CONTENTS

SECTION 6 MAINTENANCE STANDARD

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1. STRUCTURE

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

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

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

SECTION 1 GENERAL

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

SECTION 2 STRUCTURE AND FUNCTION

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

SECTION 3 HYDRAULIC SYSTEM

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

SECTION 4 ELECTRICAL SYSTEM

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

SECTION 5 TROUBLESHOOTING

This section explains the troubleshooting charts correlating problems to causes.

SECTION 6 MAINTENANCE STANDARD

This section gives the judgement standards when inspecting disassembled parts.

SECTION 7 DISASSEMBLY AND ASSEMBLY

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

SECTION 8 COMPONENT MOUNTING TORQUE

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

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

2. HOW TO READ THE SERVICE MANUAL

Distribution and updating

Any additions, amendments or other changes will be sent to HYUNDAI distributors.
Get the most up-to-date information before you start any work.

Filing method

1. See the page number on the bottom of the page.
   File the pages in correct order.
2. Following examples shows how to read the page number.
   Example 1
   2 - 3
   - Item number (2. Structure and Function)
   - Consecutive page number for each item.
3. Additional pages : Additional pages are indicated by a hyphen(-) and number after the page number. File as in the example.
   10 - 4
   10 - 4 - 1
   10 - 4 - 2] Added pages
   10 - 5

Revised edition mark (①②③…)

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

Revisions

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

Symbols

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

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

3. CONVERSION TABLE

Method of using the Conversion Table

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

Example

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

   Convert 55mm into inches.

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

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

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

2. Convert 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 55 mm.

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

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

Millimeters to inches

ⓑ

1 mm = 0.03937 in

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

Millimeters to inches

1 mm = 0.03937 in

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

Kilogram to Pound

1 kg = 2.2046 lb

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

Liter to U.S. Gallon

1 l = 0.2642 U.S.Gal

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

Liter to U.K. Gallon

1 l = 0.21997 U.K.Gal

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

kgf · m to lbf · ft

1 kgf · m = 7.233 lbf · ft

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

kgf/cm^2 to lbf/in^2

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

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

TEMPERATURE

Fahrenheit-Centigrade Conversion.

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

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

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

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

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

SECTION 1 GENERAL

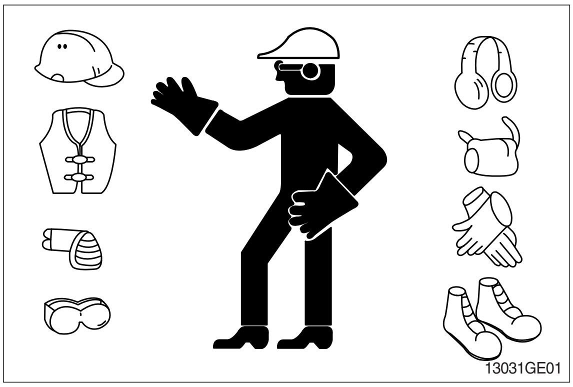
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

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

WEAR PROTECTIVE CLOTHING

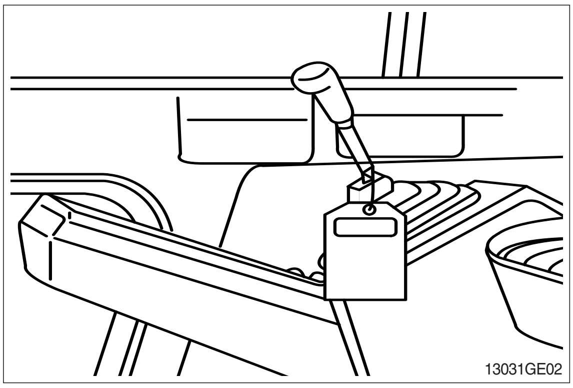
Wear close fitting clothing and safety equipment appropriate to the job.



13031GE01

WARN OTHERS OF SERVICE WORK

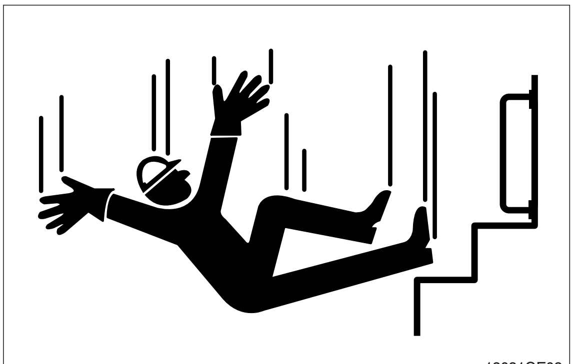
Unexpected machine movement can cause serious injury.
Before performing any work on the excavator, attach a「**Do Not Operate**」tag on the right side control lever.



13031GE02

USE HANDHOLDS AND STEPS

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



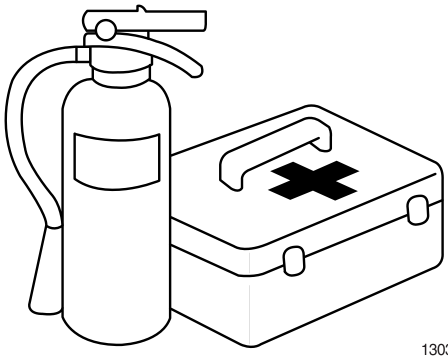
13031GE03

PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

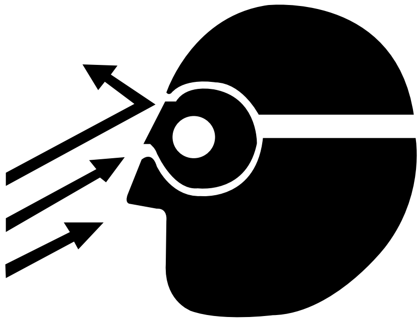
Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



13031GE04

PROTECT AGAINST FLYING DEBRIS

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



13031GE05

PROTECT AGAINST NOISE

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

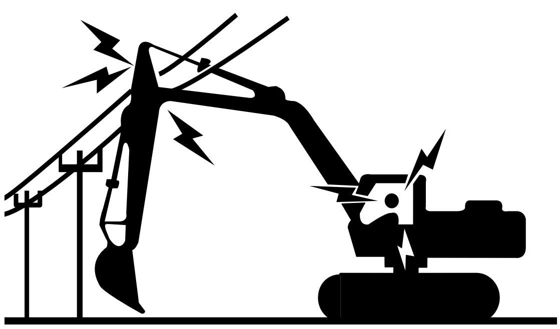
Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

13031GE06

AVOID POWER LINES

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

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

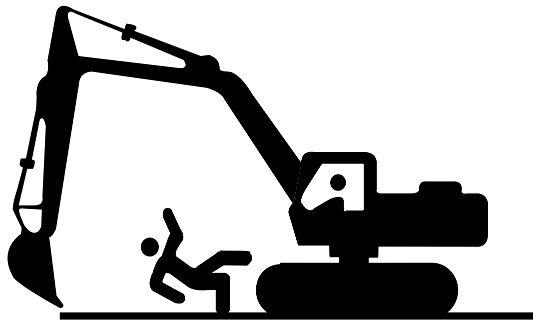


13031GE07

KEEP RIDERS OFF EXCAVATOR

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

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



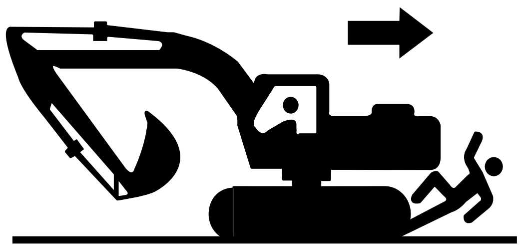
13031GE08

MOVE AND OPERATE MACHINE SAFELY

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

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

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

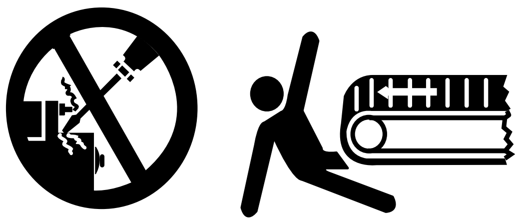


13031GE09

OPERATE ONLY FORM OPERATOR'S SEAT

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

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



13031GE26

PARK MACHINE SAFELY

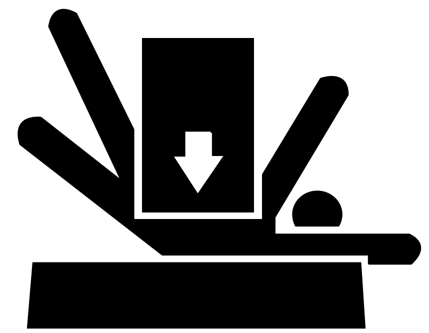
Before working on the machine:

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

SUPPORT MACHINE PROPERLY

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

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

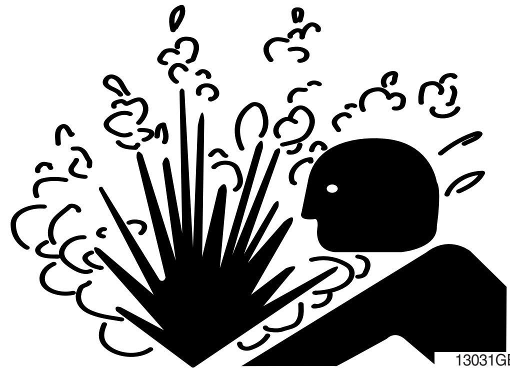


13031GE10

SERVICE COOLING SYSTEM SAFELY

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

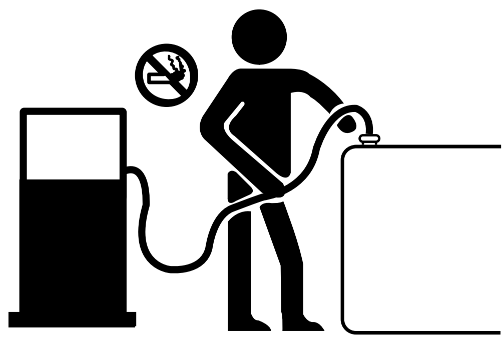
Shut off engine. Only remove filler cap when cool enough to touch with bare hands.



13031GE11

HANDLE FLUIDS SAFELY-AVOID FIRES

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



13031GE12

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

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

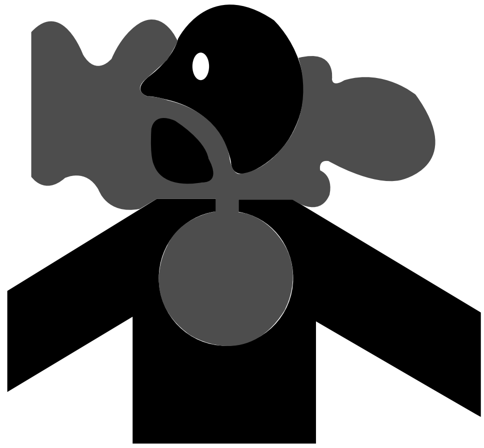
Do not store oily rags; They can ignite and burn spontaneously.

13031GE13

BEWARE OF EXHAUST FUMES

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

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



13031GE14

REMOVE PAINT BEFORE WELDING OR HEATING

Avoid potentially toxic fumes and dust.

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

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

Remove paint before welding or heating:

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

ILLUMINATE WORK AREA SAFELY

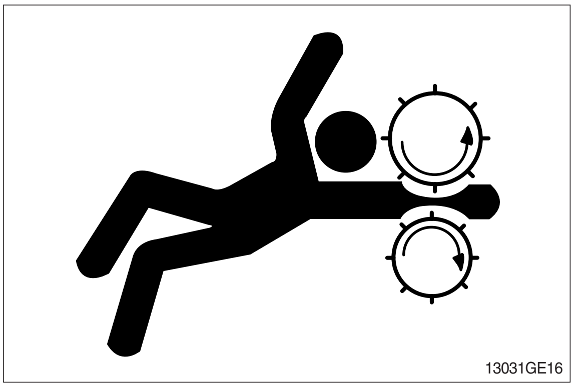
Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

13031GE15

SERVICE MACHINE SAFELY

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

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

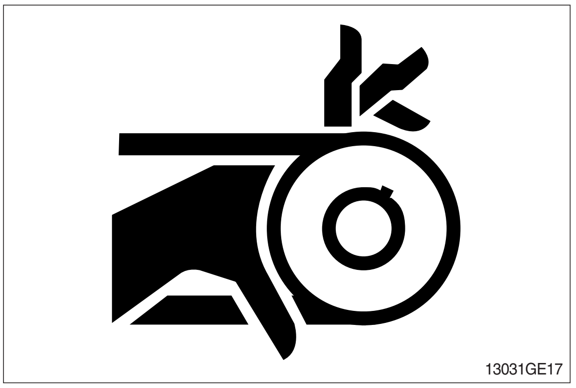


13031GE16

STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

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



13031GE17

AVOID HIGH PRESSURE FLUIDS

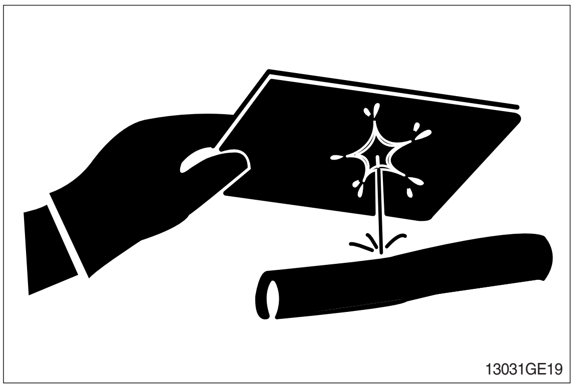
Escaping fluid under pressure can penetrate the skin causing serious injury.

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

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

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

13031GE18



13031GE19

AVOID HEATING NEAR PRESSURIZED FLUID LINES

13031GE20

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

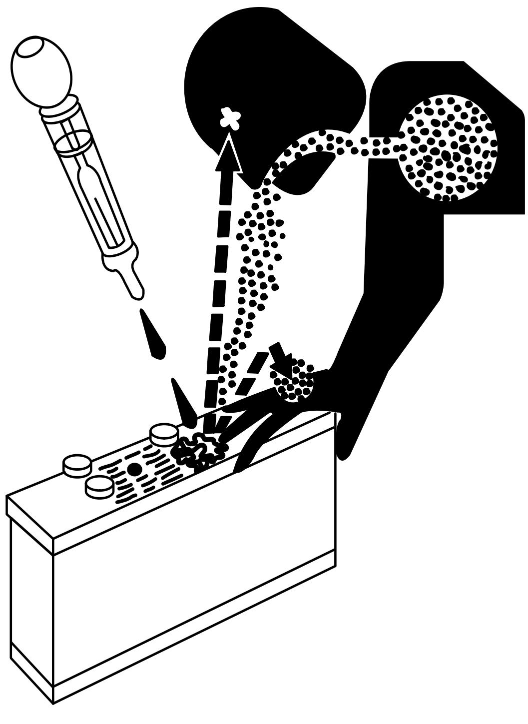
13031GE21

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



13031GE22

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

Avoid the hazard by:

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

If you spill acid on yourself:

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

If acid is swallowed:

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

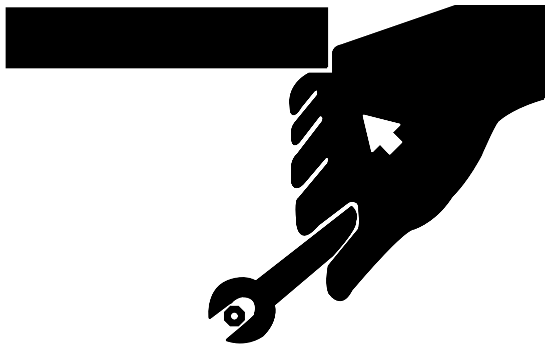
USE TOOLS PROPERLY

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

Use power tools only to loosen threaded tools and fasteners.

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

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



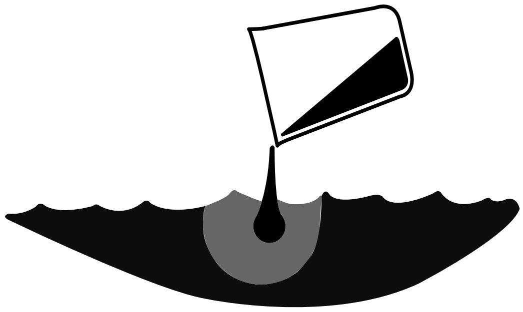
13031GE23

DISPOSE OF FLUIDS PROPERLY

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

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

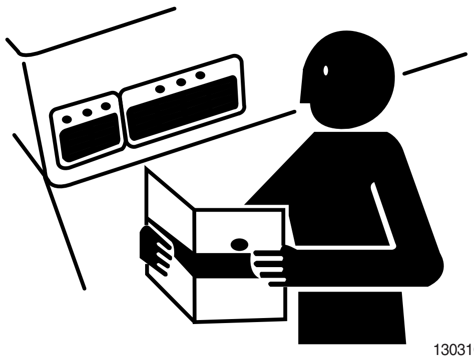
DO NOT pour oil into the ground, down a drain, or into a stream, pond, or lake. Observe relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters, batteries, and other harmful waste.



13031GE24

REPLACE SAFETY SIGNS

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



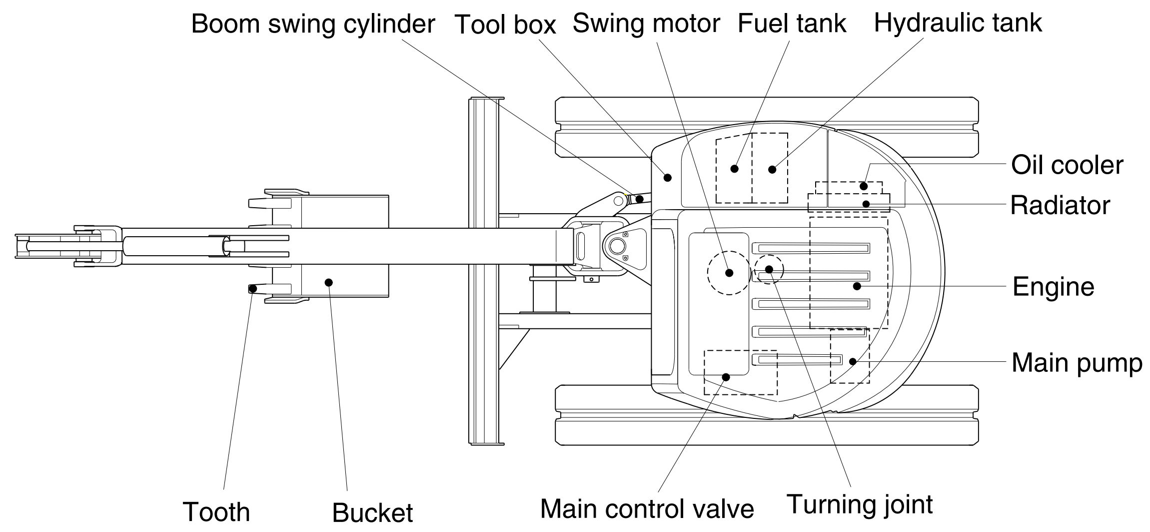
13031GE25

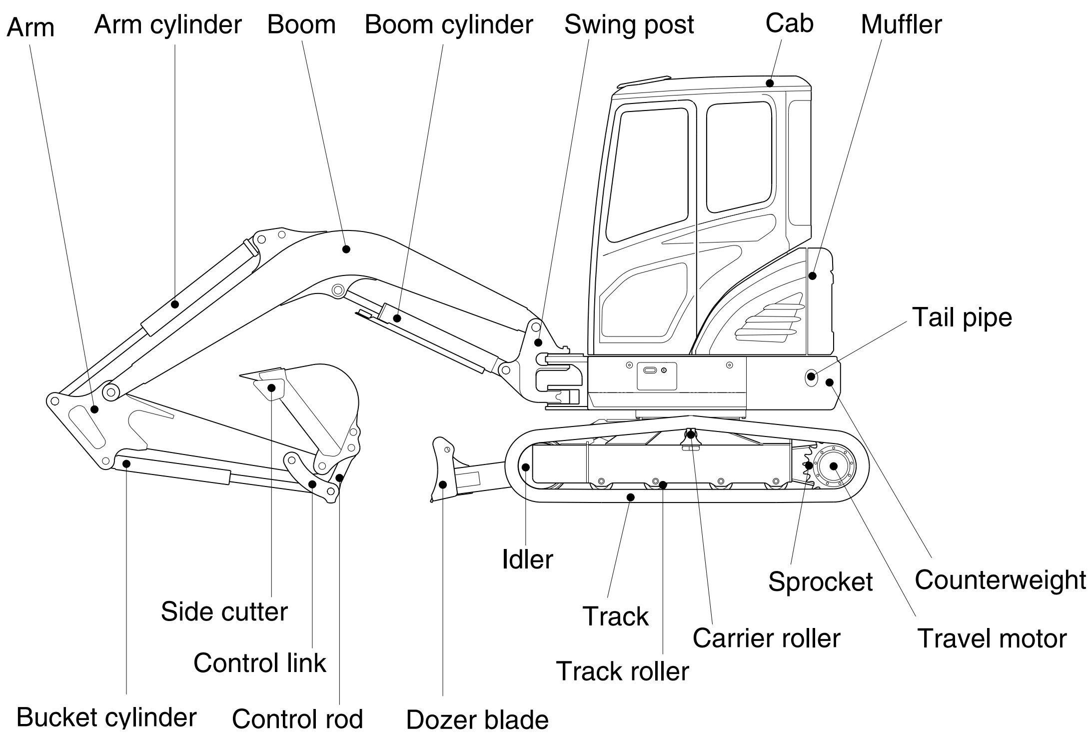
LIVE WITH SAFETY

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

GROUP 2 SPECIFICATIONS

1. MAJOR COMPONENT

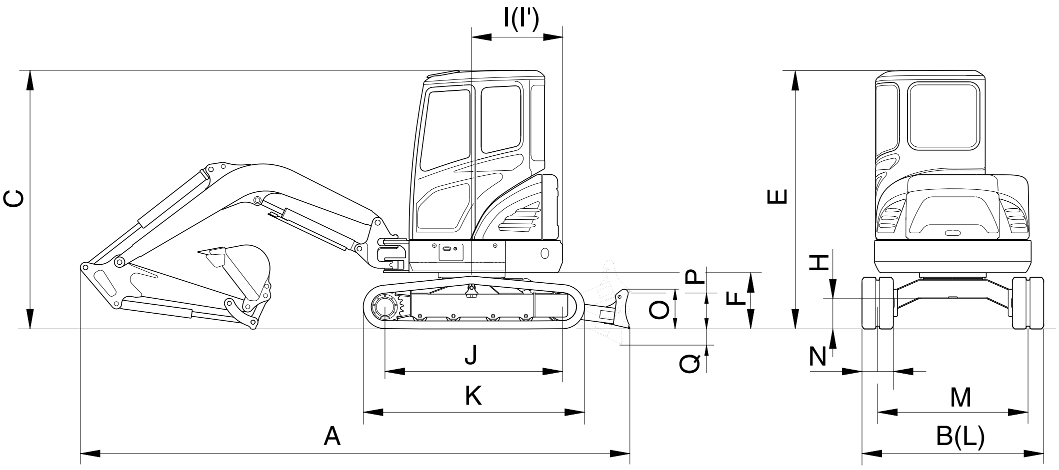




R35Z72SP01

2. SPECIFICATIONS

1) 2.5 m (8' 2") MONO BOOM, 1.3 m (4' 3") ARM, WITH BOOM SWING POST

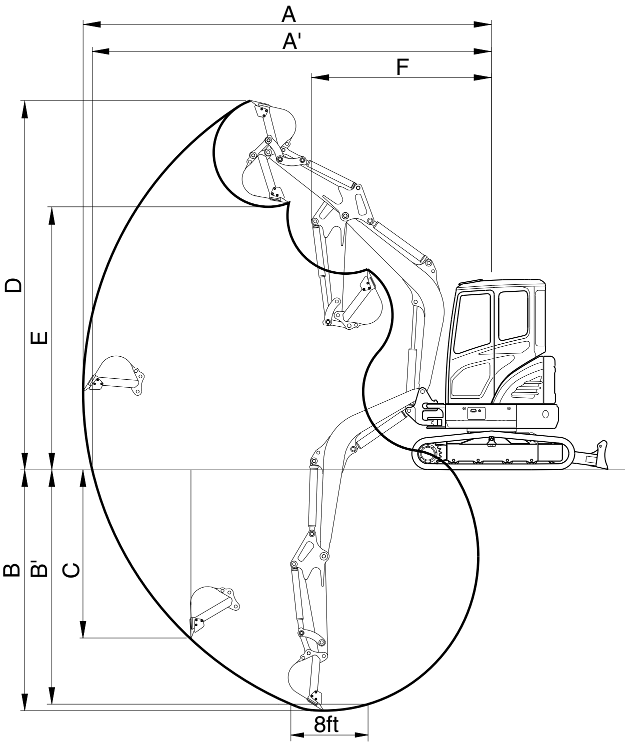


35Z9A2SP02

Description		Unit	Specification
Operating weight		kg (lb)	3690 (8140)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	0.11 (0.14)
Overall length	A	mm (ft-in)	4790 (15' 9")
Overall width, with 300 mm shoe	B		1740 (5' 9")
Overall height	C		2500 (8' 2")
Overall height of cab	E		2500 (8' 2")
Ground clearance of counterweight	F		540 (1' 9")
Minimum ground clearance	H		290 (0' 11")
Rear-end distance	I		870 (2' 10")
Rear-end swing radius	I'		870 (2' 10")
Distance between tumblers	J		1700 (5' 7")
Undercarriage length	K		2130 (7' 0")
Undercarriage width	L		1740 (5' 9")
Track gauge	M		1440 (4' 9")
Track shoe width, standard	N		300 (1' 0")
Height of blade	O		370 (1' 3")
Ground clearance of blade up	P		375 (1' 3")
Depth of blade down	Q		390 (1' 3")
Travel speed (low/high)		km/hr (mph)	2.5/4.2 (1.6/2.6)
Swing speed		rpm	9.5
Gradeability		Degree (%)	30 (58)
Ground pressure (300 mm rubber track shoe)		kgf/cm^2 (psi)	0.34 (4.83)
Max traction force		kg (lb)	3100 (6835)

3. WORKING RANGE

1) 2.5 m (8' 2") MONO BOOM WITH BOOM SWING POST



Description		1.3 m (4' 3") Arm
Max digging reach	A	5315 mm (17' 5")
Max digging reach on ground	A'	5200 mm (17' 1")
Max digging depth	B	3135 mm (10' 3")
Max digging depth (8ft level)	B'	2670 mm (8' 9")
Max vertical wall digging depth	C	2190 mm (7' 2")
Max digging height	D	4810 mm (15' 9")
Max dumping height	E	3425 mm (11' 3")
Min swing radius	F	2350 mm (7' 9")
Boom swing radius (left/right)		75°/50°
Bucket digging force	SAE	27.4 kN
		2800 kgf
		6170 lbf
	ISO	30.7 kN
		3130 kgf
		6900 lbf
Arm crowd force	SAE	18.9 kN
		1930 kgf
		4250 lbf
	ISO	19.5 kN
		1990 kgf
		4390 lbf

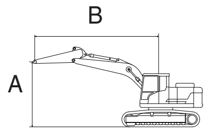
4. WEIGHT

Item	kg	lb
Upperstructure assembly	1975	4350
Main frame weld assembly	460	1010
Engine assembly	172	380
Main pump assembly	19	42
Main control valve assembly	25	55
Swing motor assembly	40	90
Hydraulic oil tank assembly	50	110
Fuel tank assembly	30	70
Boom swing post	80	180
Counterweight	410	900
Cab assembly	210	460
Canopy assembly	100	220
Lower chassis assembly	1230	2710
Track frame weld assembly	400	880
Swing bearing	50	110
Travel motor assembly	40	88
Turning joint	15	35
Track recoil spring	33.3	73
Idler	22.4	49
Carrier roller	7	15
Track roller	11.5	25
Sprocket	7	15
Rubber track (300 mm)	160	353
Dozer blade assembly	140	310
Front attachment assembly (2.5 m boom, 1.3 m arm, 0.11 m^3 SAE heaped bucket)	485	1070
2.5 m boom assembly	140	310
1.3 m arm assembly	80	180
0.11 m^3 SAE heaped bucket	87	191
Boom cylinder assembly	40	90
Arm cylinder assembly	40	90
Bucket cylinder assembly	30	70
Bucket control link assembly	20	45
Dozer cylinder assembly	30	70
Boom swing cylinder assembly	30	70

5. LIFTING CAPACITIES

Model	Type	Boom	Arm	Counterweight	Rubber shoe	Wheel	Dozer		Outtriger	
R35Z-9A	Cab	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		2500	1300	410	300	-	Up	-	-	-

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



Load point height (A)		Load radius (B) 1.0 m (3.3 ft)		2.0 m (6.6 ft)		3.0 m (9.8 ft)		4.0 m (13.1 ft)		At max. reach Capacity		Reach
		over-front	over-side	over-front	over-side	over-front	over-side	over-front	over-side	over-front	over-side	m (ft)
4.0 m	kg									*670	*670	3.12
(13.1 ft)	lb									*1480	*1480	(10.2)
3.5 m	kg									*640	570	3.66
(11.5 ft)	lb									*1410	1260	(12.0)
3.0 m	kg							570	490	560	480	4.04
(9.8 ft)	lb							1260	1080	1230	1060	(13.3)
2.5 m	kg					*670	*670	560	490	500	430	4.30
(8.2 ft)	lb					*1480	*1480	1230	1080	1100	950	(14.1)
2.0 m	kg					*790	760	560	480	460	400	4.48
(6.6 ft)	lb					*1740	1680	1230	1060	1010	880	(14.7)
1.5 m	kg					850	730	540	470	440	380	4.58
(4.9 ft)	lb					1870	1610	1190	1040	970	840	(15.0)
1.0 m	kg					820	700	530	460	430	370	4.61
(3.3 ft)	lb					1810	1540	1170	1010	950	820	(15.1)
0.5 m	kg					800	680	520	450	430	370	4.57
(1.6 ft)	lb					1760	1500	1150	990	950	820	(15.0)
Ground	kg			*1260	1260	790	670	520	450	440	390	4.46
Line	lb			*2780	2780	1740	1480	1150	990	970	860	(14.6)
-0.5 m	kg			1540	1260	780	670	520	450	470	410	4.27
(-1.6 ft)	lb			3400	2780	1720	1480	1150	990	1040	900	(14.0)
-1.0 m	kg	*1930	*1930	1550	1270	780	670	520	450	520	450	4.00
(-3.3 ft)	lb	*4250	*4250	3420	2800	1720	1480	1150	990	1150	990	(13.1)
-1.5 m	kg	*2490	*2490	1570	1290	790	680			610	530	3.61
(-4.9 ft)	lb	*5490	*5490	3460	2840	1740	1500			1340	1170	(11.8)
-2.0 m	kg			*1210	*1210	*670	*670			*650	*650	3.03
(-6.6 ft)	lb			*2670	*2670	*1480	*1480			*1430	*1430	(9.9)

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

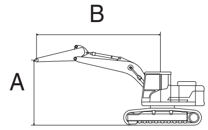
※ Lifting capacities are based upon a standard machine conditions.
Lifting capacities will vary with different work tools, ground conditions and attachments.
The difference between the weight of a work tool attachment must be subtracted.
Consult your Hyundai dealer regarding the lifting capacities for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

※ Please be aware of the local regulations and instructions for lifting operations.

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

Model	Type	Boom	Arm	Counterweight	Rubber shoe	Wheel	Dozer		Outtriger	
R35Z-9A	Cab	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		2500	1300	410	300	-	Down	-	-	-

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



Load point height (A)		Load radius (B)								At max. reach		
		1.0 m (3.3 ft)		2.0 m (6.6 ft)		3.0 m (9.8 ft)		4.0 m (13.1 ft)		Capacity		Reach
		Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	m (ft)
4.0 m	kg									*670	*670	3.12
(13.1 ft)	lb									*1480	*1480	(10.2)
3.5 m	kg									*640	630	3.66
(11.5 ft)	lb									*1410	1390	(12.0)
3.0 m	kg							*620	550	*630	540	4.04
(9.8 ft)	lb							*1370	1210	*1390	1190	(13.3)
2.5 m	kg					*670	*670	*620	550	*630	480	4.30
(8.2 ft)	lb					*1480	*1480	*1370	1210	*1390	1060	(14.1)
2.0 m	kg					*790	*790	*650	540	*630	450	4.48
(6.6 ft)	lb					*1740	*1740	*1430	1190	*1390	990	(14.7)
1.5 m	kg					*930	810	*690	530	*640	430	4.58
(4.9 ft)	lb					*2050	1790	*1520	1170	*1410	950	(15.0)
1.0 m	kg					*1060	790	*740	520	*650	420	4.61
(3.3 ft)	lb					*2340	1740	*1630	1150	*1430	930	(15.1)
0.5 m	kg					*1150	770	*770	510	*660	420	4.57
(1.6 ft)	lb					*2540	1700	*1700	1120	*1460	930	(15.0)
Ground	kg			*1260	*1260	*1190	750	*790	500	*670	430	4.46
Line	lb			*2780	*2780	*2620	1650	*1740	1100	*1480	950	(14.6)
-0.5 m	kg			*1930	1430	*1170	750	*770	500	*680	460	4.27
(-1.6 ft)	lb			*4250	3150	*2580	1650	*1700	1100	*1500	1010	(14.0)
-1.0 m	kg	*1930	*1930	*1890	1440	*1110	750	*690	510	*690	510	4.00
(-3.3 ft)	lb	*4250	*4250	*4170	3170	*2450	1650	*1520	1120	*1520	1120	(13.1)
-1.5 m	kg	*2490	*2490	*1620	1460	*970	760			*690	590	3.61
(-4.9 ft)	lb	*5490	*5490	*3570	3220	*2140	1680			*1520	1300	(11.8)
-2.0 m	kg			*1210	*1210	*670	*670			*650	*650	3.03
(-6.6 ft)	lb			*2670	*2670	*1480	*1480			*1430	*1430	(9.9)

Note 1. Lifting capacity are based on ISO 10567.
2. Lifting capacity of the Robex series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The lift-point is bucket pivot mounting pin on the arm (without bucket mass).
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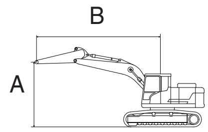
ANGLE DOZER BLADE

Model	Type	Boom	Arm	Counterweight	Rubber shoe	Wheel	Dozer		Outtriger	
R35Z-9A	Cab	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		2500	1300	410	300	-	Down	-	-	-

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



Load point height (A)		Load radius (B)								At max. reach		
		1.0 m (3.3 ft)		2.0 m (6.6 ft)		3.0 m (9.8 ft)		4.0 m (13.1 ft)		Capacity		Reach
												m (ft)
4.0 m	kg									*550	*550	3.18
(13.1 ft)	lb									*1210	*1210	(10.4)
3.5 m	kg									*530	*530	3.71
(11.5 ft)	lb									*1170	*1170	(12.2)
3.0 m	kg							*520	510	*530	490	4.08
(9.8 ft)	lb							*1150	1120	*1170	1080	(13.4)
2.5 m	kg							*530	500	*530	430	4.34
(8.2 ft)	lb							*1170	1100	*1170	950	(14.2)
2.0 m	kg					*680	*680	*560	490	*540	400	4.51
(6.6 ft)	lb					*1500	*1500	*1230	1080	*1190	880	(14.8)
1.5 m	kg					*820	770	*610	480	*550	380	4.61
(4.9 ft)	lb					*1810	1700	*1340	1060	*1210	840	(15.1)
1.0 m	kg					*960	740	*660	470	*570	370	4.64
(3.3 ft)	lb					*2120	1630	*1460	1040	*1260	820	(15.2)
0.5 m	kg			*1050	*1050	*1060	710	*700	460	*590	370	4.60
(1.6 ft)	lb			*2310	*2310	*2340	1570	*1540	1010	*1300	820	(15.1)
Ground	kg			*1520	1360	*1110	700	*720	450	*600	380	4.50
Line	lb			*3350	3000	*2450	1540	*1590	990	*1320	840	(14.8)
-0.5 m	kg	*1560	*1560	*2050	1360	*1110	690	*710	450	*620	400	4.31
(-1.6 ft)	lb	*3440	*3440	*4520	3000	*2450	1520	*1570	990	*1370	880	(14.2)
-1.0 m	kg	*1900	*1900	*1880	1370	*1060	690	*660	450	*640	440	4.04
(-3.3 ft)	lb	*4190	*4190	*4140	3020	*2340	1520	*1460	990	*1410	970	(13.3)
-1.5 m	kg	*2320	*2320	*1640	1390	*940	700			*660	520	3.66
(-4.9 ft)	lb	*5110	*5110	*3620	3060	*2070	1540			*1460	1150	(12.0)
-2.0 m	kg			*1270	*1270	*710	*710			*670	*670	3.09
(-6.6 ft)	lb			*2800	*2800	*1570	*1570			*1480	*1480	(10.2)

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

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

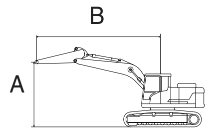
※ Please be aware of the local regulations and instructions for lifting operations.

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

ANGLE DOZER BLADE

Model	Type	Boom	Arm	Counterweight	Rubber shoe	Wheel	Dozer		Outtriger	
R35Z-9A	Cab	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		2500	1300	410	300	-	Down	-	-	-

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



Load point height (A)		Load radius (B)								At max. reach		
		1.0 m (3.3 ft)		2.0 m (6.6 ft)		3.0 m (9.8 ft)		4.0 m (13.1 ft)		Capacity		Reach
												m (ft)
4.0 m	kg									*550	*550	3.18
(13.1 ft)	lb									*1210	*1210	(10.4)
3.5 m	kg									*530	*530	3.71
(11.5 ft)	lb									*1170	*1170	(12.2)
3.0 m	kg							*520	510	*530	490	4.08
(9.8 ft)	lb							*1150	1120	*1170	1080	(13.4)
2.5 m	kg							*530	500	*530	430	4.34
(8.2 ft)	lb							*1170	1100	*1170	950	(14.2)
2.0 m	kg					*680	*680	*560	490	*540	400	4.51
(6.6 ft)	lb					*1500	*1500	*1230	1080	*1190	880	(14.8)
1.5 m	kg					*820	770	*610	480	*550	380	4.61
(4.9 ft)	lb					*1810	1700	*1340	1060	*1210	840	(15.1)
1.0 m	kg					*960	740	*660	470	*570	370	4.64
(3.3 ft)	lb					*2120	1630	*1460	1040	*1260	820	(15.2)
0.5 m	kg			*1050	*1050	*1060	710	*700	460	*590	370	4.60
(1.6 ft)	lb			*2310	*2310	*2340	1570	*1540	1010	*1300	820	(15.1)
Ground	kg			*1520	1360	*1110	700	*720	450	*600	380	4.50
Line	lb			*3350	3000	*2450	1540	*1590	990	*1320	840	(14.8)
-0.5 m	kg	*1560	*1560	*2050	1360	*1110	690	*710	450	*620	400	4.31
(-1.6 ft)	lb	*3440	*3440	*4520	3000	*2450	1520	*1570	990	*1370	880	(14.2)
-1.0 m	kg	*1900	*1900	*1880	1370	*1060	690	*660	450	*640	440	4.04
(-3.3 ft)	lb	*4190	*4190	*4140	3020	*2340	1520	*1460	990	*1410	970	(13.3)
-1.5 m	kg	*2320	*2320	*1640	1390	*940	700			*660	520	3.66
(-4.9 ft)	lb	*5110	*5110	*3620	3060	*2070	1540			*1460	1150	(12.0)
-2.0 m	kg			*1270	*1270	*710	*710			*670	*670	3.09
(-6.6 ft)	lb			*2800	*2800	*1570	*1570			*1480	*1480	(10.2)

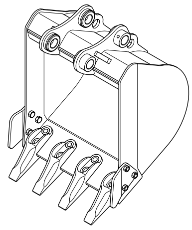
Note 1. Lifting capacity are based on ISO 10567.
2. Lifting capacity of the Robex series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates load limited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

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

※ Please be aware of the local regulations and instructions for lifting operations.

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

6. BUCKET SELECTION GUIDE



0.11 m^3
SAE heaped bucket

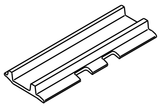
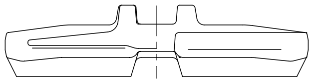
Capacity		Width		Weight	Recommendation
					2.5 m (8' 2") boom
SAE heaped	CECE heaped	Without side cutter	With side cutter		1.3 m (4' 3") arm
0.11 m^3 (0.14 yd^3)	0.09 m^3 (0.12 yd^3)	550 mm (21.7")	610 mm (24.0")	87 kg (191 lb)	Applicable for materials with density of 1600 kgf/m^3 (2700 lb/yd^3) or less

7. UNDERCARRIAGE

(1) TRACKS

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

(2) TYPES OF SHOES

Model	Shapes		Steel double grouser	Rubber track
				
R35Z-9A	Shoe width	mm (in)	300 (12")	300 (12")
	Operating weight	kg (lb)	3750 (8270)	3690 (8130)
	Ground pressure	kgf/cm^2 (psi)	0.35 (4.98)	0.34 (4.83)
	Overall width	mm (ft-in)	1740 (5' 9")	1740 (5' 9")

(3) NUMBER OF ROLLERS AND SHOES ON EACH SIDE

Item	Quantity
Carrier rollers	1EA
Track rollers	4EA
Track shoes	44EA

8. SPECIFICATIONS FOR MAJOR COMPONENTS

1) ENGINE

Item	Specification
Model	Yanmar 3TNV88F-ESHYB
Type	4-cycle diesel engine, low emission
Cooling method	Water cooling
Number of cylinders and arrangement	3 cylinders, in-line
Firing order	1-3-2
Combustion chamber type	Direct injection type
Cylinder bore × stroke	88× 90 mm (3.46" × 3.54")
Piston displacement	1642 cc (100.2 cu in)
Compression ratio	19.1 : 1
Rated gross horse power (SAE J1995)	24.4 Hp at 2200 rpm (18.2 kW at 2200 rpm)
Maximum torque at 1320 rpm	9.6 kgf · m (69.3 lbf · ft)
Engine oil quantity	6.7 ℓ (1.8 U.S. gal)
Dry weight	172 kg (380 lb)
High idling speed	2350+30 rpm
Low idling speed	1200±30 rpm
Rated fuel consumption	177 g/Hp · hr at 2200 rpm
Starting motor	12V-2.3 kW
Alternator	12V-55 A
Battery	1 ×12 V × 70 Ah (20h rating)

2) MAIN PUMP

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 ×17 cc/rev
Maximum pressure	230 kgf/cm^2 (3270 psi)
Rated oil flow	2 ×37.4 ℓ/min (2 ×9.9 U.S. gpm / 2 ×8.2 U.K. gpm)
Rated speed	2200 rpm

3) GEAR PUMP

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	10.5/4.5 cc/rev
Maximum pressure	205/40 kgf/cm^2 (2920/570 psi)
Rated oil flow	23.1/9.9 ℓ/min (6.1/2.6 U.S. gpm / 5.1/2.2 U.K. gpm)

4) MAIN CONTROL VALVE

Item	Specification
Type	Sectional, 10 spools (11 Blocks)
Operating method	Hydraulic pilot system
Main relief valve pressure (P1,P2 / P3)	230 kgf/cm^2 (3270 psi) / 205 kgf/cm^2 (2920 psi)
Overload relief valve pressure	250 kgf/cm^2 (3560 psi)

5) SWING MOTOR

Item	Specification
Type	Fixed displacement axial piston motor
Capacity	22 cc/rev
Relief pressure	200 kgf/cm^2 (2845 psi)
Braking system	Automatic, spring applied hydraulic released
Braking torque	9.2 kgf · m (66.5 lbf · ft)
Brake release pressure	20~65 kgf/cm^2 (284~925 psi)
Reduction gear type	2 - stage planetary

6) TRAVEL MOTOR

Item	Specification
Type	Variable displacement axial piston motor
Relief pressure	230 kgf/cm^2 (3270 psi)
Reduction gear type	2-stage planetary
Braking system	Automatic, spring applied hydraulic released
Brake release pressure	12.2 kgf/cm^2 (174 psi)
Braking torque	3.9 kgf · m (28 lbf · ft)

7) REMOTE CONTROL VALVE

Item		Specification
Type		Pressure reducing type
Operating pressure	Minimum	5 kgf/cm^2 (71 psi)
	Maximum	20.5 kgf/cm^2 (292 psi)
Single operation stroke	Lever	6.5/8.5 mm (0.26/0.33 in)

8) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Rod dia × Stroke	Ø85 × Ø45 × 540 mm
	Cushion	Extend only
Arm cylinder	Bore dia × Rod dia × Stroke	Ø80 × Ø45 × 585 mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia × Rod dia × Stroke	Ø70 × Ø45 × 510 mm
	Cushion	-
Boom swing cylinder	Bore dia × Rod dia × Stroke	Ø80 × Ø45 × 400 mm
	Cushion	-
Dozer cylinder	Bore dia × Rod dia × Stroke	Ø95 × Ø50 × 152 mm
	Cushion	-

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

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

9) BUCKET

Item	Capacity		Tooth quantity	Width	
	SAE heaped	CECE heaped		Without side cutter	With side cutter
STD	0.11 m^3 (0.14 yd^3)	0.09 m^3 (0.12 yd^3)	4	550 mm (21.7")	610 mm (24.0")

9. RECOMMENDED OILS

Use only oils listed below or equivalent.
Do not mix different brand oil.

Service point	Kind of fluid	Capacity ℓ (U.S. gal)	Ambient temperature °C(°F) -50 (-58), -30 (-22), -20 (-4), -10 (14), 0 (32), 10 (50), 20 (68), 30 (86), 40 (104)
Engine oil pan	Engine oil	6.7 (1.8)	★SAE 5W-40 SAE 30 SAE 10W SAE 10W-30 SAE 15W-40
Final drive	Gear oil	0.5×2 (0.13×2)	★SAE 75W-90 SAE 85W-140
Hydraulic tank	Hydraulic oil	Tank: 37 (9.8) System: 60 (15.9)	★ISO VG 15 ISO VG 46 ISO VG 68
Fuel tank	Diesel fuel★1	40 (10.5)	★ASTM D975 NO.1 ASTM D975 NO.2
Fitting (grease nipple)	Grease	As required	★NLGI NO.1 NLGI NO.2
Radiator (reservoir tank)	Mixture of antifreeze and soft water★2	5.5 (1.5)	Ethylene glycol base permanent type (50 : 50) ★Ethylene glycol base permanent type (60 : 40)

SAE : Society of Automotive Engineers
API : American Petroleum Institute
ISO : International Organization for Standardization
NLGI : National Lubricating Grease Institute
ASTM : American Society of Testing and Material

★ : Cold region
Russia, CIS, Mongolia

★1 : Ultra low sulfur diesel
- sulfur content ≤ 15 ppm

★2 : Soft water
City water or distilled water

SECTION 2 STRUCTURE AND FUNCTION

SECTION 2 STRUCTURE AND FUNCTION

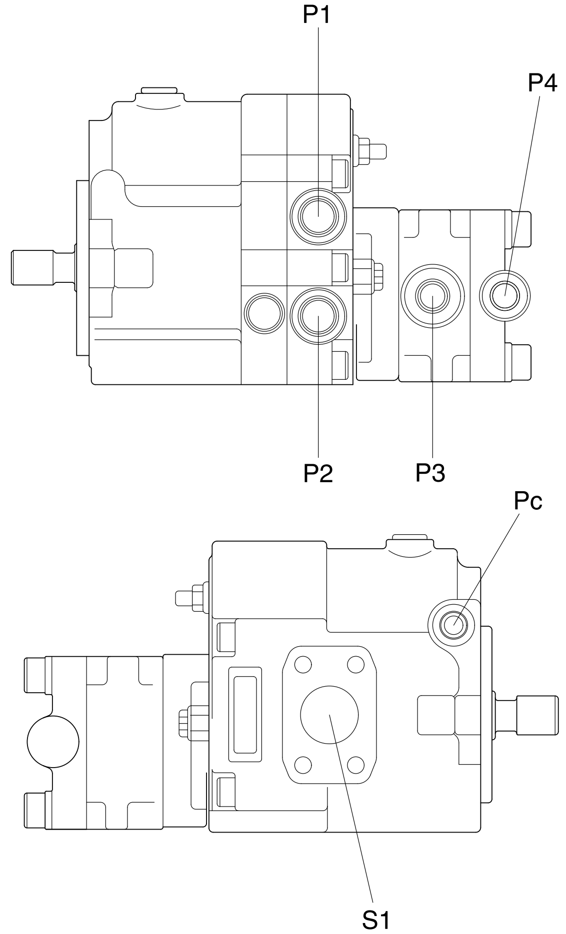
GROUP 1 HYDRAULIC PUMP

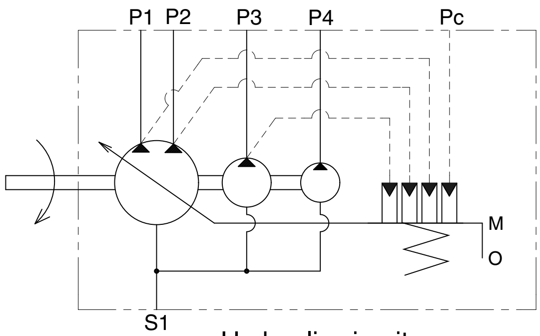
1. GENERAL

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

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

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





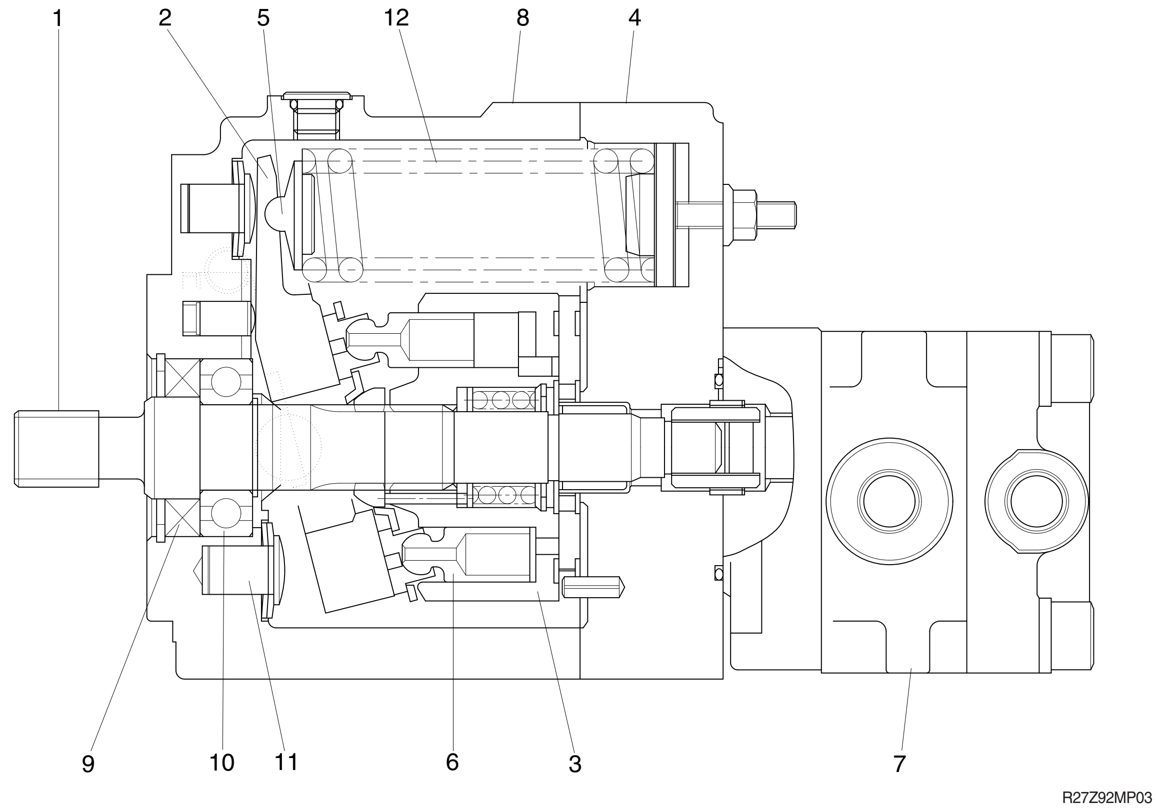
Hydraulic circuit

35Z9A2MP01

Description of the ports

Port	Port name	Port size
S1	Suction port	SAE 1 1/4
P1, P2, P3	Discharge port	PF 1/2
P4	Discharge port	PF 3/8
Pc	Pilot port	PF 1/4

2. MAJOR COMPONENTS AND FUNCTIONS



1	Drive shaft assembly	7	Gear pump
2	Swash plate assembly	8	Housing
3	Cylinder barrel	9	Oil seal
4	Port plate assembly	10	Bearing
5	Spring seat assembly	11	Stopper assembly
6	Piston	12	Spring

This is a variable displacement double-piston pump for discharge with two equal displacements from one cylinder block. Because this is one cylinder barrel, there is only one suction port.

The oil is divided into two equal flows by the control plate in the cover and directed to two discharge ports provided in the cover.

The discharge pressure directed to the piston tilts the hanger by overcoming the spring force.

Since the piston stroke changes according to the tilting angle of the hanger, the flow can be changed.

The simultaneous tilting angle constant-output control method is employed.

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

1) PRINCIPLE OF OPERATION

(1) Function of pump

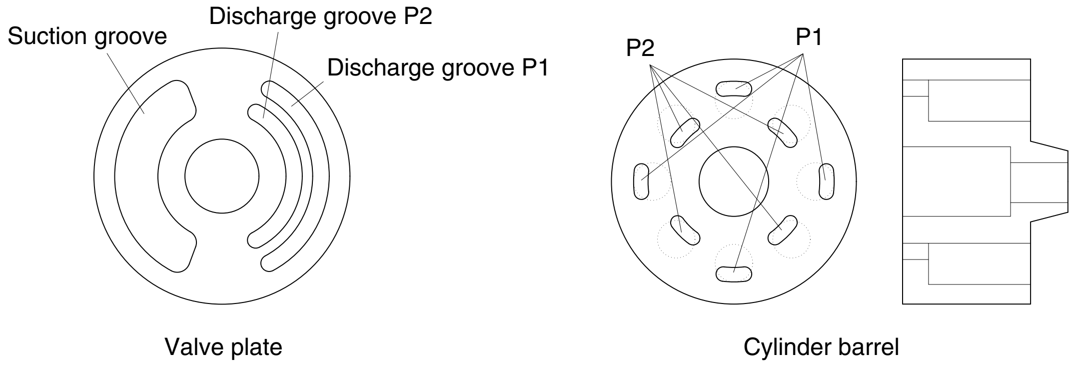


Figure 1 Working principle of PVD pump

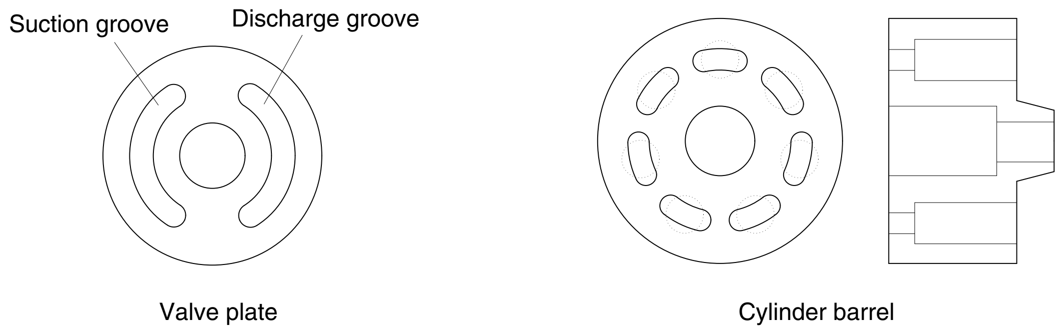


Figure 2 Working principle of Conventional type

35Z9A2MP05

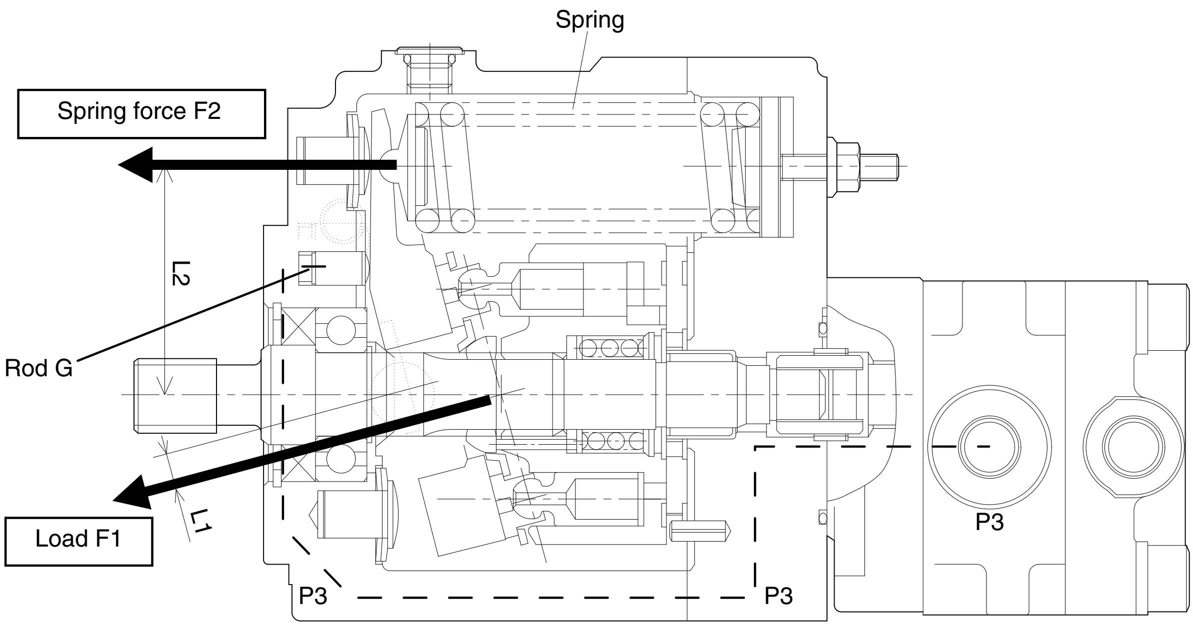
This pump adopts a new method using even numbered pistons to make functions of two same volume pumps available in one casing of a swash plate type variable volume piston pump.

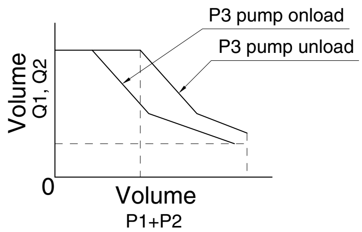
Conventional valve plate has one suction groove and one discharge groove respectively as shown in figure 2. But this method adopts one common suction groove and two discharge grooves on the outer side (P1) and the inner side (P2) as shown in figure 1, the piston room in the cylinder barrel opens to either the outer side (P1) or the inner side (P2) discharge groove of the valve plate alternately, and the discharges are performed independently on the inner side and the outer side.

Since this model has even numbered pistons, same No of pistons open to the outer side and the inner side of the valve plate. All pistons are of same swash plate, so the discharges from the outer side (P1) and the inner side (P2) are equal.

Also, since only one swash plate is used, the discharges from P1 and P2 ports changes equally when the swash plate angle of rake changes in variable controls. So, there is no difference between the two discharges.

2) CONTROL FUNCTIONS





P-Q characteristic

35Z9A2MP04

(1) Constant horse power variable structure

The pump output flow rate is variable depending on an angle of the swash plate which is controlled according to the pump output pressure. This control enables the pump consumption horse power to be sustained at the maximum. The tilt point of the swash plate is the balls located behind the swash plate. The load F1 from the pistons is in the direction shown in the illustration and generates a clockwise moment against the swash plate. Against this force the spring (force F2) is located in the opposite direction to keep the horse power constant and set at the appointed load. As the pressure increases, the above clockwise moment increases, and when it overcomes the counter-clockwise moment created by the spring force, the spring is sagged and the swash plate angle gets smaller. Then the output flow rate is reduced to keep the horse power constant.

This prevents engine stall and the engine horse power can be utilized at the maximum.

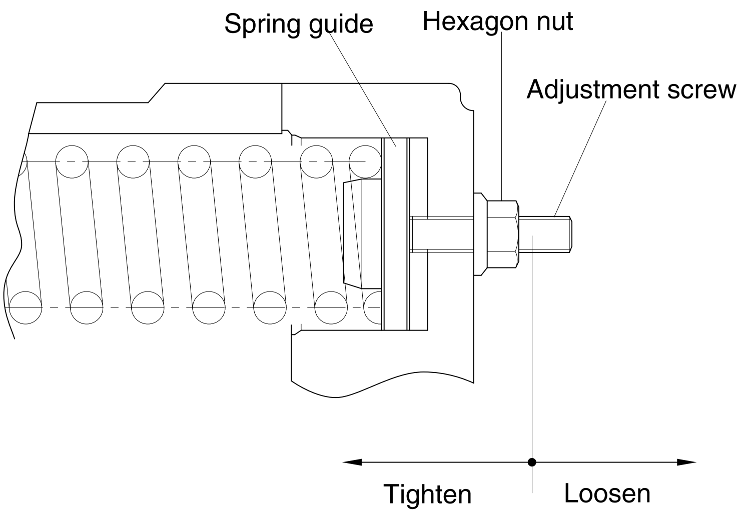
(2) Power shift mode (Reduced horse power control by P3 pressure)

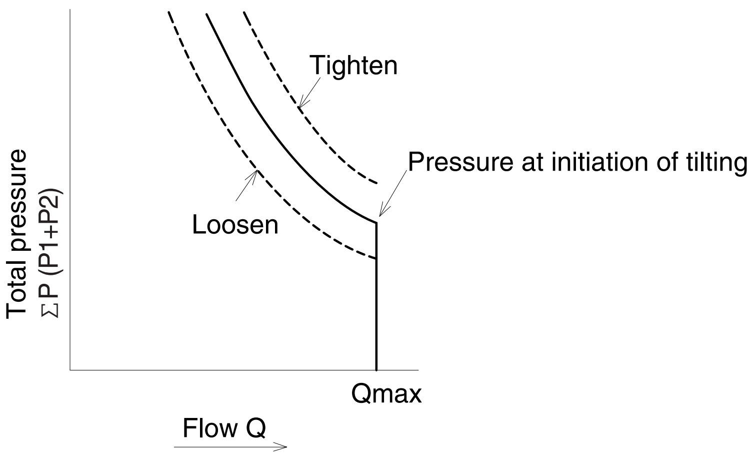
This control keeps the maximum value of the pump consumption horse power including the third pump (gear pump) constant. When the P3 (gear pump) pressure acts on the rod G, a clockwise moment proportion to the pressure acts on the swash plate and the P-Q characteristic shifts so that the total pump consumption horse power including the gear pump horse power is kept constant.

3) CONTROL / ADJUSTMENT PROCEDURE

(1) Loosen the hexagonal nut.

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

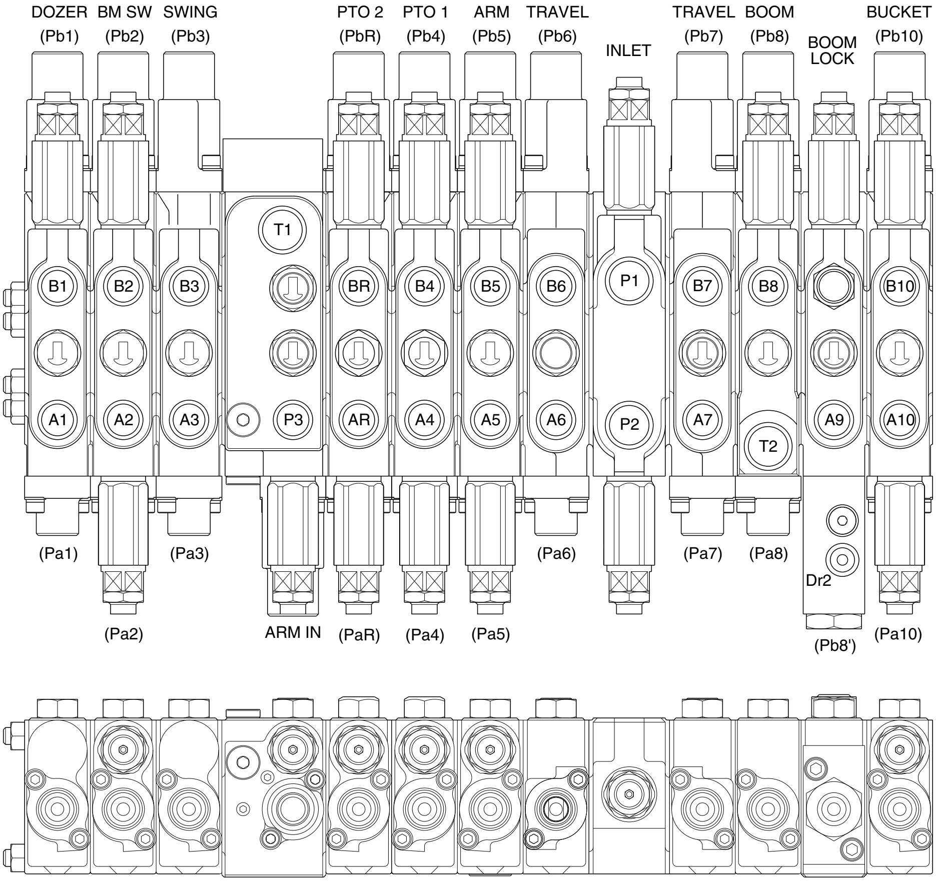




35Z9A2MP07

GROUP 2 MAIN CONTROL VALVE

1. OUTLINE

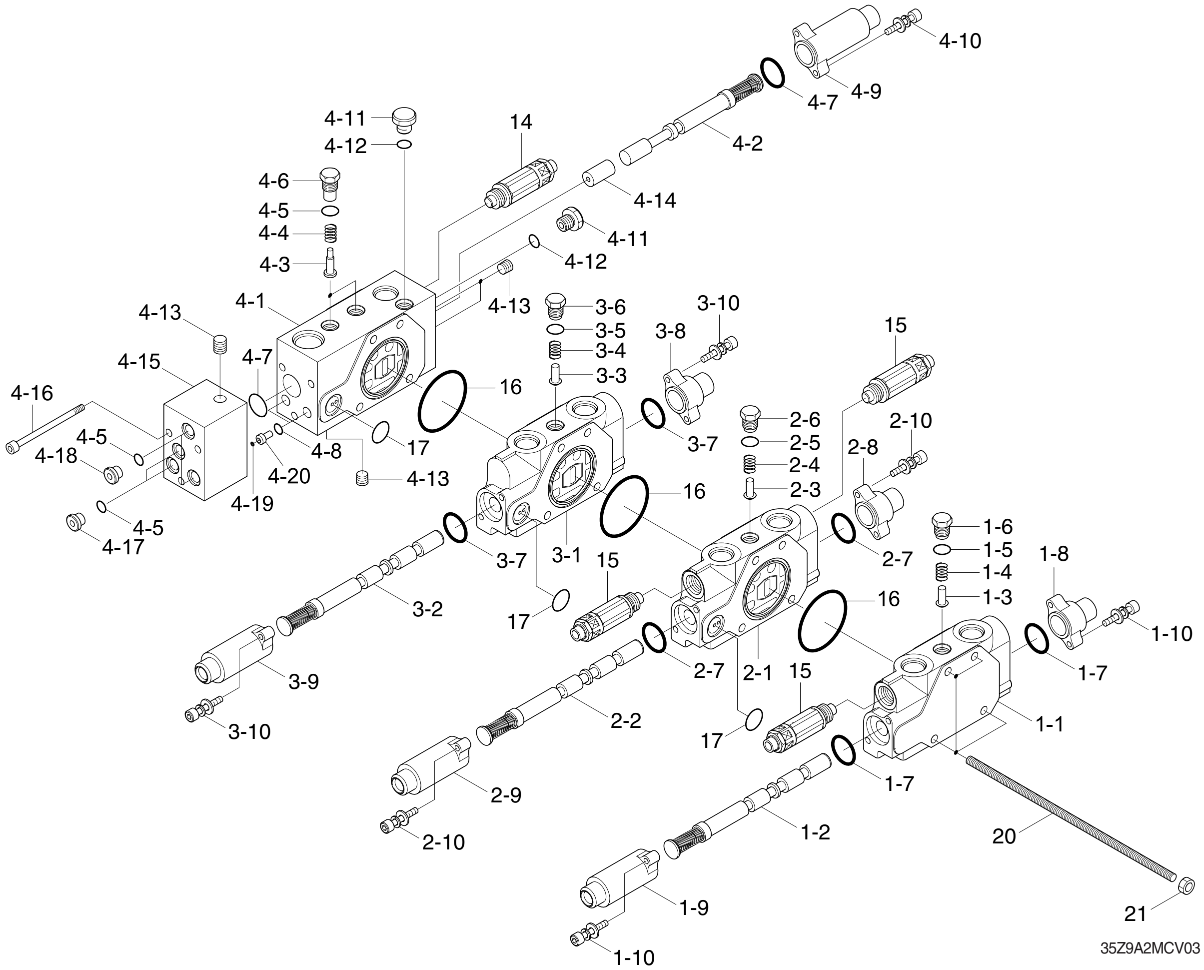


35Z9A2MCV01

Mark	Port name	Port size	Tightening torque
P1	P1 pump port	PF 1/2	6.0~7.0 kgf · m (43.4~50.6 lbf · ft)
P2	P2 pump port		
T1	Tank return port		
T2	Tank return port		
P3	P3 pump port	PF 3/8	4.0~5.0 kgf · m (28.9~36.2 lbf · ft)
A1	Dozer		
B1	Dozer		
A2	Boom swing (RH) port		
B2	Boom swing (LH) port		
A3	Swing (LH) port		
B3	Swing (RH) port		
AR/A4	Option port		
BR/B4	Option port		
A5	Arm out port		
B5	Arm in port		
A6	Travel [LH/RR] port		
B6	Travel [LH/FW] port		
A7	Travel [RH/RR] port		
B7	Travel [RH/FW] port		
A9	Boom up port		
B8	Boom down port		

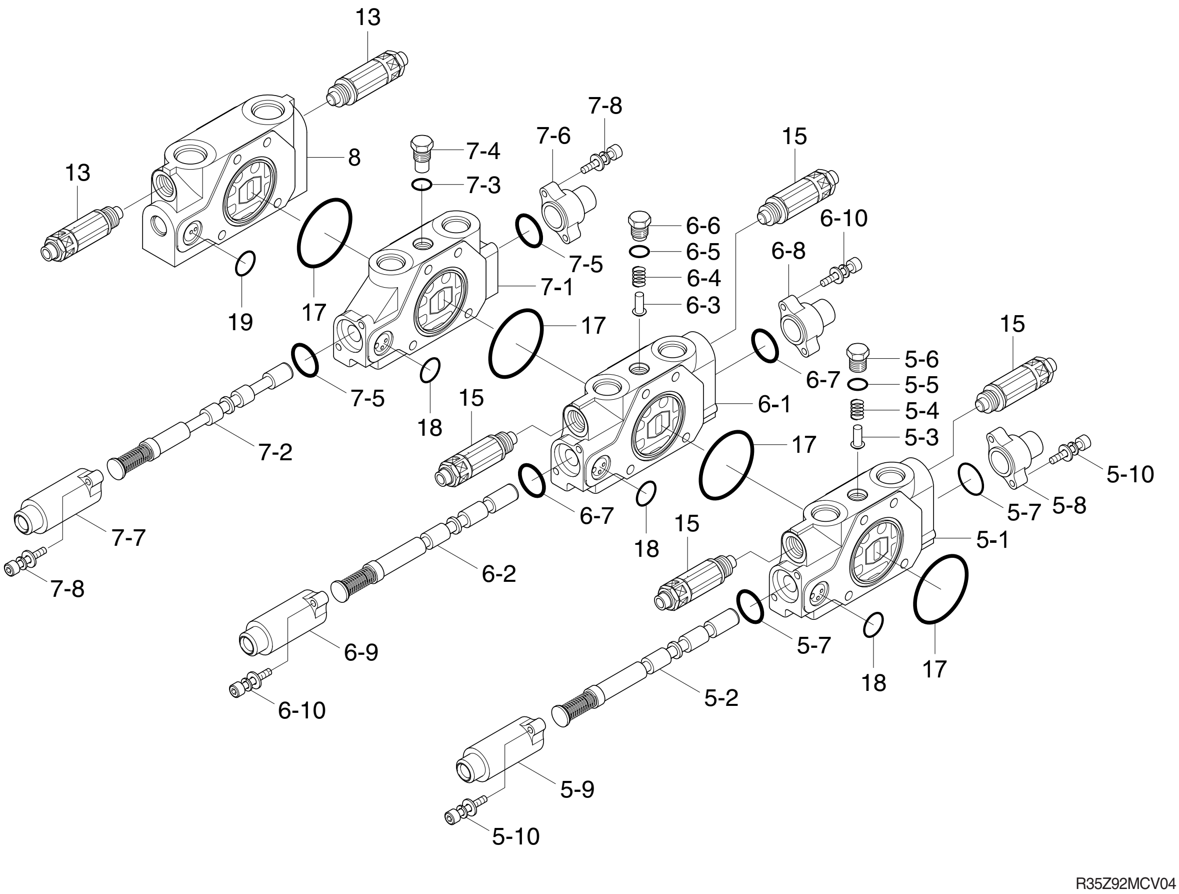
Mark	Port name	Port size	Tightening torque
A10	Bucket out port	PF 3/8	4.0~5.0 kgf · m
B10	Bucket in port		
Pa1	Dozer down pilot port	PF 1/4	2.5~3.0 kgf · m (18.1~21.7 lbf · ft)
Pb1	Dozer up pilot port		
Pa2	Boom swing (RH) pilot port		
Pb2	Boom swing (LH) pilot port		
Pa3	Swing (RH) pilot port		
Pb3	Swing (LH) pilot port		
Pa5	Arm out pilot port		
Pb5	Arm in pilot port		
Pa6	Travel [LH/RR] pilot port		
Pb6	Travel [LH/FW] pilot port		
Pa7	Travel [RH/RR] pilot port		
Pb7	Travel [RH/FW] pilot port		
Pa8	Boom up pilot port		
Pb8	Boom down pilot port		
Pa10	Bucket out pilot port		
Pb10	Bucket in pilot port		
Dr1, 2	Drain port		
PaR/Pa4	Option pilot port		
PbR/Pb4	Option pilot port		

2. STRUCTURE (1/3)



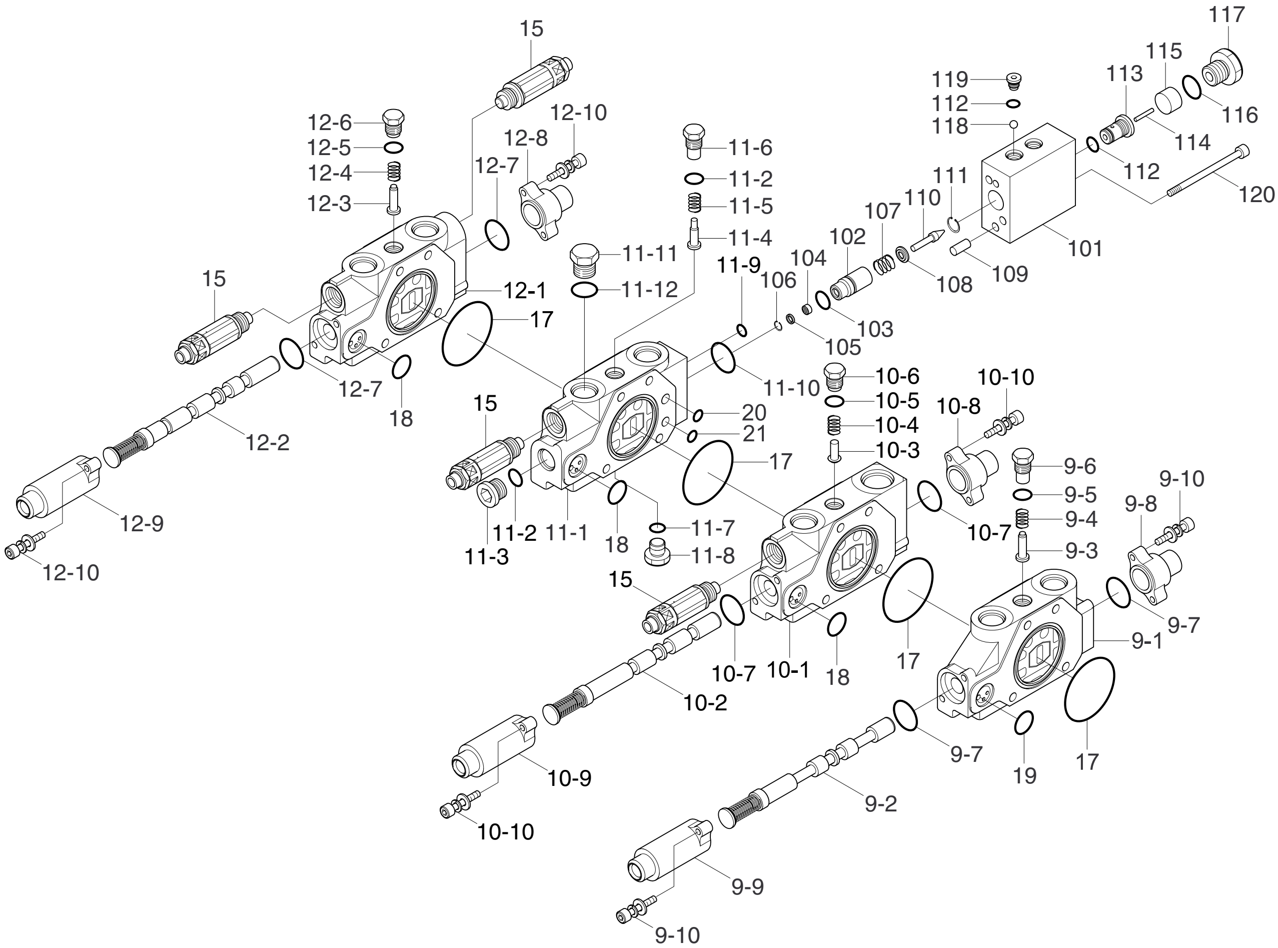
1	Dozer work block	2-9	Cover-pilot	4-7	O-ring
1-1	Body-work	2-10	Bolt-soc head w/washer	4-8	O-ring
1-2	Spool assy	3	Swing work block	4-9	Cover-pilot
1-3	Poppet	3-1	Body-work	4-10	Bolt-soc head w/washer
1-4	Spring	3-2	Spool assy	4-11	Plug
1-5	O-ring	3-3	Poppet	4-12	O-ring
1-6	Plug	3-4	Spring	4-13	Plug
1-7	O-ring	3-5	O-ring	4-14	Piston
1-8	Cover-pilot	3-6	Plug	4-15	Body-pilot
1-9	Cover-pilot	3-7	O-ring	4-16	Bolt-soc head w/washer
1-10	Bolt-soc head w/washer	3-8	Cover-pilot	4-17	Plug
2	Boom swing work block	3-9	Cover-pilot	4-18	Plug
2-1	Body-work	3-10	Bolt-soc head w/washer	4-19	Filter-coin type
2-2	Spool assy	4	Conflux block	4-20	Orifice
2-3	Poppet	4-1	Body-work	14	Relief valve
2-4	Spring	4-2	Spool assy	15	Overload relief valve
2-5	O-ring	4-3	Poppet	16	O-ring
2-6	Plug	4-4	Spring	17	O-ring
2-7	O-ring	4-5	O-ring	20	Bolt-tie
2-8	Cover-pilot	4-6	Plug	21	Nut-hex

STRUCTURE (2/3)



5	PTO work block	6-2	Spool assy	7-4	Plug
5-1	Body-work	6-3	Poppet	7-5	O-ring
5-2	Spool assy	6-4	Spring	7-6	Cover-pilot
5-3	Poppet	6-5	O-ring	7-7	Cover-pilot
5-4	Spring	6-6	Plug	7-8	Bolt-soc head w/washer
5-5	O-ring	6-7	O-ring	8	Inlet work block
5-6	Plug	6-8	Cover-pilot	13	Relief valve
5-7	O-ring	6-9	Cover-pilot	15	Overload relief valve
5-8	Cover-pilot	6-10	Bolt-soc head w/washer	17	O-ring
5-9	Cover-pilot	7	Travel work block	18	O-ring
5-10	Bolt-soc head w/washer	7-1	Body work	19	O-ring
6	Arm work block	7-2	Spool assy		
6-1	Body-work	7-3	O-ring		

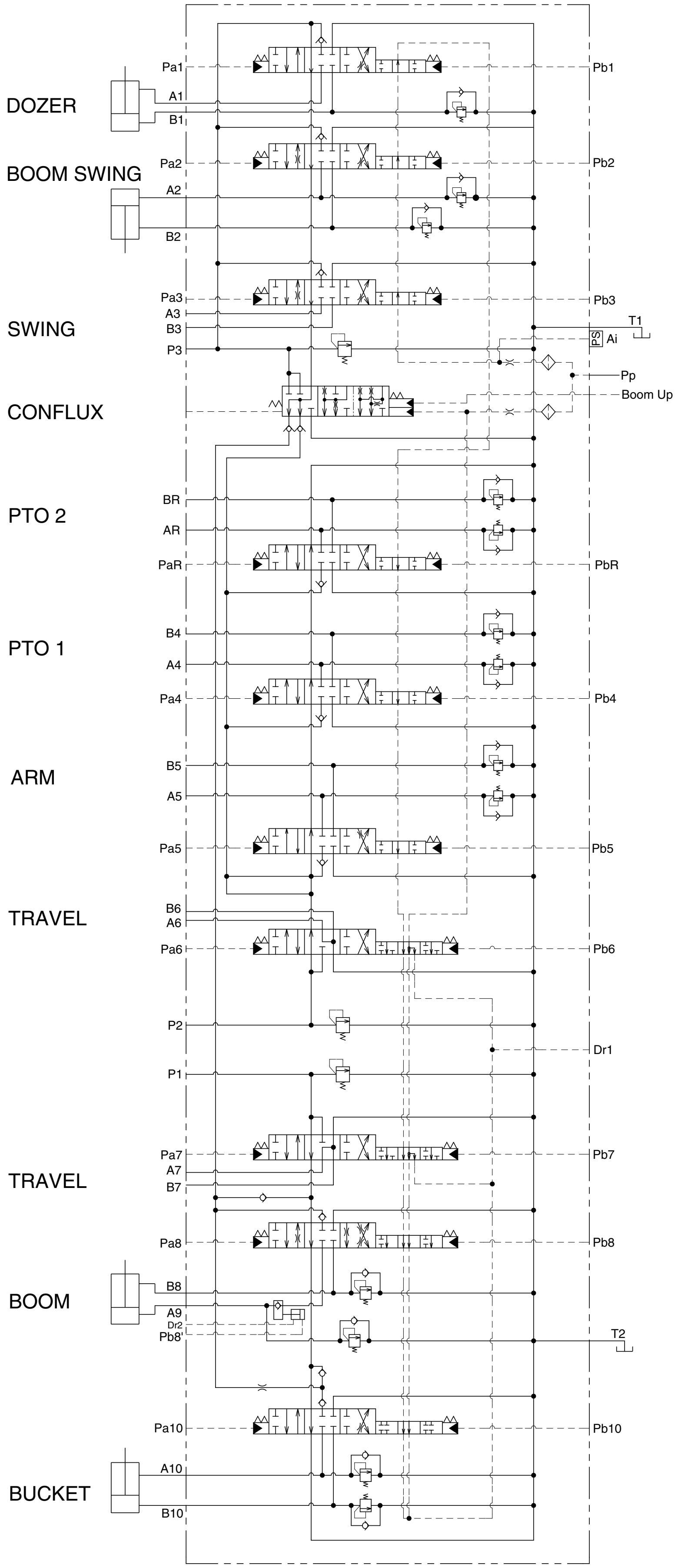
STRUCTURE (3/3)



R35Z72MCV05

9	Travel work block	10-7	O-ring	12-1	Body-work	103	Seal
9-1	Body-work	10-8	Cover-pilot	12-2	Spool assy	104	Filter
9-2	Spool assy	10-9	Cover-pilot	12-3	Poppet	105	Spacer
9-3	Poppet	10-10	Bolt-soc head w/washer	12-4	Spring	106	Ring-retaining
9-4	Spring	11	Boom lock block	12-5	O-ring	107	Spring A-lock valve
9-5	O-ring	11-1	Body-work	12-6	Plug	108	Spring seat
9-6	Plug	11-2	O-ring	12-7	O-ring	109	Pin
9-7	O-ring	11-3	Plug	12-8	Cover-pilot	110	Poppet
9-8	Cover-pilot	11-4	Poppet	12-9	Cover-pilot	111	Ring-retaining
9-9	Cover-pilot	11-5	Spring	12-10	Bolt-soc head w/washer	112	O-ring
9-10	Bolt-soc head w/washer	11-6	Plug	15	Overload relief block	113	Guide-piston
10	Boom work block	11-7	O-ring	17	O-ring	114	Piston A1
10-1	Body-work	11-8	Plug	18	O-ring	115	Piston B
10-2	Spool assy	11-9	O-ring	19	O-ring	116	O-ring
10-3	Poppet	11-10	O-ring	20	O-ring	117	Connector
10-4	Spring	11-11	Plug	21	O-ring	118	Ball-steel
10-5	O-ring	11-12	O-ring	101	Cover-lock valve	119	Plug
10-6	Plug	12	Bucket work block	102	Lock valve	120	Bolt-socket head

3. HYDRAULIC CIRCUIT



35Z9A2MCV02

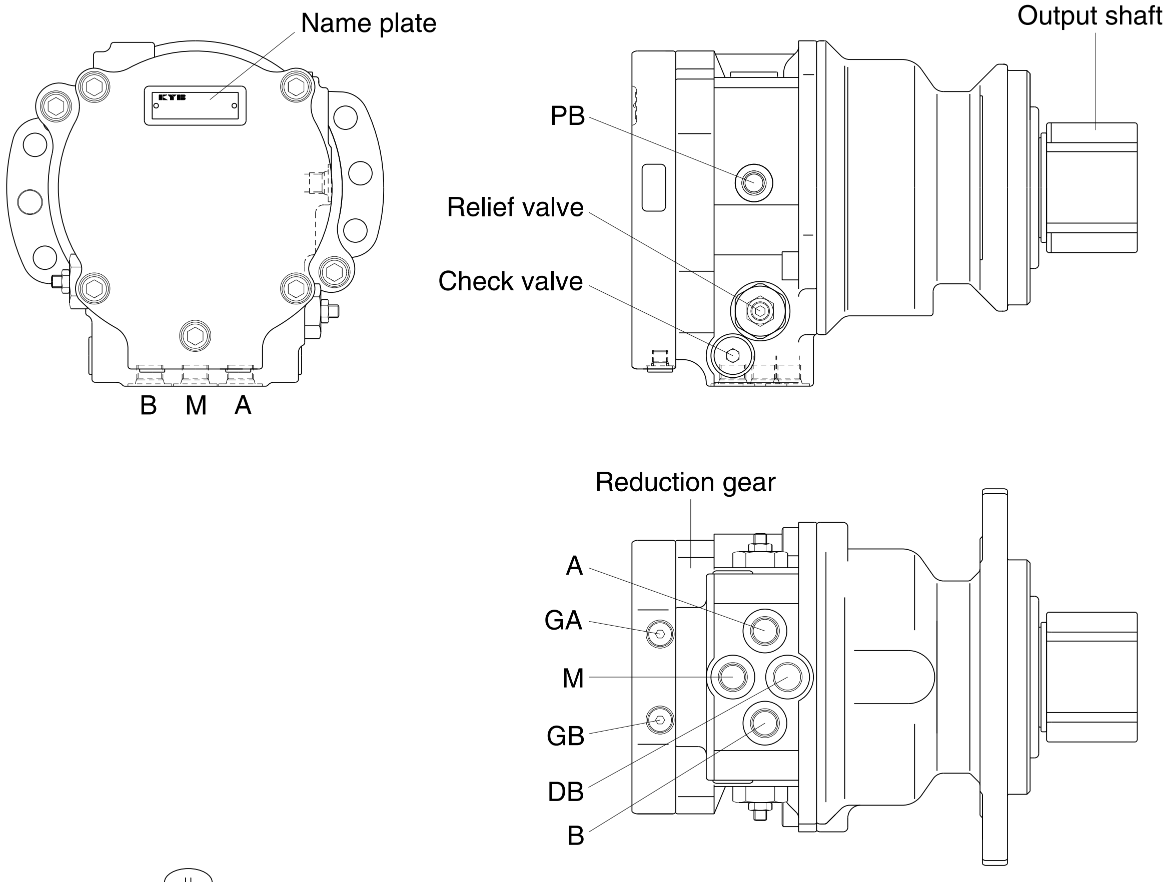
GROUP 3 SWING DEVICE

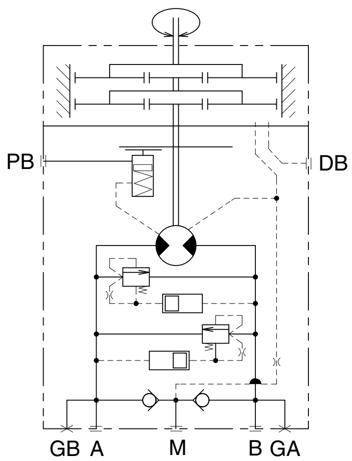
1. STRUCTURE

Swing device consists swing motor and swing reduction gear.

1) SWING MOTOR

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



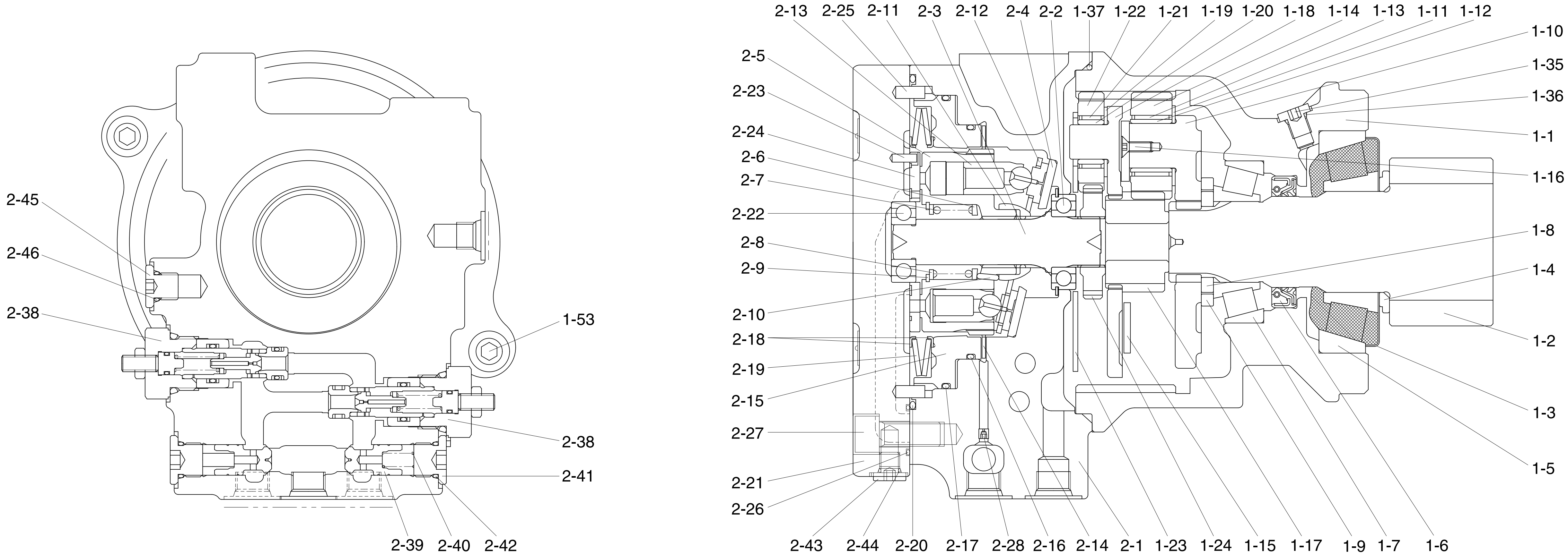


Hydraulic circuit

35Z72SM01A

Port	Port name	Port size
A	Main port	PF 3/8
B	Main port	PF 3/8
DB	Drain port	PF 3/8
M	Make up port	PF 3/8
PB	Brake release port	PF 1/4
GA,GB	Gage port	PF 1/8

2) COMPONENTS



R35Z92SM12

1	Gear box
1-1	Housing
1-2	Pinion shaft
1-3	Plate
1-4	Collar
1-5	Tapper roller bearing
1-6	Oil seal
1-7	Tapper roller bearing
1-8	Plate
1-9	Collar
1-10	Holder
1-11	Thrust washer
1-12	Inner race
1-13	Needle bearing
1-14	Planetary gear B
1-15	Thrust plate
1-16	Screw
1-17	Sun gear B
1-18	Holder
1-19	Thrust washer
1-20	Inner race
1-21	Needle bearing
1-22	Planetary gear
1-23	Thrust plate
1-24	Drive gear
1-35	Plug
1-36	O-ring
1-37	O-ring
1-53	Socket bolt
2	Axial piston motor
2-1	Case
2-2	Ball bearing
2-3	Shaft
2-4	Thrust plate
2-5	Cylinder block
2-6	Collar
2-7	Spring
2-8	Washer
2-9	Ring-snap
2-10	Pin
2-11	Retainer holder
2-12	Retainer plate
2-13	Piston assy
2-14	Disc
2-15	Brake piston
2-16	O-ring
2-17	O-ring
2-18	Spring seat
2-19	Spring
2-20	O-ring
2-21	Cover
2-22	Ball bearing
2-23	Pin
2-24	Valve plate
2-25	Pin
2-26	O-ring
2-27	Socket head bolt
2-28	Orifice
2-38	Relief valve assy
2-39	Check valve
2-40	Spring
2-41	Plug
2-42	O-ring
2-43	Plug
2-44	O-ring
2-45	Plug
2-46	O-ring

2. DESCRIPTION OF FUNCTION AND OPERATION

1) SWASH PLATE MOTOR

The cylinder block incorporates nine pistons. The end face of the cylinder block is in contact with the valve plate having two woodruff ports B and C (distributing valve to change over between high and low pressure).

Principle of generation torque

When high pressure oil (pressure P) is introduced to the B port, the inclined surface is pushed by a force of "F = P×A, A : Piston sectional area" per piston and the piston receives a reaction force from the inclined surface. The piston that is restricted in the moving direction by the cylinder block due to the reaction force generates a rotating force. The total of rotating force by the reaction force of the high pressure side pistons works on the cylinder block. The generated rotating force is transmitted as a torque to the shaft via the spline to turn the shaft.

On the other hand, if the high pressure oil is introduced to the C port, the opposite rotation is caused.

The output torque and the revolution are calculated as follows :

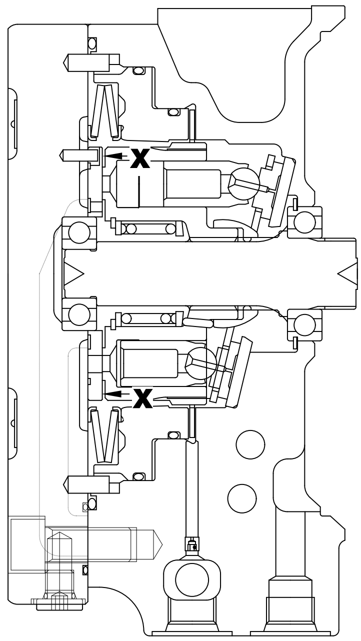
· Output torque (T)

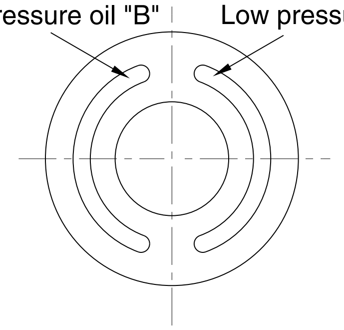
$$T = \frac{P \times D \times i \times \eta m \times \eta G}{2 \times \pi \times 100}$$

· Revolution (N)

$$N = \frac{Q \times 1000 \times \eta v}{D \times i}$$

D : Displacement (cm^3/rev)
P : Effective drive pressure (MPa)
Q : Inflow (L /min)
η m : Mechanical efficiency (motor) (% × 10^{-2})
η v : Volumetric efficiency (motor) (% × 10^{-2})
i : Speed ratio of reduction gear
η G : Efficiency of reduction gear (% × 10^{-2})





View X-X of valve plate(Outline)

R35Z72SM02

2) PARKING BRAKE

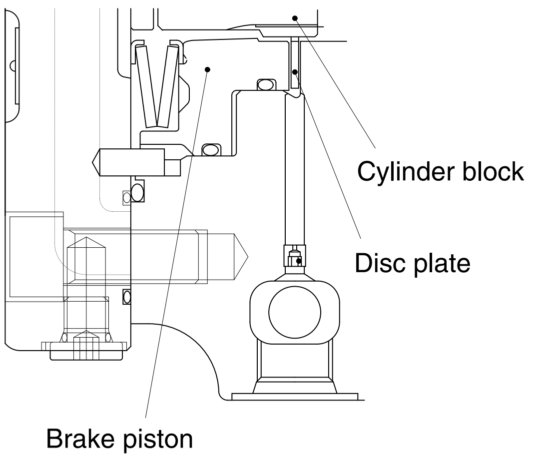
The parking brake is of wet type multi-plate construction of hydraulic release type and has a shaft lock mechanism that changes between ON and OFF of the brake by external signal pressures.

① Parking brake ON

When the hydraulic pressure for brake release is shut, the disc coupled to the periphery of the cylinder block via the spline is pushed by the spring force against the brake piston (pinned to the case so that it will not rotate) and the cylinder block and the case secured by the frictional force. Thus the shaft is locked.

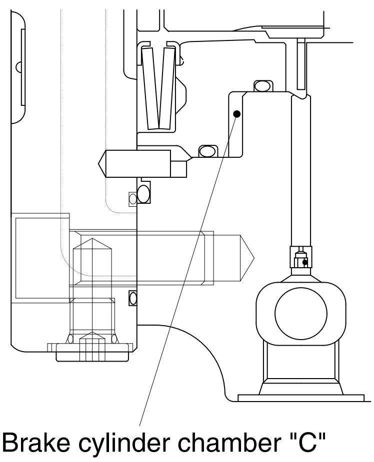
② Parking brake OFF

When the brake release pressure is introduced to the brake cylinder chamber (C) via the "PB" port, the brake piston is operated by the release pressure in opposition to the spring force to eliminate the force of friction with the disc, thus allowing the shaft to rotate freely.



"PB" (Brake releasing pressure) OFF

R35Z72SM03



"PB" (Brake releasing pressure) ON

R35Z72SM04

3) RELIEF VALVE

The relief valves determine the drive force and the brake force for hydraulic shovel swing and are installed in the main port A and B lines. The circuit is configured to return the relief valve return oil to the counterpart main low pressure line.

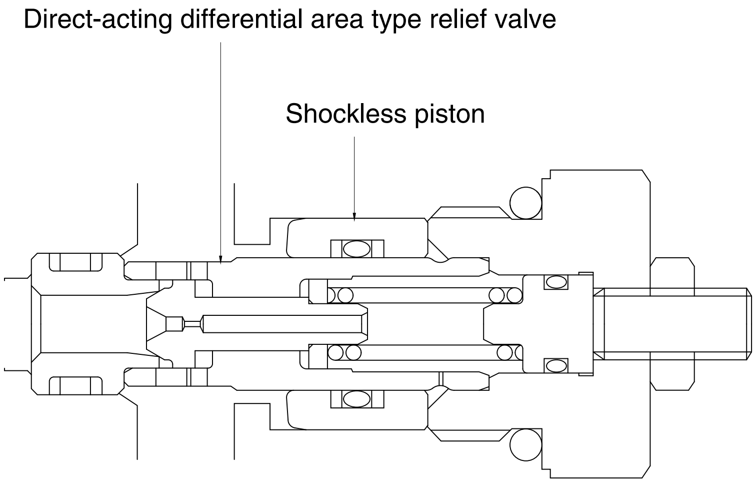
A shockless function is also incorporated to reduce shock produced at the start of both acceleration and deceleration.

(1) Construction of the relief valve

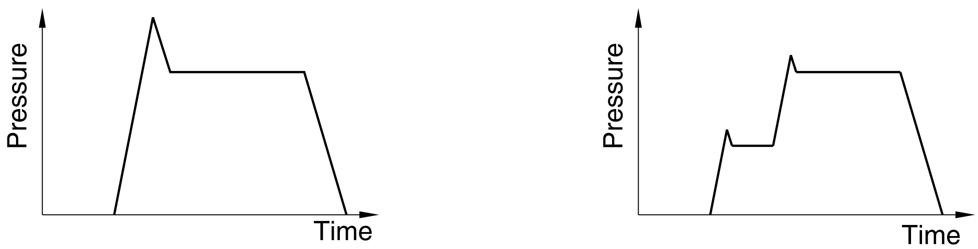
① A direct-acting differential area type relief valve

② A shockless piston

The installation of a shockless type relief valve helps reduce shock and stress produced in the strength members.



R35Z72SM05



Comparison of pressure wave forms

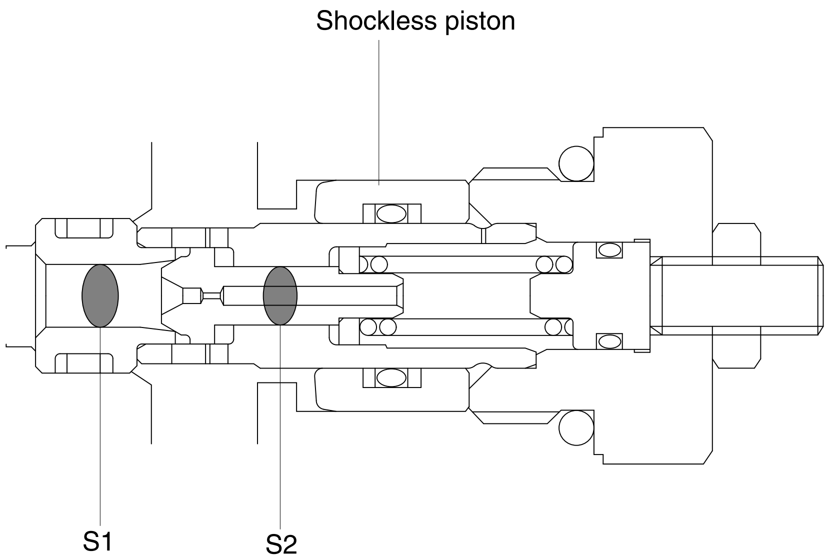
R35Z72SM08

(2) Relief valve operation

① First stage

At the start of operation, the shockless piston moves to maintain the spring chamber at a low pressure. Thus, the pressure receiving area of the poppet becomes the poppet seat area (S1), a considerably larger area than the pressure receiving area (S1-S2) at the specified relief setting. For this reason, the relief operating pressure is kept at a low pressure until the shockless piston completes its movement.

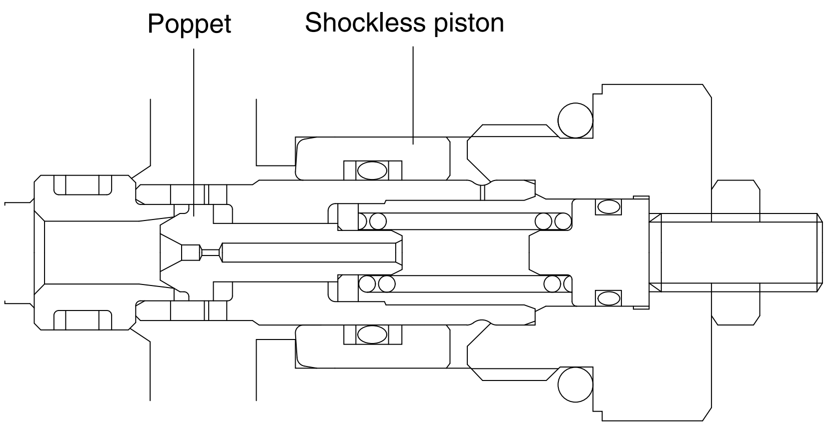
The low pressure holding time depends on the poppet orifice diameter, the free piston pressure receiving area and the free piston stroke.



R35Z72SM06

② Second stage

When the shockless piston completes its movement, the pressure inside the spring chamber increases to make the pressures before and after the poppet equal. Then the relief valve operates at the specified set pressure.



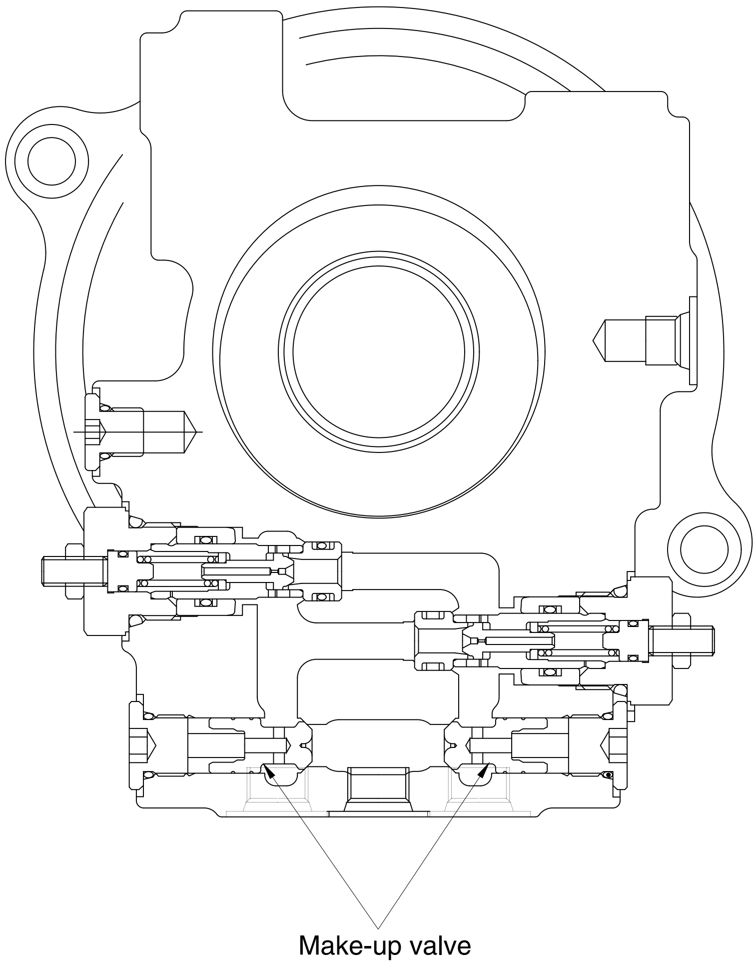
R35Z72SM07

4) MAKE-UP VALVE

The make-up valve has the following two functions.

One is to prevent cavitation produced by overrun of the piston motor in order to prevent the overrun of the upper body. When the motor is turned by the inertia of the upper body to cause the pumping action, which then causes the motor revolution to rise above the revolution equivalent to the amount of oil supplied to the motor, the amount of oil equivalent to the shortage is supplied to the motor main circuit via the make-up valve from outside to prevent occurrence of vacuum inside the circuit.

The other is a function to add the amount of motor drain and valve leak via the make-up valve to prevent vacuum inside the circuit to provide the braking capability in the normal circuit status when a closed circuit is formed between the control valve and the motor as when braking.

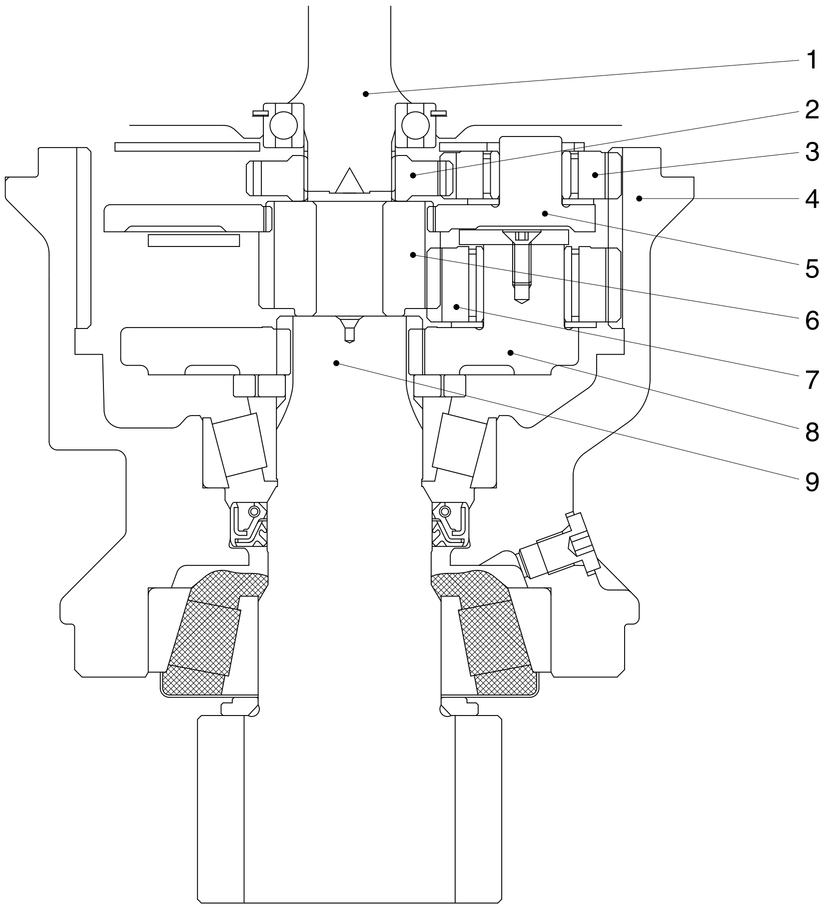


R35Z72SM09

5) **REDUCTION GEAR** (planetary two-stage)

Refer to the cross section.

The motor shaft (1) is coupled to the drive gear (2) via a spline. The drive force of the hydraulic motor is transmitted from the drive gear (2) to the engaged planetary gear (3). The planetary gear (3) is meshed with the ring gear of the reduction gear housing (4). Thus, while rotating, it revolves around the ring gear. The planetary gear (3) is held by the holder (5) via the bearing and the holder transmits the revolving motion of the planetary gear (3) to the sun gear (6) coupled via the spline. The sun gear (6) meshes with the planetary gear (7) and as with the first stage, transmits the rotary motion to the planetary gear (7). Since the planetary gear (7) is meshed with the ring gear of the housing (4), it revolves while rotating. Since the planetary gear (7) is held by the holder (8) via the bearing, the holder (8) transmits the revolving motion of the planetary gear (7) to the pinion shaft (9) coupled via the spline.



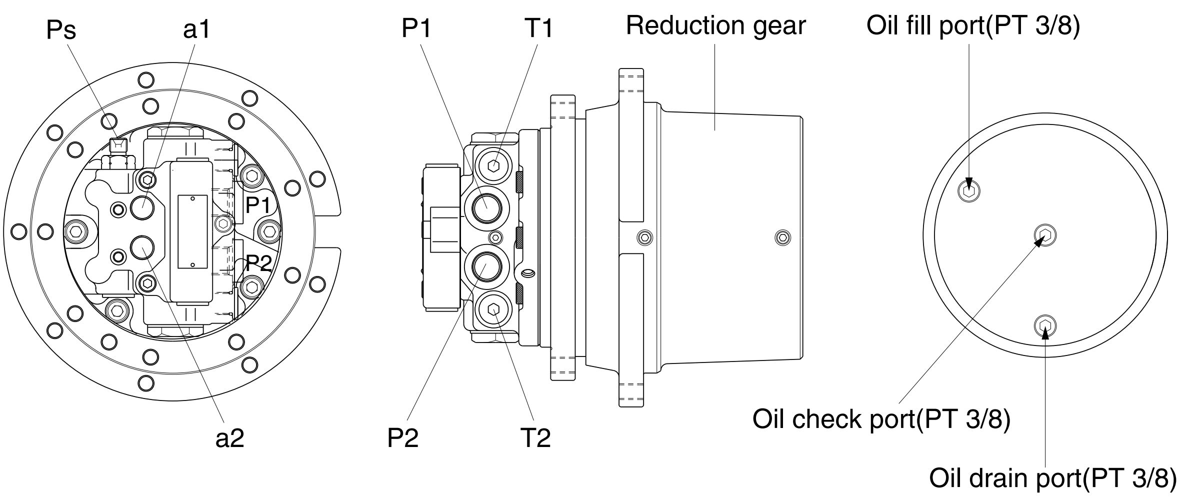
R35Z72SM10

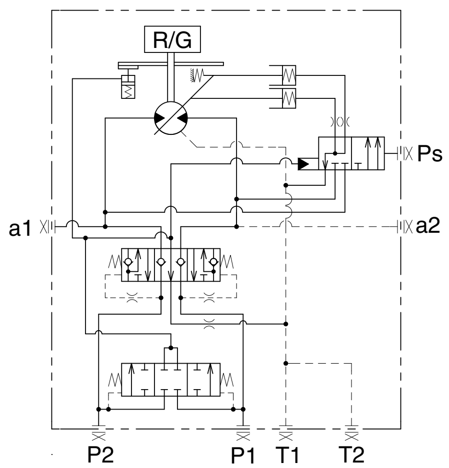
GROUP 4 TRAVEL DEVICE

1. CONSTRUCTION

Travel device consists travel motor and gear box.

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



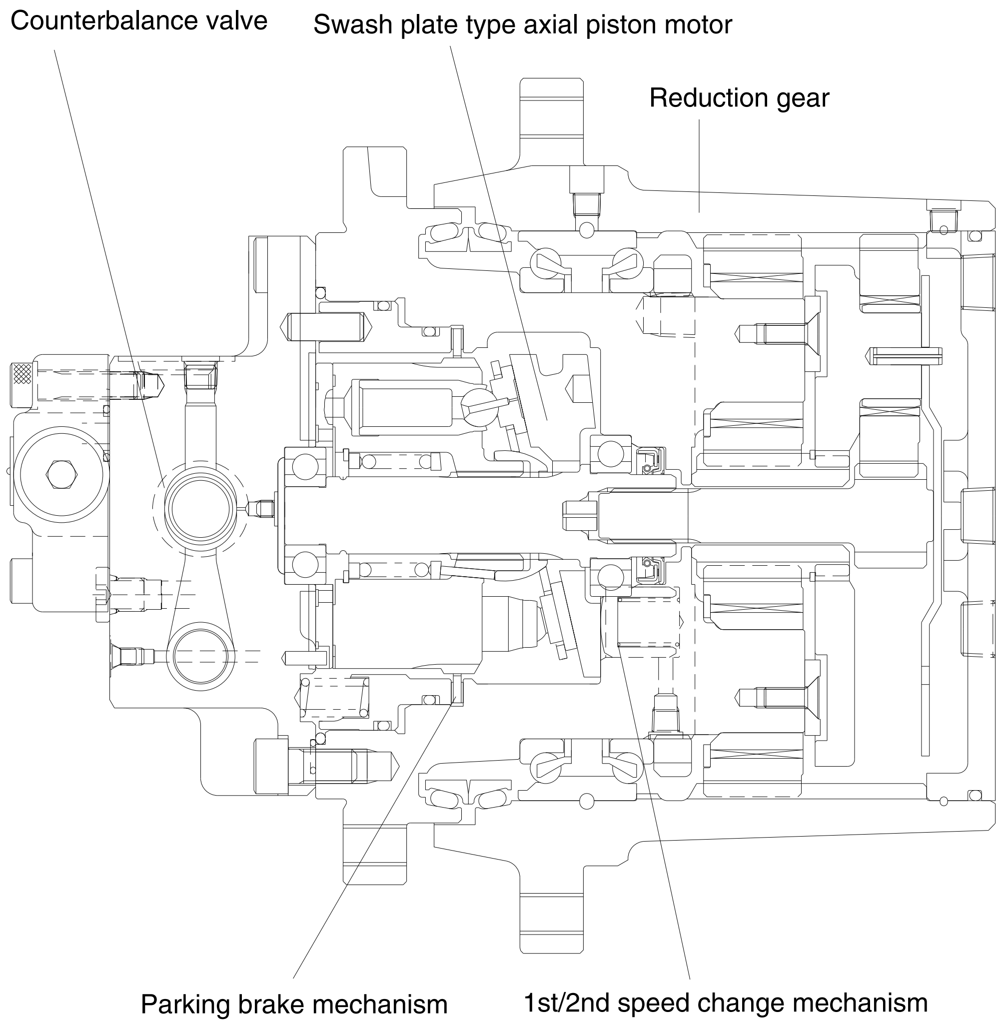


Hydraulic circuit

35Z9A2TM20

Port	Port name	Port size
P1	Main port	PF 1/2
P2	Main port	PF 1/2
a1,a2	Gauge port	PF 1/8
T1,T2	Drain port	PF 3/8
Ps	2 speed control port	9/16-18 UNF

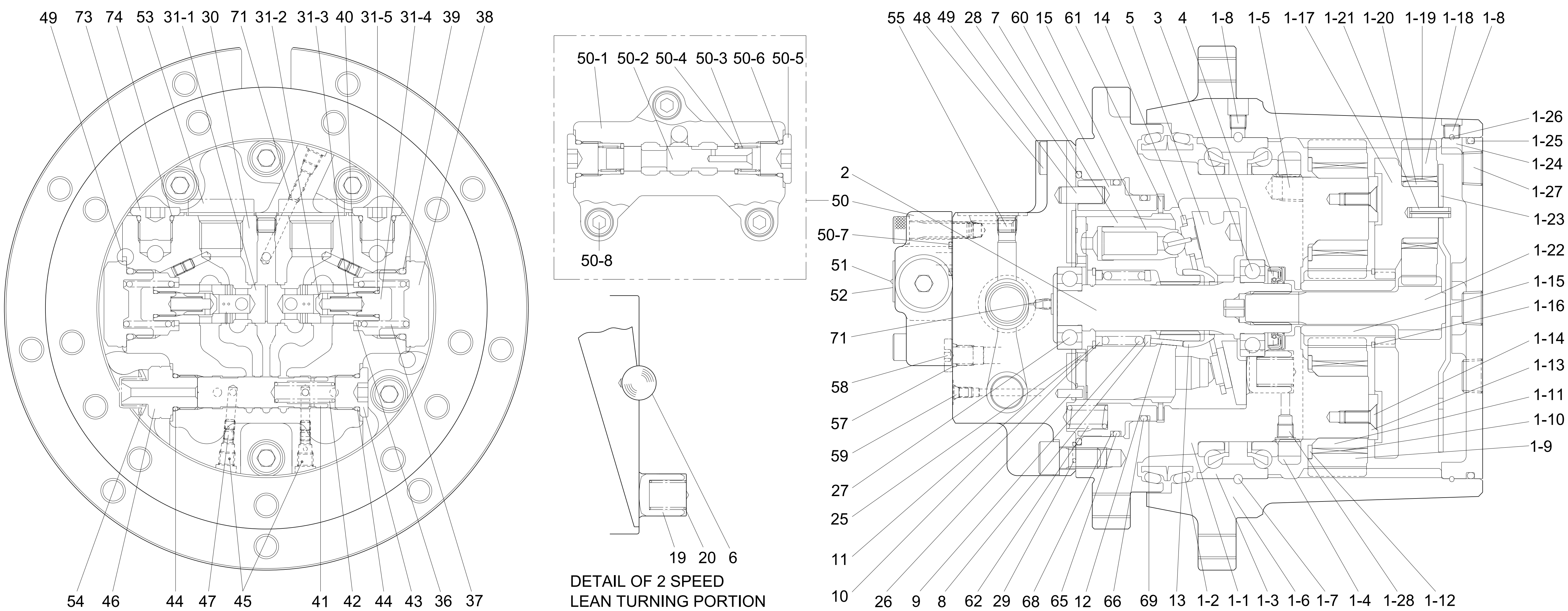
1) STRUCTURE (1/2)



R35Z72TM02

The travel motor is constituted with swash plate type axial piston motor, counterbalance valve, 2 speed change mechanism, parking brake, anti-cavitation valve and reduction gear unit.

STRUCTURE (2/2)

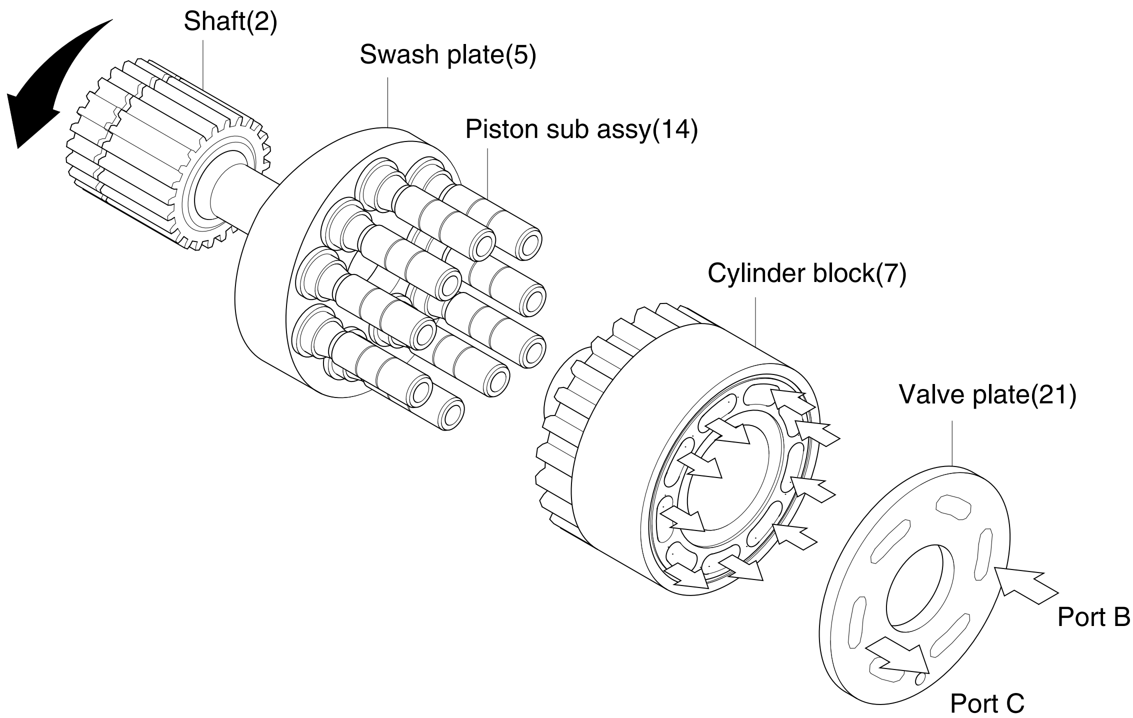


DETAIL OF 2 SPEED LEAN TURNING PORTION

1	Gear box	1-17	Holder	5	Swash plate	29	O-ring	45	Plug	57	O-ring
1-1	Flange holder	1-18	Planetary gear (A)	6	Steel ball	30	Base plate	46	Plug	58	Plug
1-2	Floating seal	1-19	Needle bearing	7	Cylinder block	31	Plunger assy	47	Orifice	59	Plug
1-3	Angular bearing	1-20	Inner race	8	Color	31-1	Plunger	48	Socket head bolt	60	Brake piston
1-4	Ring nut	1-21	Spring pin	9	Spring	31-2	Check valve	49	Pin	61	Disc
1-5	Plug	1-22	Drive gear	10	Washer	31-3	Spring	50	Valve assy	62	Spring
1-6	Housing	1-23	Thrust plate (T = 1.8)	11	Snap ring	31-4	Plug	50-1	Valve body	65	O-ring
1-7	Steel ball	1-23	Thrust plate (T = 2.3)	12	Pin	31-5	O-ring	50-2	Spool	66	O-ring
1-8	Plug	1-23	Thrust plate (T = 2.8)	13	Holder	36	Spring seat	50-3	Spring	68	Backup ring
1-9	Planetary gear B	1-24	Cover	14	Retainer plate	37	Spring	50-4	Spring seat	69	Backup ring
1-10	Needle bearing	1-25	O-ring	15	Piston assy	38	Cap	50-5	Plug	71	Spring
1-11	Collar	1-26	Wire	19	Piston assy	39	O-ring	50-6	O-ring	73	Plug
1-12	Thrust washer	1-27	Plug	20	Spring	40	Orifice	50-7	O-ring	74	O-ring
1-13	Thrust plate	1-28	Plug	25	Valve plate	41	Spool	50-8	Socket head bolt		
1-14	Screw	2	Shaft sub assy	26	Pin	42	Spring	51	Name plate		
1-15	Sun gear	3	Ball bearing	27	Ball bearing	43	Plug	52	Drive screw		
1-16	Snap ring	4	Oil seal	28	O-ring	44	O-ring	55	Plug		

2. FUNCTION

1) HYDRAULIC MOTOR



R35Z72TM03

Nine piston sub assemblies (14) are assembled in cylinder block (7). The end face of cylinder block (7) is in contact with valve plate (21) having two crescent shaped ports, B and C (high and low pressure ports).

When supplying pressure fluid (pressure P) to B port, a swash plate (5) is pushed by the force of piston sub assemblies having F = P · A (A : piston pressure area). Piston sub assemblies receive the reaction force against it, and produce the reaction force (Ft) in rotating direction. The total force of high pressure side piston sub assemblies in rotating direction produces a rotating force in the cylinder block, and the torque is transmitted to shaft (2) through the spline resulting in the rotation of the shaft.

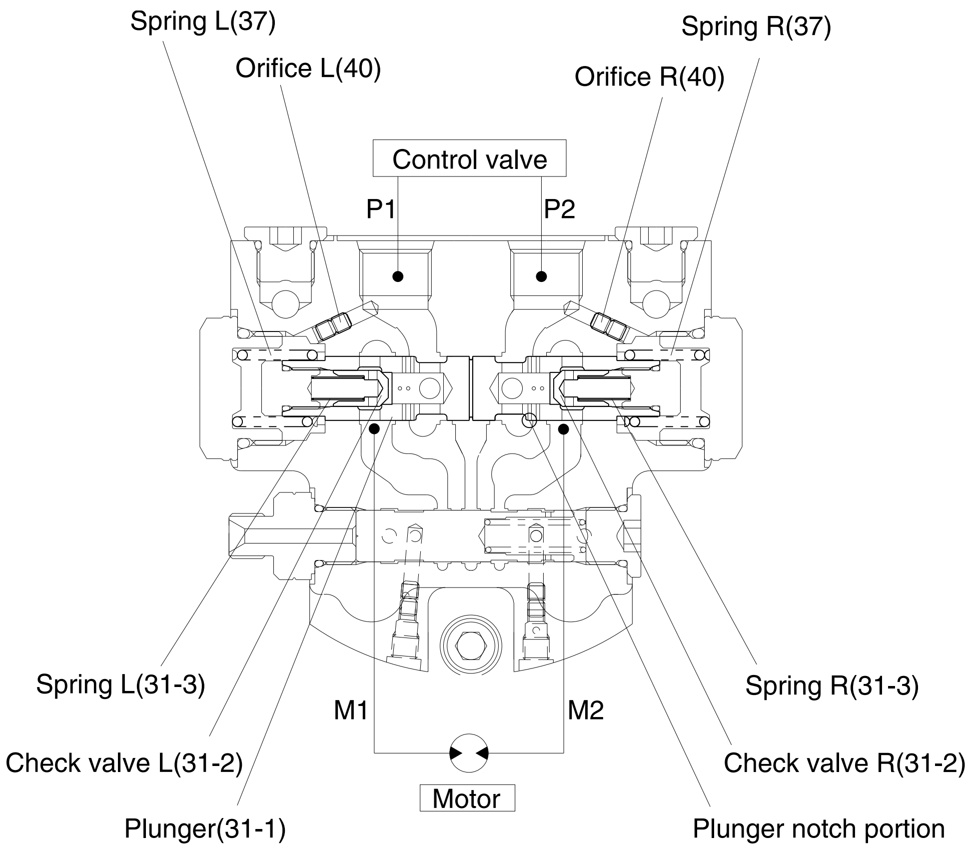
According to the above working principle, the output torque and rotating speed of the piston motor are determined by supply pressure (P) and flow rate (Q), and are calculated by the following equation.

$$T = \frac{P \times D \times \eta m}{2 * \pi}$$

$$N = \frac{Q \times 10^3 \times \eta v}{D}$$

T : Output torque [N · m]
N : Speed of rotation [rpm]
P : Working pressure [MPa]
Q : Flow rate [L/min]
D : Theoretical displacement [cm3/rev]
η m : Mechanical efficiency
η v : Volumetric efficiency

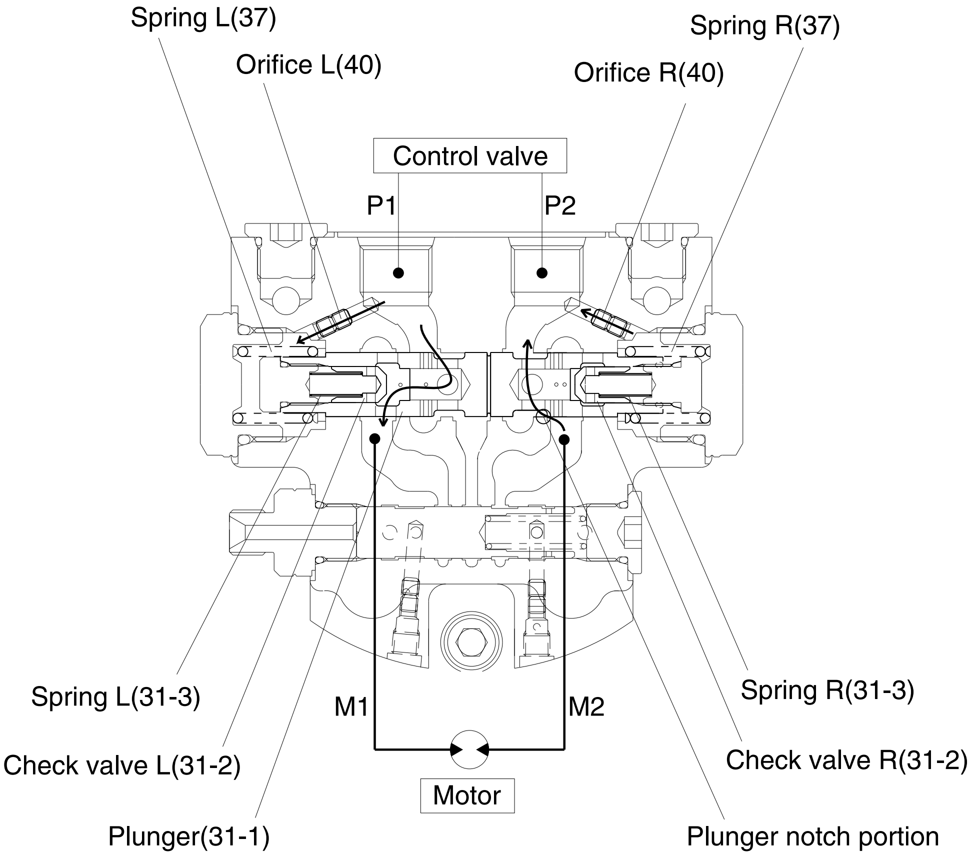
2) COUNTER BALANCE VALVE



R35Z72TM04

The counter balance valve is provided to stop the axial piston motor and to prevent overrunning. When the control valve is set to the neutral position, there is no pressure in the ports P1 and P2, and ports M1 and M2 are blocked by plunger (31-1) and check valve (31-2), consequently the motor does not start rotating.

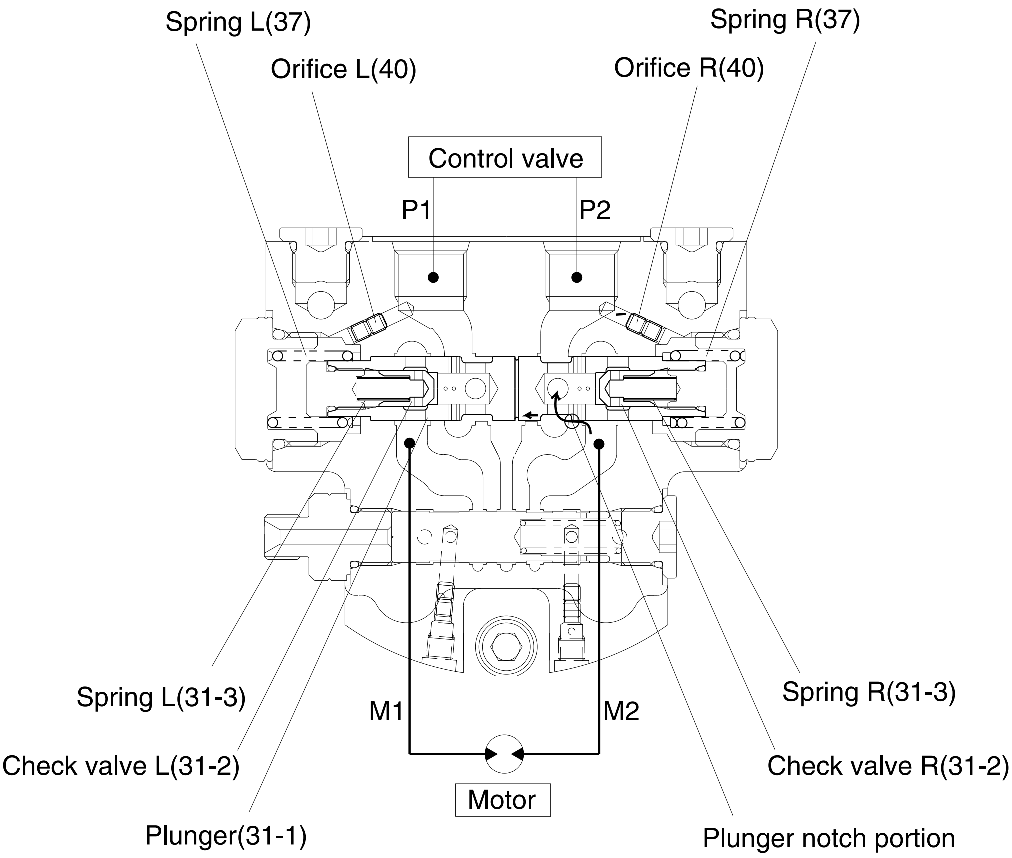
(1) Counter balance valve work



R35Z72TM05

When the fluid is supplied from pump to counter balance valve port P1 through control valve, the fluid flows into piston motor through check valve L (31-2), and rotate the piston motor.
On the other hand, the return fluid from the piston motor flows into the counterbalance valve through port M2, but the fluid is interrupted by check valve R (31-2), and consequently the pump delivery pressure will increase.
The high pressure oil at port P1 passes through orifice L (40), pushes the end of face of plunger (31-1) and pushes the plunger rightward against spring R (37) on the opposite side with the force proportional to the pressure.
When the hydraulic pressure rises to a certain pressure, plunger (31-1) starts moving rightward, and the fluid in port M2 passes through the notch machined outer circular of plunger (31-1) and flows into the port P2, producing a back pressure on the port M2, finally returning into the tank through a control valve.
And when the pump delivery pressure rises, the throttling aperture of notch in plunger (31-1) becomes larger, and consequently the back pressure of the port M2 becomes lower.
This way, the throttling aperture of the notch in plunger (31-1) automatically adjusts the area of a return side passage in order to rotate the piston motor with the appropriate speed for port P1 side flow rate (inlet flow).

(2) Brake work



R35Z72TM06

Then, when the control valve returns to the neutral position, the pressurized oil from the pump is shut off and the pressures of the ports P1 and P2 become equal. A plunger (31-1) tries to be returned to neutral position by force of spring R (37). When plunger (31-1) moves, the throttle opening of plunger becomes small.

Piston motor tries to rotate with inertia energy (motor-pumping-action) and the pressure rises on port M2.

With the movement of plunger (31-1), the oil of spring L room flows out through orifice L (40) and control the speed of plunger (31-1), By this movement, the shock pressure due to the inertia energy on the port M2 is absorbed, simultaneously preventing the cavitation on the port M1.

3) TWO SPEED CHANGE MECHANISM

(1) When running at 1st speed (low speed)

Swash plate (5) has three faces, from "a" to "c", as shown below in the figure and installed in the flange holder with two steel balls (6) in the condition where it can be tilted.

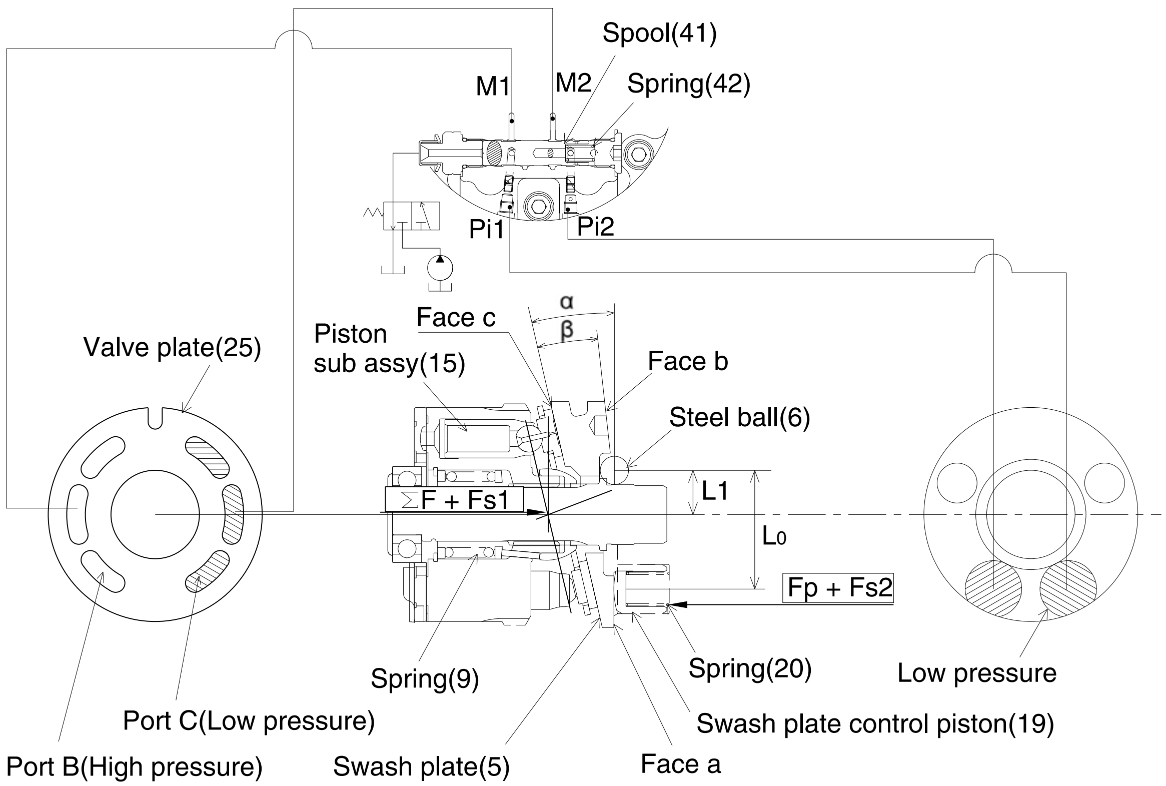
When the control valve is set to the 1st speed position, spool (41) is placed in the position shown below in the figure by the force of spring (42), and the passage of swash plate control piston (19) passes across the Pi1 and Pi2 port positions and led to the tank port. Therefore, the force pushing up the swash plate (5) does not act on the swash plate control piston (19).

$Fp = (Ap \times P) = 0$

Fp : Swash plate control piston thrust
Ap : Swash plate control piston pressure receiving area
P : Pressure

When steel ball (6) is placed on the tilting center, the balance of moment acting on swash plate (5) is in the condition of $(\sum F + Fs1) \times L1 > (Fp + Fs2) \times Lo$ depending on the total $\sum F$ of driving force of piston sub assy (15) and the force of spring (9) Fs1 and Fs2, then swash plate (5) stables at the face a and the swash plate angel is α, and consequently the motor speed corresponding to the 1st speed, low speed, is obtained.

$$(\sum F + Fs1) \times L1 > (Fp + Fs2) \times Lo$$



At 1st speed(low speed)

R35Z72TM08

(2) **When running at 2nd speed** (high speed)

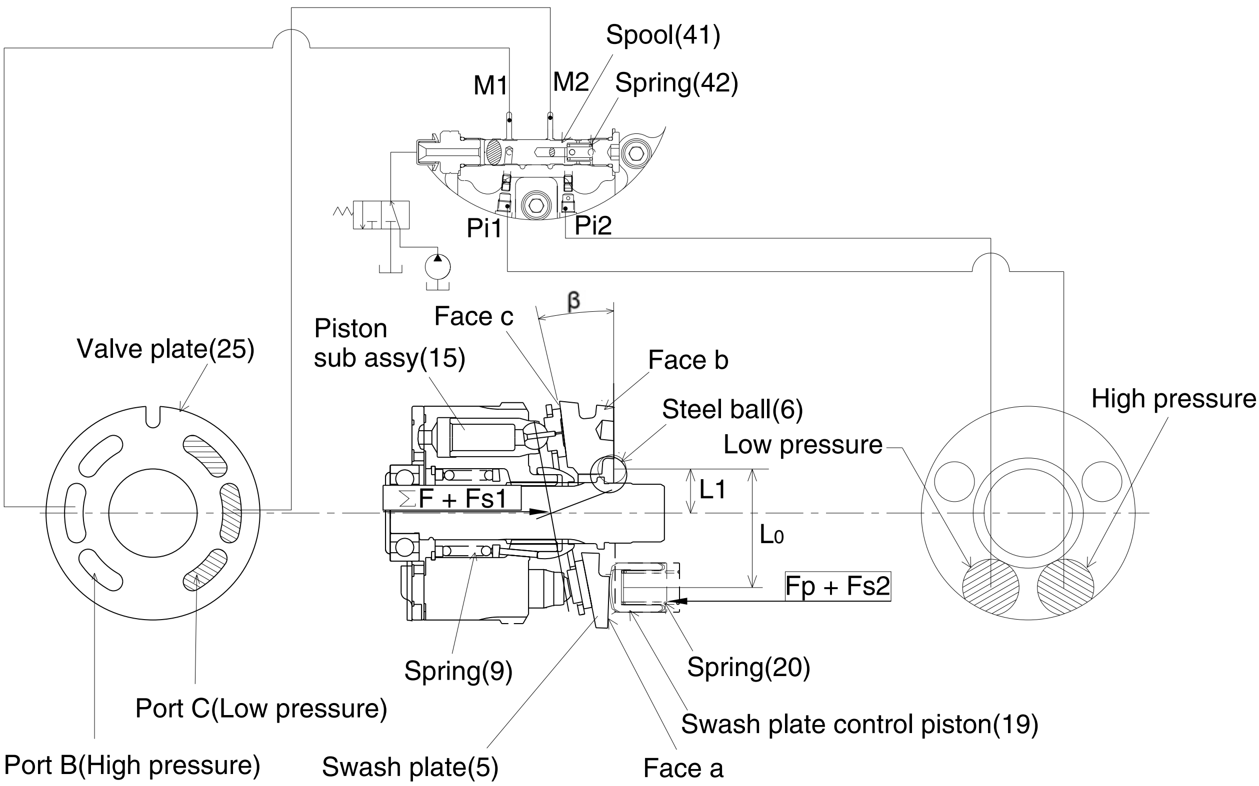
When control valve is set to the 2nd speed position, the pressure oil delivered by the pump is led to spool (41) and spool (41) is switched to the position shown below in the figure. And the pressurized oil flows into each ports Pi1 and Pi2 through ports M1 and M2 and the motor driving pressure (P1 : high pressure and P2 : low pressure) is led to each swash plate control piston (19). Therefore the force pushing up the swash plate acts on swash plate control piston (19).

$Fp1 = Ap \times P1$ $\qquad$ $Fp2 = Ap \times P2$

When steel ball (6) is placed on the tilting center, the balance of moment acting on swash plate (5) is in the condition of $(\sum F+Fs1) \times L1 < (Fp+Fs2) \times Lo$ depending on the total $\sum F$ of driving force of piston sub assy (15).

The face "b" of swash plate (5) stabilizes and the swash plate angle become β, consequently the motor speed is the 2nd speed (high speed).

While the engine is stopped, spool (41) is returned to the 1st speed position by the force of spring (9) since pressurized oil does not flow. When steel ball (6) is placed on the tilting center, the balance of moment acting on swash plate (5) is in the condition of $Fs \times L1 > Fp \times Lo$, the face "a" of swash plate (5) stabilizes and the swash plate angle become α, consequently the motor speed at starting is always the 1st speed.



At 2nd speed(high speed)

R35Z72TM21

4) AUTO TWO SPEED CHANGE MECHANISM

Auto two speed control mechanism consists of two spools and spring. This valve automatically changes motor displacement in portion to motor pressure. This valve works while the pilot port Ps is pressurized.

(1) Motor pressure is low

The motor displacement is small (high speed displacement) as shown in the figure.

When the two speed spool is on the right position, motor pressure PM1 and PM2 are connected to each side of chamber of two speed piston. So swash plate is moved to high speed position by two speed piston and motor displacement is kept on high speed position.

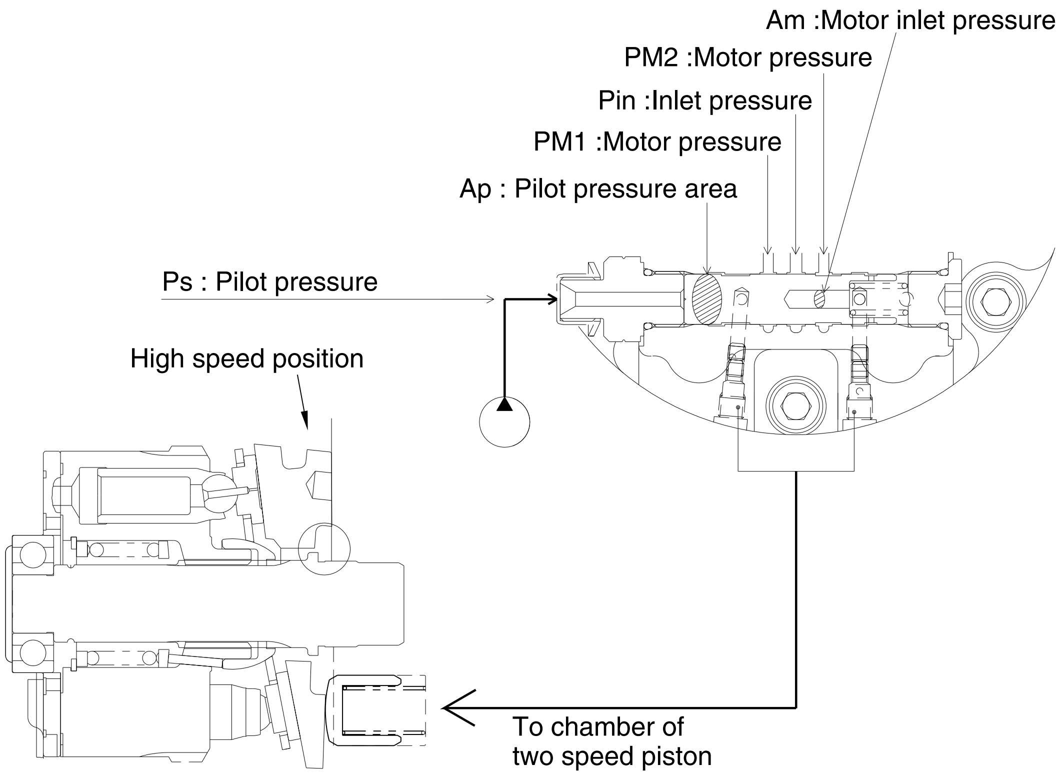
Pilot pressure is applied on the area Ap when Ps port is pressurized. Then the pressure of Ps pushes the spool to the right direction on the figure. At the same time, motor inlet pressure is applied on the area Am. So, the spool is also applied to the left direction by Am pressure.

According to above, if the motor pressure is lower and keep the following condition, the spool stay on the right position.

$$Ps \times Dp > Am \times Pin + Kx$$

Kx : the force of spring

Motor pressure is low : $(Ap \times Ps) > (Am \times Pin + Kx)$



Automatic two speed (Motor pressure is low)

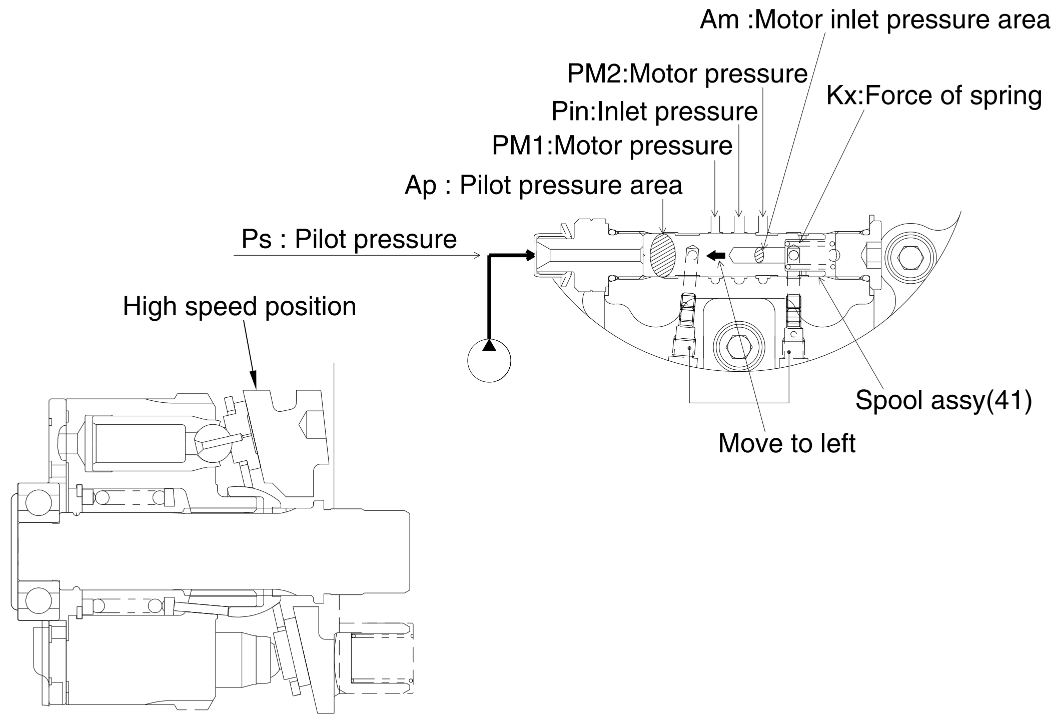
R35Z72TM11

(2) Motor pressure is high

The motor displacement is large (low speed displacement) as shown in the figure.

The two speed spool is on the left position if Pin pressure is high. Then, PM1 and PM2 are shutted by the spool. If the motor pressure is higher and keep the following condition, the spool stay on the left position.

$$Ps \times Dp < Am \times Pin + Kx$$



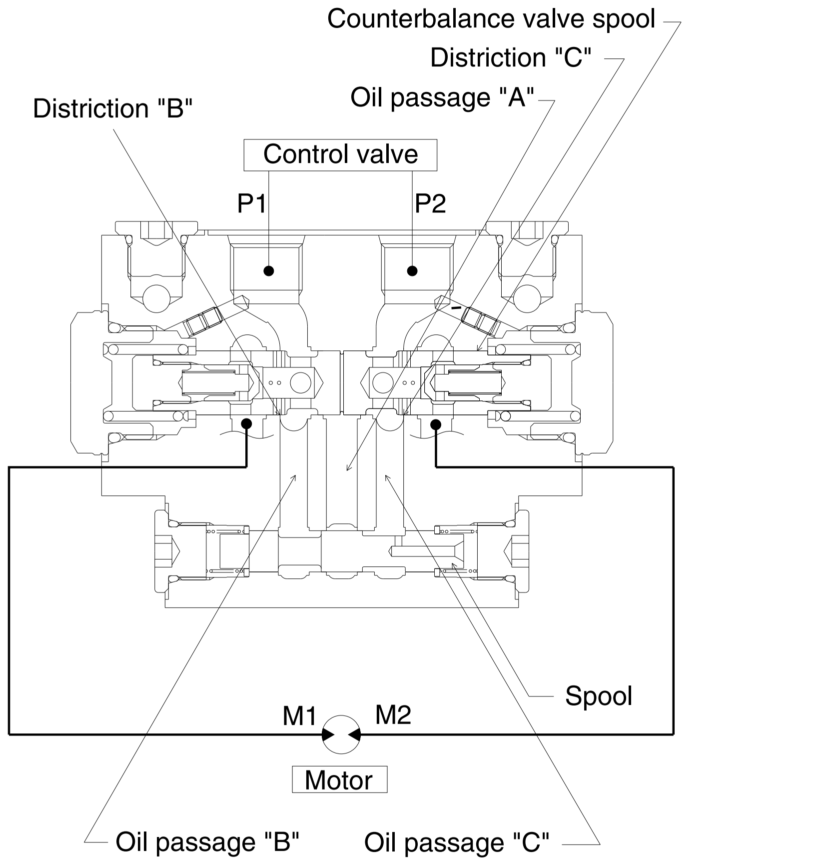
Automatic two speed (Motor pressure is high)

R35Z72TM09A

5) ANTI CAVITATION VALVE (with parking brake)

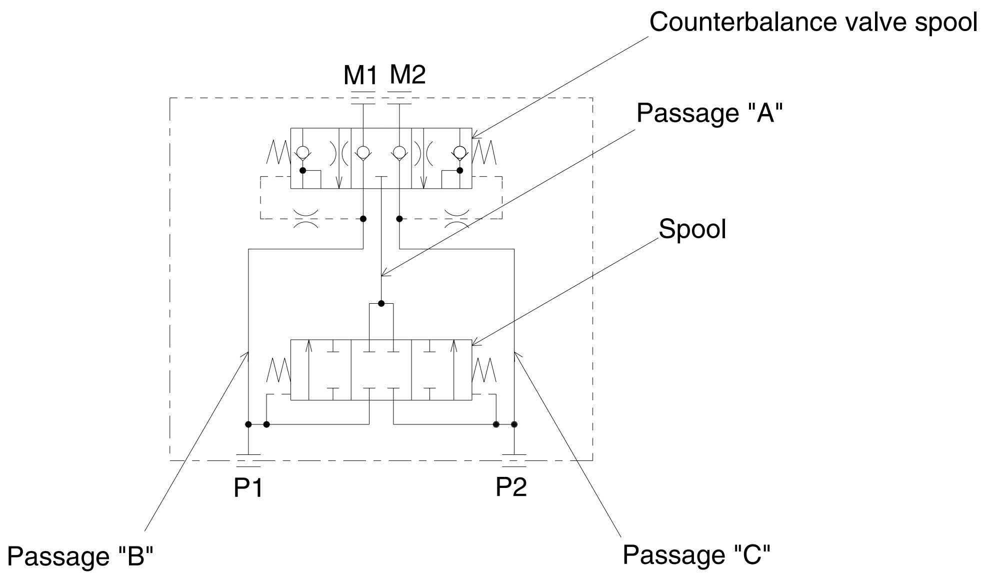
Anti cavitation valve is always working with counter balance valve.

This system consists of oil passage "A", "B", "C" and spool in addition to traditional counter balance valve.



Anti cavitation valve system

R35Z72TM12

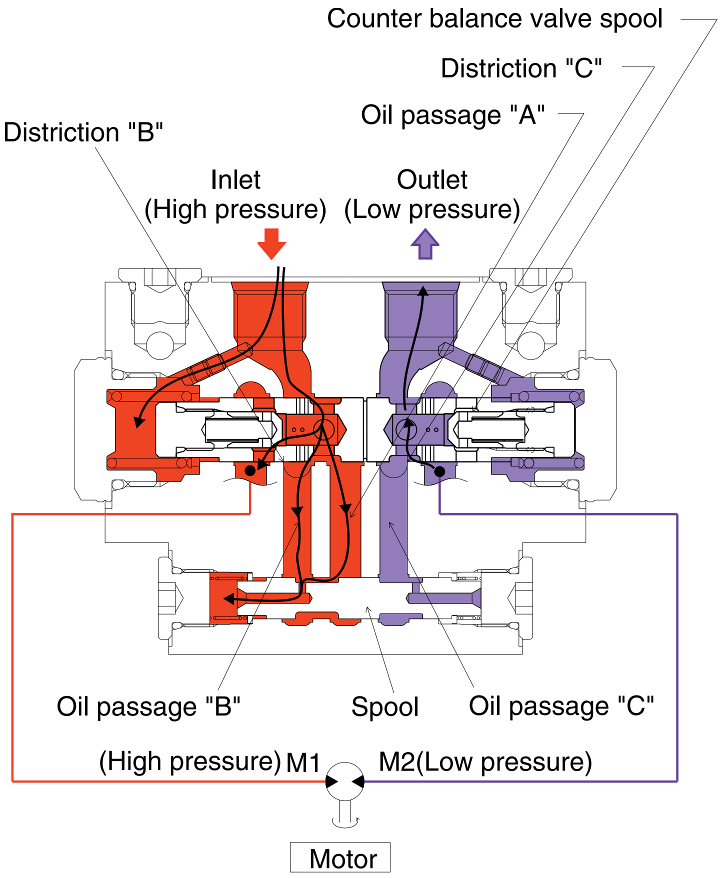


Hydraulic circuit

R35Z72TM17

(1) From stopping to starting

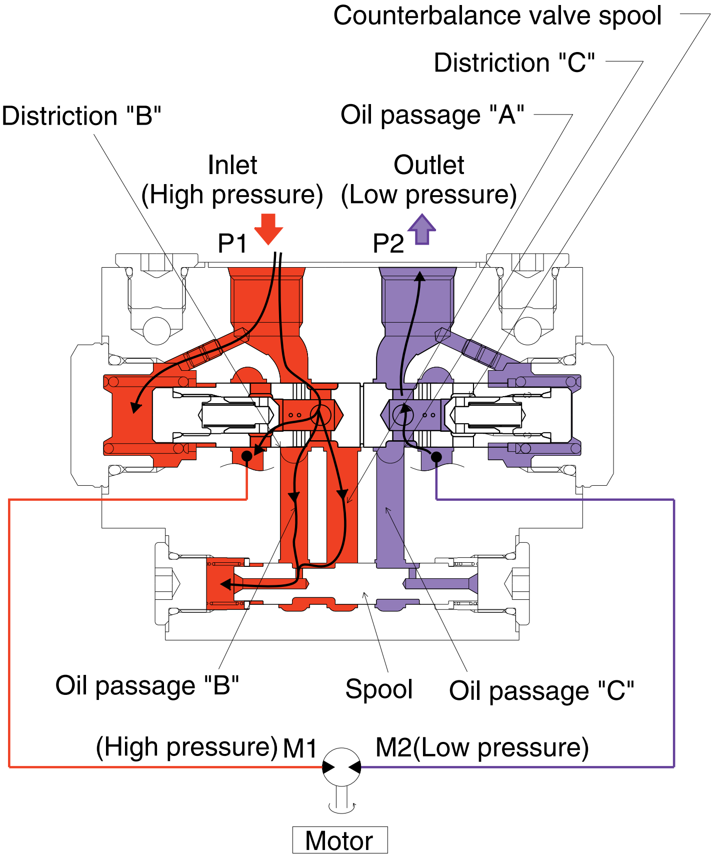
Counterbalance valve spool is moved to right position by the force of spring when port P1 is pressurized. According as the movement of spool, P1 connects to M1 and M2 connects to P2. Consequently the motor work. At the same time, oil passage A is selected high pressure, however, there is no oil flow to oil passage C because of the movement of spool.



R35Z72TM13

(2) Continuous rotating

At continuous rotating, high pressure is similiarly selected at oil passage A. However, there is no oil flow to oil passage C. So, anti cavitation valve has no influence during motor operation.

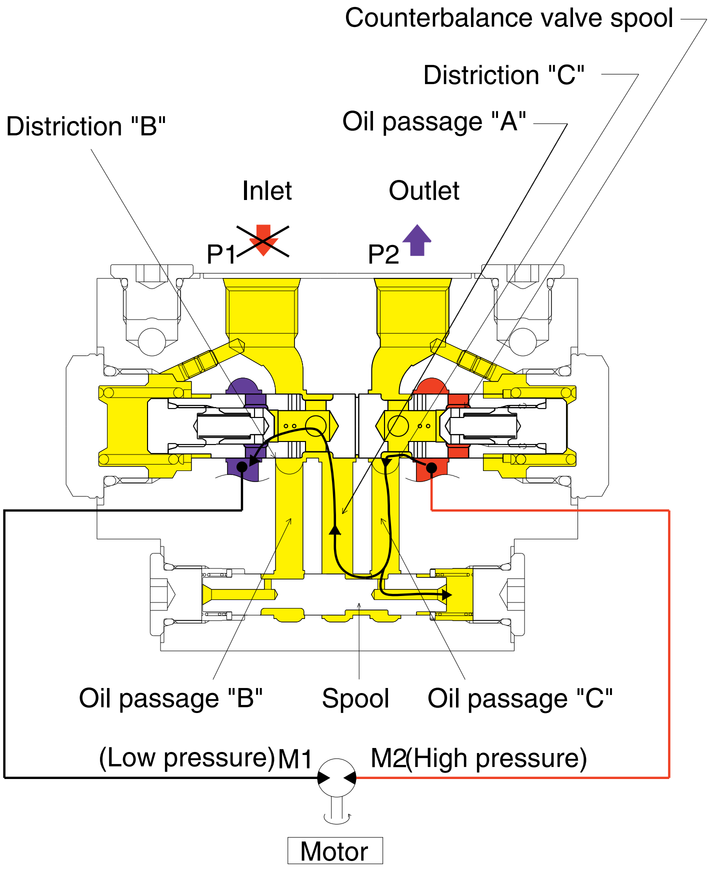


R35Z72TM14

(3) From continuous rotating to deceleration

At deceleration, the motor is still rotated by inertia. The oil flows M2 port to P2 port while counter balance valve is opened. Then, if the flow to P1 is not enough, the cavitation could be appeared in P1-M1 line.

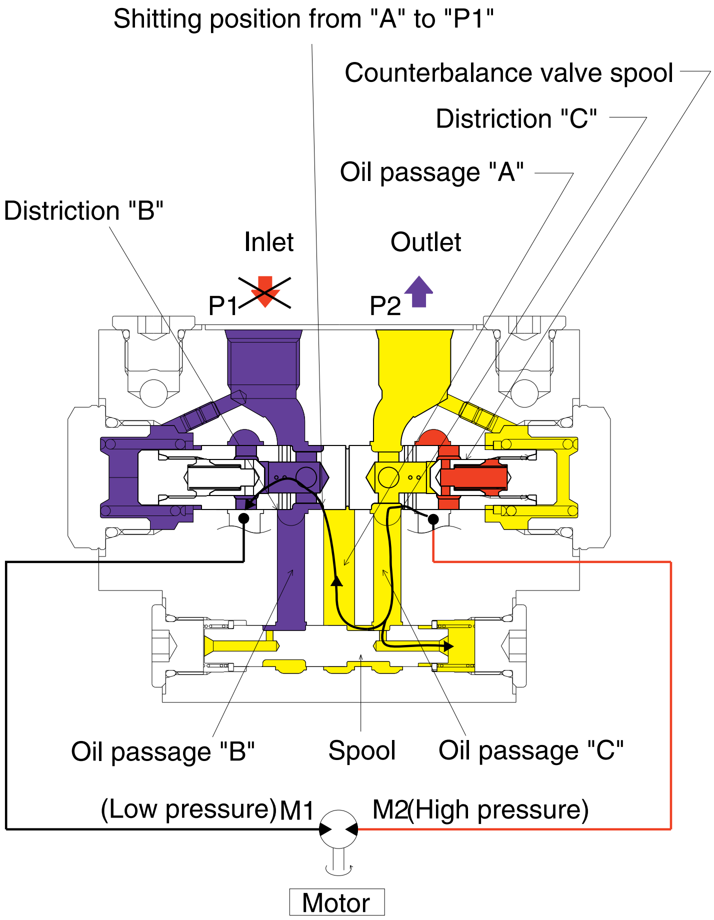
Anti cavitation valve can make a oil passage like M2 → C → spool → A → P1 → M1 and supply flow before counter balance valve spool is returned. Consequently the cavitation is reduced by the above function.



R35Z72TM15

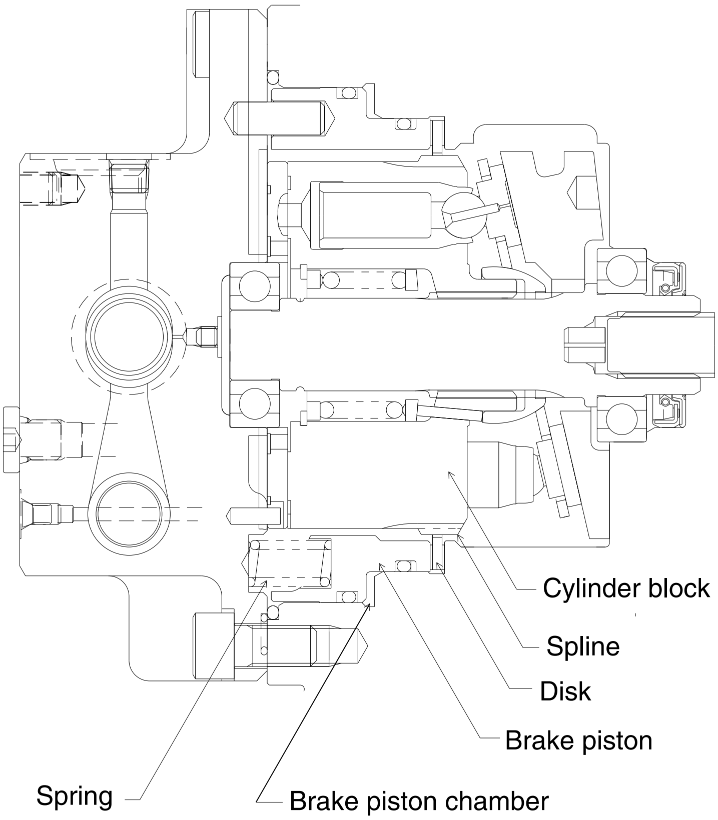
(4) From deceleration to stopping

Anti cavitation valve works until oil passage from A to P1 is shut.



R35Z72TM16

6) PARKING BRAKE



The parking brake is a negative brake consisting of disk, brake piston and spring.

The cylinder block and the disk are combined with a spline, and friction material is bonded on both sides of disk. The disk generates frictional force between the flange holder and the brake piston by the force of spring and restricts the rotating force of the motor, achieving the best performance of the parking brake.

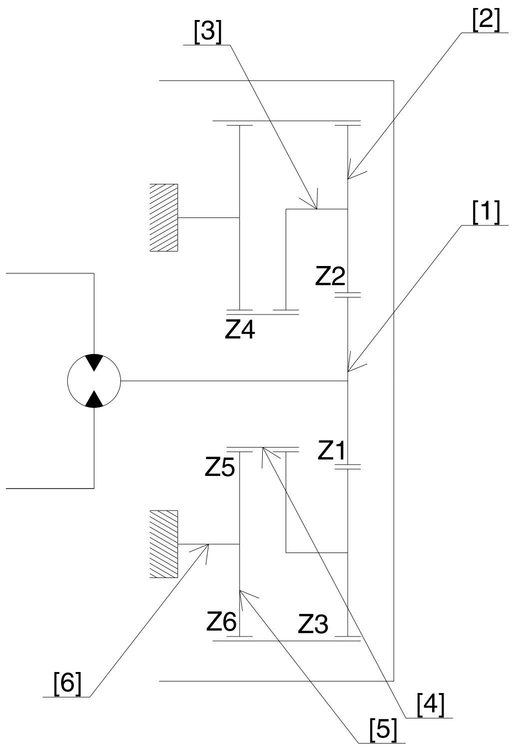
When the pressurized oil flows into the motor, the plunger moves and the parking brake release port is opened. After the oil flows into brake piston chamber, the thrust F is generated, corresponding to the pressure receiving area of brake piston and the thrust F becomes larger than the force of spring f, consequently the brake piston moves toward right.

Then, the disk rotates freely between the flange holder and brake piston, and parking brake is released.

When the motor is stopped, the plunger returns to the neutral position and the parking brake release port is closed. Consequently the pressurized oil in brake piston chamber flows into motor case, the parking brake acts by the force of spring.

7) REDUCTION UNIT

The reduction unit consists of double stage planetary gear mechanism.



R35Z72TM19

Drive gear[1] is engaged with the 1st planetary gear [2], 2nd stage sun gear [4] is engaged with the 2nd planetary gear [5]. The 2nd stage planetary carrier [6] is fixed machine body. Planetary gears [2], [5] are engaged with ring gear (housing).

The driving force form the piston motor is transmitted to drive gear [1], and the speed is reduced by each gear.

The reduced driving force is transmitted to ring gear through planetary gear [5] of planetary carrier [6] fixed on the machine body. (The driving force is also transferred from 1st stage planetary gear [2]). The direction of output rotation are reversed against that of input rotation.

The reduction gear ratio " i " is shown as follows.

※ Reduction gear ratio (i)

$$I = (i1 \times i2-1) = \left(\frac{Z1+Z3}{Z1} \times \frac{Z4+Z6}{Z4} -1 \right)$$

※ Output torque of reduction unit (T)

$$T = TM \times i \times \eta M$$

Z1 : Drive gear teeth number
Z2 : Ring gear teeth number
Z4 : Sun gear teeth number
Z6 : Ring gear teeth number

※ Reduction gear output rotating speed (N)

$$N = \frac{NM}{i}$$

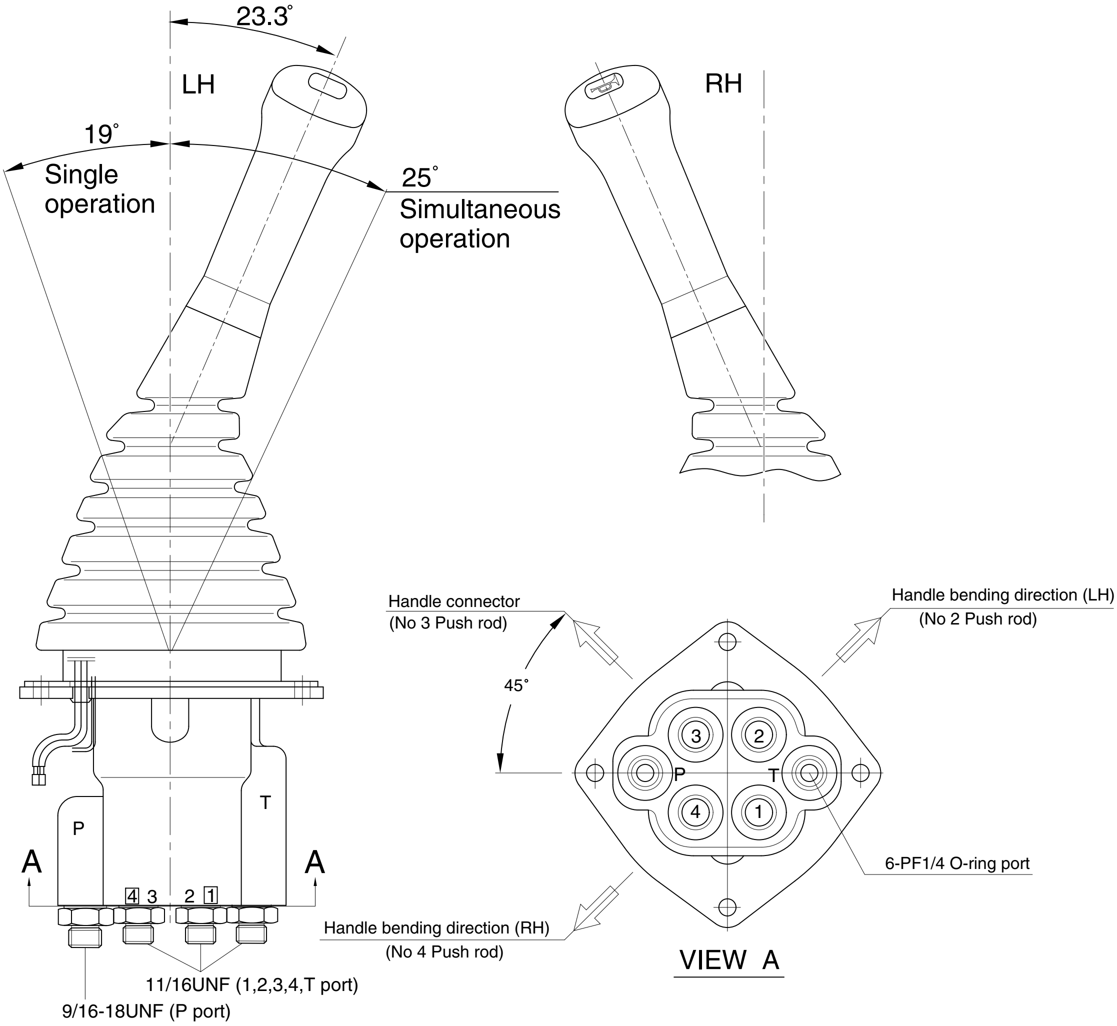
TM : Input torque (motor output torque)
i : Reduction gear ratio
η M : Mechanical efficiency
NM : Input speed of rotation (output motor speed)

GROUP 5 RCV LEVER

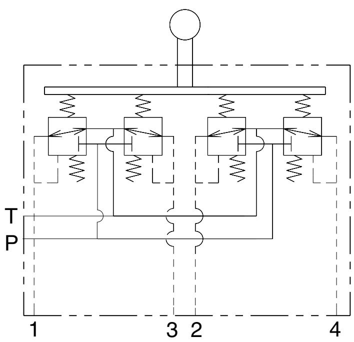
■ TYPE 1 (STD)

1. STRUCTURE

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



R25Z9A2RL01



Hydraulic circuit

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

CROSS SECTION

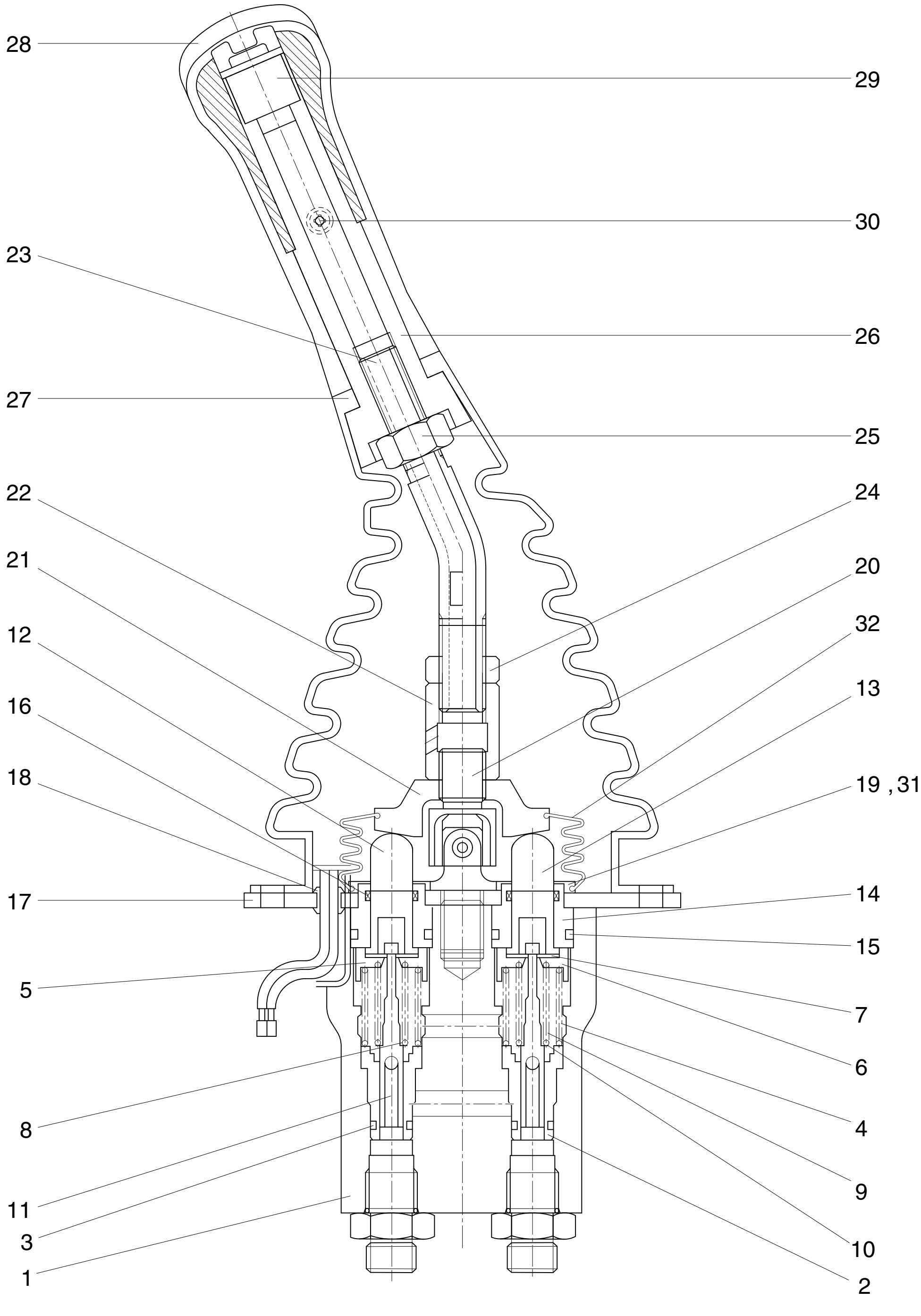
The construction of the pilot valve is shown in the attached cross section drawing. The casing has vertical holes in which reducing valves are assembled.

The pressure reducing section is composed of the spool (11), spring (8, 9) for setting secondary pressure, return spring (4), stopper (7), spring seat (5, 6) and spring seat (10). The spring for setting the secondary pressure has been generally so preset that the secondary pressure is 5 to 20.5 kgf/cm^2 (depending on the type). The spool is pushed against the push rod (12, 13) by the return spring.

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

1	Case	12	Push rod (1, 3)	23	Connector
2	Plug	13	Push rod (2, 4)	24	Nut
3	O-ring	14	Plug	25	Nut
4	Spring	15	O-ring	26	Insert
5	Spring seat (1, 3)	16	Rod seal	27	Boot
6	Spring seat (2, 4)	17	Plate (A)	28	Handle
7	Stopper	18	Bushing	29	Switch assembly
8	Spring (1, 3)	19	Machine screw	30	Screw
9	Spring (2, 4)	20	Joint assembly	31	Plate
10	Spring seat	21	Swash plate	32	Boot
11	Spool	22	Hex nut		

CROSS SECTION



R25Z9A2RL02

2. FUNCTIONS

1) FUNDAMENTAL FUNCTIONS

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

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

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

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

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

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

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

2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool (11) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output port pressure oil to tank port T.

The spring (8, 9) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (12, 13) is inserted and can slide in the plug (14).

For the purpose of changing the displacement of the push rod through the switch plate (21) and adjusting nut (22) are provided the handle (28) that can be tilted in any direction around the fulcrum of the universal joint (20) center.

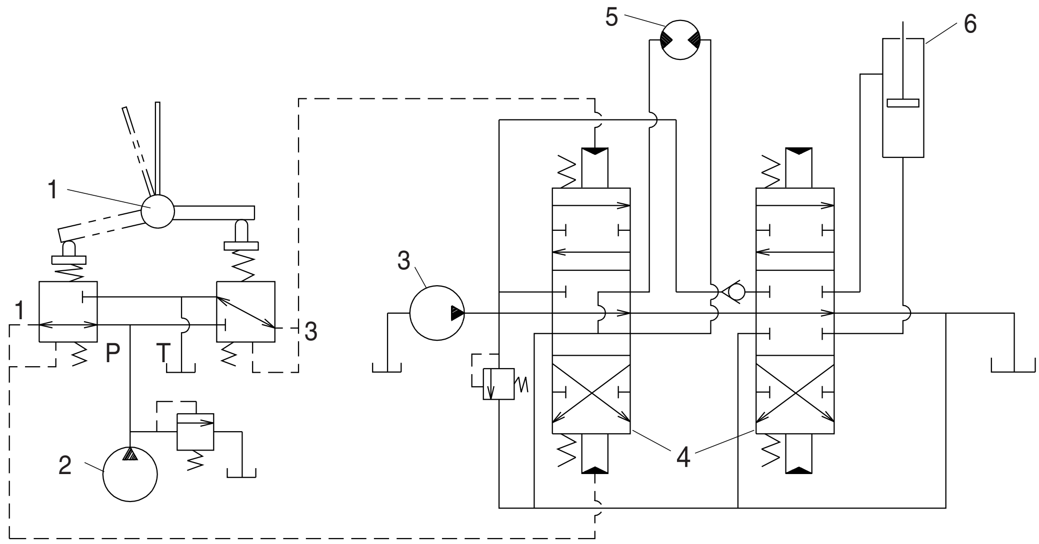
The spring (4) works on the case (1) and spring seat (5, 6) and tries to return the push rod (12, 13) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

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

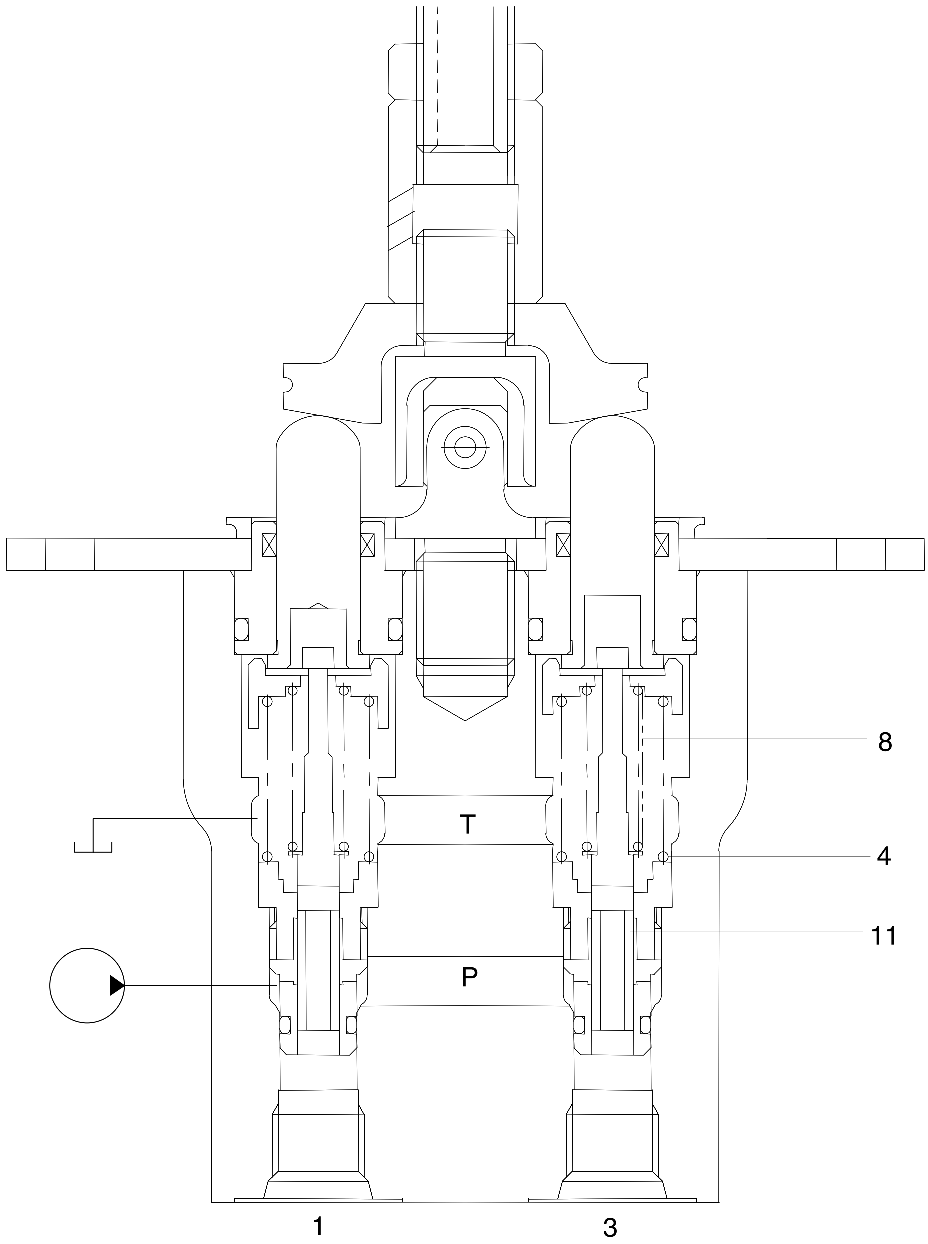
The diagram shown below is the typical application example of the pilot valve.



2-70 (140-7TIER)

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

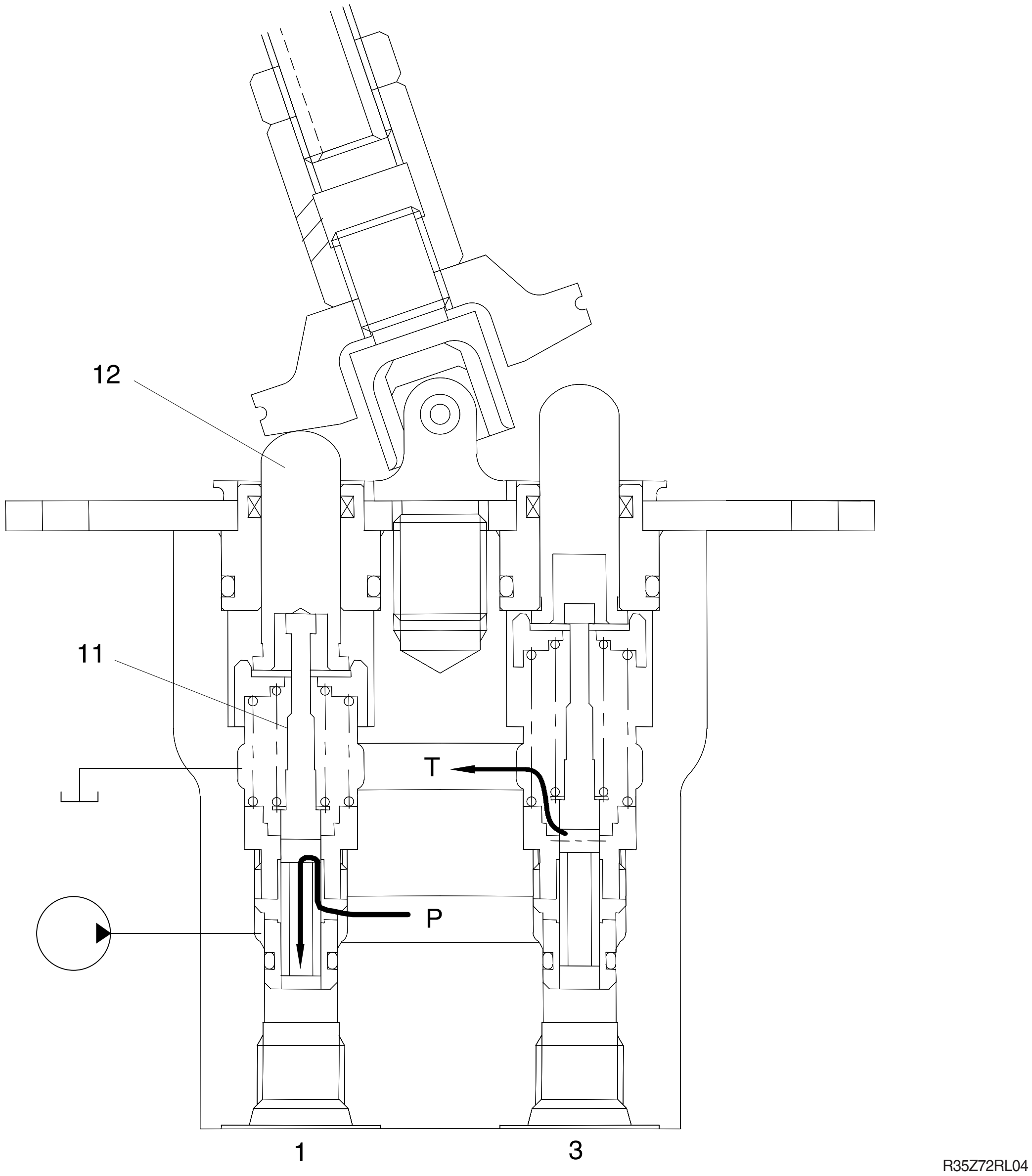
(1) Case where handle is in neutral position



R35Z72RL03

The force of the spring (8) that determines the output pressure of the pilot valve is not applied to the spool (11). Therefore, the spool is pushed up by the spring (4) to the position of port (1, 3) in the operation explanation drawing. Then, since the output port is connected to tank port T only, the output port pressure becomes equal to tank pressure.

(2) Case where handle is tilted

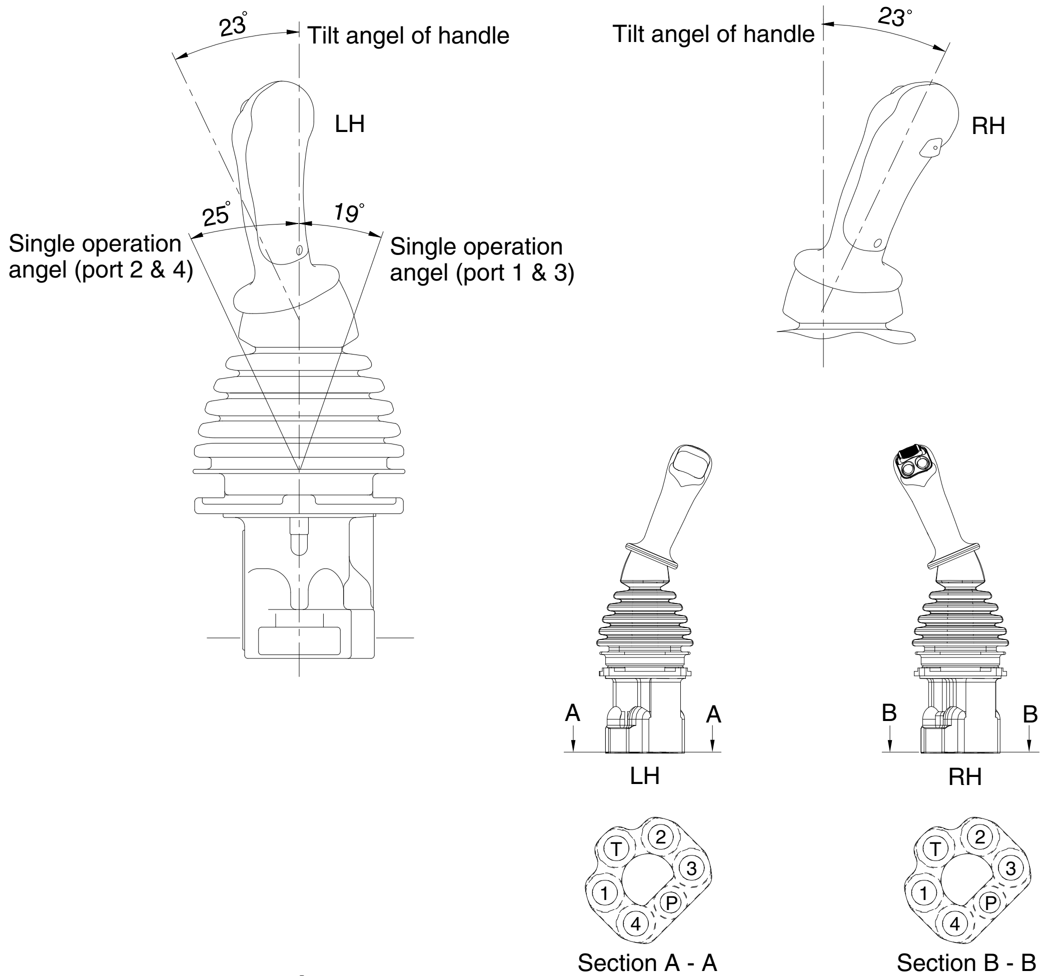


When the push rod (12) is stroked, the spool (11) moves downwards.
Then port P is connected with port (1) and the oil supplied from the pilot pump flows through port (1) to generate the pressure.
When the pressure at port (1) increases to the value corresponding to the spring force set by tilting the handle, the hydraulic pressure force balances with the spring force. If the pressure at port (1) increases higher than the set pressure, port P is disconnected from port (1) and port T is connected with port (1). If it decreases lower than the set pressure, port P is connected with port (1) and port T is disconnected from port 1.
In this manner the secondary pressure is kept at the constant value.

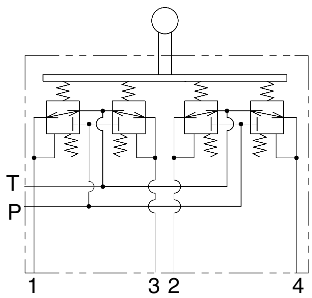
■ TYPE 2 (OPT)

1. STRUCTURE

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



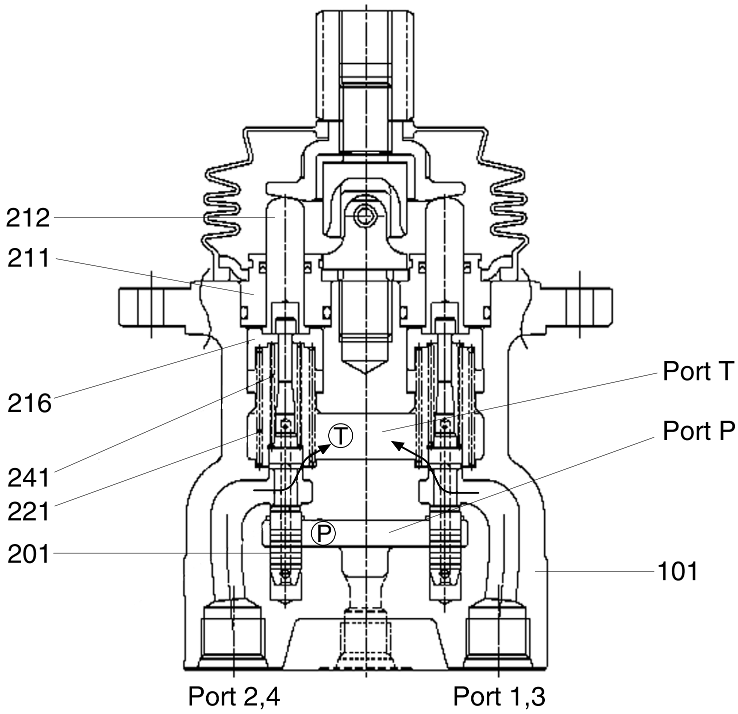
17Z9A2RL01



Hydraulic circuit

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

CROSS SECTION



17Z9A2RL02

101 Casing	216 Spring seat
201 Spool	221 Return spring
211 Plug	241 Secondary pressure setting spring
212 Push rod	

The structure of the remote control valve is as shown in the assembly. There is a vertical axial hole in the casing and the reduction valves are inserted into this.

The secondary pressure setting spring (241) is set such that the secondary pressure is calculated as 5.1~10.2 kgf/cm^2. Spool (201) is pushed onto the push rod (212) by return spring (221).
Tilting the control handle pushes down push rod (212), the spring seat (216) also moves down and the setting of the secondary pressure setting spring (241) is changed.
Port P, oil inlet (primary pressure) and port T outlet (tank) are in the casing (101).

2. PERFORMANCE

1) BASIC PERFORMANCE

The remote control valve controls the stroke and direction of the control valve spools. This is achieved by the output pressure of the remote control valve acting on the tip of the control valve spool.

To achieve satisfactory performance, the remote control valve comprises the following elements :

(1) An inlet port (P) for oil fed from the hydraulic pump.

(2) Multiple output ports (1, 2, 3 and 4) to allow pressure from the inlet port to act on the spool tips of the control valve.

(3) A tank port (T) to control the output pressure.

(4) A spool to connect the output port to the inlet port or tank port.

(5) A mechanical assembly, which contains a spring which acts on the spool and controls the output pressure.

2) PERFORMANCE OF THE MAIN PARTS

The spool (201) operates to take the supply oil pressure from the hydraulic pump. This switches the oil channel so that the port P oil pressure is directed to the output ports 1, 2, 3, 4 or to port T.

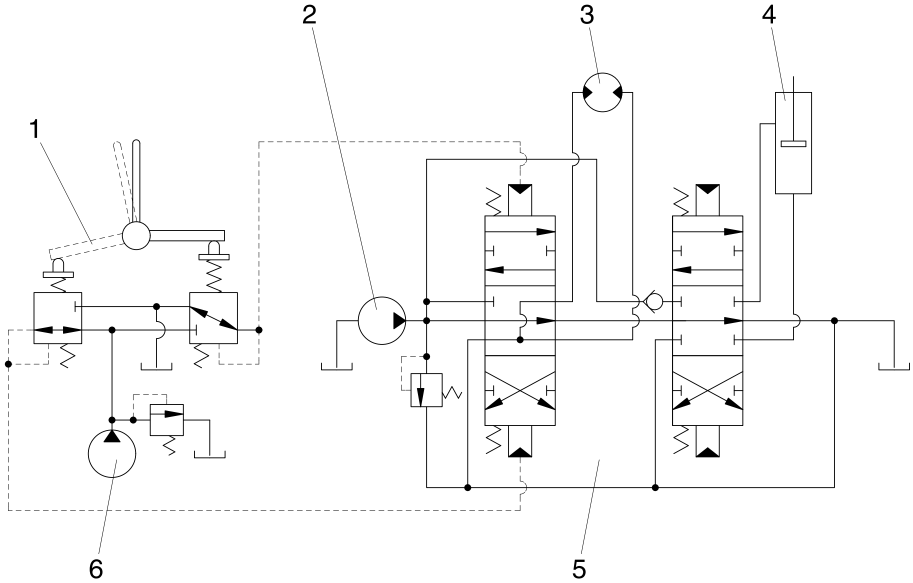
The secondary pressure setting spring (241) determines the output pressure that acts on the spool (201).

The push-rod (212), which changes the strain of the secondary pressure setting spring (241), is inserted so that it can move smoothly into the plug (211).

The return spring (221) acts to return the push-rod (212) towards zero displacement without reference to the output pressure acting on the spring seat (216) and casing (101). This acts to ensure the return to neutral of the spool (201) and also acts as a resistance spring to provide the operator with an appropriate operating "feel".

3) OPERATION

The operation of the remote control valve is described in the hydraulic circuit plan and operation explanatory figures (see figures RL04, 05 and 06). The below figure shows a typical example of the use of the remote control valve.



17Z9A2RL03

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

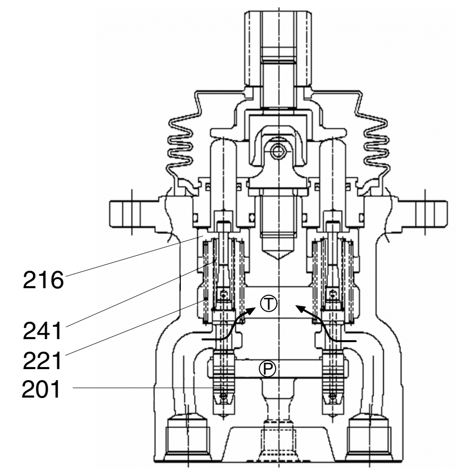
(1) Control handle neutral

The force of the secondary pressure setting spring (241) (which determines the output pressure of the pilot valve) does not act on the spool (201).

Spool (201) is pressed upward by the return spring (221) and spring seat (216) .

Output ports (2, 4) and port T are open.

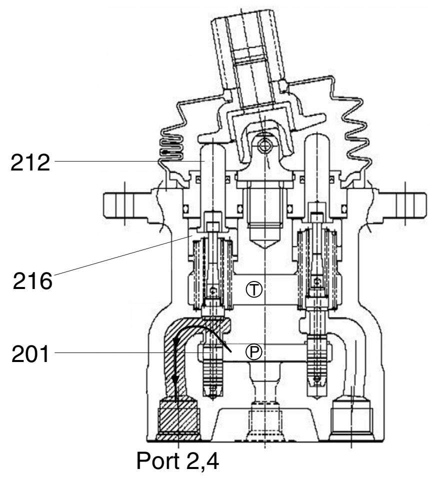
The output pressure is the same as the tank pressure.



17Z9A2RL04

(2) Control handle tilted

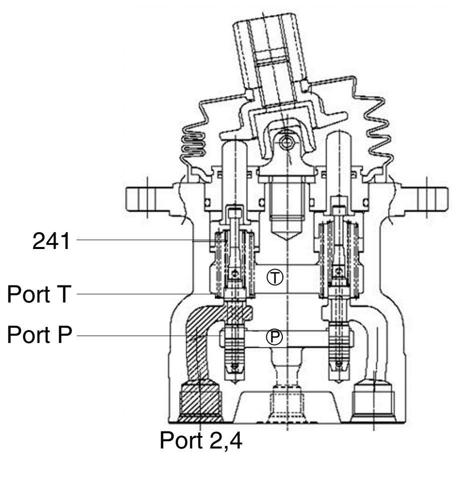
The push-rod moves, (spring seat (216)), spool (201) moves downward, port P and ports (2, 4) are open and the oil fed from the pilot pump flows to ports (2, 4) and generates pressure.



17Z9A2RL05

(3) Control handle held

The pressure of ports (2, 4) rises to become equal to the spring (241) force; the oil pressure and spring pressures become balanced. If the pressure of ports (2, 4) exceeds the set pressure, ports (2, 4) and port P close, ports (2, 4) and port T open. If the pressure of ports (2, 4) falls below the set pressure, ports (2, 4) and port P open and ports (2, 4) and port T close. The secondary pressure is kept constant.

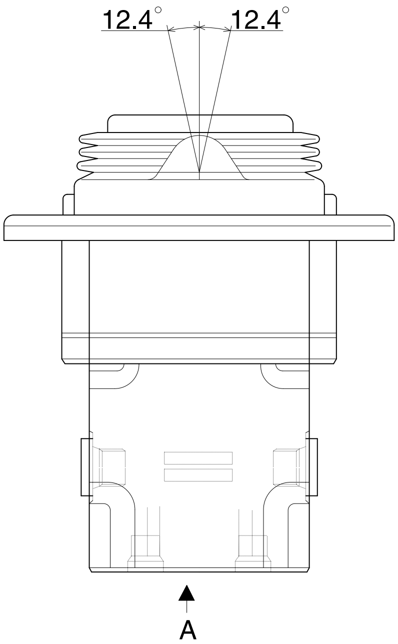


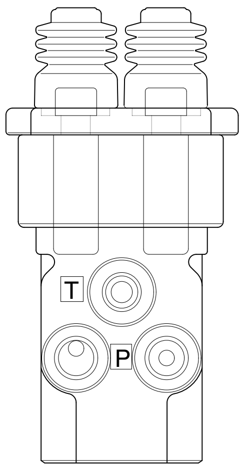
17Z9A2RL06

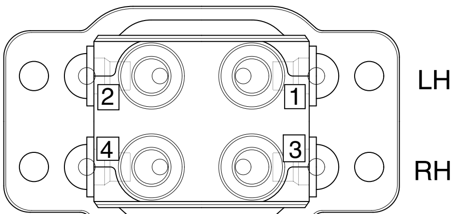
GROUP 6 RCV PEDAL

1. STRUCTURE

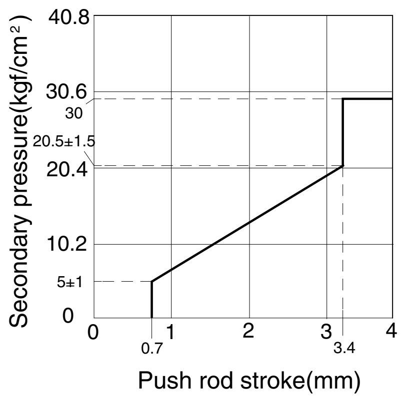
The casing has the oil inlet port P (primary pressure), and the oil outlet port T (tank). In addition the secondary pressure is taken out through ports 1, 2, 3 and 4 provided at the bottom face.



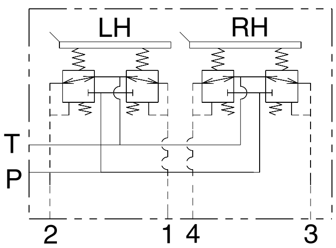




VIEW "A"



R35Z72RCP01



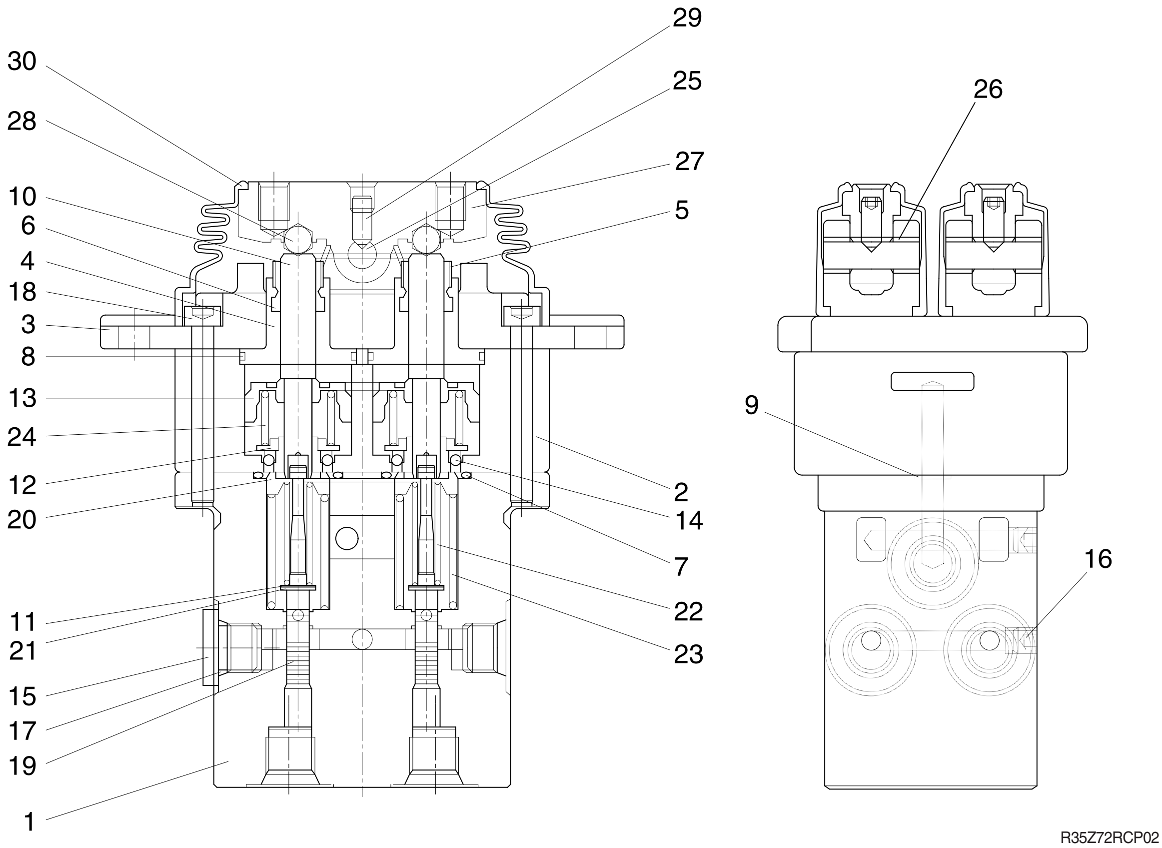
Port	Port name	Port size
P	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	
1	Travel (LH, backward)	
2	Travel (LH, forward)	
3	Travel (RH, backward)	
4	Travel (RH, forward)	

CROSS SECTION

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

The pressure reducing section is composed of the spool (19), spring (22) for setting secondary pressure, return spring (23), spring seat (20) and washer (21). The spring for setting the secondary pressure has been generally so preset that the secondary pressure is 5 to 19 kgf/cm^2 (depending on the type). The spool is pushed against the push rod (10) by the return spring.

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



1	Casing (1)	11	Shim	21	Washer
2	Casing (2)	12	Spring seat	22	Spring
3	Cover	13	Piston	23	Spring
4	Plug	14	Steel ball	24	Spring
5	Grease cap	15	Plug	25	Cam shaft
6	Packing	16	Plug	26	Bushing
7	O-ring	17	O-ring	27	Cam
8	O-ring	18	Hex soc head screw	28	Steel ball
9	O-ring	19	Spool	29	Set screw
10	Push rod	20	Spring seat	30	Bellows

2. FUNCTION

1) FUNDAMENTAL FUNCTIONS

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

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

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

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

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

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

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

2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool (19) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output spool to determine the output pressure.

The spring (22) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (10) is inserted and can slide in the plug (4).

For the purpose of changing th displacement of the push rod through the cam (27) and steel ball (28) are provided the pedal that can be tilted in any direction around the fulcrum of the cam (27) center.

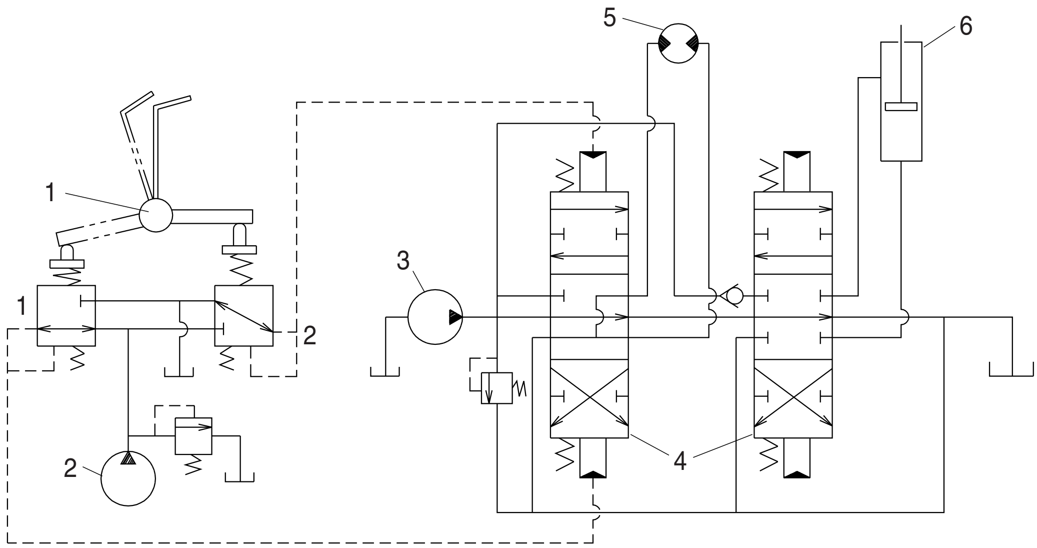
The spring (23) works on the casing (1) and washer (21) and tries to return the push rod (10) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

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

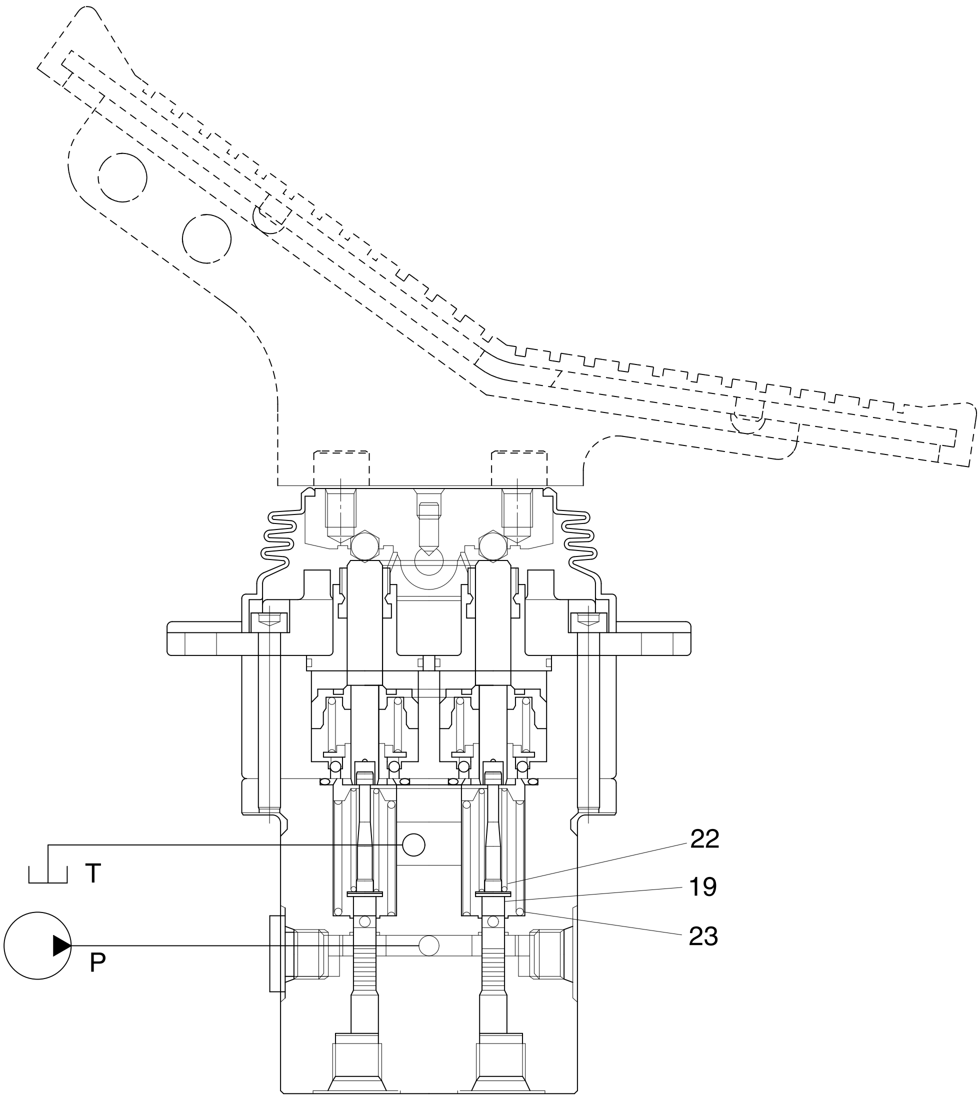
The diagram shown below is the typical application example of the pilot valve.



140LC-7 기타2-76

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

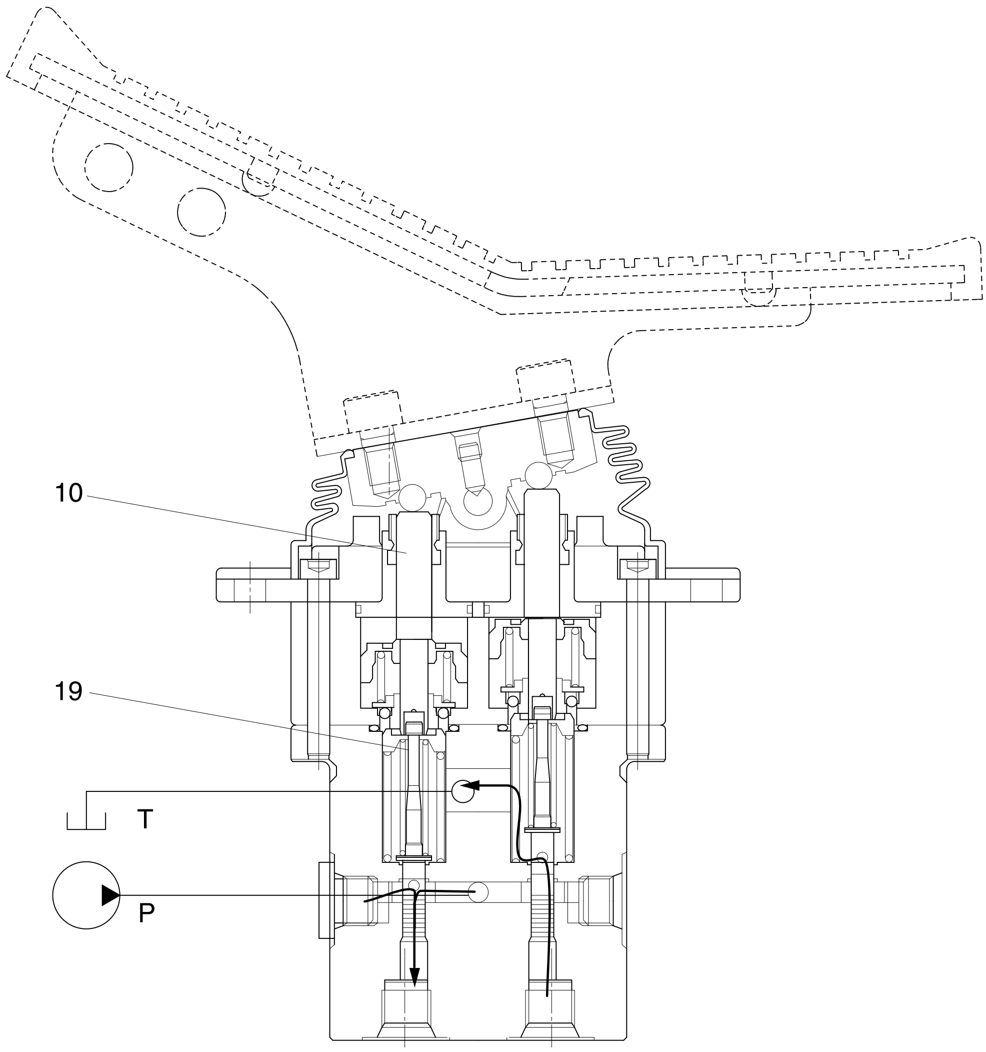
(1) Case where pedal is in neutral position



R35Z72RCP04

The force of the spring (22) that determines the output pressure of the pilot valve is not applied to the spool (19). Therefore, the spool is pushed up by the spring (23) to the position of port 2 in the operation explanation drawing. Then, since the output port is connected to tank port T only, the output port pressure becomes equal to tank pressure.

(2) Case where pedal is tilted



R35Z72RCP05

When the push rod (10) is stroked, the spool (19) moves downwards.

Then port P is connected with port 1, and the oil supplied from the pilot pump flows through port 1 to generate the pressure.

When the pressure at port 1 increases to the value corresponding to the spring force set by tilting the handle, the hydraulic pressure force balances with the spring force. If the pressure at port 1 increases higher than the set pressure, port P is disconnected from port 1 and port T is connected with port 1. If it decreases lower than the set pressure, port P is connected with port 1 and port T is disconnected from port 1.

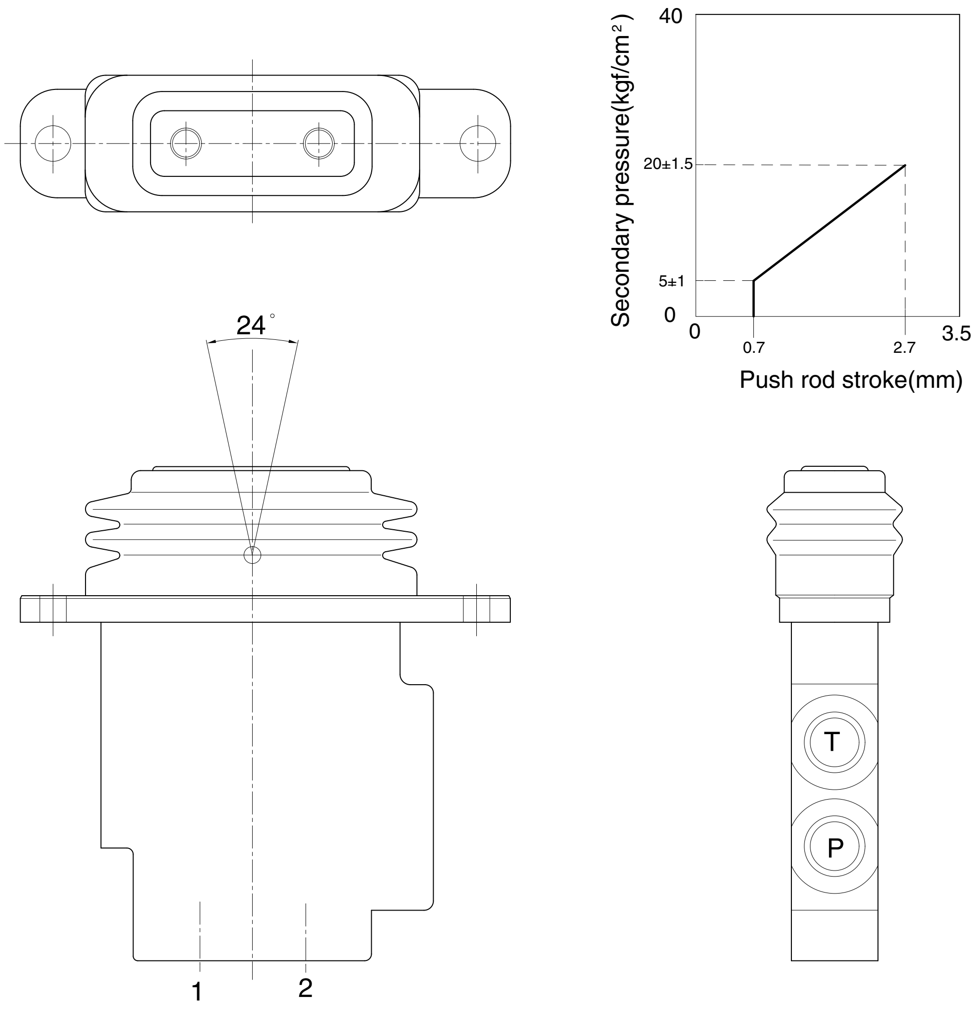
In this manner the secondary pressure is kept at the constant value.

3. BOOM SWING PEDAL

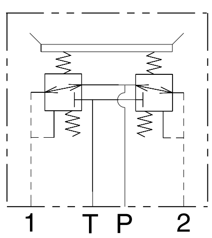
1) STRUCTURE

The casing has the oil inlet P (primary pressure) and the oil return port (tank).

In addition the secondary pressure is taken out through port 1 and port 2 provided at the housing bottom face.



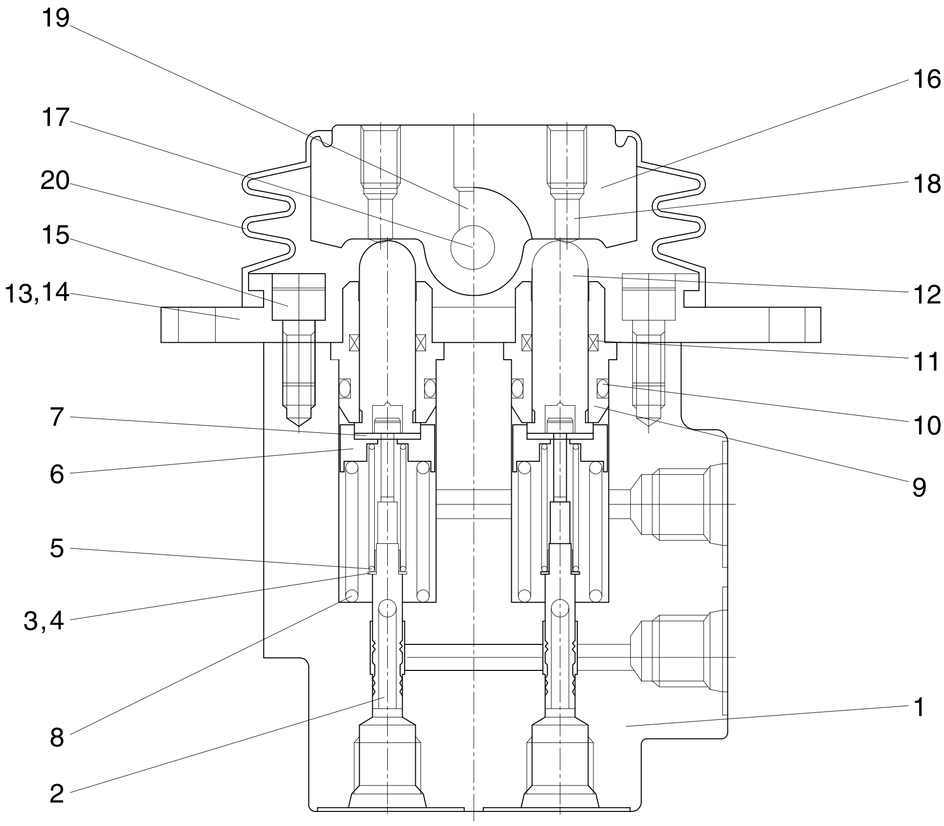
R35Z72RSP01



Hydraulic circuit

Port	Port name	Port size
P	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	
1	Boom swing (LH)	
2	Boom swing (RH)	

2) COMPONENT



R35Z72RSP02

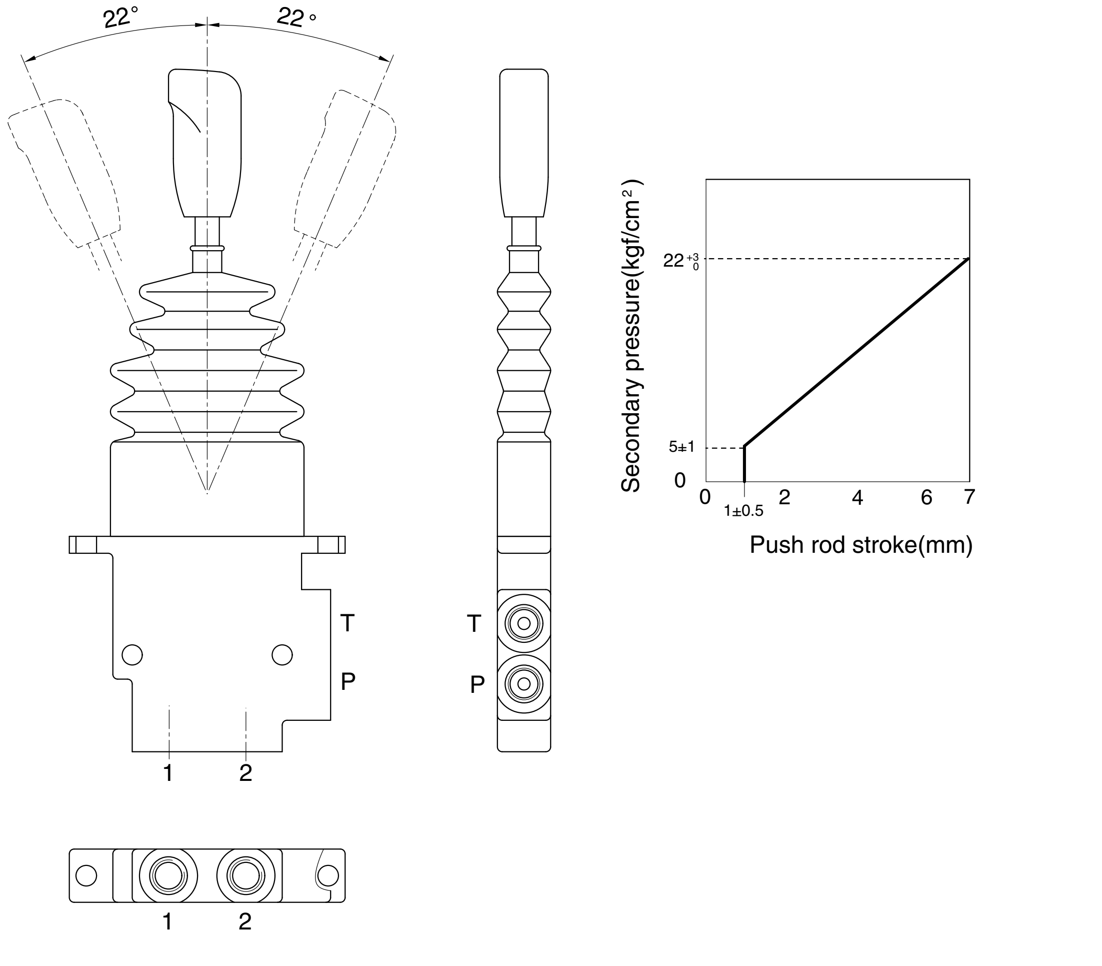
1	Body	8	Stopper	15	DU bush
2	Plug	9	Spring	16	Wrench bolt
3	O-ring	10	Plug	17	Cam
4	Spool	11	O-ring	18	Pin
5	Spring seat	12	Rod seal	19	Adjust screw
6	Spring	13	Push rod	20	Socket bolt
7	Spring seat	14	Cover	21	Bellows

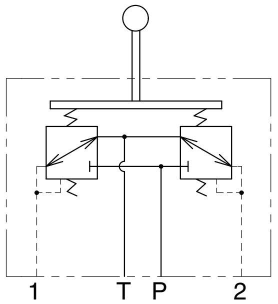
4. DOZER LEVER

1) STRUCTURE

The casing has the oil inlet P (primary pressure) and the oil return port (tank).

In addition the secondary pressure is taken out through port 1 and port 2 provided at the housing bottom face.

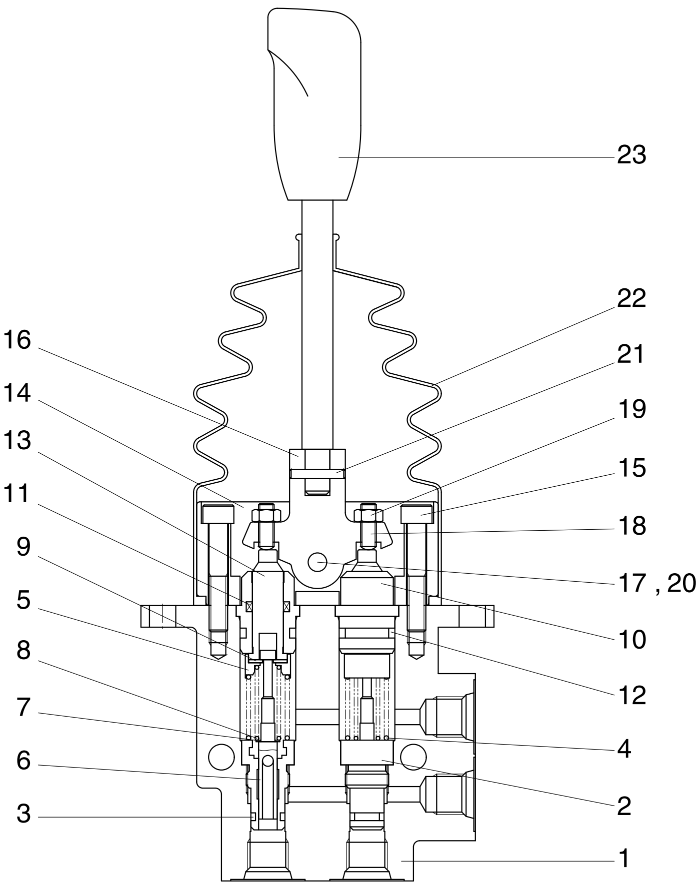




Hydraulic circuit

Port	Port	Port size
P	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	PF 1/4
1	Dozer blade up port	PF 1/4
2	Dozer blade down port	PF 1/4

2) COMPONENT

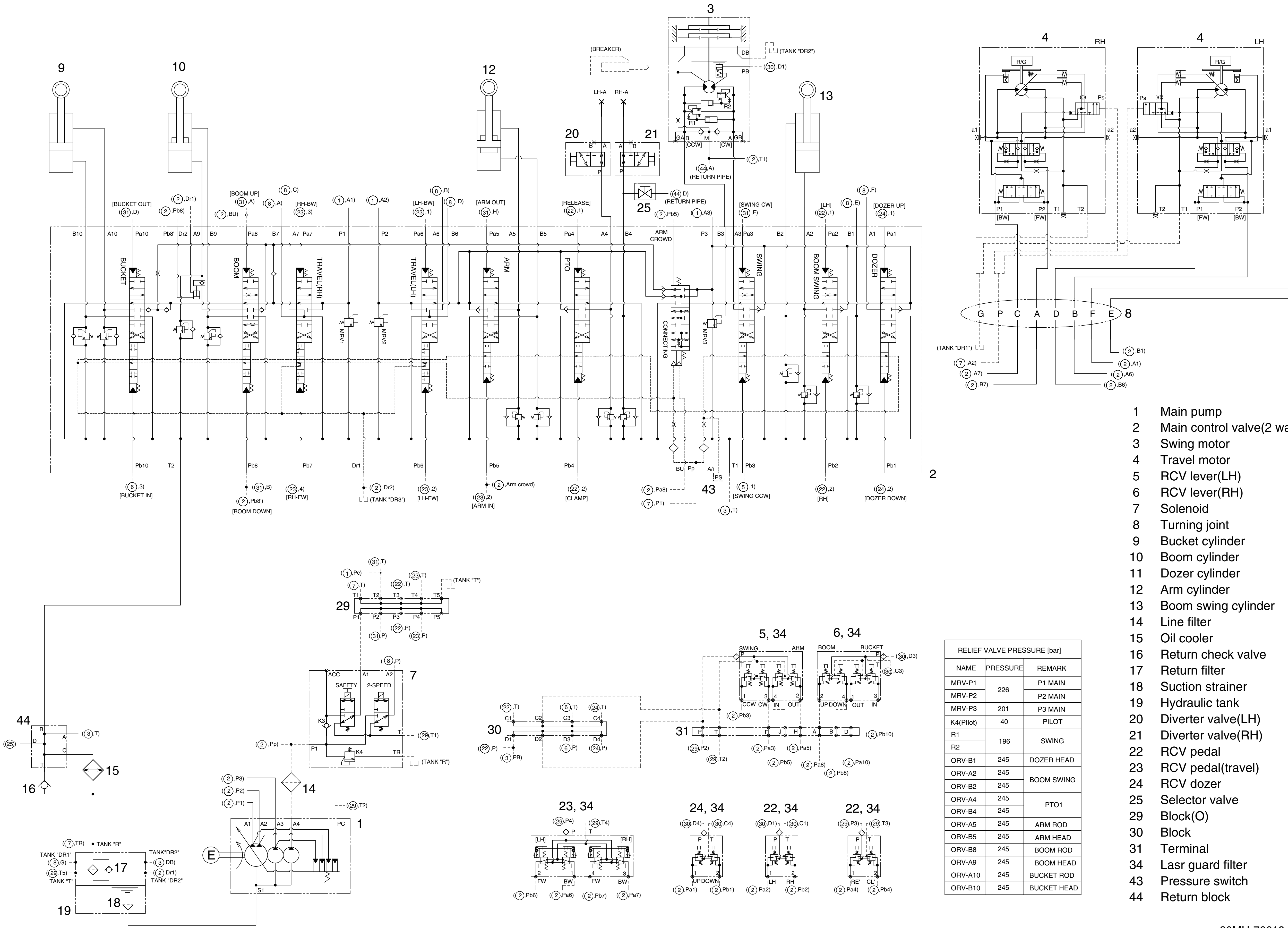


R35Z72DL02

1	Body	9	Stopper	17	Pin
2	Plug	10	Plug	18	Socket bolt
3	O-ring	11	Rod seal	19	Nut
4	Spring	12	O-ring	20	Snap ring
5	Spring seat	13	Push rod	21	Spring pin
6	Spool	14	Cover	22	Bellows
7	Spring seat	15	Wrench bolt	23	Lever
8	Spring	16	Guide		

SECTION 3 HYDRAULIC SYSTEM

GROUP 1 HYDRAULIC CIRCUIT (1/3)



RELIEF VALVE PRESSURE [bar]		
NAME	PRESSURE	REMARK
MRV-P1	226	P1 MAIN
MRV-P2		P2 MAIN
MRV-P3	201	P3 MAIN
K4(PIlot)	40	PILOT
R1	196	SWING
R2		
ORV-B1	245	DOZER HEAD
ORV-A2	245	BOOM SWING
ORV-B2	245	
ORV-A4	245	PTO1
ORV-B4	245	
ORV-A5	245	ARM ROD
ORV-B5	245	ARM HEAD
ORV-B8	245	BOOM ROD
ORV-A9	245	BOOM HEAD
ORV-A10	245	BUCKET ROD
ORV-B10	245	BUCKET HEAD

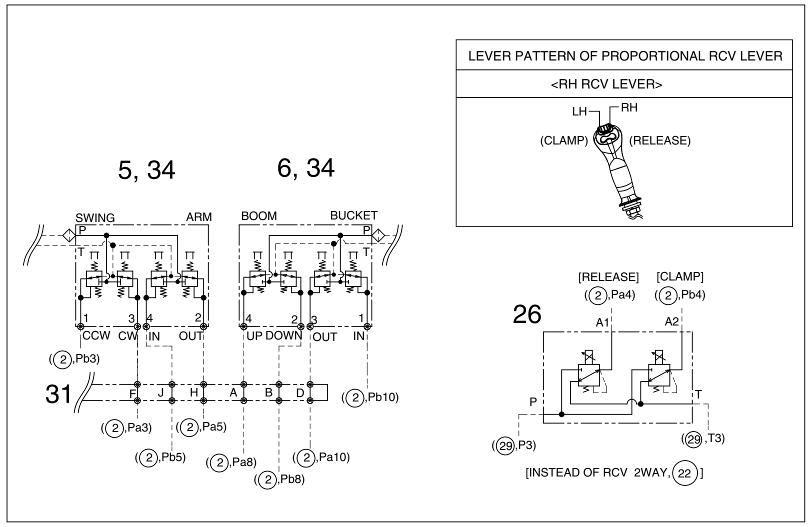
1 Main pump
2 Main control valve(2 way)
3 Swing motor
4 Travel motor
5 RCV lever(LH)
6 RCV lever(RH)
7 Solenoid
8 Turning joint
9 Bucket cylinder
10 Boom cylinder
11 Dozer cylinder
12 Arm cylinder
13 Boom swing cylinder
14 Line filter
15 Oil cooler
16 Return check valve
17 Return filter
18 Suction strainer
19 Hydraulic tank
20 Diverter valve(LH)
21 Diverter valve(RH)
22 RCV pedal
23 RCV pedal(travel)
24 RCV dozer
25 Selector valve
29 Block(O)
30 Block
31 Terminal
34 Lasr guard filter
43 Pressure switch
44 Return block

30MH-76610-08A

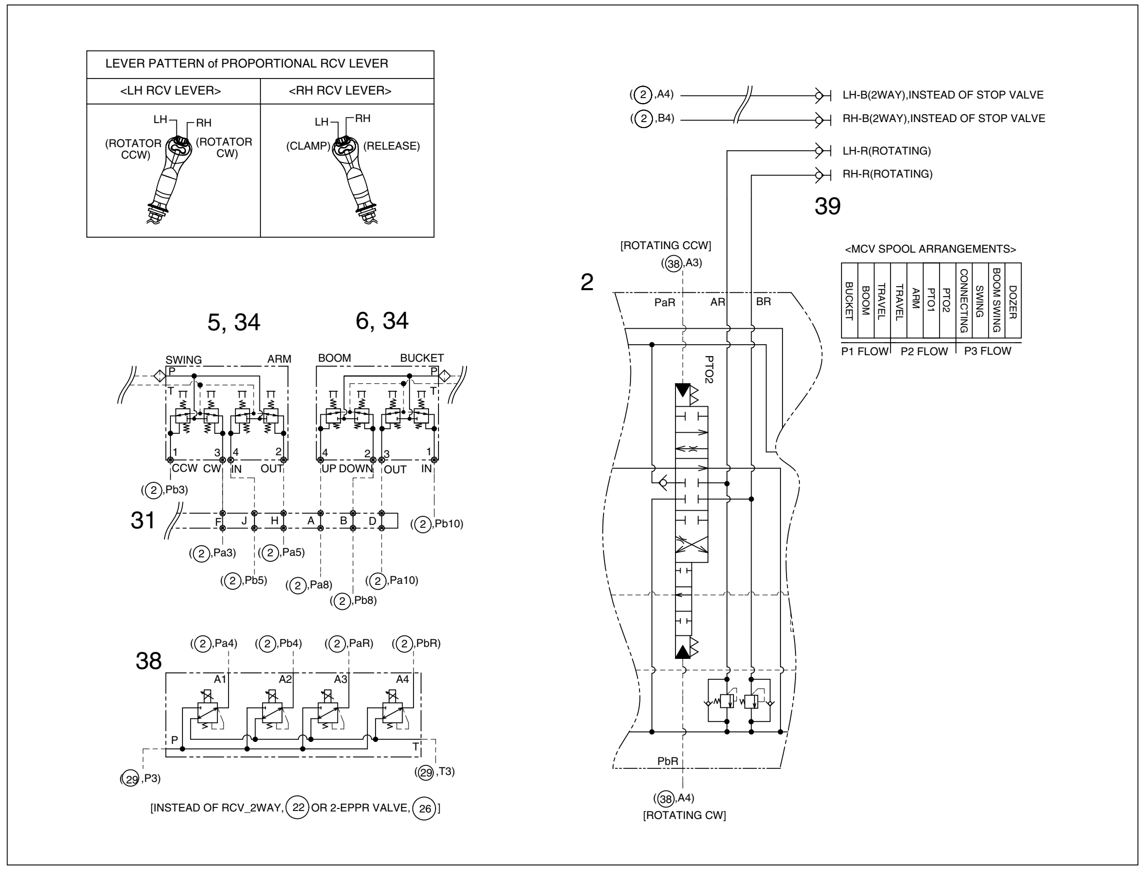
35Z9A3HC01A

HYDRAULIC CIRCUIT (2/3)

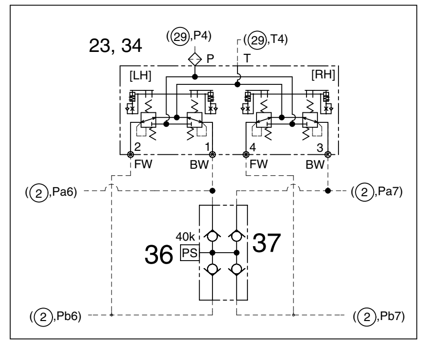
2WAY PROPORTIONAL RCV



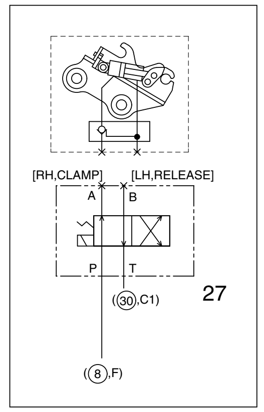
2-WAY + ROTAING PROPORTIONAL RCV



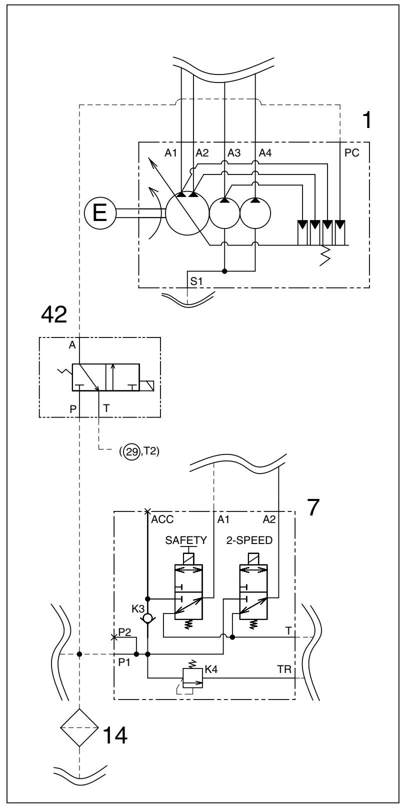
TRAVEL ALARM



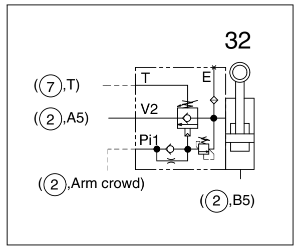
QUICK COUPLER



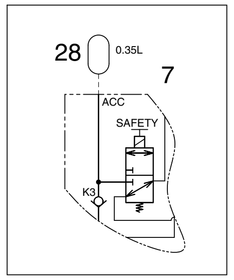
AIR CONDITIONING MODE



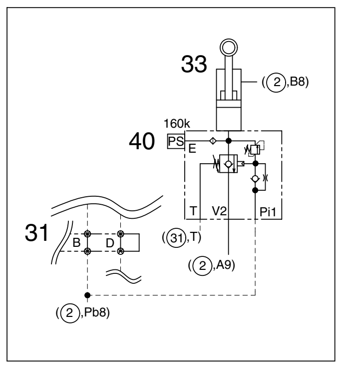
ARM SAFETY LOCK



<ACCUMULATOR>

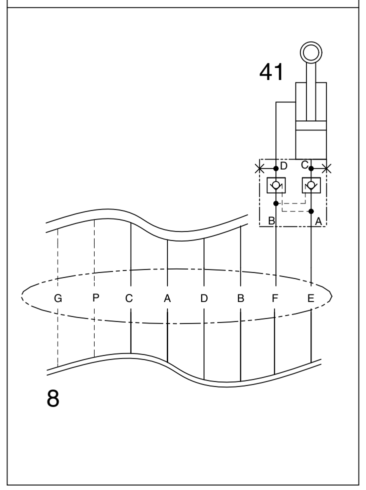


BOOM SAFETY LOCK

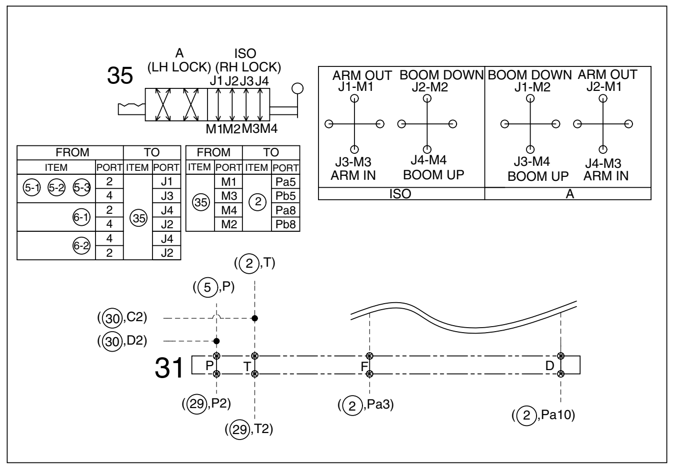


<DOZER DPC VALVE>

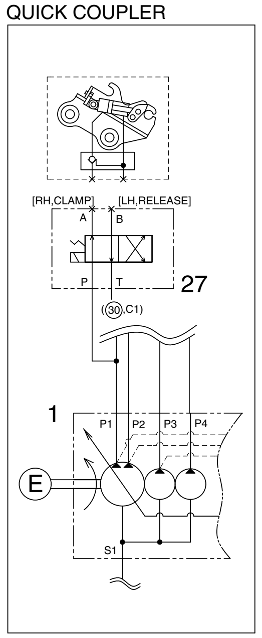
without Angle Dozer



PATTERN CHANGE



QUICK COUPLER

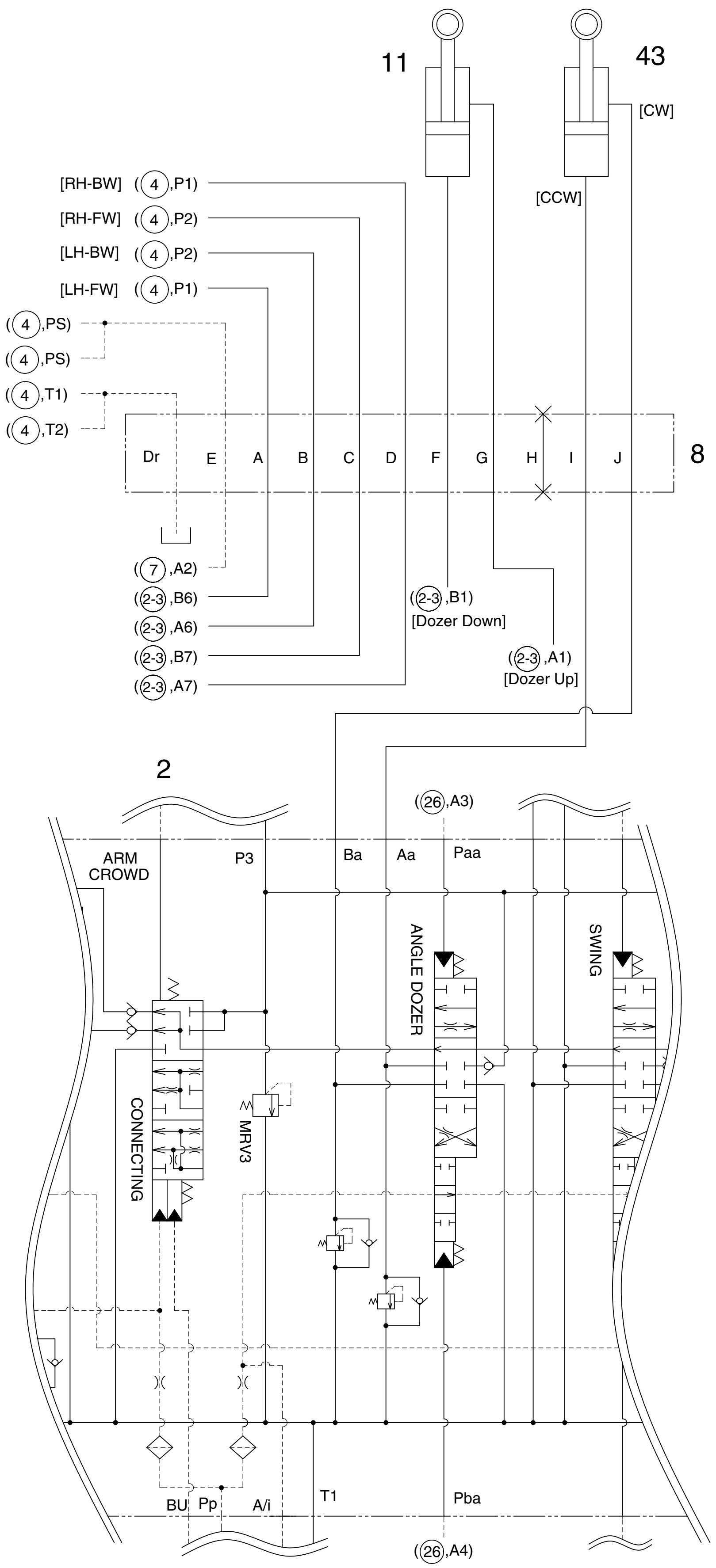


1 Main pump
2 Main control valve(option)
5 RCV lever(LH, option)
6 RCV lever(RH, option)
23 RCV pedal(travel)
26 2-EPPR valve(option)
27 Solenoid valve(option)
28 Accumulator(option)
31 Terminal(option)
32 Arm cylinder(option)
33 Boom cylinder(option)
35 Selector valve(option)
36 Pressure switch(option)
37 Shuttle valve(option)
38 4-EPPR valve(option)
39 Male coupling(option)
40 Pressure switch(option)
41 Dozer cylinder(option)
42 Solenoid valve(option)

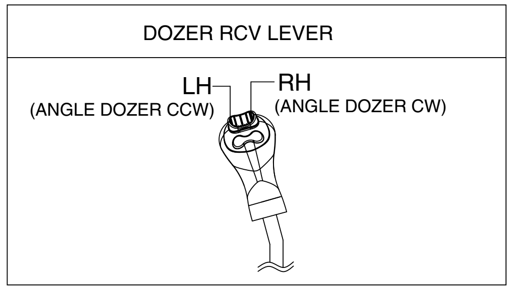
30MH-76610-08B

35Z9A3HC01B

ANGLE DOZER-OPTION(R35Z-9A)



LEVER PATTERN OF PROPORTIONAL RCV LEVER

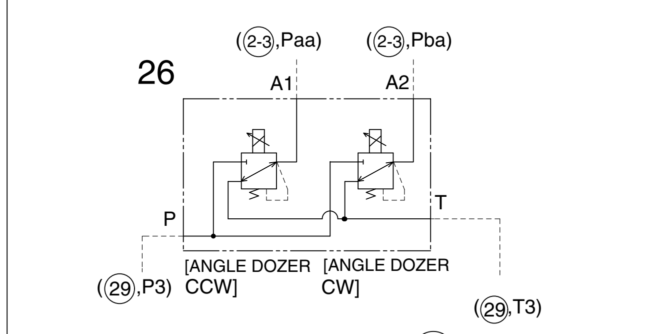


MCV SPOOL ARRANGEMENTS

BUCKET	BOOM	TRAVEL	TRAVEL	ARM	PTO1	CONNECTING	ANGLE DOZER	SWING	BOOM SWING	DOZER
P1 FLOW		P2 FLOW			P3 FLOW					

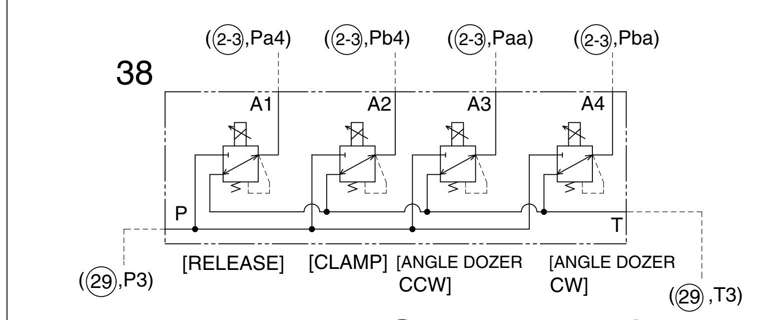
- 2 Main control valve(option)
- 8 Turning joint(option)
- 11 Dozer cylinder(option)
- 26 2-EPPR valve(option)
- 38 4-EPPR valve(option)
- 43 Angle dozer cylinder(option)

Without 2-WAY PROPORTIONAL LEVER



[INSTEAD OF RCV_2WAY, 22]

With 2-WAY PROPORTIONAL LEVER



[INSTEAD OF RCV_2WAY, 22 OR 2-EPPR VALVE, 26]

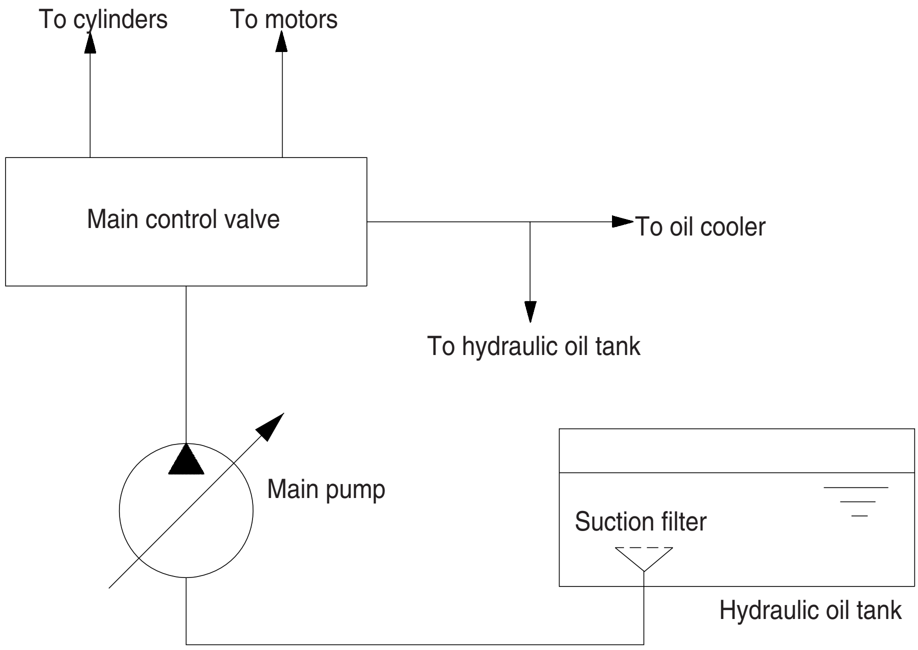
30MH-76610-08C

35Z9A3HC01C

GROUP 2 MAIN CIRCUIT

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

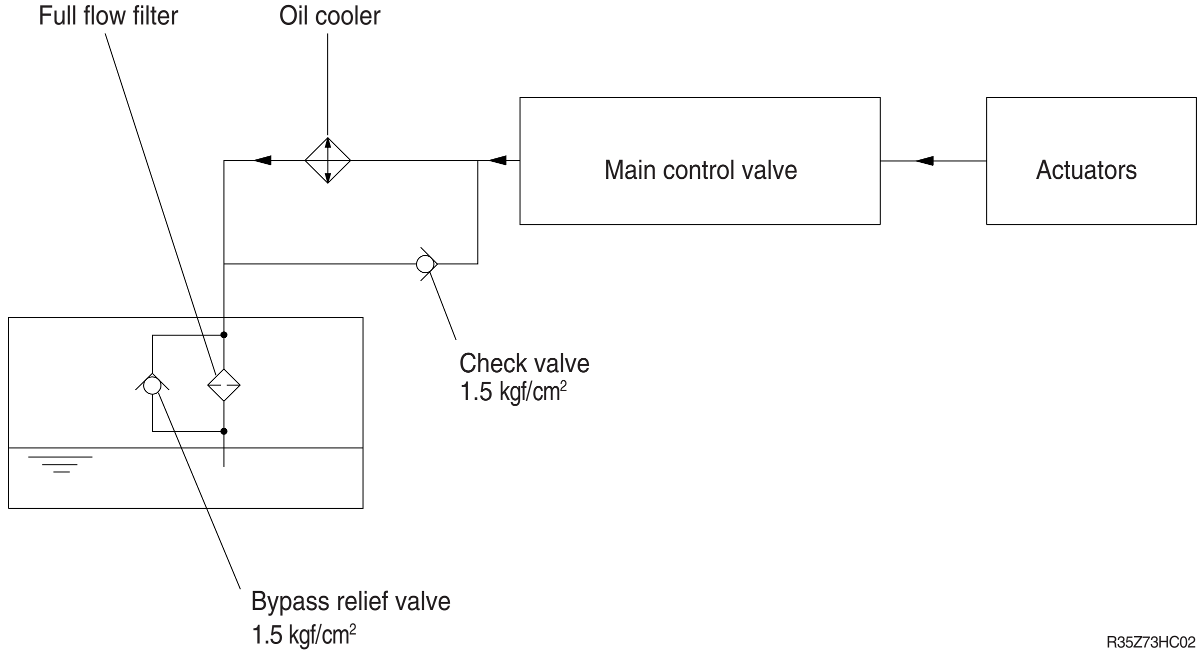
1. SUCTION AND DELIVERY CIRCUIT



3-02 (140-7 TIER)

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

2. RETURN CIRCUIT



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

The bypass check valves are provided in the return circuit.

The setting pressure of bypass check valves are 1.5 kgf/cm^2 (21 psi). Usually, oil returns to the hydraulic tank from the left side of control valve through oil cooler.

When oil temperature is low, viscosity becomes higher and flow resistance increases when passing through the oil cooler. When the oil pressure exceeds 1.5 kgf/cm^2 (21 psi), the oil returns directly to the hydraulic tank, resulting in the oil temperature being raised quickly at an appropriate level.

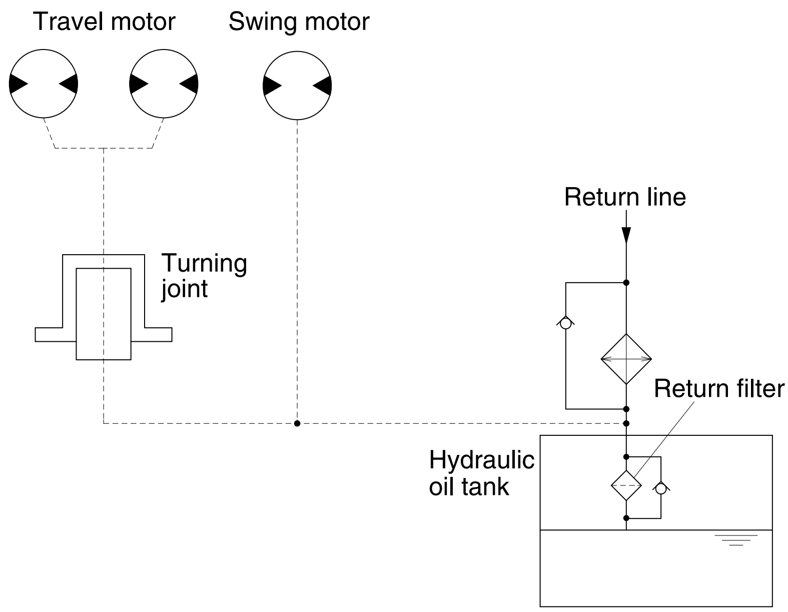
When the oil cooler is clogged, the oil returns directly to the hydraulic tank through bypass check valve.

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

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

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

3. DRAIN CIRCUIT



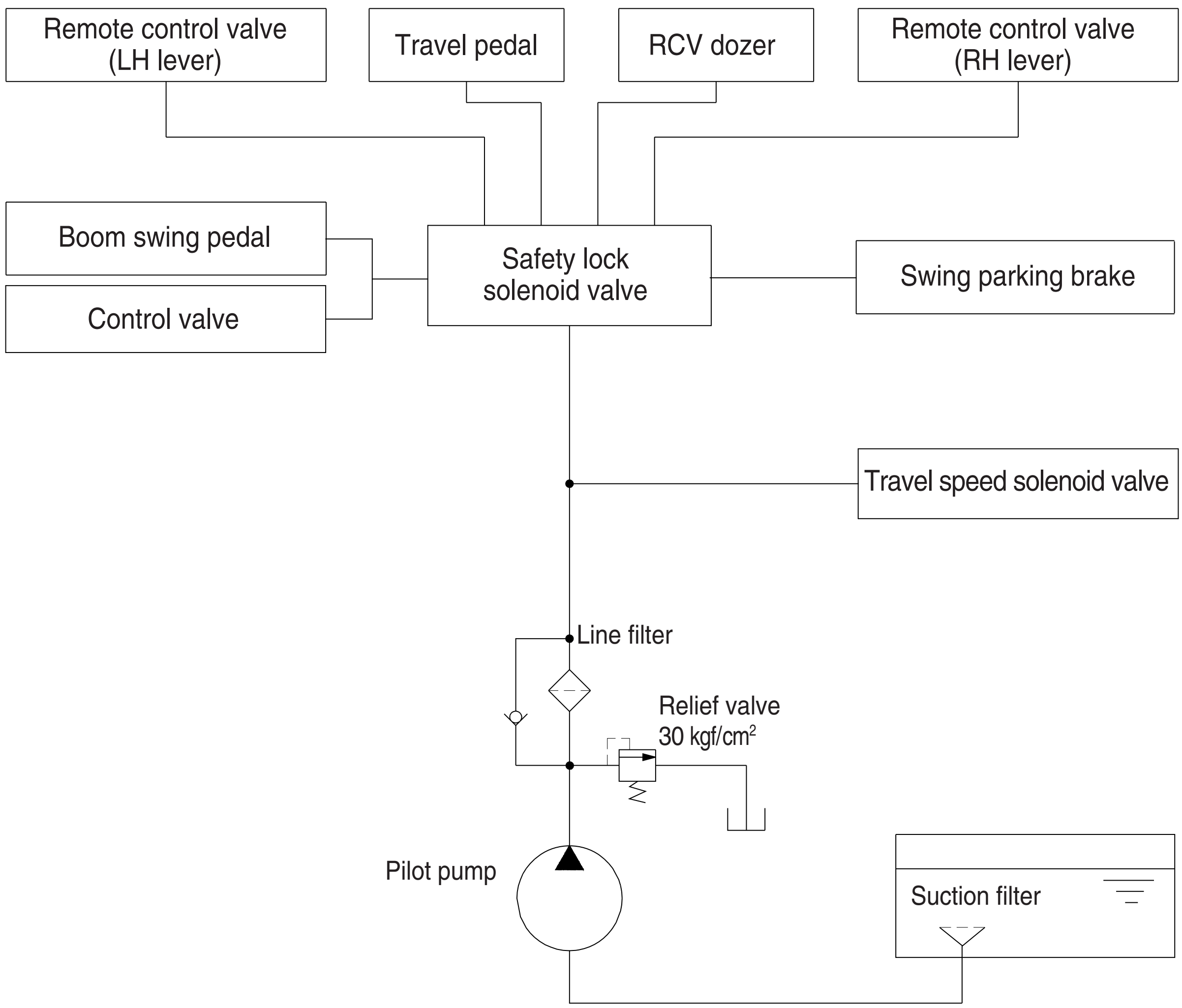
R35Z73HC43

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

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

2) SWING MOTOR DRAIN CIRCUIT
Oil leaked from the swing motor returns to the hydraulic tank passing through a return filter with oil drained from the travel circuit .

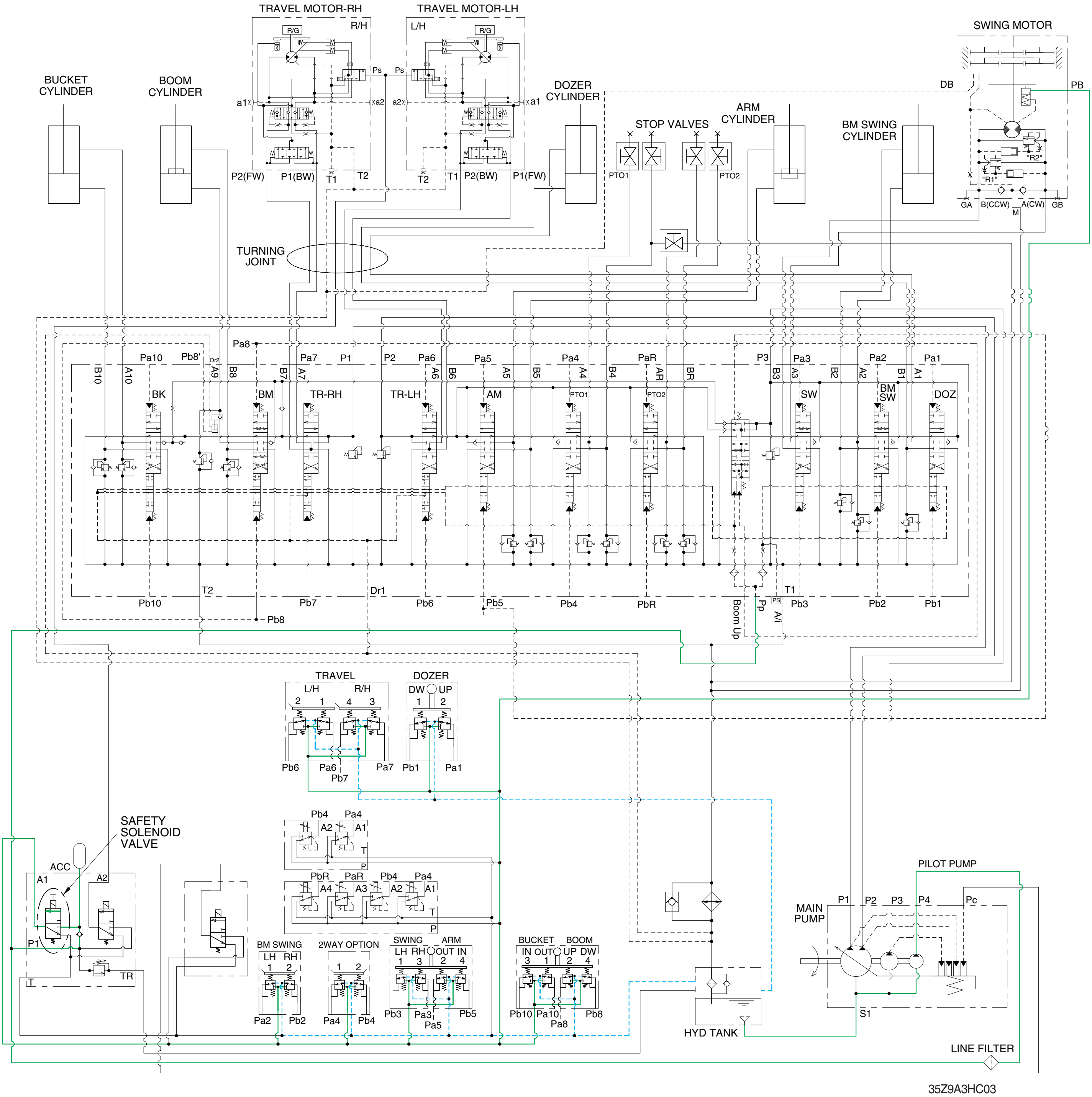
GROUP 3 PILOT CIRCUIT



R35Z73HC00

The pilot circuit consists of suction circuit, delivery circuit and return circuit.
The pilot pump is provided with relief valve, receives the oil from the hydraulic tank through the suction filter.
The discharged oil from the pilot pump flows to the remote control valve through line filter, solenoid valve assemblies, swing parking brake, main control valve and safety lock solenoid valve.

1. SUCTION, DELIVERY AND RETURN CIRCUIT

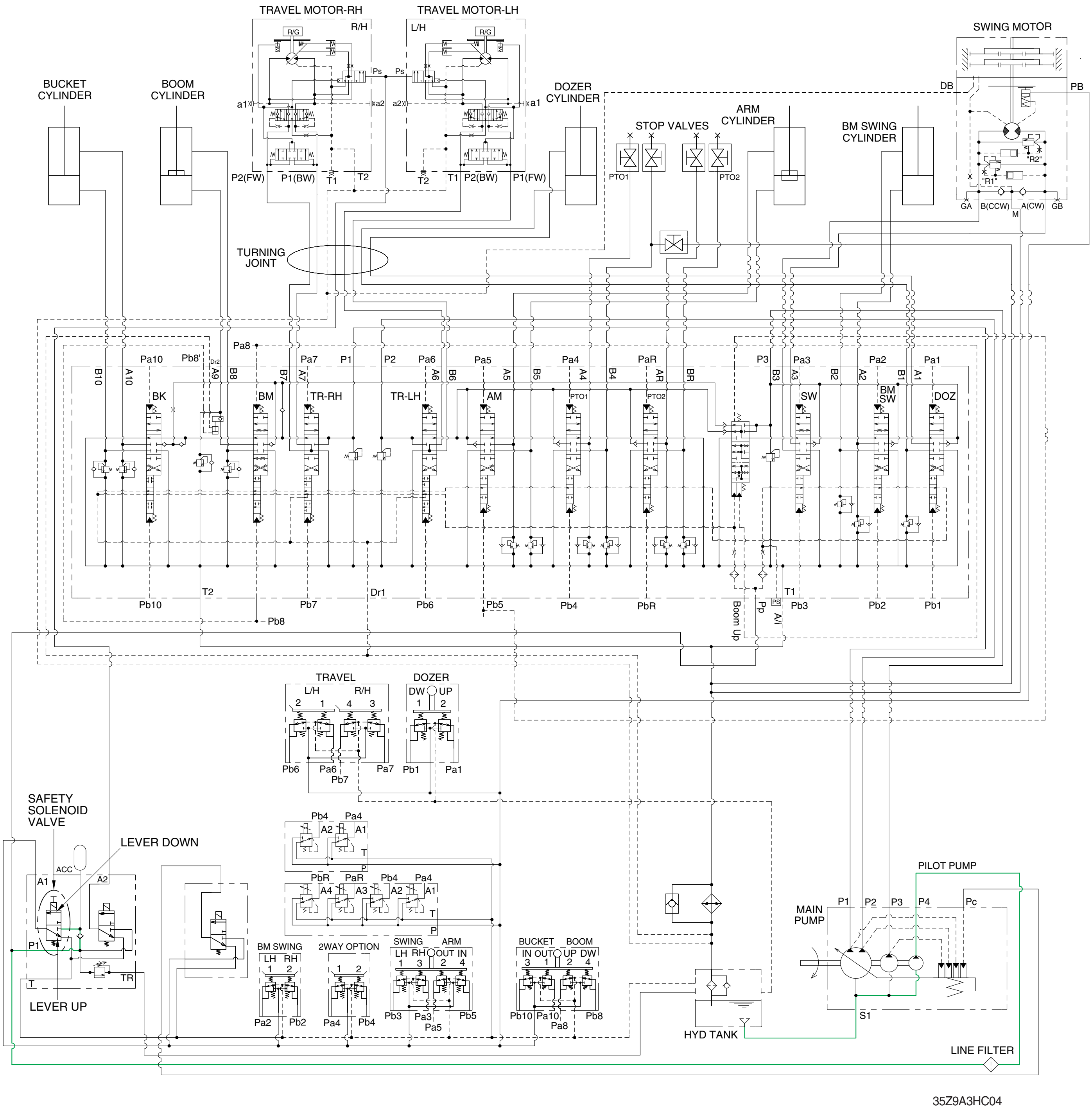


The pilot pump receive oil from the hydraulic tank. The discharged oil from the pilot pump flows to the safety solenoid valve through the line filter. The oil is filtered by the line filter. The pilot relief valve is provided in the pilot pump for limiting the pilot circuit pressure.

The oil filtered by line filter flows remote control valve, MCV and swing port through safety solenoid valve.

The return oil flow from remote control valve is returned to the hydraulic tank.

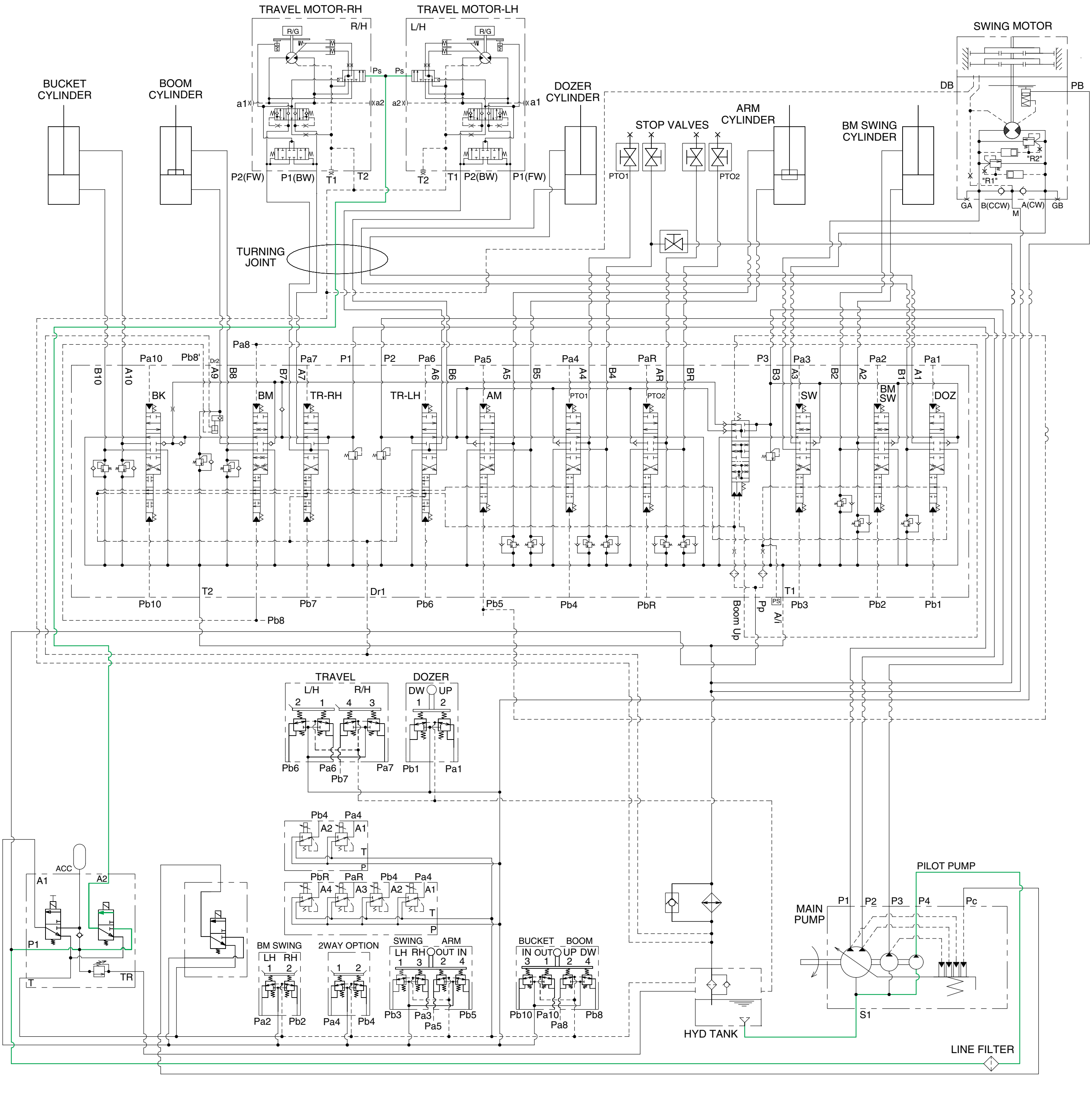
2. SAFETY VALVE (SAFETY LEVER)



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

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

3. TRAVEL SPEED CONTROL SYSTEM



35Z9A3HC05

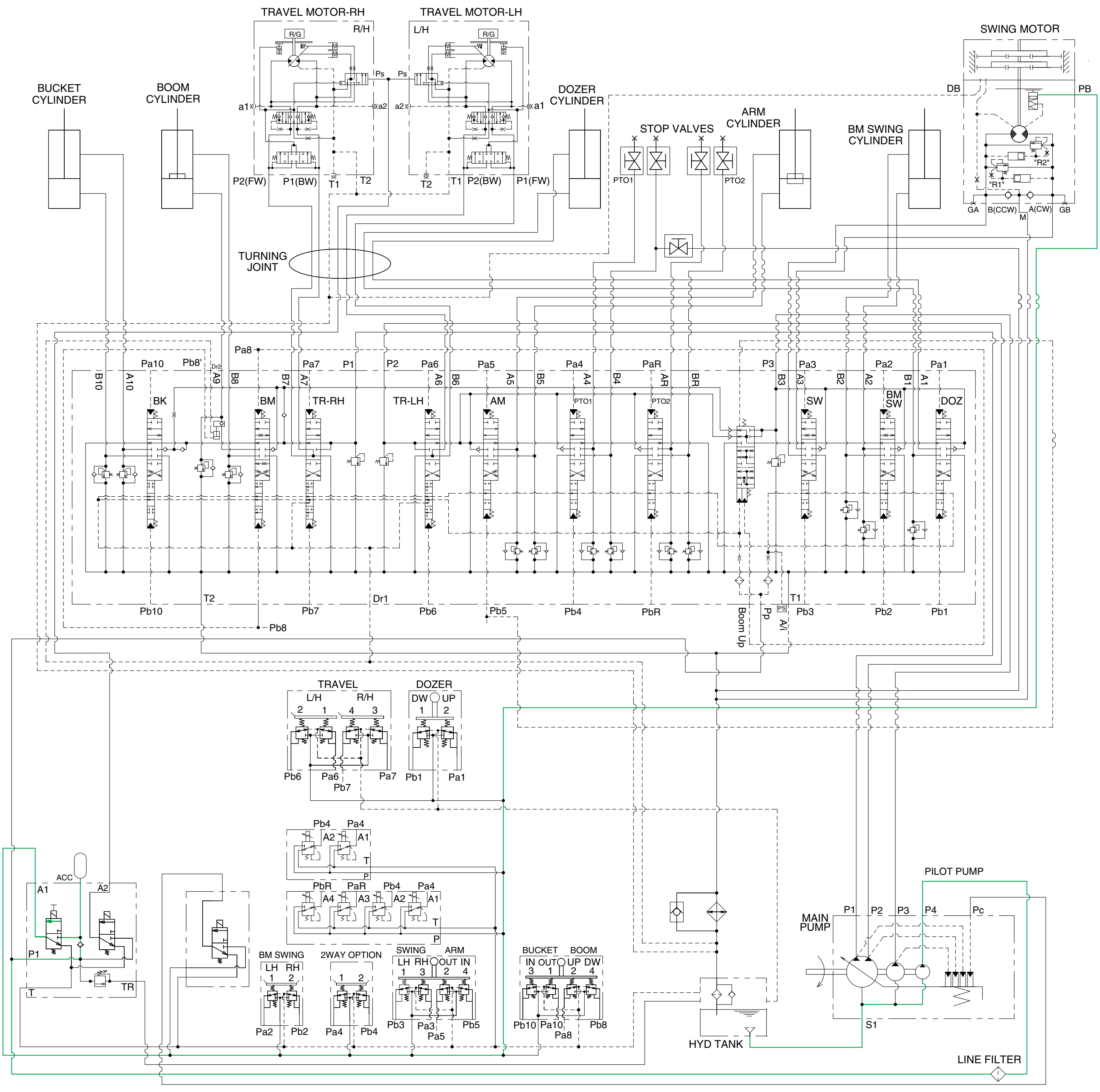
When the travel speed switch is pushed, the travel speed solenoid valve is actuated and the discharged oil from the pilot pump flows to the **Ps** port of pilot valve in the travel motors.

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

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

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

4. SWING PARKING BRAKE RELEASE

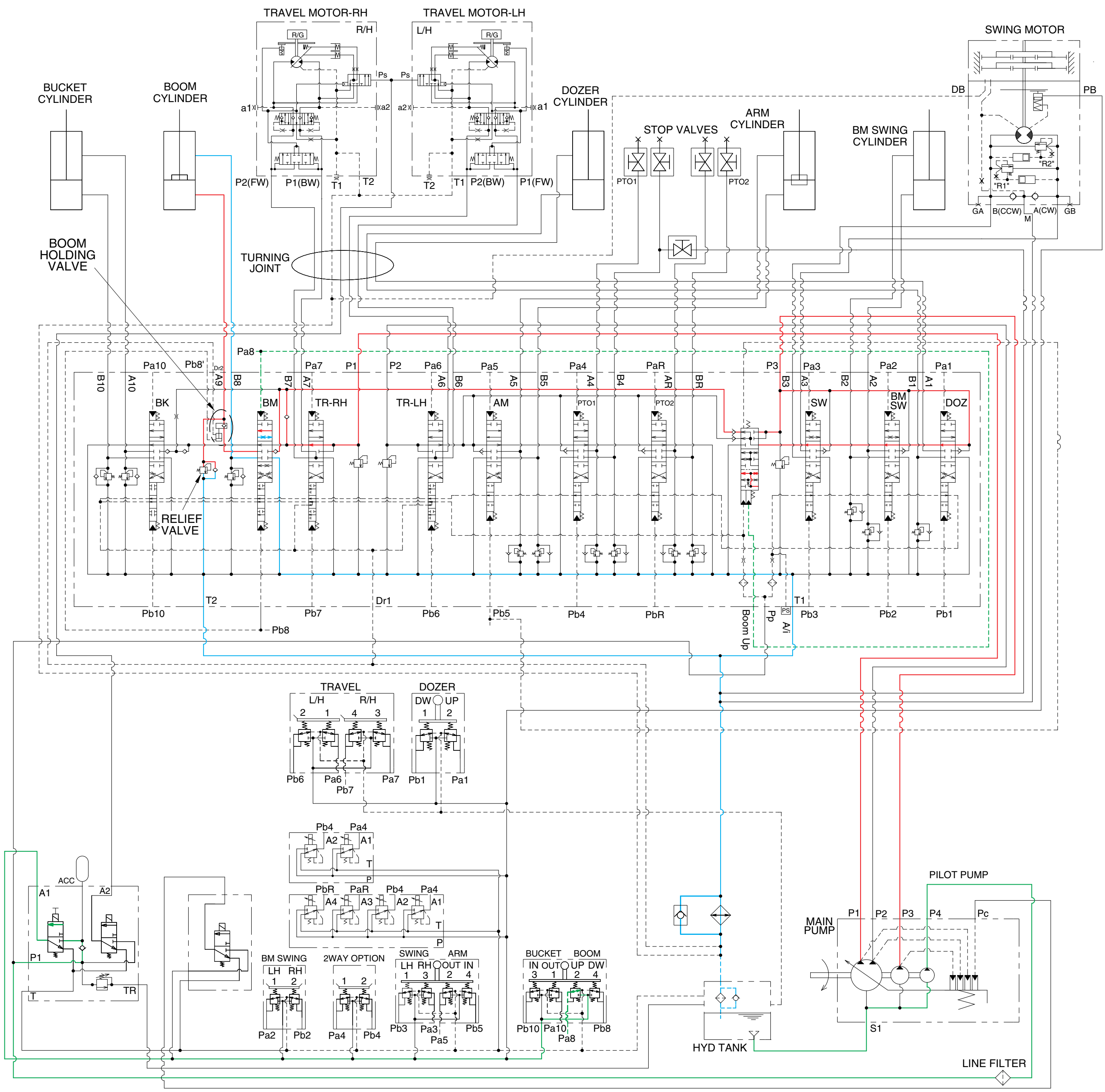


35Z9A3HC06

When the Safety solenoid lever is moved downward, the pilot oil flow into **PB** port of the swing motor through solenoid valve. This pressure is applied to swing motor disc, thus the brake is released.

When the safety solenoid lever is moved to upward, oil in the swing motor disc cylinder is drained, thus the brake is applied.

1. BOOM UP OPERATION

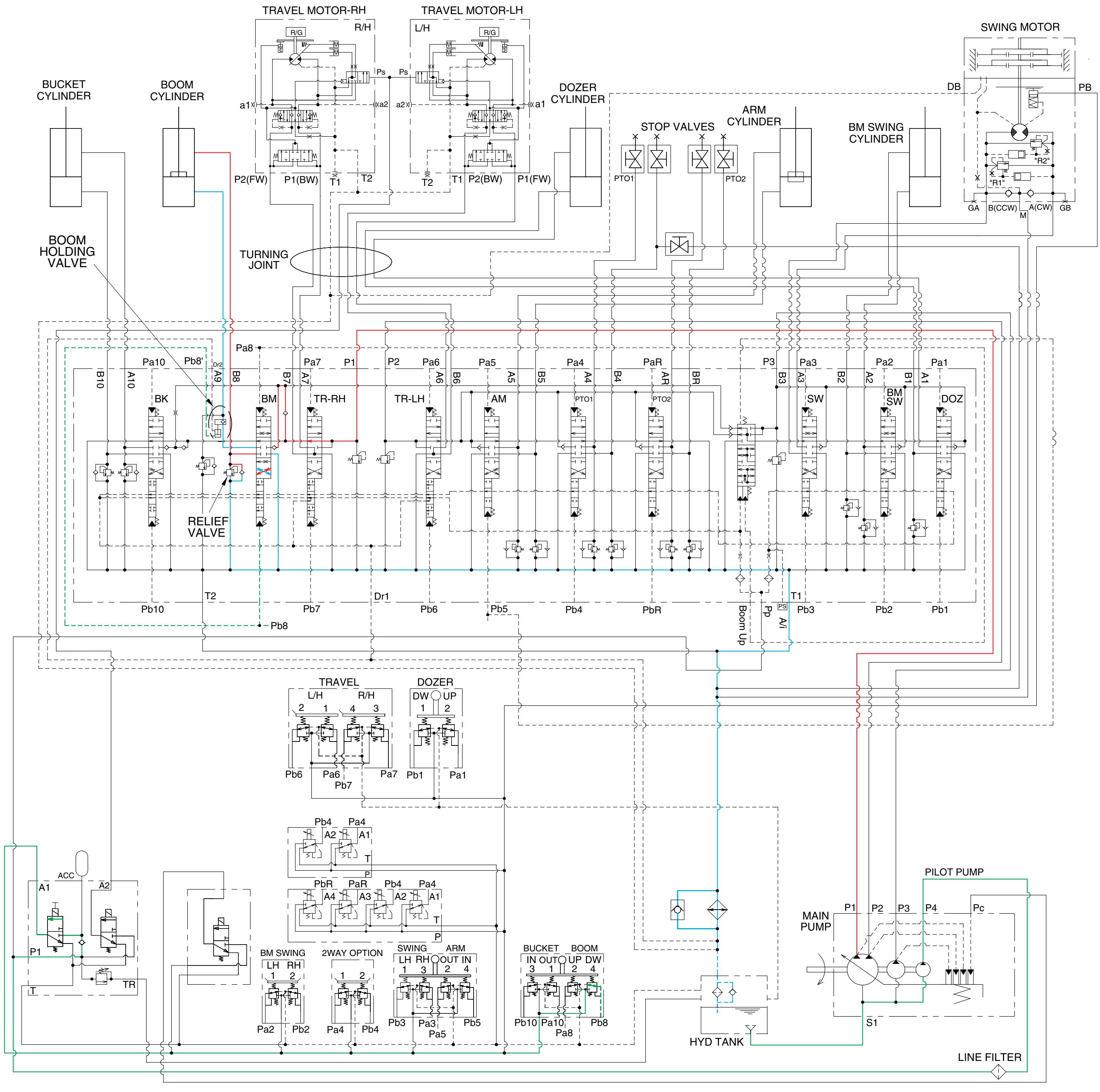


35Z9A3HC10

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

The oil from the P1 and P3 pump flows into the main control valve and then goes to the large chamber of boom cylinders. At the same time, the oil from the small chamber of boom cylinders returns to the hydraulic oil tank through the boom spool in the main control valve. When this happens, the boom goes up. The excessive pressure in the boom cylinder bottom end circuit is prevented by relief valve. When the boom is up and the control lever is returned to neutral position, the circuit for the holding pressure at the bottom end of the boom cylinder is closed by the boom holding valve. This prevents the hydraulic drift of boom cylinder.

2. BOOM DOWN OPERATION

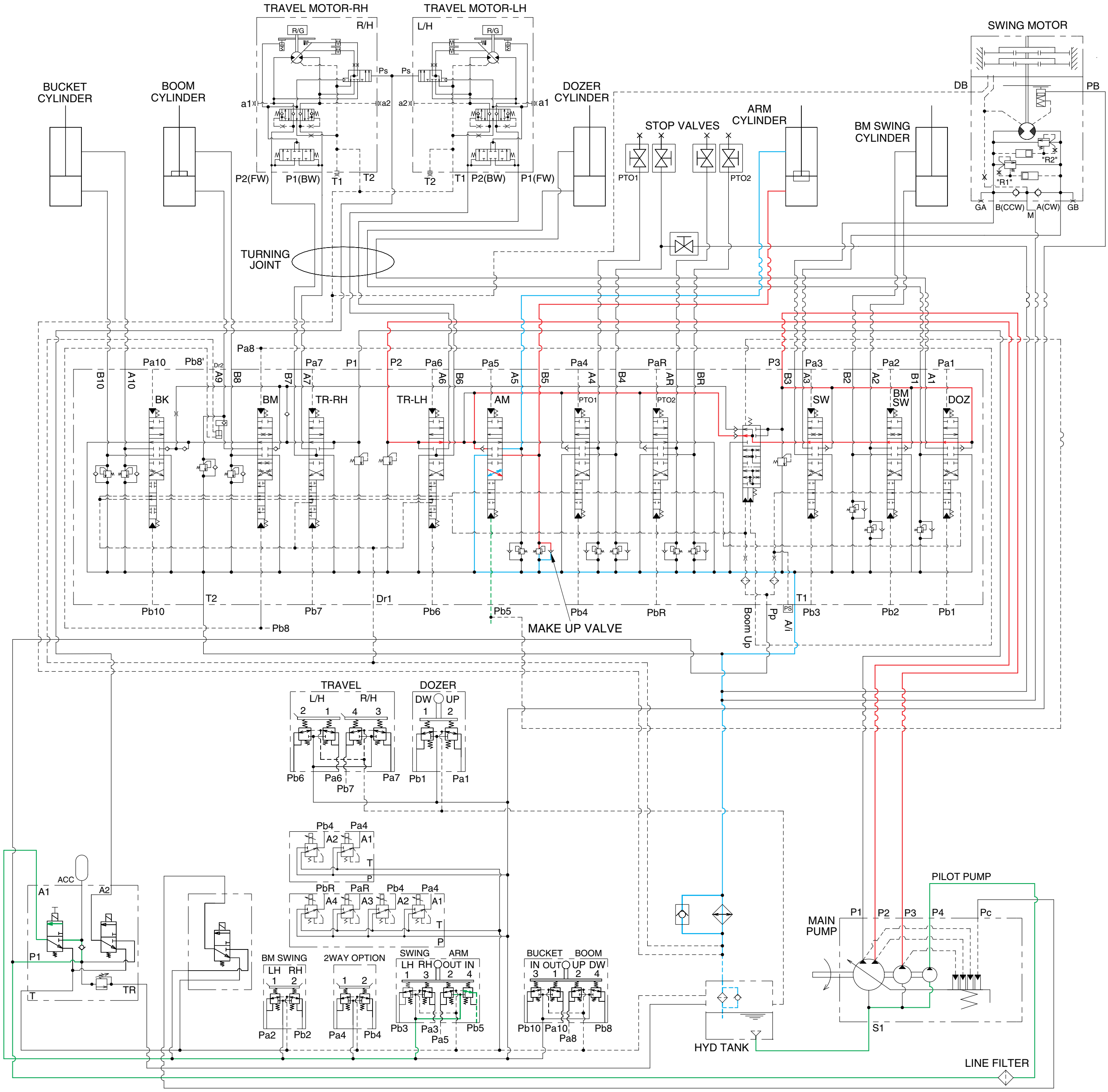


When the right control lever is pushed forward, the boom spools in the main control valve are moved to the down position by the pilot oil pressure from the remote control valve. Since Pb8 port is connected Pb8' port through the piping, boom holding valve is also released.

The oil from the P1 pump flows into the main control valve and then goes to the small chamber of boom cylinders. At the same time, the oil from the large chamber of boom cylinders returns to the hydraulic tank through the boom spool in the main control valve.

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

3. ARM ROLL IN OPERATION



35Z9A3HC12

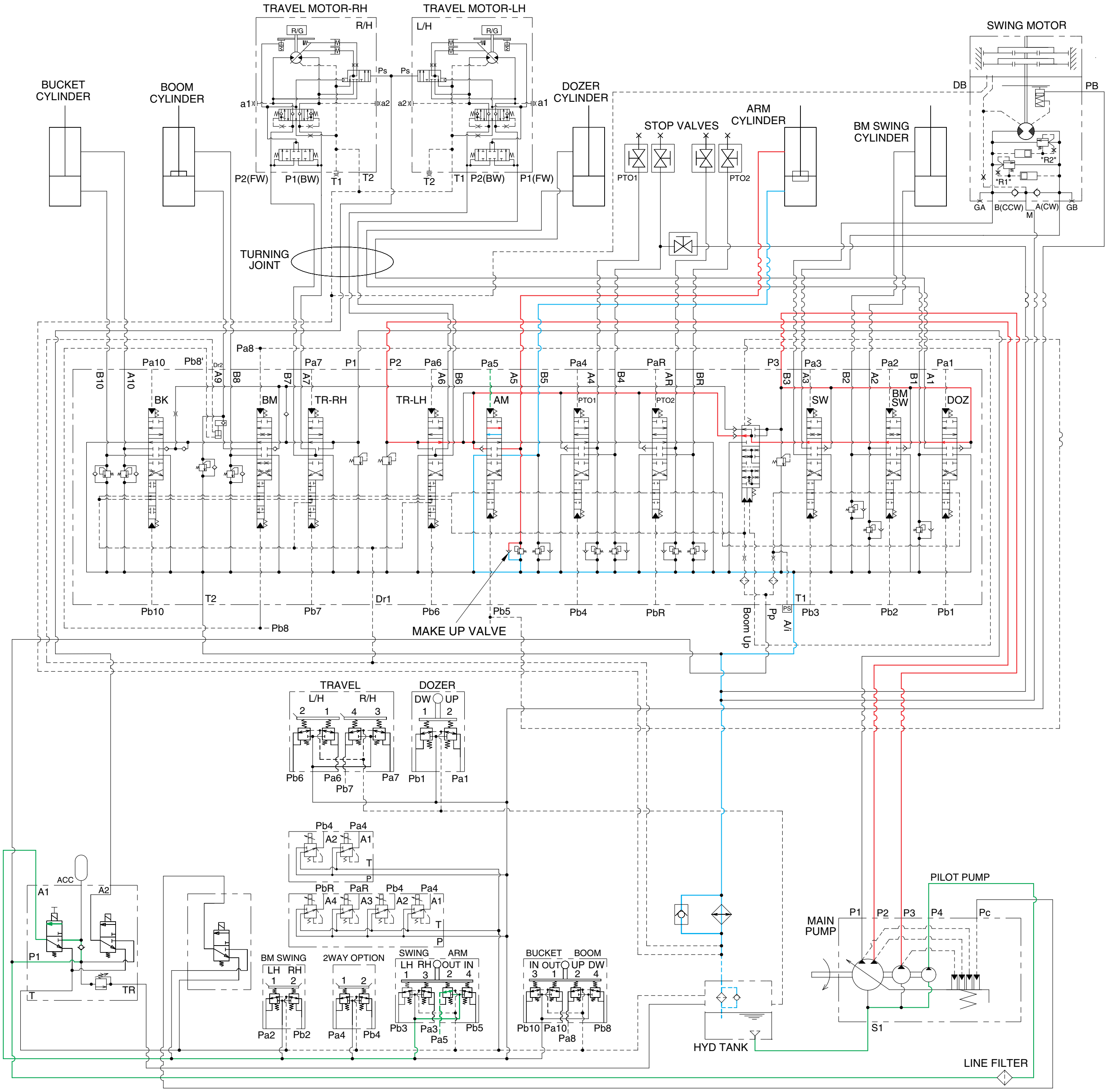
When the left control lever is pulled back, the arm spools in the main control valve are moved the to roll in position by the pilot oil pressure from the remote control valve.

The oil from the P2 and P3 pump flows into the main control valve and then goes to the large chamber of arm cylinder.

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

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

4. ARM ROLL OUT OPERATION



35Z9A3HC13

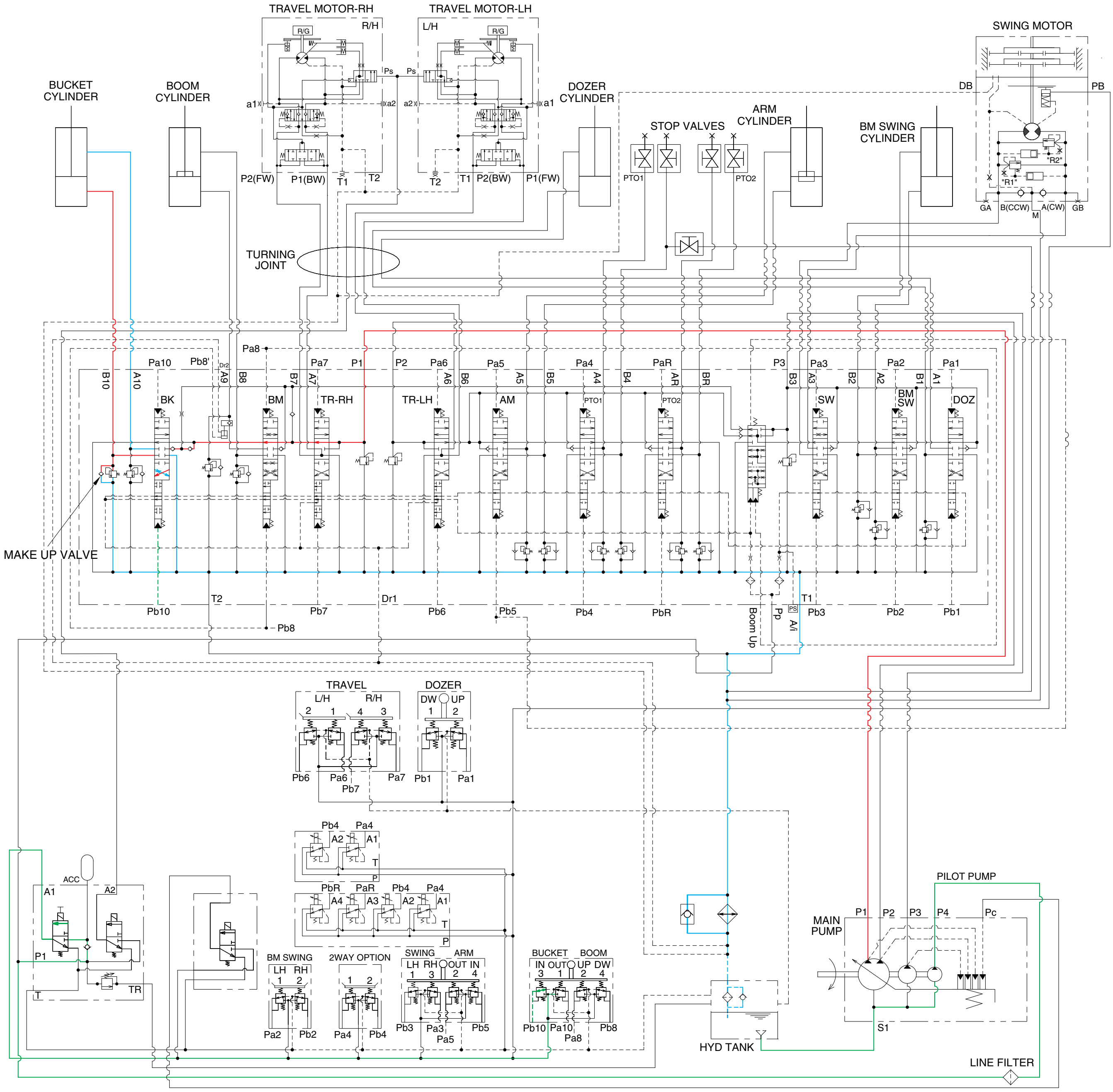
When the left control lever is pushed forward, the arm spool in the main control valve are moved to the roll out position by the pilot oil pressure from the remote control valve.

The oil from the P2 and P3 pump flows into the main control valve and then goes to the small chamber of arm cylinder.

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

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

5. BUCKET ROLL IN OPERATION



35Z9A3HC14

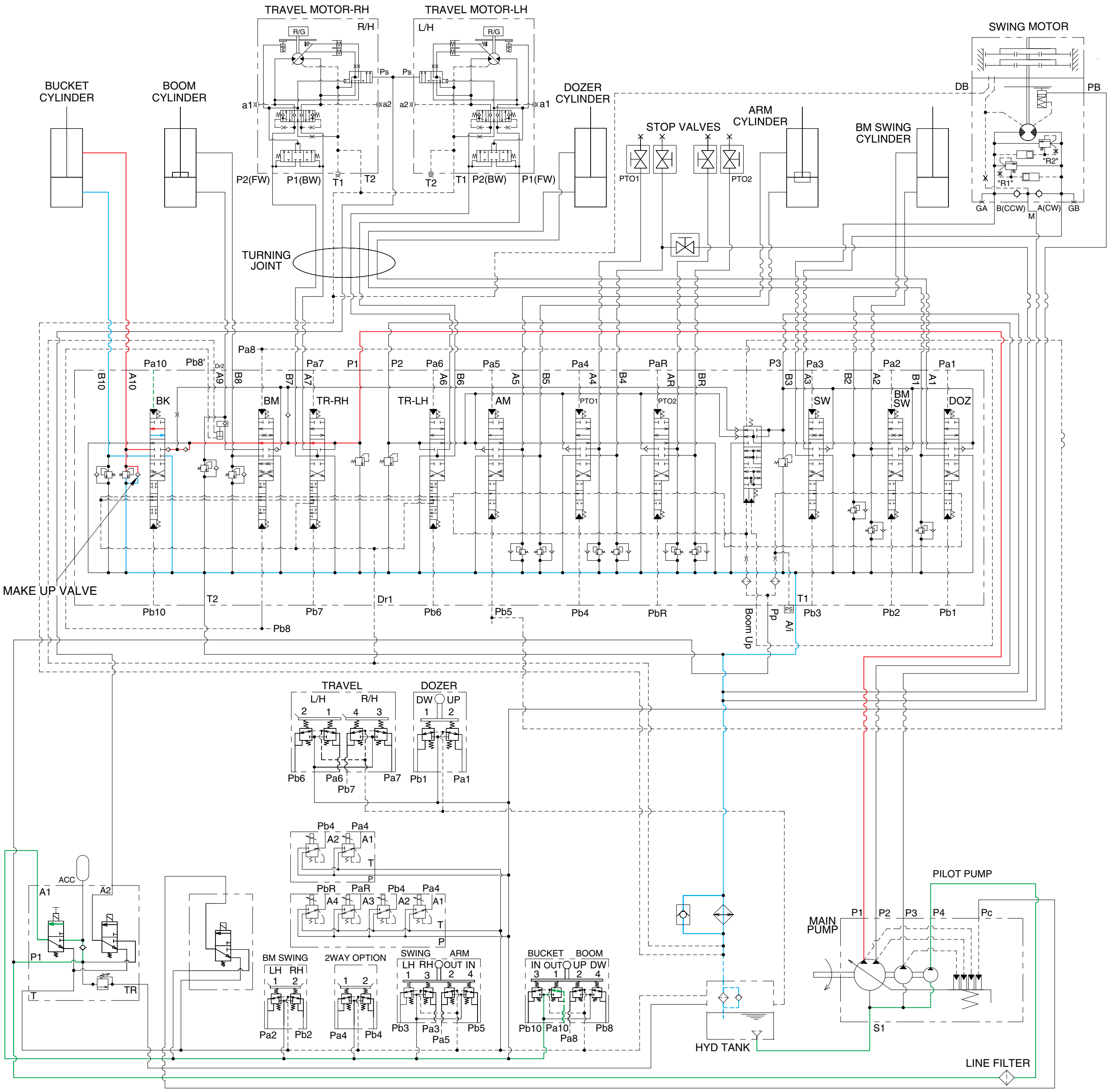
When the right control lever is pulled left, the bucket spool in the main control valve is moved to the roll in position by the pilot oil pressure from the remote control valve.

The oil from the P1 pump flows into the main control valve and then goes to the large chamber of bucket cylinder.

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

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

6. BUCKET ROLL OUT OPERATION



30Z9A3HC15

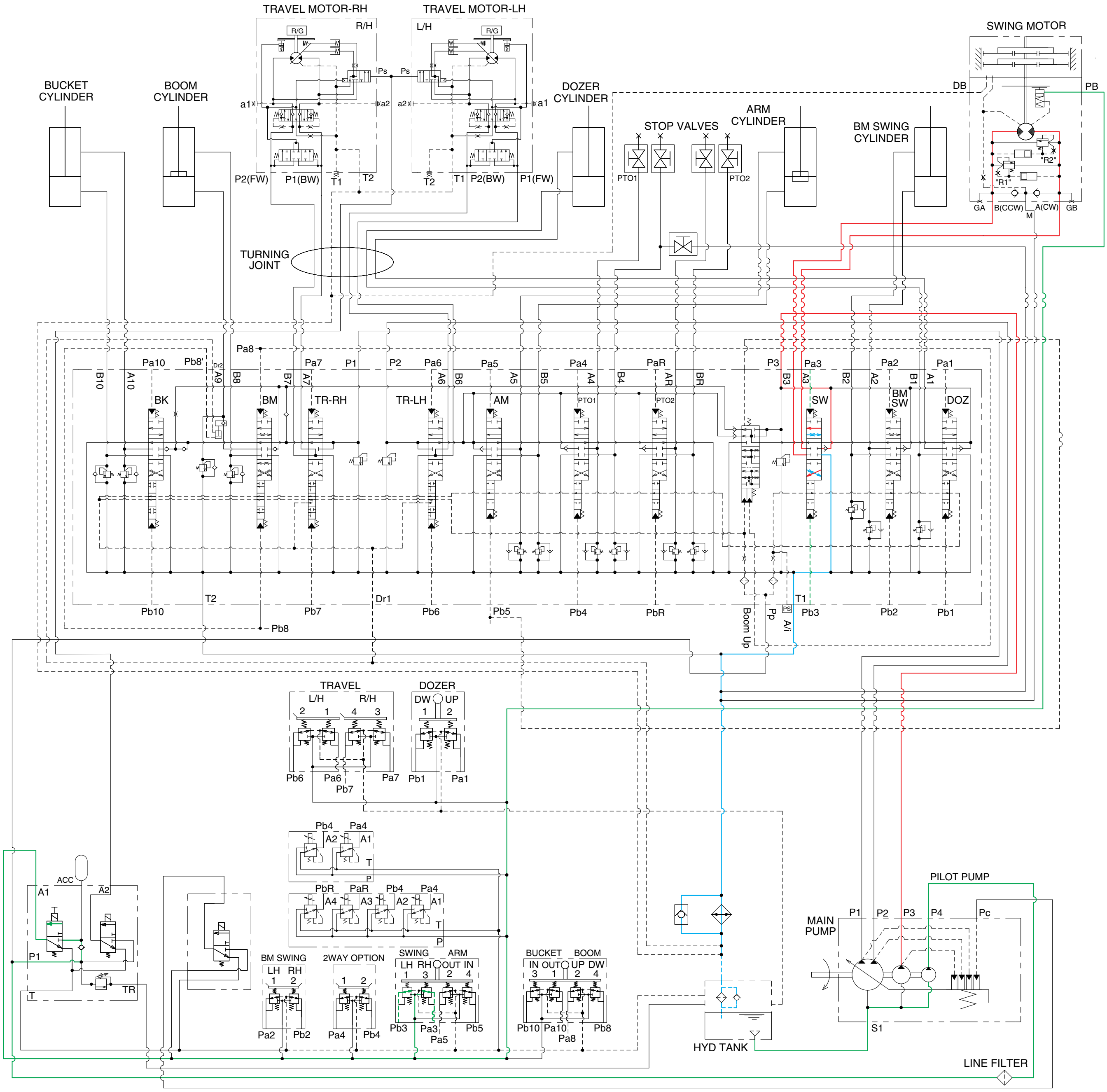
When the right control lever is pushed right, the bucket spool in the main control valve is moved to the roll out position by the pilot oil pressure from the remote control valve.

The oil from the P1 pump flows into the main control valve and then goes to the small chamber of bucket cylinder.

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

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

7. SWING OPERATION



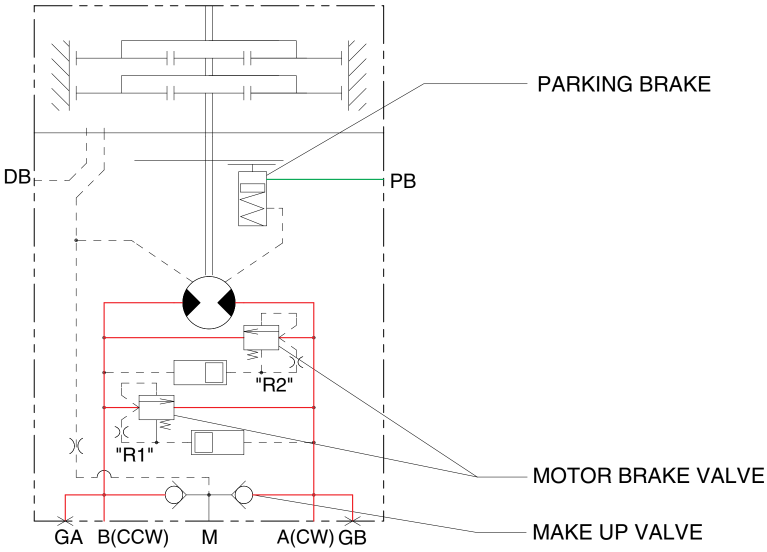
35Z9A3HC16

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

The oil from the P3 pump flows into the main control valve and then goes to the swing motor.

At the same time, the return oil from the swing motor returns to the hydraulic oil tank through the swing spool in the main control valve. When this happens, the superstructure swings to the left or right. The swing parking brake, make up valve and the overload relief valve are provided in the swing motor. The cavitation which will happen to the swing motor is also prevented by the make up valve in the swing motor itself.

SWING CIRCUIT OPERATION



R35Z73HC40A

1) MOTOR BRAKE VALVE

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

2) MAKE UP VALVE

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

3) PARKING BRAKE

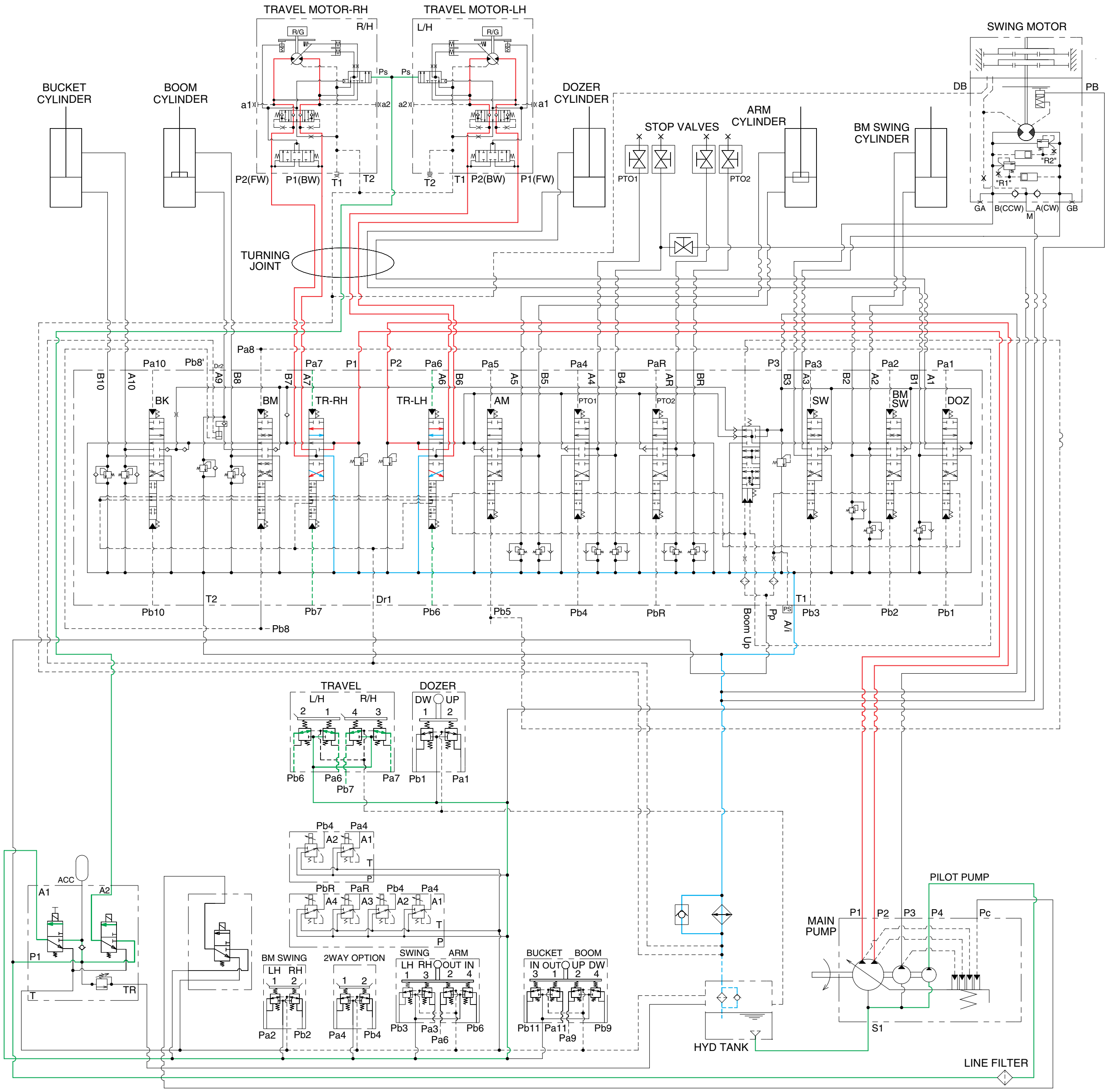
PARKING BRAKE "ON" OPERATION

When the safety solenoid lever is moved to upward, the oil in the parking brake is drained to the tank. So, parking brake is applied.

PARKING BRAKE "OFF" OPERATION

The parking brake is released by the pilot pressure oil from pilot pump.
When the safety solenoid lever is moved to downward, the pilot pressure from the P4 pilot pump is flow into parking brake through safety solenoid valve.
Then the pilot pressure lift the brake piston and release the parking brake.

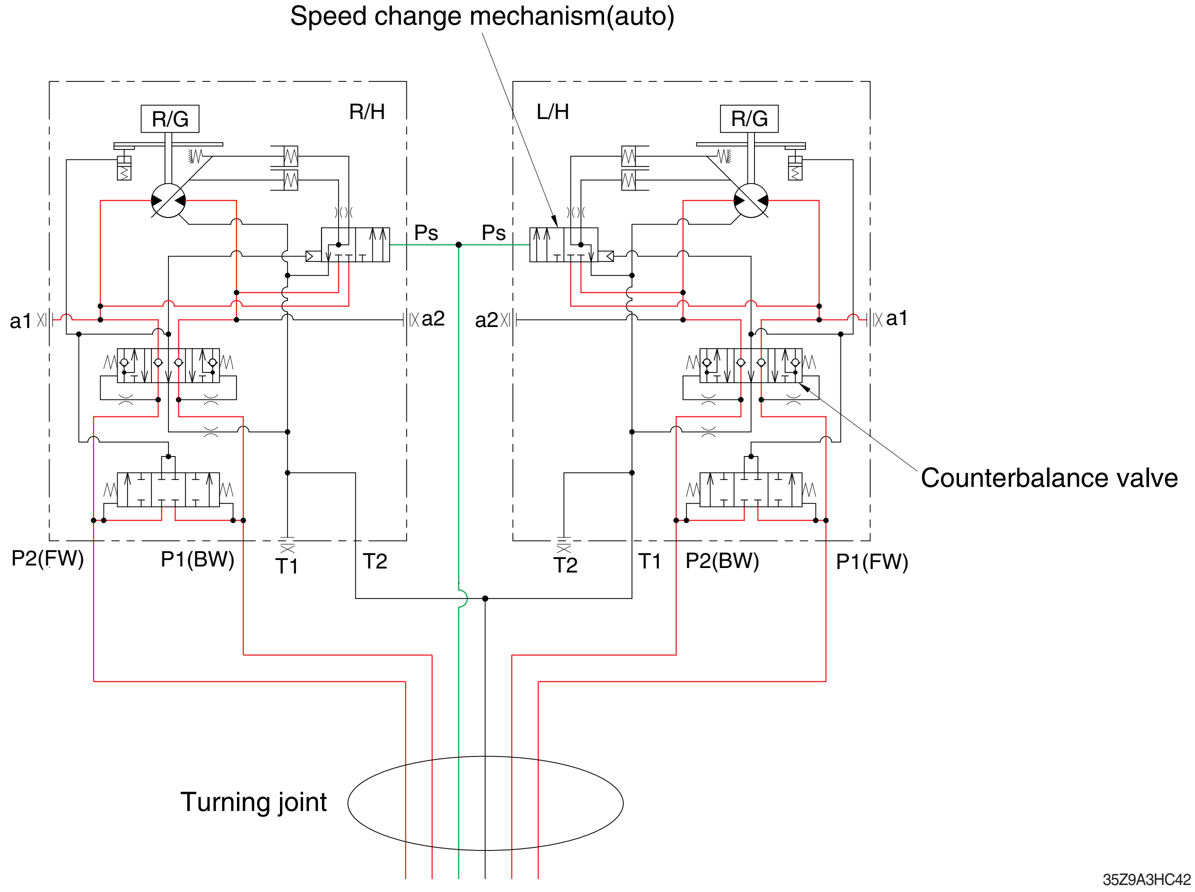
8. TRAVEL FORWARD AND REVERSE OPERATION



35Z9A3HC17

When the travel levers are pushed forward or reverse position, the travel spools in the main control valve are moved to the forward or reverse travel position by pilot pressure oil. The oil from the both pumps flows into the main control valve and then goes to the both travel motors through the turning joint. The return oil from both travel motors returns to the hydraulic oil tank through the turning joint and the travel spools in the main control valve. When this happens, the machine moves to the forward or reverse.

TRAVEL CIRCUIT OPERATION

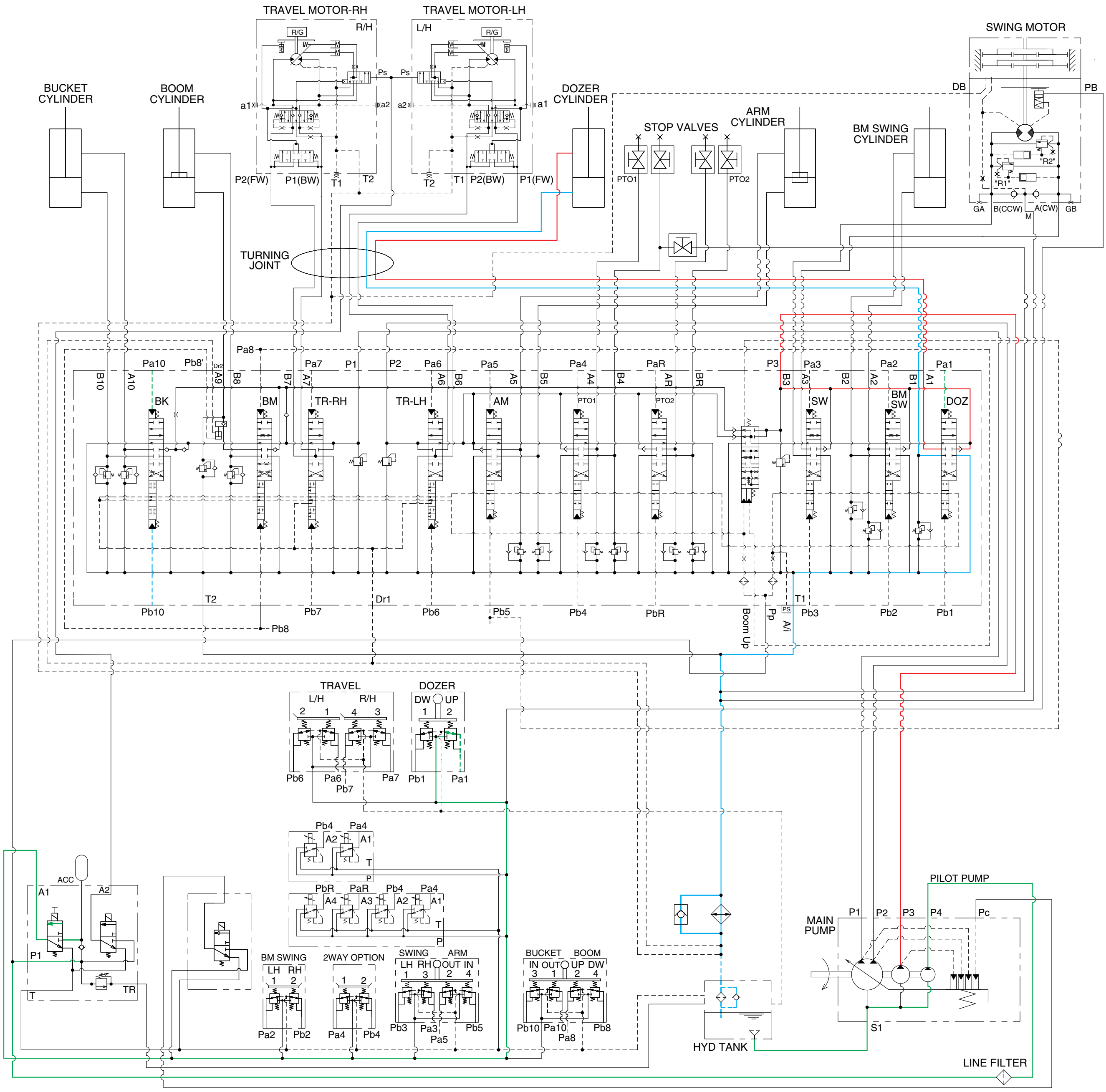


Valves are provided on travel motors to offer the following functions.

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

2) SPEED CHANGE MECHANISM (auto)
Auto two speed control mechanism consists of two spools and spring. This valve automatically changes motor displacement in portion to motor pressure

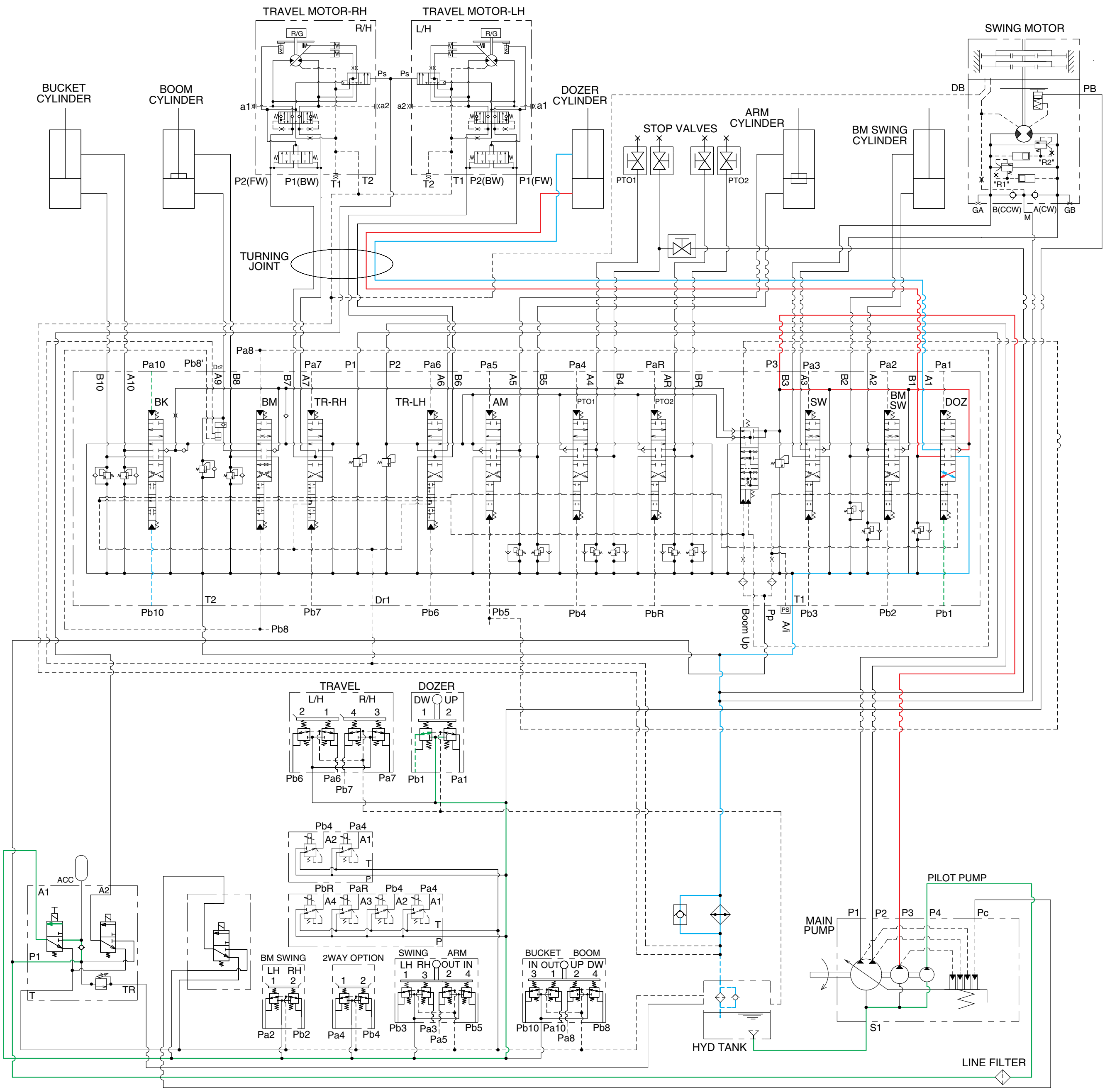
9. DOZER UP OPERATION



35Z9A3HC18

When the dozer control lever is pulled back, the dozer spool in the main control valve is moved to the dozer up position by the pilot oil pressure from the remote control valve.
The oil from the P3 pump flows into the main control valve and then goes to the small chamber of dozer cylinder.
At the same time, the oil from the large chamber of dozer cylinder returns to the hydraulic oil tank through the dozer spool in the main control valve. When this happens, the dozer goes up.

10. DOZER DOWN OPERATION



35Z9A3HC19

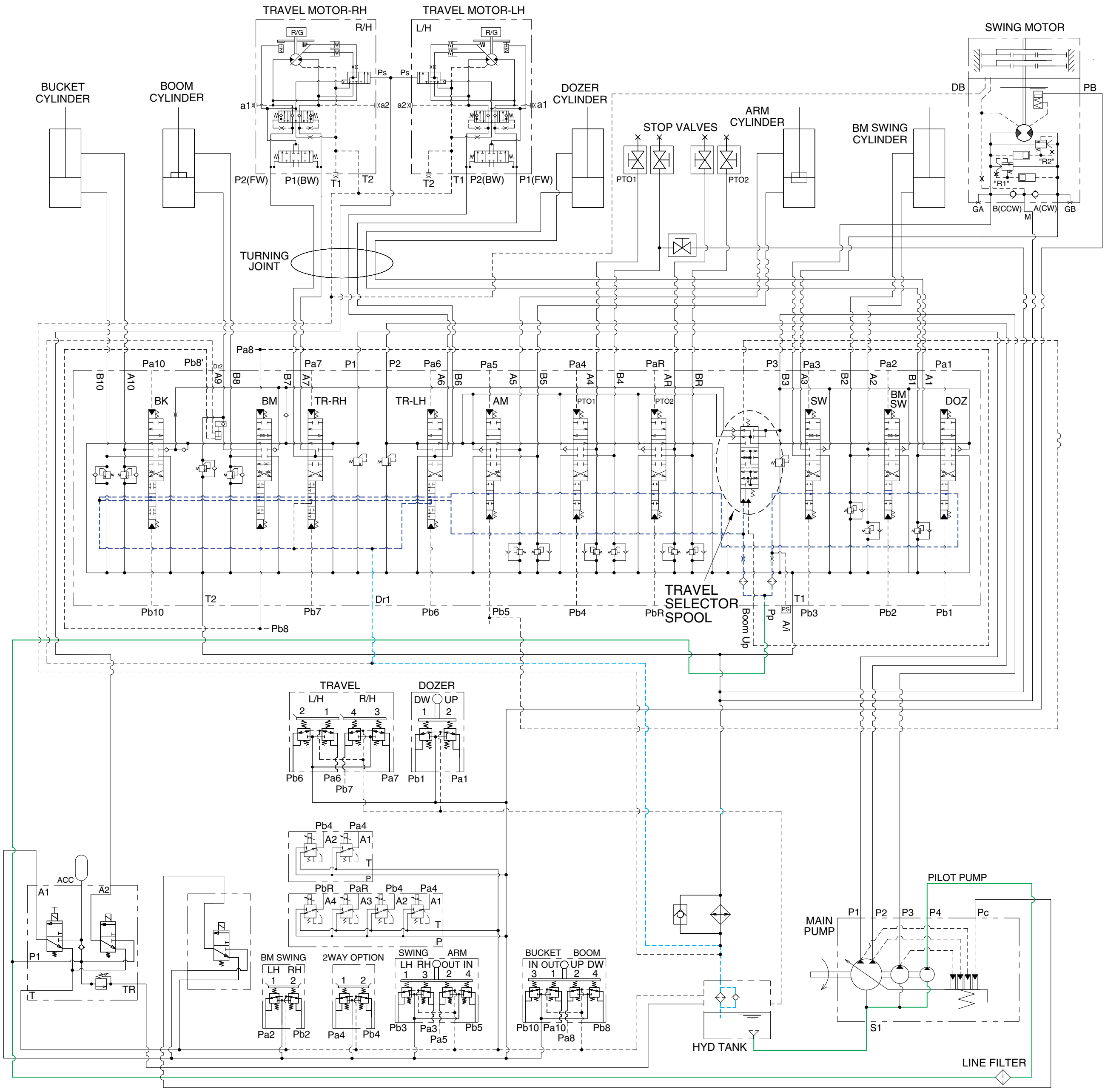
When the dozer control lever is pushed forward, the dozer spool in the main control valve is moved to the dozer down position by the pilot oil pressure from the remote control valve.

The oil from the P3 pump flows into the main control valve and then goes to the large chamber of dozer cylinder.

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

GROUP 5 COMBINED OPERATION

1. OUTLINE



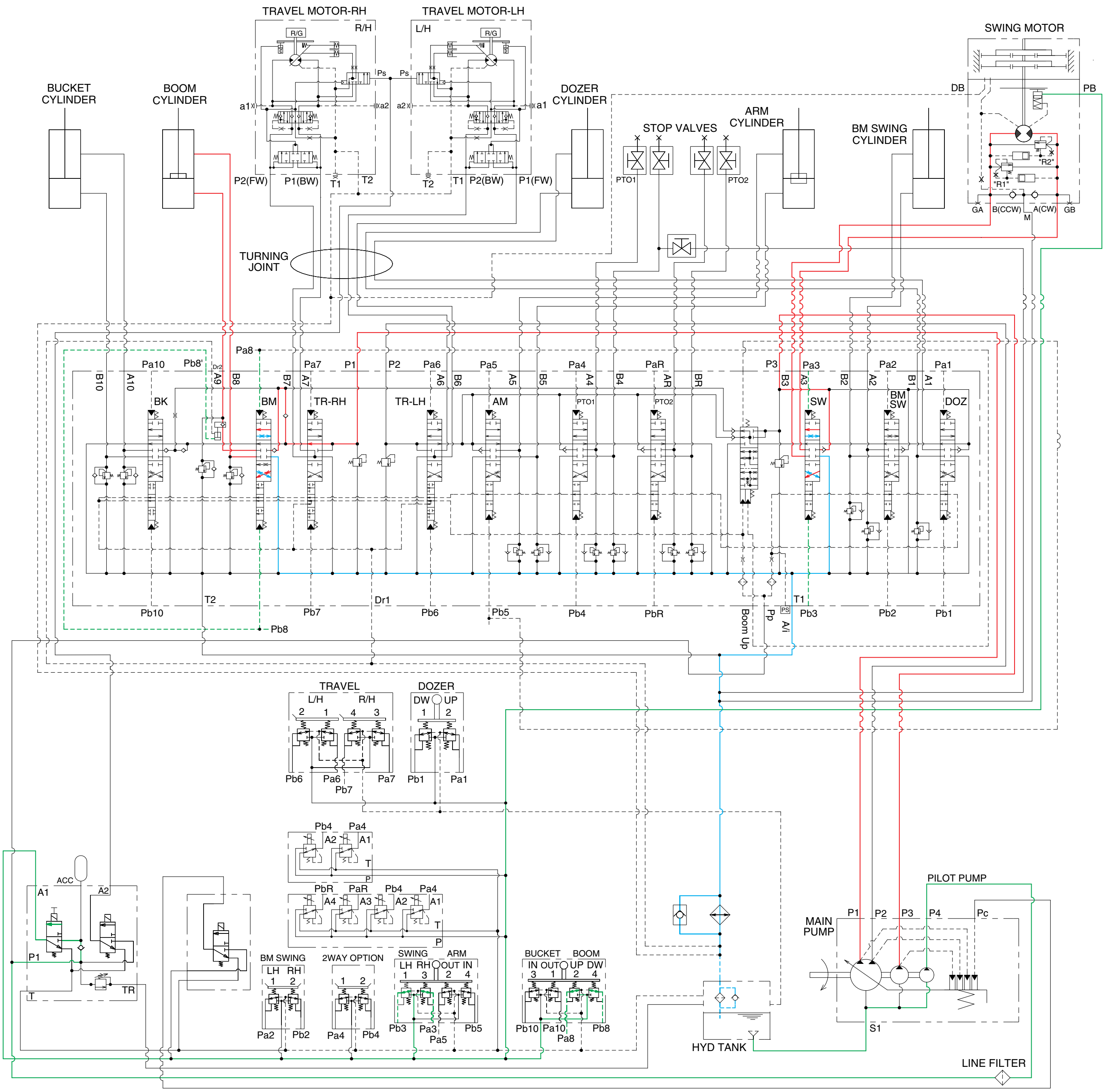
35Z9A3HC30

The oil from the P1, P2, P3 pump flows through the neutral oil passage, bypass oil passage and confluence oil passage in the main control valve. Then the oil goes to each actuator and operates them. Check valves and orifices are located on these oil passage in the main control valve. These control the oil from the main pumps so as to correspond to the operation of each actuator and smooth the combined operation.

INDEPENDENT TRAVEL SYSTEM

This independent travel system for straight travel is provided in the main control valve.
If any actuator(s) on P1 and P2 pump side is operated when traveling, the travel selector spool is moved to the selected side by the pilot oil pressure.
Consequently, the pressure oil from P1 and P2 pump are supplied to the right and left travel motor and oil from P3 pump flows into the other operated actuator.
This keeps the straight travel.

2. COMBINED SWING AND BOOM OPERATION



35Z9A3HC31

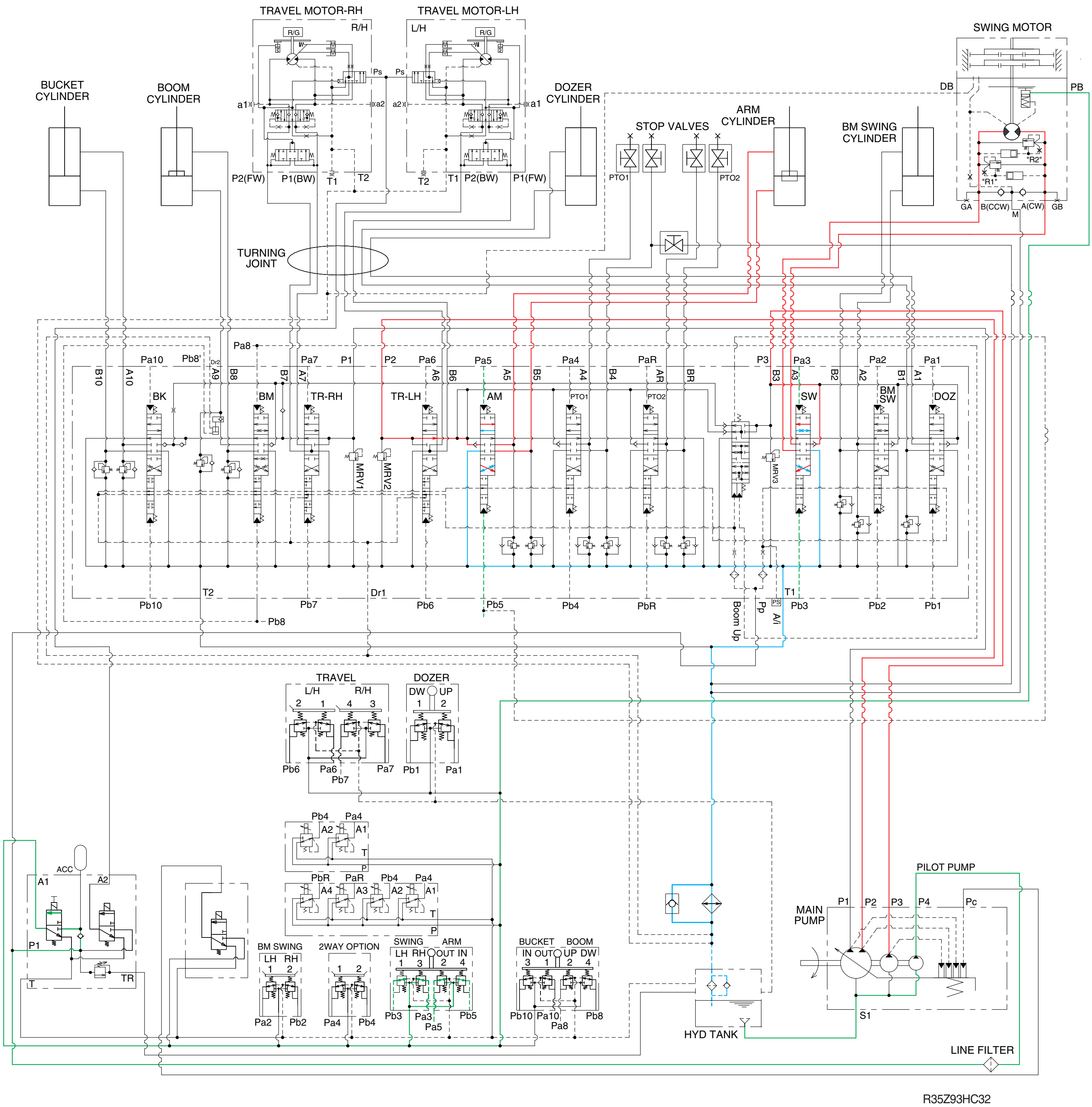
When the swing and boom functions are operated, simultaneously the swing spool and boom spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the P1 pump flows into the boom cylinder through boom.

The oil from the P3 pump flows into the swing motor through the swing spool.

The superstructure swings and the boom is operated.

3. COMBINED SWING AND ARM OPERATION



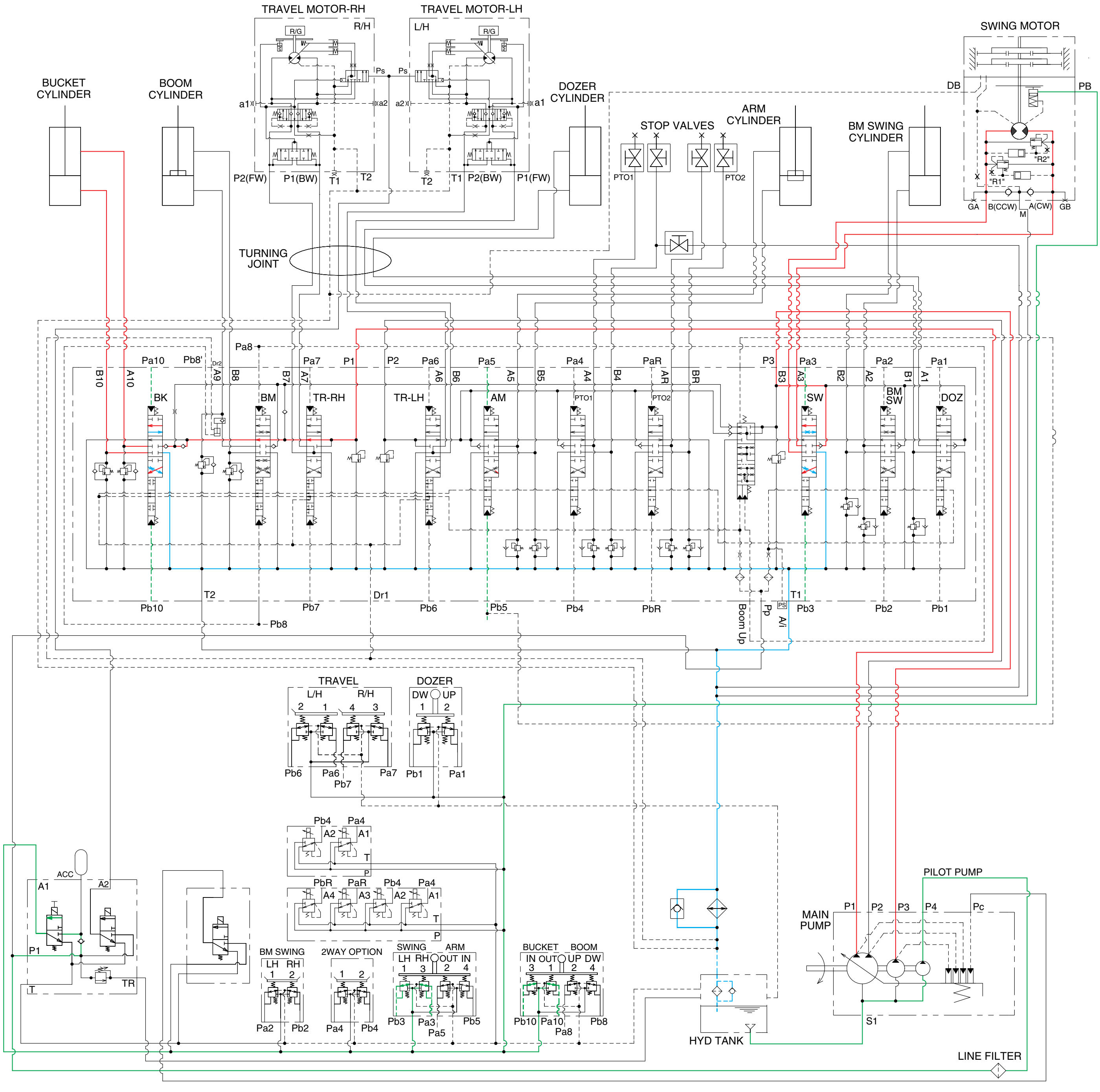
When the swing and arm functions are operated, simultaneously the swing spool and arm spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the P3 pump flows into the swing motor through swing spool.

The oil from the P2 pump flows into the arm cylinder through the arm.

The superstructure swings and the arm is operated.

4. COMBINED SWING AND BUCKET OPERATION



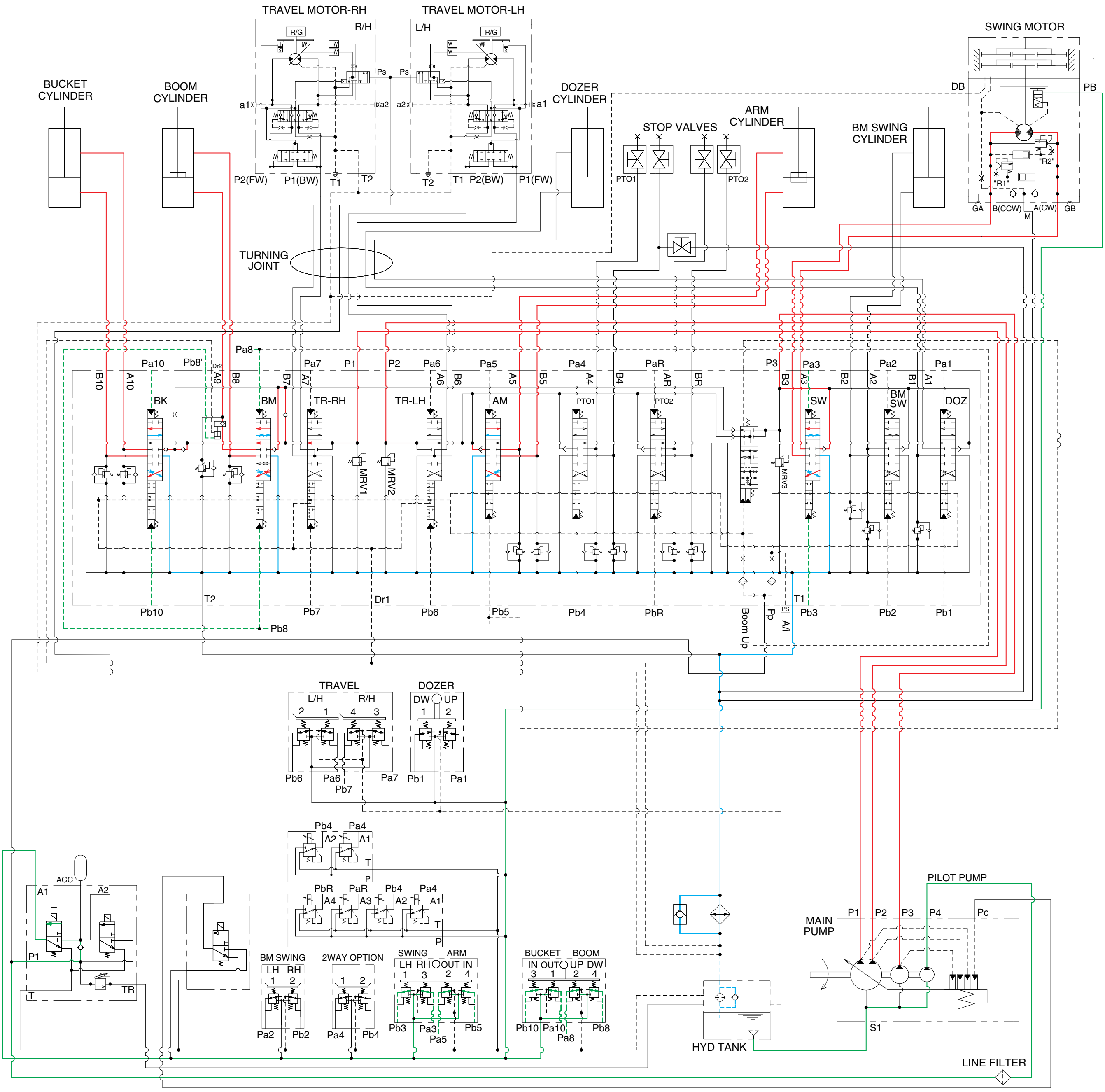
35Z9A3HC33

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

The oil from the P3 pump flows into the swing motor through the swing spool.

The oil from the P1 pump flows into the bucket cylinder through the bucket spool.

5. COMBINED SWING, BOOM, ARM AND BUCKET OPERATION



35Z9A3HC34

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

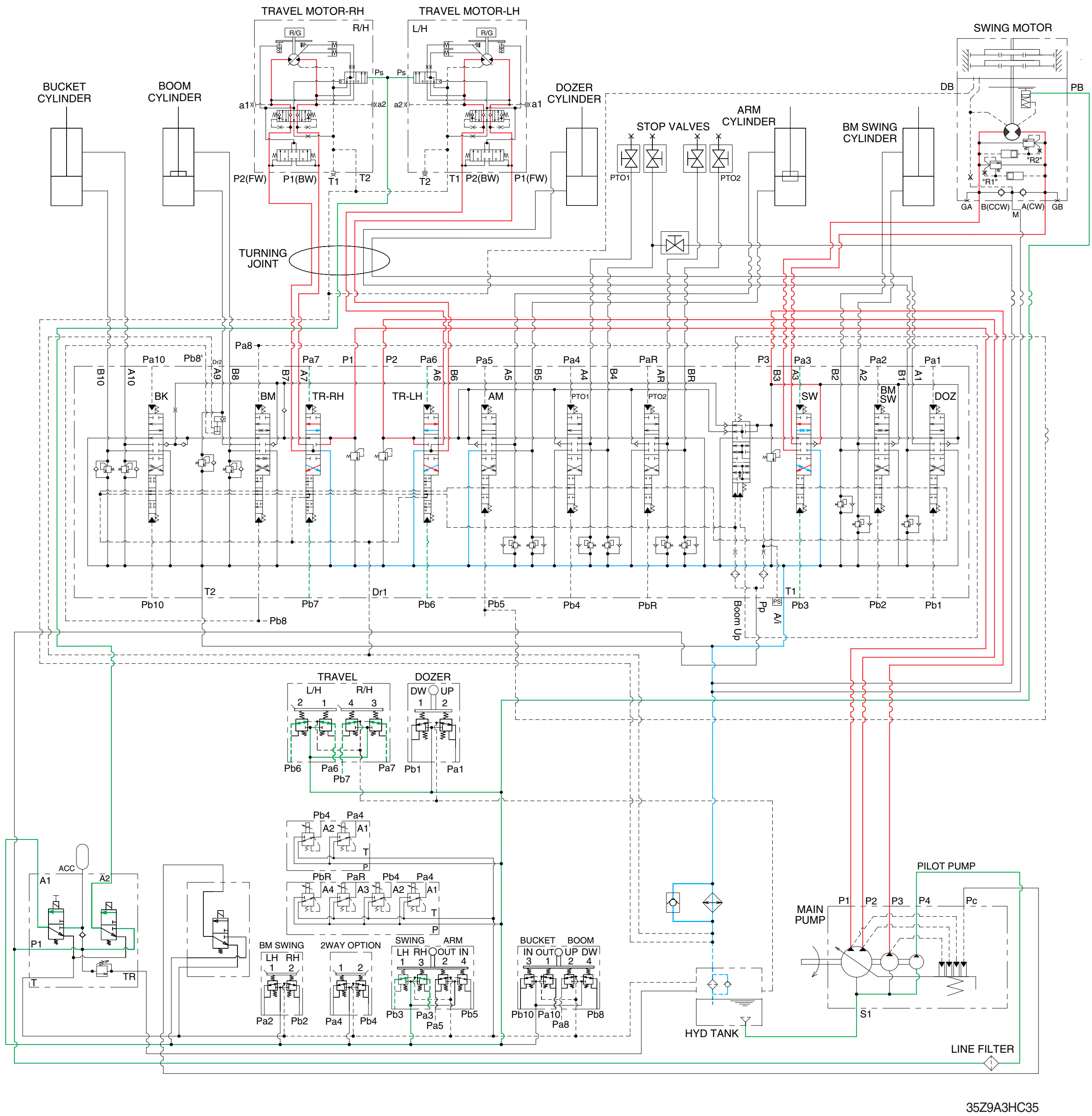
The oil from the P2 pump flows into the arm cylinder through, arm spool.

The oil from the P1 pump flows into the boom cylinders and bucket cylinder through the boom spool, bucket spool.

The oil from the P3 pump flows into the swing motor through the swing spool.

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

6. COMBINED SWING AND TRAVEL OPERATION



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

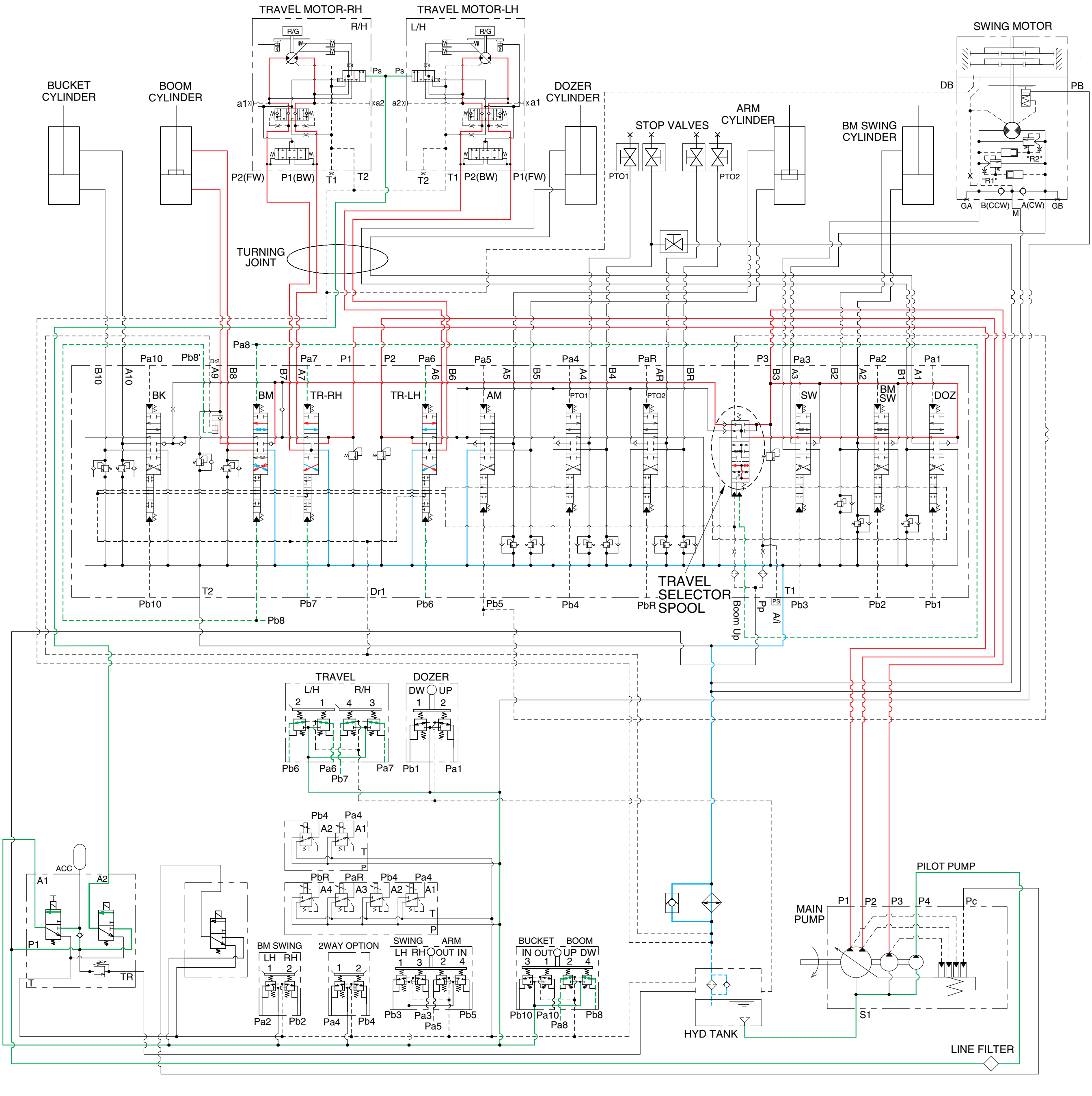
The oil from the P3 pump flows into the swing motor through the swing spool.

The oil from the P1 pump flows into the travel motor through the RH travel spool.

The oil from the P2 pump flows into the travel motor through the LH travel spool.

The superstructure swings and the machine travels straight.

7. COMBINED BOOM AND TRAVEL OPERATION



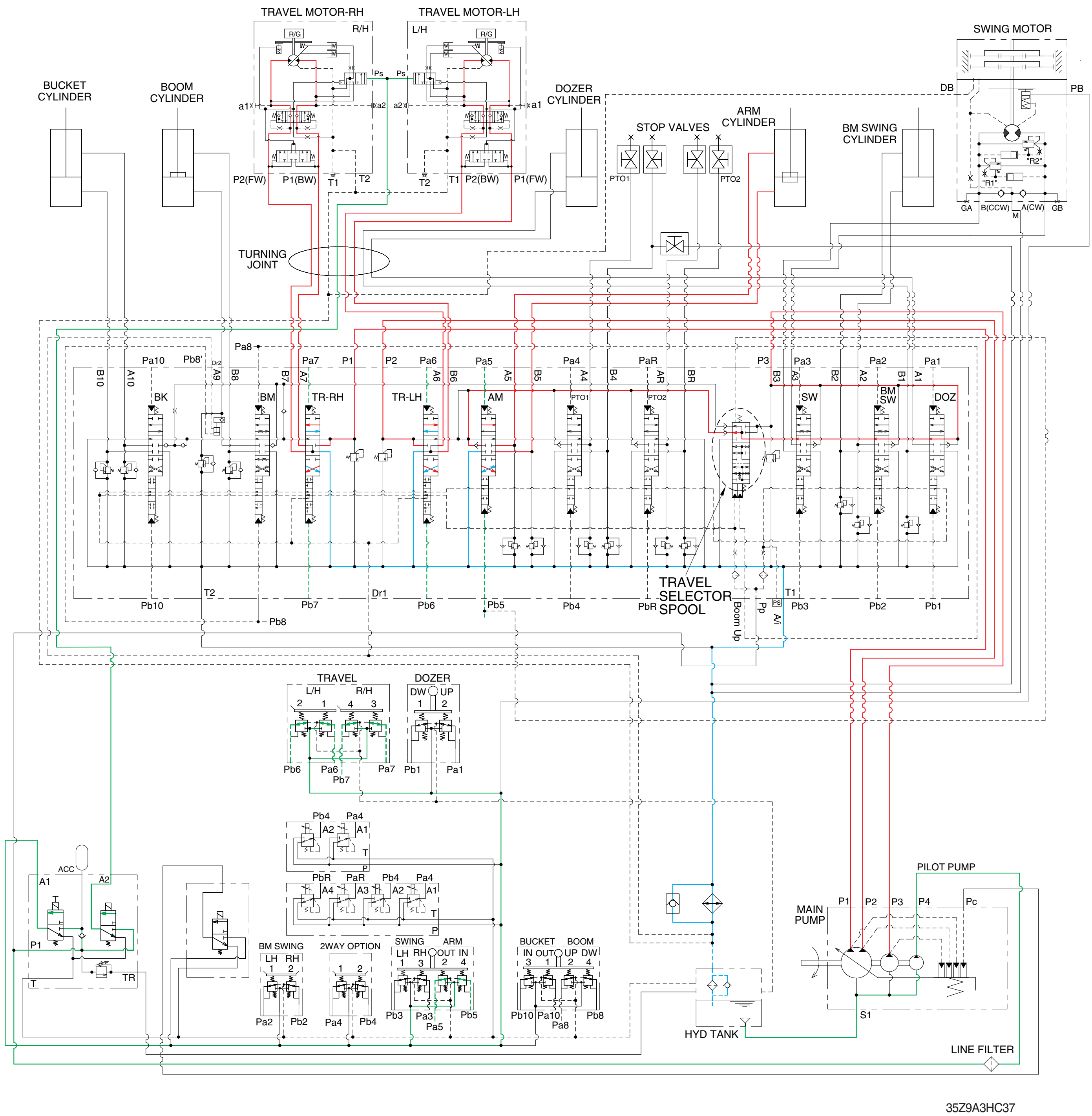
35Z9A3HC36

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

The oil from the P1 and P2 pumps flows into the travel motors through travel RH and travel LH spools.

The oil from the P3 pump flows into the boom cylinders through boom spool via the travel selector spool. The boom is operated and the machine travels straight.

8. COMBINED ARM AND TRAVEL OPERATION



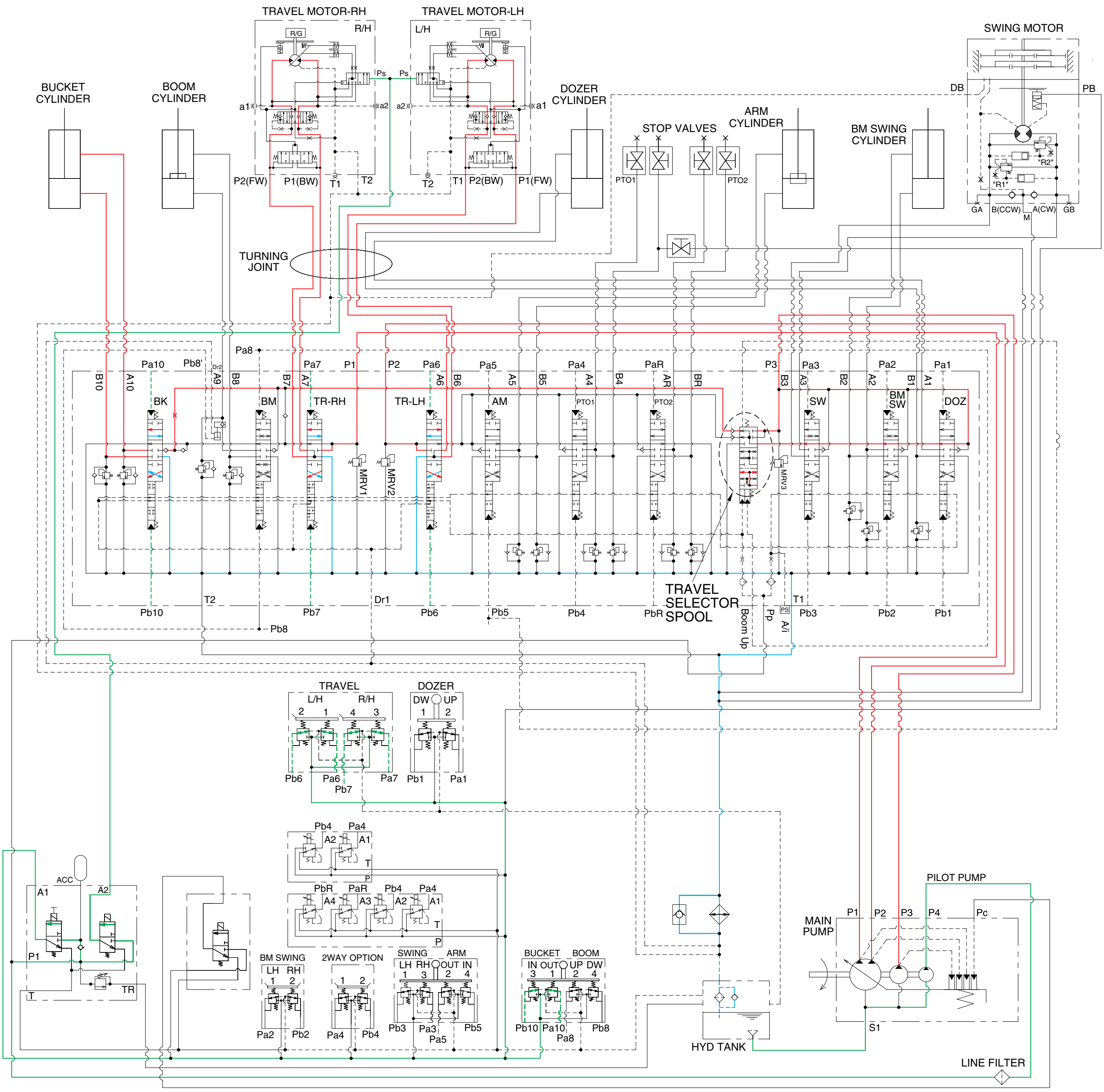
When the arm and travel functions are operated, simultaneously the arm spools and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the P1 and P2 pumps flows into the travel motors through travel spools.

The oil from the P3 pump flows into the arm cylinder through arm spool via the travel selector spool.

The arm is operated and the machine travels straight.

9. COMBINED BUCKET AND TRAVEL OPERATION



35Z9A3HC38

When the bucket and travel functions are operated, simultaneously the bucket spool and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve, and the travel selector spool is pushed to the up by the oil pressure from pilot pump. The oil from the P1 and P2 pumps flows into the travel motors.

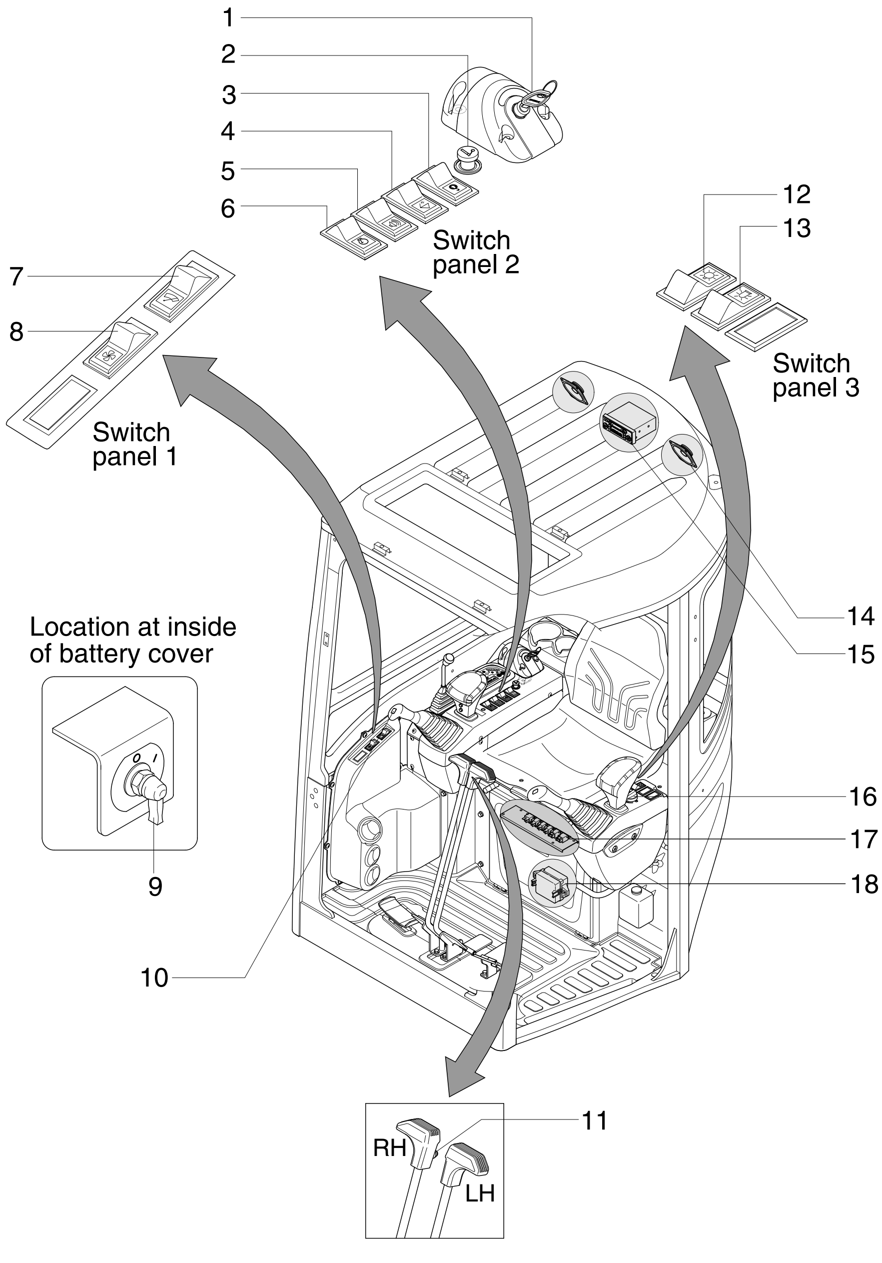
The oil from the P3 pump flows into the bucket cylinder through bucket spool via the travel selector spool.

The bucket is operated and the machine travels straight.

SECTION 4 ELECTRICAL SYSTEM

GROUP 1 COMPONENT LOCATION

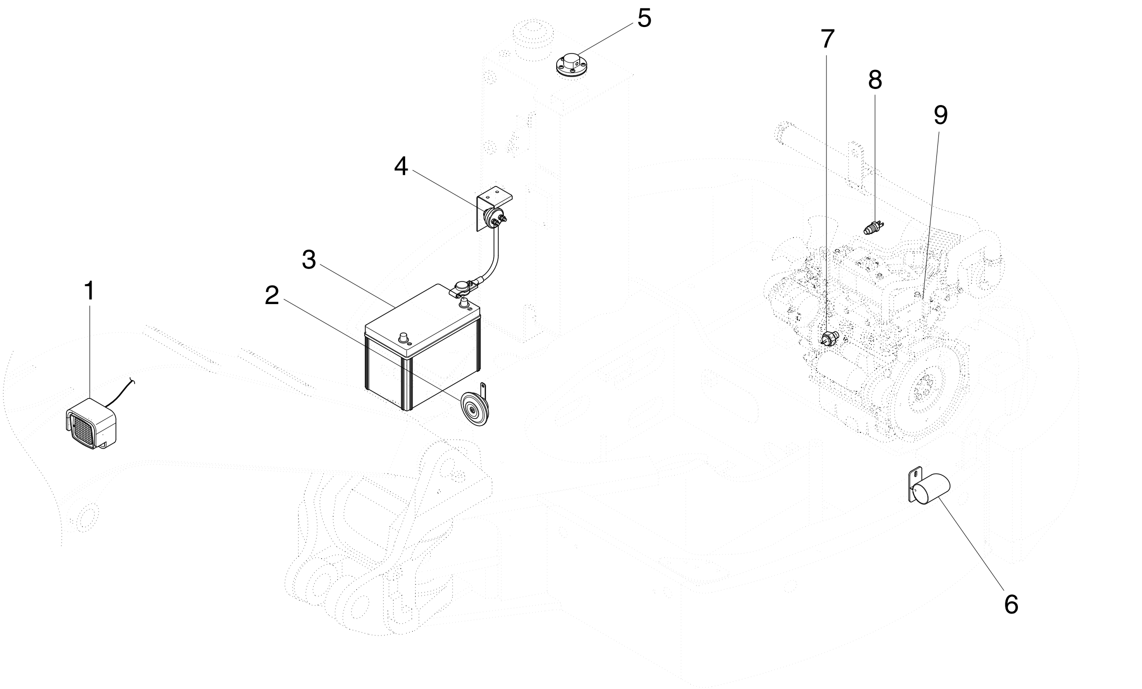
1. LOCATION 1



35Z9A4EL02

1	Start switch	7	Washer/wiper switch	13	Beacon switch
2	Cigar lighter	8	Heater switch	14	Speaker
3	Overload switch	9	Master switch	15	Radio & USB player
4	Quick clamp switch	10	Horn switch	16	Accel dial switch
5	Travel alarm switch	11	Travel speed control switch	17	Relay board assy
6	Auto idle switch	12	Main light switch	18	Fuse box

2. LOCATION 2



1	Work lamp	4	Master switch	7	Engine oil pressure switch
2	Horn	5	Fuel sender	8	Air cleaner pressure switch
3	Battery	6	Travel alarm buzzer	9	Water temperature sender

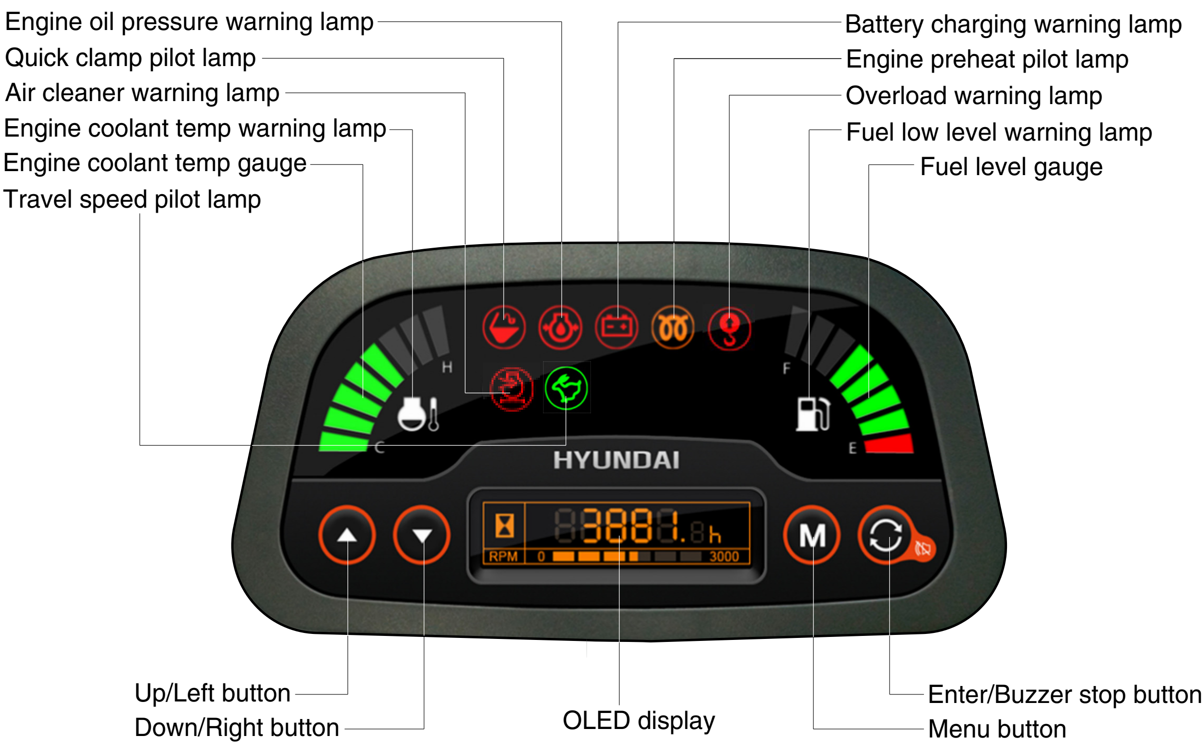
GROUP 2 MONITORING SYSTEM

The cluster consists of gauges and lamps as shown below, to warn the operator in case of abnormal machine operation or conditions for the appropriate operation and inspection.

- · Gauges : Indicate operating status of the machine.
- · Warning lamp : Indicate abnormality of the machine (red).
- · Pilot lamp : Indicate operating status of the machine.

※ The cluster installed on this machine does not entirely guarantee the condition of the machine. Daily inspection should be performed according to chapter 6, Maintenance.

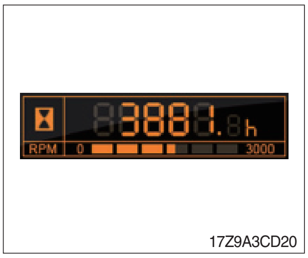
※ When the cluster provides a warning, immediately check the problem and perform the required action.



35Z9A3CD03

1) GAUGES AND DISPLAYS

(1) Service meter

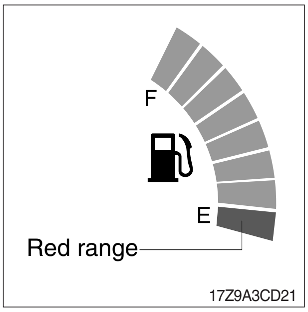


17Z9A3CD20

① This meter shows the total operation hours of the machine.

② Always ensure the operating condition of the meter during the machine operation.

(2) Fuel gauge



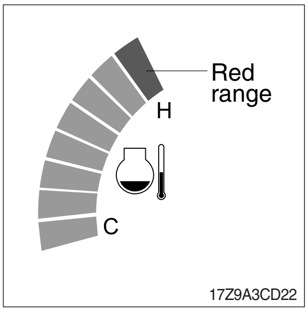
17Z9A3CD21

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

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

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

(3) Engine coolant temperature gauge



17Z9A3CD22

① This indicates the temperature of coolant.

· Red range : Above 115°C (239°F)

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

Check the radiator and engine.

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

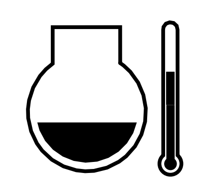
2) WARNING AND PILOT LAMPS

(1) Fuel low level warning lamp

R5573CD10

① This lamp ON and buzzer sounds when the level of fuel is below 8.5 l (2.2 U.S. gal).
② Fill the fuel immediately when the lamp ON.

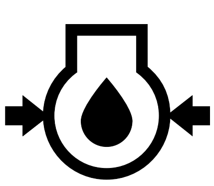
(2) Engine coolant temperature warning lamp



R25Z9A3CD08

① This lamp ON and buzzer sounds when the temperature of coolant is over the normal temperature 115˚C (239˚F) .
② Check the cooling system when the lamp ON.

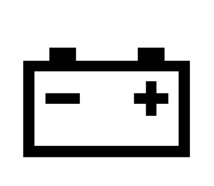
(3) Engine oil pressure warning lamp



R5573CD13

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

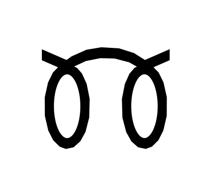
(4) Battery charging warning lamp



R5573CD16

① This lamp ON and buzzer sounds when the starting switch is ON, it is turned OFF after starting the engine.
② Check the battery charging circuit when this lamp blinks during engine operation.

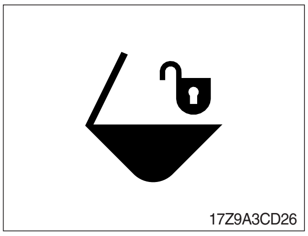
(5) Engine preheat pilot lamp



17Z9A3CD25

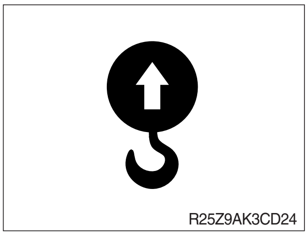
① When the start switch turn to HEAT position, pilot lamp comes ON.

(6) Quick clamp pilot lamp (option)



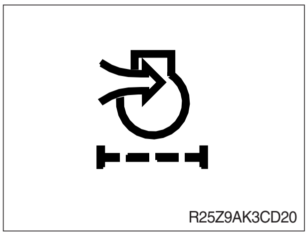
① When the quick clamp switch turned ON, this lamp turn ON and the buzzer sounds.
② This lamp turned OFF and the buzzer stop when the quick clamp switch turned OFF.

(7) Overload warning lamp (option)



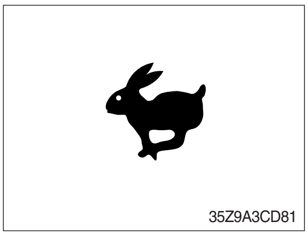
① When the machine is overload, this lamp blinks during the overload switch is ON.
② Reduce the machine load.

(8) Air cleaner warning lamp



① This lamp ON when the filter of air cleaner is clogged.
② When the air cleaner warning lamp is ON, clean the primary element.

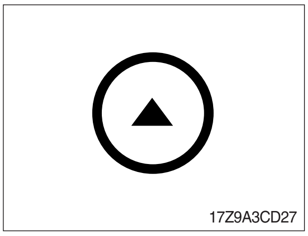
(9) Travel speed pilot lamp



① When this lamp turned ON, the machine travel high speed.
② Refer to the travel speed control switch in operator's manual for details.

3) BUTTONS

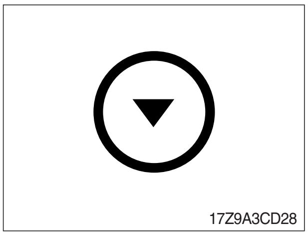
(1) Up/left button



17Z9A3CD27

① Move in menu (up, left)
② Increase input value.

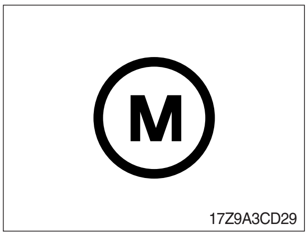
(2) Down/right button



17Z9A3CD28

① Move in menu (down, right)
② Decrease input value.

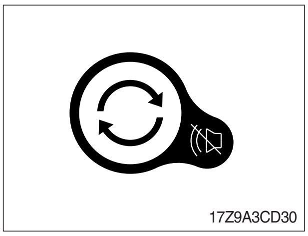
(3) Menu button



17Z9A3CD29

① Current display to next display.

(4) Enter and buzzer stop button

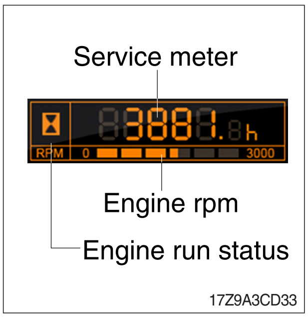


17Z9A3CD30

① Select menu (enter).
② Stop buzzer sound when sound is ON.

4) OLED display

(1) Main display



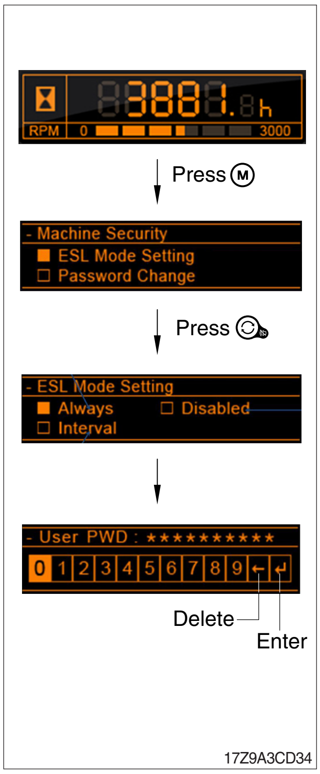
① **Service meter :** This meter shows the total operation hours of the machine.

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

② **Engine rpm** : This displays the engine speed.

③ **Engine run status :** This displays the engine run ststus.

(2) Machine security



① ESL (Engine Starting Limit) mode setting

- ESL mode is designed to be a theft deterrent or will prevent the unauthorized operation of the machine.
- If the ESL mode was selected Always, the password will be required when the start switch is turned ON.
- Disable : Not used ESL function.

  Always:The password is required whenever the operator start engine.

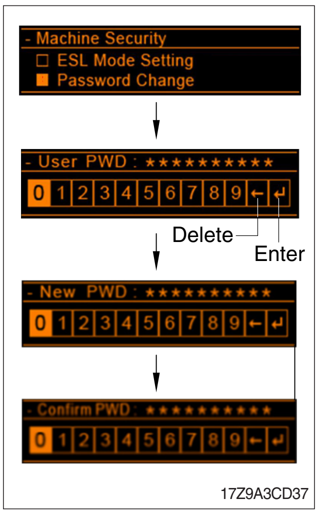
  Interval : The password is required when the operator start engine first. But the operator can restart the engine within the interval time without inputting the password.

  The interval time can be set maximum 2 days.

· Interval time

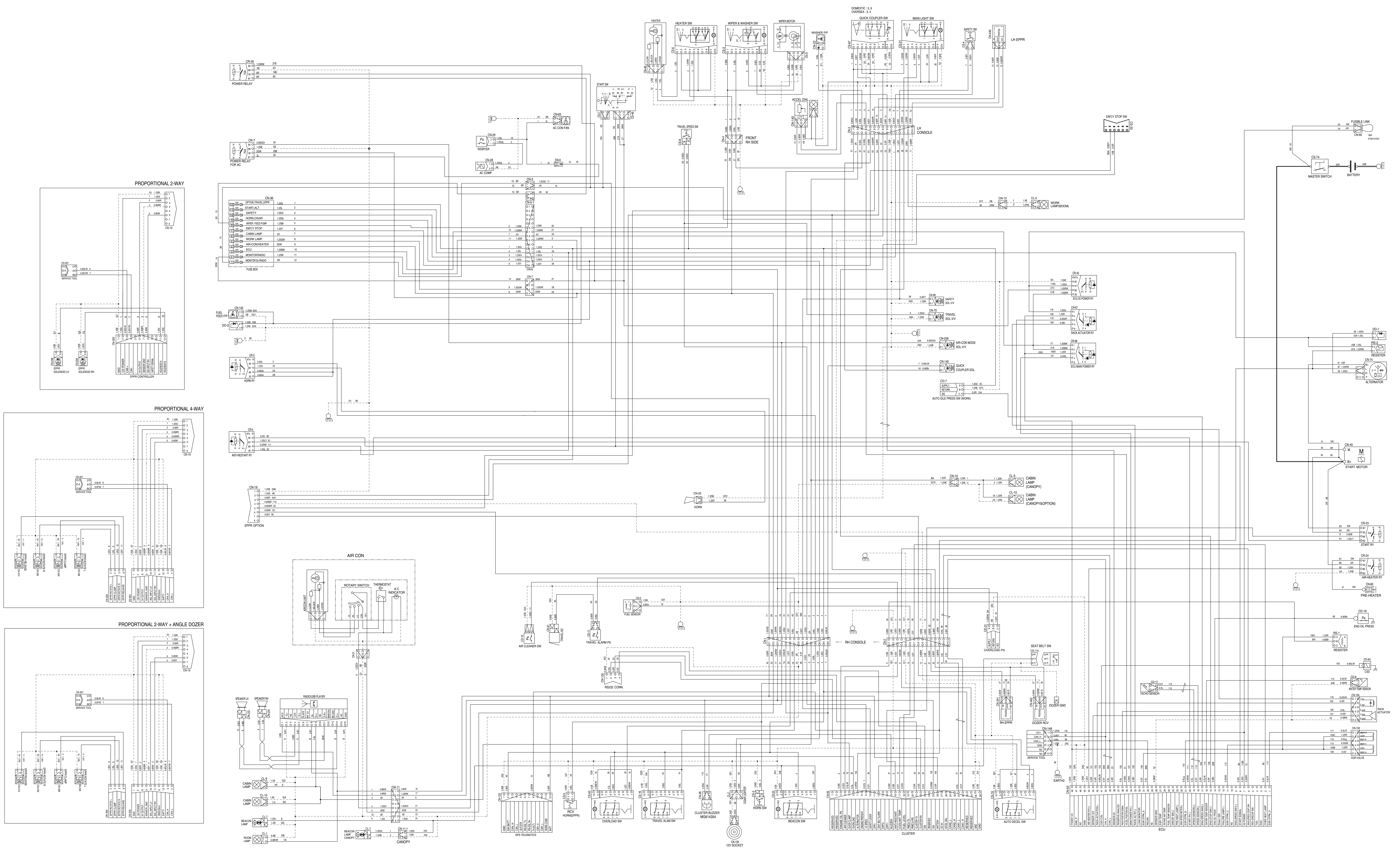
- If set interval time to 5 minutes, ESL system is activated after 5 minutes. Therefore, the password does not need to restart engine within 5 minutes.

※ **Default password : 00000**



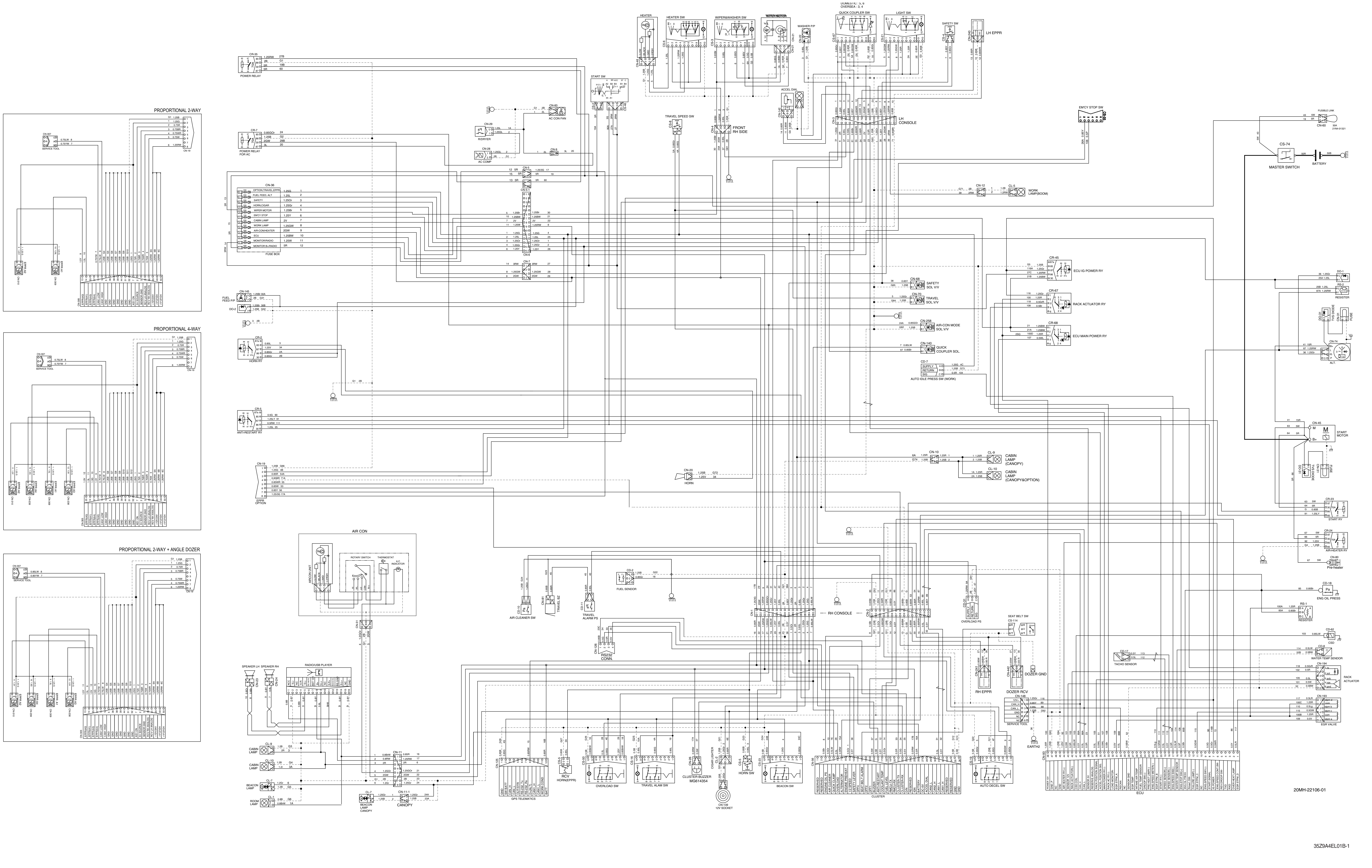
② Password change

- Input 5 to 10 digits and press Enter.



35Z9A4EL01A

ELECTRICAL CIRCUIT (machine serial No. : #0942~)



MEMORANDUM

HYUNDAI HEAVY INDUSTRIES CO., LTD.
CONSTRUCTION EQUIPMENT DIV.

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 → Master switch [CS-74] → Fusible link (CN-60) ┬→ Start switch [CS-2 (1)]
└→ I/conn [CN-5 (2)] →

Fuse box [No.1] → I/conn [CN-5 (1)] → I/conn [CN-1 (1)] ┬→ Cluster [CN-56 (26)]
└→ I/conn [CN-11 (1)] →

┬→ Room lamp [CL-1 (1)]
└→ Radio & USB player [CN-27 (8)]

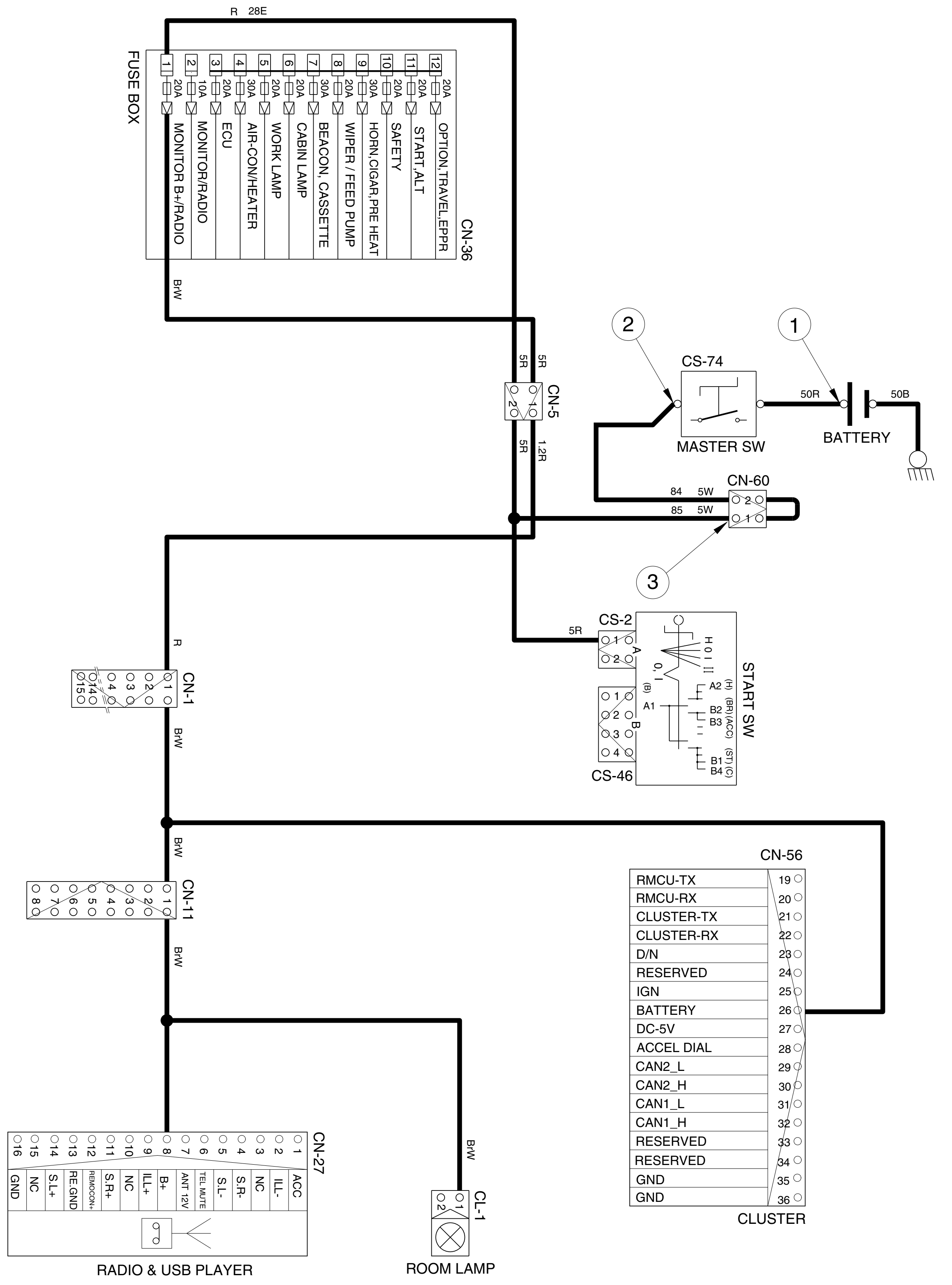
※ I/conn : Intermediate connector

2) CHECK POINT

Engine	Start switch	Check point	Voltage
OFF	OFF	① - GND (Battery) ② - GND (Master switch) ③ - GND (Fusible link)	10~12.5 V

※ GND : Ground

POWER CIRCUIT



2. STARTING CIRCUIT

1) OPERATING FLOW

Battery(+) terminal → Master switch [CS-74] → Fusible link [CN-60]

- → Start switch [CS-2 (1)]
- → I/conn [CN-5 (2)] → Fuse box No.1
- → Power relay [CR-35 (30)]

※ **Start switch : ON**

Start switch ON → [CS-46 (2, 3)] → I/conn [CN-7 (1)]

- → Fuse box No. 2 (power is supplied)
- → ECU IG power relay [CR-45 (86)]
- → Power relay [CR-35 (85) → (87)] → Fuse box (all power is supplied with electric component)

※ **Start switch : START**

Start switch START [CS-46 (1)]

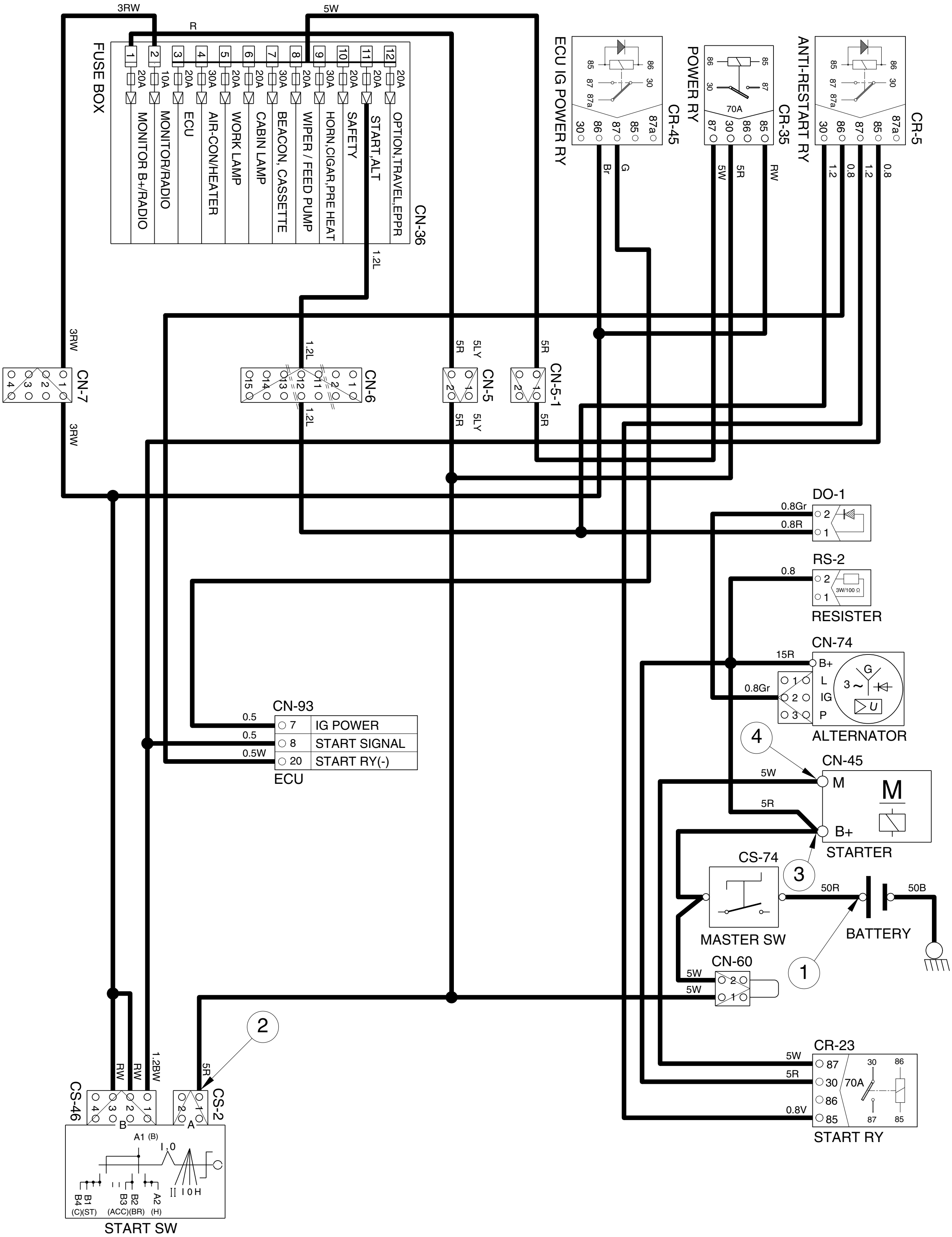
- → Anti-restart relay [CR-5 (85) → (87)] → Start relay [CR-23 (87)] → Starter [CN-45 (M)] → Starter operating
- → ECU [CN-93 (8)]

2) CHECK POINT

Engine	Start switch	Check point	Voltage
Operating	Start	① - GND (Battery) ② - GND (Start key) ③ - GND (Starter B^+) ④ - GND (Starter M)	10~12.5 V

※ GND : Ground

STARTING CIRCUIT



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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.

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 (13)] → Cluster [CN-56 (7)] → Cluster warning lamp ON

(2) Charging flow

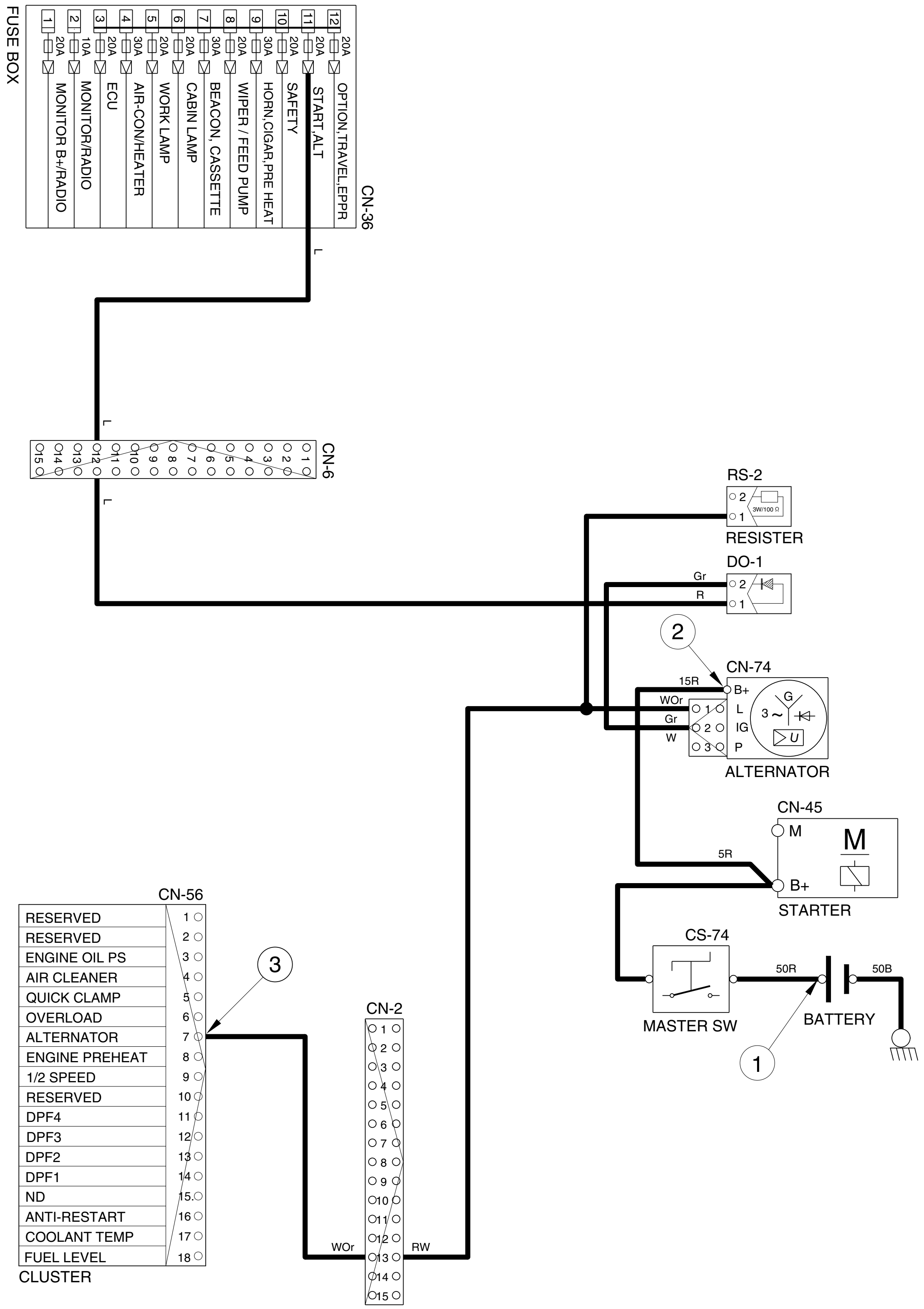
Alternator "B+" terminal → Battery(+) terminal

2) CHECK POINT

Engine	Start switch	Check point	Voltage
ON	ON	① - GND (Battery voltage) ② - GND (Alternator B^+ terminal) ③ - GND (Cluster)	10~12.5 V

※ GND : Ground

CHARGING CIRCUIT



4. HEAD AND WORK LIGHT CIRCUIT

1) OPERATING FLOW

Fuse box (No.6) → Main light switch [CS-21 (1)]
Fuse box (No.5) → Main light switch [CS-21 (4)]

(1) Main light switch ON : 1st step

Cabin light switch ON [CS-21 (5, 7)] → I/conn [CN-3 (2)] → I/conn [CN-1 (11)]
→ I/conn [CN-11 (3)] → Cabin Lamp (Head Lamp) ON [CL-9, 10 (2)]

(2) Main light switch ON : 2nd step

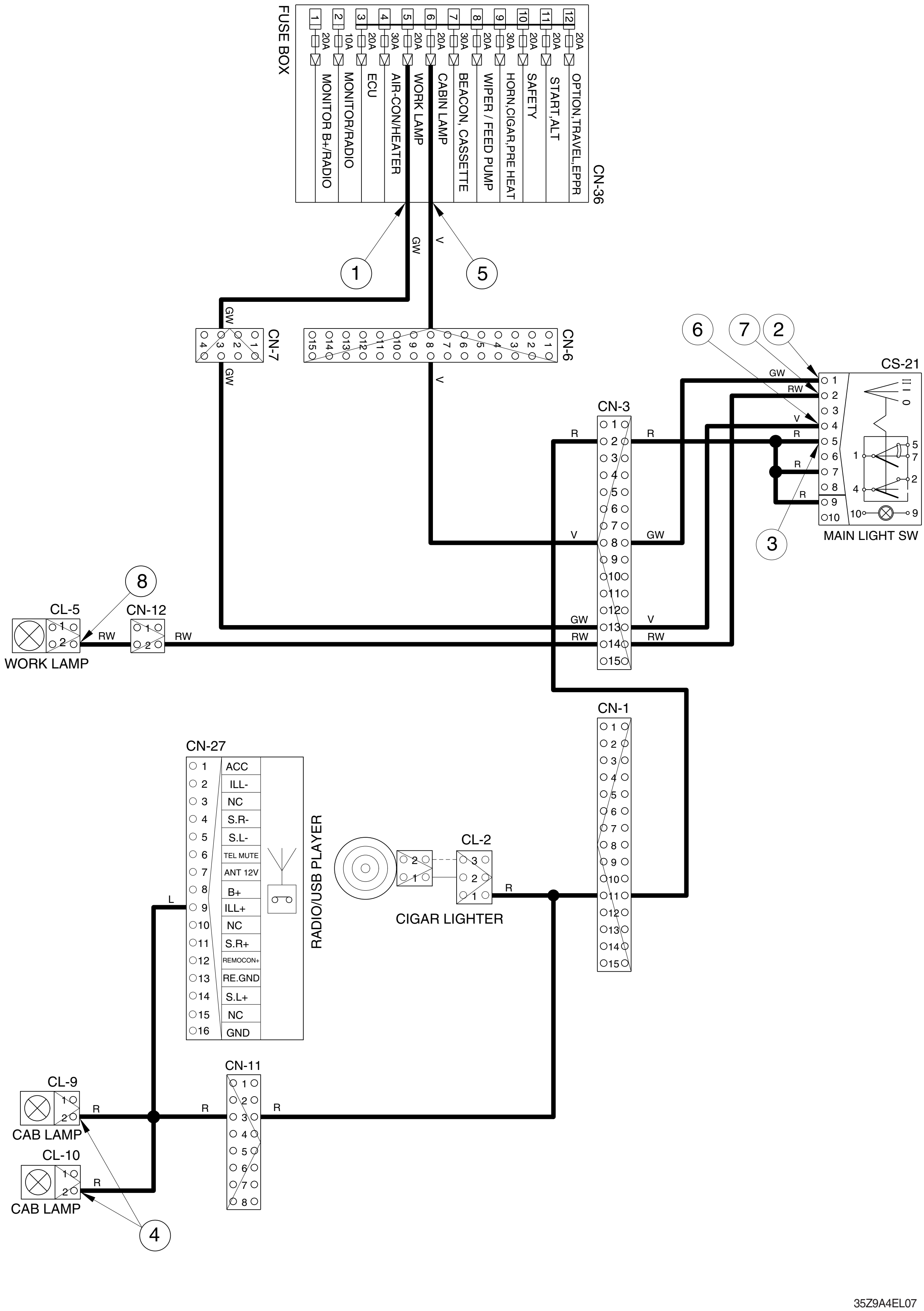
Work light switch ON [CS-21 (2)] → I/conn [CN-3 (14)] → I/conn [CN-12 (2)] → Work light ON [CL-5 (2)]

2) CHECK POINT

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

※ GND : Ground

HEAD AND WORK LAMP CIRCUIT



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5. BEACON LAMP CIRCUIT

1) OPERATING FLOW

Fuse box (No.7) → I/conn [CN-6 (15)] → I/conn [CN-3 (5)] → Beacon lamp switch [CS-23 (5)]

(1) Beacon lamp switch ON

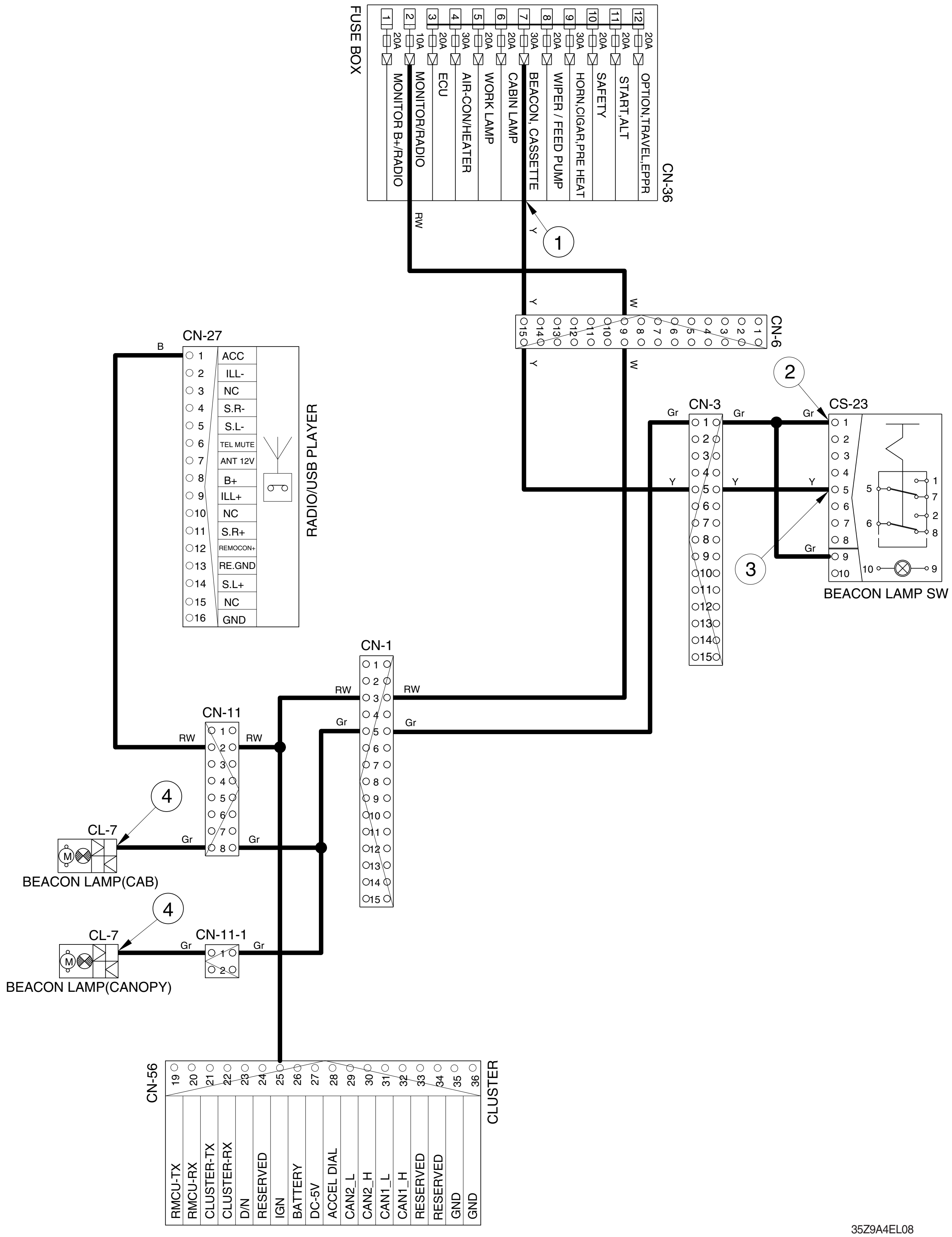
Beacon lamp switch ON [CS-23 (1)]
→ Switch Indicator lamp ON [CS-23 (9)]
→ I/conn [CN-3 (1)] → I/conn [CN-1 (5)] → I/conn [CN-11 (8)] → Beacon lamp ON [CL-7]

2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (Fuse box) ② - GND (Switch power input) ③ - GND (Switch power output) ④ - GND (Beacon lamp)	10~12.5 V

※ GND : Ground

BEACON LAMP CIRCUIT



6. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

(1) Key switch ON

Fuse box (No.8) → I/conn [CN-6 (6)] → I/conn [CN-4 (1)]
→ Wiper and washer switch [CS-3 (1)]
→ Wiper motor [CN-21 (3)]

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

Wiper switch ON [CS-3 (6)] → Wiper motor operating [CN-21 (4)]
→ Wiper & washer switch lamp ON [CS-3 (9)]

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

Wiper switch ON [CS-3 (6)] → Wiper motor operating [CN-21 (4)]
Wiper switch ON [CS-3 (3)] → I/conn [CN-4 (3)] → I/conn [CN-3 (3)]
→ Washer pump operating [CN-22 (2)]

(4) Auto parking (when switch OFF)

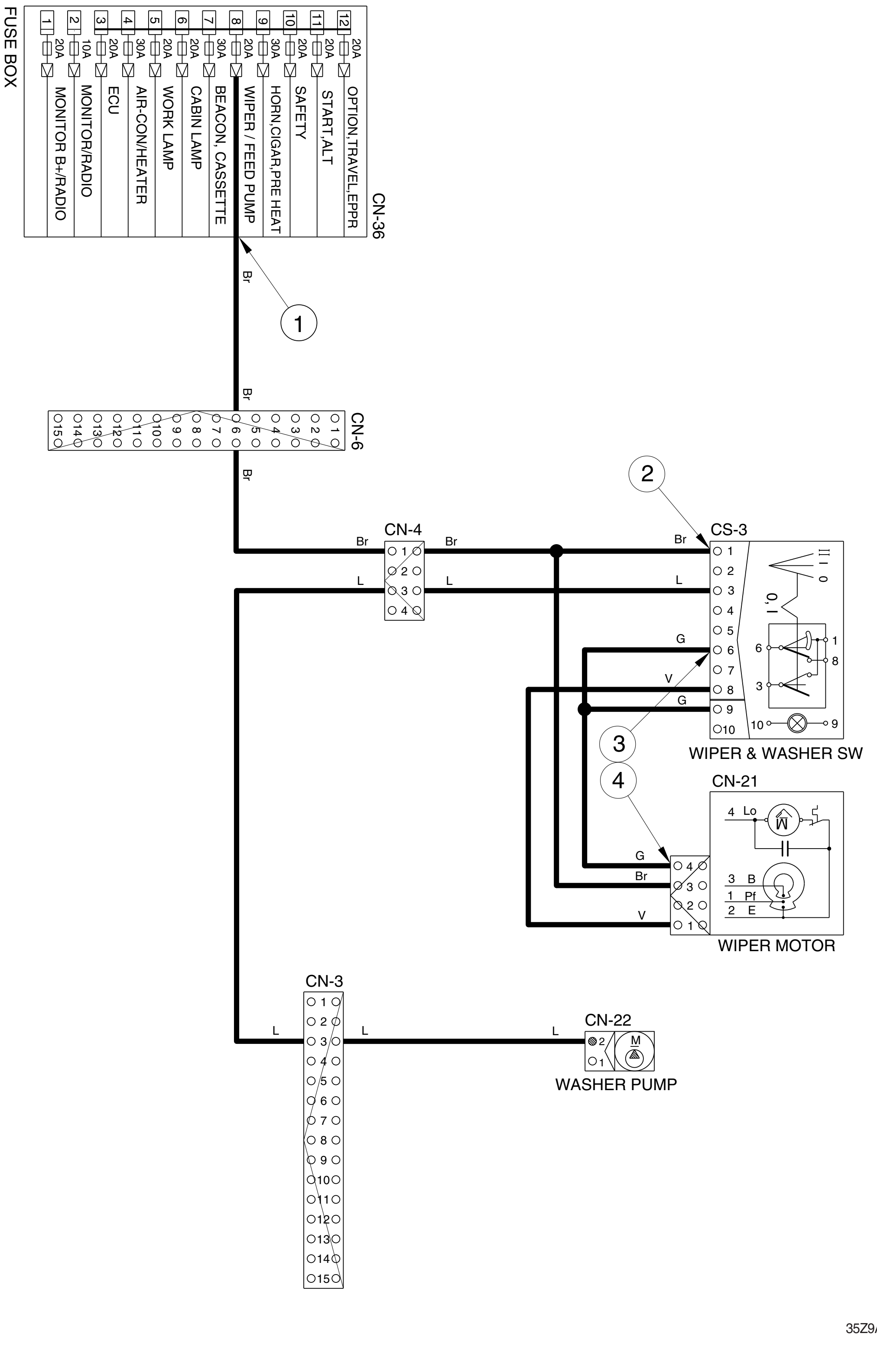
Switch OFF → Wiper motor [CN-21 (1)] → Wiper switch [CS-3 (8) → (6)]
→ Wiper motor [CN-21 (4)] → Wiper motor parking position by wiper motor controller

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)	10~12.5 V

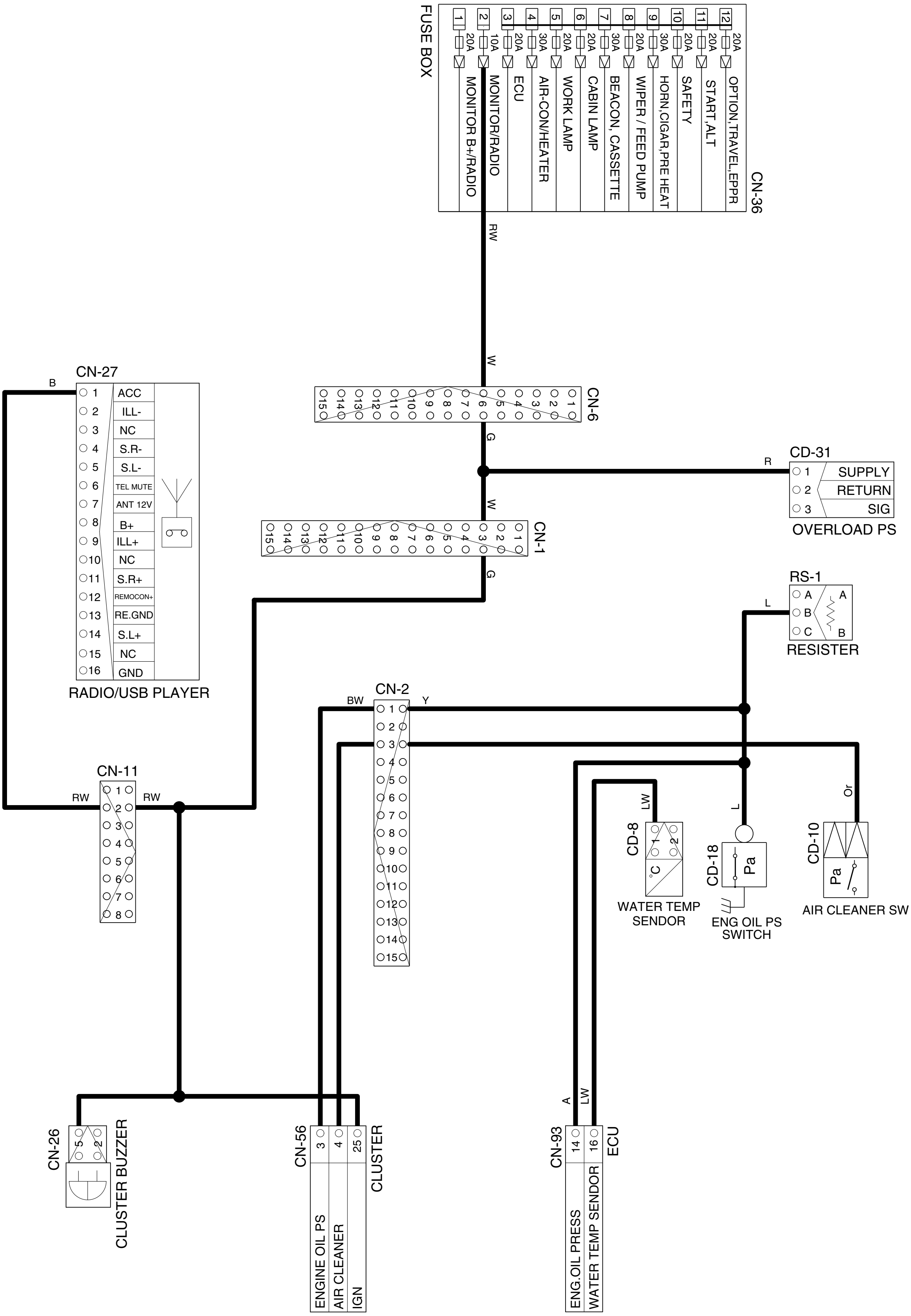
※ GND : Ground

WIPER AND WASHER CIRCUIT



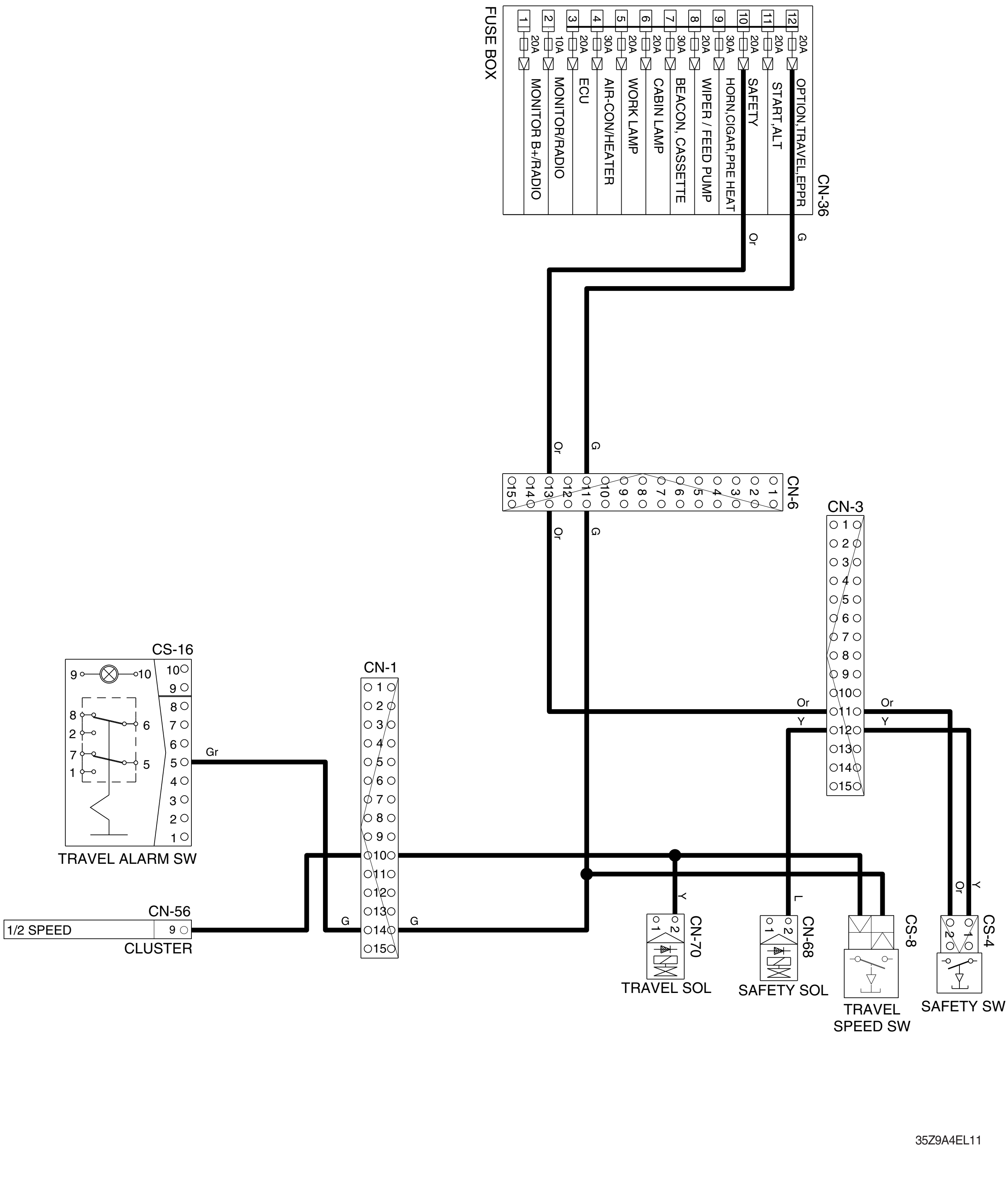
35Z9A4EL09

MONITORING CIRCUIT

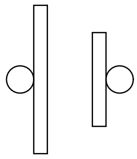
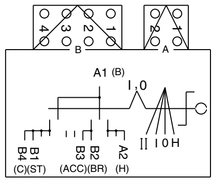
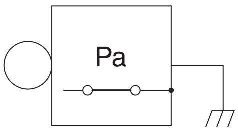
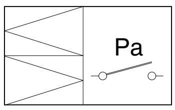


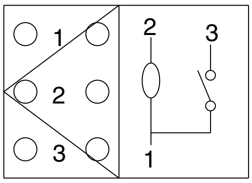
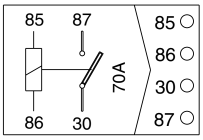
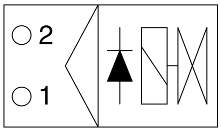
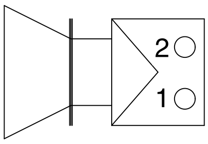
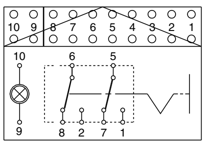
35Z9A4EL10

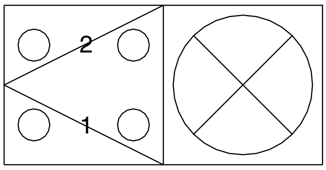
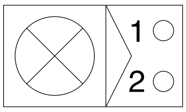
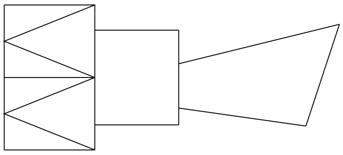
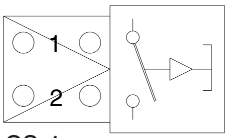
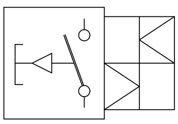
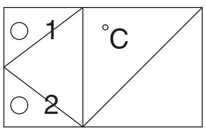
ELECTRIC CIRCUIT FOR HYDRAULIC

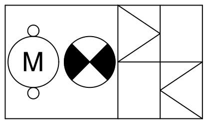
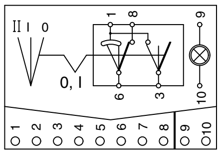
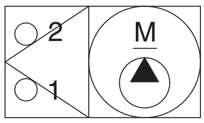
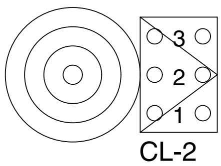
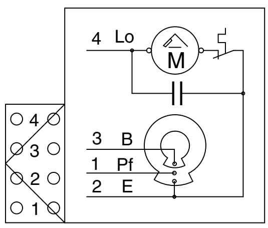
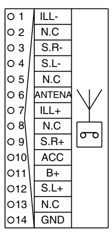


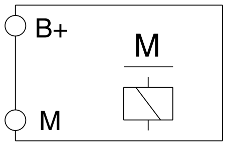
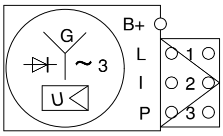
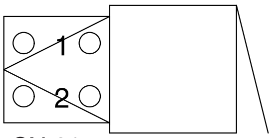
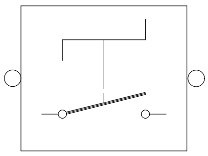
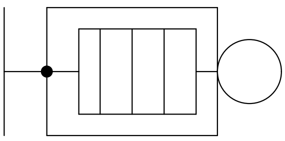
GROUP 4 ELECTRICAL COMPONENT SPECIFICATION

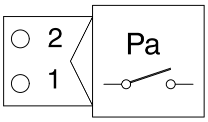
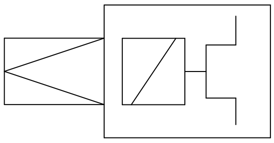
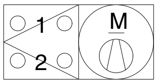
Part name	Symbol	Specification	Check
Battery		12V × 70Ah (20h rating)	※ Check specific gravity 1.280 over : Over charged 1.280 ~ 1.250 : Normal 1.250 below : Recharging
Start key	 CS-2 CS-46	12V	※ Check contact OFF : ∞ Ω (for each terminal) ON : 0 Ω (for terminal 1-3 and 1-2) START : 0 Ω (for terminal 1-5)
Pressure switch (for engine oil)	 CD-18	0.5 kgf/cm^2 (N.C TYPE)	※ Check resistance Normal : 0 Ω (CLOSE)
Air cleaner pressure switch	 CD-10	Pressure: 635 mmH_2O (N.O TYPE)	※ Check contact Normal : ∞ Ω

Part name	Symbol	Specification	Check
Fuel sender	 CD-2	-	※ Check resistance Full : 30 Ω Low : 100 Ω Empty warning : 200 Ω
Relay (power, starter, air-heater, aircon power)	 CN-7 CR-23 CR-24 CR-35	12V 70A	※ Rated coil current 1.2±0.3 A
Solenoid valve	 CN-68 CR-70 CR-140 CR-258	12V 1A	※ Check resistance Normal : 15~25 Ω (for terminal 1-2)
Speaker	 CN-23 (LH) CR-24 (RH)	4 Ω 20W	※Check resistance Normal : 4 Ω
Switch (Looking type)	 CS-16 CS-19 CS-23 CS-50	12V 16A	※ Check contact Normal OFF - ∞ Ω (for terminal 1-5,2-6) - 0 Ω (for terminal 5-7,6-8)

Part name	Symbol	Specification	Check
Lamp	 CL-5 CL-9 CL-10	12V 55W (H3 TYPE)	※ Check disconnection Normal : 1.2 Ω
Room lamp	 CL-1	12V 10W	※ Check disconnection Normal : A few Ω
Horn	 CN-20	12V 6A	132±5 dB
Safety switch	 CS-4	Micro 12V 15A	※ Check contact Normal : 0 Ω Operating : ∞ Ω
Horn switch	 CS-5	12V 10A	※ Check contact Normal : 0 Ω
Water temp sender	 CD-8	-	※ Check contact 50˚C : 0.748~0.904 Ω 67˚C : 0.538~0.650 Ω 102˚C : 0.185~0.167 Ω 110˚C : 0.143~0.130 Ω 135˚C : 0.076~0.100 Ω

Part name	Symbol	Specification	Check
Beacon lamp	 CL-7	12V (strobe type)	※ Check disconnection Normal : A few Ω
Wiper & washer switch	 CS-3	12V 16A	※Check contact Normal : ∞ Ω
Washer pump	 CN-22	12V 3.8A	※Check contact Normal : 3 Ω (for terminal 1-2)
Cigar lighter	 CL-2	12V 10A 1.4W	※Check coil resistance Normal : About 1M Ω ※ Check contact Normal : ∞ Ω Operating time : 5~15sec
Wiper motor	 CN-21	12V 3A	※Check contact Normal : 6 Ω (for terminal 2-6)
Radio & USB player	CN-27 	12V 3A	※ Check voltage 10 ~ 12.5V (for terminal 10-14,11-14)

Part name	Symbol	Specification	Check
Starter	 CN-45	12V 2.3kW	※ Check contact Normal : 0.1 Ω
Alternator	 CN-74	12V 55A	※ Check contact Normal : 0 Ω (For terminal B^{+}-1) Normal : 10 ~ 12.5V
Travel alarm	 CN-81	12V	-
Master switch	 CN-74	12V 1000A	-
Air-heater	 CN-80	12V 42A 500W	-

Part name	Symbol	Specification	Check
Receiver dryer	 CN-29	12V	※ Check contact Normal : 0 Ω
Compressor	 CN-28	12V 38W	-
Air con fan motor	 CN-83	12V 8.5A	-

GROUP 5 CONNECTORS

1. CONNECTOR DESTINATION

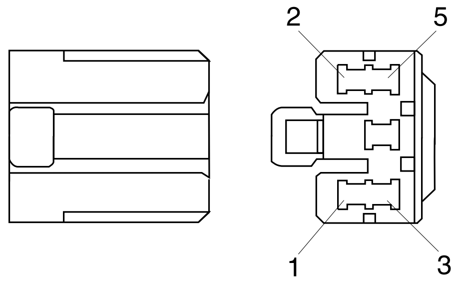
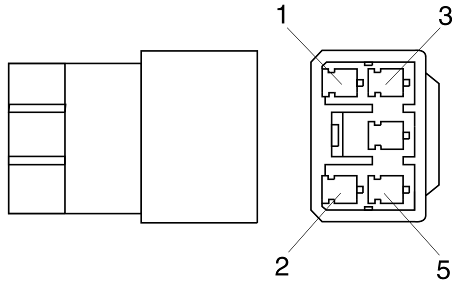
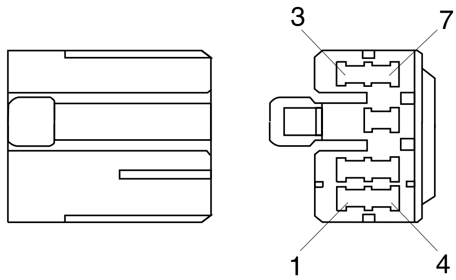
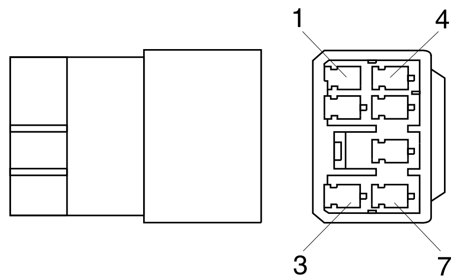
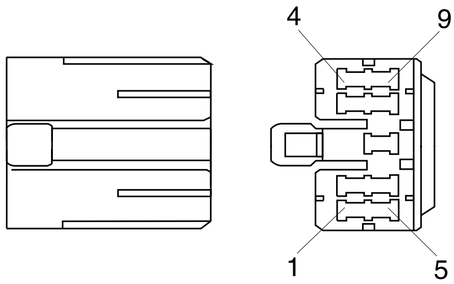
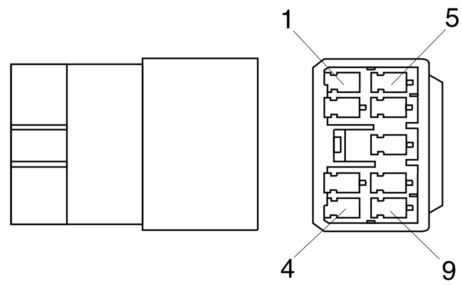
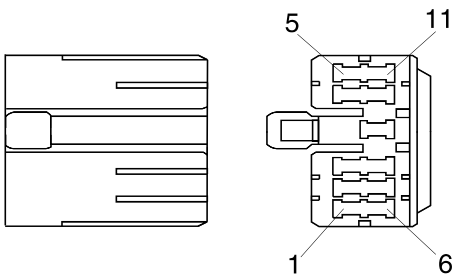
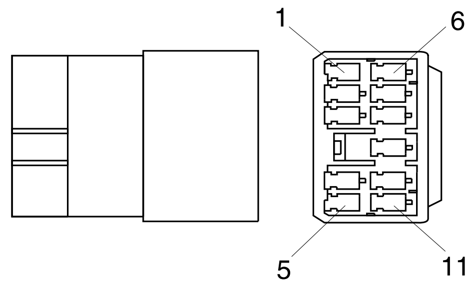
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-1	AMP	15	I/conn (RH console harness-main harness)	2-85262-1	368301-1
CN-2	AMP	15	I/conn (Main harness-RH console harness)	2-85262-1	368301-1
CN-3	AMP	15	I/conn (Main harness-LH console harness)	2-85262-1	368301-1
CN-4	AMP	4	I/conn (Main harness-heater/wiper harness)	S810-004202	S810-104202
CN-5	KET	2	I/conn (Relay harness-main harness)	S813-030201	S813-130201
CN-6	AMP	15	I/conn (Relay harness-main harness)	2-85262-1	368301-1
CN-7	AMP	4	I/conn (Relay harness-main harness)	S810-004202	S810-104202
CN-8	AMP	4	I/conn (LH EPPR harness-LH console harness)	S810-004202	S810-104202
CN-9	AMP	1	I/conn (Main harness-aircon harness)	S810-001202	S810-101202
CN-10	AMP	2	I/conn (Main harness-cab lamp harness)	S816-002002	S816-102002
CN-11	AMP	8	I/conn (RH console harness-cab harness)	S816-008202	S816-108202
CN-11-1	AMP	2	I/conn (RH console harness-canopy harness)	S816-002002	S816-102002
CN-12	AMP	2	Work lamp (boom)	DT06-2S-P012	-
CN-20	DEUTSCH	2	Horn	35825-0211	-
CN-21	AMP	4	Wiper motor	180900-0	-
CN-22	KET	2	Washer tank	MG640605	-
CN-23	KET	1	Speaker - LH	S822-014002	S822-114002
CN-24	KET	1	Speaker - RH	S822-014002	S822-114002
CN-27	-	16	Radio & USB player	173852-1	-
CN-28	AMP	2	Air-con compressor	S810-001203	-
CN-29	KET	2	Receiver dryer	MG640795	-
CN-36	-	-	Fuse box body	F12890010	-
CN-45	RING TERM	1	Starter	S820-408000	-
	RING TERM	1	Starter	ST710246-2	-
CN-46	AMP	4	Heater	180900-0	
CN-56	AMP	36	Cluster	175977-2	-
CN-60	AMP	2	Fusible link	-	S813-130200
CN-68	DEUTSCH	2	Safety solenoid	DT06-2S-P012	-
CN-70	DEUTSCH	2	Travel HI-LO solenoid	DT06-2S-P012	-
CN-74	SUMITOMO	3	Alternator	6189-0443	-
CN-80	RING TERM	1	Pre heater	S810-001302	-
CN-81	SWP	1	Travel buzzer	S822-014000	S822-114000
CN-83	KET	2	Air-con condenser fan	-	MG610164
CN-93	FCI	48	ECU	PP1000443	-
CN-113	AMP	2	Buzzer	S810-002201	-

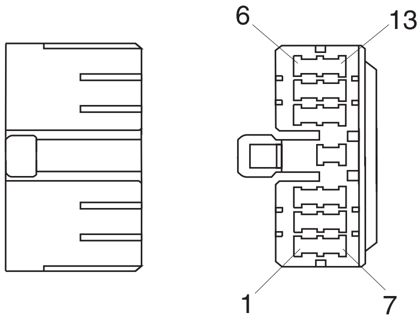
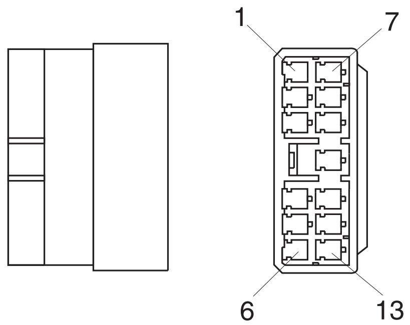
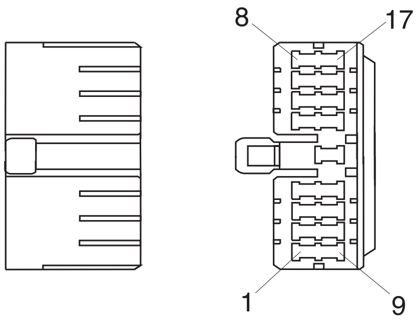
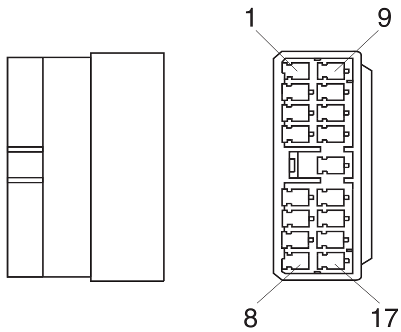
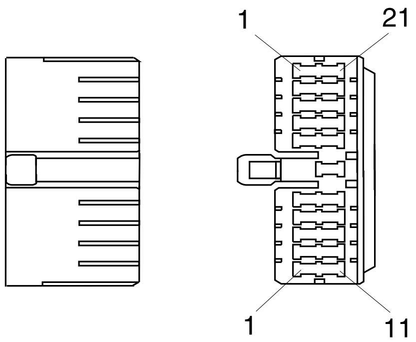
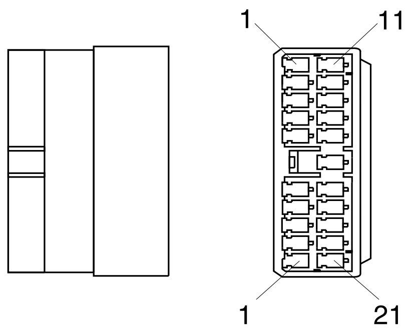
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-140	DEUTSCH	2	Quick clamp	DT06-2S-P012	DT04-2P-E004
CN-142	DEUTSCH	3	Accel dial	DT06-3P	-
CN-145	YAZAKI	2	Fuel feed pump	7123-6423-30	-
CN-241	DEUTSCH	3	RH EPPR	DT06-3S	-
CN-258	DEUTSCH	2	Aircon mode solenoid valve	DT06-2S-P012	DT04-2P-E005
CN-305	DEUTSCH	12	EPPR controller	DTM06-12SA	-
CN-307	DEUTSCH	3	Service tool	DT06-3S-EP06	-
LAMP					
CL-1	KET	2	Room lamp	MG610070	-
CL-2	AMP	3	Cigar lighter	S810-003202	-
CL-5	DEUTSCH	2	Work lamp	-	DT06-2S-E006
CL-7	KET	1	Beacon lamp	S822-014002	S822-114002
CL-9	DEUTSCH	2	Cabin lamp (canopy lamp)	DT06-2S-P012	DT04-2P-E004
CL-10	DEUTSCH	2	Cabin lamp (canopy lamp)	DT06-2S-P012	DT04-2P-E004
RELAY					
CR-2	AMP	4	Horn relay	S810-004002	-
CR-7	KET	4	Aircon power relay	MG612017-5	-
CR-23	KET	4	Start relay	MG612017-5	-
CR-24	KET	4	Preheater relay	MG612017-5	-
CR-35	KET	4	Power relay	MG612017-5	-
CR-45	KET	4	ECU IG power	MG612017-5	-
CR-62	KET	4	Air heater timer relay	MG612017-5	-
CR-66	AMP	6	ECU main power	S810-006002	-
SENSOR					
CD-2	AMP	3	Fuel sender	S816-003002	S816-102002
CD-8	AMP	2	Water temp sender	1-178390-2	-
CD-10	TYCO	2	Air cleaner switch	85202-1	-
CD-11	KET	2	Travel pressure switch	MG640795	-
CD-12	KET	2	Travel pressure switch	MG640795	-
CD-17	SUMITOMO	2	Tacho sensor	6189-0552	
CD-18	AMP	1	Engine oil pressure	17809-2	-
CD-31	DEUTSCH	3	Overload pressure switch	DT06-3S-EP06	-
DO-1	-	2	Diode	S816-002002	21EA-50570
DO-2	-	2	Diode	S816-002002	21EA-50570

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
SWITCH					
CS-2	KET	2	Start key switch	MG610557	-
CS-3	SWF	10	Wiper & washer switch	593757	-
CS-4	AMP	2	Safety switch	-	S814-102001
CS-5	-	1	Horn switch	S822-014002	-
	-	1		-	S822-114002
CS-6	SWF	10	Heater switch	593757	-
CS-8	SWF	10	Travel speed switch	593757	-
CS-16	SWF	10	Travel alarm switch	593757	-
CS-21	SWF	10	Main light switch	593757	-
CS-23	SWF	10	Beacon lamp switch	593757	-
CS-46	KET	4	Start switch	MG651926	-
CS-50	SWF	10	Overload switch	593757	-
CS-67	SWF	10	Quick clamp switch	593757	-
CS-74	RING TERM	1	Master switch	ST710287-2	-
CS-100	SWF	10	DPF switch	593757	-

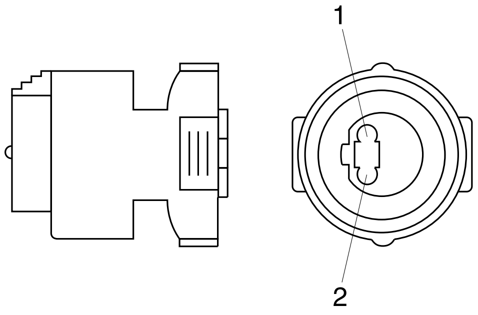
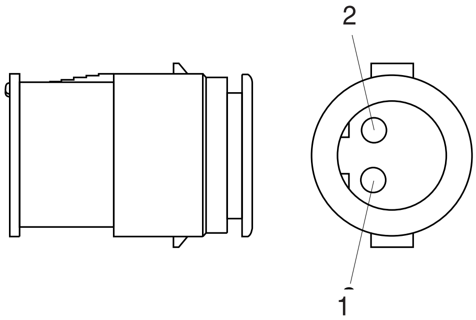
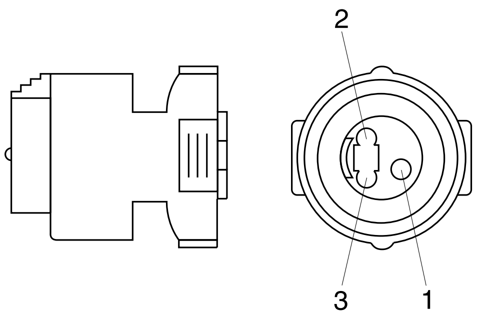
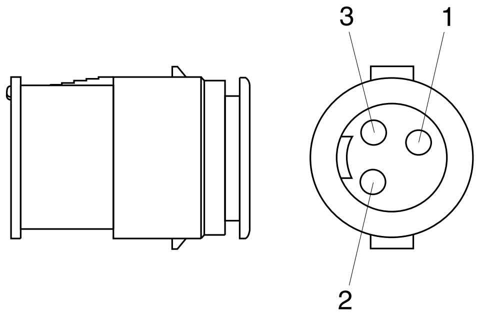
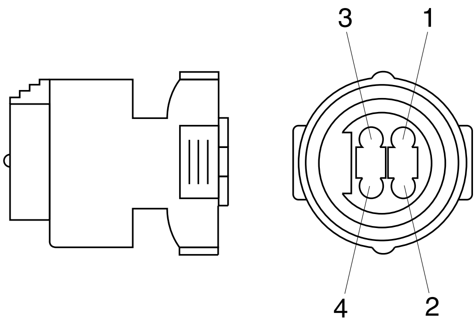
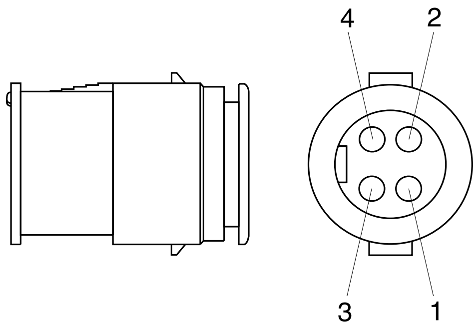
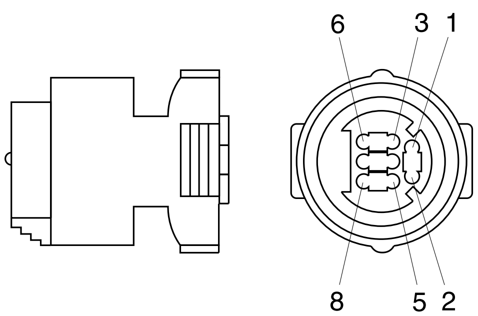
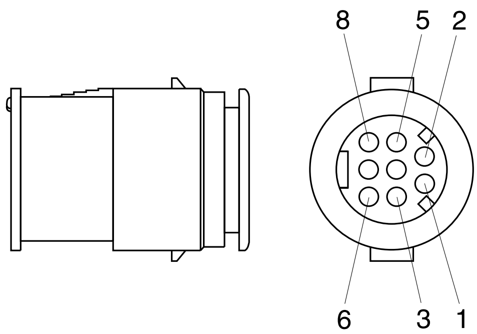
2. CONNECTION TABLE FOR CONNECTORS

1) PA TYPE CONNECTOR

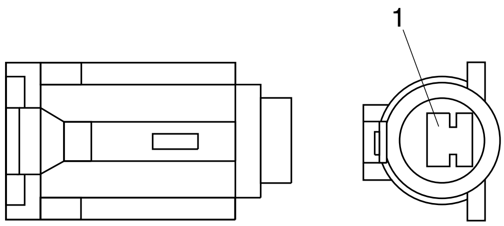
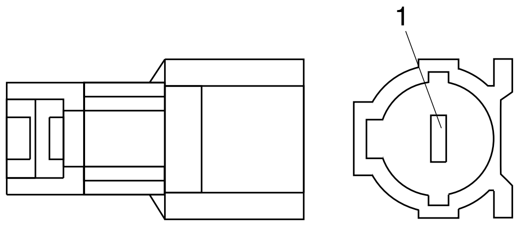
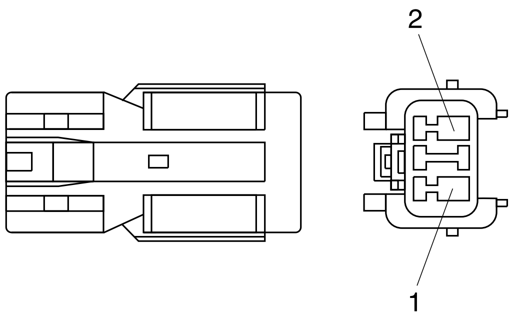
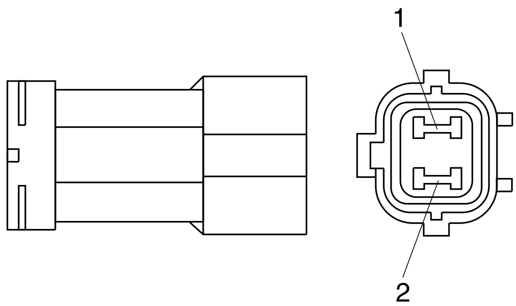
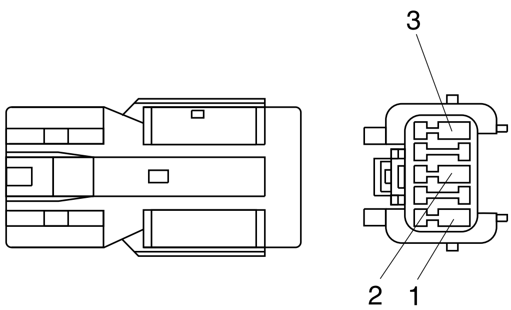
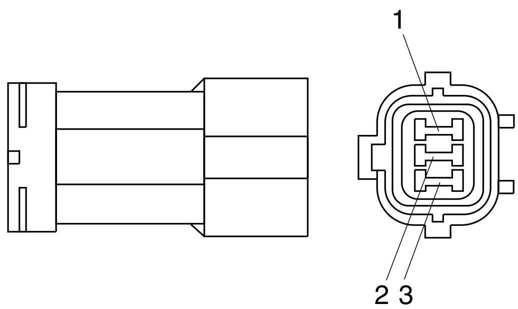
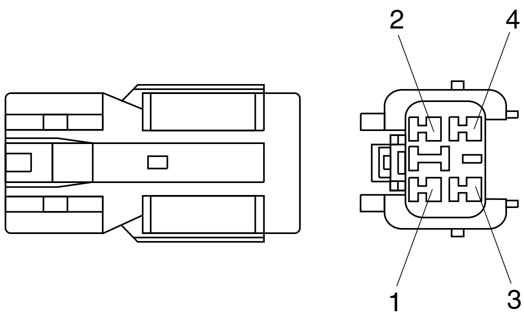
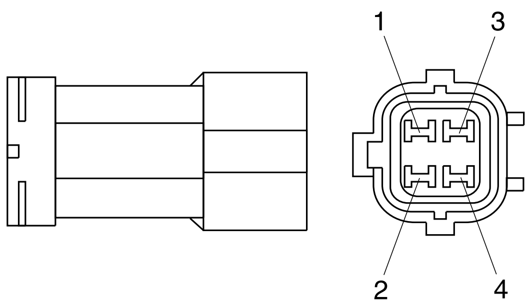
No. of pin	Receptacle connector (female)	Plug connector (male)
5	 S811-005002	 S811-105002
7	 S811-007002	 S811-107002
9	 S811-009002	 3S811-109002
11	 S811-011002	 S811-111002

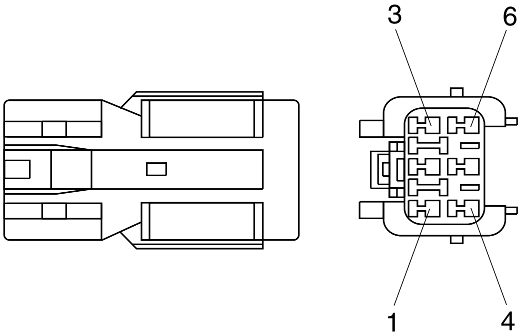
No. of pin	Receptacle connector (female)	Plug connector (male)
13	 S811-013002	 S811-113002
17	 S811-017002	 S811-117002
21	 S811-021002	 S811-121002

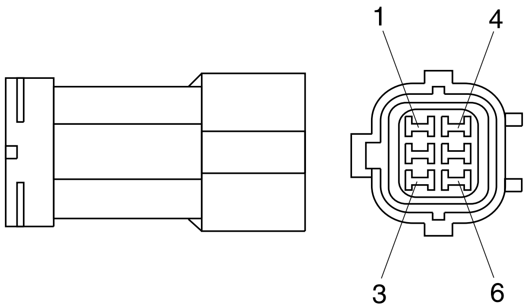
2) J TYPE CONNECTOR

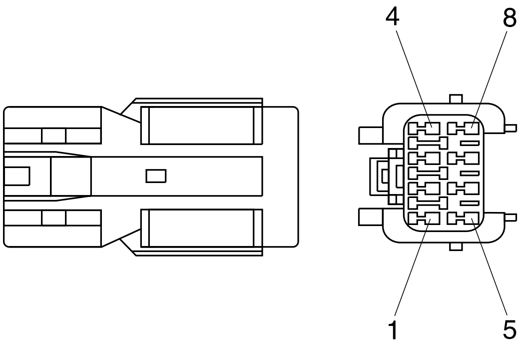
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 S816-002001	 S816-102001
3	 S816-003001	 S816-103001
4	 S816-004001	 S816-104001
8	 S816-008001	 S816-108001

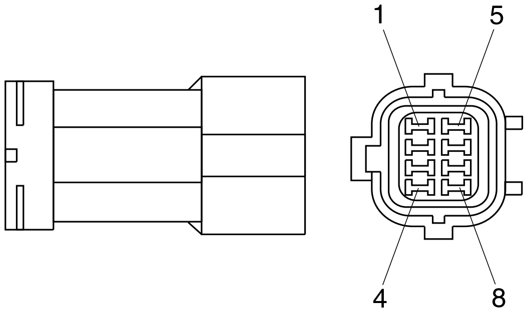
3) SWP TYPE CONNECTOR

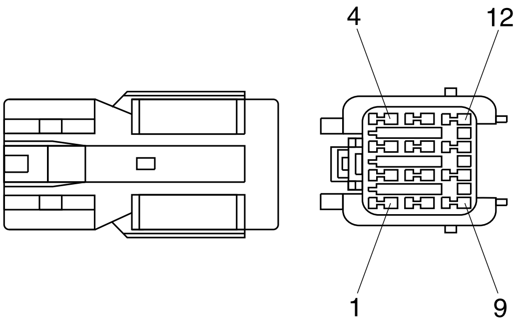
No. of pin	Receptacle connector (female)	Plug connector (male)
1	 S814-001000	 S814-101000
2	 S814-002000	 S814-102000
3	 S814-003000	 S814-103000
4	 S814-004000	 S814-104000

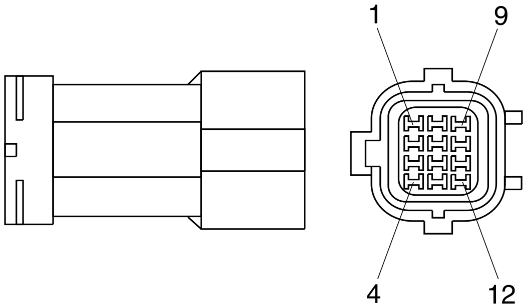
<table>
<tr><th>No. of pin</th><th>Receptacle connector (female)</th><th>Plug connector (male)</th></tr>
<tr><td>6</td><td>

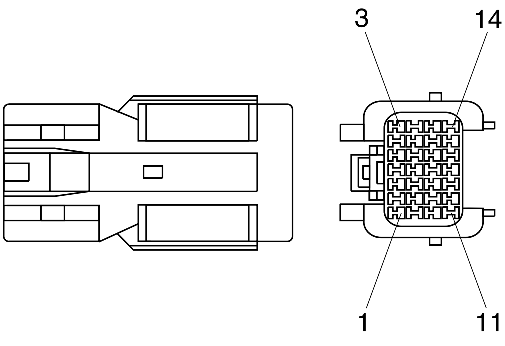
S814-006000</td><td>

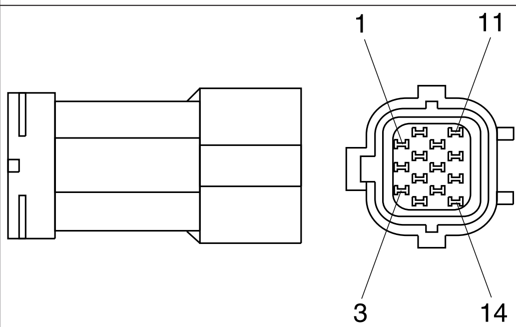
S814-106000</td></tr>
<tr><td>8</td><td>

S814-008000</td><td>

S814-108000</td></tr>
<tr><td>12</td><td>

S814-012000</td><td>

S814-112000</td></tr>
<tr><td>14</td><td>

S814-014000</td><td>

S814-114000</td></tr>
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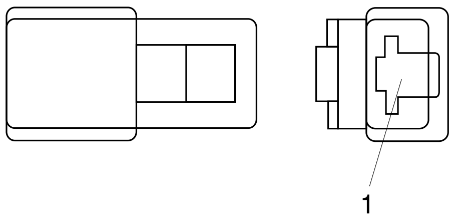
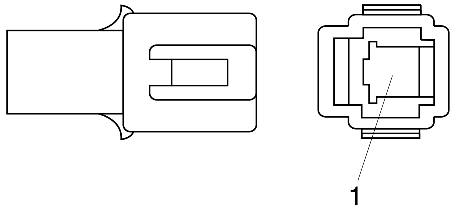
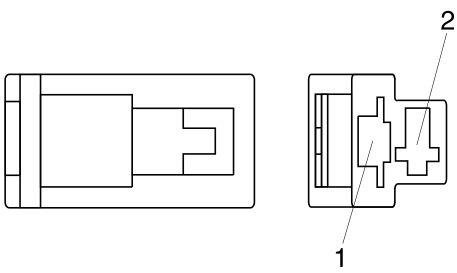
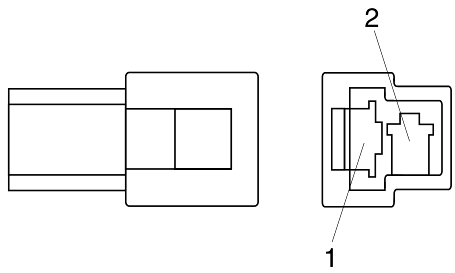
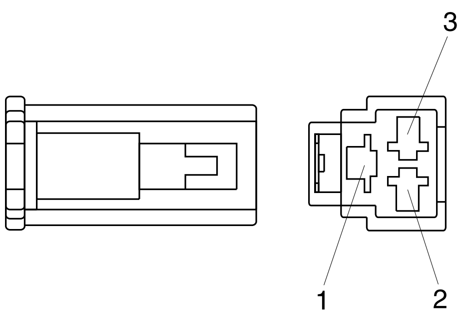
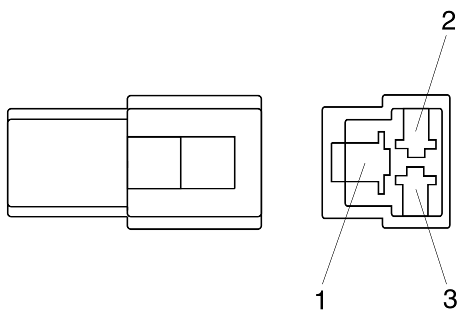
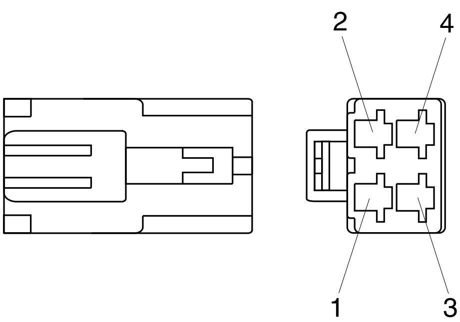
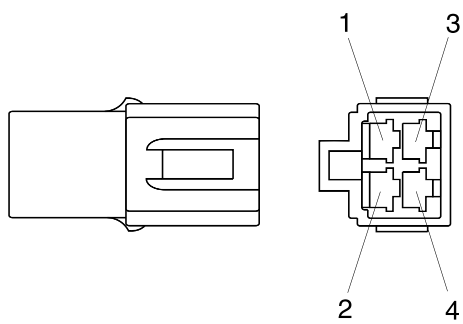
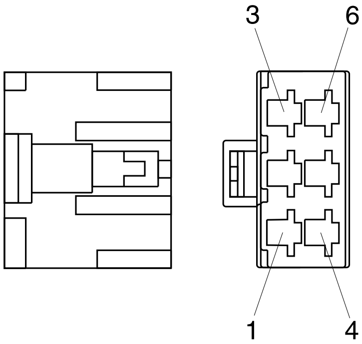
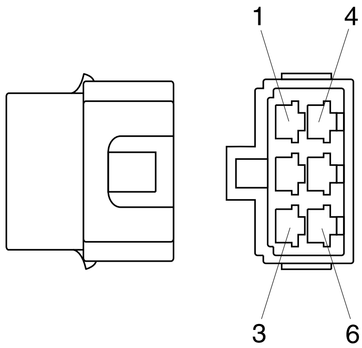
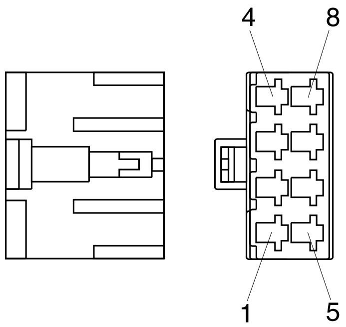
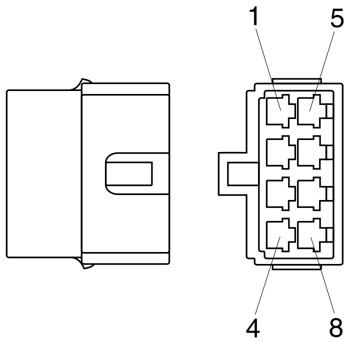
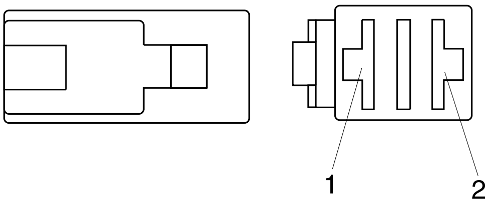
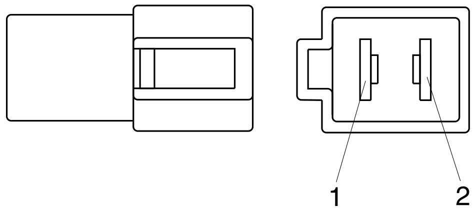
4) CN TYPE CONNECTOR

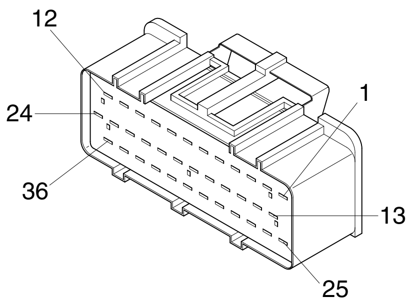
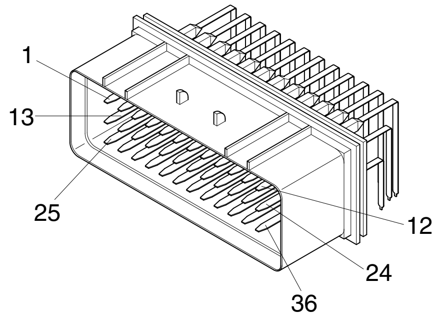
No. of pin	Receptacle connector (female)	Plug connector (male)
1	 S810-001202	 S810-101202
2	 S810-002202	 S810-102202
3	 S810-003202	 S810-103202
4	 S810-004202	 S810-104202

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

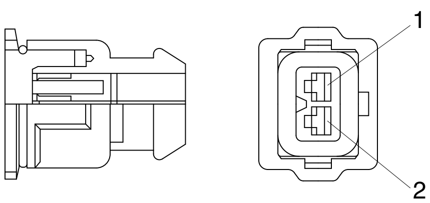
5) 375 FASTEN TYPE CONNECTOR

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

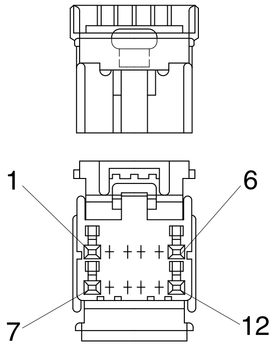
6) AMP ECONOSEAL CONNECTOR

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

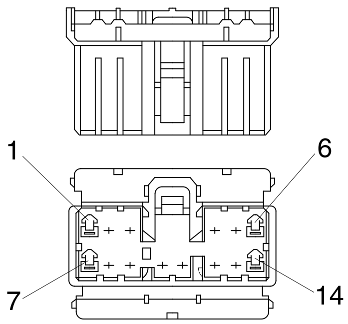
7) AMP TIMER CONNECTOR

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

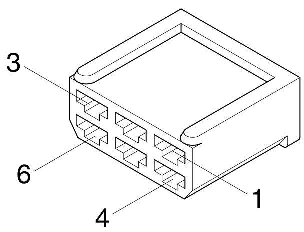
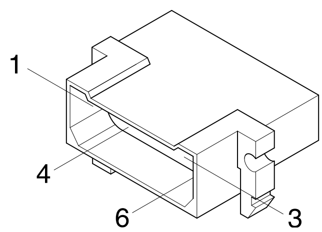
8) AMP 040 MULTILOCK CONNECTOR

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

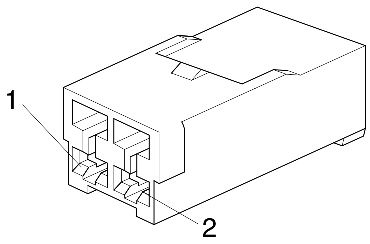
9) AMP 070 MULTILOCK CONNECTOR

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

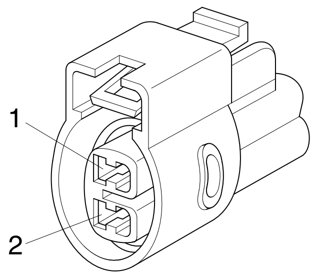
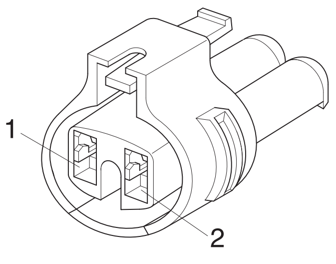
10) AMP FASTIN - FASTON CONNECTOR

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

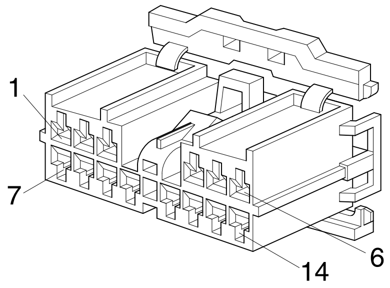
11) KET 090 CONNECTOR

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

12) KET 090 WP CONNECTORS

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

13) KET SDL CONNECTOR

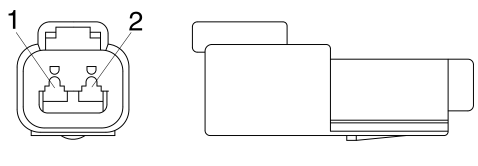
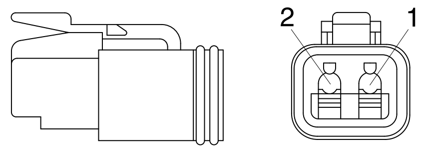
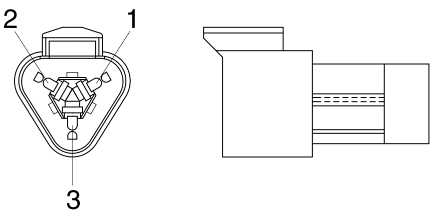
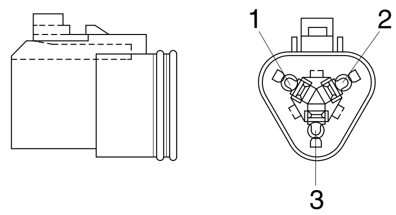
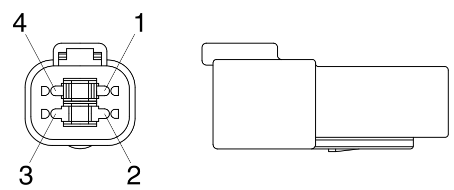
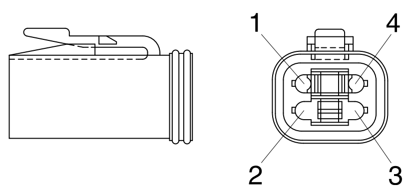
No. of pin	Receptacle connector (female)	Plug connector (male)
14	 MG610406	

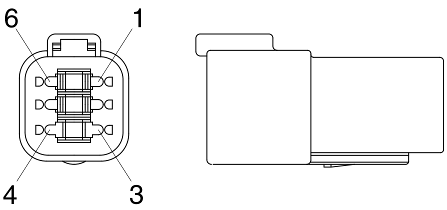
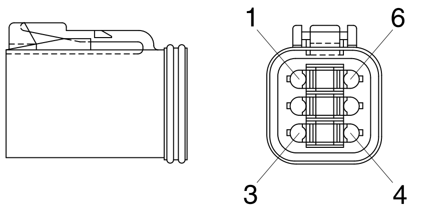
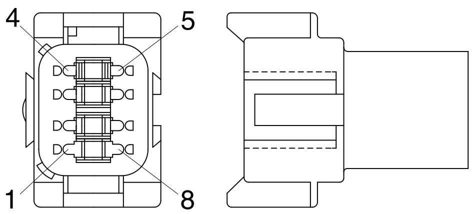
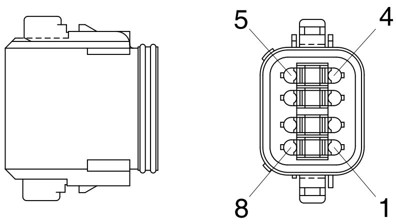
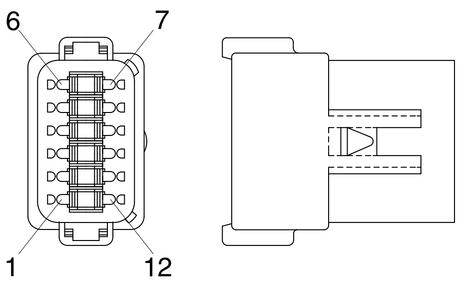
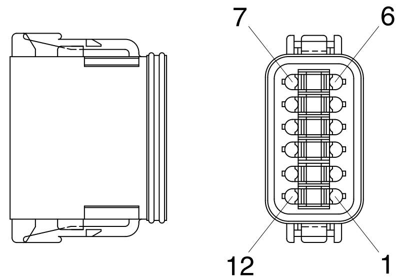
14) DEUTSCH DT CONNECTORS

DT 06 - 3S - ★★★★

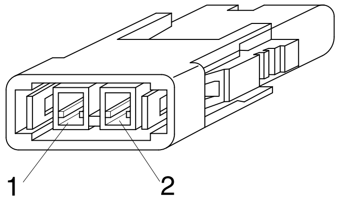
- ★★★★ : Modifications (See below)
- 3S : Number of contacts (P : Pin, S : Socket)
- 06 : 04 : Receptacle, 06 : Plug
- DT : Deutsch connectors

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

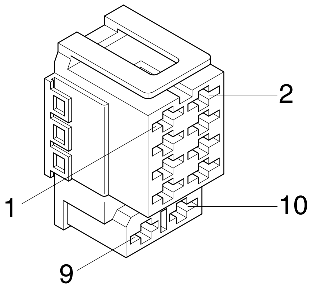
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 DT06-2S	 DT04-2P
3	 DT06-3S	 DT04-3P
4	 DT06-4S	 DT04-4P

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

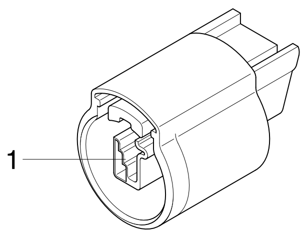
15) MOLEX 2CKTS CONNECTOR

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

16) ITT SWF CONNECTOR

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

17) MWP NMWP CONNECTOR

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

SECTION 5 TROUBLESHOOTING

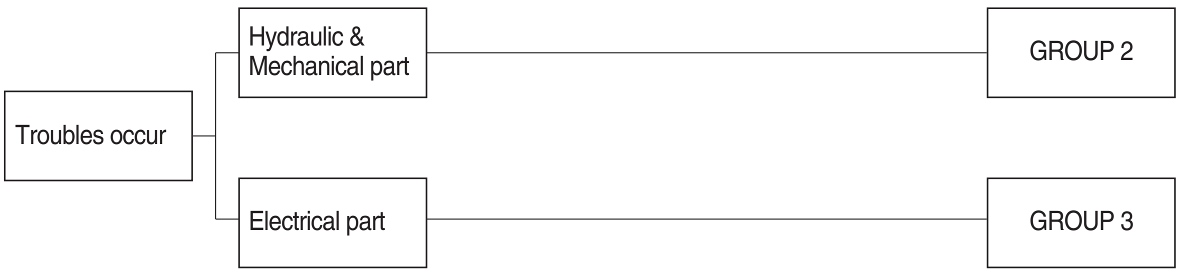
GROUP 1 BEFORE TROUBLESHOOTING

1. INTRODUCTION

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

The trouble of machine is parted Hydraulic & Mechanical system and Electrical system.

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

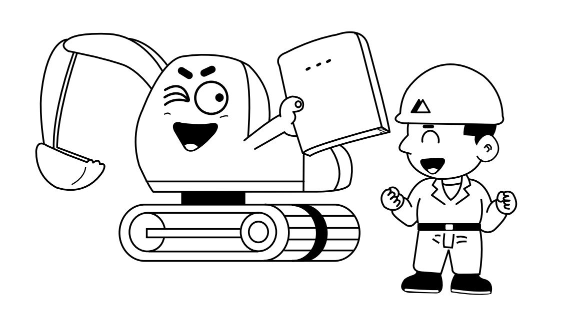


2. DIAGNOSING PROCEDURE

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

STEP 1. Study the machine system

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

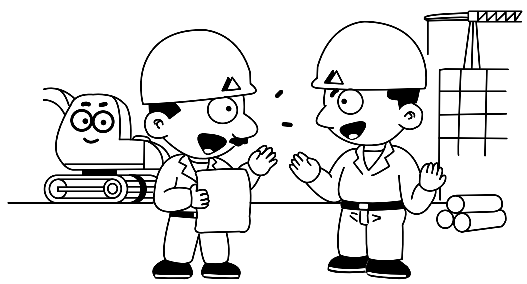


13031SH02

STEP 2. Ask the operator

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

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

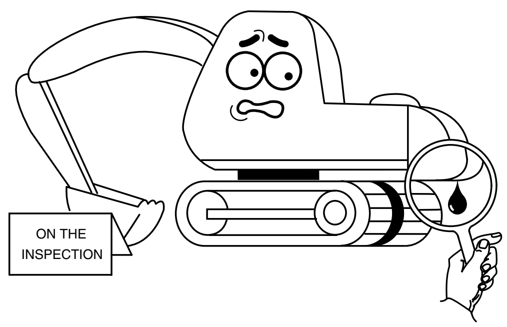


13031SH03

STEP 3. Inspect the machine

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

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

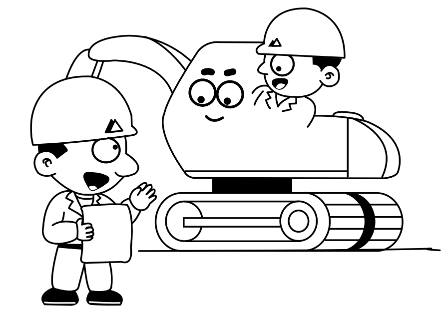


6-2(3) 140-7

STEP 4. Inspect the trouble actually on the machine

In case that some trouble cannot be confirmed, obtain the details of the malfunction from the operator.

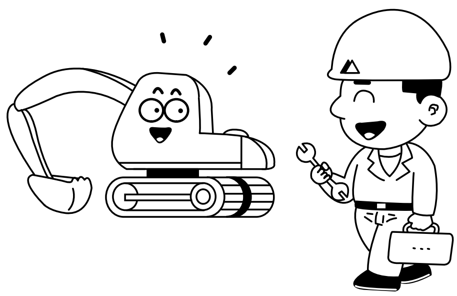
Also, check if there are any in complete connections of the wire harnesses are or not.



6-3(1) 140-7

STEP 5. Perform troubleshooting

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

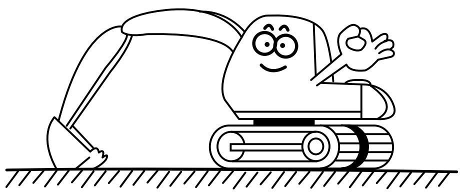


13031SH05

STEP 6. Trace a cause

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

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



6-3(3) 140-7

GROUP 2 HYDRAULIC AND MECHANICAL SYSTEM

1. INTRODUCTION

1) MACHINE IN GENERAL

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

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

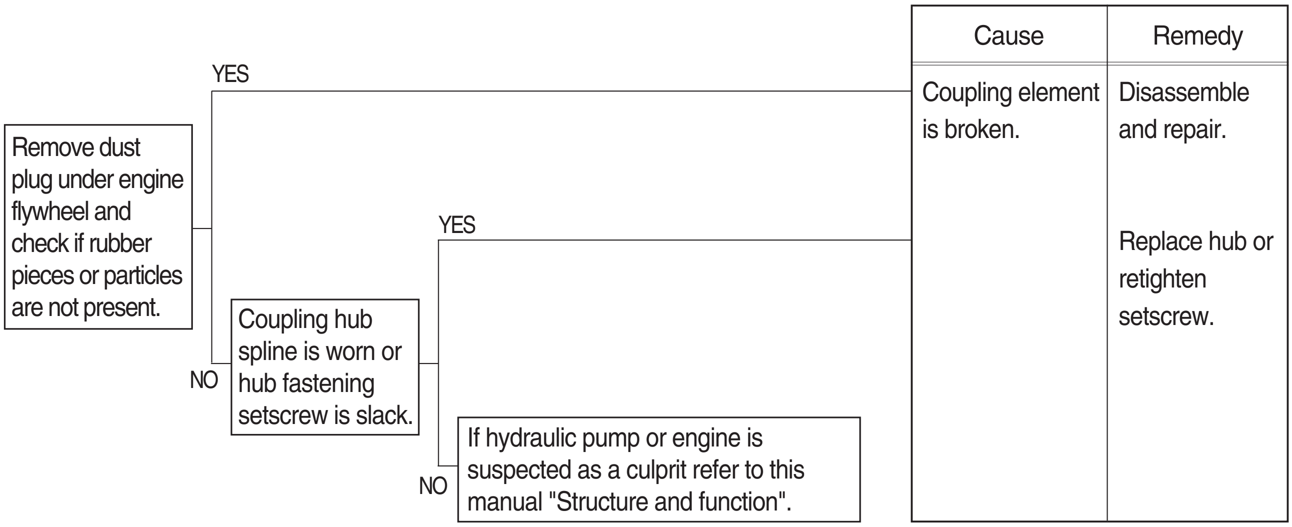
(3) When carrying out troubleshooting, do not hurry to disassemble the components.
It will become impossible to find the cause of the problem.

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

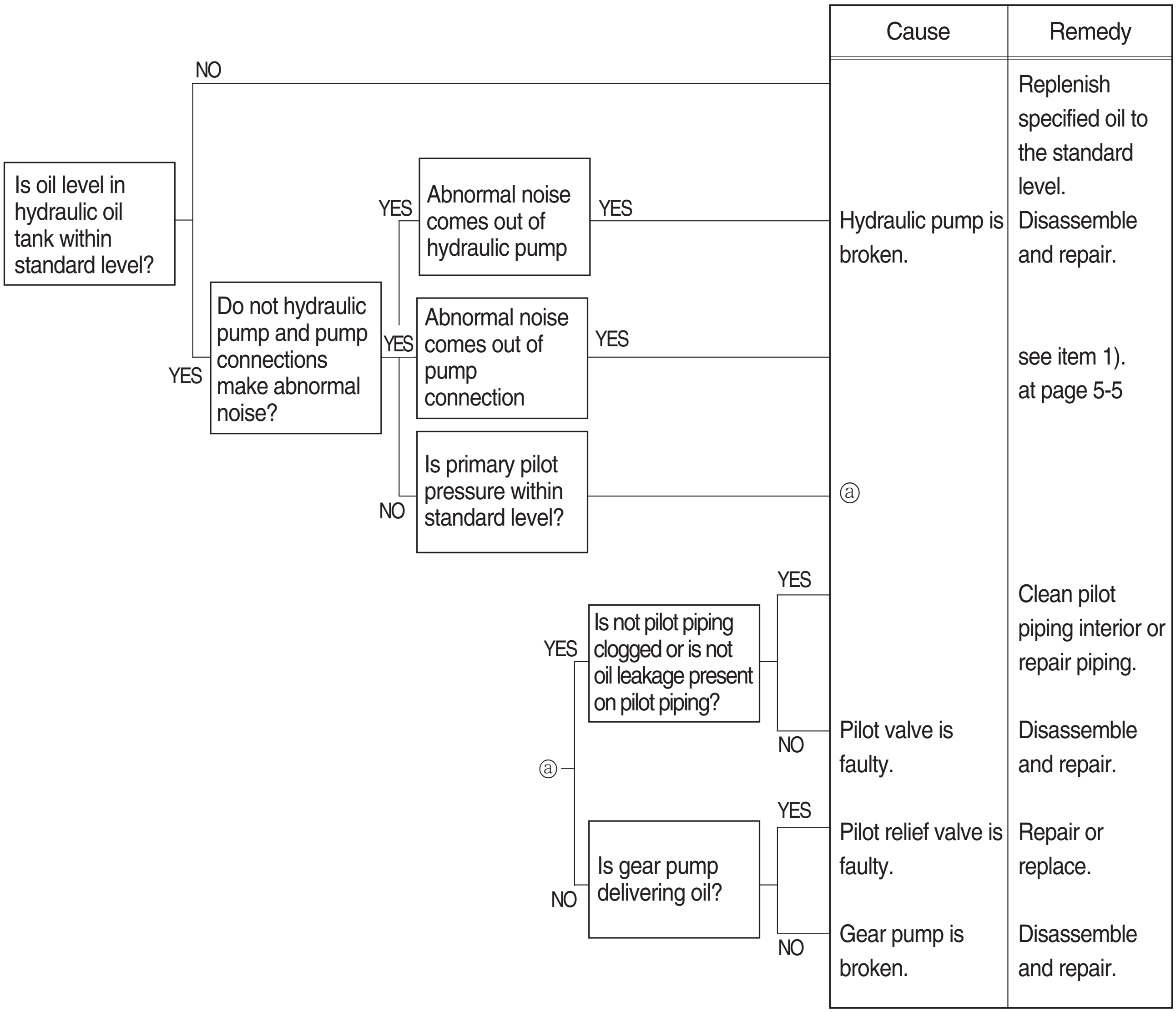
(5) Check before troubleshooting.
① Check oil and fuel level.
② Check for any external leakage of oil from components.
③ Check for loose or damage of wiring and connections.

2. DRIVE SYSTEM

1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION



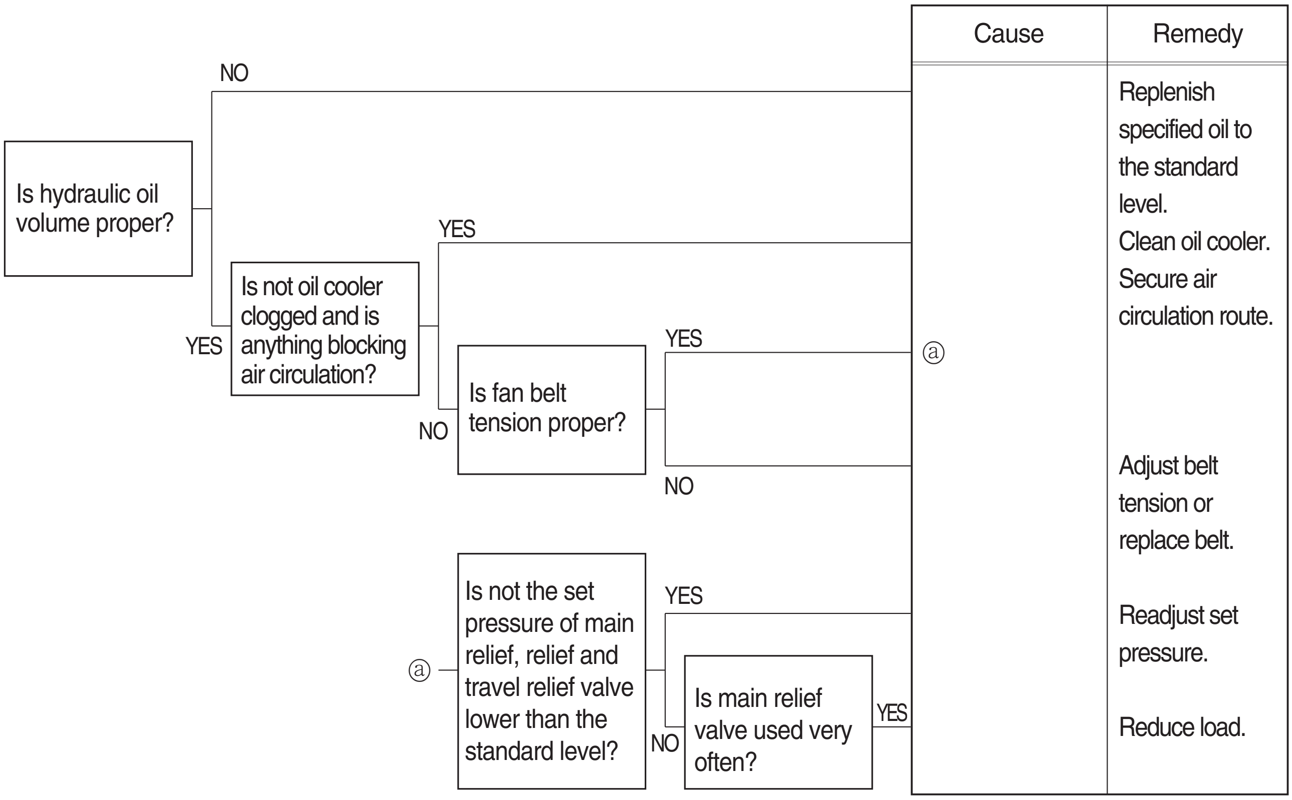
2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL



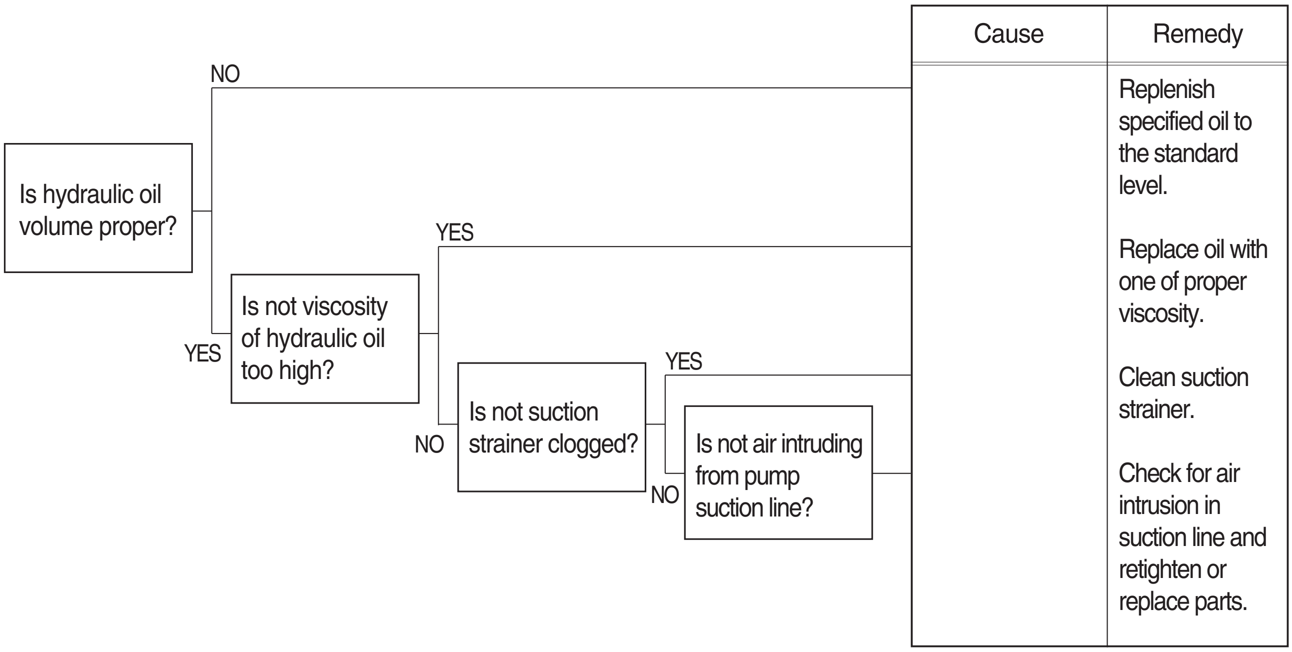
3. HYDRAULIC SYSTEM

1) HYDRAULIC OIL IS CLOUDY

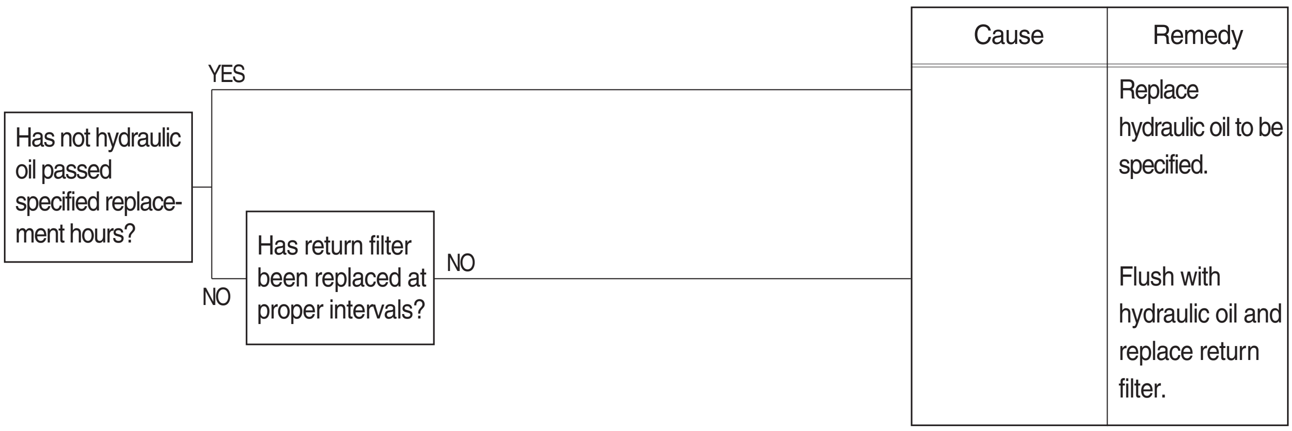
2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY



3) CAVITATION OCCURS WITH PUMP

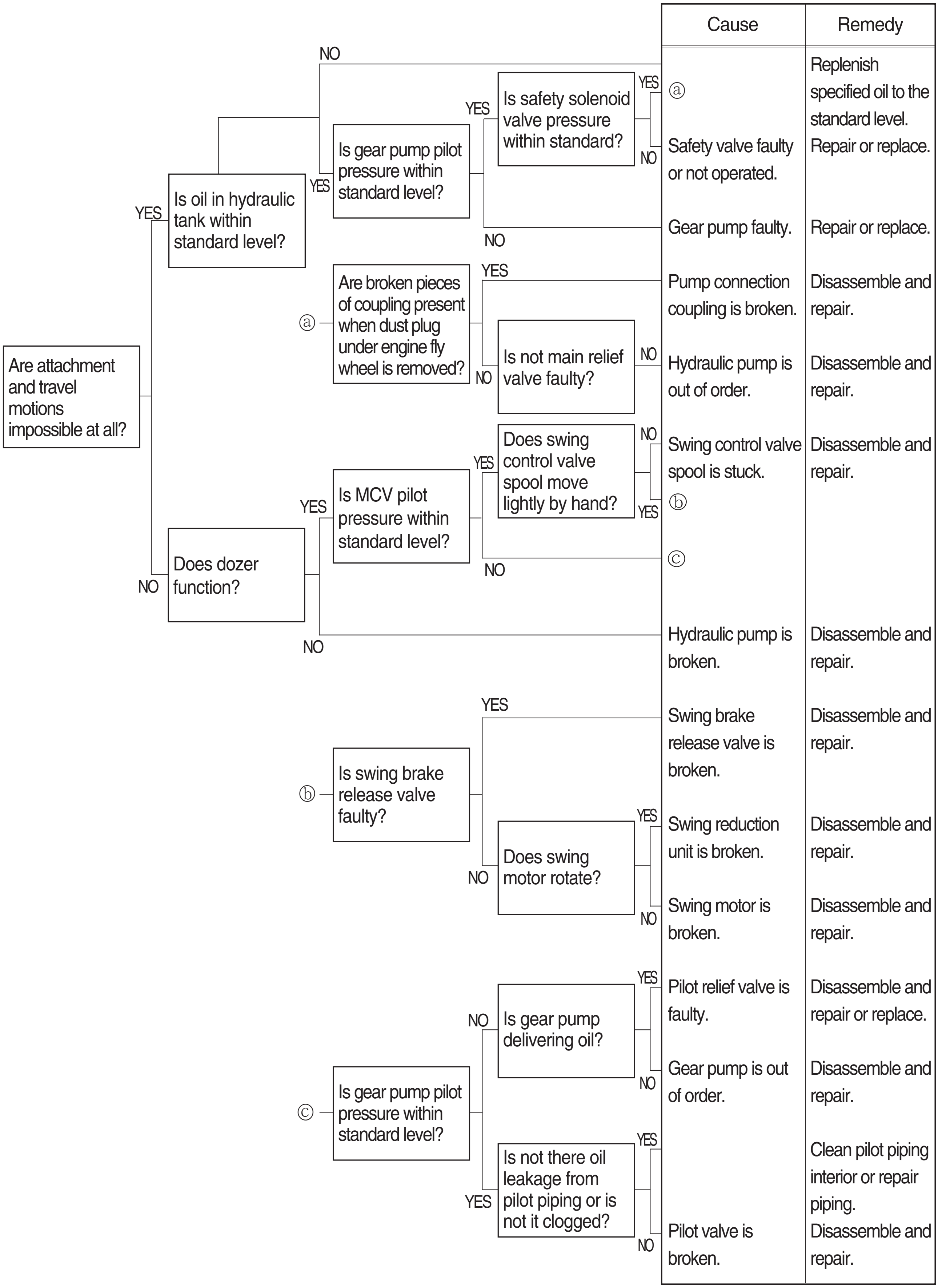


4) HYDRAULIC OIL IS CONTAMINATED

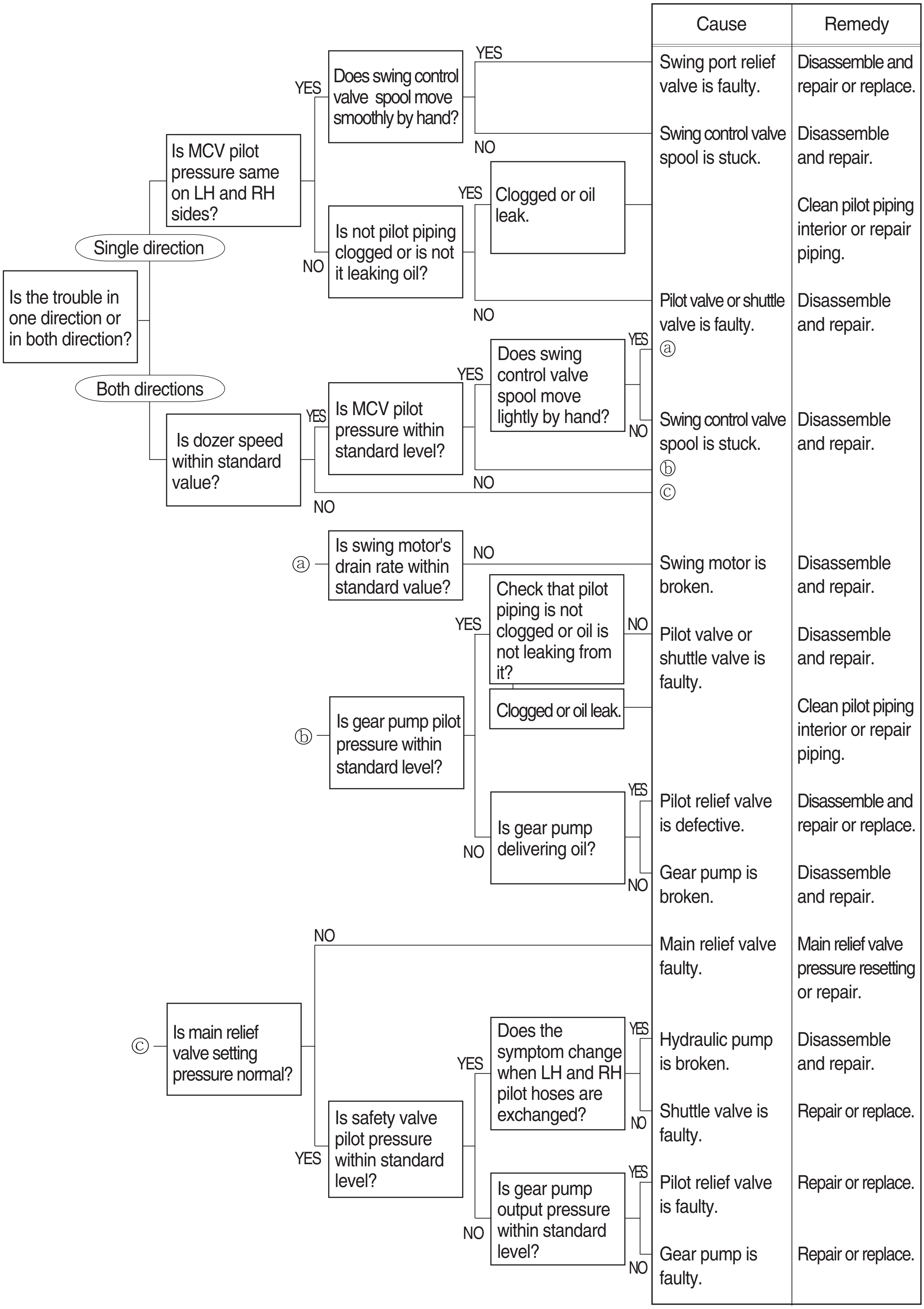


4. SWING SYSTEM

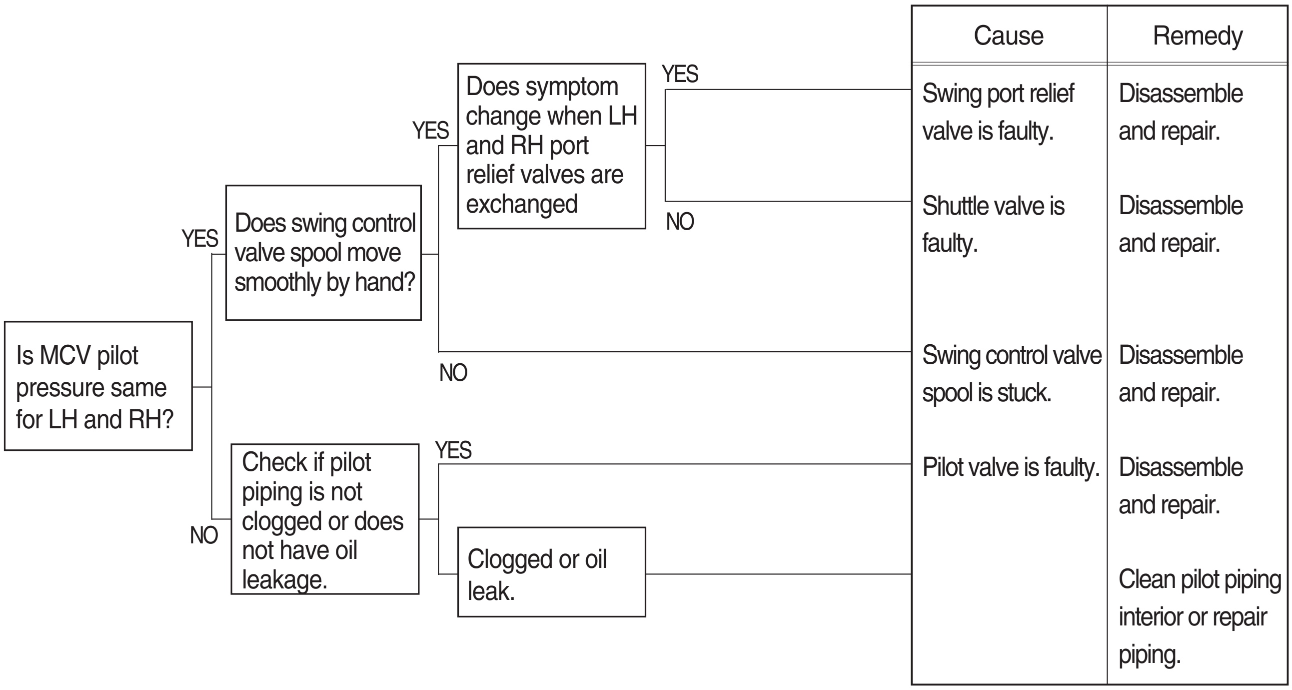
1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE



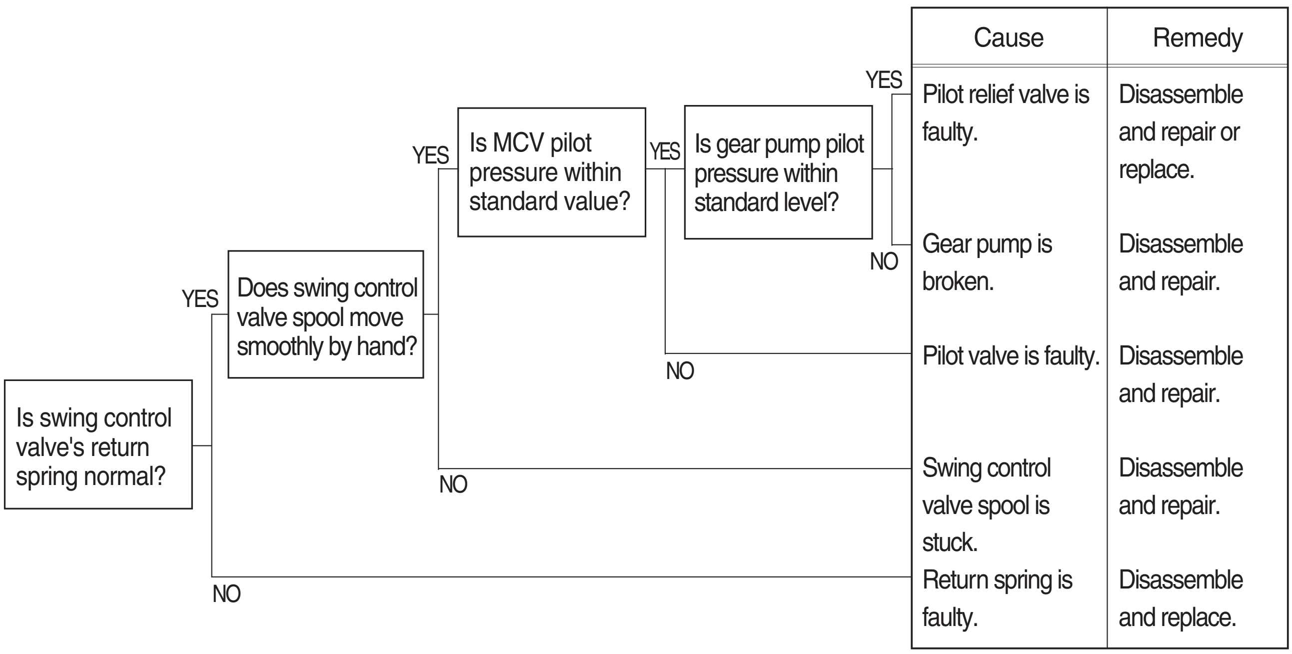
2) SWING SPEED IS LOW



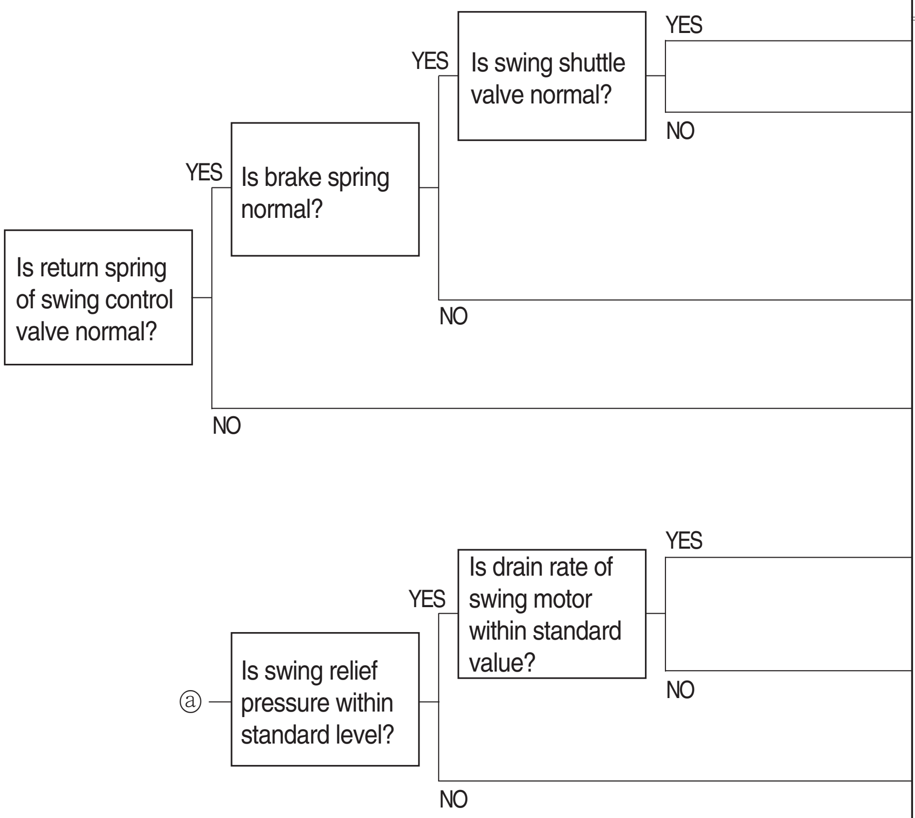
3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



4) MACHINE SWINGS BUT DOES NOT STOP



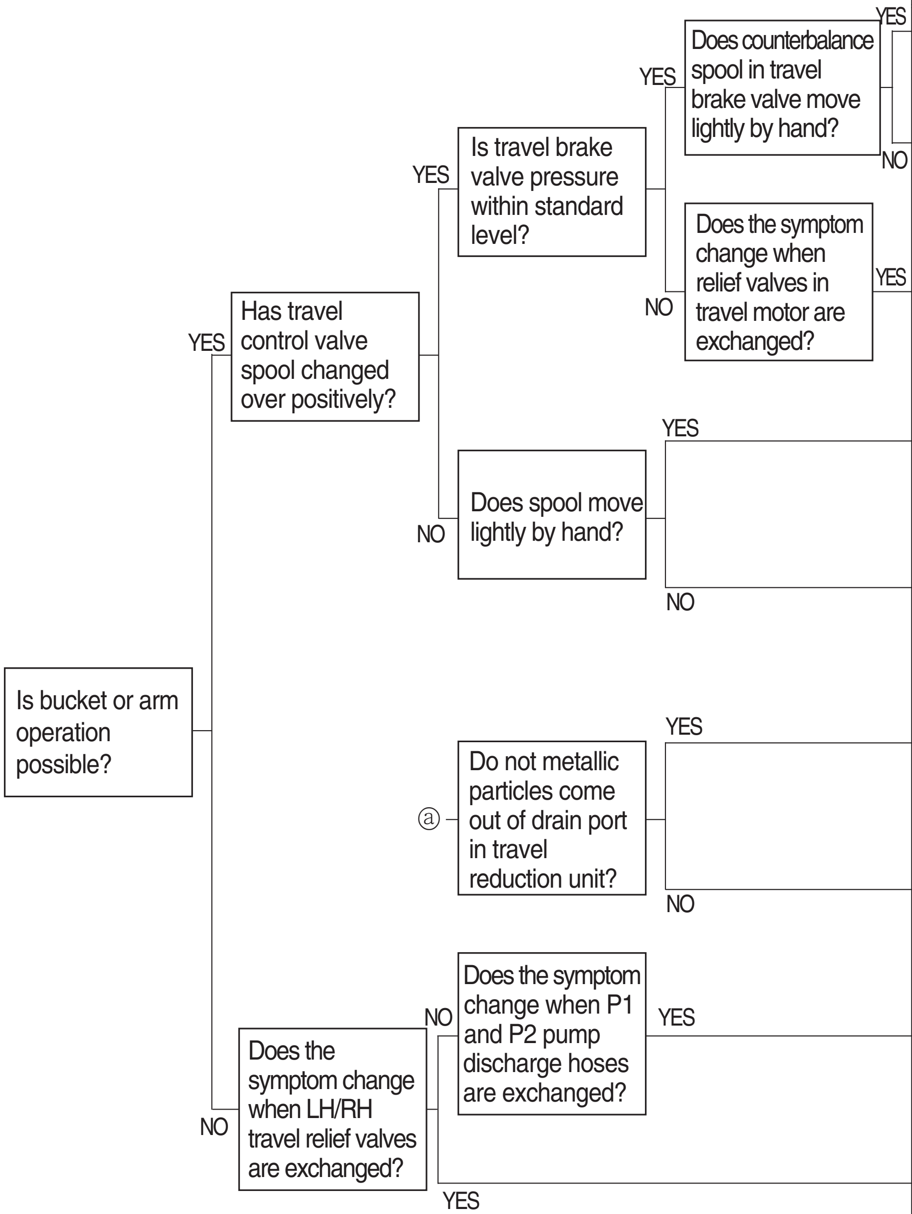
5) THE SWING UNIT DRIFTS WHEN THE MACHINE IS AT REST ON A SLOPE



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

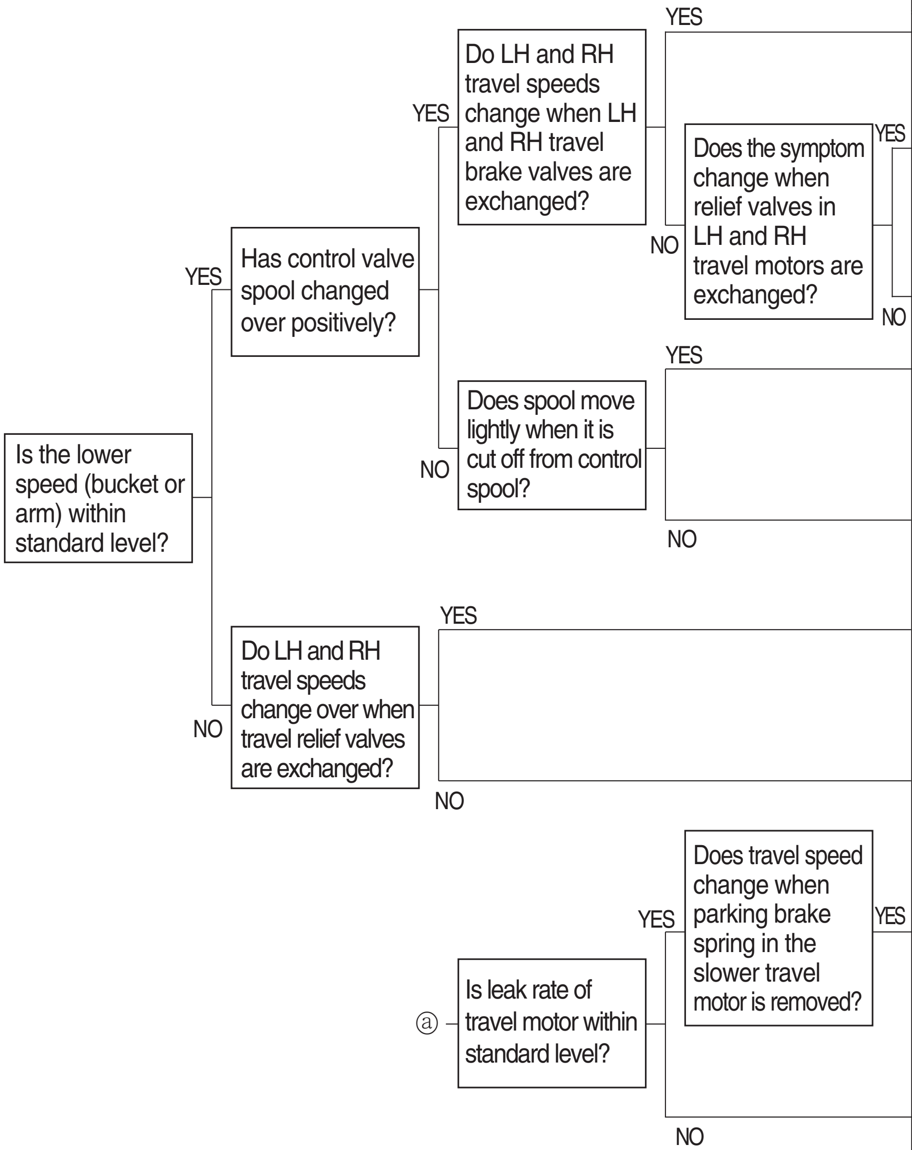
5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION AT ALL ON ONE SIDE



Cause	Remedy
ⓐ	
Counter spool in travel brake valve is stuck.	Disassemble and repair or replace.
Relief valve built in travel motor is faulty.	Disassemble and repair.
Control system is defective.	Disassemble inspect and repair.
Travel control valve spool is stuck.	Disassemble and repair.
Travel reduction unit is faulty.	Disassemble and repair.
Travel motor is out of order.	Disassemble and repair.
Hydraulic pump is broken.	Disassemble and repair.
Travel relief valves are faulty.	Disassemble and repair or replace.

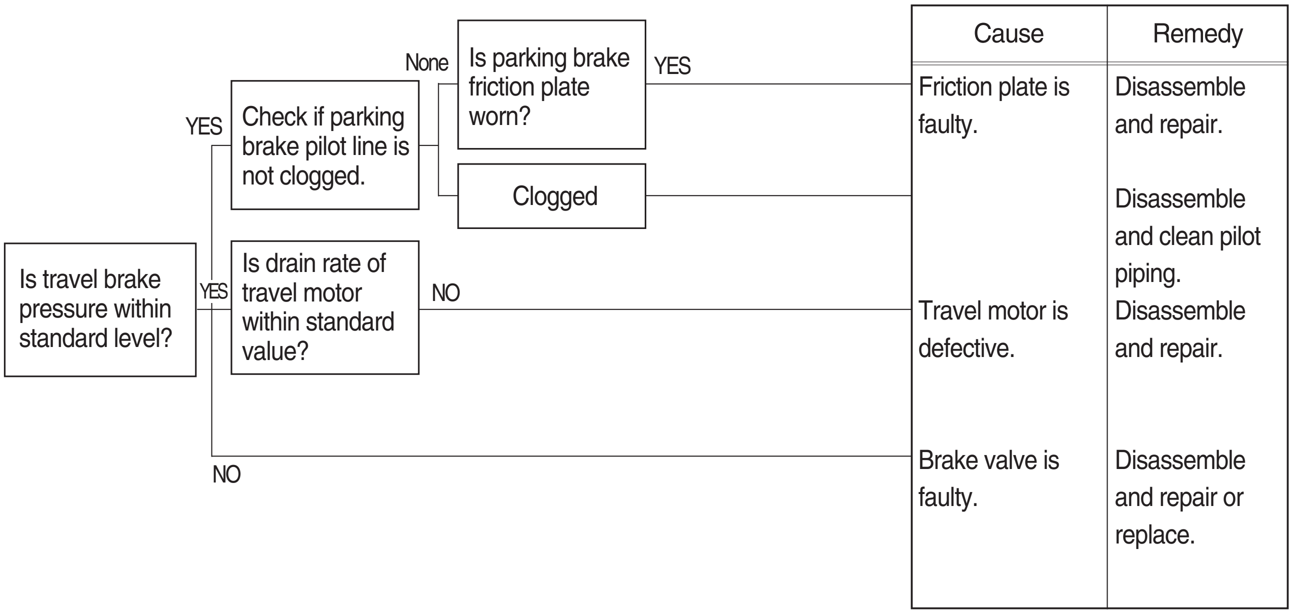
2) SPEED ON ONE SIDE FALLS AND THE MACHINE CURVES



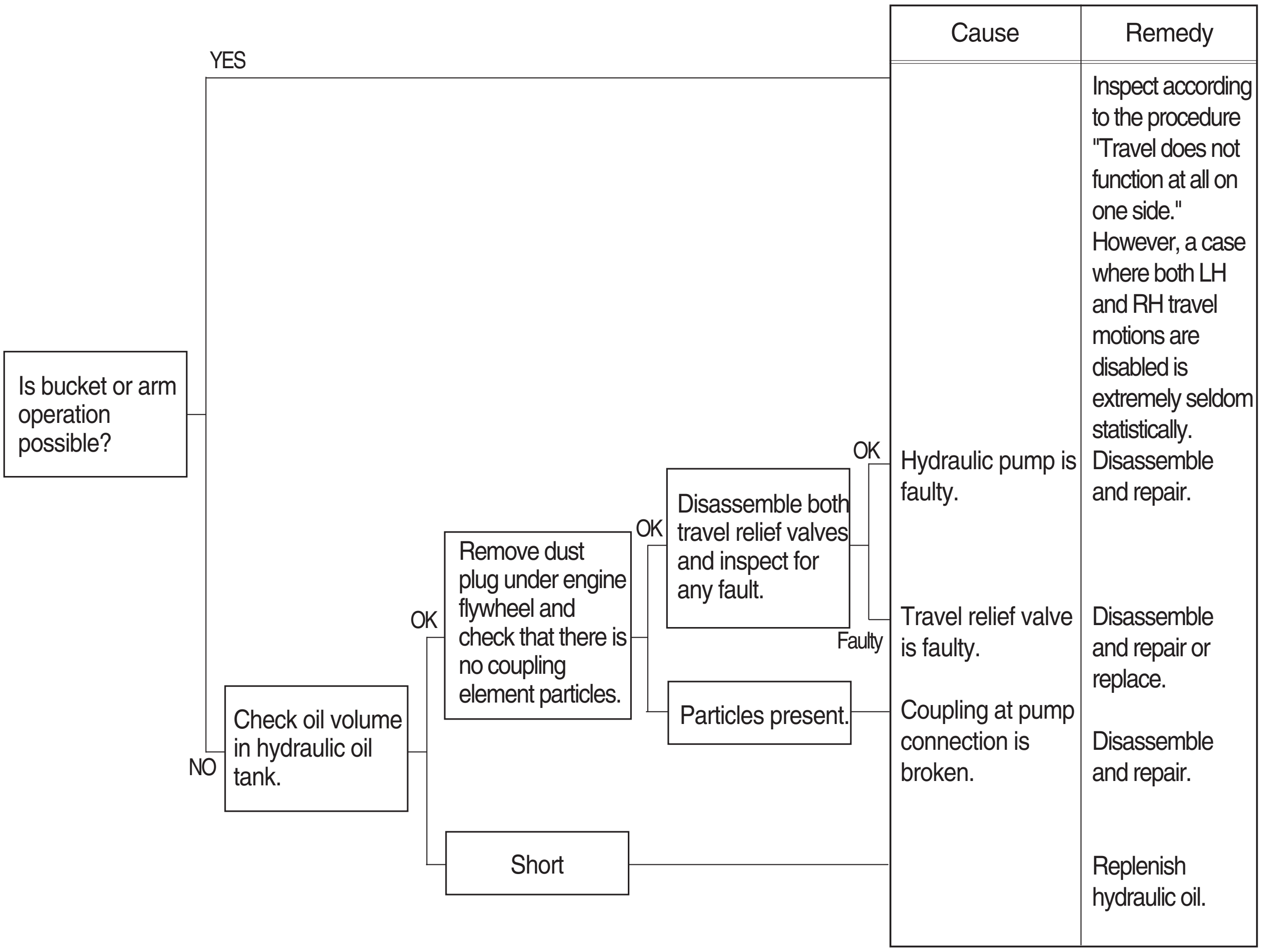
Cause	Remedy
Brake valve is defective.	Disassemble and repair or replace.
Relief valve built in travel motor is faulty.	Disassemble and repair.
ⓐ	
Control system is faulty .	Disassemble, inspect and repair.
Control valve spool is stuck.	Disassemble and repair.
Travel relief valve is faulty.	Disassemble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

3) MACHINE DOES NOT STOP ON A SLOPE

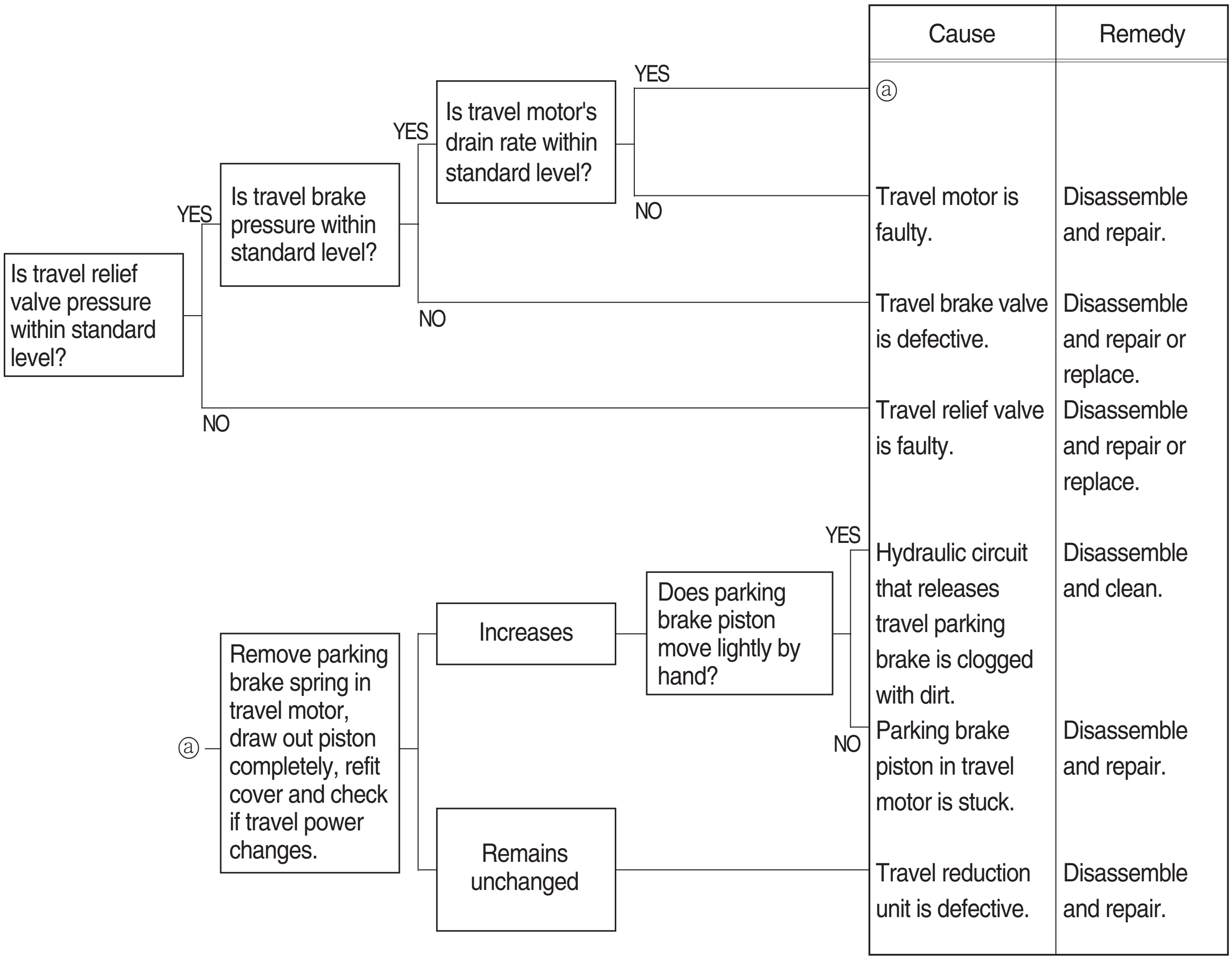
Machine is pulled forward as sprocket rotates during digging operation.



4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE

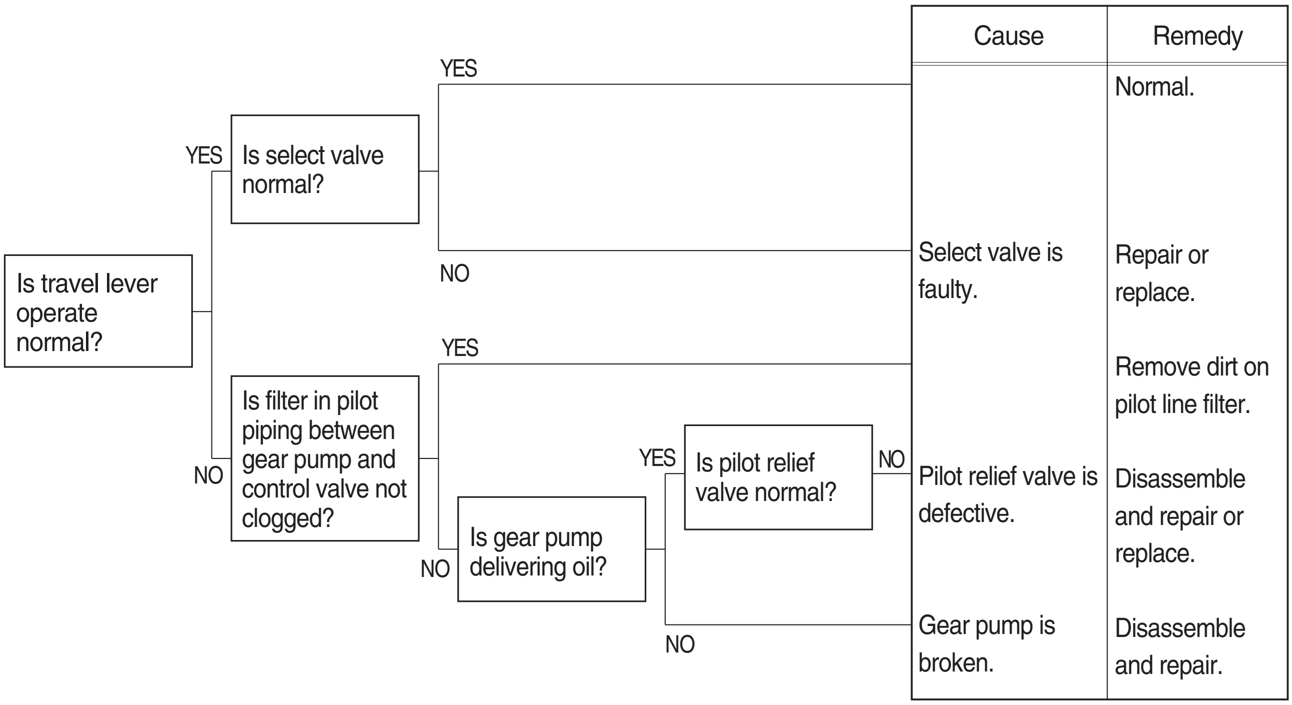


5) TRAVEL ACTION IS POWERLESS (travel only)



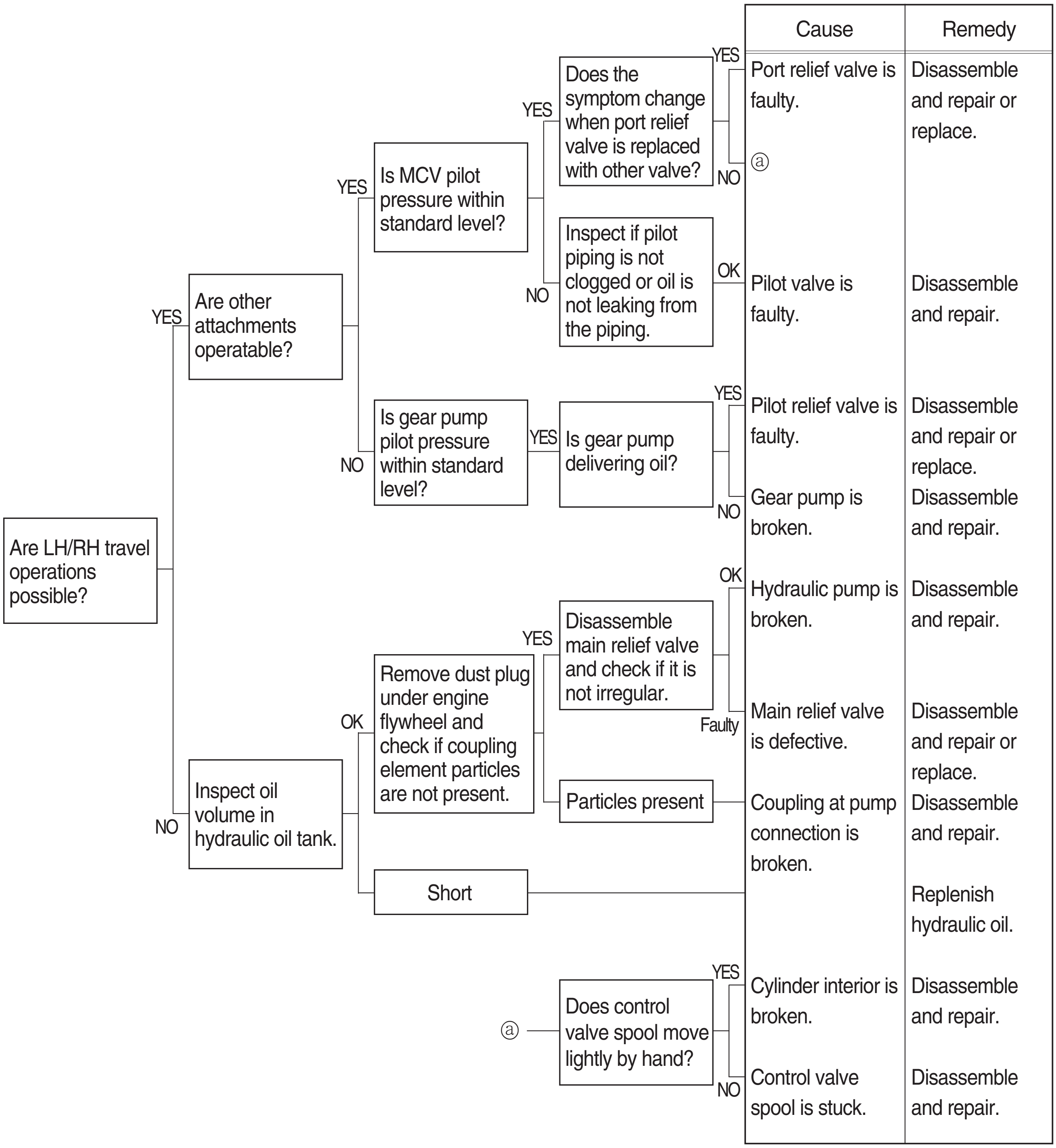
6) MACHINE RUNS RECKLESSLY ON A SLOPE

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

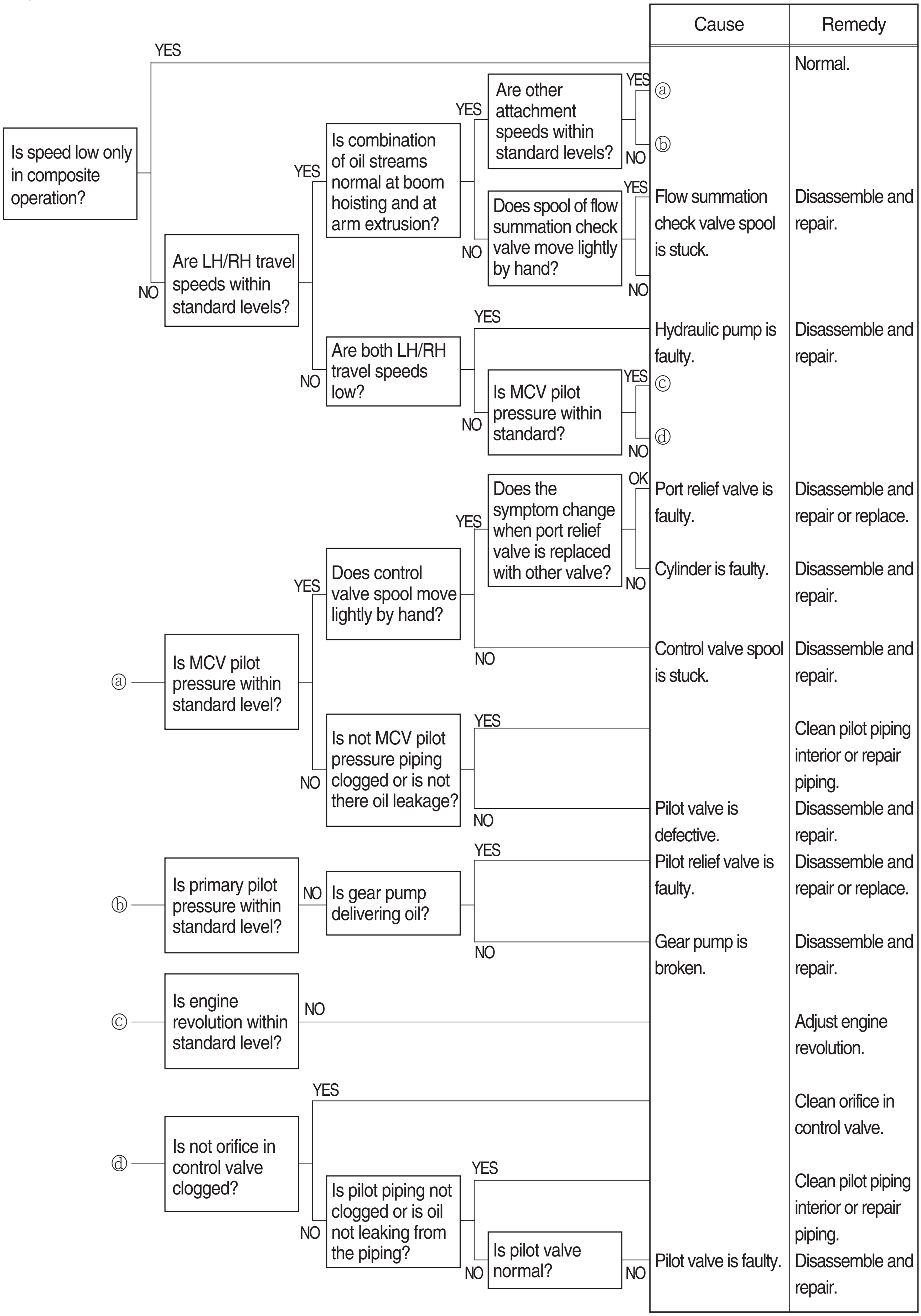


6. ATTACHMENT SYSTEM

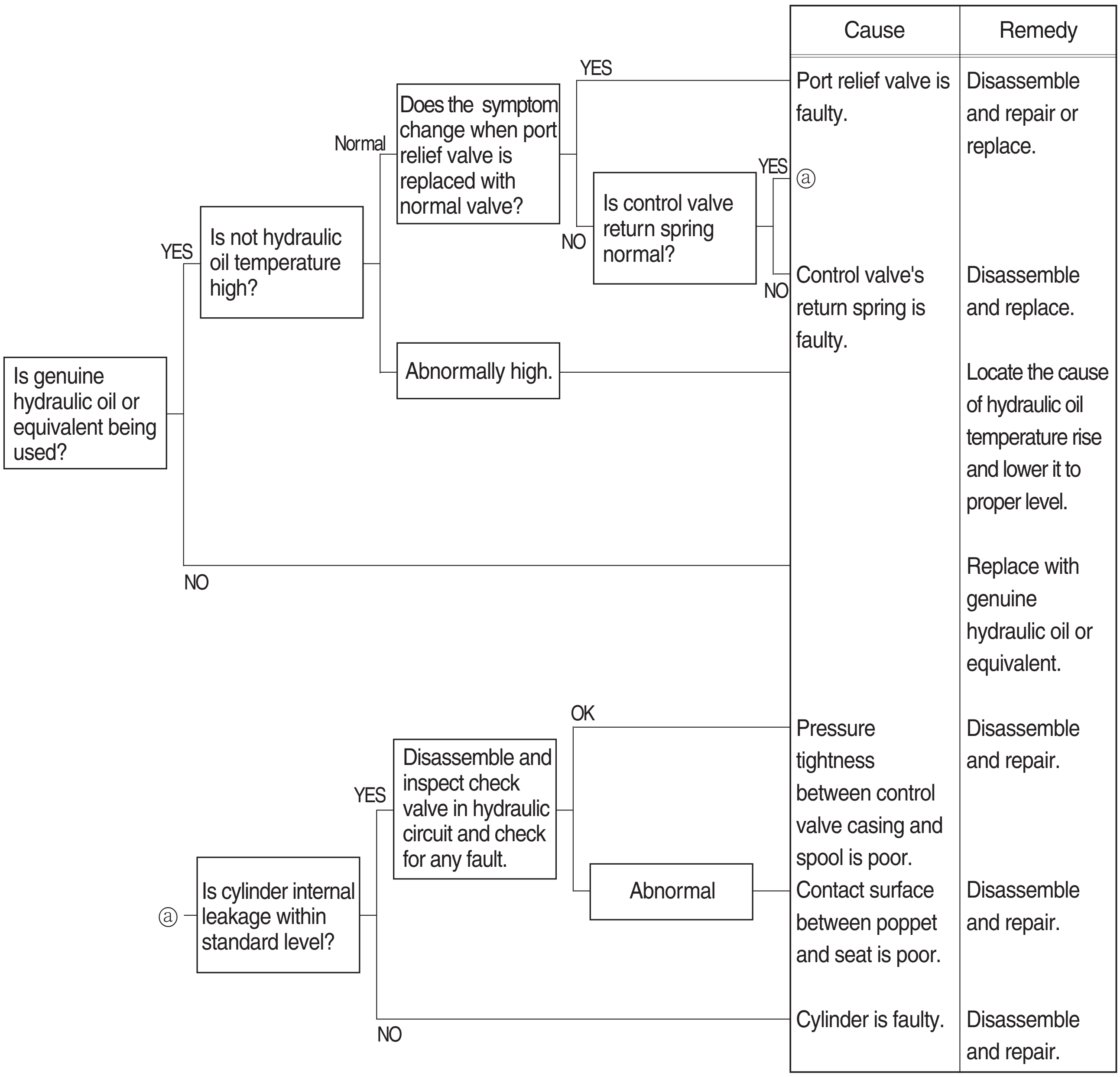
1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



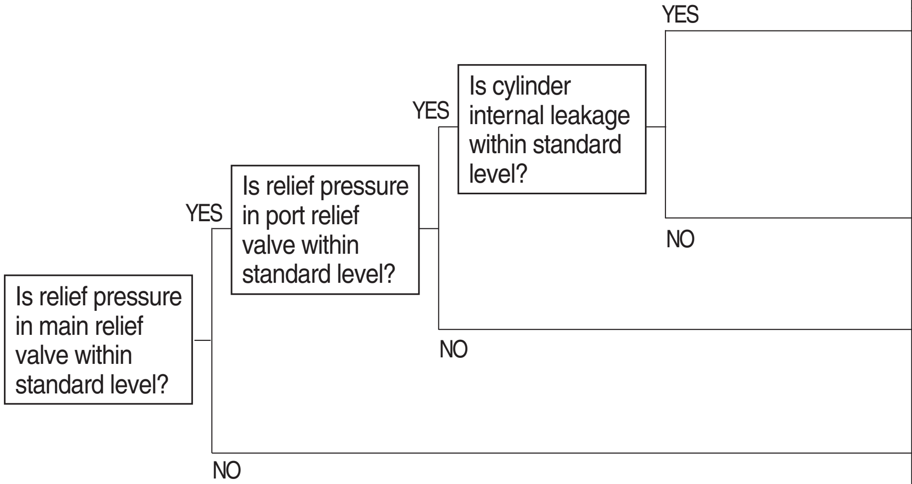
2) BOOM, ARM OR BUCKET SPEED IS LOW



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

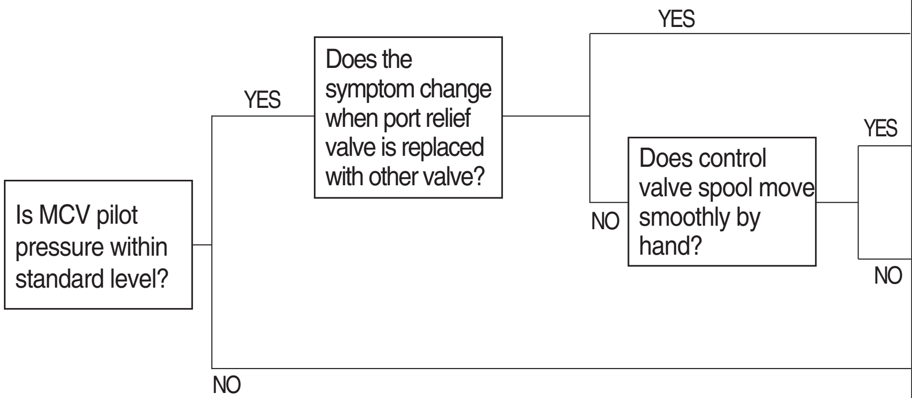


4) BOOM, ARM OR BUCKET POWER IS WEAK



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.

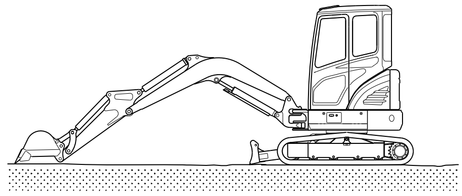
6) BOOM MAKES A SQUEAKING NOISE WHEN BOOM IS OPERATED

Is boom foot pin greased sufficiently?

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

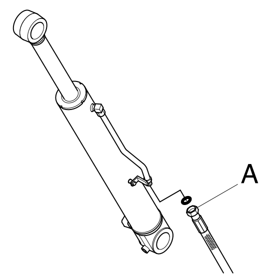
※ HOW TO CHECK INTERNAL BOOM CYLINDER LEAKAGE

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



R35Z75TS01

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



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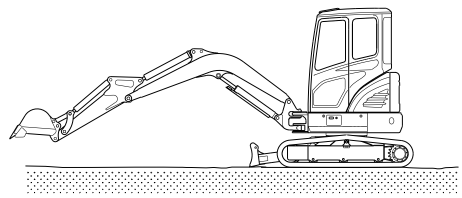
3. Raise bucket OFF the ground by retracting the arm cylinder rod.

   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.



R35Z75TS02

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

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

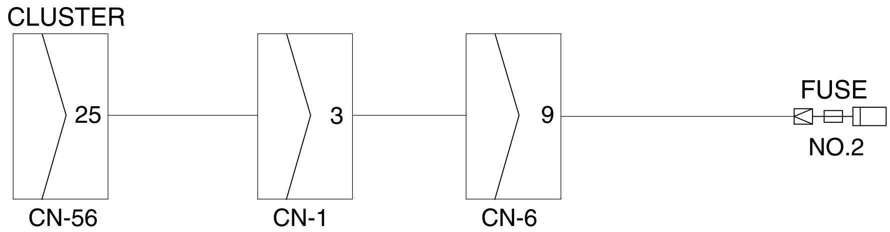
Check voltage between CN-56 (25) and chassis

Starting switch : ON
Voltage : 10~12.5V

	Cause	Remedy
YES	Defective cluster	Replace
NO	Disconnection in wiring harness or poor contact between CN-56 (25) and fuse No.2.	Repair or replace (after clean)

Check voltage

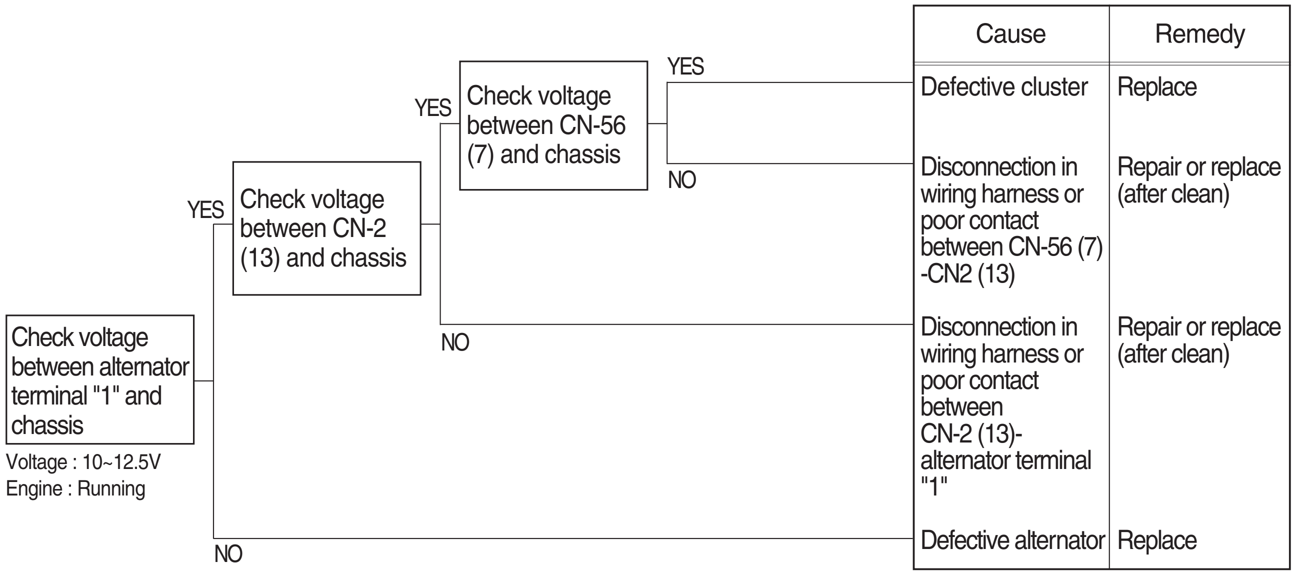
YES	10 ~ 12.5V
NO	0V



35Z9A5TS10

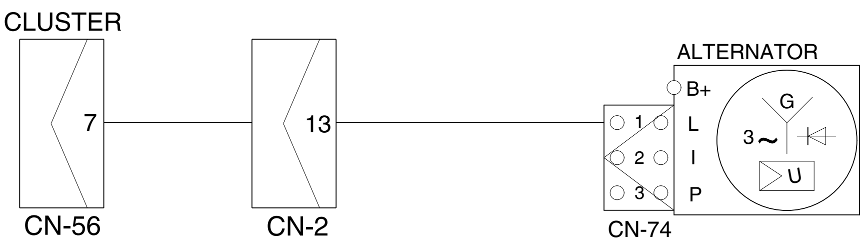
2. BATTERY CHARGING WARNING LAMP LIGHTS UP (starting switch : ON)

· 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

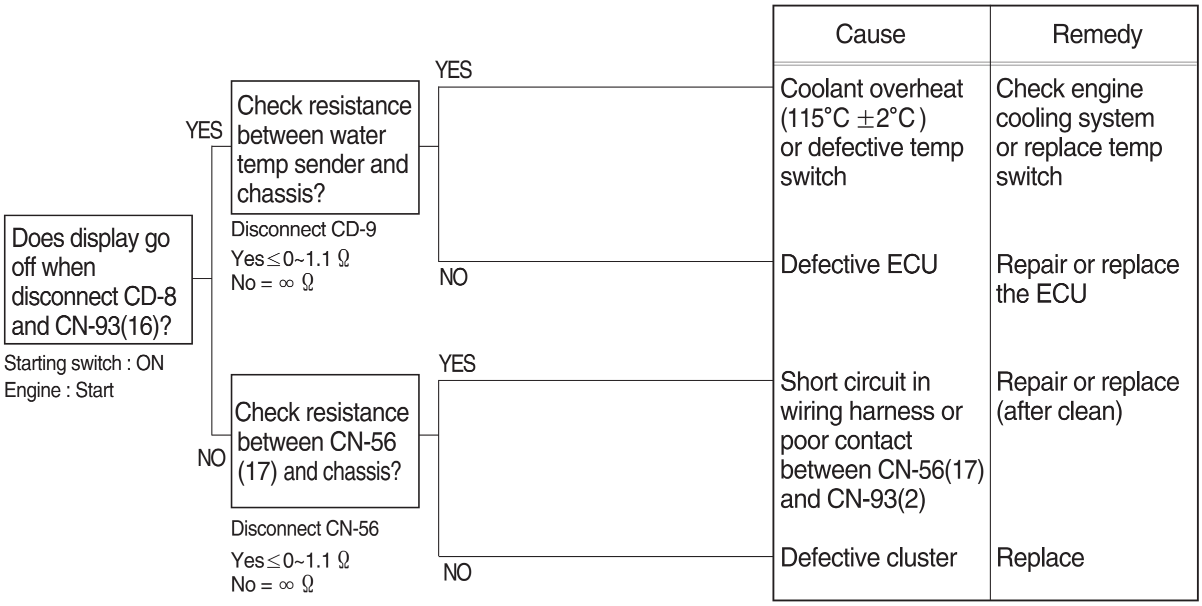
YES	10 ~ 12.5V
NO	0V

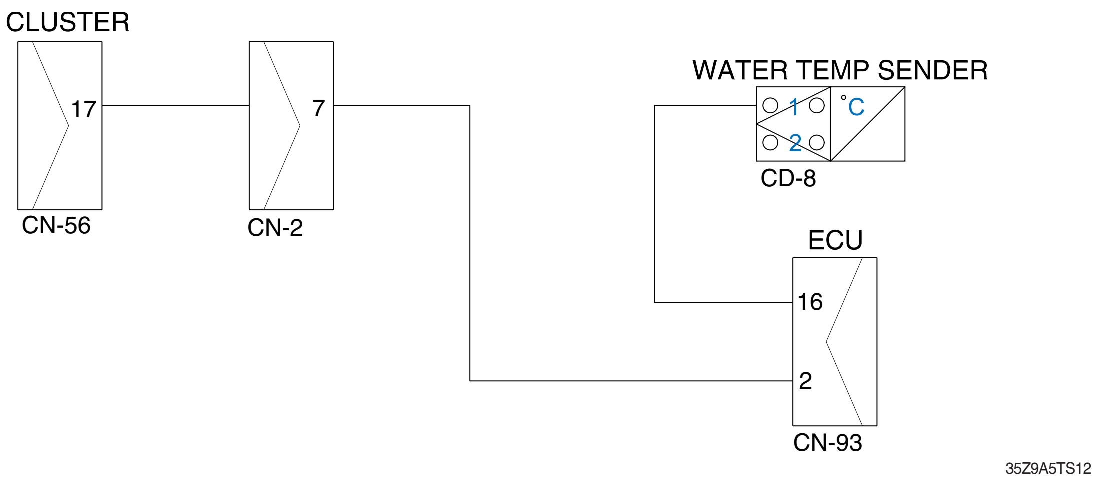


35Z9A5TS11

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

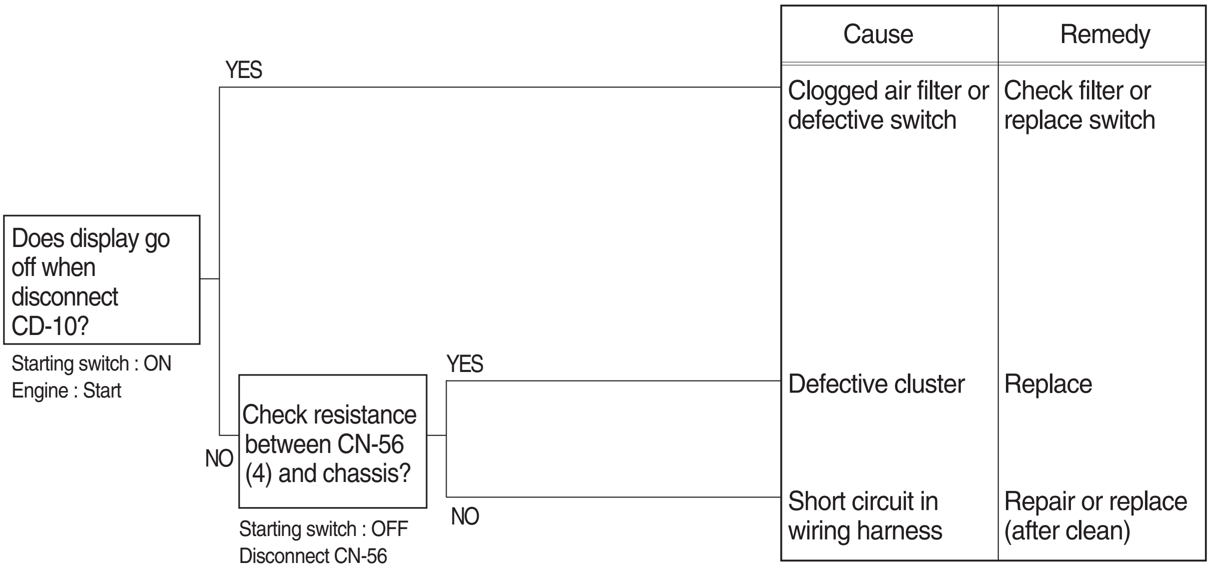
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





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

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



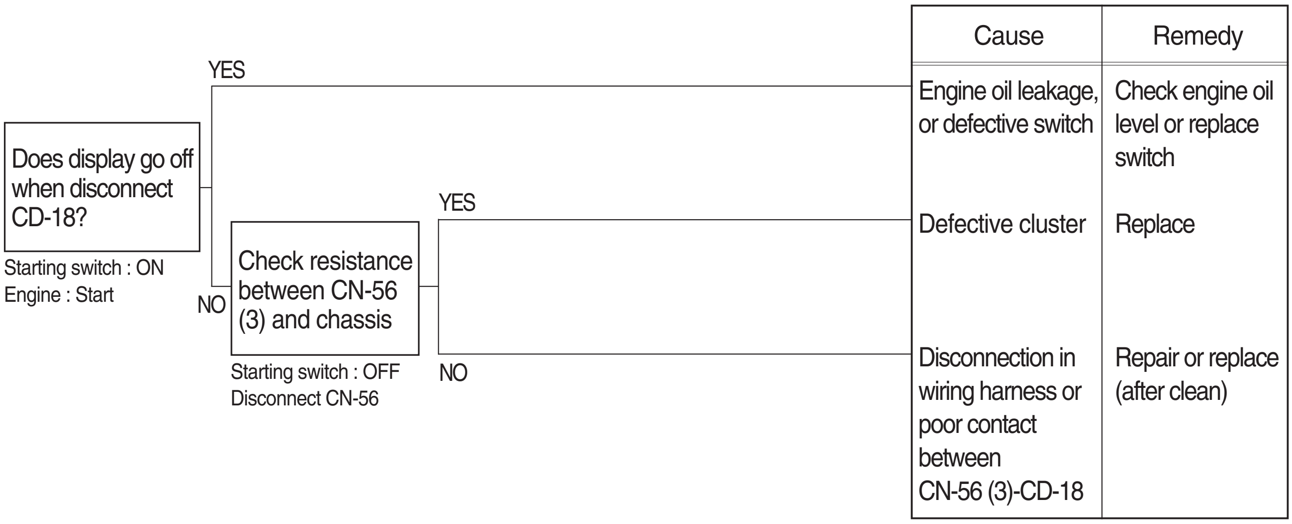
Check resistance

YES	MAX 1Ω
NO	MIN 1M Ω

35Z9A5TS13

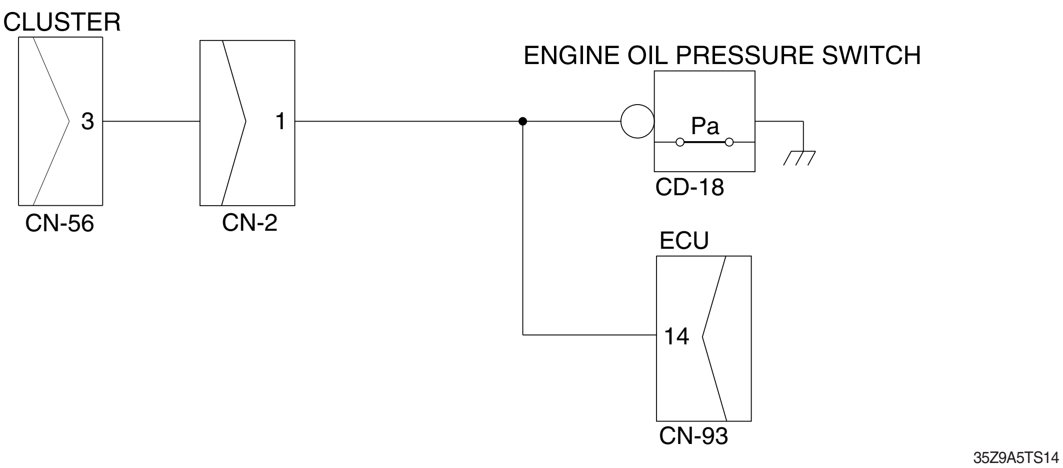
5. WHEN ENGINE OIL PRESSURE WARNING LAMP LIGHTS UP (engine is started)

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



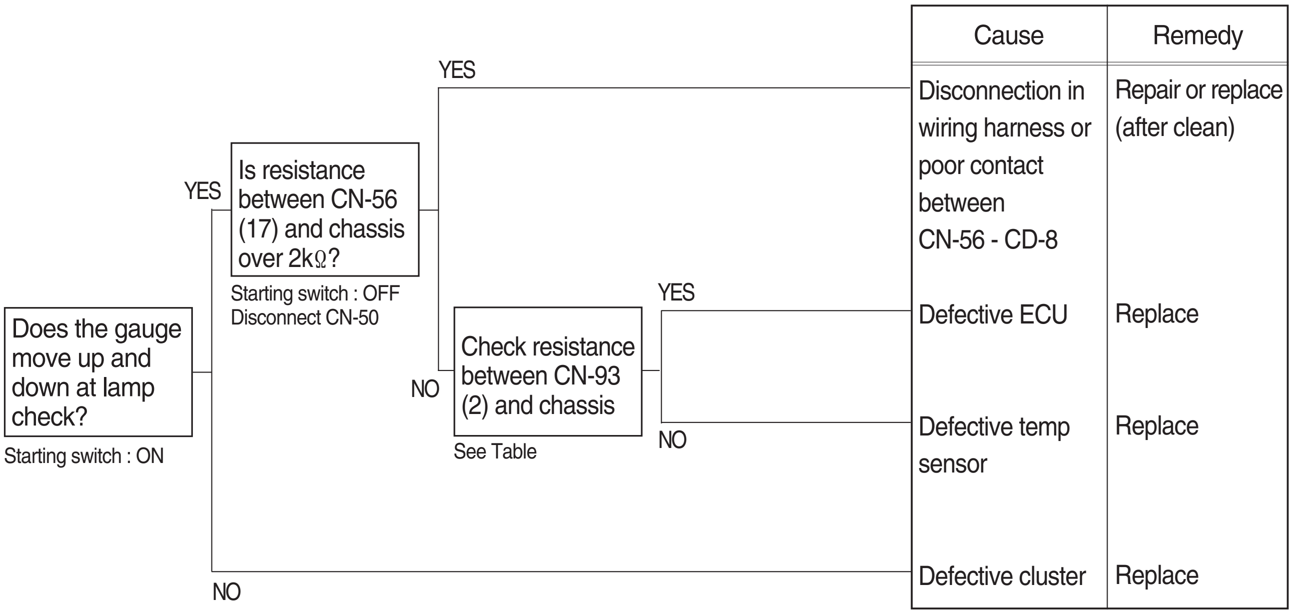
Check resistance

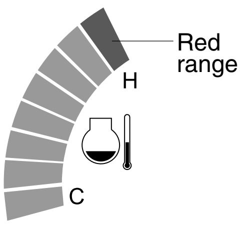
YES	MAX 1Ω
NO	MIN 1MΩ



6. WHEN COOLANT TEMPERATURE GAUGE DOES NOT OPERATE

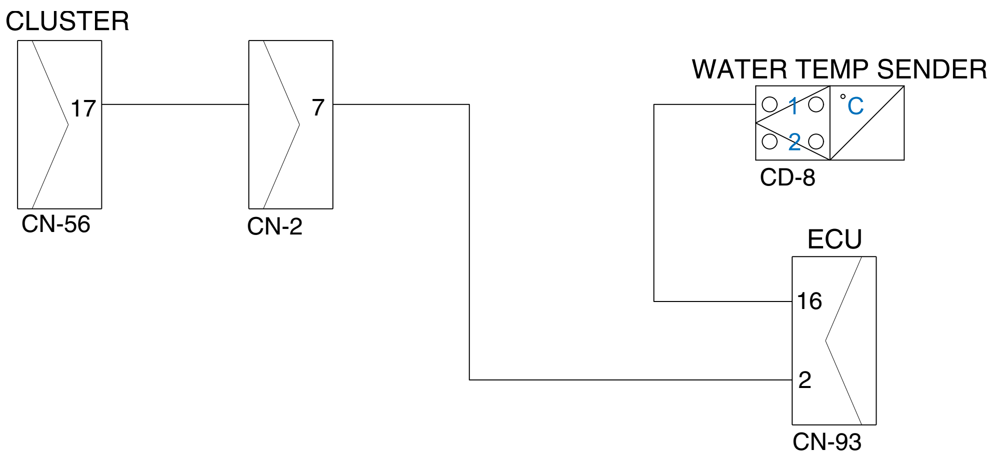
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

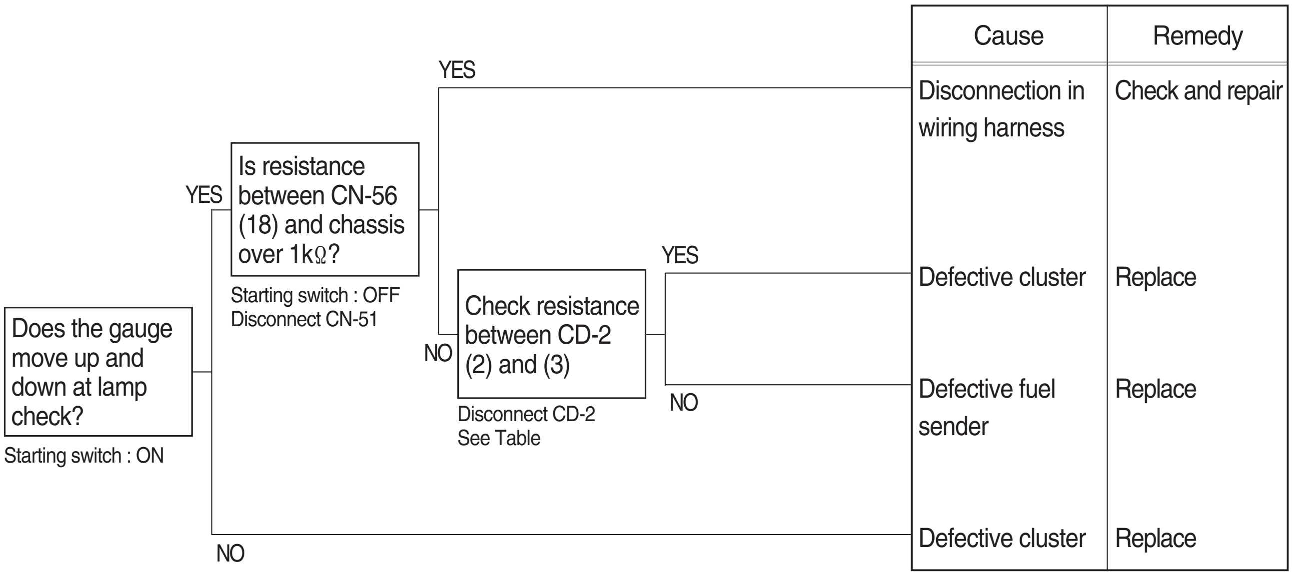
Item \ Temperature	50°C	80°C	100°C	115°C (red range)
Unit Resistance (Ω)	350	118	63.5	36.2

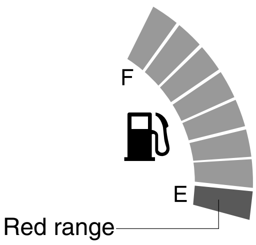


35Z9A5TS15

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

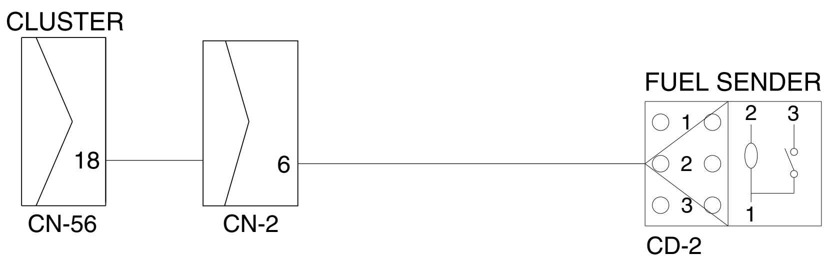
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

Temperature / Item	Empty	1/2	Full
Unit resistance (Ω)	90	38	10



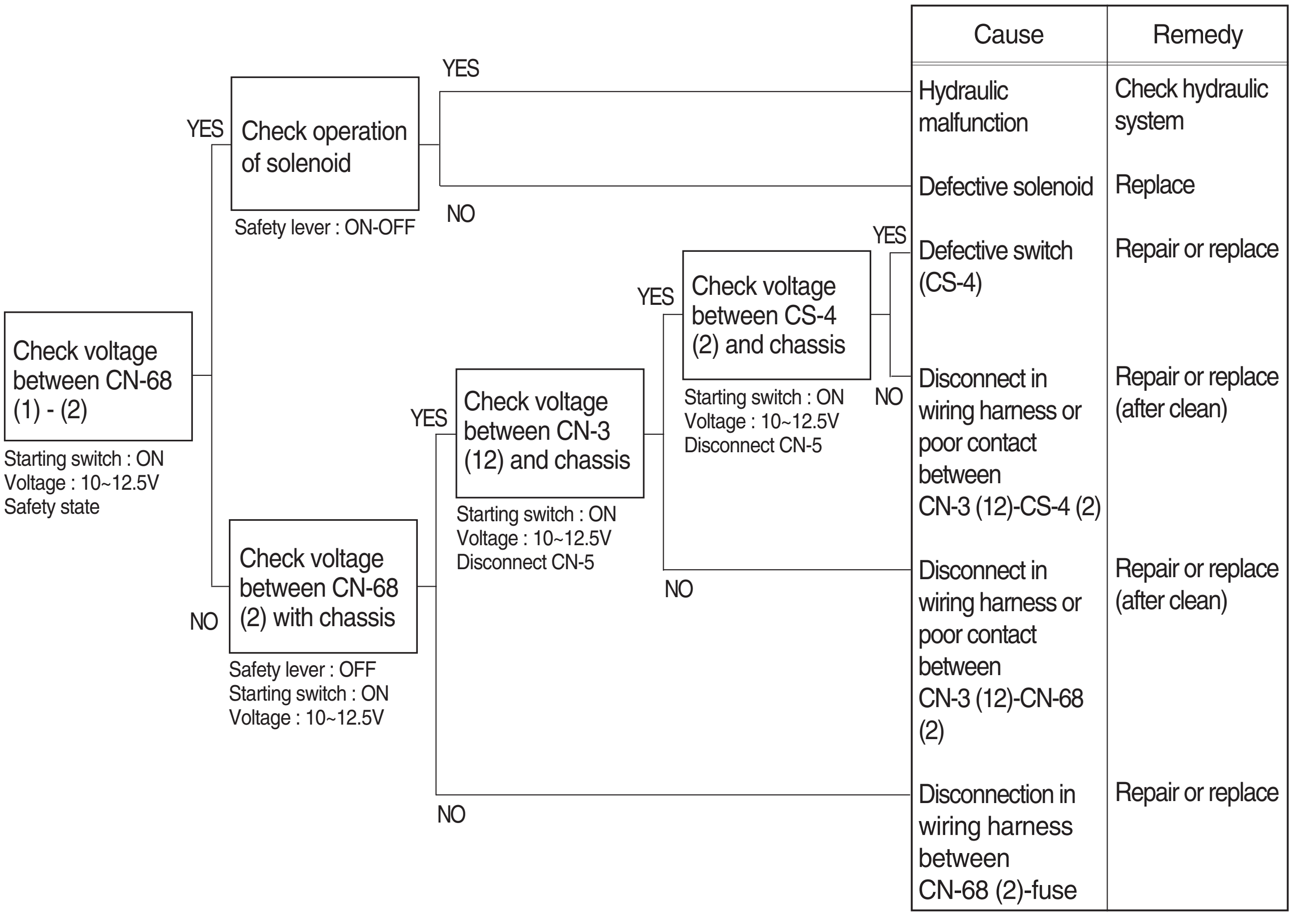
35Z9A5TS16

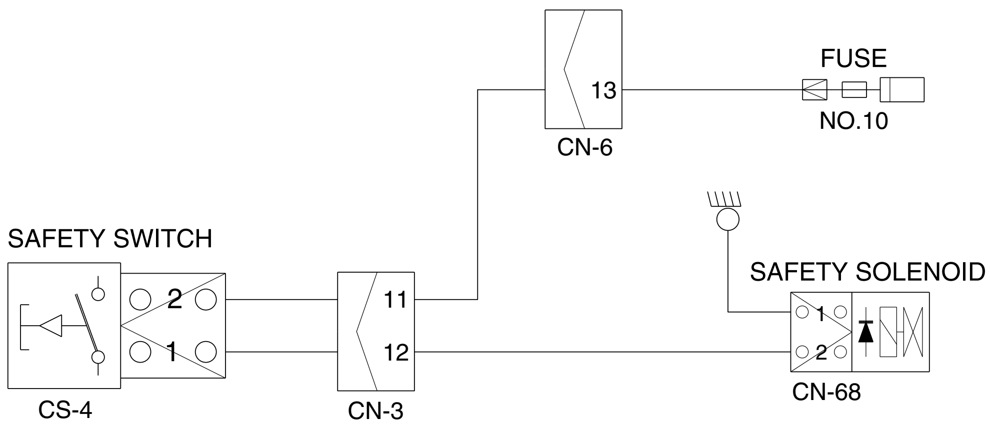
8. WHEN SAFETY SOLENOID DOES NOT OPERATE

· 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.10.

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

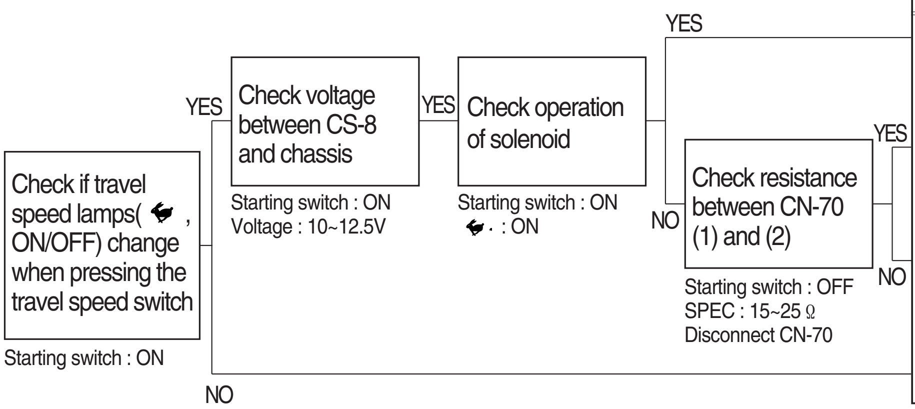




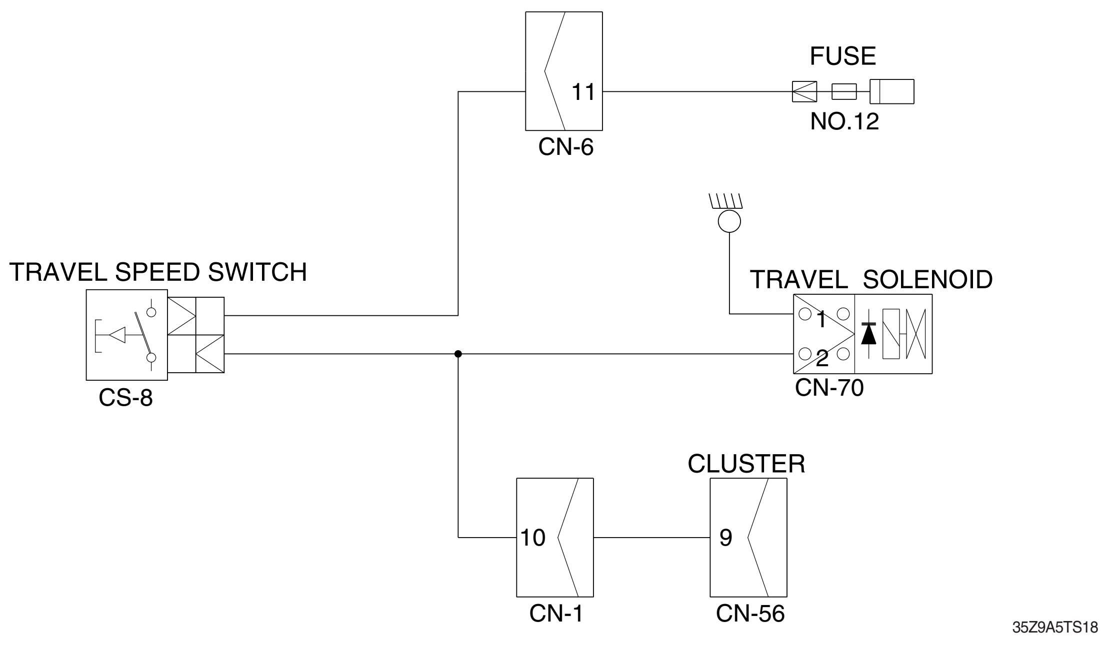
R35Z75TS17

9. 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.12 .
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

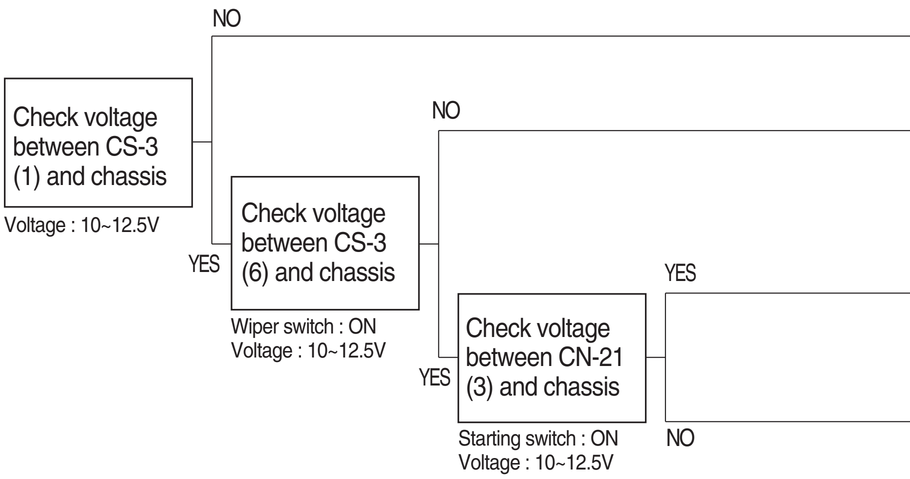


Cause	Remedy
Defective hydraulic system	Check hydraulic system
Defective cluster	Replace
Defective solenoid	Replace
Defective switch	Replace

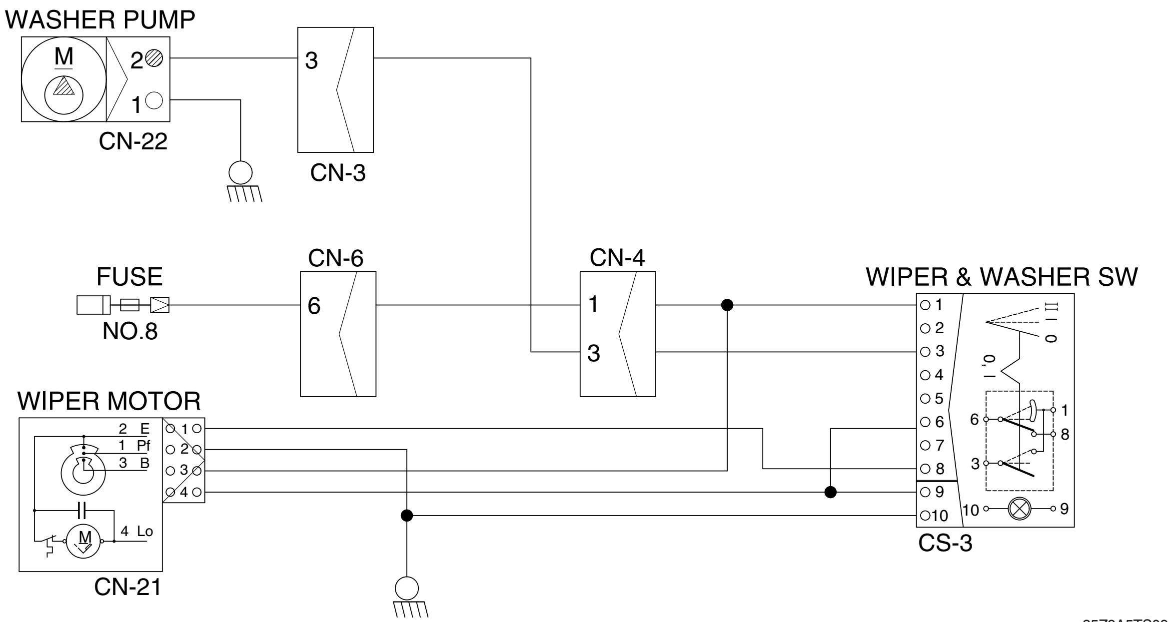


10. WHEN STARTING SWITCH IS TURNED ON, WIPER MOTOR DOES NOT OPERATE

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



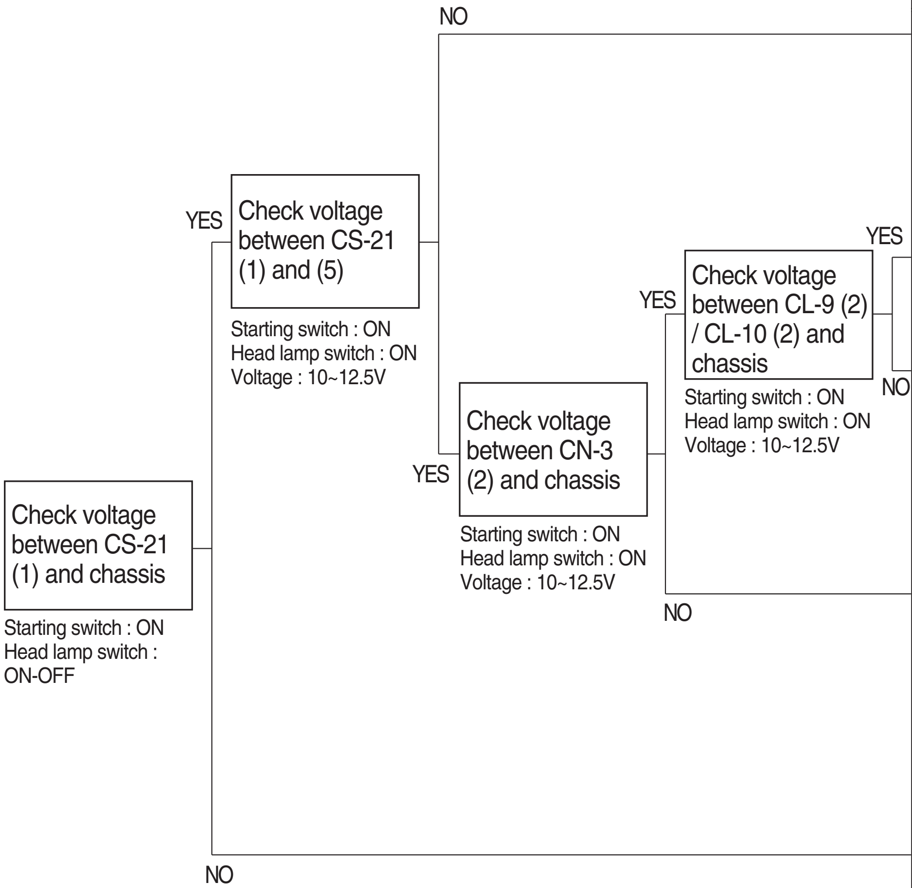
Cause	Remedy
Recheck fuse	Replace
Defective wiper switch	Replace
Defective wiper motor	Replace
Recheck fuse	Replace



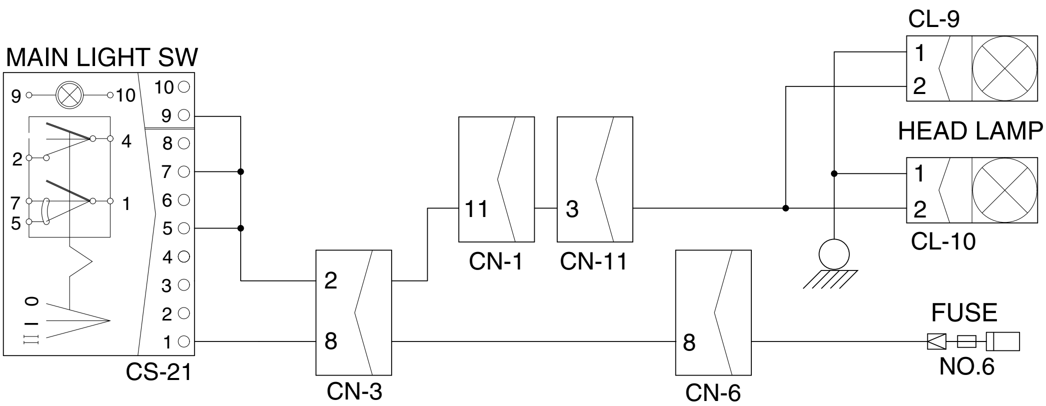
35Z9A5TS09

11. 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.6.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



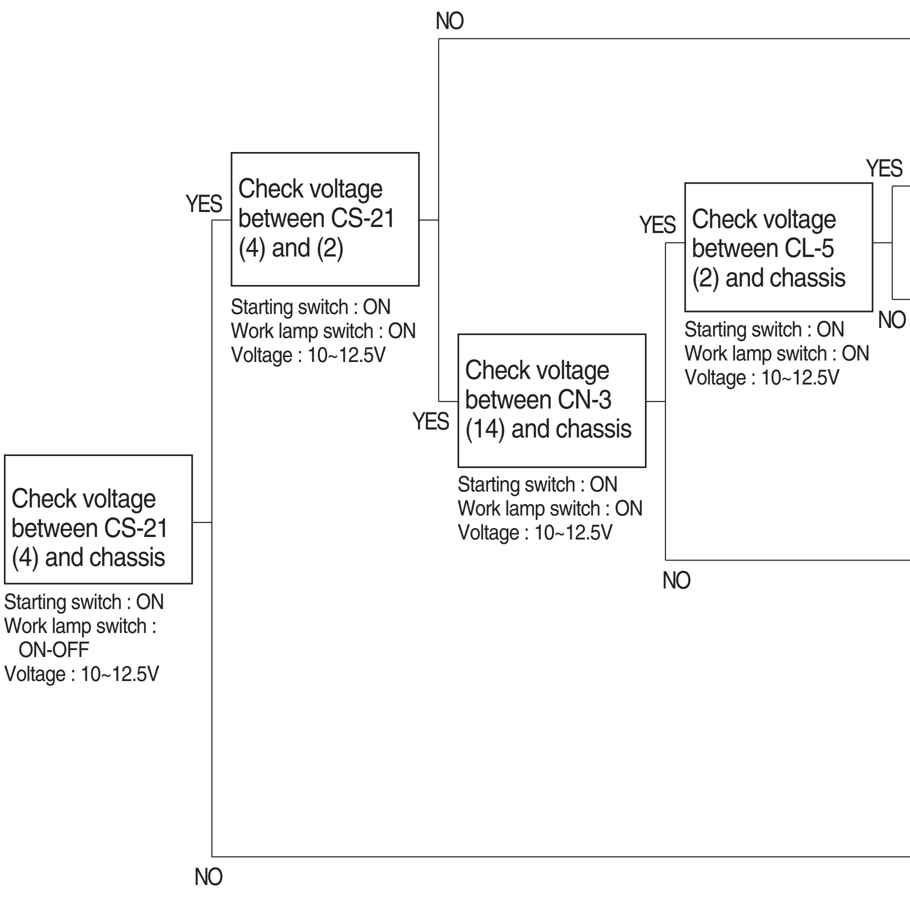
Cause	Remedy
Defective lamp switch	Replace switch
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CN-3 (2)-CL-9 (2)/CL-10 (2)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CS-21 (5)-CN-3 (2)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CS-21 (5) and fuse No.6.	Repair or replace (after clean)



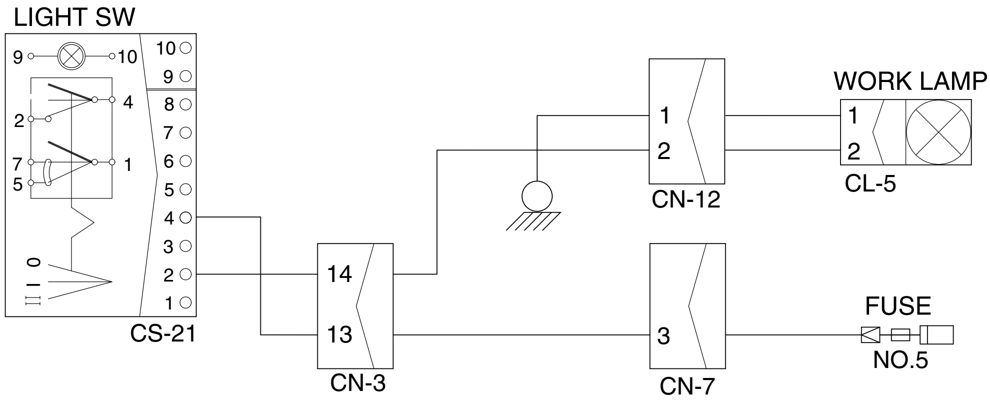
35Z9A5TS20

12. 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.5.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



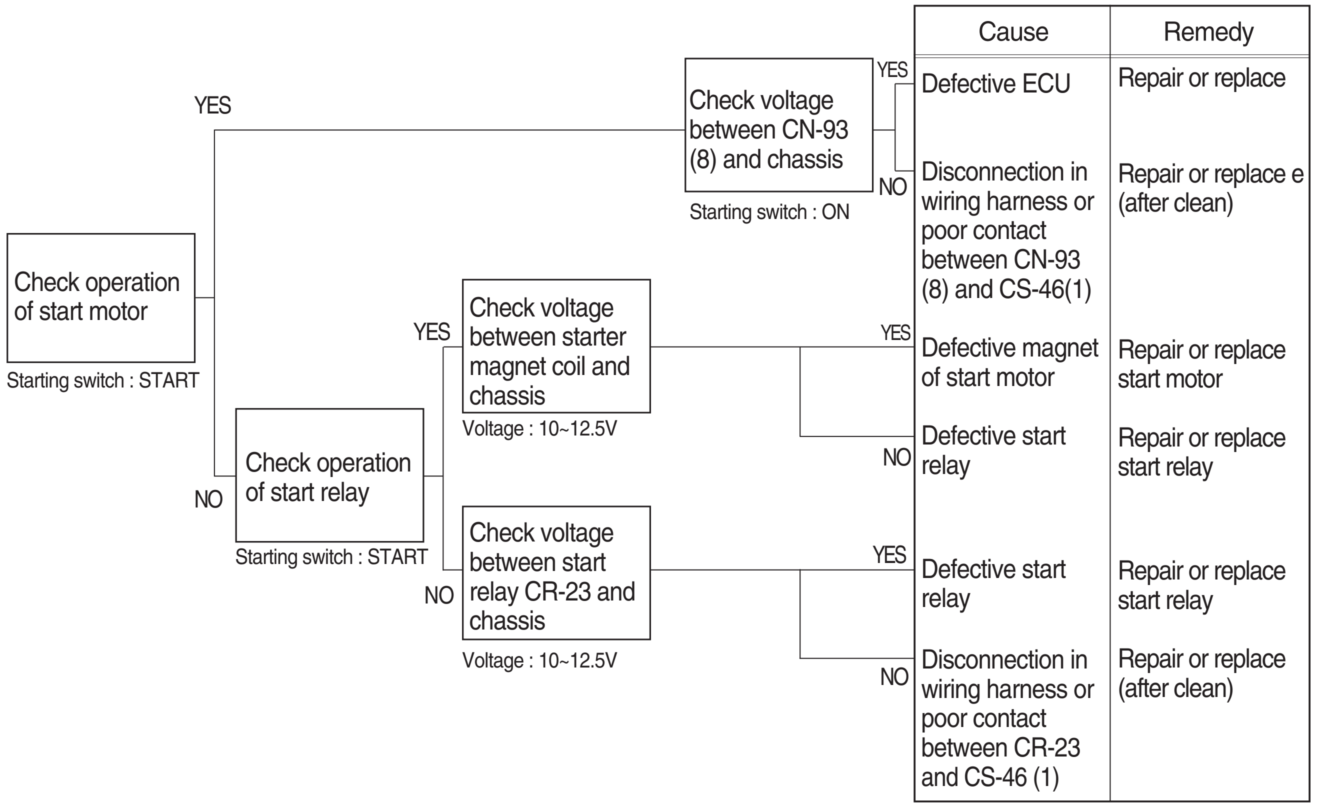
Cause	Remedy
Defective light switch	Replace switch
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CN-3 (14) and CL-5 (2)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CS-21 (2)-CN-3 (14)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CS-21 (4) and fuse	Repair or replace (after clean)

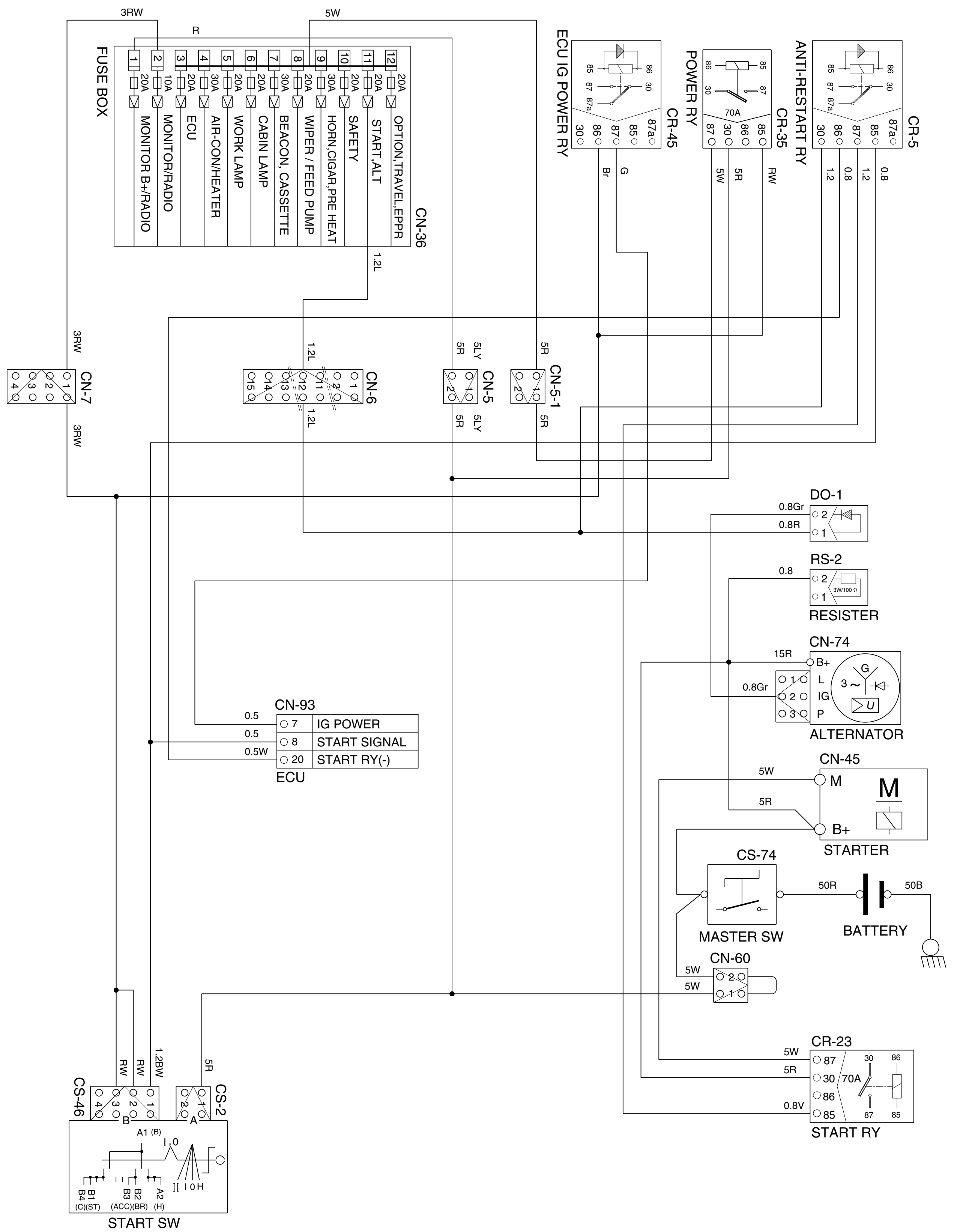


35Z9A5TS21

13. WHEN ENGINE DOES NOT START

- 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.





14. 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.

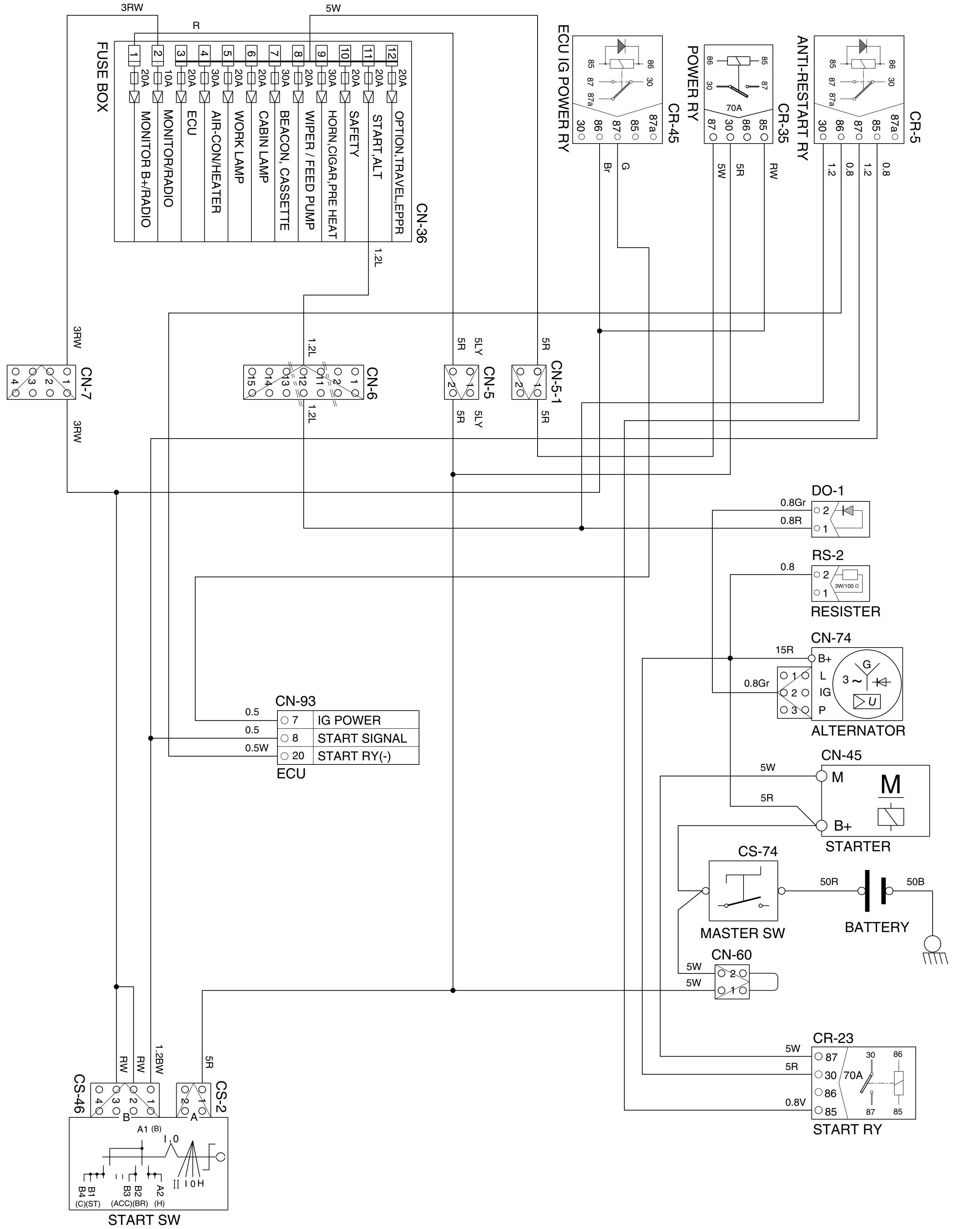
Check voltage and specific gravity of battery
Specific gravity : MIN 1.28
Voltage : MIN 12V

YES → Check voltage between CS-2 (1) and chassis
Voltage : 10~12.5V

YES → Defective start switch
NO → Disconnection in wiring harness or poor contact between CS-2 (1)-Master switch

NO → Battery capacity too low

Cause	Remedy
Defective start switch	Replace
Disconnection in wiring harness or poor contact between CS-2 (1)-Master switch	Replace
Battery capacity too low	Charge or replace (after clean)



35Z9A5TS22

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.

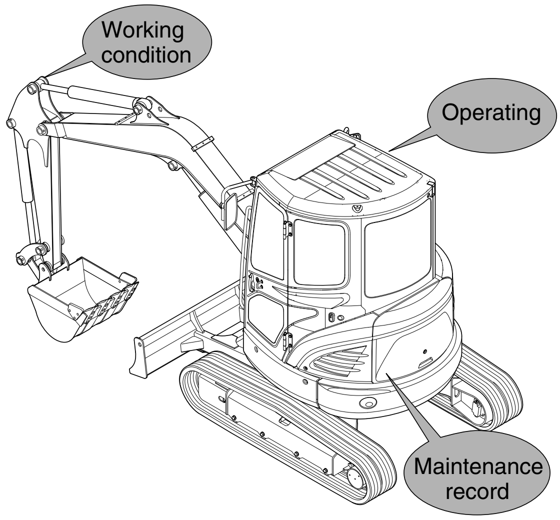
2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

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.

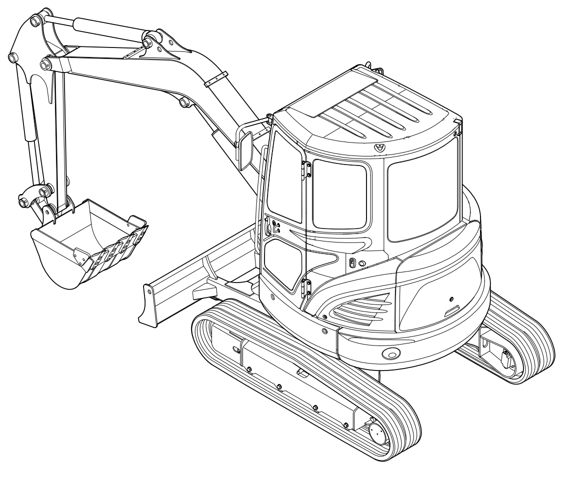


R35Z76MC01

2. TERMINOLOGY

1) STANDARD

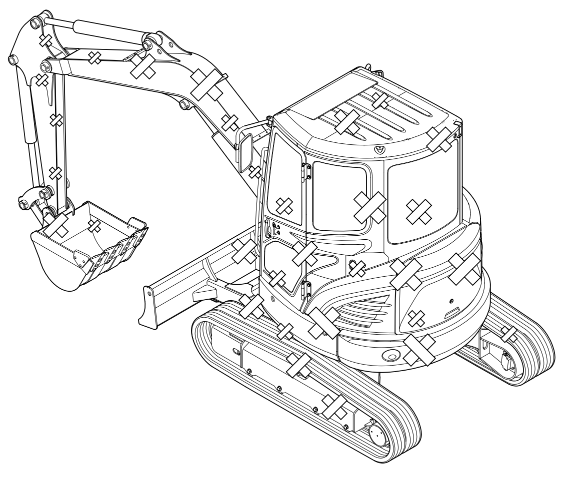
Specifications applied to the brand-new machine, components and parts.



R35Z76MC02

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.



R35Z76MC03

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.

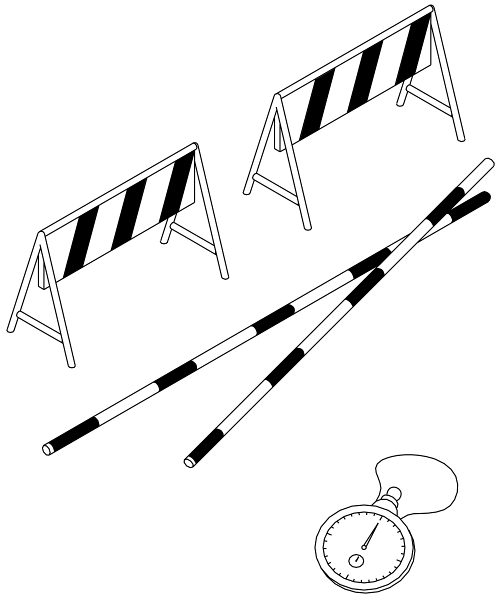
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

(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 accel dial switch at the maximum position.

③ Measure the engine RPM.

(3) Evaluation

The measured speeds should meet the following specifications.

Unit : rpm

Model	Engine speed	Standard	Remarks
R35Z-9A	Low idle	1200±30	
	High idle	2350±30	

3) TRAVEL SPEED

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

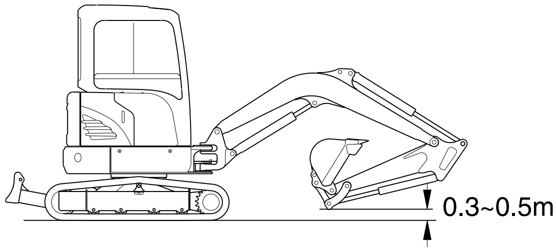
(2) Preparation

① Adjust the tension of both tracks to be equal.

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

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

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



R35Z76MC04

(3) Measurement

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

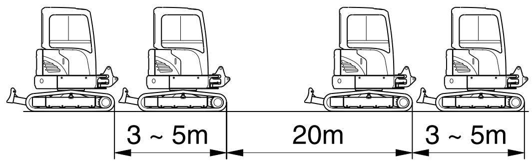
② Before starting either the low or high speed tests, adjust the travel mode switch to the speed to be tested.

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

④ Measure the time required to travel 20 m.

⑤ After measuring the forward travel speed, turn the upperstructure 180° and measure the reverse travel speed.

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



R35Z76MC05

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds / 20 m

Model	Travel speed	Standard	Maximum allowable	Remarks
R35Z-9A	1 Speed	28.8±2.0	36	
	2 Speed	17.1±1.0	21	

4) TRACK REVOLUTION SPEED

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

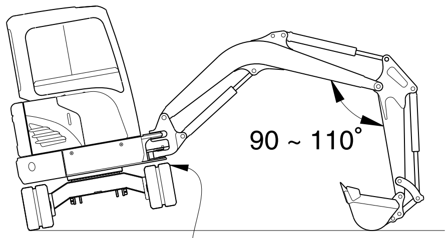
(2) Preparation

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.



(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
R35Z-9A	1 Speed	19.8±1.5	25.0
	2 Speed	11.1±1.5	13.2

5) TRAVEL DEVIATION

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

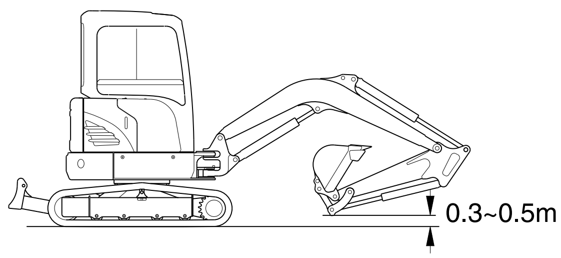
(2) Preparation

① Adjust the tension of both tracks to be equal.

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

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

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



R35Z76MC04

(3) Measurement

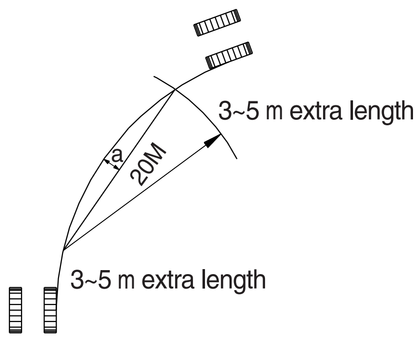
① Measure the amount of mistracking at high and low travel speeds.

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.



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(4) Evaluation

Mistrack should be within the following specifications.

Unit : mm / 20 m

Model	Standard	Maximum allowable	Remarks
R35Z-9A	200 below	240	

6) SWING SPEED

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

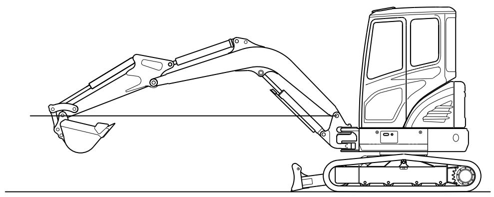
(2) Preparation

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.



R35Z76MC07

(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
R35Z-9A	12.6±0.8	15.8	

7) SWING FUNCTION DRIFT CHECK

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

(2) Preparation

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

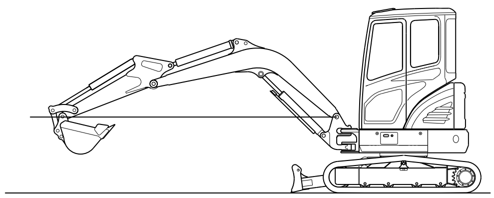
② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.

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

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

⑤ Swing the upperstructure 360°.

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



R35Z76MC07

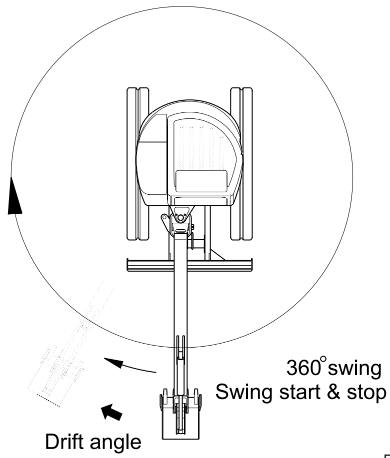
(3) Measurement

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.



R35Z76MC08

(4) Evaluation

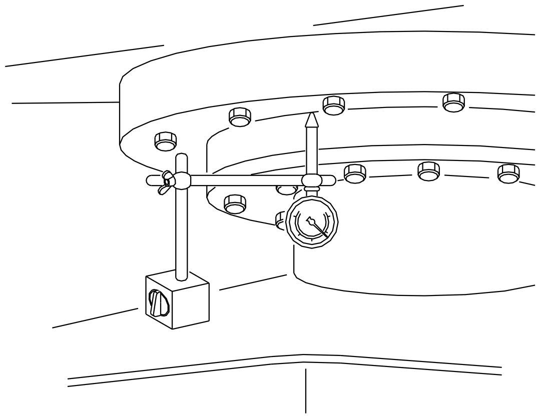
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Standard	Maximum allowable	Remarks
R35Z-9A	40 below	50	

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

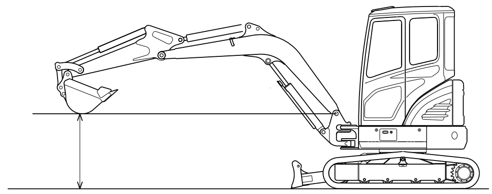
(2) Preparation

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

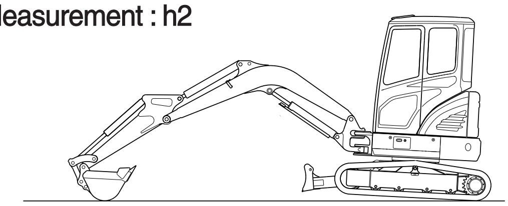
① With the arm rolled out and bucket rolled in, hold the bottom face of the bucket to the same height of the boom foot pin.
Record the dial gauge reading (h1).
② Lower the bucket to the ground and use it to raise the front idler 50 ㎝.
Record the dial gauge reading (h2).
③ Calculate bearing play (H) from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

Measurement : h1



R35Z76MC09

Measurement : h2



R35Z76MC10

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Standard	Maximum allowable	Remarks
R35Z-9A	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 0.5 m above the ground.

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

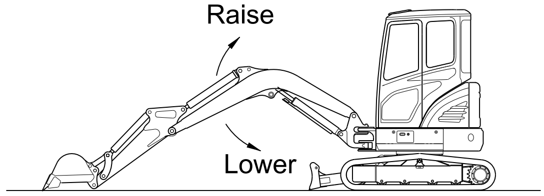
④ Keep the hydraulic oil temperature at $50\pm5^{\circ}C$.

(3) Measurement

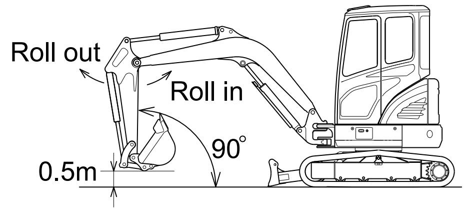
① To measure cylinder cycle times.

- 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.

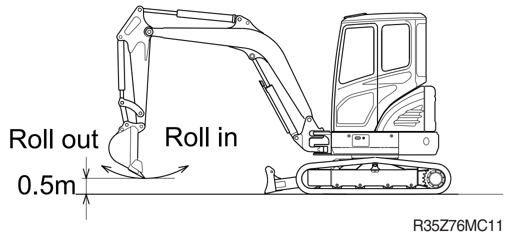
Boom cylinder



Arm cylinder



Bucket cylinder



R35Z76MC11

- 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
R35Z-9A	Boom raise	2.5±0.4	3.1	
	Boom lower	2.4±0.4	2.9	
	Arm in	3.0±0.4	3.6	
	Arm out	2.2±0.3	2.8	
	Bucket load	3.2±0.4	3.9	
	Bucket dump	2.0±0.3	2.6	
	Boom swing (LH)	5.3±0.3	6.4	
	Boom swing (RH)	3.9±0.3	4.7	
	Dozer up (raise)	2.2±0.3	2.5	
	Dozer down (lower)	2.9±0.3	3.2	

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)

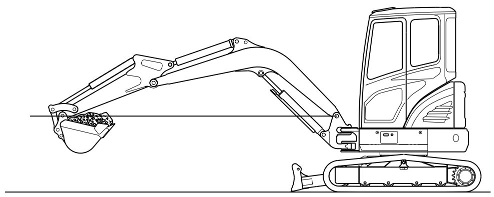
1.5= Soil specific gravity

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.



R35Z76MC12

(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) Evaluation

The measured drift should be within the following specifications.

Unit : mm / 5 min

Model	Drift to be measured	Standard	Maximum allowable	Remarks
R35Z-9A	Boom cylinder	10 below	20	
	Arm cylinder	20 below	30	
	Bucket cylinder	20 below	30	
	Dozer cylinder	30 below	40	

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
R35Z-9A	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.

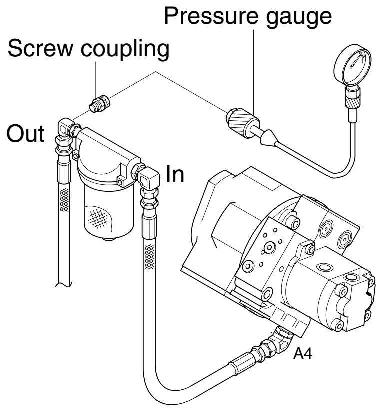
Unit : mm

Model	Kind of lever	Standard	Maximum allowable	Remarks
R35Z-9A	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 cap of screw coupling at the fitting near pilot filter 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.



R35Z76MC14

(2) Measurement

① Measure the primary pilot pressure in the H mode.

(3) Evaluation

The average measured pressure should meet the following specifications:

Unit : kgf / cm^2

Model	Standard	Remarks
R35Z-9A	40±5	

14) FOR TRAVEL SPEED SELECTING PRESSURE

(1) Preparation

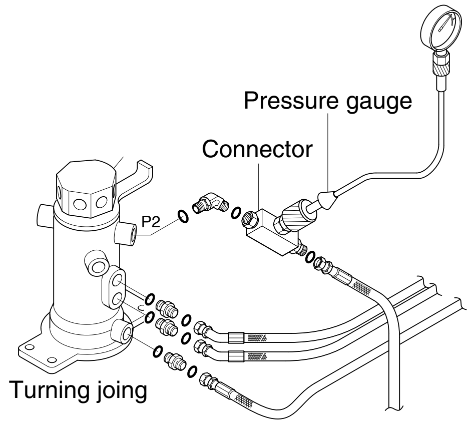
① Stop the engine.

② Push the pressure release button to bleed air.

③ To measure the speed selecting pressure: Install a connector and pressure gauge assembly to turning joint P2 port as shown.

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

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



R35Z76MC15

(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.

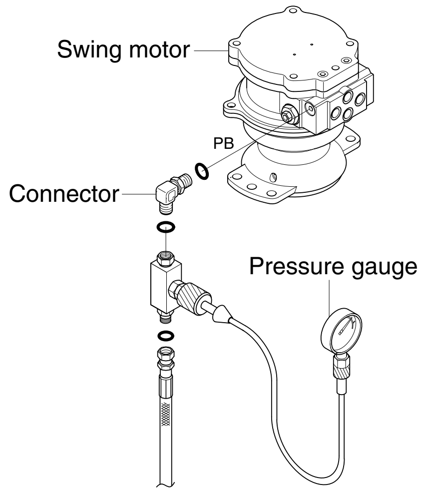
Unit : kgf / cm^2

Model	Travel speed mode	Standard	Maximum allowable	Remarks
R35Z-9A	1 Speed	0	-	
	2 Speed	40±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 PP 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.



R35Z76MC16

(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	Engine speed	Standard	Remarks
R35Z-9A	Brake disengaged	40±5	
	Brake applied	0	

16) MAIN PUMP DELIVERY PRESSURE

(1) Preparation

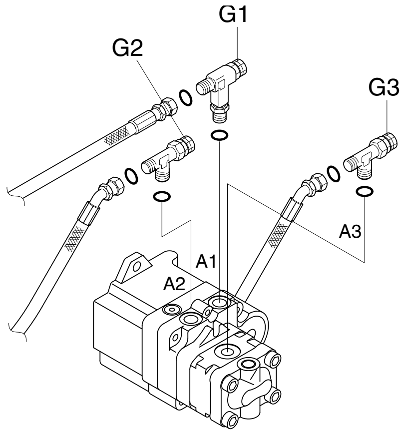
① Stop the engine.

② Push the pressure release button to bleed air.

③ To measure the main pump pressure. Loosen the cap of screw coupling and connect pressure gauge to the main pump gauge port (G1, G2, G3) as shown.

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

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



35Z9A6MC37

(2) Measurement

① Measure the main pump delivery pressure at high idle.

(3) Evaluation

The average measured pressure should meet the following specifications.

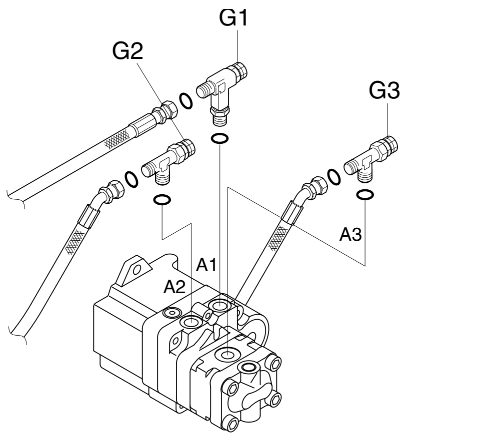
Unit : kgf / cm²

Model	Engine speed	Standard	Allowable limits	Remarks
R35Z-9A	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.
Loosen the cap of screw coupling and connect pressure gauge to the main pump gauge port (G1, G2, G3) as shown.
④ Start the engine and check for oil leakage from the port.
⑤ Keep the hydraulic oil temperature at 50±5°C.



35Z9A6MC37

(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 / cm^2

Model	Function to be tested	Standard
R35Z-9A	Boom, Arm, Bucket	230±10
	Travel	230±10
	Swing	205±10

1. MAIN PUMP

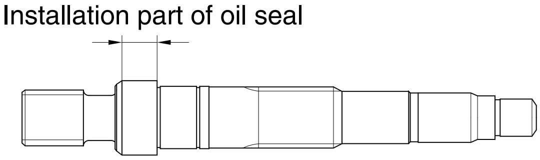
Before inspection, wash the parts well and dry them completely.

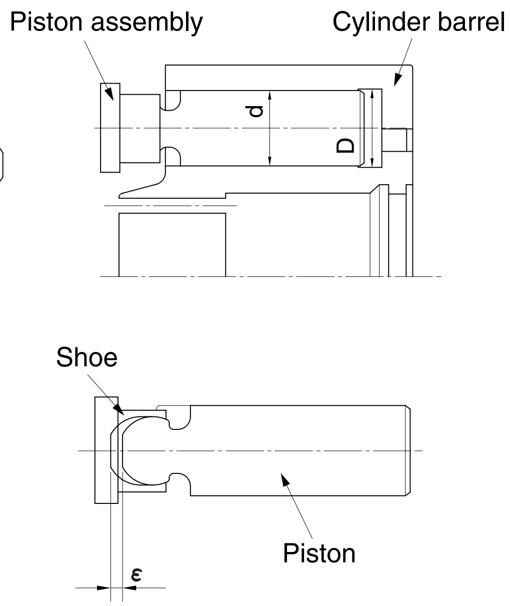
Inspect the principal parts with care and replace them with new parts when any abnormal wear exceeding the allowable limit or damage considered harmful is found.

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

1) INSPECTION POINTS WHEN DISASSEMBLED

Part	Extent of the damage	Inspection standard	Action
Shaft	Excessive wear on the seal surface.	Worn depth : 0.025 mm or more	Replace the shaft.
Valve plate	Excessive wear or damages on the sliding surface.	Worn depth : 0.020 mm or more	Replace the cylinder barrel kit.
Cylinder barrel	Excessive wear or damages on the sliding surface.	Worn depth : 0.020 mm or more	Replace the cylinder barrel kit.
	Clearance between the pistons (D-d)	0.030 mm or more	Replace the cylinder barrel kit.
Piston and shoe	Wear of joint section	Check play (ε) between the shoe and the piston ε : 0.2 mm or more by hand operation.	Replace the cylinder barrel kit.
Seals (O-rings, gasket, etc.)	Damage, excessive rust	-	Replace each part.





17Z9A6MC01

2) TROUBLESHOOTING AND COUNTERMEASURE

No.	Trouble	Possible cause	Countermeasure
1	Overload to engine	· Speed is higher than standard · Setting pressure is higher than specifications · Damage of internal parts of pump	· Readjust it as standard · Readjust it as spec · Repair or replace
2	Low pump flow or low pressure	· Speed down of engine · Wrong coupling · Damage of internal parts of pump	· Readjust of engine speed · Repair or replace · Repair or replace
3	Abnormal noise or abnormal vibration (cavitations)	· The level of oil in the tank is low · Air in the oil · Water in the oil · Clog of suction filter · High suction pressure · Damage of piston shoe · Installation condition is no good · Wrong coupling	· Replenish a tank with oil · Check piping Bleed the air in the hydraulic circuit · Replace oil · Clean or replace · Correction · Replace · Correction · Replace
4	Oil leakage	· Damage of O-ring or packing · Loosened plug · Leaking from oil seal	· Replace · Tight up · Replace Replace of oil seal

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 MOTOR

Replace the parts referring to the following table.

1) MOTOR

Part name	Service criteria
Piston assembly (2-13)	1. The sliding parts are scratched deeply or the sliding surface has become rough. 2 The clearance between the piston and the cylinder block bore is too large. Upper limit of diameter clearance : 0.04 mm 3. The piston shoe ball is loose excessively. Max. clearance (movement) : 0.4 mm
Thrust plate (2-4) Retainer holder (2-11) Retainer plate (2-12) Brake piston (2-15) Valve plate (2-24)	1. The sliding parts are scratched deeply or the sliding surface has become rough.
Cylinder block (2-5)	1. The sliding parts are scratched deeply or the sliding surface has become rough. 2. The meshing surface is worn excessively or cut.
Disc (2-14)	1. The disc (friction material) is scratched deeply or peeled. 2. The meshing surface is worn excessively or cut.
Ball bearings (2-2) (2-22)	1. The rolling contact surface has been flaked or peeled. 2. The rolling contact surface is dented. 3. Bearing rotation produces abnormality (abnormal noise, irregular rotation).
Spring (2-7)	1. The spring is broken or deformed excessively.
O-rings (2-16), (2-17), (2-20), (2-26), (2-42), (2-44), (2-46)	1. Damage that is likely to cause oil leak, damage that is likely to deteriorate the sealing or permanent deformation is noticed.

2) REDUCTION GEAR

Part name	Service criteria
Pinion shaft (1-2)	1. The gear tooth surface is damaged excessively, worn of flaked.
Plates (1-3), (1-8)	1. The plate is damaged or worn excessively.
Taper roller bearings (1-5), (1-7)	1. The roller or the race is damaged excessively, dented or flaked. 2. The rotation produces abnormal noise or is not smooth. ※ To replace the bearing, replace the body assembly.
Oil seal (1-6)	1. The lip is damaged, deformed or worn excessively. 2. The lip is hardened.
Housing (1-1) Holders (1-10), (1-18) Drive gear (1-24) Sun gear (1-17)	1. The gear tooth surface is damaged excessively, worn or flaked. ※ To replace the housing, replace the body assembly.
Inner races (1-12), (1-20)	1. The surface of the needle bearings is damaged excessively or worn or flaked.
Needle bearings (1-13), (1-21)	1. The surface of the needle bearings is damaged excessively or worn or flaked.
Planetary gears (1-14), (1-22)	1. The gear tooth surface is excessively damaged, worn of flaked. 2. The rolling contact surface in contact with the needle bearing is excessively damaged, worn or flaked.
Thrust plates (1-15), (1-23)	1. The sliding surface is excessively damaged, worn or seized.

3) VALVE

Part name	Service criteria
Piston (2-38-14) Case (2-1)	1. The sliding surface is damaged deeply or rough. 2. The clearance between the piston and the case hole is large. Upper limit of diameter clearance : 0.04 mm
Spring (2-40)	1. The spring is broken or deformed excessively.
Plugs (2-38-6), (2-41) Check valve (2-39) O-rings (2-38-8, 9, 10, 11), (2-42) Backup rings (2-38-12, 13)	1. Damage that is likely to cause oil leak, damage that is likely to deteriorate the sealing or permanent deformation is noticed.

4) OTHERS

Part name	Service criteria
Other plugs and O-rings	Damage that is likely to cause oil leak, damage that is likely to deteriorate the sealing or permanent deformation is noticed.

4. TRAVEL MOTOR

Wash all parts disassembly in treated oil and dry in the compressed air.

Perform maintenance including replacement or corrections in accordance with the following criterion.

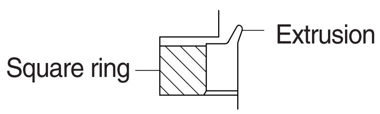
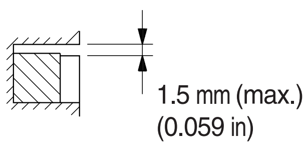
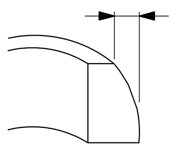
No.	Part name	Check Points	Criterion (recommended standards for replacement)	Measures
1	Floating seal (1-2)	Sliding surface	No remarkable flaws, wear, or seizure are noted.	Replacement
2	Angular bearing (1-3)	Rolling surface	No remarkable flaws, wear, or flaking are noted on balls and race.	Replacement
3	Housing (1-6)	Gear tooth surface	No remarkable flaws, wear, or flaking are noted on gear tooth surface. (note 1)	Replacement
4	Planetary gear A (1-18), B (1-9)	Gear tooth surface and rolling surface of inner side	No remarkable flaws, wear, or flaking are noted as same as No.3	Replacement
5	Needle bearing (1-10), (1-19)	Rolling surface of needle bearing	No remarkable flaws, wear, or flaking are noted.	Replacement
6	Inner race (1-11), (1-20)	Rolling surface of inner race	No remarkable flaws, wear, or flaking are noted.	Replacement
7	Thrust washer (1-12)	Sliding surface	No remarkable flaws, wear, or seizure are noted.	Replacement
8	Thrust plate (1-13), (1-23)	Sliding surface	No remarkable flaws, wear, or seizure are noted.	Replacement
9	Sun gear (1-15)	Gear tooth surface	Same as No. 3	Replacement
10	Holder (1-17)	Sliding surface of planetary gear A	No remarkable flaws, wear, or seizure are noted.	Replace planetary A and holder.
11	Drive gear (1-22)	Gear tooth surface	Same as No. 3	Replacement
13	O-ring (1-25), (1-29), (28), (29), (39), (31-5), (44), (50-5), (50-6), (50-7), (65), (66), (74)	Surface and hardness	No flaws and deflection are noted. Not hardened.	Recommend that seals be replaced with new ones at time of reassembly, since rubber materials normally deteriorate with age.
14	Shaft (2)	Sliding surface of oil seal	No remarkable flaws, wear.	Replacement
15	Ball bearing (3), (27)	Same as No. 2.	Same as No. 2.	Replacement
16	Oil seal (4)	Surface and hardness of seal lip	No flaw, wear or deflection are noted. Not hardened.	Replacement

Note 1 : Pitching in this instance refers to a case where pitching occurs in more than 10% of engagement area per tooth surface.

No.	Part name	Check Points	Criterion (recommended standards for replacement)	Measures
17	Swash plate (5)	Sliding surface and roughness between piston sub assembly and swash plate	No remarkable flaws (over 0.02 [mm] in thickness), wear, or seizure are noted. 0.4a (0.8a)	Correct lapping (#1000) if sliding surface is rough. Replace if proper correction cannot be made.
18	Cylinder block (7)	Clearance between piston sub assembly and cylinder block.	0.02 [mm] (0.04 [mm])	Replace both cylinder block and piston sub assembly concurrently. Correct lapping (#1000) if sliding surface is rough. Replace both cylinder block and piston sub assembly with new, if sliding surfaces cannot be properly corrected.
		Sliding surface and roughness between valve plate and cylinder block.	No remarkable flaws (over 0.02[mm] in thickness), wear, or seizure are noted. 0.4a (0.8a)	
19	Spring (9), (20), (37) (42), (31-3), (50-3), (62), (63)	Breakage or deflection is big.	-	Replacement
20	Piston sub assembly (15)	Clearance between piston sub assembly and cylinder block.	Same as No. 18.	Same as No. 18.
		Sliding surface and roughness between piston sub assembly and swash plate.	Same as No. 17. 0.2a (0.8a)	Same as No. 17.
		Loosen between piston and shoe is big.	0.15 [mm] (0.4 [mm])	Replacement
21	Piston (19)	Clearance between piston sub assembly and flange holder.	Same as No. 18.	Same as No. 18.
		Sliding surface and roughness between piston sub assembly and swash plate.	Same as No. 17.	Same as No. 17.
22	Valve plate (25)	Sliding surface and roughness between valve plate cylinder block.	Same as No. 18.	Same as. No. 18.
		Thickness; 5 [mm]	4.8 [mm]	Replacement
23	Base plate (30)	Sliding surface between plunger and base plate.	No remarkable flaws, wear, or seizure are noted.	Replace both base plate and plunger.
		Sliding surface between spool and base plate.	No remarkable flaws, wear, or seizure are noted.	Replace both base plate and spool.

No.	Part name	Check Points	Criterion (recommended standards for replacement)	Measures
24	Plunger (31-1)	Sliding surface between plunger and base plate.	No remarkable flaws, wear, or seizure are noted.	Replace both base plate and plunger.
		Sliding surface between plunger and check valve.	No remarkable flaws, wear, or seizure are noted.	Replace both check valve and plunger.
25	Check valve (31-2)	Sliding surface between plunger and check valve.	No remarkable flaws, wear, or seizure are noted.	Replace plunger assy.
		Seat surface between plunger and check valve.	No remarkable flaws, wear, or seizure are noted. Entire surface of seats are rubbing.	Replace both check valve and plunger.
26	Spool (41)	Sliding surface between plunger and check valve.	Same as No. 23	Same as No. 23
27	Valve body (50-1)	Sliding surface between spool and valve body.	No remarkable flaws, wear, or seizure are noted.	Replace valve assy.
28	Without parking brake check valve (50-2)	Sliding surface between plunger and check valve.	No remarkable flaws, wear, or seizure are noted.	Replace valve assy.
	With parking brake spool (50-2)	Sliding surface between spool and valve body.	No remarkable flaws, wear, or seizure are noted.	Replace valve assy.

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

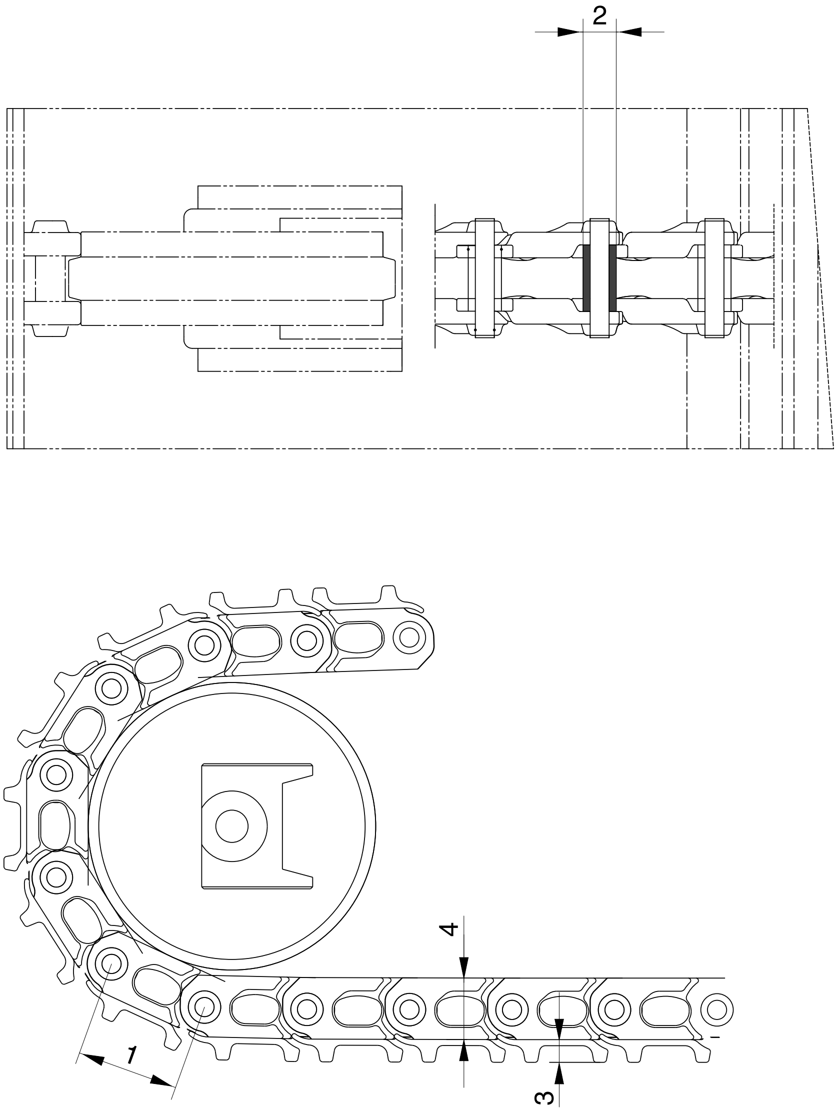
6. CYLINDER

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

GROUP 3 TRACK AND WORK EQUIPMENT

1. TRACK SHOE

1) STEEL SHOE

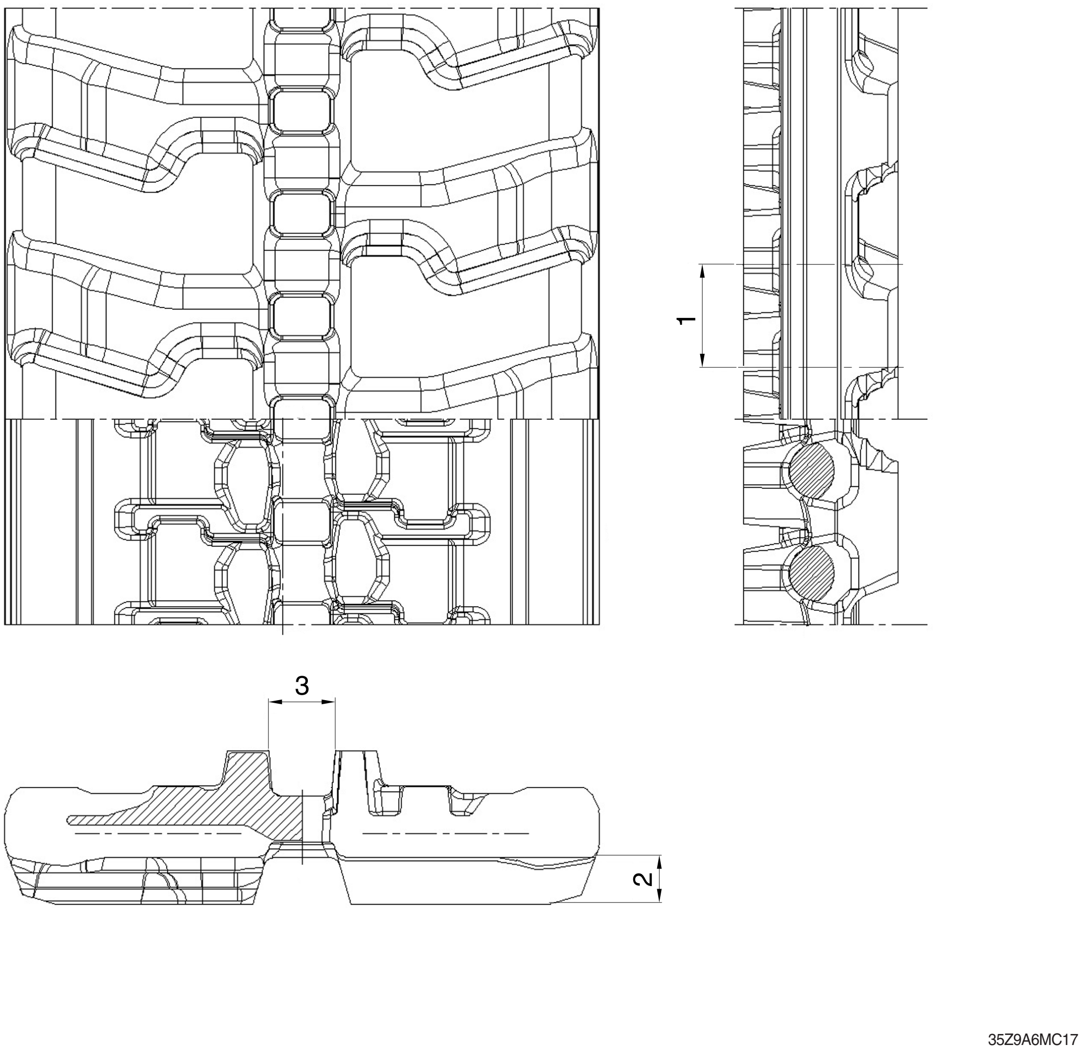


R35Z76MC18

Unit : mm

No	Check item	Criteria		Remedy
		Standard size	Repair limit	
1	Link pitch	101.6	105.0	Replace bushing and pin and link assembly
2	Outside diameter of bushing	32.17	28.77	
3	Height of grouser	16.5	12.5	Lug welding, rebuild or replace
4	Height of link	61	56	

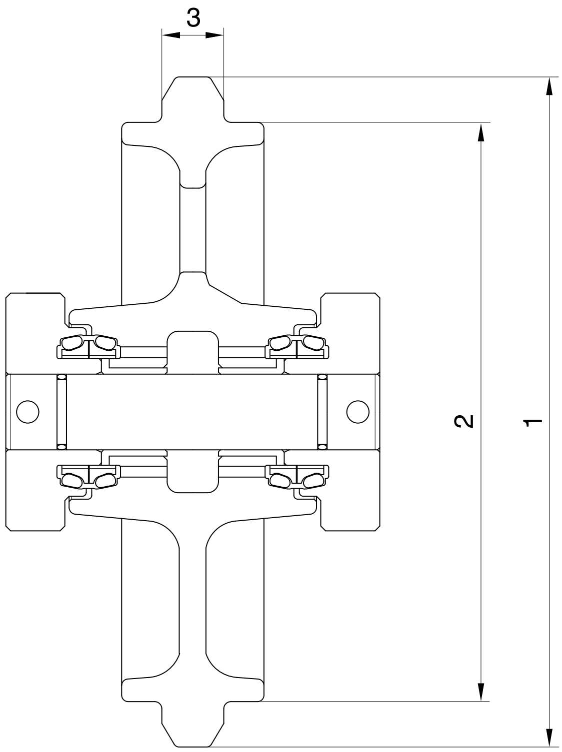
2) RUBBER SHOE



Unit : mm

No	Check item	Criteria		Remedy
		Standard size	Repair limit	
1	Link pitch	52.5	54.5	Replace
2	Height of grouser	24	5	
3	Width of link	34	46	

2. IDLER

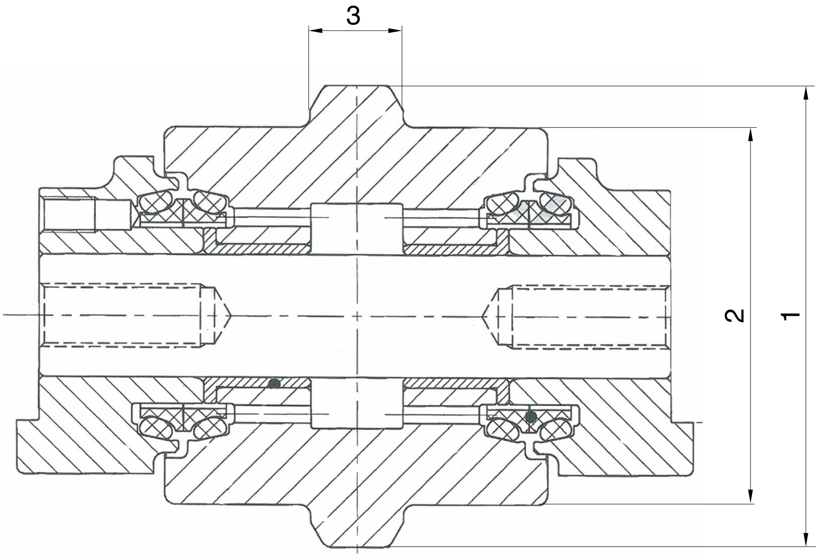


35Z9A6MC18

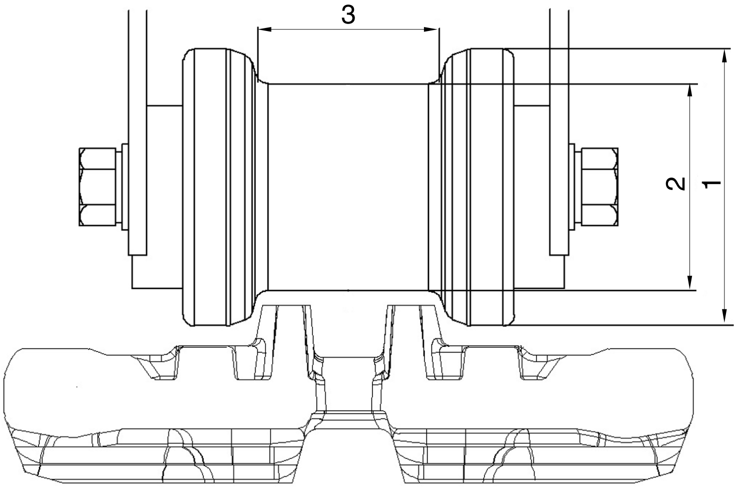
Unit : mm

No	Check item		Criteria		Remedy
			Standard size	Repair limit	
1	Outside diameter of flange	Steel	309	-	Rebuild or replace
		Rubber	331	-	
2	Outside diameter of thread	Steel	285	263	
		Rubber	289	279	
3	Width of flange		26.2	20.2	

3. TRACK ROLLER



STEEL TRACK



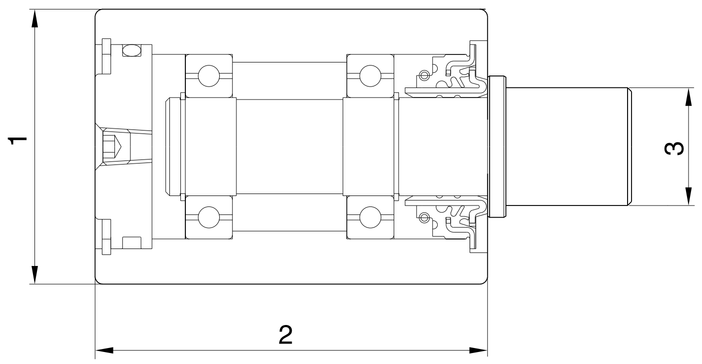
RUBBER TRACK

35Z9A6MC19

Unit : mm

No	Check item		Criteria		Remedy
			Standard size	Repair limit	
1	Outside diameter of flange	Steel	131	-	Rebuild or replace
		Rubber	135	129	
2	Outside diameter of thread	Steel	107	101	
		Rubber	95	89	
3	Width of flange	Steel	26.2	20.2	
		Rubber	80	85	

4. CARRIER ROLLER

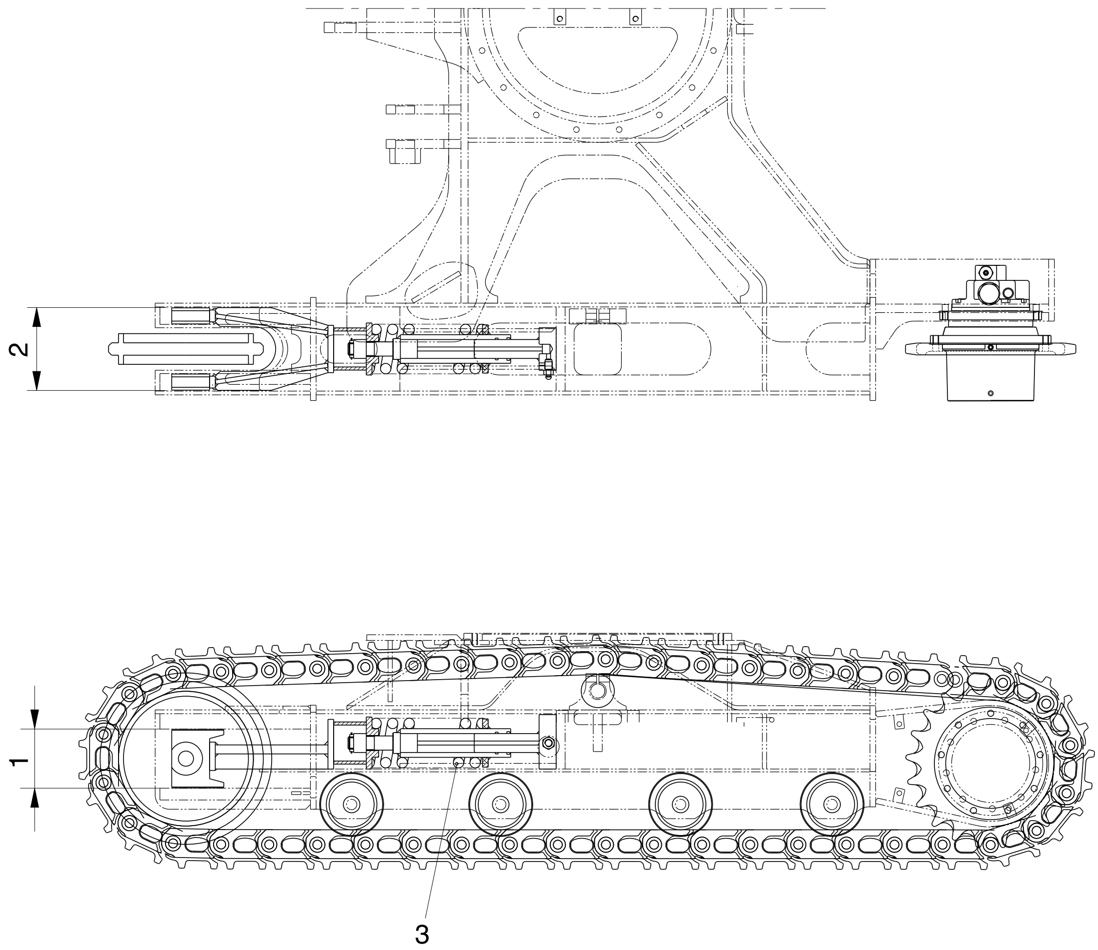


35Z9A6MC20

Unit : ㎜

No	Check item	Criteria		Remedy
		Standard size	Repair limit	
1	Outside diameter of flange	ø 70	ø 66	Replace
2	Width of tread	ø 100	-	
3	Diameter of shaft	ø 30	-	

5. TENSION CYLINDER (steel and rubber track)



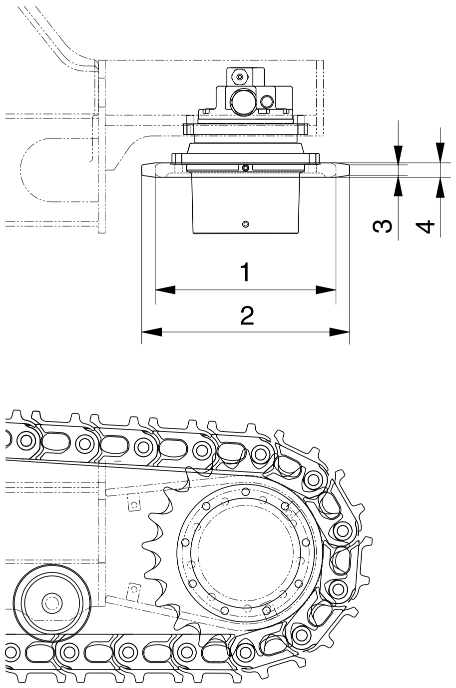
R35Z76MC21

Unit : mm

<table>
<tr><th rowspan="2">No</th><th rowspan="2">Check item</th><th colspan="5">Criteria</th><th rowspan="2">Remedy</th></tr>
<tr><th></th><th colspan="2">Standard size</th><th colspan="2">Repair limit</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Vertical width of idler guide</td><td>Track frame</td><td colspan="2">125</td><td colspan="2">129</td><td>Rebuild</td></tr>
<tr><td>Idler support</td><td colspan="2">124</td><td colspan="2">128</td><td>Rebuild or replace</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Horizontal width of idler guide</td><td>Track frame</td><td colspan="2">178</td><td colspan="2">182</td><td>Rebuild</td></tr>
<tr><td>Idler guide</td><td colspan="2">174</td><td colspan="2">178</td><td>Rebuild or replace</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">Recoil spring</td><td colspan="3">Standard size</td><td colspan="2">Repair limit</td><td rowspan="3">Replace</td></tr>
<tr><td>Free length</td><td>Installed length</td><td>Installed load</td><td>Free length</td><td>Installed load</td></tr>
<tr><td>286.5</td><td>A : 233.5
B : 220</td><td>2,698 kg</td><td>-</td><td>2,158 kg</td></tr>
</table>

A : steel track B : rubber track

6. SPROCKET (steel and rubber track)

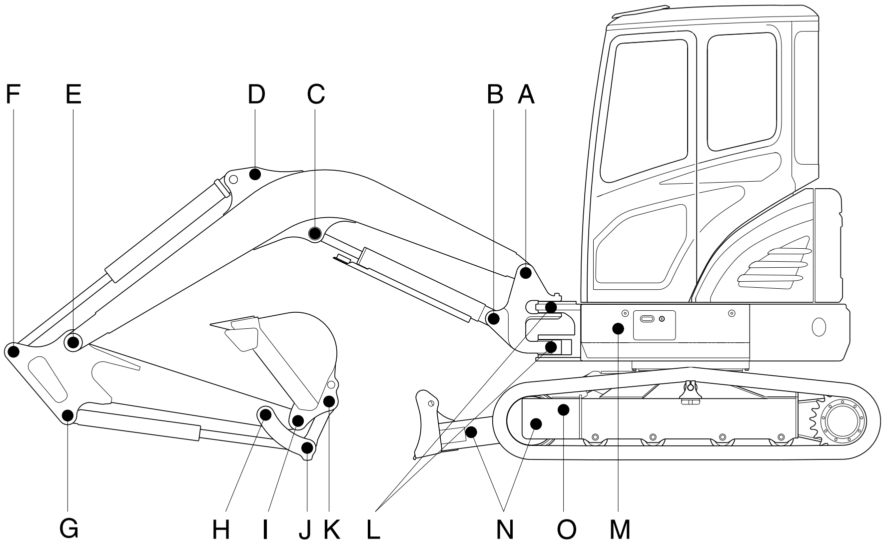


R35Z76MC22

Unit : mm

No	Check item	Criteria		Remedy
		Standard size	Repair limit	
1	Wear out of sprocket tooth lower side diameter	313.72	304.72	Repair or Replace
2	Wear out of sprocket tooth upper side diameter	359.75	-	
3	Wear out of sprocket tooth upper side width	18	-	
4	Wear out of sprocket tooth lower side width	25	17	

7. WORK EQUIPMENT



R35Z76MC30

Unit : ㎜

Mark	Measuring point (Pin and Bushing)	Normal value	Pin		Bushing		Remedy & Remark
			Recomm. service limit	Limit of use	Recomm. service limit	Limit of use	
A	Boom Rear	50	49	48.5	50.5	51	Replace
B	Boom Cylinder Head	45	44	43.5	45.5	46	〃
C	Boom Cylinder Rod	45	44	43.5	45.5	46	〃
D	Arm Cylinder Head	45	44	43.5	45.5	46	〃
E	Boom Front	45	44	43.5	45.5	46	〃
F	Arm Cylinder Rod	45	44	43.5	45.5	46	〃
G	Bucket Cylinder Head	40	39	38.5	40.5	41	〃
H	Arm Link	40	39	38.5	40.5	41	〃
I	Bucket and Arm Link	40	39	38.5	40.5	41	〃
J	Bucket Cylinder Rod	40	39	38.5	40.5	41	〃
K	Bucket Link	40	39	38.5	40.5	41	〃
L	Boom swing post	70	69	68.5	70.5	71	〃
M	Boom swing cylinder	45	44	43.5	45.5	46	〃
N	Blade cylinder	45	44	43.5	45.5	46	〃
O	Blade and frame link	40	39	38.5	40.5	41	〃

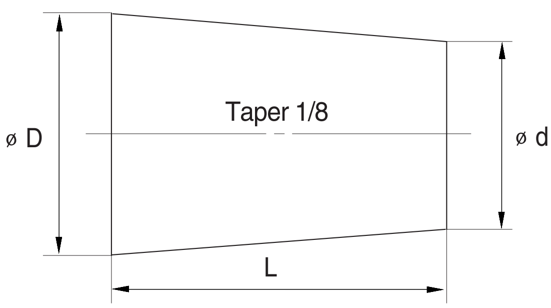
SECTION 7 DISASSEMBLY AND ASSEMBLY

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

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

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



2. INSTALL WORK

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

2) Install the hoses without twisting or interference.

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

4) Bend the cotter pin or lock plate securely.

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

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

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

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

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

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

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

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

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

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

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

(2) Operate the control lever and actuate the hydraulic cylinder 4-5 times, stopping 100 mm 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 disulphide grease) to the work equipment related parts.

GROUP 2 TIGHTENING TORQUE

1. MAJOR COMPONENTS

No.	Descriptions		Bolt size	Torque	
				kgf · m	lbf · ft
1	Engine	Engine mounting bolt (Engine-Bracket)	M10 × 1.5	6.9±1.4	50±10.0
2		Engine mounting bolt (Bracket-Frame)	M12 × 1.75	12.8±3.0	93±22.0
3		Radiator mounting bolt, nut	M10 × 1.5	6.9±1.4	50±10.0
4		Coupling mounting bolt	M12 × 1.75	9.3±0.5	67.1±3.6
5	Hydraulic system	Main pump mounting bolt	M12 × 1.75	9.5±1.9	69±14.0
6		Main control valve mounting bolt	M10 × 1.5	6.9±1.4	50±10.0
7		Fuel tank mounting bolt	M12 × 1.75	12.8±3.0	93±22.0
8		Hydraulic oil tank mounting bolt	M12 × 1.75	12.8±3.0	93±22.0
9		Turning joint mounting bolt, nut	M10 × 1.5	6.9±1.4	50±10.0
10		Swing motor mounting bolt	M14 × 2.0	19.6±2.9	142±21.0
11	Power train system	Swing bearing upper mounting bolt	M12 × 1.75	13.3±2.0	96.2±14.5
12		Swing bearing lower mounting bolt	M12 × 1.75	12.8±2.0	93±14.5
13		Travel motor mounting bolt	M12 × 1.75	13.8±1.0	100±7.2
14		Sprocket mounting bolt	M12 × 1.75	12.3±1.2	89±8.7
15	Under carriage	Carrier roller mounting bolt, nut	M12 × 1.75	12.3±1.2	89±8.7
16		Track roller mounting bolt	M18 × 2.0	41.3±4.0	299±28.9
17	Others	Counterweight mounting bolt	M20 × 2.5	57.9±8.7	419±62.9
18		Cab mounting bolt, nut	M12 × 1.75	13.0	94.0
19		Operator's seat mounting bolt	M 8 × 1.25	2.5±0.5	18.1±3.6

※ For tightening torque of engine and hydraulic components, see each component disassembly and assembly.

2. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

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

2) PIPE AND HOSE (FLARE type)

Thread size (PF)	Width across flat (mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130
1"	41	21	152
1-1/4"	50	35	253

3) PIPE AND HOSE (ORFS type)

Thread size (UNF)	Width across flat (mm)	kgf · m	lbf · ft
9/16-18	19	4	28.9
11/16-16	22	5	36.2
13/16-16	27	9.5	68.7
1-3/16-12	36	18	130
1-7/16-12	41	21	152
1-11/16-12	50	35	253

4) FITTING

Thread size	Width across flat (mm)	kgf · m	lbf · ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130
1"	41	21	152
1-1/4"	50	35	253

GROUP 3 PUMP DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

13031GE18

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

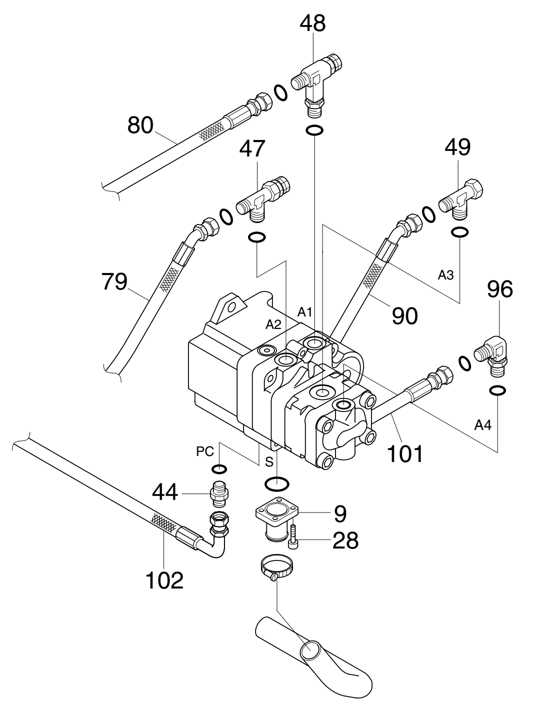
- Hydraulic tank quantity : 37 l (9.8 U.S.gal)

(5) Disconnect hoses (79, 80) and remove connectors (47, 48).

(6) Disconnect pilot line hoses (101, 102) and remove connectors (44, 96).

(7) Remove socket bolts (28) and disconnect pump suction tube (9).

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



30Z9A7MP101

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

- Weight : 19 kg (42 lb)

※ Pull out the pump assembly from housing. When removing the pump assembly, check that all the hoses have been disconnected.

2) INSTALL

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

(2) Remove the suction strainer and clean it.

(3) Replace return filter with new one.

(4) Remove breather and clean it.

(5) After adding oil to the hydraulic tank to the specified level.

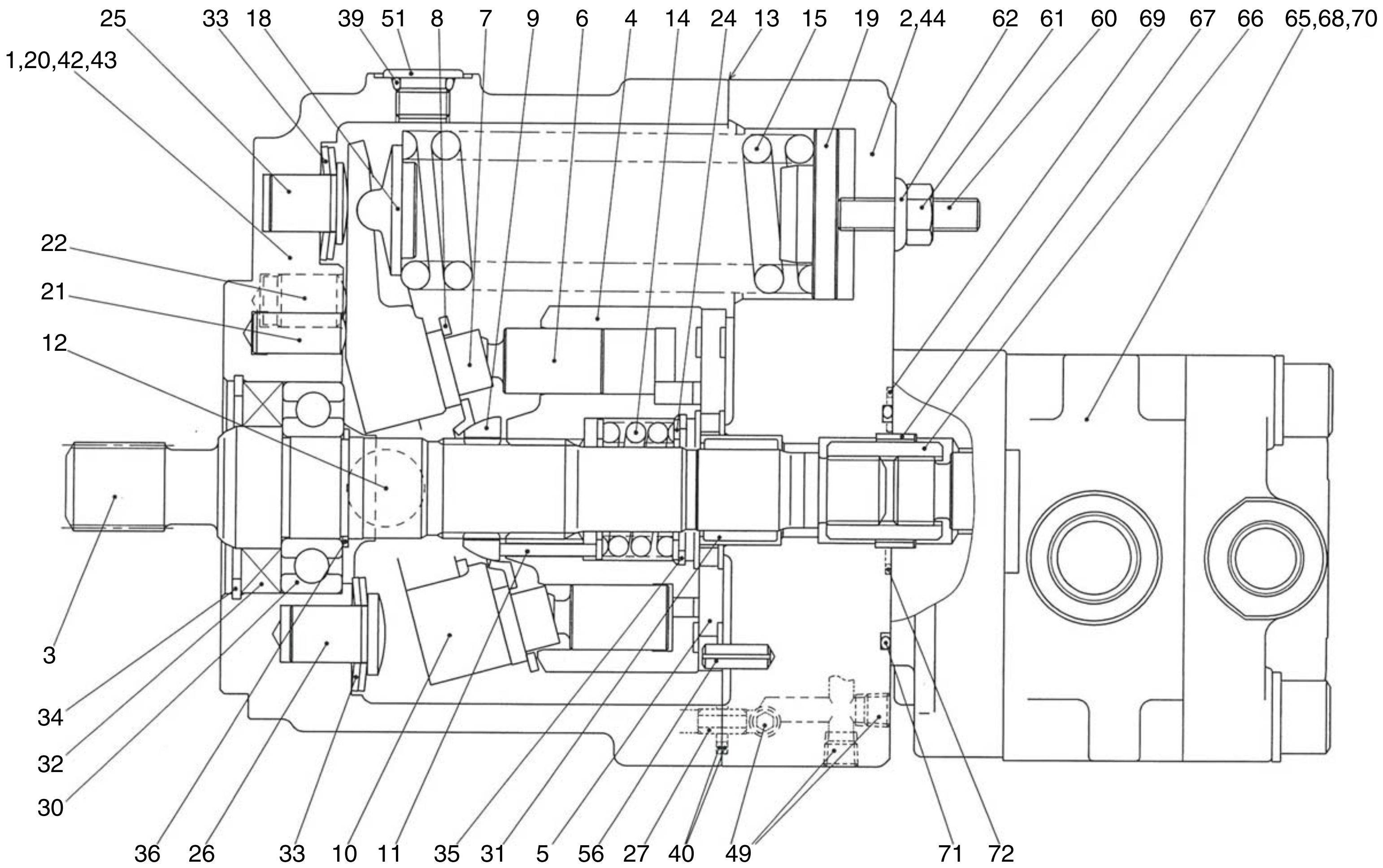
(6) Bleed the air from the hydraulic pump.
① Remove the air vent plug (1EA).
② Tighten plug lightly.
③ Start the engine, run at low idling, and check oil come out from plug.
④ Tighten plug.

(7) Start the engine, run at low idling (3~5 minutes) to circulate the oil through the system.

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

2. MAIN PUMP

1) STRUCTURE



35Z9A7MP102

1	Body S	10	Swash plate	21	Rod G	33	Dish spring	49	Plug	68	Screw
2	Body H	11	Needle	22	Rod C	34	Snap ring	51	Plug	69	O-ring
3	Shaft	12	Ball	24	Retainer	35	Snap ring	56	Spring pin	70	Washer
4	Cylinder barrel	13	Packing	25	Stopper pin A	36	Snap ring	60	Screw	71	O-ring
5	Valve plate	14	Spring C	26	Stopper pin B	39	O-ring	61	Nut	72	O-ring
6	Piston	15	Spring T1	27	Pin	40	O-ring	62	Seal washer		
7	Shoe	18	Spring holder	30	Ball bearing	42	Plug	65	Gear pump		
8	Shoe holder	19	Spring guide	31	Needle bearing	43	O-ring	66	Coupling		
9	Barrel holder	20	Pin	32	Oil seal	44	Screw	67	Collar		

3. ASSEMBLE AND DISASSEMBLE

1) General precautions

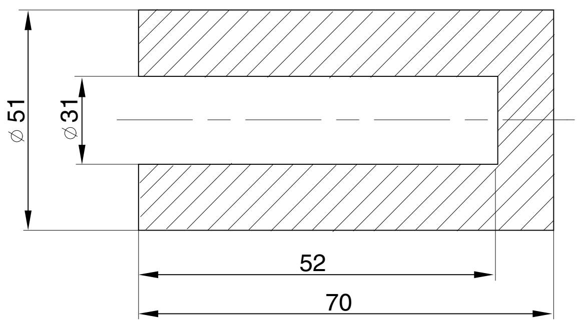
(1) Before disassembling, it is important to have fully understood the internal structure of the pump.

※ The gasket (13), oil seal (32) and O-rings will be probably damaged when you disassemble it, so be sure to have prepared spares.

(2) After having drained oil inside the pump, wash the pump and put it on a working bench covered with clean paper, cloth, or rubber mat for disassembling and assembling. Then, disassemble and assemble the pump slowly and carefully with necessary tools. Use care not to scratch even slightly, and take proper measures to prevent foreign matters from entering the assembly.

2) Tools

Tool name	Size	Quantity
Hexagon wrench	4, 6, 8 mm	1 each
Circlip player	For hole	1
Spanner wrench	13 mm	1
Torque wrench	45N (JIS B 4650) 90N (JIS B 4650)	1 1
Resin hammer	-	1
Special tooling for oil seal	See below	1
Seal kit	-	1 set
Grease	-	Small amount



Special tooling for oil seal

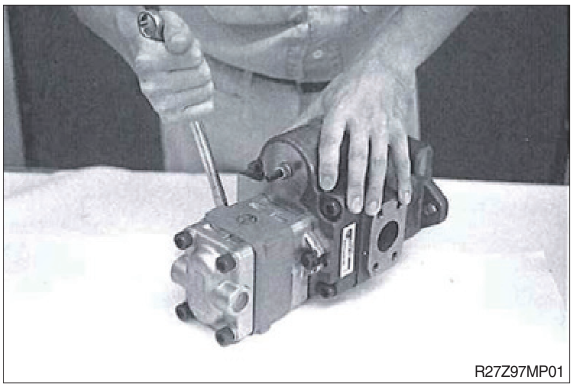
R27Z97MP98

3) DISASSEMBLING

(1) Disassembling of gear pump

Remove two screws (68) with spanner wrench 13 mm, and after that remove gear pump (65), collar (67) and coupling (66).

※ Coupling (66) and collar (67) may be attached with gear pump kit (65).

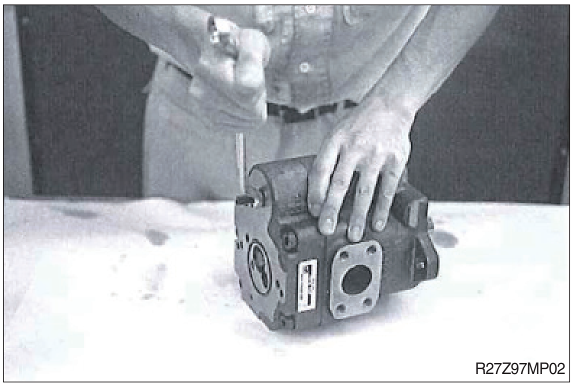


R27Z97MP01

(2) Remove the adjustment screw

Loose hexagon nut (61) with spanner wrench 13 mm, then remove the adjustment screw (60) with hexagon wrench 4 mm.

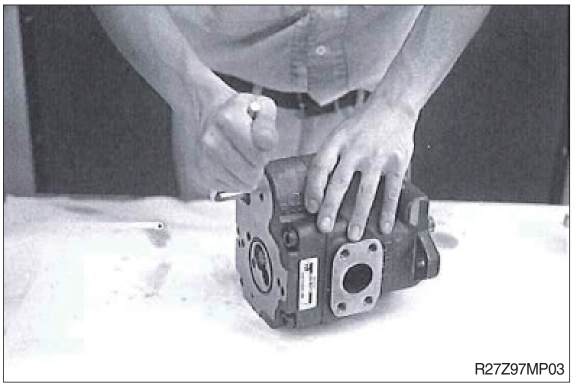
※ Suggest you to measure the outside length of the adjustment screw. Because it is a good help when you readjust it after reassembling.



R27Z97MP02

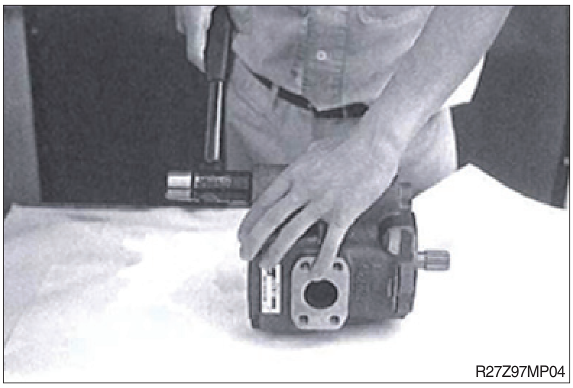
(3) Separation of body S and body H

Remove five screws (44) with hexagon wrench 8 mm.



R27Z97MP03

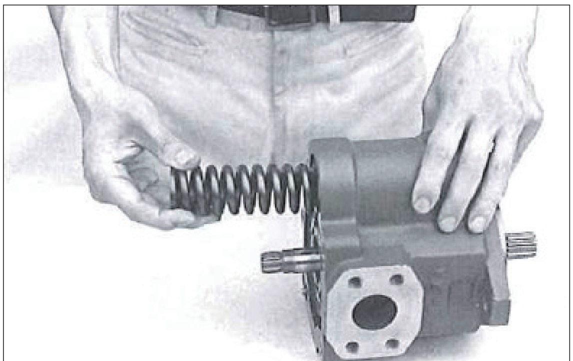
※ If you tap the part of inserted spring of body H with hummer softly, it is easy for separation.



R27Z97MP04

(4) Disassembling of body S kit

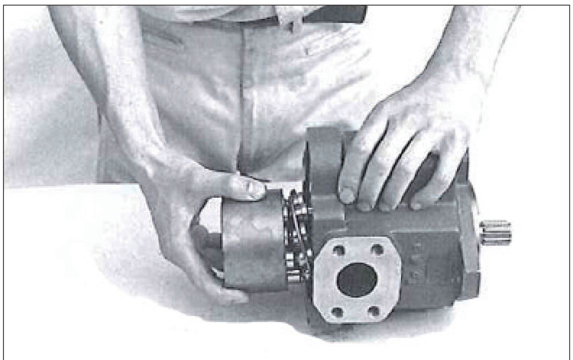
Remove spring T1 (15) from body S kit, then take off spring holder (18).



R27Z97MP05

(5) Disassembling of body S kit

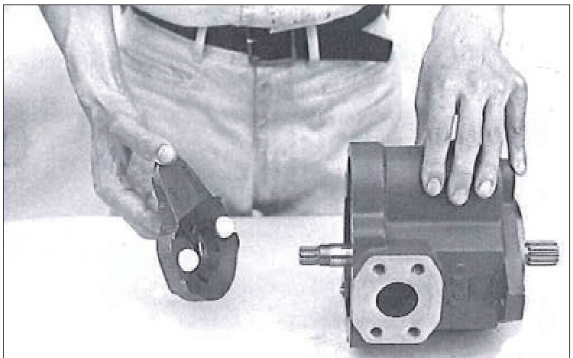
Remove cylinder barrel kit.



R27Z97MP06

(6) Disassembling of body S kit

Remove swash plate (10) and two balls (12).

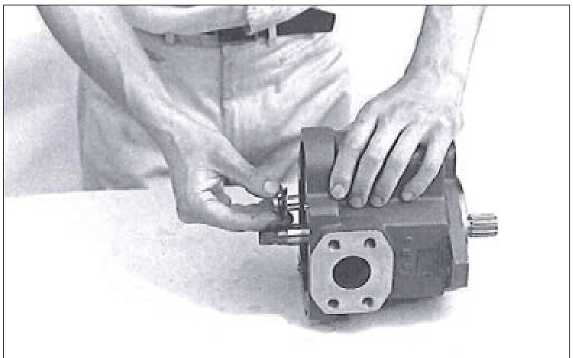


R27Z97MP07

(7) Disassembling of body S kit

Remove stopper pin A (25), stopper pin B (26), dish springs (33), rod G (21) and rod C (22).

※ The length of the stopper pin A and B is different. Pay attention not to swap when reassembling.



R27Z97MP08

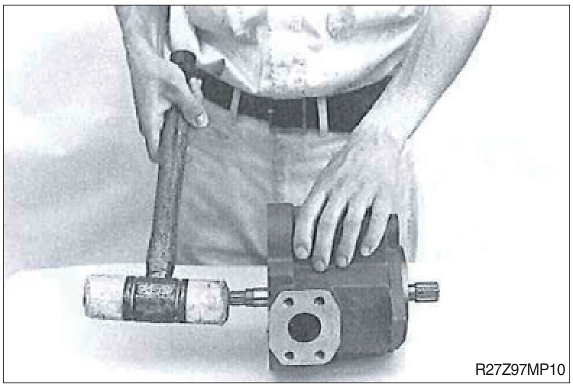
(8) Disassembling of body S kit

Remove snap ring (34) from body S (1).

R27Z97MP09

(9) Disassembling of body S kit

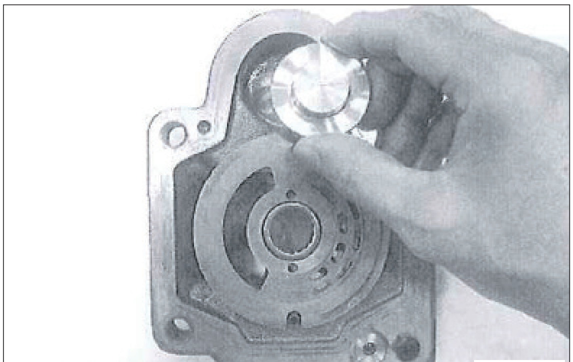
Tap the end of shaft (3) with hammer, then oil seal (32) and shaft with bearing (30) come off.



R27Z97MP10

(10) Disassembling of body H kit

Remove spring guide (19) and valve plate (5) from body H.

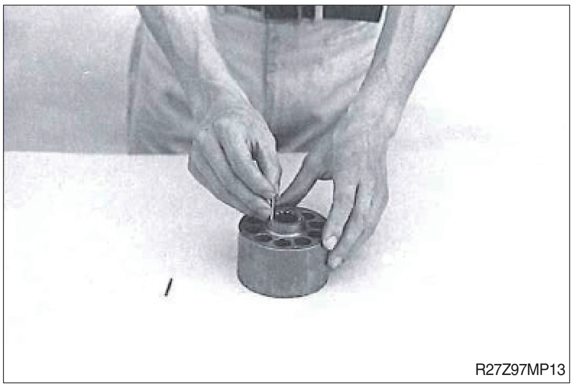


R27Z97MP11

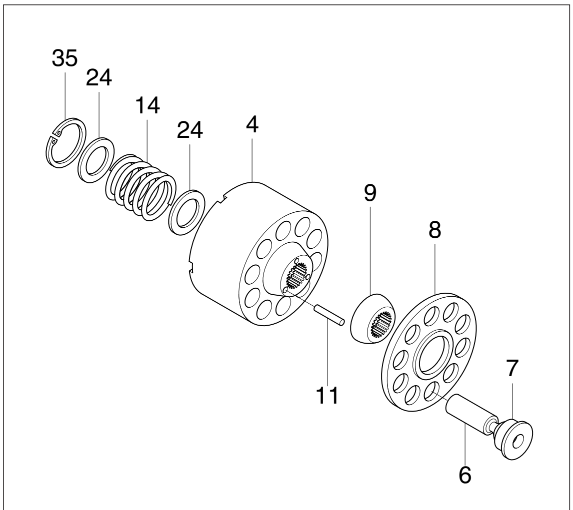
(11) Disassembling of cylinder barrel kit

Remove shoe holder (8) on which piston shoe assemblies (6) and (7) are set and disassemble it in the order of barrel holder (9) and needle (11).
Also, take off snap ring (35), retainer (24), spring C (14) and retainer (24), which are set in the cylinder barrel (4) in this order.

R27Z97MP12



R27Z97MP13



R27Z97MP14

4) ASSEMBLING

(1) Precautions during assembling

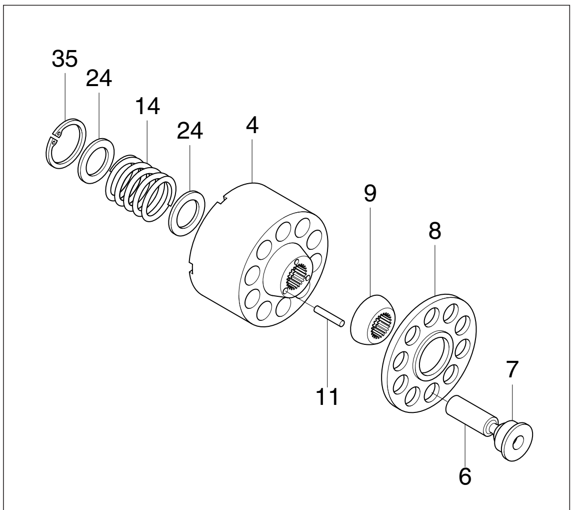
Reverse the above procedures for assembling.

When assembling, be very careful to wash parts in clean oil, to prevent dusts and water from adhering to parts entering assemblies and not to scratch on the sliding surfaces of all parts.

※ Apply small quantity of grease to the periphery of O-rings to be set in socket and spigot joints to prevent the O-rings from being damaged.

(2) Assembling of cylinder barrel kit

Set retainer (24), spring C (14), retainer (24) and snap ring (35) in the shaft center hole of cylinder barrel (4) in this order, and carefully set shoe holder (8), on which needle (11), barrel holder (9) and ten piston shoe assemblies have already been set, in cylinder barrel from the opposite side.



R27Z97MP14

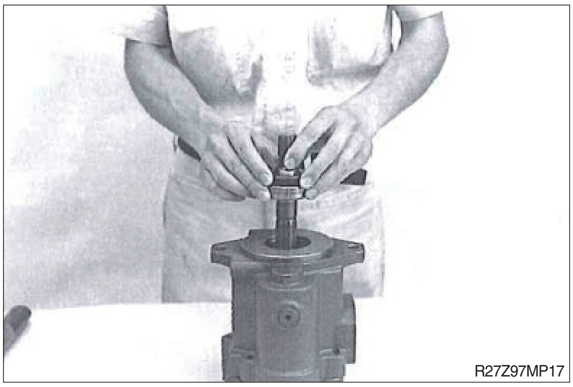
R27Z97MP15

R27Z97MP16

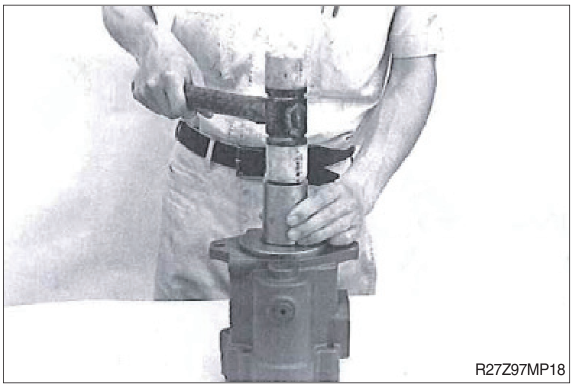
(3) Assembling of body S kit

Set shaft (3) with bearing (30), oil seal (32) and snap ring (34) in this order into body S (1).

※ Use new oil seal for assembling. Before assembling, apply a small quantity of grease to the periphery of oil seal lip and tap it together with the special tooling with hammer.
When assembling, put body S (1) onto body H (2) tentatively for easy work.



R27Z97MP17



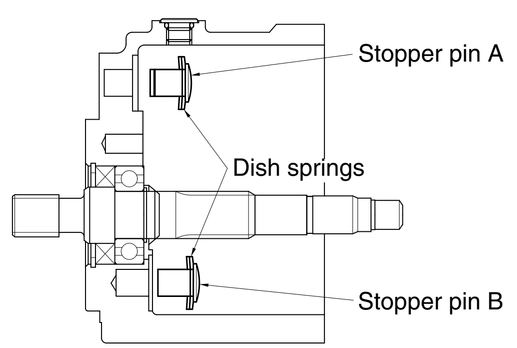
R27Z97MP18

(4) Assembling of body S kit

Set each four dish springs (33) to stopper pin A (25) and stopper pin B (26), then set them into body S (1).

※ Pay attention to the direction of the dish washer.

※ Pin A and pin B have different length. Set them to the original position. Otherwise, pump displacement changes, and engine stall or insufficient speed can occur.

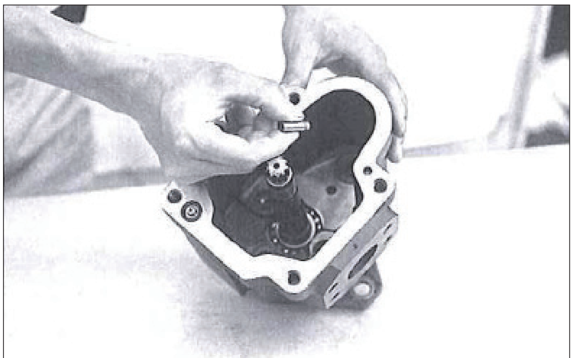


R27Z97MP19

(5) Assembling of body S kit

Set rod G (21) and rod C (22) into body S (1).

※ Pay attention to the direction of the rod G and rod C. (See cross section drawing for the direction.)

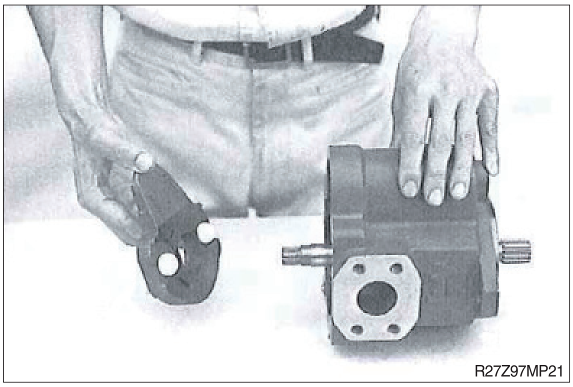


R27Z97MP20

(6) Assembling of body S kit

Put two balls (12) in the hole of swash plate (10) and install it in body S.

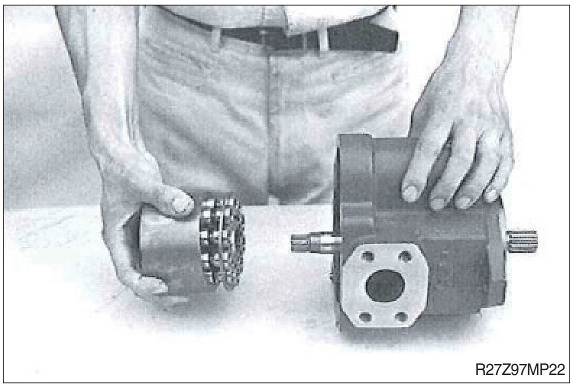
※ Apply grease on the balls if they drop out.



R27Z97MP21

(7) Assembling of body S kit

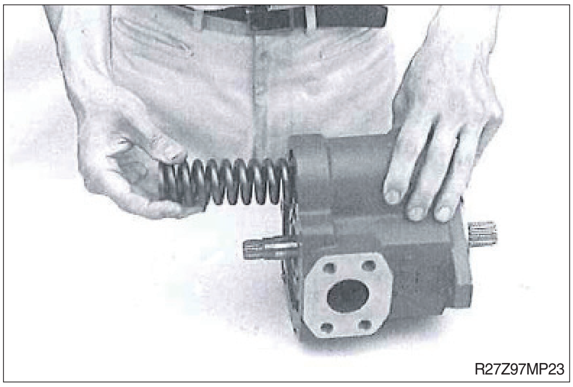
Assemble cylinder barrel kit into the body S (1).



R27Z97MP22

(8) Assembling of body S kit

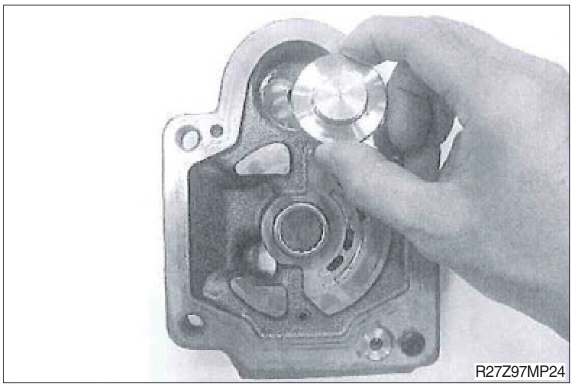
Set spring T1 (15) to spring holder (18), then set them together into the hole on swash plate (10).



R27Z97MP23

(9) Assembling of body H kit

Set spring guide (19) in body H (2).

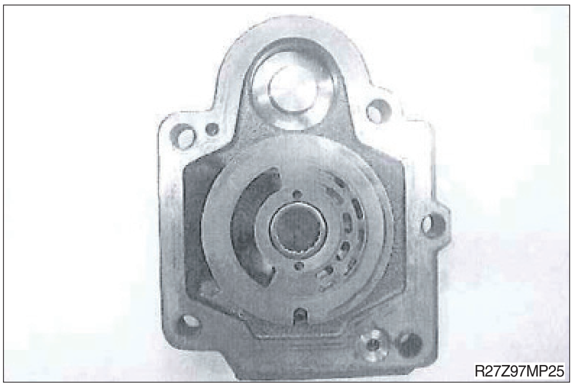


R27Z97MP24

(10) Assembling of body H kit

Place valve plate (5) slowly on body H (2) by positioning it with spring pin (56).

※ V notch copper alloy side of valve plate slides with cylinder barrel (4) and be careful not to set the valve plate to a wrong direction.

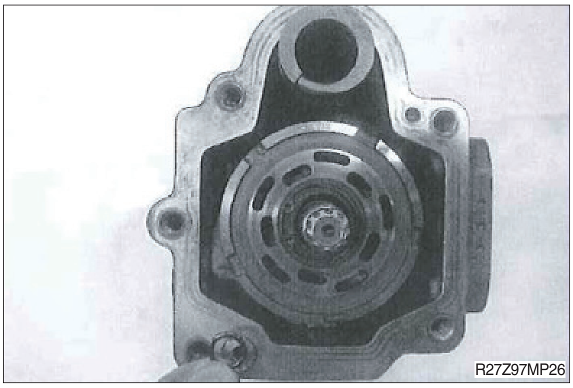


R27Z97MP25

(11) Assembling of body S kit with body H kit

Place O-ring (40) on body S.

※ Use new O-ring for assembling.

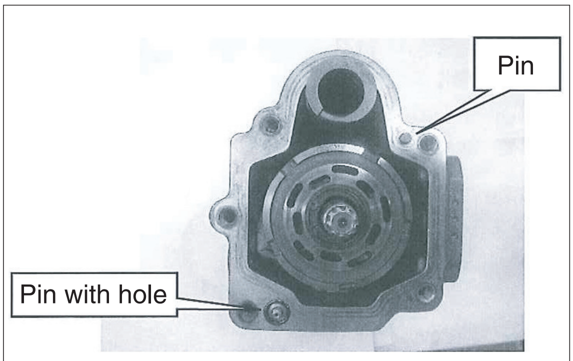


R27Z97MP26

(12) Assembling of body S kit with body H kit

Set pin (20) and pin (27) on body S.

※ Pay attention to the position of each pin. Pin (27) has a hole.

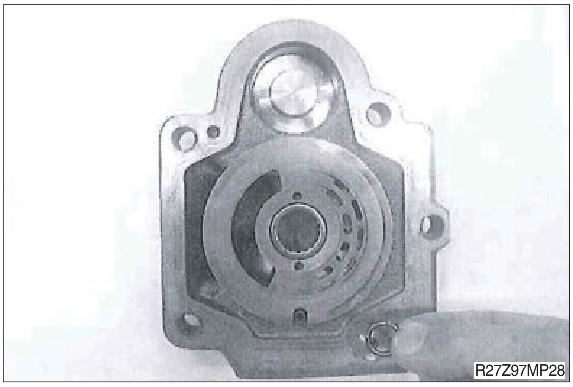


R27Z97MP27

(13) Assembling of body S kit with body H kit

Place O-ring (40) on body H.

※ Use new O-ring for assembling.

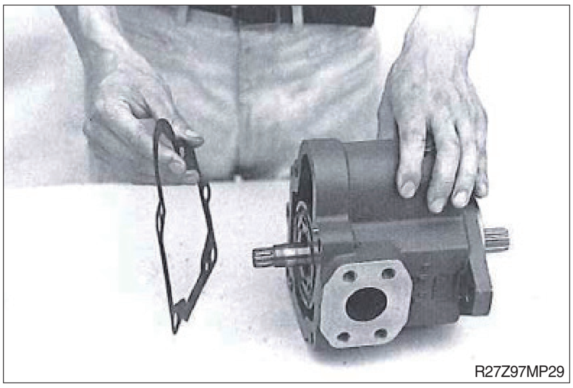


R27Z97MP28

(14) Assembling of body S kit with body H kit

Place packing (13), position it with locating pin (27) on body S.

※ Use new packing for assembling.

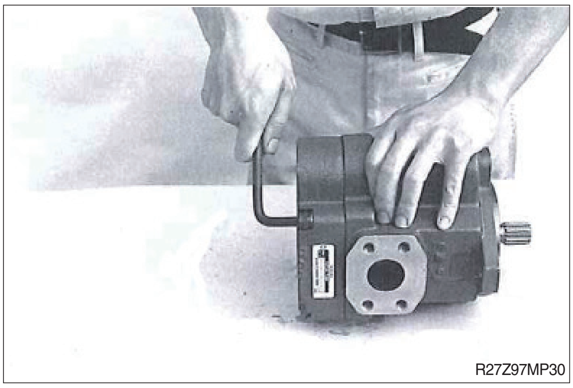


R27Z97MP29

(15) Assembling of body S kit with body H kit

Set two screws (M10×65) into the upper side two screw holes, and tighten them until the distance between body S and body H comes to 5 to 10 mm.
Then set three screws (44) into the three screw holes, after that, replace the upper side two screws (M10×65) to the regular size screws (44) and fix them.

· Tightening torque : 5.2~6.6 kgf · m (37.6~47.7 lbf · ft)

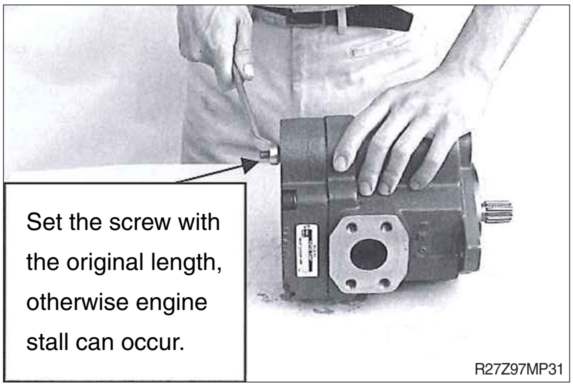


R27Z97MP30

(16) Installation of the adjusting screw

Fasten the adjusting screw (60) with hexagon wrench 4 mm, then adjust the outside length of adjusting screw and fix locknut (61) with spanner wrench 13 mm. At that time, change the seal washer (62) to new one.

· Tightening torque : 1.5~2.0 kgf · m (10.8~14.5 lbf · ft)

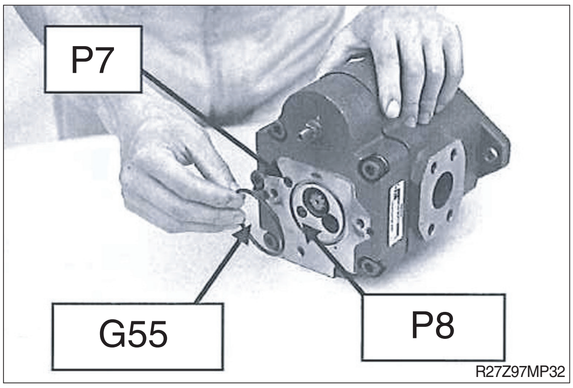


R27Z97MP31

(17) Installation of gear pump kit

Place O-ring (69, 71, 72) on the installation side of body H.

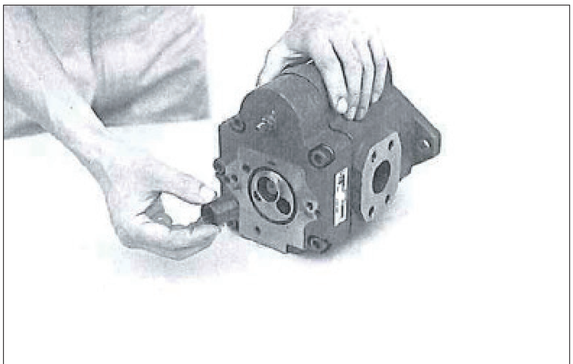
※ Use new O-ring for assembling.



R27Z97MP32

(18) Installation of gear pump kit

Set collar (67) and coupling (66).

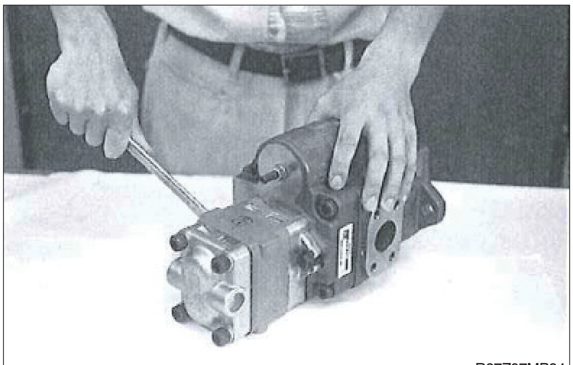


R27Z97MP33

(19) Installation of gear pump kit

Install gear pump kit (65) and fix it by two screws (68) and washers (70) with spanner wrench 13 mm.

· Tightening torque : 2.0~2.4 kgf · m
(14.5~17.3 lbf · ft)



R27Z97MP34

(20) Inspection of assembling

After completed the assembling of pump, make sure that pump shaft rotates smoothly by hand.

GROUP 4 MAIN CONTROL VALVE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

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

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

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

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

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

(4) Disconnect hydraulic hose.

(5) Disconnect pilot line hoses.

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

- Weight : 25 kg (55 lb)

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

2) INSTALL

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

(2) Bleed the air from below items.

① Cylinder (boom, arm, bucket)

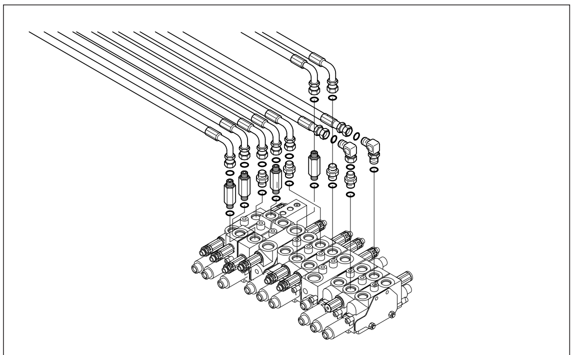
② Swing motor

③ Travel motor

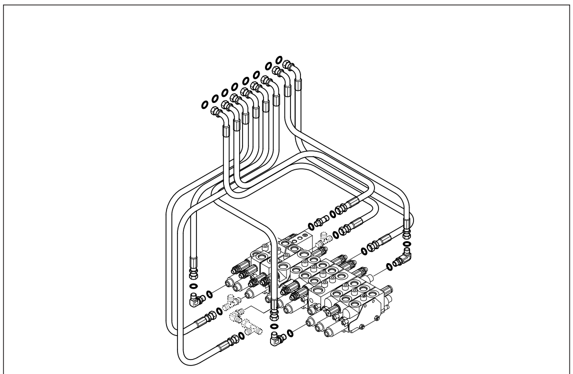
※ See each item removal and install.

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

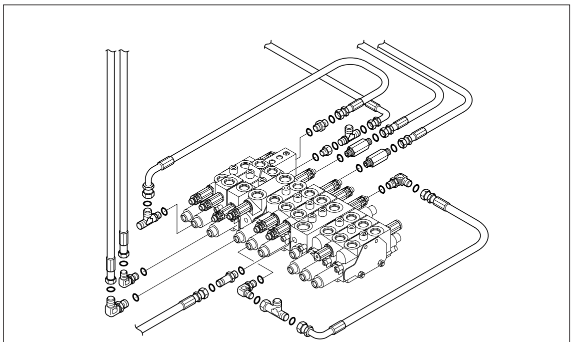
13031GE18



R35Z77MCV01

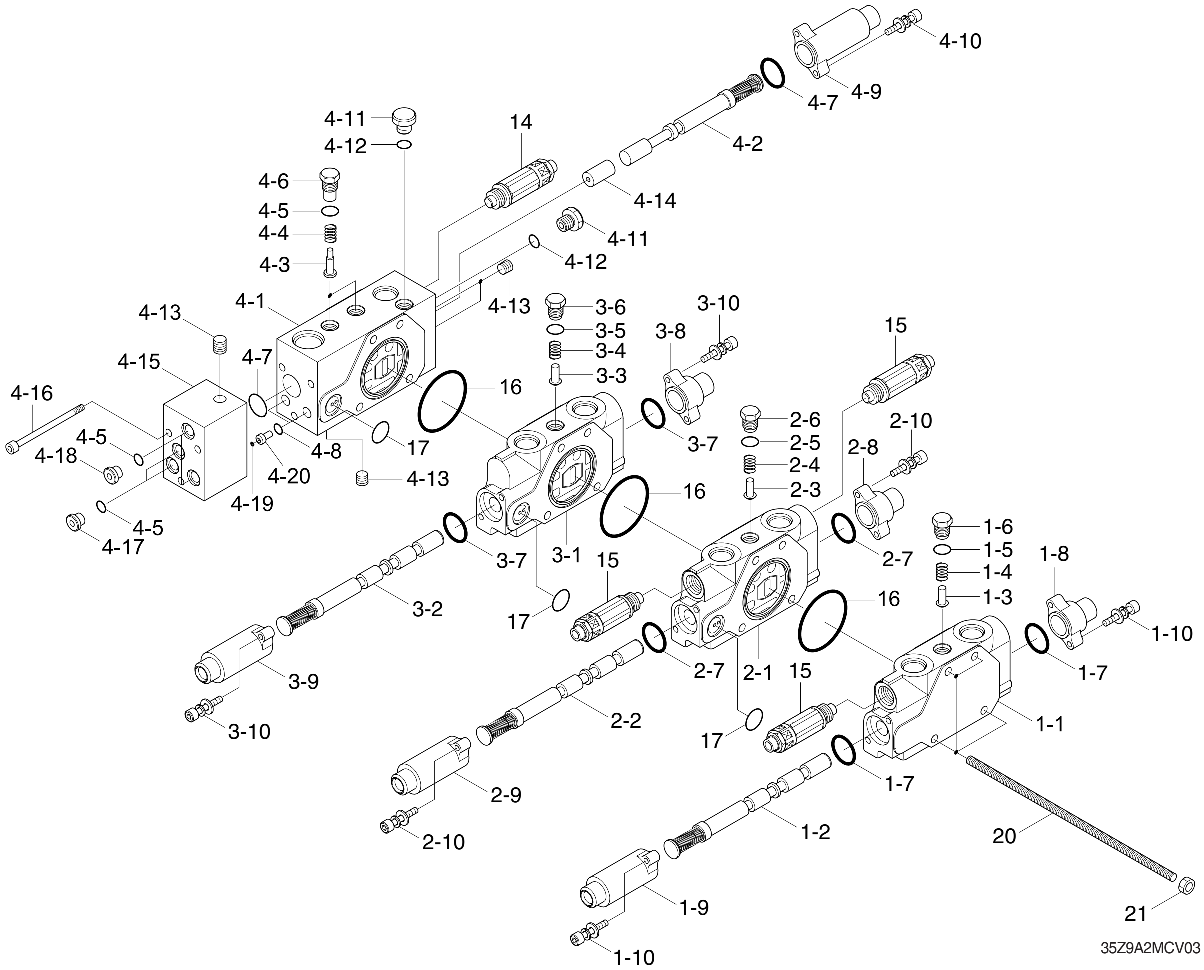


R35Z77MCV02



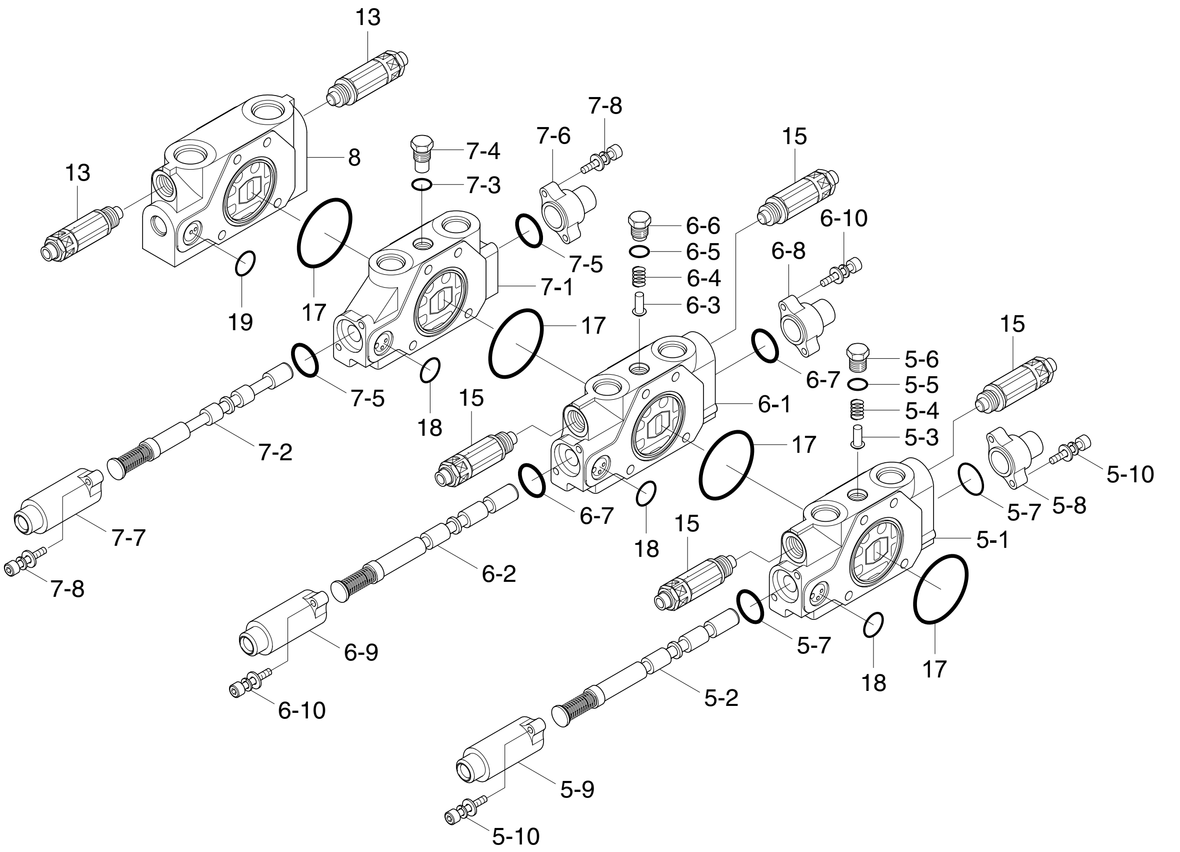
R35Z77MCV03

2. STRUCTURE (1/3)



1	Dozer work block	2-9	Cover-pilot	4-7	O-ring
1-1	Body-work	2-10	Bolt-soc head w/washer	4-8	O-ring
1-2	Spool assy	3	Swing work block	4-9	Cover-pilot
1-3	Poppet	3-1	Body-work	4-10	Bolt-soc head w/washer
1-4	Spring	3-2	Spool assy	4-11	Plug
1-5	O-ring	3-3	Poppet	4-12	O-ring
1-6	Plug	3-4	Spring	4-13	Plug
1-7	O-ring	3-5	O-ring	4-14	Piston
1-8	Cover-pilot	3-6	Plug	4-15	Body-pilot
1-9	Cover-pilot	3-7	O-ring	4-16	Bolt-soc head w/washer
1-10	Bolt-soc head w/washer	3-8	Cover-pilot	4-17	Plug
2	Boom swing work block	3-9	Cover-pilot	4-18	Plug
2-1	Body-work	3-10	Bolt-soc head w/washer	4-19	Filter-coin type
2-2	Spool assy	4	Conflux block	4-20	Orifice
2-3	Poppet	4-1	Body-work	14	Relief valve
2-4	Spring	4-2	Spool assy	15	Overload relief valve
2-5	O-ring	4-3	Poppet	16	O-ring
2-6	Plug	4-4	Spring	17	O-ring
2-7	O-ring	4-5	O-ring	20	Bolt-tie
2-8	Cover-pilot	4-6	Plug	21	Nut-hex

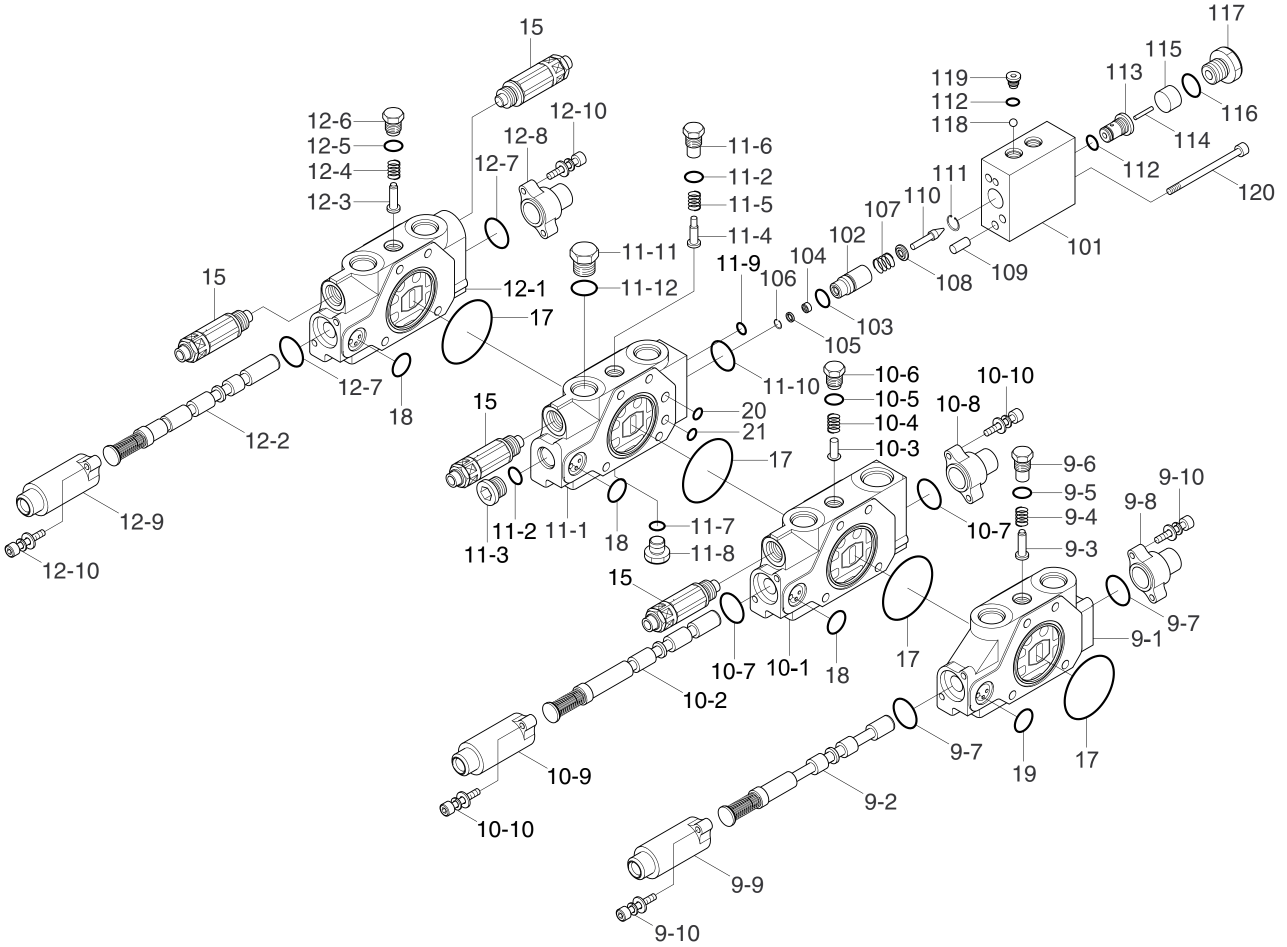
STRUCTURE (2/3)



R35Z92MCV04

5	PTO work block
5-1	Body-work
5-2	Spool assy
5-3	Poppet
5-4	Spring
5-5	O-ring
5-6	Plug
5-7	O-ring
5-8	Cover-pilot
5-9	Cover-pilot
5-10	Bolt-soc head w/washer
6	Arm work block
6-1	Body-work
6-2	Spool assy
6-3	Poppet
6-4	Spring
6-5	O-ring
6-6	Plug
6-7	O-ring
6-8	Cover-pilot
6-9	Cover-pilot
6-10	Bolt-soc head w/washer
7	Travel work block
7-1	Body work
7-2	Spool assy
7-3	O-ring
7-4	Plug
7-5	O-ring
7-6	Cover-pilot
7-7	Cover-pilot
7-8	Bolt-soc head w/washer
8	Inlet work block
13	Relief valve
15	Overload relief valve
17	O-ring
18	O-ring
19	O-ring

STRUCTURE (3/3)



R35Z72MCV05

9	Travel work block	10-7	O-ring	12-1	Body-work	103	Seal
9-1	Body-work	10-8	Cover-pilot	12-2	Spool assy	104	Filter
9-2	Spool assy	10-9	Cover-pilot	12-3	Poppet	105	Spacer
9-3	Poppet	10-10	Bolt-soc head w/washer	12-4	Spring	106	Ring-retaining
9-4	Spring	11	Boom lock block	12-5	O-ring	107	Spring A-lock valve
9-5	O-ring	11-1	Body-work	12-6	Plug	108	Spring seat
9-6	Plug	11-2	O-ring	12-7	O-ring	109	Pin
9-7	O-ring	11-3	Plug	12-8	Cover-pilot	110	Poppet
9-8	Cover-pilot	11-4	Poppet	12-9	Cover-pilot	111	Ring-retaining
9-9	Cover-pilot	11-5	Spring	12-10	Bolt-soc head w/washer	112	O-ring
9-10	Bolt-soc head w/washer	11-6	Plug	15	Overload relief valve	113	Guide-piston
10	Boom work block	11-7	O-ring	17	O-ring	114	Piston A1
10-1	Body-work	11-8	Plug	18	O-ring	115	Piston B
10-2	Spool assy	11-9	O-ring	19	O-ring	116	O-ring
10-3	Poppet	11-10	O-ring	20	O-ring	117	Connector
10-4	Spring	11-11	Plug	21	O-ring	118	Ball-steel
10-5	O-ring	11-12	O-ring	101	Cover-lock valve	119	Plug
10-6	Plug	12	Bucket work block	102	Lock valve	120	Bolt-socket head

3. DISASSEMBLY

1) PRECAUTIONS FOR DISASSEMBLY

Since hydraulic devices are all machined precisely with clearances being very little, carry out the disassembly and assembly work at a clean place and make sure to prevent the device from being entered with dust, sand, and the like.

(1) Before disassembly work, prepare necessary material such as the structural drawing for control valve to fully understand the structure and others.

(2) When removing the control valve from the machine, put a dustproof cap on each port and then clean the outside of assembly after checking the installation of caps.
Furthermore, prepare a suitable workbench with clean paper or rubber mat on it for the work.

(3) Since there is a possibility of rust when the disassembled parts are left, apply anti-corrosive oil to the parts and seal them.

(4) Hold the control valve body when carrying or moving. Especially, do not hold the exposed spool after removing a pilot cover from the control valve.

(5) Do not hit the control valve even if it does not move smoothly.

(6) It is recommend carrying out various tests (relief valve setting, leak test, internal pressure loss check, etc.) after the disassembly and assembly of the control valve, which requires a hydraulic test device.

(7) Accordingly, when the disassembly might be possible technically but the test and/or adjustment might be impossible, do not carry out the work.

⚠ **The control valve becomes high temperature after operating the machine; after checking that the temperature becomes low, start the work.**

⚠ **Before removing the pipes, attach suitable indications on them to be able to locate their positions later. If there is a mistake in piping between the ports, unintentional movement could result in an accident.**

⚠ **Falling or hitting the control valve could bend the Spool, which could result in an accident.**

⚠ **If foreign matter enters each port, there could be a control valve malfunction, resulting in an accident.**

⚠ **Since the load side port could hold an empty weight or enclosed pressure, release the inside pressure before loosening the piping.**
There could be a fall of attachments or a jet of high-temperature hydraulic fluid.

⚠ **The control valve has complicated connections and seals through the internal passages, which means that there could be enclosed pressure, resulting in an oil jet after disassembly.**
Ware safety goggles during disassembly work because there could be a blow off of parts if they are caught.

2) NECESSARY TOOLS AND OTHERS

Before disassembling the control valve, prepare the following tools. The tools below are used to disassemble this control valve only; tools for disassembling the port fittings are not included.

Name	Quantity	Application
Hexagonal wrench	Each 1	4 mm, 5 mm, 6 mm, 8 mm
Screw wrench	Each 1	13 mm, 19 mm, 21 mm, 22 mm, 26 mm
Socket wrench	Each 1	13 mm, 19 mm, 21 mm, 22 mm, 26 mm
Torque wrench	1	0.2 ~ 2.0 kgf · m (1.4 ~14.5 lbf · ft)
Torque wrench	1	2.0 ~ 10.0 kgf · m (14.5 ~ 72.3 lbf · ft)
Magnet	1	
Pliers	1	
Slotted screwdriver	1	
Tweezers	1	

※ Prepare clean wash oil, hydraulic fluid, grease, and others before work.

3) DISASSEMBLY OF EACH PART

Before disassembly work, check that there is no dust on the outside of the control valve and then place it on a workbench with actuator ports facing upward.

The numbers in ( ) in the explanation and in ○ in the figures show reference numbers (No.) in the parts table in the specifications and drawings.

(1) Spool draw-out procedures

Except P3 conflux part

Taking the swing spool as an example, the draw-out procedures are as follows (see Fig.2) .

① Remove 2 hex socket head bolts with washers (⑩) with 4 mm hexagonal wrench.
② Remove pilot cover (⑨).
③ With spring in the swing spool exposed, pull out spool assy from the control valve slowly and horizontally (parallel to spool sleeve) by holding spring.
④ The other spools can also be pulled out in the same manner.
· At this time, check O-ring (⑦) is on the bottom of body side flange.

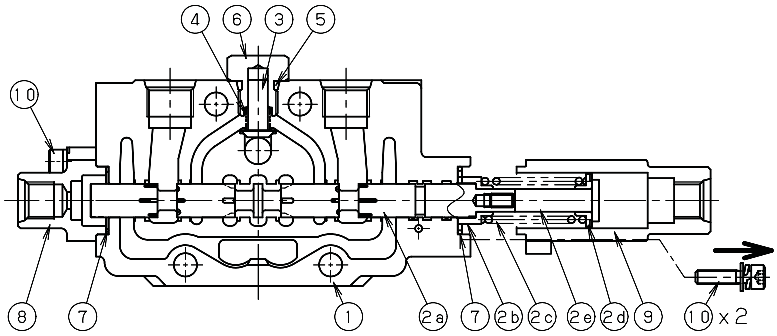


Fig.2 Except P3 Conflux Part

35Z9A7MCV02

1	Body-work	2d	Spring seat	6	Plug-check valve
2	Spool assy (swing)	2e	End-spool	7	O-ring
2a	Spool (swing)	3	Poppet-check valve	8	Pilot cover B1
2b	Spring seat	4	Spring-check valve	9	Pilot cover A1
2c	Spring	5	O-ring	10	Hex socket bolt with washer

P3 Conflux Part

The draw-out procedures for the conflux spool are as follows (see Fig.3).

① Remove 2 hex socket head bolts with washers (⑩) with 4 mm hexagonal wrench.
② Remove pilot cover (⑨).
③ With spring in the connecting spool exposed, pull out spool assy from the control valve slowly and horizontally (parallel to spool sleeve) by holding spring.
· At this time, check O-ring (⑦) is on the bottom of body side flange.

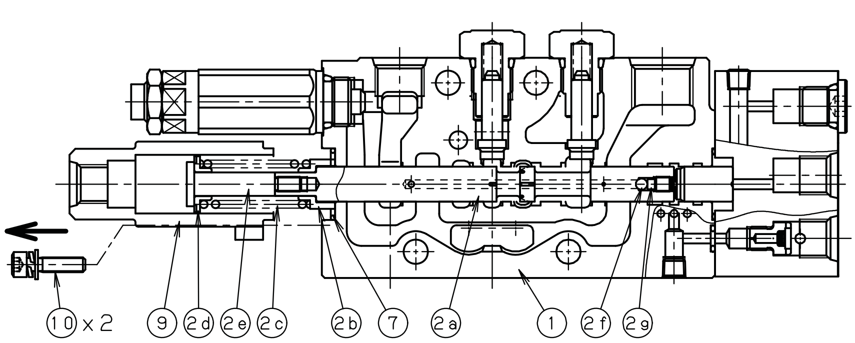


Fig.3 P3 Conflux Part

35Z9A7MCV03

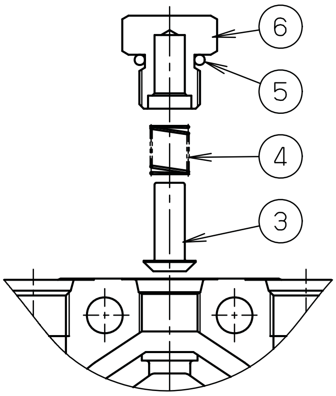
1	Body-work	2c	Spring	2g	Plug
2	Spool assy (conflux)	2d	Spring seat	7	O-ring
2a	Spool (conflux)	2e	End-spool	9	Pilot cover A1
2b	Spring seat	2f	Steel ball	10	Hex socket bolt with washer

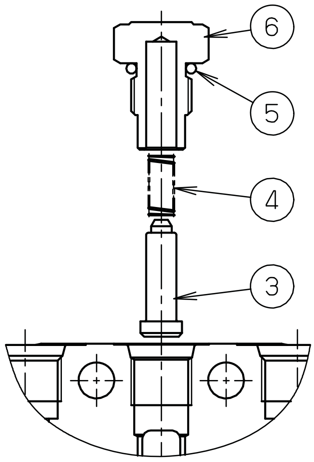
(2) Check valve disassembly procedures

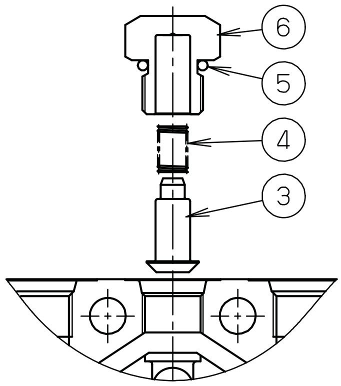
Standard type check valve (see Fig.4)

① Hold the control valve body at workbench or hold it by two or more people.
② Loosen and remove check valve plug (⑥) at the center of the control valve upper surface with 19 mm screw wrench or socket wrench. When it is hard to loosen the plug because O-ring (⑤) bites the screw, do not loosen forcibly; refasten it once and then try to loosen again.
③ From the hole where check valve plug has been removed, remove check valve spring (④) and check valve (③) with tweezers or magnet.

· The numbers in fig.4 are the same as those in the dozer component. In the specifications and drawings.
· Except for the dozer component. The shape of check valve is different; however, they can be disassembled in the same manner.
· The numbers in fig.5 are the same as those in the travel component. In the specifications and drawings.
· The numbers in fig.6 are the same as those in the PTO component. In the specifications and drawings.







35Z9A7MCV04

Fig.4 Check valve (dozer, boom swing, swing, arm, boom, bucket)

Fig.5 Check valve (P3 conflux, travel, boom lock valve)

Fig.6 Check valve (PTO 1, PTO 2)

(3) Accessory valve removal procedures

Removing main relief valve (MRV) and overload relief valve (ORV)

Taking ORV in the arm component as an example, the removal procedures are as follows (see Fig.7)

① Loosen and remove ORV (⑮) with 22 mm screw wrench or deep socket wrench.

· Put screw wrench (or deep socket wrench) to 22 mm hexagonal part of pressure regulating body.

· If there is no 22 mm screw wrench (or deep socket wrench), it is also possible to loosen and remove by putting 19 mm screw wrench to the hexagonal part as shown in the fig.7.

※ If using 19 mm screw wrench to remove, do not put it to the lock nut part. Only lock nut is loosened to change the relief valve setting, which could result in the degradation in performance or damage.

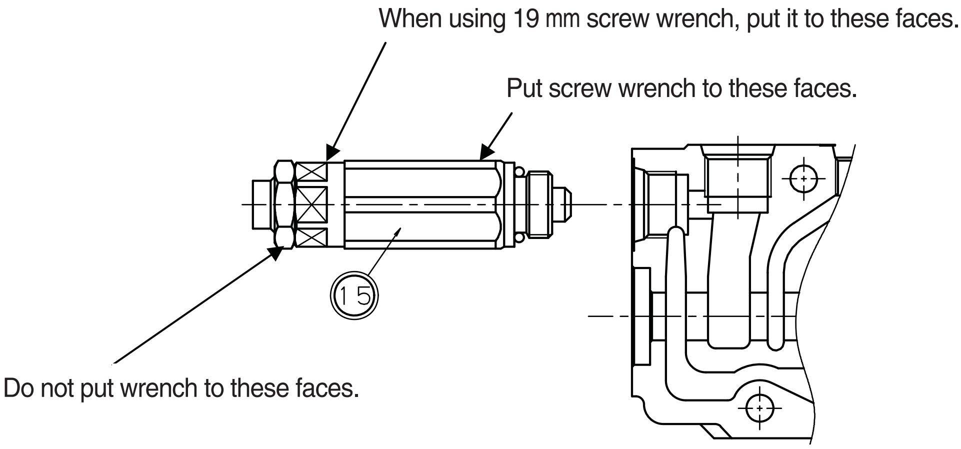


Fig.7 Removing main relief valve and overload relief valve

35Z9A7MCV05

(4) Boom lock valve disassembly procedures

If there is a malfunction, replace the lock valve assy with new one. Disassembly procedures are shown here as reference for investigating malfunction :
(see fig.8 and 9 the reference numbers below except those in double circles are according to "detail of lock valve" in the delivery specifications.)

① Remove 2 hex socket bolts (⑳) by using 5 mm hexagonal wrench.
② Remove lock valve lid (①).
  · Be careful not to fall or lose 2 locating pins (⑨) on lock valve body side.
  · Be careful to handle it to protect the pin from being damaged.
③ When lock valve (②) and needle valve (⑩) are exposed, pull them out.
  · Since the needle valve is easy to fall out, take out it first to store.
  · The lock valve is not to be disassembled but to be stored as a lock valve set (②~⑧, ⑩, ⑪).
④ Hold the lock valve cover in a vise bench or the like, and loosen and remove bush (⑰) by using a 26 mm screw wrench.
  · Hold any two sides except port side in a vise bench or the like.
⑤ From the hole that has been used to pull out the bush, pull out piston B (⑮) and piston A1 (⑭) by using tweezers or a magnet.
  · For piston B and piston A1, arrange them so that their assembled direction can be recognized.
  · Piston guide (⑬) is not to be disassembled but to be stored in a combination with lock valve cover.
⑥ Loosen and remove plug (⑲) by using 4 mm hexagonal wrench.
⑦ From the hole that has been used to pull out plug, pull out steel ball ϕ7 (⑱) by using a magnet.

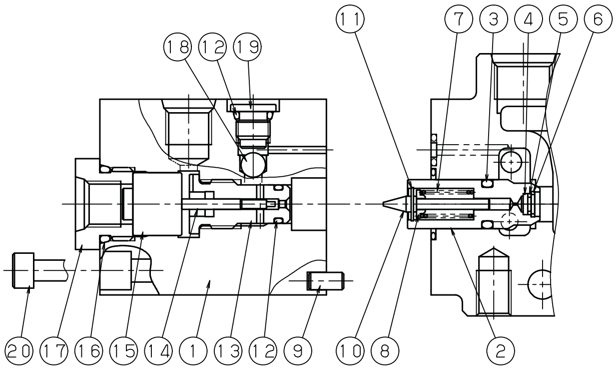


Fig.8 Boom lock valve

35Z9A7MCV06

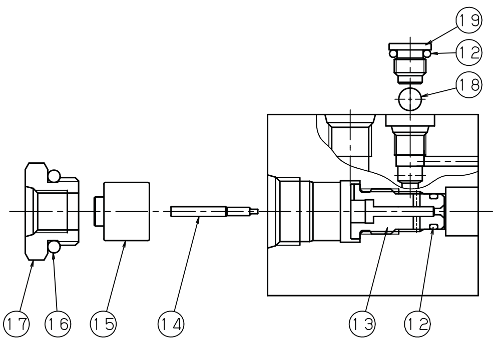


Fig.9 Lock valve cover

35Z9A7MCV07

(5) The other parts disassembly procedures

Remove the other parts that have not been removed at the work (1) through (3) as shown below.

Various plugs in boom lock valve component (see Fig.10).

① Loosen and remove plug (⑪) with 21 mm screw wrench or socket wrench.
  · Check O-ring (⑫) is on the plug side.
② Loosen and remove plug (③) with 6 mm hexagonal wrench.
  · Check O-ring (②) is on the plug side.
③ Loosen and remove plug (⑧) with 6 mm hexagonal wrench.
  · Check O-ring (⑦) is on the body side for falling off, deformation, or damage.

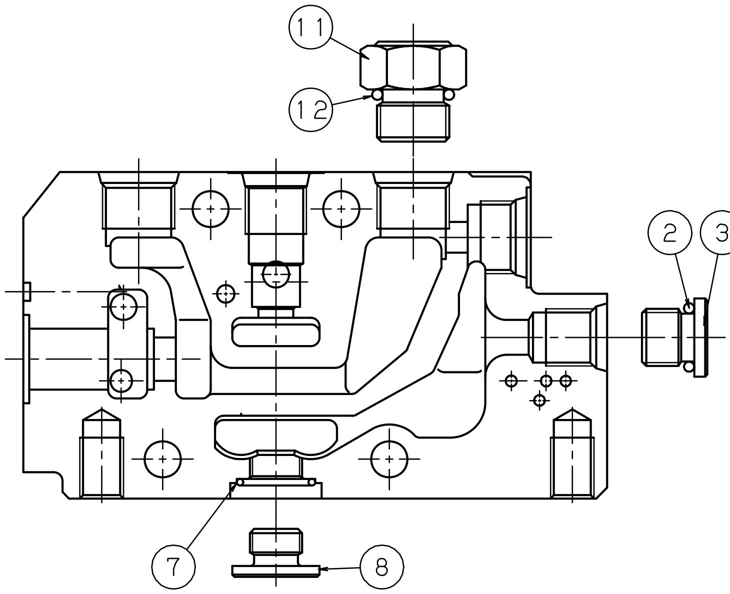


Fig.10 Plugs in boom lock valve component

35Z9A7MCV08

Body-pilot, piston and plugs for P3 conflux component (see Fig.11)

① Remove 3 hex socket head bolts (⑯) with 4 ㎜ hexagonal wrench.

② Body-pilot assy (⑤,⑬,⑮,⑰ ~ ⑳) can be removed.
Since orifice (⑳) and filter (⑲) cannot be removed from body-pilot (⑮), store them in assy condition.
· Check O-ring (⑦,⑧) are on the body side.

③ Remove piston (⑭) from the body by using a magnet or the like.
· When pushing out the piston from the opposite side (left side in the figure blow), be careful not to damage the spool hole. Damaged spool hole could cause a malfunction.

④ Loosen and remove 2 plugs (⑪) by using 4 ㎜ hexagonal wrench.
4 plugs (⑬) cannot be removed from the body.

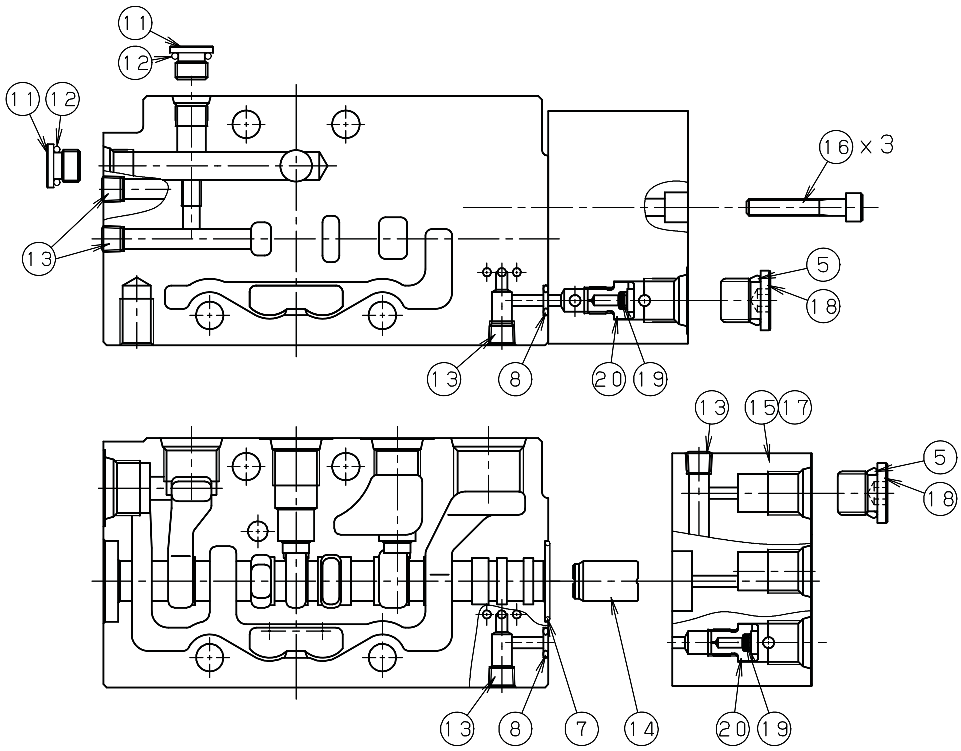


Fig.11 P3 Conflux component

35Z9A7MCV09

Pilot cover (see Fig.12)

① Remove 2 hex socket head bolts with washers (⑩) with 4 ㎜ hexagonal wrench.

② Remove pilot cover (⑧).
· Check O-ring (⑦) is on the bottom of body-side flange.

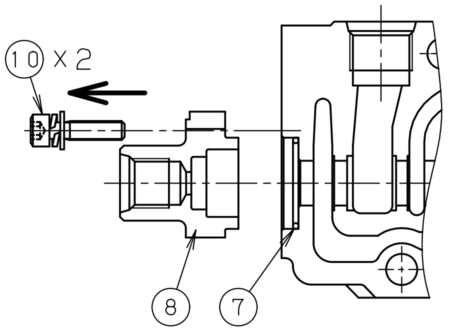


Fig.12 Pilot cover

35Z9A7MCV10

(6) **Component body disassembly procedures** (see Fig.13)

① Loosen and remove 4 M8 hex nuts (㉑) for assembling component bodies on the dozer (body-Work "sC") side with 13 ㎜ screw wrench or socket wrench.

② When 4 tie bolts (⑳) are pulled out from the dozer side, each component body can be removed.

· Be careful not to drop or lose various O-ring (⑯~⑲) installed on the matching surfaces for each component body.

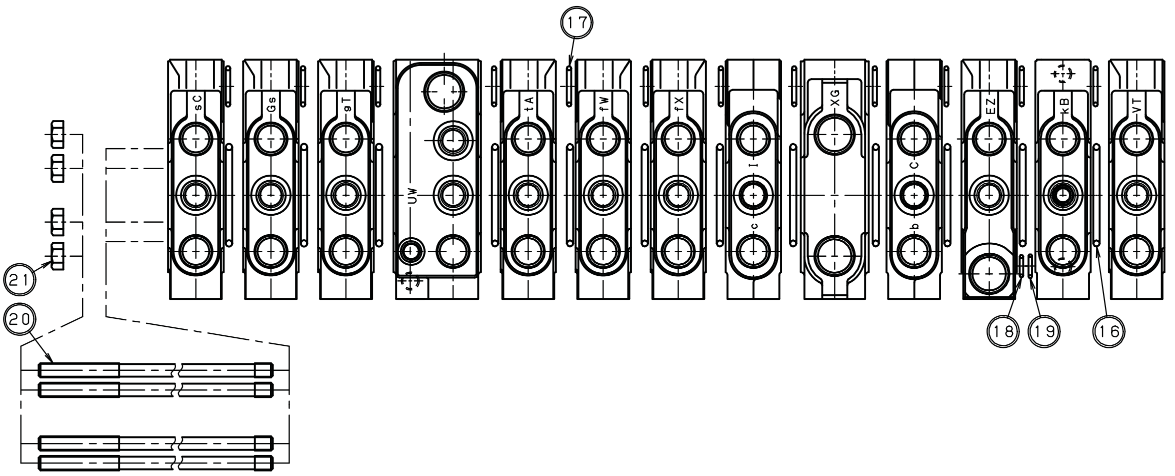


Fig.13 Body Assy

35Z9A7MCV11

16 O-ring	19 O-ring
17 O-ring	20 Tie bolt
18 O-ring	21 Hexagon nut

(7) Precautions after disassembly

▲ Accessory valves are the most important parts for performance and safety; in particular, the relief valve is very difficult to readjust the setting so that replace the accessory valve as assy if any malfunction occurs.

Disassembly procedures are shown here as reference for investigating malfunction.

■ Disassembling main relief valve and overload relief valve (see Fig.14)

① Lightly hold any two surfaces of body (⑤) in a vise bench, whose hexagonal intervals are 22 mm.
② Loosen and remove M14 nut (⑧) by using 19 mm screw wrench.
③ Loosen and remove adjustable screw (⑦) by using 4 mm hexagonal wrench.
④ Take out regulating valve spring (⑨) by using tweezers or the like.
⑤ Loosen and remove valve seat (④) by using 19 mm screw wrench.
⑥ The other parts can also be removed in the following order:
Socket (①) → Piston (③) → Spring (⑩) → Valve (②)

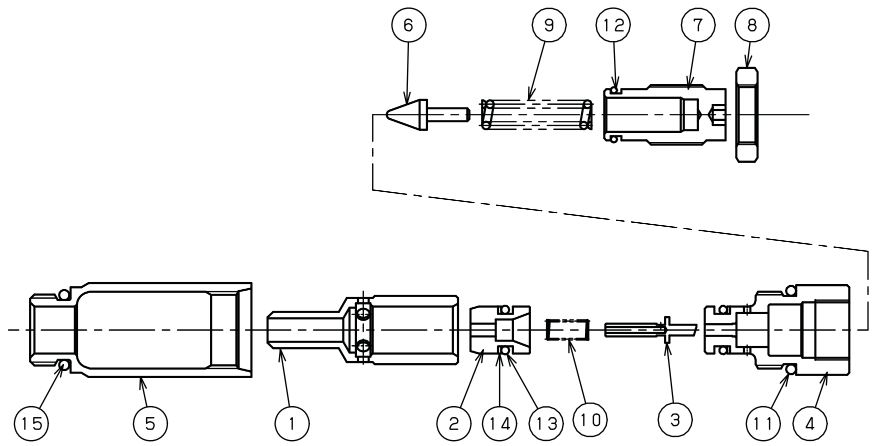


Fig.14 Disassembling main relief valve and overload relief valve

35Z9A7MCV12

1	Socke	6	Pilot poppet	11	O-ring
2	Main valve poppet	7	Adjustable screw	12	O-ring
3	Piston	8	Nut	13	O-ring
4	Pilot valve seat	9	Pilot spring	14	Back-up ring
5	Bod	10	Main valve spring	15	O-ring

(8) Precautions after disassembly

▲ For the parts already removed in the work, store and/or transport them with attention to flaws and dirt. When carrying out another work, storage, or transportation with the parts removed condition, apply caps or plastic tape to the holes from which the parts have been taken out, protecting the holes from being entered with dust or the like.

4. ASSEMBLY

1) PRECAUTIONS FOR ASSEMBLY

Be careful that the unevenness of fastening torque and the contamination of dust during assembly work could result in malfunction.
In addition, observe fastening torque values specified in the specifications and drawings.

(1) During assembly work, compare valves with the specifications and drawings and check the number of parts whether there is any improper assembly and/or the omission of parts.

(2) For the parts to be used in assembly, dip in fluid oil as need arises to reassemble after washing well in washing oil and being dried.

(3) After cleaning and degreasing the surface sufficiently, apply loctite to 2 threads of the screw from the tip (too much loctite could result in malfunction after squeezing out).

(4) For the part to be attached or assembled with two or more bolts and nuts, fastening them evenly and alternately for several times, not once with the specified torque.

(5) The unevenness of fastening torque could result in the leakage of hydraulic fluid to the outside and/or malfunctions.

2) PRECAUTIONS FOR ASSEMBLING SEAL PARTS

(1) All seals are to be renewed at assembly.

(2) Check seals for defects in molding and flaws in handling.
Do not use the seal with defect and/or flaw.

(3) The seals used on sliding surfaces and the places to be installed with seals are to be applied with grease or hydraulic fluid for sufficient lubrication where not specially noted.

(4) Do not make seals longer up to permanent deformation.

(5) O-ring is not to be twisted during assembly.
Kinked O-ring could cause oil leakage after installation because kinks are hard to restore.

3) NECESSARY TOOLS AND OTHERS

Before assembling the control valve, prepare the following tools.
The tools below are used to assemble this control valve only; tools for assembling the port fittings are not included.

Name	Quantity	Application
Hexagonal wrench	Each 1	4 mm, 5 mm, 6 mm, 8 mm
Screw wrench	Each 1	13 mm, 19 mm, 21 mm, 22 mm, 26 mm
Socket wrench	Each 1	13 mm, 19 mm, 21 mm, 22 mm, 26 mm
Torque wrench	1	0.2 ~ 2.0 kgf · m (1.4 ~14.5 lbf · ft)
Torque wrench	1	2.0 ~ 10.0 kgf · m (14.5 ~ 72.3 lbf · ft)
Magnet	1	
Pliers	1	
Slotted screwdriver	1	
Tweezers	1	

※ Prepare clean wash oil, hydraulic fluid, grease, and others before work.

4) ASSEMBLING WORK

※ The numbers in ( ) in the explanation and in ○ in the figures show reference numbers in the parts table in the specifications and drawings.
※ For the fastening torque values for screws, see the latest specifications and drawings.

(1) Assembling body work (see figure 15 and 16)

① On a surface plate with clean rubber plates on it, place component bodies with actuator port surface facing downward in the order shown in "Orders of assembling bodies" on the next page.

※ Check the matching surface in each component body for dust or the like, and check whether O-rings (⑯~⑲) shown in the specifications and drawings are surely put in each groove for O-ring.
Kinked O-ring could cause the leakage of hydraulic fluid to the outside due to the malfunction of sealing performance.
If O-rings are not installed surely in O-ring grooves, there would be the nip of O-ring, resulting in the leakage of hydraulic fluid to the outside when assembling the bodies.

② Put and fasten 4 tie bolts (⑳) through the bodies from the side of dozer component (body sC side), and fasten 4 M8 hex nuts (㉑) to the bolts by hand.
③ Check that all the body surfaces are in alignment in this condition.
If not, make all the body surfaces in alignment by hitting them with plastic hammers or the like.
Since the bottom surfaces (the opposite side of actuator port surfaces) of the control valve are not in alignment, place the bodies with actuator port facing downward to align actuator port surfaces when arranging the body surfaces.
Before aligning the body surfaces, remove the rubber plates and others that have been laid at ①.
However, check that there is no dust or no unevenness on the surface from which the above rubber plates have been removed.

※ Do not hit hard when using a plastic hammer.
Hard hitting could cause displacements in the portion that has been aligned.
Check the alignment with a flat plate or the like after aligning.
If there is large displacement in any component, bad connection between internal passages could cause a malfunction.
If any seal position overlaps the passage, there could be the leakage of hydraulic fluid to the outside.

④ After checking that the surfaces are in alignment, fasten 4 M8 hex nuts (㉑) that have been put on in ②. with the torque specified in the specifications and drawings with 13 mm socket wrench.

※ Fasten 4 M8 hex nuts evenly and little by little in several times.
Uneven fastening makes the body assy curve easily, which could result in leakage or malfunction after installation on the machine.
If you find any curve in the body assy, it is necessary to reassemble or to correct it by pressing machine or the like.

ORDERS OF ASSEMBLING BODIES

No.	1	2	3	4	5	6	7	8	9	10	11	12	13
ID	sC	Gs	gT	UW	tA	fW	fX	cI	XG	bC	EZ	kB	VT

※ Identifications (ID) are engraved on the top (actuator port side) of the body.

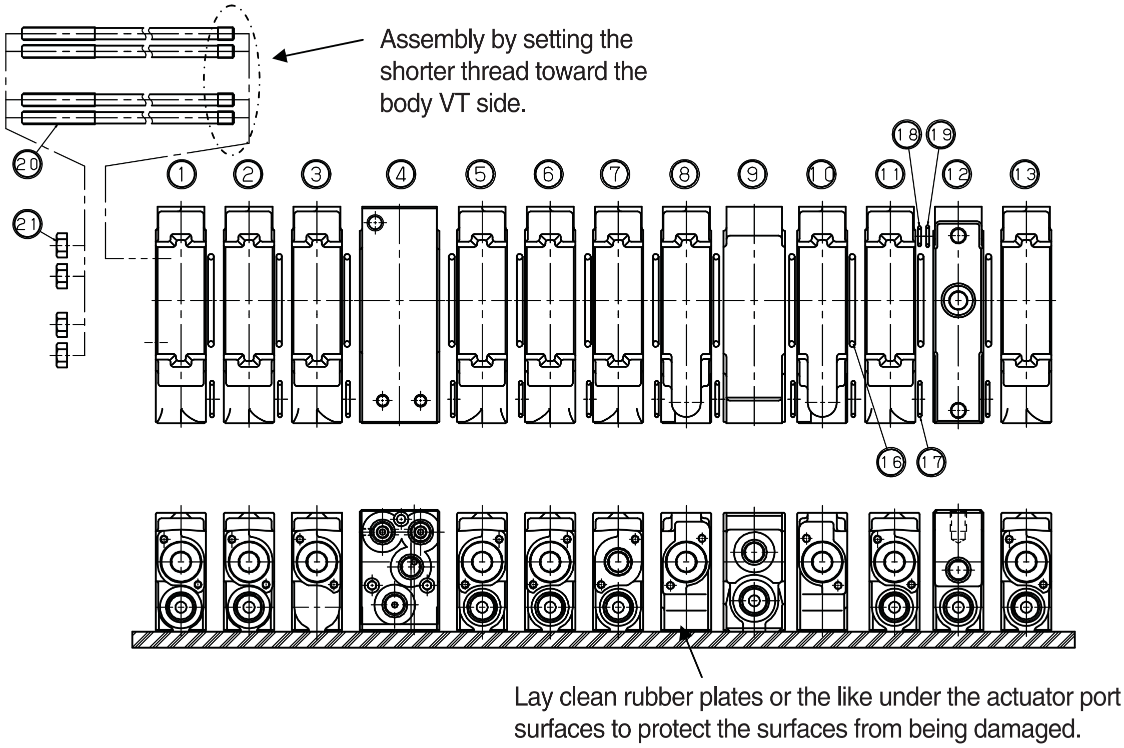


Fig.15 Body assy

35Z9A7MCV13

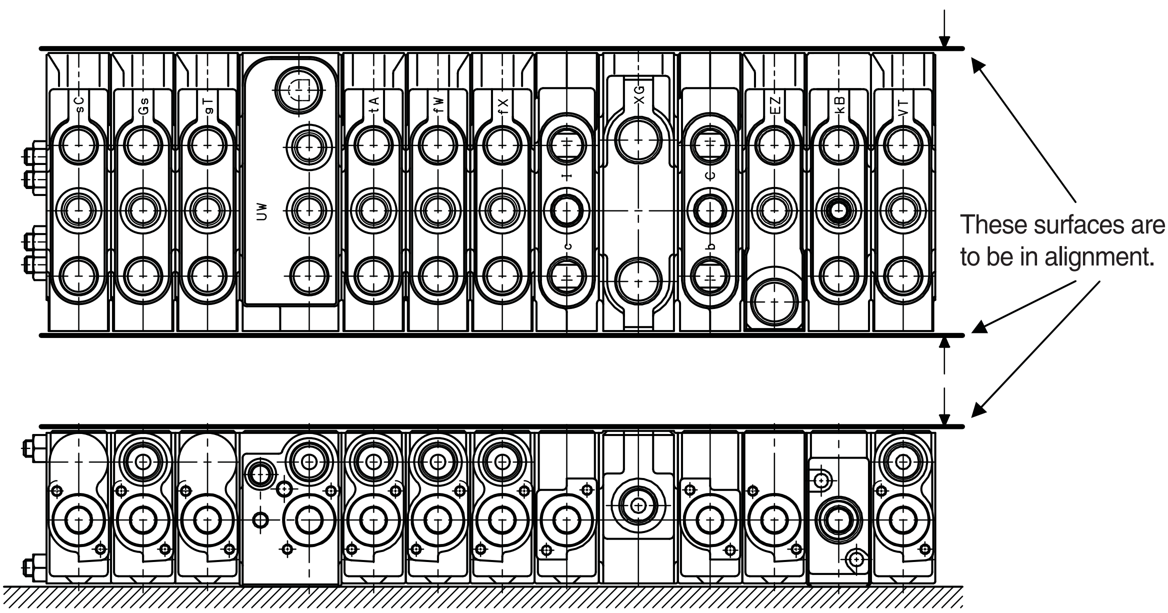


Fig.16 Body assy (after assembly)

35Z9A7MCV14

(2) Assembling small parts

Various plugs in boom lock valve (see Fig.17 and 18)

① Place control valve assy on a workbench with actuator port faces facing downward.
② Install O-ring (⑦) securely into an O-ring groove at the center of body.

※ Then, apply a light coating of grease to O-ring (⑦) as an anti-kink measure when assembling plug (⑧).
Kinked O-rings can cause the malfunction of sealing performance, resulting in the leakage of hydraulic fluid to the outside.
However, too much coating of grease to O-ring could cause the squeezing out of O-ring (leakage of hydraulic fluid to the outside) or suspected grease leakage at high temperature; a light coating of grease to O-ring is recommended.

③ Tighten plug (⑧) with specified torque by using 6 mm hexagonal wrench.
④ Place control valve assy on a workbench with actuator ports surface facing upward.
⑤ Check that plug (③) is securely installed with O-ring (②).
Furthermore, check that there is no damage such as cuts on O-ring (②).
⑥ Tighten plug (③) with specified torque by using 6 mm hexagonal wrench.
⑦ Check that plug (⑪) is securely installed with O-ring (⑫).
Furthermore, check that there is no damage such as cuts on O-ring (⑫).
⑧ Tighten plug (⑪) with specified torque by using 21 mm screw wrench (or socket wrench).

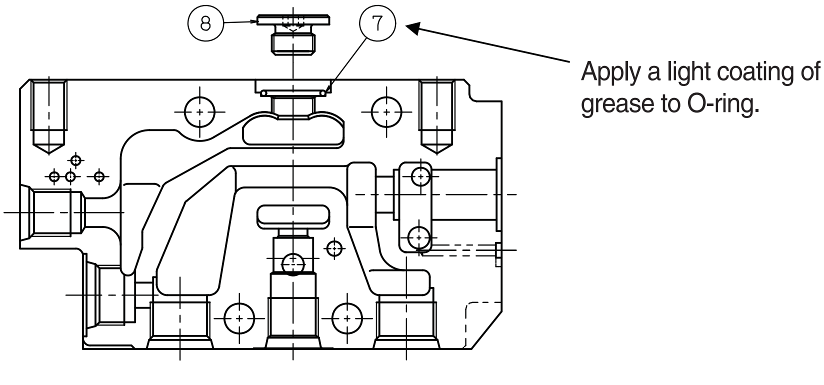


Fig.17 Bottom plug on boom lock valve

35Z9A7MCV15

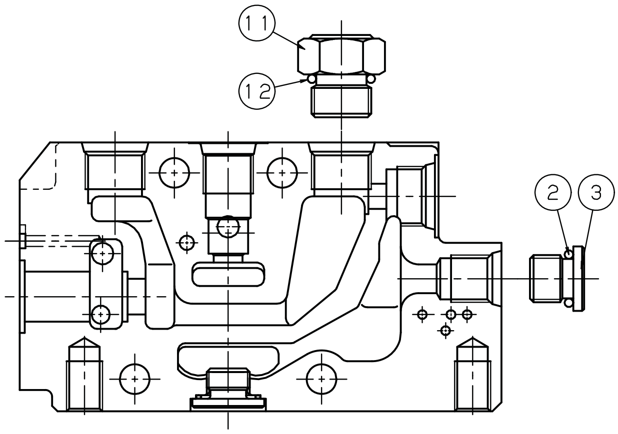


Fig.18 Plug on boom lock valve

35Z9A7MCV16

Body-pilot, piston and plugs for P3 conflux component (see Fig.19).

① Install O-rings (⑦, ⑧) securely into O-ring grooves on the body.
② Insert piston (⑭) into spool sleeve with caution in the direction.

※ Piston (⑭) is to be inserted with small-diameter side (stepped side) facing the spool sleeve. If not, the wrong direction causes malfunction.

③ Insert 3 hex. socket head bolts (⑯) toward the bolt holes of pilot body assy (⑤,⑬,⑮,⑰~⑳). Press and hold pilot body assy (⑤,⑬,⑮,⑰~⑳) to the body.
④ Fasten 3 hex socket head bolts (⑯) with specified torque with 4 mm hexagonal wrench.
⑤ Check that O-ring (⑫) is securely installed with plug (⑪).
⑥ Fasten plug (⑪) with specified torque with 4 mm hexagonal wrench.

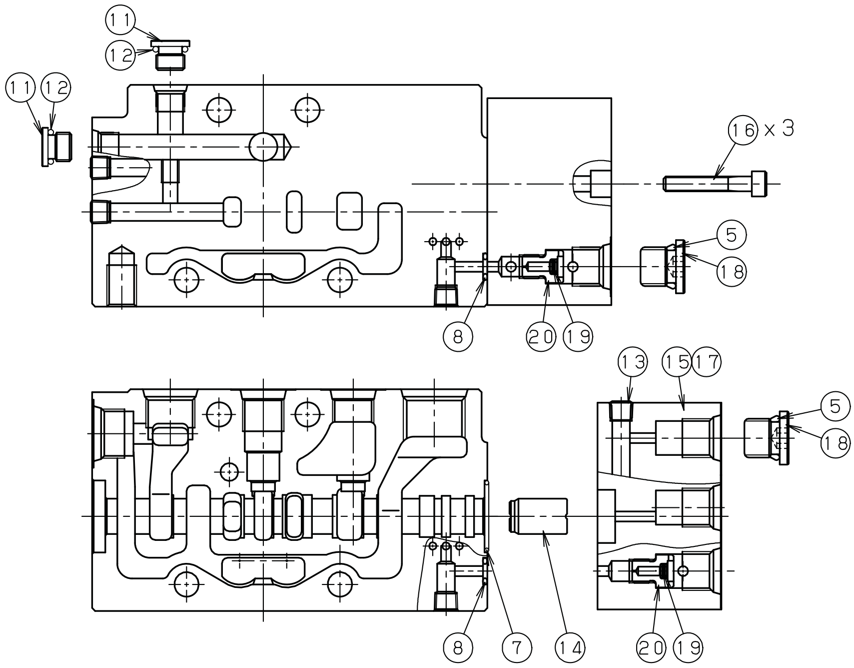


Fig.19 P3 conflux component

35Z9A7MCV17

■ Pilot cover (see Fig.20)

① Install O-ring (⑦) securely on the flange bottom of the body.
② Insert pilot cover (⑧) into the flange of the body.
③ Fasten 2 hex socket head bolts with washers (⑩) with specified torque with 4 mm hexagonal wrench.

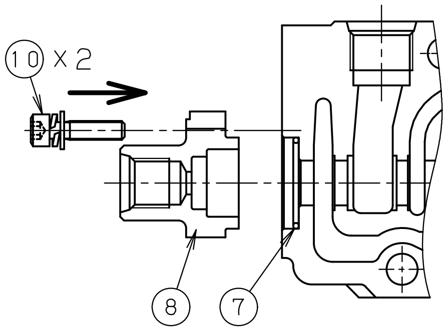


Fig.20 Pilot cover

35Z9A7MCV18

(3) Boom lock valve assembly procedures

(See Fig.21 and 22. The reference numbers below except those in double circles are according to "Detail of lock valve" in the delivery specifications.)

① Hold lock valve cover set (①, ⑫, ⑬) in a vise bench or the like.
② Put steel ball ϕ7 (⑱) into a hole on top surface of lock valve cover set.
③ Check that O-ring (⑫) is securely installed and then tighten plug (⑲) with specified torque by using 4 mm hexagonal wrench.
④ Insert piston A1 (⑭) and piston B (⑮) in sequence from a hole on lock valve cover set side (screw machined).

※ Then, check the direction of those pistons.
If the direction of piston A1 (⑭) is wrong, lock valve will not be released.
If the direction of piston B (⑮) is wrong, lock valve will be left being released.
In addition, since vush (⑰) cannot be tightened to the end, there will be the leakage of hydraulic fluid to the outside.

⑤ Check that vush (⑰) is securely installed with O-ring (⑯) and then screw bush (⑰) to the hole, into which the piston has been inserted, with specified torque by using 26 mm screw wrench (or socket wrench).
⑥ Install O-rings (㉑,㉒) securely into O-ring grooves on lock valve body.
⑦ Insert lock valve set (②~⑧, ⑪) into a hole for lock valve.
⑧ Insert needle valve (⑩) into lock valve set from the rear of lock valve set.
⑨ Install 2 positioning pins (⑨) to the surface facing the body of lock valve cover set.
⑩ Pressing lock valve cover set to the body, screw in 1-2 threads of 2 hex socket bolts (⑳) by hand.

※ Then, make sure that needle valve (⑩) is settled in the seat of piston guide (⑬) in lock valve cover set. If not, needle valve will not be seated so that lock valve will also be released.
To check the settlement, under the condition ⑩, loosen the force that is used to press lock valve cover set to the body and then check whether lock valve cover set can depart from the body by the force of spring inside lock valve set. If there is no feel of spring reaction, remove the unit once and then carry out the assembly again.

⑪ Tighten hex socket bolts (⑳) with specified torque by using hexagonal wrench.

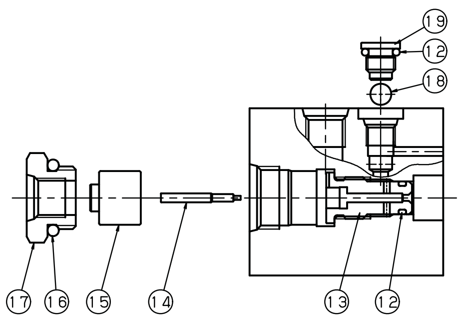


Fig.21 Lock valve cover

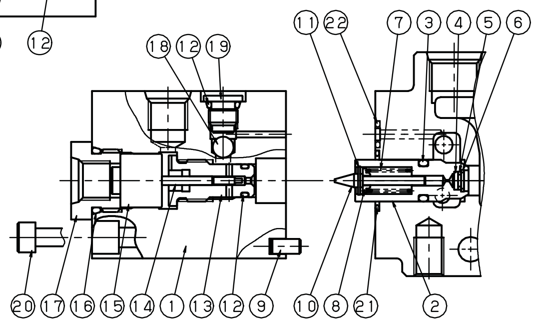


Fig.22 Boom lock valve

35Z9A7MCV19

(4) **Accessory valve installing procedures**

※ Accessory valves are the most important parts for performance and safety; in particular, the relief valve is very difficult to readjust the setting so that replace in assy if any malfunction occurs.

Installing main relief valve (MRV) and overload relief valve (ORV) (see Fig.23)

Taking ORV in the arm component as an example, the installing procedures are as follows.

① Fasten ORV (⑮) with specified torque with 22 ㎜ screw wrench or deep socket wrench.

· Put screw wrench (or deep socket wrench) to 22 ㎜ hexagonal part of pressure regulating body. Screw wrench to put the hexagonal part as shown in the Fig.23.

※ Be careful not to damage the seat of socket that sticks out above the tip when installing MRV and ORV to the body.

If the seat is damaged, there could be internal leakage, resulting in the malfunction of holding attachment.

※ Do not put 19 ㎙ screw wrench to the lock nut part when installing.

Lock nut turns with adjustable screw free turning, resulting in the degradation in performance or damage.

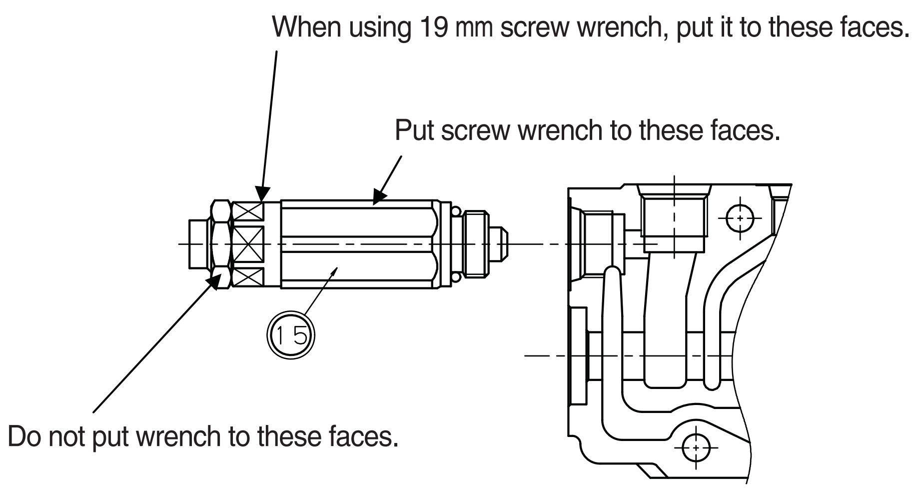


Fig.23 Installing main relief valve and overload relief valve

35Z9A7MCV20

(5) Check valve assembly procedures

Installing main relief valve (MRV) and overload relief valve (ORV) (see Fig.23)

① Hold the control valve body at workbench or hold it by two or more people.
② Assemble check valve (③) and check valve spring (④) in sequence at the center of control valve top surface.
Then, set check valve (③) vertically (check that the check valve is in nearly at the center of hole).
③ Check that O-ring (⑤) is securely installed with check valve plug (⑥) and then screw it into the part where check valve has been assembled.
④ Fasten check valve plug (⑥) with specified torque with 19 mm screw wrench or socket wrench.

· The other check valves can be assembled in the same manner; use suitable parts in the drawing (see Fig.25 and 26.).
If assembly is mistaken, check valve could not function or there could be damage.

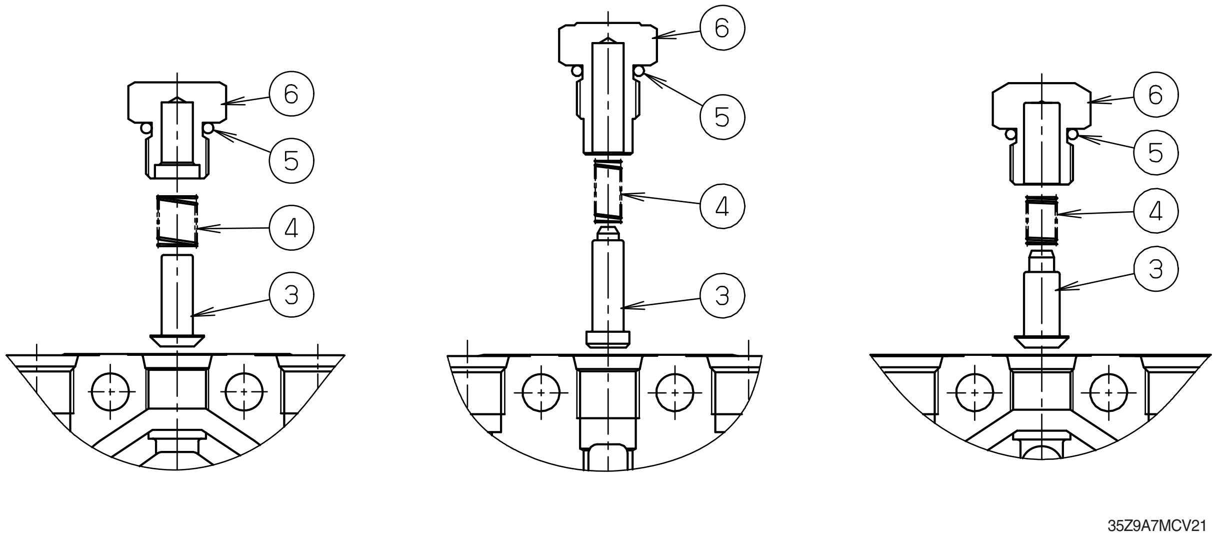


Fig.24 Check walve (dozer, boom swing, swing, arm, boom, bucket)

Fig.25 Check valve (P3 conflux, travel, boom lock valve)

Fig.26 Check valve (PTO 1,PTO 2)

(6) Spool installing procedures

Except P3 conflux part

Taking the swing spool as an example, the installing procedures are as follows (see Fig.27).

① After checking whether there is no dust or the like in the spool sleeve of the body and/or spool assy and O-ring (⑦) is securely installed with that the flange bottom of the body, insert the dozer spool ass'y into spool sleeve of the body with attention to the position and direction.

· Then, apply little hydraulic fluid to the spool before insertion.

※ Carefully insert spool ass'y into the spool sleeve horizontally.
If it is hard to insert, forcible insertion could cause impressions on spool sleeve and/or spool, resulting in malfunction.
If you feel any feeling of wrongness such as catches or strong resistance, pull it out once to check whether there is the adhesion of dust or the development of flaw or burr.
If there are flaws or burrs, there could be malfunction so that replace body and spool in set.

· When there is no feeling of wrongness, move it slowly several times checking the movement and no feeling of wrongness again.

② Press pilot cover (⑨) in a direction from the spring side of spool assy to the flange of the body.
Fasten 2 hex socket head bolts with washers (⑩) with specified torque with 4 mm hexagonal wrench.

③ The other spools can be assembled in the same manner.

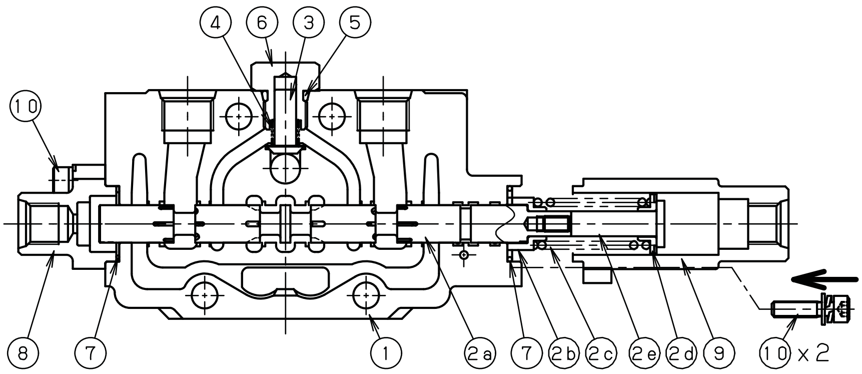


Fig.27 Except P3 conflux part

35Z9A7MCV22

1	Body-work	2d	Spring seat	6	Plug-check valve
2	Spool assy (swing)	2	End-spool	7	O-ring
2a	Spool (swing)	3	Poppet-check valve	8	Pilot cover B1
2b	Spring seat	4	Spring-check valve	9	Pilot cover A1
2c	Spring	5	O-ring	10	Hex socket bolt with washer

(7) Assembling accessory valve

Accessory valves are the most important parts for performance and safety; in particular, the relief valve is very difficult to readjust the setting so that replace in assy if any malfunction occurs.

Assembly procedures are shown here as reference for investigating malfunction:

The accessory valve assembled according to the procedures below should not be used practically.

Assembling main relief valve and overload relief valve (see Fig.29)

① After checking that O-ring (⑫) is securely installed into grooves on the top of adjustable screw (⑦), assemble regulating valve spring (⑨) and regulating valve (⑥) into the hole of adjustable screw (⑦).

② After check that back-up ring (⑭) and O-rings (⑬,⑪) are installed into regulating body (④), put the screw hole side of regulating body (④) on the assy that has been assembled in ①. and then fasten them with screws.

※ Pay attention to the positional relationship between O-ring (⑬) and back-up ring (⑭).
(Back-up ring is installed on the screw machined side of regulating body)
If it is installed oppositely, there would be the squeezing out of O-ring or the like, resulting in internal leakage, malfunction, or damage to other hydraulic devices at worst.
Then, look in the inside from a small-diameter hole of regulating body (④) to check that regulating valve (⑥) is settled in the seat of regulating body (④).
If the regulating valve is not settled, there will be no rise in pressure, resulting in malfunction.

③ Attach M14 nut (⑧) to the adjustable screw (⑦) sticking out from assy that has been assembled in ②.

④ After checking that O-ring (⑬) and back-up ring (⑭) are securely installed into grooves on the peripheral of regulating valve (②), insert regulating valve (②) into socket (①).

※ Pay attention to the positional relationship between O-ring (⑬) and back-up ring (⑭).
(Back-up ring is installed on the seat side of regulating valve)
If it is installed oppositely, there would be the same malfunction in ②.

⑤ Assemble piston (③) and regulating valve spring (⑩) in sequence into a small-diameter hole of the assy that has been assembled until ③.
· Be careful of the direction to install piston.
(The side machined with drill hole is to be the outside)
If it is inserted oppositely, the following assembly work cannot be proceeding.

⑥ Assemble the assy that has been assembled in 5. with the Ass'y that has been assembled in ④.

⑦ Insert the assy that has been assembled in 6. into regulating body (⑤) by turning regulating body.

⑧ Lightly hold any two surfaces of body (⑤) in a vise bench or the like and then fasten regulating body (④) with specified torque by using 19 mm screw wrench.

⑨ Check the installation of O-ring (⑮).

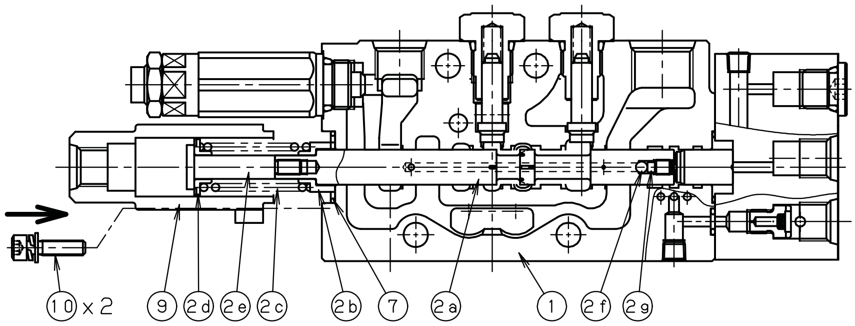


Fig.29 Assembling main relief valve and overload relief valve

35Z9A7MCV23

1	Socket	6	Pilot poppet	11	O-ring
2	Main valve poppet	7	Adjustable screw	12	O-ring
3	Piston	8	Nut	13	O-ring
4	Pilot valve seat	9	Pilot spring	14	Back-up ring
5	Body	10	Main valve spring	15	O-ring

5. MAINTENANCE STANDARD

1) PARTS CHECK

Name	Inspection item	Criterion and treatment
Component body	Presence of scratch, rust, corrosion.	Replace it if any of the followings is damaged. · Sliding parts for spools, especially lands with holding pressure. · Body flanges receiving spools. · Seal parts contacting with O-ring in ports. · Seats in relief and overload relief valves. · Damage spoiling normal functions.
Spool	Presence of scratch, scuff, rust, corrosion. Insert spool into body and stroke it with turning.	Replace it if scratch is on outer sliding part. Replace or correct it if spool does not move smoothly.
Check valve (load check valve)	Damage to check valve or check valve spring. Insert check valve into check valve plug to operate.	Replace or correct it if flaw or dent is on seat. Smooth moving without scratch is normal. Replace it if not.
Spring and related parts	Rust, corrosion, deformation, breakage in return spring seat, plug, cover.	Replace it if there is non-smooth operation or heavy damage.
Sealing of spools	Hardened, deformed, or damaged O-ring.	Replace it.
MRV, ORV	Rust in appearance. Matching surface of valve seat. O-ring, back-up ring.	Replace it. Replace it if there is flaw or dent. 100% replacement in principle.

6. PROBLEM CAUSES AND MEASURES

- If any abnormal condition is found, check whether control valve itself fails or there is problem in pump, cylinder, motor, or hydraulic circuit. for this check, it is necessary to measure pilot pressure, pump discharge pressure, and load pressure. observe the above disassembly and assembly procedures even if any part is disassembled or inspected.
- Be careful of dust proofing. dust is very harmful to hydraulic devices.
- Carefully handle moving movable parts. correct it with oilstone or replace it even if there is a minor flaw.
  Clean it sufficiently after correction.
- Protect the seal surface of o-ring from being damaged. the damage could cause oil leakage.

1) CONTROL VALVE

Phenomenon	Possible causes	Treatment
No movement in each attachment. slow operation (power shortage). Or slow response.	Operation failure in relief valve · Dust between regulating valve and seat★ · Dust between regulating valve seats★ · Stick of regulating valve★ · Breakage or fatigue of spring★ · Loosened adjustable screw★	Measure relief valve pressure · Replacement in assy★ · Replacement in assy★ · Replacement in assy★ · Replacement in assy★ Replacement in assy★
	Dust between body and spool, or stick	Disassemble and clean it. Replace body and spool if damage is big.
Cylinder's empty weight falling in neutral is big.	Excessive gap between comp. Body and spool.	Replacement in spool assy.
	Spool is not returned to neutral completely. · Dust storage between body and spool, or stick. · Breakage or fatigue of spring.	Measure pilot secondary pressure. · Disassemble and clean, or replace body and spool in set for stick. · Replacement in spool assy.
	Operation failure in overload relief valve. (see Maintenance standard)	Measure overload relief valve pressure. (see 8. Maintenance standard)
	Operation failure in lock valve. · Dust between lock valves or needle valve seats. · Stick of lock valve or needle valve. · Orifice clogging in lock valve.	Replace lock valve assy (including lock valve body)
When operating to rise cylinder at starting operation, it lowers.	Operation failure in load check valve. · Dust between load check valve and body. · Stick in load check valve. · Breakage or fatigue of spring.	 · Disassemble and clean Replace body and load check valve if damage is big · Disassemble and clean Replace body and load check valve if damage is big · Replace spring

For problem with ★ mark, must replace relief valve in assy.

2) RELIEF VALVE

Relief valve is the most important part for performance and safety, and is very difficult to readjust the setting at a place except maintenance shops with adequate equipment.
Replace in assy if any of the following malfunctions occurs.

Phenomenon	Possible causes	Treatment
Pressure cannot rise	Any pressure regulating valve, regulating valve, or piston in relief valves has stuck to keep opening, or dust presents on any seat in relief valves.	· Replacement in assy.
Relief pressure is unstable	Each regulating valve in relief valves is damaged. Piston has stuck in pressure regulating Valve.	· Replacement in assy.
Relief pressure is out of setting range	Attrition by dust Lock nut and adjustable screw are loosened. Breakage or fatigue of spring. Operation failure in relief valve (main relief valve and overload relief valve)	· Replacement in assy.
Oil leakage	Damage in each seat Attrition in O-ring Stick of each part due to dust	· Replacement in assy.

GROUP 5 SWING DEVICE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

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

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

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

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

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

(4) Disconnect hose assembly (78, 102, 103).

(5) Disconnect pilot line hoses (27, 29, 32).

(6) Sling the swing motor assembly (1) and remove the swing motor mounting bolts (24).

※ Motor device weight : 39 kg (86 lb)

(7) Remove the swing motor assembly.

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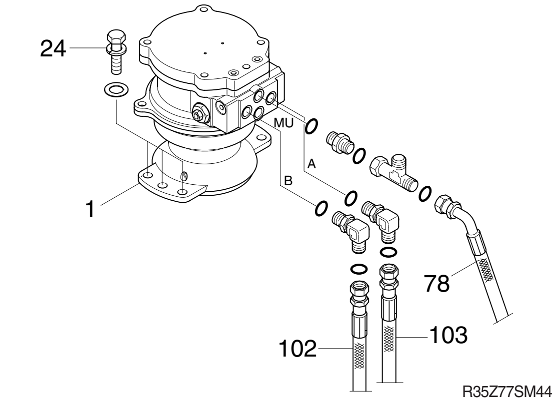


R35Z77SM44

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.

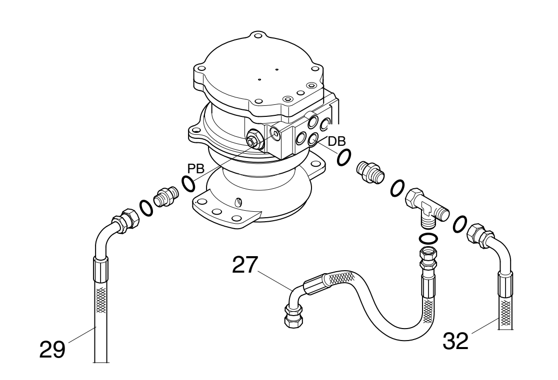
② Pour in hydraulic oil until it overflows from the port.

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.



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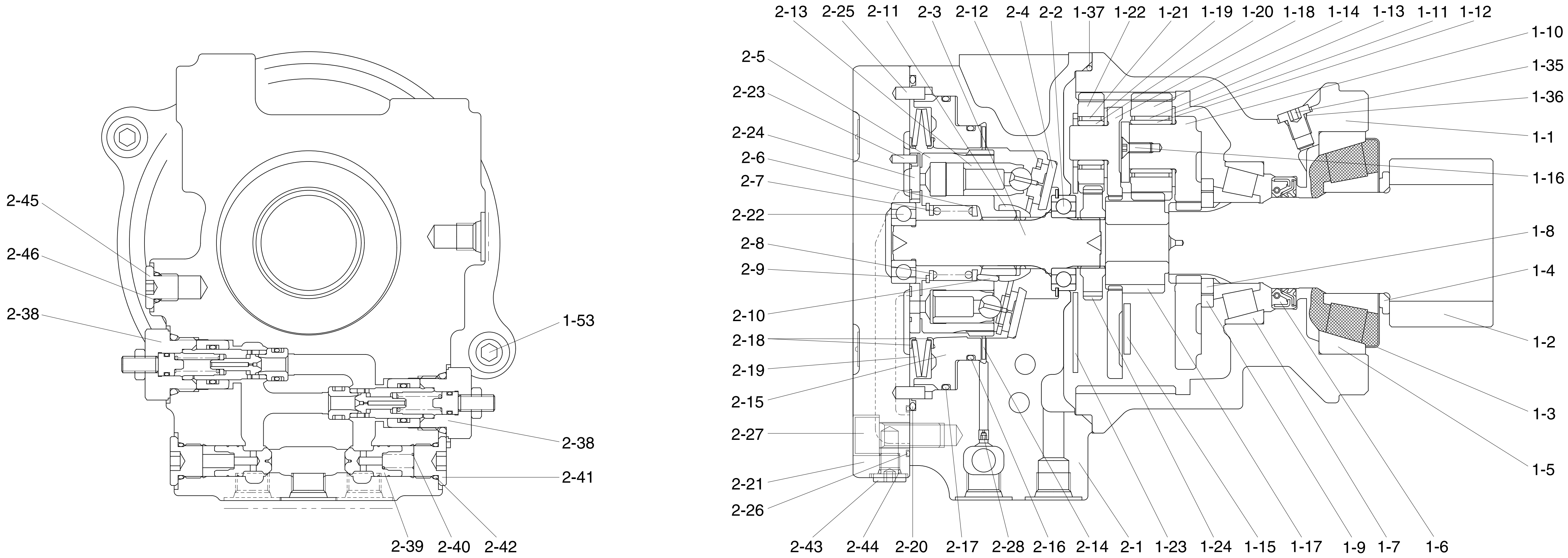
2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



R35Z92SM12

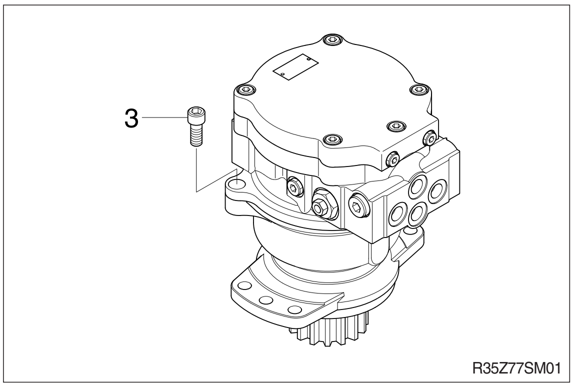
- 1 Gear box
- 1-1 Housing
- 1-2 Pinion shaft
- 1-3 Plate
- 1-4 Collar
- 1-5 Tapper roller bearing
- 1-6 Oil seal
- 1-7 Tapper roller bearing
- 1-8 Plate
- 1-9 Collar
- 1-10 Holder
- 1-11 Thrust washer
- 1-12 Inner race
- 1-13 Needle bearing
- 1-14 Planetary gear B
- 1-15 Thrust plate
- 1-16 Screw
- 1-17 Sun gear B
- 1-18 Holder
- 1-19 Thrust washer
- 1-20 Inner race
- 1-21 Needle bearing
- 1-22 Planetary gear
- 1-23 Thrust plate
- 1-24 Drive gear
- 1-35 Plug
- 1-36 O-ring
- 1-37 O-ring
- 1-53 Socket bolt
- 2 Axial piston motor
- 2-1 Case
- 2-2 Ball bearing
- 2-3 Shaft
- 2-4 Thrust plate
- 2-5 Cylinder block
- 2-6 Collar
- 2-7 Spring
- 2-8 Washer
- 2-9 Snap ring
- 2-10 Pin
- 2-11 Retainer holder
- 2-12 Retainer plate
- 2-13 Piston assy
- 2-14 Disc
- 2-15 Brake piston
- 2-16 O-ring
- 2-17 O-ring
- 2-18 Spring seat
- 2-19 Spring
- 2-20 O-ring
- 2-21 Cover
- 2-22 Ball bearing
- 2-23 Pin
- 2-24 Valve plate
- 2-25 Pin
- 2-26 O-ring
- 2-27 Socket head bolt
- 2-28 Orifice
- 2-38 Relief valve assy
- 2-39 Check valve
- 2-40 Spring
- 2-41 Plug
- 2-42 O-ring
- 2-43 Plug
- 2-44 O-ring
- 2-45 Plug
- 2-46 O-ring

2) DISASSEMBLY

Disassemble the parts by the following procedure.

(1) Separating the motor and the reduction gear

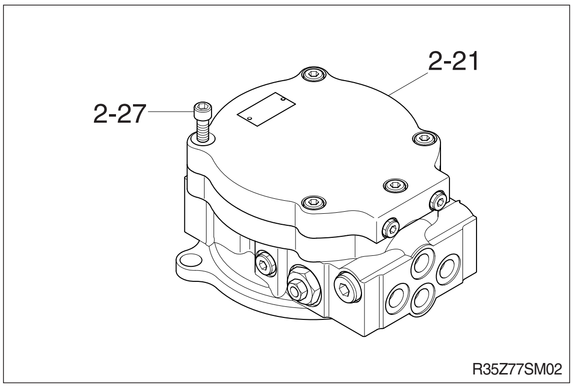
Secure the motor assembly in a vice and remove the socket head bolt (3).



(2) Disassembling the motor

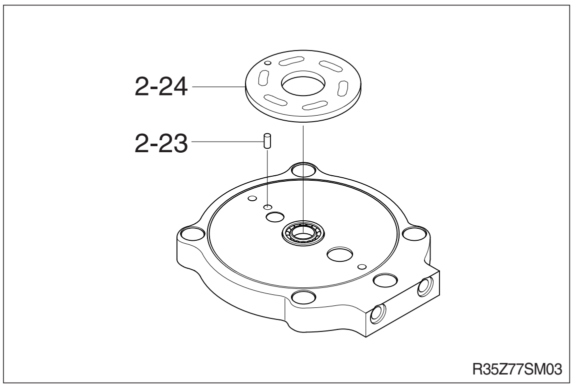
① Secure the motor assembly in a vice. Remove the socket head bolts (2-27) and separate the cover (2-21).

※ When separating the cover (2-21), be careful not to drop the valve plate (2-24).

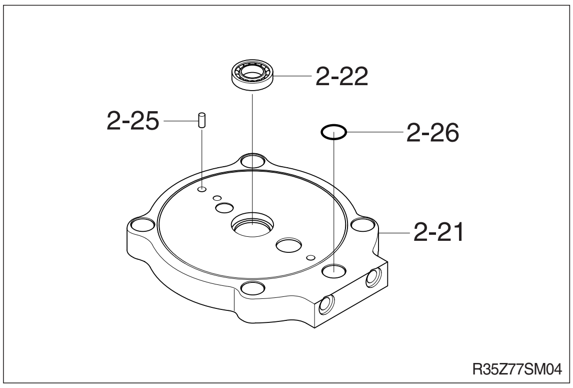


② Remove the valve plate (2-24) and the pin (2-23).

※ The valve plate (2-24) may remain on the motor side.

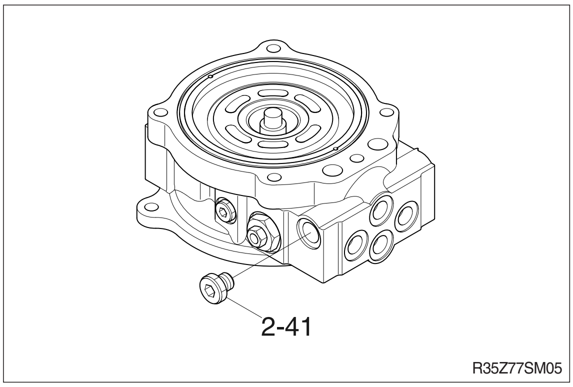


③ Remove the bearing (2-22). Remove the O-ring (2-26).

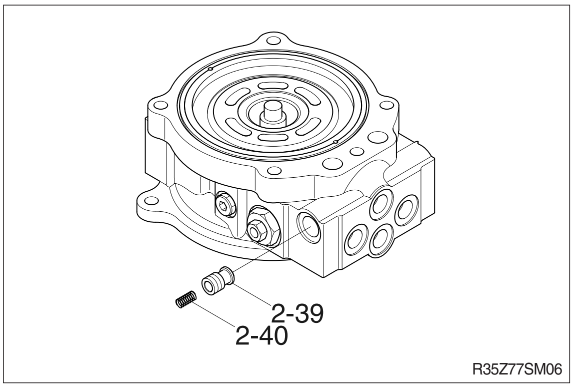


④ Disassemble the check valve.

a. Loosen to remove the plug (2-41).



b. Remove the spring (2-40) and the check valve (2-39).

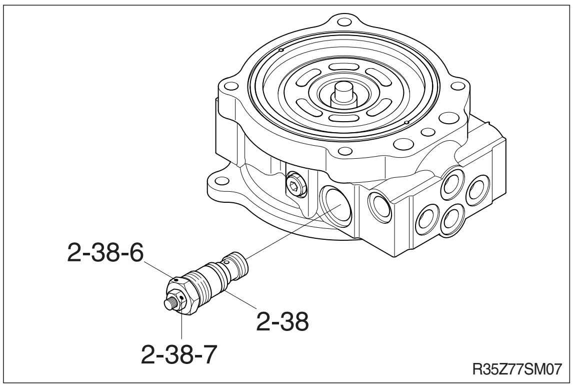


⑤ Remove the relief valve.

a. Loosen the plug (2-38-6) to remove the relief valve assembly (2-38).

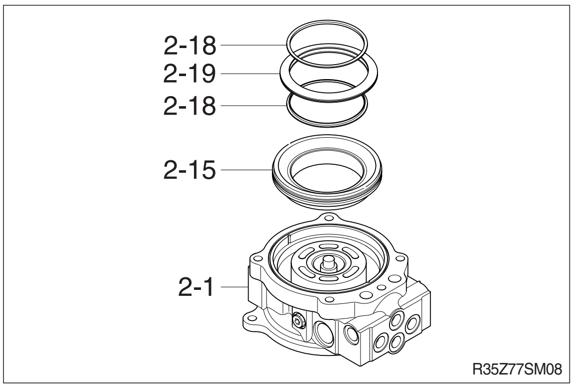
※ Do not move the adjuster kit (2-38-7). Otherwise, the set pressure will change.

※ Do not disassemble the relief valve assembly (2-38) because it is a functional component.



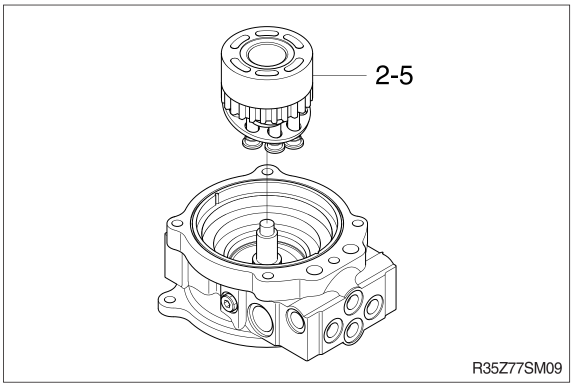
⑥ Remove the disc spring assembly (2-19) and the spring seat (2-18), and utilizing the gage port of the case (2-1), remove the parking brake piston (2-15).

※ The piston may be ejected by the air pressure. Exercise sufficient care during removal. At the beginning of the work, set a lower air pressure and adjust it while checking the piston for ejection.

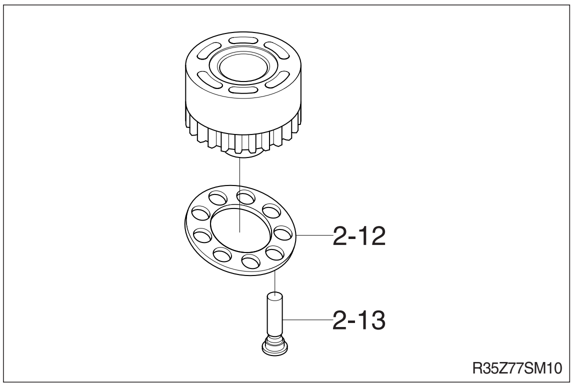


⑦ Remove the cylinder block and other associated parts.

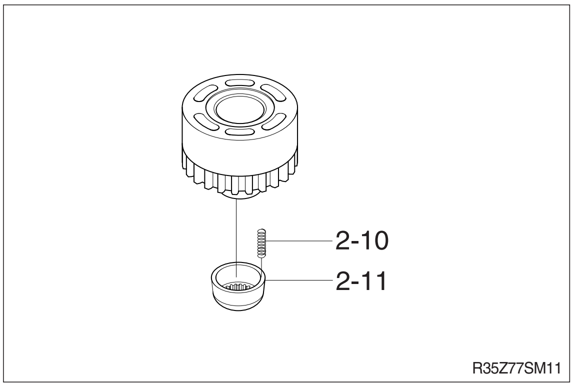
(2-5) Cylinder block
(2-6) Collar
(2-7) Spring
(2-8) Washer
(2-9) Snap ring
(2-10) Pin
(2-11) Retainer holder
(2-12) Retainer plate
(2-13) Piston assembly
(2-14) Disc(Parking brake spec. only)



⑧ Remove the retainer plate (2-12) and the piston assembly (2-13).

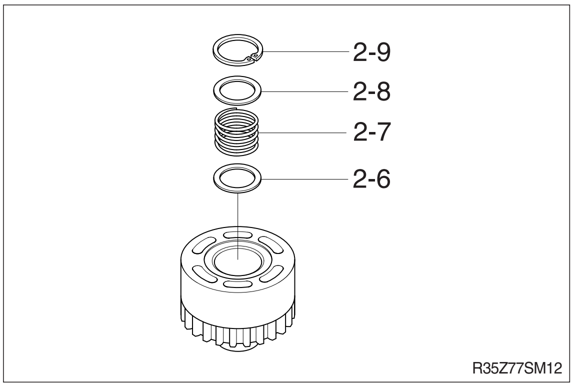


⑨ Remove the pin (2-10) and the retainer holder (2-11).

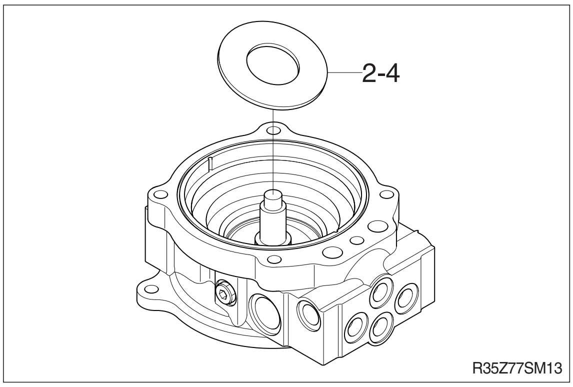


⑩ While pushing the washer (2-8), remove the snap ring (2-9).

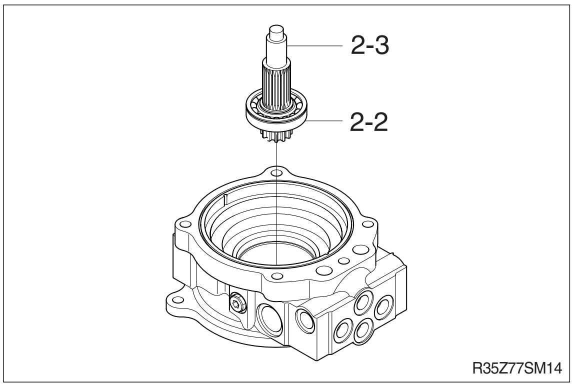
⑪ Remove the collar (2-6), the spring (2-7) and the washer (2-8).



⑫ Remove the thrust plate (2-4).

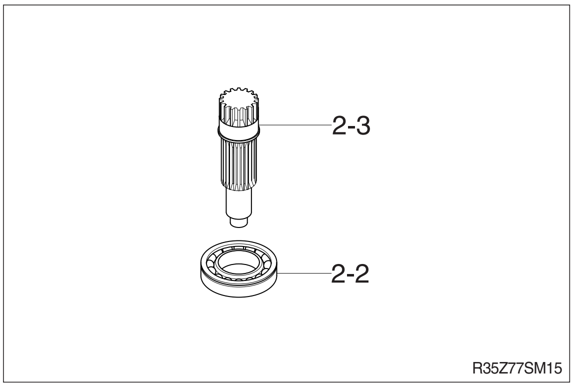


⑬ Lightly strike the end of the shaft (2-3) with a plastic hammer to remove the shaft.



⑭ Disassemble the ball bearing (2-2) and the shaft (2-3).

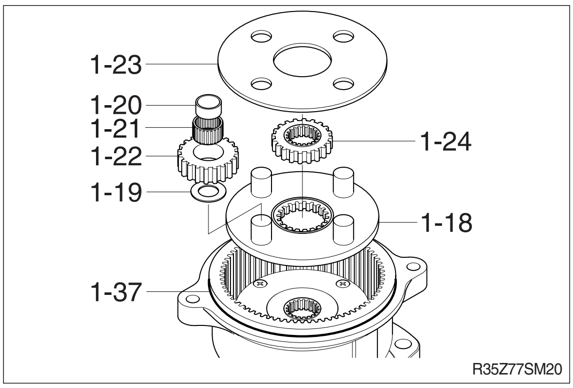
※ The disassembled bearing must not be used.



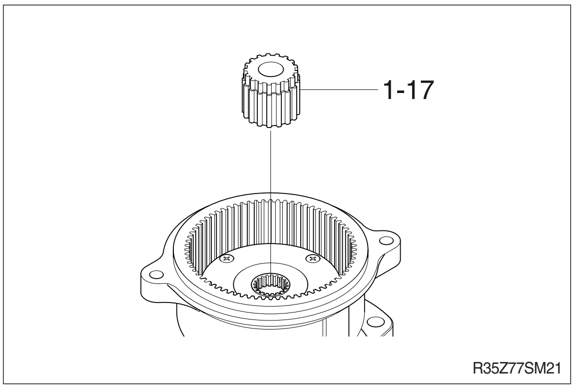
(3) Disassembling the reduction gear

① Remove the following parts.

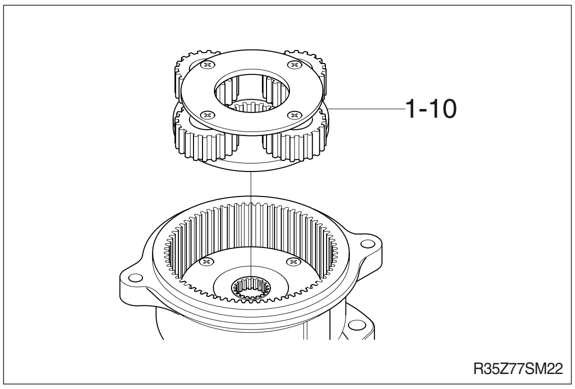
(1-37) O-ring
(1-24) Drive gear
(1-23) Thrust plate
(1-22) Planetary gear
(1-21) Needle bearing
(1-20) Inner race
(1-19) Thrust washer
(1-18) Holder



② Remove the sun gear (1-17).



③ Remove the holder (1-10) and other associated parts.

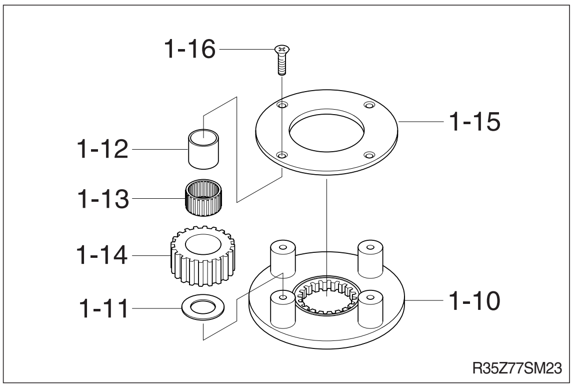


④ Secure the holder (1-10) in a vice and loosen the screw (1-16) to remove the thrust plate (1-15).

※ The screw is hard to remove because loctite was used during assembly. To facilitate the removal of the screw, warm the screw with a drier.

⑤ Remove the following parts.

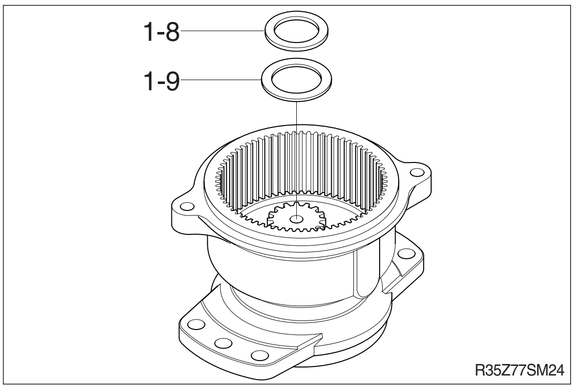
(1-14) Planetary gear
(1-13) Needle bearing
(1-12) Inner race



※ When replacing the taper roller bearings (1-5) and (1-7), the collar (1-9) and the plate (1-8), they are to be replaced by the body assembly.

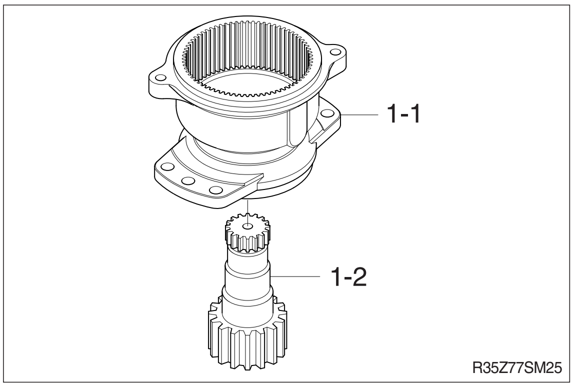
⑥ Remove the following parts.

(1-8) Plate
(1-9) Collar

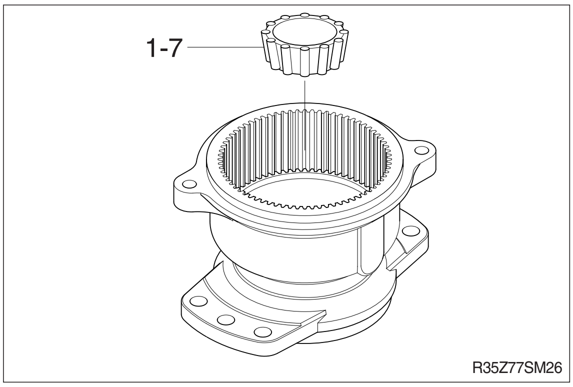


⑦ Remove the pinion shaft (1-2)

※ When removing the shaft, be careful not to drop it. If it is hard to remove, lightly strike it with a plastic hammer.

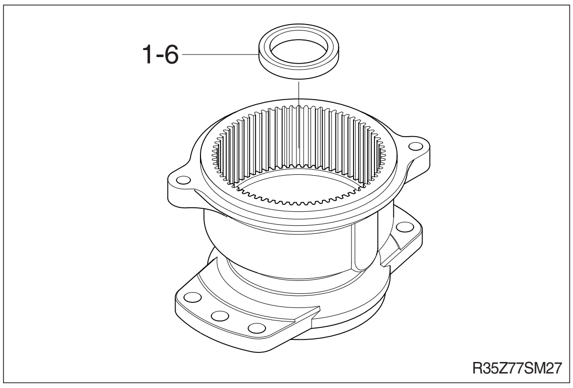


⑧ Remove the inner race of the taper roller bearing (1-7).

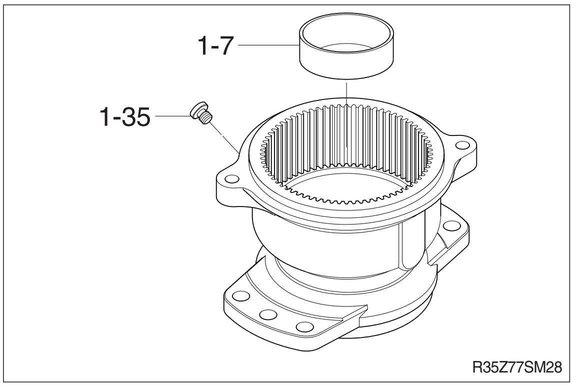


⑨ Break the oil seal (1-6) to remove it.

※ The removed oil seal must not be used again.
When removing it, exercise care to prevent damage to the outer races of the taper roller bearing (1-8) and (1-6).



⑩ Remove the outer race of the taper roller bearing (1-7) and the plug (1-35).



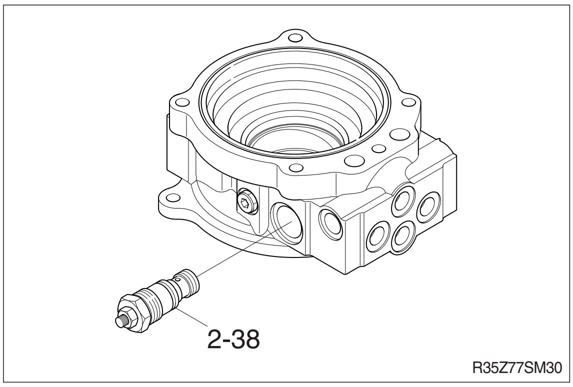
3) ASSEMBLY

Assemble the parts by the following procedure.

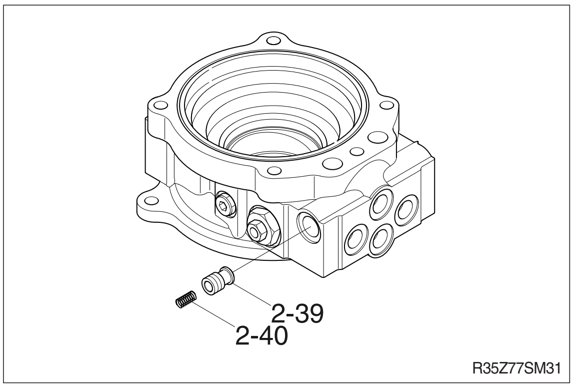
(1) Assembling the motor

① Install the relief valve assembly (2-38).

· Tightening torque : 157±10 N · m
161±1 kgf · m

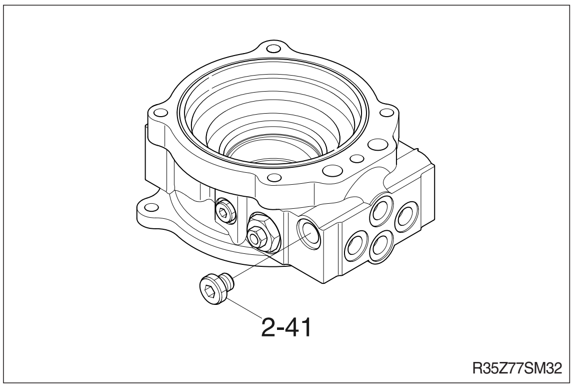


② Assemble the check valve (2-39) and the spring (2-40).



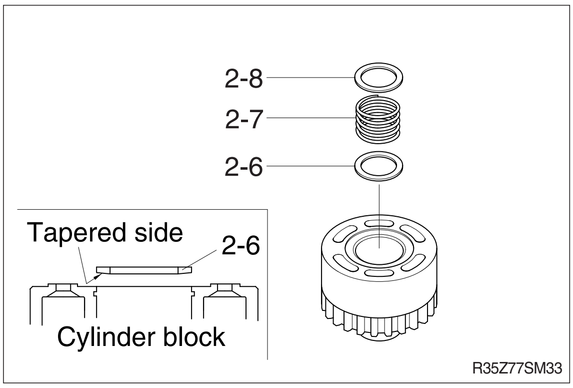
③ Install the plug (2-41).

· Tightening torque : 39.2±2.0 N · m
4.0±0.2 kgf · m

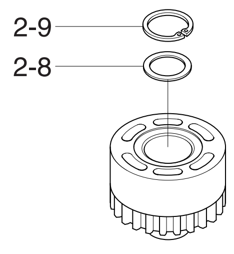


④ Assemble the collar (2-6), the spring (2-7) and the washer (2-8) in the cylinder block (2-5).

※ Be sure to assemble the collar (2-6) in the correct direction.



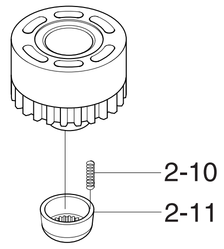
⑤ While pushing the washer (2-8), assemble the snap ring (2-9).



R35Z77SM35

⑥ Apply grease to the pin (2-10) and assemble it in the cylinder block (2-5).

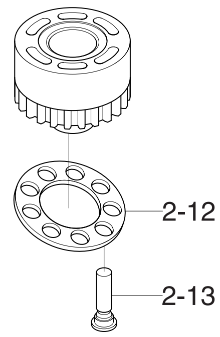
⑦ Assemble the retainer holder (2-11).



R35Z77SM11

⑧ Set the piston assembly (2-13) on the retainer plate (2-12) and assemble it in the cylinder block (2-5).

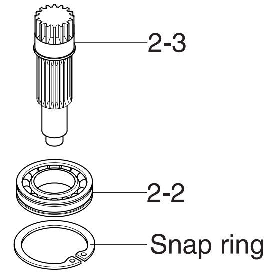
※ Apply an ample amount of hydraulic fluid to the sliding part before assembly.



R35Z77SM10

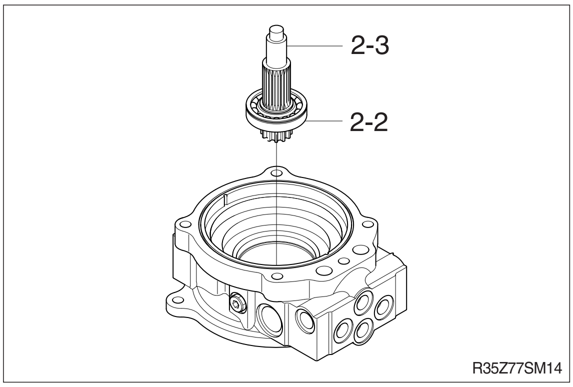
⑨ Press-fit the ball bearing (2-2) on the shaft (2-3).

※ Press-fit the ball bearing (2-2) with the attached snap ring facing as shown in the figure.



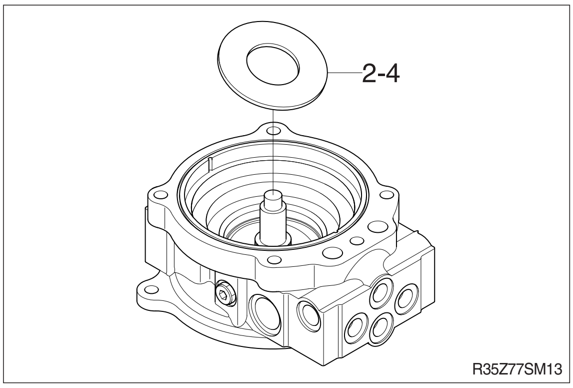
R35Z77SM36

⑩ Press-fit the shaft (2-3) and the ball bearing (2-2) in the case (2-1).



⑪ Apply grease to the back side of the thrust plate (2-4) and assemble it.

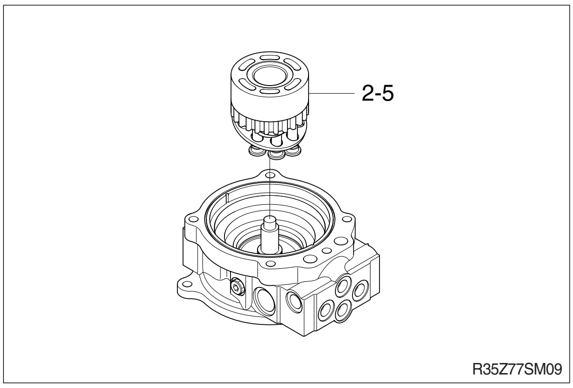
※ The thrust plate must be assembled in the correct direction.



⑫ Assemble the cylinder block (2-5) and other associated parts.

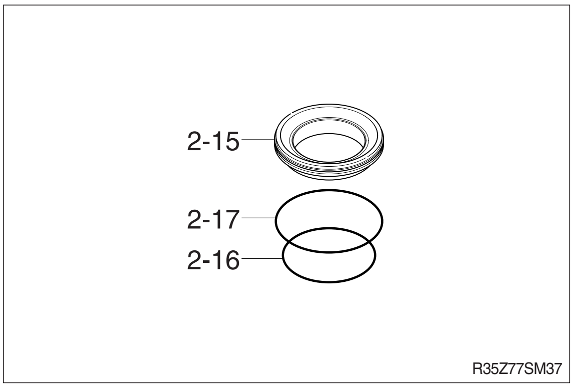
※ During assembly, be sure that the pin (2-10) will not come out.

※ The disc (2-14) is assembled only for the parking brake spec only.

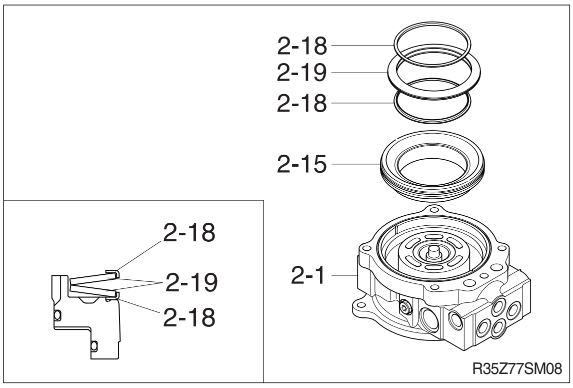


⑬ Apply grease to the O-ring (2-16) and the O-ring (2-17) and assemble them on the brake piston (2-15).

⑭ While paying attention to the location of the hole of the pin (2-25), assemble the brake piston (2-15) in the case (2-1).

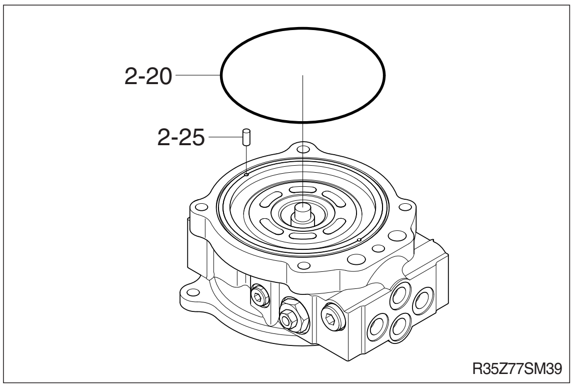


⑮ Assemble the spring seat (2-18) and the disc spring (2-19) in the correct direction.

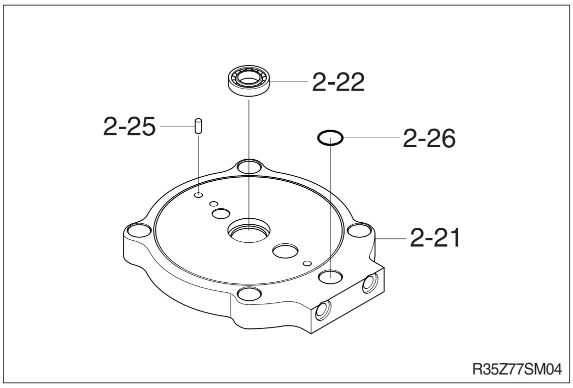


⑯ Apply grease to the O-ring (2-20) and assemble it in the case (2-1).
Check to see if the pin (2-25) can be assembled in the brake piston and case hole. If not, remove the brake piston (2-15) and re-orient it, then reassemble.

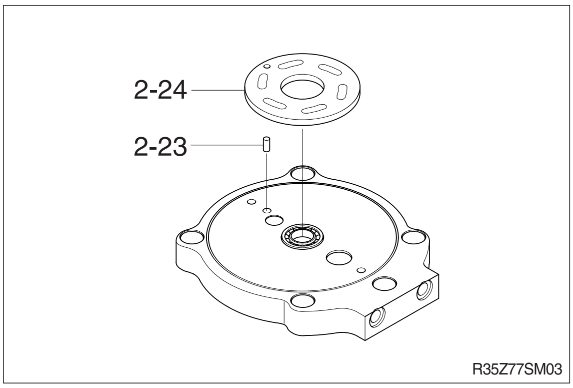
※ Assemble the pin (2-25) while being attached on the cover.



⑰ Apply grease to the O-ring (2-26) and the pin (2-25), then assemble them in the cover (2-21).
Press-fit the ball bearing (2-22).



⑱ Install the pin (2-23), then install the valve plate (2-24).
To prevent it from falling, apply grease to the back side.

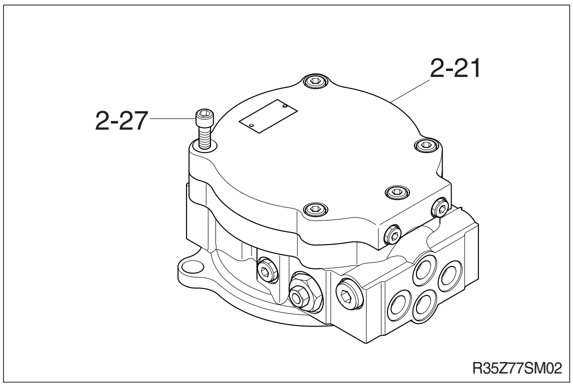


⑲ While paying attention to the location of the pin (2-25), install the cover (2-21) and other associated parts to the case (2-1).

※ Exercise care so that the pin (2-25) and

⑳ Loosely tighten the socket head bolts (2-27), then using a torque wrench, tighten them to the specified torque.

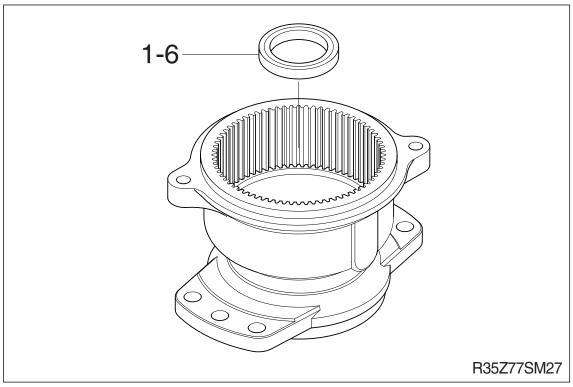
· Tightening torque : 13±0.7 kgf · m
(94.4±5 lbf · ft)



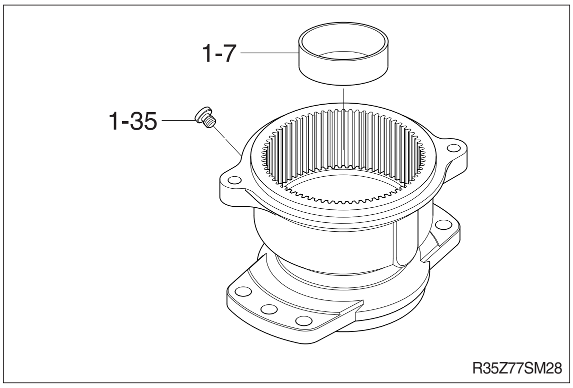
(2) Assembling the reduction gear

① Press-fit the oil seal (1-6).

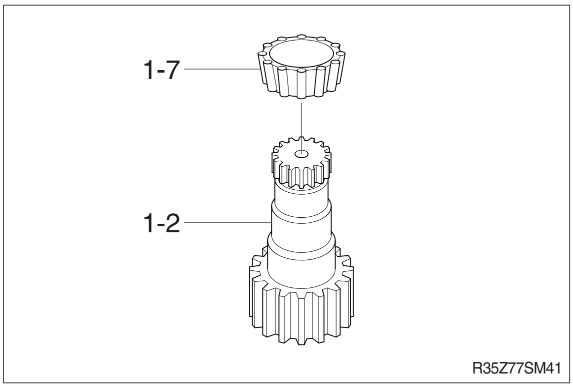
※ Prior to press-fit, apply grease to the oil seal mounting area of the housing and the periphery of the oil seal.



② Press-fit the taper roller bearing (1-7) and install the plug (1-35).

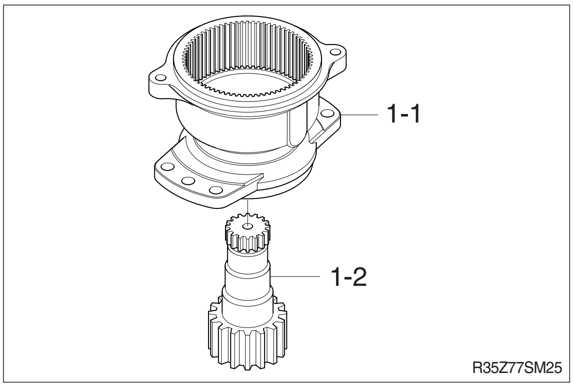


③ Apply grease to the inner race of the taper roller bearing (1-7) assembled on the pinion shaft (1-2).

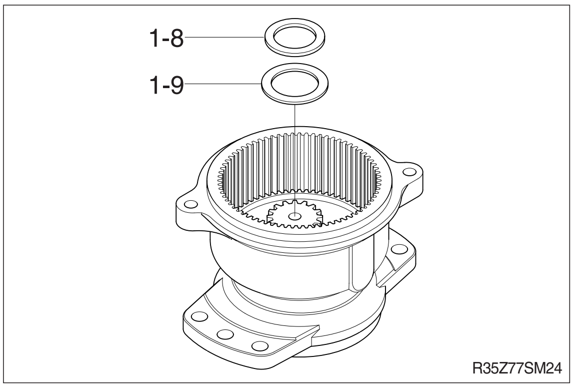


④ Install the pinion shaft (1-2) and other associated parts. Install the taper roller bearing inner race (1-7).

※ Prior to assembling the pinion shaft (1-2), etc. apply grease to the lip of the o i l seal (1-6).

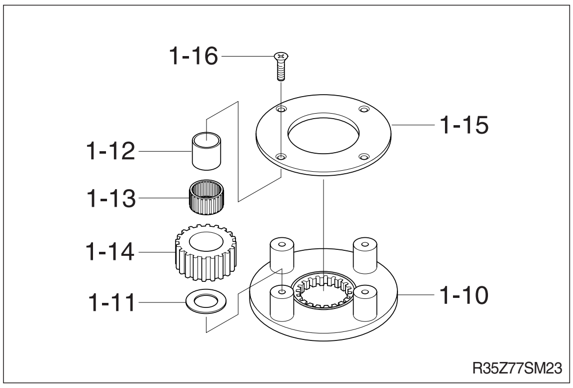


⑤ Install the collar (1-9) and the plate (1-8).



⑥ Install the following parts on the holder.

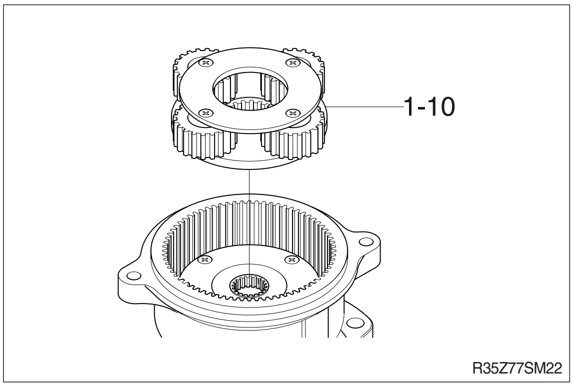
(1-10) Holder
(1-11) Thrust washer
(1-12) Inner race
(1-13) Needle bearing
(1-14) Planetary gear B
(1-15) Thrust plate
(1-16) Screw



※ Apply loctite 242 to the screw prior to tightening it.

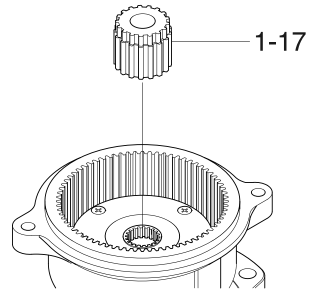
· Tightening torque : 0.4±0.05 kgf · m
2.9±0.3 lbf · ft

⑧ Install the holder (1-10) and other associated parts.



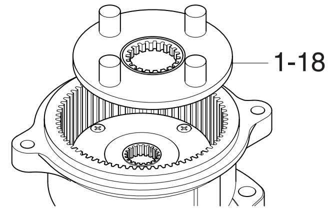
⑨ Install the sun gear (1-17).

※ Install the sun gear (1-17) with the snap ring facing as shown in the figure.



R35Z77SM21

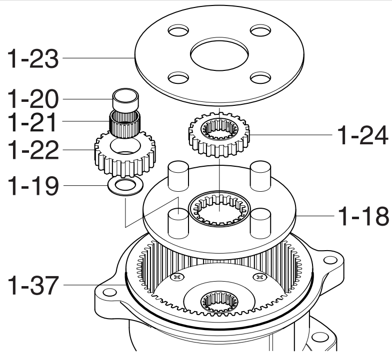
⑩ Install the holder (1-18).



R35Z77SM42

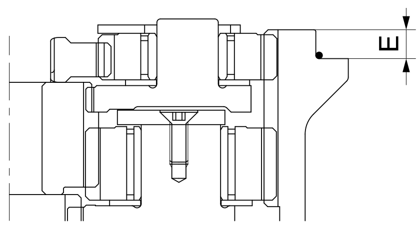
⑪ Install the following parts.

(1-19) Thrust washer
(1-20) Inner race
(1-21) Needle bearing
(1-22) Planetary gear A
(1-23) Thrust plate
(1-24) Drive gear
(1-37) O-ring



R35Z77SM20

※ Selection for thrust plate (1-15).
When any consisting parts of reduction unit were changed, select and install thrust plate corresponding to the measured value "E" referring to the below table.



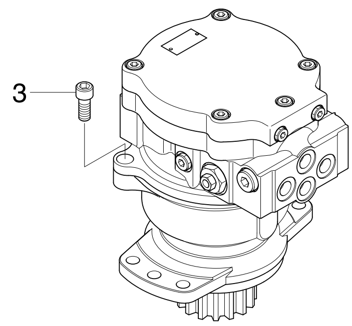
R35Z77SM43

E dimension (measured value)	Less than 6.6	6.6~7.2	More than 7.2
Part no. of thrust plate 1-23 (plate thickness)	XJBV-00129 (3.2 mm)	XJBV-00130 (2.8 mm)	XJBV-00131 (2.3 mm)

(3) Assembling the whole motor assembly

Place the reduction gear assembly on the motor assembly and loosely tighten the socket head bolt (3), then tighten it to the specified torque.

· Tightening torque : 13±0.7 kgf · m
(94.4±5 lbf · ft)



R35Z77SM01

GROUP 6 TRAVEL DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL

(1) Swing the work equipment 90° and lower it completely to the ground.

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

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

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

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

(4) Remove the track shoe assembly.
For details, see **removal of track shoe assembly.**

(5) Remove the cover.

(6) Remove the hose.
※ Fit blind plugs to the disconnected hoses.

(7) Remove the bolts and the sprocket.

(8) Sling travel device assembly (1).

(9) Remove the mounting bolts (2), then remove the travel device assembly.
· Weight : 40 kg (88 lb)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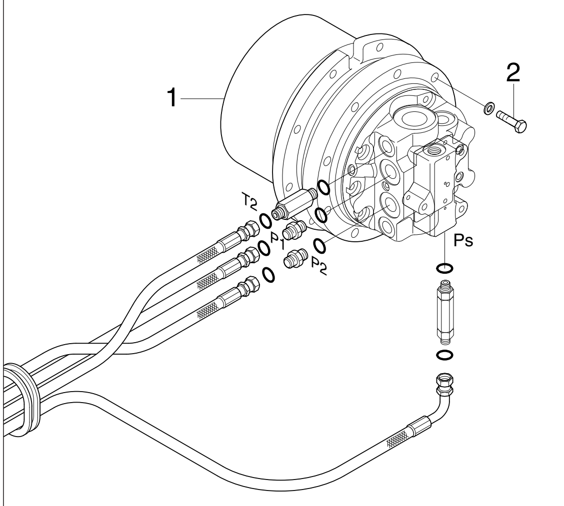


35Z9A7TM91

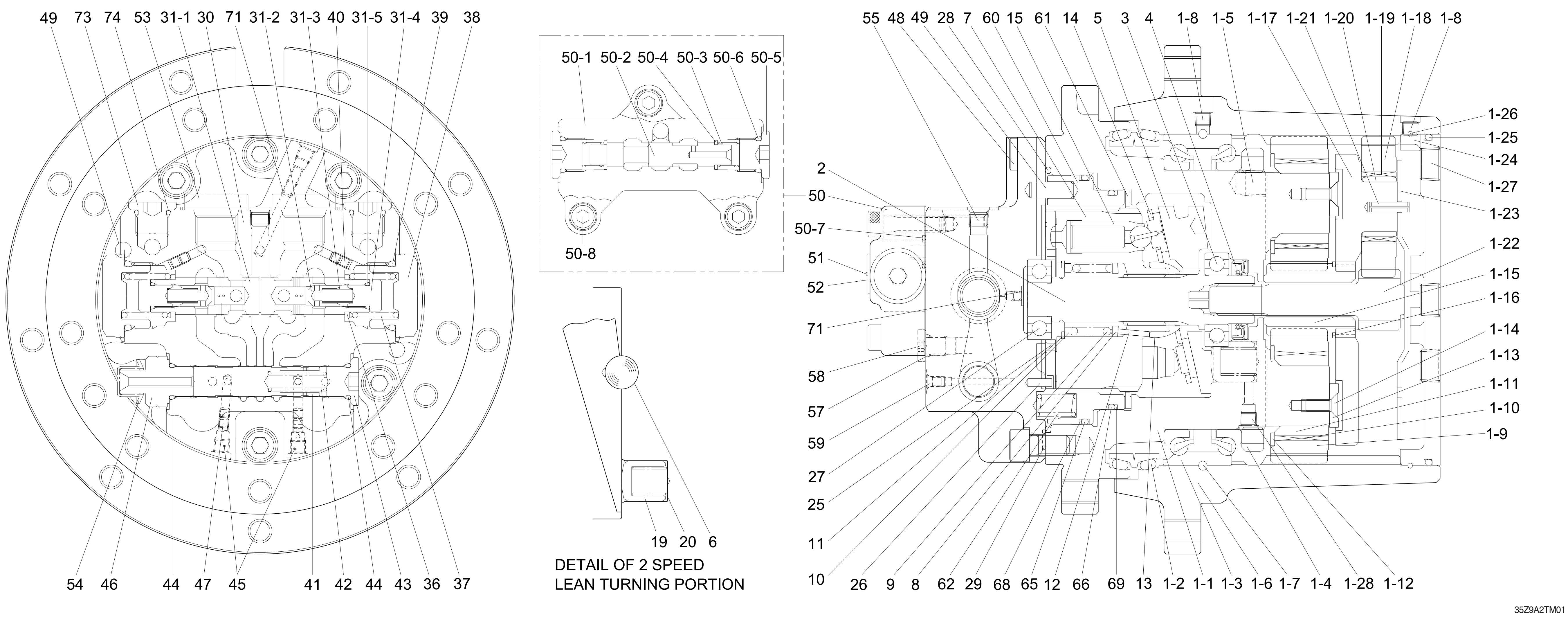
2) INSTALL

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

(2) Bleed the air from the travel motor.
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling, and check oil come out from plug.
⑤ Tighten plug fully.

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

2) STRUCTURE



1	Gear box	1-17	Holder	5	Swash plate	29	O-ring	45	Plug	57	O-ring
1-1	Flange holder	1-18	Planetary gear (A)	6	Steel ball	30	Base plate	46	Plug	58	Plug
1-2	Floating seal	1-19	Needle bearing	7	Cylinder block	31	Plunger assy	47	Orifice	59	Plug
1-3	Angular bearing	1-20	Inner race	8	Color	31-1	Plunger	48	Socket head bolt	60	Brake piston
1-4	Ring nut	1-21	Spring pin	9	Spring	31-2	Check valve	49	Pin	61	Disc
1-5	Plug	1-22	Drive gear	10	Washer	31-3	Spring	50	Valve assy	62	Spring
1-6	Housing	1-23	Thrust plate (T = 1.8)	11	Snap ring	31-4	Plug	50-1	Valve body	65	O-ring
1-7	Steel ball	1-23	Thrust plate (T = 2.3)	12	Pin	31-5	O-ring	50-2	Spool	66	O-ring
1-8	Plug	1-23	Thrust plate (T = 2.8)	13	Holder	36	Spring seat	50-3	Spring	68	Backup ring
1-9	Planetary gear B	1-24	Cover	14	Retainer plate	37	Spring	50-4	Spring seat	69	Backup ring
1-10	Needle bearing	1-25	O-ring	15	Piston assy	38	Cap	50-5	Plug	71	Spring
1-11	Collar	1-26	Wire	19	Piston assy	39	O-ring	50-6	O-ring	73	Plug
1-12	Thrust washer	1-27	Plug	20	Spring	40	Orifice	50-7	O-ring	74	O-ring
1-13	Thrust plate	1-28	Plug	25	Valve plate	41	Spool	50-8	Socket head bolt		
1-14	Screw	2	Shaft sub assy	26	Pin	42	Spring	51	Name plate		
1-15	Sun gear	3	Ball bearing	27	Ball bearing	43	Plug	52	Drive screw		
1-16	Snap ring	4	Oil seal	28	O-ring	44	O-ring	55	Plug		

3) MAINTENANCE INSTRUCTION

(1) Necessary tool to assemble

No.	Parts name		Applicable components or parts
1	Torque wrench (preset type)	~23 N.m	Plug (1-5), (1-8), (45), (55), (58), (59), (73), Screw (1-14) Orifice (40), (47), (71) Socket head bolt (50-7), (50-8)
2		~45 N.m	Socket head bolt (48) Plug (1-27), (31-4), (43), (46), (50-4), (50-5)
3		~400 N.m	Ring nut (1-4) Cap (38)
5	Hexagon bit for torque wrench	Width across flats 2.5	Orifice (40), (47), (71)
6		Width across flats 4.0	Plug (45), Screw (1-14)
7		Width across flats 5.0	Plug (1-8), Screw (1-14)
8		Width across flats 6.0	Socket head bolt (50-7), (50-8) Plug (1-5), (1-27), (31-4), (58), (59) Socket head bolt (48)
9		Width across flats 8.0	Plug (1-5), (43), (50-4), (50-5), (73)
10		Width across flats 10.0	Socket head bolt (48), Housing (1-6)
		Width across flats 12.0	Housing (1-6)
11	Socket for socket wrench	Width across flats 22.0	Plug (46)
12		Width across flats 36.0	Cap (38)
13	Screw driver		Floating seal (1-2) Wire (1-26), Base plate (30) Oil seal (4)
14	Hammer		Angular bearing (1-3) Plug (1-5), Steel ball (1-7) Shaft (2), Oil seal (4) Pin (26)
15	Plastic hammer		Base plate (30), Cover (1-24)
16	Cutting pliers		Wire (1-26)
17	Snap ring pliers		Snap ring (11)
18	Punch		Plug (1-5), Pin (26)

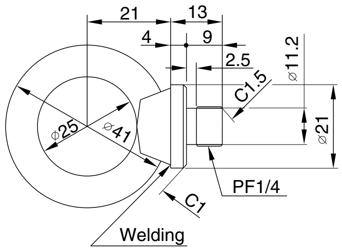
(2) Special Tools

·Table

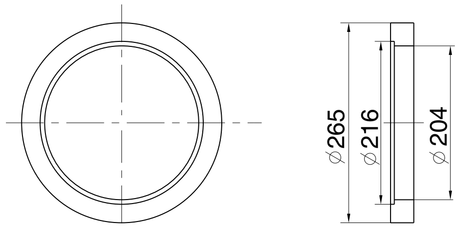
No.	Parts name	Applicable components or parts
S-1	Pin Dia. 5.5×30 mm	Plug (31-4)
S-2	Eyebolt PF 1/4	Cover (1-24), Wire (1-26)
S-3	Round bar dia. 20×1000 mm	Cover (1-24), Wire (1-26)
S-4	Piano wire dia. 0.2×700 mm	Steel ball (1-7)
S-5	Housing disassembly jig	Housing (1-6)
S-6	Ring nut tightener	Ring nut (1-4)
S-7	Round bar dia. 10×150 mm	Angular bearing (1-3), Shaft (2)
S-8	Ball bearing disassembly jig	Ball bearing (3)
S-9	Floating seal assembly jig	Floating seal (1-2)
S-10	Angular bearing press fitting jig	Angular bearing (1-3)
S-11	Flange holder press fitting jig	Flange holder (1-1)
S-12	Oil seal press fitting jig	Oil seal (4)
S-13	Ball bearing press fitting jig	Shaft (2), Ball bearing (3)
S-15	Snap ring assembly jig	Snap ring (11)
S-16	Ball bearings press fitting jig	Ball bearing (27)

※ Refer to the next page for detail figure. (S1~S16)

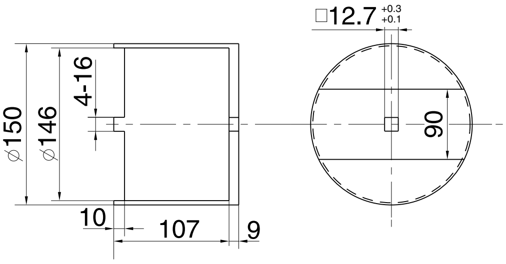
· Tools



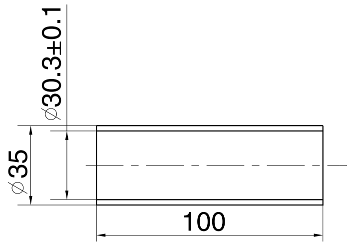
S-2 Eye bolt



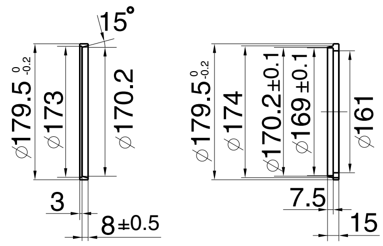
S-5 Housing disassembly



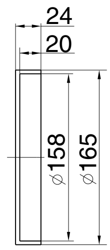
S-6 Ring nut tightener



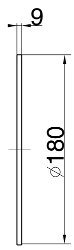
S-8 Ball bearing disassembly



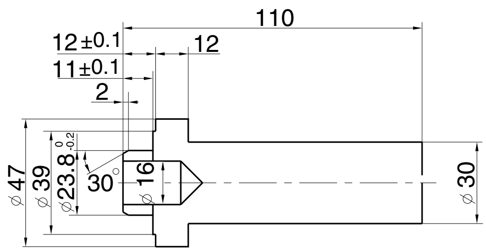
S-9 Floating seal assembly



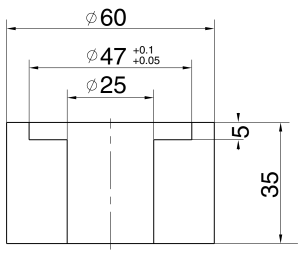
S-10 Angular bearing press fitting



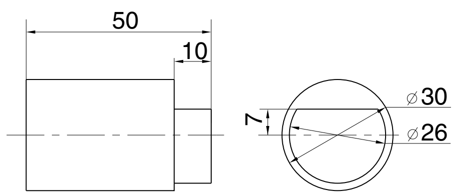
S-11 Flange holder press fitting



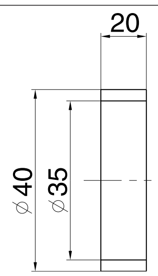
S-12 Oil seal press fitting



S-13 Ball bearing press fitting



S-15 Snap ring assembly



S-16 Ball bearing press fitting

2. DISASSEMBLY

1) GENERAL PRECAUTIONS

(1) Before disassembling the travel motors, check the items to be inspected and, for remedy against trouble, closely examine the nature of the trouble, so that the motor can be disassembled effectively.

(2) To disassemble the motor, use the disassembling procedures described in section 2-2, and select a clean place.

(3) Place a rubber or vinyl sheet or other such protective materials on your working bench to protect the surface of the motor to be serviced.

(4) During disassembly, give a match mark to the mating surfaces of each part.

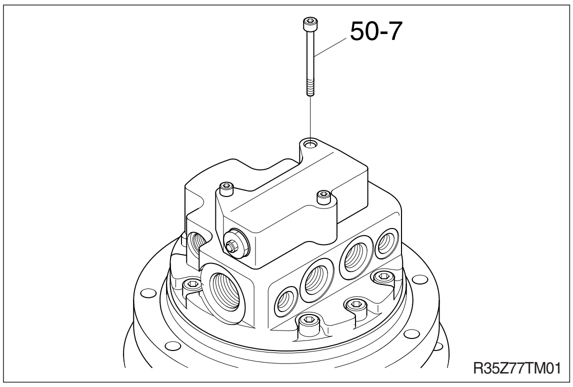
(5) Arrange removed parts in order so that they will not become damaged or missing during disassembly.

(6) Once seals have been disassembled, they should be replaced even if damage is not observed. Have replacement seals ready on hand before starting your disassembling job.

2) DISASSEMBLE TRAVEL MOTOR BY THE FOLLOWING PROCEDURE

(1) Fix the motor with vise.
Loosen socket head bolt (50-7), (50-8) and remove valve assy (50).

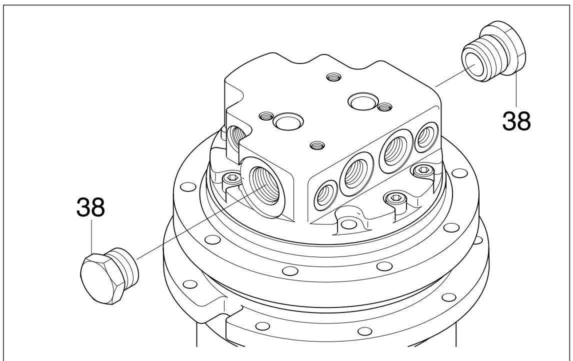
· Tools required :
Torque wrench (No. 1)
Hexagonal bit for torque wrench (No. 7)



R35Z77TM01

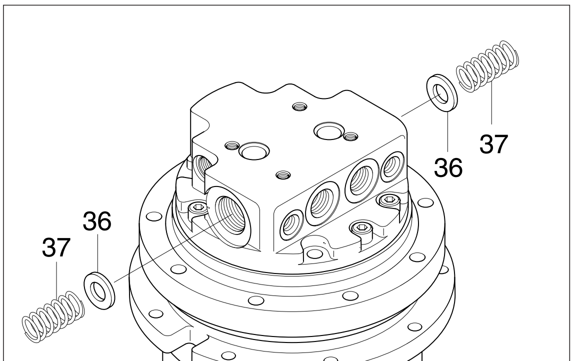
(2) Remove cap (38).

· Tools required :
Torque wrench (No. 3)
Socket for torque wrench (No. 12)



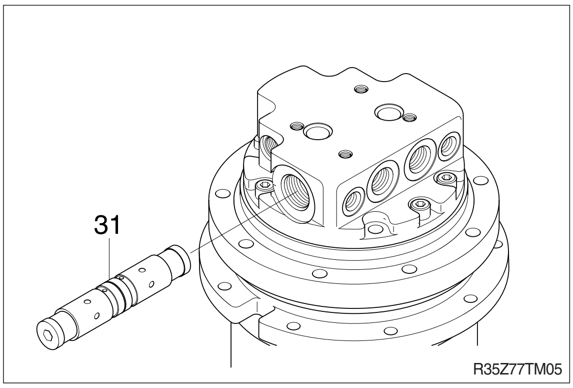
R35Z77TM03

(3) Take out spring (37), spring seat (36).



R35Z77TM04

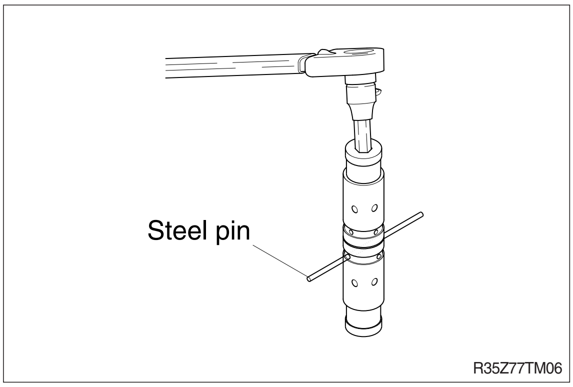
(4) Remove plunger sub assy (31) turning slowly.
Be careful not to damage around the perimeter part of the plunger.



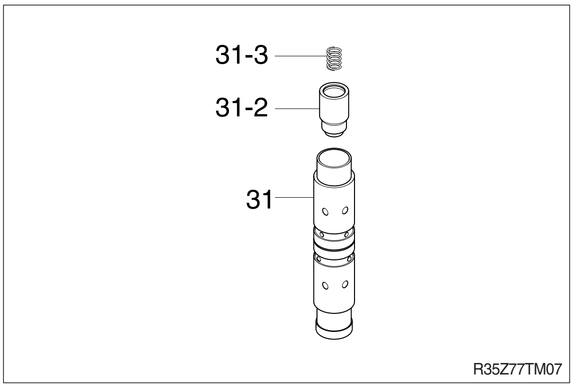
R35Z77TM05

(5) Disassembly of plunger sub assy is not required when it operates normally.
Insert pin S-1, dia. 5.5×30, in the through hole of the plunger sub assy, and fix it with vase.

· Tools required :
Torque wrench (No. 2)
Hexagonal bit for torque wrench (No. 7)
Pin (S-1)

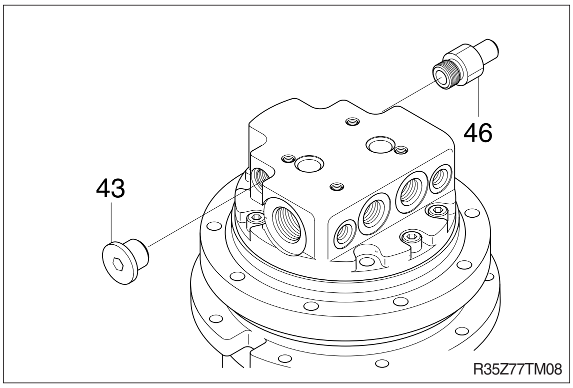


(6) Remove spring (31-3), check valve (31-2).
Note the position of the right and left check valves to the plunger. When assembling, keep the parts in the same position as when disabled.

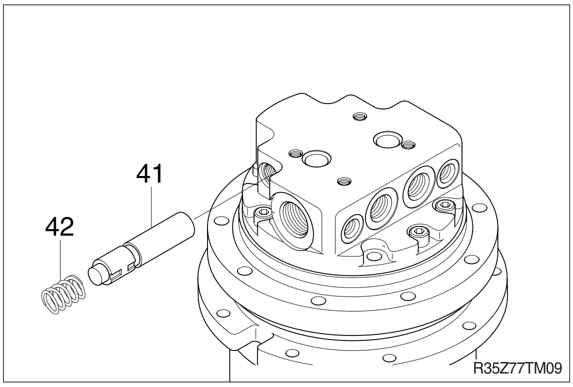


(7) Remove plugs (43), (46).

· Tools required :
Torque wrench (No. 2)
Hexagonal bit for torque wrench (No. 8)
Socket for torque wrench (No. 10)



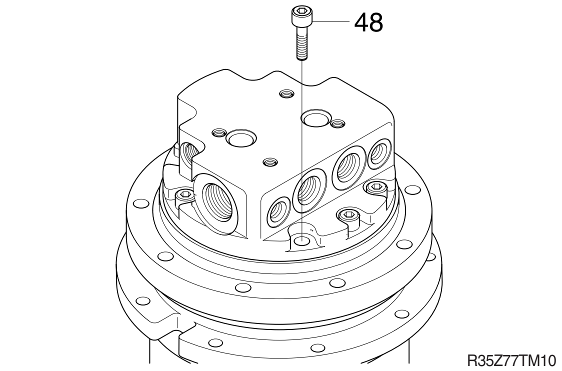
(8) Removing spring (42), spool assy (41) and spring seat (72).
Be careful not to damage around the spool.



(9) Remove socket head bolt (48).

· Tools required :
Torque wrench (No. 3)
Hexagonal bit for torque wrench (No. 8, 9)

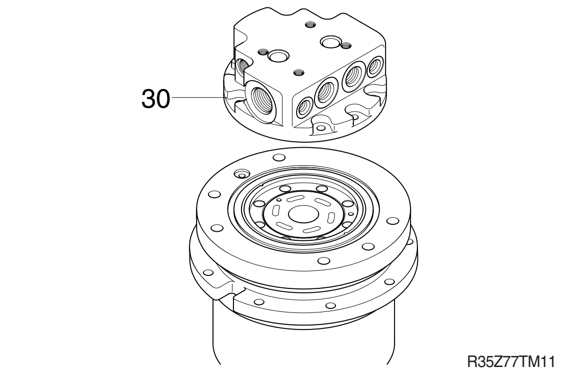
※ Points (with parking brake type)
Since base plate (30) lifts up by the reactive force of springs (62), (63), evenly loosening the socket head bolt (48) makes motor disassembly easier.



R35Z77TM10

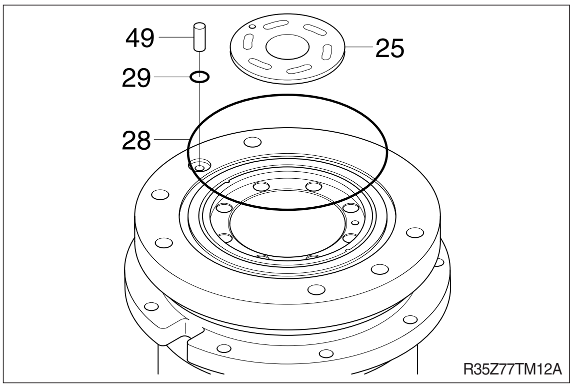
(10) Remove base plate (30).
Then, pay attention so that cylinder block (7) does not come out. When it is difficult to remove, strike it by use of plastic hammer. If it is more difficult to remove, remove it by lightly prying with screwdriver.

· Tools required :
Plastic hammer (No. 15)
Screwdriver (No. 13)



R35Z77TM11

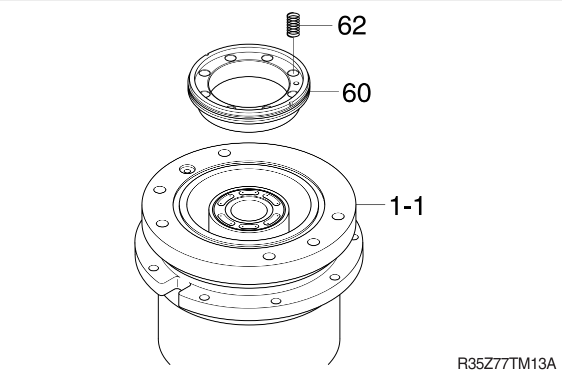
(11) With parking brake type.
Remove pin (49), valve plate (25), O-rings (28, 29).



R35Z77TM12A

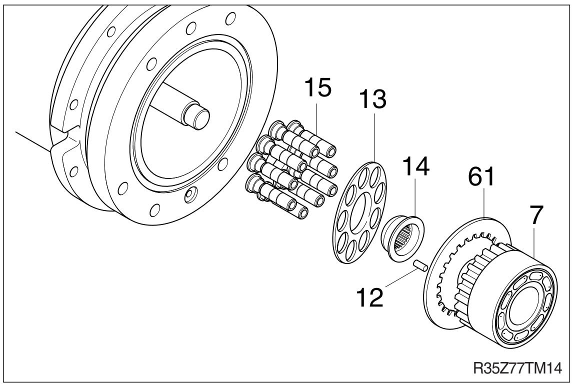
(12) This process is the only parking brake type.
Remove springs (62) and brake piston (60). Blow compressed air into parking brake releasing port on flange holder(1-1).

※ Before work, put a rag on all surface of the brake piston because the brake piston pops out and oil may be sprayed simultaneously during work.



R35Z77TM13A

(13) Remove cylinder block sub assy (7), pin (12), retainer holder (13), retainer plate (14), piston sub assy (15). Be careful not to damage the sliding surface of the cylinder block.
Only parking brake type, remove disk plate (61)

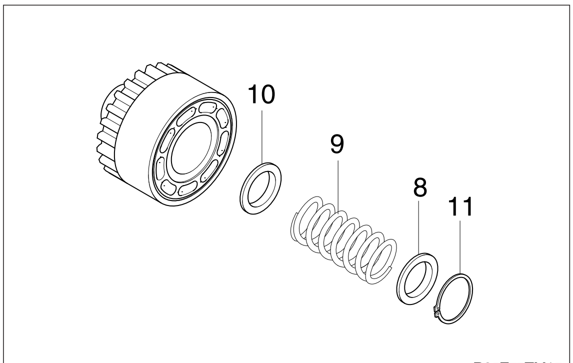


R35Z77TM14

(14) Remove snap ring (11) by use of plier.
Remove washer (8), spring seat (10) and spring (9). Be careful not to damage the sliding surface of the cylinder block.

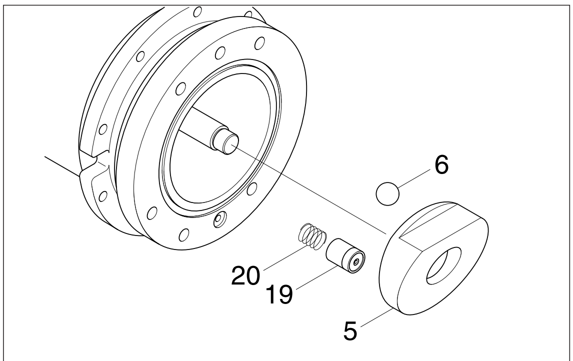
· Tools required :
Snap ring pliers (No. 17)

※ Since the inside spring is under pressure, when removing the snap ring, be cautions about ejecting parts and protect fingers.



R35Z77TM15

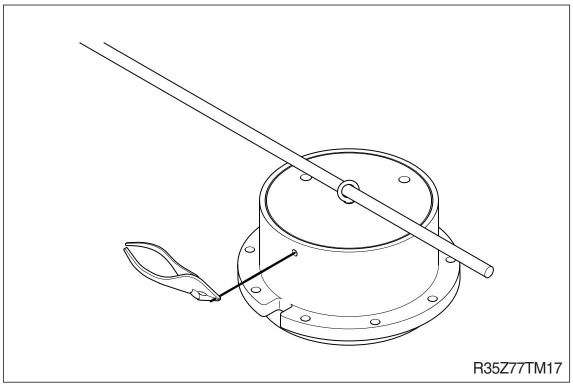
(15) Remove swash plate (5), steel ball (6), piston sub assy (19) and spring (20).



R35Z77TM16

(16) Remove plugs (1-27), (1-8). Attach eyebolt (PF 1/4) to the threaded hole of plug (1-27) and insert pry-bar (length 1 [m]) in the eye hole, and turn the bar until wire (1-26) can be seen through the threaded hole of plug (1-8). Draw the wire outside when the wire end can be seen.

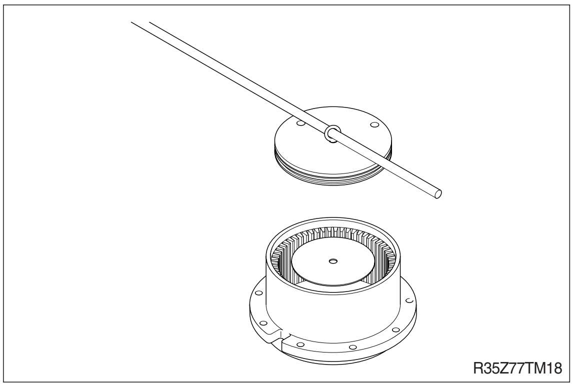
· Tools required :
  Torque wrench (No. 1, No. 2)
  Eyebolt PF 1/4 (S-2)
  Hexagonal bit for torque wrench (No. 6, No. 7, No. 8)
  Round bar dia. 20×1000 mm (S-3)
  Screw driver (No. 13), cutting pliers (No. 16)



R35Z77TM17

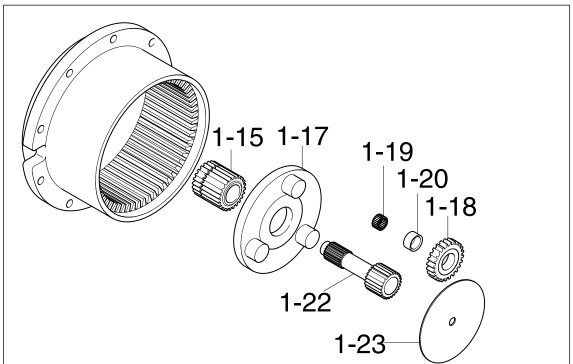
(17) Hook eyebolt and remove cover (1-24)

· Tools required :
  Eyebolt PF 1/4 (S-2)
  Round bar dia. 20×1000 mm (S-3)



R35Z77TM18

(18) Remove sun gear assy (1-15), holder (1-17), planetary gear A (1-18), needle bearing (1-19), inner race (1-20), drive gear (1-22) and thrust plate (1-23).

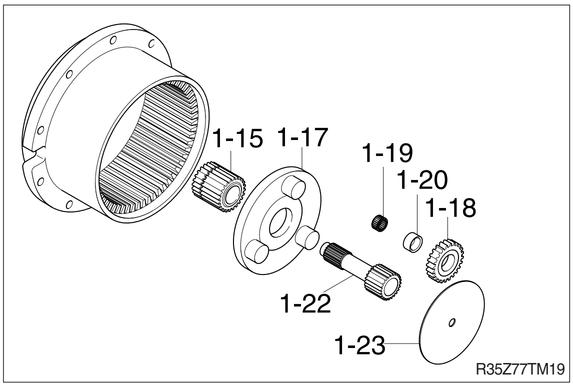


R35Z77TM19

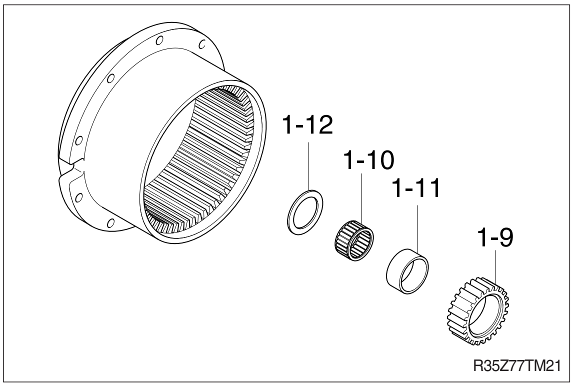
(19) Remove thrust plate (1-13) and screw (1-14).

· Tools required :
Torque wrench (No. 1)
Hexagonal bit for torque wrench (No. 5, No. 6)

※ Heating screws willl make removal easier because screw (1-14) is coated with locite when installed.

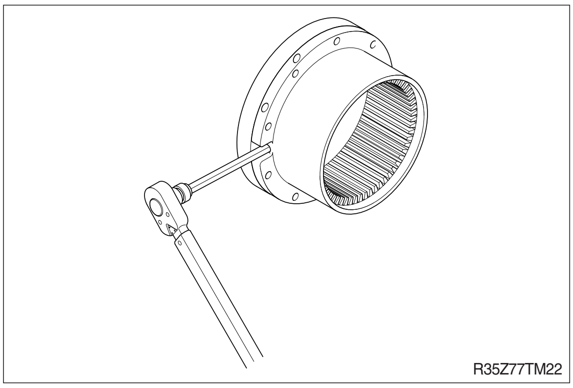


(20) Remove planetary gear B (1-9), needle bearing (1-10), inner race (1-11) and thrust washer (1-12).
Be careful not to damage the tooth surface of gear and the rolling section of the collar.



(21) Remove plug (1-8).

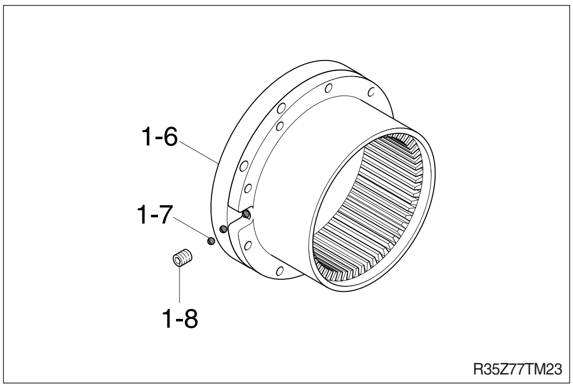
· Tools required :
Torque wrench (No. 1)
Hexagonal bit for torque wrench (No. 6)



(22) Take out steel balls (1-7) from the threaded hole of plug (1-8). After decreasing (thinner, cleaner. etc), remove by blowing air. Check that all steel balls (1-7) are removed by using wire.

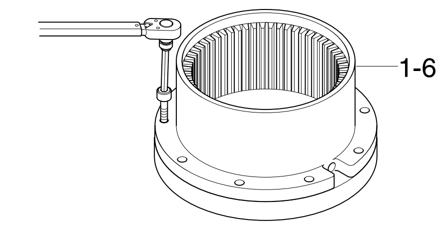
· Tools required :
Hammer (No. 14), wire (S-4)

※ When difficult to remove, steel balls (1-7) may be removed by striking the perimeter of housing (1-6) with a hammer.



(23) Attach jig between flange holder (1-1) and housing (1-6), and tighten 3 bolts M14×2.0 uniform from the housing side.

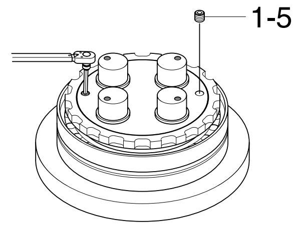
· Tools required :
  Torque wrench (No. 3)
  Hexagonal bit for torque wrench (No. 9, No. 10)
  Housing disassembly jig (S-5)



R35Z77TM24

(24) Remove plug (1-5).

· Tools required :
  Torque wrench (No. 1)
  Hexagonal bit for torque wrench (No. 7)

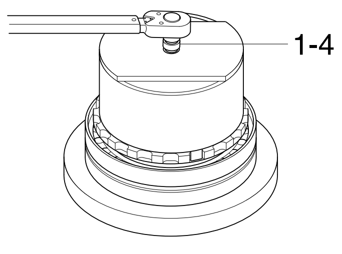


R35Z77TM25

(25) Removing ring nut (1-4).

· Tools required :
  Torque wrench (No. 3)
  Ring nut tightener (S-6)

※ If using a vise, fix the permeter of the flange holder.

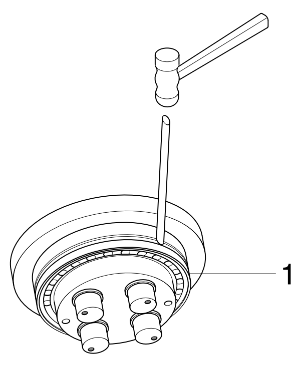


R35Z77TM26

(26) Fix round bar to the groove for steel balls (1-7), and remove angular bearing (1-3) while striking by hammer lightly.

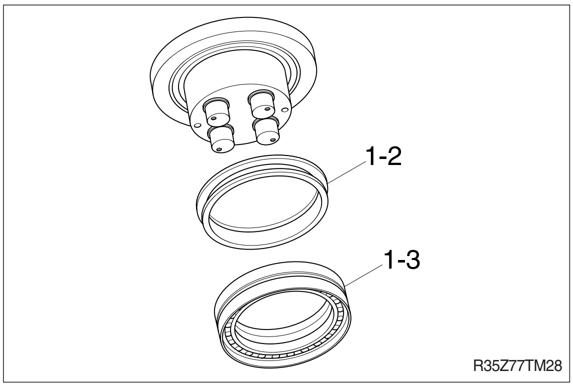
· Tools required :
  Hammer (No. 14)
  Round bar dia. 10×150 mm (S-7)

※ **Rotate the striking position around the angular bearing (1-13) gradually the angular-bearing may not be removed if striking one place only.**



R35Z77TM27

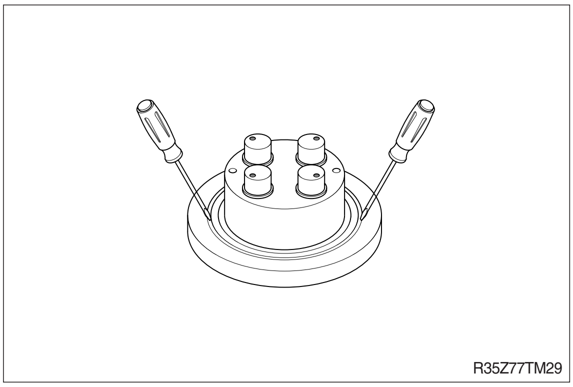
(27) Remove floating seal (1-2) and angular bearing (1-3).



(28) Remove other floating seal (1-2) using two drivers.

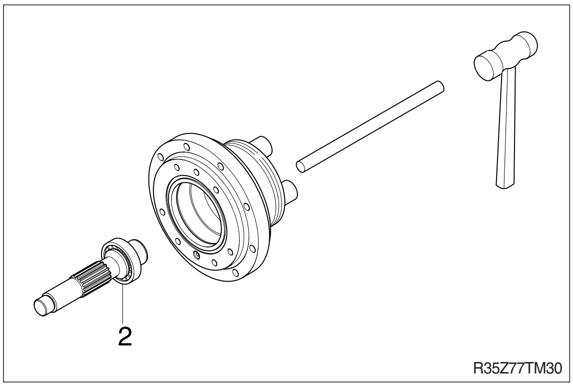
· Tools required :
Screw driver (No. 13)

※ Be careful not to damage the sliding surface of floating seal (1-2).



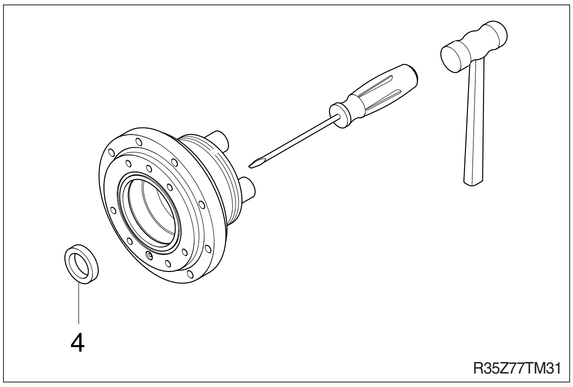
(29) Fit around bar into the shaft hole and remove shaft (2) while striking by hammer lightly.

· Tools required :
Screw driver (No. 13)
Round bar dia. 10×150 mm (S-7)



(30) Remove oil seal (4).

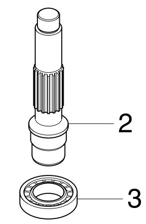
· Tools required :
Screw driver (No. 13)
Hammer (No. 14)



(31) Take out ball bearing (3) from shaft (2).

· Tools required :
Ball bearing disassembly jig (S-8)

(32) Completed.



3. REASSEMBLY

1) GENERAL PRECAUTIONS

(1) Reassemble in a work area that is clean and free from dust and grit.

(2) Handle parts with bare hands to keep them free or linty contaminants.

(3) Repair or replace the damage parts.
Each parts must be free of burrs its corners.

(4) Do not reuse O-rings, oil seal and floating seal that were removed in disassembly.
Provide the new parts.

(5) Wash all parts thoroughly in a suitable solvent.
Dry thoroughly with compressed air
Do not use the cloths.

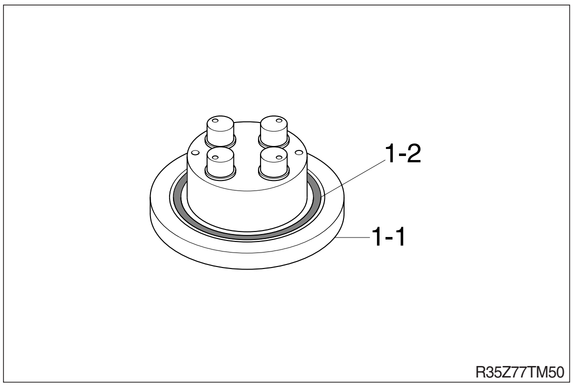
(6) When reassembling oil motor components of travel motor, be sure to coat the sliding parts of the motor and valve with fresh hydraulic oil.(NAS class 9 or above).

(7) Use a torque wrench to tighten bolts and plugs, to the torque specified as follows.

2) ASSEMBLE THE TRAVEL MOTOR BY THE FOLLOWING PROCEDURE

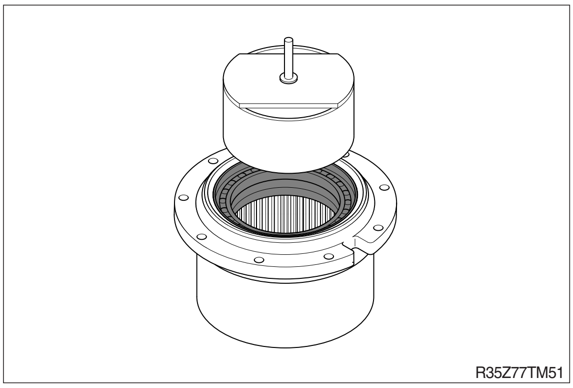
(1) Apply grease to floating seal (1-2) and install it on flange holder (1-1).

· Tools required :
Floating seal assembly jig (S-9)



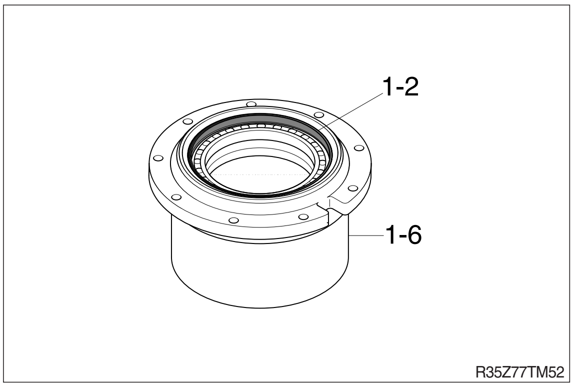
(2) Press fit angular bearings (1-3) to housing (1-6).

· Tools required :
Angular bearings press fitting jig (S-10)



(3) Apply grease to the second floating seal and place it on the concentric circle. Install it on housing (1-6).

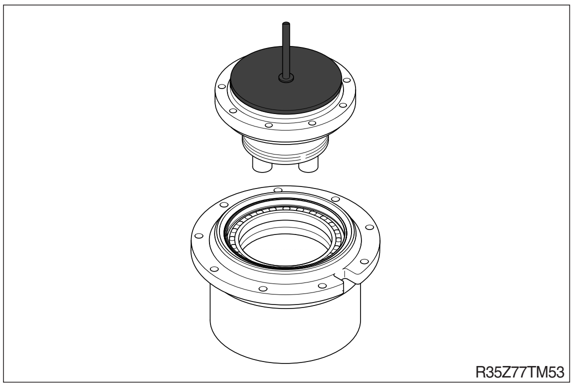
· Tools required :
Floating seal assembly jig (S-9)



(4) Apply lubricating oil on the sliding surface of floating seal after making the surface clean.
Install flange holder (1-1) in housing (1-6).

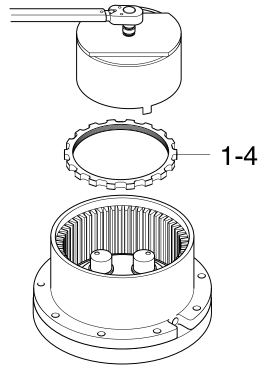
· Tools required :
Flange holder press fitting jig (S-11)

※ If there are foreign substance on the sliding surface of floating seal (1-2), it will cause oil leak.



(5) Tighten angular bearing (1-3) with ring nut (1-4)

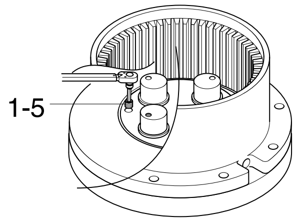
· Tools required :
Torque wrench (No. 3)
Ring nut tightener (S-6)
Tightening torque 23.9±1.0 kgf · m
(173±7.2 lbf · ft)



R35Z77TM54

(6) Tighten plug (1-5).
Seal tape is not allowed to wrap for assembling of the plug.

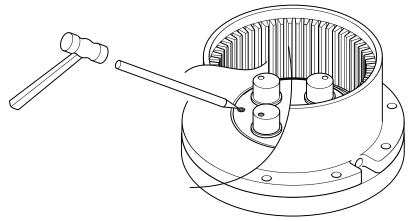
· Tools required :
Torque wrench (No. 1)
Hexagonal bit for torque wrench (No. 7), (No. 8)
Tightening torque 3.5±0.5 kgf · m
(25.2±3.6 lbf · ft)



R35Z77TM55

(7) After tightening plug (55), punch two positions of the plug to prevent loosening.

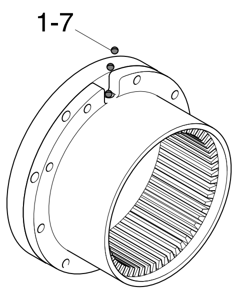
· Tools required :
Hammer (No. 14)
Punch (No. 18)



R35Z77TM56

(8) Insert steel balls (1-7) (99 pcs) in.

※ If it is difficult to insert steel balls (1-7) strike the housing (1-6) side with a plastic hammer.

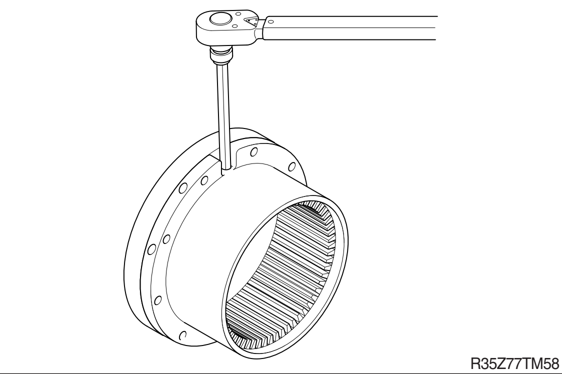


R35Z77TM57

(9) Install plug (1-8) with seal tape, and tighten it.

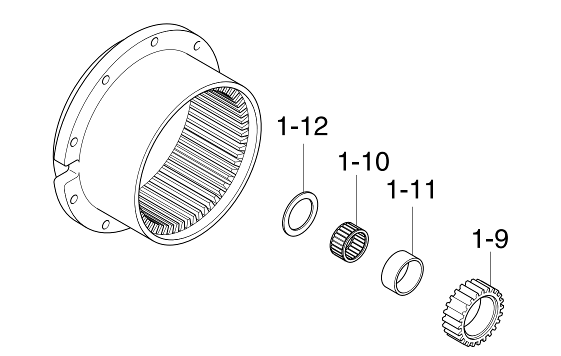
· Tools required :
Torque wrench (No. 1)
Hexagonal bit for torque wrench (No. 6)
Tightening torque 0.8±0.1 kgf · m
(5.8±0.7 lbf · ft)

※ Tighten the plug (1-8) until the head is below the surface of sprocket guide.



R35Z77TM58

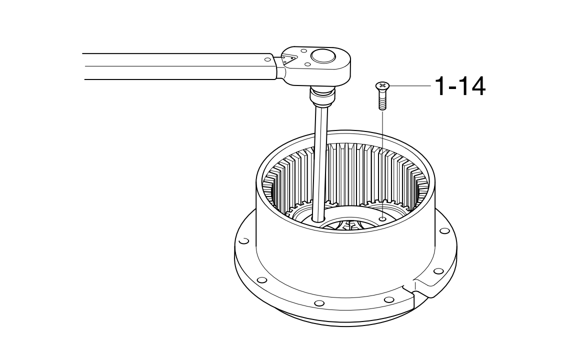
(10) Install planetary gear B (1-9), needle bearing (1-10), inner race (1-11) and thrust washer (1-12).



R35Z77TM59

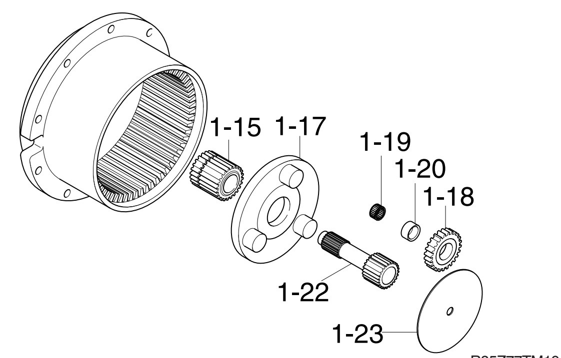
(11) Put thrust plate (1-13) on the trunnion section of flange holder, apply loctite #262 to screw (1-14) and tighten it.
Before applying the loctite, decrease the parts completely and use hardening catalyst.

· Tools required :
Torque wrench (No. 1)
Hexagonal bit for torque wrench (No. 5), (No. 6)
Tightening torque 1.3±0.06 kgf · m
(9.4±0.4 lbf · ft)



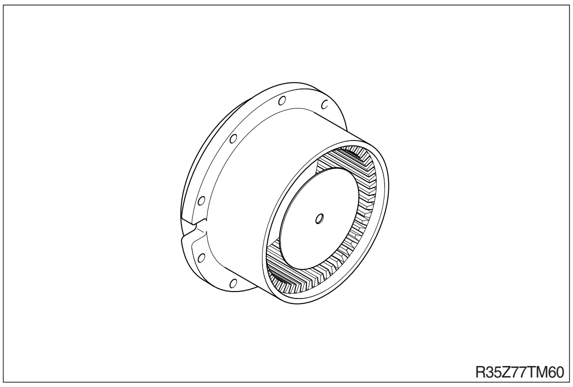
R35Z77TM20

(12) Install sun gear assy (1-15) with snap ring (1-16), holder (1-17) with inner race (1-20), planetary gear A (1-18), needle bearing (1-19) and drive gear (1-22).



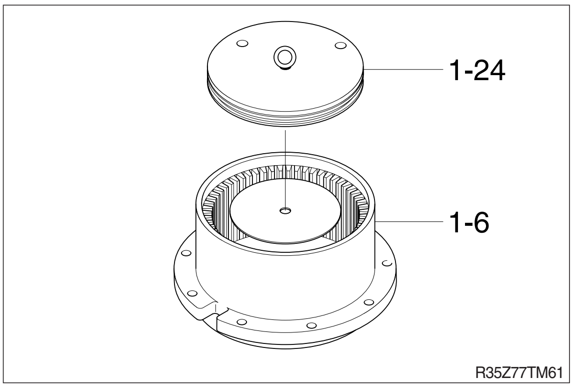
R35Z77TM19

(13) Install thrust plate (1-23).


R35Z77TM60

(14) Apply grease to O-ring (1-25), fit the O-ring on cover (1-24), and install housing (1-6) so that the cover may be fitted in line with the U-groove (for wire) and the screw hole position of the housing plug.

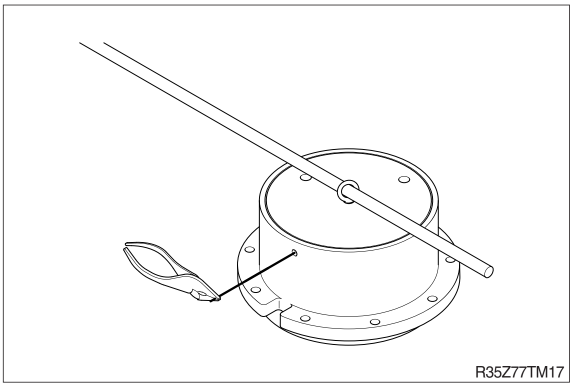
· Tools required :
Plastic hammer (No. 14)
Eye bolt (S-2)



R35Z77TM61

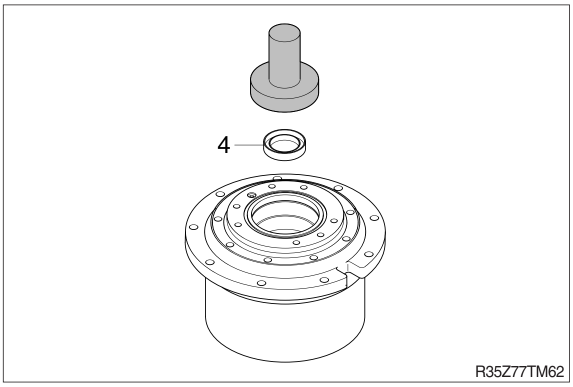
(15) Bend 6 [mm] of the top end of wire (1-26) at right angle, insert it into the threaded hole of the housing, and wind the piano wire turning the cover. Wrap socket plug (1-8) with seal tape before tightening.

· Tools required :
Eye bolt (S-2)
Round bar dia. 20×1000 [mm] (S-3)
Torque wrench (No. 1)
Hexagonal bit for torque wrench (No. 7)
Tightening torque 0.8±0.1 kgf · m
(5.8±0.7 lbf · ft)


R35Z77TM17

(16) Grease oil seal (4) and perform press-fitting into flange holder.

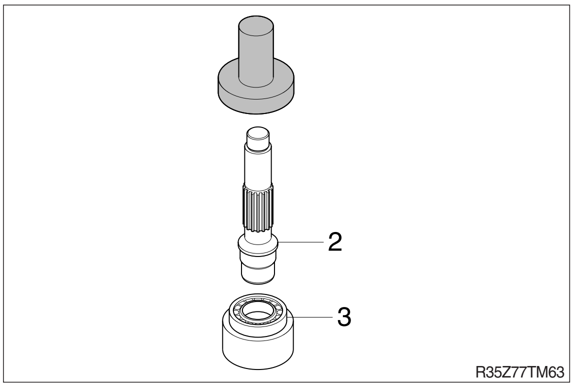
· Tools required :
Oil seal press fitting jig (S-12)



R35Z77TM62

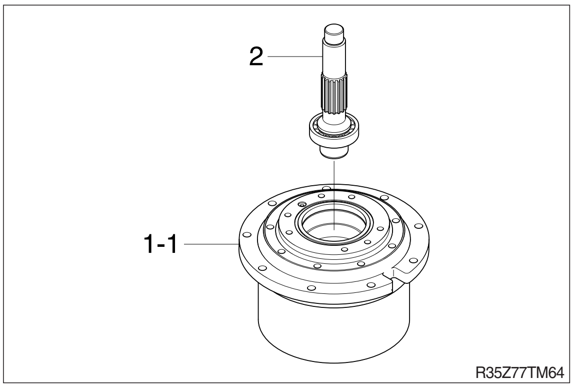
(17) Perform press-fitting of ball bearing (3) into shaft (2).

· Tools required :
Ball bearing press fitting jig (S-13)



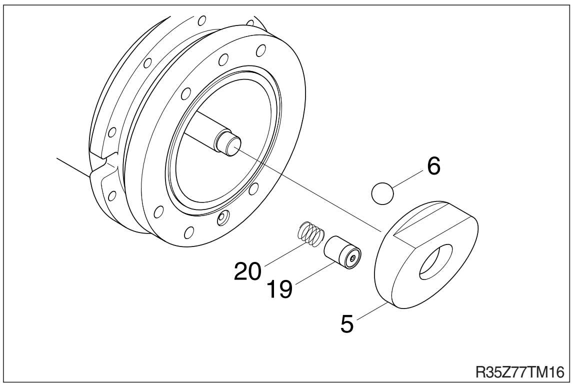
(18) Perform press-fitting of shaft sub assy (2) into flange holder (1-1).

· Tools required :
Shaft sub assembly press fitting jig (S-14)



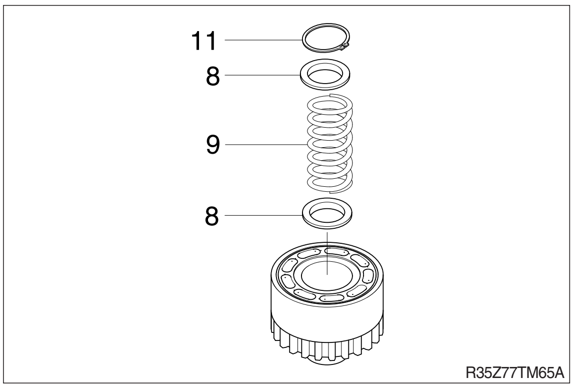
(19) Install steel ball (6), spring (20), piston assy (19) and swash plate (5) in flange holder (1-1).
Apply hydraulic oil to the sliding surface of the swash plate.

※ If there are foreign substances on the sliding surface of swash plate (5), it will cause damage.

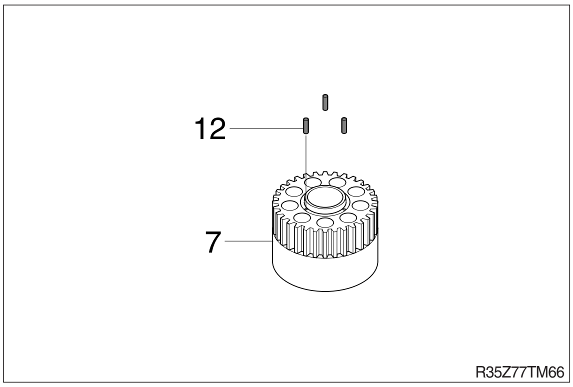


(20) Install washer (8), spring (9), spring seat (8) and snap ring (11) on cylinder block (7).

· Tools required :
Snap ring pliers (No. 17)
Snap ring assembly jig (S-15)

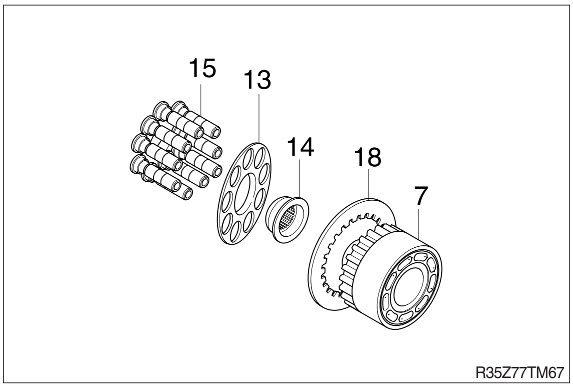


(21) Grease pins (12) and install in holes of cylinder block (7).



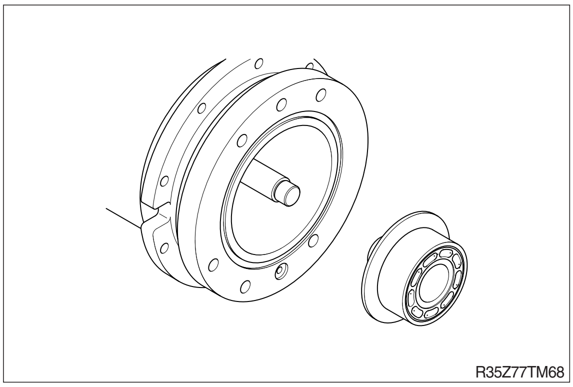
(22) Install retainer holder (13), retainer plate (14) and piston sub assy (15). Apply hydraulic oil in 99 holes of cylinder block (7).

Only parking brake type
Install disk plate (61).



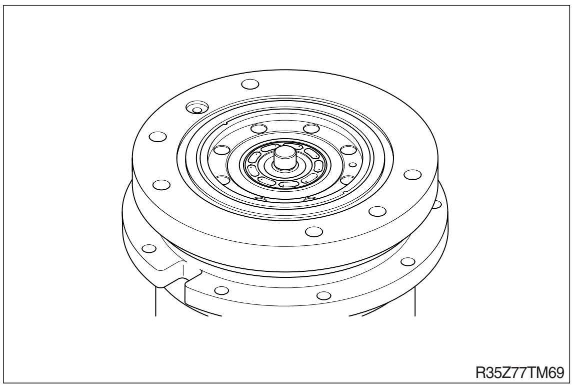
(23) Place the motor laterally, and install the cylinder block sub assy using spline of the shaft as a guide.

※ It is easier to install if spline teeth of the cylinder block (7) and retainer holden (13) are aligned before installing.

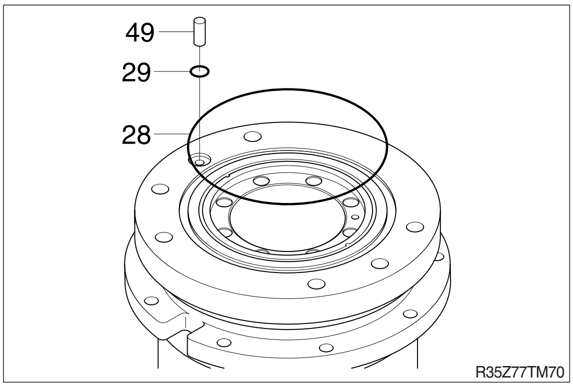


(24) Push the cylinder block by hand, and check that the spring contracts. Apply hydraulic oil to the sliding surface of the cylinder block.

※ Confirm no foreign articles on surface of cylinder block, marked a circle. If there are foreign articles on it, wipe off them.



(25) Grease O-rings (28), (29) slightly and install pin (49) and the O-rings in the groove of flange holder (1-1).



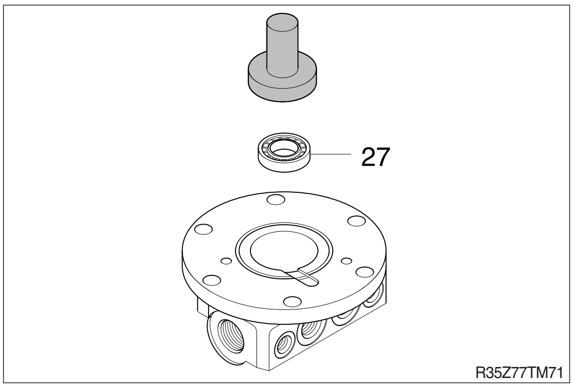
(26) Perform press-fitting of ball bearing (27) onto base plate (30).

· Tools required :
Ball bearing press fitting jig (S-16)

Install pin (26) and punch one place.

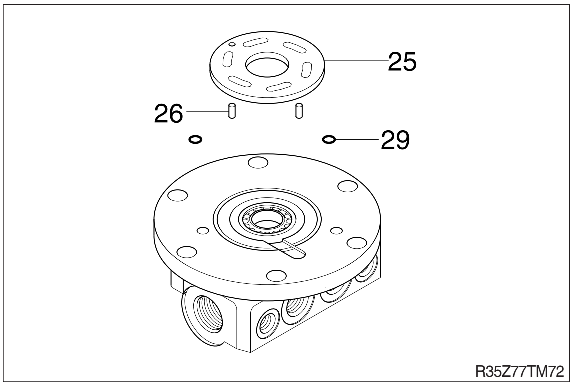
· Tools required :
Hammer (No. 14)
Punch (No. 18)

※ Pay attention to the punch position and direction.



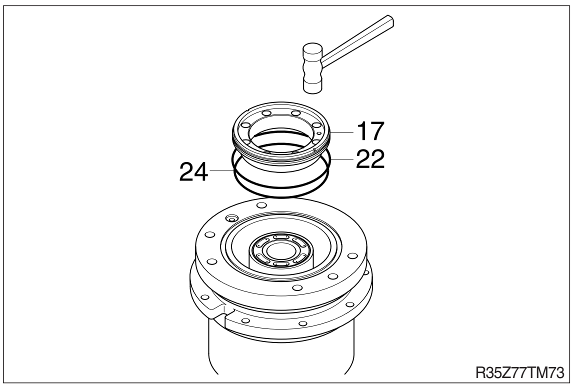
(27) Apply grease on the back side of valve plate (25), and install it and pin (26), O-ring (29) on base plate.

※ Excessive grease will prevent proper performance.



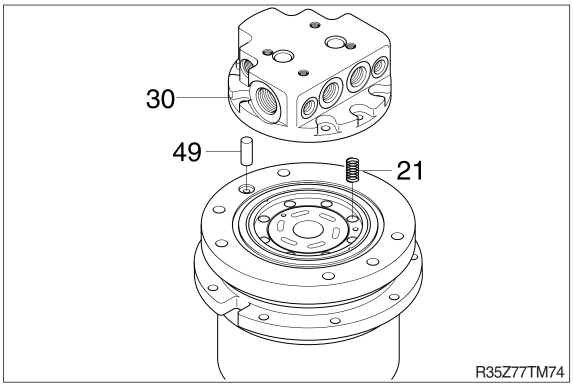
(28) This process is only parking brake type.
Apply grease to O-rings (65), (66) and install them to brake piston (60).
Align the pin (49) holes for the brake piston installed and flange holder (1-1).
Tap the brake piston perimeter equally by using plastic hammer.

· Tools required :
Plastic hammer (No. 15)



(29) With parking brake type.
Install springs (62), base plate (30), Pin (49).

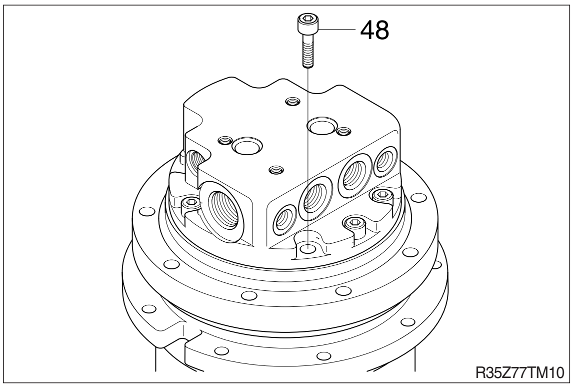
※ Apply grease to springs to prevent dropping when base plate is turned over for installation.
※ Install gently so the springs (62), (63) don't fall.



R35Z77TM74

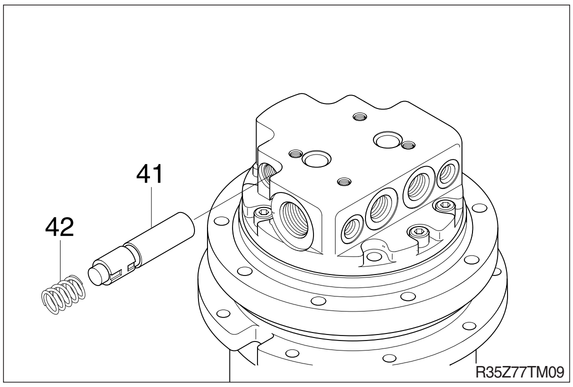
(30) Tighten socket head bolt (48).

· Tools required :
Torque wrench (No. 2)
Hexagonal bit for torque wrench (No. 8), (No. 9)
Tightening torque : 13.1±0.7 kgf · m
(94.8±5.1 lbf · ft)



R35Z77TM10

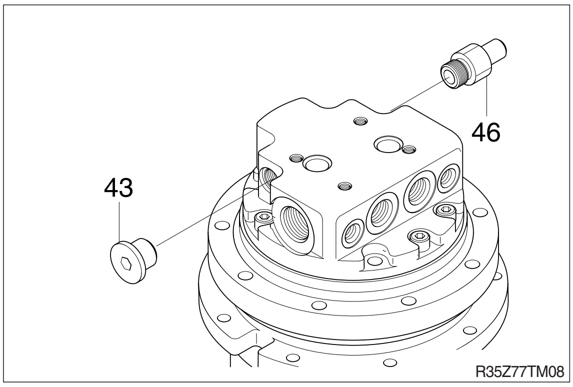
(31) Place spool (41) and spring (42) in.
Place the spool in while turning to prevent them from sticking.
Apply hydraulic oil to the spool before installation.



R35Z77TM09

(32) Tighten plugs (43), (46) with O-ring (44).

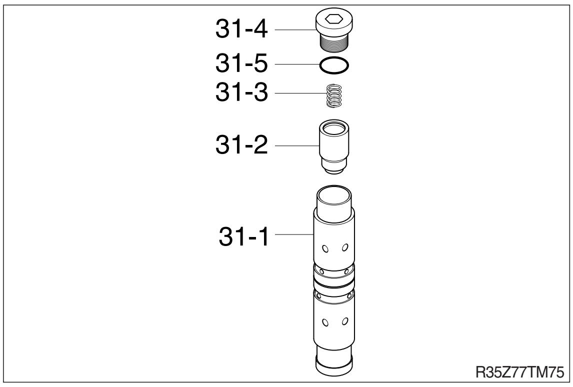
· Tools required :
Torque wrench (No. 2)
Hexagonal bit for torque wrench (No. 9)
Socket for torque wrench (No. 11)
Tightening torque : 5.5±0.5 kgf · m
(39.8±3.6 lbf · ft)



R35Z77TM08

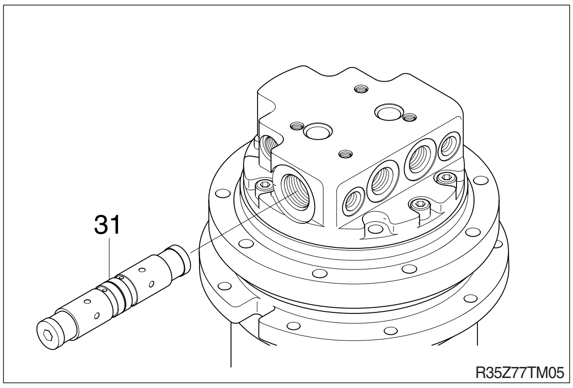
(33) Install check valve (31-2), spring (31-3) and plug (31-4) with O-ring (31-5) to plunger (31-1).
Apply a slight grease to the O-ring.

· Tools required :
Torque wrench (No. 2)
Hexagonal bit for torque wrench (No. 7)
Tightening torque : 3.3±0.2 kgf · m
(23.5±1.8 lbf · ft)



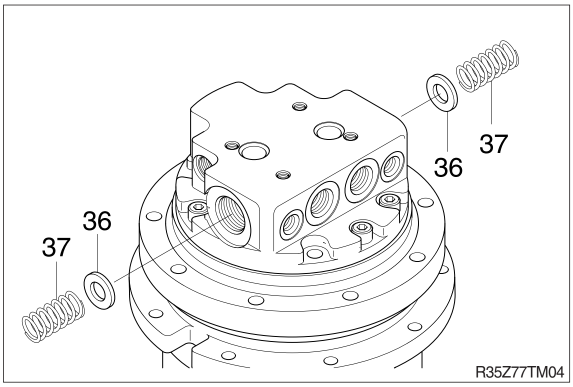
R35Z77TM75

(34) Install plunger assy (31) on base plate (30).
Install it while turning to prevent it from sticking.
Apply hydraulic oil to plunger assy (31) before installation.



R35Z77TM05

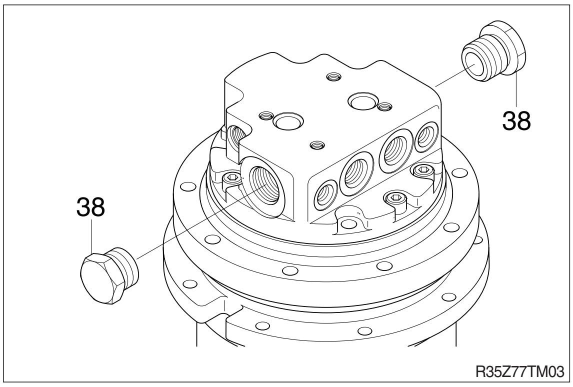
(35) Place spring (37) and spring seat (36) in.



R35Z77TM04

(36) Tighten cap (38) with O-ring (39).
Apply a slight grease to the O-ring.

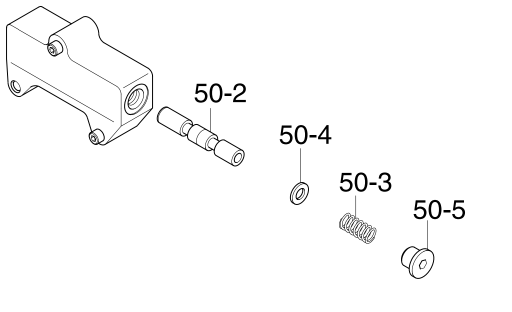
· Tools required :
Torque wrench (No. 3)
Hexagonal bit for torque wrench (No. 10)
Tightening torque : 24.5±0.5 kgf · m
(177±3.7 lbf · ft)



R35Z77TM03

(37) With parking brake type
Install spool (50-2), spring (50-3) and spring seat (50-4) in valve body (50-1), and tighten plug (50-5)

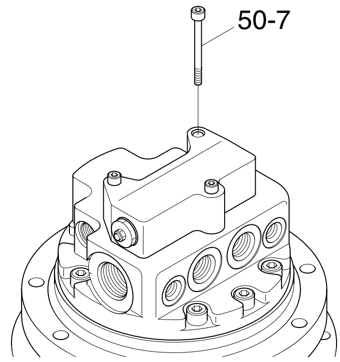
· Tools required :
Torque wrench (No. 2)
Hexagonal bit for torque wrench (No. 8)
Tightening torque : 5.5±0.5 kgf · m
(39.8±3.6 lbf · ft)



R35Z77TM02

(38) Fit O-rings (50-6) or (50-7) in valve body, and put valve assy (50) on base plate (30).
Tighten socket head bolt (50-7), (50-8).

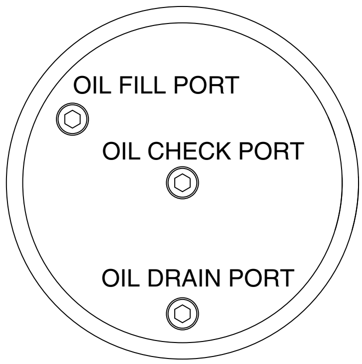
· Tools required :
Torque wrench (No. 1)
Hexagonal bit for torque wrench (No. 7)
Tightening torque : 3.8±0.2 kgf · m
(27.2±1.4 lbf · ft)



R35Z77TM01

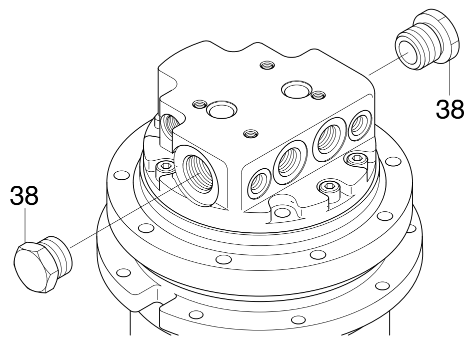
(39) Pour the gear oil through the threaded hole of plug (1-27).
Wind the plug with seal tape before tightening.

· Tools required :
Torque wrench (No. 2)
Hexagonal bit for torque wrench (No. 8)
(No. 9)
PF 1/4 ··· Tightening torque wrench
3.5±0.5 kgf · m
(25.3±3.6 lbf · ft)
PF 1/4 ··· Tightening torque wrench
4.0±0.2 kgf · m
(28.9±1.5 lbf · ft)



R35Z77TM76

(40) Completed.



R35Z77TM03

3) QUALITY CHECK AFTER REASSEMBLY

(1) Air leak test of reduction unit

Remove one plug (① or ② or ③) of the reduction unit apply compressed air (0.03 [MPa]) through tapped hole of plug in water for two minutes, and observe that are no bubbles.

(2) Air leak test of motor

Seal all piping ports on the motor except one port with plugs, and apply compressed air (0.03 [MPa]) through open port in water for two minutes. Observe that there are no bubbles.

(3) Upon completion of leak test in subparagraphs (1) and (2) above, fill the motor case with new hydraulic fluid. Run the motor crosswise for two minutes filling hydraulic fluid at flow rate of 20 liters per minute.

Confirm that there is no excessive heat, vibration or noise during running.

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

13031GE18

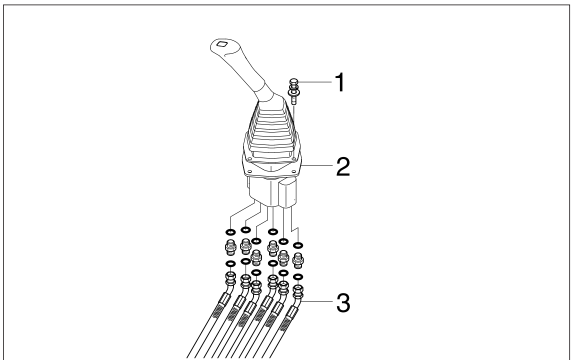
(4) Loosen the socket bolt(1).

(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.



R25Z9AK8DA06

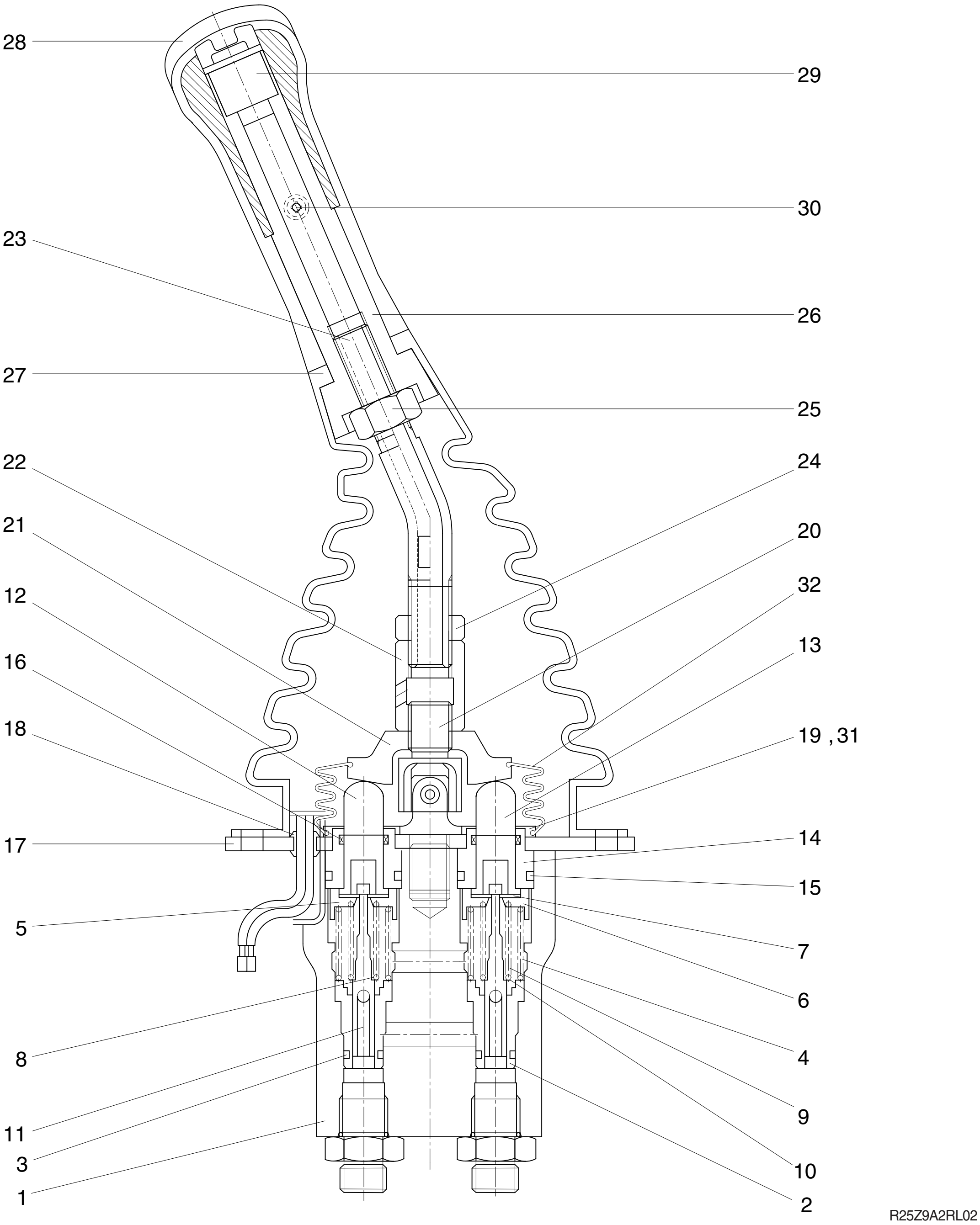
2) INSTALL

(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 (Type 1)

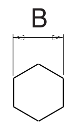
1) STRUCTURE



1	Case	12	Push rod (1, 3)	23	Connector
2	Plug	13	Push rod (2, 4)	24	Nut
3	O-ring	14	Plug	25	Nut
4	Spring	15	O-ring	26	Insert
5	Spring seat (1, 3)	16	Rod seal	27	Boot
6	Spring seat (2, 4)	17	Plate (A)	28	Handle
7	Stopper	18	Bushing	29	Switch assembly
8	Spring (1, 3)	19	Machine screw	30	Screw
9	Spring (2, 4)	20	Joint assembly	31	Plate
10	Spring seat	21	Swash plate	32	Boot
11	Spool	22	Hex nut		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

<table>
<tr><th>Tool name</th><th colspan="2">Remark</th></tr>
<tr><td>(L) Hexagonal wrench</td><td>10</td><td rowspan="3"></td></tr>
<tr><td rowspan="2">Spanner</td><td>22</td></tr>
<tr><td>27</td></tr>
<tr><td>(+) Driver</td><td colspan="2">Length 150</td></tr>
<tr><td>(-) Driver</td><td colspan="2">Width 4~5</td></tr>
<tr><td>Torque wrench</td><td colspan="2">Capable of tightening with the specified torques</td></tr>
</table>

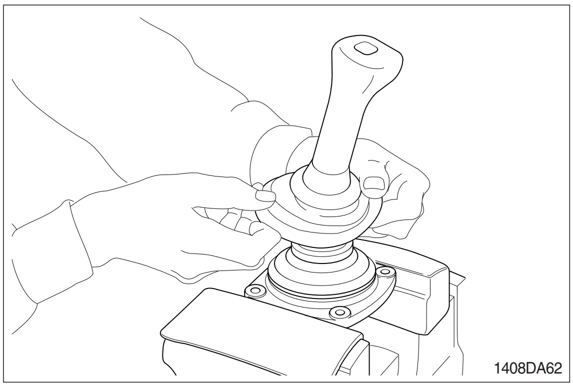
3) DISASSEMBLY

(1) Clean pilot valve with kerosene.

※ Put blind plugs into all ports.

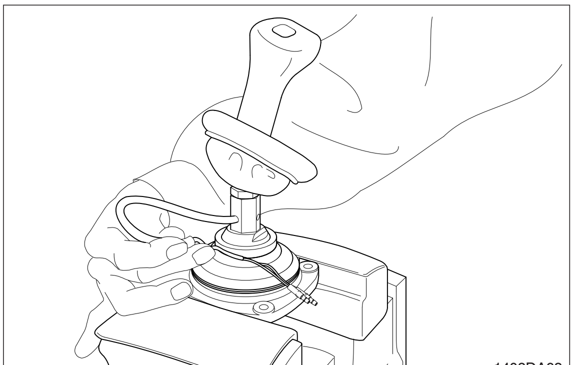
(2) Fix pilot valve in a vise with copper (or lead) sheets.

(3) Remove end of boot (32) from case (1) and take it out upwards.



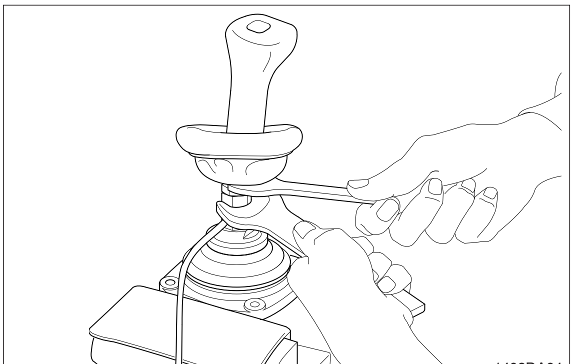
1408DA62

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



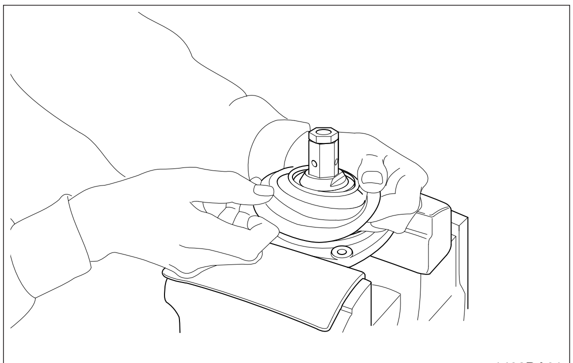
1408DA63

(4) Loosen lock nut (24) and adjusting nut (22) with spanners on them respectively, and take out handle section as one body.



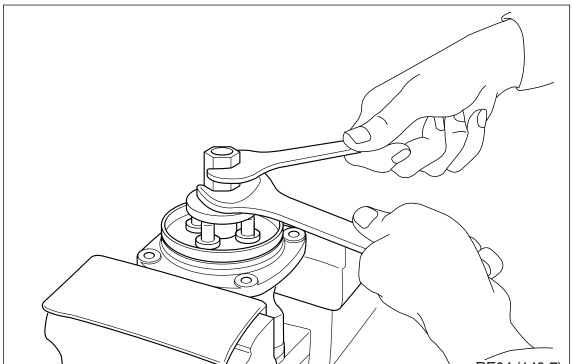
1408DA64

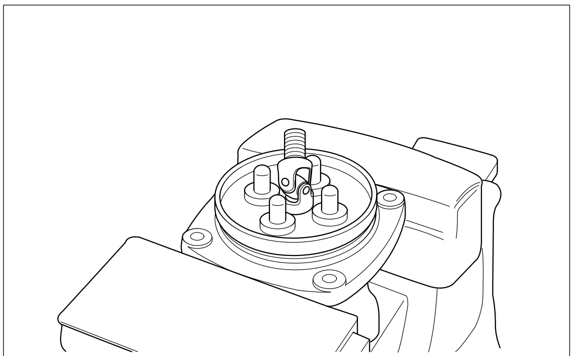
(5) Remove the boot (32).



1408DA61

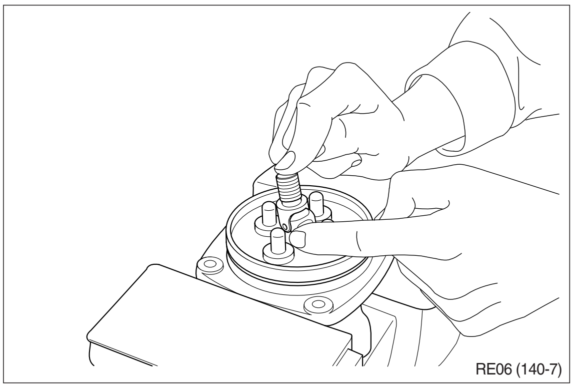
(6) Loosen adjusting nut(22) and plate(31) with spanners on them respectively, and remove them.

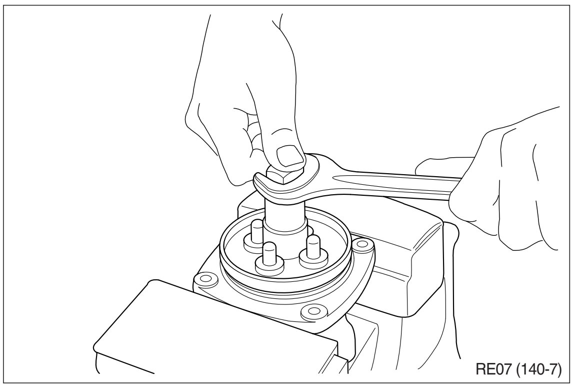

RE04 (140-7)


RE05 (140-7)

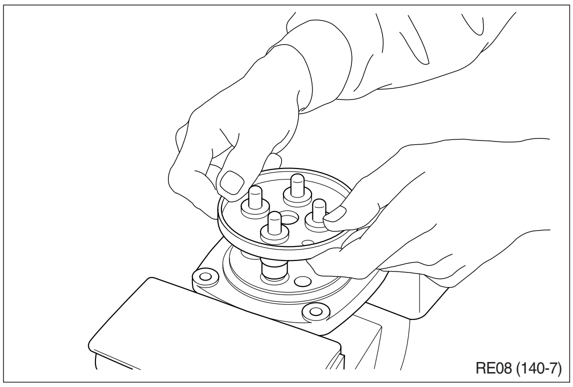
(7) Turn joint anticlockwise to loosen it, utilizing jig (special tool).

※ When return spring(8, 9) is strong in force, plate(31), plug(14) and push rod(12, 13) will come up on loosening joint.
Pay attention to this.


RE06 (140-7)


RE07 (140-7)

(8) Remove plate (31).

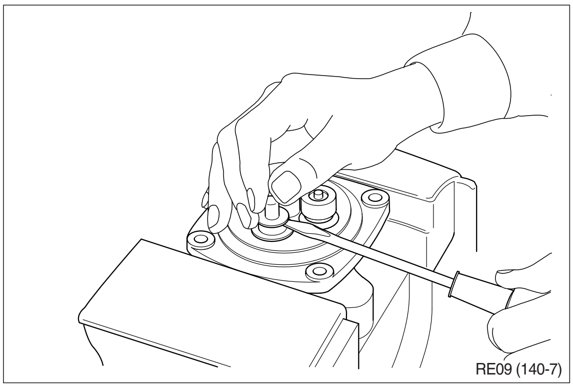


RE08 (140-7)

(9) When return spring (8, 9) is weak in force, plug (14) 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.

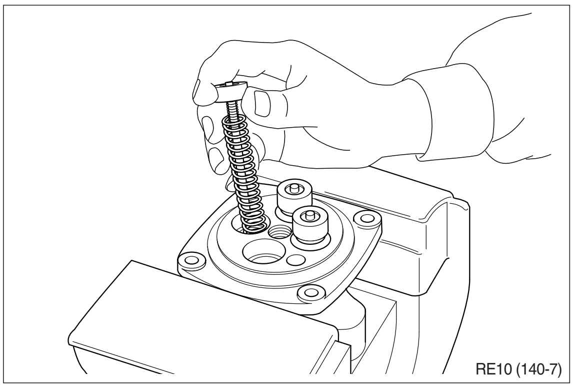
※ During taking out, plug may jump up due to return spring (8, 9) force.
Pay attention to this.



RE09 (140-7)

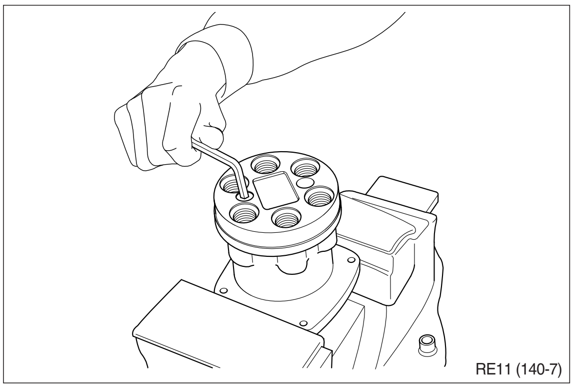
(10) Remove reducing valve subassembly and return spring (8, 9) out of casing.

※ 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.



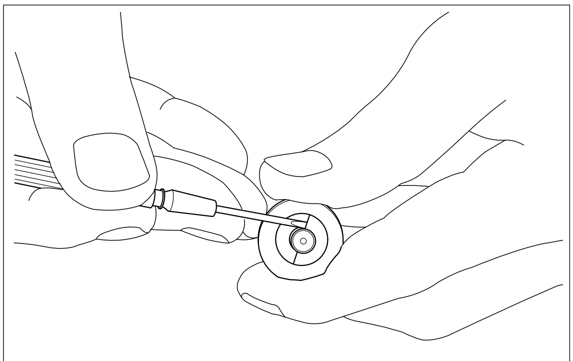
RE11 (140-7)

(12) For disassembling reducing valve section, stand it vertically with spool (11) bottom placed on flat workbench. Push down spring seat (5, 6) and remove two pieces of semicircular stopper (7) with tip of small minus screwdriver.

※ Pay attention not to damage spool surface.

※ Record original position of spring seat (5, 6).

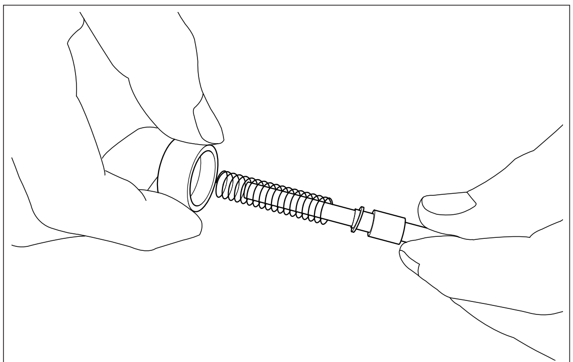
※ Do not push down spring seat more than 6 mm.



RE14 (140-7)

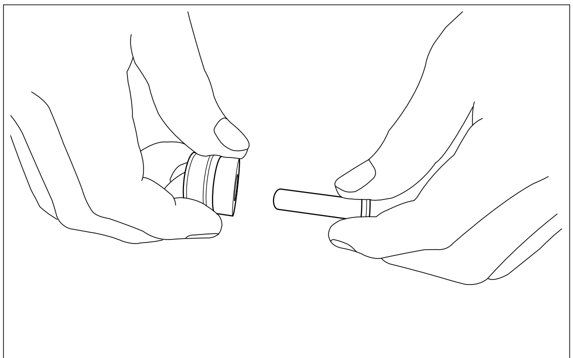
(13) Separate spool (11), spring seat (5, 6), spring (8, 9) and spring seat (10) individually.

※ Until being assembled, they should be handled as one subassembly group.



RE15 (140-7)

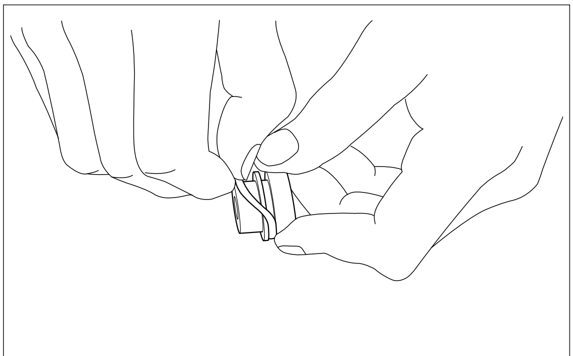
(14) Take push rod (12, 13) out of plug (14).



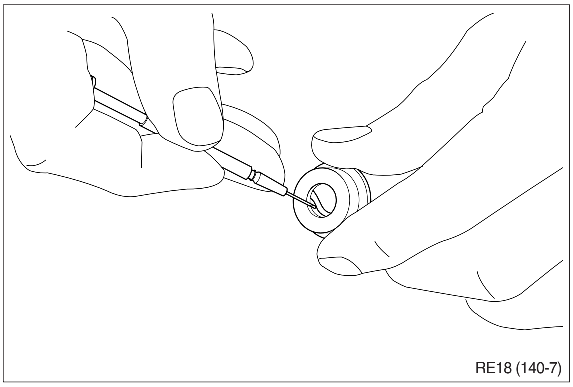
RE16 (140-7)

(15) Remove O-ring (15) and seal (16) from plug (14).

Use small minus screwdriver or so on to remove this seal.

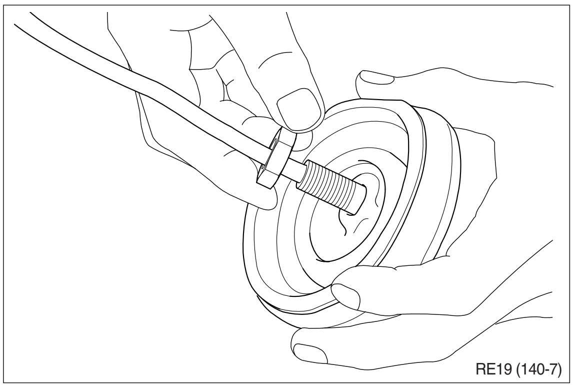


RE17 (140-7)

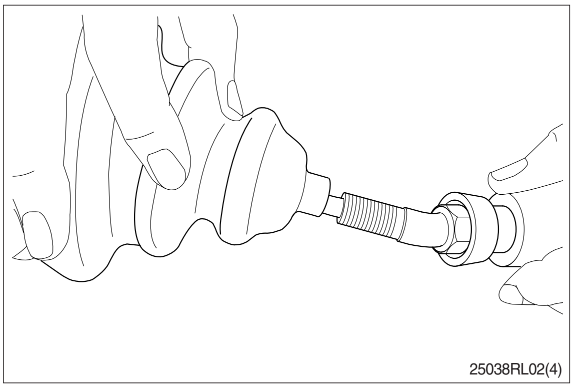


RE18 (140-7)

(16) Remove lock nut (24) and then boot (27).



RE19 (140-7)



25038RL02(4)

(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.

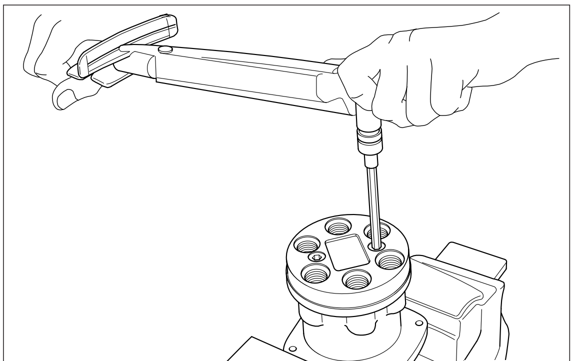
(18) Rust prevention of parts.
Apply rust-preventives to all parts.

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

4) ASSEMBLY

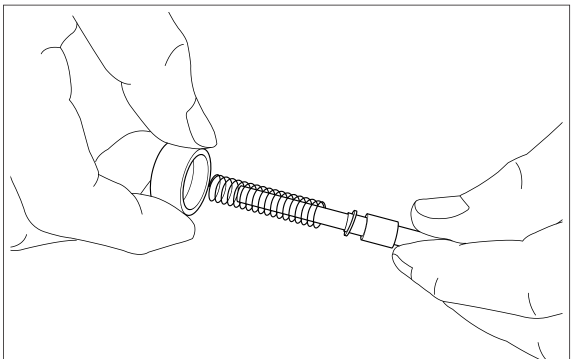
(1) Tighten hexagon socket head plug (2) to the specified torque.

※ Tighten two bolts alternately and slowly.



RE29 (140-7)

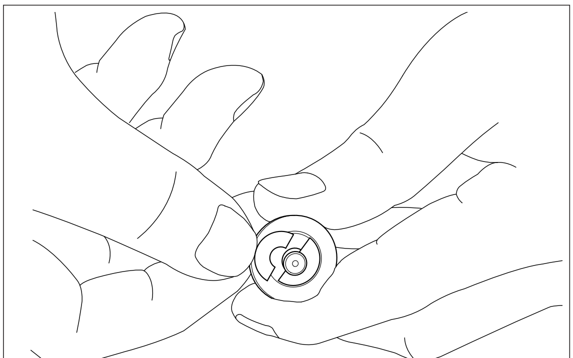
(2) Put spring seat (10), springs (8, 9) and spring seat (5, 6) onto spool (11) in this order.



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 (7) on spring seat without piling them on.

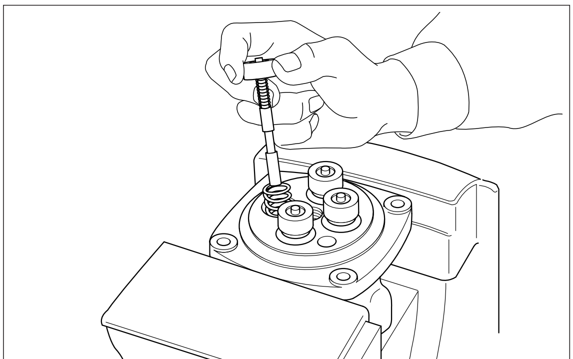
※ Assemble stopper (7) so that its sharp edge side will be caught by head of spool. Do not push down spring seat more than 6 mm.



RE31 (140-7)

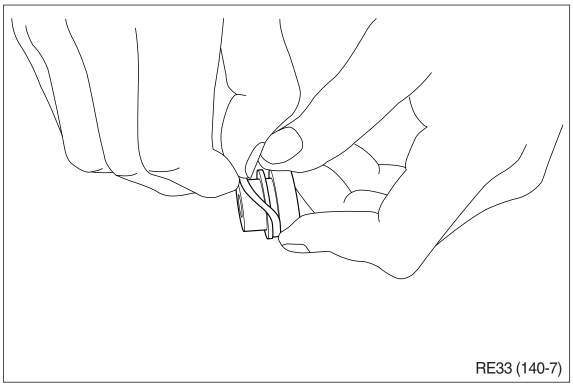
(4) Assemble spring (8, 9) into casing. Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.



RE32 (140-7)

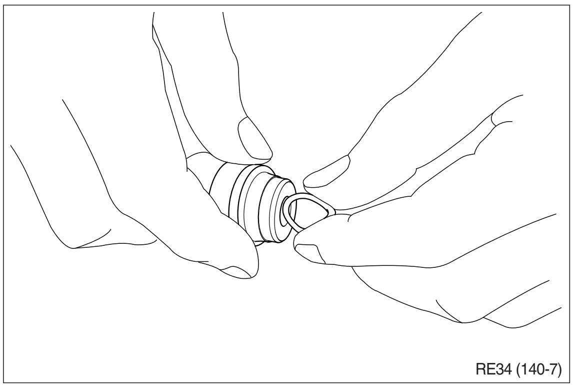
(5) Assemble O-ring (15) onto plug (14).



RE33 (140-7)

(6) Assemble seal (16) to plug (14).

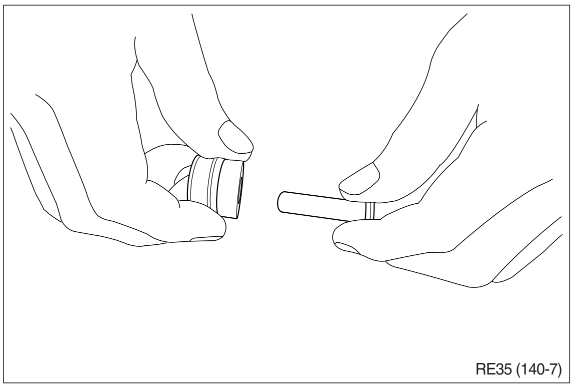
※ Assemble seal in such lip direction as shown below.



RE34 (140-7)

(7) Assemble push rod (12, 13) to plug (14).

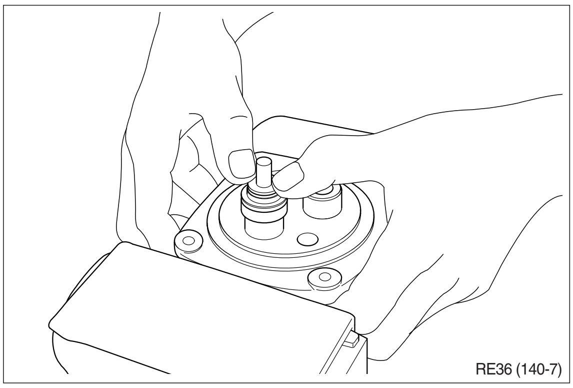
※ Apply working oil on push-rod surface.



RE35 (140-7)

(8) Assemble plug subassembly to casing.

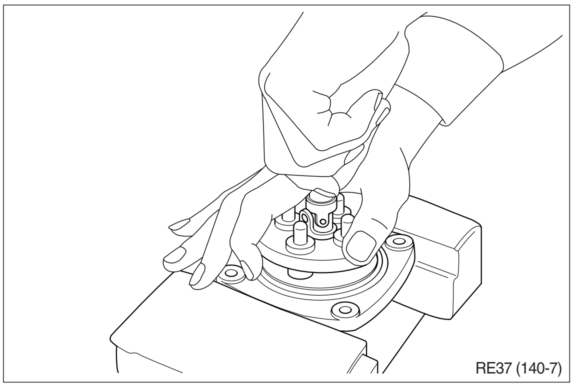
※ When return spring is weak in force, subassembly stops due to resistance of O-ring.



RE36 (140-7)

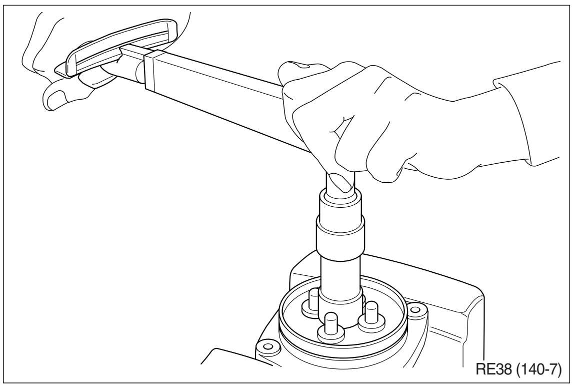
(9) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (31), and tighten joint (20) temporarily.

(10) Fit plate (31).



RE37 (140-7)

(11) Tighten joint (20) with the specified torque to casing, utilizing jig.

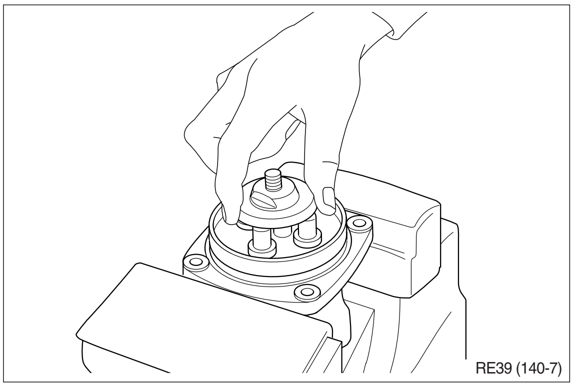


RE38 (140-7)

(12) Assemble plate (21) to joint (20).

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

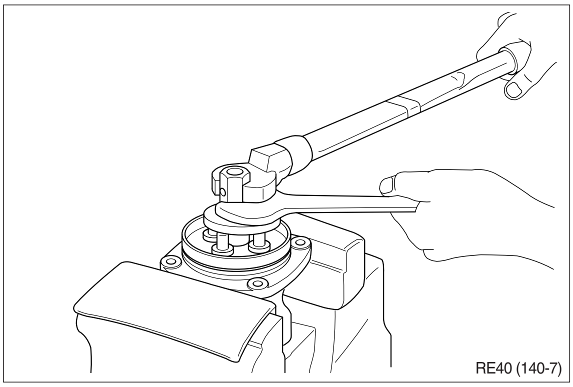
※ Do not screw it over.



RE39 (140-7)

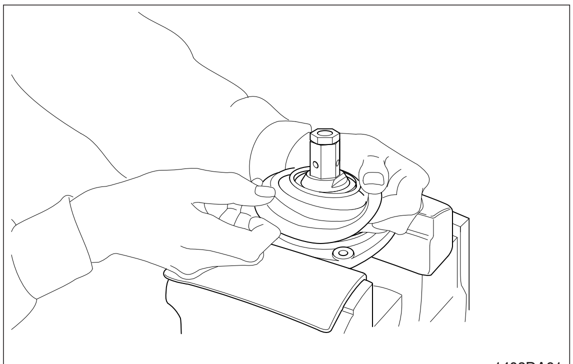
(13) Assemble adjusting nut (22), apply spanner to width across flat of plate (21) to fix it, and tighten adjusting nut to the specified torque.

※ During tightening, do not change position of disk.



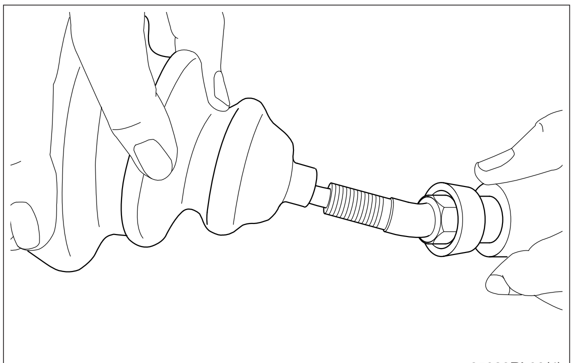
RE40 (140-7)

(14) Fit boot (32) to plate.

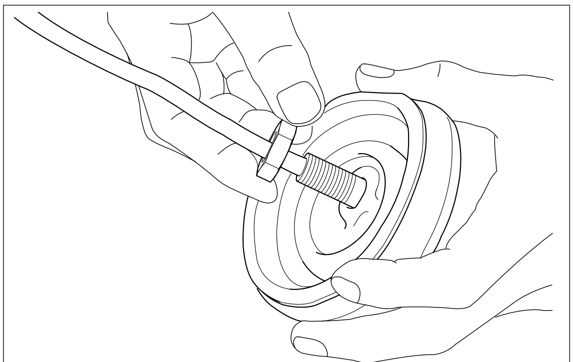


1408DA61

(15) Fit boot (27) and lock nut (24), and handle subassembly is assembled completely.

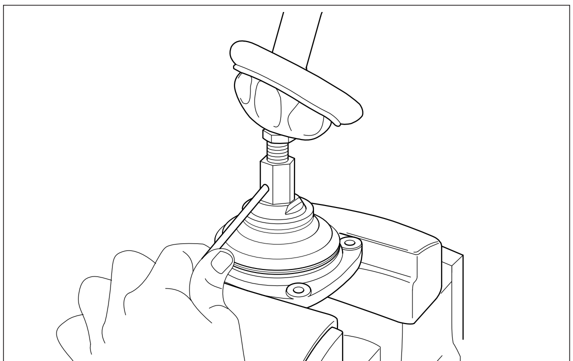


25038RL02(4)



RE48 (140-7)

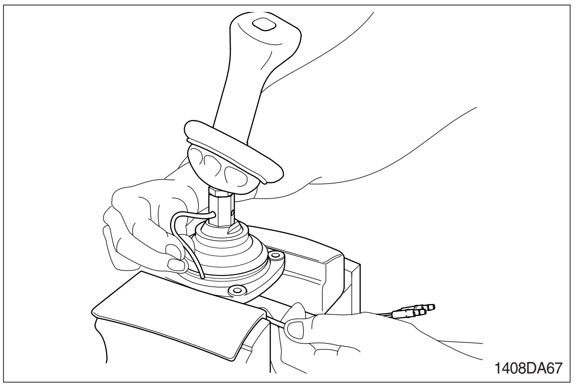
(16) Pull out cord and tube through adjusting nut hole provided in direction 60° to 120° from casing hole.



1408DA66

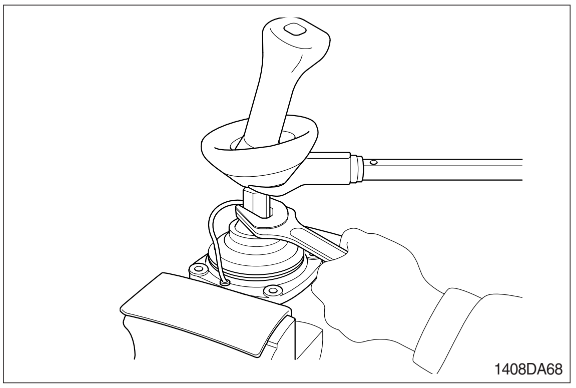
(17) Assemble bushing (18) to plate and pass cord and tube through it.

※ Provide margin necessary to operation.



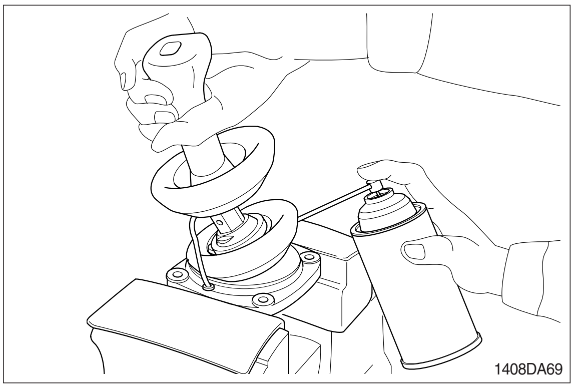
1408DA67

(18) Determine handle direction, tighten lock nut (21) to specified torque to fix handle.



1408DA68

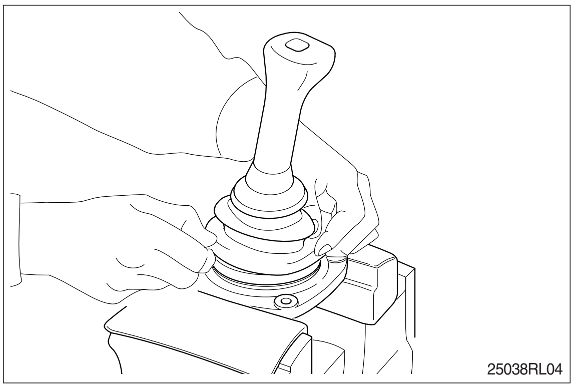
(19) Apply grease to rotating section of joint and contacting faces of disk and push rod.



1408DA69

(20) Assemble lower end of bellows to casing.

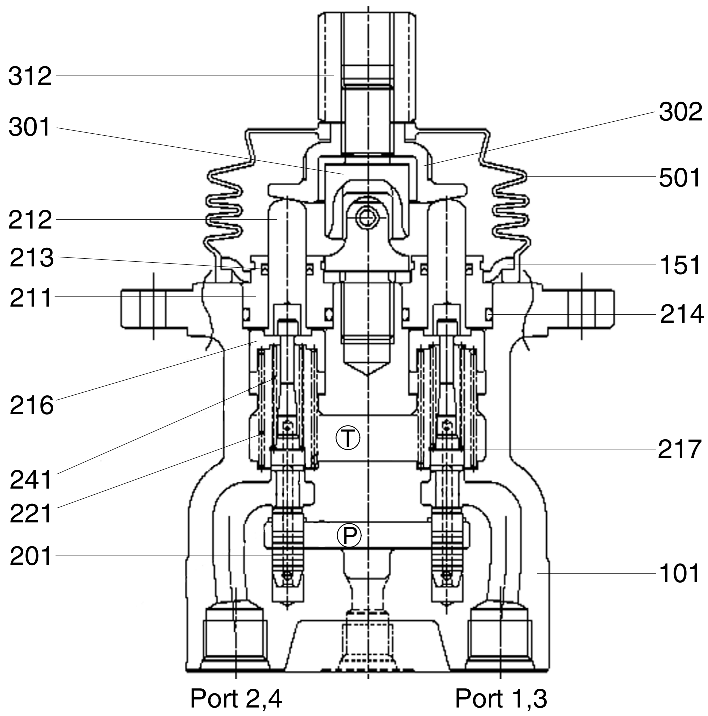
(21) Inject volatile rust-preventives through all ports and then put blind plugs in ports.



25038RL04

3. DISASSEMBLY AND ASSEMBLY (Type 2)

1) STRUCTURE



17Z9A7RCV50

101	Casing	213	Seal	241	Spring
151	Plate	214	O-ring	301	Joint
201	Spool	216	Spring seat	302	Disc
211	Plug	217	Washer	312	Nut
212	Push rod	221	Spring	501	Bellows

2) DISASSEMBLY AND ASSEMBLY

(1) Rinse the pilot valve in paraffin.

※ Place blind plug in all ports.

(2) Secure the pilot valve in a vice using a copper or aluminium faced jaws.

(3) Detach the bellows (501) (If outer bellows is attached, then this bellows may not be attached).

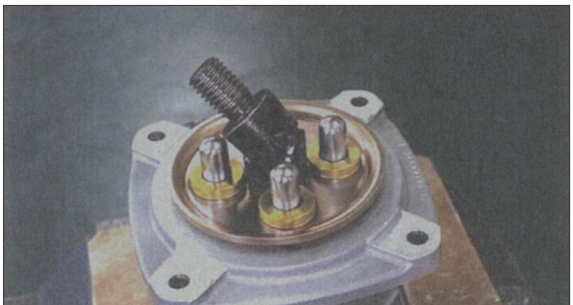
※ Take care not to damage the bellows (501).

17Z9A7RCV01

(4) Use a spanner applied to both the adjustment nut (312) and disc (302) and loosen and then remove them.

17Z9A7RCV02

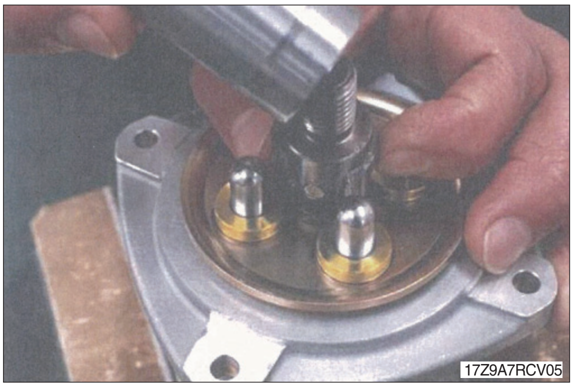
17Z9A7RCV03



17Z9A7RCV04

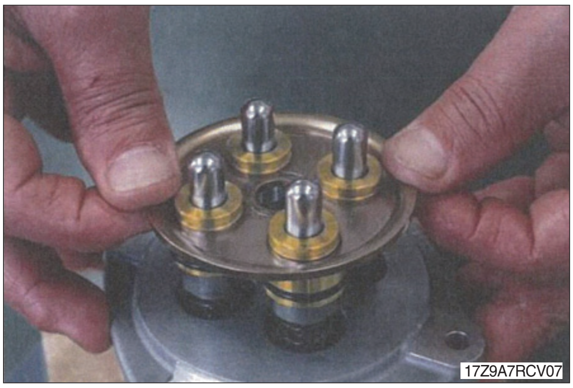
⚠ Items under tension. The return spring (221), plate (151) and push-rod (212) will rise as joint (301) is loosened. Make sure the items do not fly out and damage personnel in the vicinity.

(5) Using the jig, turn the joint (301) counter-clockwise to loosen it.
The right illustration shows the jig attached.

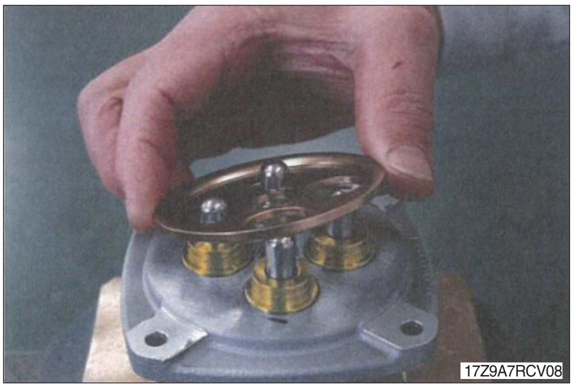

17Z9A7RCV05


17Z9A7RCV06

(6) Remove the plate (151).
- When the return spring (221) is strong


17Z9A7RCV07

- When the return spring (221) is weak


17Z9A7RCV08

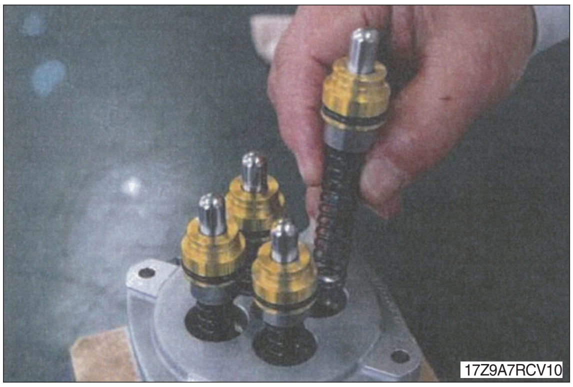
⚠ Items under tension. The return spring (221) tension will be released when plug (211) is removed. Make sure the item does not fly out and damage personnel in the vicinity.

(7) When the return spring (221) is weak, the plug (211) is held in the casing (101) by the friction of the O-ring. Remove this using a screwdriver.

※ Use the groove around the plug and take care to apply force evenly to avoid damage.

(8) Remove the push-rod (212), plug (211), reduction valve assembly and return spring (221) from the casing (101).

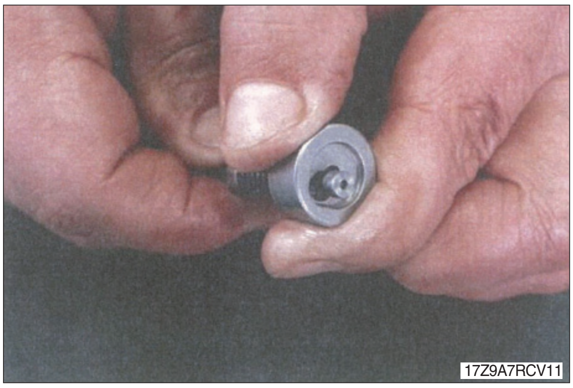
※ The location in relationship with the casing aperture.



※ The surface of the spool (201) and the spring seat (216) can be damaged by mis-handling. Take care not to damage the surface of the spool during removal and do not push the spring seat down more than 6 mm.

(9) The reduction valve is disassembled by pressing down the spring seat (216) and flexing the secondary pressure spring (241), sliding the spring seat (216) sideways and removing it from the spool (201) via the larger aperture.

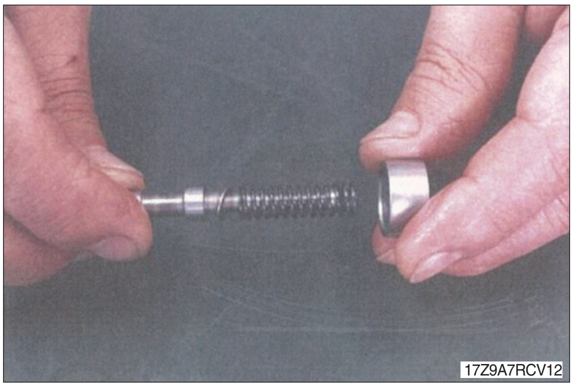
※ Take care not to damage the surface of the spool (201).



(10) Take the spool (201), spring seat (216), secondary pressure spring (241) and washer #2 (217) apart.

※ Take care not to damage the surface of the spool (201).

※ Keep these parts together until reassembly.

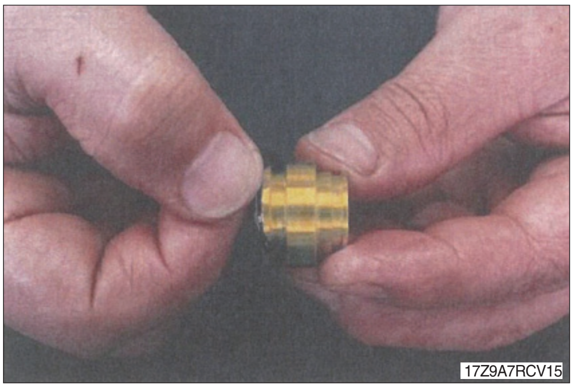


17Z9A7RCV12

(11) Extract the push-rod (212) from the plug (211).

17Z9A7RCV14

(12) Detach the O-ring (214) and seal (213) from the plug (211). Detach the seal (213) using a small screwdriver.



17Z9A7RCV15

17Z9A7RCV16

(13) CLEANING OF PARTS

① Wash the parts by placing in an initial bath containing paraffin oil (or similar cleaning fluid).

※ To reduce the risk of damage if dirty parts are initially washed in oil. To remove the dirt and oil, soak thoroughly so that dirt and oil float to the surface.

※ Dirty paraffin could result in damage to the parts, and deterioration in performance after reassembly. Ensure the contamination of the paraffin is thoroughly monitored and controlled.

② Place the parts in a finish wash container, rotate this slowly until even the inner areas of the parts are clean (Finish wash).
Wipe of the paraffin oil on the parts using clean cloth.

※ If compressed air is used for drying, dust and moisture in the compressed air may damage the parts and make corrosion more likely.

(14) PREVENTION OF CORROSION OF PARTS
Coat the parts with the anti-corrosion preparation.

※ If the parts are left to stand for some time after cleaning, they may start to corrode and the performance after reassembly will be impaired.

3) ASSEMBLY

※ The surface of the spool (201) and the spring seat (216) can be damaged by mis-handling. Take care not to damage the surface of the spool during assembly and do not push the spring seat down more that 6 mm.

(1) Insert, in this order, the washer #2 (217), secondary spring (241) and spring seat (216) onto the spool (201).

17Z9A7RCV17

(2) Press down the spring seat (216) to flex the secondary pressure spring (241) while sliding the spring sideways through the larger aperture to attach it to the spool (201).
Fit the return spring (221) into the casing (101).

※ Do not press the spring seat down more than 6mm.

17Z9A7RCV18

(3) Fit the reduction valve assembly into the casing (101).

※ Fit in the locations noted in step 8 of the disassembly procedure.

17Z9A7RCV19

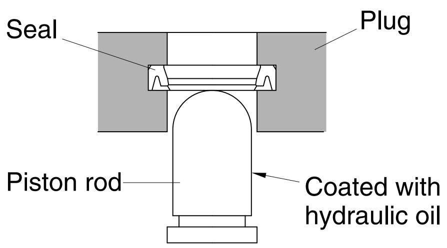
(4) Fit the O-ring (214) into the plug (221).

(5) Fit the seal (213) into the plug (211).

※ Fit the lip of the seal (213) as shown right.

(6) Fit the push-rod (212) into the plug (211).

※ Apply hydraulic oil to the surface of the push rod.



Push rod, plug & seals

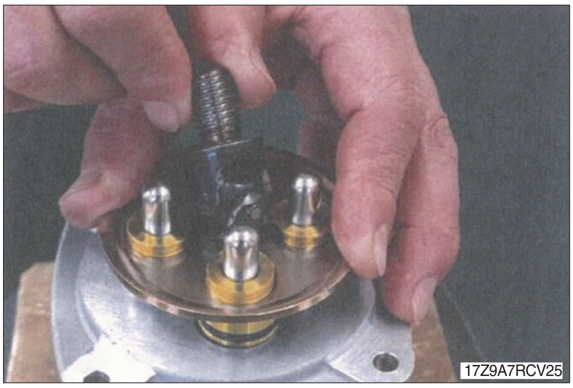
17Z9A7RCV32

⚠ Items under tension. The plug assembly and plate (151) have to be assembled against spring tension. Make sure the item does not fly out and damage personnel in the vicinity.

※ The surface of the spool (201) and aperture (101) can be damaged by mis-handling. Take care not to damage the surface of either during assembly.

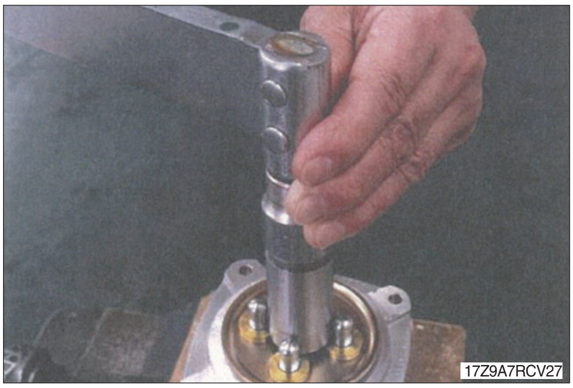
(7) Fit the plug assembly into the casing (101). When the return spring (221) is weak, it is held in place by the friction of the O-ring (214).
When the return spring (221) is strong, use the plate (151) to insert all four simultaneously and temporarily secure them with the joint (301).

(8) Attach the plate (151).



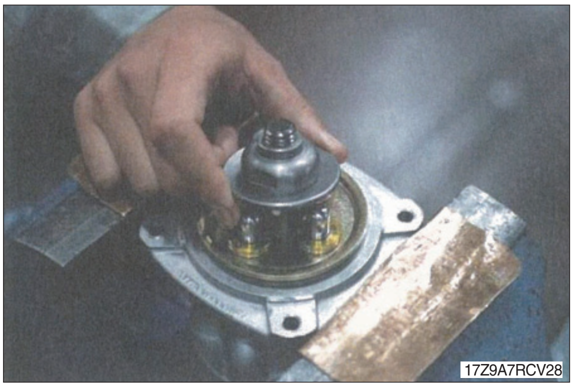
(9) Tighten the joint (301) to the casing (101) to the specified torque using the special jig.

※ The right figure shows the jig attached. Screw down to a position where the four push rods (212) are in contact equally.



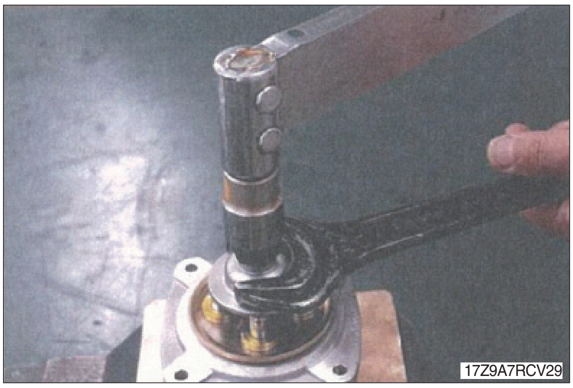
※ Excessive tightening or wrong positioning of the disc can cause the valve to malfunction.

(10) Attach the disc (302) onto the joint (301).



(11) Install the adjustment nut (312), tighten up the discs (302) with a spanner on both and tighten the adjustment nut to the specified torque.

※ Do not allow the position of the disc (302) to shift during tightening.



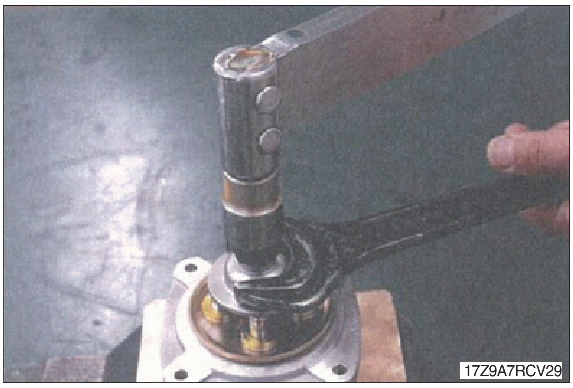
(12) Apply grease to the rotating part of the joint (301) and end of the push-rod (212).

(13) Attach the bellows (501).
If outer bellows is attached, then this bellows may not be attached.

※ Take care not to tear the bellows.

(14) Fit the handle assembly into the valve.

(15) Spray anti-corrosion preparation into each port and insert blind plugs.



GROUP 8 TURNING JOINT

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

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

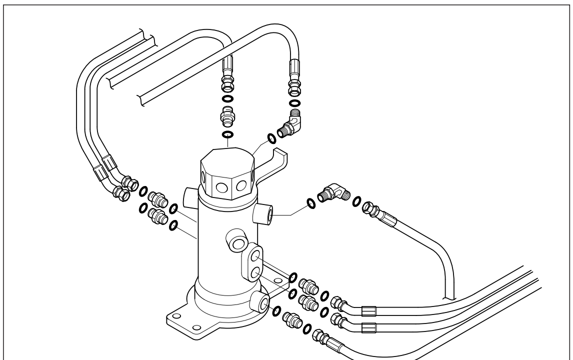
13031GE18

(4) Disconnect all hoses.

(5) Sling the turning joint assembly (1) and remove the mounting bolt (2).

· Weight : 15 kg (35 lb)

· Tightening torque : 6.9± 1.4 kgf · m (49.9± 10.1 lbf · ft)



R35Z77TJ01

(6) Remove the turning joint assembly.

※ When removing the turning joint, check that all the hoses have been disconnected.

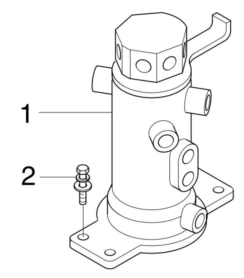
2) INSTALL

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

※ Take care of turning joint direction.

※ Assemble hoses to their original positions.

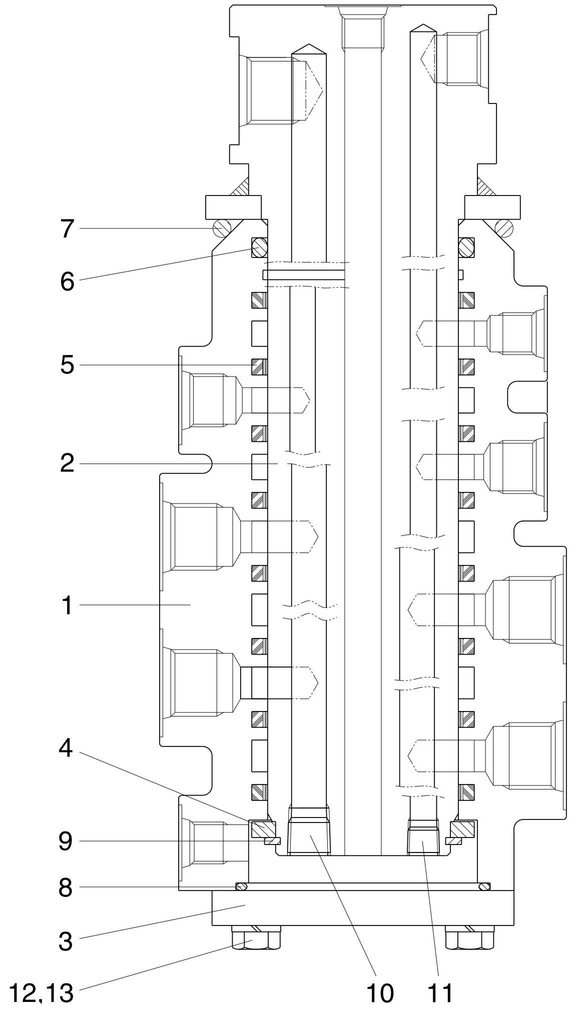
※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.



R35Z77TJ02

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



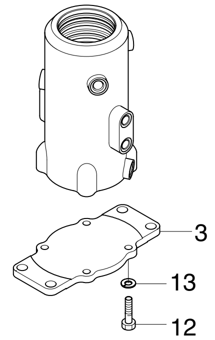
R35Z77TJ03

1	Hub	5	Slipper seal	9	Retainer ring
2	Shaft	6	O-ring	10	Plug
3	Cover	7	O-ring	11	Plug
4	Spacer	8	O-ring	12	Hexagon bolt
				13	Spring washer

2) DISASSEMBLY

※ Before the disassembly, clean the turning joint.

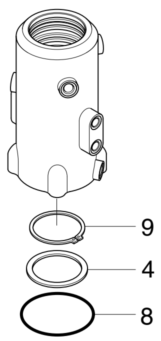
(1) Remove bolts (12), washer (13) and cover (3).



R35Z77TJ04

(2) Remove O-ring (8).

(3) Remove retainer ring (9) and spacer (4).

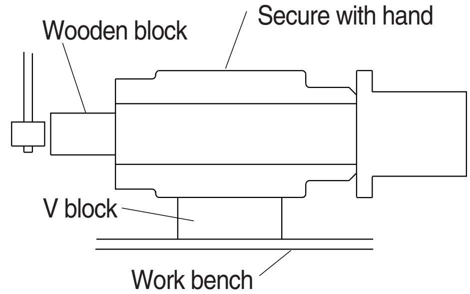


R35Z77TJ05

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

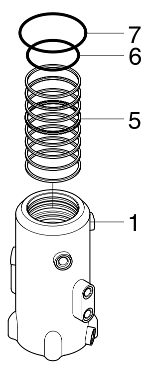
※ Take care not to damage the shaft (2) when remove hub (1) or rest it sideway.

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



8-141(3) 210-7

(5) Remove eight slipper seals (5) and O-ring (6, 7) from hub (1).



R35Z77TJ06

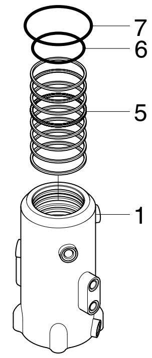
3) ASSEMBLY

※ Clean all parts.

※ As a general rule, replace oil seals and O-ring.

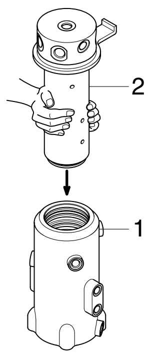
※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(1) Fix eight slipper seal (5) and O-ring (6, 7) to hub (1).



R35Z77TJ06

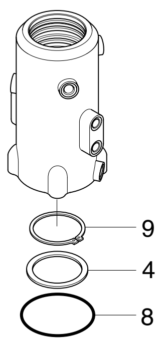
(2) Set hub (1) on block, install shaft (2) into hub (1) by hand.



R35Z77TJ07

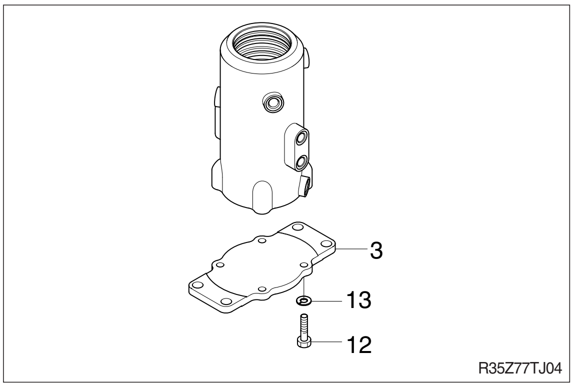
(3) Fit spacer (4) and retainer ring (9) to shaft (2).

(4) Fit O-ring (8) to hub (1).



R35Z77TJ05

(5) Install cover (3) to hub and tighten bolts (12).



1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

(1) Removal


13031GE18

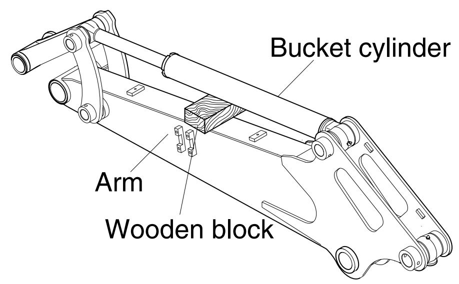
※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

※ 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.

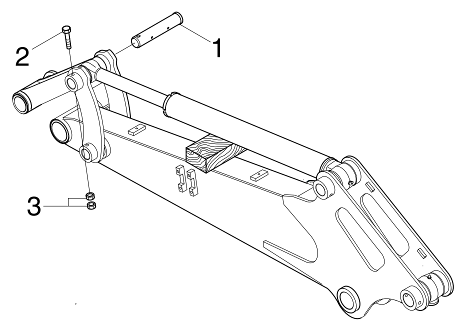
① Set block between bucket cylinder and arm.



R35Z77CY03

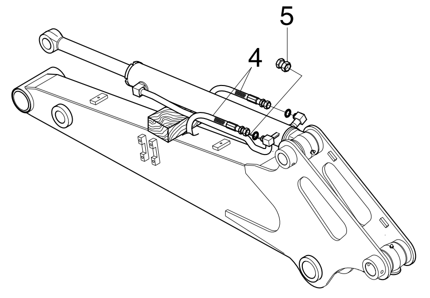
② Remove bolt (2), nut (3) and pull out pin (1).

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



R35Z77CY02

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

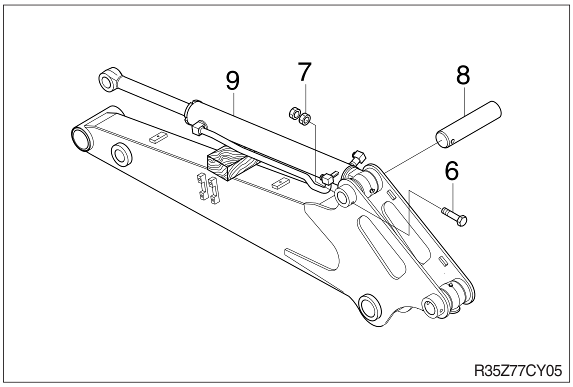


R35Z77CY04

④ Sling bucket cylinder assembly (9) and remove bolt (6) and nut (7) then pull out pin (8).

⑤ Remove bucket cylinder assembly (9).

  · Weight : 30 ㎏ (70 ℔)



(2) Install

① Carry out installation in the reverse order to removal.

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

※ Bleed the air from the bucket cylinder.

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

2) ARM CYLINDER

(1) Removal

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

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

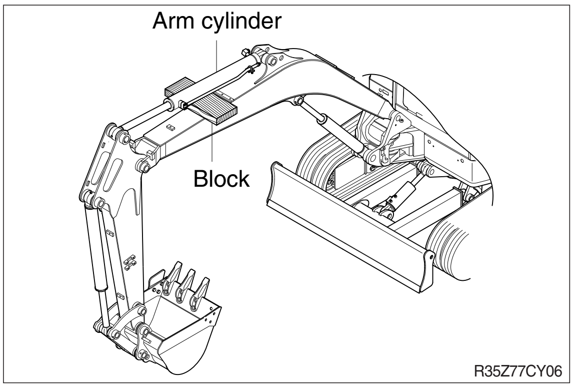
13031GE18

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

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

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

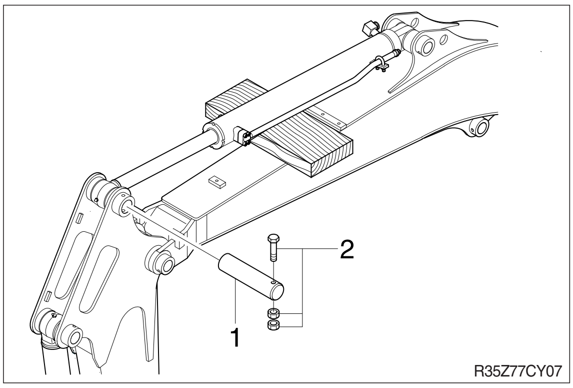
① Set block between arm cylinder and boom.



R35Z77CY06

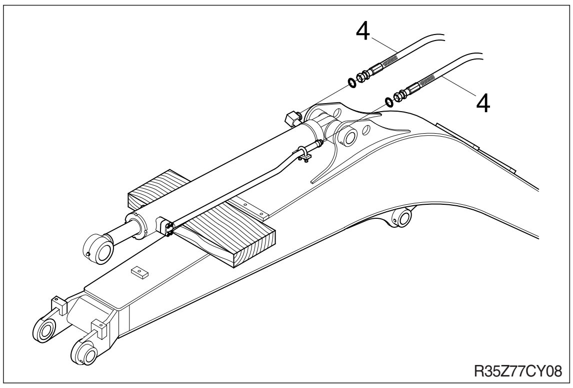
② Remove bolt and nut (2) and pull out pin (1).

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



R35Z77CY07

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

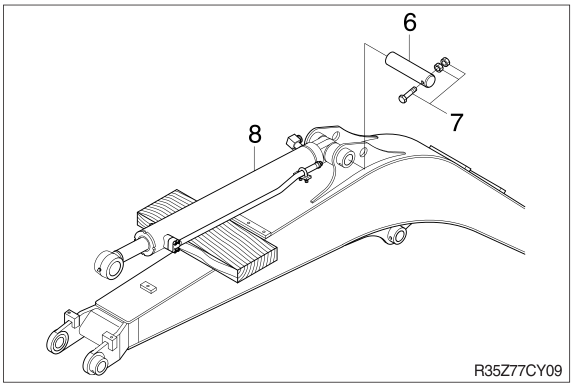


R35Z77CY08

⑤ Sling arm assembly (8) and remove bolt and nut (7) then pull out pin (6).

⑥ Remove arm cylinder assembly (8).

· Weight : 40 ㎏ (90 ㏌)



(2) Install

① Carry out installation in the reverse order to removal.

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

※ Bleed the air from the arm cylinder.

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

3) BOOM CYLINDER

(1) Removal

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

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

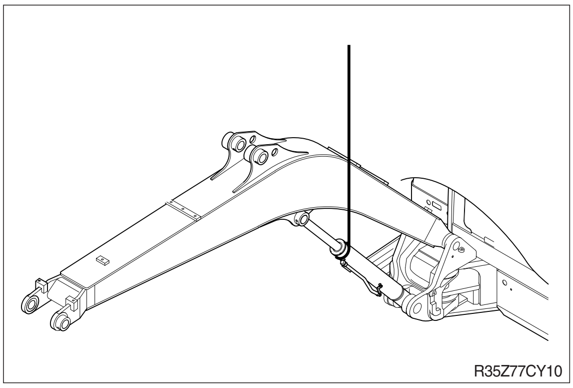
13031GE18

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

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

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

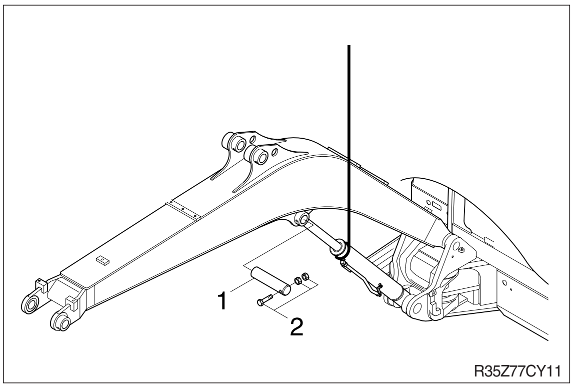
① Sling boom cylinder assembly.



R35Z77CY10

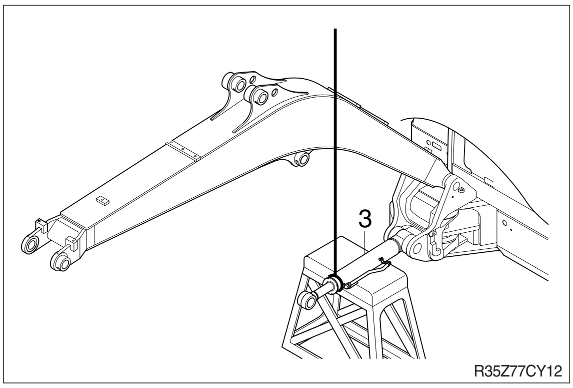
③ Remove bolt and nut (2) and pull out pin (1).

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



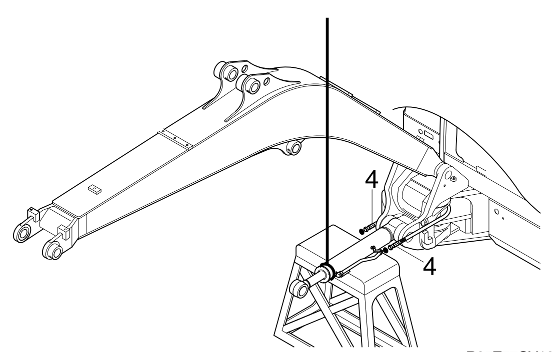
R35Z77CY11

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



R35Z77CY12

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

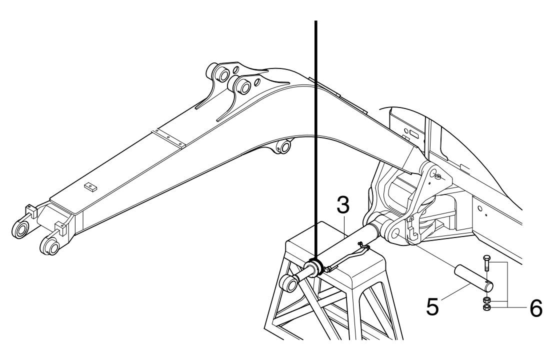


R35Z77CY13

⑥ Remove bolt (6) and pull out pin (5).

⑦ Remove boom cylinder assembly (3).

· Weight : 60 ㎏ (130 ℔)



R35Z77CY14

(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.**

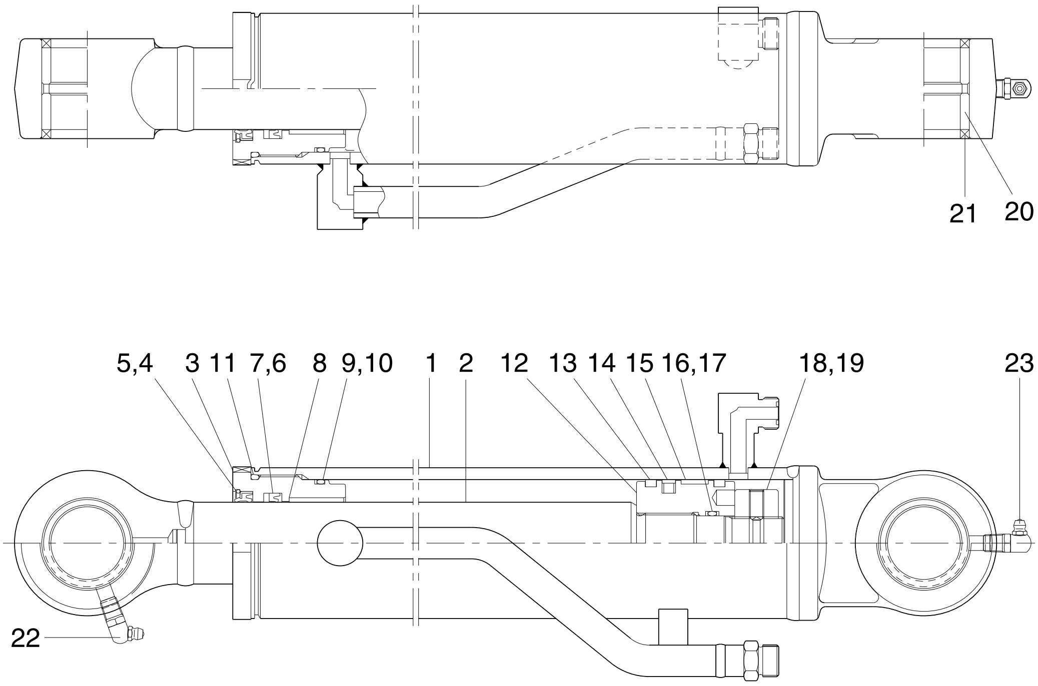
※ Bleed the air from the boom cylinder.

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

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

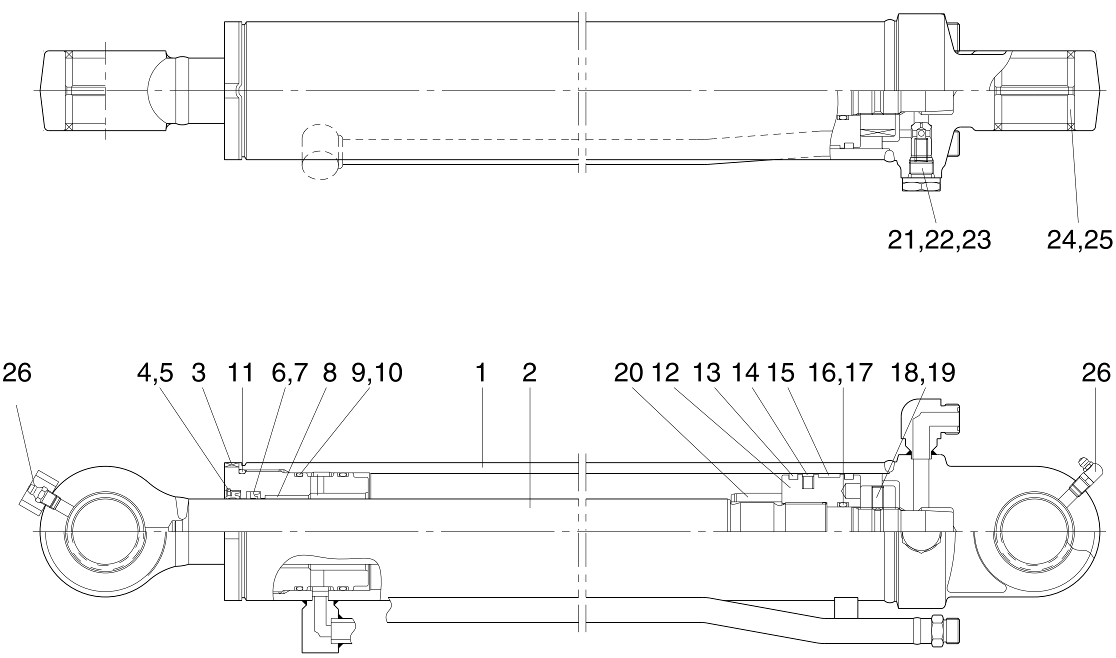
(1) Bucket cylinder



R35Z77CY15

1	Tube assembly	9	O-ring	17	Back-up ring
2	Rod assembly	10	Back-up ring	18	Piston nut
3	Gland	11	O-ring	19	Set screw
4	Dust wiper	12	Piston	20	Pin bushing
5	Snap ring	13	Dust ring	21	Dust seal
6	Rod seal	14	Piston seal	22	Grease nipple
7	Back-up ring	15	Wear ring	23	Grease nipple
8	DU bushing	16	O-ring		

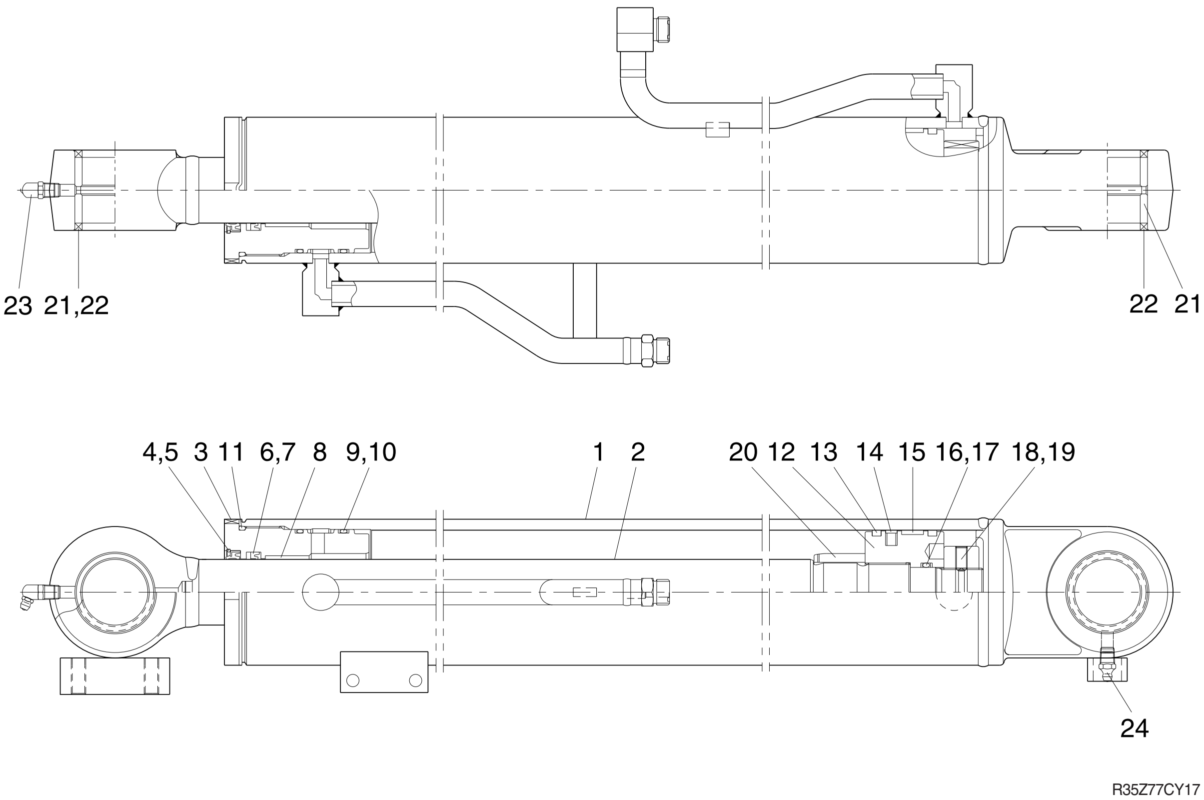
(2) Arm cylinder



R35Z97CY16

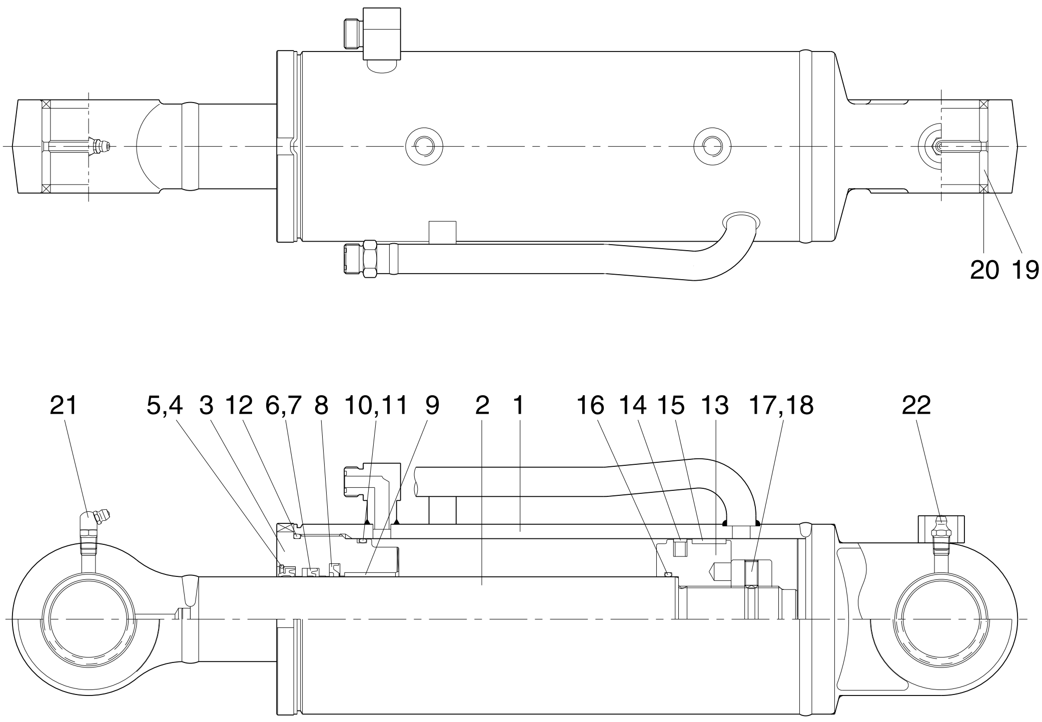
1	Tube assembly	10	Back-up ring	19	Set screw
2	Rod assembly	11	O-ring	20	Cushion ring
3	Gland	12	Piston	21	Check valve
4	Dust wiper	13	Dust ring	22	Coil spring
5	Snap ring	14	Piston seal	23	Plug
6	Rod seal	15	Wearring	24	Pin bushing
7	Back-up ring	16	O-ring	25	Dust seal
8	DU bushing	17	Back-up ring	26	Grease nipple
9	O-ring	18	Piston nut		

(3) Boom cylinder



1	Tube assembly	9	O-ring	17	Back-up ring
2	Rod assembly	10	Back-up ring	18	Piston nut
3	Gland	11	O-ring	19	Set screw
4	Dust wiper	12	Piston	20	Cushion ring
5	Snap ring	13	Dust ring	21	Pin bushing
6	Rod seal	14	Piston seal	22	Dust seal
7	Back-up ring	15	Wear ring	23	Grease nipple
8	DU bushing	16	O-ring	24	Grease nipple

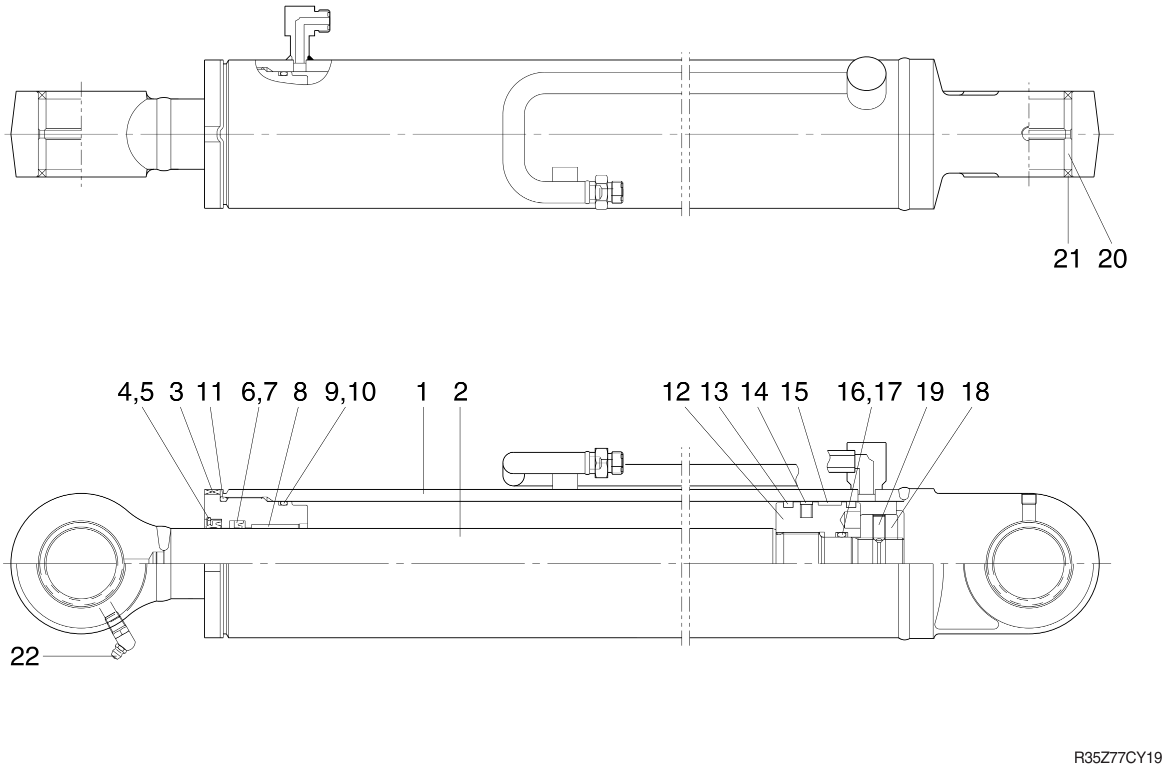
(4) Dozer cylinder



R35Z77CY18

1	Tube assembly	8	Buffer ring	15	Wear ring
2	Rod assembly	9	DU bushing	17	Piston nut
3	Gland	10	O-ring	18	Set screw
4	Dust wiper	11	Back-up ring	19	Pin bushing
5	Snap ring	12	O-ring	20	Dust seal
6	Rod seal	13	Piston	21	Grease nipple
7	Back-up ring	14	Piston seal	22	Grease nipple

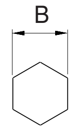
(5) Boom swing cylinder



1	Tube assembly	9	O-ring	16	O-ring
2	Rod assembly	10	Back-up ring	17	Back-up ring
3	Gland	11	O-ring	18	Piston nut
4	Dust wiper	12	Piston	19	Set screw
5	Snap ring	13	Dust ring	20	Pin bushing
6	Rod seal	14	Piston seal	21	Dust seal
7	Back-up ring	15	Wear ring	22	Grease nipple
8	DU bushing				

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Allen wrench	8	
	3	
Spanner	M22	
Hook spanner	Suitable size (80~120 mm)	
(-) 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
Gland	Boom cylinder	3	M90	68±6.8	492±49
	Arm cylinder	3	M85	64±6.4	463±46
	Bucket cylinder	3	M75	56±5.6	405±41
	Dozer cylinder	3	M100	75±7.5	542±54
	Boom swing cylinder	3	M85	64±6.4	463±46
Piston	Boom cylinder	18	M33	82±8	593±59
	Arm cylinder	18	M33	82±8	593±59
	Bucket cylinder	18	M29	73±7	528±53
	Dozer cylinder	17	M39	150±15	1085±109
	Boom swing cylinder	18	M33	93±9	673±67

3) DISASSEMBLY

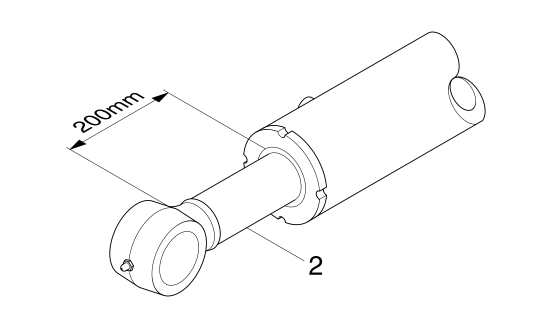
※ Procedures are based on the boom cylinder.

(1) Remove cylinder head and piston rod

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

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

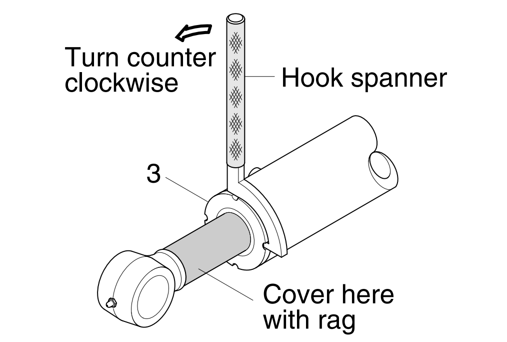
② Pull out rod assembly (2) about 200 mm (7.1 in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



R35Z77CY20

③ Loosen and remove the gland (3) by hook spanner.

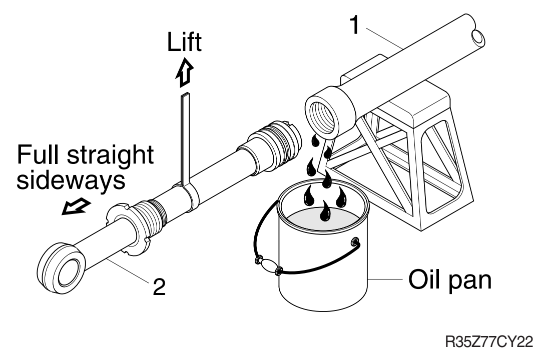
※ Cover the extracted rod assembly (2) with rag to prevent it from being accidentally damaged during operation.



R35Z77CY21

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

※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (2) with a crane or some means and draw it out. However, when rod assembly (2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.

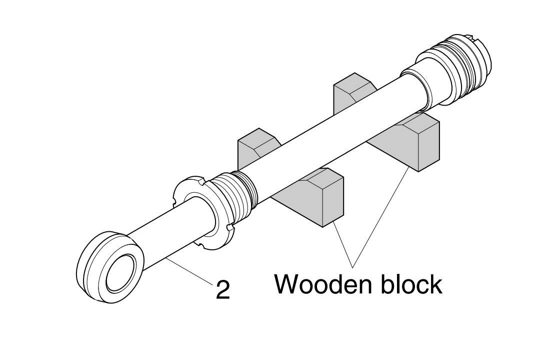


R35Z77CY22

Note that the plated surface of rod assembly (2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

⑤ Place the removed rod assembly on a wooden V-block that is set level.

※ Cover a V-block with soft rag.



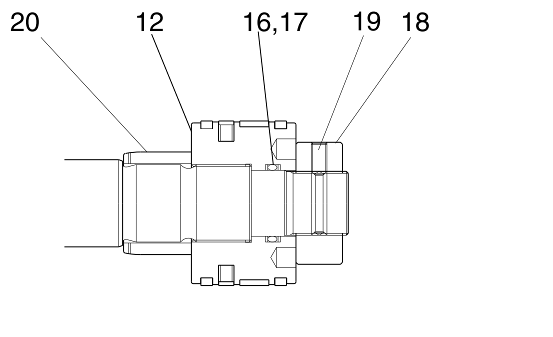
R35Z77CY23

(2) Remove piston and gland

① Remove set screw (19)

② Remove piston nut (18).

※ Since piston nut (18) is tightened to a high torque, use a hydraulic and power wrench that utilizers a hydraulic cylinder, to remove the piston nut (18).



R35Z77CY24

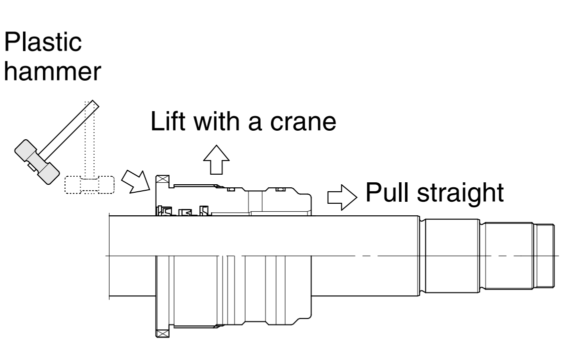
③ Remove piston assembly (12), back up ring (17), O-ring (10) and cushion ring (20).

④ Remove the gland assembly from rod assembly (2).

※ If it is too heavy to move, move it by striking the flanged part of gland with a plastic hammer.

※ Pull it straight with gland assembly lifted with a crane.

Exercise care so as not to damage the lip of DU bushing (8) and packing (4,5,6,7,9,10) by the threads of rod assembly (2).



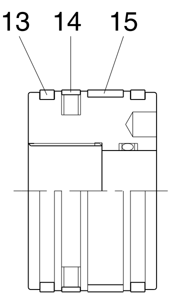
R5577CY35

(3) Disassemble the piston assembly

① Remove wear ring (15).

② Remove dust ring (13) and piston seal (14).

※ Exercise care in this operation not to damage the grooves.



R35Z77CY25

(4) Disassemble gland assembly

① Remove back up ring (10) and O-ring (9).

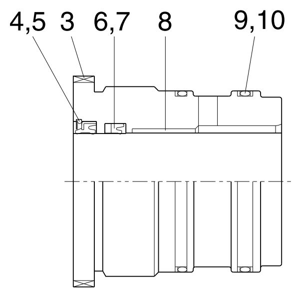
② Remove snap ring (5), dust wiper (4).

③ Remove back up ring (7), rod seal (6).

④ Remove the cushion ring (8).

※ Exercise care in this operation not to damage the grooves.

※ Do not remove seal and ring, if does not damaged.



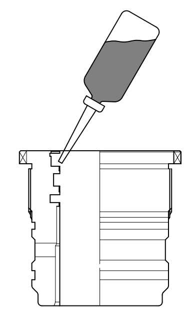
R35Z77CY26

4) ASSEMBLY

(1) Assemble cylinder head assembly

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

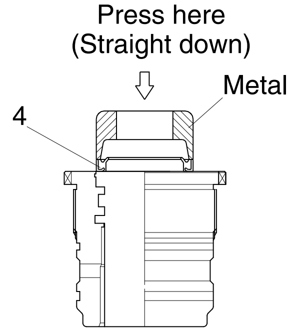
① Coat the inner face of gland (3) with hydraulic oil.



R5577CY38

② Coat dust wiper (4) with grease and fit dust wiper (4) 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 retain ring (5) to the stop face.

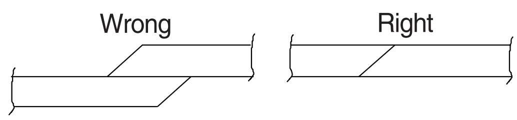


R35Z77CY29

④ Fit back up ring (7), rod seal (6) to corresponding grooves, in that order.

※ Coat each packing with hydraulic oil before fitting it.

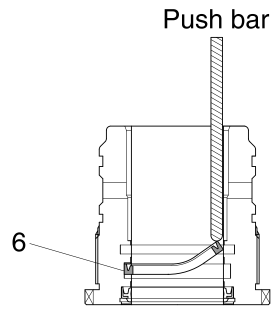
※ Insert the backup ring until one side of it is inserted into groove.



8-157(3) 210-7

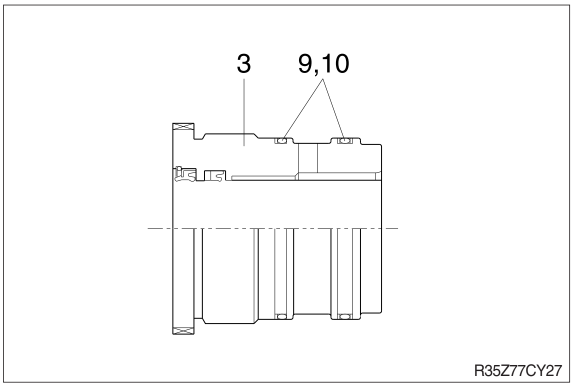
※ Rod seal (6) has its own fitting direction. Therefore, confirm it before fitting them.

※ Fitting rod seal (6) upside down may damage its lip. Therefore check the correct direction that is shown in fig.



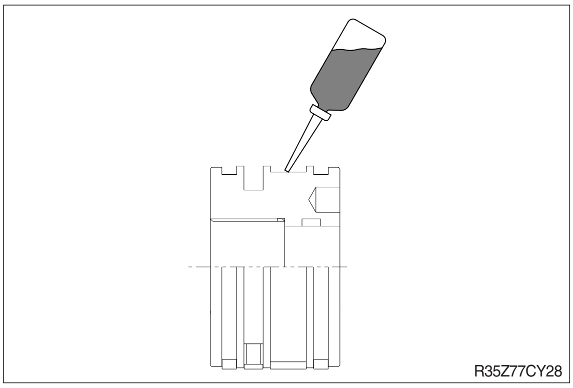
R35Z77CY35

⑤ Fit back up ring (10) to gland (3).
※ Put the backup ring in the warm water of 30~50°C .
⑥ Fit O-ring (9) to gland (3).

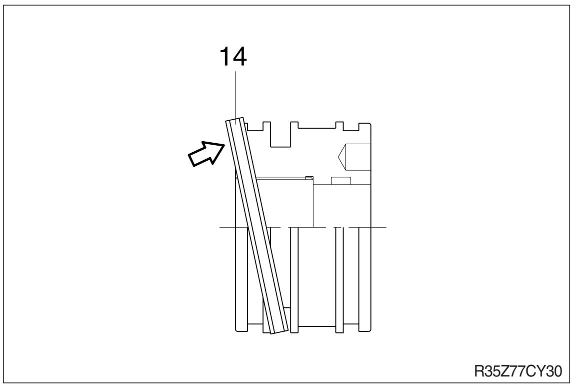


(2) Assemble piston assembly

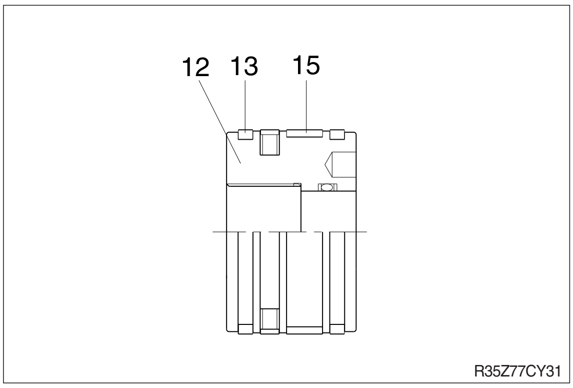
※ Check for scratches or rough surfaces. If found smooth with an oil stone.
① Coat the outer face of piston (16) with hydraulic oil.



② Fit piston seal (14) 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 (15) and dust ring (13) to piston (12).

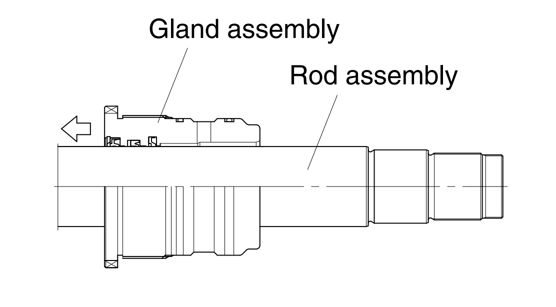


(3) Install piston and cylinder head

① Fix the rod assembly to the work bench.

② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and gland.

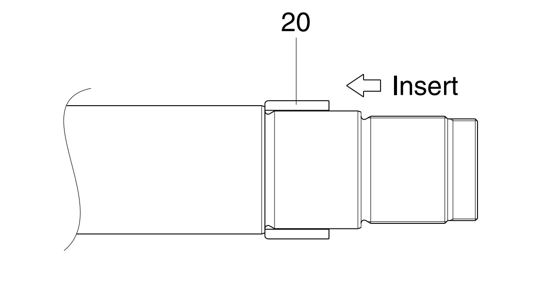
③ Insert gland assembly to rod assembly.



R5577CY45

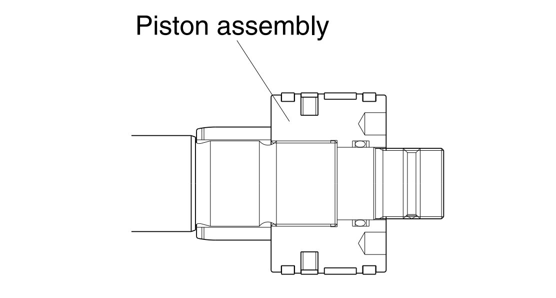
④ Insert cushion ring (20) to rod assembly.

※ Note that cushion ring (20) has a direction in which it should be fitted.



R35Z77CY32

⑤ Fit piston assembly to rod assembly.

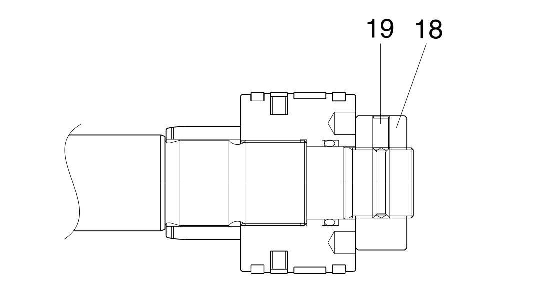


R35Z77CY34

⑥ Fit piston nut (18) and set screw (19).

· Tightening torque :

Item		kgf · m	lbf · ft
Boom	18	82±8	593±59
Arm	18	82±8	593±59
Bucket	18	73±7	528±53
Dozer	17	150±15	1085±109
Boom swing	18	93±9	673±67



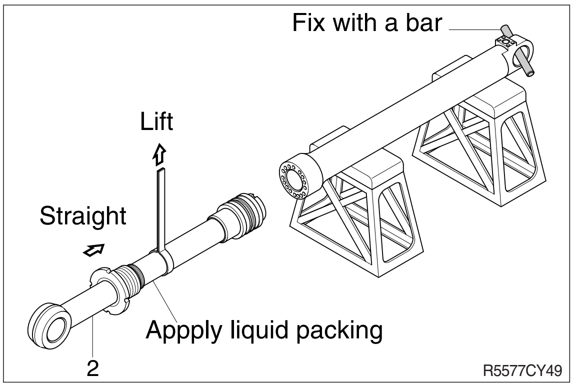
R35Z77CY33

(3) Overall assemble

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

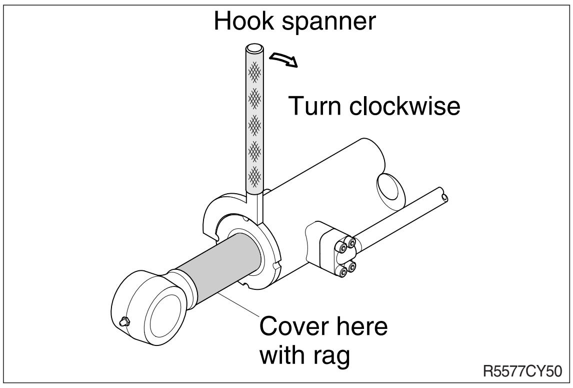
② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.

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



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

※ Refer to the table of tightening torque.

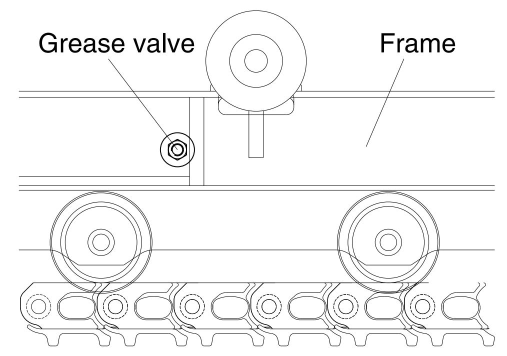


1. RUBBER TRACK

1) REMOVAL

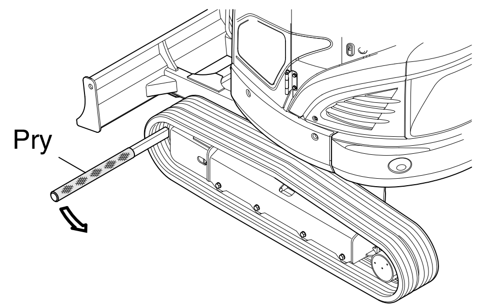
(1) Loosen tension of the rubber track.

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



R35Z77TR04

(2) Remove the rubber track from lower frame using pry.

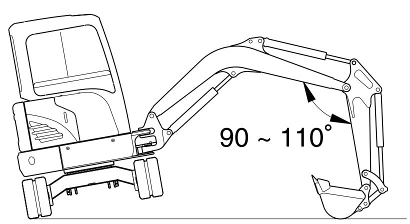


R35Z77TR22

2) INSTALL

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

※ Adjust the tension of the rubber track.



R35Z77TR03

2. TRACK LINK

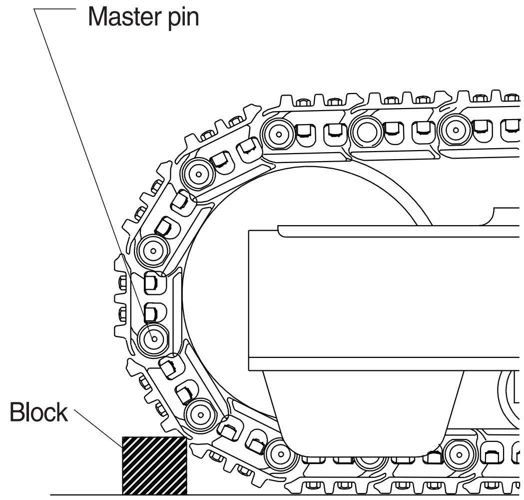
1) REMOVAL

(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.

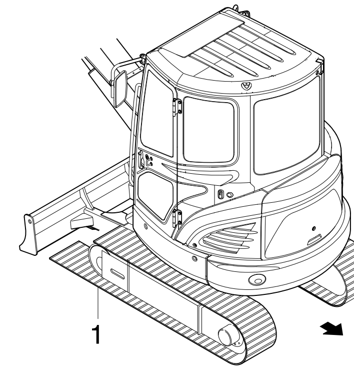


8-161(1) 140-7

(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.

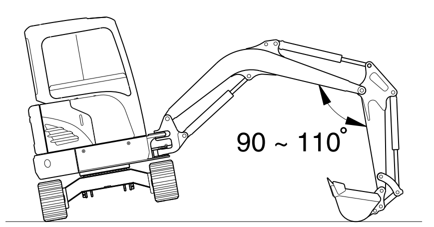


R35Z77TR01

2) INSTALL

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

※ Adjust the tension of the track link.

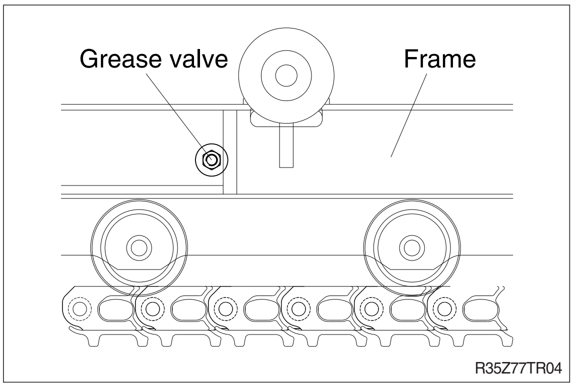


R35Z77TR02

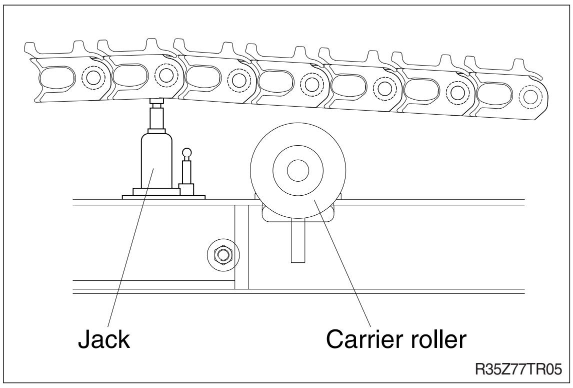
3. CARRIER ROLLER

1) REMOVAL

(1) Loosen tension of the track link.



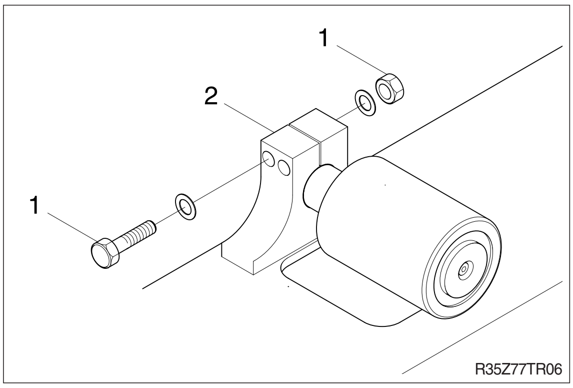
(2) Jack up the track link height enough to permit carrier roller removal.



(3) Loosen the bolt and nut (1)

(4) Open bracket (2) with a screwdriver, push out from inside, and remove carrier roller assembly.

· Weight : 7 ㎏ (15 ℔)



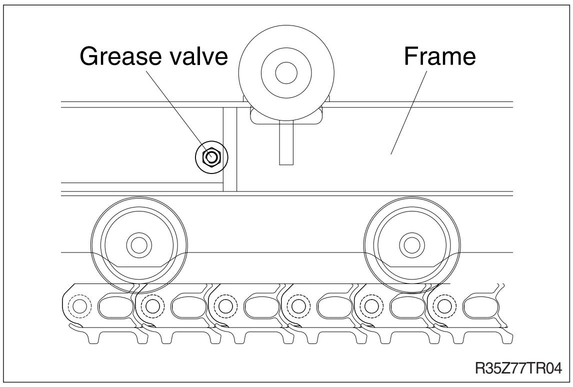
2) INSTALL

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

4. TRACK ROLLER

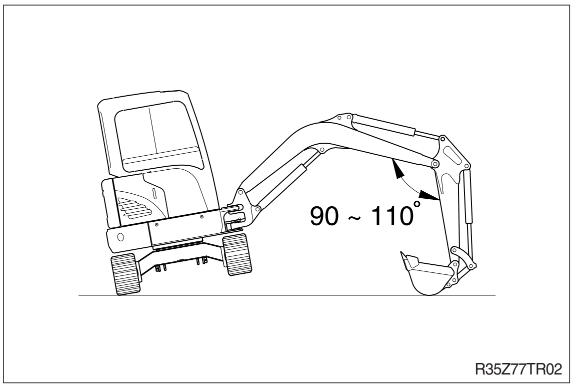
1) REMOVAL

(1) Loosen tension of the rubber track.



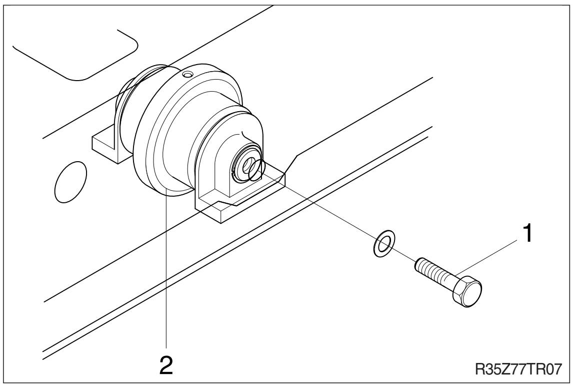
(2) Using the work equipment, push up track frame on side which is to be removed.

※ After jack up the machine, set a block under the unit.



(3) Remove the mounting bolt (1) and draw out the track roller (2).

· Weight : 11.5 kg (25 lb)



2) INSTALL

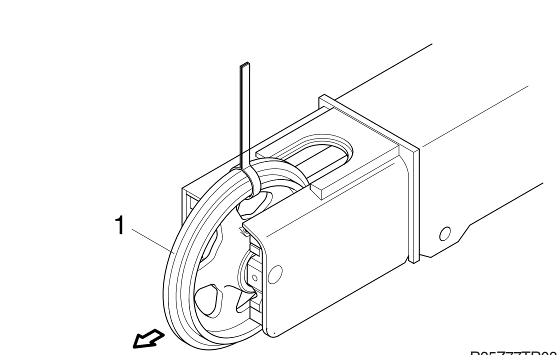
(1) Carry out installation in the reverse order to removal.

5. IDLER AND RECOIL SPRING

1) REMOVAL

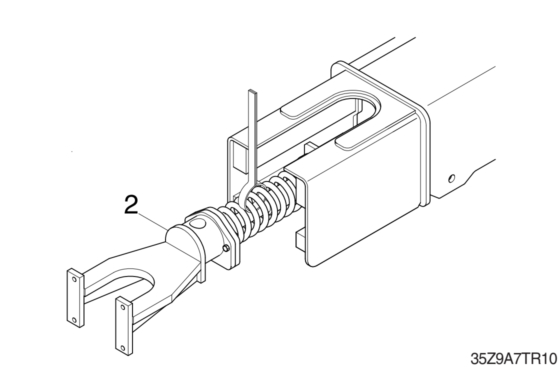
(1) Remove the track link.
For detail, see removal of track link.

(2) Sling the idler (1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 58.3 ㎏ (129 ㏏)



R35Z77TR08

(3) Pull out yoke and recoil spring assembly (2) from track frame, using a pry.
· Weight : 36 ㎏ (79 ㏏)

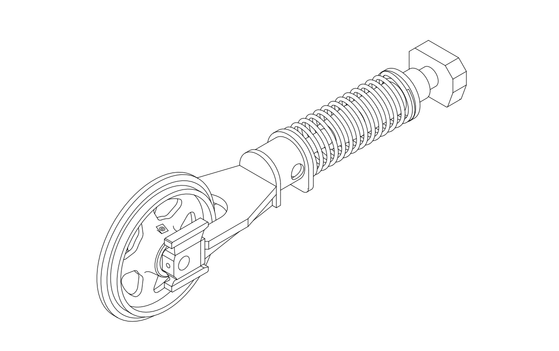


35Z9A7TR10

2) INSTALL

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

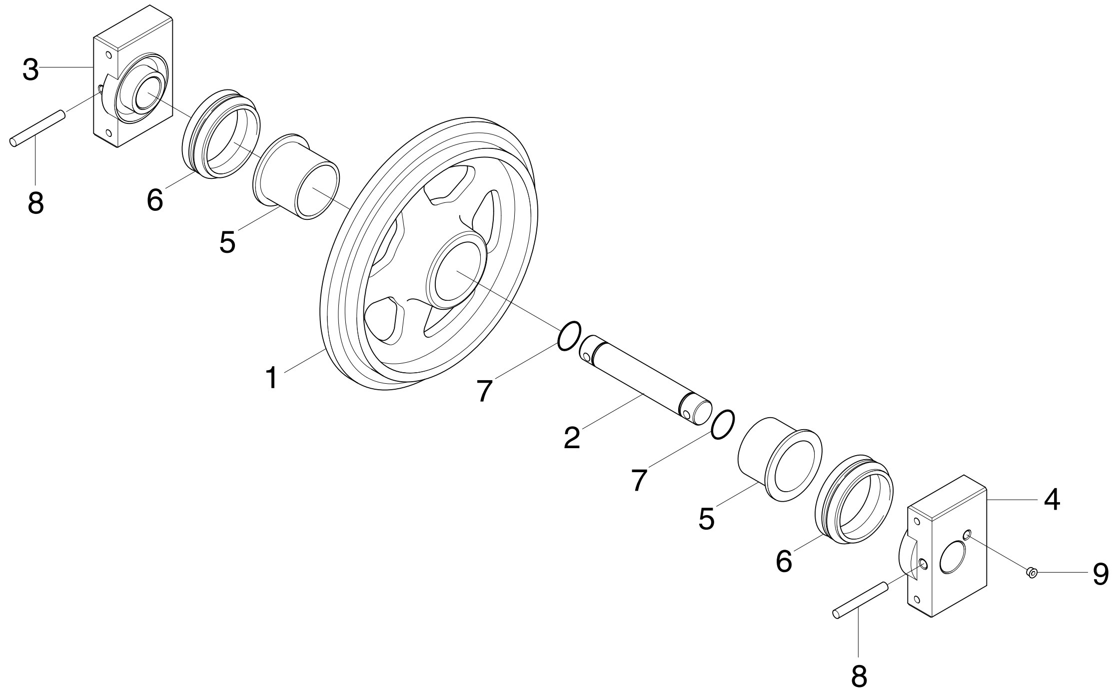
※ Make sure that the boss on the end face of the recoil cylinder rod is in the hole of the track frame.



35Z9A7TR09

3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure



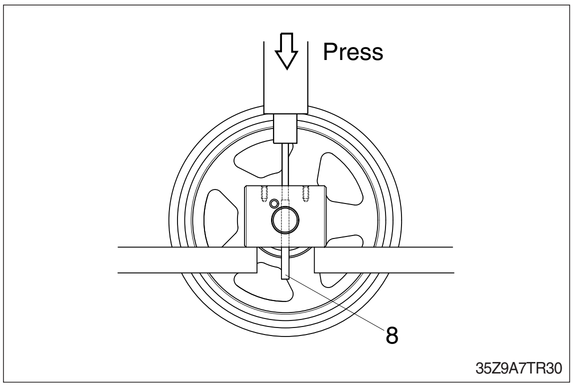
35Z9A7TR11

1	Idler shell	4	Collar-RH	7	O-ring
2	Shaft	5	Bushing	8	Spring pin
3	Collar-LH	6	Seal assembly	9	Plug

(2) Disassembly

① Remove plug (9) and drain oil.

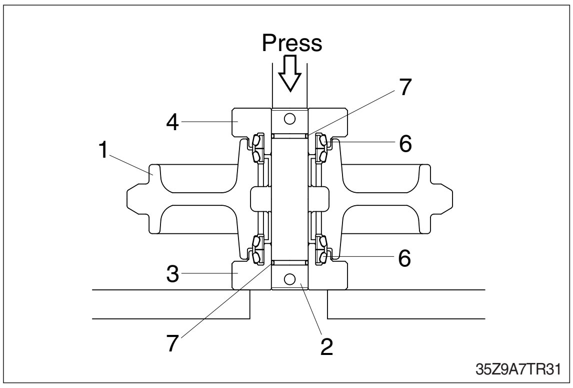
② Draw out the spring pin (8), using a press.



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

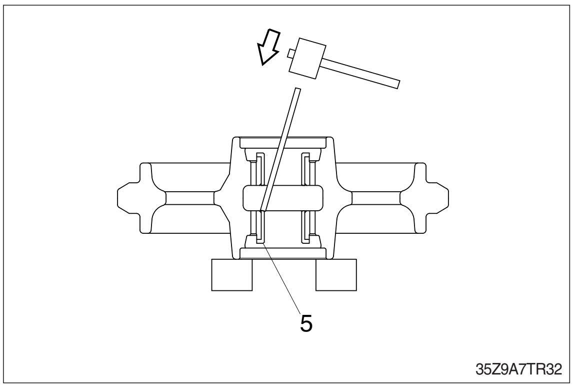
④ Remove seal (6) from idler shell (1) and collar (3,4).

⑤ Remove O-ring (7) from shaft.



⑥ Remove the bushing (5) from idler, using a special tool.

※ Only remove bushing if replacement is necessity.

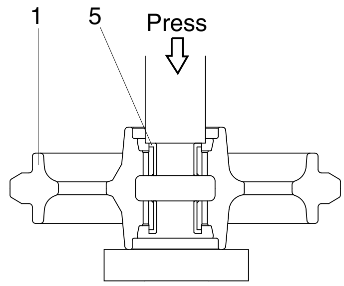


(3) Assembly

※ Before assembly, clean the parts.

※ Coat the sliding surfaces of all parts with oil.

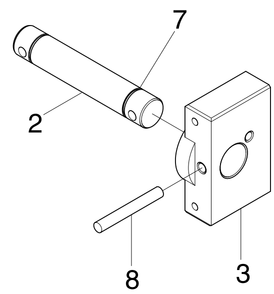
① Cool up bushing (5) fully by some dry ice and press it into idler shell (1).
Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.



35Z9A7TR33

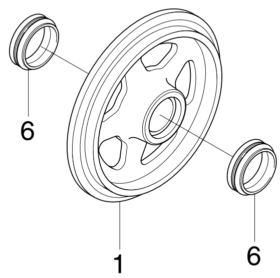
② Coat O-ring (7) with grease thinly, and install it to shaft (2).

③ Insert shaft (2) into collar (3) and drive in the spring pin (8).



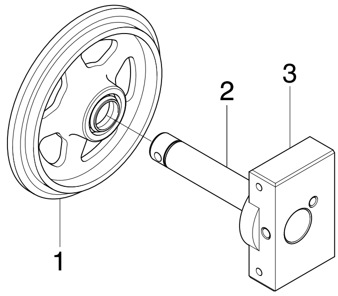
35Z9A7TR34

④ Install seal (6) to idler shell (1).



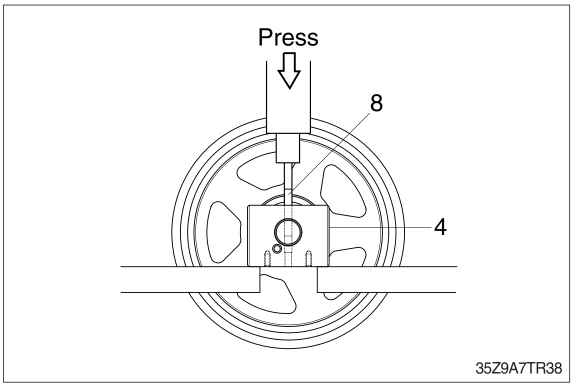
35Z9A7TR35

⑤ Install shaft (2) and collar (3) to idler shell (1).

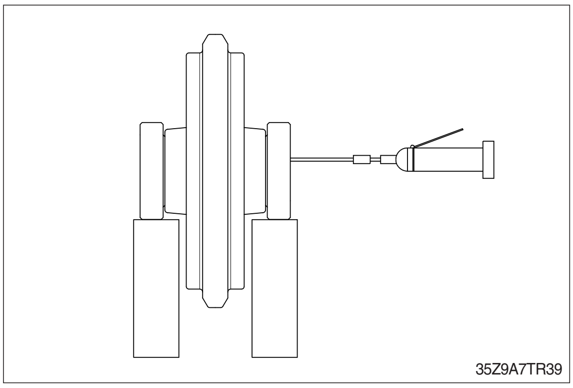


35Z9A7TR36

⑥ Lay collar (4) on its side. Knock in the spring pin (8) with a hammer.

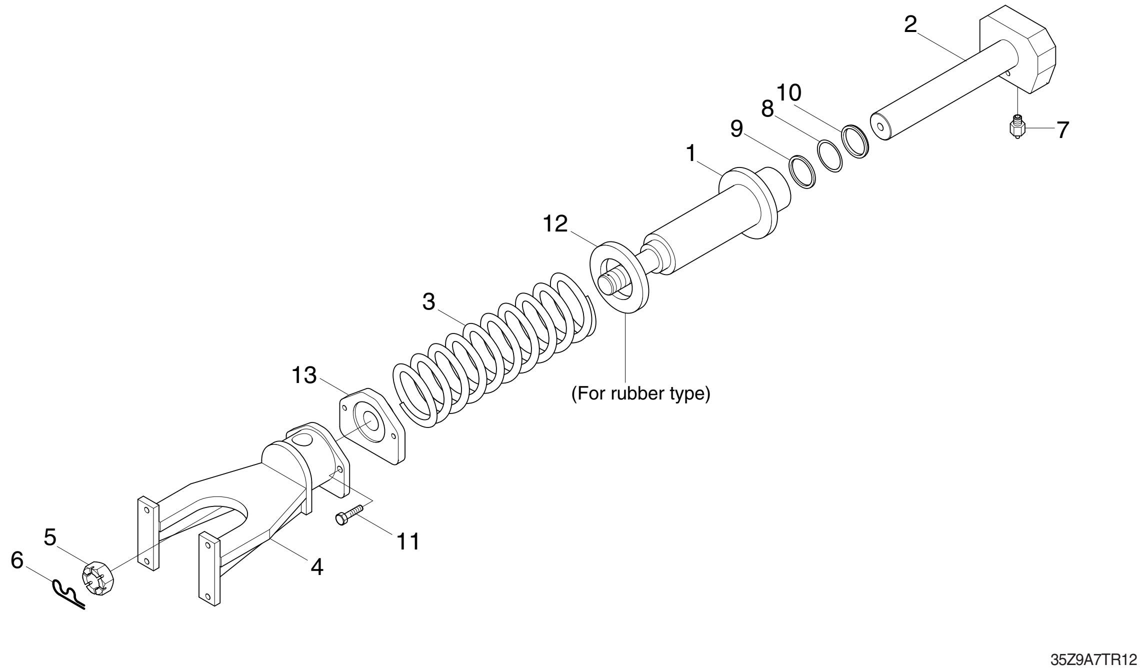


⑦ Supply engine oil to the specified level, and tighten plug.



4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure



1	Body assy	6	Split pin	11	Bolt
2	Rod assy	7	Grease valve	12	Spacer (rubber type)
3	Tension spring	8	O-ring	13	Cap
4	Yoke	9	Back-up ring		
5	Nut	10	Packing		

(2) Disassembly

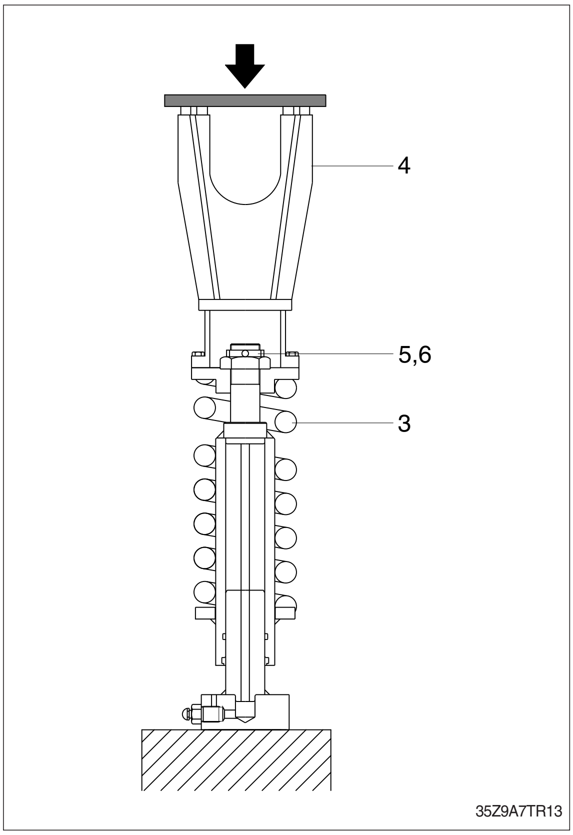
① Apply pressure on yoke (4) with a press.

※ The spring is under a large installed load. This is dangerous, so be sure to set properly.

· Spring set load : 2700 ㎏ (6000 ℔)

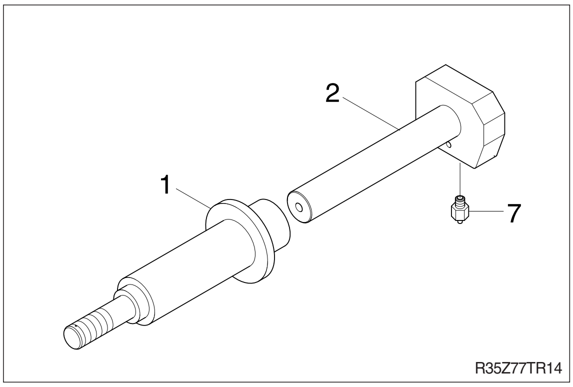
② Remove split pin (6) and nut (5).
Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.

③ Lighten the press load slowly and remove cap (4) and spring (3).

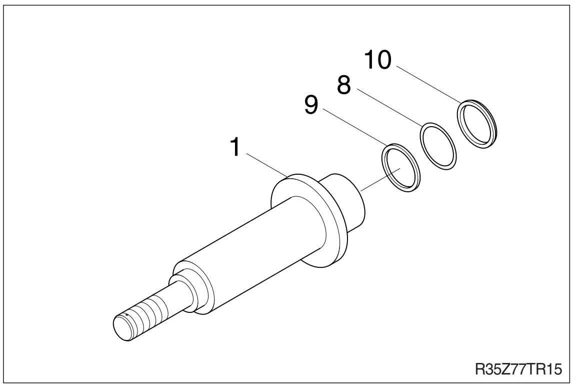


⑤ Remove rod (2) from body (1).

⑥ Remove grease valve (7) from rod (2).

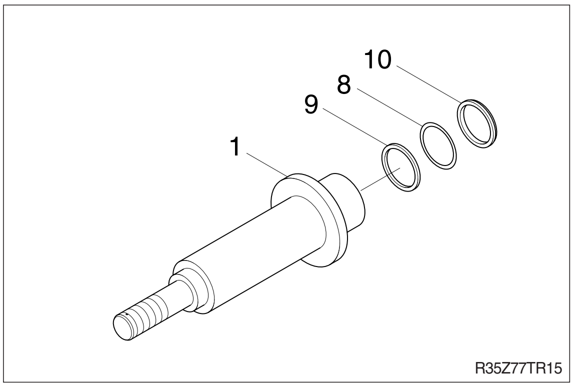


⑦ Remove packing (10), back-up ring (9) and O-ring (8) from body (1).



(3) Assembly

① Install O-ring (8), back-up ring (9), and packing (10) body (1).

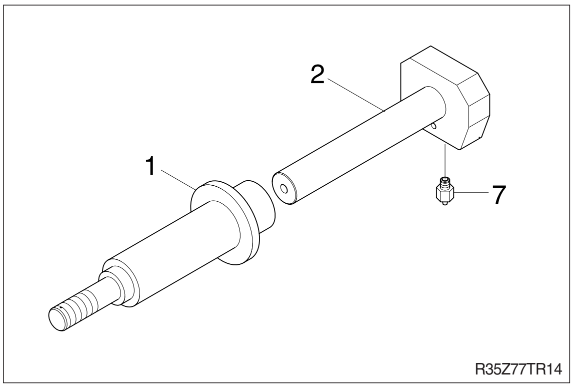


② Pour grease into body (1), then push in rod (2) by hand.
After take grease out of grease valve mounting hole, let air out.

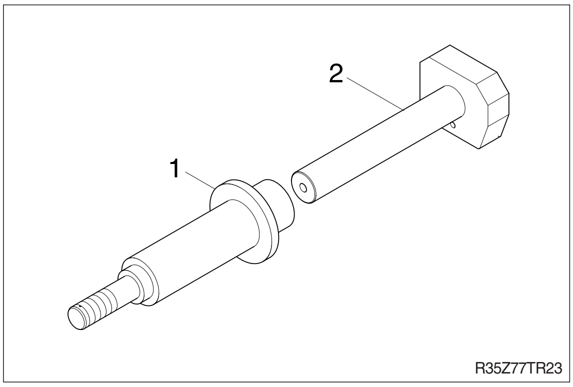
※ If air letting is not sufficient, it may be difficult to adjust the tension of crawler.

③ Fit grease valve(7) to rod(2).

· Tightening torque : 10±0.5 kgf · m
(72.4±3. 6 lbf · ft)



④ Install rod (2) to body (1).

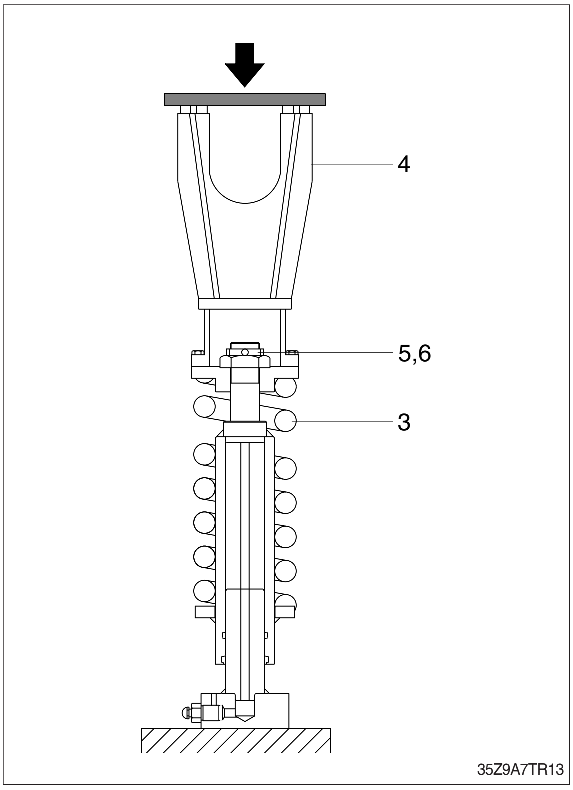


⑤ Install spring (3) and yoke (4) to body (1).

⑥ Apply pressure to spring (3) with a press and tighten nut (5).

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

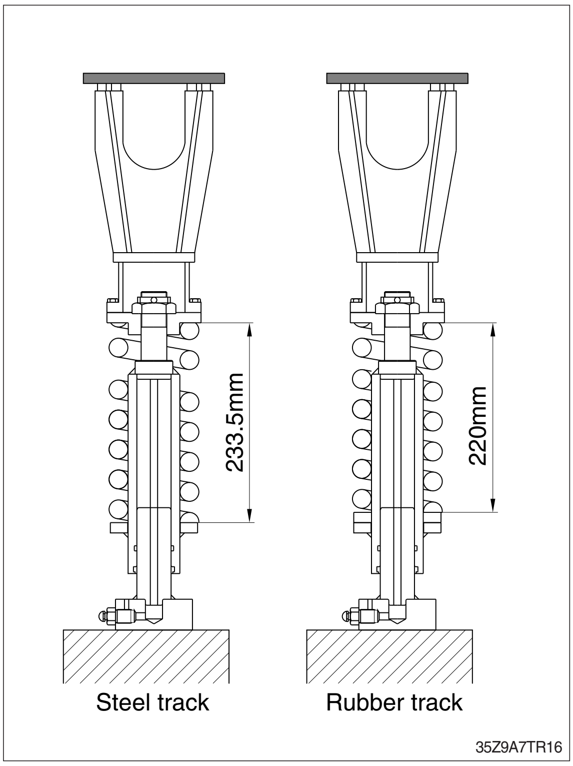
⑦ Tighten nut (5) and insert split pin (6).



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

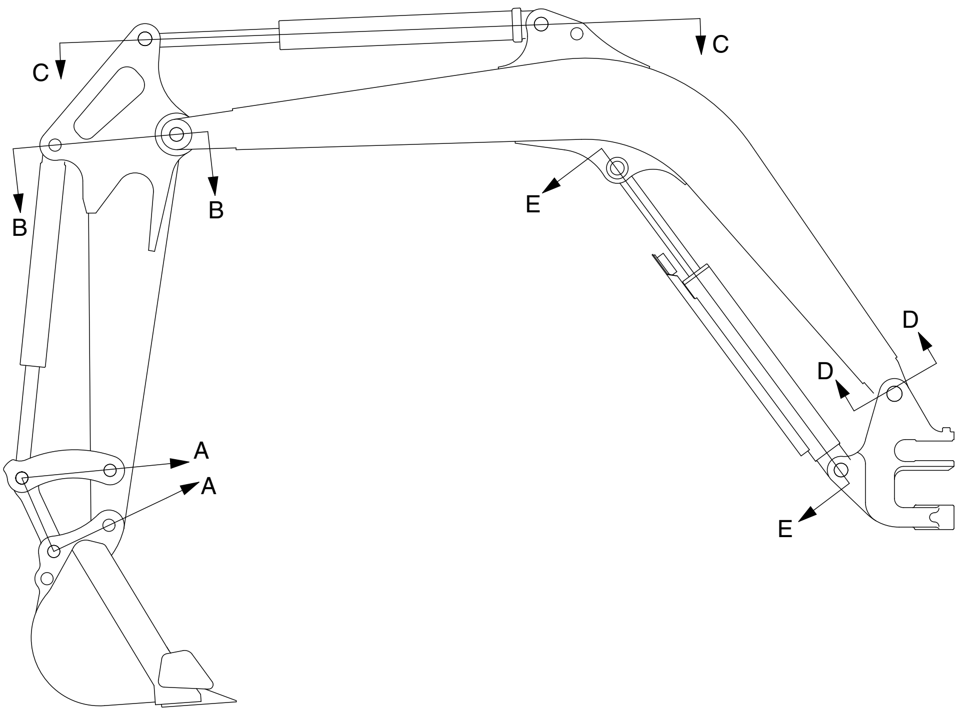
· Spring length (steel track) : 233.5 mm

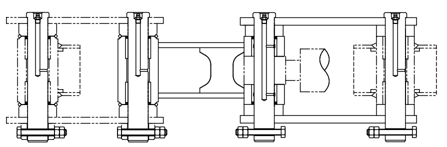
· Spring length (rubber track) : 220 mm



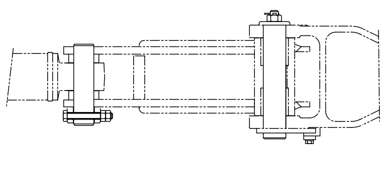
GROUP 11 WORK EQUIPMENT

1. STRUCTURE

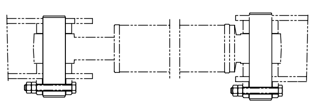




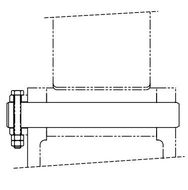
SECTION A-A



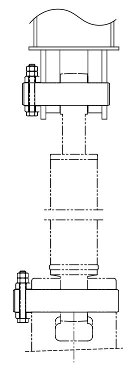
SECTION B-B



SECTION C-C



SECTION D-D



SECTION E-E

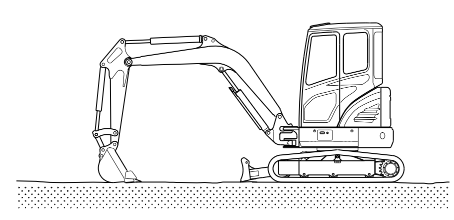
35Z9A7AT01

2. REMOVAL AND INSTALL

1) BUCKET ASSEMBLY

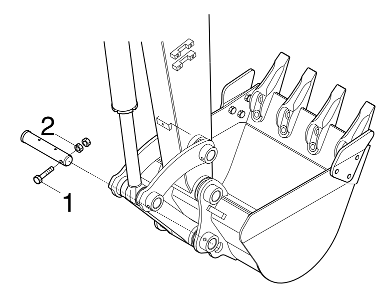
(1) Removal

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



R27Z97AT02

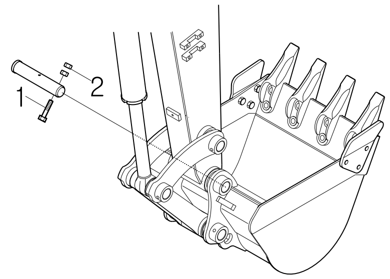
② Remove nut (1), bolt (2) and draw out the pin (4).



R35Z77AT03

③ Remove nut (1), bolt (2) and draw out the pin (3) then remove the bucket assembly (0.11 m³).

· Weight : 80 kg (180 lb)



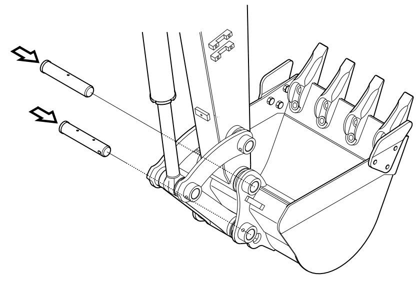
R35Z77AT04

(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 operator's manual.



R35Z77AT05

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.**

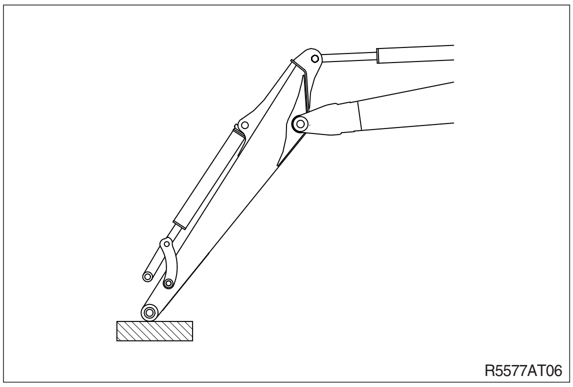
③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

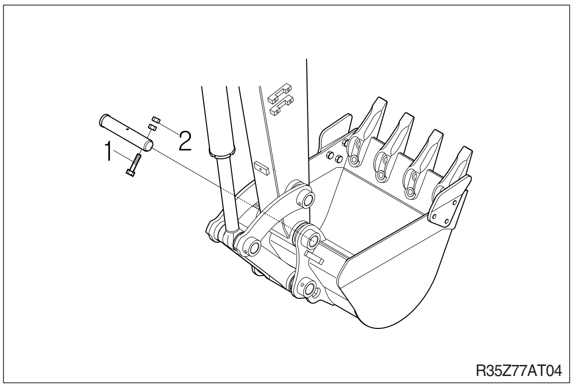
※ Tie the rod with wire to prevent it from coming out.

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

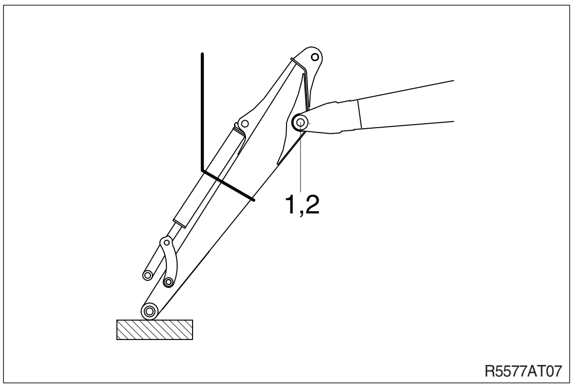
⑤ Remove bolt (1) and pull out the pin (2) then remove the arm assembly (1.3 ㎥).
・Weight : 80 ㎏ (180 ㏖)

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


R5577AT06



R35Z77AT04



R5577AT07

(2) Install

① Carry out installation in the reverse order to removal.

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

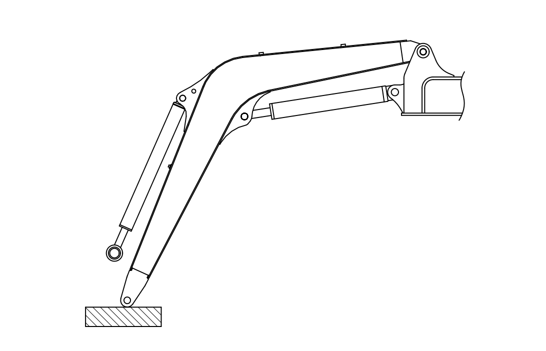
※ Bleed the air from the cylinder.

3) BOOM CYLINDER

(1) Removal

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

② Remove boom cylinder assembly from boom.
For details, see removal of arm cylinder assembly.



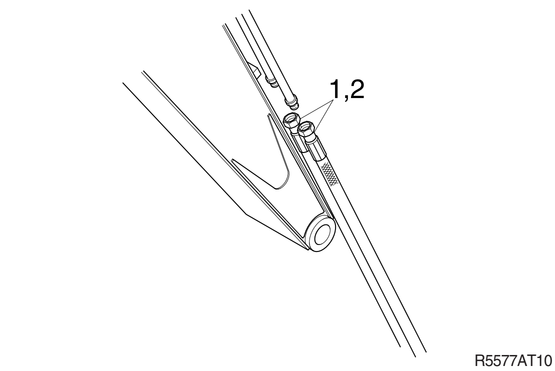
R5577AT08

③ Disconnect head lamp wiring.

④ Disconnect bucket cylinder hose (2) and arm cylinder hose (1).

※ When the hose are disconnected, oil may spurt out.

⑤ Sling boom assembly (3).

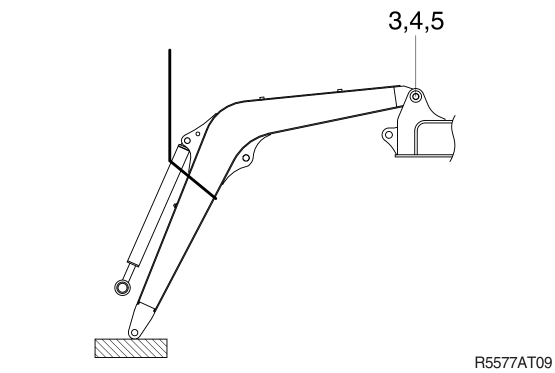


R5577AT10

⑥ Remove bolt (3), nut (4) and pull out the pin (5) then remove boom assembly (2.5 m).

- Weight : 140 kg (310 lb)

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



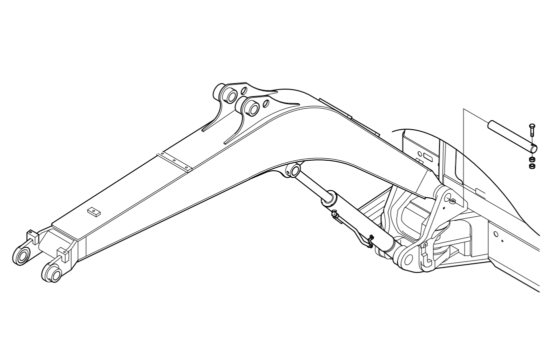
R5577AT09

(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.



R35Z77AT06

SECTION 8 COMPONENT MOUNTING TORQUE

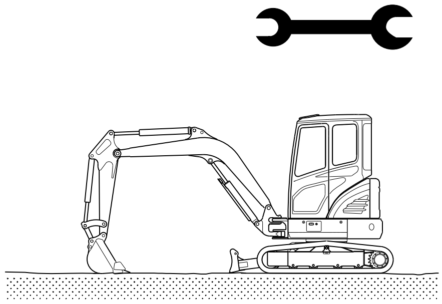
SECTION 8 COMPONENT MOUNTING TORQUE

GROUP 1 INTRODUCTION GUIDE

1. This section shows bolt specifications and standard torque values needed when mounting components to the machine.
2. Use genuine Hyundai spare parts.
   We expressly point out that Hyundai will not accept any responsibility for defects resulted from non-genuine parts.
   In such cases Hyundai cannot assume liability for any damage.

※ Only metric fasteners can be used and incorrect fasteners may result in machine damage or malfunction.

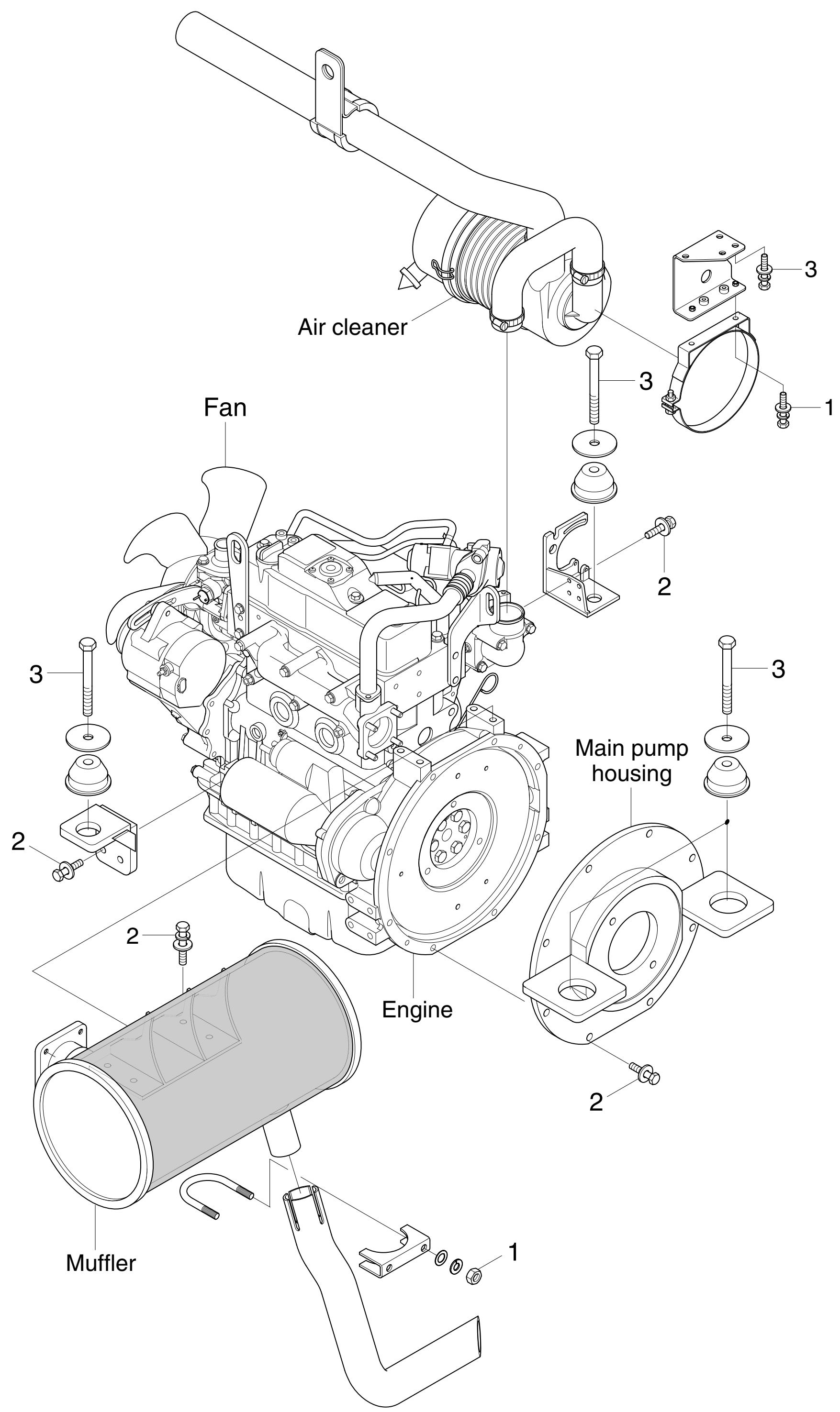
※ Before installation, clean all the components with a non-corrosive cleaner. Bolts and threads must not be worn or damaged.



R35Z78CM20

GROUP 2 ENGINE SYSTEM

1. ENGINE AND ACCESSORIES MOUNTING



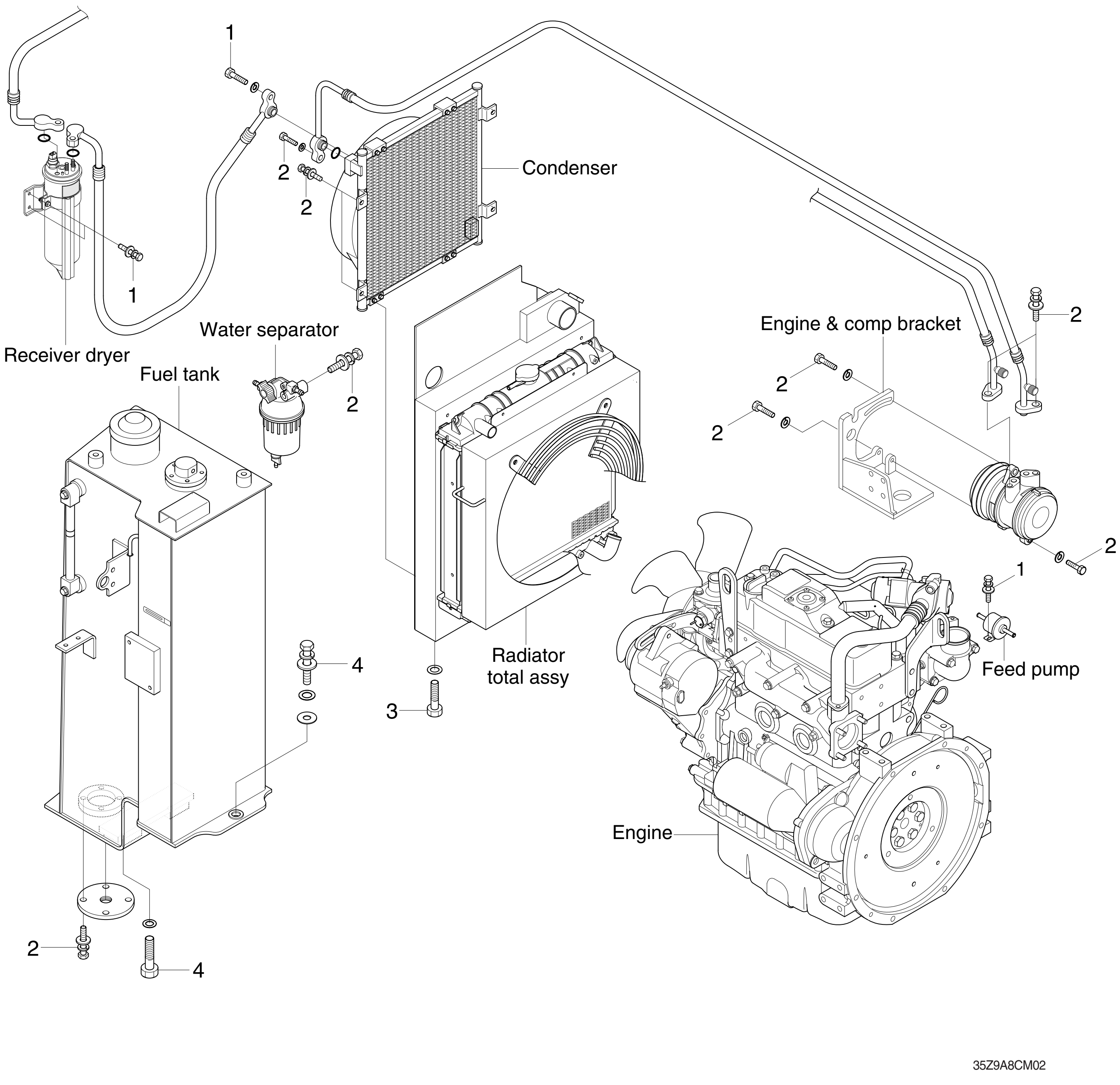
35Z9A8CM01

· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	2.5±0.5	18.1±3.6
2	M10×1.5	6.9±1.4	50±10.0

Item	Size	kgf · m	lbf · ft
3	M 12×1.75	12.8±3.0	93±22.0

2. COOLING SYSTEM AND FUEL TANK MOUNTING



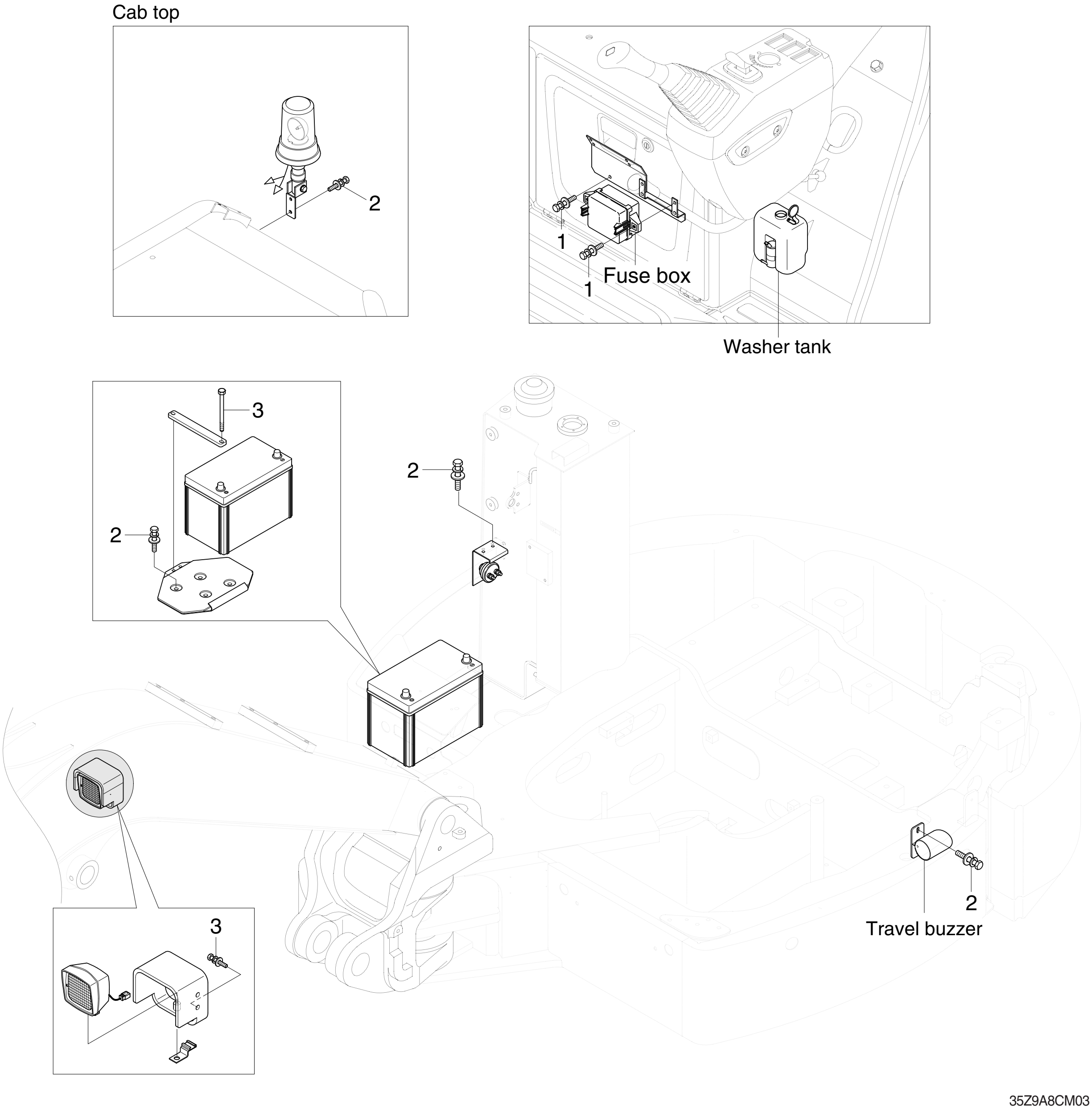
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6 × 1.0	1.05 ± 0.2	7.6 ± 1.45
2	M 8 × 1.25	2.5 ± 0.5	18.1 ± 3.6

Item	Size	kgf · m	lbf · ft
3	M 10 × 1.5	6.9 ± 1.4	50 ± 10.0
4	M 12 × 1.75	12.8 ± 3.0	93 ± 22.0

GROUP 3 ELECTRIC SYSTEM

1. ELECTRIC COMPONENTS MOUNTING 1



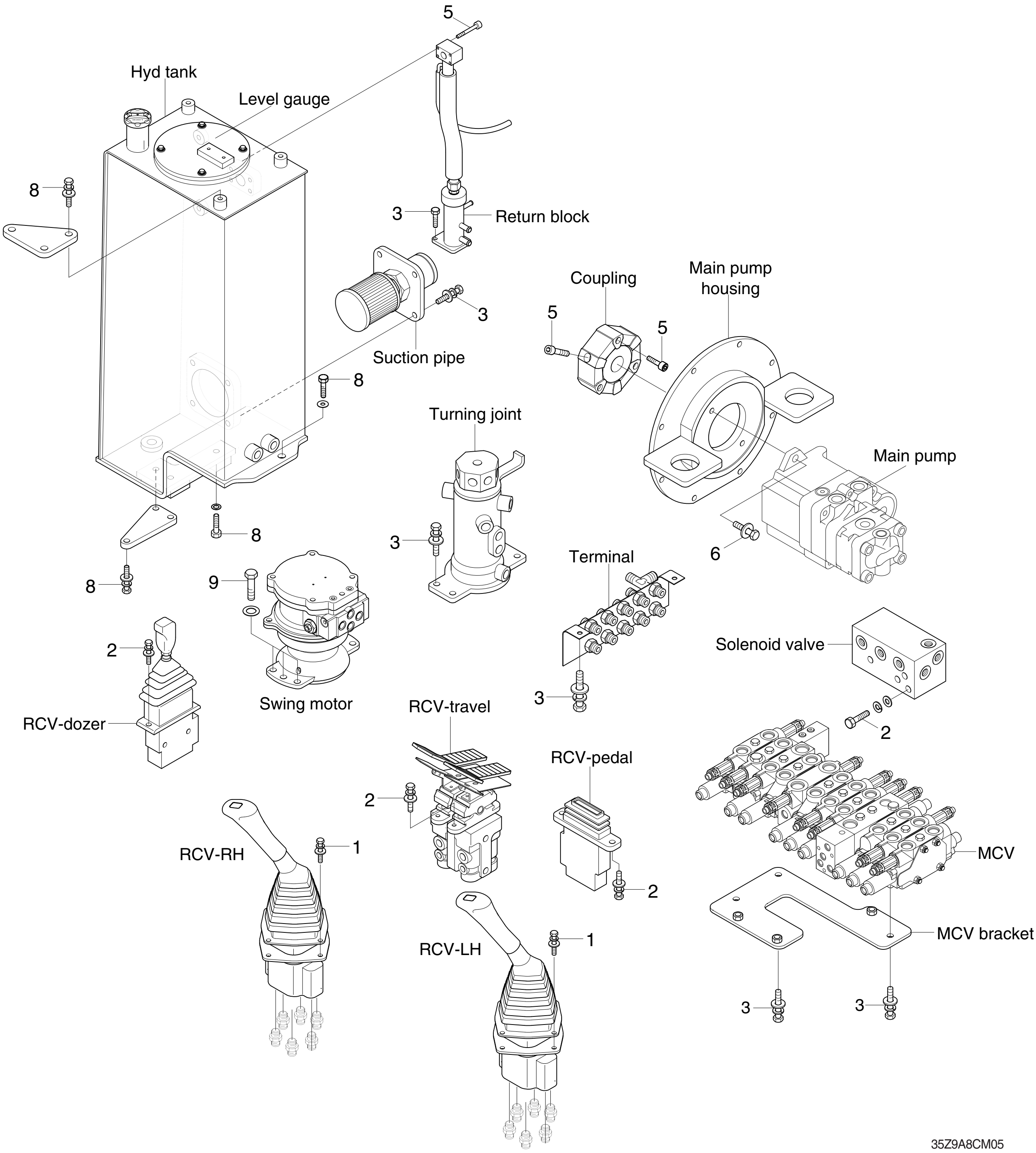
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6

Item	Size	kgf · m	lbf · ft
3	M10×1.5	6.9±1.4	49.9±10.1

GROUP 4 HYDRAULIC SYSTEM

1. HYDRAULIC COMPONENTS MOUNTING 1

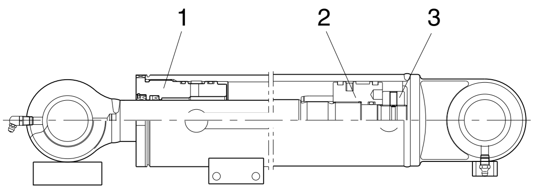


· Tightening torque

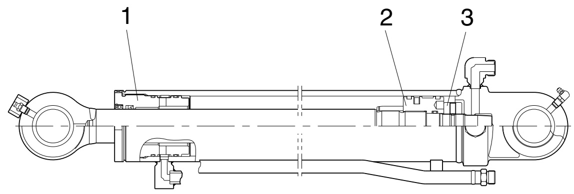
Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M10×1.5	6.9±1.4	49.9±10.1
5	M10×1.5	8.27±1.7	59.8±12.3

Item	Size	kgf · m	lbf · ft
6	M12×1.75	9.5±1.9	69±14.0
8	M12×1.75	12.8±3.0	93±22.0
9	M14×2.0	19.6±2.9	142±21.0

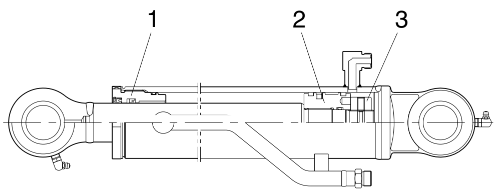
2. HYDRAULIC COMPONENTS MOUNTING 2



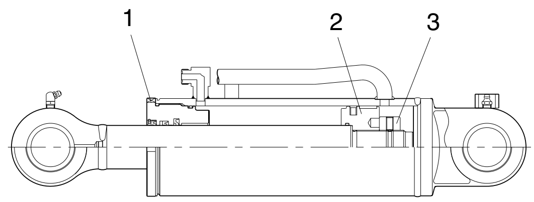
Boom cylinder



Arm cylinder

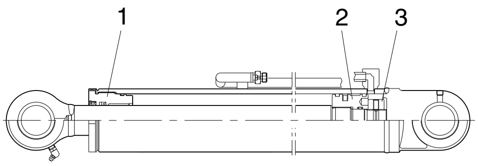


Bucket cylinder



Dozer cylinder

R35Z98CM07



Boom swing cylinder

· Tightening torque

1) Gland

Item	Size	kgf · m	lbf · ft
Boom cylinder	M90×2	68±6.8	492±49
Arm cylinder	M85×2	64±6.4	463±46
Bucket cylinder	M75×2	56±5.6	405±41
Dozer cylinder	M100×2	75±7.5	542±54
Boom swing cylinder	M85×2	64±6.4	463±46

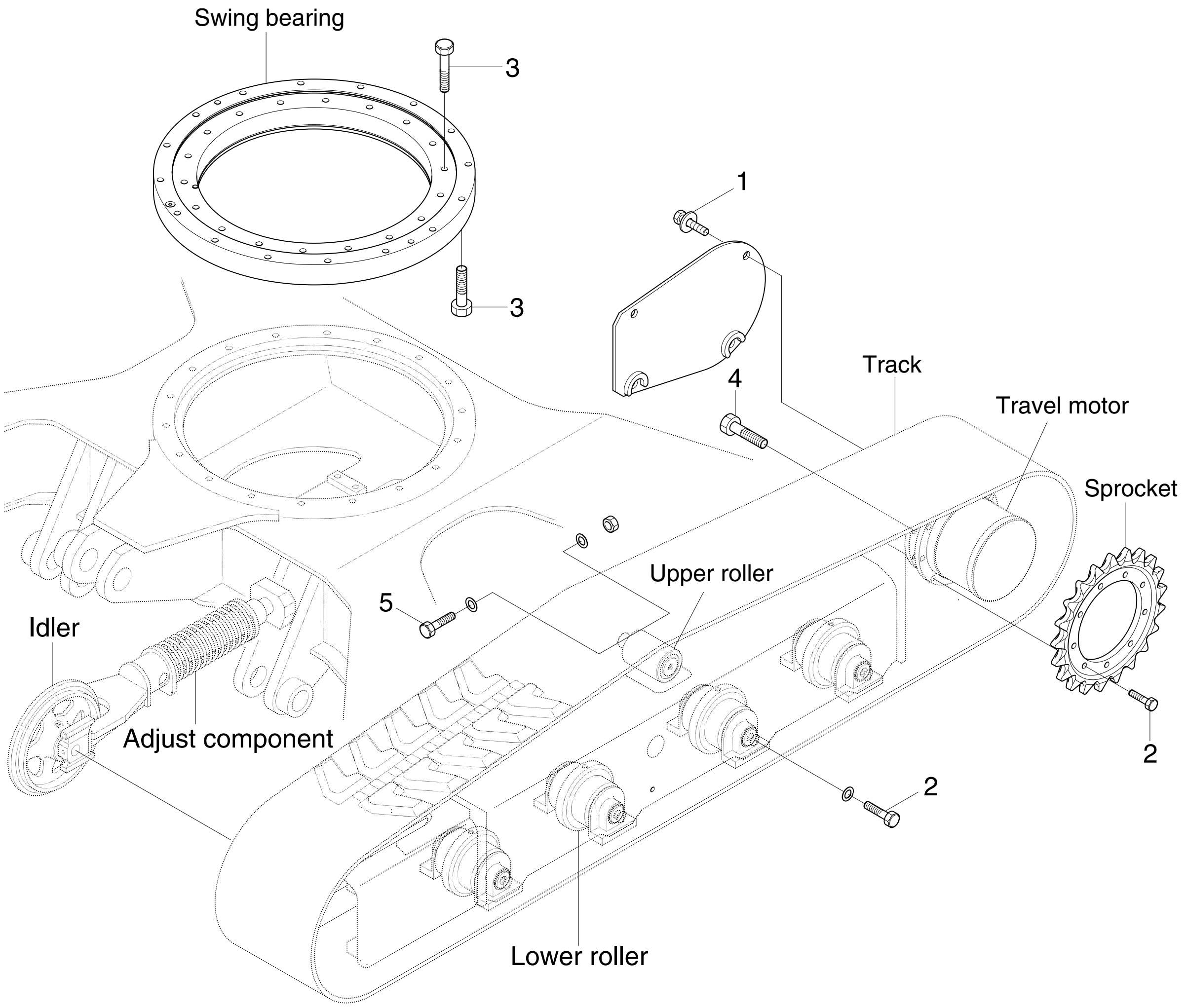
2) Piston

Item	Size	kgf · m	lbf · ft
Boom cylinder	M40×2	100±10	723±72
Arm cylinder	M40×2	100±10	723±72
Bucket cylinder	M33×2	83±8	600±60
Dozer cylinder	M39×2	98±9.8	709±71
Boom swing cylinder	M40×2	100±10	723±72

3) Piston nut

Item	Size	kgf · m	lbf · ft
Boom cylinder	M33×2	82±8	593±59
Arm cylinder	M33×2	82±8	593±59
Bucket cylinder	M29×2	73±7	528±53
Dozer cylinder	M39×2	150±15	1085±109
Boom swing cylinder	M33×2	93±9	673±67

GROUP 5 UNDERCARRIAGE



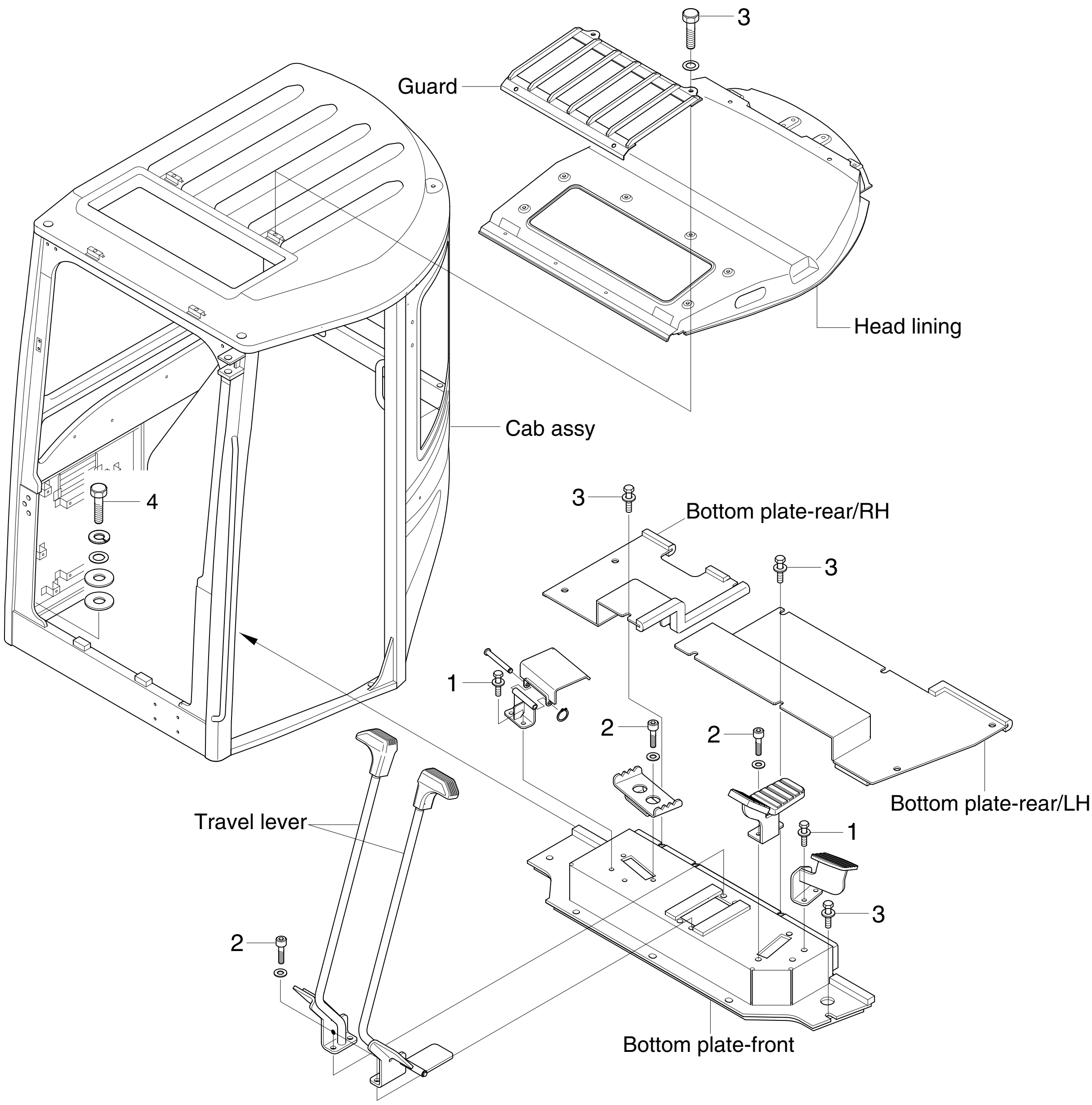
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M10×1.5	6.9±1.4	50±10.1
2	M12×1.75	12.3±1.2	89±8.7
3	M12×1.75	13.3±2.0	96.2±14.5

Item	Size	kgf · m	lbf · ft
4	M12×1.75	13.8±1.0	100±7.2
5	M18×2.0	41.3±4.0	299±28.9

GROUP 6 STRUCTURE

1. CANOPY AND ACCESSORIES MOUNTING



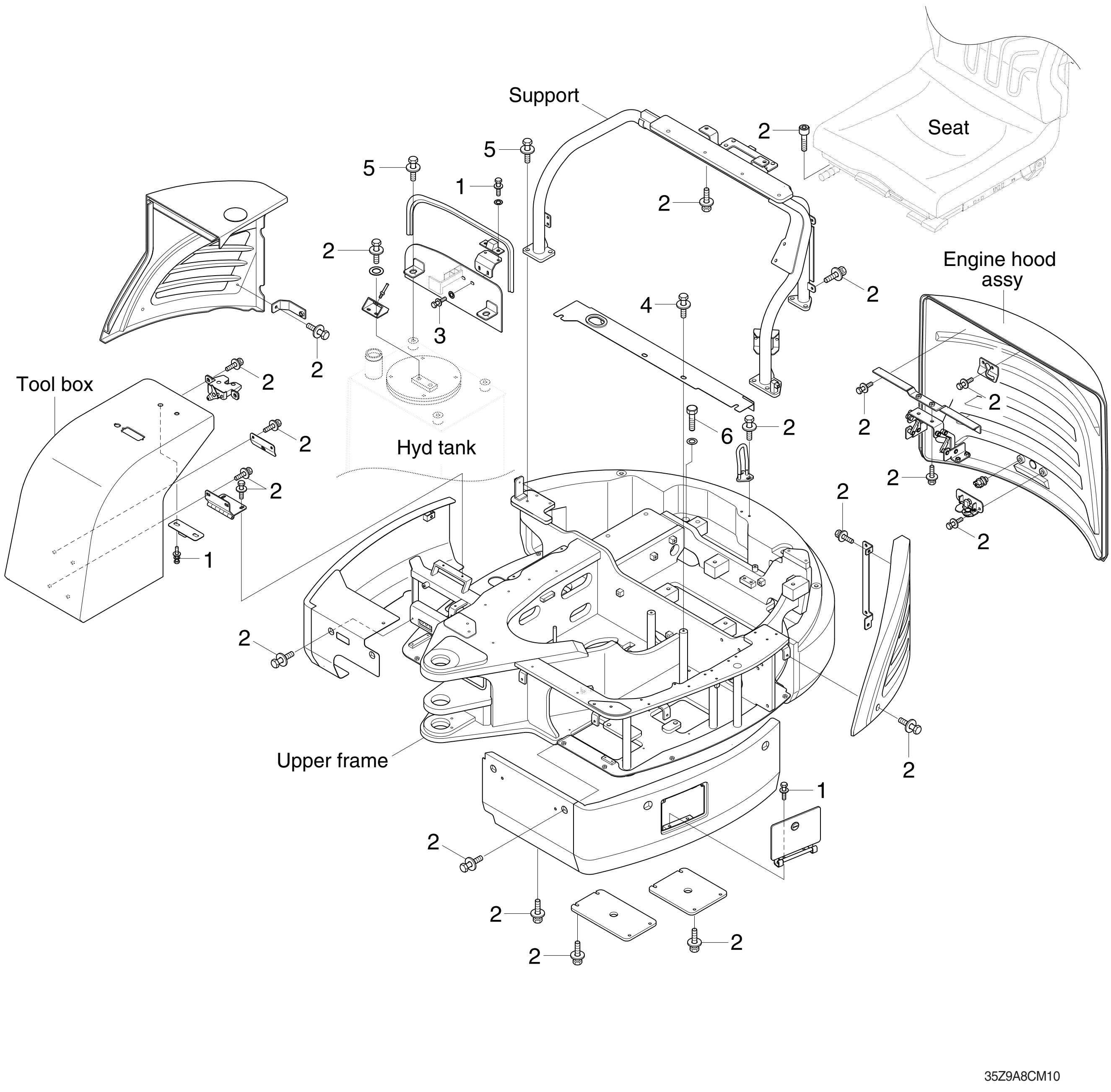
35Z9A8CM09

· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8 × 1.25	2.5 ± 0.5	18.1 ± 3.6
2	M 8 × 1.25	4.05 ± 0.8	29.3 ± 5.8

Item	Size	kgf · m	lbf · ft
3	M 10 × 1.5	6.9 ± 1.4	50 ± 10
4	M 12 × 1.75	12.8 ± 3.0	92.6 ± 21.7

2. COWLING MOUNTING

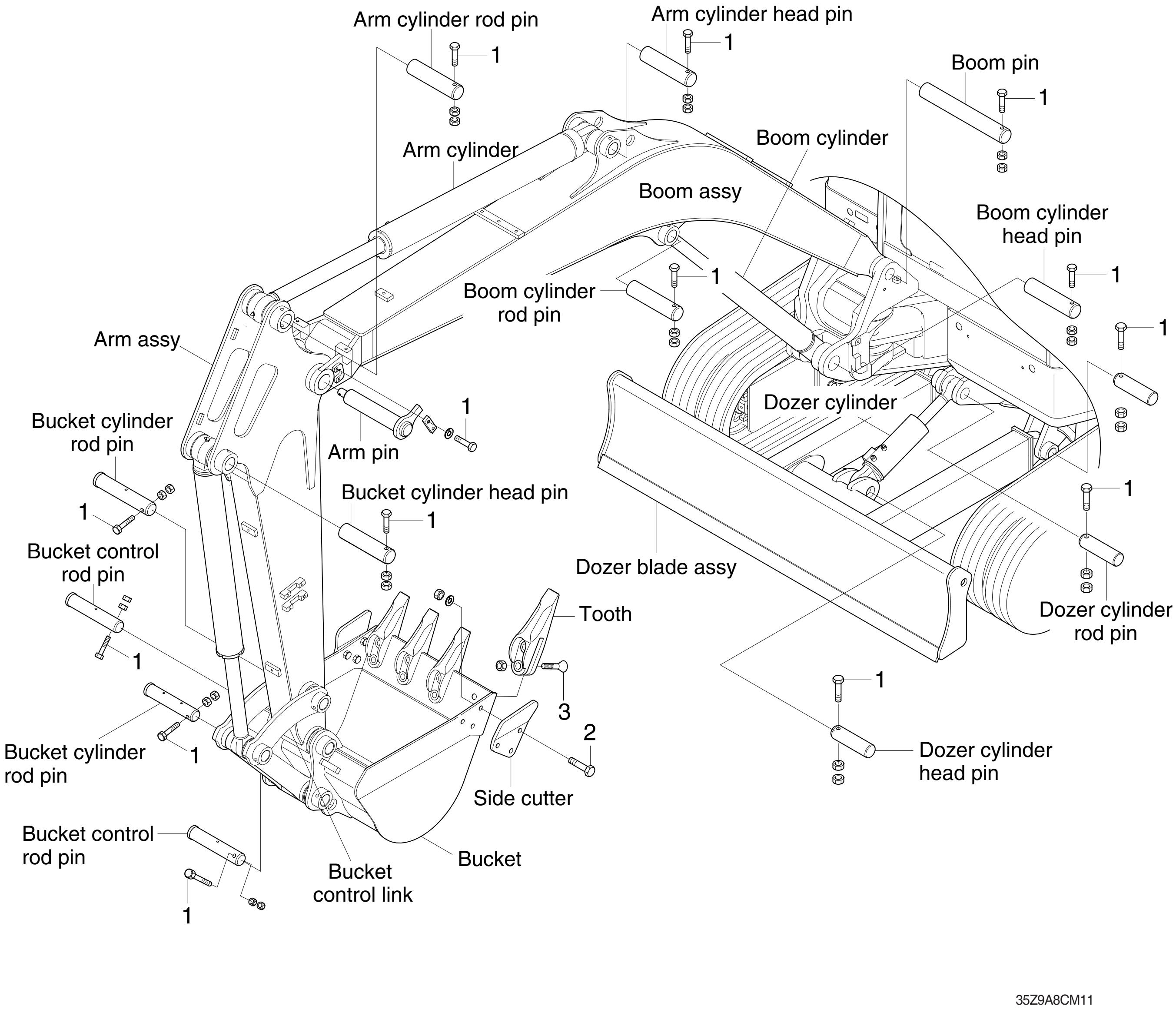


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M 8×1.25	3.43±0.7	24.8±5.1

Item	Size	kgf · m	lbf · ft
4	M10×1.25	8.27±1.7	59.8±12.3
5	M12×1.75	12.8±3.0	93±22.0
6	M20×2.5	57.9±8.7	419±62.9

GROUP 7 WORK EQUIPMENT



· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M12×1.75	12.8±3.0	92.6±21.7
2	M16×2.0	29.7±4.5	215±32.5

Item	Size	kgf · m	lbf · ft
3	M16×1.5	31.3±4.7	226±34