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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 ┐ Added pages
   10 - 4 - 2 ┘
   10 - 5

Revised edition mark (①②③…)

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

Revisions

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

Symbols

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

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

3. CONVERSION TABLE

Method of using the Conversion Table

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

Example

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

   Convert 55mm into inches.

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

   (2) Locate the number 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

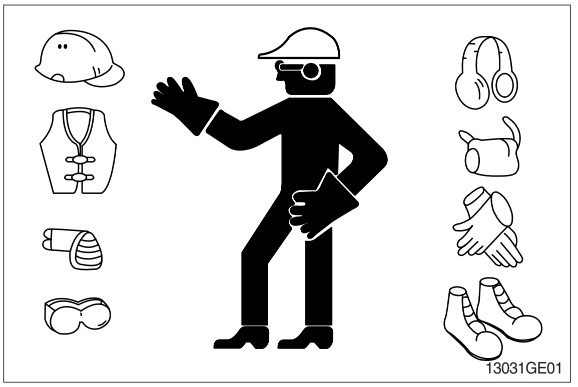
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

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

WEAR PROTECTIVE CLOTHING

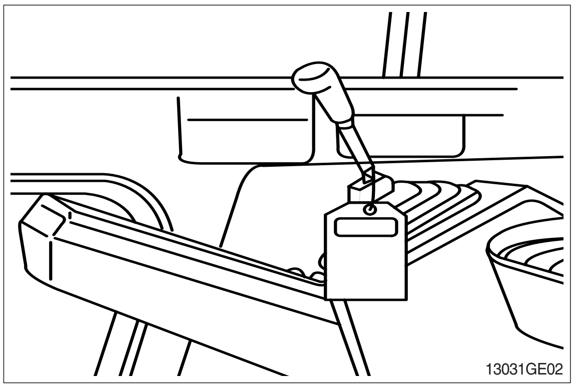
Wear close fitting clothing and safety equipment appropriate to the job.



13031GE01

WARN OTHERS OF SERVICE WORK

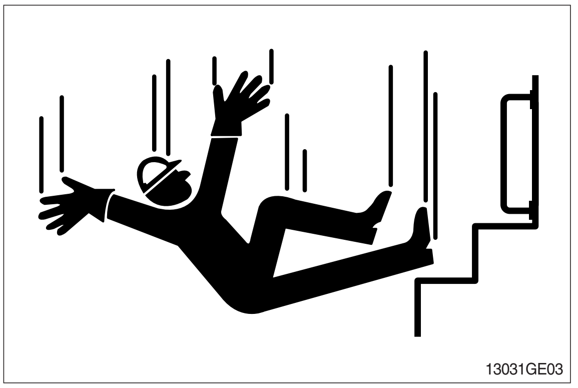
Unexpected machine movement can cause serious injury.
Before performing any work on the excavator, attach a 「**Do Not Operate**」 tag on the right side control lever.



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.



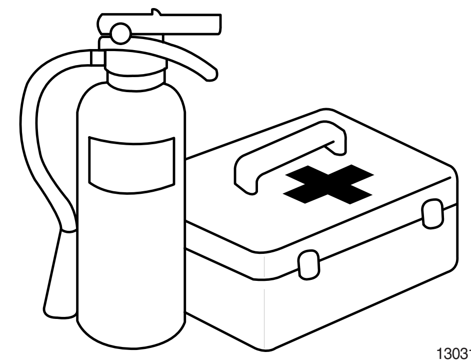
13031GE03

PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

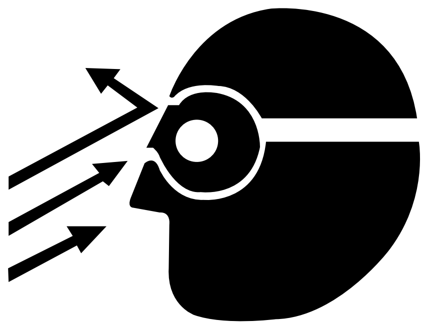
Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



13031GE04

PROTECT AGAINST FLYING DEBRIS

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

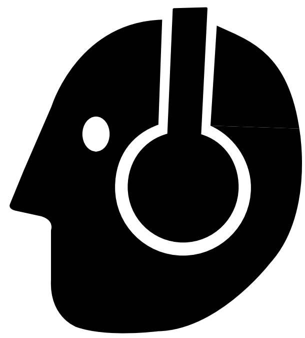


13031GE05

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.

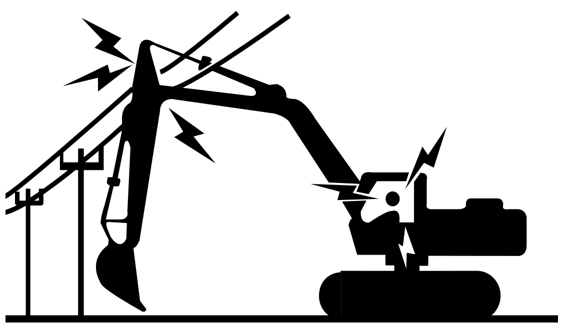


13031GE06

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.

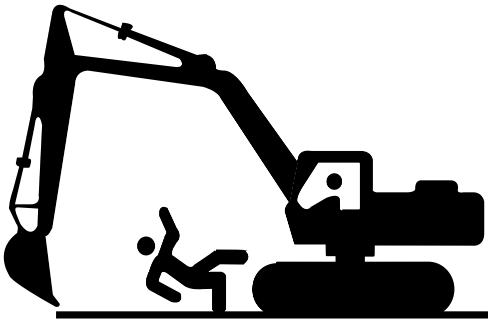


13031GE07

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.



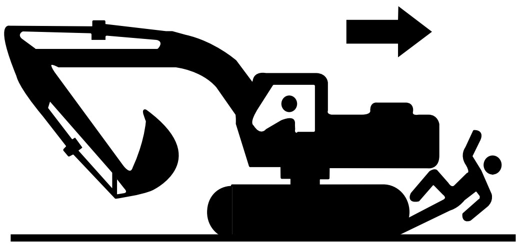
13031GE08

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.

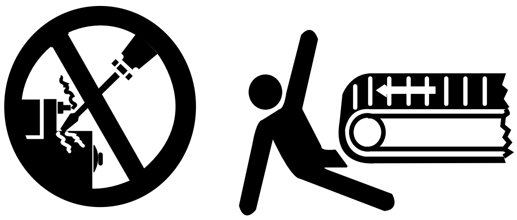


13031GE09

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

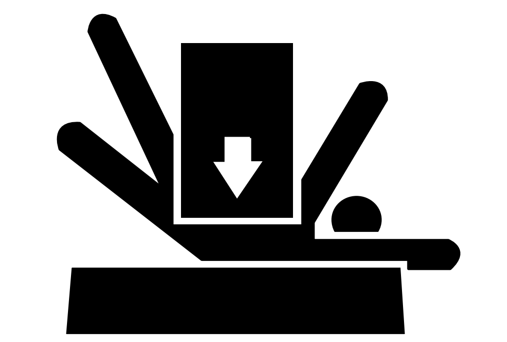
Before working on the machine:

- 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.

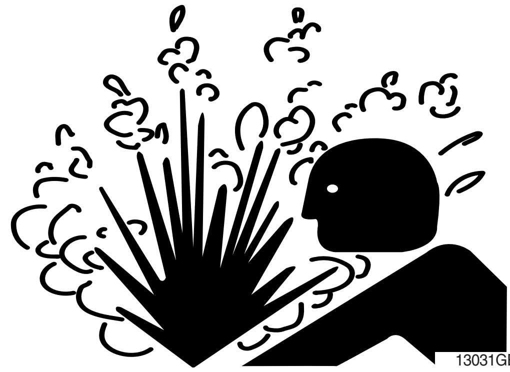


13031GE10

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.

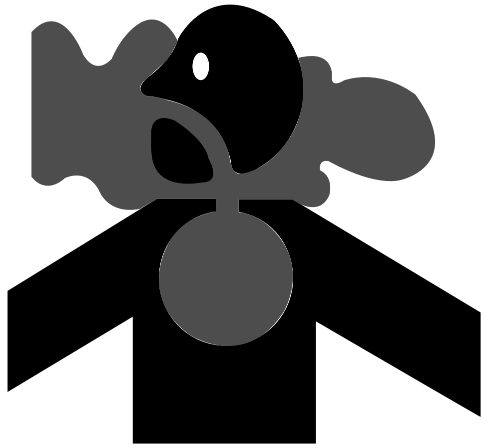
Do not store oily rags; They can ignite and burn spontaneously.

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

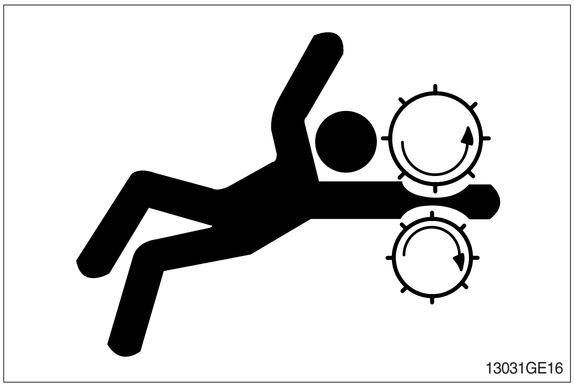
Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

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.

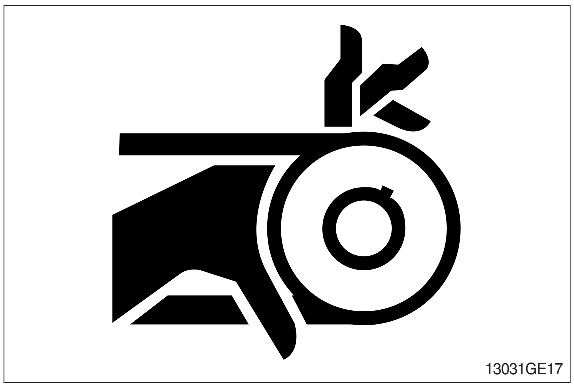
Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

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



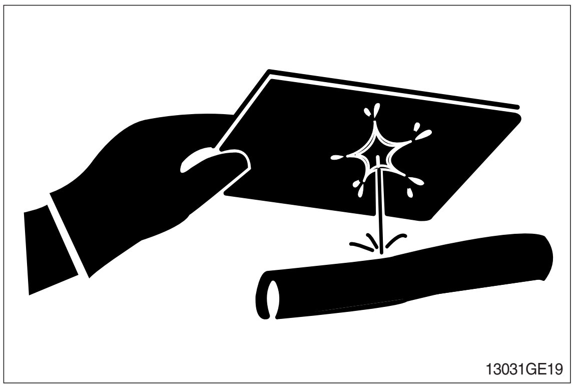
AVOID HIGH PRESSURE FLUIDS

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

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

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

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



AVOID HEATING NEAR PRESSURIZED FLUID LINES

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

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

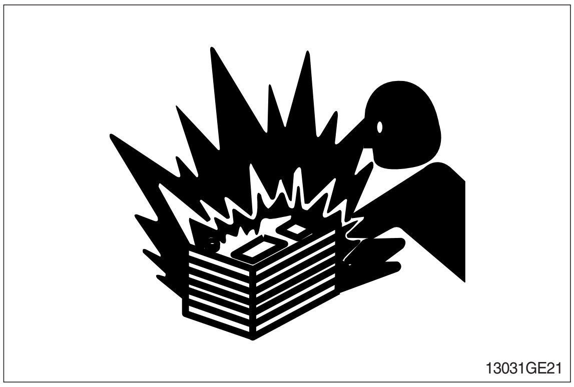
13031GE20

PREVENT BATTERY EXPLOSIONS

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

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

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



13031GE21

PREVENT ACID BURNS

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

Avoid the hazard by:

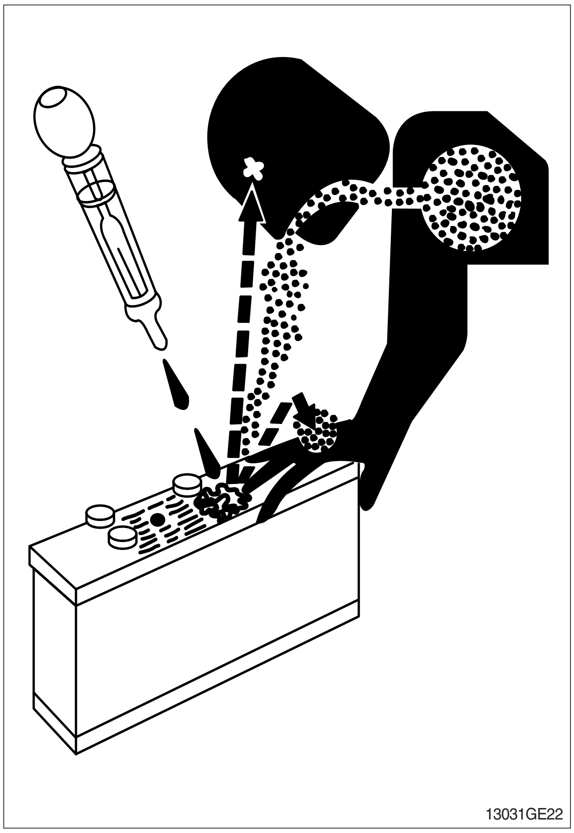
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling of dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

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

If acid is swallowed:

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



13031GE22

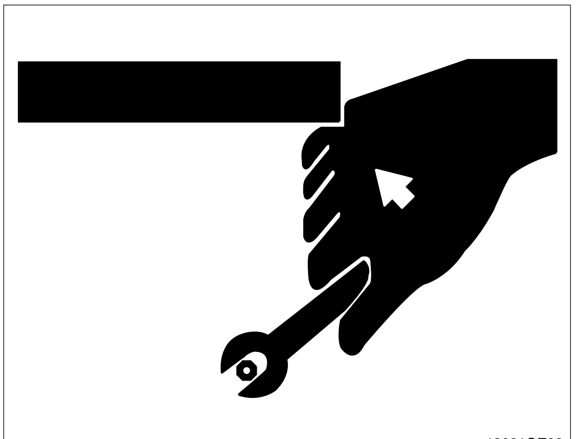
USE TOOLS PROPERLY

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

Use power tools only to loosen threaded tools and fasteners.

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

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



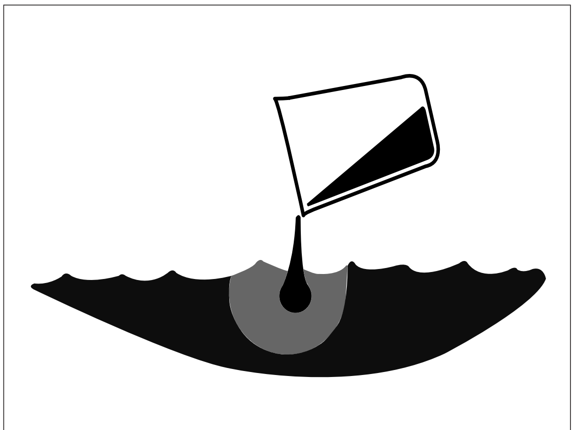
13031GE23

DISPOSE OF FLUIDS PROPERLY

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

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

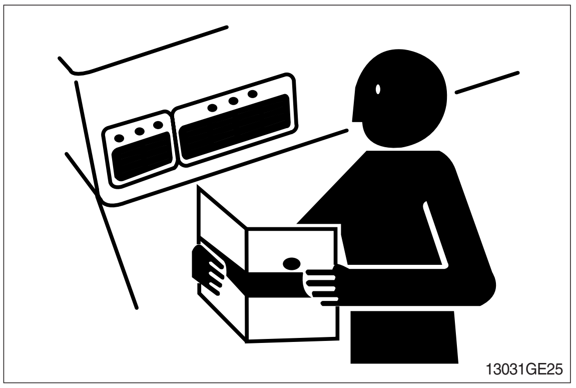
DO NOT pour oil into the ground, down a drain, or into a stream, pond, or lake. Observe relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters, batteries, and other harmful waste.



13031GE24

REPLACE SAFETY SIGNS

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



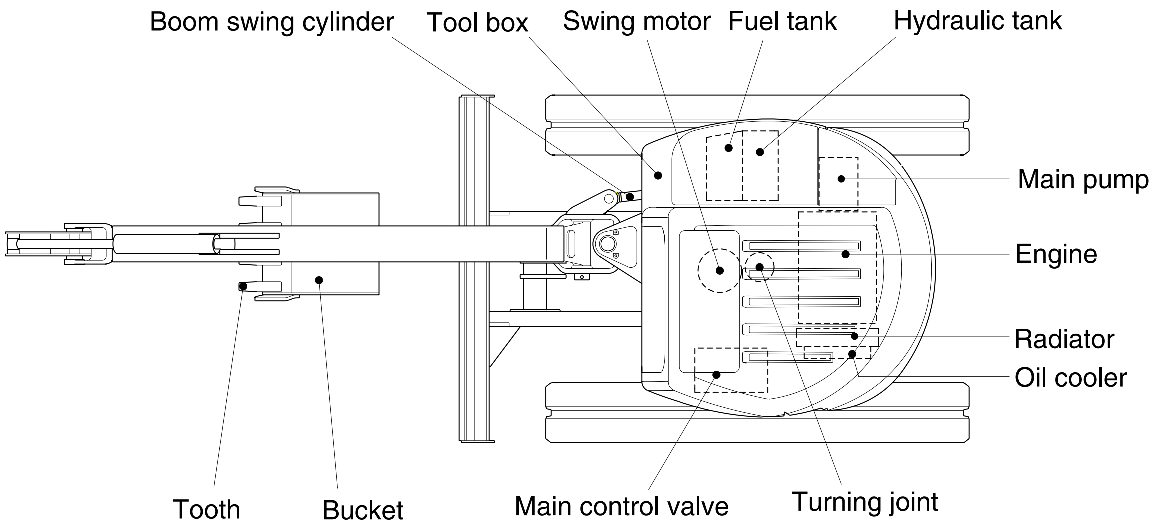
13031GE25

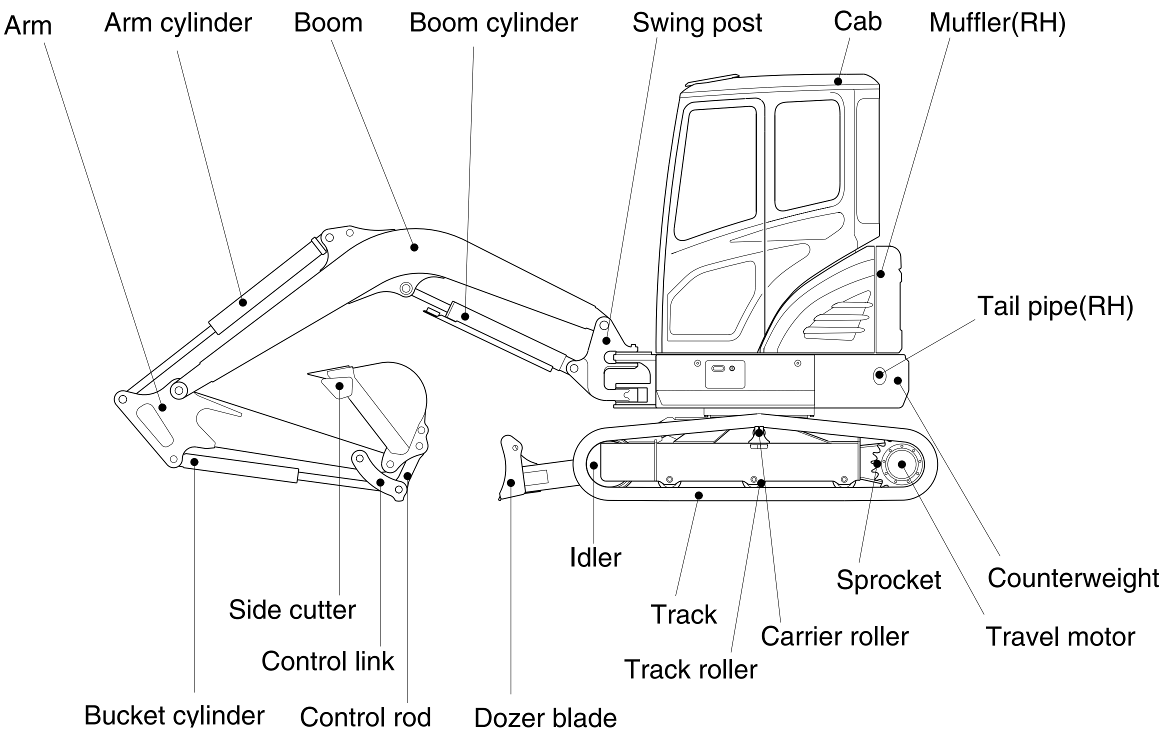
LIVE WITH SAFETY

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

GROUP 2 SPECIFICATIONS

1. MAJOR COMPONENT

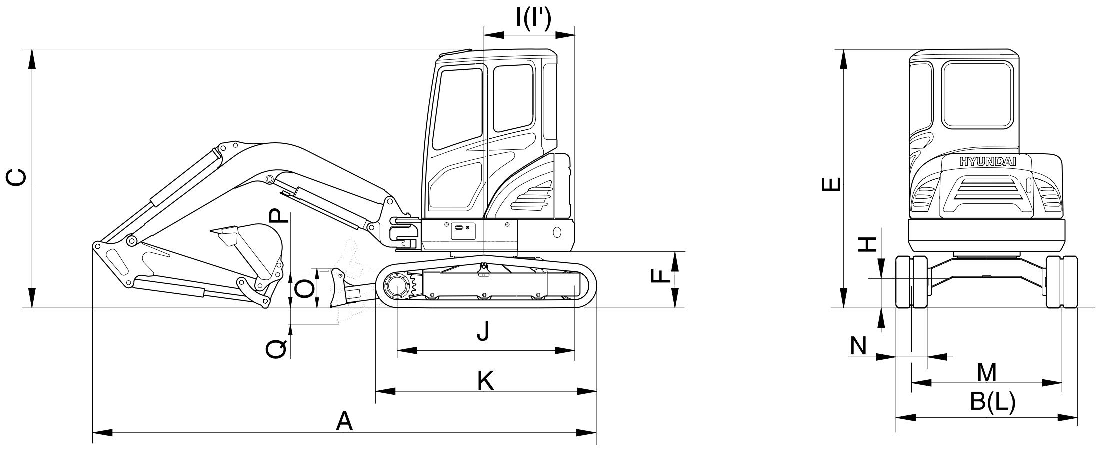




R25Z9AK2SP01

2. SPECIFICATIONS

1) 1.945 m (6' 5") MONO BOOM, 1.12 m (3' 8") ARM, WITH BOOM SWING POST

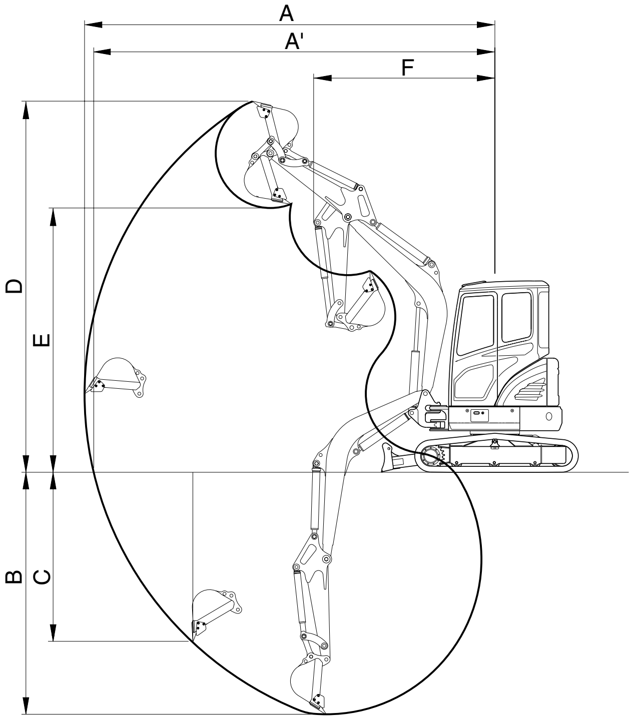


R25Z9AK2SP02

Description		Unit	Specification
Operating weight (cabin / canopy)		kg (lb)	2580 (5690) / 2430 (5360)
Bucket capacity (SAE heaped), standard		m^3 (yd^3)	0.07 (0.09)
Overall length	A	mm (ft-in)	4030 (13' 3")
Overall width, with 250 mm shoe	B		1500 (4' 11")
Overall height	C		2500 (8' 2")
Overall height of cab	E		2500 (8' 2")
Ground clearance of counterweight	F		510 (1' 8")
Minimum ground clearance	H		290 (0' 11")
Rear-end distance	I		775 (2' 7")
Rear-end swing radius	I'		775 (2' 7")
Distance between tumblers	J		1490 (4' 11")
Undercarriage length	K		1910 (6' 3")
Undercarriage width	L		1500 (4' 11")
Track gauge	M		1250 (4' 1")
Track shoe width, standard	N		250 (9.8")
Height of blade	O		300 (1' 0")
Ground clearance of blade up	P		330 (1' 1")
Depth of blade down	Q		380 (1' 3")
Travel speed (low/high)		km/hr (mph)	2.4/4.3 (1.5/2.7)
Swing speed		rpm	9.1
Gradeability		Degree (%)	30 (58)
Ground pressure 250 mm rubber shoe (cab / canopy)		kgf/cm^2 (psi)	0.32 (4.6) / 0.3 (4.34)

3. WORKING RANGE

1) 1.945 m (6' 5") MONO BOOM WITH BOOM SWING POST



R27Z92SP03

Description		1.12 m (3' 8") Arm
Max digging reach	A	4480 mm (14' 8")
Max digging reach on ground	A'	4340 mm (14' 3")
Max digging depth	B	2420 mm (7' 11")
Max vertical wall digging depth	C	1460 mm (4' 9")
Max digging height	D	4150 mm (13' 7")
Max dumping height	E	2930 mm (9' 7")
Min swing radius	F	1980 mm (6' 6")
Boom swing radius (left/right)		75°/50°
Bucket digging force	SAE	19.2 kN
		1960 kgf
		4320 lbf
	ISO	21.1 kN
		2150 kgf
		4740 lbf
Arm crowd force	SAE	14.2 kN
		1450 kgf
		3200 lbf
	ISO	14.6 kN
		1490 kgf
		3280 lbf

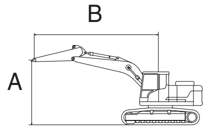
4. WEIGHT

Item	kg	lb
Upperstructure assembly	979	2158
Main frame weld assembly	305	672
Engine assembly	124	273
Main pump assembly	19	42
Main control valve assembly	25	55
Swing motor assembly	34	75
Hydraulic oil tank assembly	50	110
Fuel tank assembly	30	70
Boom swing post	65	143
Counterweight	117	258
Cab assembly	210	460
Lower chassis assembly	828	1825
Track frame weld assembly	220	485
Swing bearing	47	100
Travel motor assembly	36	80
Turning joint	11	24
Track recoil spring	16	35
Idler	20	44
Carrier roller	3	7
Track roller	10	22
Sprocket	7	15
Rubber track (250 mm)	117	258
Dozer blade assembly	92	200
Front attachment assembly (1.945 m boom, 1.12 m arm, 0.07 m^3 SAE heaped bucket)	318	701
1.945 m boom assembly	80	176
1.12 m arm assembly	45	99
0.07 m^3 SAE heaped bucket	57	126
Boom cylinder assembly	26	57
Arm cylinder assembly	26	57
Bucket cylinder assembly	20	44
Bucket control link assembly	20	45
Dozer cylinder assembly	21	46
Boom swing cylinder assembly	23	51

5. LIFTING CAPACITIES

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
		Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
R25Z-9AK	Canopy	1945	1120	117	250	-	Down	-	-	-

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



Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.0 m (3.3 ft)		1.5 m (4.9 ft)		2.0 m (6.6 ft)		2.5 m (8.2 ft)		3.0 m (9.8 ft)		3.5 m (11.5 ft)		Capacity		Reach
																m (ft)
3.0 m	kg									*700	390			*720	370	3.08
(9.8 ft)	lb									*1540	860			*1590	820	(10.1)
2.5 m	kg									*680	390			*720	310	3.45
(8.2 ft)	lb									*1500	860			*1590	680	(11.3)
2.0 m	kg							*780	520	*740	380	*720	300	*700	270	3.69
(6.6 ft)	lb							*1720	1150	*1630	840	*1590	660	*1540	600	(12.1)
1.5 m	kg					*1390	710	*1010	500	*850	370	*770	290	*710	250	3.82
(4.9 ft)	lb					*3060	1570	*2230	1100	*1870	820	*1700	640	*1570	550	(12.5)
1.0 m	kg							*1250	470	*970	360	*830	280	*750	240	3.86
(3.3 ft)	lb							*2760	1040	*2140	790	*1830	620	*1650	530	(12.7)
0.5 m	kg					*1190	630	*1420	450	*1070	350	*880	280	*790	240	3.82
(1.6 ft)	lb					*2620	1390	*3130	990	*2360	770	*1940	620	*1740	530	(12.5)
Ground	kg			*810	*810	*1640	630	*1480	450	*1120	340	*890	270	*820	250	3.69
Line	lb			*1790	*1790	*3620	1390	*3260	990	*2470	750	*1960	600	*1810	550	(12.1)
-0.5 m	kg	*1220	*1220	*1460	1060	*2020	630	*1440	440	*1090	340			*850	280	3.46
(-1.6 ft)	lb	*2690	*2690	*3220	2340	*4450	1390	*3170	970	*2400	750			*1870	620	(11.3)
-1.0 m	kg	*1820	*1820	*2280	1070	*1770	640	*1280	450	*940	340			*870	330	3.09
(-3.3 ft)	lb	*4010	*4010	*5030	2360	*3900	1410	*2820	990	*2070	750			*1920	730	(10.1)
-1.5 m	kg			*1900	1090	*1280	650	*870	460					*870	460	2.50
(-4.9 ft)	lb			*4190	2400	*2820	1430	*1920	1010					*1920	1010	(8.2)

Note 1. Lifting capacity are based on SAE J1097 and ISO 10567.
2. Lifting capacity does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The load point is a hook located on the back of the bucket.
4. *Indicates load limited by hydraulic capacity.

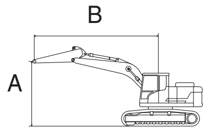
※ Lifting capacities are based upon a standard machine conditions.
Lifting capacities will vary with different work tools, ground conditions and attachments.
The difference between the weight of a work tool attachment must be subtracted.
Consult your Hyundai dealer regarding the lifting capacities for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

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
R25Z-9AK	Cabin	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		1945	1120	117	250	-	Down	-	-	-

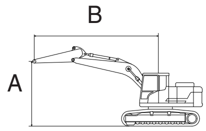
· : Rating over-front · : Rating over-side or 360 degree



Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.0 m (3.3 ft)		1.5 m (4.9 ft)		2.0 m (6.6 ft)		2.5 m (8.2 ft)		3.0 m (9.8 ft)		3.5 m (11.5 ft)		Capacity		Reach
																m (ft)
3.0 m	kg									*580	410			*610	370	3.16
(9.8 ft)	lb									*1280	900			*1340	820	(10.4)
2.5 m	kg									*580	410	*610	300	*590	300	3.52
(8.2 ft)	lb									*1280	900	*1340	660	*1300	660	(11.5)
2.0 m	kg									*650	400	*640	300	*590	260	3.75
(6.6 ft)	lb									*1430	880	*1410	660	*1300	570	(12.3)
1.5 m	kg					*1160	760	*880	520	*760	380	*690	290	*610	240	3.88
(4.9 ft)	lb					*2560	1680	*1940	1150	*1680	840	*1520	640	*1340	530	(12.7)
1.0 m	kg					*1740	700	*1140	500	*890	370	*760	290	*650	230	3.92
(3.3 ft)	lb					*3840	1540	*2510	1100	*1960	820	*1680	640	*1430	510	(12.9)
0.5 m	kg					*1630	670	*1330	470	*1000	360	*820	280	*720	230	3.88
(1.6 ft)	lb					*3590	1480	*2930	1040	*2200	790	*1810	620	*1590	510	(12.7)
Ground	kg	*830	*830	*970	*970	*1850	660	*1420	460	*1060	350	*850	270	*770	240	3.75
Line	lb	*1830	*1830	*2140	*2140	*4080	1460	*3130	1010	*2340	770	*1870	600	*1700	530	(12.3)
-0.5 m	kg	*1220	*1220	*1480	1120	*2030	660	*1410	460	*1060	340	*820	270	*810	270	3.52
(-1.6 ft)	lb	*2690	*2690	*3260	2470	*4480	1460	*3110	1010	*2340	750	*1810	600	*1790	600	(11.6)
-1.0 m	kg	*1690	*1690	*2110	1130	*1810	670	*1290	460	*960	350			*860	320	3.17
(-3.3 ft)	lb	*3730	*3730	*4650	2490	*3990	1480	*2840	1010	*2120	770			*1900	710	(10.4)
-1.5 m	kg	*2260	*2260	*2180	1160	*1410	680	*990	470					*920	440	2.60
(-4.9 ft)	lb	*4980	*4980	*4810	2560	*3110	1500	*2180	1040					*2030	970	(8.5)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
R25Z-9AK	Canopy	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		1945	1120	117	250	-	Up	-	-	-

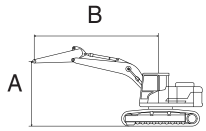
· : Rating over-front · : Rating over-side or 360 degree



Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.0 m (3.3 ft)		1.5 m (4.9 ft)		2.0 m (6.6 ft)		2.5 m (8.2 ft)		3.0 m (9.8 ft)		3.5 m (11.5 ft)		Capacity		Reach
																m (ft)
3.0 m	kg													520	430	2.88
(9.8 ft)	lb													1150	950	(9.5)
2.5 m	kg									490	410			410	340	3.32
(8.2 ft)	lb									1080	900			900	750	(10.9)
2.0 m	kg									480	410	370	310	350	300	3.61
(6.6 ft)	lb									1060	900	820	680	770	660	(11.8)
1.5 m	kg					920	750	630	530	470	390	370	310	320	270	3.78
(4.9 ft)	lb					2030	1650	1390	1170	1040	860	820	680	710	600	(12.4)
1.0 m	kg							610	500	460	380	360	300	310	260	3.86
(3.3 ft)	lb							1340	1100	1010	840	790	660	680	570	(12.7)
0.5 m	kg							580	480	440	370	350	300	310	260	3.85
(1.6 ft)	lb							1280	1060	970	820	770	660	680	570	(12.6)
Ground	kg					820	660	570	470	440	360	350	290	310	260	3.75
Line	lb					1810	1460	1260	1040	970	790	770	640	680	570	(12.3)
-0.5 m	kg	*1010	*1010	*1190	1080	810	650	570	470	430	360	350	290	340	280	3.56
(-1.6 ft)	lb	*2230	*2230	*2620	2380	1790	1430	1260	1040	950	790	770	680	750	620	(11.7)
-1.0 m	kg	*1570	*1570	1420	1090	820	660	570	470	430	360			390	320	3.25
(-3.3 ft)	lb	*3460	*3460	3130	2400	1810	1460	1260	1040	950	790			860	710	(10.7)
-1.5 m	kg	*2290	*2290	1440	1110	830	670	580	480					500	410	2.77
(-4.9 ft)	lb	*5050	*5050	3170	2450	1830	1480	1280	1060					1100	900	(9.1)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
R25Z-9AK	Cabin	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		1945	1120	117	250	-	Up	-	-	-

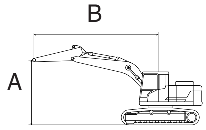
· : Rating over-front · : Rating over-side or 360 degree



Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.0 m (3.3 ft)		1.5 m (4.9 ft)		2.0 m (6.6 ft)		2.5 m (8.2 ft)		3.0 m (9.8 ft)		3.5 m (11.5 ft)		Capacity		Reach
																m (ft)
3.0 m	kg									460	380			410	350	3.16
(9.8 ft)	lb									1010	840			900	770	(10.4)
2.5 m	kg									460	380	340	280	340	280	3.52
(8.2 ft)	lb									1010	840	750	620	750	620	(11.5)
2.0 m	kg									450	370	340	280	300	250	3.75
(6.6 ft)	lb									990	820	750	620	660	550	(12.3)
1.5 m	kg					870	710	590	490	430	360	330	270	280	230	3.88
(4.9 ft)	lb					1920	1570	1300	1080	950	790	730	600	620	510	(12.7)
1.0 m	kg					810	650	560	460	420	340	320	260	260	220	3.92
(3.3 ft)	lb					1790	1430	1230	1010	930	750	710	570	570	490	(12.9)
0.5 m	kg					780	620	540	440	400	330	310	260	270	220	3.88
(1.6 ft)	lb					1720	1370	1190	970	880	730	680	570	600	490	(12.7)
Ground	kg	*830	*830	*970	*970	760	610	530	430	390	320	310	250	280	230	3.75
Line	lb	*1830	*1830	*2140	*2140	1680	1340	1170	950	860	710	680	550	620	510	(12.3)
-0.5 m	kg	*1220	*1220	1350	1020	760	610	520	420	390	320	310	250	300	250	3.52
(-1.6 ft)	lb	*2690	*2690	2980	2250	1680	1340	1150	930	860	710	680	550	660	550	(11.6)
-1.0 m	kg	*1690	*1690	1360	1030	770	610	530	420	390	320			360	300	3.17
(-3.3 ft)	lb	*3730	*3730	3000	2270	1700	1340	1170	930	860	710			790	660	(10.4)
-1.5 m	kg	*2260	*2260	1390	1060	790	630	540	440					500	410	2.60
(-4.9 ft)	lb	*4980	*4980	3060	2340	1740	1390	1190	970					1100	900	(8.5)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
R25Z-9AK	Canopy	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		1945	1120	247	250	-	Down	-	-	-

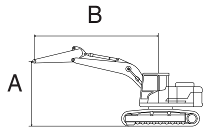
· : Rating over-front · : Rating over-side or 360 degree



Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.0 m (3.3 ft)		1.5 m (4.9 ft)		2.0 m (6.6 ft)		2.5 m (8.2 ft)		3.0 m (9.8 ft)		3.5 m (11.5 ft)		Capacity		Reach
																m (ft)
3.0 m	kg													*720	530	2.88
(9.8 ft)	lb													*1590	1170	(9.5)
2.5 m	kg									*670	500			*720	420	3.32
(8.2 ft)	lb									*1480	1100			*1590	930	(10.9)
2.0 m	kg									*710	490	*720	390	*710	370	3.61
(6.6 ft)	lb									*1570	1080	*1590	860	*1570	820	(11.8)
1.5 m	kg					*1150	920	*910	640	*800	480	*750	380	*710	340	3.78
(4.9 ft)	lb					*2540	2030	*2010	1410	*1760	1060	*1650	840	*1570	750	(12.4)
1.0 m	kg							*1160	620	*920	470	*810	380	*730	320	3.86
(3.3 ft)	lb							*2560	1370	*2030	1040	*1790	840	*1610	710	(12.7)
0.5 m	kg							*1360	600	*1040	460	*860	370	*780	320	3.85
(1.6 ft)	lb							*3000	1320	*2290	1010	*1900	820	*1720	710	(12.6)
Ground	kg					*1430	820	*1470	590	*1110	450	*890	360	*810	330	3.75
Line	lb					*3150	1810	*3240	1300	*2450	990	*1960	790	*1790	730	(12.3)
-0.5 m	kg	*1010	*1060	*1190	*1190	*2080	820	*1470	580	*1110	450	*870	360	*840	350	3.56
(-1.6 ft)	lb	*2230	*2230	*2620	*2620	*4590	1810	*3240	1280	*2450	990	*1920	790	*1850	770	(11.7)
-1.0 m	kg	*1570	*1570	*1920	1370	*1880	820	*1360	580	*1020	450			*860	400	3.25
(-3.3 ft)	lb	*3460	*3460	*4230	3020	*4140	1810	*3000	1280	*2250	990			*1900	880	(10.7)
-1.5 m	kg	*2290	*2290	*2280	1390	*1510	830	*1090	590					*880	510	2.77
(-4.9 ft)	lb	*5050	*5050	*5030	3060	*3330	1830	*2400	1300					*1940	1120	(9.1)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
R25Z-9AK	Cabin	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		1945	1120	247	250	-	Down	-	-	-

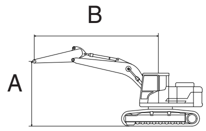
· : Rating over-front · : Rating over-side or 360 degree



Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.0 m (3.3 ft)		1.5 m (4.9 ft)		2.0 m (6.6 ft)		2.5 m (8.2 ft)		3.0 m (9.8 ft)		3.5 m (11.5 ft)		Capacity		Reach
																m (ft)
3.0 m	kg									*580	470			*610	430	3.16
(9.8 ft)	lb									*1280	1040			*1340	950	(10.4)
2.5 m	kg									*580	470	*610	360	*590	350	3.52
(8.2 ft)	lb									*1280	1040	*1340	790	*1300	770	(11.5)
2.0 m	kg									*650	460	*640	350	*590	310	3.75
(6.6 ft)	lb									*1430	1010	*1410	770	*1300	680	(12.3)
1.5 m	kg					*1160	870	*880	600	*760	450	*690	350	*610	290	3.88
(4.9 ft)	lb					*2560	1920	*1940	1320	*1680	990	*1520	770	*1340	640	(12.7)
1.0 m	kg					*1740	810	*1140	580	*890	430	*760	340	*650	280	3.92
(3.3 ft)	lb					*3840	1790	*2510	1280	*1960	950	*1680	750	*1430	620	(12.9)
0.5 m	kg					*1630	780	*1330	550	*1000	420	*820	330	*720	280	3.88
(1.6 ft)	lb					*3590	1720	*2930	1210	*2200	930	*1810	730	*1590	620	(12.7)
Ground	kg	*830	*830	*970	*970	*1850	770	*1420	540	*1060	410	*850	320	*770	290	3.75
Line	lb	*1830	*1830	*2140	*2140	*4080	1700	*3130	1190	*2340	900	*1870	710	*1700	640	(12.3)
-0.5 m	kg	*1220	*1220	*1480	1300	*2030	770	*1410	540	*1060	410	*820	320	*810	320	3.52
(-1.6 ft)	lb	*2690	*2690	*3260	2870	*4480	1700	*3110	1190	*2340	900	*1810	710	*1790	710	(11.6)
-1.0 m	kg	*1690	*1690	*2110	1310	*1810	780	*1290	540	*960	410			*860	380	3.17
(-3.3 ft)	lb	*3730	*3730	*4650	2890	*3990	1720	*2840	1190	*2120	900			*1900	840	(10.4)
-1.5 m	kg	*2260	*2260	*2180	1340	*1410	790	*990	550					*920	520	2.60
(-4.9 ft)	lb	*4980	*4980	*4810	2950	*3110	1740	*2180	1210					*2030	1150	(8.5)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
R25Z-9AK	Canopy	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		1945	1120	247	250	-	Up	-	-	-

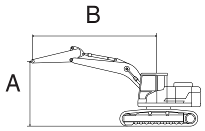
· : Rating over-front　　· : Rating over-side or 360 degree



Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.0 m (3.3 ft)		1.5 m (4.9 ft)		2.0 m (6.6 ft)		2.5 m (8.2 ft)		3.0 m (9.8 ft)		3.5 m (11.5 ft)		Capacity		Reach
																m (ft)
3.0 m (9.8 ft)	kg lb													590 1300	500 1100	2.88 (9.5)
2.5 m (8.2 ft)	kg lb									550 1210	470 1040			470 1040	400 880	3.32 (10.9)
2.0 m (6.6 ft)	kg lb									550 1210	470 1040	430 950	360 790	410 900	340 750	3.61 (11.8)
1.5 m (4.9 ft)	kg lb					1040 2290	860 1900	720 1590	600 1320	540 1190	460 1010	420 930	360 790	370 820	320 710	3.78 (12.4)
1.0 m (3.3 ft)	kg lb							690 1520	580 1280	520 1150	440 970	420 930	350 770	360 790	300 660	3.86 (12.7)
0.5 m (1.6 ft)	kg lb							670 1480	560 1230	510 1120	430 950	410 900	350 770	360 790	300 660	3.85 (12.6)
Ground Line	kg lb					940 2070	760 1680	660 1460	550 1210	500 1100	420 930	400 880	340 750	370 820	310 680	3.75 (12.3)
-0.5 m (-1.6 ft)	kg lb	*1010 *2230	*1010 *2230	*1190 *2620	*1190 *2620	940 2070	760 1680	650 1430	540 1190	500 1100	420 930	400 880	340 750	390 860	330 730	3.56 (11.7)
-1.0 m (-3.3 ft)	kg lb	*1570 *3460	*1570 *3460	1630 3590	1260 2780	940 2070	760 1680	660 1460	540 1190	500 1100	420 930			450 990	380 840	3.25 (10.7)
-1.5 m (-4.9 ft)	kg lb	*2290 *5050	*2290 *5050	1650 3640	1280 2820	950 2090	780 1720	660 1460	550 1210					570 1260	480 1060	2.77 (9.1)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
R25Z-9AK	Cabin	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		1945	1120	247	250	-	Up	-	-	-

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

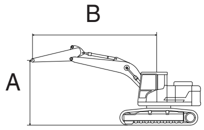


Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.0 m (3.3 ft)		1.5 m (4.9 ft)		2.0 m (6.6 ft)		2.5 m (8.2 ft)		3.0 m (9.8 ft)		3.5 m (11.5 ft)		Capacity		Reach
																m (ft)
3.0 m	kg									520	440			480	400	3.16
(9.8 ft)	lb									1150	970			1060	880	(10.4)
2.5 m	kg									520	440	400	330	390	330	3.52
(8.2 ft)	lb									1150	970	880	730	860	730	(11.5)
2.0 m	kg									510	430	390	330	350	290	3.75
(6.6 ft)	lb									1120	950	860	730	770	640	(12.3)
1.5 m	kg					1000	810	680	560	500	420	390	320	320	270	3.88
(4.9 ft)	lb					2200	1790	1500	1230	1100	930	860	710	710	600	(12.7)
1.0 m	kg					940	760	650	540	490	400	380	310	310	260	3.92
(3.3 ft)	lb					2070	1680	1430	1190	1080	880	840	680	680	570	(12.9)
0.5 m	kg					900	720	630	510	470	390	370	310	310	260	3.88
(1.6 ft)	lb					1980	1590	1390	1120	1040	860	820	680	680	570	(12.7)
Ground	kg	*830	*830	*970	*970	890	710	610	500	460	380	360	300	330	270	3.75
Line	lb	*1830	*1830	*2140	*2140	1960	1570	1340	1100	1010	840	790	660	730	600	(12.3)
-0.5 m	kg	*1220	*1220	*1480	1190	890	710	610	500	460	380	360	300	360	300	3.52
(-1.6 ft)	lb	*2690	*2690	*3260	2620	1960	1570	1340	1100	1010	840	790	660	790	660	(11.6)
-1.0 m	kg	*1690	*1690	1570	1200	890	720	610	500	460	380			430	350	3.17
(-3.3 ft)	lb	*3730	*3730	3460	2650	1960	1590	1340	1100	1010	840			950	770	(10.4)
-1.5 m	kg	*2260	*2260	1600	1220	910	730	630	510					590	480	2.60
(-4.9 ft)	lb	*4980	*4980	3530	2690	2010	1610	1390	1120					1300	1060	(8.5)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
R25Z-9AK	Canopy	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		1945	1350	117	250	-	Down	-	-	-

· : Rating over-front

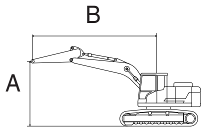
· : Rating over-side or 360 degree



Lift-point height (A)		Lift-point radius (B)												At max. reach		
		1.0 m (3.3 ft)		1.5 m (4.9 ft)		2.0 m (6.6 ft)		2.5 m (8.2 ft)		3.0 m (9.8 ft)		3.5 m (11.5 ft)		Capacity		Reach
																m (ft)
3.0 m	kg									*600	440			*640	400	3.17
(9.8 ft)	lb									*1320	970			*1410	880	(10.4)
2.5 m	kg									*570	440	*640	310	*590	330	3.56
(8.2 ft)	lb									*1260	970	*1410	680	*1300	730	(11.7)
2.0 m	kg									*620	440	*640	340	*580	290	3.82
(6.6 ft)	lb									*1370	970	*1410	750	*1280	640	(12.5)
1.5 m	kg							*770	570	*720	430	*680	330	*580	270	3.98
(4.9 ft)	lb							*1700	1260	*1590	950	*1500	730	*1280	600	(13.1)
1.0 m	kg					*1470	770	*1030	550	*850	410	*750	320	*600	260	4.05
(3.3 ft)	lb					*3240	1700	*2270	1210	*1870	900	*1650	710	*1320	570	(13.3)
0.5 m	kg					*1720	730	*1270	520	*980	400	*820	320	*640	250	4.05
(1.6 ft)	lb					*3790	1610	*2800	1150	*2160	880	*1810	710	*1410	550	(13.3)
Ground	kg					*1580	700	*1420	500	*1070	390	*880	310	*700	260	3.96
Line	lb					*3480	1540	*3130	1100	*2360	860	*1940	680	*1540	570	(13.0)
-0.5 m	kg	*900	*900	*1120	*1120	*1970	700	*1470	500	*1110	380	*890	310	*780	270	3.78
(-1.6 ft)	lb	*1980	*1980	*2470	*2470	*4340	1540	*3240	1100	*2450	840	*1960	680	*1720	600	(12.4)
-1.0 m	kg	*1330	*1330	*1660	1170	*2000	700	*1420	490	*1070	380	*810	310	*820	310	3.50
(-3.3 ft)	lb	*2930	*2930	*3660	2580	*4410	1540	*3130	1080	*2360	840	*1790	680	*1810	680	(11.5)
-1.5 m	kg	*1860	*1860	*2410	1180	*1720	710	*1230	500	*900	380			*850	370	3.07
(-4.9 ft)	lb	*4100	*4100	*5310	2600	*3790	1570	*2710	1100	*1980	840			*1870	820	(10.1)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
R25Z-9AK	Cabin	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		1945	1350	117	250	-	Down	-	-	-

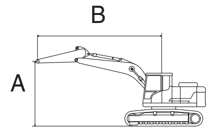
· : Rating over-front · : Rating over-side or 360 degree



Lift-point height (A)		Lift-point radius (B)														At max. reach		
		1.0 m (3.3 ft)		1.5 m (4.9 ft)		2.0 m (6.6 ft)		2.5 m (8.2 ft)		3.0 m (9.8 ft)		3.5 m (11.5 ft)		4.0 m (13.1 ft)		Capacity		Reach
																		m (ft)
3.5 m	kg															*530	420	2.94
(11.5 ft)	lb															*1170	930	(9.6)
3.0 m	kg															*500	320	3.43
(9.8 ft)	lb															*1100	710	(11.3)
2.5 m	kg											*530	310			*480	270	3.76
(8.2 ft)	lb											*1170	680			*1060	600	(12.3)
2.0 m	kg									*550	400	*560	300			*480	240	3.97
(6.6 ft)	lb									*1210	880	*1230	660			*1060	530	(13.0)
1.5 m	kg							*730	530	*670	390	*630	300	*610	230	*490	220	4.09
(4.9 ft)	lb							*1610	1170	*1480	860	*1390	660	*1340	510	*1080	490	(13.4)
1.0 m	kg					*1470	720	*1010	500	*810	370	*700	290	*640	220	*520	210	4.13
(3.3 ft)	lb					*3240	1590	*2230	1100	*1790	820	*1540	640	*1410	490	*1150	460	(13.6)
0.5 m	kg					*1910	680	*1240	480	*940	360	*780	280	*680	220	*570	210	4.09
(1.6 ft)	lb					*4210	1500	*2730	1060	*2070	790	*1720	620	*1500	490	*1260	460	(13.4)
Ground	kg	*700	*700	*930	*930	*1880	660	*1380	460	*1030	350	*830	270			*650	220	3.98
Line	lb	*1540	*1540	*2050	*2050	*4140	1460	*3040	1010	*2270	770	*1830	600			*1430	490	(13.0)
-0.5 m	kg	*1030	*1030	*1310	1100	*2080	650	*1420	450	*1060	340	*840	270			*740	240	3.77
(-1.6 ft)	lb	*2270	*2270	*2890	2430	*4590	1430	*3130	990	*2340	750	*1850	600			*1630	530	(12.4)
-1.0 m	kg	*1410	*1410	*1790	1110	*1940	650	*1360	450	*1020	340					*790	270	3.44
(-3.3 ft)	lb	*3110	*3110	*3950	2450	*4280	1430	*3000	990	*2250	750					*1740	600	(11.3)
-1.5 m	kg	*1850	*1850	*2430	1130	*1640	660	*1160	460							*860	350	2.96
(-4.9 ft)	lb	*4080	*4080	*5360	2490	*3620	1460	*2560	1010							*1900	770	(9.7)
-2.0 m	kg			*1640	1170	*1050	690									*950	620	2.12
(-6.6 ft)	lb			*3620	2580	*2310	1520									*2090	1370	(7.0)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
R25Z-9AK	Canopy	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		1945	1350	117	250	-	Up	-	-	-

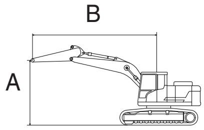
· : Rating over-front · : Rating over-side or 360 degree



Lift-point height (A)		Lift-point radius (B)														At max. reach		
		1.0 m (3.3 ft)		1.5 m (4.9 ft)		2.0 m (6.6 ft)		2.5 m (8.2 ft)		3.0 m (9.8 ft)		3.5 m (11.5 ft)		4.0 m (13.1 ft)		Capacity		Reach
																		m (ft)
3.0 m	kg									490	410					450	380	3.17
(9.8 ft)	lb									1080	900					990	840	(10.4)
2.5 m	kg									490	420	380	320			360	310	3.56
(8.2 ft)	lb									1080	930	840	710			790	680	(11.7)
2.0 m	kg									490	410	380	320			320	270	3.82
(6.6 ft)	lb									1080	900	840	710			710	600	(12.5)
1.5 m	kg							640	530	470	400	370	310			300	250	3.98
(4.9 ft)	lb							1410	1170	1040	880	820	680			660	550	(13.1)
1.0 m	kg					880	720	610	510	460	380	360	300	290	240	280	240	4.05
(3.3 ft)	lb					1940	1590	1340	1120	1010	840	790	660	640	530	620	530	(13.3)
0.5 m	kg					830	670	590	480	440	370	350	290	290	240	280	240	4.05
(1.6 ft)	lb					1830	1480	1300	1060	970	820	770	640	640	530	620	530	(13.3)
Ground	kg					810	650	570	470	430	360	350	290			290	240	3.96
Line	lb					1790	1430	1260	1040	950	790	770	640			640	530	(13.0)
-0.5 m	kg	*900	*900	*1120	1060	800	640	560	460	430	350	340	280			310	260	3.78
(-1.6 ft)	lb	*1980	*1980	*2470	2340	1760	1410	1230	1010	950	770	750	620			680	570	(12.4)
-1.0 m	kg	*1330	*1330	1400	1070	800	650	560	460	430	350	340	290			340	290	3.50
(-3.3 ft)	lb	*2930	*2930	3090	2360	1760	1430	1230	1010	950	770	750	640			750	640	(11.5)
-1.5 m	kg	*1860	*1860	1410	1080	810	650	570	460	430	360					420	350	3.07
(-4.9 ft)	lb	*4100	*4100	3110	2380	1790	1430	1260	1010	950	790					930	770	(10.1)
-2.0 m	kg			1450	1110	830	670									630	520	2.37
(-6.6 ft)	lb			3200	2450	1830	1480									1390	1150	(7.8)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
		Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
R25Z-9AK	Cabin	1945	1350	117	250	-	Up	-	-	-

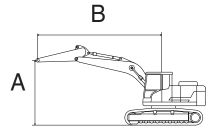
· : Rating over-front · : Rating over-side or 360 degree



Lift-point height (A)		Lift-point radius (B)														At max. reach		
		1.0 m (3.3 ft)		1.5 m (4.9 ft)		2.0 m (6.6 ft)		2.5 m (8.2 ft)		3.0 m (9.8 ft)		3.5 m (11.5 ft)		4.0 m (13.1 ft)		Capacity		Reach
																		m (ft)
3.5 m	kg															470	390	2.94
(11.5 ft)	lb															1040	860	(9.6)
3.0 m	kg															360	300	3.43
(9.8 ft)	lb															790	660	(11.3)
2.5 m	kg											350	290			300	250	3.76
(8.2 ft)	lb											770	640			660	550	(12.3)
2.0 m	kg									450	370	340	280			270	220	3.97
(6.6 ft)	lb									990	820	750	620			600	490	(13.0)
1.5 m	kg							600	500	440	360	330	270	260	210	250	200	4.09
(4.9 ft)	lb							1320	1100	970	790	730	600	570	460	550	440	(13.4)
1.0 m	kg					830	670	570	470	420	340	320	260	250	210	240	190	4.13
(3.3 ft)	lb					1830	1480	1260	1040	930	750	710	570	550	460	530	420	(13.6)
0.5 m	kg					780	620	540	440	400	330	310	250	250	200	240	190	4.09
(1.6 ft)	lb					1720	1370	1190	970	880	730	680	550	550	440	530	420	(13.4)
Ground	kg	*700	*700	*930	*930	760	600	530	420	390	320	310	250			250	200	3.98
Line	lb	*1540	*1540	*2050	*2050	1680	1320	1170	930	860	710	680	550			550	440	(13.0)
-0.5 m	kg	*1030	*1030	*1310	1000	760	600	520	420	390	310	300	240			270	220	3.77
(-1.6 ft)	lb	*2270	*2270	*2890	2200	1680	1320	1150	930	860	680	660	530			600	490	(12.4)
-1.0 m	kg	*1410	*1410	1340	1010	760	600	520	420	380	310					310	250	3.44
(-3.3 ft)	lb	*3110	*3110	2950	2230	1680	1320	1150	930	840	680					680	550	(11.3)
-1.5 m	kg	*1850	*1850	1360	1030	770	610	520	420							400	330	2.96
(-4.9 ft)	lb	*4080	*4080	3000	2270	1700	1340	1150	930							880	730	(9.7)
-2.0 m	kg			1400	1070	790	630									720	570	2.12
(-6.6 ft)	lb			3090	2360	1740	1390									1590	1260	(7.0)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
R25Z-9AK	Canopy	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		1945	1350	247	250	-	Down	-	-	-

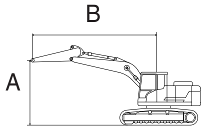
· : Rating over-front · : Rating over-side or 360 degree



Lift-point height (A)		Lift-point radius (B)														At max. reach		
		1.0 m (3.3 ft)		1.5 m (4.9 ft)		2.0 m (6.6 ft)		2.5 m (8.2 ft)		3.0 m (9.8 ft)		3.5 m (11.5 ft)		4.0 m (13.1 ft)		Capacity		Reach
																		m (ft)
3.0 m	kg									*600	500					*640	460	3.17
(9.8 ft)	lb									*1320	1100					*1410	1010	(10.4)
2.5 m	kg									*570	510	*640	390			*590	380	3.56
(8.2 ft)	lb									*1260	1120	*1410	860			*1300	840	(11.7)
2.0 m	kg									*620	500	*640	390			*580	340	3.82
(6.6 ft)	lb									*1370	1100	*1410	860			*1280	750	(12.5)
1.5 m	kg							*770	650	*720	490	*680	380			*580	310	3.98
(4.9 ft)	lb							*1700	1430	*1590	1080	*1500	840			*1280	680	(13.1)
1.0 m	kg					*1470	880	*1030	620	*850	470	*750	380	*700	310	*600	300	4.05
(3.3 ft)	lb					*3240	1940	*2270	1370	*1870	1040	*1650	840	*1540	680	*1320	660	(13.3)
0.5 m	kg					*1720	840	*1270	600	*980	460	*820	370	*730	300	*640	300	4.05
(1.6 ft)	lb					*3790	1850	*2800	1320	*2160	1010	*1810	820	*1610	660	*1410	660	(13.3)
Ground	kg					*1580	810	*1420	580	*1070	450	*880	360			*700	300	3.96
Line	lb					*3480	1790	*3130	1280	*2360	990	*1940	790			*1540	660	(13.0)
-0.5 m	kg	*900	*900	*1120	*1120	*1970	810	*1470	580	*1110	440	*890	360			*780	320	3.78
(-1.6 ft)	lb	*1980	*1980	*2470	*2470	*4340	1790	*3240	1280	*2450	970	*1960	790			*1720	710	(12.4)
-1.0 m	kg	*1330	*1330	*1660	1350	*2000	810	*1420	570	*1070	440	*810	360			*820	360	3.50
(-3.3 ft)	lb	*2930	*2930	*3660	2980	*4410	1790	*3130	1260	*2360	970	*1790	790			*1810	790	(11.5)
-1.5 m	kg	*1860	*1860	*2410	1360	*1720	820	*1230	580	*900	450					*850	430	3.07
(-4.9 ft)	lb	*4100	*4100	*5310	3000	*3790	1810	*2710	1280	*1980	990					*1870	950	(10.1)
-2.0 m	kg			*1780	1390	*1170	840									*860	650	2.37
(-6.6 ft)	lb			*3920	3060	*2580	1850									*1900	1430	(7.8)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
		Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
R25Z-9AK	Cabin	1945	1350	247	250	-	Down	-	-	-

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

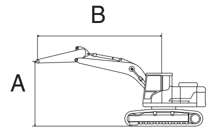


Lift-point height (A)		Lift-point radius (B)														At max. reach		
		1.0 m (3.3 ft)		1.5 m (4.9 ft)		2.0 m (6.6 ft)		2.5 m (8.2 ft)		3.0 m (9.8 ft)		3.5 m (11.5 ft)		4.0 m (13.1 ft)		Capacity		Reach
		Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	Over-front	Over-side	m (ft)
3.5 m	kg															*530	490	2.94
(11.5 ft)	lb															*1170	1080	(9.6)
3.0 m	kg															*500	370	3.43
(9.8 ft)	lb															*1100	820	(11.3)
2.5 m	kg											*530	360			*480	310	3.76
(8.2 ft)	lb											*1170	790			*1060	680	(12.3)
2.0 m	kg									*550	460	*560	350			*480	280	3.97
(6.6 ft)	lb									*1210	1010	*1230	770			*1060	620	(13.0)
1.5 m	kg							*730	610	*670	450	*630	350	*610	270	*490	260	4.09
(4.9 ft)	lb							*1610	1340	*1480	990	*1390	770	*1340	600	*1080	570	(13.4)
1.0 m	kg					*1470	830	*1010	580	*810	430	*700	340	*640	270	*520	250	4.13
(3.3 ft)	lb					*3240	1830	*2230	1280	*1790	950	*1540	750	*1410	600	*1150	550	(13.6)
0.5 m	kg					*1910	790	*1240	560	*940	420	*780	330	*680	260	*570	250	4.09
(1.6 ft)	lb					*4210	1740	*2730	1230	*2070	930	*1720	730	*1500	570	*1260	550	(13.4)
Ground	kg	*700	*700	*930	*930	*1880	770	*1380	540	*1030	410	*830	320			*650	260	3.98
Line	lb	*1540	*1540	*2050	*2050	*4140	1700	*3040	1190	*2270	900	*1830	710			*1430	570	(13.0)
-0.5 m	kg	*1030	*1030	*1310	1280	*2080	760	*1420	530	*1060	400	*840	320			*740	280	3.77
(-1.6 ft)	lb	*2270	*2270	*2890	2820	*4590	1680	*3130	1170	*2340	880	*1850	710			*1630	620	(12.4)
-1.0 m	kg	*1410	*1410	*1790	1290	*1940	760	*1360	530	*1020	400					*790	330	3.44
(-3.3 ft)	lb	*3110	*3110	*3950	2840	*4280	1680	*3000	1170	*2250	880					*1740	730	(11.3)
-1.5 m	kg	*1850	*1850	*2430	1310	*1640	770	*1160	540							*860	420	2.96
(-4.9 ft)	lb	*4080	*4080	*5360	2890	*3620	1700	*2560	1190							*1900	930	(9.7)
-2.0 m	kg			*1640	1350	*1050	800									*950	720	2.12
(-6.6 ft)	lb			*3620	2980	*2310	1760									*2090	1590	(7.0)

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
R25Z-9AK	Canopy	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		1945	1350	247	250	-	Up	-	-	-

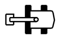
· : Rating over-front

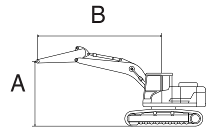
· : Rating over-side or 360 degree

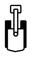
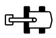
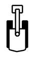
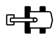
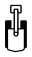
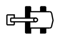
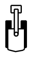
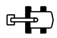
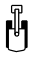
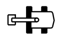
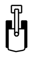
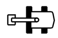
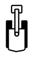
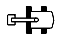
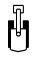
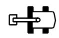


Lift-point height (A)		Lift-point radius (B)														At max. reach		
		1.0 m (3.3 ft)		1.5 m (4.9 ft)		2.0 m (6.6 ft)		2.5 m (8.2 ft)		3.0 m (9.8 ft)		3.5 m (11.5 ft)		4.0 m (13.1 ft)		Capacity		Reach
																		m (ft)
3.0 m	kg									560	470					510	430	3.17
(9.8 ft)	lb									1230	1040					1120	950	(10.4)
2.5 m	kg									560	480	430	370			420	360	3.56
(8.2 ft)	lb									1230	1060	950	820			930	790	(11.7)
2.0 m	kg									550	470	430	370			370	320	3.82
(6.6 ft)	lb									1210	1040	950	820			820	710	(12.5)
1.5 m	kg							730	610	540	460	420	360			340	290	3.98
(4.9 ft)	lb							1610	1340	1190	1010	930	790			750	640	(13.1)
1.0 m	kg					1000	820	700	590	530	440	420	350	340	290	330	280	4.05
(3.3 ft)	lb					2200	1810	1540	1300	1170	970	930	770	750	640	730	620	(13.3)
0.5 m	kg					960	780	670	560	510	430	410	340	330	280	330	280	4.05
(1.6 ft)	lb					2120	1720	1480	1230	1120	950	900	750	730	620	730	620	(13.3)
Ground	kg					930	760	660	540	500	420	400	340			340	280	3.96
Line	lb					2050	1680	1460	1190	1100	930	880	750			750	620	(13.0)
-0.5 m	kg	*900	*900	*1120	*1120	930	750	650	540	490	410	400	330			360	300	3.78
(-1.6 ft)	lb	*1980	*1980	*2470	*2470	2050	1650	1430	1190	1080	900	880	730			790	660	(12.4)
-1.0 m	kg	*1330	*1330	1600	1240	930	750	650	540	490	410	400	330			400	340	3.50
(-3.3 ft)	lb	*2930	*2930	3530	2730	2050	1650	1430	1190	1080	900	880	730			880	750	(11.5)
-1.5 m	kg	*1860	*1860	1620	1250	940	760	650	540	500	420					480	410	3.07
(-4.9 ft)	lb	*4100	*4100	3570	2760	2070	1680	1430	1190	1100	930					1060	900	(10.1)
-2.0 m	kg			1650	1280	960	780									730	600	2.37
(-6.6 ft)	lb			3640	2820	2120	1720									1610	1320	(7.8)

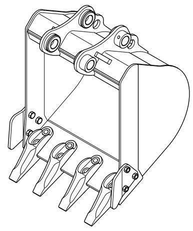
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outtriger	
R25Z-9AK	Cabin	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		1945	1350	247	250	-	Up	-	-	-

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



Lift-point height (A)		Lift-point radius (B)														At max. reach		
		1.0 m (3.3 ft)		1.5 m (4.9 ft)		2.0 m (6.6 ft)		2.5 m (8.2 ft)		3.0 m (9.8 ft)		3.5 m (11.5 ft)		4.0 m (13.1 ft)		Capacity		Reach
																		m (ft)
3.5 m	kg															*530	460	2.94
(11.5 ft)	lb															*1170	1010	(9.6)
3.0 m	kg															410	350	3.43
(9.8 ft)	lb															900	770	(11.3)
2.5 m	kg											400	340			350	290	3.76
(8.2 ft)	lb											880	750			770	640	(12.3)
2.0 m	kg									520	440	400	330			310	260	3.97
(6.6 ft)	lb									1150	970	880	730			680	570	(13.0)
1.5 m	kg							690	570	500	420	390	320	310	250	290	240	4.09
(4.9 ft)	lb							1520	1260	1100	930	860	710	680	550	640	530	(13.4)
1.0 m	kg					960	780	660	540	490	400	380	310	300	250	280	230	4.13
(3.3 ft)	lb					2120	1720	1460	1190	1080	880	840	680	660	550	620	510	(13.6)
0.5 m	kg					910	730	630	520	470	390	370	300	300	240	280	230	4.09
(1.6 ft)	lb					2010	1610	1390	1150	1040	860	820	660	660	530	620	510	(13.4)
Ground	kg	*700	*700	*930	*930	890	710	610	500	460	380	360	300			290	240	3.98
Line	lb	*1540	*1540	*2050	*2050	1960	1570	1340	1100	1010	840	790	660			640	530	(13.0)
-0.5 m	kg	*1030	*1030	*1310	1170	880	700	600	490	450	370	360	290			320	260	3.77
(-1.6 ft)	lb	*2270	*2270	*2890	2580	1940	1540	1320	1080	990	820	790	640			710	570	(12.4)
-1.0 m	kg	*1410	*1410	1550	1180	880	710	600	490	450	370					370	300	3.44
(-3.3 ft)	lb	*3110	*3110	3420	2600	1940	1570	1320	1080	990	820					820	660	(11.3)
-1.5 m	kg	*1850	*1850	1570	1200	890	720	610	500							470	390	2.96
(-4.9 ft)	lb	*4080	*4080	3460	2650	1960	1590	1340	1100							1040	860	(9.7)
-2.0 m	kg			1610	1230	920	740									830	670	2.12
(-6.6 ft)	lb			3550	2710	2030	1630									1830	1480	(7.0)

6. BUCKET SELECTION GUIDE



0.07 m^3 SAE
heaped bucket

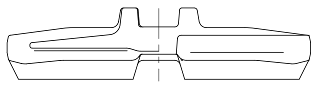
Capacity		Width		Weight	Recommendation
					1.945 m (6' 5") boom
SAE heaped	CECE heaped	Without side cutter	With side cutter		1.12 m (3' 8") arm
0.07 m^3 (0.09 yd^3)	0.06 m^3 (0.07 yd^3)	435 mm (17.1")	490 mm (19.3")	57 kg (125 lb)	Applicable for materials with density of 1600 kgf/m^3 (2700 lb/yd^3) 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 triple grousers.

(2) TYPES OF SHOES

Model	Shapes		Rubber track	
				
			Cab	Canopy
R25Z-9AK	Shoe width	mm (in)	250 (10")	250 (10")
	Operating weight	kg (lb)	2580 (5690)	2430 (5360)
	Ground pressure	kgf/cm^2 (psi)	0.32 (4.6)	0.30 (4.34)
	Overall width	mm (ft-in)	1500 (4' 11")	1500 (4' 11")

(3) NUMBER OF ROLLERS AND SHOES ON EACH SIDE

Item	Quantity
Carrier rollers	1 EA
Track rollers	3 EA

8. SPECIFICATIONS FOR MAJOR COMPONENTS

1) ENGINE

Item	Specification
Model	Kubota D1305
Type	4-cycle vertical overhead valve, diesel fuel
Cooling method	Water cooling
Number of cylinders and arrangement	3 cylinders, in-line
Firing order	1-2-3
Combustion chamber type	Swirl chamber type
Cylinder bore × stroke	78× 88 mm (3.07" × 3.46")
Piston displacement	1261 cc (77.0 cu in)
Compression ratio	24 : 1
Rated gross horse power (SAE J1995)	24.9 Hp at 2400 rpm (18.5 kW at 2400 rpm)
Maximum torque at 1600 rpm	8.3 kgf · m (60.0 lbf · ft)
Engine oil quantity	5.7 ℓ (1.3 U.S. gal)
Dry weight	124 kg (273 lb)
High idling speed	2350＋50 rpm
Low idling speed	1450＋50 rpm
Rated fuel consumption	192 g/Hp · hr at 2400 rpm (257 g/kW · hr at 2400 rpm)
Starting motor	12V-1.4 kW
Alternator	12V-40 A
Battery	1× 12 V × 58 Ah (5h rating)

2) MAIN PUMP

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 × 12 cc/rev
Rated oil flow	2 × 27.6 ℓ/min (7.3 U.S. gpm / 6.1 U.K. gpm)
Rated speed	2300 rpm

3) GEAR PUMP

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	8.5/4.5 cc/rev
Rated oil flow	19.6/10.4 ℓ/min (5.2/2.7 U.S. gpm / 4.3/2.3 U.K. gpm)

4) MAIN CONTROL VALVE

Item	Specification
Type	Sectional, 9 spools (12 blocks)
Operating method	Hydraulic pilot system
Main relief valve pressure : P1, P2 / P3	220 kgf/cm^2 (3130 psi) / 175 kgf/cm^2 (2490 psi)
Overload relief valve pressure	240 kgf/cm^2 (3410 psi)

5) SWING MOTOR

Item	Specification
Type	Fixed displacement axial piston motor
Capacity	12.5 cc/rev
Relief pressure	170 kgf/cm^2 (2420 psi)
Braking system	Automatic, spring applied hydraulic released
Braking torque	7.0 kgf · m (50.6 lbf · ft)
Brake release pressure	25~50 kgf/cm^2 (356~710 psi)
Reduction gear type	2 - stage planetary

6) TRAVEL MOTOR

Item	Specification
Type	Variable displacement axial piston motor
Relief pressure	220 kgf/cm^2 (3130 psi)
Reduction gear type	2-stage planetary
Braking system	Automatic, spring applied hydraulic released
Brake release pressure	19 kgf/cm^2 (270 psi)
Braking torque	5.7 kgf · m (41 lbf · ft)

7) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Rod dia × Stroke	Ø75 × Ø45 × 565 mm
	Cushion	Extend only
Arm cylinder	Bore dia × Rod dia × Stroke	Ø70 × Ø45 × 500 mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia × Rod dia × Stroke	Ø60 × Ø35 × 420 mm
	Cushion	-
Boom swing cylinder	Bore dia × Rod dia × Stroke	Ø75 × Ø40 × 400 mm
	Cushion	-
Dozer cylinder	Bore dia × Rod dia × Stroke	Ø85 × Ø45 × 140 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.

8) BUCKET

Item	Capacity		Tooth quantity	Width	
	SAE heaped	CECE heaped		Without side cutter	With side cutter
Standard	0.07 m^3 (0.09 yd^3)	0.06 m^3 (0.07 yd^3)	4	435 mm (17.1")	490 mm (19.3")

9. RECOMMENDED OILS

HYUNDAI genuine lubricating oils have been developed to offer the best performance and service life for your equipment. These oils have been tested according to the specifications of HYUNDAI and, therefore, will meet the highest safety and quality requirements.

We recommend that you use only HYUNDAI genuine lubricating oils and grease officially approved by HYUNDAI.

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	5.7 (1.5)	★SAE 5W-40 SAE 30 SAE 10W SAE 10W-30 SAE 15W-40
Final drive	Gear oil	0.6×2 (0.16×2)	★SAE 75W-90 SAE 85W-140
Hydraulic tank	Hydraulic oil	Tank; 27(7.1) System; 55 (14.5)	★ISO VG 15 ISO VG 46, HBHO VG 46★3 ISO VG 68
Fuel tank	Diesel fuel★1	30 (7.9)	★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	5.0 (1.3)	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
UTTO : Universal Tractor Transmission Oil

★ : Cold region
Russia, CIS, Mongolia
★1 : Ultra low sulfur diesel
- sulfur content ≤ 15 ppm
★2 : Soft water
City water or distilled water
★3 : Hyundai Bio Hydraulic Oil
- For more information, contact HYUNDAI dealers.

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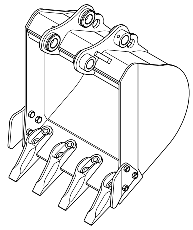
6. BUCKET SELECTION GUIDE



0.07 m³ SAE
heaped bucket

Capacity		Width		Weight	Recommendation
					1.945 m (6' 5") boom
SAE heaped	CECE heaped	Without side cutter	With side cutter		1.12 m (3' 8") arm
0.07 m^3 (0.09 yd^3)	0.06 m^3 (0.07 yd^3)	435 mm (17.1")	490 mm (19.3")	57 kg (125 lb)	Applicable for materials with density of 1600 kgf/m^3 (2700 lb/yd^3) or less

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			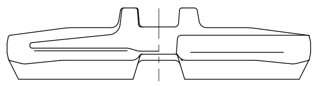	
			Cab	Canopy
R25Z-9AK	Shoe width	mm (in)	250 (10")	250 (10")
	Operating weight	kg (lb)	2580 (5690)	2430 (5360)
	Ground pressure	kgf/cm^2 (psi)	0.32 (4.6)	0.30 (4.34)
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Item	Specification
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Type	4-cycle vertical overhead valve, diesel fuel
Cooling method	Water cooling
Number of cylinders and arrangement	3 cylinders, in-line
Firing order	1-2-3
Combustion chamber type	Swirl chamber type
Cylinder bore × stroke	78 × 88 mm (3.07" × 3.46")
Piston displacement	1261 cc (77.0 cu in)
Compression ratio	24 : 1
Rated gross horse power (SAE J1995)	24.9 Hp at 2400 rpm (18.5 kW at 2400 rpm)
Maximum torque at 1600 rpm	8.3 kgf · m (60.0 lbf · ft)
Engine oil quantity	5.7 ℓ (1.3 U.S. gal)
Dry weight	124 kg (273 lb)
High idling speed	2350 + 50 rpm
Low idling speed	1450 + 50 rpm
Rated fuel consumption	192 g/Hp · hr at 2400 rpm (257 g/kW · hr at 2400 rpm)
Starting motor	12V-1.4 kW
Alternator	12V-40 A
Battery	1 × 12 V × 58 Ah (5h rating)

2) MAIN PUMP

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 × 12 cc/rev
Rated oil flow	2 × 27.6 ℓ/min (7.3 U.S. gpm / 6.1 U.K. gpm)
Rated speed	2300 rpm

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Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	8.5/4.5 cc/rev
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Item	Specification
Type	Sectional, 9 spools (12 blocks)
Operating method	Hydraulic pilot system
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Item	Specification
Type	Fixed displacement axial piston motor
Capacity	12.5 cc/rev
Relief pressure	170 kgf/cm^2 (2420 psi)
Braking system	Automatic, spring applied hydraulic released
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Braking system	Automatic, spring applied hydraulic released
Brake release pressure	19 kgf/cm^2 (270 psi)
Braking torque	5.7 kgf · m (41 lbf · ft)

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Item		Specification
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	Cushion	Extend only
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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	5.7 (1.5)	★SAE 5W-40
			SAE 30
			SAE 10W
			SAE 10W-30
			SAE 15W-40
Final drive	Gear oil	0.6×2 (0.16×2)	★SAE 75W-90
			SAE 85W-140
Hydraulic tank	Hydraulic oil	Tank; 27(7.1) System; 55 (14.5)	★ISO VG 15
			ISO VG 46, HBHO VG 46★3
			ISO VG 68
Fuel tank	Diesel fuel★1	30 (7.9)	★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	5.0 (1.3)	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
UTTO : Universal Tractor Transmission Oil

★ : Cold region
Russia, CIS, Mongolia
★1 : Ultra low sulfur diesel
- sulfur content ≤ 15 ppm
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City water or distilled water
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SECTION 2 STRUCTURE AND FUNCTION

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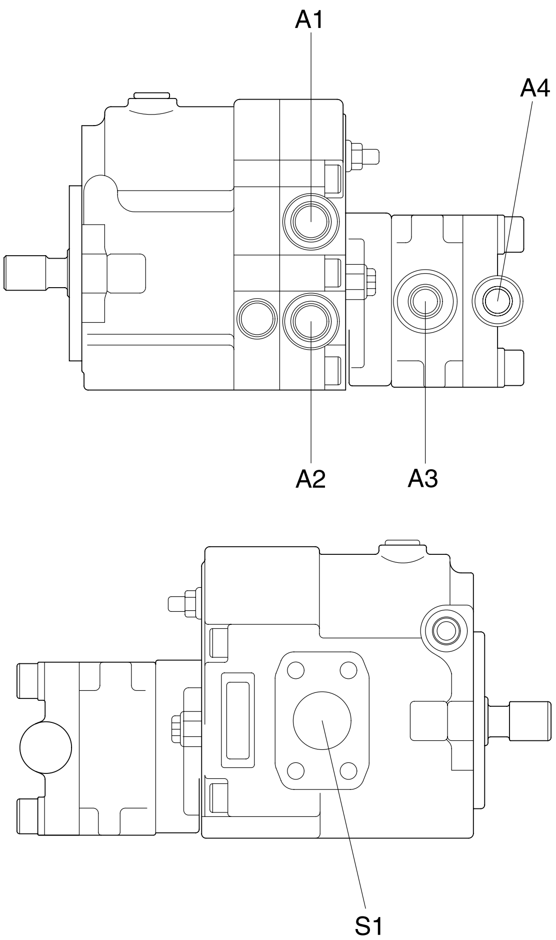
GROUP 1 HYDRAULIC PUMP

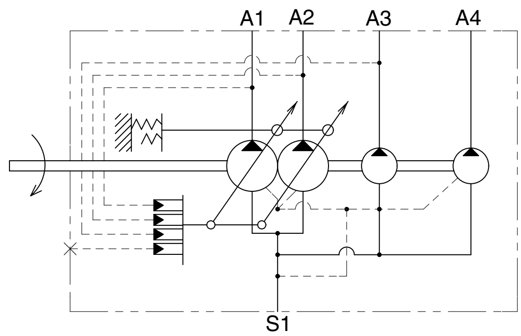
1. GENERAL

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 A1 + A2. Namely, the output is controlled to the constant value so that the relationship between the discharge pressure and flow rate Q becomes constant, (A1 + A2) * Q =Constant.

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





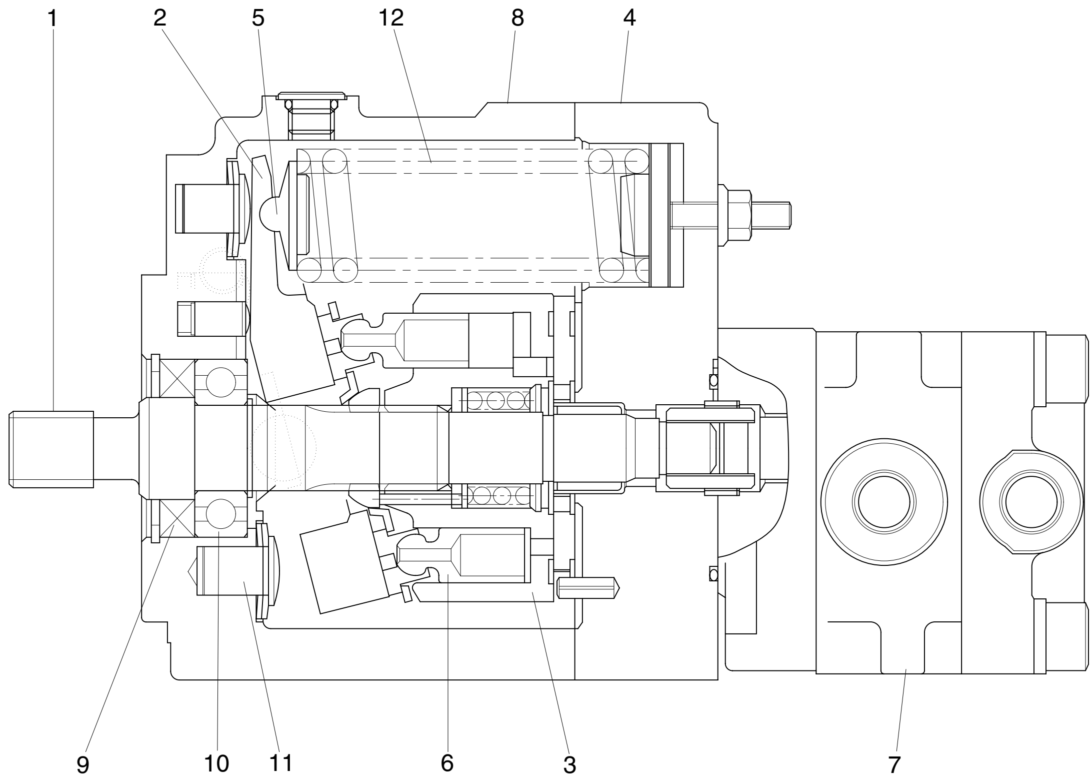
Hydraulic circuit

R27Z92MP01

Description of the ports

Port	Port name	Port size
S1	Suction port	SAE 1 1/4
A1, A2	Discharge port	PF 1/2
A3, A4	Discharge port	PF 3/8

2. MAJOR COMPONENTS AND FUNCTIONS



R27Z92MP03

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

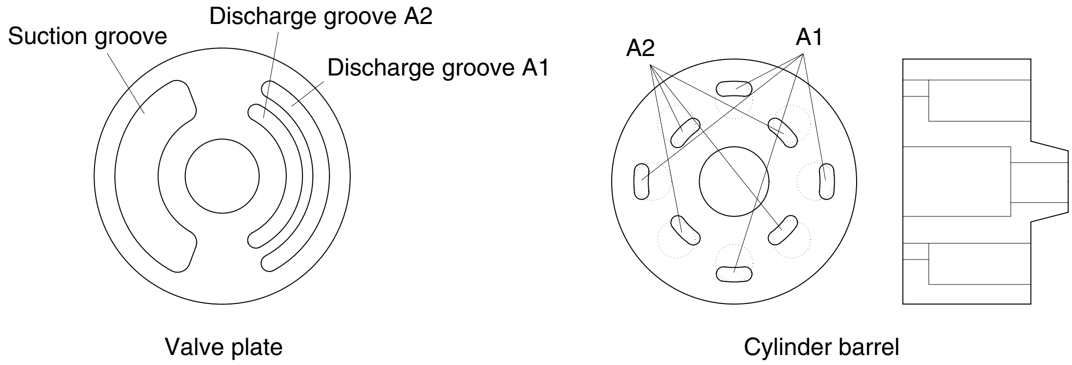


Figure 1 Working principle of PVD pump

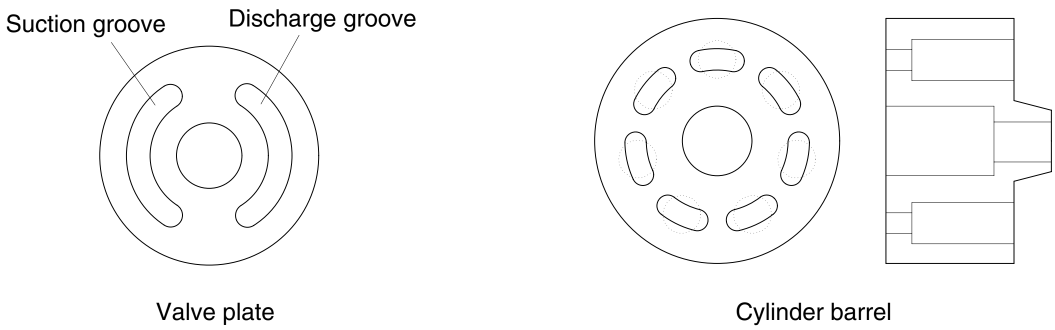
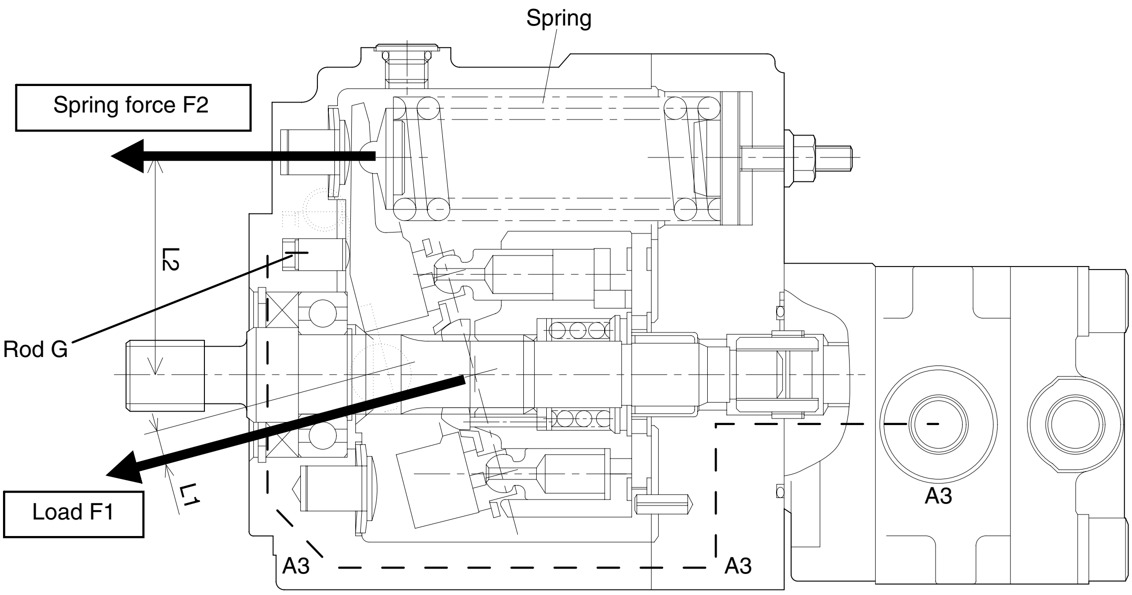


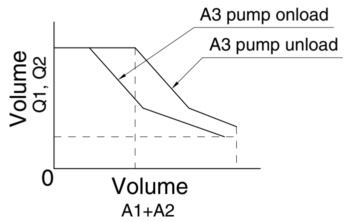
Figure 2 Working principle of Conventional type

R27Z92MP05

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 (A1) and the inner side (A2) as shown in figure 1, the piston room in the cylinder barrel opens to either the outer side (A1) or the inner side (A2) 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 (A1) and the inner side (A2) are equal.
Also, since only one swash plate is used, the discharges from A1 and A2 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





A-Q characteristic

R27Z92MP04

(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.

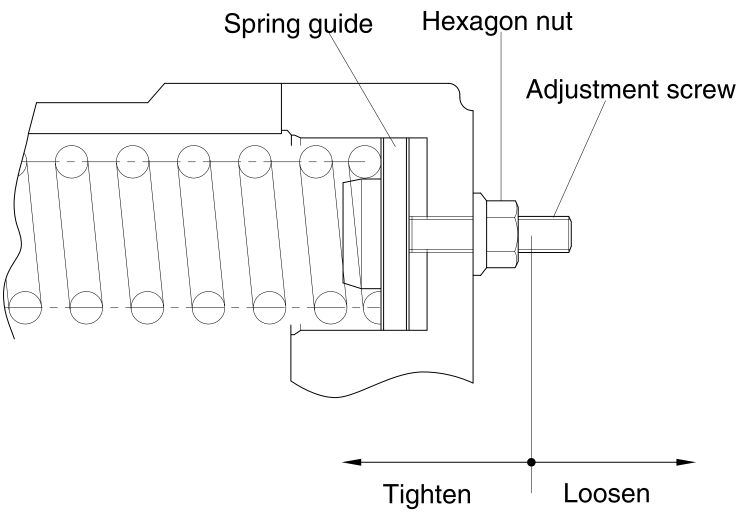
(2) Power shift mode (Reduced horse power control by A3 pressure)

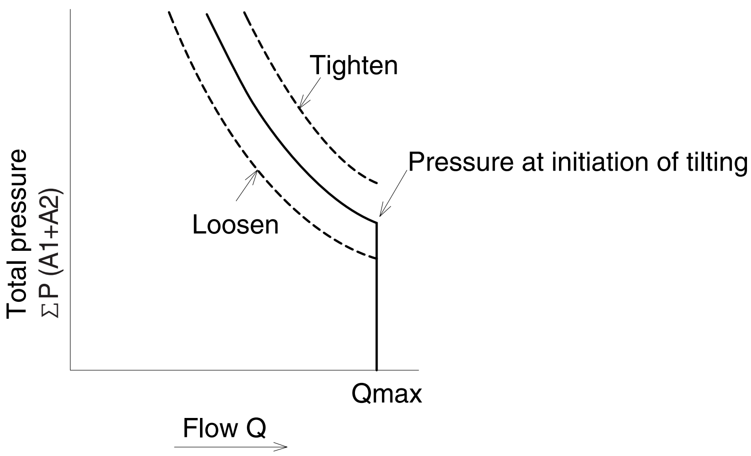
This control keeps the maximum value of the pump consumption horse power including the third pump (gear pump) constant. When the A3 (gear pump) pressure acts on the rod G, a clockwise moment proportion to the pressure acts on the swash plate and the A-Q characteristic shifts so that the total pump consumption 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.

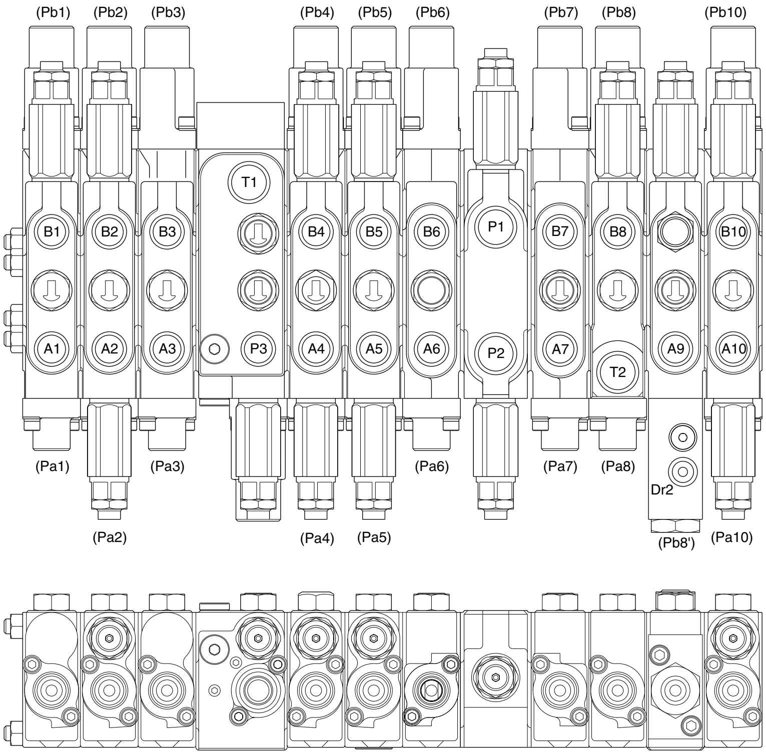




R27Z92MP07

GROUP 2 MAIN CONTROL VALVE

1. OUTLINE

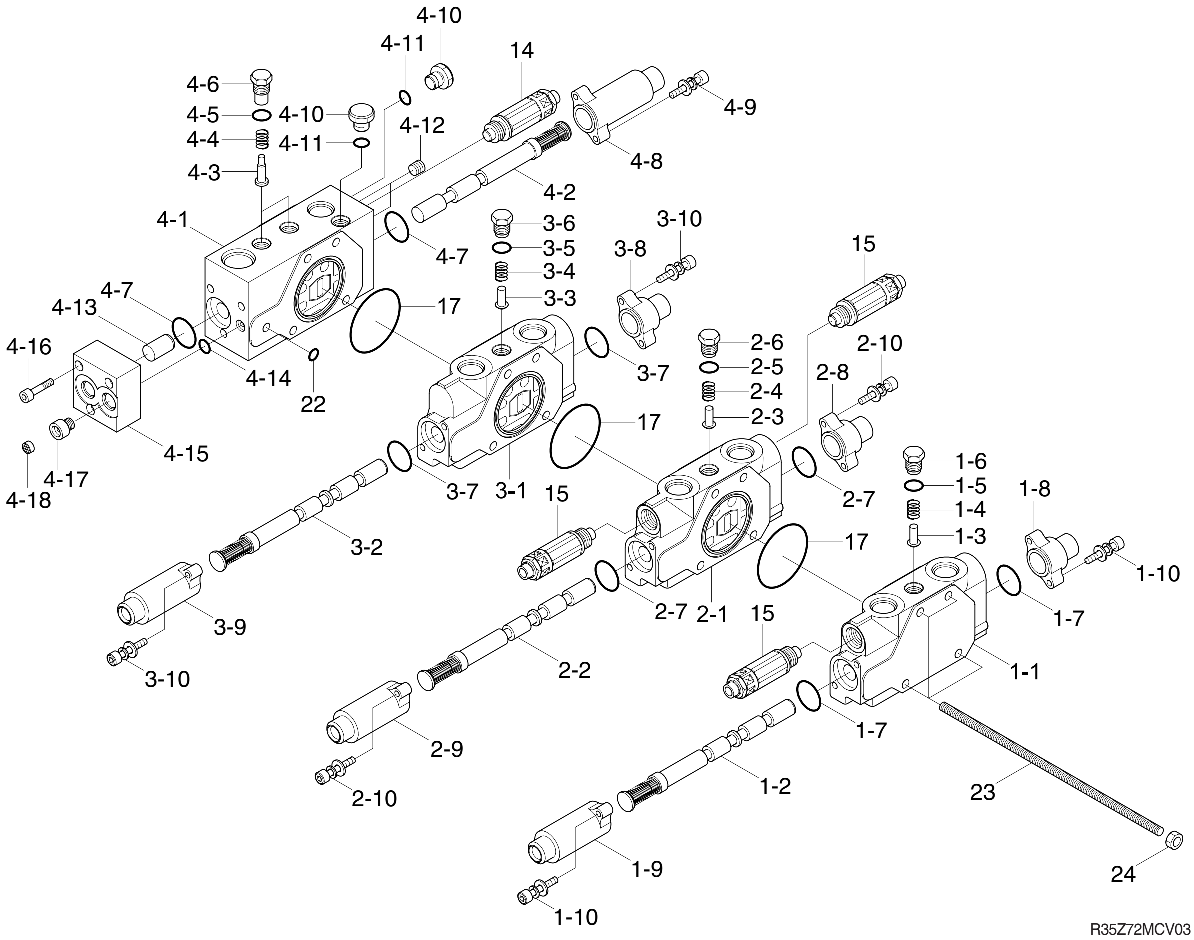


R27Z92MCV01

Mark	Port name	Port size	Tightening torque
P1	P1 (A1) pump port	PF 1/2	6~7 kgf · m
P2	P2 (A2) pump port		
T1	Tank return port		
T2	Tank return port		
P3	P3 (A3) pump port	PF 3/8	4.0~5.0 kgf · m
A1	Dozer		
B1	Dozer		
A2	Boom swing (RH) port		
B2	Boom swing (LH) port		
A3	Swing (LH) port		
B3	Swing (RH) port		
A4	Option port		
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		

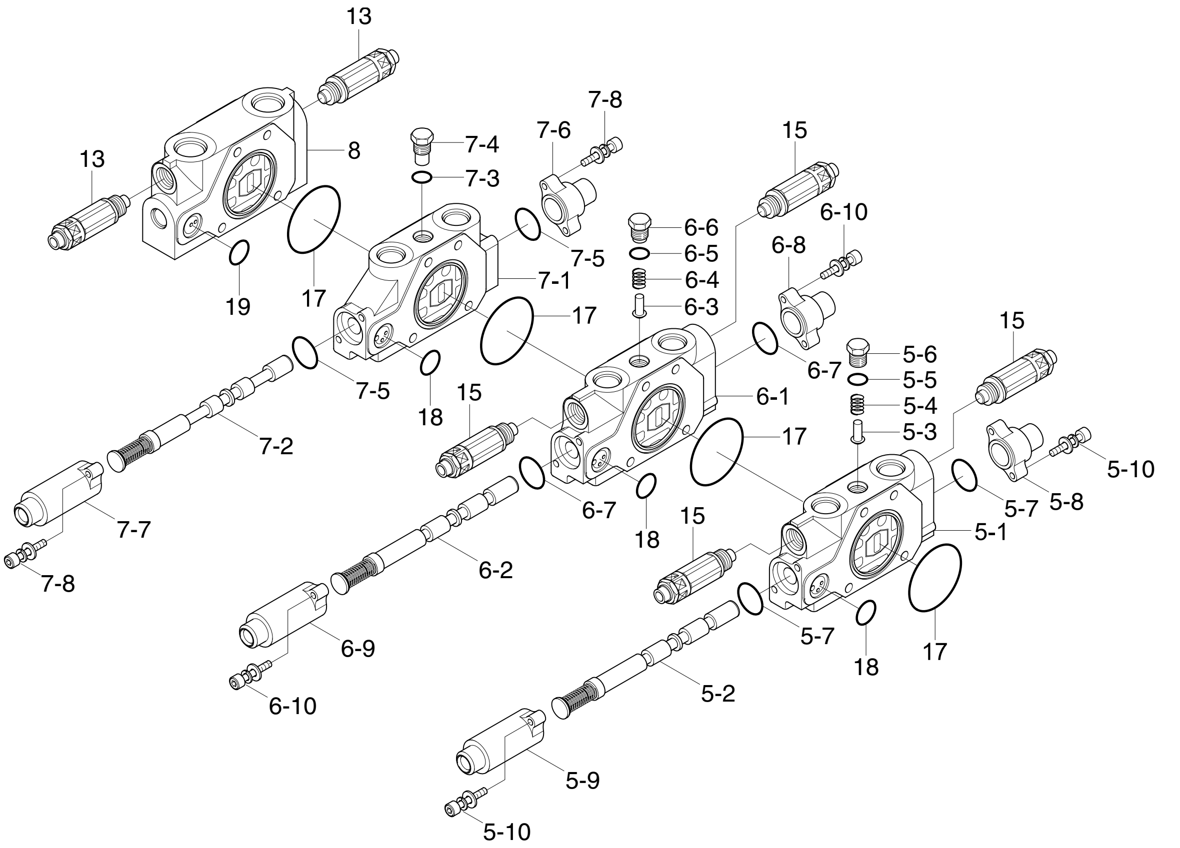
Mark	Port name	Port size	Tightening torque
A10	Bucket out port	PF 3/8	4.0~5.0 kgf · m
B10	Bucket in port		
Pa1	Dozer down pilot port	PF 1/4	2.5~3.0 kgf · m
Pb1	Dozer up pilot port		
Pa2	Boom swing (RH) pilot port		
Pb2	Boom swing (LH) pilot port		
Pa3	Swing (RH) pilot port		
Pb3	Swing (LH) pilot port		
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		

2. STRUCTURE (1/3)



1	Dozer work block	2-9	Cover-pilot	4-6	Plug
1-1	Body-work	2-10	Bolt-w/washer	4-7	O-ring
1-2	Spool assy	3	Swing work block	4-8	Cover-pilot
1-3	Poppet	3-1	Body-work	4-9	Bolt-w/washer
1-4	Spring	3-2	Spool assy	4-10	Plug
1-5	O-ring	3-3	Poppet	4-11	O-ring
1-6	Plug	3-4	Spring	4-12	Plug
1-7	O-ring	3-5	O-ring	4-13	Piston
1-8	Cover-pilot	3-6	Plug	4-14	O-ring
1-9	Cover-pilot	3-7	O-ring	4-15	Body-pilot
1-10	Bolt-w/washer	3-8	Cover-pilot	4-16	Bolt-w/washer
2	Boom swing work block	3-9	Cover-pilot	4-17	Orifice
2-1	Body-work	3-10	Bolt-w/washer	4-18	Filter-coin type
2-2	Spool assy	4	Connecting block	14	Relief valve
2-3	Poppet	4-1	Body-work	15	Overload relief valve
2-4	Spring	4-2	Spool assy	17	O-ring
2-5	O-ring	4-3	Poppet	22	O-ring
2-6	Plug	4-4	Spring	23	Bolt-tie
2-7	O-ring	4-5	O-ring	24	Nut-hex
2-8	Cover-pilot				

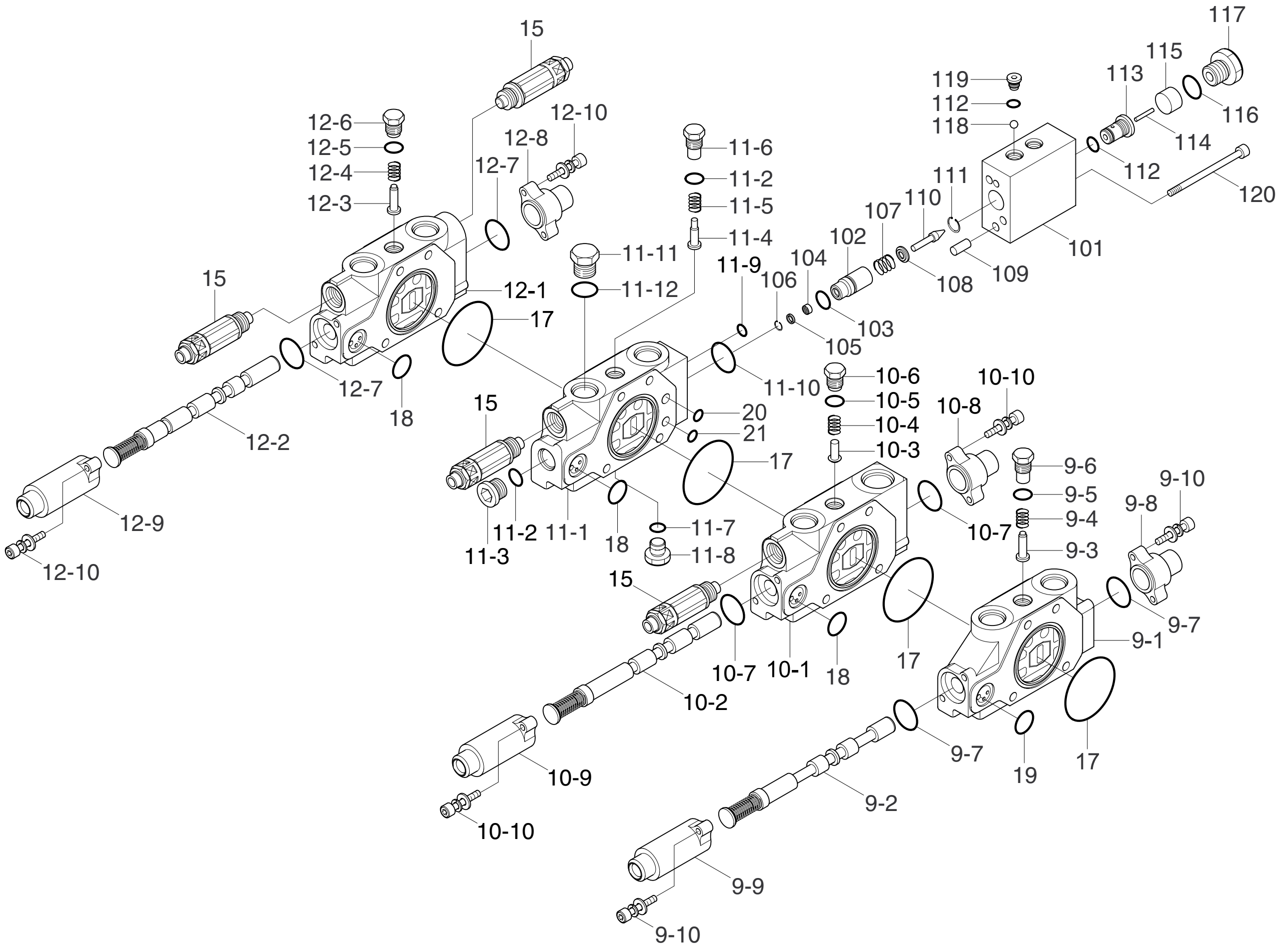
STRUCTURE (2/3)



R27Z92MCV04

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-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	Bol-w/washer	17	O-ring
5-9	Cover-pilot	7	Travel work block	18	O-ring
5-10	Bolt-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		

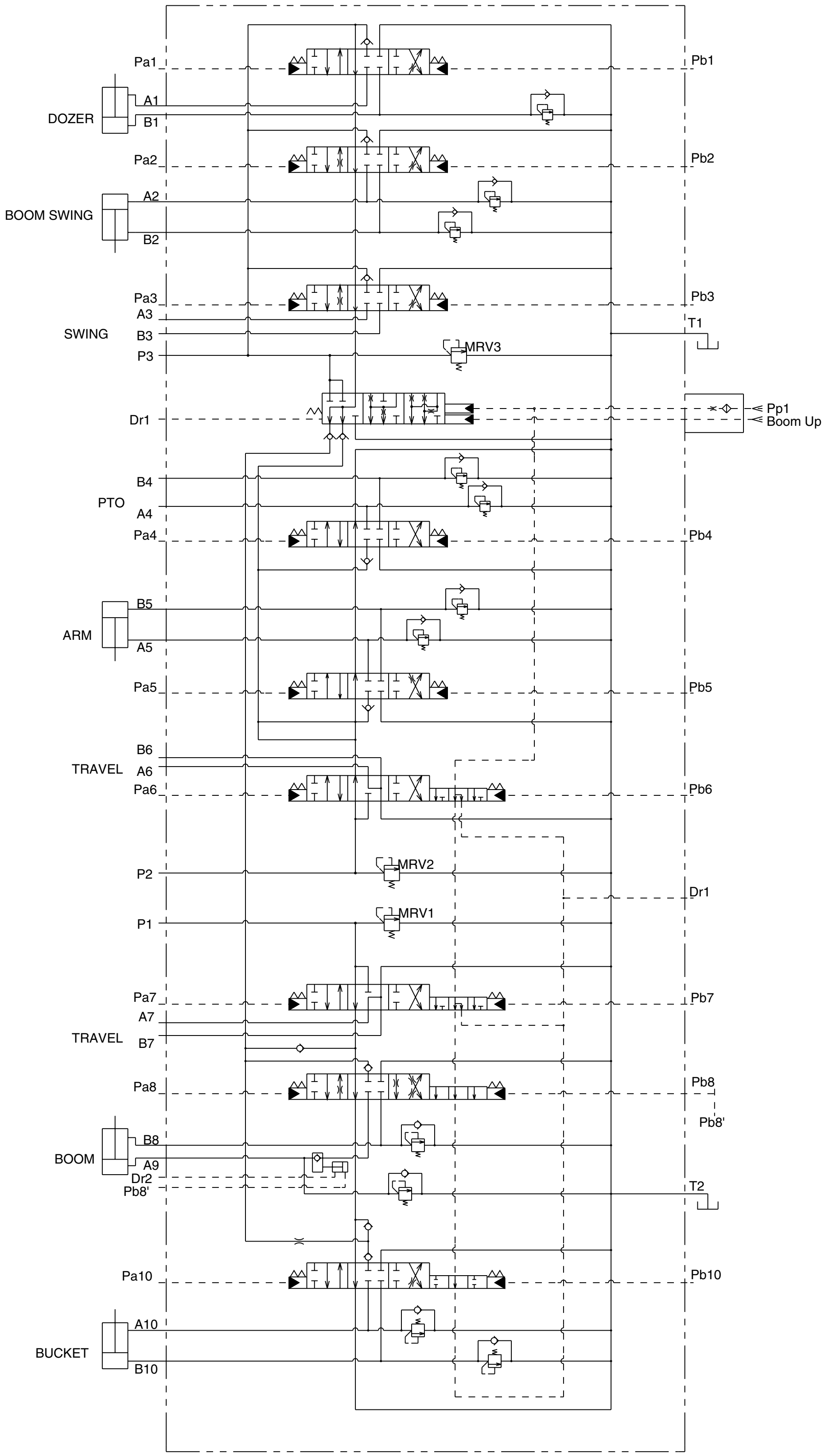
STRUCTURE (3/3)



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-w/washer	12-4	Spring	106	Ring-retaining
9-4	Spring	11	Boom lock valve	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-w/washer	112	O-ring
9-10	Bolt-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-hexagon

3. HYDRAULIC CIRCUIT



R27Z92MCV02

4. FUNCTION

1) IN NEUTRAL (When all spools are in neutral position)

P1 : The oil discharged from the hydraulic pump flows into control valve P1 port, and then flows through P1 and P2 supply body the P1 side travel spool. The oil flows through the bypass passage in the direction of travel → boom → bucket spool, and then flows from the bypass passage to the tank passage in the bucket section.

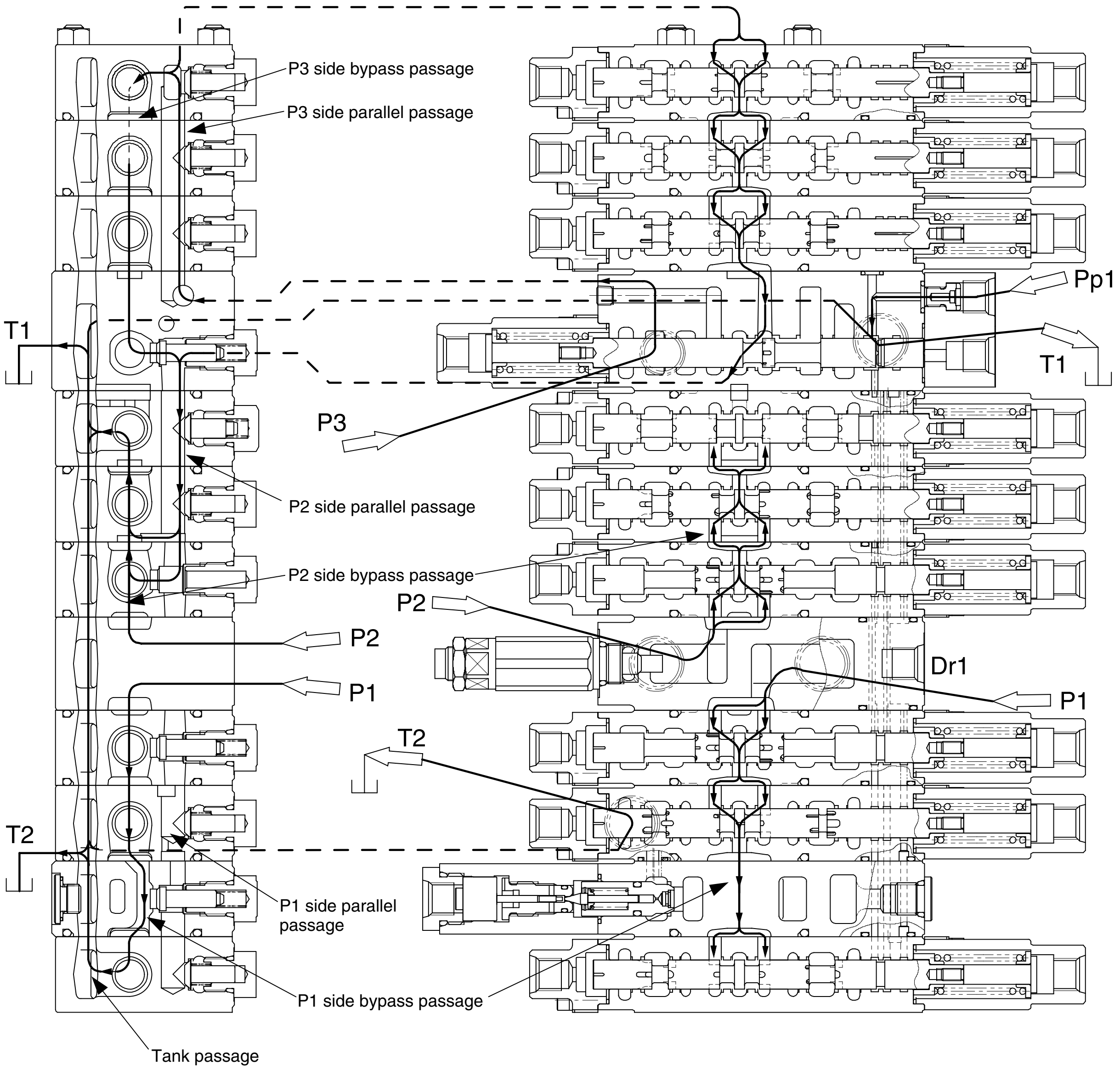
P2 : The oil discharged for the hydraulic pump flows into the control valve from P2 port, and then flows through P1 and P2 supply body to the P2 side travel spool. The oil flows through the bypass passage in the direction of travel → arm → PTO spool, and the flows from the bypass passage to the tank passage in the PTO section.

P3 : The oil discharged from the hydraulic pump flows into the control valve from P3 port, and then flows through the parallel passage of dozer, boom swing, and swing. The oil that has followed into the parallel passage flows through the bypass passage in the direction of dozer → Boom swing → swing spool, the connecting spool land, the P2 side parallel passage, the bypass passage from arm to PTO spool, the bypass passage in the PTO section, and then to the tank passage.

※ **Since each line (P1, P2, P3) is supplied with oil from the pump, the section is operatable; therefore, do not operate the control valve except the working time.**

- · P1 line : Travel, boom, bucket
- · P2 line : Travel, arm, PTO
- · P3 line : Dozer, boom swing, arm, PTO, boom (up only)

P_P1 : When P_P1 port is applied with pilot pressure, the oil flows into the travel independent passage via an orifice.
With the spool in neutral, the oil flows into Dr1 port provided in the P1 and P2 supply body.



Hydraulic oil flow in neutral

R35Z72MCV11

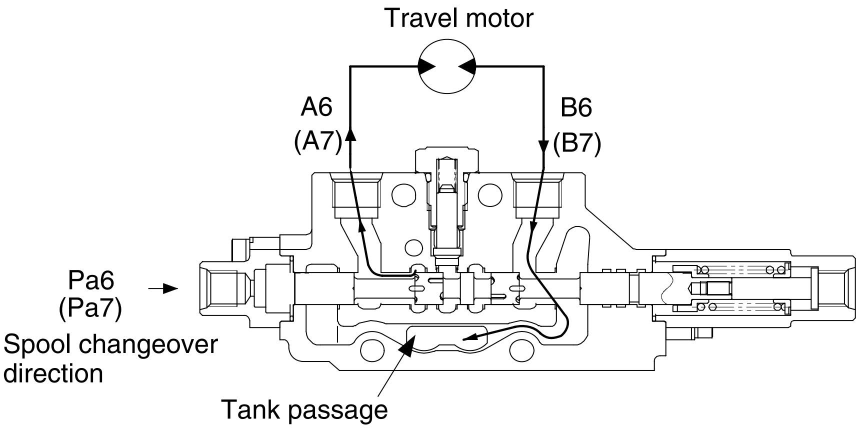
2) TRAVEL OPERATION

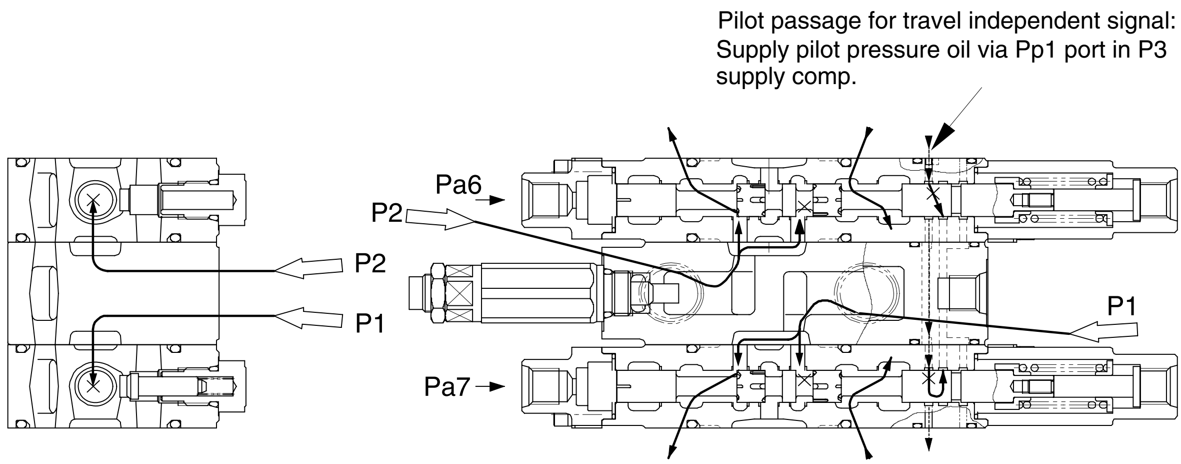
For the travel operation, both Pa pressurization and Pb pressurization are the same on operation so that only Pa pressurization is explained as follows.

When left (right) travel reverse is operated, the secondary pressure from the remote control valve is applied to Pa6 [Pa7] port to change over the travel spool. The oil flowed from P2 [P1] port flows through the supply body into the P2 [P1] side bypass passage. The oil flowed into the P2 [P1] side bypass passage flows through A6 [A7] port that has been opened by the spool changeover to the travel motor. On the other hand, the oil returned from the travel motor flows into the control valve from B6 [B7] port and then to the tank passage has been opened after the spool changeover.

The oil flowed from P_P1 port flows through the orifice passage provided in the P3 supply section into the travel independent signal passage.

Although the travel independent passage (see page 2-14) in the travel section that has been opened during neutral is blocked after the both travel spools changeover, the travel independent signal passage is connected to the drain port via the bucket section Accordingly, when the bucket section has not changed over, the connecting spool in the P3 supply section does not change over because the pressure in the travel independent signal passage is equal to the drain pressure.





Operation during travel(Forward)

R35Z72MCV12

3) BOOM OPERATION

Boom up operation

When the boom up operation is carried out, the secondary pressure from the remote control valve is applied to Pa8 port to change over the boom spool. Since Pa8 port is connected to boom up port through the piping, the pressure oil supplied to boom up port changes over the connecting spool through the connecting piston in the P3 supply section

Also, since the P1 side bypass passage is shut off at the boom section after the boom spool changeover, the oil flowed from P1 port flows through the check valve provided above the bypass passage in the travel section into the P1 side parallel passage.

On the other side, after the connecting spool changeover the oil flowed into P3 port.

① Flows through the internal passage in connecting spool and the check valve in the P3 supply section into the P1 side parallel passage.

② The oil flows through the P3 side parallel passage and P3 side bypass passage and then:

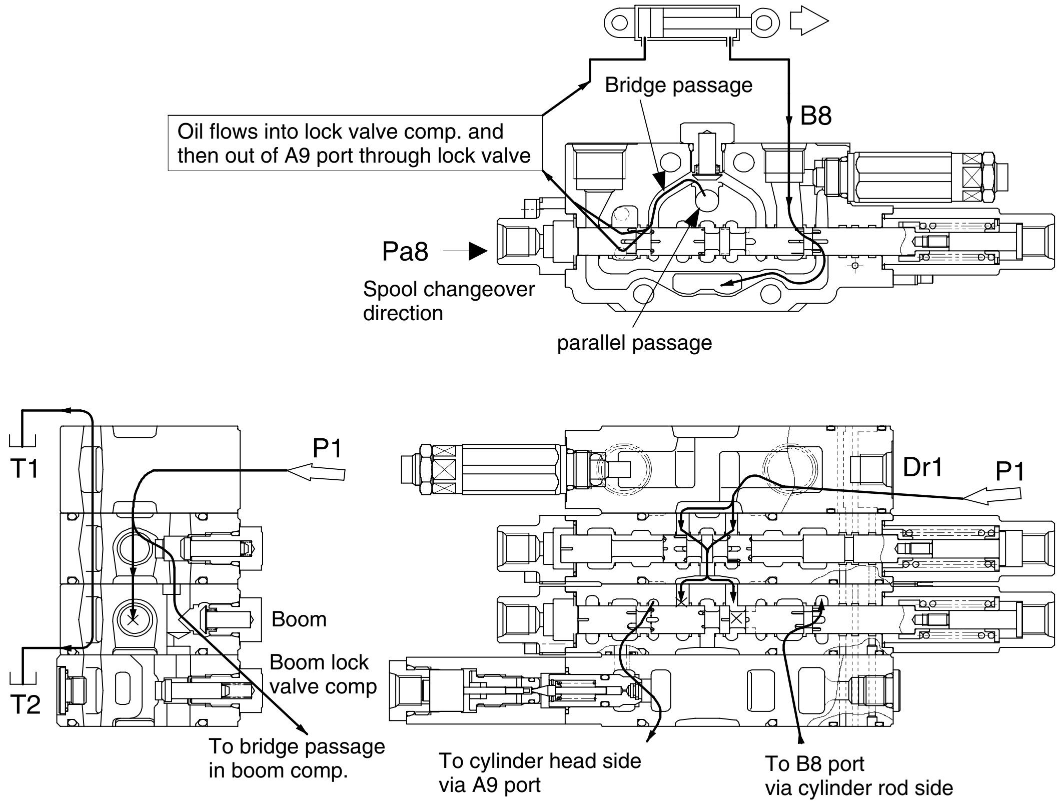
a. Flows through the check valve in the P3 supply section into the P1 side parallel passage.
b. Some oil flows through the orifice passage provided in the connecting spool and the check valve in the P3 supply section into the P2 side parallel passage.

The oil flowed into the P1 side parallel passage is connected with the oil from P1 pump.
The oil flowed into the P2 side parallel passage flows through the bypass passages in the arm section and PTO section to the tank passage.

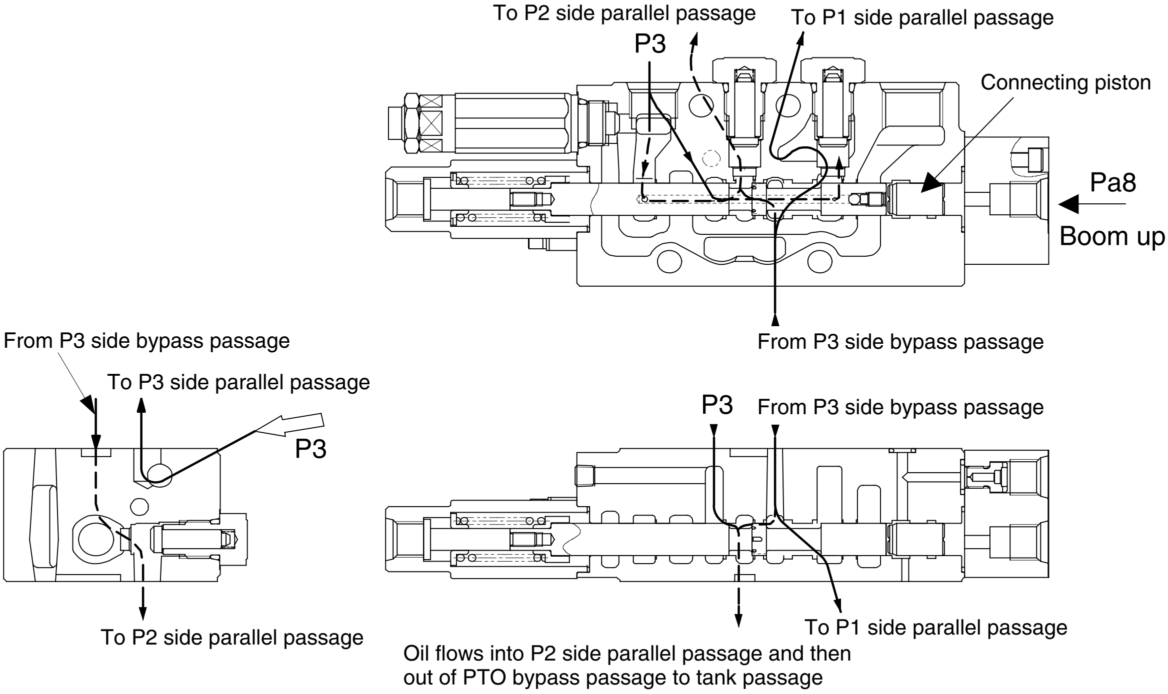
Since the passage connected to the boom lock valve and the bridge passage are opened after the boom spool changeover, the oil flowed into the P1 side parallel passage flows through the load check valve in the boom section and the bridge passage into the boom lock valve section
The oil flowed into the boom lock valve section opens the lock valve (free flow condition), flows into A9 port, and the to the head side of the boom cylinder.

On the other hand, the oil returned from the rod side of the boom cylinder flows into B8 port to the tank passage that has opened with the spool's notch after the spool changeover. Then, the boom cylinder extends to raise the boom.

P1 side circuit



P3 side (Connecting side) circuit



Boom up operation

R35Z72MCV13

Boom down operation

When the boom down operation is carried out, the secondary pressure from the remote control valve is applied to Pb8 port to change over the boom spool.

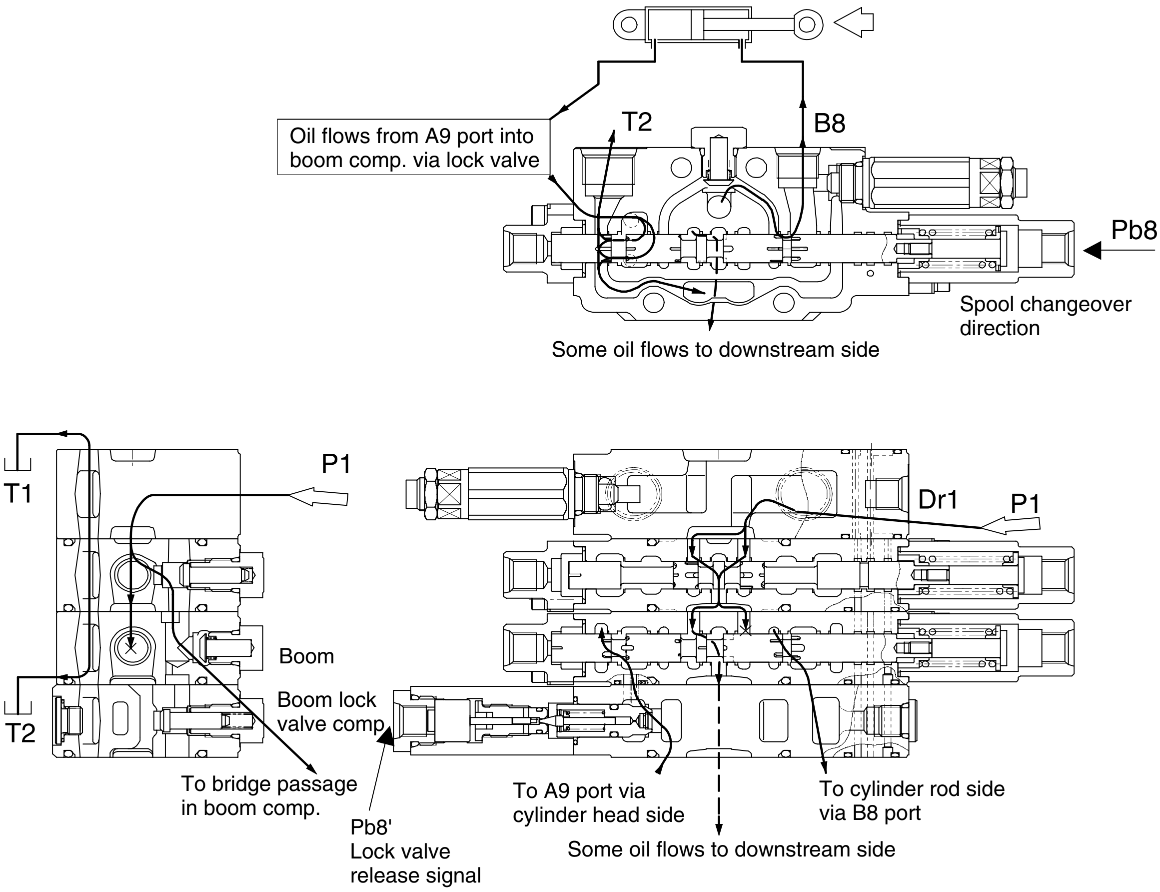
Since Pb8 port is connected to Pb8' port through the piping, the pressure is also applied to pb8' port (Boom lock valve release port) to release the boom lock valve.

(For the explanation of boom lock valve operation, see pages 2-19, 20)

Since the bypass passage is shut off at the boom section after the spool changeover (some oil flows through the orifice passage provided in the boom spool's bypass passage to the downstream side of the bypass passage), the oil flowed from P1 port flows through the check valve provided above the bypass passage in the travel section into the P1 side parallel passage.

Also, since a passage between B8 port and bridge passage is opened with the spool's notch after the spool changeover, the oil flowed into the P1 side parallel passage flows through the load check valve in the boom section into B8 port via the bridge passage and then into the rod side of the boom cylinder.

On the other side, the oil returned from the head side of the boom cylinder flows into A9 port to the tank passage that has been opened with the spool's notch after the spool changeover through the boom lock valve that has been released by Pb8' port pressure. Then, the boom cylinder retracts to lower the boom.



Boom down operation

R35Z72MCV14

4) Operation of boom lock valve

(1) Holding

In the boom spool neutral condition,

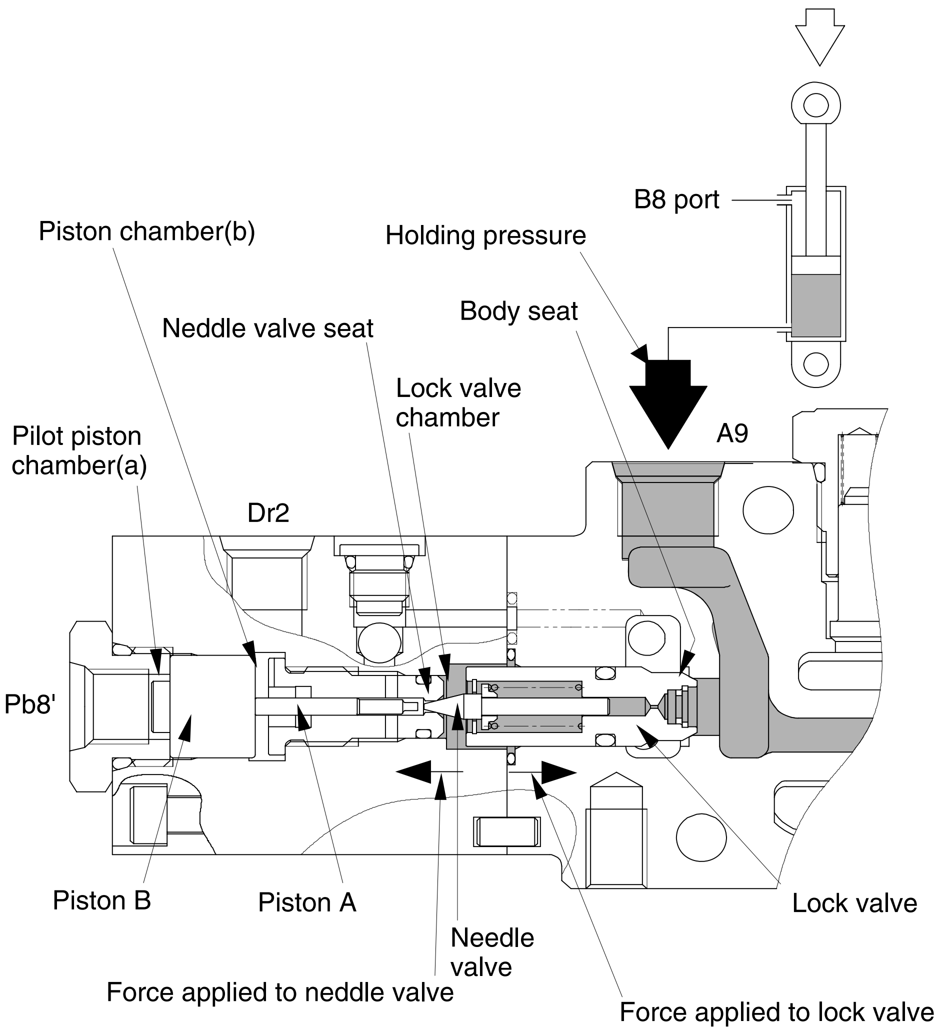
- The pilot piston chamber (a) is connected to the drain passage through the pilot port (Pb8') for releasing the boom lock valve.
- The piston chamber (b) is also connected to the drain passage through the drain port (Dr2).

Therefore, the piston (B) maintains the condition shown in the figure.

The boom cylinder holding pressure (shown in half-tone dot meshing) is applied to the lock valve chamber as shown in the figure to :

- Press the needle valve against the needle valve seat.
- Press the lock valve against the body seat.

Then, oil leakage from the boom cylinder head side is prevented to stop the movement of the boom cylinder due to leakage.



Operation of boom lock valve (holding)

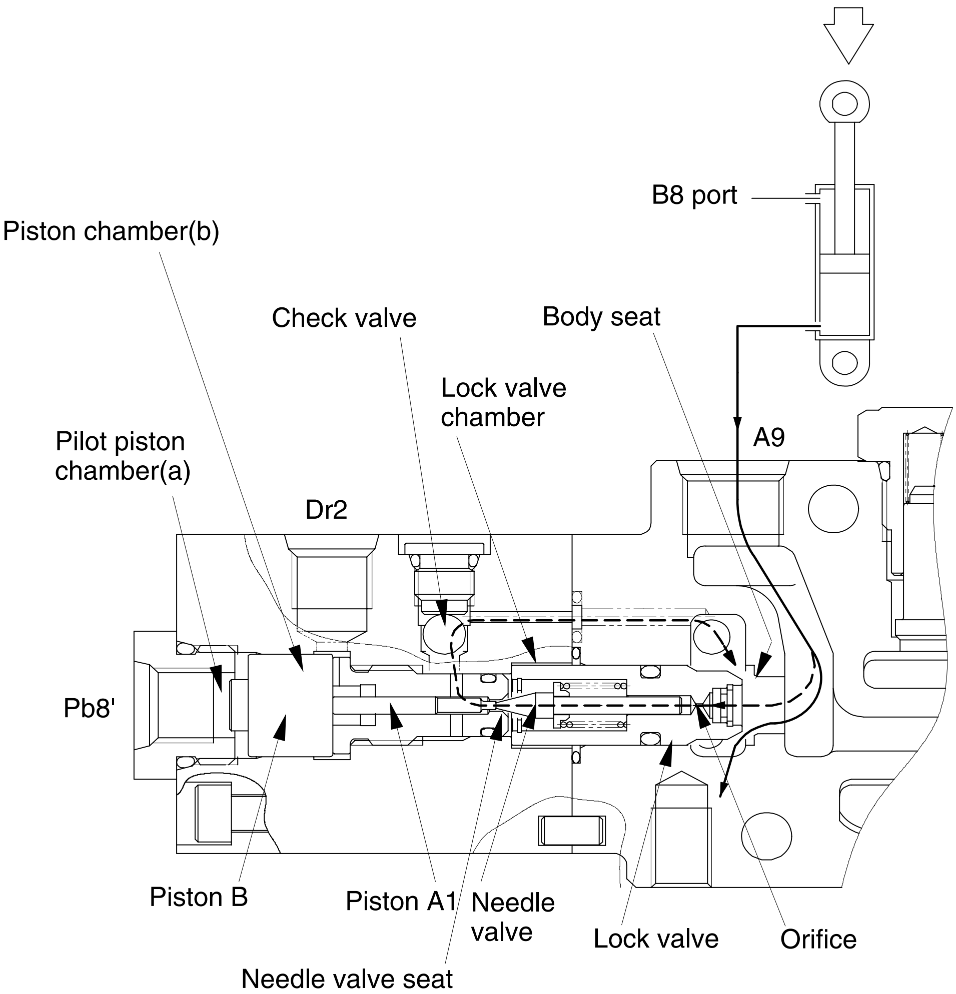
R35Z72MCV15

(2) Release

When the pilot pressure is applied to the pilot port (Pb8') for boom lock valve release, the piston (B) moves rightward to open the needle valve through the piston (A1).

Then, the oil returned from the boom cylinder flows through the passage in the direction of lock valve's orifice → lock valve chamber → needle valve seat → check valve into the lock valve's downstream side chamber (boom section).

When the lock valve's downstream chamber is connected to the tank passage after the boom spool changeover and the needle valve is released, the pressure in the lock valve chamber decreases to open the lock valve by the oil returned from the boom cylinder. The returned oil flows into the tank passage with the boom spool's notch to operate the cylinder.



Operation of boom lock valve (release)

R35Z72MCV16

5) BUCKET OPERATION

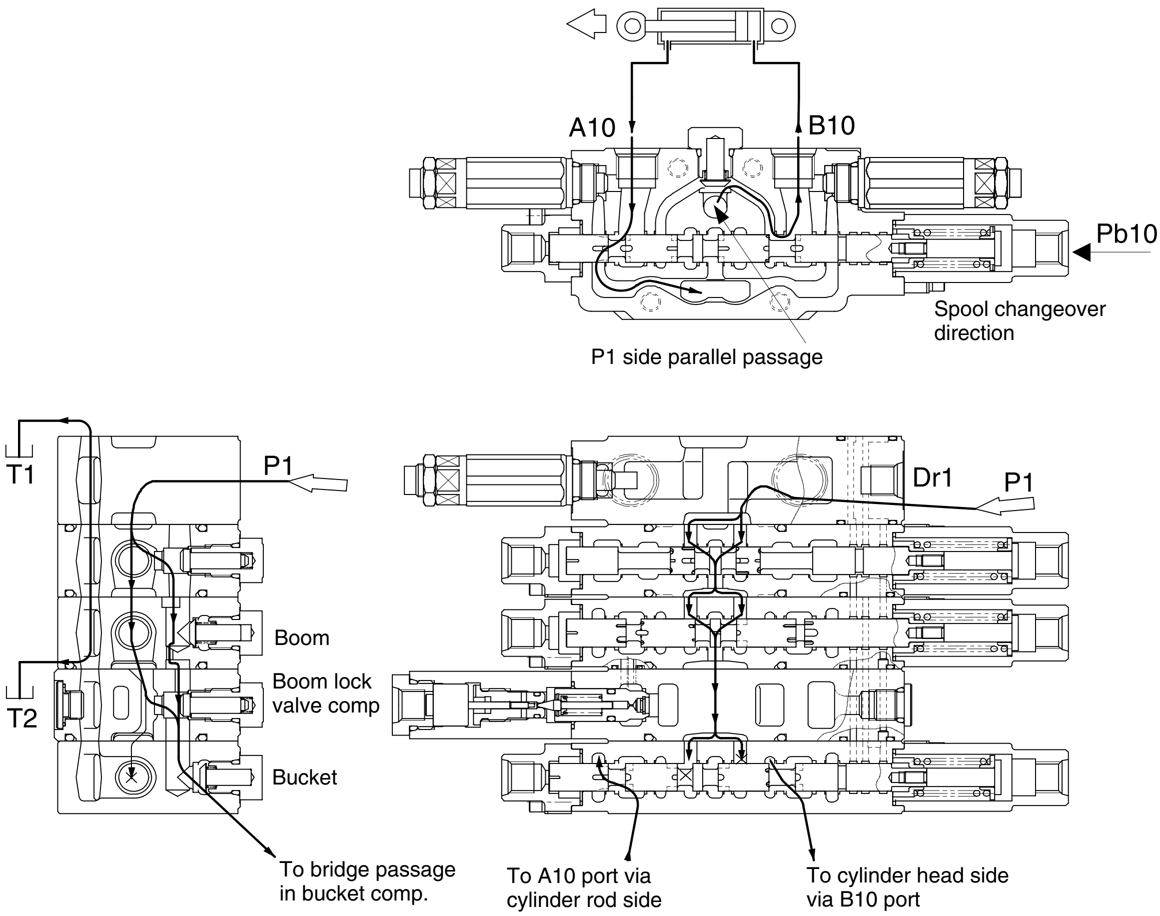
Bucket in operation

When the bucket in operation is carried out, the secondary pressure from the remote control valve flows into Pb10 port to change over the bucket spool.

Since the P1 side bypass passage is shut off at the bucket section after the bucket spool changeover, the oil flowed from P1 port flows through the check valve provided above the bypass passage in the travel section into the P1 side parallel passage.

Also, since a passage between B10 port and the bridge passage is opened after the spool changeover, the oil flowed into the P1 side parallel passage flows through the load check valve in the bucket section into B10 port via the bridge passage and then the head side of the bucket cylinder.

On the other hand, the oil returned from the rod side of the bucket cylinder flows into A10 port to the tank passage that has opened with the spool's notch after the spool changeover. Then, the bucket cylinder extends to make the bucket in.



Bucket in operation

R35Z72MCV17

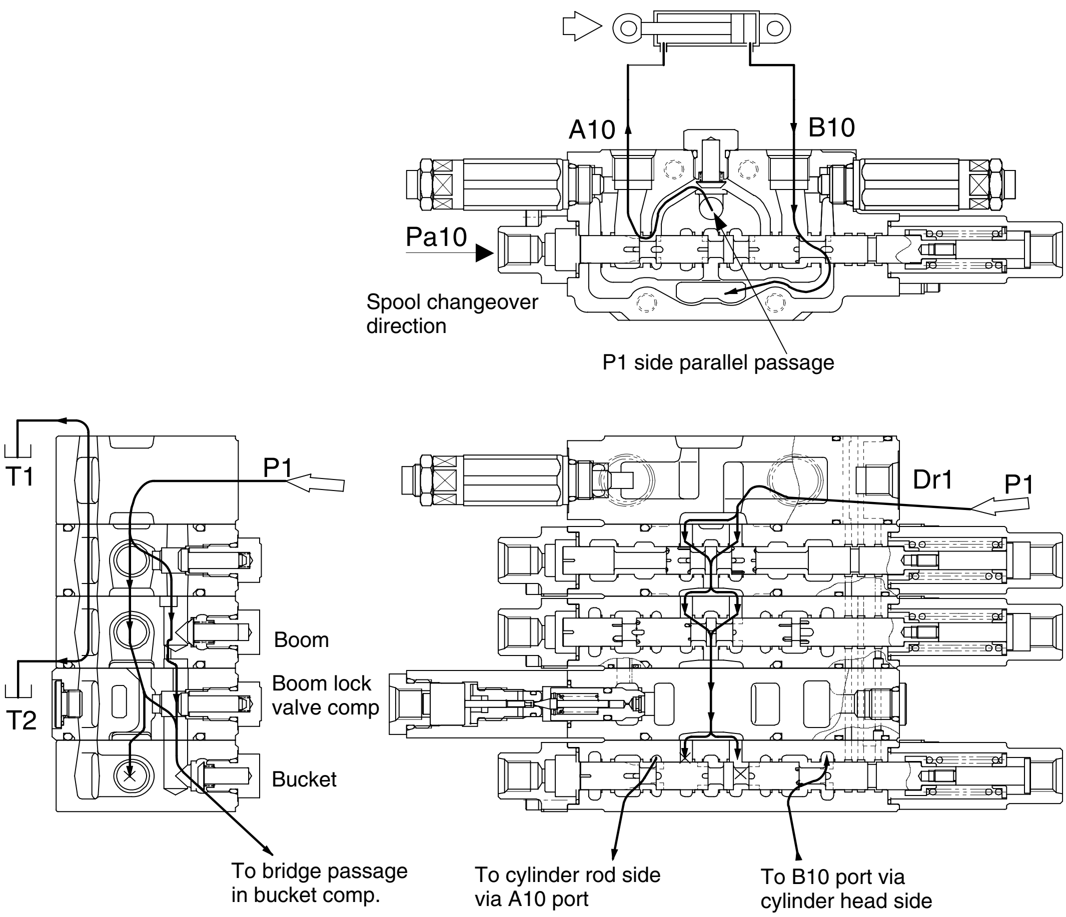
Bucket out operation

When the bucket out operation is carried out, the secondary pressure from the remote control valve flows into Pa10 port to change over the bucket spool.

Since the P1 side bypass passage is shut off at the bucket section after the bucket spool changeover, the oil flowed from P1 port flows through the check valve provided above the bypass passage in the travel section into the P1 side parallel passage.

Also, since a passage between A10 port and the bridge passage is opened after the spool changeover, the oil flowed into the P1 side parallel passage flows through the load check valve in the bucket section into A10 port via the bridge passage and then the head side of the bucket cylinder.

On the other hand, the oil returned from the head side of the bucket cylinder flows into B10 port to the tank passage that has opened after the spool changeover.



Bucket out operation

R35Z72MCV18

6) ARM OPERATION

Arm in operation

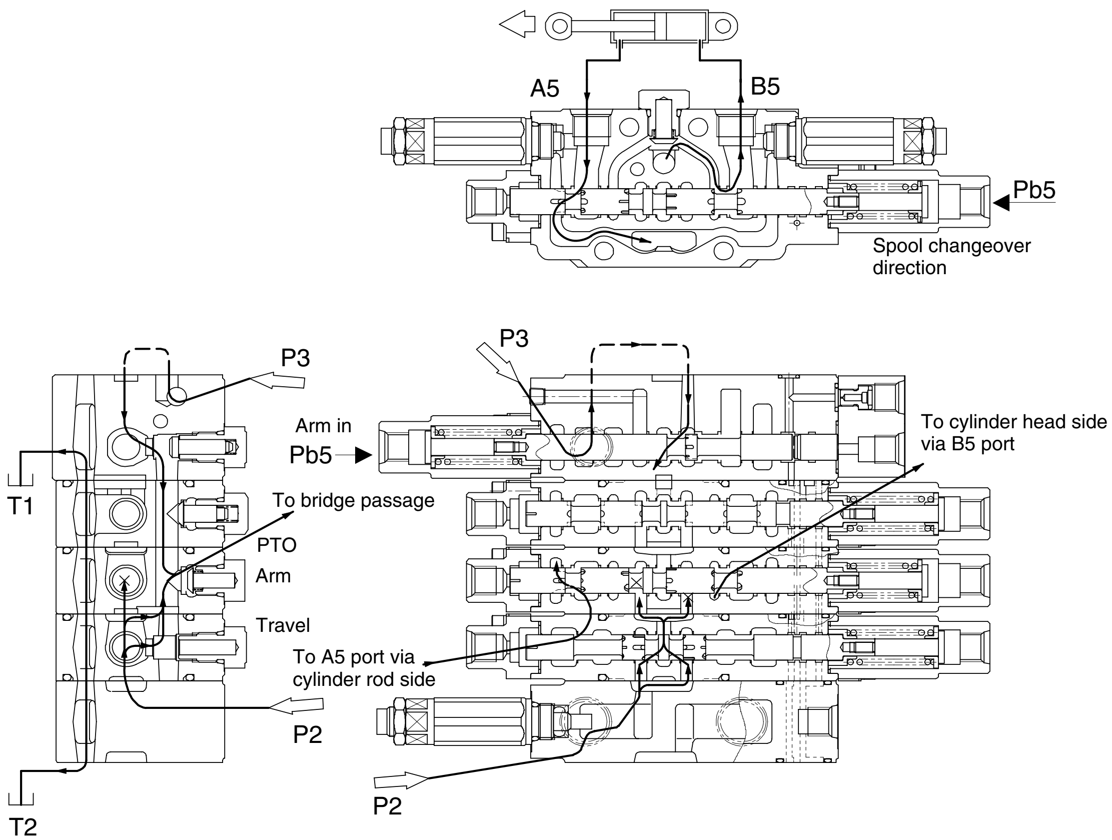
When the arm in operation is carried out, the secondary pressure from the remote control valve is applied to Pb5 port to change over the arm spool. The secondary pressure is also applied to the pilot chamber (arm in port) on the connecting section spring chamber side that has been connected through the piping. Therefore, when the operation is carried out together with the boom up operation at the same time, the connecting spool is hard to change over against the pilot pressure for arm in operation.

Since the P2 port bypass passage is shut off at the arm section after the arm spool change over, the oil flowed from P2 port flows through the travel section and a passage between travel section and arm section into the P2 side parallel passage.

Also, since the oil flowed from P3 port flows through the direction of dozer → boom swing → swing section and then into the P2 side parallel passage via the check valve in the P3 supply section, the connecting flow of P2 pump and P3 pump is supplied to the P2 side parallel passage. [Although the P3 side bypass passage is also connected to the P1 side parallel passage through the check valve in the P3 section, there is no oil flow into the P1 side as long as the P1 side sections (boom , bucket) are not operated.]

Since a passage between B5 port and the bridge passage is opened after the spool changeover, the oil flowed into the P2 side parallel passage flows through the load check valve in the arm section into B5 port via the bridge passage and then into the head side of the arm cylinder.

On the other hand, the oil returned from the rod side of the arm cylinder flows into A5 port to the tank passage that has opened with the spool's notch after the spool changeover. Then, the arm cylinder extends to make the arm in.



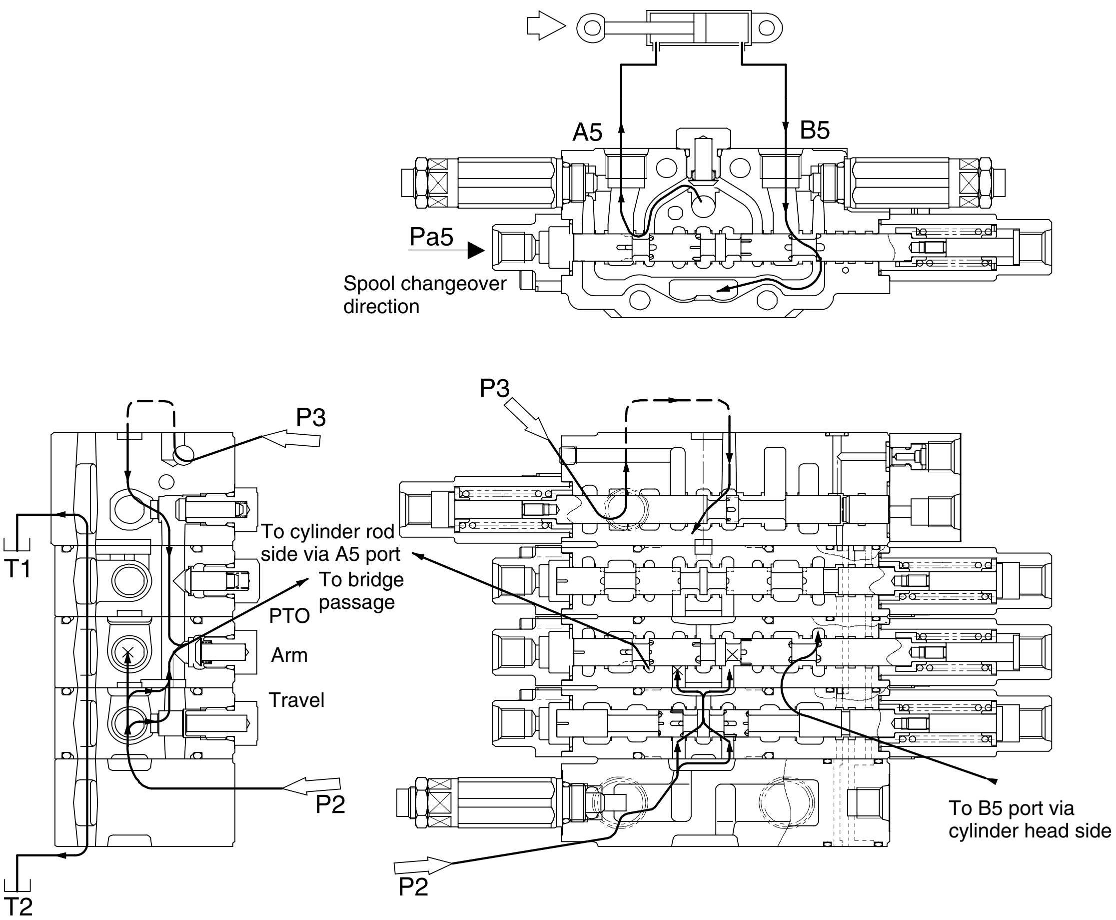
Arm in operation

R35Z72MCV19

Arm out operation

When the arm out operation is carried out, the secondary pressure from the remote control valve is applied to Pa5 port to change over the arm spool.
Since the P2 side bypass passage is shut off at the arm section after the arm spool changeover, the oil flowed from P2 port flows through the travel section and a passage between travel section and arm section into the P2 side parallel passage.
Also, since the oil flowed from P3 port flows through the direction of dozer → boom swing → swing section and then into the P2 side parallel passage via the check valve in the P3 supply section, the connecting flow of P2 pump and P3 pump is supplied to the P2 side parallel passage. [Although the P3 side bypass passage is also connected to the P1 side parallel passage through the check valve in the P3 section, there is no oil flow into the P1 side as long as the P1 side sections (boom , bucket) are not operated.]

Since a passage between A5 port and the bridge passage is opened after the spool changeover, the oil flowed into the P2 side parallel passage flows through the load check valve in the arm section into A5 port via the bridge passage and then into the rod side of the arm cylinder.
On the other hand, the oil returned from the head side of the arm cylinder flows into B5 port to the tank passage that has opened after the spool changeover. Then, the arm cylinder retracts to make the arm out.



Arm out operation

R35Z72MCV20

7) PTO OPERATION

For the PTO operation, both Pa pressurization and Pb pressurization are the same on operation so that only Pa pressurization is explained as follows.

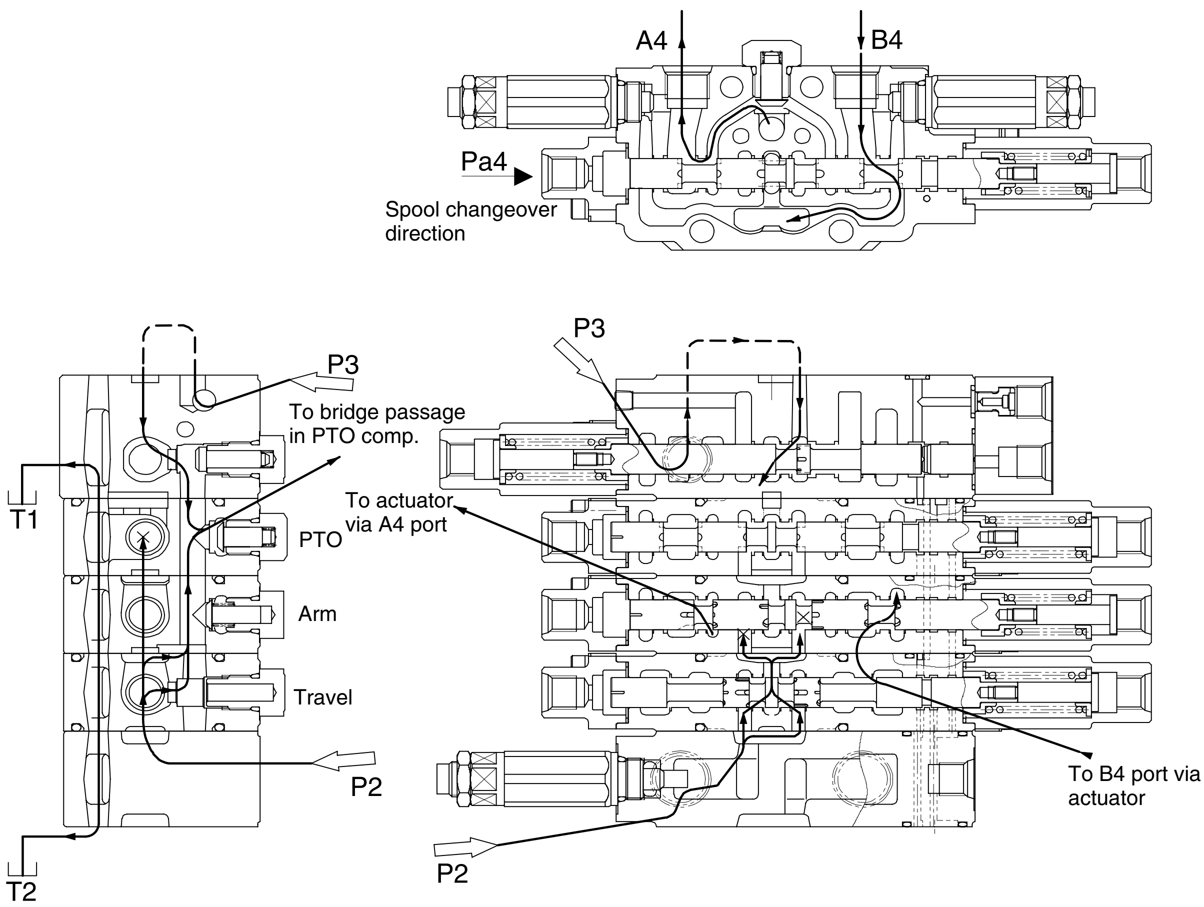
When the PTO operation (Pa4 pressurization) is carried out, the secondary pressure from the remote control valve is applied to Pa4 port to change over the PTO spool. Since the P2 side bypass passage is shut off at the PTO section after the PTO spool changeover, the oil flowed from P2 port flows through the travel section and a passage between travel section and arm section into the P2 side parallel passage.

Also, since the oil flowed from P3 port flows through the direction of dozer → boom swing → swing section and then into the P2 side parallel passage via the check valve in the P3 supply section, the connecting flow of P2 pump and P3 pump is supplied to the P2 parallel passage.

[Although the P3 side bypass passage is also connected to the P1 side parallel passage through the check valve in the P3 section, there is no oil flow into the P1 side as long as the P1 side sections (boom , bucket) are not operated.]

Since a passage between A4 port and the bridge passage is opened after the spool changeover, the oil flowed into the P2 side parallel passage flows through the load check valve in the PTO section into A4 port via the bridge passage and then into the actuator for PTO.

On the other hand, the oil returned from actuator for PTO flows into B4 port to the tank passage that has opened after the spool changeover.



PTO operation

R27Z92MCV21

8) DOZER OPERATION

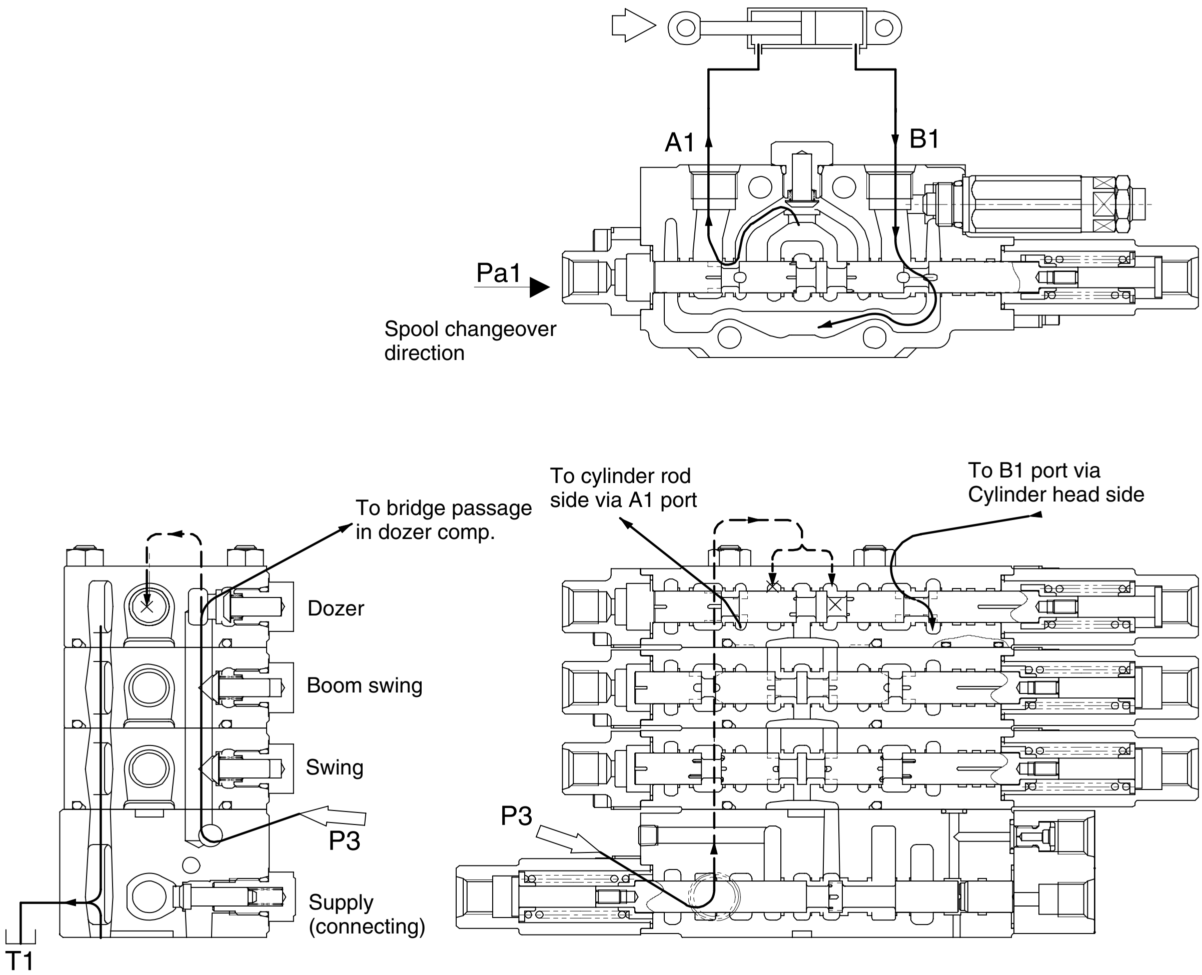
Dozer up operation

When the dozer up operation is carried out, the secondary pressure from the remote control valve is applied to Pa1 port to change over the dozer spool.

Since the P3 side bypass passage is shut off at the dozer section after the dozer spool changeover, the oil flowed from P3 port through the P3 side parallel passage flows into A1 port through the load check valve in the dozer section and the bridge passage since A1 port and the bridge passage have been opened after the spool changeover and then into the rod side of the dozer cylinder.

On the other hand, the oil returned from the head side of the dozer cylinder flows into B1 port to the tank passage that has opened after the spool changeover.

Then, the dozer cylinder retracts to raise the dozer.



Dozer up operation

R35Z72MCV22

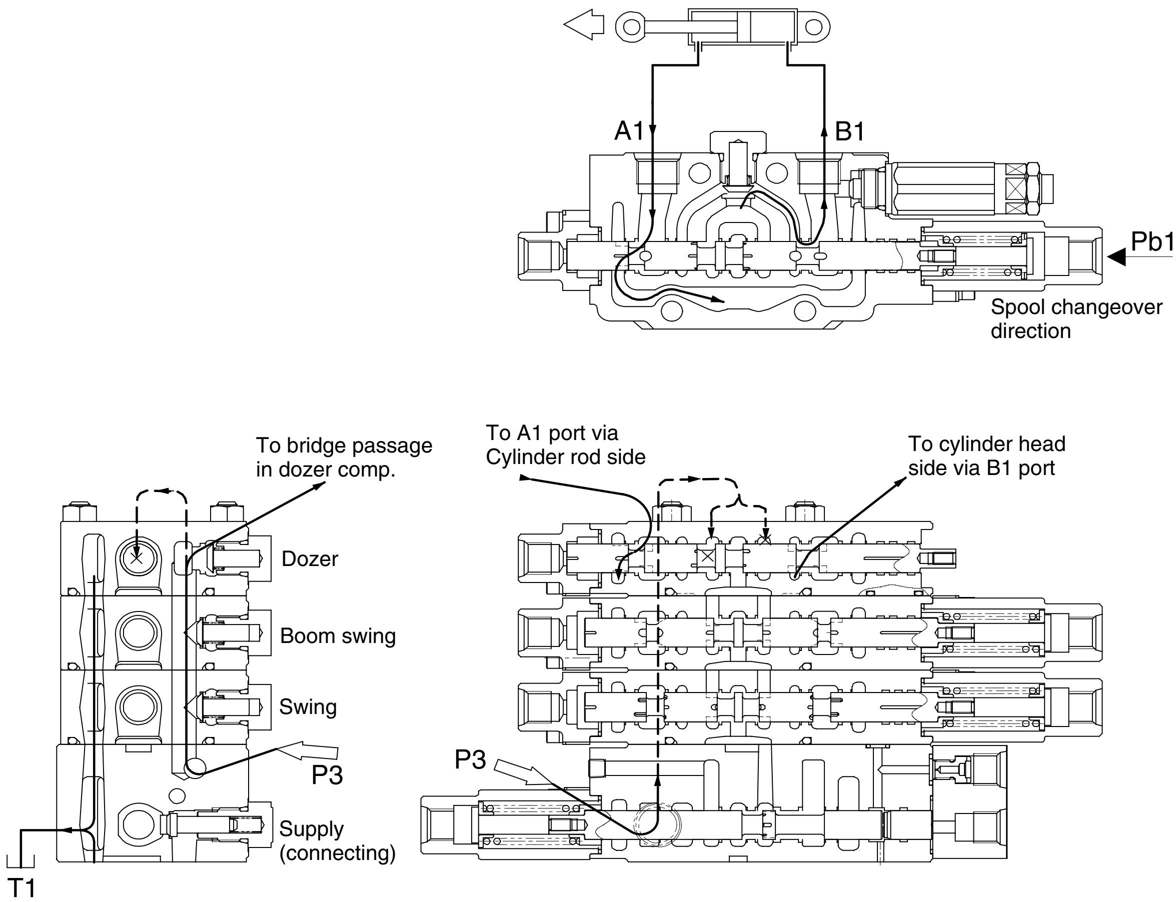
Dozer down operation

When the dozer down operation is carried out, the secondary pressure from the remote control valve is applied to Pb1 port to change over the dozer spool.

Since the P3 side bypass passage is shut off at the dozer section after the dozer spool changeover, the oil flowed from P3 port through the P3 side parallel passage flows into B1 port through the load check valve in the dozer section and the bridge passage since B1 port and the bridge passage have been opened after the spool changeover and then into the head side of the dozer cylinder.

On the other hand, the oil returned from the rod side of the dozer cylinder flows into A1 port to the tank passage that has opened with the spool's notch after the spool changeover.

Then, the dozer cylinder extends to lower the dozer.



Dozer down operation

R35Z72MCV23

9) BOOM SWING OPERATION

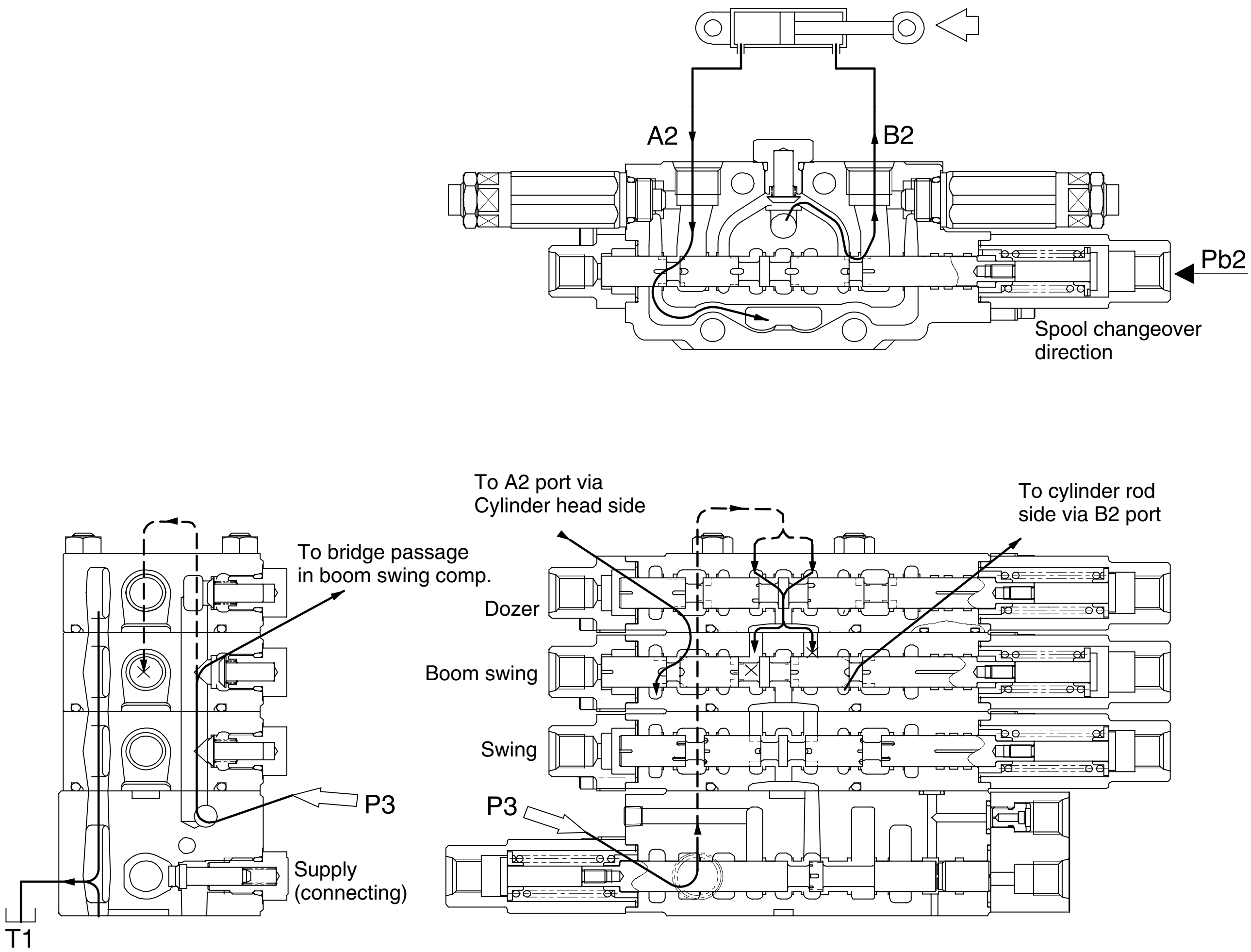
Boom left swing operation

When the boom left swing operation is carried out, the secondary pressure from the remote control valve is applied to Pb2 port to change over the boom swing spool.

Since the P3 side bypass passage is shut off at the boom swing section after the boom swing spool changeover, the oil flowed from P3 port through the P3 side parallel passage flows into B2 port through the load check valve in the boom swing section and the bridge passage since B2 port and the bridge passage have been opened after the spool changeover and then into the rod side of the boom swing cylinder.

On the other hand, the oil returned from the head side of the boom swing cylinder flows into A2 port to the tank passage that has opened with the spool's notch after the spool changeover.

Then, the boom swing cylinder retracts to swing the attachment left.



Boom left swing operation

R35Z72MCV24

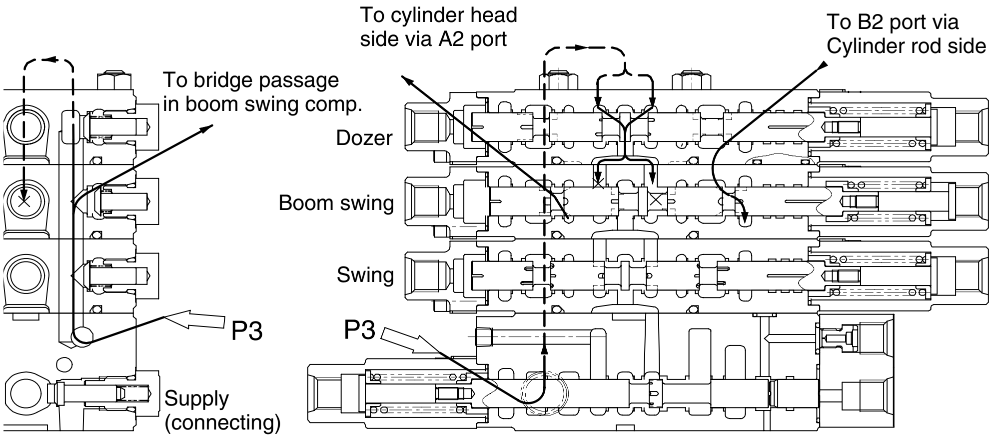
Boom right swing operation

When the boom right swing operation is carried out, the secondary pressure from the remote control valve is applied to Pa2 port to change over the boom swing spool.

Since the P3 side bypass passage is shut off at the boom swing section after the boom swing spool changeover, the oil flowed from P3 port through the P3 side parallel passage flows into A2 port through the load check valve in the boom swing section and the bridge passage since A2 port and the bridge passage have been opened after the spool changeover and then into the head side of the boom swing cylinder.

On the other hand, the oil returned from the rod side of the boom swing cylinder flows into B2 port to the tank passage that has opened with the spool's notch after the spool changeover.

Then, the boom swing cylinder extends to swing the attachment right.



Boom right swing operation

R35Z72MCV25

(10) SWING OPERATION

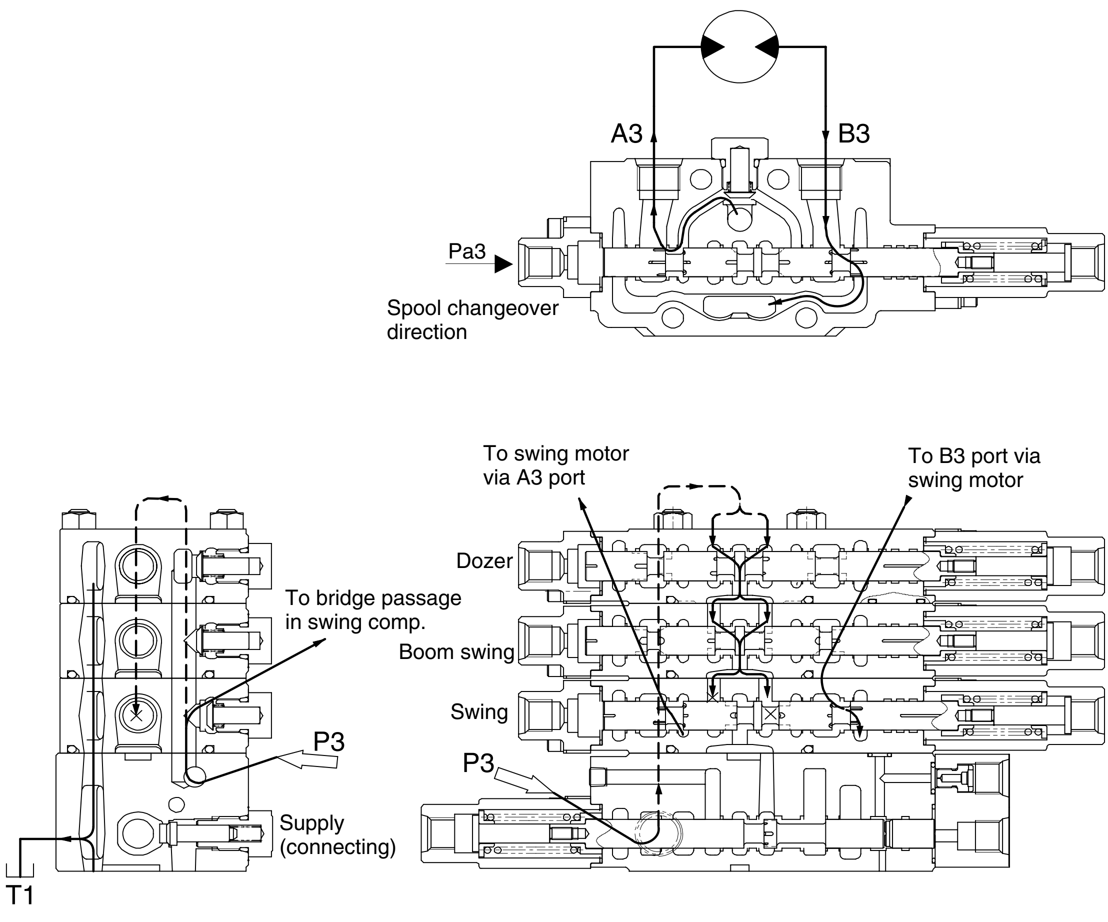
For the swing operation, both Pa pressurization and Pb pressurization are the same on operation so that only Pa pressurization is explained as follows.

When the right swing operation is carried out, the secondary pressure from the remote control valve is applied to Pa3 port to change over the swing spool.

Since the P3 side bypass passage is shut off at the swing section after the swing spool changeover, the oil flowed from P3 port through the P3 side parallel passage flows into A3 port through the load check valve in the swing section and the bridge passage since A3 port and the bridge passage have been opened after the spool changeover and then into the swing motor.

On the other hand, the oil returned from the swing motor flows into B3 port to the tank passage that has opened with the spool's notch after the spool changeover.

Then, the upper swing body swings right.



Right swing operation

R35Z72MCV26

(11) COMBINED CONTROL OPERATION ①

Boom up + Arm in + bucket

When the above combined control is carried out, the secondary pressure from the remote control valve is applied to each spool to change over them. Since the secondary pressure for arm in operation is also applied to the pilot chamber on the connecting section spring chamber side according to the piping, the connecting spool operates against the secondary pressure developed from boom up operation and arm in operation.
(Boom up operation secondary pressure - Arm in operation secondary pressure = connecting spool changeover pressure)

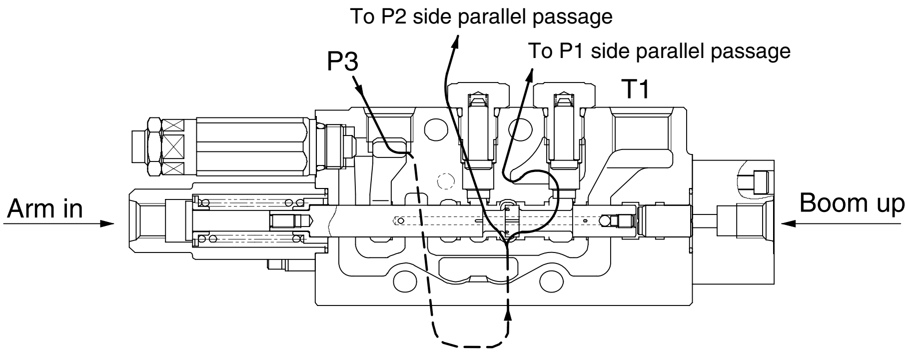
When all the above combined operations are carried out in full lever operation (full changeover), the oil supplied from P1 pump is supplied to the boom and bucket and the oil from P2 pump to the arm. Since the connecting spool changeover pressure becomes "0" as mentioned above, the connecting spool cannot change over and the oil from P3 pump flows to the P1 and P2 side parallel passages through the connecting section. Accordingly, much oil flows to the arm side normally because of its low working load.

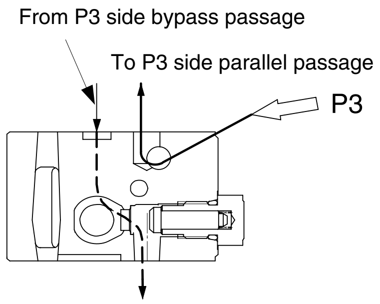
In this condition, since gradually restricting the arm in operation (returning the lever) causes the secondary pressure for arm in operation to decrease, the connecting spool changeover pressure to increase, the connecting spool to start changing over, and the passage to the arm side to be narrowed, the oil supplied from P3 pump flows abundantly into the P1 side (Boom, bucket).

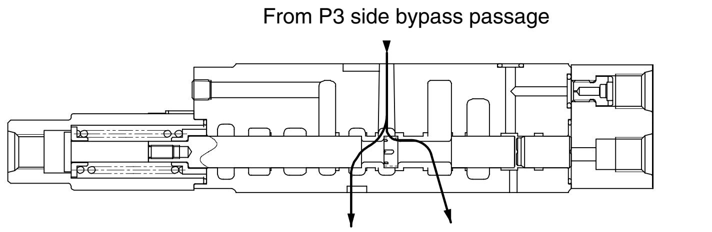
As mentioned above, the oil supplied from P3 pump flows suitably into each attachment according to the control input during the above combined control, resulting in a well-balanced and efficient working speed.

Besides, since the oil flow to the bucket whose working load is less than the boom is restricted with an orifice (the orifice of boom priority) provided before the bucket section in the P1 side parallel passage, much oil flows into the boom section. As a result, the working speed balance between both attachments is maintained during the combined operation of boom and bucket.

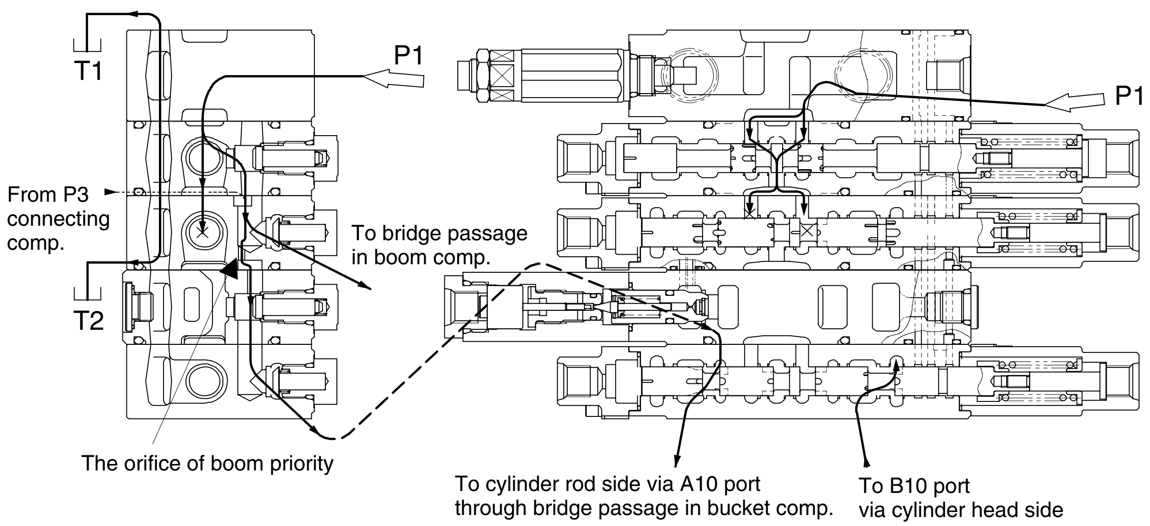
P3 side (connecting side) circuit







P1 side circuit (the orifice of boom priority)



Oil flow during combined operation

R35Z72MCV27

(12) COMBINED CONTROL OPERATION ②

Both travels + bucket

When the both travels operation is carried out together with the bucket operation at the same time, the oil flowed from Pp1 port flows through the orifice passage and into the travel independent signal passage; both travels and the bucket spool changeover make a passage to the drain port shut off.

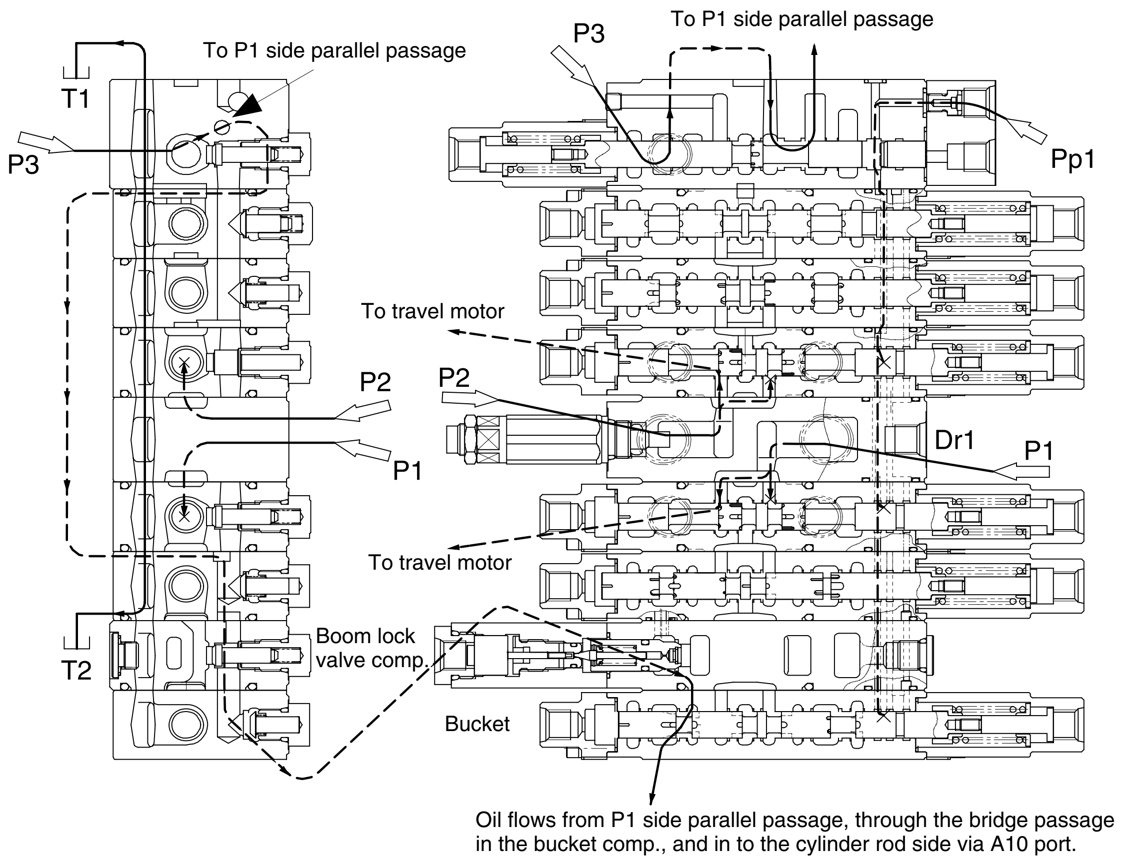
Then, the travel independent passage becomes the same pressure as Pp1 port pressure (pilot primary pressure).

When the travel independent passage becomes Pp1 pressure, the Pp1 pressure is applied to the connecting spool to change over the connecting spool.

Since the bypass passage from P3 to P2 side, which is a passage to the tank, in restricted, the oil from P3 side flows into the P1 side parallel passage that is connected through a check valve.

With his circuit arrangement, the bucket section is supplied with pressure oil from P3 during both travels operation, the simultaneous operation becomes possible.

Besides, since each of P1 and P2 is used independently during both travels and only P3 is used for bucket operation, stable travel is possible to continue even if there is change in the bucket load.



Travel independence operation

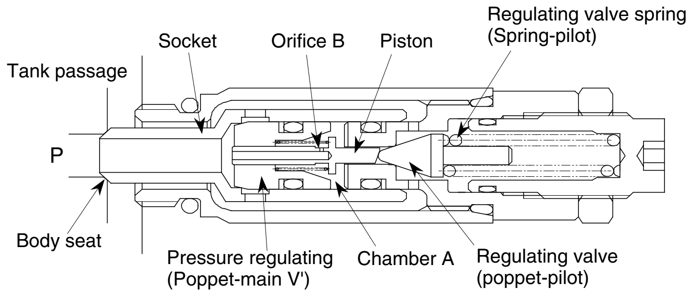
R35Z72MCV28

(13) MAIN AND PORT RELIEF VALVE OPERATION

Main relief valve operation

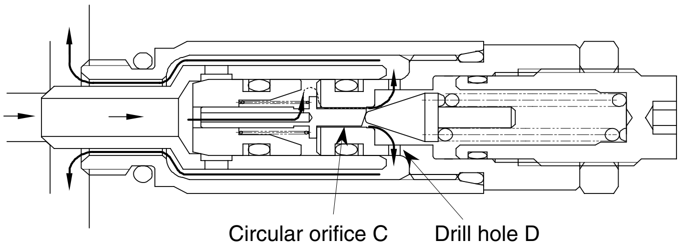
Main relief valves (MRV) are different in the uses for P1/P2 and P3; however, their structures and operation are the same.

① Pressure oil flows through the inside of the piston built in the pressure regulating valve (poppet-main V') and the orifice B and then into the internal chamber A until it is filled up. The filled up pressure causes both of the pressure regulating valve and the socket and body seat to be seated securely.



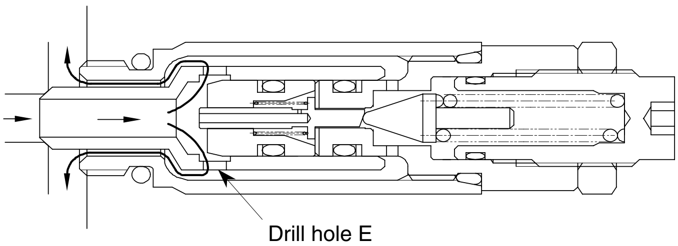
MRV operation (1) R35Z72MCV29

② When the oil pressure at port P increases up to the setting pressure of regulating valve spring, the pressure oil is applied to the regulating valve via the piston to open the regulating valve. Then, the pressure oil flows through a passage in the direction of piston inside → orifice B → chamber A → circular orifice C → Drill hole D and the external of socket and then into the tank passage.



MRV operation (2) R35Z72MCV30

③ Since the pressure inside the chamber A decreases when the regulating valve is opened, which causes the pressure regulating valve to open to let the pressure oil port P flows into the tank passage through drill hole E.

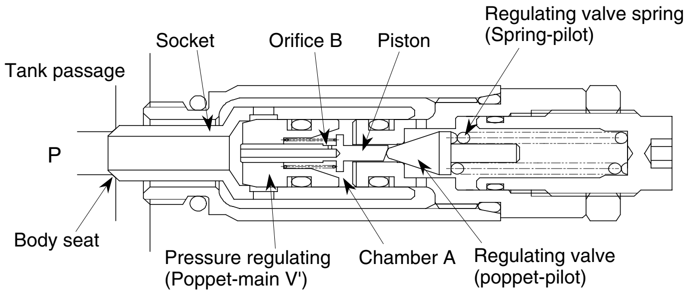


MRV operation (3) R35Z72MCV31

④ Also, since the regulating valve is pressed to the seat by regulating valve spring when the pressure at port P decreases below the setting pressure of regulating valve spring, the pressure inside chamber A becomes the same as the pressure at port P to cause the pressure regulating valve to be pressed to the seat, resulting in the original condition (①).

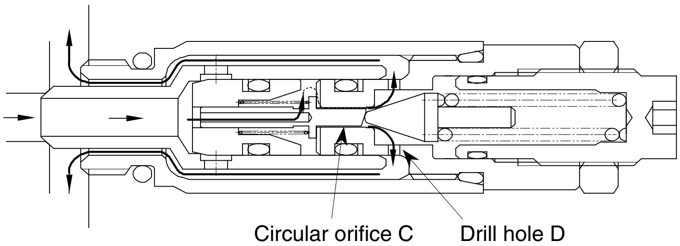
Overload relief valve (ORV) operation ①

① Pressure oil flows through the inside of the piston built in the pressure regulating valve (poppet-main V') and the orifice B and then into the internal chamber A until it is filled up. The filled up pressure causes both of the pressure regulating valve and socket and body seat to be seated securely.



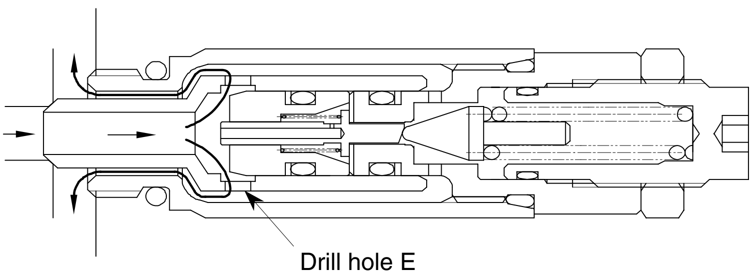
ORV operation (1) R35Z72MCV32

② When the oil pressure at port P increases up to the setting pressure of regulating valve spring, the pressure oil is applied to the regulating valve via the piston to open the regulating valve. Then, the pressure oil flows through a passage in the direction of piston inside → orifice B → chamber A → circular orifice C → Drill hole D and the external of socket and then into the tank passage.



ORV operation (2) R35Z72MCV33

③ Since the pressure inside the chamber A decreases when the regulating valve is opened, which causes the pressure regulating valve to open to let the pressure oil port P flows into the tank passage through drill hole E.

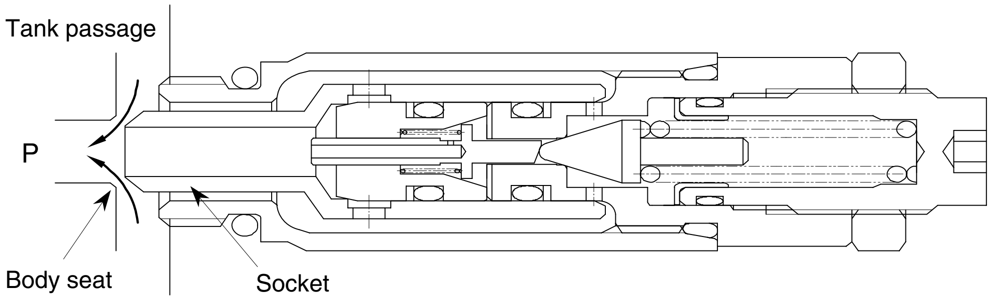


ORV operation (3) R35Z72MCV34

④ Also, since the regulating valve is pressed to the seat by regulating valve spring when the pressure at port P decreases below the setting pressure of regulating valve spring, the pressure inside chamber A becomes the same as the pressure at port P to cause the pressure regulating valve to be pressed to the seat, resulting in the original condition (①).

Overload relief valve (ORV) operation ② 【Operation during suction】

If there is negative pressure at port P (or the tank passage pressure is higher than P pressure), the socket is applied with press and open force. Then, the opening between body seat and socket increases to cause the oil to flow into port P from the tank passage, filling up the space.



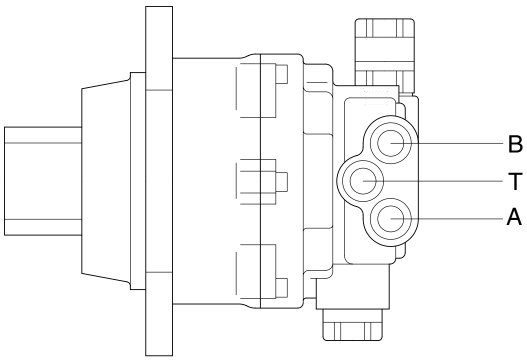
ORV operation (during suction) R35Z72MCV35

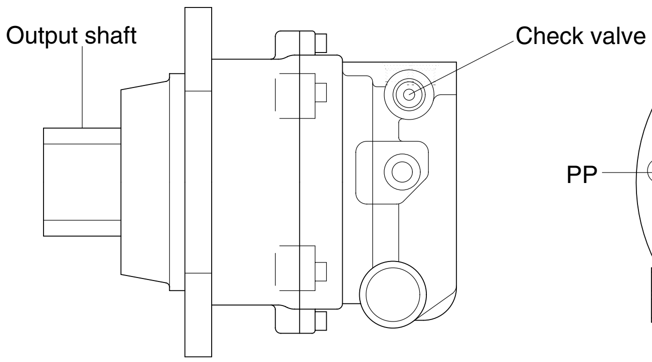
1. STRUCTURE

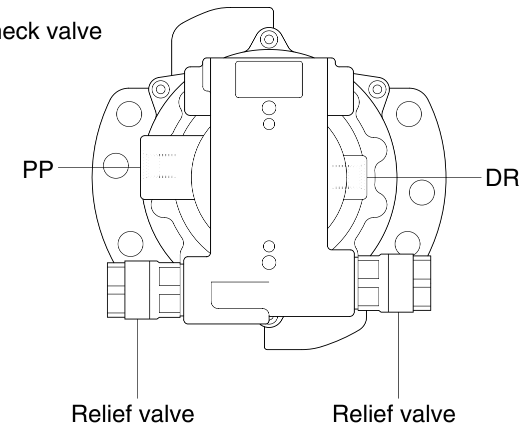
Swing device consists swing motor and swing reduction gear.

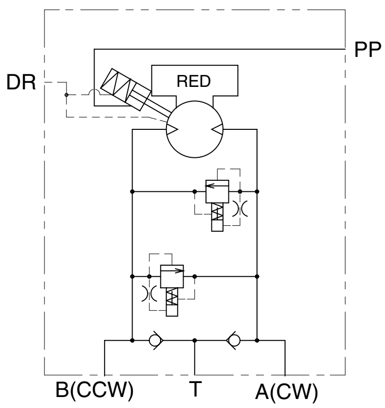
1) SWING MOTOR

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







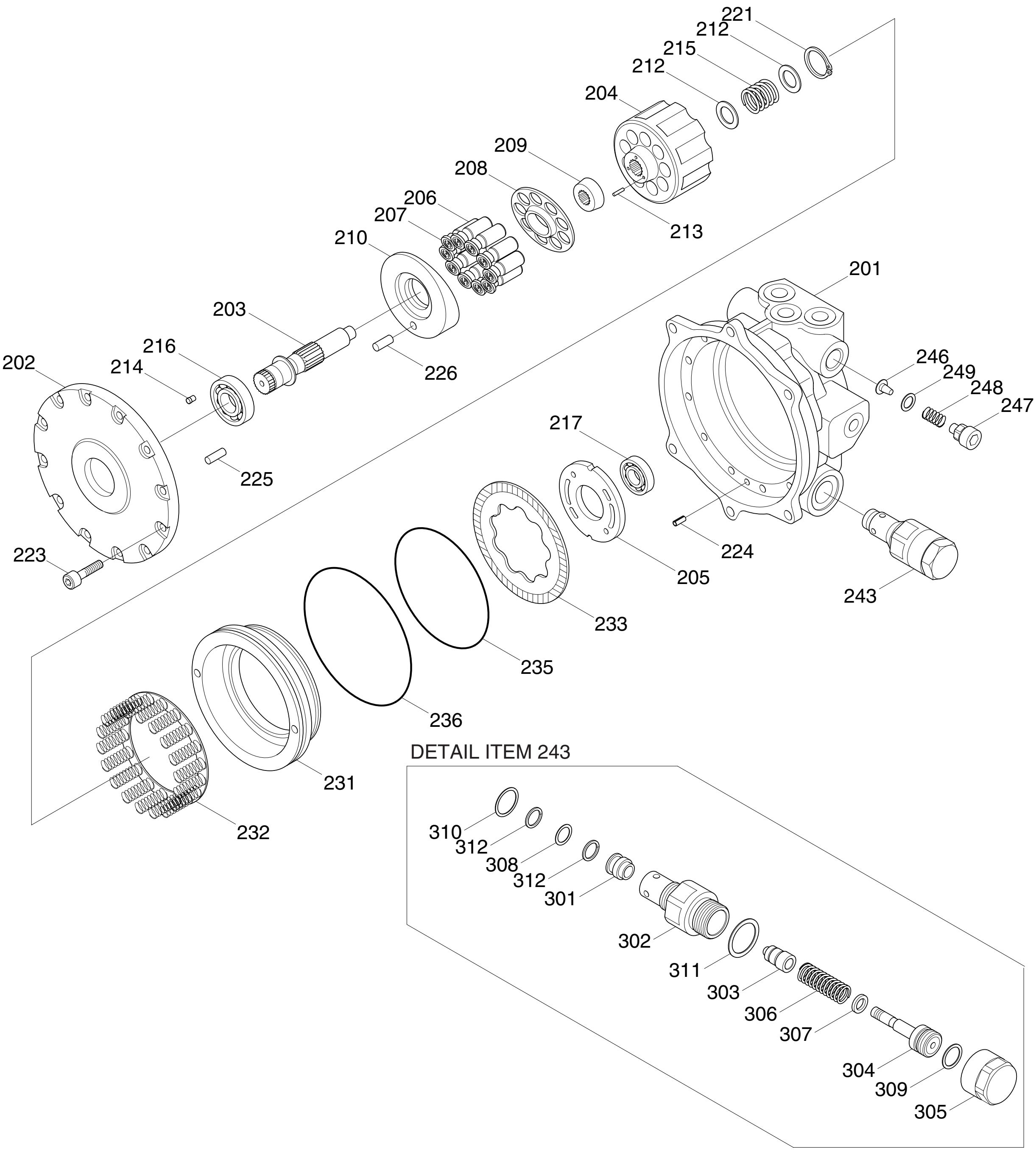


HYDRAULIC CIRCUIT

R27Z92SM01

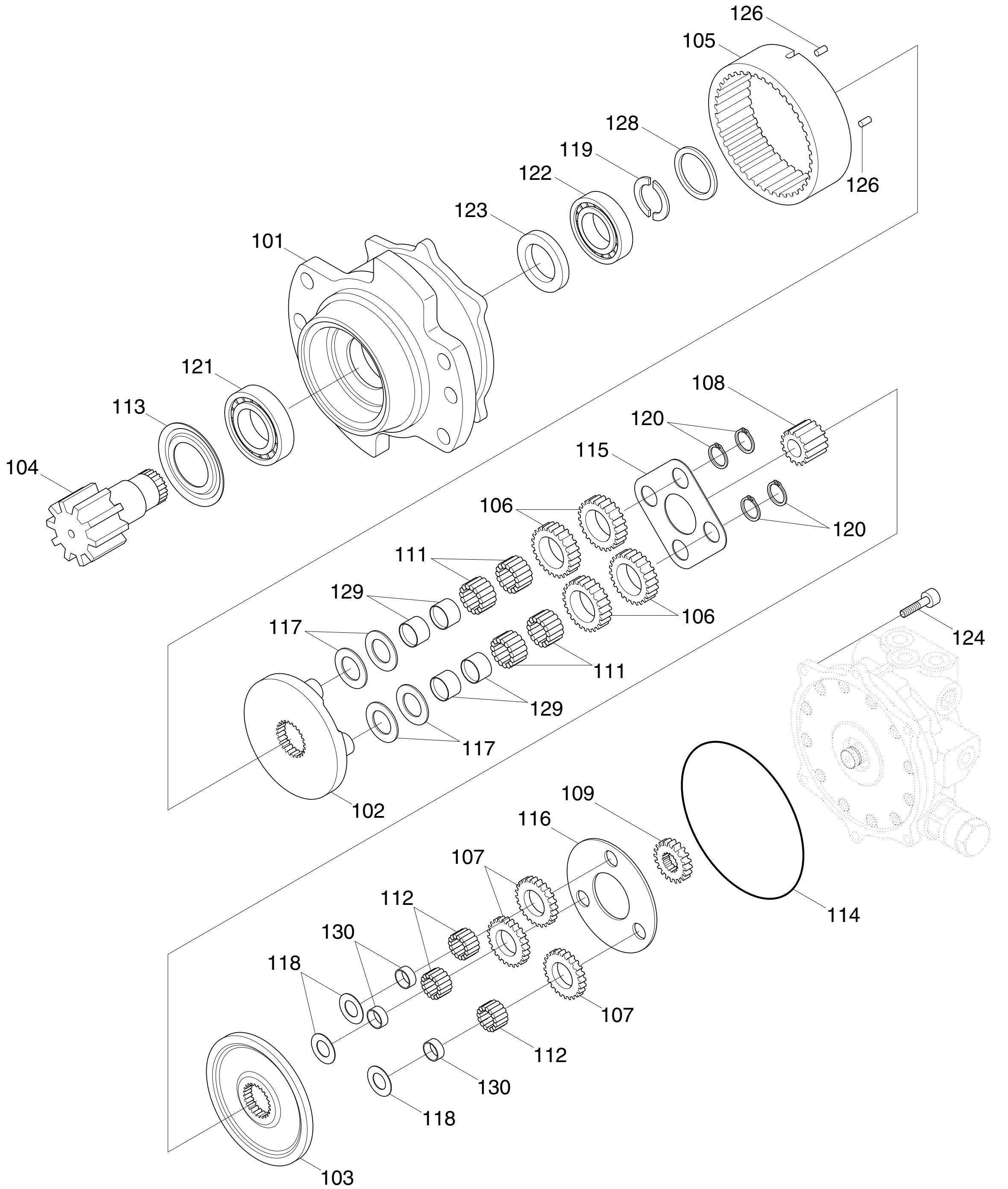
Port	Port name	Port size
A	Main port	PF 3/8
B	Main port	PF 3/8
DR	Drain port	PF 3/8
T	Make up port	PF 3/8
PP	Brake release port	PF 1/4

2) COMPONENTS (1/2)



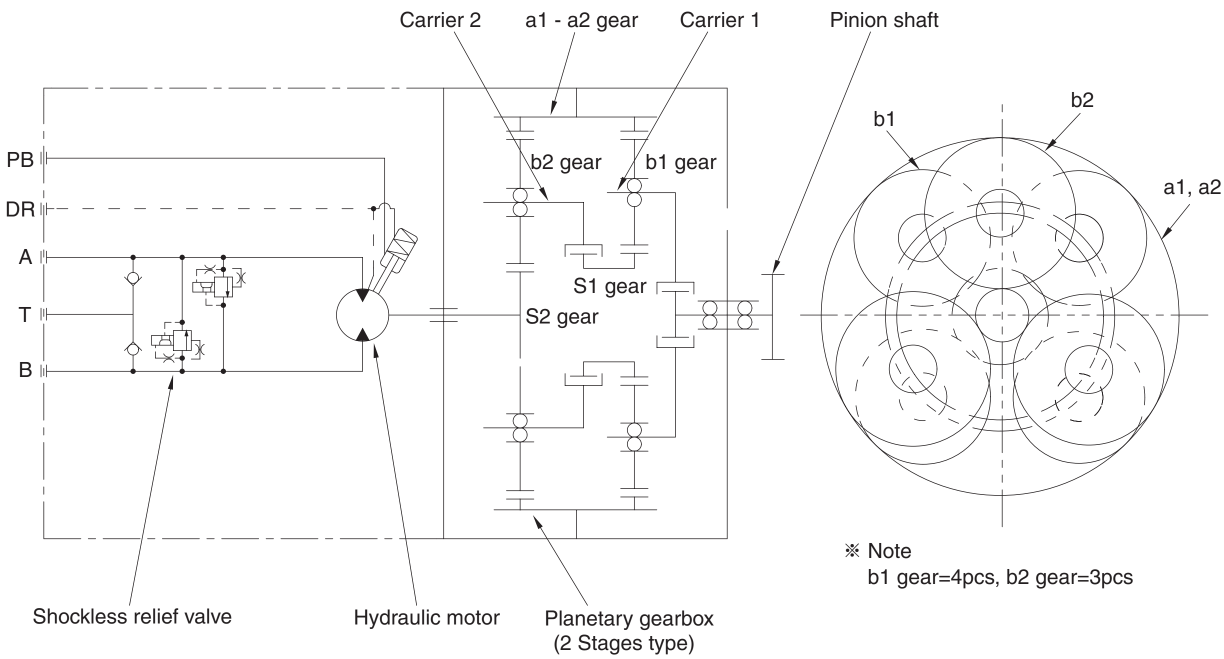
201	Body	213	Pin	232	Spring assy	303	Poppet
202	Plate	214	Filter	233	Disk plate	304	Piston
203	Shaft	215	Spring C	235	O-ring	305	Cap
204	Cylinder barrel	216	Bearing	236	O-ring	306	Spring
205	Valve plate	217	Bearing	243	Relief valve	307	Spacer
206	Piston	221	Snap ring	246	Check valve	308	O-ring
207	Shoe	223	Screw	247	Plug	309	O-ring
208	Shoe holder	224	Spring pin	248	Spring	310	O-ring
209	Barrel holder	225	Pin	249	O-ring	311	O-ring
210	Swash plate	226	Pin	301	Seat	312	Back up-ring
212	Retainer	231	Brake piston	302	Retainer		

COMPONENTS (2/2)



101	Body	111	Needle	120	Snap ring
102	Carrier 1	112	Needle	121	Bearing
103	Carrier 2	113	Seal ring	122	Bearing
104	Pinion shaft	114	O-ring	123	Oil seal
105	Internal gear	115	Thrust plate 1	124	Screw
106	Gear B1	116	Thrust plate 2	126	Pin
107	Gear B2	117	Thrust washer 1	128	Ring
108	Gear S1	118	Thrust washer 2	129	Ring 1
109	Gear S2	119	Preload collar	130	Ring 2

2. OPERATION PRINCIPLE



R27Z92SM02

3. OPERATION

The swing motor consists of a planetary gear speed reducer, a hydraulic motor and the hydraulic valves.

1) REDUCTION GEAR SECTION

(1) Function

The speed reducer of swing motor is a simple planetary gear type with two stages. The high output speed of the hydraulic motor is reduced to low speed with high torque and obtaining the pinion shaft rotation.

(2) Operation

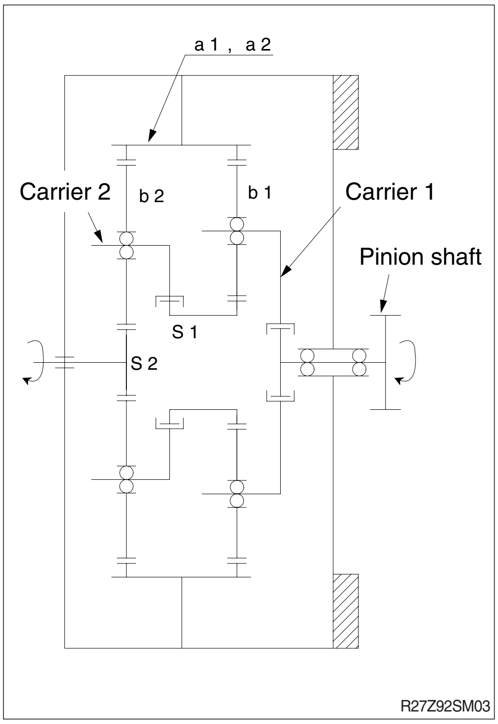
The s2 gear is attached to the hydraulic motor shaft, and the s2 output speed is reduced between the gears (s2, b2, a2).

This reduced output speed is transmitted to the s1 gear and the speed is reduced again between the gears (s1, b1, a1), and it is transmitted to the pinion shaft, and drives the machine.

The gear ratio of two stages simple planetary speed reducer is calculated using the following formula.

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

※ Z ** : Number of gear teeth.



2) HYDRAULIC MOTOR SECTION

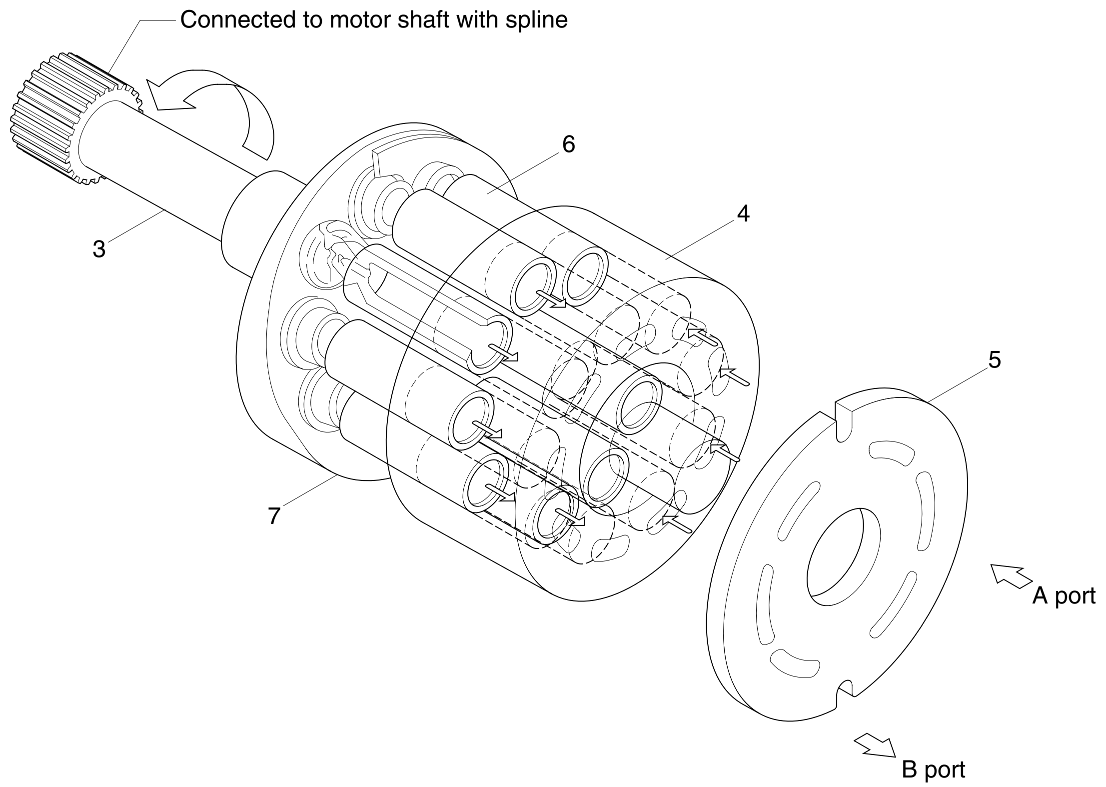
(1) Function

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

(2) Structure

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

To reverse rotation, pressurized oil is supplied to the B port and returning oil exits through the A port.



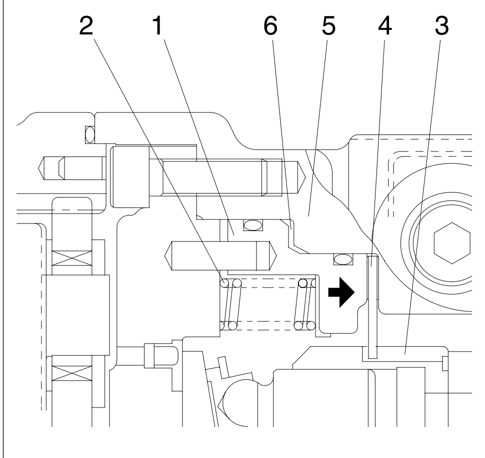
R27Z92SM04

(3) Parking brake

The parking brake fixes the output shaft of hydraulic motor mechanically while the wheel motor is stopped.

① At the brake releasing pressure OFF

When brake releasing pressure is not supplied, the brake piston (1) is pressed in the direction (shown as arrow) by the spring (2). Then the disk plate (4) which is fixed to the cylinder barrel (3) is held between the body H (5) and the brake piston (1). As a result, with the friction of these parts, the cylinder barrel (3) and the hydraulic motor are unable to rotate.

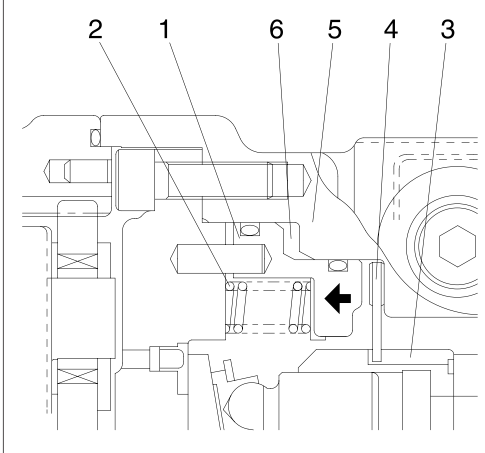


R27Z92SM05

② At the brake releasing pressure ON

When brake releasing pressure is supplied, the oil is lead to chamber (6).

Then the brake piston (1) is moved to the direction (shown as arrow in) against the force of spring (2). As a result, the disk plate (4) is released from the friction, and the cylinder barrel (3) can be rotated.



R27Z92SM06

3) HYDRAULIC VALVE SECTION

(1) Shockless relief valve

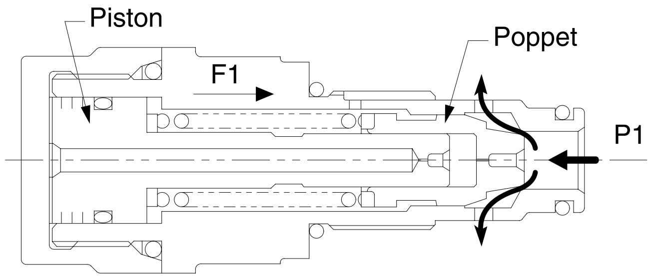
The shockless relief valve consists of the direct relief valve (poppet) and the piston for changing the spring force with two stages.

When the hydraulic motor is stopped, even after closing IN and OUT port of the hydraulic motor, the motor tries to run with inertia. Motor works as like a pump, and the pressure (brake pressure) is made on the OUT port side. The shockless relief valve releases this brake pressure with two stages of operation. This makes the shock smooth, and prevents the motor being damaged.

It also makes the start of the motor smooth.

① First stage

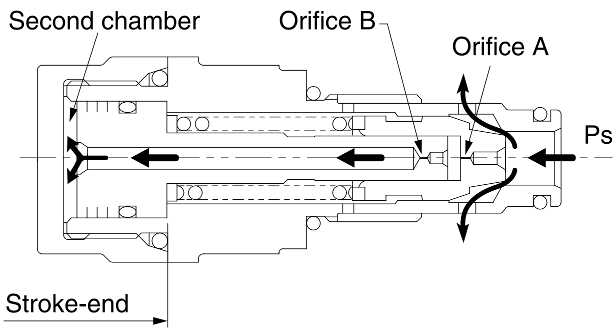
When the P1 pressure is going up, the poppet opens due to the pressure of the spring force F1.



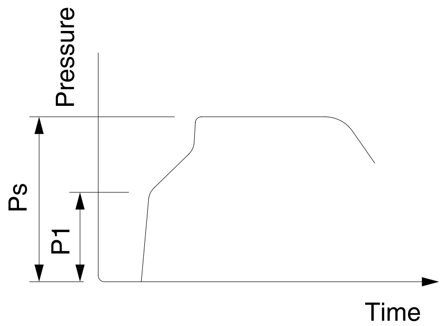
R27Z92SM07

② Second stage

When P1 pressure enters the second chamber through the orifice A and B, the piston moves to its stroke-end. With this action, the spring is compressed, the spring force becomes stronger, and the P1 pressure is increased to the setting pressure Ps.



R27Z92SM08



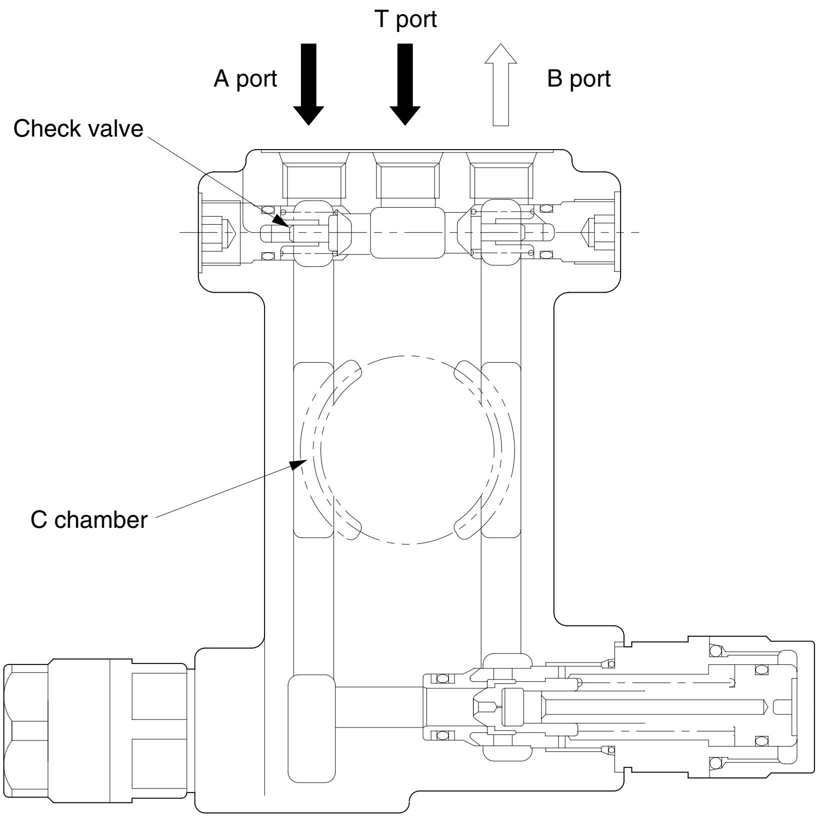
R27Z92SM09

With the above two stages of operation, the motor starts and stops smoothly.

(2) Check valve

When the swing motor is decelerated by operating the control valve, it continues to be moved by the inertia of the machine. Then, it works as pump, and the pressure of C chamber tends to become negative. However, when B port pressure is below cracking pressure of the relief valve, all flow in A port goes out from B port through the motor.

Therefore, if C chamber can get flow only from the control valve, the flow will not be enough to prevent the negative pressure; as a result, cavitation could occur. The check valve works to supply the flow from T port to C chamber; and prevents cavitation.



R27Z92SM10

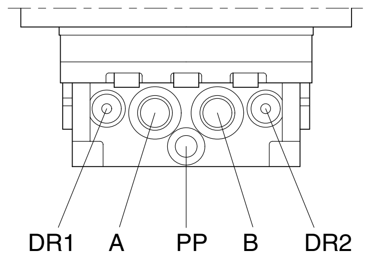
GROUP 4 TRAVEL DEVICE

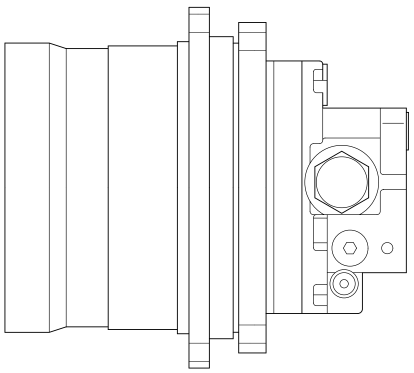
1. CONSTRUCTION

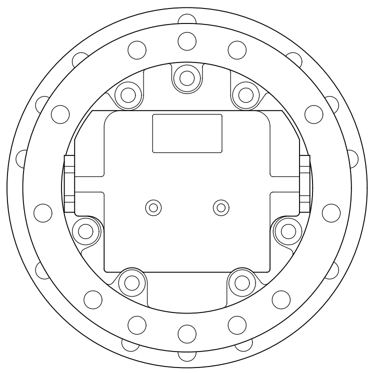
Travel device consists travel motor and gear box.

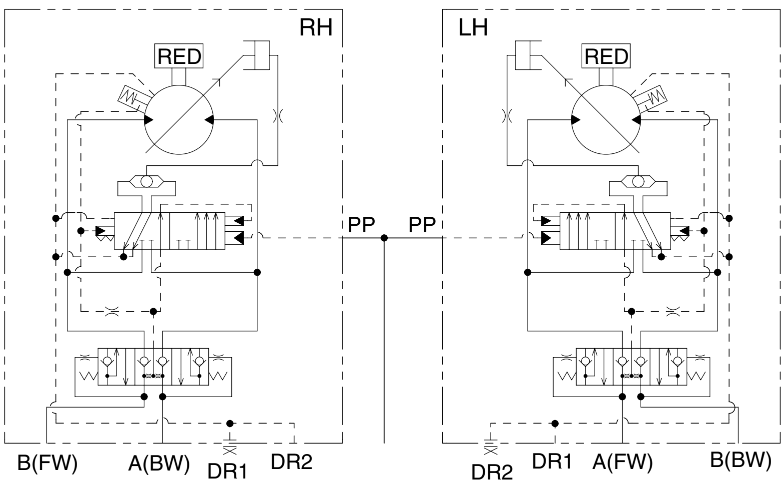
Travel motor includes counterbalance valve, parking brake and high/low speed changeover mechanism.

Port	Port name	Port size
A	Main port	PF 1/2
B	Main port	PF 1/2
DR1, DR2	Drain port	PF 1/4
PP	2 speed control port	PF 1/4





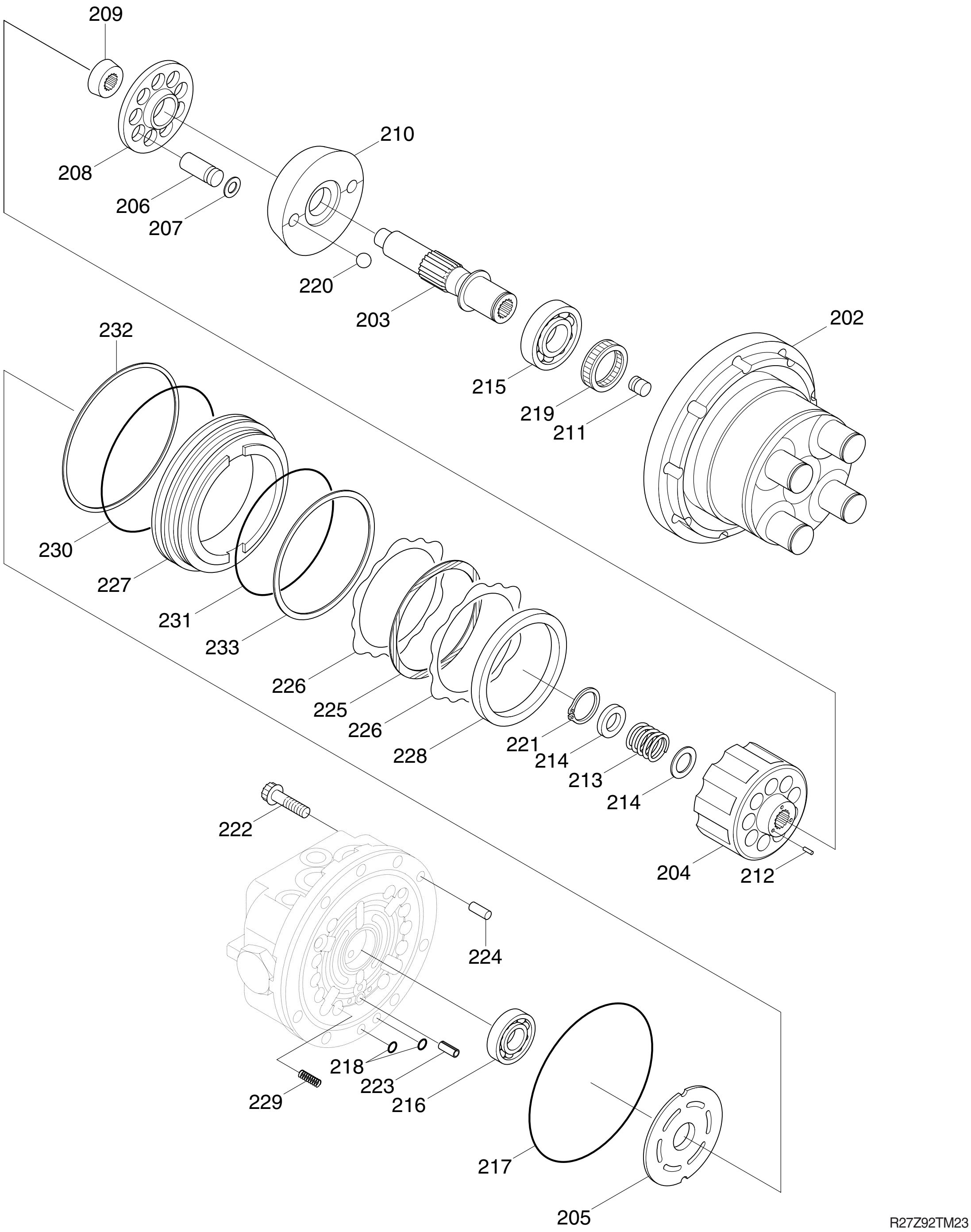




HYDRAULIC CIRCUIT

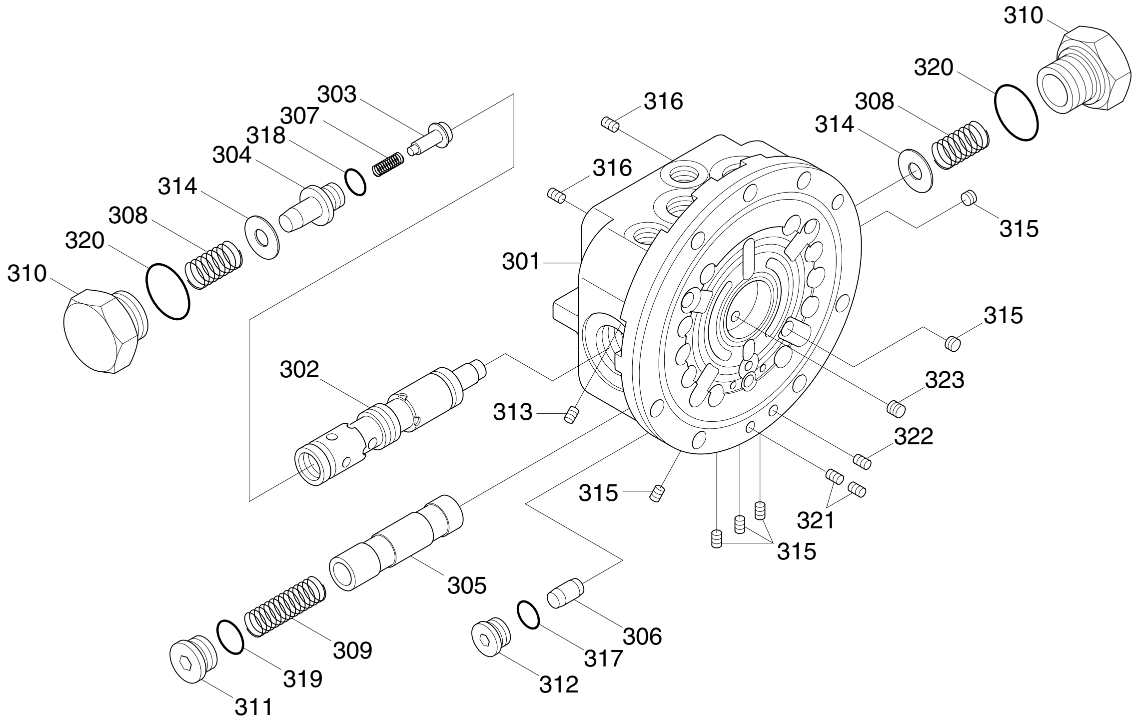
R27Z9AK2TM20

2) STRUCTURE (1/3)



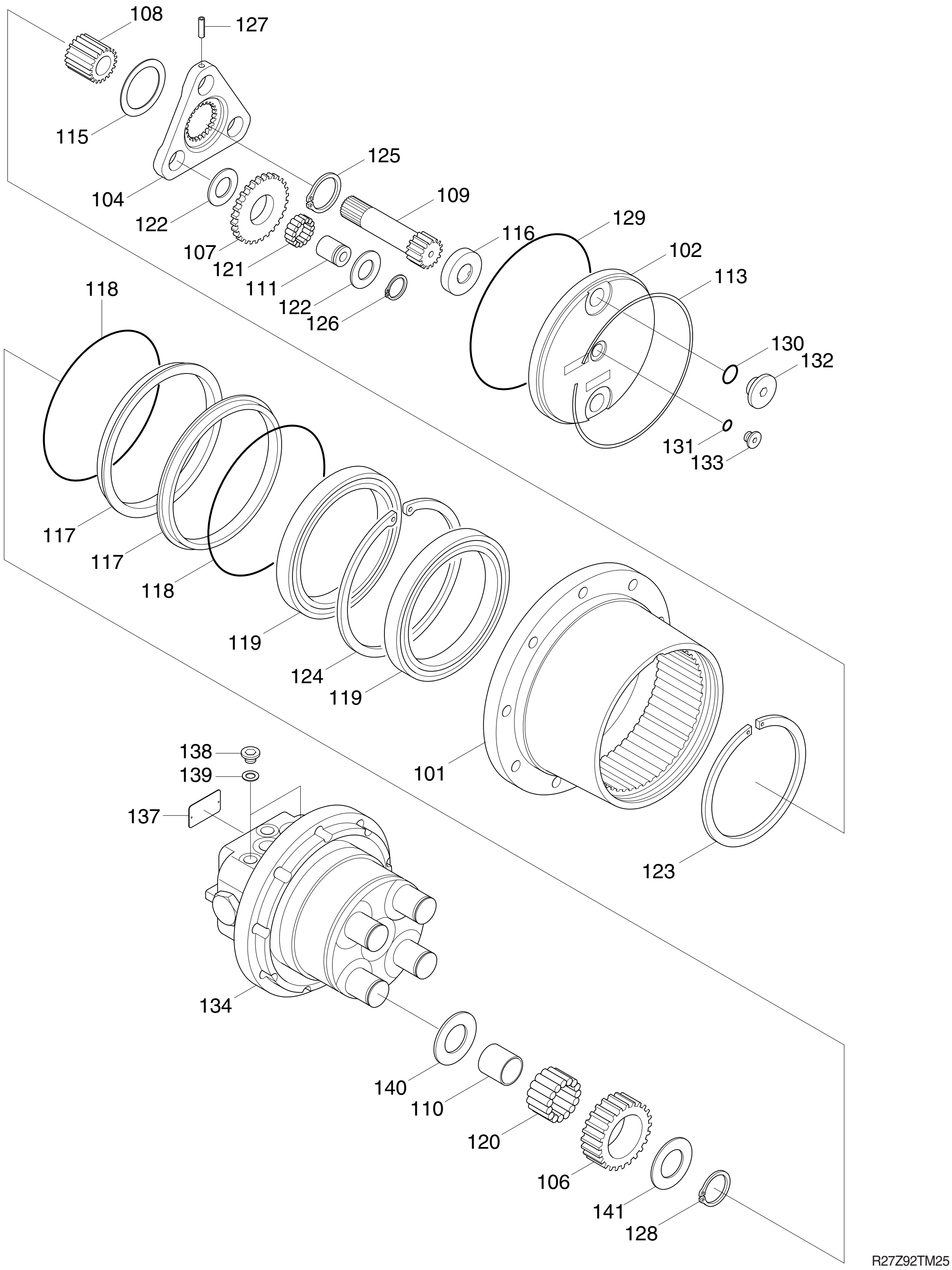
202	Body 2	213	Spring C	224	Pin
203	Shaft	214	Retainer	225	Disk plate
204	Cylinder barrel	215	Bearing	226	Steel plate
205	Valve plate	216	Bearing	227	Brake piston
206	Piston	217	O-ring	228	Brake spacer
207	Shoe	218	O-ring	229	Spring B
208	Shoe holder	219	Oil seal	230	O-ring
209	Barrel holder	220	Ball	231	O-ring
210	Swash plate	221	Snap ring	232	Back up-ring
211	Control piston	222	Screw	233	Back up-ring
212	Pin	223	Spring pin		

STRUCTURE (2/3)



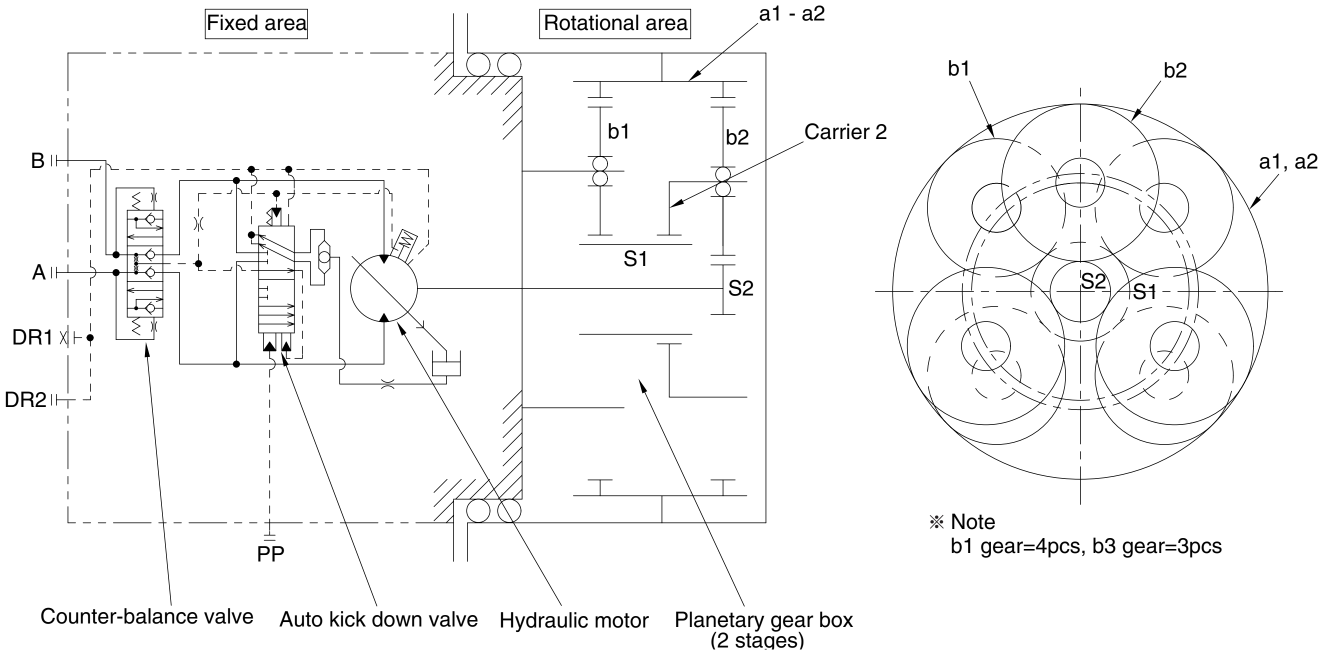
301	Body 1	309	Spring V3	317	O-ring
302	Spool	310	Plug	318	O-ring
303	Check valve	311	Plug	319	O-ring
304	Spring guide	312	Plug	320	O-ring
305	Spool	313	Choke	321	Choke
306	spool	314	Ring	322	Choke
307	Spring V1	315	Plug	323	Plug
308	Spring V2	316	Plug		

STRUCTURE (3/3)



101	Body	113	Snap ring	122	Thrust washer	131	O-ring
102	Cover	115	Thrust collar	123	Snap ring	132	Plug
104	Carrier 2	116	Slide ring	124	Snap ring	133	Plug
106	Gear B1	117	Floating seat	125	Snap ring	134	Hydraulic motor
107	Gear B2		(Incl 118)	126	Snap ring	137	Name plate
108	Gear S1	118	O-ring	127	Spring pin	138	Plug
109	Gear S2	119	Bearing	128	Snap ring	139	O-ring
110	Ring	120	Needle	129	O-ring	140	Thrust washer
111	Pin B2	121	Needle	130	O-ring	141	Thrust washer

2. DRAWING OF OPERATIONAL PRINCIPLE



R27Z9AK2TM03

3. OPERATION

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

1) REDUCTION GEAR SECTION

(1) Function

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

(2) Operation

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

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

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

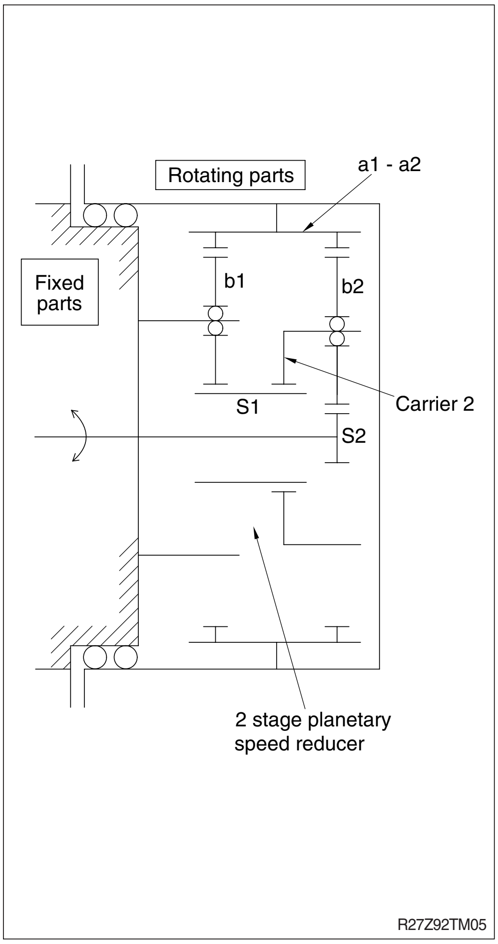
The gear ratio of 2 stage simple planetary speed reducer is calculated using the following formula.

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

※ Z** : Number of teeth

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

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

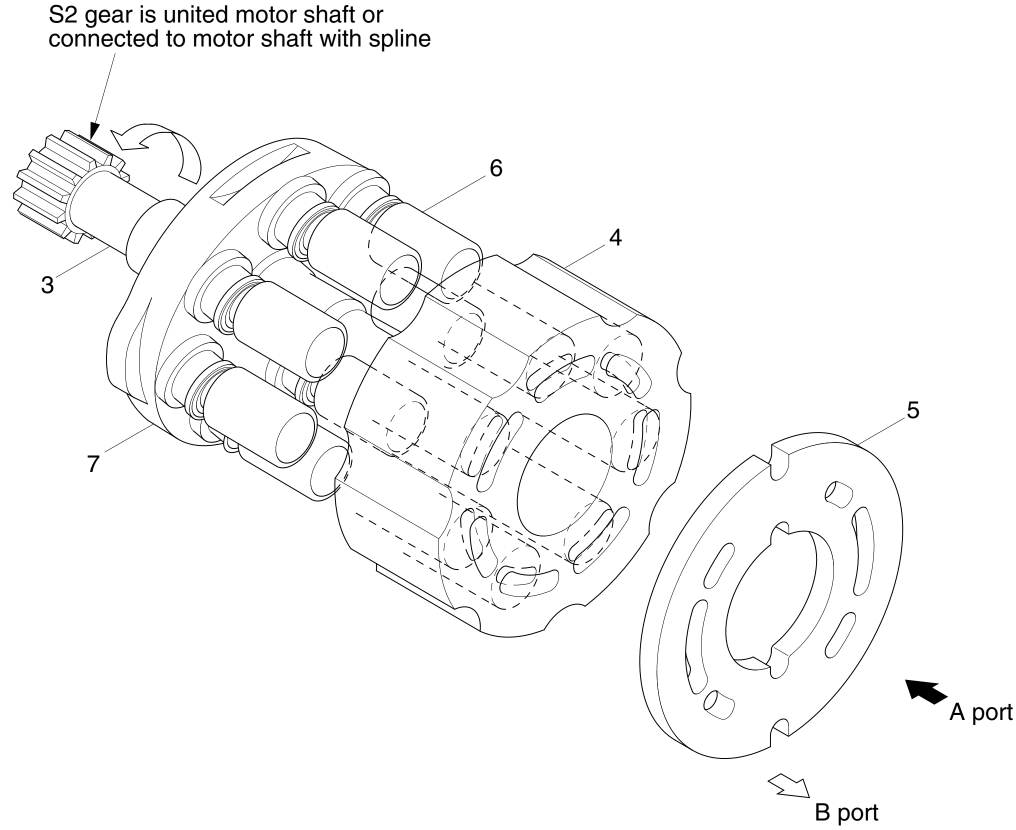


2) HYDRAULIC MOTOR SECTION

(1) Function

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

(2) Structure



R27Z92TM06

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

(3) 2 Speed motor operation

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

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

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

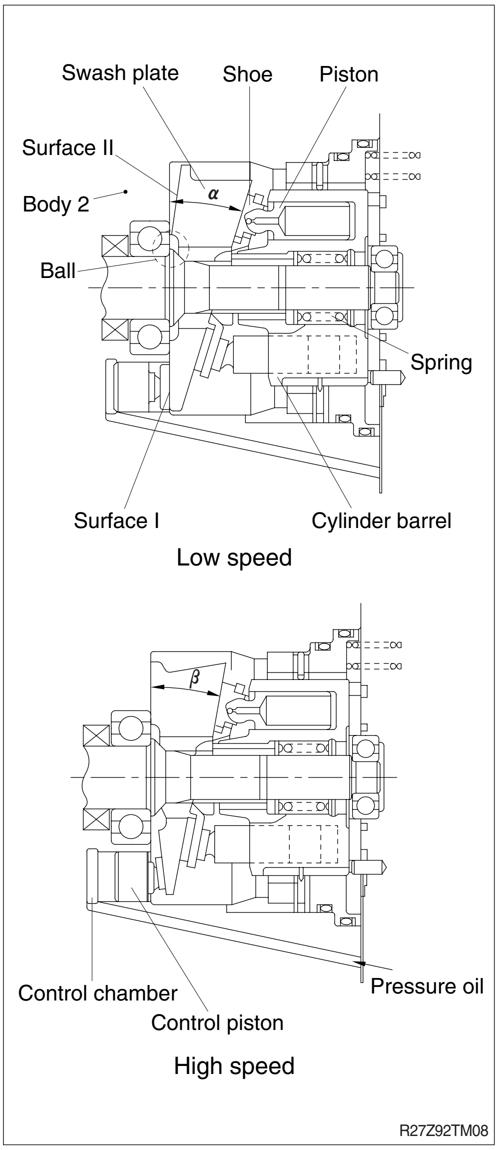
And the pressurized oil of inlet is led to the control chamber through the two-speed spool.

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

The capacity of the hydraulic motor is made small.

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

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



(4) Auto kick down valve

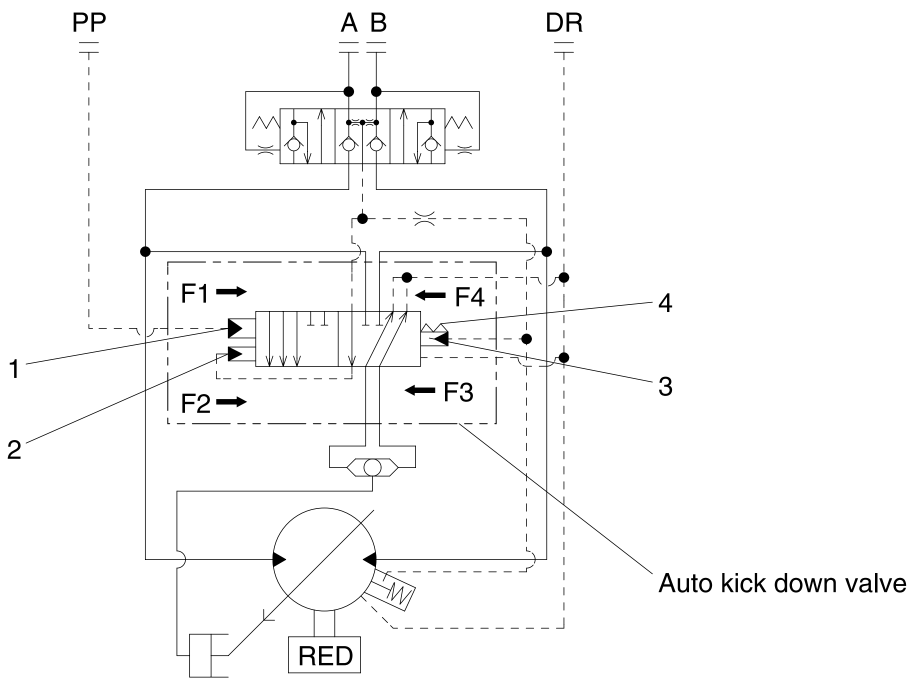
When the pilot switch for Hi speed mode is turned on, the pilot pressure for Hi speed mode comes from PP port to the hydraulic pilot (1), then the force F1 occurs, The auto kick down valve moves to the right direction because the F1 is larger than F4, which is by spring (4). Then the speed of track motor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

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

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

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

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



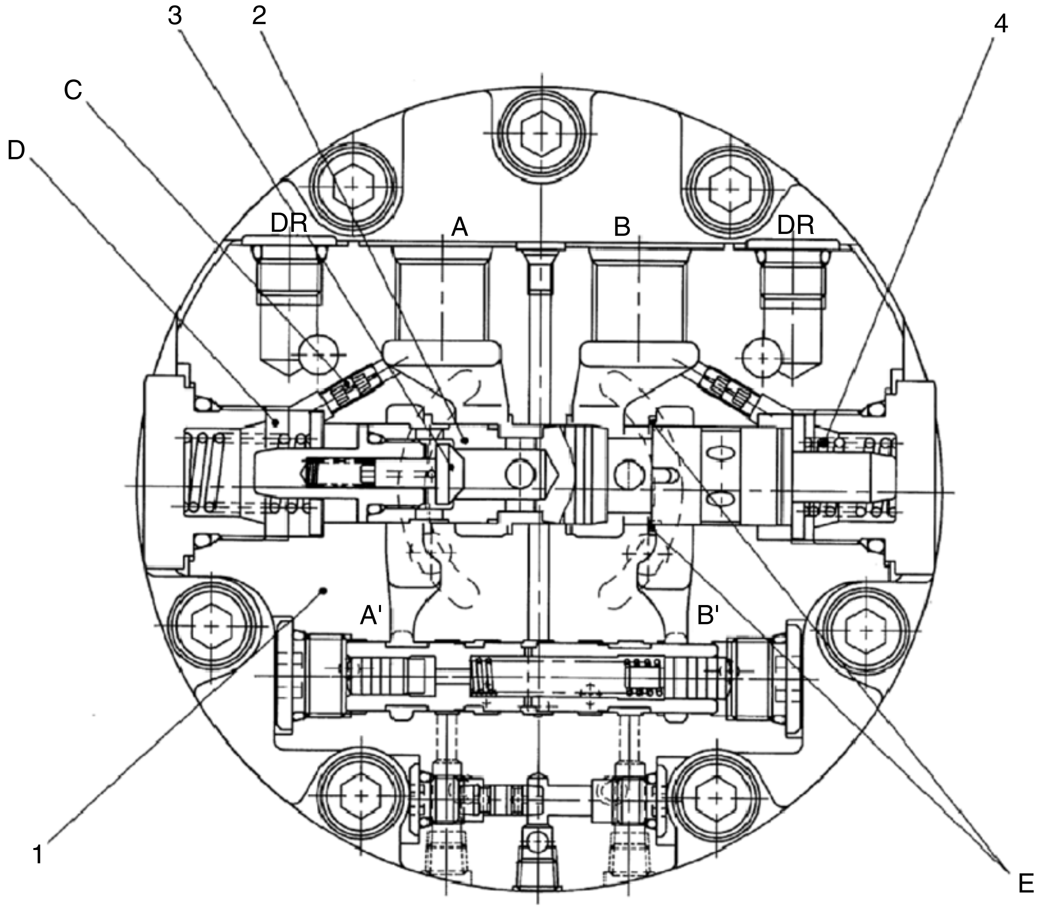
R27Z9AK2TM09

3) HYDRAULIC VALVE SECTION

(1) Counter-balance valve

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

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



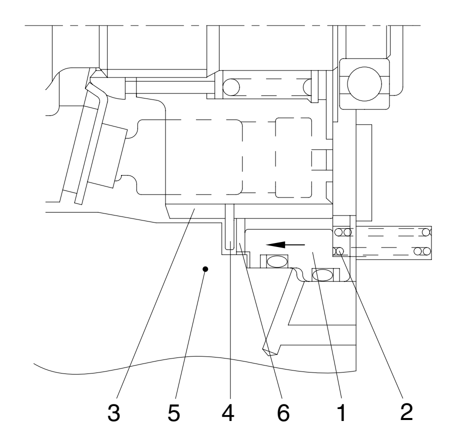
R25Z9AK2TM19

4) PARKING BRAKE SECTION

(1) Structure

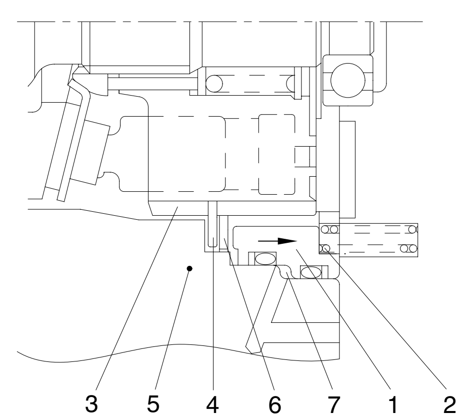
The parking brake fixes the output shaft of hydraulic motor mechanically while the travel motor is stopped. And it is applied automatically in the following fashion.

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



R27Z92TM10

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



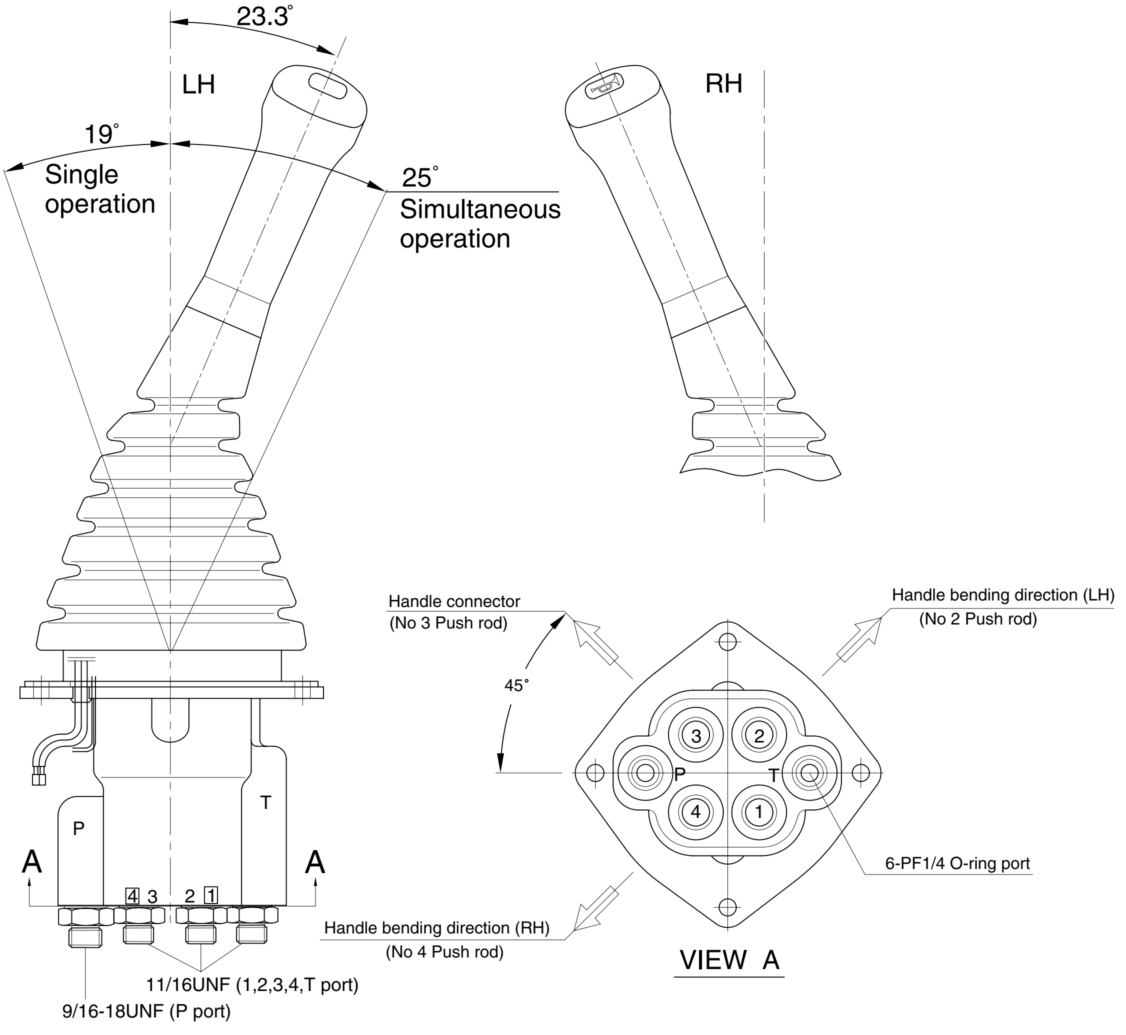
R27Z92TM11

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.



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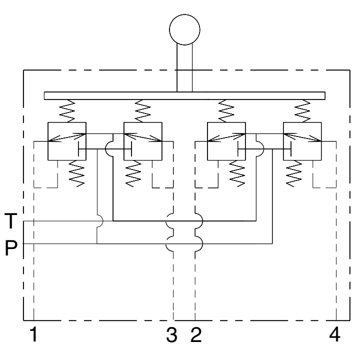


Hydraulic circuit

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

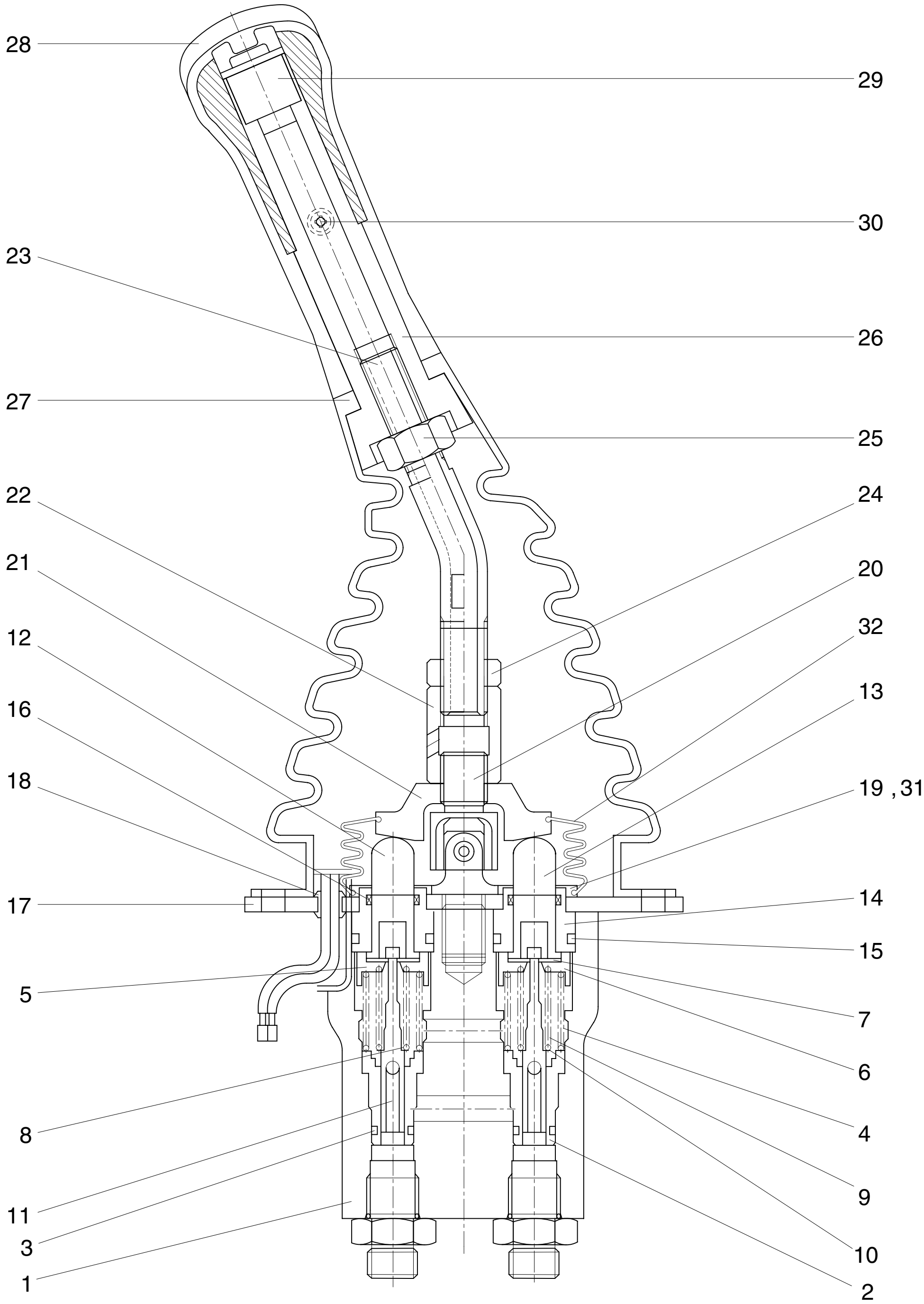
The construction of the pilot valve is shown in the attached cross section drawing. The casing has vertical holes in which reducing valves are assembled.

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.

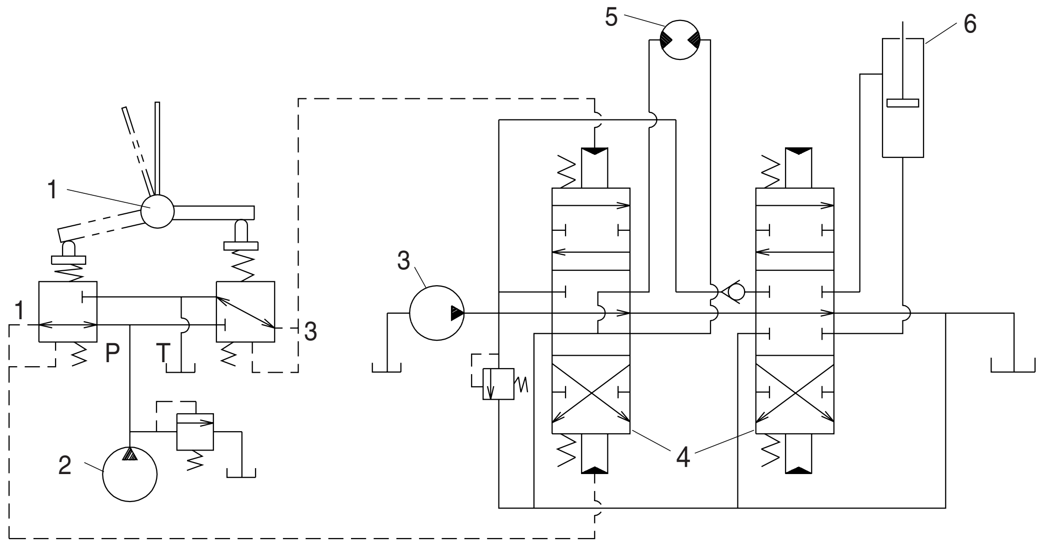
The spring (4) works on the case (1) and spring seat (5, 6) and tries to return the push rod (12, 13) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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.

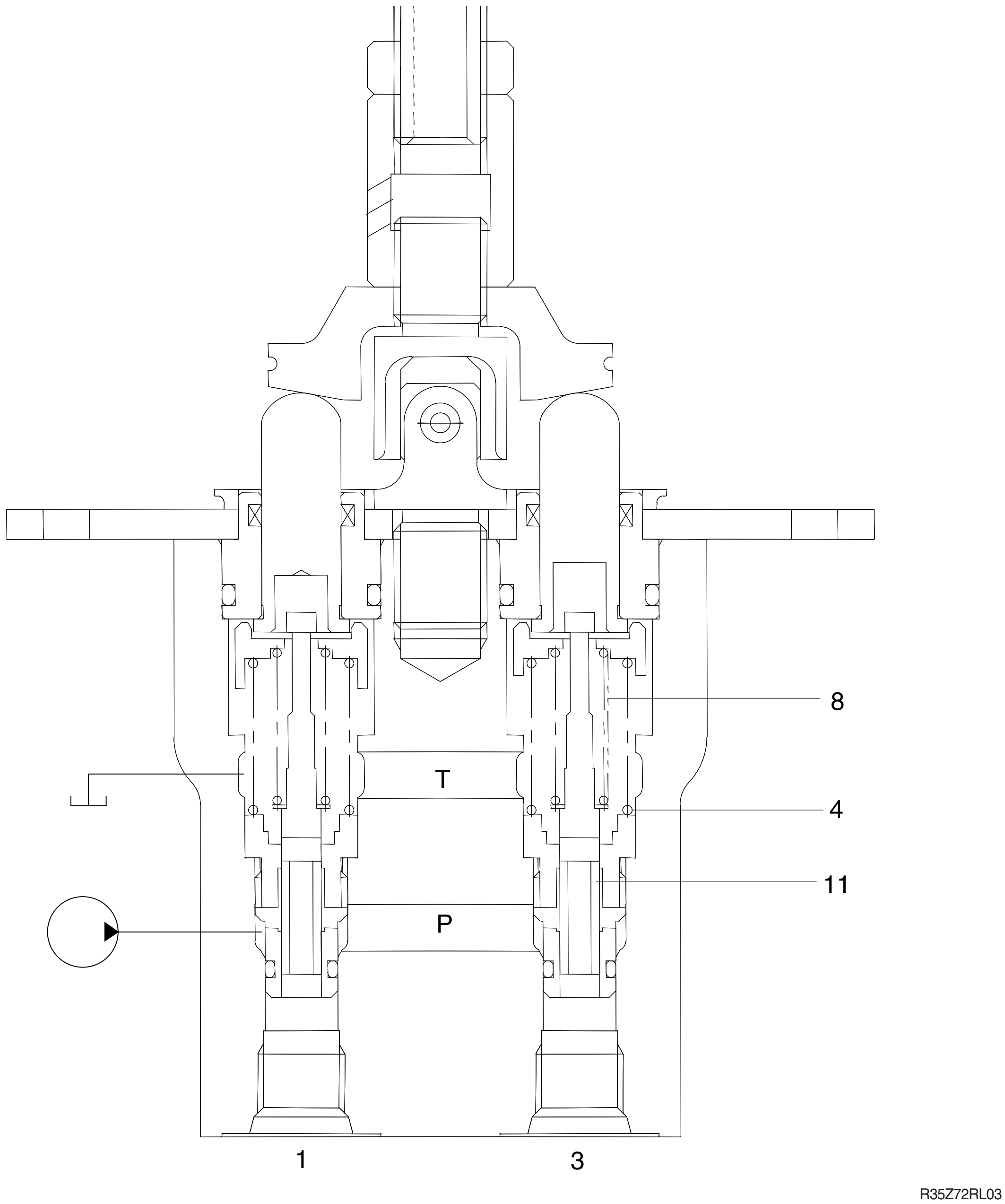
The diagram shown below is the typical application example of the pilot valve.



2-70 (140-7TIER)

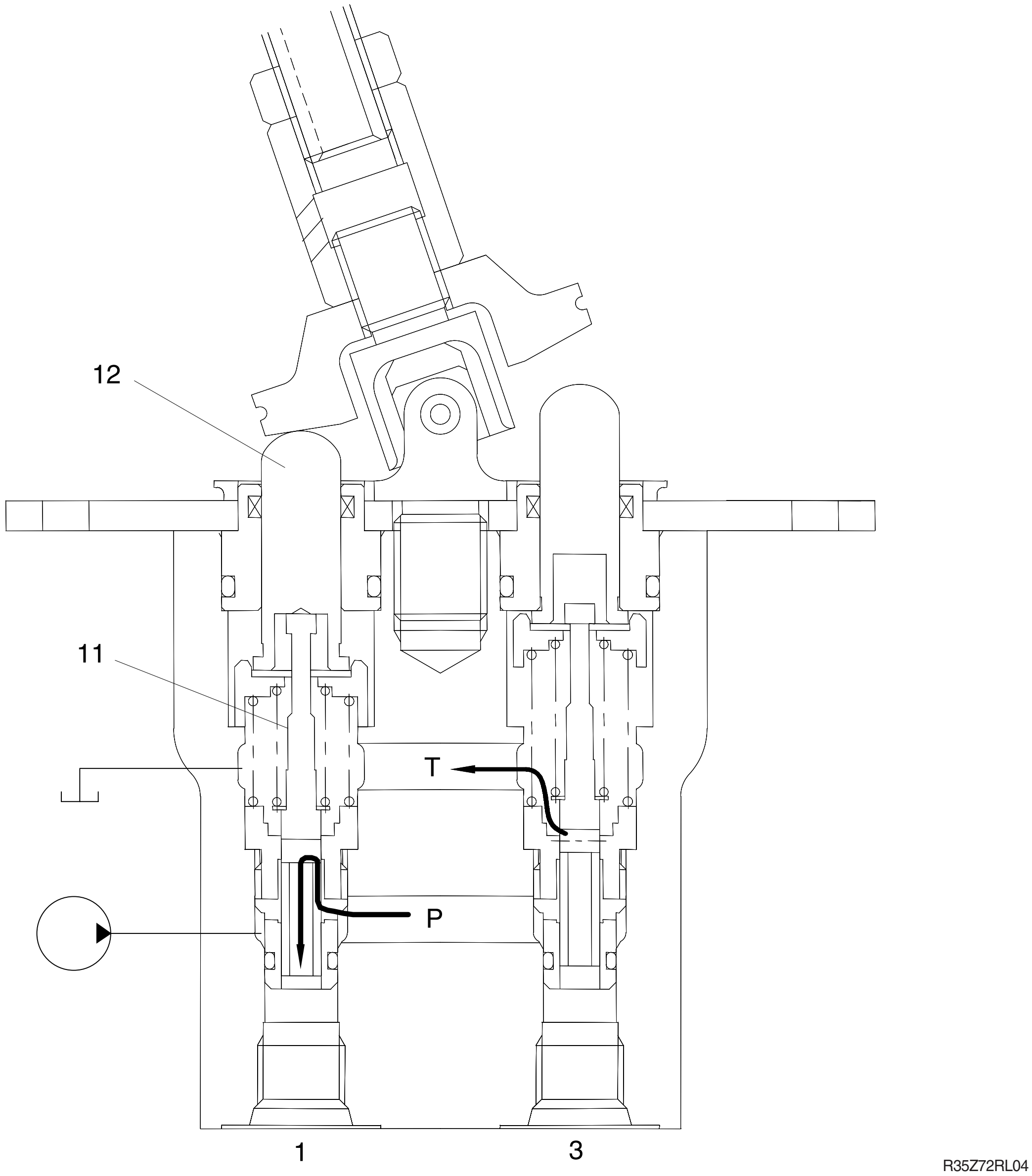
1	Pilot valve	3	Main pump	5	Hydraulic motor
2	Pilot pump	4	Main control valve	6	Hydraulic cylinder

(1) Case where handle is in neutral position



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

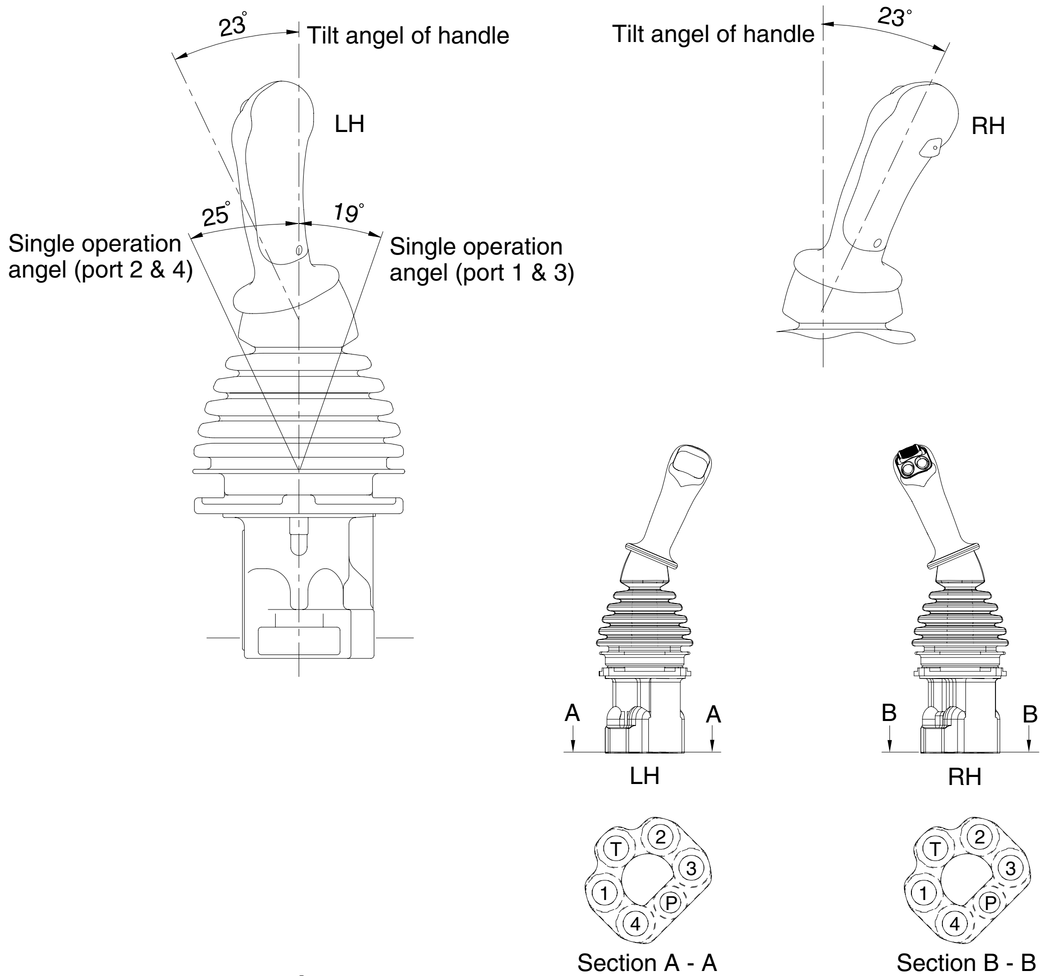


When the push rod (12) is stroked, the spool (11) moves downwards.
Then port P is connected with port (1) and the oil supplied from the pilot pump flows through port (1) to generate the pressure.
When the pressure at port (1) increases to the value corresponding to the spring force set by tilting the 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.



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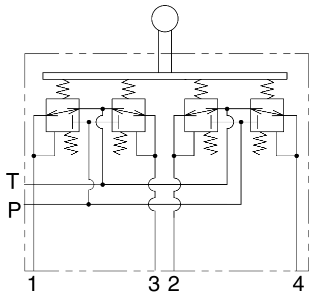
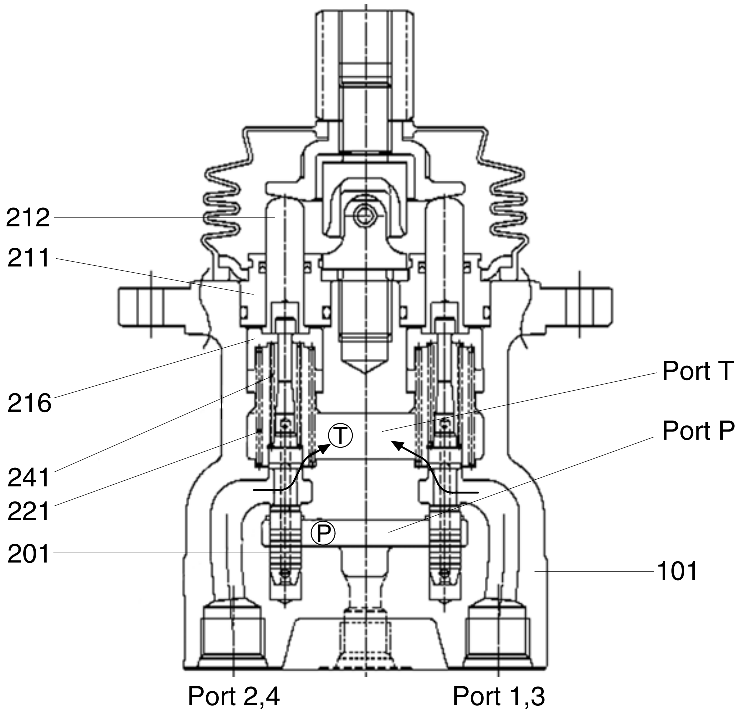


Hydraulic circuit

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 in port	
2	Arm out port	Boom down port	
3	Right swing port	Bucket out 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

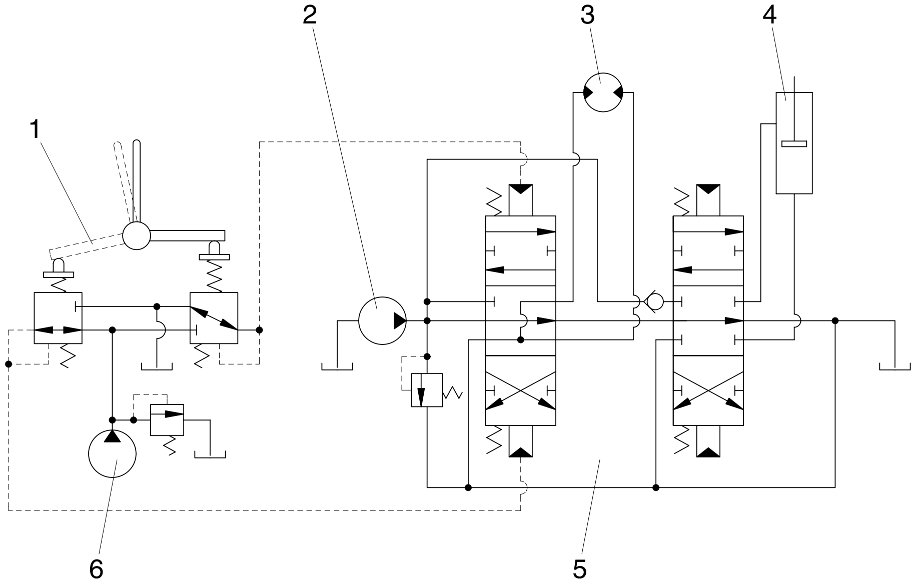
The spool (201) operates to take the supply oil pressure from the hydraulic pump. This switches the oil channel so that the port P oil pressure is directed to the output ports 1, 2, 3, 4 or to port T. The secondary pressure setting spring (241) determines the output pressure that acts on the spool (201).

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

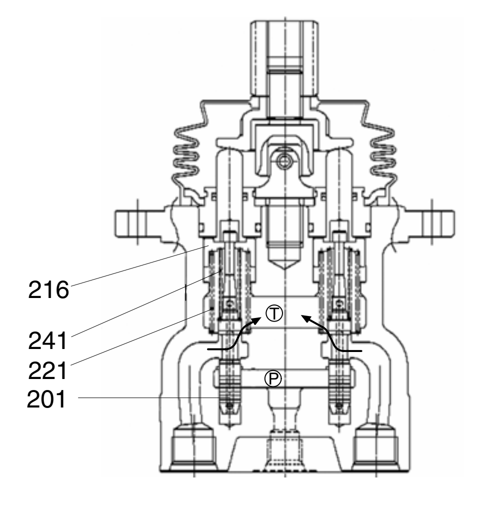
(1) Control handle neutral

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.

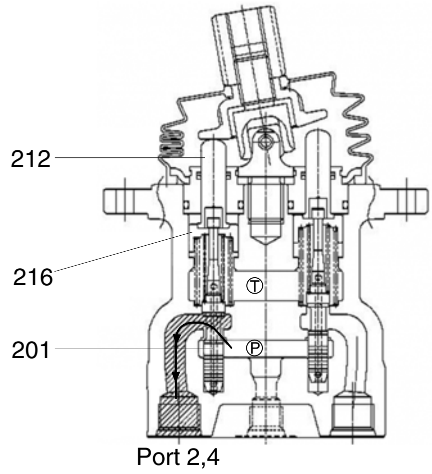
The output pressure is the same as the tank pressure.



17Z9A2RL04

(2) Control handle tilted

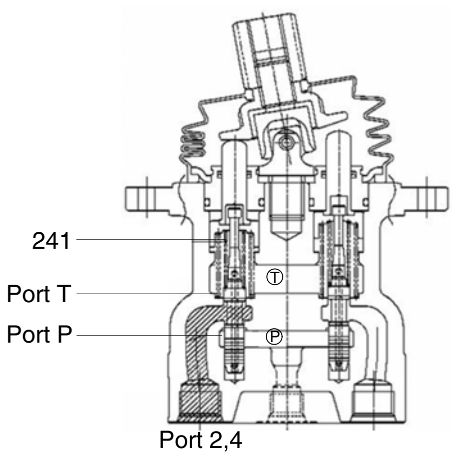
The push-rod moves, (spring seat (216)), spool (201) moves downward, port P and ports (2, 4) are open and the oil fed from the pilot pump flows to ports (2, 4) and generates pressure.



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.

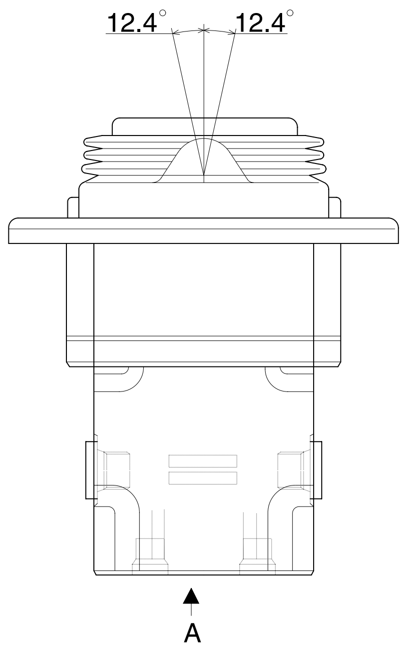


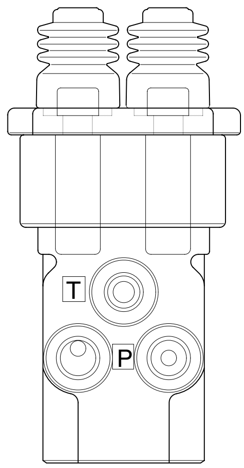
17Z9A2RL06

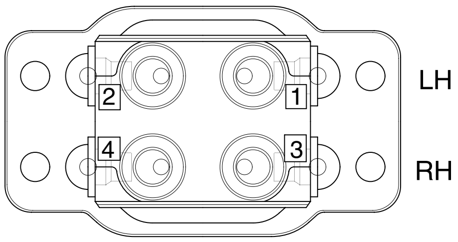
GROUP 6 RCV PEDAL

1. STRUCTURE

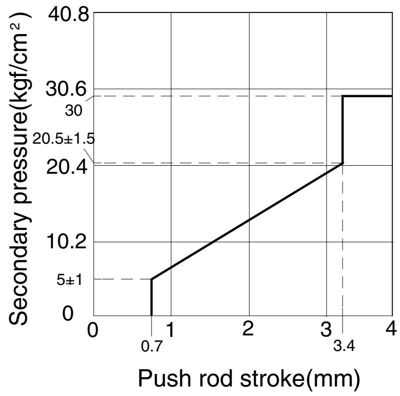
The casing has the oil inlet port P (primary pressure), and the oil outlet port T (tank). In addition the secondary pressure is taken out through ports 1, 2, 3 and 4 provided at the bottom face.



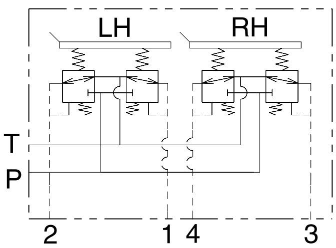




VIEW "A"



R35Z72RCP01



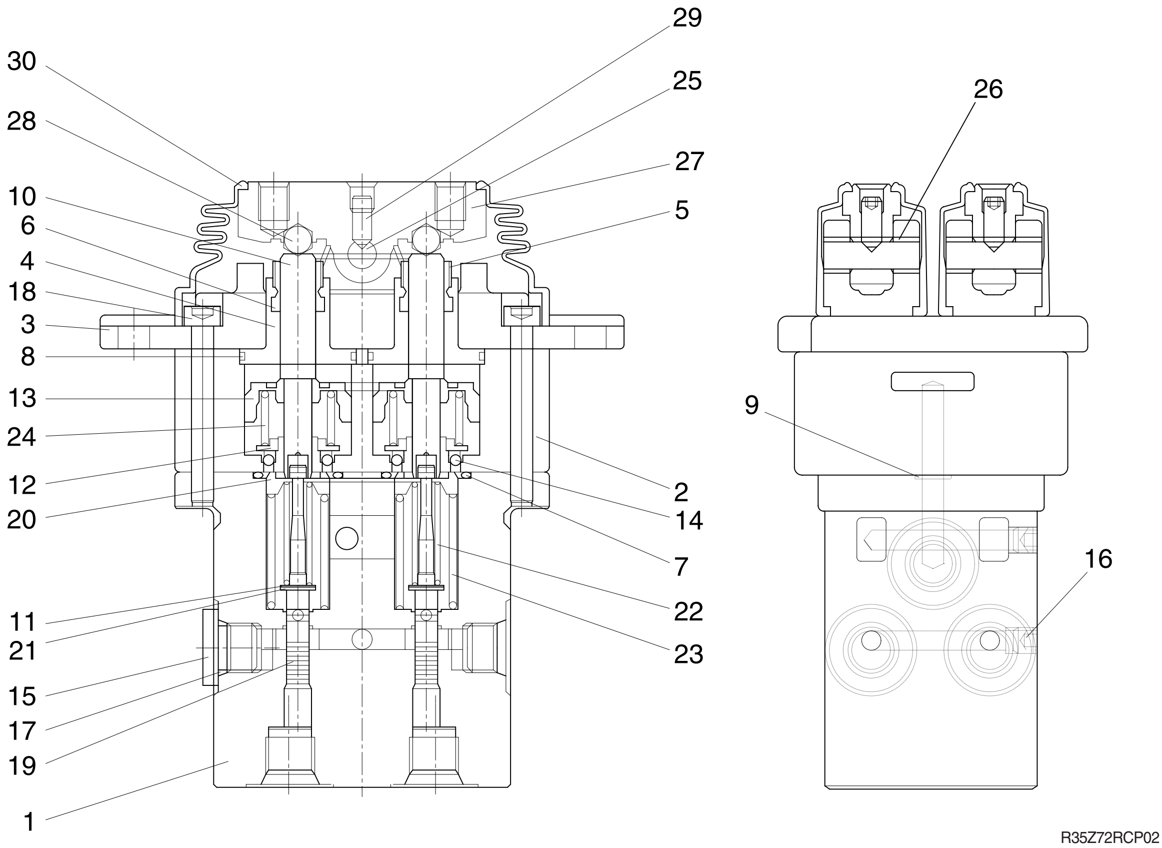
Port	Port name	Port size
P	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	
1	Travel (LH, Backward)	
2	Travel (LH, Forward)	
3	Travel (RH, Backward)	
4	Travel (RH, Forward)	

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.



R35Z72RCP02

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.

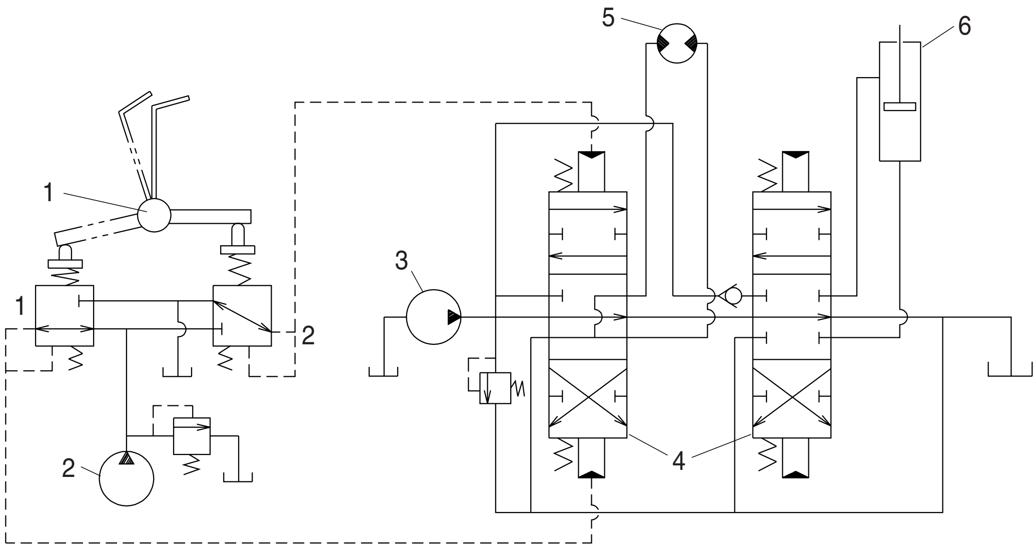
The spring (23) works on the casing (1) and washer (21) and tries to return the push rod (10) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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.

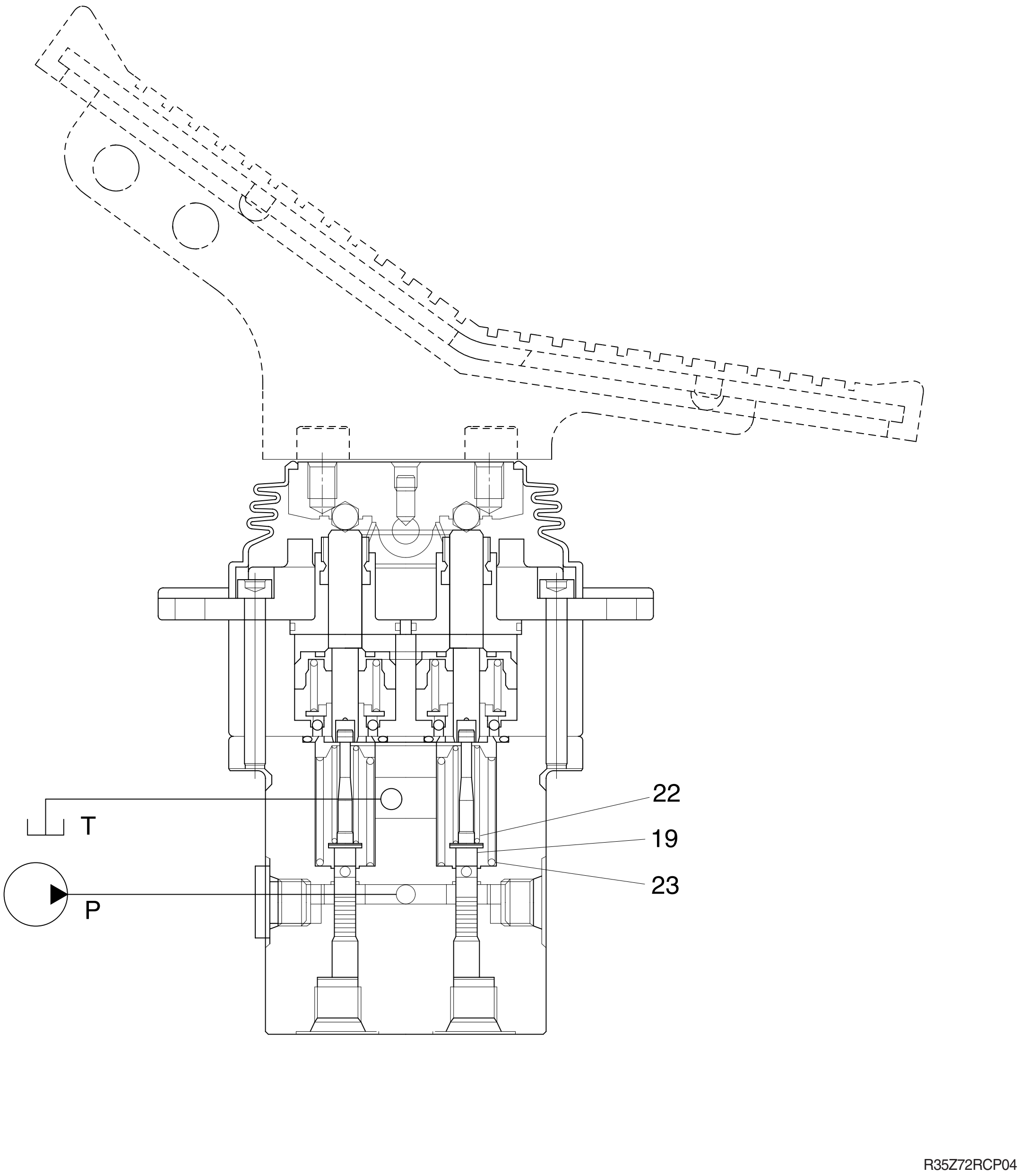
The diagram shown below is the typical application example of the pilot valve.



140LC-7 기타2-76

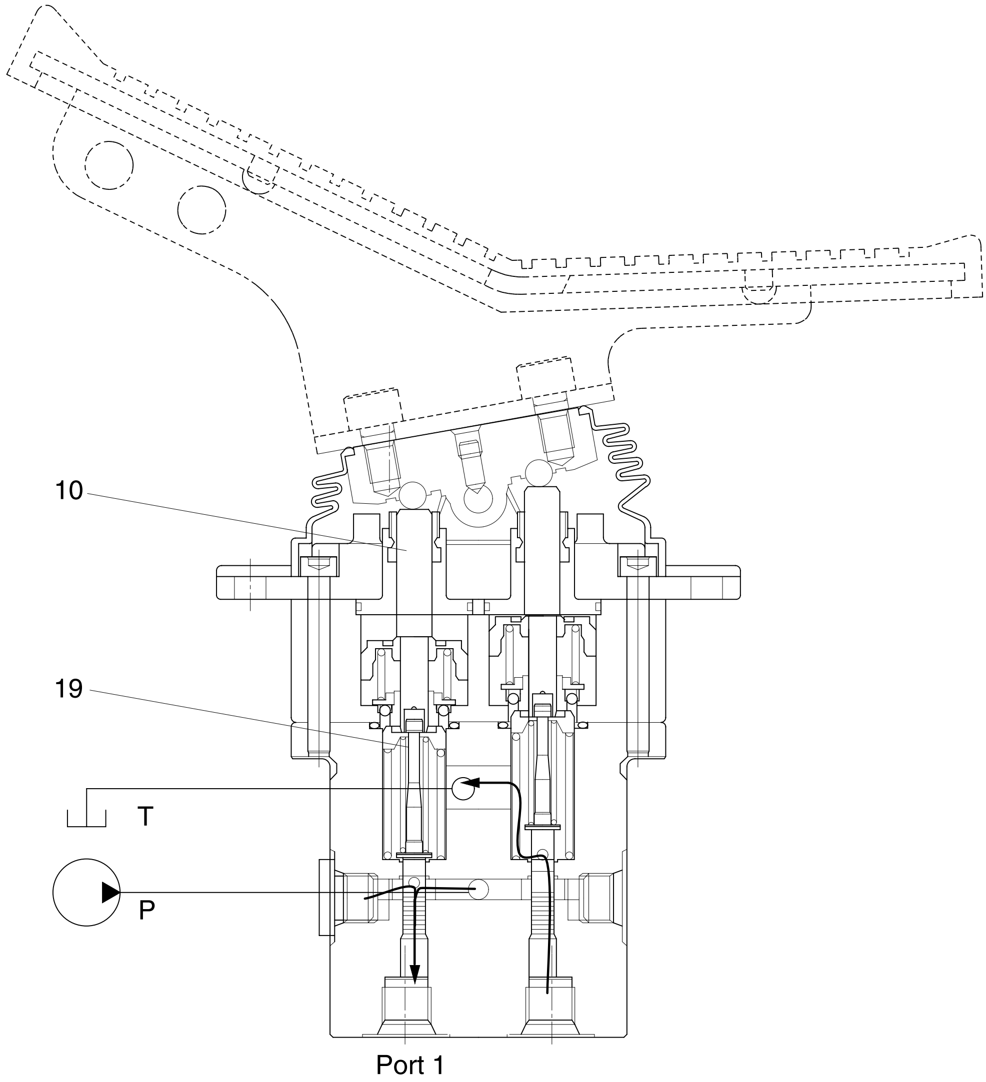
1	Pilot valve	3	Main pump	5	Hydraulic motor
2	Pilot pump	4	Main control valve	6	Hydraulic cylinder

(1) Case where pedal is in neutral position



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

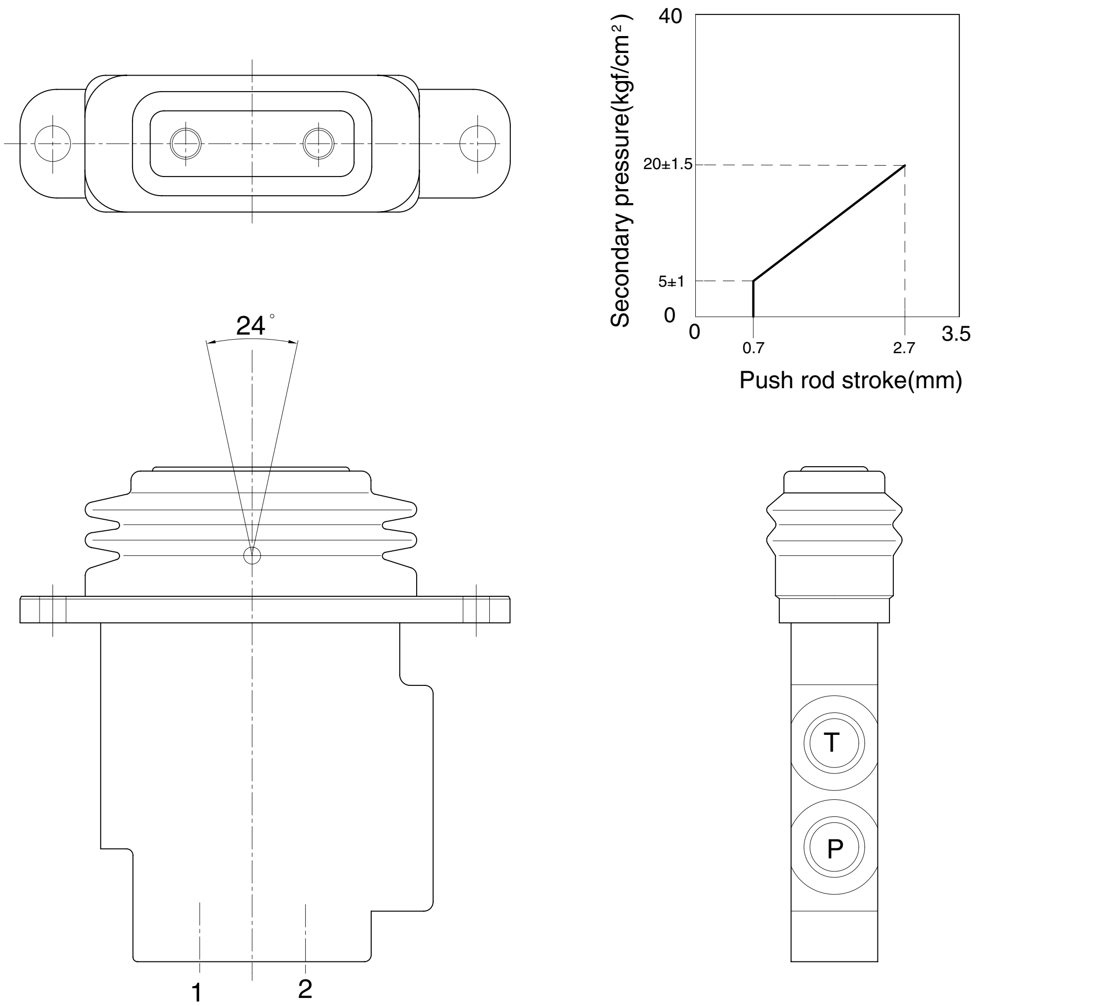
When the push rod (10) is stroked, the spool (19) moves downwards.
Then port P is connected with port 1, and the oil supplied from the pilot pump flows through port 1 to generate the pressure.
When the pressure at port 1 increases to the value corresponding to the spring force set by tilting the handle, 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

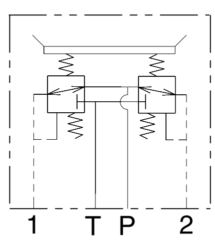
1) STRUCTURE

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.



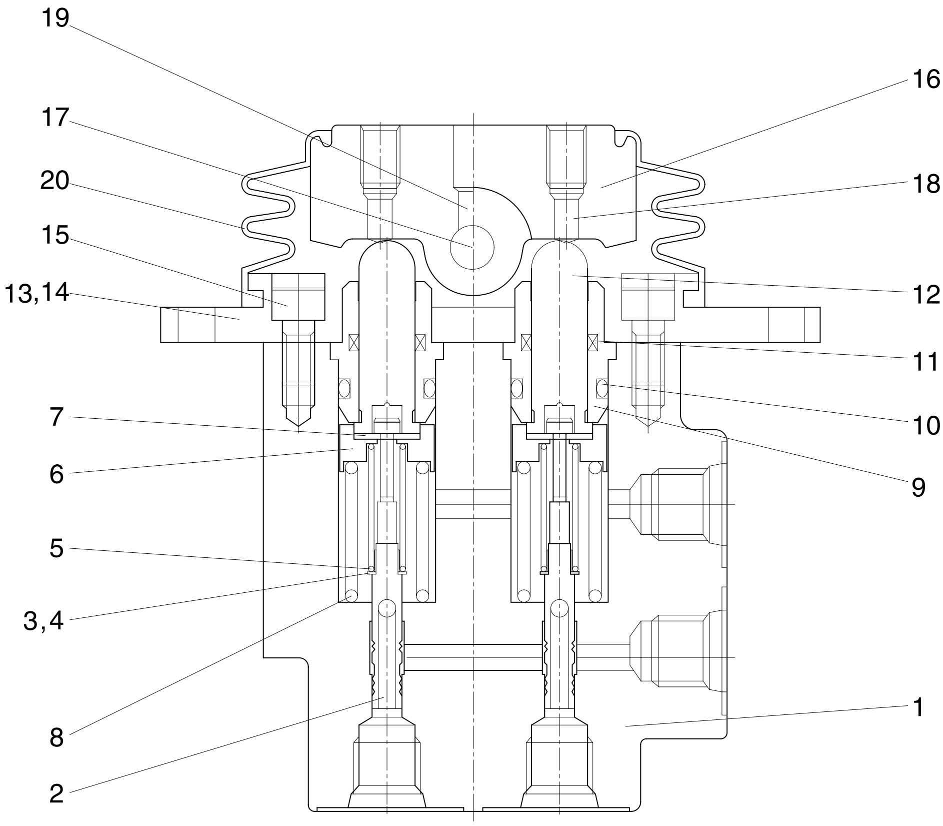
R35Z72RSP01



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

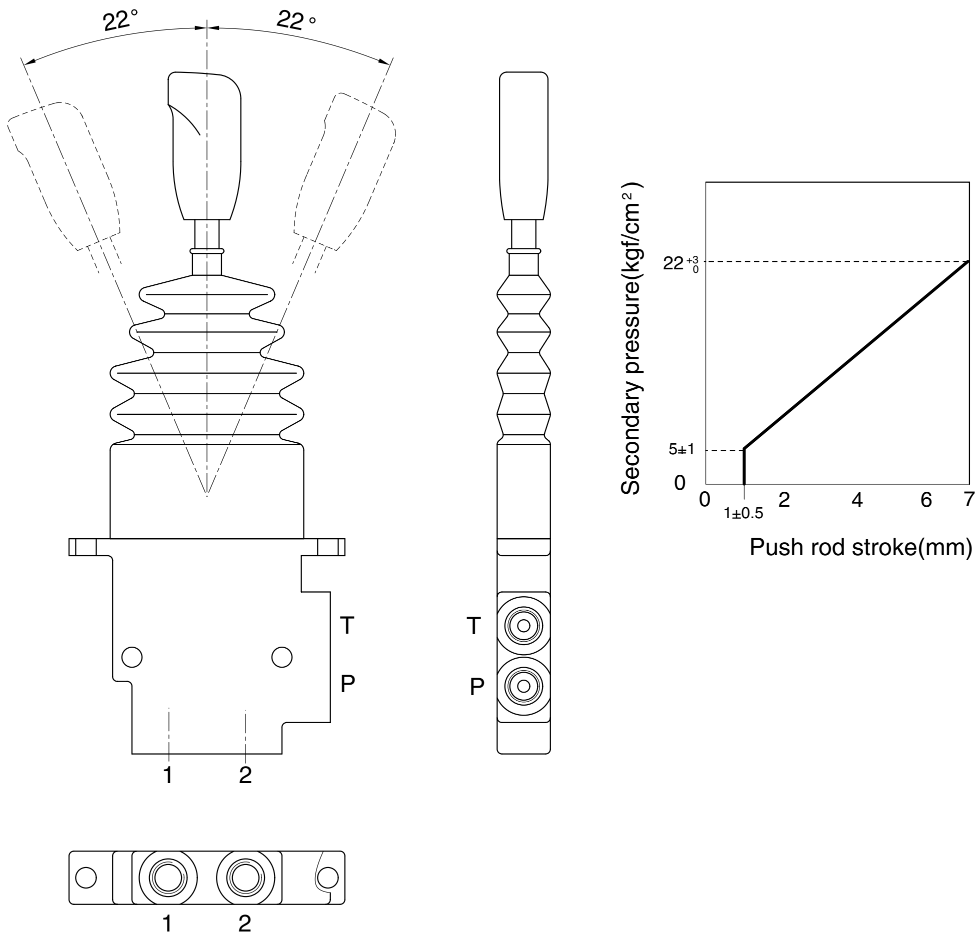
1	Body	8	Stopper	15	DU bush
2	Plug	9	Spring	16	Wrench bolt
3	O-ring	10	Plug	17	Cam
4	Spool	11	O-ring	18	Pin
5	Spring seat	12	Rod seal	19	Adjust screw
6	Spring	13	Push rod	20	Socket bolt
7	Spring seat	14	Cover	21	Bellows

4. DOZER LEVER

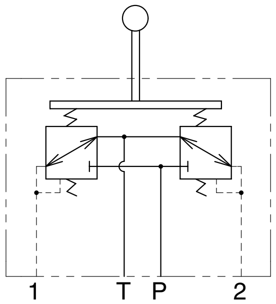
1) STRUCTURE

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.



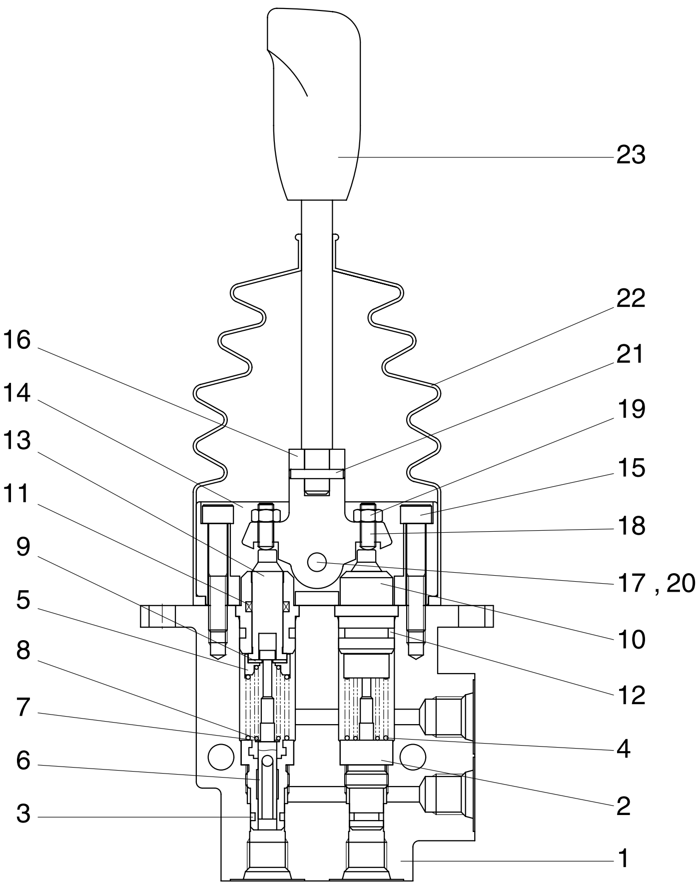
R35Z72DL01



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

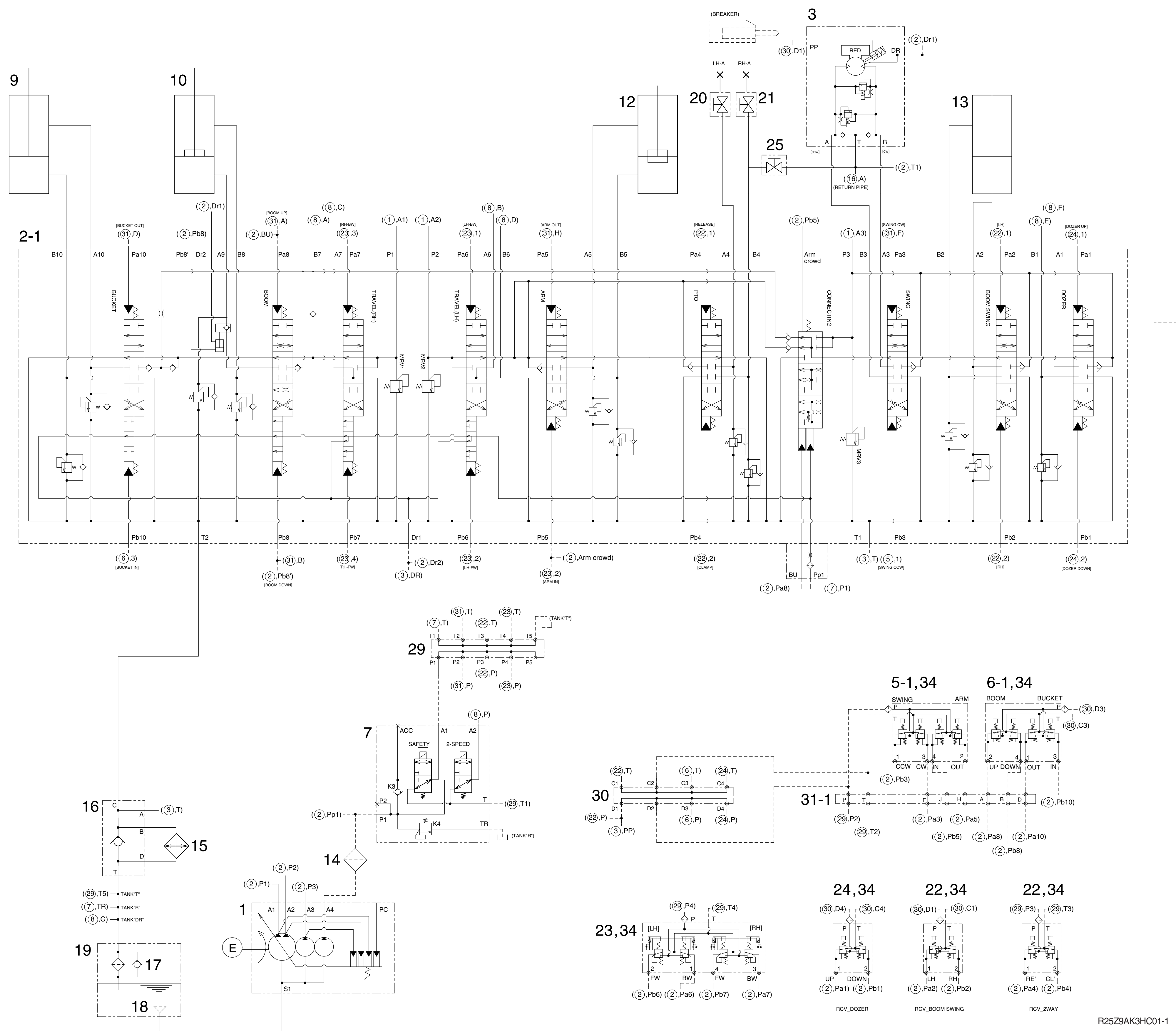


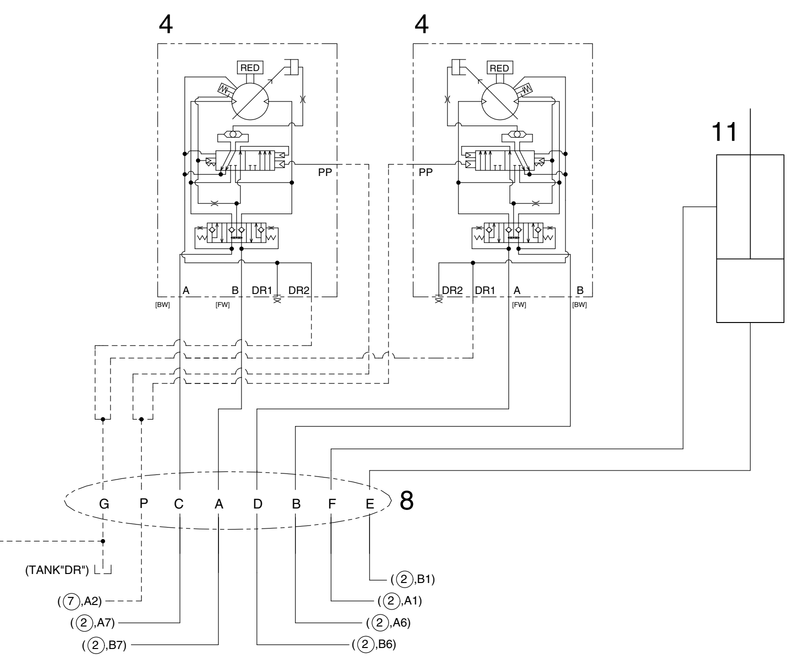
R35Z72DL02

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		

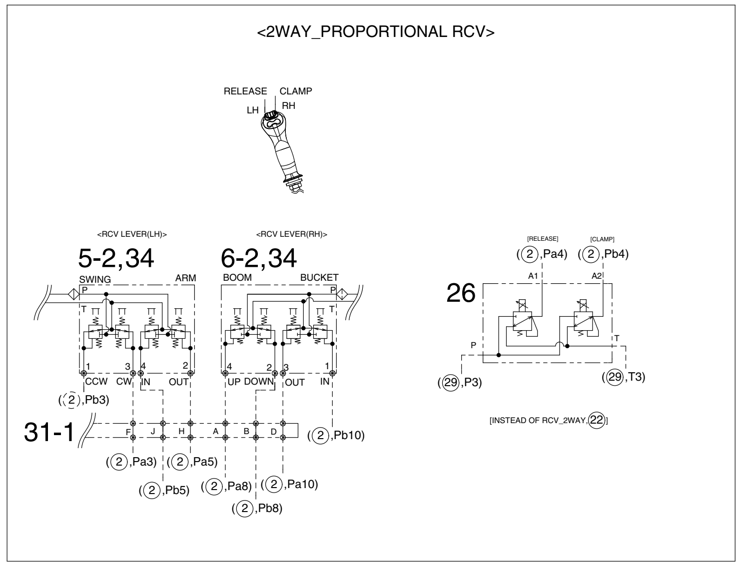
SECTION 3 HYDRAULIC SYSTEM

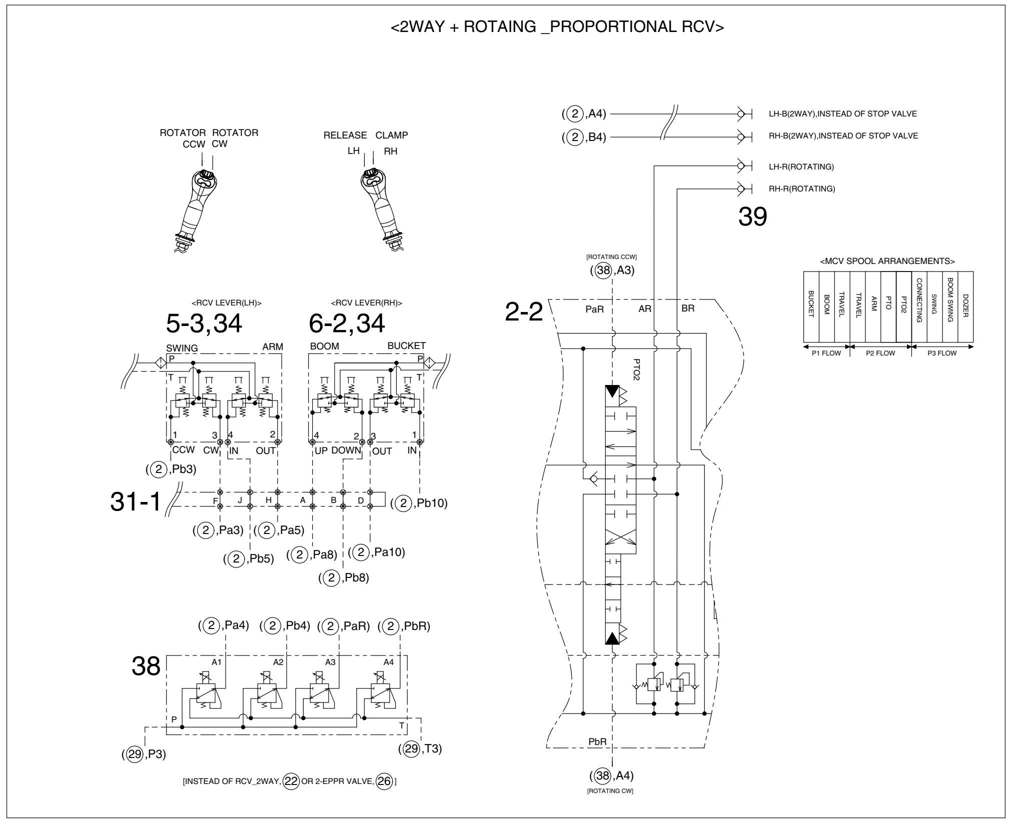
GROUP 1 HYDRAULIC CIRCUIT

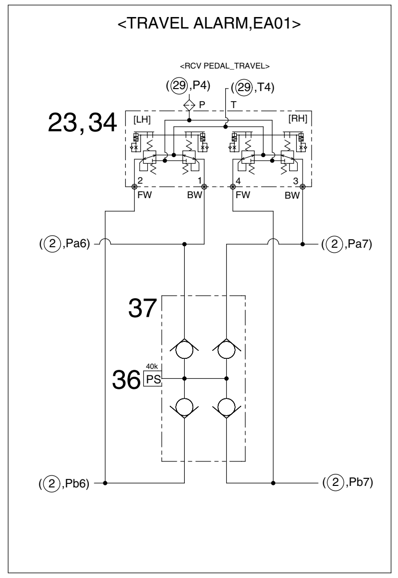


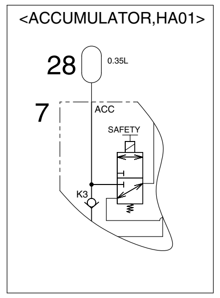


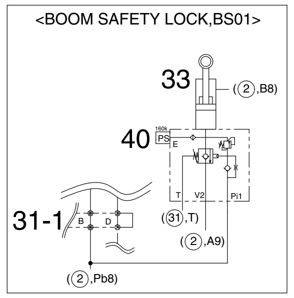
1 MAIN PUMP
2-1 MAIN CONTROL VALVE
3 SWING MOTOR
4 TRAVEL MOTOR
5-1 RCV LEVER-LH
6-1 RCV LEVER-RH
7 SOLENOID VALVE
8 TURNING JOINT
9 BUCKET CYLINDER
10 BOOM CYLINDER
11 DOZER CYLINDER
12 ARM CYLINDER
13 BOOM SWING CYLINDER
14 LINE FILTER
15 OIL COOLER
16 RETURN CHECK VALVE
17 RETURN FILTER
18 SUCTION STRAINER
19 HYD TANK
20 STOP VALVE-LH
21 STOP VALVE-RH
22 RCV PEDAL
23 RCV PEDAL
24 RCV DOZER
25 3 WAY VALVE
29 BLOCK
30 BLOCK
31-1 TERMINAL ASSY
34 FILTER LAST GUARD

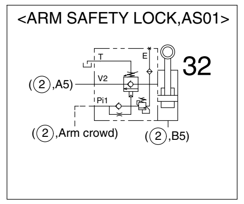


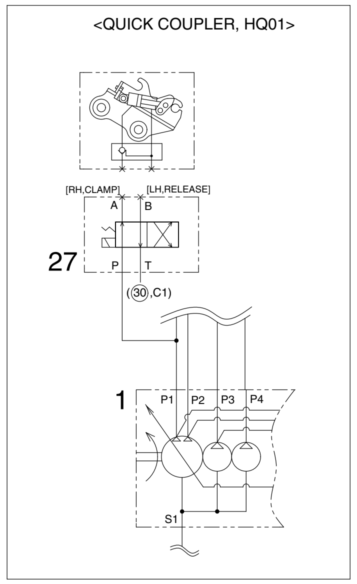


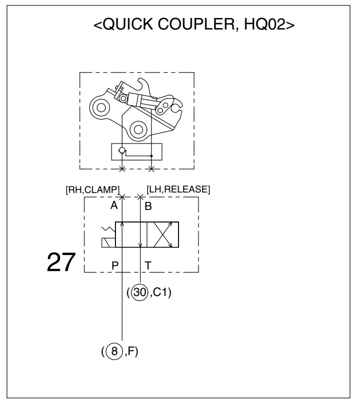


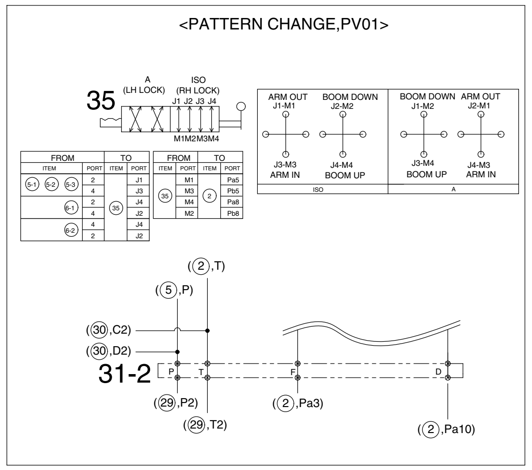












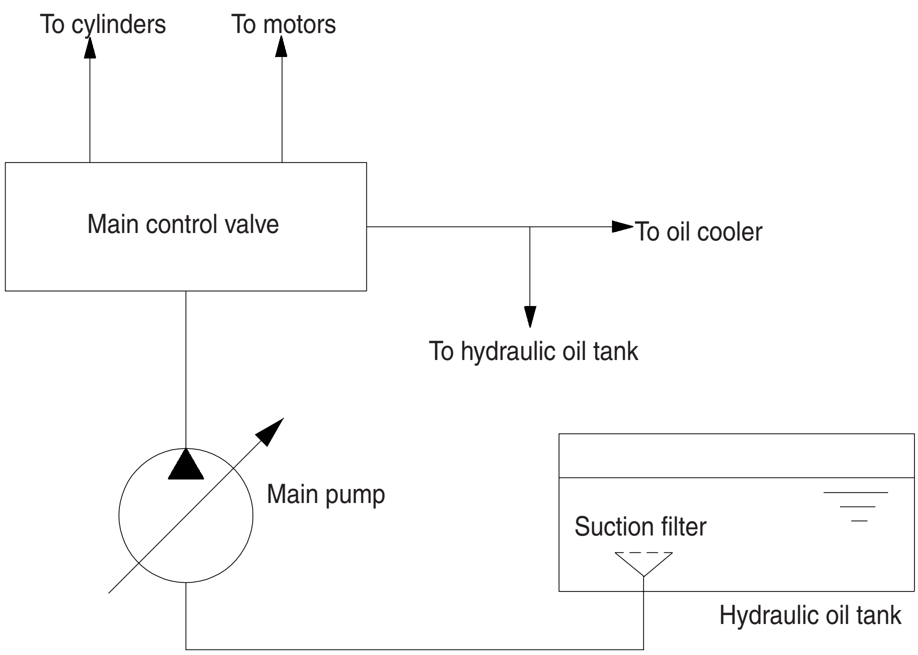
2-2 MAIN CONTROL VALVE
5-2 RCV-LH
5-3 RCV-PROPORTIONAL,LH
6-2 RCV-PROPORTIONAL,RH
26 2 EPPR VALVE
27 SOLENOID VALVE
28 ACCUMULATOR
31-2 TERMINAL ASSY
32 ARM CYLINDER
33 BOOM CYLINDER
35 SELECTOR VALVE
36 PRESSURE SWITCH
37 SHUTTLE VALVE
38 4-EPPR VALVE
39 NIPPLE
40 PRESSURE SWITCH

R25Z9AK3HC01-2

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.

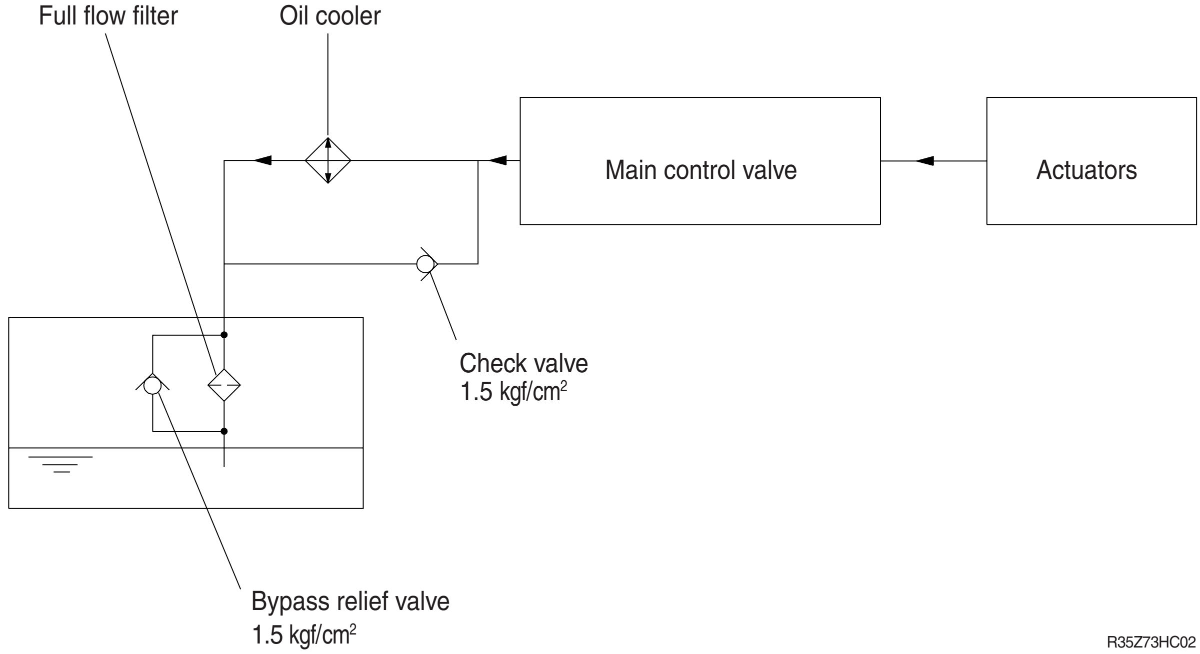
1. SUCTION AND DELIVERY CIRCUIT



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.

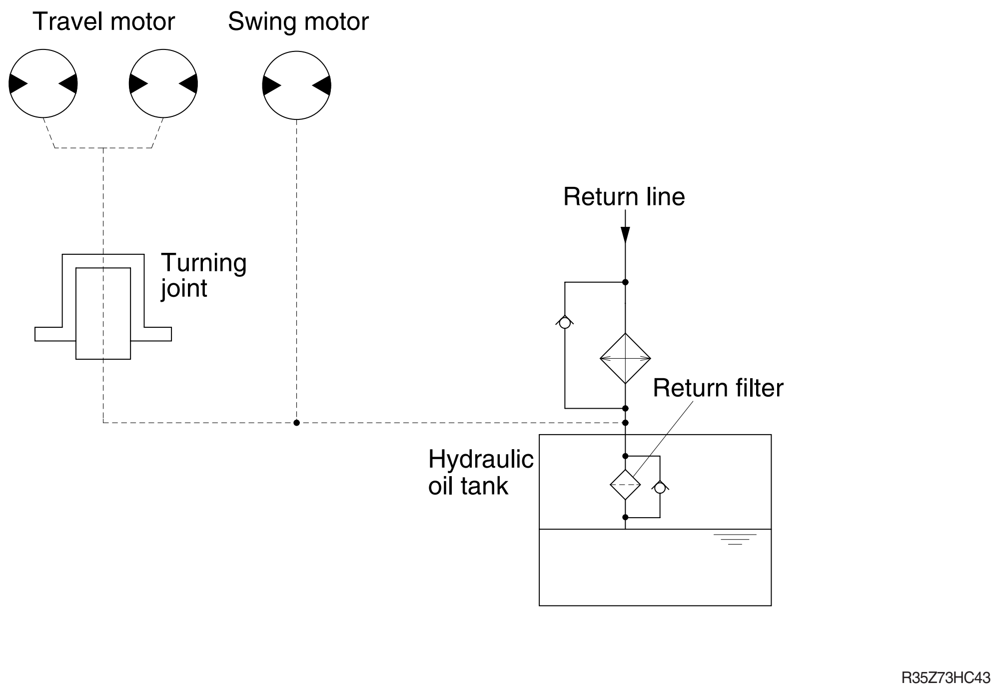
When the oil cooler is clogged, the oil returns directly to the hydraulic tank through bypass check valve.

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



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

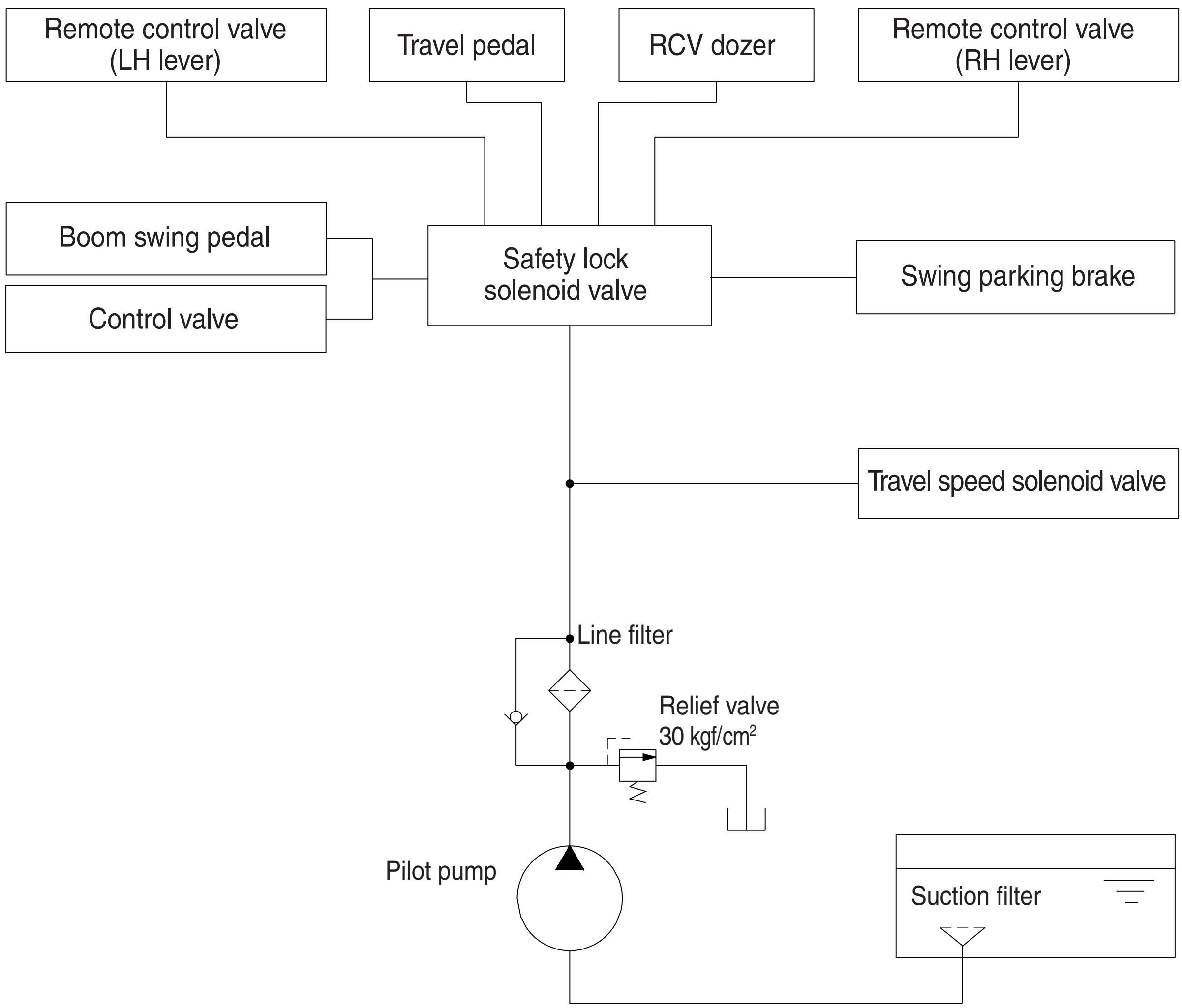
1) TRAVEL MOTOR DRAIN CIRCUIT

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 .

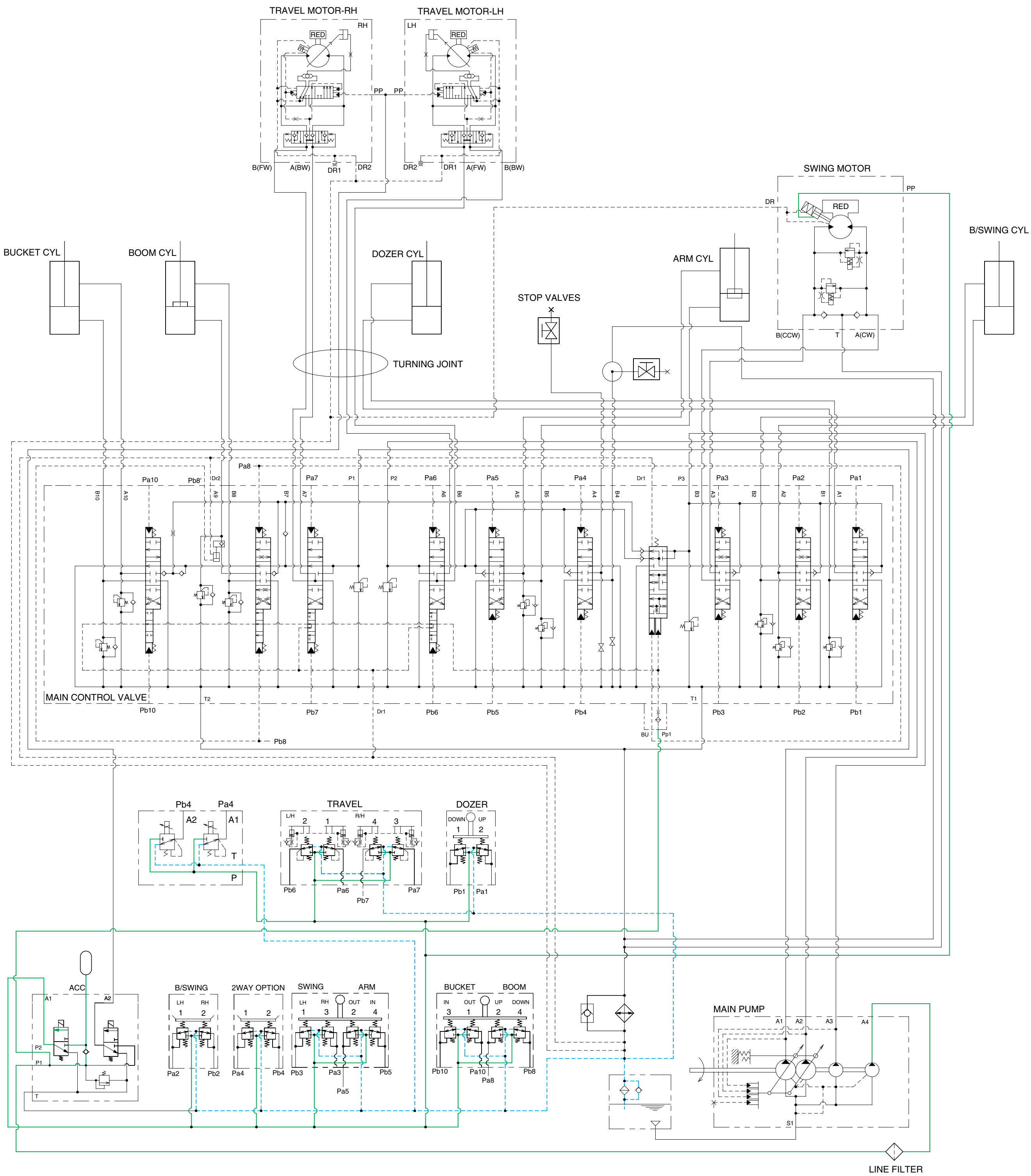
GROUP 3 PILOT CIRCUIT



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

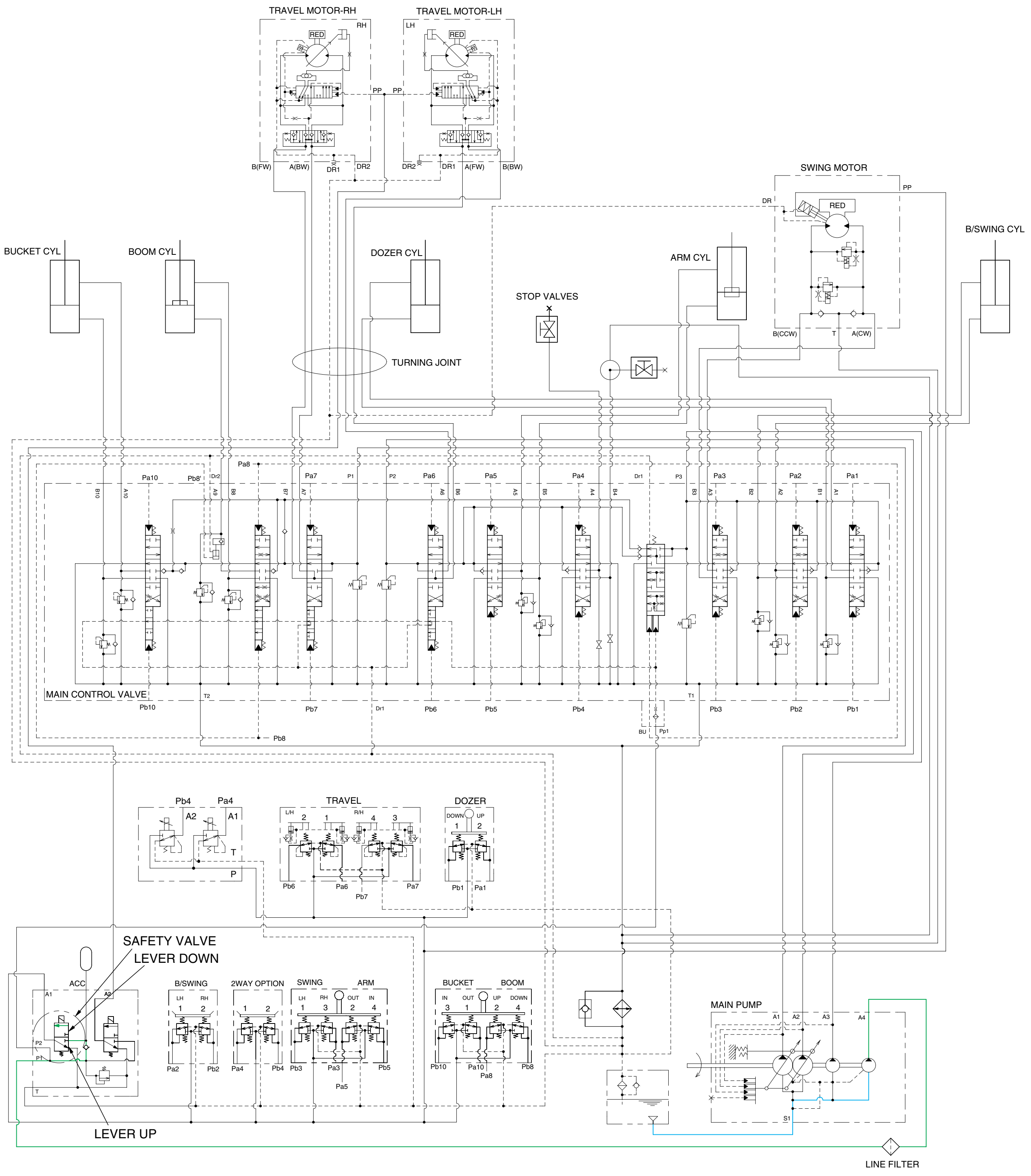


R25Z9AK3HC03

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 into the hydraulic tank.

2. SAFETY VALVE (SAFETY LEVER)

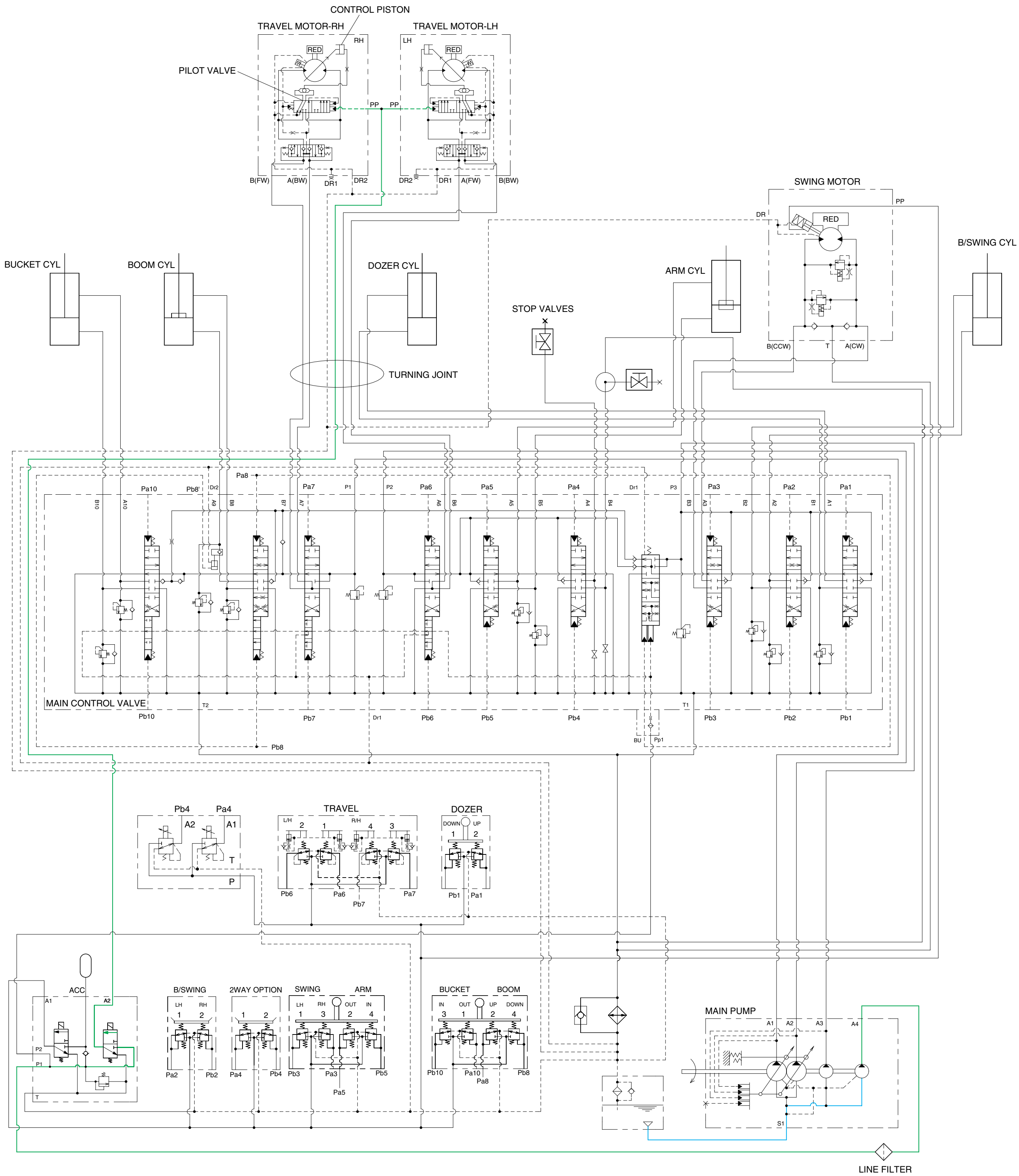


R25Z9AK3HC04

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.

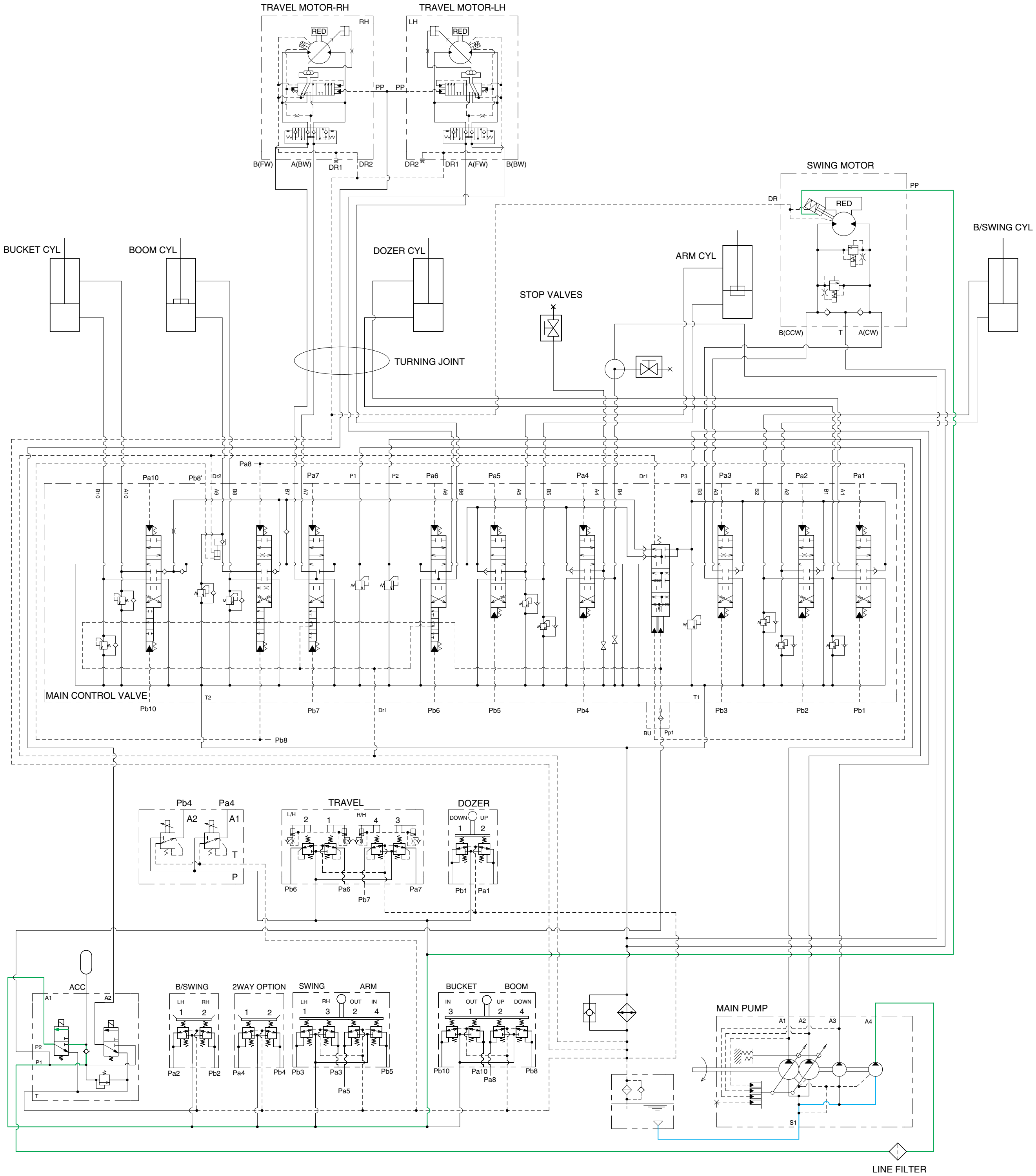
3. TRAVEL SPEED CONTROL SYSTEM



R25Z9AK3HC05

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 PP 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 PP 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

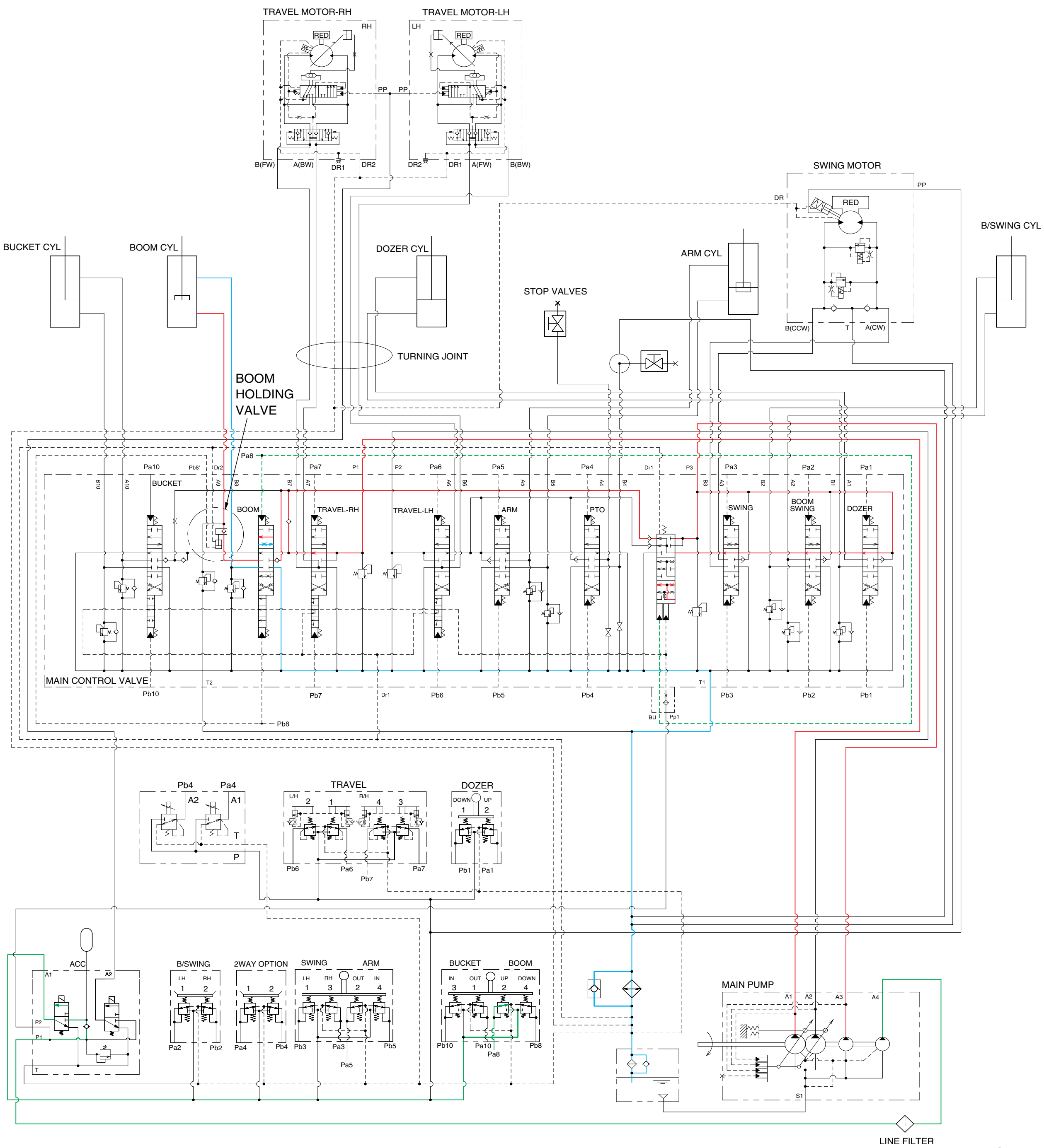


R25Z9AK3HC06

When the Safety solenoid lever is moved downward, the pilot oil flow into PP 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.

GROUP 4 SINGLE OPERATION

1. BOOM UP OPERATION

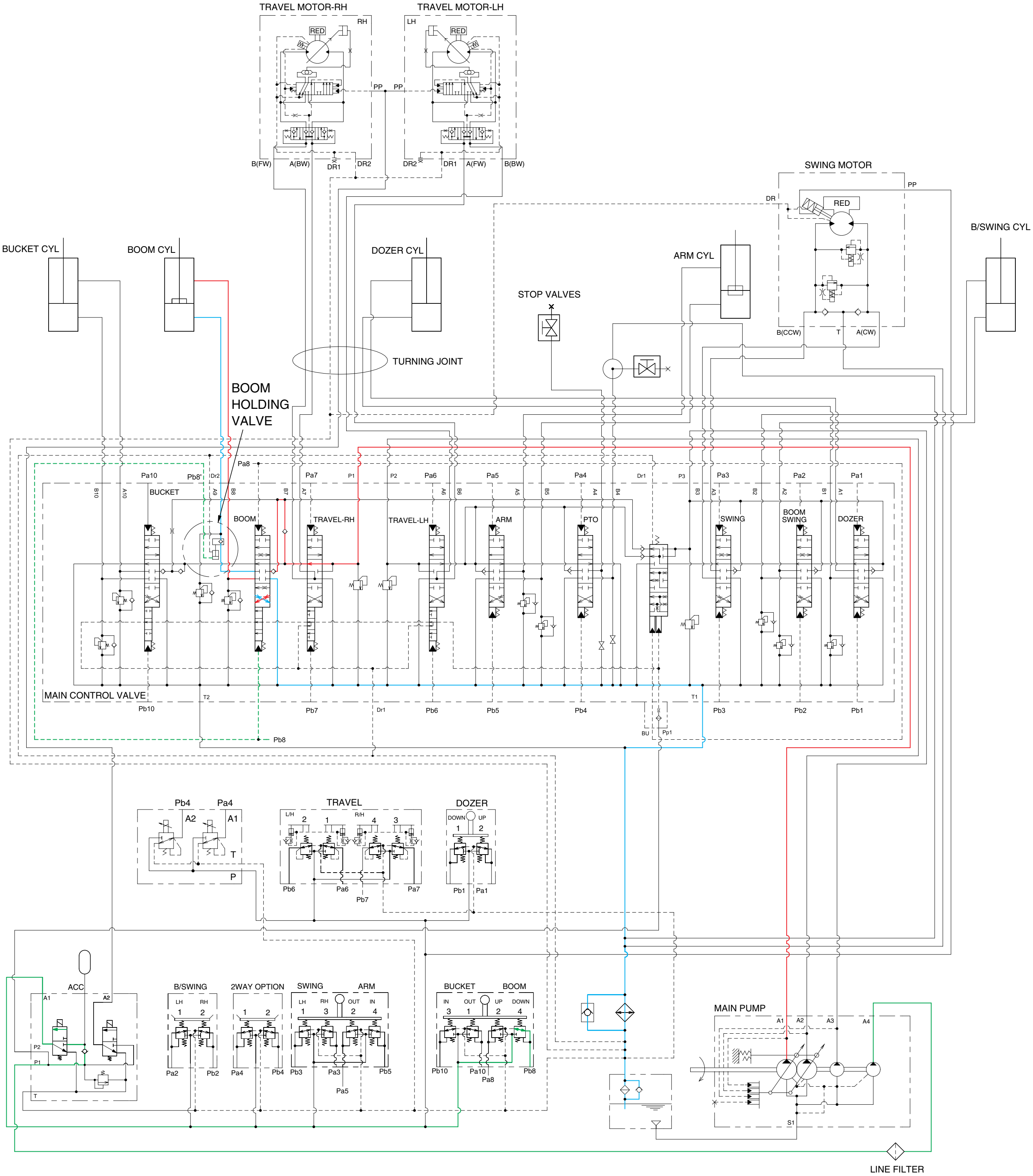


R25Z9AK3HC10

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

The oil from the A1 and A3 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



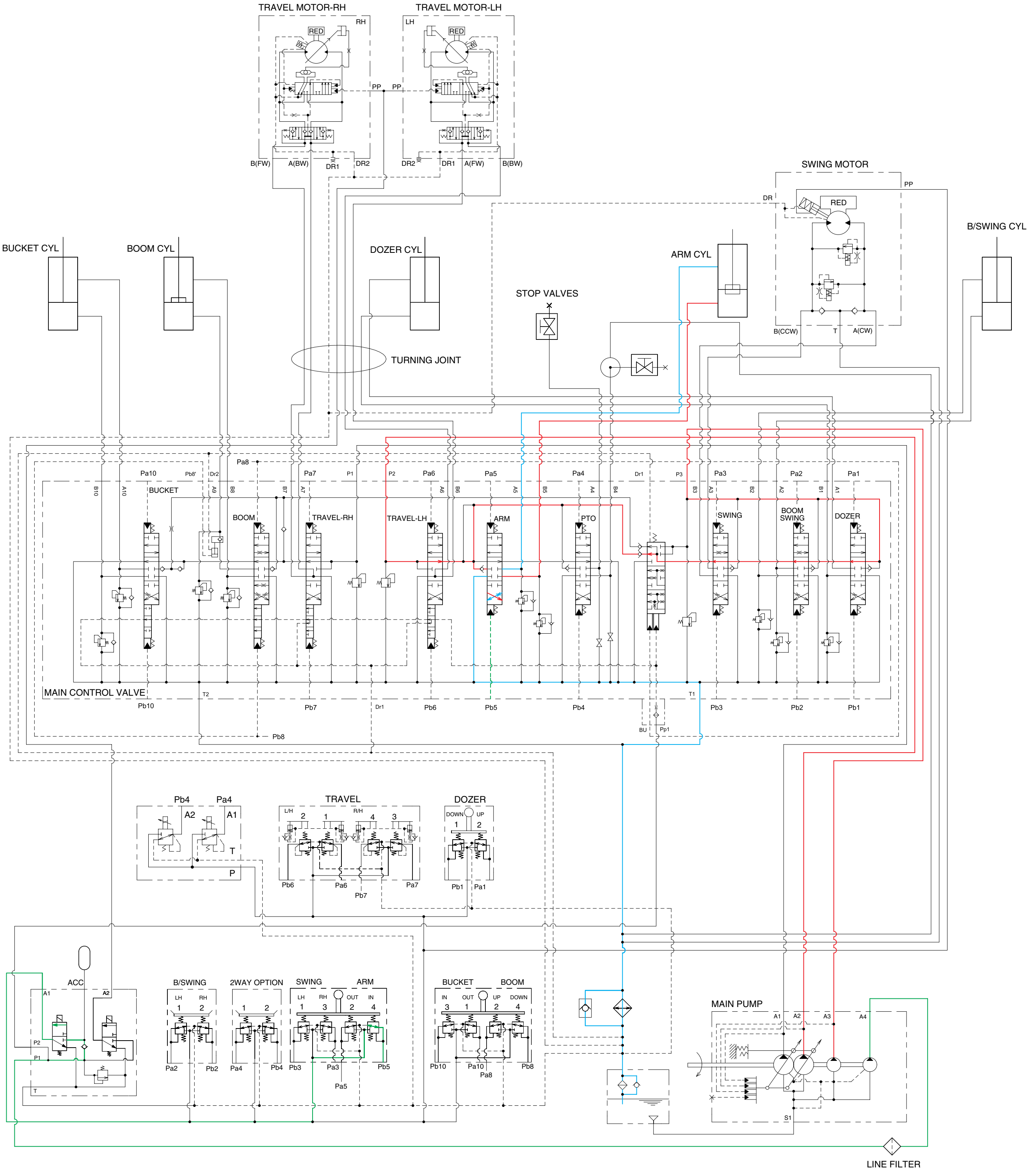
R25Z9AK3HC11

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 A1 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



R25Z9AK3HC12

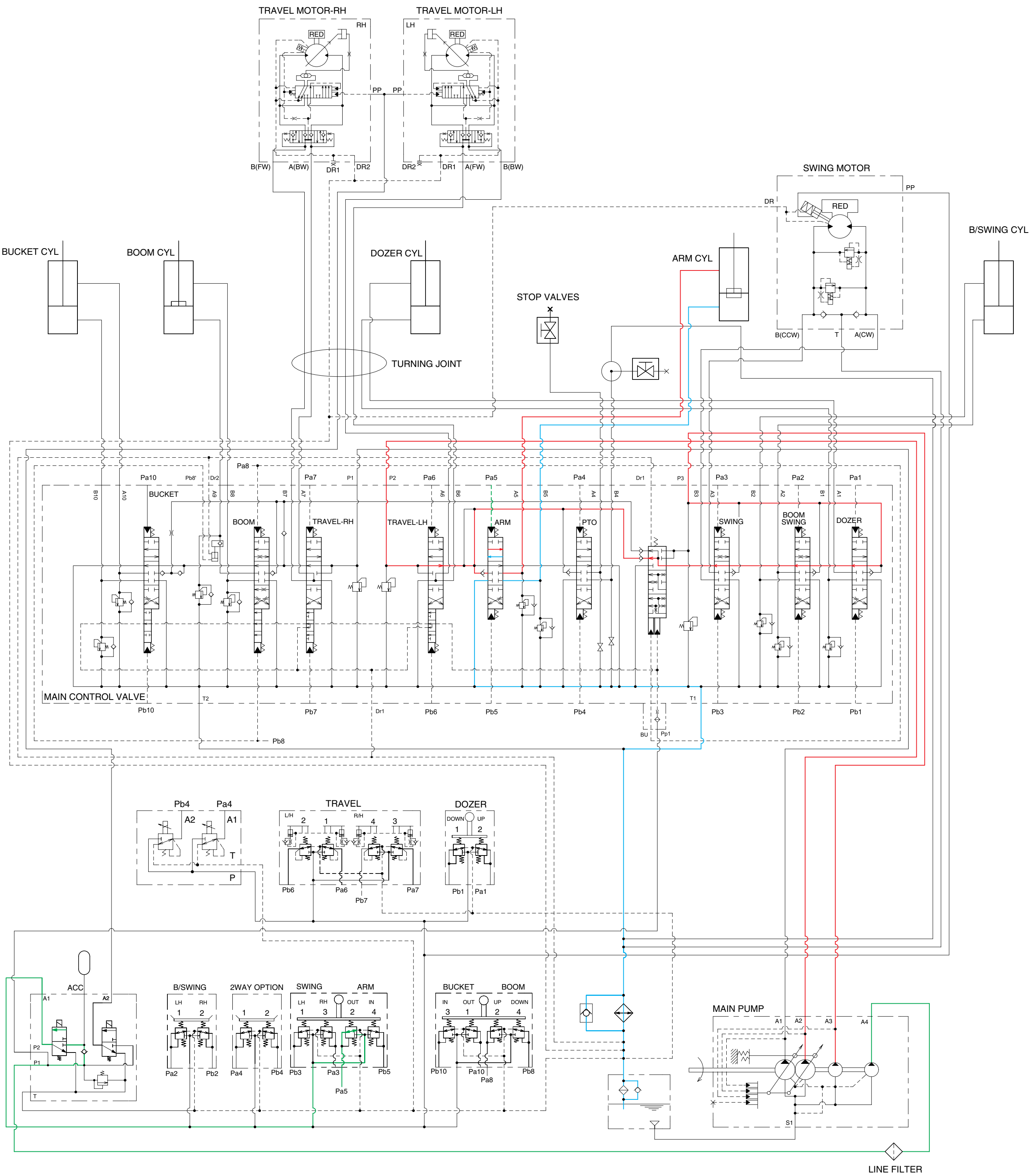
When the left control lever is pulled back, the arm spools in the main control valve are moved the to roll in position by the pilot oil pressure from the remote control valve.

The oil from the A2 and A3 pump flows into the main control valve and then goes to the large chamber of arm cylinder.

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

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

4. ARM ROLL OUT OPERATION



R25Z9AK3HC13

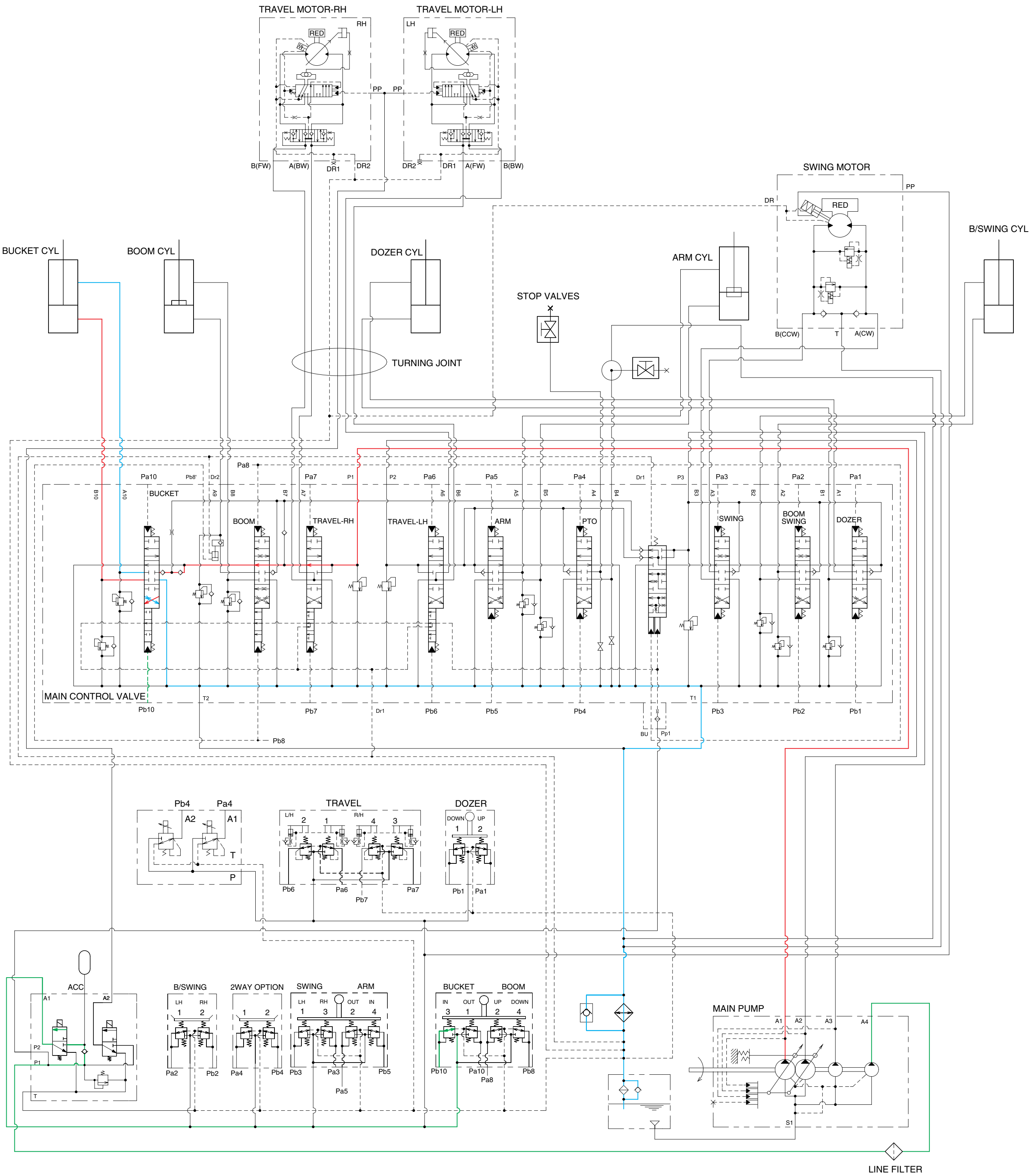
When the left control lever is pushed forward, the arm spool in the main control valve are moved to the roll out position by the pilot oil pressure from the remote control valve.

The oil from the A2 and A3 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



R25Z9AK3HC14

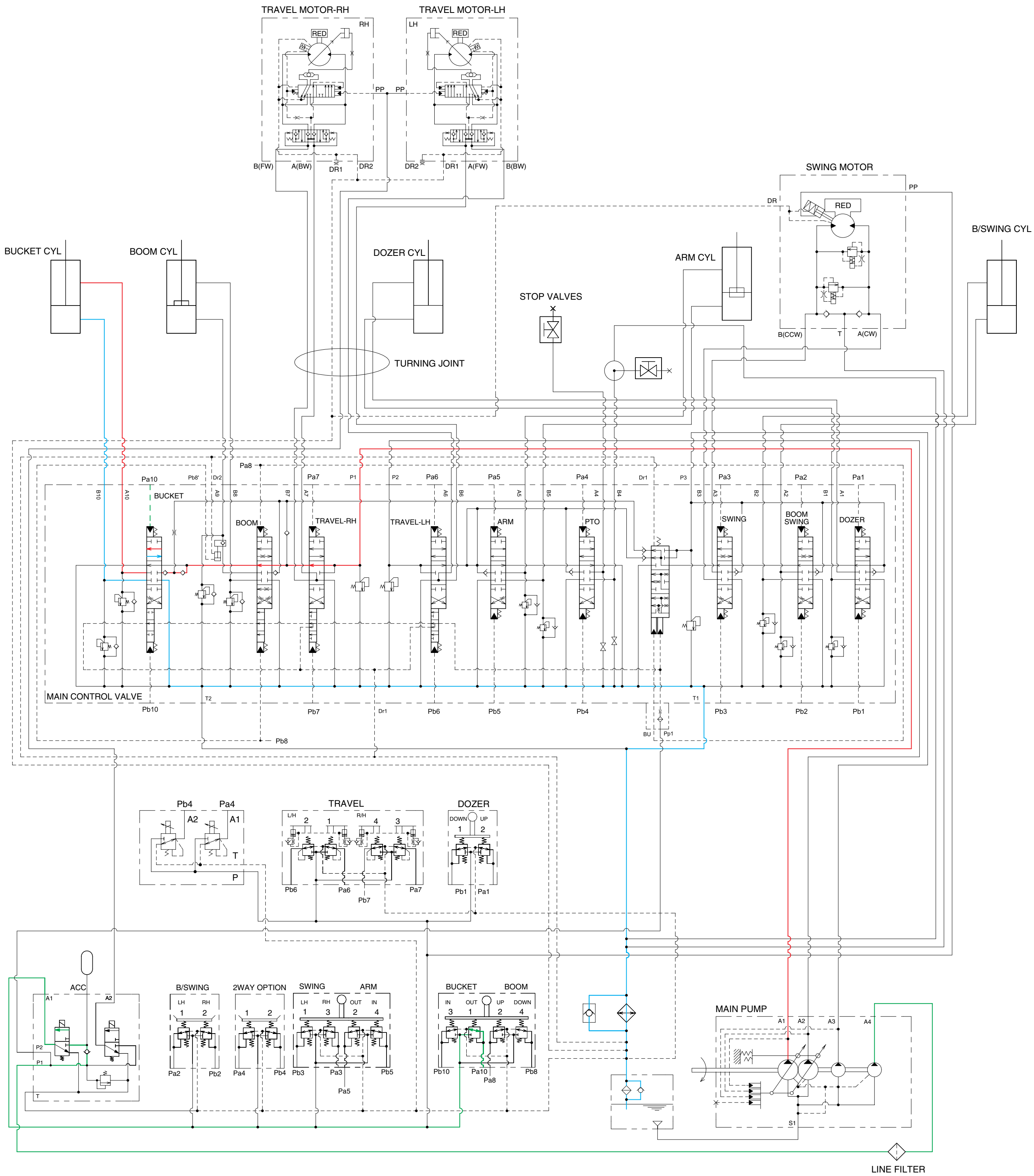
When the right control lever is pulled left, the bucket spool in the main control valve is moved to the roll in position by the pilot oil pressure from the remote control valve.

The oil from the A1 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



R25Z9AK3HC15

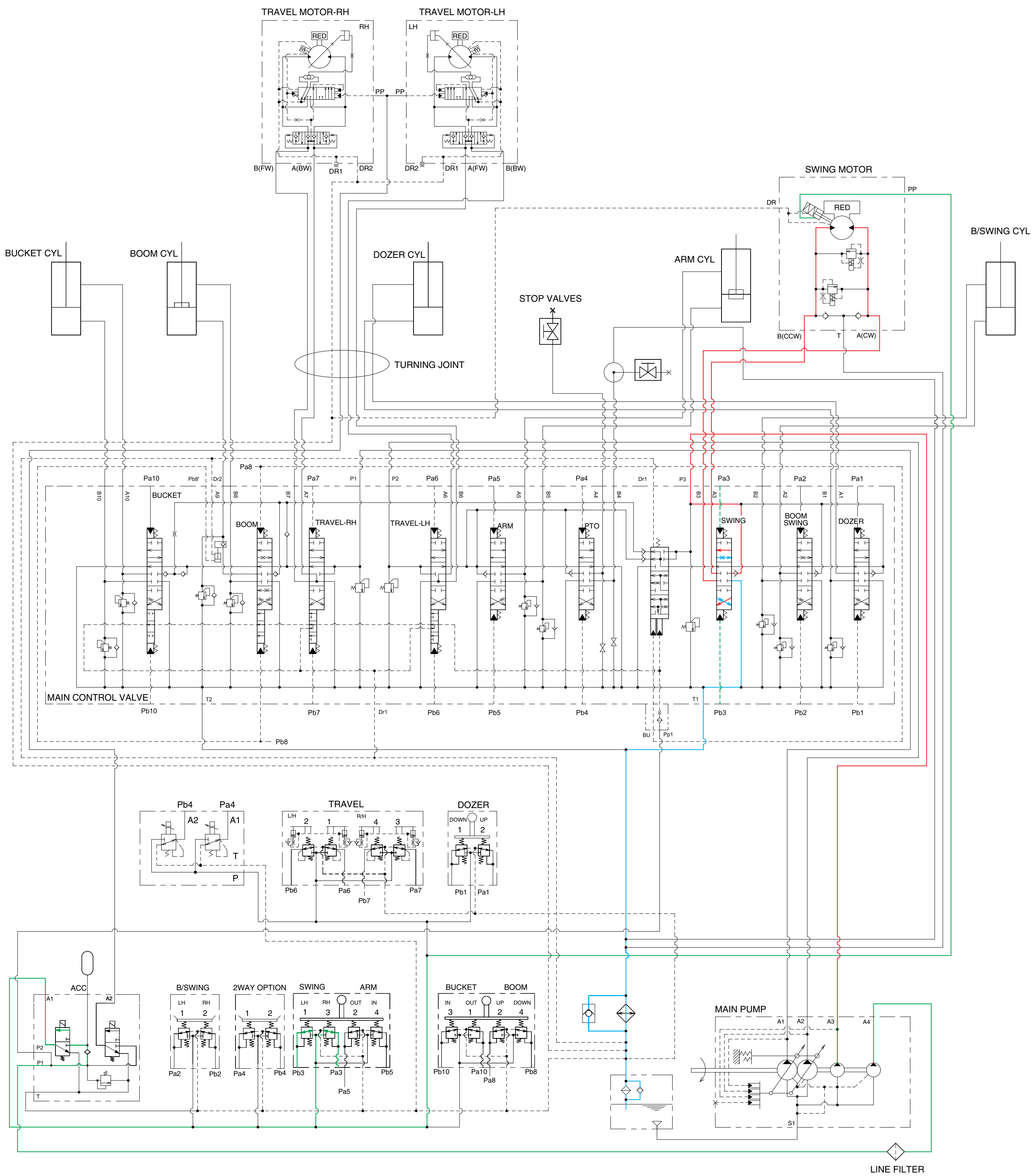
When the right control lever is pushed right, the bucket spool in the main control valve is moved to the roll out position by the pilot oil pressure from the remote control valve.

The oil from the A1 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.

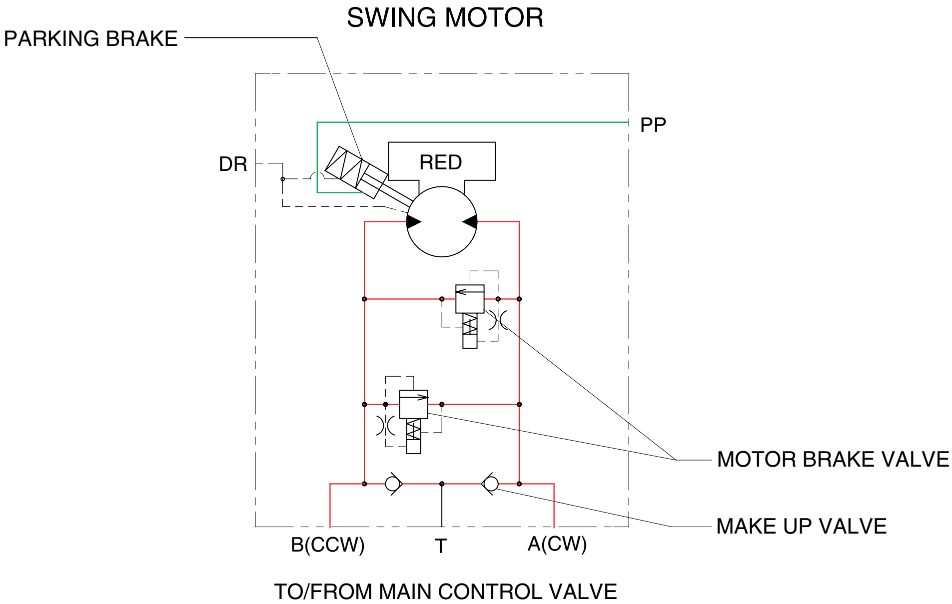
7. SWING OPERATION



R25Z9AK3HC16

When the left control lever is pushed left or right, the swing spool in the main control valve is moved to the left or right swing position by the pilot oil pressure from the remote control valve.
The oil from the A3 pump flows into the main control valve and then goes to the swing motor.
At the same time, the return oil from the swing motor returns to the hydraulic oil tank through the swing spool in the main control valve. When this happens, the superstructure swings to the left or right. The swing parking brake, make up valve and the overload relief valve are provided in the swing motors. The cavitation which will happen to the swing motor is also prevented by the make up valve in the swing motor itself.

SWING CIRCUIT OPERATION



R27Z93HC40

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

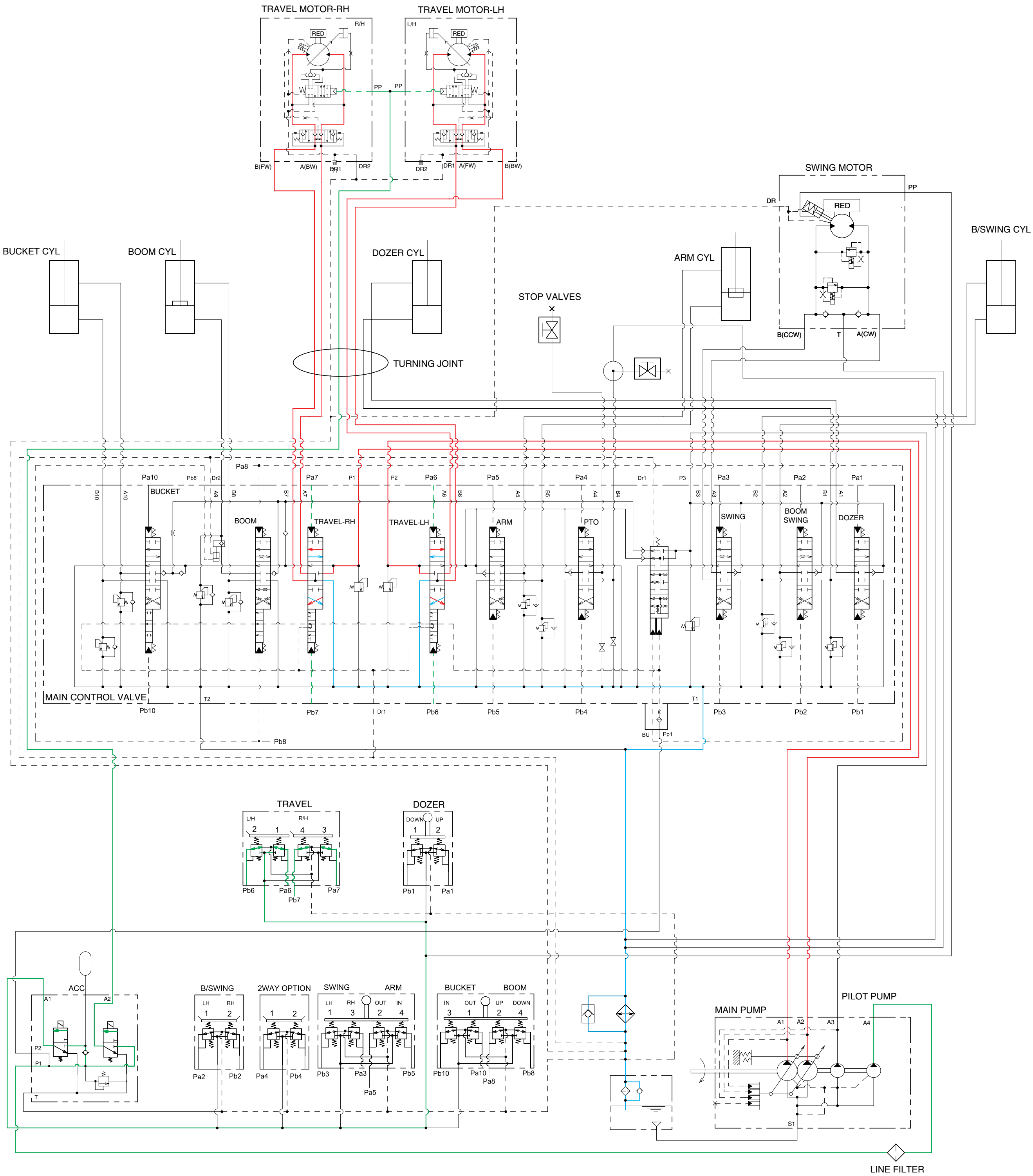
PARKING BRAKE "ON" OPERATION

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 A4 pilot pump is flow into parking brake through safety solenoid valve.
Then the pilot pressure lift the brake piston and release the parking brake.

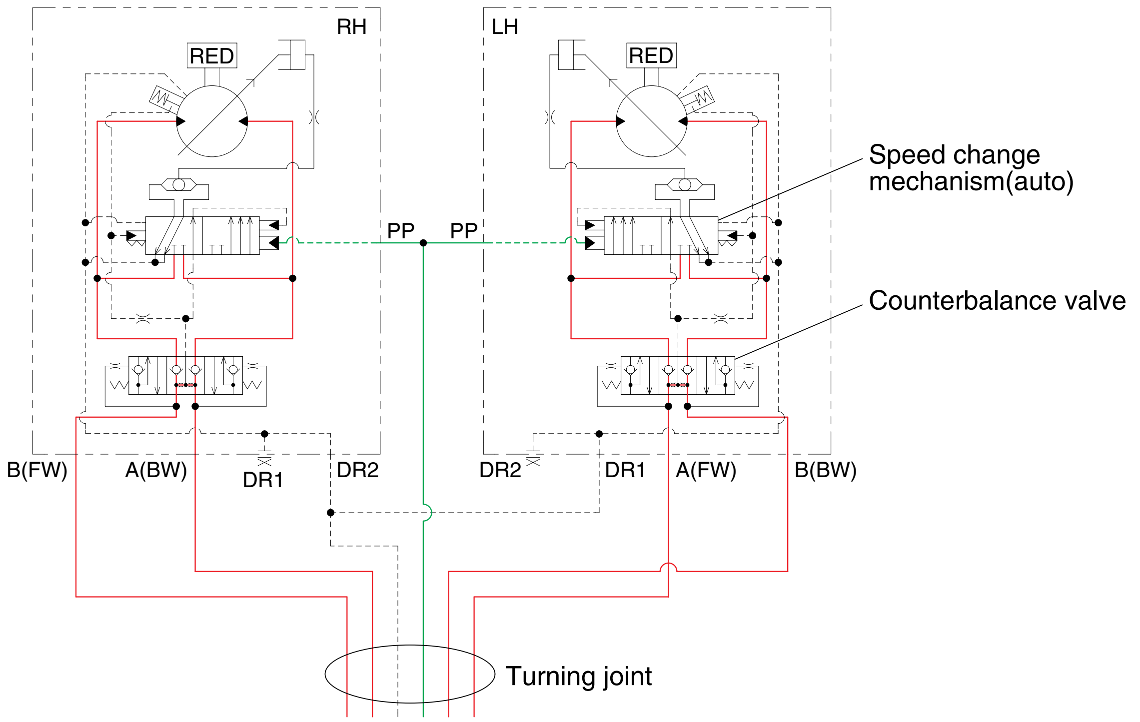
8. TRAVEL FORWARD AND REVERSE OPERATION



R25Z9AK3HC17

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



R25Z9AK3HC42

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

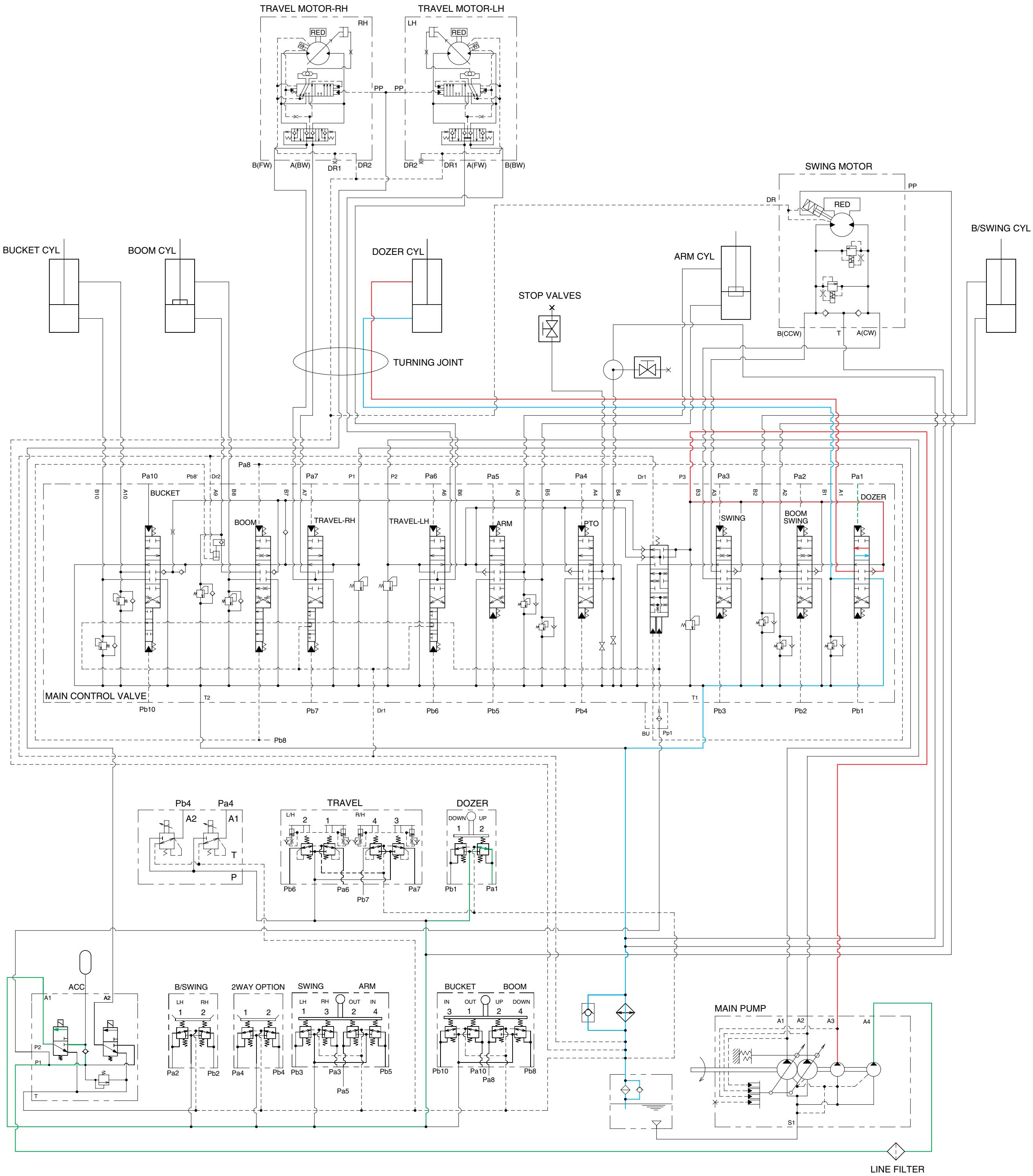
1) COUNTERBALANCE VALVE

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



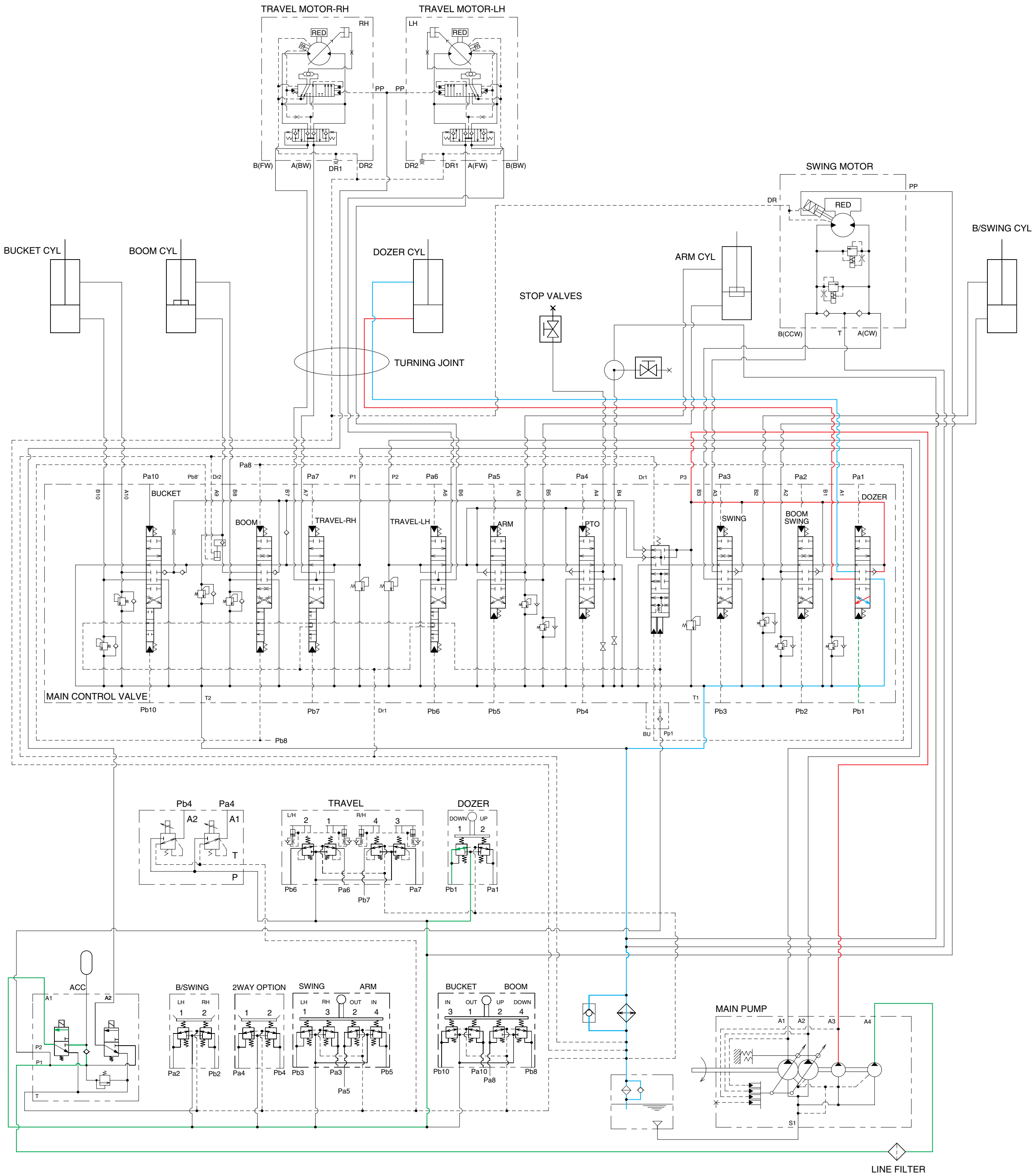
R25Z9AK3HC18

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

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

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

10. DOZER DOWN OPERATION



R25Z9AK3HC19

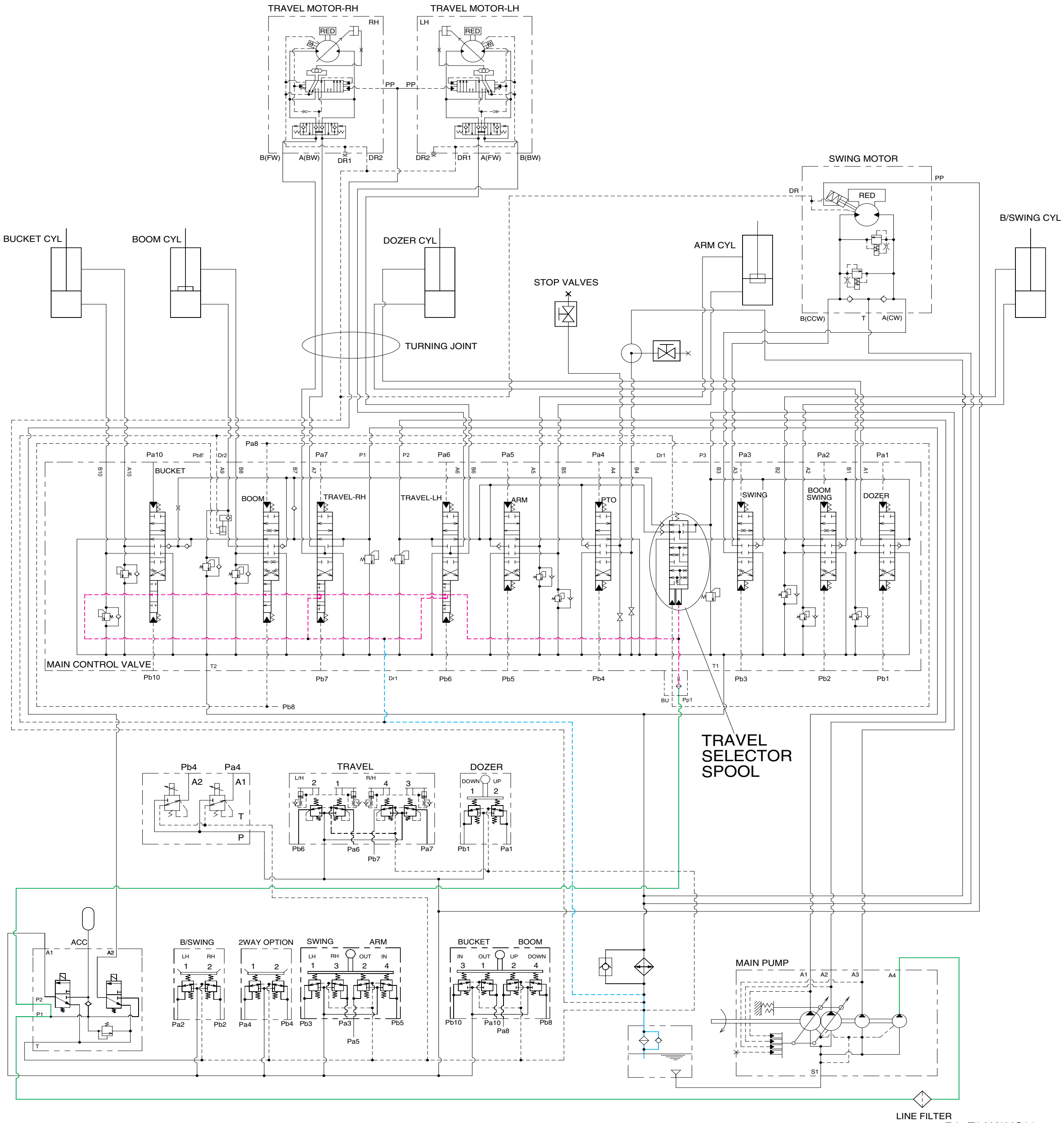
When the dozer control lever is pushed forward, the dozer spool in the main control valve is moved to the dozer down position by the pilot oil pressure from the remote control valve.

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

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

GROUP 5 COMBINED OPERATION

1. OUTLINE



R25Z9AK3HC30

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

INDEPENDENT TRAVEL SYSTEM

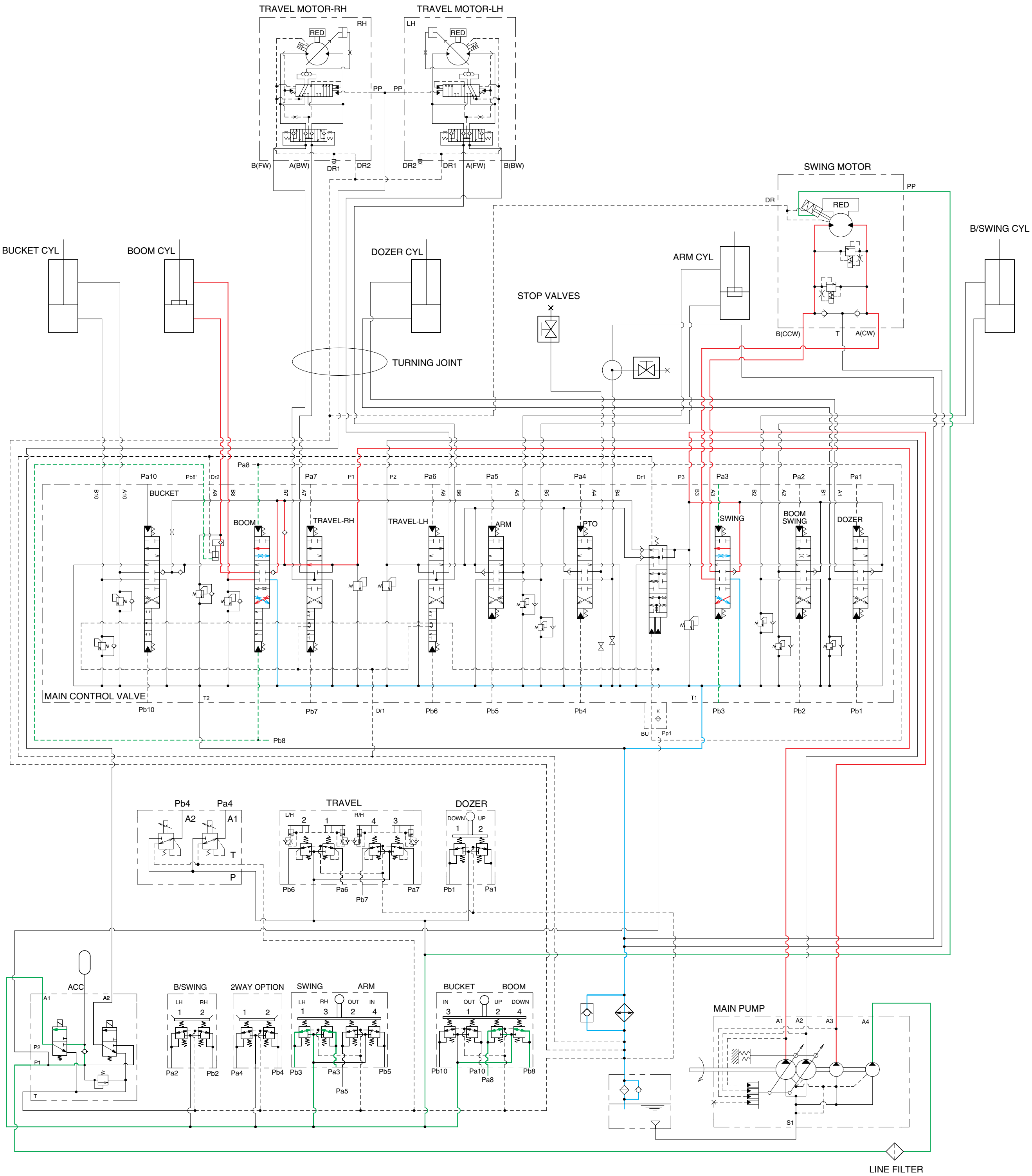
This independent travel system for straight travel is provided in the main control valve.

If any actuator(s) on A1 and A2 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 A1 and A2 pump are supplied to the right and left travel motor and oil from A3 pump flows into the other operated actuator.

This keeps the straight travel.

2. COMBINED SWING AND BOOM OPERATION



R25Z9AK3HC31

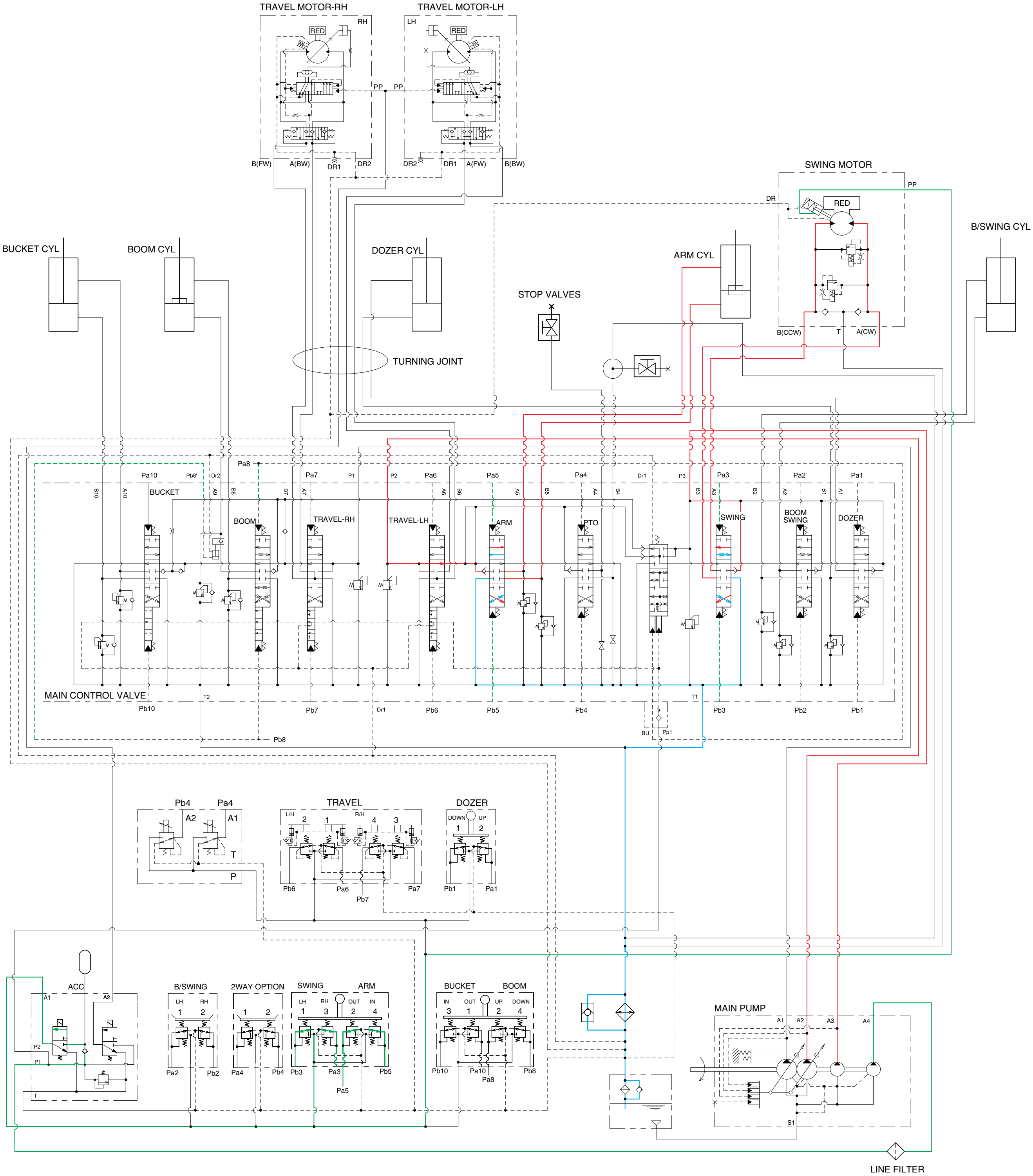
When the swing and boom functions are operated, simultaneously the selector spool, swing spool and boom spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the A1 pump and solenoid from the A3 pump flows into the boom cylinder through boom.

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

The superstructure swings and the boom is operated.

3. COMBINED SWING AND ARM OPERATION



R25Z9AK3HC32

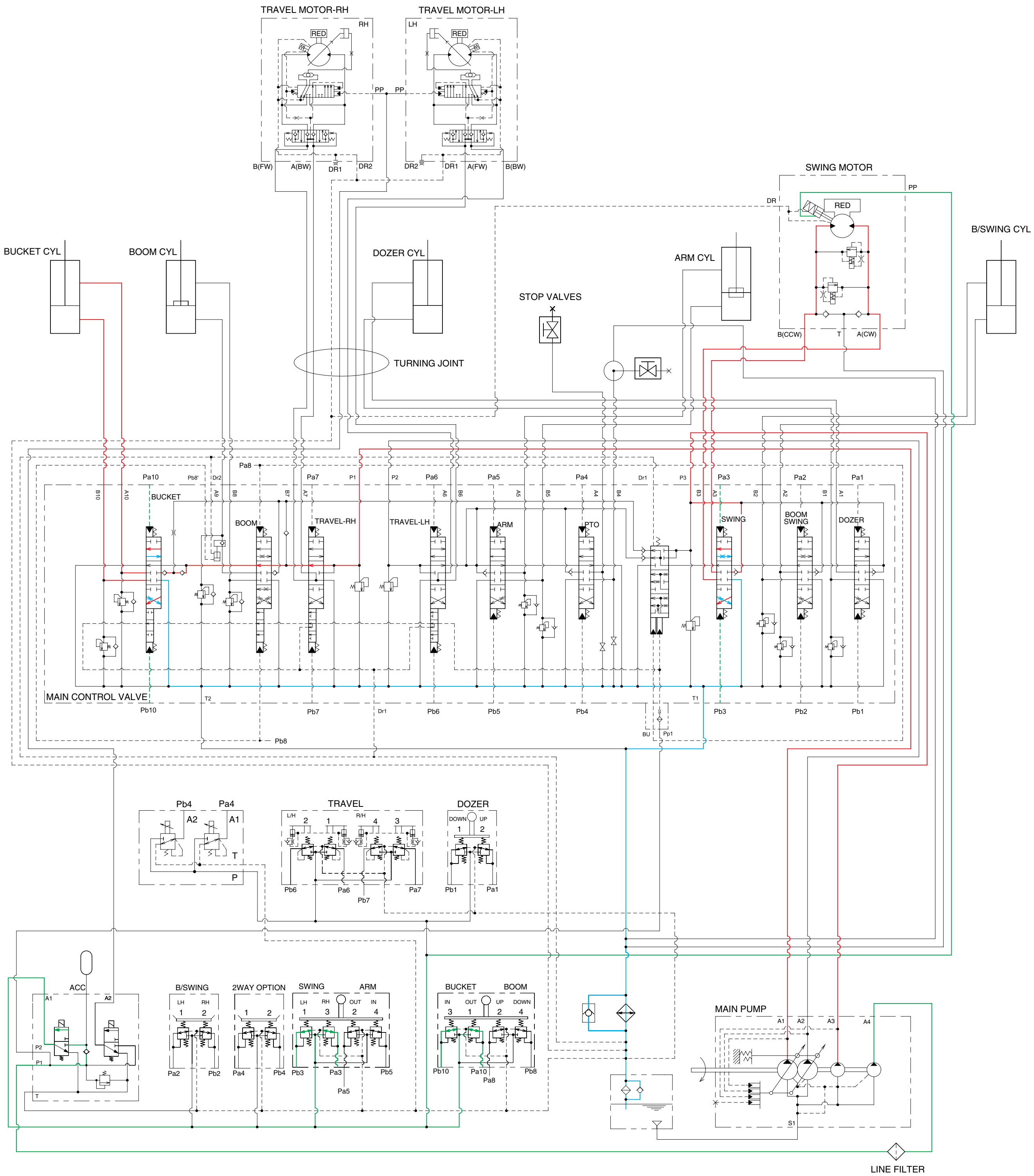
When the swing and arm functions are operated, simultaneously the swing spool and arm spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

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

The oil from the A2 pump flows into the arm cylinder through the arm.

The superstructure swings and the arm is operated.

4. COMBINED SWING AND BUCKET OPERATION



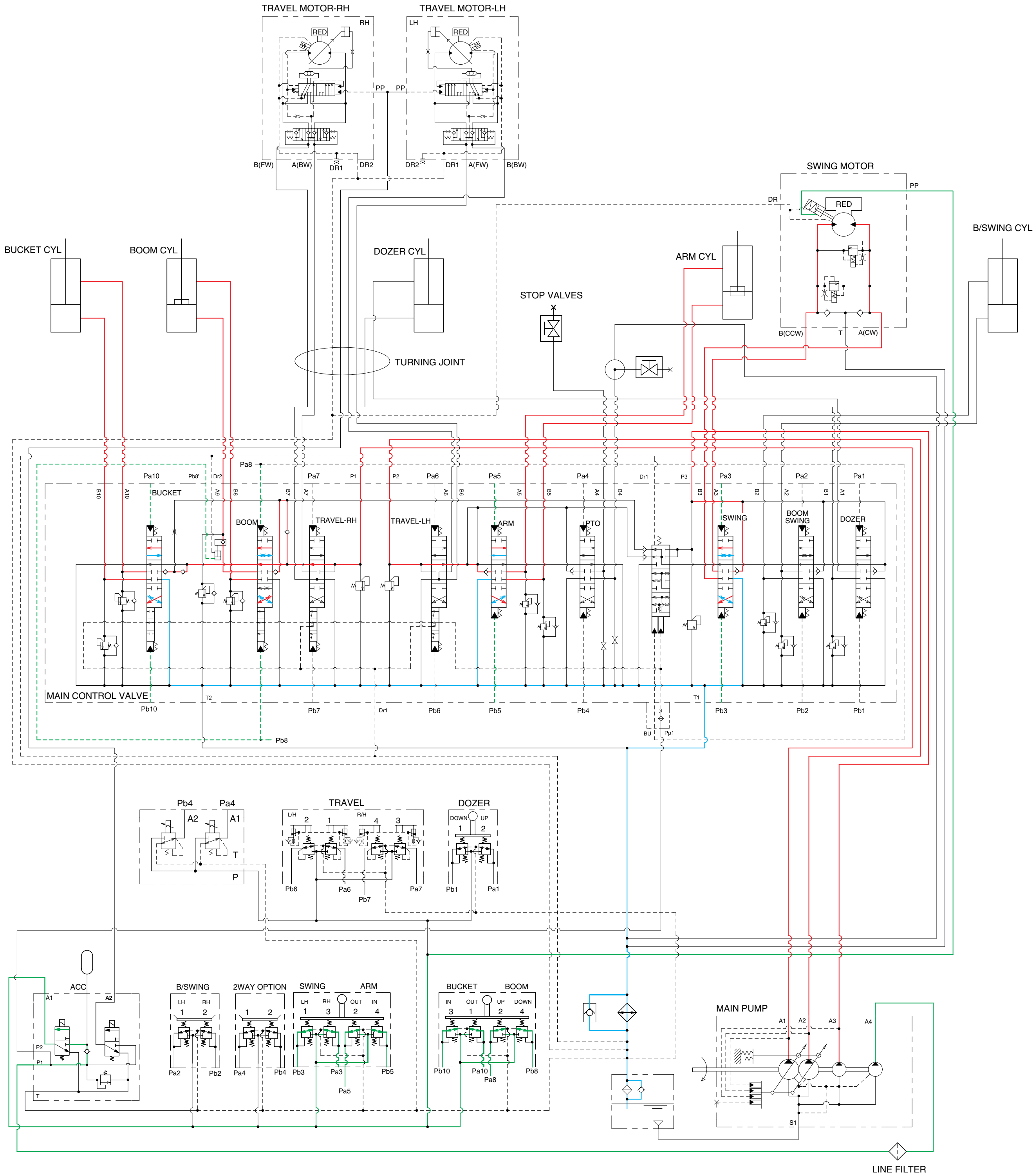
R25Z9AK3HC33

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

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

The oil from the A1 pump flows into the bucket cylinder through the bucket spool.

5. COMBINED SWING, BOOM, ARM AND BUCKET OPERATION



R25Z9AK3HC34

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.

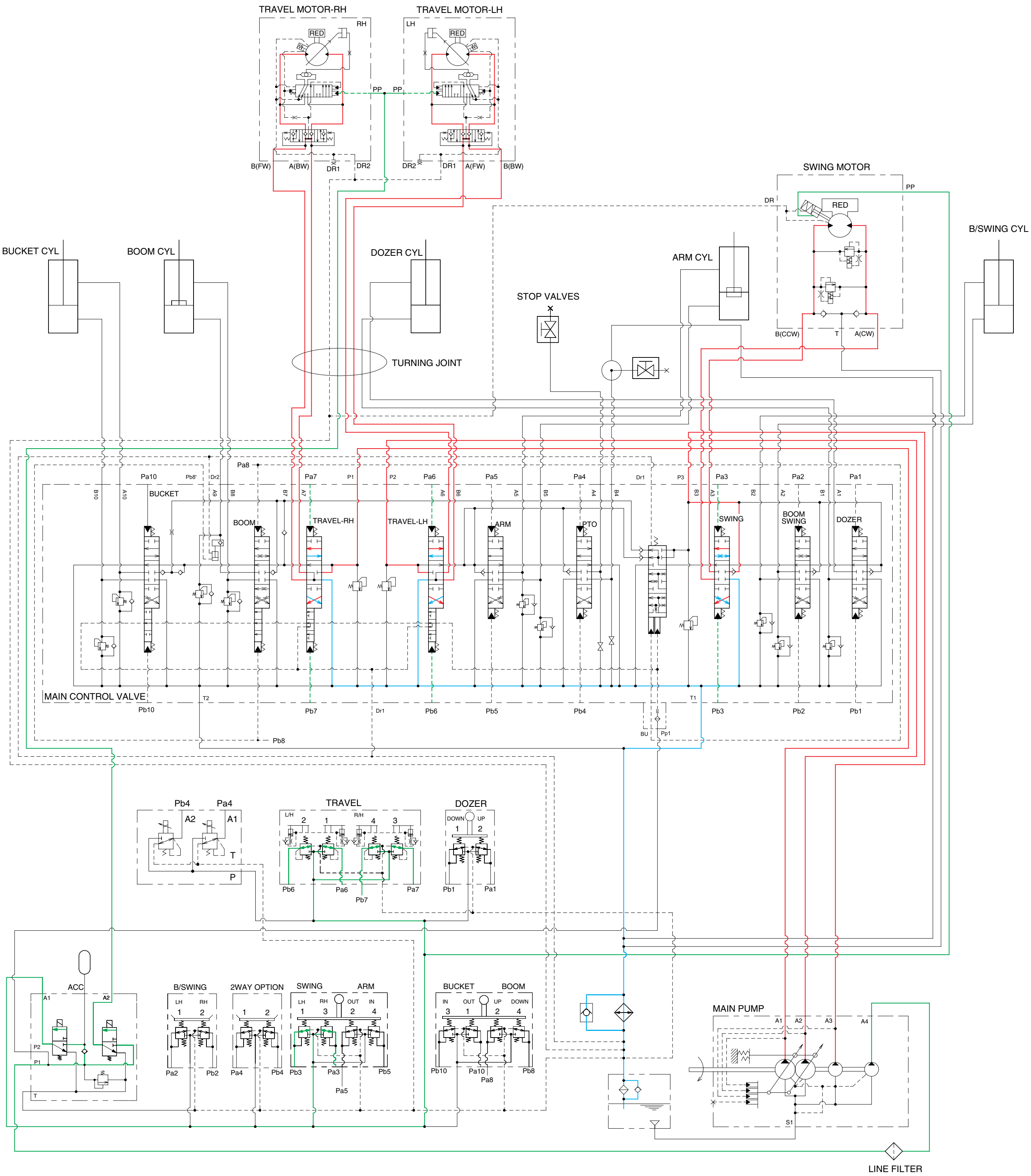
The oil from the A2 pump flows into the arm cylinder through, arm spool.

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

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

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

6. COMBINED SWING AND TRAVEL OPERATION



R25Z9AK3HC35

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

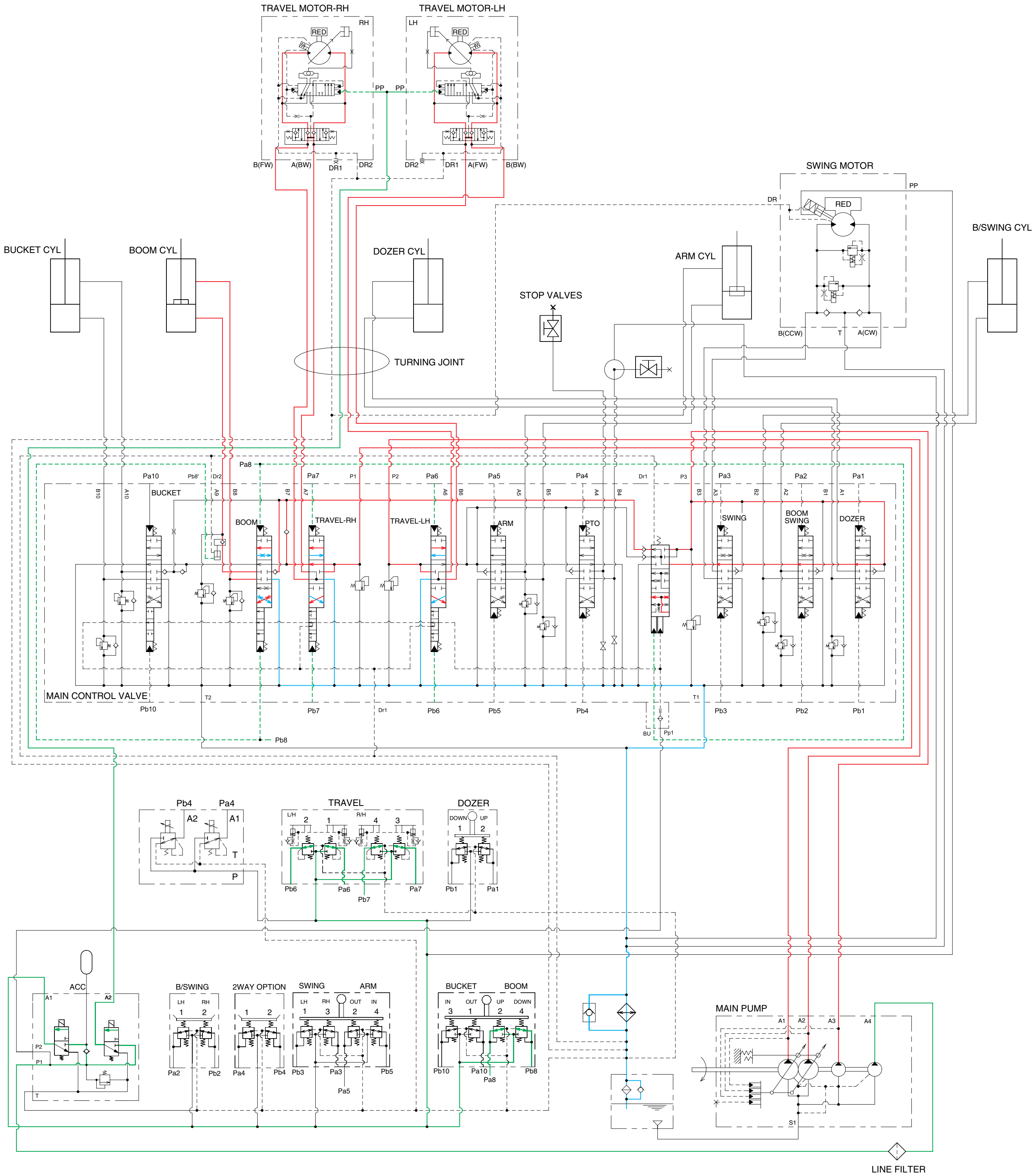
The oil from the A3 pump flows into the swing motor through the swing spool.

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

The oil from the A2 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



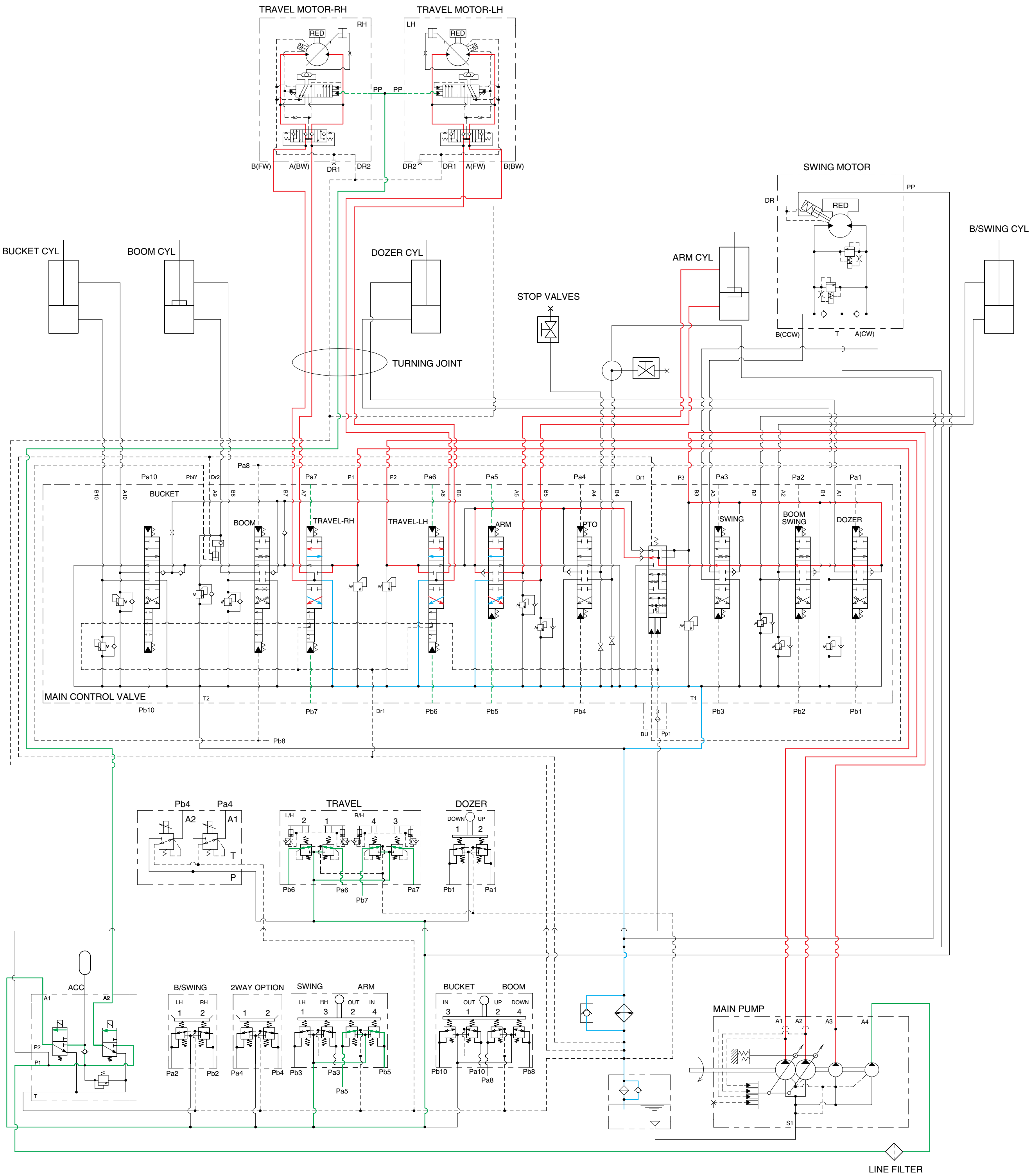
R25Z9AK3HC36

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 A1 and A2 pumps flows into the travel motors through travel RH and travel LH spools.

The oil from the A3 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



R25Z9AK3HC37

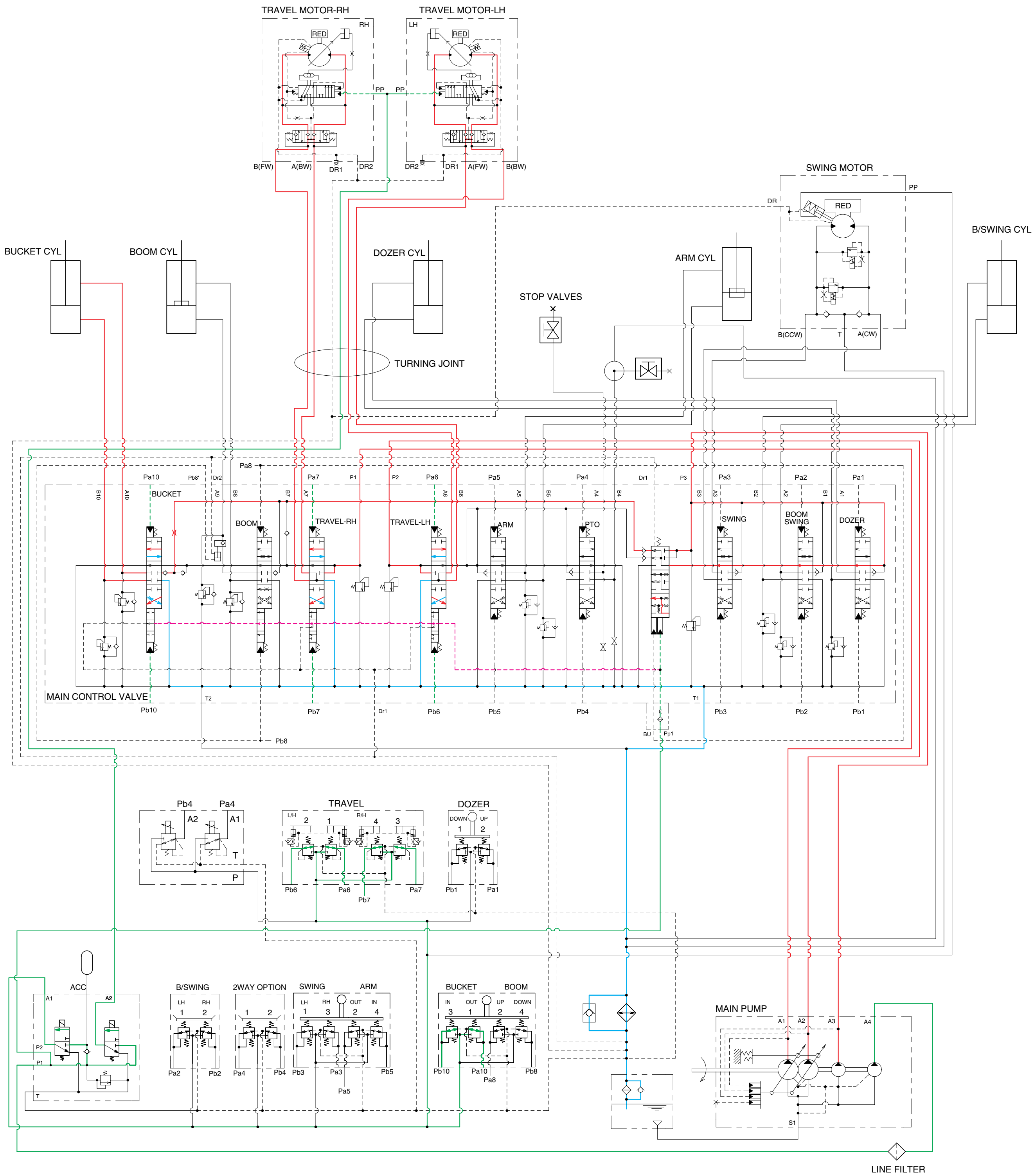
When the arm and travel functions are operated, simultaneously the arm spools and travel spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the A1 and A2 pumps flows into the travel motors through travel spools.

The oil from the A3 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



R25Z9AK3HC38

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 A1 and A2 pumps flows into the travel motors.

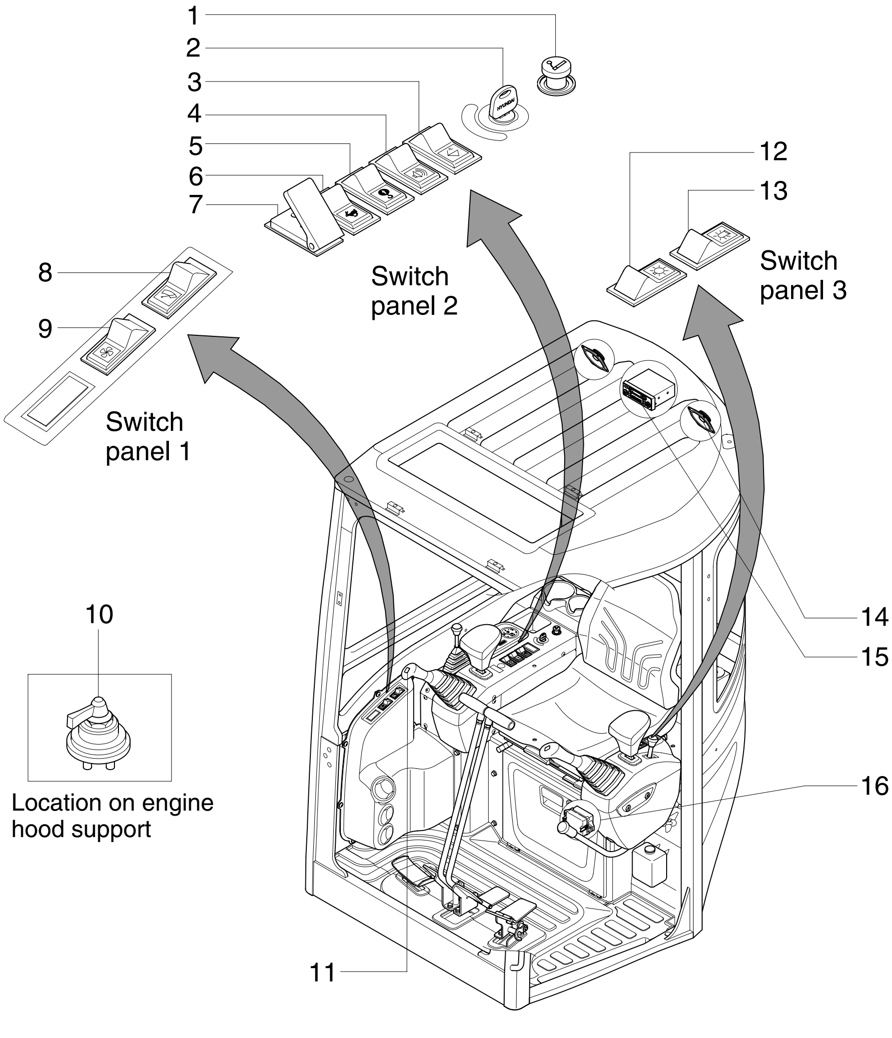
The oil from the A3 pump flows into the bucket cylinder through bucket spool via the travel selector spool.

The bucket is operated and the machine travels straight.

SECTION 4 ELECTRICAL SYSTEM

GROUP 1 COMPONENT LOCATION

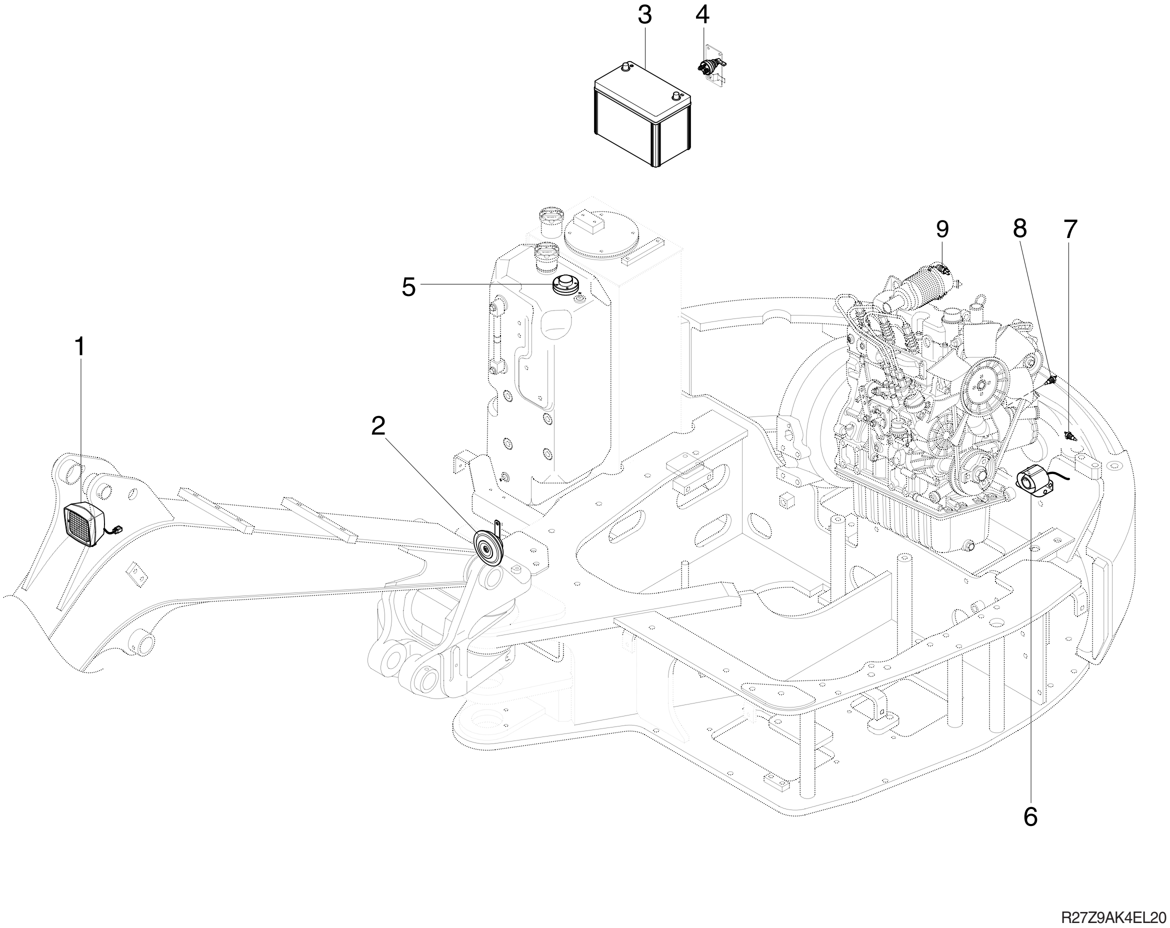
1. LOCATION 1



R25Z9AK4EL02

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

2. LOCATION 2



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

GROUP 2 MONITORING SYSTEM

1. OUTLINE

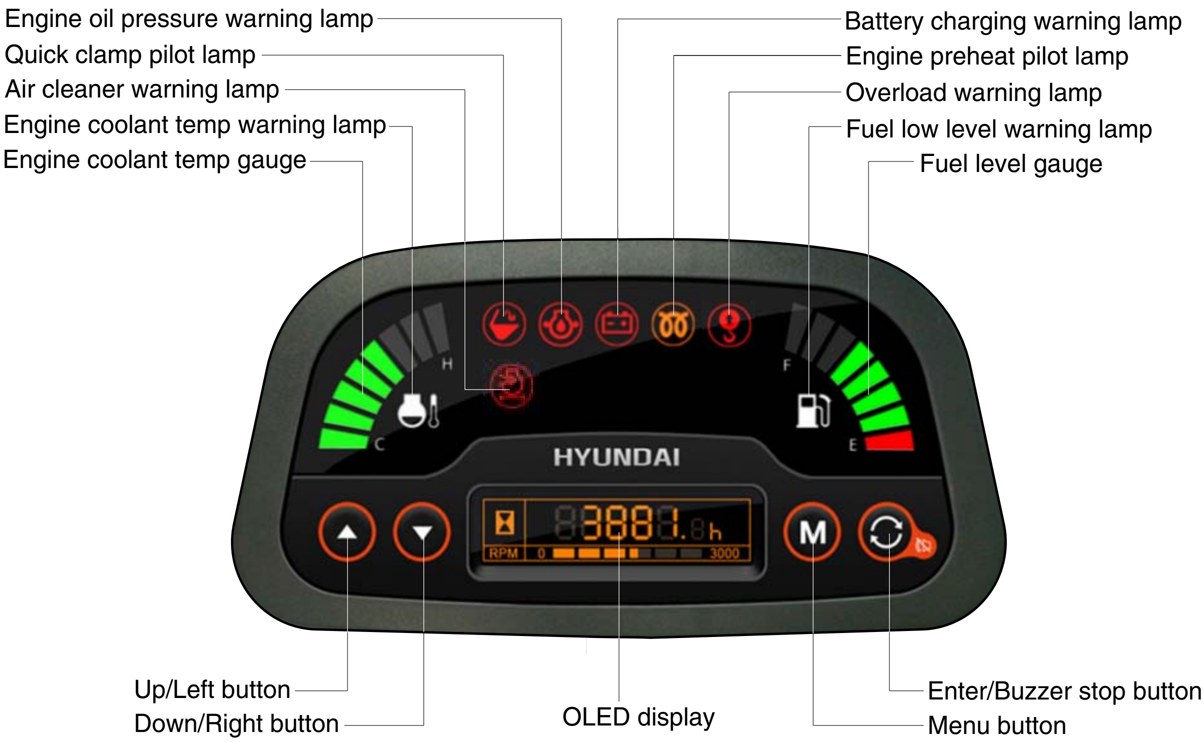
Monitoring system consists of the monitor part and switch part.

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

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

2. CLUSTER

1) MONITOR PANEL



R25Z9AK3CD03

2) CLUSTER CHECK PROCEDURE

(1) Start key : ON

① Check monitor initial 6 seconds

a. All lamps light up.

② Check monitor after 2 seconds : Indicate machine condition

a. Tachometer : 0 rpm

b. Fuel gauge : Pointed at appropriate level

c. Engine coolant temperature gauge : Pointed at appropriate level

d. Warning lamp

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

(2) Start of engine

① Check machine condition

a. Tachometer pointed at present rpm

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

※ When normal condition : All warning lamp OFF

② When abnormal condition

a. The lamp lights up.

b. The lamp light up until normal condition.

3. CLUSTER FUNCTION

1) GAUGES AND DISPLAYS

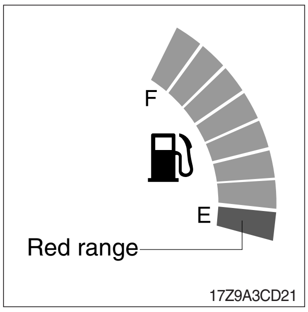
(1) Service meter

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.
Inspect and service the machine based on hours as indicated in chapter 6, maintenance.

(2) Fuel gauge



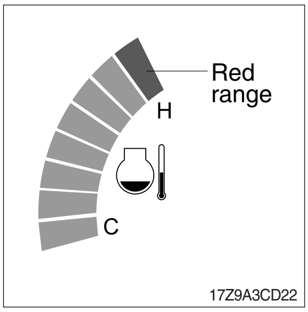
17Z9A3CD21

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.**

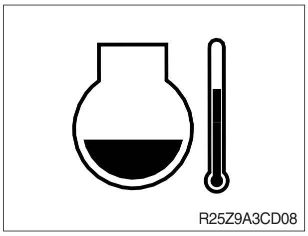
2) WARNING AND PILOT LAMPS

(1) Fuel low level warning lamp

R5573CD10

① This lamp ON and buzzer sounds when the level of fuel is below 5.5 l (1.5 U.S. gal).
② Fill the fuel immediately when the lamp ON.

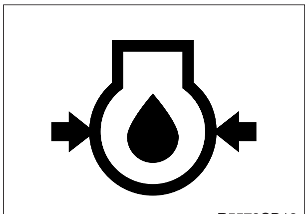
(2) Engine coolant temperature warning lamp



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.

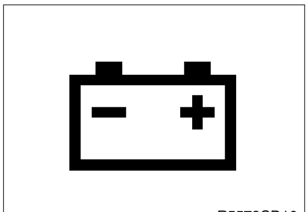
(3) Engine oil pressure warning lamp



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.

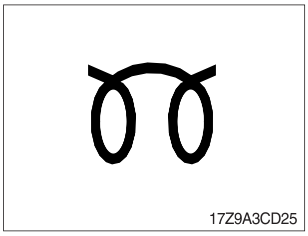
(4) Battery charging warning lamp



R5573CD16

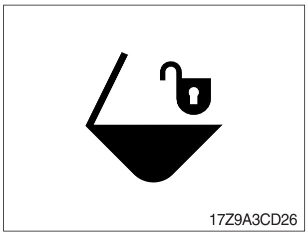
① This lamp ON and buzzer sounds when the starting switch is ON, it is turned OFF after starting the engine.
② Check the battery charging circuit when this lamp blinks during engine operation.

(5) Engine preheat pilot lamp



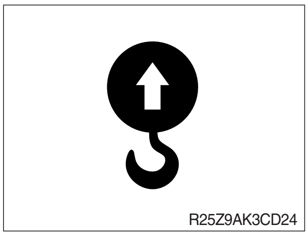
① When the start switch turn to HEAT position, pilot lamp comes ON.
② Refer to the page 4-4 for details in operator's manual.

(6) Quick clamp lock pilot lamp



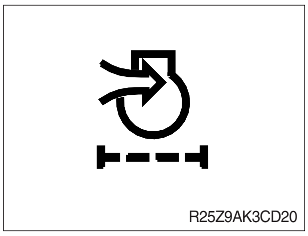
① When the quick clamp switch turned ON, this lamp turn ON and the buzzer sounds.
② This lamp turned OFF and the buzzer stop when the quick clamp switch turned OFF.

(7) Overload warning lamp

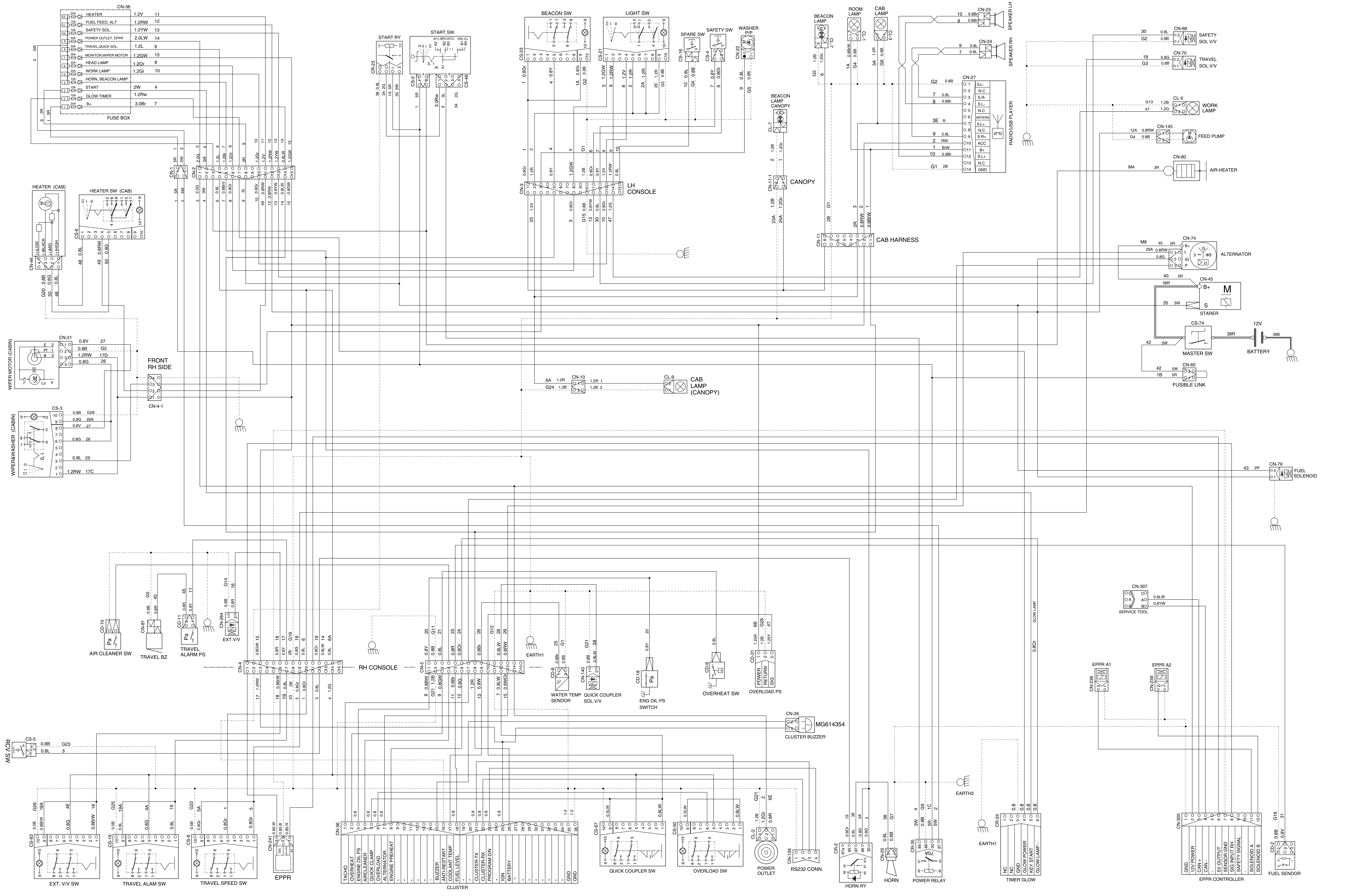


① When the machine is overload, this lamp ON during the overload switch is ON.
② Reduce the machine load.

(8) Air cleaner warning lamp

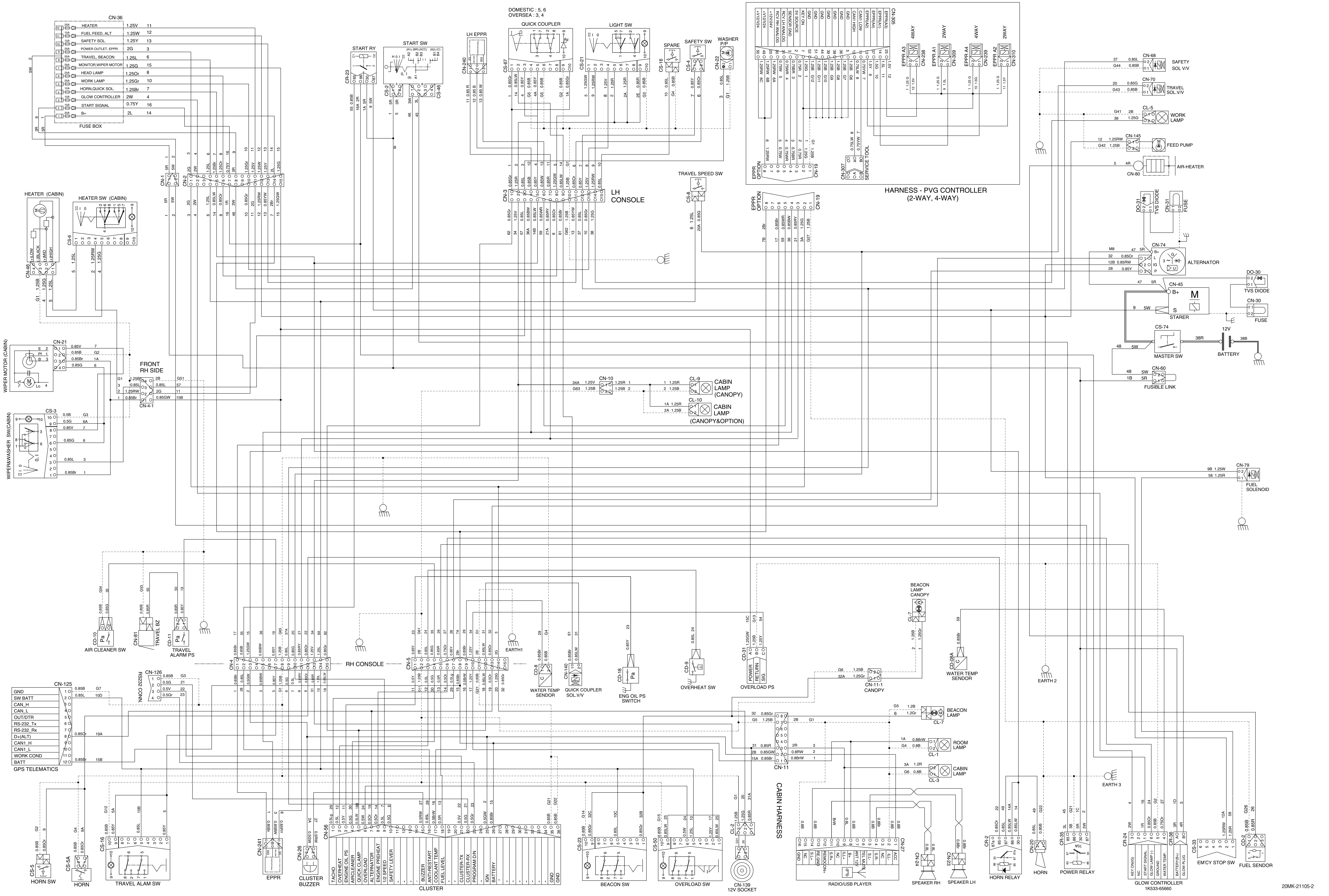


① This lamp ON when the filter of air cleaner is clogged.
② Check the filter and clean or replace it.



R25Z9AK4EL01

ELECTRICAL CIRCUIT (machine serial No. : #0159~)



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-1 (1)] →

Fuse box [No.1] → I/conn [CN-2 (14)] ┬→ I/conn [CN-5 (8)] → Cluster [CN-56 (26)]
└→ I/conn [CN-11 (1)] →

┬→ Room lamp [CL-1 (1)]
└→ Radio & USB player [CN-27 (11)]

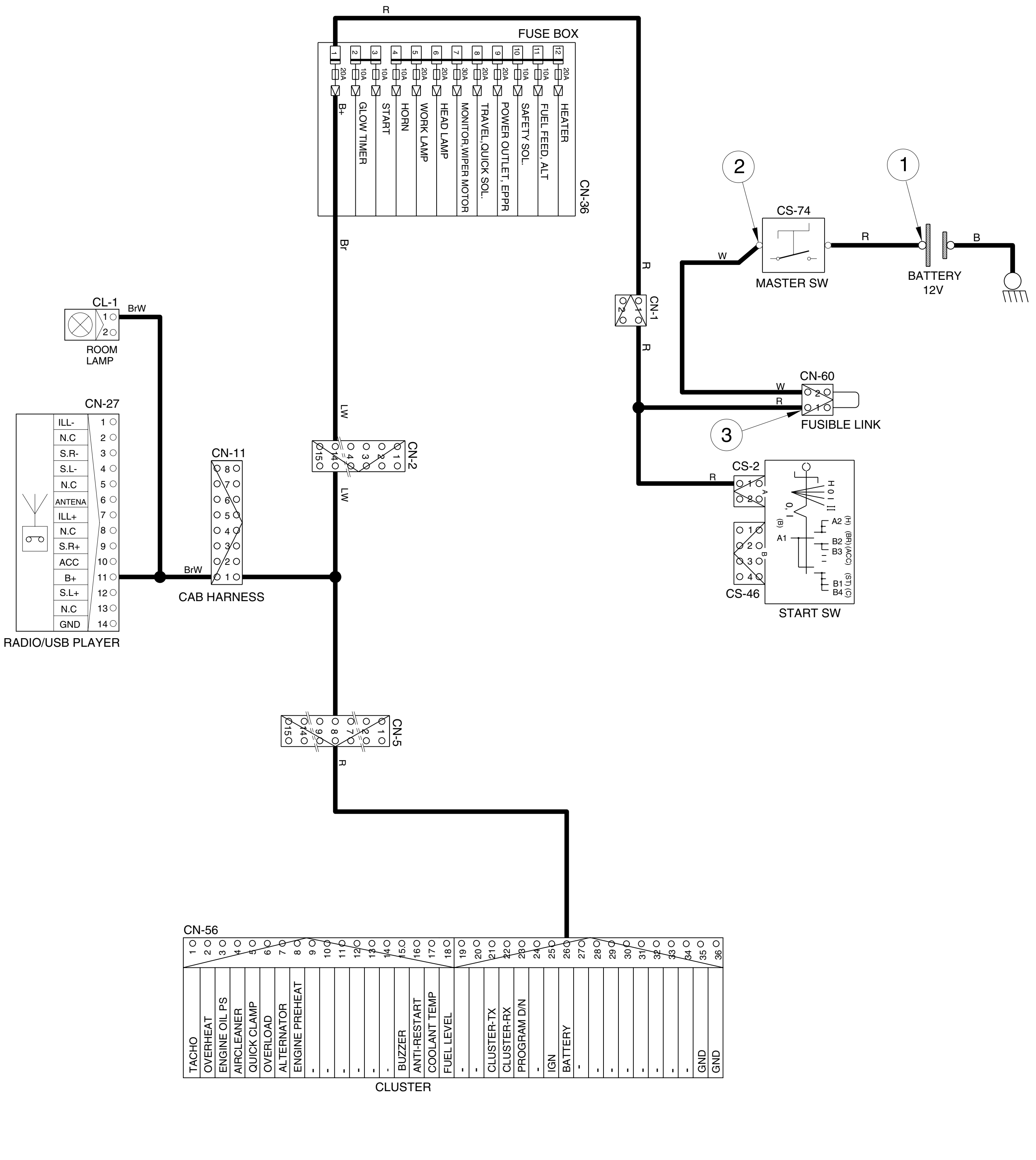
※ I/conn : Intermediate connector

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



R25Z9AK4EL04

2. STARTING CIRCUIT

1) OPERATING FLOW

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

- → Start switch [CS-2 (1)]
- → Fuse box No.1
- → Power relay [CR-35 (30)]
- → Start relay [CR-23 (1)]

※ Start switch : HEAT

Start switch [CS-2 (2)] → Preheater [CN-80]

→ I/conn [CN-2 (3)] → Fuse box [CN-36 (2)] → I/conn [CN-2 (7)]

→ Glow timer [CR-24 (4)]

※ Start switch : ON

Start switch [CS-46 (2)] → Power relay [CR-35 (30) → (87)] → I/conn [CN-1 (2)]

→ Fuse box [all power is supplied with electric component)

※ Start switch : START

Start switch START [CS-46 (1)] → Start relay [CR-23 (1) → (2)]

→ Starter [CN-45 (S)] → Start motor operating

→ I/conn [CN-2 (8)] → Fuse box [CN-36 (3)] → I/conn [CN-2 (2)]

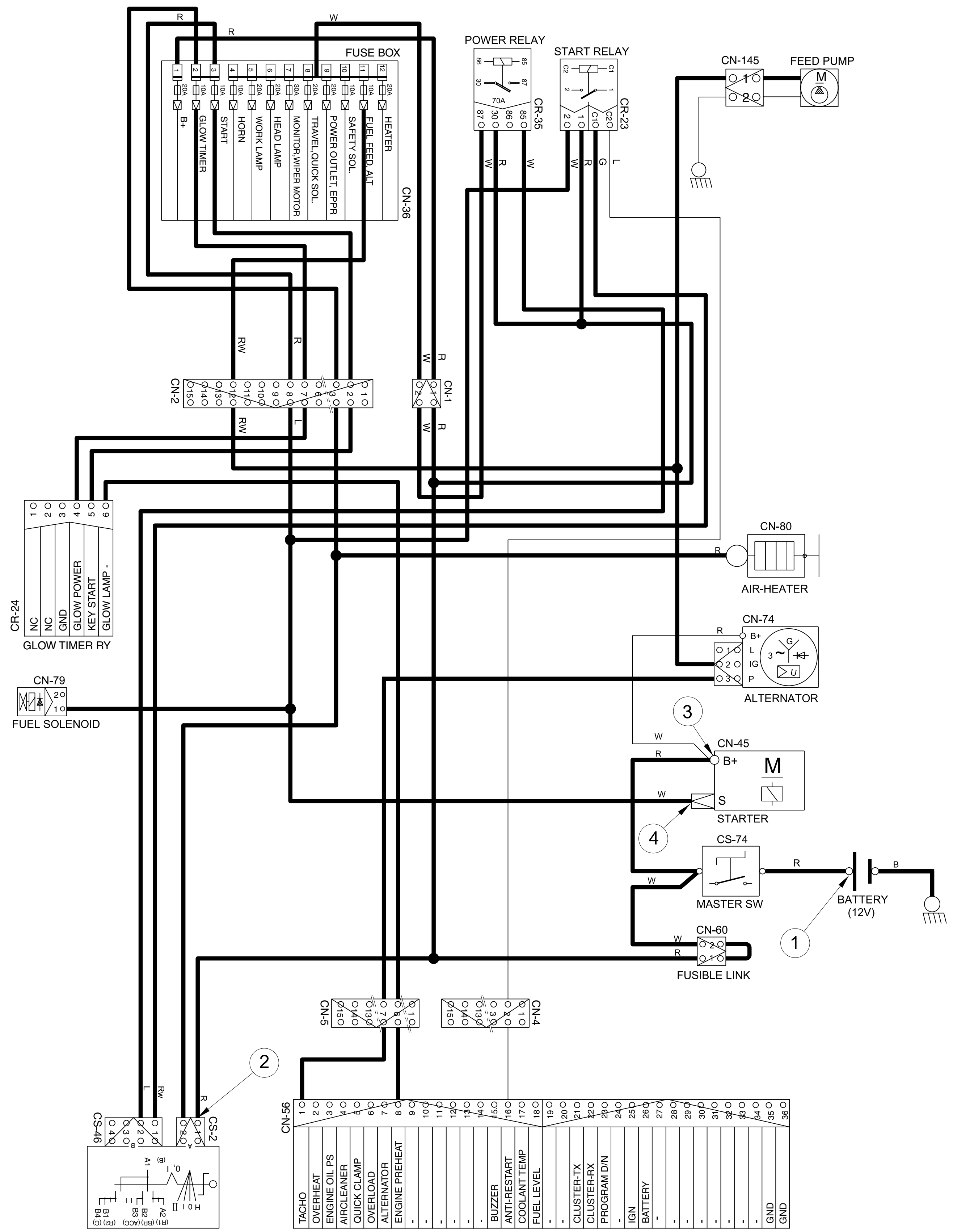
→ Glow timer relay [CR-24 (5)]

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 S)	10~12.5 V

※ GND : Ground

STARTING CIRCUIT



R25Z9AK4EL05

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-5 (13)] → Cluster [CN-56 (7)] → Cluster warning lamp ON

(2) Charging flow

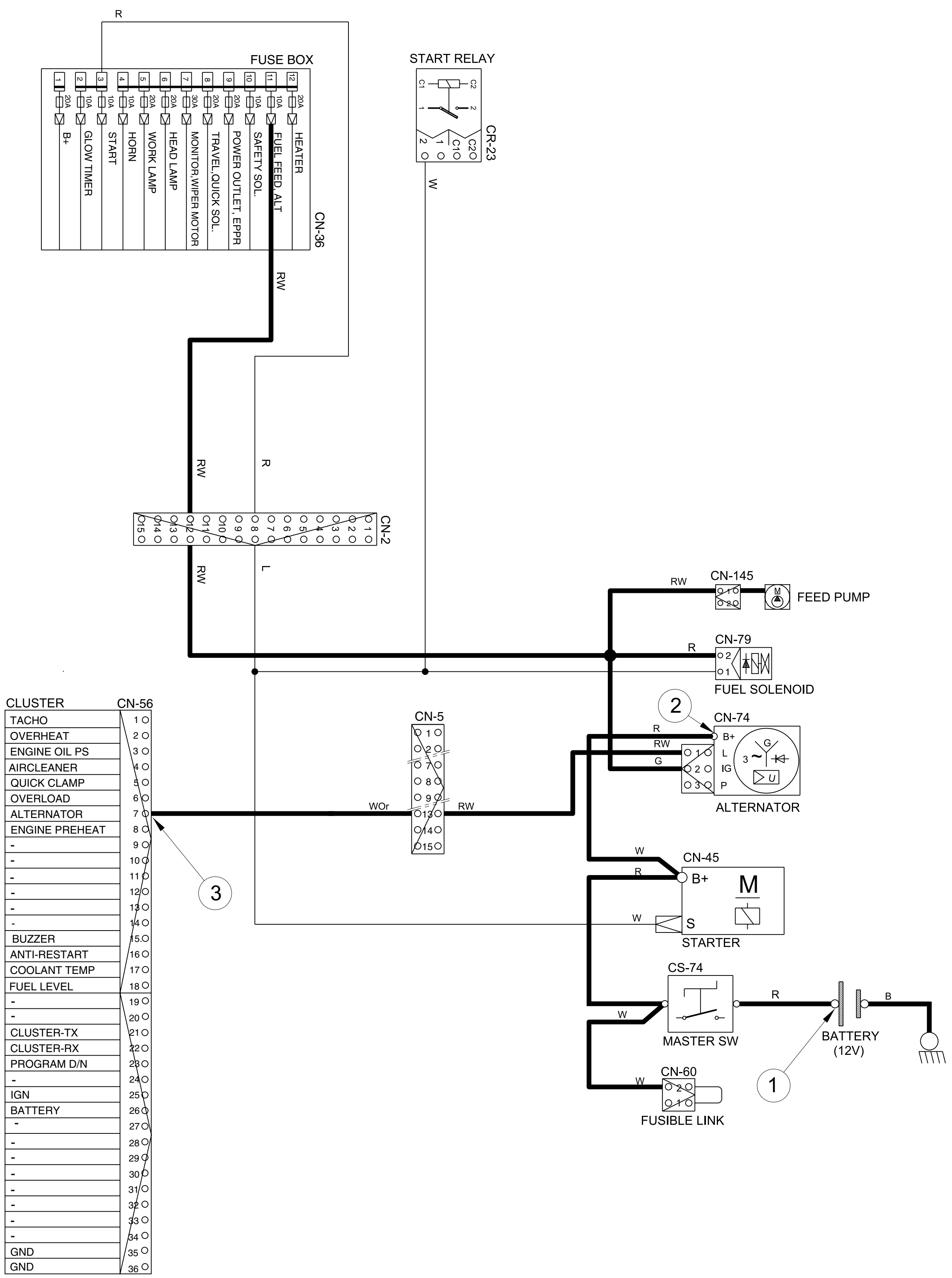
Alternator "B^+" terminal → Battery(+) terminal

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



R25Z9AK4EL06

4. HEAD AND WORK LIGHT CIRCUIT

1) OPERATING FLOW

Fuse box (No.6) → I/conn [CN-2 (6)] → I/conn [CN-3 (8)] → Light switch [CS-21 (1)]
Fuse box (No.5) → I/conn [CN-2 (10)] → I/conn [CN-3 (13)] → Light switch [CS-21 (4)]

(1) Main light switch ON : 1st step

Main light switch ON [CS-21 (5,7)] → I/conn [CN-3 (2)]
→ I/conn [CN-11 (3)] → Head light ON [CL-3 (2)] (cab type)
→ Radio & USB player illumination ON [CN-27 (7)]
→ I/conn [CN-10 (1)] → Canopy Lamp ON [CL-9 (2)] (canopy type)

(2) Main light switch ON : 2nd step

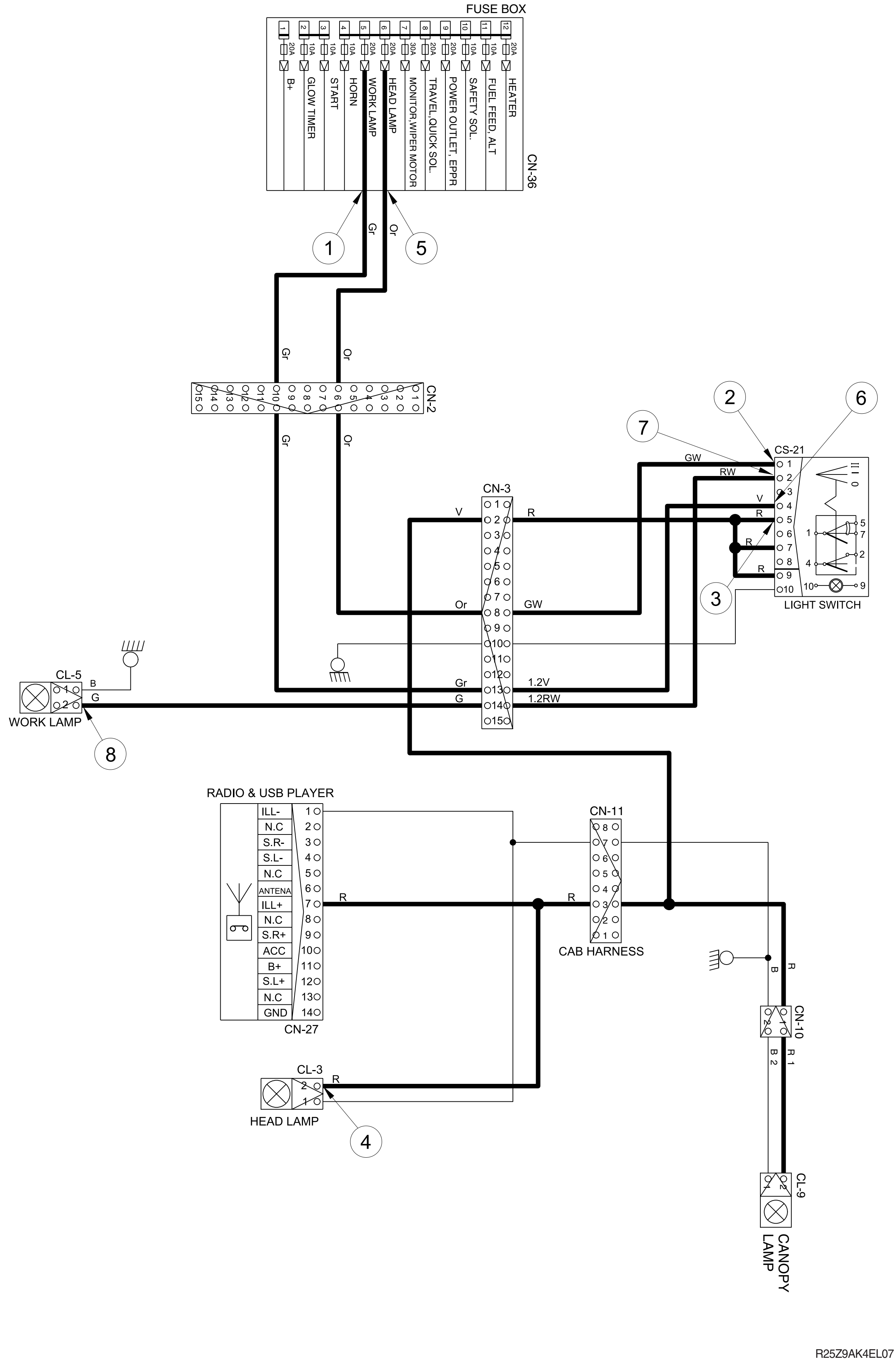
Main light switch ON [CS-21 (2)] → I/conn [CN-3 (14)] → Work light ON [CL-5 (2)]

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 LIGHT CIRCUIT



5. BEACON LAMP CIRCUIT

1) OPERATING FLOW

Fuse box (No.4) → I/conn [CN-2 (5)] → 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-11 (8)] → Beacon lamp ON [CL-7] (cab type)

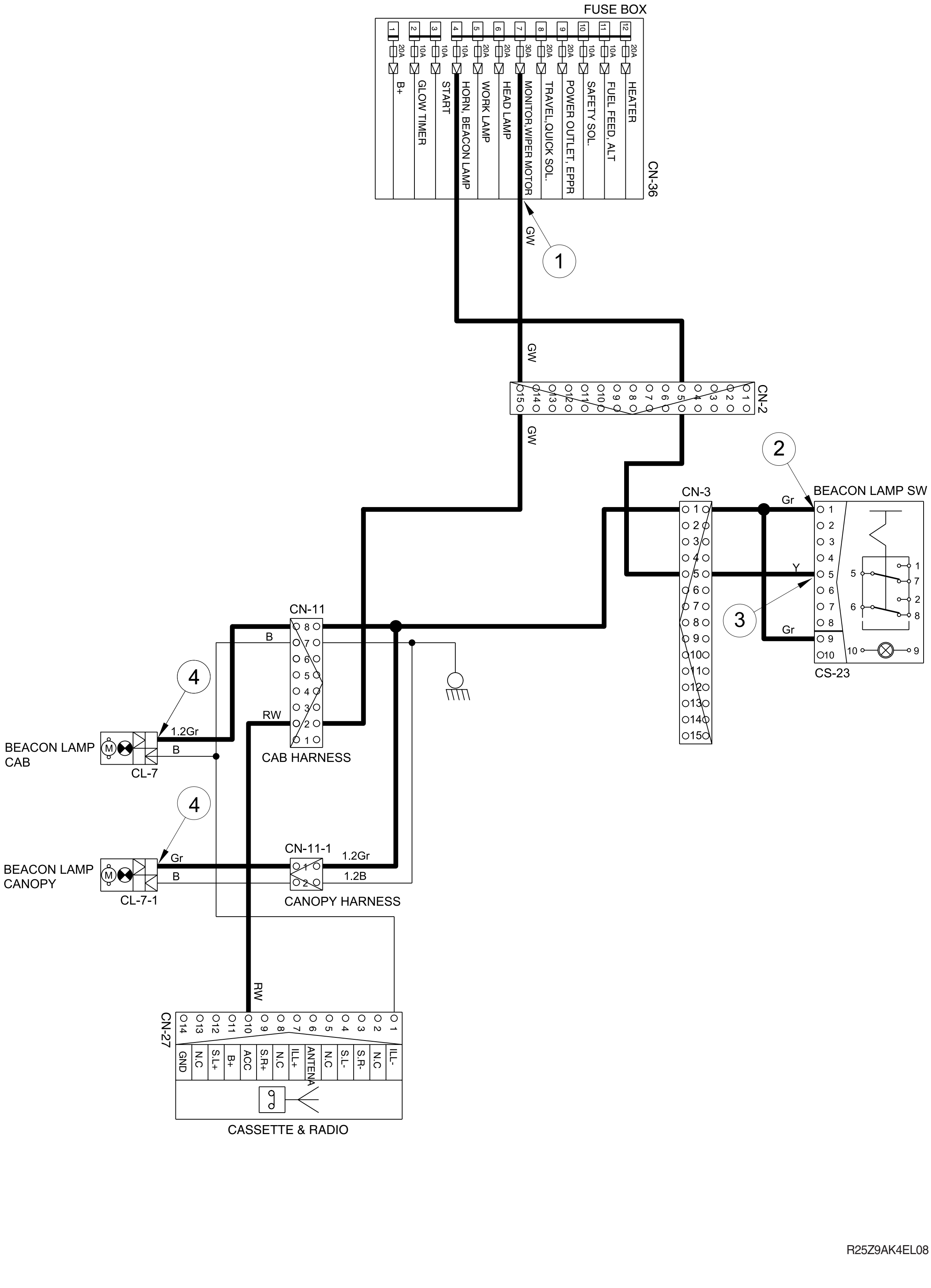
→ I/conn [CN-11-1 (1)] → Beacon lamp ON [CL-7-1] (canopy type)

2) CHECK POINT

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

※ GND : Ground

BEACON LAMP CIRCUIT



6. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

(1) Start switch ON

Fuse box (No.7) → I/conn [CN-2 (15)] → 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)]

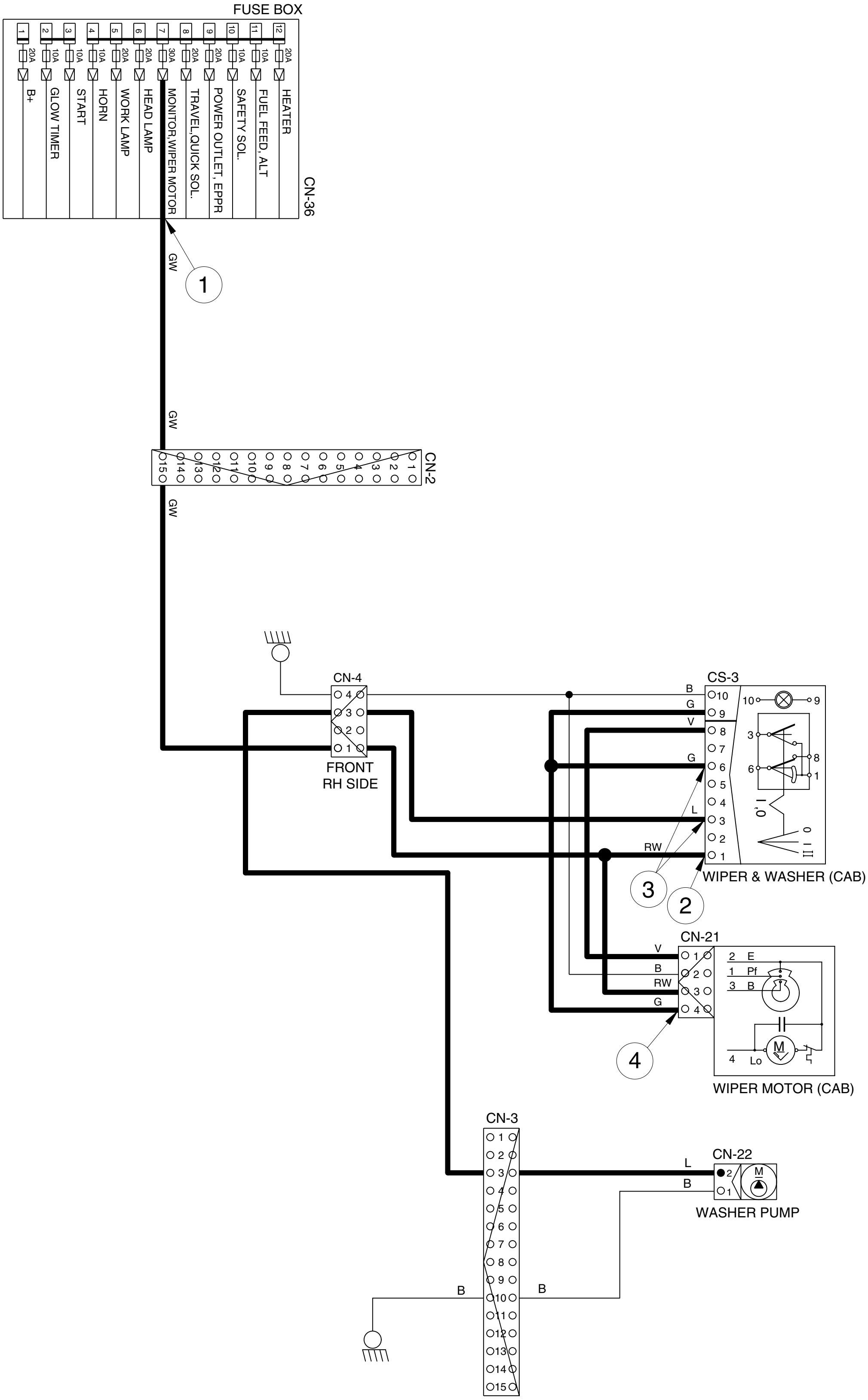
→ Wiper motor [CN-21 (4)] → Wiper motor parking position by wiper motor controller

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

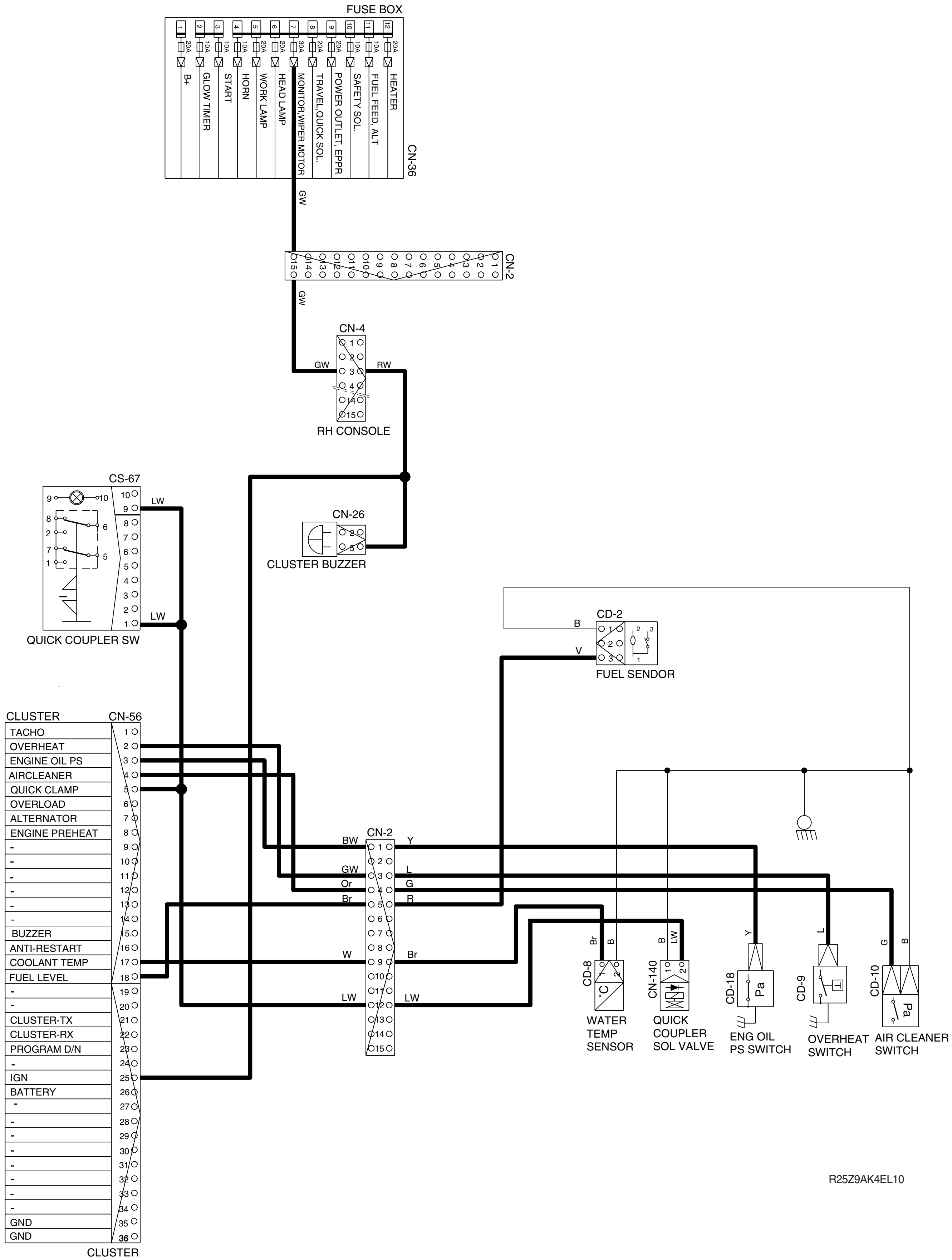
※ GND : Ground

WIPER AND WASHER CIRCUIT

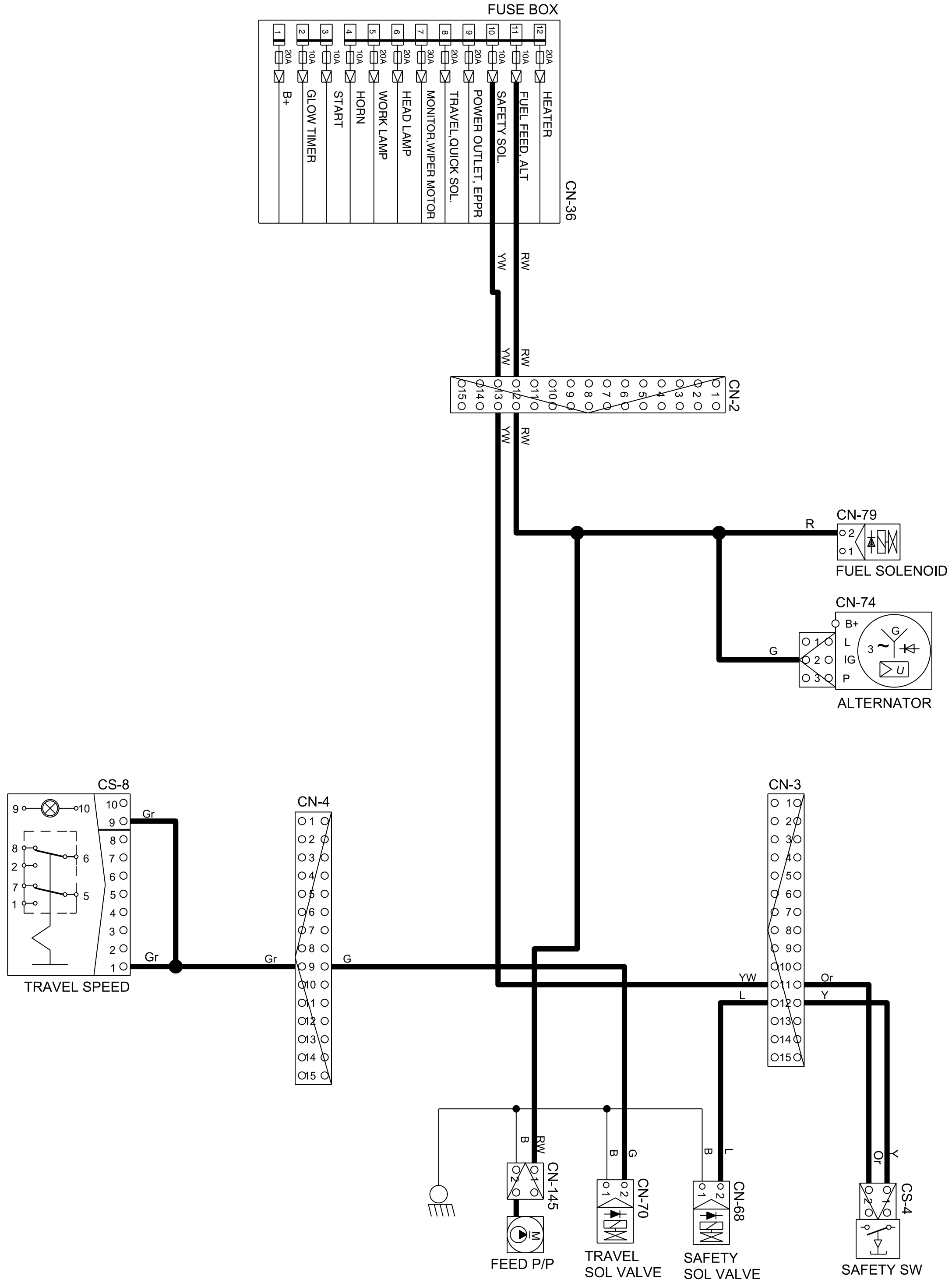


R27Z9AK4EL09

MONITORING CIRCUIT

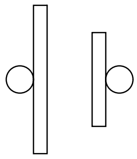
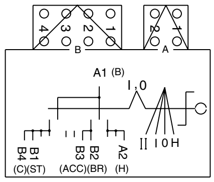
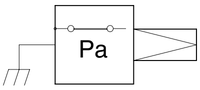
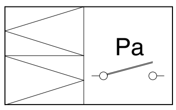
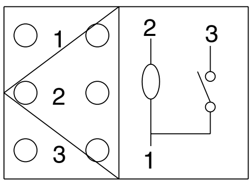


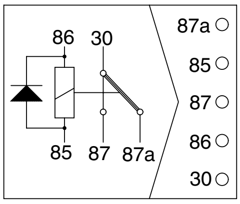
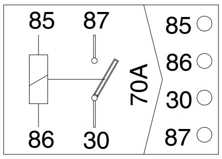
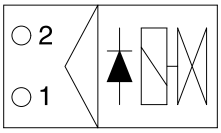
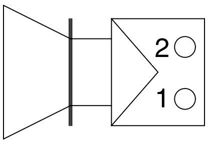
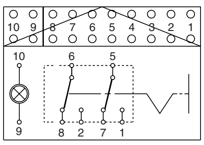
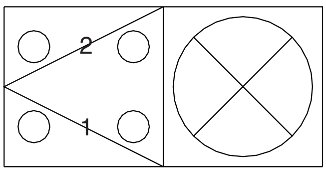
ELECTRIC CIRCUIT FOR HYDRAULIC

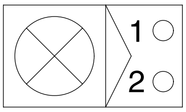
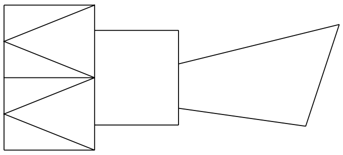
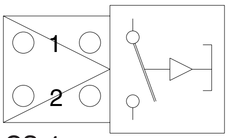
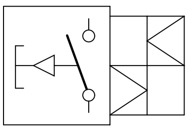
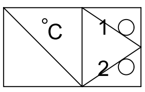
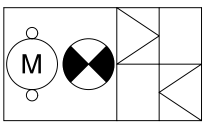


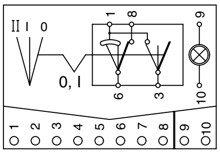
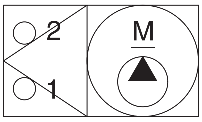
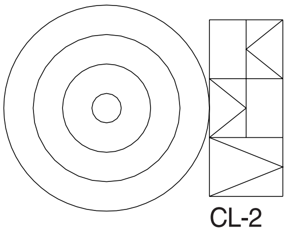
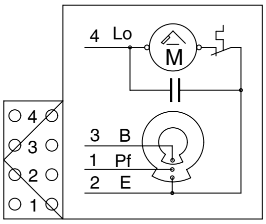
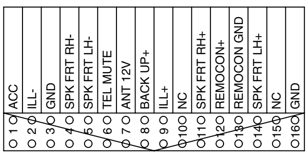
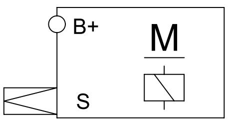
R27Z9AK4EL11

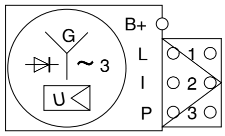
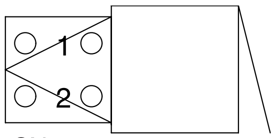
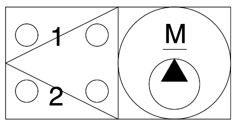
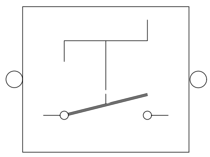
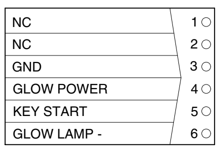
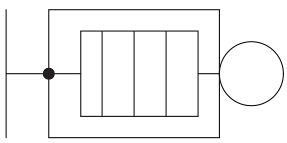
GROUP 4 ELECTRICAL COMPONENT SPECIFICATION

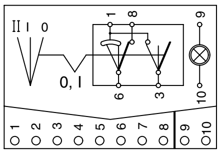
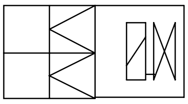
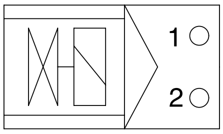
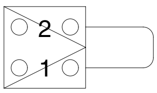
Part name	Symbol	Specification	Check
Battery		12V × 58Ah (5h rating)	※ Check specific gravity 1.280 over : Over charged 1.280 ~ 1.250 : Normal 1.250 below : Recharging
Start key	 CS-2 CS-46	12V	※ Check contact OFF : ∞ Ω (for each terminal) ON : 0 Ω (for terminal 1-3 and 1-2) START : 0 Ω (for terminal 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
Fuel sender	 CD-2	-	※ Check resistance Full : 30 Ω Low : 100 Ω Empty warning : 200 Ω

Part name	Symbol	Specification	Check
Horn relay	 CR-2	12V 20A	※ Check resistance Normal : About 200 Ω (for terminal 1-3) : 0 Ω (for terminal 2-4)
Power relay	 CR-35	12V 70A	※ Rated coil current 1.2±0.3 A
Solenoid valve	 CN-68 CN-70 CN-140	12V 1A	※ Check resistance Normal : 15~25 Ω (for terminal 1-2)
Speaker	 CN-23 (LH) CN-24 (RH)	4 Ω 20W	※Check resistance Normal : 4 Ω
Switch (Looking type)	 CS-8 CS-16 CS-83	12V 16A	※ Check contact Normal OFF - ∞ Ω (for terminal 1-5,2-6) - 0 Ω (for terminal 5-7,6-8)
Lamp	 CL-3 CL-5	12V 55W (H3 TYPE)	※ Check disconnection Normal : 1.2 Ω

Part name	Symbol	Specification	Check
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 CS-16	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
Beacon lamp	 CL-7	12V (strobe type)	※ Check disconnection Normal : A few Ω

Part name	Symbol	Specification	Check
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 20W	※ Check resistance Power ON : 4 Ω ±4 Ω (for pin 1-6, 4-8)
Starter	 CN-45	12V 1.7kW	※ Check contact Normal : 0.1 Ω

Part name	Symbol	Specification	Check
Alternator	 CN-74	12V 40A	※ Check contact Normal : 0 Ω (For terminal B^{+}-1) Normal : 10 ~ 12.5V
Travel alarm	 CN-81	12V	-
Fuel feed pump	 CN-145	12V	-
Master switch	 CN-74	12V 1000A	-
Glow timer	 CR-24	12V	-
Air-heater	 CN-80	12V 42A 500W	-

Part name	Symbol	Specification	Check
Light switch	 CS-21	12V 16A	※Check contact Normal : ∞ Ω
Solenoid valve (engine stop)	 CN-79	12V	※Coil resistance : 1.8 Ω
EPPR valve	 CN-238 CN-239	700mA	※ Check resistance Normal : 15~25 Ω (for terminal 1-2)
Fusible link	 CN-60	27A	※Check coil resistance Normal : 3.26m Ω /m

GROUP 5 CONNECTORS

1. CONNECTOR DESTINATION

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-1	AMP	2	I/conn (Main harness-fuse box)	S813-130200	S813-030201
CN-2	AMP	15	I/conn (Main harness-fuse box)	2-85262-1	368301-1
CN-3	AMP	15	I/conn (Main harness-LH console harness)	2-85262-1	368301-1
CN-4	AMP	15	I/conn (Main harness-heater & wiper harness)	2-85262-1	368301-1
CN-5	AMP	15	I/conn (Main harness-RH console harness)	2-85262-1	368301-1
CN-10	AMP	2	I/conn (Main harness-cab lamp harness)	S816-002002	S816-102002
CN-11	KET	8	I/conn (Main harness-cab harness)	MG610051	S816-108202
CN-11-1	AMP	4	I/conn (Main harness-front RH side harness)	S810-004202	S810-104202
CN-20	DEUTSCH	2	Horn	DT06-2S-E012	-
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-26	KET	5	Cluster buzzer	MG614354	-
CN-27	-	16	Radio & USB player	PK145-16017	-
CN-31	DEUTSCH	3	Air-con	DT06-3S	-
CN-36	-	-	Fuse box body	F12890010	-
CN-45	RING TERM	1	Starter	ST710258-2	-
	YAZAKI	1	Starter	7123-2115	-
CN-46	AMP	4	Heater	180900-0	
CN-56	AMP	16	Cluster	-	145966-2
	AMP	20	Cluster	-	145967-2
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-E012	-
CN-74	RING TERM	1	Alternator B+	GP110021	-
CN-74A	YAZAKI	2	Alternator	7122-2820	-
CN-79	SUMITOMO	2	Fuel cut-off solenoid	6195-0003	-
CN-80	RING TERM	1	Pre heater	GP110021	-
CN-81	SWP	1	Travel buzzer	S822-014000	S822-114000
CN-126	DEUTSCH	4	RS232 connection	DT06-4S-EP06	DT04-4P-E004
CN-139	AMP	2	Socket 12V	172434-2	-
CN-140	DEUTSCH	2	Quick clamp	DT06-2S-P012	-
CN-145	YAZAKI	2	Fuel feed pump	7122-2820	-
CN-238	DEUTSCH	2	EPPR rotate L	DT06-2S-P012	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-239	DEUTSCH	2	EPPR rotate R	DT06-2S-P012	-
CN-240	DEUTSCH	3	RH EPPR	DT06-3P	-
CN-246	DEUTSCH	2	EXT valve	DT06-2S-P012	-
CN-305	DEUTSCH	12	EPPR controller	DTM06-12SA	-
LAMP					
CL-1	KET	2	Room lamp	MG610070	-
CL-2	AMP	3	Cigar lighter	S810-003202	-
CL-5	DEUTSCH	2	Work lamp	DT06-2S-P012	-
CL-7	KET	1	Beacon lamp	S822-014002	S822-114000
CL-9	KET	2	Head lamp (cab type)	S822-014002	-
CL-10	KET	2	Head lamp (canopy type)	S822-014002	-
RELAY					
CR-2	KET	4	Horn relay	MG612017-5	-
CR-23	KET	5	Start relay	MG640927	-
CR-24	SUMITOMO	6	Glow timer relay	174204-1	-
CR-35	KET	5	Power relay	MG640927	-
SENSOR					
CD-2	AMP	3	Fuel sender	S816-003002	S816-102002
CD-8	AMP	2	Water temp sender	174374-3	-
CD-9	AMP	1	Water temp switch	172320-2	-
CD-10	-	1	Air cleaner pressure switch	ST730135-3	-
CD-11	KET	2	Travel pressure switch	MG640795	-
CD-18	RING TERM	1	Engine oil pressure	GP110021	-
SWITCH					
CS-2	AMP	2	Start key switch	S813-030201	-
CS-3	SWF	10	Wiper & washer switch	593757	-
CS-4	AMP	2	Safety switch	S814-102001	-
CS-5	DEUTSCH	1	Horn-RH switch	-	DT04-3P-CE03
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	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 coupler switch	593757	-
CS-83	SWF	10	EXT valve switch	593757	-

SECTION 5 TROUBLESHOOTING

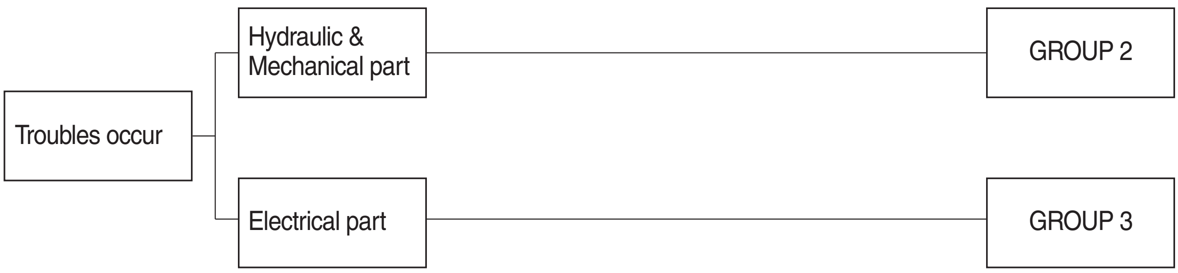
GROUP 1 BEFORE TROUBLESHOOTING

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.

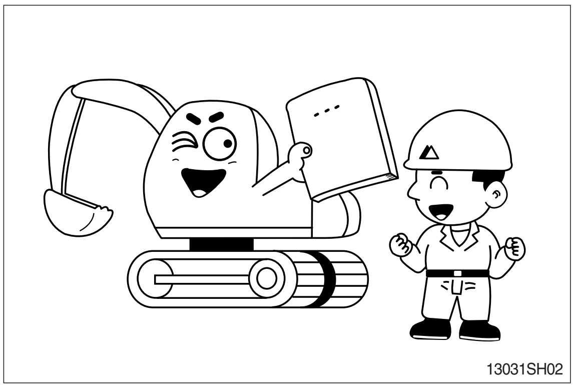


2. DIAGNOSING PROCEDURE

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.

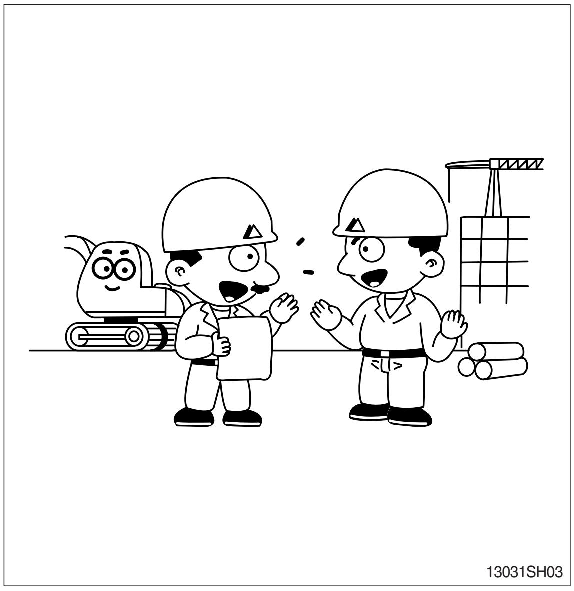


13031SH02

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.

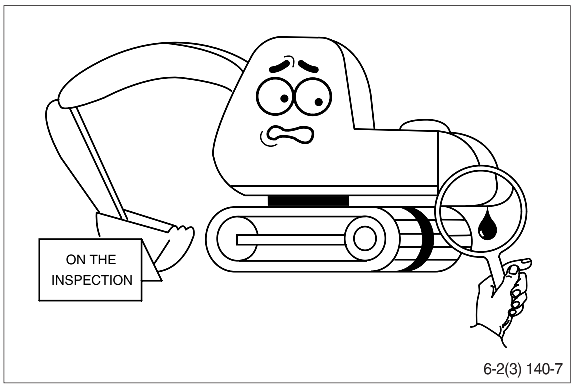


13031SH03

STEP 3. Inspect the machine

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

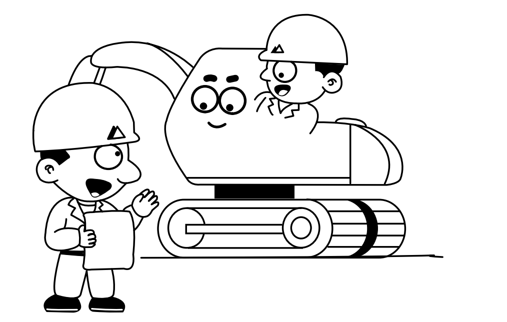
And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.



6-2(3) 140-7

STEP 4. Inspect the trouble actually on the machine

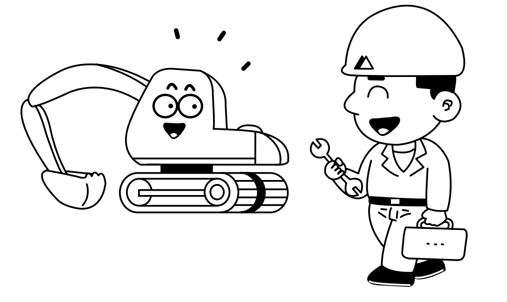
In case that some trouble cannot be confirmed, obtain the details of the malfunction from the operator.
Also, check if there are any in complete connections of the wire harnesses are or not.



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.

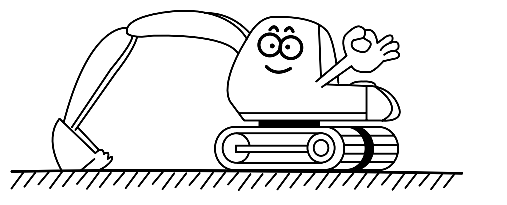


13031SH05

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.

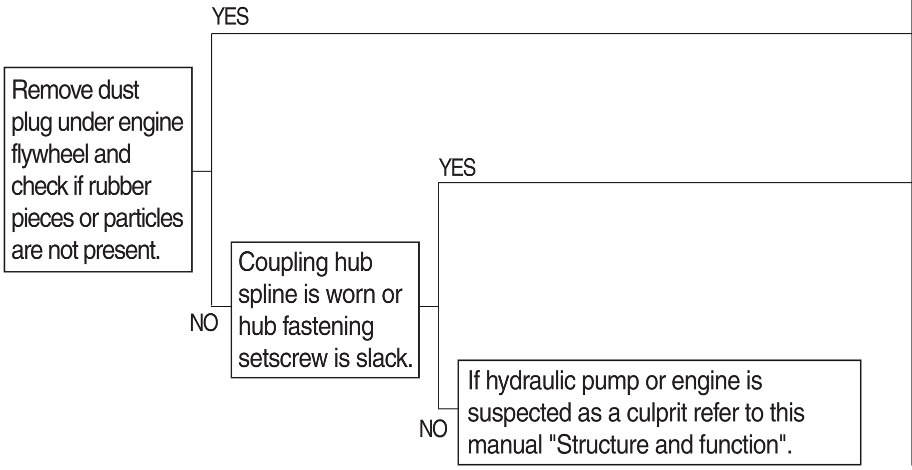
(3) When carrying out troubleshooting, do not hurry to disassemble the components.
It will become impossible to find the cause of the problem.

(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.

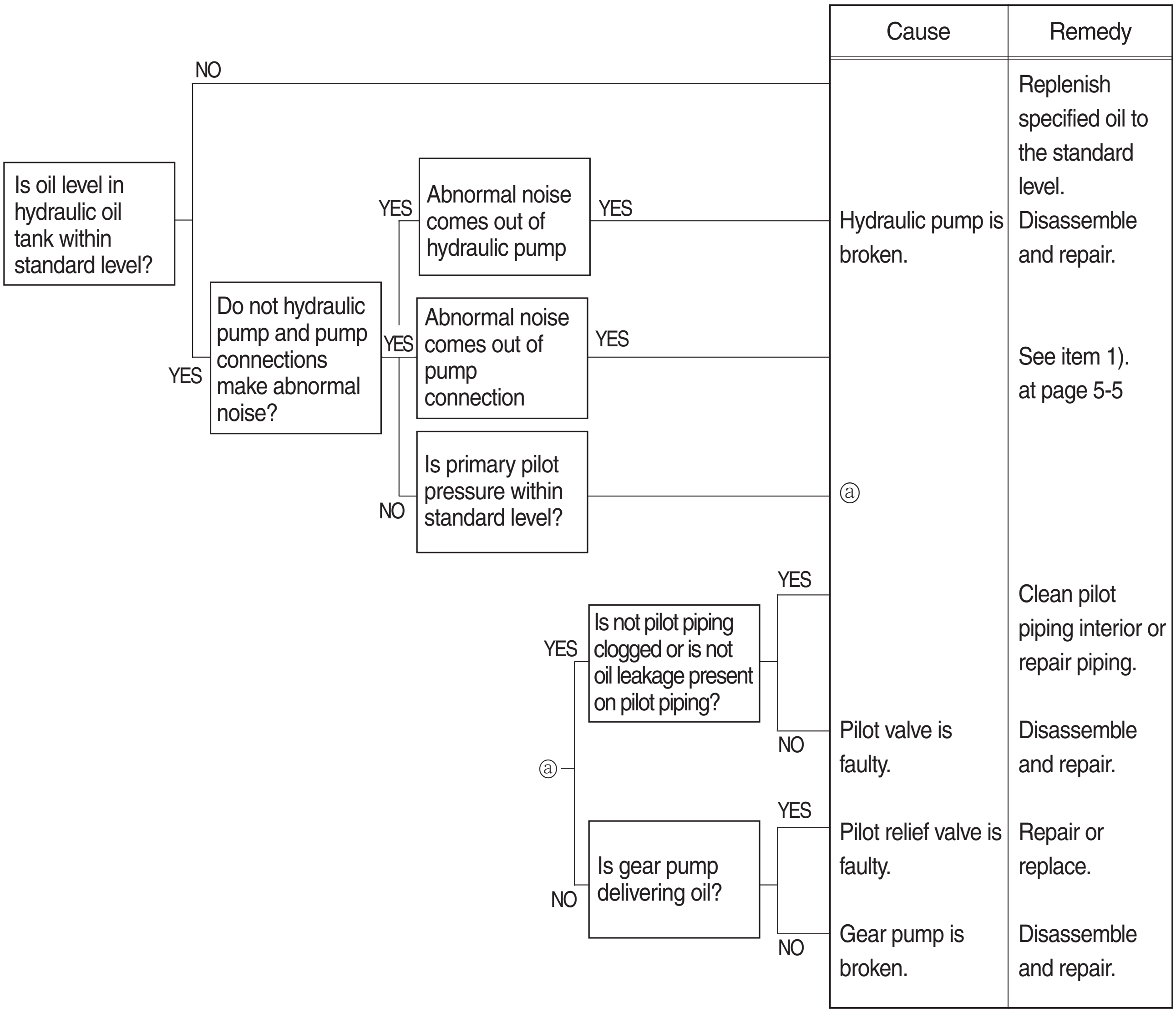
2. DRIVE SYSTEM

1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION



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

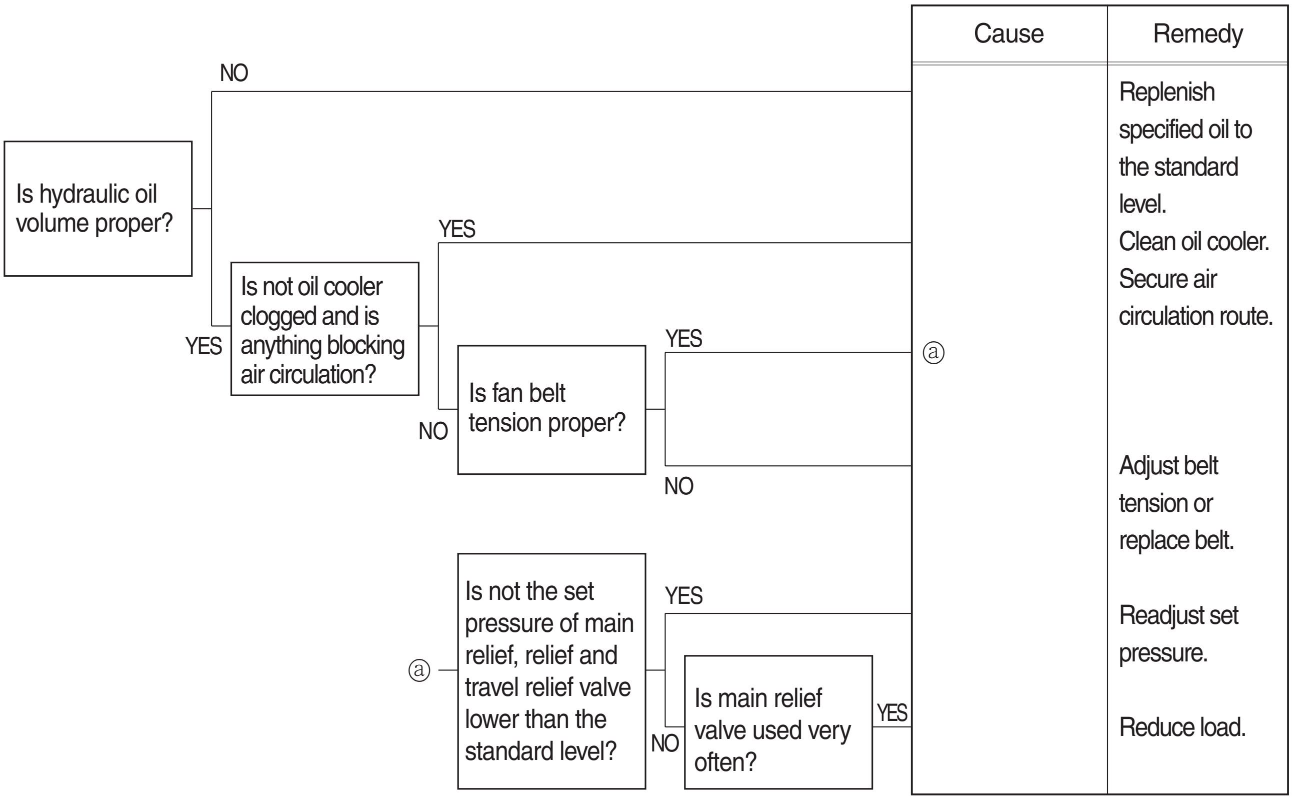
2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL



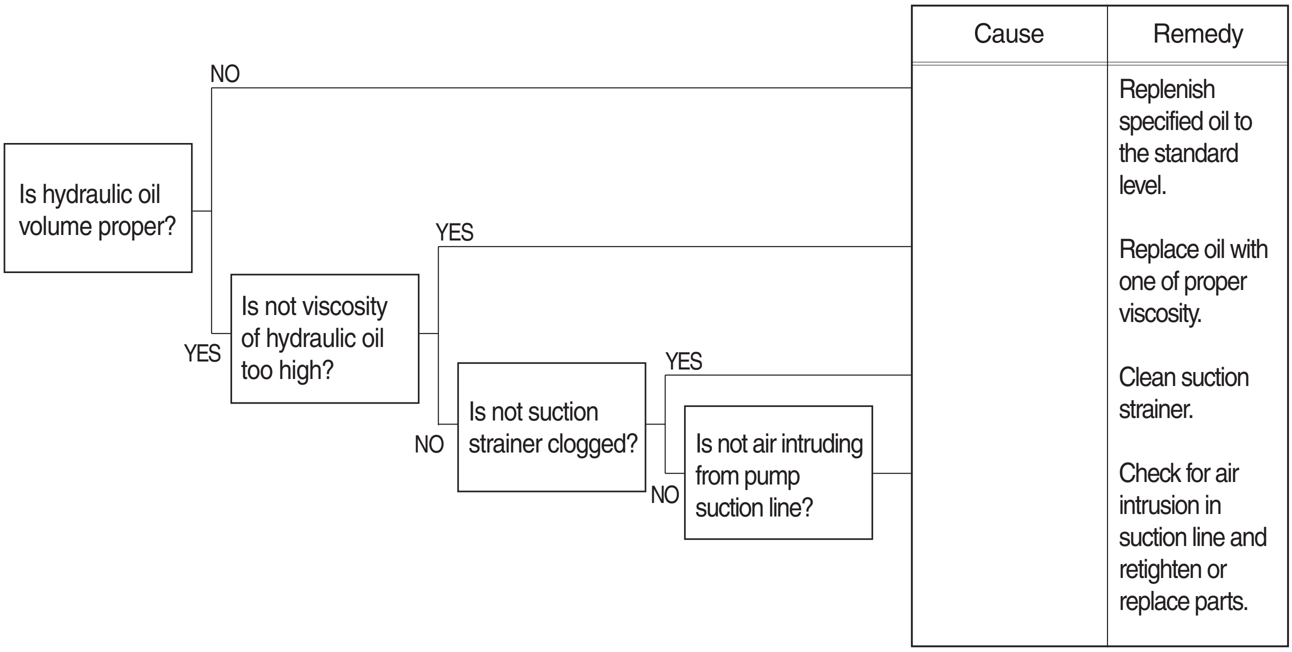
3. HYDRAULIC SYSTEM

1) HYDRAULIC OIL IS CLOUDY

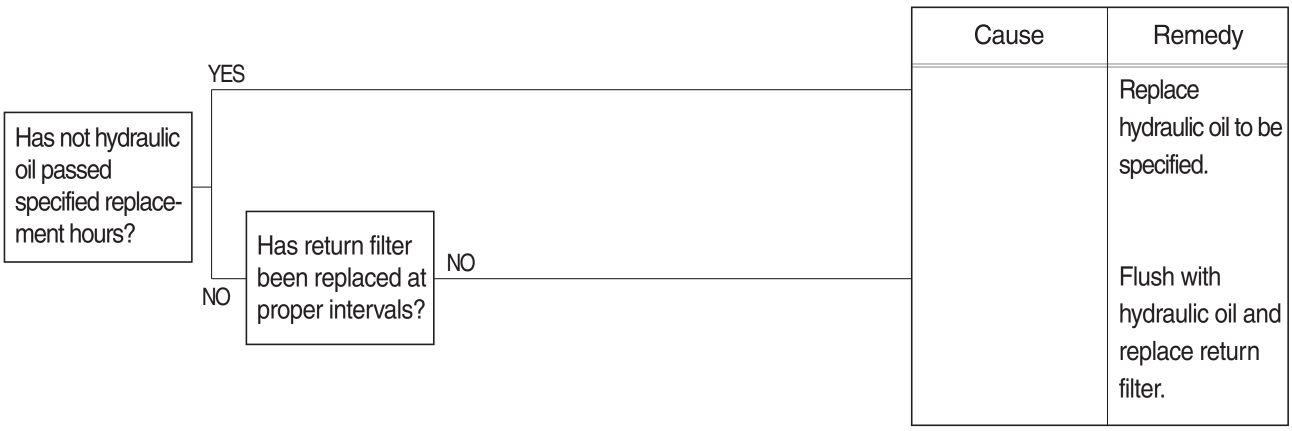
2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY



3) CAVITATION OCCURS WITH PUMP

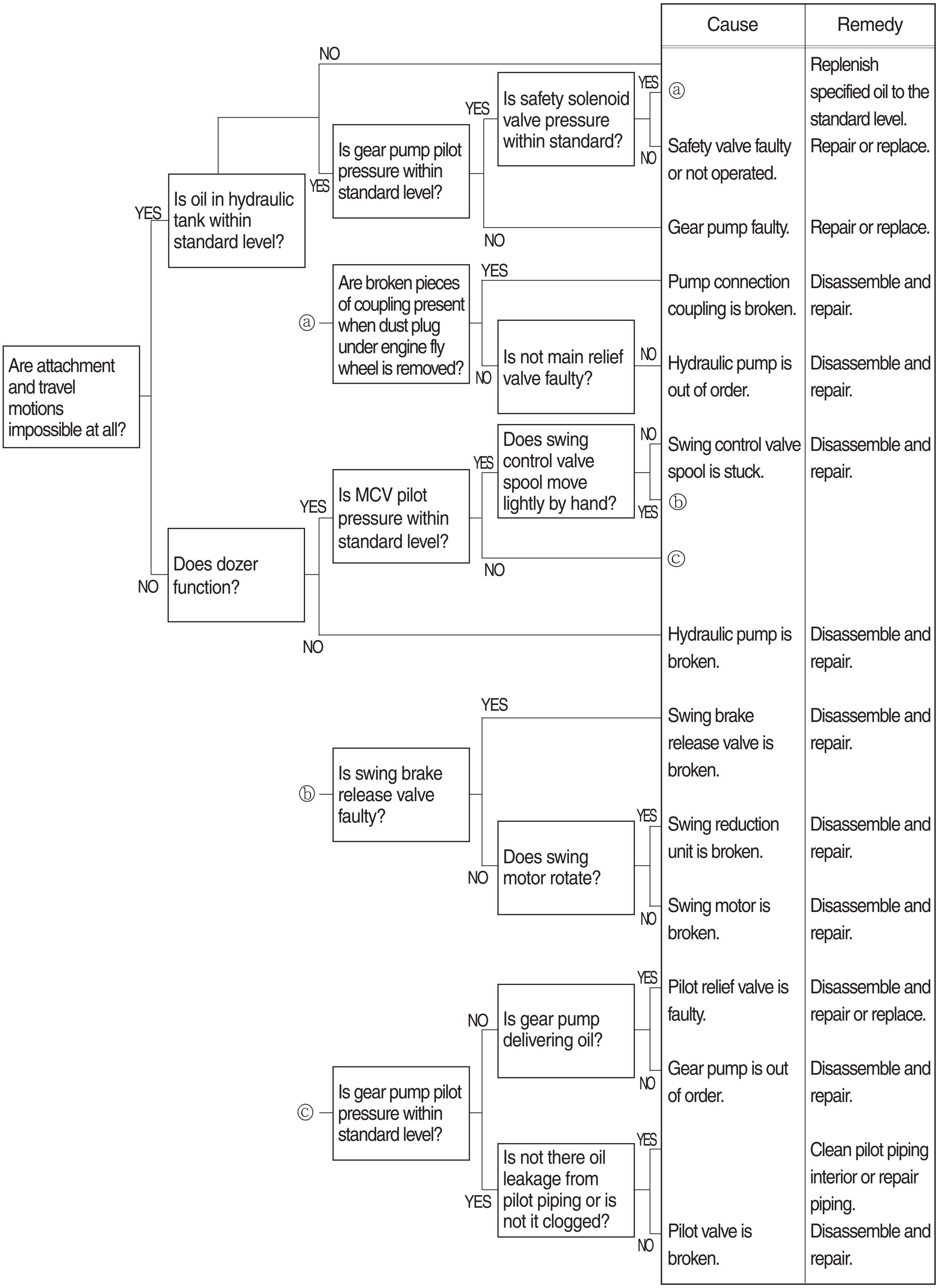


4) HYDRAULIC OIL IS CONTAMINATED

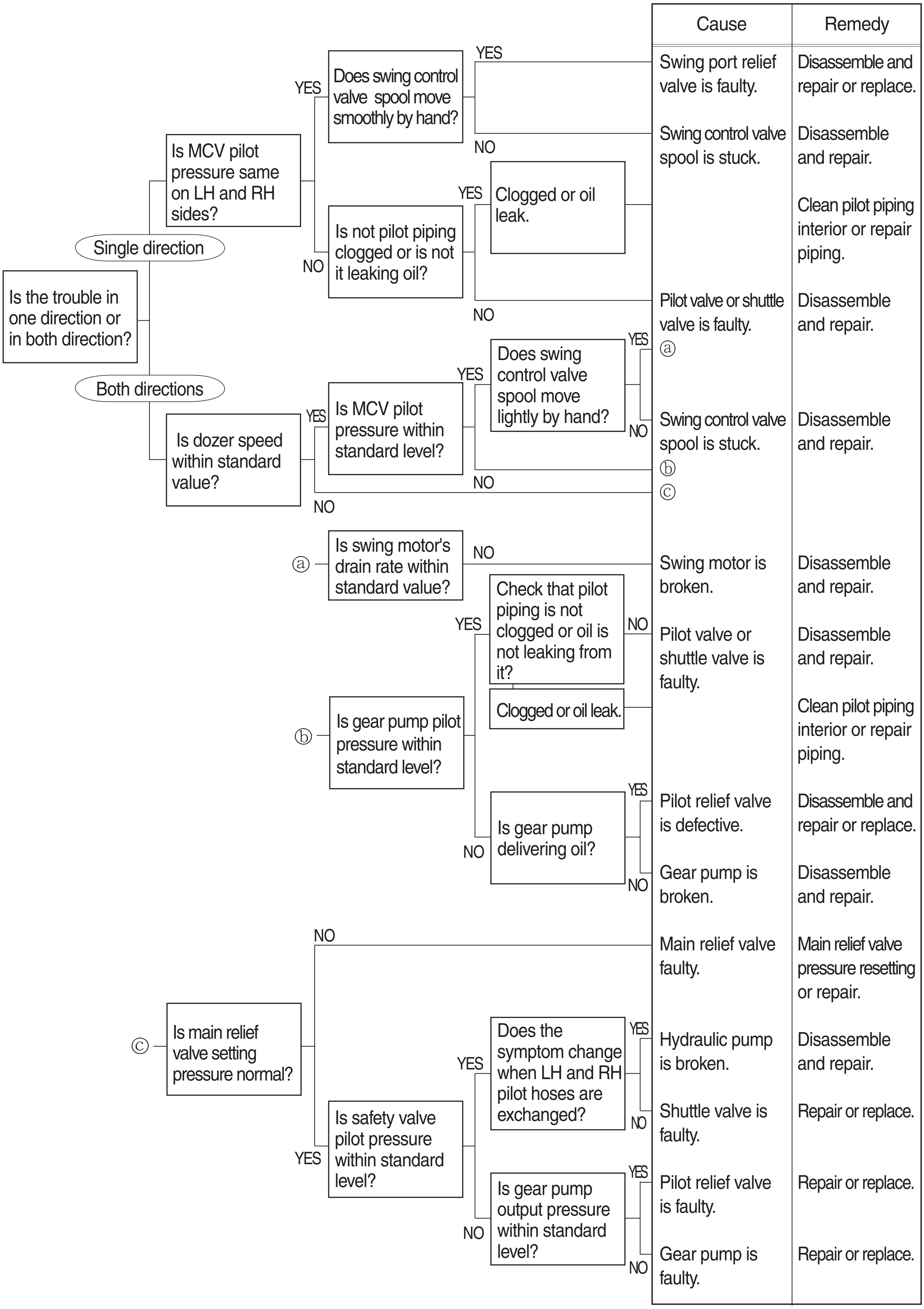


4. SWING SYSTEM

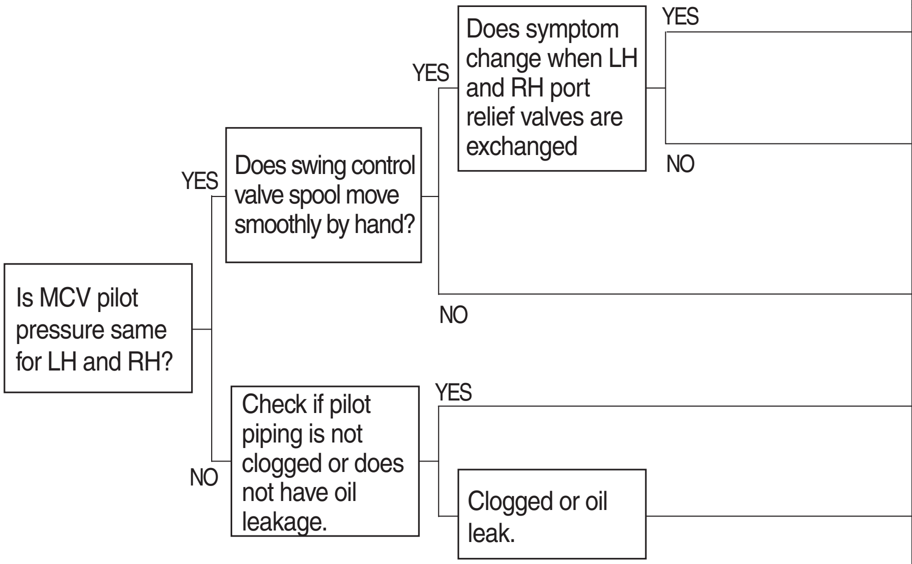
1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE



2) SWING SPEED IS LOW

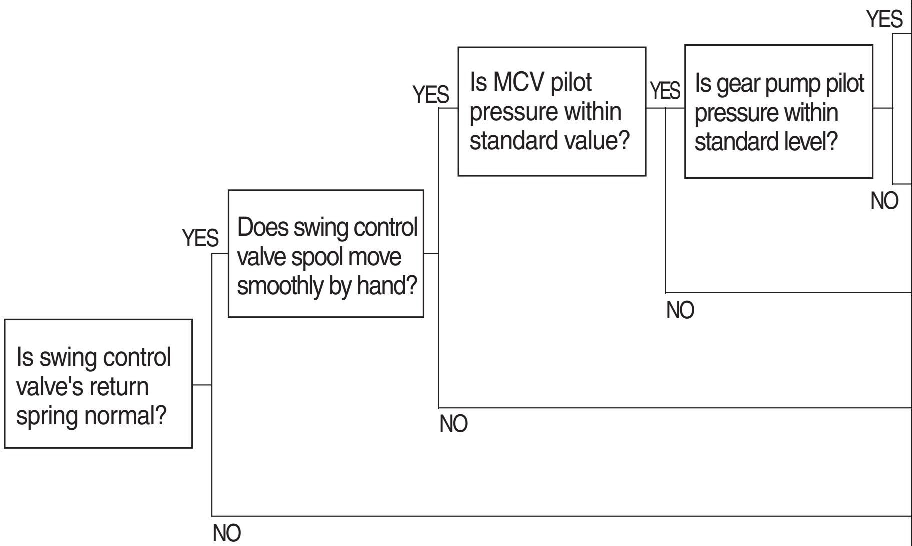


3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



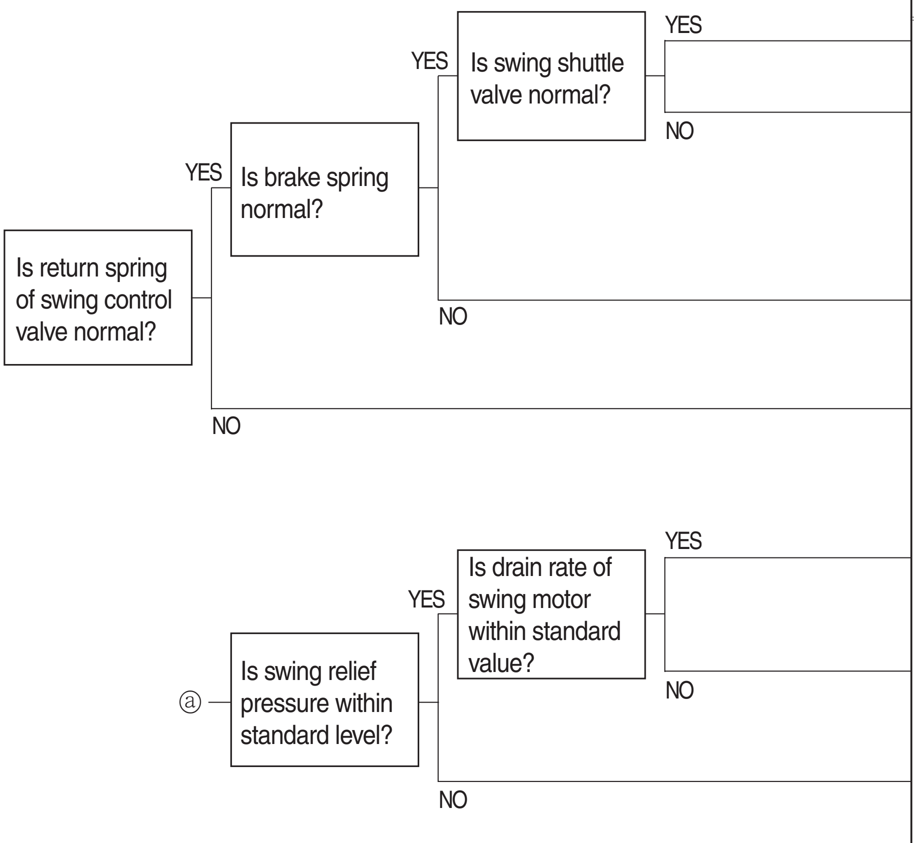
Cause	Remedy
Swing port relief valve is faulty.	Disassemble and repair.
Shuttle valve is faulty.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
Pilot valve is faulty.	Disassemble and repair.
	Clean pilot piping interior or repair piping.

4) MACHINE SWINGS BUT DOES NOT STOP



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

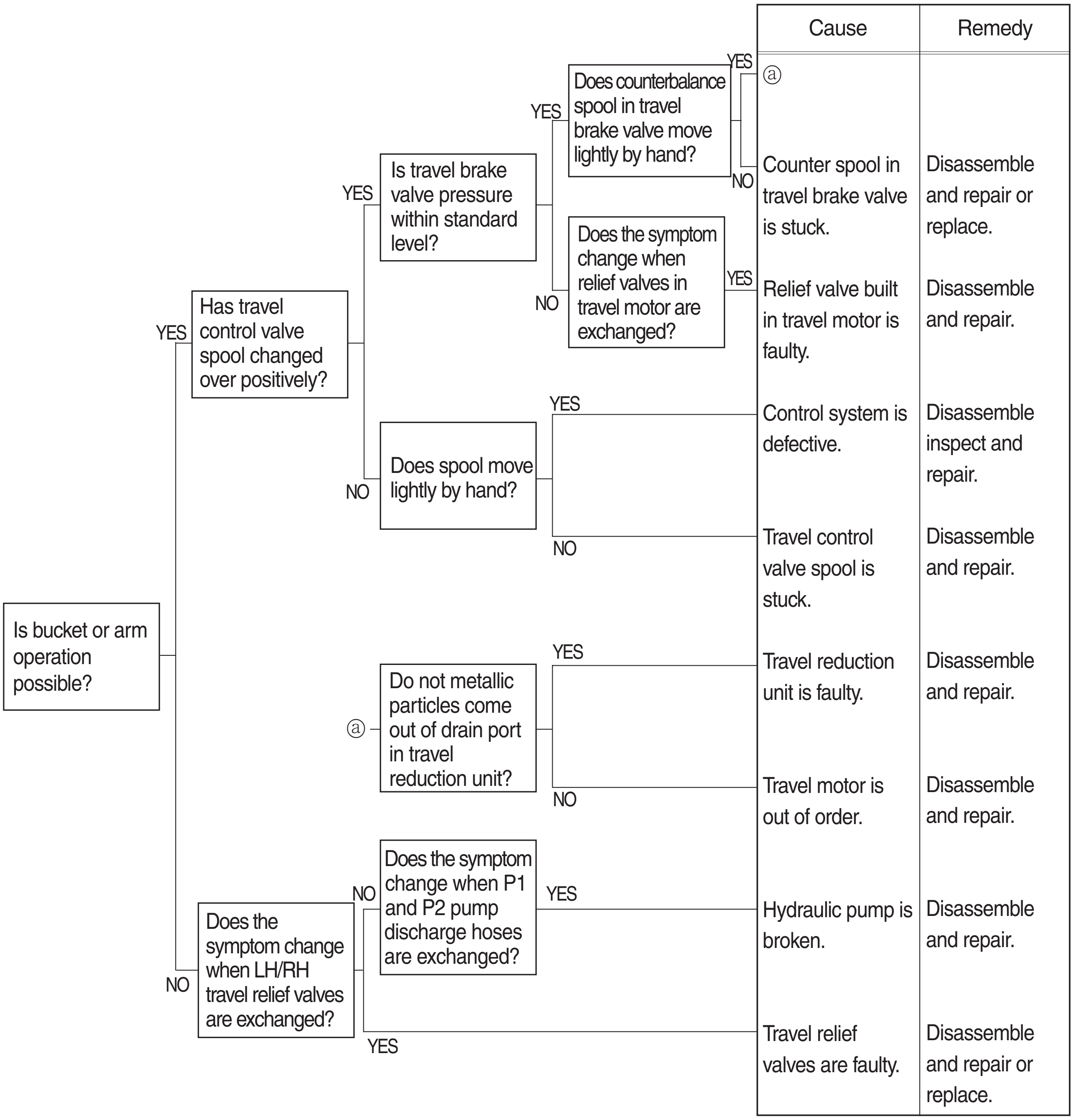
5) THE SWING UNIT DRIFTS WHEN THE MACHINE IS AT REST ON A SLOPE



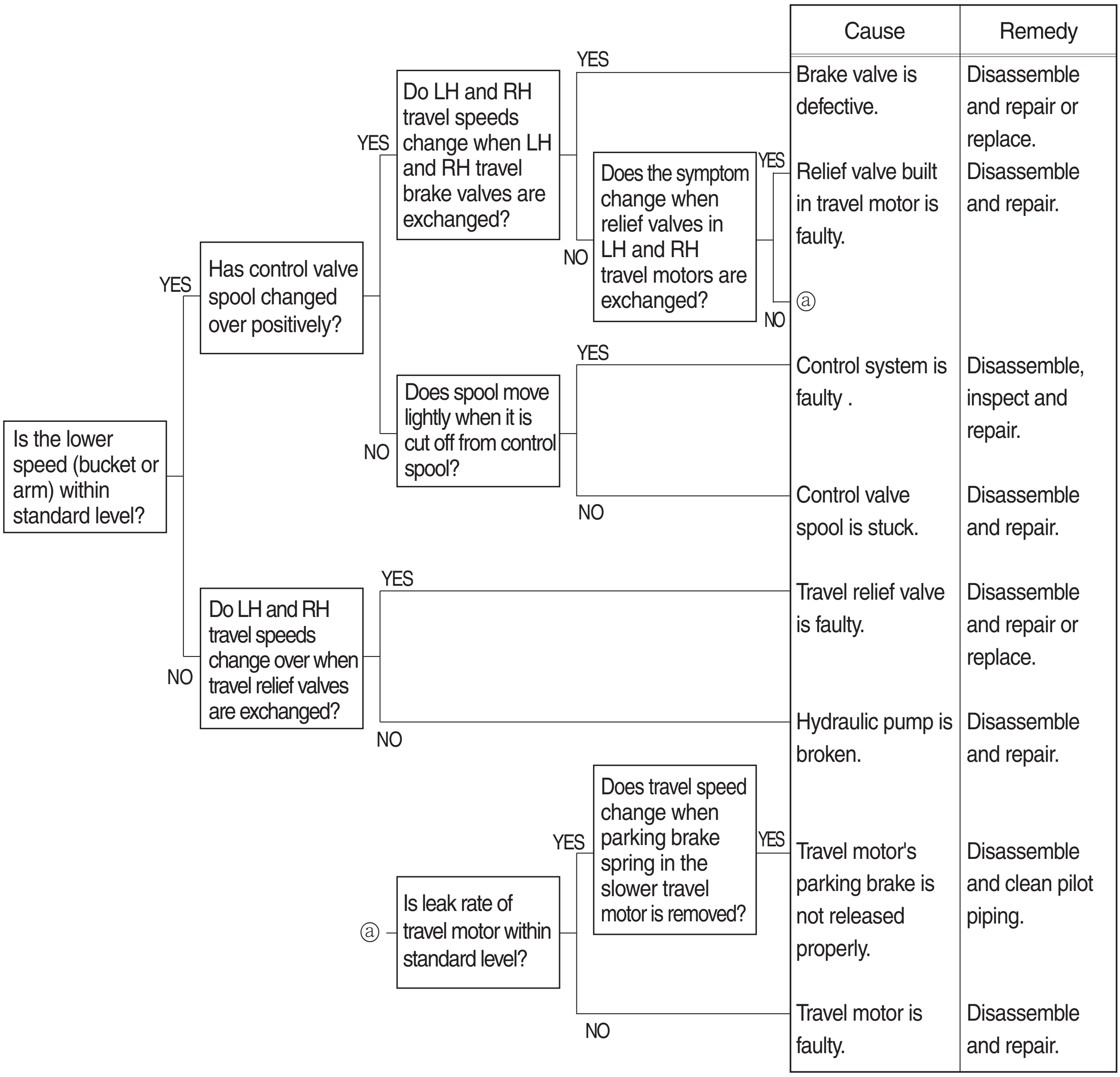
Cause	Remedy
ⓐ	
Shuttle valve is faulty.	Disassemble and replace.
Brake spring is faulty.	Disassemble and replace.
Return spring of swing control valve is faulty.	Disassemble and replace.
Swing relief valve is faulty.	Disassemble and repair or replace.
Swing motor is broken.	Disassemble and repair.
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

5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION AT ALL ON ONE SIDE

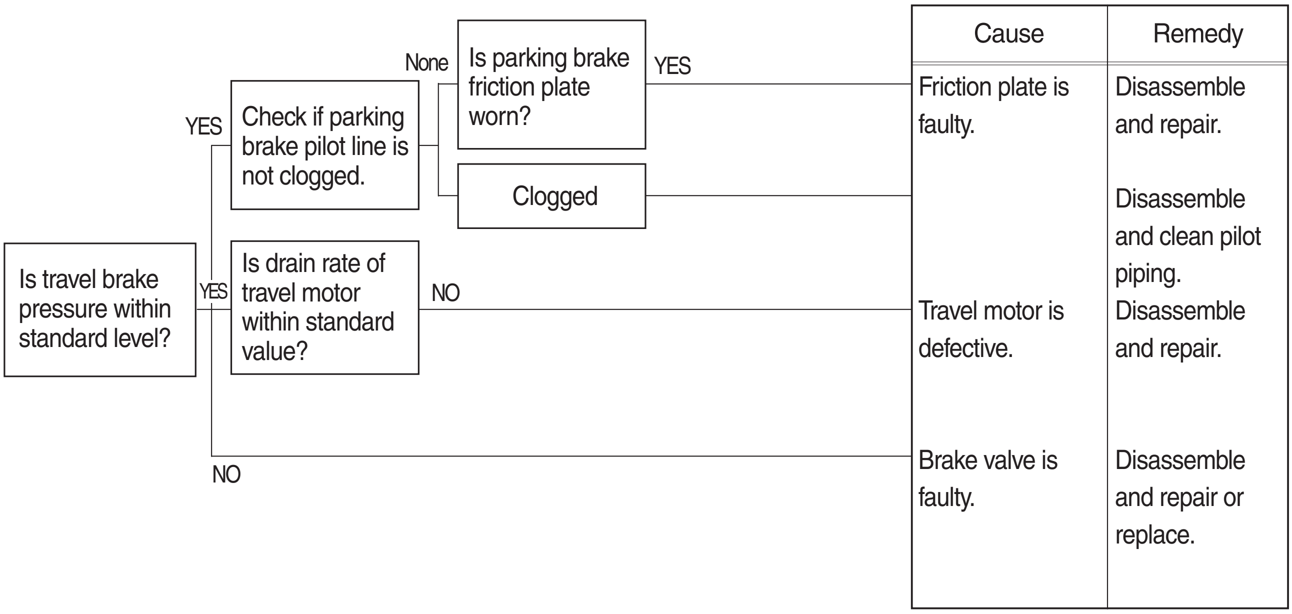


2) SPEED ON ONE SIDE FALLS AND THE MACHINE CURVES

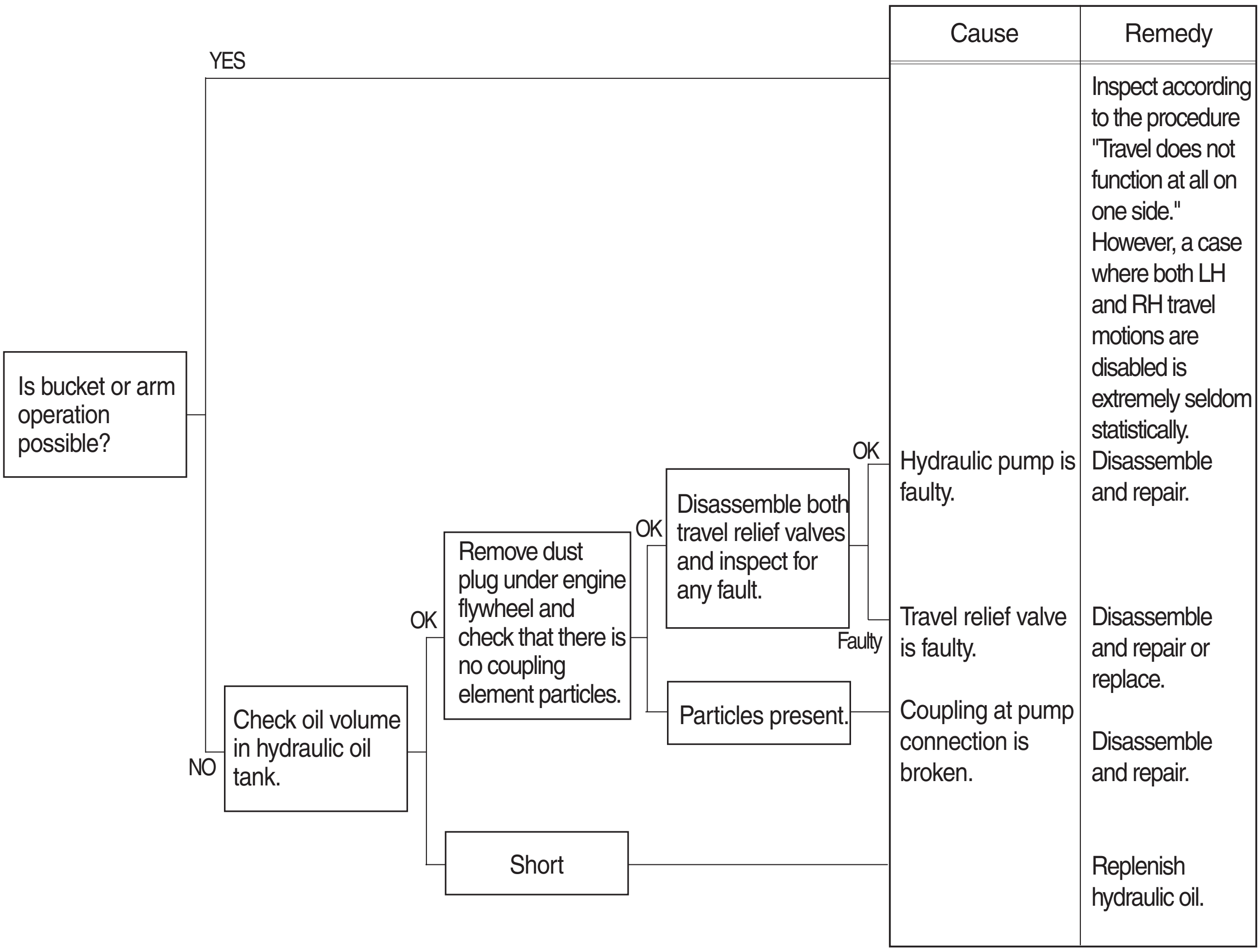


3) MACHINE DOES NOT STOP ON A SLOPE

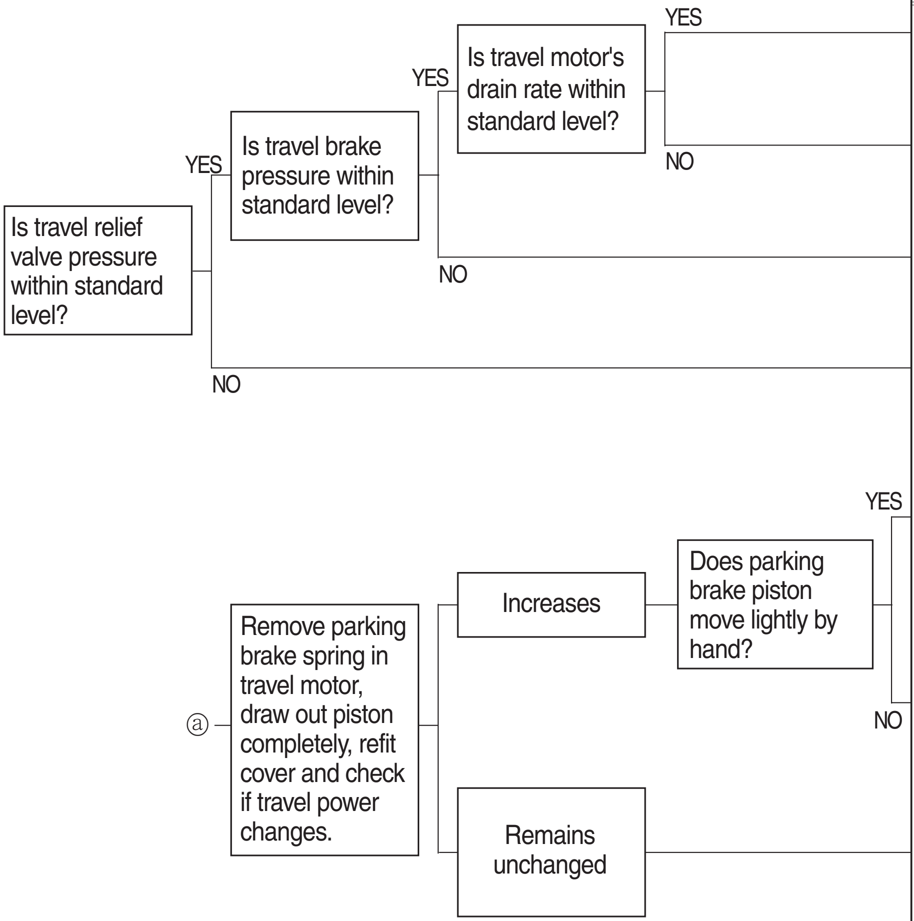
Machine is pulled forward as sprocket rotates during digging operation.



4) LH AND RH TRAVEL MOTIONS ARE IMPOSSIBLE



5) TRAVEL ACTION IS POWERLESS (travel only)

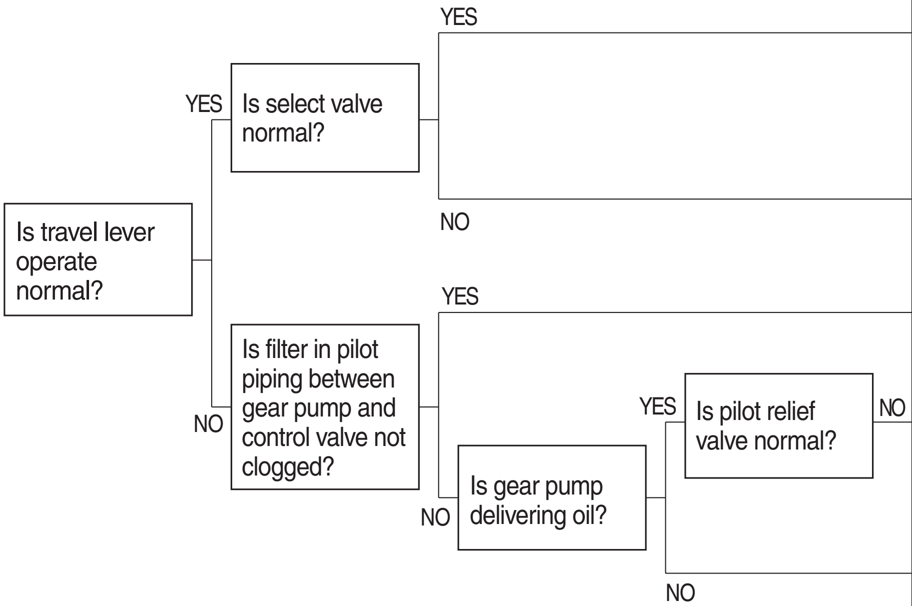


Cause	Remedy
ⓐ	
Travel motor is faulty.	Disassemble and repair.
Travel brake valve is defective.	Disassemble and repair or replace.
Travel relief valve is faulty.	Disassemble and repair or replace.
Hydraulic circuit that releases travel parking brake is clogged with dirt.	Disassemble and clean.
Parking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

6) MACHINE RUNS RECKLESSLY ON A SLOPE

Cause	Remedy
	Disassemble and repair or replace.

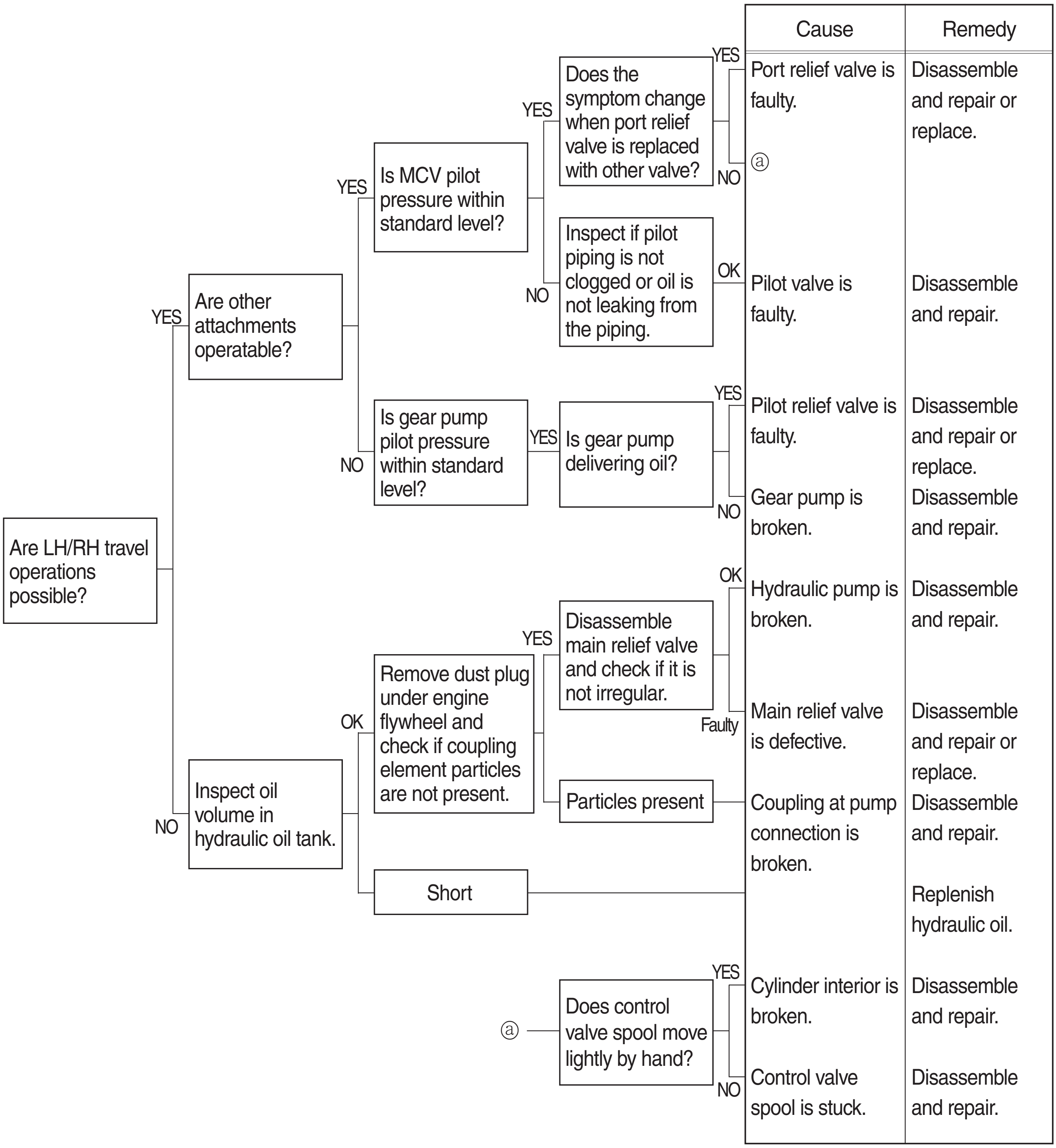
7) MACHINE MAKES A CURVED TRAVEL OR DOES NOT TRAVEL AT ALL WHEN TRAVEL AND ATTACHMENT OPERATIONS ARE EXECUTED AT THE SAME TIME



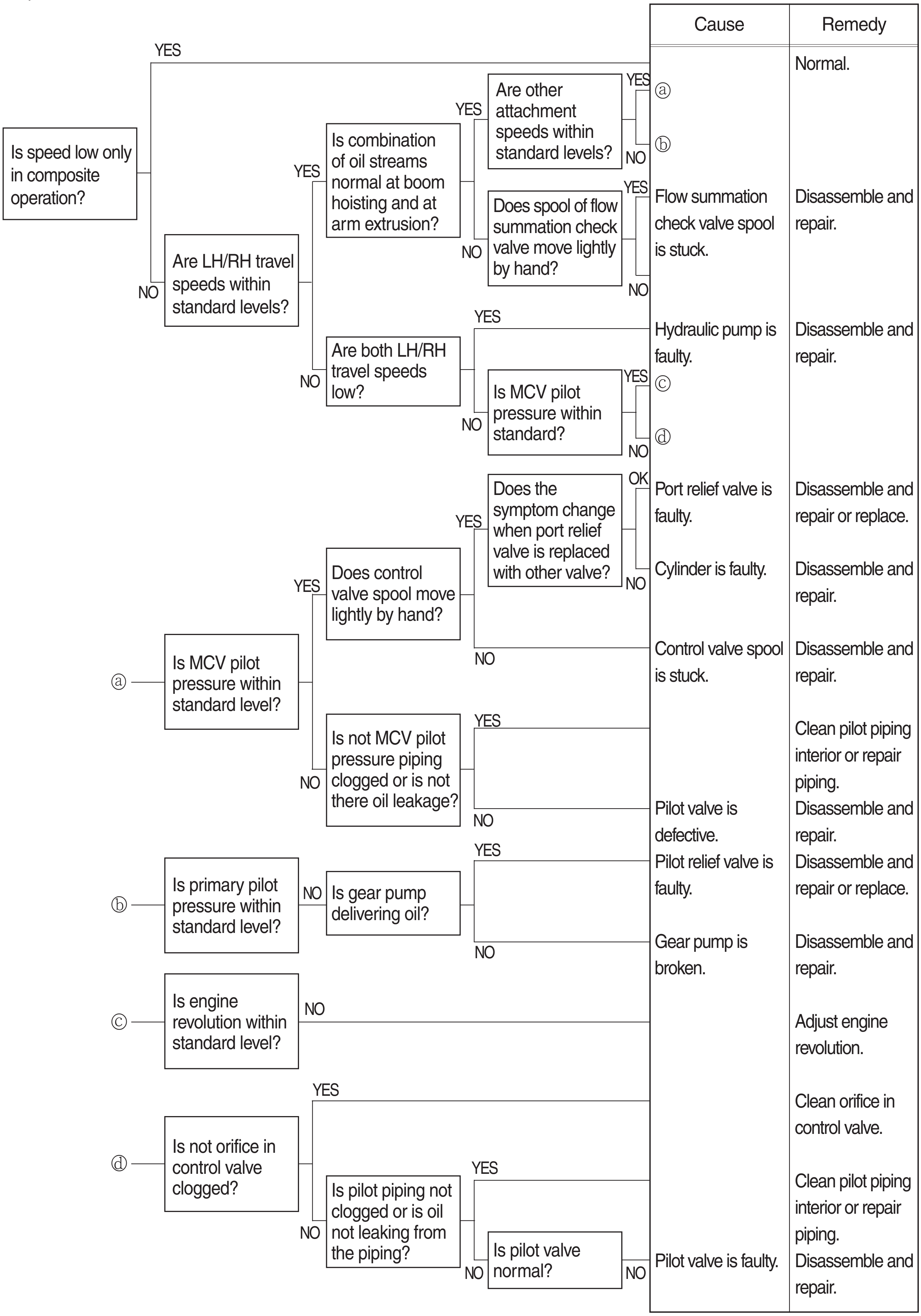
Cause	Remedy
	Normal.
Select valve is faulty.	Repair or replace.
	Remove dirt on pilot line filter.
Pilot relief valve is defective.	Disassemble and repair or replace.
Gear pump is broken.	Disassemble and repair.

6. ATTACHMENT SYSTEM

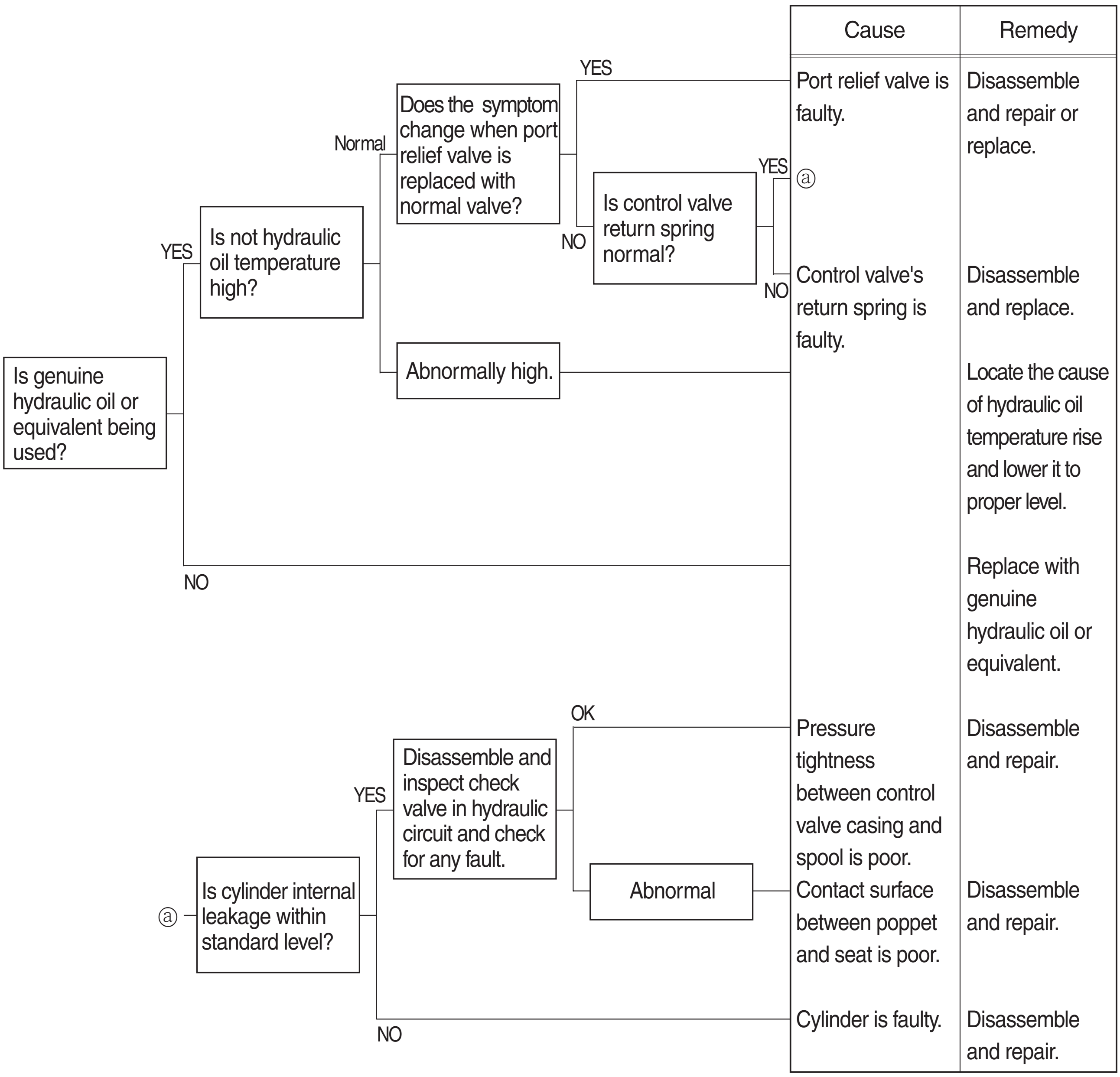
1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



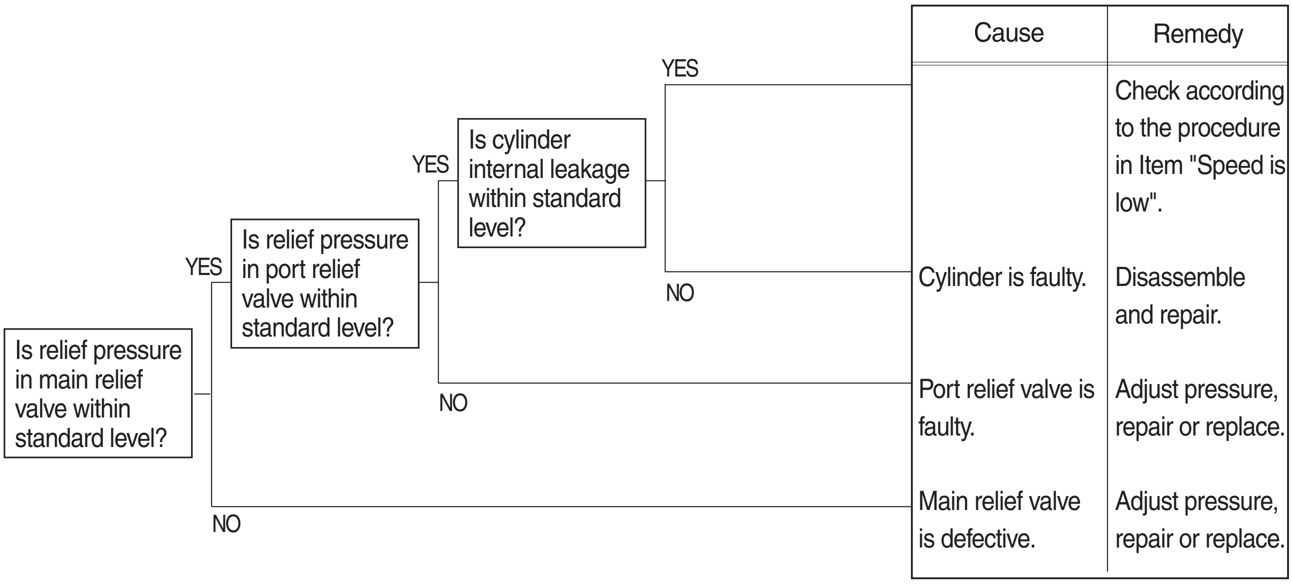
2) BOOM, ARM OR BUCKET SPEED IS LOW



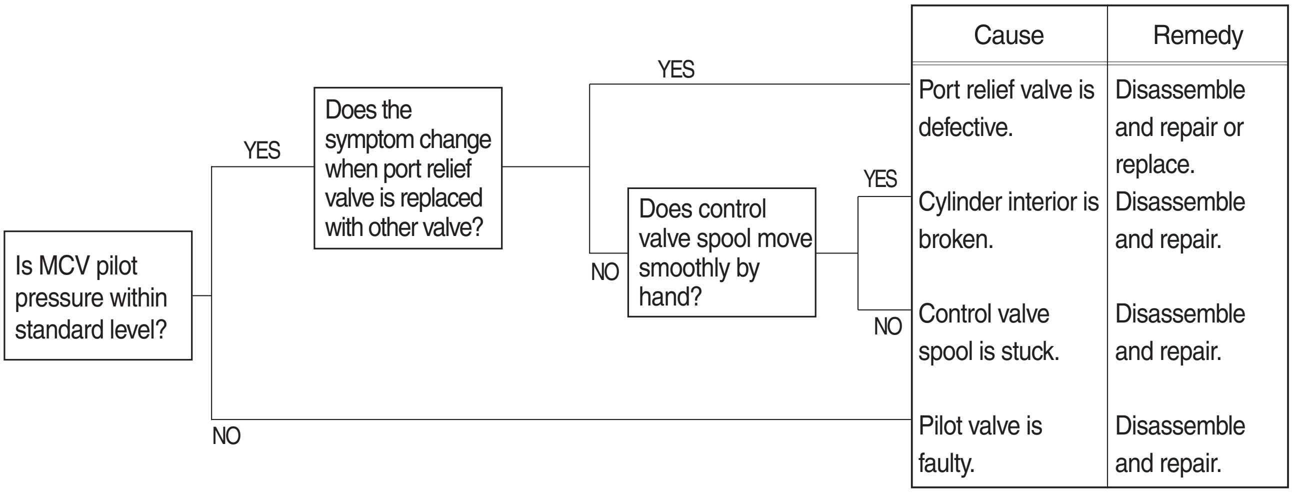
3) BOOM, ARM OR BUCKET CYLINDER EXTENDS OR CONTRACTS ITSELF AND ATTACHMENT FALLS



4) BOOM, ARM OR BUCKET POWER IS WEAK



5) ONLY BUCKET OPERATION IS TOTALLY IMPOSSIBLE



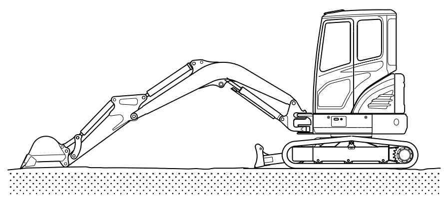
6) BOOM MAKES A SQUEAKING NOISE WHEN BOOM IS OPERATED

Is boom foot pin greased sufficiently?

Check	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.

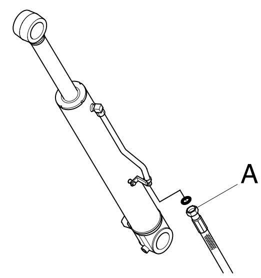
※ HOW TO CHECK INTERNAL BOOM CYLINDER LEAKAGE

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



R27Z96MA02

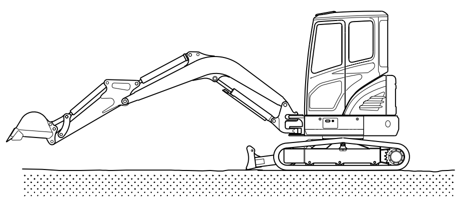
2. Disconnect hose (A) from rod side of boom cylinder and drain oil from cylinders and hose. (Put cups on piping and hose ends)



R5575BY02

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

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

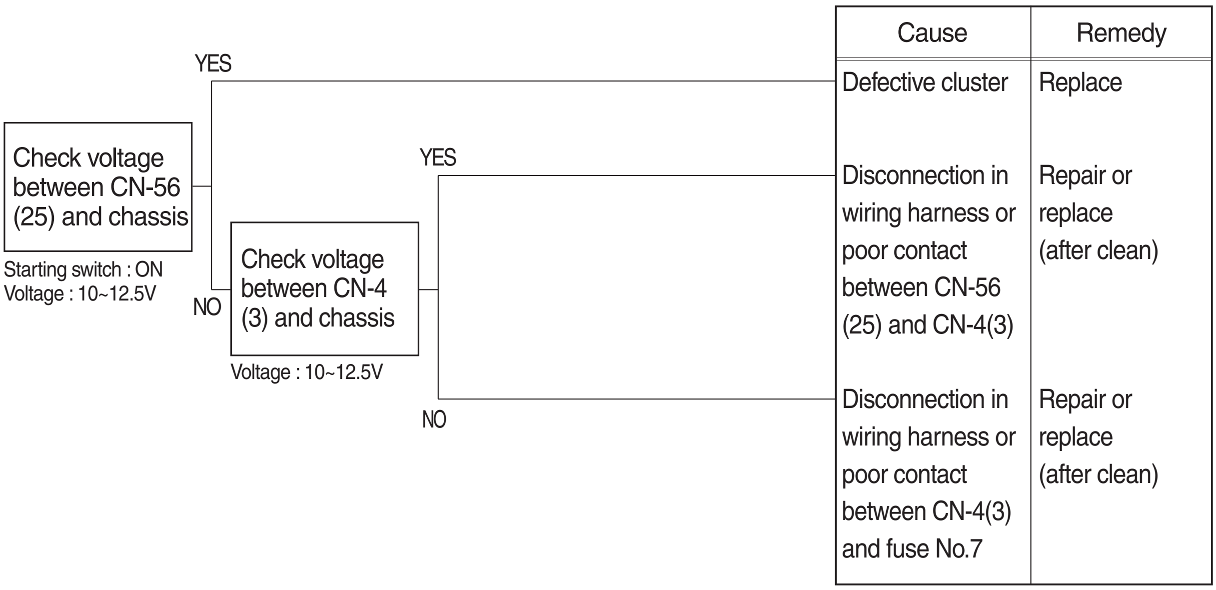


R35Z75TS02

GROUP 3 ELECTRICAL SYSTEM

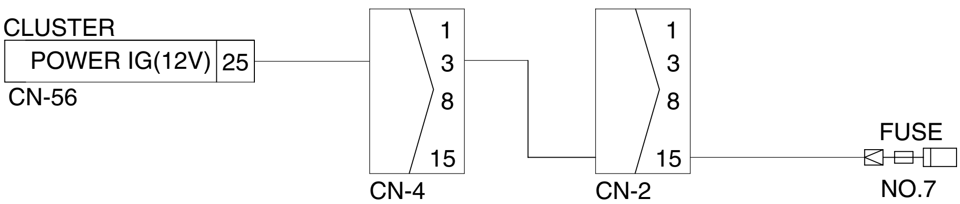
1. WHEN STARTING SWITCH IS TURNED ON, MONITOR PANEL DISPLAY DOES NOT APPEAR

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 7.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



Check voltage

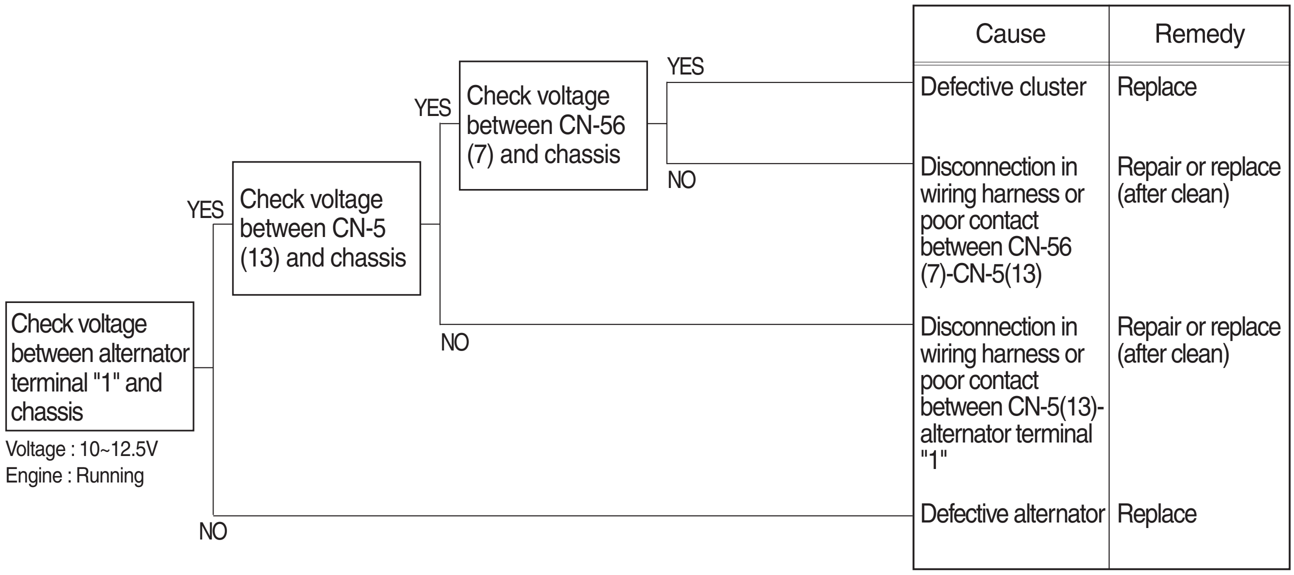
YES	10 ~ 12.5V
NO	0V



R25Z9AK5TS02

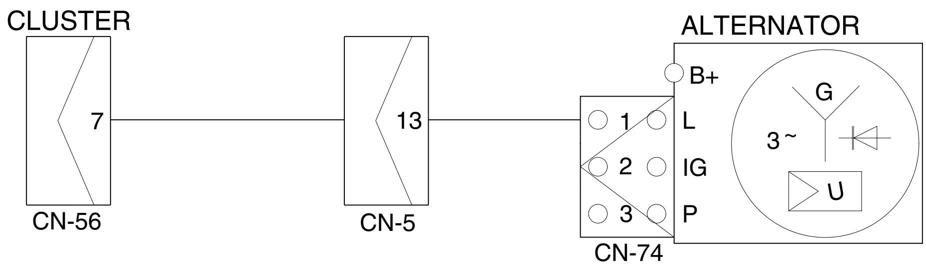
2. BATTERY CHARGING WARNING LAMP LIGHTS UP (starting switch : ON)

· 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

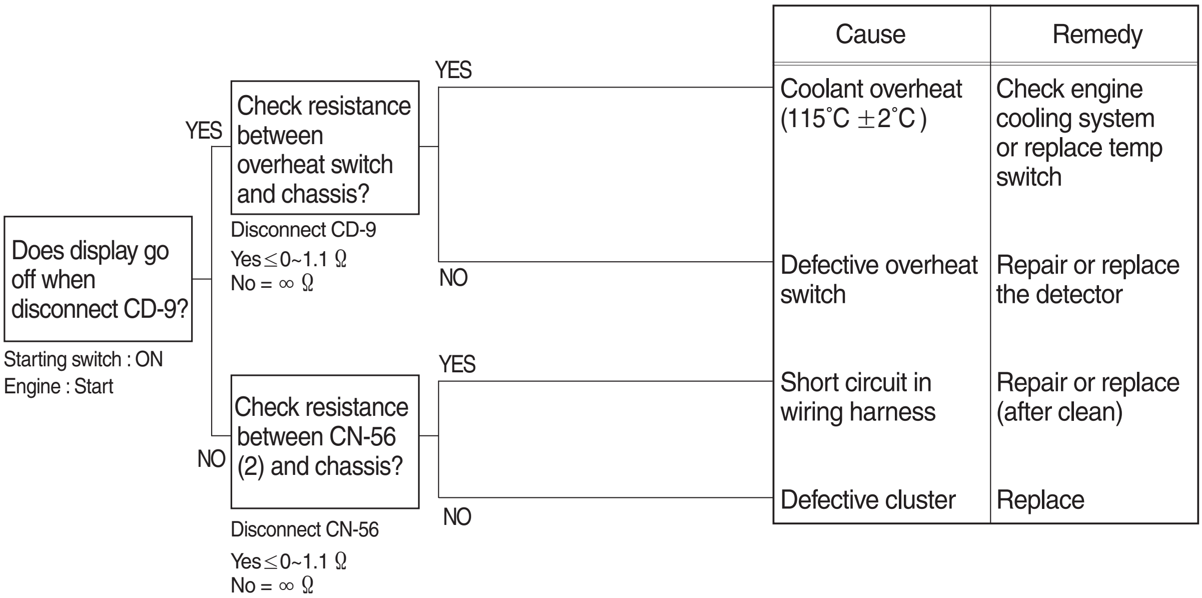
YES	10 ~ 12.5V
NO	0V



17Z9A5TS03

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

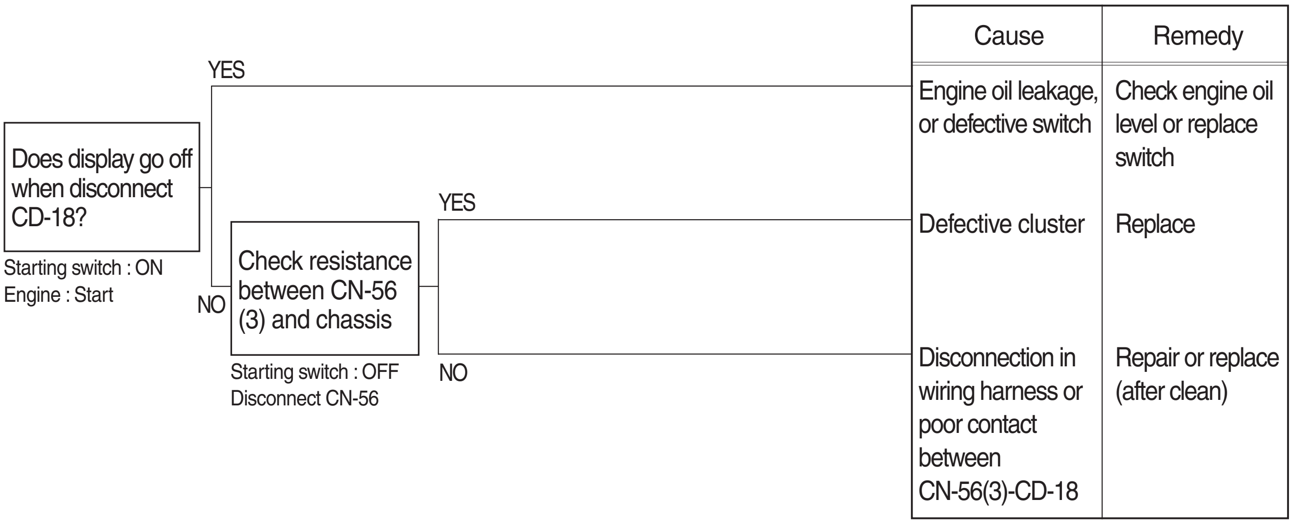
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



17Z9A5TS04

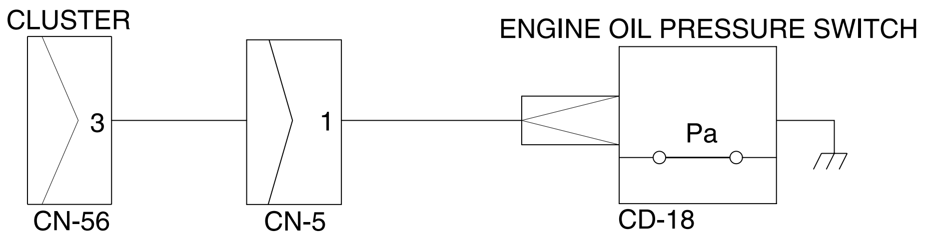
4. WHEN ENGINE OIL PRESSURE WARNING LAMP LIGHTS UP (Engine is started)

· 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

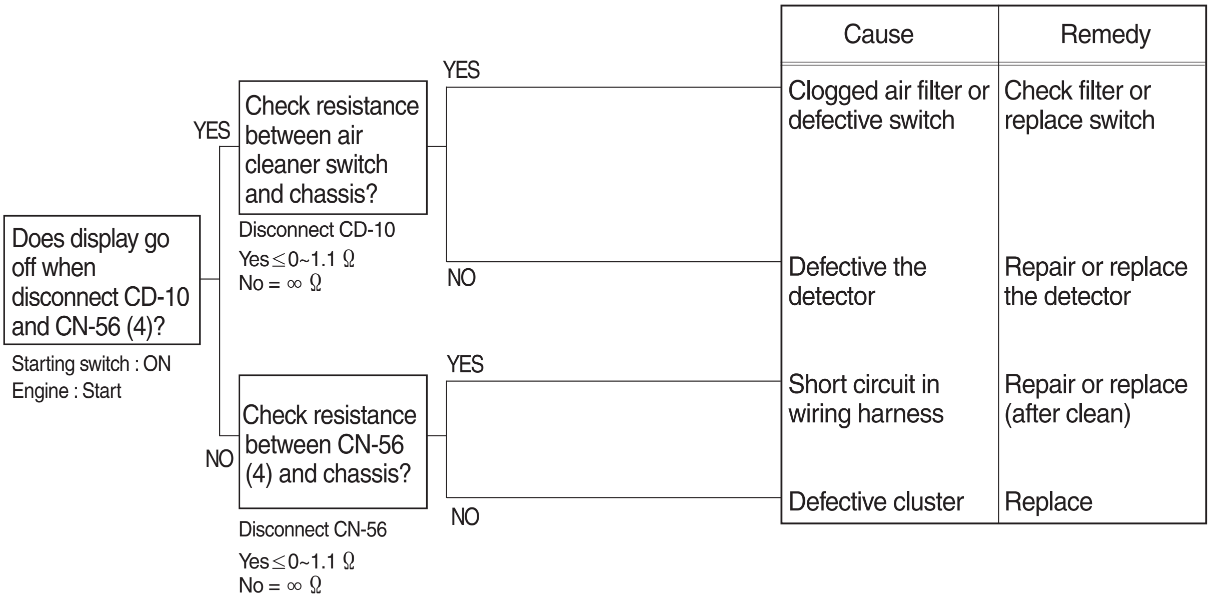
YES	MAX 1Ω
NO	MIN 1MΩ



1695TS06

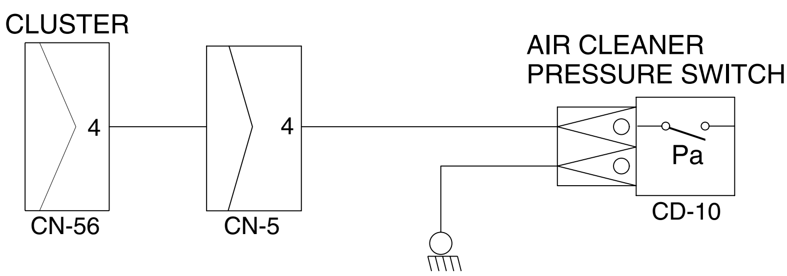
5. WHEN AIR CLEANER WARNING LAMP LIGHTS UP (Engine is started)

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



Check resistance

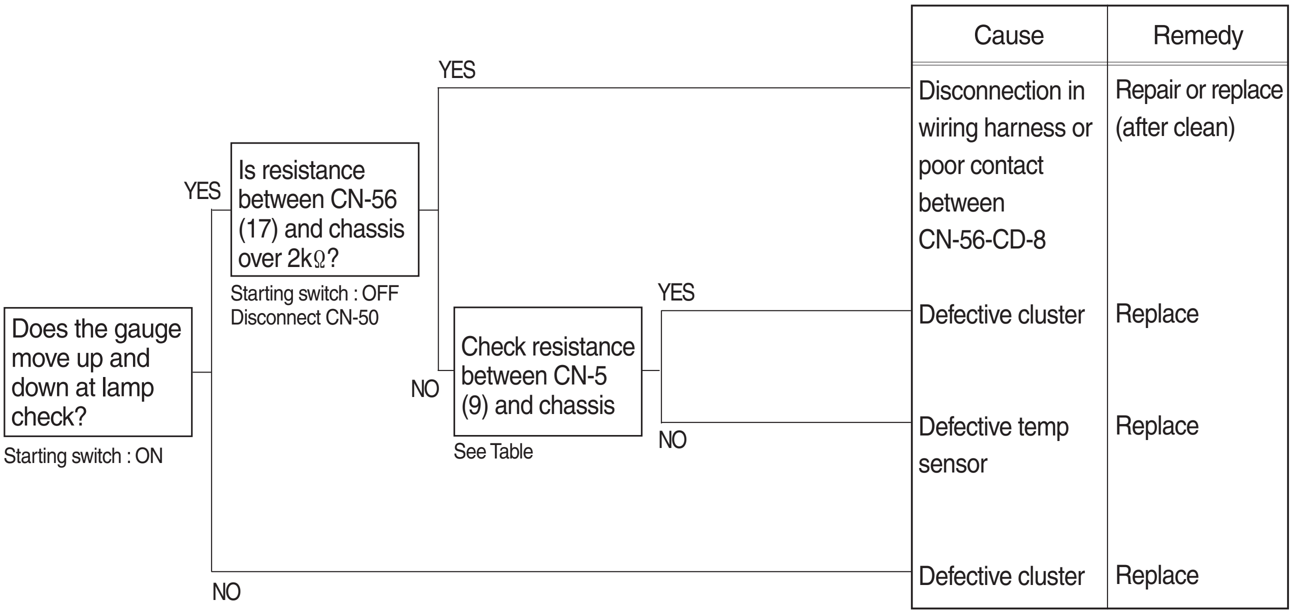
YES	MAX 1Ω
NO	MIN 1M Ω

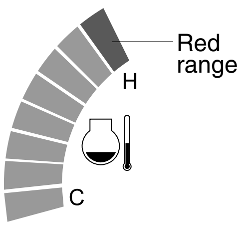


R25Z9AK5TS13

6. WHEN COOLANT TEMPERATURE GAUGE DOES NOT OPERATE

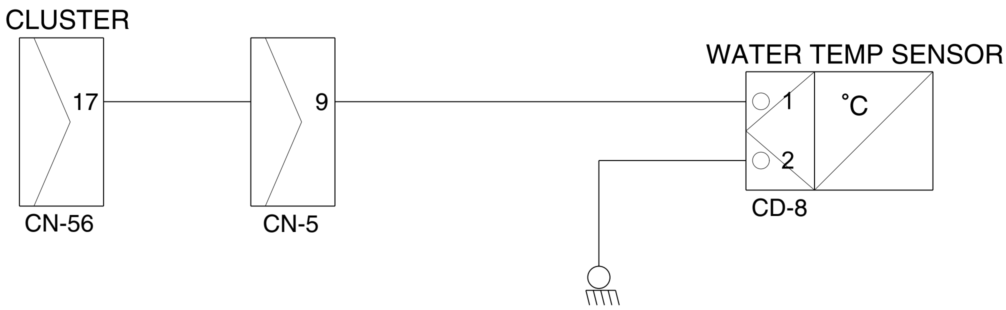
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

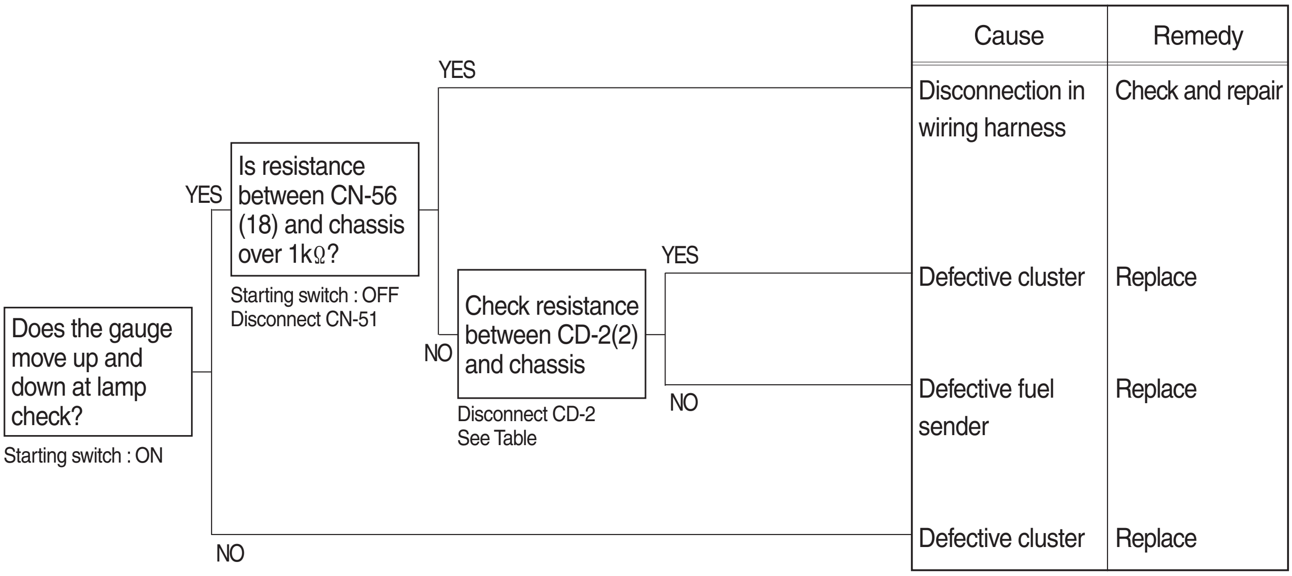
Item \ Temperature	50˚C	80˚C	100˚C	115˚C (red range)
Unit resistance (Ω)	350	118	63.5	36.2

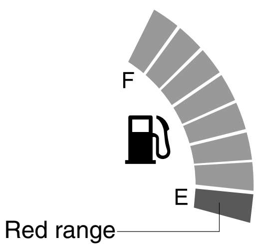


R25Z9AK5TS07

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

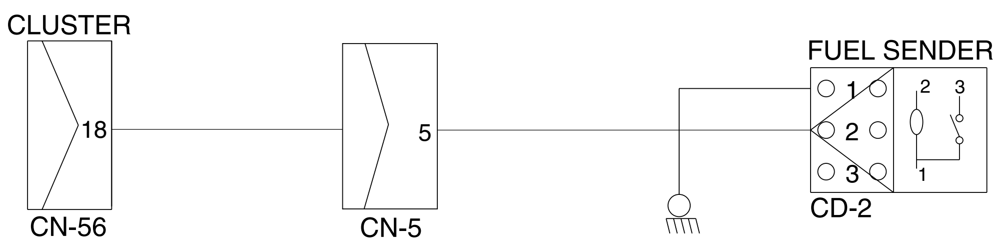
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

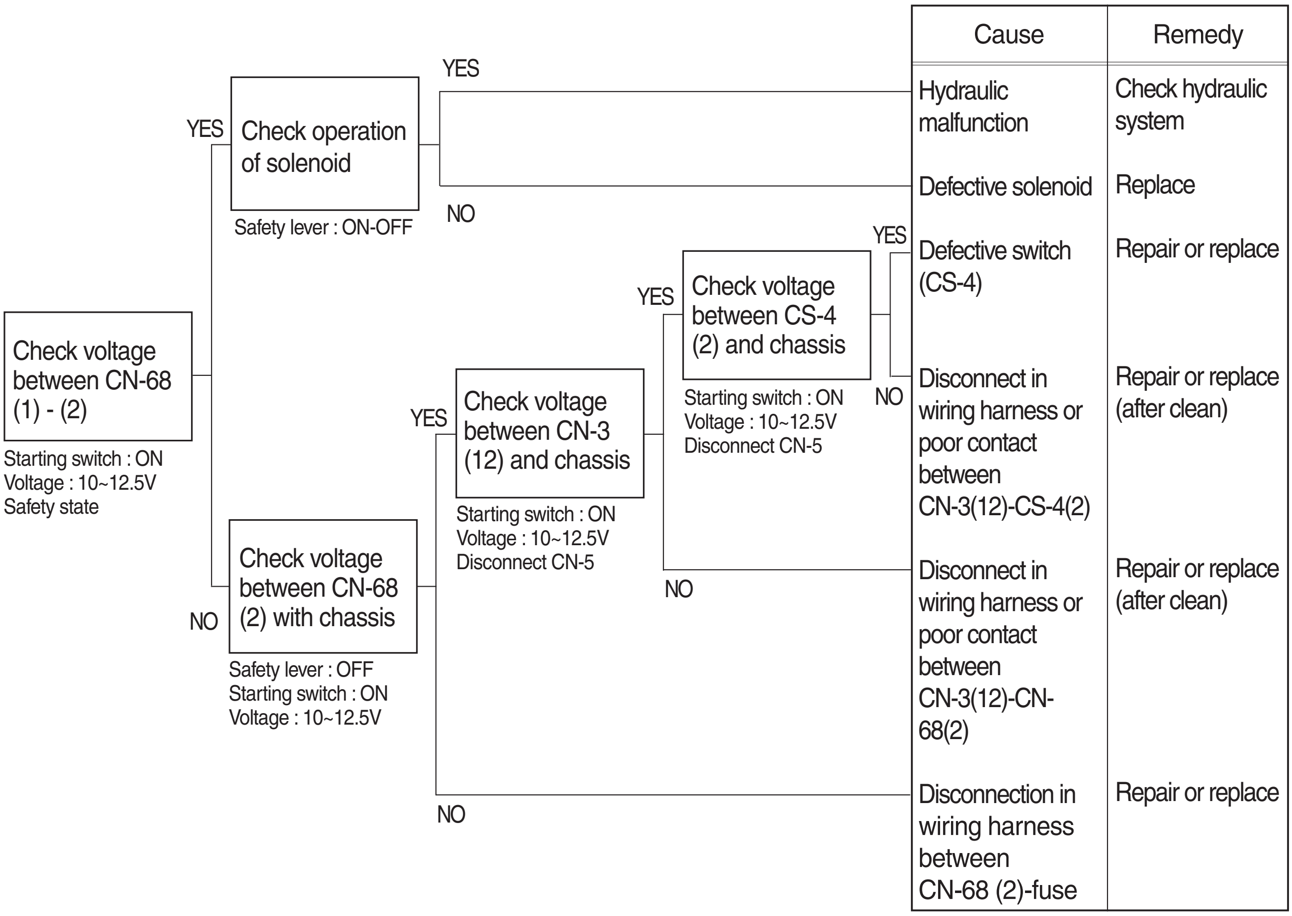
Item \ Temperature	Empty	1/2	Full
Unit resistance (Ω)	90	38	10

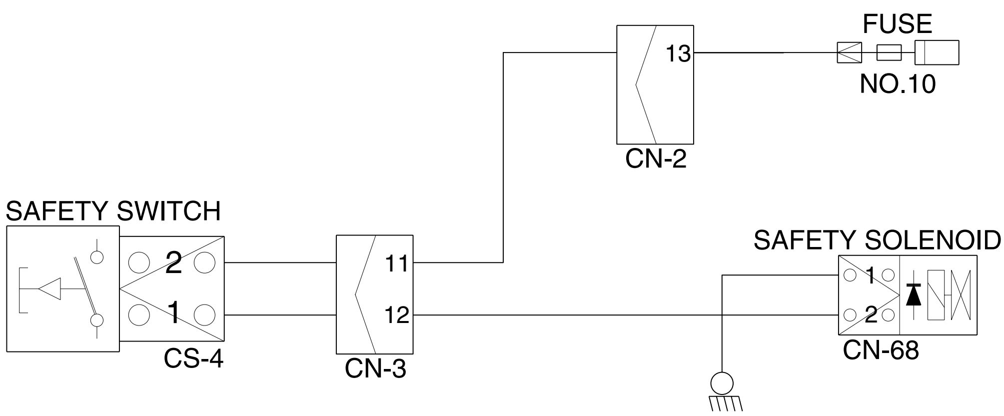


17Z9A5TS08

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.

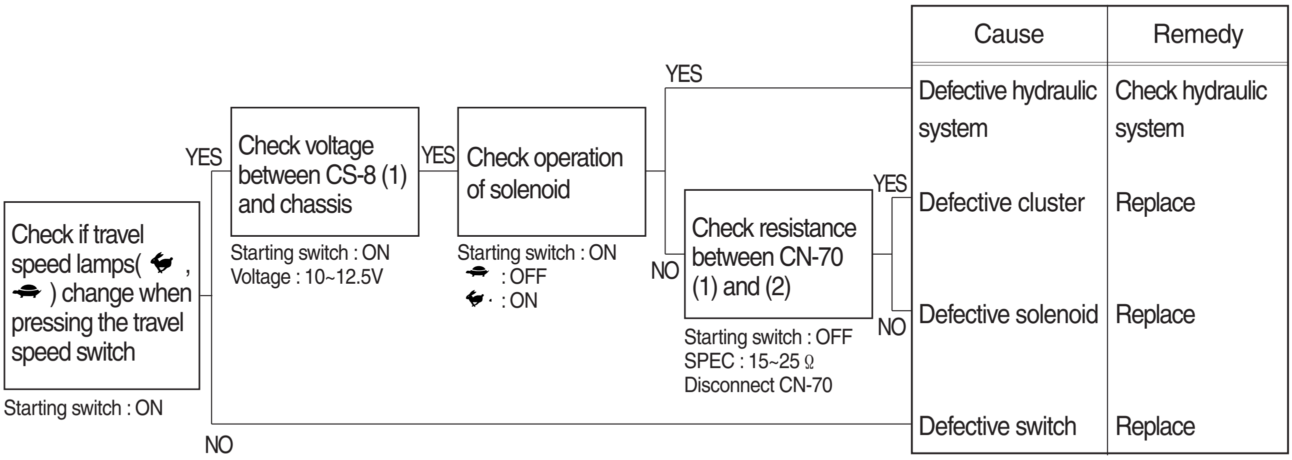


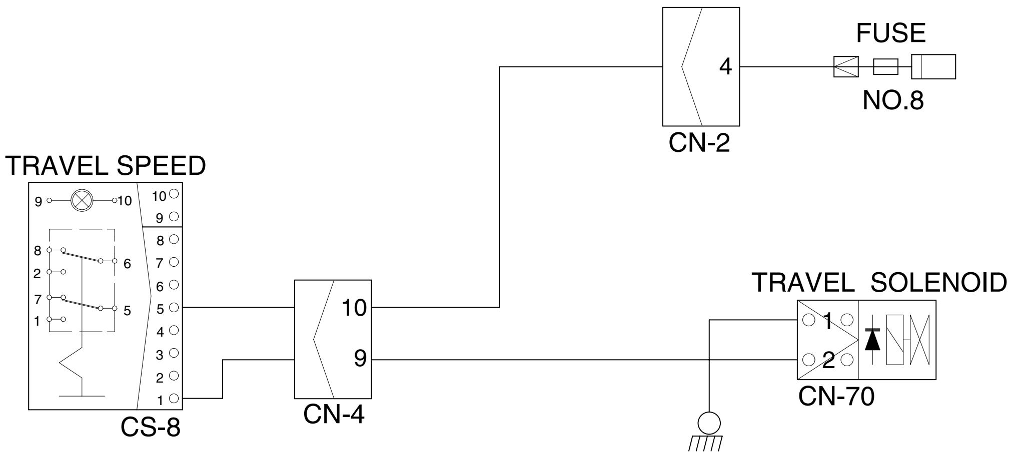


R25Z9AK5TS20

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

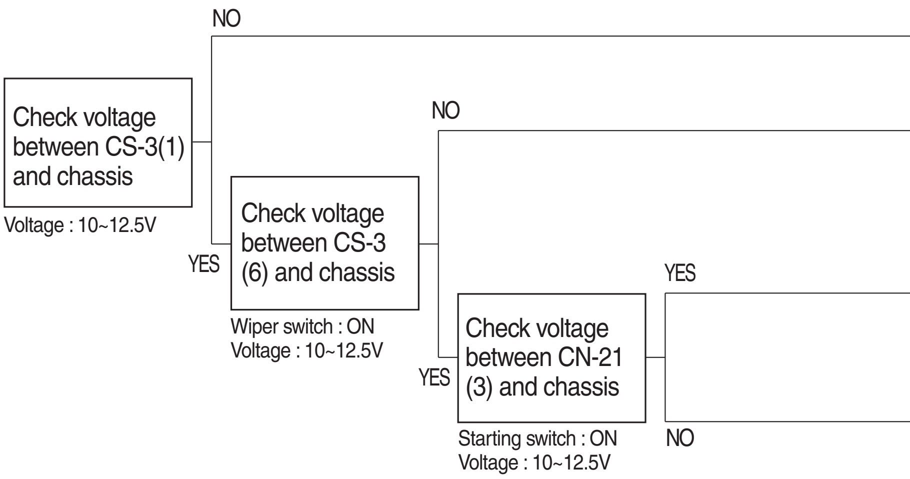




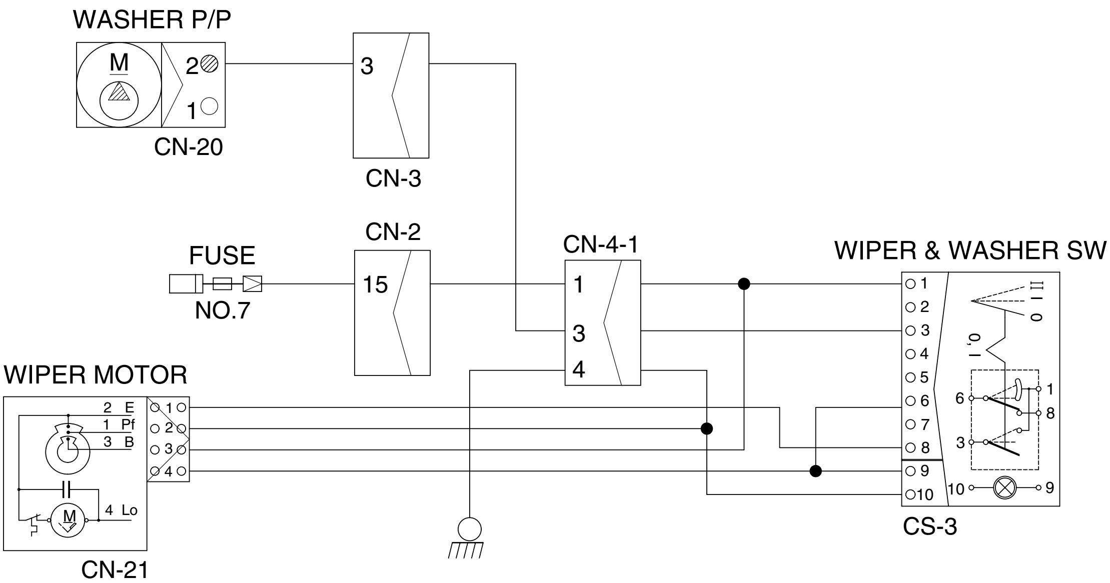
R25Z9AK5TS21

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.7 is not blown out.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



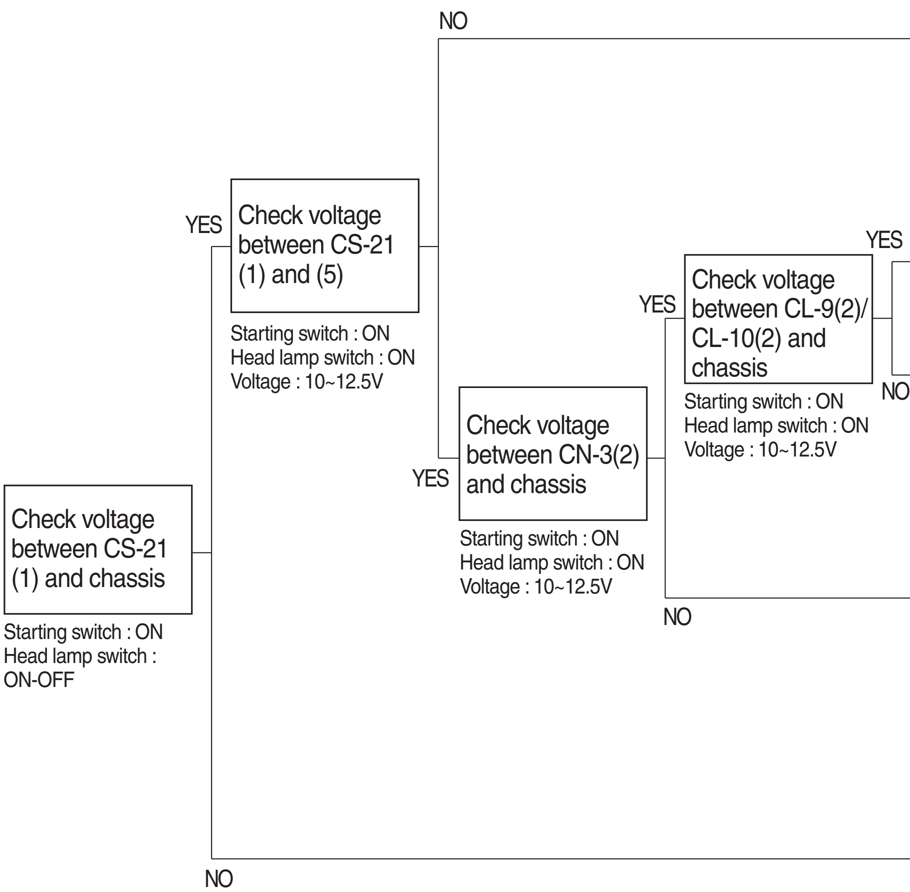
Cause	Remedy
Recheck fuse	Replace
Defective wiper switch	Replace
Defective wiper motor	Replace
Recheck fuse	Replace



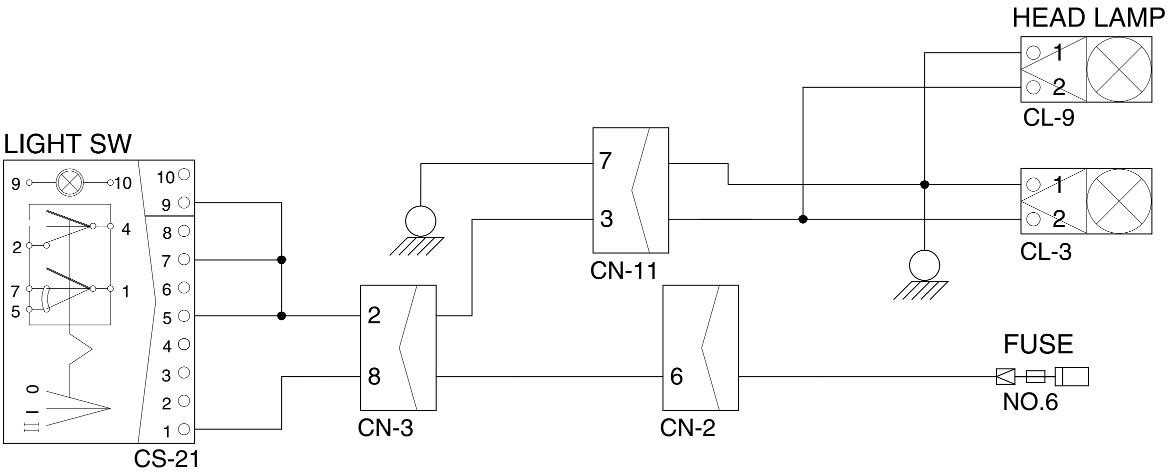
R27Z9AK5TS14

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.



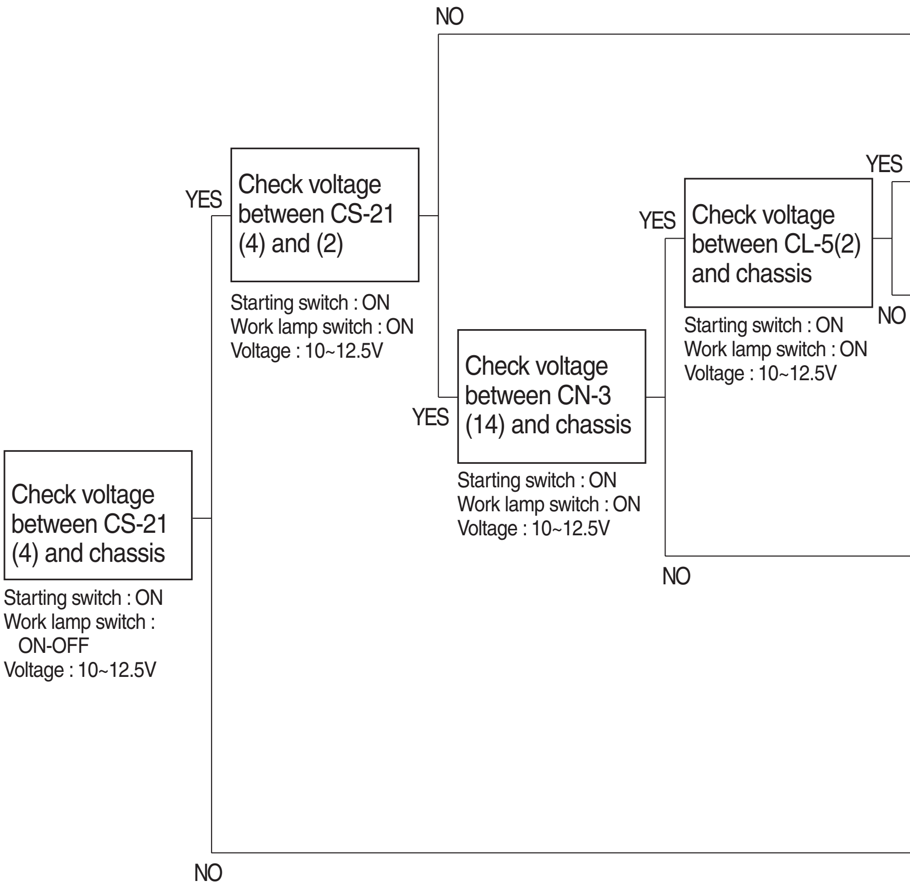
Cause	Remedy
Defective lamp switch	Replace switch
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CN-3(2)-CL-3(2)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CS-21(5)-CN-3(2)	Repair or replace (after clean)
Disconnection in wiring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



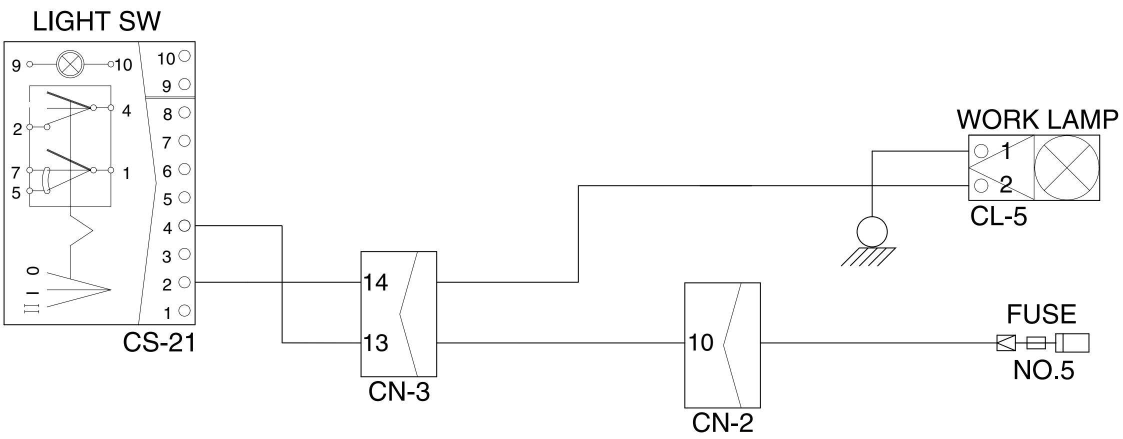
R25Z9AK5TS15

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.



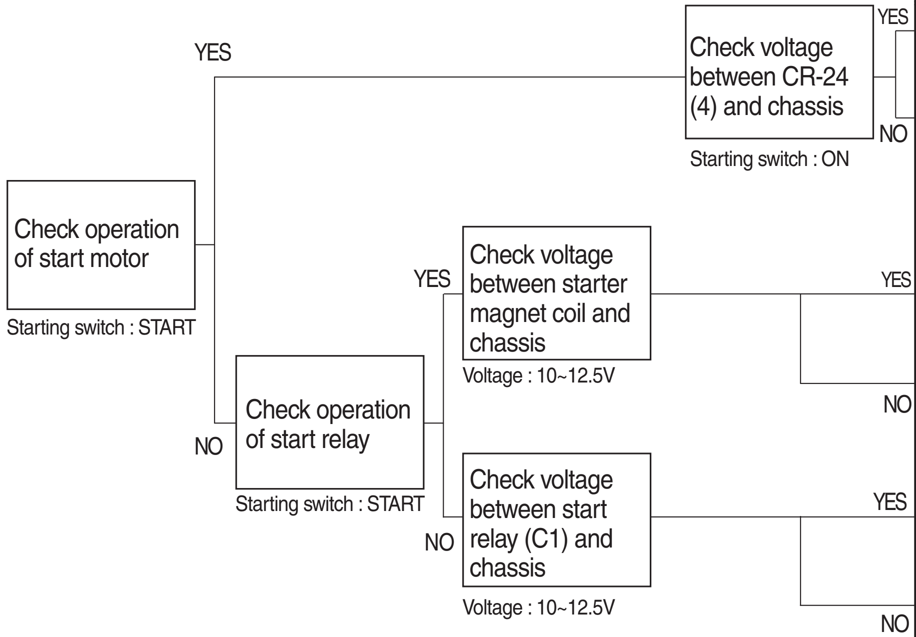
Cause	Remedy
Defective lamp switch	Replace switch
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CN-3(14) and CL-5(2)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CS-21(2)-CN-3(14)	Repair or replace (after clean)
Disconnection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



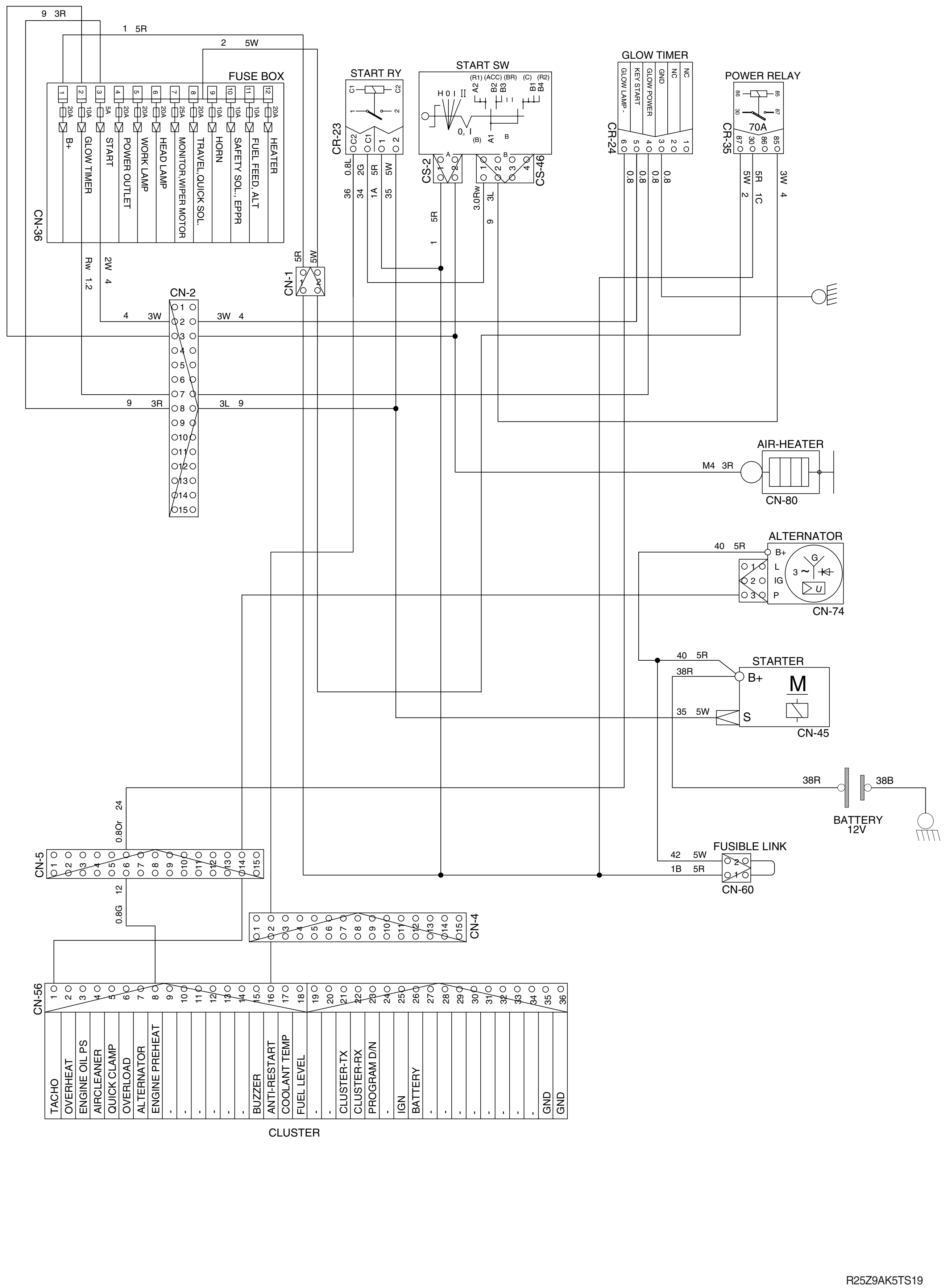
R25Z9AK5TS12

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.



Cause	Remedy
Defective timer	Repair or replace Timer
Disconnection in wiring harness or poor contact between CR-24 (4) and fuse box	Repair or replace fuel cut off relay or repair or replace (after clean)
Defective magnet of start motor	Repair or replace start motor
Defective start relay	Repair or replace start relay
Defective start relay	Repair or replace start relay
Disconnection in wiring harness or poor contact between CR-23 (C1)and CS-46 (1)	Repair or replace (after clean)



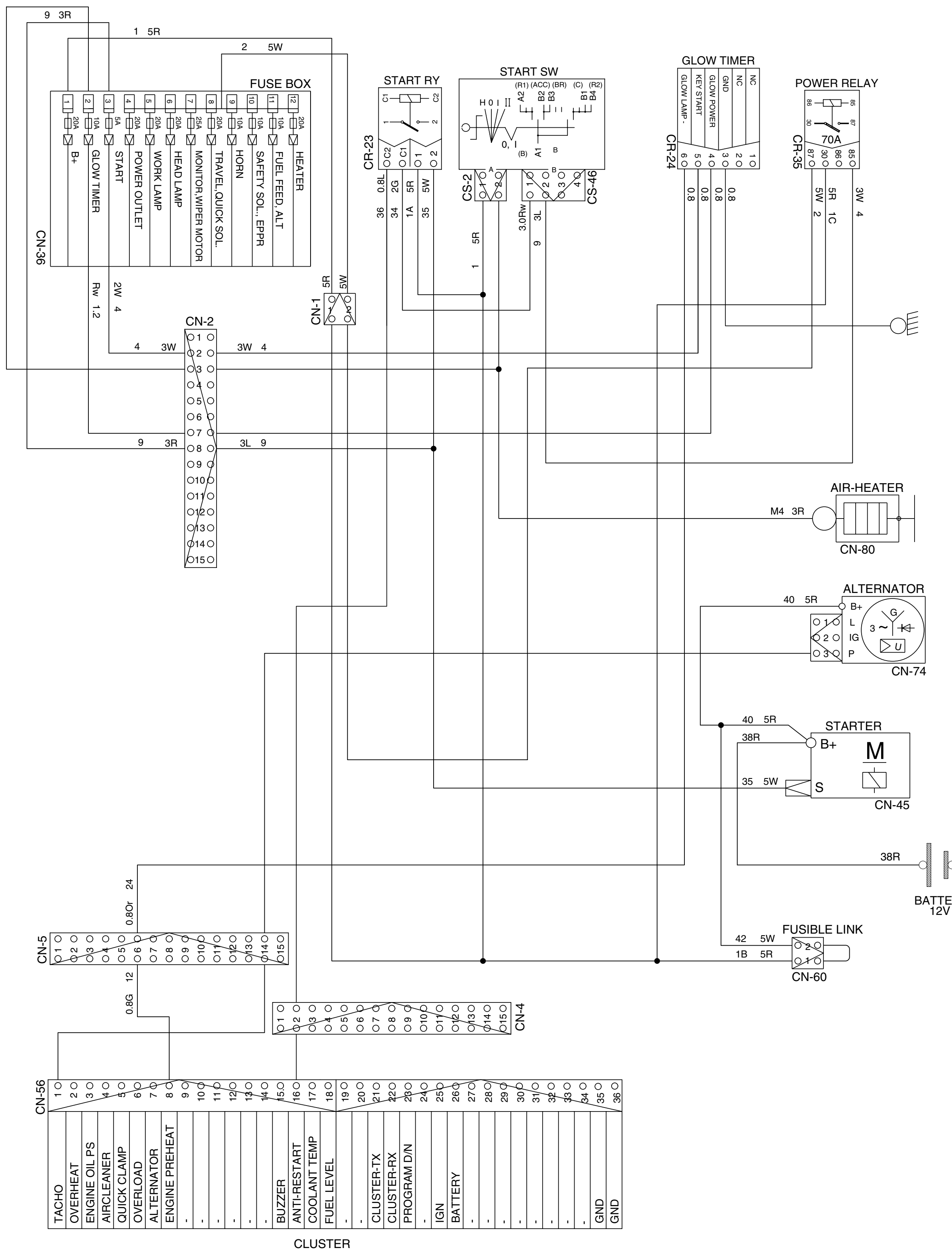
14. WHEN STARTING SWITCH ON DOES NOT OPERATE

- 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)-Starter
- NO → Battery capacity too low

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



R25Z9AK5TS19

SECTION 6 MAINTENANCE STANDARD

SECTION 6 MAINTENANCE STANDARD

GROUP 1 OPERATIONAL PERFORMANCE TEST

1. PURPOSE

Performance tests are used to check:

1) OPERATIONAL PERFORMANCE OF A NEW MACHINE

Whenever a new machine is delivered in parts and reassembled at a customer's site, it must be tested to confirm that the operational performance of the machine meets Hyundai spec.

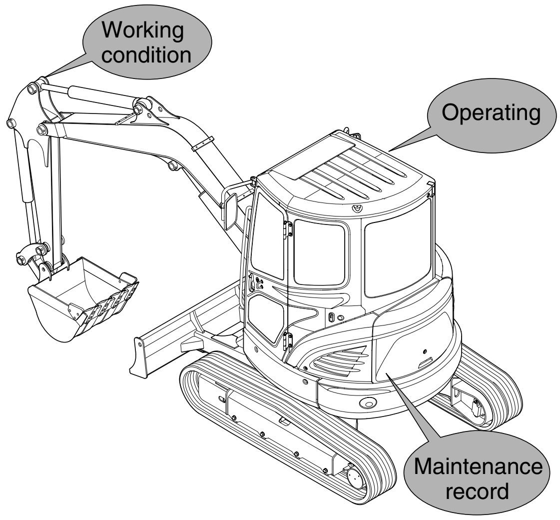
2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

With the passage of time, the machine's operational performance deteriorates, so that the machine needs to be serviced periodically to restore it to its original performance level.

Before servicing the machine, conduct performance tests to check the extent of deterioration, and to decide what kind of service needs to be done (by referring to the "Service Limits" in this manual).

3) OPERATIONAL PERFORMANCE OF A REPAIRED MACHINE

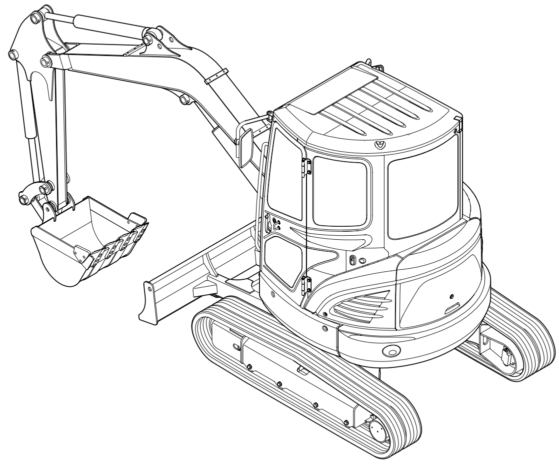
After the machine is repaired or serviced, it must be tested to confirm that its operational performance was restored by the repair and/or service work done.



2. TERMINOLOGY

1) STANDARD

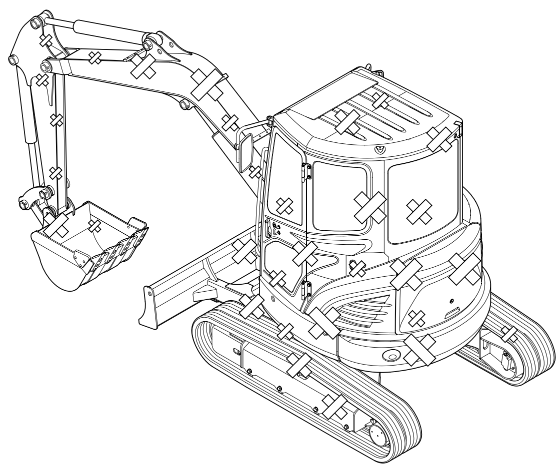
Specifications applied to the brand-new machine, components and parts.



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.

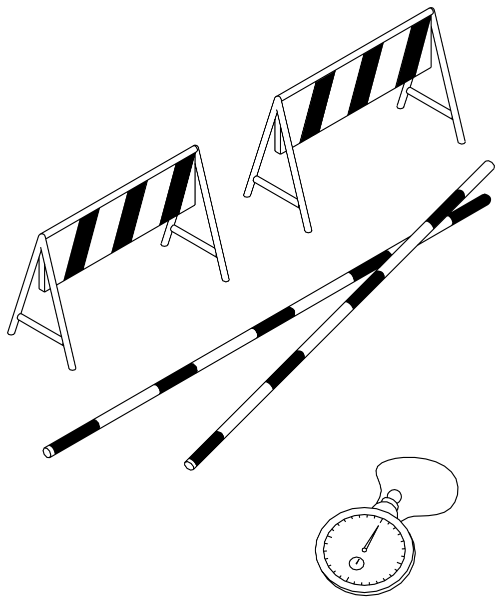
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

(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 lever at the maximum stroke.

③ Measure the engine RPM.

(3) Evaluation

The measured speeds should meet the following specifications.

Unit : rpm

Model	Engine speed	Standard	Remarks
R25Z-9AK	Low idle	1450±50	
	High idle	2350±50	

3) TRAVEL SPEED

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

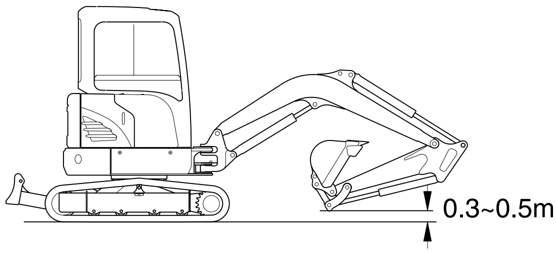
(2) Preparation

① Adjust the tension of both tracks to be equal.

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

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

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



R35Z76MC04

(3) Measurement

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

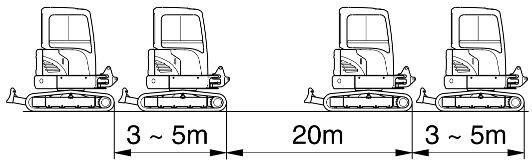
② Before starting either the low or high speed tests, adjust the travel mode switch to the speed to be tested.

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

④ Measure the time required to travel 20m.

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

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



R35Z76MC05

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds / 20m

Model	Travel speed	Standard	Maximum allowable	Remarks
R25Z-9AK	1 Speed	30.0±2.0	37.5	
	2 Speed	16.8±1.0	21.0	

4) TRACK REVOLUTION SPEED

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

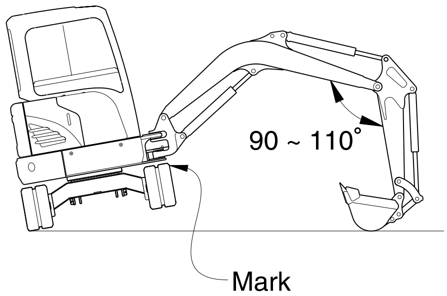
(2) Preparation

① Adjust the tension of both side tracks to be equal.

② On the track to be measured, mark one shoe with chalk.

③ Swing the upperstructure 90° and lower the bucket to raise the track off ground. Keep the boom-arm angle between 90 to 110° as shown. Place blocks under machine frame.

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



R35Z76MC06

(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
R25Z-9AK	1 Speed	18.4±2.0	23
	2 Speed	10.3±2.0	12.9

5) TRAVEL DEVIATION

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

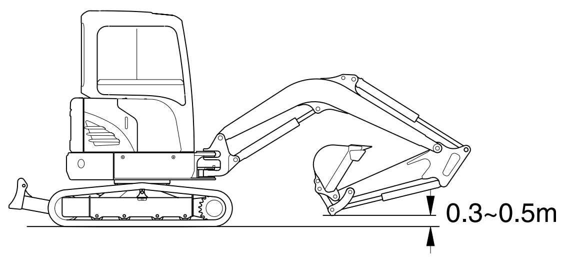
(2) Preparation

① Adjust the tension of both tracks to be equal.

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

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

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



R35Z76MC04

(3) Measurement

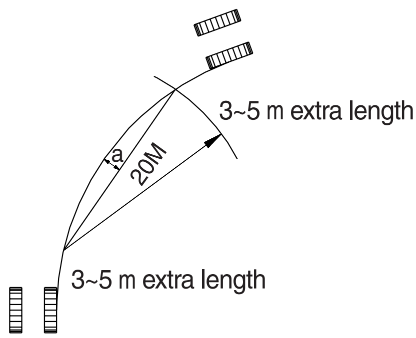
① Measure the amount of mistracking at high and low travel speeds.

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

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

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

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



7-7(2) 140-7

(4) Evaluation

Mistrack should be within the following specifications.

Unit : ㎜ / 20 ㎙

Model	Standard	Maximum allowable	Remarks
R25Z-9AK	200 below	240	

6) SWING SPEED

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

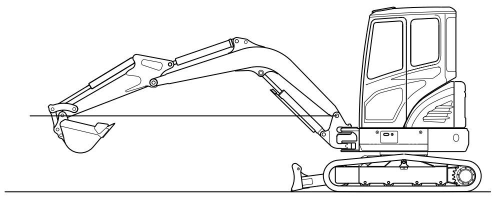
(2) Preparation

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
R25Z-9AK	13.2±1.0	16.5	

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.

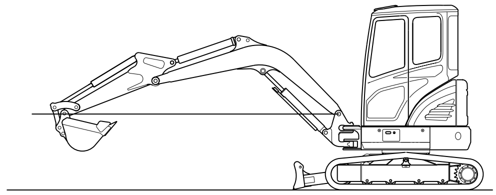
② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.

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

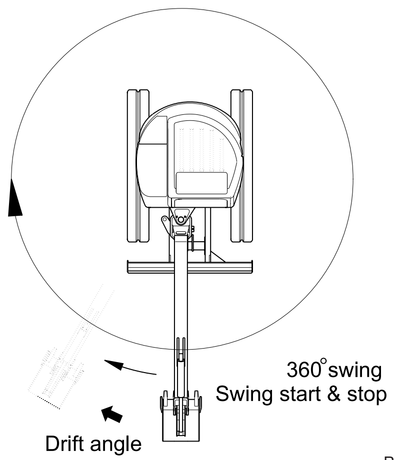
(3) Measurement

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

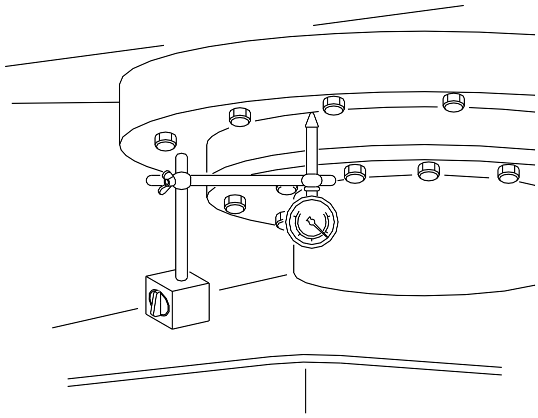
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Standard	Maximum allowable	Remarks
R25Z-9AK	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.

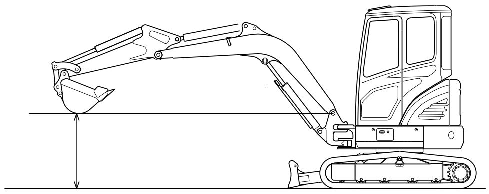
(3) Measurement

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).

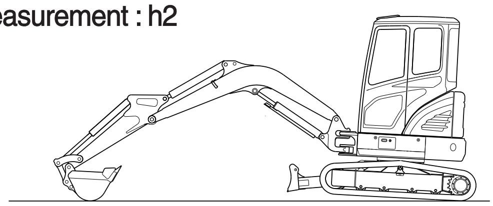
③ Calculate bearing play (H) from this data (h1 and h2) as follows. H=h2-h1

Measurement : h1



R35Z76MC09

Measurement : h2



R35Z76MC10

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Standard	Maximum allowable	Remarks
R25Z-9AK	0.5 ~ 1.2	2.4	

9) HYDRAULIC CYLINDER CYCLE TIME

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

(2) Preparation

① To measure the cycle time of the boom cylinders:
With the arm rolled out and the empty bucket rolled out, lower the bucket to the ground, as shown.

② To measure the cycle time of the arm cylinder.
With the empty bucket rolled in, position the arm so that it is vertical to the ground. Lower the boom until the bucket is 0.5m above the ground.

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

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

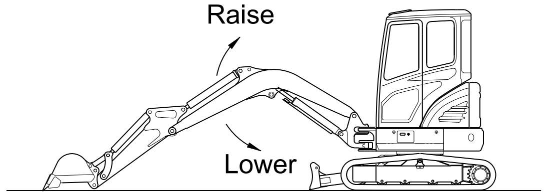
(3) Measurement

① To measure cylinder cycle times.

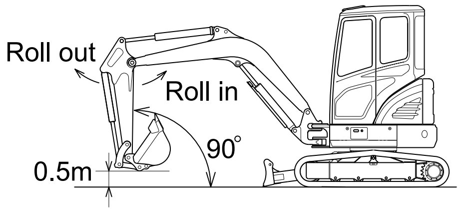
- Boom cylinders
Measure the time it takes to raise the boom, and the time it takes to lower the boom. To do so, position the boom at one stroke end then move the control lever to the other stroke end as quickly as possible.

- Arm cylinder
Measure the time it takes to roll in the arm, and the time it takes to roll out the arm. To do so, position the bucket at one stroke end, then move the control lever to the other stroke end as quickly as possible.

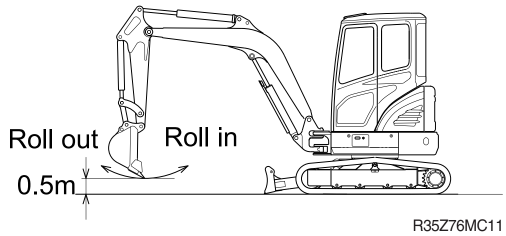
Boom cylinder



Arm cylinder



Bucket cylinder



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
R25Z-9AK	Boom raise	2.4±0.4	3.0	
	Boom lower	2.4±0.4	3.0	
	Arm in	2.7±0.4	3.4	
	Arm out	1.7±0.4	2.4	
	Bucket load	2.6±0.4	3.4	
	Bucket dump	1.9±0.4	2.4	
	Boom swing (LH)	5.7±0.4	7.1	
	Boom swing (RH)	4.3±0.4	5.4	
	Dozer up (raise)	1.9±0.3	2.4	
	Dozer down (lower)	2.5±0.3	3.1	

10) DIG FUNCTION DRIFT CHECK

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

(2) Preparation

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

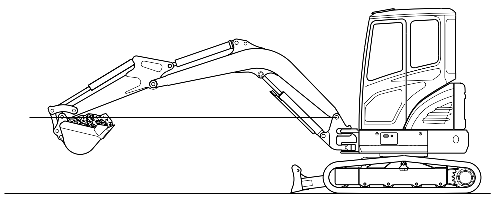
· W = $M^3 \times 1.5$
Where :
M^3 = Bucket heaped capacity(m^3)
1.5= Soil specific gravity

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

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

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

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



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
R25Z-9AK	Boom cylinder	10 below	20	
	Arm cylinder	20 below	30	
	Bucket cylinder	20 below	30	

11) CONTROL LEVER OPERATING FORCE

(1) Use a spring scale to measure the maximum resistance of each control lever at the middle of the grip.

(2) Preparation

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

(3) Measurement

① Start the engine.

② Operate each boom, arm, bucket and swing lever at full stroke and measure the maximum operating force for each.

③ Lower the bucket to the ground to raise one track off the ground. Operate the travel lever at full stroke and measure the maximum operating force required. When finished, lower the track and then jack-up the other track.

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

(4) Evaluation

The measured operating force should be within the following specifications.

Unit : kgf

Model	Kind of lever	Standard	Maximum allowable	Remarks
R25Z-9AK	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.

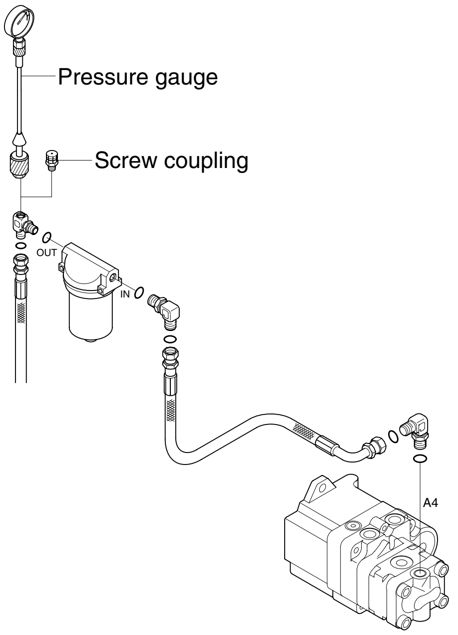
(4) Evaluation

The measured drift should be within the following specifications.

Unit : kgf

Model	Kind of lever	Standard	Maximum allowable	Remarks
R25Z-9AK	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.

(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
R25Z-9AK	30±5	

14) FOR TRAVEL SPEED SELECTING PRESSURE

(1) Preparation

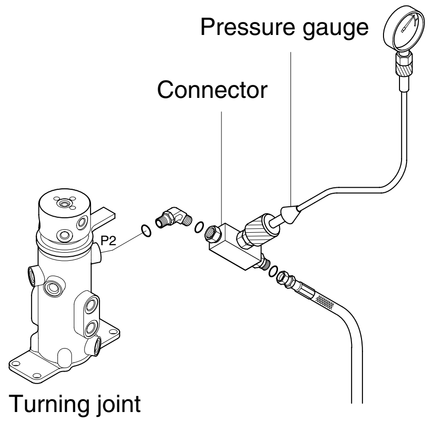
① Stop the engine.

② Push the pressure release button to bleed air.

③ To measure the speed selecting pressure: Install a connector and pressure gauge 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.



R27Z96MC18

(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
R25Z-9AK	1 Speed	0	-	
	2 Speed	30±5	-	

15) SWING PARKING BRAKE RELEASING PRESSURE

(1) Preparation

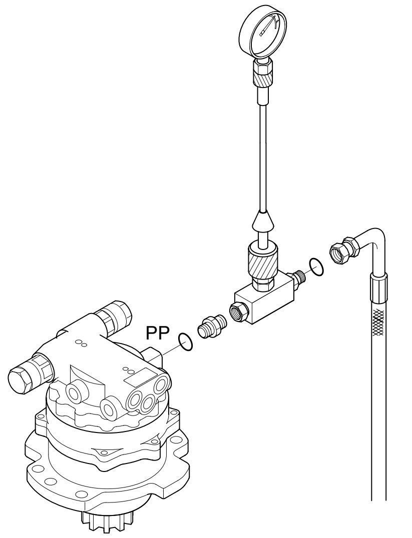
① Stop the engine.

② Push the pressure release button to bleed air.

③ Install a connector and pressure gauge assembly to swing motor 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.



R27Z96MC16

(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
R25Z-9AK	Brake disengaged	30±5	
	Brake applied	0	

16) MAIN PUMP DELIVERY PRESSURE

(1) Preparation

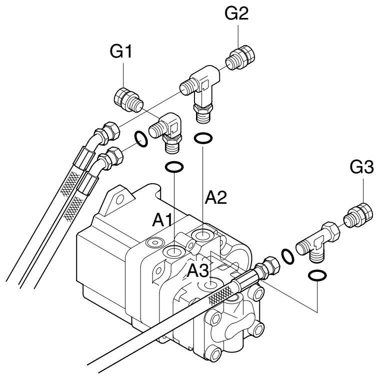
① Stop the engine.

② Push the pressure release button to bleed air.

③ To measure the main pump pressure. 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.



R27Z96MC17

(2) Measurement

① Measure the main pump delivery pressure at high idle.

(3) Evaluation

The average measured pressure should meet the following specifications.

Unit : kgf / cm^2

Model	Engine speed	Standard	Allowable limits	Remarks
R25Z-9AK	High idle	20±5	-	

17) SYSTEM PRESSURE REGULATOR RELIEF SETTING

(1) Preparation

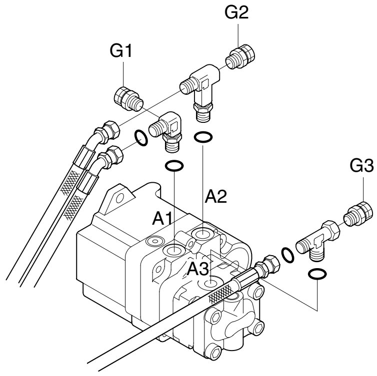
① Stop the engine.

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.



R27Z96MC17

(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
R25Z-9AK	Boom, Arm, Bucket	220±10
	Travel	220±10
	Swing	170±10

GROUP 2 MAJOR COMPONENT

1. MAIN PUMP

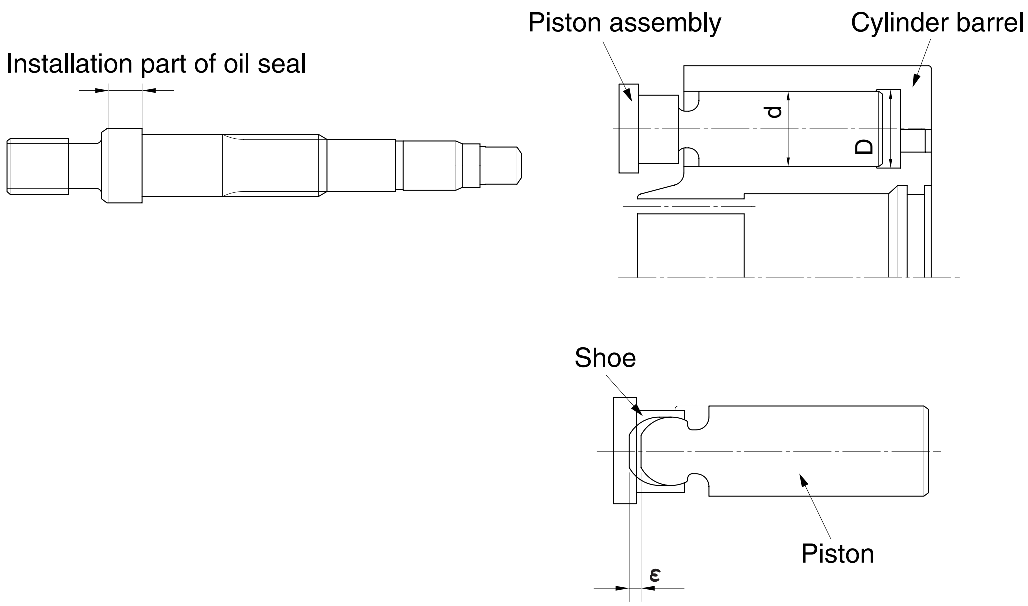
Before inspection, wash the parts well and dry them completely.

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

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

1) INSPECTION POINTS WHEN DISASSEMBLED

Part	Extent of the damage	Inspection standard	Action
Shaft (3)	Excessive wear on the seal surface.	Worn depth : 0.025 mm or more	Replace the shaft.
Valve plate (5)	Excessive wear or damages on the sliding surface.	Worn depth : 0.020 mm or more	Replace the cylinder barrel kit.
Cylinder barrel (4)	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).	0.050 mm or more	Replace the cylinder barrel kit.
Piston (6), Shoe (7)	Wear of joint section	Play (ε) between the shoe and the piston (0.2 mm or more by hand operation).	Replace the cylinder barrel kit.
Seals (O-rings, gasket, etc.)	Damage, excessive rust	-	Replace each part.



R27Z96MC01

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)	· 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	· 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.

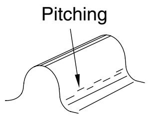
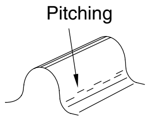
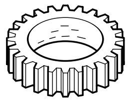
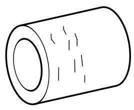
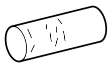
3. SWING MOTOR

1) POSSIBLE REASONS FOR THE TROUBLE AND ITS COUNTERMEASURES

Trouble	Possible reasons		Countermeasure
Motor does not move. The supplied pressure is enough.	Relief valve	Setting pressure is too low.	Replace the relif valve assembly.
		Faulty operation.	
	Hydraulic motor	Burned inner parts.	Replace the hydraulic motor assembly.
		Too much internal leakage.	
	Reduction gear	Damage to the gears.	Replace the reduction gear assembly.
	Overload	-	Remove the overload.
Insufficient torque	Relief valve	Setting pressure is too low.	Replace the relief valve assembly.
		Faulty operation.	
	Hydraulic motor	Burned sliding parts.	Replace the hydraulic motor assembly.
		Too much internal leakage.	
	Reduction gear	Damage to the gears.	Replace the pinion kit, carrier kit.
		Damage to bearings.	
Abnormal noise	Cavitation noise	Insufficient flow.	Adjust the piping.
	Hydraulic motor	Damage to sliding parts.	Replace the hydraulic motor assembly.
	Reduction gear	Damage to the gears.	Replace the pinion kit, carrier kit.
		Damage to bearings	
	Pinion gear	Damage to the gear surface.	Replace the pinion kit.
Oil leakage	Body gasket	Damage to O-rings.	Replace the O-ring
		Loose bolts.	Re-tighten the loose bolts.
	Pinion gear	Damage to oil seal.	Replace the pinion kit.
Delay in start up, or delay in stopping	Relief valve	Faulty operation.	Replace the relief valve assembly.
	Check valve	Internal leakage.	Replace the body H kit.
Excessive heat generation	Hydraulic motor	Burned or damaged sliding parts.	Replace the hydraulic motor assembly.
	Reduction gear	Damage to the gears.	Replace the pinion kit, carrier kit.
		Damage to bearings	

2) STANDARD FOR PARTS INSPECTION

(1) Reduction gear section

Part	Extent of the damage	Inspection standard	Action
A internal gear	Excessive wear of the surface	Pitching area 5% or more of the gear surface 	Replace the pinion kit.
Carrier 1 Carrier 2	Damage to spline section	By visual	Replace the carrier kit.
S1 gear S2 gear b1 gear b2 gear	Excessive wear of the surface	Pitching area 5% or more of the gear surface 	Replace the carrier kit.
	Excessive wear of the bearing surface	By visual pitching, flaking 	
Ring	Excessive wear of the bearing surface	By visual pitching, flaking 	Replace the carrier kit.
Roller	Excessive wear of the bearing surface	By visual pitching, flaking 	Replace the carrier kit.
Other (O-ring, screw, etc.)	Damage, excessive rust	-	Replace each part.

(2) Hydraulic motor section

Part	Extent of the damage	Inspection standard	Action
Shaft	Excessive wear of the spline section	Worn depth : 25 μm or more	Replace the hydraulic motor assembly.
Cylinder barrel	Excessive wear to the sliding surface of the valve plate	Worn depth : 20 μm or more	Replace the cylinder barrel kit.
Valve plate	Excessive wear to the sliding surface of the cylinder barrel	Worn depth : 20 μm or more	Replace the cylinder barrel kit.
Piston shoe	Wear of joint section of shoe	Play of piston and shoe : 0.3 mm or more by hand operation	Replace the cylinder barrel kit.
Swash plate	Excessive wear to the sliding surface of the shoe	Worn depth : 0.1 mm or more	Replace the swash plate kit.
Other (O-ring, screw, etc.)	Damage, excessive rust	-	Replace each part.

4. TRAVEL MOTOR

1) MAINTENANCE STANDARD FOR TRAVEL MOTOR

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

(1) Reducer

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

(2) Hydraulic valve and motor

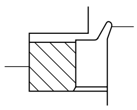
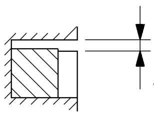
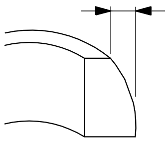
No.	Part name	Point to be checked	Standard	Action
12	Body 1	Spool sliding contact surface	No abnormal damage, wear	Relpace whole body 1 kit
13	Counter valve spool Two-speed spool Shuttle spool	Body 1 sliding contact surface	No abnormal damage, wear	Relpace whole body 1 kit
14	Body 2	Spline tooth surface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

2) FAILURE DIAGNOSIS OF TRAVEL MOTOR

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

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

5. TURNING JOINT

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

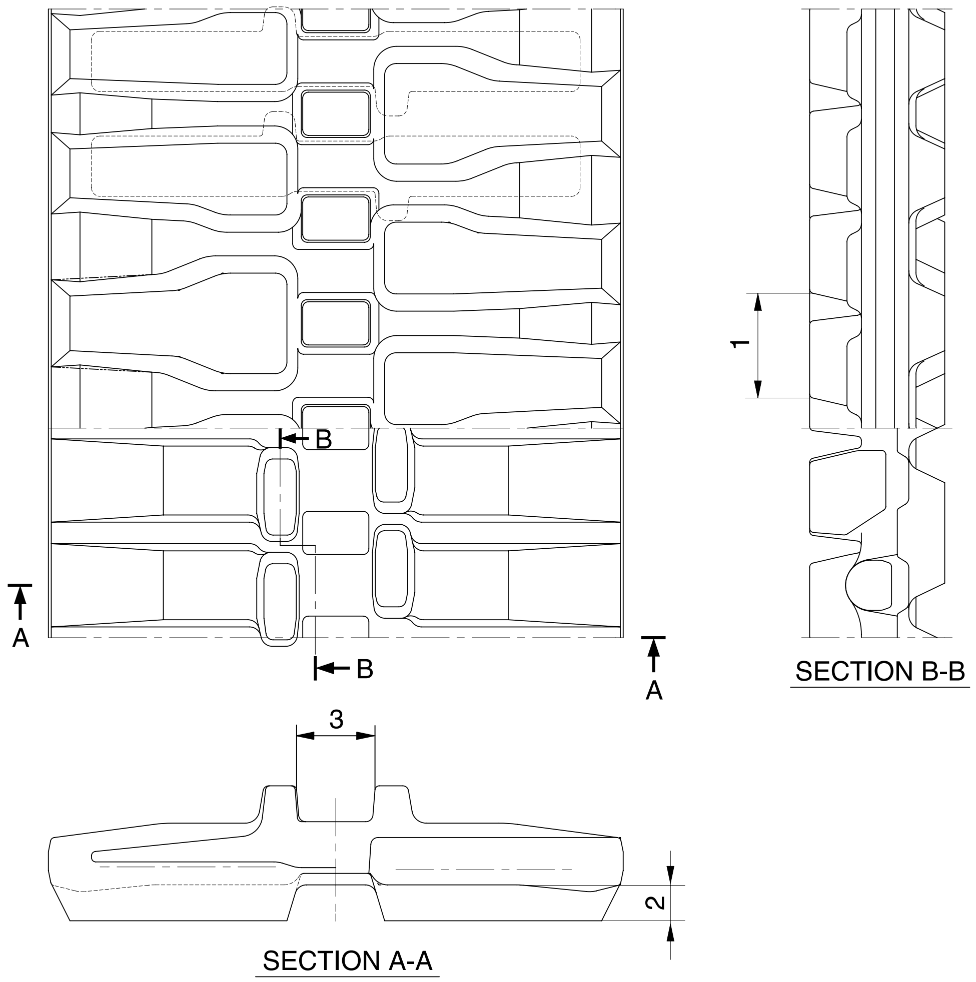
6. CYLINDER

Part name	Inspecting section	Inspection item	Remedy
Piston rod	· Neck of rod pin	· Presence of crack	· Replace
	· Weld on rod hub	· Presence of crack	· Replace
	· Stepped part to which piston is attached.	· Presence of crack	· Replace
	· Threads	· Presence of crack	· Recondition or replace
	· Plated surface	· Plating is not worn off to base metal.	· Replace or replate
		· Rust is not present on plating.	· Replace or replate
		· Scratches are not present.	· Recondition, replate or replace
	· Rod	· Wear of O.D.	· Recondition, replate or replace
	· Bushing at mounting part	· Wear of I.D.	· Replace
Cylinder tube	· Weld on bottom	· Presence of crack	· Replace
	· Weld on head	· Presence of crack	· Replace
	· Weld on hub	· Presence of crack	· Replace
	· Tube interior	· Presence of faults	· Replace if oil leak is seen
	· Bushing at mounting part	· Wear on inner surface	· Replace
Gland	· Bushing	· Flaw on inner surface	· Replace if flaw is deeper than coating

GROUP 3 TRACK AND WORK EQUIPMENT

1. TRACK SHOE

1) RUBBER SHOE SPEC

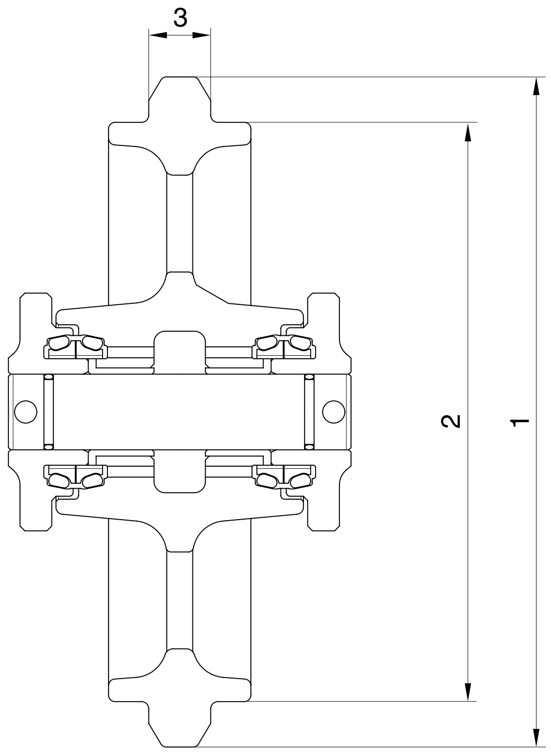


R5576MC17

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

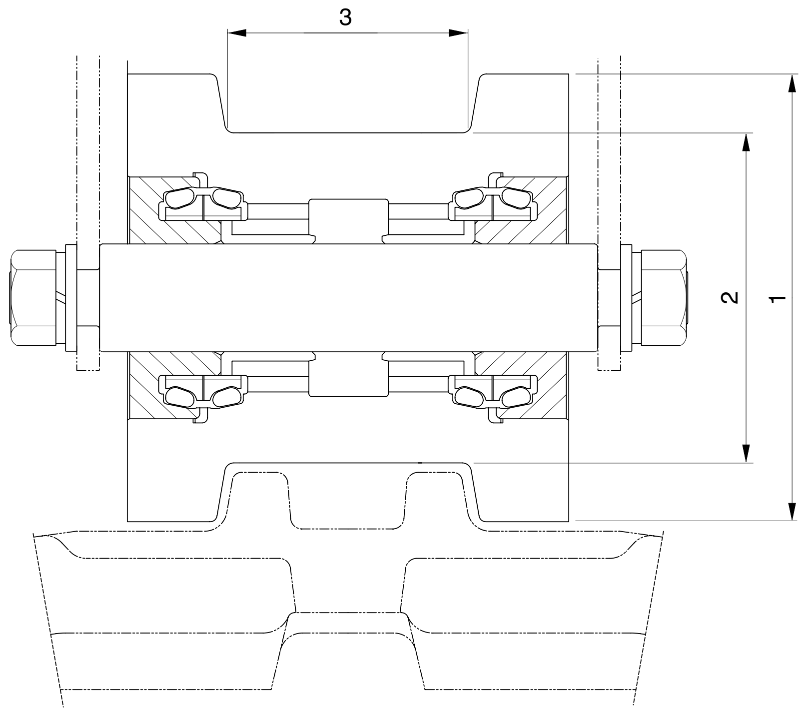


R25Z9A6MC23

Unit : mm

No	Check item		Criteria		Remedy
			Standard size	Repair limit	
1	Outside diameter of flange	Rubber	311	-	Rebuild or replace
2	Outside diameter of thread	Rubber	269	263	
3	Width of flange		29	20.2	

3. TRACK ROLLER

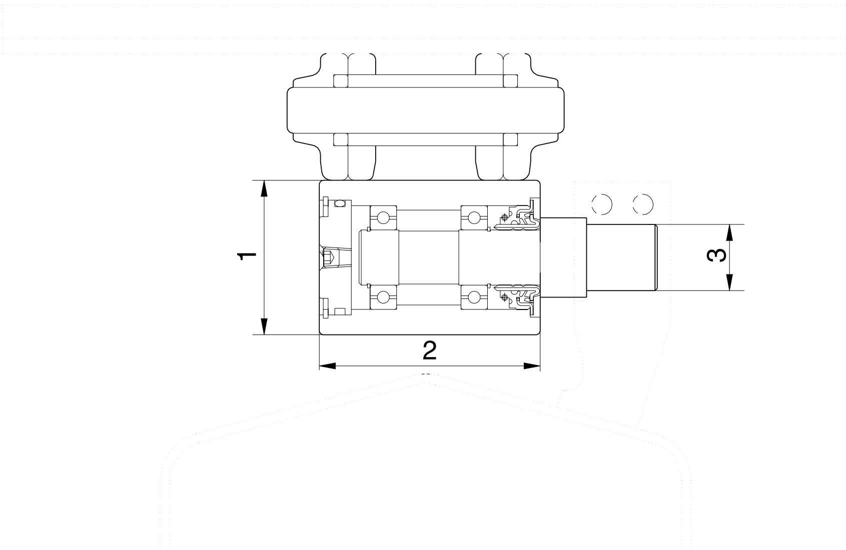


R25Z9AK6MC19

Unit : mm

No	Check item		Criteria		Remedy
			Standard size	Repair limit	
1	Outside diameter of flange	Rubber	ø 135	ø 130	Rebuild or replace
2	Outside diameter of thread	Rubber	ø 95	ø 90	
3	Width of flange		81	86	

4. CARRIER ROLLER

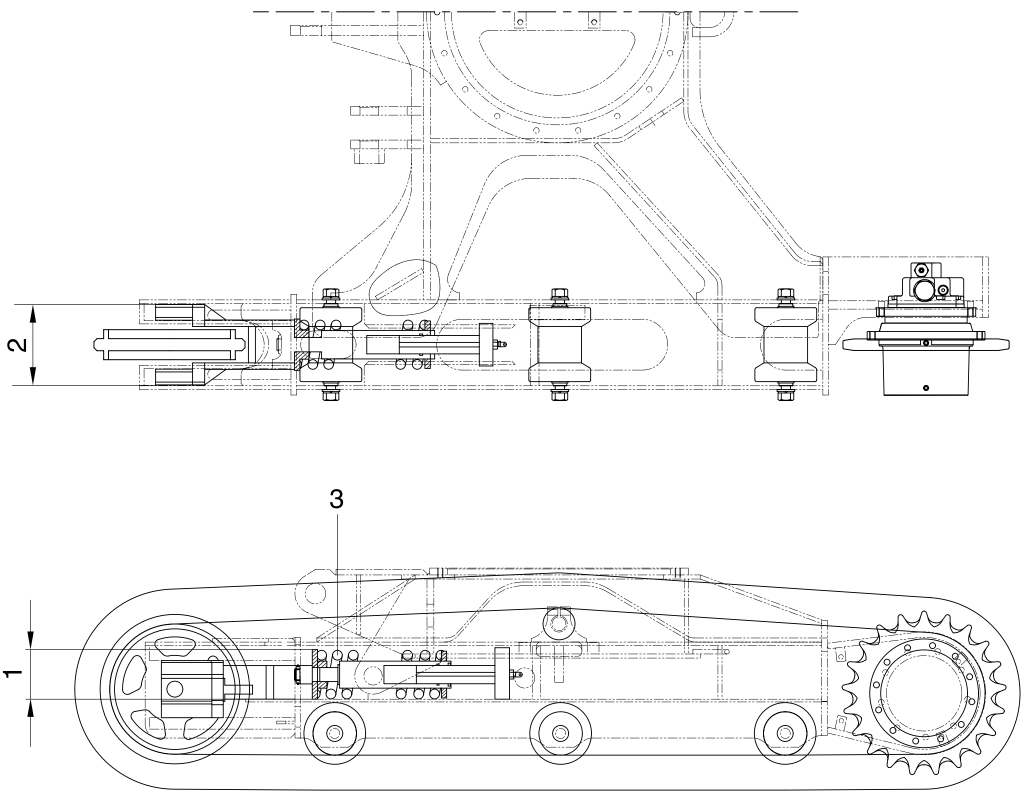


R35Z76MC20

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

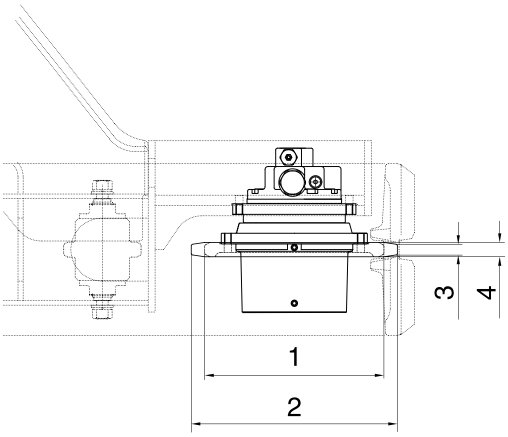


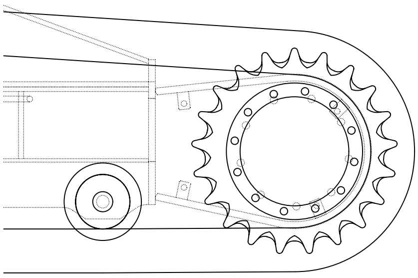
R25Z9AK6MC20

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">112</td><td colspan="2">114</td><td>Rebuild</td></tr>
<tr><td>Idler support</td><td colspan="2">110</td><td colspan="2">112</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">160</td><td colspan="2">164</td><td>Rebuild</td></tr>
<tr><td>Idler guide</td><td colspan="2">156</td><td colspan="2">152</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>280</td><td>230</td><td>2,380 kg</td><td>-</td><td>1,904 kg</td></tr>
</table>

6. SPROCKET



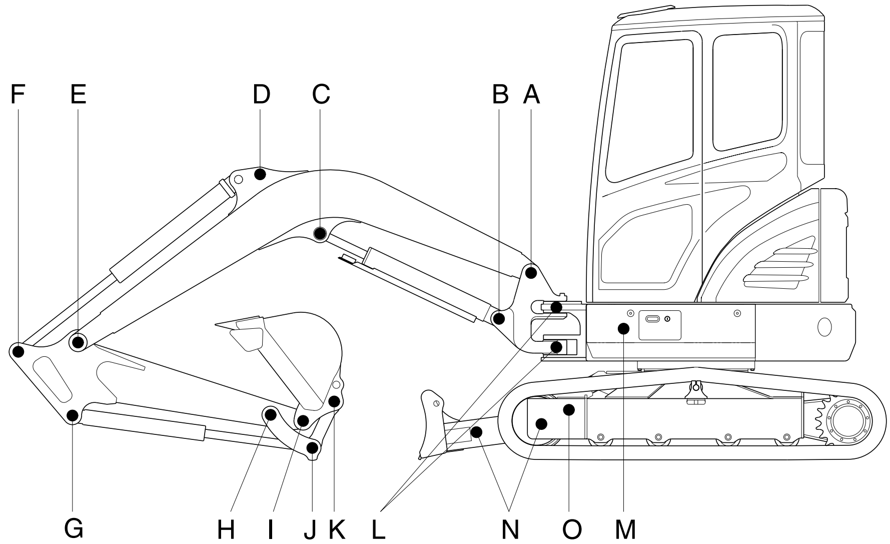


R27Z96MC22

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: Recomm. service limit	Pin: Limit of use	Bushing: Recomm. service limit	Bushing: Limit of use	Remedy & Remark
A	Boom rear	40	39	38.5	40.5	41	Replace
B	Boom cylinder head	40	39	38.5	40.5	41	〃
C	Boom cylinder rod	40	39	38.5	40.5	41	〃
D	Arm cylinder head	35	34	33.5	35.5	36	〃
E	Boom front	35	34	33.5	35.5	36	〃
F	Arm cylinder rod	35	34	33.5	35.5	36	〃
G	Bucket cylinder head	35	34	33.5	35.5	36	〃
H	Arm link	35	34	33.5	35.5	36	〃
I	Bucket and arm link	35	34	33.5	35.5	36	〃
J	Bucket cylinder rod	35	34	33.5	35.5	36	〃
K	Bucket link	35	34	33.5	35.5	36	〃
L	Boom swing post	70	69	68.5	70.5	71	〃
M	Boom swing cylinder	35	34	33.5	35.5	36	〃
N	Blade cylinder	35	34	33.5	35.5	36	〃
O	Blade and frame link	35	34	33.5	35.5	36	〃

SECTION 7 DISASSEMBLY AND ASSEMBLY

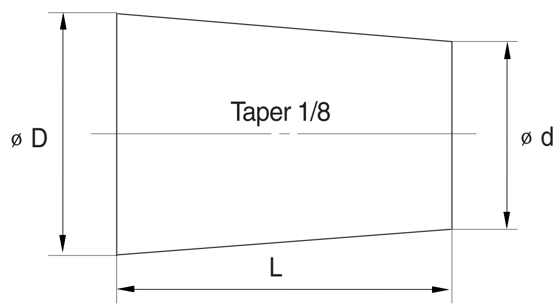
SECTION 7 DISASSEMBLY AND ASSEMBLY

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

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

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



2. INSTALL WORK

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

2) Install the hoses without twisting or interference.

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

4) Bend the cotter pin or lock plate securely.

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

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

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

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

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

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

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

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

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

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

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

(2) Operate the control lever and actuate the hydraulic cylinder 4-5 times, stopping 100 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 × 1.25	7.4±1.5	53.5±10.9
2		Engine mounting bolt (bracket-frame)	M12 × 1.75	13±1.0	94±7.2
3		Radiator mounting bolt, nut	M12 × 1.75	12.8±3.0	93±22.0
4		Coupling mounting bolt	M12 × 1.75	9.25±0.25	67±1.8
5	Hydraulic system	Main pump mounting bolt	M12 × 1.75	10±1.0	72±7.2
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	Power train system	Swing motor mounting bolt	M16 × 2.0	29.7±4.5	215±32.5
11		Swing bearing upper mounting bolt	M12 × 1.75	12.8±3.0	93±22.0
12		Swing bearing lower mounting bolt	M12 × 1.75	12.8±3.0	93±22.0
13		Travel motor mounting bolt	M12 × 1.75	13.8±2.0	100±14.0
14		Sprocket mounting bolt	M12 × 1.75	12.8±3.0	93±22.0
15	Under carriage	Carrier roller mounting bolt, nut	M12 × 1.75	12.8±3.0	93±22.0
16		Track roller mounting bolt	M16 × 2.0	29.7±4.0	215±29.0
17	Others	Counterweight mounting bolt	M20 × 2.5	57.8±6.4	418±46.3
18		Additional counterweight mounting bolt	M24 × 3.0	100±15	723±108
19		Cab and canopy mounting bolt	M12 × 1.75	12.8±3.0	92±22.0
20		Operator's seat mounting bolt	M 8 × 1.25	1.17±0.1	8.5±0.7

※ 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.**

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

· Hydraulic tank quantity : 27 l (7.1 U.S.gal)

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

(6) Disconnect pilot line hoses (25, 90) and remove connectors (49, 50).

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

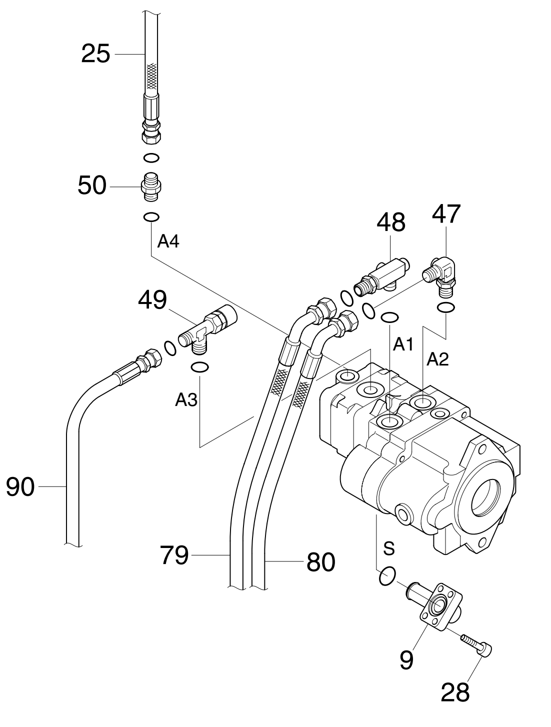
※ When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.

(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.

13031GE18



R25Z9AK7MP101

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.

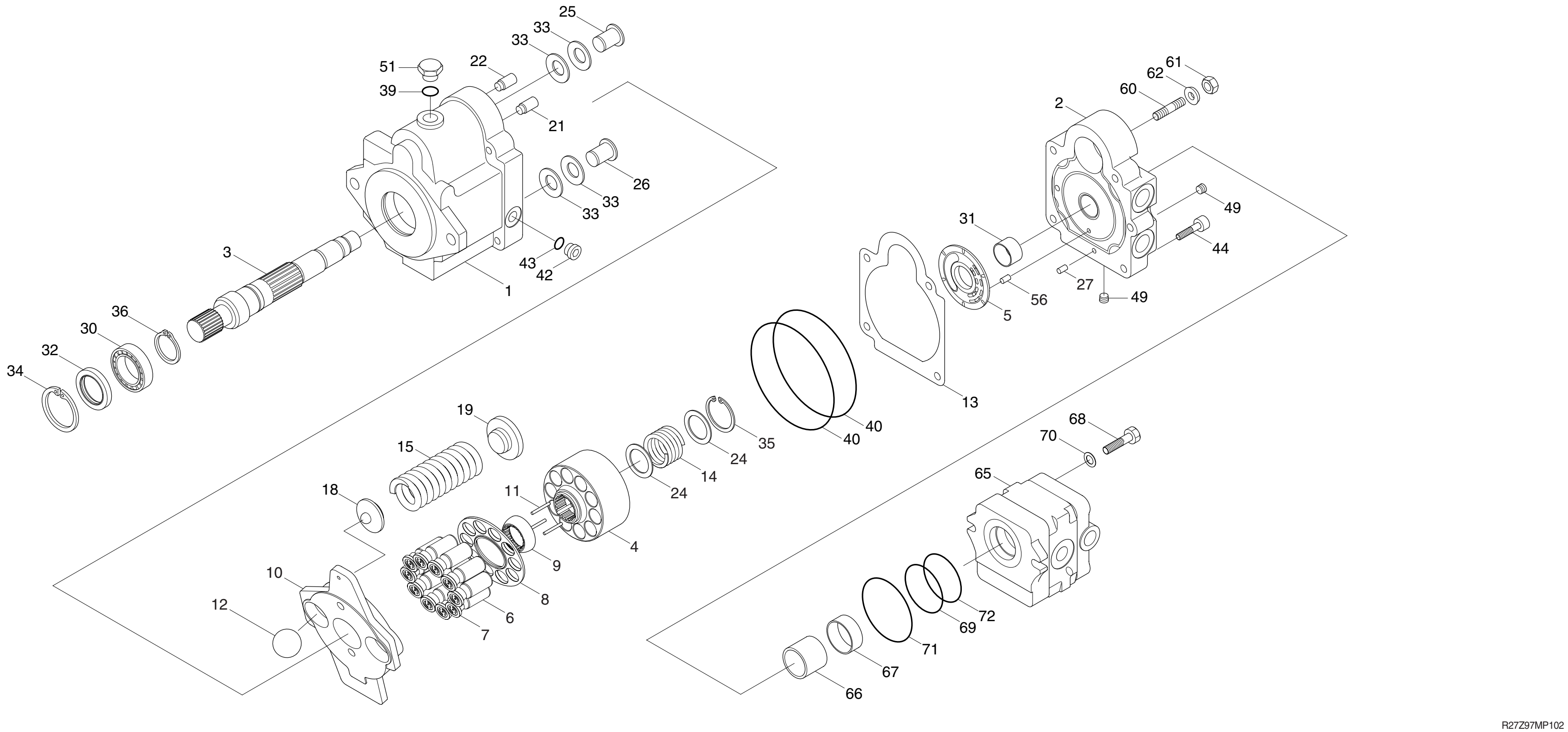
(6) Bleed the air from the hydraulic pump.
① Remove the air vent plug (1EA).
② Tighten plug lightly.
③ Start the engine, run at low idling, and check oil come out from plug.
④ Tighten plug.

(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



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

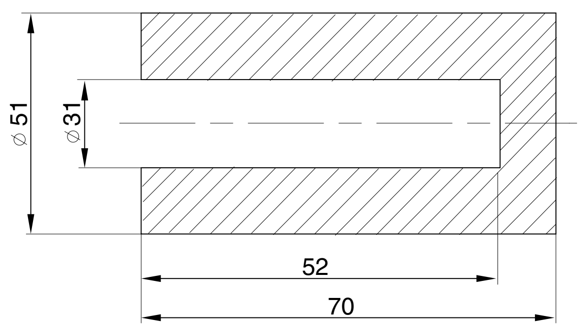
(1) Before disassembling, it is important to have fully understood the internal structure of the pump.

※ 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

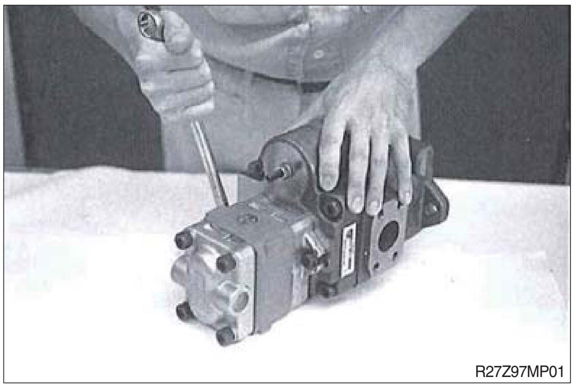
R27Z97MP98

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).

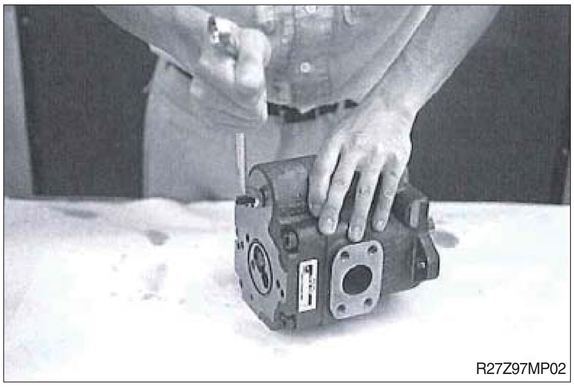


R27Z97MP01

(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.

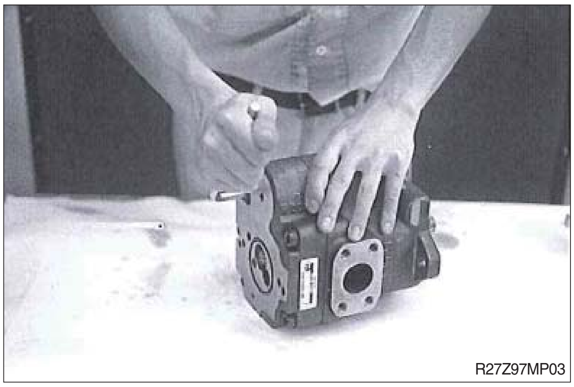
※ Suggest you to measure the outside length of the adjustment screw. Because it is a good help when you readjust it after reassembling.



R27Z97MP02

(3) Separation of body S and body H

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



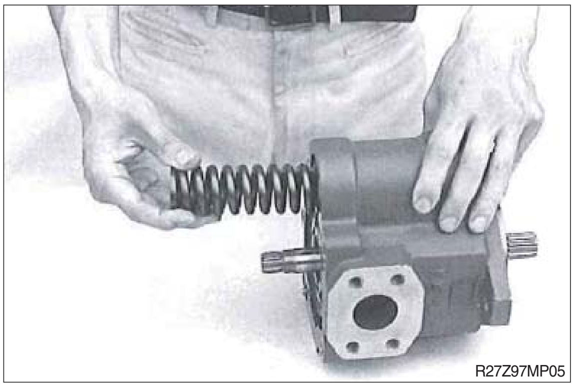
R27Z97MP03

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

R27Z97MP04

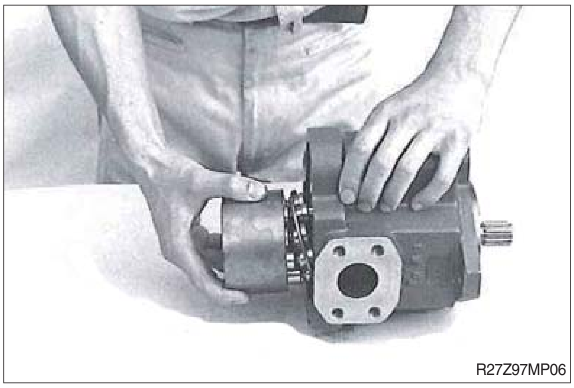
(4) Disassembling of body S kit

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


R27Z97MP05

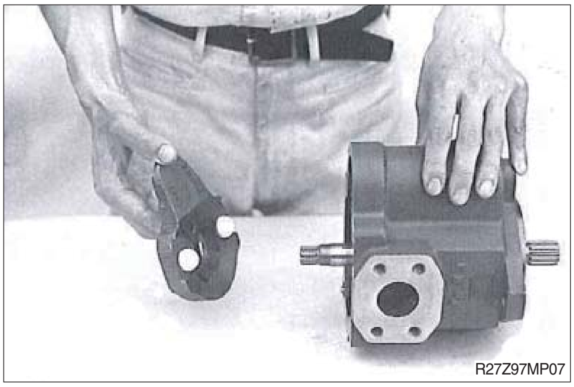
(5) Disassembling of body S kit

Remove cylinder barrel kit.


R27Z97MP06

(6) Disassembling of body S kit

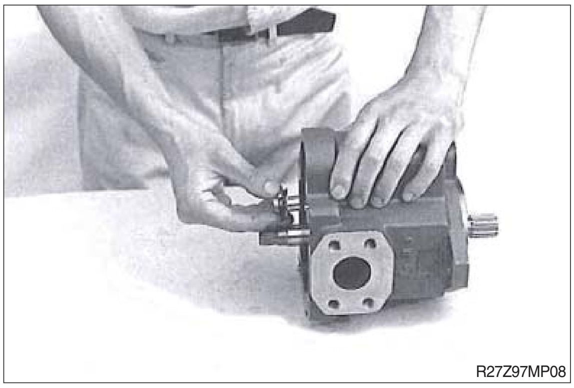
Remove swash plate (10) and two balls (12).


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

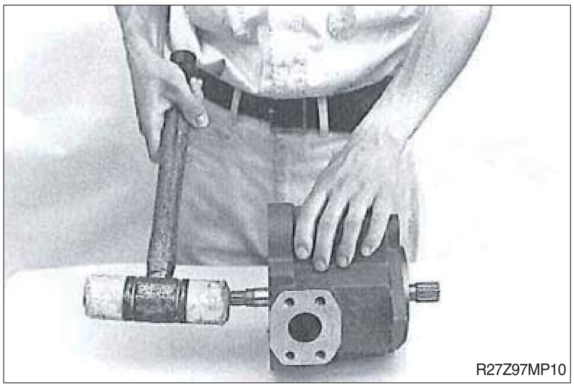
(8) Disassembling of body S kit

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

R27Z97MP09

(9) Disassembling of body S kit

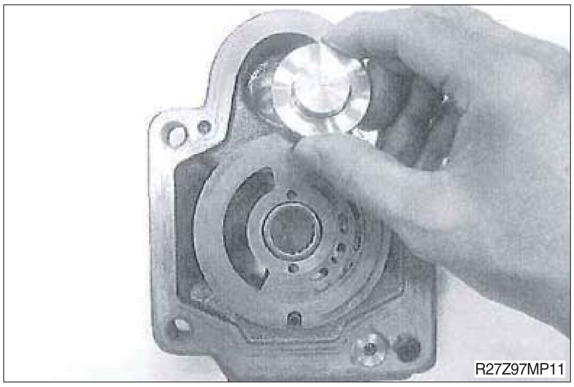
Tap the end of shaft (3) with hammer, then oil seal (32) and shaft with bearing (30) come off.



R27Z97MP10

(10) Disassembling of body H kit

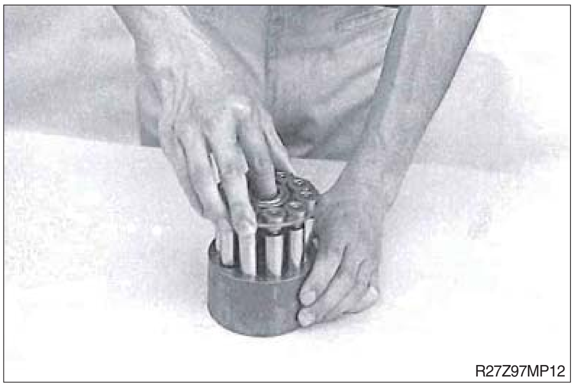
Remove spring guide (19) and valve plate (5) from body H.



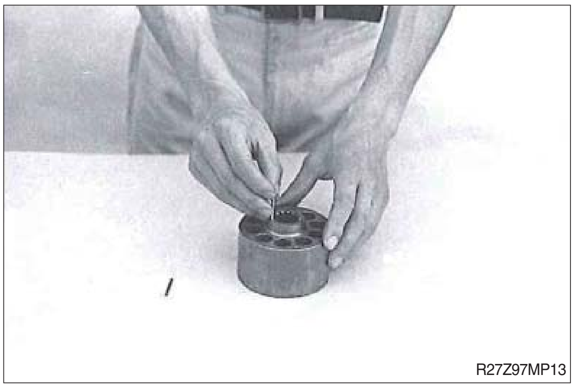
R27Z97MP11

(11) Disassembling of cylinder barrel kit

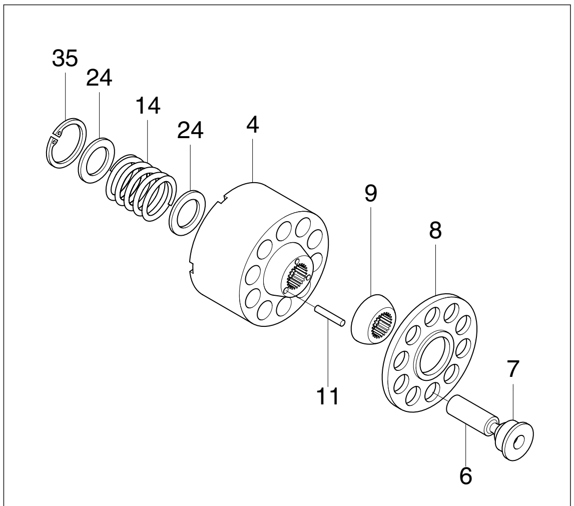
Remove shoe holder (8) on which piston shoe assemblies (6) and (7) are set and disassemble it in the order of barrel holder (9) and needle (11).
Also, take off snap ring (35), retainer (24), spring C (14) and retainer (24), which are set in the cylinder barrel (4) in this order.



R27Z97MP12



R27Z97MP13



R27Z97MP14

4) ASSEMBLING

(1) Precautions during assembling

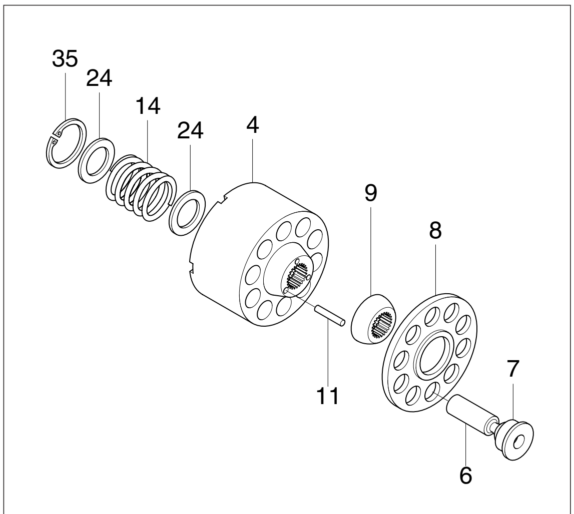
Reverse the above procedures for assembling.

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

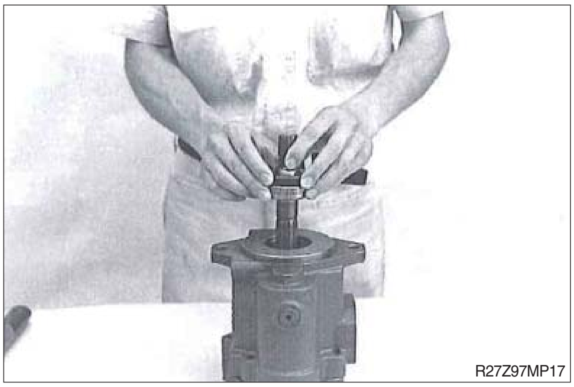

R27Z97MP15


R27Z97MP16

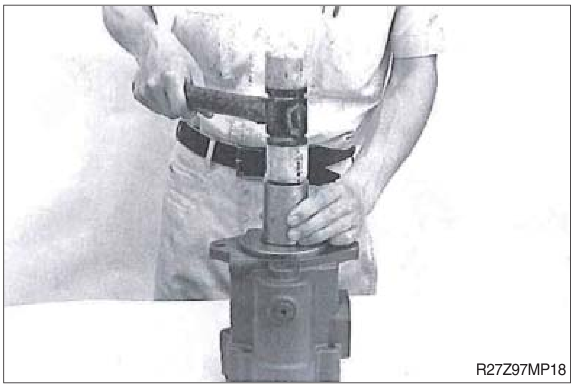
(3) Assembling of body S kit

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



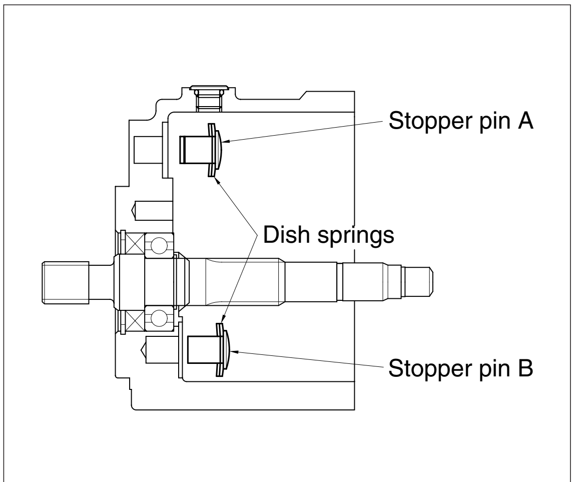
R27Z97MP18

(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.

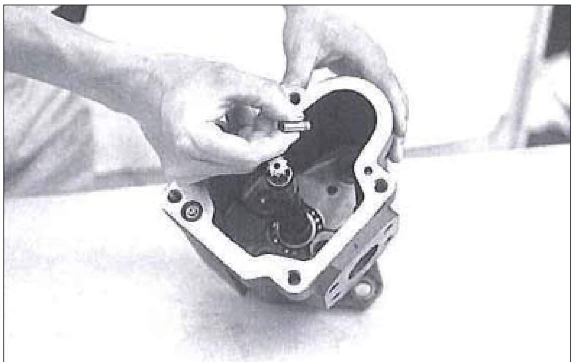


R27Z97MP19

(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.)

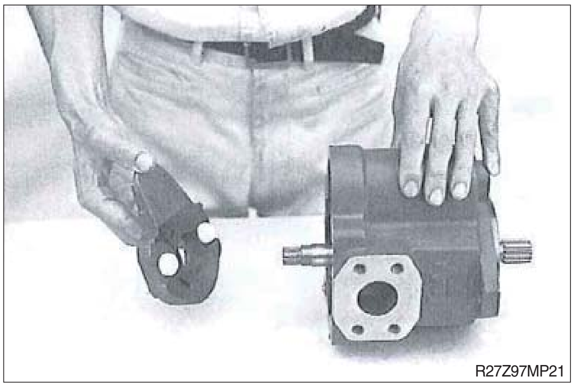


R27Z97MP20

(6) Assembling of body S kit

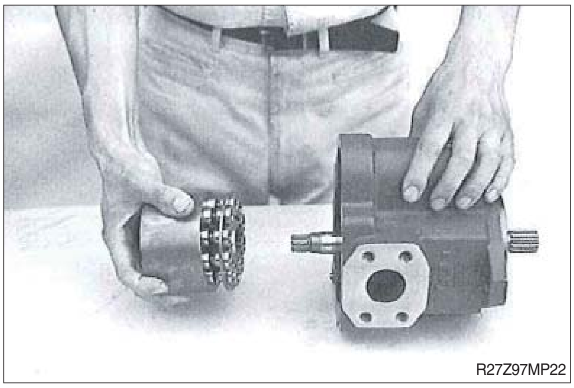
Put two balls (12) in the hole of swash plate (10) and install it in body S.

※ Apply grease on the balls if they drop out.



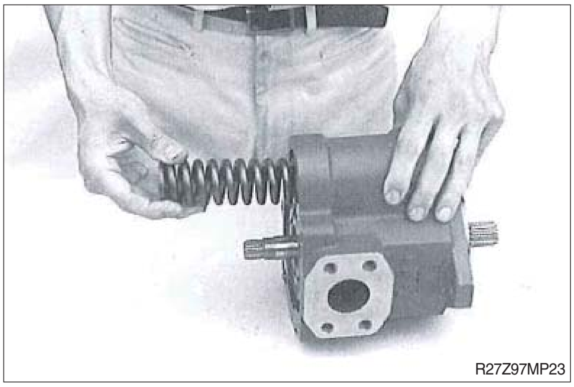
(7) Assembling of body S kit

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



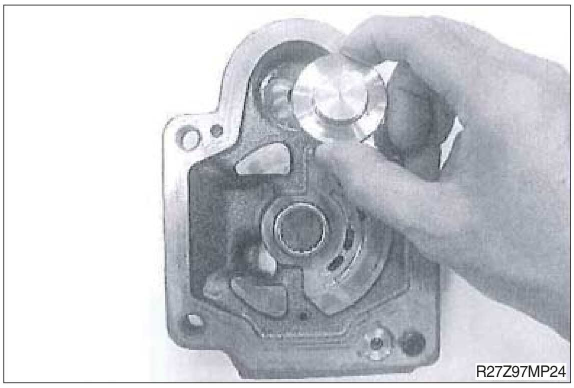
(8) Assembling of body S kit

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



(9) Assembling of body H kit

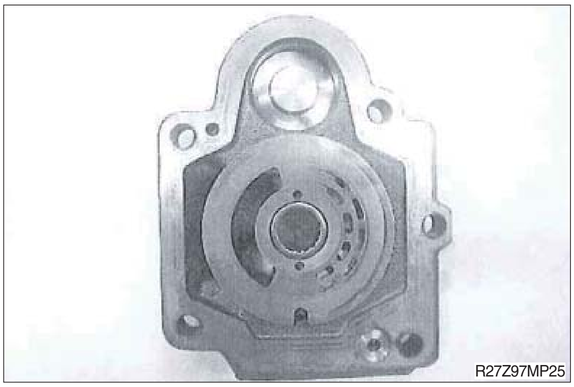
Set spring guide (19) in body H (2).



(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.

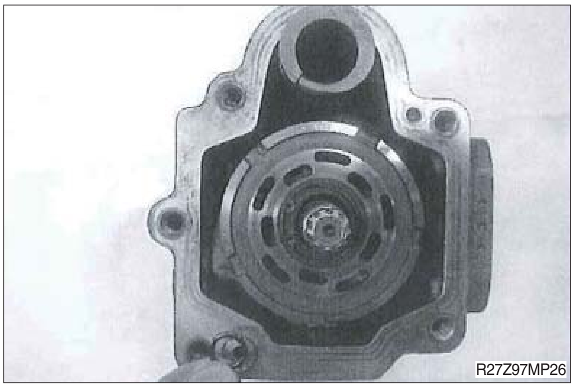


R27Z97MP25

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

Place O-ring (40) on body S.

※ Use new O-ring for assembling.

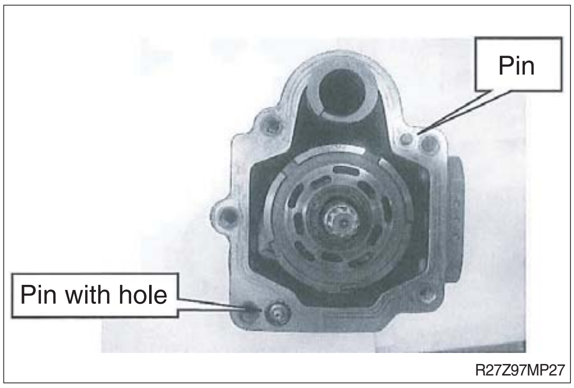


R27Z97MP26

(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.

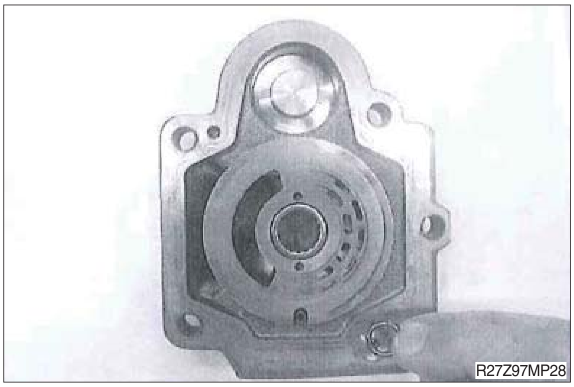


R27Z97MP27

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

Place O-ring (40) on body H.

※ Use new O-ring for assembling.

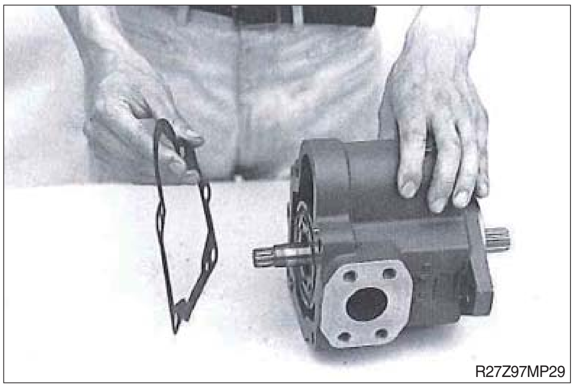


R27Z97MP28

(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.



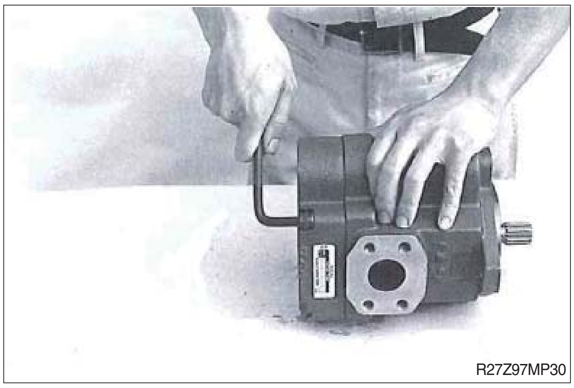
R27Z97MP29

(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)

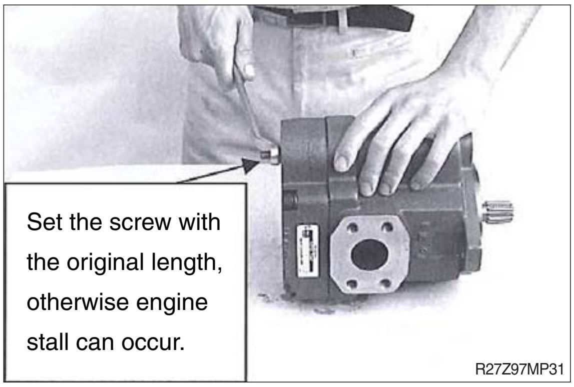


R27Z97MP30

(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)

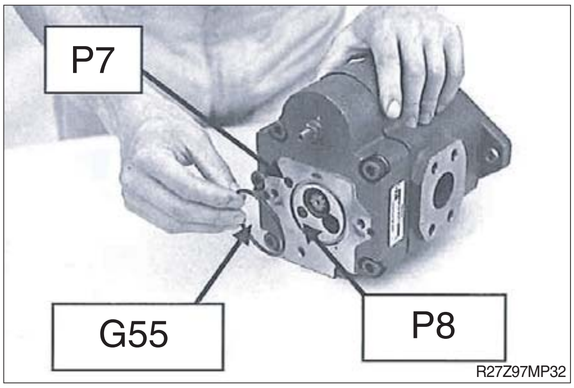


R27Z97MP31

(17) Installation of gear pump kit

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

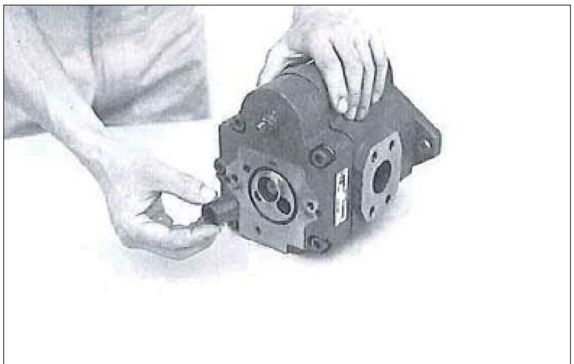
※ Use new O-ring for assembling.



R27Z97MP32

(18) Installation of gear pump kit

Set collar (67) and coupling (66).

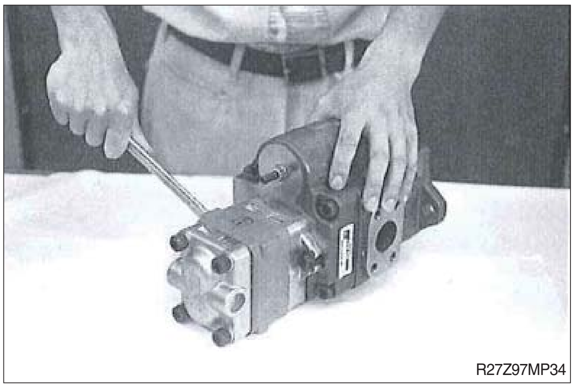


R27Z97MP33

(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 ㎏ (55 ㏈)

(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.

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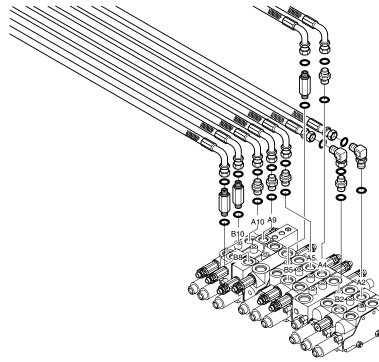
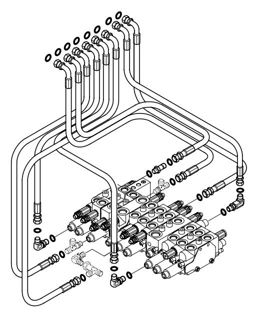
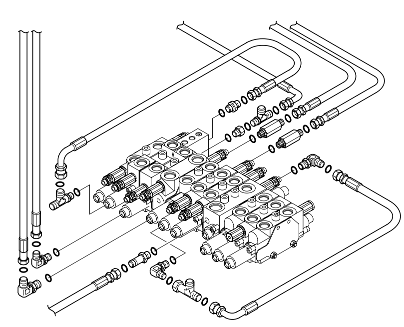


R27Z97MCV01

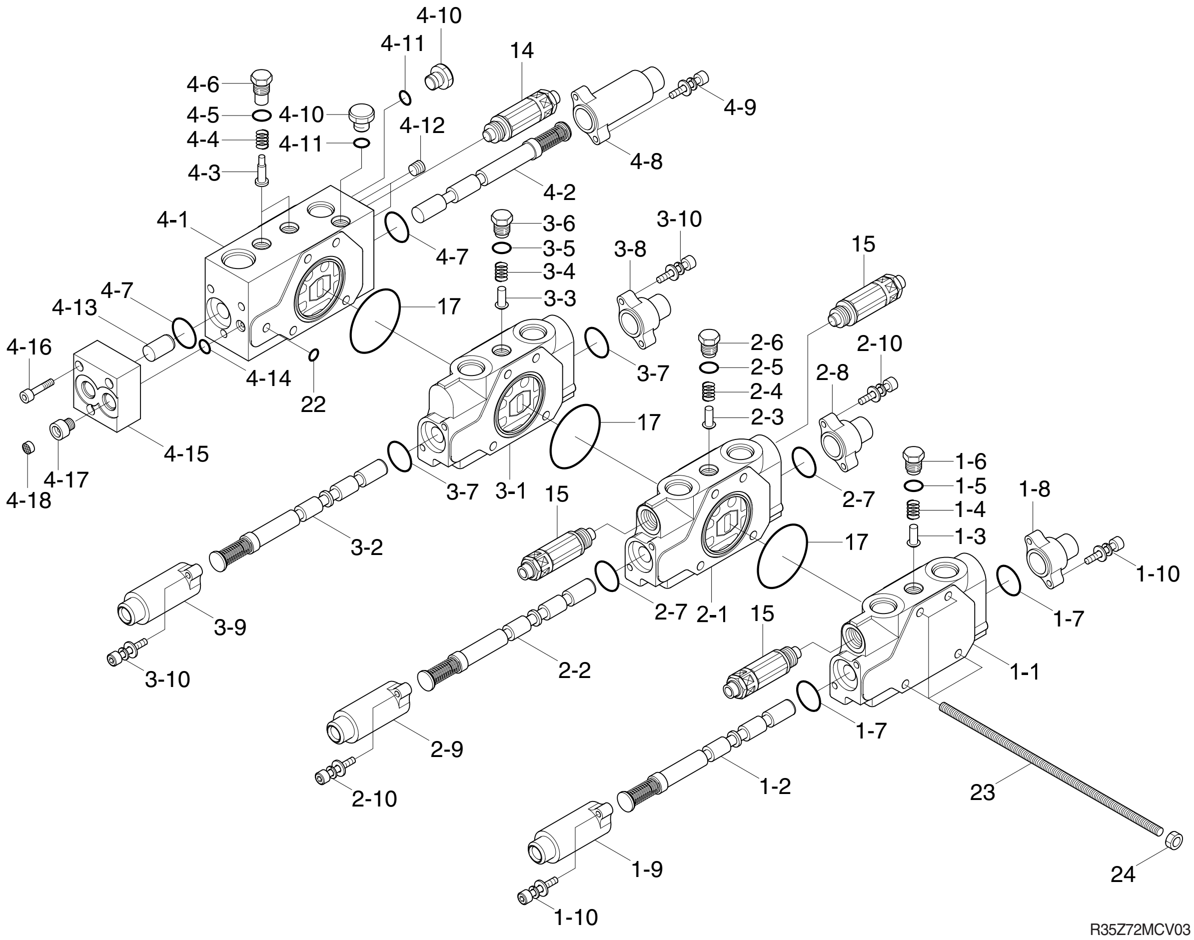


R35Z77MCV02



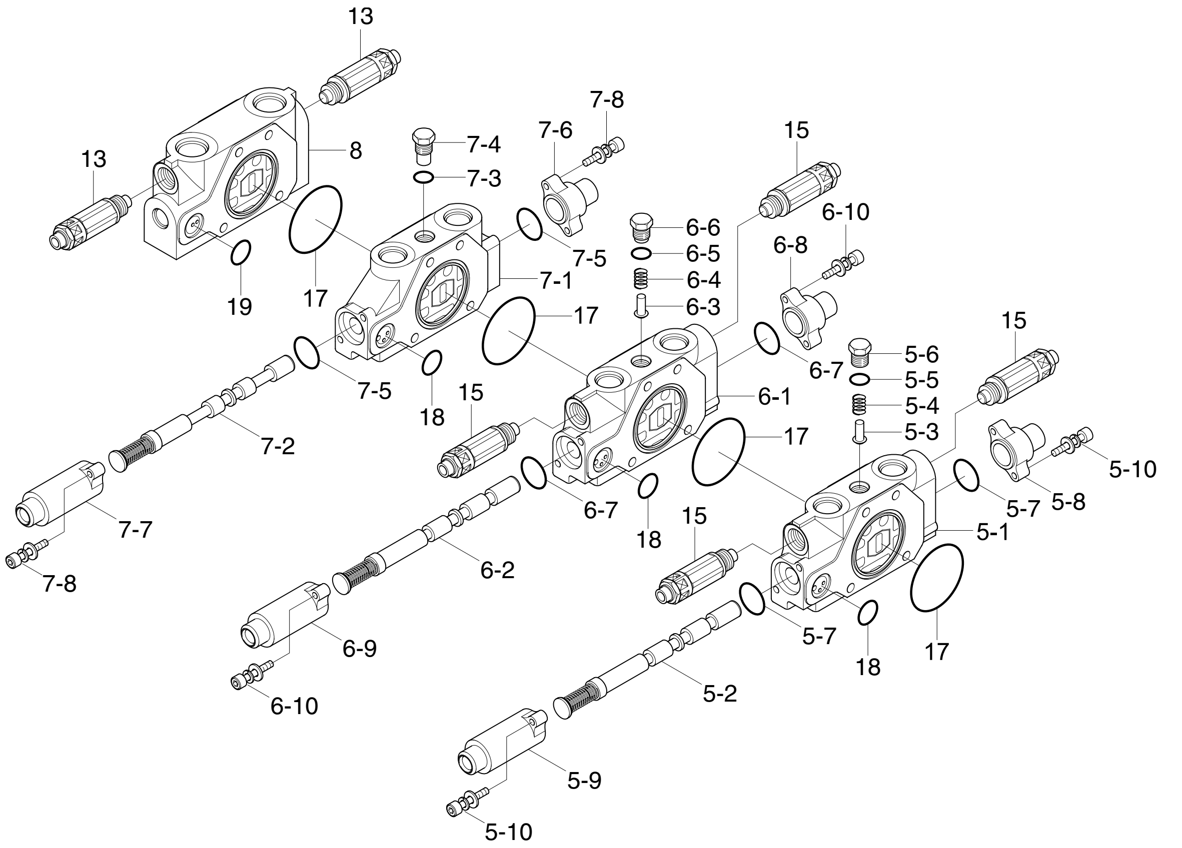
R35Z77MCV03

2. STRUCTURE (1/3)



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

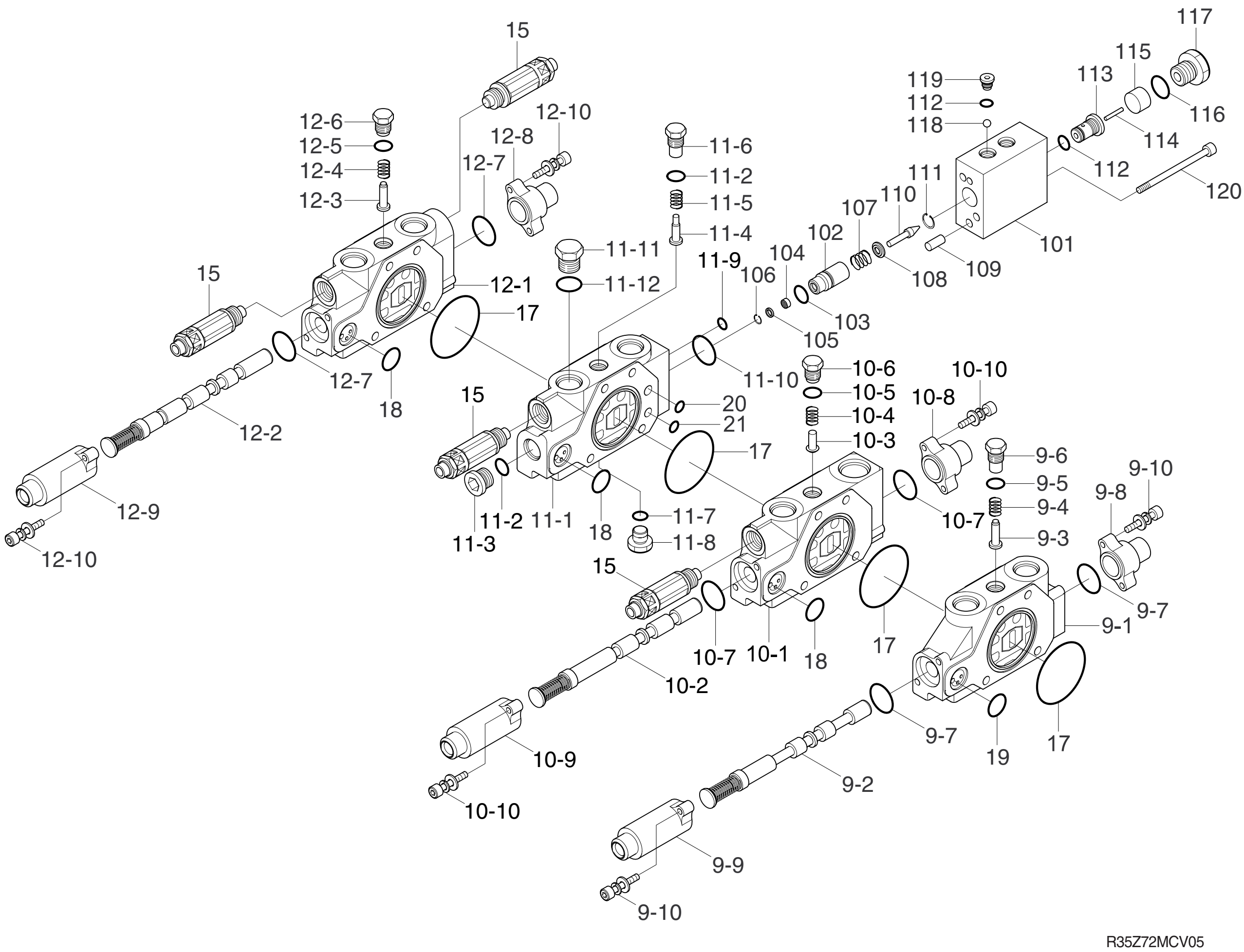
STRUCTURE (2/3)



R35Z72MCV04

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-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-w/washer	17	O-ring
5-9	Cover-pilot	7	Travel work block	18	O-ring
5-10	Bolt-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)



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-w/washer	12-4	Spring	106	Ring-retaining
9-4	Spring	11	Boom lock valve	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-w/washer	112	O-ring
9-10	Bolt-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-hexagon

3. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

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

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

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

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

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

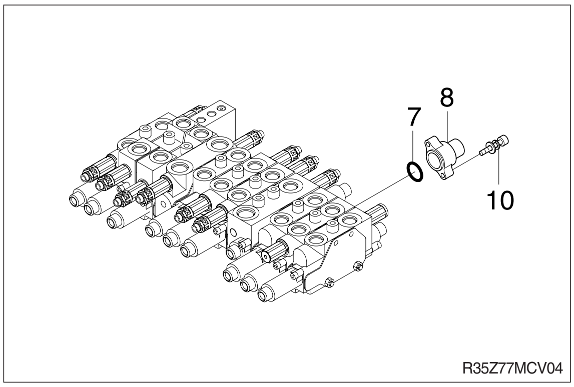
2) TOOLS

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

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

3) DISASSEMBLY

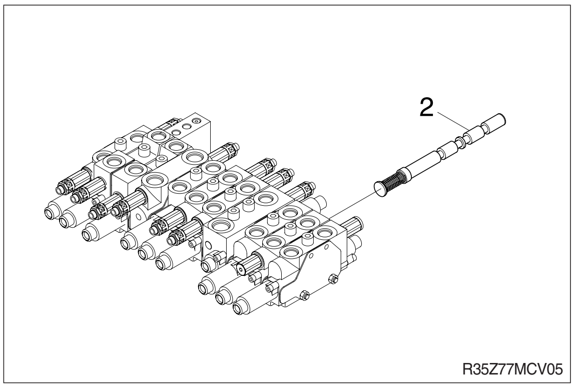
(1) Disassembly of spools (pilot type)



① Loosen hexagon socket head bolts (10) with washer.
(Hexagon wrench : 5 ㎜)

② Remove the pilot cover (8).

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



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

※ When extracting each spool from its body, pay attention not to damage the body.

※ When extracting each spool assembly, it must be extracted from spring side only.

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

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

(2) Disassembly of holding valve (boom 1)

① Loosen hexagon socket head bolts(120). (Hexagon wrench : 5 ㎜)

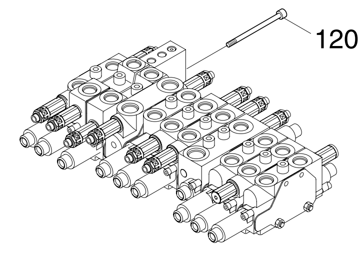
② Remove the holding valve.

※ Pay attention not to lose the O-ring and the poppet under the pilot cover.

※ Pay attention not to damage the "piston A" under pilot cover.

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

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



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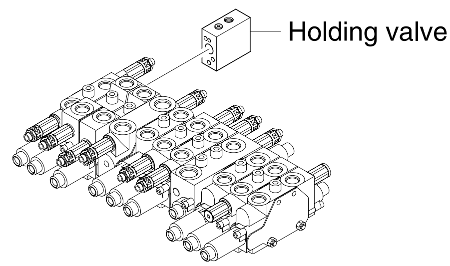


R35Z77MCV14

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

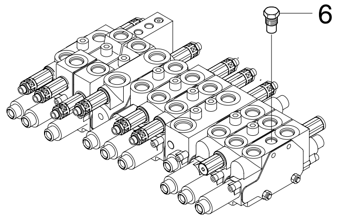
① The load check valve

a. Fix the body to suitable work bench.

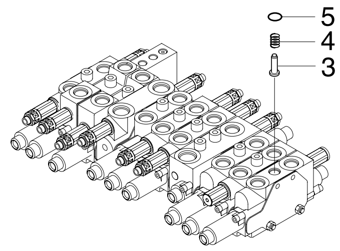
※ Pay attention not to damage the body.

b. Loosen the plug (6)
(Hexagon wrench : 10 mm).

c. Remove the O-ring (5), spring (4) and the load check valve (3) with pincers or magnet.



R35Z77MCV11



R35Z77MCV12

(4) Disassembly of the main and overload relief valve

① Fix the body to suitable work bench.

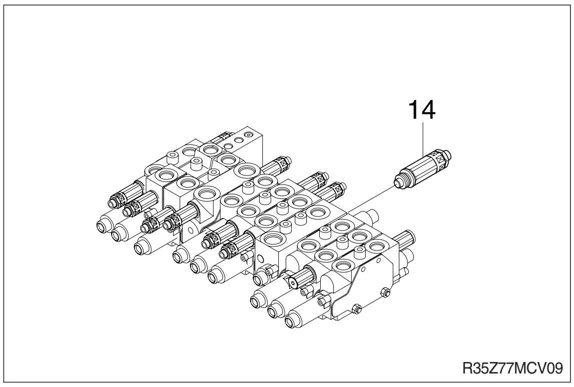
② Remove the main relief valve (14). (Spanner : 30 ㎜)

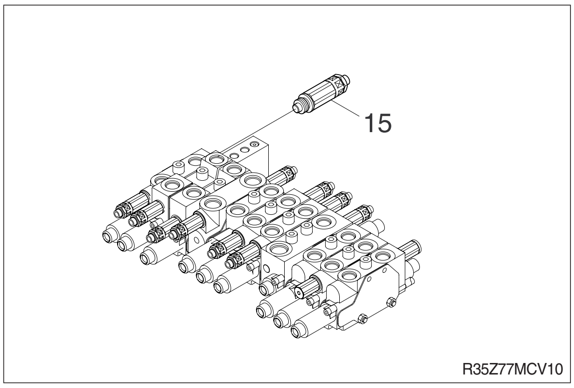
③ Remove the overload relief valve (15). (Spanner : 22 ㎜)

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

※ Pay attention not to damage seat face.

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

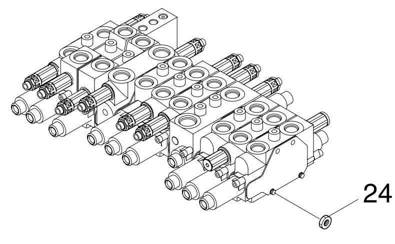




(5) Disassembly of the block assembly

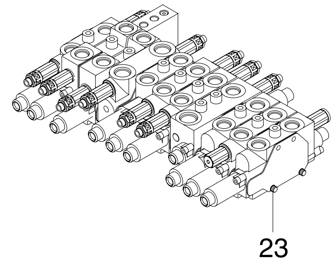
① Fix the body to suitable work bench.

② Remove the nut (24).
(Spanner : 13 ㎜)



R35Z77MCV15

※ Do not removed the tie bolt (23).



R35Z77MCV16

(6) Inspection after disassembly

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

① Control valve

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

② Relief valve

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

4) ASSEMBLY

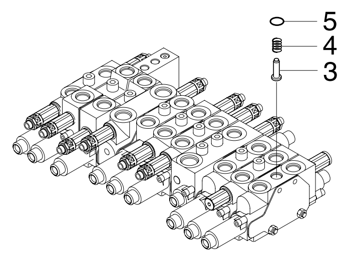
(1) General precaution

① In this assembly section, explanation only is shown.
For further understanding, please refer to the figures shown in the previous structure & disassembly section.
② Pay close attention to keeping all seals free from handling damage and inspect carefully for damage before using them.
③ Apply clean grease or hydraulic oil to the seal so as to ensure it is fully lubricated before assembly.
④ Do not stretch seals so much as to deform them permanently.
⑤ In fitting O-rings, pay close attention not to roll them into their final position in addition, a twisted O-ring cannot easily untwist itself naturally and could thereby cause inadequate sealing and thereby both internal and external oil leakage.
⑥ Tighten fitting bolts for all sections with a torque wrench adjusted to the respective tightening torque.
⑦ Do not reuse removed O-rings and seals.

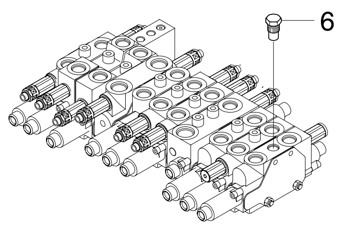
(2) Load check valve

① Assemble the load check valve (3) and O-ring (5), spring (4).
② Put O-rings on to plug (6).
③ Tighten plug to the specified torque.

· Hexagon wrench : 8 mm
· Tightening torque : 3.7 kgf · m
(26.7 lbf · ft)



R35Z77MCV12

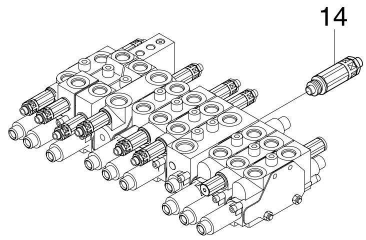


R35Z77MCV11

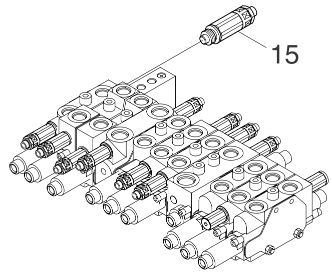
(3) Main relief, port relief valves

① Install the main relief valve (14).
- · Spanner : 30 mm
- · Tightening torque : 6 kgf · m (43.4 lbf · ft)

② Install the over load relief valve (15).
- · Spanner : 22 mm
- · Tightening torque : 4 kgf · m (28.9 lbf · ft)



R35Z77MCV09

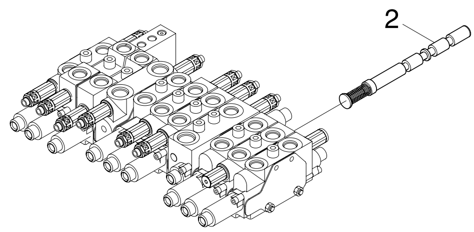


R35Z77MCV10

(4) Main spools

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

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



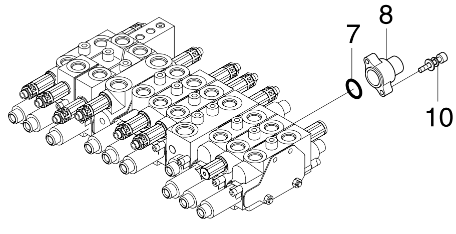
R35Z77MCV05

(5) Covers of pilot type

① Fit spool covers (8) tighten the hexagonal socket head bolts (10) with washer to the specified torque.

- · Hexagon wrench : 5mm
- · Tightening torque : 1~1.1kgf · m (7.2~7.9lbf · ft)

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

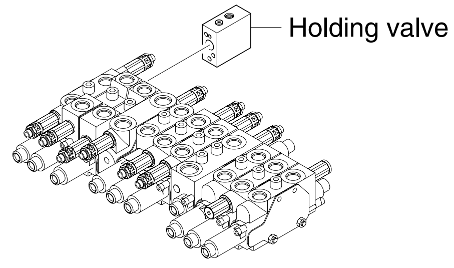


R35Z77MCV04

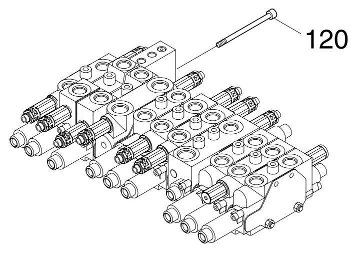
(6) Holding valve

① Fit the holding valve to the body and tighten hexagon socket head bolt (120) to specified torque.

· Hexagon wrench : 5 mm
· Tightening torque :1.1 kgf · m (7.9 lbf · ft)



R35Z77MCV14



R35Z77MCV13

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 (76, 102).

(5) Disconnect pilot line hoses (24, 25, 32).

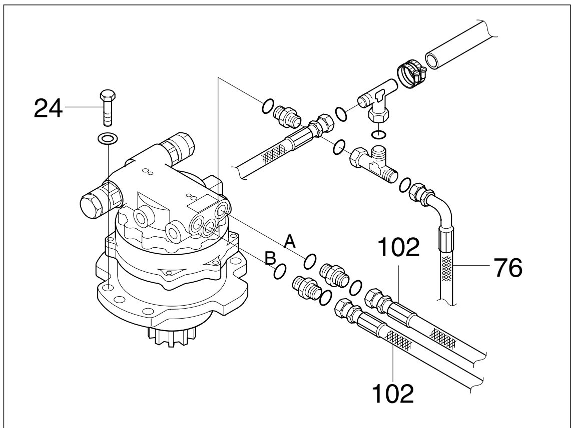
(6) Sling the swing motor assembly (1) and remove the swing motor mounting bolts (24).

※ Motor device weight : 34 kg (75 lb)

(7) Remove the swing motor assembly.

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


13031GE18



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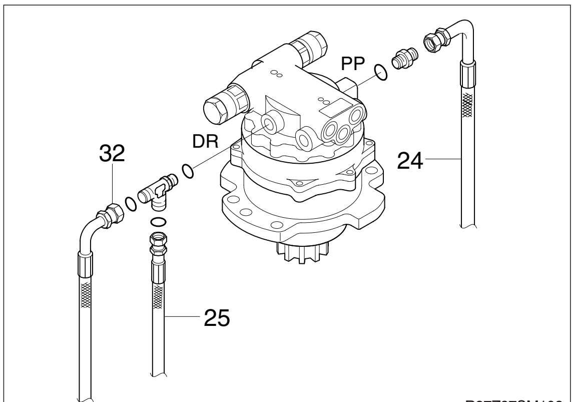


R27Z97SM102

2) INSTALL

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

(2) Bleed the air from the swing motor.

① Remove the air vent plug.

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

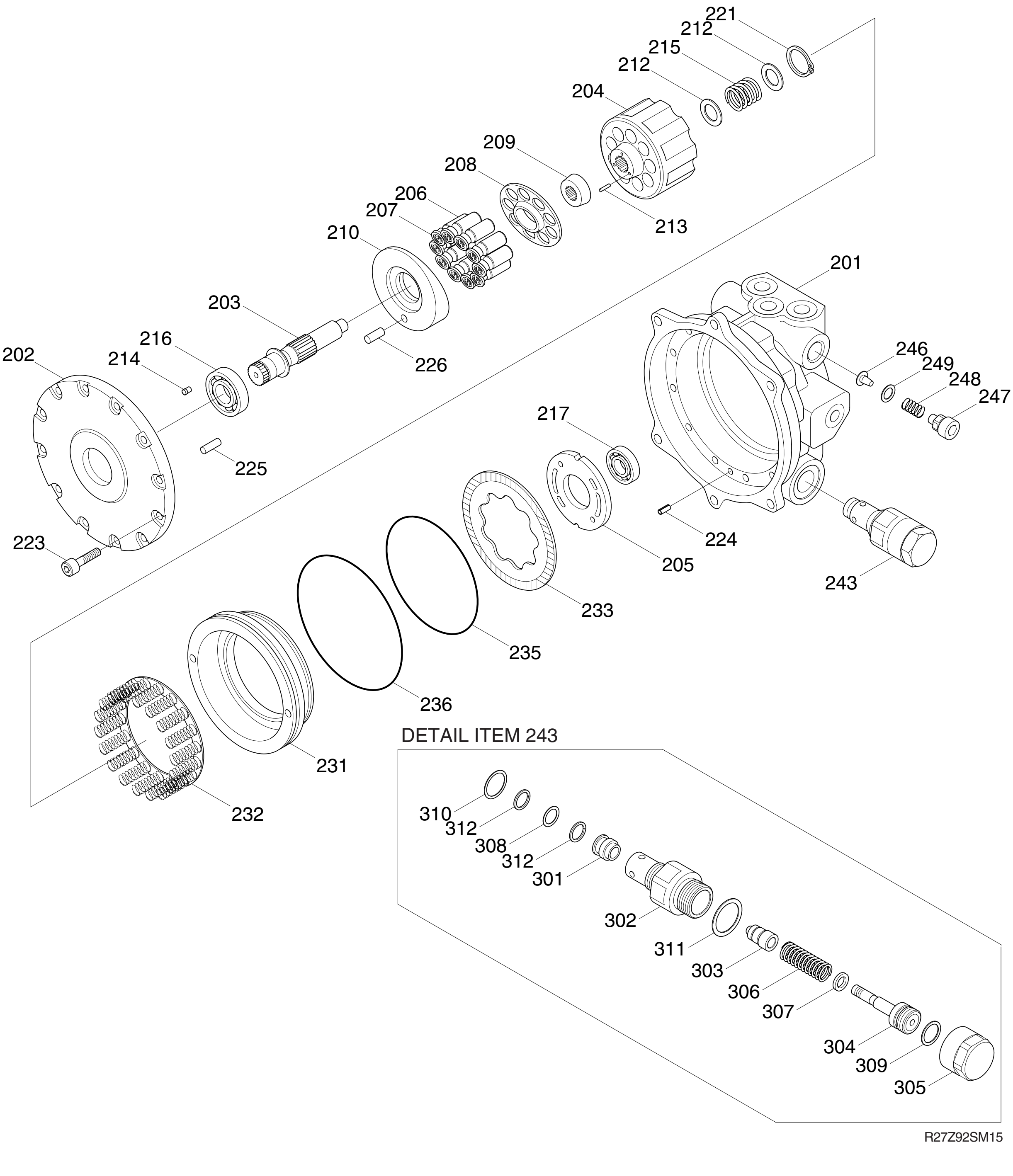
③ Tighten plug lightly.

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

⑤ Tighten plug fully.

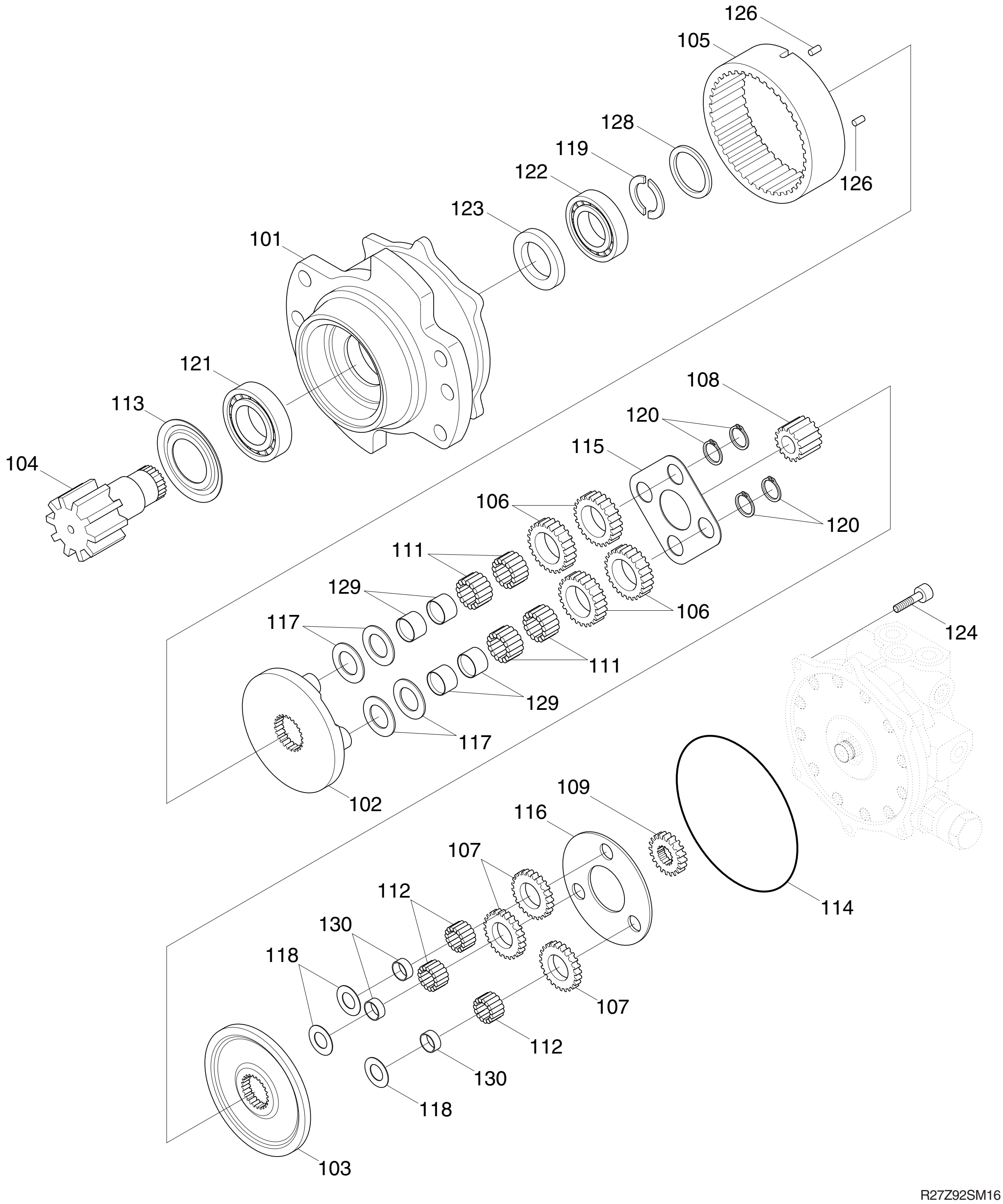
(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2) COMPONENTS (1/2)



201	Body	213	Pin	232	Spring assy	303	Poppet
202	Plate	214	Filter	233	Disk plate	304	Piston
203	Shaft	215	Spring C	235	O-ring	305	Cap
204	Cylinder barrel	216	Bearing	236	O-ring	306	Spring
205	Valve plate	217	Bearing	243	Relief valve	307	Spacer
206	Piston	221	Snap ring	246	Check valve	308	O-ring
207	Shoe	223	Screw	247	Plug	309	O-ring
208	Shoe holder	224	Spring pin	248	Spring	310	O-ring
209	Barrel holder	225	Pin	249	O-ring	311	O-ring
210	Swash plate	226	Pin	301	Seat	312	Back up-ring
212	Retainer	231	Brake piston	302	Retainer		

COMPONENTS (2/2)



101	Body	111	Needle	120	Snap ring
102	Carrier 1	112	Needle	121	Bearing
103	Carrier 2	113	Seal ring	122	Bearing
104	Pinion shaft	114	O-ring	123	Oil seal
105	Internal gear	115	Thrust plate 1	124	Screw
106	Gear B1	116	Thrust plate 2	126	Pin
107	Gear B2	117	Thrust washer 1	128	Ring
108	Gear S1	118	Thrust washer 2	129	Ring 1
109	Gear S2	119	Preload collar	130	Ring 2

2) GENERAL ATTENTION

Please pay attention following points.

(1) Working should be done at the clean place and pay attention not to attach dust, paint cake and water. And prepare the clean box to put into the disassembled parts.

(2) Before disassembling, clean up the dust which is attached to the outside of the swing motor and take out paint which is attached to the binding parts by the wire brush.

(3) To make the original position when assembling, make a marking before disassembling.

(4) Give special care to protect parts from damage.

(5) Wash parts with washing oil sufficiently.

(6) Check parts whether there is friction loss or seize and take out burr with sand paper.

(7) Change the seals and snap rings to new ones.

3) DISASSEMBLY AND ASSEMBLY PROCEDURE

As the swing motor composes 2 blocks (hydraulic motor and reduction gear), explain each block disassembly and assembly procedure.

And please refer to the page 7-36~37.

4) TOOLS FOR DISASSEMBLY AND ASSEMBLY

No.	Tool	
1 2	Preset type hand torque wrench	45 N (JIS B4650) 90 N (JIS B4650)
3 4 5	Hexagon bar bit for above wrench	Two-plane width 6 Two-plane width 8
6	Single purpose type hand torque	T = 15±1.5 kgf · m (108±10.8 lbf · ft) Two-plane 36
7 8 9	Hexagon bar wrench	Two-plane width 6 Two-plane width 8
10	Spanner	Two-plane width 36
11	Minus driver	Width 6~10
12 13	Snap ring pliers	ø 28 For hole ø 22 For shaft
14	Hammer	-
15	Plastic hammer	-
16 17 18 19 20	Other	Grease (Oil designated hydraulic oil) Wire brush Sand paper Anti-loose adhesive (three bond #1305)

3. DISASSEMBLY

1) HYDRAULIC MOTOR

(1) Loose the hexagon socket head cap bolts (124), and take out the hydraulic motor assembly from the reduction gear body.

· Tools required :
Hexagon bar wrench : 6 mm

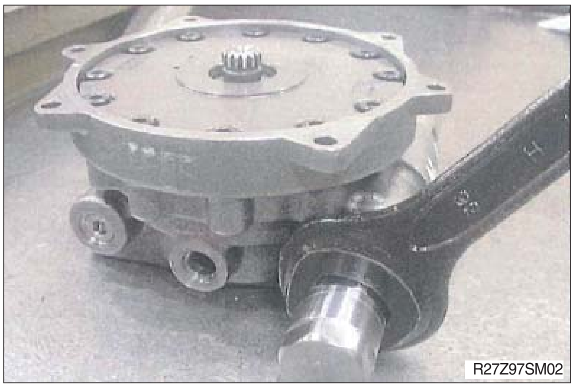
※ When taking out the hydraulic motor assembly from the reduction gear body, the drain port should be open.
When it is difficult to take out, insert the minus driver into the binding face to the body and take out the burr completely.

R27Z97SM01

(2) Take out the relief valve assembly.

· Tools required :
Spanner : 36 mm

※ Do not disassemble the relief valve assembly, unless it is necessary.



R27Z97SM02

(3) Loose the hexagon socket head cap bolts (223), and take out it.

· Tools required :
Hexagon bar wrench : 6 mm

R27Z97SM03

(4) Take out the plate S (202).

※ Pay attention not to drop off swash plate.

R27Z97SM04

(5) Take out the swash plate (210) and the shaft kit from the plate S (202).

※ When it is difficult to take out the shaft, hit the opposite side slightly by the plastic hammer.
As the bearing (216) is pressed into the shaft, do not disassemble unless it is necessary to change the bearing.


R27Z97SM05

(6) Take out the filter (214) and the parallel pin (225) from the plate S (202).

· Filter (214) : 1 pcs
· Parallel pin (225) : 3 pcs


R27Z97SM06

(7) Take out the spring assembly (232) from the body H (201).

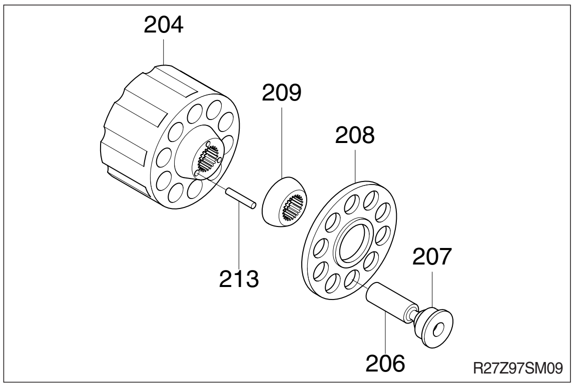

R27Z97SM07

(8) Take out the cylinder barrel kit.

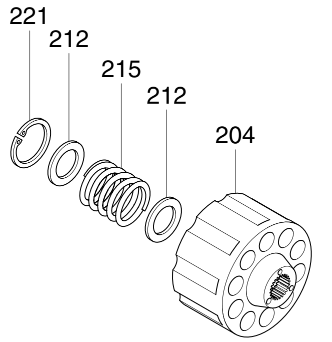
※ The small parts are easily dispersed, pay attention not to miss.
The valve plate (205) is sometime attached, pay attention not to drop out.


R27Z97SM08

(9) Take out the piston (206) and the shoe (207) assembly, the shoe holder (208), the barrel holder (209) and the pin (213).



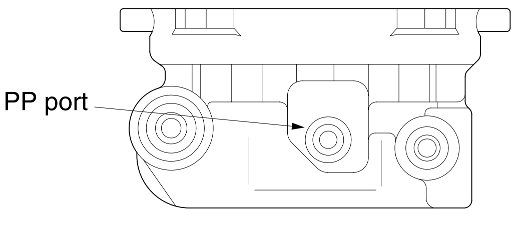
(10) Take out the snap ring (221), the retainer (212) and the spring C (215).
· Tools required :
Snap ring plier : ø 28 for hole



R27Z97SM10

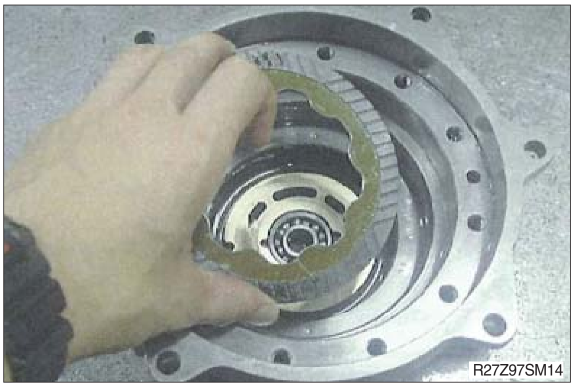
(11) Take out the brake piston (231) and the O-ring (235, 236).

※ The brake piston is drawn out by the air blowing gradually from the PP port.
Pay attention not to draw out the brake piston rapidly by the air blowing gradually.

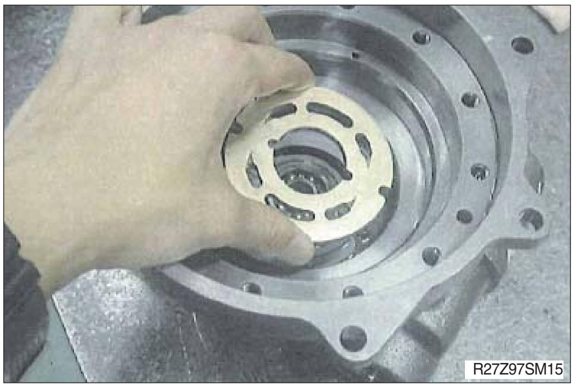


R27Z97SM12

(12) Take out the disk plate (233).



(13) Take out the valve plate (205).

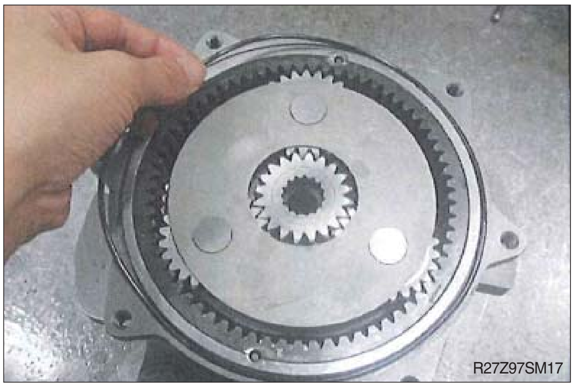


(14) Loose the plug (247), and take out the check valve (246) and the spring (248). (2 locations)

· Tools required :
Hexagon bar wrench : 8 mm

2) REDUCTION GEAR

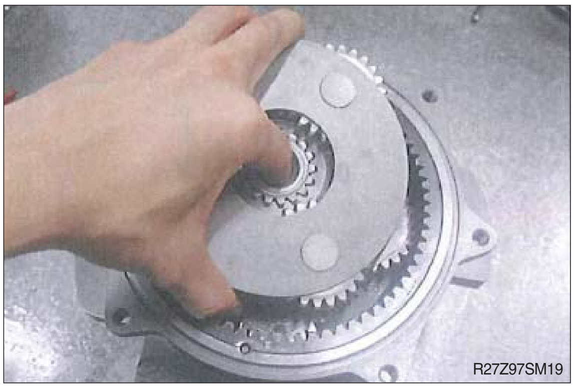
(1) Take out the O-ring (114).



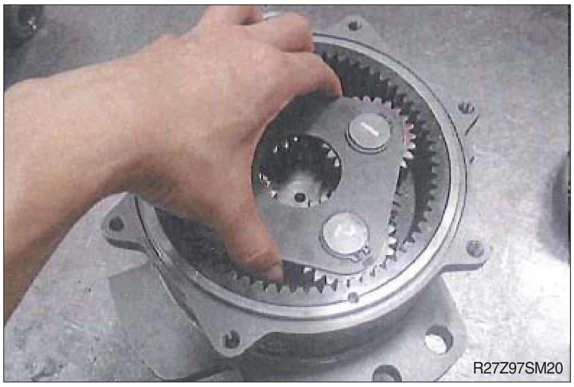
(2) Take out the S2 gear (109).

(3) Take out the carrier 2 kit.

※ Pay attention not to scattered each parts as lifting S1 gear up.

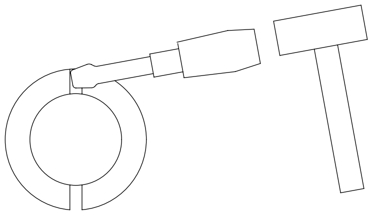


(4) Take out the carrier 1 kit.



(5) Take out the ring (128) and the pre-load collar (119).

※ To attach the minus driver to the gap of 2 pcs pre-load collar, and take out by hitting with the hammer.
As pre-adjusted the gap with the bearing, do not disassemble unless it is necessary.



R27Z97SM21

R27Z97SM22

(6) Take out the pinion kit.

※ To secure the drawing space of the pinion shaft, attach the approximate 130 mm pad to the flange part, and push out the pinion shaft (104) by the press.

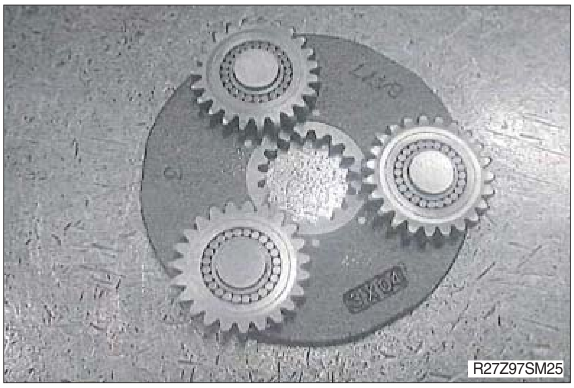
As pre-adjusted the gap with the bearing, do not disassemble unless it is necessary.

R27Z97SM23

(7) Take out the thrust plate 2 (116) from the carrier 2 kit.

R27Z97SM24

(8) Take out the b2 gears (107) and the needles 2 (112) from the carrier 2 kit.



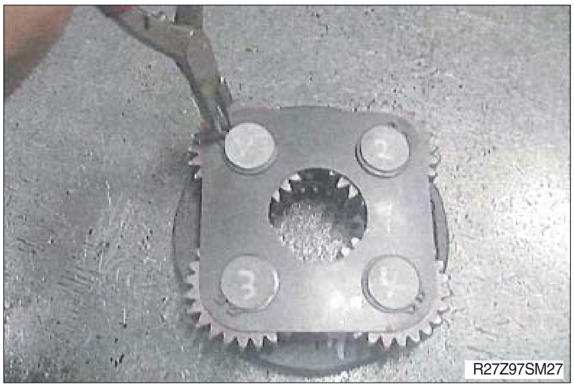
R27Z97SM25

(9) Take out the rings 2 (130) and thrust washers 2 (118) from the carrier 2 kit.

R27Z97SM26

(10) Take out the thrust plate 1 (115) from the carrier 1 kit.

· Tools required :
  Snap ring plier : ø 22 for shaft



R27Z97SM27

(11) Take out the b1 gears (116) and needles 1 (111) from the carrier 1 kit.

R27Z97SM28

(12) Take out the rings 1 (129) and the thrust washers 1 (117) from the carrier 1 kit.

R27Z97SM29

4. ASSEMBLY

1) HYDRAULIC MOTOR SECTION

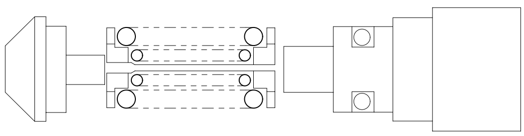
(1) Press-fit the bearing (217) and spring pin (224) into the body H (201).

(2) Insert the 2 check valves (246) (1 pc/side), 2 springs (248) (1pc/side) and 2 plugs (247) (1pc/side) with O-ring (249) in that order into the body H (201).

· Tools required :
Hexagon bar wrench : 8 mm
Torque wrench

※ Apply grease slightly to the O-ring and assemble to pay attention not biting the seals.

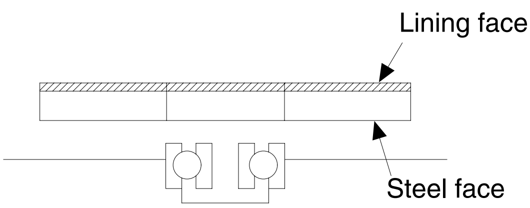
· Plug tightening torque :
6±0.3 kgf · m (43.4±2.17 lbf · ft)



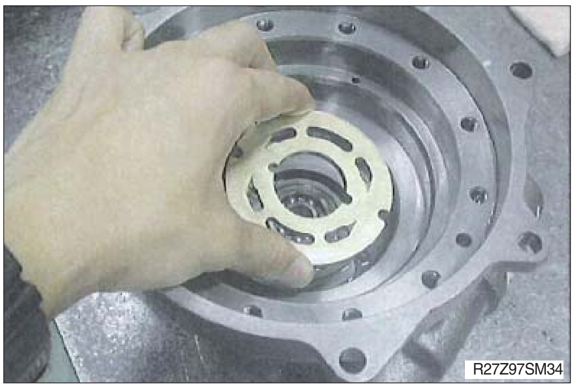
R27Z97SM31

(3) Place the valve plate (205) onto the body H (201).

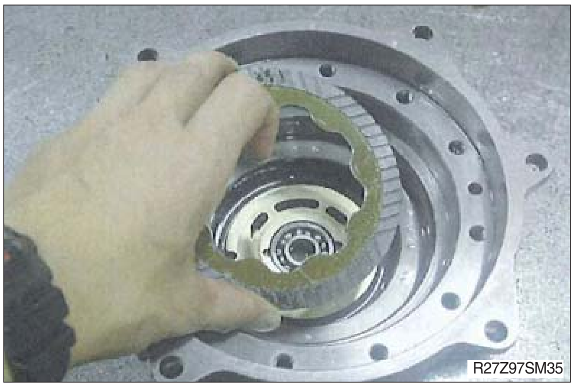
※ The steel face of the valve plate should be downside and assemble.



R27Z97SM33



(4) Assemble the disk plate (233).

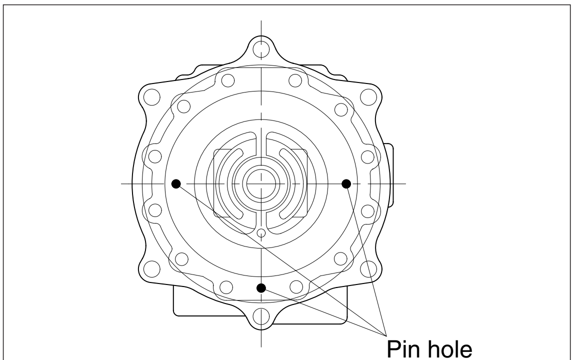

R27Z97SM35

(5) Make the brake piston assembly which placed O-rings (235, 236) on brake piston (231), and place it onto the body H (201).

Place the brake piston assembly onto plate S placed 3 pins, then place it onto the body H as matched pin hole position. After that, press-fit it by tightening hexagon bolts little by little.
Check no pushed out, scratches and dust on O-ring at this time.
For prevention of brake piston assembly, apply grease on plate S.
Take out the plate S after placed brake piston assembly.

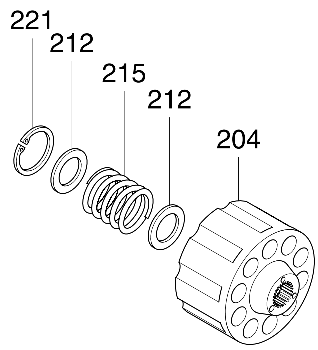
※ Pay attention to jam seal parts, install them applying grease on O-rings.


R27Z97SM36



R27Z97SM37

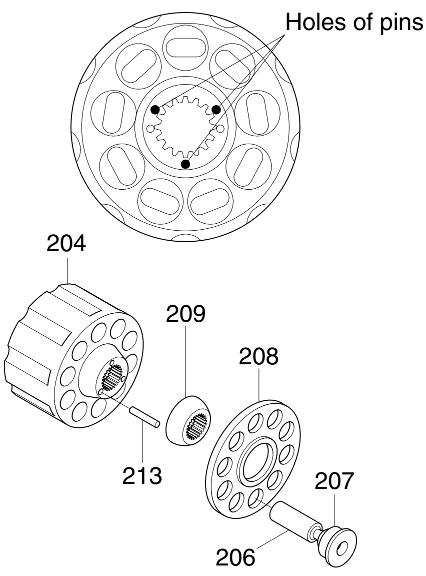
(6) Place the retainer (212), spring C (215) and retainer (212) in that order into the cylinder barrel (204), and then secure them with the snap ring (221).
   · Tools required :
   Snap ring plier : ø 28 for hole



R27Z97SM38

(7) Make the shoe holder assembly which has the 9 piston-shoe (206, 207) assemblies placed on the shoe holder (208).

(8) Place the 3 pins (213), barrel holder (209) and the shoe holder assembly onto the cylinder barrel (204) to make up a cylinder barrel assembly.



R27Z97SM41

(9) Insert cylinder barrel assembly along ditch of disk plate into body H (201).

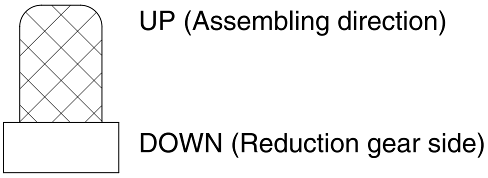

R27Z97SM43

(10) Insert the spring assembly (232) into the body H (201).


R27Z97SM44

(11) Place the filter (214) and the parallel pins (225) into the plate S (202).

※ Filter (214) : 1 pc
Parallel pin (225) : 3 pcs



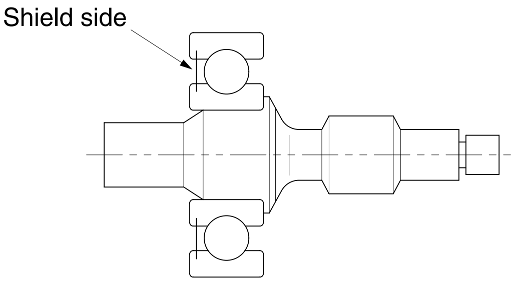
R27Z97SM45


R27Z97SM46

Use a plastic hammer when it is tight.

※ Pay attention height of pins are 8 mm from surface after installation.

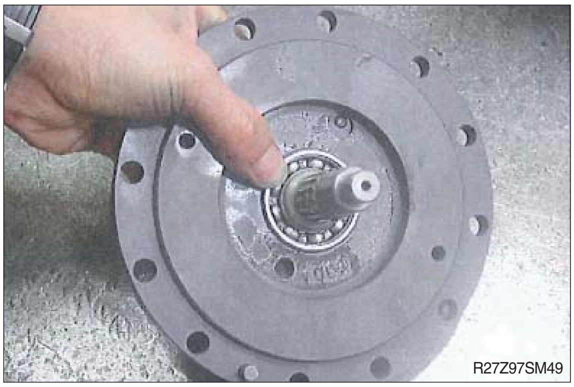
(12) Press-fit bearing (216) with shaft (203).



R27Z97SM47


R27Z97SM48

(13) Place the shaft kit into the plate S (202).


R27Z97SM49

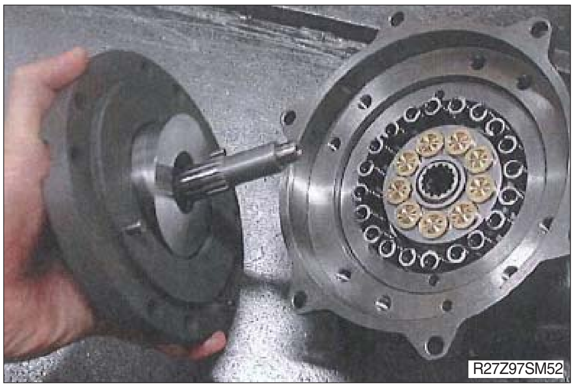
(14) Place the swash plate (210) onto the plate S (202).

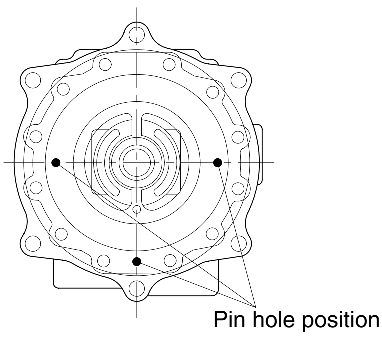
※ In case the swash plate drops out, apply grease to the plate S side of it.


R27Z97SM50

(15) Join the body H (201) and the plate S (202).

※ Align the serration of the shaft which is assembled to the plate S to the serration of the cylinder barrel assembly which is assembled to the body H.


R27Z97SM52



R27Z97SM51

(16) Bolt the plate S (202) together with the 12 hexagon socket head cap bolts (223).

· Tools required :
Hexagon bar wrench : 6 mm
Torque wrench

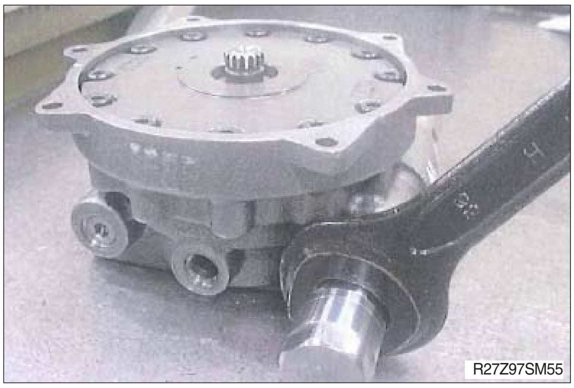
· Plug tightening torque :
3±0.3 kgf · m (21.7±2.17 lbf · ft)


R27Z97SM53

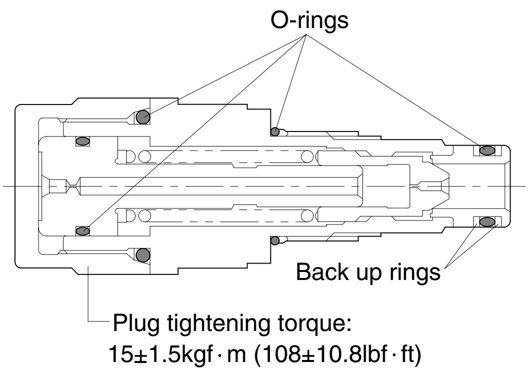
(17) Screw up the relief valve assembly. (both side)

· Tools required :
Spanner : 36 mm
Torque wrench

· Plug tightening torque :
15±1.5 kgf · m (108±10.8 lbf · ft)

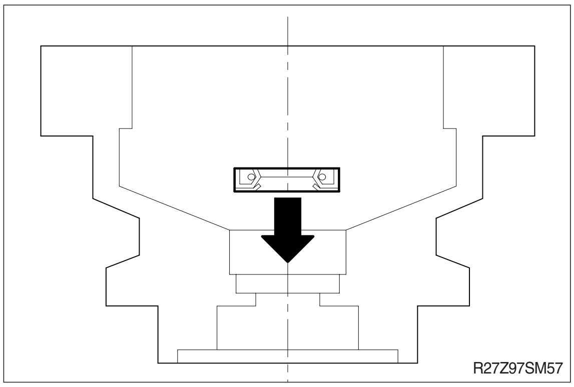

R27Z97SM55

※ Once the relief valve is disassembled, replace the O-ring and the back up ring in the below, and screw the cap with the following torque.



R27Z97SM54

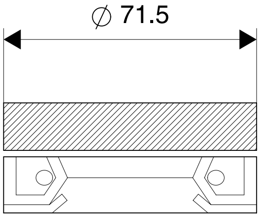
2) REDUCTION GEAR SECTION


R27Z97SM57

(1) Press-fit the oil seal (123) into the body (101).

※ Pay attention to the direction of the oil seal, use round steel plate for pressing to prevent misalignment.

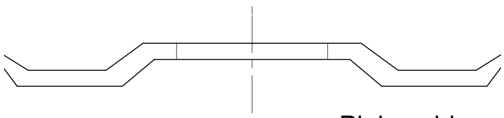
Steel plate outer diameter : ø 71.5



R27Z97SM56

(2) Place the ring seal (113) onto the pinion shaft (104).

※ Pay attention to direction of the ring seal.



R27Z97SM58


R27Z97SM59

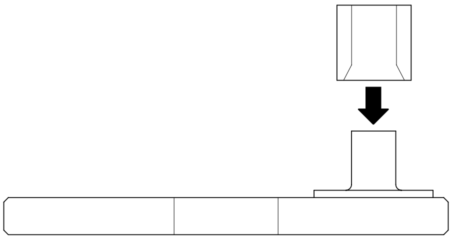
(3) Press-fit the inner ring of the bearing (121) to the pin pinion shaft (104).

※ After press fitting, apply grease onto the surface of the rollers, and turn them manually so that the grease can spread to the whole roller surface.


R27Z97SM60

(4) Place the 4 rings (129) (1 pc/pin) and the 4 thrust washers 1 (117) (1 pc/pin) in that order onto the 4 pins of the carrier 1 (102).

※ Pay attention to direction of the ring. Beveling part of the ring should be down side.



R27Z97SM61

R27Z97SM62

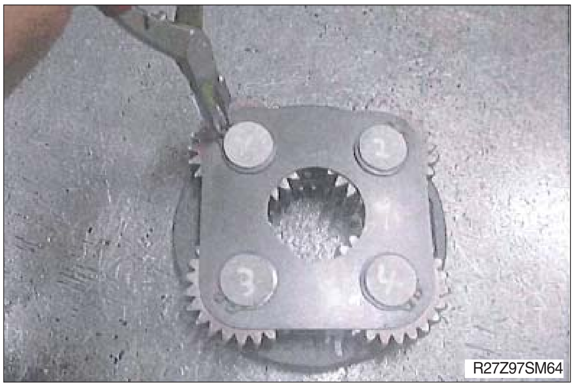
(5) Place the 4 b1 gears (106) (1 pc/pin) and the 92 needles 1 (111) (23 pcs/pin) in that order onto the 4 pins of the carrier 1 (102).

R27Z97SM63

(6) Place the thrust plate 1 (115) and the 4 snap rings (120) (1 pc/pin) to make up a carrier 1 kit.

· Tools required :

Snap ring plier : ø 22 for shaft

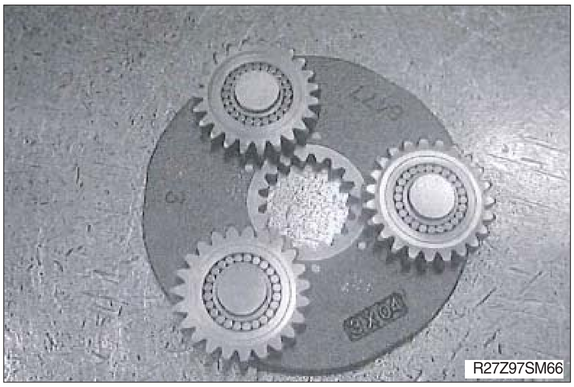


R27Z97SM64

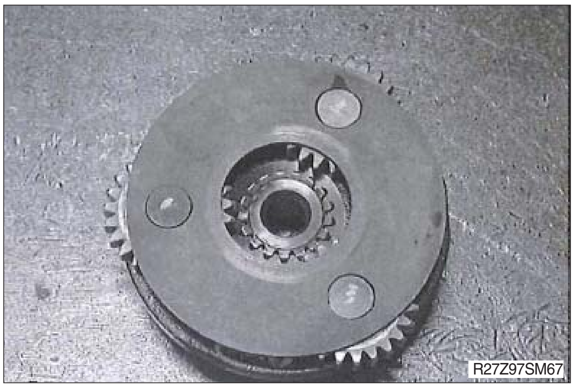
(7) Place the 3 thrust washers 2 (118) (1 pc/pin) and the 3 rings 2 (130) (1 pc/pin) in that order onto the 3 pins of the carrier 2 (103).

R27Z97SM65

(8) Place the 3 b2 gears (107) (1 pc/pin) and the 72 needles 2 (112) (24 pcs/pin) in that order onto the 3 pins of the carrier 2 (103).



(9) Place the thrust plate 2 (116) and the S1 gear (108) to make up a carrier 2 kit.

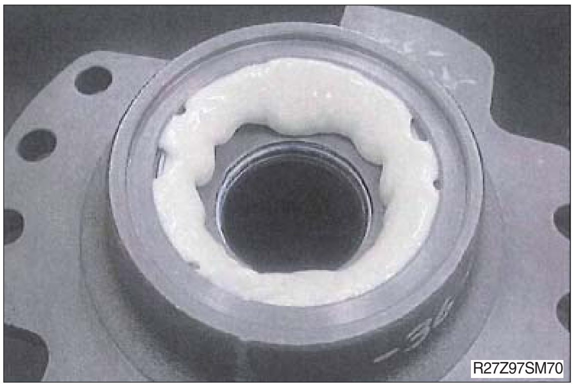


(10) Press-fit the outer ring of the bearing (122) into the body (101).

(11) Press-fit the outer ring of the bearing (121) into the body (101).

(12) Fill grease in the bearing (121) section of the body (101).

※ Grease amount : approx. 80% of the space inside the outer ring.


R27Z97SM70

(13) Insert the pinion shaft (104) into the body (101).

※ Pay attention not to damage the lip of the oil seal.

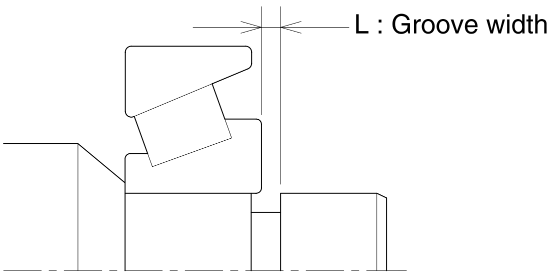

R27Z97SM71

(14) Turn over the body (101), then press-fit inner ring of the bearing (122).


R27Z97SM72

(15) Fix the pinion shaft (104) with the 2 pre-load collars (119).

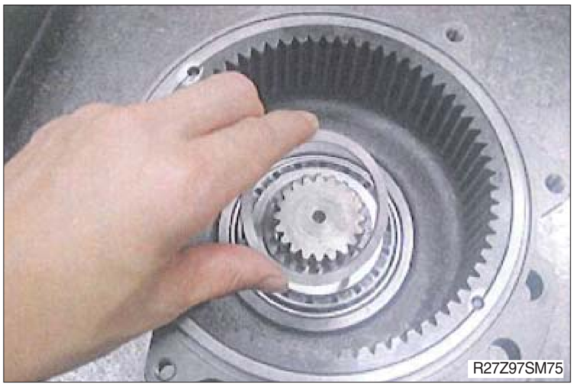
※ Thickness of the pre-load collar must be adjusted for the below L dimension.
Standard's +0 to +0.05 mm



R27Z97SM73

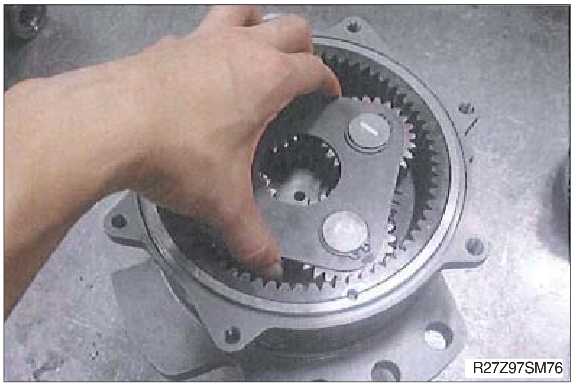

R27Z97SM74

(16) Place the ring (128) over the pre-load collars.



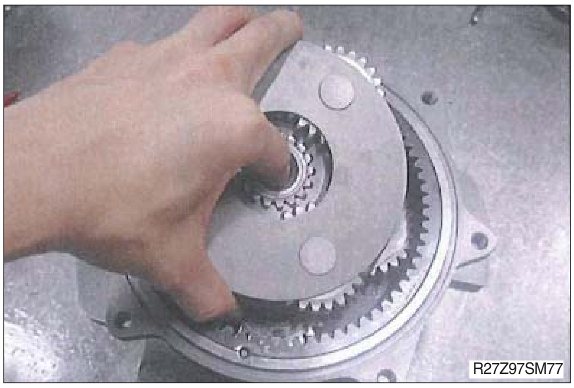
R27Z97SM75

(17) Place the carrier 1 assembly into the body (101) align spline of carrier to the pinion shaft (104).



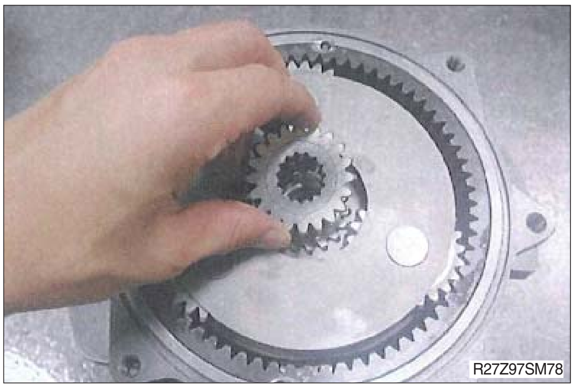
R27Z97SM76

(18) Place the carrier 2 assembly into the body (101) align spline of S1 gear to the b1 gear.



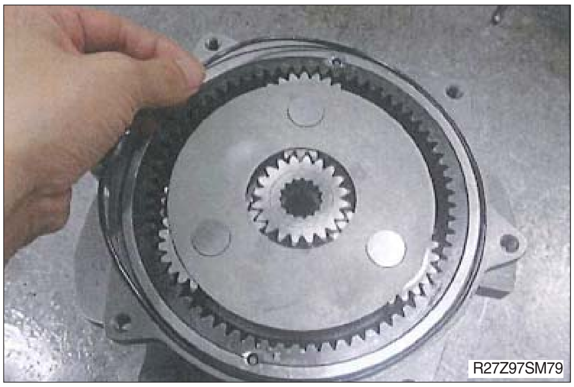
R27Z97SM77

(19) Place the S2 gear (109) into the carrier 2 assembly.



R27Z97SM78

(20) Place the O-ring (114) onto the body (101).


R27Z97SM79

(21) Fill body (101) with hydraulic oil.

※ Oil : ISO VG 46 or equivalent
Oil amount : 2 to 3 mm below top of the thrust plate 2
Wipe oil off flange surface if it is spilled.


R27Z97SM80

(22) Join the hydraulic motor and the body, and then bolt them together with the 4 hexagon socket head cap bolts (124).

· Tools required :
Hexagon bar wrench : 6 mm
Torque wrench

※ Align the shaft of the motor to the S2 gear.
Apply anti-loose adhesive to the screws.

· Plug tightening torque :
3±0.3 kgf · m (21.7±2.17 lbf · ft)


R27Z97SM81

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.

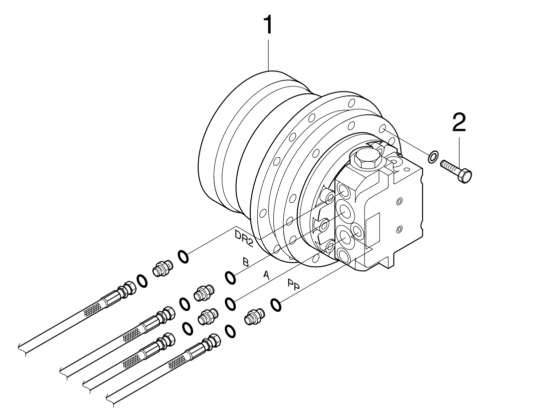
(7) Remove the bolts and the sprocket.

(8) Sling travel device assembly (1).

(9) Remove the mounting bolts (2), then remove the travel device assembly.

· Weight : 36 kg (80 lb)

13031GE18



R27Z97TM101

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.

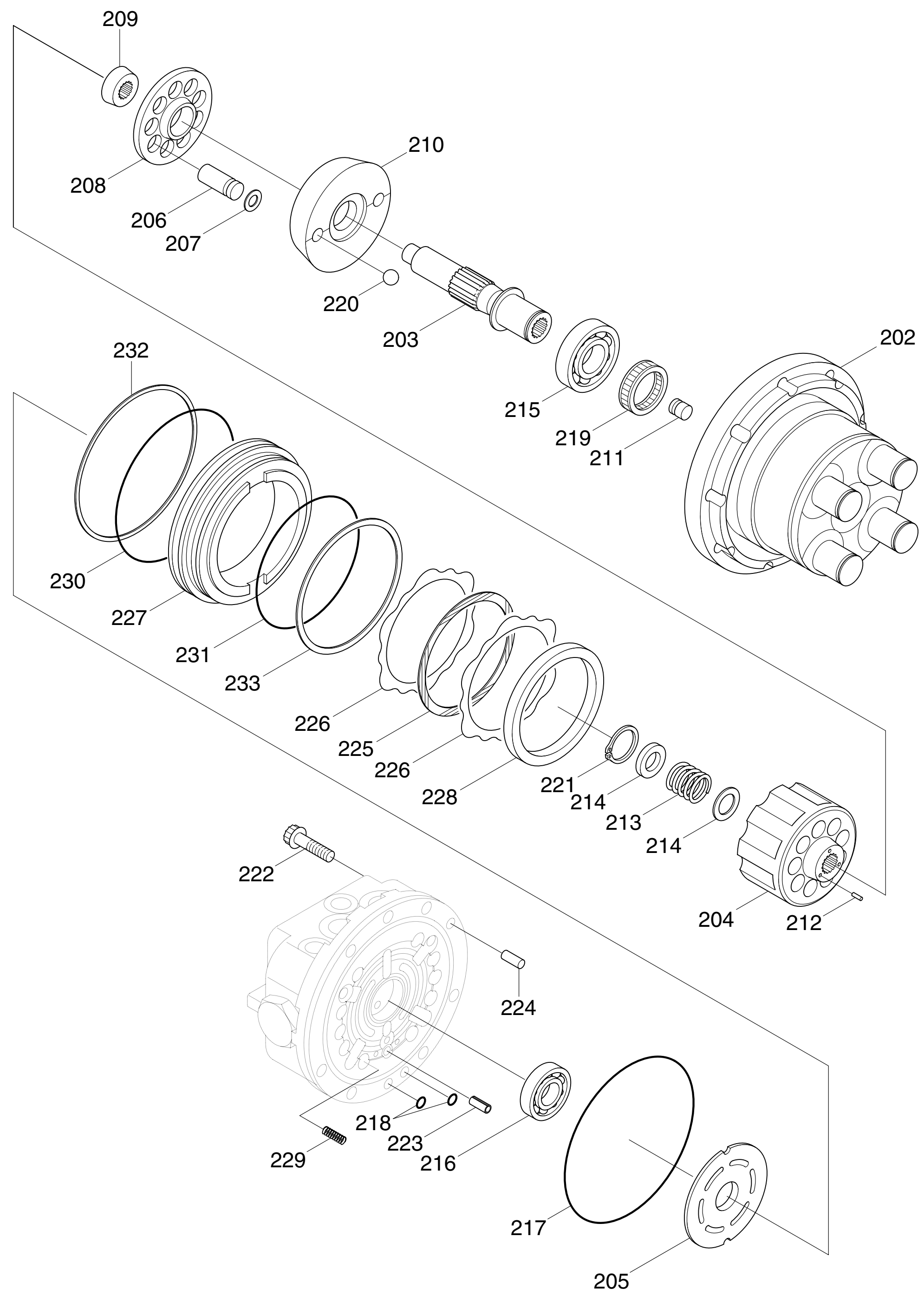
③ Tighten plug lightly.

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.

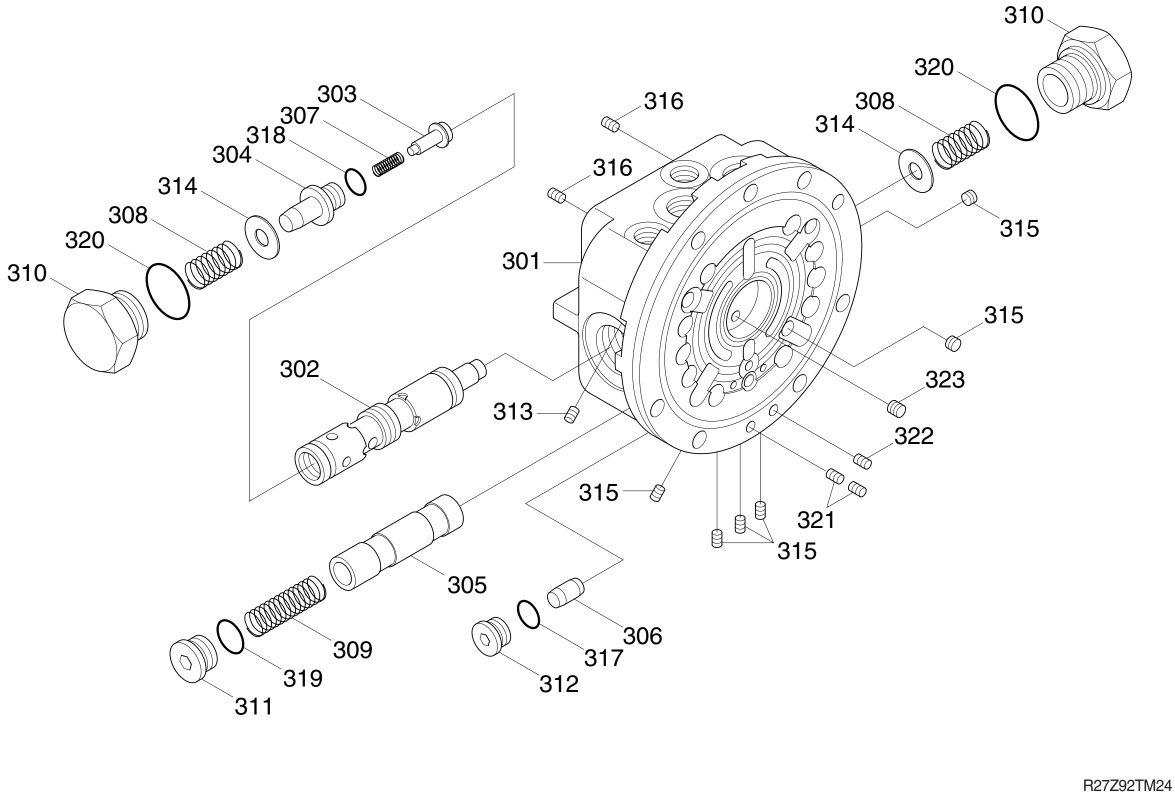
2) STRUCTURE (1/3)



R27Z92TM23

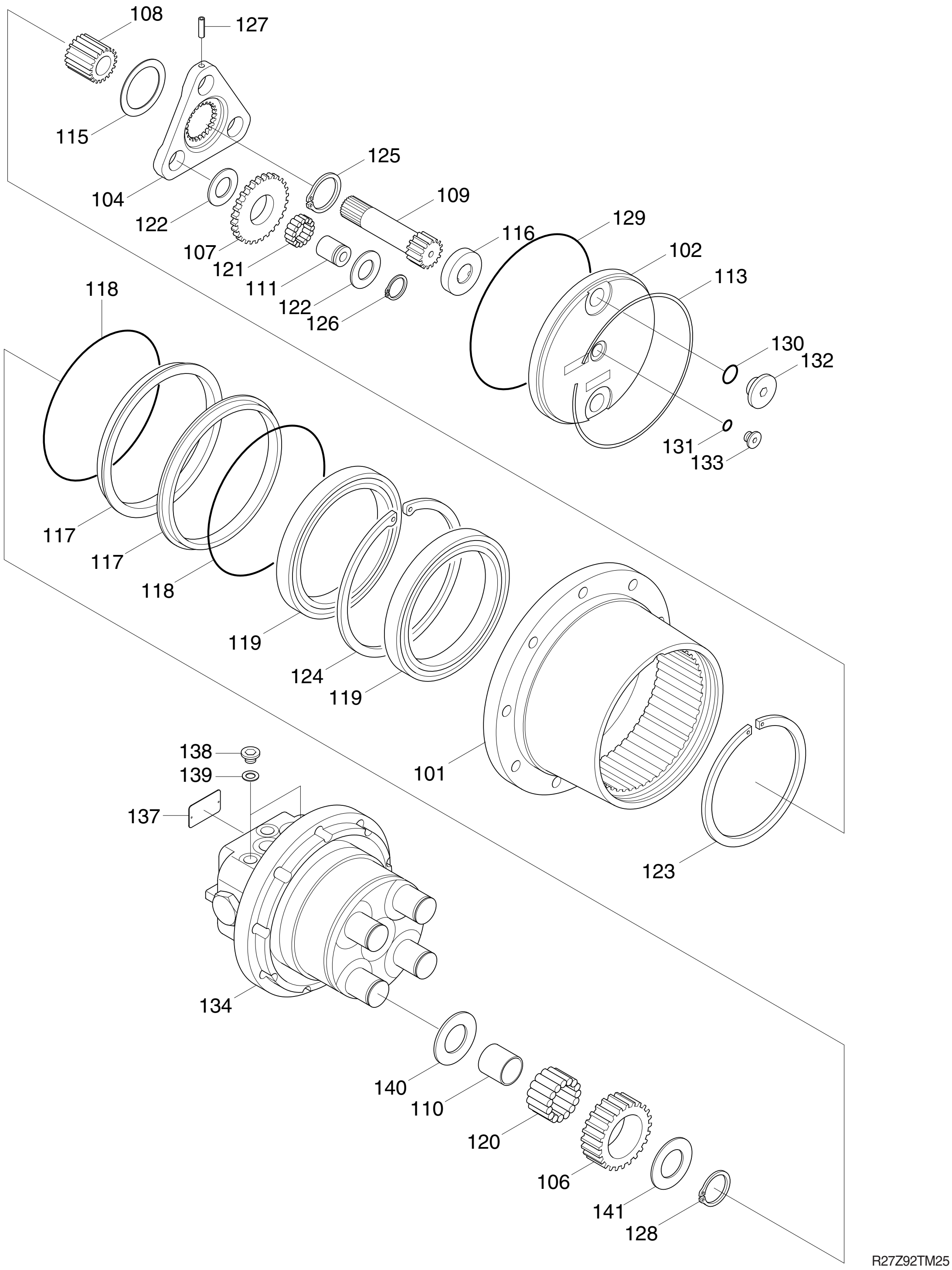
202	Body 2	213	Spring C	224	Pin
203	Shaft	214	Retainer	225	Disk plate
204	Cylinder barrel	215	Bearing	226	Steel plate
205	Valve plate	216	Bearing	227	Brake piston
206	Piston	217	O-ring	228	Brake spacer
207	Shoe	218	O-ring	229	Spring B
208	Shoe holder	219	Oil seal	230	O-ring
209	Barrel holder	220	Ball	231	O-ring
210	Swash plate	221	Snap ring	232	Back up-ring
211	Control piston	222	Screw	233	Back up-ring
212	Pin	223	Spring pin		

STRUCTURE (2/3)



301	Body 1	309	Spring V3	317	O-ring
302	Spool	310	Plug	318	O-ring
303	Check valve	311	Plug	319	O-ring
304	Spring guide	312	Plug	320	O-ring
305	Spool	313	Choke	321	Choke
306	spool	314	Ring	322	Choke
307	Spring V1	315	Plug	323	Plug
308	Spring V2	316	Plug		

STRUCTURE (3/3)



101	Body	113	Snap ring	122	Thrust washer	131	O-ring
102	Cover	115	Thrust collar	123	Snap ring	132	Plug
104	Carrier 2	116	Slide ring	124	Snap ring	133	Plug
106	Gear B1	117	Floating seal (Incl 118)	125	Snap ring	134	Hydraulic motor
107	Gear B2			126	Snap ring	137	Name plate
108	Gear S1	118	O-ring	127	Spring pin	138	Plug
109	Gear S2	119	Bearing	128	Snap ring	139	O-ring
110	Ring	120	Needle	129	O-ring	140	Thrust washer
111	Pin B2	121	Needle	130	O-ring	141	Thrust washer

3) MAINTENANCE INSTRUCTION

(1) Necessary tool to assemble

No.	Necessary tool	
1 2 3	Torque wrenches	45N (JIS B4650) 90N (JIS B4650) 280N (JIS B4650)
4 5	Hexagon socket	Hexagon size : 5 mm Hexagon size : 8 mm
6	Socket wrenches	Hexagon size : 36 mm
7 8	Hexagon socket wrenches	Hexagon size : 5 mm Hexagon size : 8 mm
9	Screwdrivers	Width : 6~10 mm
10 11 12 13 14	Snap ring pliers	ø 28 mm for hole ø 25 mm for shaft ø 28 mm for shaft ø 30 mm for shaft ø 130 mm for shaft
15	Plastic hammer	-
16 17 18 19	Other	Grease Oil Sand paper C-clamps

2. DISASSEMBLY

1) GENERAL PRECAUTIONS

(1) Before disassembling the TM 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.

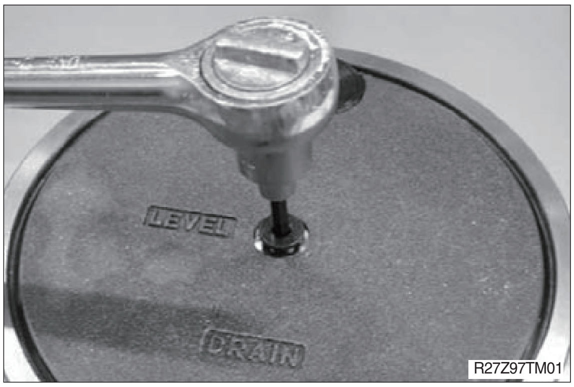
(5) Arrange removed parts in order so that they will not become damaged or missing during disassembly.

(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) REDUCTION GEAR SECTION

(1) Remove the three plugs (PF3/8 and PF1/8).

· Tools required :
  Hexagon size : 8 mm
  Hexagon size : 5 mm



R27Z97TM01

(2) Remove the snap-ring.

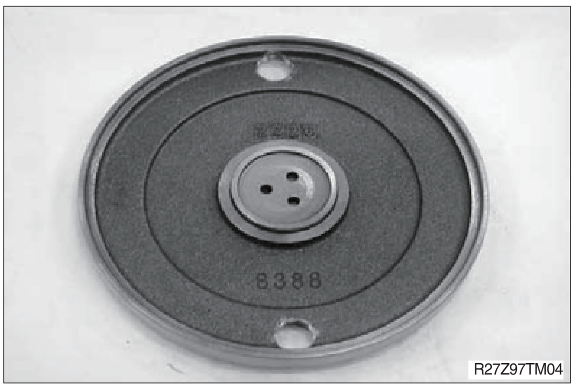
※ Put the screwdriver into the notch of the body, and then pull the snap-ring.


R27Z97TM02

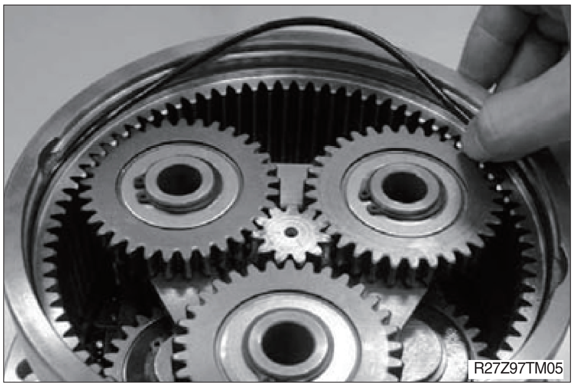
(3) Remove the cover.

R27Z97TM03

(4) Remove the slide ring from the cover.

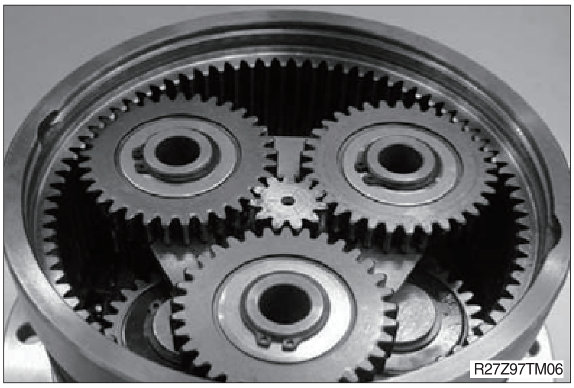

R27Z97TM04

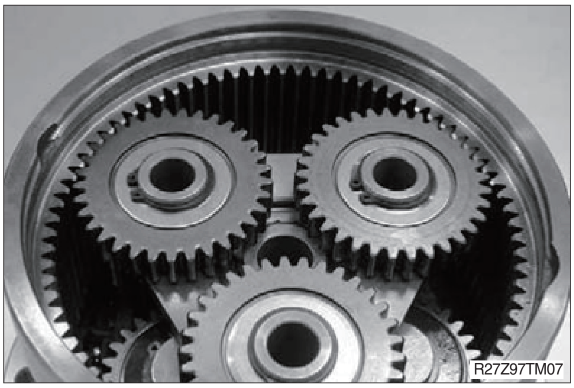
(5) Remove the O-ring from the body.



(6) Remove the s2 gear, the carrier 2 kit and thrust collar from the body.

※ There is possibility the thrust collar sticks to the carrier 2 kit.

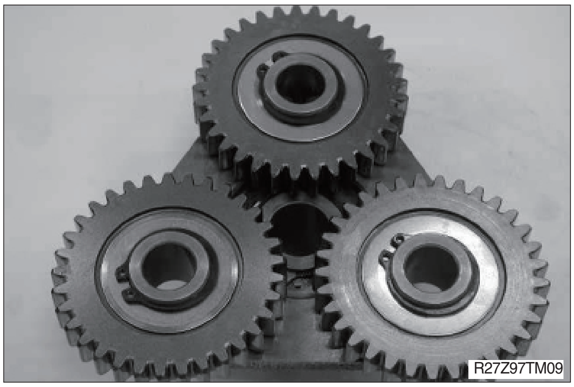




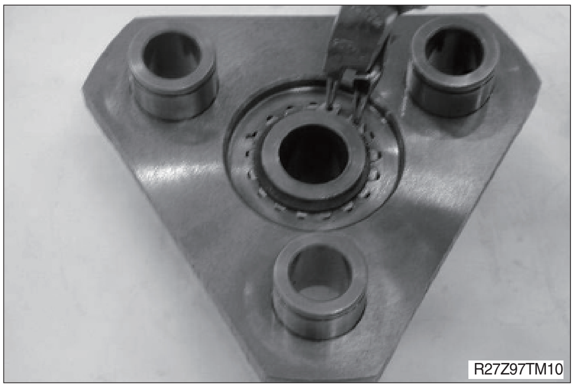
(7) Remove the three snap rings, three thrust washers, three b2 gears, forty-eight needles and three thrust washers.

※ The thrust washers on both sides of the b2 gears are the same.

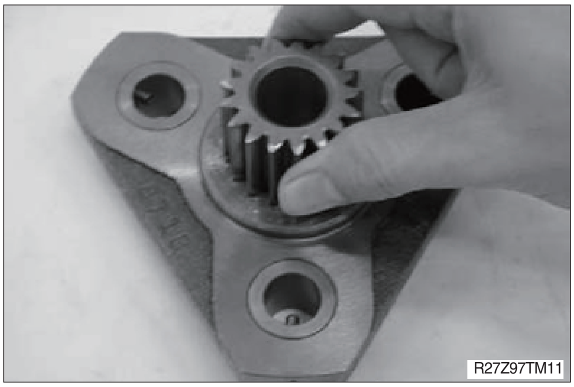
※ The b2 pins and spring pins are not able to disassemble, because they are press-fitted.


R27Z97TM09

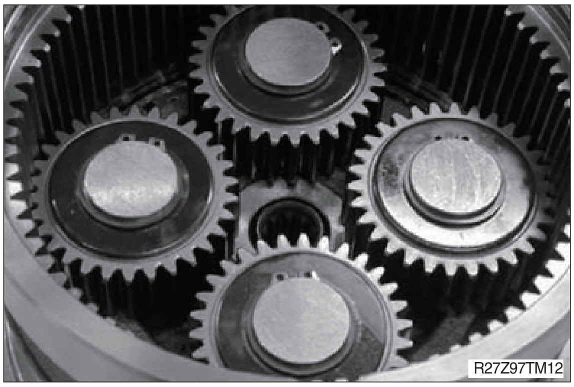
(8) Remove the snap ring from the carrier 2.


R27Z97TM10

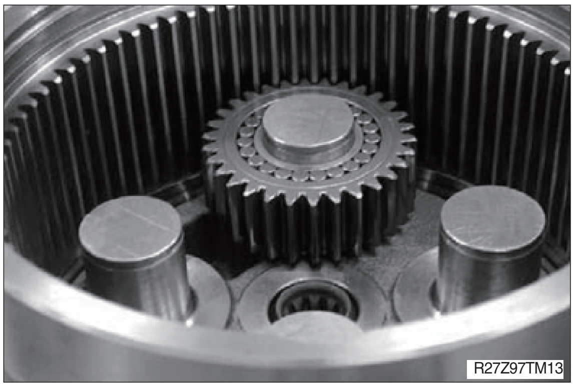
(9) Remove the s1 gear from the carrier 2.


R27Z97TM11

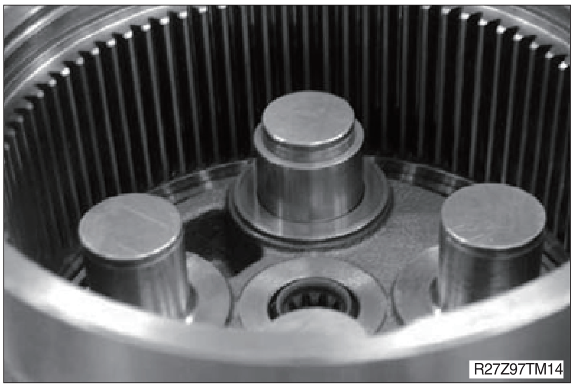
(10) Remove the four snap rings and the four thrust washers.


R27Z97TM12

(11) Remove the four b1 gears, ninety-two needles, four thrust washers and four rings.



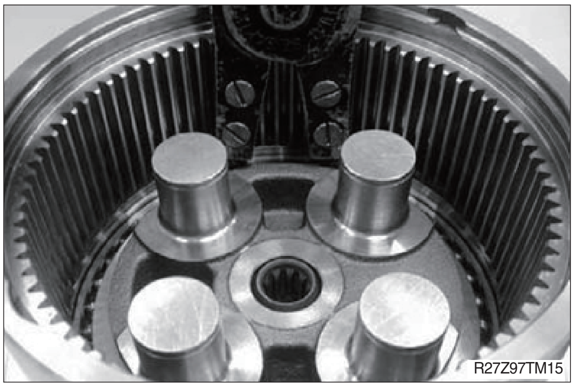
R27Z97TM13



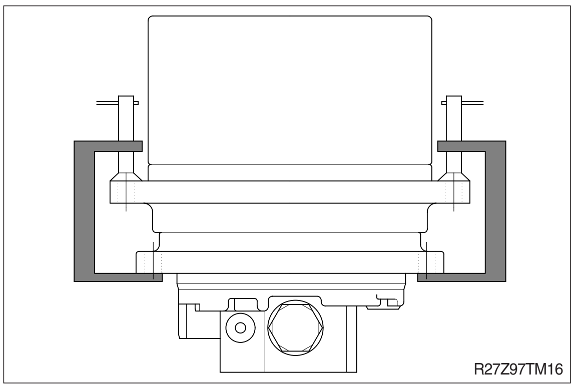
R27Z97TM14

(12) Remove the snap ring and remove the body from the hydraulic motor.

※ Tighten the speed reducer flange and the motor flange with C-clamps or a hydraulic press (see the illustration) to make it easy.



R27Z97TM15



R27Z97TM16

(13) Remove the floating seal with O-ring from the body.


R27Z97TM17

(14) Remove the floating seal with O-ring from the hydraulic motor.

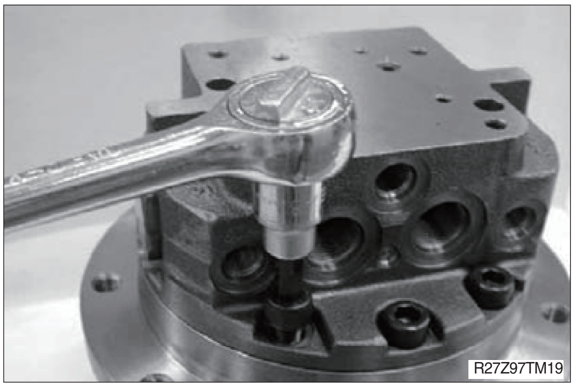

R27Z97TM18

3) HYDRAULIC MOTOR SECTION

(1) Remove the seven hexagon socket head cap bolts.

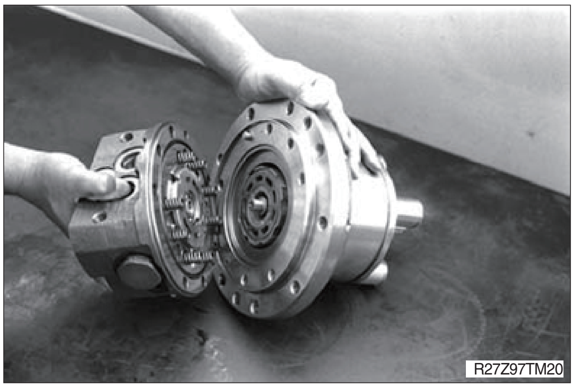
· Tools required :
Hexagon size : 8 mm

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

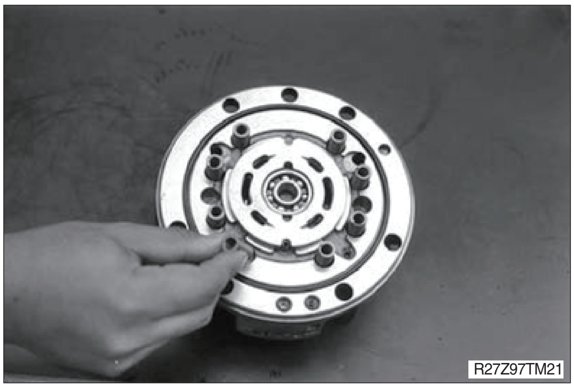


(2) Remove the body 1 from the body 2.

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



(3) Remove the valve plate and the ten spring B.

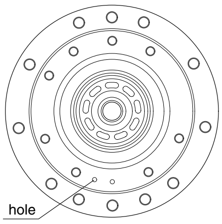


(4) Remove the three O-rings from the body 1.

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

(5) Remove the brake piston assembly from the body 2.

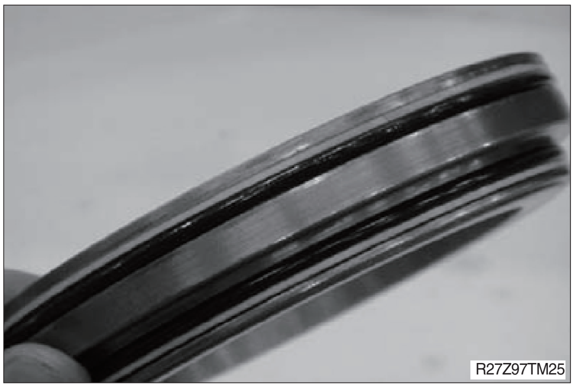
※ The brake piston removes when the air comes into the inside from the hole. Do not blow it suddenly, the brake piston assembly fly out.



R27Z97TM23

R27Z97TM24

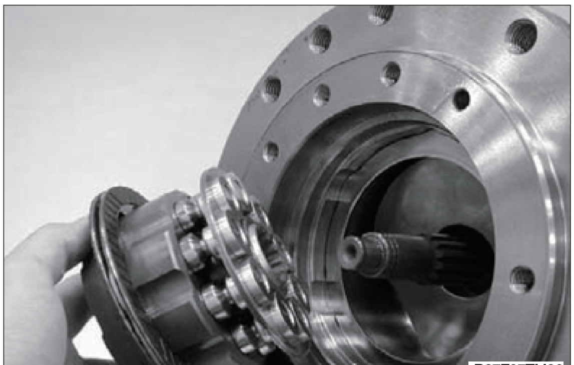
(6) Remove the two O-rings and two back up rings from the brake piston.



R27Z97TM25

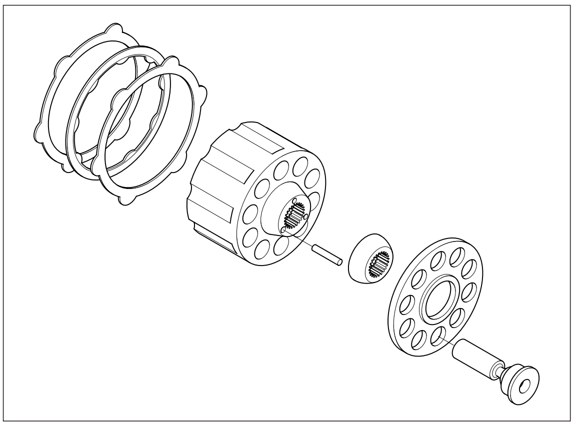
(7) Remove the cylinder barrel assembly and brake spacer from the body 2.

※ Pay attention not to lose the each part.



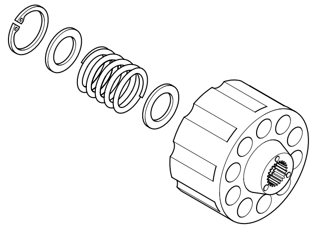
R27Z97TM26

(8) Remove the nine piston-shoe assemblies, shoe holder, barrel holder, three pins, two steel plates and disk plate.



R27Z97TM27

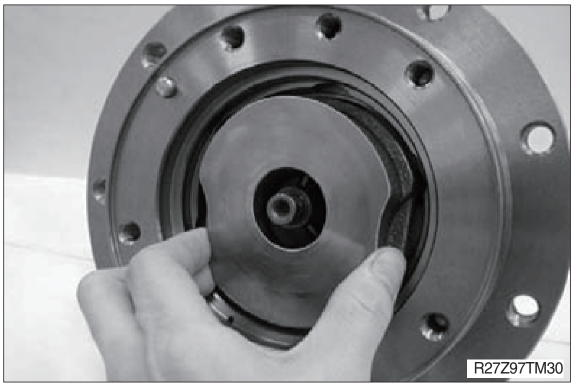
(9) Remove the snap ring, retainer, spring-C and retainer.



R27Z97TM28

R27Z97TM29

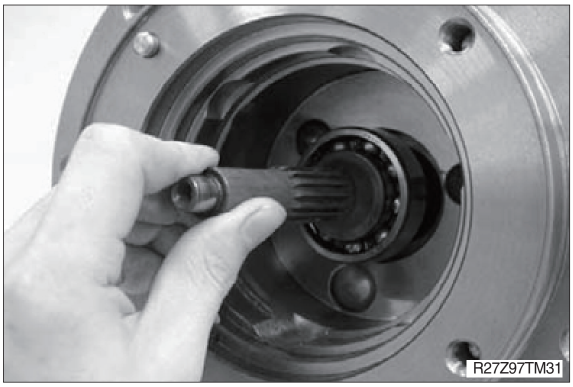
(10) Remove the swash plate and two balls from the body 2.



R27Z97TM30

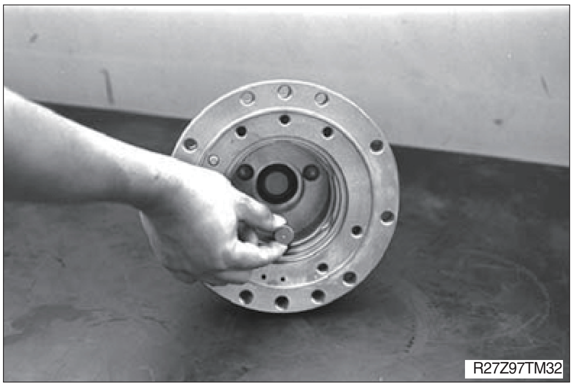
(11) Remove the shaft from the body 2.

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



R27Z97TM31

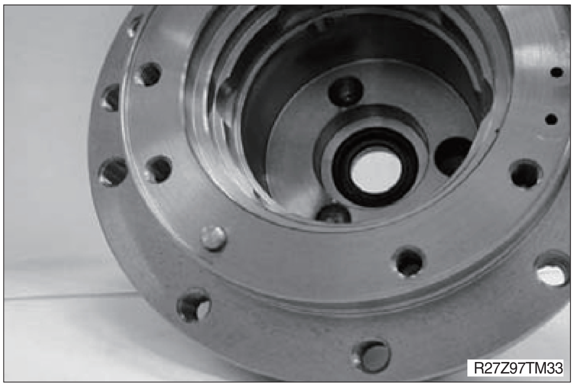
(12) Remove the control piston from the body 2.



R27Z97TM32

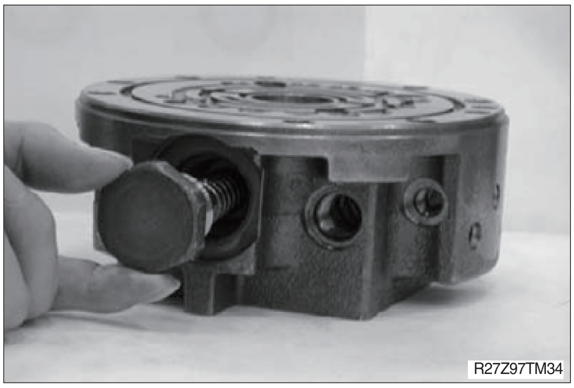
(13) Remove the oil seal from the body 2.

(14) Remove the pin from the body 2.



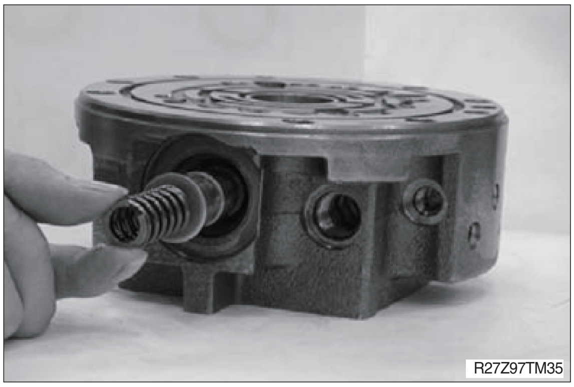
(15) Remove the two plugs with O-rings from the body 1.

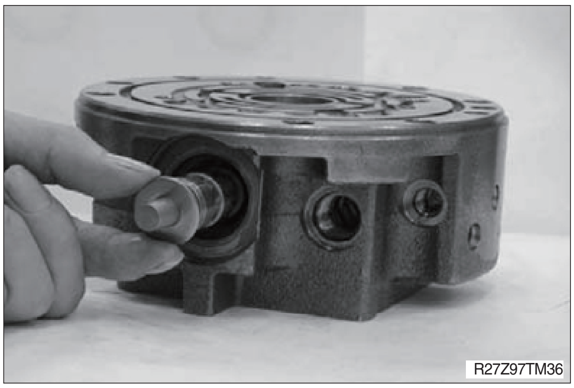
· Tools required :
Hexagon size : 36 mm

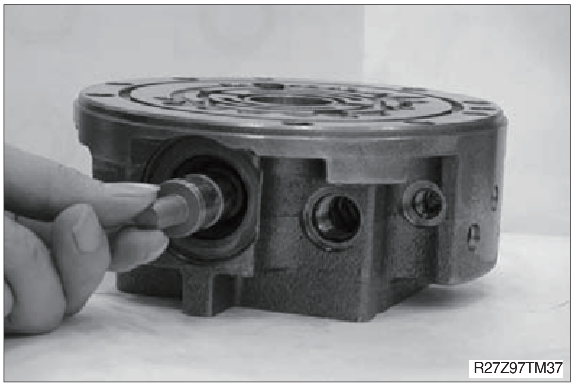


(16) Remove the two spring V2, two rings and spool assembly.

※ The spool assembly is not able to disassemble.



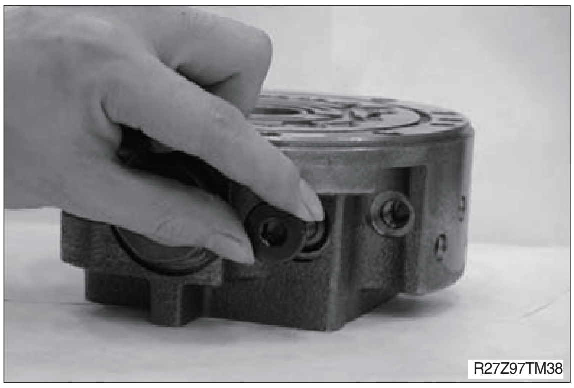




R27Z97TM37

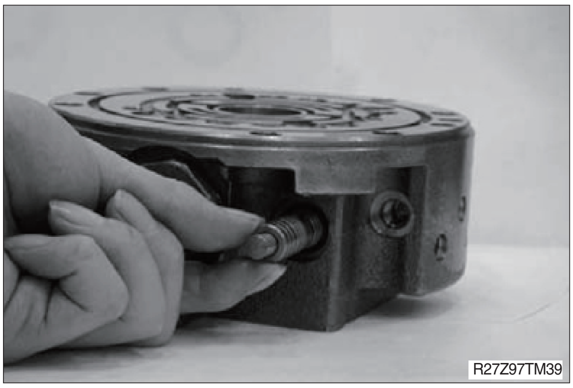
(17) Remove the two plugs with O-rings from the body 1.

· Tools required :
Hexagon size : 8 mm



R27Z97TM38

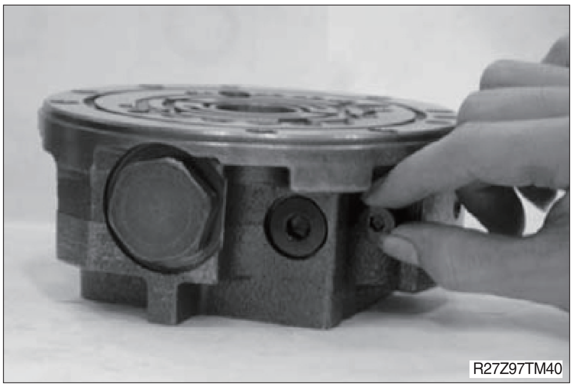
(18) Remove the spring V3 and two speed spool.



R27Z97TM39

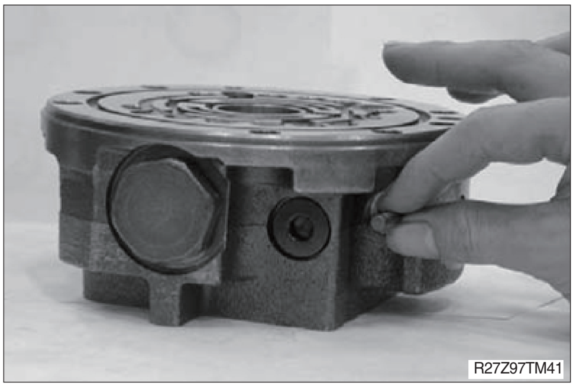
(19) Remove the plugs with O-rings from the body 1.

· Tools required :
Hexagon size : 5 mm



R27Z97TM40

(20) Remove the shuttle spool.



3. ASSEMBLY

1) HYDRAULIC MOTOR SECTION

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

R27Z97TM42

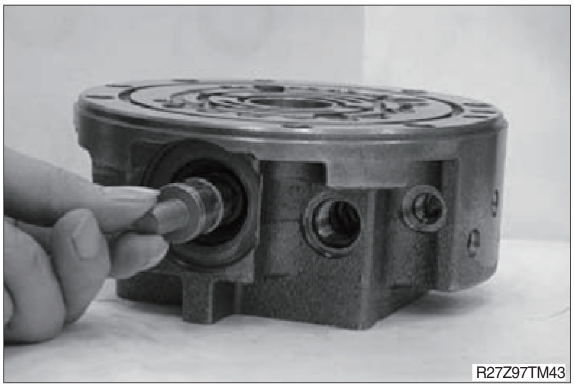
(2) Insert the spool assembly, two rings (1pc/side) and two springs (1pc/side) in that order into the body 1, and then screw the two plugs (1pc/side) with two O-rings (1pc/side).

※ The spool assembly is not able to disassemble.

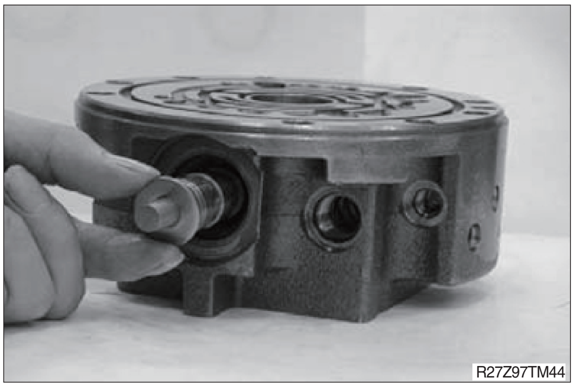
· Plugs tightening torque :

20~25 kgf · m (145~180 lbf · ft)

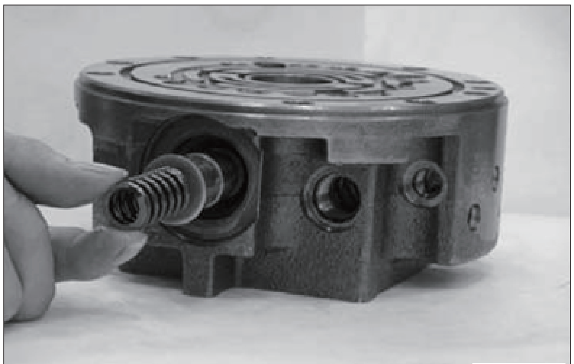
· Hexagon size : 36 mm



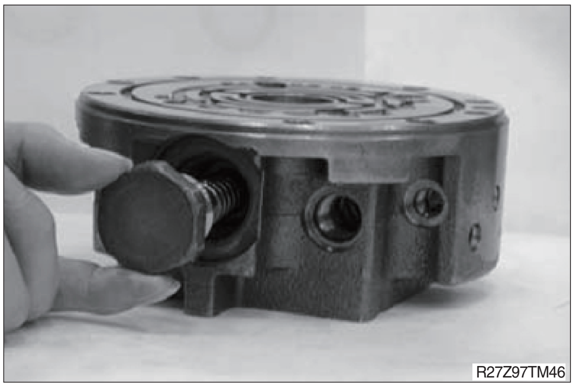
R27Z97TM43



R27Z97TM44



R27Z97TM45



R27Z97TM46

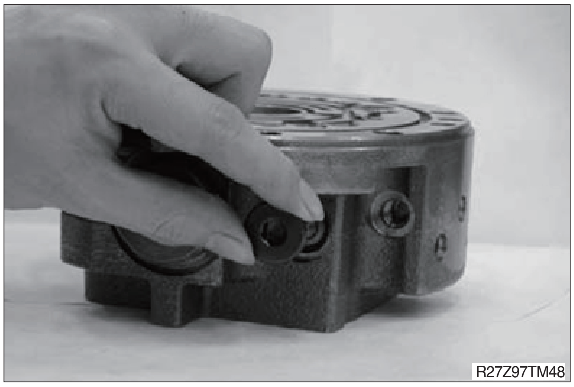
(3) Insert the spring V3 and two speed spool into the body 1, and screw the two plugs (1pc/side) with two O-rings (1pc/side).

· Plugs tightening torque :
4.69~5.2 kgf · m (33.9~37.6 lbf · ft)

· Hexagon size : 8 mm

※ Pay attention to the direction of the spool. (See cross sectional drawing for the direction, page 7-59~61).

R27Z97TM47

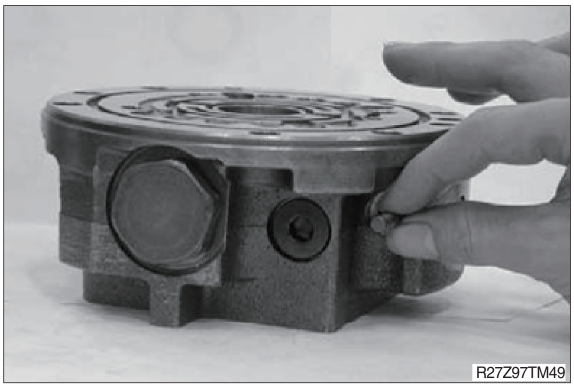


R27Z97TM48

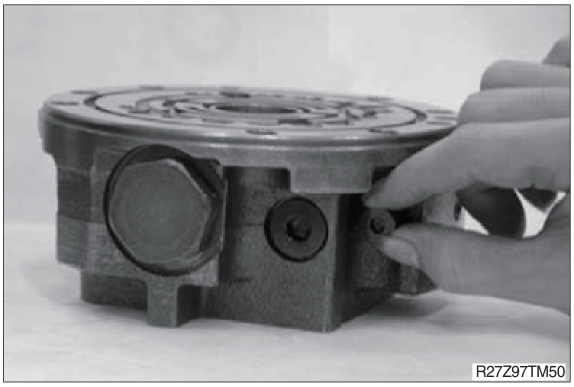
(4) Insert the shuttle spool into the body 1, and then screw the two plugs (1pc/side), with two O-rings (1pc/side).

· Plugs tightening torque :
1.22~1.84 kgf · m (8.82~13.3 lbf · ft)

· Hexagon size : 5 mm



R27Z97TM49



R27Z97TM50

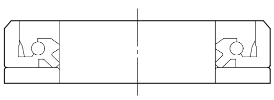
(5) Place three O-rings onto the body 1.

R27Z97TM51

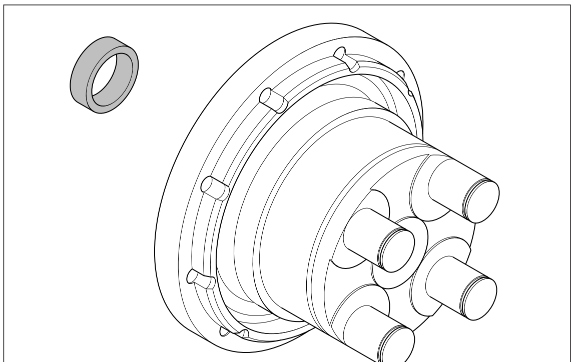
(6) Press-fit the oil seal into the body 2.

※ Apply grease to the periphery of the oil seal.

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



R27Z97TM52

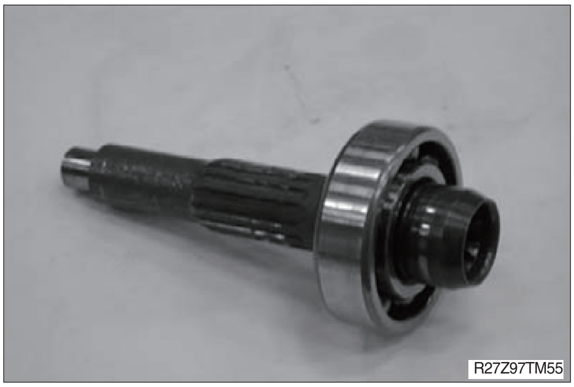


R27Z97TM53

(7) Place the pin into the body 2.

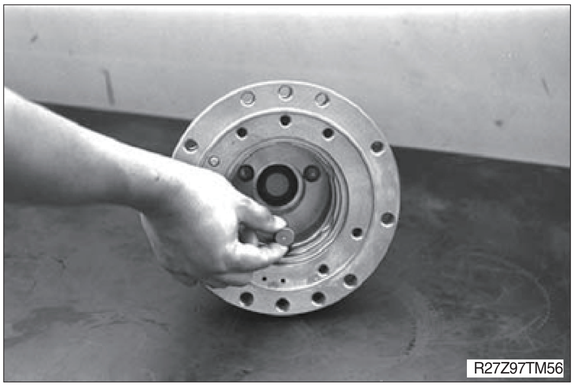
R27Z97TM54

(8) Press-fit the bearing with the shaft.


R27Z97TM55

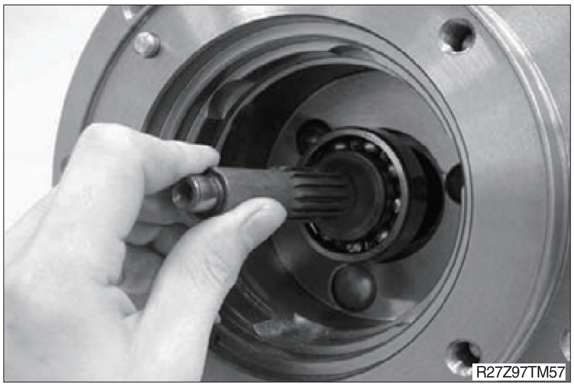
(9) Insert the control piston into the body 2.

※ Pay attention to the direction of the control piston. (See cross sectional drawing for the direction, page 7-59~61).


R27Z97TM56

(10) Place the shaft into the body 2.

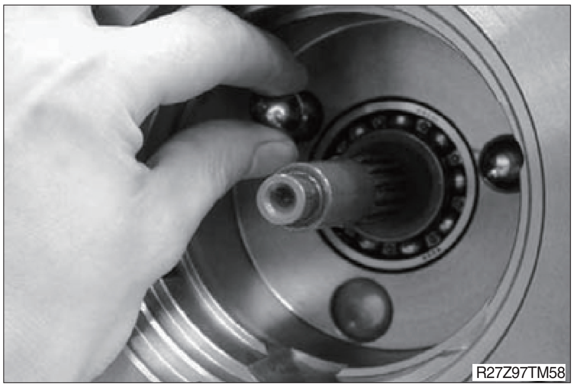
※ Pay attention not to damage the oil seal with the shaft.
A oil which damaged should be replaced.

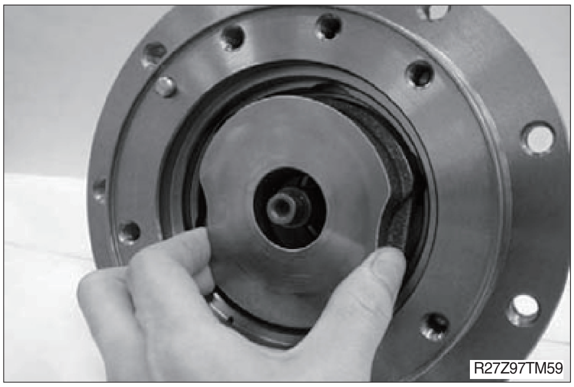

R27Z97TM57

(11) Place the two balls and the swash plate onto the body 2.

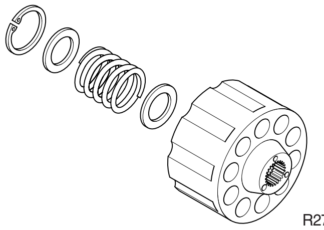
※ Apply oil to the working face of the swash plate.

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


R27Z97TM58

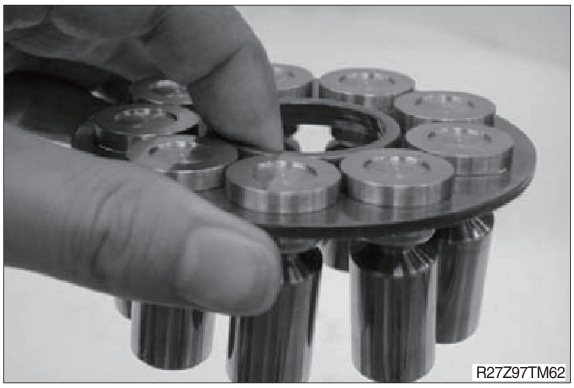

R27Z97TM59

(12) Place the retainer, spring and retainer in that order into the cylinder barrel, and then secure them with the snap ring.


R27Z97TM60


R27Z97TM61

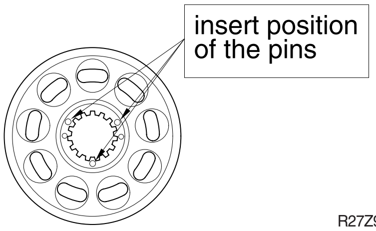
(13) Place the piston-shoe assemblies into the shoe holder.


R27Z97TM62

(14) Place the three pins, barrel holder and piston-shoe assemblies in that order into the cylinder barrel.

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

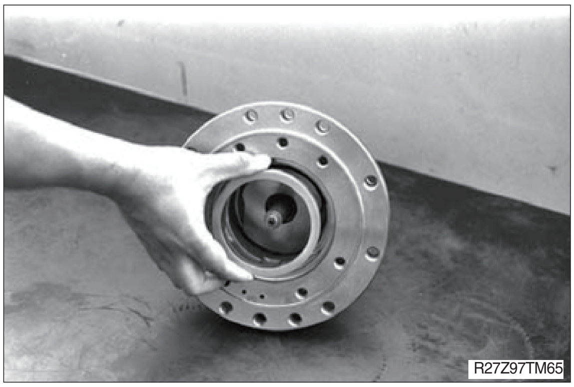
※ Pay attention to the order of pins, barrel holder and piston-shoe assemblies.



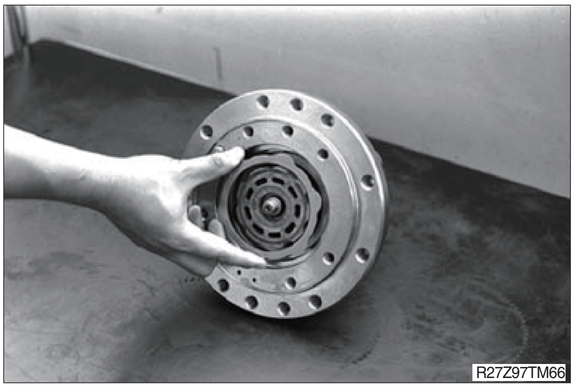
R27Z97TM63


R27Z97TM64

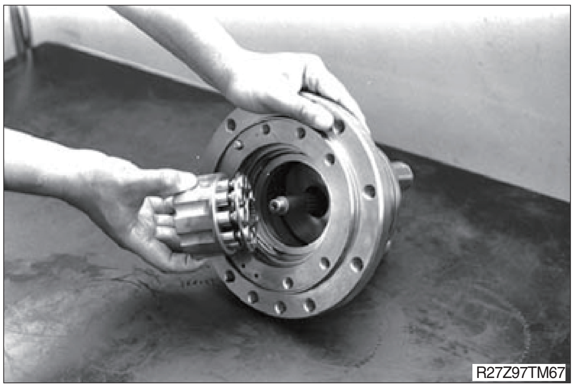
(15) Place the brake spacer plate into the body 2.


R27Z97TM65

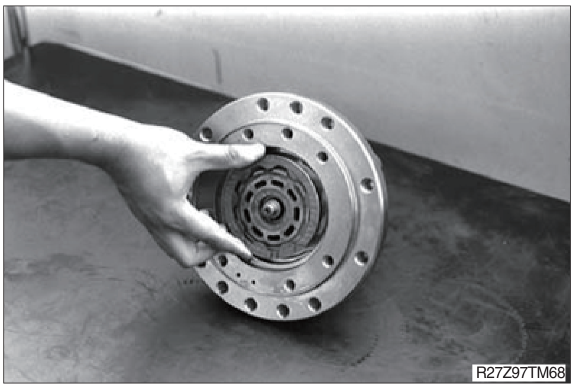
(16) Place the steel plate into the body 2 along the groove.


R27Z97TM66

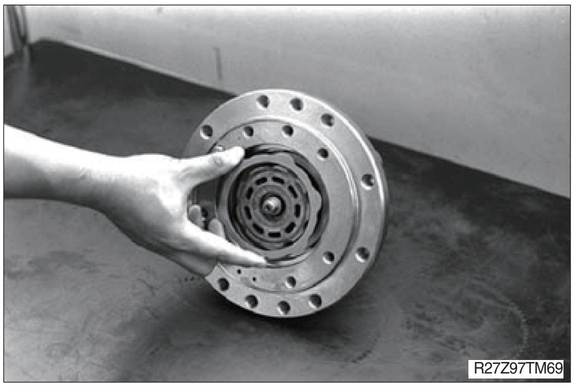
(17) Insert the cylinder barrel assembly into the body 2 so that the shoes contact the swash plate.


R27Z97TM67

(18) Place the disk plate into the body 2 along the groove.

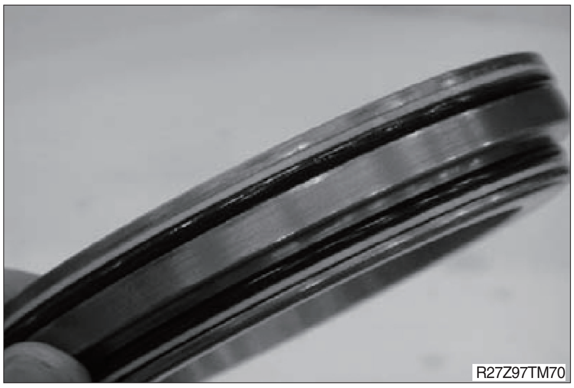

R27Z97TM68

(19) Place the steel plate into the body 2 along the groove.



(20) Place the two O-rings and two back up rings onto the brake piston.

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



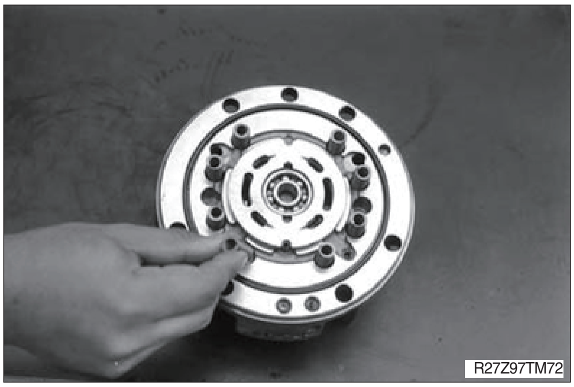
(21) Inset the brake piston assembly into the body 2.

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

(22) Fill the body 2 with 0.1ℓ hydraulic oil for lubrication.

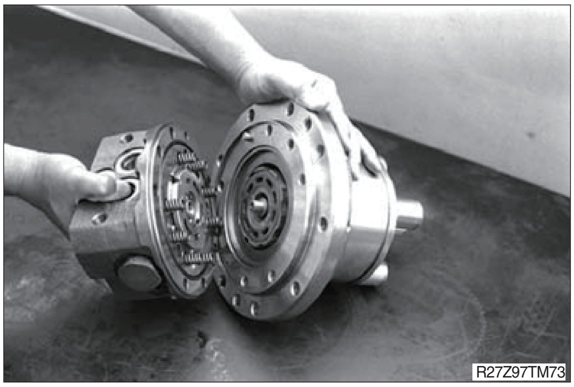
(23) Place the valve plate and ten springs onto the body 1.

※ The copper face of the valve plate should be uppermost.
※ Apply oil to the copper face of the valve plate.
※ In case the valve plate drops out, apply grease to the steel face of it.
※ In case the springs drop out, apply grease to the bottom of it.
※ Please refer to the parts list for the number and the position with the spring B.



R27Z97TM72

(24) Join the body 1 to the body 2.

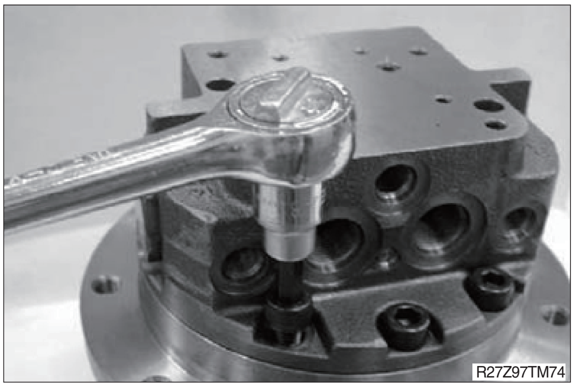


R27Z97TM73

(25) Bolt them with seven hexagon socket head cap bolts.

· Bolt tightening torque :
5.2~6.6 kgf · m (37.6~47.7 lbf · ft)
· Hexagon size : 8 mm

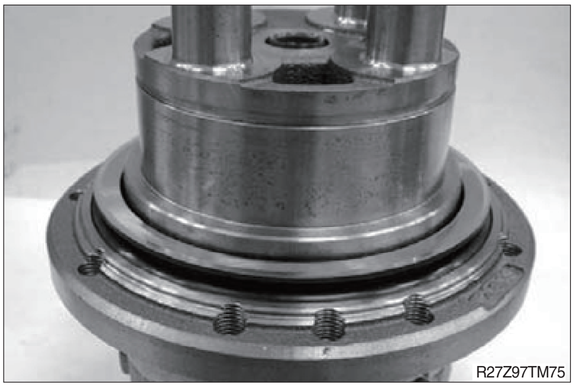
※ If you fix the motor with a vice, protect it with aluminum plates or equivalent.



R27Z97TM74

2) REDUCTION GEAR SECTION

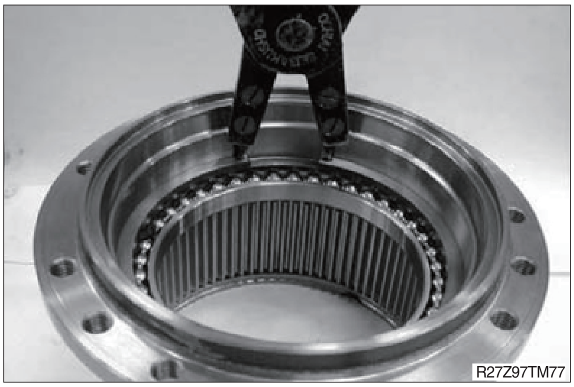
(1) Place the floating seal with O-ring into the hydraulic motor.


R27Z97TM75

(2) Join the bearing and snap ring to the body.

※ Pay attention to the direction of the bearings.
(See cross sectional drawing for the direction, page 7-59~61).


R27Z97TM76


R27Z97TM77


R27Z97TM78

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

R27Z97TM79

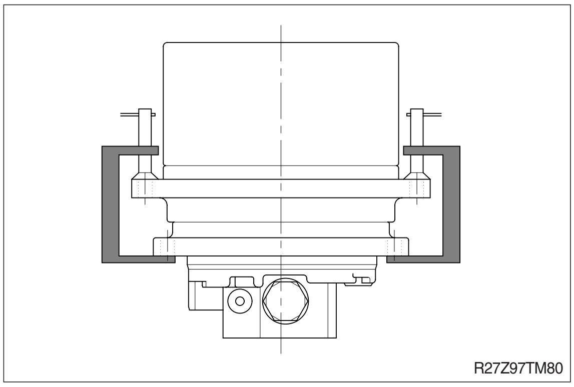
(4) Join the body to the motor, and secure it with snap ring.

※ Degrease the surface of floating seal.

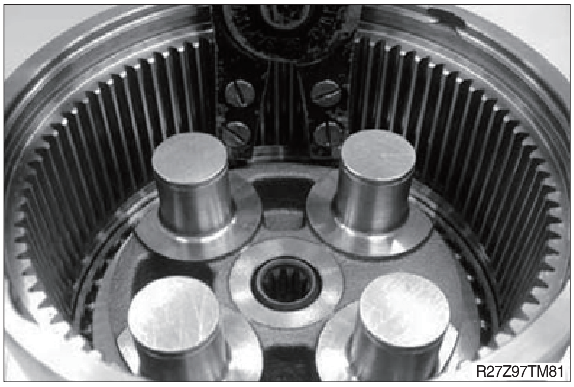
※ Hit around the body by the resinous hammer equally to make it easy.

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

※ The pre-load for the bearings is adjusted by thickness of the snap ring.



R27Z97TM80



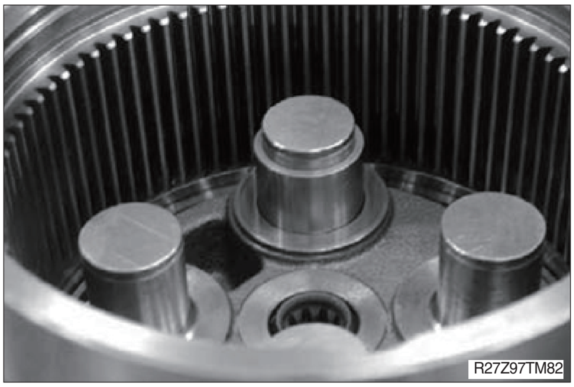
R27Z97TM81

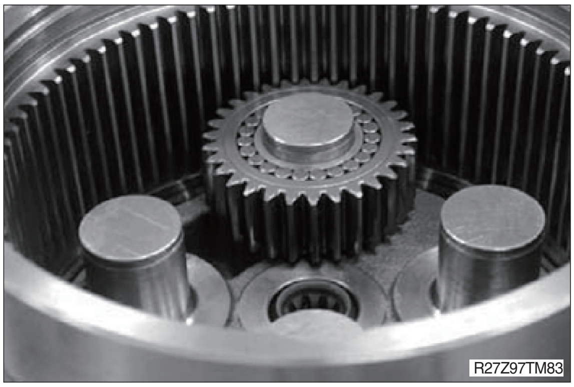
(5) Place the four rings (1pc/1pin), four thrust washers (1pc/1pin), four b1 gears (1pc/1pin) and ninety-two needles (23pcs/1pin), and four thrust washers in that order onto the body 2, and secure it with four snap rings.

※ Pay attention to the direction of the b1 gears (see cross sectional drawing for the direction, page 7-59~61).

※ Pay attention to the direction of the snap ring. The edge side should be uppermost.

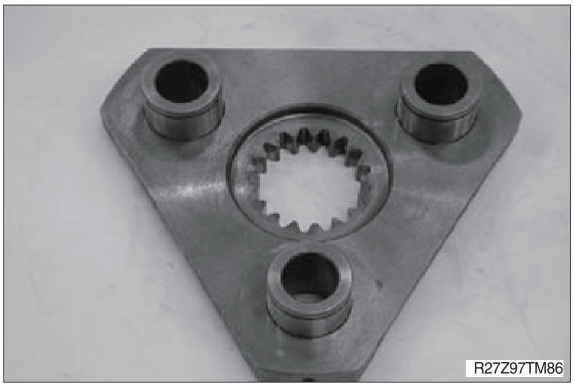
※ Pay attention not to open the snap ring too much. A snap ring which loses tension should be replaced.





(6) Place thrust collar onto the gears.

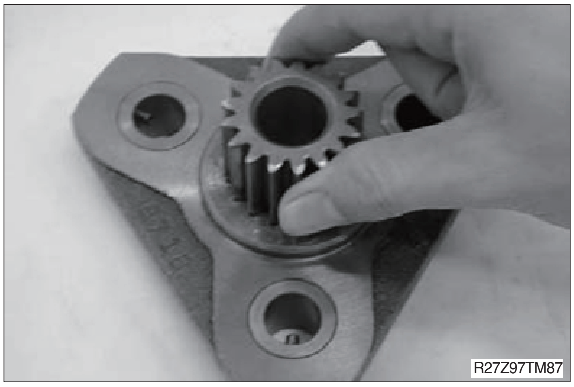
(7) Press-fit the three b2 pins and three spring pins (1pc/pin) into the carrier 2.

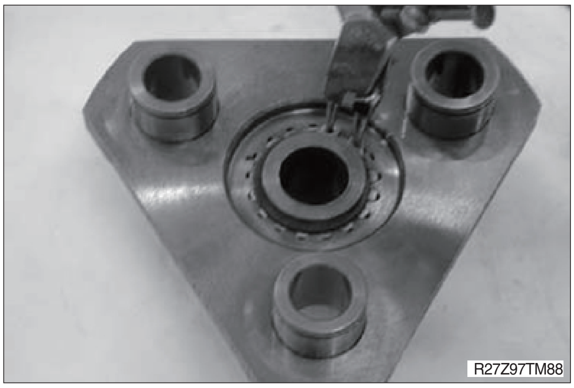

R27Z97TM86

(8) Put the S1 gear to the carrier 2, and then secure them with the snap ring.

※ Pay attention to the direction of the snap ring. The edge side should be uppermost.

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


R27Z97TM87

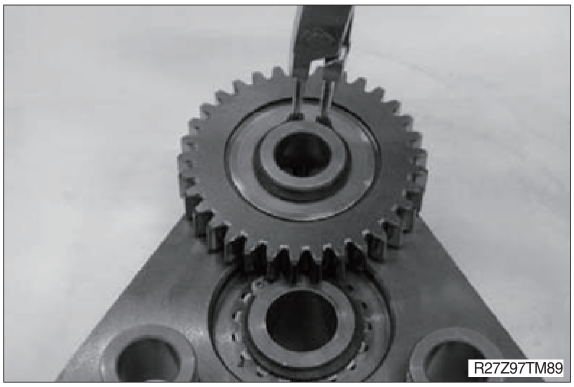

R27Z97TM88

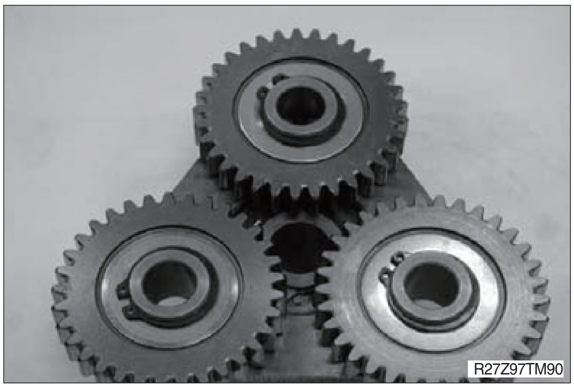
(9) Place the three thrust washers (1pc/1pin), three b2 gears (1pc/1pin), forty-eight needles (16pcs/1pin) and the three thrust washers (1pc/1pin), and secure it with three snap rings.

※ Pay attention to the direction of the b2 gears (see cross sectional drawing for the direction).

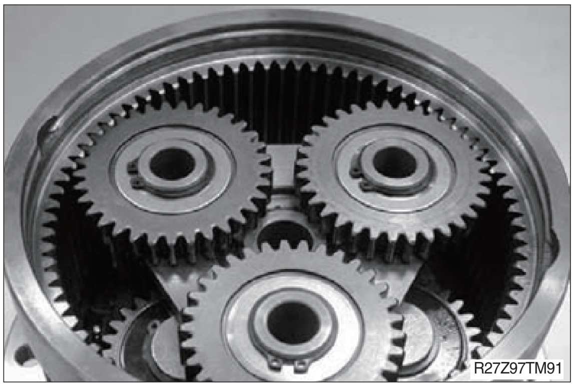
※ Pay attention to the direction of the snap ring. The edge side should be uppermost.

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

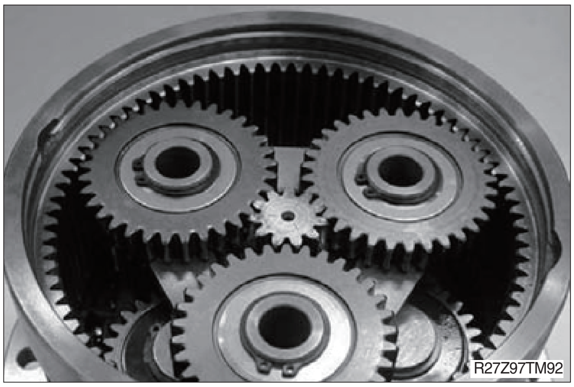




(10) Place the carrier 2 assembly into the body.



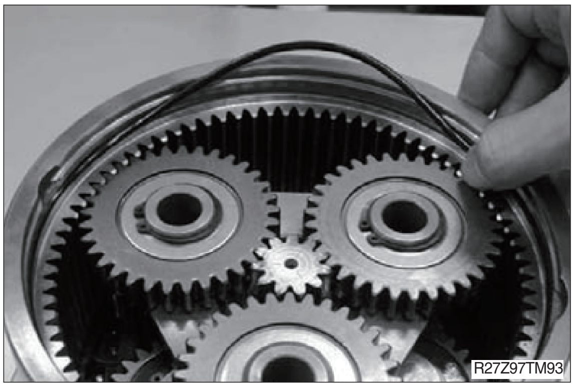
(11) Join the S2 gear to the body.



(12) Place the O-ring to the body.

※ Apply grease to the O-ring.

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



(13) Fill 0.6ℓ (0.16 U.S. gal) gear oil in the body.

(14) Insert the slide ring in the cover.

※ Pay attention to the direction of the slide ring (see cross sectional drawing for the direction, page 7-59~61).

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

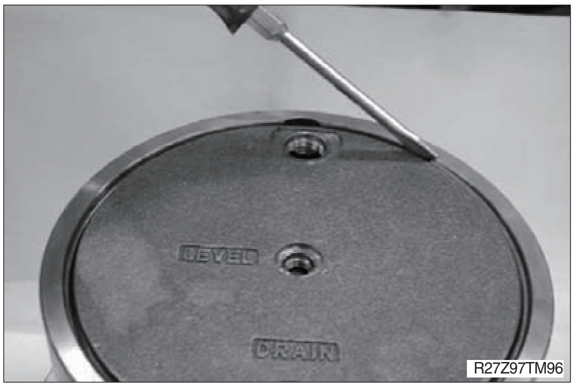
(15) Insert cover in the body.

※ Pay attention not to damage the O-ring.

※ The vertical tapped hole should be aligned with notches of the body.

(16) Put the snap ring into the groove of the body to secure the cover.

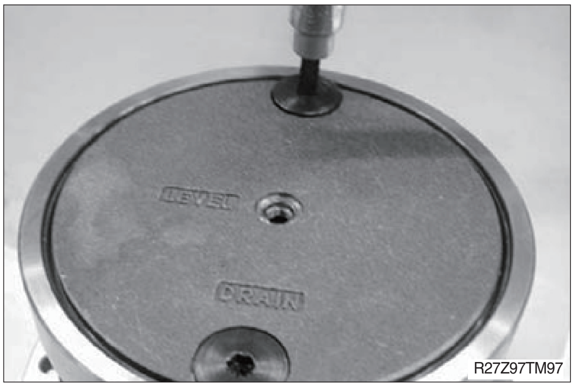
※ Put the flat blade-flared tip screwdriver to the end of the snap ring, and tap it in the direction of the circumference.



R27Z97TM96

(17) Screw the two plugs (size : PF3/8) with O-rings to the cover.

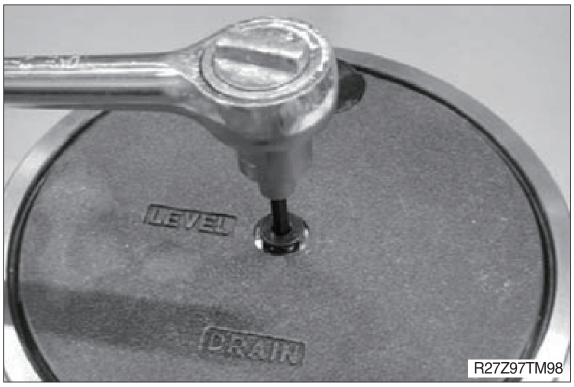
· Plug tightening torque :
4.69~5.2 kgf · m (33.9~37.6 lbf · ft)
· Hexagon size : 8 mm



R27Z97TM97

(18) Screw the three plugs (size : PF3/8, PF1/8) with O-rings (1pc/plug) to the cover.

· Plug tightening torque (PF3/8) :
4.69~5.2 kgf · m (33.9~37.6 lbf · ft)
· Hexagon size : 8 mm (PF3/8)
· Plug tightening torque (PF1/8) :
1.22~1.84 kgf · m (8.82~13.3 lbf · ft)
· Hexagon size : 5 mm (PF1/8)



R27Z97TM98

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

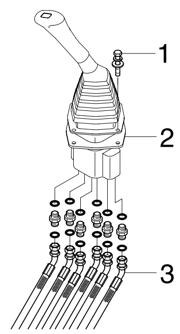
(4) Loosen the socket bolt(1).

(5) Remove the cover of the console box.

(6) Disconnect pilot line hoses(3).

(7) Remove the pilot valve assembly(2).

※ When removing the pilot valve assembly, check that all the hoses have been disconnected.



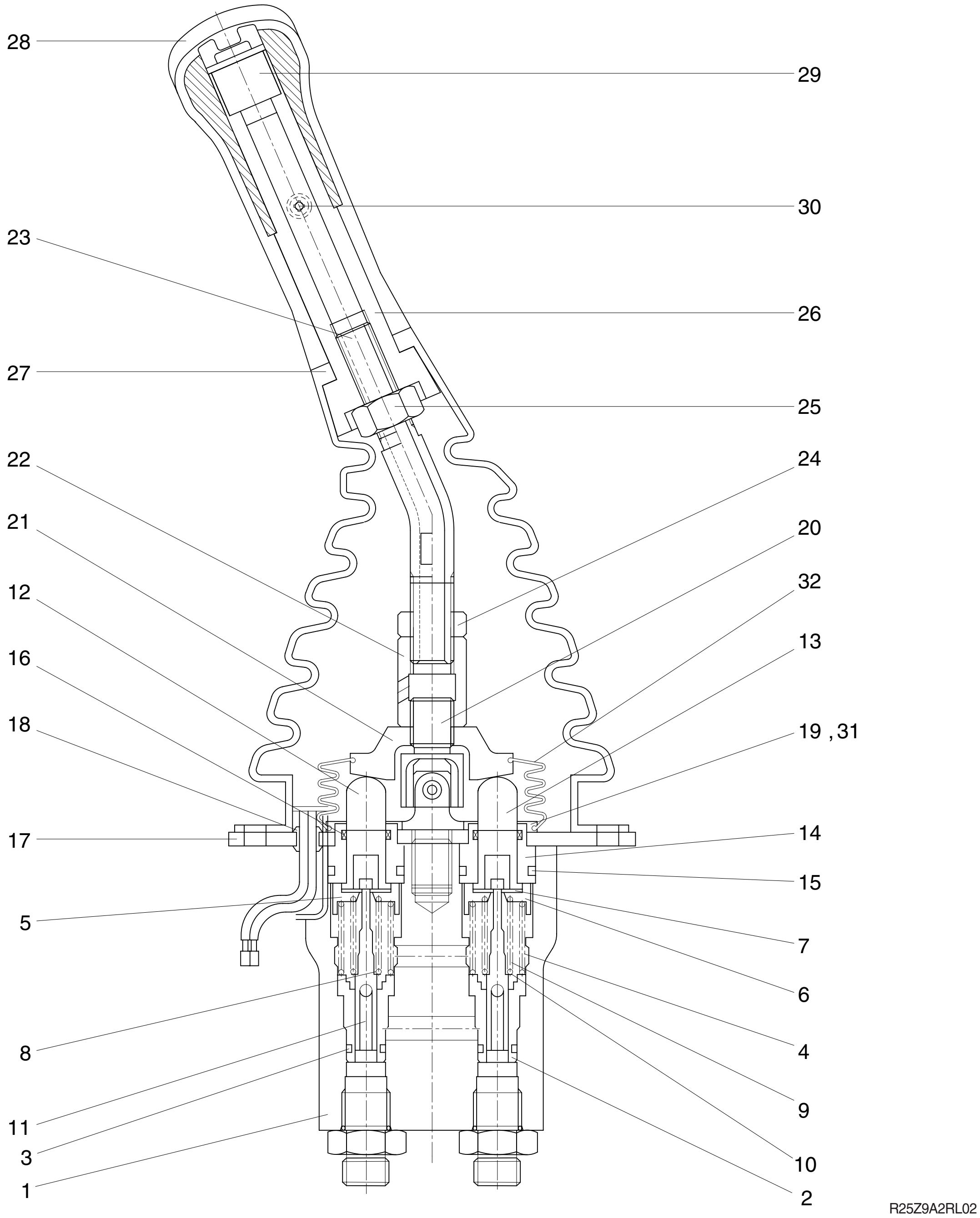
2) INSTALL

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

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

2. DISASSEMBLY AND ASSEMBLY (Type 1)

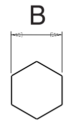
1) STRUCTURE



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

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

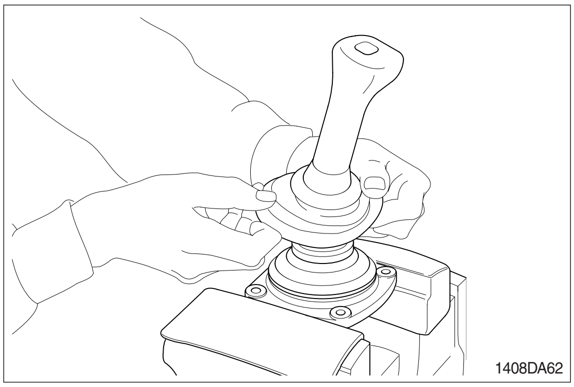
3) DISASSEMBLY

(1) Clean pilot valve with kerosene.

※ Put blind plugs into all ports.

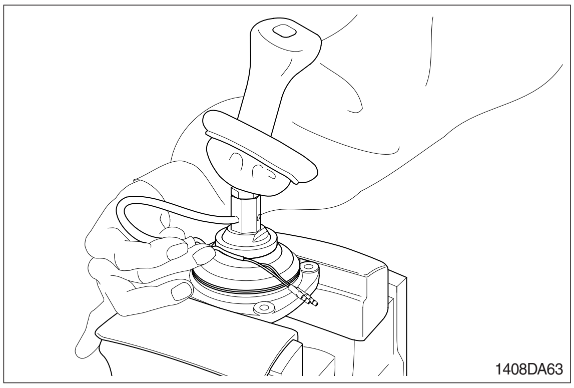
(2) Fix pilot valve in a vise with copper (or lead) sheets.

(3) Remove end of boot (32) from case (1) and take it out upwards.



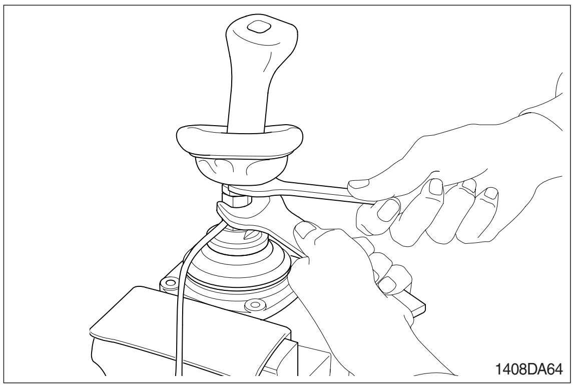
1408DA62

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



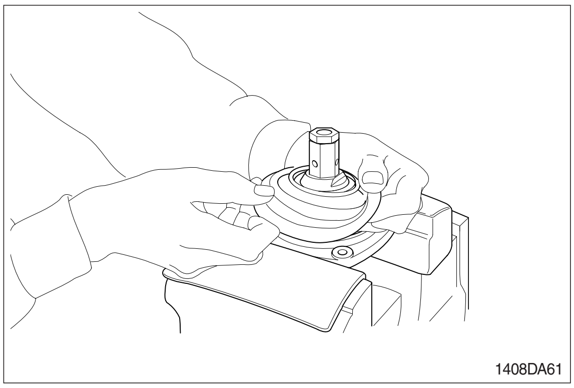
1408DA63

(4) Loosen lock nut (24) and adjusting nut (22) with spanners on them respectively, and take out handle section as one body.



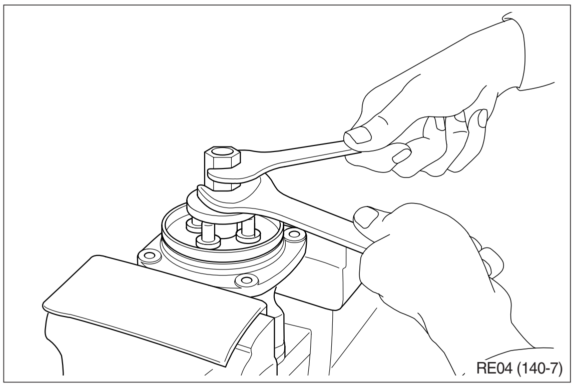
1408DA64

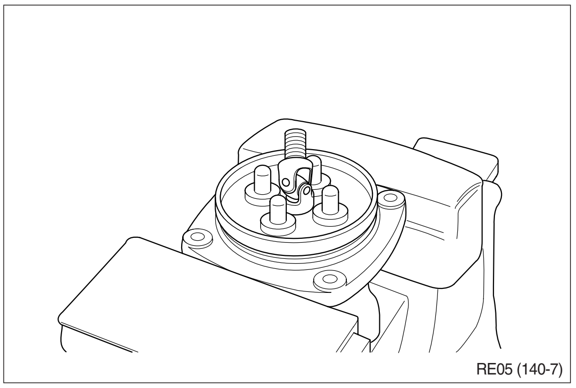
(5) Remove the boot (32).



1408DA61

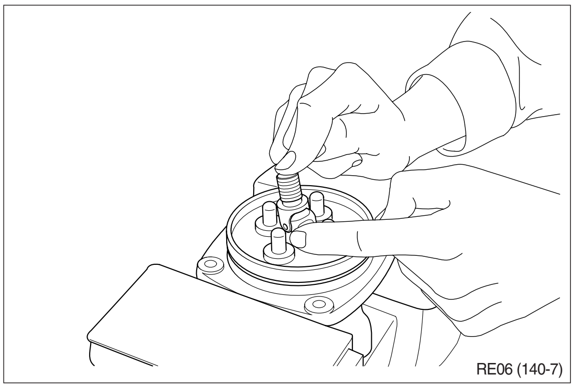
(6) Loosen adjusting nut(22) and plate(31) with spanners on them respectively, and remove them.

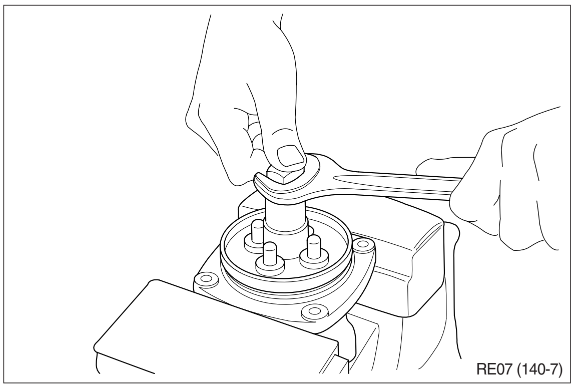

RE04 (140-7)


RE05 (140-7)

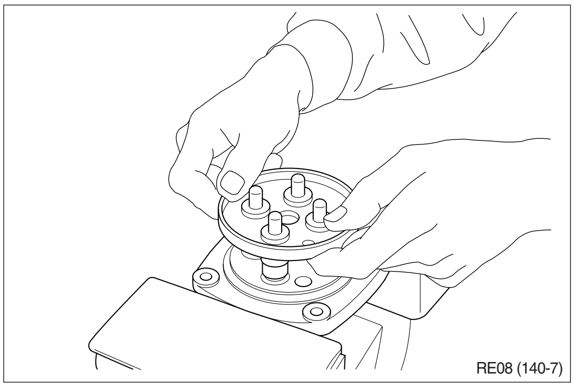
(7) Turn joint anticlockwise to loosen it, utilizing jig (special tool).

※ 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).

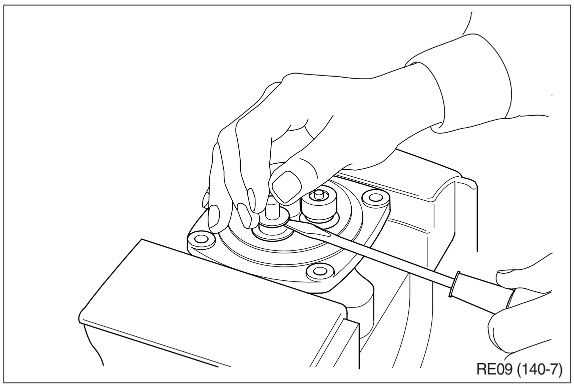


RE08 (140-7)

(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.

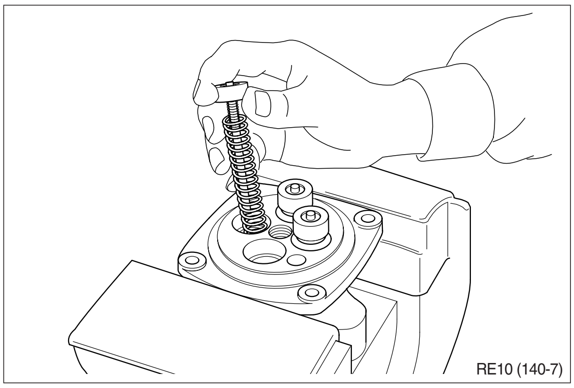
※ During taking out, plug may jump up due to return spring (8, 9) force.
Pay attention to this.



RE09 (140-7)

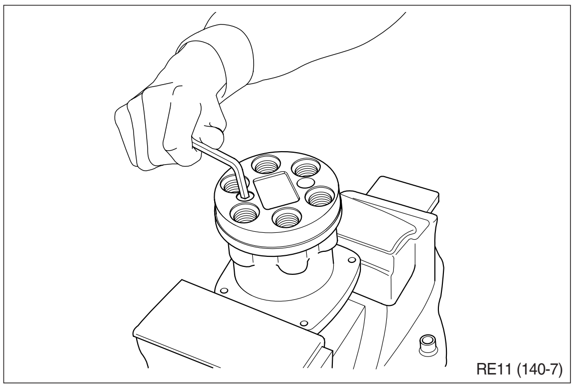
(10) Remove reducing valve subassembly and return spring (8, 9) out of casing.

※ 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.



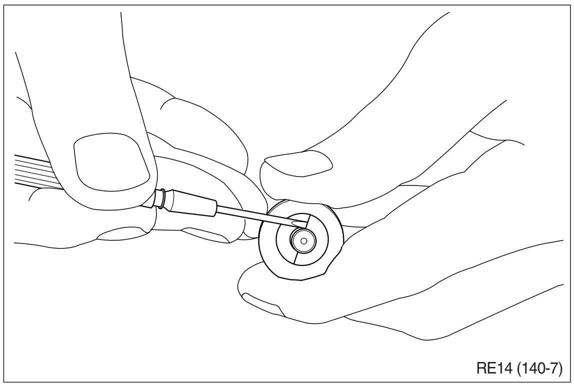
RE11 (140-7)

(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).

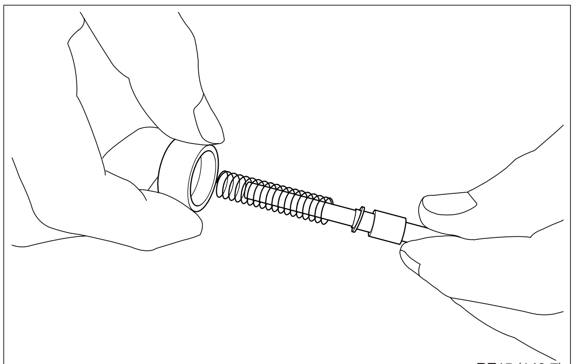
※ Do not push down spring seat more than 6 mm.



RE14 (140-7)

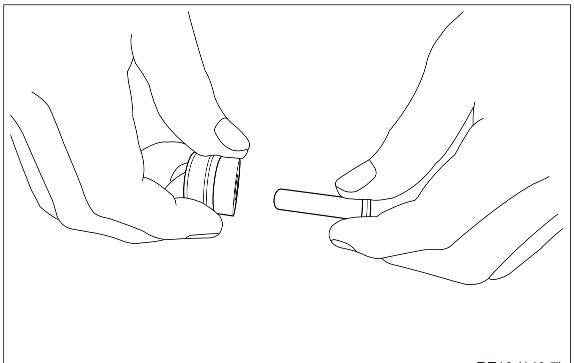
(13) Separate spool (11), spring seat (5, 6), spring (8, 9) and spring seat (10) individually.

※ Until being assembled, they should be handled as one subassembly group.



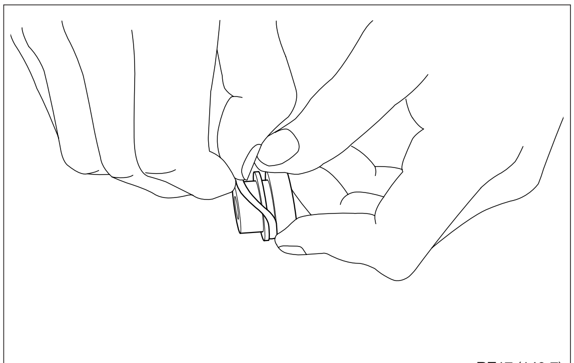
RE15 (140-7)

(14) Take push rod (12, 13) out of plug (14).

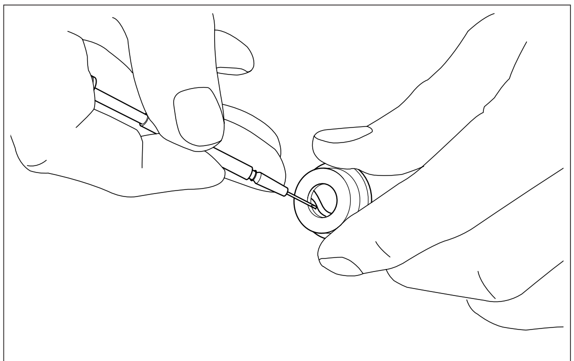


RE16 (140-7)

(15) Remove O-ring (15) and seal (16) from plug (14).
Use small minus screwdriver or so on to remove this seal.

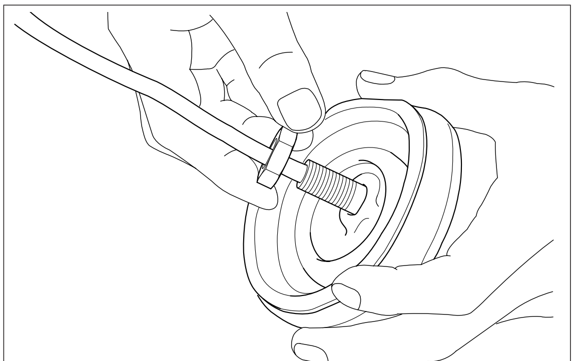


RE17 (140-7)

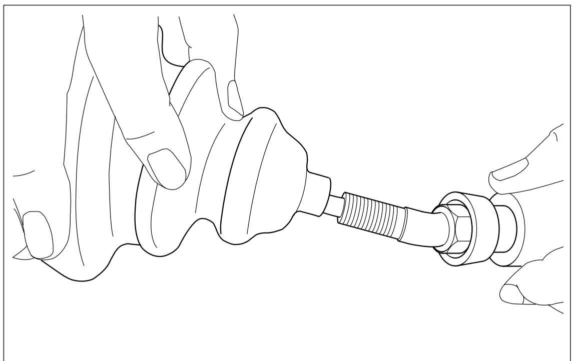


RE18 (140-7)

(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.

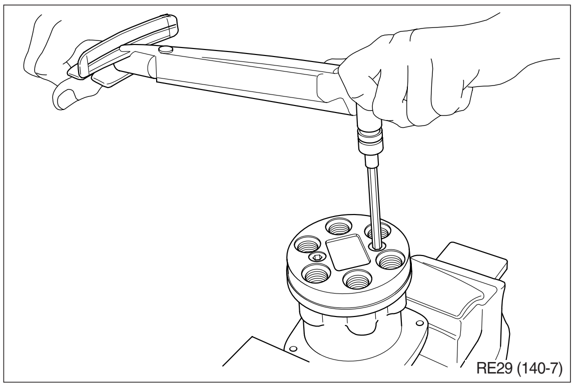
(18) Rust prevention of parts.
Apply rust-preventives to all parts.

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

4) ASSEMBLY

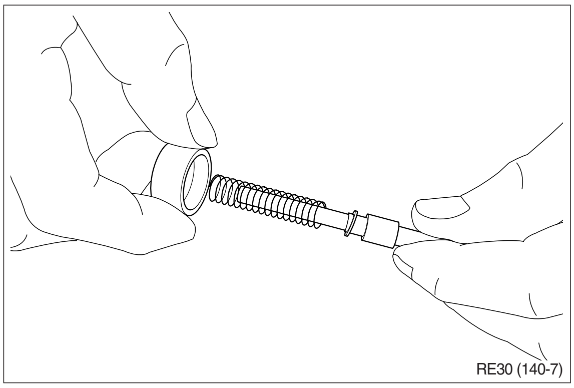
(1) Tighten hexagon socket head plug (2) to the specified torque.

※ Tighten two bolts alternately and slowly.



RE29 (140-7)

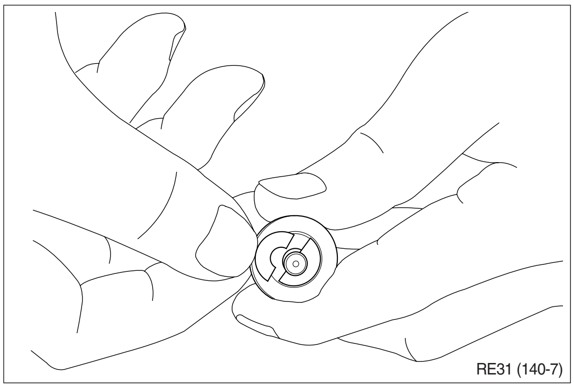
(2) Put spring seat (10), springs (8, 9) and spring seat (5, 6) onto spool (11) in this order.



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.

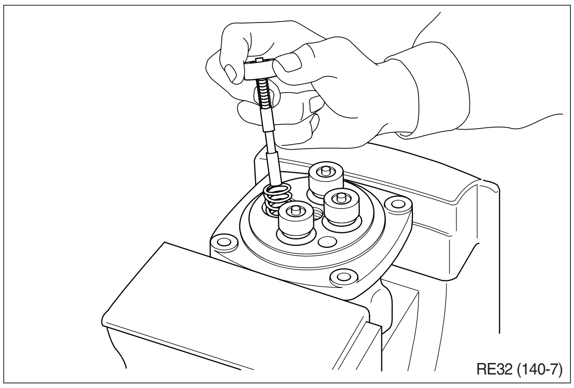
※ Assemble stopper (7) so that its sharp edge side will be caught by head of spool. Do not push down spring seat more than 6 mm.



RE31 (140-7)

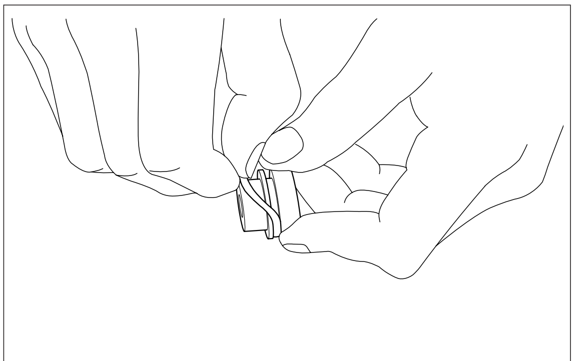
(4) Assemble spring (8, 9) into casing. Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.



RE32 (140-7)

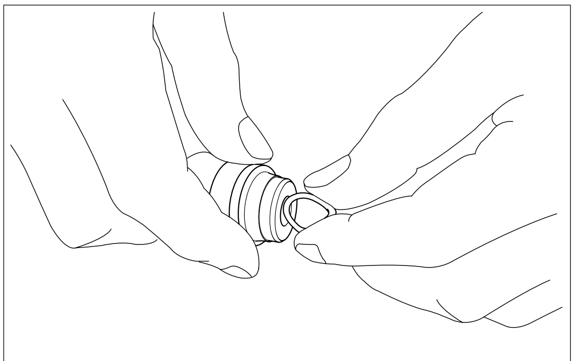
(5) Assemble O-ring (15) onto plug (14).



RE33 (140-7)

(6) Assemble seal (16) to plug (14).

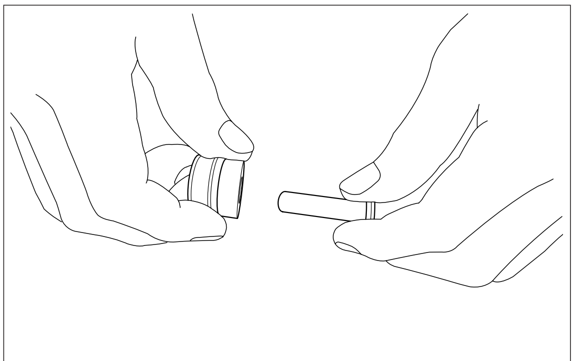
※ Assemble seal in such lip direction as shown below.



RE34 (140-7)

(7) Assemble push rod (12, 13) to plug (14).

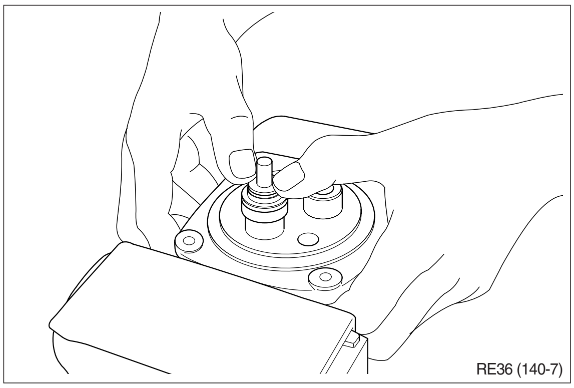
※ Apply working oil on push-rod surface.



RE35 (140-7)

(8) Assemble plug subassembly to casing.

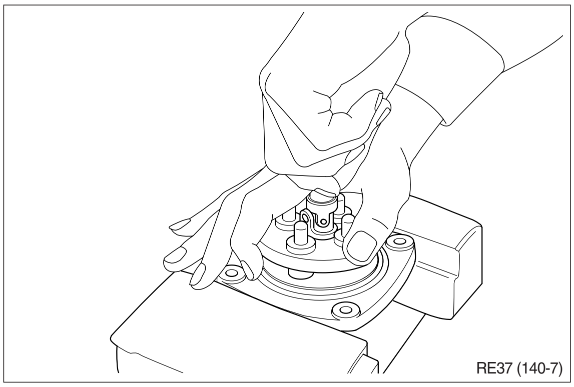
※ When return spring is weak in force, subassembly stops due to resistance of O-ring.



RE36 (140-7)

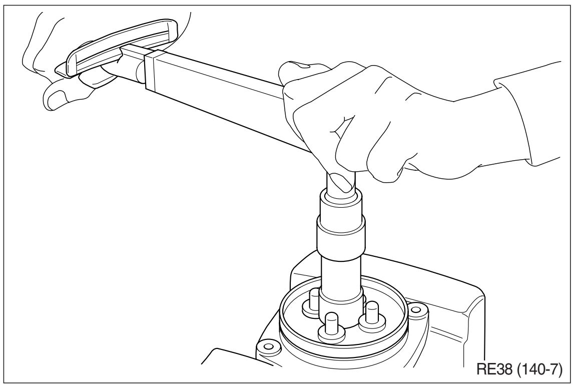
(9) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (31), and tighten joint (20) temporarily.

(10) Fit plate (31).



RE37 (140-7)

(11) Tighten joint (20) with the specified torque to casing, utilizing jig.

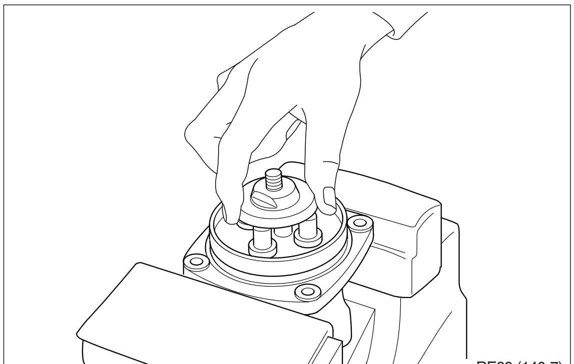


RE38 (140-7)

(12) Assemble plate (21) to joint (20).

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

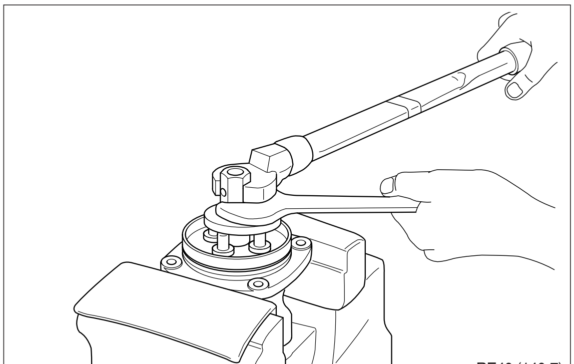
※ Do not screw it over.



RE39 (140-7)

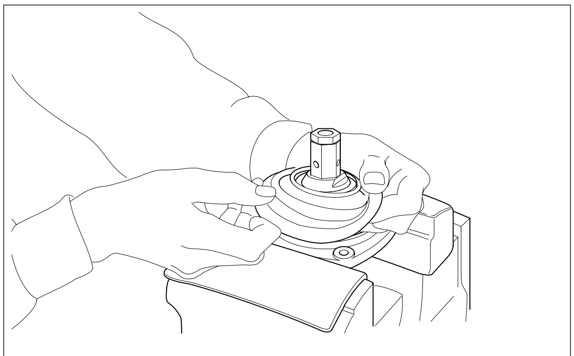
(13) Assemble adjusting nut (22), apply spanner to width across flat of plate (21) to fix it, and tighten adjusting nut to the specified torque.

※ During tightening, do not change position of disk.



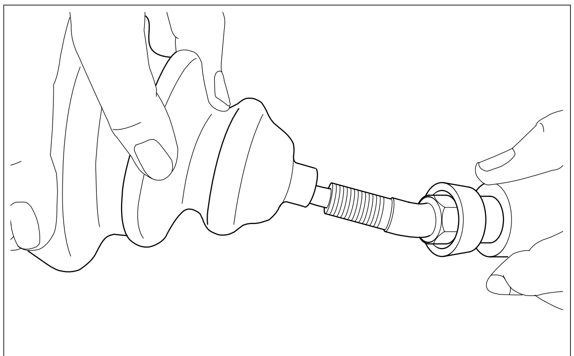
RE40 (140-7)

(14) Fit boot (32) to plate.

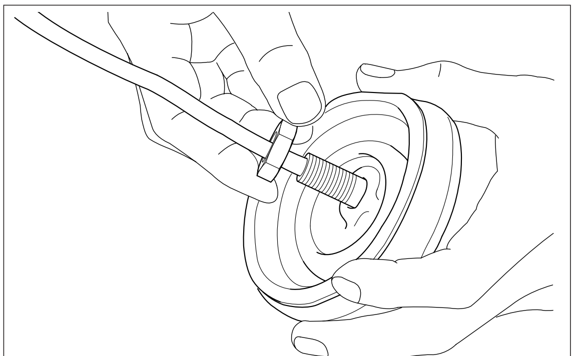


1408DA61

(15) Fit boot (27) and lock nut (24), and handle subassembly is assembled completely.

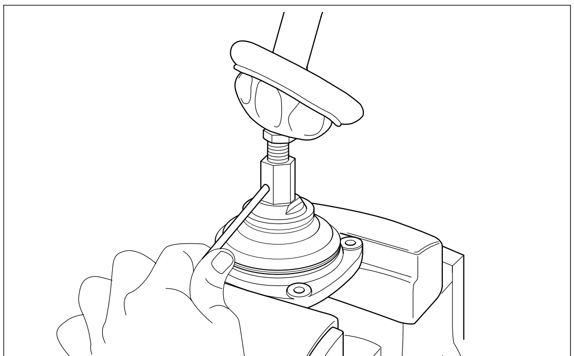


25038RL02(4)



RE48 (140-7)

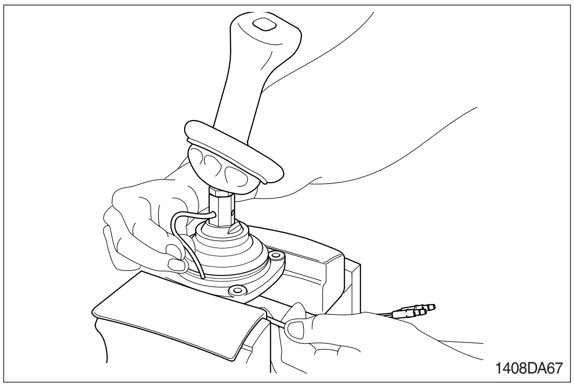
(16) Pull out cord and tube through adjusting nut hole provided in direction 60° to 120° from casing hole.



1408DA66

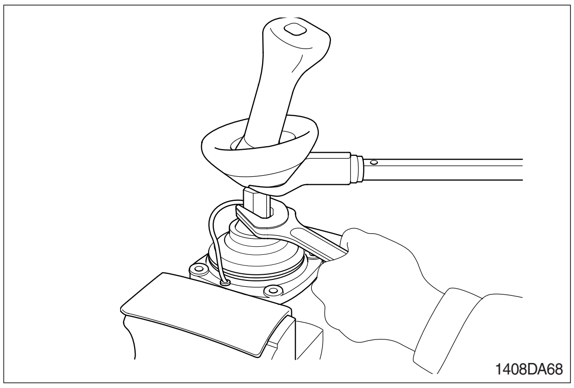
(17) Assemble bushing (18) to plate and pass cord and tube through it.

※ Provide margin necessary to operation.



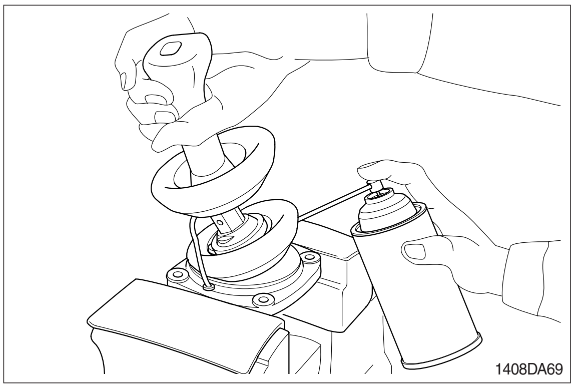
1408DA67

(18) Determine handle direction, tighten lock nut (21) to specified torque to fix handle.



1408DA68

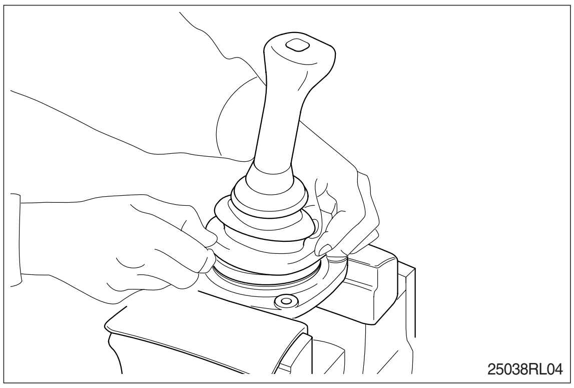
(19) Apply grease to rotating section of joint and contacting faces of disk and push rod.



1408DA69

(20) Assemble lower end of bellows to casing.

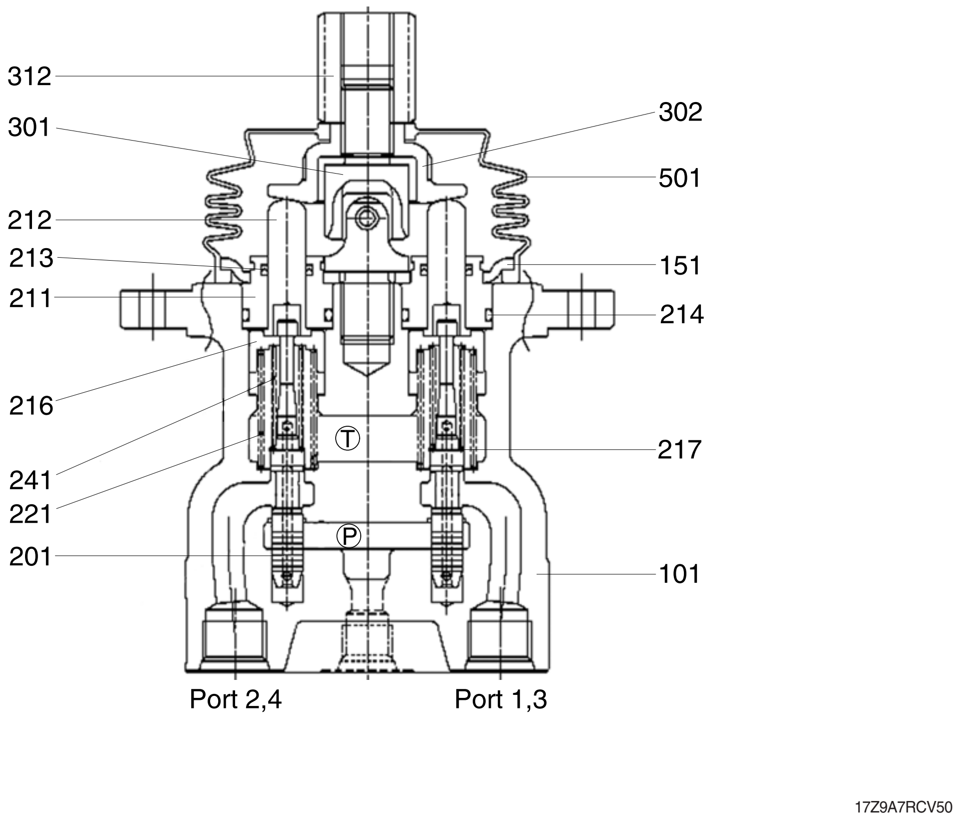
(21) Inject volatile rust-preventives through all ports and then put blind plugs in ports.



25038RL04

3. DISASSEMBLY AND ASSEMBLY (Type 2)

1) STRUCTURE



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.

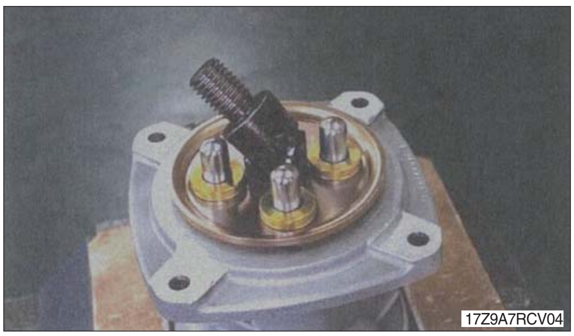
※ Place blind plug in all ports.

(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).

(4) Use a spanner applied to both the adjustment nut (312) and disc (302) and loosen and then remove them.



⚠ 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.


17Z9A7RCV09

(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.


17Z9A7RCV10

※ 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).


17Z9A7RCV11

(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.

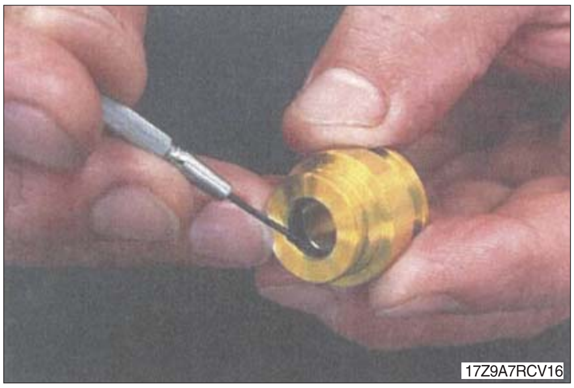
17Z9A7RCV12

(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).


17Z9A7RCV20

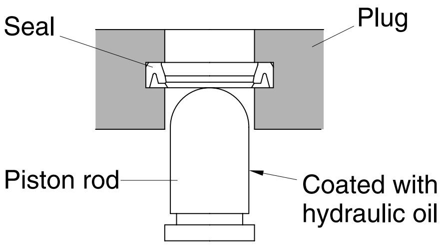
(5) Fit the seal (213) into the plug (211).

※ Fit the lip of the seal (213) as shown right.


17Z9A7RCV21

(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


17Z9A7RCV22


17Z9A7RCV23

▲ 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.

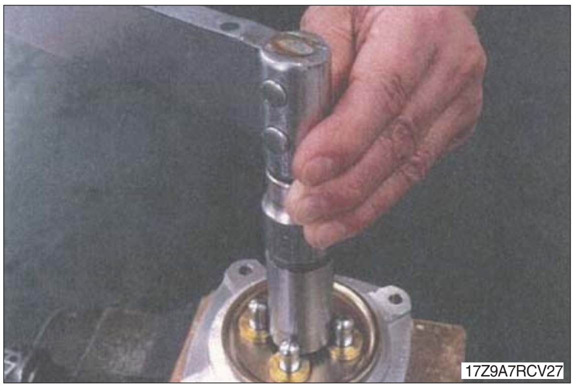
※ The surface of the spool (201) and aperture (101) can be damaged by mis-handling. Take care not to damage the surface of either during assembly.

(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).


17Z9A7RCV28

(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.


17Z9A7RCV29

(12) Apply grease to the rotating part of the joint (301) and end of the push-rod (212).


17Z9A7RCV30

(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.


17Z9A7RCV29

GROUP 8 TURNING JOINT

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

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

(4) Disconnect all hoses.

(5) Sling the turning joint assembly (1) and remove the mounting bolt (2).

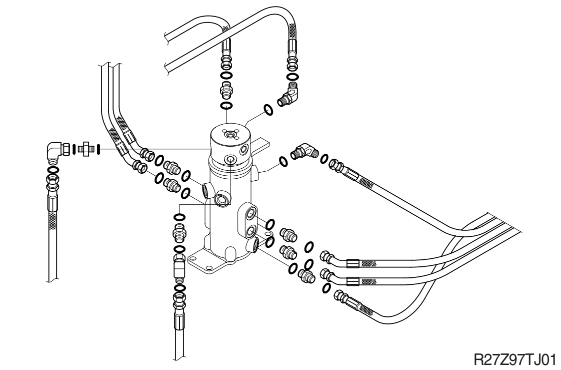
· Weight : 11 kg (24 lb)

· Tightening torque : 6.9± 1.4 kgf · m (49.9± 10.1 lbf · ft)

(6) Remove the turning joint assembly.

※ When removing the turning joint, check that all the hoses have been disconnected.

13031GE18



R27Z97TJ01

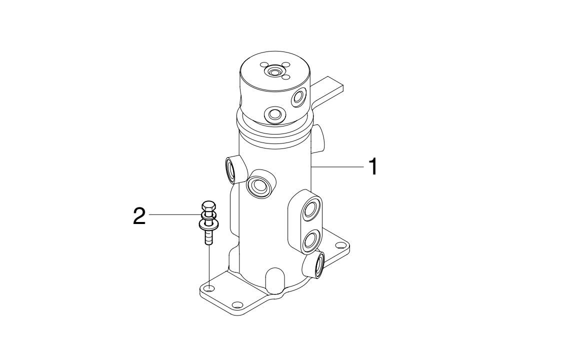
2) INSTALL

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

※ Take care of turning joint direction.

※ Assemble hoses to their original positions.

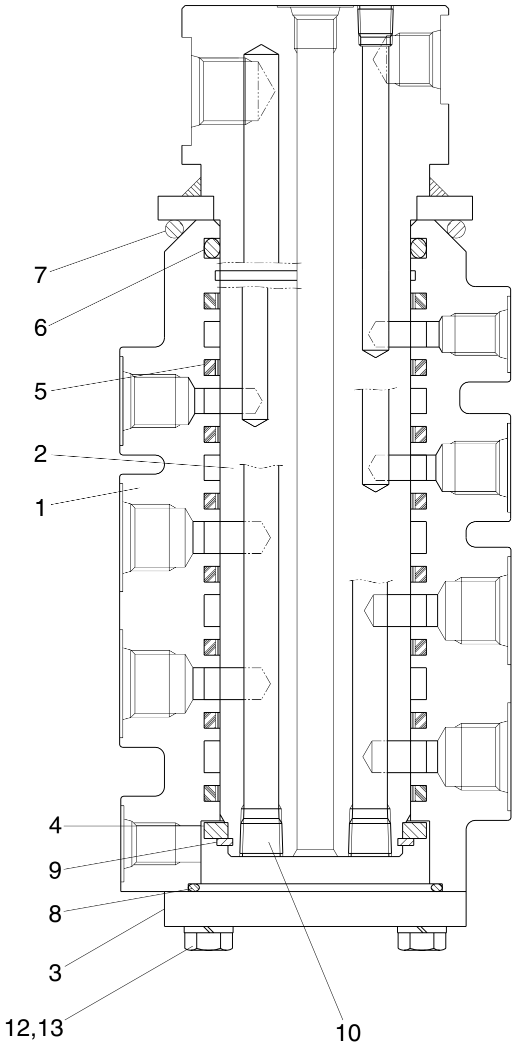
※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.



R27Z97TJ02

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



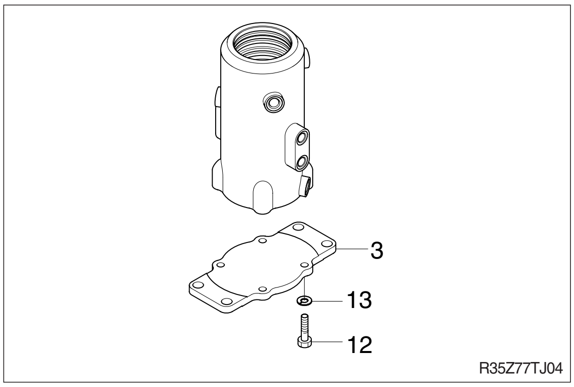
R27Z97TJ03

1	Hub	5	Slipper seal	9	Retainer ring
2	Shaft	6	O-ring	10	Plug
3	Cover	7	O-ring	12	Hexagon bolt
4	Spacer	8	O-ring	13	Spring washer

2) DISASSEMBLY

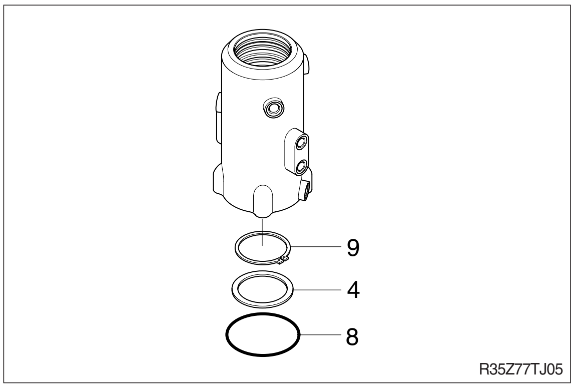
※ Before the disassembly, clean the turning joint.

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



(2) Remove O-ring (8).

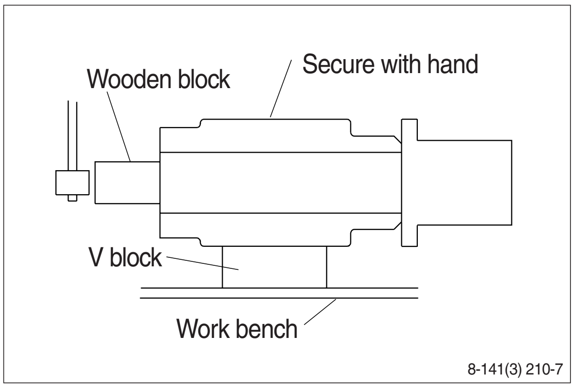
(3) Remove retainer ring (9) and spacer (4).



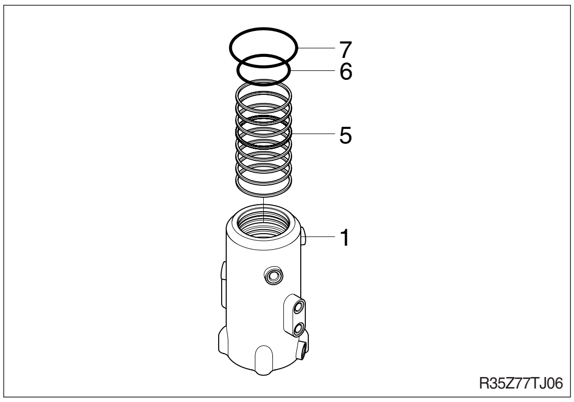
(4) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

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

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



(5) Remove eight slipper seals (5) and O-ring (6, 7) from hub (1).



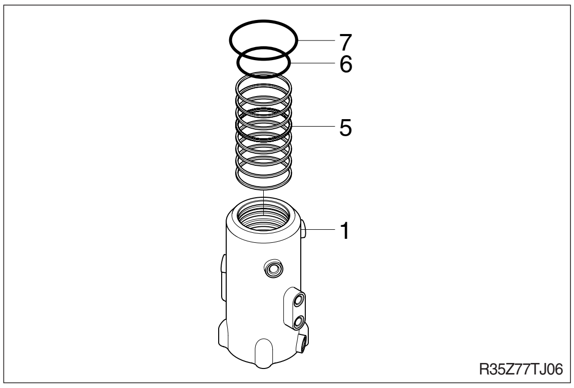
3) ASSEMBLY

※ Clean all parts.

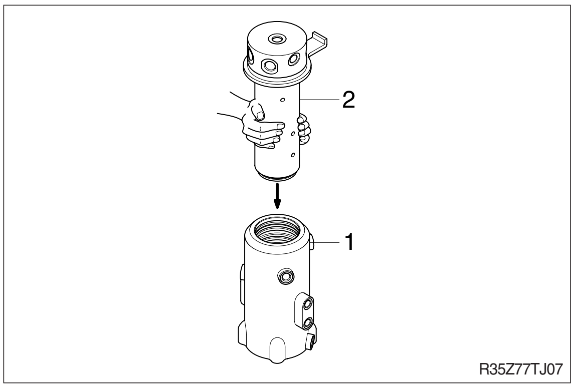
※ As a general rule, replace oil seals and O-ring.

※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(1) Fix eight slipper seal (5) and O-ring (6, 7) to hub (1).

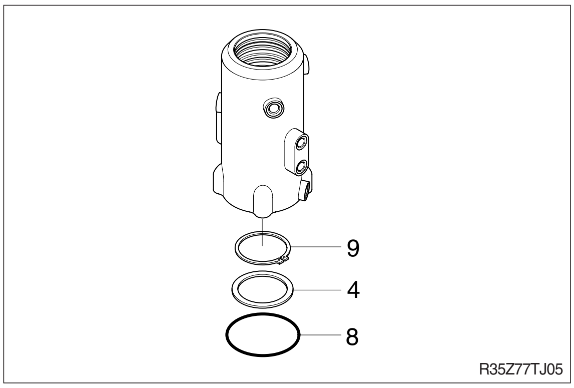


(2) Set hub (1) on block, install shaft (2) into hub (1) by hand.

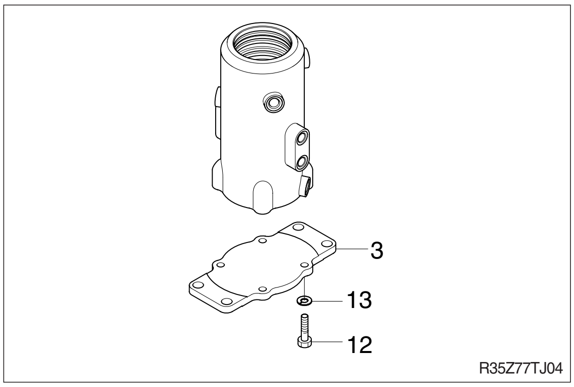


(3) Fit spacer (4) and retainer ring (9) to shaft (2).

(4) Fit O-ring (8) to hub (1).



(5) Install cover (3) to hub and tighten bolts (12).



1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

(1) Removal

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

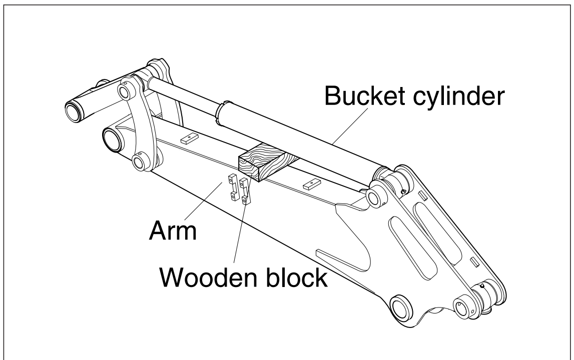
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.


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.

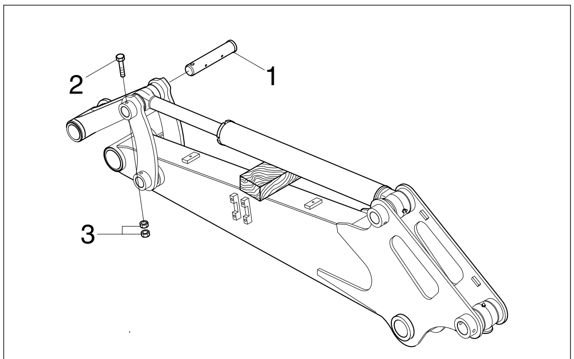
① Set block between bucket cylinder and arm.



R35Z77CY03

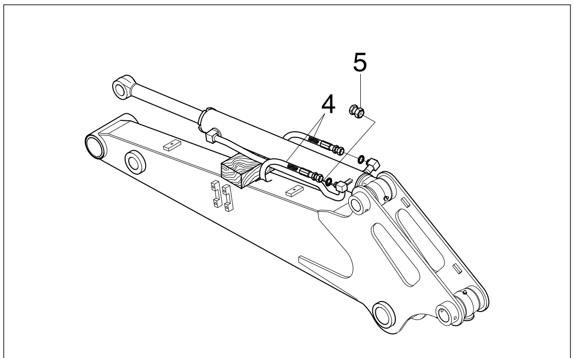
② Remove bolt (2), nut (3) and pull out pin (1).

※ 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.

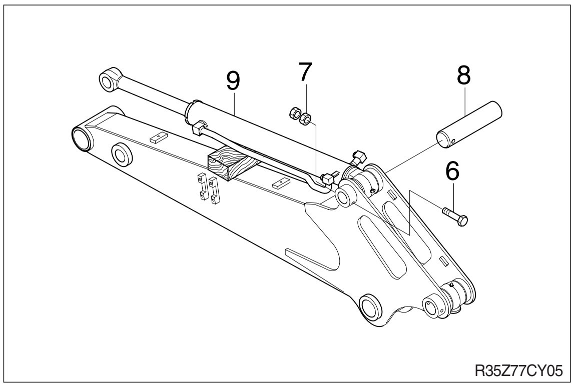


R35Z77CY04

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 : 20 kg (44 lb)



(2) Install

① Carry out installation in the reverse order to removal.

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

※ Bleed the air from the bucket cylinder.

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

2) ARM CYLINDER

(1) Removal

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

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

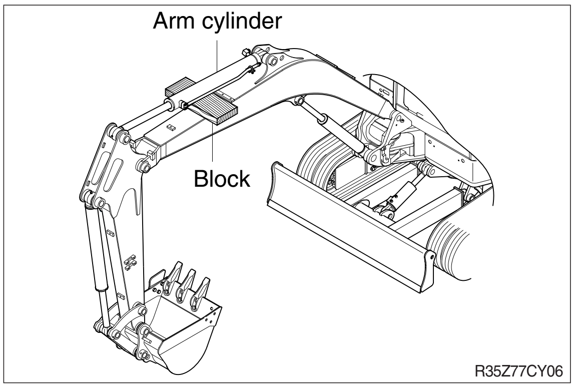

13031GE18

⚠ **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.

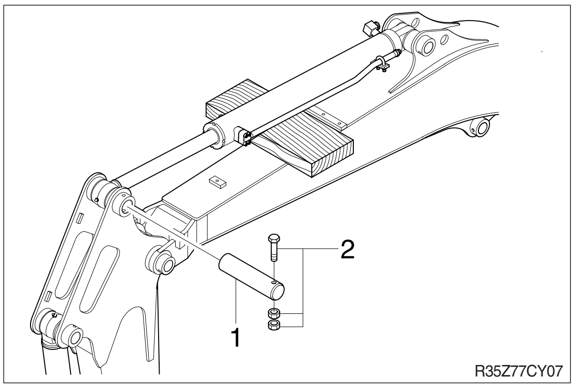
① Set block between arm cylinder and boom.



R35Z77CY06

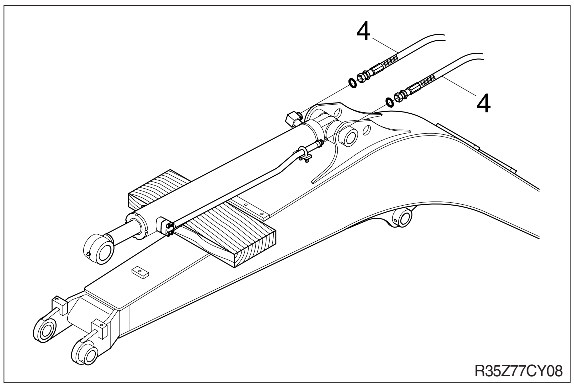
② Remove bolt and nut (2) and pull out pin (1).

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



R35Z77CY07

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

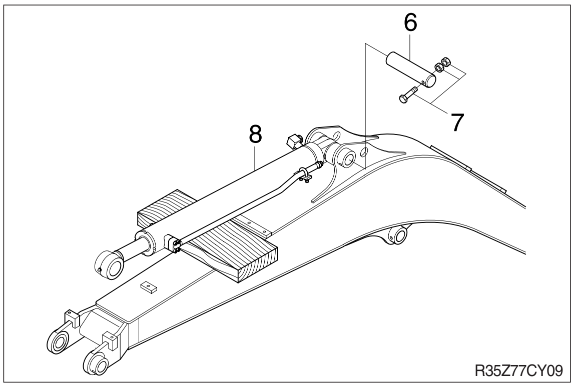


R35Z77CY08

⑤ Sling arm assembly (8) and remove bolt and nut (7) then pull out pin (6).

⑥ Remove arm cylinder assembly (8).

· Weight : 26 ㎏ (57 ℔)



(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.

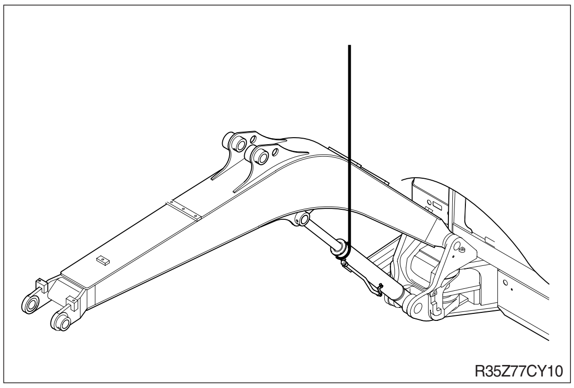
13031GE18

⚠ **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.

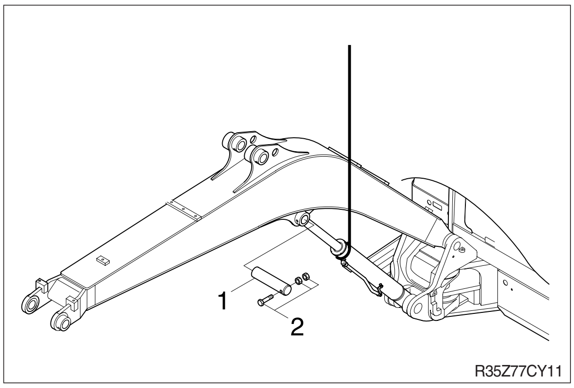
① Sling boom cylinder assembly.



R35Z77CY10

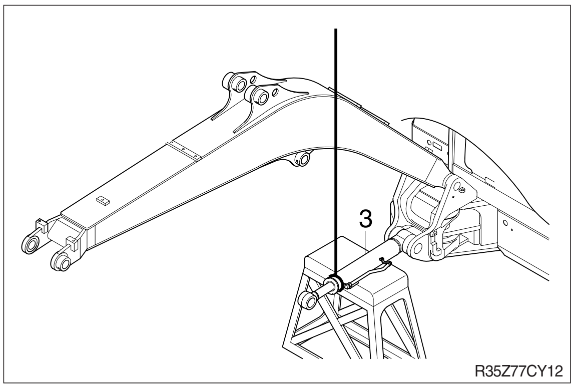
③ Remove bolt and nut (2) and pull out pin (1).

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



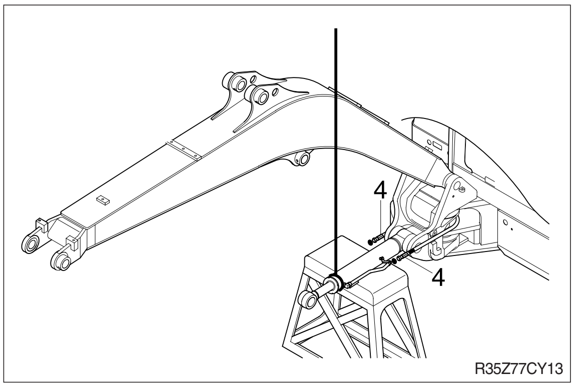
R35Z77CY11

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



R35Z77CY12

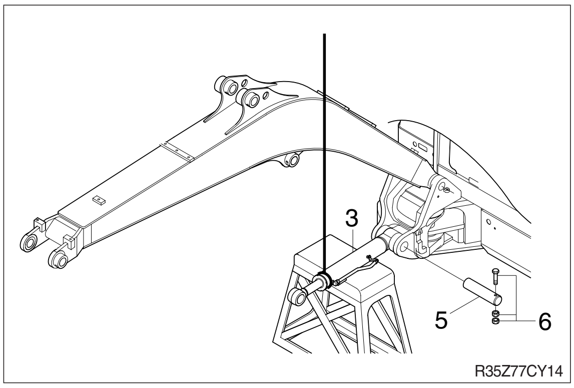
⑤ Disconnect boom cylinder hoses(4) and put plugs on cylinder pipe.



⑥ Remove bolt (6) and pull out pin (5).

⑦ Remove boom cylinder assembly (3).

· Weight : 26 ㎏ (57 ℔)



(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.

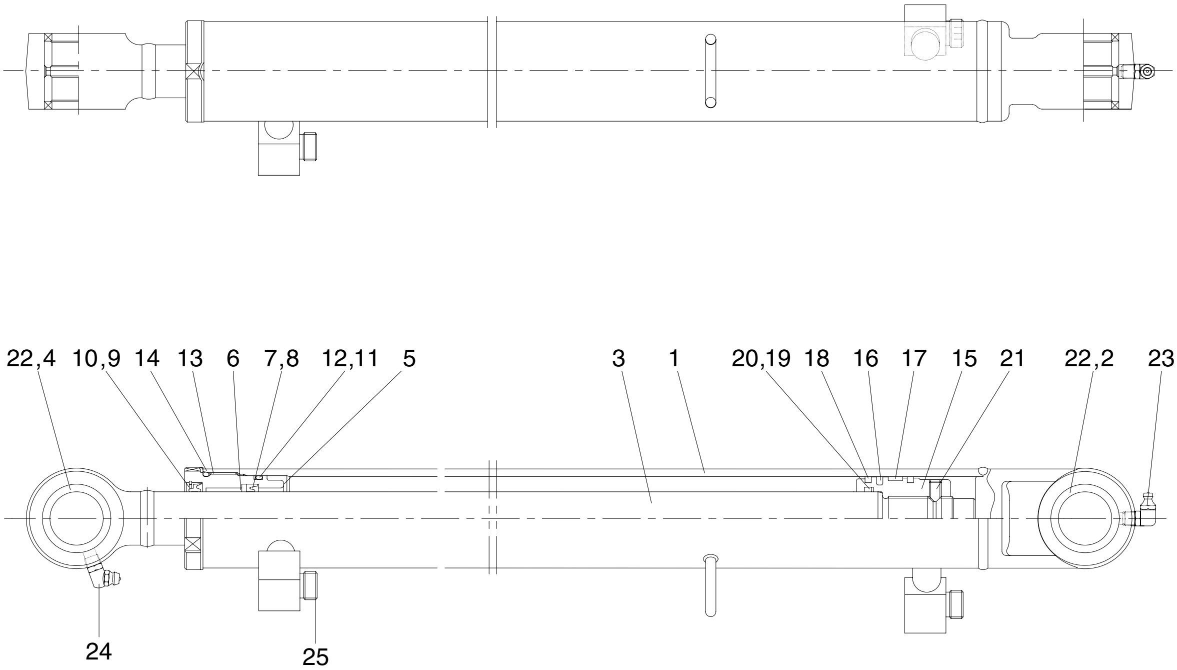
※ Bleed the air from the boom cylinder.

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

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

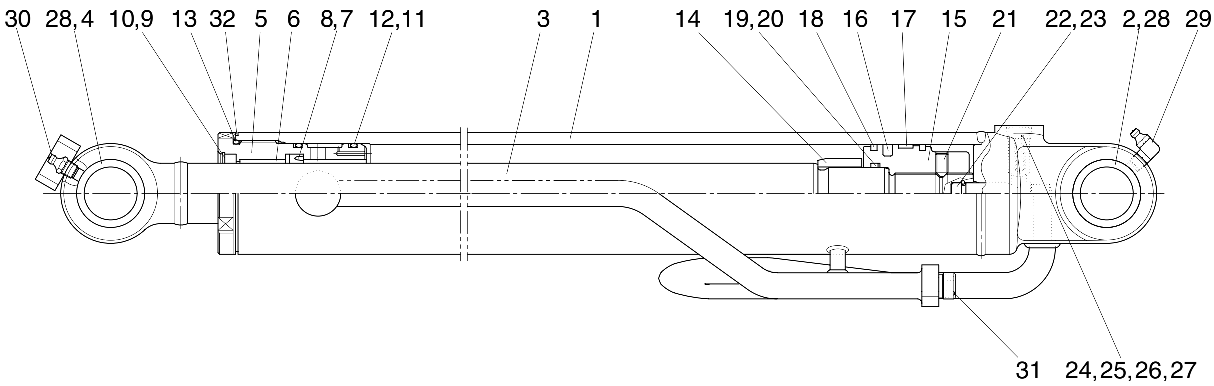
(1) Bucket cylinder



R25Z9A7CY15

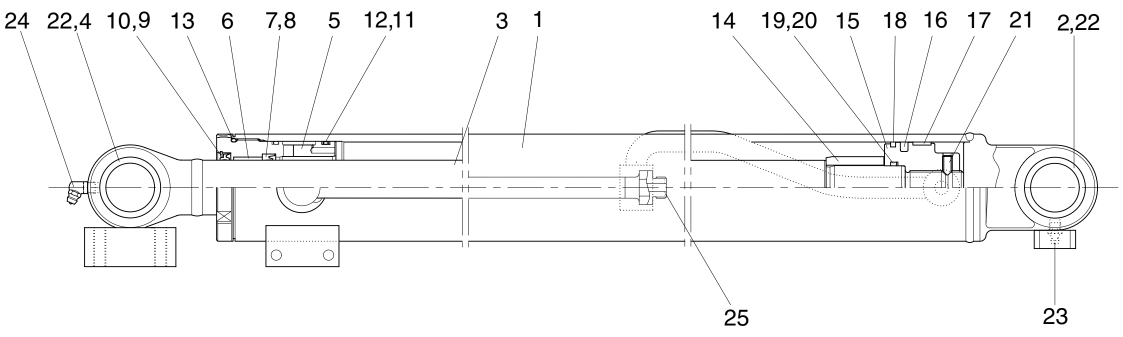
1	Tube assembly	10	Retaining ring	19	O-ring
2	Pin bushing	11	O-ring	20	Back up ring
3	Rod assembly	12	Back-up ring	21	Set screw
4	Pin bushing	13	O-ring	22	Pin wiper
5	Rod cover	14	Washer	23	Grease nipple
6	Rod bushing	15	Piston	24	Grease nipple
7	U-packing	16	Piston seal	25	O-ring
8	Back-up ring	17	Wear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

(2) Arm cylinder



1	Tube assembly	12	Back-up ring	23	Stop ring
2	Pin bushing	13	O-ring	24	Check valve
3	Rod assembly	14	Cushion ring	25	Spring
4	Pin bushing	15	Piston	26	Spring support
5	Rod cover	16	Piston seal	27	Hexagon socket plug
6	Rod bushing	17	Wear ring	28	Pin wiper
7	U-packing	18	Dust ring	29	Grease nipple
8	Back-up ring	19	O-ring	30	Grease nipple
9	Dust wiper	20	Back up ring	31	O-ring
10	Retaining ring	21	Set screw	32	Washer
11	O-ring	22	Cushion plunger		

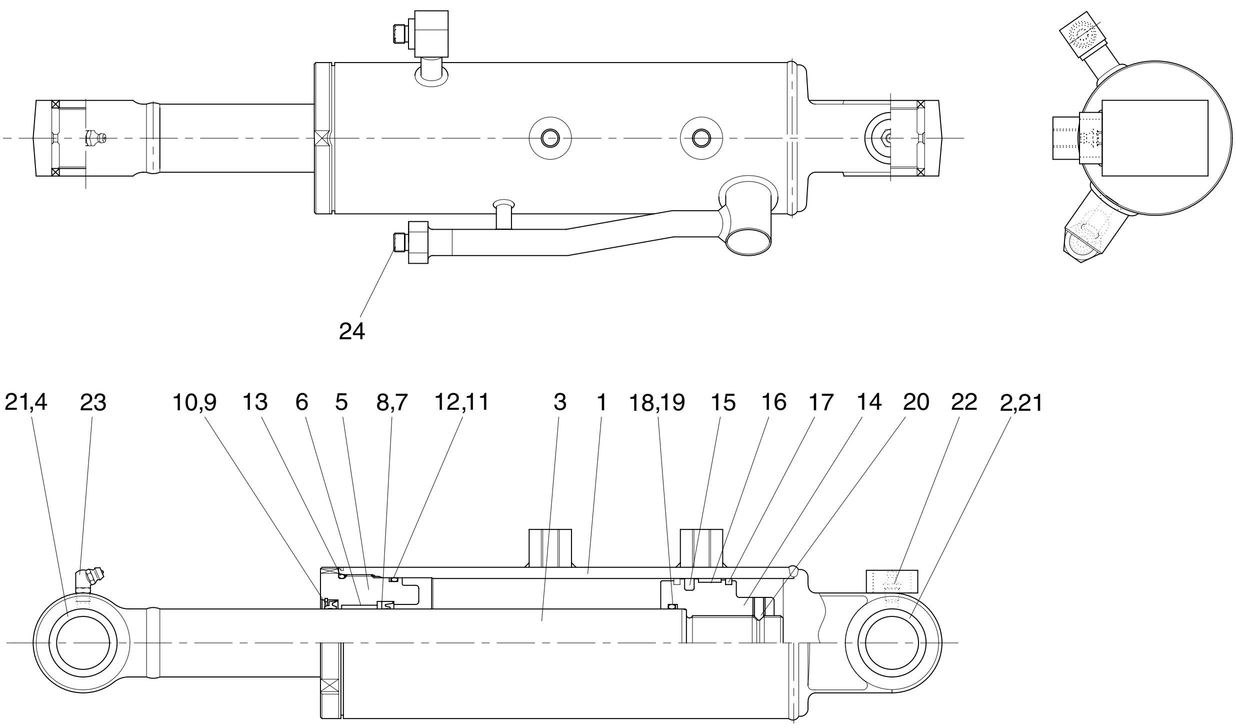
(3) Boom cylinder



R27Z97CY17

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

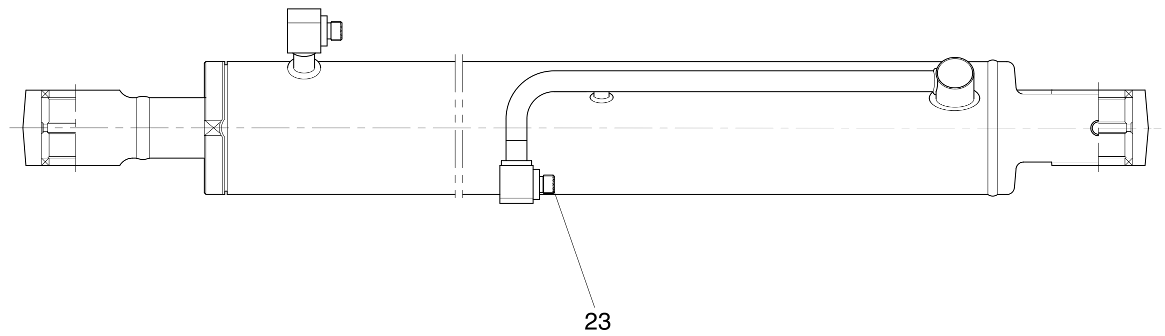
(4) Dozer cylinder

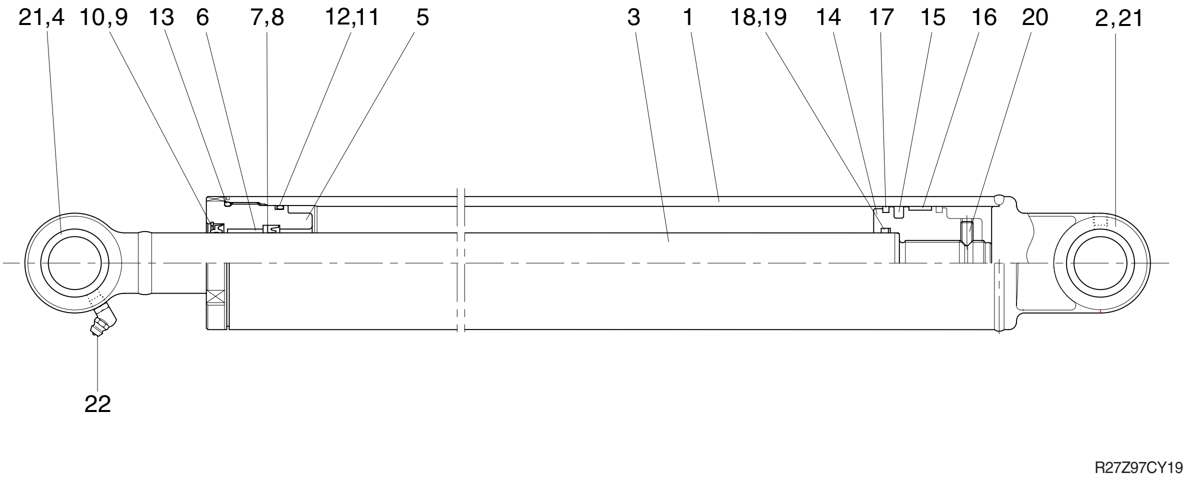


R27Z97CY18

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

(5) Boom swing cylinder

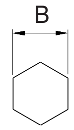




1	Tube assembly	9	Dust wiper	17	Dust ring
2	Pin bushing	10	Retaining ring	18	O-ring
3	Rod assembly	11	O-ring	19	Back up ring
4	Pin bushing	12	Back-up ring	20	Set screw
5	Rod cover	13	O-ring	21	Pin wiper
6	Rod bushing	14	Piston	22	Grease nipple
7	U-packing	15	Piston seal	23	O-ring
8	Back-up ring	16	Wear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

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	5	M80	70±7.0	506±50.6
	Arm cylinder	5	M75	70±5.0	506±36.2
	Bucket cylinder	5	M65	50±5.0	362±36.2
	Dozer cylinder	5	M90	70±7.0	506±50.6
	Boom swing cylinder	5	M80	70±7.0	506±50.6
Piston	Boom cylinder	15	M30	75±7.5	542±54.2
	Arm cylinder	16	M30	75±7.5	542±54.2
	Bucket cylinder	15	M27	50±5.0	362±36.2
	Dozer cylinder	14	M36	75±7.5	542±54.2
	Boom swing cylinder	14	M32	75±7.5	542±54.2

3) DISASSEMBLY

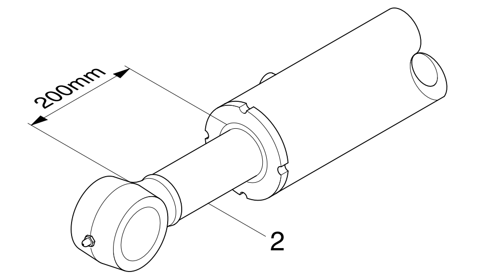
※ Procedures are based on the boom cylinder.

(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.

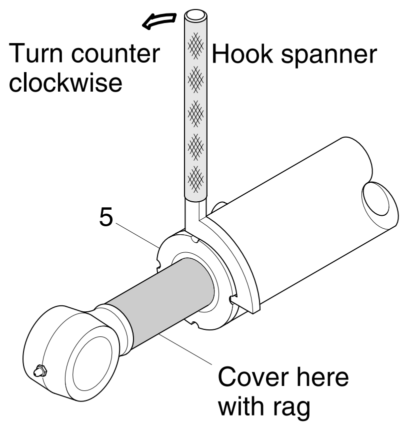
② Pull out rod assembly (3) about 200 ㎜ (7.1 in). Because the rod assembly is rather heavy, finish extending it with air pressure after the oil draining operation.



R35Z77CY20

③ Loosen and remove the gland (5) by hook spanner.

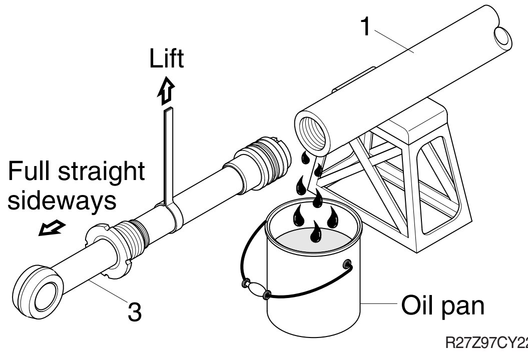
※ Cover the extracted rod assembly (3) with rag to prevent it from being accidentally damaged during operation.



R27Z97CY21

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

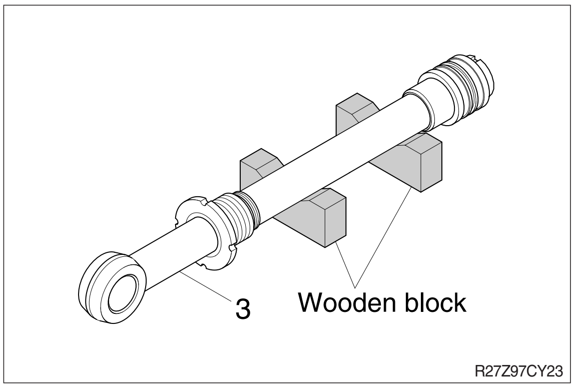


R27Z97CY22

Note that the plated surface of rod assembly(3) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

⑤ Place the removed rod assembly on a wooden V-block that is set level.

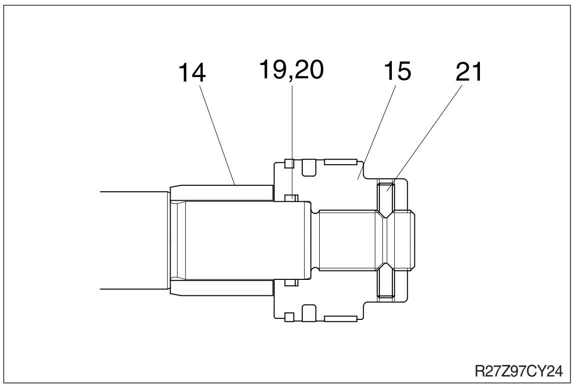
※ Cover a V-block with soft rag.



(2) Remove piston and gland

① Remove set screw (21).

② Remove piston assembly (15), back up ring (20), O-ring (19) and cushion ring (14).

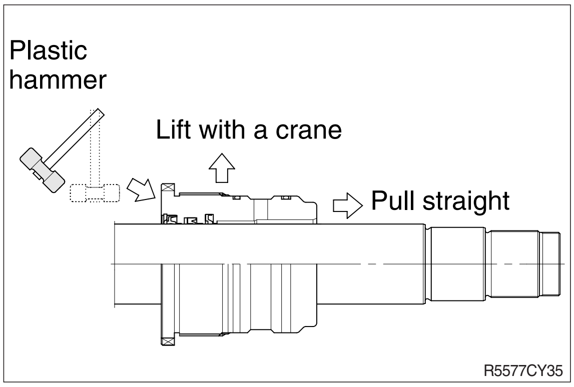


④ Remove the gland assembly from rod assembly (3).

※ If it is too heavy to move, move it by striking the flanged part of gland with a plastic hammer.

※ Pull it straight with gland assembly lifted with a crane.

Exercise care so as not to damage the lip of DU bushing (6) and packing (7, 8, 9, 10, 11, 12) by the threads of rod assembly (3).

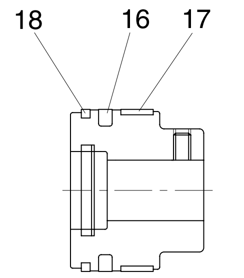


(3) Disassemble the piston assembly

① Remove wear ring (17).

② Remove dust ring (18) and piston seal (16).

※ Exercise care in this operation not to damage the grooves.



R27Z97CY25

(4) Disassemble gland assembly

① Remove back up ring (12) and O-ring (11).

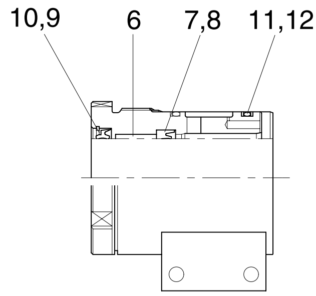
② Remove snap ring (10), dust wiper (9).

③ Remove back up ring (8), U-packing (7).

④ Remove the rod bushing (6).

※ Exercise care in this operation not to damage the grooves.

※ Do not remove seal and ring, if does not damaged.



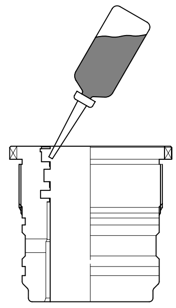
R27Z97CY26

4) ASSEMBLY

(1) Assemble cylinder head assembly

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

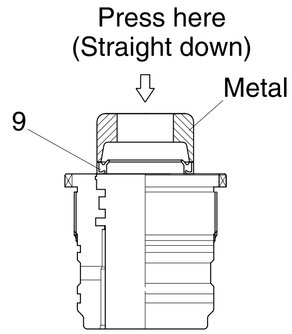
① Coat the inner face of gland (5) with hydraulic oil.



R5577CY38

② Coat dust wiper (9) with grease and fit dust wiper (9) to the bottom of the hole of dust seal.
At this time, press a pad metal to the metal ring of dust seal.

③ Fit retain ring (10) to the stop face.

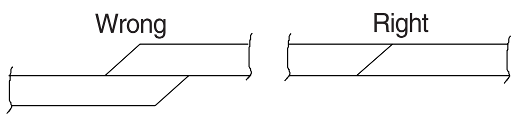


R27Z97CY29

④ Fit back up ring (7), rod seal (6) to corresponding grooves, in that order.

※ Coat each packing with hydraulic oil before fitting it.

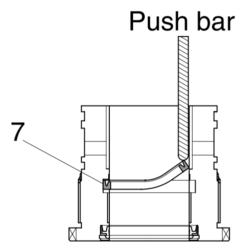
※ Insert the backup ring until one side of it is inserted into groove.



8-157(3) 210-7

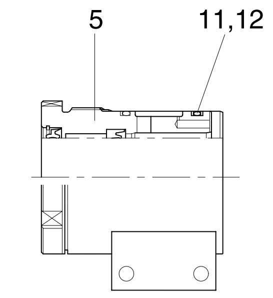
※ U-packing (7) has its own fitting direction. Therefore, confirm it before fitting them.

※ Fitting U-packing (7) upside down may damage its lip. Therefore check the correct direction that is shown in fig.



R27Z97CY35

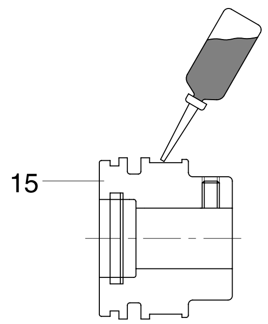
⑤ Fit back up ring (12) to gland (5).
※ Put the backup ring in the warm water of 30~50°C .
⑥ Fit O-ring (11) to gland (5).



R27Z97CY27

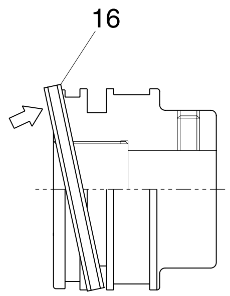
(2) Assemble piston assembly

※ Check for scratches or rough surfaces. If found smooth with an oil stone.
① Coat the outer face of piston (15) with hydraulic oil.



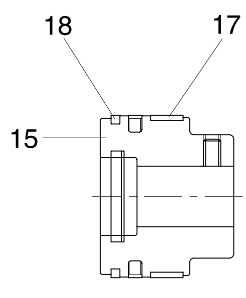
R27Z97CY28

② Fit piston seal (16) to piston.
※ Put the piston seal in the warm water of 60~100°C for more than 5 minutes.
※ After assembling the piston seal, press its outer diameter to fit in.



R27Z97CY30

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



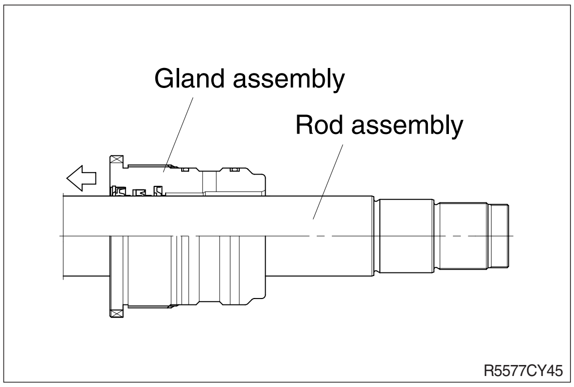
R27Z97CY31

(3) Install piston and cylinder head

① Fix the rod assembly to the work bench.

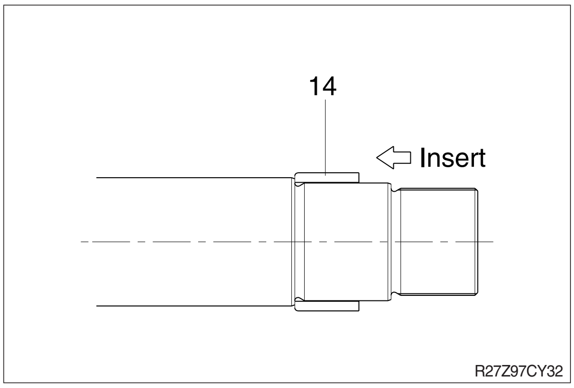
② Apply hydraulic oil to the outer surface of rod assembly (3), the inner surface of piston and gland.

③ Insert gland assembly to rod assembly.

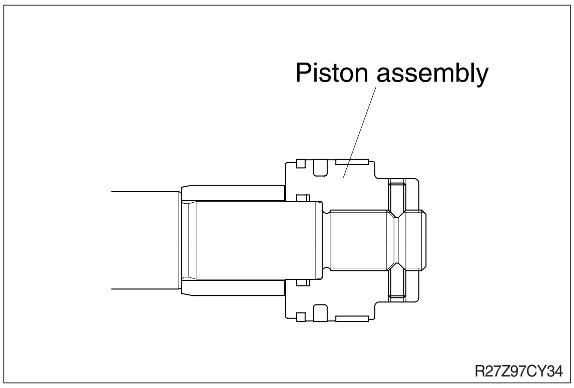


④ Insert cushion ring (14) to rod assembly.

※ Note that cushion ring (14) has a direction in which it should be fitted.



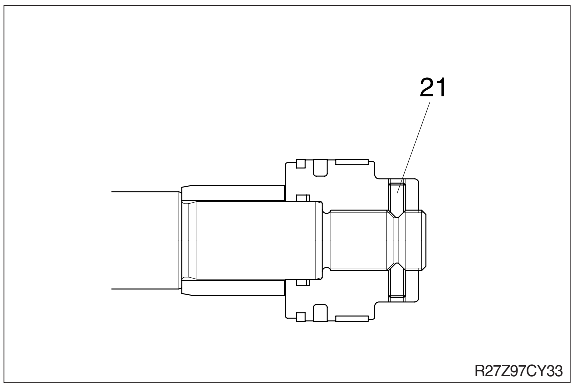
⑤ Fit piston assembly to rod assembly.



⑥ Fit set screw (21).

· Tightening torque :

1.5 kgf · m (10.8 lbf · ft)

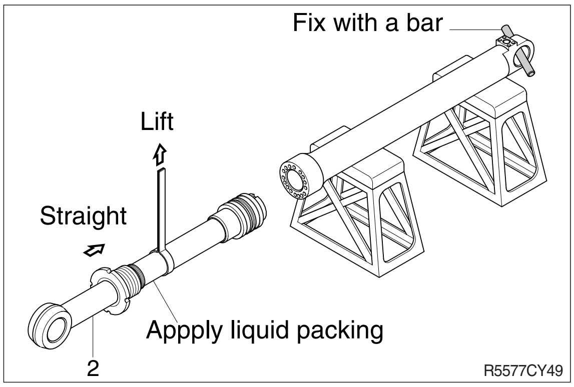


(3) Overall assemble

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.

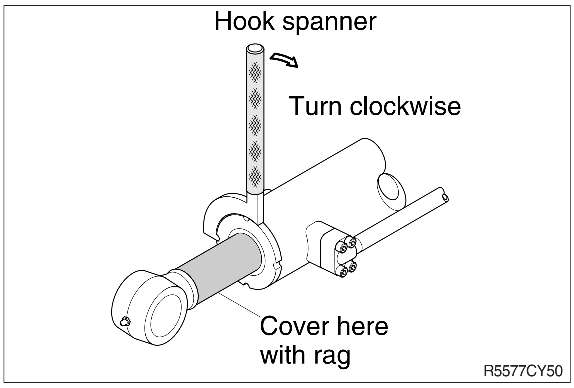
② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.

※ 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.



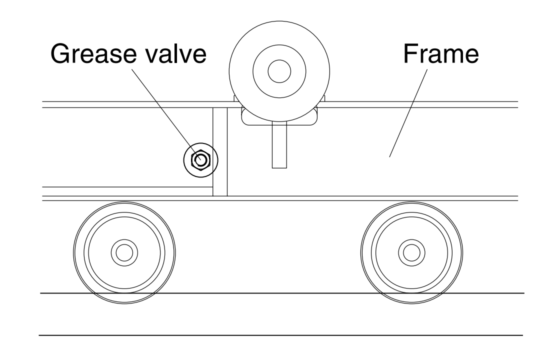
GROUP 10 UNDERCARRIAGE

1. RUBBER TRACK

1) REMOVAL

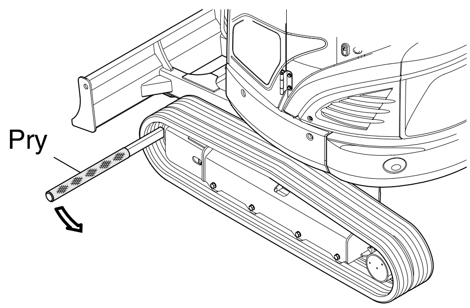
(1) Loosen tension of the rubber track.

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



R27Z97TR04

(2) Remove the rubber track from lower frame using pry.

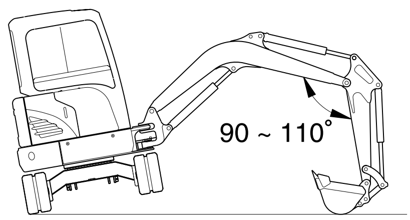


R35Z77TR22

2) INSTALL

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

※ Adjust the tension of the rubber track.

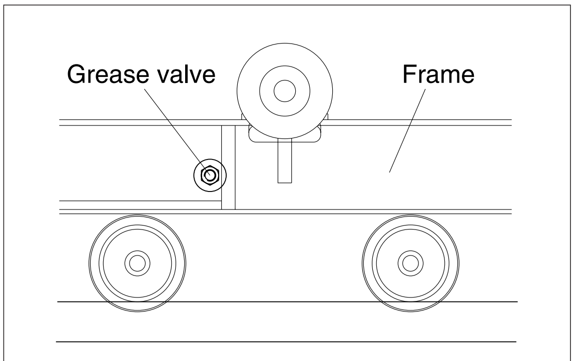


R35Z77TR03

2. CARRIER ROLLER

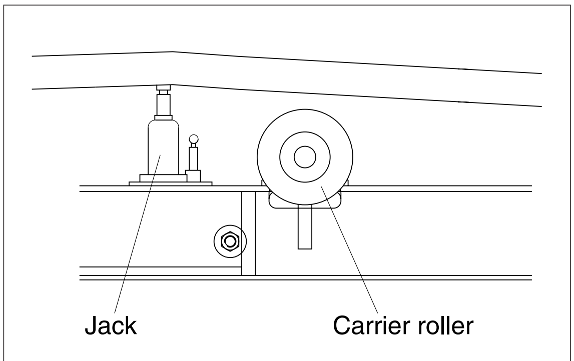
1) REMOVAL

(1) Loosen tension of the rubber track.



R27Z97TR04

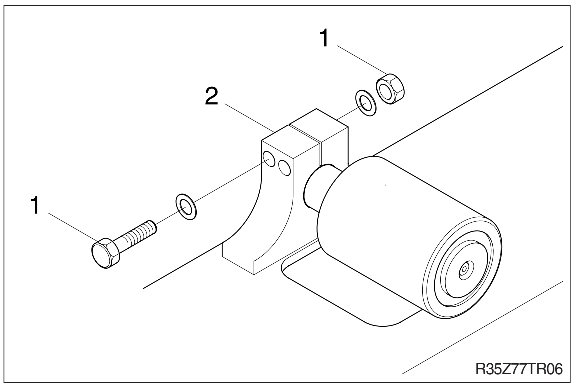
(2) Jack up the rubber track height enough to permit carrier roller removal.



R27Z97TR05

(3) Loosen the bolt and nut (1).
  · Tightening torque : 12.3±1.2 kgf · m (89±8.68 lbf · ft)

(4) Open bracket (2) with a screwdriver, push out from inside, and remove carrier roller assembly.
  · Weight : 3 kg (7 lb)



R35Z77TR06

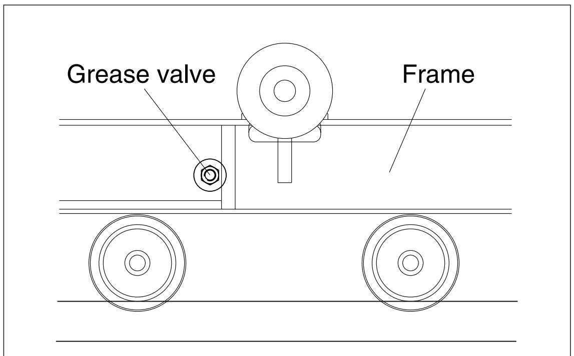
2) INSTALL

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

3. TRACK ROLLER

1) REMOVAL

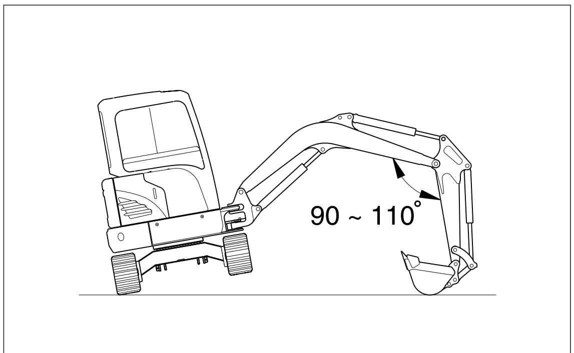
(1) Loosen tension of the rubber track.



R27Z97TR04

(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.

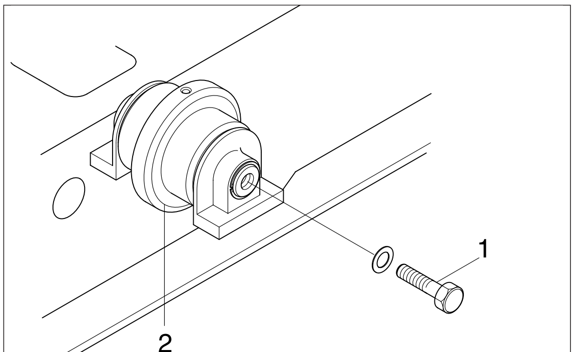


R35Z77TR02

(3) Remove the mounting bolt (1) and draw out the track roller (2).

· Weight : 6 kg (13 lb)

· Tightening torque : 29.7±3.0 kgf · m (215±21.7 lbf · ft)



R27Z97TR30

2) INSTALL

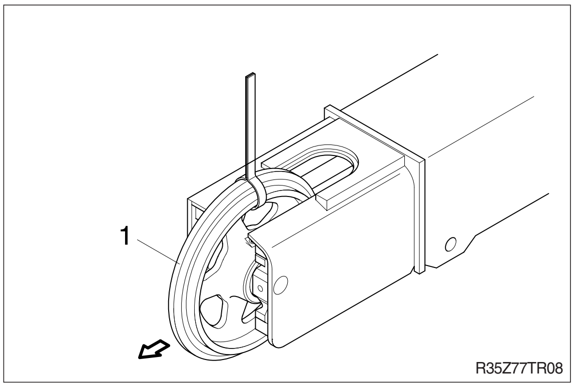
(1) Carry out installation in the reverse order to removal.

4. IDLER AND RECOIL SPRING

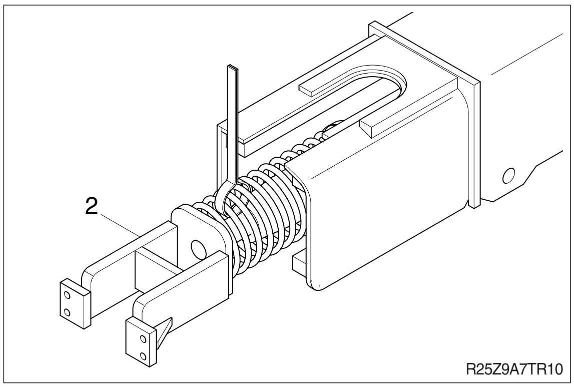
1) REMOVAL

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

(2) Sling the idler (1) and pull out idler and recoil spring assembly from track frame, using a pry.
· Weight : 36 kg (79 lb)



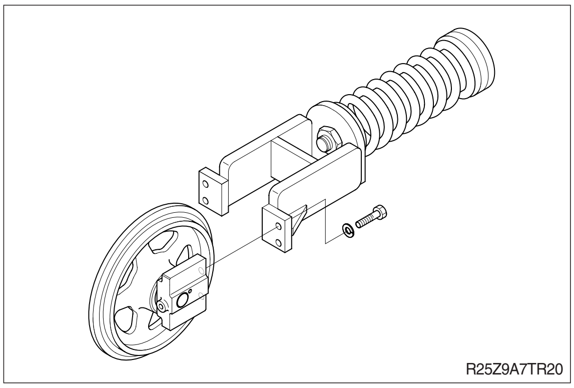
(3) Pull out yoke and spring weld assembly from track frame, using a pry.



2) INSTALL

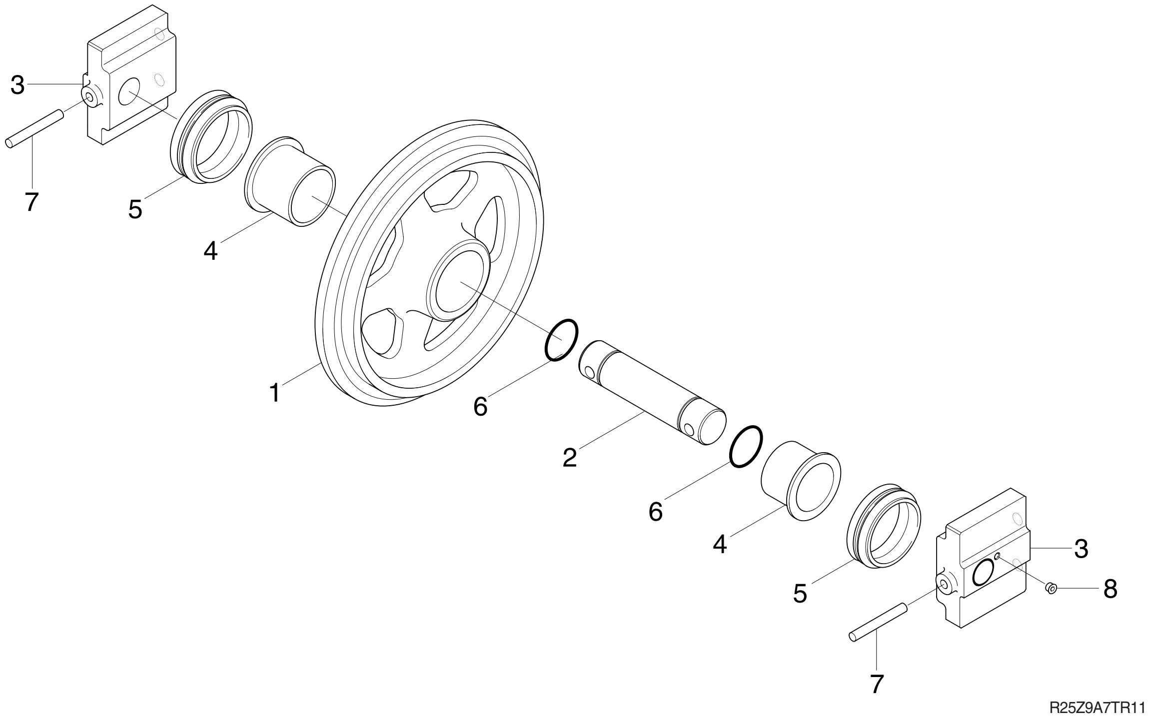
(1) Carry out installation in the reverse order to removal.

※ Make sure that the boss on the end face of the recoil cylinder rod is in the hole of the track frame.



3) DISASSEMBLY AND ASSEMBLY OF IDLER

(1) Structure

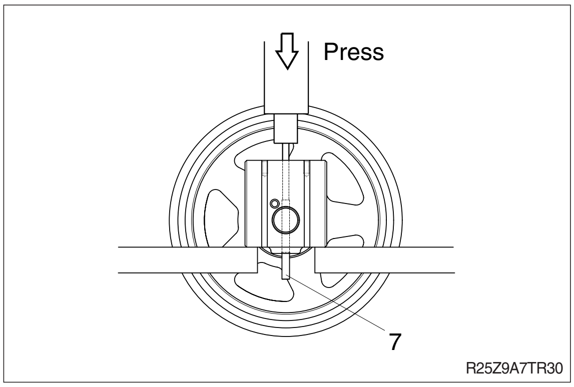


1	Shell	4	Bushing	7	Spring pin
2	Shaft	5	Seal assembly	8	Plug
3	Collar	6	O-ring		

(2) Disassembly

① Remove plug (8) and drain oil.

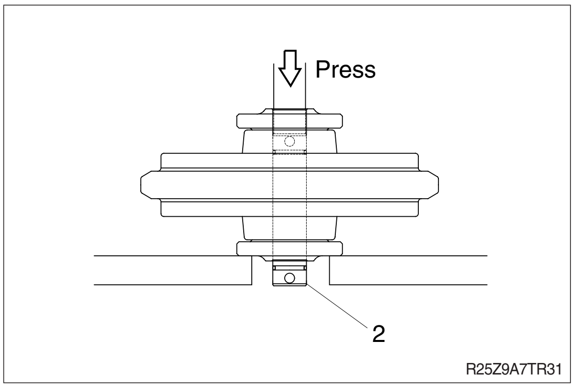
② Draw out the spring pin (7), using a press.



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

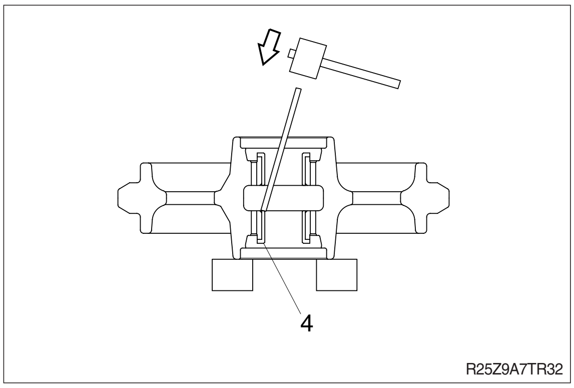
④ Remove seal (5) from idler (1) and collar (3).

⑤ Remove O-ring (6) from shaft.



⑥ Remove the bushing (4) from idler, using a special tool.

※ Only remove bushing if replacement is necessity.

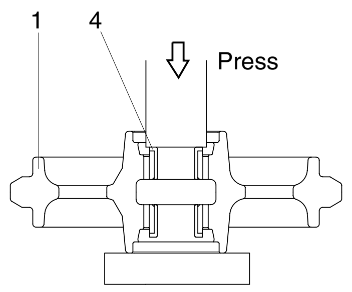


(3) Assembly

※ Before assembly, clean the parts.

※ Coat the sliding surfaces of all parts with oil.

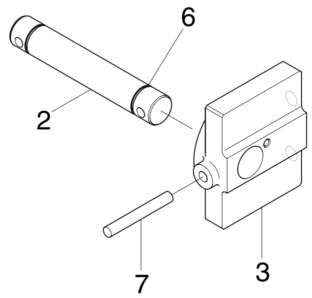
① Cool up bushing (4) fully by some dry ice and press it into shell (1).
Do not press it at the normal temperature, or not knock in with a hammer even after the cooling.



R25Z9A7TR33

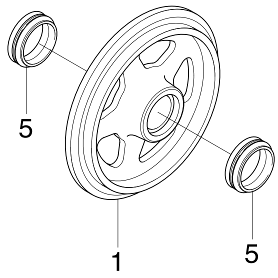
② Coat O-ring (6) with grease thinly, and install it to shaft (2).

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



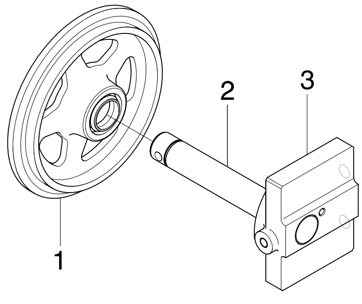
R25Z9A7TR34

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



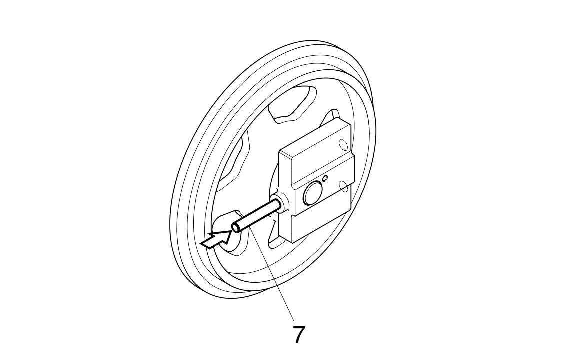
R25Z9A7TR35

⑤ Install shaft (2) and collar (3) to shell (1).



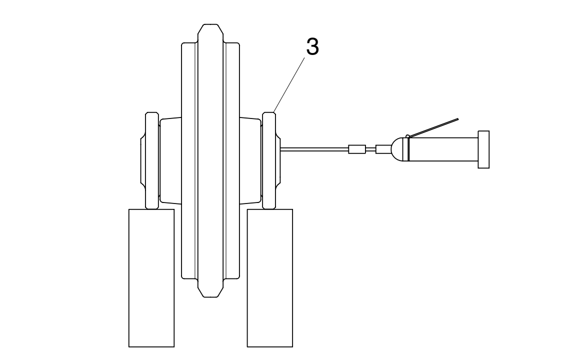
R25Z9A7TR36

⑥ Knock in the spring pin (7) with a hammer.



R25Z9A7TR38

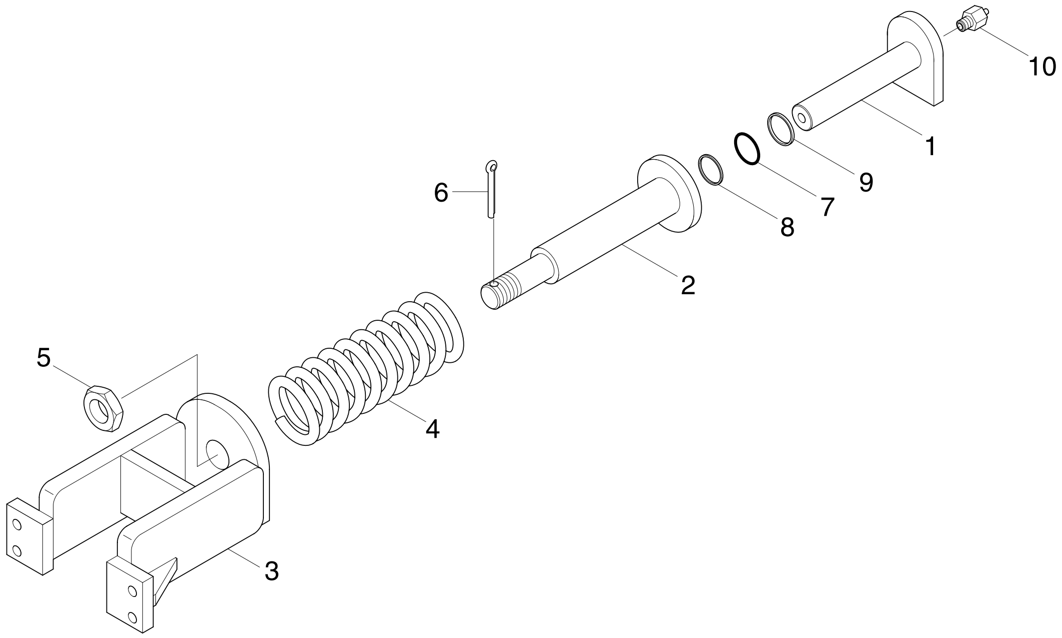
⑦ Lay collar (3) on its side.
Supply engine oil to the specified level, and tighten plug.



R25Z9A7TR39

4) DISASSEMBLY AND ASSEMBLY OF RECOIL SPRING

(1) Structure



R25Z9AK7TR12

1	Piston rod	5	Nut	9	Packing
2	Cylinder	6	Split pin	10	Grease valve
3	Yoke	7	O-ring		
4	Spring	8	Back-up ring		

(2) Disassembly

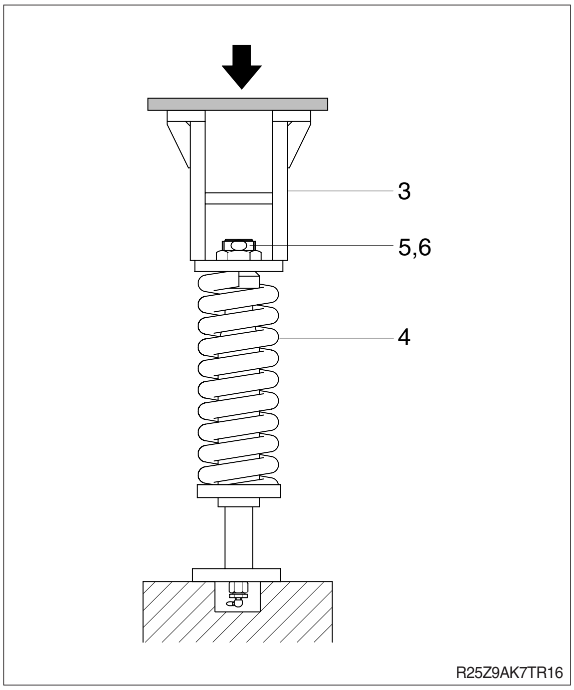
① Apply pressure on yoke (3) with a press. The spring is under a large installed load. This is dangerous, so be sure to set properly.

· Spring set load : 2374 ㎏ (5230 ㏈)

※ Remove split pin (6) and nut (5).

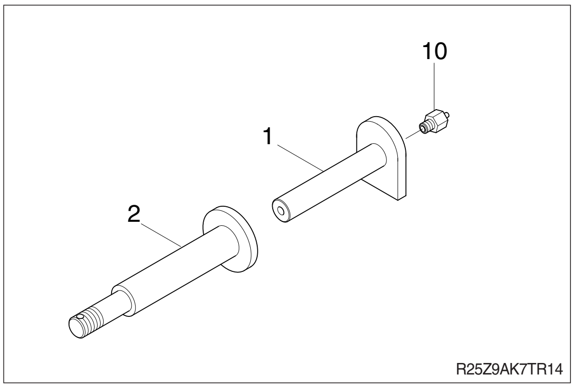
② Take enough notice so that the press which pushes down the spring, should not be slipped out in its operation.

③ Lighten the press load slowly and remove yoke (3) and spring (4).

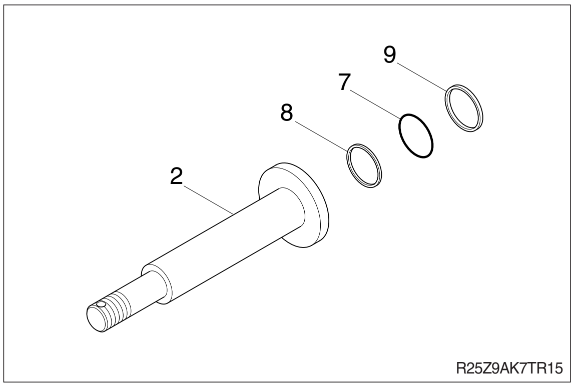


⑤ Remove rod (1) from cylinder (2).

⑥ Remove grease valve (10) from rod (1).

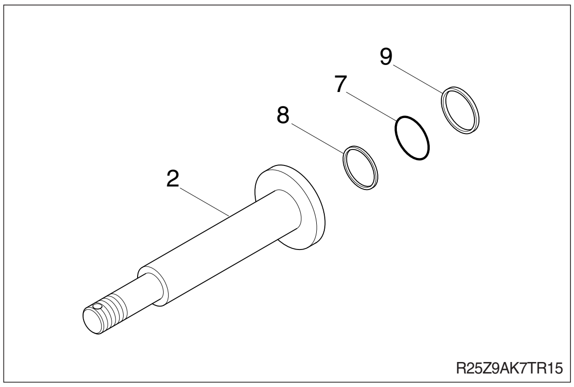


⑦ Remove packing (9), back-up ring (8) and O-ring (7) from cylinder (2).



(3) Assembly

① Install O-ring (7), back-up ring (8), and packing (9) to cylinder (2).

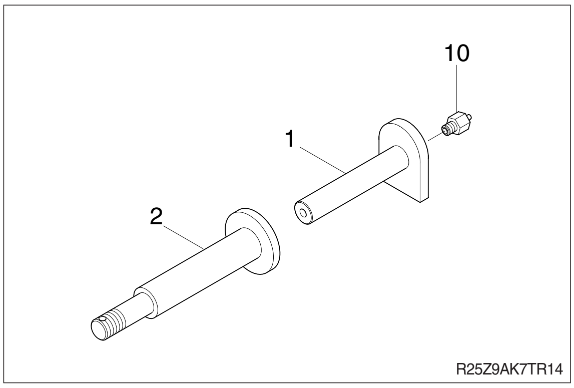


② Pour grease into cylinder (2), then push in rod (1) by hand.
After take grease out of grease valve mounting hole, let air out.

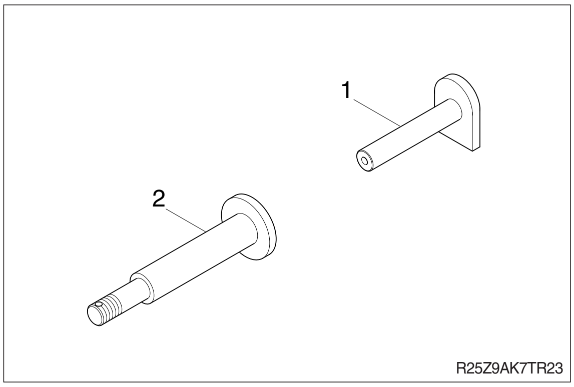
※ If air letting is not sufficient, it may be difficult to adjust the tension of crawler.

③ Fit grease valve (10) to rod (1).

· Tightening torque : 10±0.5 kgf · m
(72.4±3. 6 lbf · ft)



④ Install rod (1) to cylinder (2).

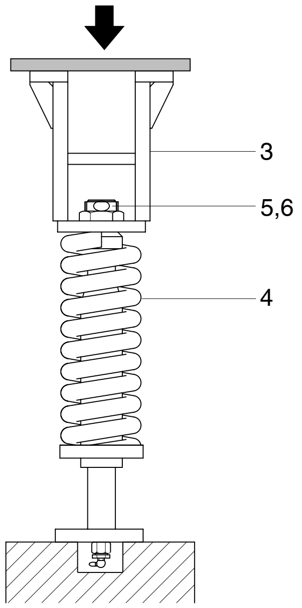


⑤ Install spring (4) and yoke (3) to cylinder (2).

⑥ Apply pressure to spring (4) with a press and tighten nut (5).

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

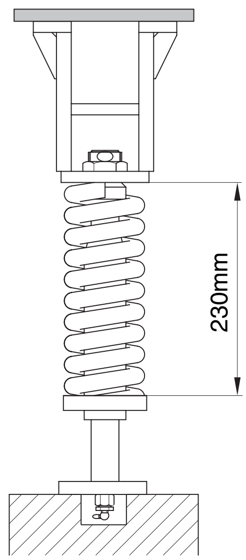
⑦ Tighten nut (5) and insert split pin (6).



R25Z9AK7TR16

⑧ Lighten the press load and confirm the set length of spring (4).

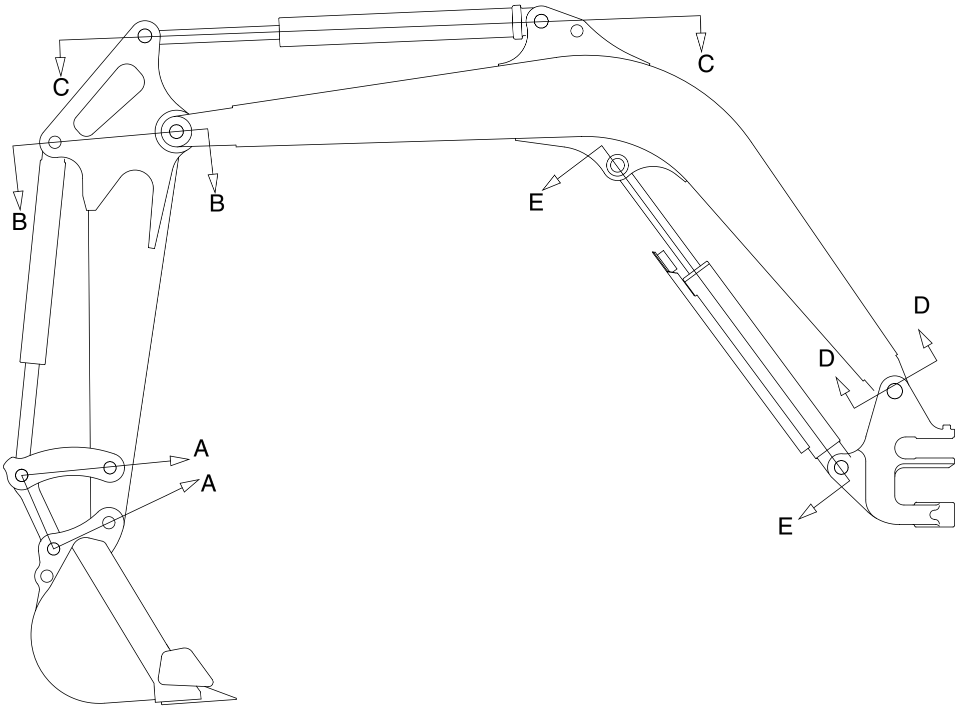
· Spring length : 230 ㎜ (9.1")

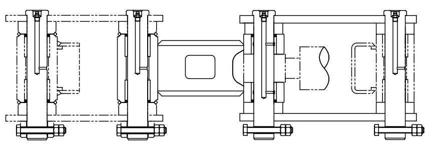


R25Z9AK7TR17

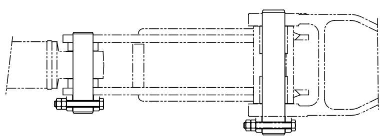
GROUP 11 WORK EQUIPMENT

1. STRUCTURE

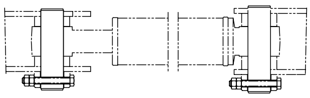




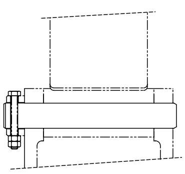
SECTION A-A



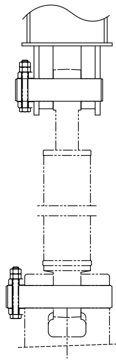
SECTION B-B



SECTION C-C



SECTION D-D



SECTION E-E

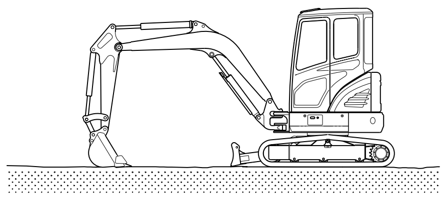
R27Z97AT01

2. REMOVAL AND INSTALL

1) BUCKET ASSEMBLY

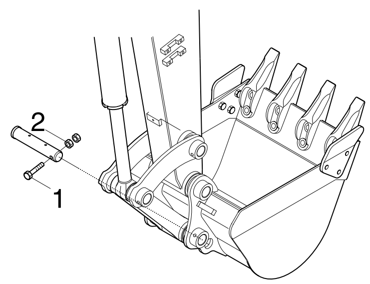
(1) Removal

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



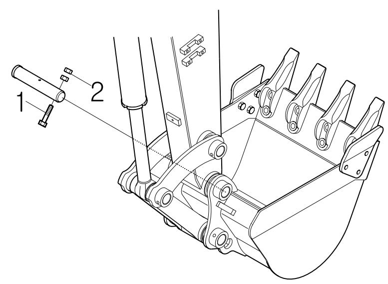
R27Z97AT02

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.
· Weight : 57 ㎏ (126 ℔)



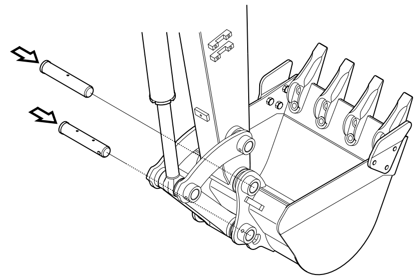
R35Z77AT04

(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

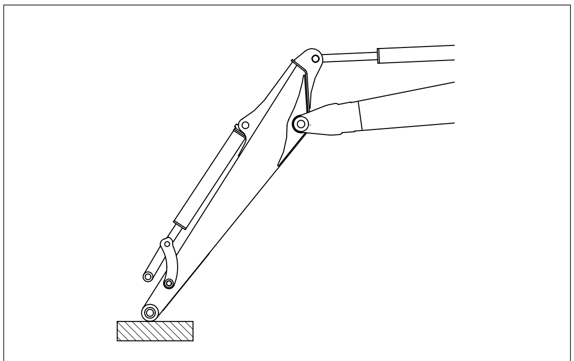
2) ARM ASSEMBLY

(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.



R5577AT06

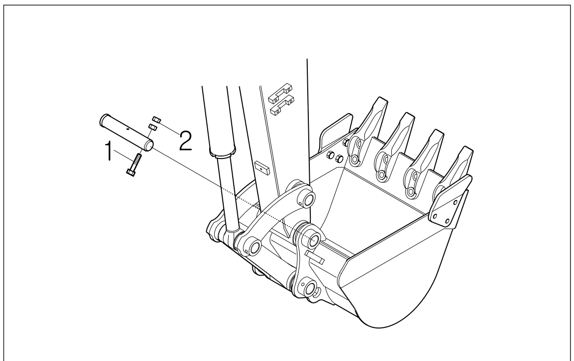
② Disconnect bucket cylinder hose (4).

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

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

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

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

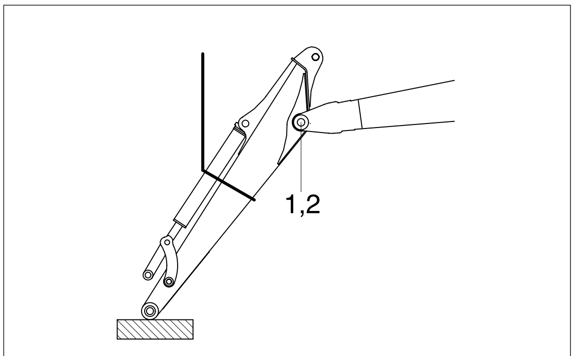


R35Z77AT04

⑤ Remove bolt (1) and pull out the pin (2) then remove the arm assembly.

· Weight (1.12 m arm) : 45 kg (99 lb)

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



R5577AT07

(2) Install

① Carry out installation in the reverse order to removal.

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

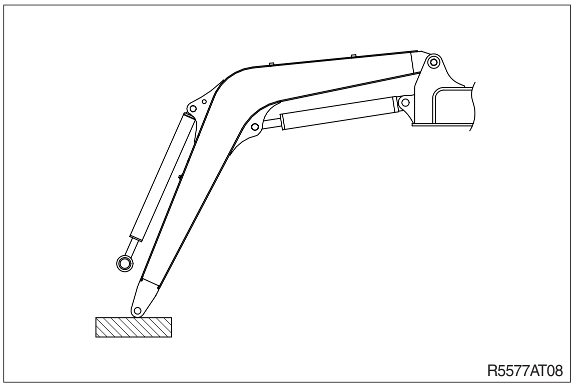
※ Bleed the air from the cylinder.

3) BOOM CYLINDER

(1) Removal

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

② Remove boom cylinder assembly from boom.
For details, see removal of arm cylinder assembly.

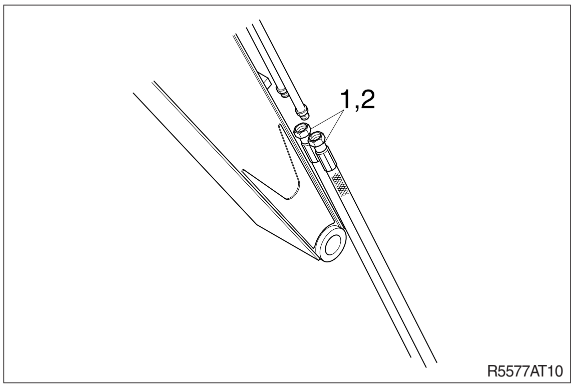

R5577AT08

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.

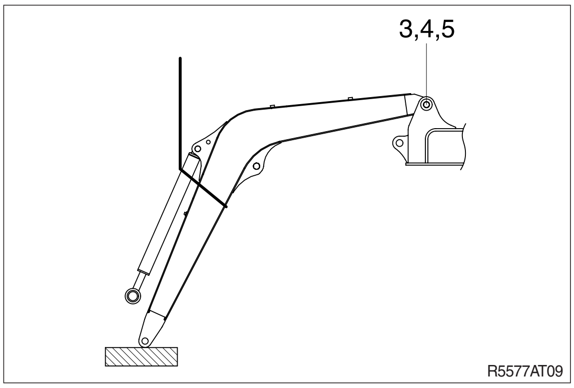
⑤ Sling boom assembly (3).



R5577AT10

⑥ Remove bolt (3), nut (4) and pull out the pin (5) then remove boom assembly.
· Weight : 80 ㎏ (176 ℓb)

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



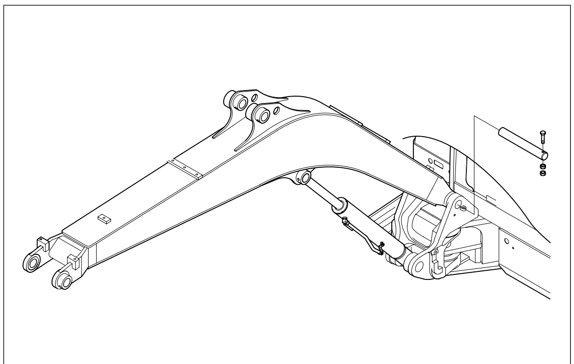
R5577AT09

(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

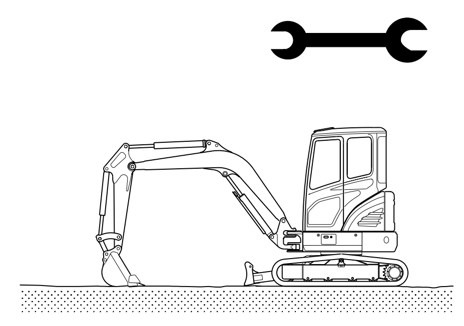
SECTION 8 COMPONENT MOUNTING TORQUE

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.

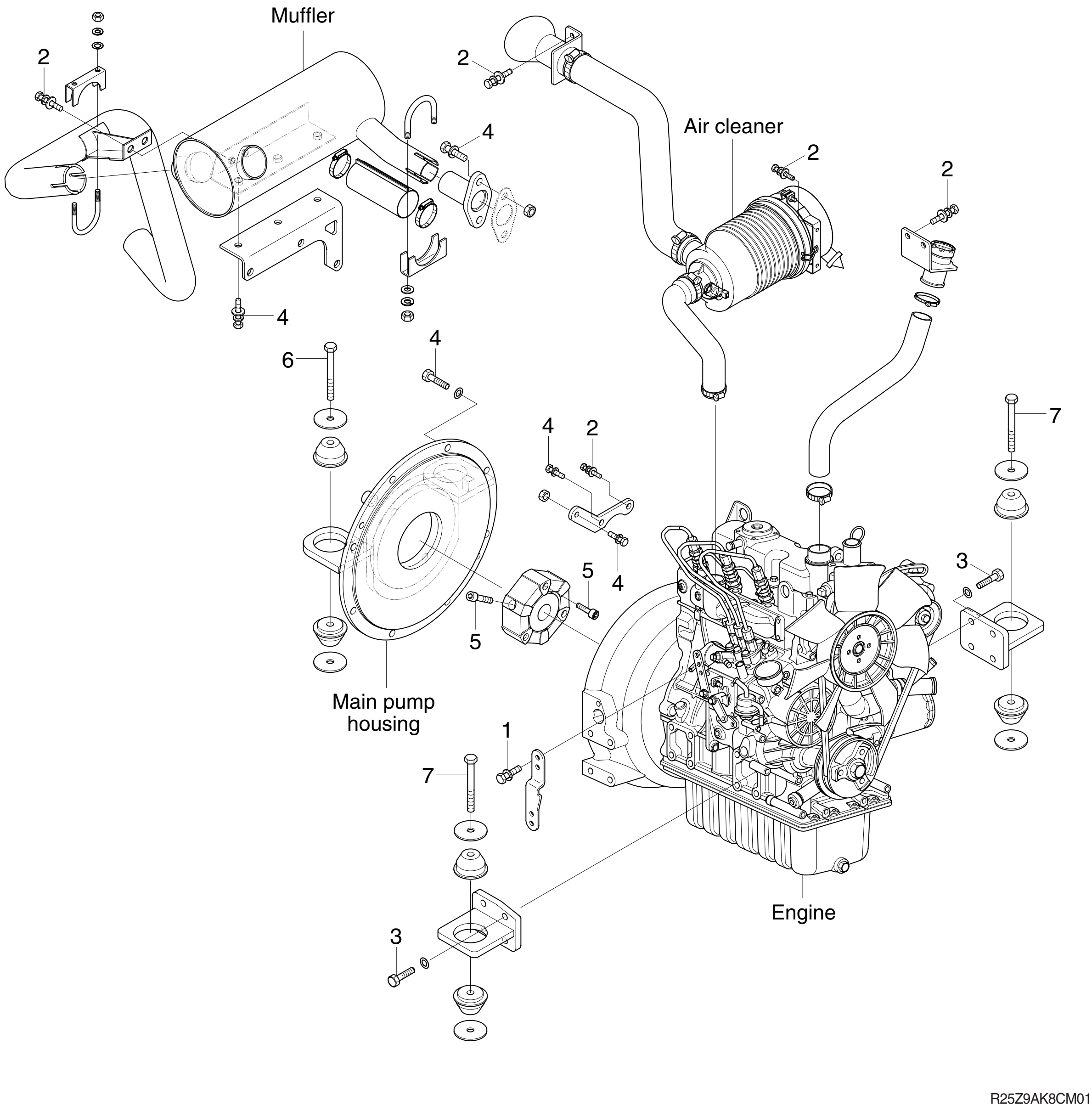
※ Only metric fasteners can be used and incorrect fasteners may result in machine damage or malfunction.

※ 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

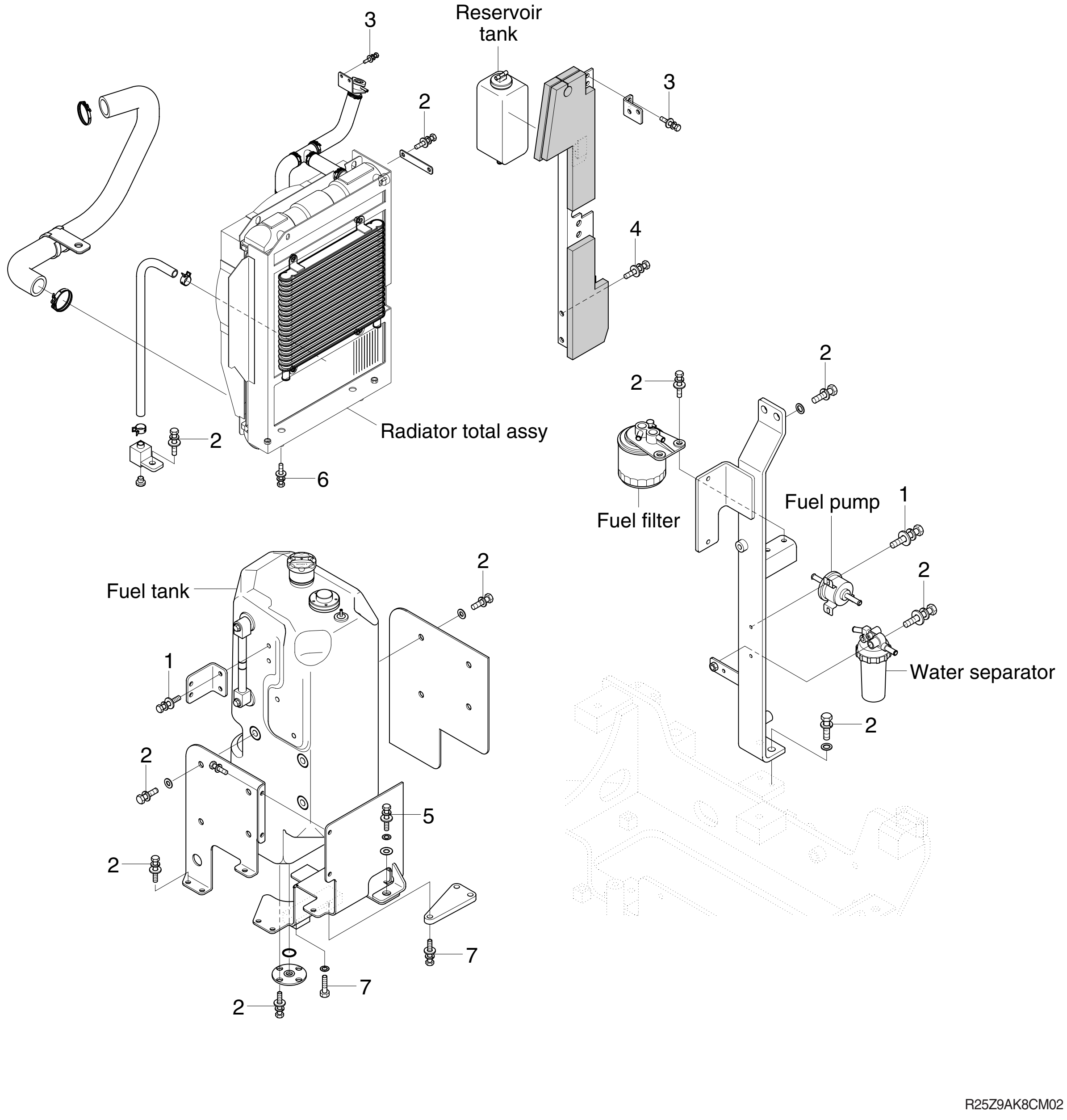


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M10×1.25	7.4±1.5	53.5±10.9
4	M10×1.5	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
5	M12×1.75	9.25±0.25	67±1.8
6	M12×1.75	13±1.0	94±7.2
7	M12×1.75	12.8±3.0	92.6±21.7

2. COOLING SYSTEM AND FUEL TANK MOUNTING



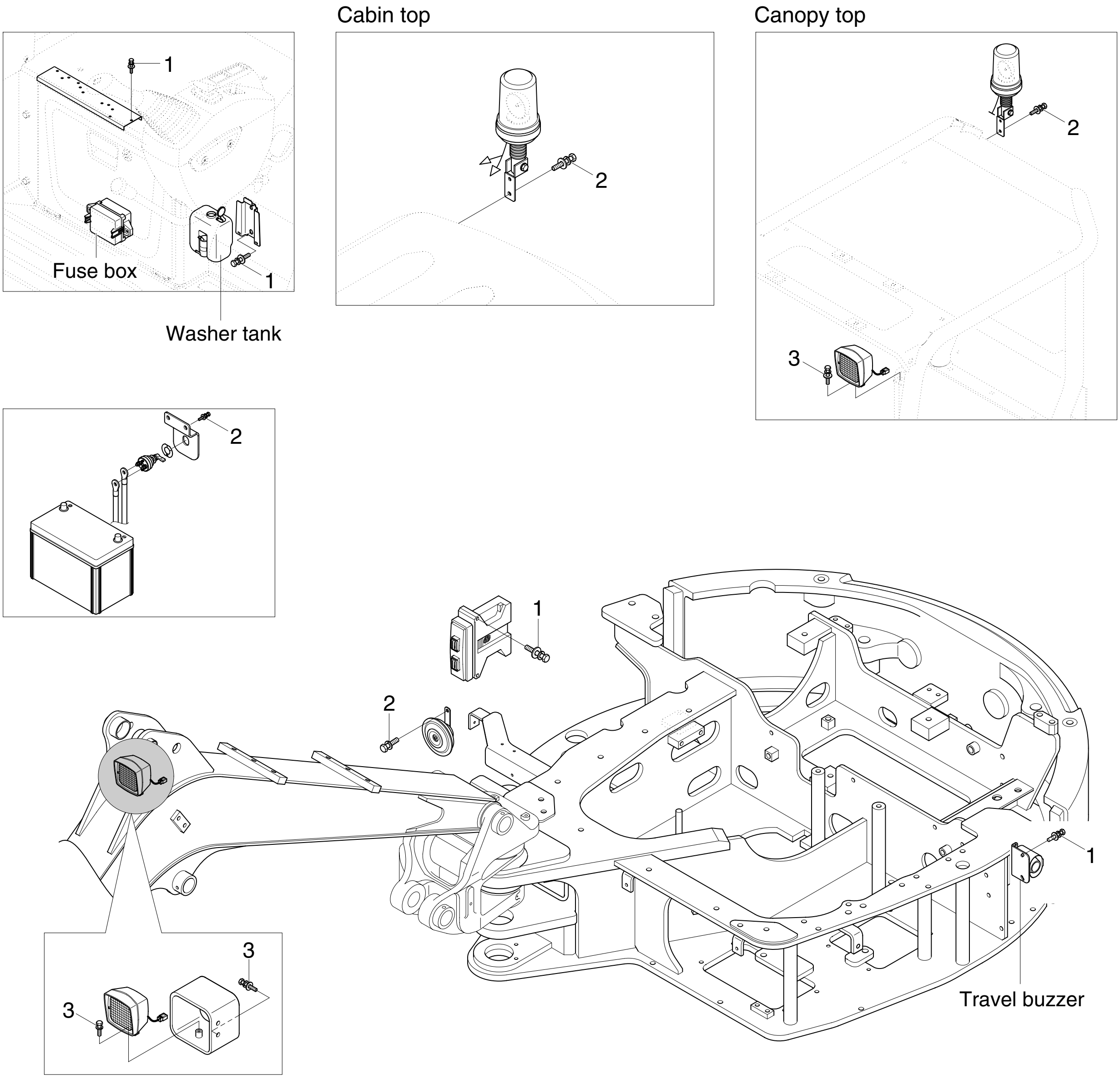
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M 8×1.25	3.43±0.7	24.8±5.1
4	M10×1.5	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
5	M12×1.75	9.3±1.9	67.3±13.7
6	M12×1.75	12.6±3.0	93±22.0
7	M12×1.75	12.8±3.0	93±22.0

GROUP 3 ELECTRIC SYSTEM

1. ELECTRIC COMPONENTS MOUNTING 1



R25Z9AK8CM03

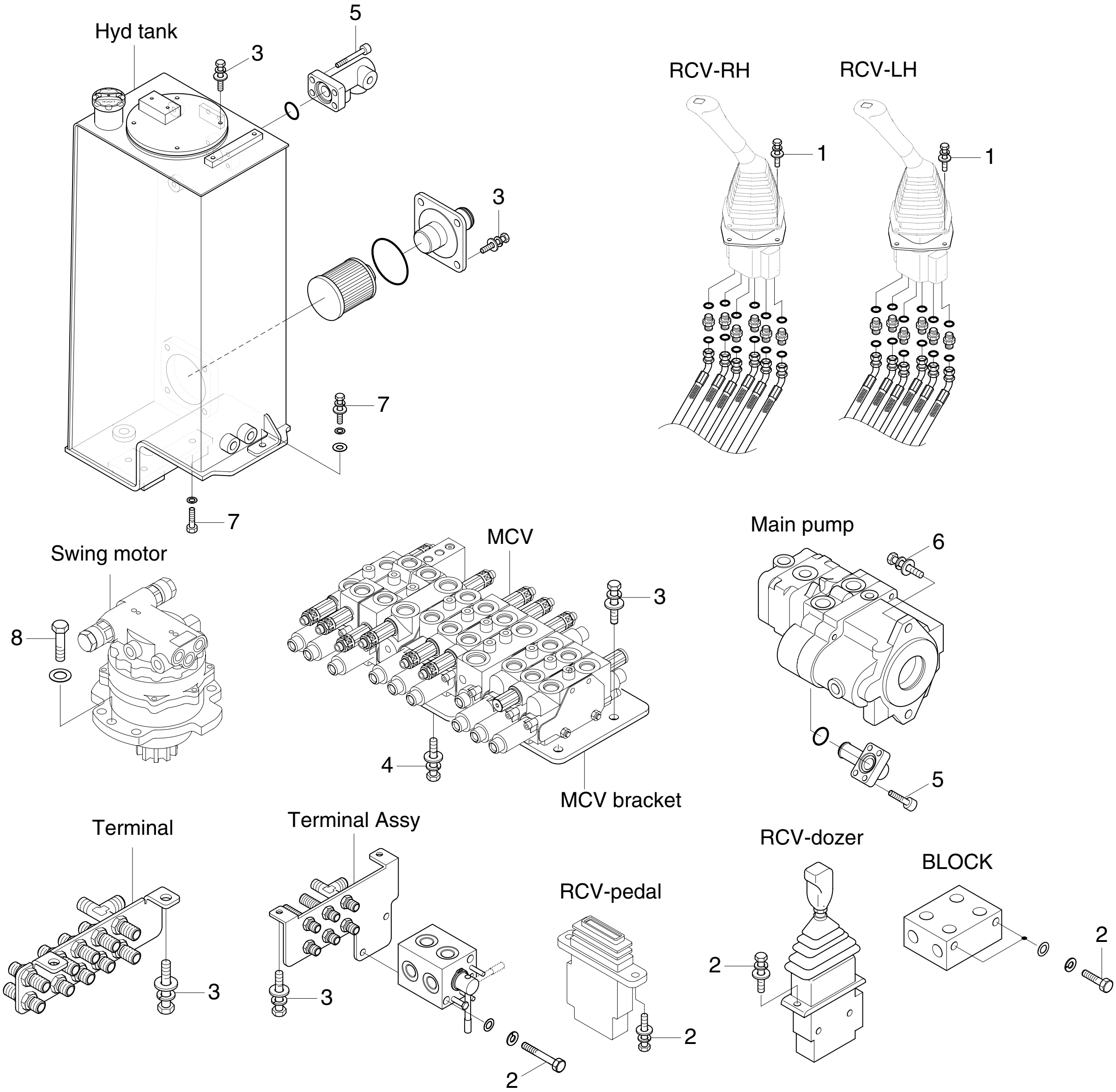
· Tightening torque

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

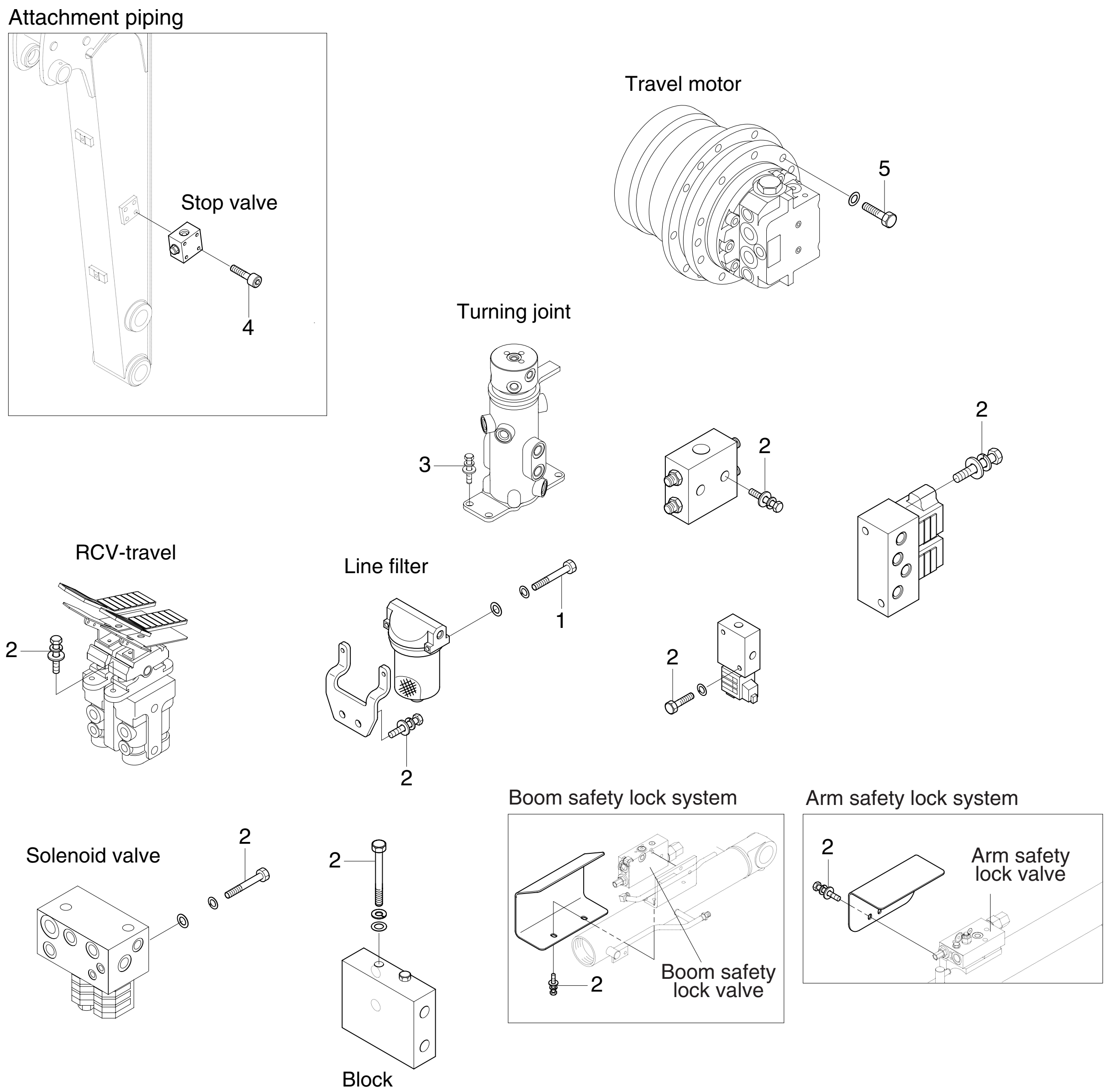


R25Z9AK8CM05

· 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
4	M10×1.5	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
5	M10×1.5	8.27±1.7	59.8±12.3
6	M12×1.75	10±1.0	72±7.2
7	M12×1.75	12.8±3.0	93±22.0
8	M16×2.0	29.7±4.5	215±32.5



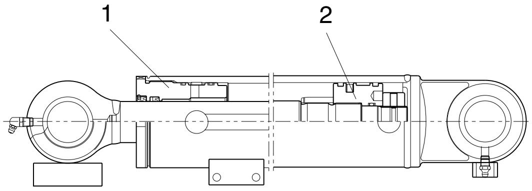
R25Z9A8KCM06

· Tightening torque

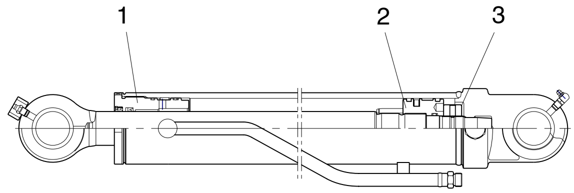
Item	Size	kgf · m	lbf · ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M10×1.5	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
4	M10×1.5	8.27±1.7	59.8±12.3
5	M12×1.75	13.8±2.0	100±14.0

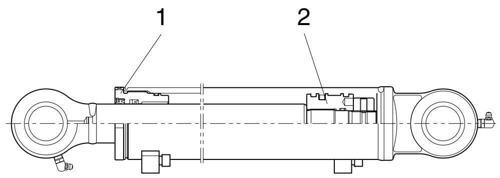
2. HYDRAULIC COMPONENTS MOUNTING 2



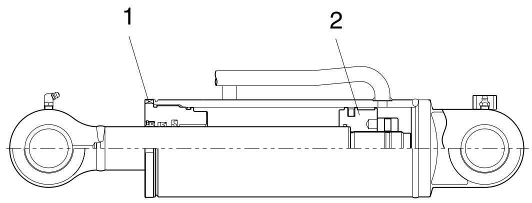
Boom cylinder



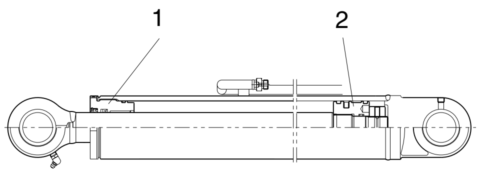
Arm cylinder



Bucket cylinder



Dozer cylinder



Boom swing cylinder

R25Z9AK8CM07

· Tightening torque

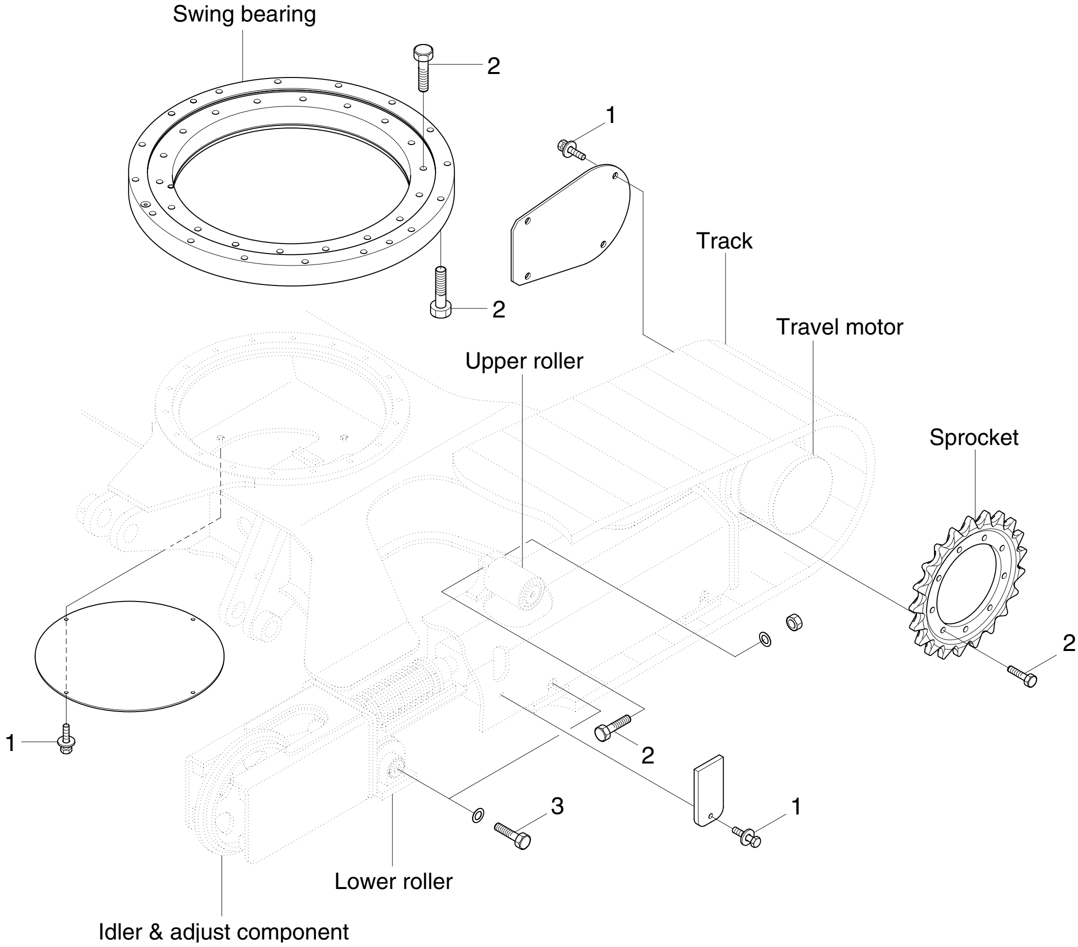
1) Gland

Item	Size	kgf · m	lbf · ft
Boom cylinder	M80×2	70±7.0	506±50.6
Arm cylinder	M75×2	70±5.0	506±36.2
Bucket cylinder	M65×2	50±5.0	362±36.2
Dozer cylinder	M90×2	70±7.0	506±50.6
Boom swing cylinder	M80×2	70±7.0	506±50.6

2) Piston

Item	Size	kgf · m	lbf · ft
Boom cylinder	M30×2	75±7.5	542±54.2
Arm cylinder	M30×2	75±7.5	542±54.2
Bucket cylinder	M27×2	50±5.0	362±36.2
Dozer cylinder	M36×2	75±7.5	542±54.2
Boom swing cylinder	M32×2	75±7.5	542±54.2

GROUP 5 UNDERCARRIAGE



R25Z9AK8CM08

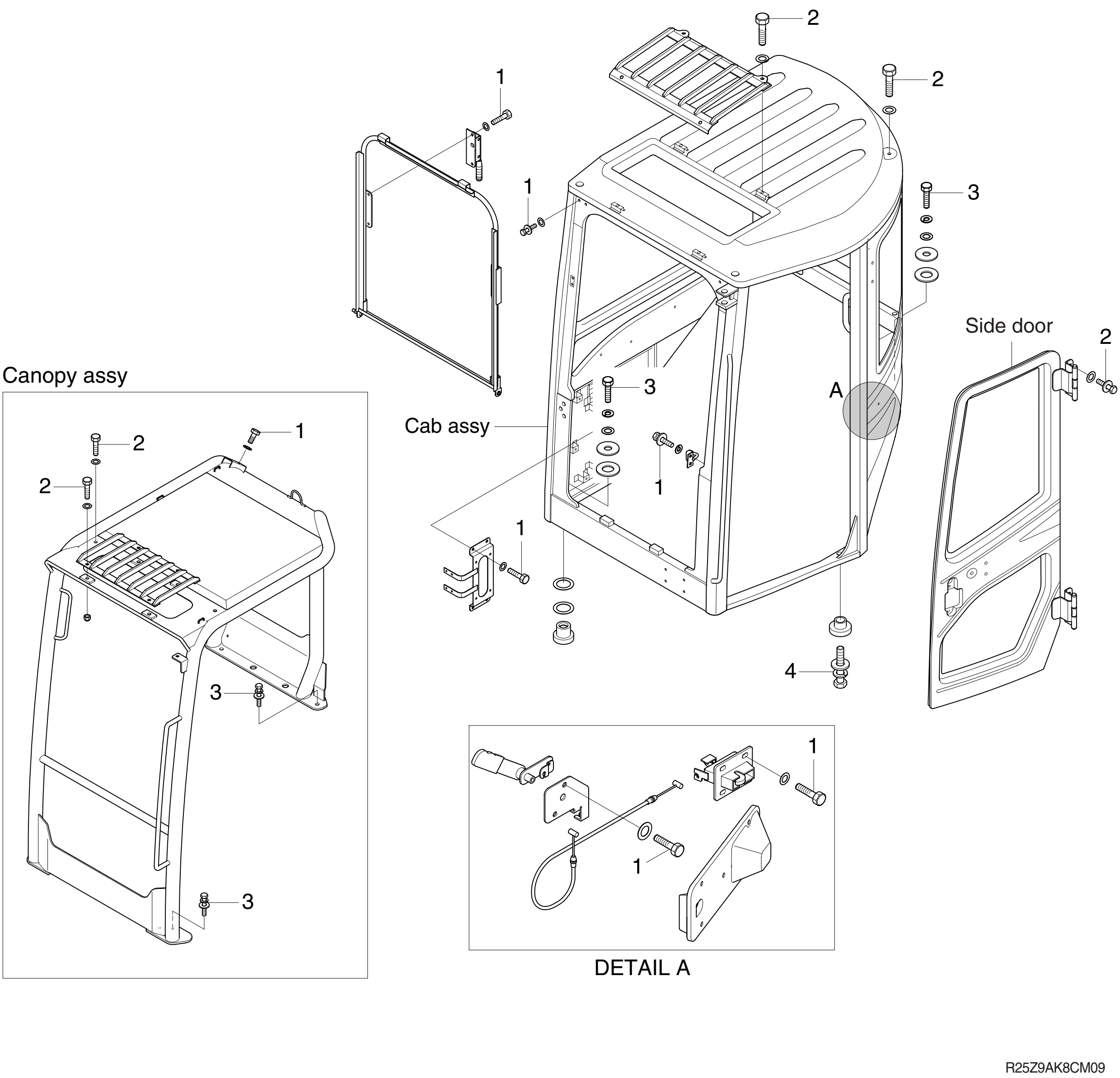
· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M10 × 1.5	6.9 ± 1.4	49.9 ± 10.1
2	M12 × 1.75	12.8 ± 3.0	93 ± 22.0

Item	Size	kgf · m	lbf · ft
3	M16 × 2.0	29.7 ± 4.0	215 ± 29.0

GROUP 6 STRUCTURE

1. CAB (CANOPY) AND ACCESSORIES MOUNTING

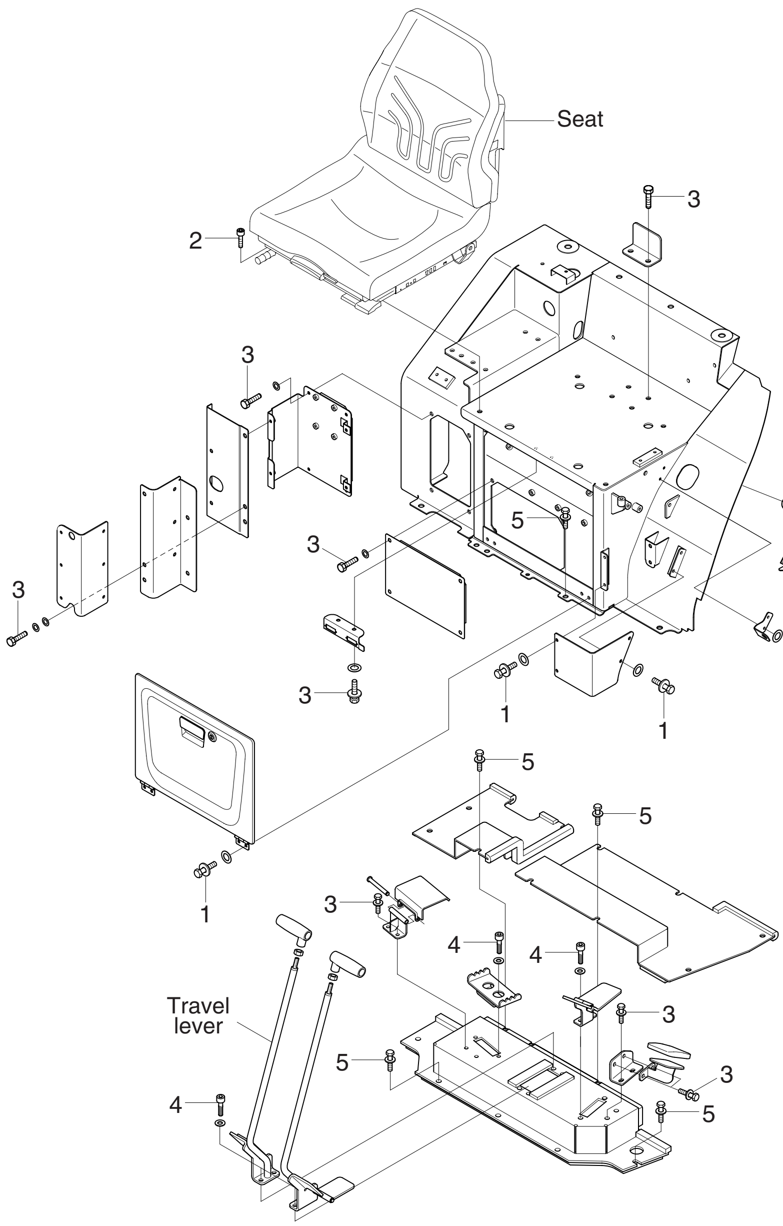


· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M 8×1.25	2.5±0.5	18.1±3.6
2	M10×1.5	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
3	M12×1.75	12.8±3.0	92.6±21.7
4	M12×1.75	12.8±3.0	92.6±21.7

2. CAB INTERIOR MOUNTING



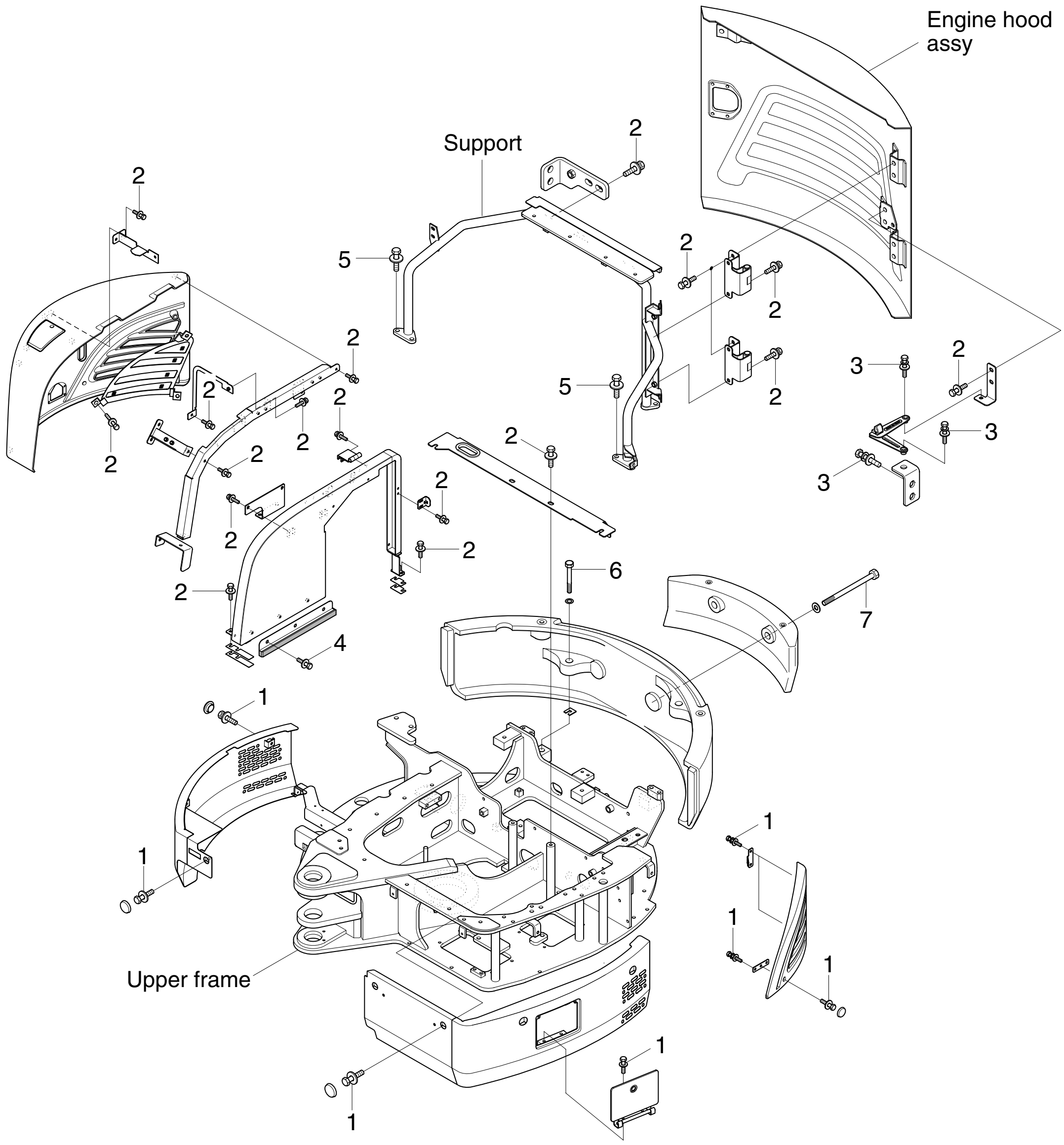
R25Z9A8KCM10

· 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	1.17±0.1	8.5±0.7
3	M 8×1.25	2.5±0.5	18.1±3.6

Item	Size	kgf · m	lbf · ft
4	M 8×1.25	4.05±0.8	29.3±5.8
5	M10×1.5	6.9±1.4	49.9±10.1

3. COWLING AND COUNTERWEIGHT MOUNTING

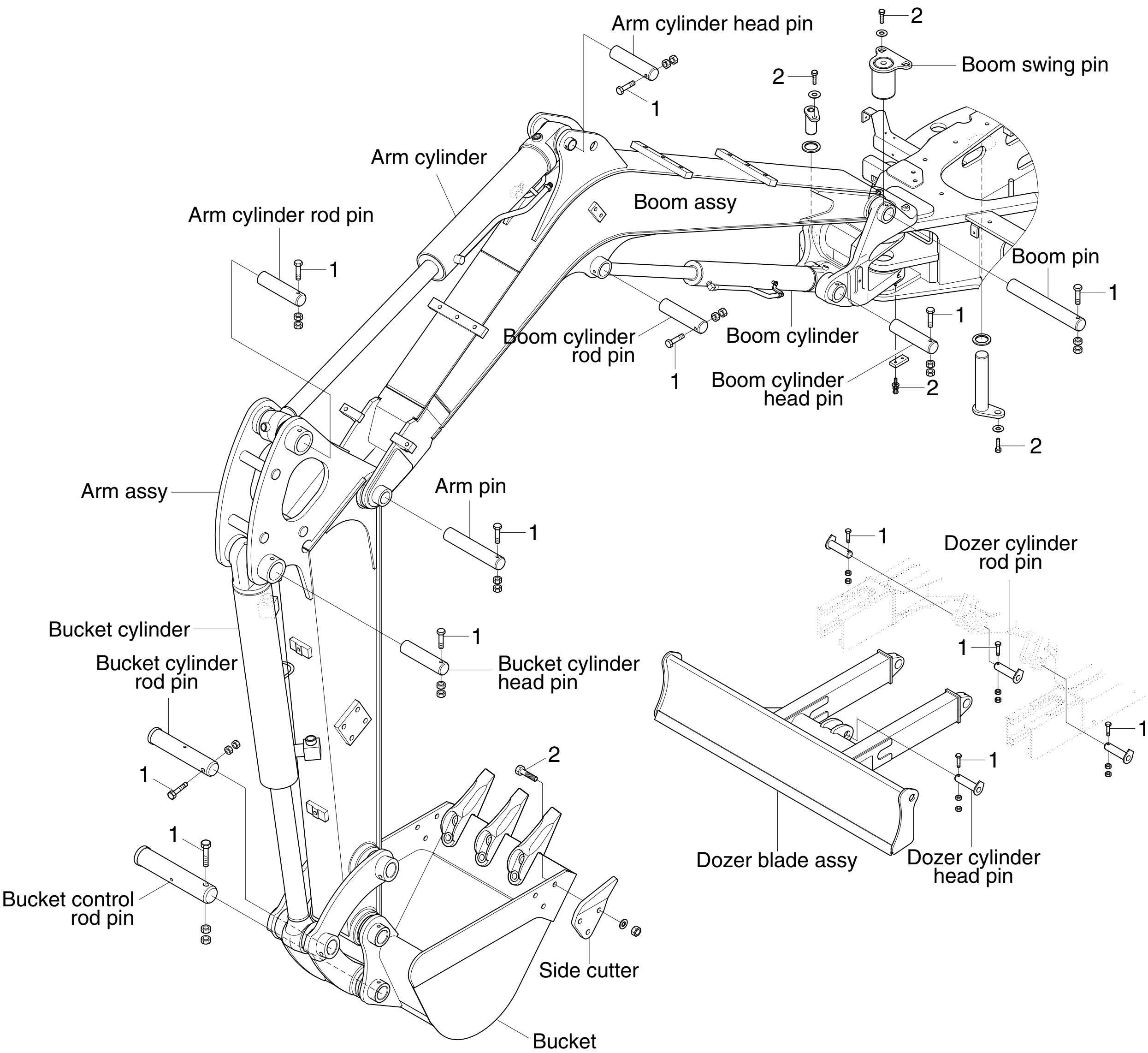


R25Z9AK8CM11

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	5.0±1.0	36.2±7.2
4	M10×1.5	6.9±1.4	49.9±10.1

Item	Size	kgf · m	lbf · ft
5	M12×1.75	12.8±3.0	92.6±21.7
6	M20×2.5	57.8±6.4	418±46.3
7	M24×3.0	100±15	723±108

GROUP 7 WORK EQUIPMENT



R25Z9AK8CM12

· Tightening torque

Item	Size	kgf · m	lbf · ft
1	M10×1.5	6.9±1.4	49.9±10.1
2	M12×1.75	12.8±3.0	92.6±21.7