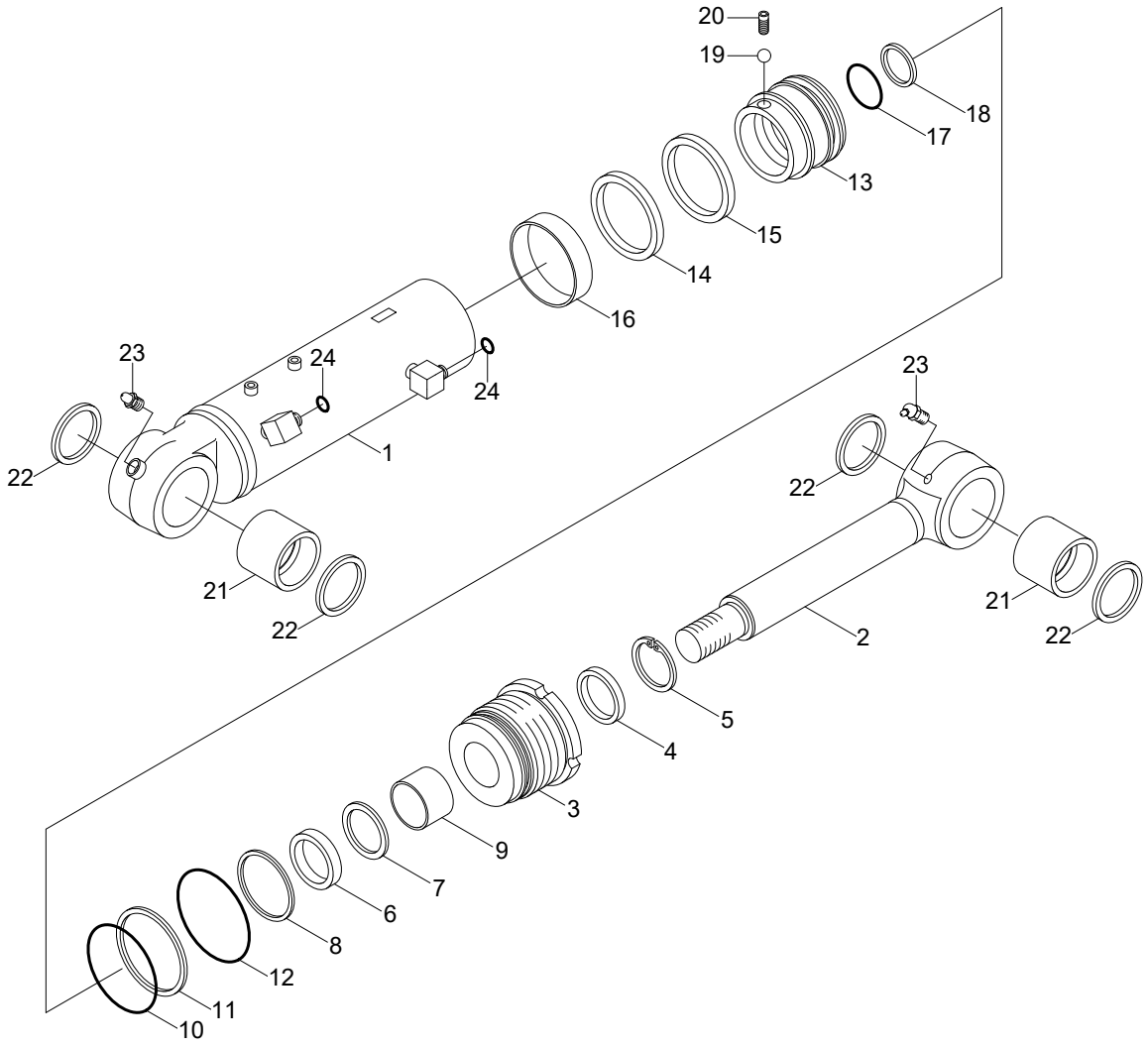
(3) Boom cylinder



555C97CY21

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

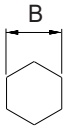


5597CY23

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

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	Boom cylinder	5	M115	70±7.0	510±51
	Arm cylinder	5	M95	70±7.0	510±51
	Bucket cylinder	3	M85	75±7.5	540±54
	Dozer cylinder	3	M115	95±9.5	690±69
Piston nut	Boom cylinder	24	M45	75±7.5	540±54
	Arm cylinder	22	M39	75±7.5	540±54
	Bucket cylinder	21	M36	75±7.5	540±54
Piston	Dozer cylinder	13	M45	113±11.3	817±137
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	M8	2±0.2	14.5±1.4

3) DISASSEMBLY

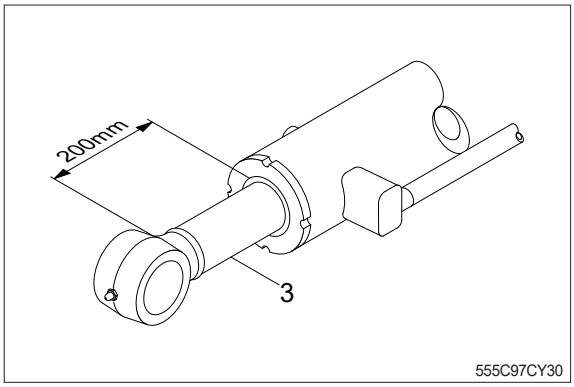
(1) Remove cylinder head and piston rod

※ Procedure are based on the bucket cylinder.

① Hold the clevis section of the tube in a vise.

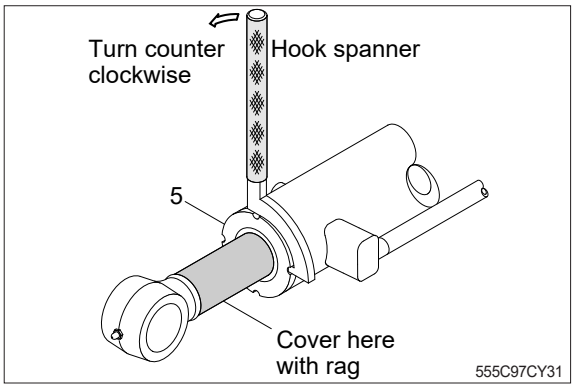
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

② Pull out rod assembly (3) about 200 ㎜ (7.1 in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



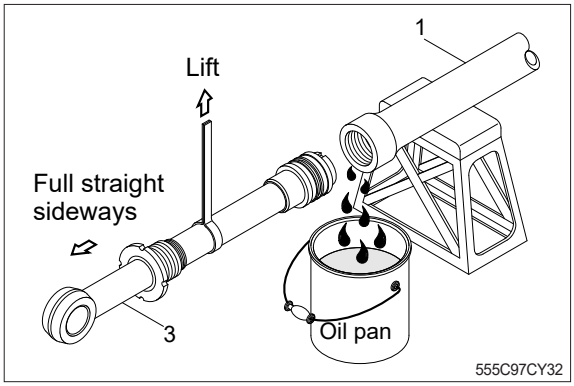
③ Remove rod cover (5) by hook spanner.

※ Cover the extracted rod assembly (3) with rag to prevent it from being accidentally damaged during operation.



④ Draw out cylinder head and rod assembly (3) together from tube assembly (1).

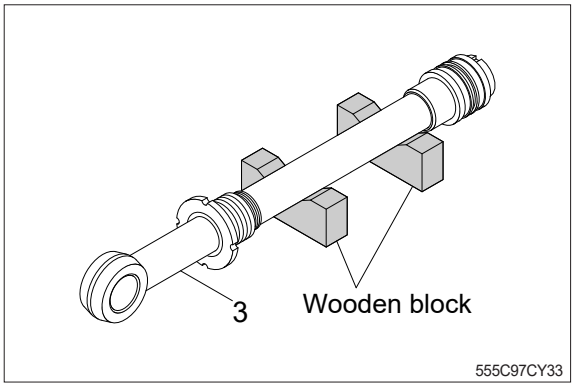
※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (3) with a crane or some means and draw it out. However, when rod assembly (3) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



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.

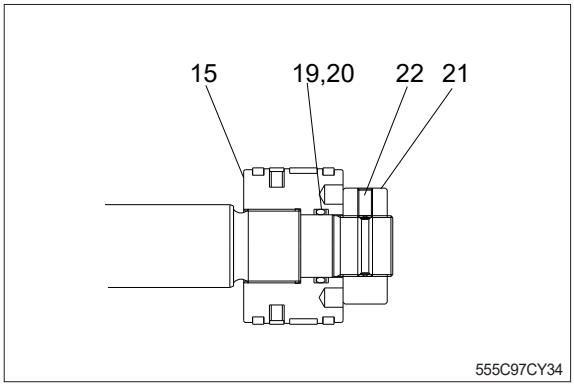


(2) Remove piston and rod cover

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).

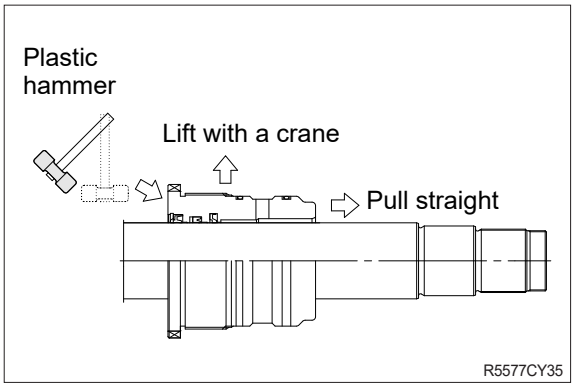


③ Remove the rod cover from rod assembly (3).

※ 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).

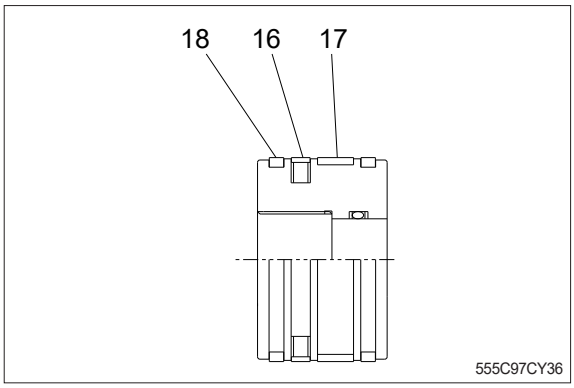


(3) Disassemble the piston assembly

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

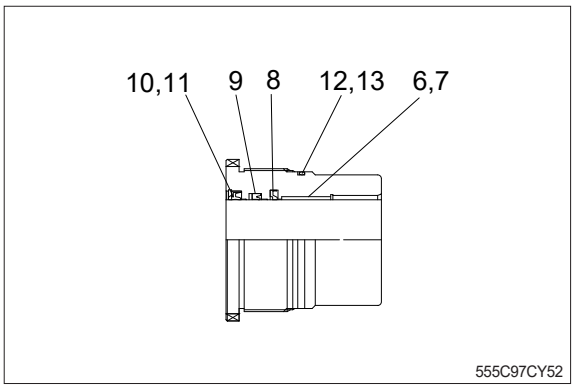
① Remove back up ring (12) and O-ring (13).

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.

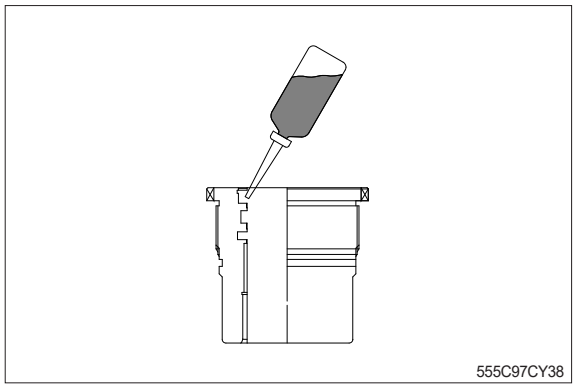


4) ASSEMBLY

(1) Assemble cylinder head assembly

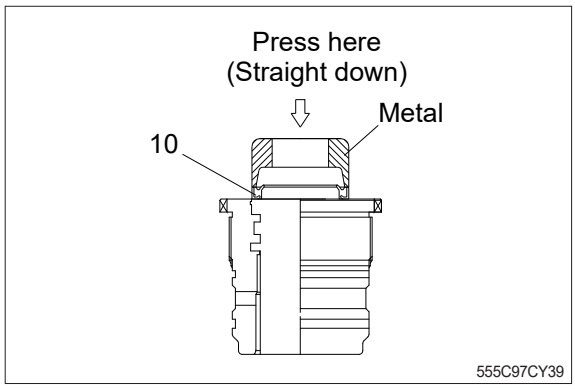
※ Check for scratches or rough surfaces if found smooth with an oil stone.

① Coat the inner face of rod cover (5) with hydraulic oil.



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.

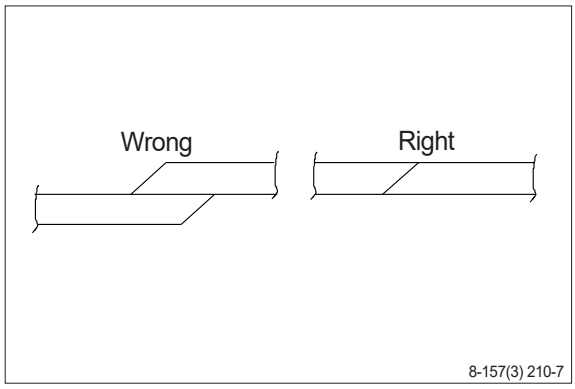
③ Fit snap ring (11) to the stop face.



④ Fit U-packing (9) and buffer seal (8) to corresponding grooves, in that order.

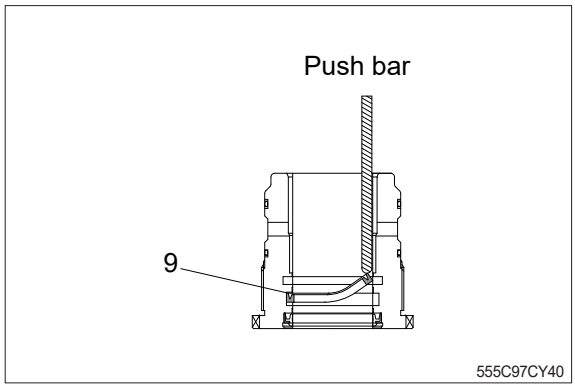
※ Coat each packing with hydraulic oil before fitting it.

※ Insert the backup ring until one side of it is inserted into groove.



※ U-packing (9) has its own fitting direction. Therefore, confirm it before fitting them.

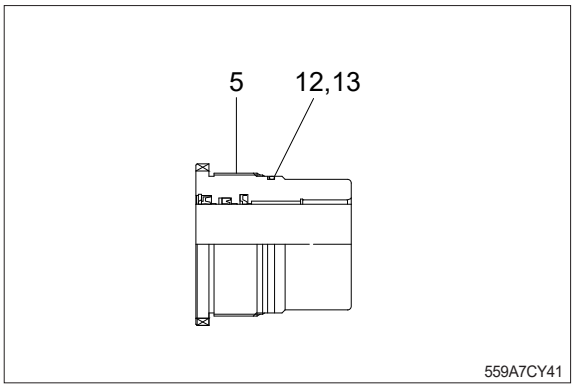
※ Fitting U-packing (9) upside down may damage its lip. Therefore check the correct direction that is shown in fig.



⑤ Fit back up ring (12) to rod cover (5).

※ Put the backup ring in the warm water of 30~50°C .

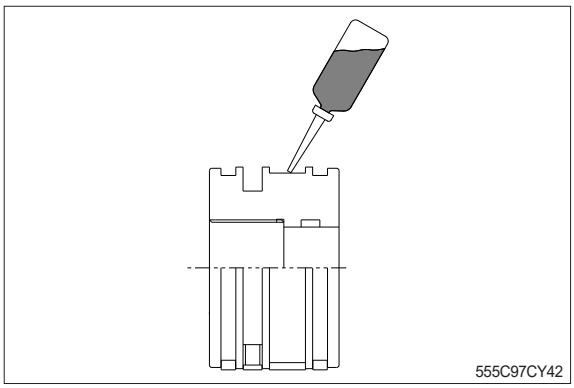
⑥ Fit O-ring (13) to rod cover (5).



(2) Assemble piston assembly

※ Check for scratches or rough surfaces. If found smooth with an oil stone.

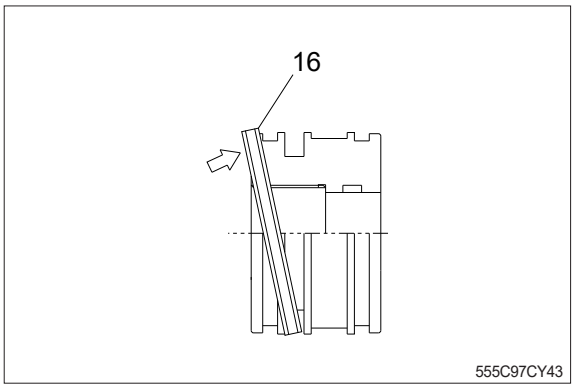
① Coat the outer face of piston (15) with hydraulic oil.



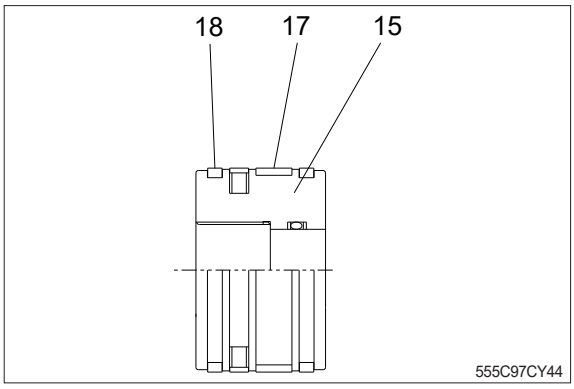
② Fit piston seal (16) to piston.

※ 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.



③ Fit wear ring (17) and dust ring (18) to piston (15).

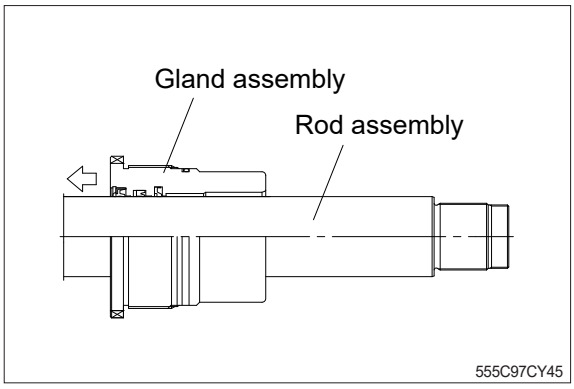


(3) Install piston and cylinder head

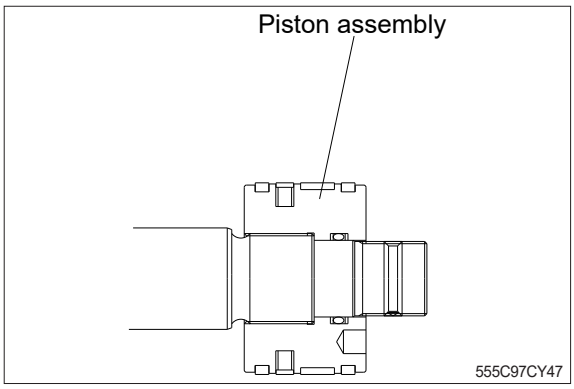
① Fix the rod assembly to the work bench.

② Apply hydraulic oil to the outer surface of rod assembly, the inner surface of piston and cylinder head.

③ Insert cylinder head assembly to rod assembly.

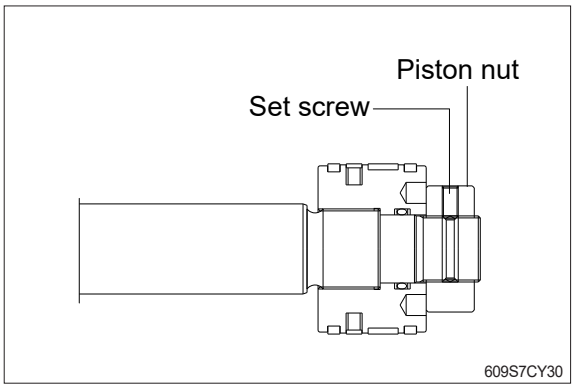


⑤ Fit piston assembly to rod assembly.



⑥ Fit piston nut and tighten the set screw (22).

· Tightening torque : Refer to page 7-130.



(3) Overall assemble

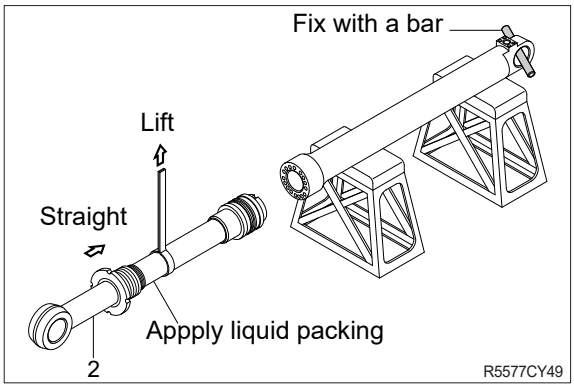
① Place a V-block on a rigid work bench. Mount the tube assembly (2) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

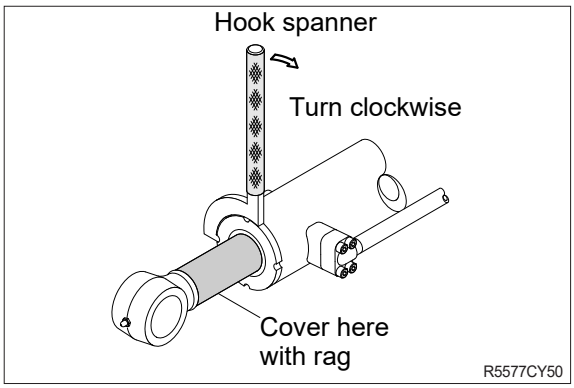
② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.

※ Be careful not to damage piston seal by thread of tube assembly.

③ Match the bolt holes in the cylinder head flange to the tapped holes in the tube assembly and tighten socket bolts to a specified torque.

※ Refer to the table of tightening torque.





1. TRACK LINK

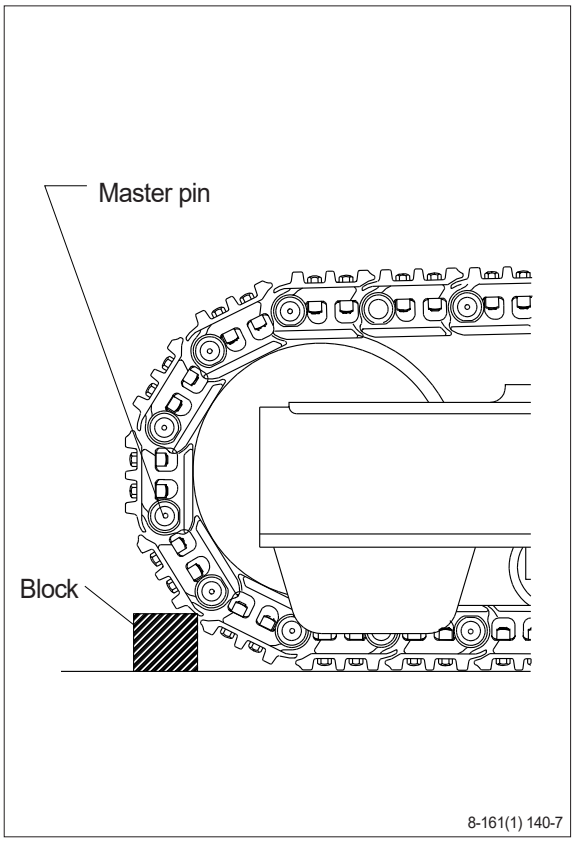
1) REMOVAL

(1) Move track link until master pin is over front idler in the position put wooden block as shown.

(2) Loosen tension of the track link.

※ If track tension is not relieved when the grease valve is loosened, move the machine backwards and forwards.

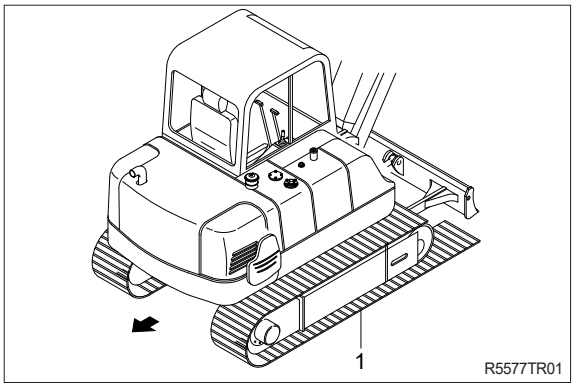
(3) Push out master pin by using a suitable tool.



(4) Move the machine slowly in reverse, and lay out track link assembly (1).

※ Jack up the machine and put wooden block under the machine.

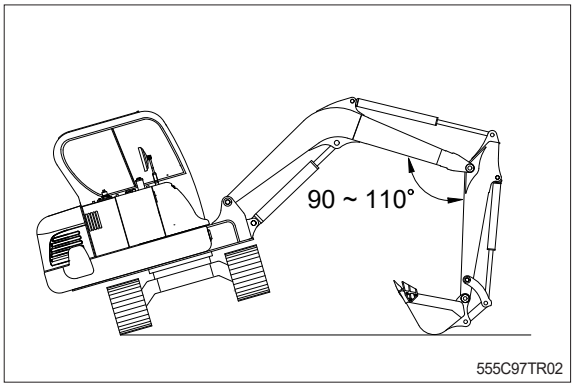
※ Don't get close to the sprocket side as the track shoe plate may fall down on your feet.



2) INSTALL

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

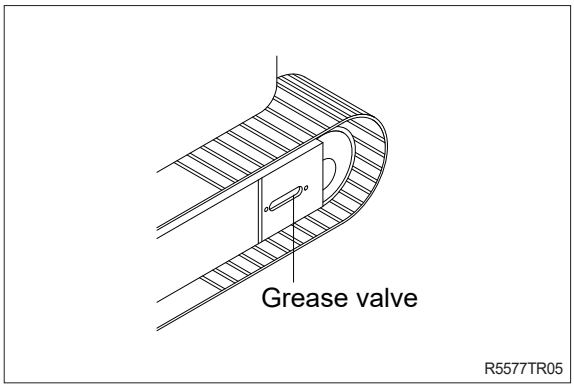
※ Adjust the tension of the track link.



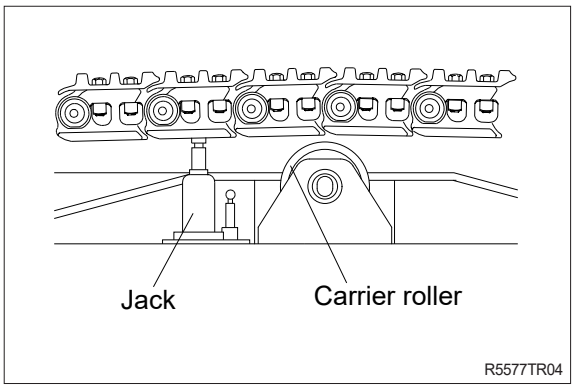
2. CARRIER ROLLER

1) REMOVAL

(1) Loosen tension of the track link.

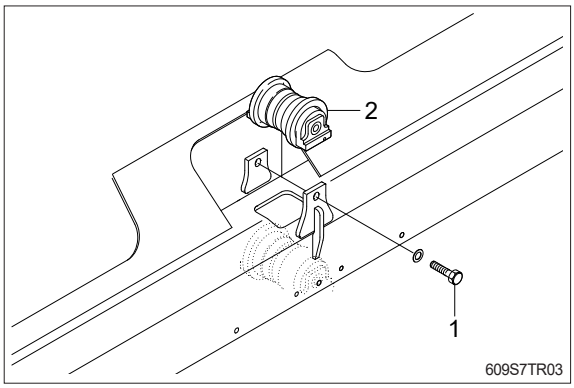


(2) Jack up the track link height enough to permit carrier roller removal.



(3) Remove bolt (1) at both side.

(4) Remove carrier roller (2).
· Weight : 12 kg (26 lb)



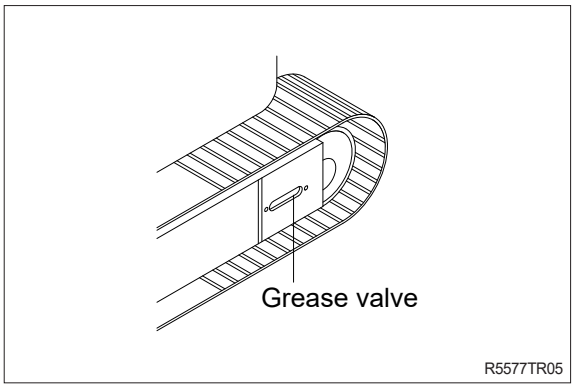
2) INSTALL

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

3. TRACK ROLLER

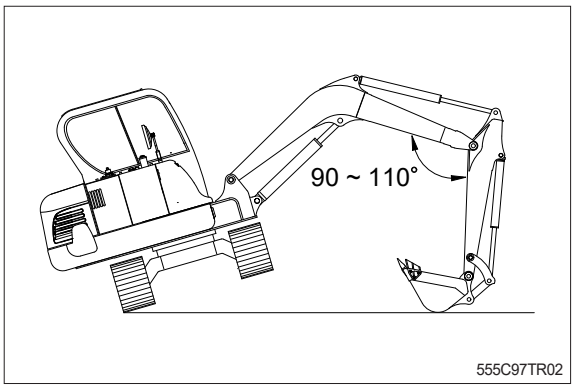
1) REMOVAL

(1) Loosen tension of the track link.



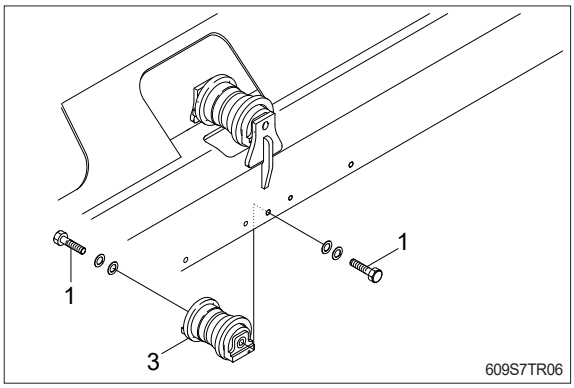
(2) Using the work equipment, push up track frame on side which is to be removed.

※ 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 kg (26 lb)



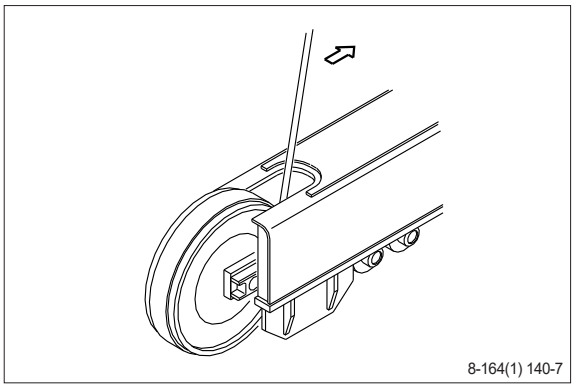
2) INSTALL

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

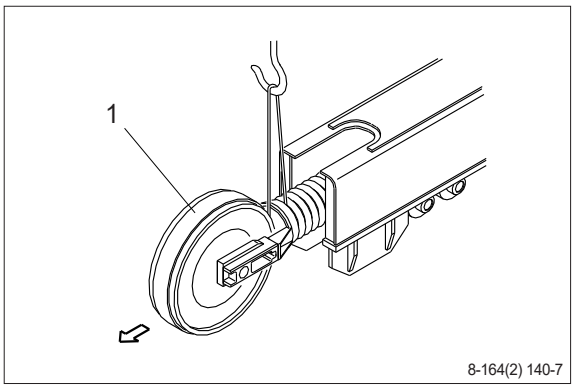
4. IDLER AND RECOIL SPRING

1) REMOVAL

(1) Remove the track link.
For detail, see removal of track link.

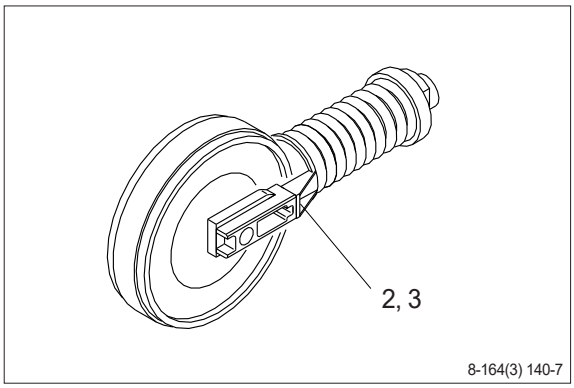

8-164(1) 140-7

(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.

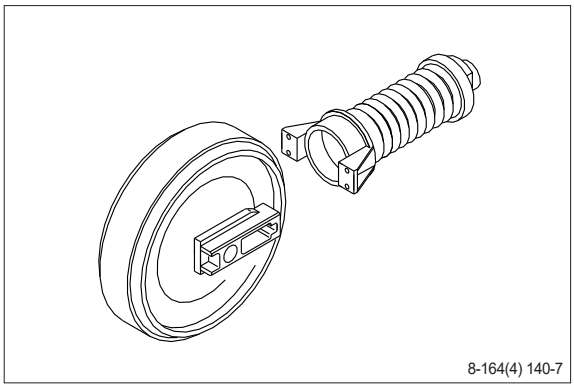


8-164(3) 140-7

2) INSTALL

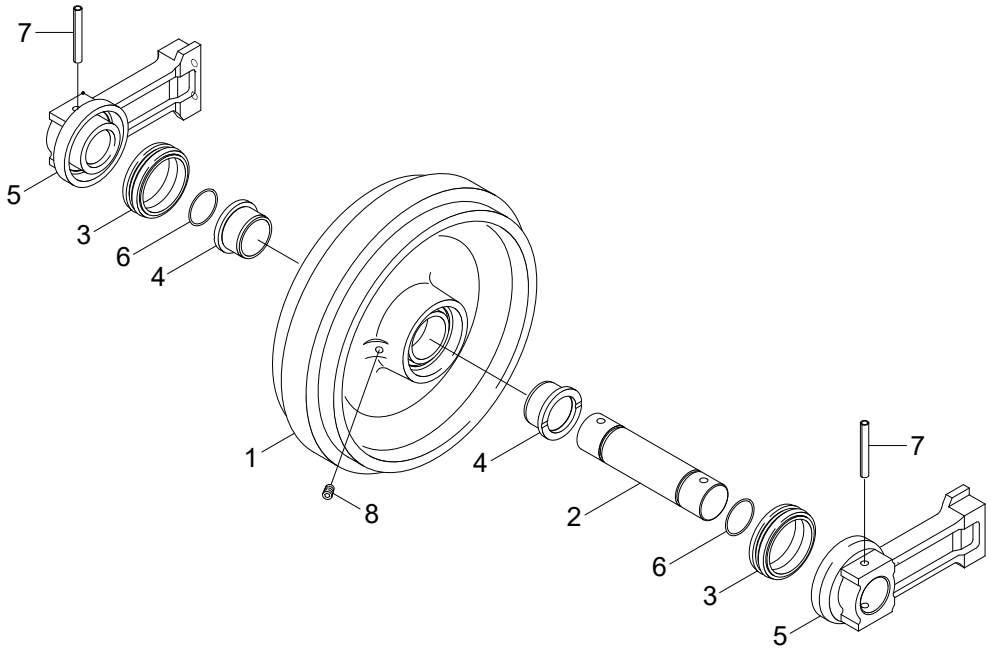
(1) Carry out installation in the reverse order to removal.

※ 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



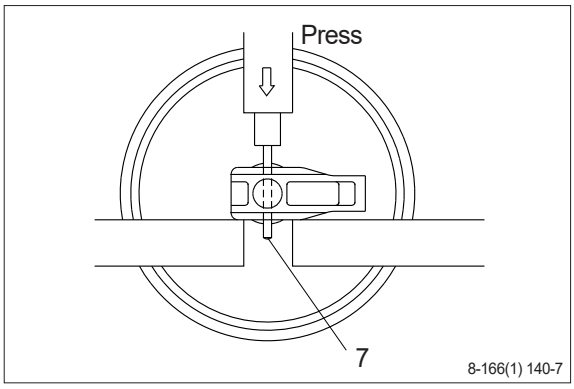
555K7ID43

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.

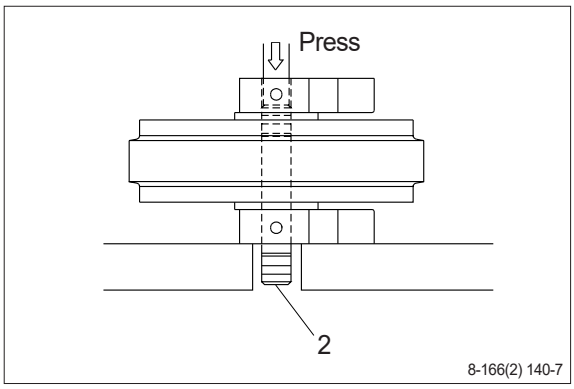
② Draw out the spring pin (7), using a press.



③ Pull out the shaft (2) with a press.

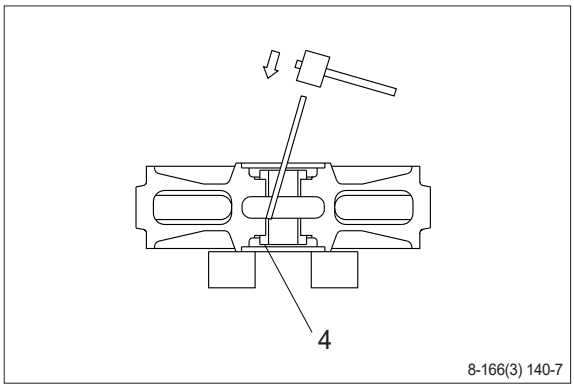
④ Remove seal (3) from idler (1) and bracket (5).

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.

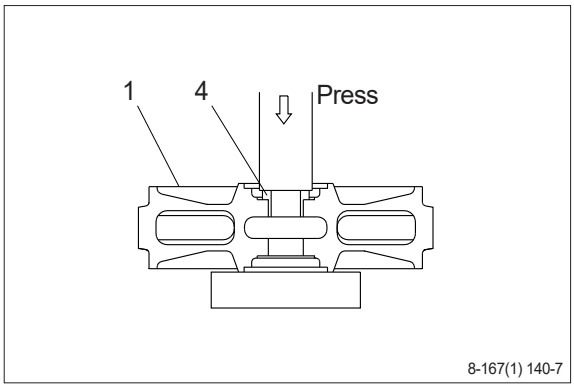


(3) **Assembly**

※ Before assembly, clean the parts.

※ Coat the sliding surfaces of all parts with oil.

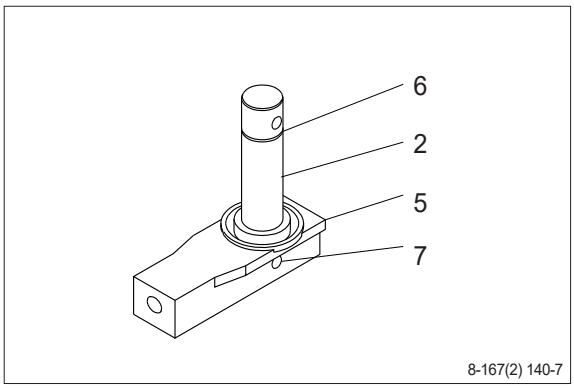
① Cool up bushing (4) fully by some dry ice and press it into shell (1).
Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.



8-167(1) 140-7

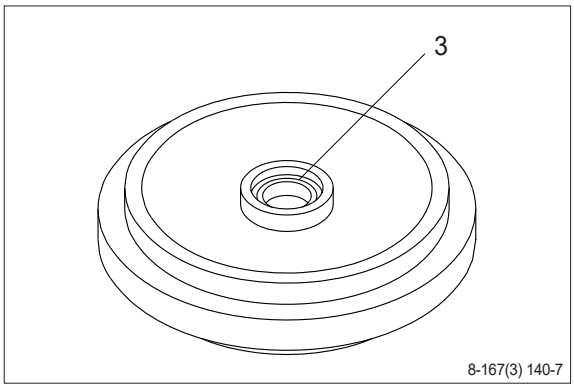
② Coat O-ring (6) with grease thinly, and install it to shaft (2).

③ Insert shaft (2) into bracket (5) and drive in the spring pin (7).



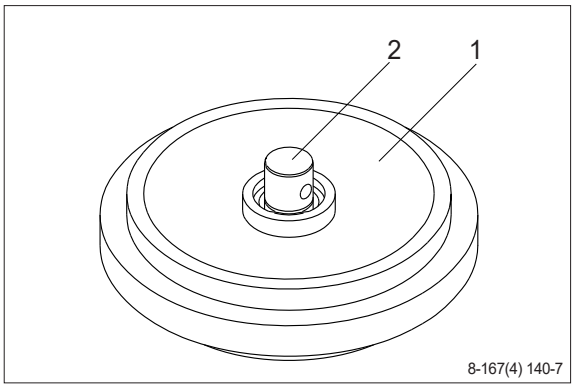
8-167(2) 140-7

④ Install seal (3) to shell (1) and bracket (5).



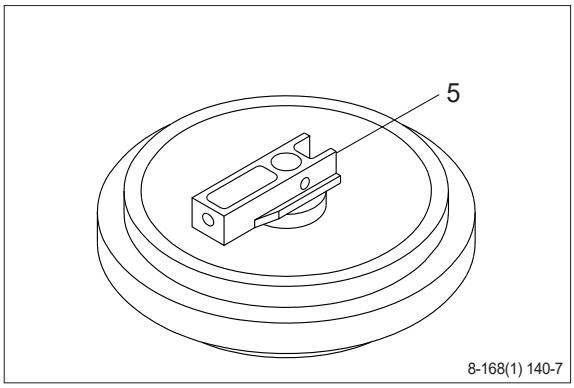
8-167(3) 140-7

⑤ Install shaft (2) to shell (1).

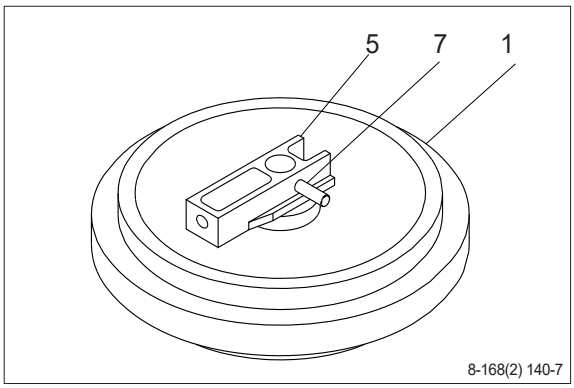


8-167(4) 140-7

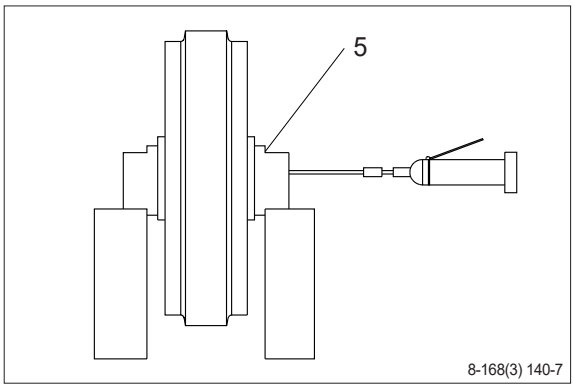
⑥ Install bracket (5) attached with seal (3).



⑦ Knock in the spring pin (7) with a hammer.

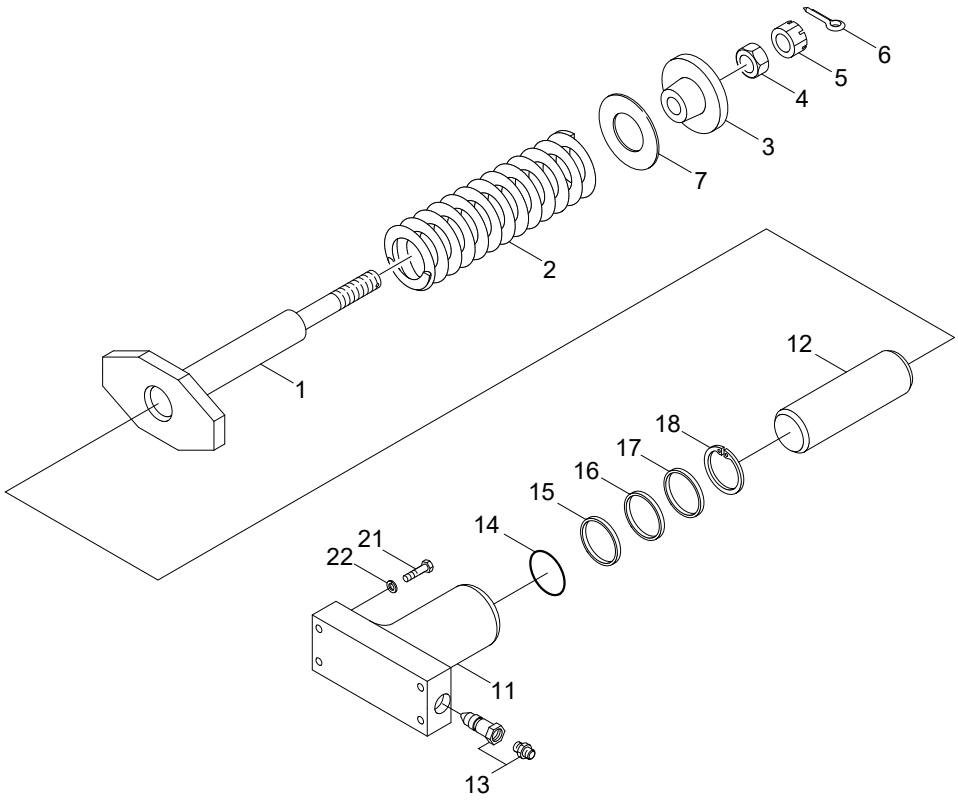


⑧ Lay bracket (5) on its side.
Supply engine oil to the specified level, and tighten plug.



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure



R5577RS01

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.

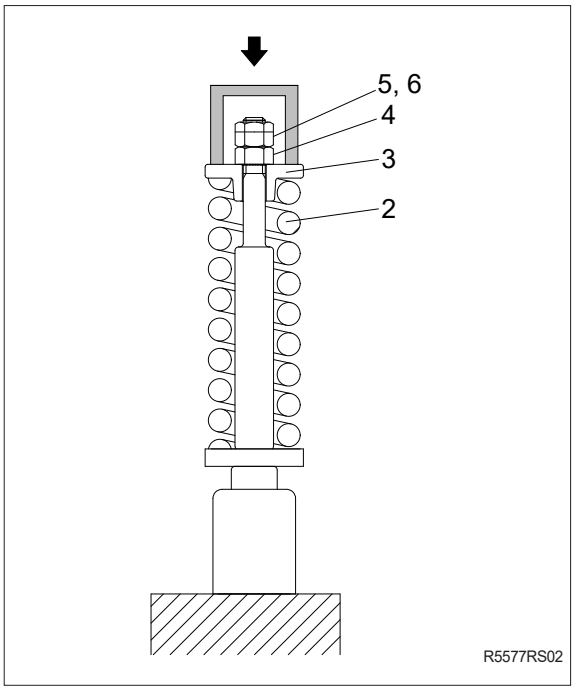
※ This is dangerous, so be sure to set properly.

· Spring set load : 3900 kg (8600 lb)

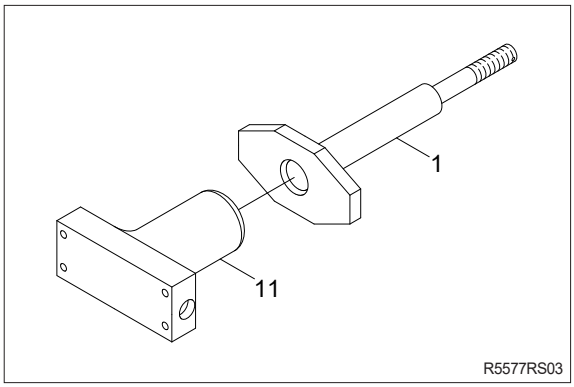
② Remove split pin (6) and nut (5).

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).

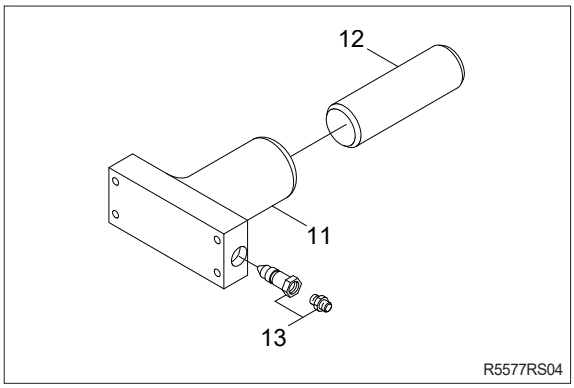


⑤ Remove rod (1) from bracket (11).

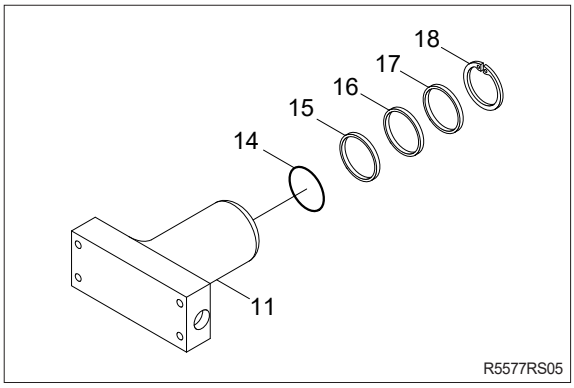


⑥ Remove grease valve (13) from bracket (11).

⑦ Remove piston (12) from bracket (11).



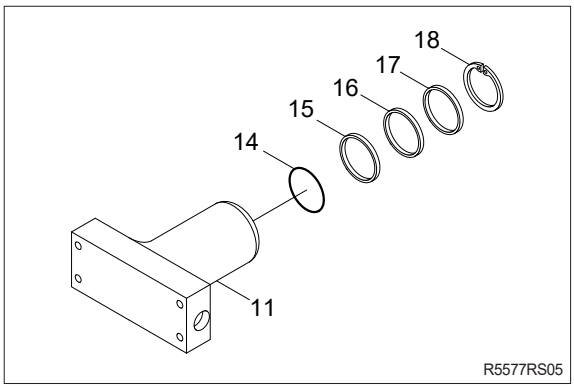
⑧ Remove retaining ring (18), spacer (17), dust seal (16), back-up ring (15) and O-ring (14).



(3) Assembly

① Install O-ring (14), back-up ring (15), dust seal (16), spacer (17) and retaining ring (18) to bracket (11).

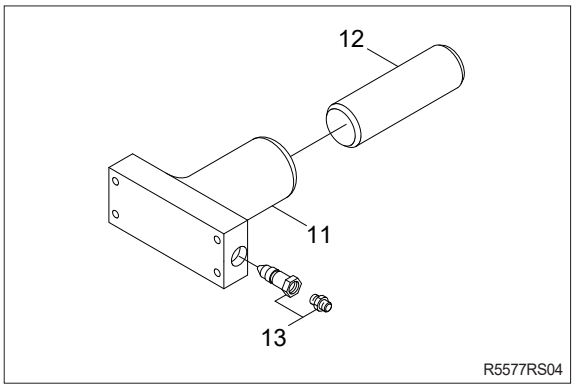
※ When installing dust seal (16) take full care so as not to damage the lip.



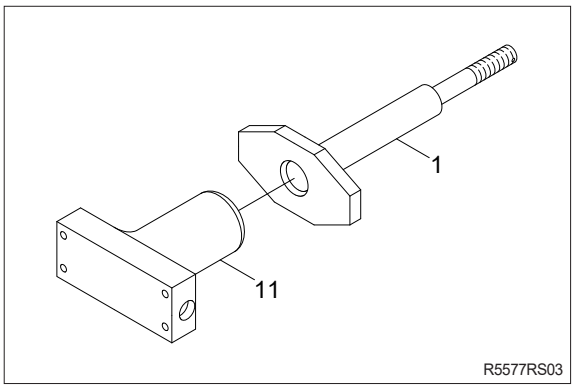
② Pour grease into bracket (11), then push in piston (12) by hand.
After take grease out of grease valve mounting hole, let air out.

※ 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 : 8±1.0 kg · m
(57.9±7.2 lb · ft)



④ Install rod (1) to bracket (11).



⑤ Install spring (3) and bracket (4) to body (1).

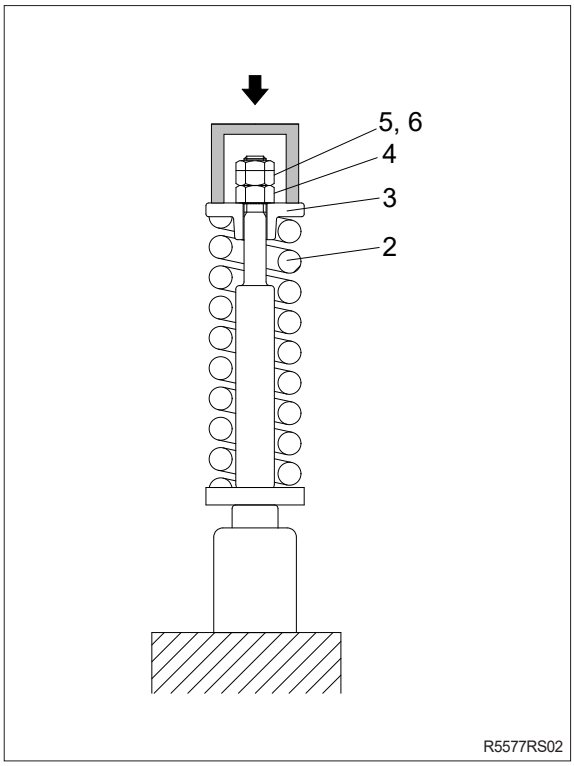
⑥ Apply pressure to spring (3) with a press and tighten nut (4).

※ Apply sealant before assembling.

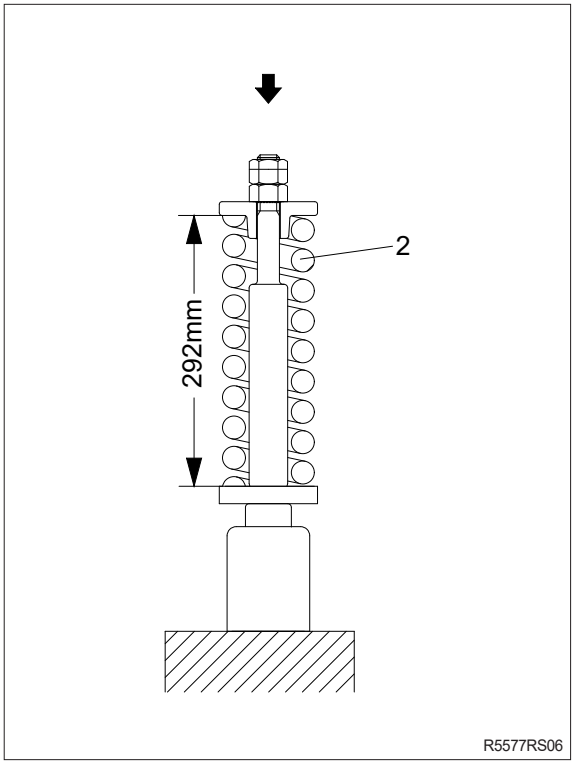
※ During the operation, pay attention specially to prevent the press from slipping out.

· Tightening torque : 30±3 kgf · m
(217±21 lbf · ft)

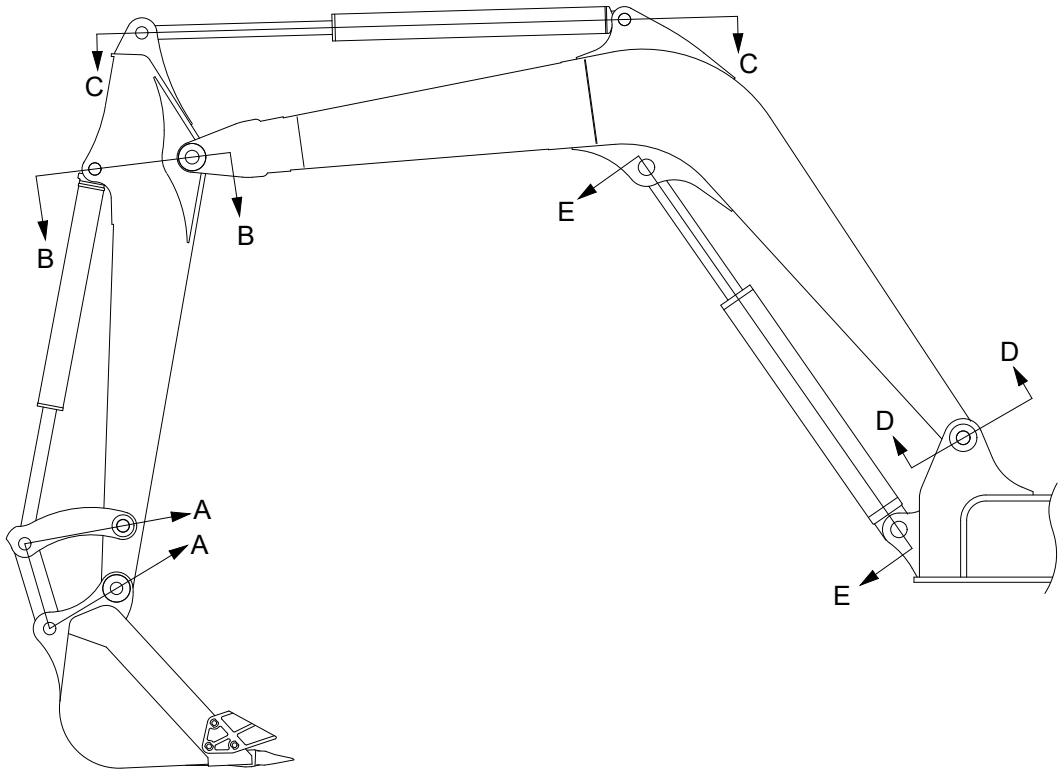
⑦ Tighten nut (5) and insert split pin (6).

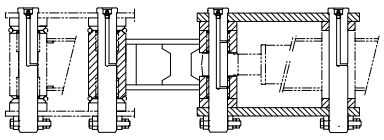


⑧ Lighten the press load and confirm the set length of spring (2).

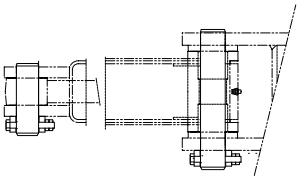


1. STRUCTURE

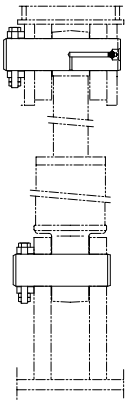




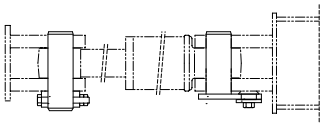
SECTION A-A



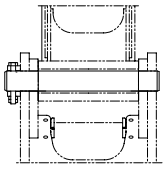
SECTION B-B



SECTION E-E



SECTION C-C



SECTION D-D

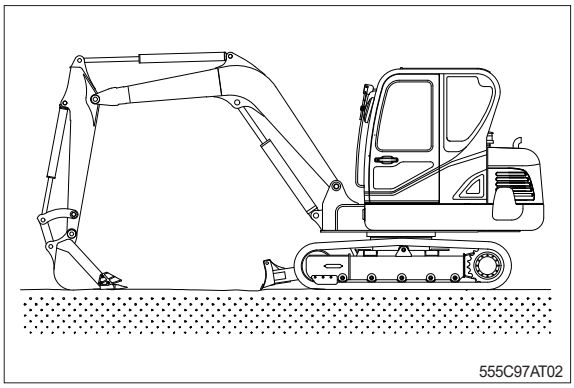
R5577AT01

2. REMOVAL AND INSTALL

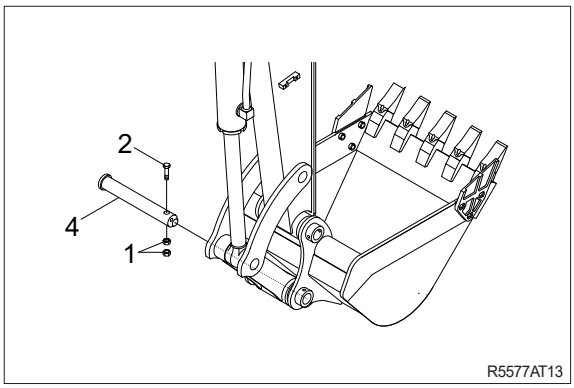
1) BUCKET ASSEMBLY

(1) Removal

① Lower the work equipment completely to ground with back of bucket facing down.

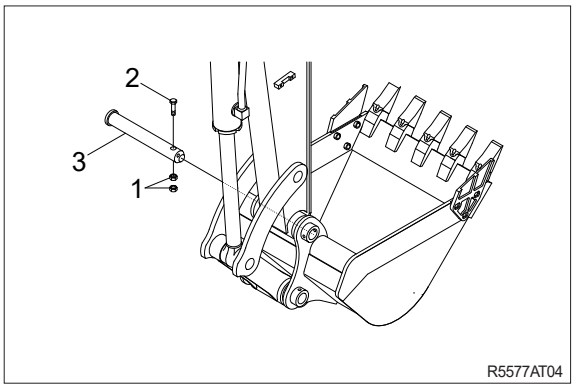


② Remove nut (1), bolt (2) and draw out the pin (4).



③ Remove nut (1), bolt (2) and draw out the pin (3) then remove the bucket assembly.

· Weight (0.32 ㎥) : 250 kg

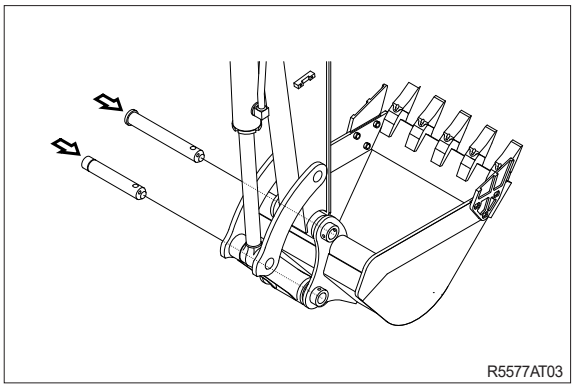


(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When aligning the mounting position of the pin, do not insert your fingers in the pin hole.**

※ Adjust the bucket clearance.
For detail, see operation manual.



2) ARM ASSEMBLY

(1) Removal

※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

① Remove bucket assembly.
For details, see removal of bucket assembly.

② Disconnect bucket cylinder hose (4).

⚠ **Fit blind plugs (5) in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.**

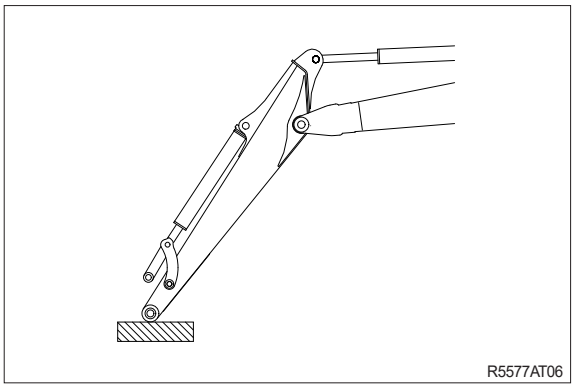
③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

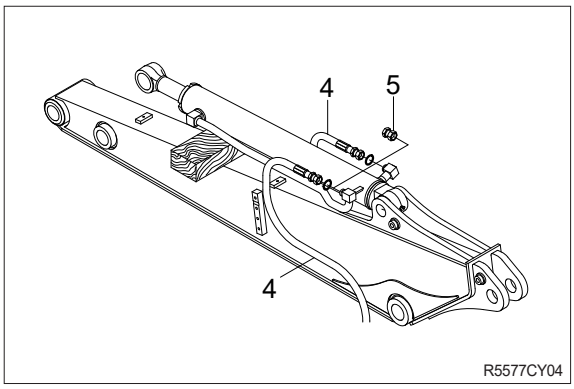
※ Tie the rod with wire to prevent it from coming out.

④ For details, see removal of arm cylinder assembly.
Place a wooden block under the cylinder and bring the cylinder down to it.

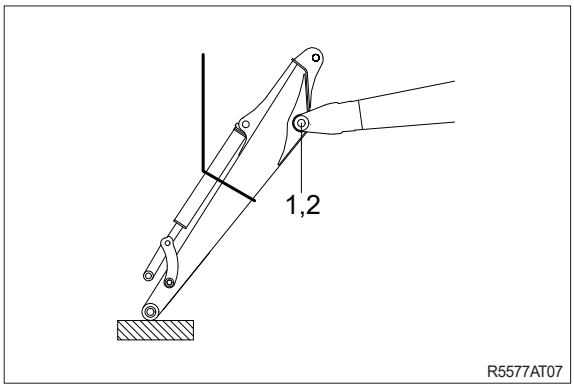
⑤ Remove bolt (1) and pull out the pin (2) then remove the arm assembly.
· Weight (1.67m) : 192 kg

※ When lifting the arm assembly, always lift the center of gravity.


R5577AT06



R5577CY04



R5577AT07

(2) Install

① Carry out installation in the reverse order to removal.

⚠ **When lifting the arm assembly, always lift the center of gravity.**

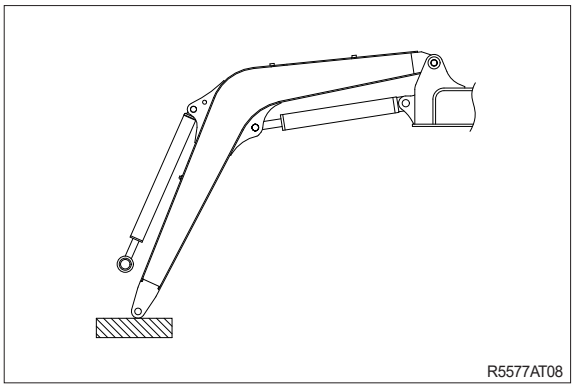
※ Bleed the air from the cylinder.

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.

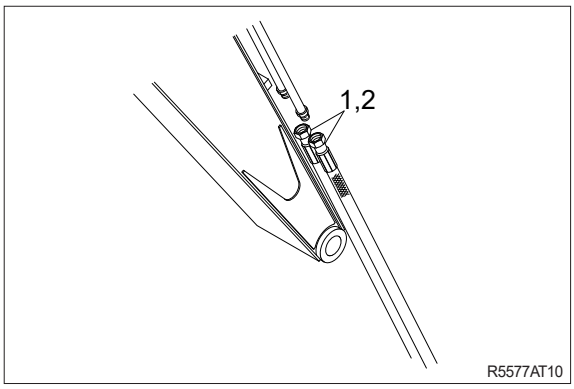

R5577AT08

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.

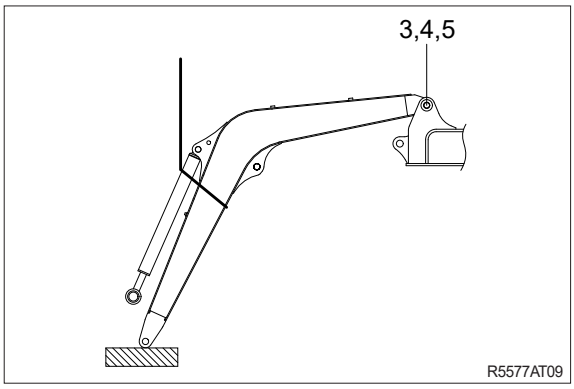
⑤ Sling boom assembly (3).



R5577AT10

⑥ Remove bolt (3), nut (4) and pull out the pin (5) then remove boom assembly.
· Weight (3.7m) : 481 kg

※ When lifting the boom assembly always lift the center of gravity.



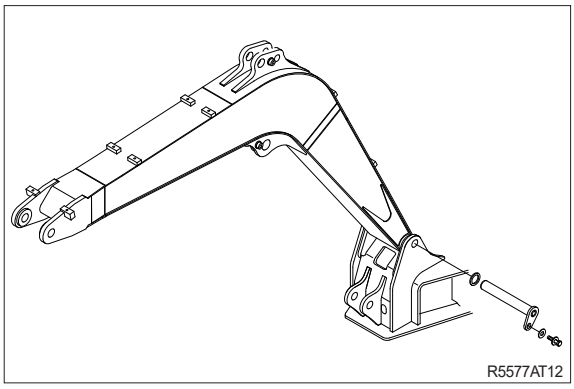
R5577AT09

(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.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