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1. STRUCTURE

This service manual has been prepared as an aid to improve the quality of repairs by giving the serviceman an accurate understanding of the product and by showing him the correct way to perform repairs and make judgements. Make sure you understand the contents of this manual and use it to full effect at every opportunity.
This service manual mainly contains the necessary technical information for operations performed in a service workshop.
For ease of understanding, the manual is divided into the following sections.

SECTION 1 GENERAL
This section explains the safety hints and gives the specification of the machine and major components.

SECTION 2 STRUCTURE AND FUNCTION
This section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting.

SECTION 3 HYDRAULIC SYSTEM
This section explains the hydraulic circuit, single and combined operation.

SECTION 4 ELECTRICAL SYSTEM
This section explains the electrical circuit, monitoring system and each component. It serves not only to give an understanding electrical system, but also serves as reference material for trouble shooting.

SECTION 5 MECHATRONICS SYSTEM
This section explains the computer aided power optimization system and each component.

SECTION 6 TROUBLESHOOTING
This section explains the troubleshooting charts correlating **problems** to **causes**.

SECTION 7 MAINTENANCE STANDARD
This section gives the judgement standards when inspecting disassembled parts.

SECTION 8 DISASSEMBLY AND ASSEMBLY
This section explains the order to be followed when removing, installing, disassembling or assembling each component, as well as precautions to be taken for these operations.

SECTION 9 COMPONENT MOUNTING TORQUE
This section shows bolt specifications and standard torque values needed when mounting components to the machine.

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

2. HOW TO READ THE SERVICE MANUAL

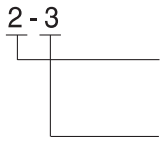
Distribution and updating

Any additions, amendments or other changes will be sent to HYUNDAI distributors.

Get the most up-to-date information before you start any work.

Filing method

1. See the page number on the bottom of the page.
   File the pages in correct order.
2. Following examples shows how to read the page number.
   Example 1



   Item number (2. Structure and Function)
   Consecutive page number for each item.
3. Additional pages : Additional pages are indicated by a hyphen(-) and number after the page number. File as in the example.

   10 - 4
   10 - 4 - 1 ┐
   10 - 4 - 2 ┘ Added pages
   10 - 5

Revised edition mark (①②③…)

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

Revisions

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

Symbols

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

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

3. CONVERSION TABLE

Method of using the Conversion Table

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

Example

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

   Convert 55mm into inches.

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

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

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

2. Convert 550mm into inches.

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

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

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

Millimeters to inches

1 mm = 0.03937 in

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

Millimeters to inches

1 mm = 0.03937 in

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

Kilogram to Pound

1 kg = 2.2046 lb

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

Liter to U.S. Gallon

1ℓ = 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

1ℓ = 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/cm² to lbf/in²

1 kgf / cm² = 14.2233 lbf / in²

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

TEMPERATURE

Fahrenheit-Centigrade Conversion.

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

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

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

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

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

SECTION 1 GENERAL

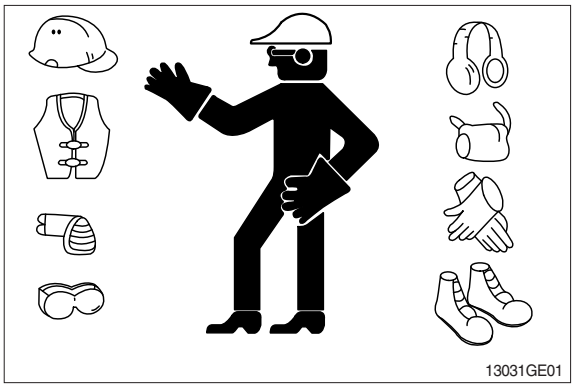
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

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

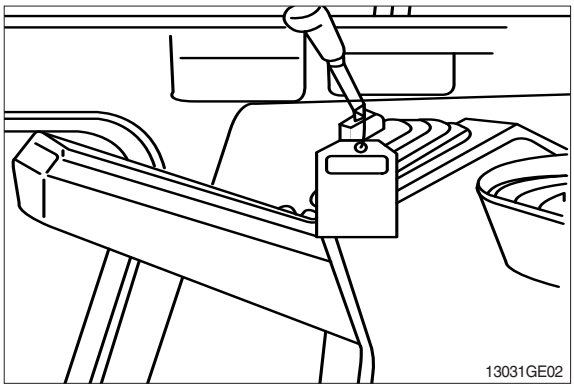
WEAR PROTECTIVE CLOTHING

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



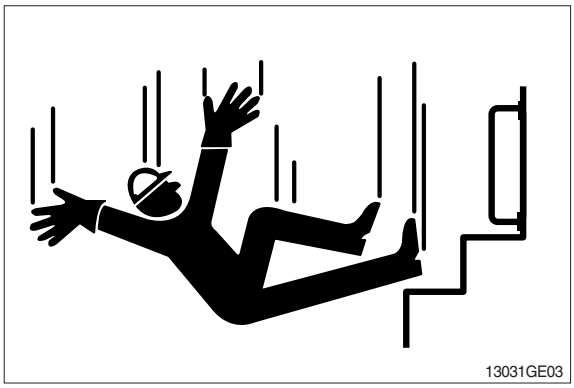
WARN OTHERS OF SERVICE WORK

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



USE HANDHOLDS AND STEPS

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

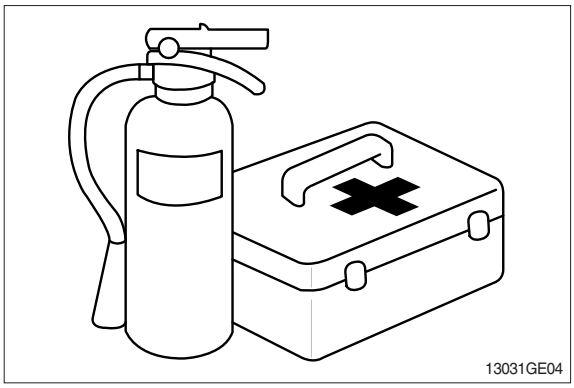


PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

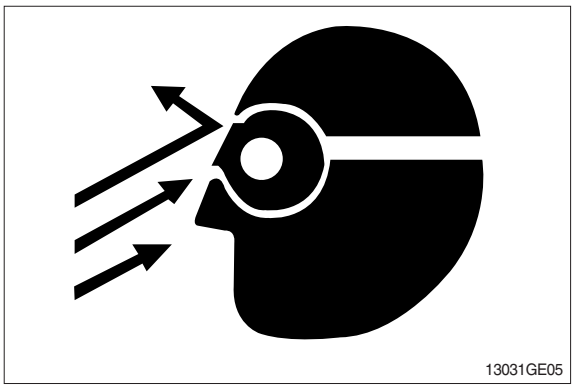
Keep a first aid kit and fire extinguisher handy.

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


13031GE04

PROTECT AGAINST FLYING DEBRIS

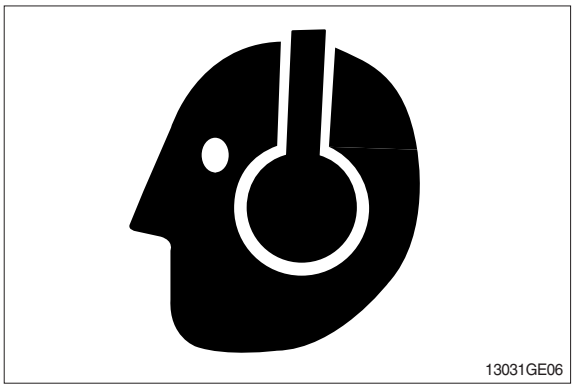
Guard against injury from flying pieces of metal or debris; wear goggles or safety glasses.


13031GE05

PROTECT AGAINST NOISE

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

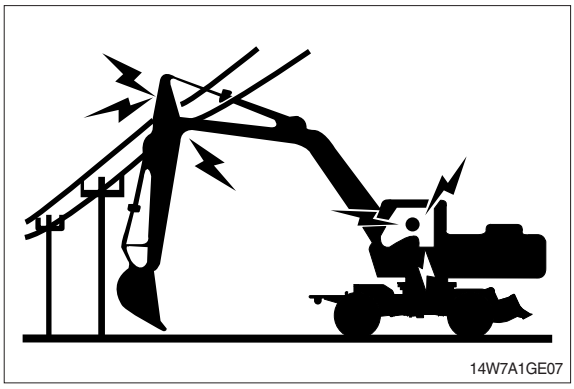
Wear a suitable hearing protective device such as ear-
muffs or earplugs to protect against objectionable or uncomfortable loud noises.


13031GE06

AVOID POWER LINES

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

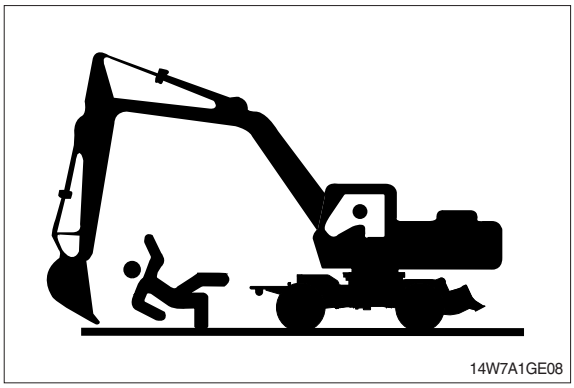
Never move any part of the machine or load closer to electric line than 3 m (10 ft) plus twice the line insulator length.


14W7A1GE07

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.

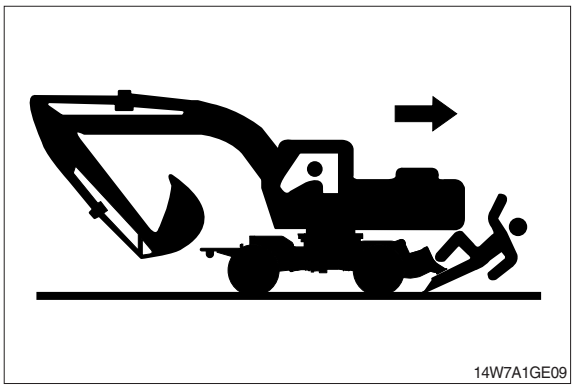

14W7A1GE08

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.

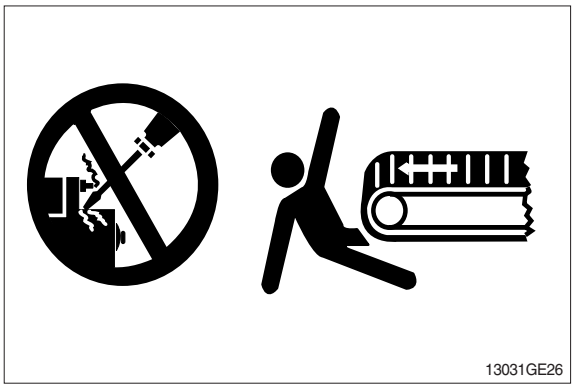
Use a signal person when moving, swinging, or operating the machine in congested areas. Coordinate hand signals before starting the excavator.


14W7A1GE09

OPERATE ONLY FORM OPERATOR'S SEAT

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

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


13031GE26

PARK MACHINE SAFELY

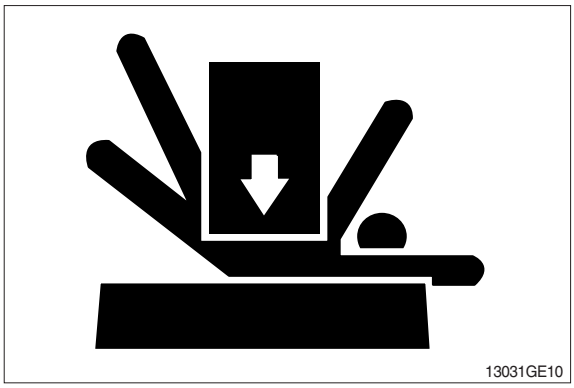
Before working on the machine:

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

SUPPORT MACHINE PROPERLY

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

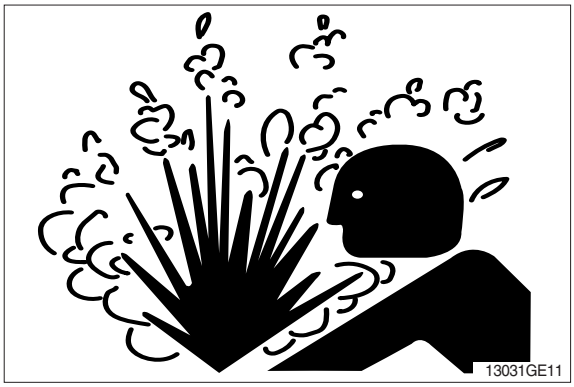
Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load.
Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.



SERVICE COOLING SYSTEM SAFELY

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

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



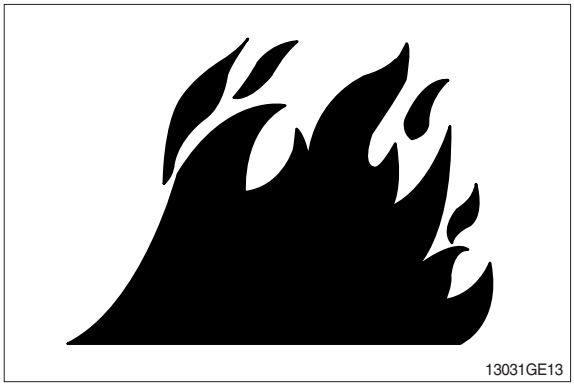
HANDLE FLUIDS SAFELY-AVOID FIRES

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

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

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

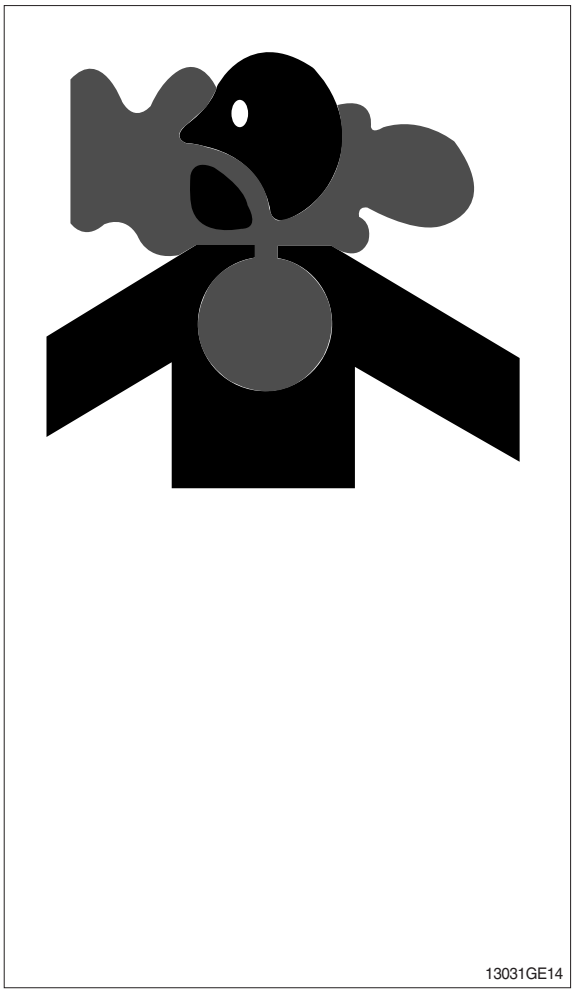
Do not store oily rags ; they can ignite and burn spontaneously.



BEWARE OF EXHAUST FUMES

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

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



REMOVE PAINT BEFORE WELDING OR HEATING

Avoid potentially toxic fumes and dust.

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

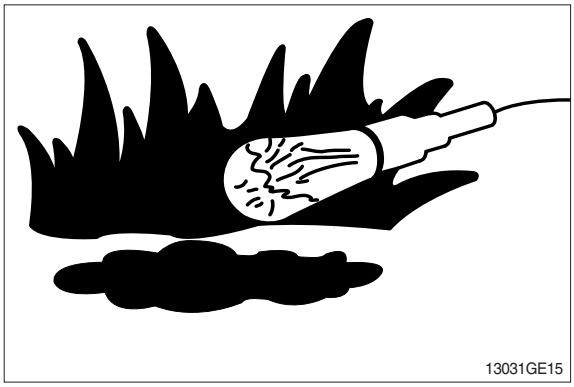
Do all work outside or in a well ventilated area. Dispose of paint and solvent properly.

Remove paint before welding or heating:

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

ILLUMINATE WORK AREA SAFELY

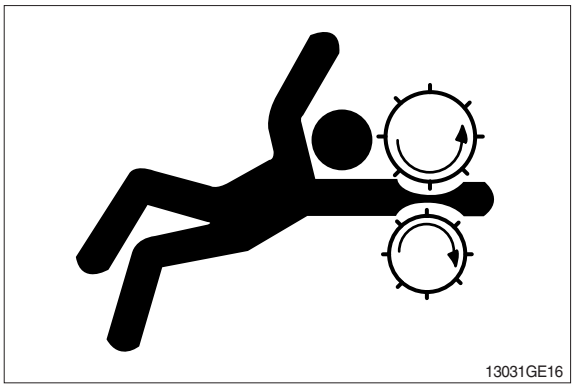
Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.



SERVICE MACHINE SAFELY

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

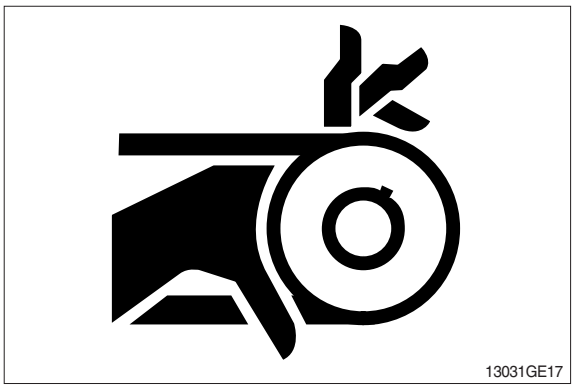
Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

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



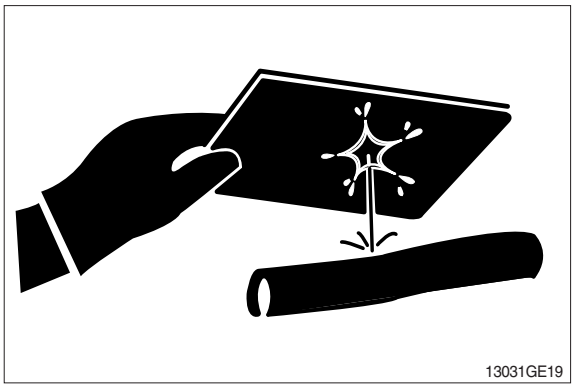
AVOID HIGH PRESSURE FLUIDS

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

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

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

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



AVOID HEATING NEAR PRESSURIZED FLUID LINES

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

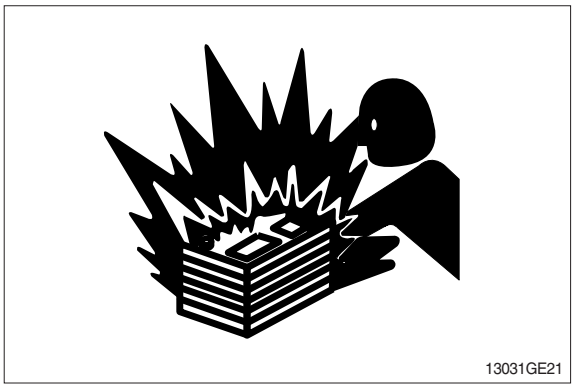
Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area. Install fire resisting guards to protect hoses or other materials.

PREVENT BATTERY EXPLOSIONS

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

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

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



PREVENT ACID BURNS

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

Avoid the hazard by:

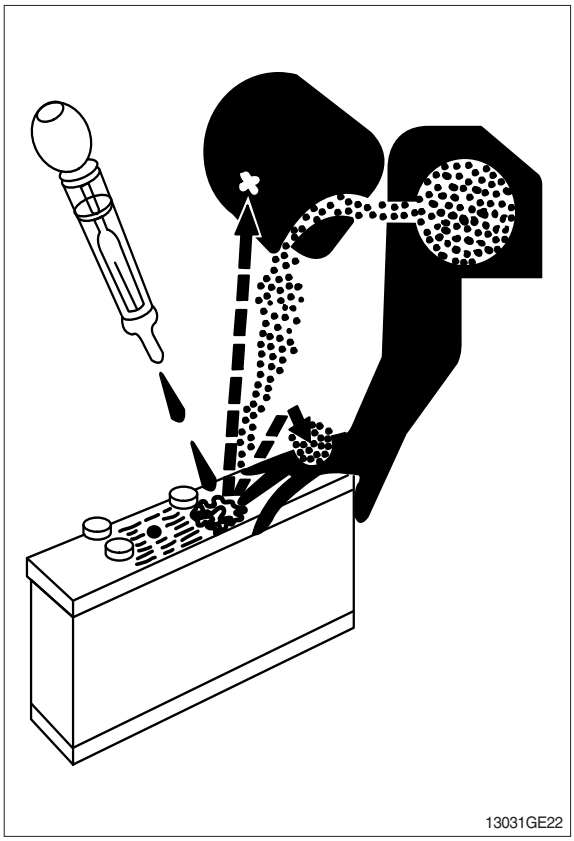
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling of dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

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

If acid is swallowed:

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



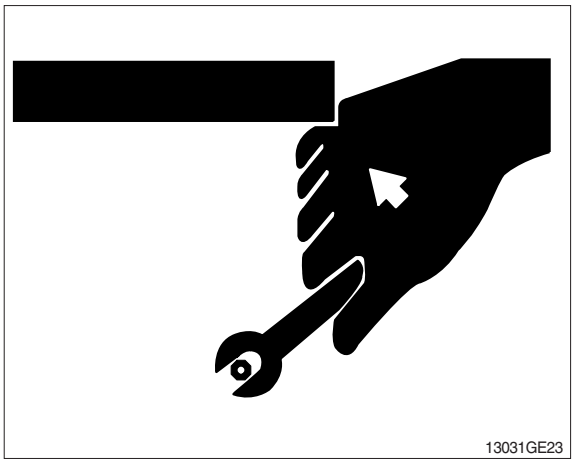
USE TOOLS PROPERLY

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

Use power tools only to loosen threaded tools and fasteners.

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

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

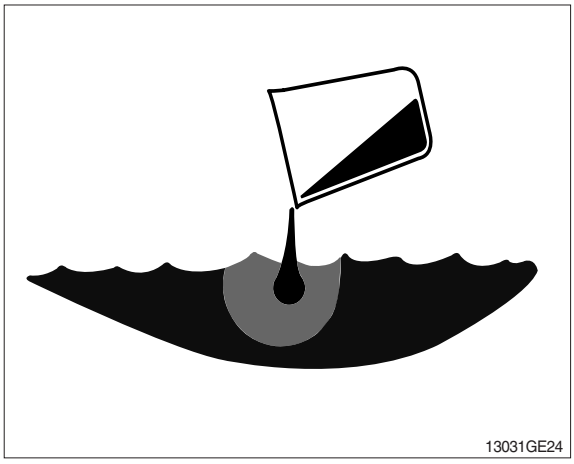


DISPOSE OF FLUIDS PROPERLY

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

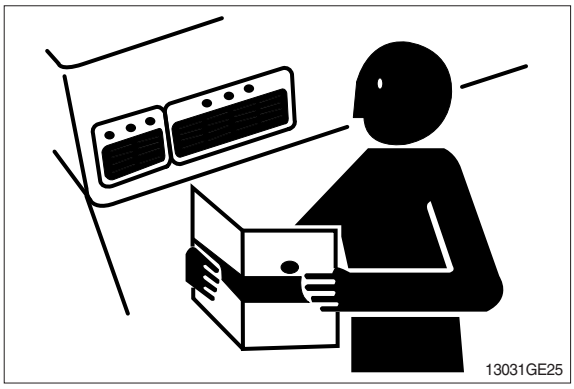
Use proper containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

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



REPLACE SAFETY SIGNS

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

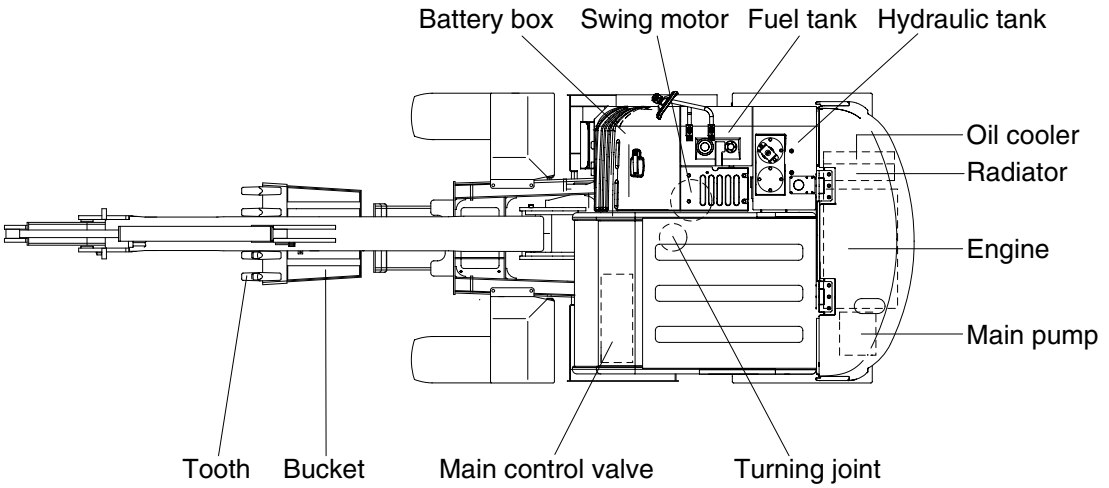


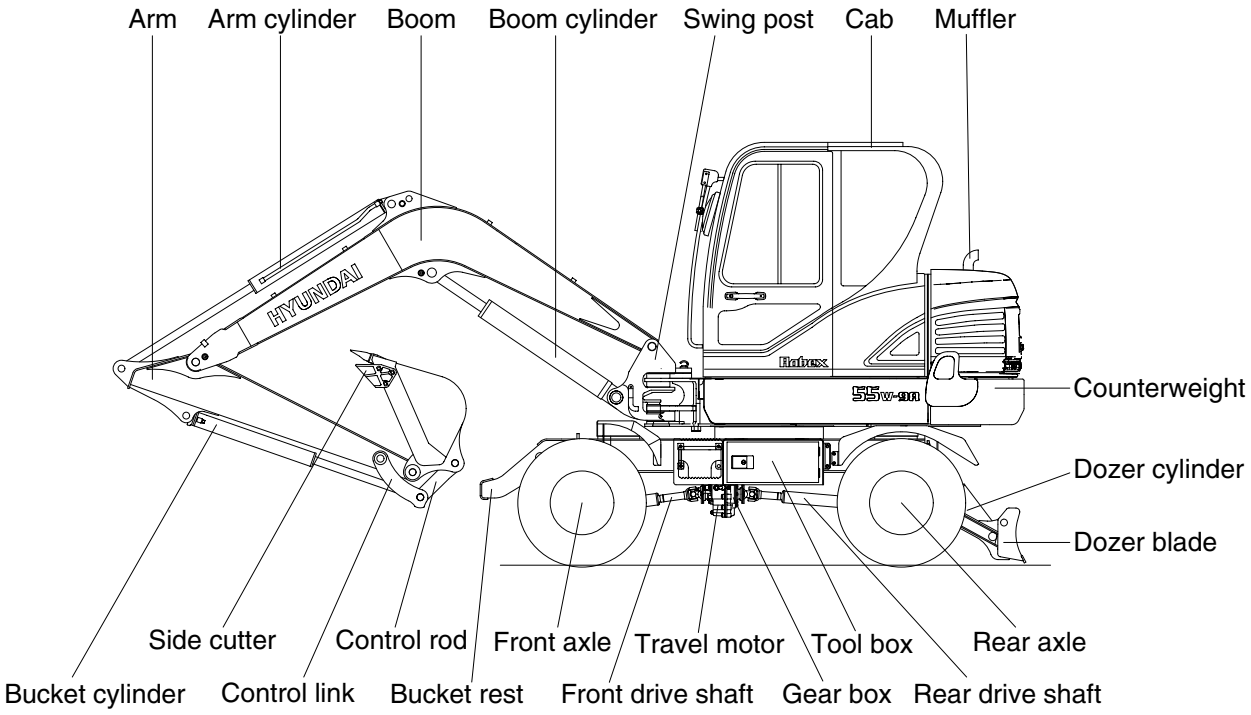
LIVE WITH SAFETY

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

GROUP 2 SPECIFICATIONS

1. MAJOR COMPONENT

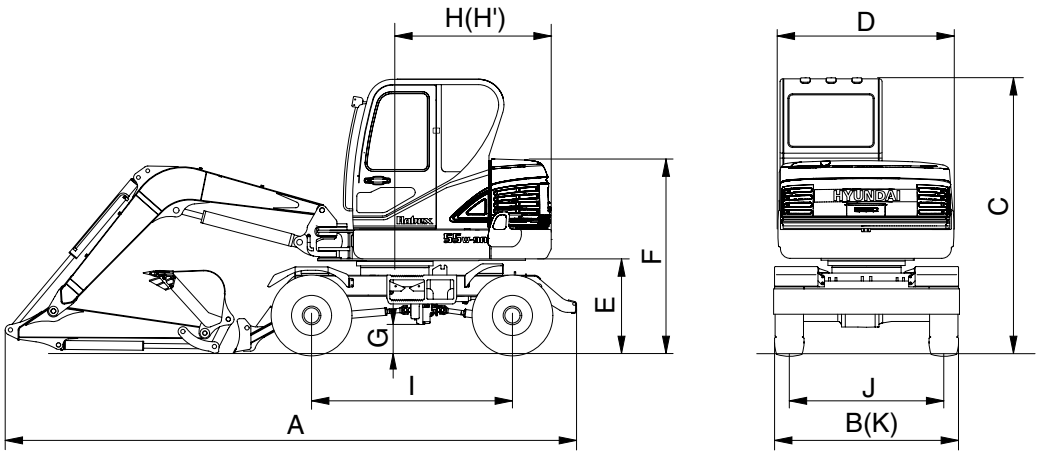




55W9A2SP01

2. SPECIFICATIONS

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

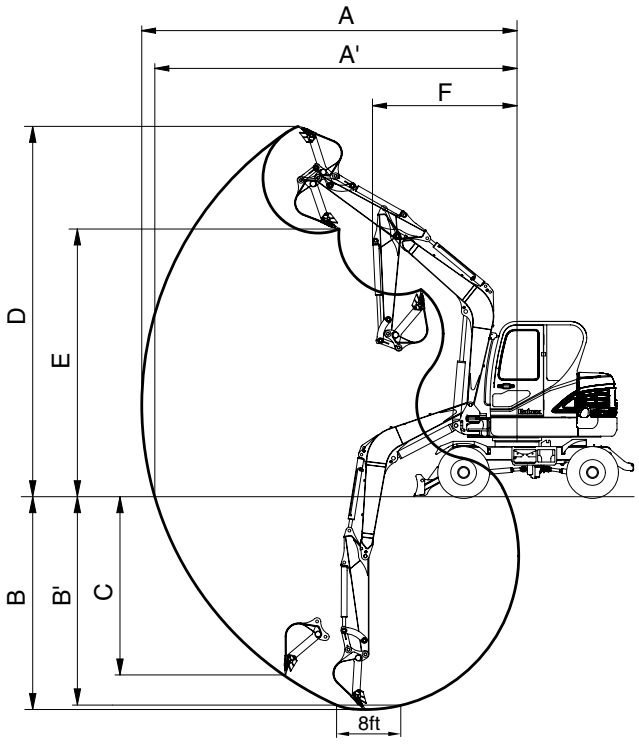


55W9A2SP02

Description		Unit	Specification
Operating weight		kg (lb)	5550 (12240)
Bucket capacity(SAE heaped), standard		m^3 (yd^3)	0.18 (0.24)
Overall length	A	mm (ft-in)	5970 (19' 6")
Overall width	B		1925 (6' 4")
Overall height	C		2850 (9' 4")
Upperstructure width	D		1850 (6' 1")
Ground clearance of counterweight	E		986 (3' 3")
Engine cover height	F		1970 (6' 6")
Minimum ground clearance	G		290 (11.4")
Rear-end distance	H		1650 (5' 5")
Rear-end swing radius	H'		1650 (5' 5")
Wheel base	I		2100 (6'11")
Tread	J		1600 (5' 3")
Dozer blade width	K		1925 (6' 4")
Travel speed	Low	km/hr (mph)	11.6 (7.2)
	High		30 (18.7)
Swing speed		rpm	7.8
Gradeability		Degree (%)	35 (70)
Max traction force		kg (lb)	3400 (7500)

3. WORKING RANGE

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



55W9A2SP03

Description		1.6 m (5' 3") Arm
Max digging reach	A	6150 mm (20' 2")
Max digging reach on ground	A'	5980 mm (19' 7")
Max digging depth	B	3500 mm (11' 6")
Max digging depth (8 ft level)	B'	3100 mm (10' 2")
Max vertical wall digging depth	C	2960 mm (9' 9")
Max digging height	D	6070 mm (19' 11")
Max dumping height	E	4340 mm (14' 3")
Min swing radius	F	2350 mm (7' 9")
Boom swing radius (left/right)		80˚/50˚
Bucket digging force	SAE	37.7 kN
		3850 kgf
		8490 lbf
	ISO	42.4 kN
		4330 kgf
		9550 lbf
Arm crowd force	SAE	28.4 kN
		2900 kgf
		6390 lbf
	ISO	31.9 kN
		3260 kgf
		7190 lbf

4. WEIGHT

Item	R55W-9A	
	kg	lb
Upperstructure assembly	2680	5910
Main frame weld assembly	600	1320
Engine assembly	280	620
Main pump assembly	30	70
Main control valve assembly	40	90
Swing motor assembly	75	165
Hydraulic oil tank assembly	90	200
Fuel tank assembly	60	130
Boom swing post	110	240
Counterweight	210	460
Cab assembly	350	770
Lower chassis assembly	2080	4590
Lower frame weld assembly	550	1210
Swing bearing	90	200
Travel motor assembly	40	90
Turning joint	30	70
Gear box	94	207
Front axle assembly	280	617
Rear axle assembly	200	440
Dozer blade assembly	200	440
Front attachment assembly (3.0 m boom, 1.6 m arm, 0.18 m^3 SAE heaped bucket)	790	1740
3.0 m boom assembly	240	530
1.6 m arm assembly	130	290
0.18 m^3 SAE heaped bucket assembly	170	370
Boom cylinder assembly	70	155
Arm cylinder assembly	60	130
Bucket cylinder assembly	35	80
Bucket control link assembly	40	90
Boom swing cylinder assembly	40	90
Blade cylinder assembly	30	70

5. LIFTING CAPACITIES

1) 3.0 m (9'10") boom, 1.6 m(5' 3") arm equipped with 0.18m³ (SAE heaped) bucket and the dozer blade down.

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

Load point height		Load radius								At max. reach		
		2.0 m (7 ft)		3.0 m (10 ft)		4.0 m (13 ft)		5.0 m (16 ft)		Capacity		Reach
												m (ft)
5.0 m (16 ft)	kg									*960	*960	4.47
	lb									*2120	*2120	(14.7)
4.0 m (13 ft)	kg					*1020	*1020			*990	720	5.26
	lb					*2250	*2250			*2180	1590	(17.3)
3.0 m (10 ft)	kg					*1150	1120	*990	760	*1020	620	5.69
	lb					*2540	2470	*2180	1680	*2250	1370	(18.7)
2.0 m (7 ft)	kg			*1900	1690	*1400	1070	*1200	740	*1070	570	5.86
	lb			*4190	3730	*3090	2360	*2650	1630	*2360	1260	(19.2)
1.0 m (3 ft)	kg			*2500	1580	*1670	1020	*1310	720	*1110	570	5.81
	lb			*5510	3480	*3680	2250	*2890	1590	*2450	1260	(19.1)
Ground Line	kg	*2690	*2690	*2720	1530	*1820	990	*1350	700	*1160	620	5.51
	lb	*5930	*5930	*6000	3370	*4010	2180	*2980	1540	*2560	1370	(18.1)
-1.0 m (-3 ft)	kg	*4040	3040	*2610	1520	*1760	980			*1180	740	4.92
	lb	*8910	6700	*5750	3350	*3880	2160			*2600	1630	(16.1)
-2.0 m (-7 ft)	kg	*3400	3100	*2090	1550							
	lb	*7500	6830	*4610	3420							

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

Load point height		Load radius								At max. reach		
		2.0 m (7 ft)		3.0 m (10 ft)		4.0 m (13 ft)		5.0 m (16 ft)		Capacity		Reach
												m (ft)
5.0 m (16 ft)	kg									*960	880	4.47
	lb									*2120	1940	(14.7)
4.0 m (13 ft)	kg					*1020	*1020			760	650	5.26
	lb					*2250	*2250			1680	1430	(17.3)
3.0 m (10 ft)	kg					*1150	1010	810	690	650	550	5.69
	lb					*2540	2230	1790	1520	1430	1210	(18.7)
2.0 m (7 ft)	kg			1770	1510	1130	960	790	670	610	510	5.86
	lb			3900	3330	2490	2120	1740	1480	1340	1120	(19.2)
1.0 m (3 ft)	kg			1660	1410	1080	910	760	640	610	510	5.81
	lb			3660	3110	2380	2010	1680	1410	1340	1120	(19.1)
Ground Line	kg	*2690	2630	1610	1360	1040	880	750	630	650	550	5.51
	lb	*5930	5800	3550	3000	2290	1940	1650	1390	1430	1210	(18.1)
-1.0 m (-3 ft)	kg	3210	2650	1600	1350	1040	870			790	660	4.92
	lb	7080	5840	3530	2980	2290	1920			1740	1460	(16.1)
-2.0 m (-7 ft)	kg	3270	2700	1630	1380							
	lb	7210	5950	3590	3040							

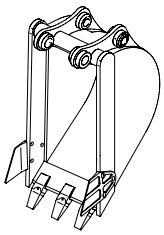
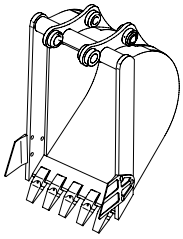
Note 1. Lifting capacity are based on SAE J1097 and ISO 10567.

2. Lifting capacity of the ROBEX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.

3. The load point is a hook located on the back of the bucket.

4. *indicates load limited by hydraulic capacity.

6. BUCKET SELECTION GUIDE

	
0.07m³ SAE heaped bucket	0.18 m³ SAE heaped bucket

Capacity		Width		Weight	Recommendation
					3.0 m (9' 10") boom
SAE heaped	CECE heaped	Without side cutter	With side cutter		1.6 m (5' 3") arm
0.07 m³ (0.09 yd³)	0.06 m³ (0.08 yd³)	315 mm (12.4")	360 mm (14.2")	115 kg (255 lb)	Applicable for materials with density of 1600 kgf/m³ (2700 lb/yd³) or less
0.18 m³ (0.24 yd³)	0.15 m³ (0.20 yd³)	670 mm (26.4")	740 mm (29.1")	170 kg (375 lb)	

7. SPECIFICATIONS FOR MAJOR COMPONENTS

1) ENGINE

Item	Specification
Model	Yanmar 4TNV98C
Type	4-cycle diesel engine, low emission
Cooling method	Water cooling
Number of cylinders and arrangement	4 cylinders, in-line
Firing order	1-3-4-2
Combustion chamber type	Direct injection type
Cylinder bore × stroke	98 × 110 mm (3.85" × 4.33")
Piston displacement	3319 cc (203 cu in)
Compression ratio	18.5 : 1
Rated gross horse power(SAE J1995)	66.9 Hp at 2400 rpm (49.9 kW at 2400 rpm)
Maximum torque at 1550rpm	24 kgf · m (173.6 lbf · ft)
Engine oil quantity	11.6 ℓ (3.1 U.S. gal)
Dry weight	270 kg (595 lb)
High idling speed	2550+50 rpm
Low idling speed	1000± 100 rpm
Rated fuel consumption	176 g/Hp · hr at 2400 rpm
Starting motor	12V-3.0 kW
Alternator	12V-80A(-#0214), 12V-100 A(#0215-)
Battery	1 × 12V × 100Ah

2) MAIN PUMP

Item	Specification
Type	Variable displacement tandem axis piston pumps
Capacity	2 × 25 cc/rev
Maximum pressure	220 kgf/cm^2 (3130 psi)
Rated oil flow	2 × 63.5 ℓ /min (16.5 U.S. gpm/ 13.7 U.K. gpm)
Rated speed	2500 rpm

3) GEAR PUMP

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	16.2/6.5 cc/rev
Maximum pressure	220/30 kgf/cm^2 (3130/430 psi)
Rated oil flow	40.5/16.3 ℓ /min (10.7/4.3 U.S. gpm/8.9/3.6 U.K. gpm)

4) MAIN CONTROL VALVE

Item	Specification
Type	9 spools sectional block
Operating method	Hydraulic pilot system
Main relief valve pressure	220 kgf/cm^2(3130 psi)
Overload relief valve pressure	240 kgf/cm^2(3410 psi)

5) SWING MOTOR

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

6) TRAVEL MOTOR

Item	Specification
Type	Bent axis design variable displacement axial piston motor
Relief pressure	220 kgf/cm^2 (3130 psi)
Counterbalance valve	Applied
Capacity	80 cc

7) POWER TRAIN

Item	Description		Specification
Gear box	Type		2 speed hydrostatic
	Gear ratio	1st	6.357
		2nd	1.961
Parking brake	Type		Multi disc brake integrated in rear axle
	Maximum braking power		700 kgf · m (5060 lbf · ft)
Axle	Type		4 wheel drive with differential
	Gear ratio		8.67
	Brake		Multi disc brake

8) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Rod dia × Stroke	ø 110 × ø 65 × 715mm
	Cushion	Extend only
Arm cylinder	Bore dia × Rod dia × Stroke	ø 90 × ø 55 × 850mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia × Rod dia × Stroke	ø 80 × ø 50 × 660mm
	Cushion	Extend only
Dozer cylinder	Bore dia × Rod dia × Stroke	ø 110 × ø 60 × 219mm
	Cushion	-
Boom swing cylinder	Bore dia × Rod dia × Stroke	ø 95 × ø 50 × 535mm
	Cushion	-

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

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

9) BUCKET

Item		Capacity		Tooth quantity	Width	
		SAE heaped	CECE heaped		Without side cutter	With side cutter
R55W-9A	STD	0.18 m^3 (0.24 yd^3)	0.15 m^3 (0.20 yd^3)	5	670 mm (26.4")	740 mm (29.1")
	OPT	0.07 m^3 (0.09 yd^3)	0.06 m^3 (0.08 yd^3)	3	315 mm (12.4")	360 mm (14.2")

8. RECOMMENDED LUBRICANTS

Use only oils listed below or equivalent.

Do not mix different brand oil.

Service point	Kind of fluid	Capacity ℓ (U.S. gal)	Ambient temperature ˚C(˚F) -50 (-58) -30 (-22) -20 (-4) -10 (14) 0 (32) 10 (50) 20 (68) 30 (86) 40 (104)
Engine oil pan	Engine oil	11.6 (3.1)	★SAE 5W-40 SAE 30 SAE 10W SAE 10W-30 SAE 15W-40
Swing drive	Grease	0.2 (0.1)	★NLGI NO.1 NLGI NO.2
	Gear oil	1.5 (0.4)	★SAE 75W-90 SAE 85W-140
Gear box case	Gear oil	1.8 (0.5)	SAE 85W-90 LSD(GL-5)
Front axle		Center : 4.5 (1.19) Hub : 0.4×2 (0.11×2)	
Rear axle		Center : 4.5 (1.19) Hub : 0.4×2 (0.11×2)	
Hydraulic tank	Hydraulic oil	Tank; 70 (18.5) System; 120 (31.7)	★ISO VG 15 ISO VG 32 ISO VG 46, HBHO VG 46★3 ISO VG 68
Fuel tank	Diesel fuel★1	120 (31.7)	★ASTM D975 NO.1 ASTM D975 NO.2
Fitting (grease nipple)	Grease	As required	★NLGI NO.1 NLGI NO.2
Radiator (reservoir tank)	Mixture of antifreeze and water 50 : 50★2	9.5 (2.5)	Ethylene glycol base permanent type ★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.

※ Using any lubricating oils other than HYUNDAI genuine products may lead to a deterioration of performance and cause damage to major components.

※ Do not mix HYUNDAI genuine oil with any other lubricating oil as it may result in damage to the systems of major components.

※ Do not use any engine oil other than that specified above, as it may clog the diesel particulate filter(DPF).

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

SECTION 2 STRUCTURE AND FUNCTION

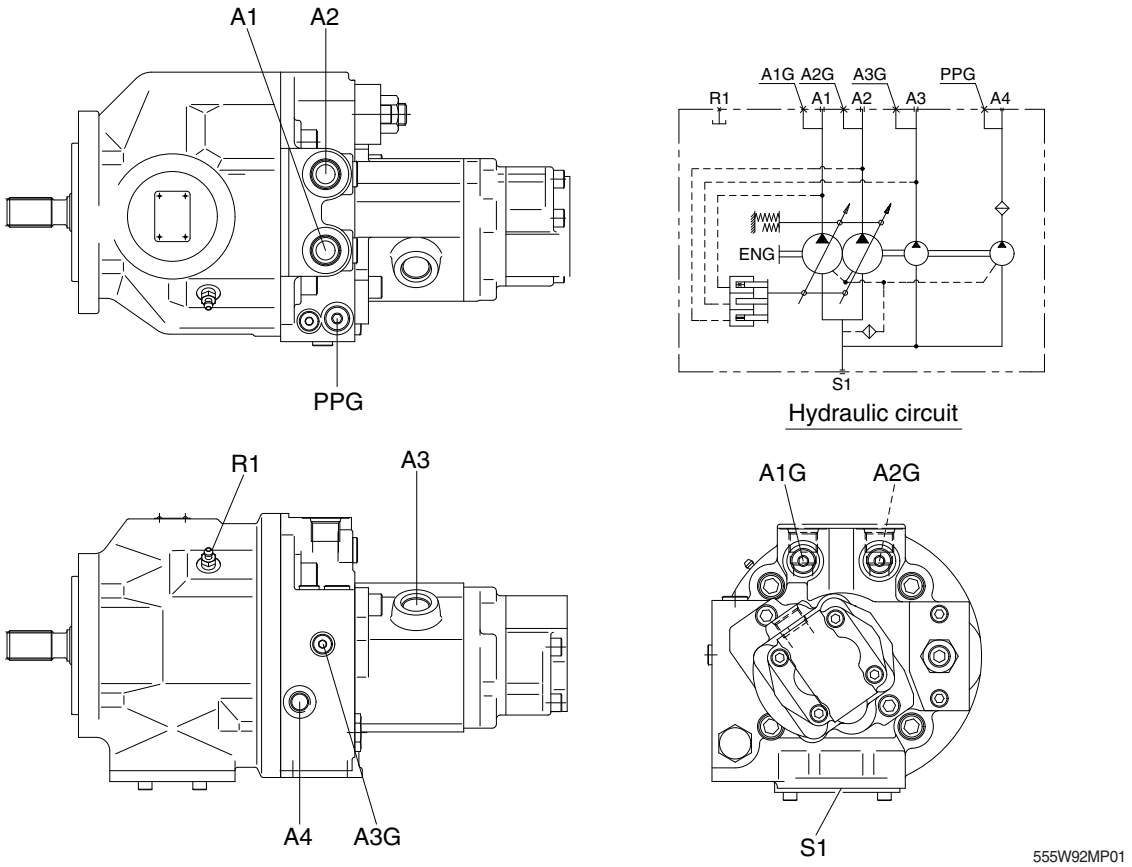
GROUP 1 HYDRAULIC PUMP

1. GENERAL

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

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

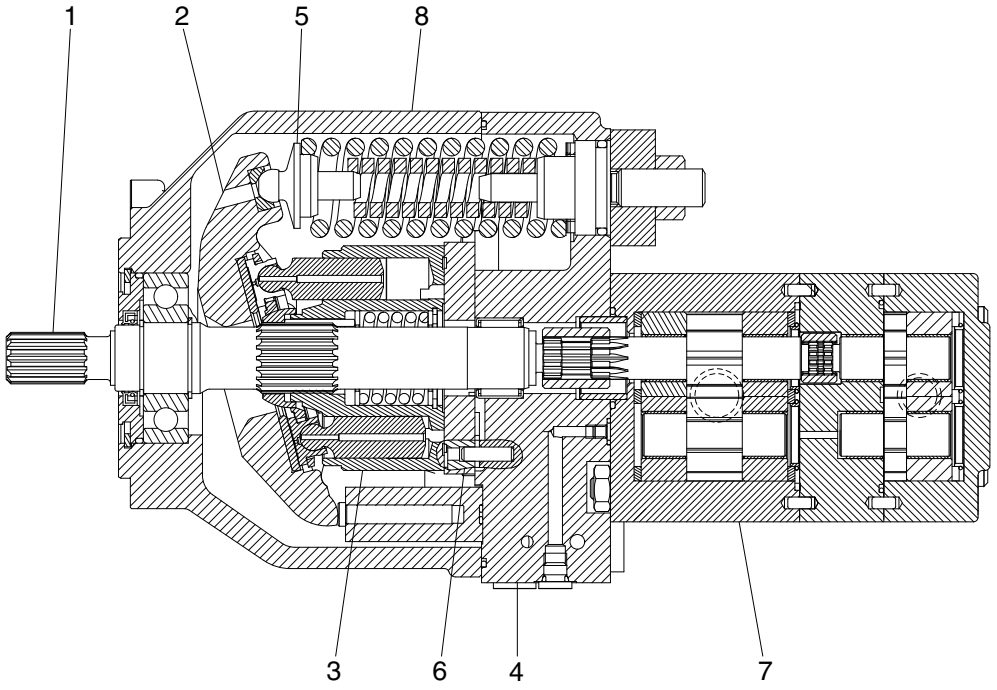
The third pump and pilot pump can be connected to the same shaft via a coupling.



Description of the ports

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

2. PRINCIPAL COMPONENTS AND FUNCTIONS



55W72MP02

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

SPECIFICATIONS

- Capacity : 2×25+16.2+6.5 cc/rev
- Rated oil flow : 2×60+38.9+15.6 ℓ /min
- Rated pressure : 2×220+200+30 kgf/cm^2

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

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

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

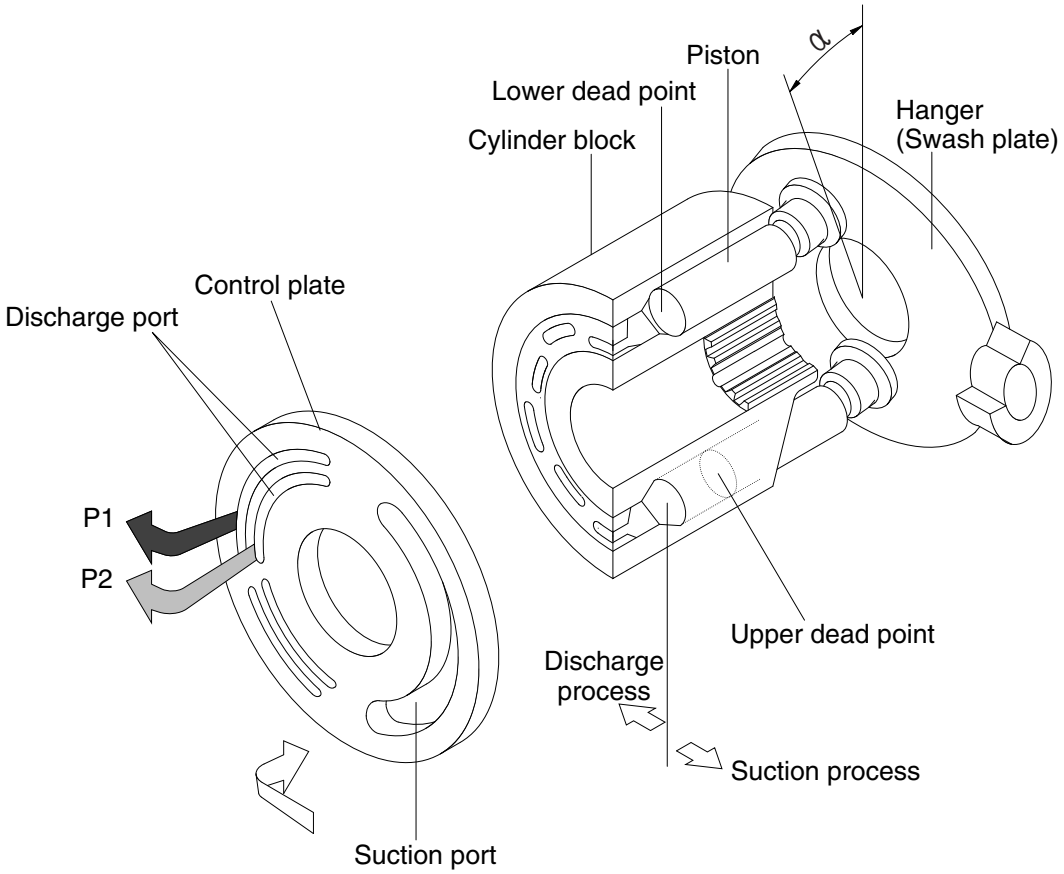
Since the piston stroke changes according to the tilting angle of the hanger, the flow can be changed.

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

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

1) PRINCIPLE OF OPERATION

(1) Function of pump



R5572SF03

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

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

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

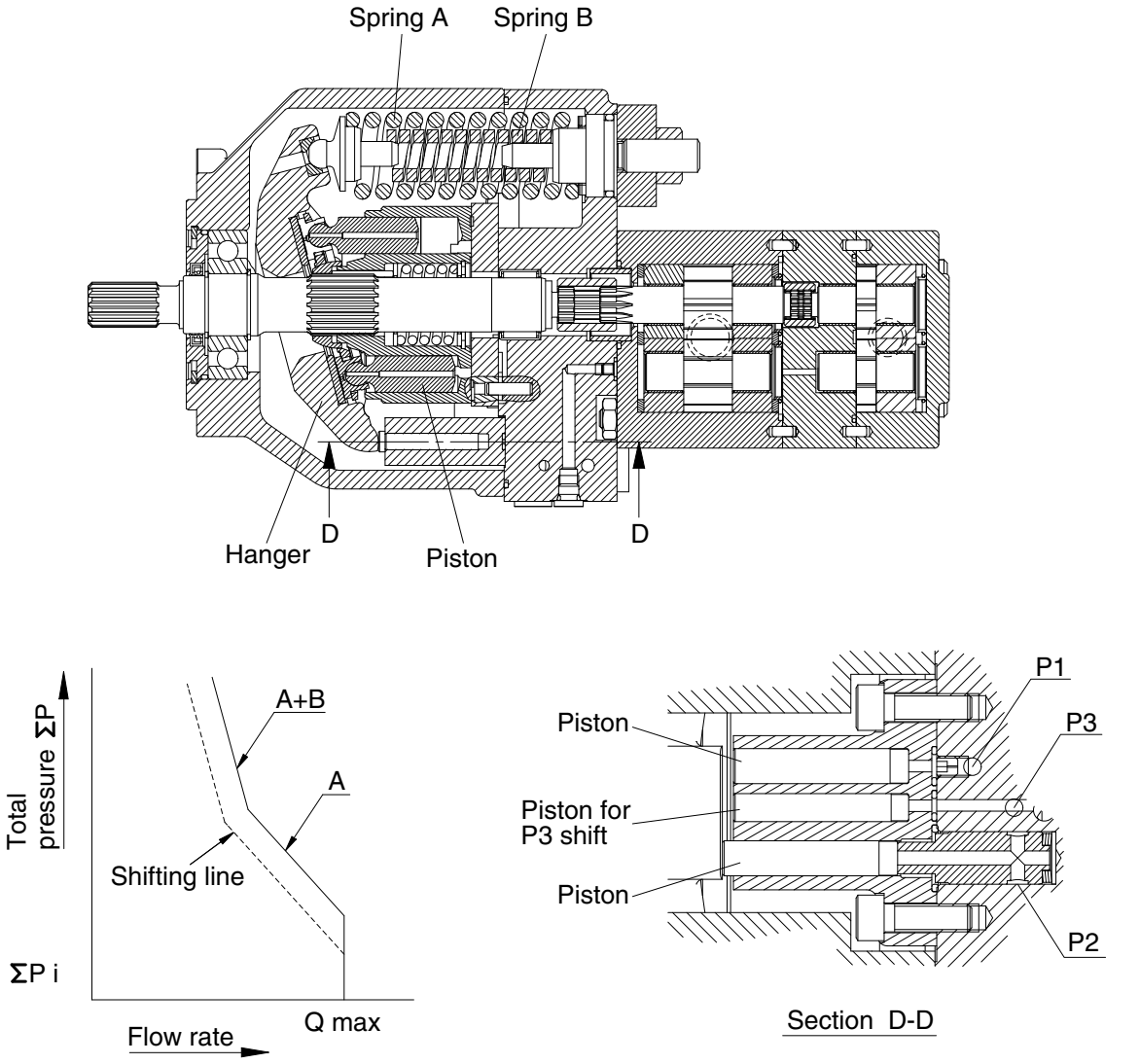
During a stroke from the upper to the lower dead points, the piston moves in a direction to decrease the displacement. The oil is discharged to the discharge port (discharge process).

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

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

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

2) CONTROL FUNCTIONS

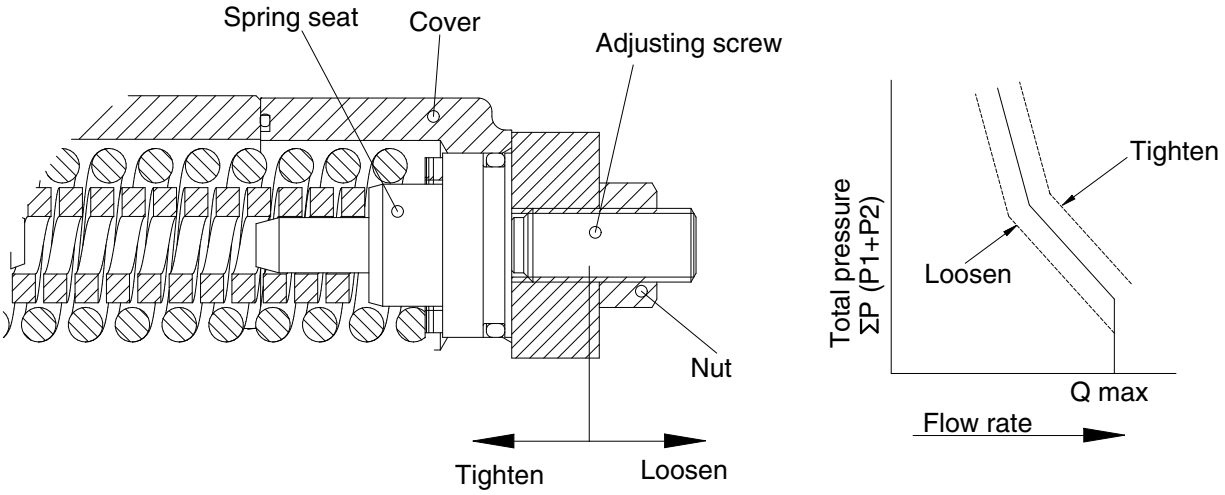


The discharge pressures P1 and P2 are directed to the pistons of equal area act on the hanger.
The spring is provided to act against the discharge pressure. When the oil pressure acting on the piston is less than the installation load of the spring A (outer spring), the hanger is fixed to the maximum tilting position. When the oil, pressure acting on the piston exceeds the installation load of the spring A the hanger is tilted and kept tilted at a position where the oil pressure is balanced with the spring force. (Region A in the middle of the figure above)
When the oil pressure acting on the piston rises further to reduce the tilting angle, the spring B which has been inactive up to now becomes active.
To overcome the spring force of two springs, the oil pressure must be higher and the shifting line becomes more steep. (Regions A + B in the middle of the figure above)
When the P3 oil pressure acts on the shift piston, the control shifting line is shifted.

3) CONTROL / ADJUSTMENT PROCEDURE

(1) Loosen the hexagonal nut.

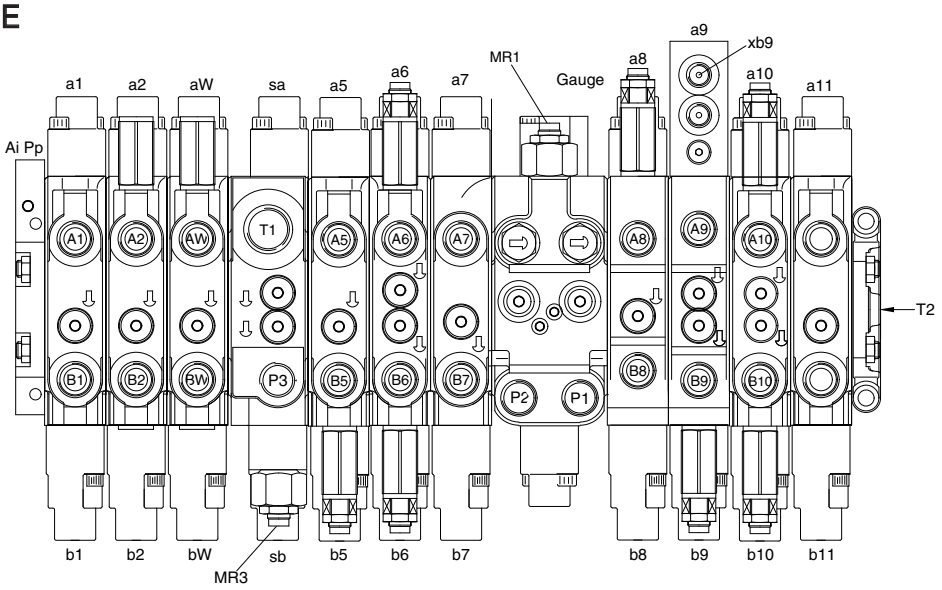
(2) Tighten or loosen the adjusting screw to set the power shifting line.

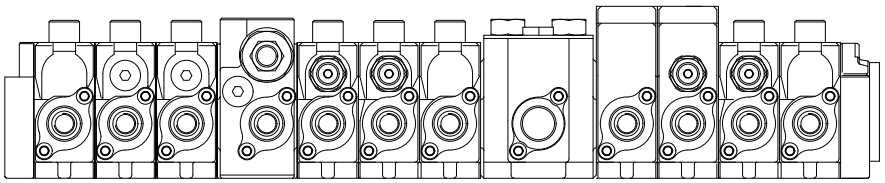


R5572SF05

GROUP 2 MAIN CONTROL VALVE

1. OUTLINE



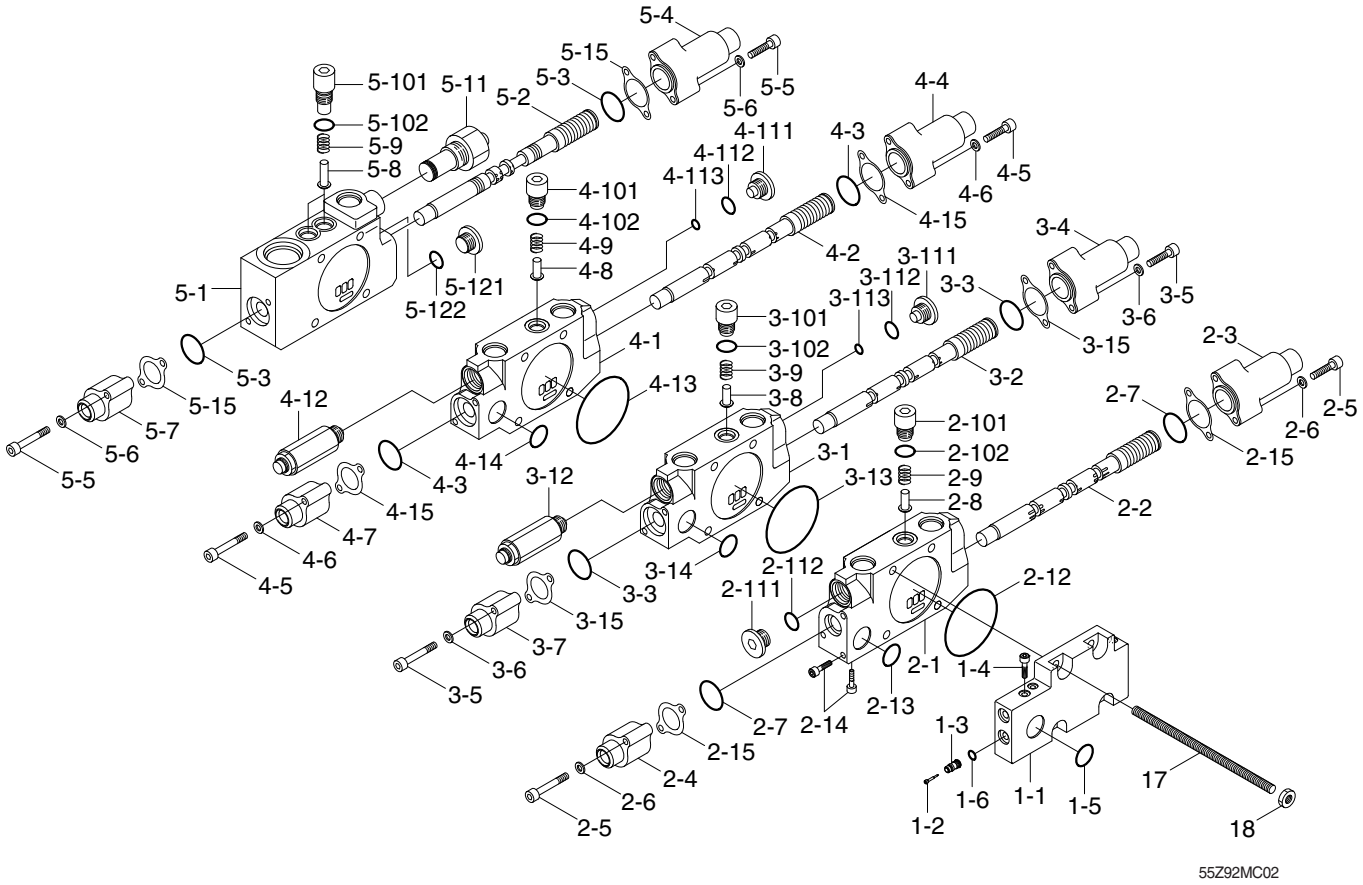


55W9A2MC01

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

Mark	Port name	Port size	Tightening torque
B10	Bucket in port	PF1/2	6~7 kgf · m
B11	Arm 2 port		
T2	Tank return port	PF3/4	8~9 kgf · m
T1	Tank return port	PF1	10~12 kgf · m
a1	Swing pilot port (LH)	PF1/4	2.5~3.0 kgf · m
b1	Swing pilot port (RH)		
a2	Dozer down pilot port		
b2	Dozer up pilot port		
aw	Boom swing pilot port (LH)		
bw	Boom swing pilot port (RH)		
a5	Boom 2 pilot port		
b5	Breaker pilot port		
a6	Arm out pilot port		
b6	Arm in pilot port		
a7	Travel pilot port (LH/FW)		
b7	Travel pilot port (LH/RR)		
a8	Travel pilot port (RH/FW)		
b8	Travel pilot port (RH/RR)		
a9	Boom up pilot port		
b9	Boom down pilot port		
a10	Bucket out pilot port		
b10	Bucket in pilot port		
a11	Arm 2 pilot port		
b11	Arm 2 pilot port		
Pp	Pilot supply port	PF1/4	
Ai	Auto idle signal port		

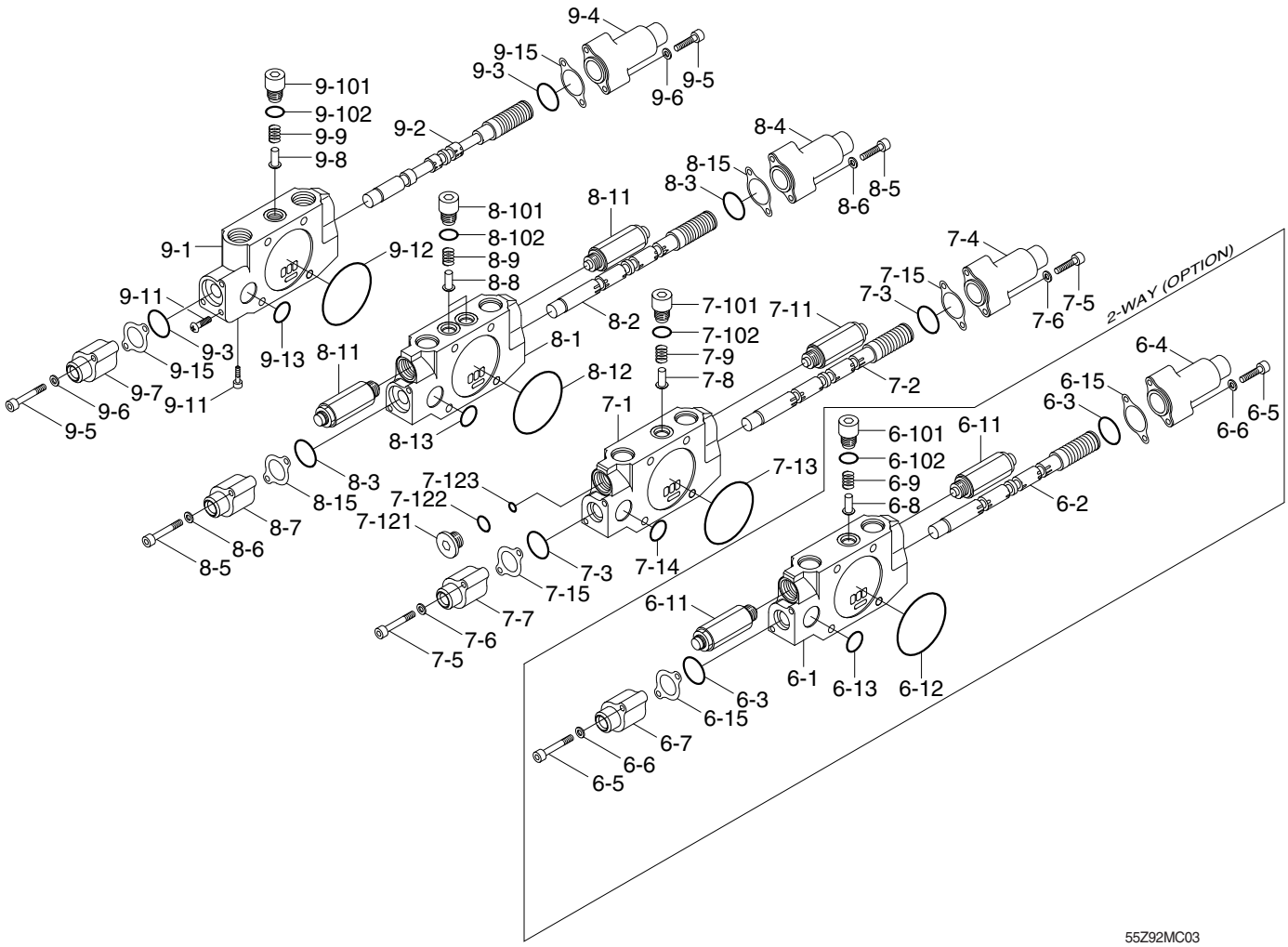
2. STRUCTURE (1/4)



55Z92MC02

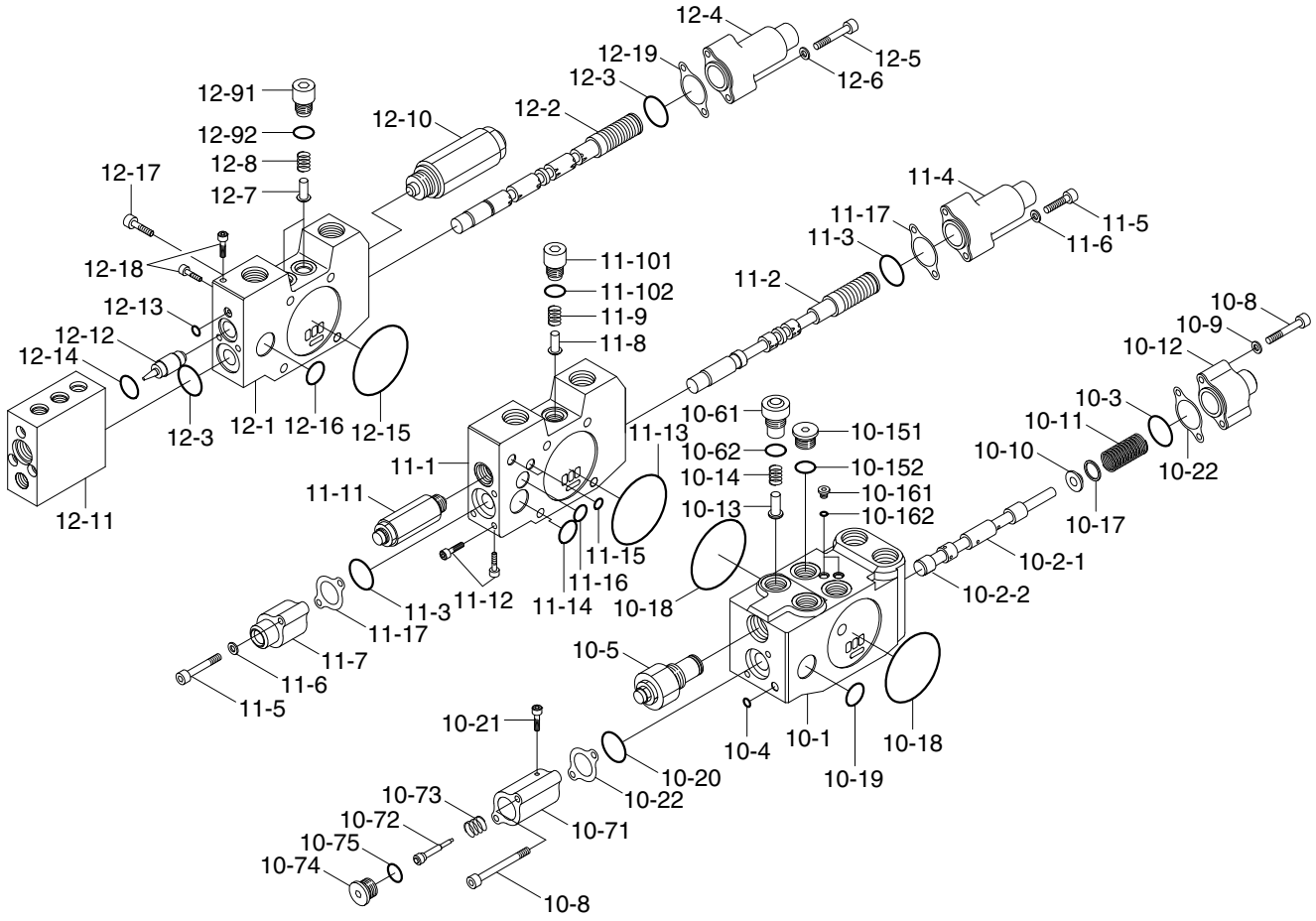
1	Ai cover	3	Dozer block	4	Boon swing assy	5	Inlet assy
2	Section assy-Swing	3-1	Work block	4-1	Work block	5-1	Work block (Ta)
2-1	Work block	3-2	Dozer spool assy	4-2	Spool assy (B/S)	5-2	Spool assy
2-2	Spool assy-Swing	3-3	O-ring	4-3	O-ring	5-3	O-ring
2-3	Pilot cap (A)	3-4	Pilot cap (A)	4-4	Pilot cap (A)	5-4	Pilot cap (A)
2-4	Pilot cap (B1)	3-5	Socket bolt	4-5	Wrench bolt	5-5	Wrench bolt
2-5	Wrench bolt	3-6	Plain washer	4-6	Plain washer	5-6	Plain washer
2-6	Plain washer	3-7	Pilot cap (B1)	4-7	Pilot cap (B1)	5-7	Pilot cap (B1)
2-7	O-ring	3-8	Check poppet	4-8	Check poppet	5-8	Check poppet
2-8	Check poppet	3-9	Check spring	4-9	Check spring	5-9	Check spring
2-9	Check spring	3-10	Plug	4-10	Plug assy	5-10	Plug assy
2-10	Plug	3-101	Check plug (M14)	4-101	Plug 1- check (M14)	5-101	Plug 1- check (M14)
2-101	Plug 1-Check M14	3-102	O-ring	4-102	O-ring	5-102	O-ring
2-102	O-ring	3-11	Plug	4-11	Plug assy	5-11	Main relief valve
2-11	Plug	3-111	Plug	4-111	Plug	5-12	Cap-Pf1/4 plug
2-111	Plug-PF3/8	3-112	O-ring	4-112	O-ring	5-121	Cap-Pf1/4 plug
2-112	O-ring	3-113	O-ring	4-113	O-ring	5-122	O-ring
2-12	O-ring	3-12	Check valve	4-12	Check valve	5-15	Gasket
2-13	O-ring	3-13	O-ring	4-13	O-ring	17	Tie bolt
2-14	Plug-Taper	3-14	O-ring	4-14	O-ring	18	Nut
2-15	Gasket	3-15	Gasket	4-15	Gasket		

STRUCTURE (2/4)



6	2 Way block	7-1	Work block (Ba3)	7-14	O-ring	8-15	Gasket
6-1	Work block	7-2	Boom 2 spool assy	7-15	Gasket	9	Travel block assy
6-2	Rotator spool assy	7-3	O-ring	8	Arm 1 block assy	9-1	Work block (Dk)
6-3	O-ring	7-4	Pilot cap (A)	8-1	Work block (B3)	9-2	Travel spool assy
6-4	Pilot cap (A)	7-5	Wrench bolt	8-2	Arm 1 spool assy	9-3	O-ring
6-5	Wrench bolt	7-6	Plain washer	8-3	O-ring	9-4	Pilot cap (A)
6-6	Plain washer	7-7	Pilot cap (B1)	8-4	Pilot cap (A)	9-5	Wrench bolt
6-7	Pilot cap (B1)	7-8	Check poppet	8-5	Socket bolt	9-6	Plain washer
6-8	Check poppet	7-9	Check spring	8-6	Plain washer	9-7	Pilot cap (B1)
6-9	Check spring	7-10	Plug assy	8-7	Pilot cap (B1)	9-8	Check poppet
6-10	Plug assy	7-101	Plug	8-8	Check poppet	9-9	Check spring
6-101	Plug 1 check (M14)	7-102	O-ring	8-9	Check spring	9-10	Plug 1 check (M14)
6-102	O-ring	7-11	Overload relief valve	8-10	Plug	9-101	Plug 1 check (M14)
6-11	Overload relief valve	7-12	Plug assy	8-101	Plug 1 check (M14)	9-102	O-ring
6-12	O-ring	7-121	Plug	8-102	O-ring	9-11	Taper plug
6-13	O-ring	7-122	O-ring	8-11	Overload relief valve	9-12	O-ring
6-15	Gasket	7-123	O-ring	8-12	O-ring	9-13	O-ring
7	Boom 2 breaker	7-13	O-ring	8-13	O-ring	9-15	Gasket

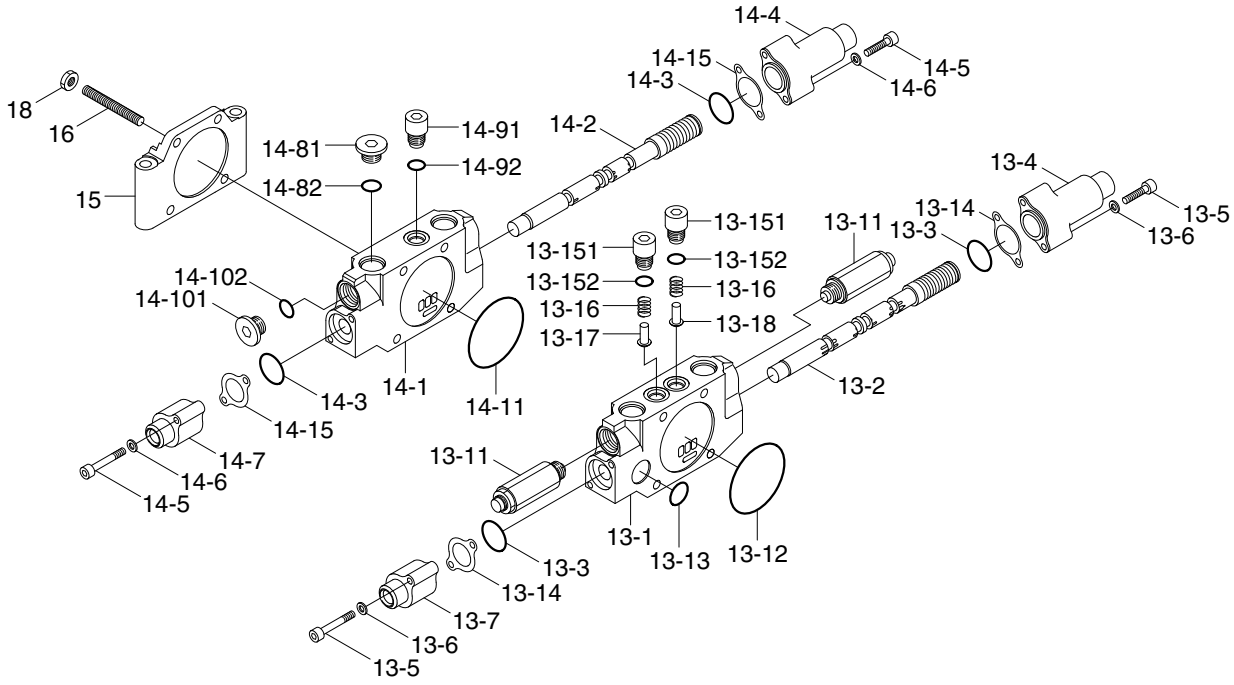
STRUCTURE (3/4)



55Z92MC04

10	Inlet block (P1, P2)	10-11	Pilot spring	11-4	Pilot cap (A)	12-4	Pilot cap (A)
10-1	Work block	10-12	Pilot cap (B2)	11-5	Wrench bolt	12-5	Wrench bolt
10-2	Spool (Ts)	10-13	Check poppet	11-6	Plain washer	12-6	Plain washer
10-2-1	Spool (Ts)	10-14	Check spring	11-7	Pilot cap (B1)	12-7	Check poppet
10-2-2	Spool plug bolt	10-15	Plug assy-PF3/8	11-8	Check poppet	12-8	Check spring
10-3	O-ring	10-151	Plug	11-9	Check spring	12-9	Plug assy
10-4	O-ring	10-152	O-ring	11-10	Plug 1 assy	12-91	Check plug 1 (M14)
10-5	Main relief valve	10-16	Plug UNF5/16	11-101	Check plug 1 (M14)	12-92	O-ring
10-6	Plug 3 assy	10-161	Plug UNF5/16	11-102	O-ring	12-10	Overload relief valve
10-61	Plug-PF3/8	10-162	O-ring	11-11	Overload relief valve	12-11	Holding valve
10-62	O-ring	10-17	Spring shim	11-12	Taper plug	12-12	Holding valve
10-7	Cap assy-Ts check	10-18	O-ring	11-13	O-ring	12-13	O-ring
10-71	Cap -Ts check	10-19	O-ring	11-14	O-ring	12-14	O-ring
10-72	Poppet check valve	10-20	O-ring	11-15	O-ring	12-15	O-ring
10-73	Check spring	10-21	Taper plug	11-16	O-ring	12-16	O-ring
10-74	Plug-PF1/8	10-22	Gasket	11-17	Gasket	12-17	Wrench bolt
10-75	O-ring	11	Travel block assy	12	Boom 1 block assy	12-18	Taper plug
10-8	Wrench bolt	11-1	Work block (Od)	12-1	Block boom 1	12-19	Gasket
10-9	Plain washer	11-2	Travel spool assy (R)	12-2	Boom 1 spool assy		
10-10	Spring seat	11-3	O-ring	12-3	O-ring		

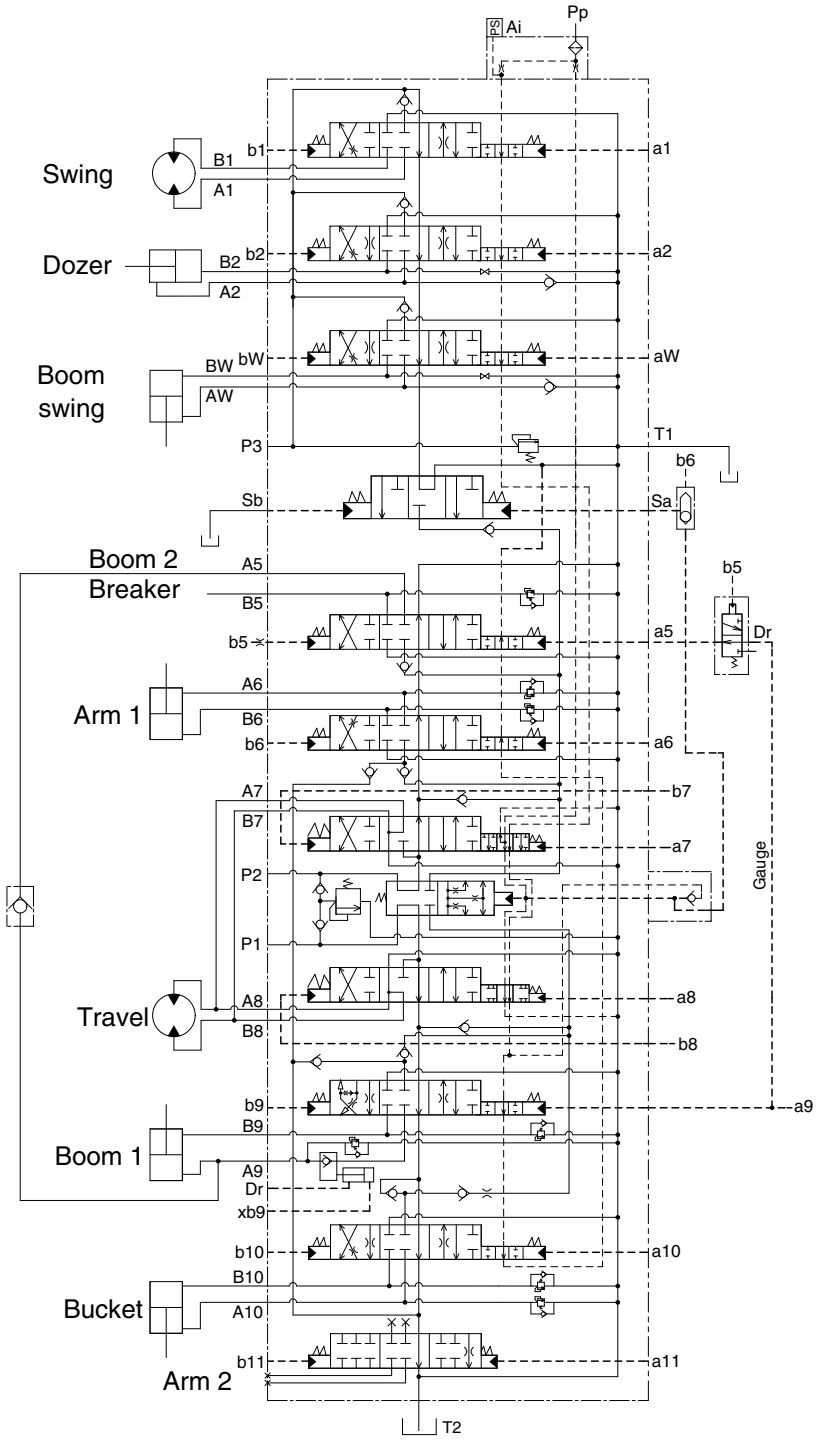
STRUCTURE (4/4)



55Z92MC05

13	Bucket block assy	13-152	O-ring	14-81	Plug PF1/2
13-1	Bucket block	13-16	Check spring	14-82	O-ring
13-2	Bucket spool assy	13-17	Check poppet	14-9	Plug assy
13-3	O-ring	13-18	Check poppet	14-91	Check plug 1 (M14)
13-4	Pilot cap (A)	14	Arm 2 assy	14-92	O-ring
13-5	Wrench bolt	14-1	Work block (Ae)	14-10	Plug assy
13-6	Plain washer	14-2	Arm 2 assy	14-101	Plug PF3/8
13-7	Pilot cap (B1)	14-3	O-ring	14-102	O-ring
13-11	Overload relief valve	14-4	Pilot cap (A)	14-11	O-ring
13-12	O-ring	14-5	Wrench bolt	14-15	Gasket
13-13	O-ring	14-6	Plain washer	15	End cover (He)
13-14	Gasket	14-7	Pilot cap (B1)	16	Tie bolt
13-15	Plug assy	14-8	Plug PF1/2	18	Nut
13-151	Check plug 1 (M14)				

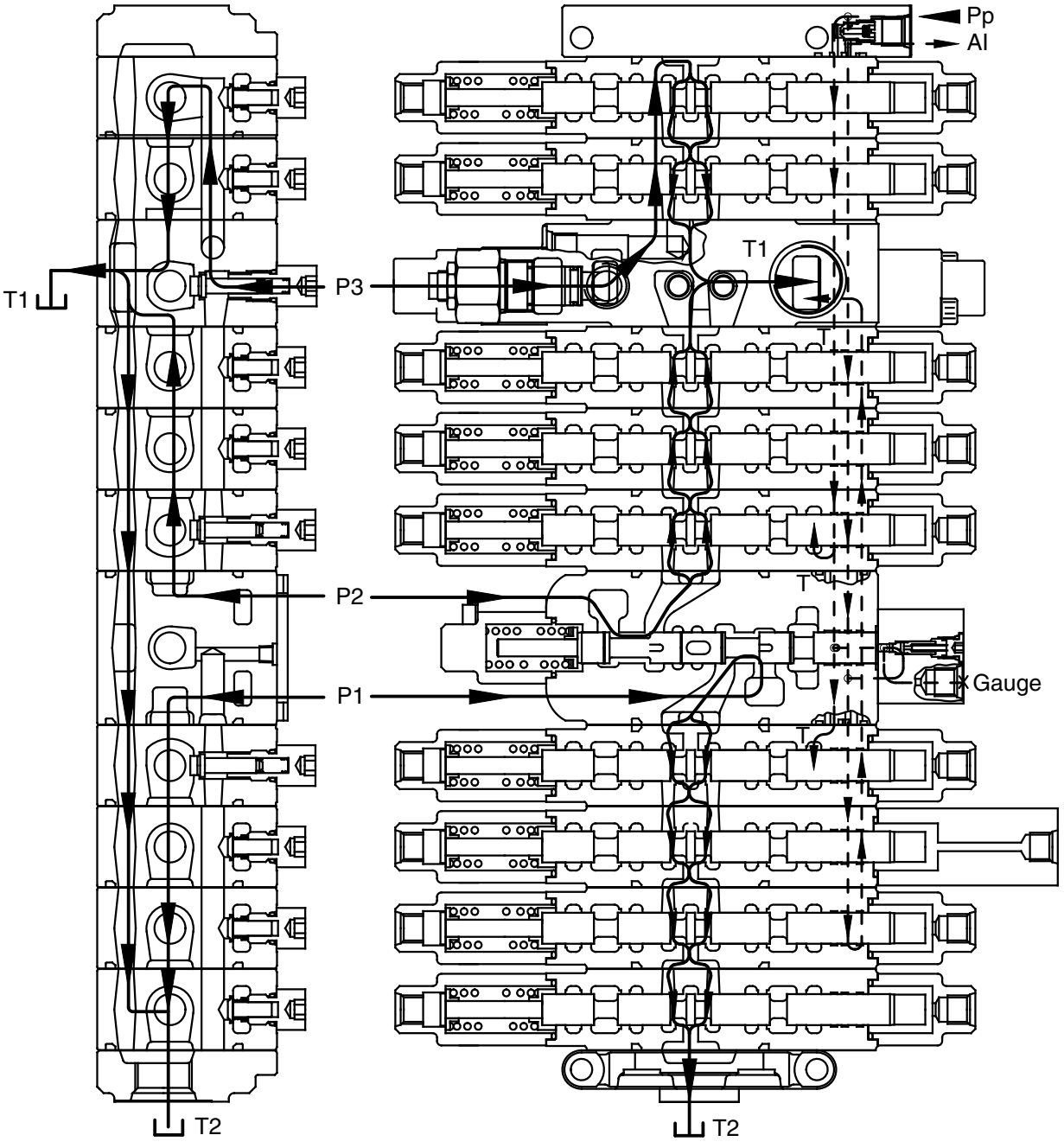
3. HYDRAULIC CIRCUIT (boom swing)



55W9AMO02

4. FUNCTION

1) CONTROL IN NEUTRAL FUNCTION



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

(1) P1

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

(2) P2

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

(3) P3

The oil discharged from the hydraulic pump flows into control valve P3.

In neutral, the oil flows through the center bypass passage in the direction of swing → dozer spool, and then flows from the center bypass passage to the tank port T1 and T2.

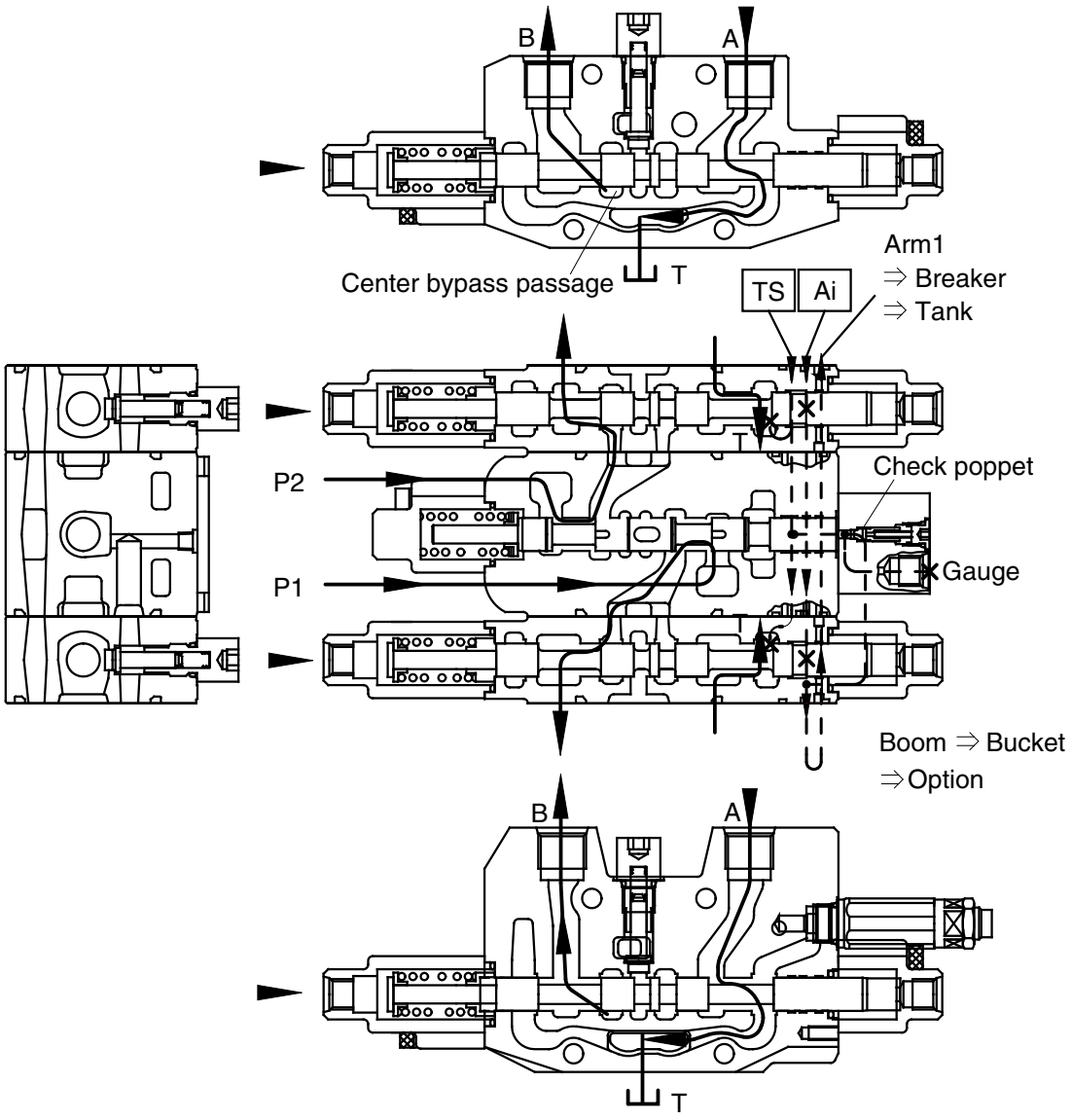
(4) Pp

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

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

2) EACH SPOOL OPERATION

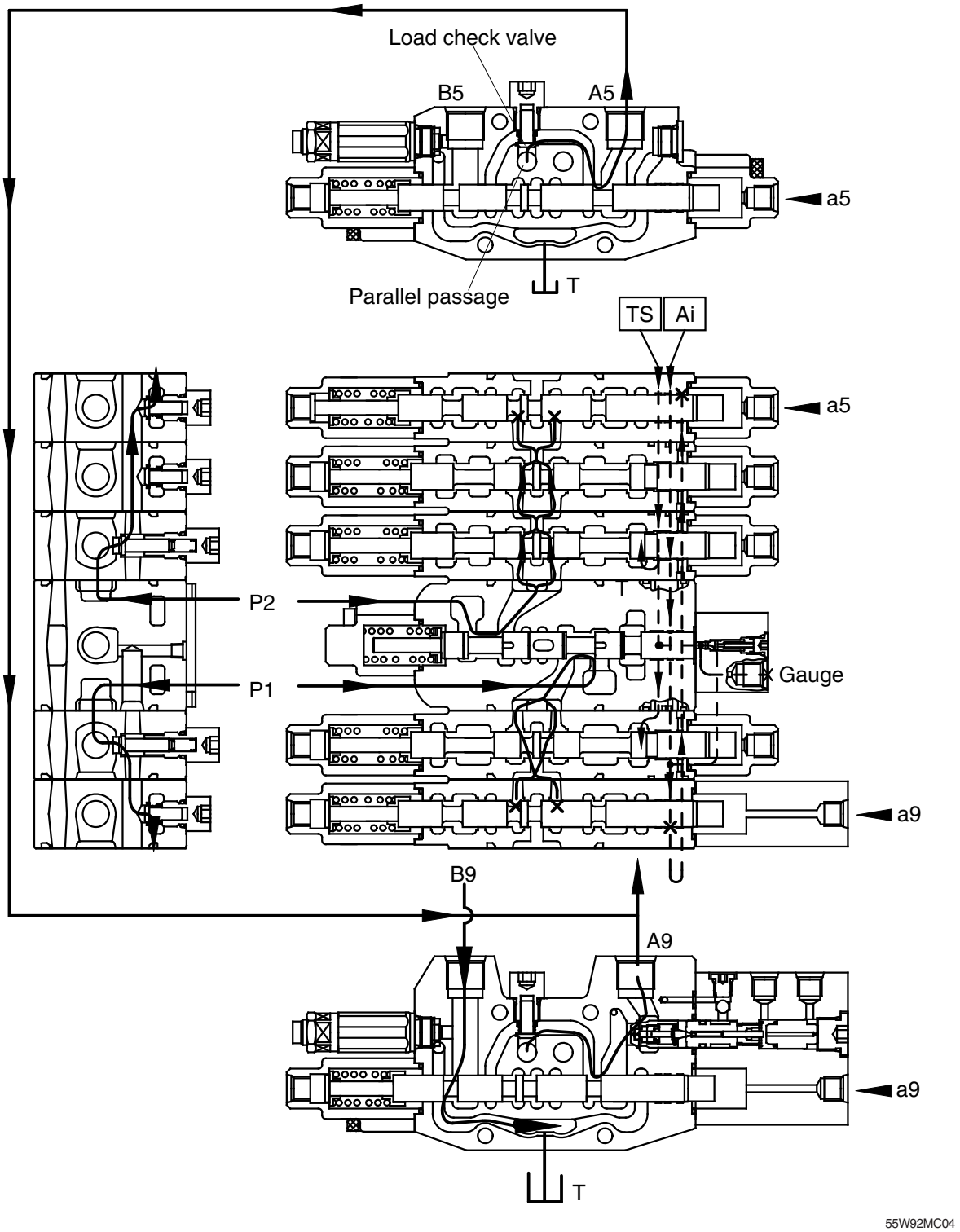
(1) Travel operation (forward / backward)



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

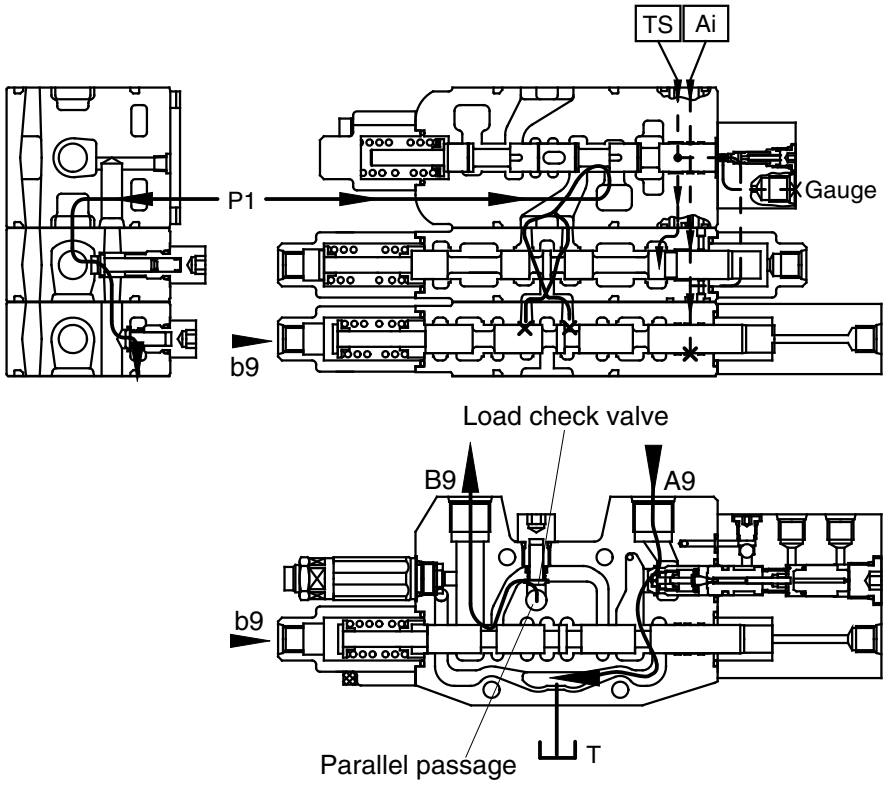
(2) Boom operation

① **Boom up operation** (P1 and P2 summation)



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

② **Boom down operation**



55W92MC05

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

(3) Bucket operation

① Bucket roll in operation

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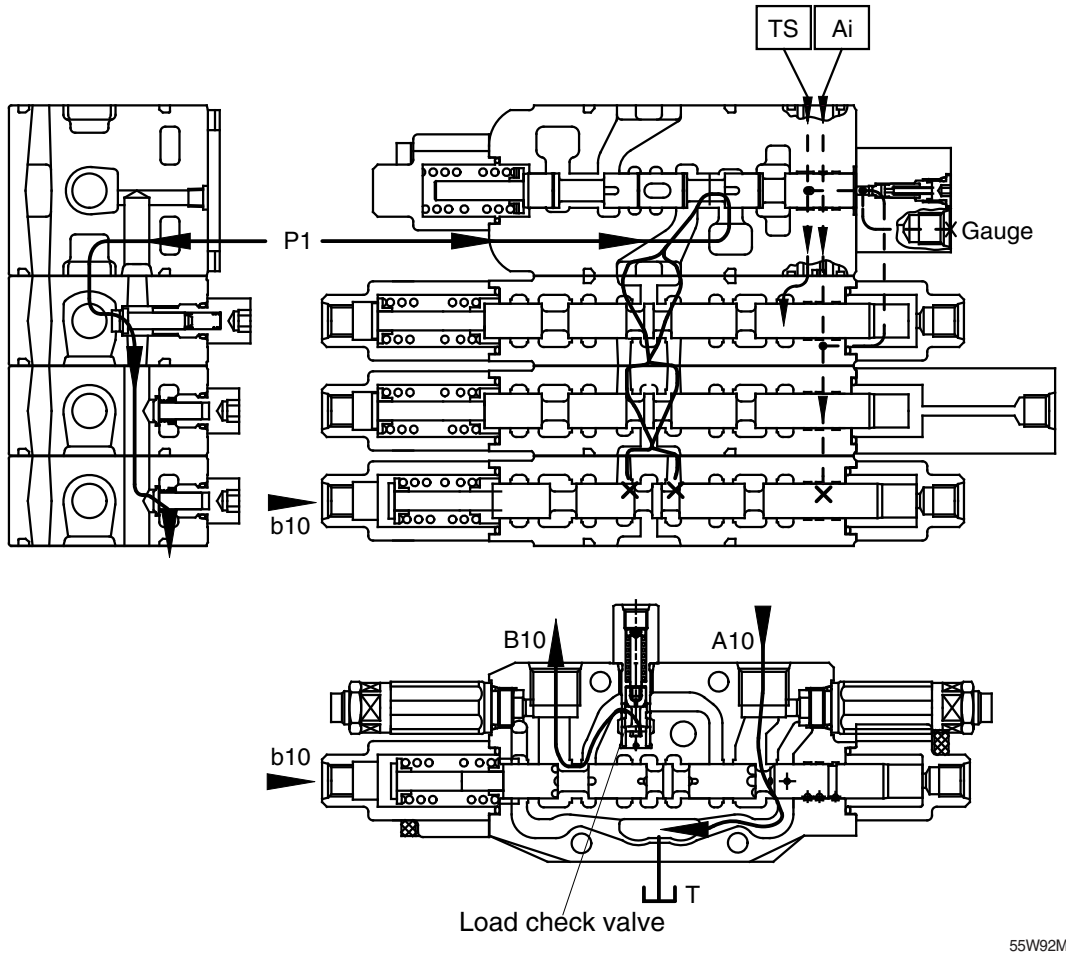
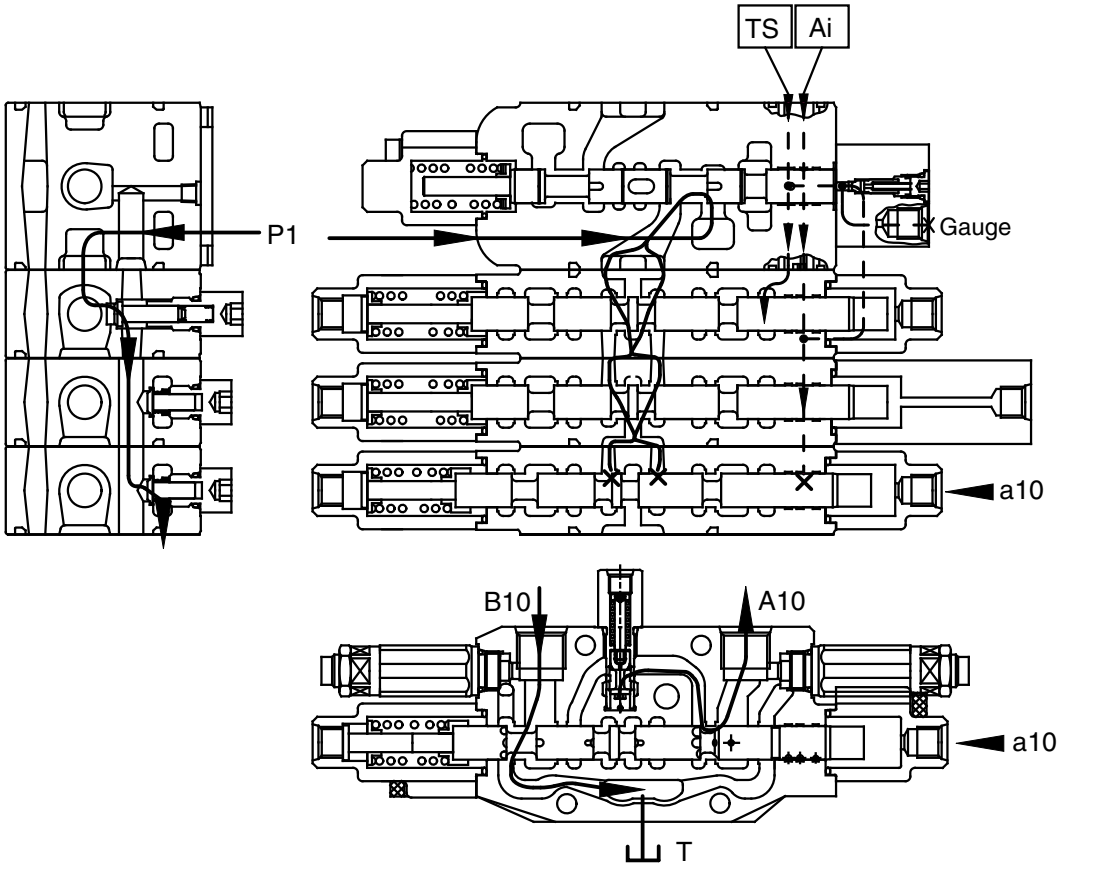


- During the bucket roll in operation, the pilot pressure from RCV is supplied to port b10 and shift the bucket spool in the right direction.
  The hydraulic fluid from pump P1 entered P1 parallel passage and is directed to the port B10 through the load check valve.
  Following this, it flows into the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

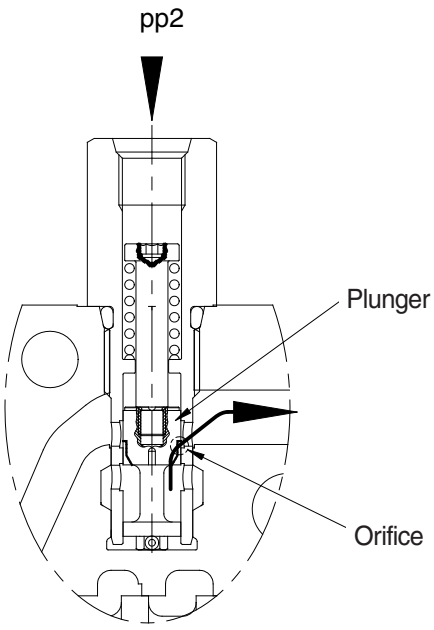
② **Bucket roll out operation**



55W92MC07

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

③ Bucket load check valve operation

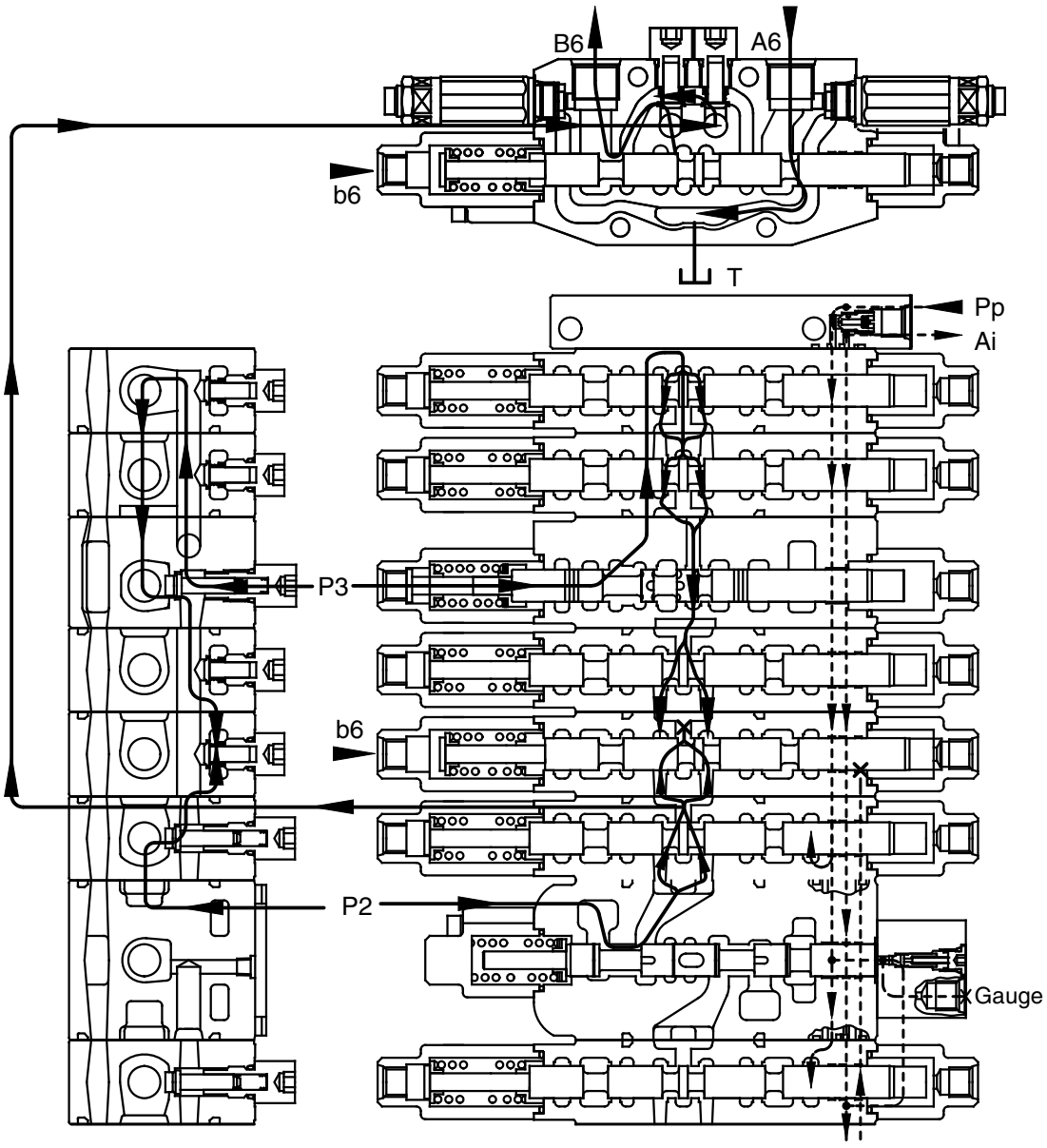


555C92MC13

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

(4) Arm operation

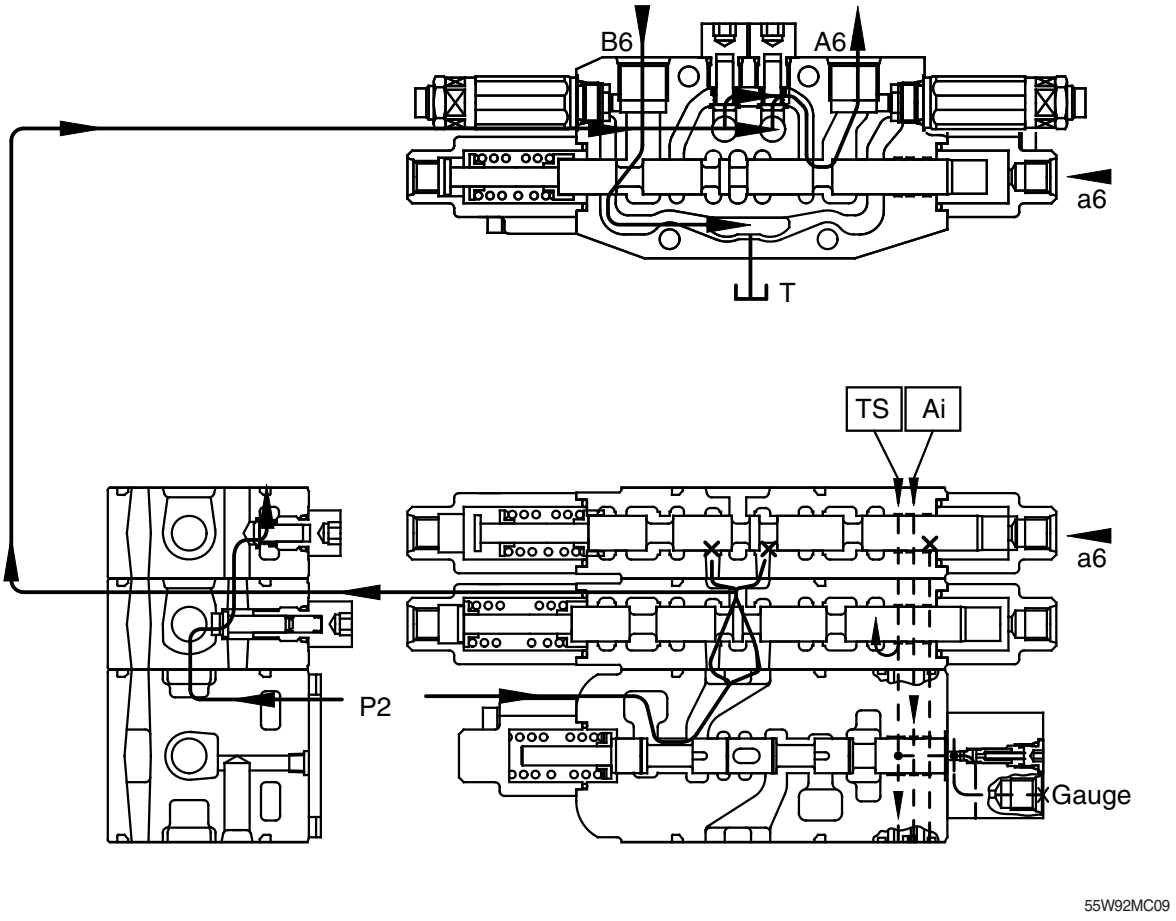
① **Arm roll in operation** (P1 and P2 summation)



55W92MC08

- During arm roll in operation the pilot pressure from the RCV is supplied to the port b6 and shifts arm 1 spool in the right direction.
- Also, the pilot pressure is supplied to the port Sa through the external piping and shift the spool of P3 inlet block.
  The hydraulic oil from the pump P2 flows into the arm cylinder head side through P2 parallel passage, the load check valve and the port B6.
  At same time, the hydraulic fluid from the pump P3 flows into the arm summation passage in arm 1 spool through the P3 inlet spool. Then it entered the arm cylinder head side with hydraulic fluid from arm 1 spool.
- The TS signal passage oil from the Pp port is drain to the hydraulic oil tank through the left/right travel valve and the signal pressure is not raised.
- The Ai signal passage oil from the Pp port is shut off by shifting of the arm spool and then signal pressure of auto idle is raised.

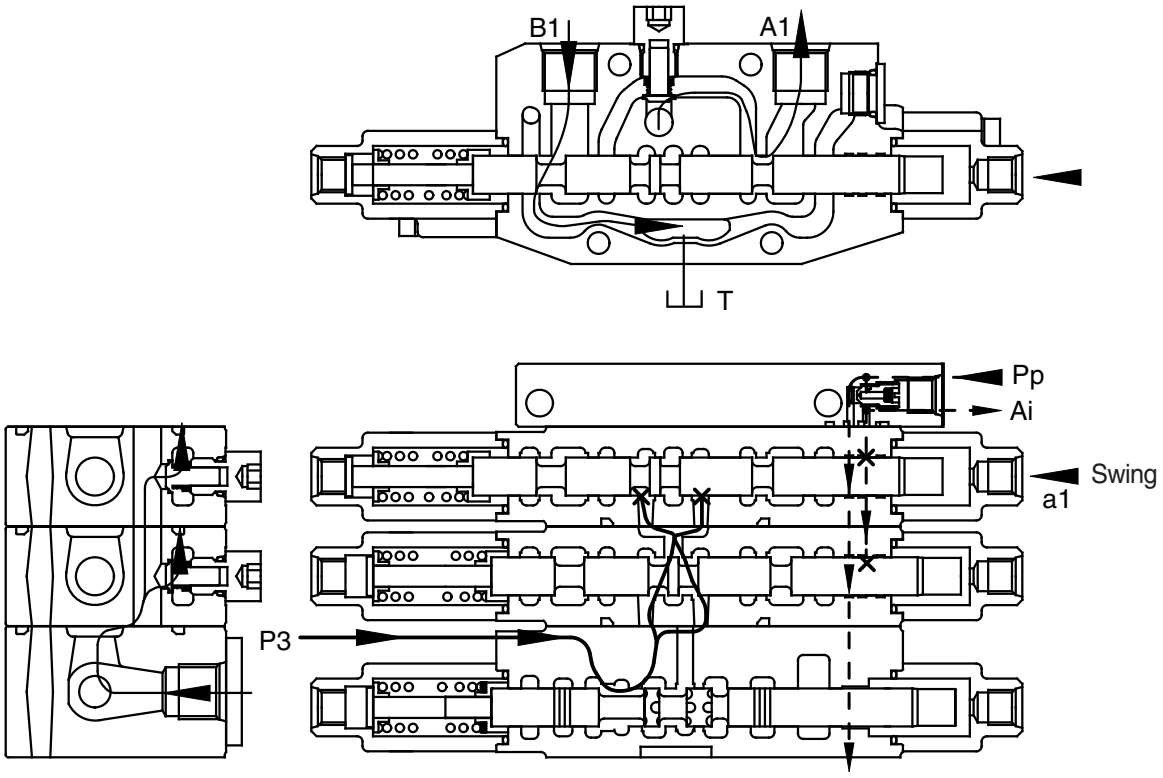
② **Arm roll out operation**



55W92MC09

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

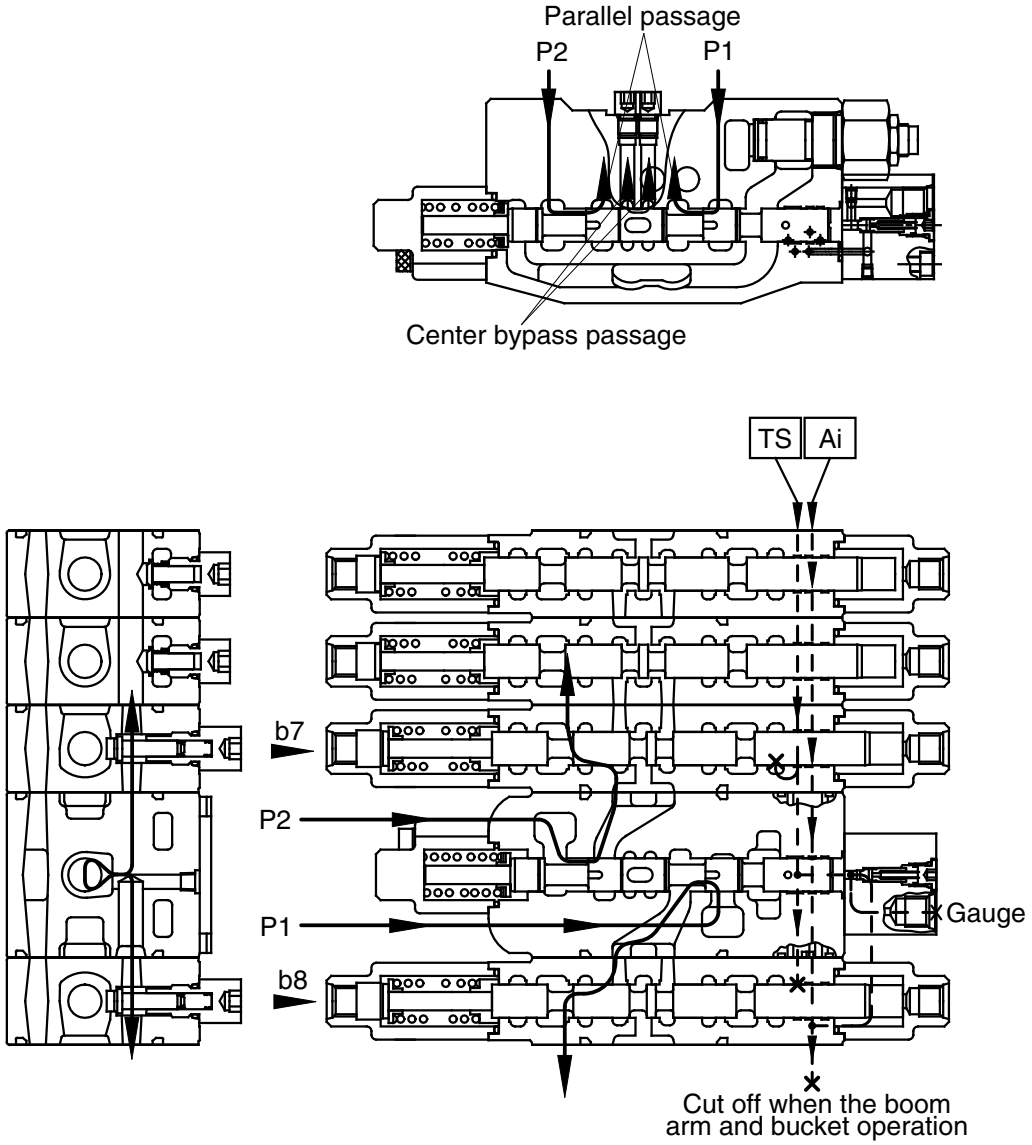
(5) Swing operation



555C92MC16

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

(6) Travel straight spool



55W92MC10

① The other actuator operation during travel operation.

When the other actuator spool(s) is selected under travel operation, the straight travel spool is moved.

Some of hydraulic fluid from pump P1 and P2 is supplied to the travel motors through parallel passage and the other hydraulic fluid is supplied to the actuator(s) through center bypass passage via orifice passage.

Thus, the machine keeps the speed and power of the actuator and travel.

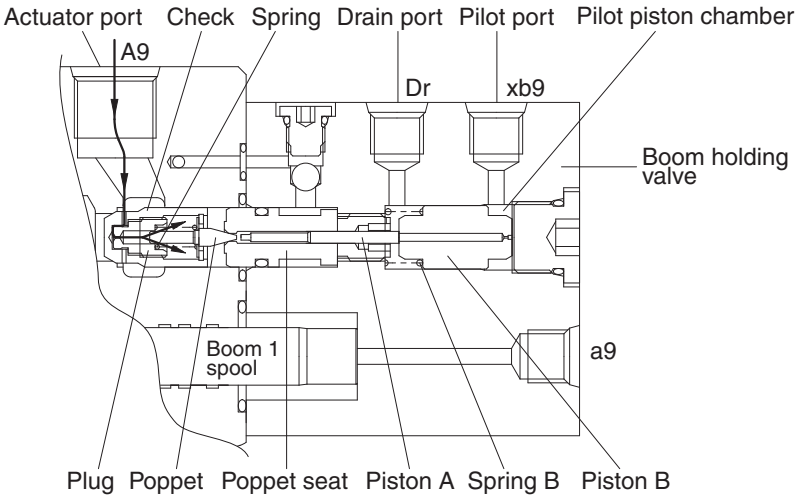
② The arm in operation during straight travel operation.

The arm in pilot pressure flows into P3 pilot port Sa through the external piping and the spool is shifted. As a result, the fluid of P3 pump is combined with the arm in operation through parallel passage and then the arm in speed up.

Refer to the arm in operation for the details.

(7) Holding valve operation

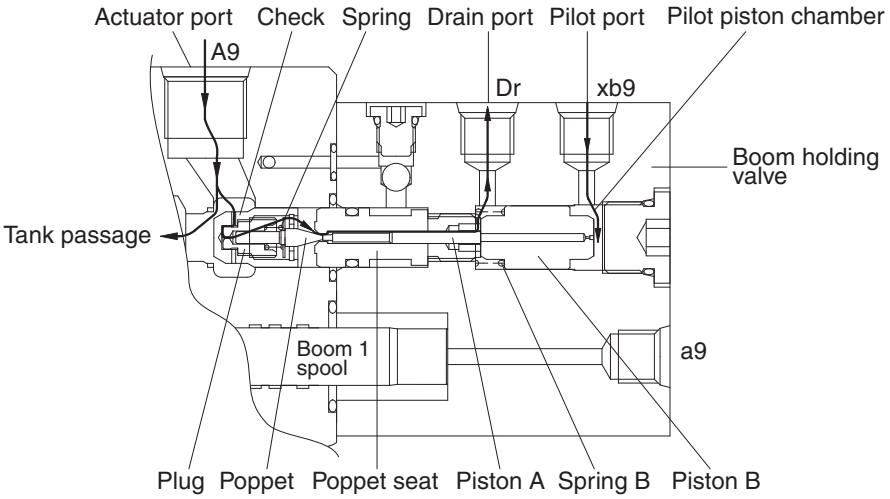
① Holding operation



55W72MC16

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

② Release holding operation



55W72MC17

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

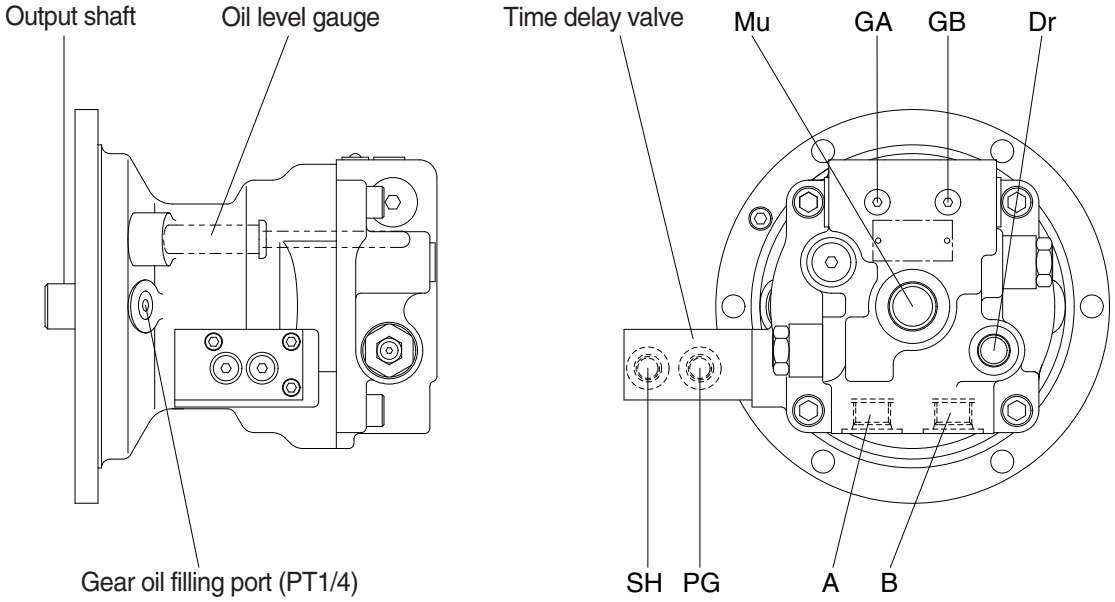
GROUP 3 SWING DEVICE

1. STRUCTURE

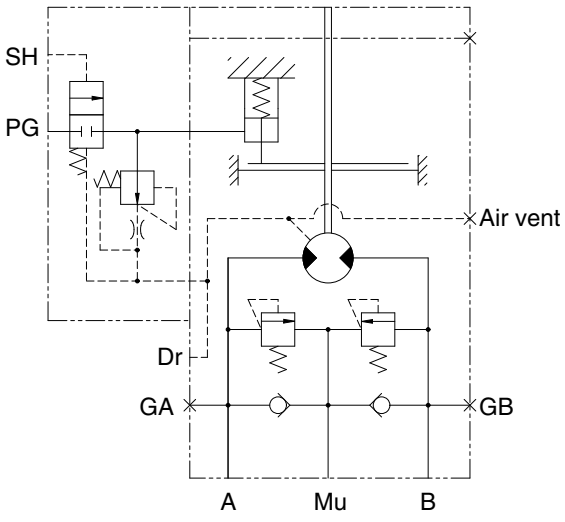
Swing device consists swing motor, swing reduction gear.

1) SWING MOTOR

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

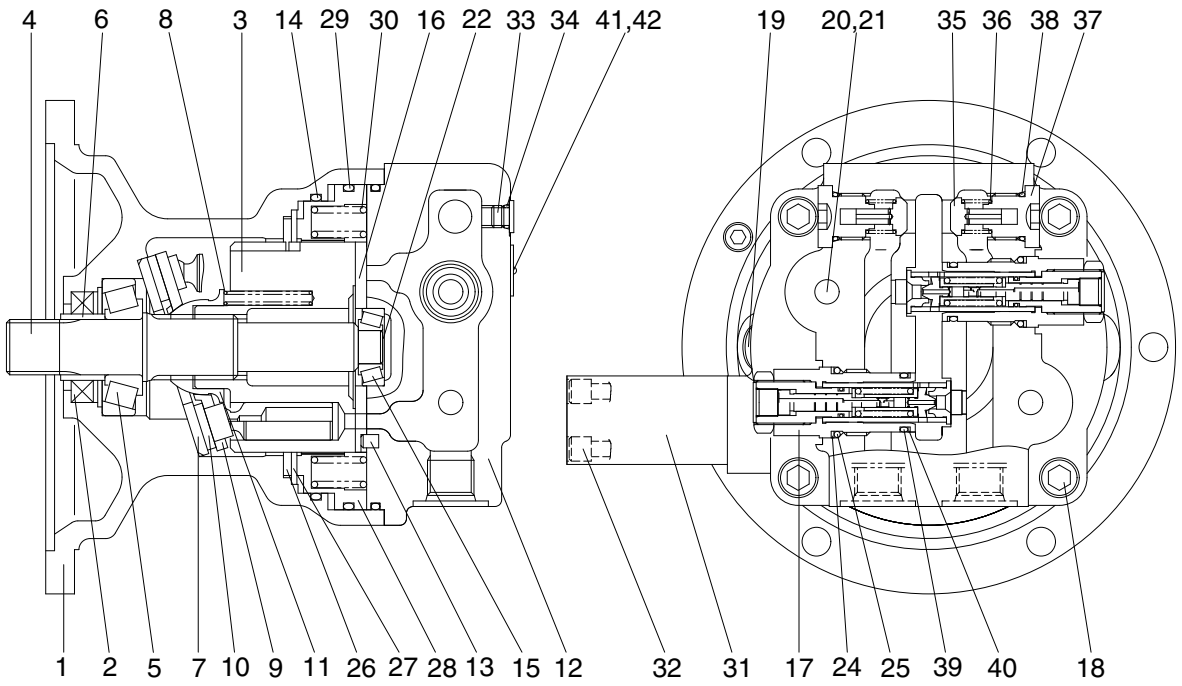


555K2SM01



Hydraulic circuit

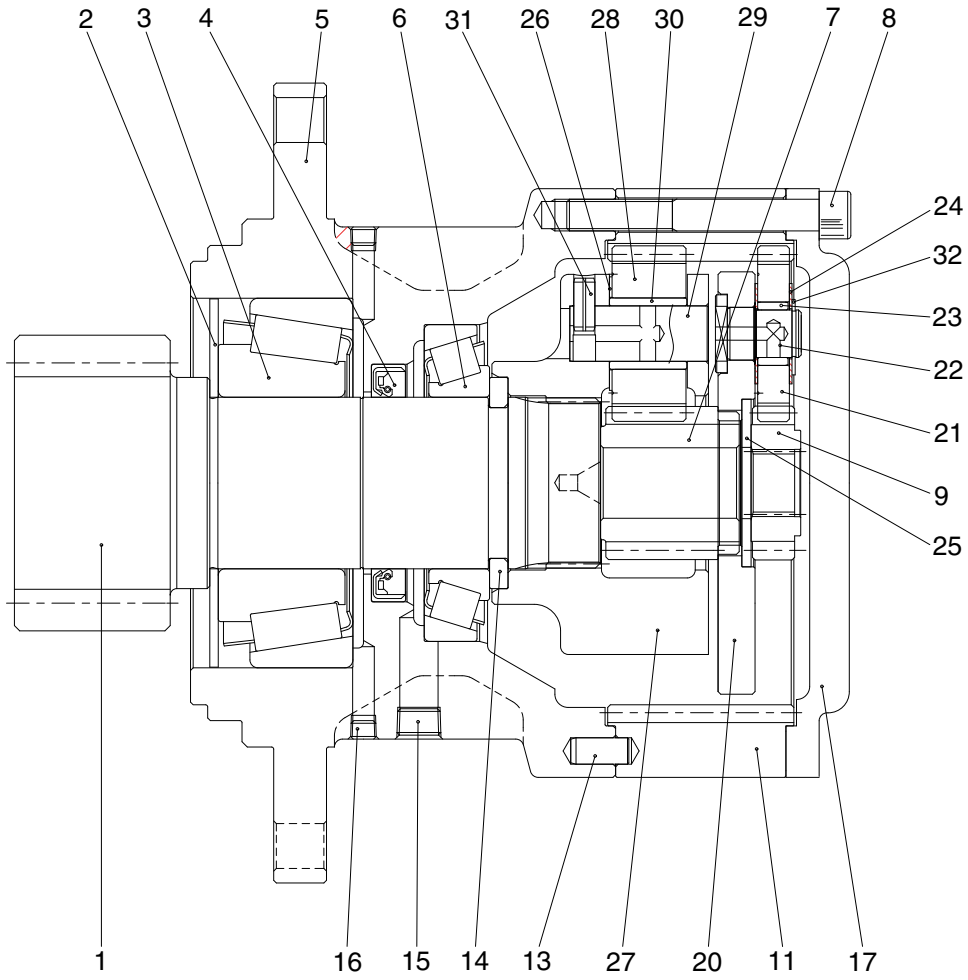
Port	Port name	Port size
A	Main port	SAE PF 1/2
B	Main port	SAE PF 1/2
Dr	Drain port	PF 3/8
Mu	Make up port	PF 3/4
PG	Brake release stand by port	PF 1/4
SH	Brake release pilot port	PF 1/4
GA,GB	Gauge port	PF 1/4



555K2SM03

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

2) REDUCTION GEAR



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

2. FUNCTION

1) ROTARY PART

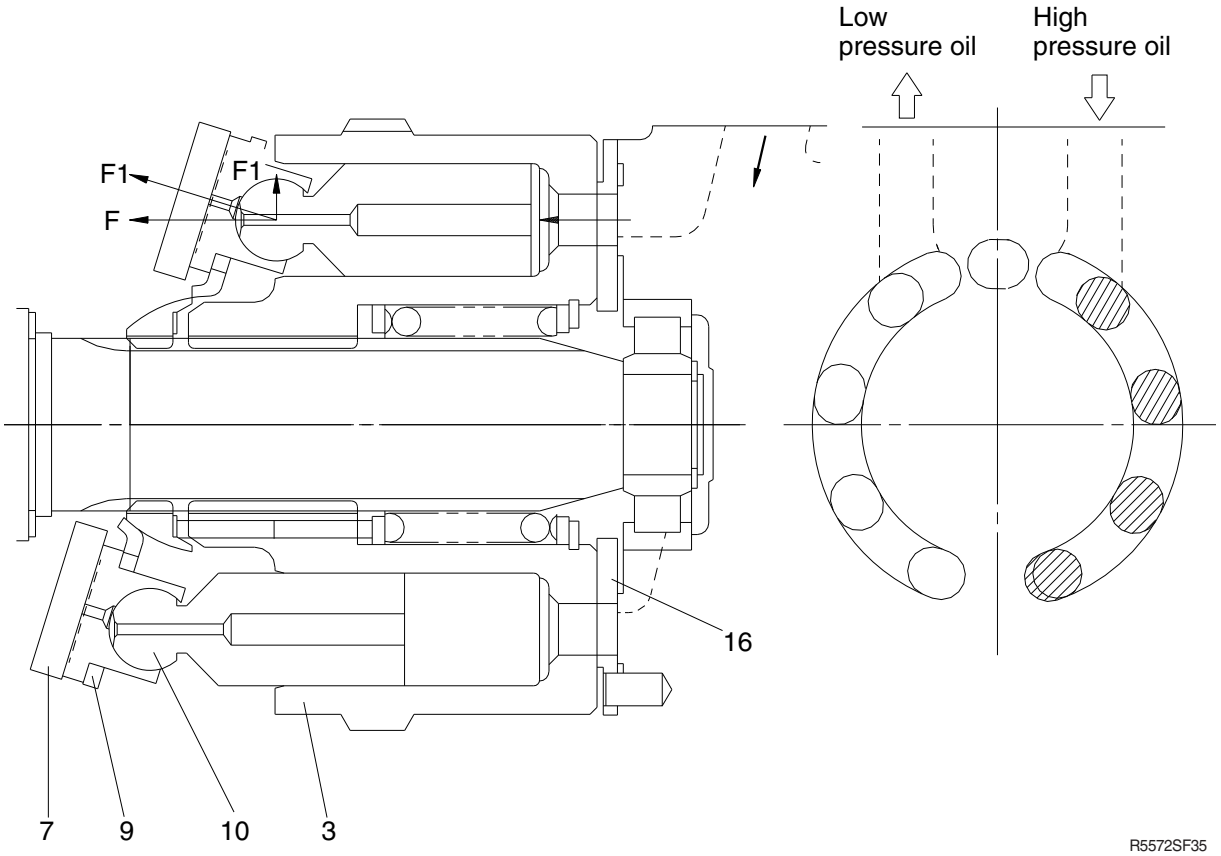
When high pressurized oil enters a cylinder through port(a), which is the inlet of balance plate(16), hydraulic pressure acting on the piston causes axial force F. The pressure force F works via the piston(10) upon the return plate(9) which acts upon the swash plate(7) via an hydrostatic bearing. Force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

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

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

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

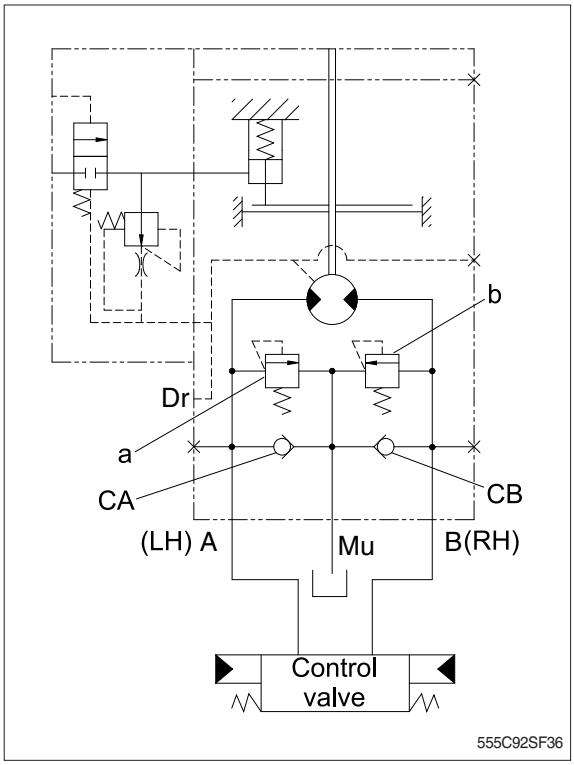
Where p : Effective difference of pressure (kgf/cm^2)
q : Displacement (cc/rev)
T : Output torque (kgf·cm)
Z : Piston number (9EA)
A : Piston area (cm^2)
θ: Tilting angle of swash plate (degree)
S : Piston stroke (cm)



2) MAKE UP VALVE

(1) Outline

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



(2) Function

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

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

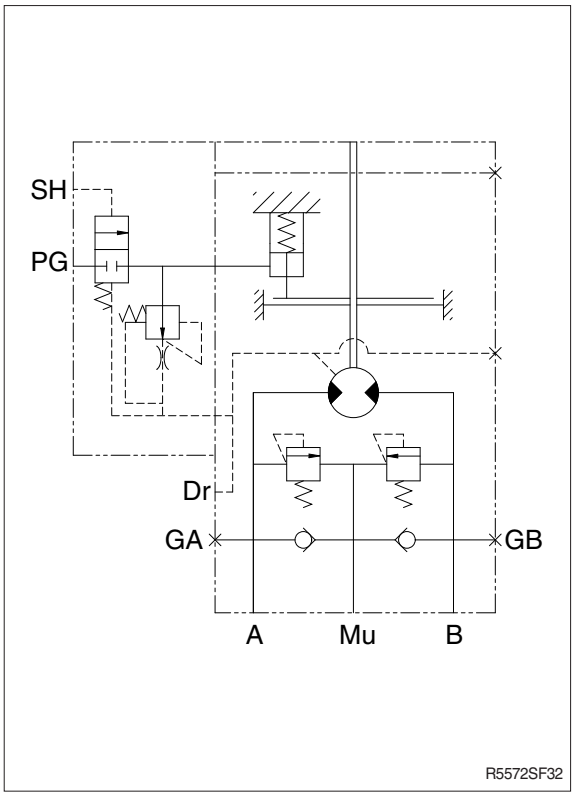
(3) Operation

① When starting swing

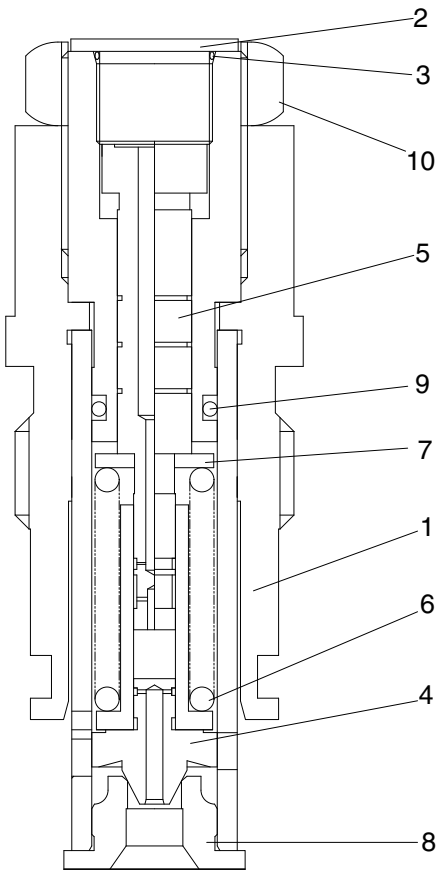
When the swing control lever is operated to left swing, the pressurized oil from the pump passes through the control valves and is supplied to port B. Because of this, the pressure at port B rises, staring torque is generated in the motor, and the motor starts to rotate. The oil from the outlet port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

② When stopping swing

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



3) RELIEF VALVE



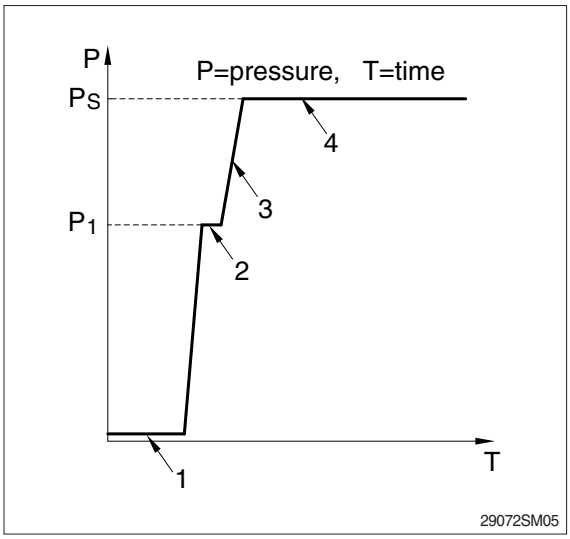
1 Body
2 Plug
3 O-ring
4 Plunger
5 Piston
6 Spring
7 Spring seat
8 Seat
9 O-ring
10 Nut

(1) Construction of relief valve

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

(2) Function of relief valve

Figure illustrates how the pressure acting on the relief valve is related to its rising process. Here is given the function, referring to the figure following page.

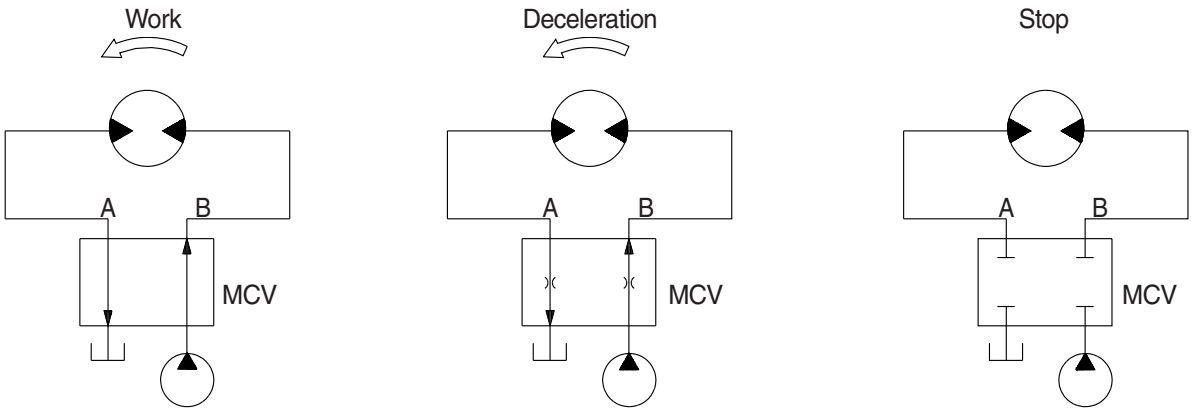


4) BRAKE SYSTEM

(1) Control valve swing brake system

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

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



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

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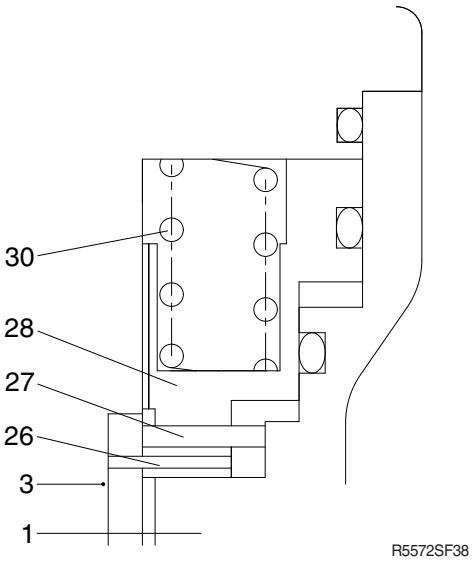
(2) Mechanical swing parking brake system

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

① Brake assembly

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

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



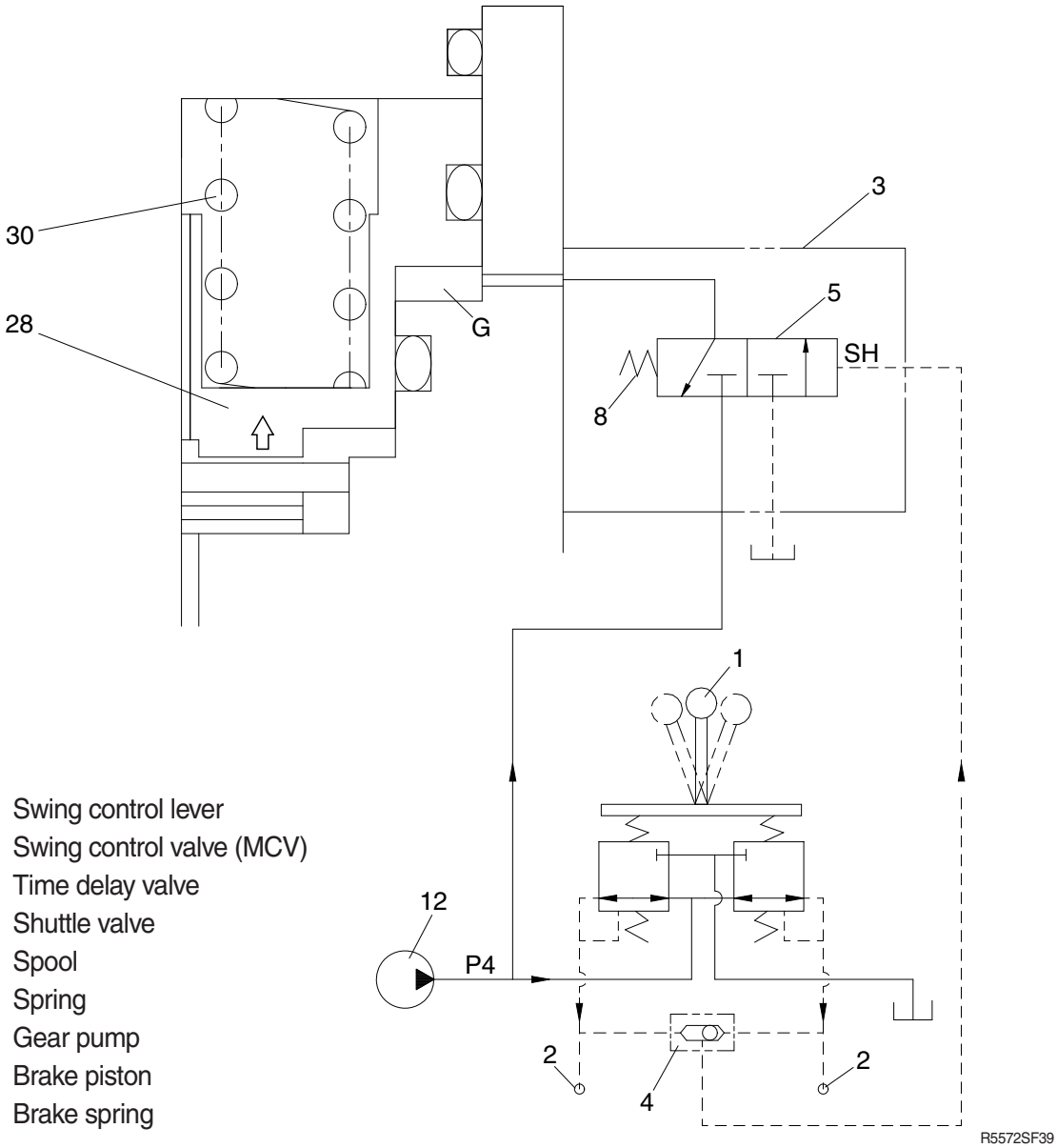
R5572SF38

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

② Operating principle

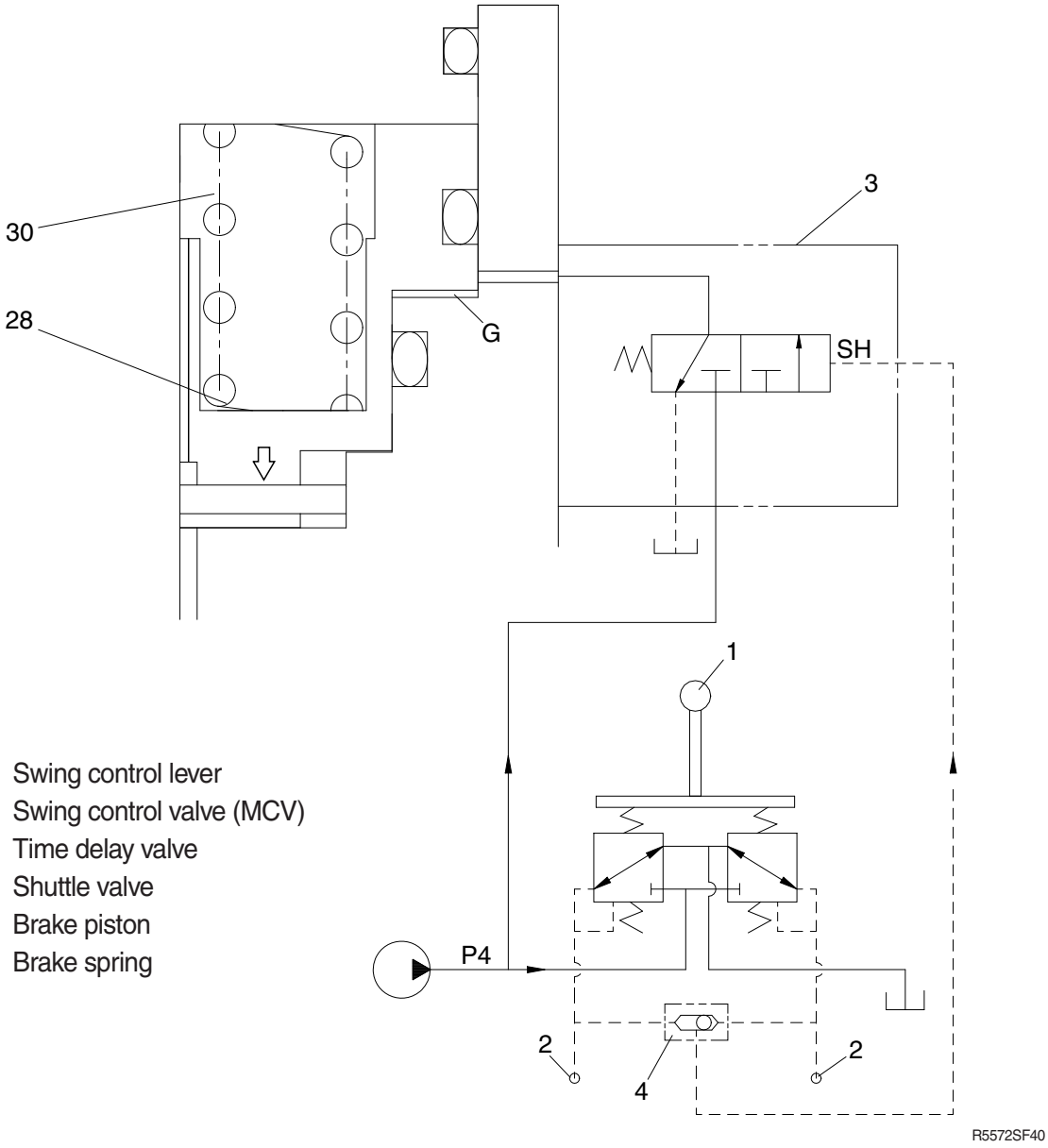
a. When the swing control lever (1) is set to the swing position, the pilot oil go to the swing control valve (2) and to SH of the time delay valve (3) via the shuttle valve (4), this pressure move spool (5) to the leftward against the force of the spring (8), so pilot pump charged oil (P4) goes to the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

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



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

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

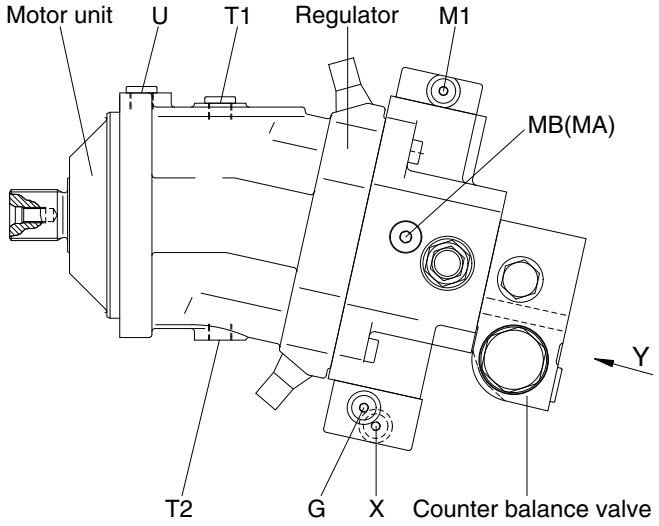


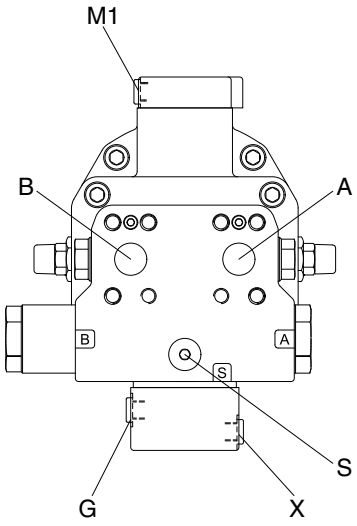
1 Swing control lever
2 Swing control valve (MCV)
3 Time delay valve
4 Shuttle valve
28 Brake piston
30 Brake spring

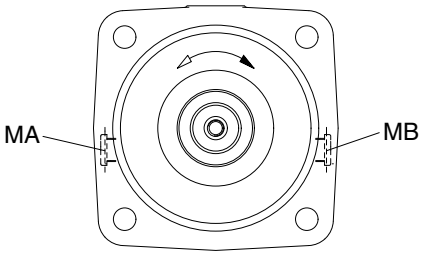
GROUP 4 TRAVEL DEVICE

1. CONSTRUCTION

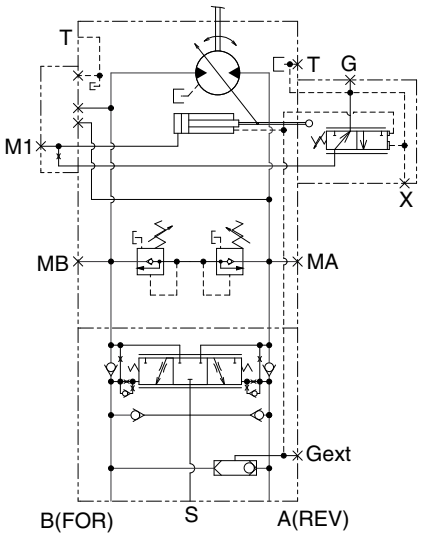
Travel motor consists motor unit, regulator and counter balance valve.







VIEW Y

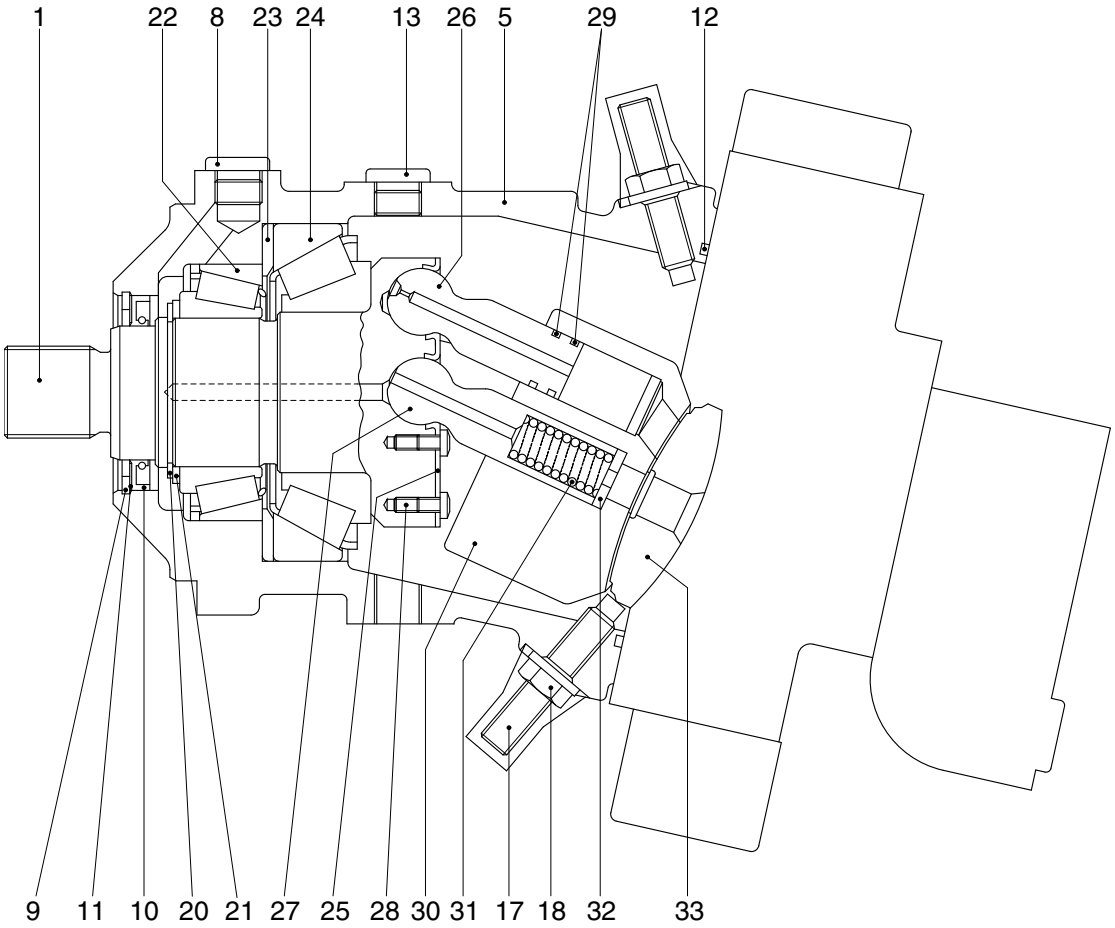


Hydraulic circuit

Port	Port name	Port size
A, B	Main port	SAE 6000psi 1
G	Gauge port	M14×1.5
M1	Gauge port	M14×1.5
X	Pilot pressure port	M14×1.5
T2	Drain port	M18×1.5
U	Flushing port	M18×1.5
S	Make up port	M22×1.5
MA,MB	Gauge port	M18×1.5

55W9A2TM01

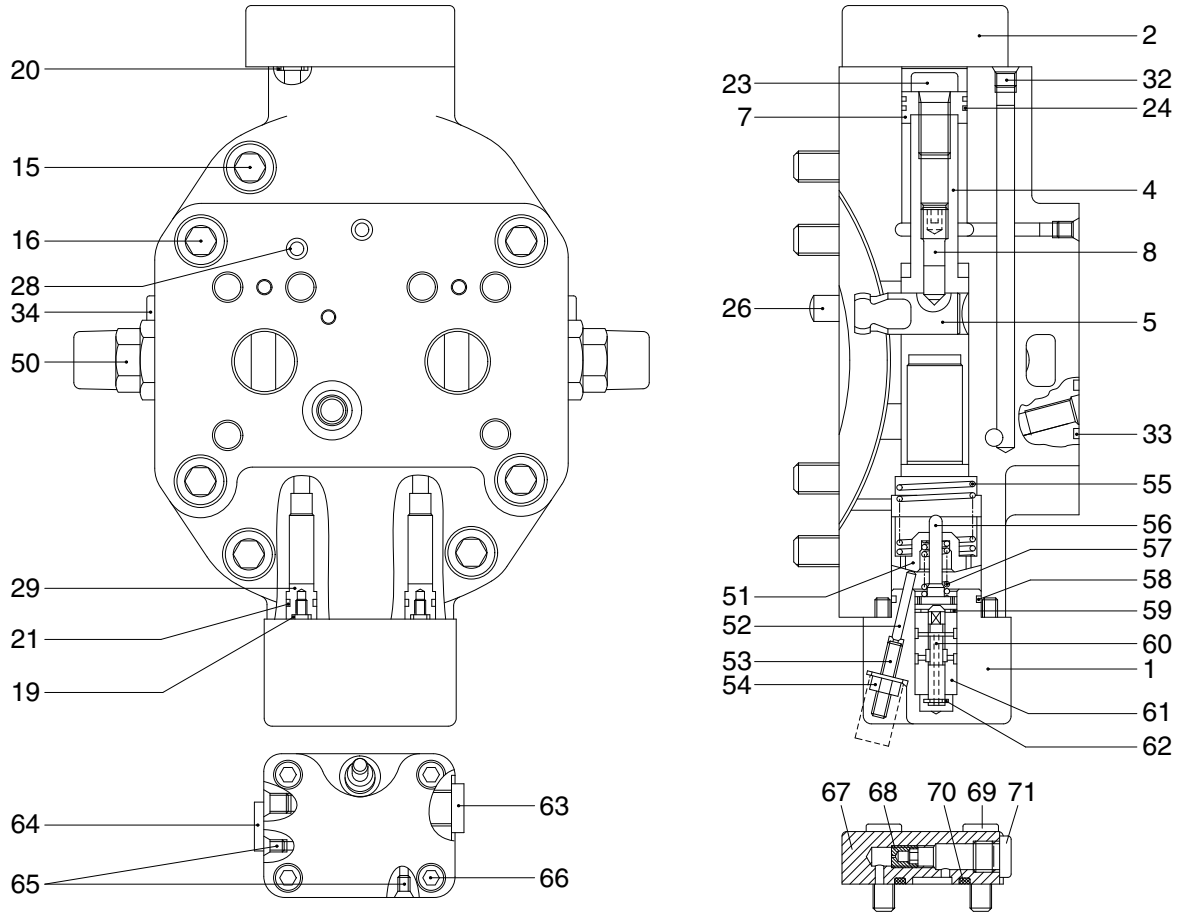
1) MOTOR UNIT



200W34TM02

1	Drive shaft	17	Threaded pin	26	Piston
5	Housing	18	Seal lock nut	27	Center pin
8	Locking screw	20	Retaining ring	28	Pan head screw
9	Retaining ring	21	Back up plate	29	Steel sealing ring
10	Shaft seal ring	22	Taper roller bearing	30	Cylinder block
11	Back up plate	23	Shim	31	Pressure spring
12	O-ring	24	Taper roller bearing	32	Adjustment shim
13	Locking screw	25	Retaining plate	33	Control lens

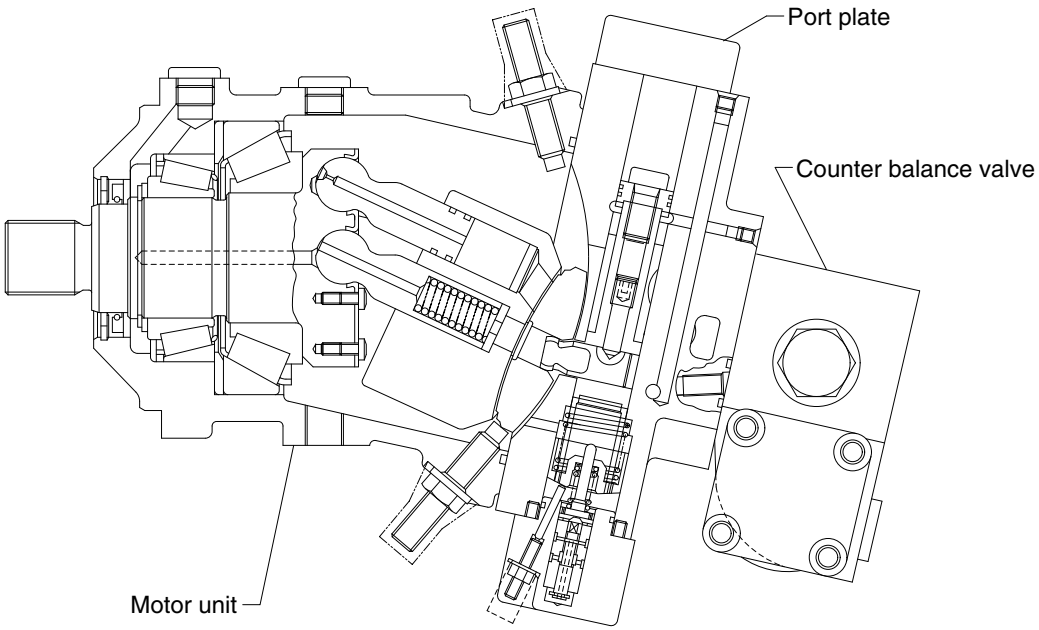
2) REGULATOR



55W72TM03

1	Control housing	28	Double break off pin	59	Retaining ring
2	Cover	29	Plug	60	Control piston
4	Positioning piston	32	Double break off pin	61	Control bushing
5	Positioning trunnion	33	O-ring	62	Retaining disc
7	Piston	34	Locking screw	63	Locking screw
8	Threaded pin	50	Relief valve	64	Locking screw
15	Socket head screw	51	Adjusting bushing	65	Double break off pin
16	Socket head screw	52	Cylinder pin	66	Socket head screw
19	O-ring	53	Threaded pin	67	Cover
20	O-ring	54	Seal lock nut	68	Throttle screw
21	O-ring	55	Pressure spring	69	Socket head screw
23	Socket head screw	56	Spring collar	70	O-ring
24	Square ring	57	Pressure spring	71	Locking screw
26	Cylinder pin	58	O-ring		

2. FUNCTION



14W72TM05

1) **VARIABLE DISPLACEMENT MOTOR** (with integrated counterbalance valve)

The variable displacement motor has a rotary group in bent axis design.
The torque is generated directly at the drive shaft.
The cylinder barrel is driven by a tapered piston arrangement.
The change of displacement is generated by the control lens via positioning piston. The control lens slides on a circular shaped surface.

In case of constant pump flow volume and high pressure
- The output speed is increased at smaller swivel angle, the torque is reduced
- The torque rises at swivel angle increase, the output speed is decreased

The max swivel angle is 25˚, the min swivel angle is 0˚.

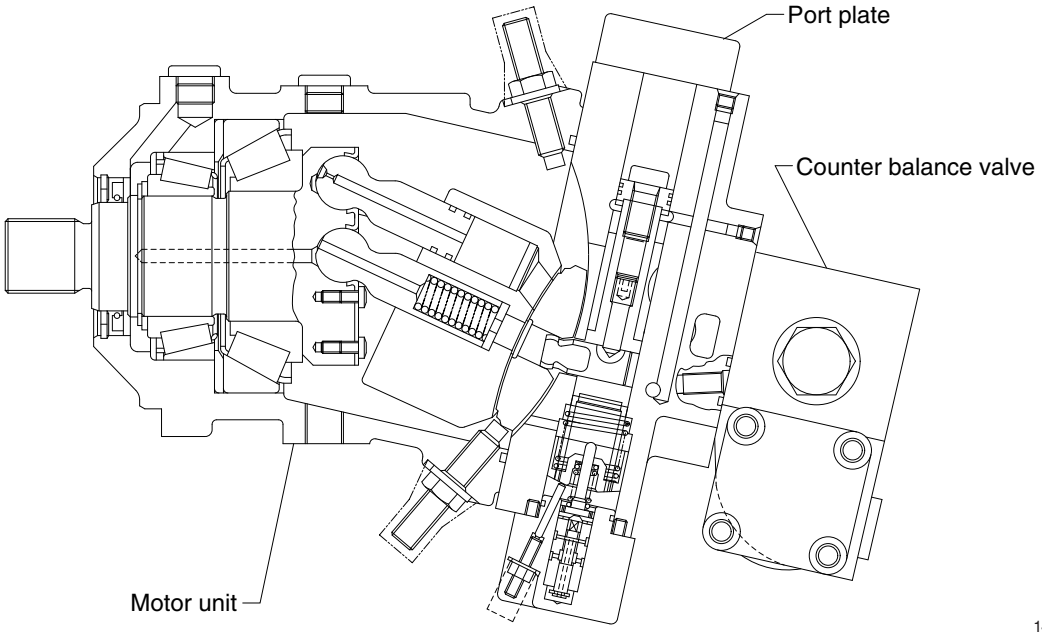
The variable displacement motor with integrated counterbalance valve is designed to be operated in open loop.

Min and max displacement are limited by a stop screw. Stepless adjustment to various higher values is possible.

※ Reduction to smaller displacement may result in overspeeding the motor.

2) **PORT PLATE**

With high pressure dependent control HA1, mounted counterbalance valve, integrated secondary pressure relief valves, plugged gauge and boosting ports, service ports to the rear.



3) HIGH PRESSURE DEPENDENT CONTROL

The displacement is-dependent on operating pressure - automatically adjusted. Upon reaching the operating pressure set at the control valve - internally measured at A or B - the motor swivels from V_{gmin} to V_{gmax} until output torque = load torque. For values lower than the adjusted one the motor keeps min swivel angle. The necessary positioning energy is taken from the respective high pressure side via shuttle valve.

Swivelling results in a change of the displacement.
Swivel time is controlled by an orifice installed in the cover of the large positioning piston side.

4) COUNTERBALANCE VALVE

Mounted at the rear of the port plate.
Incase of downhill traveling or deceleration of the machine a counterbalance valve avoids overspeeding and cavitation of hydraulic motor.

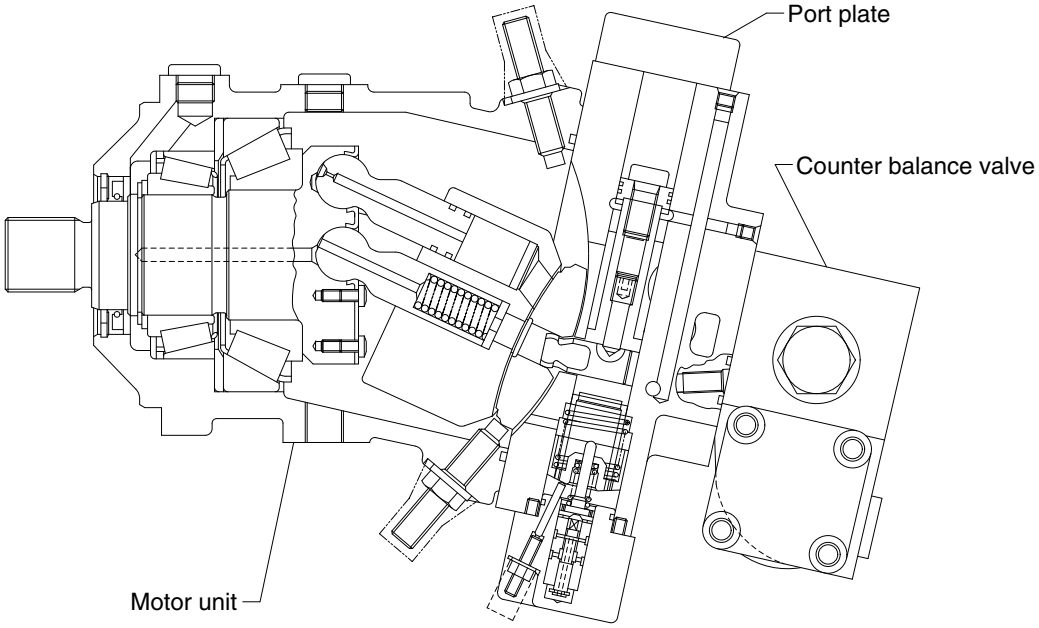
5) FUNCTION AS TO CIRCUIT DIAGRAM

Check valves in the inlet line A and B for by passing of the counterbalance valve.
At traveling forward the return oil flow is controlled by a counterbalance spool. At drop in inlet pressure the counterbalance spool throttles the return oil flow. The motor is locked. The oil behind the spool is led to the low pressure side via an additional check valve. Same function for traveling forward and backward.

Braking means for the motor that
- At reduced or zero inlet flow the counterbalance spool reaches a modulating position or a neutral position caused by spring force
- The high pressure oil (at outlet side of the motor) is returned to the low pressure side(At inlet side) of the motor via crossover relief valves.

As the control pressure for regulation of the HA control via the integrated shuttle valve is no longer available, the motor with HA control and counterbalance valve will swivel to its minimum displacement during deceleration.
In addition, an external boost flow/pressure can be applied at port S for preventing cavitation.

※ Counterbalance valves do not replace the service and parking brake.



14W72TM05

6) INSTALLATION

The housing must be filled entirely with oil and shall also not run empty at rotary group standstill.

7) FILTRATION

According to purity class 9 as to NAS 1638, 6 as to SAE, ASTM, AIA and 18/15 as to ISO/DIS 4406.

8) PRESSURE

Ports A or B : Normal 400bar, peak pressure 450 bar
Port A + B : Pressure summation below 700 bar
Max permissible intermittent case pressure : 6 bar

9) DIRECTION OF ROTATION/ DIRECTION OF FLOW

With view on the drive shaft - clockwise/ A to B; Counter-clockwise/ B to A

10) LEAKAGE OIL TEMPERATURE

In the bearing area max permitted -25˚C to +80˚C; Short time operation -40˚C to +115˚C

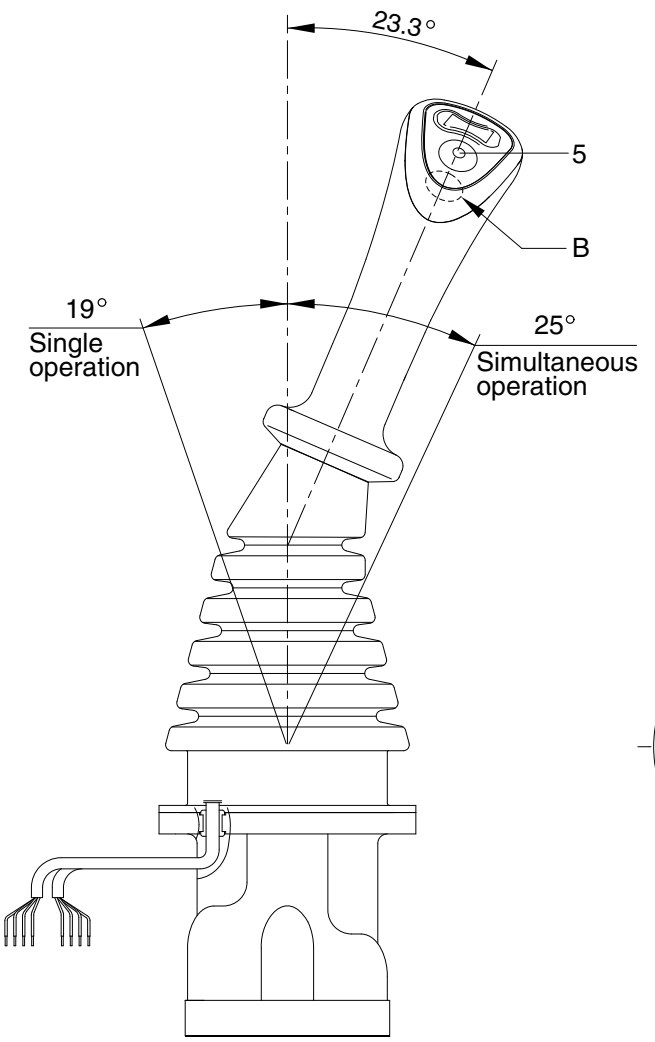
11) COMMISSIONING

Fill the housing entirely with oil through highest located T port. Also connect the leakage oil pipe at this port. After commissioning check sealing and make visual control of the complete installation.

GROUP 5 RCV LEVER

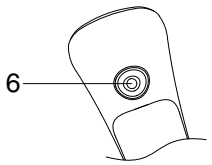
1. STRUCTURE

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

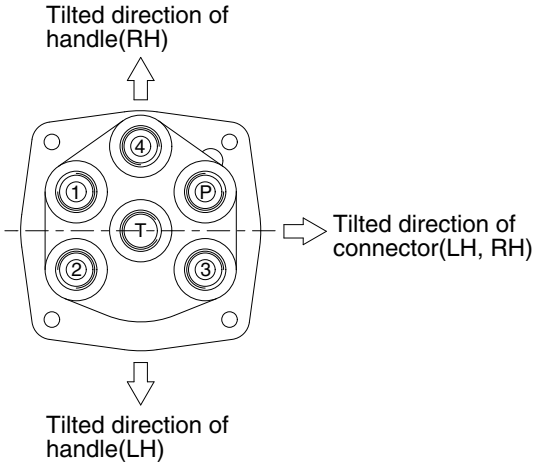


Switches

No.	LH	RH
5	One touch decel	Horn
6	-	Breaker

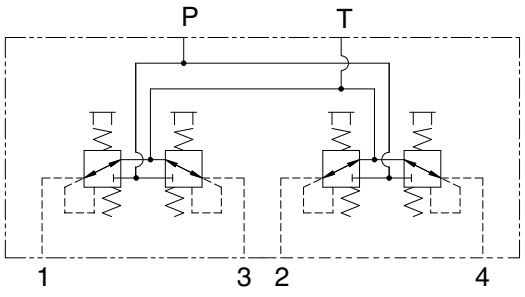


DETAIL B



VIEW A

21092RL01



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

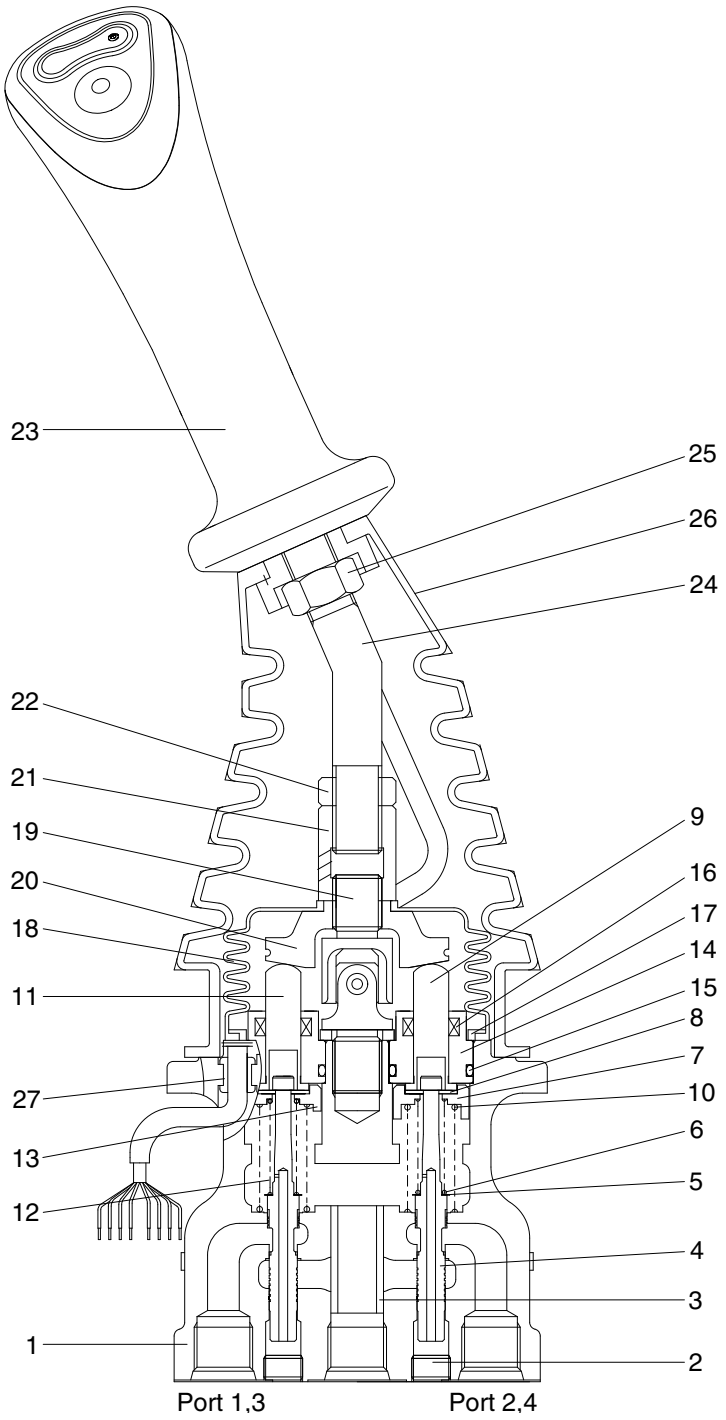
CROSS SECTION

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

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

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

CROSS SECTION



21092RL02

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

2. FUNCTIONS

1) FUNDAMENTAL FUNCTIONS

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

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

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

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

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

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

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

2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool (4) 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 (6) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (9,11) is inserted and can slide in the plug (14).

For the purpose of changing the displacement of the push rod through the swash plate (20) and adjusting nut (21) are provided the handle (23) that can be tilted in any direction around the fulcrum of the universal joint (19) center.

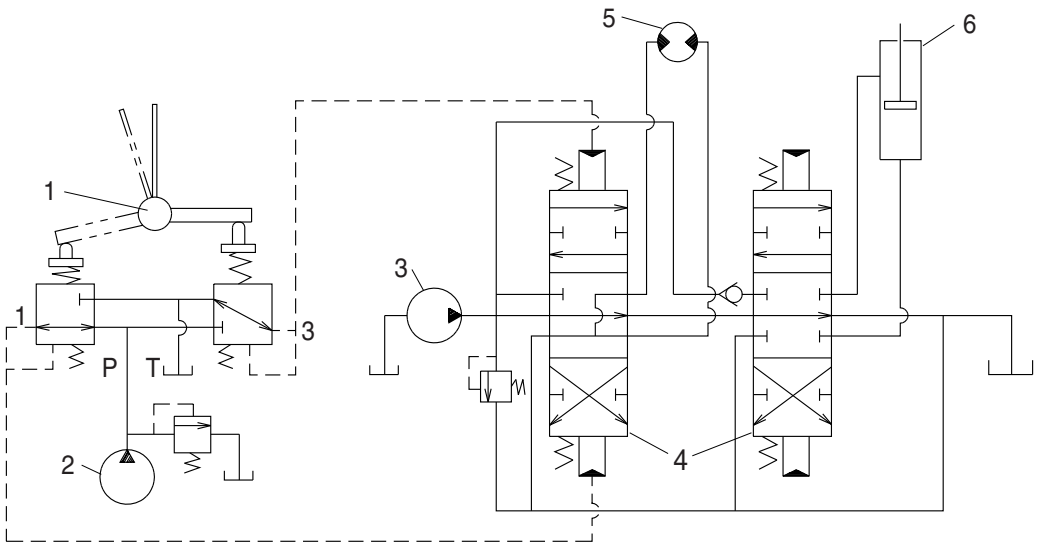
The spring (10) works on the case (1) and spring seat (7, 13) and tries to return the push rod (9,11) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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

3) OPERATION

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

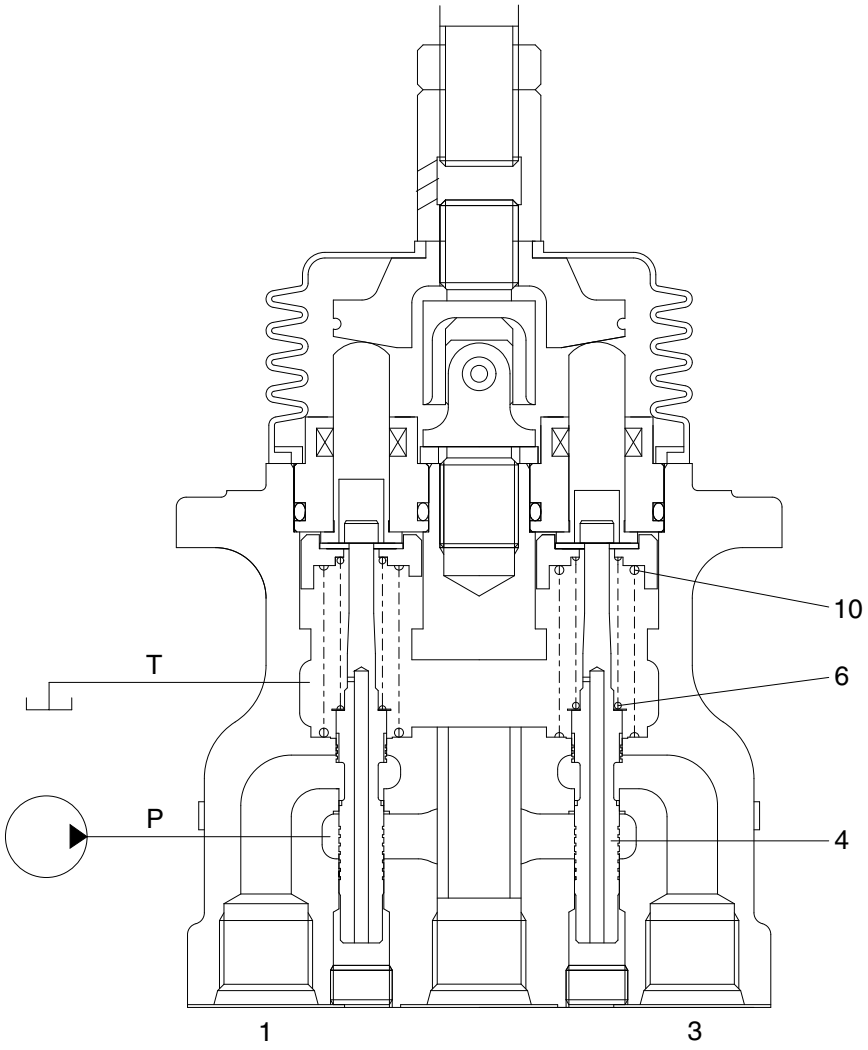
The diagram shown below is the typical application example of the pilot valve.



2-70

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

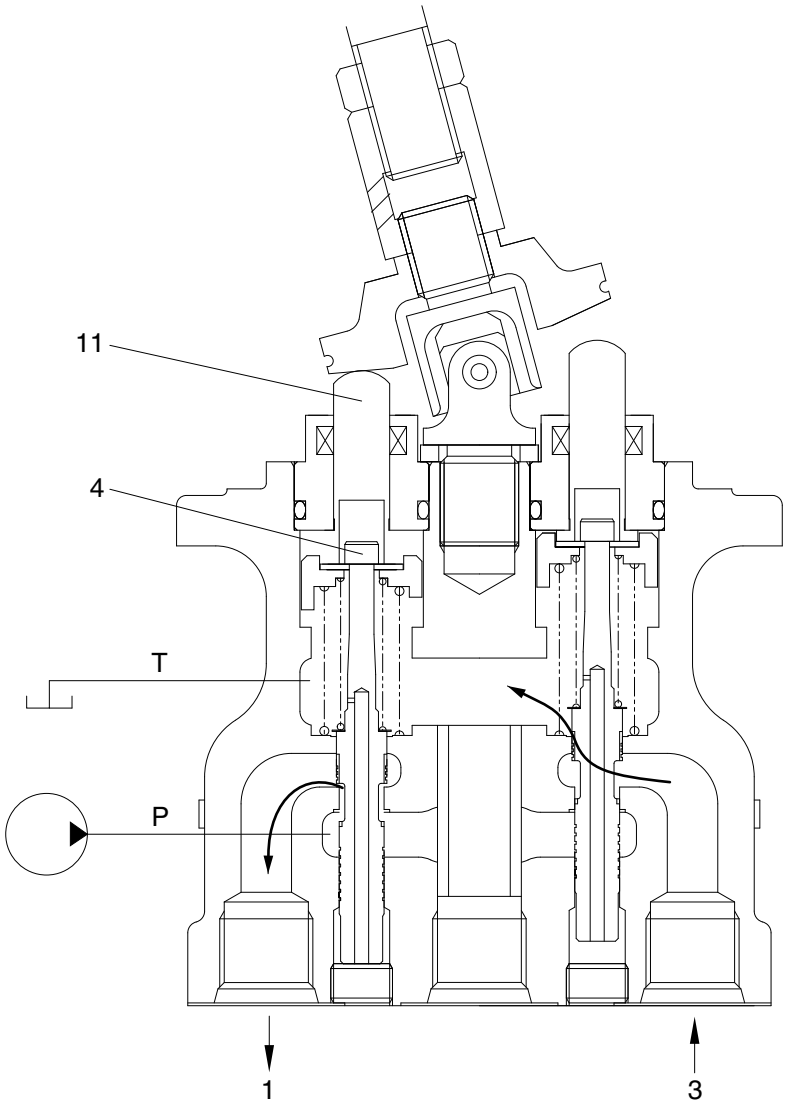
(1) Case where handle is in neutral position



21092RL03

The force of the spring (6) that determines the output pressure of the pilot valve is not applied to the spool (4). Therefore, the spool is pushed up by the spring (10) 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



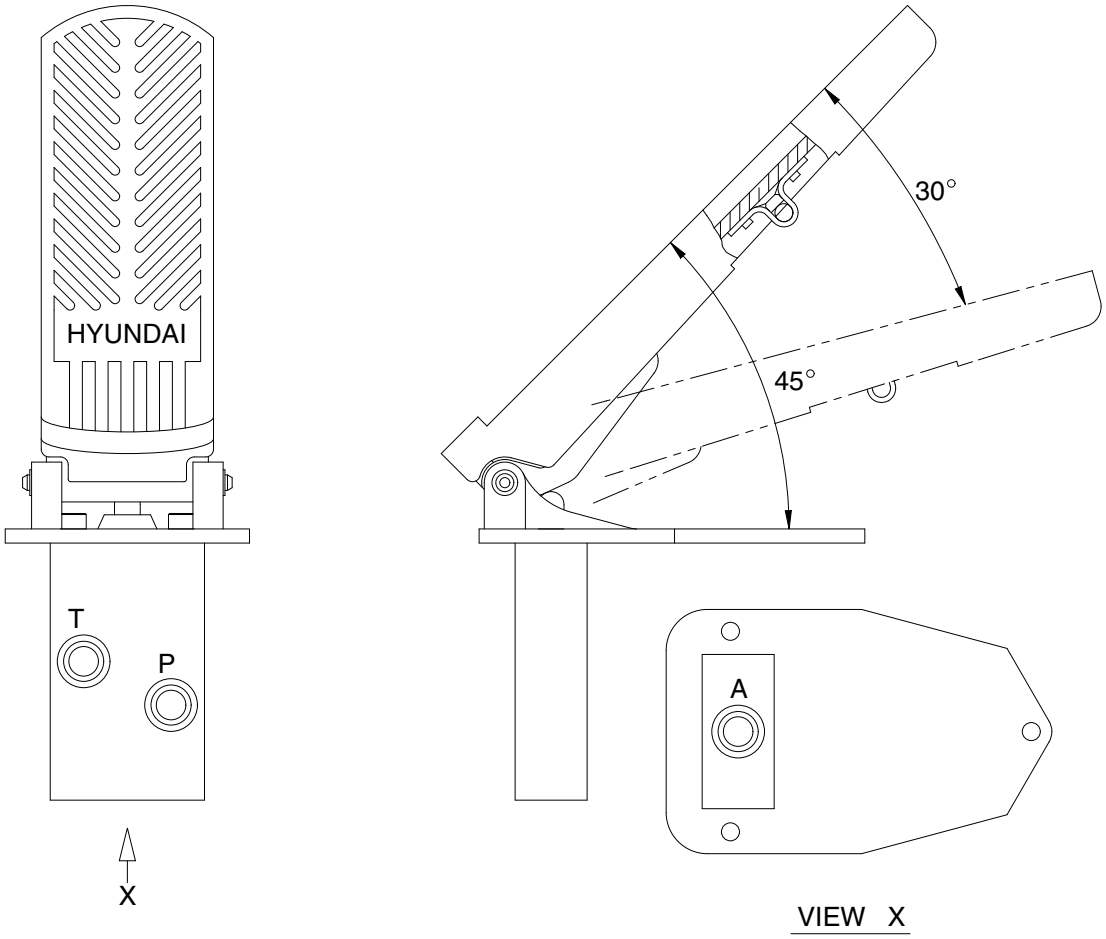
21092RL04

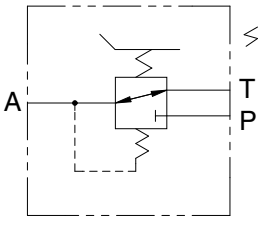
When the push rod (11) is stroked, the spool (4) moves downwards.
Then port P is connected with port (1) and the oil supplied from the pilot pump flows through port (1) to generate the pressure.
When the pressure at port (1) increases to the value corresponding to the spring force set by tilting the handle, the hydraulic pressure force balances with the spring force. If the pressure at port (1) increases higher than the set pressure, port P is disconnected from port (1) and port T is connected with port (1). If it decreases lower than the set pressure, port P is connected with port (1) and port T is disconnected from port 1.
In this manner the secondary pressure is kept at the constant value.
Besides, in some type, when the handle is tilted more than a certain angle, the upper end of the spool contacts with the inside bottom of the push rod and the output pressure is left to be connected with port P.

GROUP 6 ACCELERATOR PEDAL

1. STRUCTURE

The casing has the oil inlet port P (primary pressure), and the oil return port T (tank). In addition the secondary pressure is taken out through port A.





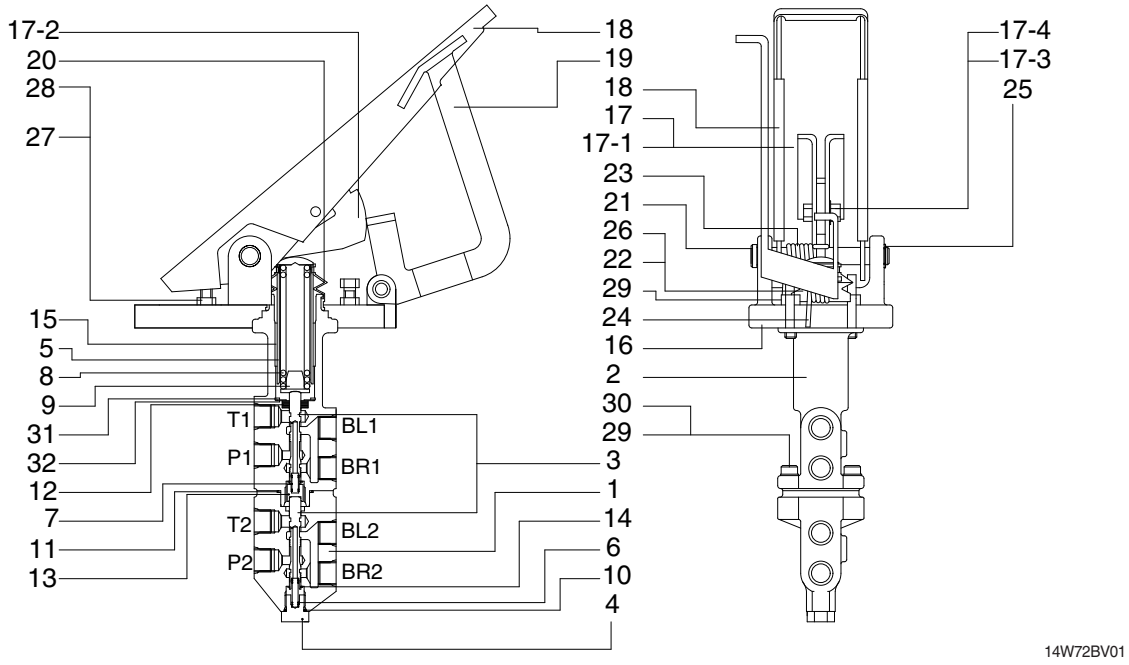
Port	Port name	Port size
P	Pilot oil inlet port	PF 1/4
T	Pilot oil return port	
A	Pilot oil output port	

55W72AP01

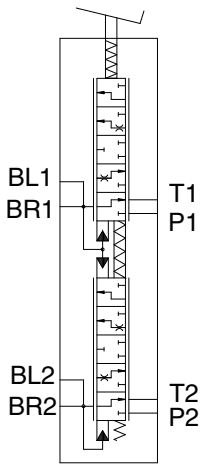
GROUP 7 BRAKE PEDAL (VALVE)

1. STRUCTURE

The casing (spacer) has the oil inlet port A(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.



1	Lower body	13	Spring guide	21	Lock pin 1
2	Upper body	14	Stop ring-C	22	Lock pin 2
3	Spool	15	DU bushing	23	Torsion spring 1
4	Plug	16	Pedal plate	24	Torsion spring 2
5	Holder	17	Pedal assy	25	Stop ring-C
6	Lower spring	17-1	Pedal	26	E-ring
7	Upper spring	17-2	Lock plate	27	Hex bolt
8	Main spring	17-3	Hex bolt	28	Hex nut
9	Spring retainer	17-4	Plat washer	29	Socket head bolt
10	O-ring	18	Pedal rubber	30	Spring washer
11	O-ring	19	Latch	31	Plat washer
12	Oil seal	20	Rubber cover	32	Stop ring-C



14W72BV02

Port	Port name	Port size
P1	Port	PF 3/8
P2	Port	PF 3/8
BR1	Brake cylinder port	PF 3/8
BR2	Brake cylinder port	PF 3/8
BL1	Pluging	PF 3/8
BL2	Pluging	PF 3/8
T1	Drain port	PF 3/8
T2	Drain port	PF 3/8

2. FUNCTION

1) PURPOSE

The purpose of the brake valve is to sensitively increase and decrease the braking pressure when the brake pedal is actuated.

2) READY POSITION

When the braking system is ready for operation, its accumulator pressure acts directly on port P1/P2 of the brake valve. A connection is established between ports BR1/BR2 and port T1/T2 so that the wheel brakes ports BR1/BR2 are pressureless via the returns ports T1/T2.

3) PARTIAL BRAKING

When the brake valve is actuated, an amount of hydraulic pressure is output as a ratio of the foot force applied.

The spring assembly (8) beneath pedal plate (16) is designed in such a way that the braking pressure changes depending on the angle. In the lower braking pressure range, the machine can be slowed sensitively.

When the braking process is commenced, the upper spool (3) is mechanically actuated via spring assembly (8), and the lower spool (3) is actuated hydraulically by spool (3). As spools (3) move downward, they will first close returns T1/T2 via the control edges, thus establishing a connection between accumulator port P1/P2 and ports BR1/BR2 for the wheel brake cylinders. The foot force applied now determines the output braking pressure. The control spools (3) are held in the control position by the force applied (spring assembly) above the spools and the hydraulic pressure below the spool (balance of forces).

After output of the braking pressure, spools (3) are in a partial braking position, causing ports P1/P2 and T1/T2 to close and holding the pressure in ports BR1/BR2.

4) FULL BRAKING POSITION

When pedal (17) is fully actuated, an end position of the brakes is reached and a connection established between accumulator ports P1/P2 and brake cylinder ports BR1/BR2. Returns T1/T2 are closed at this point.

When the braking process ended, a connection is once again established between brake cylinder ports BR1/BR2 and return ports T1/T2, closing accumulator ports P1/P2.

The arrangement of spools in the valve ensures that even if one braking circuit fails the other remains fully operational. This is achieved by means of the mechanical actuation of both spools and requires slightly more pedal travel.

5) LIMITING THE BRAKING PRESSURE

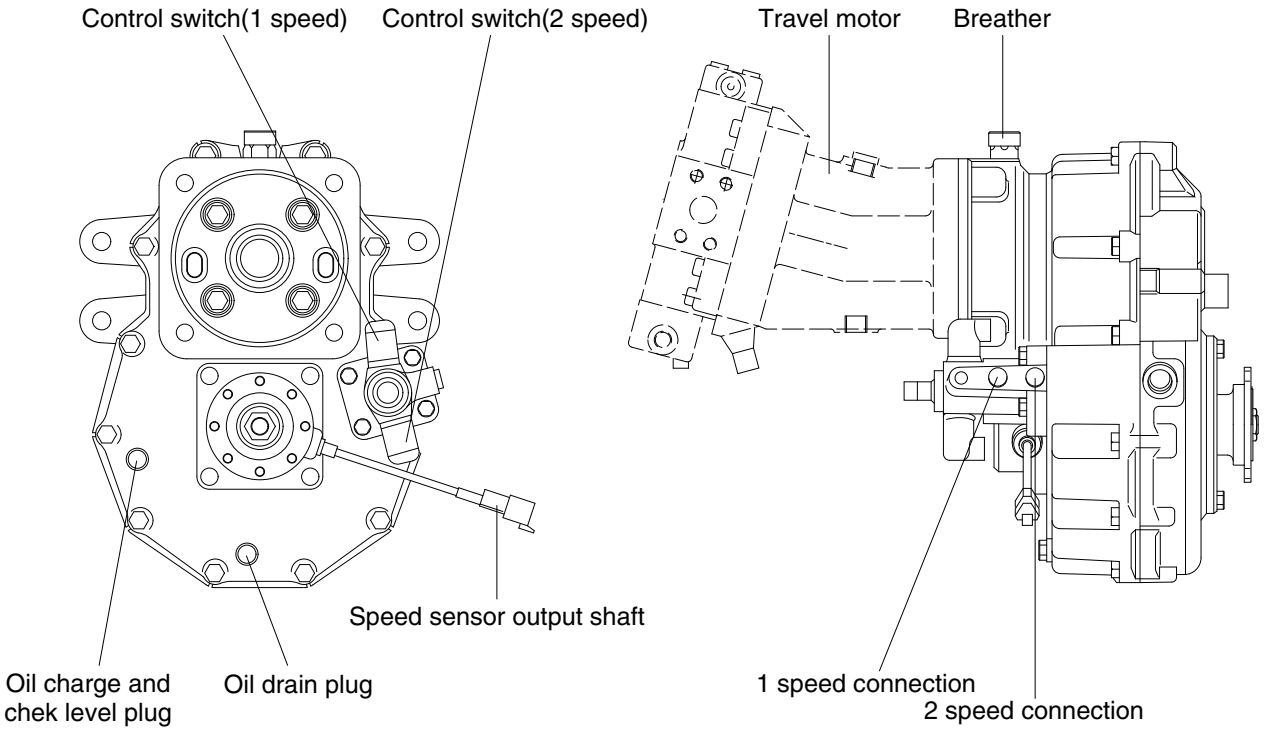
Pedal restriction screw (29) on pedal plate (16) below pedal (17) is used to limit the braking pressure.

6) FAILURE OF A CIRCUIT

In the event of the lower circuit failing, the upper circuit will remain operational. Spring assembly (8) will mechanically actuate spool (3). In the event of the upper circuit failing, the lower circuit will remain operational since the lower spool (3) is mechanically actuated by spring assembly (8) and spool (3).

GROUP 8 GEAR BOX

1. STRUCTURE

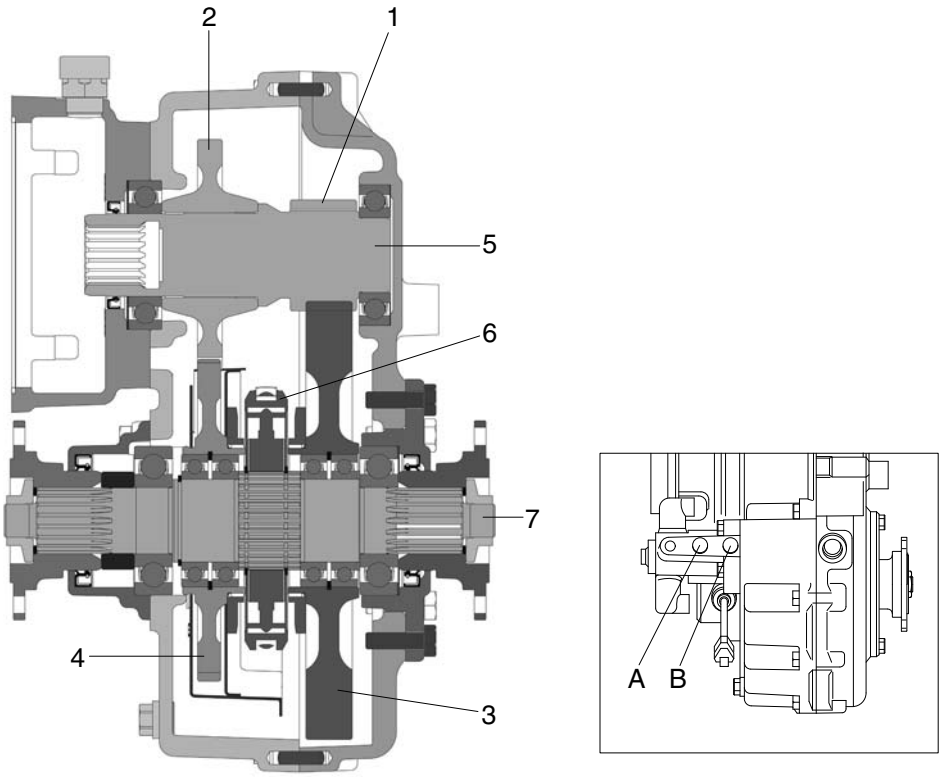


60W9S2GB01

2. GEAR BOX FUNCTION

It explains mechanism, function operation principle and caution in the operation of transfer gear box applied to for this equipment.

1) GEAR BOX MECHANISM



60W9S2GB02

1	Input shaft gear 1	4	Output shaft gear 2	7	Output shaft
2	Input shaft gear 2	5	Input shaft		
3	Output shaft gear 1	6	Change selector		

2) FUNCTION

Transfer gear box applied to R60W-9S is a hydraulic system having 1, 2 speed gear and its system is dog clutch type.

Once pushing 1 speed button for speed change, exhausted hydraulic power flow from the pump supplied to port "A" by operating 1, 2 speed solenoid valve and change selector (6) pushed by selector shift goes in gear with output shaft gear 1 (3).

The power gear box is moved to input gear shaft 1 (1), output shaft gear 1 (3), change selector (6), output shaft (7) and this procedure lead to 1 speed operation status.

Meanwhile, once pushing 2 speed button in the equipment stop condition, hydraulic power flow from the pump supplied to port "B" and change selector (6) pushed by selector shaft goes in gear with output shaft gear 2 (4).

The power gear box is moved to input shaft gear 2 (2), output shaft gear 2 (4), change selector (6), output shaft (7) and this procedure lead to 2 speed operation status.

3. TECHNICAL DATA

1) GENERAL DATA

(1) Max. input power : 70 kW

(2) Max. input torque : 71.4 kgf·m

(3) Max. input speed : 4500 rpm

(4) Hydraulic motor : 80 cc/rev

(5) Gear ration
- ·1st speed : 4.06 : 1
- ·2nd speed : 1.31 : 1

(6) Output flange
- ·Bolt for propshaft connection : M10×1.25
- ·Gear box weight : 75 kg (165 lb)

2) GEAR BOX CONTROL

(1) Control pressure

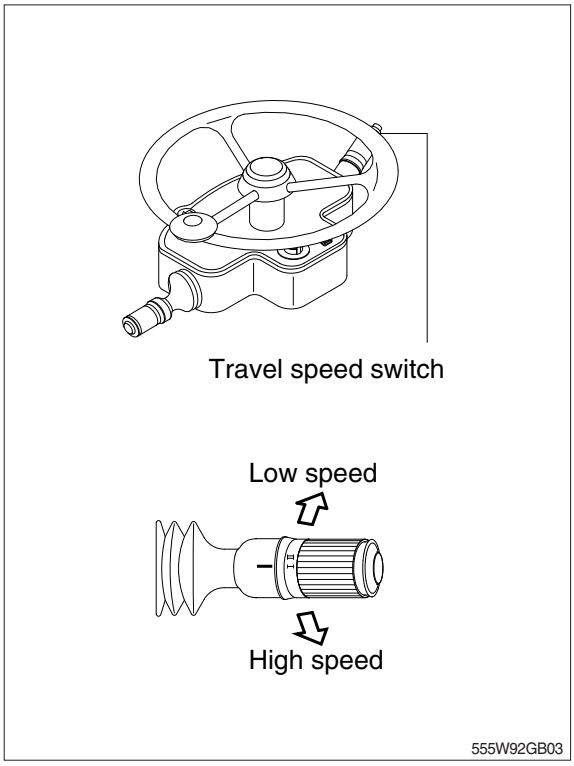
① At connection P1 and P2 at Low/High speed : 26~32 kgf/cm^2

② Definition of lubricants : SAE 80W-90 API GL-4

3) HOW TO CHANGE THE TRAVEL SPEED

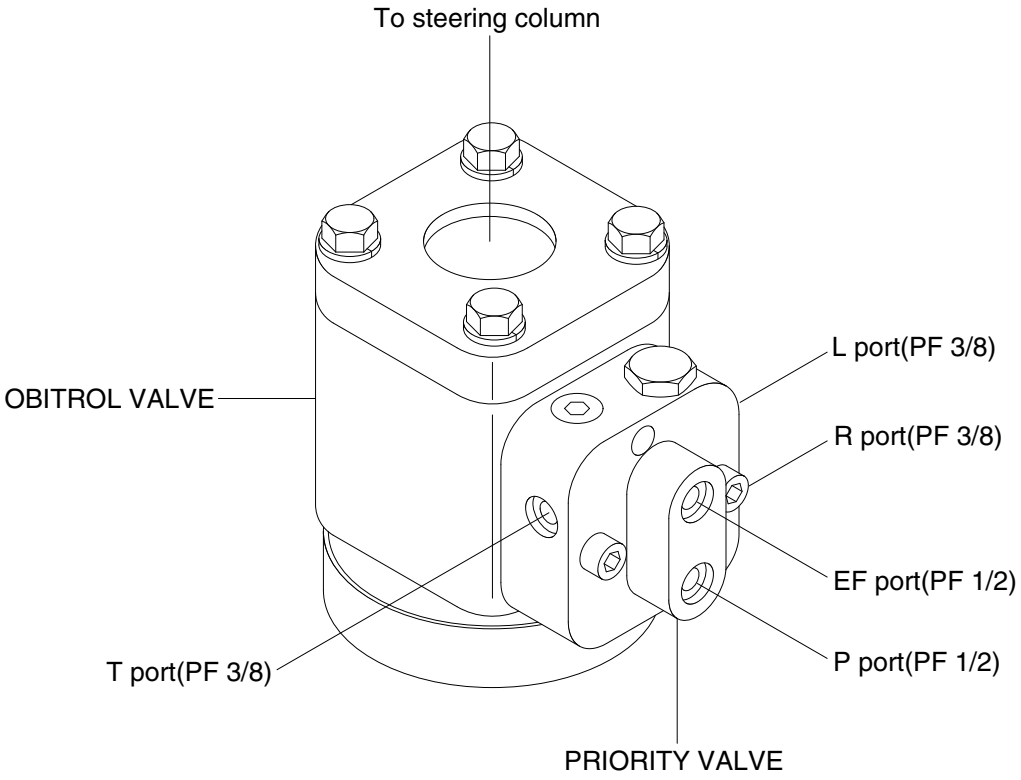
If you want to change the speed, be sure to operate according to the following procedure. Otherwise, unreasonable operation may cause fatal impact and failure to the transfer box (gear box).

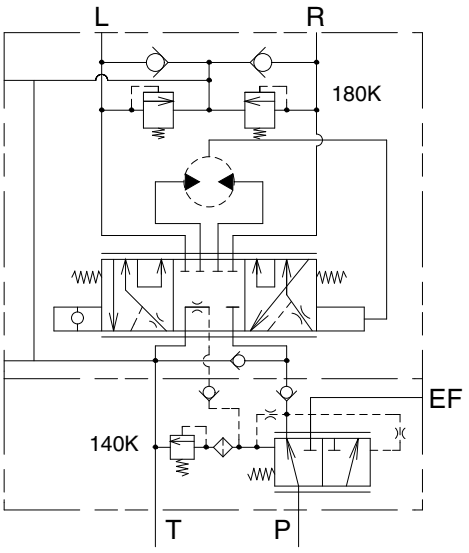
- In case of changing the travel speed, be sure to stop the machine completely.
- Keep the machine on the stationary state and stepping the brake pedal to full stroke. Thereafter, select the speed switch to the desired position.
  When operating the travel speed switch without stepping brake pedal and stopping the machine completely, the operation of gear box can not be worked actually even though the position of speed switch is left to the desired position.
- When turning the key switch to "OFF" position to stop the machine, be sure to transfer the travel speed switch to the low speed position.
  Because the position of solenoid valve for travel is automatically transferred to the low speed position when turning the key switch to "OFF"position.



GROUP 9 STEERING VALVE

1. STRUCTURE



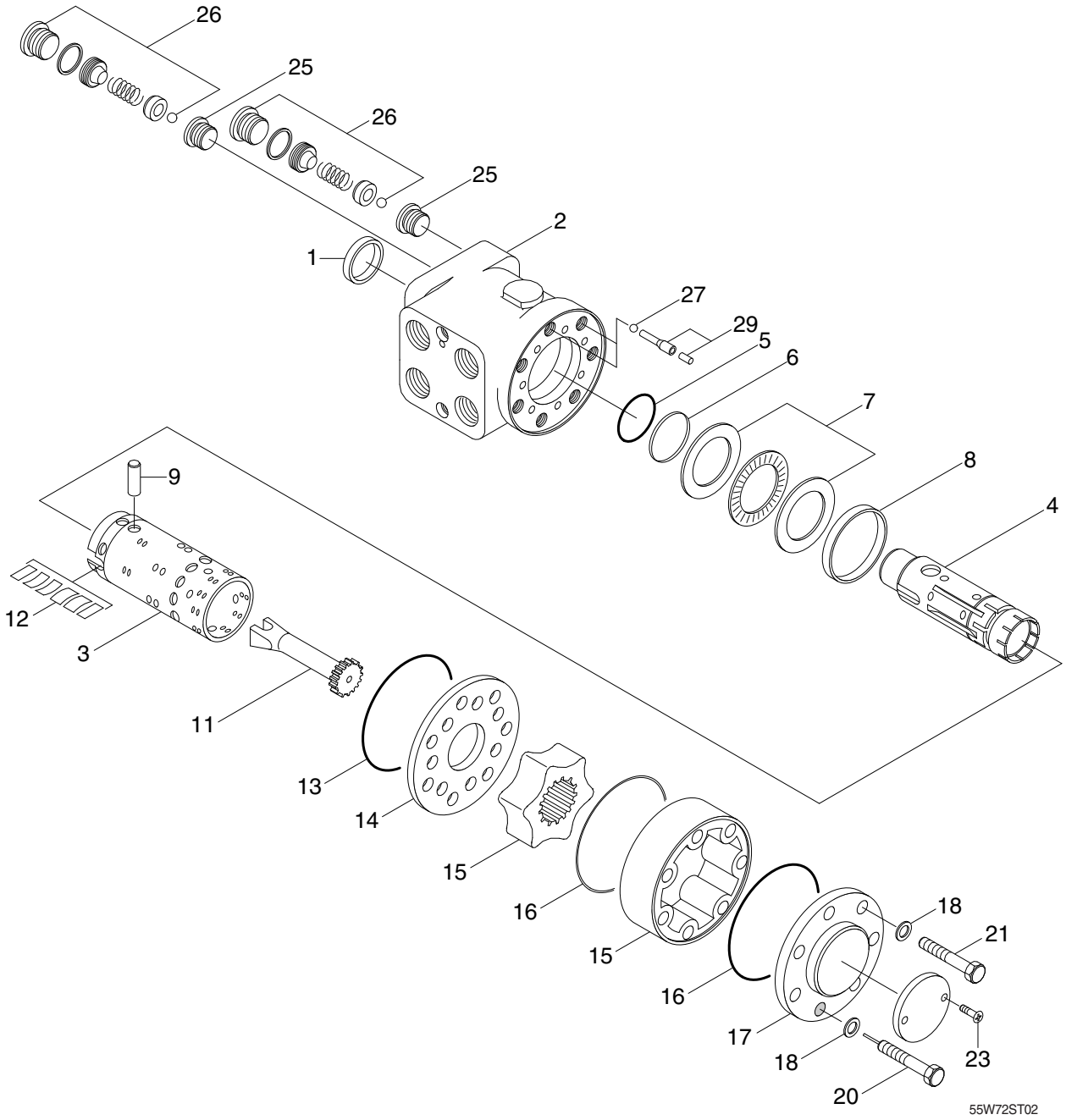


Hydraulic circuit

55W7A2ST01

Port	Port name	Port size
L	Left port	PF 3/8
R	Right port	PF 3/8
P	Pump port	PF 1/2
T	Tank port	PF 3/8
EF	Auxiliary port	PF 1/2

2. COMPONENTS



1	Dust seal ring	11	Shaft	21	Screw
2	Housing	12	Spring set	22	Name plate
3	Sleeve	13	O-ring	23	Drive screw
4	Spool	14	Distributor plate	25	Plug
5	O-ring	15	Gear wheel set	26	Shock valve
6	Kin-ring	16	O-ring	27	Ball
7	Bearing assy	17	End cover	29	Suction valve pin
8	Ring	18	Washer		
9	Cross pin	20	Pin screw		

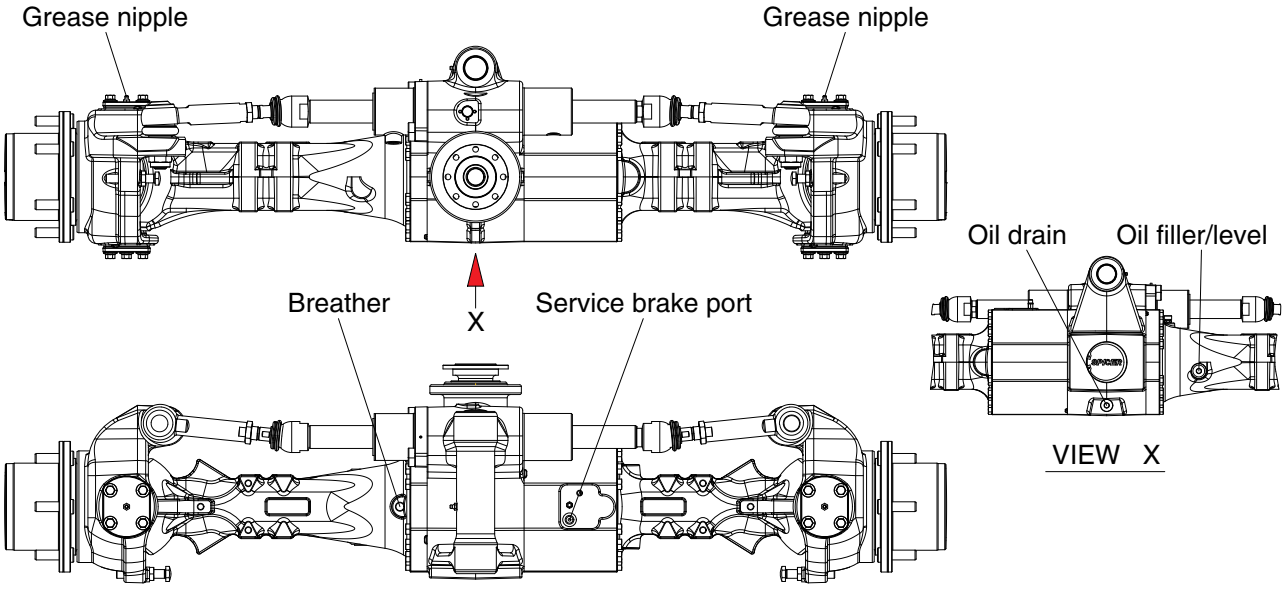
GROUP 10 AXLE

1. OPERATION

·The power from the engine passes through main pump, travel motor and transmission and drive shafts, and is then sent to the front and rear axles.

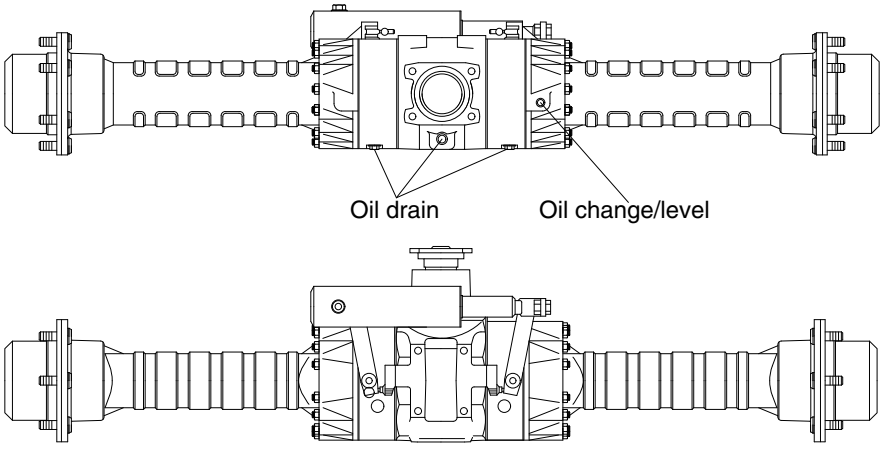
·Inside the axles, the power passes from the bevel pinion to the bevel gear and is sent at right angles. At the same time, the speed is reduced and passes through the both differentials to the axle shafts. The power of the axle shafts is further reduced by planetary-gear-type final drives and is sent to the wheels.

1) FRONT AXLE



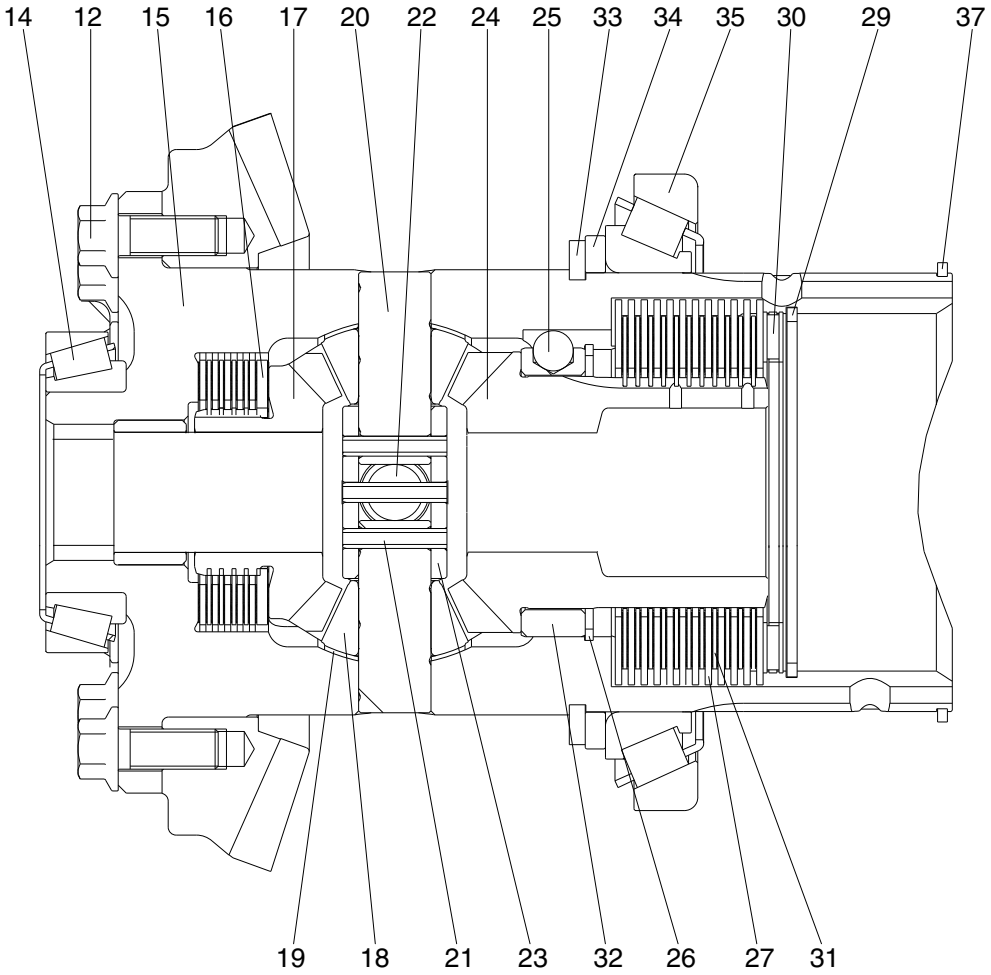
55W72AX01

2) REAR AXLE



55W92AX01

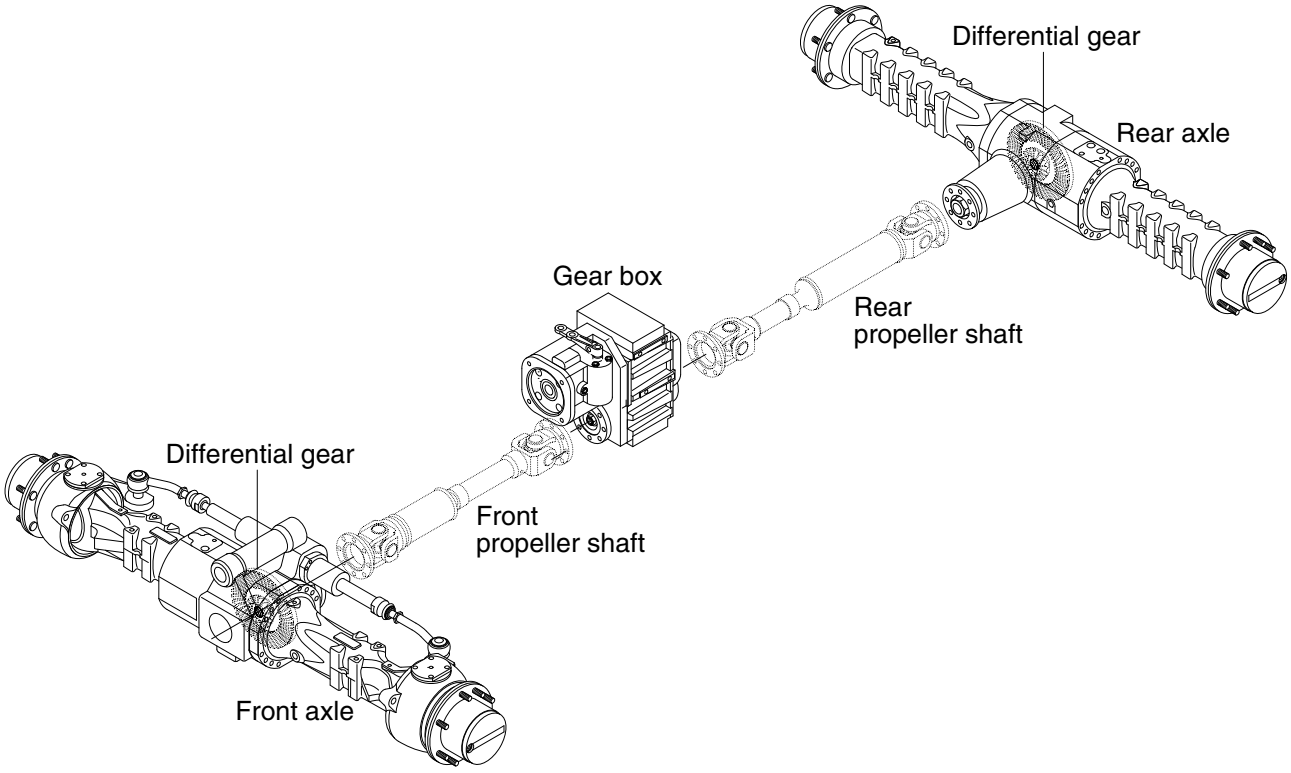
2. SECTION OF DIFFERENTIAL



55W72AX03

11	Bevel gear set
12	Bolt
14	Taper roller bearing
15	Differential carrier
16	Friction washer
17	Differential side gear
18	Differential pinion
19	Friction gear
20	Pin
21	Dowel
22	Pin
23	Shaft retainer
24	Differential side gear
25	Detend ball
26	Circlip
27	Clutch disc
29	Circlip
30	Bearing
31	Clutch disc
32	Bushing
33	Circlip
34	Spacer
35	Bearing
37	Circlip

3. DIFFERENTIAL



55W72AX04

The differential is installed on the front and rear axle to transfer the driving torque from the axle to the wheels. The differential transfers half of the output torque of the transmission via the universal drive shaft to the planetary gear of the wheel hubs and transfers the rpm and torque from the gear via the pinion and the ring.

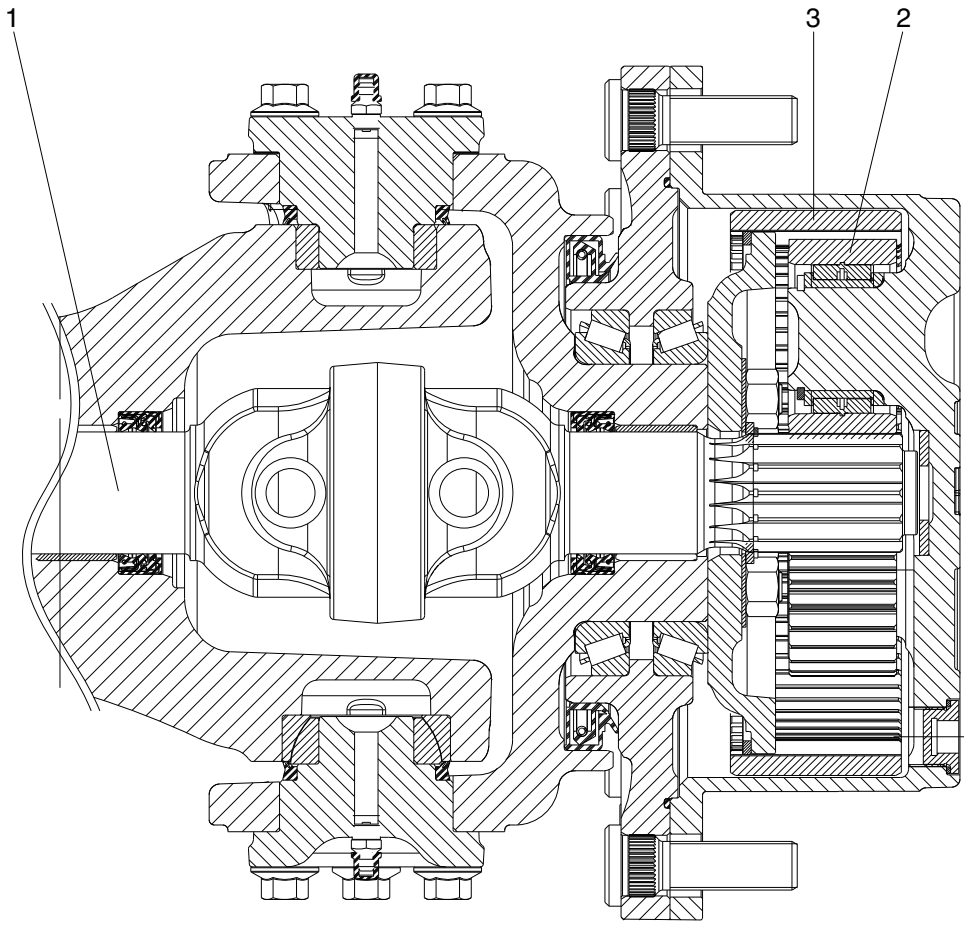
In addition, the differential also servers as an equalizer when going around curves. If the mechanical connection from the transmission to the universal drive shaft, differential, shaft, and planetary gears to the wheels would be rigid, every steering movement would strain the axle construction and would result in increased tire wear.

The equalizing function comes from the special construction of the differential. The power input from the input flange to the pinion shaft, ring and differential housing to the equalizing axle in the differential housing meshes the four equalizing tapered gears with the axle gears, which are located in the equalizing axles. This changes the relative direction of rotation between the shafts meshed with the side gears. This means that one shaft turns clockwise and the other counterclockwise, and one shaft turns faster than the other.

This balancing movement has the disadvantage that when traveling off road, traction is reduced on uneven ground, on loose ground or on snow or ice only wheel per axle is engaged. This disadvantage can be corrected in part by installing a self locking differential.

4. FINAL DRIVE

1) FRONT AXLE



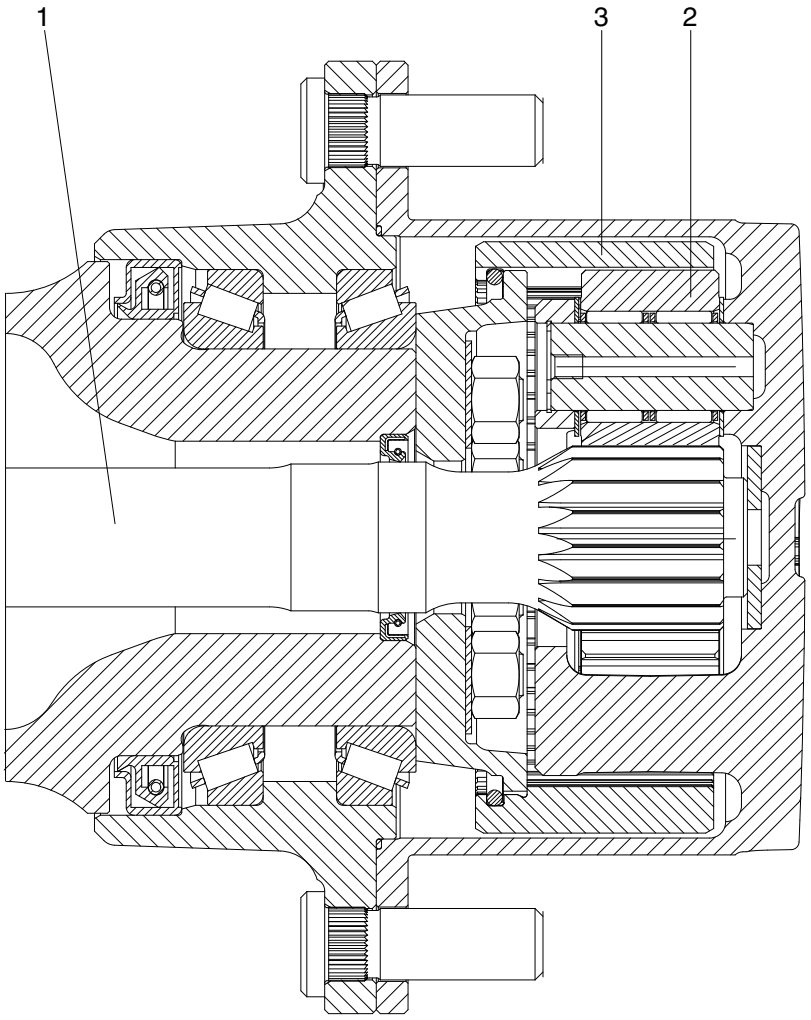
55W72AX05

1 Universal joint 2 Pinion gear 3 Ring gear

(1) To gain a large drive force, the final drive uses a planetary gear system to reduce the speed and send drive force to the tires.

(2) The power transmitted from the differential through universal joint (1) to pinion gear (2).
The pinion gear rotates around the inside of a fixed ring gear (3) and in this way transmits rotation at a reduced speed to the planetary carrier.
This power is then sent to the wheels which are installed to the planetary carriers.

2) REAR AXLE



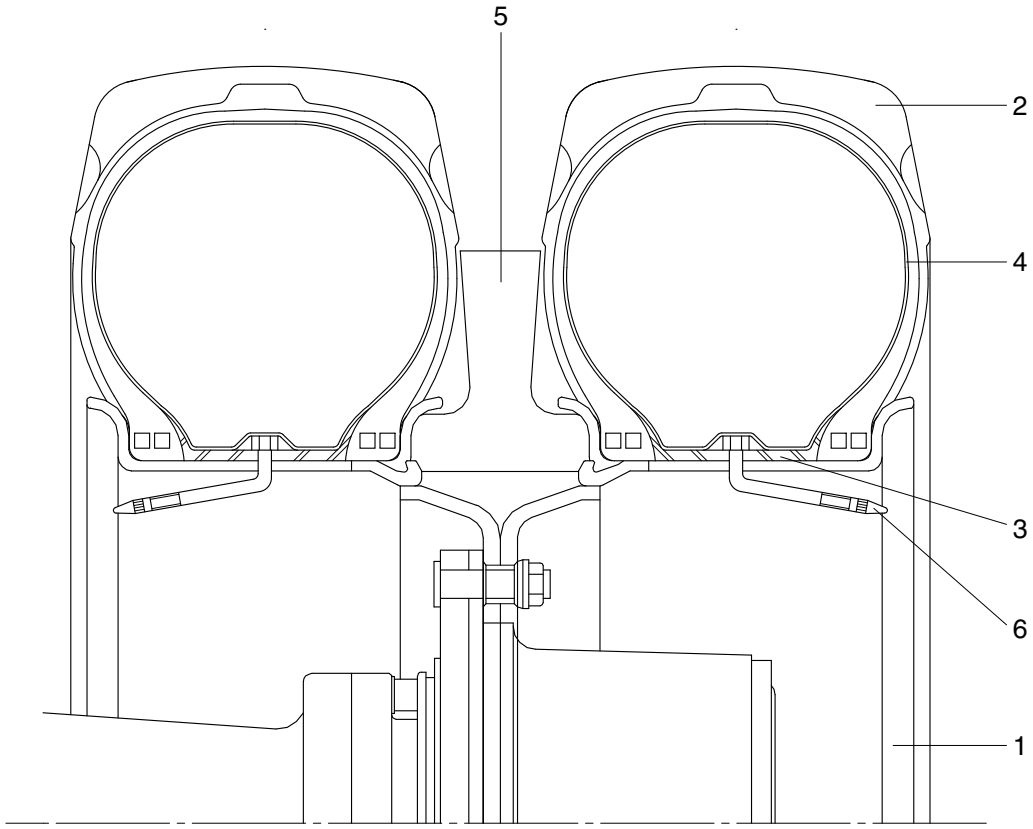
55W72AX06

1 Axle half shaft 2 Pinion gear 3 Ring gear

(1) To gain a large drive force, the final drive uses a planetary gear system to reduce the speed and send drive force to the tires.

(2) The power transmitted from the differential through axle half shaft (1) to pinion gear (2). The pinion gear rotates around the inside of a fixed ring gear (3) and in this way transmits rotation at a reduced speed to the planetary carrier.
This power is then sent to the wheels which are installed to the planetary carriers.

5. TIRE AND WHEEL



17032TI01

1	Wheel rim	3	Flap	5	Stone resister ring
2	Tire	4	Tube	6	Valve assembly

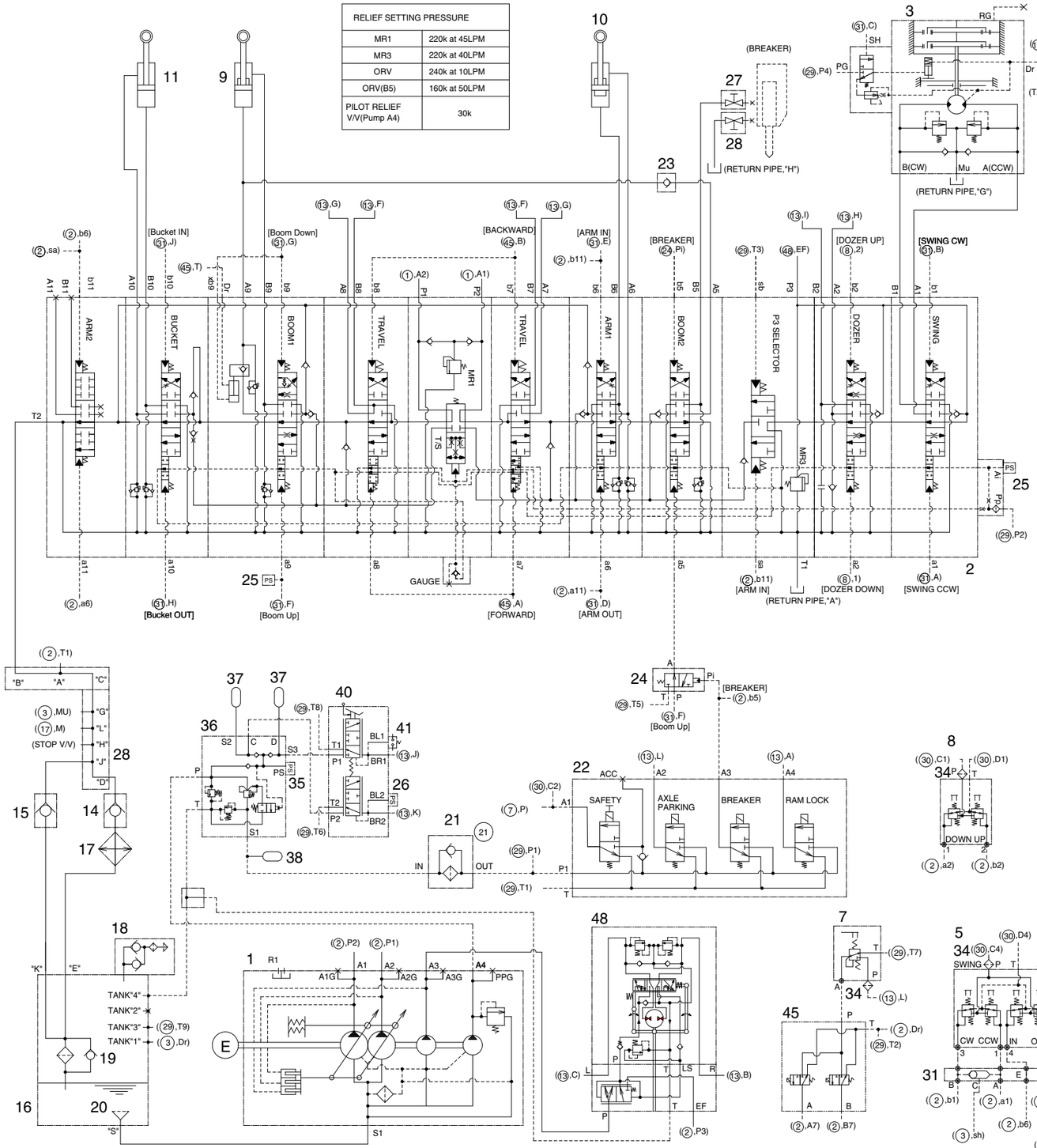
1) The tire acts to absorb the shock from the ground surface to the machine, and at the same time they must rotate in contact with the ground to gain the power which drives the machine.

2) Various types of tires are available to suit the purpose. Therefore it is very important to select the correct tires for the type of work and bucket capacity.

SECTION 3 HYDRAULIC SYSTEM

GROUP 1 HYDRAULIC CIRCUIT (1/2)

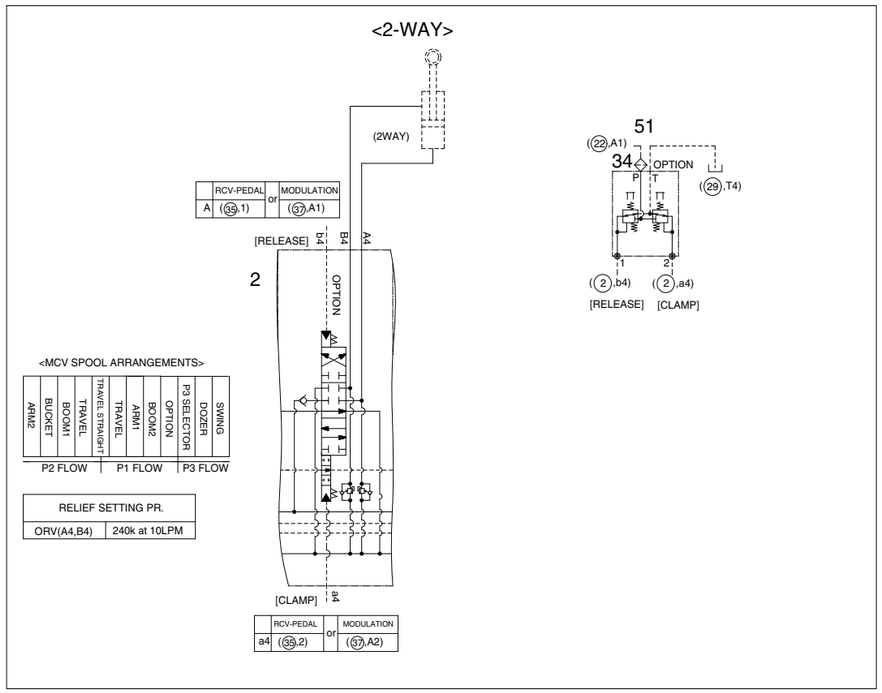
RELIEF SETTING PRESSURE	
MR1	220k at 45LPM
MR3	220k at 40LPM
ORV	240k at 10LPM
ORV(B5)	160k at 50LPM
PILOT RELIEF V/V(Pump A4)	30k

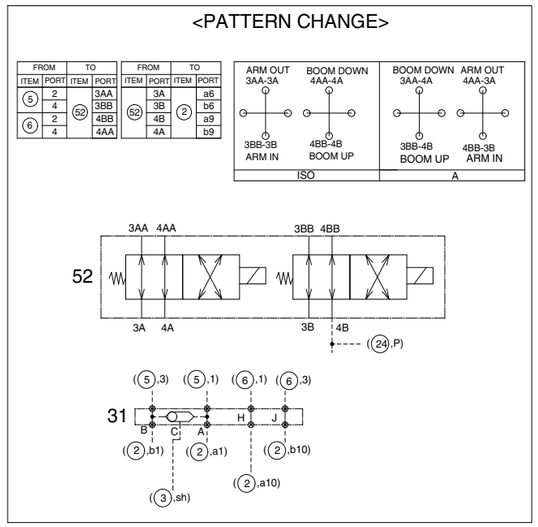


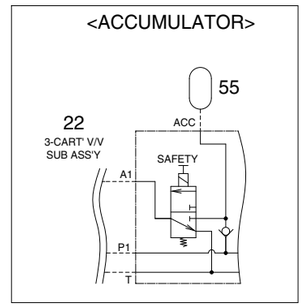
1 Main pump
2 Main control valve
3 Swing motor
4 Travel motor
5 RCV lever (LH)
6 RCV lever (RH)
7 RCV pedal
8 RCV dozer
9 Boom cylinder
10 Arm cylinder
11 Bucket cylinder
12 Dozer cylinder
13 Turning joint
14 Check valve
15 Check valve
16 Hydraulic tank
17 Oil cooler
18 Air breather
19 Bypass valve
19 Return element
20 Suction strainer
21 Pilot filter
22 4-cartridge valve sub
23 Check valve
24 Pilot selector valve
25 Pressure sensor
26 Pressure sensor
27 Stop valve (LH)
28 Stop valve (RH)
29 Block (A)
30 Block (B)
31 Terminal
34 Last guard filter
35 Pressure sensor
36 Cut off valve
37 Accumulator
38 Accumulator
39 Solenoid valve
40 Brake valve
41 Pressure switch
42 Rear axle
43 Gear box
44 Front axle
45 Solenoid valve
46 Oscillating cylinder
47 Locking valve
48 Steering valve

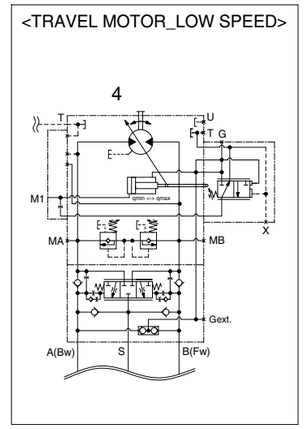
55W9A3HC01A

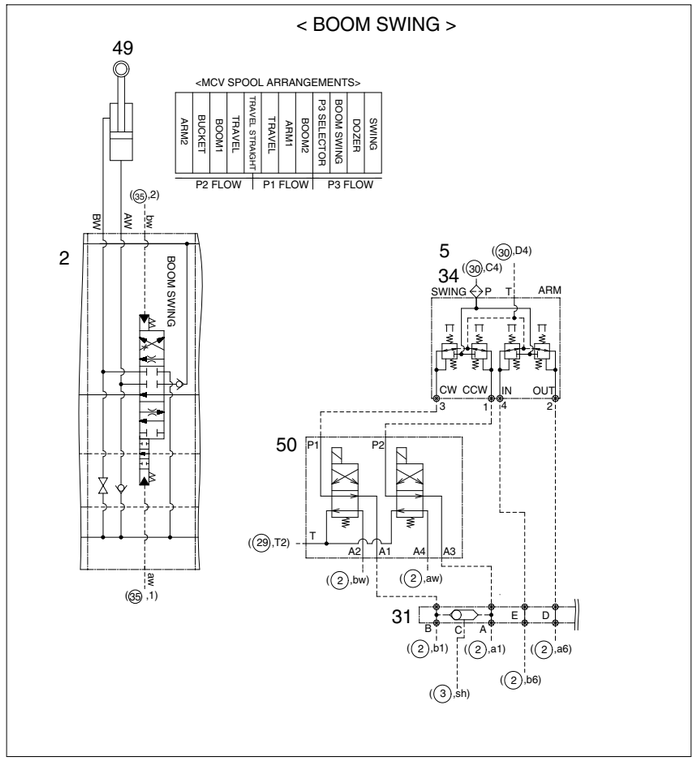
HYDRAULIC CIRCUIT (2/2)

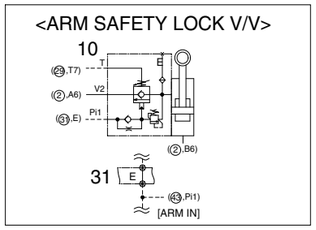


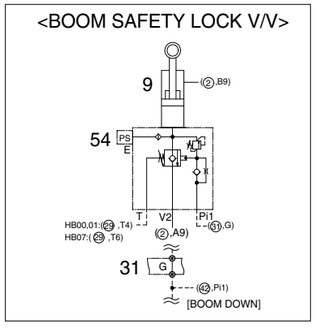


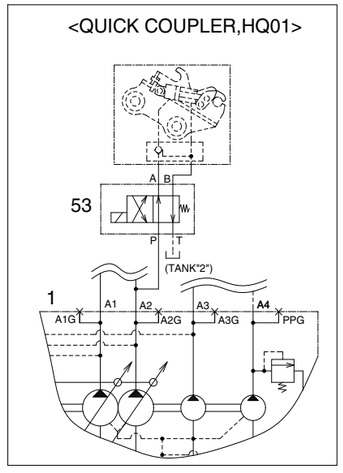


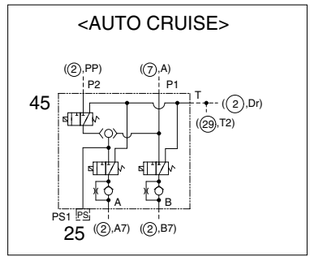












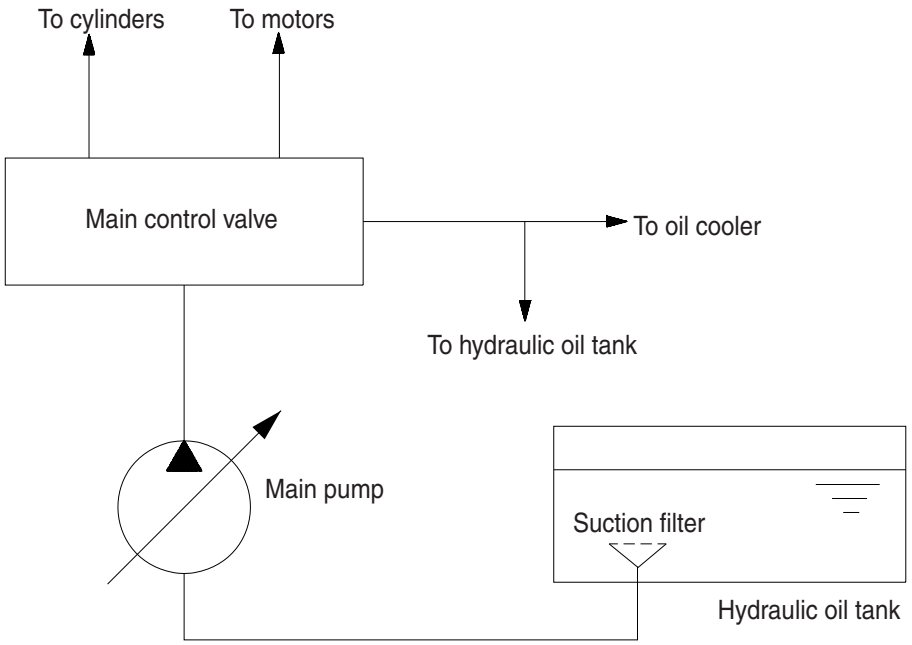
2 Main control valve
4 Travel motor
9 Boom cylinder (with SLV)
10 Arm cylinder (with SLV)
25 Pressure sensor
31 Terminal
34 Last guard filter
45 Solenoid
49 Cylinder
50 Solenoid valve
51 RCV pedal
52 Lever pattern valve
53 Solenoid valve
54 Pressure senor
55 Accmulator

55W9A3HC02A

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.

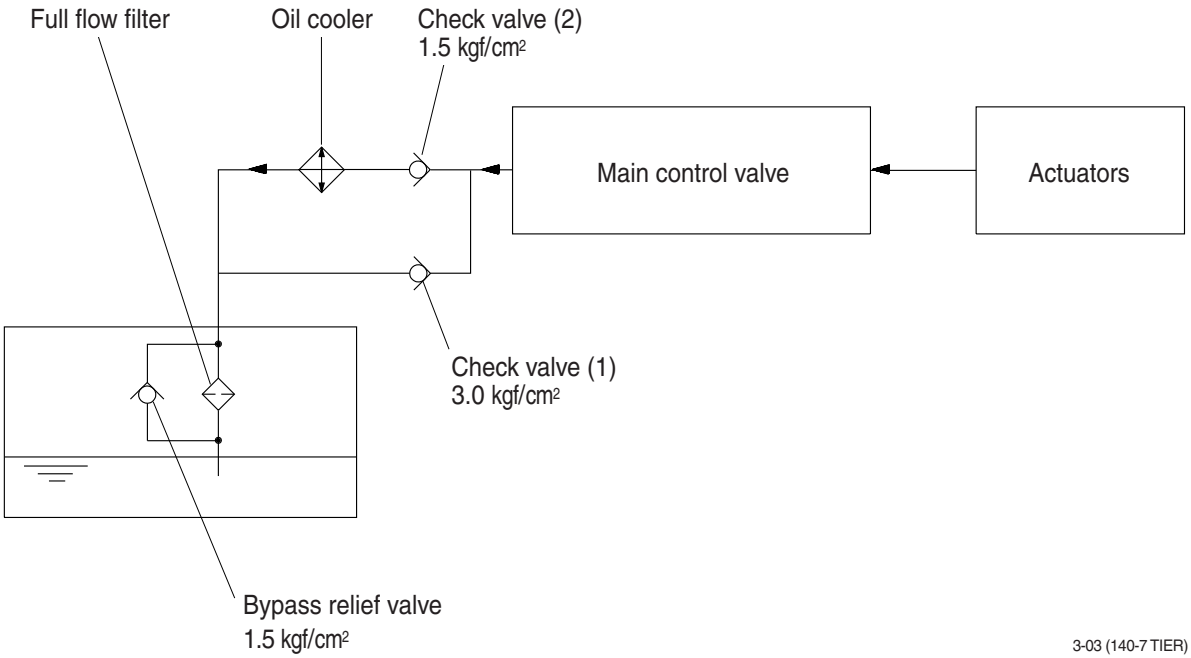
1. SUCTION AND DELIVERY CIRCUIT



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.

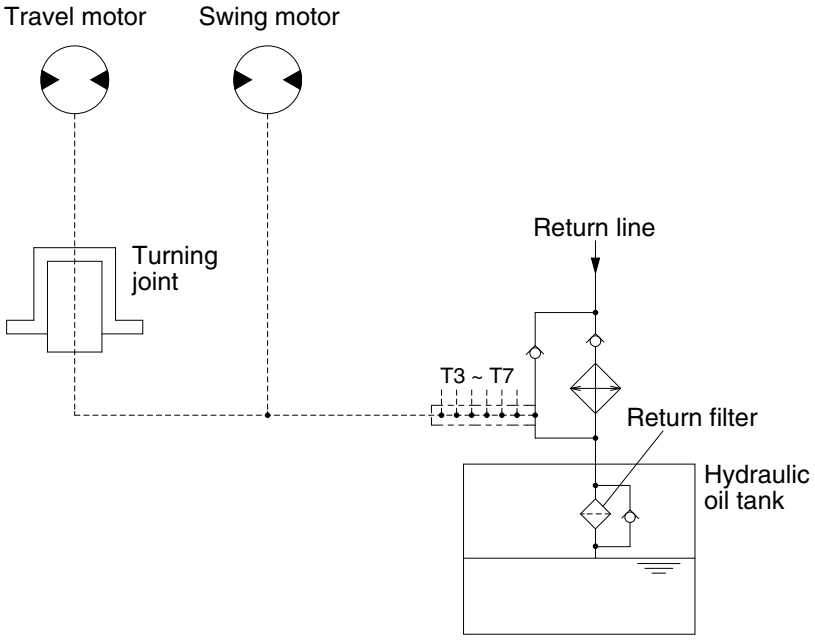
2. RETURN CIRCUIT



3-03 (140-7 TIER)

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/cm2 (21 psi) and 3.0 kgf/cm2 (43 psi). Usually, oil returns to the hydraulic tank from the left side of control valve through oil cooler.
When oil temperature is low, viscosity becomes higher and flow resistance increases when passing through the oil cooler. When the oil pressure exceeds 3.0 kgf/cm2 (43 psi), the oil returns directly to the hydraulic tank, resulting in the oil temperature being raised quickly at an appropriate level.
When the oil cooler is clogged, the oil returns directly to the hydraulic tank through bypass check valve (1).
The full-flow filter and bypass relief valve are provided in the hydraulic tank.
The oil returned from right and left side of control valve is combined and filtered by the full-flow filter. A bypass relief valve is provided in the full-flow filter.
When the filter element is clogged, the bypass relief valve opens at 1.5 kgf/cm2 (21 psi) differential pressure.

3. DRAIN CIRCUIT



55W73CI02

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

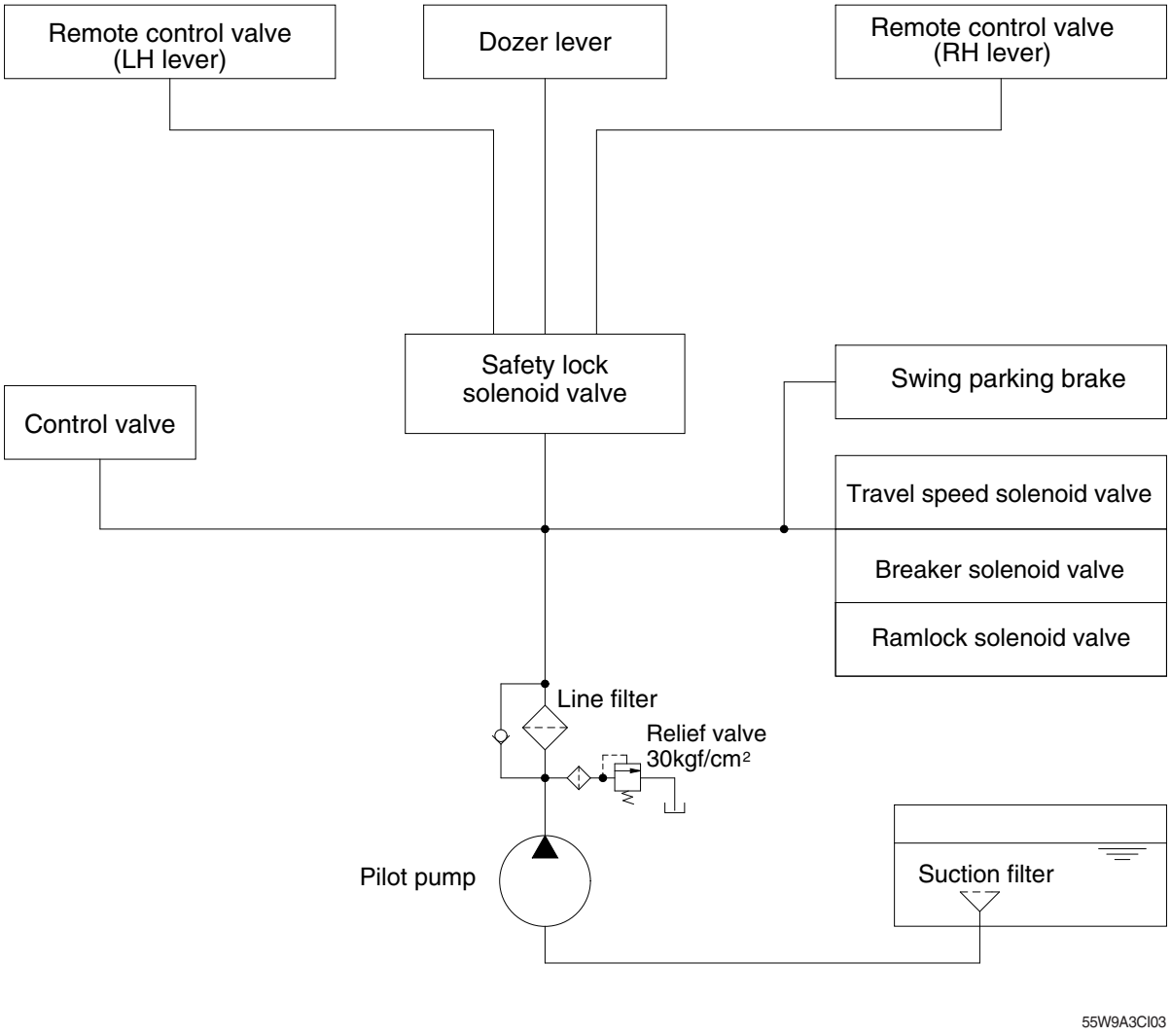
1) TRAVEL MOTOR DRAIN CIRCUIT

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

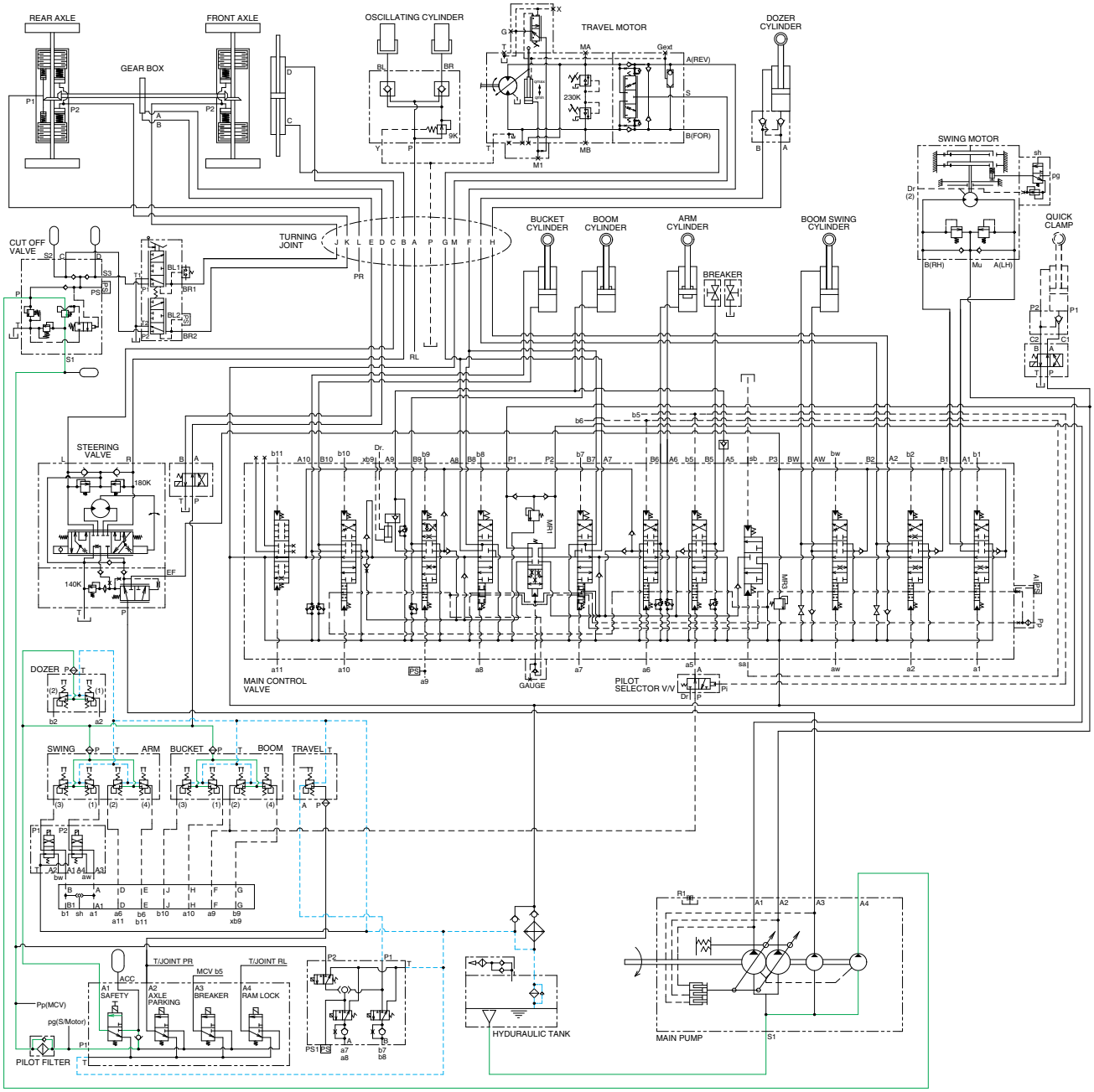


The pilot circuit consists of suction circuit, delivery circuit and return circuit.

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

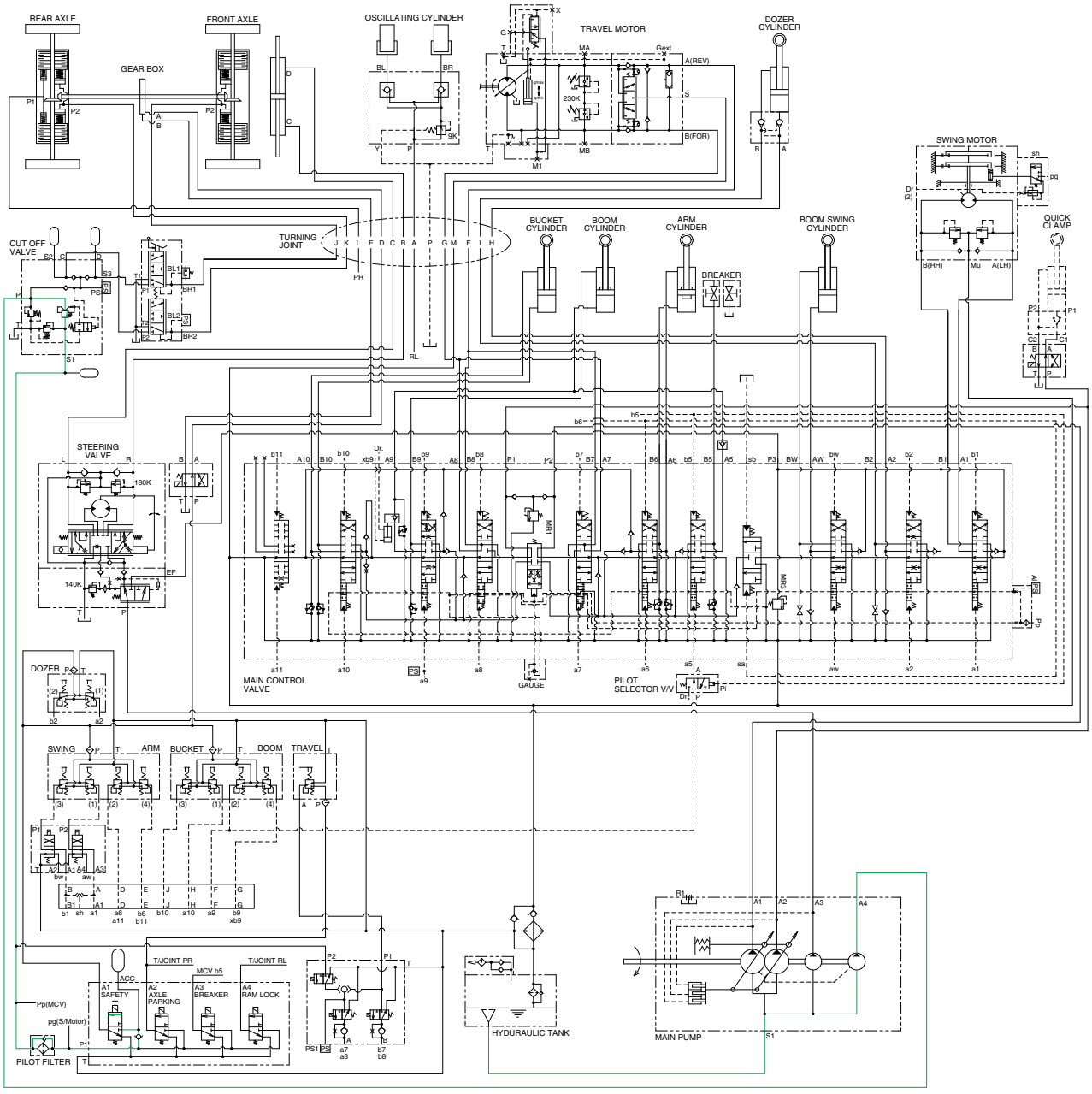


55W9A3HC02

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

The return oil flow into the hydraulic tank.

2. SAFETY VALVE (SAFETY LEVER)

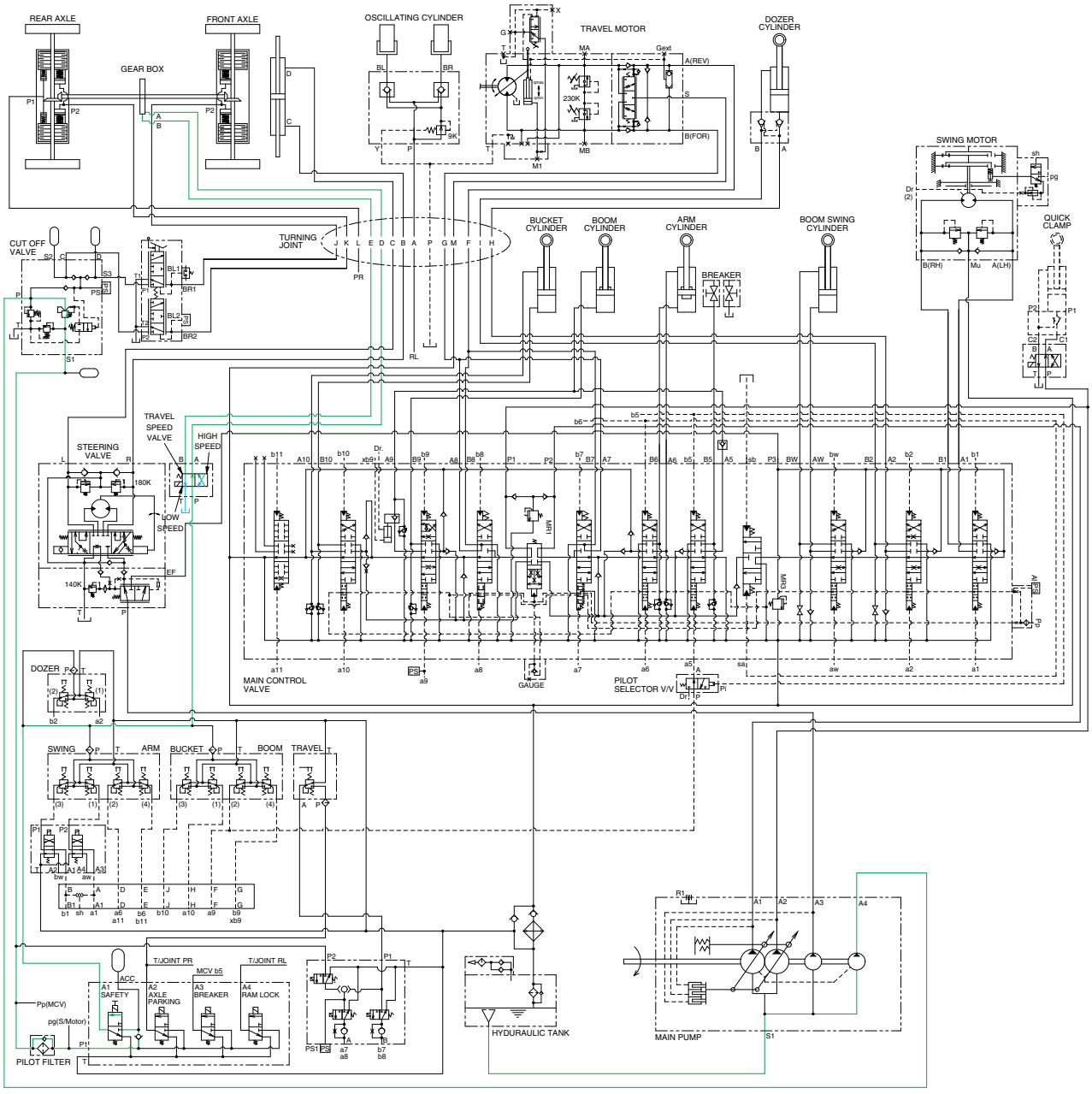


55W9A3HC03

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.

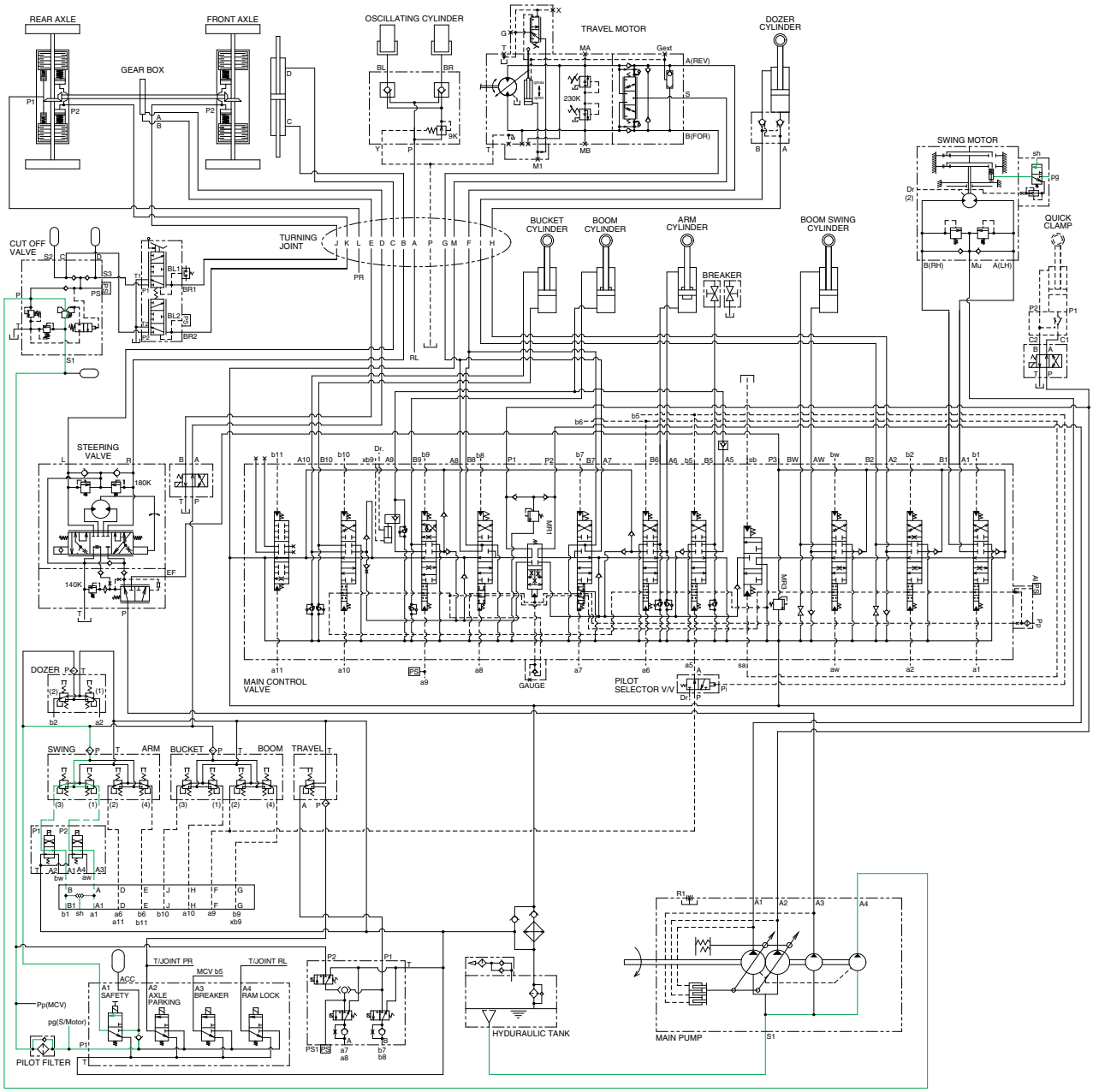
3. TRAVEL SPEED CONTROL SYSTEM



55W9A3HC04

When RH multifunction switch was placed in high or low position, the pressure oil from pilot pump flows through relief valve of cut off valve to travel speed solenoid valve, thus the gear box is changed into high or low speed condition.

4. SWING PARKING BRAKE RELEASE



55W9A3HC05

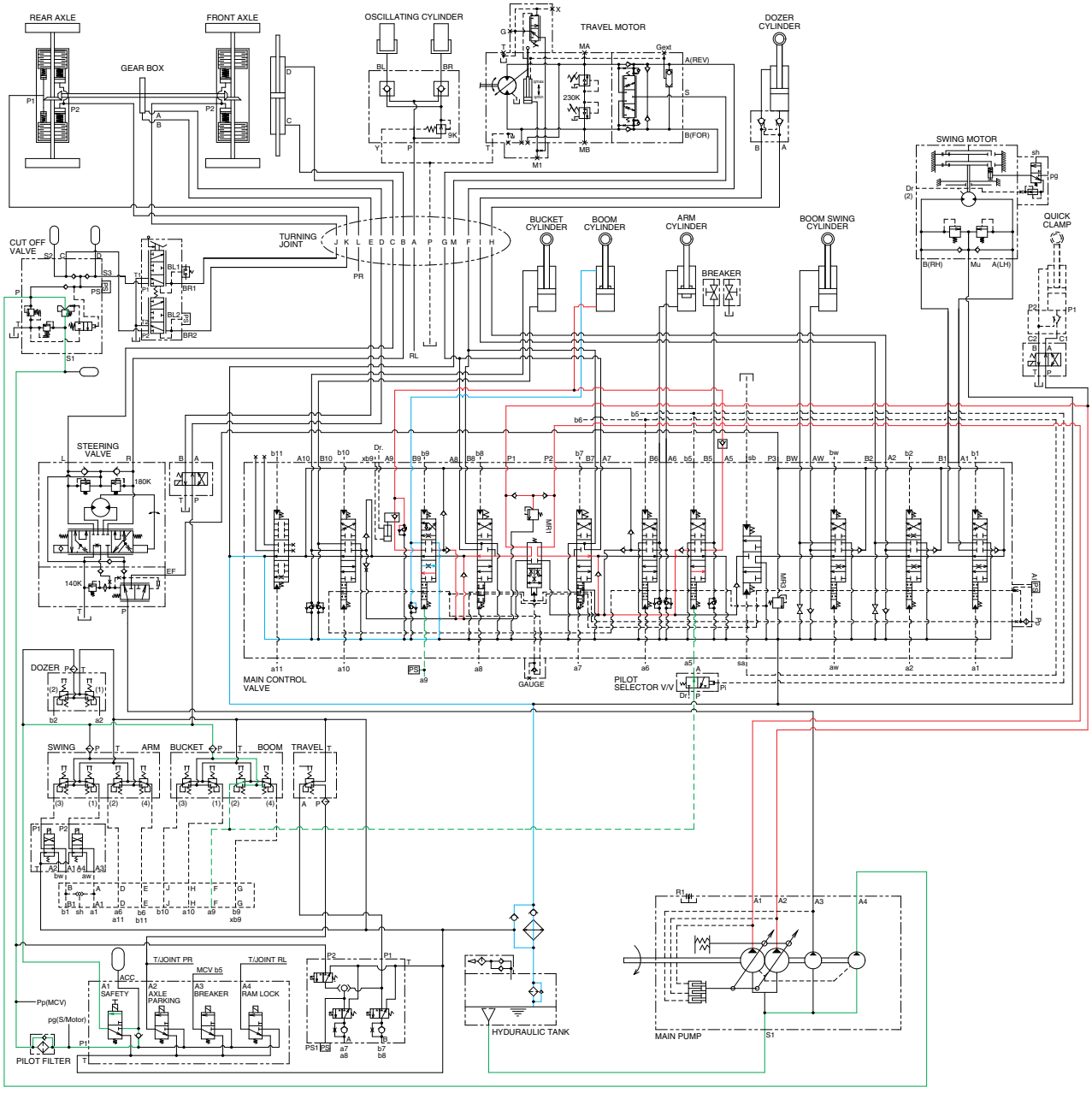
When the swing control lever is tilted, the pilot oil flow into SH port of shuttle valve, this pressure move spool so, discharged oil from pilot valve flow into PG port.

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

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

GROUP 4 SINGLE OPERATION

1. BOOM UP OPERATION

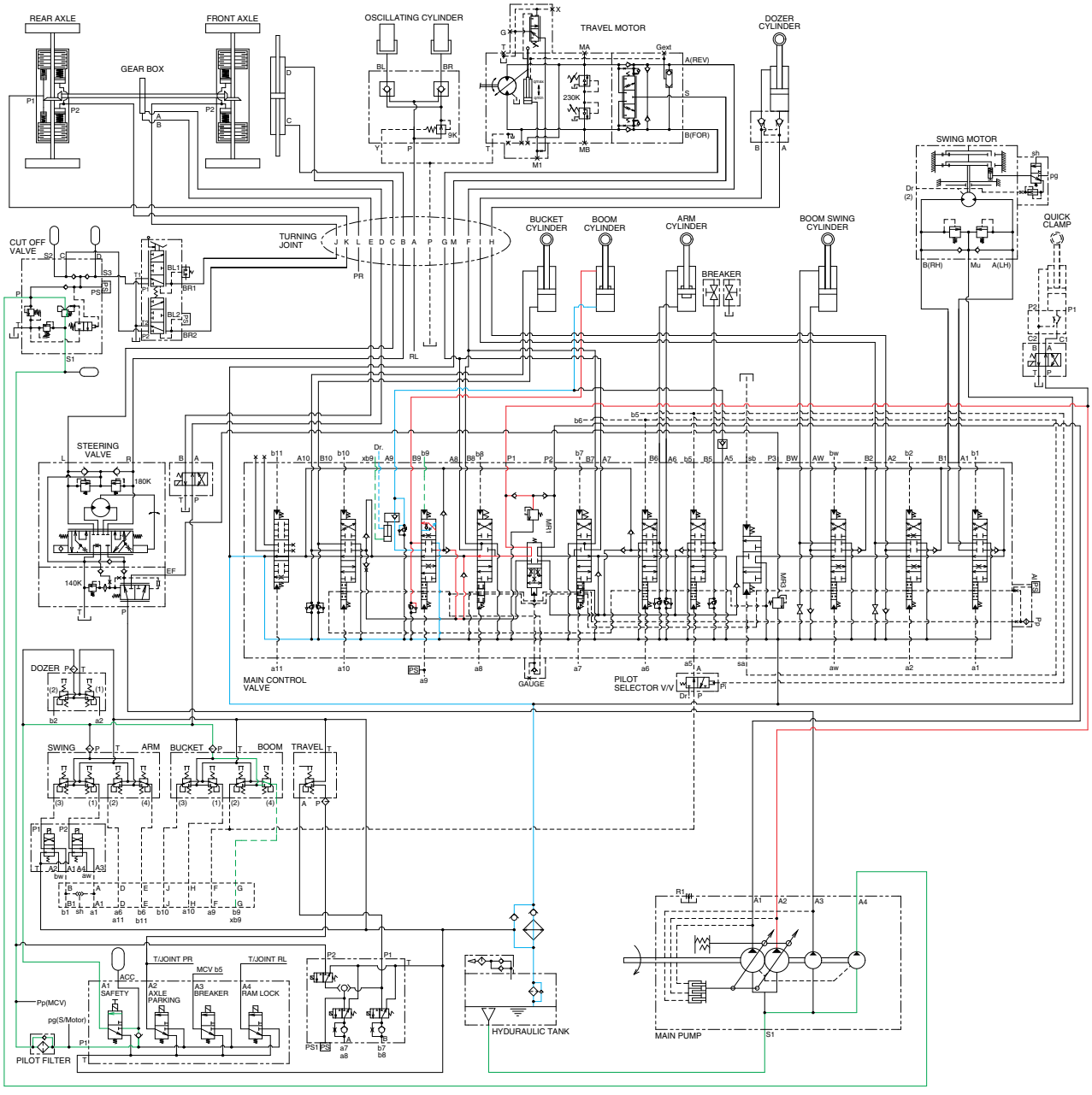


55W9A3HC06

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

The oil from the A1 and A2 pump flows into the main control valve and then goes to the large chamber of boom cylinder. At the same time, the oil from the small chamber of boom cylinder 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



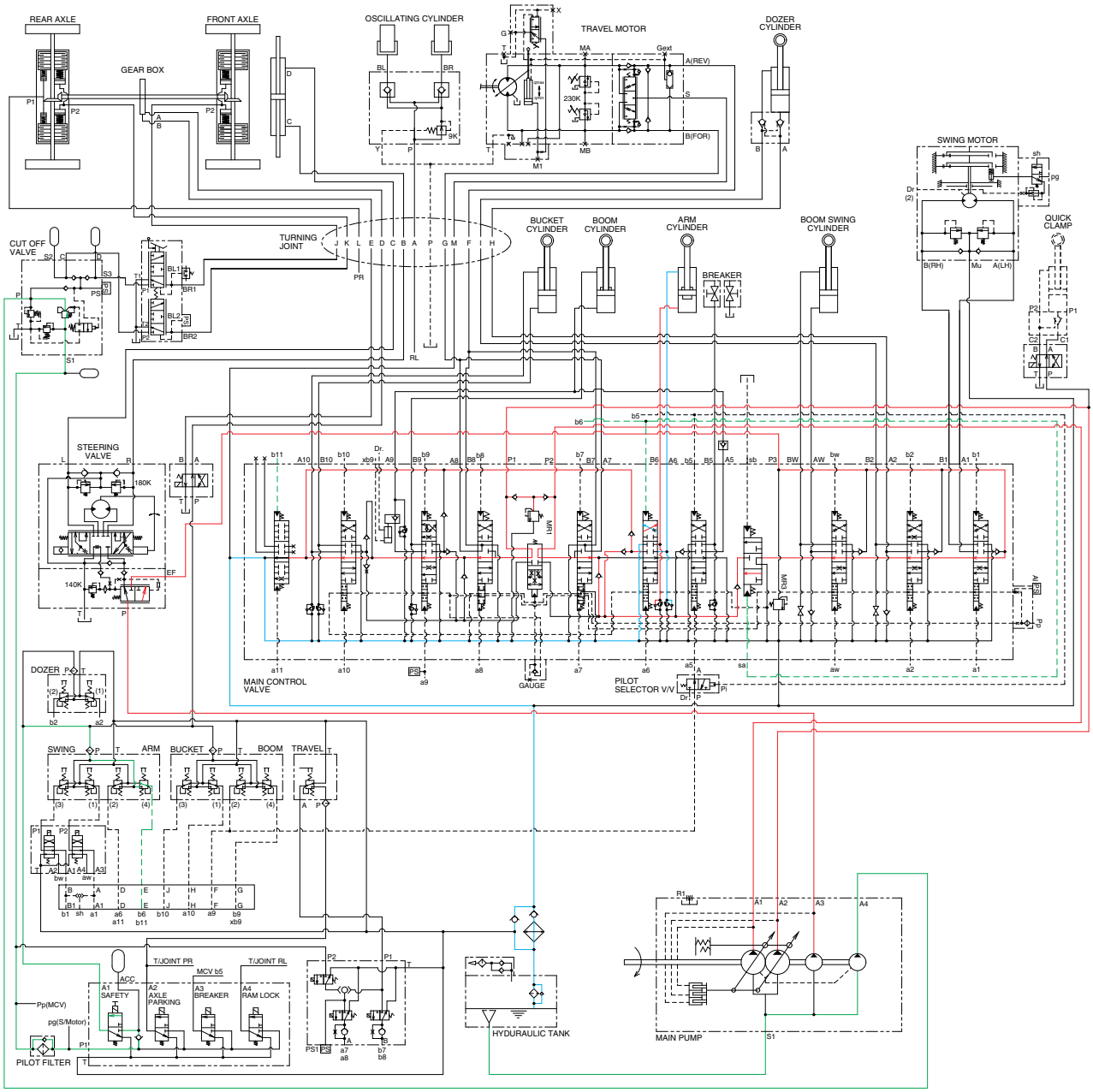
55W9A3HC07

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

The oil from the A2 pump flows into the main control valve and then goes to the small chamber of boom cylinder. At the same time, the oil from the large chamber of boom cylinder 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



55W9A3HC08

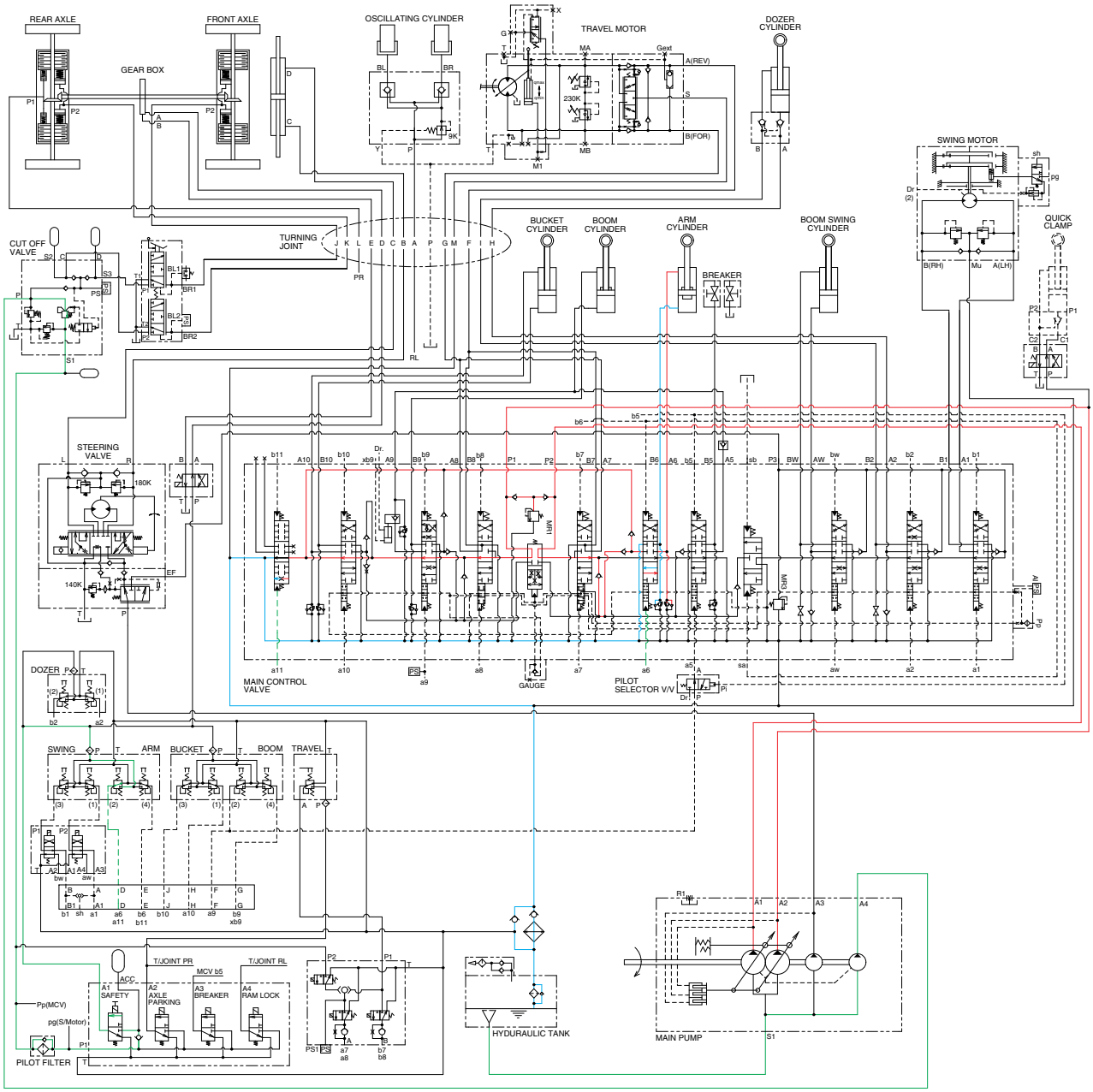
When the left control lever is pulled back, the arm spools in the main control valve are moved to the roll in position by the pilot oil pressure from the remote control valve.

The oil from the A1, A2 and A3 pump flows into the main control valve and then goes to the large chamber of arm cylinder.

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

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

4. ARM ROLL OUT OPERATION



55W9A3HC09

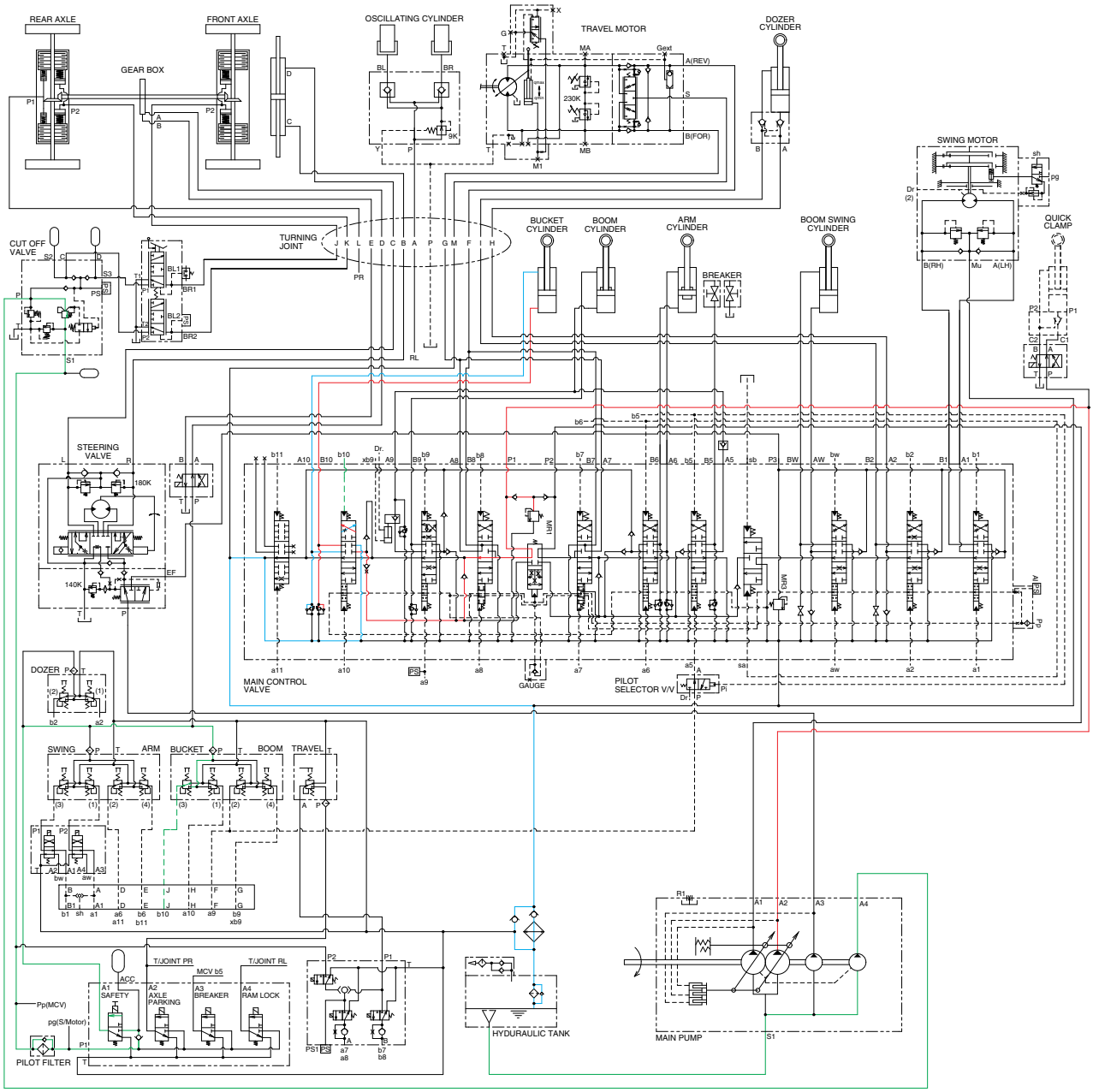
When the left control lever is pushed forward, the arm spool in the main control valve are moved to the roll out position by the pilot oil pressure from the remote control valve.

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

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

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

5. BUCKET ROLL IN OPERATION



55W9A3HC10

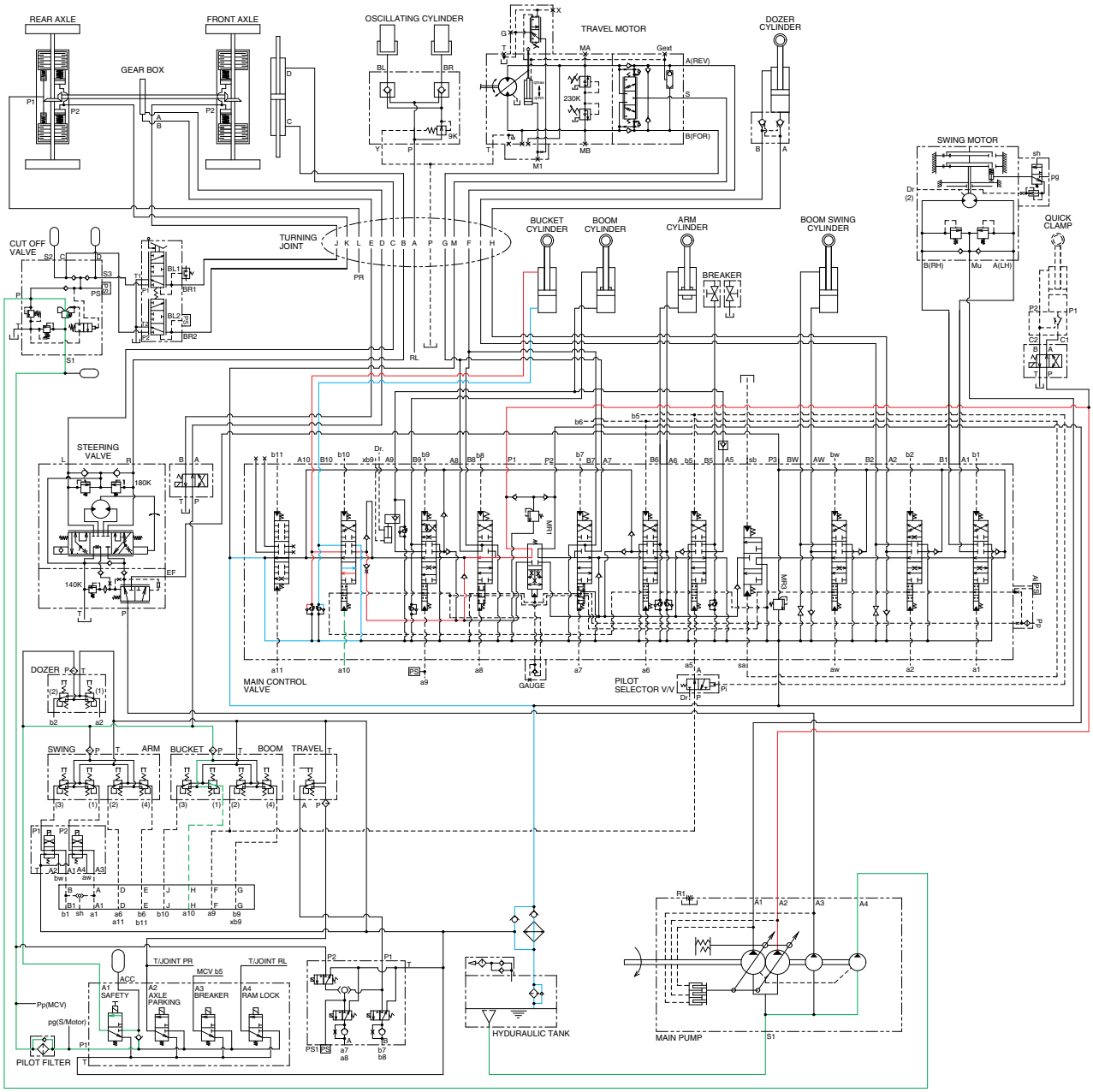
When the right control lever is pulled left, the bucket spool in the main control valve is moved to the roll in position by the pilot oil pressure from the remote control valve.

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

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

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

6. BUCKET ROLL OUT OPERATION



55W9A3HC11

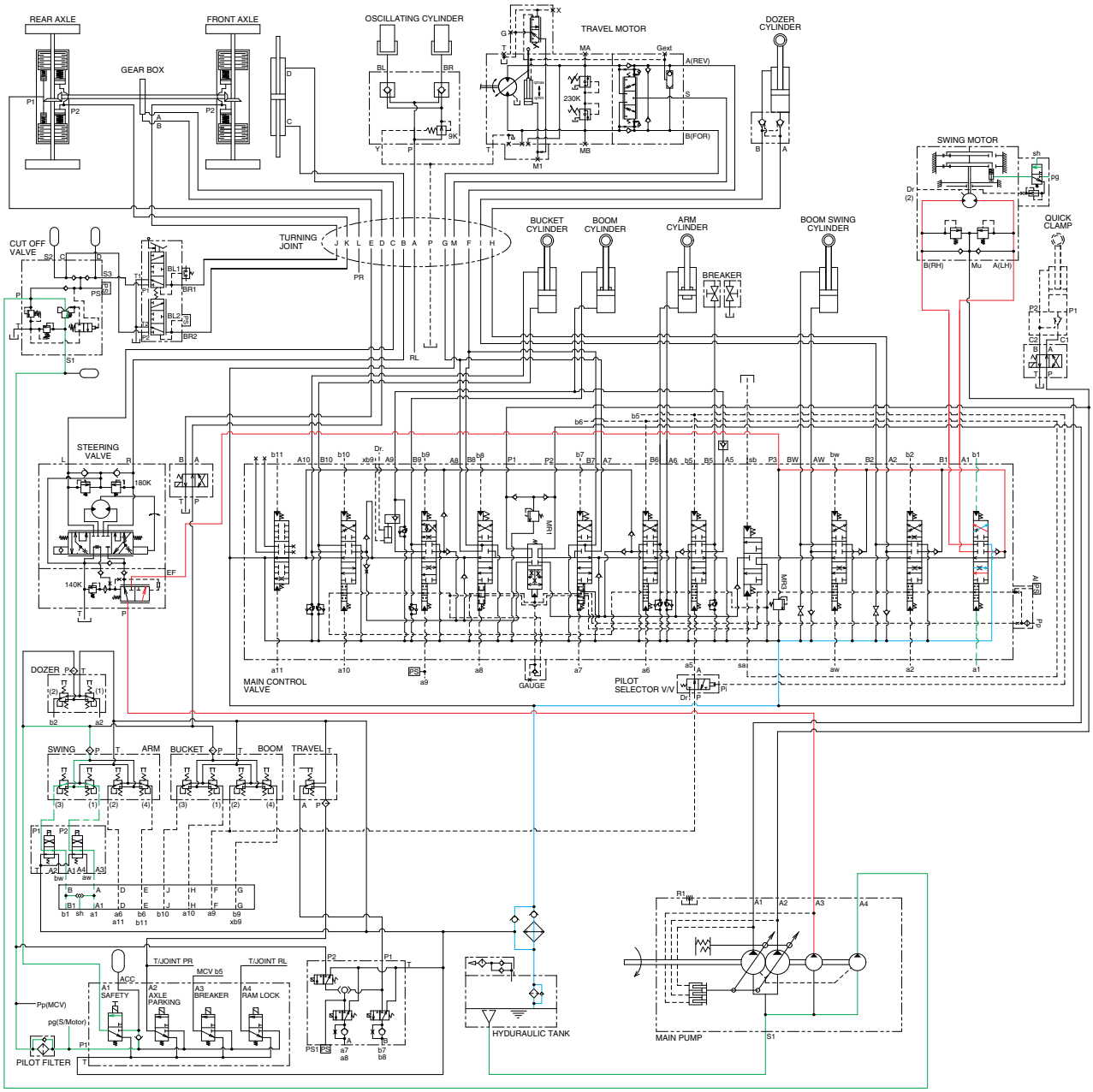
When the right control lever is pushed right, the bucket spool in the main control valve is moved to the roll out position by the pilot oil pressure from the remote control valve.

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

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

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

7. SWING OPERATION



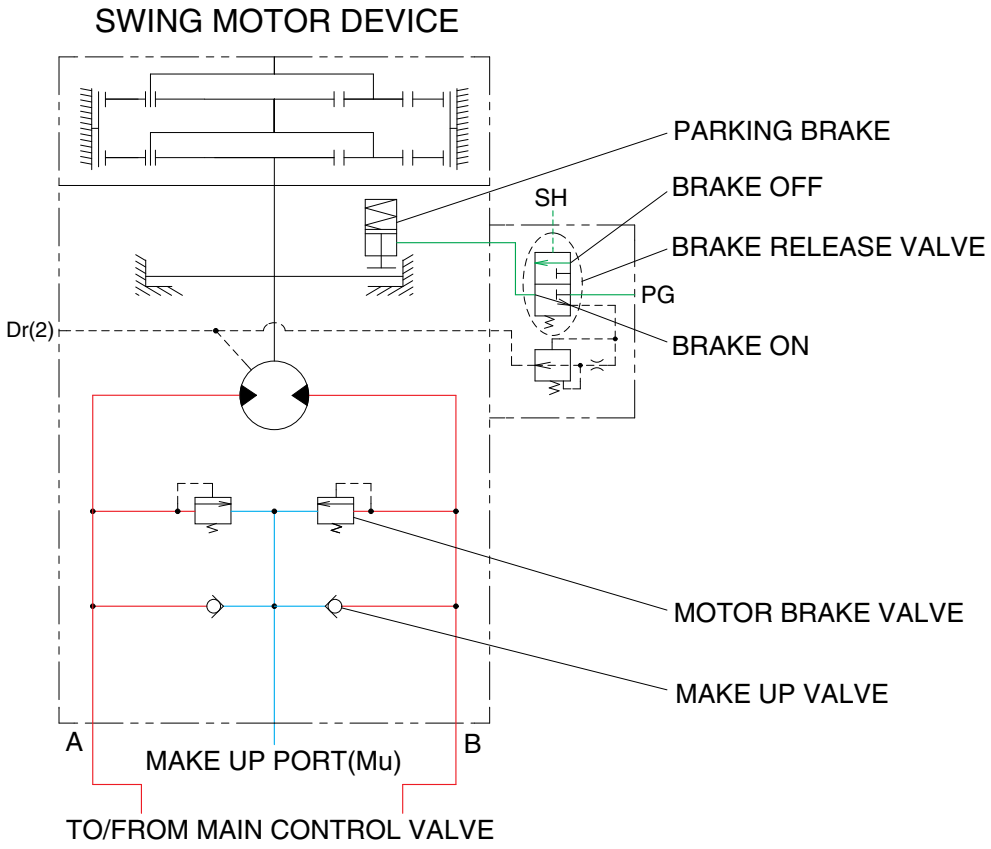
55W9A3HC12

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 motor. The cavitation which will happen to the swing motor is also prevented by the make up valve in the swing motor itself.

SWING CIRCUIT OPERATION



55W7HC13

1) MOTOR BRAKE VALVE

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

2) MAKE UP VALVE

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

3) PARKING BRAKE

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

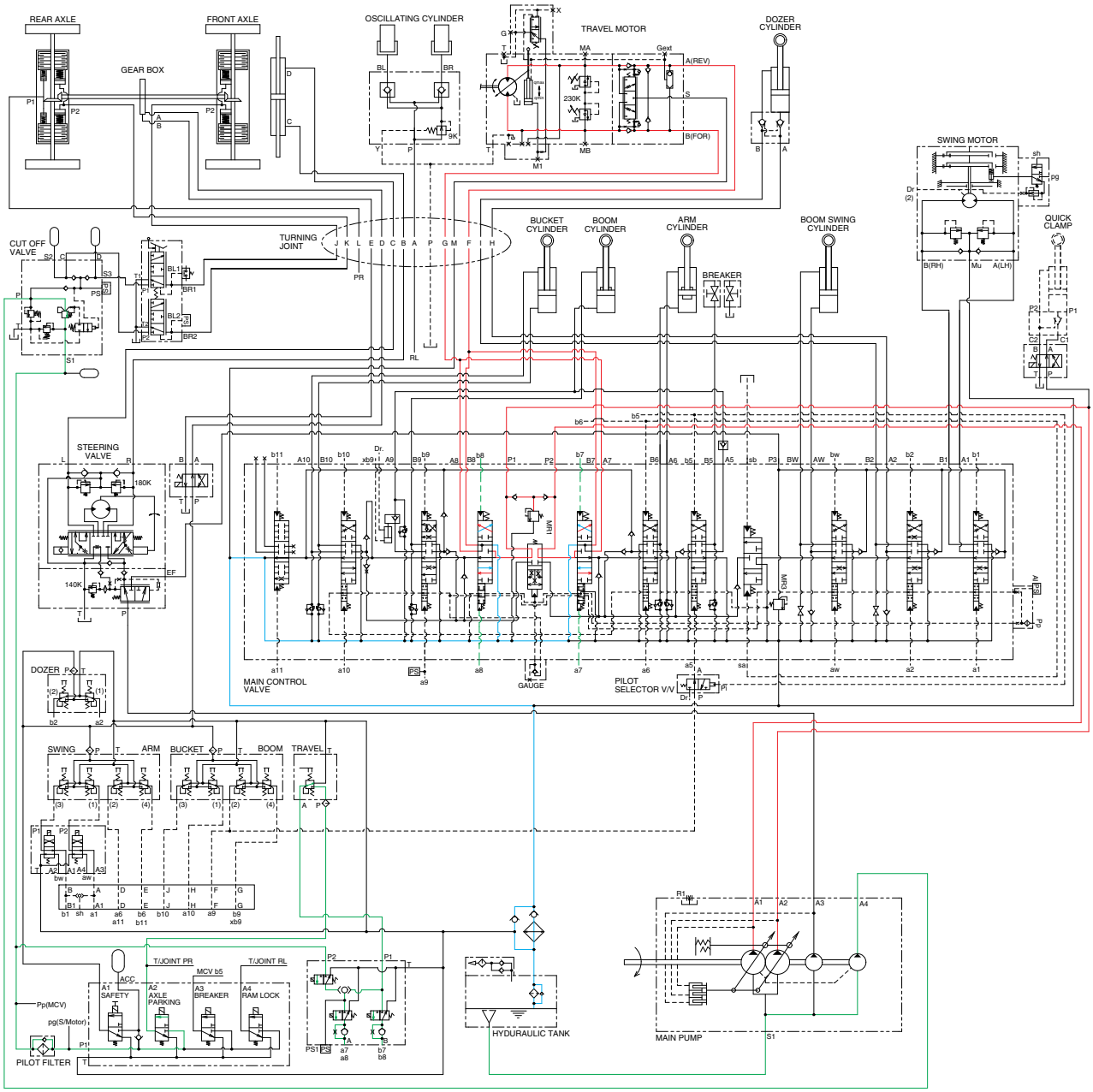
PARKING BRAKE "OFF" OPERATION

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

PARKING BRAKE "ON" OPERATION

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

8. TRAVEL FORWARD AND REVERSE OPERATION

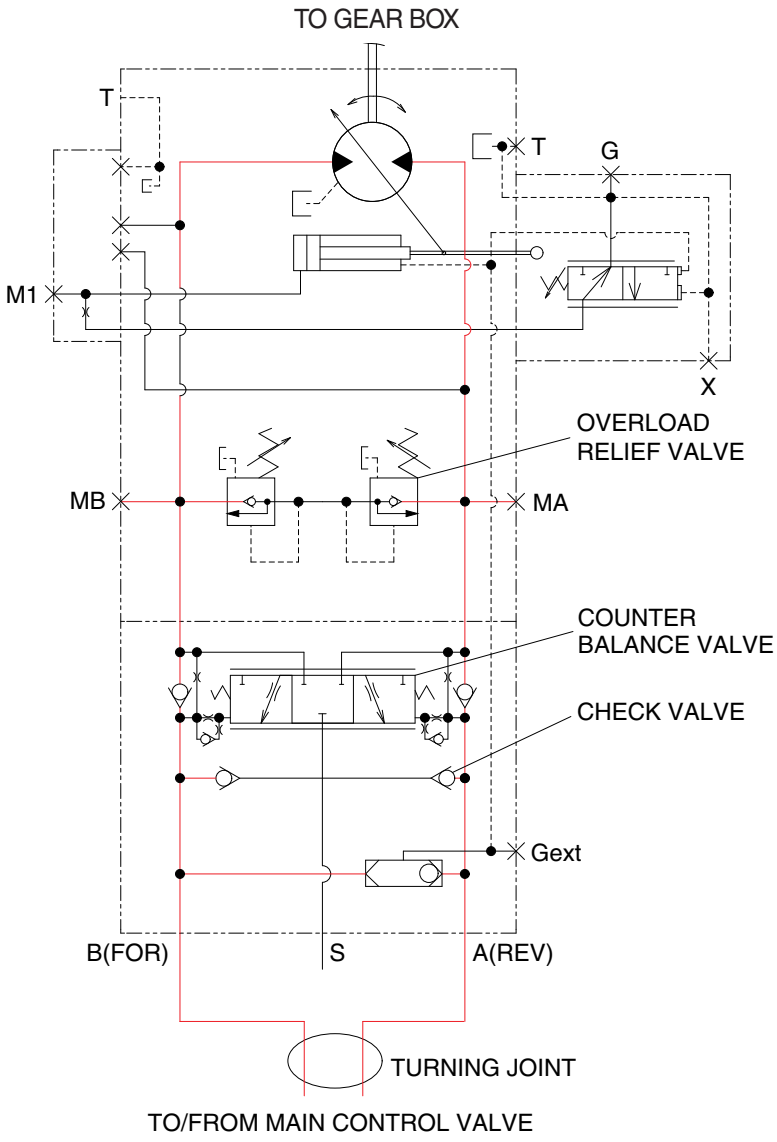


55W9A3HC14

When the RH multifunction switch is placed in forward or reverse position, the travel spool in the main control valve is moved to the forward or reverse position by the pilot oil pressure from pilot pump through the 5 solenoid valve and then goes to the travel Forward/Reverse solenoid valve. The oil from the both pumps (A1, A2) flows into the main control valve and then goes to the travel motor. At the same time, the oil returned from the travel motor returns to the hydraulic oil tank through the turning joint and travel spools in the main control valve.

When this happens, the machine moves forward or reverse.

TRAVEL CIRCUIT OPERATION



55W9A3HC15

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

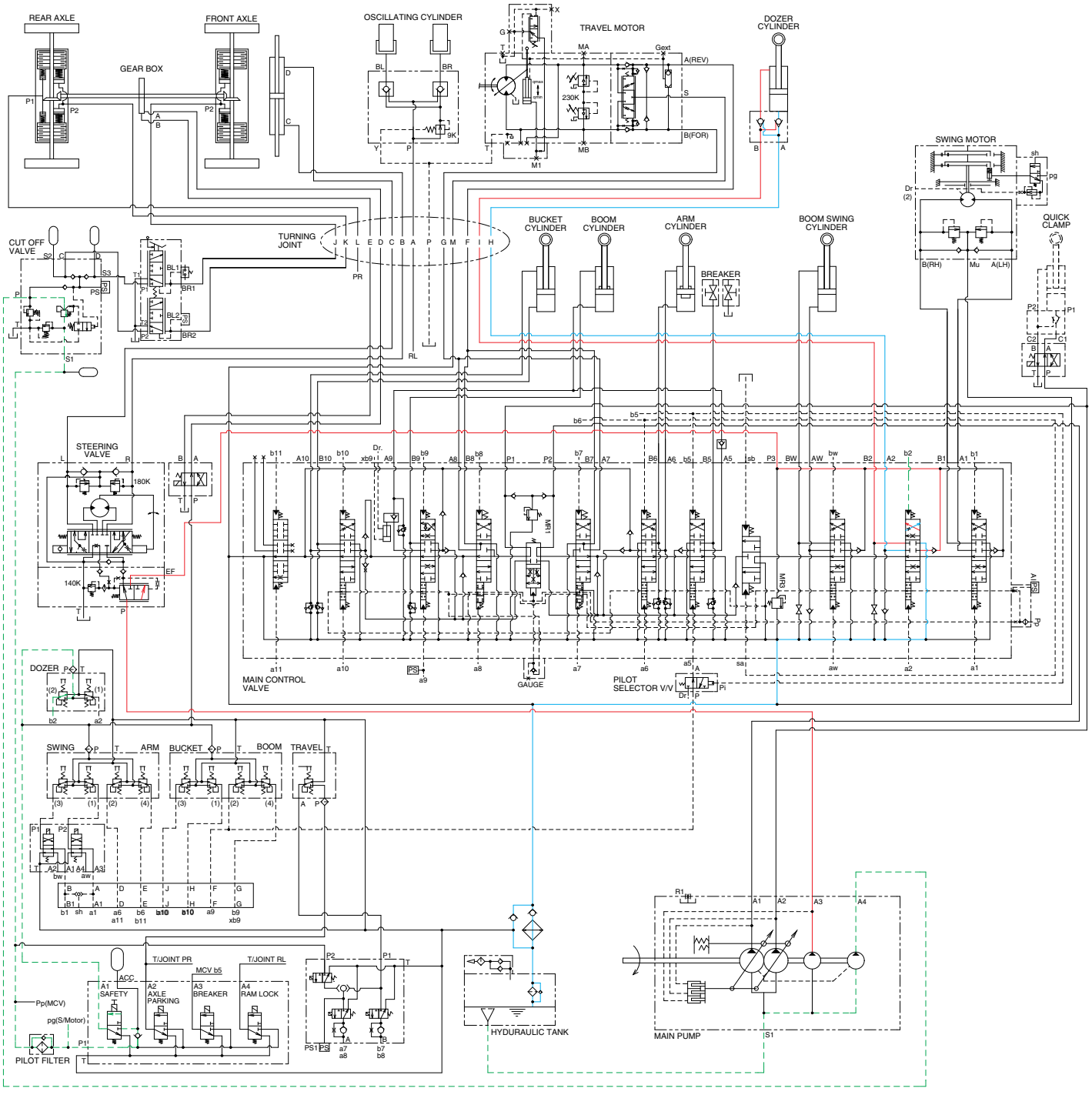
1) COUNTER BALANCE VALVE

When stopping the motor of slope descending, this valve to prevent the motor over run.

2) OVERLOAD RELIEF VALVE

Relief valve limit the circuit pressure below 230 kgf/cm^2 to prevent high pressure generated at at time of stopping the machine. Stopping the motor, this valve sucks the oil from lower pressure passage for preventing the negative pressure and the cavitation of the motor.

9. DOZER UP OPERATION



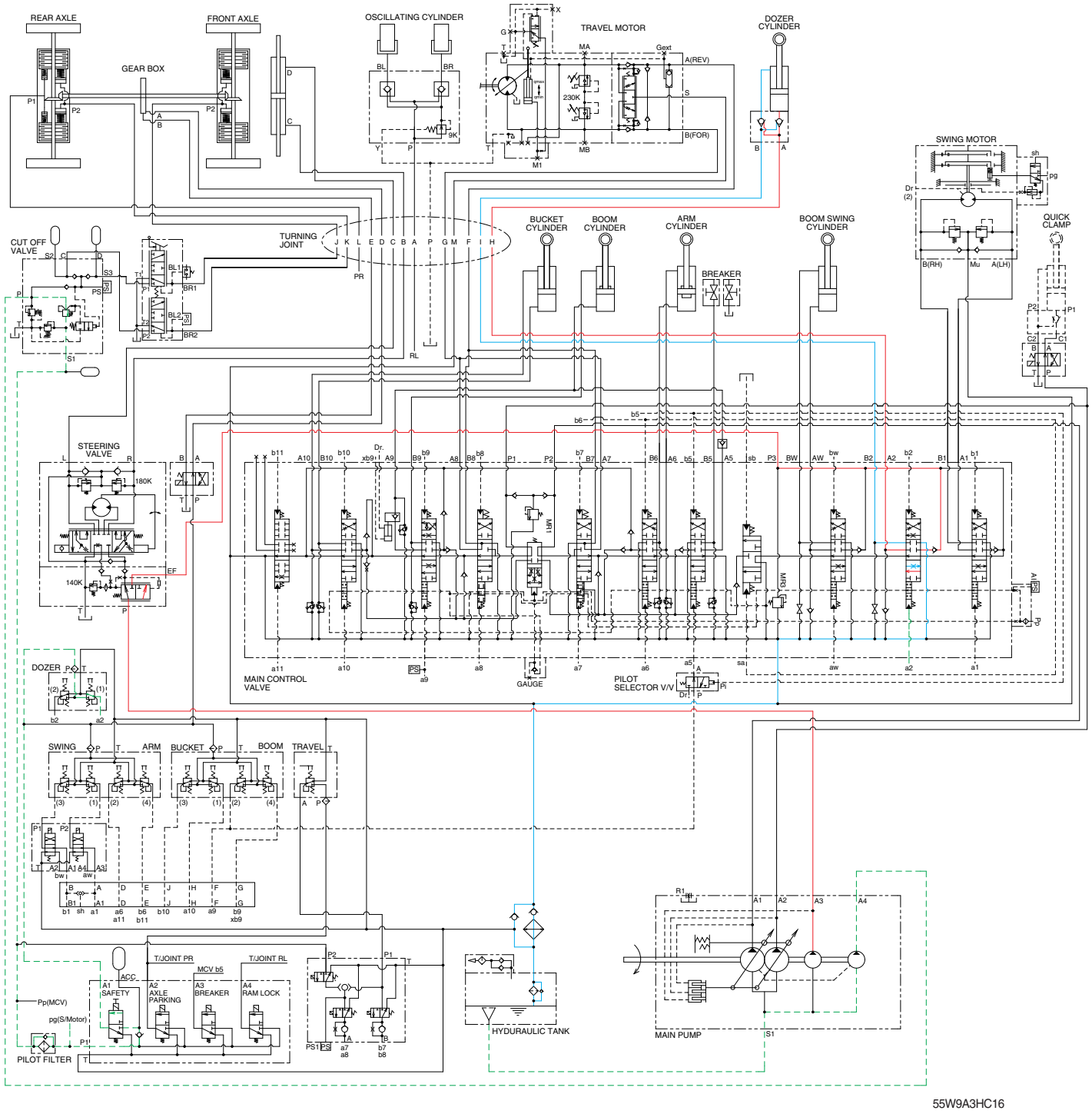
55W9A3HC17

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 cylinder.

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

10. DOZER DOWN OPERATION

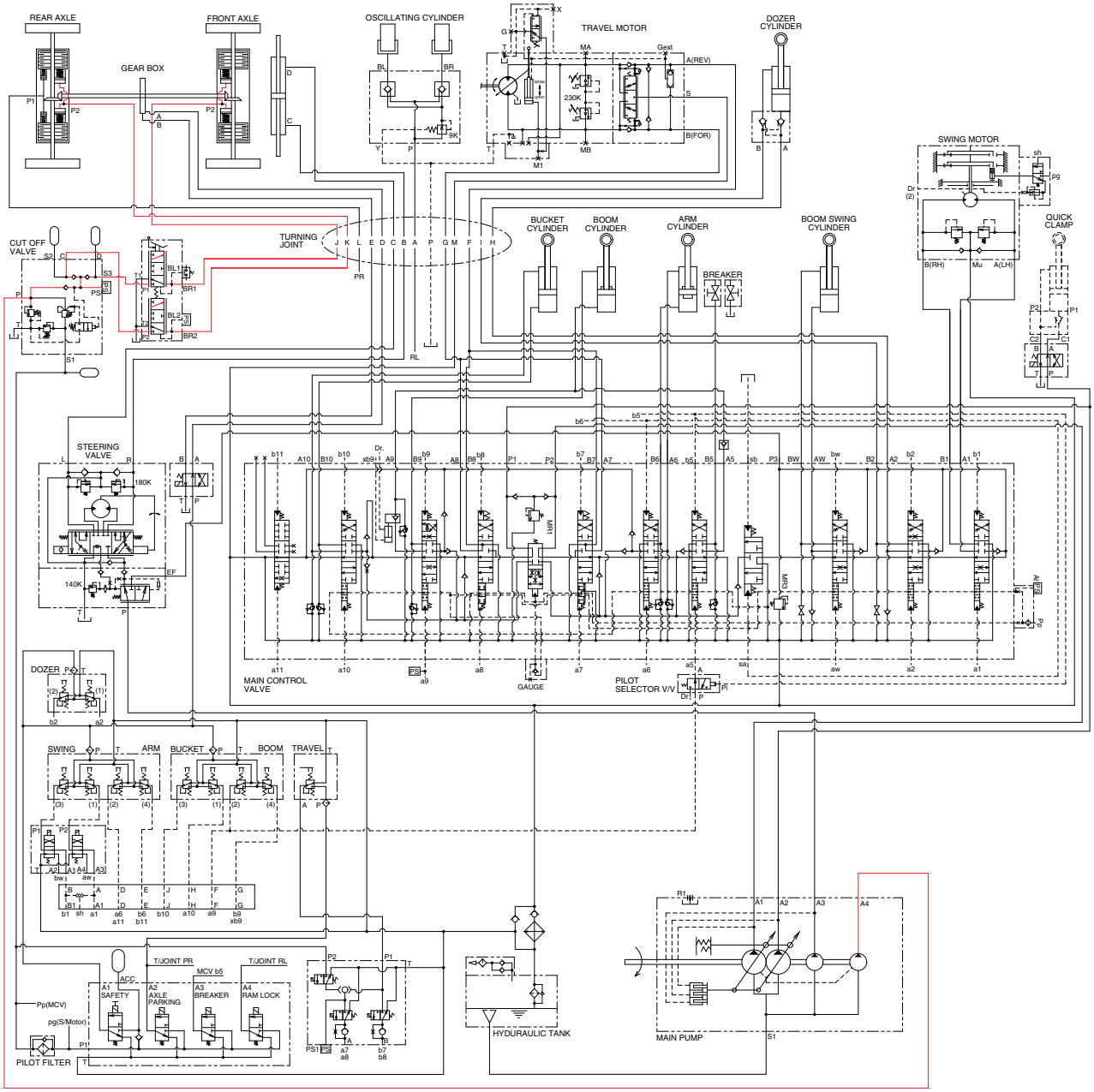


When the dozer control lever is pushed forward, the dozer spool in the main control valve is moved to the dozer down position by the pilot oil pressure from the remote control valve.

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

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

11. FRONT AND REAR AXLE BRAKE SYSTEM (SERVICE BRAKE)

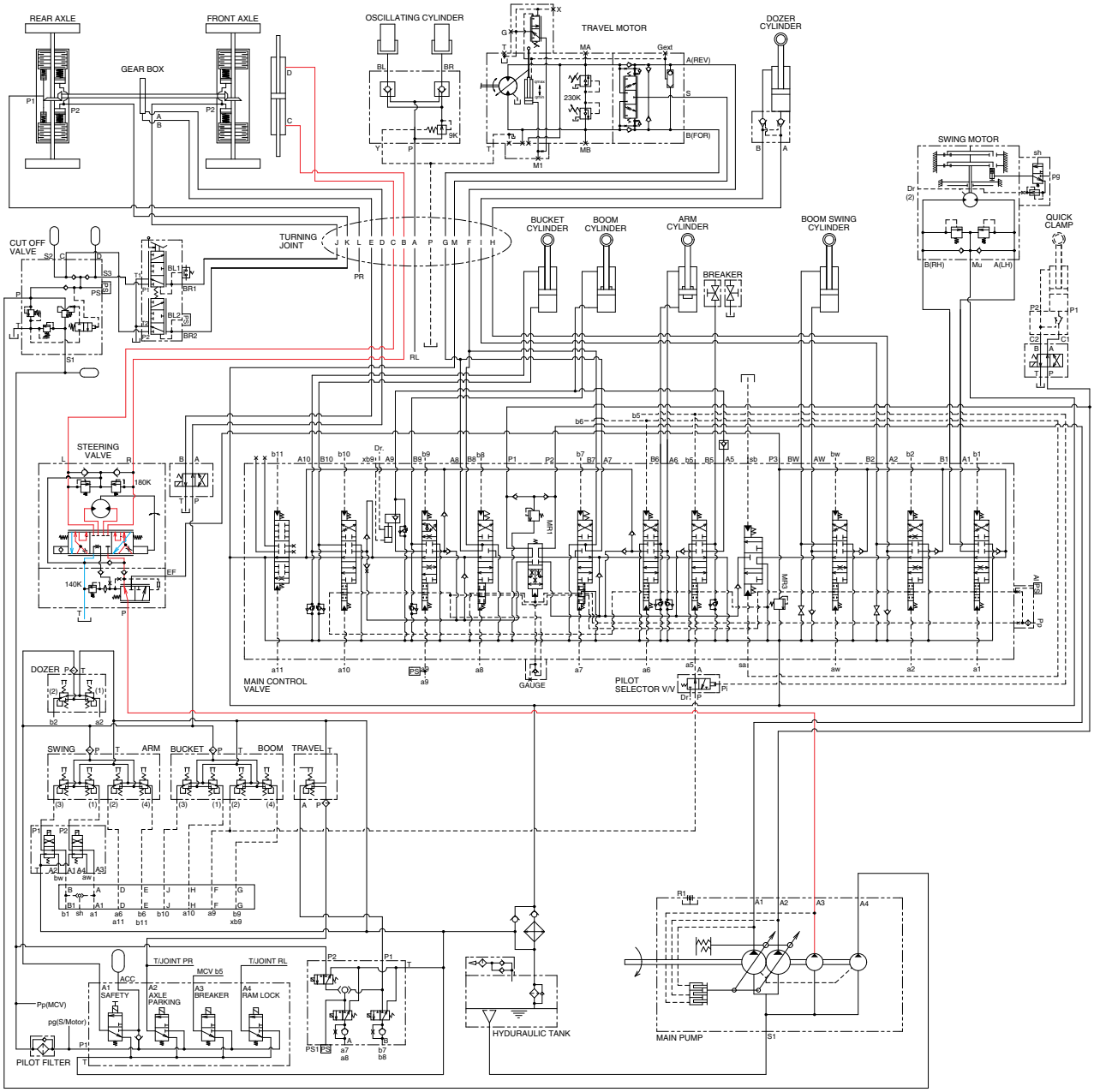


55W9A3HC18

When the brake pedal (valve) is pushed, the discharged oil from the pilot pump (P4) flows into the front and rear axle brake disc through the solenoid valve of cut-off valve.

This pressure is applied to axle brake disc, thus the brake is applied.

12. STEERING CIRCUIT OPERATION



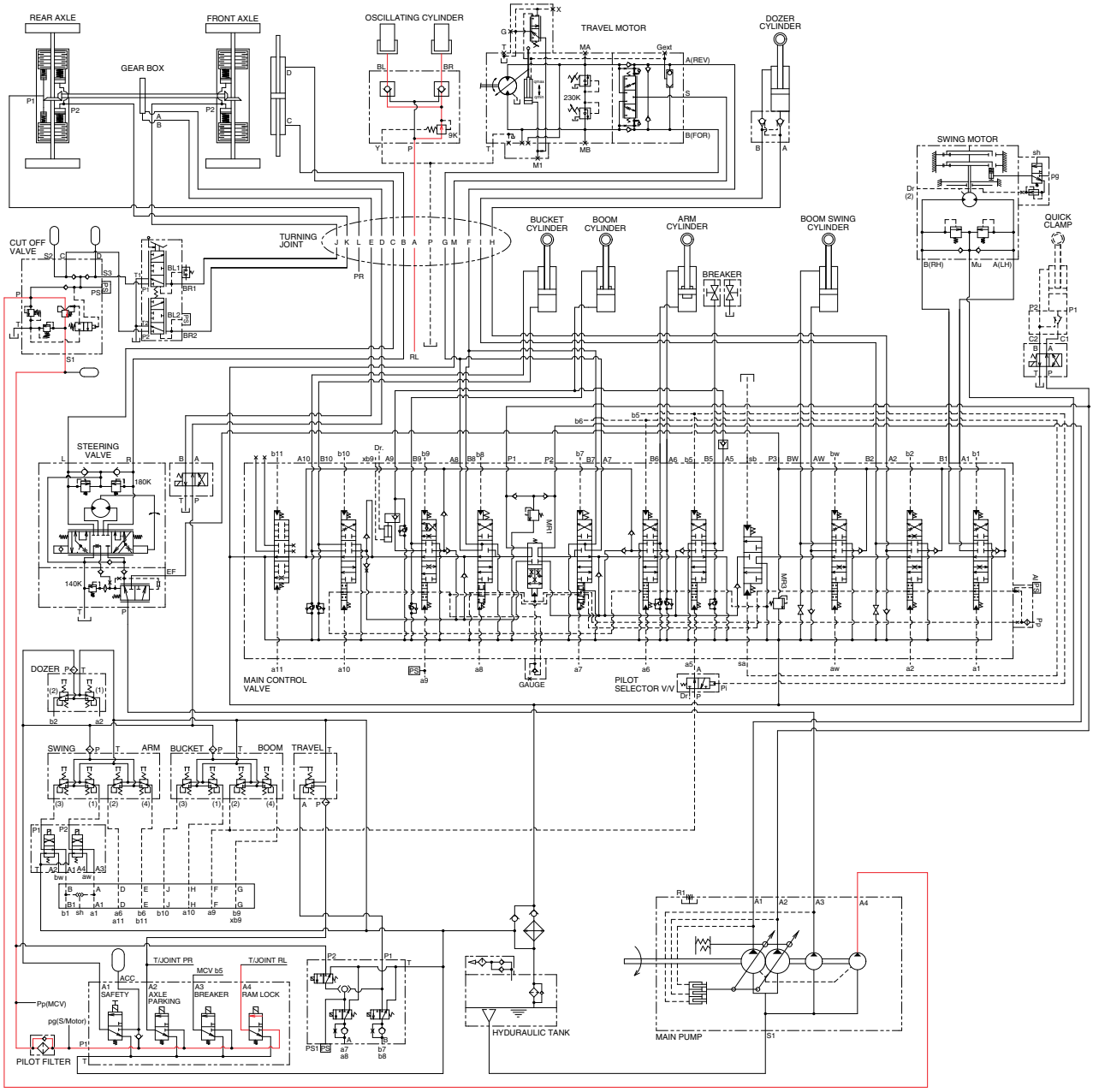
55W9A3HC19

When the steering wheel is turned to the left or right, the spool within the steering valve turns left or right hand direction : Because the spool is connected with steering column.

At this time, the oil discharged from the pump (A3) flows into steering cylinder through spool and gerotor within the steering valve.

Then the steering direction is applied.

13. RAM LOCK CIRCUIT OPERATION



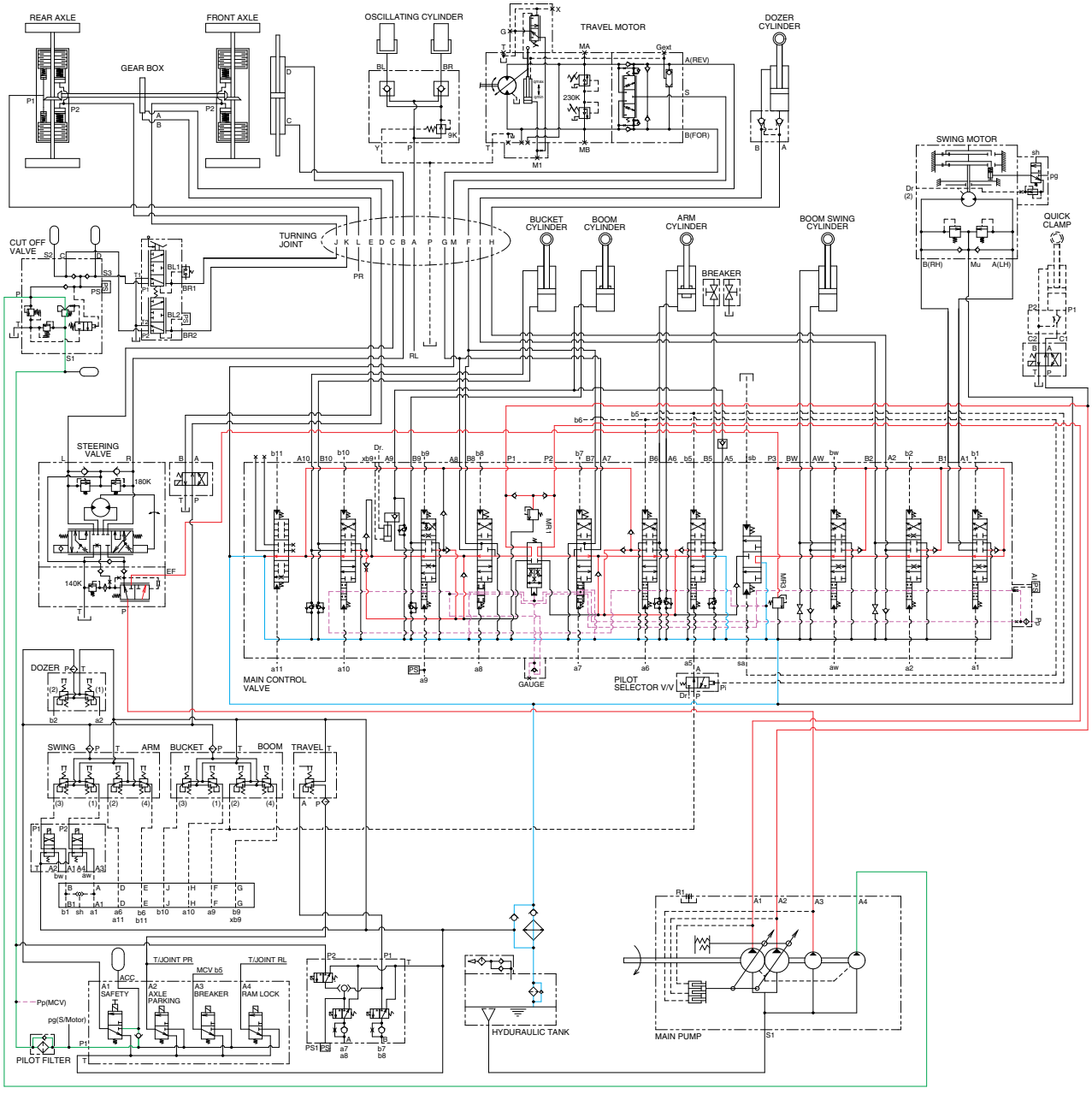
55W9A3HC20

When the ram lock switch is selected on the switch panel, the oil discharged from the pilot pump flows into oscillating cylinder through ram lock solenoid and locking valve.

This pressure is applied to check valve and oscillating cylinder, thus the oscillating function is operated (ram lock released).

GROUP 5 COMBINED OPERATION

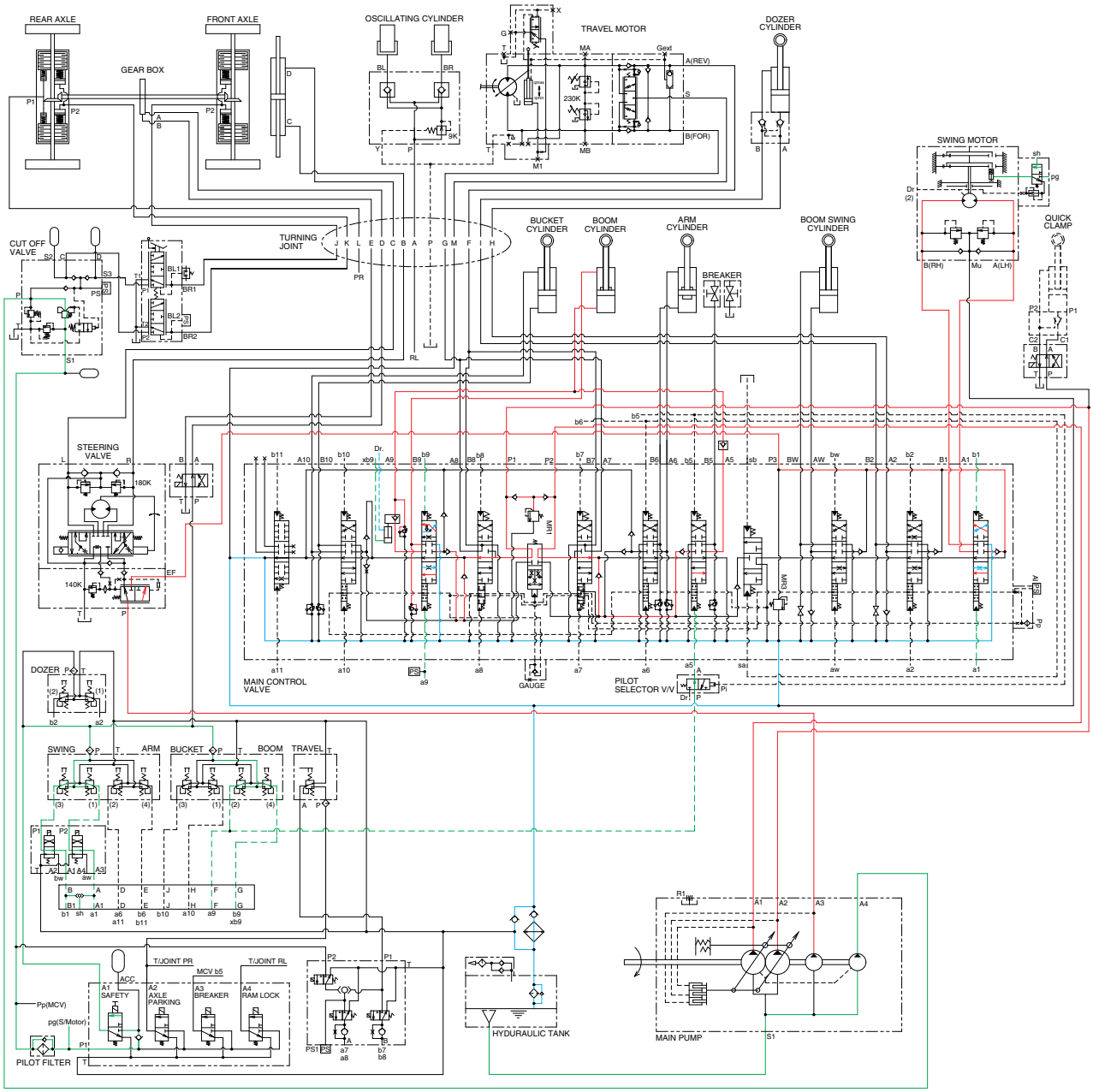
1. OUTLINE



55W9A3HC21

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.

2. COMBINED SWING AND BOOM OPERATION



55W9A3HC22

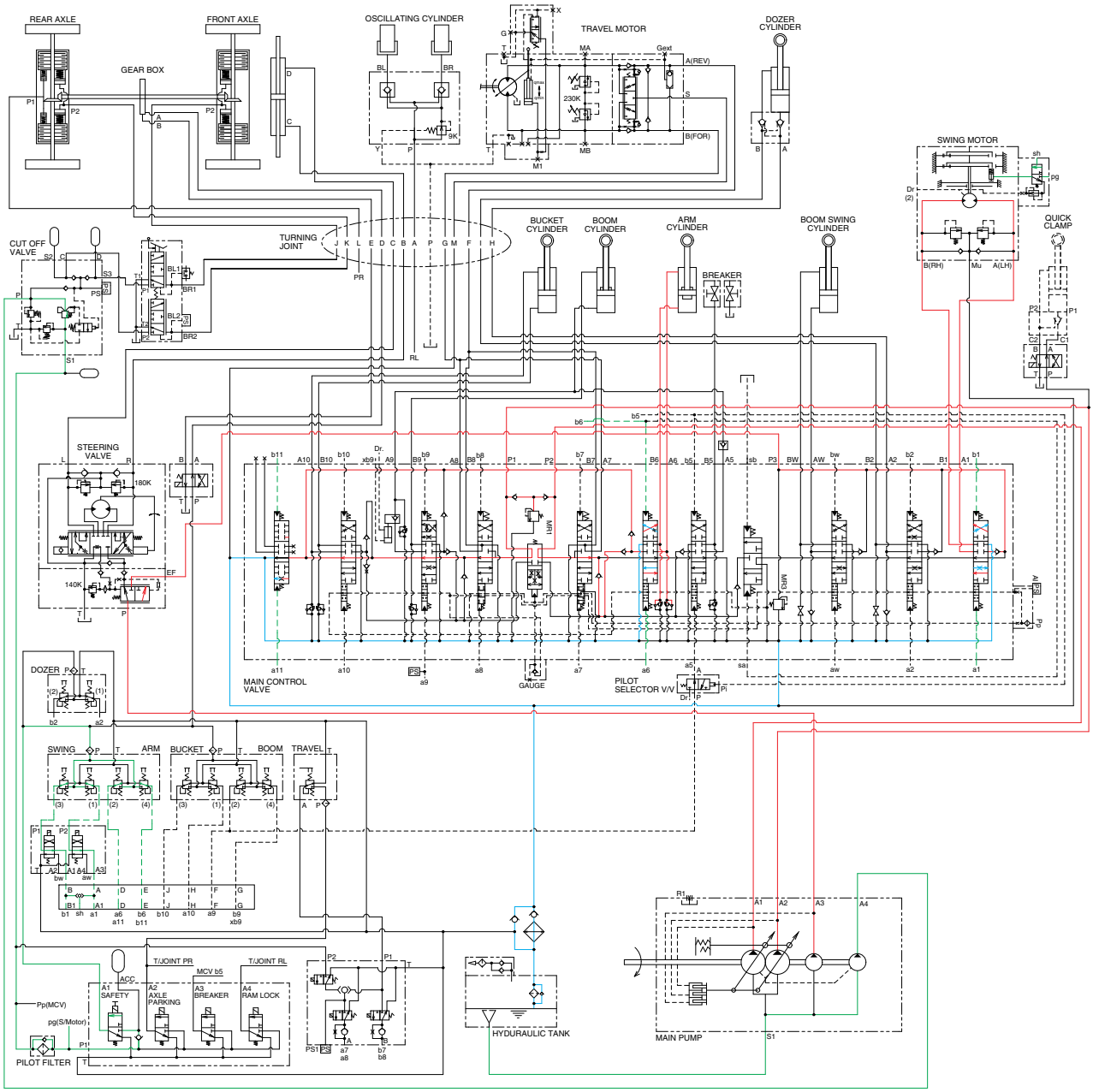
When the swing and boom functions are operated, simultaneously the swing spool and boom spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the A1 and A2 pump flows into the boom cylinder through boom 1 and boom 2 spool.

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

The superstructure swings and the boom is operated.

3. COMBINED SWING AND ARM OPERATION



55W9A3HC23

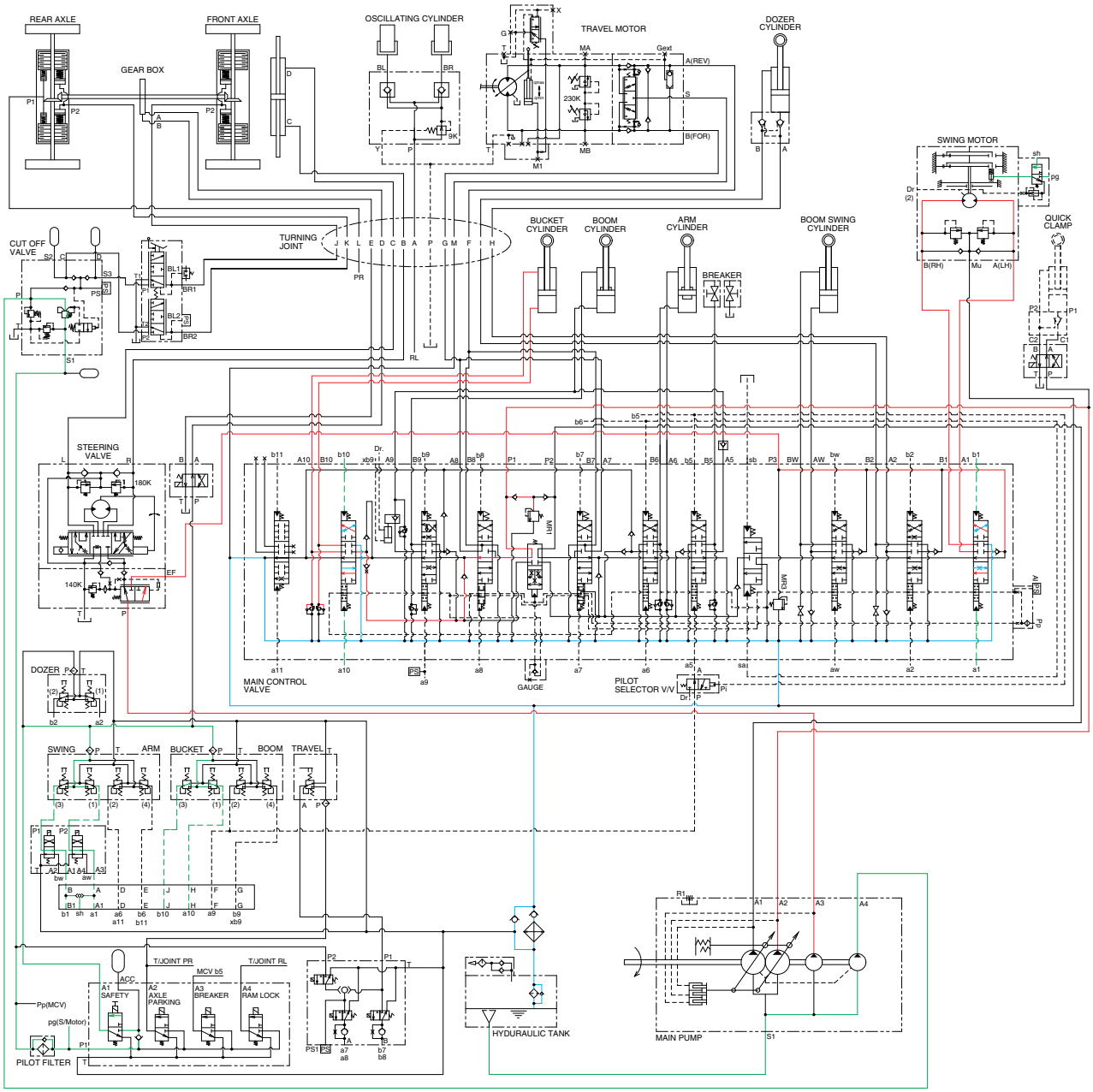
When the swing and arm functions are operated, simultaneously the swing spool and arm spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

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

The oil from the A1 and A2 pump flows into the arm cylinder through the arm 1 and arm 2 spool.

The superstructure swings and the arm is operated.

4. COMBINED SWING AND BUCKET OPERATION



55W9A3HC24

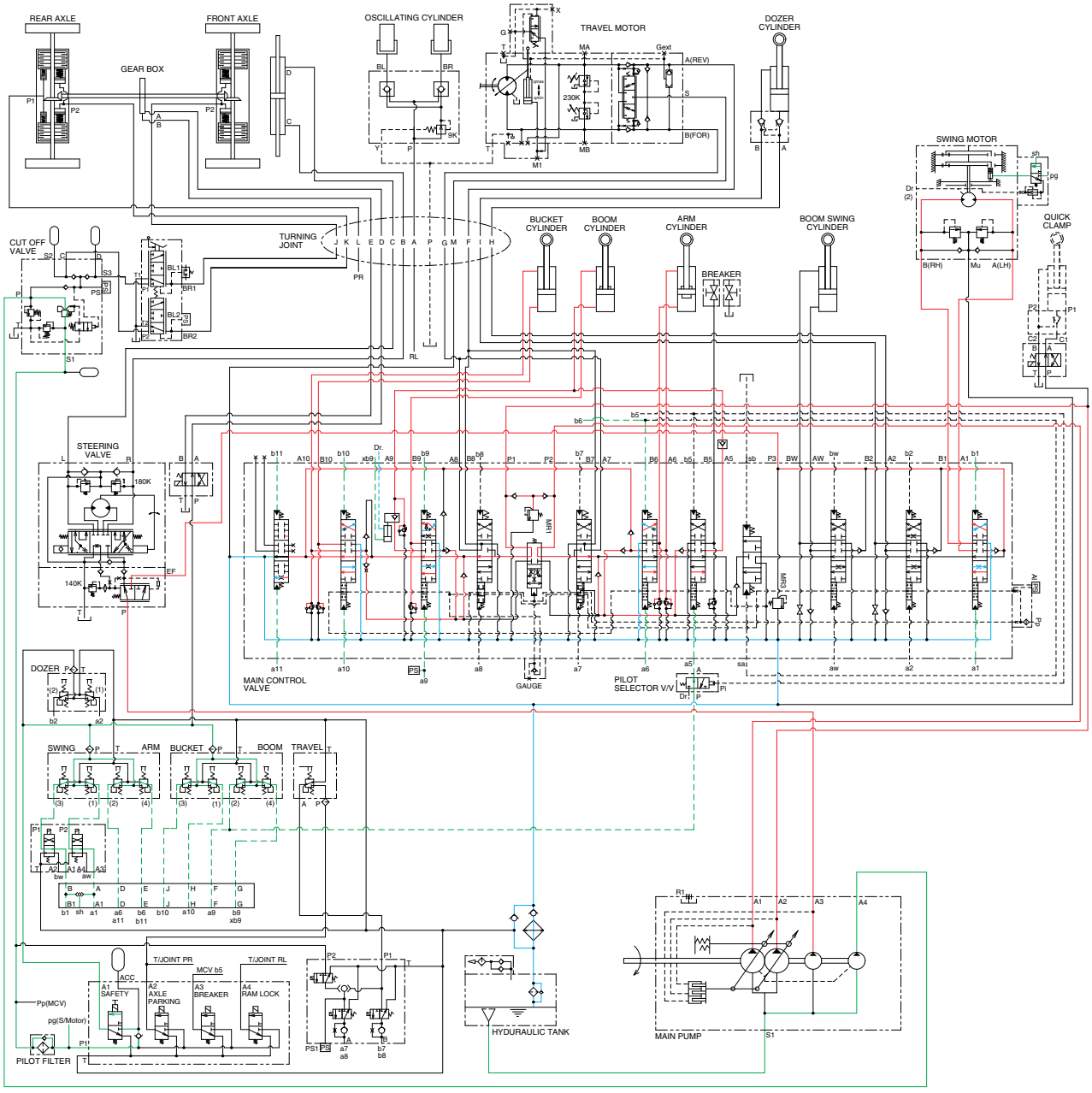
When the swing and bucket functions are operated, simultaneously the swing spool and bucket spool in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

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

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

The superstructure swings and the bucket is operated.

5. COMBINED SWING, BOOM, ARM AND BUCKET OPERATION



55W9A3HC25

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 boom cylinder, arm cylinder and bucket cylinder through boom 1 spool, arm 2 spool, bucket spool.

The oil from the A1 pump flows into the boom cylinder and arm cylinder through the boom 2 spool and arm 1 spool.

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

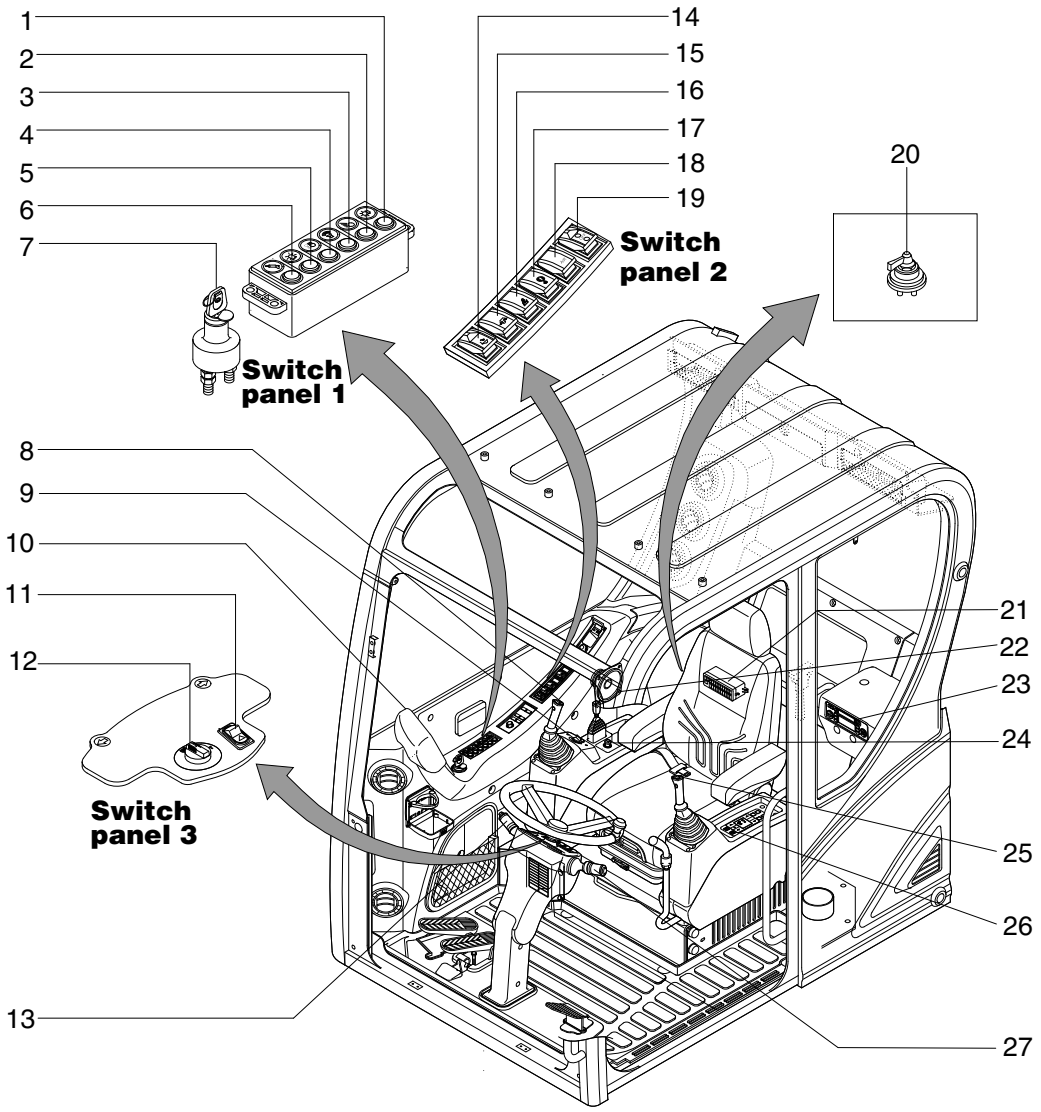
The superstructure swings and the boom, arm and bucket are operated.

SECTION 4 ELECTRICAL SYSTEM

SECTION 4 ELECTRICAL SYSTEM

GROUP 1 COMPONENT LOCATION

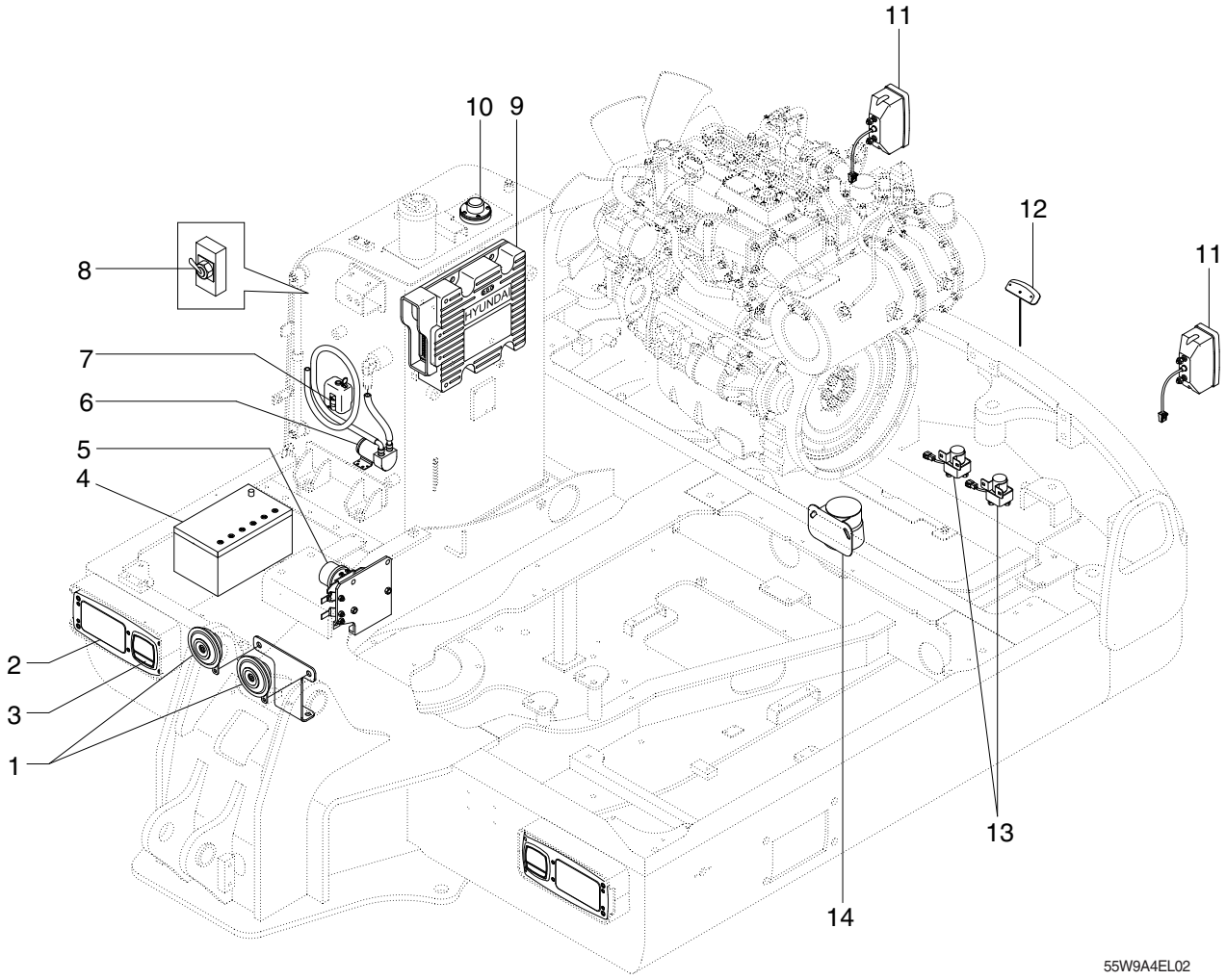
1. LOCATION 1



55W9A4EL01

1	Head light switch	10	Cluster	19	DPF switch
2	Work light switch	11	Hazard switch	20	Master switch
3	Travel alarm switch	12	Select switch	21	Fuse box
4	Cab light switch	13	Multifunction switch (RH)	22	Speaker
5	Beacon switch	14	Quick clamp switch (opt)	23	Radio & USB player
6	Breaker selection switch	15	Boom offset switch	24	Cigar light
7	Start switch	16	Auto ram lock switch	25	Horn switch
8	Breaker operation switch	17	Overload switch (opt)	26	Aircon and heater switch
9	Accel dial switch	18	Air compressor switch (opt)	27	Multifunction switch (LH)

2. LOCATION 2



1	Horn	6	Fuel filler pump	11	Combination lamp
2	Head lamp	7	Washer pump	12	Number plate lamp
3	Flasher position lamp	8	Filler pump toggle switch	13	Relays
4	Battery	9	Machine control unit (MCU)	14	Travel alarm buzzer
5	Battery relay	10	Fuel sender		

GROUP 2 MONITORING SYSTEM (machine serial No.:~#0578)

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

55W9A4EL20

3. CLUSTER FUNCTION

1) GAUGES AND DISPLAYS

(1) Operation screen

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

Default (A type)

559A3CD07A

Option (B type)

559A3CD07B

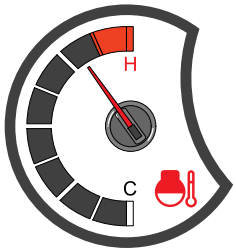
Option (C type)

559A3CD07C

1	Engine coolant temp gauge	3	Fuel level gauge	5	Accel dial
2	Hydraulic oil temp gauge	4	Engine rpm		

※ Operation screen type can be set by the screen type menu of the display.
Refer to page 4-22 for details.

(2) Engine coolant temperature gauge



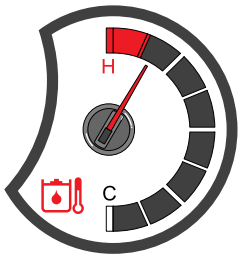
55I3CD07G

① This gauge indicates the temperature of coolant.
- Black range : 40-115˚C (104-239˚F)
- Red range : Above 115˚C (239˚F)

② If the indicator is in the red range or lamp lights ON in red, turn OFF the engine and check the engine cooling system.

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

(3) Hydraulic oil temperature gauge



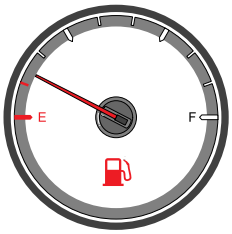
55I3CD07E

① This gauge indicates the temperature of hydraulic oil.
- Black range : 40-105˚C (104-221˚F)
- Red range : Above 105˚C (221˚F)

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

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

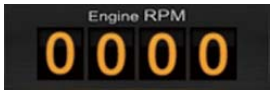
(4) Fuel level gauge



55I3CD07F

① This gauge indicates the amount of fuel in the fuel tank.
② Fill the fuel when the red range, or lamp lights ON in red.
※ **If the gauge indicates the red range or lamp lights ON in red even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.**

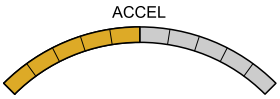
(5) Engine rpm display



559A3CD35

① This displays the engine speed.

(6) Accel dial display



55I3CD07C

① This displays acceleration dial level from 0 to 10 step.

3) COMMUNICATION ERROR AND LOW VOLTAGE WARNING POP-UP

(1) Communication error pop-up

559A3CD71

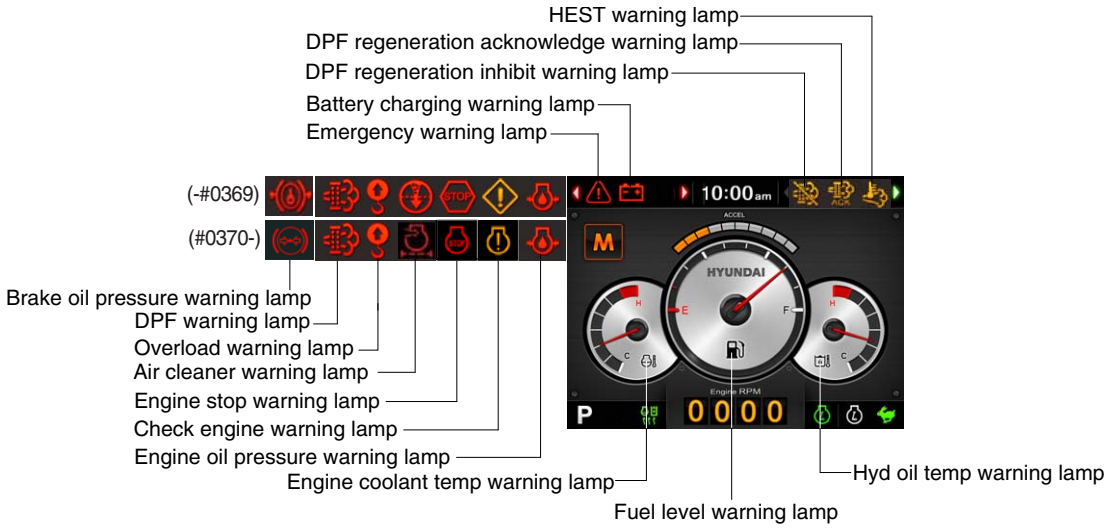
① Cluster displays this communication error pop-up when it has communication error with MCU.
② Communication error pop-up displays at operation screen only. Just buzzer alarm at the other screen.
③ If communication with MCU become normal state, it will disappear automatically.

(2) Low voltage warning pop-up

559A3CD72

① Cluster displays this low voltage warning pop-up when the battery voltage is low.
② Low voltage warning pop-up displays at operation screen only. Just buzzer alarm at the other screen.
③ This pop-up will disappear with using touch screen or buzzer stop switch. While the battery voltage is low, buzzer sounds every minute.
④ When the battery voltage is higher than 11.5 V, the pop-up off.

4) WARNING LAMPS

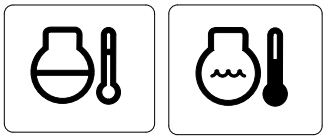


559A3CD08EA

※ **Each warning lamp on the left-top of the LCD pops up on the center of LCD and the buzzer sounds when the each warning is happened. The pop-up warning lamp moves to the original position and lights ON when the buzzer stop switch is pushed or the pop-up is touched. And the buzzer stops. Refer to page 4-14 for the switch.**

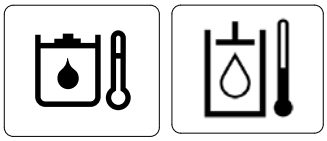
※ **When the warning lamps light ON more than 4, you can check all lamps with next page button (◀ , ▶) near the warning lamps.**

(1) Engine coolant temperature warning lamp



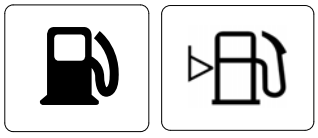
① The ⚠ lamp pops up on the center of LCD and the buzzer sounds when the engine coolant temperature is over 115˚C.
② The pop-up ⚠ lamp moves to the original position and lights ON when the buzzer stop switch is pushed or pop-up is touched. Also, the buzzer stops and lamp keeps ON.
③ Check the cooling system when the lamp keeps ON.

(2) Hydraulic oil temperature warning lamp



① The ⚠ lamp pops up on the center of LCD and the buzzer sounds when the hydraulic oil temperature is over 105˚C.
② The pop-up ⚠ lamp moves to the original position and lights ON when the buzzer stop switch is pushed or pop-up is touched. Also, the buzzer stops and lamp keeps ON.
③ Check the hydraulic oil level and hydraulic oil cooling system.

(3) Fuel level warning lamp



① This warning lamp lights ON and the buzzer sounds when the level of fuel is below 10%.
② Fill the fuel immediately when the lamp is ON.

(4) Emergency warning lamp

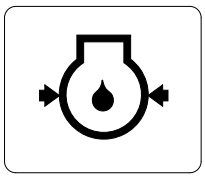
21093CD30

① This lamp pops up and the buzzer sounds when each of the below warnings are happened.
- Engine coolant overheating (over 115˚C)
- Hydraulic oil overheating (over 105˚C)
- MCU input voltage abnormal
- Accel dial circuit abnormal or open

※ **The pop-up warning lamp moves to the original position and lights ON when the buzzer stop switch is pushed or pop-up is touched. Also the buzzer stops.**
This is same as following warning lamps.

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

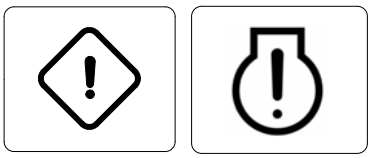
(5) Engine oil pressure warning lamp



21093CD32

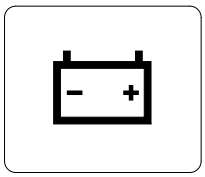
① This lamp lights ON when the engine oil pressure is low.
② If the lamp lights ON, shut OFF the engine immediately. Check oil level.

(6) Check engine warning lamp



① This lamp lights ON when the communication between MCU and engine ECM on the engine is abnormal, or if the cluster received any fault code from engine ECM.
② Check the communication line between them.
If the communication line is OK, then check the fault codes on the cluster.
③ Also, this lamp pops up when the level of DPF soot is high.
※ Refer to the page 4-8 for the DPF warning lamp.

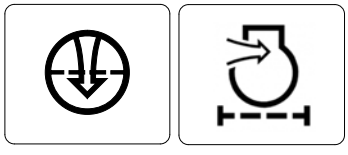
(7) Battery charging warning lamp



21093CD34

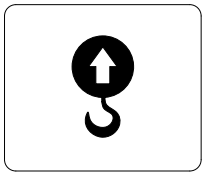
① This lamp lights ON when the battery charging voltage is low.
② Check the battery charging circuit when this lamp is ON.

(8) Air cleaner warning lamp



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

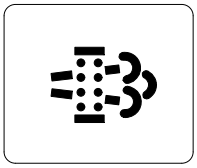
(9) Overload warning lamp (opt)



21093CD36

① When the machine is overload, the overload warning lamp lights ON during the overload switch is ON. (if equipped)
② Reduce the machine load.
Initiate a manual regeneration

(10) DPF (diesel particulate filter) warning lamp



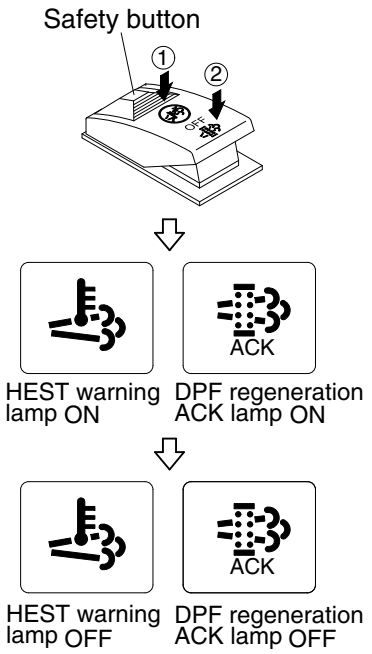
2609A3CD19

① This warning lamp lights ON or OFF when the regeneration is needed.
② This warning lamp lights ON while DPF regeneration inhibit switch is in "Regeneration ingibited" state, when stationary regeneration is permitted.
③ This warning lamp lights ON during reset regeneration standby or in back up mode.
④ This warning lamp lights flash during reset regeneration standby DPF regeneration inhibit switch is in "Regeneration inhibited" state.

※ Consequences of delaying regeneration
- Poor performance caused by increasing exhaust gas pressure.
- Higher fuel consumption
- Shorter filter lifetime

Condition	Warning lamp			Remedy
	DPF	Check engine (pop up)	Stop engine (pop up)	
Normal	Off	Off	Off	· Automatic regeneration
Soot low	On	Off	Off	· Push DPF switch to OFF position if DPF switch is in inhibit position. · Engine power may be reduced automatically (soot medium)
Soot midium	Blink	Off	Off	
Soot high	On	On	Off	· Engine power and speed will be reduced automatically · Initiate a manual regeneration
Stop	On	Off	On	· Stop the engine immediatary. · Please contact your Hyundai service center or local dealer.

※ Manual regeneration method of DPF



559A3CD143

※ Manual regeneration applies if the machine is in a fireproof area and there is no plan to turn off the maching during the regeneration.

① Stop and park the machine.

② The accel dial to the lowerest position and operate the engine in idling.

③ Pull the safety button and push the switch to position ② to initiate the manual regeneration of DPF.

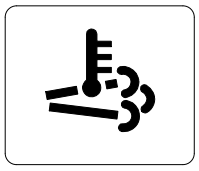
※ Refer to the page 4-62 for the switch operation.

※ The engine speed may increase gradually to high idle rpm and DPF regeneration begins and it will take approximately 25~30 minutes.

④ When the manual regeneration starts, the DPF warning lamp turns OFF and the regeneration acknowledge lamp and HEST warning lamp will light ON during the regeneration function is operating.

⑤ The regeneration acknowledge lamp and HEST warning lamp will light OFF when the regeneration function is completed.

(11) **HEST** (High exhaust system temperature) **warning lamp**



2609A3CD21

① This warning lamp indicates, when illuminated, that exhaust temperatures are high due to regeneration of the DPF.

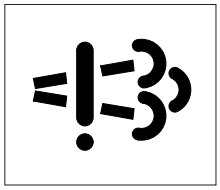
② The lamp will also illuminate during a manual regeneration.

③ When this lamp is illuminated, be sure the exhaust pipe outlet is not directed at any surface or material that can melt, burn, or explode.

⚠ When this lamp is illuminated, the exhaust gas temperature could reach 600˚C [1112˚F], which is hot enough to ignite or melt common materials, and to burn people.

※ The lamp does not signify the need for any kind of equipment or engine service; It merely alerts the equipment operator to high exhaust temperatures. It will be common for the lamp to illuminate on and off during normal equipment operation as the engine completes regeneration.

(12) Emission system fail warning lamp



300A3CD15

① This warning lamp indicates there are faults related to the emission system.

② The lamp lights ON when each of the below warnings is happened.

a. The EGR valve malfunctions.

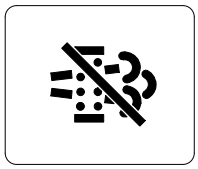
b. Electrical malfunction of the EGR control sensors. (disconnection, short)

c. Tampering with the EGR control sensors.

③ This warning lamp can be shown together with DPF warning lamp or engine fail lamp or engine stop warning lamp when diagsis DPF systems.

※ Please contact your Hyundai service center or local dealer.

(13) DPF regeneration inhibit warning lamp

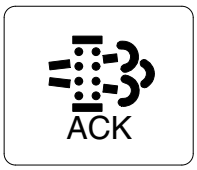


2609A3CD20

① This warning lamp indicates, when illuminated, the DPF switch is pushed inhibit position, therfore automatic and manual regeneration can not occur.

※ **Refer to the page 4-62 for the DPF switch.**

(14) DPF regeneration acknowledge warning lamp



559A3CD10

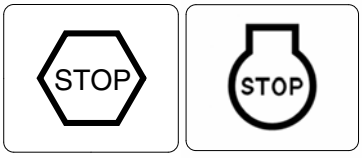
① This warning lamp lights ON stationary regeneration is in process.

② This warning lamp lights ON, when stationary regeneration is in process after DPF regeneration request switch is pressed and hold for more than 3 seconds.

③ This warning lamp lights flash when stationary regeneration standby or regeneration interlock switch is in "regeneration permitted (interlock enabled) status.

④ This warning lamp lights flash while stationary regeneration standby or back mode, when DPF regeneration inhibit switch in "Regeneration permitted" status and regeneration interlock switch is in regeneration permitted status.

(15) Stop engine warning lamp

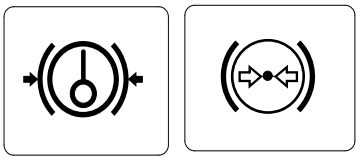


① If the lamp lights ON, stop the engine immediately and check the engine.

② Check the fault codes on the monitor.

※ **Please contact your Hyundai service center or local dealer.**

(16) Brake oil pressure warning lamp

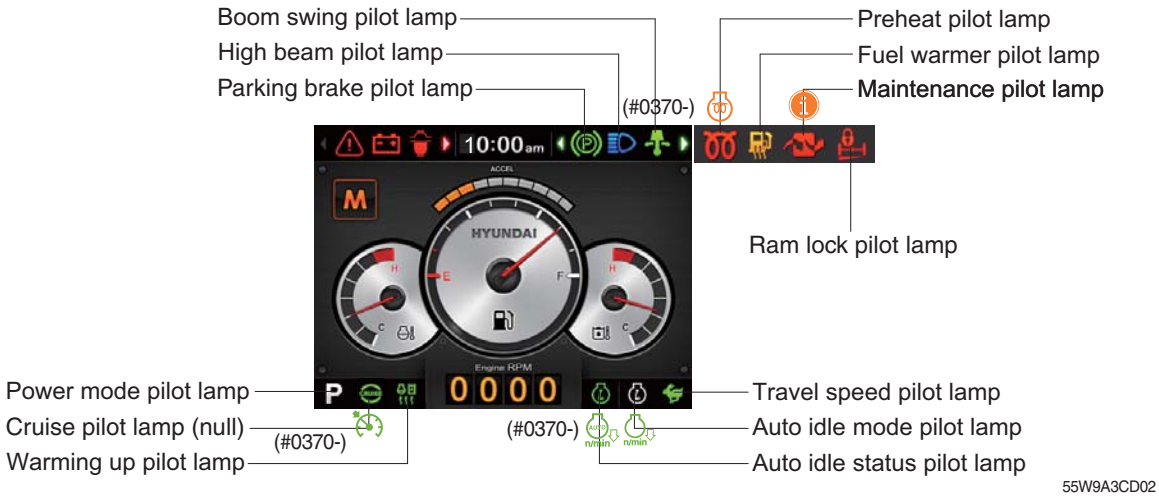


① The lamp lights ON when the oil pressure of service brake drops below the normal range.

② When the lamp is ON, stop the engine and check for its cause.

※ **Do not operate until any problems are corrected.**

5) PILOT LAMPS



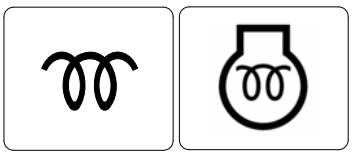
55W9A3CD02

※ **When the pilot lamps light ON more than 3, you can check all lamps with next page button (◀ , ▶).**

(1) Mode pilot lamps

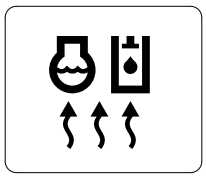
No	Mode	Pilot lamp	Selected mode
1	Power mode	P	Heavy duty power work mode
		S	Standard power mode
2	Travel mode		Low speed traveling
			High speed traveling
3	Auto idle mode		Auto idle status
			Auto idle mode

(2) Preheat pilot lamp



① Turning the start key switch ON position starts preheating in cold weather.
② Start the engine after this lamp is OFF.

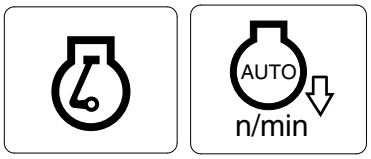
(3) Warming up pilot lamp



21093CD40

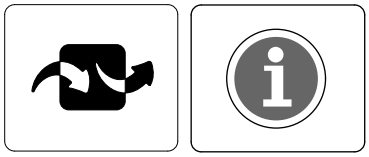
① This lamp is turned ON when the coolant temperature is below 30˚C(86˚F).
② The automatic warming up is cancelled when the engine coolant temperature is above 30˚C, or when 10 minutes have passed since starting the engine.

(4) Auto idle status/ mode pilot lamp



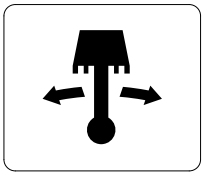
① The auto idle pilot lamp will be ON when the idle mode is selected.
② The auto idle status pilot lamp will be ON when all levers and pedals are at neutral position, and the auto idle mode is selected.

(5) Maintenance pilot lamp



① This lamp will be ON when the consuming parts are needed to change or replace. It means that the change or replacement interval of the consuming parts remains below 30 hours.
② Check the message in maintenance information of main menu. Also, this lamp lights ON for 3 minutes when the start switch is ON position.
※ **Refer to the page 4-20.**

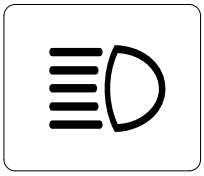
(6) Boom swing pilot lamp



559A3CD31

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

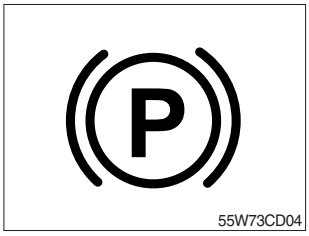
(7) High beam pilot lamp



55WI3CD50

① This lamp works when the illuminating direction is upward.
② This lamp comes ON when the dimmer switch is operated, e.g, when passing another vehicle.

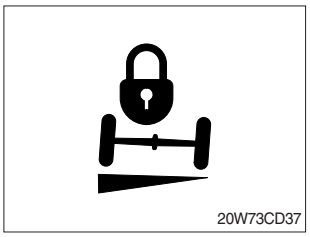
(8) Parking brake pilot lamp



55W73CD04

① When the parking brake is actuated, the lamp lights ON.
※ **Check the lamp is OFF before driving.**

(9) Ram lock pilot lamp



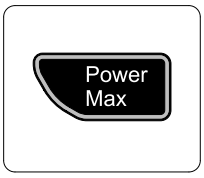
① This pilot lamp lights ON when ram lock switch is rear position.
② Also, the pilot lamp lights ON when the parking switch is ON or service brake is applied.

6) SWITCHES

559A3CD47

※ **When the switches are selected, the pilot lamps are displayed on the LCD. Refer to the page 4-11 for details.**

(1) Power mode switch

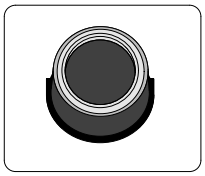


559A3CD25

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

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

(2) Select switch



55I3CD50C

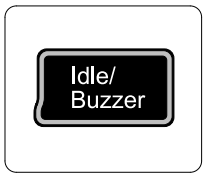
① This switch is used to select or change the menu and input value.

② Knob push
- Long (over 2 sec) : Return to the operation screen
- Medium (0.5~2 sec) : Return to the previous screen
- Short (below 0.5 sec) : Select menu

③ Knob rotation

This knob changes menu and input value.
- Right turning : Down direction / Increase input value
- Left turning : Up direction / Decreased input value

(3) Auto idle/ buzzer stop switch



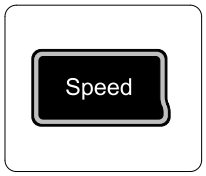
559A3CD50D

① This switch is used to activate or cancel the auto idle function.

※ **Refer to the page 4-12 for details.**

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

(4) Travel speed control switch

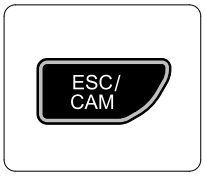


55I33CD50B

① This switch is used to select the travel speed alternatively.

- : Low speed
- : High speed

(5) Escape/ Camera switch



559A3CD50E

① This switch is used to return to the previous menu or parent menu.

② In the operation screen, pushing this switch will display the view of the camera on the machine (if equipped).
Please refer to page 4-24 for the camera.

③ If the camera is not installed, this switch is used only ESC function.

7) MAIN MENU

· Operation screen

559A3CD32A

559A3CD32B

559A3CD32C

Tap **M** or Press

Press ESC/CAM

Main menu screen

559A3CD32D

Sub menu screen

559A3CD32E

※ **Please refer to select switch, page 4-14 for selection and change of menu and input value.**

(1) Structure

No	Main menu	Sub menu	Description
1	 Monitoring 55I3CD51A	Active fault - Machine Active fault - Engine Logged fault - Machine Logged fault - Engine Monitoring (Analog) Monitoring (Digital) - Input Monitoring (Digital) - Output	MCU ECU MCU ECU Machine information Switch status Output status
2	 Management 55I3CD51B	ESL mode setting Change password Maintenance information Machine Information A/S phone number Service menu	ESL mode setting Password change Replacement, Change interval oils and filters Cluster, MCU, Engine, Machine A/S phone number, A/S phone number change Delete logged faults, Software download, Operating hour, power shift
3	 Display 55I3CD51C	Clock Screen type Brightness setting Unit setting Language Calibration	Clock A type, B type, C type Manual, Auto Temperature, Pressure 12 language Calibrating the touch screen
4	 Utilities 55I3CD51D	Camera setting Mode Video	Number of active, Display order, Camera No. Operation mode select Play music and video file

(2) Monitoring

① Active fault - Machine

559A3CD50 559A3CD50A

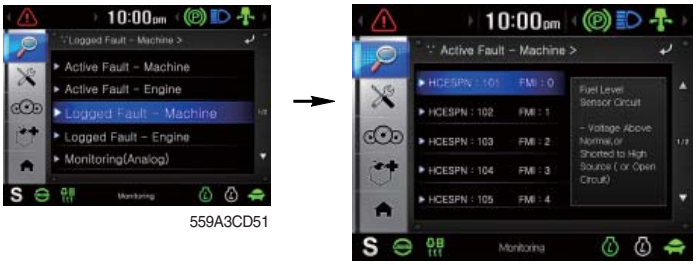
· The active faults of the MCU can be checked by this menu.

② Active fault - Engine

559A3CD50B 559A3CD50C

· The active faults of engine ECU can be checked by this menu.

③ Logged fault - Machine/ Engine



559A3CD51 559A3CD50A

· The logged faults of the MCU or engine ECU can be checked by this menu.
· Only for the service person.

④ Monitoring (Analog)

559A3CD52 559A3CD52A

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

⑤ **Monitoring** (Digital) - **Input**

559A3CD53

559A3CD53A

· The switch status can be confirmed by this menu.
· The activated switchs are blue light ON.

⑥ **Monitoring** (Digital) - **Output**

559A3CD54

559A3CD54A

· The output status can be confirmed by this menu.
· The output pilot lamps are blue light ON.

(3) Management

① ESL mode setting

559A3CD55

559A3CD55A

559A3CD55B

· **ESL mode setting**

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

  Enable (always) : The password is required whenever the operator starts engine.

  Enable (Interval): The password is required when the operator starts engine first. But the operator can restart the engine within the interval time without inputting the password. The interval time can be set maximum 2 days.

  ※**Default password : 00000**

  ※**Password length : 5~10 digit**

② Change password

- The password is 5~10 digits.

559A3CD56

559A3CD56A

Enter the current password

559A3CD56B

Enter the new password

559A3CD56C

Enter the new password again

559A3CD56D

The new password is stored in the MCU.

③ Maintenance information

559A3CD57 559A3CD57A 559A3CD57B

- Elapse : Maintenance elapsed time.
- Interval : The change or replace interval can be changed in the unit of 50 hours.
- History-Hour : Maintenance replacement history.
- Replacement : The elapsed time will be reset to zero (0).
- **Change or relpace interval**

No	Item	Interval
1	Engine oil	500
2	Final gear oil	1000
3	Swing gear oil	1000
4	Hydraulic oil	5000
5	Pilot line filter	1000
6	Hydraulic oil return filter	1000
7	Engine oil filter	500
8	Fuel filter	500
9	Pre-filter	500
10	Hydraulic tank breather	250
11	Air cleaner	500
12	Radiator coolant	2000
13	Swing gear pinion grease	1000

④ Machine Information

559A3CD58 559A3CD58A

- This can confirm the identification of the cluster, MCU, engine and machine.

⑤ A/S phone number

559A3CD59 559A3CD59A 559A3CD59B

· The A/S phone number can be checked and changed.

⑥ Service menu

559A3CD60 Enter the password 559A3CD60A 559A3CD60B

· Delete logged fault : Logged faults of MCU or engine ECU can be deleted.
· S/W download : Update and display software about operating system, application, image and font.
· Operating hours : Operating hours since the machine line out can be checked.
· Power shift : Set power shift mode (standard/option)

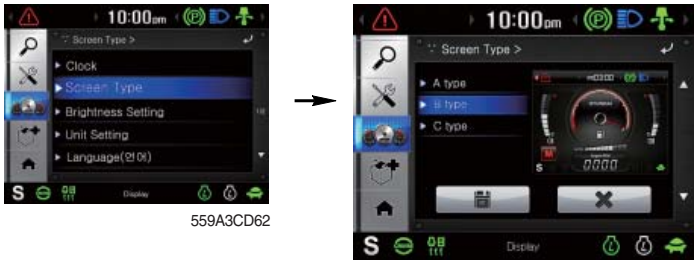
(4) Display

① Clock

559A3CD61 559A3CD61A

· The first line's three spots "****－**－**" represent Year/Month/Day each.
· The second line shows the current time. (AM, PM/0:00~12:59)

② Screen type



559A3CD62 559A3CD62A

· The screen type (A,B,C) of the LCD can be selected by this menu.

③ Brightness setting calibration

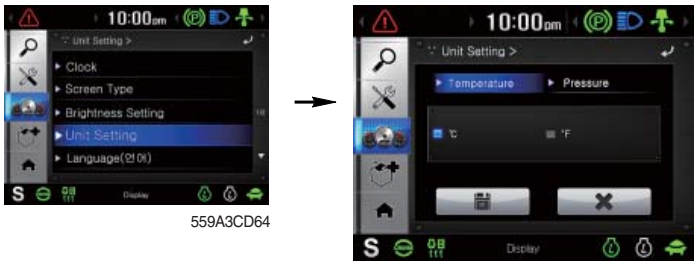
559A3CD63 559A3CD63A

Manual (1st~10th step)

Auto (day/night) 559A3CD63B Auto (time) 559A3CD63C

· If "Auto" is chosen, brightness for day and night can be differently set up. Also, users can define which day time interval. (Set day starting time and ending time)

④ Unit setting



559A3CD64 559A3CD64A

· Temperature : ˚C ↔ ˚F

· Pressure : bar ↔ MPa ↔ kgf/cm² ↔psi

⑤ Language

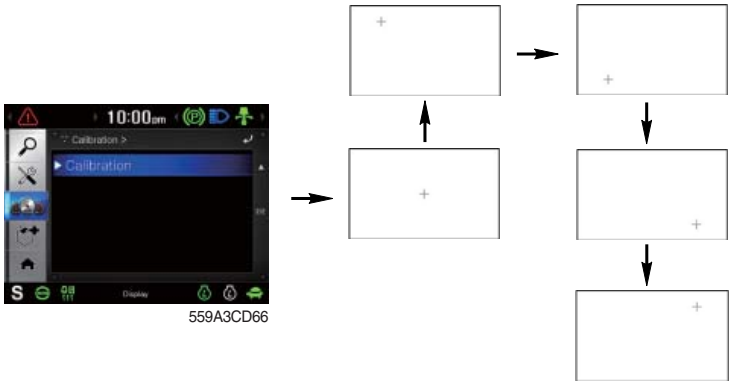
559A3CD65

559A3CD65A

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

⑥ Calibration

· When touch awareness goes wrong, this function use.
Fall in the next step if touches the middle point of cross with fingernail.
If touches total five points as follows, the setting is completed.



559A3CD66

2609A3CD149-153

(5) Utilities

① Camera setting

- Three cameras can be installed on the machine and the display order can be set by this menu.
- If the camera was not equipped, this menu is not useful.

559A3CD67

559A3CD67A

- In the operation screen, if the ESC/CAM switch is pushed, rear view camera display or stop.
- Turnning the select switch in clockwise direction, the next ordered will be shown and in counter-clockwise direction, the previously ordered will be shown. Also, you can change camera channel using touch the screen.
- Push the select switch or touch the screen, the displayed screen will be enlargement.

559A3CD68

559A3CD68A

559A3CD68B

② Mode

559A3CD69

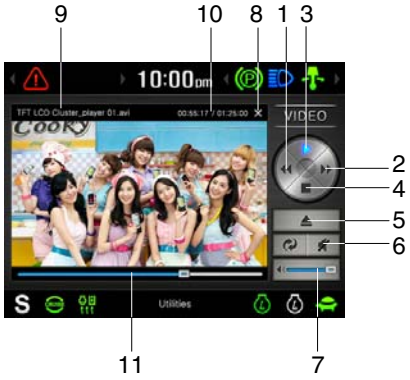
559A3CD69A

- When this cluster's buttons are not work, you can control using touch screen instead of these buttons.
- You can only control in this mode screen.

③ Video

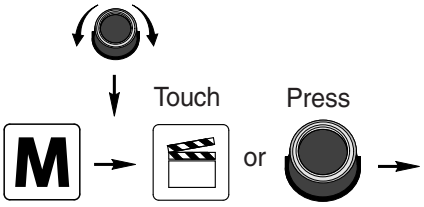
· Play MP4 or codec file of external hard disk through USB port.
· The USB port is located under the cluster.

559A3CD70



559A3CD70A

559A3CD70B



559A3CD70C

· Over 1100 engine rpm, the screen turns into the operation screen with MP4 or codec file playing for the safety.

No.	Function	Control	No.	Function	Control
1	Previous track	Power mode switch or touch	7	Sound volume	Speed switch or touch
2	Next track	Speed switch or touch	8	Stop	ESC/CAM button or touch
3	Play	Touch	9	File name	-
4	Pause	Touch	10	Current time/ Total time	-
5	Contents display	Touch	11	Current playing time	-
6	Mute	Touch	-	-	-

MONITORING SYSTEM (machine serial No.: #0579~)

1) STRUCTURE

The cluster consists of LCD and switches as shown below. The LCD is to warn the operator in case of abnormal machine operation or conditions for the appropriate operation and inspection.
Also, The LCD is to set and display for modes, monitoring and utilities with the switches.
The switches or touch screen are to set the machine operation modes.

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

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

HX60A3CD100B

※ **The warning lamp pops up, lights ON (on the left-top side) and the buzzer sounds when the machine has a problem.**
The warning lamp lights ON until the problem is cleared. Refer to page 4-29 for details.

2) GAUGE

(1) Operation screen

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

HX60A3CD101A

1	Engine coolant temp gauge	3	Fuel level gauge	5	Accel dial
2	Hydraulic oil temp gauge	4	Engine rpm	6	Clinometer

(2) Engine coolant temperature gauge

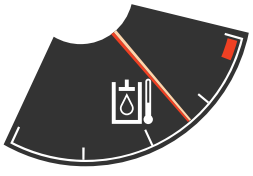
290F3CD53

① This gauge indicates the temperature of coolant.
- Black range : 40-115˚C (104-239˚F)
- Red range : Above 115˚C (239˚F)

② If the indicator is in the red range or lamp lights ON in red, turn OFF the engine and check the engine cooling system.

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

(3) Hydraulic oil temperature gauge



290F3CD54

① This gauge indicates the temperature of hydraulic oil.
- Black range : 40-105˚C (104-221˚F)
- Red range : Above 105˚C (221˚F)

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

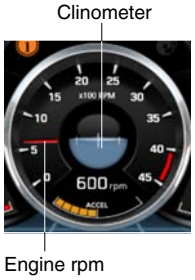
※ If the gauge indicates the red range or lamp lights ON in red even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.

(4) Fuel level gauge

HX60A3CD55A

① This gauge indicates the amount of fuel in the fuel tank.
② Fill the fuel when the red range, or lamp lights ON in red.
※ **If the gauge indicates the red range or lamp lights ON in red even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.**

(5) Engine rpm display



HX60A3CD105K

① This displays the engine speed.

(6) Accel dial display

290F3CD59

① This displays acceleration dial level from 0 to 10 step.

3) COMMUNICATION ERROR AND LOW VOLTAGE WARNING POP-UP

(1) Communication error pop-up

HX60A3CD107A

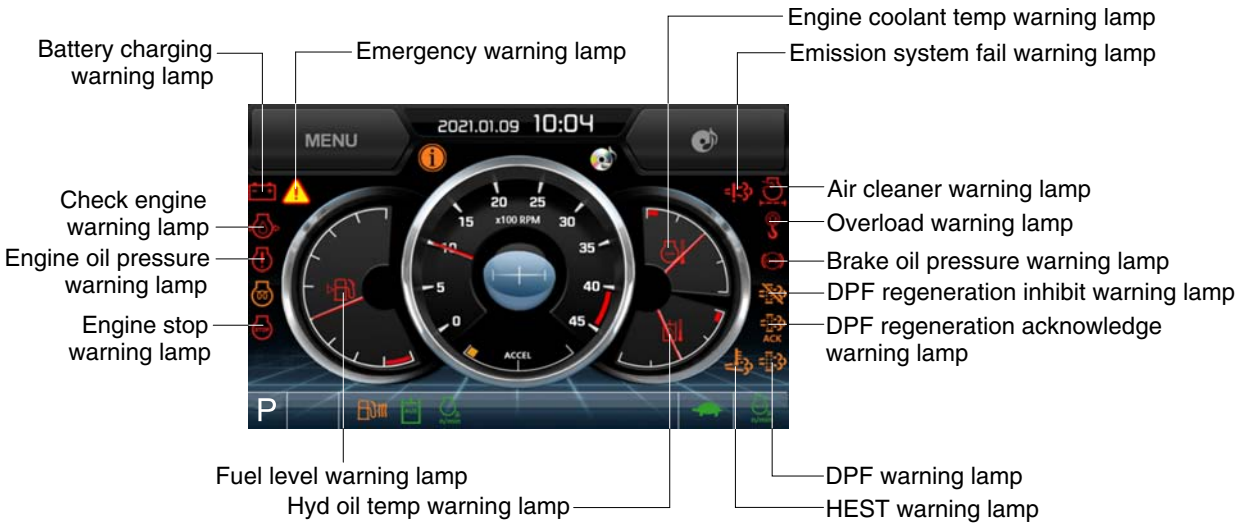
① Cluster displays this communication error pop-up when it has communication error with MCU.
② Communication error pop-up displays at operation screen only. Just buzzer alarm at the other screen.
③ If communication with MCU become normal state, it will disappear automatically.

(2) Low voltage warning pop-up

HX60A3CD108

① Cluster displays this low voltage warning pop-up when the battery voltage is low.
② Low voltage warning pop-up displays at operation screen only. Just buzzer alarm at the other screen.
③ This pop-up will disappear with using touch screen or buzzer stop switch. While the battery voltage is low, buzzer sounds every minute.
④ When the battery voltage is higher than 11.5 V, the pop-up off.

4) WARNING LAMPS

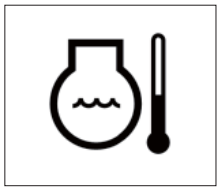


HX60A3CD109C

※ **Each warning lamp on the left-top of the LCD pops up on the center of LCD and the buzzer sounds when the each warning is happened. The pop-up warning lamp moves to the original position and lights ON when the buzzer stop switch is pushed or the pop-up is touched. And the buzzer stops. Refer to page 4-38 for the switch.**

※ **When the warning lamps light ON more than 4, you can check all lamps with next page button (◀, ▶) near the warning lamps.**

(1) Engine coolant temperature warning lamp



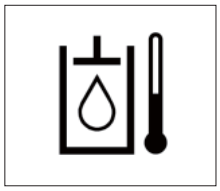
290F3CD61

① The lamp pops up on the center of LCD and the buzzer sounds when the engine coolant temperature is over 115˚C or more.

② The pop-up lamp moves to the original position and lights ON when the buzzer stop switch is pushed or pop-up is touched. Also, the buzzer stops and lamp keeps ON.

③ Check the cooling system when the lamp keeps ON.

(2) Hydraulic oil temperature warning lamp



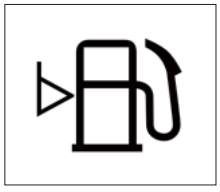
290F3CD62

① The lamp pops up on the center of LCD and the buzzer sounds when the hydraulic oil temperature is over 105˚C or more.

② The pop-up lamp moves to the original position and lights ON when the buzzer stop switch is pushed or pop-up is touched. Also, the buzzer stops and lamp keeps ON.

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

(3) Fuel level warning lamp



290F3CD63

① This warning lamp lights ON and the buzzer sounds when the level of fuel is below 10%.

② Fill the fuel immediately when the lamp is ON.

(4) Emergency warning lamp

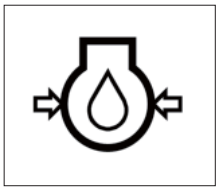
290F3CD64

① This lamp pops up and the buzzer sounds when each of the below warnings are happened.
- Engine coolant overheating (over 115˚C)
- Hydraulic oil overheating (over 105˚C)
- MCU input voltage abnormal
- Accel dial circuit abnormal or open

※ **The pop-up warning lamp moves to the original position and lights ON when the buzzer stop switch is pushed or pop-up is touched. Also the buzzer stops.**
This is same as following warning lamps.

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

(5) Engine oil pressure warning lamp



290F3CD65

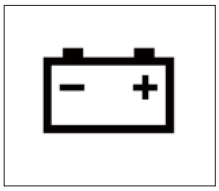
① This lamp lights ON when the engine oil pressure is low.
② If the lamp lights ON, shut off the engine immediately. Check oil level.

(6) Check engine warning lamp

290F3CD66

① This lamp lights ON when the communication between MCU and engine ECM on the engine is abnormal, or if the cluster received any fault code from engine ECM.
② Check the communication line between them.
If the communication line is OK, then check the fault codes on the cluster.
③ Also, this lamp pops up when the level of DPF soot is high.
※ Refer to the page 4-31 for the DPF warning lamp.

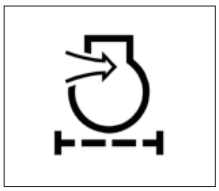
(7) Battery charging warning lamp



290F3CD67

① This lamp lights ON when the battery charging voltage is low.
② Check the battery charging circuit when this lamp is ON.

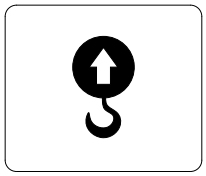
(8) Air cleaner warning lamp



290F3CD68

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

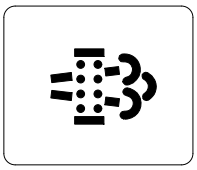
(9) Overload warning lamp (option)



21093CD36

① When the machine is overload, the overload warning lamp lights ON during the overload switch is ON. (if equipped)
② Reduce the machine load.
Initiate a manual regeneration

(10) DPF (diesel particulate filter) warning lamp



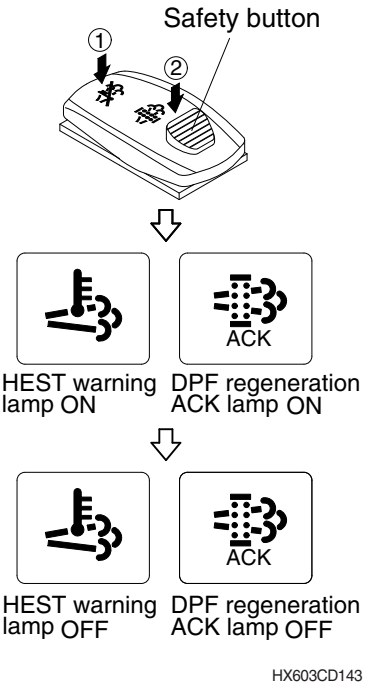
2609A3CD19

① This warning lamp lights ON or OFF when the regeneration is needed.
② This warning lamp lights ON while DPF regeneration inhibit switch is in "Regeneration ingibited" state, when stationary regeneration is permitted.
③ This warning lamp lights ON during reset regeneration standby or in back up mode.
④ This warning lamp lights flash during reset regeneration standby DPF regeneration inhibit switch is in "Regeneration inhibited" state.

※ Consequences of delaying regeneration
- Poor performance caused by increasing exhaust gas pressure.
- Higher fuel consumption
- Shorter filter lifetime

Condition	Warning lamp			Remedy
	DPF	Check engine (pop up)	Stop engine (pop up)	
Normal	Off	Off	Off	· Automatic regeneration
Soot low	On	Off	Off	· Push DPF switch to OFF position if DPF switch is in inhibit position. (see 4-62 page) · Engine power may be reduced automatically (soot medium)
Soot midium	Blink	Off	Off	
Soot high	On	On	Off	· Engine power and speed will be reduced automatically · Initiate a manual regeneration
Stop	On	Off	On	· Stop the engine immediatary. · Please contact your Hyundai service center or local dealer.

※ **Manual regeneration method of DPF**



HX603CD143

※ Manual regeneration applies if the machine is in a fireproof area and there is no plan to turn off the maching during the regeneration.

① Stop and park the machine.

② The accel dial to the lowerest position and operate the engine in idling.

③ Pull the safety button and push the switch to position ② to initiate the manual regeneration of DPF.

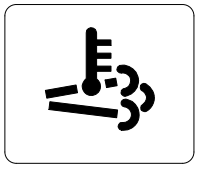
※ Refer to the page 4-62 for the switch operation.

※ The engine speed may increase gradually to high idle rpm and DPF regeneration begins and it will take approximately 25~30 minutes.

④ When the manual regeneration starts, the DPF warning lamp turns OFF and the regeneration acknowledge lamp and HEST warning lamp will light ON during the regeneration function is operating.

⑤ The regeneration acknowledge lamp and HEST warning lamp will light OFF when the regeneration function is completed.

(11) HEST (High exhaust system temperature) **warning lamp**



2609A3CD21

① This warning lamp indicates, when illuminated, that exhaust temperatures are high due to regeneration of the DPF.

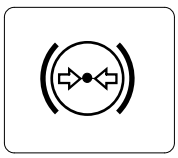
② The lamp will also illuminate during a manual regeneration.

③ When this lamp is illuminated, be sure the exhaust pipe outlet is not directed at any surface or material that can melt, burn, or explode.

⚠ When this lamp is illuminated, the exhaust gas temperature could reach 600˚C [1112˚F], which is hot enough to ignite or melt common materials, and to burn people.

※ The lamp does not signify the need for any kind of equipment or engine service; It merely alerts the equipment operator to high exhaust temperatures. It will be common for the lamp to illuminate on and off during normal equipment operation as the engine completes regeneration.

(12) Brake oil pressure warning lamp

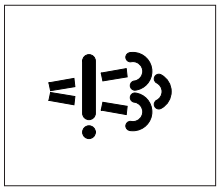


① The lamp lights ON when the oil pressure of service brake drops below the normal range.

② When the lamp is ON, stop the engine and check for its cause.

※ Do not operate until any problems are corrected.

(13) Emission system fail warning lamp



300A3CD15

① This warning lamp indicates there are faults related to the emission system.

② The lamp lights ON when each of the below warnings is happened.

a. The EGR valve malfunctions.

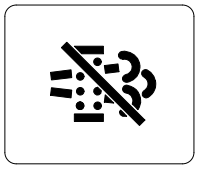
b. Electrical malfunction of the EGR control sensors. (disconnection, short)

c. Tampering with the EGR control sensors.

③ **This warning lamp can be shown together with DPF warning lamp or engine fail lamp or engine stop warning lamp when diagsis DPF systems.**

※ **Please contact your Hyundai service center or local dealer.**

(14) DPF regeneration inhibit warning lamp

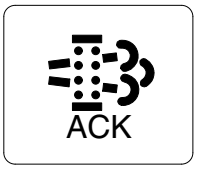


2609A3CD20

① This warning lamp indicates, when illuminated, the DPF switch is pushed inhibit position, therfore automatic and manual regeneration can not occur.

※ **Refer to the page 4-62 for the DPF switch.**

(15) DPF regeneration acknowledge warning lamp



559A3CD10

① This warning lamp lights ON stationary regeneration is in process.

② This warning lamp lights ON, when stationary regeneration is in process after DPF regeneration request switch is pressed and hold for more than 3 seconds.

③ This warning lamp lights flash when stationary regeneration standby or regeneration interlock switch is in "regeneration permitted (interlock enabled) status.

④ This warning lamp lights flash while stationary regeneration standby or back mode, when DPF regeneration inhibit switch in "Regeneration permitted" status and regeneration interlock switch is in regeneration permitted status.

(16) Engine stop warning lamp

① If the lamp lights ON, stop the engine immediately and check the engine.

② Check the fault codes on the monitor.

※ **Please contact your Hyundai service center or local dealer.**

5) PILOT LAMPS

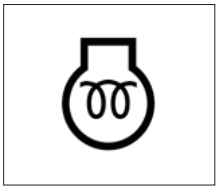
HW60A3CD112C

※ The left and the right movement buttons (◀ and ▶) are activated when nine indicator or more light, and touching the button shifts to the previous/next page. The buttons are not activated when eight indicators or less light.

(1) Mode pilot lamp

Sequence	Mode	Pilot lamp	Selected mode
1	Power mode	P	Heavy duty power work mode
		S	Standard power mode
2	Travel mode		Low speed traveling
			High speed traveling
3	Auto idle mode	AUTO n/min	Auto idle mode
		n/min	Auto idle status

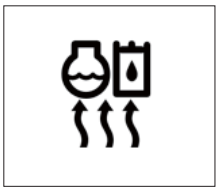
(2) Engine preheat pilot lamp



290F3CD79

① Turning the start switch ON automatically starts preheating.
② Start the engine after this indicator turns off.
See Page 4-4.

(3) Warming up pilot lamp

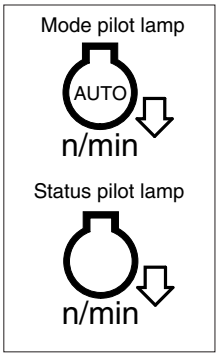


290F3CD80

① This lamp is turned ON when the coolant temperature is below 30˚C(86˚F).

② The automatic warming up is cancelled when the engine coolant temperature is above 30˚C, or when 10 minutes have passed since starting the engine.

(4) Auto idle status/ mode pilot lamp



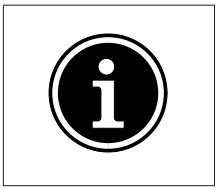
85A3CD106

① The auto idle mode pilot lamp will be ON when the idle mode is selected.

② The auto idle status pilot lamp will be ON when all levers and pedals are at neutral position, and the auto idle mode is selected.

③ One of the lever or pedal is operated, the status lamp will be OFF and the engine speed returns to the previous conditions.

(5) Maintenance pilot lamp



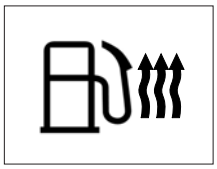
HX60A3CD116

① This lamp will be ON when the consuming parts are needed to change or replace. It means that the change or replacement interval of the consuming parts remains below 30 hours.

② Check the message in maintenance information of main menu. Also, this lamp lights ON for 3 minutes when the start switch is ON position.

※ **Refer to the page 4-43.**

(6) Fuel warmer pilot lamp

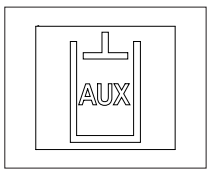


HX60A3CD111

① This lamp is turned ON when the coolant temperature is below 10˚C(50˚F) or the hydraulic oil temperature 20˚C(68˚F).

② The automatic fuel warming is cancelled when the engine coolant temperature is above 60˚C, and the hydraulic oil temperature is above 45˚C since the start switch was ON position.

(7) Optional flow control pilot lamp

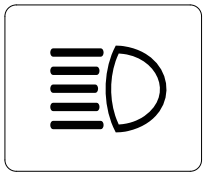


HW60A3CD48A

① The indicator lights when activating (performing) the optional flow control function.

※ **Refer to the Page 4-43.**

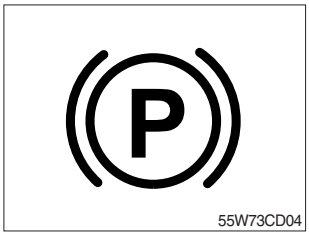
(8) High beam pilot lamp



55WI3CD50

① This lamp works when the illuminating direction is upward.
② This lamp comes ON when the dimmer switch is operated, e.g, when passing another vehicle.

(9) Parking brake pilot lamp



55W73CD04

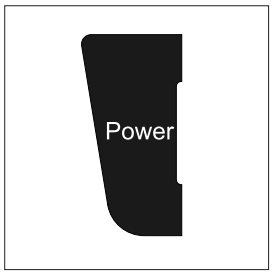
① When the parking brake is actuated, the lamp lights ON.
※ **Check the lamp is OFF before driving.**

6) SWITCHES

HX60A3CD117D

※ **Selecting the switch displays the indicator on LCD. See Page 4-34 for further information.**

(1) Power mode switch

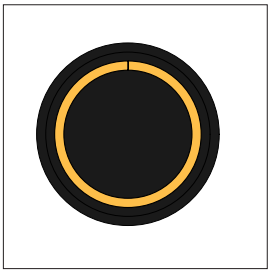


HX60A3CD118

① This switch selects the system power mode, and the selected power mode indicator is displayed on the indicator position.
- P : High-load work
- S : Standard load work

② The indicators shifts in the sequence of S → P → S.

(2) Select switch



HX60A3CD119

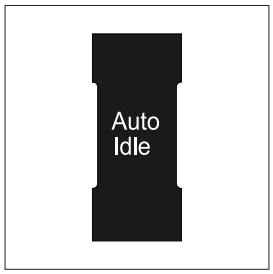
① The switch is used for selecting or changing the menus and input values.

② Knob pressing
- Pressing short (0.5 sec. or less) : Menu selecting

③ Knob turning

This knob is used for changing menus and input values :
- Right turning : Increasing downward direction and input value
- Left turning : Decreasing upward direction and input value

(3) Auto idle switch



HX60A3CD120

① This switch is used for operating or canceling the auto idle function.

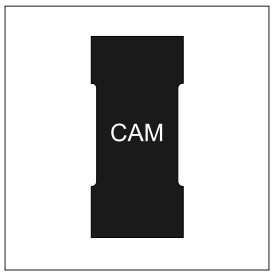
※ **See Page 4-34 for further information.**

(4) Buzzer stop switch

HX60A3CD121

① The buzzer sounds when the system fails.
In such a case, press the switch to stop the buzzer. The alarm indication is kept lit until trouble is resolved.

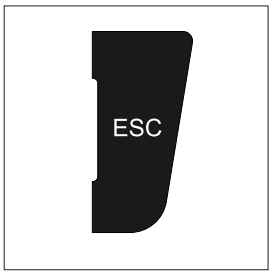
(5) Camera switch



HX60A3CD122

① Pressing this switch on the operation screen of the main menu displays the area illuminated by the camera mounted on the system (if the camera is mounted).
See Page 4-53 for information of the camera.

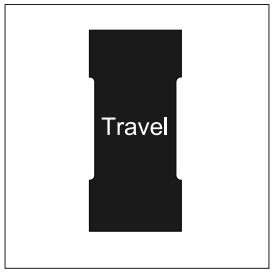
(6) Escape switch



HX60A3CD123

① This switch is used for return to the previous or the next menu.

(7) Travel speed switch



HX60A3CD104

① This switch is used for changing driving speed.
: High speed
: Low speed

※ **Do not operated the driving speed switch during driving. System stability may adversely be affected.**

⚠ **Rapid change of system stability may cause injury or death of driver.**

7) MAIN MENU

Main menu screen

HX60A3CD124A

Tap MENU or Press

Press ESC

Sub menu screen

HX60A3CD125A

※ See “Selection Switch” on page 4-37 for further information on selection and change of the menus and input values.

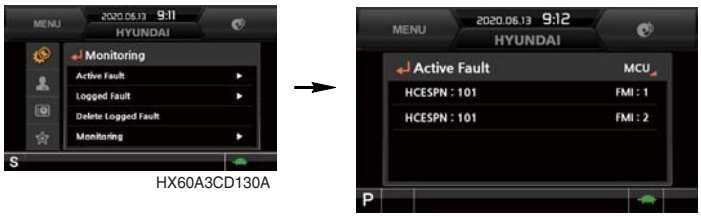
※ Touching the main menu switch, or pressing the selection switch prompts the sub-menu screen.

(1) Structure

No.	Main menu	Sub-menu	Description
1	 Monitoring	Active fault Logged fault Delete logged fault Monitoring	List of active fault of system/engine List of logged fault of system/engine Deleting specifics of logged fault (system/engine) Monitoring (conditions of system, switch, and output)
2	 Management	Maintenance info. Aux flow setting ELS mode setting Machine information Contact Cluster update Service menu	Checking and initialization of service Interval of oil and filters Optional attachment setting ELS mode setting/user password changing Information of cluster, MCU, engine system Display and change of contact information for after-sales services System and application updating Power shift, Operation hours, Main gauge type, Display RPM, DPF filter exchange, AVCU setting, Adding language
3	 Display	Clock adjust Brightness setting Unit setting Language selection	Current time setting Manual, auto Temperature, Distance, Pressure, Flow, Volumn 24 languages
4	 Utilities	Entertainment Camera setting Clinometer setting Emergency mode	Video/music file playing Setup of number of active cameras, display sequences, and camera numbers Initializing slope sensor Back-up switch for failed cluster switch

(2) Monitoring

① Active fault - system

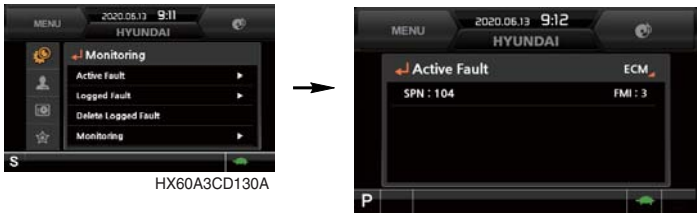


HX60A3CD130A

HX60A3CD131A

· You may use this menu to check active fault of MCU.

② Active fault - engine



HX60A3CD130A

HX60A3CD133A

· You may use this menu to check active fault of engine ECM.

③ Logged fault - system/engine

HX60A3CD134A

HX60A3CD135A

HX60A3CD136A

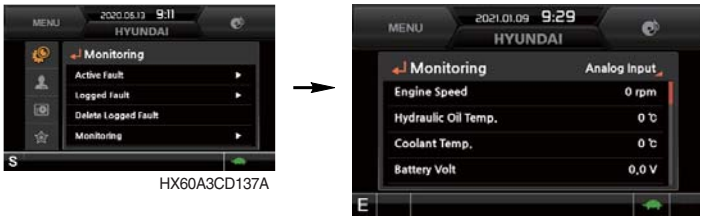
· You may use this menu to check fault logged on system MCU or engine ECM.
· The menu is accessible by maintenance engineer only.

④ Delete logged fault

HX60A3CD143A HX60A3CD144A HX60A3CD145A HX60A3CD146A HX60A3CD147A

· Delete logged fault: You are allowed to delete fault logged on system MCU or engine ECM. (Deletion can be deleted only while the engine is kept stopped.)

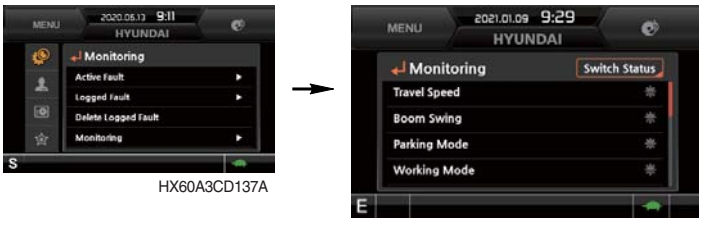
⑤ Monitoring (system conditions)



HX60A3CD137A HX60A3CD138A

· You may use this menu to check the system conditions such as engine rotation rate, oil temperature, voltage and pressure.

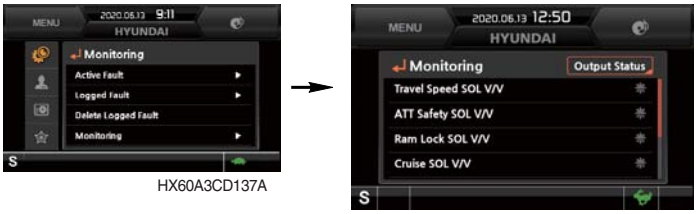
⑥ Monitoring (switch conditions)



HX60A3CD137A HX60A3CD140A

· You may use this menu to check digital switch information of the system.
· The operation switch lights blue.

⑦ Monitoring (output conditions)



HX60A3CD137A

HX60A3CD142A

- You may use this menu to check digital output information of the system.
- Output lights blue.

(3) Management

① Maintenance info.

HX60A3CD158A

HX60A3CD157A

HX60A3CD159A

- Elapsed: Time elapsed since inspection and maintenance is displayed.
- Change interval: You are allowed of changing exchange cycle in 50 hours.
- History-Hourmeter: History of inspection, maintenance and exchange is displayed.
- Replacement: Elapsed time is reset to zero.
- **Change or replace interval**

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

② Aux flow setting

a. Optional attachment setup

HW60A3CD33OA

HW60A3CD41OA

HW60A3CD42O

- Setup up to three optional attachments.

ⓐ Rotary grapple (4-way)

ⓑ Grapple (2-way)

ⓒ Auger (2-way)

※ Each option attachment operating in one of two user modes (Type A and B)

b. Proportional flow control setting

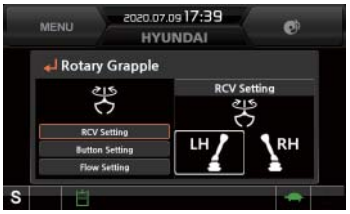
You may use this menu to set the values of individual option attachments.

a) Rotary setup

HW60A3CD42O

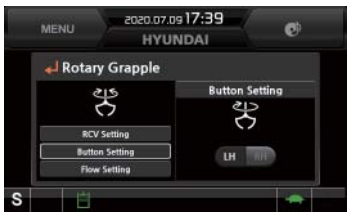
HW60A3CD51OA

· Rotary selecting
RCV, button, and flow setup.



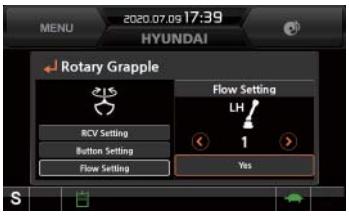
HW60A3CD52OA

· RCV setup
- It is possible to set operating RCV for rotary operation to LH or RH .
- Selecting rotary RCV to LH automatically sets grapple RCV to RH.



HW60A3CD53OA

· Button setup (rotating clockwise)
- Selecting clockwise rotating direction to LH automatically sets counterclockwise rotating direction to RH.



HW60A3CD54OA

· Flow setup
- You may set flow between Level 1 and 5.

b) Grapple setting

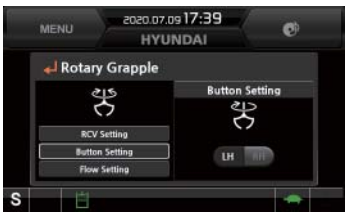
HW60A3CD42O

HW60A3CD61OA

· Grapple selection
RCV, button and flow setup

HW60A3CD62OA

· RCV setup
- It is possible to set RCV for grapple operation to LH or RH.
- Selecting grapple RCV to RH automatically sets rotary RCV to LH.



HW60A3CD63OA

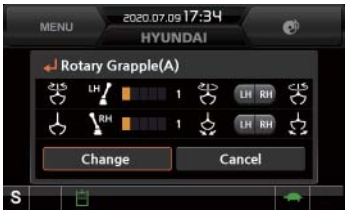
· Button setup (Close)
- Setting Close to RH automatically sets Open to LH.

HW60A3CD72OA

HW60A3CD64OA

· Flow setup
- Setting between Level 1 and 5.

HW60A3CD42O

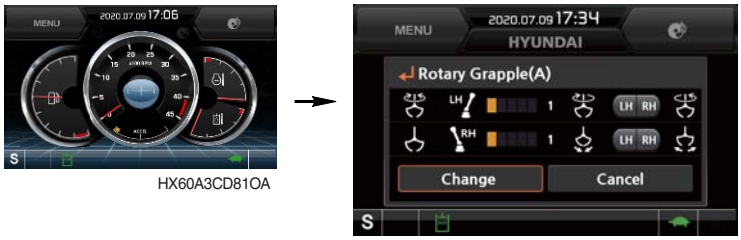


HW60A3CD71OA

· Never forget to select Change button **once** flow setting is complete.

※ Saved setting is stored in each icon, and value finally stored becomes active.
※ You may use any stored values by pressing Icon button.
※ It is possible to perform two user's settings per attachment (A and B), and to store up to six values. (Two for 4-way, four for 2-way)

c) Checking settings



HX60A3CD81OA

HW60A3CD71OA

※ Operating optional attachment function activates the symbol on the bottom of the main screen.

※ You are allowed of checking settings as follows in the course of Menu - Administrator Functions - Optional Attachment.

(a) Rotary setup
- Rotary RCV setup : LH
- Rotary flow level : 3
- CW direction control : LH
- CCW direction control : RH

(b) Grapple setup
- Grapple RCV setup : RH
- Grapple flow level : 3
- Open control : LH
- Close contro l: RH

③ ESL mode setting

HX60A3CD148A

HX60A3CD149A

HX60A3CD150A

- The ESL mode setting is designed to prevent theft and unauthorized operation of the system.
- When selecting the ESL mode setting to continuous operation, password should be entered when turning the Start button ON.
- Disabled : The ESL mode setting function does not operate.
  Continuous operation : Password should be entered whenever operator starts the engine.
  Enable(interval): Password should be entered when operator starts the engine first. It is not required to enter the password until restart within specified time.
  You may set the specified time up to two days.

※ Default password : 00000

※ Length of password : 5-10 digits

④ Changing password

- The length of the password is between 5 and 10 digits.

HX60A3CD151A

HX60A3CD149A

Entering current password

HX60A3CD153A

Selecting Change Password

HX60A3CD156A

Storing new password in MCU

HX60A3CD155A

Entering new password again

HX60A3CD149A

Entering new password

⑤ Machine information

HX60A3CD160A

HX60A3CD161A

HX60A3CD162A

· On this screen, you may check information of the instrument panel, the system controller (MCU), the engine and the system.

⑥ Contact

HX60A3CD163A

HX60A3CD164A

HX60A3CD165A

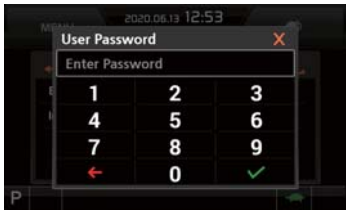
· You may check or change the contact information for after-sales services.

⑦ Cluster update

HX60A3CD169A

HX60A3CD170A

Selecting Cluster Update



HX60A3CD149A

Entering user's password

· It is possible to update the cluster and CAN.

※ **Do not turn power off while updating.**

a. Application update

HX60A3CD172A

Selecting application items

HX60A3CD173A

Selecting files to update

HX60A3CD174A

Selecting OK

HX60A3CD175A

In progress

HX60A3CD176

Completed

b. System update

HX60A3CD177A

Selecting system items

HX60A3CD173A

Selecting files to update

HX60A3CD174A

Selecting OK

HX60A3CD175A

In progress

HX60A3CD176

Completed

⑧ Service menu

HX60A3CD165A HX60A3CD144A HX60A3CD168A

Entering service password

- Power shift : Set the power shift mode (default/option).
- Operating hours : You may check operating hours of the system in individual modes after acceptance of the system.
- Main gauge type : It is possible to display engine rotation rate or fuel level on the main gage of the main screen.
- Display RPM : It is possible to set display of numeric value of engine rotation rate on the main gauge of the main screen.
- DPF filter exchange : You may initialize parameters relevant to DPF of engine ECU after cleaning the DPF filter.
- AVCU setting : You may select Standard, 2-Way or 4-Way dependent upon the system options.
- Adding language : It is possible to update language displayed on the cluster when it is required to correct language.

※ The service menu is accessible by maintenance engineer only. Do not attempt unauthorized adjustment.

(4) Display

① Clock adjust

HX60A3CD191A

HX60A3CD192A

- "****-**-**" on the first line indicates year/month/day.
- The second line indicates current time (00:00 - 12:59 am/pm)

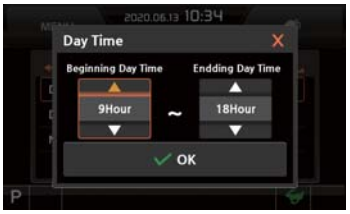
② Brightness setting

HX60A3CD193A

Manual (Level 1 to 10) HX60A3CD194A

HX60A3CD195A

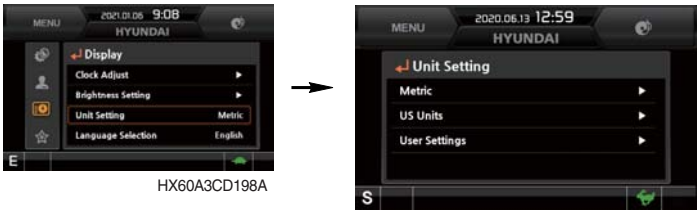
Auto (daytime) HX60A3CD196A



Auto (day/night) HX60A3CD197A

- Selecting “Auto” allows setting brightness different in day and night. It is also allowed to set hours in daytime. (Setting beginning day time and ending day time)

③ Unit setting



HX60A3CD198A

HX60A3CD199A

- Metric: Units are changed to metric units.
- U.S. units: Units are changed to U.S. units.
- User setting : Units are changed to user setting.

Item	Metric system	U.S. unit	User's setup
Temperature	˚C	˚F	˚C, ˚F
Distance	km	mile	km, mile
Pressure	bar	Mpa	bar, Mpa, kgf/cm^2, psi
Flow	lpm	gpm	lpm, gpm
Volume	l	gal	l, gal

④ Language selection

HX60A3CD200A

HX60A3CD201A

· You may select your language (from 24 languages), and all the information is displayed in the selected language.

(5) Utilities

① Entertainment

HX60A3CD70A HX60A3CD208A HX60A3CD209A

- You may play MP4 or CODEC files of detachable hard disk through USB port.
- USB port is on the left of the instrument panel.
- When engine rotation rate exceeds 1100 rpm or higher, the screen is switched to the operation screen even while MP4 or CODEC file is played for safety. When engine rotation rate drops to 1100 rpm or lower, animation clip is played again.

⚠ Do not play animation clip while operating the system to prevent risks of accident.

② Camera setting

HX60A3CD202A HX60A3CD203A

- You may install three cameras on the system, and set display sequence on this menu.
- If no camera is installed, this menu is disabled.

- When rotating Select switch clockwise, the screen of the next camera is displayed. When rotating the switch counterclockwise, the screen of the previous camera is displayed. You may also change the camera channel by touching the screen.
- You may display or hide the mini instrument panel by pressing Select switch or touching the screen.
  (Mini instrument panel displayed → hidden → displayed)

HX60A3CD204

- Pressing ESC switch or touching X icon on the screen terminates the camera mode.

③ Clinometer setting

HX60A3CD210A

HX60A3CD211A

· Pressing “Default” when the system is kept on flat surface resets X and Y values to zero.
· You may check gradient of the system on the operating screen of the instrument panel.

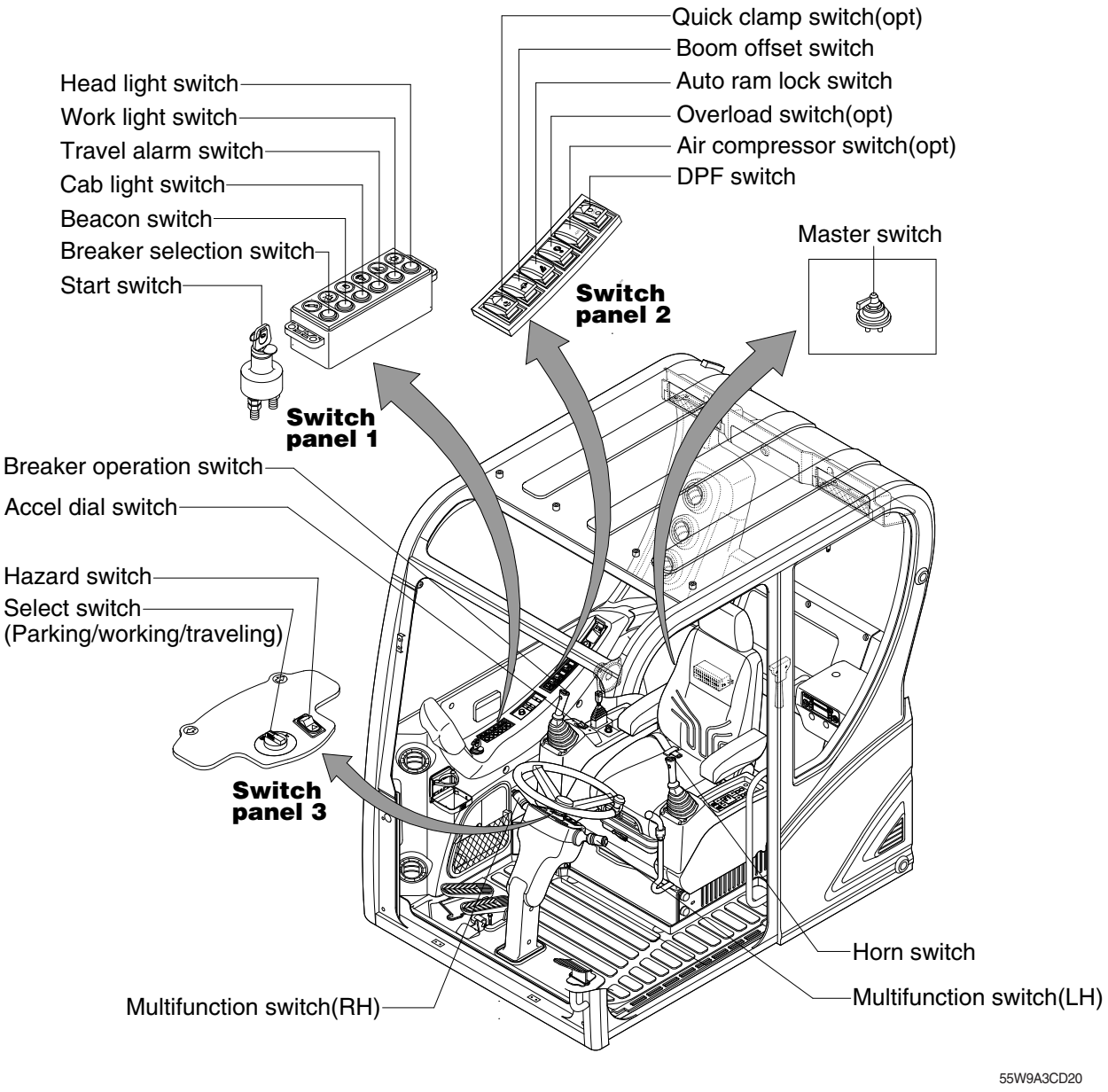
④ Emergency mode

HX60A3CD205A

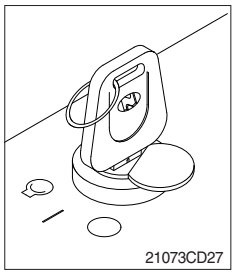
HX60A3CD206A

· When the switch or the acceleration dial of the monitor fails, the switch is displayed on LCD, and you are allowed to perform operation by touching the screen.
· Such operation is allowed only on this mode screen.

4. SWITCHES



1) STARTING SWITCH

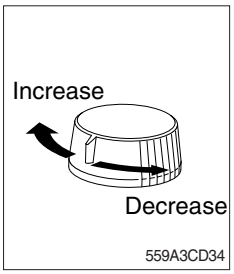


(1) There are three positions, OFF, ON and START.

- (OFF) : None of electrical circuits activate.
- (ON) : All the systems of machine operate.
- (START) : Use when starting the engine.
  Release key immediately after starting.

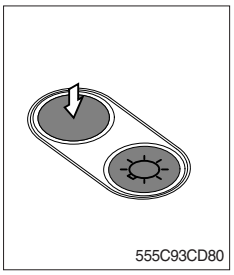
※ **Key must be in the ON position with engine running to maintain electrical and hydraulic function and prevent serious machine damage.**

2) ACCEL DIAL



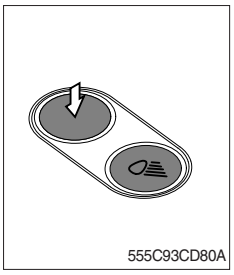
(1) There are 10 dial setting.
(2) Setting 1 is low idle and setting 10 is high idle.
- By rotating the accel dial to right : Engine speed increased.
- By rotating the accel dial to left : Engine speed decreased.

3) HEAD LIGHT SWITCH



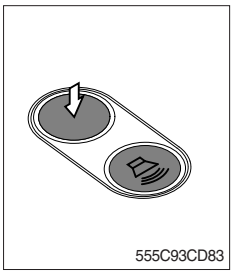
(1) This switch is used to operate the head light.
- Press the switch once, the head light comes ON and the pilot lamp ON.
- Press the switch once more, the head light and pilot lamp turn off.

4) WORK LIGHT



(1) This switch is used to operate the work light.
- Press the switch once, the work light comes ON and the pilot lamp ON.
- Press the switch once more, the work light and pilot lamp turn off.

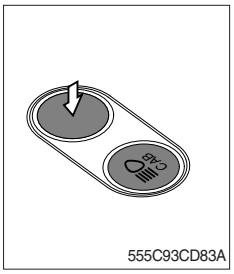
5) TRAVEL ALARM SWITCH



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

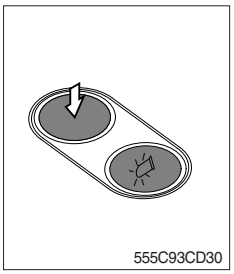
(2) On pressing this switch, the alarm operates only when the machine is traveling.

6) CAB LIGHT SWITCH



(1) This switch turns on the cab light on the cab.

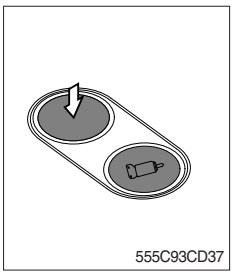
7) BEACON SWITCH (option)



(1) This switch turns ON the rotary light on the cab.

(2) The below indicator lamp is turned ON when operating this switch.

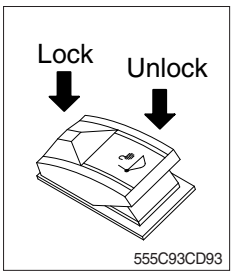
8) BREAKER SELECTION SWITCH (option)



(1) This switch is used to operate breaker.

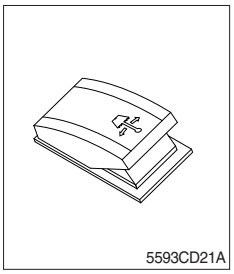
※ **The breaker operates only when this switch is pressed.**

9) QUICK CLAMP SWITCH (option)



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

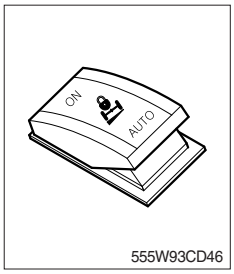
10) BOOM OFFSET SWITCH



(1) This switch is used to swing the boom to the right or left direction.

(2) The indicator lamp turned ON when selected this switch.

11) AUTO RAM LOCK SWITCH



(1) This switch activate front axle oscillation cylinder to locking position for increase of stability.

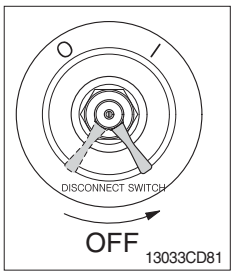
· ON : Set front axle to locking position for excavation work or travels even ground. Also, the ram lock pilot lamp comes ON at the travel pilot lamp.

· AUTO : Set front axle to locking or unlocking as table.

※ **Refer to page 4-32 for select switch.**

Select switch (parking/working/ traveling)	Ram lock	Conditions
Parking (P)	Locking	· Always
Traveling (T)	Unlocking	· Always
Working (W)	Locking	· FNR lever in neutral position · Service brake pedal is depressed.
	Unlocking	· FNR lever in forward/reverse position and service brake pedal is not depressed. · 2 way pedal is equipped and service brake pedal is not depressed.

12) MASTER SWITCH

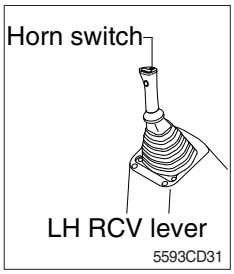


(1) This switch is used to shut off the entire electrical system.

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

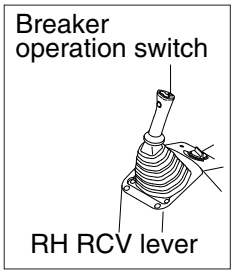
※ **Never turn the master switch to O (OFF) with the engine running. It could result in engine and electrical system damage.**

13) HORN SWITCH



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

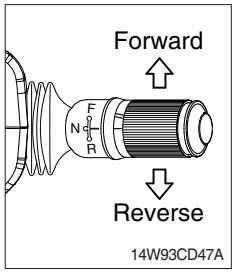
14) BREAKER OPERATION SWITCH



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

15) RH MULTI FUNCTION SWITCH

(1) FNR lever



① This lever changes travel direction of machine.

- **F** : Machine moves forward
- **N** : Neutral position
- **R** : Machine moves backward

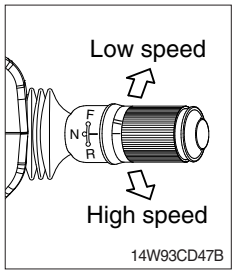
⚠ **Travel direction will be reversed if lower structure is positioned with dozer in front.**

② The warning buzzer sounds when the lever is in the reverse position.

⚠ **If this lever is not in the neutral position, engine does not started.**

⚠ **Be sure to stop the machine when changing the direction forward or backward while traveling.**

(2) Travel speed switch

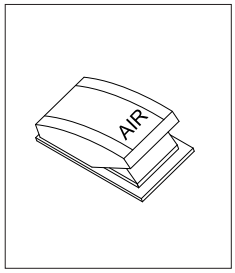


① This switch is for selecting travelling speed between high and low.

- Low speed (−) : 11.3 km/hr (7.0 mph), turtle mark
- High speed (=) : 30 km/hr (19.0 mph), rabbit mark

⚠ **In case of changing the travel speed, be sure to stop the machine completely.**

16) AIR COMPRESSOR SWITCH (option)

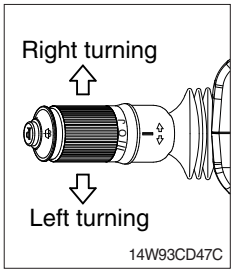


(1) This switch is used to activate the air compressor.

(2) The indicator lamp turned ON when selected this switch.

17) LH MULTI FUNCTION SWITCH

(1) Direction indication lamp switch

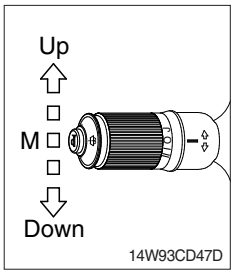


① This switch is used to warn or signal the turning direction of the machine to other machines or equipment.

② Push the lever to forward for turning right (⇧), pull the lever to backward for turning left (⇩).

③ The turning pilot lamp comes ON at the travel pilot lamp on the steering column.

(2) Dimmer switch



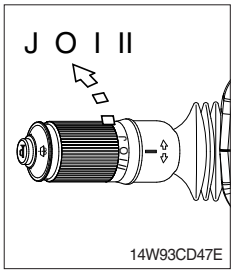
① This switch is used to turn the head lights direction.

② Switch positions.

- Up ( ) : To flash for passing
- Middle ( ) : Head lights low beam ON
- Down ( ) : Head lights high beam ON

③ If you release the switch when it's in up position, the switch will return to middle.

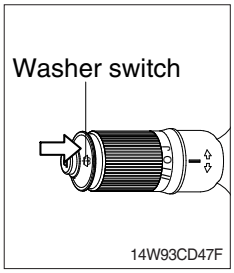
(3) WIPER SWITCH



① When the switch is in J position, the wiper moves intermittently.

② When placed in I or II position, the wiper moves continuously.

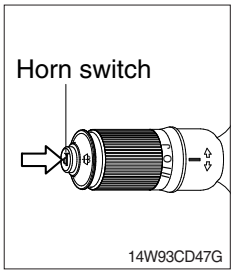
(4) WASHER SWITCH



① If you push the grip of the lever, washer liquid will be sprayed and the wiper will be activated 2-3 times.

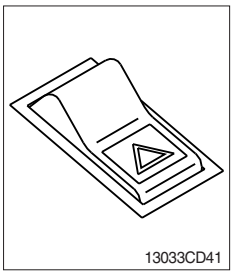
※ Check the quantity of washer liquid in the tank. If the level of the washer liquid is LOW, add the washer liquid (in cold, winter days) or water. The capacity of tank is 1.5 liter.

(5) HORN SWITCH



① This switch is at the end of left side multifunction switch. On pressing, the horn sounds.

18) HAZARD SWITCH

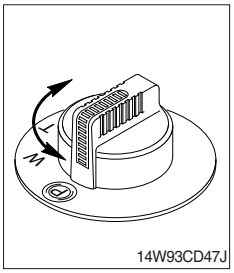


(1) Use for parking, or roading machine.

(2) LH and RH turn signal lamps come ON at the same time by this switch.

※ **If the switch is left ON for a long time, the battery may be discharged.**

19) SELECT SWITCH (parking / working / traveling)

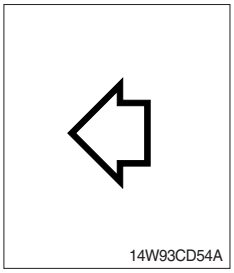


(1) This switch is used to select the operation mode as below.

- Parking (Ⓟ) : The parking brake is applied.
- Working (W) : The machine needs to be working.
- Traveling (T) : The machine needs to be traveling.

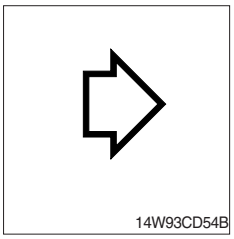
20) TURNING PILOT LAMP

(1) Left turning pilot lamp



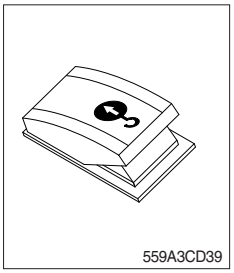
(1) This lamp flashes with sound when the LH multifunction switch is move to backward position.

(2) Right turning pilot lamp



① This lamp flashes with sound when the LH multifunction switch is
② move to forward position.

21) OVERLOAD SWITCH (option)



(1) When this switch pressed ON position, buzzer makes sound and overload warning lamp comes ON in case that the machine is overload.

(2) When it pressed OFF position, buzzer stops and warning lamp goes out.

22) DPF (diesel particulate filter) SWITCH

(1) This switch is used to select the regeneration function of the DPF.

(2) Inhibit position (①)

① The inhibit position disallows any automatic or manual regeneration of the DPF.

② This may be used by operator to prevent regeneration when the machine is operating in a hazardous environment concerned about high temperature.

③ It is strongly recommended that this position is only activated when high temperatures may cause a hazardous condition.

(3) OFF position

This position will initate a automatic regeneration of the DPF.

(4) Manual regeneration position (②)

① This position will only initate a manual regeneration of the DPF when the machine is in non-mission condition, engine must run at low idle speed and DPF soot levels are high enough to allow regeneration.

② HEST lamp will be illuminated during the entire regeneration.

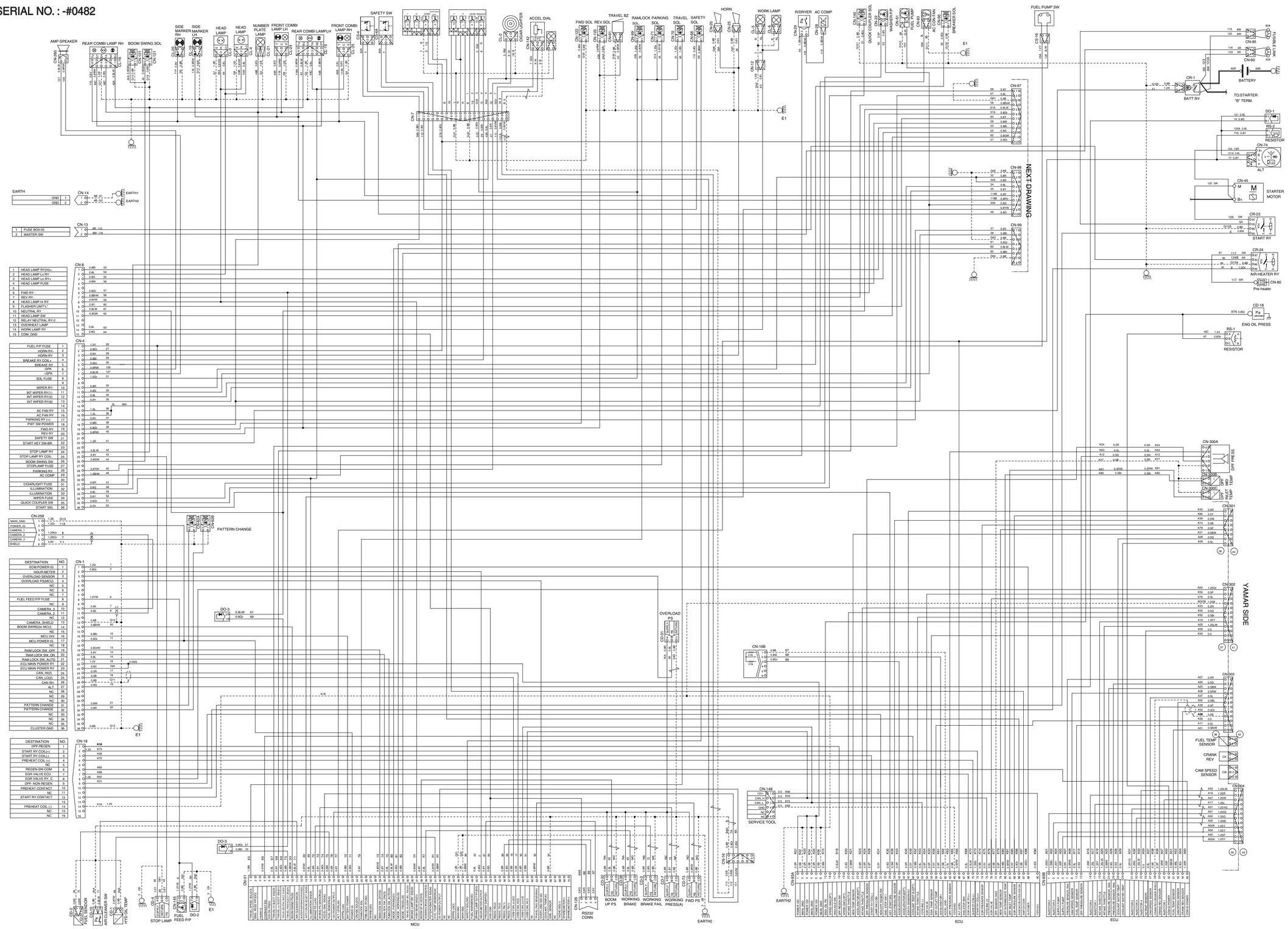
※ **Refer to the page 4-9 for details.**

※ **This switch can be move to the manual regeneration position (②) only when the safety button is pulled to backward.**

※ **Also, this switch return to the OFF position when released the manual regeneration position (②).**

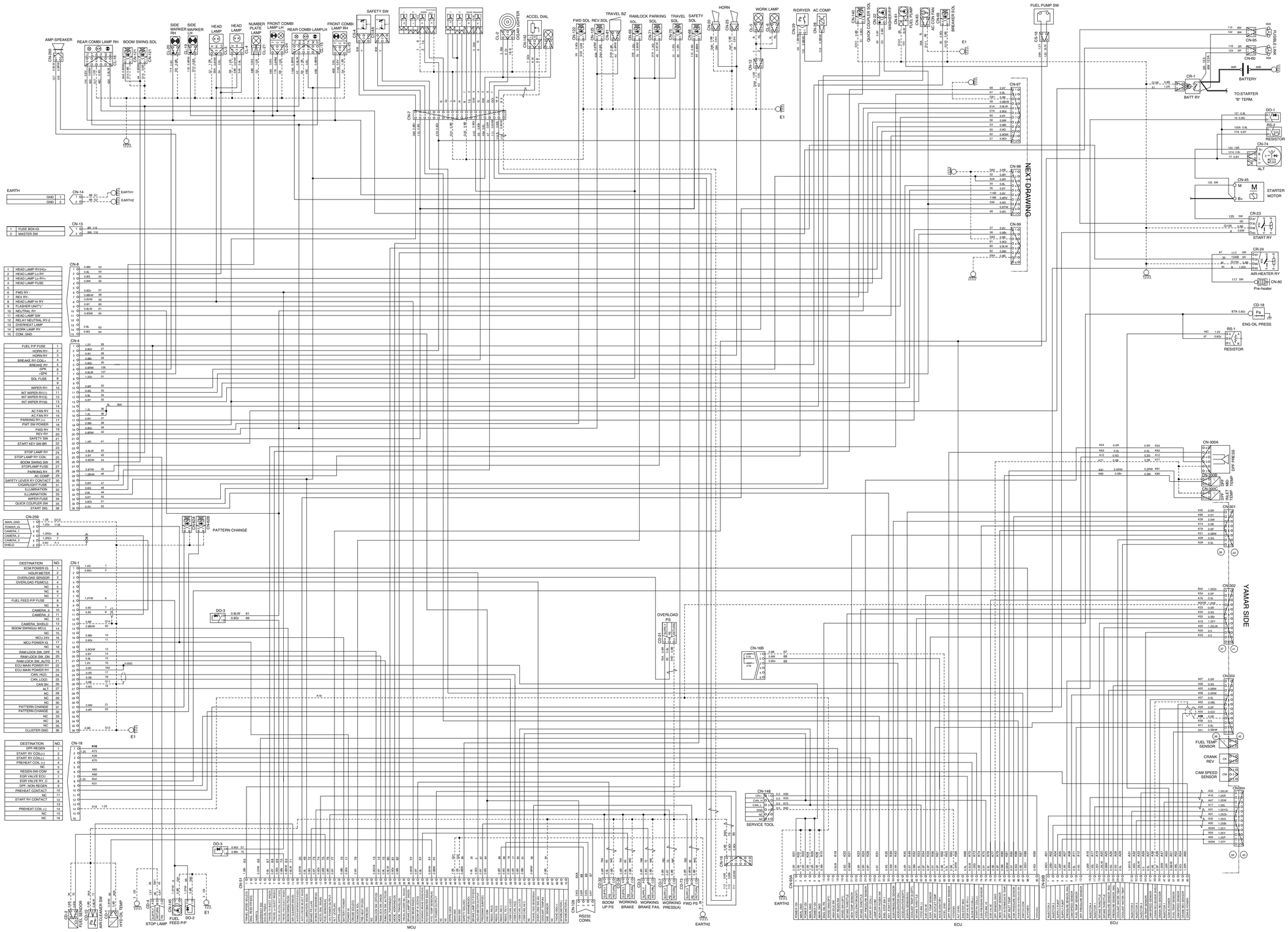
· ELECTRICAL CIRCUIT (1/3)

- MACHINE SERIAL NO. : -#0482



20M9-95122-00

- MACHINE SERIAL NO. : #0483-#0642



1	HEAD LAMP RY(HI)+
2	HEAD LAMP Lo RY
3	HEAD LAMP Lo RY+
4	HEAD LAMP FUSE
5	
6	FWD RY -
7	REV RY -
8	HEAD LAMP HI RY
9	FLASHER UNIT(+)
10	NEUTRAL RY
11	HEAD LAMP SW
12	RELAY NEUTRAL RY-2
13	OVERHEAT LAMP
14	WORK LAMP RY
15	COM_GND

FUEL P/P FUSE	1
HORN RY-	2
HORN RY	3
BREAKE RY COIL+	4
BREAKE RY	5
-SPK	6
+SPK	7
SOL FUSE	8
	9
WIPER RY-	10
INT WIPER RY(+)	11
INT WIPER RY(3)	12
INT WIPER RY(6)	13
	14
AC FAN RY	15
AC FAN RY	16
PARKING RY (+)	17
PWT SW POWER	18
FWD RY	19
REV RY	20
SAFETY SW	21
START KEY SW-BR	22
	23
STOP LAMP RY	24
STOP LAMP RY COIL	25
BOOM SWING SW	26
STOPLAMP FUSE	27
PARKING RY	28
AC COMP	29
SAFETY LEVER RY CONT ACT	30
CIGARLIGHT FUSE	31
ILLUMINATION	32
ILLUMINATION	33
WIPER FUSE	34
QUICK COUPLER SW	35
START SIG.	36

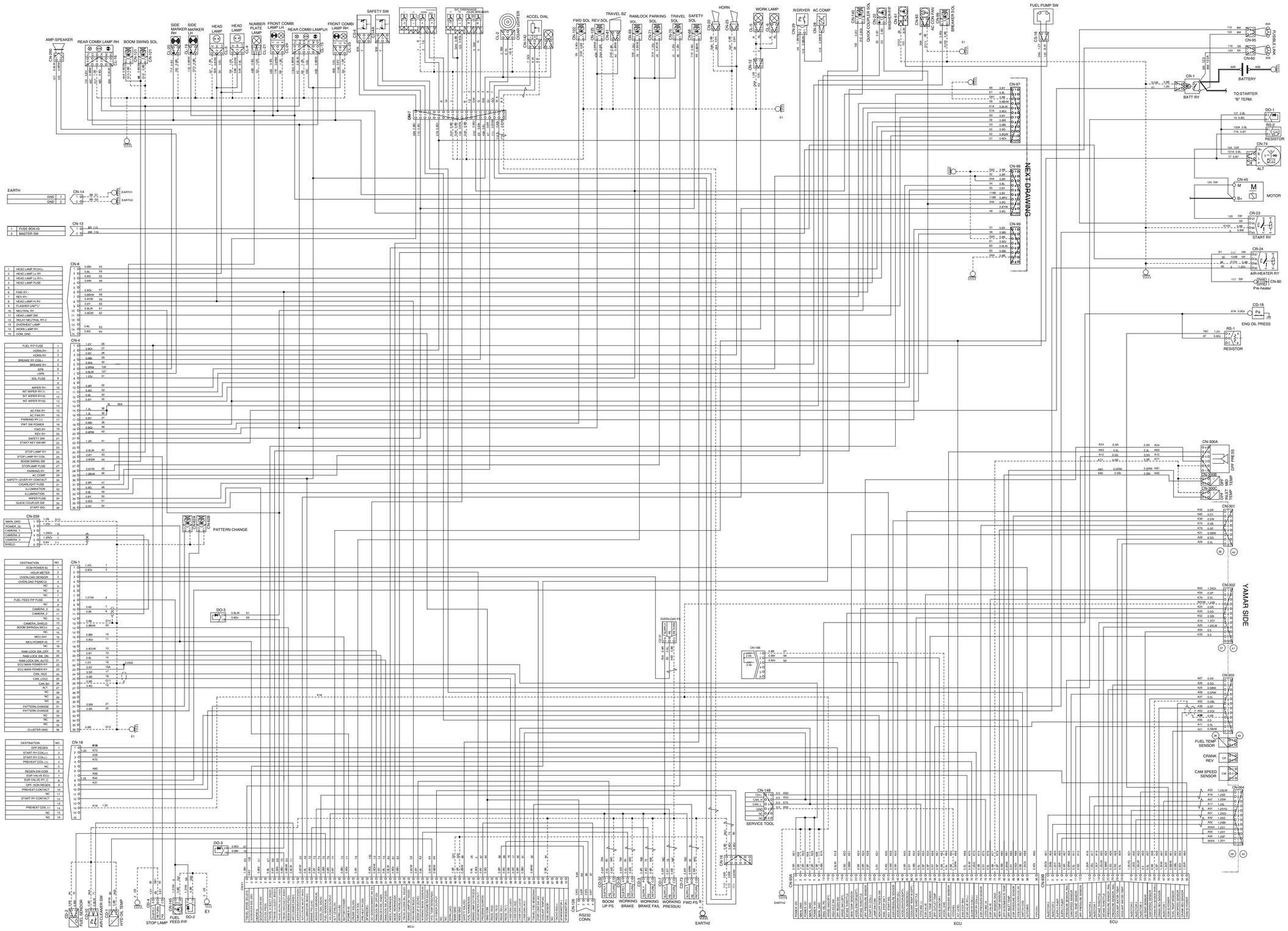
MAIN_GND	1
POWER_IG	2
CAMERA_1	3
CAMERA_2	4
CAMERA_3	5
SHIELD	6

DESTINATION	NO.
ECM POWER IG	1
HOUR METER	2
OVERLOAD SENSOR	3
OVERLOAD PS/MCU	4
NC	5
NC	6
NC	7
FUEL FEED P/P FUSE	8
NC	9
CAMERA_3	10
CAMERA_2	11
NC	12
CAMERA_SHIELD	13
BOOM SWING(to MCU)	14
NC	15
MCU 24V	16
MCU POWER IG	17
NC	18
RAM LOCK SW_OFF	19
RAM LOCK SW_ON	20
RAM LOCK SW_AUTO	21
ECU MAIN POWER RY	22
ECU MAIN POWER RY	23
CAN_HI(2)	24
CAN_LO(2)	25
CAN SH	26
ALT	27
NC	28
NC	29
NC	30
PATTERN CHANGE	31
PATTERN CHANGE	32
NC	33
NC	34
NC	35
CLUSTER GND	36

DESTINATION	NO.
DPF REGEN	1
START RY COIL(-)	2
START RY COIL(+)	3
PREHEAT COIL (+)	4
NC	5
REGEN SW-COM	6
EGR VALVE ECU	7
EGR VALVE RY_C	8
DPF- NON REGEN	9
PREHEAT CONTACT	10
NC	11
START RY CONTACT	12
	13
PREHEAT COIL (-)	14
NC	15
NC	16

20M9-95123-00

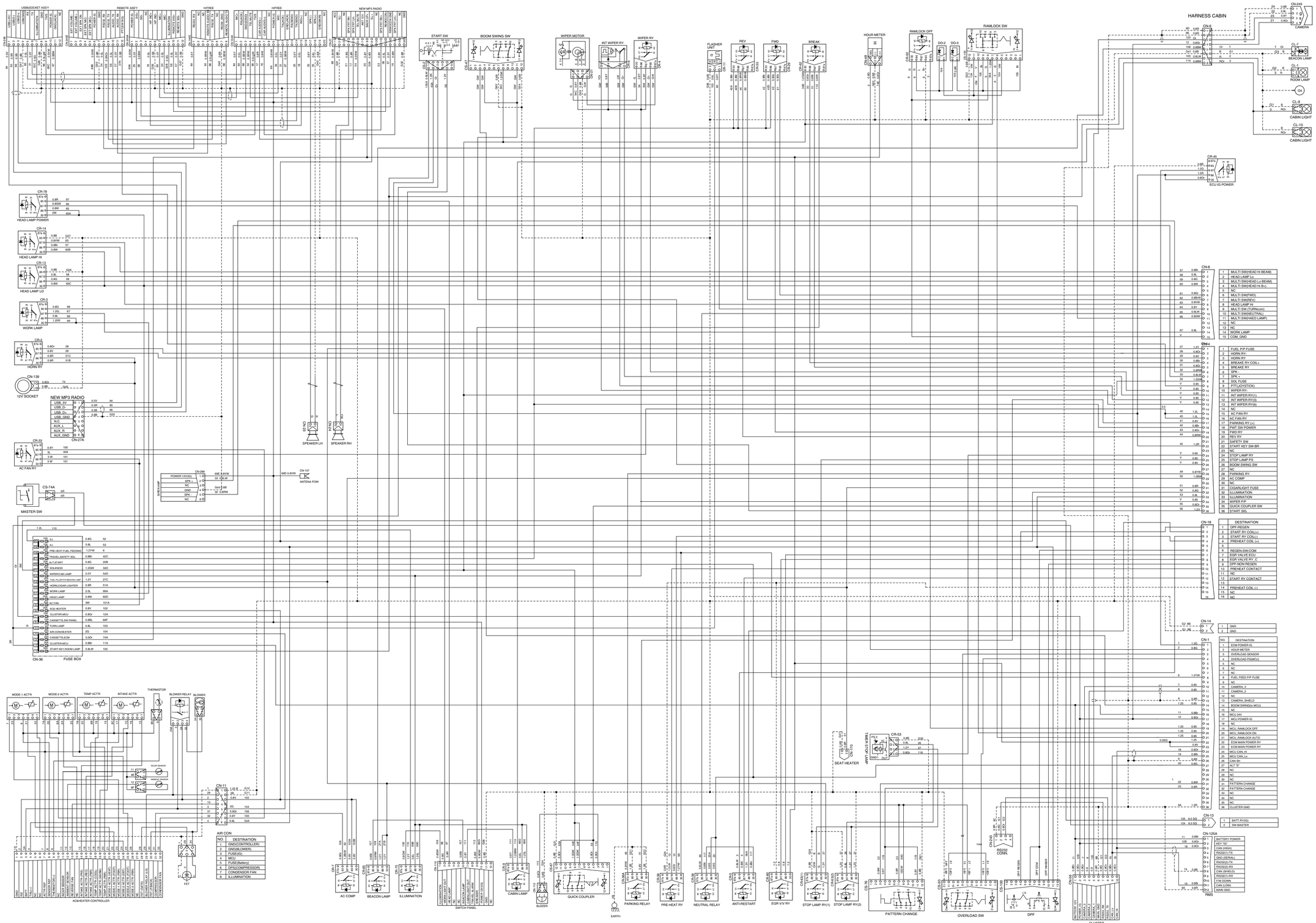
- MACHINE SERIAL NO. : #0643-



20M9-95123-00

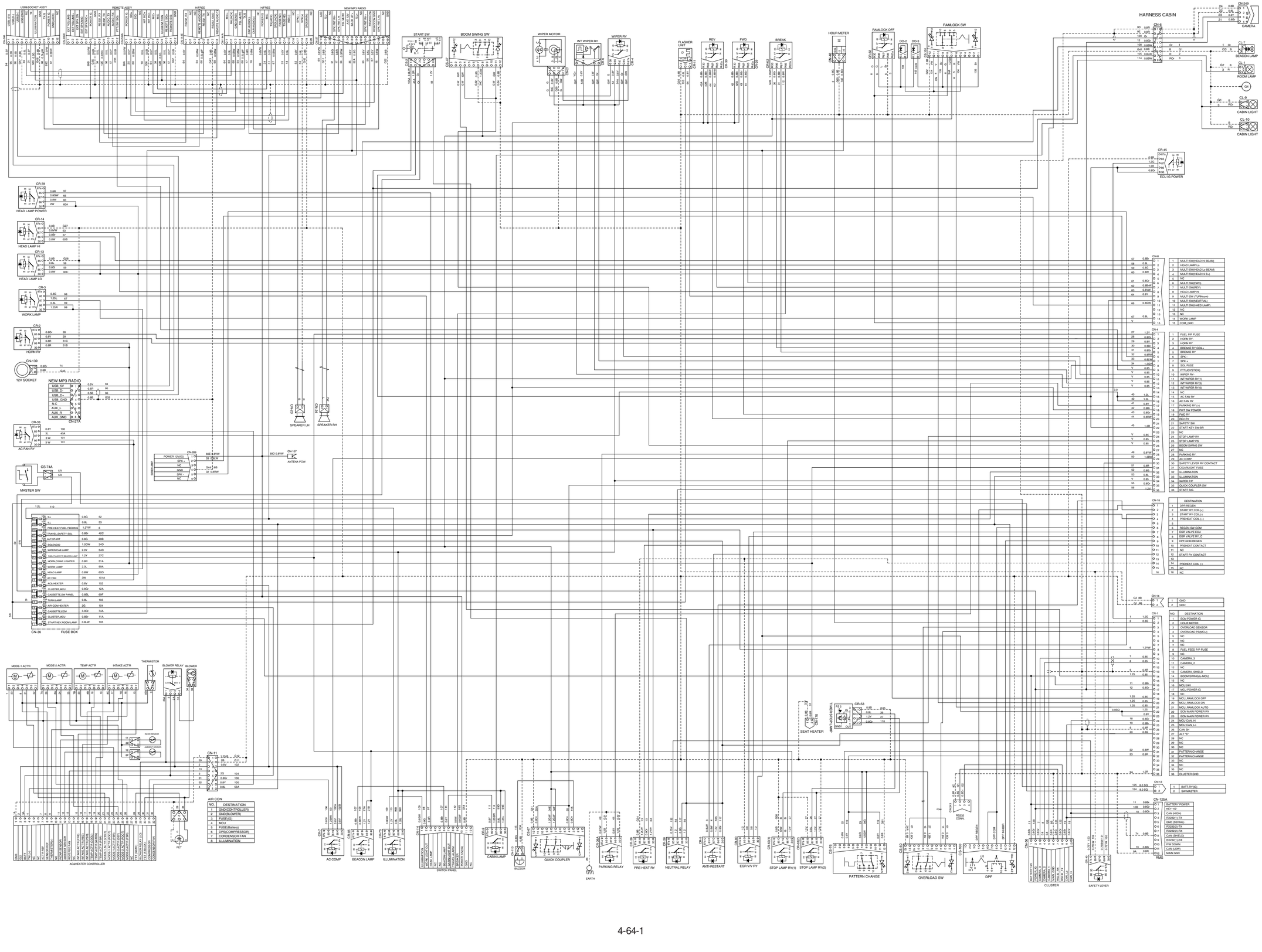
· ELECTRICAL CIRCUIT (2/3)

- MACHINE SERIAL NO. : -#0482



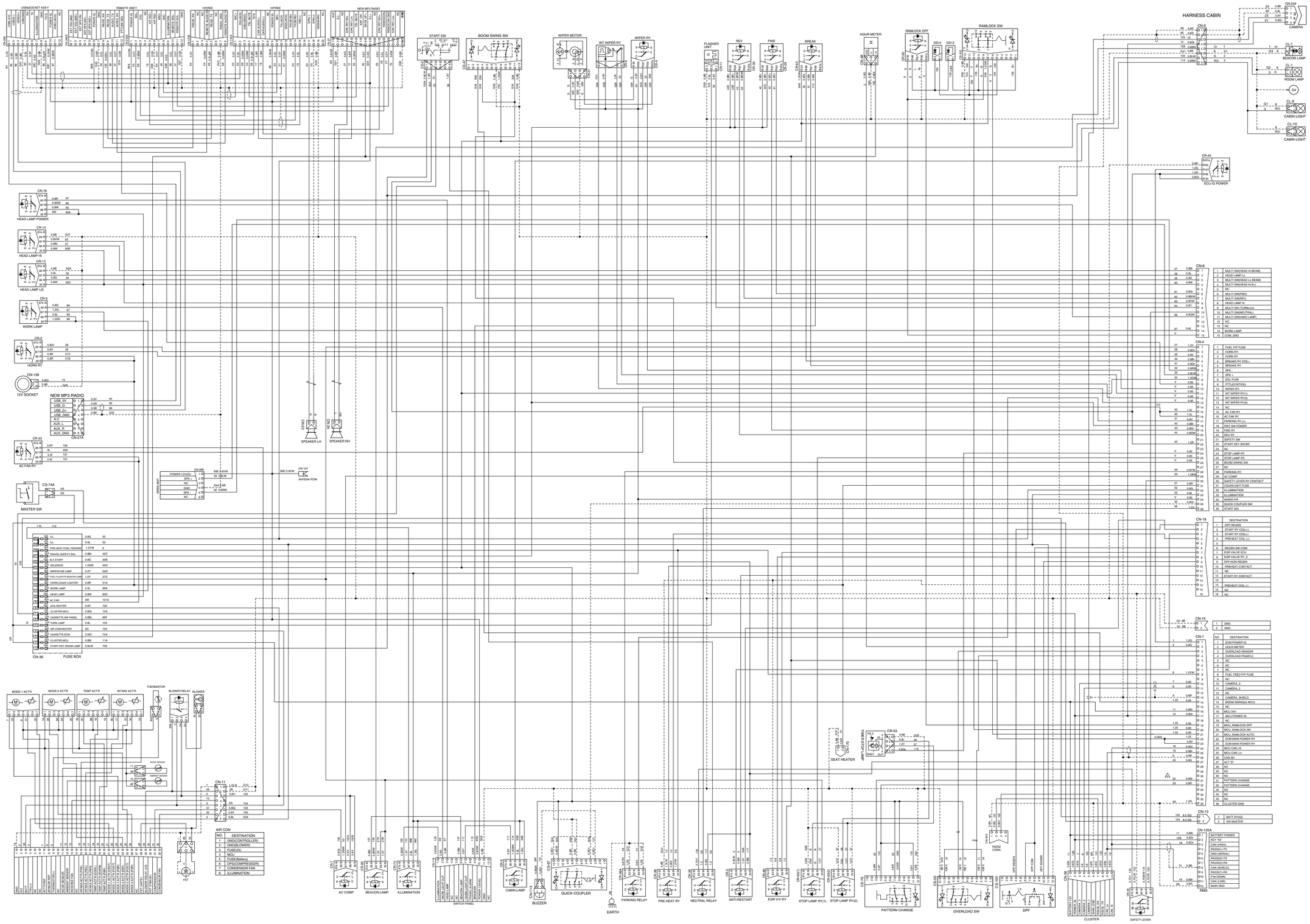
20M9-95111-00

- MACHINE SERIAL NO. : #0483-#0642



20M9-95112-00

- MACHINE SERIAL NO. : #0643-



NO.	DESTINATION
1	GND(CONTROLLER)
2	GND(BLOWER)
3	FUSE(IG)
4	MCU
5	FUSE(Battery)
6	DPS(COMPRESSOR)
7	CONDENSOR FAN
8	ILLUMINATION

1	MULTI SW(HEAD HI BEAM)
2	HEAD LAMP LH
3	MULTI SW(HEAD LH BEAM)
4	MULTI SW(HEAD HI B+)
5	NC
6	MULTI SW(WD)
7	MULTI SW(REV)
8	HEAD LAMP HI
9	MULTI SW (TURN)com)
10	MULTI SW(NEUTRAL)
11	MULTI SW(HEAD LAMP)
12	NC
13	NC
14	WORK LAMP
15	COM_GND

1	FUEL P/P FUSE
2	HORN RY-
3	HORN RY
4	BREAKE RY COIL+
5	BREAKE RY
6	SPK-
7	SPK +
8	SOL FUSE
9	PTT(JOYSTICK)
10	WIPER RY-
11	INT WIPER RY(1)
12	INT WIPER RY(3)
13	INT.WIPER RY(B)
14	NC
15	AC FAN RY
16	AC FAN RY
17	PARKING RY (+)
18	PWT SW POWER
19	FWD RY
20	REV RY
21	SAFETY SW
22	START KEY SW-BR
23	NC
24	STOP LAMP RY
25	STOP LAMP FB
26	BOOM SWING SW
27	NC
28	PARKING RY
29	AC COMP
30	SAFETY LEVER-RY CONTACT
31	CIGARLIGHT FUSE
32	ILLUMINATION
33	ILLUMINATION
34	WIPER P/P
35	QUICK COUPLER SW
36	START SIG.

	DESTINATION
1	OFF-REGEN
2	START RY COIL(+)
3	START RY COIL(-)
4	PREHEAT COIL (+)
5	
6	REGEN-SW-COM
7	EGR VALVE ECU
8	EGR VALVE RY_C
9	OFF-NON REGEN
10	PREHEAT CONTACT
11	NC
12	START RY CONTACT
13	
14	PREHEAT COIL (-)
15	NC
16	NC

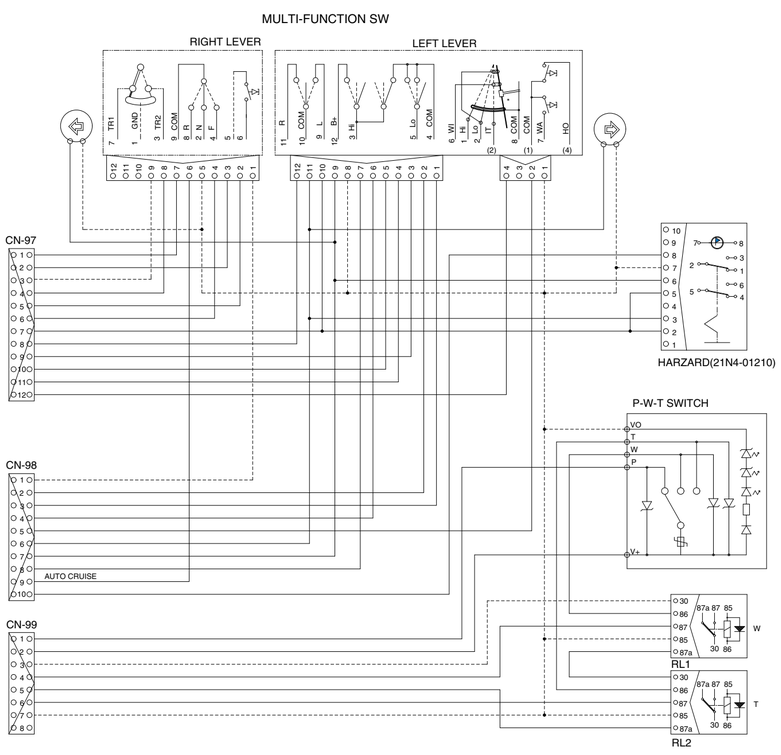
1	GND
2	GND

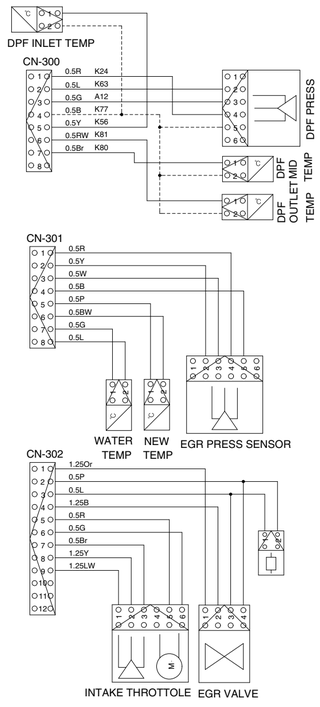
NO.	DESTINATION
1	ECM POWER-IG
2	HOUR METER
3	OVERLOAD SENSOR
4	OVERLOAD PS(MCU)
5	NC
6	NC
7	NC
8	FUEL FEED P/P FUSE
9	NC
10	CAMERA_3
11	CAMERA_2
12	NC
13	CAMERA_SHIELD
14	BOOM SWING(to MCU)
15	NC
16	MCU 24V
17	MCU POWER IG
18	NC
19	MCU_RAMLOCK OFF
20	MCU_RAMLOCK ON
21	MCU_RAMLOCK AUTO
22	ECM MAIN POWER RY
23	ECM MAIN POWER RY
24	MCU CAN_HI
25	MCU CAN_Lo
26	CAN SH
27	ALT "S"
28	NC
29	NC
30	NC
31	PATTERN CHANGE
32	PATTERN CHANGE
33	NC
34	NC
35	NC
36	CLUSTER GND

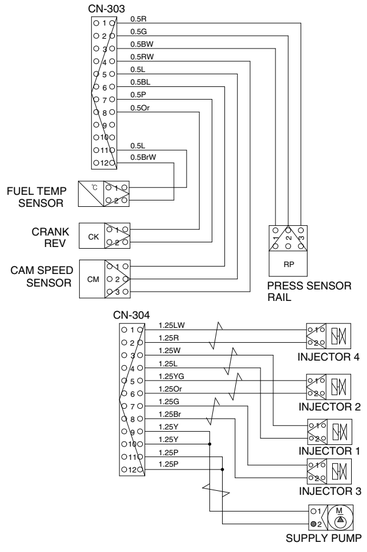
1	BATT.RY(G)
2	SW.MASTER

1	BATTERY POWER
2	KEY "IG"
3	CAN (HIGH)
4	RX232(1)-TX
5	GND (SERIAL)
6	RX232(2)-TX
7	RX232(2)-RX
8	CAN (SHIELD)
9	RX232(1)-RX
10	F/W DOWN
11	CAN (LOW)
12	MAIN GND

· ELECTRICAL CIRCUIT (3/3)







YANMAR SIDE

20M9-95130-00

MEMORANDUM

1. POWER CIRCUIT

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

When the start switch is in the OFF position, the current flows from the positive battery terminal as shown below.

1) OPERATING FLOW

Battery → Battery relay → Fusible link (CN-60) → I/conn [CN-13 (2)] → Master switch [CS-74A]

- → Fuse box [No.1]
  - → Start switch [CS-2 (1)]
  - → I/conn [CN-6 (7)] → Room lamp [CL-1 (2)]
- → Fuse box [No.2]
  - → Cluster [CN-56 (1)]
  - → I/conn [CN-1 (16)] → MCU [CN-51 (22)]
- → Fuse box [No.3]
  - → I/conn [CN-1 (22, 23)] → ECU [CN-93A (1), (3), (5)]
  - → Radio & USB player [CN-27 (8)]
  - → Hour meter [CN-48 (1)]
  - → EGR valve relay [CR-80 (30)]
- → Fuse box [No.4] → Aircon & heater controller [CN-31 (5)]

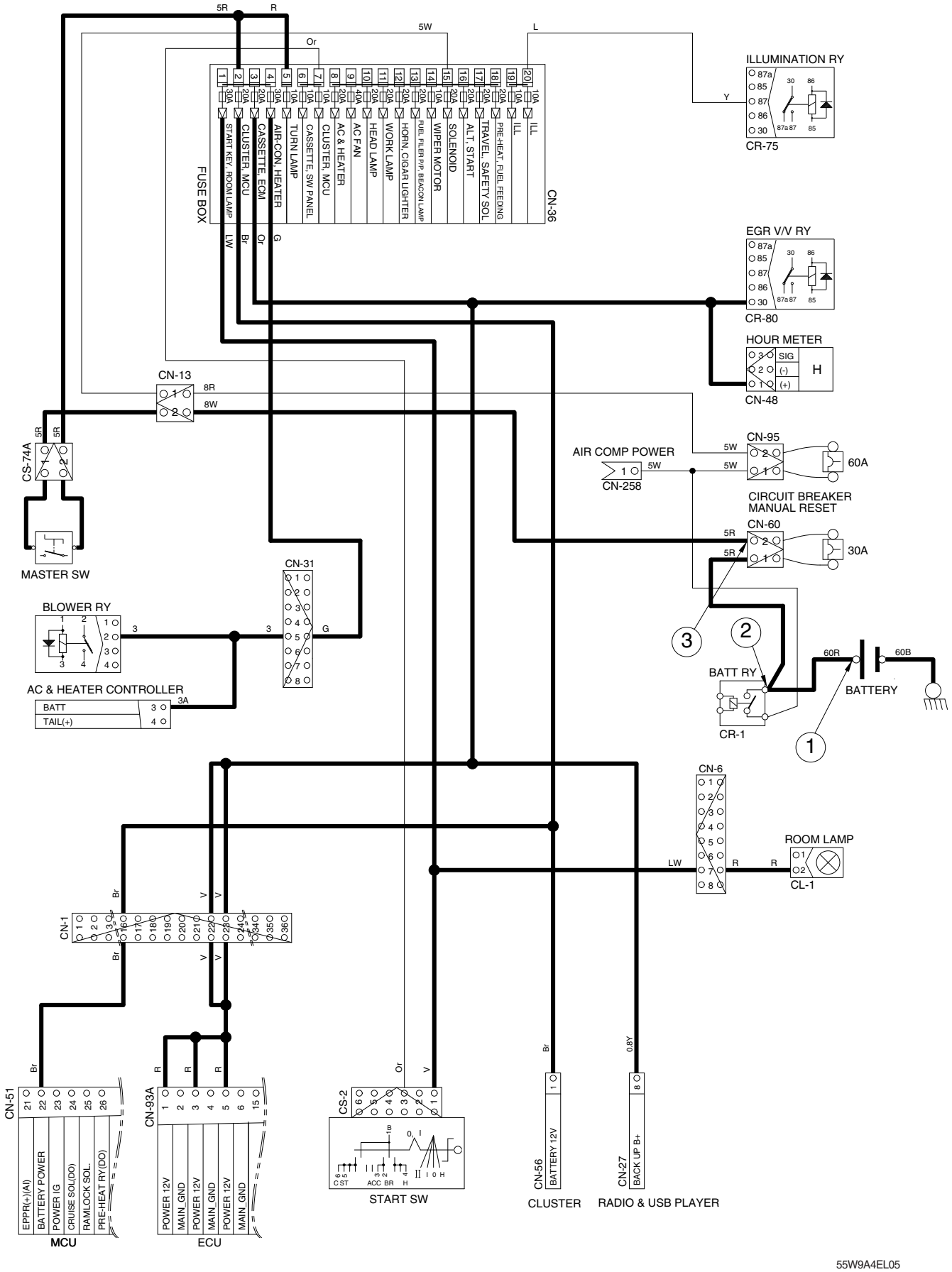
※ I/conn : Intermediate connector

2) CHECK POINT

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

※ GND : Ground

POWER CIRCUIT



2. STARTING CIRCUIT

1) OPERATING FLOW

Battery (+) terminal → Battery relay[CR-1] → Fusible link [CN-60]
→ I/conn [CN-13 (2)] → Master switch [CS-74A] → Fuse box No.1 → Start key [CS-2 (1)]

※ Start switch : ON

→ Start switch ON [CS-2 (2)] → ECU IG power relay [CR-45 (30,86)]
→ I/conn [CN-4 (22)] →
Battery relay [CR-1] : Battery relay operating (all power is supplied with the electric component)
→ Start switch ON [CS-2 (3)] → Fuse box (all power is supplied with electric component)

※ Start switch : START

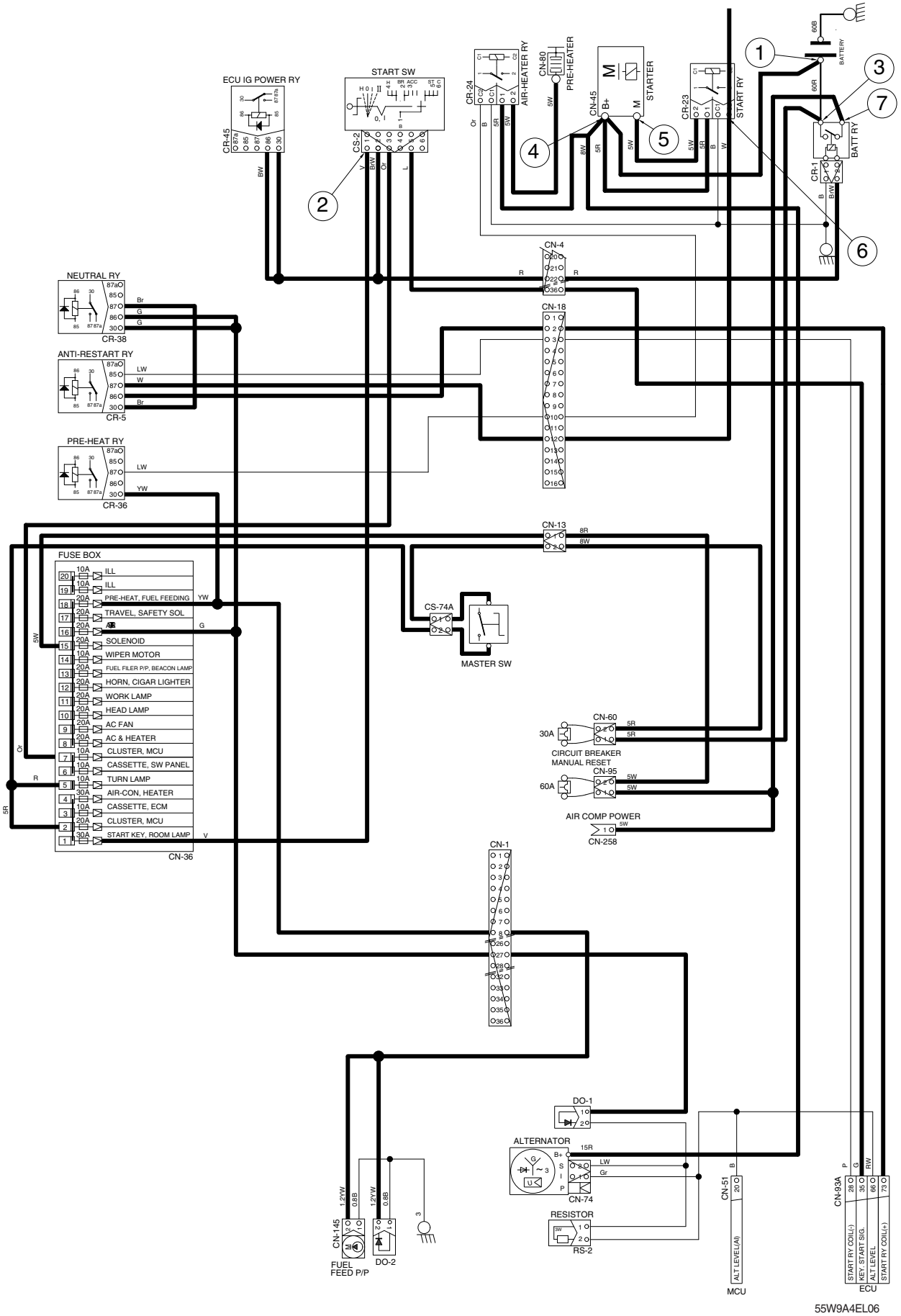
Start switch START [CS-2 (5)]
→ I/conn [CN-4 (36)] → ECU [CN-93A (35)→(28, 73)] → I/conn [CN-18 (2, 3)]
→ Anti-restart relay [CR-5 (30,86)→(87)] → I/conn [CN-18 (12)]
→ Start relay [CR-23 (1)→(2)] → Start motor operating

2) CHECK POINT

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

※ GND : Ground

STARTING CIRCUIT



3. CHARGING CIRCUIT

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

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

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

1) OPERATING FLOW

(1) **Warning flow**

Alternator "L" terminal → MCU [CN-51 (20)] → Cluster warning lamp

(2) Charging flow

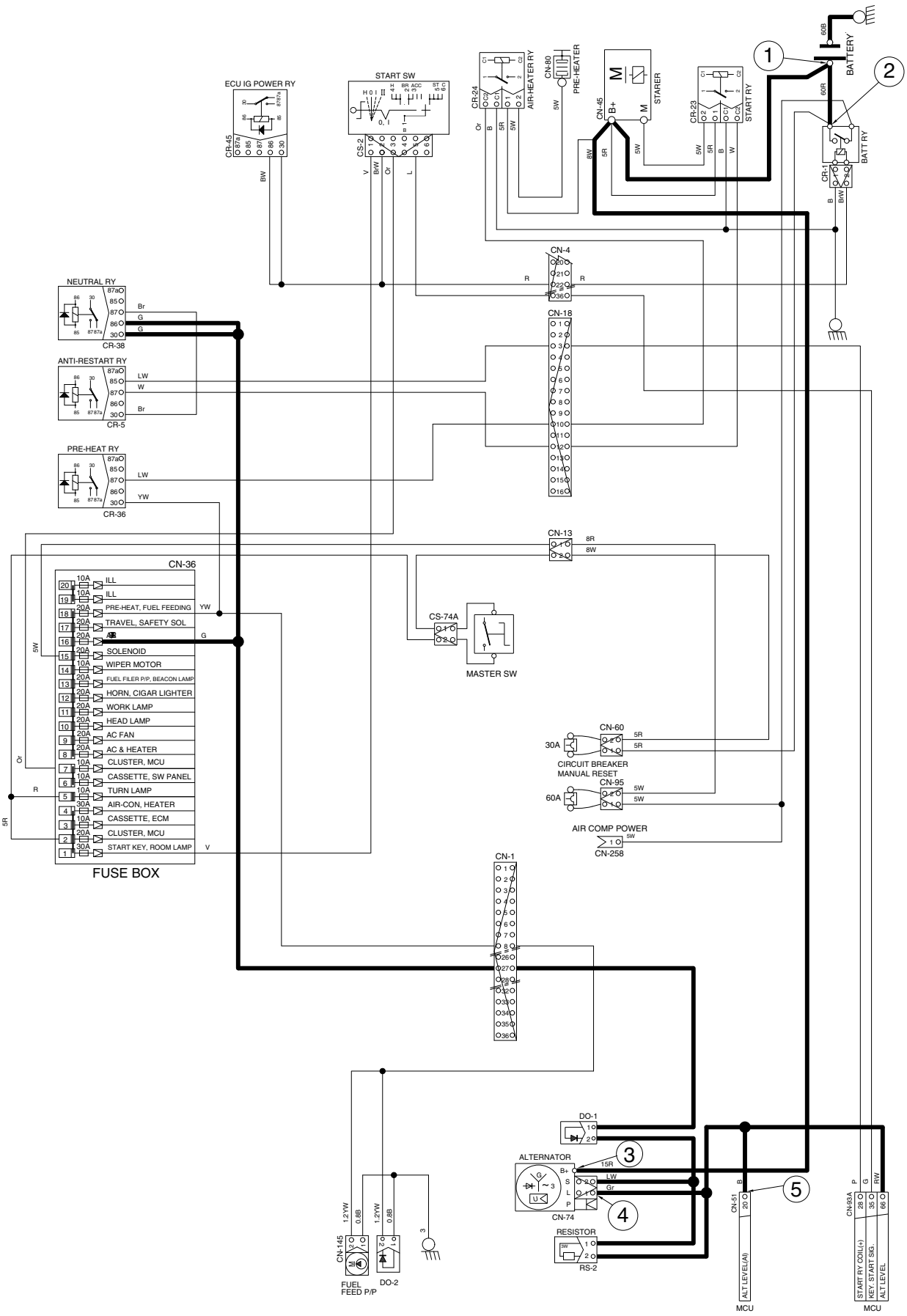
Alternator "B^+" terminal → Battery relay → Battery (+) terminal

2) CHECK POINT

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

※ GND : Ground

CHARGING CIRCUIT



55W9A4EL07

4. HEAD AND WORK LIGHT CIRCUIT

1) OPERATING FLOW

Fuse box (No.10) → Head lamp relay [CR-13 (30)→(86)] → I/conn [CN-8 (3)]
I/conn [CN-97 (10)] → Multifunction switch left lever
Head lamp power relay [CR-78 (30)→(85)] → Switch panel [CN-116 (3)]
Fuse box (No.11) → Work lamp relay [CR-3 (30)→(85)] → Switch panel [CN-116 (2)]

(1) Main light switch ON : 1st step

Head light switch ON [CN-116 (3)] → Head lamp power relay [CR-78 (85)→(87)]
→ I/conn [CN-8 (11)] → I/conn [CN-97 (11)] → Multifunction sw left lever [(4)→(5)]
→ I/conn [CN-97 (10)] → I/conn [CN-8 (3)] → Head light low relay [CR-13 (86),(87)]
→ I/conn [CN-8 (2)] → Head light ON [CL-3 (1), CL-4 (1)] : Head light ON

(2) Main light switch ON : 2nd step

Head light switch [CN-116 (3)] → Head lamp power relay [CR-78 (85)→(87)]
→ I/conn [CN-8 (11)] → I/conn [CN-97 (11)] → Multifunction sw left lever [(4)→(3)]
→ I/conn [CN-97 (9)] → I/conn [CN-8 (1)]
→ Head light high relay [CR-14 (86)→(87)] → I/conn [CN-8 (8)]
→ Head light ON [CL-3 (2), CL-4 (2)] : Head light high beam ON

(3) Work lamp switch ON :

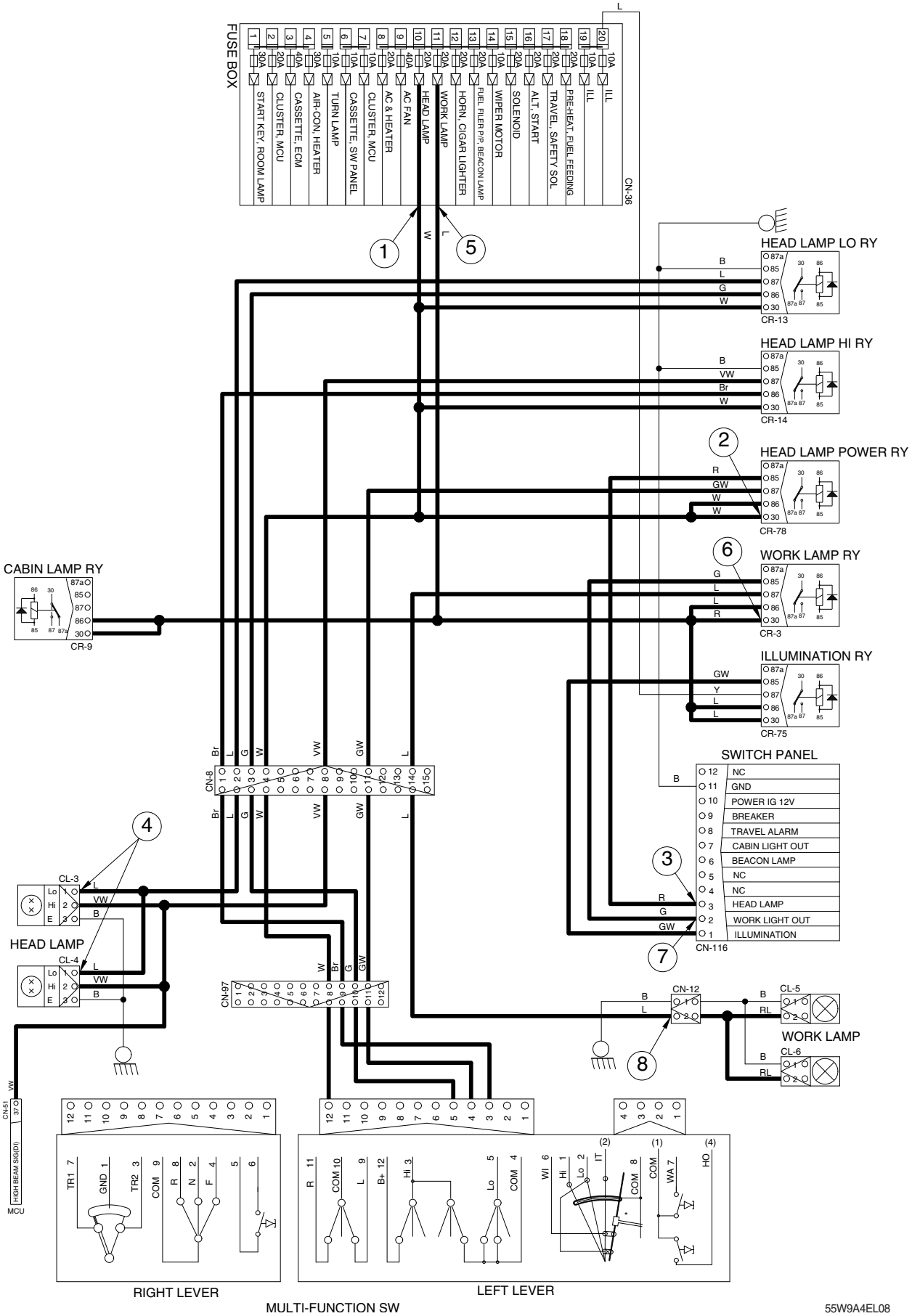
Work lamp switch ON [CS-116 (2)] → Work lamp relay [CR-3 (85)→(87)] → I/conn [CN-8 (14)]
→ I/conn [CN-12 (2)] → Work lamp ON [CL-5 (2), CL-6 (2)] : Work lamp ON

2) CHECK POINT

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

※ GND : Ground

HEAD AND WORK LAMP CIRCUIT



55W9A4EL08

5. BEACON LAMP AND CAB LAMP CIRCUIT

1) OPERATING FLOW

Fuse box (No.13) → Beacon lamp relay [CR-85 (30)→(85)] → Switch panel [CN-116 (6)]
Fuse box (No.11) → Cab lamp relay [CR-9 (30)→(85)] → Switch panel [CN-116 (7)]

(1) Beacon lamp switch ON

Switch panel [CN-116 (6)] → Beacon lamp relay [CR-85 (85)→(87)] → I/conn [CN-6 (5)]
→ Beacon lamp [CL-7]

(2) Cab lamp switch ON

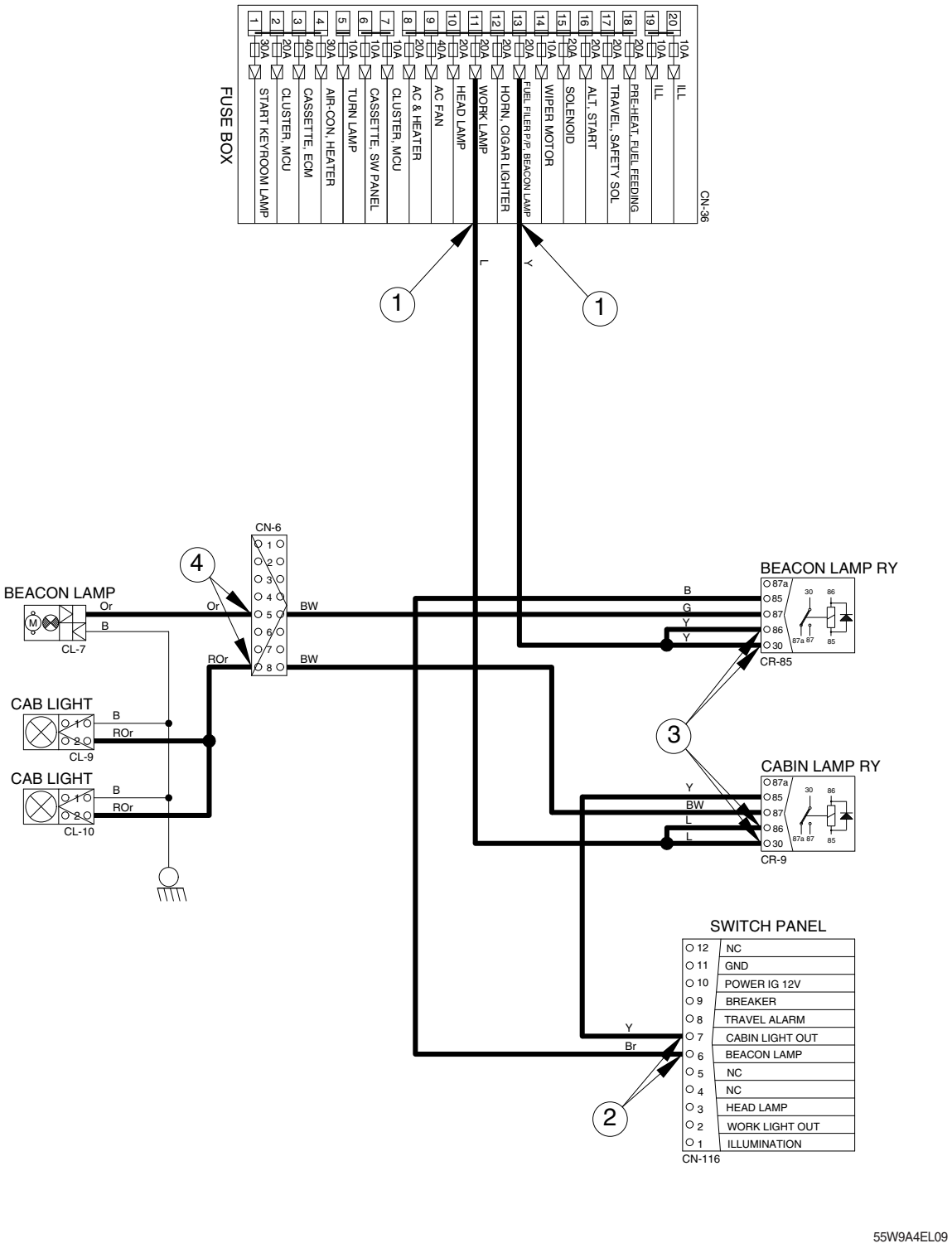
Switch panel [CN-116 (7)] → Cab lamp relay [CR-9 (85)→(87)] → I/conn [CN-6 (8)]
→ Cab light [CL-9 (2), CL-10 (2)]

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 (beacon & cab lamp)	10~12.5V

※ GND : Ground

BEACON AND CAB LAMP CIRCUIT



55W9A4EL09

6. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

(1) Key switch ON

Fuse box (No.14) → Wiper motor [CN-21 (3)]
→ Int wiper relay [CR-6 (4)]
→ Wiper relay [CR-4 (86)]
→ Wiper relay [CR-4 (87)]
→ I/conn [CN-4 (34)] → Washer pump [CN-22 (2)]

(2) Wipe switch ON : 1st step (intermittent)

Multifunction switch left lever (2) → I/conn [CN-98 (5)] → I/conn [CN-4 (13)]
→ Int wiper relay [CR-6 (6)] : Wiper motor intermittently operating → Int wiper relay [CR-6 (6)→(3)]
→ I/conn [CN-4 (12)] → I/conn [CN-98 (4)] → Multifunction switch left lever (6)→(2)
→ I/conn [CN98 (2)] → I/conn [CN-4 (10)] → Wiper relay [CR-4 (85)] : Wiper relay operating
→ Wiper relay [CR-4 (87)→(30)] → Wiper motor [CN-21 (4)] : Wiper motor operating

(3) Wiper switch ON : 2nd or 3rd step

Multifunction switch left lever (2) → I/conn [CN-98 (2)] → I/conn [CN-4 (10)]
→ Wiper relay [CR-4 (85)] : Wiper relay operating → Wiper relay [CR-4 (87)→(30)]
→ Wiper motor operating [CN-21(1)] : Wiper motor operating

(4) Auto parking (when switch OFF)

Wiper switch OFF → Wiper relay OFF
→ Int wiper relay OFF
→ Wiper motor [CN-21 (3)→(1)] → Wiper relay [CR4 (87a)→(30)]
→ Wiper motor [CN-21 (4)] : Wiper motor parking position

(5) Washer switch ON

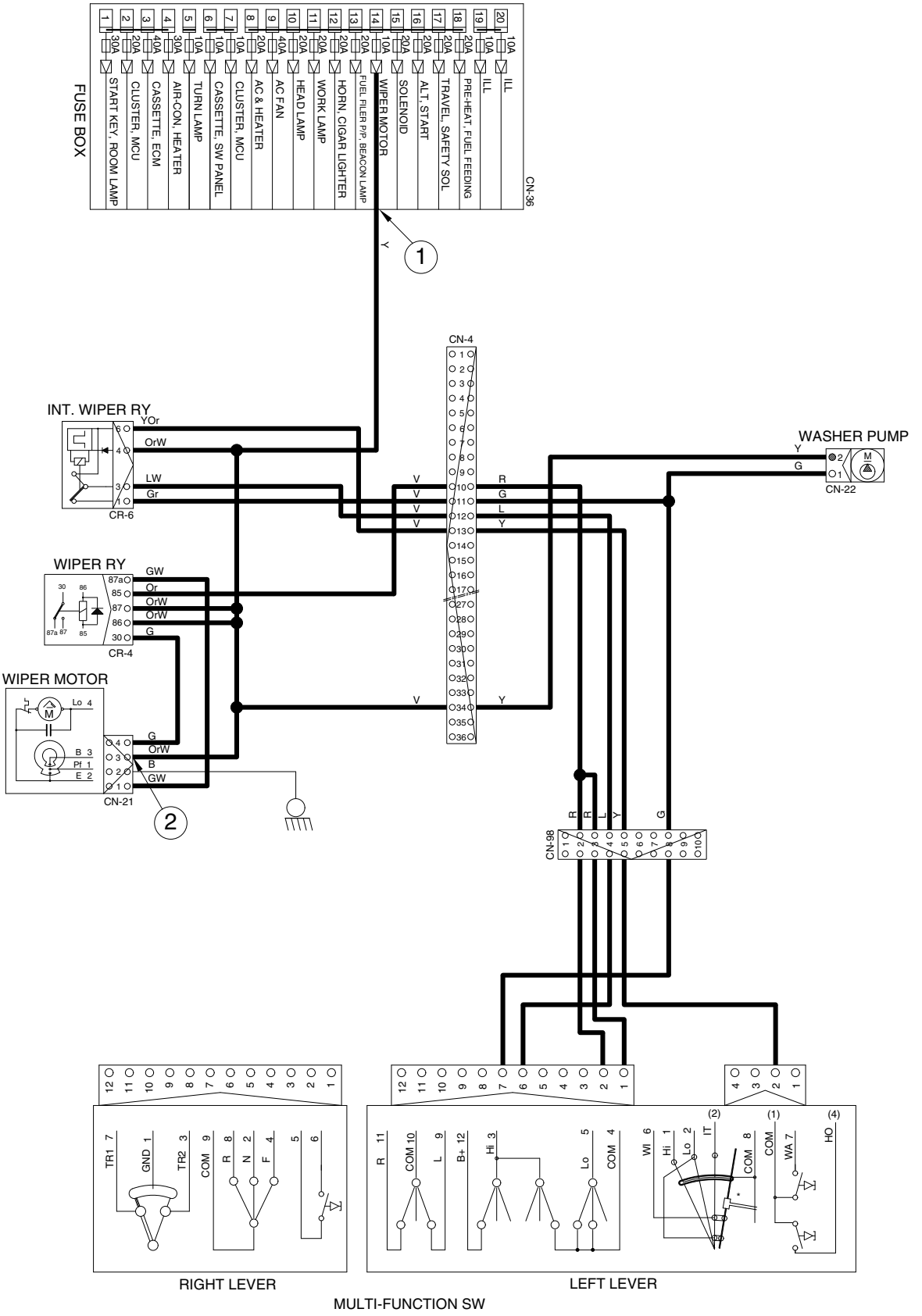
Multifunction sw left lever (7) → I/conn [CN-98 (8)] → Washer pump [CN-22 (1)] : Washer pump operating

2) CHECK POINT

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

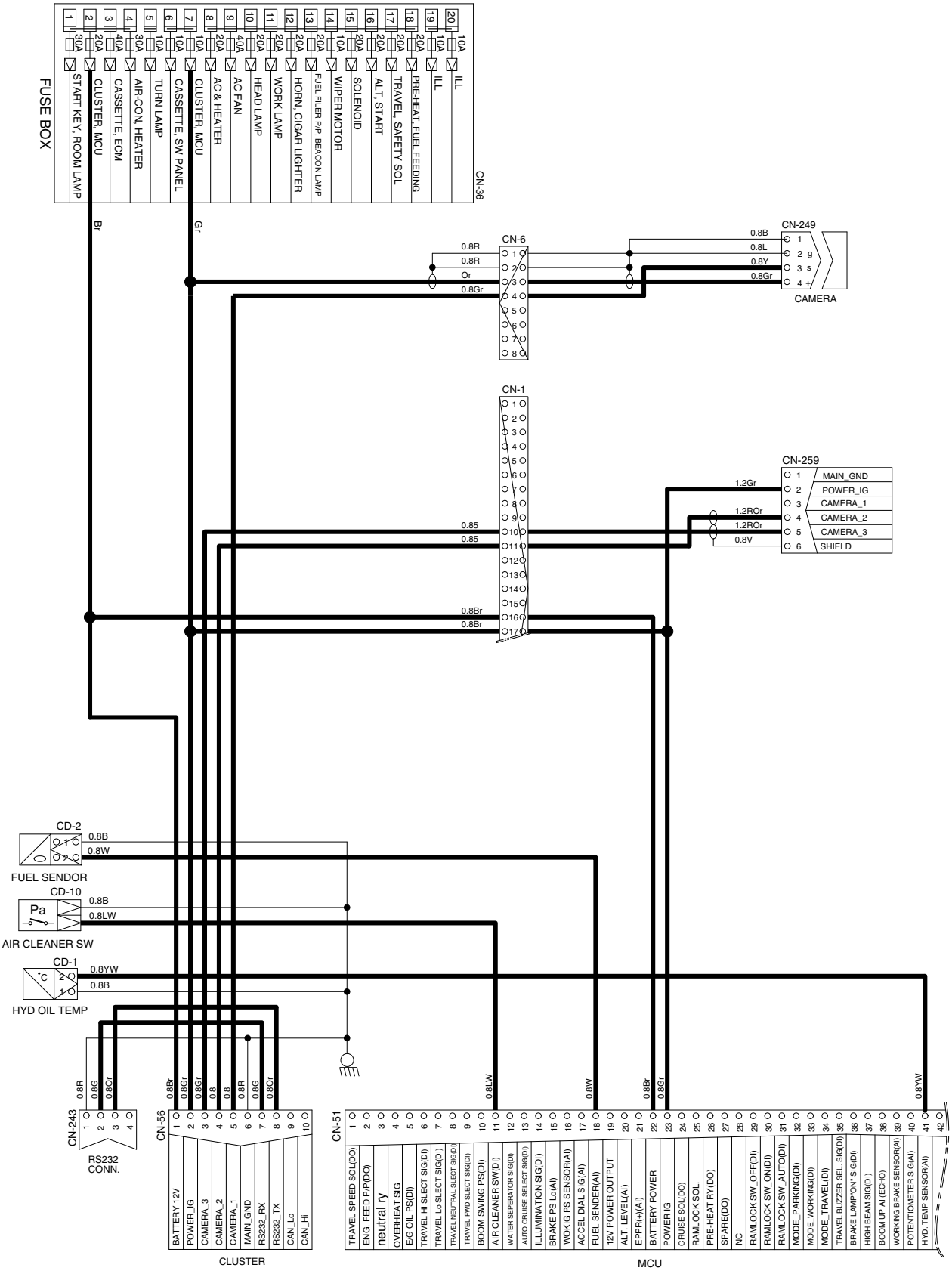
※ GND : Ground

WIPER AND WASHER CIRCUIT



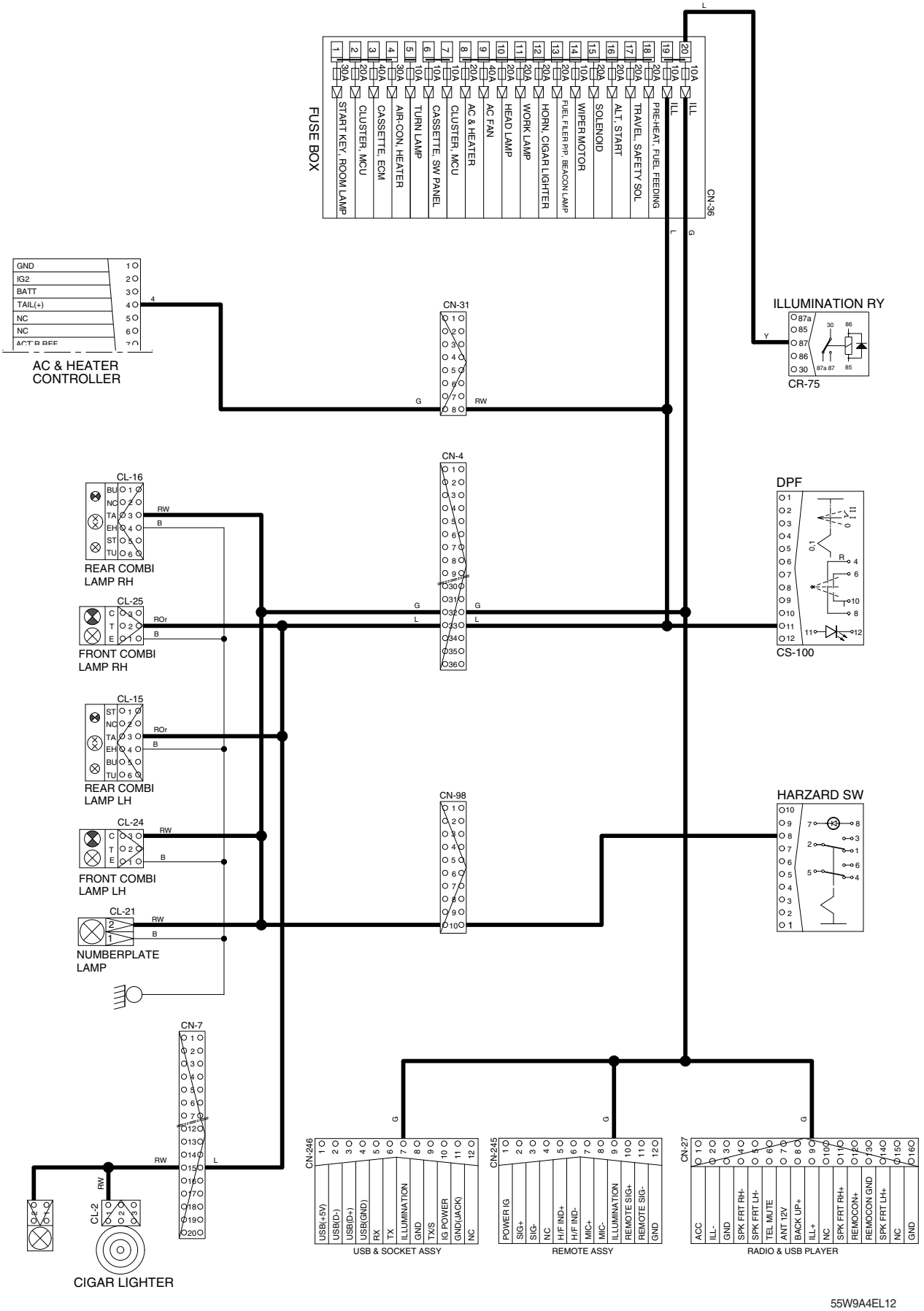
55W9A4EL10

MONITORING CIRCUIT

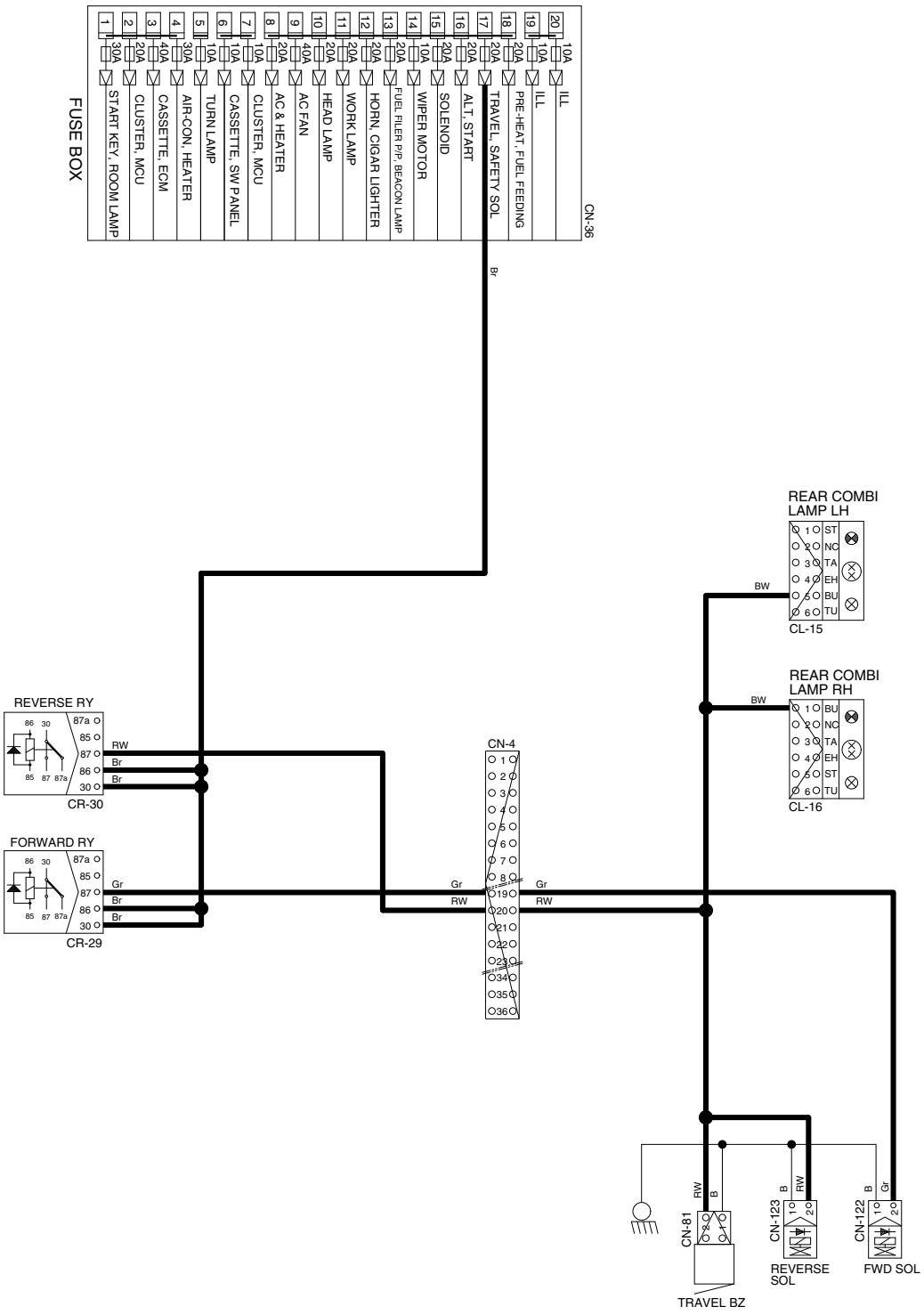


55W9A4EL11

ILLUMINATION CIRCUIT

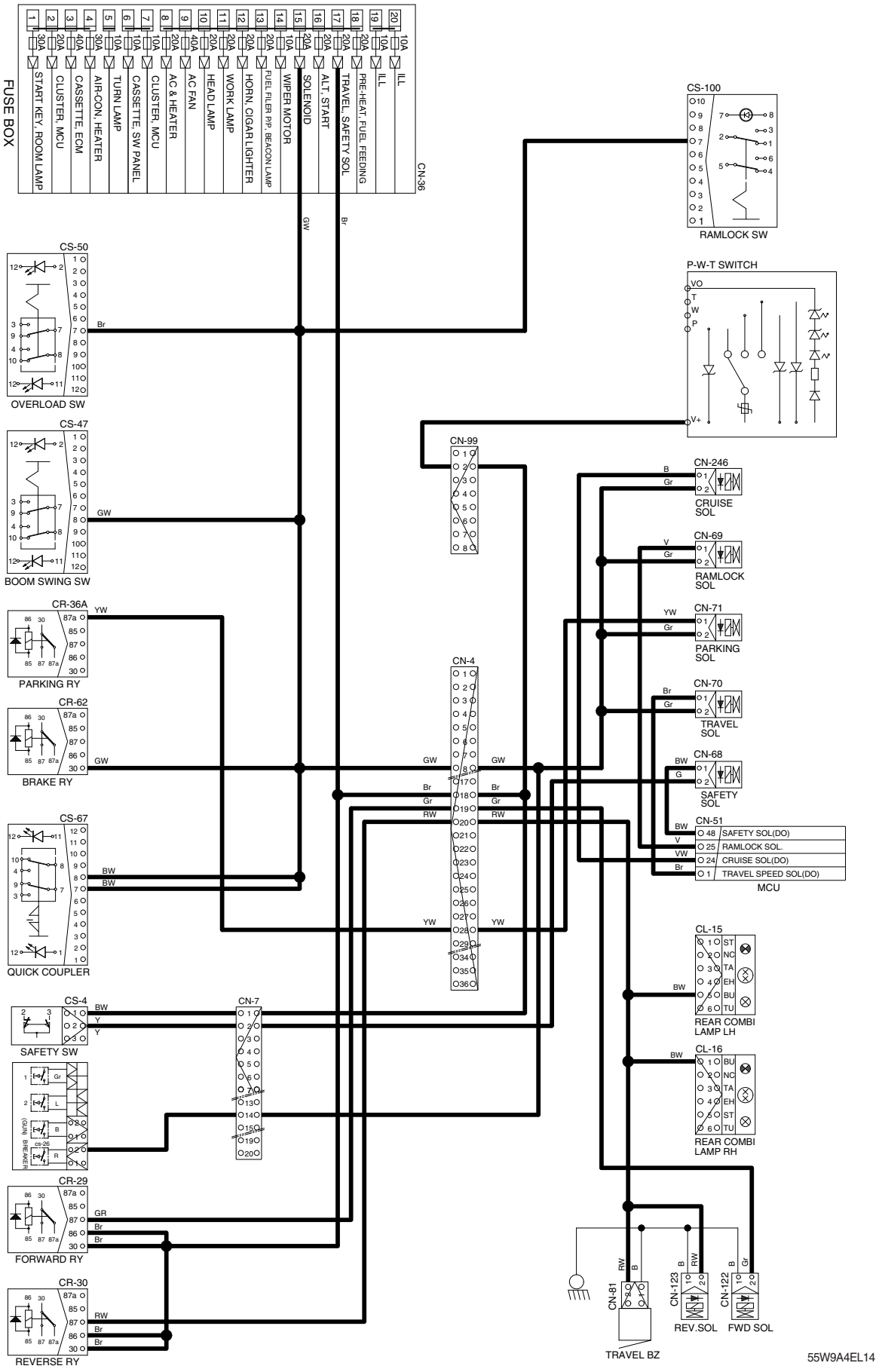


COMBINATION LAMP CIRCUIT

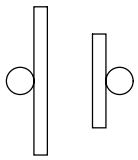
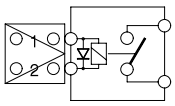
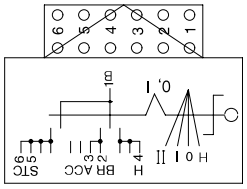
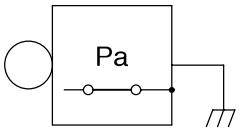
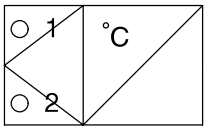


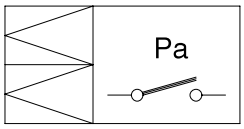
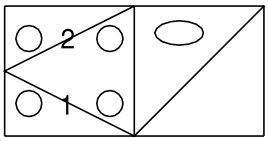
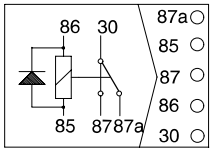
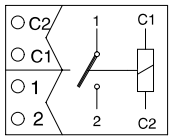
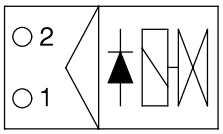
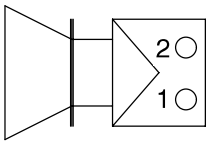
55W9A4EL13

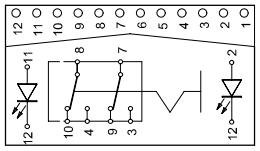
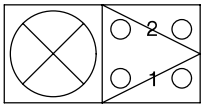
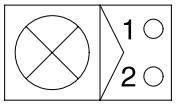
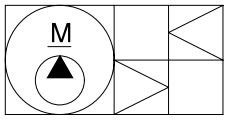
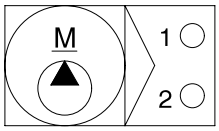
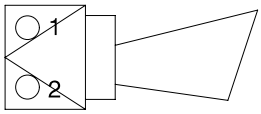
ELECTRIC CIRCUIT FOR HYDRAULIC

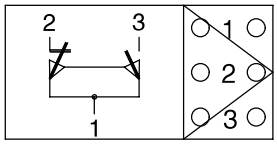
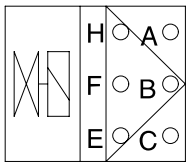
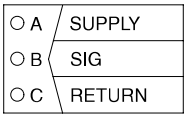
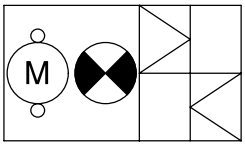
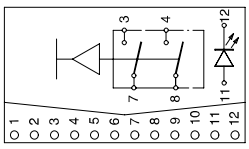
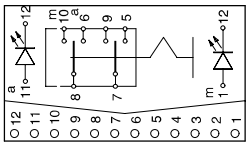


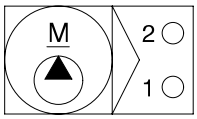
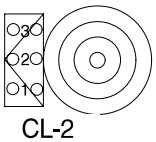
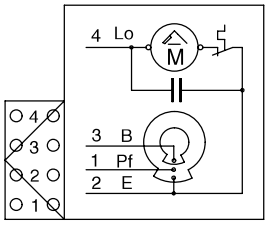
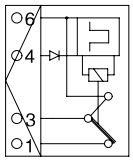
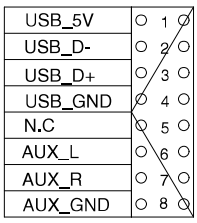
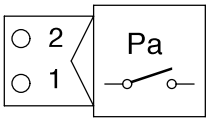
GROUP 4 ELECTRICAL COMPONENT SPECIFICATION

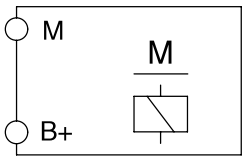
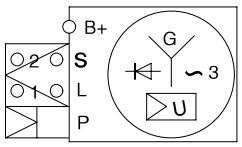
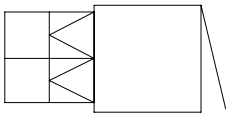
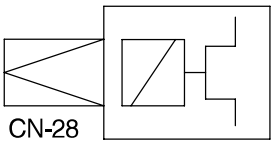
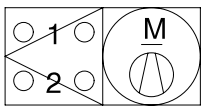
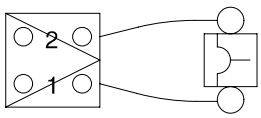
Part name	Symbol	Specification	Check
Battery		12V × 100Ah	※ Check specific gravity 1.280 over : Over charged 1.280 ~ 1.250 : Normal 1.250 below : Recharging
Battery relay	 CR-1	Rated load : 12V 100A (continuity) 1000A (30 second)	※ Check coil resistance Normal : about 12Ω ※ Check contact Normal : ∞Ω
Start key	 CS-2	12V	※Check contact OFF : ∞Ω (for each terminal) ON : 0Ω (for terminal 1-3 and 1-2) START : 0Ω (for terminal 1-5)
Pressure switch (for engine oil)	 CD-18	0.5 kgf/cm² (N.C TYPE)	※ Check resistance Normal : 0Ω (CLOSE)
Temperature sensor	 CD-1 CN-300B CD-8 CN-300C	-	※ Check resistance 50˚C : 804Ω 80˚C : 310Ω 100˚C : 180Ω

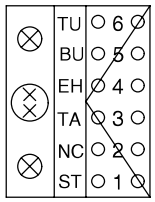
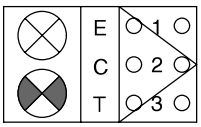
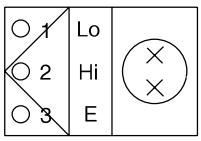
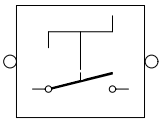
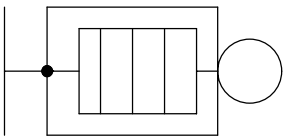
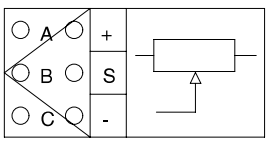
Part name	Symbol	Specification	Check
Air cleaner pressure switch	 CD-10	Pressure: 635mmH_2O (N.O TYPE)	※ Check contact Normal : ∞Ω
Fuel sender	 CD-2	-	※ Check resistance Full : 100Ω Low : 500Ω Empty warning :700Ω
Relay	 CR-2 CR-3 CR-4 CR-5 CR-6 CR-7 CR-9 CR-13 CR-14 CR-29 CR-30 CR-33 CR-36 CR-36A CR-38 CR-45 CR-62 CR-65 CR-63(1), (2) CR-75 CR-78 CR-80 CR-85	12V 20A	※ Check resistance Normal : About 200Ω (for terminal 85-86) : 0Ω(for terminal 30-87a)
Relay	 CR-23 CR-24 CR-47	12V 60A	※ Rated coil current 1.2±0.3A
Solenoid valve	 CN-66 CN-68 CN-69 CN-70 CN-71 CN-121 CN-122 CN-123 CN-140 CN-246	12V 1A	※ Check resistance Normal : 15~25Ω (for terminal 1-2)
Speaker	 CN-23(LH) CN-24(RH)	4Ω 20W	※Check resistance Normal : 4Ω

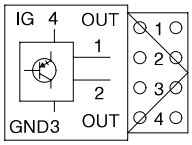
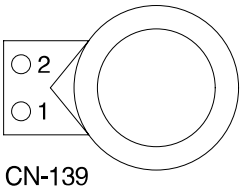
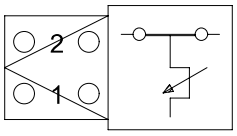
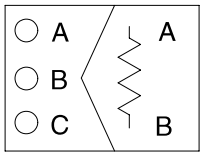
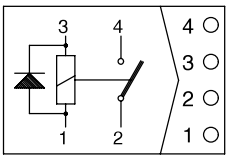
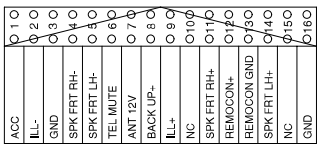
Part name	Symbol	Specification	Check
Switch (looking type)	 CS-47 CS-50 CS-67 CS-99	12V 16A	※ Check contact Normal OFF - ∞Ω(for terminal 1-5,2-6) - 0Ω(for terminal 5-7,6-8)
Work lamp	 CL-5 CL-6 CL-9 CL-10 CL-19 CL-20	12V 55W (H3 TYPE)	※ Check disconnection Normal : 1.2Ω
Room lamp	 CL-1	12V 10W	※ Check disconnection Normal : A few Ω
Fuel filler pump	 CN-61	12V 35 ℓ/min	※Check operation Supply power(for terminal 1) : 12V
Fuel feed pump	 CN-145	12V	-
Horn	 CN-20 CN-25	12V	100±5dB

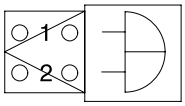
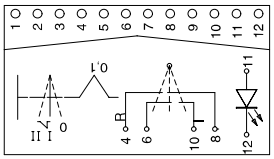
Part name	Symbol	Specification	Check
Safety switch	 CS-4 CS-4A	Micro	※ Check contact Normal : 0Ω (for terminal A-B) : ∞Ω (for terminal A-C) Operating : ∞Ω (for terminal A-B) : 0Ω (for terminal A-C)
Cut-off solenoid	 CN-79	12V	※ Check operation.
Pressure sensor	 CD-3 CD-4 CD-7 CD-26 CD-31 CD-32 CD-38 CD-73	8-30V	※ Check contact Normal : 0.1Ω
Beacon lamp	 CL-7	12V (strobe type)	※ Check disconnection Normal : A few Ω
Auto cruise switch	 CS-23	12V 16A	※ Check contact Normal : ∞Ω
Auto ram lock switch	 CS-100	12V 16A	※ Check contact Normal : 0Ω

Part name	Symbol	Specification	Check
Washer pump	 CN-22	12V 3.8A	※Check contact Normal : 3Ω(for terminal 1-2)
Cigar lighter	 CL-2	12V 10A 1.4W	※Check coil resistance Normal : About 1MΩ ※ Check contact Normal : ∞Ω Operating time : 5~15sec
Wiper motor	 CN-21	12V 3A	※Check contact Normal : 6Ω(for terminal 2-6)
Int wiper relay	 CR-6	12V 12A	–
Radio & USB player	 CN-27A	12V 3A	※ Check voltage 10 ~ 12.5V (for terminal 10-14,11-14)
Receiver dryer	 CN-29	12V	※ Check contact Normal : 0Ω

Part name	Symbol	Specification	Check
Starter	 CN-45	12V	※ Check contact Normal : 0.1Ω
Alternator	 CN-74	12V 80A	※ Check contact Normal : 0Ω (for terminal B^+-1) Normal : 10 ~ 12.5V
Travel buzzer	 CN-81	12V	-
Compressor	 CN-28	12V 38W	-
Air con fan motor	 CN-83	12V 8.5A	-
Circuit breaker manual reset	 CN-60 CN-95	12V, 30A (CN-65) 12V, 60A (CN-95)	-

Part name	Symbol	Specification	Check
Rear combination lamp-LH, RH	 CL-15 CL-16	12V 21W×2 12V 21/5W	※Normal : 4.8Ω (for terminal 1-4) Normal : 2.1Ω (for terminal 2-4, 4-5, 4-6)
Front combination lamp-LH, RH	 CL-24 CL-25	12V 21W 12V 5W	※Normal : 4.8Ω (for terminal 1-2) Normal : 2.1Ω (for terminal 2-3)
Head lamp -LH, RH	 CL-3 CL-4	12V 60/55W	※Normal : 1.0Ω (for terminal 1-3, 2-3) Normal : 1.5Ω (for terminal 1-2)
Master switch		12V 1000A	-
Preheater	 CN-80	12V 42A 500W	-
Accel dial	 CN-142	-	※ Check resistance Normal : about 5KΩ (for terminal A-C) ※ Check voltage Normal : about 5V (for terminal A-C) : 2-4.5V (for terminal C-B)

Part name	Symbol	Specification	Check
Timer	 CR-50	12V	-
12V socket	 CN-139	12V 120W	-
Dust sensor (switch)		1˚C OFF 4˚C ON	※Check resistance Normal : 0Ω (for terminal 1-2) The atmosphere temp : over 4˚C
Resistor	 RS-1	3W	※ Check resistance A-B : 120Ω
Relay (air con blower)		12V 20A	※ Check resistance Normal : About 200Ω (for terminal 1-3) 0 Ω (for terminal 2-4)
Radio & USB plalyer	 CN-27	12V 2A	※Check voltage 10~16V (for terminal 1-3, 3-8)

Part name	Symbol	Specification	Check
Quick clamp buzzer	 CN-113	12V 60mA 65dB Min	-
DPF switch	 CS-100	12V 16A	-

GROUP 5 CONNECTORS

1. CONNECTOR DESTINATION

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-1	AMP	36	I/conn (Cab room harness-Main harness)	1743059-2	1743062-2
CN-3	YAZAKI	2	I/conn (Cab room harness)	S813-030201	S813-130201
CN-4	AMP	36	I/conn (Cab room harness-Frame harness)	1743059-2	1743062-2
CN-6	DEUTSCH	8	I/conn (Frame harness-Console harness)	S816-008002	-
CN-7	AMP	20	I/conn (Main harness-Console harness)	936777-2	936780-2
CN-8	AMP	15	I/conn (Cab room harness-Cab harness)	2-85262-1	368301-1
CN-11	KET	2	Flasher unit	S810-002202	-
CN-12	AMP	2	I/conn (Boom harness-Main harness)	S816-002002	S816-102002
CN-13	KET	2	Master switch	MG620558	-
CN-14	KET	2	Earth	-	610557
CN-16	AMP	6	Emergency engine start	S816-006002	S816-106002
CN-16A	AMP	6	Emergency engine start	S816-006002	-
CN-16B	AMP	6	Emergency engine start	S816-006002	-
CN-18	AMP	16	I/conn (Cab room harness-Main harness)	368047-1	368050-1
CN-20	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-21	AMP	8	Wiper motor	S816-102002	-
CN-22	KET	2	Washer tank	MG640605	-
CN-23	KET	2	Speaker LH	HG610070	-
CN-24	KET	2	Speaker RH	HG610070	-
CN-25	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-27	-	16	Cassette radio	PK145-16017	-
CN-27A	-	8	Cassette radio	-	S816-108002
CN-28	AMP	1	Air-con comp	S810-001002	-
CN-29	KET	2	Receiver dryer	MG640795	-
CN-31	DEUTSCH	8	I/conn (Cab room harness-Aircon harness)	DT06-8S-EP06	DT04-8S-EP06
CN-36	-	-	Fuse box	21L7-00250	-
CN-45	TERM	1	Starter	ST710246-2	-
CN-51	AMP	70	MCU	1-968879-1	-
CN-52	DEUTSCH	24	Governor DC motor controller	DRC26-24SA	-
CN-56	AMP	10	Cluster	-	S816-110002
CN-57	AMP	16	Cluster	175966-2	-
CN-60	YAZAKI	2	Fusible link	-	7122-4125-50
CN-61	TERM	1	Fuel filler pump	S822-014000	-
CN-66	DEUTSCH	2	Breaker solenoid	DT06-2S-EP06	-
CN-68	DEUTSCH	2	Safety solenoid	DT06-2S-EP06	-
CN-69	DEUTSCH	2	Ram lock solenoid	DT06-2S-EP06	-
CN-70	DEUTSCH	2	Travel solenoid	DT06-2S-EP06	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-71	DEUTSCH	2	Parking solenoid	DT06-2S-EP06	-
CN-74	KET	2	Alternator	MG640188-5	-
CN-80	YAZAKI	1	Air heater	7323-3010	-
CN-81	DEUTSCH	2	Travel buzzer	DT06-2S-EP06	DT04-2P-E005
CN-83	KET	2	Air-con fan	MG640188-5	-
CN-92AB	KET	1	Safety	S814-001100	S814-101100
CN-93A	AMP	74	ECU	3-1355136-3	-
CN-93B	AMP	60	ECU	1897635-2	-
CN-95	KET	2	Fusible link	-	610557
CN-97	AMP	12	Multifunction switch	S816-012002	S816-112002
CN-98	AMP	10	Multifunction switch	S816-010002	S816-110002
CN-99	AMP	8	Multifunction switch	S816-008002	S816-108002
CN-113	-	2	Buzzer	S810-002202	-
CN-116	AMP	12	Switch panel	368542-1	-
CN-121	DEUTSCH	2	Boom swing solenoid	DT06-2S-EP06	-
CN-122	DEUTSCH	2	Forward solenoid	DT06-2S-EP06	-
CN-123	DEUTSCH	2	Reverse solenoid	DT06-2S-EP06	-
CN-126	DEUTSCH	4	RS232	DT06-4S-EP06	DT06-4P-E005
CN-139	AMP	2	12V socket	S810-002202	-
CN-140	DEUTSCH	2	Quick clamp solenoid	DT06-2S-EP06	DT04-2P-E005
CN-142	DEUTSCH	3	Accel dial	DT06-3S-EP06	-
CN-144A	KET	20	Handfree	MG610240	-
CN-144B	KET	8	Handfree	175964-2	-
CN-145	YAZAKI	2	Fuel feed pump	7123-6423-30	-
CN-148	DEUTSCH	6	Service tool	DTM06-6S-E008	ST710285-2
CN-157	-	1	Antena power	S822-014000	-
CN-170	PACKARD	2	Seat heat switch	12052641	-
CN-193	SUMITOMO	6	EGR step motor	6195-0021	-
CN-194	YAZAKI	3	Rack actuator	7323-7414-40	-
CN-243	DEUTSCH	4	RS232 connector	DT06-4S-EP06	DT04-4P-E004
CN-245A	AMP	12	Remote controller	368542-1	-
CN-245B	AMP	12	Remote controller	174045-2	-
CN-246	AMP	12	USB and socket	174045-2	-
CN-258	-	1	Aircon comp power	21N4-01311	-
CN-259	AMP	6	Aux camera	S816-006002	S816-106002
CN-263	DEUTSCH	2	Air comp relay	DT06-2S-EP06	DT04-2P-E005
CN-289	-	6	Amp assy	MG610049	-
CN-300A	AMP	6	DPF pressure	1438153-5	-
CN-300B	FCI	2	DPF mid temp	54200206	-
CN-300C	FCI	2	DPF inlet temp	54200208	-

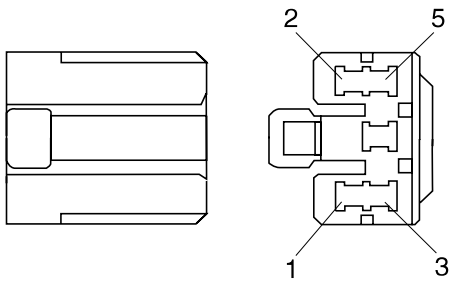
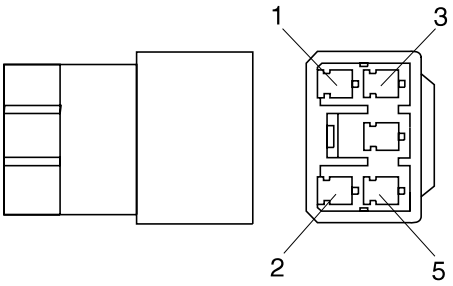
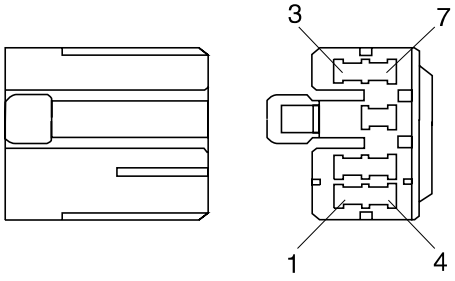
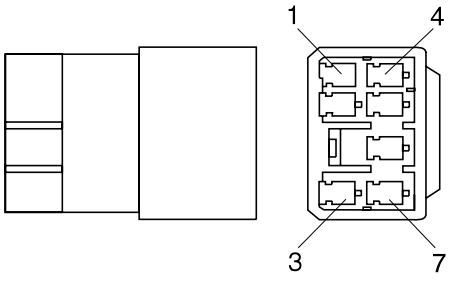
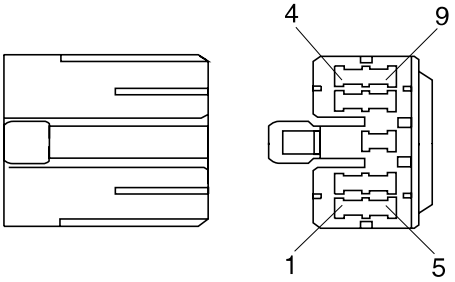
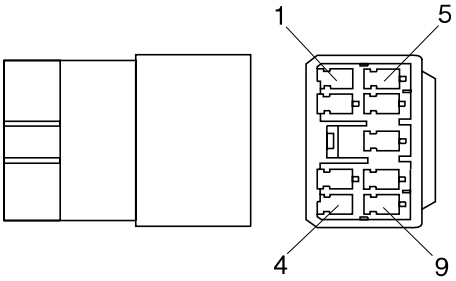
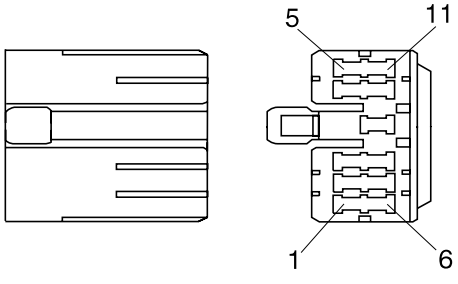
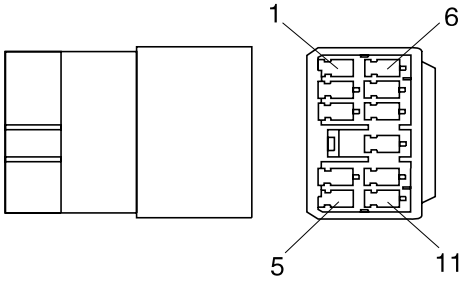
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN301	AMP	8	EGR sensor	776532-1	-
CN302	AMP	12	EGR valve	776533-1	-
CN303	AMP	12	Engine sensor	776533-2	-
CN304	AMP	12	C/rail	776533-3	-
· LAMP					
CL-1	KET	2	Room lamp	MG610392	-
CL-2	AMP	3	Cigar lighter	S810-003201	-
CL-3	KET	3	Head lamp	S810-003702	-
CL-4	KET	3	Head lamp	S810-003702	-
CL-5	DEUTSCH	2	Work lamp	DT06-2S-EP06	-
CL-7	-	1	Beacon lamp	S822-014000	S822-114000
CL-9	DEUTSCH	2	Cabin lamp	DT06-2S-EP06	-
CL-10	DEUTSCH	2	Cabin lamp	DT06-2S-EP06	-
CL-15	DEUTSCH	6	Rear combination lamp-LH	DT06-6S-EP06	-
CL-16	DEUTSCH	6	Rear combination lamp-RH	DT06-6S-EP06	-
CL-19	AMP	2	Side maker lamp-LH	S816-002002	-
CL-20	AMP	2	Side maker lamp-RH	S816-002002	-
CL-21	KET	2	Number plate lamp	GP890469	-
CL-24	KET	3	Front combination lamp-LH	S814-003001	-
CL-25	KET	3	Front combination lamp-RH	S814-003001	-
· RELAY					
CR-1	AMP	2	Battery relay	S816-002002	S816-102002
CR-2	HELLA	5	Horn relay	SJA003526-001	-
CR-3	HELLA	5	Work lamp relay	SJA003526-001	-
CR-4	HELLA	5	Wiper relay	SJA003526-001	-
CR-5	HELLA	5	Anti-restart relay	SJA003526-001	-
CR-6	AMP	6	Int wiper relay	S810-006002	-
CR-7	HELLA	4	Aircon comp relay	SJA003526-001	-
CR-9	HELLA	4	Cabin lamp relay	SJA003526-001	-
CR-11	HELLA	3	Flasher unit relay	SJA003526-001	-
CR-13	HELLA	4	Head lamp low relay	SJA003526-001	-
CR-14	HELLA	4	Head lamp high relay	SJA003526-001	-
CR-18	HELLA	5	Ram lock	SJA003526-001	-
CR-23	KET	2	Start relay	S814-002001	-
	HMC	2		S810-002302	-
CR-24	KET	2	Air heater relay	S814-002001	-
	HMC	2		S810-002302	-
CR-29	HELLA	4	Forward relay	SJA003526-001	-
CR-30	HELLA	4	Reverse relay	SJA003526-001	-
CR-33	HELLA	4	Air-con fan relay	SJA003526-001	-

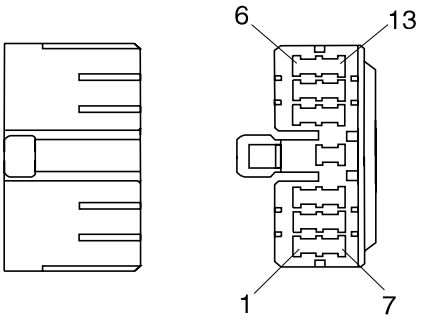
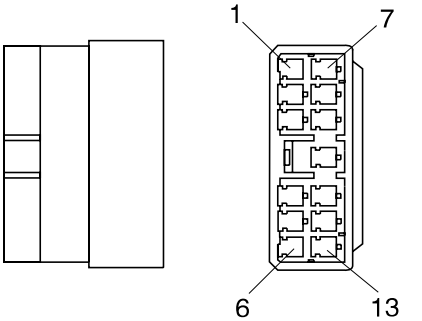
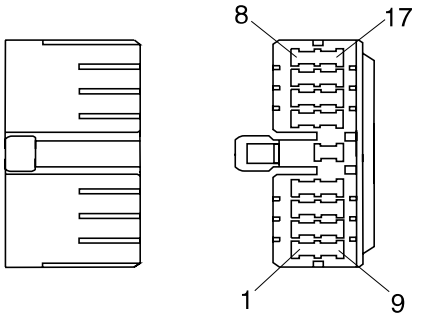
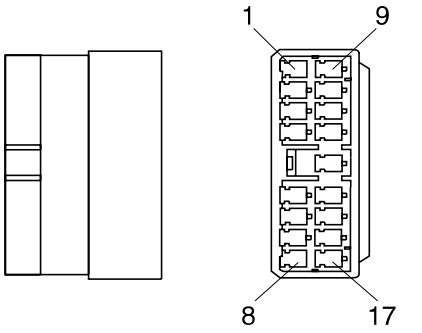
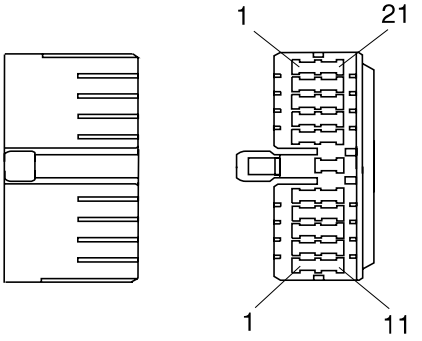
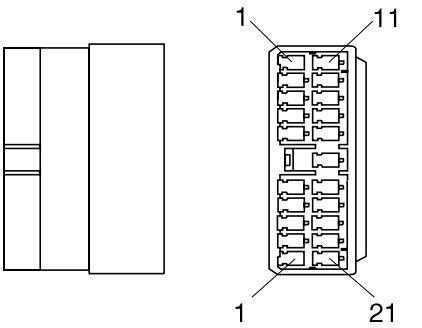
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CR-36A	HELLA	4	Pre-heater relay	SJA003526-001	-
CR-38	HELLA	4	Neutral relay	SJA003526-001	-
CR-45	HELLA	4	ECU power relay	SJA003526-001	-
CR-53	HELLA	2	Timer stop lamp	S810-002202	-
CR-62	HELLA	4	Breaker relay	SJA003526-001	-
CR-63B	HELLA	4	Stop lamp relay	SJA003526-001	-
CR-67	AMP	6	Rack actuator	S816-002002	-
CR-68	AMP	6	ECU main power	S816-002002	-
CR-71	HELLA	4	Boom swing relay	SJA003526-001	-
CR-75	HELLA	4	Illumination relay	SJA003526-001	-
CR-78	HELLA	4	Head lamp relay	SJA003526-001	-
CR-80	HELLA	5	EGR valve	SJA003526-001	-
CR-85	HELLA	4	Beacon lamp relay	SJA003526-001	-
· SENDER					
CD-1	AMP	2	Hydraulic temp sender	85202-1	-
CD-2	AMP	2	Fuel sender	-	S816-102002
CD-3	DEUTSCH	3	Brake oil pressure switch	DT06-3S-EP06	-
CD-4	DEUTSCH	3	Stop lamp pressure switch	DT06-3S-EP06	-
CD-7	DEUTSCH	3	Working pressure switch	DT06-3S-EP06	-
CD-8	AMP	2	Water temp sender	1-178390-2	-
CD-10	KET	1	Air cleaner switch	ST730057-2	-
CD-17	SUMITOMO	2	Tacho sensor	6189-0552	-
CD-18	YAZAKI	1	Engine oil pressure switch	7123-5014	-
CD-26	DEUTSCH	3	Parking pressure switch	DT06-3S-EP06	-
CD-30	AMP	2	Water temp	85202-1	-
CD-31	DEUTSCH	3	Overload pressure switch	DT06-3S-EP06	-
CD-32	DEUTSCH	3	Boom up pressure switch	DT06-3S-EP06	-
CD-38	DEUTSCH	3	Working brake	DT06-3S-EP06	-
CD-62	YAZAKI	3	CSD	7323-7414-40	-
CD-73	DEUTSCH	3	Forward pressure switch	DT06-3S-EP06	-
· SWITCH					
CS-2	KET	6	Start key switch	S814-006000	-
CS-4	AMP	3	Safety switch	S816-003002	-
CS-4A	AMP	3	Safety switch	-	174359-2
CS-5	DEUTSCH	2	Horn-switch	-	DT04-2P-E005
CS-16	KET	2	Fuel pump switch	S810-002201	-
CS-26	DEUTSCH	2	Breaker switch	-	DT04-2P-E005
CS-29	DEUTSCH	2	Spare	DT06-2S-EP06	-
CS-47	SWF	12	Boom swing switch	589790	-
CS-50	SWF	12	Overload switch	589790	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CS-67	SWF	12	Quick clamp switch	589790	-
CS-74	YAZAKI	2	Master switch	MG620558	-
CS-99	SWF	12	Air comp switch	589790	-
CS-100	SWF	12	Ram lock switch	589790	-
CS-106	SWF	12	DPF switch	589790	-
· DIODE					
DO-1	-	2	Diode (alternator)	21EA-50550	-
DO-2	-	2	Diode (fuel feed pump)	21EA-50550	-
DO-3	-	2	Diode (neutral)	21EA-50550	-

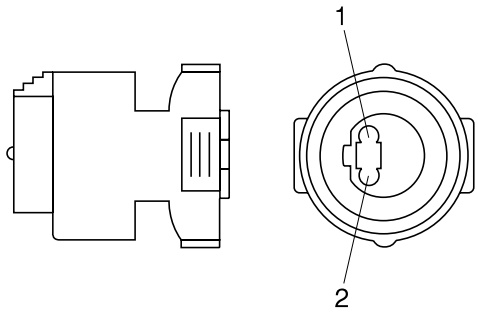
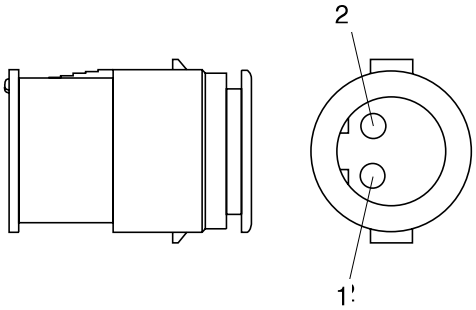
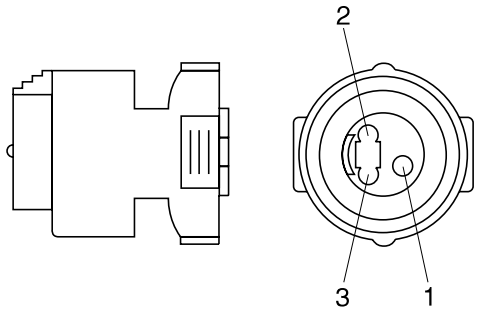
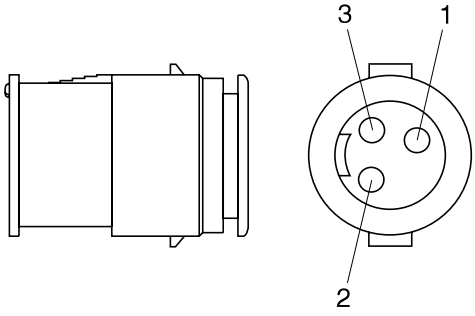
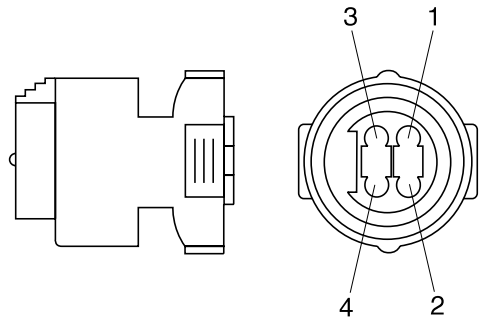
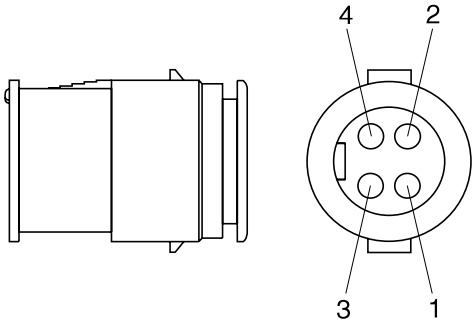
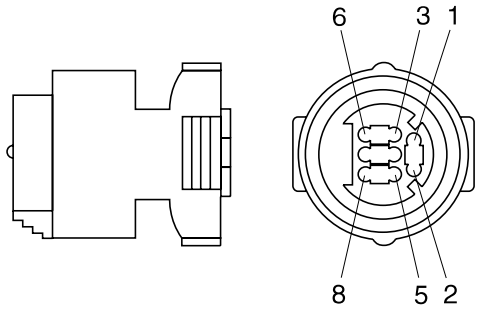
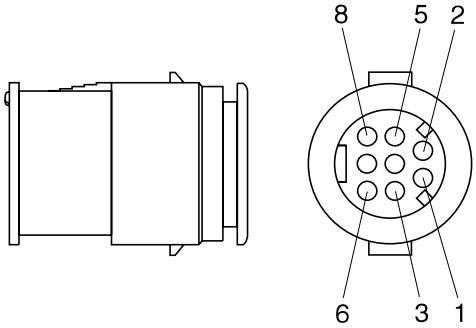
2. CONNECTION TABLE FOR CONNECTORS

1) PA TYPE CONNECTOR

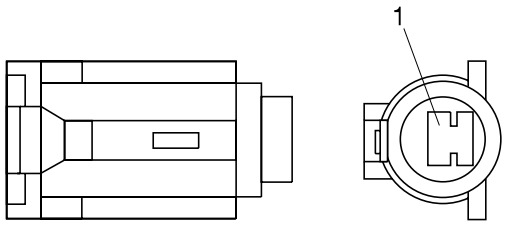
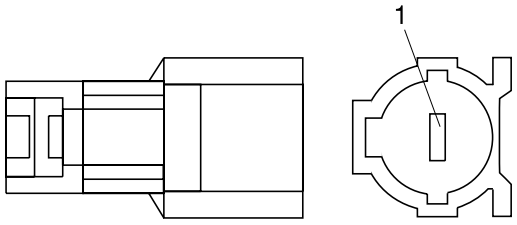
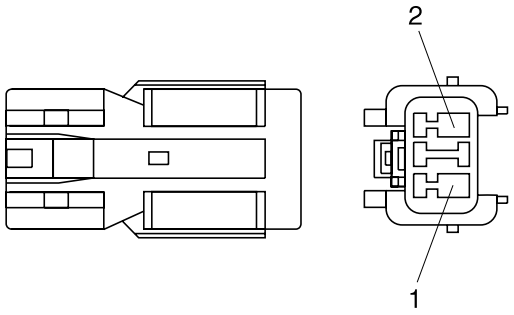
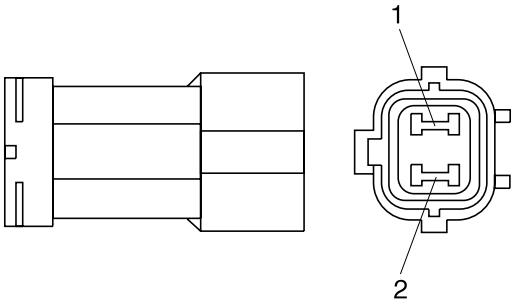
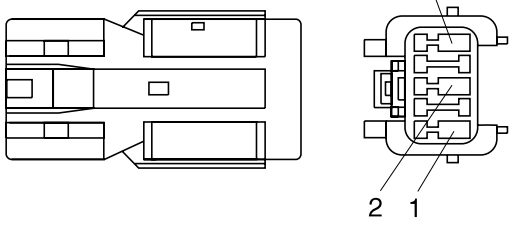
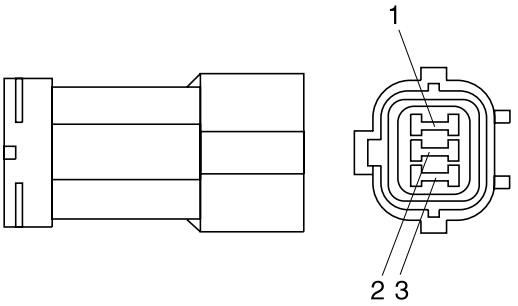
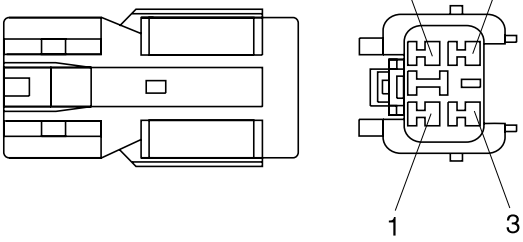
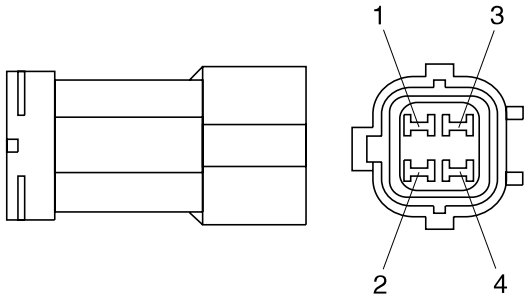
No. of pin	Connector (female)	Connector (male)
5	 S811-005002	 S811-105002
7	 S811-007002	 S811-107002
9	 S811-009002	 3S811-109002
11	 S811-011002	 S811-111002

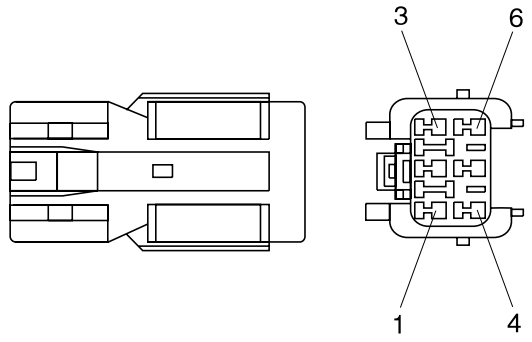
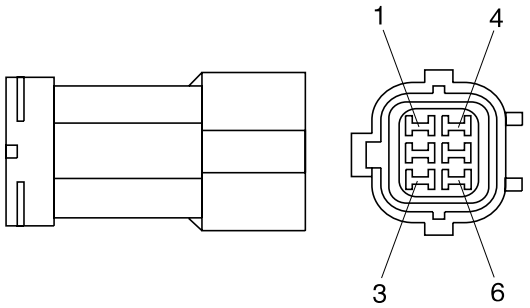
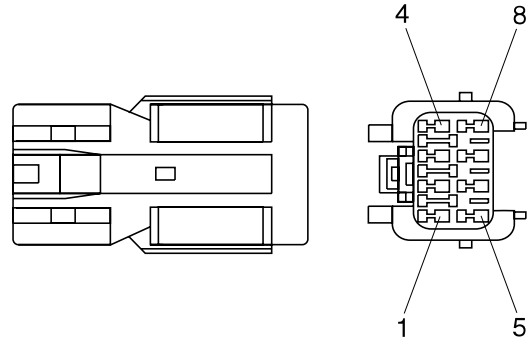
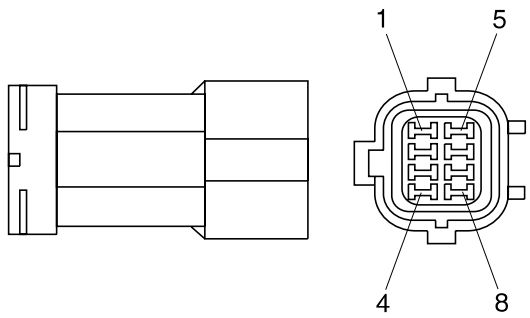
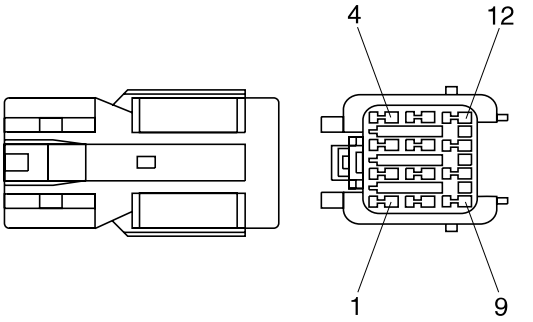
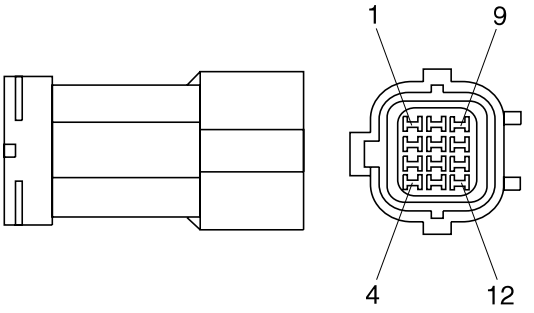
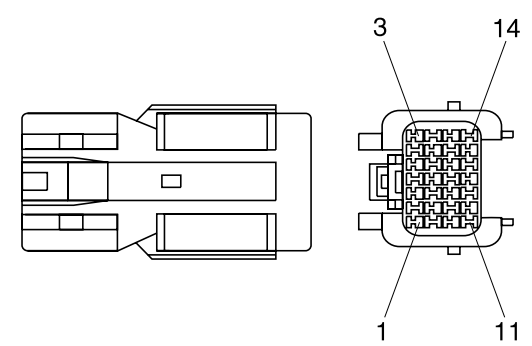
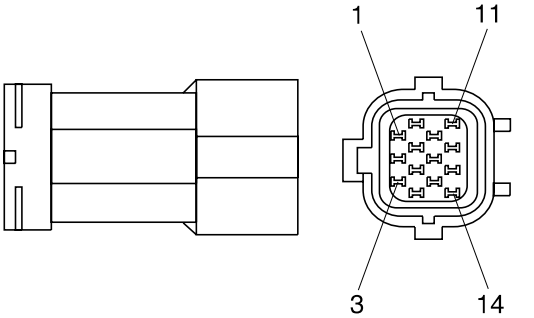
No. of pin	Connector (female)	Connector (male)
13	 S811-013002	 S811-113002
17	 S811-017002	 S811-117002
21	 S811-021002	 S811-121002

2) J TYPE CONNECTOR

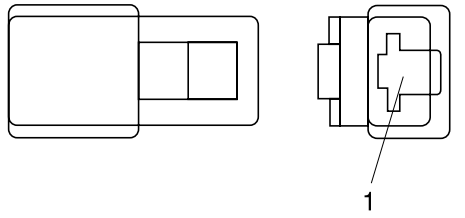
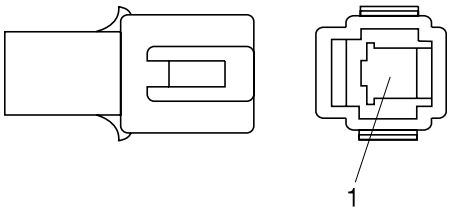
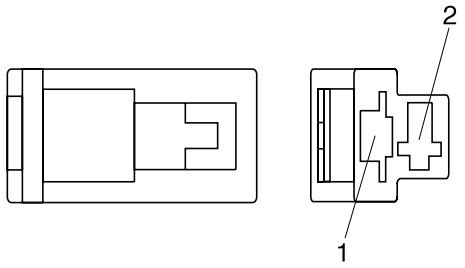
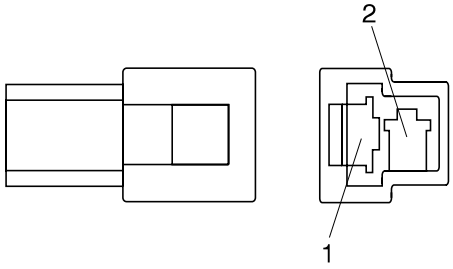
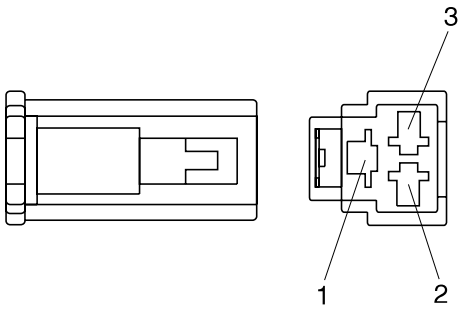
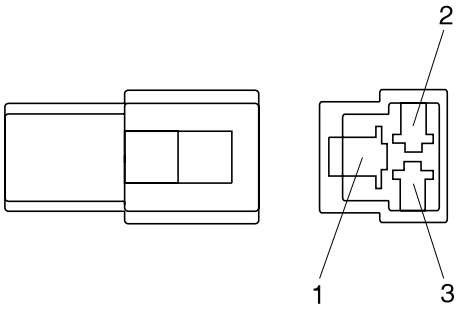
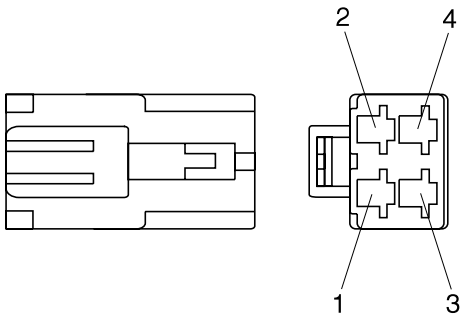
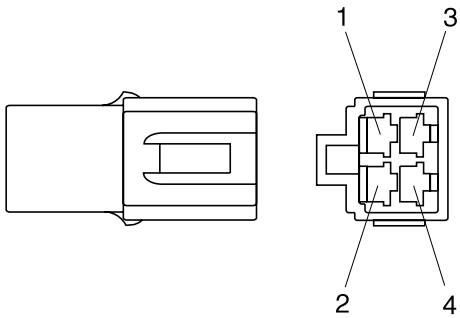
No. of pin	Connector (female)	Connector (male)
2	 S816-002001	 S816-102001
3	 S816-003001	 S816-103001
4	 S816-004001	 S816-104001
8	 S816-008001	 S816-108001

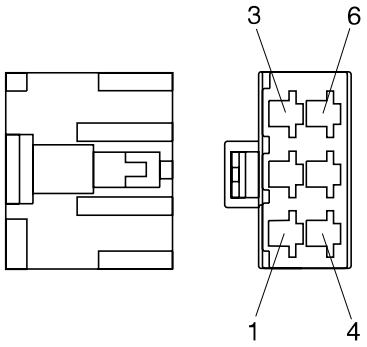
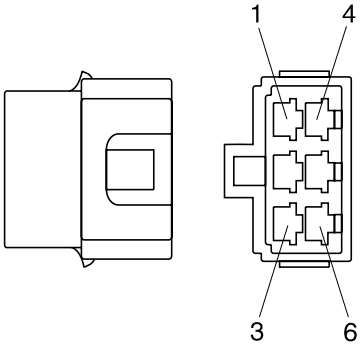
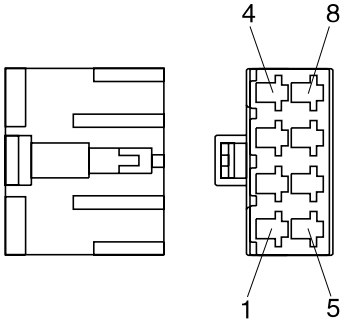
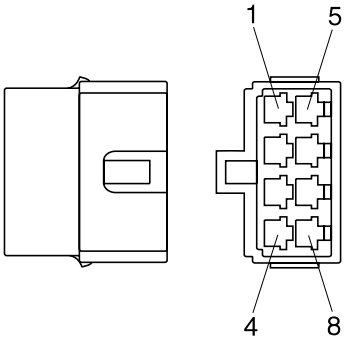
3) SWP TYPE CONNECTOR

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

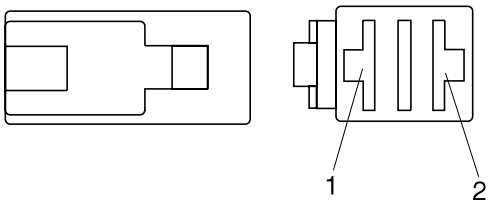
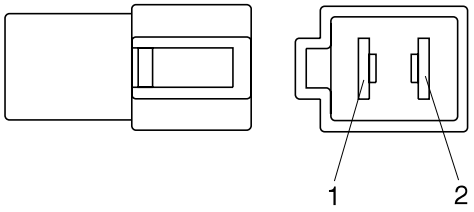
No. of pin	Connector (female)	Connector (male)
6	 S814-006000	 S814-106000
8	 S814-008000	 S814-108000
12	 S814-012000	 S814-112000
14	 S814-014000	 S814-114000

4) CN TYPE CONNECTOR

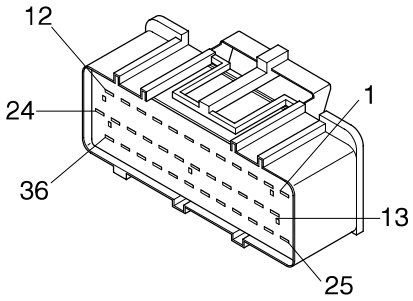
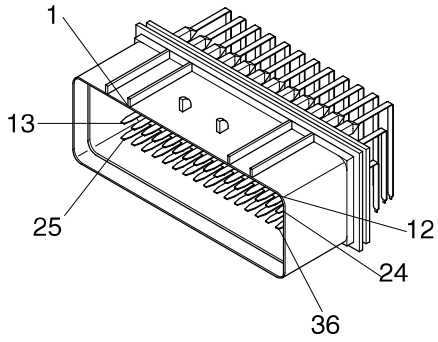
No. of pin	Connector (female)	Connector (male)
1	 S810-001202	 S810-101202
2	 S810-002202	 S810-102202
3	 S810-003202	 S810-103202
4	 S810-004202	 S810-104202

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

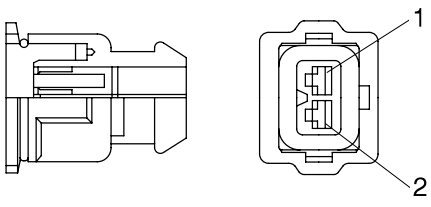
5) 375 FASTEN TYPE CONNECTOR

No. of pin	Connector (female)	Connector (male)
2	 S810-002402	 S810-102402

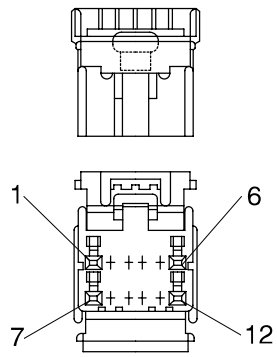
6) AMP ECONOSEAL CONNECTOR

No. of pin	Connector (female)	Connector (male)
36	 344111-1	 344108-1

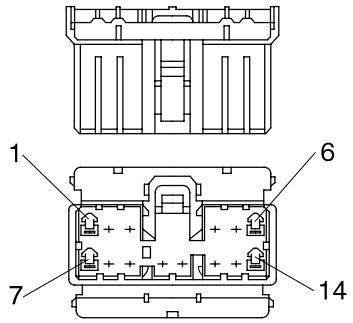
7) AMP TIMER CONNECTOR

No. of pin	Connector (female)	Connector (male)
2	 85202-1	

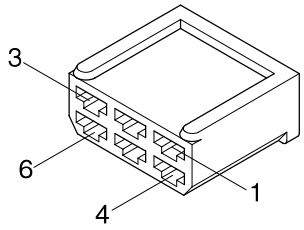
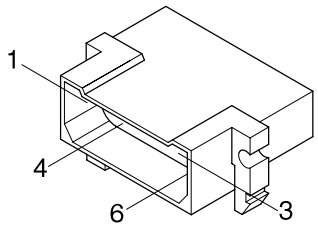
8) AMP 040 MULTILOCK CONNECTOR

No. of pin	Connector (female)	Connector (male)
12	 174045-2	

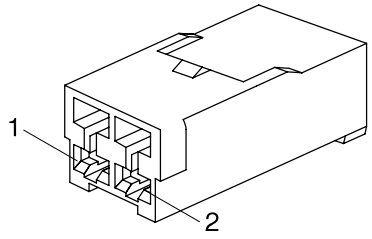
9) AMP 070 MULTILOCK CONNECTOR

No. of pin	Connector (female)	Connector (male)
14	 173852	

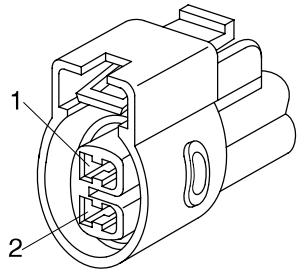
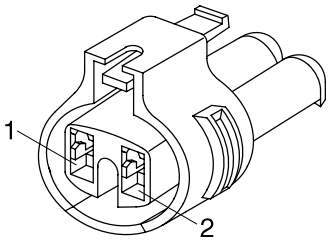
10) AMP FASTIN - FASTON CONNECTOR

No. of pin	Connector (female)	Connector (male)
6	 925276-0	 480003-9

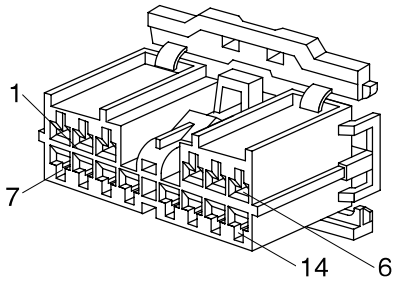
11) KET 090 CONNECTOR

No. of pin	Connector (female)	Connector (male)
2	 MG610070	

12) KET 090 WP CONNECTORS

No. of pin	Connector (female)	Connector (male)
2	 MG640605	
2	 MG640795	

13) KET SDL CONNECTOR

No. of pin	Connector (female)	Connector (male)
14	 MG610406	

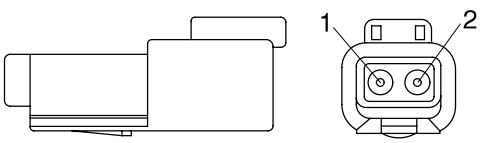
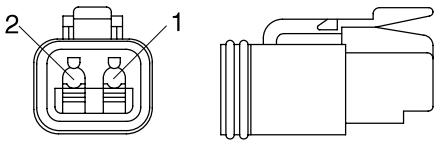
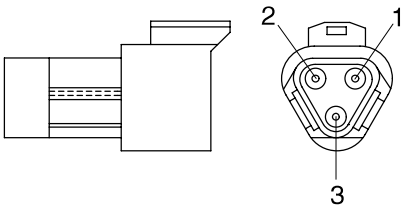
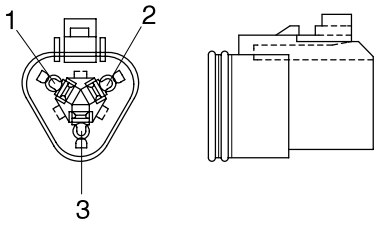
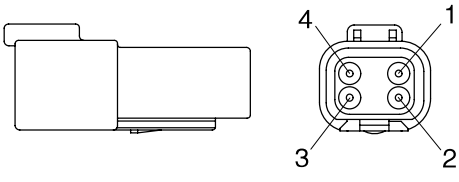
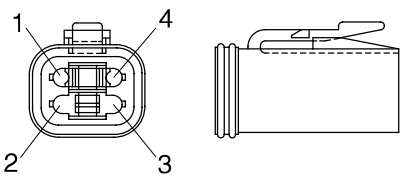
14) DEUTSCH DT CONNECTORS

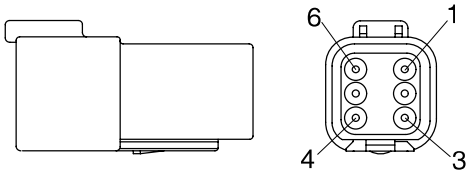
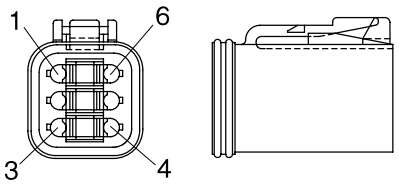
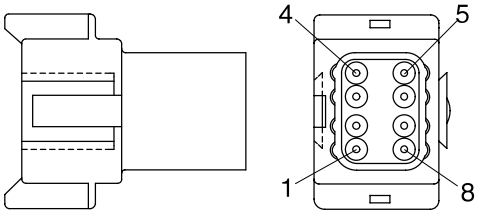
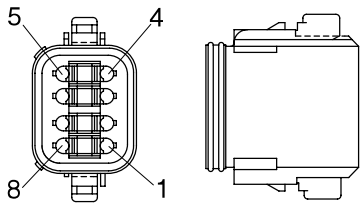
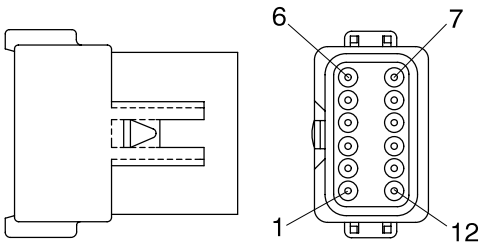
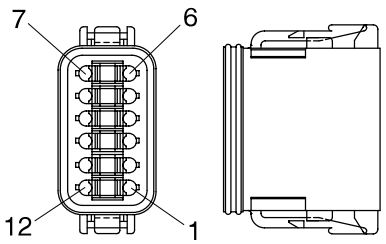
DT 06 - 3S - ★★★★

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

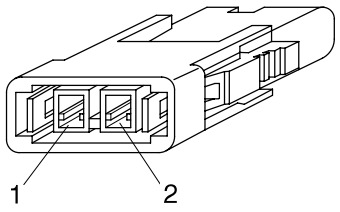
※ Modification

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

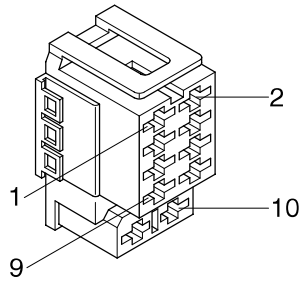
No. of pin	Connector (female)	Connector (male)
2	 DT06-2S	 DT06-2P
3	 DT06-3S	 DT06-3P
4	 DT06-4S	 DT06-4P

No. of pin	Connector (female)	Connector (male)
6	 DT06-6S	 DT06-6P
8	 DT06-8S	 DT06-8P
12	 DT06-12S	 DT06-12P

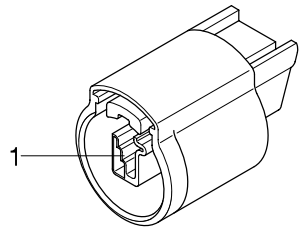
15) MOLEX 2CKTS CONNECTOR

No. of pin	Connector (female)	Connector (male)
2	 35215-0200	

16) ITT SWF CONNECTOR

No. of pin	Connector (female)	Connector (male)
10	 SWF593757	

17) MWP NMWP CONNECTOR

No. of pin	Connector (female)	Connector (male)
1	 NMWP01F-B	

GROUP 6 FAULT CODES

1. MACHINE FAULT CODE

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

2. ENGINE FAULT CODE

Fault code		Description	
YANMAR SPN	FMI	Area	Status
522400	2	Crankshaft speed sensor	Crankshaft signal error
	5		No signal from crankshaft
522401	2	Camshaft speed sensor	Camshaft signal error
	5		No signal from camshaft
	7		Angle offset error
523249	5	Crankshaft speed sensor, Camshaft speed sensor	Crankshaft/camshaft, speed sensor non-input (simultaneous)
91	3	Accelerator sensor 1	Accelerator sensor 1 error (voltage high)
	4		Accelerator sensor 1 error (voltage low)
28	3	Accelerator sensor 2	Accelerator sensor 2 error (voltage high)
	4		Accelerator sensor 2 error (voltage low)
522624	7	Accelerator sensor 1 + 2	Dual accelerator sensor error (closed position)
522623	7		Dual accelerator sensor error (open position)
29	3	Accelerator sensor 3	Accelerator sensor 3 error (voltage high)
	4		Accelerator sensor 3 error (voltage low)
	8	Pulse sensor	Pulse accelerator sensor error (pulse communication)
28	0	Accelerator sensor 3	Accelerator sensor 3 error (foot pedal in open position)
	1		Accelerator sensor 3 error (foot pedal in closed position)
51	3	Intake throttle position sensor	Intake throttle position sensor error (voltage high)
	4		Intake throttle position sensor error (voltage low)
102	3	EGR low pressure side pressure sensor	ERG low pressure side pressure sensor error (excessive sensor output)
	4		ERG low pressure side pressure sensor error (insufficient sensor output)
	13		ERG low pressure side pressure sensor error (abnormal learning value)
	10		ERG low pressure side pressure sensor error (detected value error)
1209	3	EGR pressure sensor (high-pressure side)	ERG high pressure side pressure sensor error (excessive sensor output)
	4		ERG high pressure side pressure sensor error (insufficient sensor output)
	13		ERG high pressure side pressure sensor error (abnormal learning value)
	10		ERG high pressure side pressure sensor error (detected value error)
110	3	Engine coolant temperature sensor	Engine coolant temperature sensor error (excessive sensor output)
	4		Engine coolant temperature sensor error (insufficient sensor output)
	10		Engine coolant temperature sensor error (detected value error)
	0		Engine coolant temperature high (overheat)
172	3	Ambient air temperature sensor	Ambient air temperature sensor error (voltage high)
	4		Ambient air temperature sensor error (voltage low)

Fault code		Description	
YANMAR SPN	FMI	Area	Status
174	3	Fuel temperature sensor	Fuel temperature sensor error (voltage high)
	4		Fuel temperature sensor error (voltage low)
	0		Fuel temperature high
157	3	Rail pressure sensor	Rail pressure sensor error (voltage high)
	4		Rail pressure sensor error (voltage low)
3251	3	DPF differential pressure sensor	DPF differential pressure sensor error (excessive sensor output)
	4		DPF differential pressure sensor abnormal rise in differential pressure
	0		DPF differential pressure sensor error abnormal rise in differential pressure
	13		DPF differential pressure sensor error (abnormal learning value)
4795	31	DPF substrate/DPF differential pressure sensor	DPF substrate/DPF differential pressure sensor error (DPF substrate removal/DPF differential pressure sensor detected value error)
3609	3	DPF high pressure side pressure sensor	DPF high pressure side pressure sensor error (excessive sensor output)
	4		DPF high pressure side pressure sensor error (insufficient sensor output)
	10		DPF high pressure side pressure sensor error (detected value error)
3242	3	DPF intermediated temperature sensor	DPF inlet temperature sensor error (excessive sensor output)
	4		DPF inlet temperature sensor error (insufficient sensor output)
	10		DPF inlet temperature sensor error (detected value error)
	0		DPF inlet temperature sensor abnormal temperature (abnormally high)
3250	3	DPF intermediate temperature sensor	DPF intermediate temperature sensor error (excessive
	4		DPF intermediate temperature sensor error (insufficient sensor output)
	10		DPF intermediate temperature sensor error (detected value error)
	1		DPF intermediate temperature sensor abnormal temperature (abnormally low)
108	3	Atmospheric pressure sensor	Atmospheric pressure sensor error (excessive sensor output)
	4		Atmospheric pressure sensor error (insufficient sensor output)
	10		Atmospheric pressure sensor error (characteristic error)
173	3	Exhaust manifold temperature sensor	Exhaust manifold temperature sensor error (excessive sensor output)
	4		Exhaust manifold temperature sensor error (insufficient sensor output)
	10		Exhaust manifold temperature sensor error (detected value error)
1485	7	Main relay	Main relay contact sticking
	2		Main relay early opening

Fault code		Description	
YANMAR SPN	FMI	Area	Status
522243	5	Starting aid relay	Starting aid relay disconnection
	6		Starting aid relay relay GND short circuit
654	5	Injector (No.1 cylinder)	Disconnection (injector-specific)
	6		Coil short circuit
	3		Short circuit
653	5	Injector (No.2 cylinder)	Disconnection (injector-specific)
	6		Coil short circuit
	3		Short circuit
652	5	Injector (No.3 cylinder)	Disconnection (injector-specific)
	11		Coil short circuit
	3		Short circuit
651	5	Injector (No.4 cylinder)	Disconnection (injector-specific)
	6		Coil short circuit
	3		Short circuit
4257	12	All injectors	Injector drive IC error
2797	6		Injector drive circuit (Bank1) shotrt circuit (4TN: common circuit for No.1, No4 and all 3TN cylinders)
2798	6		Injector drive circuit (Bank2) short circuit (4TN: circuit for No.2 and 3 cylinders)
523462	13	Injector (correction value)	Inujector (No.1 cylinder) correction value error
523463	13		Inujector (No.2 cylinder) correction value error
523464	13		Inujector (No.3 cylinder) correction value error
522465	13		Inujector (No.4 cylinder) correction value error
522571	3	SCV (MPROP)	SCV (MPROP) L side VB short circuit
	6		SCV (MPROP) L side GND short circuit
633	3		SCV (MPROP) H side VB short circuit
	6		SCV (MPROP) H side GND short circuit
	5		SCV (MPROP) disconnection
522572	6		SCV (MPROP) drive current (high level)
	11		SCV (MPROP) pump overload error
157	0	Rail pressure error	Rail pressure too high
	18		Rail pressure deviation error (low rail pressure)
	15		Rail pressure deviation errer (high rail pressure)
	16	PLV (common rail pressure limit valve)	PLV open valve
523469	0		Rail pressure fault (The times of PLV valve opening error)
523470	0		Rail pressure fault (The time of PLV valve opening error)
523489	0		Rail pressure fault (The actual rail pressure is too high during PRV limp home)
523498	9		Rail pressure fault (contrilled rail pressure error after PLV valve opening)
523491	0	Rail pressure control	Rail pressure fault (injector B/F temperature error during PLV4 limp home)
523460	7		Rail pressure fault (operation time error during RPS limp home)

Fault code		Description	
YANMAR SPN	FMI	Area	Status
190	16	Overspeed	Overspeed
2950	5	Intake throttle drive circuit	No-load of throttle valve drive H bridge circuit
	3		Power short circuit of throttle valve drive H bridge output 1
	4		GND short circuit of throttle valve drive H bridge output 1
	6		Overload on the drive H bridge circuit of throttle valve
2951	3		VB power short circuit of throttle valve drive H bridge output 2
	4		GND short circuit of throttle valve drive H bridge output 1
2950	7		Throttle valve sticking (sticking open)
2951	7		Throttle valves sticking (sticking closed)
522596	9	CAN 2	TSC1 (SA1) reception timeout
522597	9		TSC1 (SA2) reception timeout
522599	9		Y_ECR1 reception timeout
522600	9		Y_EC reception timeout
522601	9		Y_RSS reception timeout
237	31		VI_ reception timeout
	13		VI_ reception data error
522609	9		Y_ETCP1 reception timeout
522618	9		EBC1 reception timeout
522619	9		Y_DPFIF reception timeout
522730	12		Immobilzer error (CAN communication)
1202	2		Immobilizer error (system)
522610	9	CAN 1	CAN 1 (for EGR): reception timeout from the EGR valve
522611	9		CAN 1 (for exhaust throttle): receptiom timeout
2791	0	EGR valve	EGR overvoltage error
	1		EGR low voltage error
	7		EGR feedback error
	9		EGR ECM data error
	12		Disconnection in EGR motor coils
522579	12		Short circuit in EGR motor coils
522580	12		EGR position sensor error
522581	7		EGR valve sticking error
522183	7		EGR initialization error
522184	1		EGR high temperature thermistor error
522617	1		EGR low temperature thermistor error
522746	12		EGR target value out of range
522747	12	Exhaust throttle	Exhaust throttle (voltage fault)
522748	12		Exhaust throttle (motor fault)
522749	12		Exhaust throttle (sensor system fault)
	12		Exhaust throttle (MPU fault)
522750	12		Exhaust throttle (PCB fault)
522751	19		Exhaust throttle (CAN fault)

Fault code		Description	
YANMAR SPN	FMI	Area	Status
630	12	EEPROM	EEPROM memory deletion error
522576	12		EEPROM memory reading error
522578	12		EEPROM memory writing error
522585	12	ECU internal fault	CY 146 SPI communication fault
522588	12		Excessive voltage of supply 1
522589	12		Insufficient voltage of supply 1
522590	12		Sensor supply voltage error 1
522591	12		Sensor supply voltage error 2
522592	12		Sensor supply voltage error 3
522744	4		Actuator drive circuit 1 short to ground
522994	4		Actuator drive circuit 2 short to ground
523471	6		Actuator drive circuit 3 chort to ground
523473	12		AD converter fault 1
523474	12		AD converter fault 2
523475	12		External monitoring IC and CPU fault 1
523476	12		External monitoring IC and CPU fault 2
523477	12		ROM fault
523478	12		Shutoff path fault 1
523479	12		Shutoff path fault 2
523480	12		Shutoff path fault 3
523481	12		Shutoff path fault 4
523482	12		Shutoff path fault 5
523483	12		Shutoff path fault 6
523484	12		Shutoff path fault 7
523485	12		Shutoff path fault 8
523486	12		Shutoff path fault 9
523487	12		Shutoff path fault 10
523488	0		Recognition error of engine speed
3059	5	Breather heater (optional parts for 4TNV86CT and 4TNV98CT)	Breather heater disconnection
	4		Breather heater short circuit (GND)
	3		Breather heater short circuit (VB)
522323	0	Air cleaner switch	Air cleaner clogged alarm
522329	0	Water weparator switch	Water separator alarm
167	5	Charge switch	Charge switch disconnection
	1		Charge alarm
100	4	Oil pressure switch	Oil pressure switch disconnection
	1		Low oil pressure alarm
522573	0	DPF	Excessive PM accumulation (method C)
522574	0		Excessive PM accumulation (method P)
522575	7		Regeneration falure (stationary regeneration failure)
522577	11		Regeneration failure (staonary regeneration not performed)
3250	0	DPF intermediate temperature sensor	DPF intermediate temperature sensor abnormal rise in temperature (post-injection malfunction)

Fault code		Description	
YANMAR SPN	FMI	Area	Status
3720	16	DPF OP interface	Ash cleaning request 1
	0		Ash cleaning request 2
3719	16		Stationary regeneration standby
	0		Backup mode
3695	14		Reset regeneration is inhibited
3719	9		Regeneration faulure (recovery regeneration failure)
	7		Recovery regeneration is inhibited

SECTION 5 TROUBLESHOOTING

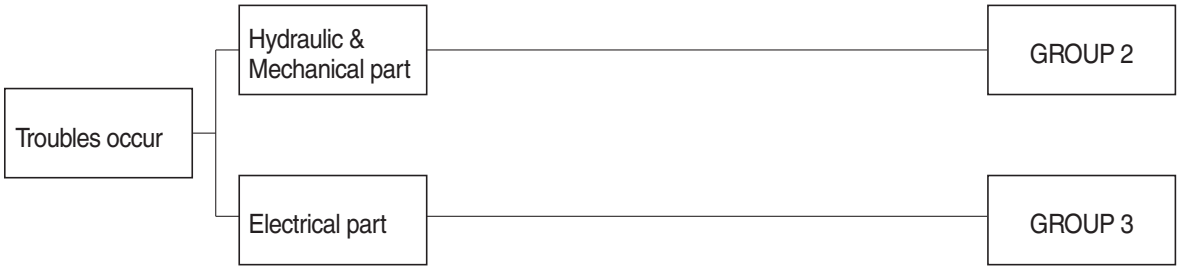
GROUP 1 BEFORE TROUBLESHOOTING

1. INTRODUCTION

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

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

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

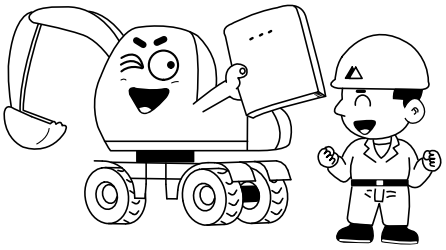


2. DIAGNOSING PROCEDURE

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

STEP 1. Study the machine system

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



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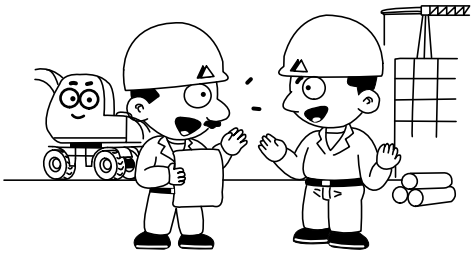
STEP 2. Ask the operator

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.

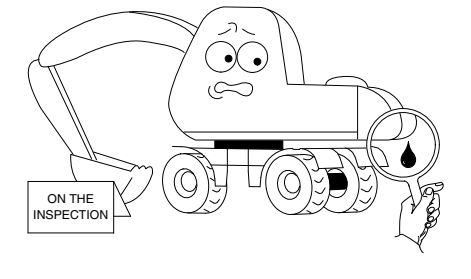


17W31SH03

STEP 3. Inspect the machine

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

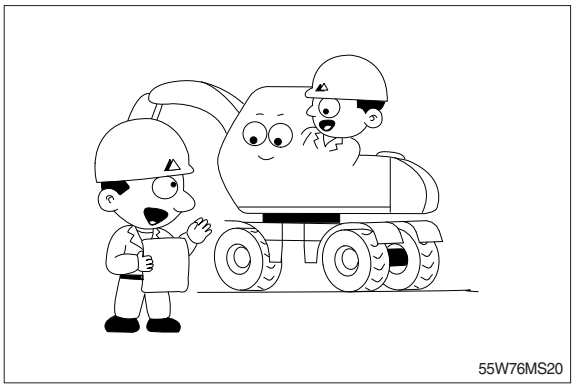
And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.



55W76MS21

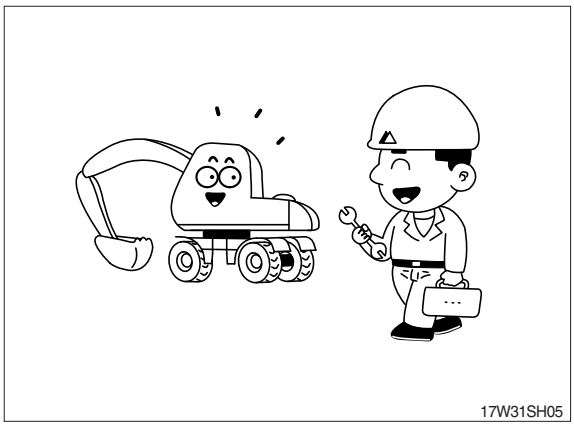
STEP 4. Inspect the trouble actually on the machine

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.


55W76MS20

STEP 5. Perform troubleshooting

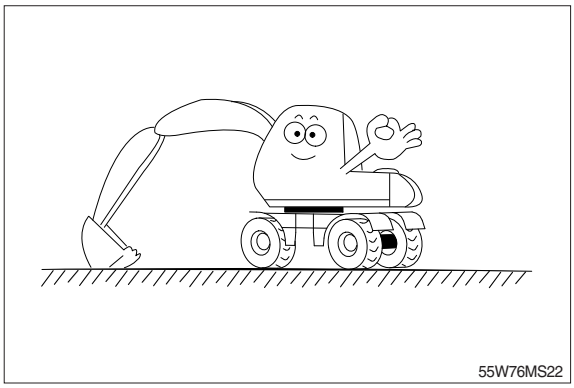
According to where the trouble parts are located, hydraulic & mechanical system part or electrical system part or mechatronics system part, perform troubleshooting the machine refer to the each system part's troubleshooting process diagram.


17W31SH05

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.


55W76MS22

GROUP 2 HYDRAULIC AND MECHANICAL SYSTEM

1. INTRODUCTION

1) MACHINE IN GENERAL

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

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

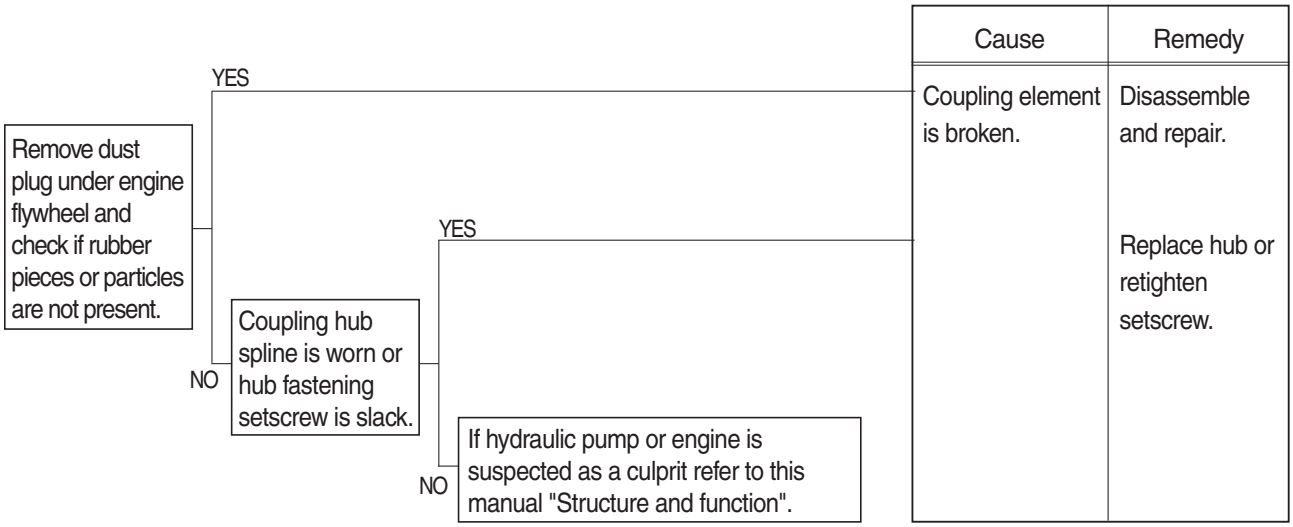
(3) When carrying out troubleshooting, do not hurry to disassemble the components.
It will become impossible to find the cause of the problem.

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

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

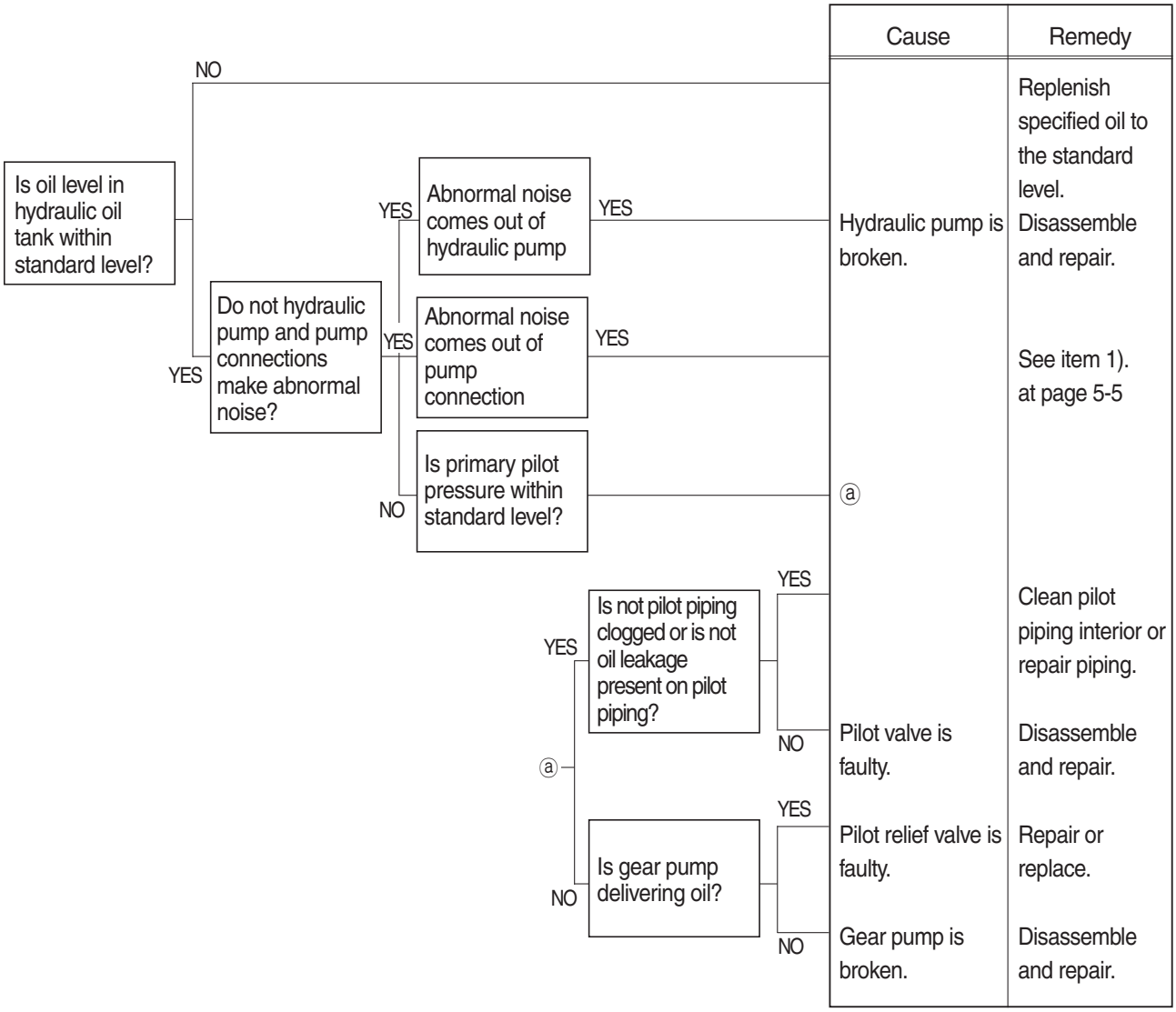
2. DRIVE SYSTEM

1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION



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

2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL



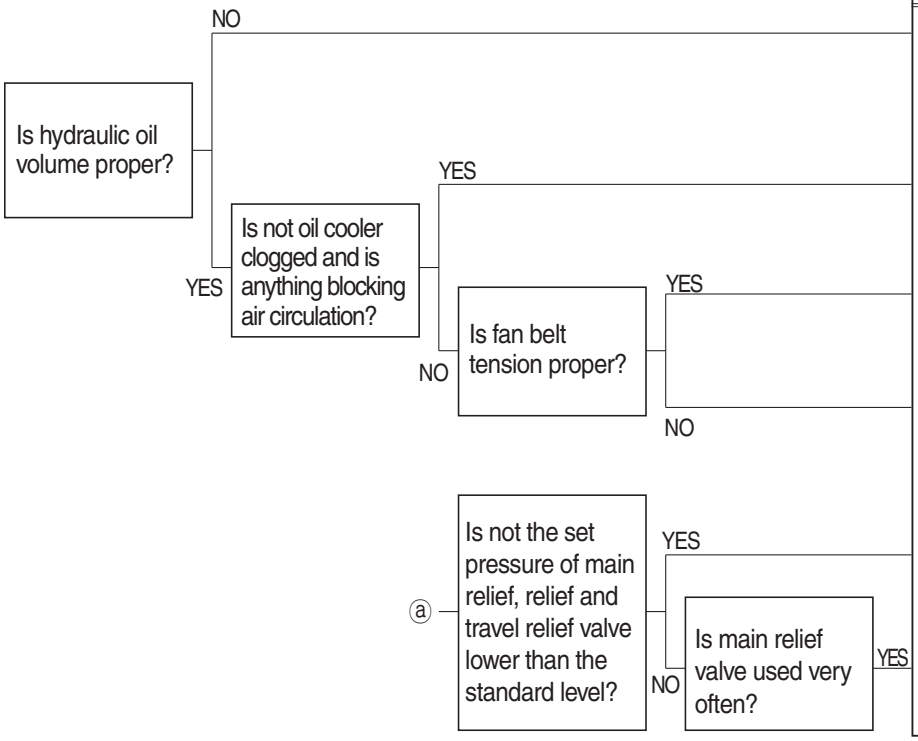
Cause	Remedy
Hydraulic pump is broken.	Disassemble and repair.
	See item 1). at page 5-5
ⓐ	
Pilot valve is faulty.	Disassemble and repair.
Pilot relief valve is faulty.	Repair or replace.
Gear pump is broken.	Disassemble and repair.
	Replenish specified oil to the standard level.
	Clean pilot piping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

3. HYDRAULIC SYSTEM

1) HYDRAULIC OIL IS CLOUDY

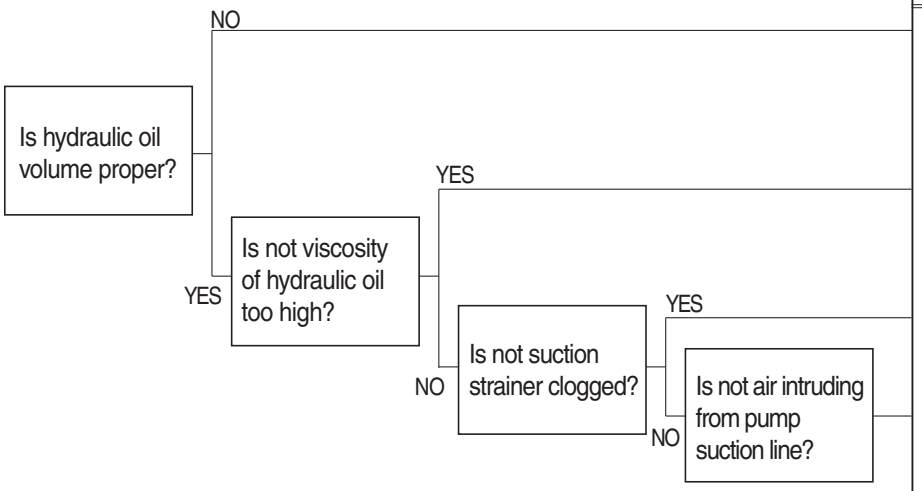
Cause	Remedy
Water is mixed.	Put hydraulic oil still, separate water and dispose it or replace hydraulic oil.
Air is intruded.	Check suction line and return line and eliminate the air intruding source.

2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY



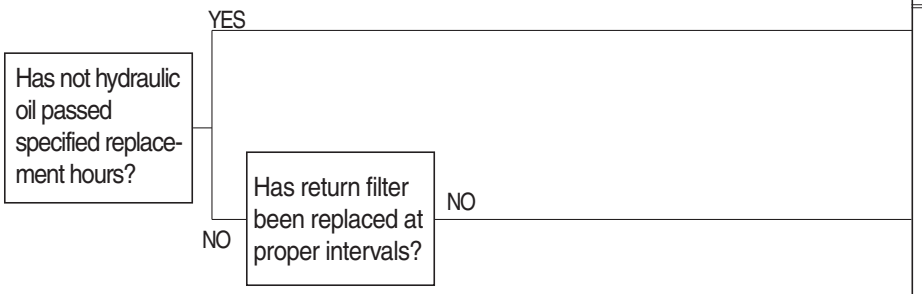
Cause	Remedy
ⓐ	Replenish specified oil to the standard level. Clean oil cooler. Secure air circulation route. Adjust belt tension or replace belt. Readjust set pressure. Reduce load.

3) CAVITATION OCCURS WITH PUMP



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

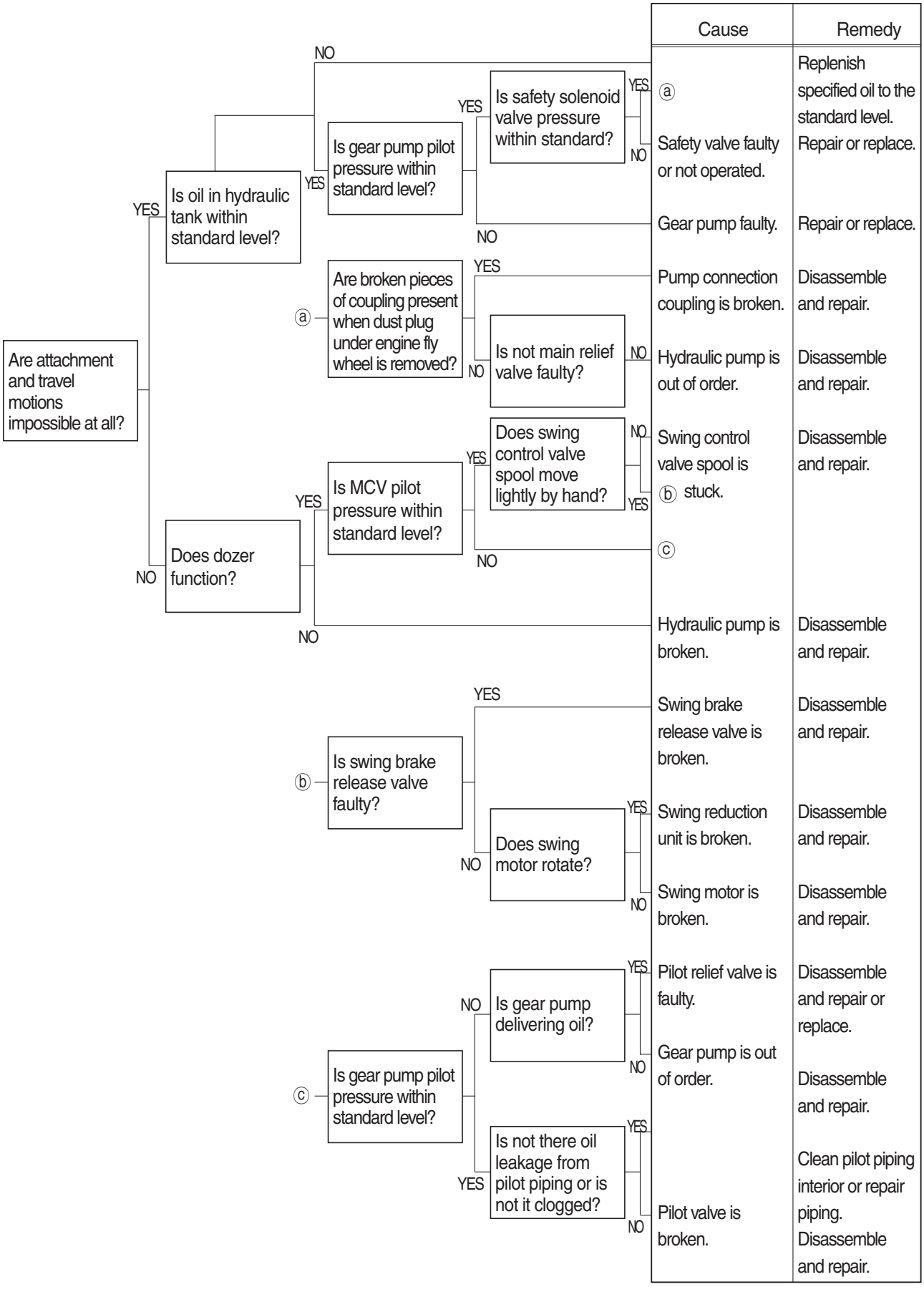
4) HYDRAULIC OIL IS CONTAMINATED



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

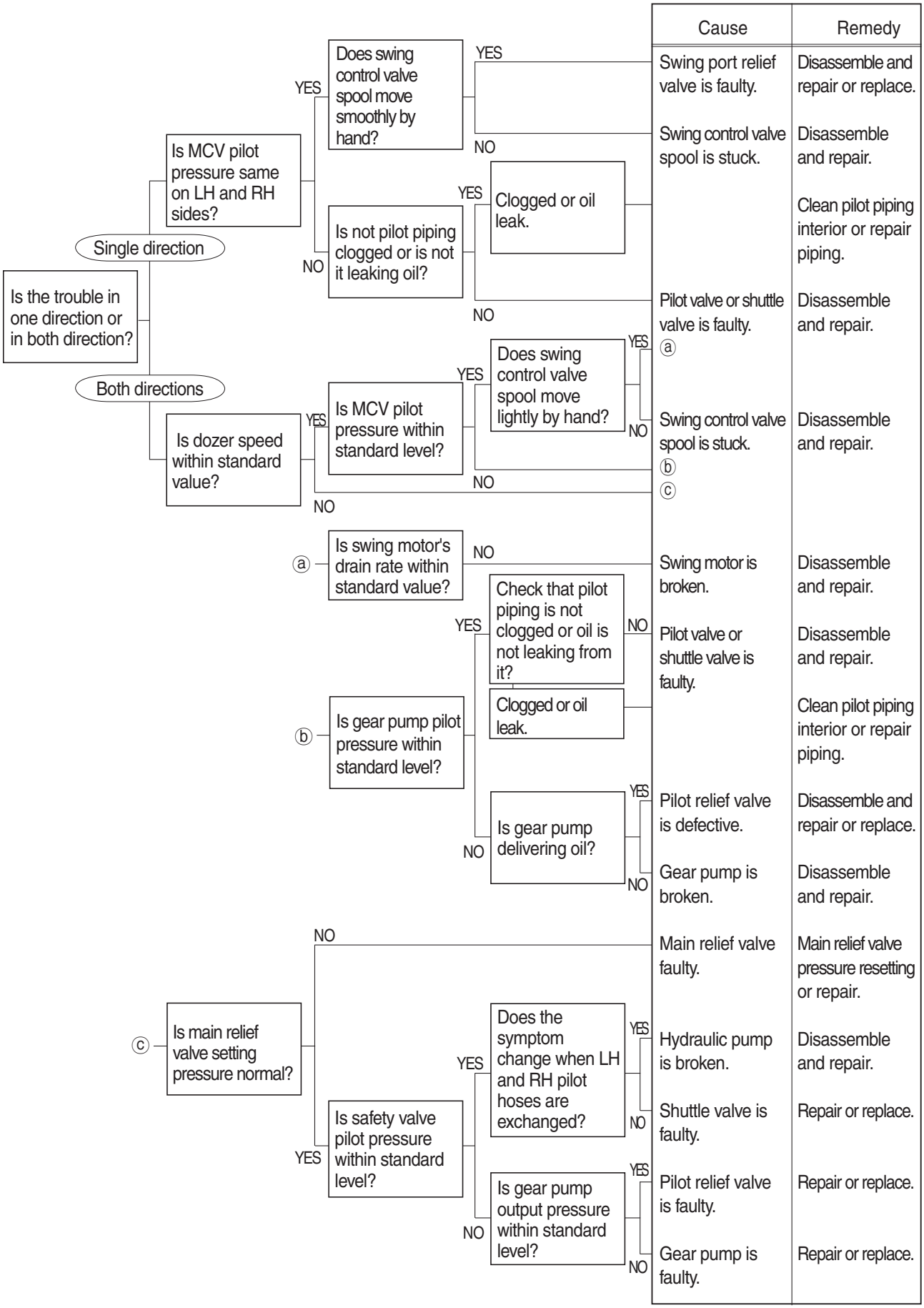
4. SWING SYSTEM

1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE

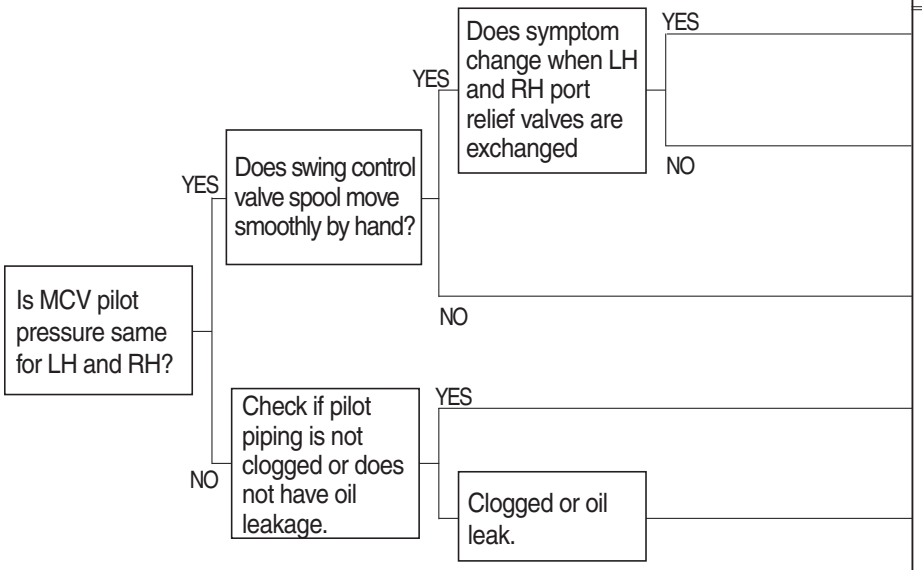


Cause	Remedy
ⓐ Safety valve faulty or not operated.	Replenish specified oil to the standard level. Repair or replace.
Gear pump faulty.	Repair or replace.
Pump connection coupling is broken.	Disassemble and repair.
Hydraulic pump is out of order.	Disassemble and repair.
Swing control valve spool is ⓑ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

2) SWING SPEED IS LOW

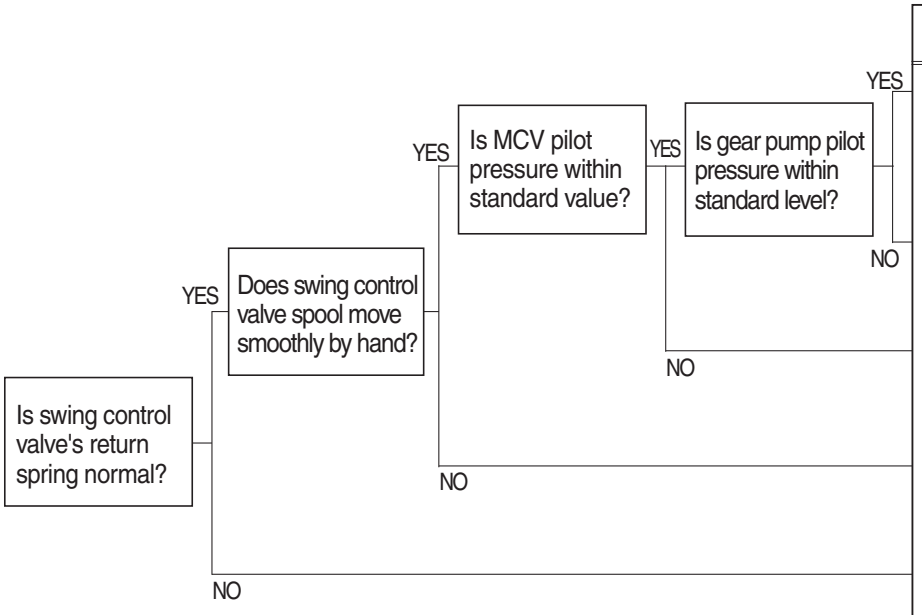


3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



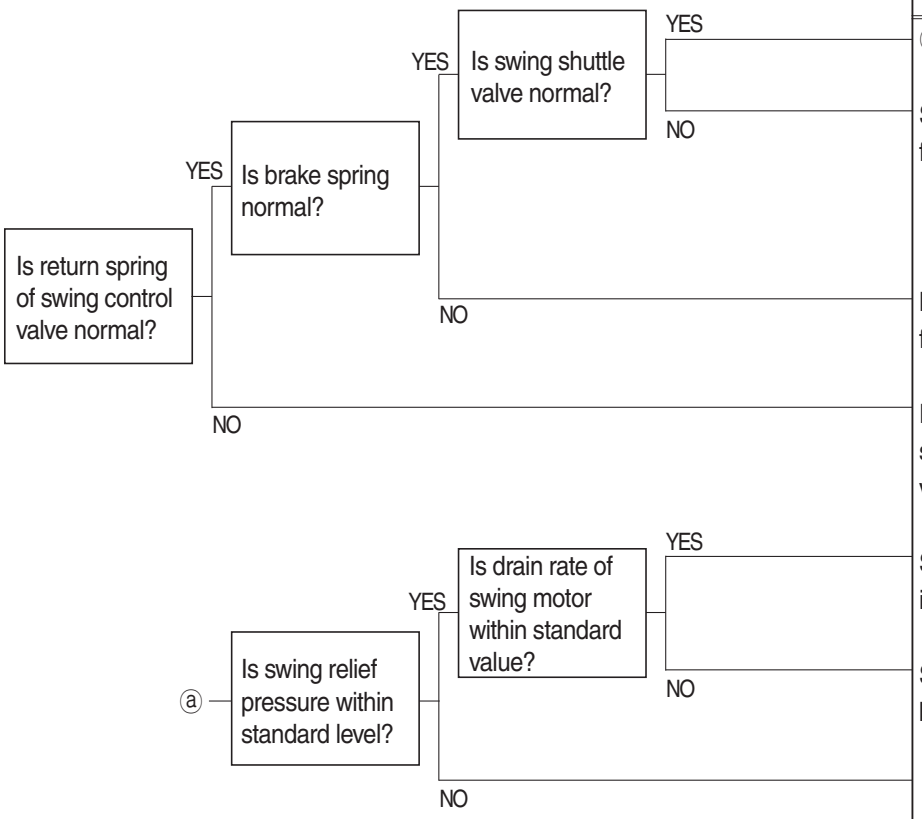
Cause	Remedy
Swing port relief valve is faulty.	Disassemble and repair.
Shuttle valve is faulty.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
Pilot valve is faulty.	Disassemble and repair.
	Clean pilot piping interior or repair piping.

4) MACHINE SWINGS BUT DOES NOT STOP



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

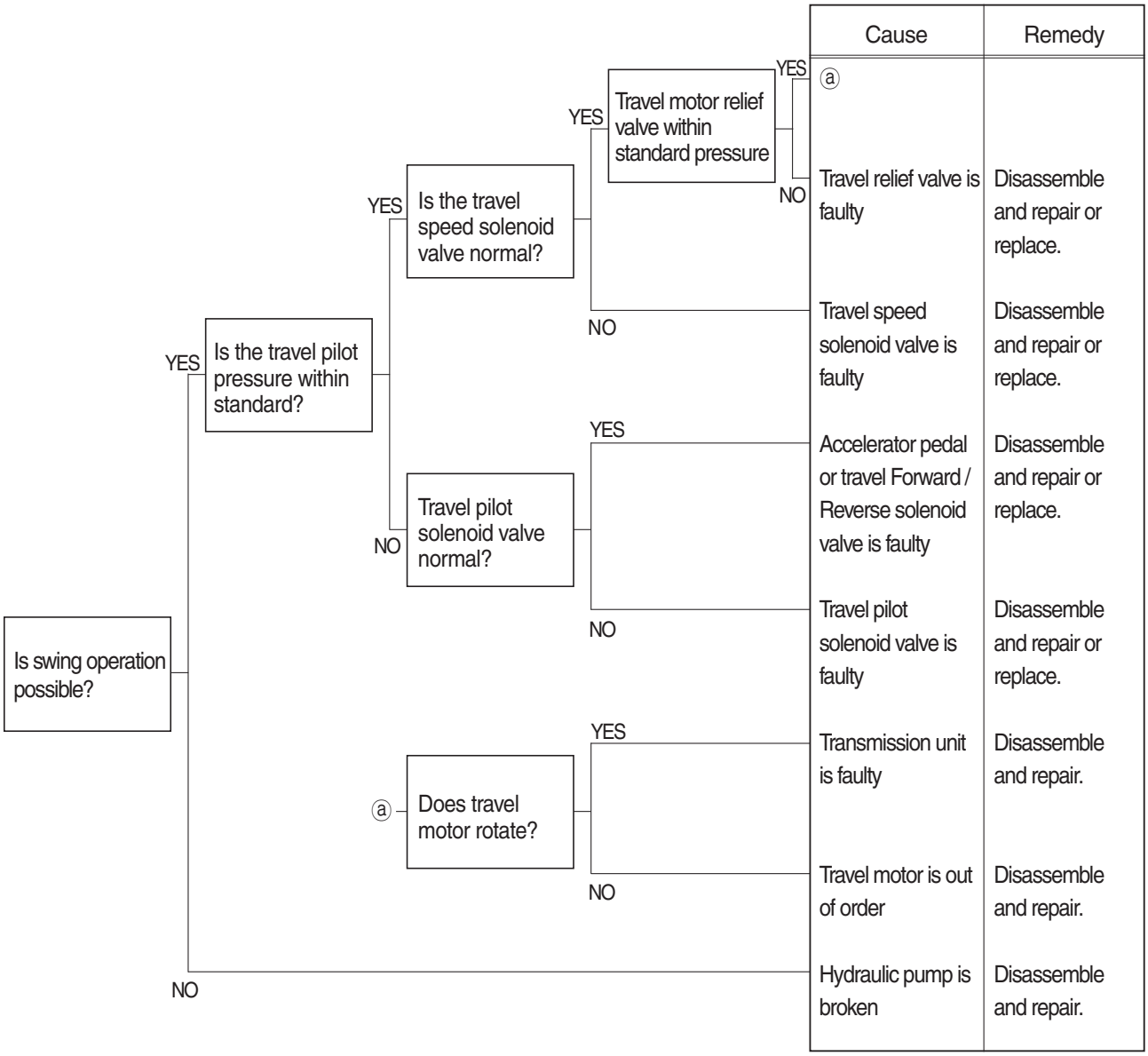
5) THE SWING UNIT DRIFTS WHEN THE MACHINE IS AT REST ON A SLOPE



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

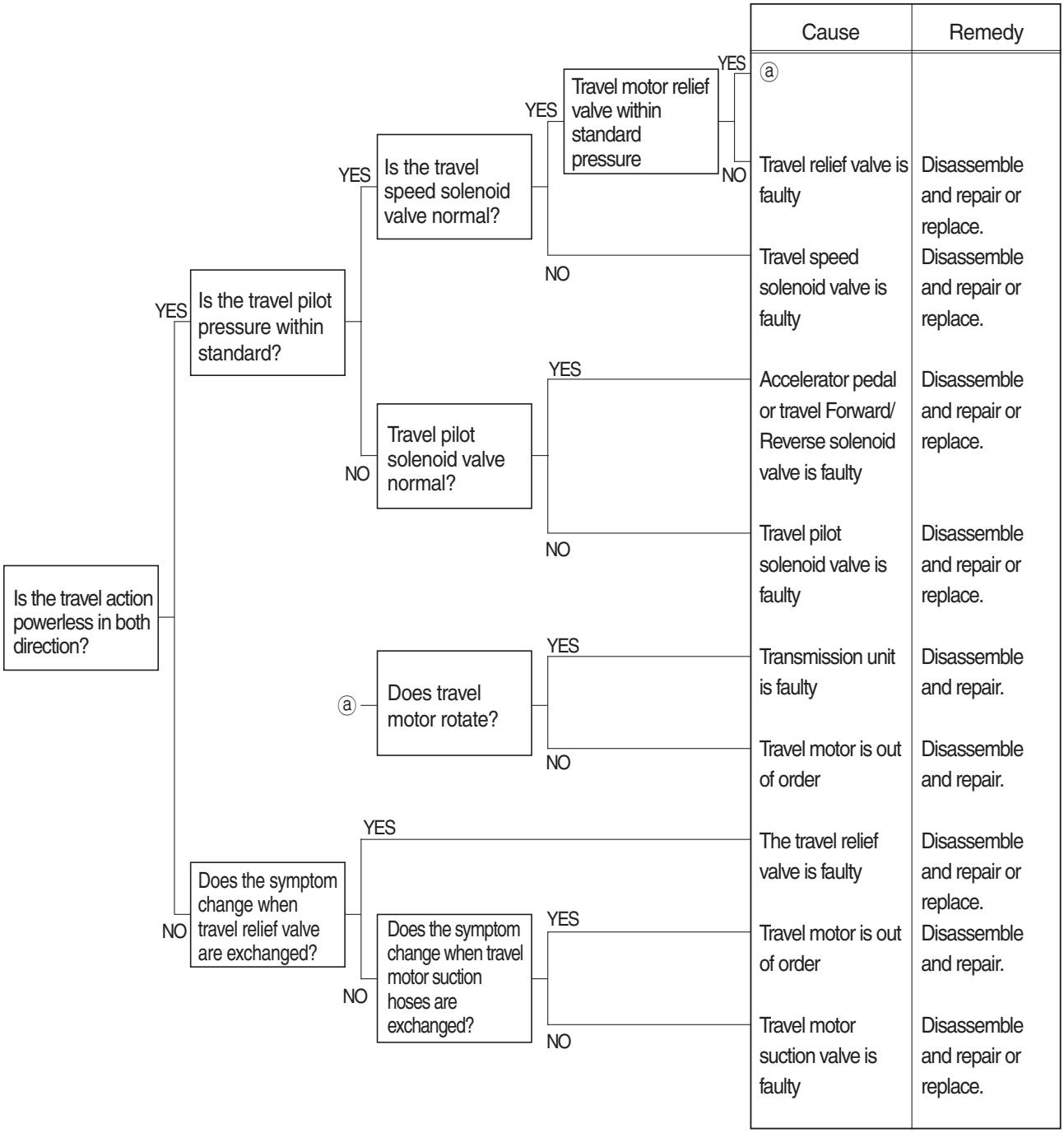
5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION



Cause	Remedy
ⓐ	
Travel relief valve is faulty	Disassemble and repair or replace.
Travel speed solenoid valve is faulty	Disassemble and repair or replace.
Accelerator pedal or travel Forward / Reverse solenoid valve is faulty	Disassemble and repair or replace.
Travel pilot solenoid valve is faulty	Disassemble and repair or replace.
Transmission unit is faulty	Disassemble and repair.
Travel motor is out of order	Disassemble and repair.
Hydraulic pump is broken	Disassemble and repair.

2) TRAVEL ACTION IS POWERLESS (travel only)



3) THE HYDRAULIC MOTOR DOSE NOT GET STARTED

The hydraulic motor does not get started

Cause	Remedy
The spool does work properly. (the spool keeps fully open)	Screw the fitting bolts one more time with correct tightening torque. If the spool turns out to be damaged, it should be repaired or the new one should be used
The anti-cavitation check valve does not work properly. (the check valve is kept open.)	Ditto

4) IT TAKES TIME TO ACCELERATE THE MOTOR

It takes time to accelerate the motor

Cause	Remedy
The spool does not work properly.	Screw the fitting bolts one more time with correct tightening torque. If the spool turns out to be damaged, it should be repaired, or the new one should be used.
The orifice for closing the counterbalance is clogged.	Remove the foreign matter by disassembling and cleaning.
Wrong setting of pressure of the relief valve.	Adjust at the correct value. If the relief valve turns out to be out of order, the new one should be used.

5) IT IS NOT POSSIBLE TO REDUCE THE MOTOR SMOOTHLY

It is not possible to reduce the motor smoothly

Cause	Remedy
The orifice for closing the counterbalance is clogged. The opening of the neutral position of the spool is clogged.	Remove the foreign matter by disassembling and cleaning.
Wrong setting of pressure of the relief valve.	Adjust at the correct value. If the relief valve turns out to be out of order, the new one should be used.

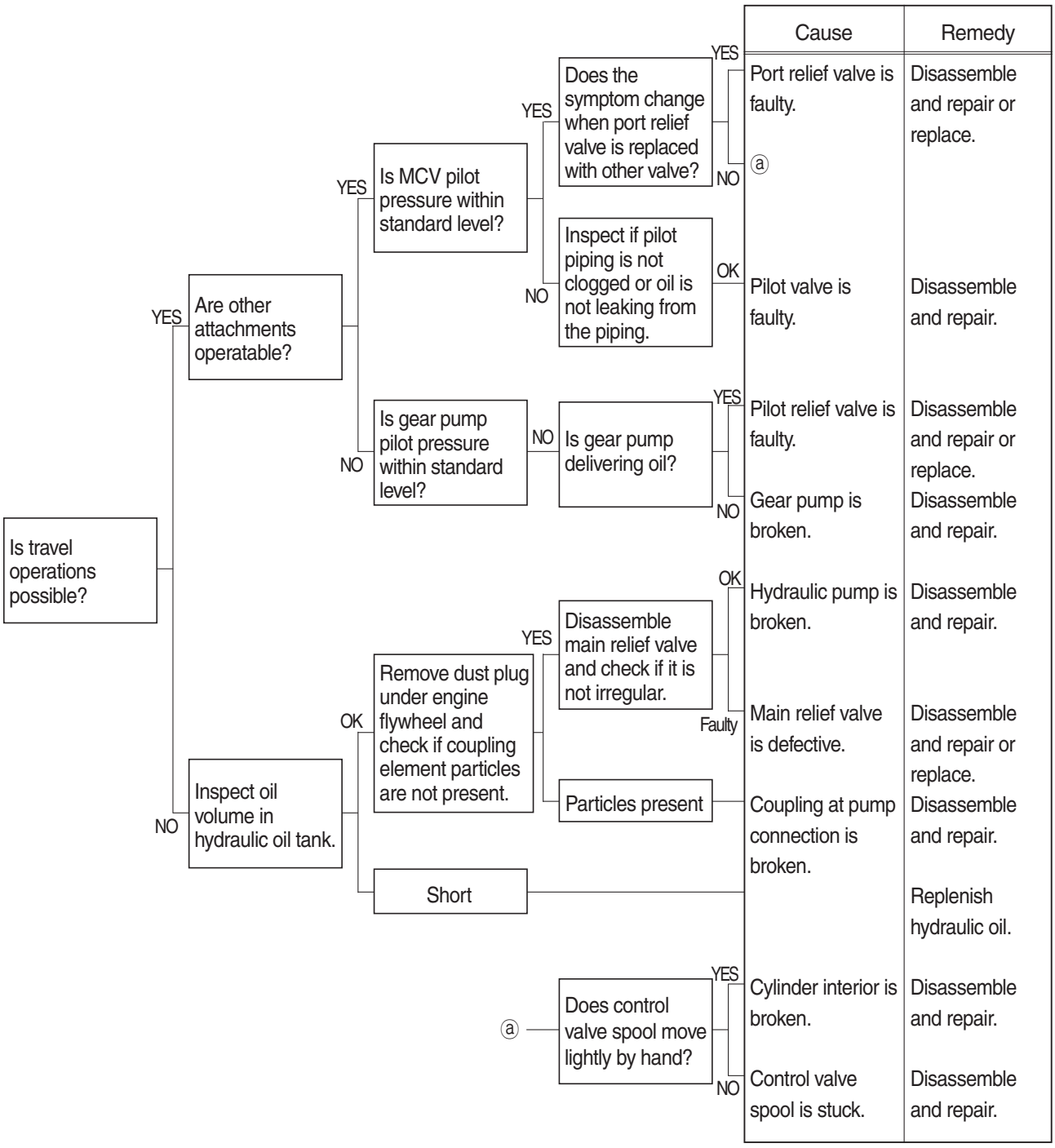
6) EXTRAORDINARY NOISE IS HEARD WHEN SUDDENLY REDUCING THE SPEED FROM THE HIGH-SPEED MODE

It takes time to accelerate the motor

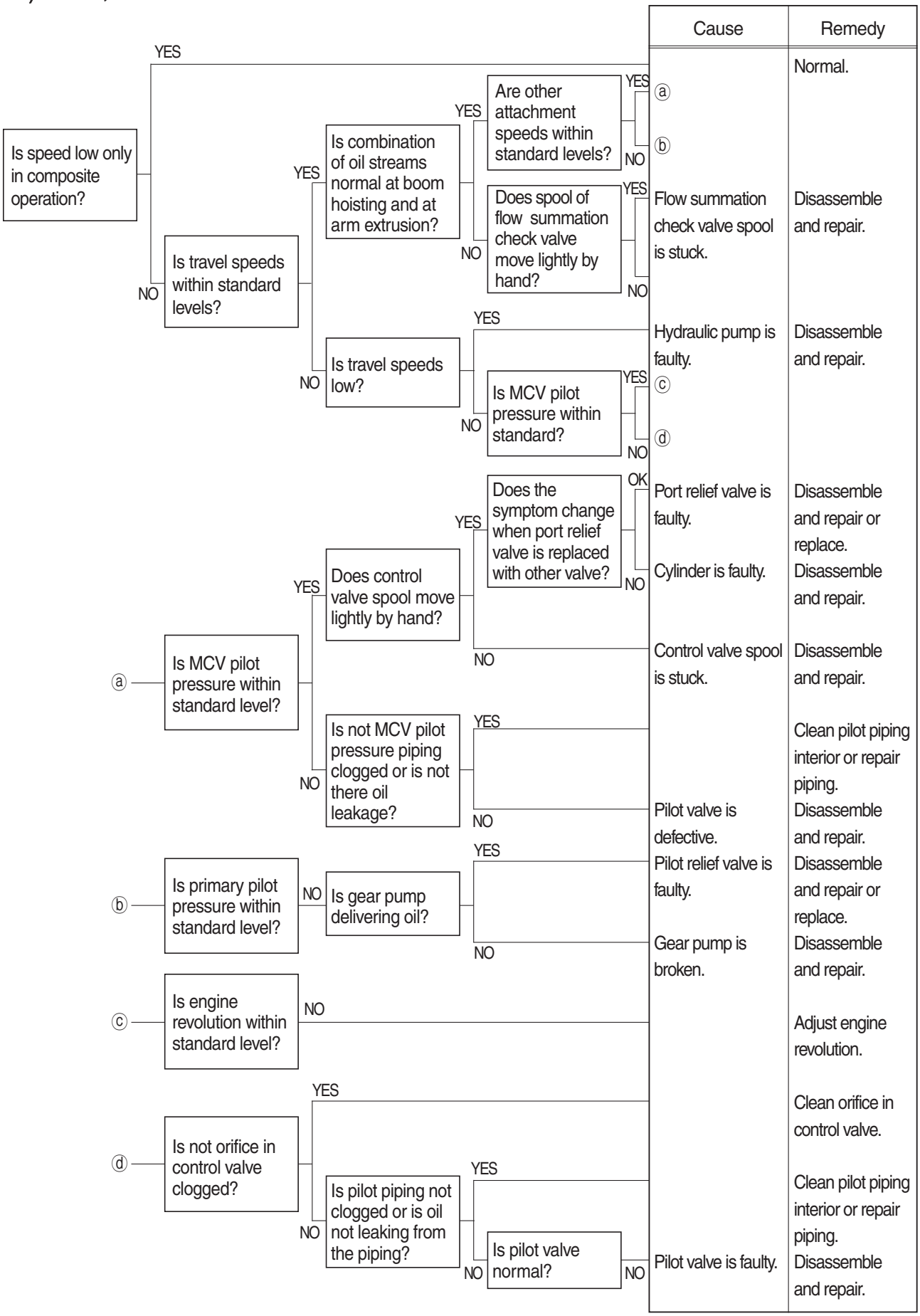
Cause	Remedy
The anti-cavitation valve does not not work properly.	Screw the fitting bolts one more time with correct tightening torque. If the valve turns out to be damaged, is should be repaired.

6. ATTACHMENT SYSTEM

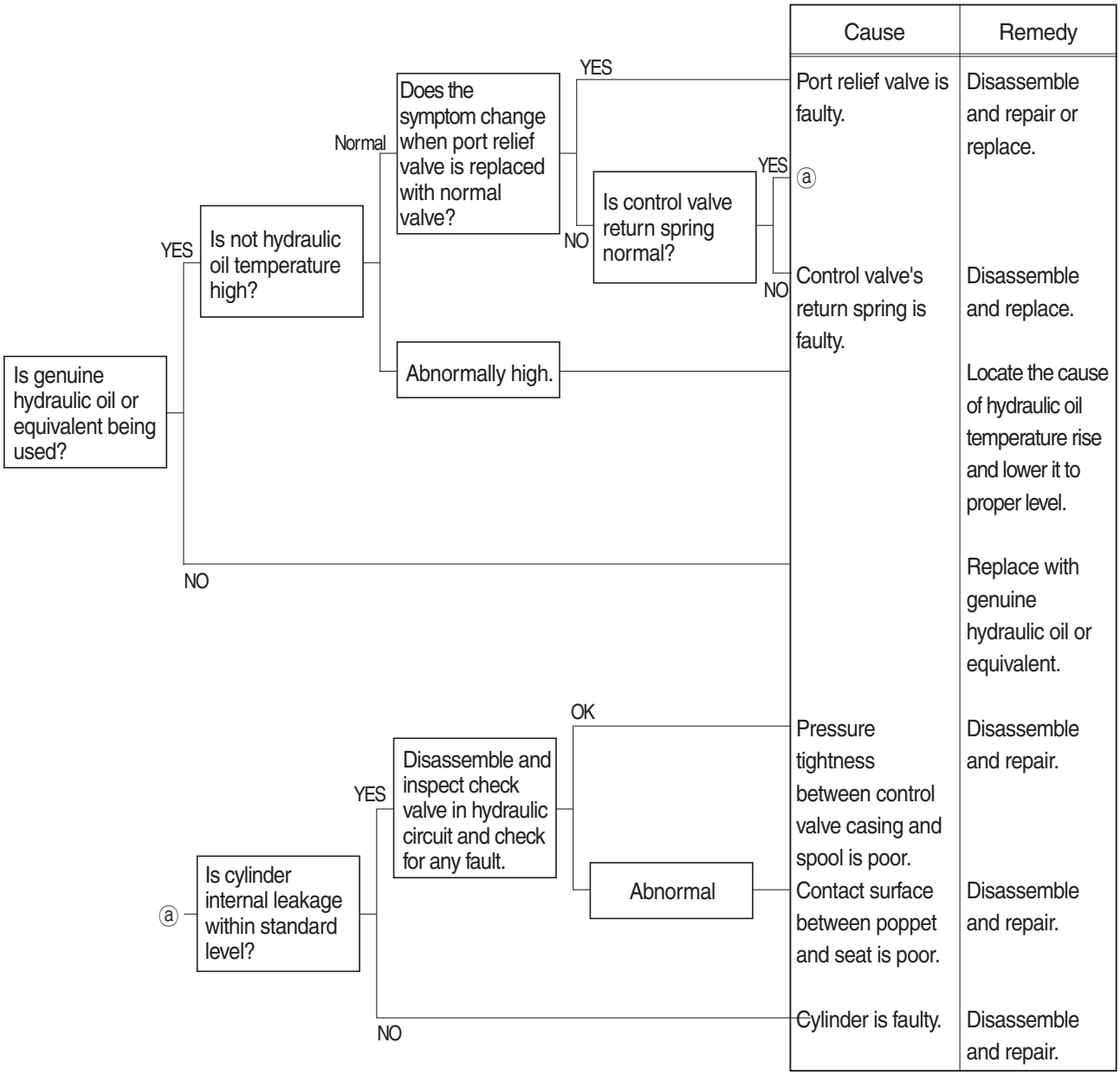
1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



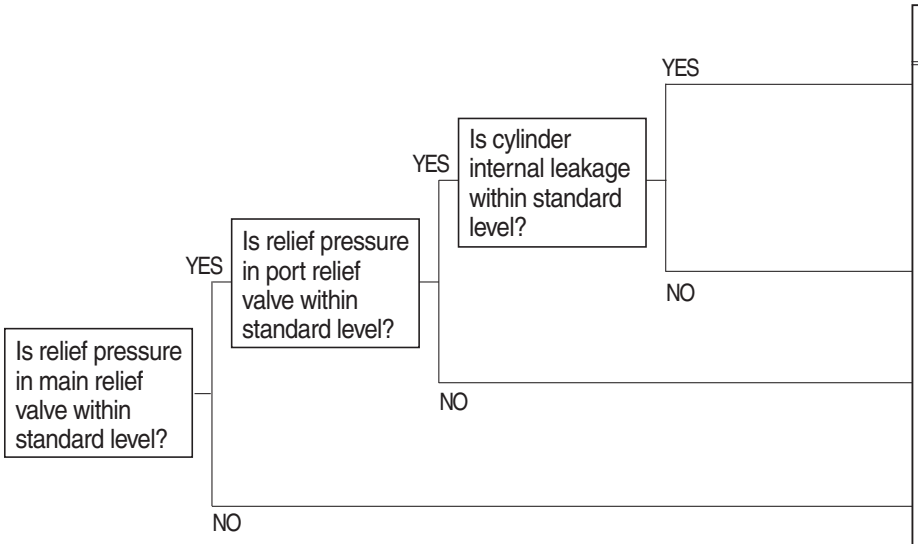
2) BOOM, ARM OR BUCKET SPEED IS LOW



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

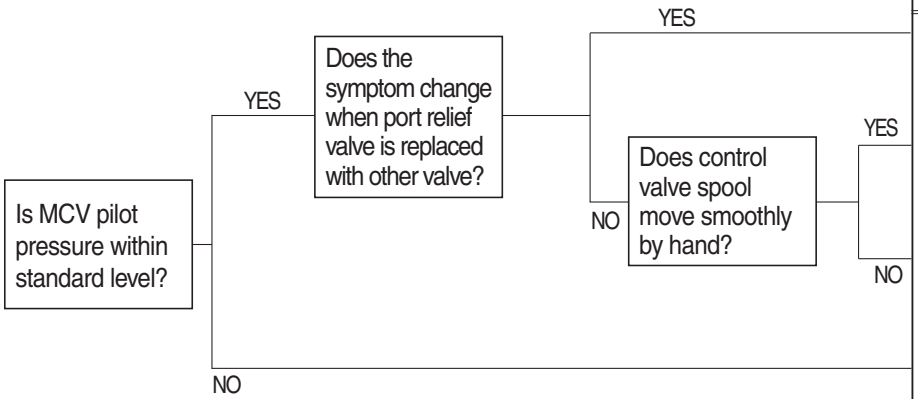


4) BOOM, ARM OR BUCKET POWER IS WEAK



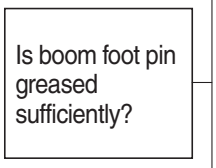
Cause	Remedy
	Check according to the procedure in Item "Speed is low".
Cylinder is faulty.	Disassemble and repair.
Port relief valve is faulty.	Adjust pressure, repair or replace.
Main relief valve is defective.	Adjust pressure, repair or replace.

5) ONLY BUCKET OPERATION IS TOTALLY IMPOSSIBLE



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

6) BOOM MAKES A SQUARING NOISE WHEN BOOM IS OPERATED



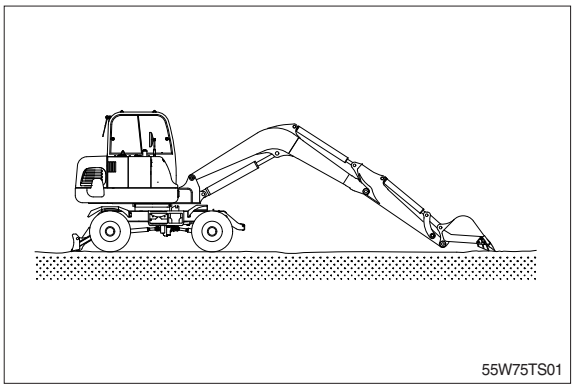
YES

NO

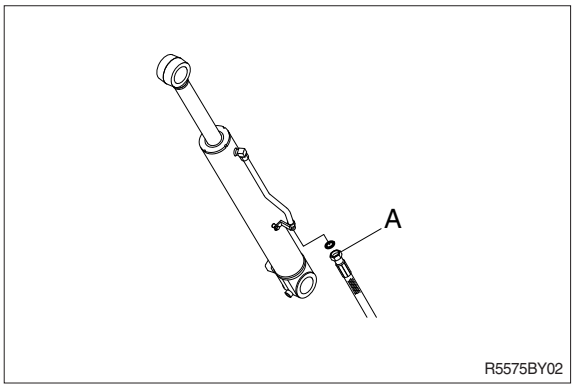
Cause	Remedy
	Frictional noise occurs between the sliding faces of boom cylinder's oil seal and boom proper. ※ Frictional noise will disappear if they are kept used.
Boom foot pin has run out of grease.	Supply grease to it. ※ If seizure is in an initial stage, supply sufficient grease. If seizure is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

※ HOW TO CHECK INTERNAL BOOM CYLINDER LEAKAGE

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

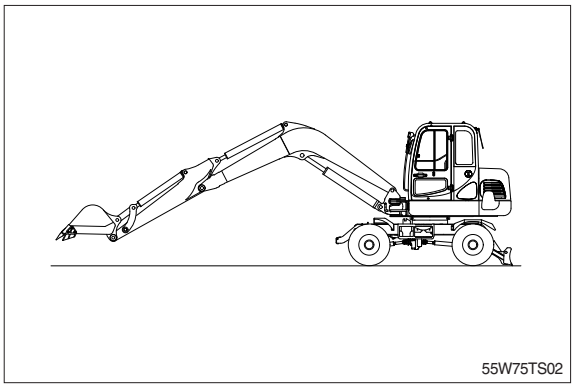


2. Disconnect hose (A) from rod side of boom cylinder and drain oil from cylinder and hose. (put cups on piping and hose ends)



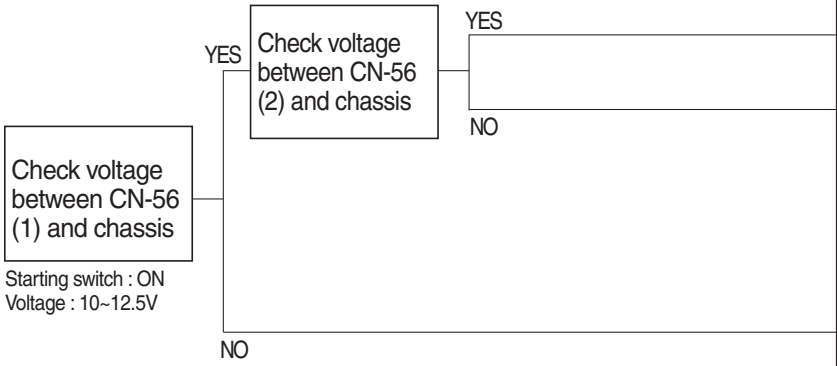
3. Raise bucket OFF the ground by retracting the arm cylinder rod.

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



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

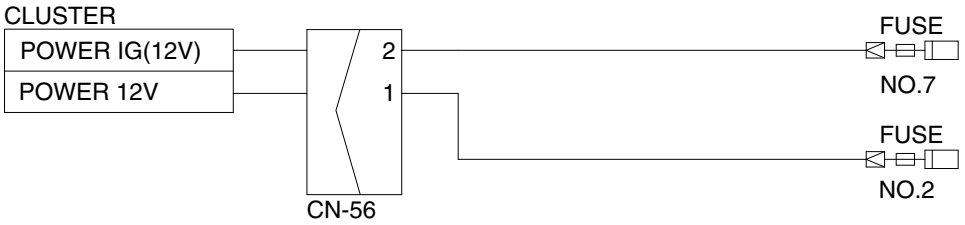
·Before disconnecting the connector, always turn the starting switch OFF.
·Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.2 and No.7.
·After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective cluster	Replace
Disconnection in wiring harness or poor contact between CN-56 (2) and fuse No.7.	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-56 (1) and fuse No.2	Repair or replace (after clean)

Check voltage

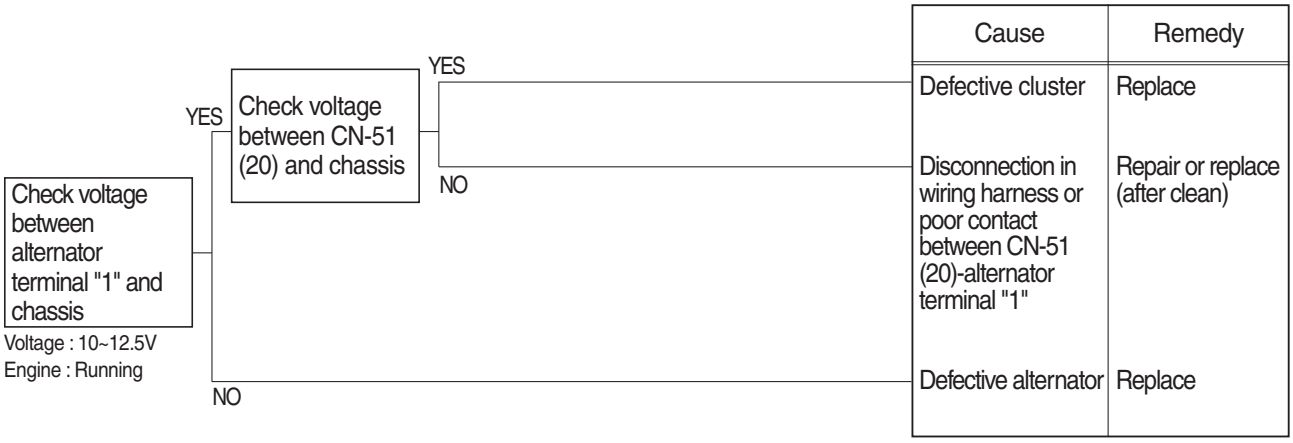
YES	10 ~ 12.5V
NO	0V



55W9A5TS10

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

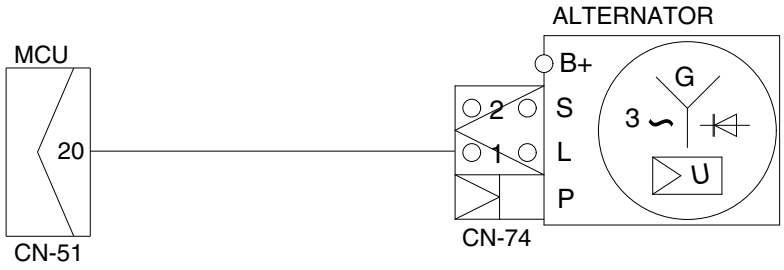
·Before disconnecting the connector, always turn the starting switch OFF.
·Before carrying out below procedure, check all the related connectors are properly inserted.
·After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective cluster	Replace
Disconnection in wiring harness or poor contact between CN-51 (20)-alternator terminal "1"	Repair or replace (after clean)
Defective alternator	Replace

Check voltage

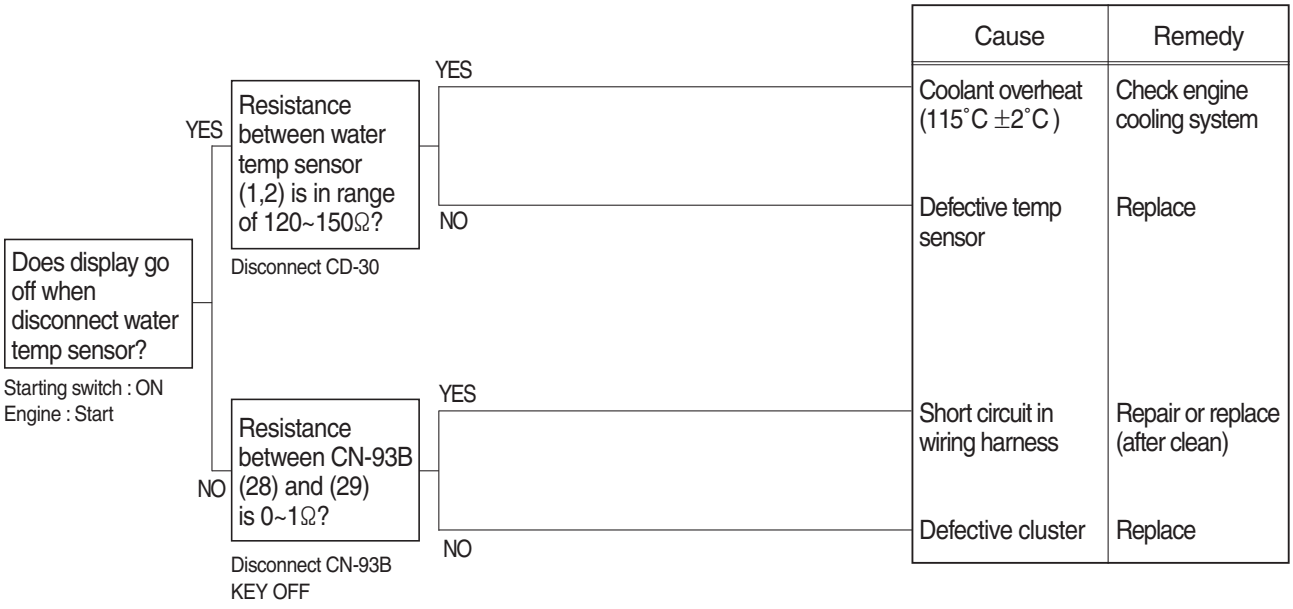
YES	10 ~ 12.5V
NO	0V

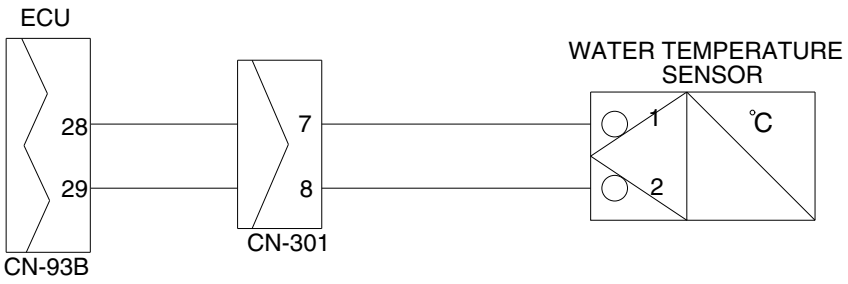


55W9A5TS11

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.

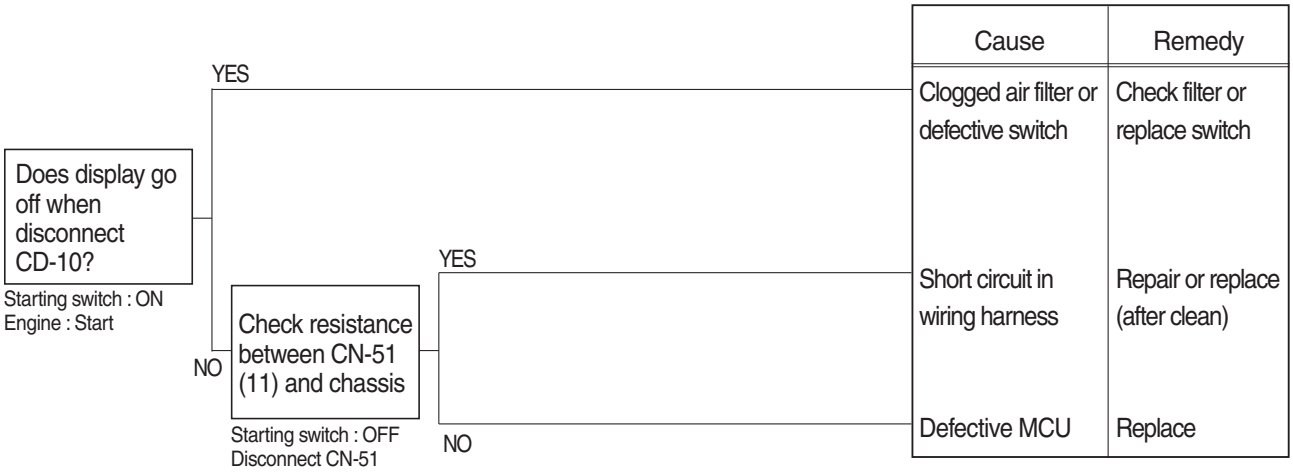




55W9A5TS12

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

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



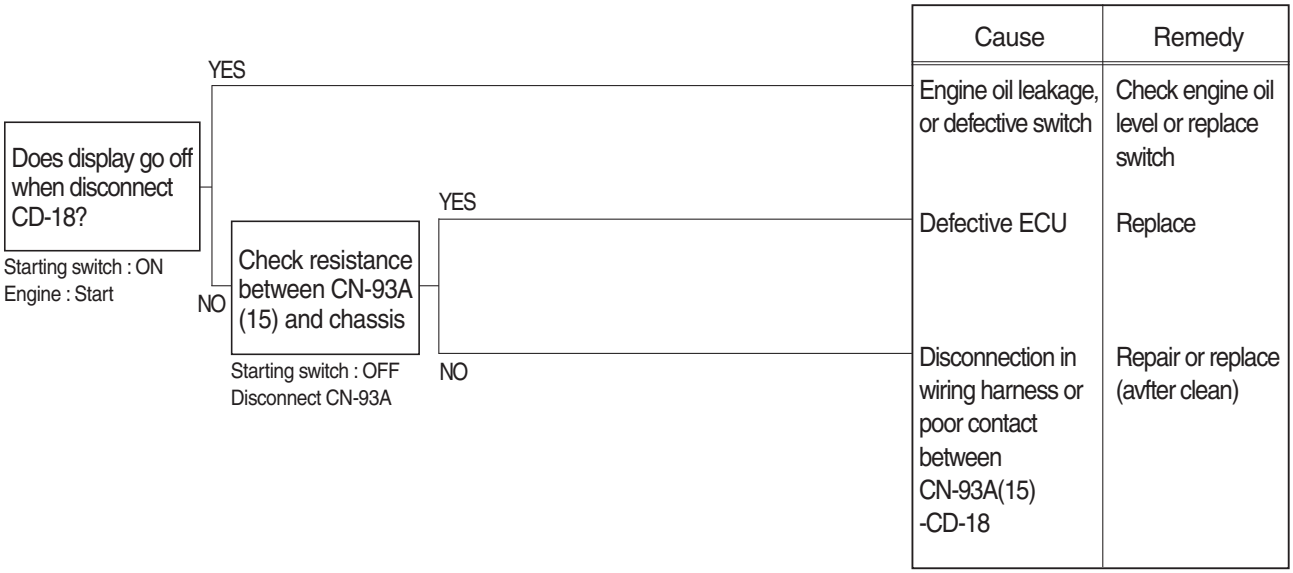
Check resistance

YES	MAX 1Ω
NO	MIN 1MΩ

55W9A5TS13

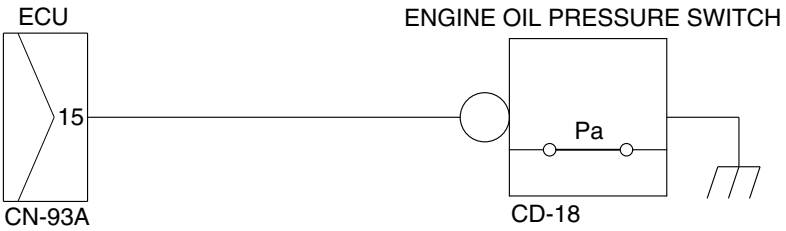
5. WHEN ENGINE OIL PRESSURE WARNING LAMP LIGHTS UP (engine is started)

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



Check resistance

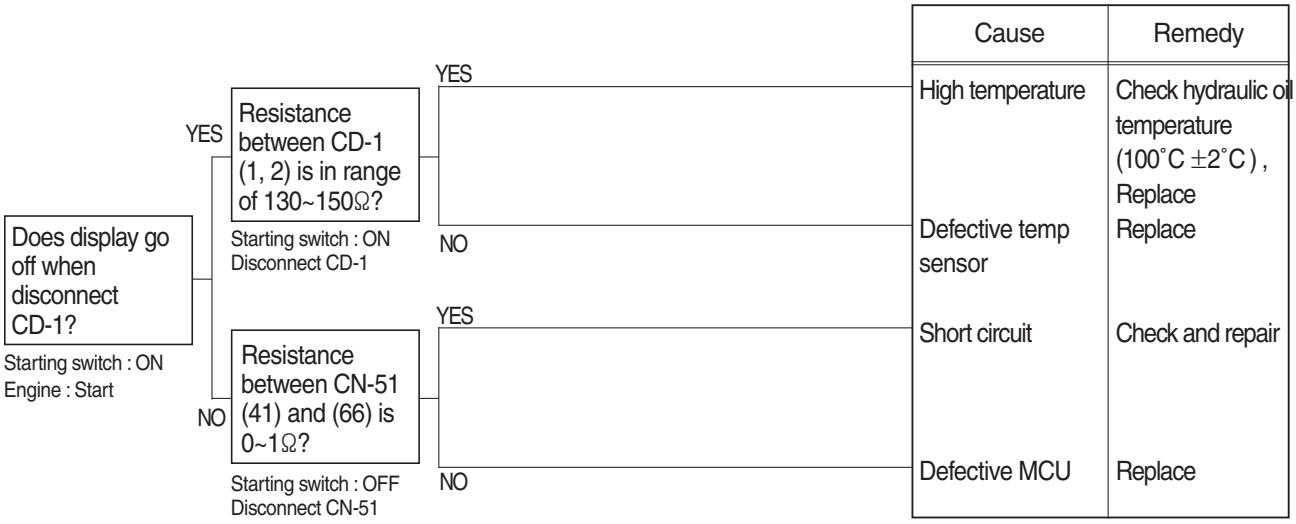
YES	MAX 1Ω
NO	MIN 1MΩ

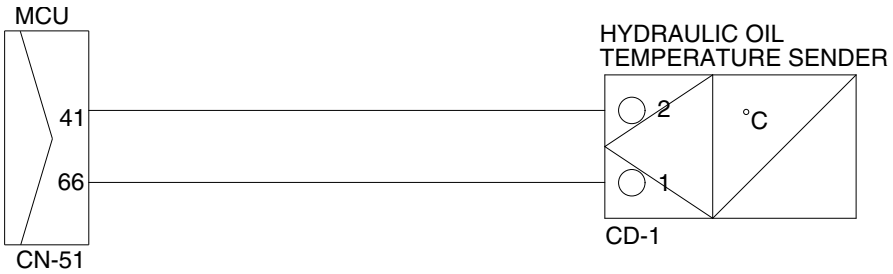


55W9A5TS14

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

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

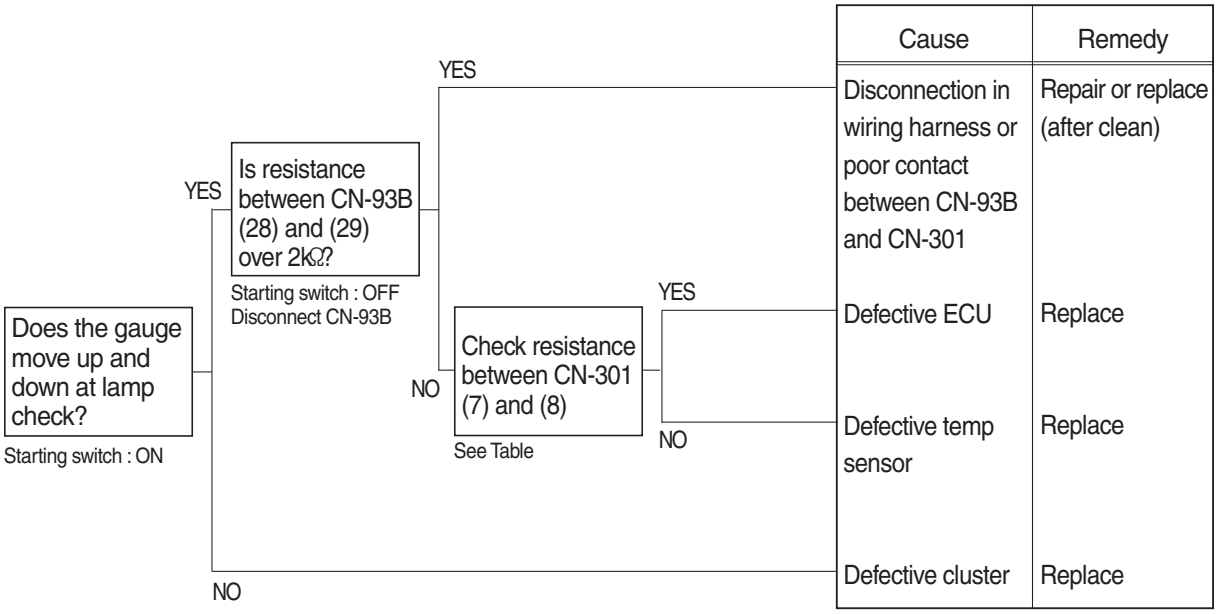


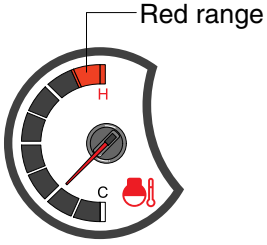


55W9A5TS15

7. WHEN COOLANT TEMPERATURE GAUGE DOES NOT OPERATE

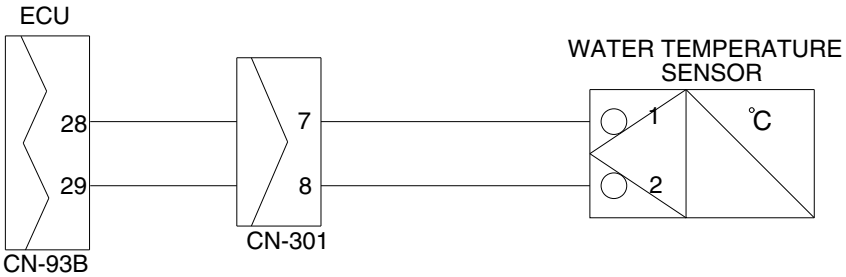
·Before disconnecting the connector, always turn the starting switch OFF.
·Before carrying out below procedure, check all the related connectors are properly inserted.
·After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

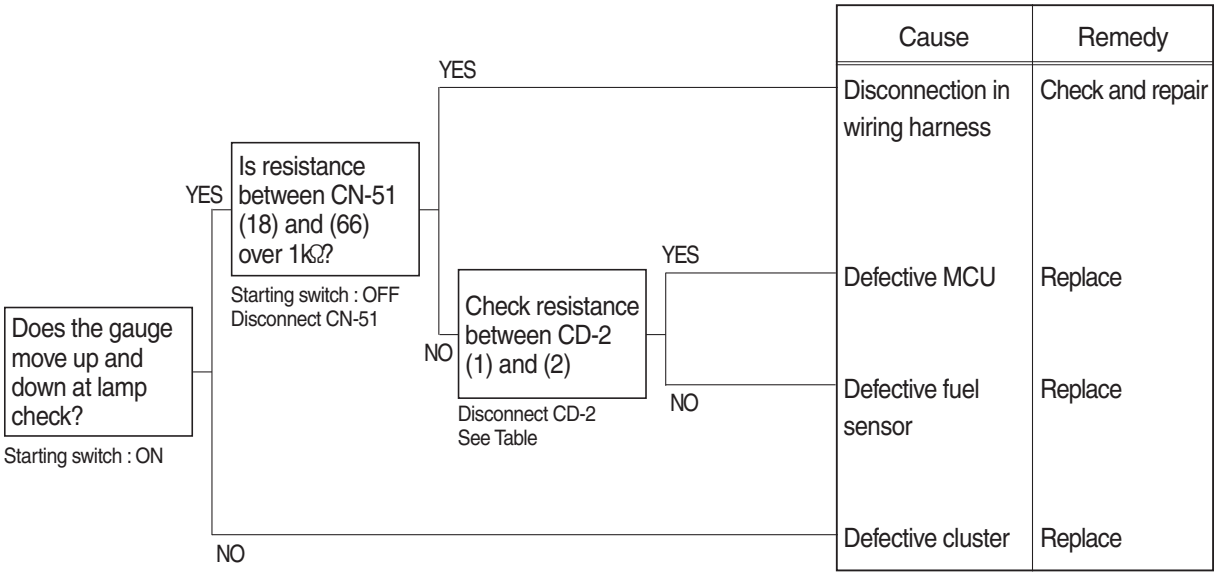
Item \ Temperature	40˚C	85~110˚C	115˚C (red range)
Unit Resistance(Ω)	1170~	270~130	~124
Tolerance(%)	±5	−8~0	±5

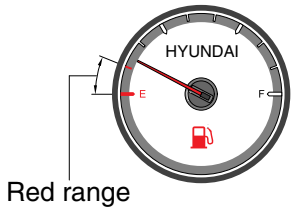


55W9A5TS12

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

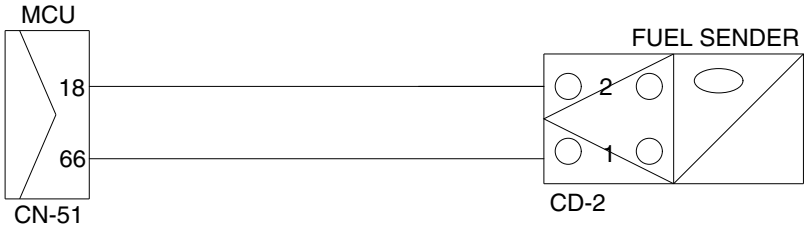
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

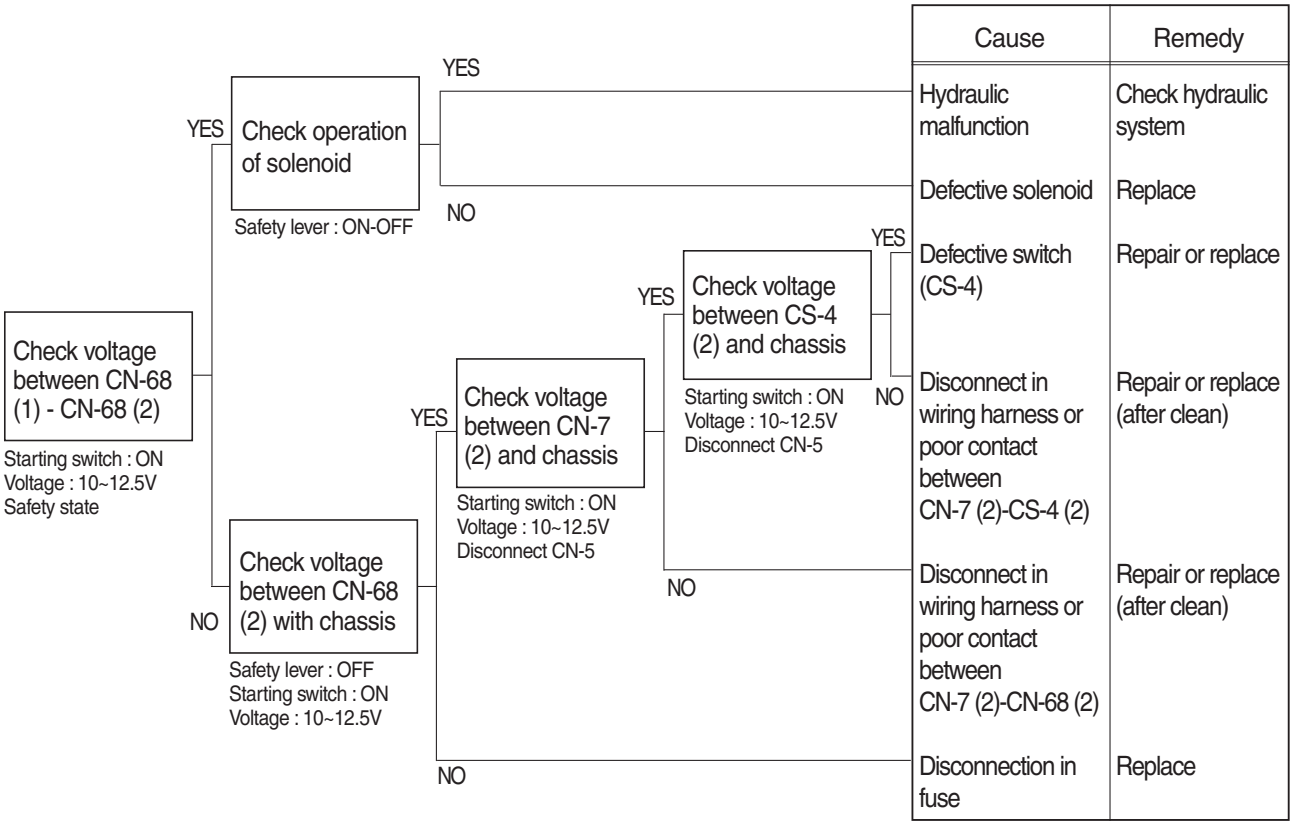
Item \ Level	Empty	1/2	Full
Unit Resistance (Ω)	700	300	~100
Tolerance (%)	±5	±8	±5

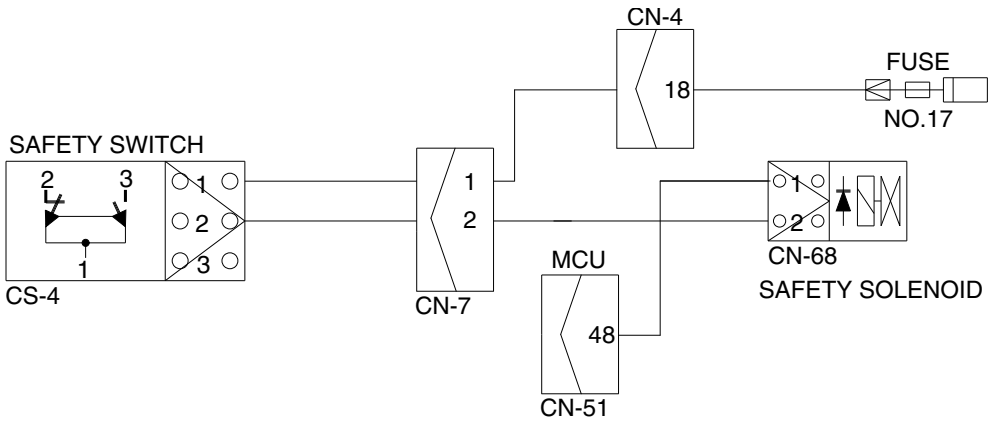


55W95TS16

9. WHEN SAFETY SOLENOID DOES NOT OPERATE

·Before disconnecting the connector, always turn the starting switch OFF.
·Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.17.
·After checking, insert the disconnected connectors again immediately unless otherwise specified.





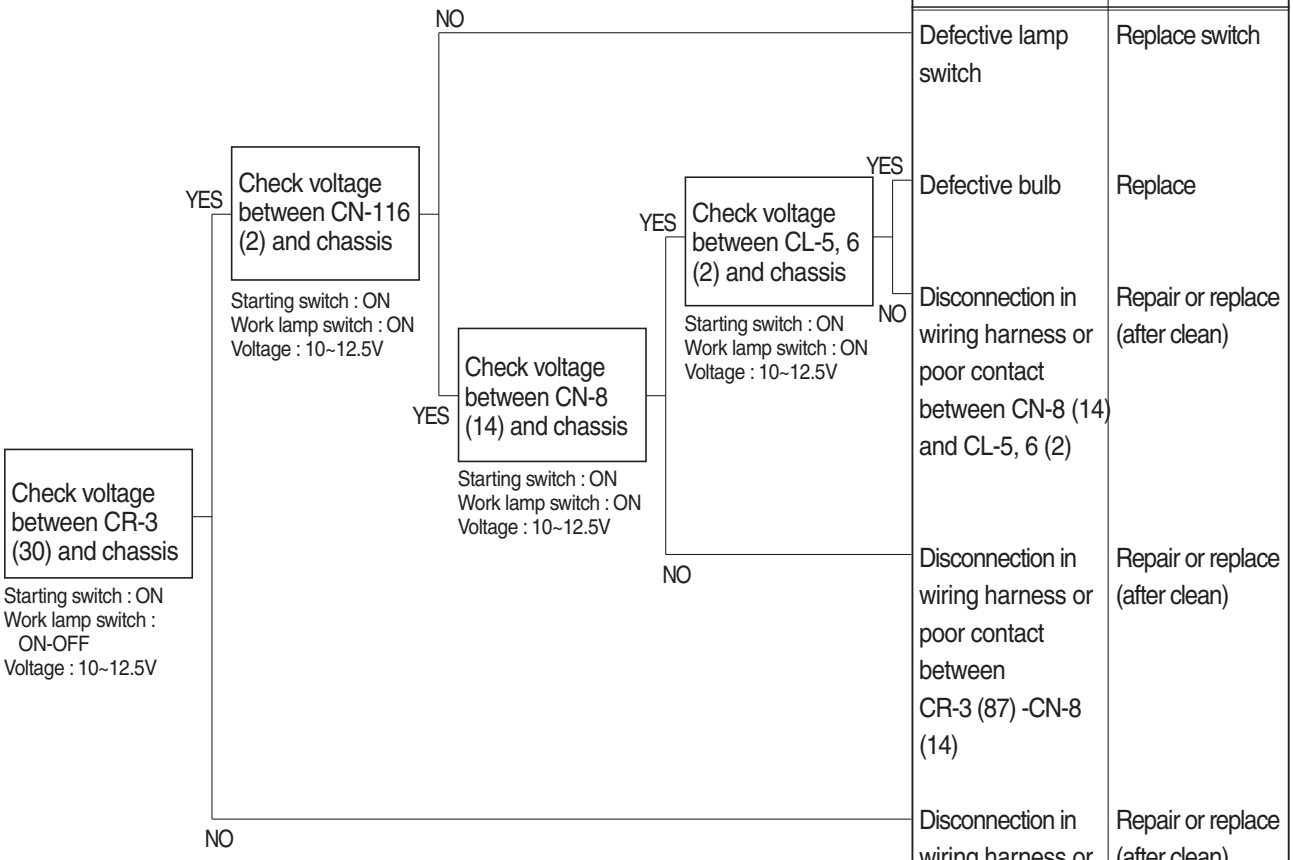
55W9A5TS17

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

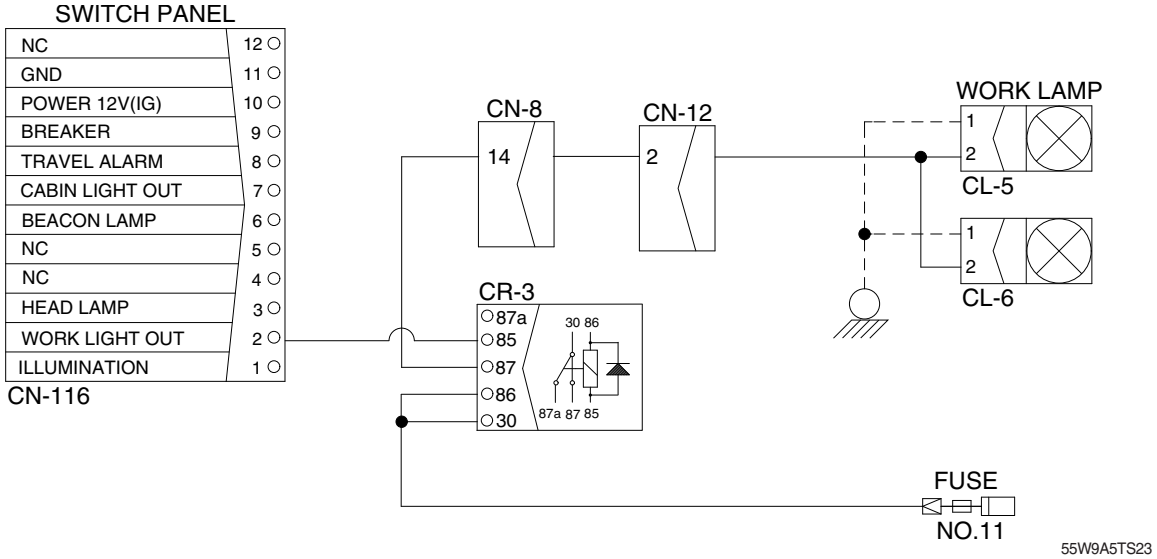
·Before disconnecting the connector, always turn the starting switch OFF.

·Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.11.

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

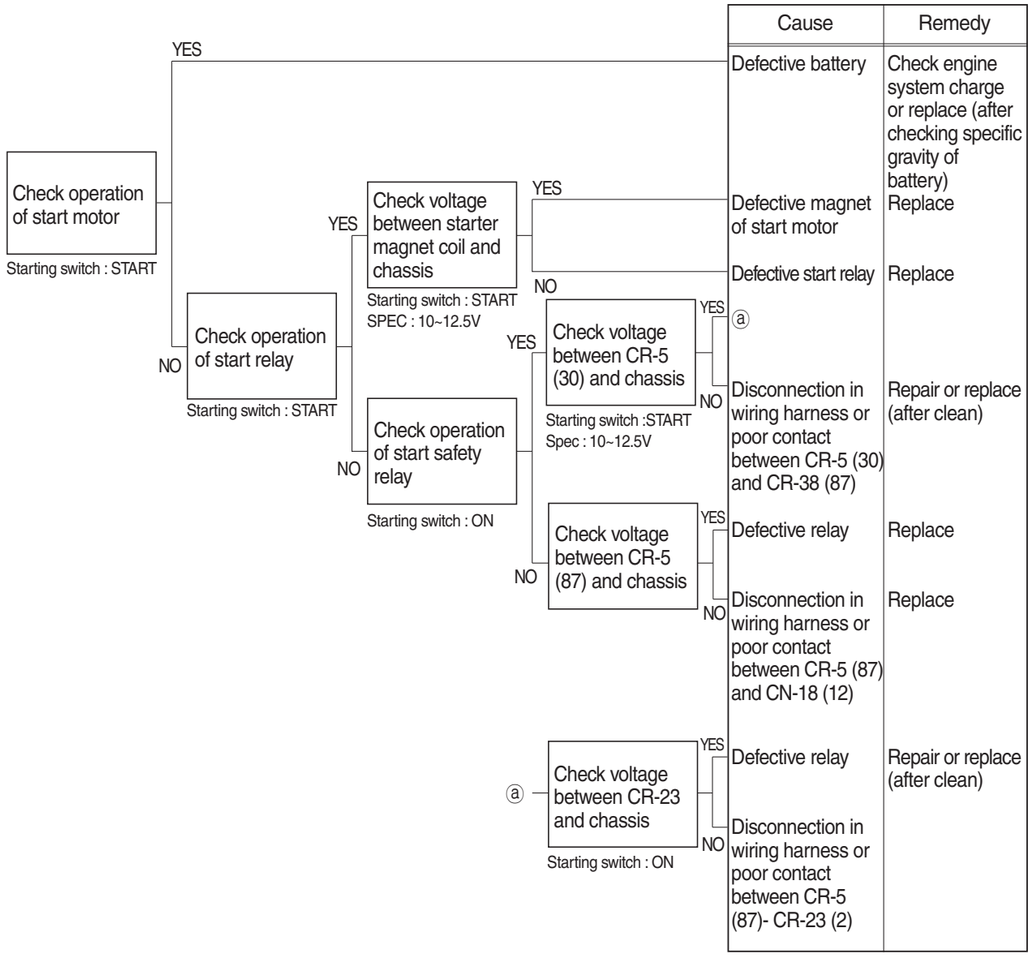


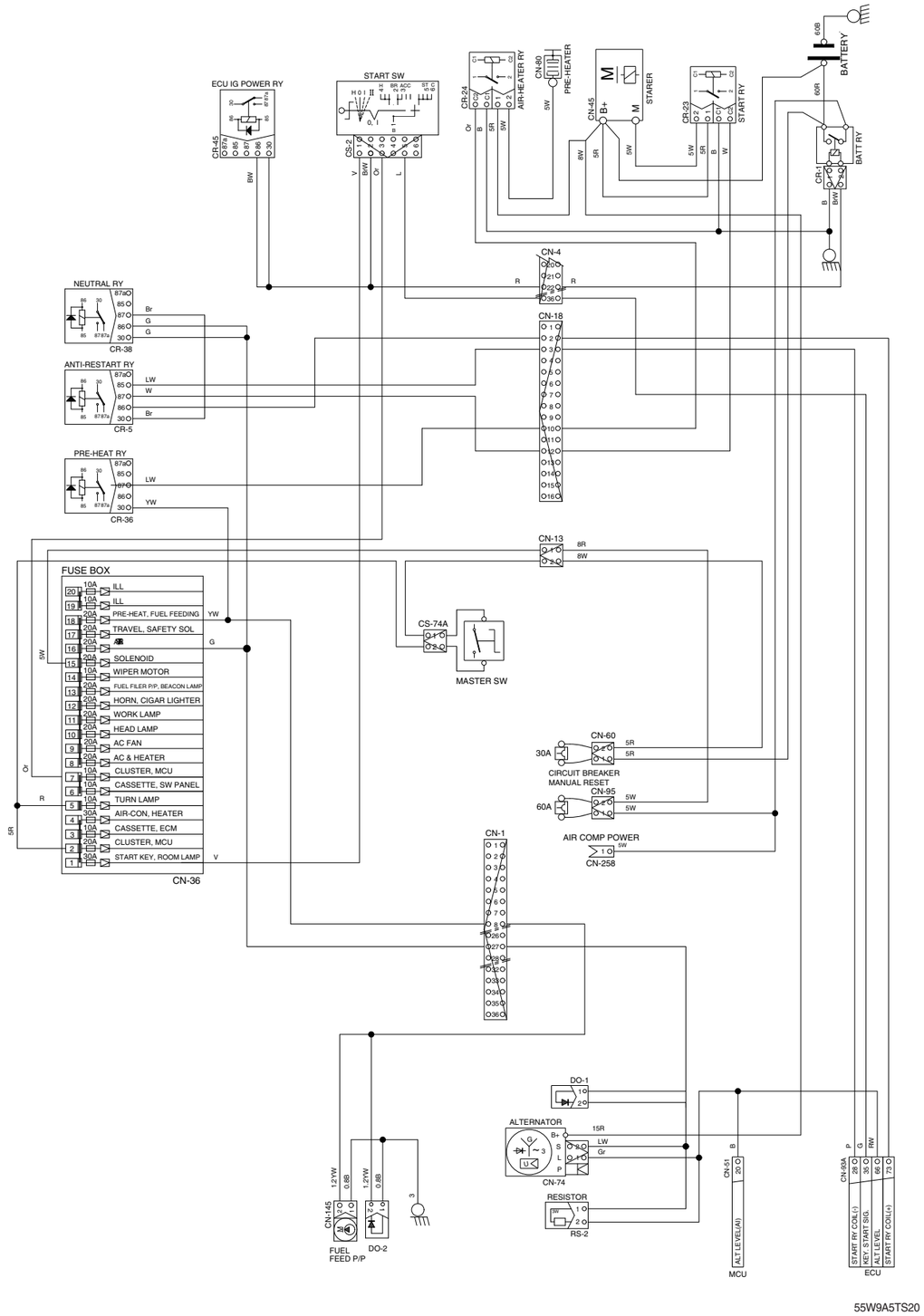
Cause	Remedy
Defective lamp switch	Replace switch
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CN-8 (14) and CL-5, 6 (2)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CR-3 (87) -CN-8 (14)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-116 (2) and fuse	Repair or replace (after clean)



11. WHEN ENGINE DOES NOT START

·Check supply of the power at engine stop solenoid while starting switch is ON.
·Before disconnecting the connector, always turn the starting switch OFF.
·Before carrying out below procedure, check all the related connectors are properly inserted.
·After checking, insert the disconnected connectors again immediately unless otherwise specified.

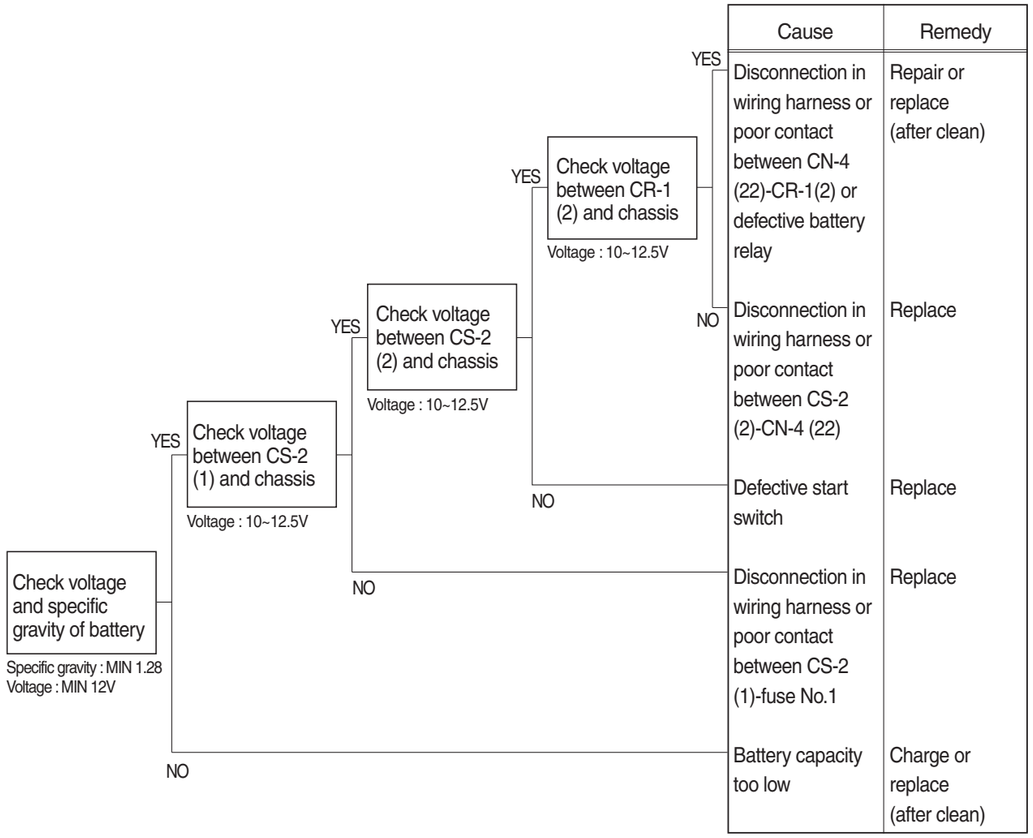




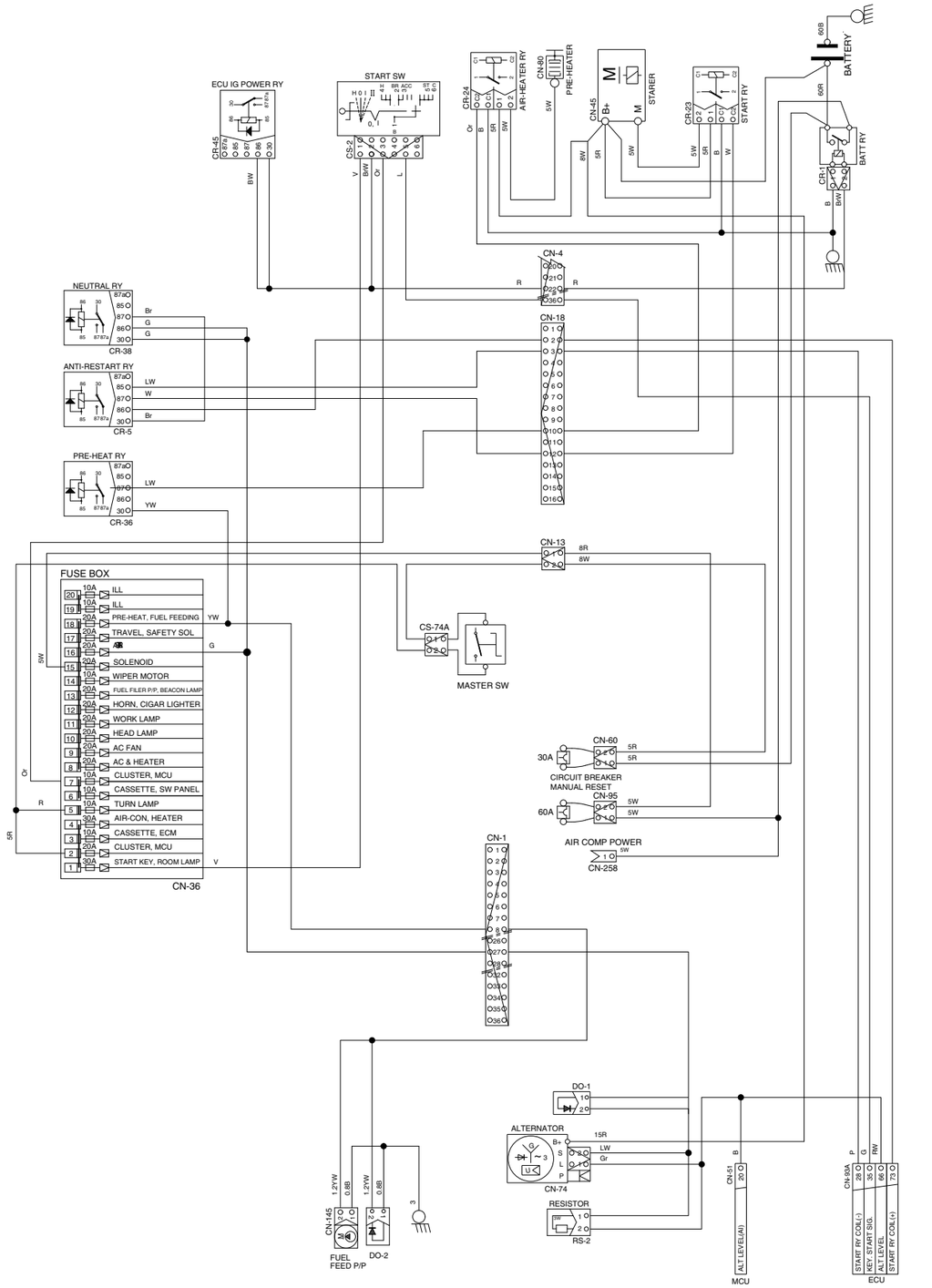
55W9A5TS20

12. WHEN STARTING SWITCH ON DOES NOT OPERATE

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



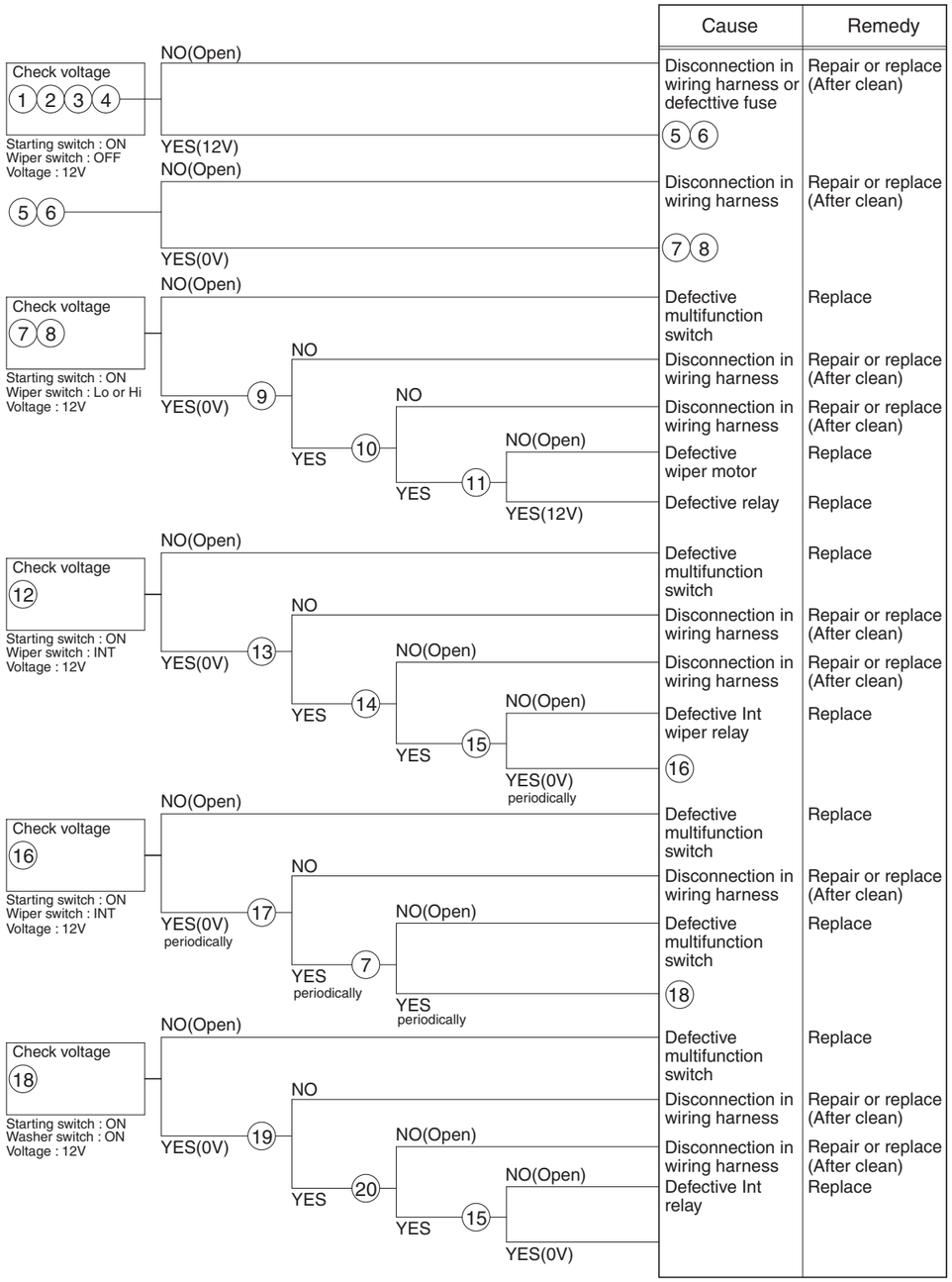
Cause	Remedy
Disconnection in wiring harness or poor contact between CN-4 (22)-CR-1(2) or defective battery relay	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CS-2 (2)-CN-4 (22)	Replace
Defective start switch	Replace
Disconnection in wiring harness or poor contact between CS-2 (1)-fuse No.1	Replace
Battery capacity too low	Charge or replace (after clean)



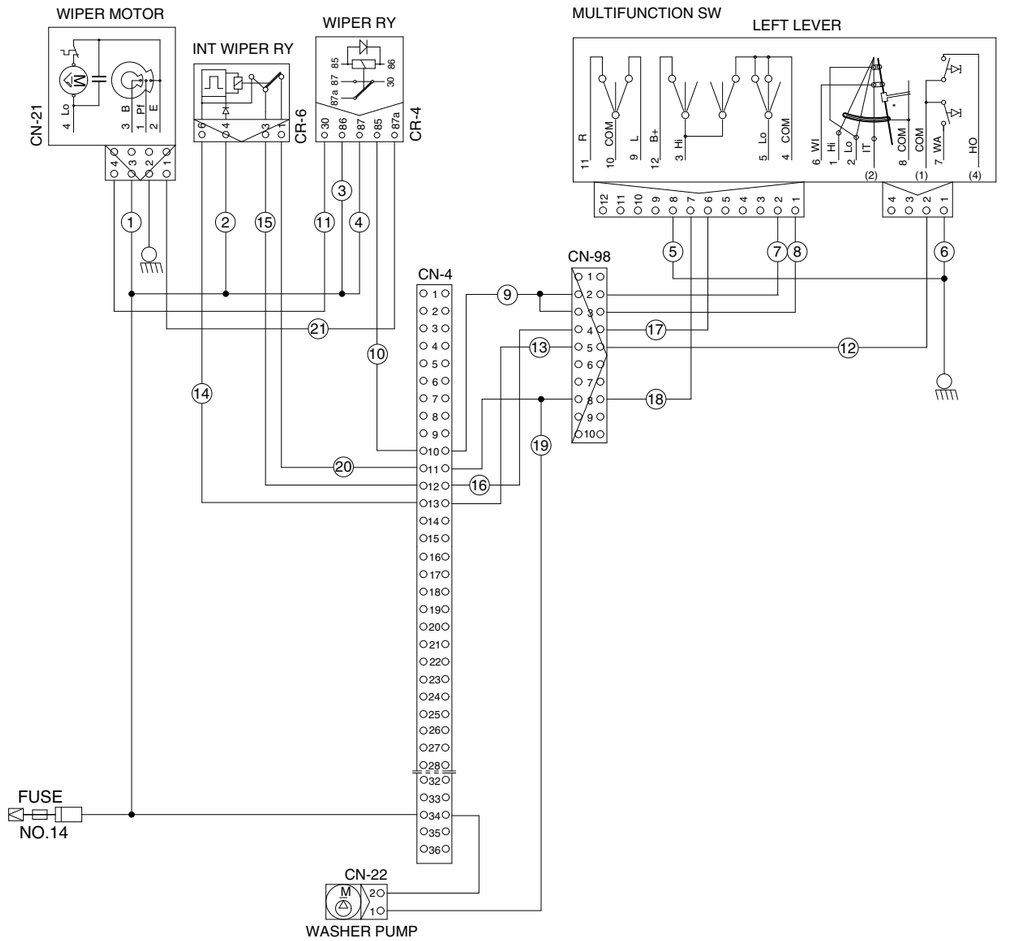
55W9A5TS20

13. 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.14 is not blown out.
- ·After checking, insert the disconnected connectors again immediately unless otherwise specified.



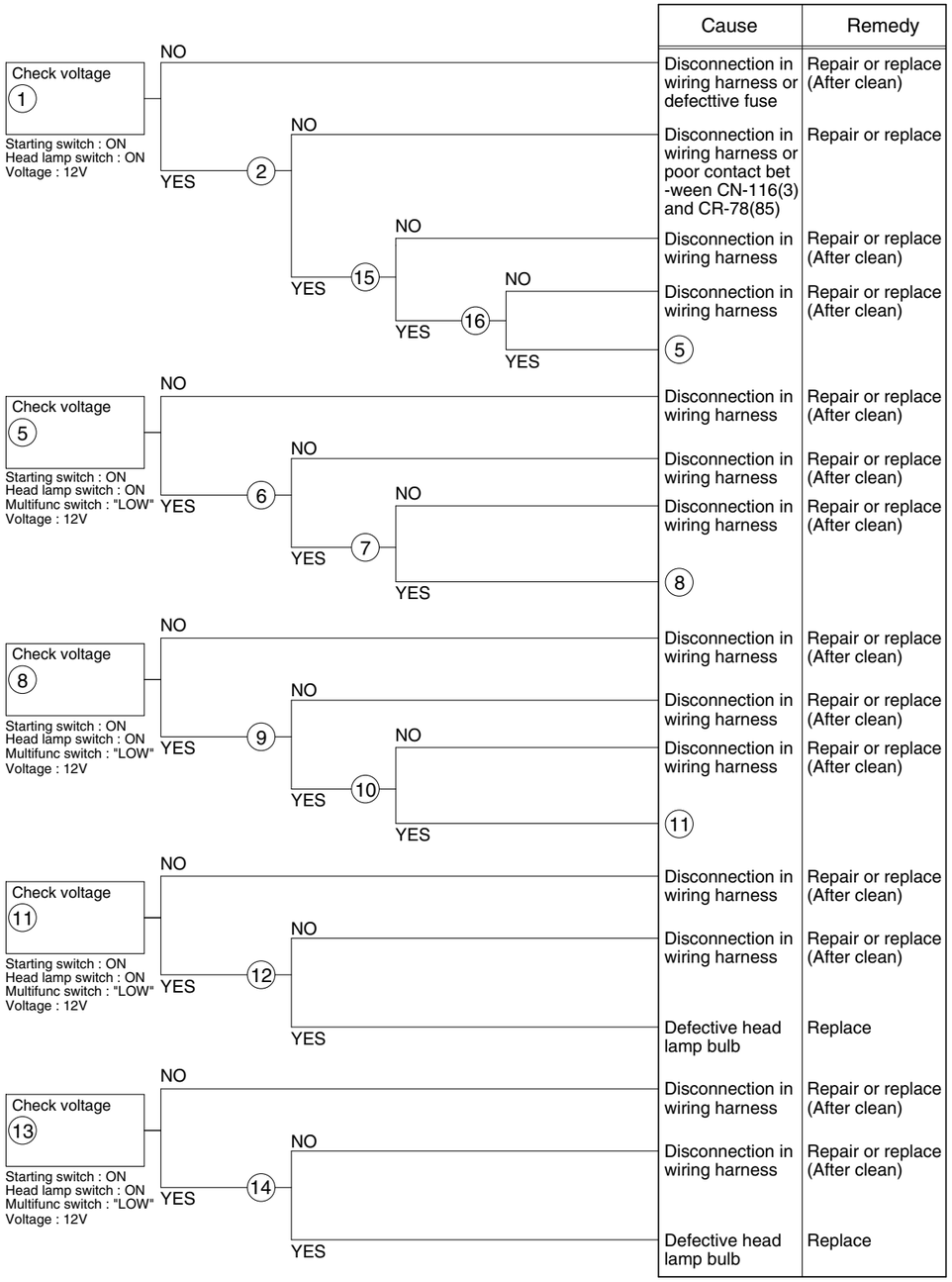
Cause	Remedy
Disconnection in wiring harness or defecttive fuse	Repair or replace (After clean)
5 6	
Disconnection in wiring harness	Repair or replace (After clean)
7 8	
Defective multifunction switch	Replace
Disconnection in wiring harness	Repair or replace (After clean)
Disconnection in wiring harness	Repair or replace (After clean)
Defective wiper motor	Replace
Defective relay	Replace
Defective multifunction switch	Replace
Disconnection in wiring harness	Repair or replace (After clean)
Disconnection in wiring harness	Repair or replace (After clean)
Defective Int wiper relay	Replace
16	
Defective multifunction switch	Replace
Disconnection in wiring harness	Repair or replace (After clean)
Defective multifunction switch	Replace
18	
Defective multifunction switch	Replace
Disconnection in wiring harness	Repair or replace (After clean)
Disconnection in wiring harness	Repair or replace (After clean)
Defective Int relay	Replace



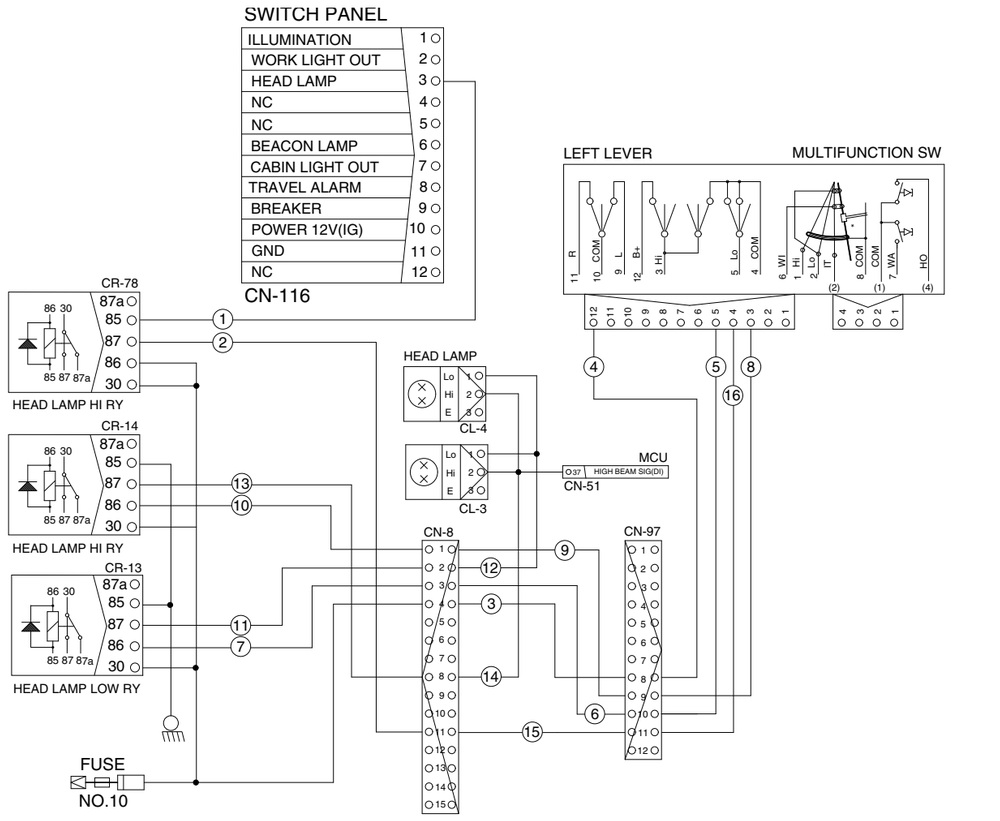
55W9A5TS21

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

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



Cause	Remedy
Disconnection in wiring harness or defecttive fuse	Repair or replace (After clean)
Disconnection in wiring harness or poor contact bet -ween CN-116(3) and CR-78(85)	Repair or replace
Disconnection in wiring harness	Repair or replace (After clean)
Disconnection in wiring harness	Repair or replace (After clean)
⑤	
Disconnection in wiring harness	Repair or replace (After clean)
Disconnection in wiring harness	Repair or replace (After clean)
Disconnection in wiring harness	Repair or replace (After clean)
⑧	
Disconnection in wiring harness	Repair or replace (After clean)
Disconnection in wiring harness	Repair or replace (After clean)
Disconnection in wiring harness	Repair or replace (After clean)
⑪	
Disconnection in wiring harness	Repair or replace (After clean)
Disconnection in wiring harness	Repair or replace (After clean)
Defective head lamp bulb	Replace
Disconnection in wiring harness	Repair or replace (After clean)
Disconnection in wiring harness	Repair or replace (After clean)
Defective head lamp bulb	Replace



55W9A5TS22

GROUP 4 AXLE

1. TROUBLE SHOOTING

Problem	Cause	Correction
Loss of brakes	1. Incorrect adjustment	Inspect disc thickness (see page 7-149) and if discs are usable readjust brakes to the specifications in the manual.
	2. Brake discs worn out	Inspect disc thickness (see page 7-149) and replace if needed
	3. Incorrect brake fluid	Replace all seals in axle and master cylinder that have made contact with the incorrect fluid and all brake hoses. If incorrect fluid leaked into axle oil, seals and O-rings in axle must be replaced.
	4. Loss of brake fluid	Inspect for and repair any leaks in outside circuit or master cylinder. If caused by incorrect brake fluid see correction No.3. If leak is to the outside replace the O-rings between the center and intermediate sections. If leak is to the inside replace above O-rings and brake piston O-rings.
	5. Overheated axle causing brake fluid to vaporize (brake return when axle cools).	See "Overhearing" problem.
Soft brake pedal	6. Air in brake fluid	Bleed brakes.
Ineffective safety brake	7. One or both overrides are engaged	Check override bolts and adjust if needed (see page 7-155).
	8. Incorrect adjustment	See correction No.1.
	9. Brake disc worn out	See correction No.2.
Overheating	10. Oil level wrong	Drain, flush and refill oil to proper level.
	11. Too small of a brake gap.	Readjust brakes to the specifications (see page 7-155)
	12. Park brake dragging.	Unlock the brake and adjust the correct gap.
	13. Incorrect brake fluid in system.	See correction No.3.
	14. No free-pedal at master cylinder.	Readjust brake pedal.
	15. Restriction in brake lines.	Inspect for and replace damage lines.
	16. Restriction in return line of brake servo system.	Inspect for and replace damaged return line. Inspect for and remove any filter, tee'd in line or any other source of back pressure from the return line.
	17. Incorrect oil	Drain, flush and refill to the proper level with oil recommended.

Problem	Cause	Correction
Diff-lock inoperative	18. If manual, loss or misadjusted linkage.	Inspect and correct linkage and readjust.
	19. If hydraulic, problems in the hydraulic or electrical circuits of the vehicle.	Refer to the Group 2 and 3 of this section.
	20. If hydraulic, problems in the hydraulic or electrical circuits of the vehicle.	Rebuilt cylinder as described on page 7-192.
	21. If with self locking differential, weared discs.	Replace discs as described on page 7-189.
Oil coming out of breather	22. Hydraulic leak in brake system.	See corrections No.2 & 3.
	23. Hydraulic leak in diff-lock activating cylinder.	See corrections No.20.
No spin indexing noise when driven straight.	24. Unequal tire pressure from one side to the other.	Inflate tires to the recommended pressure or until the rolling radius is equal.
	25. Different style, size or brand of tires from one side to the other.	Change tires to make the rolling radius equal. Vary the tire pressure within the specifications until the rolling radius is equal.
Noise during coast and under power the same	26. Wheel bearings	Replace and adjust as described on page 7-157.
Noise under power greater than during coast.	27. Low oil level	Refill oil to proper level
	28. Incorrect oil	See correction No.17.
	29. Ring and pinion worn	Inspect through rear cover. Replace and adjust as described on page 7-173.
	30. Worn ring and pinion bearings	Replace and adjust as described on page 7-173.
	31. Worn planetary gears or bearings	Replace as described on page 7-157.
Noise during coast greater than under power	32. Loose pinion nut	Inspect ring, pinion and pinion bearings. If undamaged, retighten nut as described on page 7-173.
	33. Only one pinion bearing damages.	See correction No.30.
Noise during turn (without no spin)	34. Worn spider and / or side gears	Replace as described on page 7-185.

Problem	Cause	Correction
A "Stick slip" noise when going from forward to reverse.	35. Worn or damaged U-joint on drive shaft	Inspect and replace the u-joint.
	36. Loose wheel	Inspection for wheel and wheel stud damage. Replace if needs and retorque nuts.
	37. Worn or damaged U-joint at steering knuckle	Inspect and replace as described on page 7-166.
	38. Spider pins loose in carrier.	Inspect through rear cover. Replace as described on page 7-185.
	39. Damaged or missing spider and / or side gear washers	See correction No.34.

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.

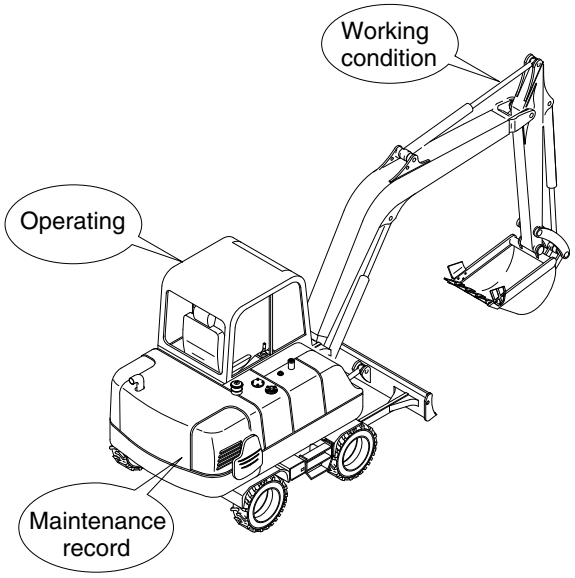
2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

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.

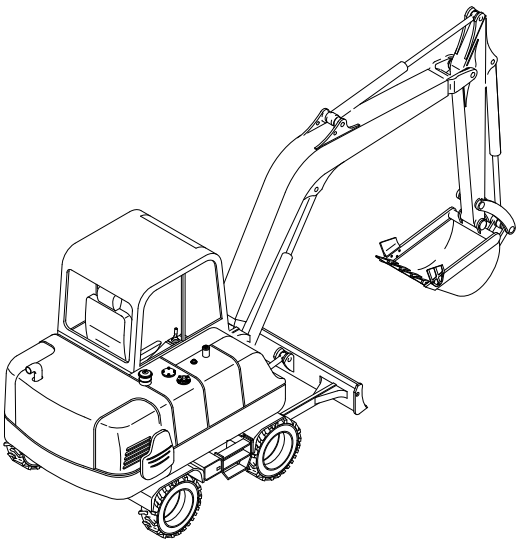


55W76MS01

2. TERMINOLOGY

1) STANDARD

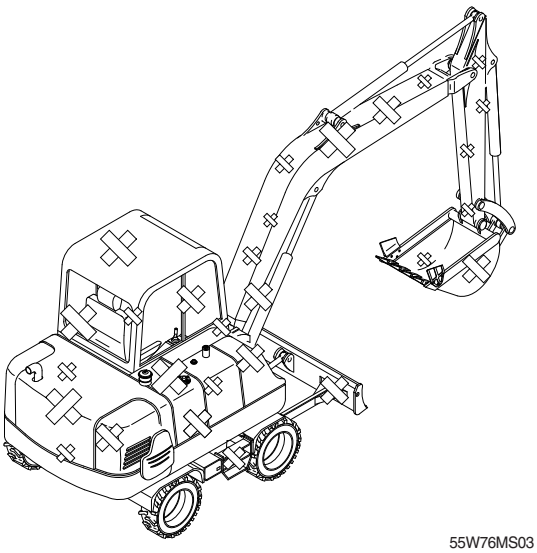
Specifications applied to the brand-new machine, components and parts.



55W76MS02

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.



55W76MS03

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.

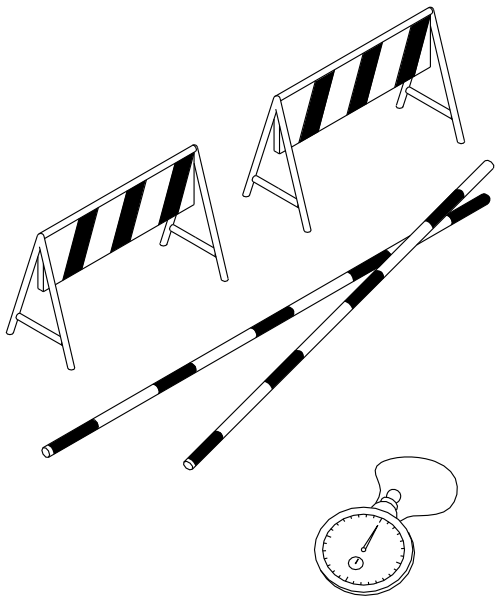
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

(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 each power mode

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

(2) Preparation

① Warm up the machine, until the engine coolant temperature reaches 50˚C or more, and the hydraulic oil is 50±5˚C.

② Set the accel dial at 10 (Max) position.

③ Measure the engine RPM.

(3) Measurement

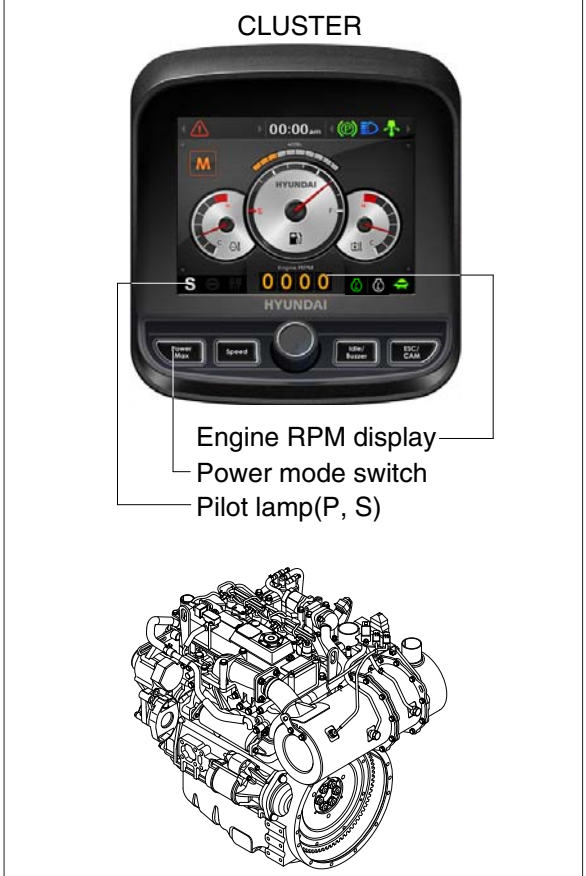
① Start the engine. The engine will run at start idle speed. Measure engine speed with a engine rpm display.

② Measure and record the engine speed at each mode (P, S).

③ Select the P-mode.

④ Lightly operate the bucket control lever a few times, then return the control lever to neutral; The engine will automatically enter the auto-idle speed after 4 seconds.

⑤ Measure and record the auto deceleration speed.



60CR9AMS01

(4) Evaluation

The measured speeds should meet the following specifications.

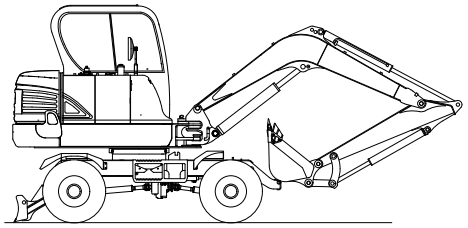
Unit : rpm

Model	Engine speed	Standard	Remark
R55W-9A	Start idle	1000±50	
	P mode	2000±50	
	S mode	1800±50	
	Auto decel	1100±50	

Condition : Set the accel dial at 10 (Max) position.

3) TRAVEL SPEED

(1) Measure the time required for the excavator to travel a 50m at high speed and a 20m at low speed test run.



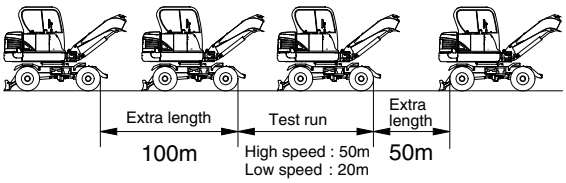
555W96MS04

(2) Preparation

① Adjust the pressure of both tires to be equal.
② Prepare a flat and solid test track 50m in length, with extra length of 150m for machine acceleration.
③ Set the traveling position as figure.
④ Keep the hydraulic oil temperature at 50±5˚C.

(3) Measurement

① Measure both the low and high speed of the machine.
② Before starting either the low or high speed tests, adjust the RH multifunction switch to the speed to be tested.
③ Start traveling the machine in the extra length with the two speed switch at high or low speed.
④ Measure the time required to travel 50m at high speed or 20m at low speed.
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.



555W96MS05

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds

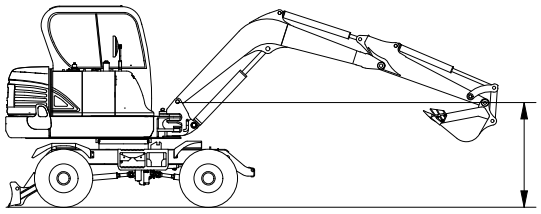
Model	Travel speed	Standard	Maximum allowable	Remarks
R55W-9A	Low speed	6.3±0.5	7.9	Seconds/20m
	High speed	6.0±0.5	7.5	Seconds/50m

4) 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 Lower the dozer blade at ground.
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. The bucket must be empty.
⑤ Keep the hydraulic oil temperature at 50±5˚C.



555W96MS07

(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

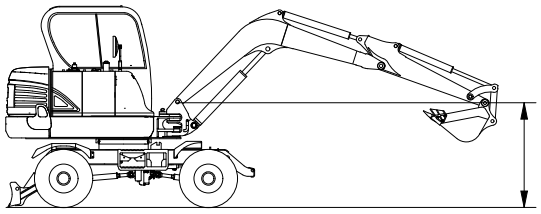
Model	Standard	Maximum allowable	Remark
R55W-9A	15.4±1.0	19.3	-

5) SWING FUNCTION DRIFT CHECK

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

(2) Preparation

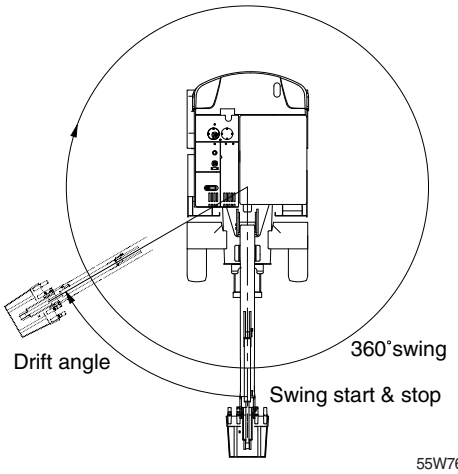
① Check the lubrication of the swing gear and swing bearing.
② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.
③ Lower the dozer blade at ground.
④ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. The bucket must be empty.
⑤ Make two chalk marks: one on the swing
⑥ bearing and one directly below it on the track frame.
Swing the upperstructure 360˚.
⑦ Keep the hydraulic oil temperature at 50±5˚C.



555W96MS07

(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.



55W76MS08

(4) Evaluation

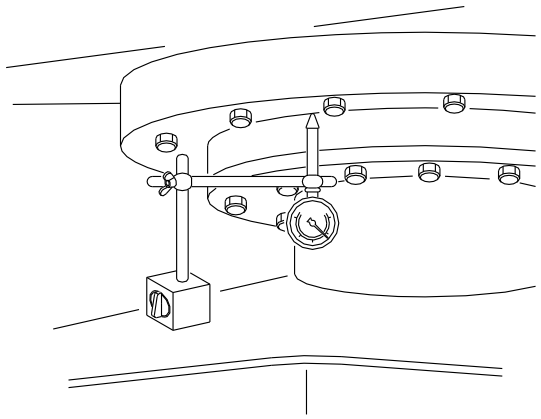
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Standard	Maximum allowable	Remark
R55W-9A	45 below	60	-

6) 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

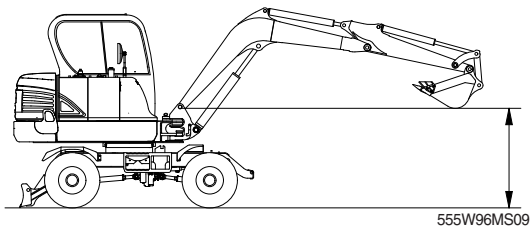
(2) Preparation

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 axle.
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 axle 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



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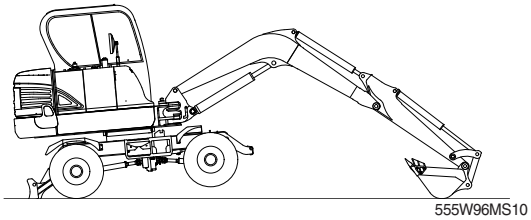
Measurement : h2



555W96MS10

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Standard	Maximum allowable	Remark
R55W-9A	0.5 ~ 1.2	2.4	

7) 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 cylinder.
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.

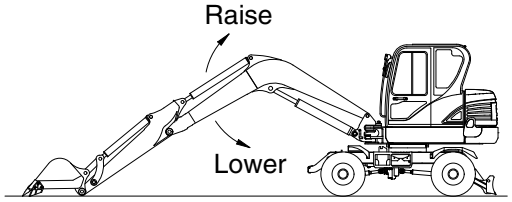
(3) Measurement

① To measure cylinder cycle times.

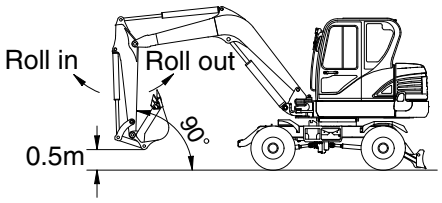
- Boom cylinder.
Measure the time it takes to raise the boom, and the time it takes to lower the boom. To do so, position the boom at one stroke end then move the control lever to the other stroke end as quickly as possible.

- 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.

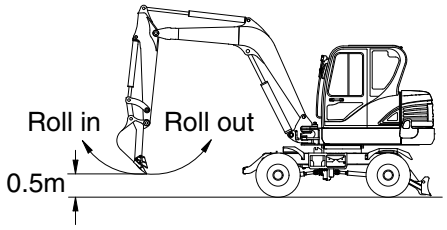
Boom cylinder



Arm cylinder



Bucket cylinder



555W96MS11

- 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
R55W-9A	Boom raise	2.5±0.4	3.0	
	Boom lower	2.6±0.4	3.3	
	Arm in	2.7±0.4	3.3	
	Arm out	2.7±0.4	3.2	
	Bucket load	3.9±0.4	4.7	
	Bucket dump	2.5±0.4	3.1	
	Boom swing (LH)	6.5±0.4	7.8	
	Boom swing (RH)	5.5±0.4	6.6	
	Dozer up (raise)	2.5±0.3	3.2	
	Dozer down (lower)	3.2±0.3	4.1	

8) 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)

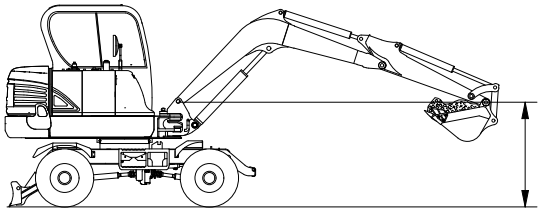
1.5 = Soil specific gravity

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.



555W96MS12

(3) Measurement

① Stop the engine.

② Five minutes after the engine has been stopped, measure the changes in the positions of the boom, arm and bucket cylinders.

③ Repeat step ② three times and calculate the average values.

(4) The measured drift should be within the following specifications.

Unit : mm / 5min

Model	Drift to be measured	Standard	Maximum allowable	Remarks
R55W-9A	Boom cylinder	10 below	20	
	Arm cylinder	20 below	30	
	Bucket cylinder	20 below	30	

9) 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 Repeat steps ② 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
R55W-9A	Boom lever	1.4 or below	1.9	
	Arm lever	1.4 or below	1.9	
	Bucket lever	1.4 or below	1.9	
	Swing lever	1.4 or below	1.9	

10) CONTROL LEVER STROKE

(1) Measure each lever stroke at the lever top using a ruler.

※ When the lever has play, take a half of this value and add it to the measured stroke.

(2) Preparation

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

(3) Measurement

① Stop the engine.

② Measure each lever stroke at the lever top from neutral to the stroke end using a ruler.

③ Repeat step ② three times and calculate the average values.

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Kind of lever	Standard	Maximum allowable	Remarks
R55W-9A	Boom lever	87±10	109	
	Arm lever	87±10	109	
	Bucket lever	87±10	109	
	Swing lever	87±10	109	

11) PILOT PRIMARY PRESSURE

(1) Preparation

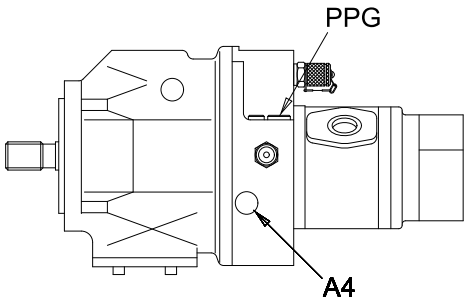
① Stop the engine.

② Push the pressure release button to bleed air.

③ Loosen and remove plug on the pilot pump delivery port (A4) 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.



555C96MA14

(2) Measurement

① Measure the primary pilot pressure at rated rpm.

(3) Evaluation

The average measured pressure should meet the following specifications:

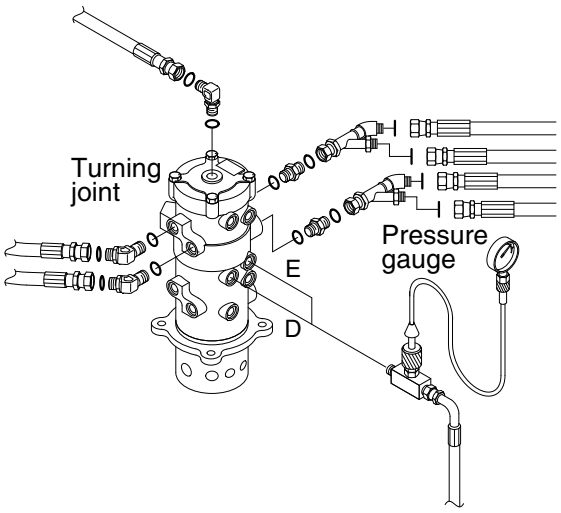
Unit : kgf / cm²

Model	Standard	Remark
R55W-9A	30±5	

12) 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 D, E 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.



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(2) Measurement

① Lower the bucket and dozer blade to the ground to raise the tires off the ground.
② Select the following switch positions.
Parking switch : OFF
③ Measure the travel speed selecting pressure in the Hi or Lo position.
④ Operate the travel speed switch turns to the high or low position and measure the port D (high) or E (low) pressure.
⑤ Repeat steps ③ three times and calculate the average values.

(3) Evaluation

The average measured pressure should be within the following specifications.

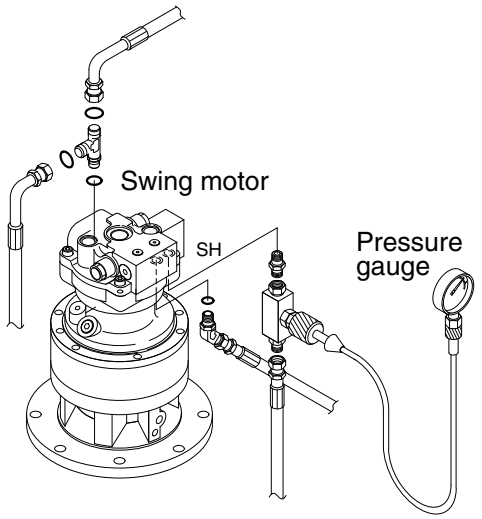
Unit : kgf / cm^2

Model	Travel speed mode	Standard		Maximum allowable	Remarks
		D port	E port		
R55W-9A	Low speed	-	30±5	-	
	High speed	30±5	-	-	

13) SWING PARKING BRAKE RELEASING PRESSURE

(1) Preparation

① Stop the engine.
② Push the pressure release button to bleed air.
③ Install a connector and pressure gauge assembly to swing motor SH port, as shown.
④ Start the engine and check for oil leakage from the adapter.
⑤ Keep the hydraulic oil temperature at 50±5˚C.



55W76MS16

(2) Measurement

① Operate the swing function or arm roll in function and measure the swing brake control pressure with the brake disengaged. Release the control lever to return to neutral and measure the control pressure when the brake is applied.
② Repeat three times and calculate the average values.

(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm²

Model	Description	Standard	Remarks
R55W-9A	Brake disengaged	30±5	
	Brake applied	0	

14) MAIN PUMP DELIVERY PRESSURE

(1) Preparation

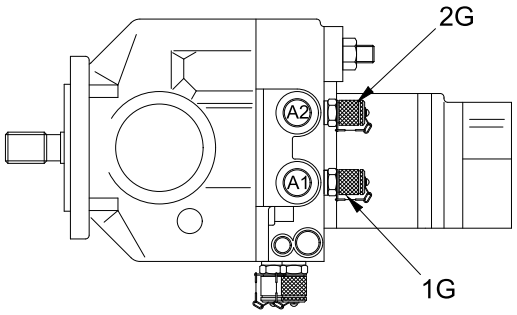
① Stop the engine.

② Push the pressure release button to bleed air.

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

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

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



R55NN7MA17

(2) Measurement

① Measure the main pump delivery pressure at high idle.

(3) Evaluation

The average measured pressure should meet the following specifications.

Unit : kgf / cm²

Model	Engine speed	Standard	Allowable limits	Remarks
R55W-9A	High ilde	20±5	-	

15) SYSTEM PRESSURE REGULATOR RELIEF SETTING

(1) Preparation

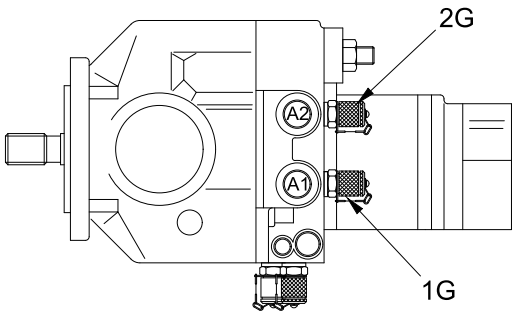
① Stop the engine.

② Push the pressure release button to bleed air.

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

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

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



R55NN7MA17

(2) Measurement

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

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

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

(3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm^2

Model	Function to be tested	Standard
R55W-9A	Boom, Arm, Bucket	220±10
	Travel	220±10
	Swing	220±10

GROUP 2 MAJOR COMPONENT

1. MAIN PUMP

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

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

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

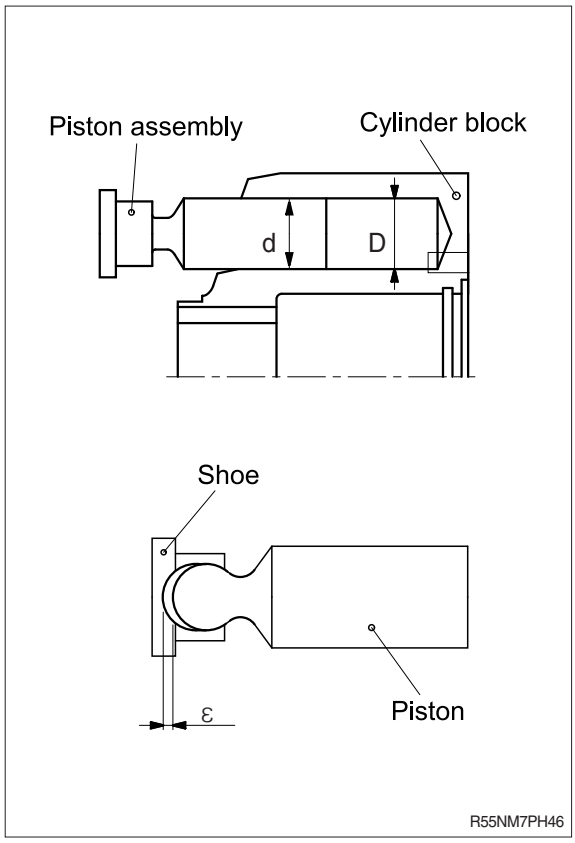
1) PISTON ASSEMBLY AND CYLINDER BLOCK

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

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

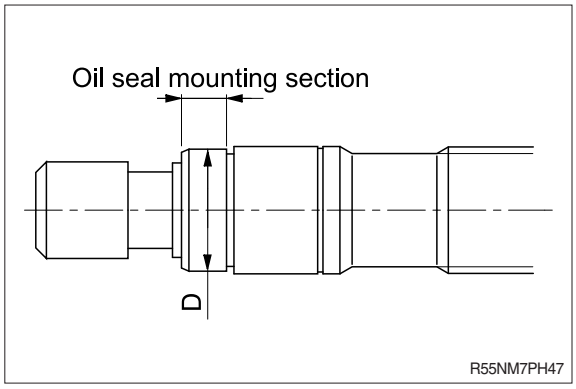
2) PISTON SHOE AND PISTON

(1) Check the axial play of the piston and piston shoe.
ε ≤ 0.2mm



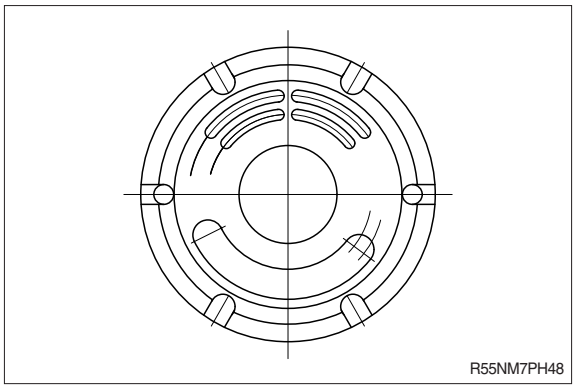
3) SHAFT

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



4) CONTROL PLATE

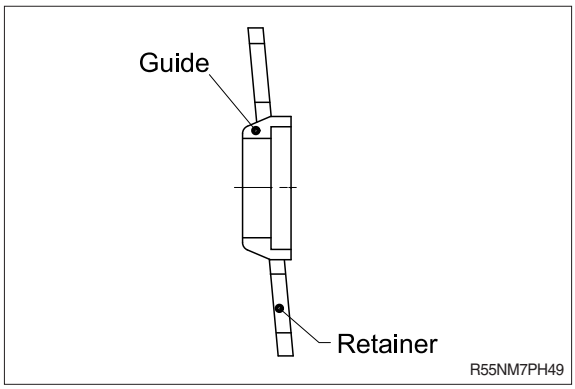
(1) Check the slide surface for any damage. When the damage is large, replace the plate with new one.



5) GUIDE AND RETAINER

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

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

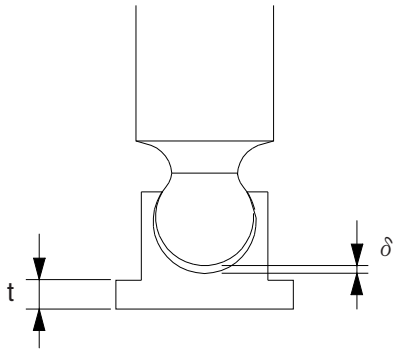
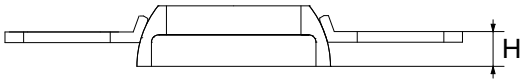


2. MAIN CONTROL VALVE

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

3. SWING DEVICE

1) WEARING PARTS

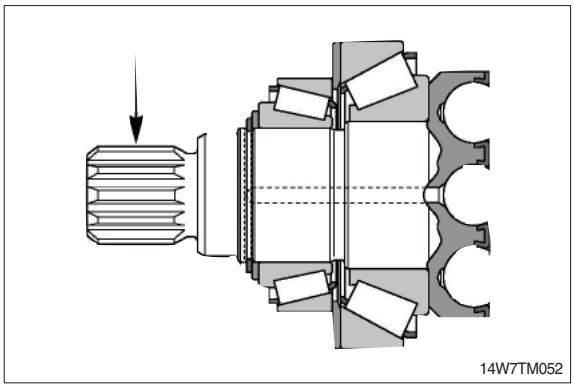
Inspection item	Standard dimension	Recommended replacement value	Counter measures
Clearance between piston and cylinder block bore	0.020	0.045	Replace piston or cylinder block
Play between piston and shoe caulking section (δ)	0	0.3	Replace assembly of piston and shoe
Thickness of shoe (t)	4	3.8	Replace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

2) SLIDING PARTS

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

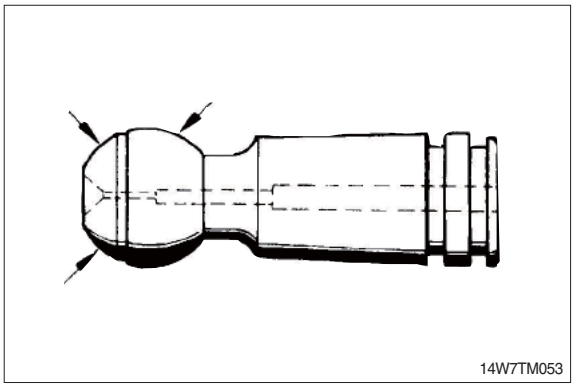
4. TRAVEL MOTOR

1) Free of corrosion, erosion or fretting; no damage to splines or keyways.



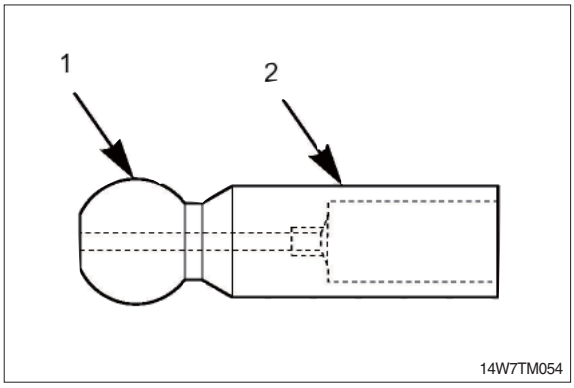
2) Pistons

No scoring and no pittings.



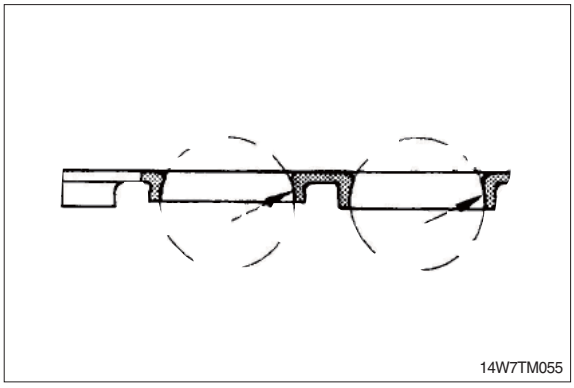
3) Center pin

No scoring and no pittings.



4) Retaining plate

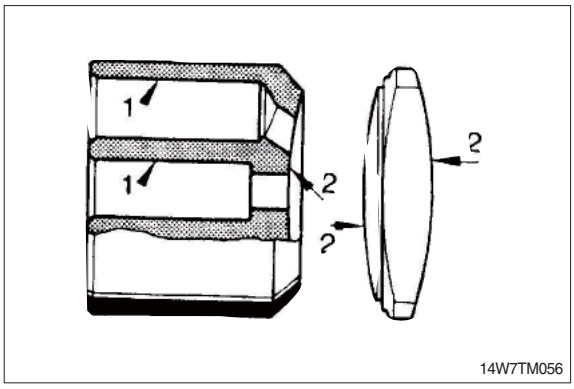
No scoring and no evidence of wear.



5) Cylinder block/control lens

① Bores free of scoring, no evidence of wear.

② Faces smooth and even, free of cracks and scoring.



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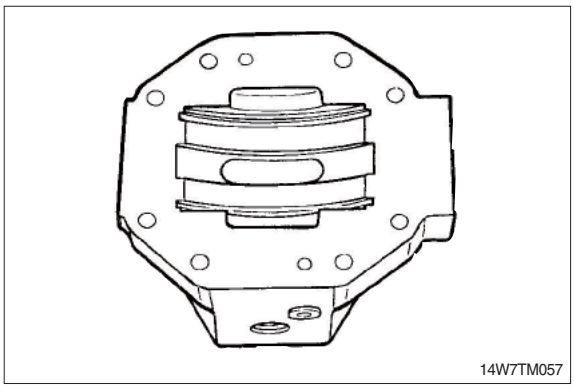
6) Control housing

Sliding surface and side guides free of scoring and no wear.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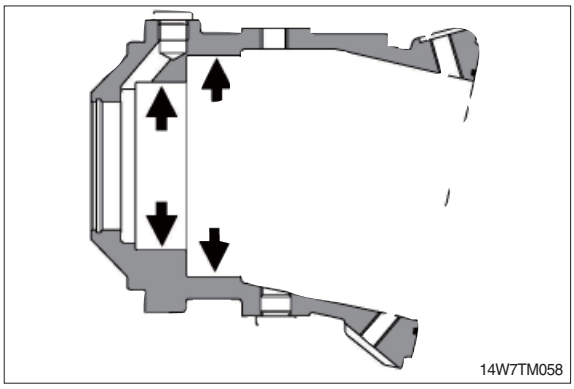
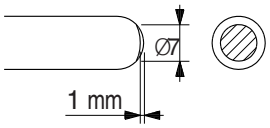
7) Visual check

Bearing areas free of scoring and no evidence of wear.

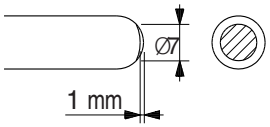

14W7TM058

5. RCV LEVER

Maintenance check item	Criteria	Remark
Leakage	The valve is to be replaced when the leakage becomes more than 1000 cc/m at neutral handle position, or more than 2000 cc/m during operation.	Conditions : Primary pressure : 30 kgf/cm^2 Oil viscosity : 23 cSt
Spool	This is to be replaced when the sliding surface has worn more than 10 μm, compared with the non-sliding surface.	The leakage at the left condition is estimated to be nearly equal to the above leakage.
Push rod	 This is to be replaced when the top end has worn more than 1mm.	
Play at operating section	The pin, shaft, and joint of the operating section are to be replaced when their plays become more than 2 mm due to wears or so on.	When a play is due to looseness of a tightened section, adjust it.
Operation stability	When abnormal noises, hunting, primary pressure drop, etc. are generated during operation, and these cannot be remedied, referring to section 6 troubleshooting, replace the related parts.	

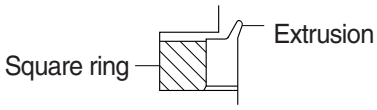
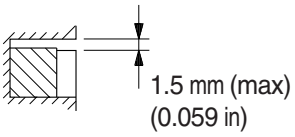
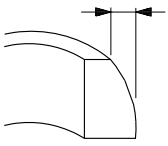
Notes 1. It is desirable to replace seal materials, such as O-rings, every disassembling. However, they may be reused, after being confirmed to be free of damage.

6. ACCELERATOR PEDAL

Maintenance check item	Criteria	Remark
Leakage	The valve is to be replaced when the leakage effect to the system. For example, the primary pressure drop.	Conditions : Primary pressure : 30 kgf/cm^2 Oil viscosity : 23 cSt
Spool	This is to be replaced when the sliding surface has worn more than 10μm, compared with the non-sliding surface.	The leakage at the left condition is estimated to be nearly equal to the above leakage.
Push rod	 This is to be replaced when th top end has worn more than 1mm.	
Play at operating section	The pin, shaft, and joint of the operating section are to be replaced when their plays become more than 2mm due to wears or so on.	When a play is due to looseness of a tightened section, adjust it.
Operation stability	When abnormal noises, hunting, primary pressure drop, etc. are generated during operation, and these cannot be remedied, referring to section 6 troubleshooting, replace the related parts.	

Notes 1. It is desirable to replace seal materials, such as O-rings, every disassembling. However, they may be reused, after being confirmed to be free of damage.

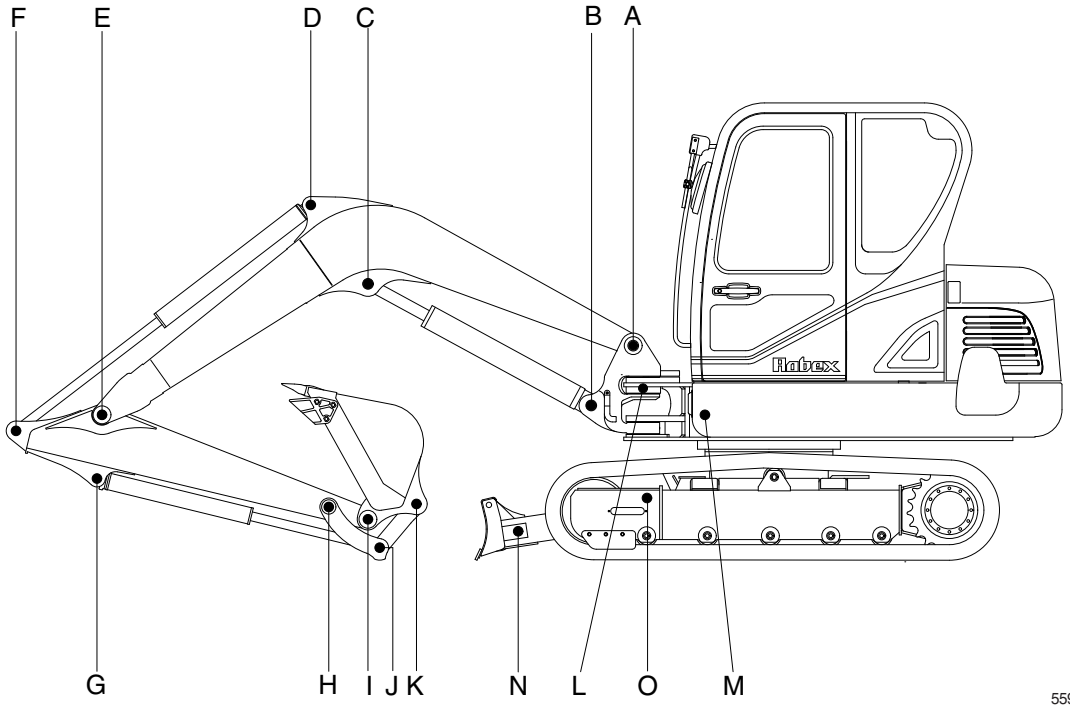
7. TURNING JOINT

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

8. CYLINDER

Part name	Inspecting section	Inspection item	Remedy
Piston rod	· Neck of rod pin	· Presence of crack	· Replace
	· Weld on rod hub	· Presence of crack	· Replace
	· Stepped part to which piston is attached	· Presence of crack	· Replace
	· Threads	· Presence of crack	· Recondition or replace
	· Plated surface	· Plating is not worn off to base metal	· Replace or replate
		Rust is not present on plating	· Replace or replate
		Scratches are not present	· Recondition, replate or replace
	· Rod	· Wear of O.D.	· Recondition, replate or replace
Cylinder tube	· Bushing at mounting part	· Wear of I.D.	· Replace
	· 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

9. WORK EQUIPMENT



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Unit : mm

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

SECTION 7 DISASSEMBLY AND ASSEMBLY

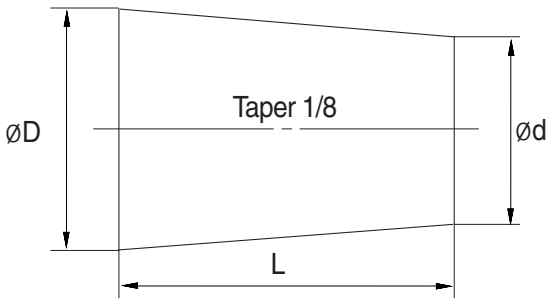
SECTION 7 DISASSEMBLY AND ASSEMBLY

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

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

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



2. INSTALL WORK

1) Tighten all bolts and nuts (sleeve nuts) to the specified torque.
2) Install the hoses without twisting or interference.
3) Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.
4) Bend the cotter pin or lock plate securely.
5) When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with 2-3 drops of adhesive.
6) When coating with gasket sealant, clean the surface and remove all oil and grease, check that there is no dirt or damage, then coat uniformly with gasket sealant.
7) Clean all parts, and correct any damage, dents, burrs, or rust.
8) Coat rotating parts and sliding parts with engine oil.
9) When press fitting parts, coat the surface with antifriction compound (LM-P).
10) After installing snap rings, check that the snap ring is fitted securely in the ring groove (check that the snap ring moves in the direction of rotation).
11) When connecting wiring connectors, clean the connector to remove all oil, dirt, or water, then connect securely.
12) When using eyebolts, check that there is no deformation or deterioration, and screw them in fully.
13) When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.
14) When operating the hydraulic cylinders for the first time after repairing and reassembling the hydraulic cylinders, pumps, or other hydraulic equipment or piping, always bleed the air from the hydraulic cylinders as follows:
    (1) Start the engine and run at low idling.
    (2) Operate the control lever and actuate the hydraulic cylinder 4-5 times, stopping 100 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 disulphied grease) to the work equipment related parts.

GROUP 2 TIGHTENING TORQUE

1. MAJOR COMPONENTS

No.	Descriptions		Bolt size	Torque	
				kgf·m	lbf·ft
1	Engine	Engine mounting bolt (engine-Bracket)	M10 × 1.5	6.9±1.0	50±7.2
2		Engine mounting bolt (bracket-Frame)	M16 × 2.0	25±2.5	181±18.1
3		Radiator mounting bolt, nut	M10 × 1.5	6.9±1.4	50±10.0
4		Cooling fan mounting bolt	M 8 × 1.25	1.8±0.2	13±1.4
5		Coupling mounting bolt	M10 × 1.5	6.0±1.0	43.4±7.2
6	Hydraulic system	Main pump mounting bolt	M12 × 1.75	12.3±3.0	92±22.0
7		Main control valve mounting bolt	M 8 × 1.25	2.5±0.5	18±3.6
8		Travel motor mounting bolt	M12 × 1.75	14.7±2.2	106±15.9
9		Fuel tank mounting bolt	M16 × 2.0	29.7±4.5	215±33
10		Hydraulic oil tank mounting bolt	M16 × 2.0	29.7±4.5	215±33
11		Turning joint mounting bolt, nut	M12 × 1.75	14.7±2.2	106±16.0
12	Power train system	Swing motor mounting bolt	M16 × 2.0	29.7±4.5	215±33.0
13		Swing bearing upper mounting bolt	M16 × 2.0	29.7±4.5	215±33.0
15		Swing bearing lower mounting bolt	M16 × 2.0	29.7±4.5	215±33.0
16		Front axle mounting bolt, nut	M16 × 2.0	29.7±4.5	215±33.0
17		Rear axle mounting bolt, nut	M16 × 2.0	29.7±4.5	215±33.0
18		Gear box mounting bolt	M14 × 2.0	19.6±2.9	142±21.0
19		Oscillating cylinder mounting bolt	M16 × 2.0	29.7±4.5	215±33.0
20		Oscillating cylinder support bolt	M12 × 1.75	12.8±3.0	92.6±22.0
21		Wheel nut	M18 × 1.5	46.0±3.0	333±22.0
22		Front drive shaft mounting bolt, nut	M10 × 1.25	7.4±1.5	53.5±11.0
23		Rear drive shaft mounting bolt, nut	M10 × 1.25	7.4±1.5	53.5±11.0
24	Others	Counterweight mounting bolt	M20 × 2.5	57.8±6.4	418±46.3
25		Cab mounting bolt, nut	M12 × 1.75	12.8±3.0	92±22.0
26		Operator's seat mounting bolt	M 8 × 1.25	1.17±0.1	8.5±0.7

2. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

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

(2) Fine thread

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

2) PIPE AND HOSE (FLARE type)

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

3) PIPE AND HOSE (ORFS type)

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

4) FITTING

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

GROUP 3 PUMP DEVICE

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

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

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

(5) Disconnect hydraulic hoses (22, 64, 65).

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

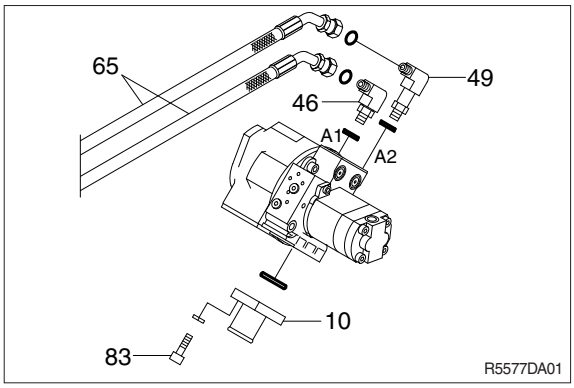
※ When pump suction pipe is disconnected, the oil inside the piping will flow out, so catch it in oil pan.

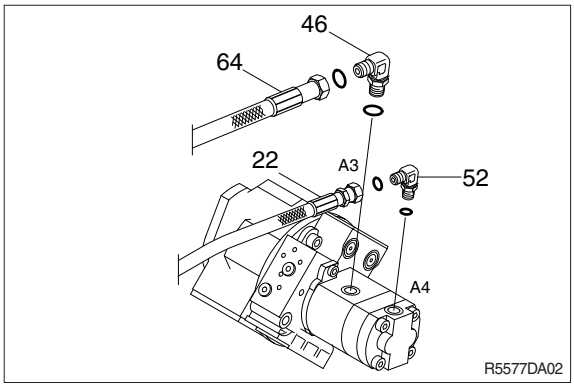
(7) Sling the pump assembly and remove the pump mounting bolts.

·Weight : 30 kg (70 lb)

※ Pull out the pump assembly from housing.

When removing the pump assembly, check that all the hoses have been disconnected.





2) INSTALL

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

(2) Remove the suction strainer and clean it.

(3) Replace return filter with new one.

(4) Remove breather and clean it.

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

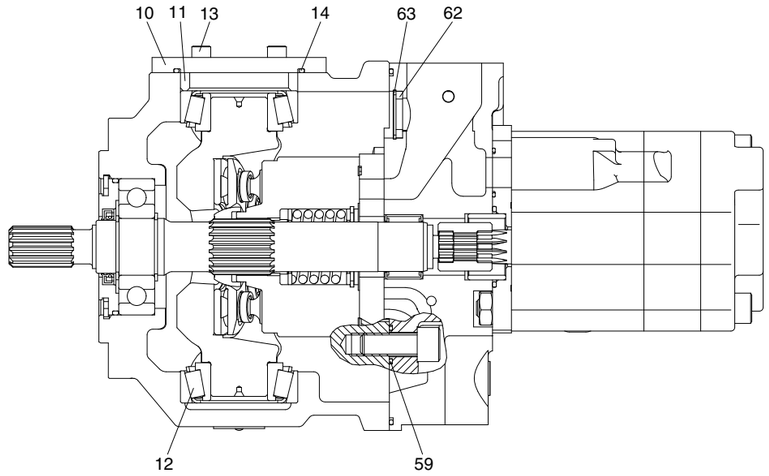
(6) Bleed the air from the hydraulic pump.
- ① Loosen the air vent plug.
- ② Start the engine, run at low idling, and check oil come out from plug.
- ③ Tighten plug.

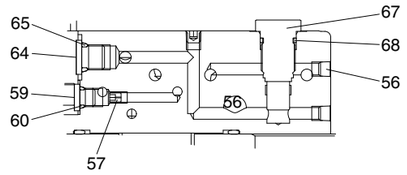
(7) Start the engine, run at low idling (3~5 minutes) to circulate the oil through the system.

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

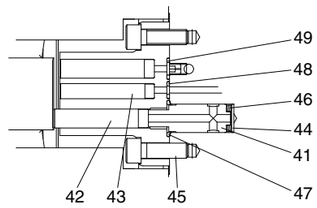
2. MAIN PUMP

1) STRUCTURE

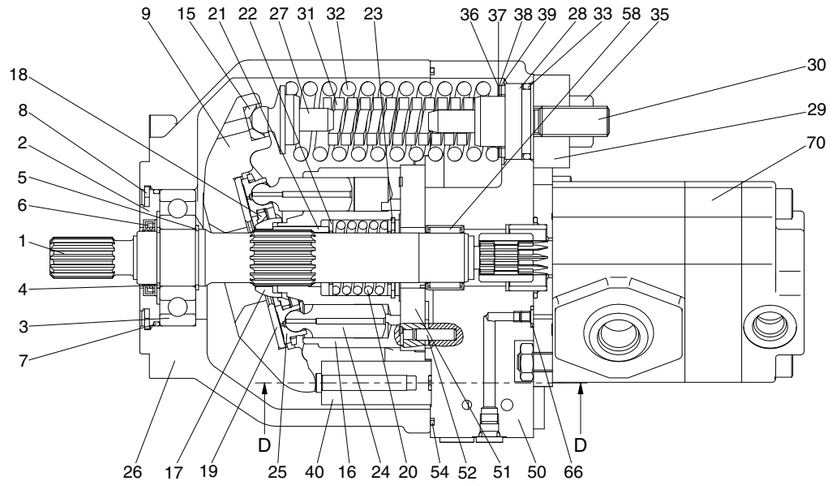


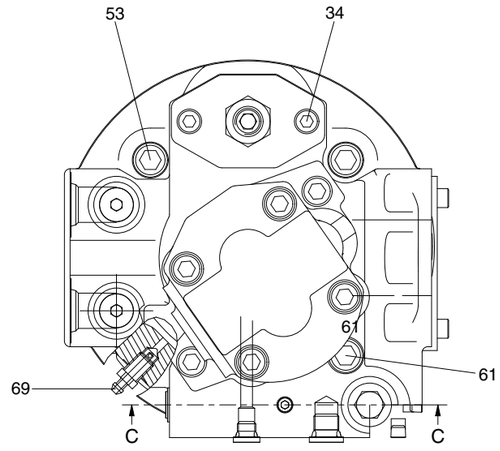


SECTION C-C



SECTION D-D





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

2) TOOLS AND TIGHTENING TORQUE

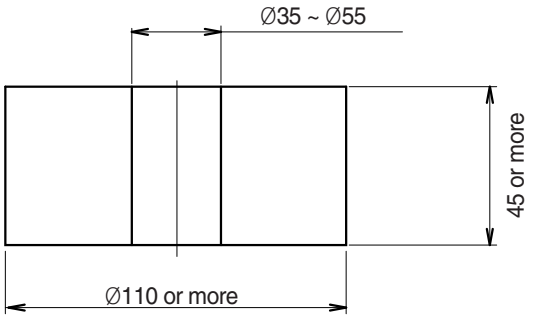
(1) Tools

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

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

(2) Jigs

① Disassembling table.



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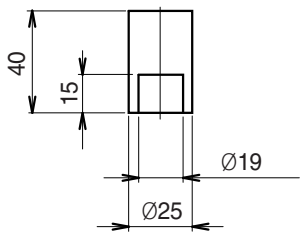
This is plate to stand the pump facing downward.
A square block may be used instead if the shaft end does not contact.

② Bearing assembling jig



R55NM7HP02

(3) Tightening torque

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

3. DISASSEMBLY PROCEDURE

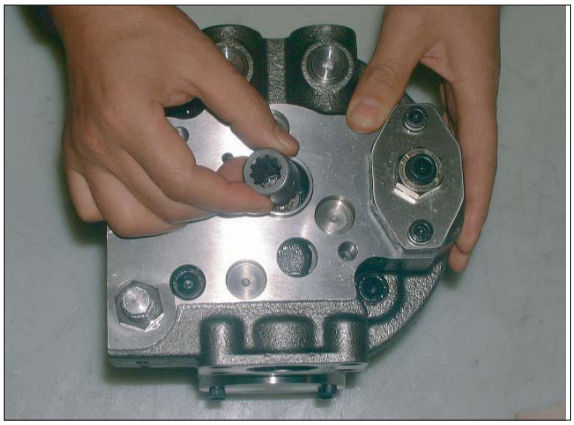
1) DISASSEMBLING THE GEARED PUMP

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

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

R55NM7HP03

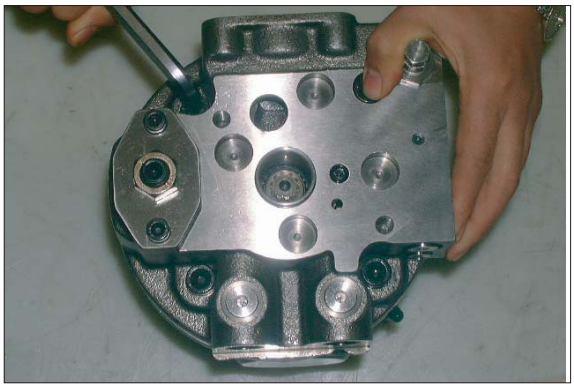
② Remove the coupling.



R55NM7HP04

2) DISASSEMBLING THE MAIN PUMP

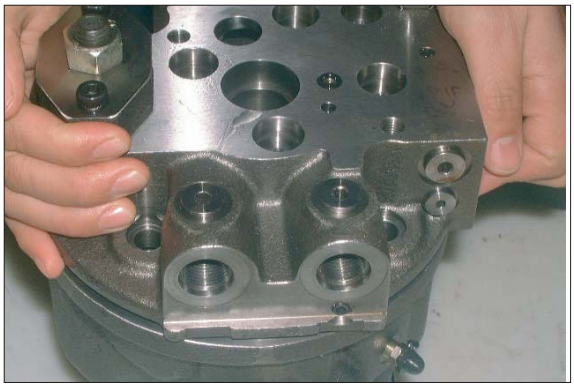
① Remove the cover.
Remove the hexagonal socket headed bolts. (M12 × 30, 3pieces) and (M12× 55, 1piece).
Hexagonal bar spanner
(Hex. side distance : 10)



R55NM7HP05

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

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

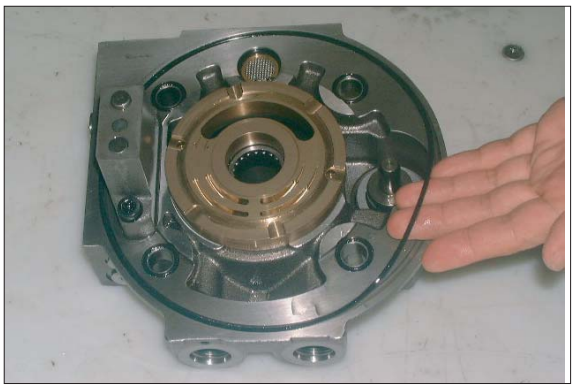


R55NM7HP06

③ This photo shows the state with the cover removed.

R55NM7HP07

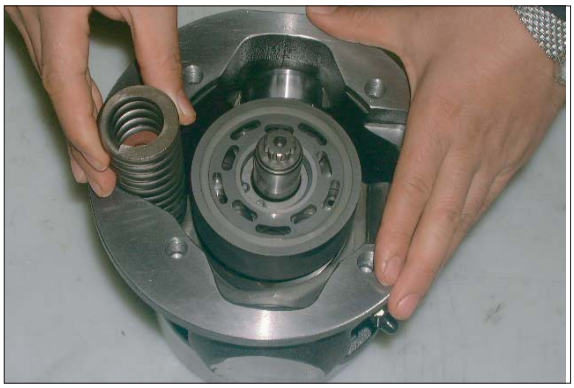
④ Remove the O-ring from the cover.



R55NM7HP08

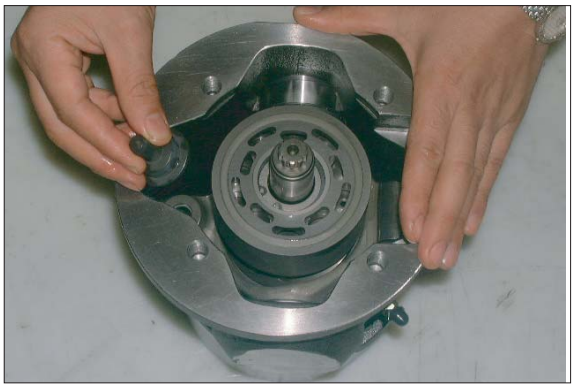
(1) The removal of the control spring

① Remove 2 springs (inner and outer).



R55NM7HP09

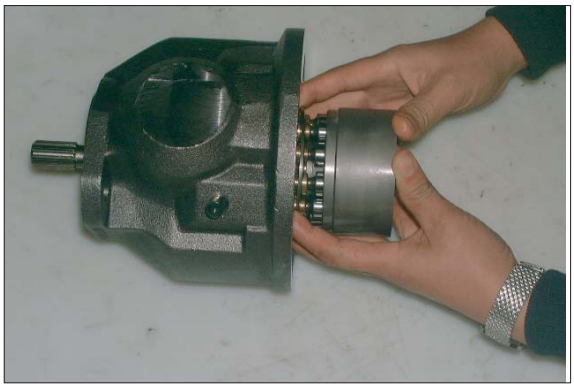
② Remove the spring seat.



R55NM7HP10

(2) The removal of rotary group

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



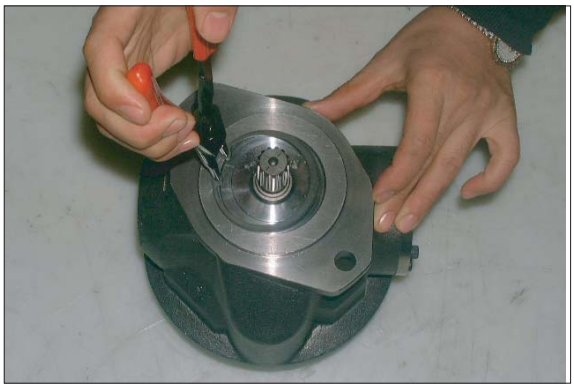
R55NM7HP11

② Remove the plate.

R55NM7HP12

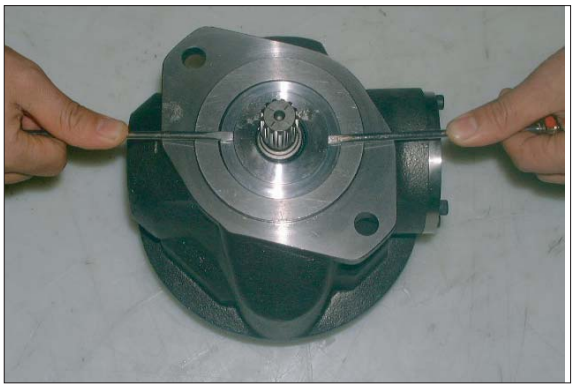
(3) The removal of the shaft

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



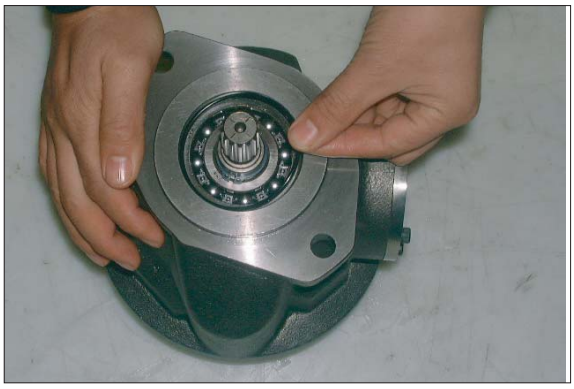
R55NM7HP13

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



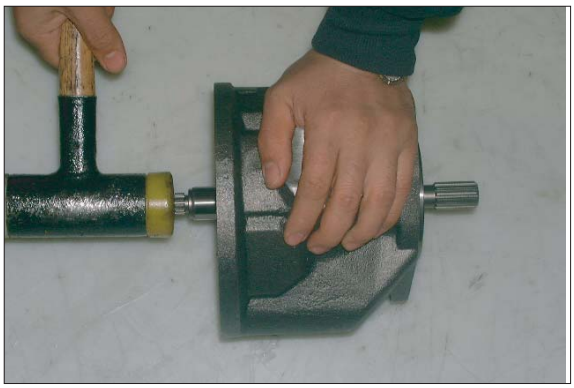
R55NM7HP14

③ Remove the O-ring.



R55NM7HP15

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



R55NM7HP16

(4) The removal of the hanger

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

R55NM7HP17

② Remove the distance piece.

R55NM7HP18

③ Remove the bearing.

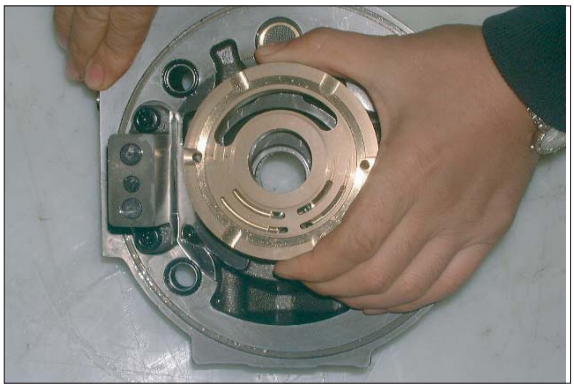
R55NM7HP19

④ Remove the hanger.

R55NM7HP20

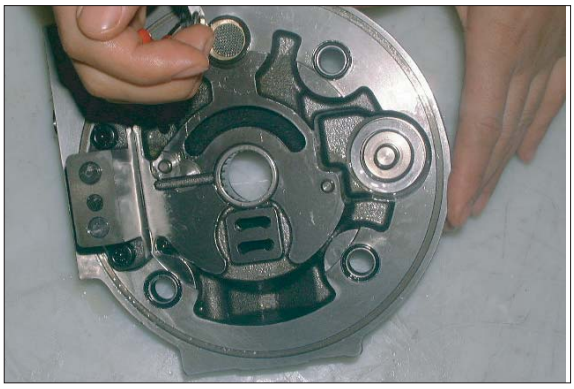
(5) The removal of the cover

① Remove the control plate.



R55NM7HP21

② Remove the C-type stop ring.



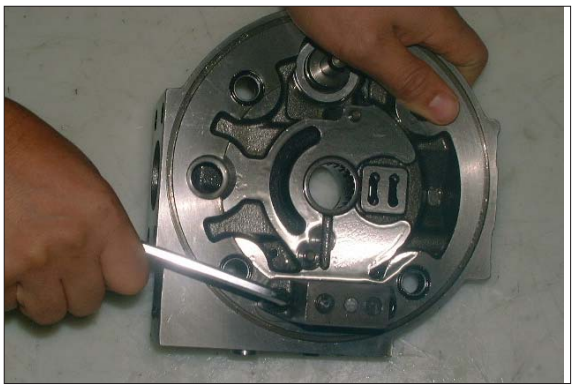
R55NM7HP22

③ Remove the filter.

R55NM7HP23

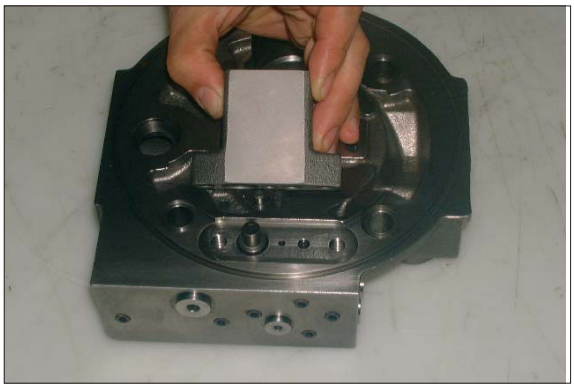
(6) The removal of the control piston

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



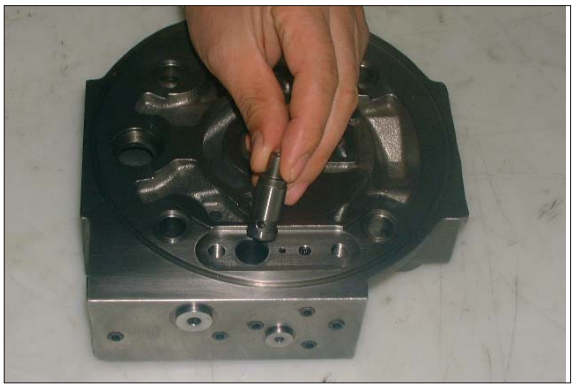
R55NM7HP24

② Remove the cylinder and parallel pin.
※ Be careful because 3 O-rings are provided to the cylinder.



R55NM7HP25

③ Take out the piston.



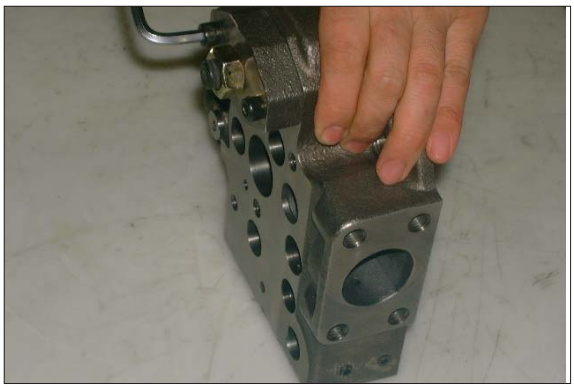
R55NM7HP26

④ Take out three caned disk springs and spring seats.

R55NM7HP27

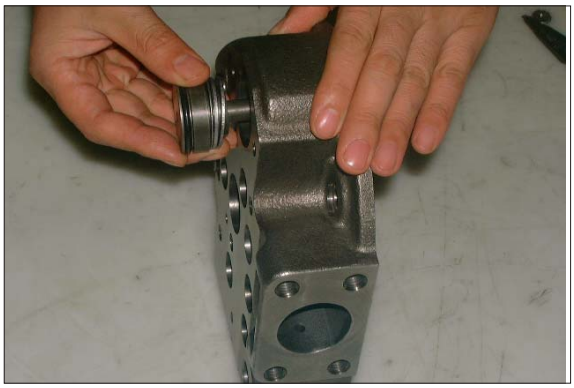
(7) The removal of the control spring

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



R55NM7HP28

② Remove the spring seat.

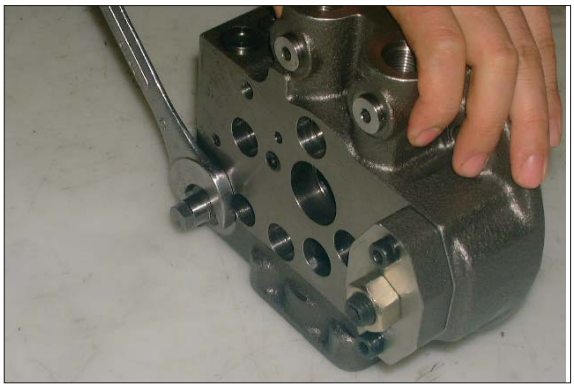


R55NM7HP29

(8) The removal of the relief valve

① Remove the hexagonal nuts.

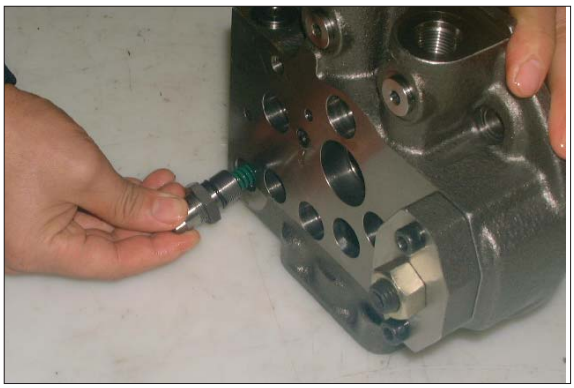
※ Since the pressure has been set, this assembly must be made only when necessary.
Spanner (Hex. side distance : 24).



R55NM7HP30

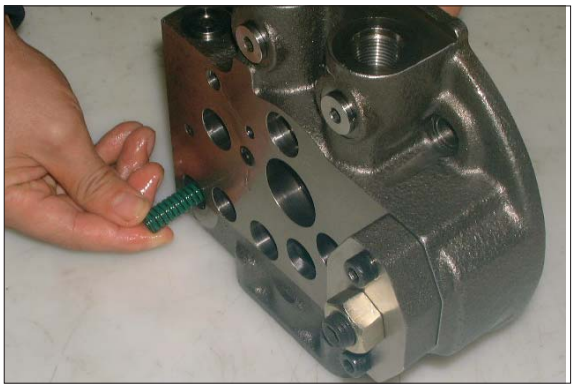
② Remove the adjusting screw.

※ Be careful because the shim is inserted.



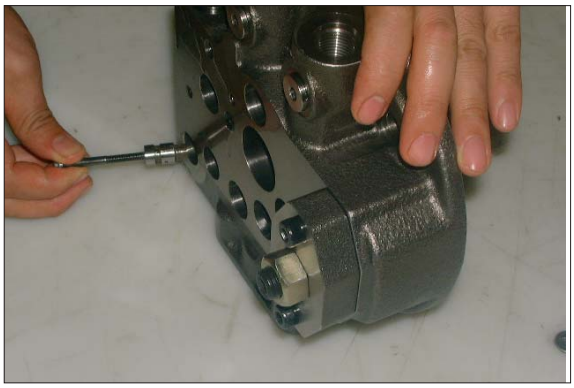
R55NM7HP31

③ Remove the spring.



R55NM7HP32

④ Remove the spool.



R55NM7HP33

(9) Disassembly of the shaft

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

R55NM7HP34

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

R55NM7HP35

3) DISASSEMBLING THE GEARED PUMP

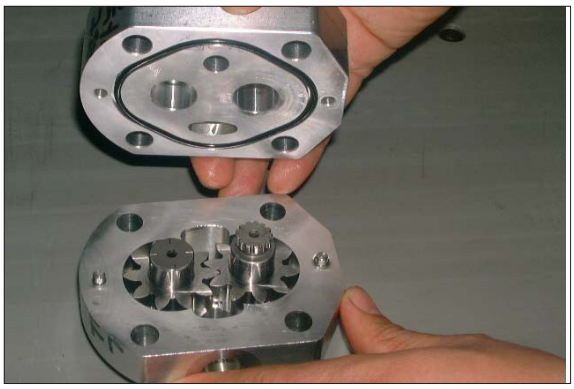
(1) Disassembling the P3 and P4 pump

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

R55NM7HP209

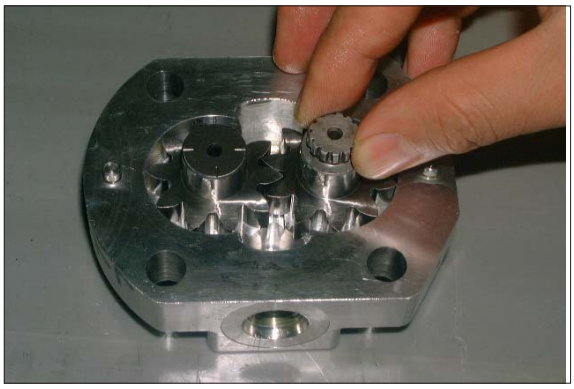
(2) Disassembling the geared pump (P4)

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



R55NM7HP208

② Pulling out the drive gear and the idle gear.



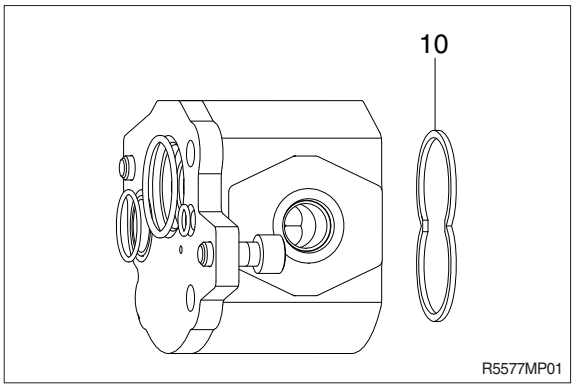
R55NM7HP207

③ Remove the O-ring from the center frame.

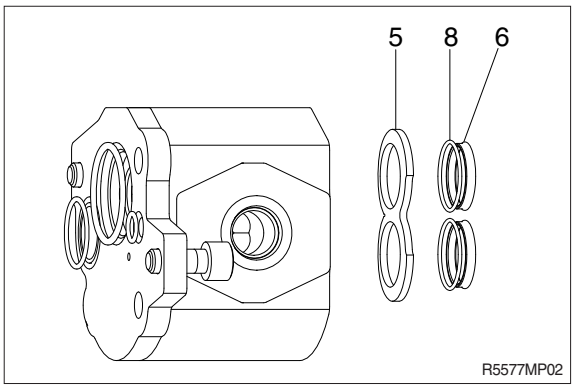
R55NM7HP206

(3) Disassembling the geared pump (P3)

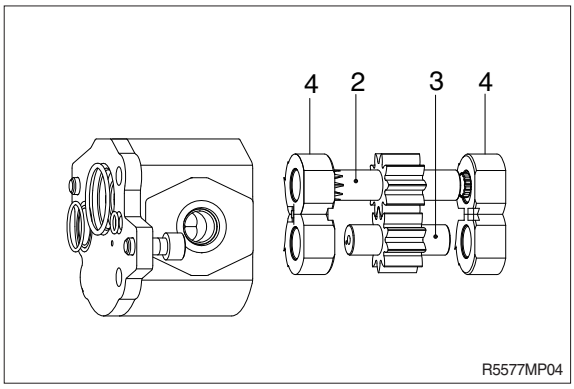
① Remove the square ring (10).



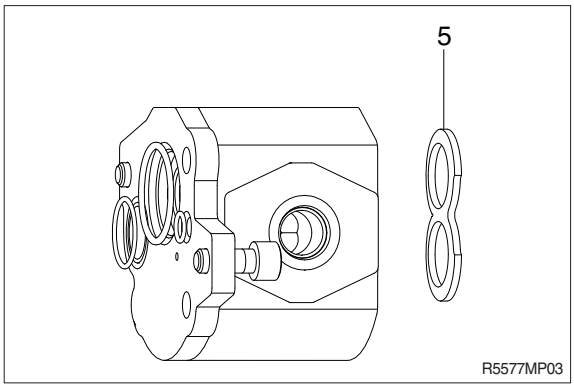
② Remove the plate (5) and the guide ring (pieces). With O-ring (6, 8).
Remove the O-ring (8) from guide ring (6).



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



④ Remove the plate (5).



4. ASSEMBLING PROCEDURE

1) ASSEMBLING THE MAIN PUMP

(1) Assembling the hanger.

R55NM7HP50

(2) Install the bearing.

R55NM7HP50A

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

R55NM7HP51

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

R55NM7HP52

(5) Assembling the shaft

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

R55NM7HP53

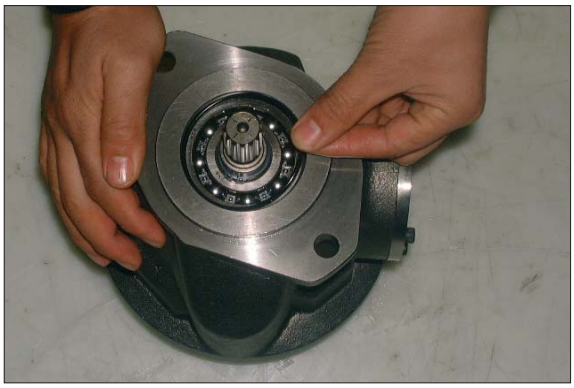
② Install the C-type stop ring to fix the bearing.

R55NM7HP54

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

R55NM7HP55

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



R55NM7HP56

(7) Install the case with oil seal vertically without tilting.

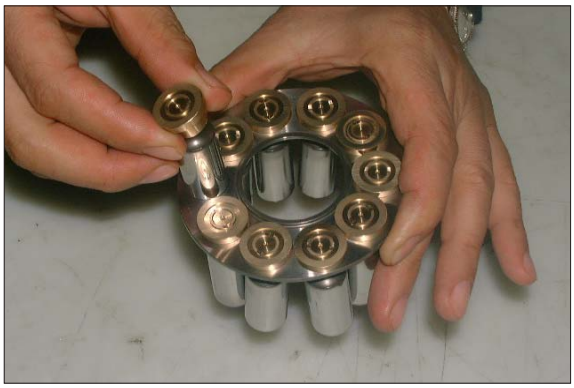
※ Apply grease to the oil seal lip beforehand.

R55NM7HP57

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

R55NM7HP58

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

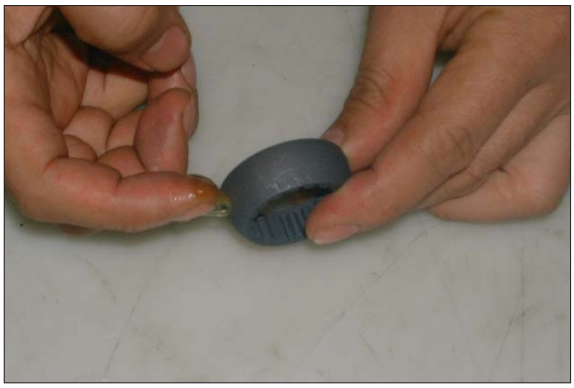


R55NM7HP59

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

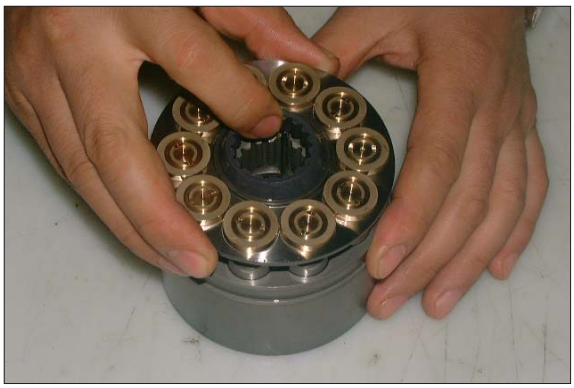
R55NM7HP60

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



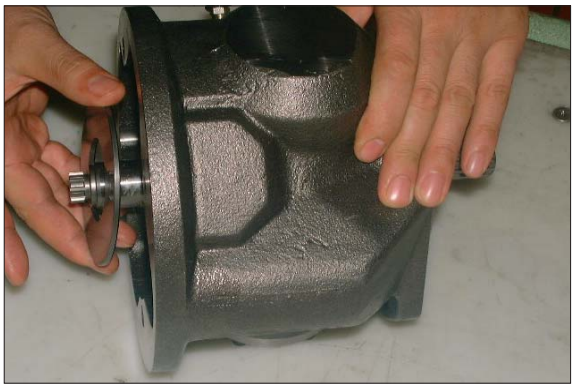
R55NM7HP61

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



R55NM7HP62

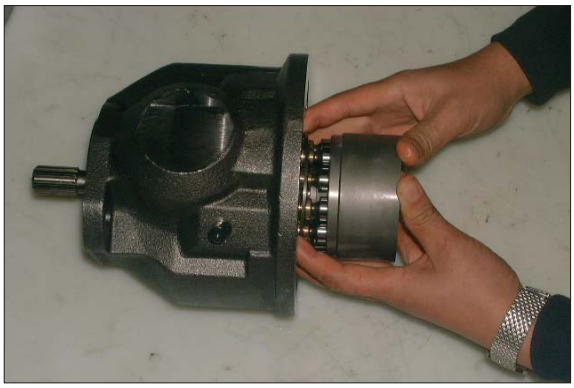
(13) Assembling the rotary group.
To prevent dislodgement, apply grease to the back side of the plate and assemble it to the hanger.



R55NM7HP63

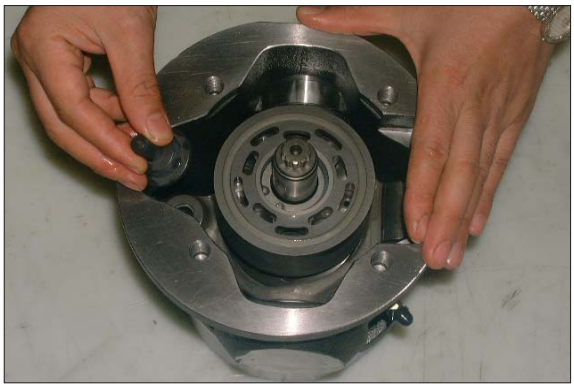
(14) Assemble the rotary group along the shaft spline.

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



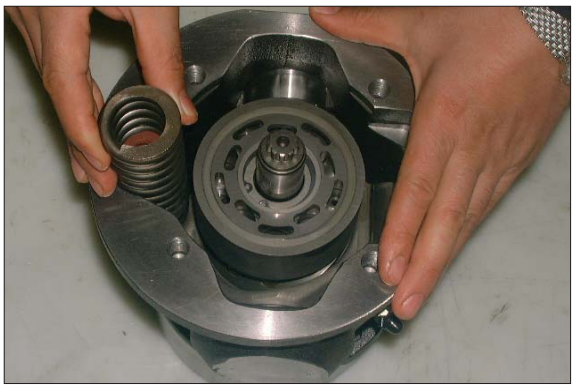
R55NM7HP64

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



R55NM7HP65

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

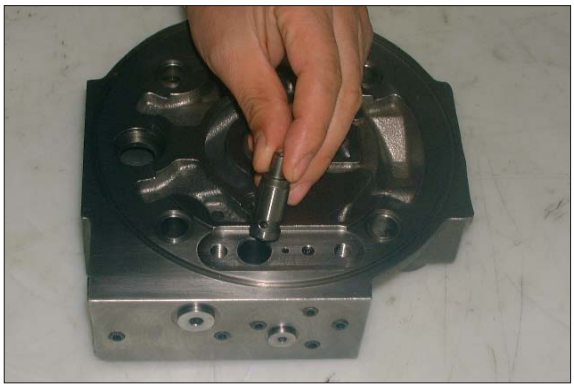


R55NM7HP66

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

R55NM7HP67

(18) Assembling the control piston.



R55NM7HP68

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

R55NM7HP69

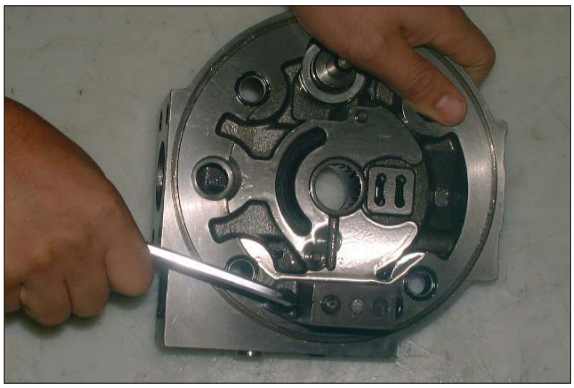
(20) Apply grease to 3 parallel pins and assemble 3 pins into the cylinder.

R55NM7HP70

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

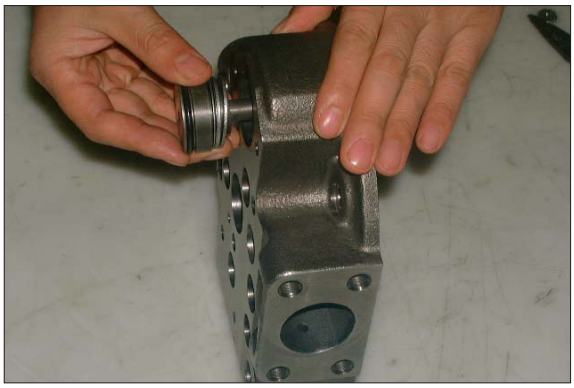
※ Apply LOCTITE #270 to the threaded portion of bolt.

Hexagonal bar spanner
(Hex. side distance : 6)
Tightening torque : 2.9 ~ 3.5 kgf·m
(21 ~ 25.3 lbf·ft)



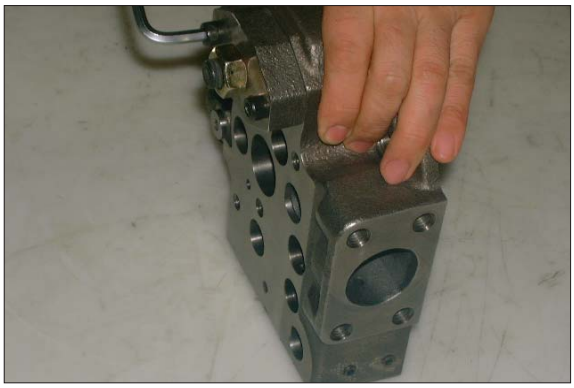
R55NM7HP71

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



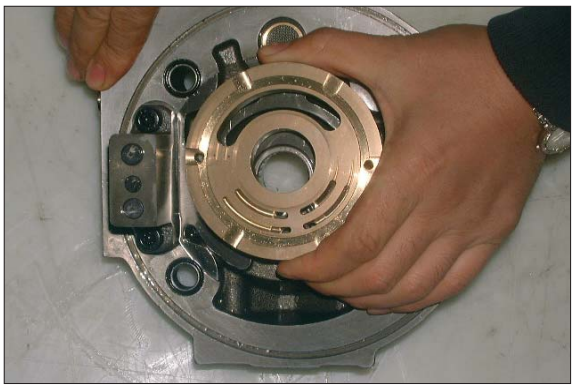
R55NM7HP72

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



R55NM7HP73

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

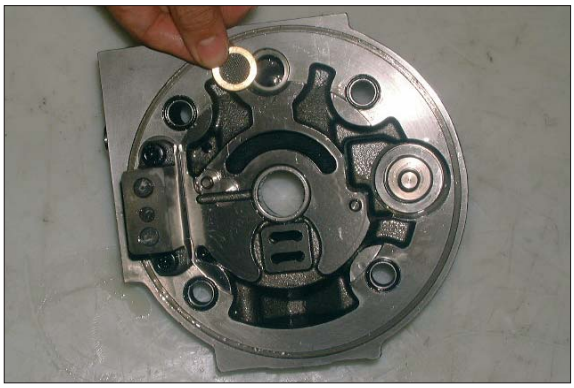


R55NM7HP74

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

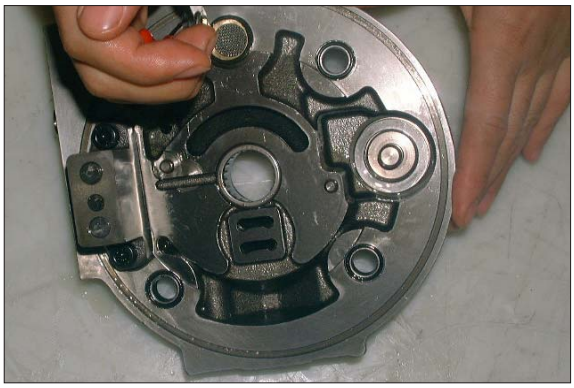
R55NM7HP75

(26) Install the filter into the cover.



R55NM7HP76

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

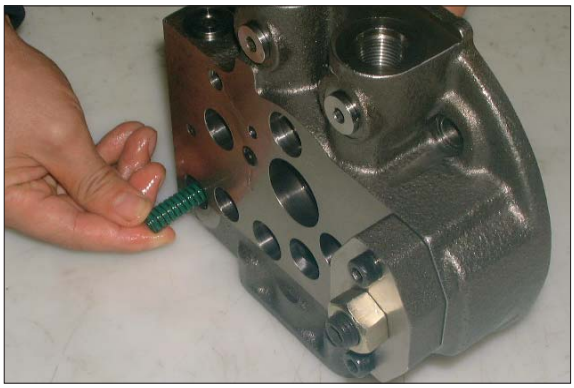


R55NM7HP77

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

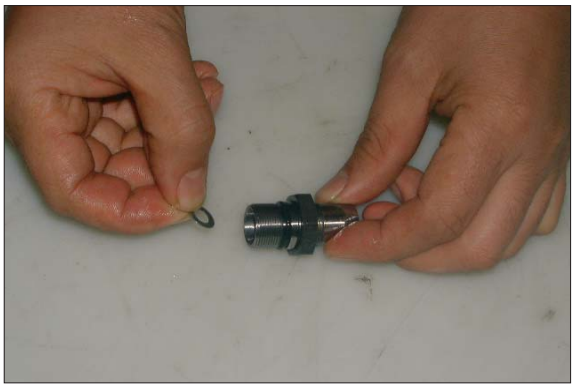
R55NM7HP78

(29) Assemble the spring.



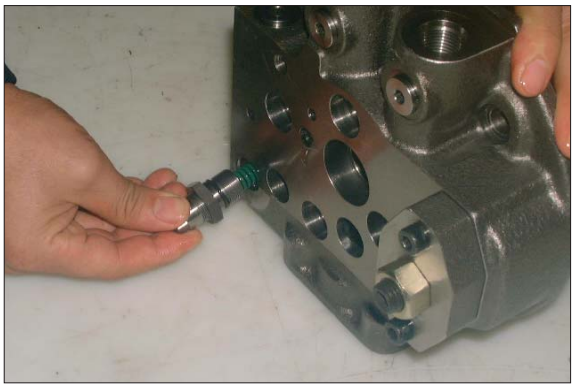
R55NM7HP79

(30) Insert the shim into the adjusting screw.



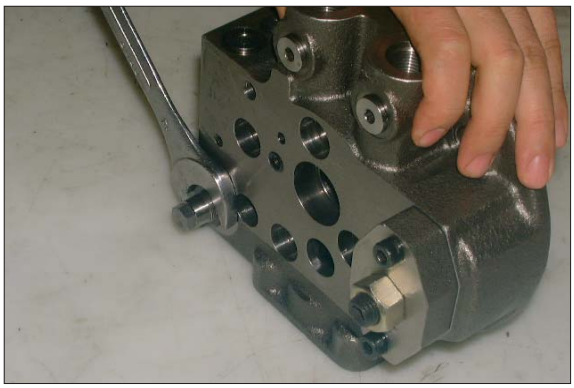
R55NM7HP80

(31) Assemble the adjusting screw.



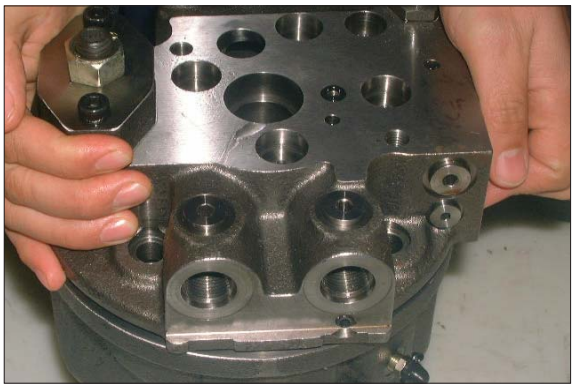
R55NM7HP81

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



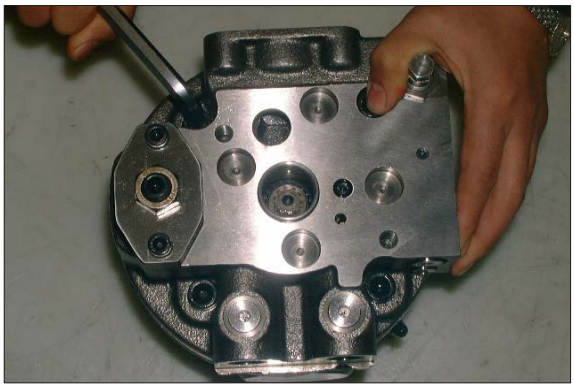
R55NM7HP82

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



R55NM7HP83

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



R55NM7HP84

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

R55NM7HP85

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

R55NM7HP86

(37) Connect the main and geared pump.

R55NM7HP87

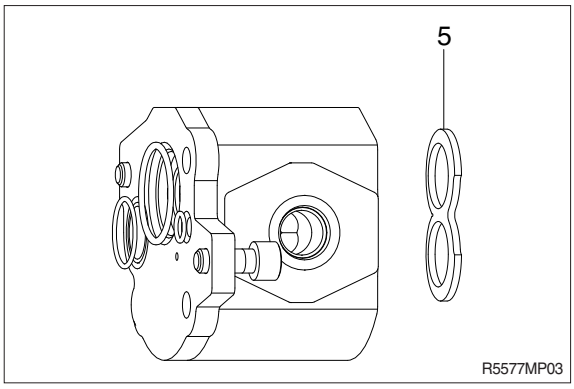
(38) Fix the geared pump with the hexagonal socket headed bolts (M10×25, 2pieces).
Hexagonal bar spanner
(Hex. side distance : 8)
Tightening torque : 5.6 ~ 7.0 kgf·m
(40.5 ~ 50.6 lbf·ft)

R55NM7HP88

4) REASSEMBLING THE GEARED PUMP

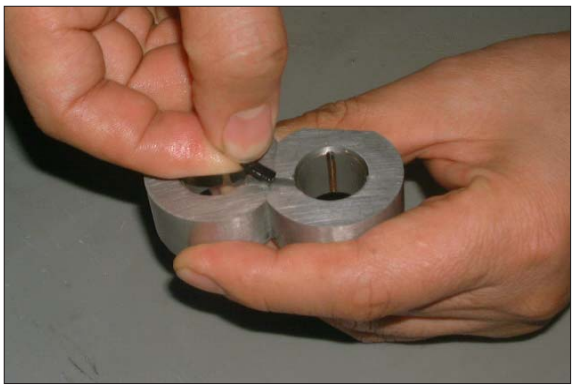
(1) Reassembling the geared pump (P3)

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



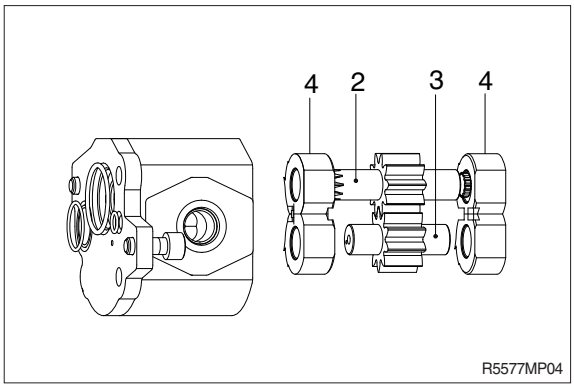
② Insert the square ring into the side plate.

※ Be careful to suction and discharge side.



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

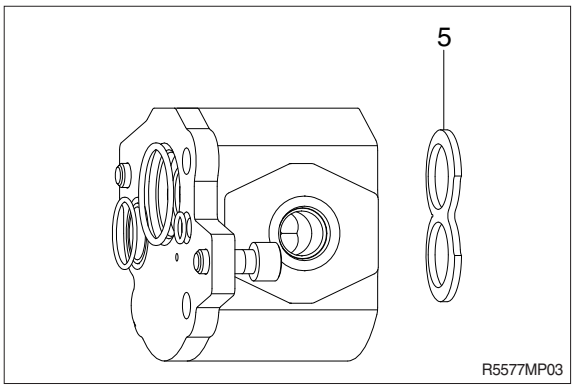
④ Assemble the gear assembly into the gear casing.



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

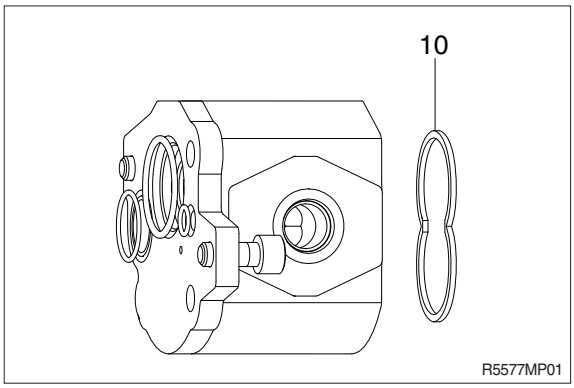
R55NM7HP213

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



R5577MP03

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



R5577MP01

(2) Reassembling the geared pump (P4)

① Insert the drive gear into the gear casing.

R55NM7HP219

② Insert the idle gear to into the gear casing.

R55NM7HP220

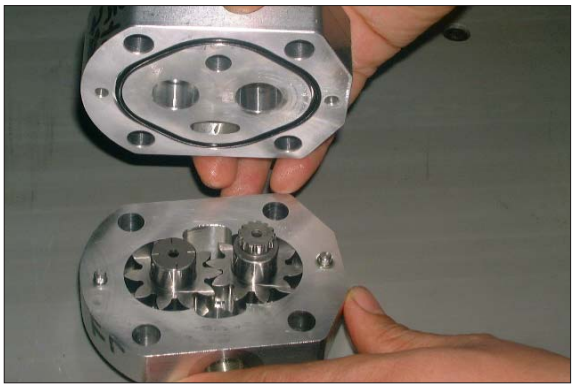
③ Insert the pins (2-pieces) to the center frame.

R55NM7HP221

④ Assemble the O-ring to the center frame.

R55NM7HP222

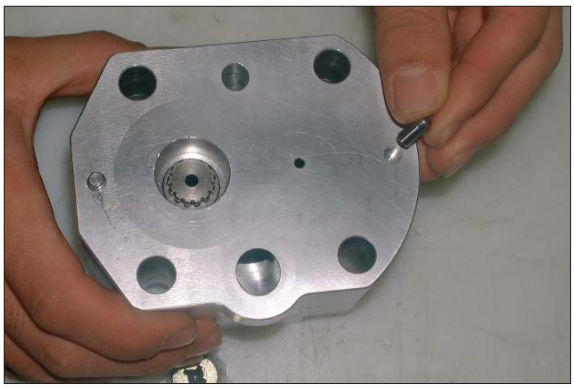
⑤ Assemble the center frame sub-assemble to the gear casing sub-assembly.



R55NM7HP223

(3) Reassembling the P3 and P4 pumps

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



R55NM7HP224

② Insert coupling to the P3 geared pump.

R55NM7HP225

③ Assemble the P3 and P4 geared pumps.

R55NM7HP226

④ Assemble the hexagonal socket bolts and nuts.

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

R55NM7HP227

⑤ Assemble the O-ring to the pump housing.

R55NM7HP228

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) Remove link.

(7) Sling the control valve assembly and remove the control valve mounting bolt.
·Weight : 40 kg (90 lb)

(8) 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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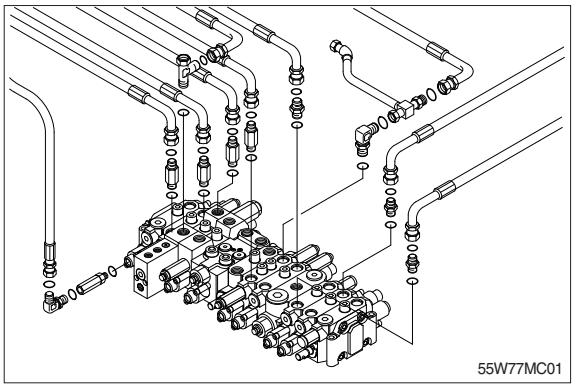
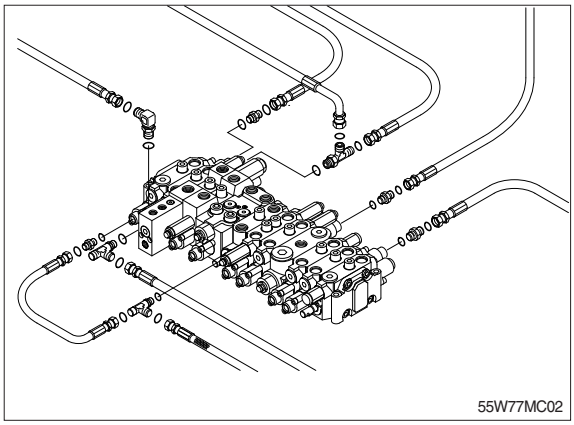
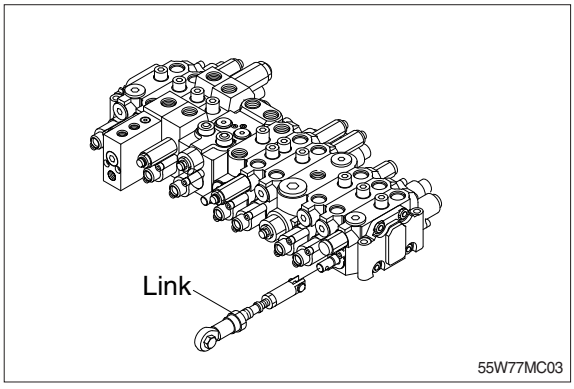
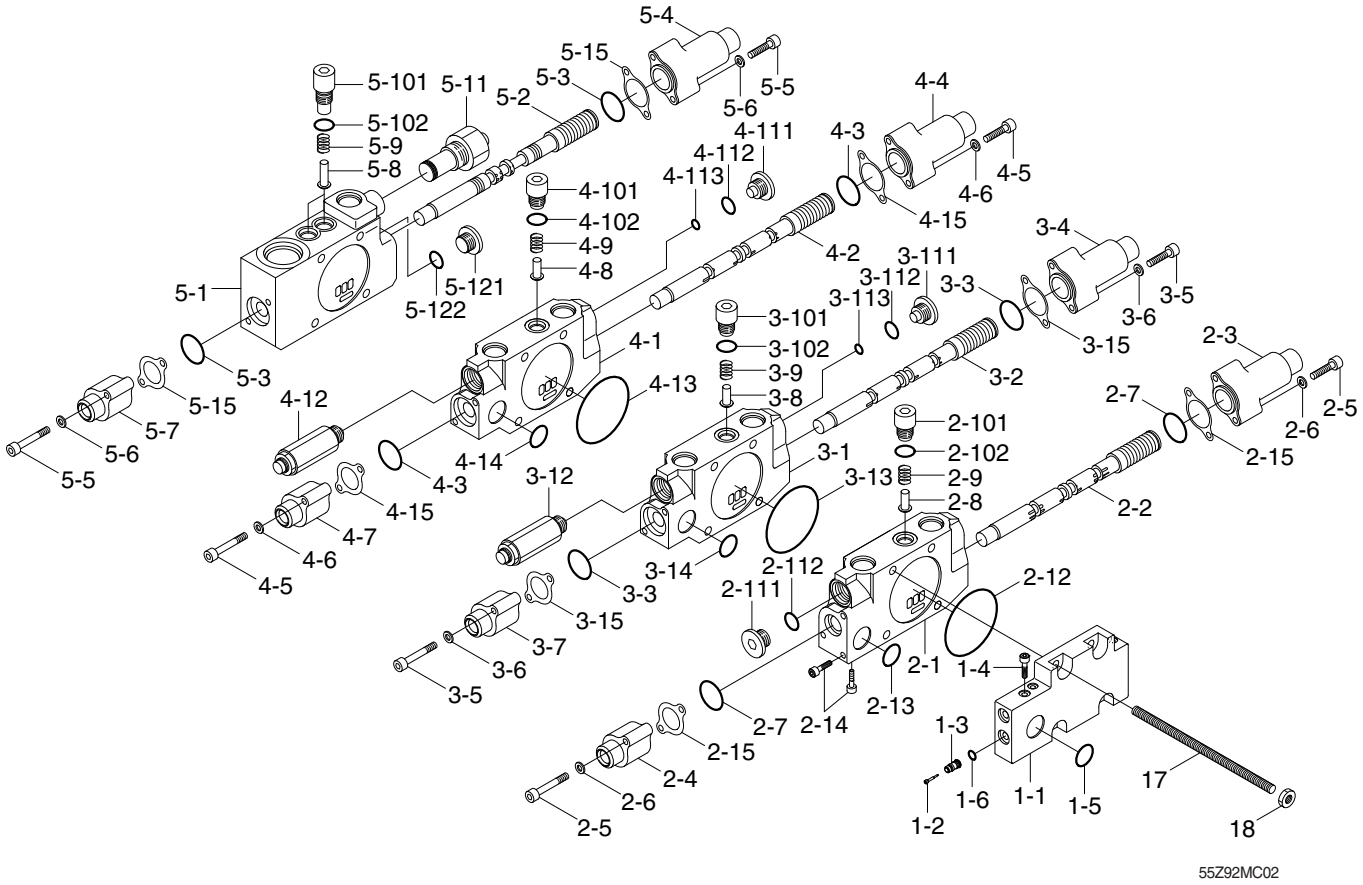

55W77MC01


55W77MC02



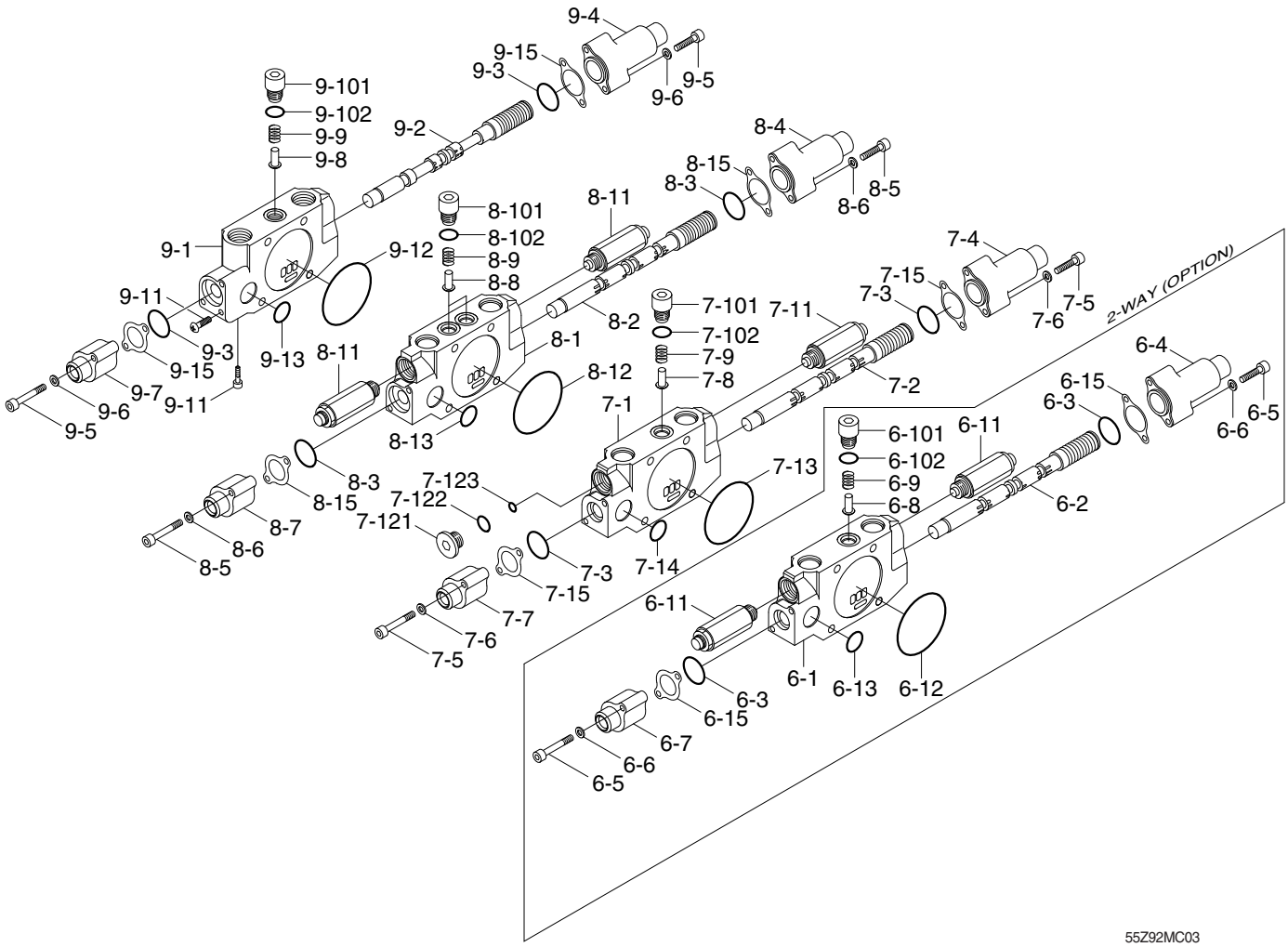
55W77MC03

2. STRUCTURE (1/4)



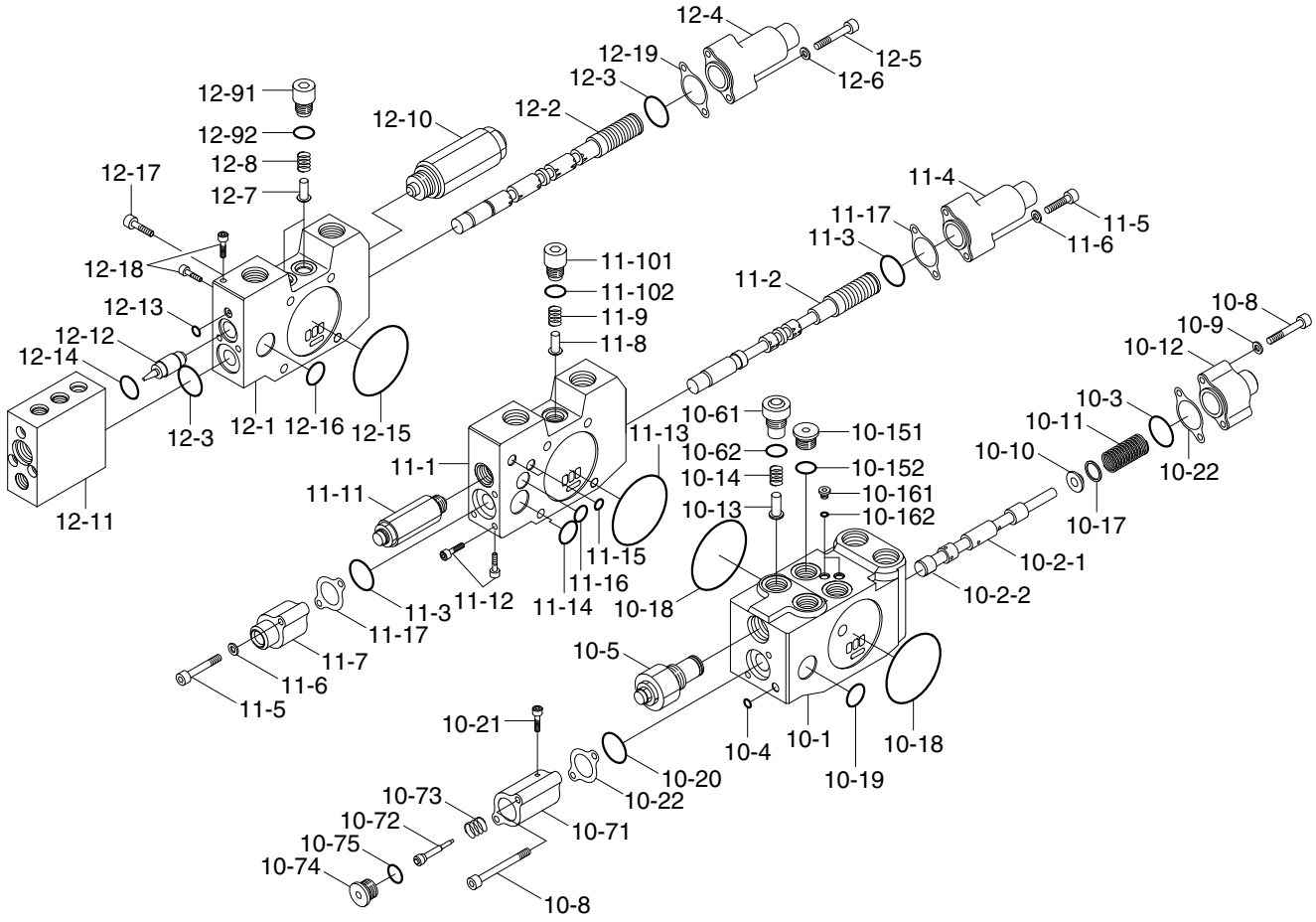
1	Ai cover	3	Dozer block	4	Boon swing assy	5	Inlet assy
2	Section assy-Swing	3-1	Work block	4-1	Work block	5-1	Work block (Ta)
2-1	Work block	3-2	Dozer spool assy	4-2	Spool assy (B/S)	5-2	Spool assy
2-2	Spool assy-Swing	3-3	O-ring	4-3	O-ring	5-3	O-ring
2-3	Pilot cap (A)	3-4	Pilot cap (A)	4-4	Pilot cap (A)	5-4	Pilot cap (A)
2-4	Pilot cap (B1)	3-5	Socket bolt	4-5	Wrench bolt	5-5	Wrench bolt
2-5	Wrench bolt	3-6	Plain washer	4-6	Plain washer	5-6	Plain washer
2-6	Plain washer	3-7	Pilot cap (B1)	4-7	Pilot cap (B1)	5-7	Pilot cap (B1)
2-7	O-ring	3-8	Check poppet	4-8	Check poppet	5-8	Check poppet
2-8	Check poppet	3-9	Check spring	4-9	Check spring	5-9	Check spring
2-9	Check spring	3-10	Plug	4-10	Plug assy	5-10	Plug assy
2-10	Plug	3-101	Check plug (M14)	4-101	Plug 1- check (M14)	5-101	Plug 1- check (M14)
2-101	Plug 1-Check M14	3-102	O-ring	4-102	O-ring	5-102	O-ring
2-102	O-ring	3-11	Plug	4-11	Plug assy	5-11	Main relief valve
2-11	Plug	3-111	Plug	4-111	Plug	5-12	Cap-Pf1/4 plug
2-111	Plug-PF3/8	3-112	O-ring	4-112	O-ring	5-121	Cap-Pf1/4 plug
2-112	O-ring	3-113	O-ring	4-113	O-ring	5-122	O-ring
2-12	O-ring	3-12	Check valve	4-12	Check valve	5-15	Gasket
2-13	O-ring	3-13	O-ring	4-13	O-ring	17	Tie bolt
2-14	Plug-Taper	3-14	O-ring	4-14	O-ring	18	Nut
2-15	Gasket	3-15	Gasket	4-15	Gasket		

STRUCTURE (2/4)



6	2 Way block	7-1	Work block (Ba3)	7-14	O-ring	8-15	Gasket
6-1	Work block	7-2	Boom 2 spool assy	7-15	Gasket	9	Travel block assy
6-2	Rotator spool assy	7-3	O-ring	8	Arm 1 block assy	9-1	Work block (Dk)
6-3	O-ring	7-4	Pilot cap (A)	8-1	Work block (B3)	9-2	Travel spool assy
6-4	Pilot cap (A)	7-5	Wrench bolt	8-2	Arm 1 spool assy	9-3	O-ring
6-5	Wrench bolt	7-6	Plain washer	8-3	O-ring	9-4	Pilot cap (A)
6-6	Plain washer	7-7	Pilot cap (B1)	8-4	Pilot cap (A)	9-5	Wrench bolt
6-7	Pilot cap (B1)	7-8	Check poppet	8-5	Socket bolt	9-6	Plain washer
6-8	Check poppet	7-9	Check spring	8-6	Plain washer	9-7	Pilot cap (B1)
6-9	Check spring	7-10	Plug assy	8-7	Pilot cap (B1)	9-8	Check poppet
6-10	Plug assy	7-101	Plug	8-8	Check poppet	9-9	Check spring
6-101	Plug 1 check (M14)	7-102	O-ring	8-9	Check spring	9-10	Plug 1 check (M14)
6-102	O-ring	7-11	Overload relief valve	8-10	Plug	9-101	Plug 1 check (M14)
6-11	Overload relief valve	7-12	Plug assy	8-101	Plug 1 check (M14)	9-102	O-ring
6-12	O-ring	7-121	Plug	8-102	O-ring	9-11	Taper plug
6-13	O-ring	7-122	O-ring	8-11	Overload relief valve	9-12	O-ring
6-15	Gasket	7-123	O-ring	8-12	O-ring	9-13	O-ring
7	Boom 2 breaker	7-13	O-ring	8-13	O-ring	9-15	Gasket

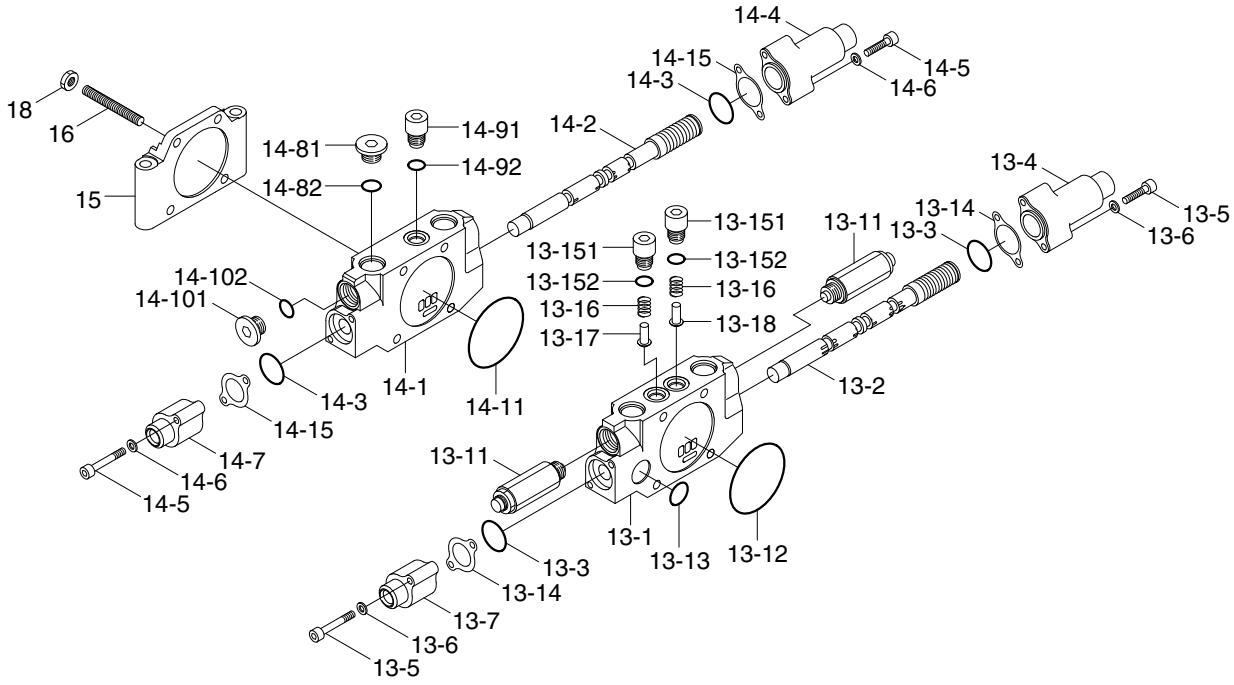
STRUCTURE (3/4)



55Z92MC04

10	Inlet block (P1, P2)	10-11	Pilot spring	11-4	Pilot cap (A)	12-4	Pilot cap (A)
10-1	Work block	10-12	Pilot cap (B2)	11-5	Wrench bolt	12-5	Wrench bolt
10-2	Spool (Ts)	10-13	Check poppet	11-6	Plain washer	12-6	Plain washer
10-2-1	Spool (Ts)	10-14	Check spring	11-7	Pilot cap (B1)	12-7	Check poppet
10-2-2	Spool plug bolt	10-15	Plug assy-PF3/8	11-8	Check poppet	12-8	Check spring
10-3	O-ring	10-151	Plug	11-9	Check spring	12-9	Plug assy
10-4	O-ring	10-152	O-ring	11-10	Plug 1 assy	12-91	Check plug 1 (M14)
10-5	Main relief valve	10-16	Plug UNF5/16	11-101	Check plug 1 (M14)	12-92	O-ring
10-6	Plug 3 assy	10-161	Plug UNF5/16	11-102	O-ring	12-10	Overload relief valve
10-61	Plug-PF3/8	10-162	O-ring	11-11	Overload relief valve	12-11	Holding valve
10-62	O-ring	10-17	Spring shim	11-12	Taper plug	12-12	Holding valve
10-7	Cap assy-Ts check	10-18	O-ring	11-13	O-ring	12-13	O-ring
10-71	Cap -Ts check	10-19	O-ring	11-14	O-ring	12-14	O-ring
10-72	Poppet check valve	10-20	O-ring	11-15	O-ring	12-15	O-ring
10-73	Check spring	10-21	Taper plug	11-16	O-ring	12-16	O-ring
10-74	Plug-PF1/8	10-22	Gasket	11-17	Gasket	12-17	Wrench bolt
10-75	O-ring	11	Travel block assy	12	Boom 1 block assy	12-18	Taper plug
10-8	Wrench bolt	11-1	Work block (Od)	12-1	Block boom 1	12-19	Gasket
10-9	Plain washer	11-2	Travel spool assy (R)	12-2	Boom 1 spool assy		
10-10	Spring seat	11-3	O-ring	12-3	O-ring		

STRUCTURE (4/4)



55Z92MC05

13	Bucket block assy	13-152	O-ring	14-81	Plug PF1/2
13-1	Bucket block	13-16	Check spring	14-82	O-ring
13-2	Bucket spool assy	13-17	Check poppet	14-9	Plug assy
13-3	O-ring	13-18	Check poppet	14-91	Check plug 1 (M14)
13-4	Pilot cap (A)	14	Arm 2 assy	14-92	O-ring
13-5	Wrench bolt	14-1	Work block (Ae)	14-10	Plug assy
13-6	Plain washer	14-2	Arm 2 assy	14-101	Plug PF3/8
13-7	Pilot cap (B1)	14-3	O-ring	14-102	O-ring
13-11	Overload relief valve	14-4	Pilot cap (A)	14-11	O-ring
13-12	O-ring	14-5	Wrench bolt	14-15	Gasket
13-13	O-ring	14-6	Plain washer	15	End cover (He)
13-14	Gasket	14-7	Pilot cap (B1)	16	Tie bolt
13-15	Plug assy	14-8	Plug PF1/2	18	Nut
13-151	Check plug 1 (M14)				

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

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

② Remove the pilot cover (3).

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

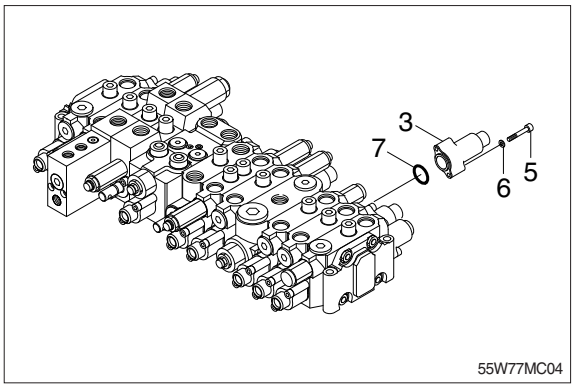
③ Remove the spool assembly (2) from the body by hand slightly.

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

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

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

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



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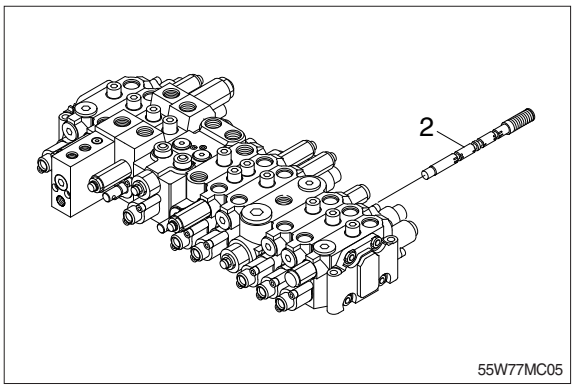


55W77MC05

(2) Disassembly of holding valve (boom 1)

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

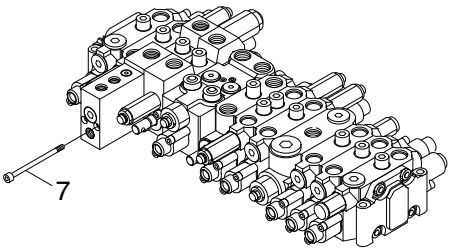
② Remove the holding valve.

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

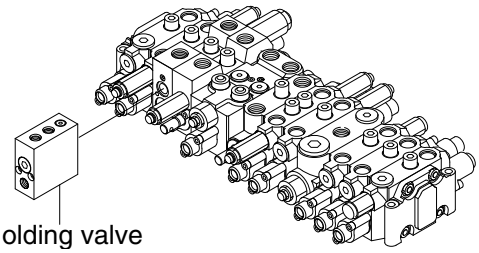
※ Pay attention not to damage the "piston A" under pilot cover.

※ 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.



55W77MC13



55W77MC14

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

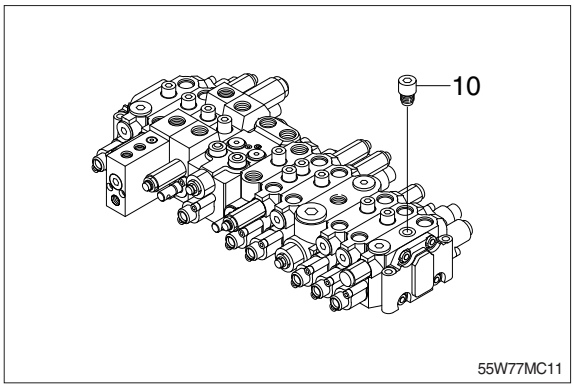
① The load check valve

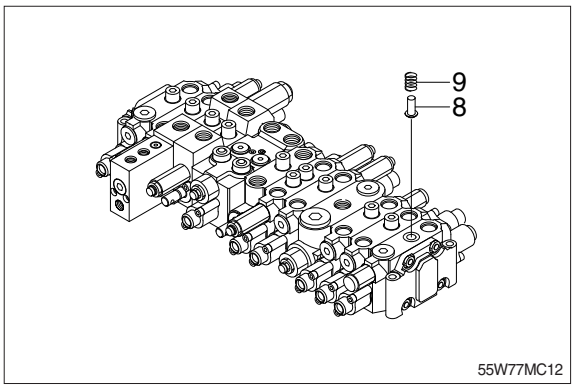
a. Fix the body to suitable work bench.

※ Pay attention not to damage the body.

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

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





(4) Disassembly of the main and overload relief valve

① Fix the body to suitable work bench.

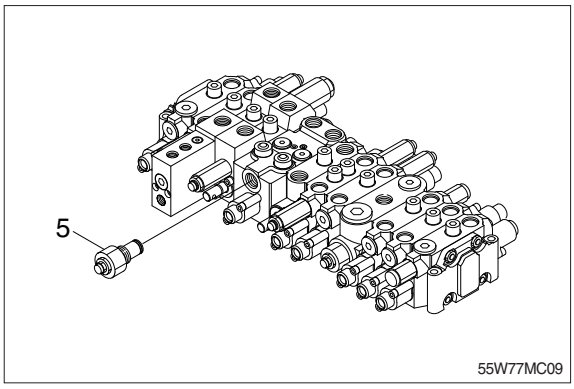
② Remove the main relief valve (5).
(spanner : 30 ㎜)

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

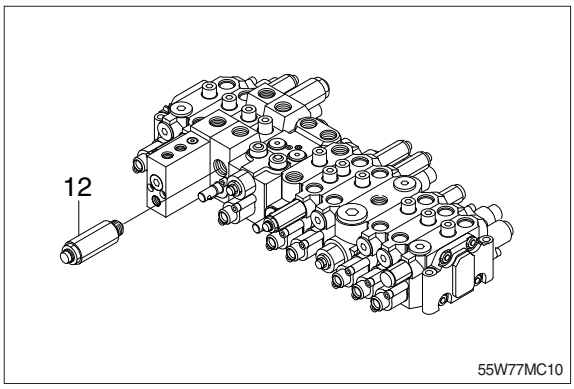
※ When disassembled, tag the relief valve for identification so that they can be reassembled correctly.

※ Pay attention not to damage seat face.

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



55W77MC09



55W77MC10

(5) Disassembly of the block assembly

① Fix the body to suitable work bench.

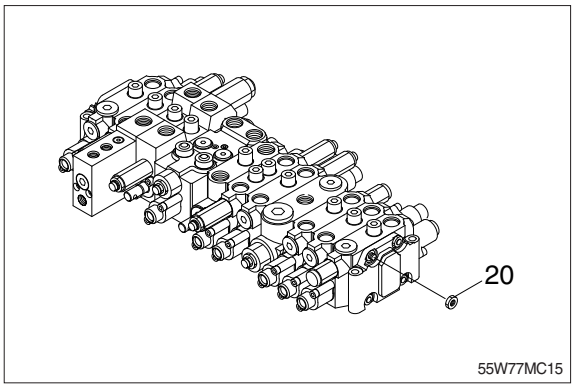
② Remove the nut (20).
(spanner : 13 ㎜)

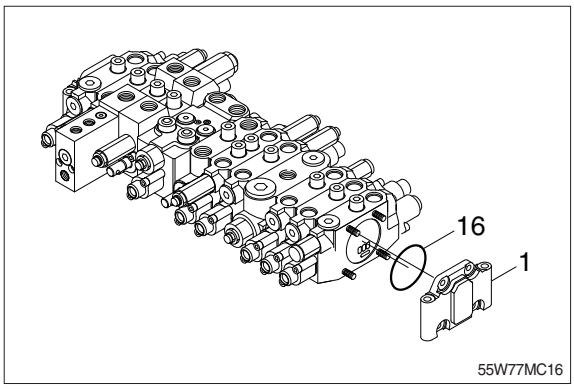
※ The work block is assembled by two sets of tie-bolts.

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

※ Do not removed the tie bolt.

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





(6) Inspection after disassembly

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

① Control valve

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

② Relief valve

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

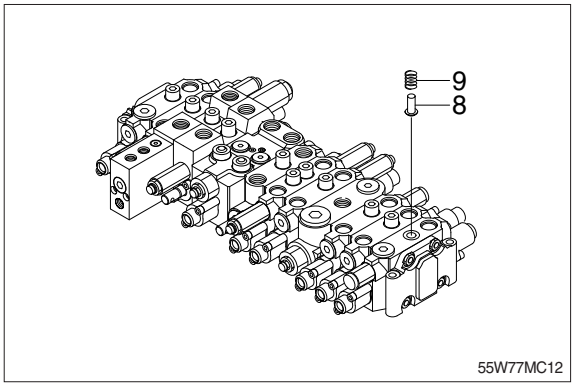
4) ASSEMBLY

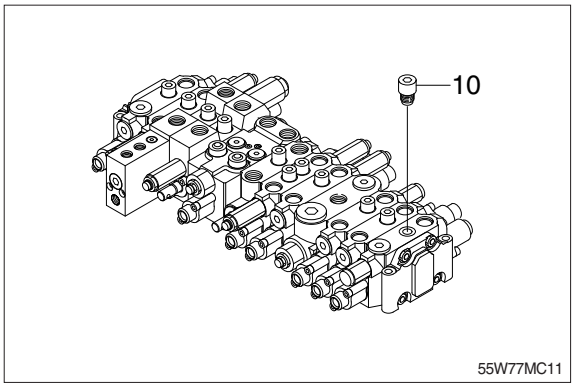
(1) General precaution

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

(2) Load check valve

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

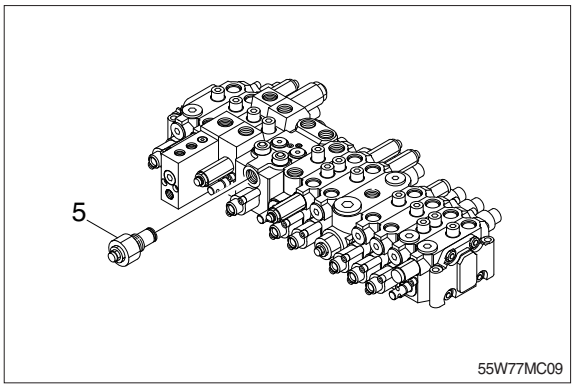


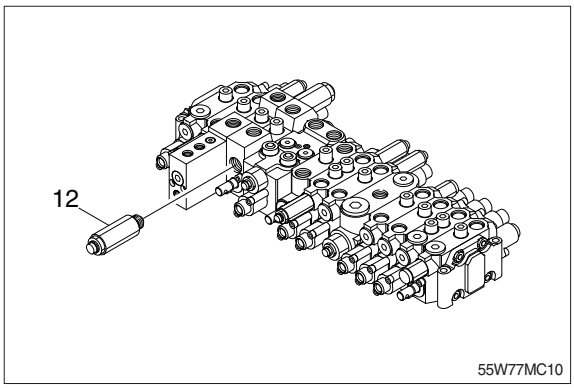


(3) Main relief, port relief valves

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

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

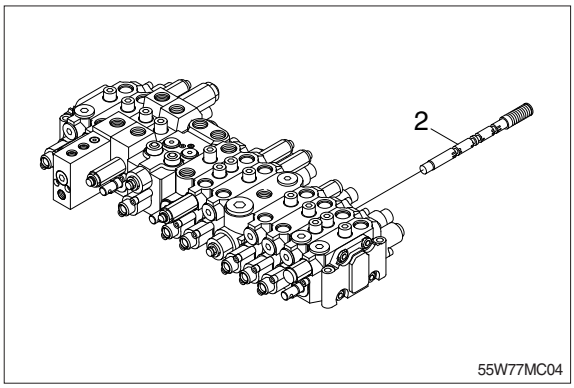




(4) Main spools

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

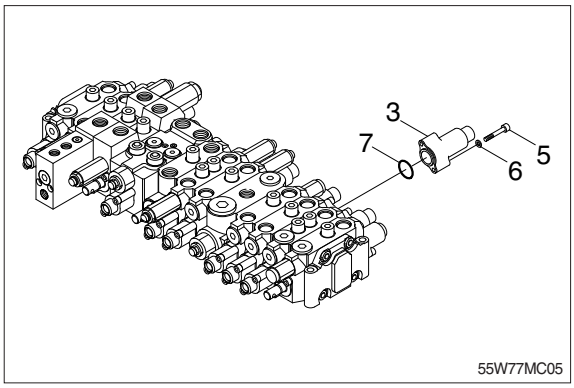
※ Fit spool assemblies into body carefully and slowly. Do not under any circumstances push them forcibly in.



(5) Covers

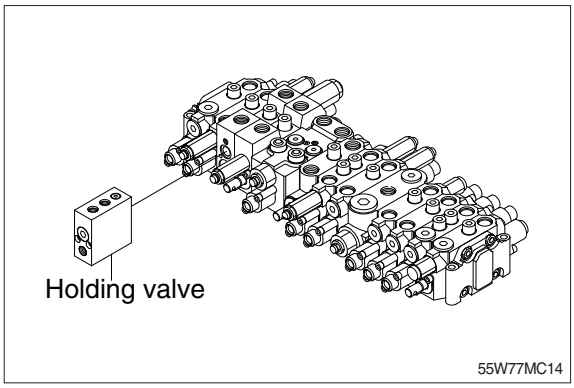
① Fit spool covers (3) tighten the hexagonal socket head bolts (5) to the specified torque.
·Hexagon wrench : 5 mm
·Tightening torque : 1~1.1 kgf·m
(7.2~7.9 lbf·ft)

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

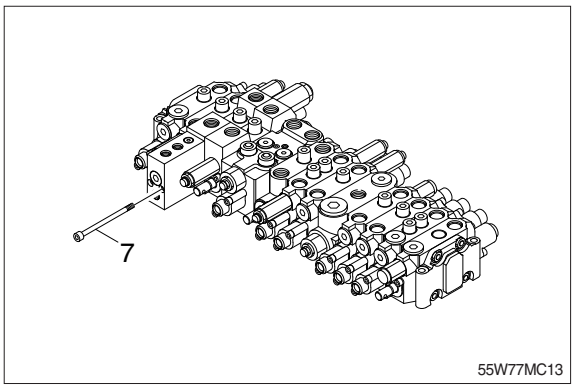


(6) Holding valve

① Fit the holding valve to the body and tighten hexagon socket head bolt (7) to specified torque.
·Hexagon wrench : 5 mm
·Tightening torque : 1.1 kgf·m (7.9 lbf·ft)



55W77MC14



55W77MC13

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

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

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

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

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

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

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

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

(6) Sling the swing motor assembly (1) and remove the swing motor mounting bolts (9).
·Motor device weight : 23 kg (51 lb)

(7) Remove the swing motor assembly.

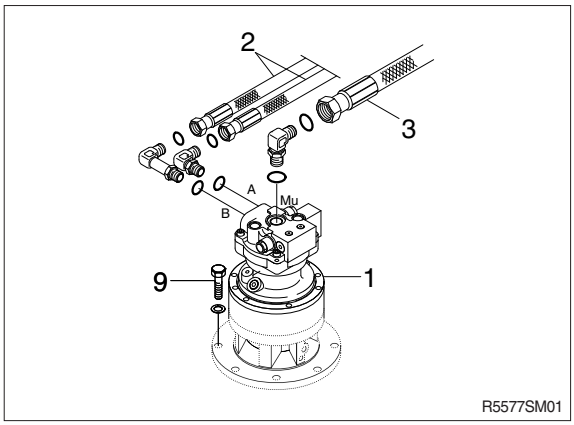
※ When removing the swing motor assembly, check that all the piping have been disconnected.

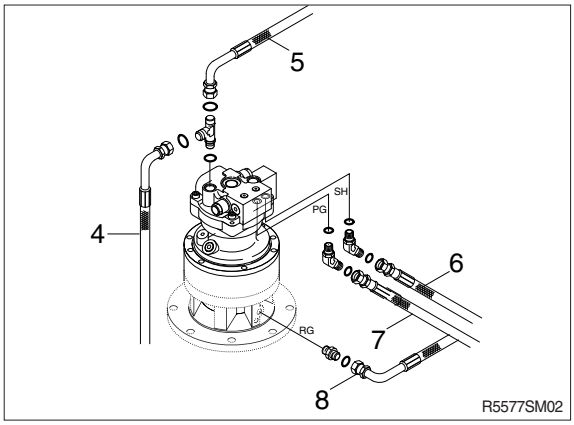
2) INSTALL

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

(2) Bleed the air from the swing motor.
① Remove the air vent plug.
② Pour in hydraulic oil until it overflows from the port.
③ Tighten plug lightly.
④ Start the engine, run at low idling and check oil come out from plug.
⑤ Tighten plug fully.

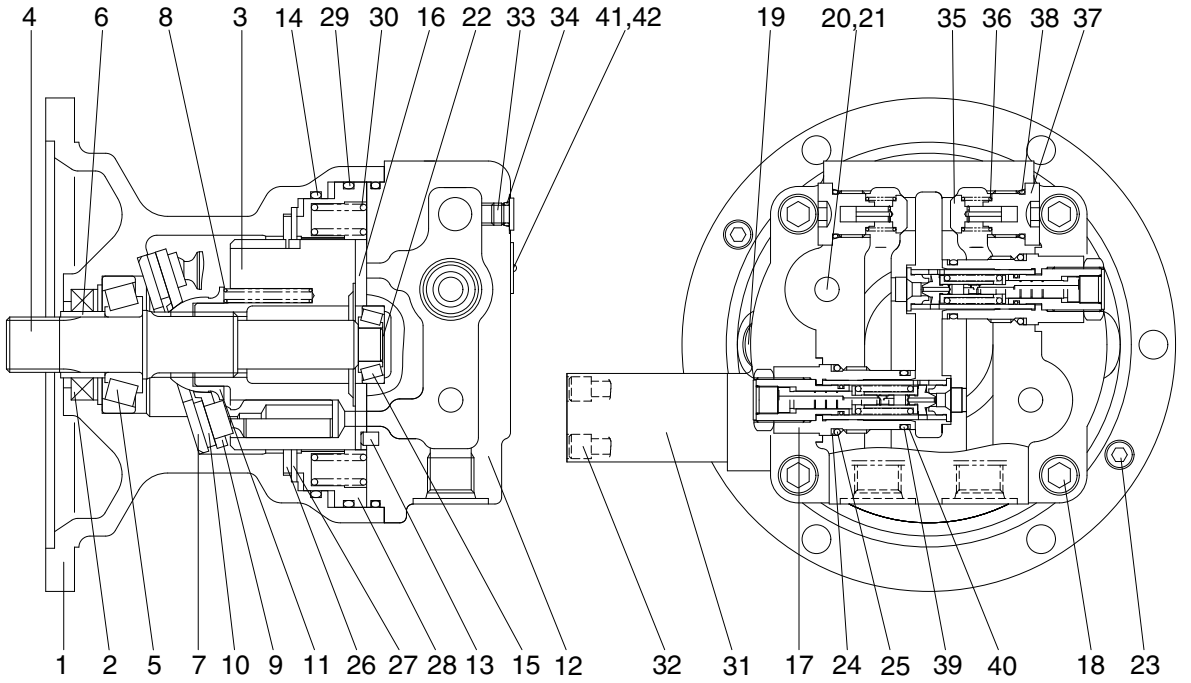
(3) Confirm the hydraulic oil level and check the hydraulic oil leak or not.





2. DISASSEMBLY AND ASSEMBLY OF SWING MOTOR

1) STRUCTURE



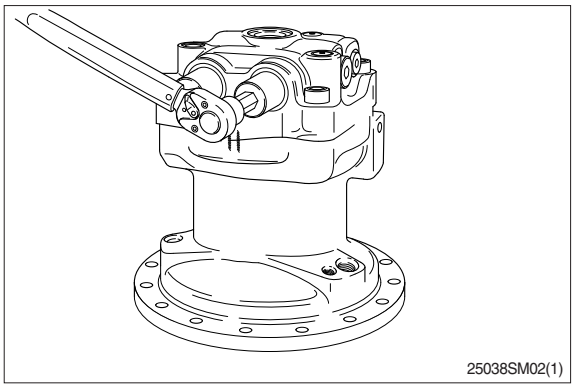
55W72SM03

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

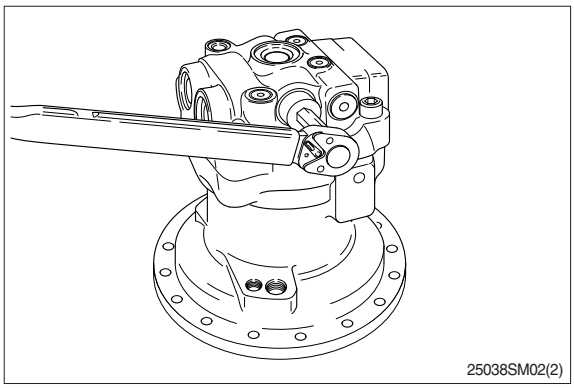
2) DISASSEMBLY

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

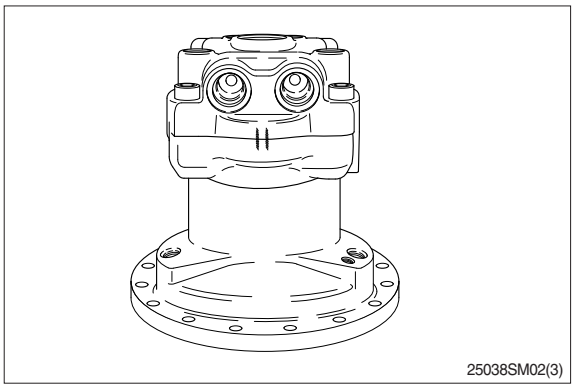
※ Assemble removed relief valve assembly (17) to original state when reassembling.


25038SM02(1)

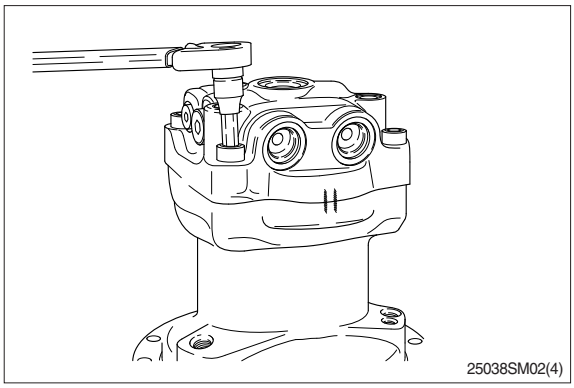
(2) Removal of make up valve and bypass valve assembly
Loosen plug (37) with 14㎜ hexagonal wrench, and remove check valve (35) and spring (36).


25038SM02(2)

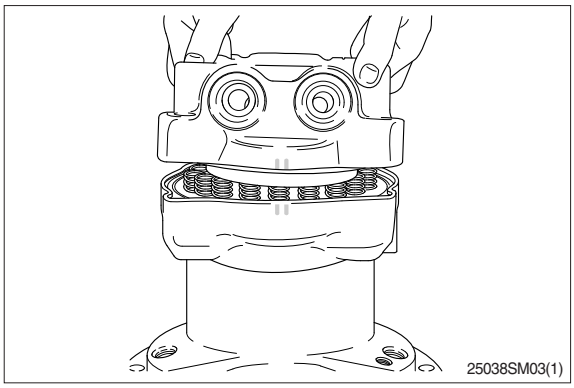
(3) Marking at swing motor
Before disassembling motor, make a matching mark between cover (12) and housing (1) for easy reassembling.


25038SM02(3)

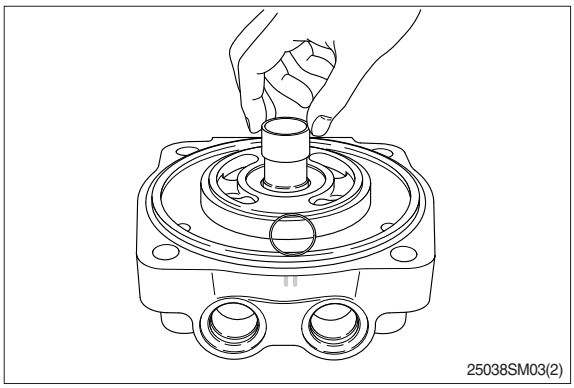
(4) Remove mounting bolts of cover
Loosen hexagon socket bolt (18) with 12 ㎜ hexagonal wrench.


25038SM02(4)

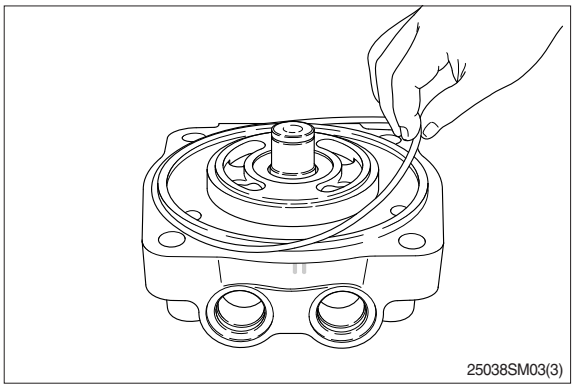
(5) Removal of cover assembly
Place shaft of motor assembly to downward and take cover (12) out.



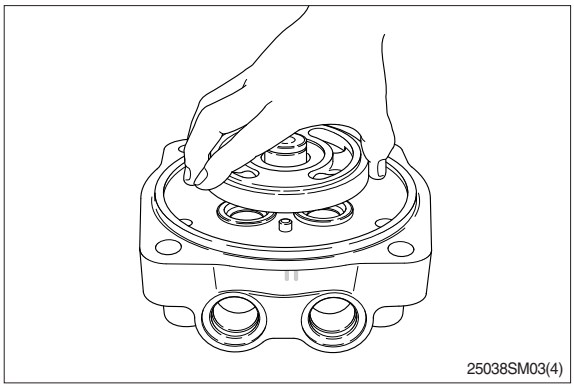
(6) Remove shim (22) remove inner race of needle bearing (15) by bearing puller.



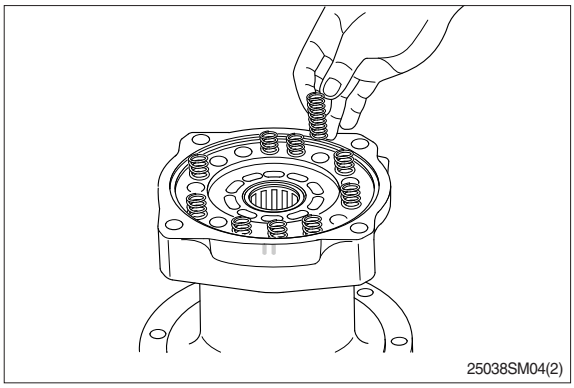
(7) Remove O-ring (29) from cover.



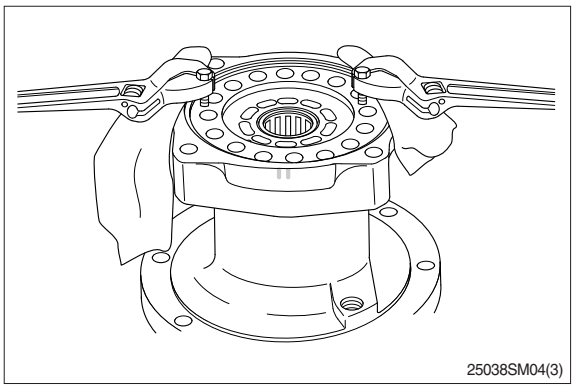
(8) Remove balance plate
Valve plate (16) is adhered on end surface of cylinder (3) by oil viscosity. Take off balance plate (16) with hands.
Assembling method of balance plate (16) depends on cover (12).
(band groove and round groove of high· low pressure transmission area)
Before removing, check and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



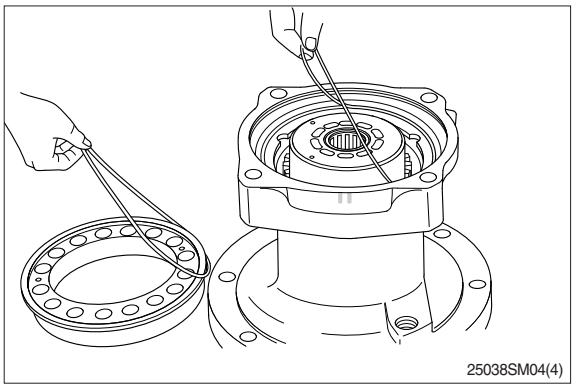
(9) Removal of spring (30, brake area)
Remove spring (30) from piston (28).
Check and record original position of each spring (30) for correct assembling.


25038SM04(2)

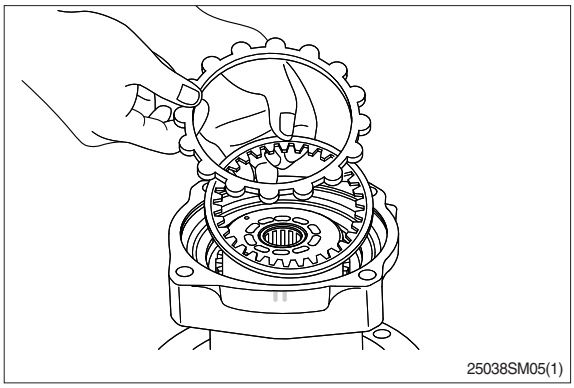
(10) Removal of brake piston
When removing piston (28) from housing (1), there is a sliding resistance against tightening of O-rings (14,29). Use tap hole on piston (28) as shown in the picture.


25038SM04(3)

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


25038SM04(4)

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


25038SM05(1)

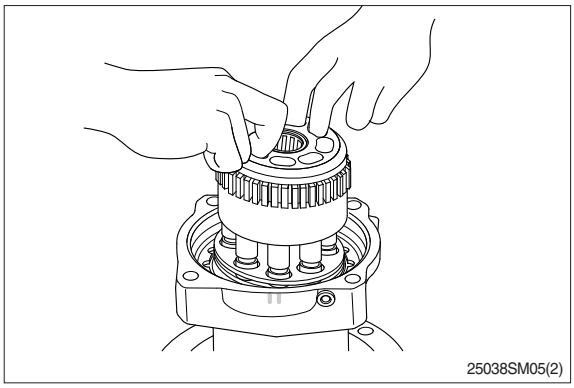
(13) Removal of cylinder assembly

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

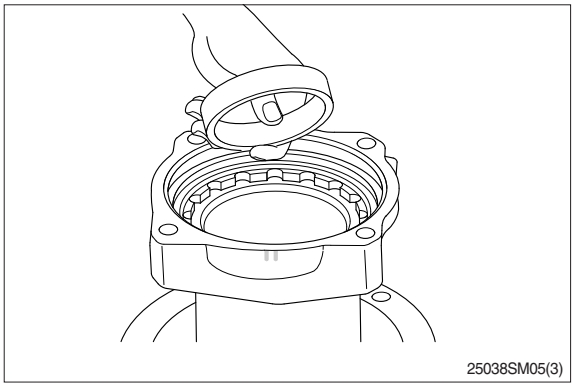
※ Oil seal (2) and outer race of taper roller bearing (15) are left inside of housing.

※ End surface of cylinder (3) is sliding face. So, protect the surface with a scrap of cloth against damage.

※ Make a matching mark on piston hole of cylinder (3) and piston assembly (10) to fit piston into the same hole when reassembling.



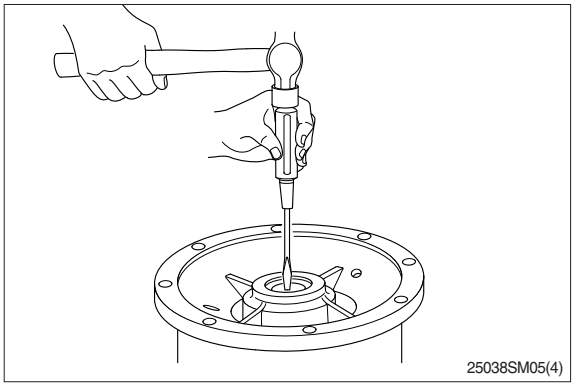
(14) Separate outer race of taper roller bearing (5) from housing.



(15) Removal of oil seal

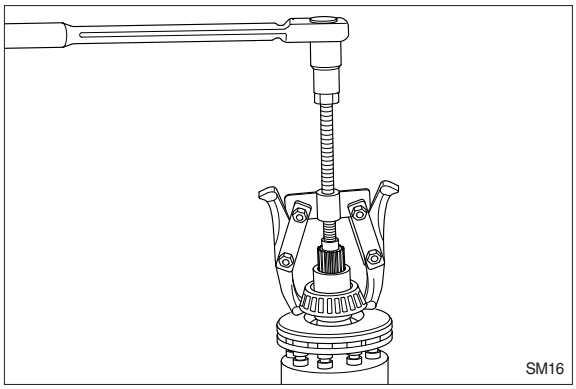
Remove oil seal (2) from housing (1) with driver and hammer.

※ Do not reuse oil seal after removal.

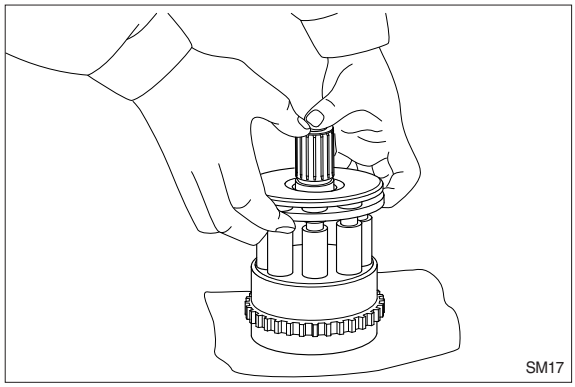


(16) Disassembly of cylinder assembly

① Removal of inner race of taper roller bearing (5).
Lift out cylinder block (3) with 2 inner race of roller bearing (5) by applying gear puller at the end of spline in the cylinder.

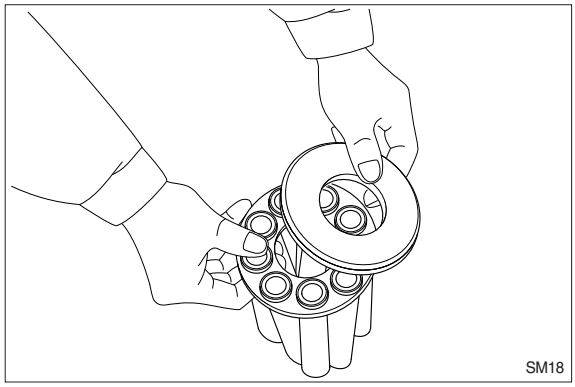

SM16

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

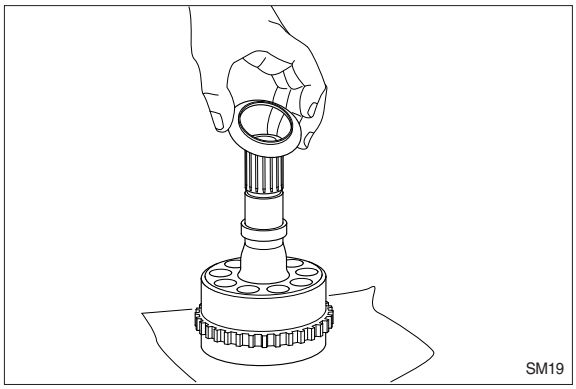

SM17

③ Get shoe plate (7) slide on sliding face of piston assembly (10) and remove it.

※ Be cautious not to damage on sliding face of cam plate.


SM18

④ Remove ball guide (11) from cylinder block (3).


SM19

This completes disassembly.

3) ASSEMBLY

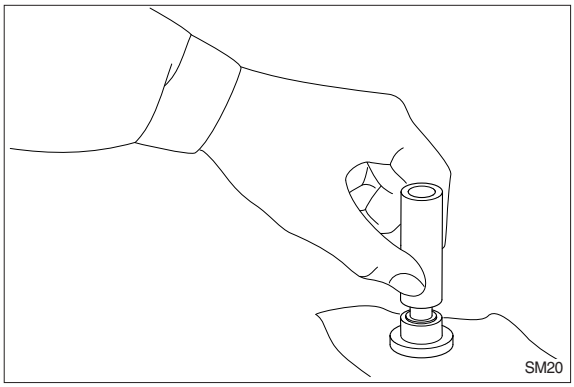
(1) Preparation

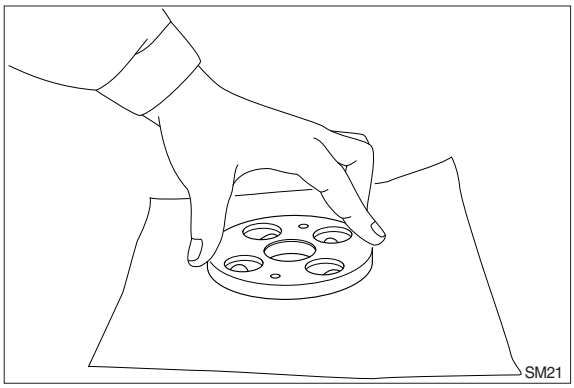
Before reassembling, perform below procedure.

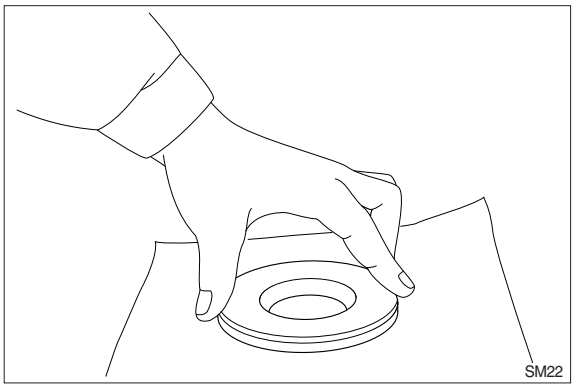
① Check each part for damage caused by using or disassembling. If damaged, eliminate damage by grinding with proper sandpaper, wash them with cleaning oil and dry with compressed air.

② Replace seal with new one.

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





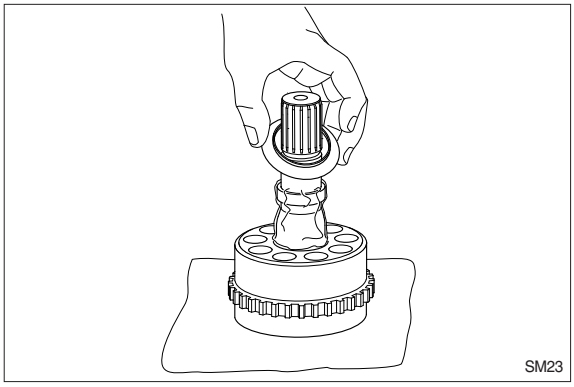


④ When assembling, lubricate with specified clean hydraulic oil.

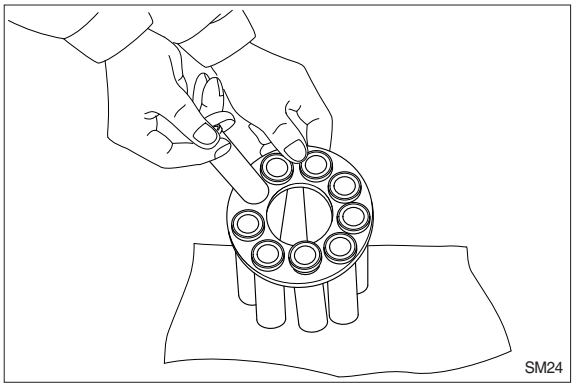
⑤ When assembling piston assembly (10) to piston hole of cylinder block (3), check matching mark between them.

(2) Cylinder assembly

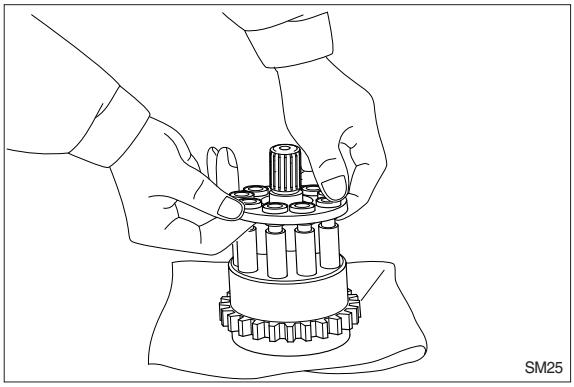
① Lubricate grease on round area (contacting area withball guide (11)) of cylinder block (3) and assemble spring (4).



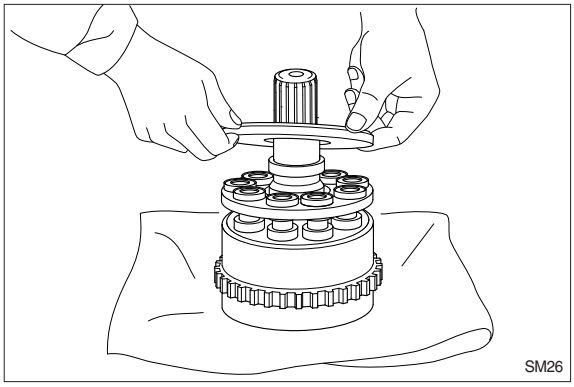
② Insert piston assembly (10) in hole of set plate (9).



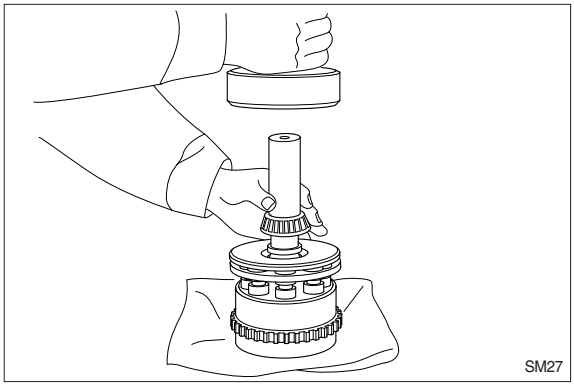
③ Assemble piston assembly (10) and set plate (9) to cylinder block (3). When assembling, check matching mark between them. Before assembling, lubricate specified hydraulic oil in piston hole of cylinder block (3).



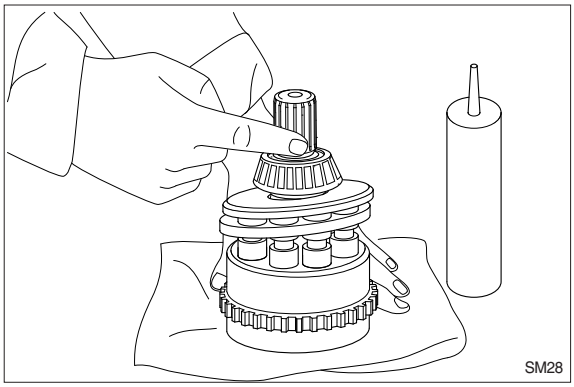
④ Lubricate specified hydraulic oil on shoe sliding face of piston assembly (10) and assemble shoe plate (7).



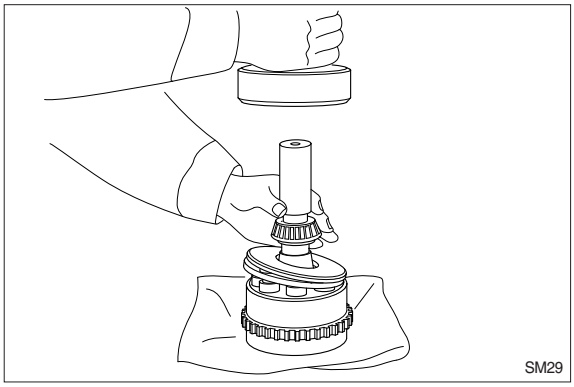
⑤ Assemble inner race of taper roller bearing (5) to cylinder block (3).



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



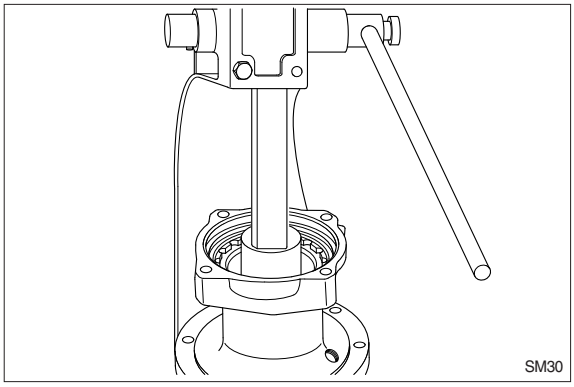
⑦ Assemble bushing (6) to cylinder block (3).



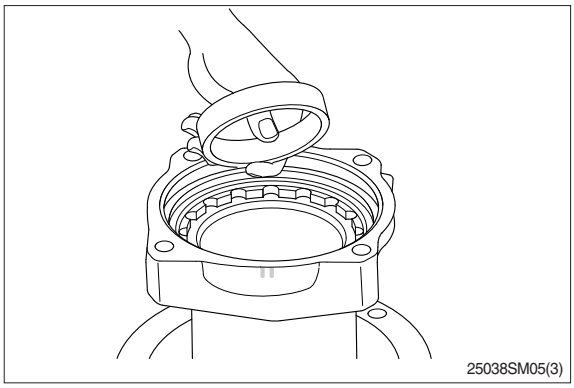
(3) Oil seal

Apply three bond of white color on outer surface of oil seal (2) and assemble and insert it.

※ Before assembling, lubricate lip of oil seal with grease.



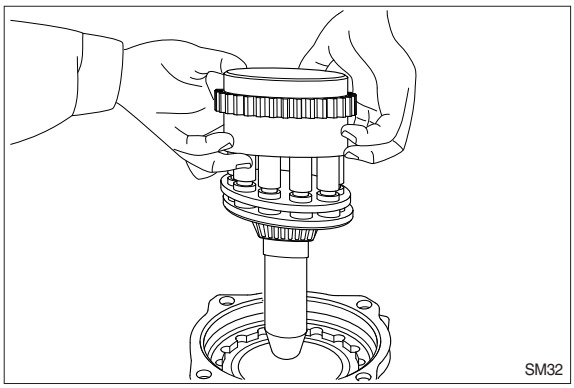
(4) Assemble outer race of taper roller bearing (5) to motor housing (1).



(5) Cylinder assembly

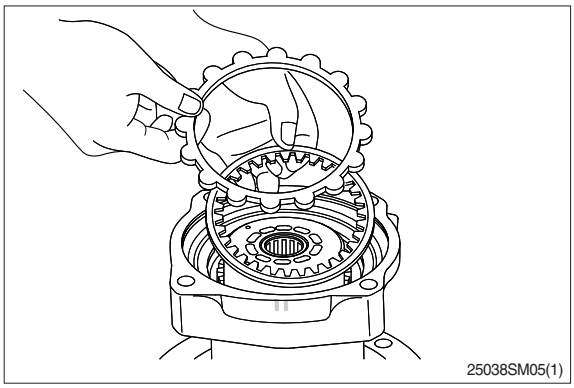
Hold end of cylinder assembly (3) with hands and assemble cylinder assembly to housing (1). Be careful to prevent damage of seal by spline of shaft.

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



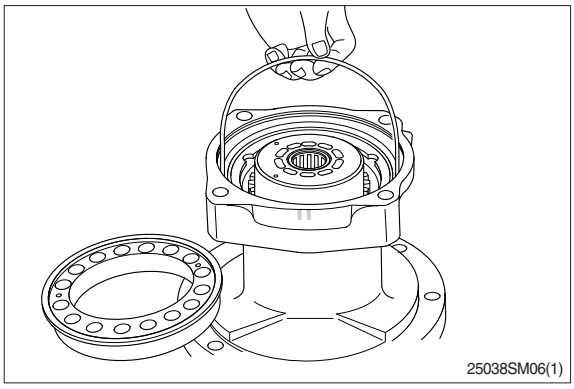
(6) Assemble friction plate (26) and lining plate (27).

※ Lubricate specified hydraulic oil on each side.



(7) Insert O-rings (14,29) into housing (1) and piston (28).

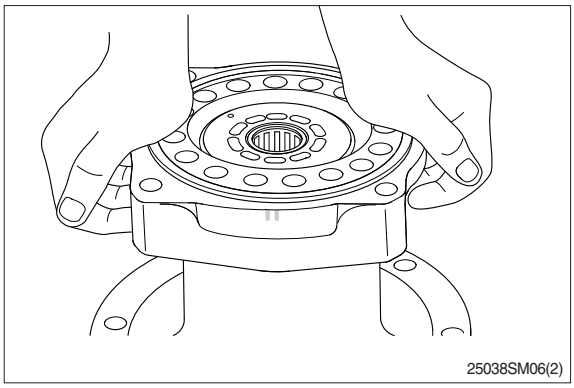
※ Lubricate O-ring with grease.



(8) Brake piston

Lubricate specified hydraulic oil on outer sliding face of piston (28) and assemble brake piston to housing (1).

※ It is too tight to assemble piston (10) because O-rings (14,29) are fitted, therefore it is recommended to push piston (28) horizontally by hands at once.

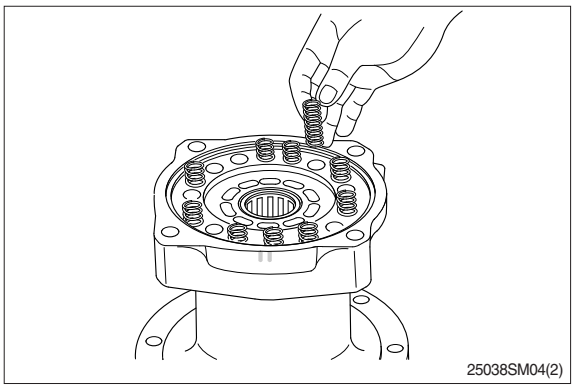


25038SM06(2)

(9) Spring (30, brake unit)

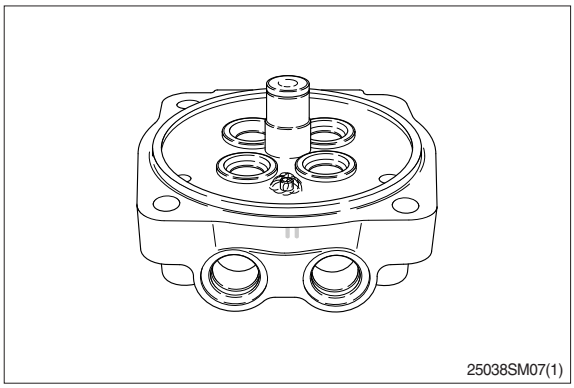
Assemble spring (30) to piston (28) of brake unit.

※ Insert spring (30) into original position.



25038SM04(2)

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

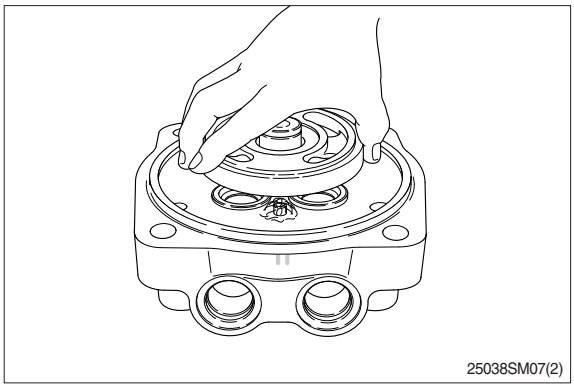


25038SM07(1)

(11) Balance plate

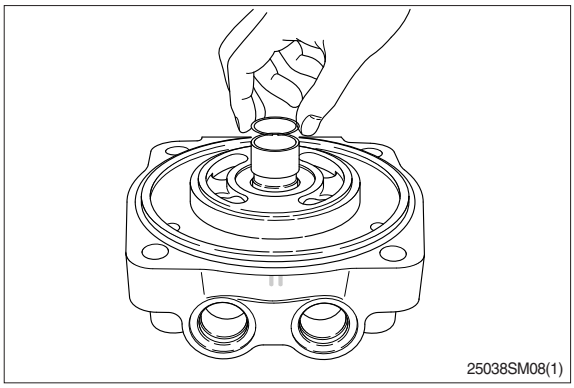
Assemble valve plate (16) to cover (12).

※ Be cautious of assembling direction.



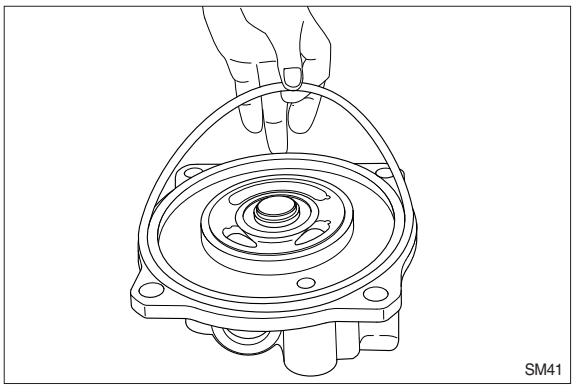
25038SM07(2)

(12) Assemble inner race of needle bearing (15) and shim (22) to cover (12).

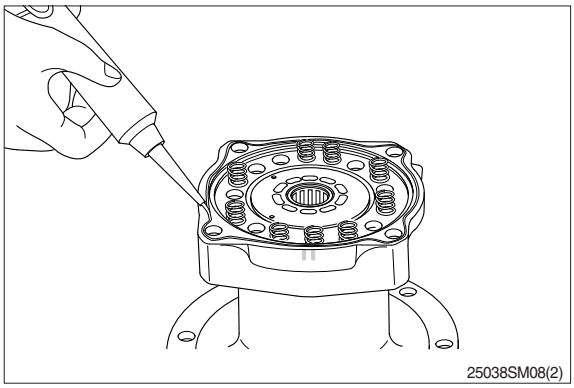


(13) Assemble O-ring (29) to cover (12).

※ Lubricate O-ring with grease.



(14) Apply three bond of white color to distinguish oil leakage from remaining oil in bolt hole of cover (12).

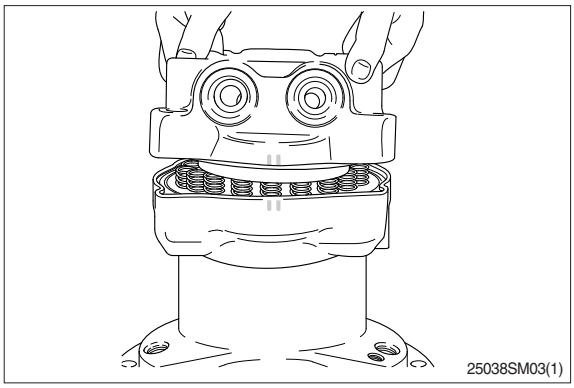


(15) Cover

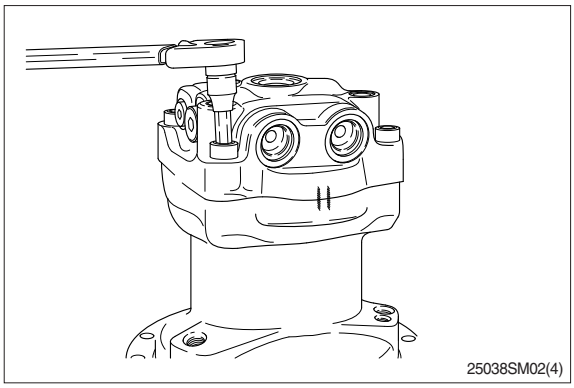
Assemble cover (12) and valve plate (16) to housing (1) lightly, holding them up with hands.

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

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

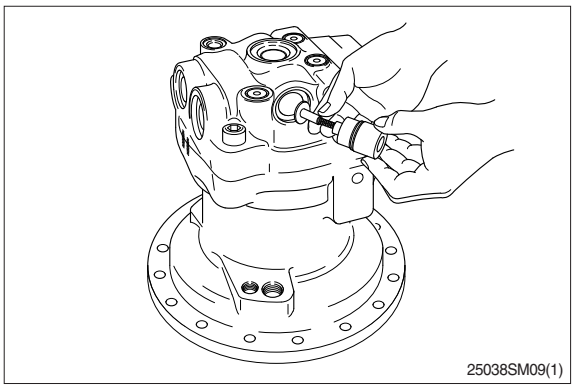


(16) Tighten cover (12) and housing (1) with 12 mm hexagonal socket bolt (18).
·Tightening torque : 16 kgf·m (116 lbf·ft)


25038SM02(4)

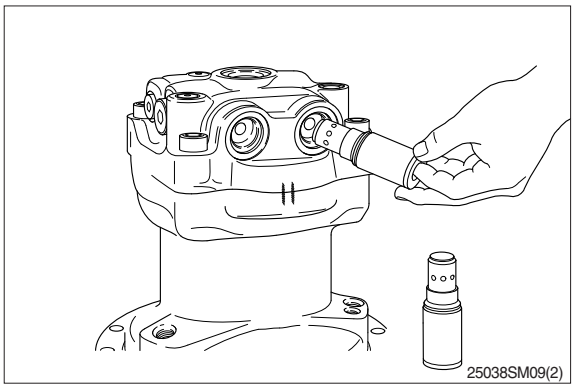
(17) Make up valve

Assemble check (35) and spring (36) to cover (12) and tighten plug (37) with 14 mm hexagonal socket bolt.
·Tightening torque : 14 kgf·m (101 lbf·ft)


25038SM09(1)

(18) Relief assembly

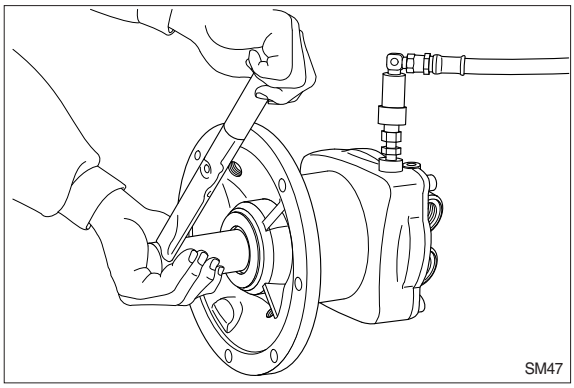
Assemble relief valve assembly (17) to cover (12) with 14 mm hexagonal socket bolt.
·Tightening torque : 8 kgf·m (58 lbf·ft)
※ Be cautious of assembling method.


25038SM09(2)

(19) Check of assembly

Load pilot pressure of 20 kgf/cm^2 to brake release port after opening inlet and outlet port.
Check if output shaft is rotated smoothly around torque of 0.5~1 kgf·m.
If not rotated, disassemble and check.

This completes assembly.


SM47

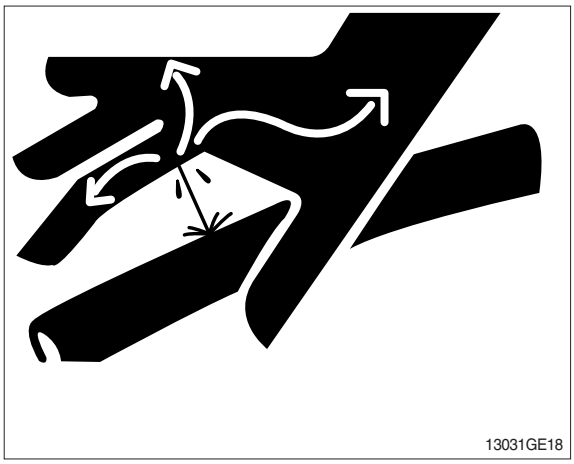
3. REMOVAL AND INSTALL OF REDUCTION GEAR

1) REMOVAL

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

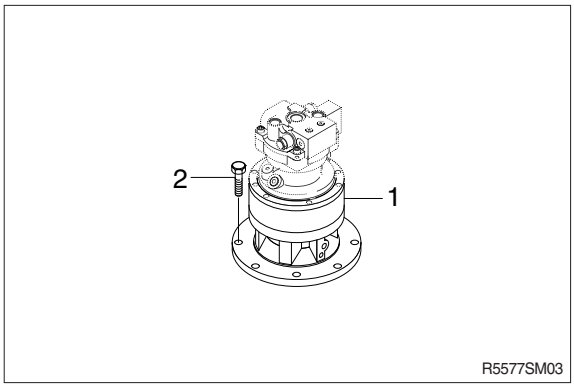
(2) Sling reduction gear assembly (1) and remove mounting bolts (2).

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


13031GE18

2) INSTALL

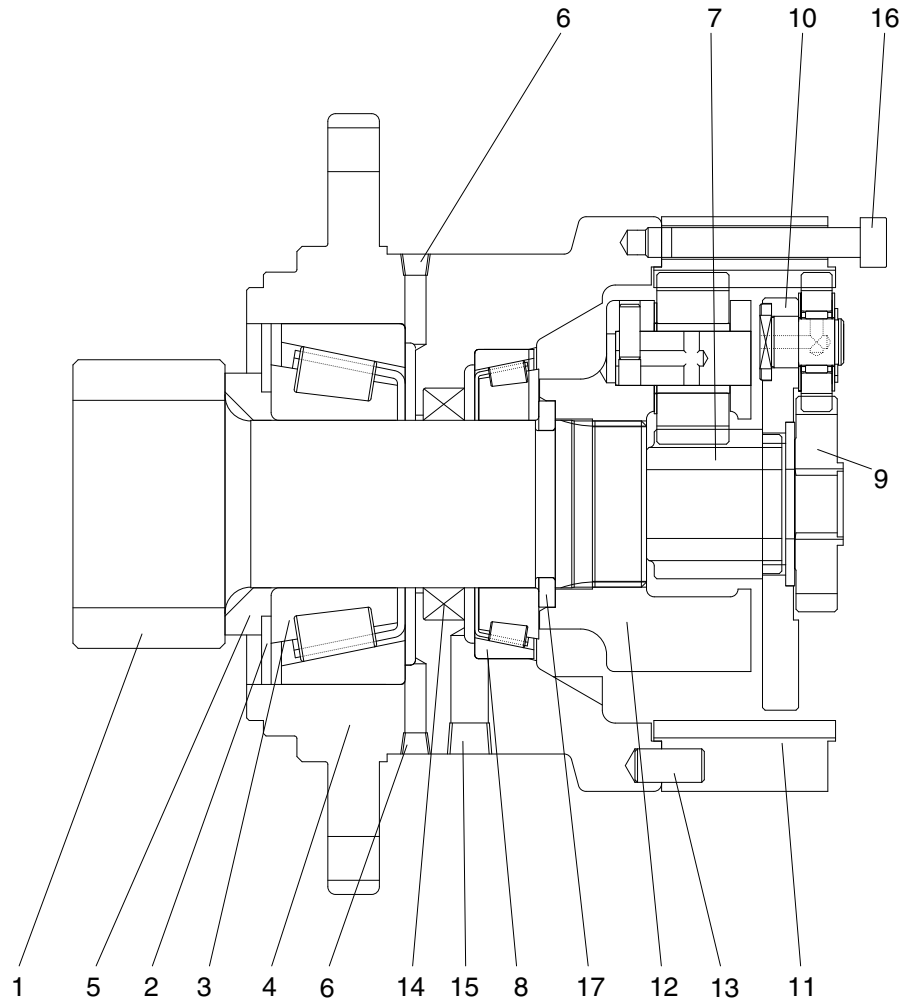
(1) Carry out installation in the reverse order to removal.
·Tightening torque : 10.5 kgf·m
(76 lbf·ft)



R5577SM03

4. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE

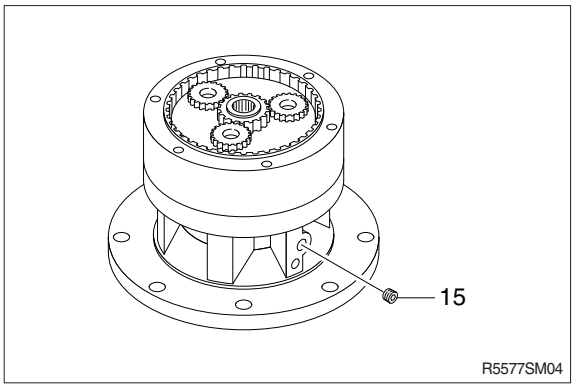


R5572SF34

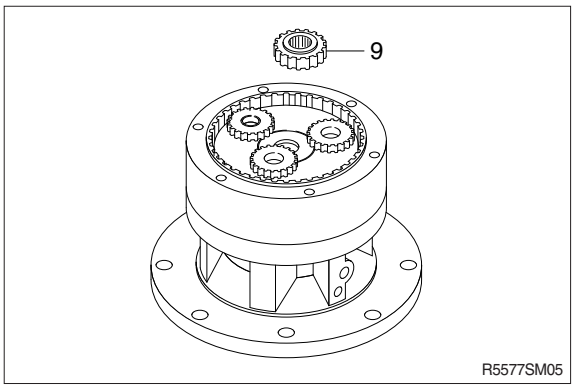
1	Pinion shaft	7	Sun gear No.2	13	Pin
2	Plate	8	Taper bearing	14	Oil seal
3	Taper bearing	9	Sun gear No.1	15	Plug
4	Case	10	Carrier assy No.1	16	Socket bolt
5	Collar No.1	11	Ring gear	17	Collar No.2
6	Plug	12	Carrier assy No.2		

2) DISASSEMBLY

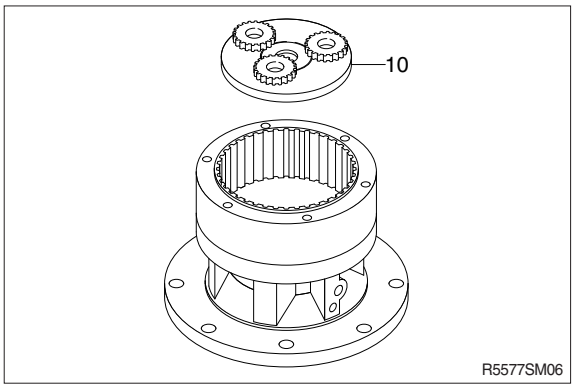
(1) Remove the plug (15) and drain out gear oil.



(2) Remove the No.1 sun gear (9).

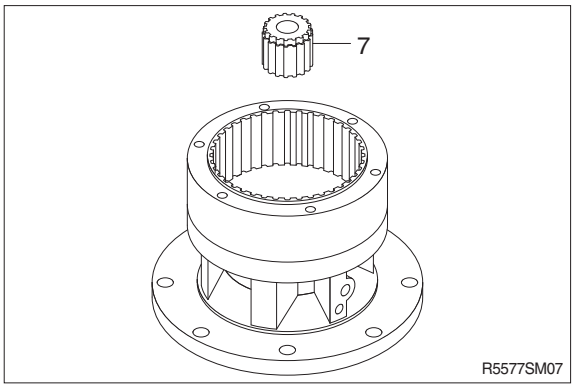


(3) Remove the No.1 carrier sub-assembly (10) using the jig.

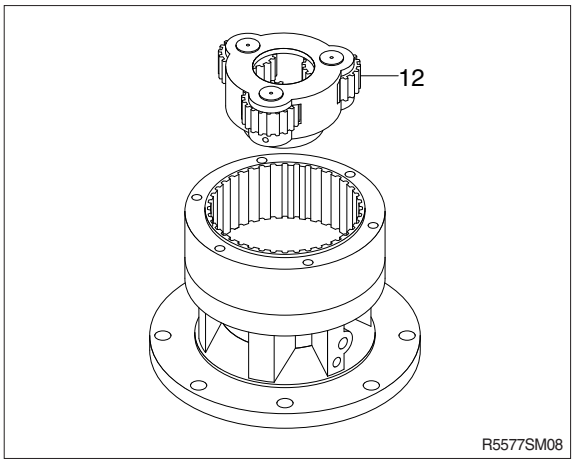


(4) Remove the No.2 sun gear (7).

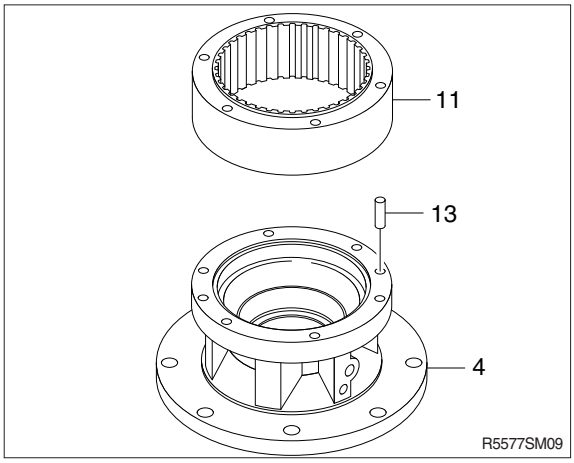
※ Pay attention to ensure the gear is not damaged during disassembling.



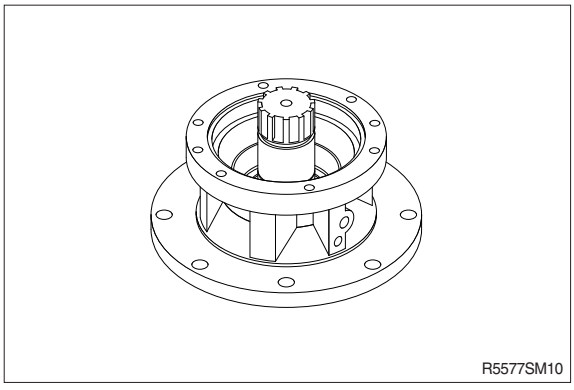
(5) Remove the No.2 carrier sub assembly (12).



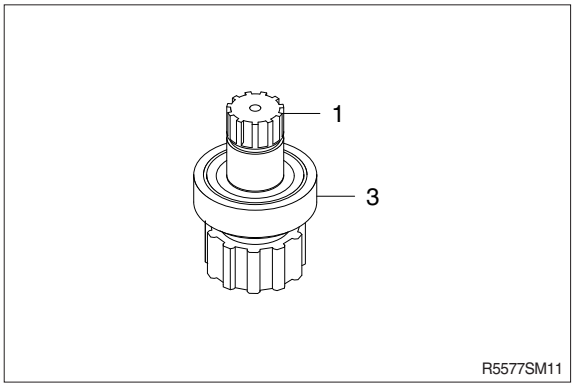
(6) Remove the ring gear by the removal groove between the ring gear (11) and casing (4) by using jig.
Full out the knock pin (13).
Do not need to remove the knock pin (13) if it is not worn or damaged.



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

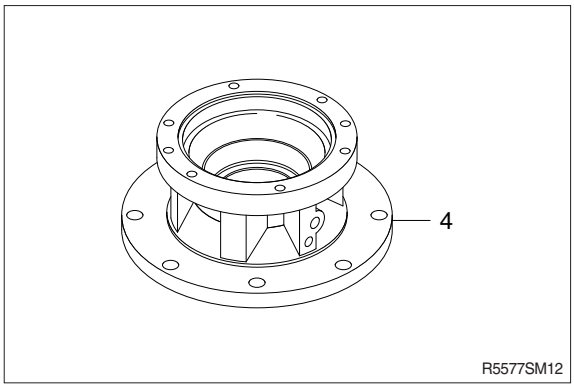


(8) Disassemble the drive shaft (1) with bearing (3) by using jig.



3) ASSEMBLING SWING REDUCTION GEAR

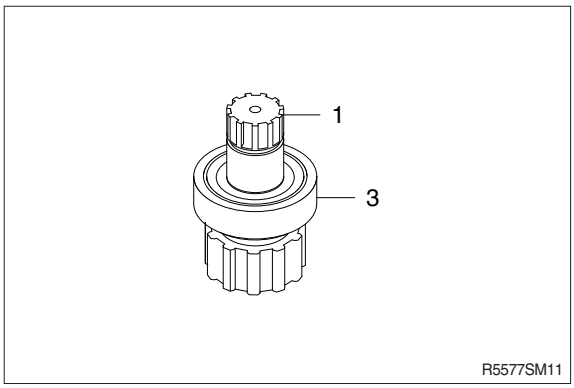
(1) Place the case (4) on the reversing machine having the flange side of the case up.



(2) Install shaft assembly (1) into case (4).

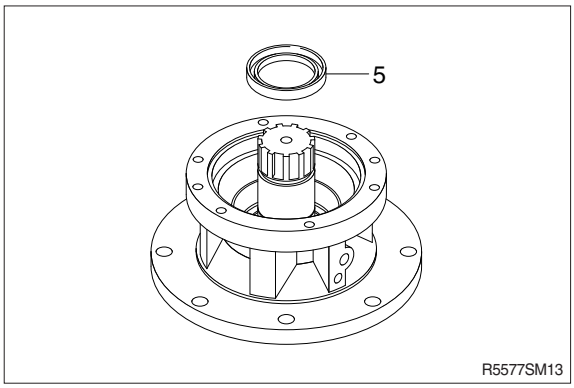
※ Be sure to clean the case before install, using washing machine with the temperature of 80˚C

※ Do not install shaft assembly by force.

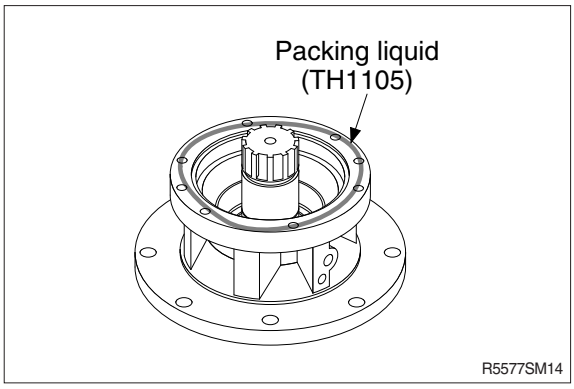


(3) Reverse case and press to insert oil seal (5) by using pressing jig after spreading grease oil around the outside ring of the seal and bearing.
Coat grease oil slightly on the lip surface to prevent any scratch when installing.

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



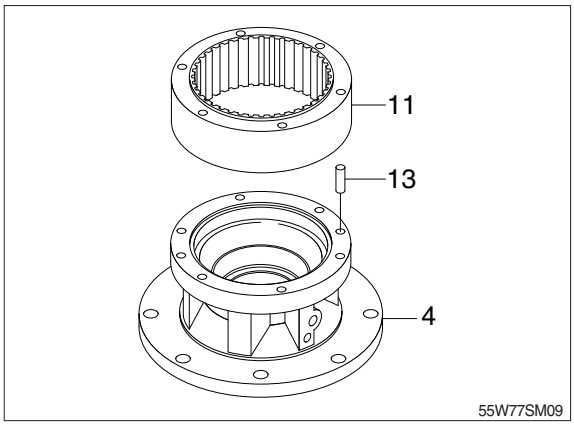
(4) Clean the assembling surface of case and spread packing liquid (TH1105) as shown in figure.



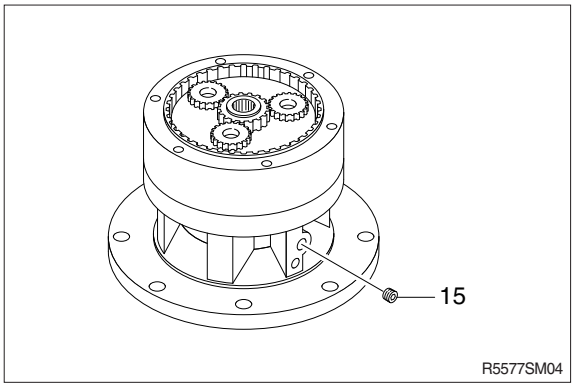
(5) Place ring gear on the case by matching it with knock pin hole.

(6) Insert 2 knock pins by using jig.

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

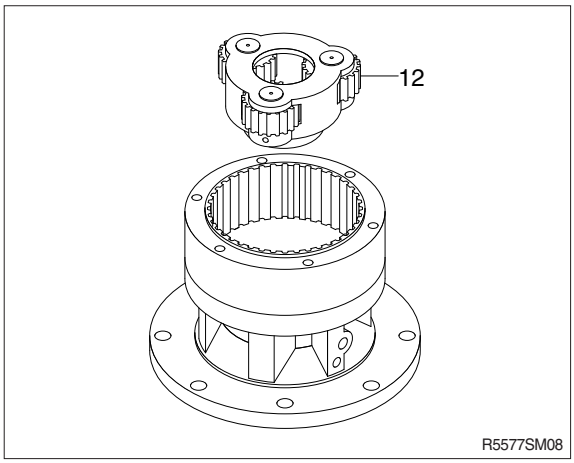


(7) Screw drain plug into drain plug (15) after winding sealing tape.



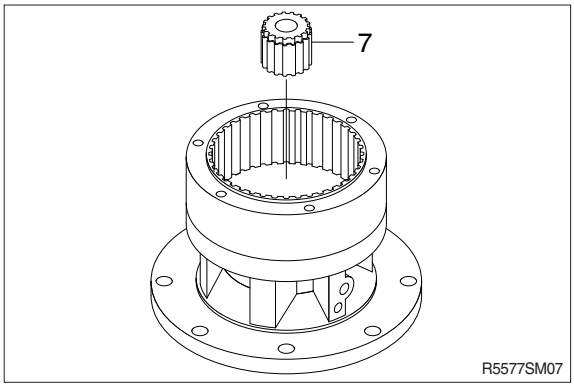
(8) Mount No.2 carrier assembly (12) in the case sub assembly and install bolts into 2 TAP holes (M6) as shown in figure.

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



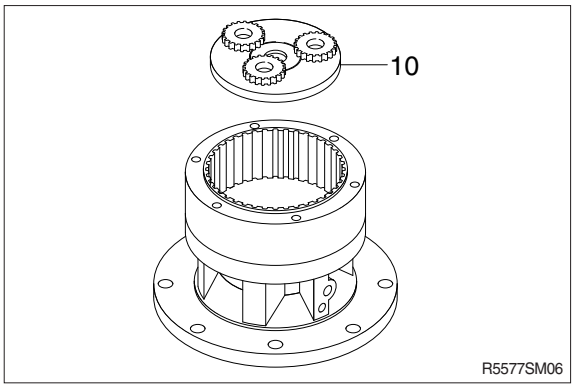
(9) Install No.2 sun gear (7).

※ Be sure to check the direction of sun gear (7) when assembling.

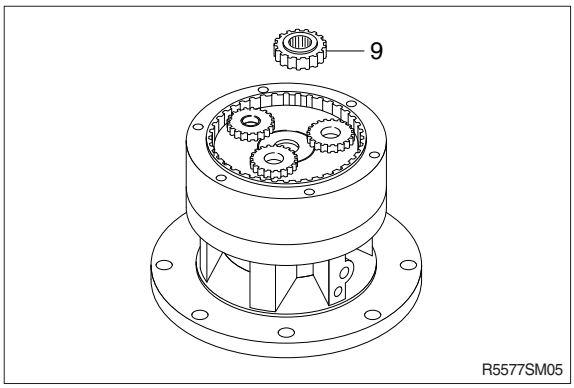


(10) Mount No.1 carrier assembly (10) in the case sub assembly and install bolts into 2 TAP holes (M6) as shown in figure.

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



(11) Assemble No.1 sun gear (9).



GROUP 6 TRAVEL MOTOR

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.

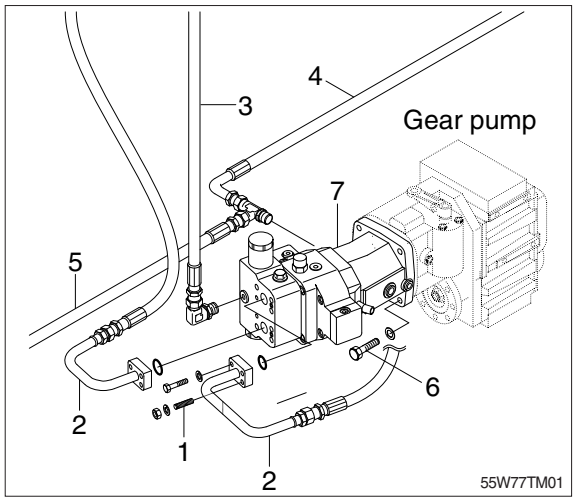
⚠ Escaping fluid under pressure can penetrate the skin causing serious injury.

(4) Loosen the socket stud (1) and remove the pipe assy (2).

(5) Disconnect hoses (3,4,5).

(6) Loosen the hex bolt (6) and remove travel motor (7).
·Weight : 80 kg (180 lb)

※ When removing the travel motor assembly, check that all the hoses have been disconnected.



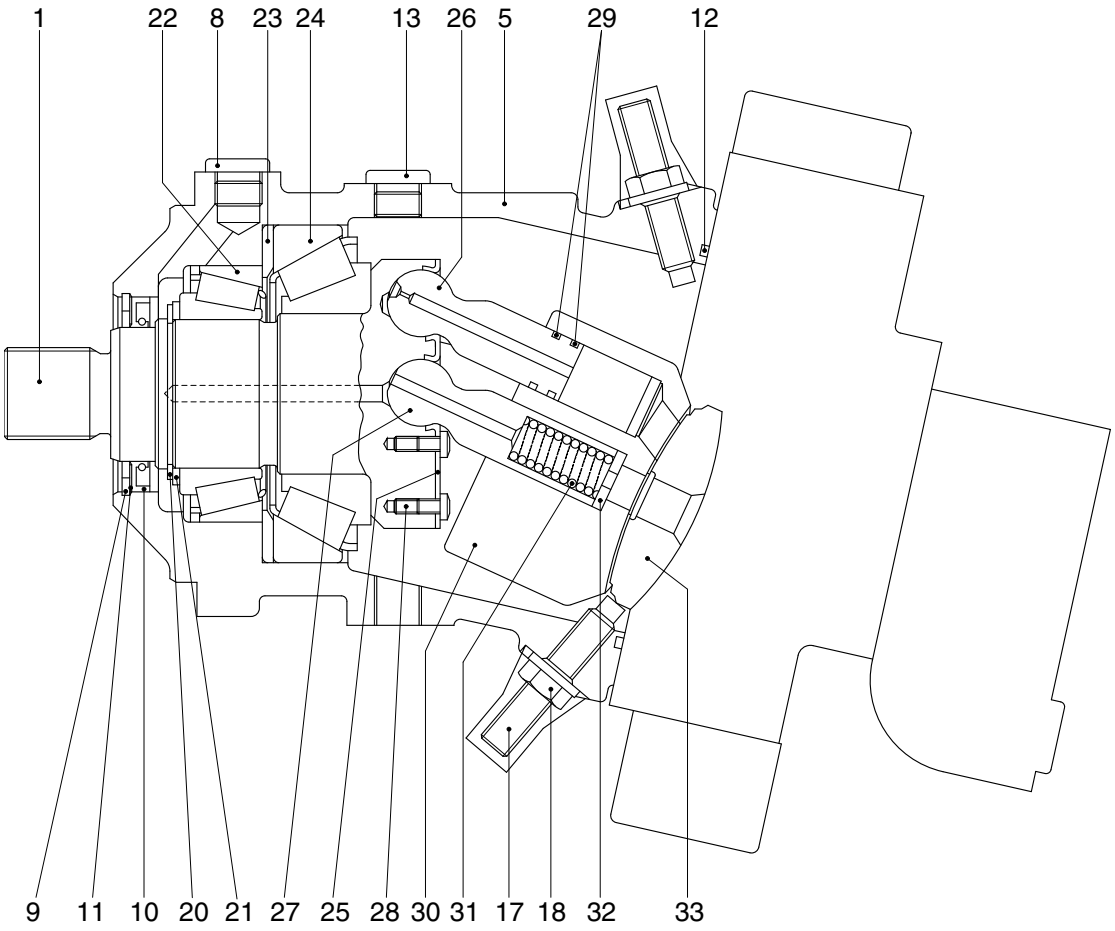
2) INSTALL

(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. STRUCTURE

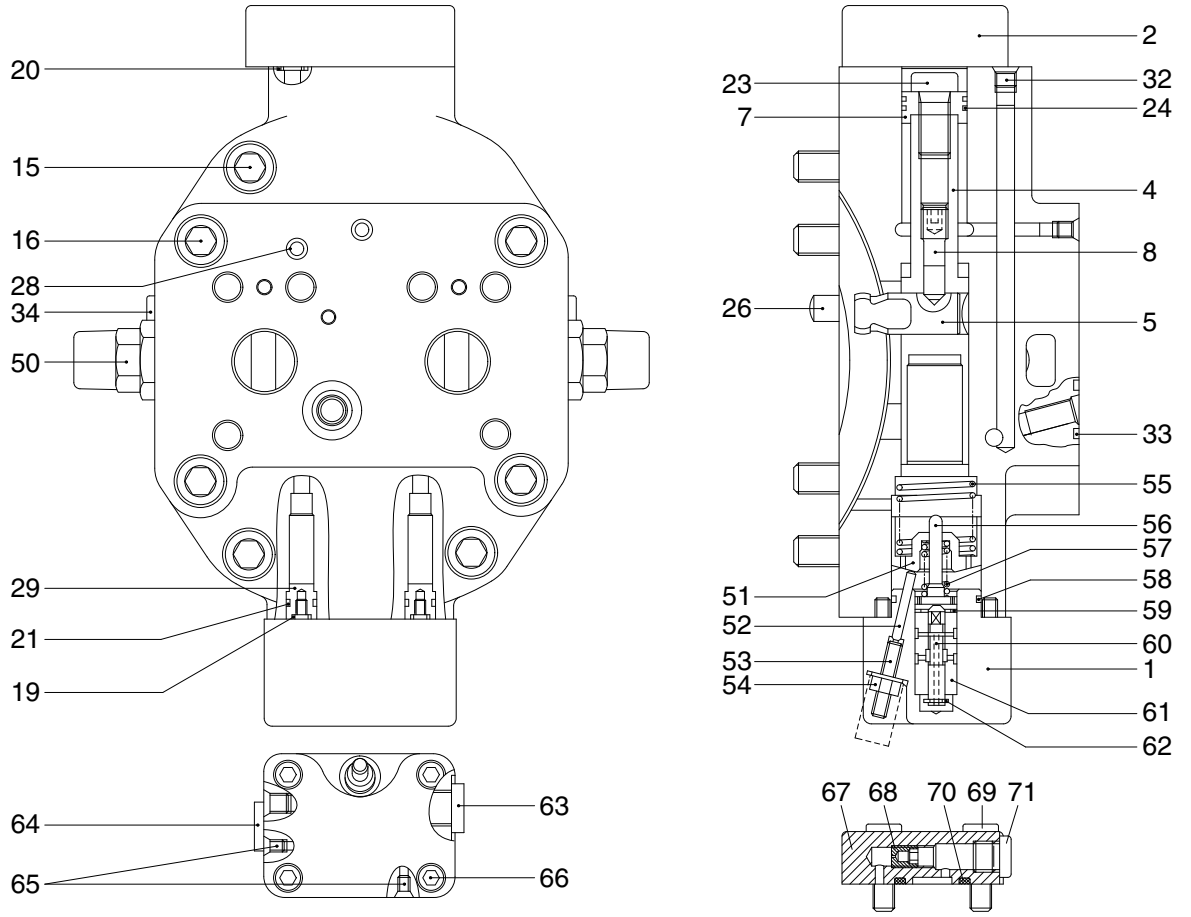
1) MOTOR UNIT



200W34TM02

1	Drive shaft	17	Threaded pin	26	Piston
5	Housing	18	Seal lock nut	27	Center pin
8	Locking screw	20	Retaining ring	28	Pan head screw
9	Retaining ring	21	Back up plate	29	Steel sealing ring
10	Shaft seal ring	22	Taper roller bearing	30	Cylinder block
11	Back up plate	23	Shim	31	Pressure spring
12	O-ring	24	Taper roller bearing	32	Adjustment shim
13	Locking screw	25	Retaining plate	33	Control lens

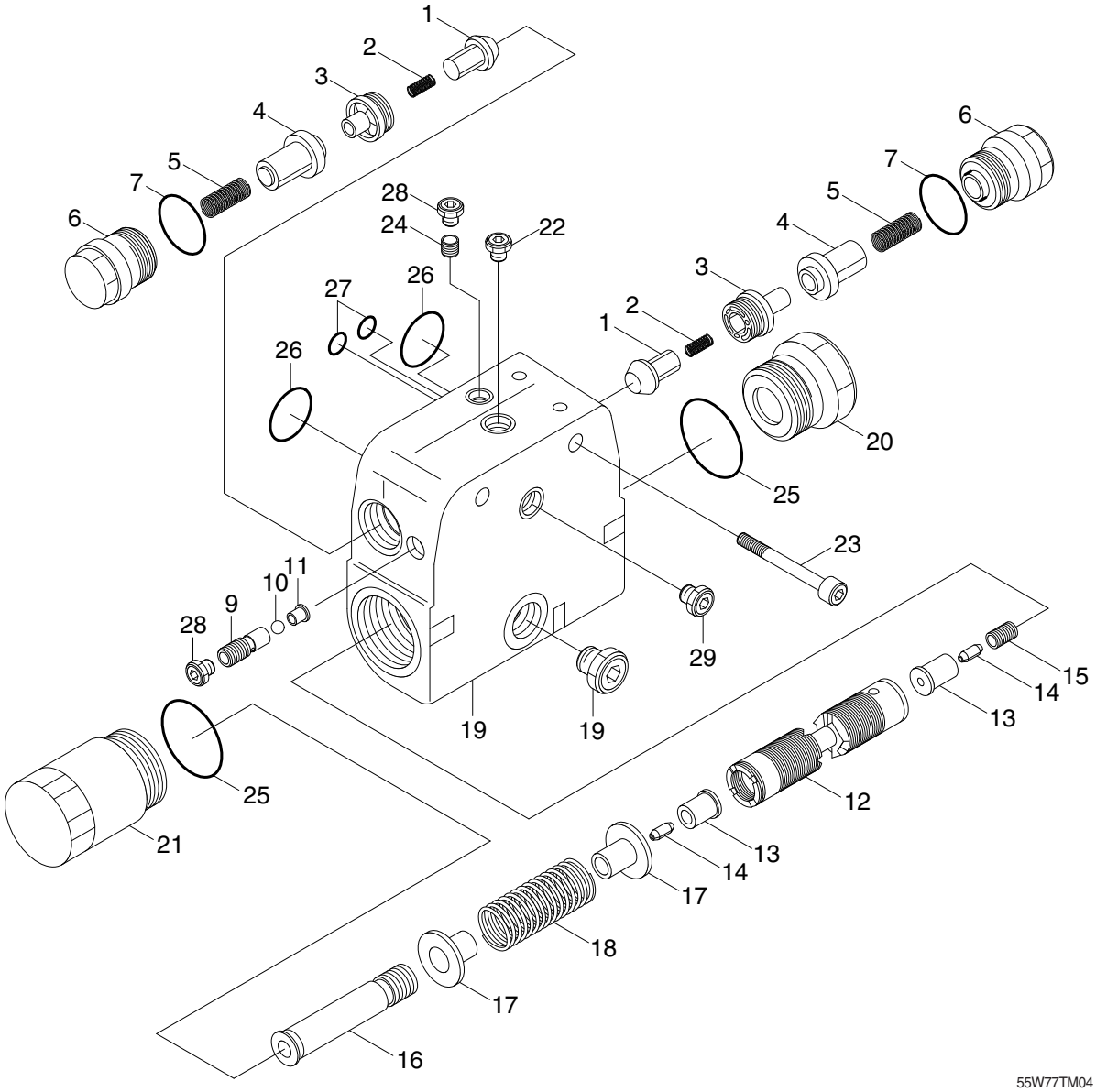
2) CONTROL UNIT



55W72TM03

1	Control housing	28	Double break off pin	59	Retaining ring
2	Cover	29	Plug	60	Control piston
4	Positioning piston	32	Double break off pin	61	Control bushing
5	Positioning trunnion	33	O-ring	62	Retaining disc
7	Piston	34	Locking screw	63	Locking screw
8	Threaded pin	50	Relief valve	64	Locking screw
15	Socket head screw	51	Adjusting bushing	65	Double break off pin
16	Socket head screw	52	Cylinder pin	66	Socket head screw
19	O-ring	53	Threaded pin	67	Cover
20	O-ring	54	Seal lock nut	68	Throttle screw
21	O-ring	55	Pressure spring	69	Socket head screw
23	Socket head screw	56	Spring collar	70	O-ring
24	Square ring	57	Pressure spring	71	Locking screw
26	Cylinder pin	58	O-ring		

3) COUNTER-BALANCE VALVE



1	Valve poppet	12	Brake piston	21	Locking screw
2	Pressure spring	13	Valve bushing	22	Locking screw
3	Poppet seat	14	Throttle pin	23	Socket screw
4	Valve poppet	15	Valve screw	24	Plug
5	Pressure spring	16	Bolt	25	O-ring
6	Locking screw	17	Spring collar	26	O-ring
7	O-ring	18	Pressure spring	27	O-ring
9	Valve screw	19	Housing	28	Locking screw
10	Ball	20	Locking screw	29	D/Break OFF pin
11	Bushing				

3. TIGHTENING TORQUE

The torques given are standard figures. Any figures specifically described in the procedure has priority.

Page	Item	Size	kgf·m	lbf·ft
8-75	8	M22 × 1.5	6.1	44
	13	M26 × 1.5	7.1	51
	18	M12	7.0	50.9
	28	M 6 × 20	1.4	10.3
8-76	15	M16 × 45	21.4	155
	23	M14 × 25	13.8	99.5
	34	M18 × 1.5	4.0	29
	53	M 6 × 30	1.4	10.3
	54	M6	1.0	7.4
	63	M14 × 1.5	3.0	22
	66	M 8 × 40	2.5	18.4
	69	M12 × 35	12.2	88.4
	71	M14 × 1.5	3.0	22

4. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

(1) Disassembly

① Before disassembling the motor, check the items to be inspected and, for remedy against trouble, closely examine the nature of the trouble, so that the motor can be disassembled effectively.

② To disassemble the motor, use the disassembling procedures described in section 2) and select a clean place.

③ Place a rubber or vinyl sheet or other such protective materials on your working bench to protect the surface of the motor to be serviced.

④ During disassembly, give a match mark to the mating surfaces of each part.

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

⑥ Once seals have been disassembled, they should be replaced even if damage is not observed. Have replacement seals ready on hand before starting your disassembling job.

(2) Assembly

① Reassemble in a work area that is clean and free from dust and grit.

② Handle parts with bare hands to keep them free of linty contaminants.

③ Repair or replace the damaged parts.
Each parts must be free of burrs its corners.

④ Do not reuse O-ring oil seal and floating seal that were removed in disassembly.
Provide the new parts.

⑤ Wash all parts thoroughly in a suitable solvent.
Dry thoroughly with compressed air.
Do not use the cloths.

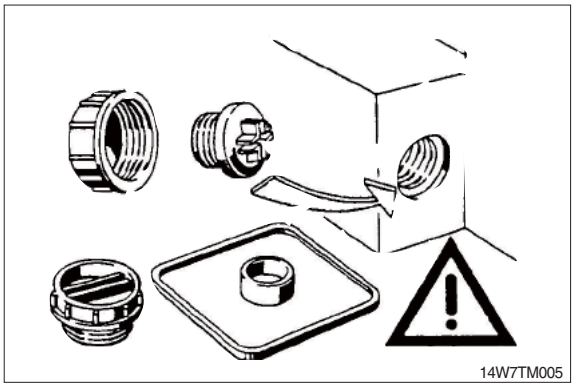
⑥ When reassembling oil motor components of motor, be sure to coat the sliding parts of the motor and valve with fresh hydraulic oil. (NAS class 9 or above)

⑦ Use a torque wrench to tighten bolts and plugs, to the torque specified as follows.

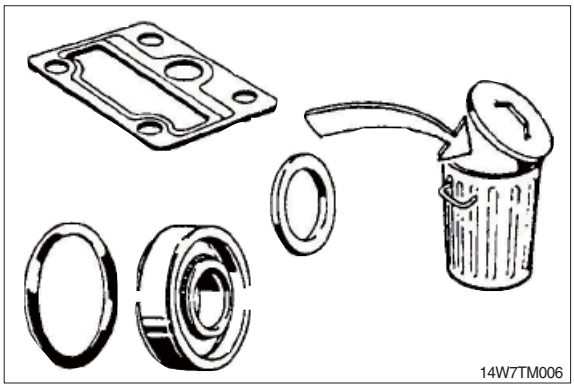
2) SEAL KITS AND COMPONENT GROUPS

Observe the following notices when carrying out repair work at hydraulic aggregates.

(1) Close all ports of the hydraulic aggregates.

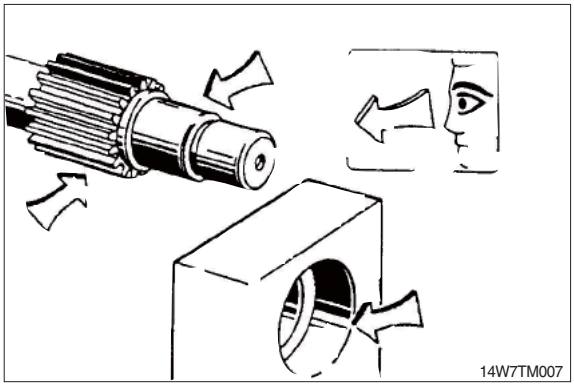


(2) Replace all seals.
Use only original hydromatik spare parts.

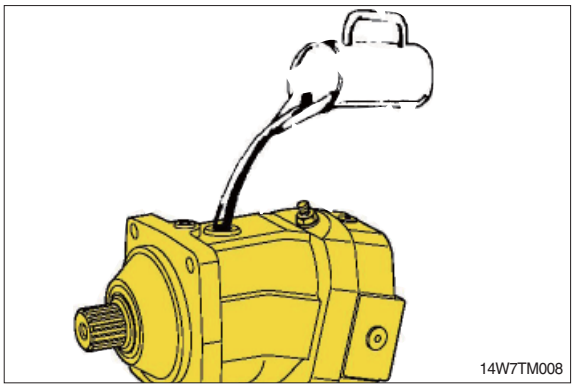


(3) Check all seal and sliding surfaces for wear.

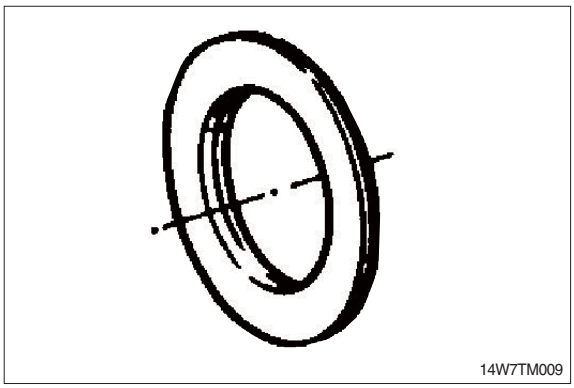
※ Rework of sealing area f.ex. with abrasive paper can damage surface.



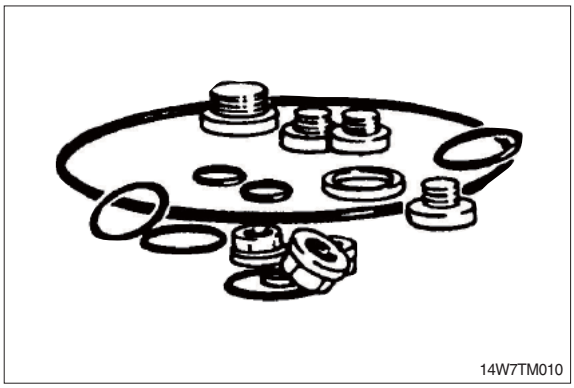
(4) Fill up hydraulic aggregates with hydraulic oil before start up.



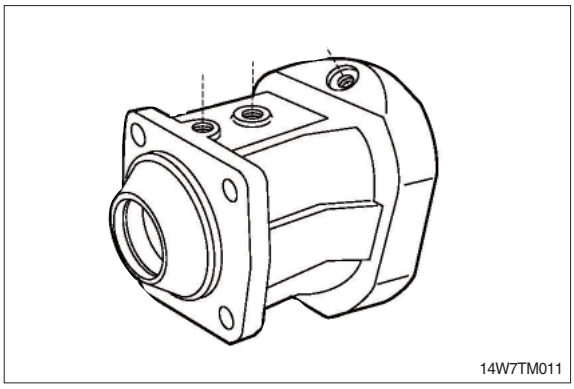
(5) Seal kit for drive shaft



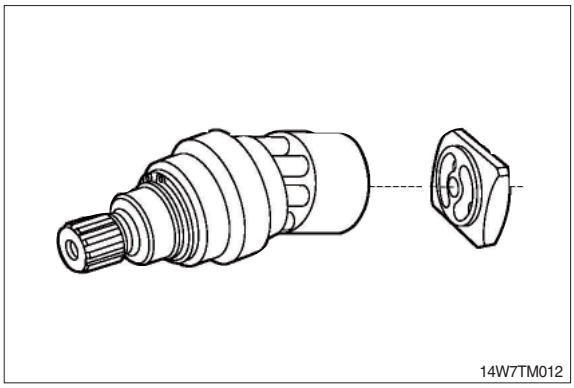
(6) External seal kit.



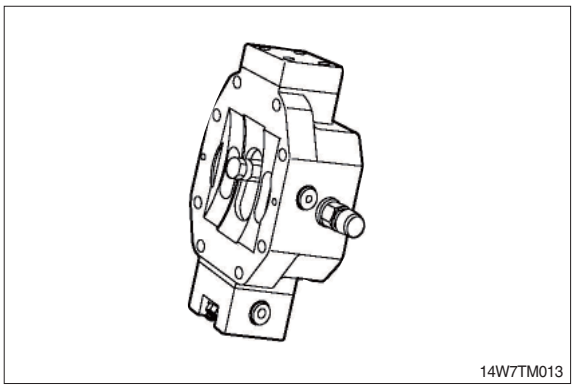
(7) Housing.



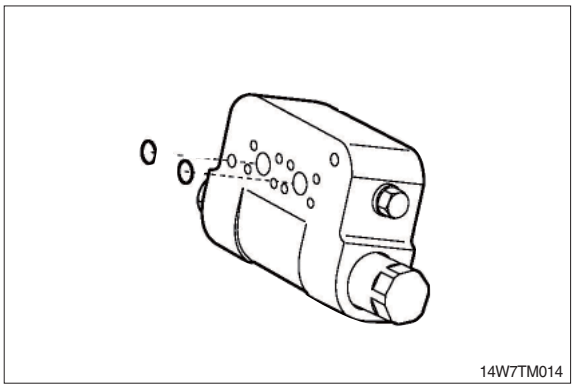
(8) Complete rotary group.



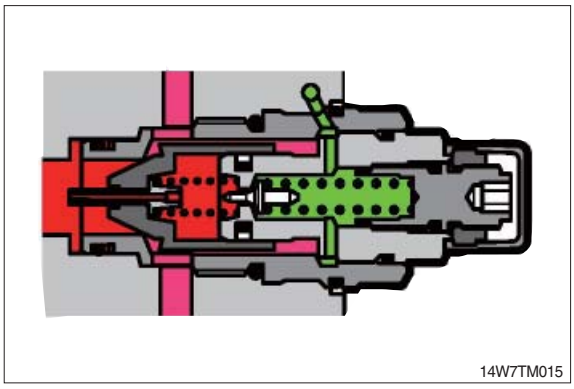
(9) Port plate with control piston.



(10) Counter balance valve.

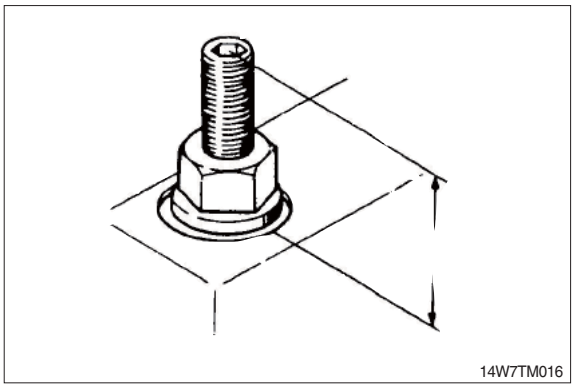


(11) Relief valve / Make up check valve.

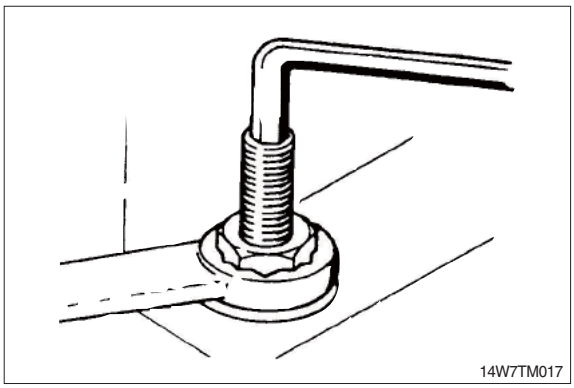


3) SEAL NUT

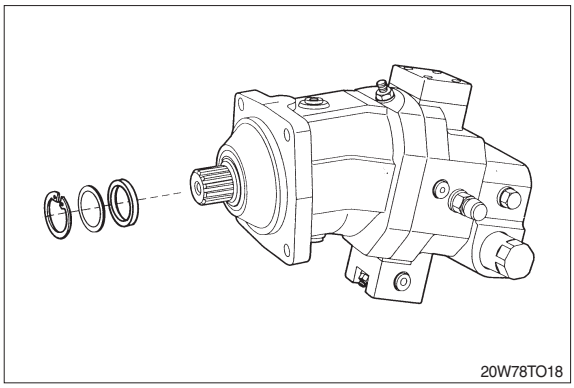
(1) Replace seal nut.
First measure and record setting height.



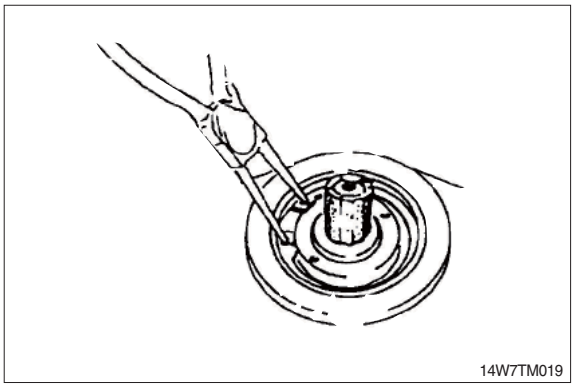
(2) When tightening, counterhold setting screw, then check setting height.



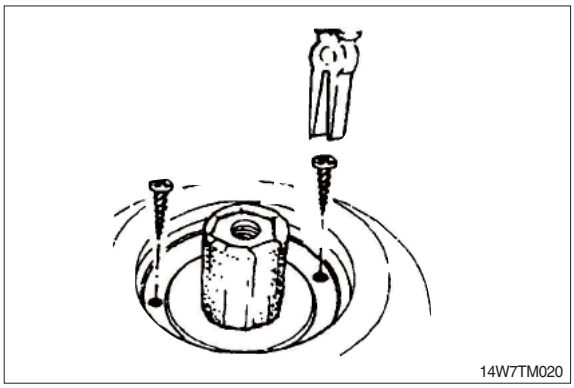
4) SEALING THE DRIVE SHAFT



(1) Protecting the drive shaft.
Remove retaining ring and shim.



(2) Screw in sheet metal screw into the holes fitted with rubber.
Pull out seal with pliers.

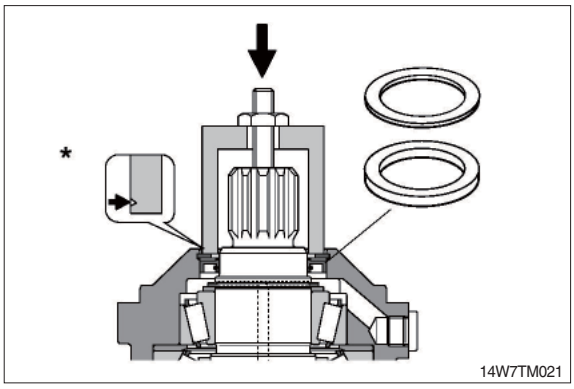


(3) Press in shaft seal and shim with bush to stop.

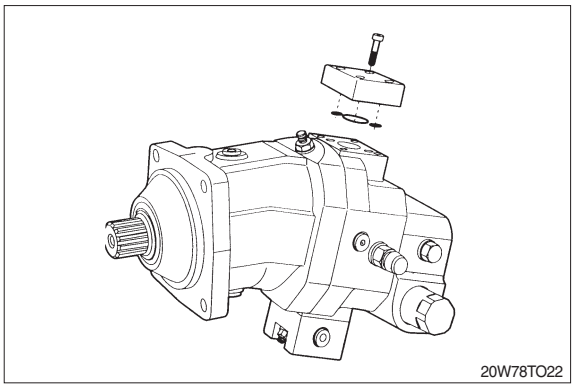
⚠ **Pay attention to pressing depth.**

* Mark for pressing depth.

Assemble retaining ring.

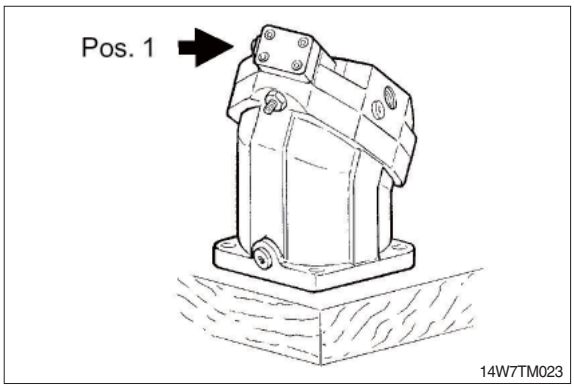


5) SEALING OF THE CONTROL PARTS



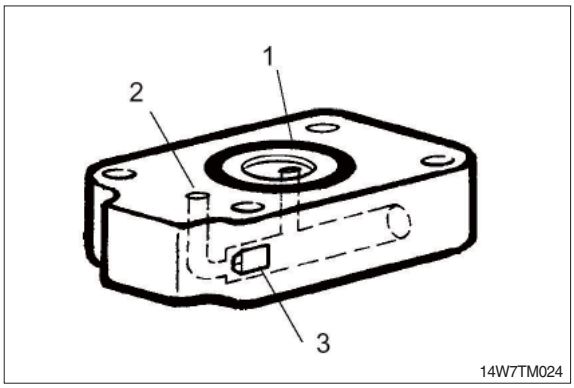
(1) Disassembly position

Remove cover 1.

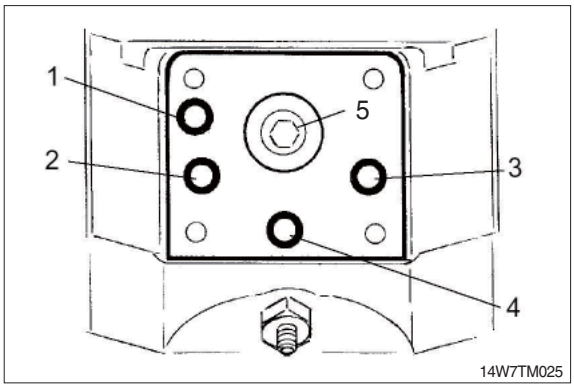


1 O-ring
2 Input flow of oil control
3 Throttle pin

※ Installation position differs according to the control components.

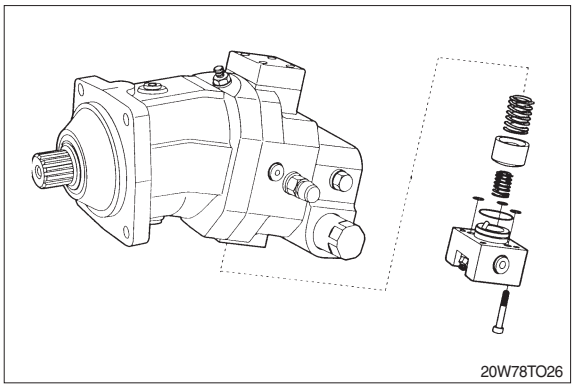


1 Input flow of oil control
2 High pressure / Low pressure
3 High pressure / Low pressure
4 Leakage oil
5 Control piston

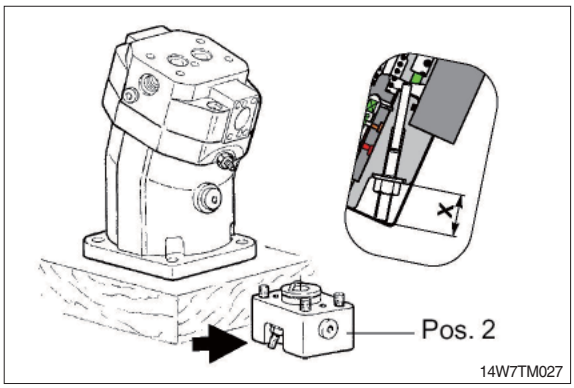


(2) Disassembly position : Remove cover 2.

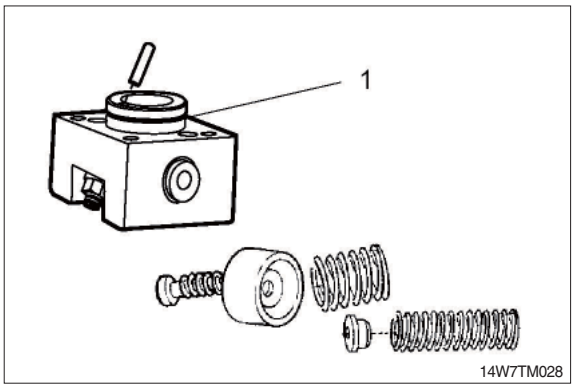
※ Attention spring load.



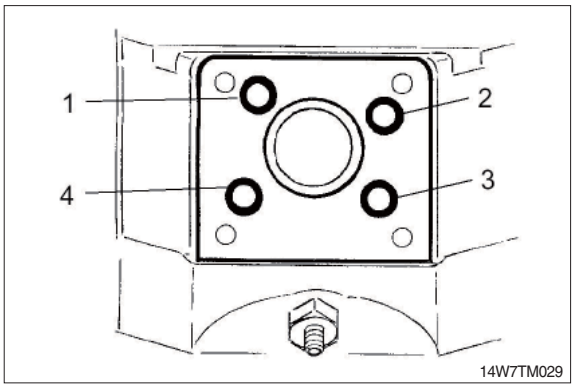
※ Dimension X : Note dimension (begin of regulation)



1 Check of O-ring

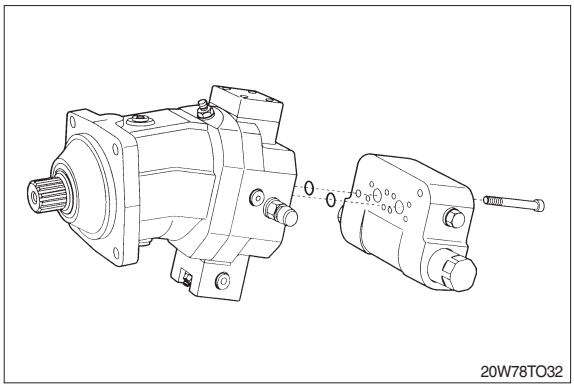


1 O-ring / High pressure-small control position side
2 O-ring / Control pressure
3 O-ring / High pressure-check valve
4 O-ring / High pressure-check valve

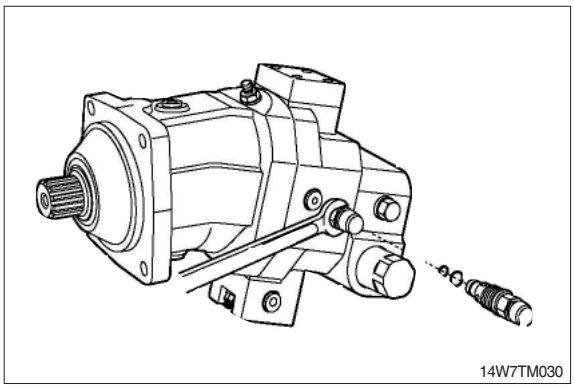


6) SEALING OF THE RELIEF VALVE / COUNTER BALANCE VALVE

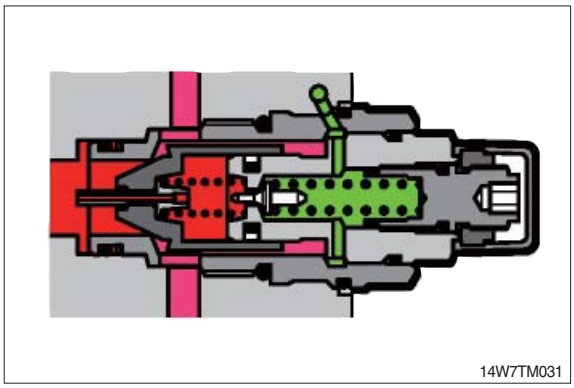
·Remove counter balance valve
·Inspect
·O-ring



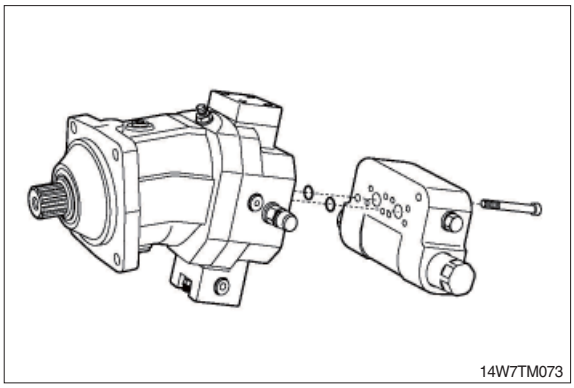
(1) Remove relief valve



(2) Inspect
O-ring



(3) Remove counter-balance valve.
Inspect
O-ring

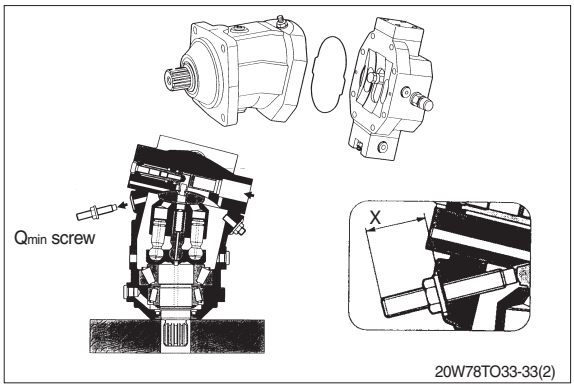


7) DISASSEMBLY OF THE PORT PLATE

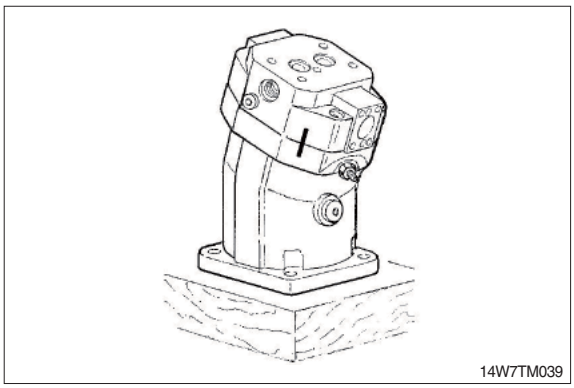
·Note dimension X

·Remove Q_{min} screw

·Swivel rotary group to zero P

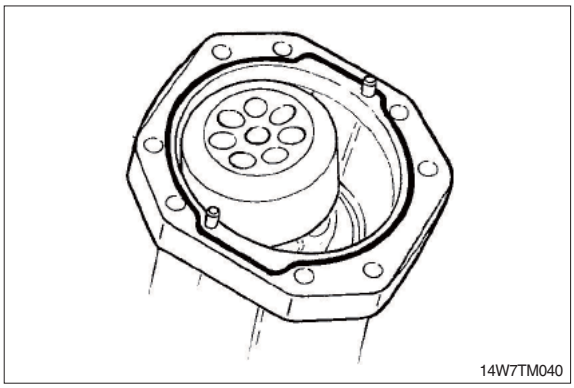


(1) Port plate.
Mark position. Loosen screws.
Removal.

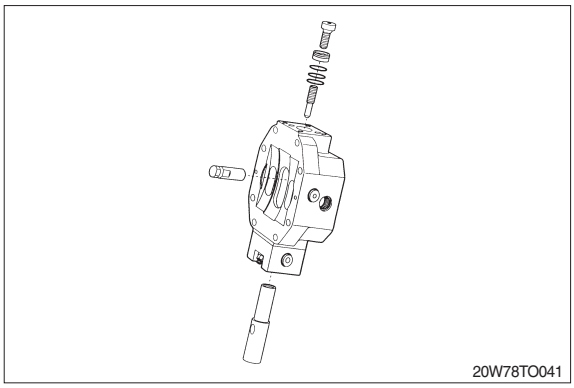


(2) Check O-ring.

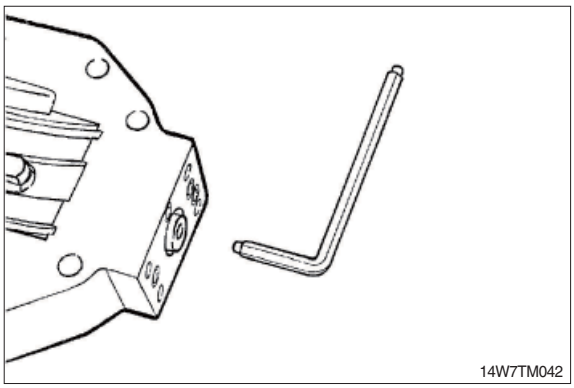
※ Stick new O-ring with some grease.
Do not swivel rotary group.
Piston rings to hang out from the cylinder boring.



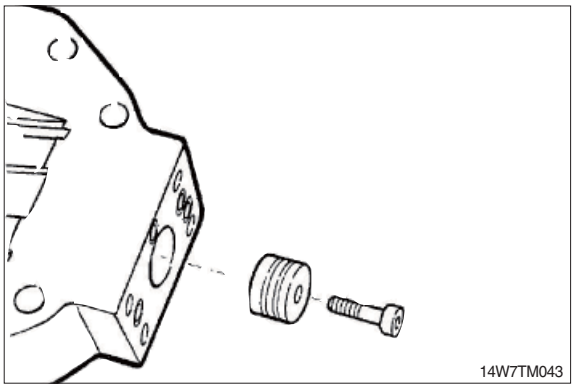
8) REMOVE OF THE POSITIONING PISTON



(1) Loosen fixing screw.
Use only socket wrench.

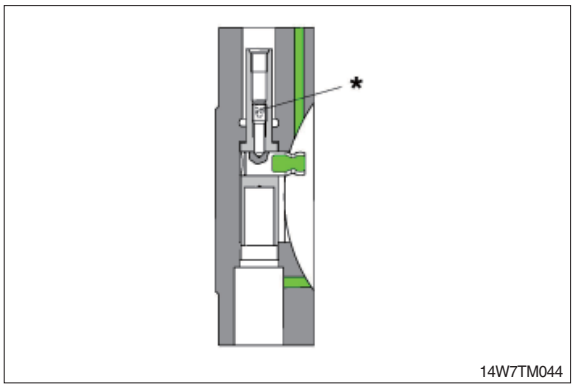


(2) Remove piston with piston ring.



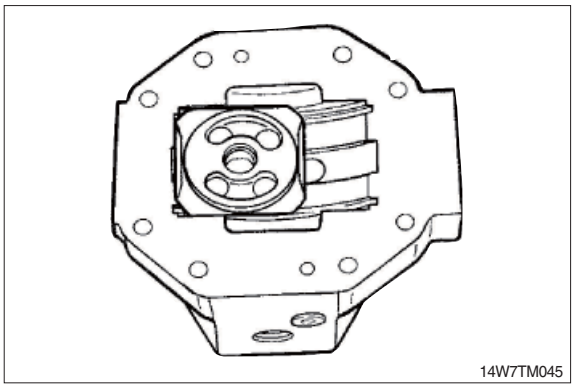
(3) Warm up fixation screw *for positioning plug via boring (screw glued-to turn out).

※ Use new screw.
Precode coating.
Note tightening torque.

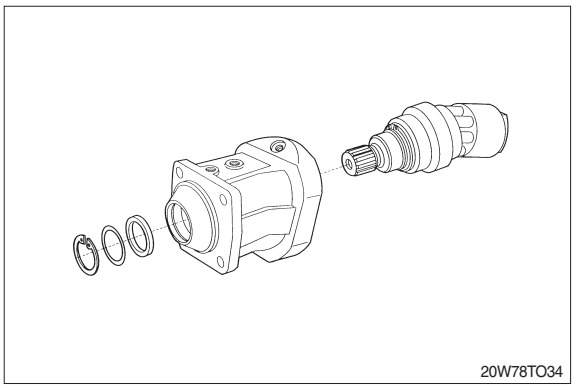


※ Stick control lens in sliding surface with grease. Assembly in reversal order. Mount port plate.

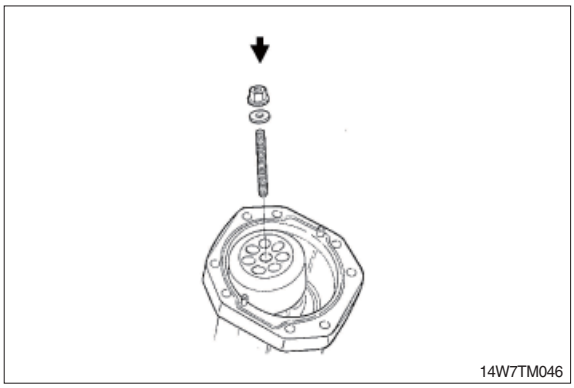
※ Rotary group vertical.



9) REMOVE ROTARY GROUP

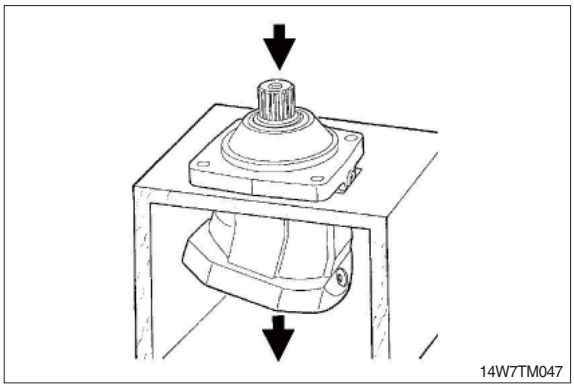


(1) Screw in threaded pin into center pin. Fix the cylinder with disc and locknut. M8×105ℓ



(2) Press out rotary group.

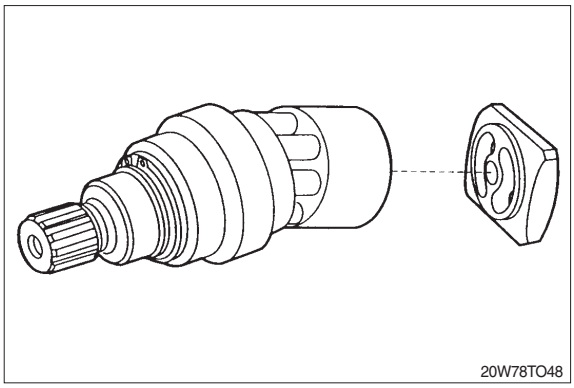
※ If the bearings are used again do not hit on the drive shaft.



10) EXCHANGING OF THE ROTARY GROUP

Complete rotary group

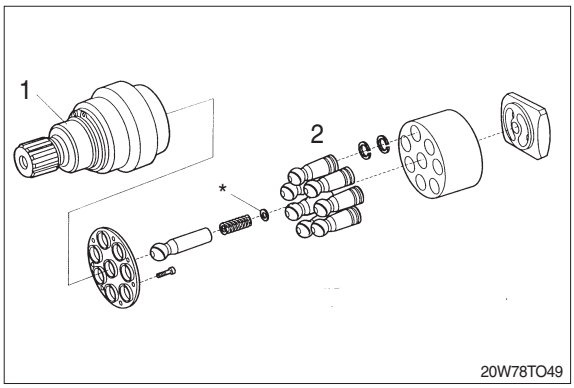
※ Setting of hydraulic part necessary.



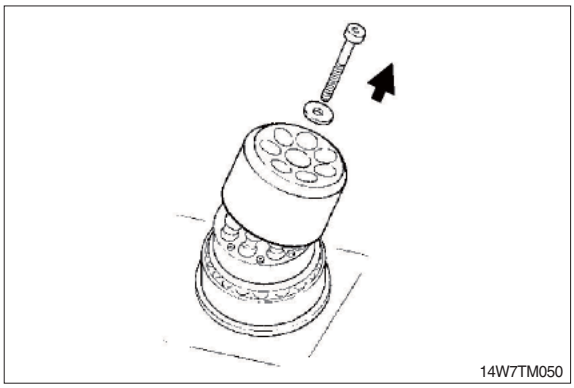
Rotary group

1 Mechanical part : Adjust drive shaft with bearing

2 Hydraulic part : Adjustment necessary

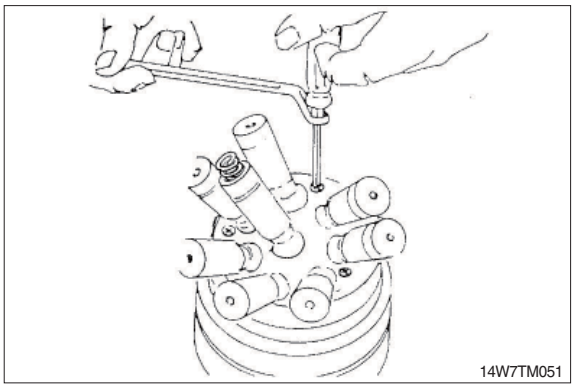


(1) Remove fixing screw (cylinder).
Remove cylinder.



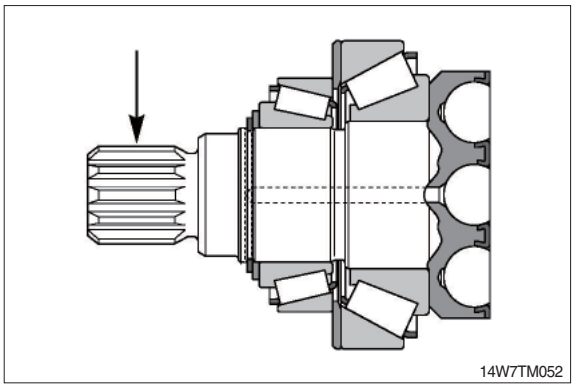
(2) Disassemble retaining plate.

※ Screws are glued.
Use Torx tools.



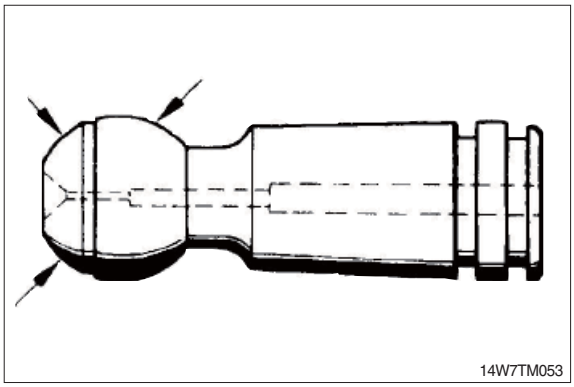
11) INSPECTION INSTRUCTIONS

(1) Free of corrosion, erosion or fretting; No damage to splines or keyways.



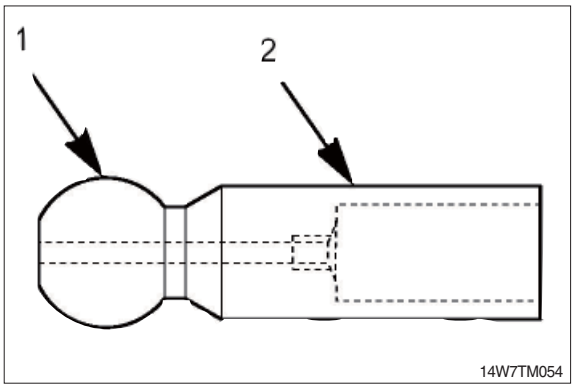
(2) Pistons

No scoring and no pittings.



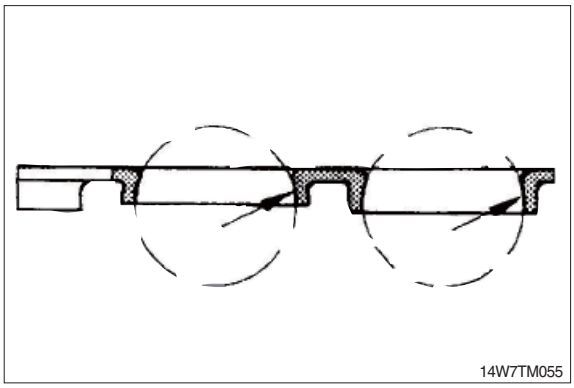
(3) Center pin

No scoring and no pittings.



(4) Retaining plate

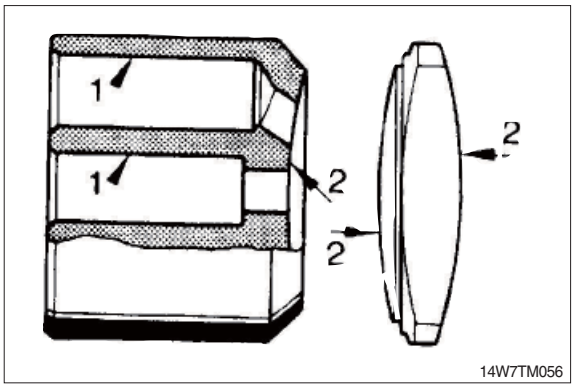
No scoring and no evidence of wear.



(5) Cylinder block / Control lens

1 Bores free of scoring, no evidence of wear

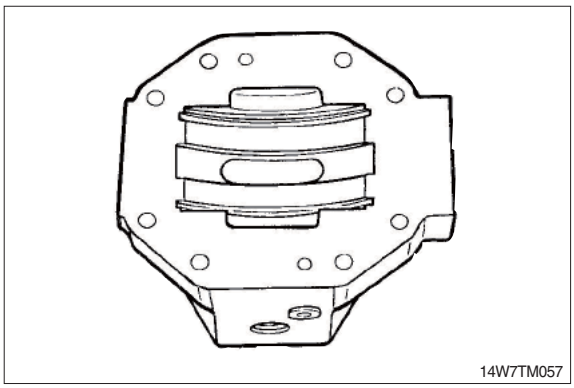
2 Faces smooth and even, free of cracks and scoring



14W7TM056

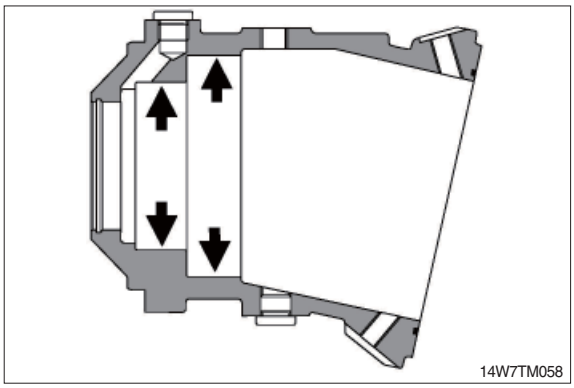
(6) Control housing

Sliding surface and side guides free of scoring and no wear.


14W7TM057

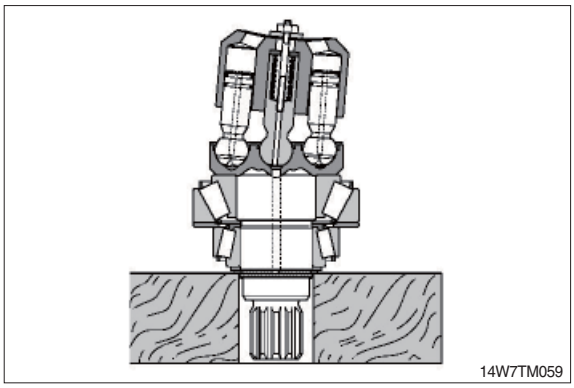
(7) Visual check

Bearing areas free of scoring and no evidence of wear.

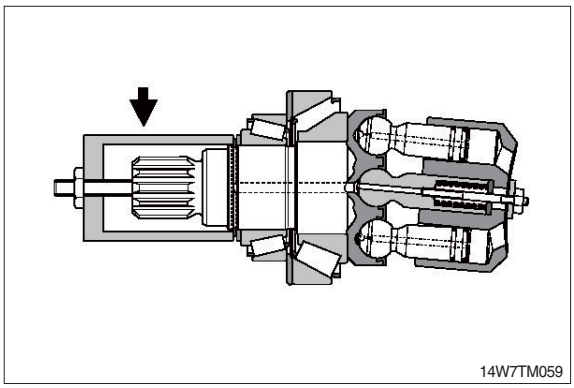

14W7TM058

12) ROTARY GROUP ASSEMBLY

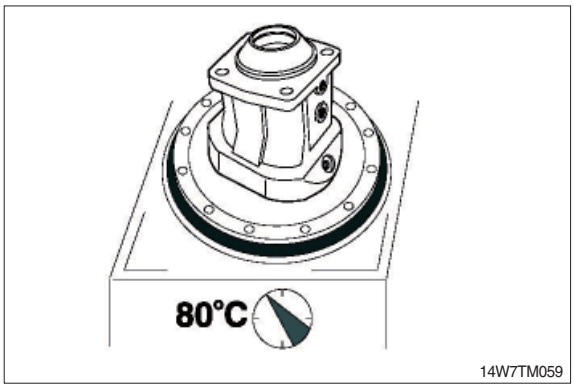
(1) Rotary group completely assembled ready for assembly.



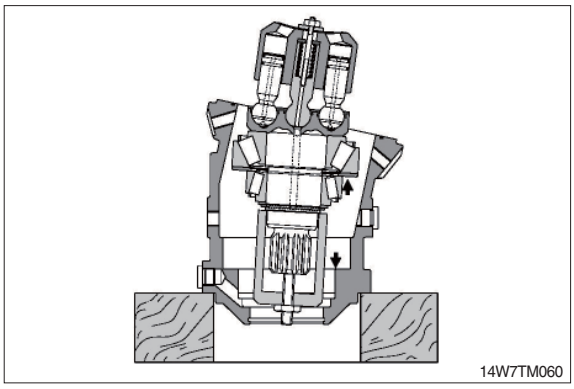
(2) Place assembly sleeve.



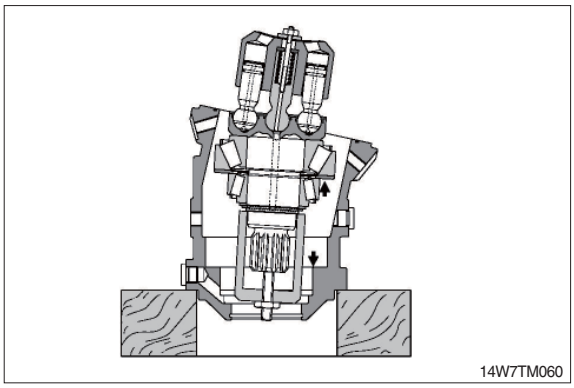
(3) Warm up housing to 80˚C.



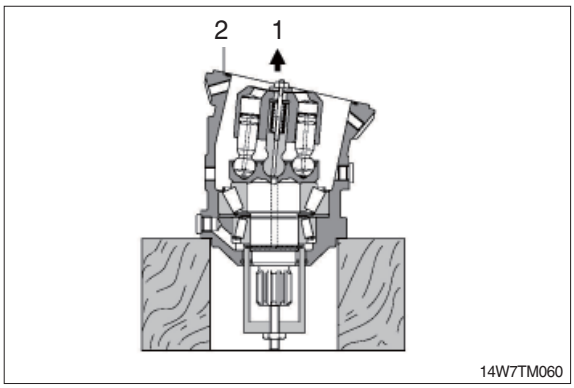
(4) Insert rotary group into housing to seat position.



(5) Insert rotary group into housing to seat position.

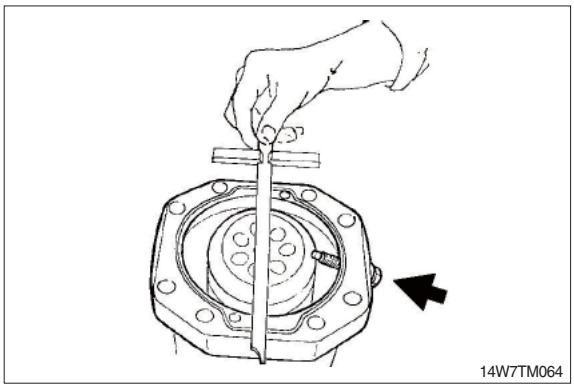


(6) Fix zero position of cylinder with Q_{max} screw.
1 Disassemble cylinder fixing screw
2 Insert O-ring

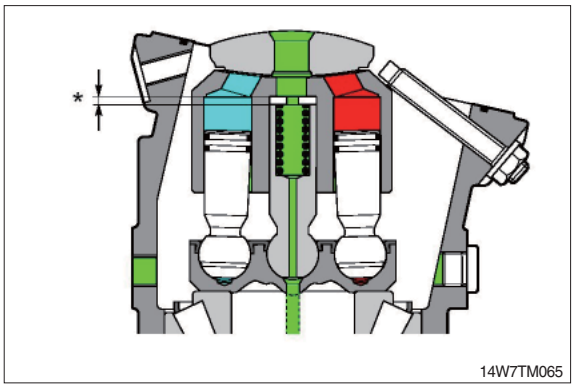


13) ROTARY GROUP ADJUSTMENT

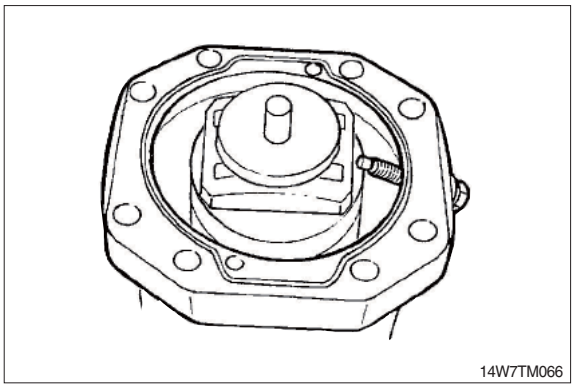
(1) Determine cylinder swivel range to max angle with screw.



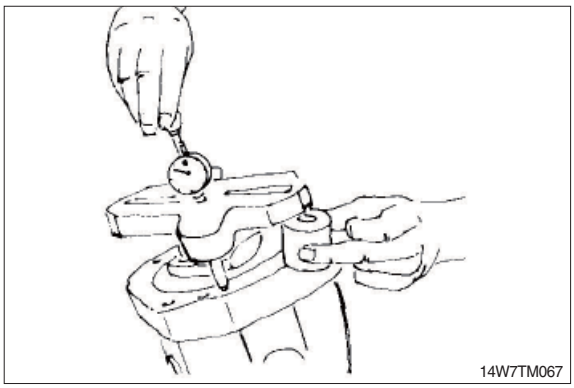
(2) * Disc



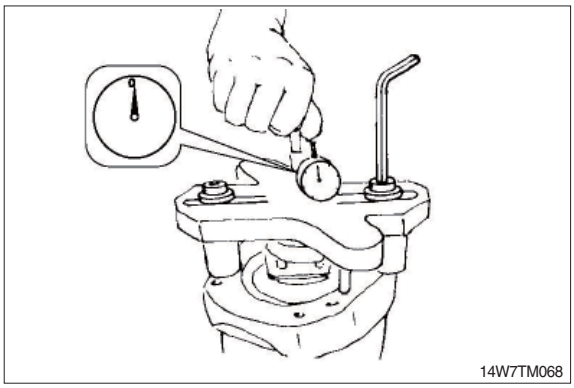
(3) Place centering disc.



(4) Mount measuring device.



(5) Check dimension X.



14) ASSEMBLY OF THE PORT PLATE

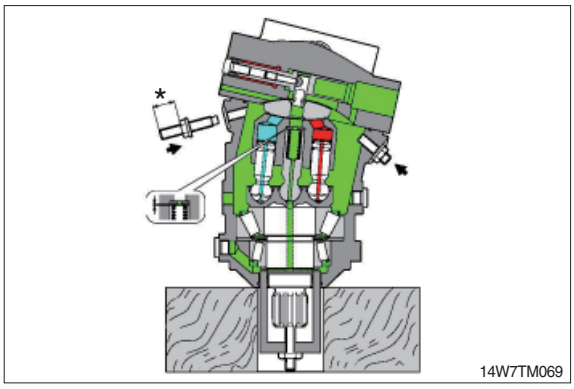
(1) Assemble port plate.

※ Take care of assembly design.
Tighten fixing screws with torque.

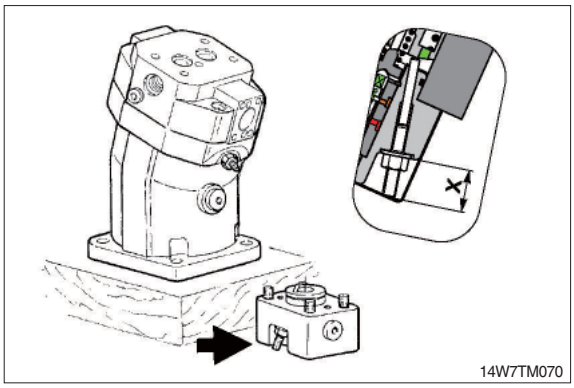
(2) Set Q_{min} screw to dimension (*).

(3) Assemble plug.

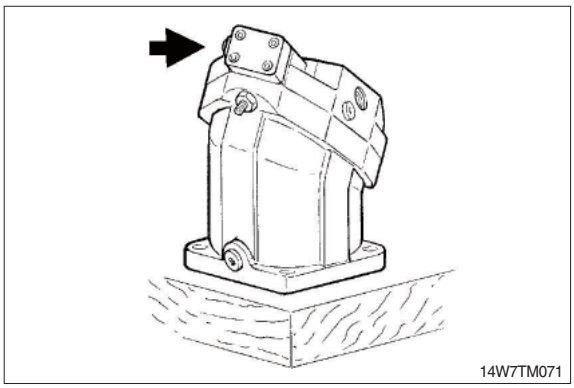
(4) Remove assembly sleeve.



(5) Assemble control components.

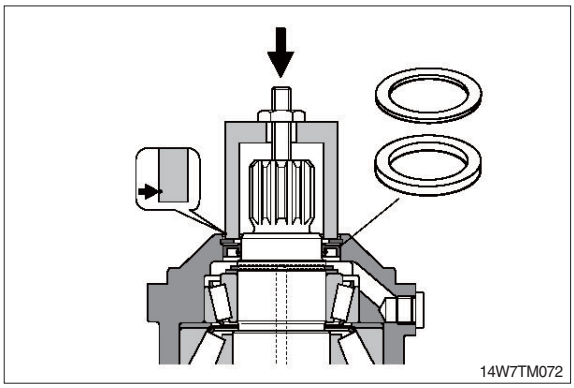


(6) Assemble cover.

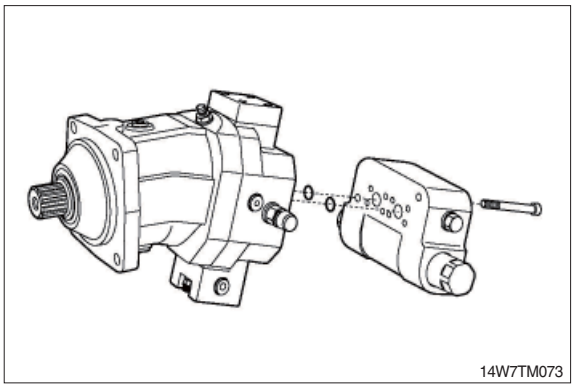


(7) Assemble shaft seal, disc and safety ring.
Press in with assembly sleeve.

※ Take care of press in depth.



(8) Assemble counter balance valve.



1. REMOVAL AND INSTALL

1) REMOVAL

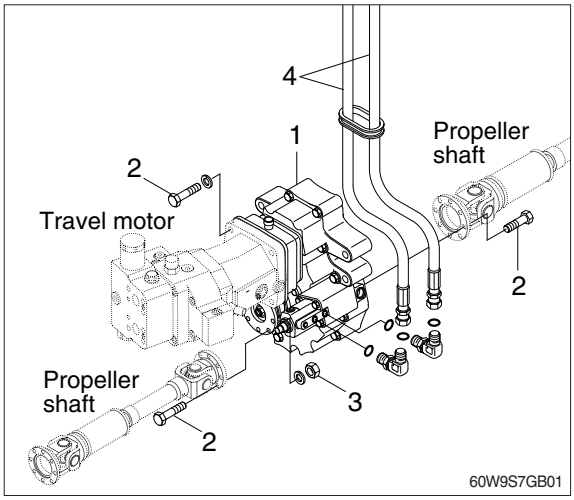
(1) Swing the work equipment 90° and lower it completely to the ground.

(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 propeller shaft mounting nuts (3).
- Tightening torque : 7.4±1.5 kgf · m (53.5±10.8 lbf · ft)

(5) Remove the travel motor mounting bolts (2).
- Tightening torque : 14.7±2.2 kgf · m (53.5±10.8 lbf · ft)

(6) Remove the hoses (4).

※ Fit blind plugs to the disconnected hoses.

(7) Remove the mounting bolts (2), then remove the gear box (1) device assembly.
- Weight : 63 kg (140 lb)
- Tightening torque : 19.6±2.9 kgf · m (142±21 lbf · ft)

2) INSTALL

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

(2) Bleed the air from the gear box.
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. INSTRUCTIONS

The efficiency and continued operation of mechanical units depend on constant and correct maintenance and also on efficient repair work, should there be a break-down or malfunction. The instructions in this manual have been based on a complete overhaul of the unit. However, the mechanic must decide whether or not it is necessary to dismantle the individual components when only partial repair work is needed. The manual provides a quick and sure guide which, with the use of photographs and diagrams illustrating the various phases of the operations, allows to perform accurate work to take place.

Therefore all the information needed for correct disassembly, the relative check and assembly of each individual component, has been written down.

In order to remove the different unit from the vehicle, the manuals provided by the vehicle manufacturer should be consulted. In describing the following operations it is presumed that the unit has already been removed from the vehicle.

1) IMPORTANT

Throughout the phases of repair or maintenance work it is advisable to use proper equipment such as : Trestles or supporting benches, plastic or copper hammers, appropriate levers, extractor and specific spanners or wrenches. So that the work is facilitated and the working surfaces and the operators themselves are protected. Before going on to disassemble the parts itis beat to thoroughly clean the unit, removing any encrusted or accumulated greases and then drain the oil through the oil-draining plug.

2) INTRODUCTORY REMARKS

All the disassembled mechanical units should be thoroughly cleaned with appropriate products and then restored or replaced if damage, wear, cracking or seizing have occurred.

In particular, thoroughly check the state of all moving parts (bearings, gear, crown wheel and pinion, shaft) and sealing parts (O-ring, oil shield) which are subject to major stress and wear. In any case it is a disable to replace the seals every time a component is overhauled or repaired. During assembly the sealing rings must be lubricated on the sealing edge. In the case of the crown wheel and pinion, replacement of one component requires the replacement of the other one.

During assembly the prescribed pre-loading and backlash of the parts must be maintained.

3) MAINTENANCE AND REPAIR

We have compiled these instructions for maintenance and repair in order to facilitate any such work on the DANA components differential units and change units. The drawings of any special tools required for maintenance and repair work can be bought directly from us. Spare parts can be ordered either through the vehicle manufacturer or to us directly.

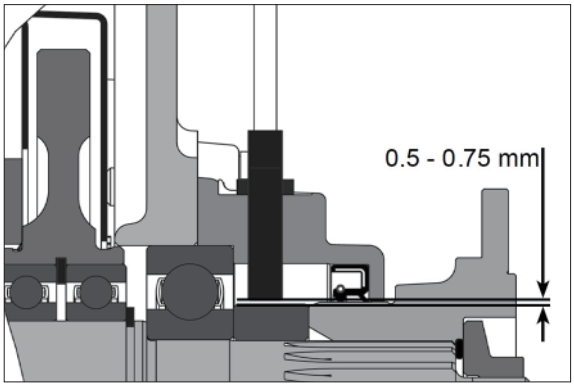
4) LUBRICANT SPECIFICATIONS

SAE 85W-90 (API GL-5)

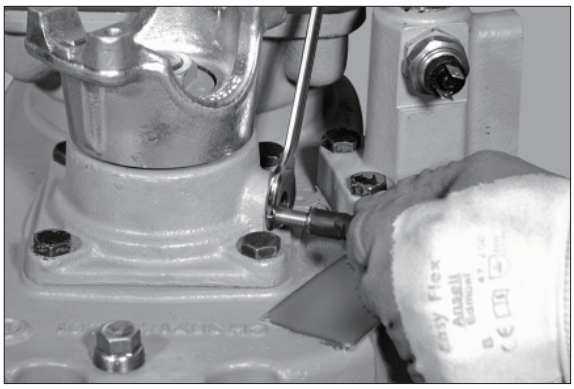
3. COUNTER - REVOLUTION SENSOR

1) REPLACING

(1) Undo the sensor adjuster screw lock nut and the counter-revolution sensor.



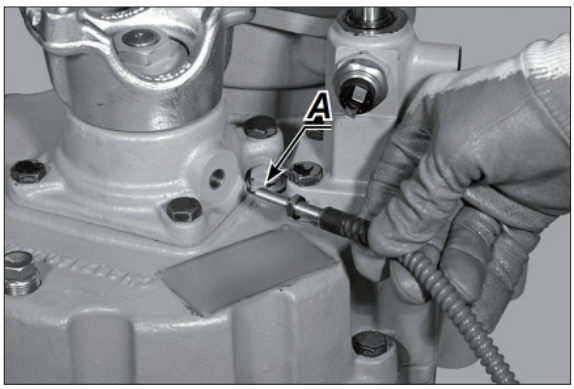
55W9NGB001



55W9NGB002

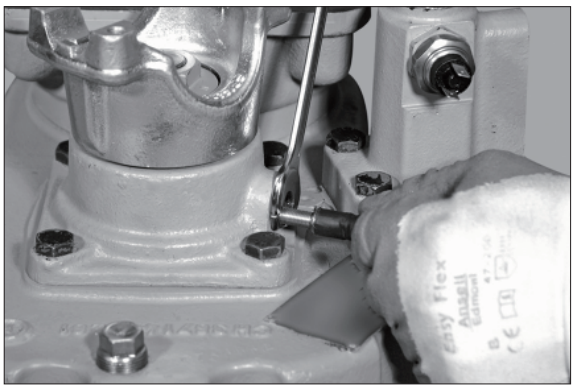
(2) Replace the counter-revolution sensor if damaged.

※ Clean the sensor reading zone “A” every oil change and every malfunctioning.



55W9NGB003

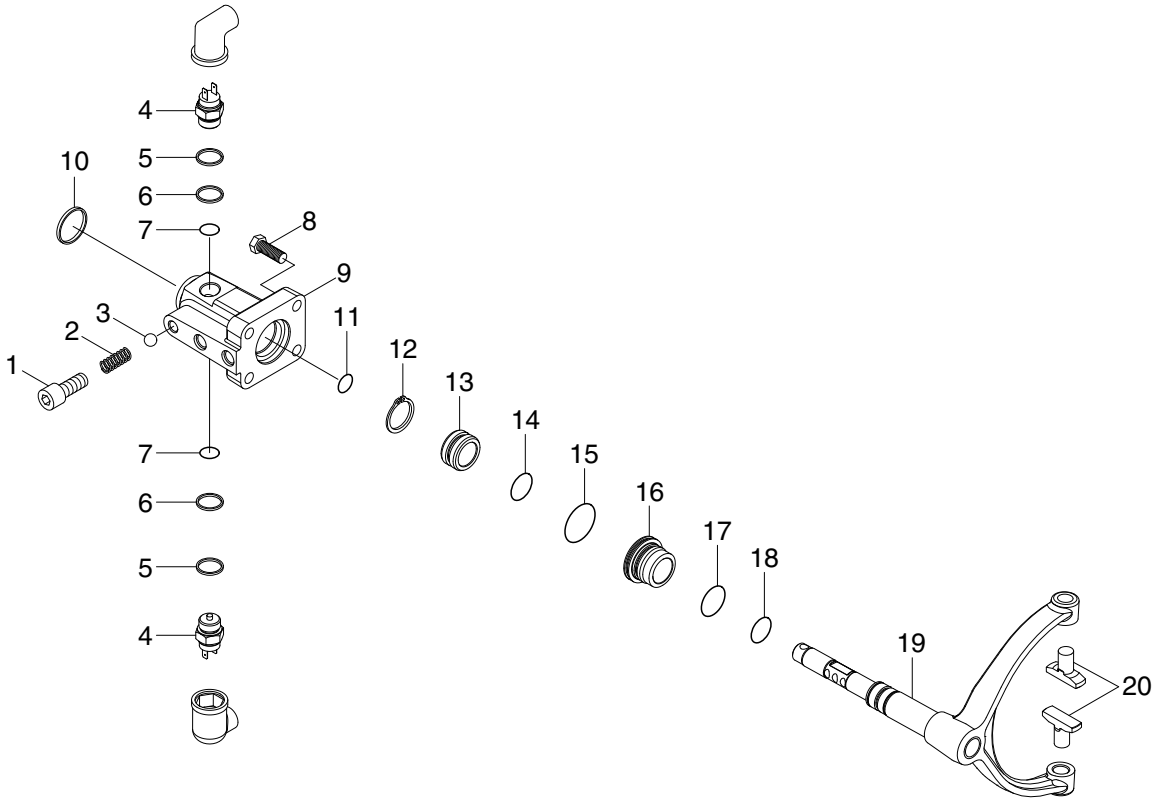
(3) Screw the counter-revolution sensor untill to the contact with the phonic end disk, then unloose the sensor 1/2 ~ 3/4 turn. Tighten the lock nuts completely.



55W9NGB004

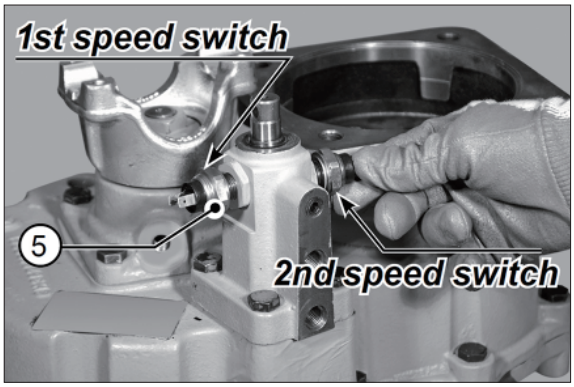
4. HYDRAULIC GEAR CONTROL

1) DISASSEMBLY



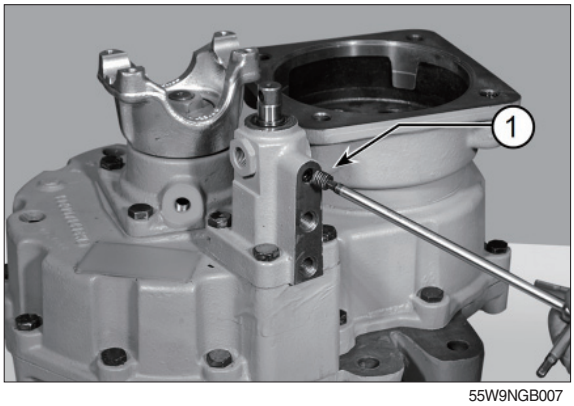
55W9NGB005

(1) Remove gear-in position switch (4), O-ring (5) and (7) and washer (7).



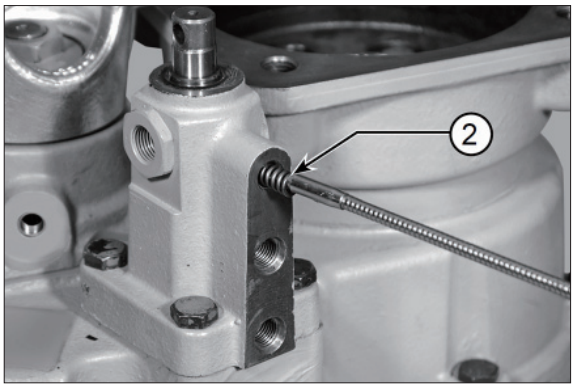
55W9NGB006

(2) Remove the cap (1) from the gear selector.



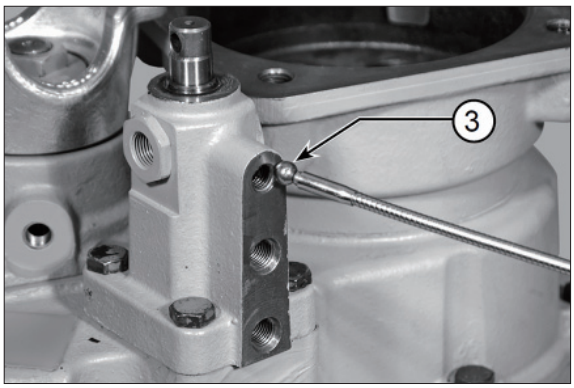
55W9NGB007

(3) Use a magnet to remove the spring (2) from the gear selector.



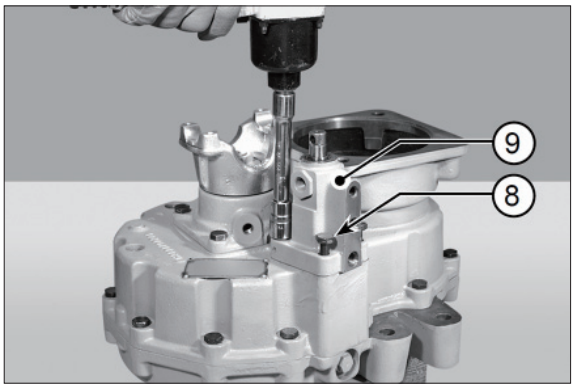
55W9NGB008

(4) Remove the gear selector balls (3).



55W9NGB009

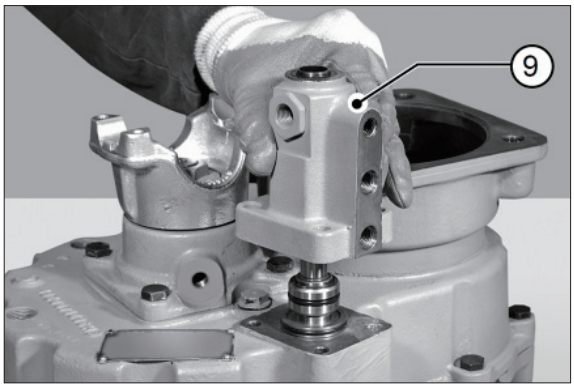
(5) Remove screws (8) on the gear control cylinder (9).



55W9NGB010

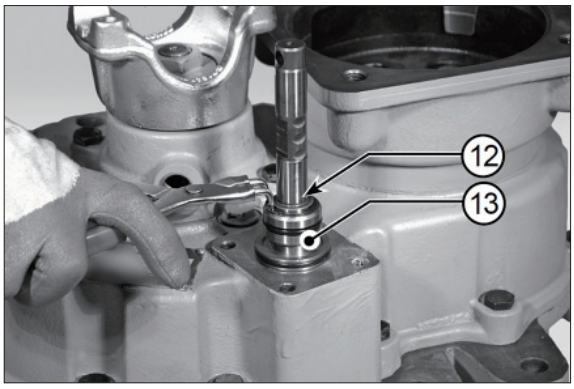
(6) Remove the gear control cylinder (9).

※ Carefully remove all residue of loctite from the surfaces.



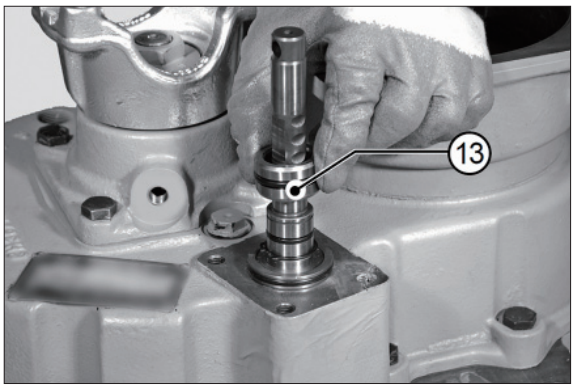
55W9NGB011

(7) Remove the snap ring (12) securing the piston (13).



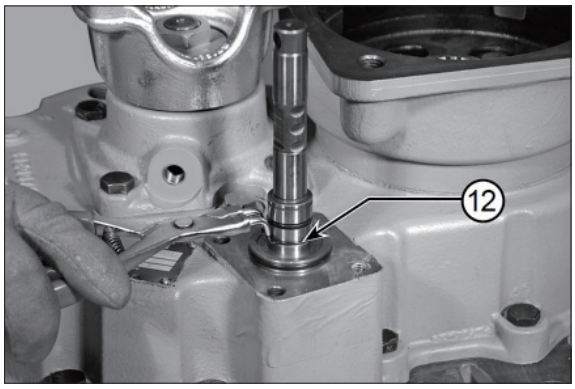
55W9NGB012

(8) Remove the piston (13), complete with seals.



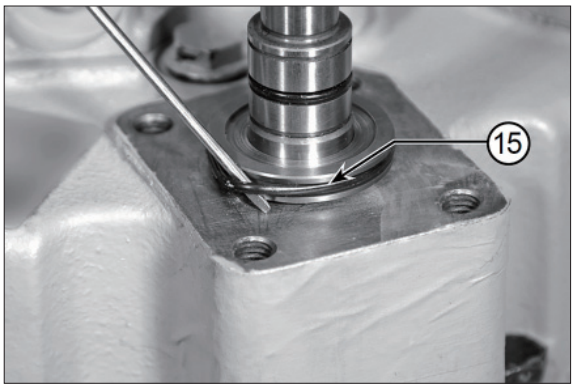
55W9NGB013

(9) Remove the snap ring (12) securing the piston (13).



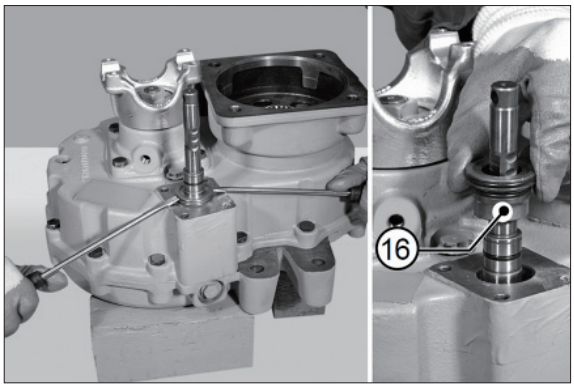
55W9NGB014

(10) Remove the O-ring (15).



55W9NGB015

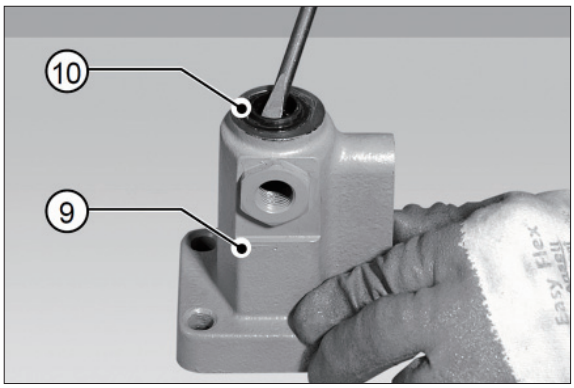
(11) Use two levers to remove the bushing (16).



55W9NGB016

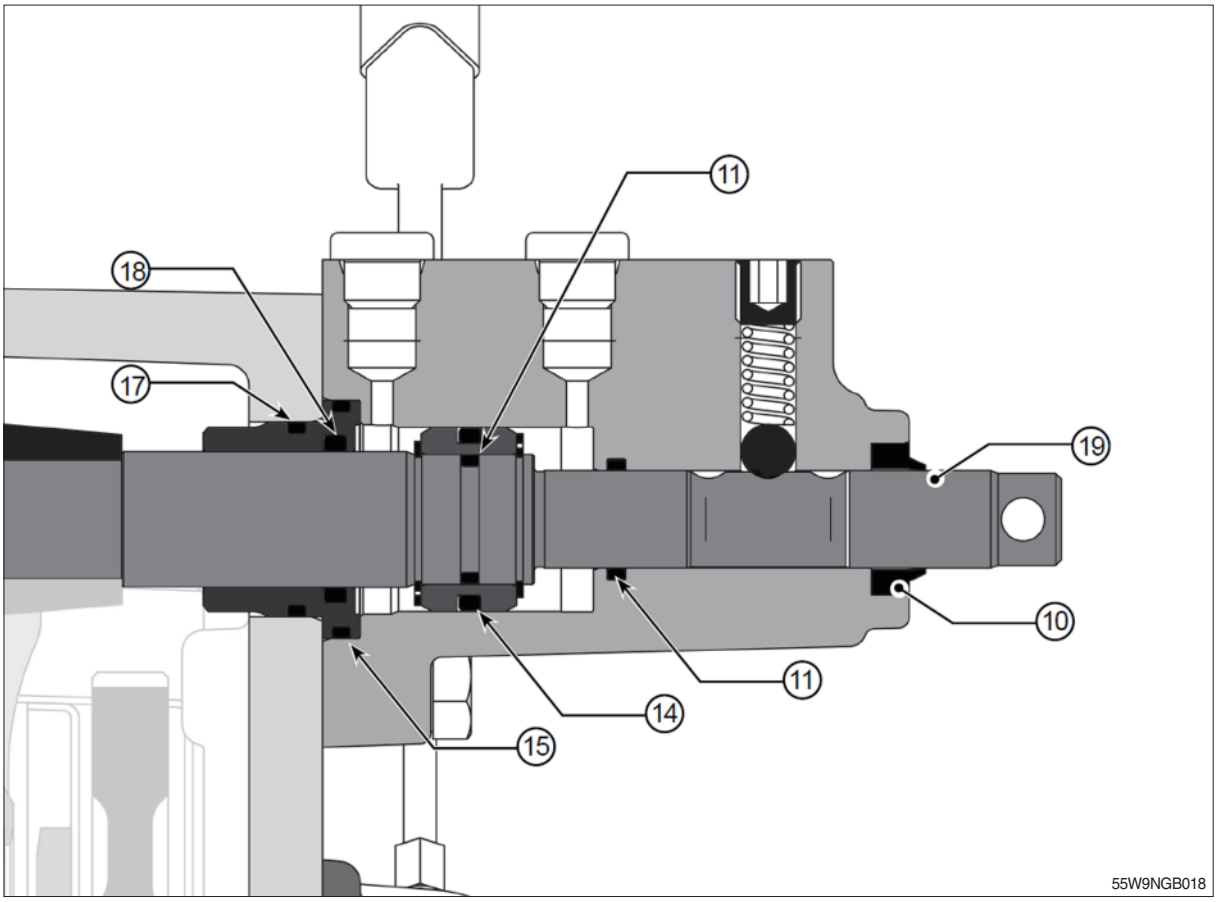
(12) Remove the dust scraper ring (10) and the rod's O-ring (11) from the gearshift cylinder (9).

※ The O-rings and the dust scraper ring must be replaced every time the unit is disassembled.

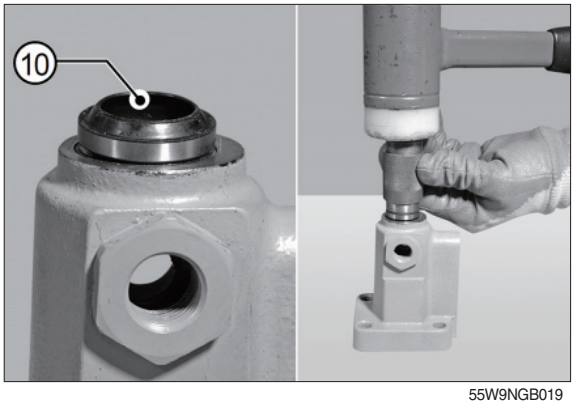


55W9NGB017

2) ASSEMBLY

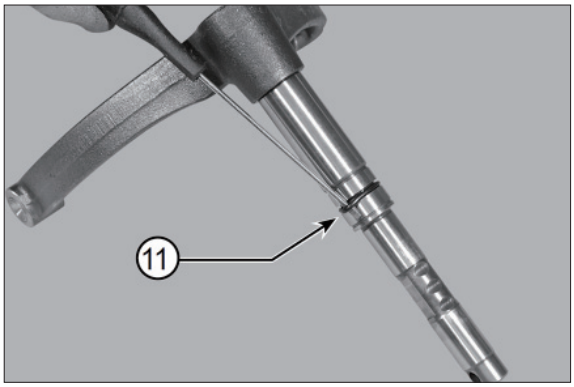


(1) Fit the rod's O-ring (11) and the dust scraper ring (10) into the cylinder.

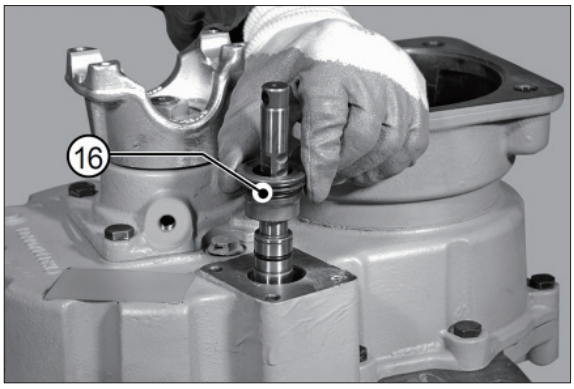


(2) Fit the new O-ring (11) on the gear selector rod (19).

※ Lubricate before installing.

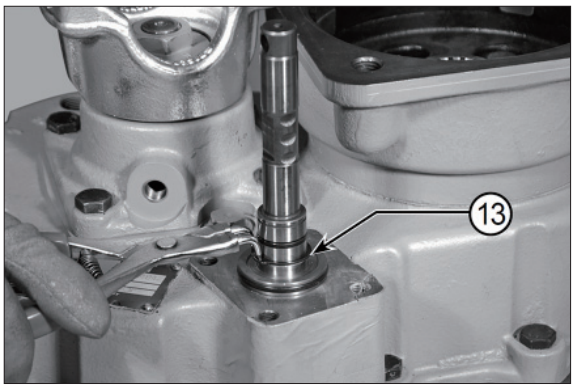


(3) Fit the O-rings (15), (17), (18) on the guide bush (16) and lubricate rings.
Fit the bush (16) onto the gear selector rod (19).



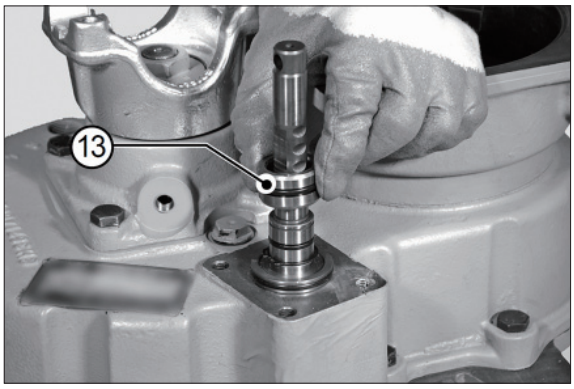
55W9NGB021

(4) Insert the snap ring (12).



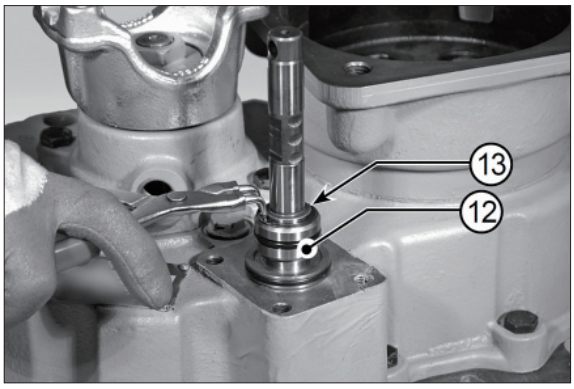
55W9NGB022

(5) Fit the O-rings (11), (14) onto the piston (13) and lubricate rings.
Fit the complete piston (15) onto the gear selector rod (20) and engage it by means of the snap ring (12).



55W9NGB023

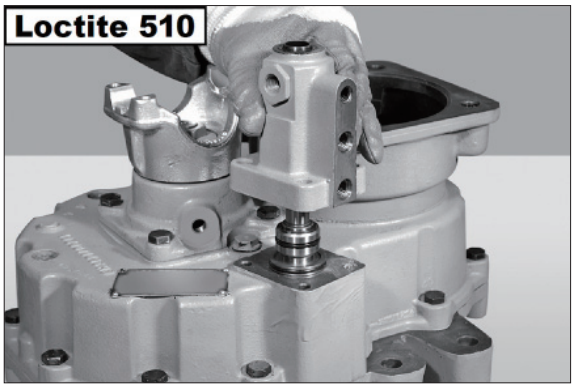
(6) Secure the piston (13) in position with the snap ring (12).



55W9NGB024

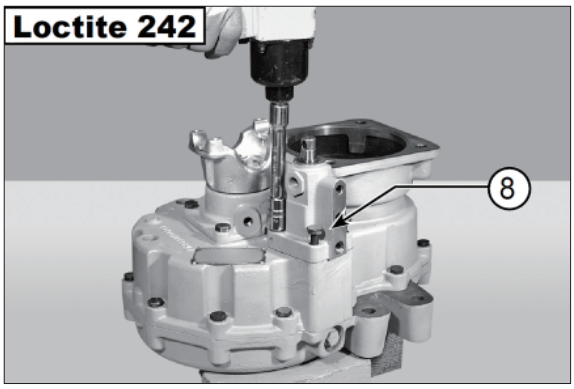
(7) Coat the coupling surface of the gearshift cylinder (9) with loctite 510; fit the cylinder on the gear selector rod (19).

※ Make sure that the sealant forms a continuous film around the locking holes.



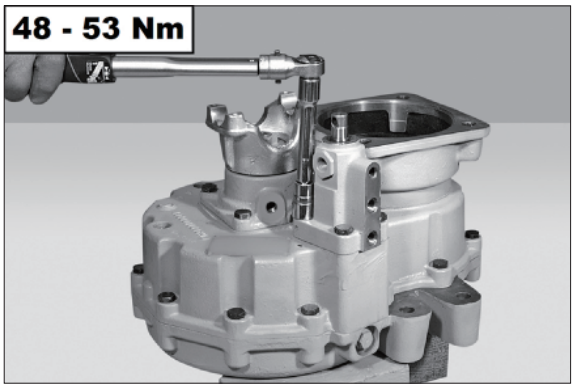
55W9NGB025

(8) Assembly the screws (8), spreading loctite 242 on screws.



55W9NGB026

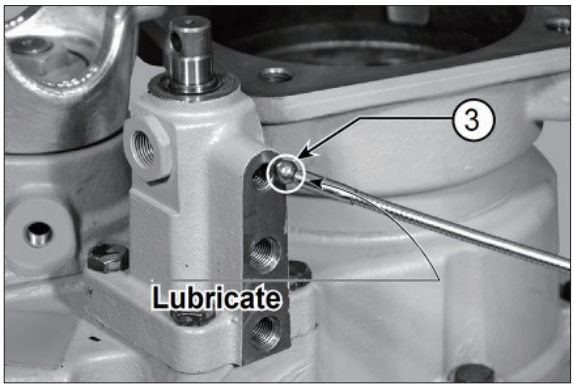
(9) Tighten screws (8) using a torque wrench setting of 4.89~5.4 kgf · m (35.4~39.1 lbf · ft).



55W9NGB027

(10) Fit the gear selector balls (3).

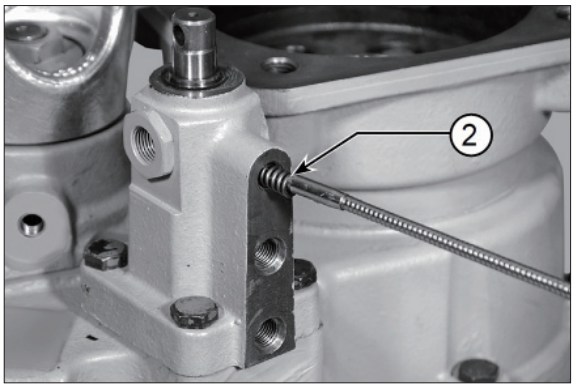
※ Lubricate before installing.



55W9NGB028

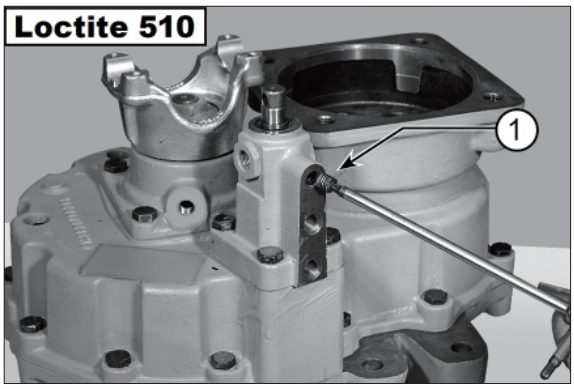
(11) Fit the gear selector springs.

※ Replace the springs (14) if they are weakened or bent.



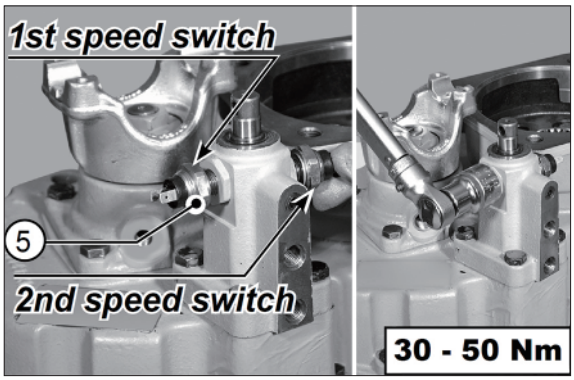
55W9NGB029

(12) Coat the dowel (1) with loctite 510 and screw it until it is level with the cylinder.



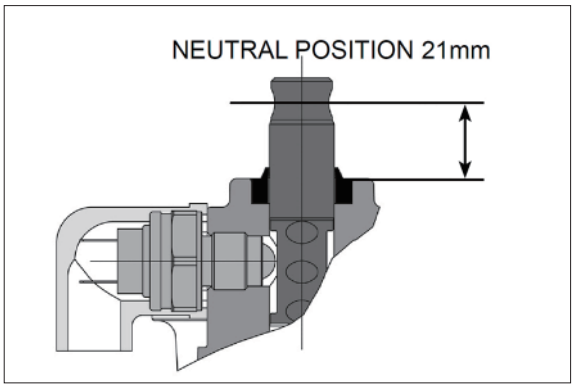
55W9NGB030

(13) Fix the gear-in position switch (4) with washer (7) and O-ring (5), (6).
Tighten with torque wrench setting of 3.57~5.09 kgf · m (25.8~36.9 lbf · ft).



55W9NGB031

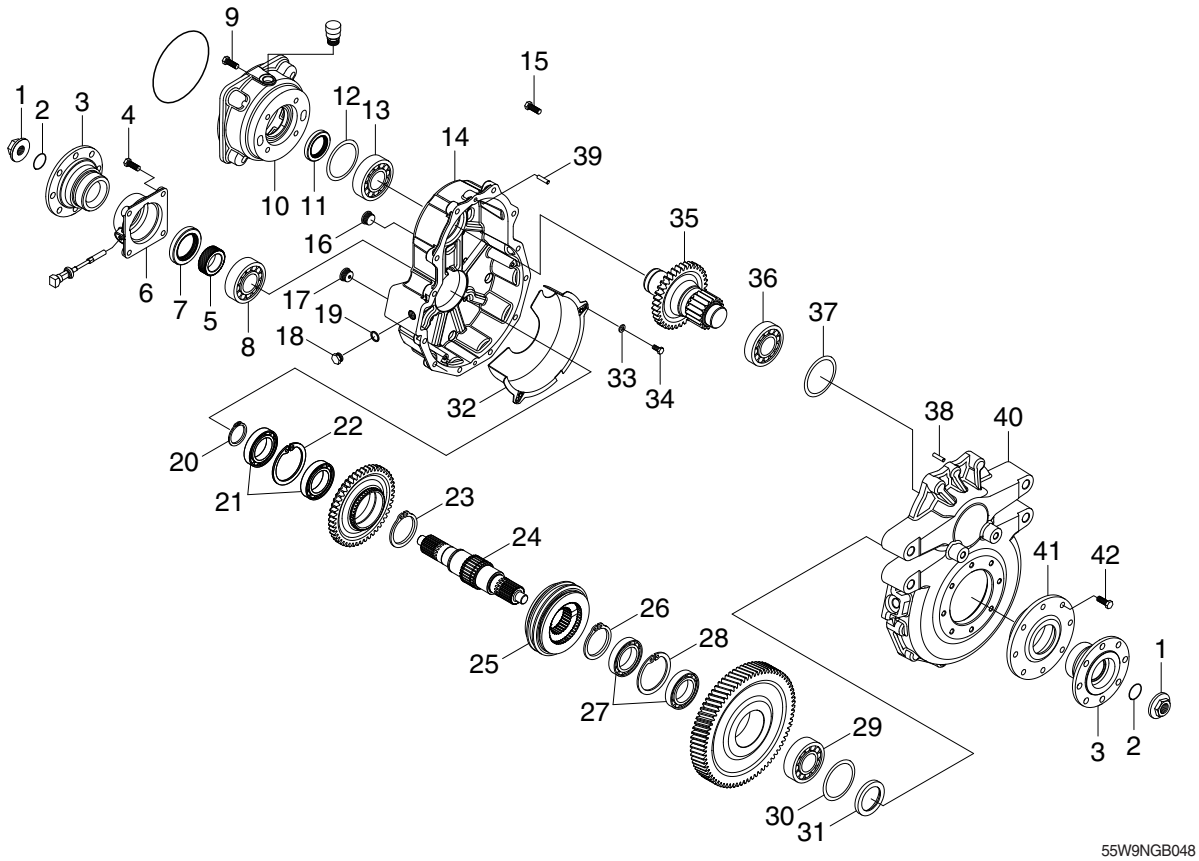
(14) Engage the 1st speed and verify with a control device (tester) that the switch 1st speed gives signal and that the switch 2nd speed is disabled.
Repeat the operation on the switch 2nd speed.



55W9NGB032

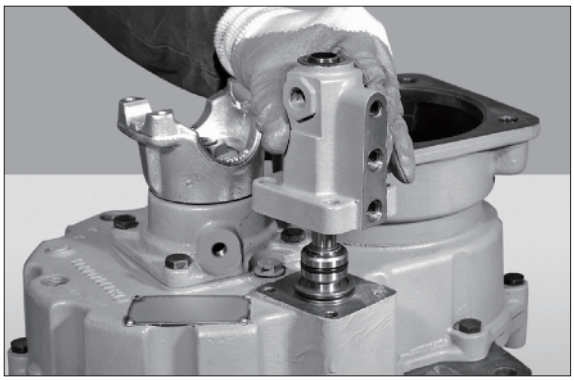
5. INTEGRATED REDUCTION GEAR

1) DISASSEMBLY



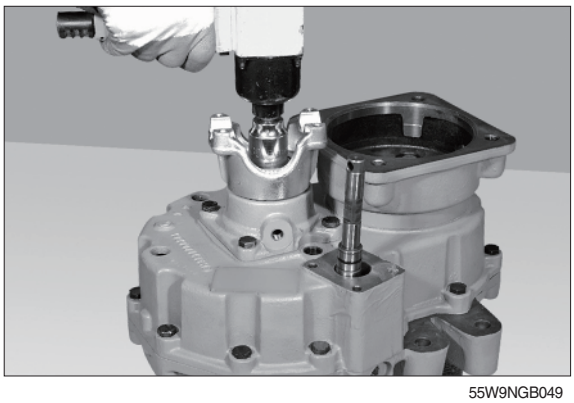
55W9NGB048

(1) Remove the gear control cylinder.
For more details, see : REMOVAL OF HYDRAULIC GEAR CONTROL



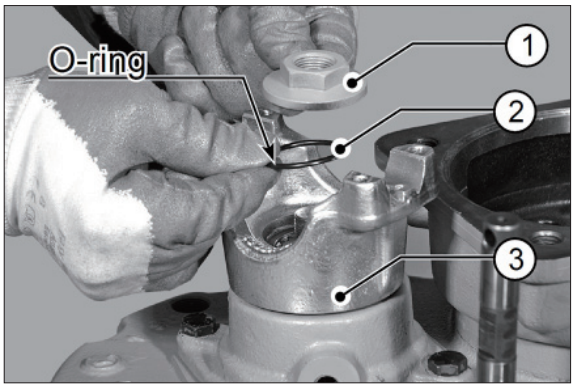
55W9NGB048-1

(2) Unloose the nut (1) from the flange (3).



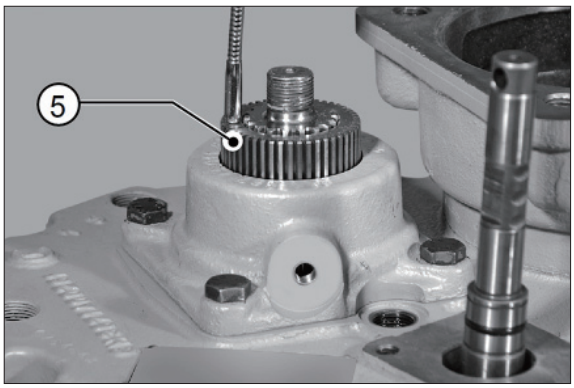
55W9NGB049

(3) Remove the nut (1) and O-ring (2) and pull out the flange (3).



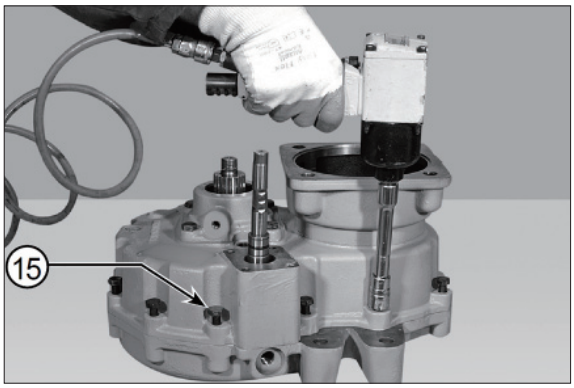
55W9NGB050

(4) Remove the phonic end disk (5).



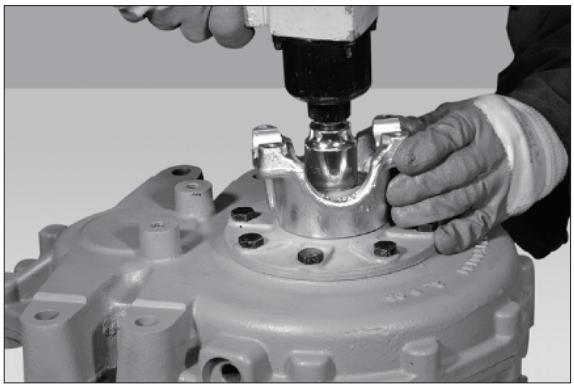
55W9NGB051

(5) Remove screws (15) of the cover (40).

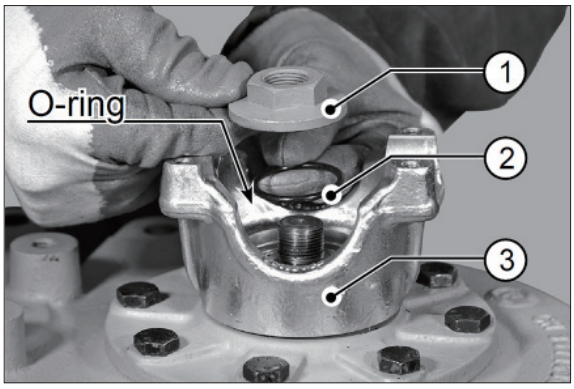


55W9NGB052

(6) Unloose the nut (10) from the flange (12).

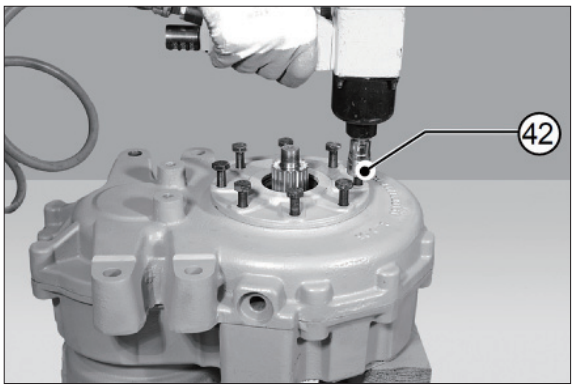

55W9NGB053

(7) Remove the nut (1) and O-ring (2) and pull out the flange (3).



55W9NGB054

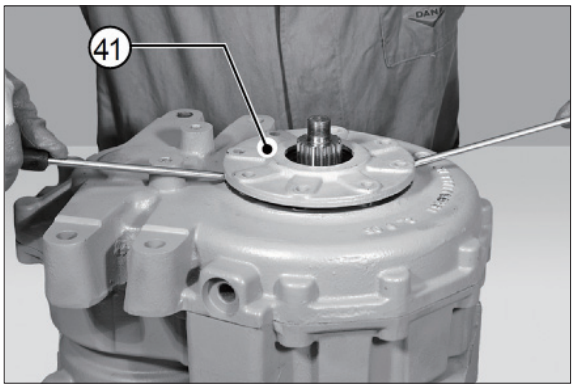
(8) Loosen and remove the check screws (42) of the cover (41).



55W9NGB055

(9) Disjoin and remove the cover (41).

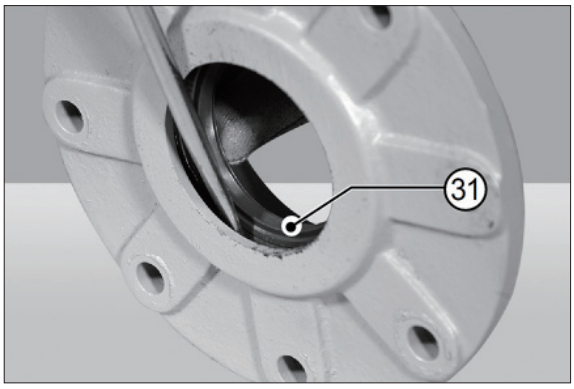
※ Carefully remove all residue of loctite from the surfaces.



55W9NGB056

(10) Remove seal ring (31).

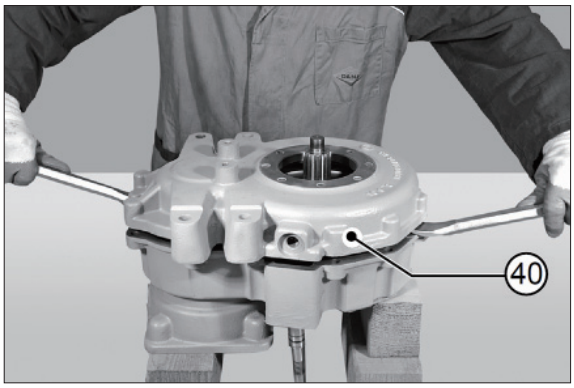
※ Note down direction of installation.



55W9NGB057

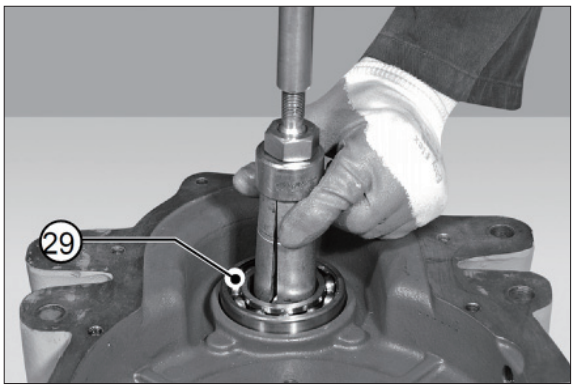
(11) Disjoin and remove the cover (40).

※ Carefully remove all residue of loctite from the surfaces.



55W9NGB058

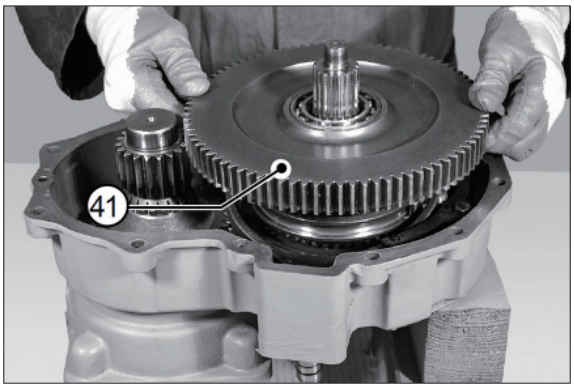
(12) Using an internal extractor, remove the bearing (29).



55W9NGB059

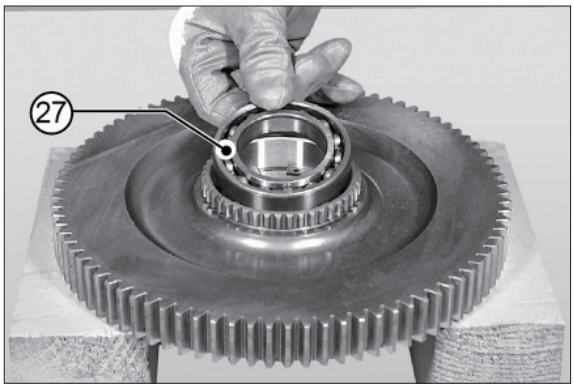
(13) Remove gear (41).

※ Note the correct mounting direction.



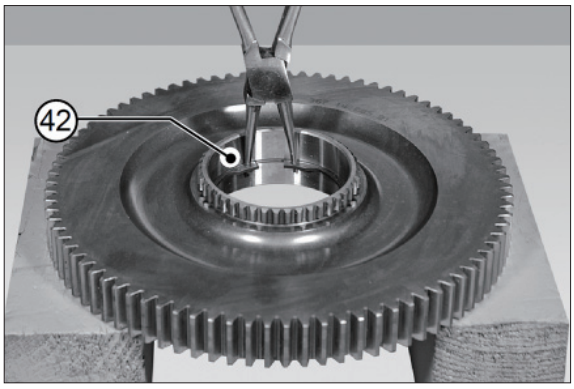
55W9NGB060

(14) Remove the bearing (27) from the gear (41).



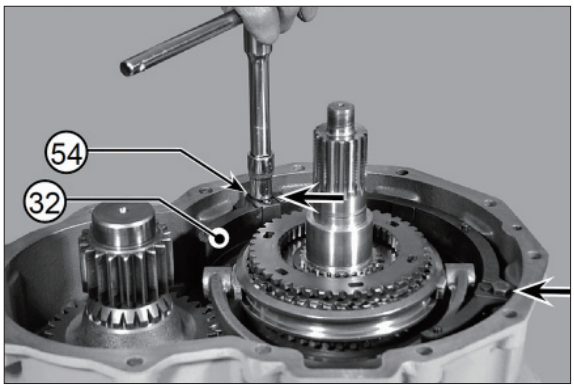
55W9NGB061

(15) Remove the snap ring (42).



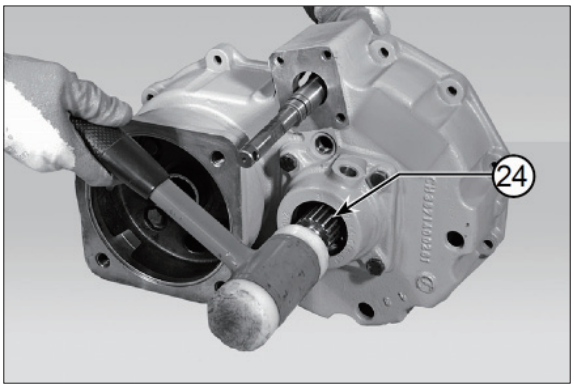
55W9NGB062

(16) Remove the baffle plate (32) and retainer screws (54).



55W9NGB063

(17) Remove the lower shaft (24).

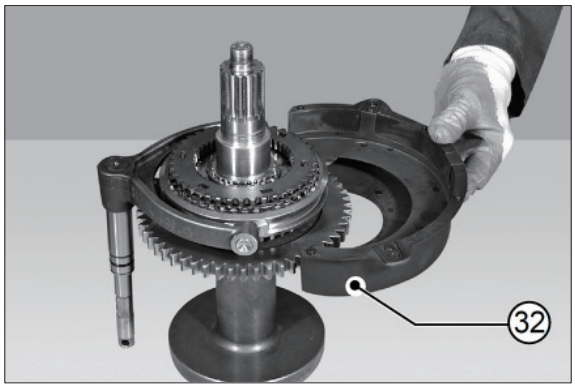


55W9NGB064

(18) Secure the lower shaft assembly to a hoist.
Remove the lower shaft assembly, complete with yoke and gearbox control rod.

55W9NGB065

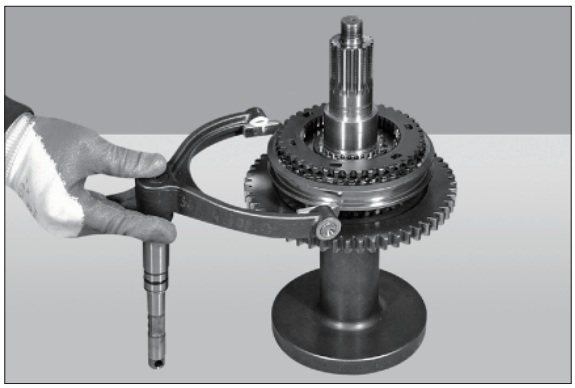
(19) Remove the internal baffle plate (32).



55W9NGB066

(20) Remove yoke and gearbox control rod. Check the yoke pads for wear.

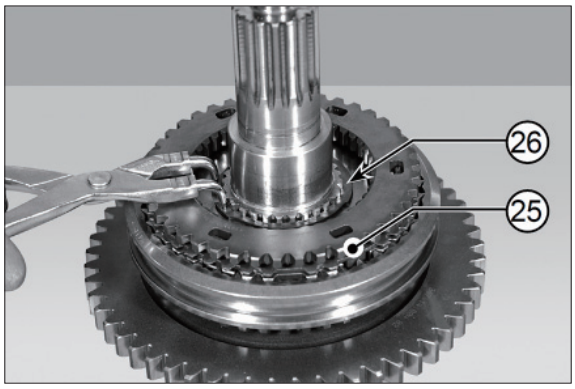
※ Replace if worn.



55W9NGB067

(21) Remove the snap ring (26) securing the synchroniser (25).

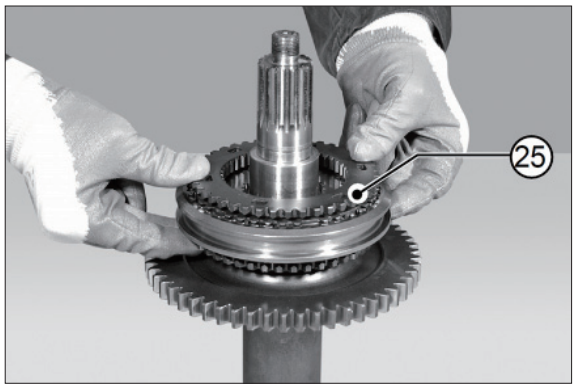
※ Take care not to bend the snap ring (26).



55W9NGB068

(22) Remove the complete synchroniser (25).

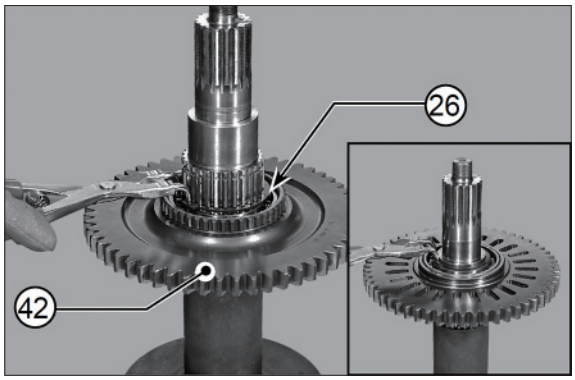
※ Note the correct mounting direction.



55W9NGB069

(23) Repeat the operation on both sides.
Remove the snap ring (23) securing the gear (42).

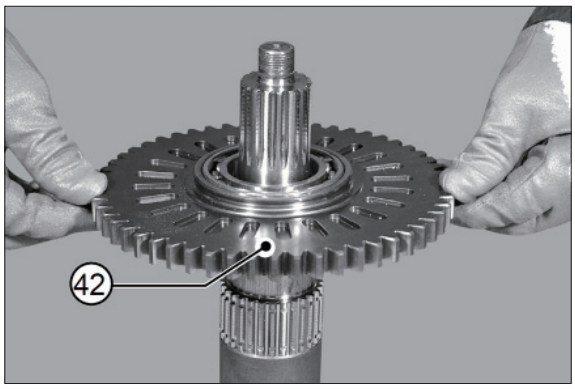
※ Take care not to bend the snap ring (23).



55W9NGB070

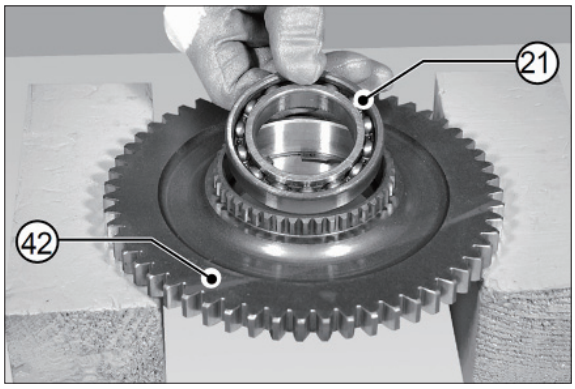
(24) Remove gear (42).

※ Note the correct mounting direction.



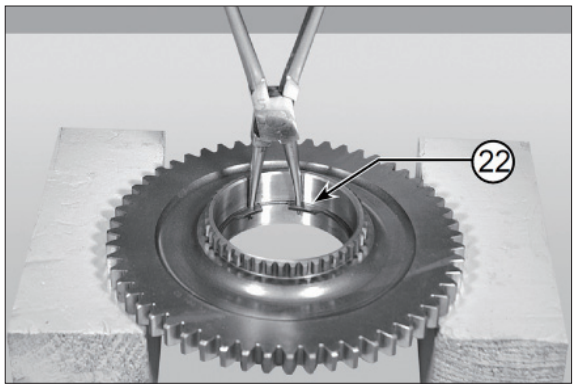
55W9NGB071

(25) Remove the bearings (21) from the gear (42).



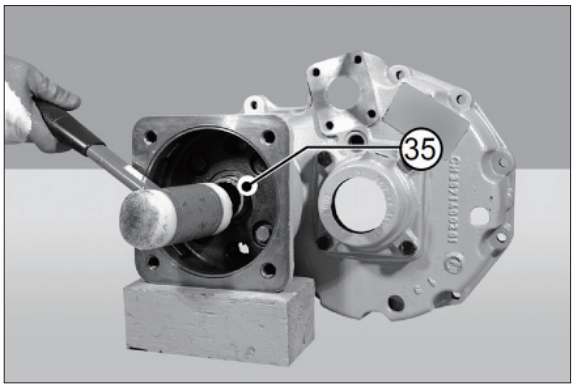
55W9NGB072

(26) Remove the snap ring (22).



55W9NGB073

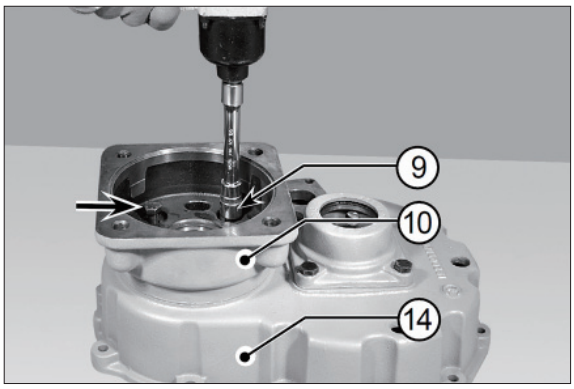
(27) Remove the upper shaft (35).



55W9NGB074

(28) Input shaft

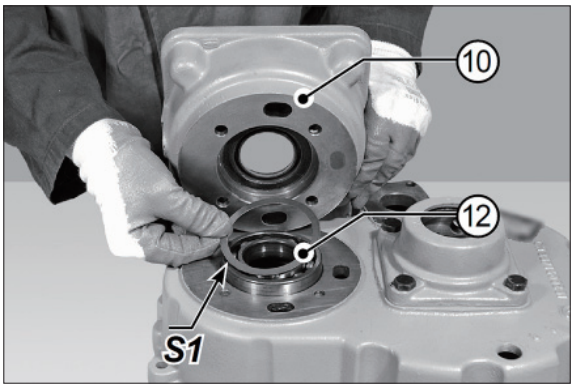
Mark the position between the motion entrace cover (10) and reduction gear cover (14); remove screws (9) from the motion entrace cover (10).



55W9NGB075

(29) Remove the cover by fixing the distance washers (12) onto the cover (10) itself.

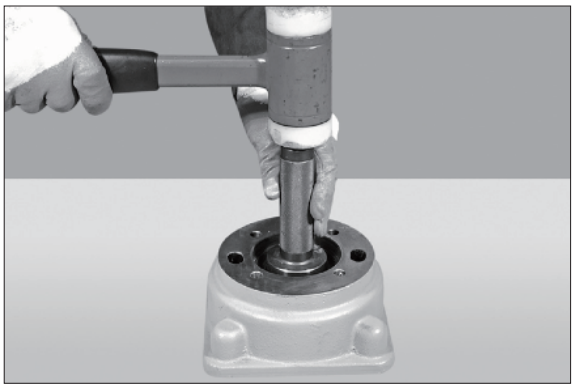
※ Carefully remove all residue of loctite from the surfaces.



55W9NGB076

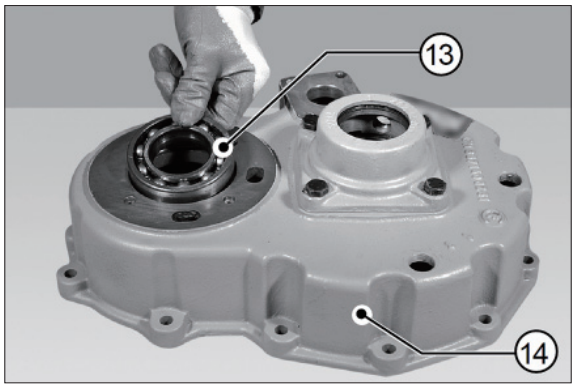
(30) Remove seal ring (11).

※ Note down direction of installation.



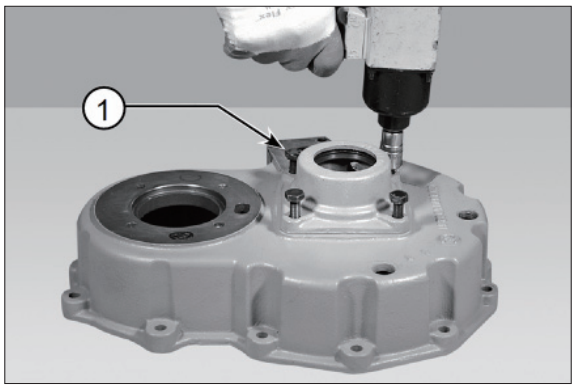
55W9NGB077

(31) Remove the bearing (13) from the cover (14).



55W9NGB078

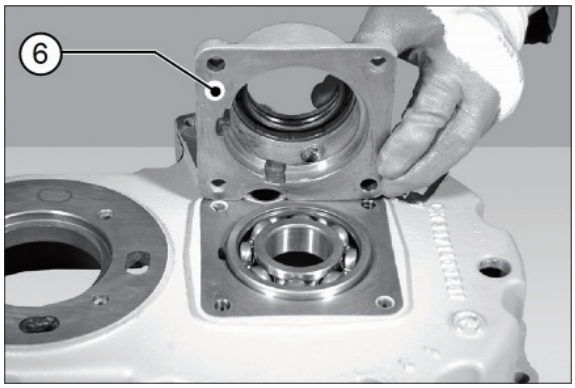
(32) Loosen and remove the check screws (4) of the cover (6).



55W9NGB079

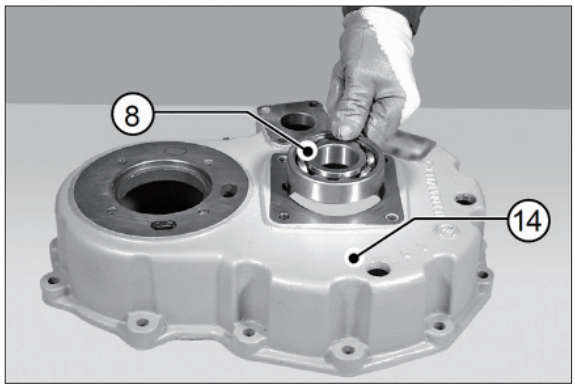
(33) Disjoin and remove the cover (6).

※ Carefully remove all residue of loctite from the surfaces.



55W9NGB080

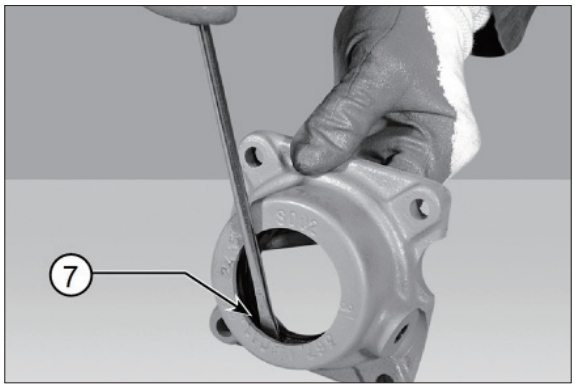
(34) Remove the bearing (8) from the cover (14).



55W9NGB081

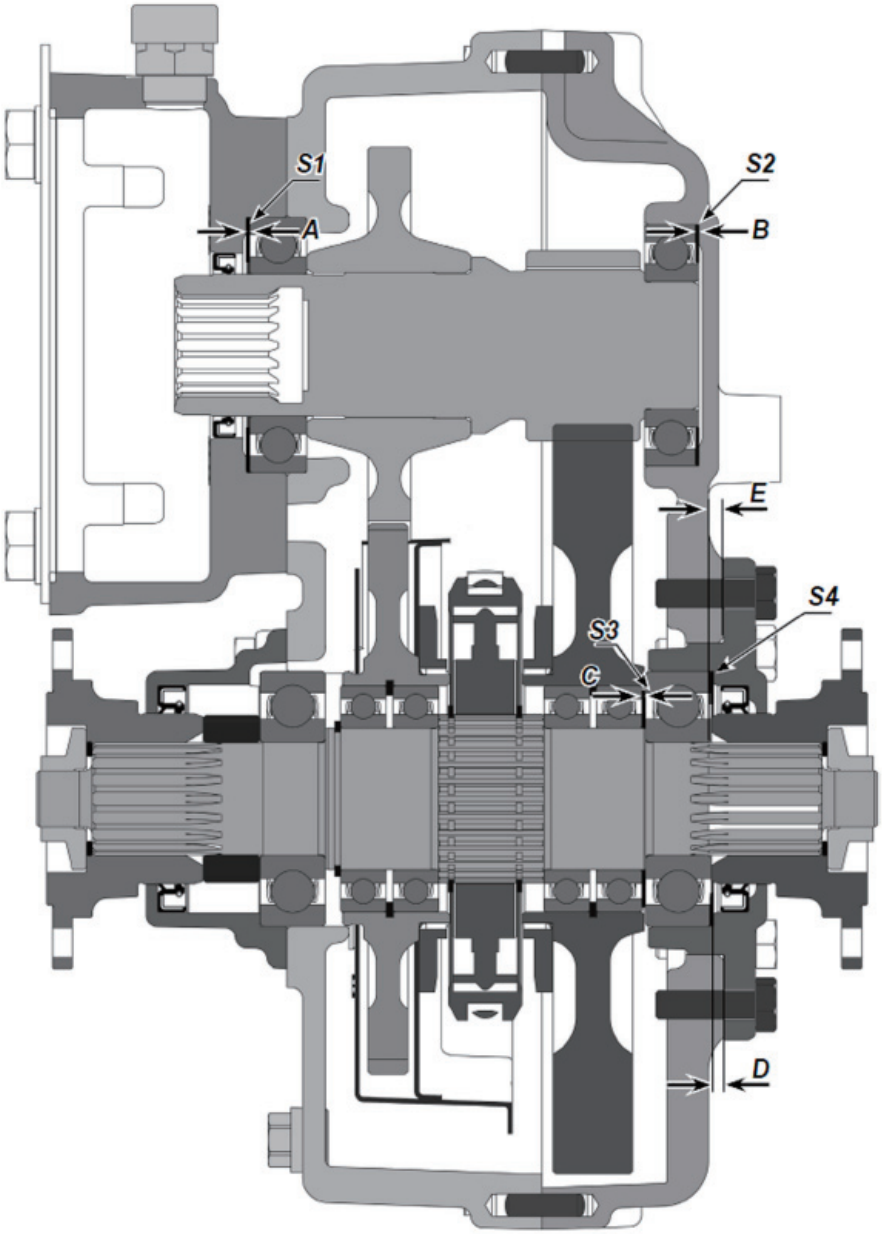
(35) Remove seal ring (7).

※ Note down direction of installation.



55W9NGB082

2) ASSEMBLY

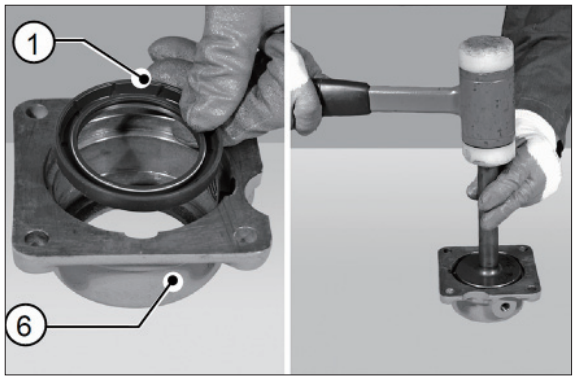


55W9NGB083

(1) Re-insert the new sealing ring (7) in the output cover (6).

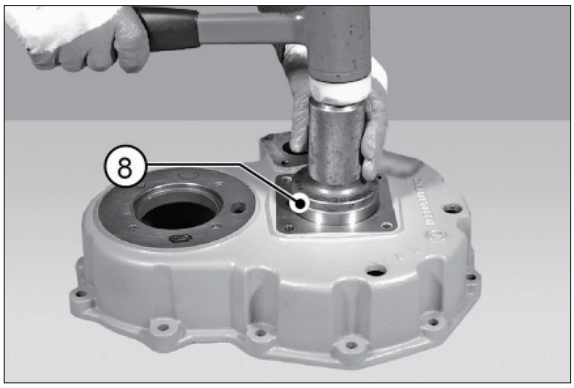
※ Pay particular attention to the direction of assembly of the rings (7).

Lubricate the lip of the sealing ring with grease.



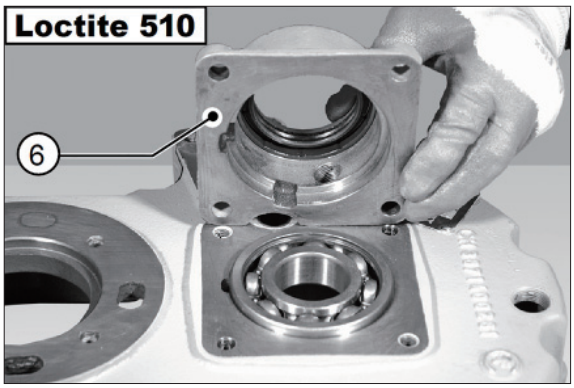
55W9NGB084

(2) Using a normal tool insert the bearing (8).



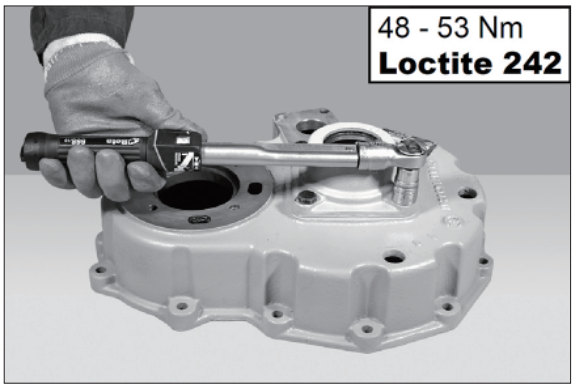
55W9NGB085

(3) Assembly the cover (16) spreading loctite 510 on planes.



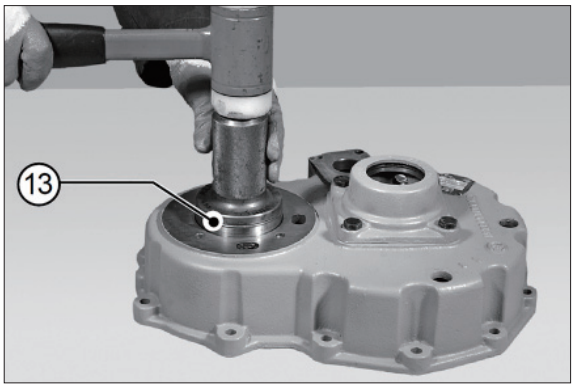
55W9NGB086

(4) Assembly the screws (4) spreading loctite 242.
Tighten screws (4) using a torque wrench setting of 4.89~5.4 kgf · m (35.4~39.1 lbf · ft).



55W9NGB087

(5) Using a normal tool insert the bearing (13).

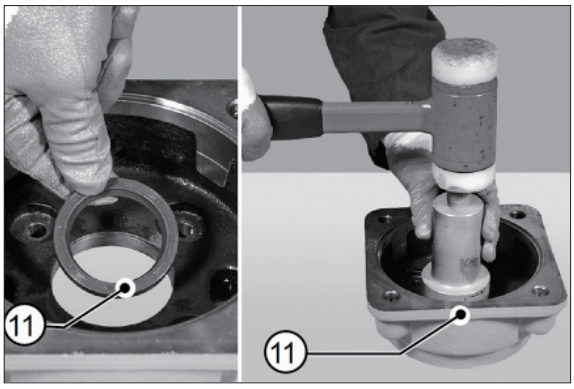


55W9NGB088

(6) Re-insert the new sealing ring (11) in the motion input cover (10).

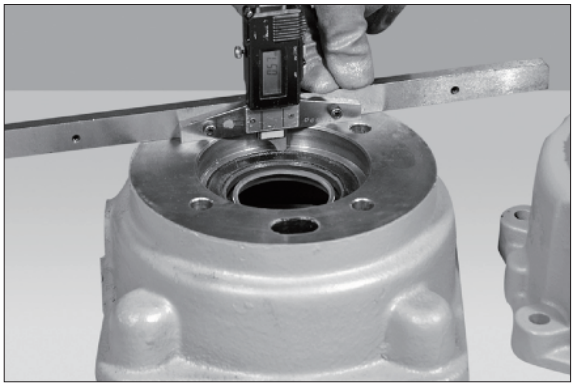
※ Pay particular attention to the direction of assembly of the rings (11).

Lubricate the lip of the sealing ring with grease.



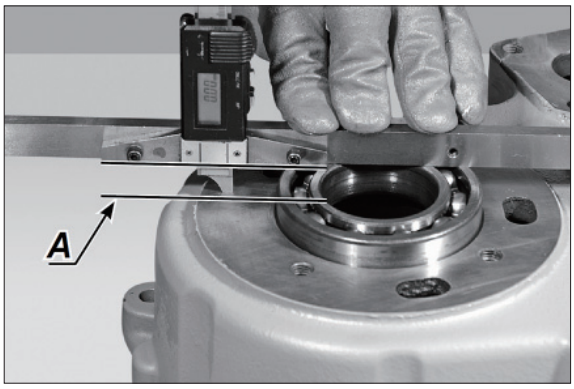
55W9NGB089

(7) Zero the depth gauge between the cover surface and bearing contact surface.


55W9NGB090

(8) Measure distance “A” between the surface and thrust block.

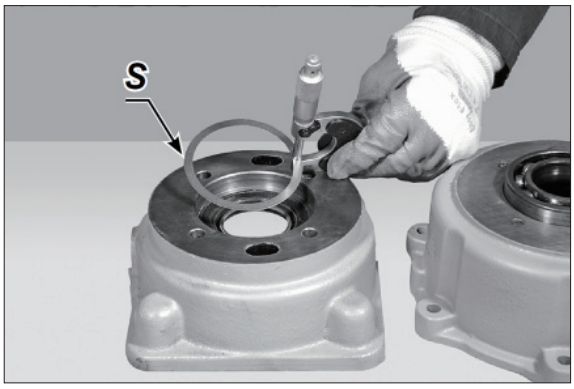
· Example : A = 0.50



55W9NGB091

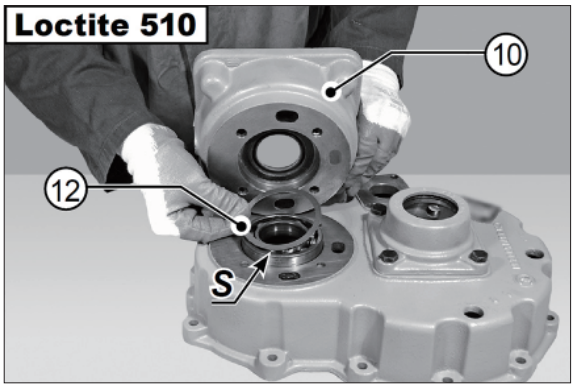
(9) Calculate thickness “S” of the shims by using this formula :
S = A - Y = S, where Y is the predefined axial backlash.
Y = backlash = 0.15 ± 0.35 mm
Example : S=A-Y=0.50-0.25=0.25 mm=S

Make up the appropriate pack of shims.



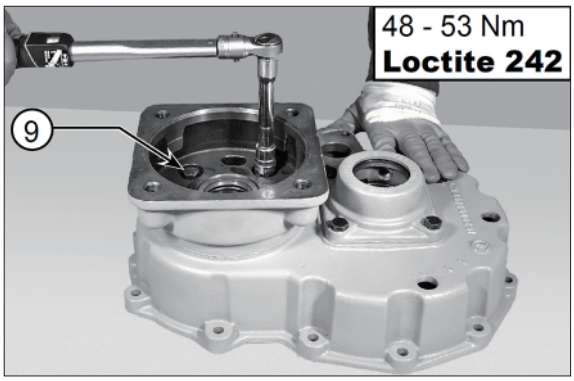
55W9NGB092

(10) Apply loctite 510 to the machined surfaces.
Assembly the cover (10) and shims (12).



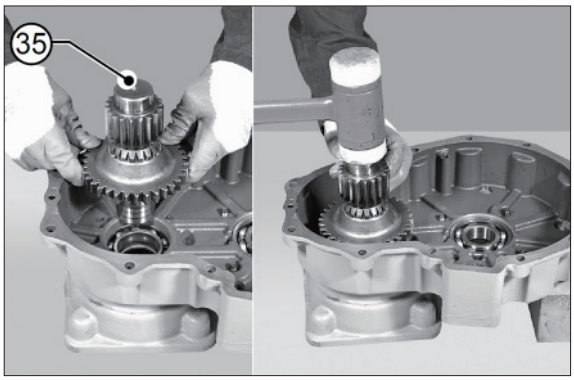
55W9NGB093

(11) Assembly the screws (9) spreading loctite 242.
Tighten screws (9) using a torque wrench setting of 4.89~5.4 kgf · m (35.4~39.1 lbf · ft).



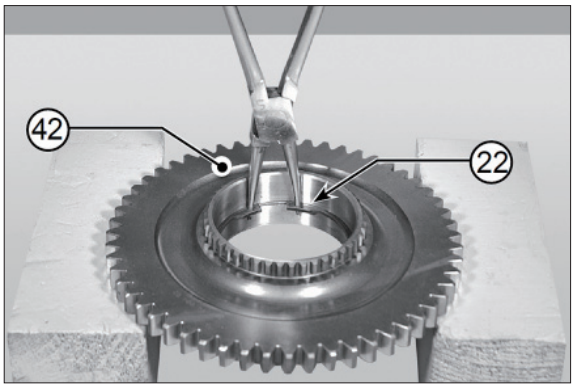
55W9NGB094

(12) Install the drive side shaft (35) with a plastic hammer.



55W9NGB095

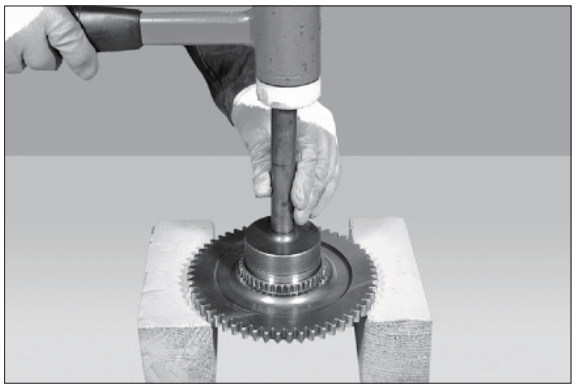
(13) Fit the snap ring (22) in the gear (42).



55W9NGB096

(14) Using a pusher of suitable diameter, fit the bearings (21).

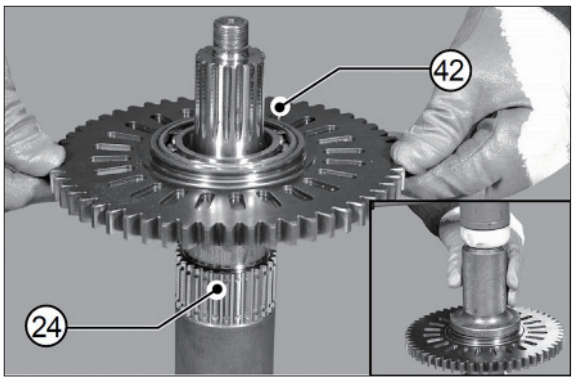
※ Ensure that the bearing is seated securely.



55W9NGB097

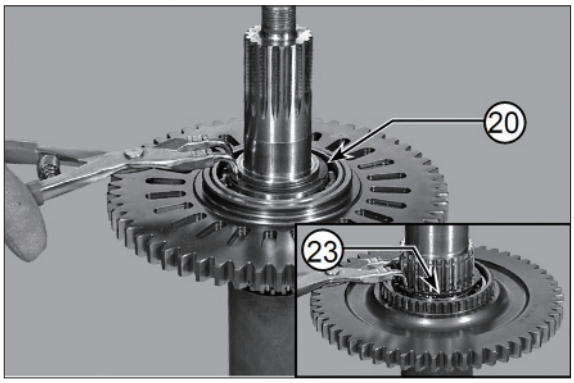
(15) Fit gear (42) onto the shaft (24).

※ Fit as originally mounted, using the markings made previously as reference.



55W9NGB098

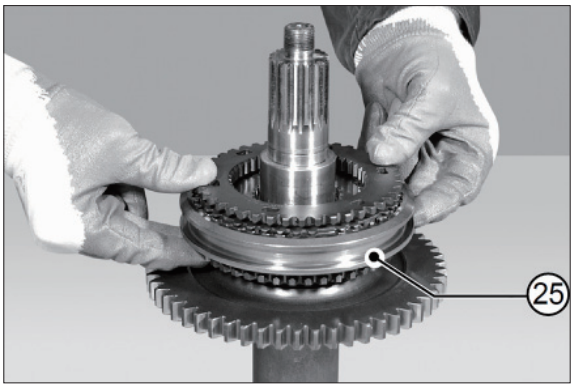
(16) Repeat the operation on both sides. Secure the gear (42) in position with the snap ring (20), (23).



55W9NGB099

(17) Fit the complete synchroniser (25).

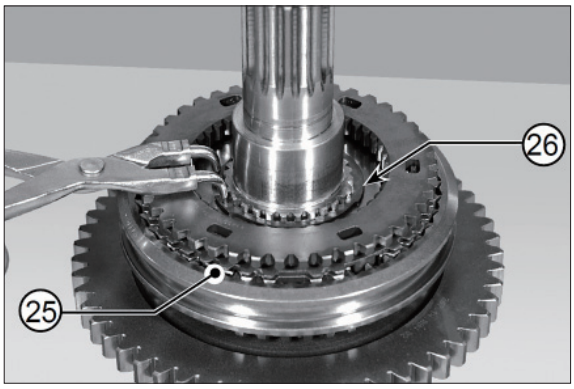
※ Fit as originally mounted, using the markings made previously as reference.



55W9NGB100

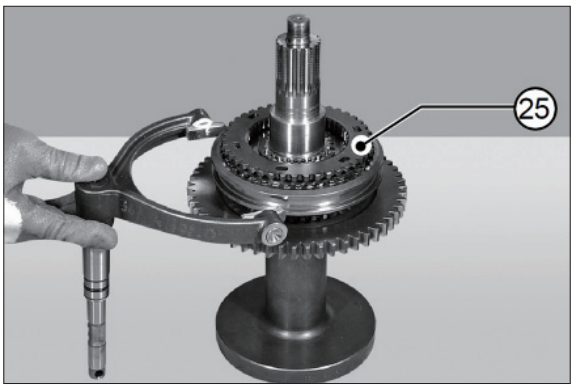
(18) Secure the synchroniser (25) in position with the snap ring (26).

※ Check that the snap ring is seated correctly.



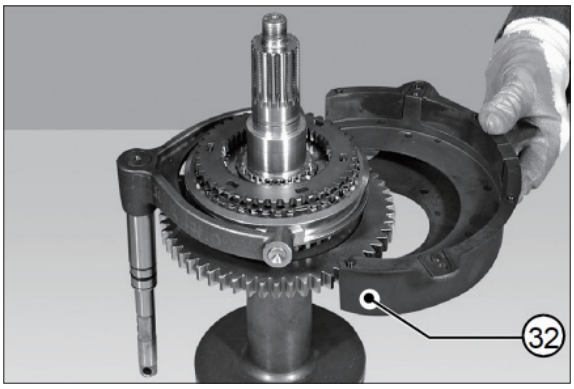
55W9NGB101

(19) Fit the gear selector yoke in the synchroniser (25).



55W9NGB102

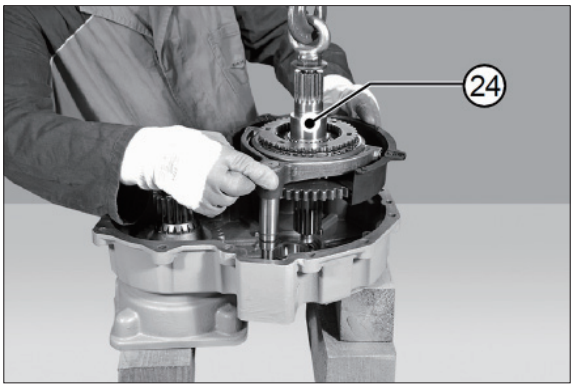
(20) Fit the internal baffle plate (32) in position.



55W9NGB103

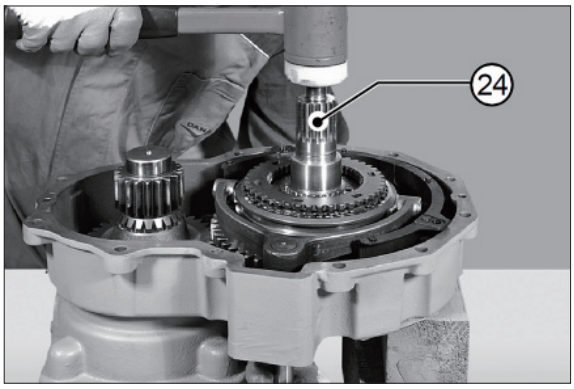
(21) Secure the lower shaft assembly (24) to a hoist.

Install the lower shaft assembly (24), complete with yoke and gearbox control rod.



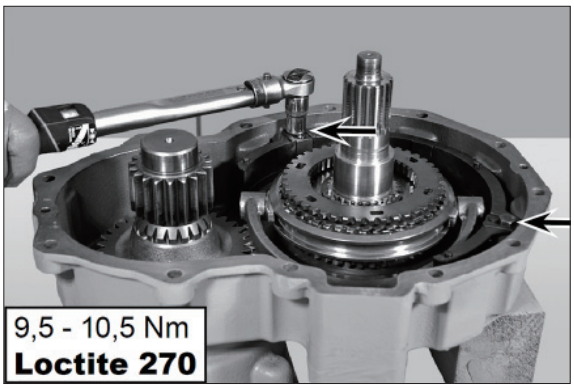
55W9NGB104

(22) Using a plastic hammer, install the lower shaft (24).



55W9NGB105

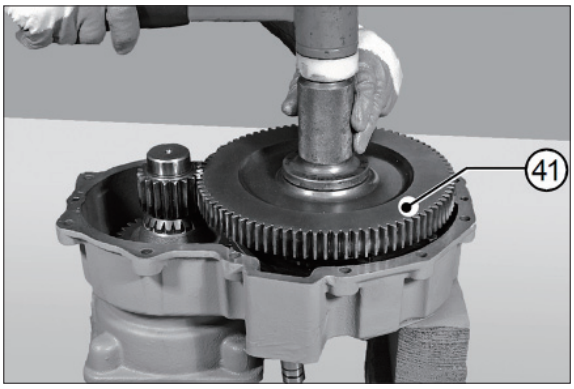
(23) Spread loctite 270 on the screws and tighten to a torque of 0.97~1.07 kgf · m (7.02~7.74 lbf · ft).



55W9NGB106

(24) Using a pusher of suitable diameter, fit gear (41) onto the shaft (24).

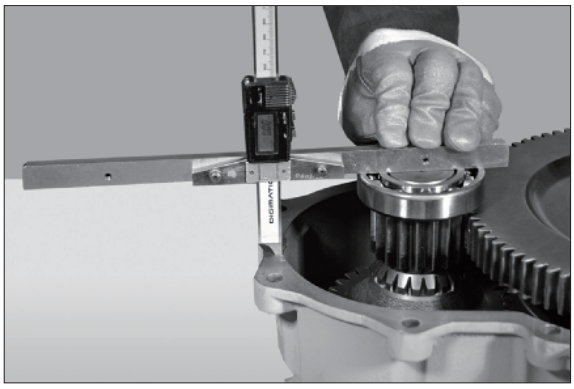
※ Fit as originally mounted, using the markings made previously as reference.



55W9NGB107

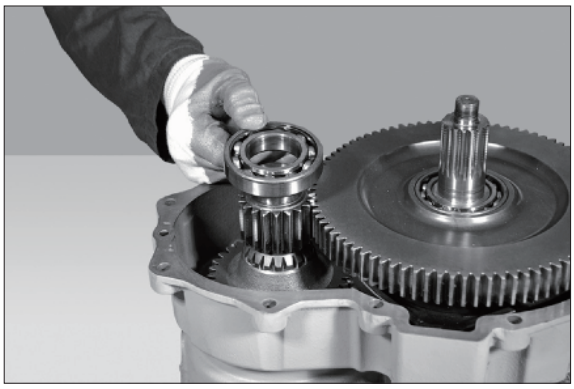
(25) By hand install the bearing on the input shaft.

Reset a digital depth gauge between cover surface and bearing.



55W9NGB108

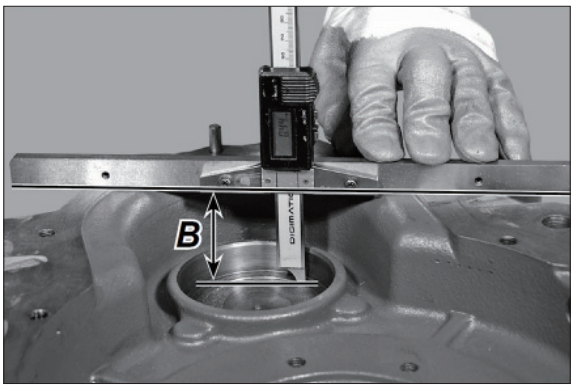
(26) Remove the bearing (75) from the input shaft (73).



55W9NGB109

(27) Measure distance “B” between the cover surface and bearing contact surface.

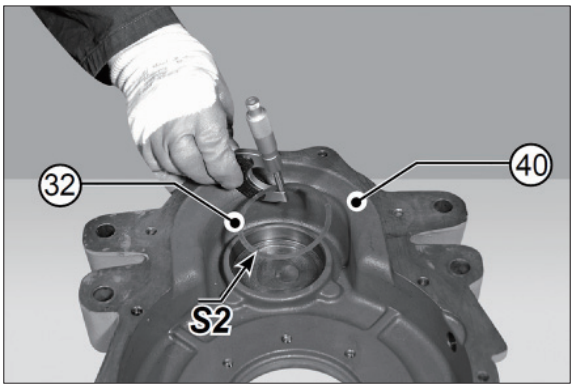
· Example : B = 0.45



55W9NGB110

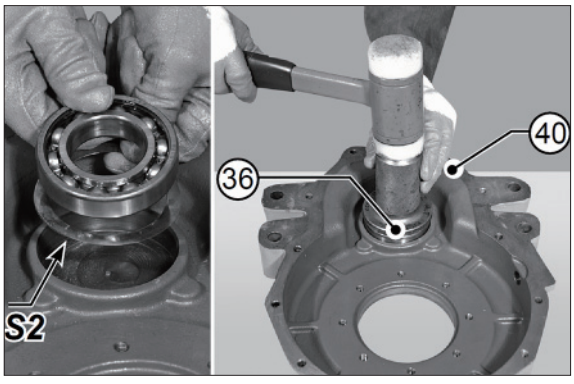
(28) Calculate thickness “S2” of the shims by using this formula :
S2 = B - Y = S2, where Y is the predefined axial backlash.
Y = backlash = 0.15 ± 0.35 mm
Example :
S2 = B-Y = 0.45 - 0.25 = 0.20 mm = S2

Make up the appropriate pack of shims.



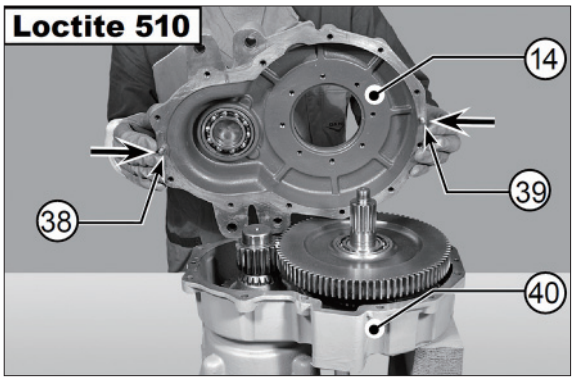
55W9NGB111

(29) Using a normal tool, push the bearing (36) and shims into its seat in the cover (40).



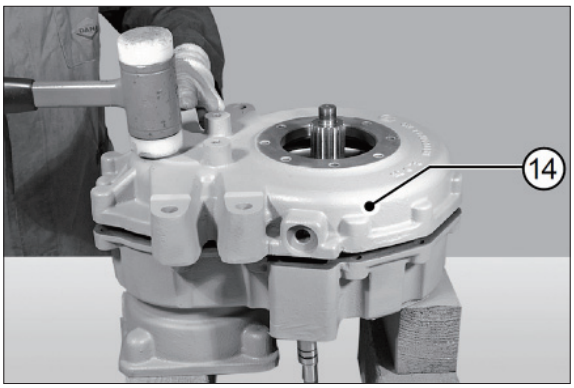
55W9NGB112

(30) Insert guide bushings (38), (39) .
Apply loctite 510 to the machined surfaces, Fit the cover (14) onto the casing (40) and align the pins (38), (39).



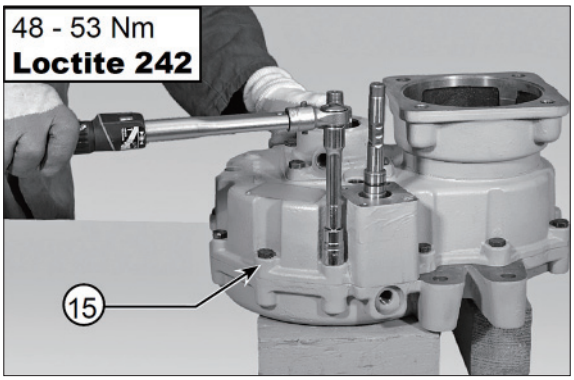
55W9NGB113

(31) Tap the cover (14) gently with a mallet to seat correctly.



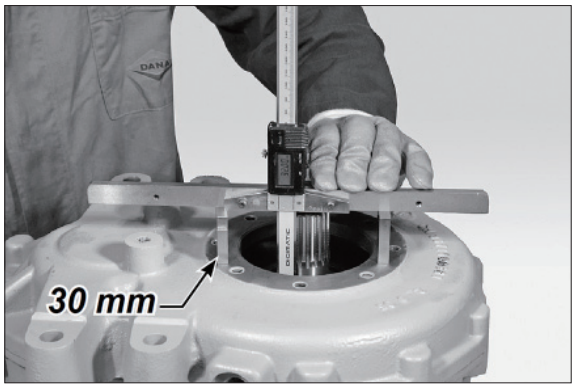
55W9NGB114

(32) Spread loctite 242 on the screws (15).
Secure in position with the screws (15), tightening to a torque of 4.89~5.4 kgf · m (35.4~39.1 lbf · ft).

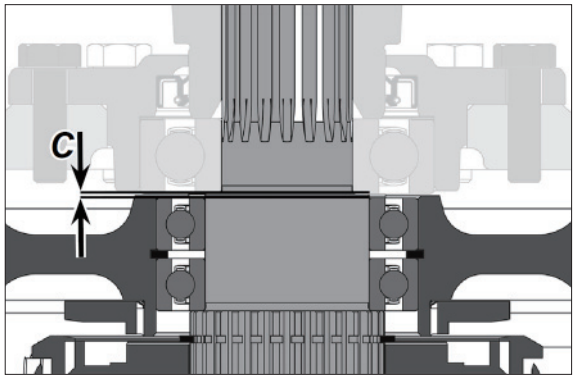


55W9NGB115

(33) Reset a centesimal digital depth gauge between calibrated blocks (whose known thickness is 30 mm) and output shaft.



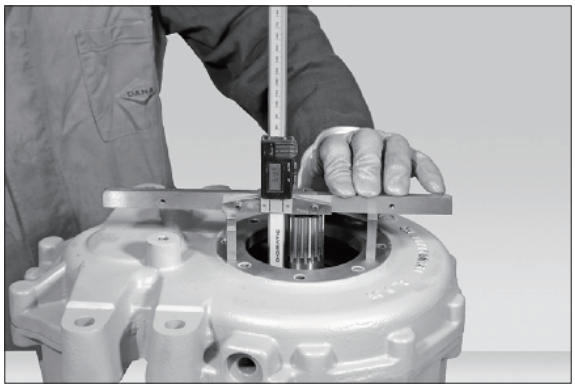
55W9NGB116



55W9NGB117

(34) Measure distance “C” between the output shaft and bearing thrust block.

· Example : C = 0.45



55W9NGB118

(35) Calculate thickness “S3” of the shims by using this formula :

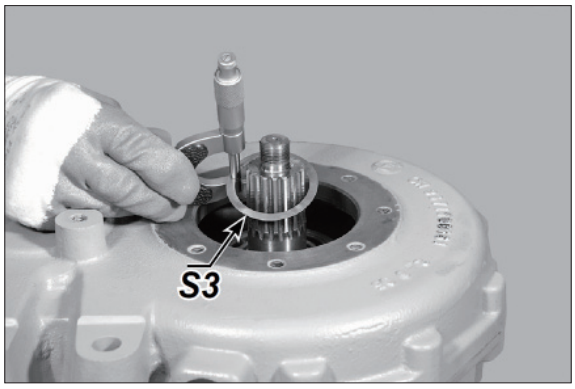
S3 = C - X = S3, where X is the predefined axial backlash.

X = backlash = 0.15 ± 0.35 mm

Example :

S3 = C-X = 0.45 - 0.25 = 0.20 mm = S3

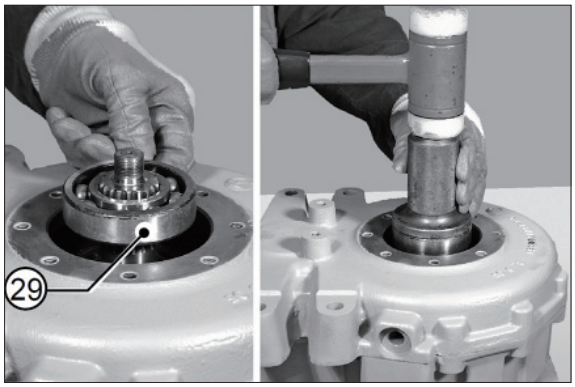
Make up the appropriate pack of shims.



55W9NGB119

(36) Using a pusher of suitable diameter, fit the bearing (29) into output shaft (24).

※ Ensure that the bearing is seated securely.

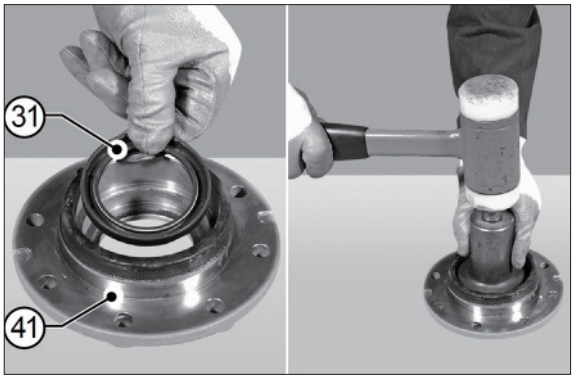


55W9NGB120

(37) Re-insert the new sealing ring (31) in the motion output cover (41).

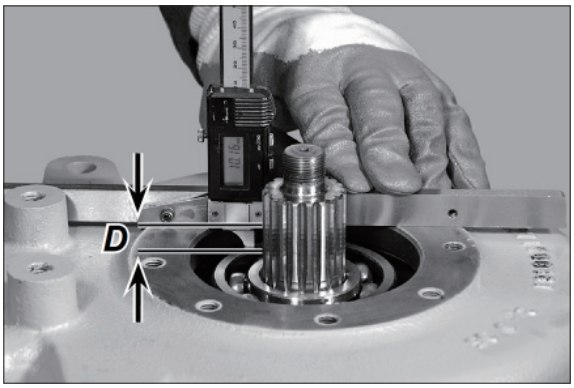
※ Pay particular attention to the direction of assembly of the rings (31).

Lubricate the lip of the sealing ring with grease.



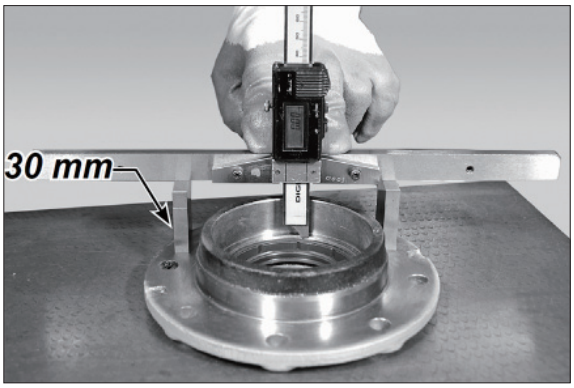
55W9NGB121

(38) Measure distance “D” between cover surface and bearing.



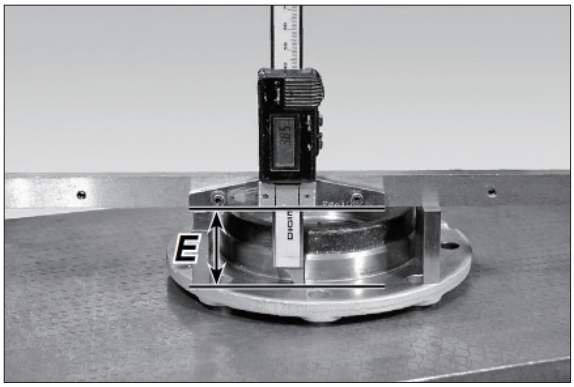
55W9NGB122

(39) Zero the depth gauge between calibrated blocks (whose known thickness is 30 mm) and bearing seat.



55W9NGB123

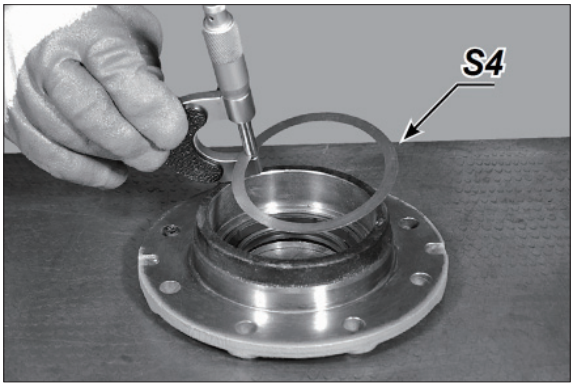
(40) Measure dimension “E” on the cover.



55W9NGB124

(41) Calculate thickness “S4” of the shims by using this formula :
S4 = (Dimension E - Dimension D) - X = S4, where X is the predefined axial backlash.
X = backlash = 0.15 ± 0.25 mm
Example : S4 = (E-D)-X = (3.85-3.40)-0.20 = 0.25 mm =S4

Make up the appropriate pack of shims.

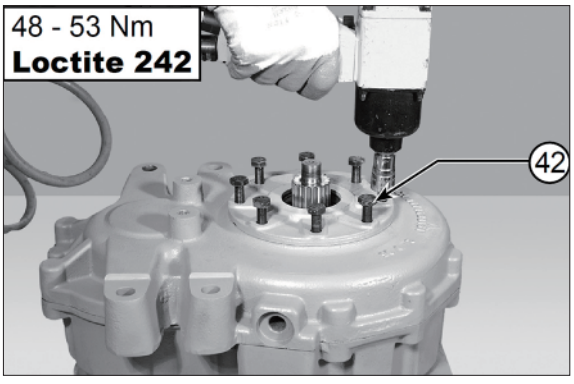


55W9NGB125

(42) Assembly the cover (41) spreading loctite 510 on planes.

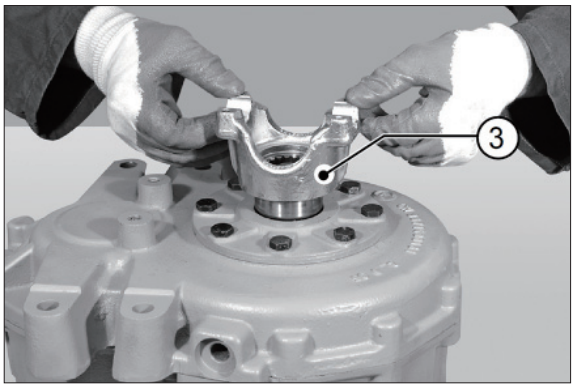
55W9NGB126

(43) Assembly the screws (42) spreading loctite 242.
Tighten screws (42) using a torque wrench setting of 4.89~5.4 kgf · m (35.4~39.1 lbf · ft).



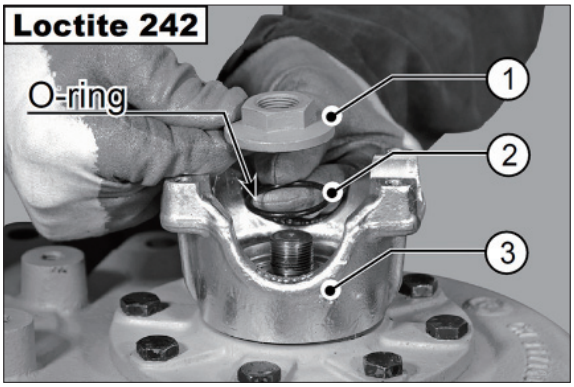
55W9NGB127

(44) Fit the flange (3) on the shaft (24), seating completely.



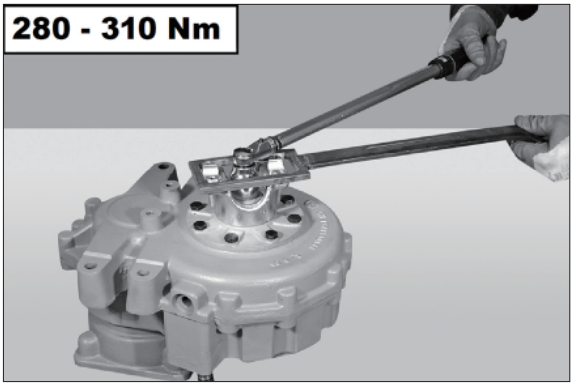
55W9NGB128

(45) Lubricate the O-ring (2) with grease and fit in the flange (3) seating.
Spread with loctite 242 the lock nut (1) and fit.



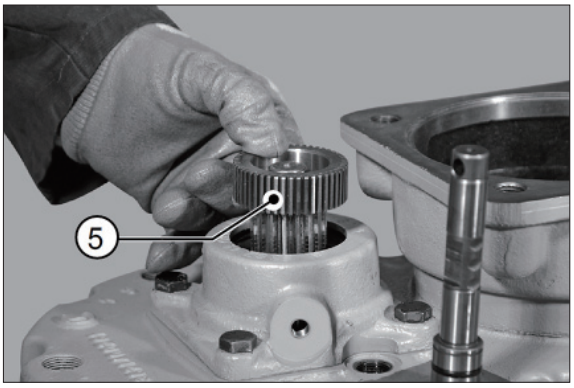
55W9NGB129

(46) Tighten the lock nut (1) to a torque of 28.6~31.6 kgf · m (207~229 lbf · ft).



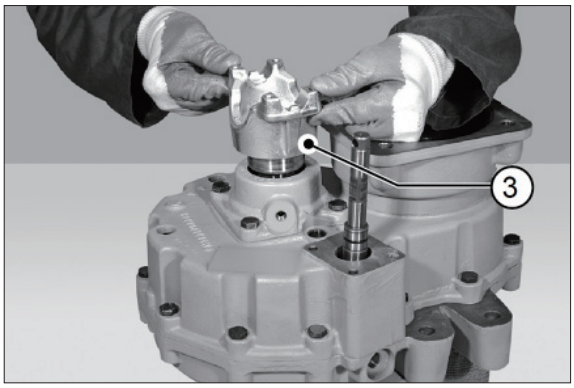
55W9NGB130

(47) Insert the phonic end disk (5).



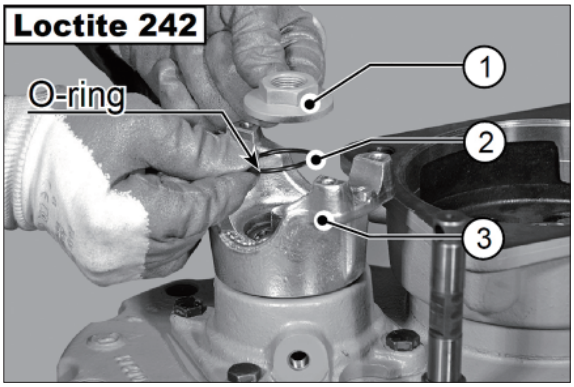
55W9NGB131

(48) Fit the flange (3) on the shaft (24), seating completely.



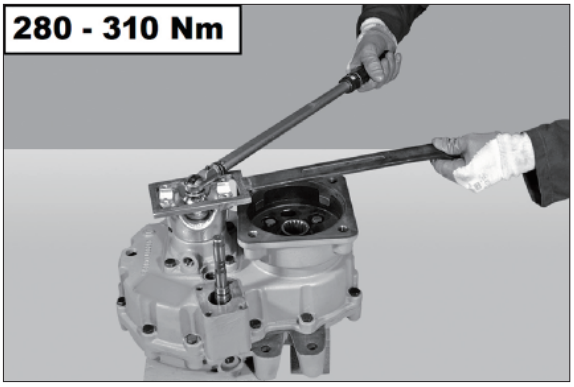
55W9NGB132

(49) Lubricate the O-ring (2) with grease and fit in the flange (3) seating.
Spread with loctite 242 the lock nut (1) and fit.



55W9NGB133

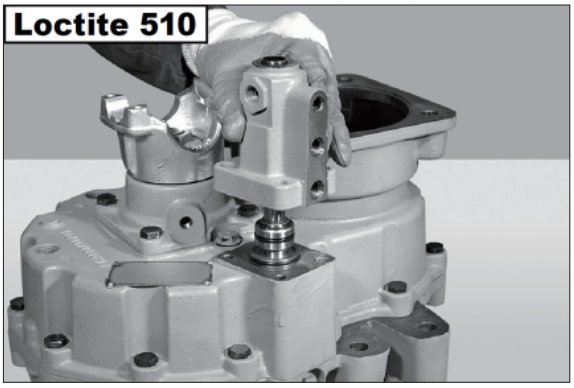
(50) Tighten the lock nut (1) to a torque of 28.6~31.6 kgf · m (207~229 lbf · ft).



55W9NGB134

(51) Coat the coupling surface of the gearshift cylinder with loctite 510 ; fit the cylinder on the gear selector rod.

※ Make sure that the sealant forms a continuous film around the locking holes.
For more details, see : INSTALLATION OF HYDRAULIC GEAR CONTROL



55W9NGB135

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.

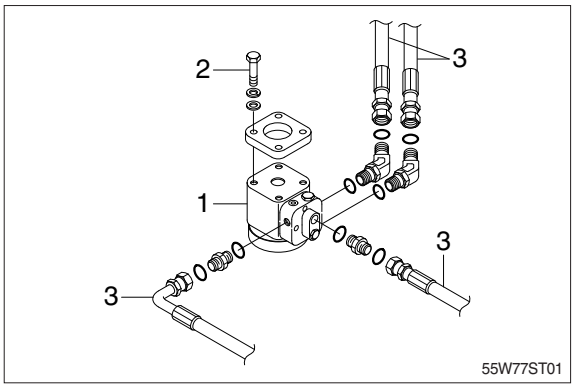
(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

(4) Disconnect steering line hoses (3).

(5) Loosen the hexagon bolt (2) and remove the steering valve assembly (1).

· Tightening torque : 4.8 ± 0.3 kgf · m
(34.7 ± 2.2 lbf · ft)



2) INSTALL

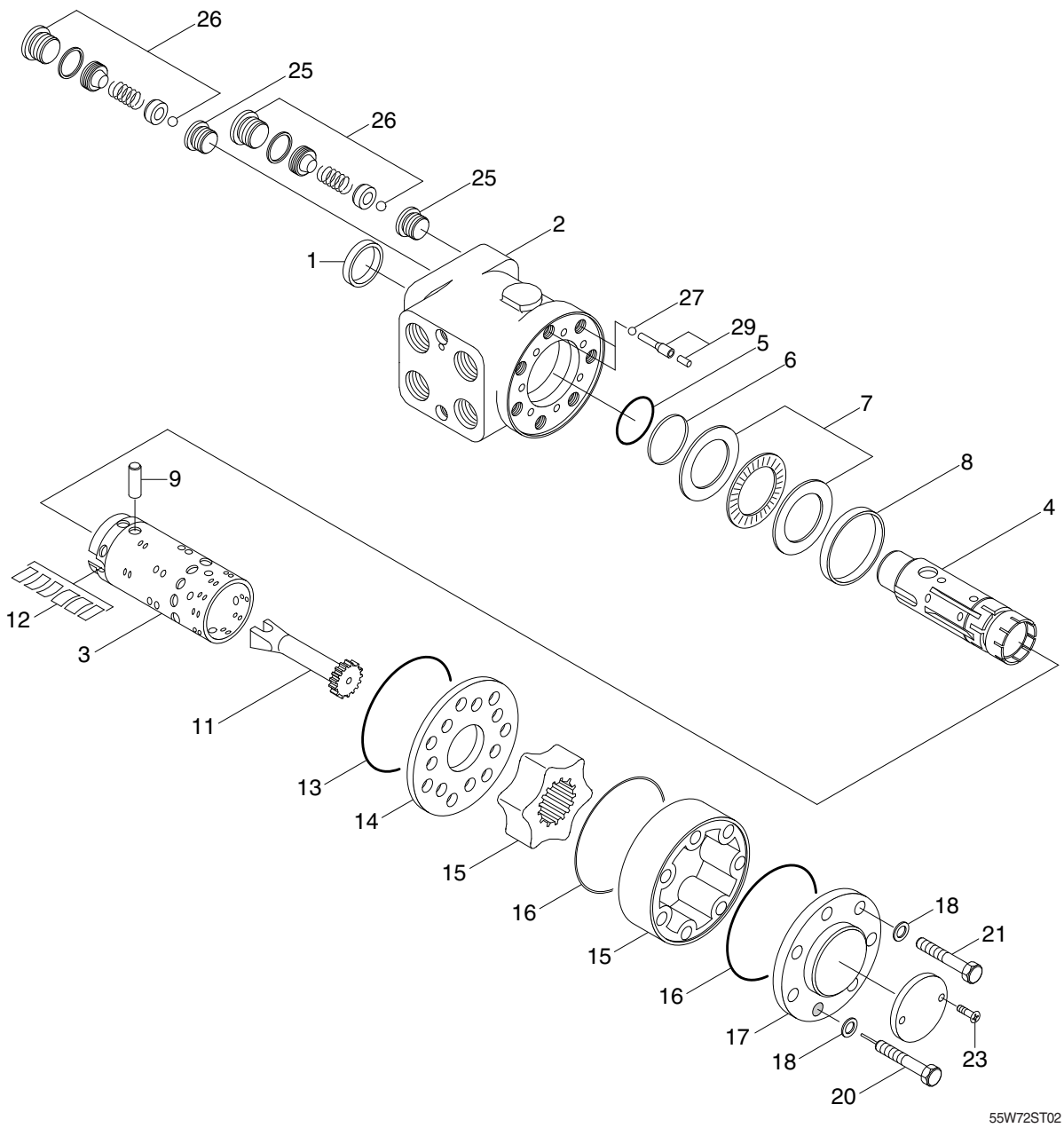
(1) Carry out installation in the reverse order to removal.

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

※ When removing the steering valve assembly, check that all the hoses have been disconnected.

2. STEERING VALVE

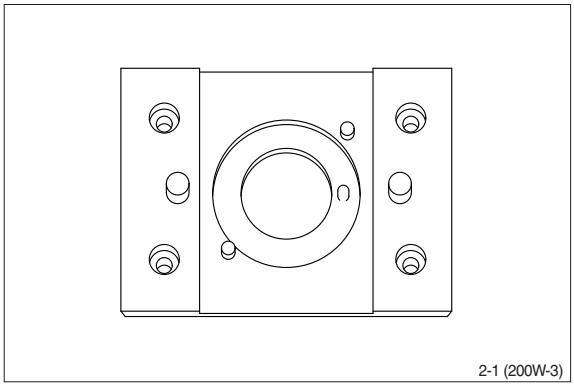
1) STRUCTURE



1	Dust seal ring	11	Shaft	20	Pin screw
2	Housing	12	Spring set	21	Screw
3	Sleeve	13	O-ring	22	Name plate
4	Spool	14	Distributor plate	23	Drive screw
5	O-ring	15	Gear wheel set	25	Plug
6	Kin ring	16	O-ring	26	Shock valve
7	Bearing assy	17	End cover	27	Ball
8	Ring	18	Washer	29	Suction valve pin
9	Cross pin				

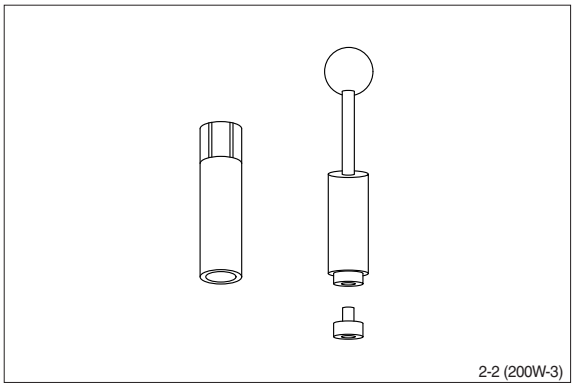
2) TOOLS

(1) Holding tool.



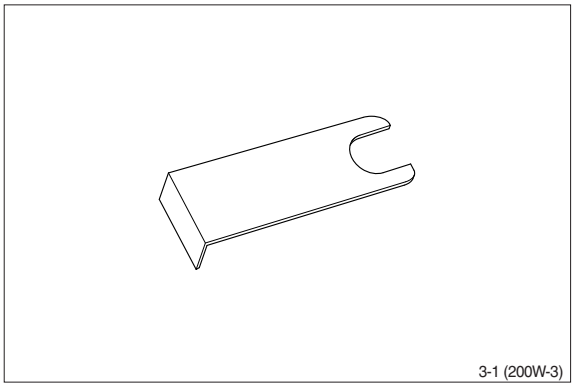
2-1 (200W-3)

(2) Assembly tool for O-ring (5,13,16) and kin-ring (6).



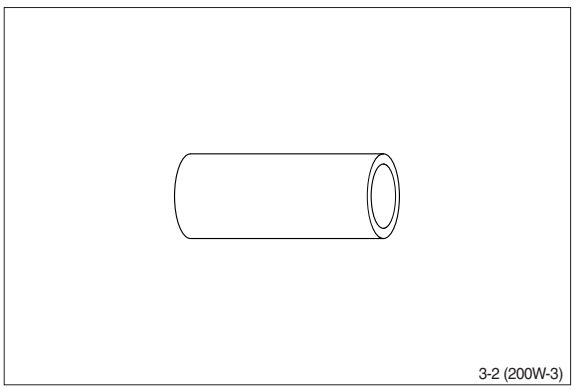
2-2 (200W-3)

(3) Assembly tool for cardan shaft (11).



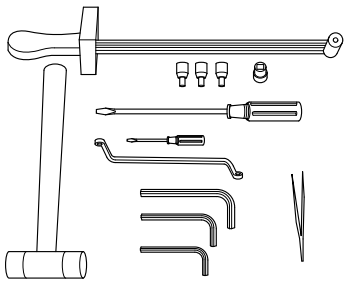
3-1 (200W-3)

(4) Assembly tool for dust seal (1).



3-2 (200W-3)

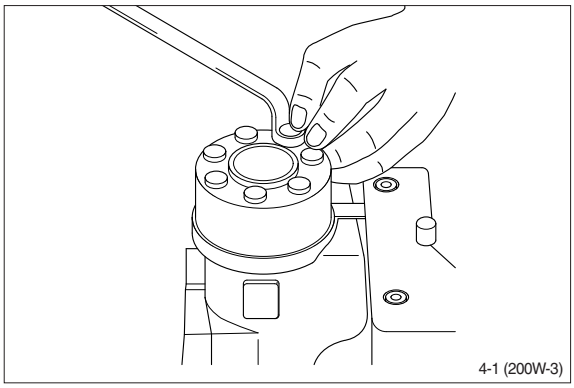
(5) Torque wrench : 0~7.1 kgf · m
(0~54.4 lbf · ft).
13 mm socket spanner.
6, 8 mm and 12 mm hexagon sockets.
12 mm screwdriver.
2 mm screwdriver.
13 mm ring spanner.
6,8 mm and 12 mm hexagon socket spanners.
Plastic hammer.
Tweezers.



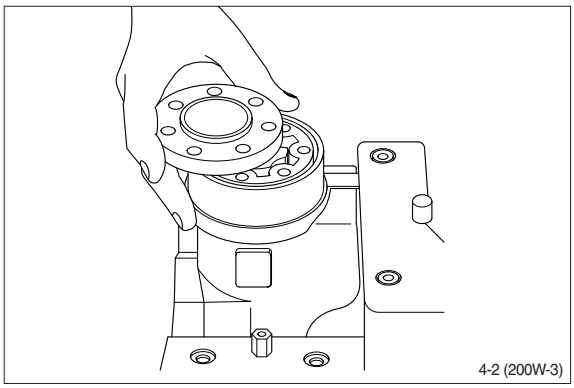
3-3 (200W-3)

3) DISASSEMBLY

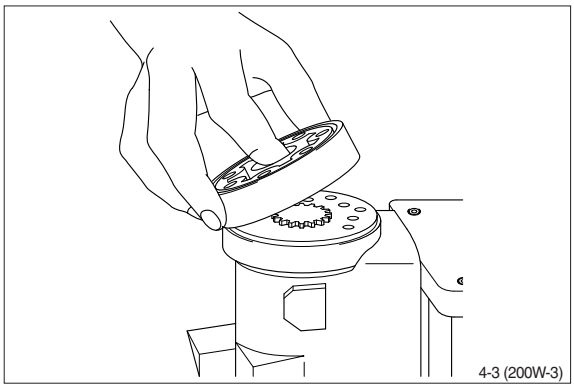
(1) Dissemble steering column from steering valve and place the steering valve in the holding tool.
Screw out the screws in the end cover (6-off plus one special screw).


4-1 (200W-3)

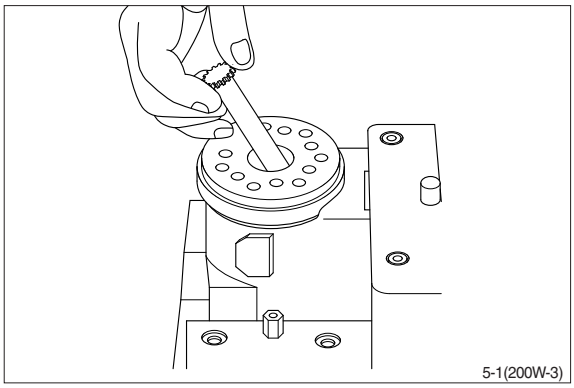
(2) Remove the end cover, sideways.


4-2 (200W-3)

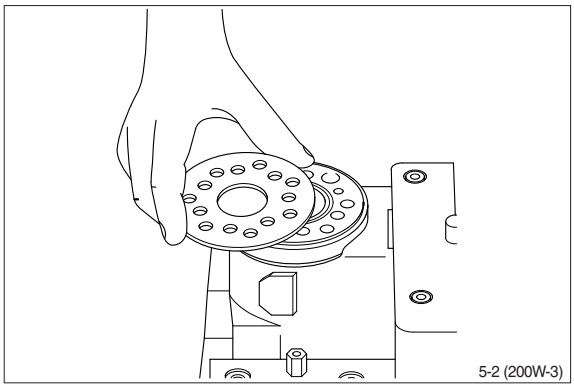
(3) Lift the gearwheel set (with spacer if fitted) off the unit.
Take out the two O-rings.


4-3 (200W-3)

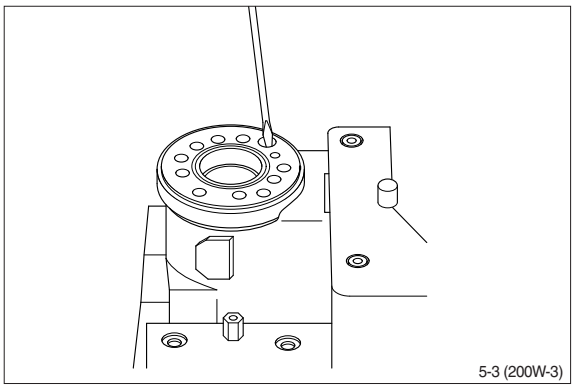
(4) Remove cardan shaft.


5-1(200W-3)

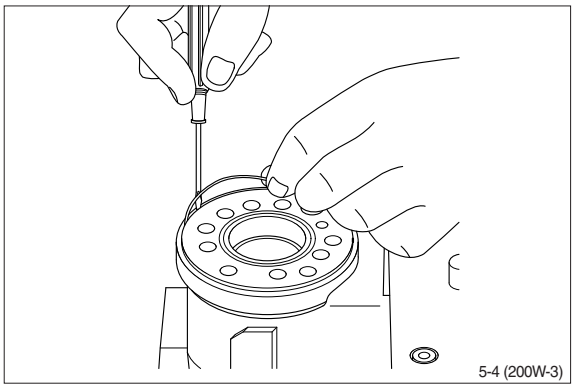
(5) Remove distributor plate.


5-2 (200W-3)

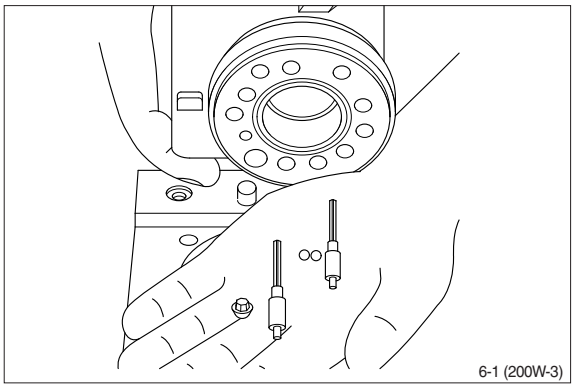
(6) Screw out the threaded bush over the check valve.


5-3 (200W-3)

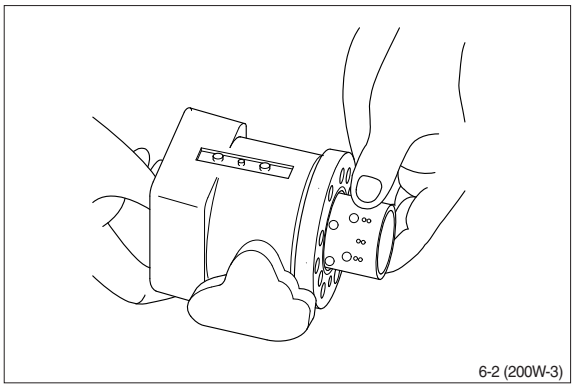
(7) Remove O-ring.


5-4 (200W-3)

(8) Shake out the check valve ball and suction valve pins and balls.

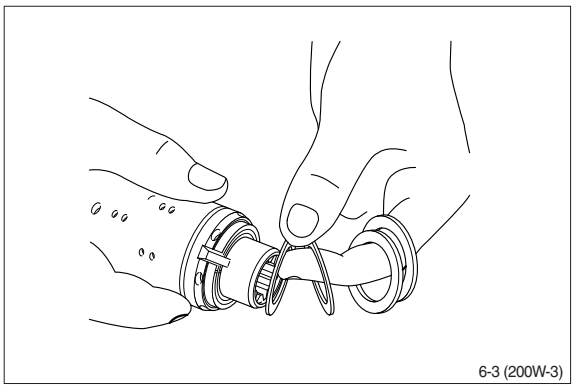

6-1 (200W-3)

(9) Take care to keep the cross pin in the sleeve and spool horizontal. The pin can be seen through the open end of the spool. Press the spool inwards and the sleeve, ring, bearing races and needle bearing will be pushed out of the housing together.



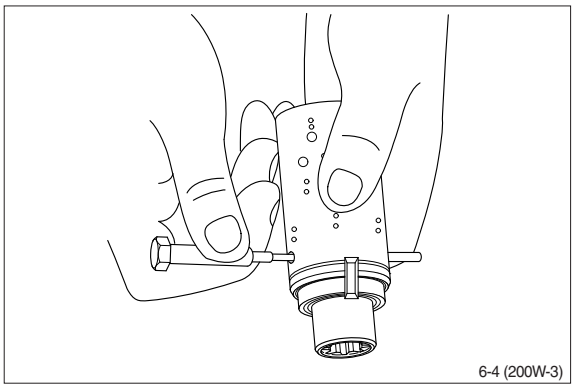
6-2 (200W-3)

(10) Take ring, bearing races and needle bearing from sleeve and spool. The outer (thin)bearing race can sometimes "stick" in the housing, therefore check that it has come out.



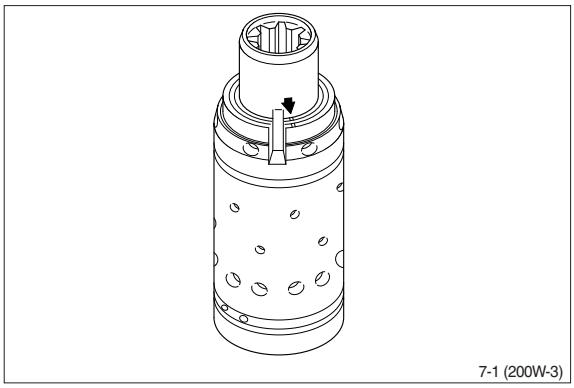
6-3 (200W-3)

(11) Press out the cross pin. Use the special screw from the end cover.



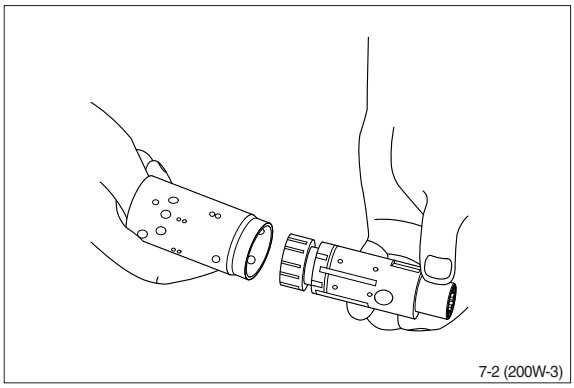
6-4 (200W-3)

※ A small mark has been made with a pumice stone on both spool and sleeve close to one of the slots for the neutral position spring as figure.
If the mark is not visible, remember to leave a mark of your own on sleeve and spool before the neutral position springs are disassembled.



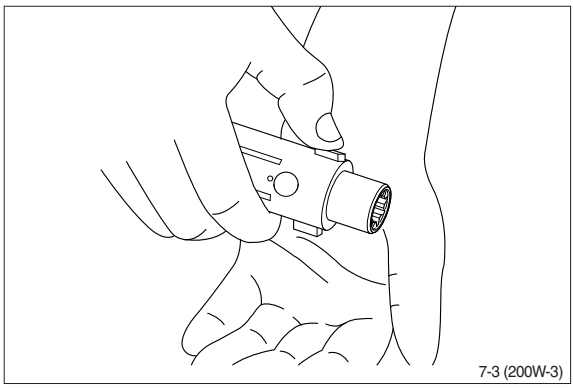
7-1 (200W-3)

(12) Carefully press the spool out of the sleeve.



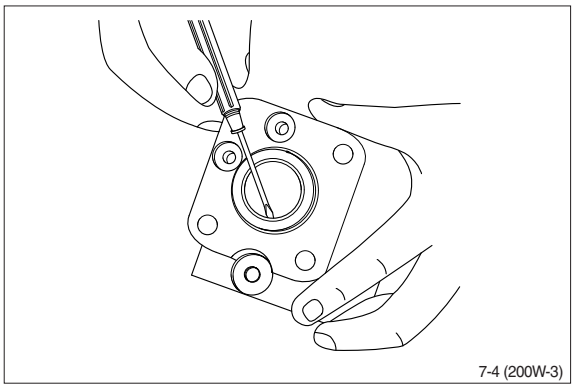
7-2 (200W-3)

(13) Press the neutral position springs out of their slots in the spool.



7-3 (200W-3)

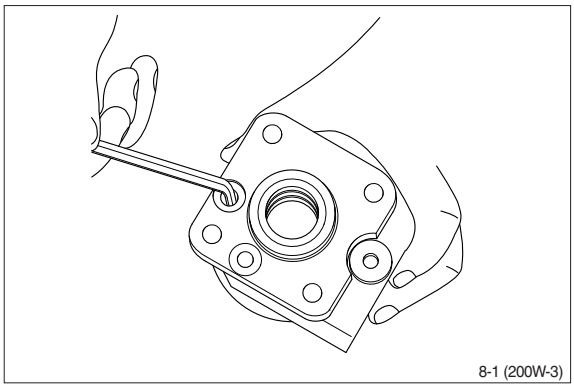
(14) Remove dust seal and O-ring/kin ring.



7-4 (200W-3)

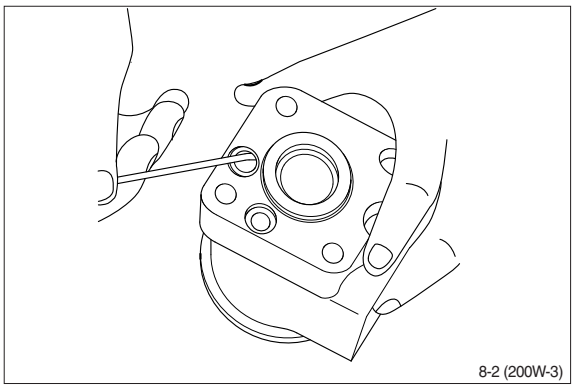
(15) Disassemble the dual shock valve

① Remove plugs from shock valves using a 6㎜ hexagon socket spanner.



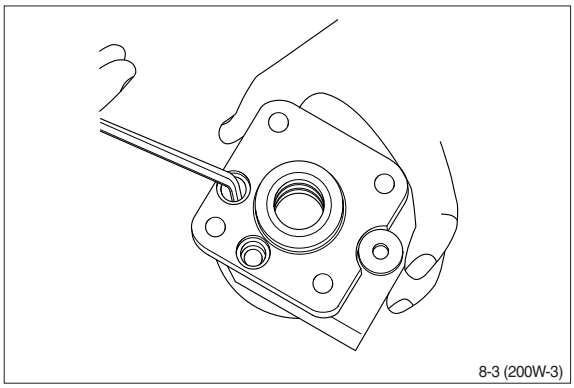
8-1 (200W-3)

② Remove seal washers (2-off).



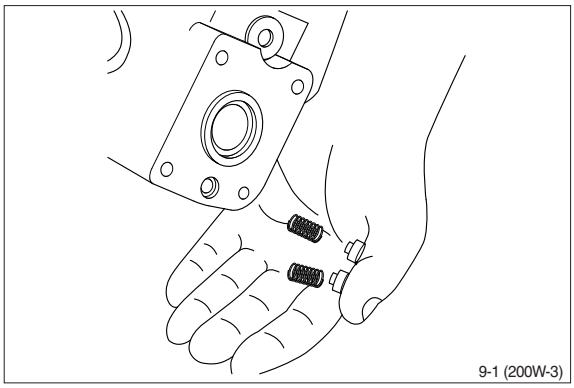
8-2 (200W-3)

③ Unscrew the setting screws using a 6 ㎜ hexagon socket spanner.



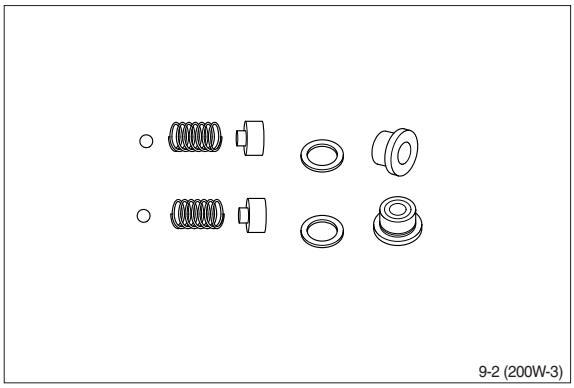
8-3 (200W-3)

④ Shake out the two springs and two valve balls into your hand. The valve seats are bonded into the housing and cannot be removed.



9-1 (200W-3)

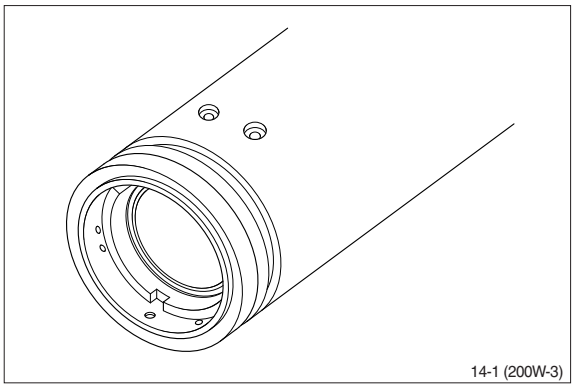
⑤ The dual shock valves are now disassembled.



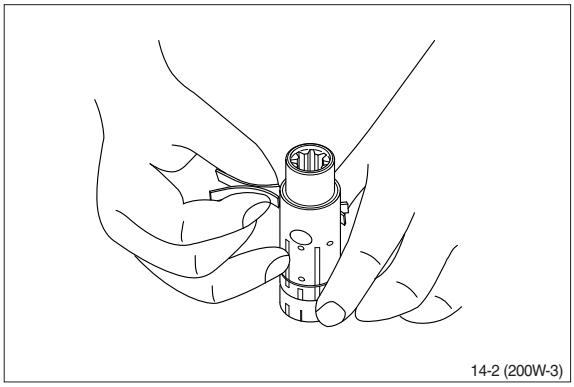
9-2 (200W-3)

4) ASSEMBLY

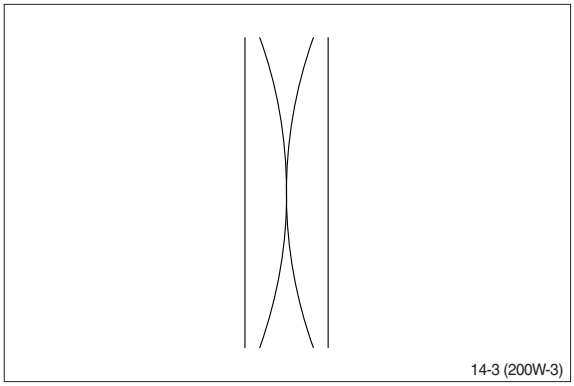
(1) Assemble spool and sleeve.
When assembling spool and sleeve only one of two possible ways of positioning the spring slots is correct. There are three slots in the spool and three holes in the sleeve in the end of the spool / sleeve opposite to the end with spring slots.
Place the slots and holes opposite each other so that parts of the holes in the sleeve are visible through the slots in the spool.


14-1 (200W-3)

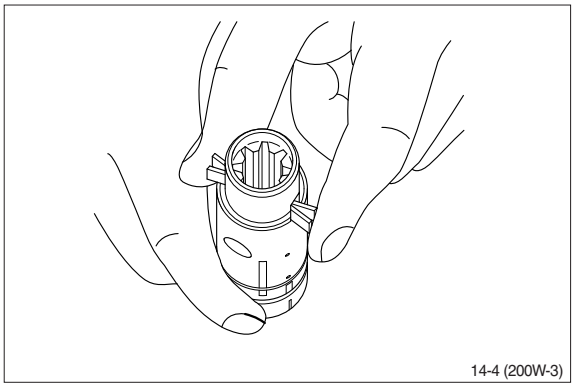
(2) Place the two flat neutral position springs in the slot.
Place the curved springs between the flat ones and press them into place (see assembly pattern).


14-2 (200W-3)

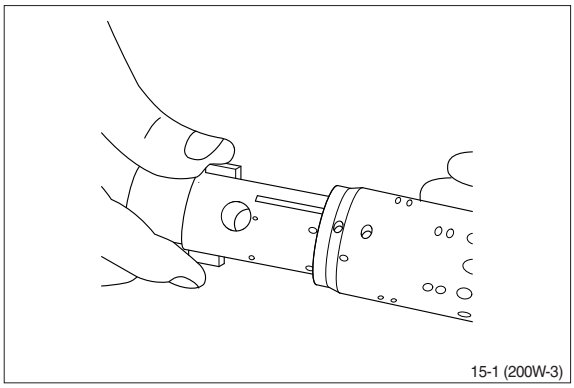
※ Assembly pattern.
Part no. : 150N4035


14-3 (200W-3)

(3) Line up the spring set.

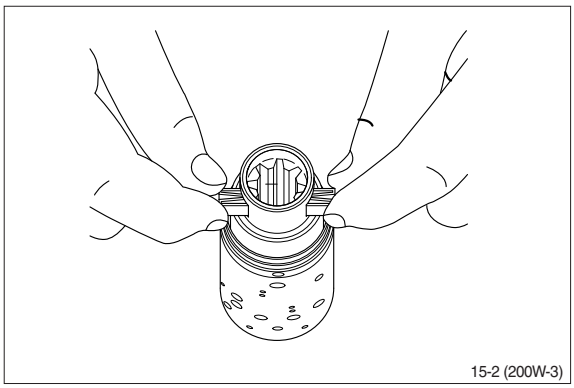

14-4 (200W-3)

(4) Guide the spool into the sleeve. Make sure that spool and sleeve are placed correctly in relation to each other.



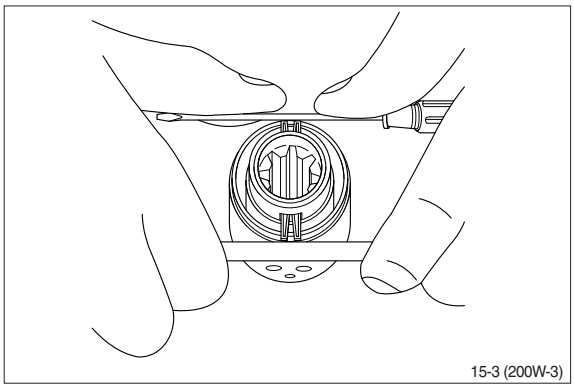
15-1 (200W-3)

(5) Press the springs together and push the neutral position springs into place in the sleeve.



15-2 (200W-3)

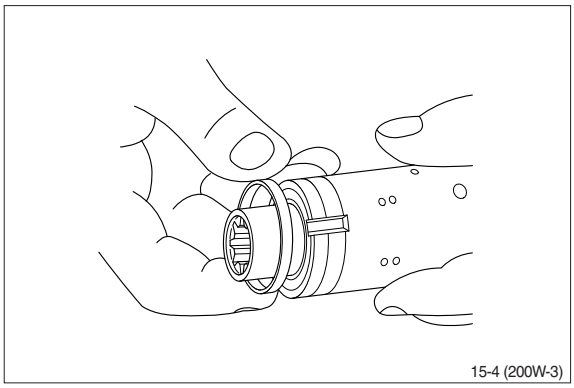
(6) Line up the springs and center them.



15-3 (200W-3)

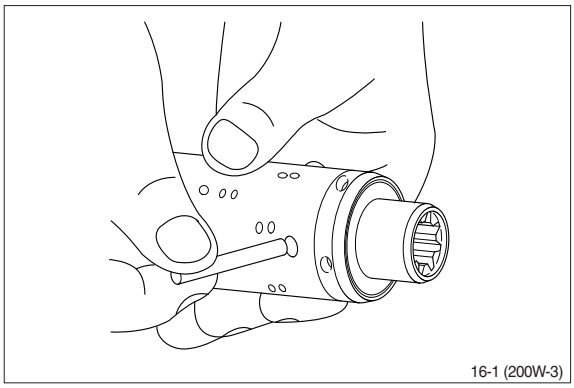
(7) Guide the ring down over the sleeve.

※ The ring should be able to rotate free of the springs.



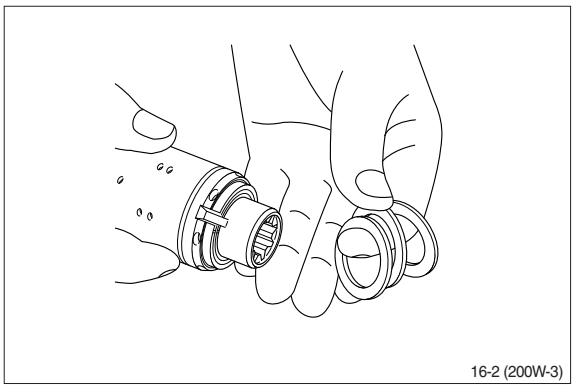
15-4 (200W-3)

(8) Fit the cross pin into the spool / sleeve.



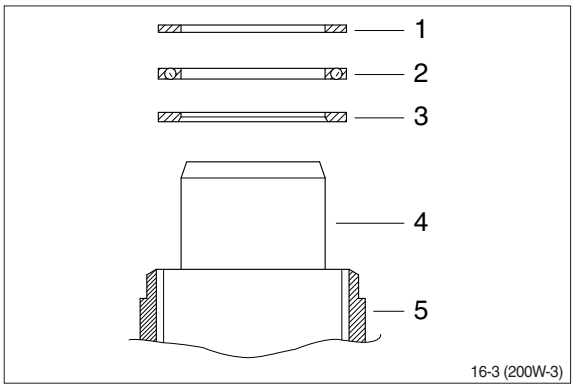
16-1 (200W-3)

(9) Fit bearing races and needle bearing as shown on below drawing.



16-2 (200W-3)

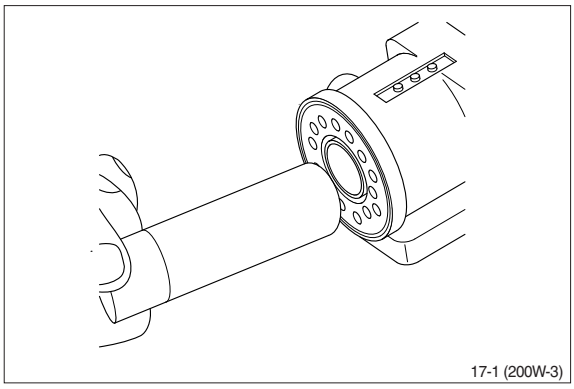
※ Assembly patted for standard bearings
1 Outer bearing race
2 Needle bearing
3 Inner bearing race
4 Spool
5 Sleeve



16-3 (200W-3)

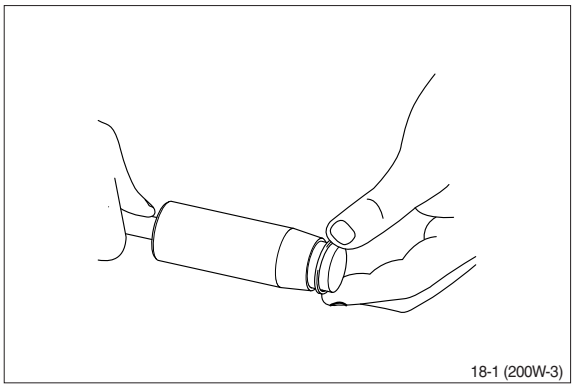
Installation instruction for O-ring/Kin-ring

(10) Turn the steering unit until the bore is horizontal. Guide the outer part of the assembly tool into the bore for the spool / sleeve.

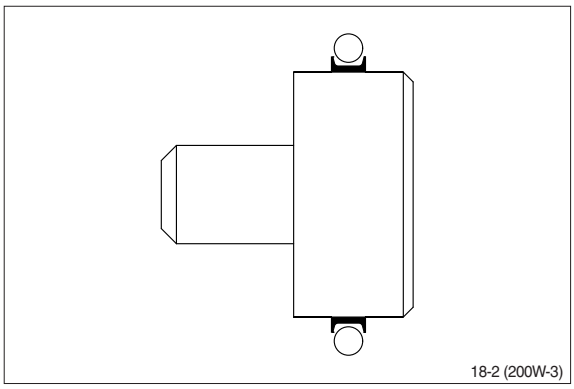


17-1 (200W-3)

(11) Grease O-ring and kin-ring with hydraulic oil and place them on the tool.

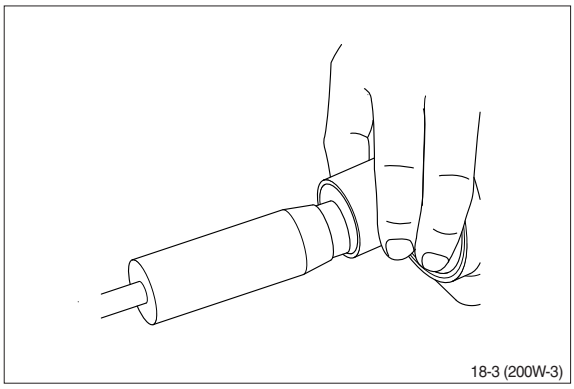


18-1 (200W-3)



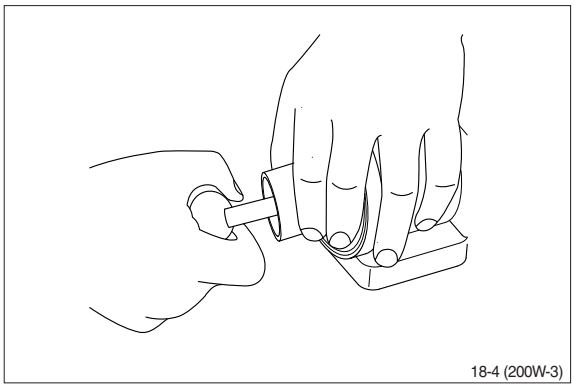
18-2 (200W-3)

(12) Hole the outer part of the assembly tool in the bottom of the steering unit housing and guide the inner part of the tool right to the bottom.



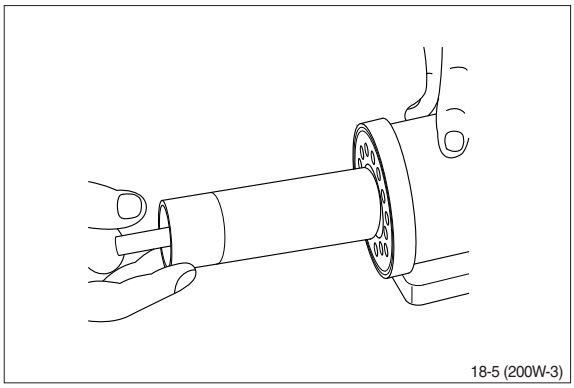
18-3 (200W-3)

(13) Press and turn the O-ring / kin-ring into position in the housing.



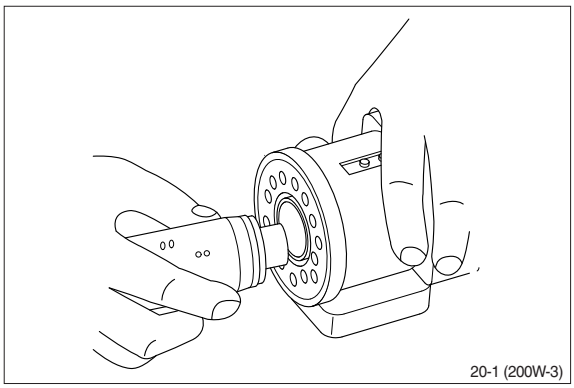
18-4 (200W-3)

(14) Draw the inner and outer parts of the assembly tool out of the steering unit bore, leaving the guide from the inner part in the bore.

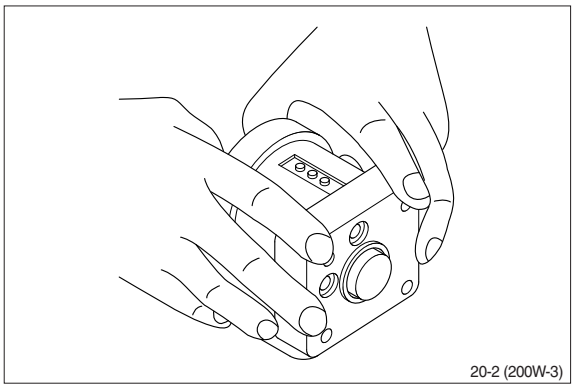

18-5 (200W-3)

(15) With a light turning movement, guide the spool and sleeve into the bore.

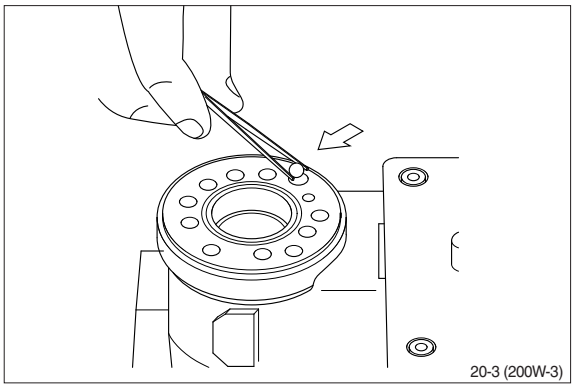
※ Fit the spool set holding the cross pin horizontal.


20-1 (200W-3)

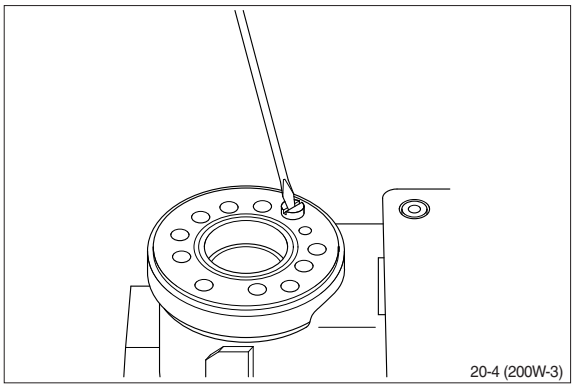
(16) The spool set will push out the assembly tool guide. The O-ring and kin-ring are now in position.


20-2 (200W-3)

(17) Turn the steering unit until the bore is vertical again. Put the check valve ball into the hole indicated by the arrow.

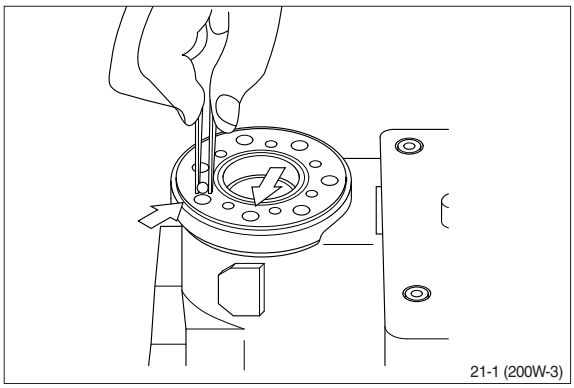

20-3 (200W-3)

(18) Screw the threaded bush lightly into the check valve bore. The top of the bush must lie just below the surface of the housing.

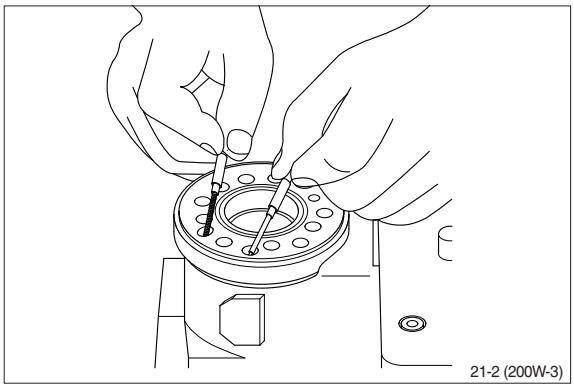

20-4 (200W-3)

Assembly of the two suction valve

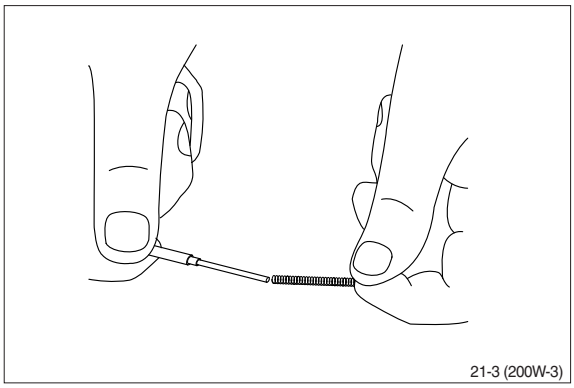
(19) Place a ball in the two holes indicated by the arrows.


21-1 (200W-3)

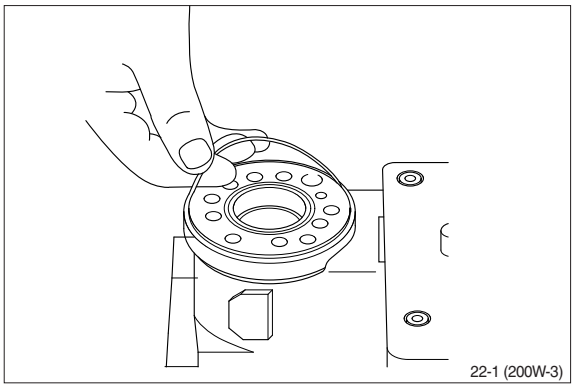
(20) Place a pin in the same two holes.


21-2 (200W-3)

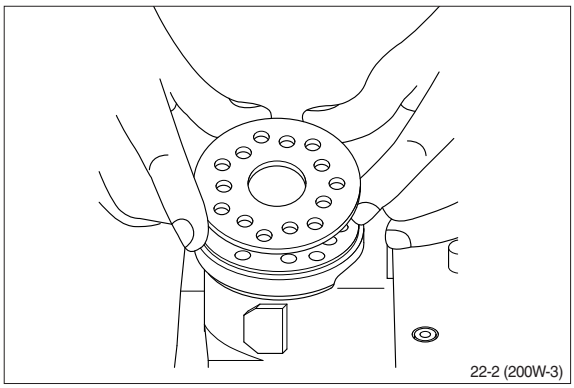
(21) In some cases a spring has to be fitted on the pin before it is placed in the housing.


21-3 (200W-3)

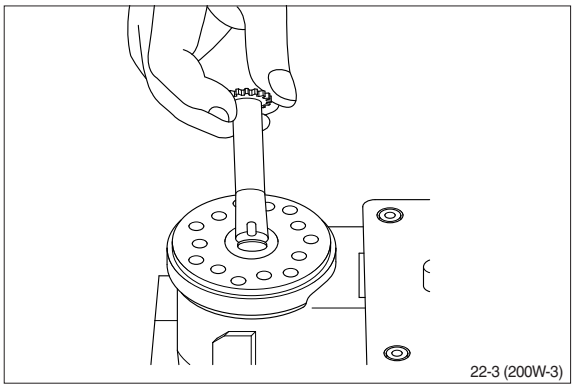
(22) Grease the O-ring with mineral oil approx viscosity 500 cST at 20˚C.


22-1 (200W-3)

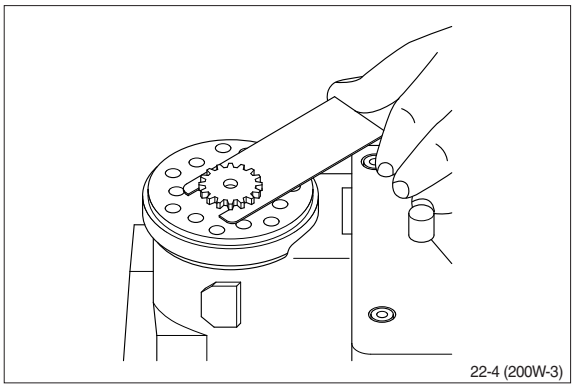
(23) Place the distributor plate so that the channel holes match the holes in the housing.


22-2 (200W-3)

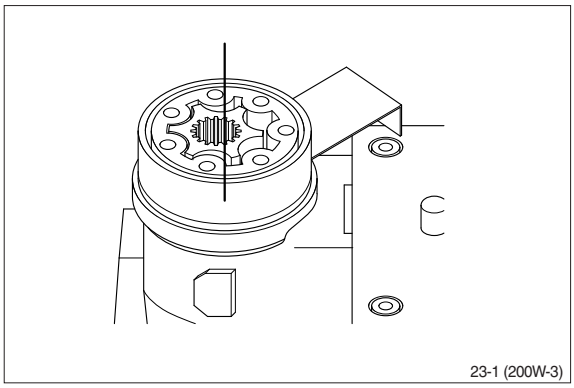
(24) Guide the cardan shaft down into the bore so that the slot is parallel with the connection flange.


22-3 (200W-3)

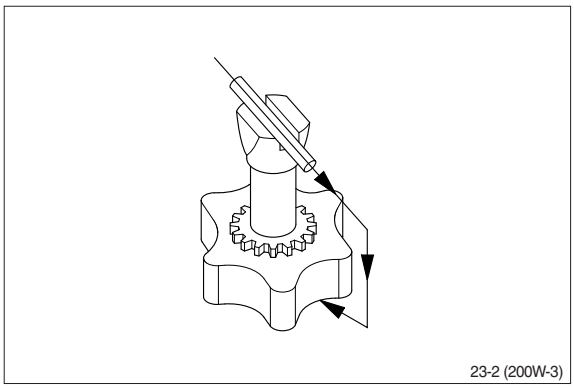
(25) Place the cardan shaft as shown so that it is held in position by the mounting fork.


22-4 (200W-3)

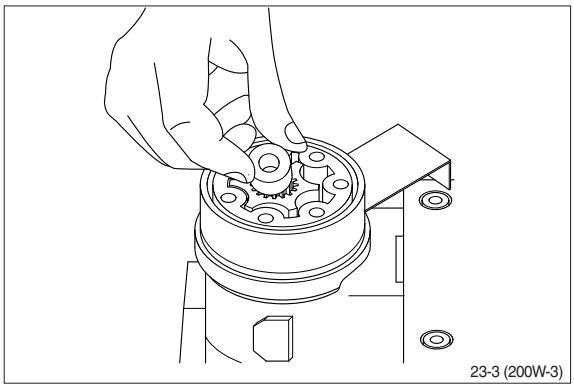
(26) Grease the two O-rings with mineral oil approx. viscosity 500 cST at 20˚C and place them in the two grooves in the gear rim. Fit the gearwheel and rim on the cardan shaft.


23-1 (200W-3)

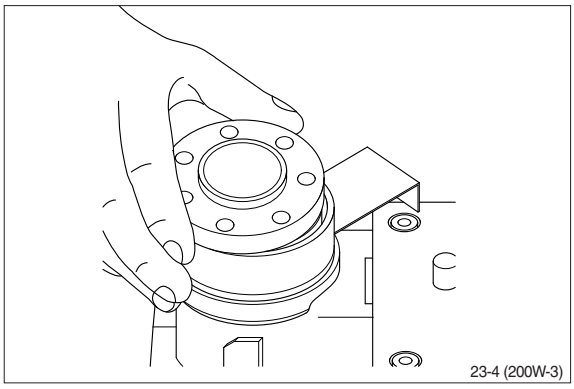
(27) Fit the gearwheel (rotor) and cardan shaft so that a tooth base in the rotor is positioned in relation to the shaft slot as shown. Turn the gear rim so that the seven through holes match the holes in the housing.


23-2 (200W-3)

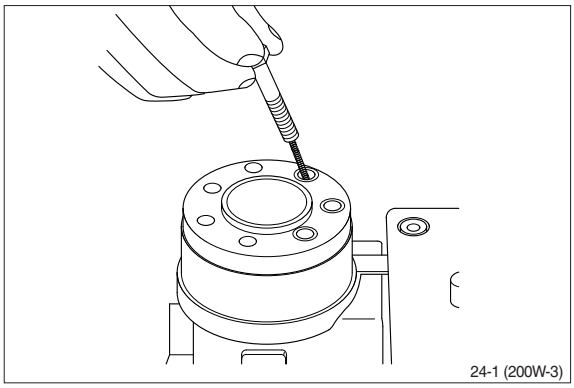
(28) Fit the spacer, if any.


23-3 (200W-3)

(29) Place the end cover in position.

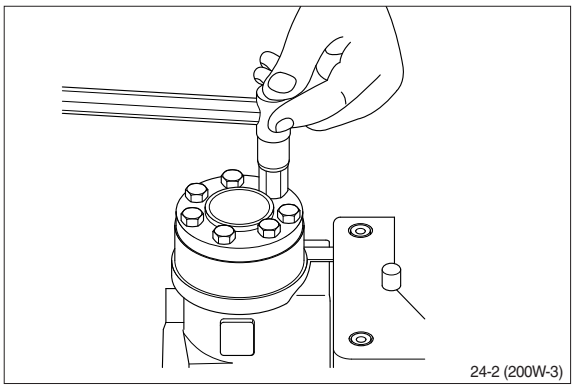

23-4 (200W-3)

(30) Fit the special screw with washer and place it in the hole shown.

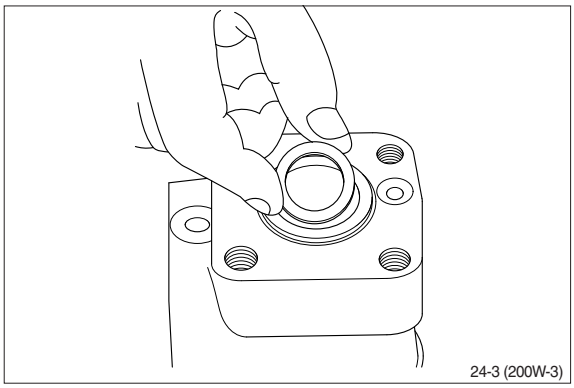

24-1 (200W-3)

(31) Fit the six screws with washers and insert them. Cross-tighten all the screws and the rolled pin.

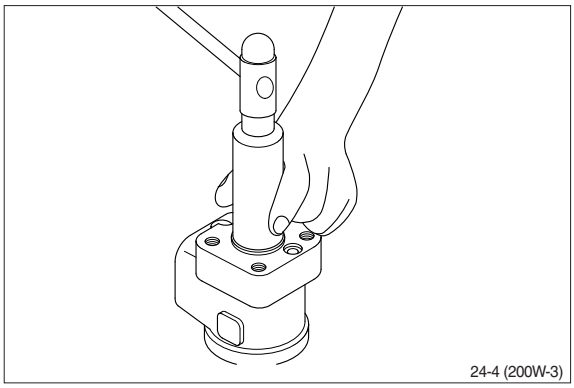
· Tightening torque : 2.3±0.6 kgf · m
(16.6±4.3 lbf · ft)


24-2 (200W-3)

(32) Place the dust seal ring in the housing.
The dust seal ring must be placed only after the pressure relief valve and shock valves have been fitted.

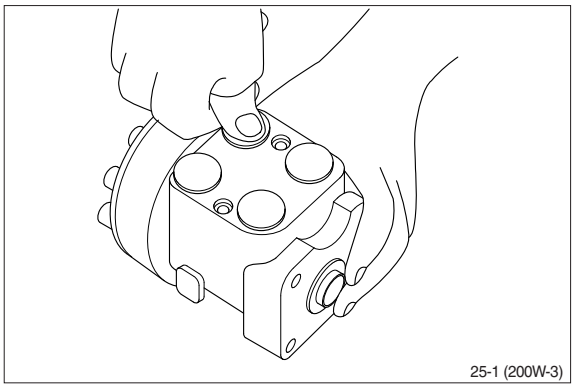

24-3 (200W-3)

(33) Fit the dust seal ring in the housing.


24-4 (200W-3)

(34) Press the plastic plugs into the connection ports.

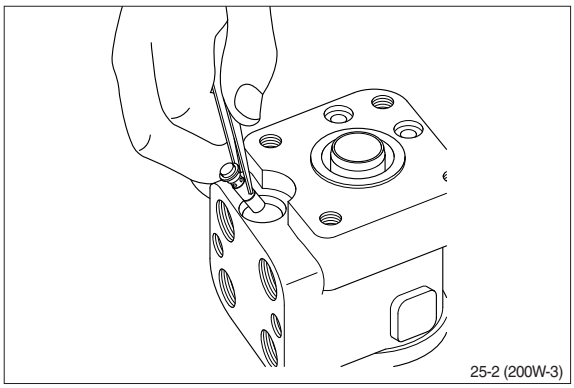
※ Do not use a hammer!



25-1 (200W-3)

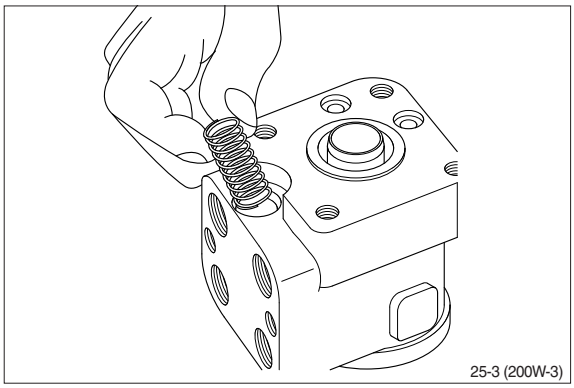
Assembly of the pressure relief valve

(35) Fit the piston.



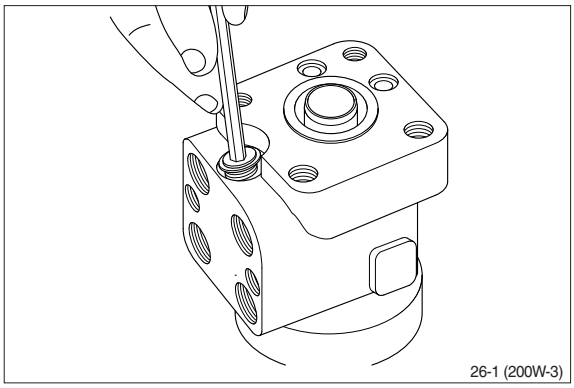
25-2 (200W-3)

(36) Fit the spring.



25-3 (200W-3)

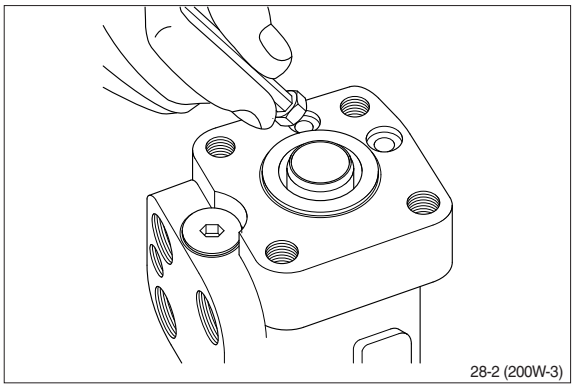
(37) Screw in the setting screw with an 8㎜ hexagon socket spanner. Make the pressure setting on a panel or the machine.



26-1 (200W-3)

(38) Screw plug with seal ring into the two shock valves using a 6㎜ hexagon socket spanner.

· Tightening torque : 3.1 ㎏f · m
(22.4 lbf · ft)


28-2 (200W-3)

Steering valve is now assembled.

1. REMOVAL AXLE

1) FRONT

(1) Propeller shaft mounting nut (2, M10)
· Tightening torque : 6.9±1.4 kgf · m
(49.9±10.1 lbf · ft)

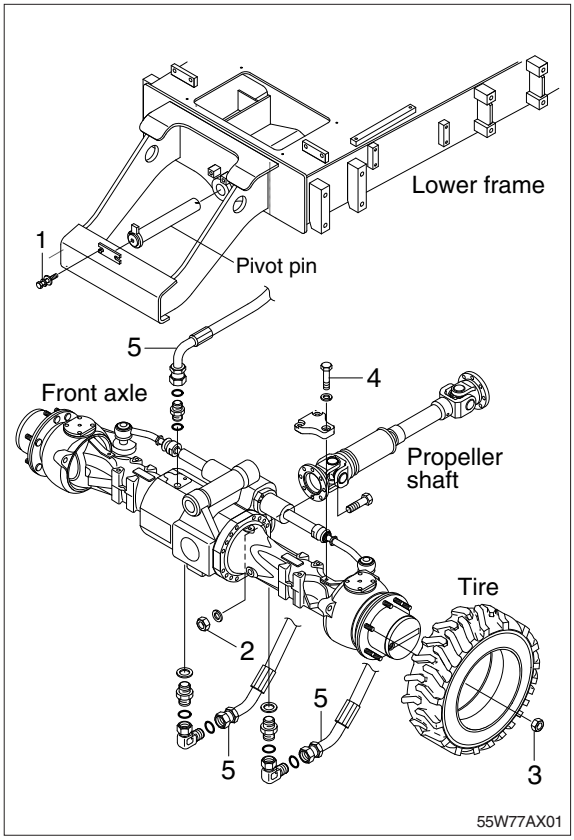
(2) Wheel nut (3, M18)
· Tightening torque : 46±3.0 kgf · m
(333±21.7 lbf · ft)

(3) Oscillating cylinder supporting mounting bolt (4, M12)
· Tightening torque : 12.8±3.0 kgf · m
(92.6±21.7 lbf · ft)

(4) Front axle mounting pin lock bolt (1, M10)
· Tightening torque : 6.9±1.4 kgf · m
(49.9±10.1 lbf · ft)

(5) Hose assy (5)

(4) Front axle weight : 280 kg (610 lb)



2) REAR

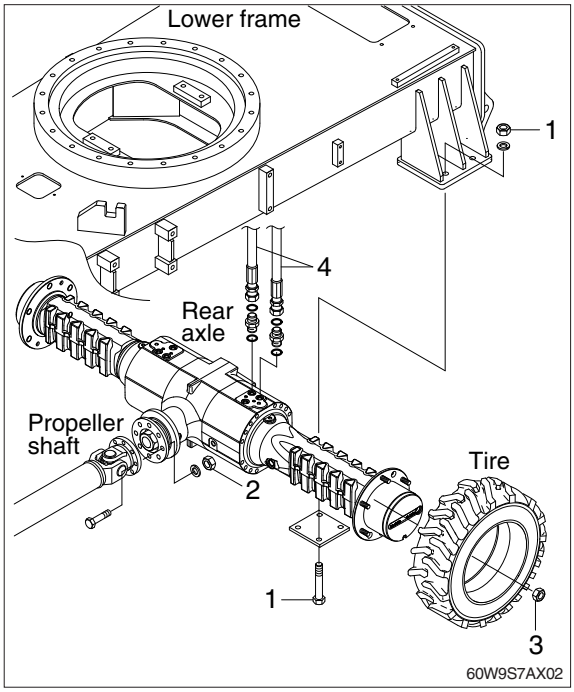
(1) Rear axle mounting bolt and nut (1, M16)
· Tightening torque : 6.9±1.4 kgf · m
(49.9±10.1 lbf · ft)

(2) Propeller shaft mounting nut (2, M10)
· Tightening torque : 7.4±1.5 kgf · m
(53.5±10.8 lbf · ft)

(3) Wheel nut (3)
· Tightening torque : 46±3 kgf · m
(333±21.7 lbf · ft)

(4) Hose assy (4)

(5) Rear axle weight : 200 kg (440 lb)



2. GENERAL INTRODUCTIONS

1) Introduction

The efficiency and continued operation of mechanical units depends on constant and correct maintenance and also on efficient repair work should there be a break-down or malfunction.

The instructions in this manual have been made based on a complete overhaul of the unit. However the mechanic must decide whether or not it is necessary to dismantle the individual components when only partial repair work is needed.

The manual provided a quick and sure guide which, with the use of photographs and diagrams illustrating the various phases of the operations, allows accurate work to take place. Therefore all the information needed for correct disassembly, the relative checks and assembly of each individual component, has been written down.

In order to remove the differential unit from the vehicle, the manuals provided by the vehicle manufacturer should be consulted. In describing the following operations it is presumed that the unit has already been removed from the vehicle.

※ Throughout the phases of repair or maintenance work it is advisable to use proper equipment such as : trestles, or supporting benches, plastic or copper hammers, appropriate levers, extractors and specific spanners or wrenches. So that the work is facilitated and the working surfaces and the operators themselves are protected.

Before going on to disassemble the parts it is best to thoroughly clean the unit, removing any encrusted or accumulated greases and then drain the oil through the oil-draining plugs.

2) Introductory statement

All the disassembled mechanical units should be thoroughly cleaned with appropriate products and then restored or replaced if damage, wear, cracking or seizing have occurred. In particular, thoroughly check the state of all moving parts (bearing, gears, crown wheel and pinion, shafts) and sealing parts (O-ring, oil shield) which are subject to major stress and wear. In any case it is advisable to replace the seals every time a component is overhauled or repaired. During assembly the sealing rings must be lubricated on the sealing edge. In the case of the crown wheel and pinion, replacement of one requires the replacement of the other. During assembly the prescribed pre-loading and backlash of the parts must be maintained.

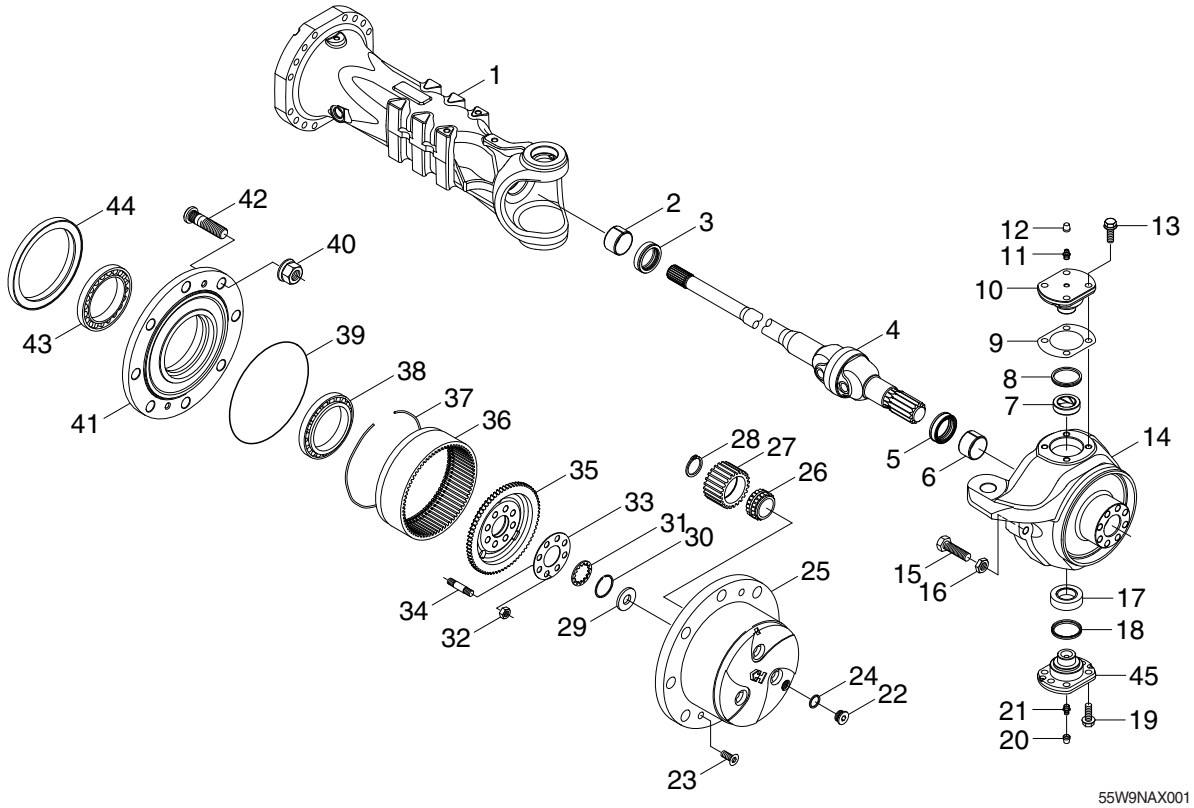
3) Maintenance and repair

We have compiled these instructions for maintenance and repair in order to facilitate any such work on the CLARK-HURTH Components differential units and gear change unit.

3. FRONT AXLE

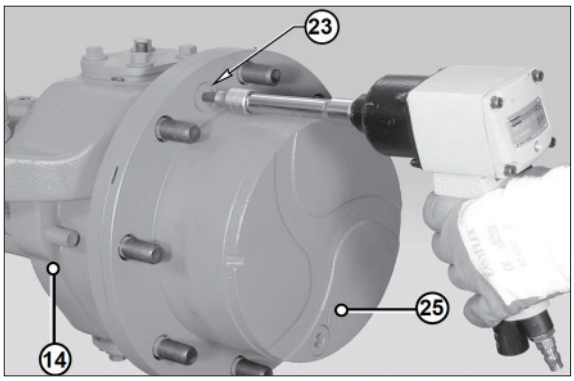
1) THE PLANETARY REDUCTION AND THE COMPLETE STEERING CASE

(1) Disassembly



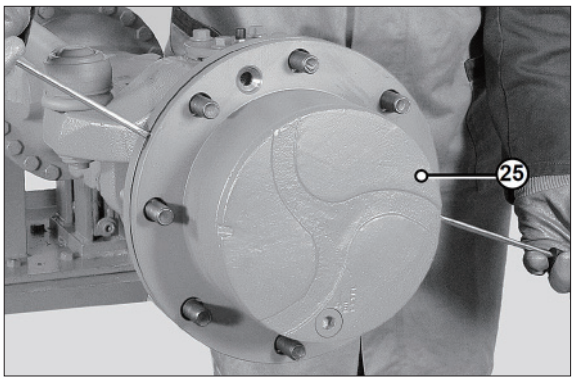
55W9NAX001

① Remove the securing screws (23) from the planetary carrier cover (25).
Disconnect the steering bars from the steering case (14).



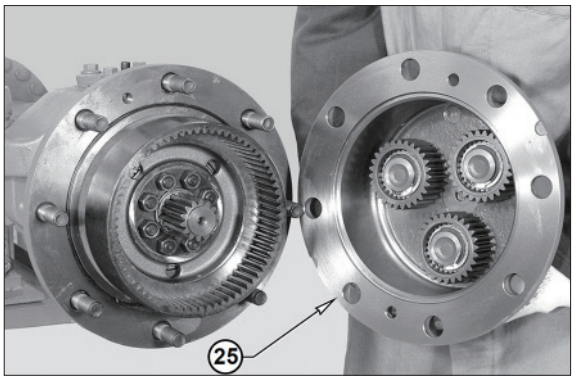
55W9NAX002

② Disjoint the planetary carrier cover (25) from the steering case by alternatively forcing a screwdriver into the appropriate slots.



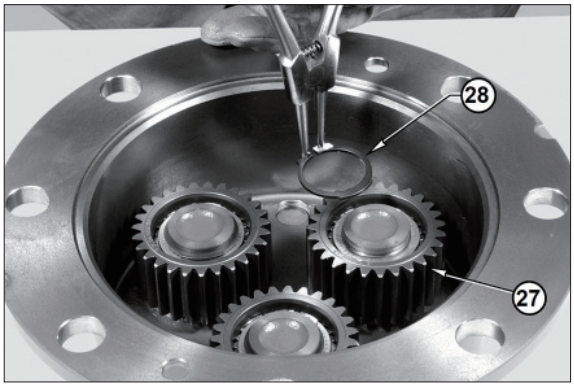
55W9NAX003

③ Remove the complete planetary carrier cover (25).



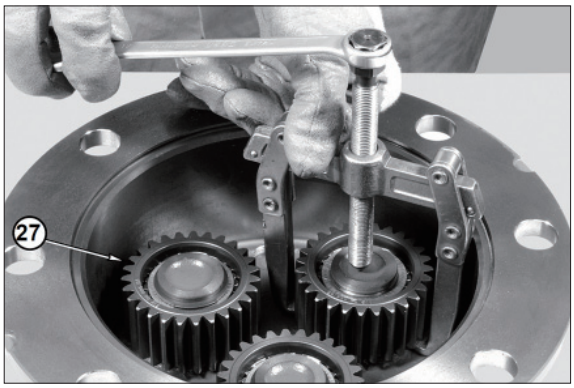
55W9NAX004

④ Remove the safety spring rings (28) of the planetary gears (27).



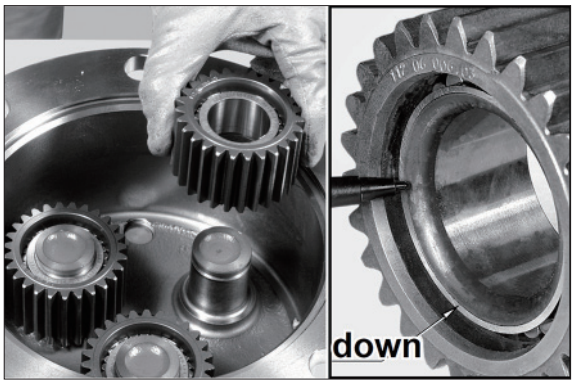
55W9NAX005

⑤ Remove the planetary gears (27).



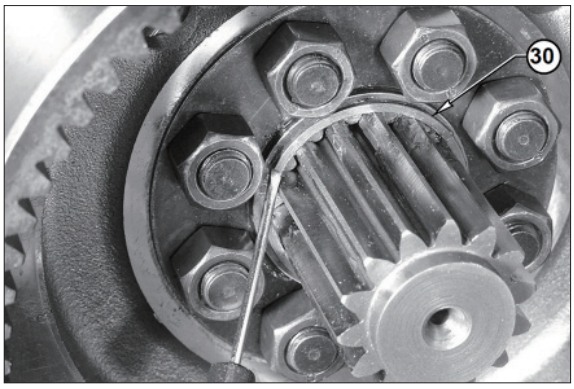
55W9NAX006

※ Note down direction of assembly of planetary gears.



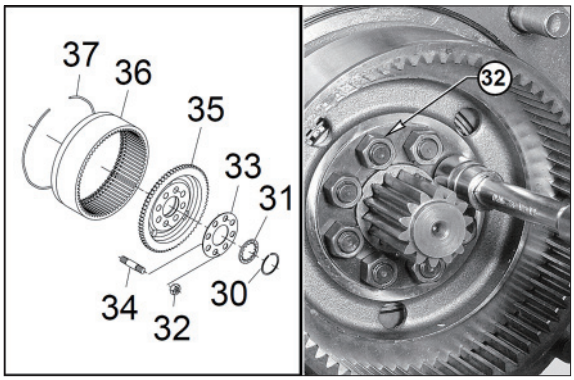
55W9NAX007

⑥ Remove the snap ring (30).



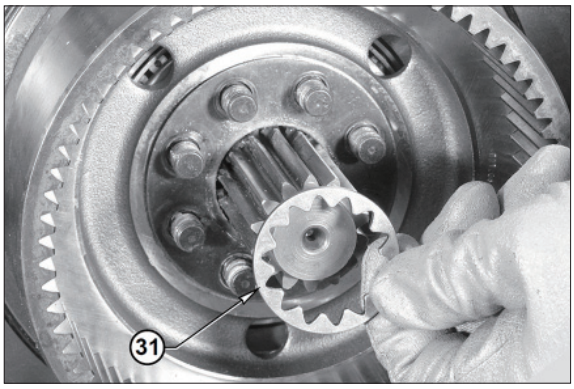
55W9NAX008

⑦ Unloose and remove the tightening nuts (32) from the crown flange (35).



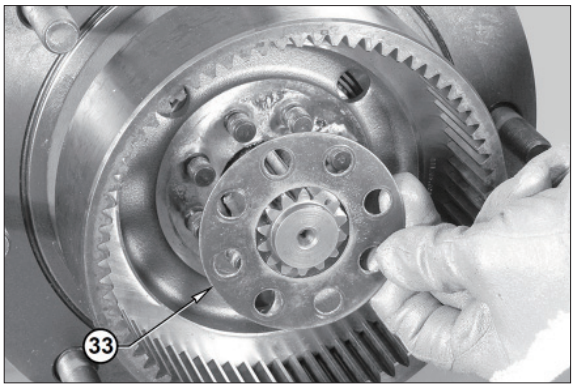
55W9NAX009

⑧ Remove the shim washer (31).



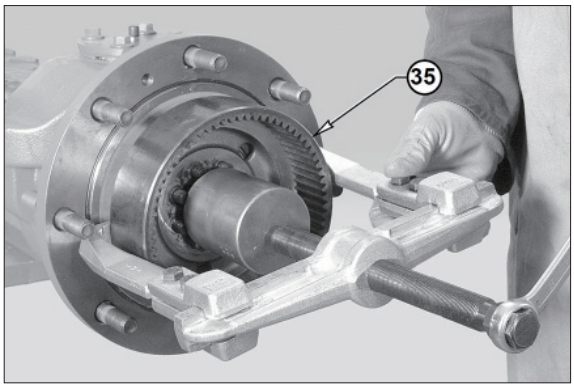
55W9NAX010

⑨ Remove the safety flange (33).

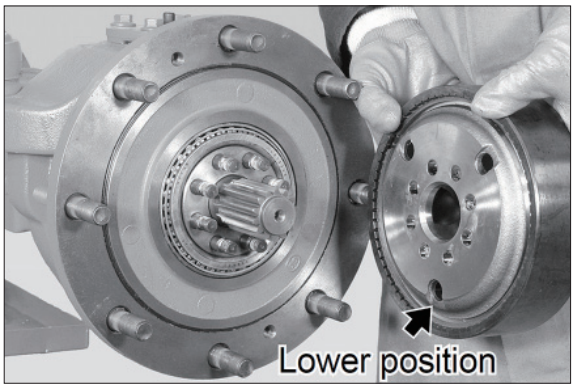


55W9NAX011

⑩ Using a puller, remove the complete crown flange (35) by acting on the stud bolts.



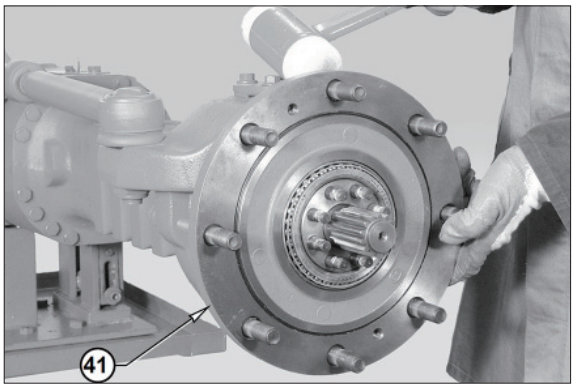
55W9NAX012



55W9NAX013

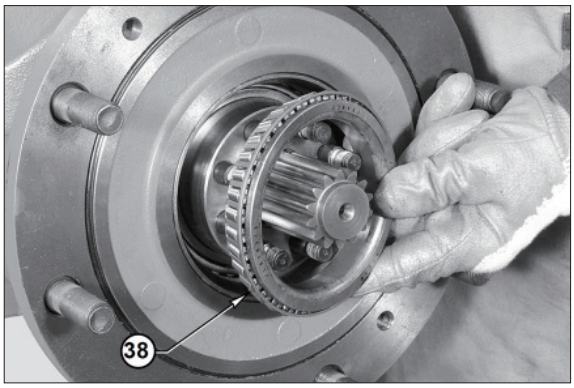
⑪ Partially extract the hub (41) using a plastic hammer.

※ Alternately hammer on several equidistant points.



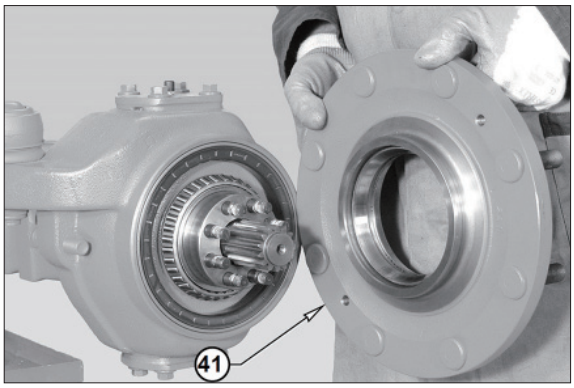
55W9NAX014

⑫ Remove the external bearing (38).



55W9NAX015

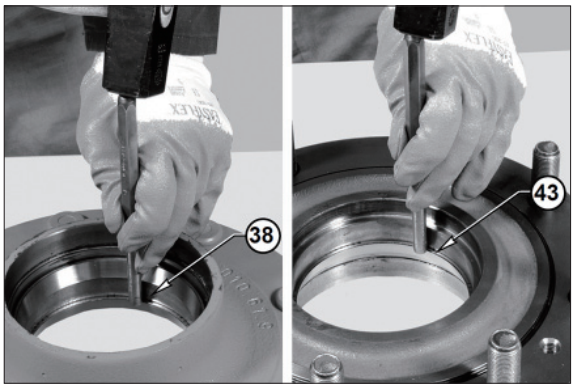
⑬ By hand remove the complete hub (41).



55W9NAX016

⑭ Remove the external thrust blocks of bearings, using a pindriver.

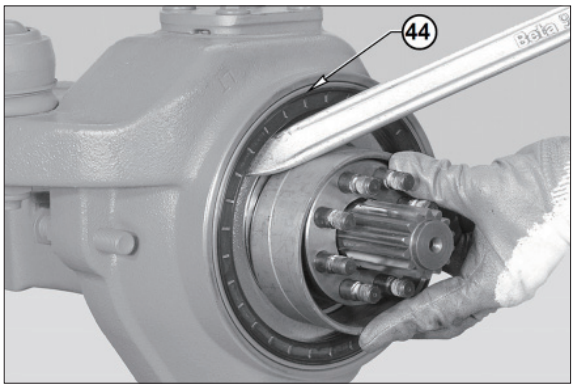
※ Hammer in an alternate sequence to prevent crawling and deformation of the thrust blocks.



55W9NAX017

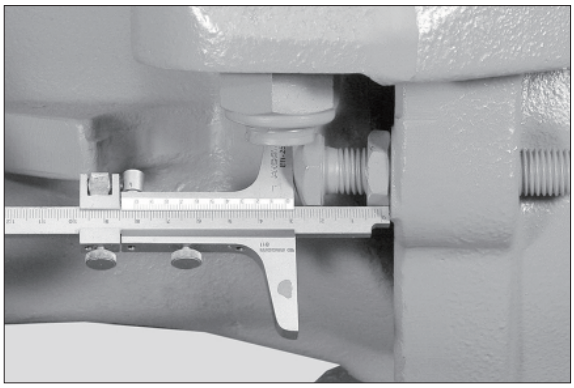
⑮ Remove the sealing ring from the steering case (44).

※ Pay due attention not to damage the seat of bearing.



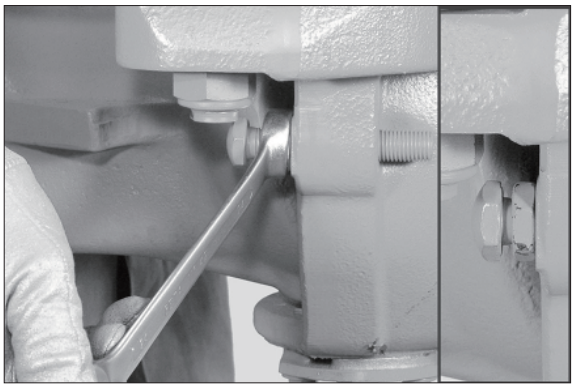
55W9NAX018

⑯ Note the measure of the screw of lock steering case.



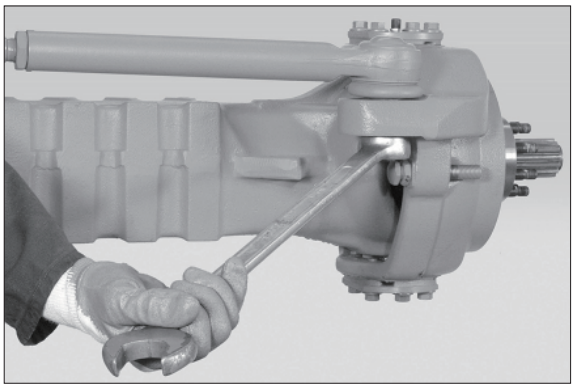
55W9NAX019

⑰ Loose the lockscrew and insert it to allow the passage of tool.



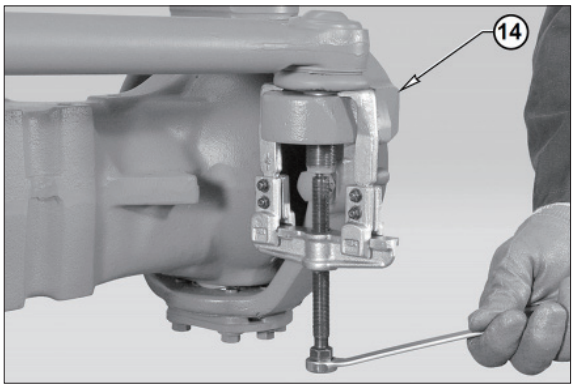
55W9NAX020

⑱ Remove the nuts that lock the articulation pins.



55W9NAX021

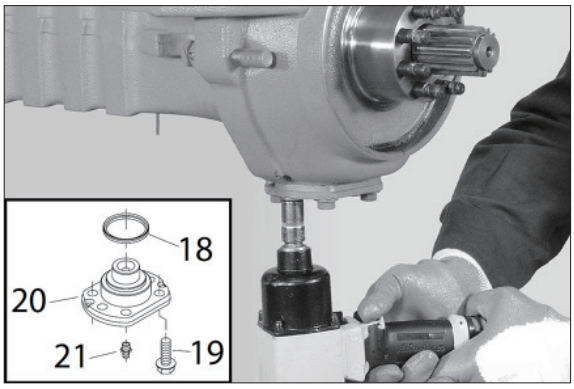
⑲ Disconnect the tapered pins of the articulation from the steering case (14) by means of a puller.



55W9NAX022

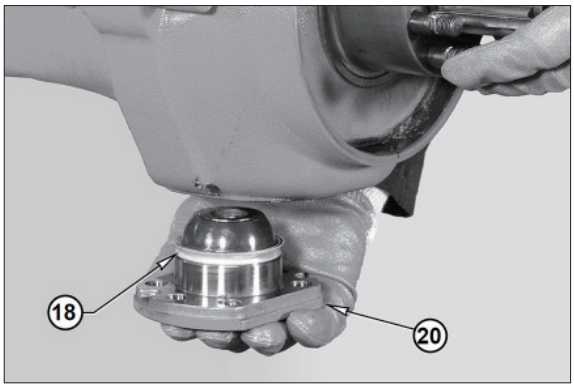
⑳ Unloose and remove the fitting screws (19) from the bottom articulation pin (20).

※ Screws cannot be reused.



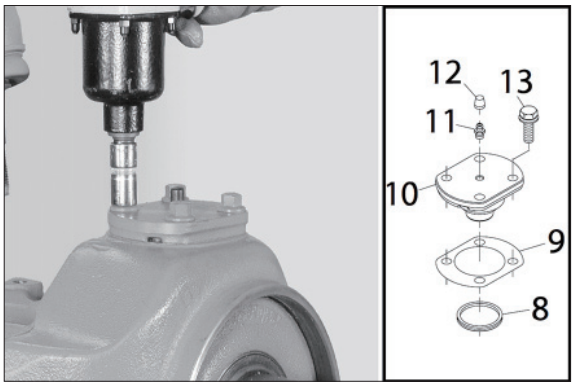
55W9NAX023

㉑ Remove the bottom articulation pin (18) complete with front sealing ring (20).



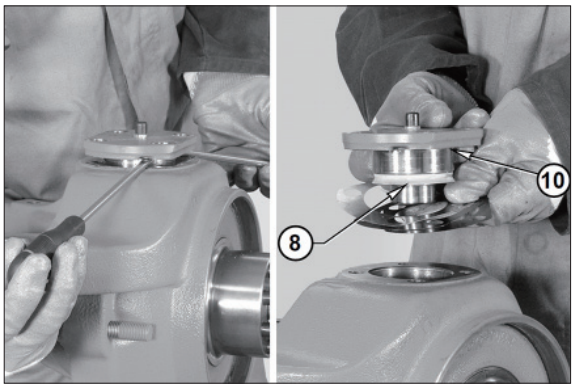
55W9NAX024

㉒ Unloose and remove the fitting screws (13) from the top articulation pin (10).



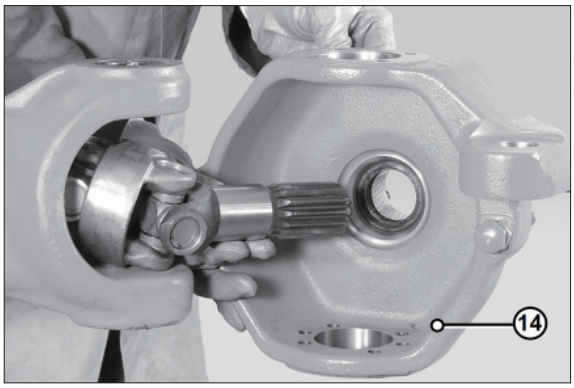
55W9NAX025

㉓ Using two levers, remove the top articulation pin (10) complete with front seal (8).
Pay attention not to damage the surfaces.



55W9NAX026

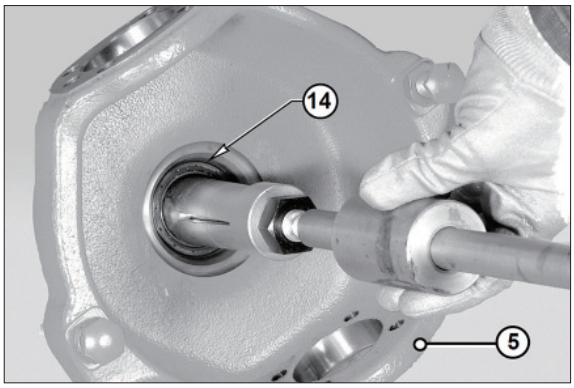
㉔ Remove the complete steering case (14).



55W9NAX027

㉕ Use a puller to remove the sealing ring from the steering case (14).

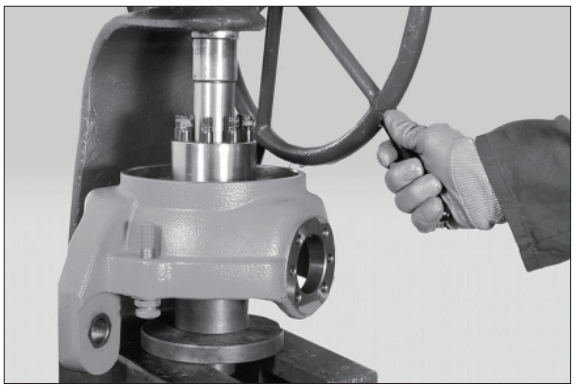
※ Note down the orientation of sealing ring (5).



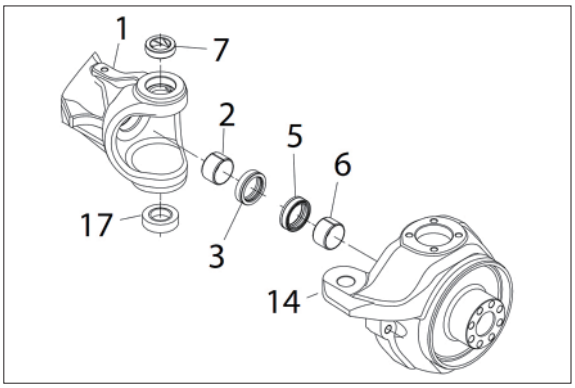
55W9NAX028

㉖ Remove the bushing (6) from the steering case (14).

※ Note down the orientation of bushing.



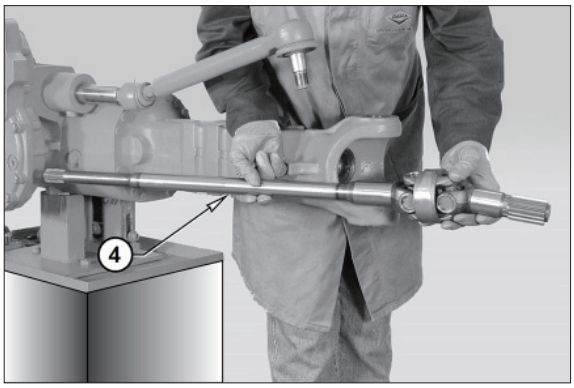
55W9NAX029



55W9NAX030

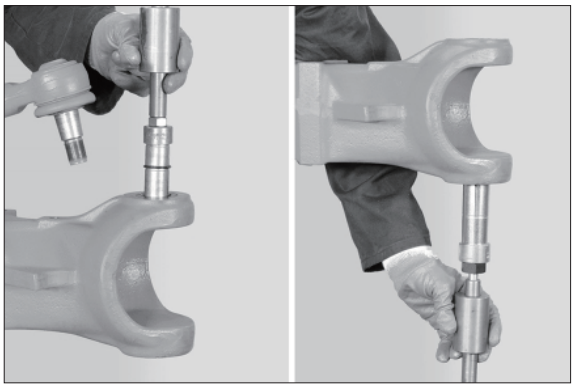
㉗ Remove the u-joint (4).

※ To remove the u-joint use, if necessary, a plastic hammer or a lever.



55W9NAX031

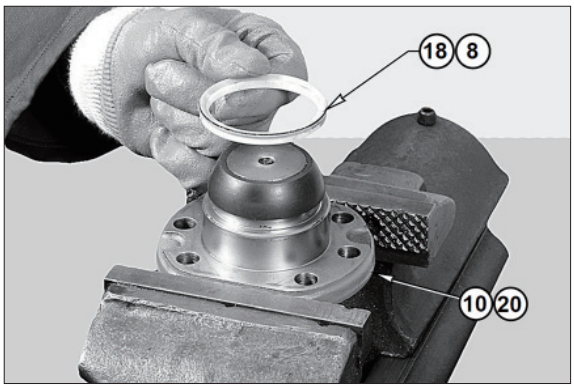
㉘ Using a puller for inner parts, remove the top bush (7) and the bottom ball-bush (17).



55W9NAX032

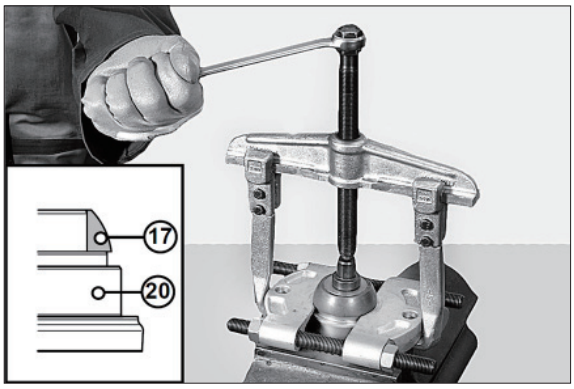
㉙ Remove the articulation pins (10) (20) and the front sealing rings (8) (18).

※ Note down the side for assembly.



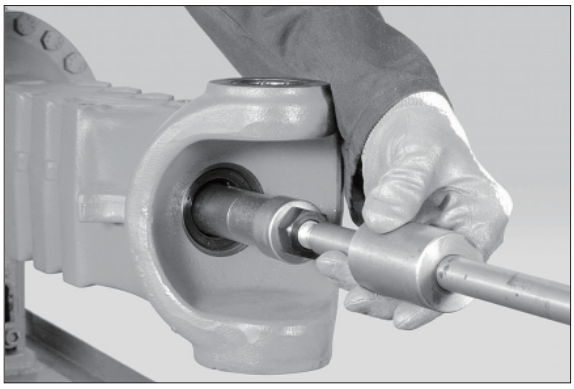
55W9NAX033

㉚ If the ball cover (17) needs replacing, remove it from the bottom articulation pin (20).

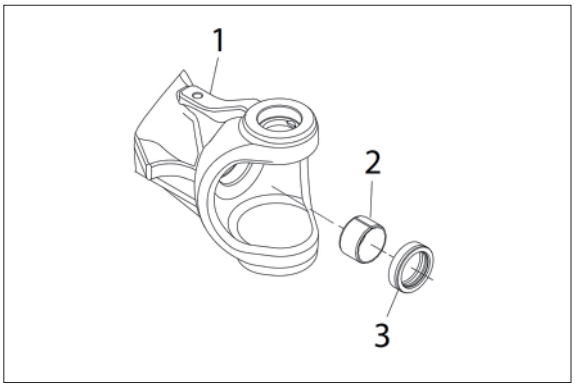


55W9NAX034

㉛ Remove seal ring (3) and the bushing (2) from the arm (1).

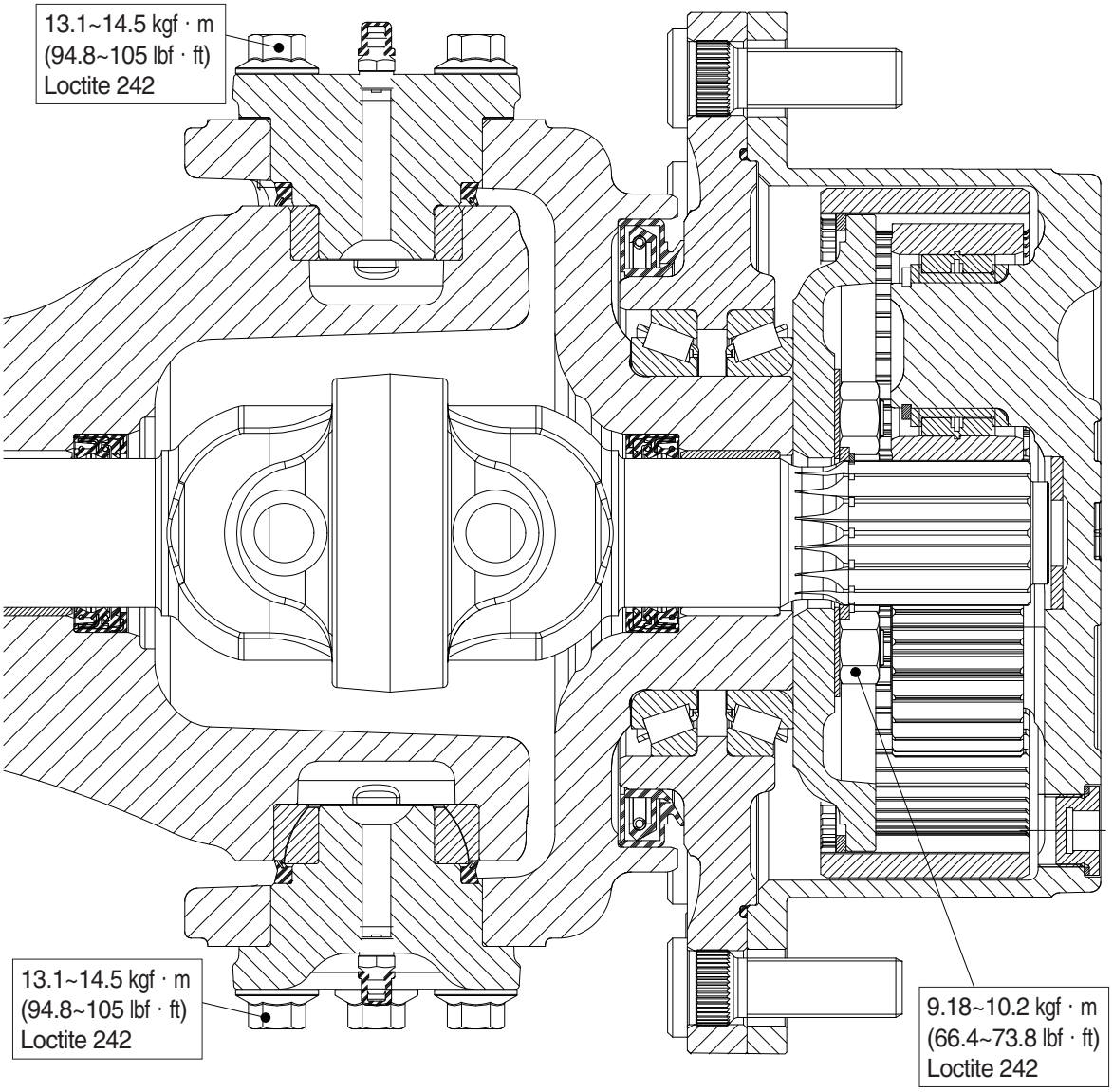


55W9NAX035



55W9NAX036

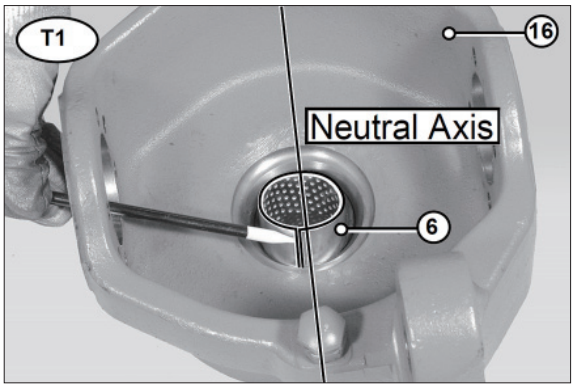
(2) Assembly



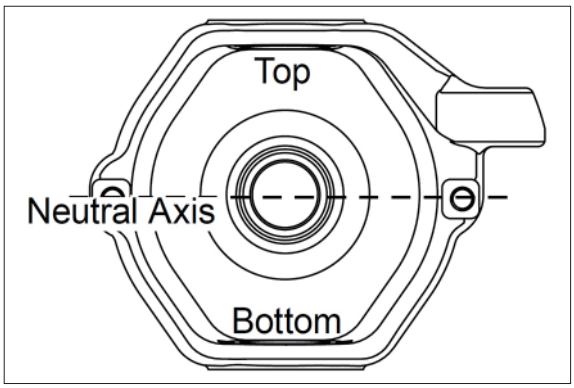
55W9NAX037

· **Continuos rolling torque** without planetary gear cover 0.71~2.04 kgf · m (5.14~14.8 lbf · ft)
· **Preload steering case** 4.08~8.16 kgf · m (29.5~59.0 lbf · ft)

① Lubricate the bushing (6) and the seat of the steering case (14).
Install the bushing (6), using tool T1.

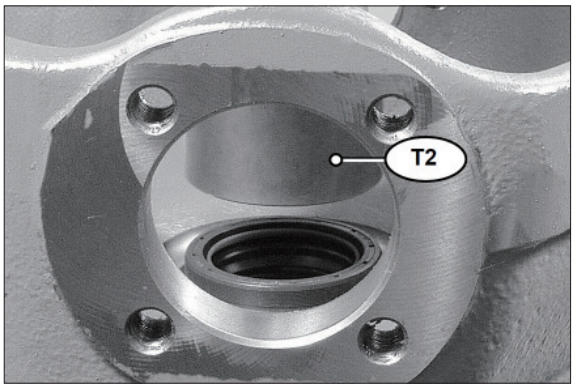


55W9NAX038

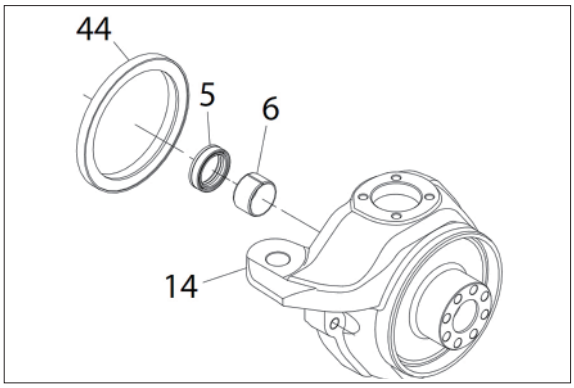


55W9NAX039

② Lubricate the outer surface of the sealing ring (5); fit them into their seat using tool T2.



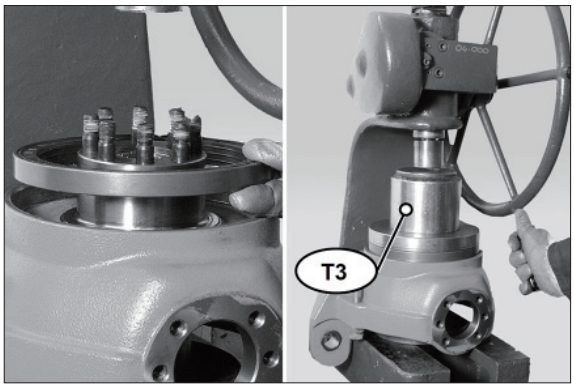
55W9NAX040



55W9NAX041

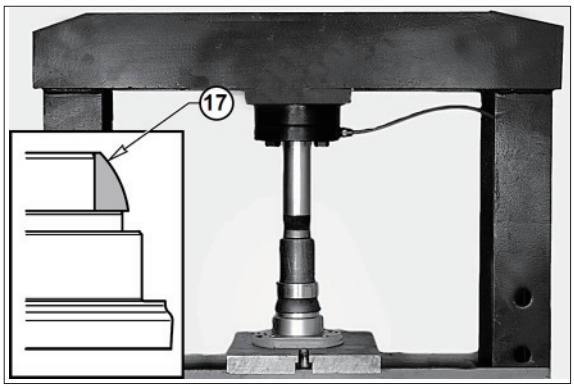
③ Using special tool T3 apply a repositionable jointing compound for seals to the outer surface of the sealing ring (44). Position the sealing ring (44) in the steering case (14).

※ Check that the ring (44) is correctly oriented.



55W9NAX042

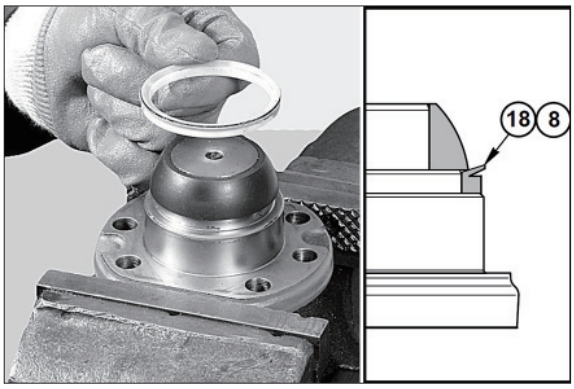
④ If the bottom articulation pin (17) has been extracted, position the pin under a press and fit the ball cover (20).



55W9NAX043

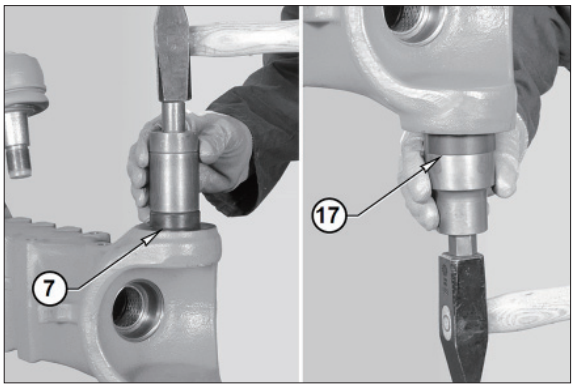
⑤ Fit the front sealing rings (18) (8) onto the articulation pins (4) and (6).

※ Carefully check that the rings are properly oriented (18) (8).



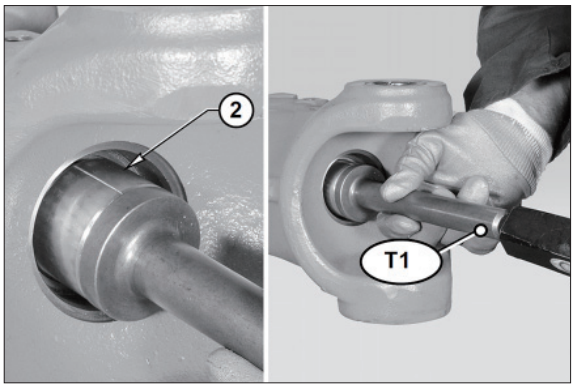
55W9NAX044

⑥ Lubricate the top bush (7) or the bottom ball bush (17) and fit them into the fulcrum holes of the arm.



55W9NAX045

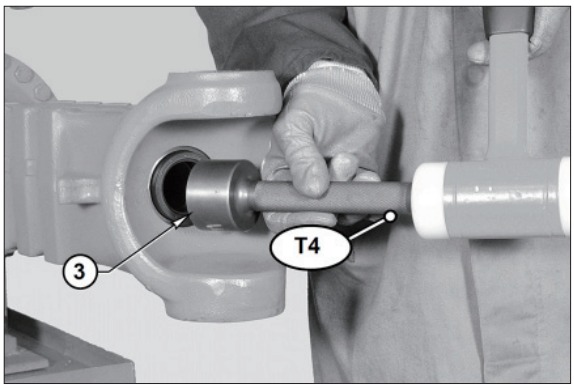
⑦ Lubricate the bushing (2) and the seat of the steering case (1).
Install the bushing (2), using tool T1.



55W9NAX046

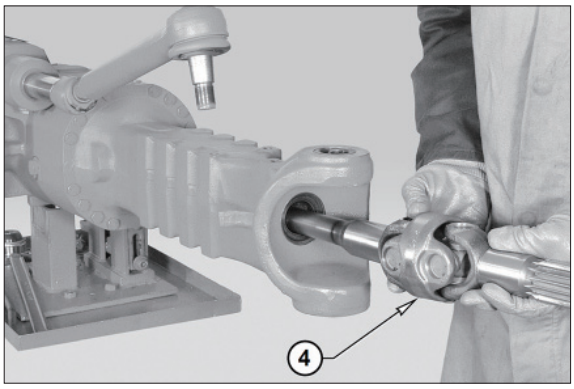
⑧ Lubricate and fit the sealing ring (3) onto tool T4 ; install the rings into the arm.

※ Pay particular attention to the direction of assembly of the rings.



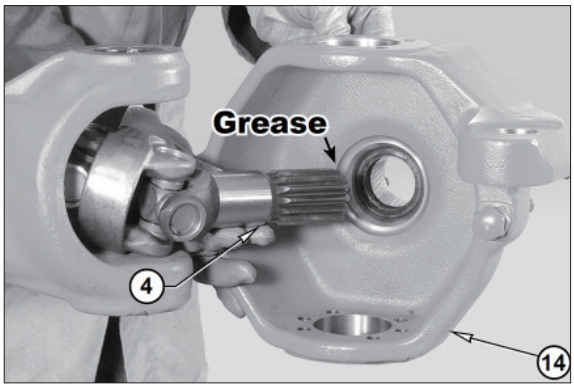
55W9NAX047

⑨ Insert the u-joint (4).



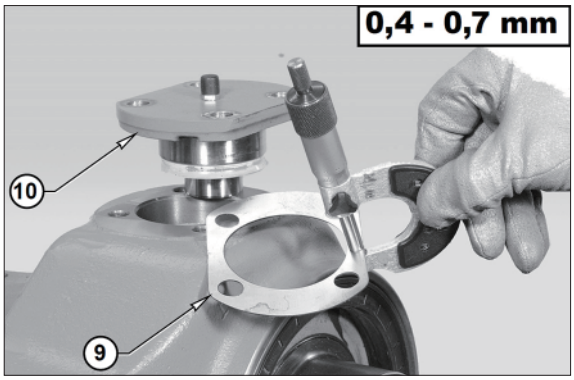
55W9NAX048

⑩ Lubricate the terminal of the u-joint (4) and install the steering case (14).
Pay due attention not to damage the dust cover rings and the sealing rings.



55W9NAX049

⑪ Prepare a series of shims (9) of 0.4 up to 0.7 mm.
To be assembled under the upper pin (10).

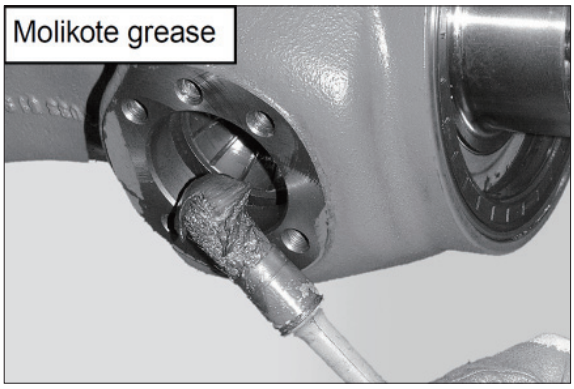


55W9NAX050

⑫ Lubricate and install the unit in the steering case.

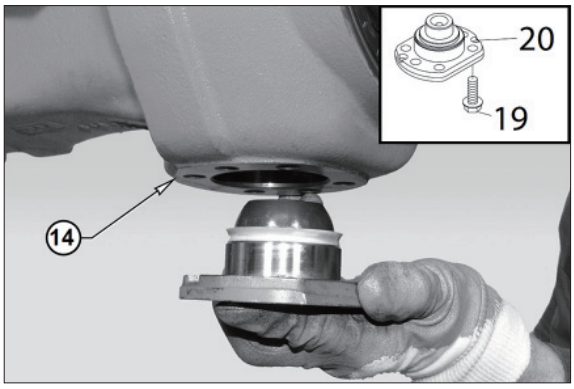
55W9NAX051

⑬ Lubricate the steering case.



55W9NAX052

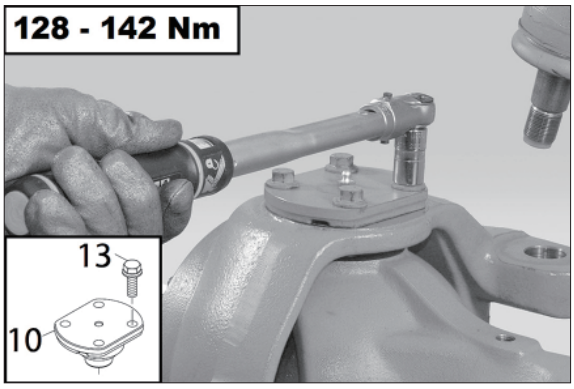
⑭ Fit the unit (20) in the steering case (14).
Position the screws (19) and tightly tighten.



55W9NAX053

⑮ Tighten the new fitting screws (13) of top articulation pins in sequence using the cross tightening method.

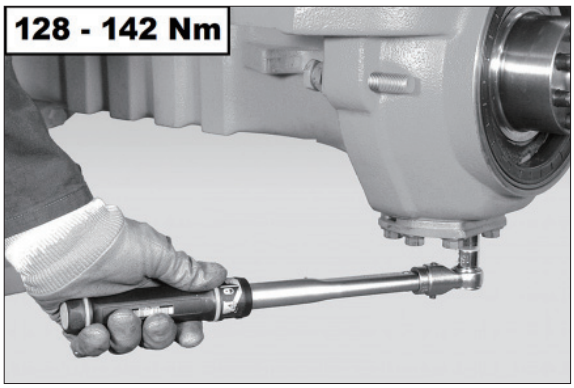
· Torque wrench setting :
13.1~14.5 kgf · m (94.8~105 lbf · ft)



55W9NAX054

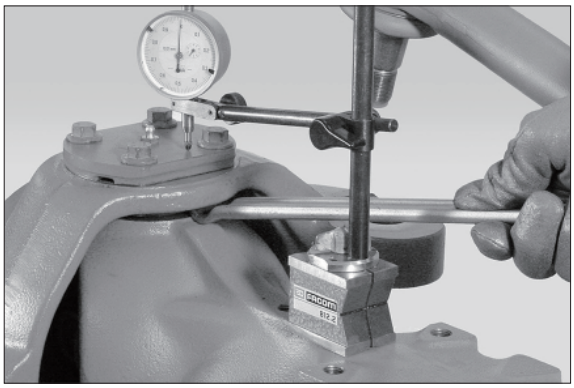
⑯ Tighten the new fitting screws (19) of bottom articulation pins in sequence using the cross tightening method.

· Torque wrench setting :
13.1~14.5 kgf · m (94.8~105 lbf · ft)

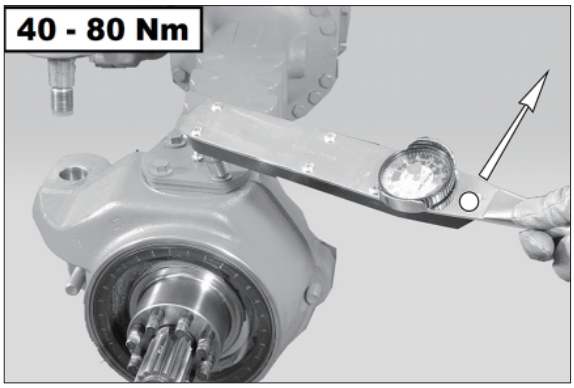


55W9NAX055

⑰ Check by means of a lever that there is no vertical gap.
In case there is any gap, determine the width and reduce it by removing shims.

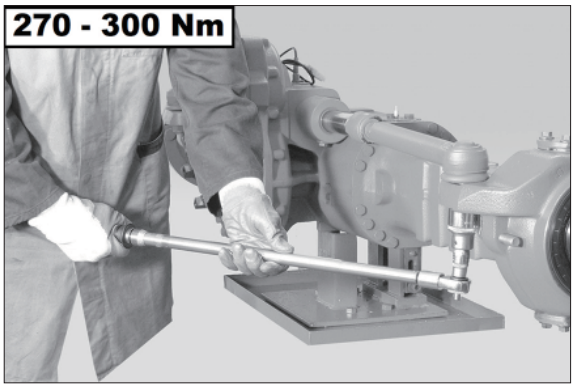

55W9NAX056

⑱ Check the torque of the pins, which has to be between 4.08 and 8.16 kgf · m.
If the preliminary measured value is too high, the shims have to be increased.



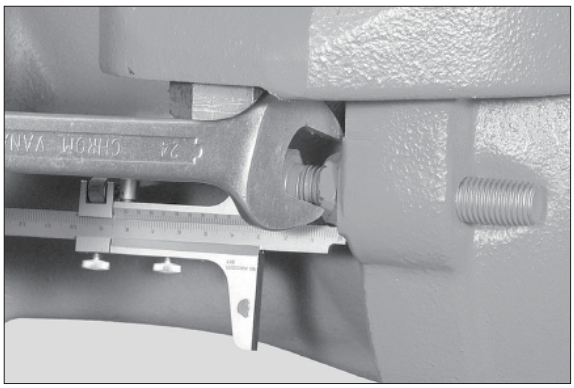
55W9NAX057

⑲ Look for the position of the notch regarding the safety cotter pin hole when the nut is finaly locked max 30.6 kgf · m (221 lbf · ft).



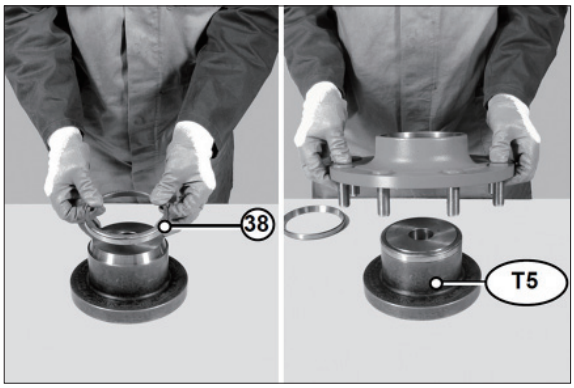
55W9NAX058

⑳ Bring the lockscrew to the quote at the measure previously survey.



55W9NAX059

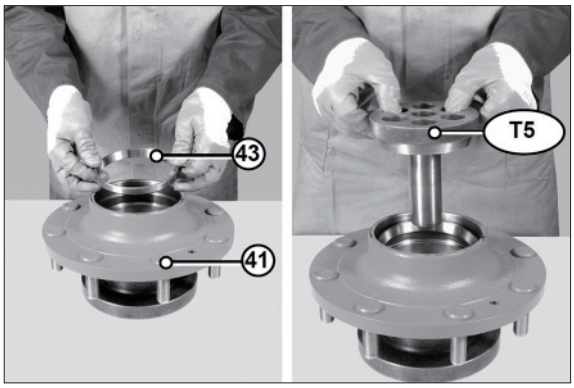
㉑ Position the lower part of tool T5 and the thrust block of the external bearing (38).



55W9NAX060

㉒ Lubricate the seats of the bearings and position the hub (41) on tool T5 ; position the thrust block of the internal bearing (43).

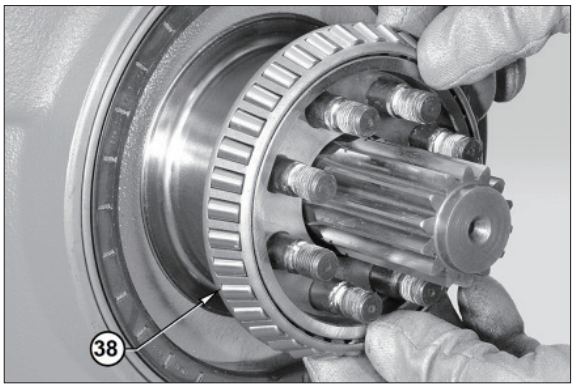
※ Check that the thrust block is correctly oriented.



55W9NAX061

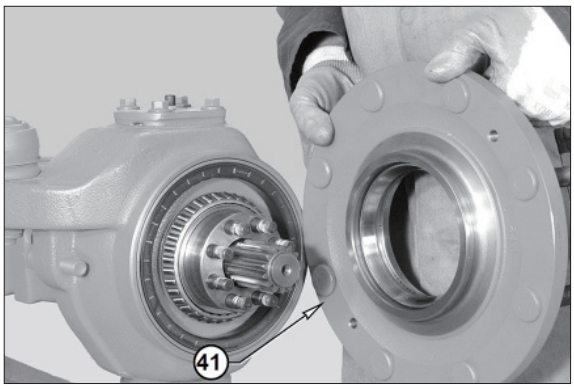
㉓ Install the external bearing (38).

※ Move the bearing to the limit stop by hammering lightly all around the edge.



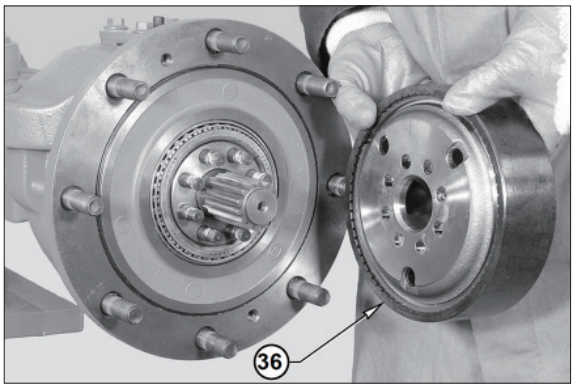
55W9NAX062

㉔ Install the wheel hub (41).



55W9NAX063

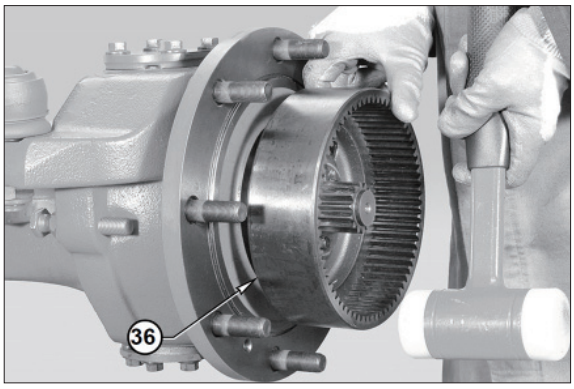
㉕ Install the crown wheel (36).



55W9NAX064

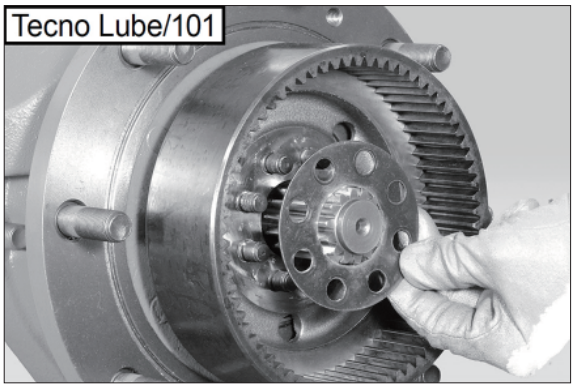
㉖ Fit the complete crown flange (36).

※ In order to fasten the flange (36), use a plastic hammer and alternately hammer on several equidistant points.



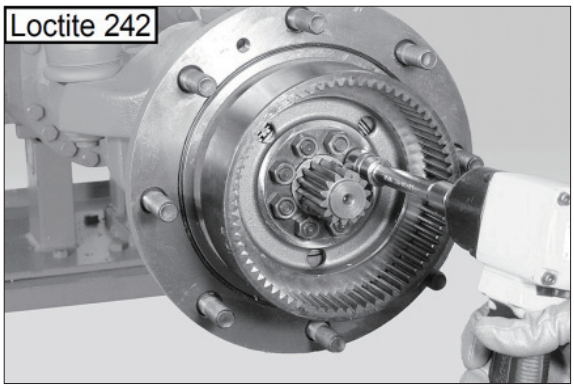
55W9NAX065

㉗ Install the security flange (33).
Grease the surface of the safety flange (33) that touches the crown wheel.



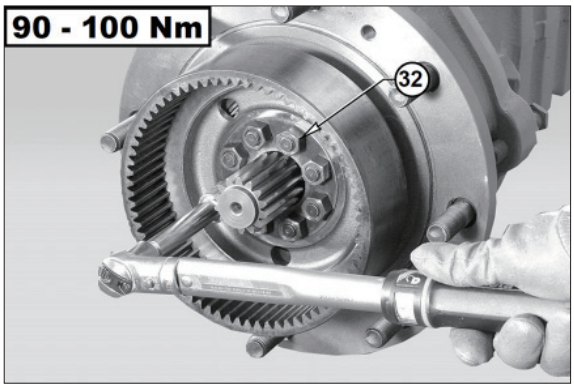
55W9NAX066

㉘ Coat the nuts (23) with loctite 242 and screw them.



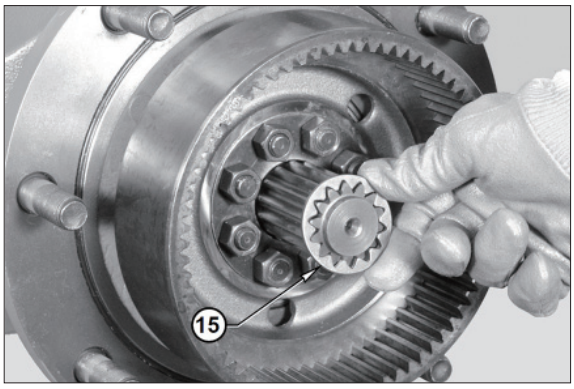
55W9NAX067

㉙ Tighten nuts (32) in two stages, using the criss-cross method.
· Initial torque wrench setting :
9.18 kgf · m (66.4 lbf · ft)
· Final torque wrench setting :
10.2 kgf · m (73.8 lbf · ft)



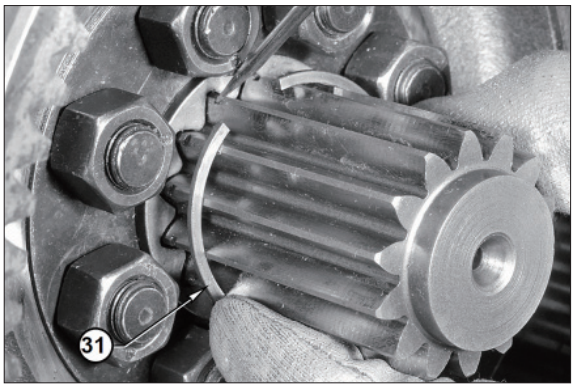
55W9NAX068

㉚ Install the distance piece (31).



55W9NAX069

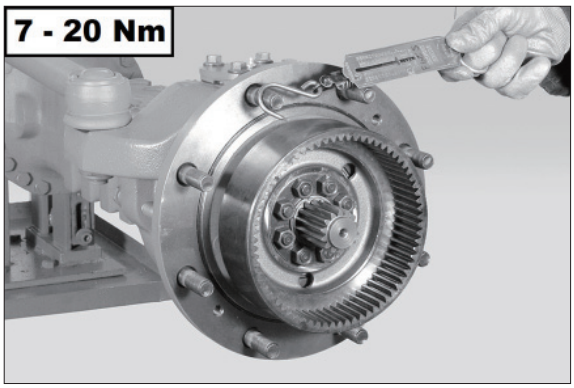
㉛ Install the snap ring (31).



55W9NAX070

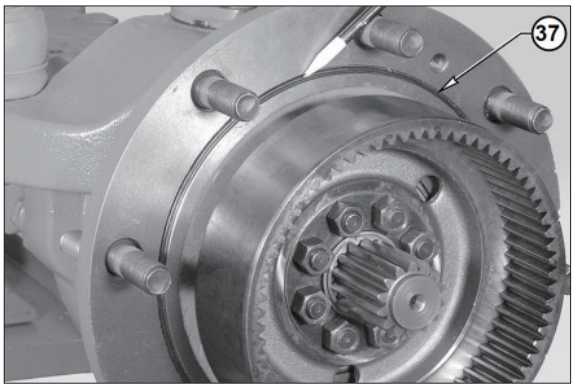
㉜ Check the continuous rolling torque on the hub.

· Torque : 0.71~2.04 kgf · m
(5.14~14.8 lbf · ft)



55W9NAX071

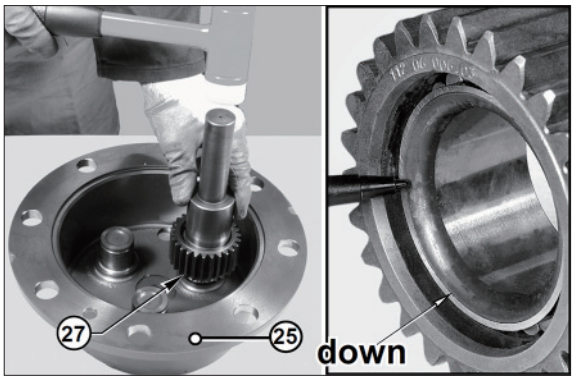
※ Check the condition and position of the O-ring (37).



55W9NAX072

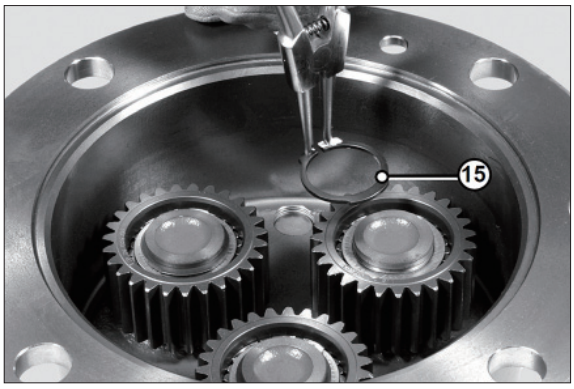
㉝ Fit the planetary gear (27) onto the planetary gear cover (25).

※ The jointed portion of the internal ring of the bearings must face the bottom of the pin.



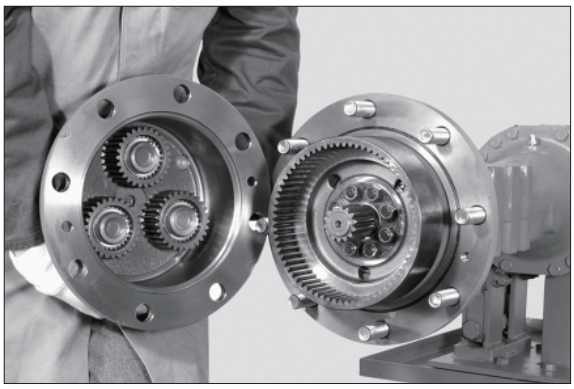
55W9NAX073

㉞ Lock into position the planetary gears (16) with the snap rings (15).



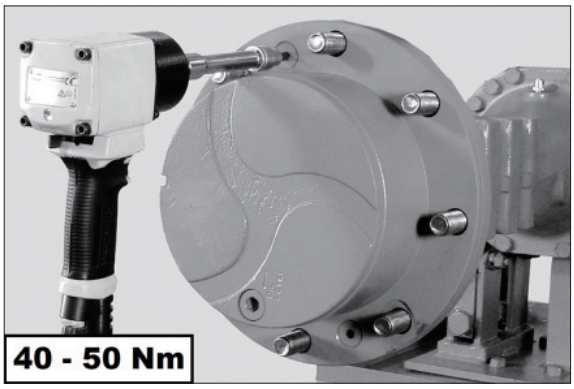
55W9NAX074

㉟ Fit the planetary gear cover (18) onto the wheel hub (4).



55W9NAX075

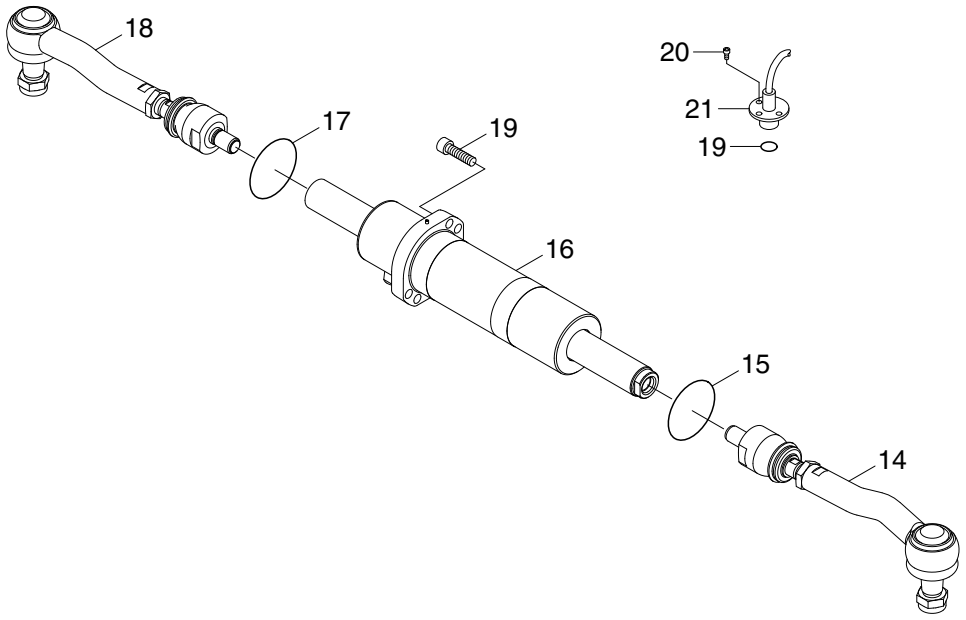
㊱ Torque wrench : 4.08~5.1 kgf · m
(29.5~36.9 lbf · ft)



55W9NAX076

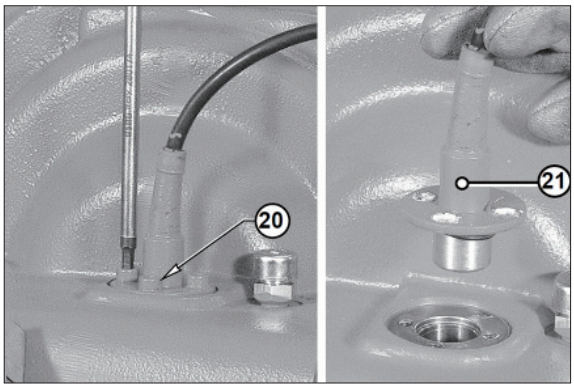
2) STEERING CYLINDER

(1) Disassembly



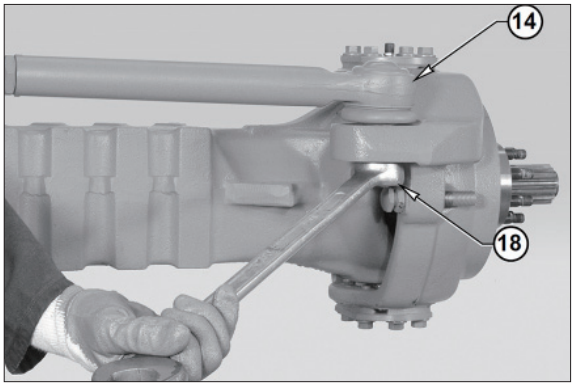
55W9NAX077

① Remove the centring sensor (21) of the steering piston.



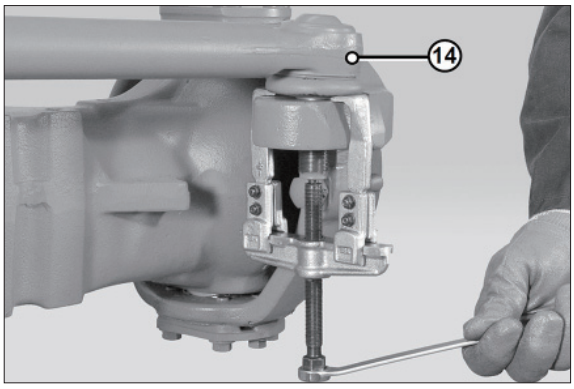
55W9NAX078

② Remove the nuts (18) that lock the articulation pins (14).



55W9NAX079

③ Disconnect the tapered pins of the articulation (14) from the steering case by means of a puller.

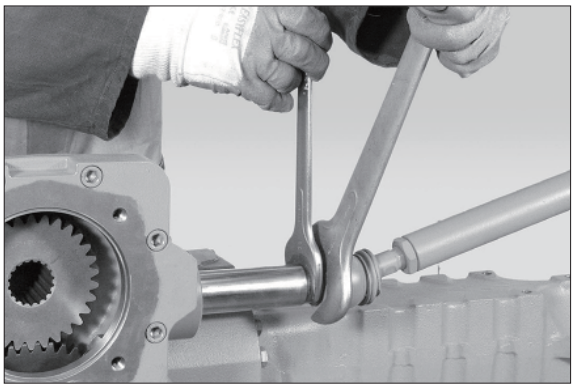


55W9NAX080

④ If the connection of the steering bars includes a safety collar, raise the border.

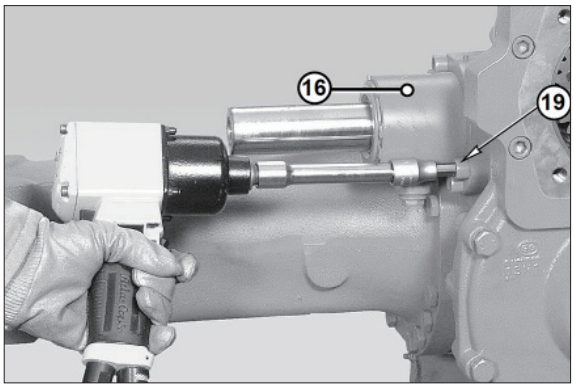
55W9NAX081

⑤ Disconnect left and right steering bars from the piston.



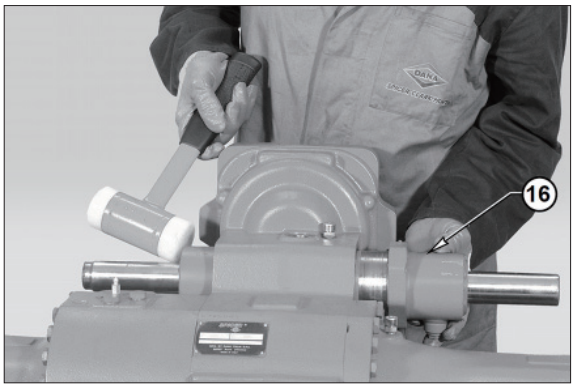
55W9NAX082

⑥ Remove the securing screws (19) from the steering cylinder (16).

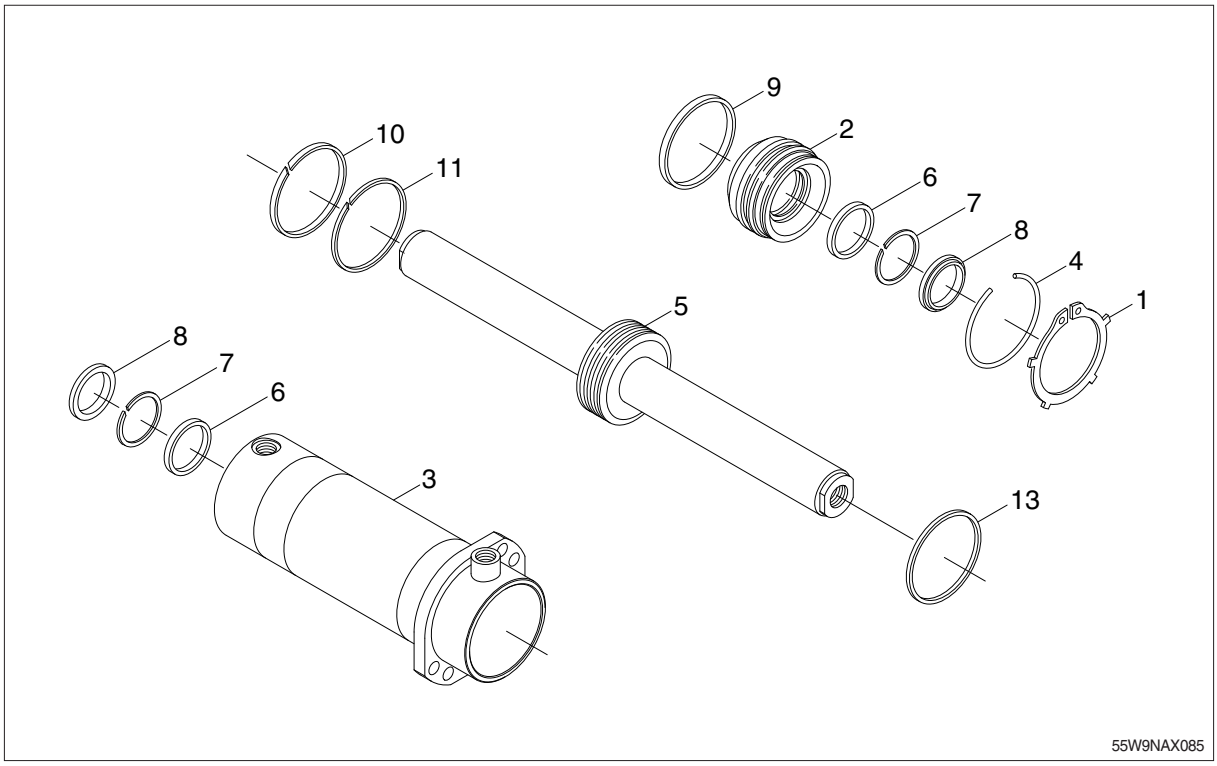


55W9NAX083

⑦ Extract the cylinder (16) using a plastic hammer.

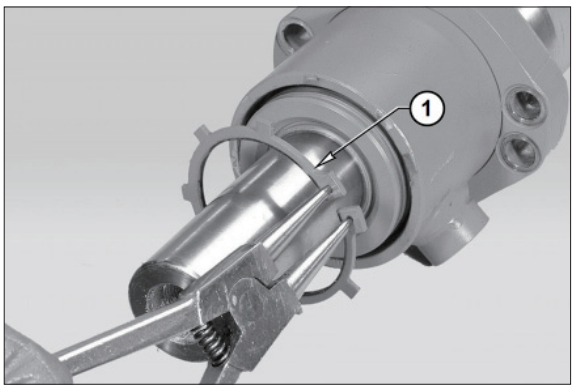


55W9NAX084



55W9NAX085

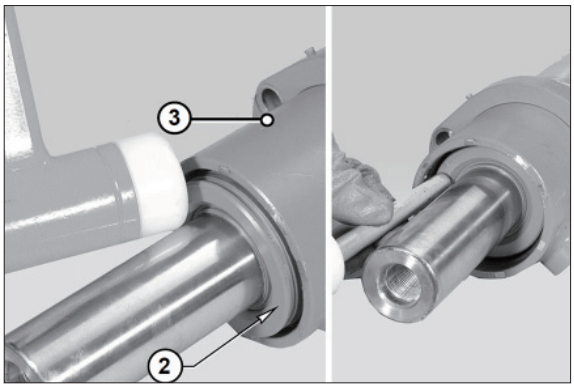
※ Before attempting to disassemble the unit, drain the oil in the cylinder chambers completely.
Using a screwdriver, remove the snap ring (1) of the cylinder head.



55W9NAX086

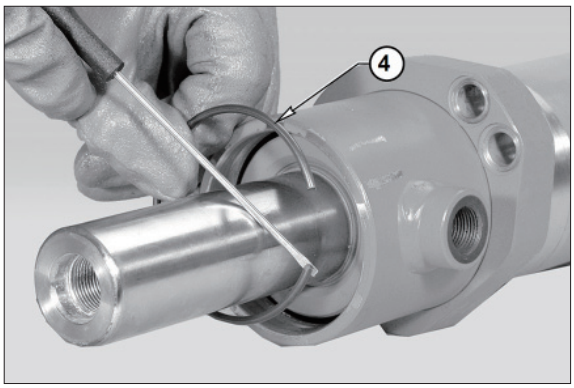
⑧ Lightly tap the cylinder head (2) with a plastic hammer so as to push it inside the cylinder (3).

※ Insert the cylinder head so it is flush with the cylinder.



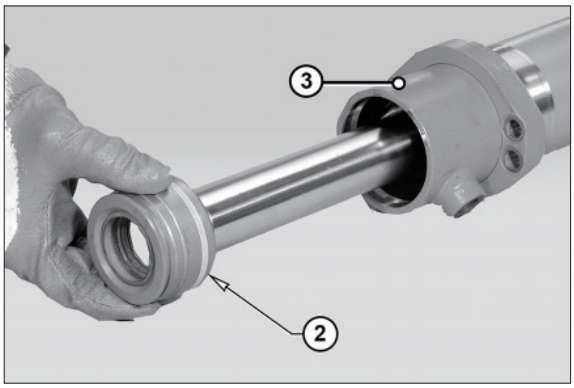
55W9NAX087

⑨ Using a punch, force the stop ring (4) located inside the cylinder (3) and extract ring using a screwdriver.



55W9NAX088

⑩ Take the cylinder unit a part by extracting the head first, followed by the piston.



55W9NAX089

※ Note down direction of installation of piston whose seal ring is oriented towards cylinder head.


55W9NAX090

⑪ Remove all seals, anti-extrusion rings and scraper rings from head (2), cylinder (3) and piston (5).

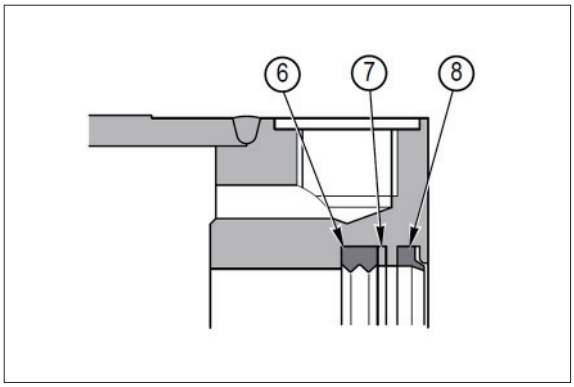
※ All seals must be replaced every time the unit is disassembled.

※ Particular attention must be paid not to damage the seats of both seals and piston slide.

55W9NAX091

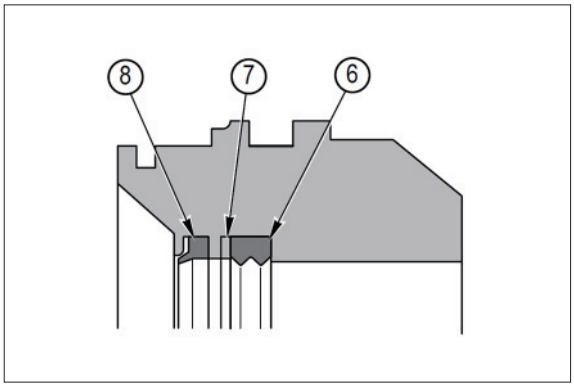
(2) Assembly

① Grease and install the piston rod seal ring (6), rod wiper (8) and back up washer (7) into cylinder (3).



55W9NAX092

② Grease and install the piston rod seal ring (6), rod wiper (8) and anti-extrusion ring (7) into the head (2).

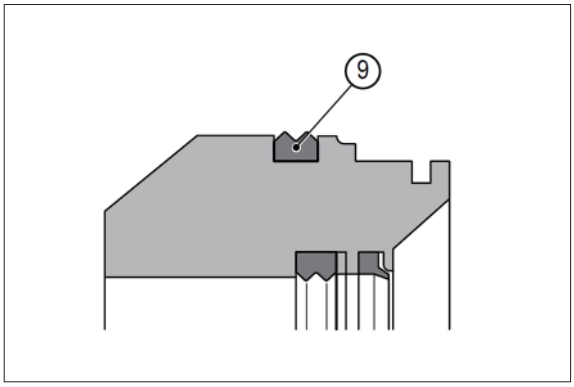


55W9NAX093

③ Fit seal (9) on the outside of the head (2).

※ To ease installation, grease the outer surface of the piston

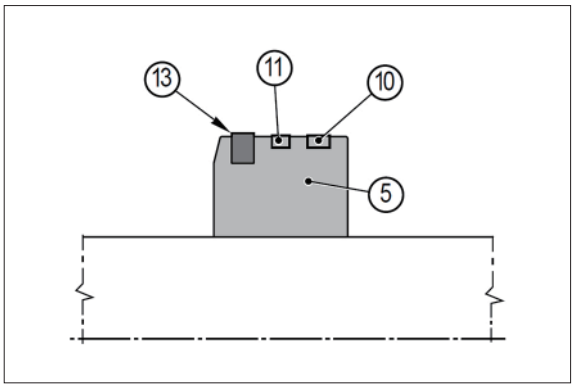
※ Do not roll the seal (9).



55W9NAX094

④ Prepare piston (5) by fitting it with magnetic ring (11), anti-extrusion ring (10) and piston seal (13).

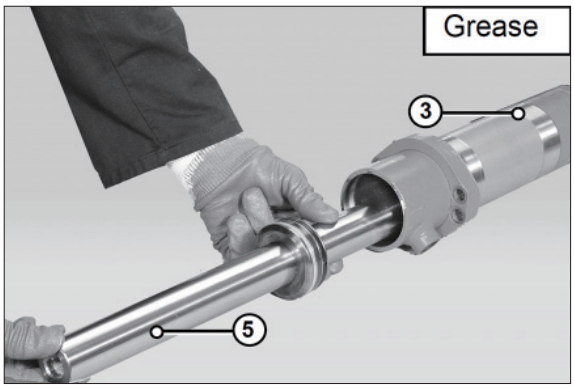
※ To ease installation, lubricate with grease.



55W9NAX095

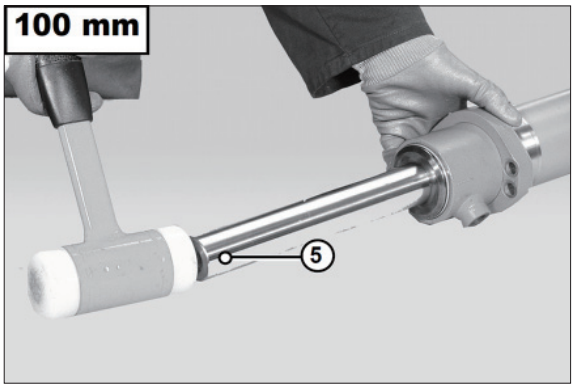
⑤ Center the shaft on the cylinder (3) so that it fits into the piston (5).

※ Apply a little grease to seals and cylinder.



55W9NAX096

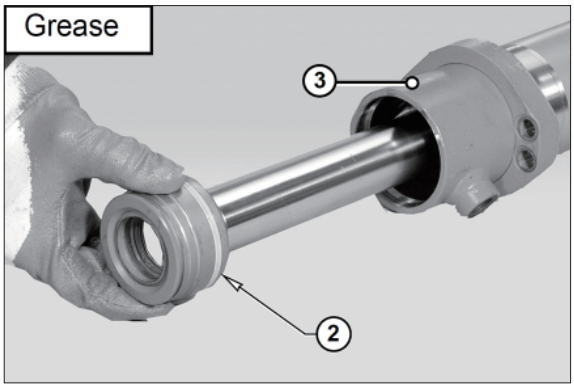
⑥ Push the piston (5) into the cylinder for 100 mm using a plastic hammer.



55W9NAX097

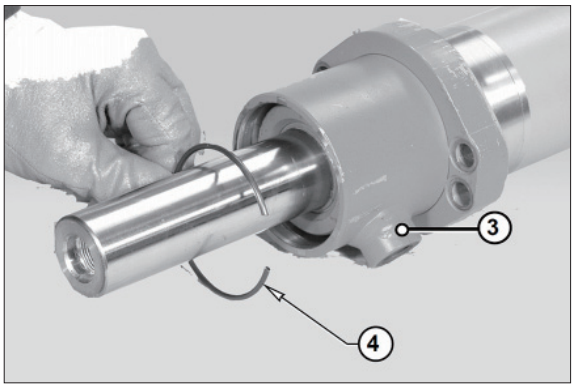
⑦ Apply grease to head (5) seals, fit the head onto the piston and push it into the cylinder (3) using a plastic hammer.

※ Insert the head as to line it up with the edge of the cylinder.



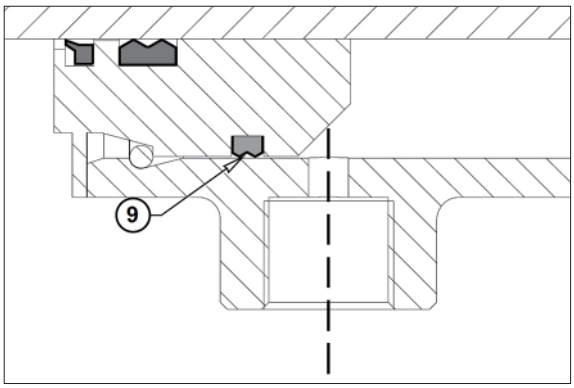
55W9NAX098

⑧ Introduce the stop ring (4) and ensure that it sets in the seat of cylinder (3).



55W9NAX099

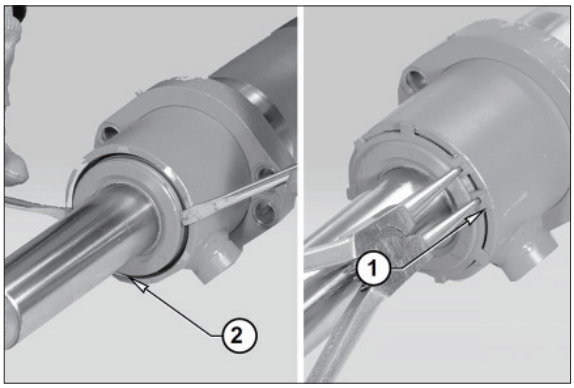
※ To insert the heading not to go beyond with the ring of gasket the hole of feeding because it could be cut.



55W9NAX100

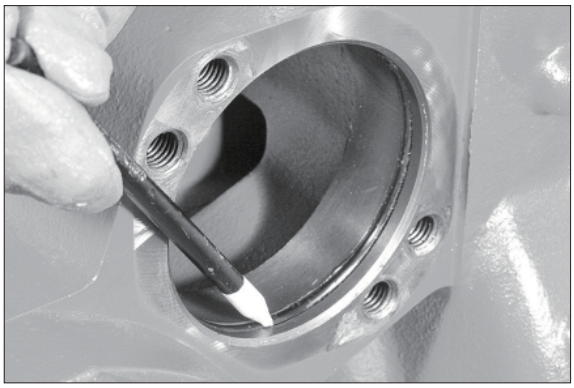
⑨ Using two screwdrivers or levers, force the head until it is seated against the stop ring (4).
Fit the snap ring (1) on the head (2).

※ Make sure that the snap ring (1) is securely fastened in its seat.
If necessary, force it into its seat using a drift and a hammer.



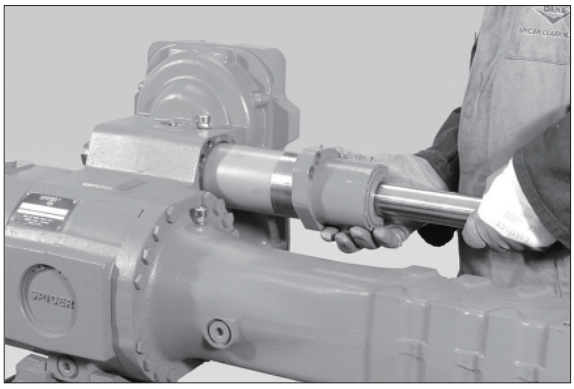
55W9NAX101

⑩ Renew at each reassembly.



55W9NAX102

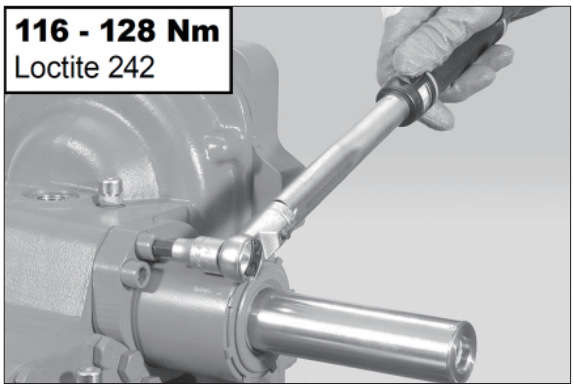
⑪ Check that the O-rings (17) (15) of the axle unit are in good condition ;
lubricate the seats of the seals and fit the steering cylinder (3).



55W9NAX103

⑫ Lock the cylinder by cross- tightening the screws (3).

· Torque wrench setting :
11.8~13.1 kgf · m (85.3~94.8 lbf · ft)

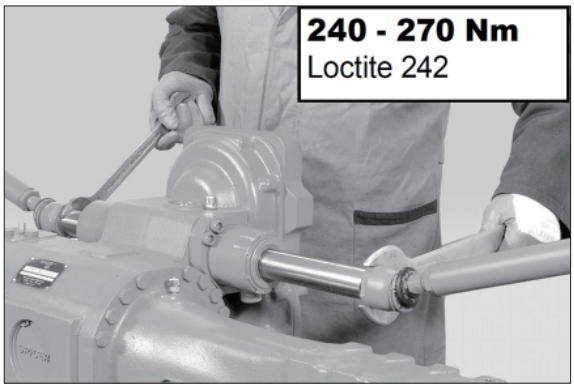


55W9NAX104

⑬ Apply loctite 242 to the thread and connect the steering bars by screwing the terminals onto the piston stem.

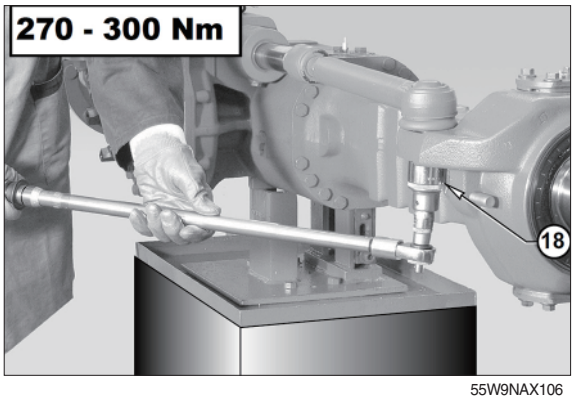
· Torque wrench setting :
24.5~27.5 kgf · m (177~199 lbf · ft)

※ Versions with coupling require that the rim of the articulation is riveted onto the surfaces of the piston stem.



55W9NAX105

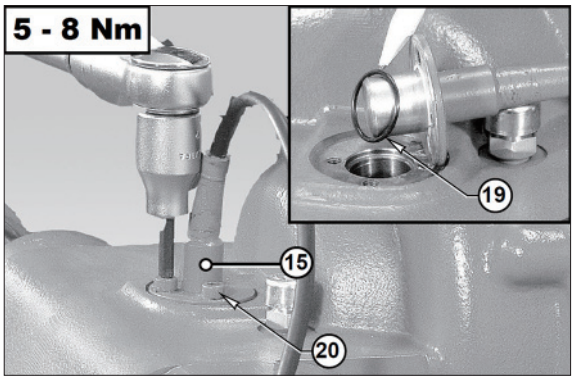
⑭ Insert the pins (18) in the steering case and lock into position using a torque wrench setting of 27.5~30.6 kgf · m (199~221 lbf · ft).



55W9NAX106

⑮ Install the proximity (21) for checking piston centring - if applicable - and tighten the screws (20).

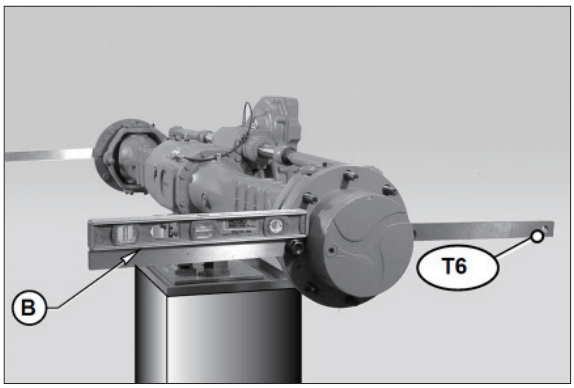
· Torque wrench setting :
0.51~0.82 kgf · m (3.7~5.9 lbf · ft)



55W9NAX107

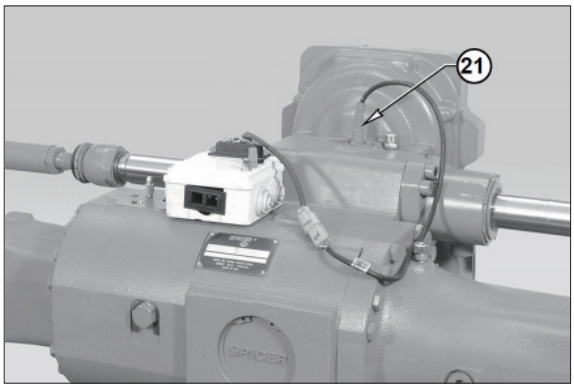
※ Eliminate the action of the negative brake, if fitted.
Apply tools T6 to the hubs and lock them.

Using a level “B”, check that tools are perfectly flat and parallel to each other.

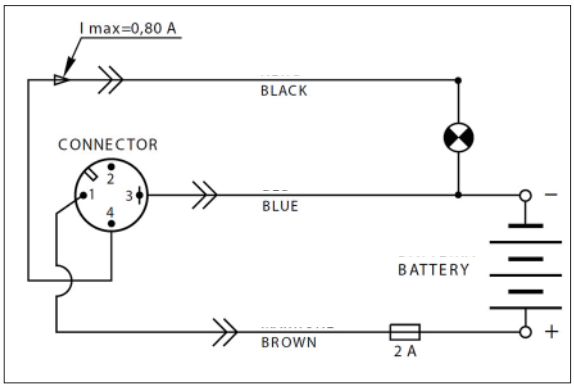


55W9NAX108

⑯ Connect the sensor (21) to the inspection device according to either diagram.

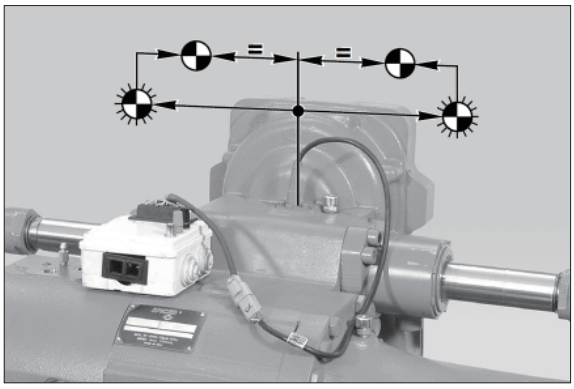


55W9NAX109



55W9NAX110

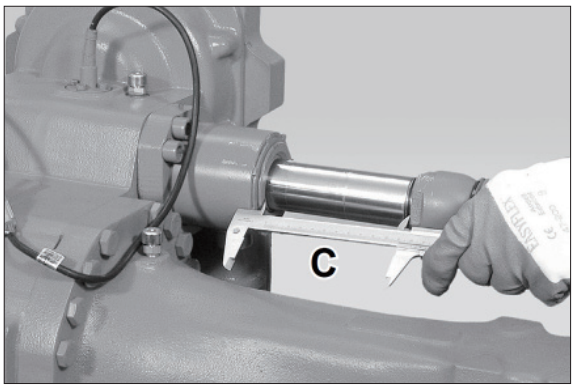
⑰ Center the piston by slowly moving it first in one direction then in the other and position it half way on the stroke, which is determined by the switching on and off of the signal lamp of the inspection device in the reversal stage.



55W9NAX112

⑱ Inspect jut “C” on one side of the piston and note down the size for checking later adjustments.

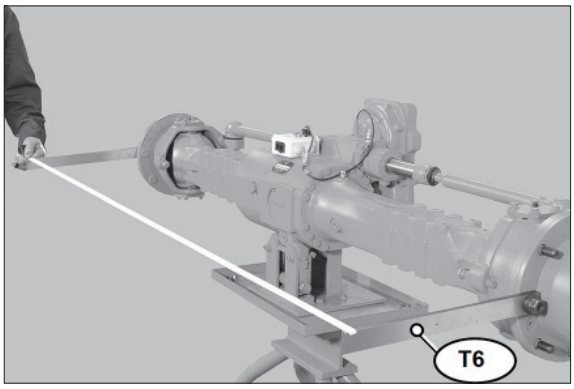
※ If cylinders come without a sensor, the centering of the piston must be carried out on the basis of the maximum stroke.



55W9NAX113

⑲ Without moving the piston, check front and rear size at the edge of tools T6.
Max. difference : 0.6-0.7 ㎜

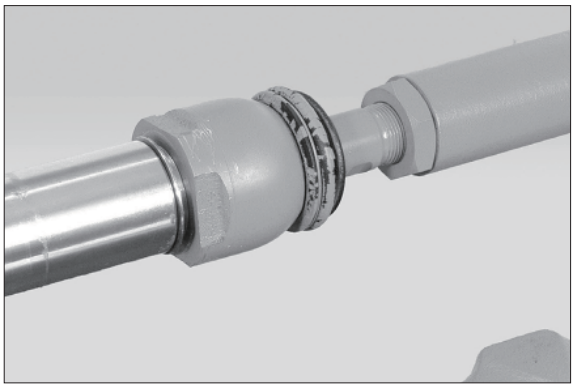
※ In order to check the rear size, rotate the bevel pinion and check that tools T6 are flat.



55W9NAX114

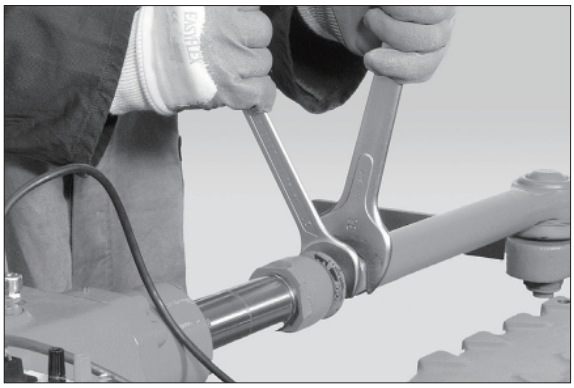
⑳ If necessary, adjust convergency without moving the centering of the piston and adjust the length of the steering bars (14).

※ With a half turn of screw, the front size is reduced by about 3 ㎜, whereas the rear one is increased by about 3 ㎜.



55W9NAX115

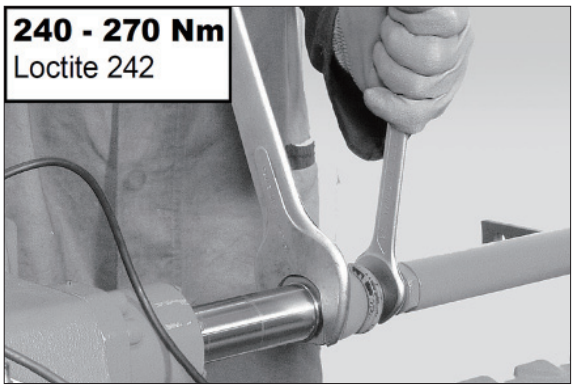
㉑ Unloose the nuts and screw them onto the ball-and-socket joints.



55W9NAX116

㉒ Hold the articulations still and rotate the ball-and-socket joints.
Once the convergency has been adjusted, lock the nuts.

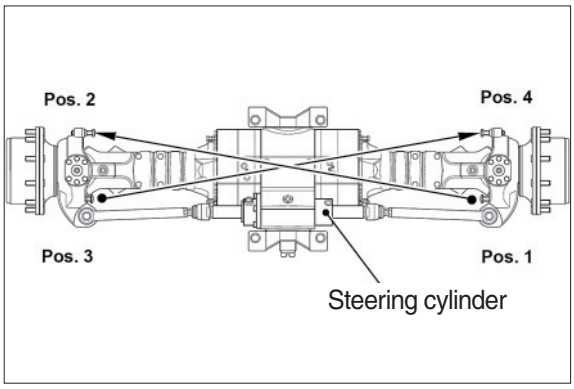
· Torque wrench setting for nuts :
24.5~27.5 kgf · m (177~199 lbf · ft)



55W9NAX117

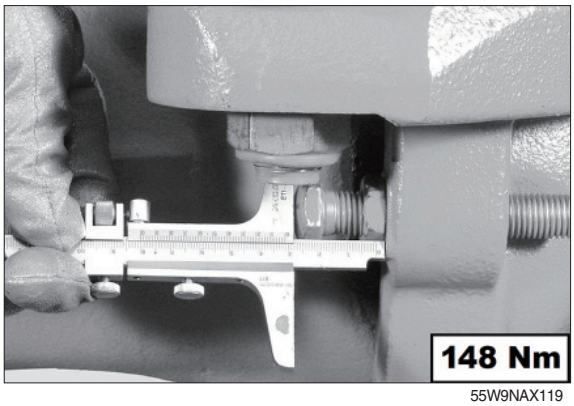
ADJUSTING THE STEERING ANGLE

※ Perform the same operations on both sides (see diagram).
Loosen the nut of one of the adjusting screws on cylinder side.



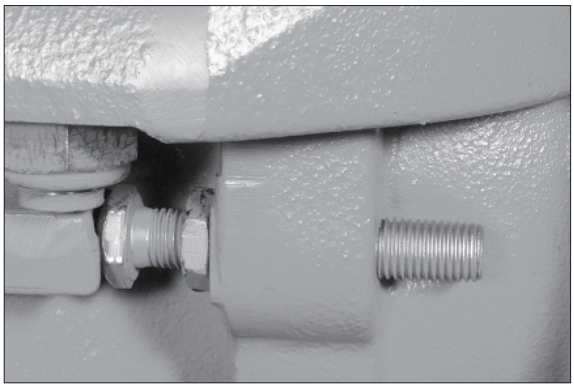
55W9NAX118

㉓ Adjust the jutting portion of the screw according to data shown in the table (see the next page).
Lock into the position with nut tightened to max 15.1 kgf · m (109 lbf · ft).



55W9NAX119

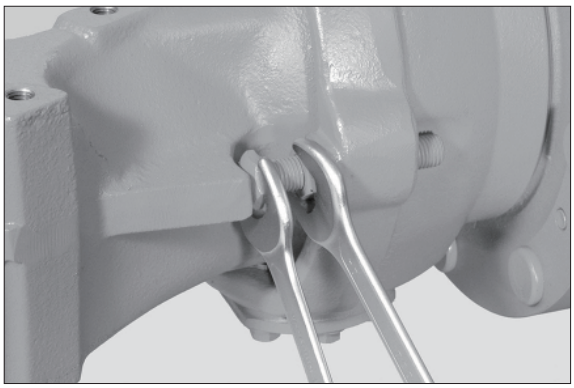
㉔ Perform one full steering operation until the adjusted screw leans against the arm stop.



55W9NAX120

㉕ As you hold the adjusted screw in position against the arm stop, adjust the screw opposite, on non-cylinder side, until it leans against the arm stop.

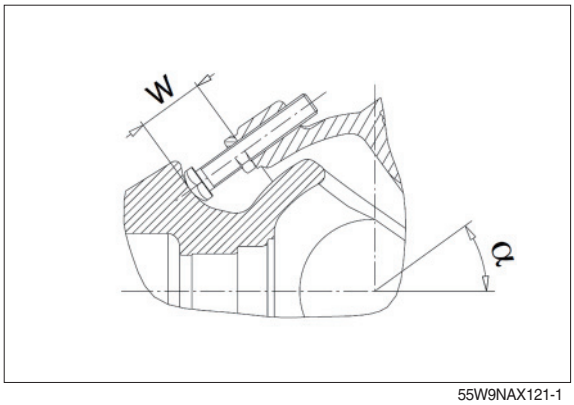
※ The screws must lean against the respective arm stops all at the same time.



55W9NAX121

Requested steering angle : value α	25˚	27˚	30˚	32˚	35˚	36˚	40˚	42˚	45˚
Steering cases versions based on max. steering angle	Value W = Adjustment of the steering stop screw, steering cylinder side [mm]								
35˚ max angle	55.1	51.2	45.4	41.4	35.0				
45˚ max angle			57.4		47.0	44.7	35.8	31.2	24.6

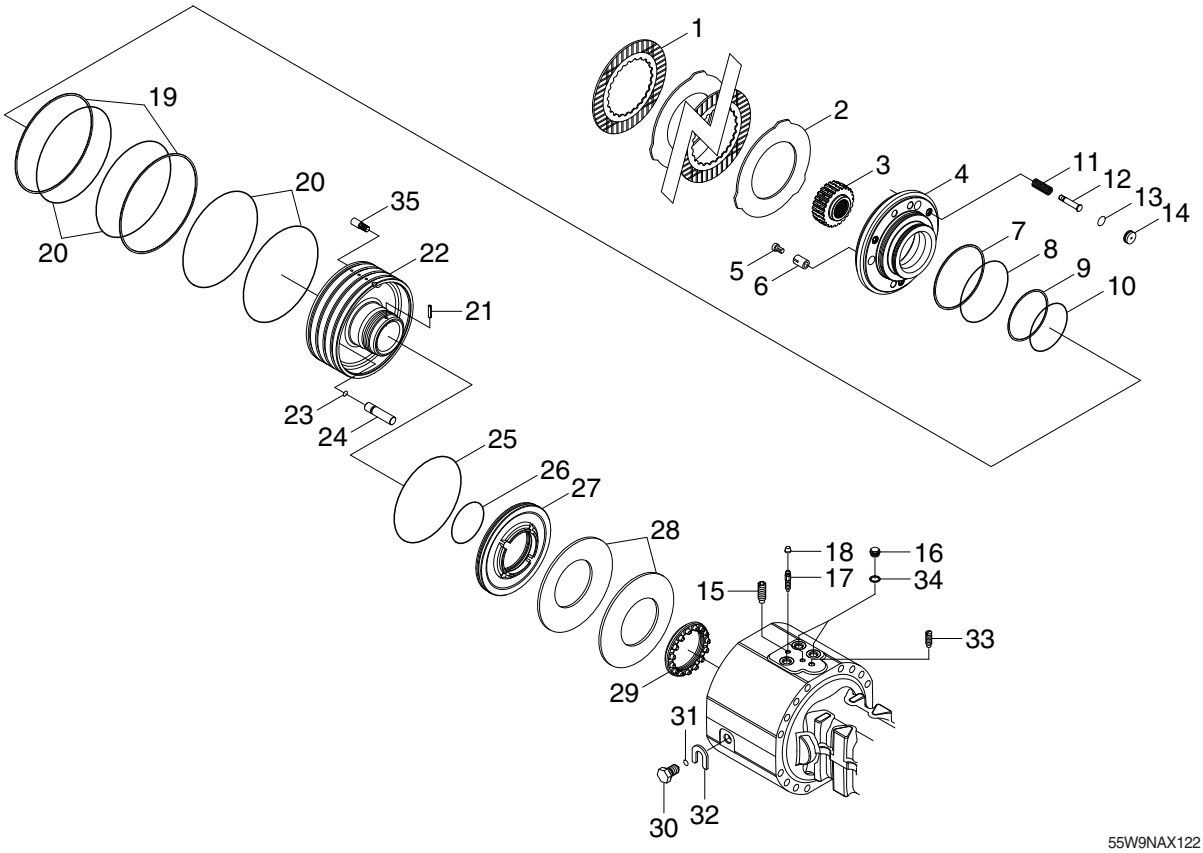
※ The screws must lean against the respective arm stops all at the same time.



55W9NAX121-1

3) BRAKE : SERVICE BRAKE, NEGATIVE BRAKE

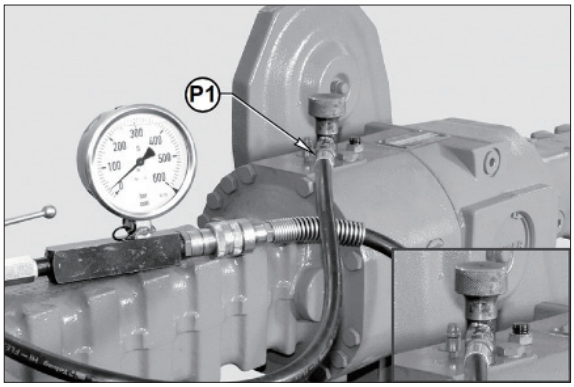
(1) Disassembly



55W9NAX122

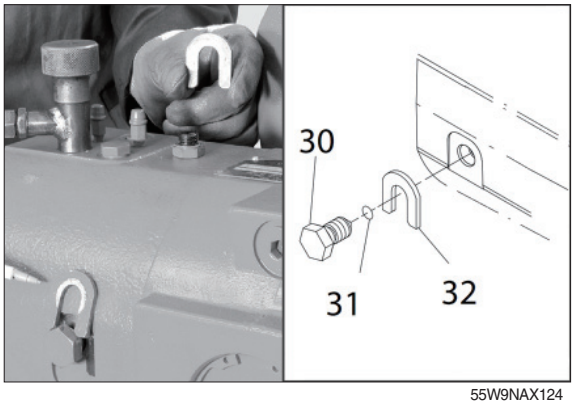
① Connect an external pump to the union piece “P1” of the negative brake and introduce a pressure of 15±30 bar to eliminate the pressure of the belleville washers.

※ Perform all operations on both arms.



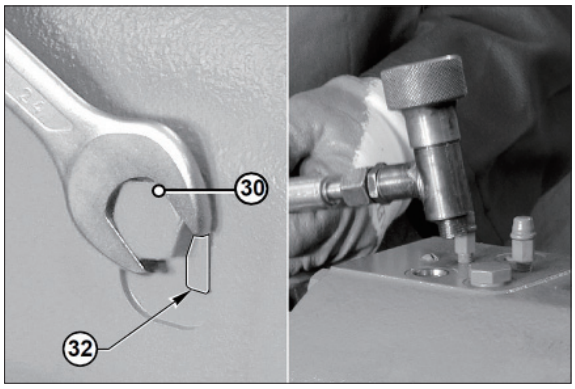
55W9NAX123

② Loosen the unlocking screws (30) and remove both stop washers (32).



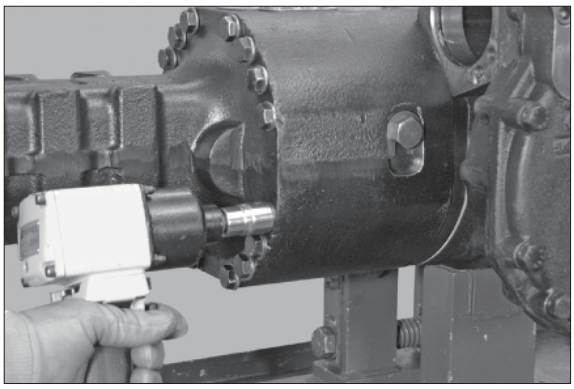
55W9NAX124

③ Insert block screws to end stroke and release pression.

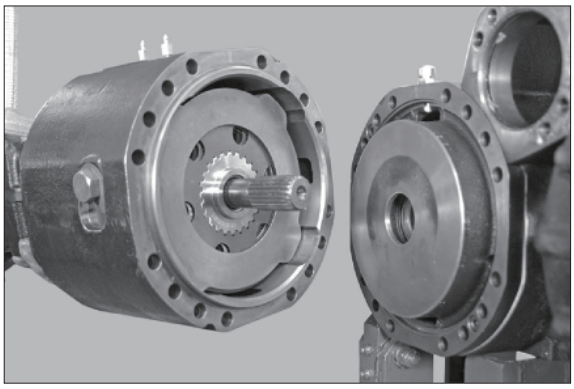


55W9NAX125

④ Sling the arm to be removed and connect it to a hoist, remove screws.

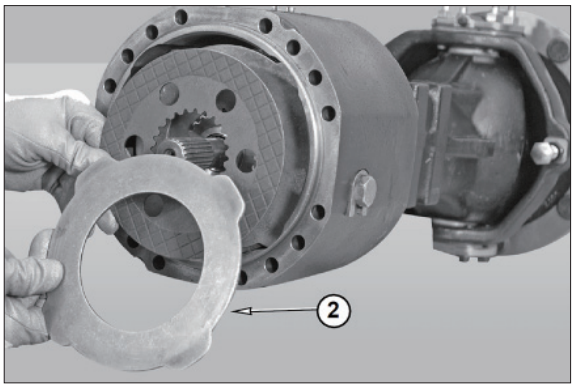

55W9NAX126

⑤ Take off the arm and lay it down vertically.


55W9NAX127

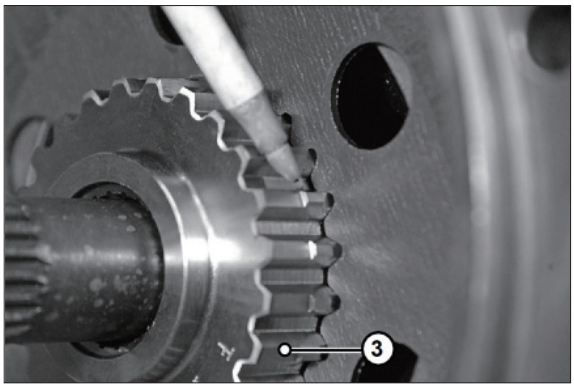
⑥ Remove the brake discs one after the other (2).

※ If they are not to be substituted, do not mix up the sequence.



55W9NAX128

⑦ Remove the flange (3) complete with the discs.

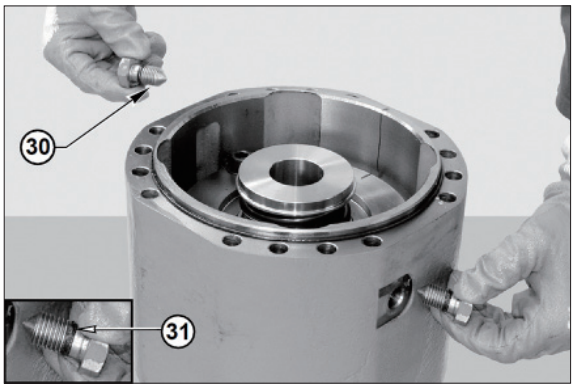


55W9NAX129

⑧ In order to keep the disc springs of the negative brake preloaded, screw down the screws with washers to the end stop.

55W9NAX130

⑨ Remove the negative brake locking screws (30).
Always exchange the O-ring (31).

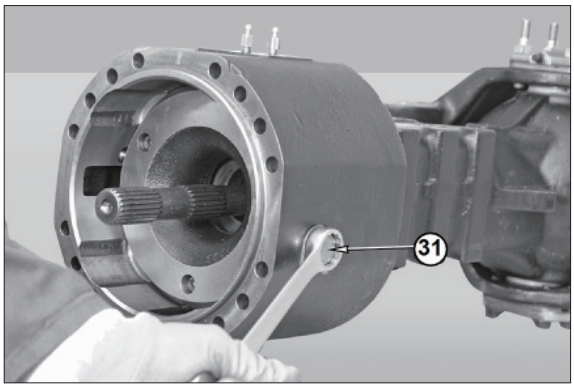


55W9NAX131

⑩ Loosen the before installed provisional screws in the same sequence and same measure.

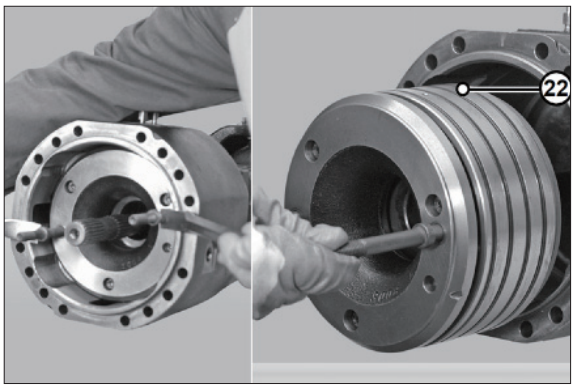
55W9NAX132

⑪ Remove the negative brake locking screws (30).
Always exchange the O-ring (31).



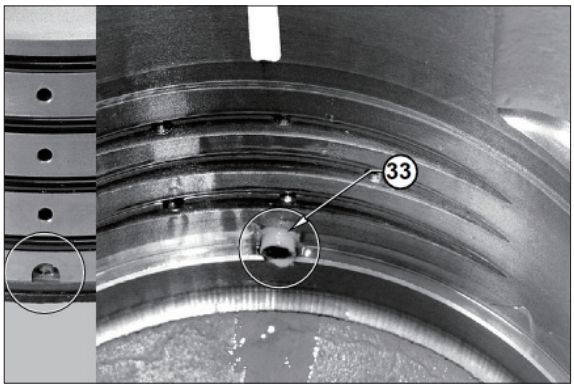
55W9NAX133

⑫ Pull out brake piston assembly module (22).



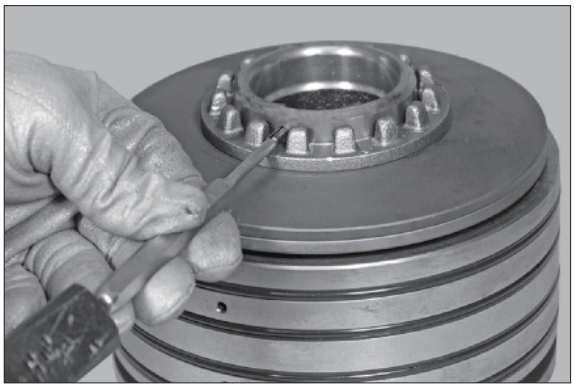
55W9NAX134

※ Check locking screw (33) of the brake piston module.

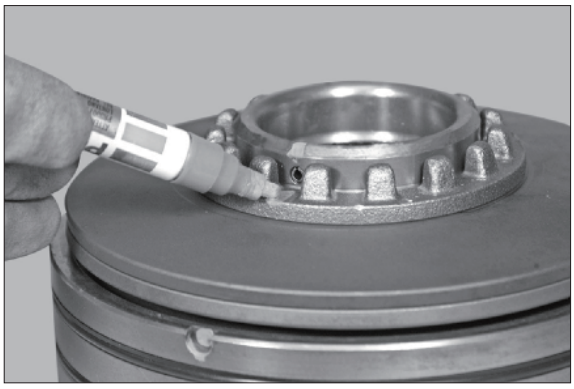


55W9NAX135

⑬ Turn upside down the brake module and with a pin driver remove the locking pin of the slotted nut.

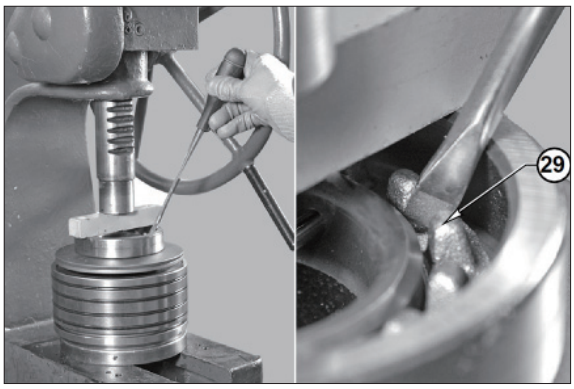

55W9NAX136

⑭ Sign the position of the slotted nut.



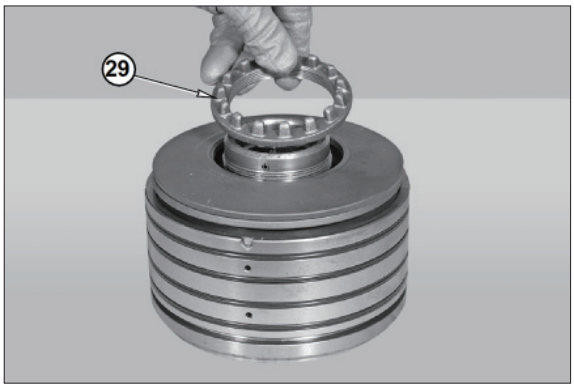
55W9NAX137

⑮ Bring the piston group below a press, compress the cup springs and loosen the metal ring.



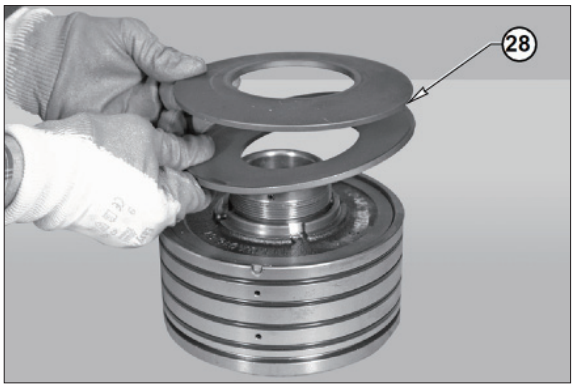
55W9NAX138

⑯ Remove nut (29).



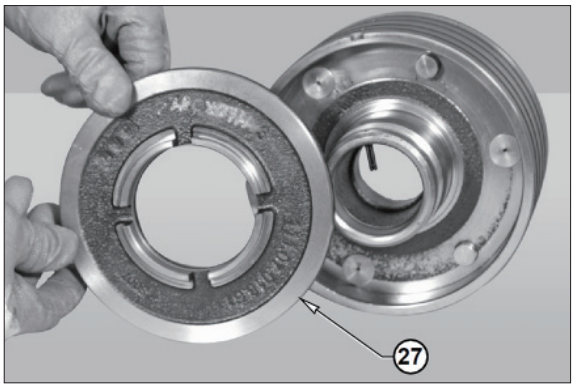
55W9NAX139

⑰ Remove the disc springs (28).



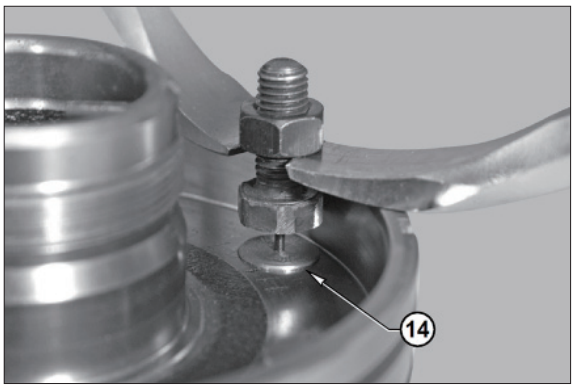
55W9NAX140

⑱ Applying air pressure, remove the piston (27) of the negative brake.



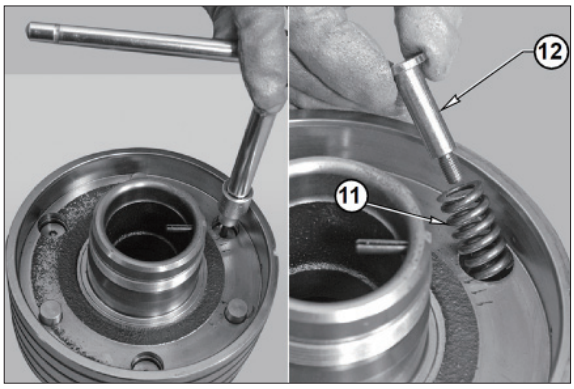
55W9NAX141

⑲ Using a new screw remove the pressure seal caps.



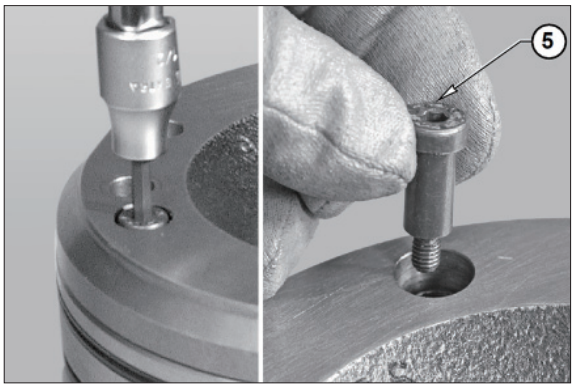
55W9NAX142

⑳ Remove the reversal springs (11).



55W9NAX143

㉑ Remove the adjusting screws (5).

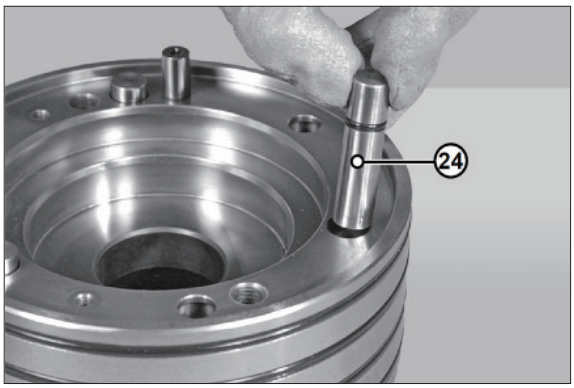


55W9NAX144

㉒ Remove the service brake piston (4).

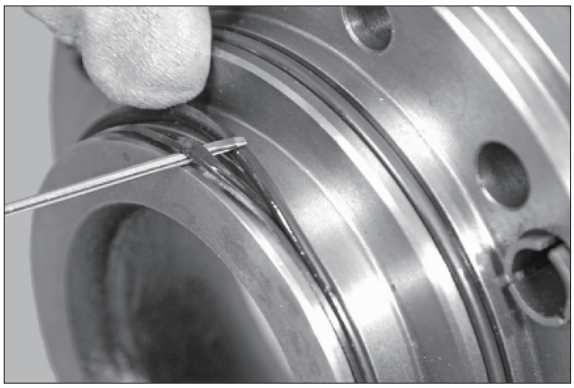
55W9NAX145

㉓ Remove the three bolts (24).

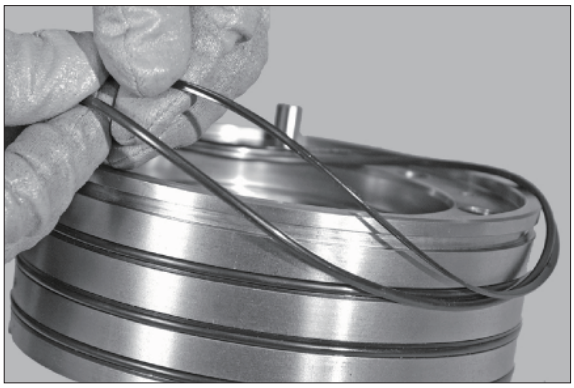


55W9NAX146

㉔ Remove the O-rings and the anti-extrusions rings from the service brake, the negative brake piston and from the piston.

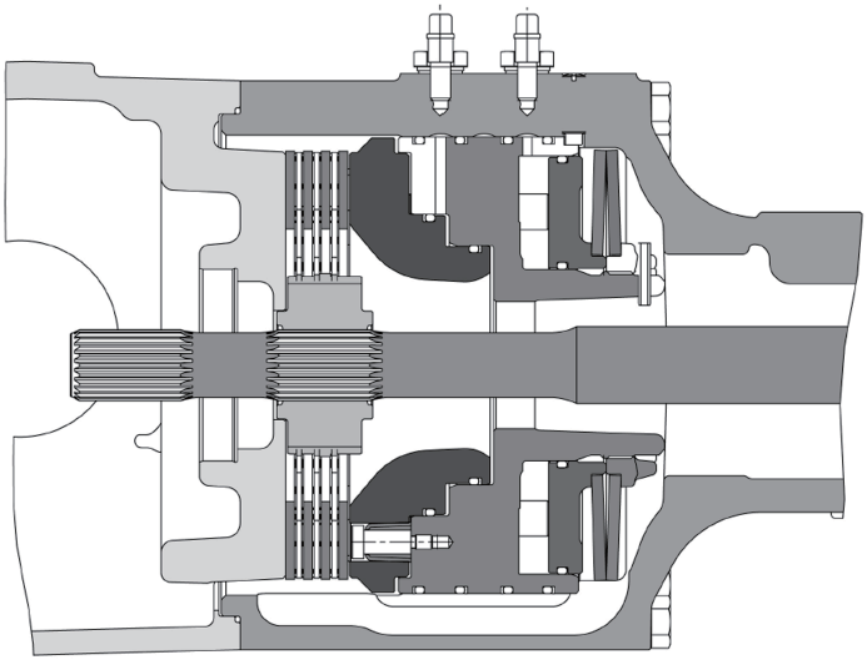


55W9NAX147



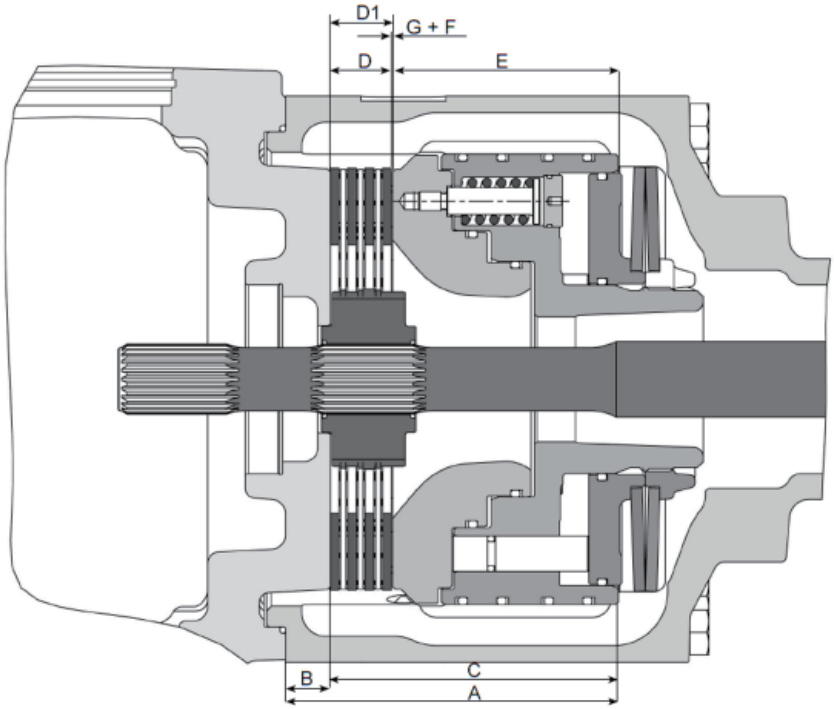
55W9NAX148

(2) Assembly



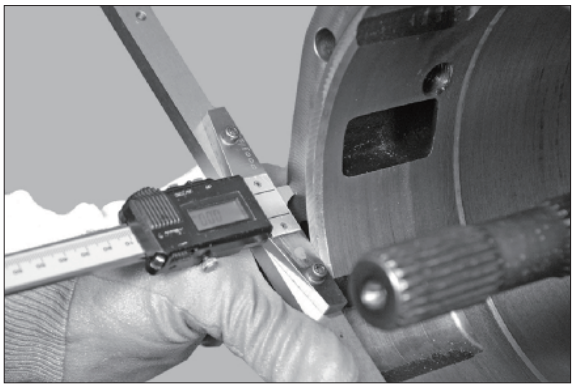
55W9NAX149

C = A - B
141.0 - 19.0 = 122 mm
C = arm quote
D1 = D + G + F
26.0 + 0.75 + 0.2 = 26.95 mm
D = tickness of discs pack
G = brake discs gap
F = fix quote
E = C - D1
122 - 26.95 = 95.05 mm
E = piston pack quote



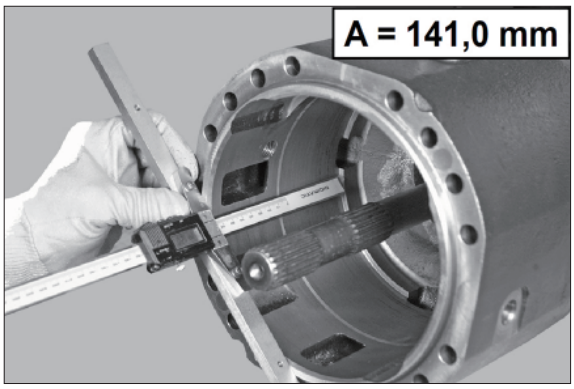
55W9NAX150

① Zero the centesimal calibre between the support plane and the centering arm.



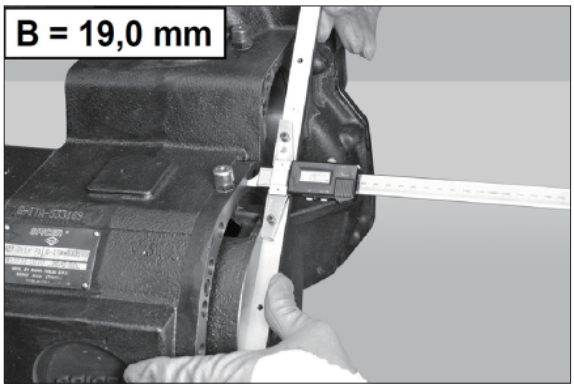
55W9NAX151

② Then measure the distance between the arm support plane and the piston pack stop.



55W9NAX152

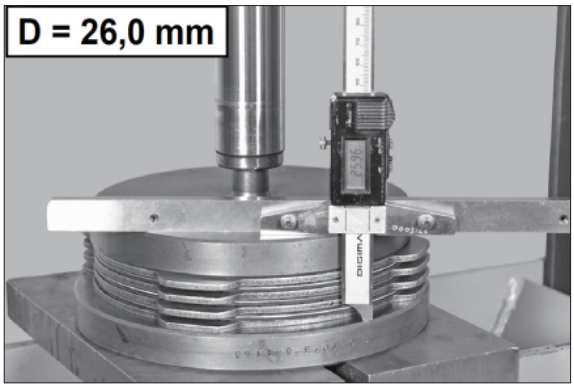
③ Measure the distance between the disk support plane and the arm support plane.
Subtract the value B from the value A to obtain the effective dimension of the arm containing the brake disks and the piston pack.



55W9NAX153

④ Bring the disk pack beneath a press, load with 1000 kg, then measure the dimension D.
Add the play G and the fixed value F (equal to 0.2 mm) to the value D.

※ Do not take into account the thickness between the press piston and the disks.



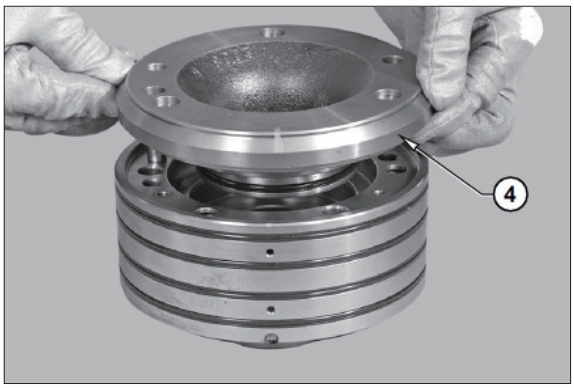
55W9NAX154

⑤ To determine the value of the piston pack, subtract value C from value D1.

C = A - B
141,0 - 19,0 = 122 mm
C= arm quote
D1 = D + G + F
26,0 + 0,75 + 0,2 = 26,95 mm
D= tickness of discs pack
G= brake discs gap
F= fix quote
E = C - D1
122 - 26,95 = 95,05 mm
E = piston pack quote

55W9NAX155

⑥ Insert the service brake piston (4) hammering alternately with a plastic hammer.

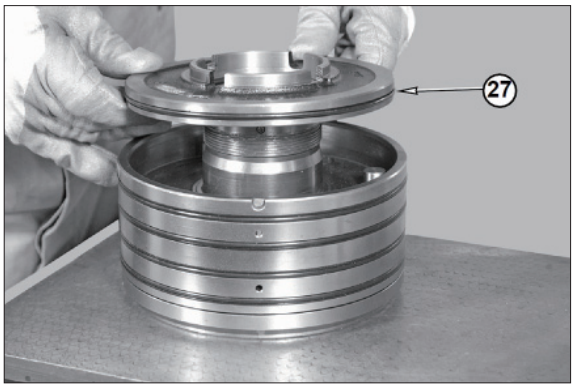


55W9NAX156

⑦ Insert the bolts (24).

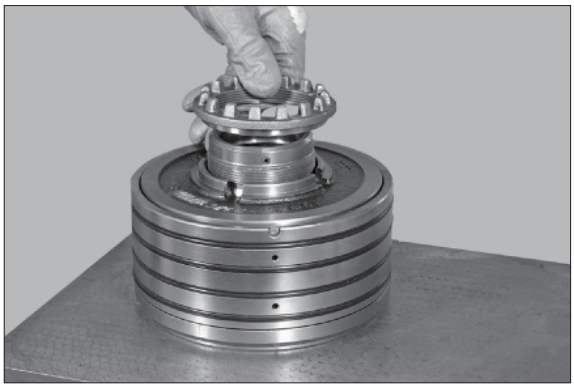
55W9NAX157

⑧ Turn upside down and insert the negative brake piston (27).



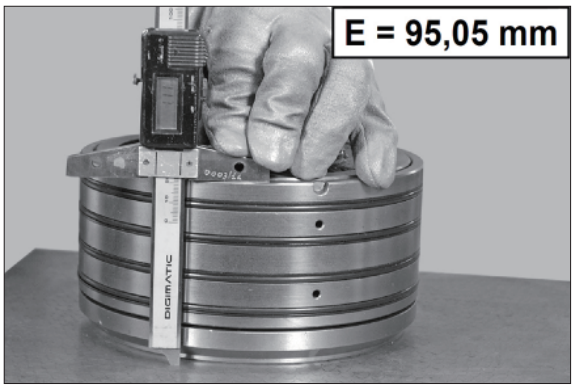
55W9NAX158

※ To determin the level “E” the slotted nut has to be operated without spring mounted.



55W9NAX159

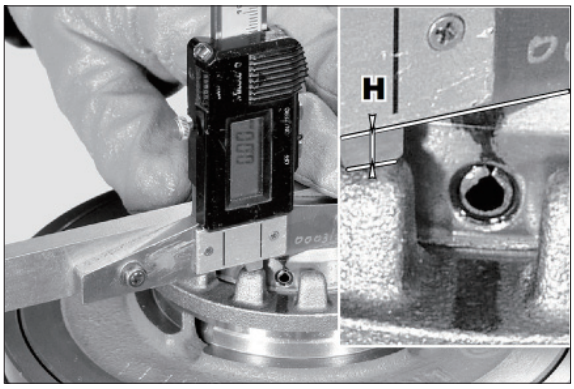
※ To define the level “E” adjust the slotted nut always to the smaller value by driving to the closer notch.



55W9NAX160

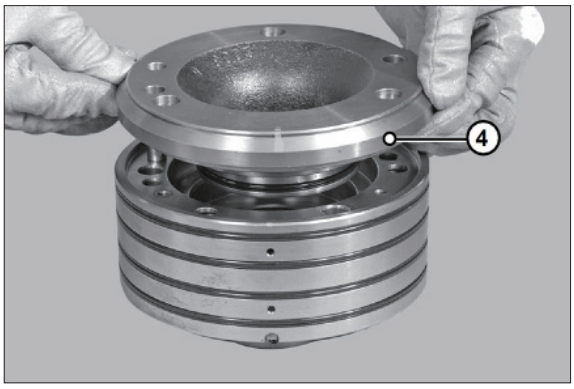
⑨ Before removing the slotted nut in order to insert the springs, note down the distance “H” from the plane to the tooth near the pin.

※ Sign.



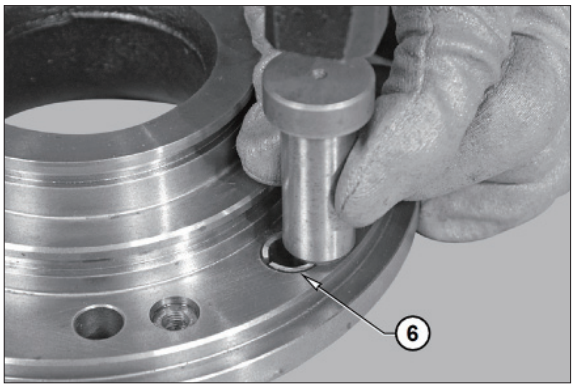
55W9NAX161

⑩ Remove the service brake piston (4).



55W9NAX162

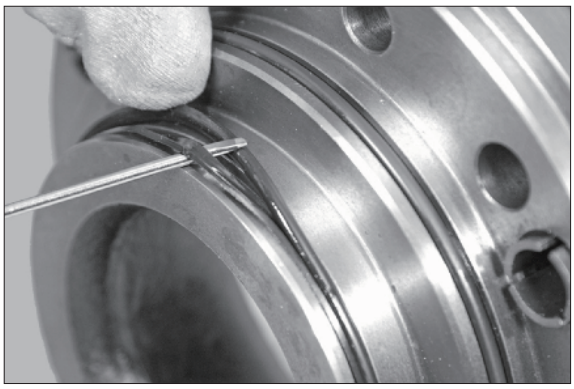
⑪ Insert the stroke automatic regulation springs (6); place them in line with the piston (4).



55W9NAX163

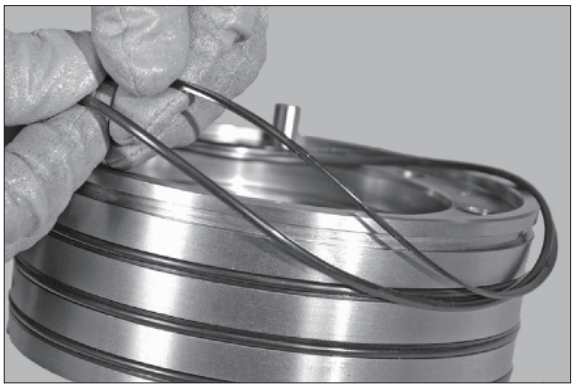
⑫ Complete the O-rings and anti-extrusion rings on all pistons.

※ The O-rings always have to be assembled from the pressure facing side.



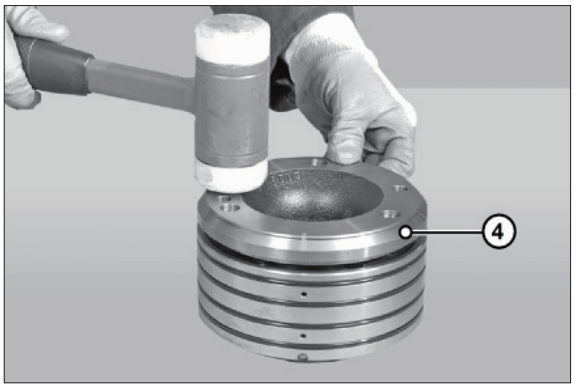
55W9NAX164

55W9NAX165



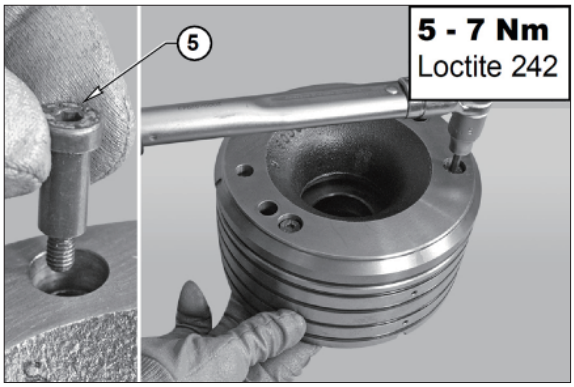
55W9NAX166

⑬ Insert the service brake piston (4) hammering alternately with a plastic hammer.



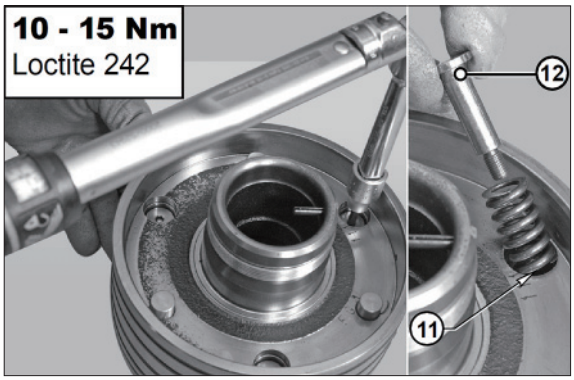
55W9NAX167

⑭ Fit the adjusting screws (5).
Apply loctite 242 to the thread.
· Torque wrench setting :
0.51~0.71 kgf · m (3.69~5.16 lbf · ft)



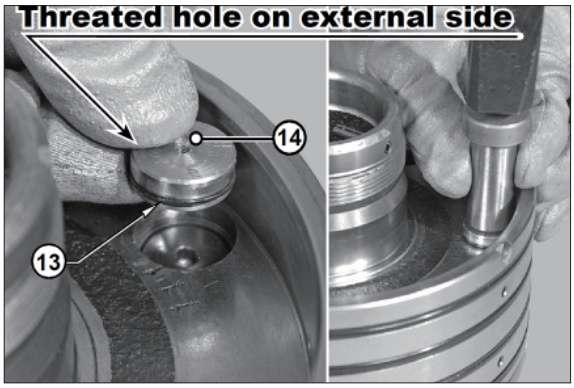
55W9NAX168

⑮ Fit the reversal springs (11) on the piston (4).
Apply loctite 242 to the thread of the adjustment screw.
Tighten with torque wrench setting of 1.02~1.53 kgf · m (7.38~11.1 lbf · ft).



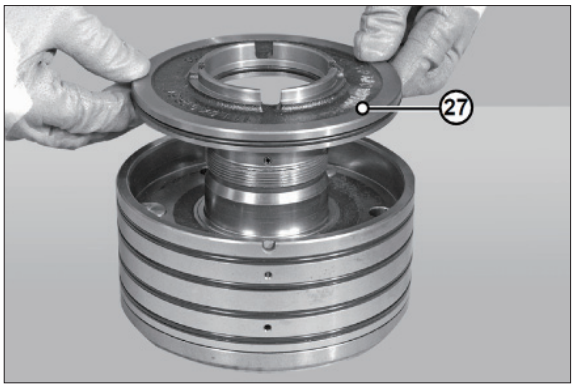
55W9NAX169

⑯ Insert the stroke end seal caps.



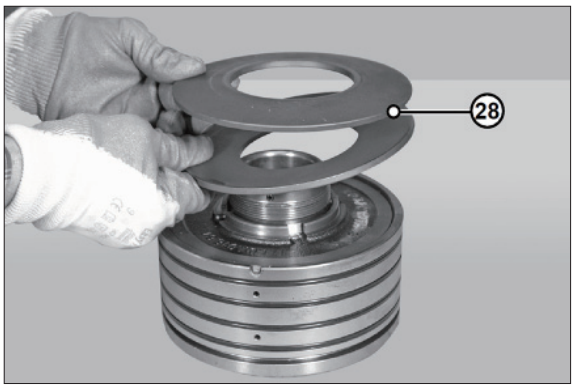
55W9NAX170

⑰ Insert the negative brake piston (27).



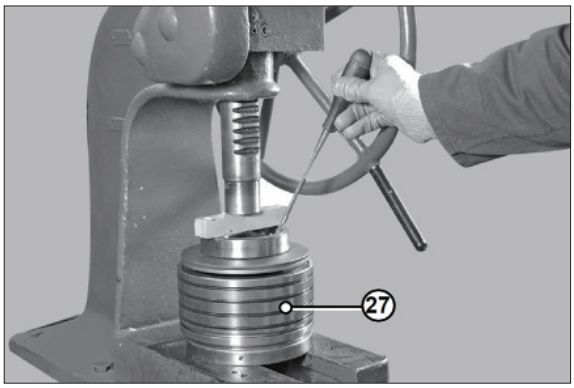
55W9NAX171

⑱ Insert the disc springs in the right position (28).



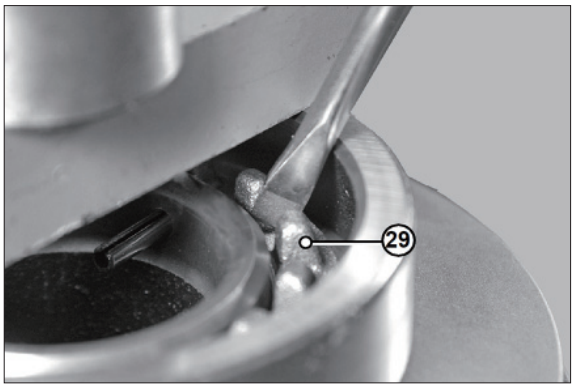
55W9NAX172

⑲ Insert at the bottom the piston of the negative brake (27) and screw up the slotted nut (29).



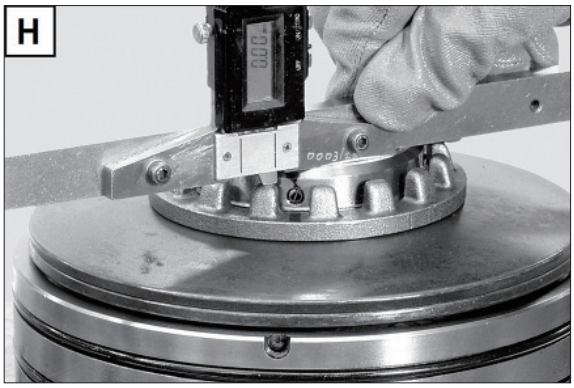
55W9NAX173

⑳ Screw down the slotted nut to the earlier determined position.



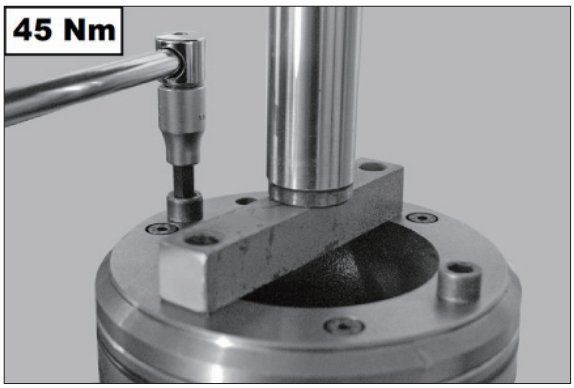
55W9NAX174

㉑ Check the earlier measured distance “H” from the plane to the tooth next to the pin.



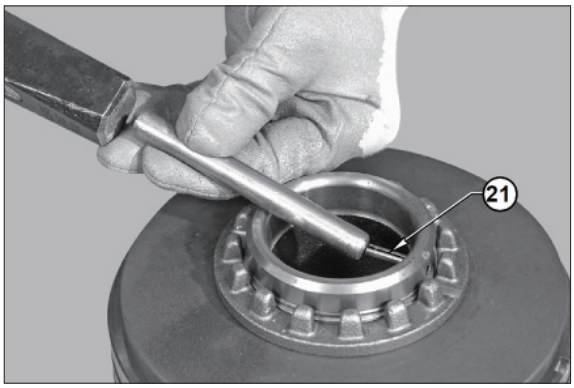
55W9NAX175

㉒ Alternately tighten with a torque wrench setting of maximum 4.59 kgf · m (33.2 lbf · ft).



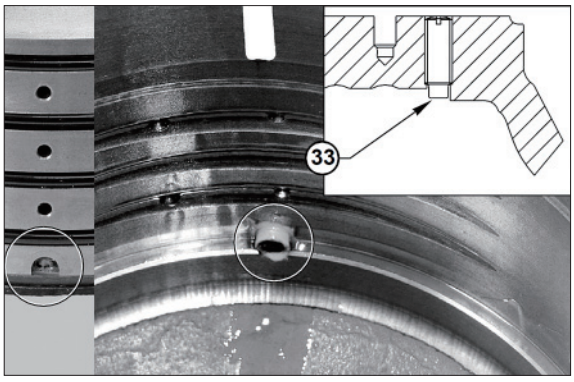
55W9NAX176

㉓ Put the pin in locking (21) position.



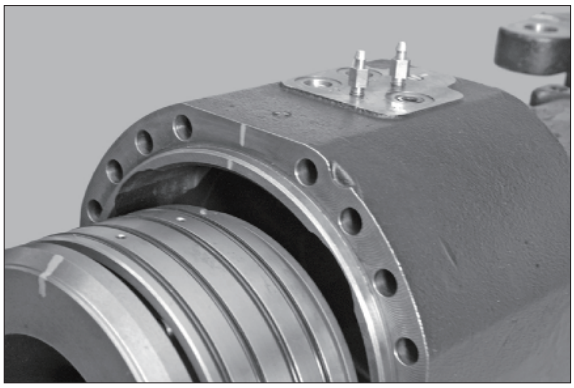
55W9NAX177

※ Check locking screw (33) of the brake piston module.



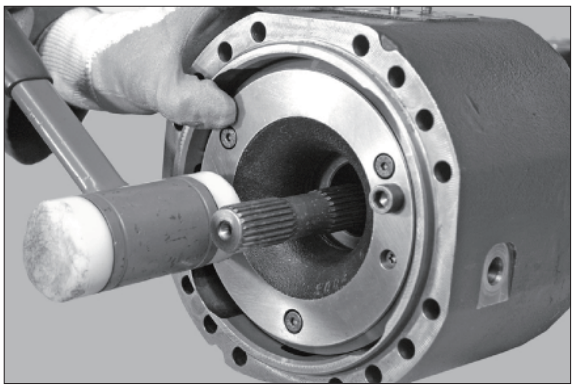
55W9NAX178

㉔ Insert the brake module facing the input holes to the top.



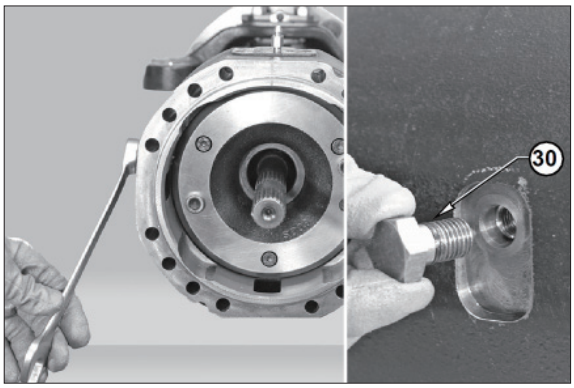
55W9NAX179

㉕ Insert the piston to the end stop by alternating light strokes and remove the screws.



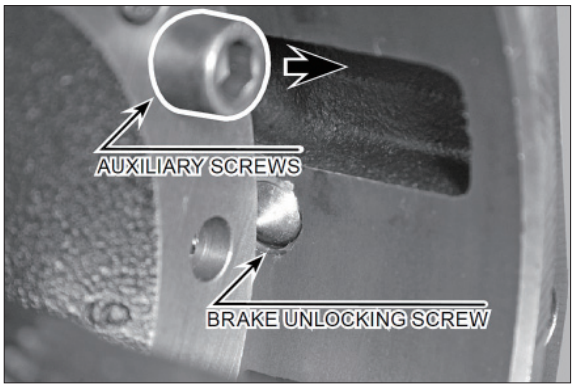
55W9NAX180

㉖ Insert the negative brake unlocking screw (30) up to the end stop.



55W9NAX181

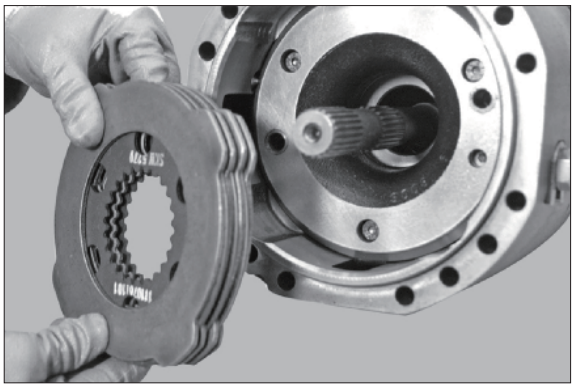
㉗ Remove the two auxiliary screws.



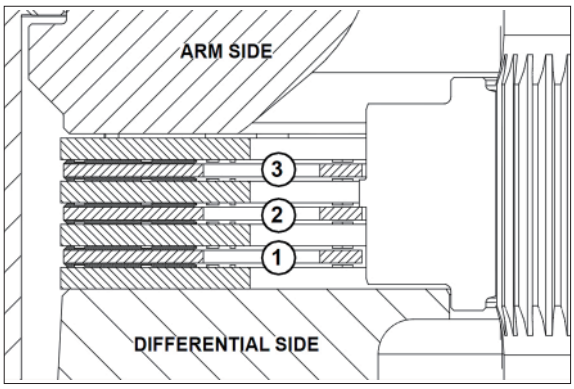
55W9NAX182

㉘ Insert the brake discs (1) (2) in the right sequence.

※ The first brake disc to be inserted must be of friction material.

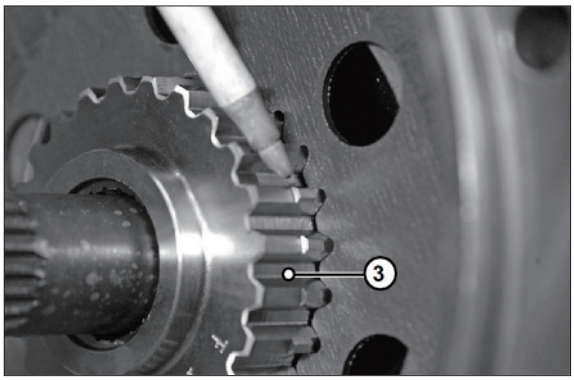


55W9NAX183



55W9NAX184

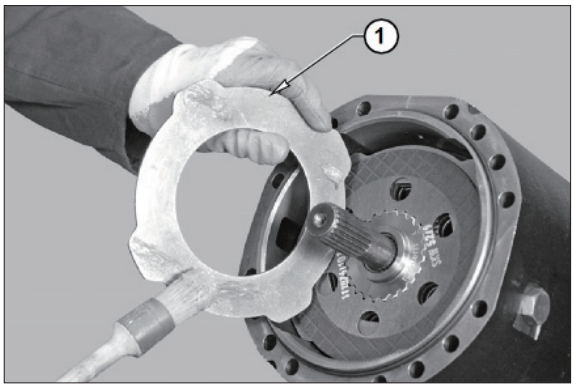
㉙ Install the flange (3) on the arm.



55W9NAX185

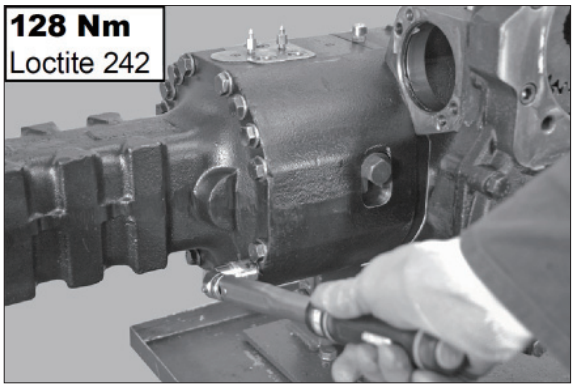
㉚ Insert the brake discs (1) (2) in the right sequence.

※ The last brake disc to be inserted must be of metal material.



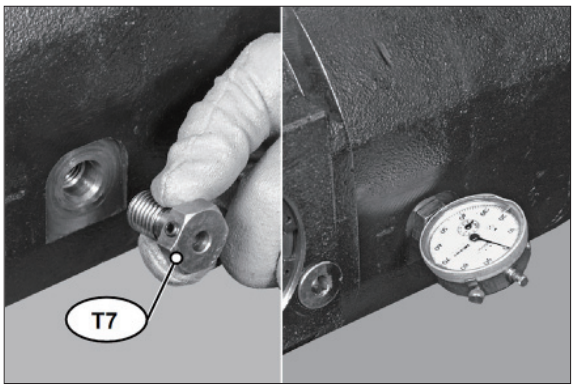
55W9NAX186

㉛ Insert the screws and tighten them alternately.



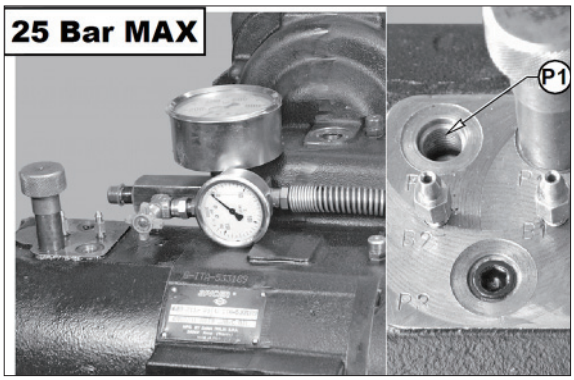
55W9NAX187

㉜ Remove the negative brake locking screws (30).
Fit the special tool T7 into the seat of the manual release of the screws, insert a comparator and pre-load it with 1 mm.



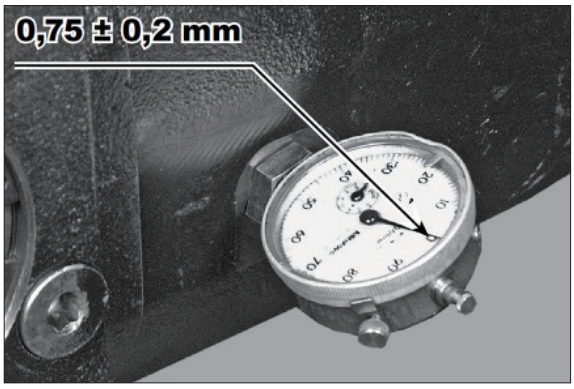
55W9NAX188

㉝ Introduce a pressure of maximum 25 bar.



55W9NAX189

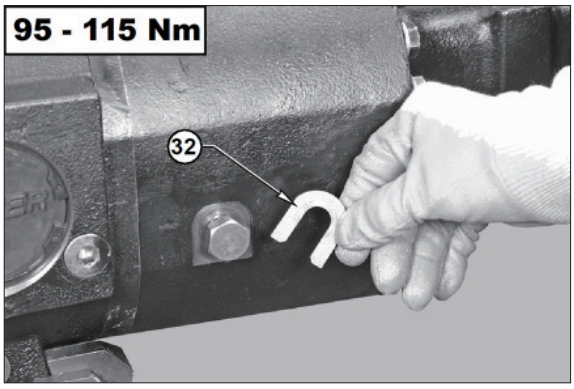
㉞ Once the pressure is inserted into the circuit the comparator must give a measurement equal to play X (0.75 mm).



55W9NAX190

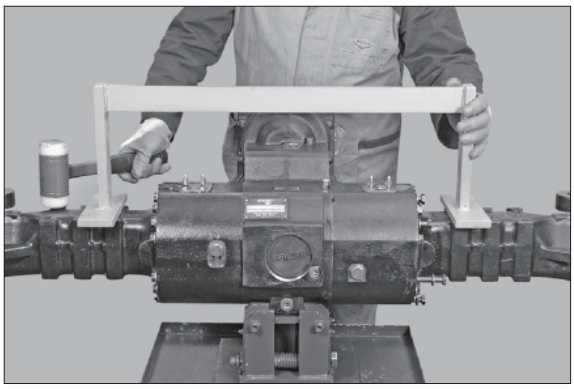
㉟ Insert the two “U”-shaped shims and tighten the screws with a torque wrench setting of 9.69~11.7 kgf · m (70.1~84.8 lbf · ft).

※ The position of the negative brake is unlocked.



55W9NAX191

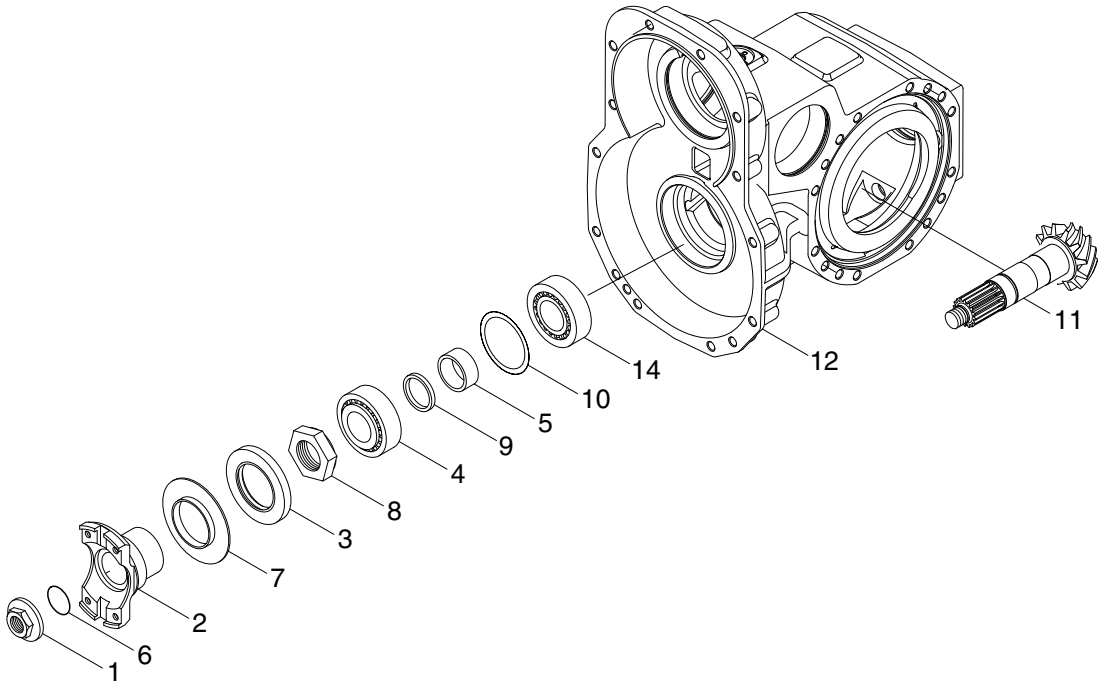
㊱ Check the flatness of the arms and finally lock the arms with the screws (4) and the washer (5) using the crosstightening method.



55W9NAX192

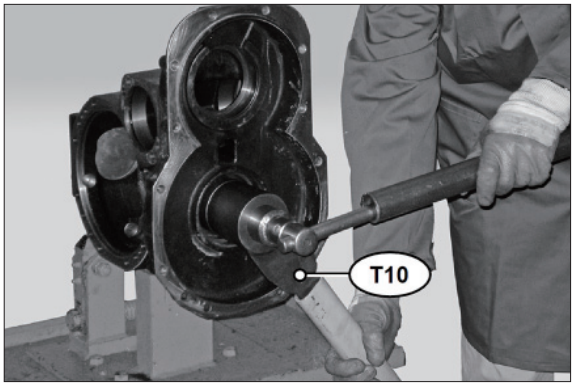
4) BEVEL PINION

(1) Disassembly



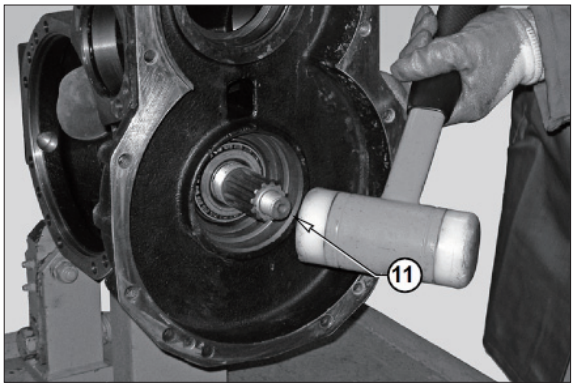
55W9NAX223

① Position tool T10, so as to avoid pinion rotation.
Unloose and remove the nut (1); also remove the O-ring (6).



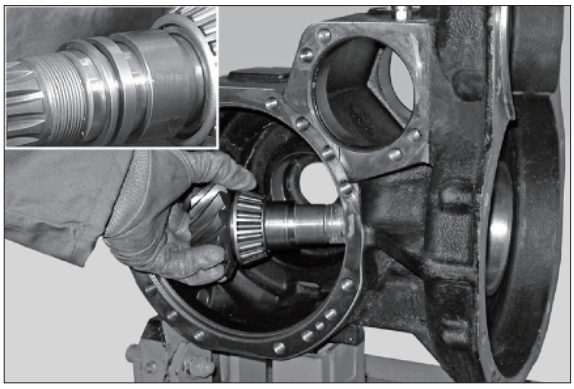
55W9NAX224

② Remove the pinion (11), shims and distance piece.



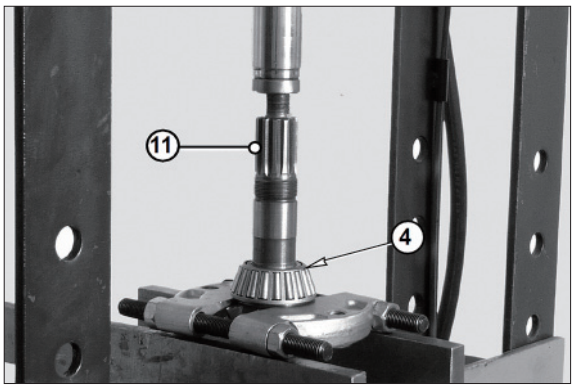
55W9NAX225

③ Refer and keep to the positions marked during disassembly.



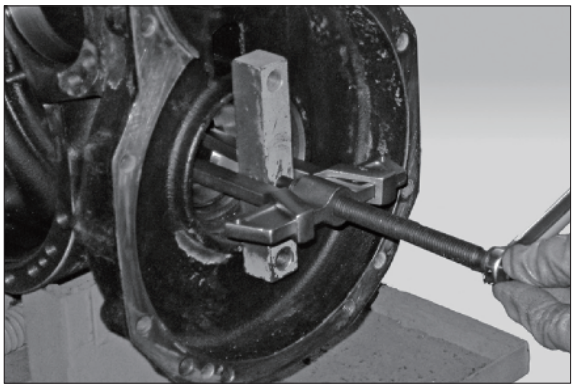
55W9NAX226

④ Using a puller and a press, remove the inner bearing (4) from the pinion (11).



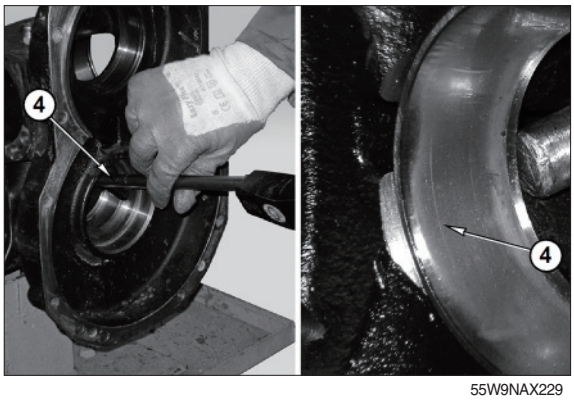
55W9NAX227

⑤ Remove the thrust block of the external bearing (14).



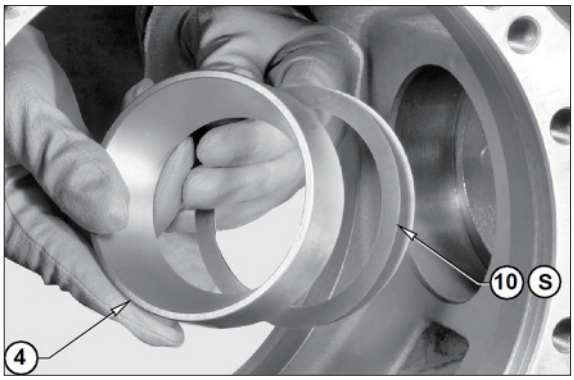
55W9NAX228

⑥ Insert a drift in the appropriate holes.



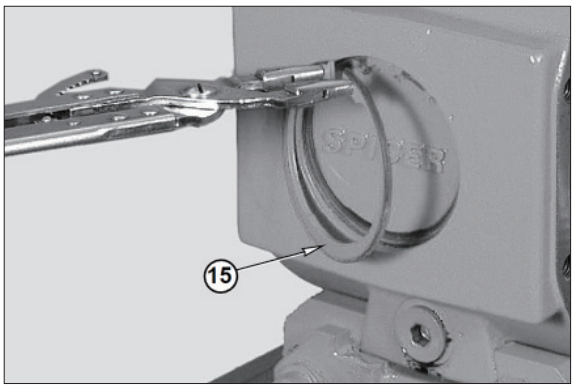
55W9NAX229

⑦ Remove the thrust block of the internal bearing (4) as well as the shim washers (10) (S).



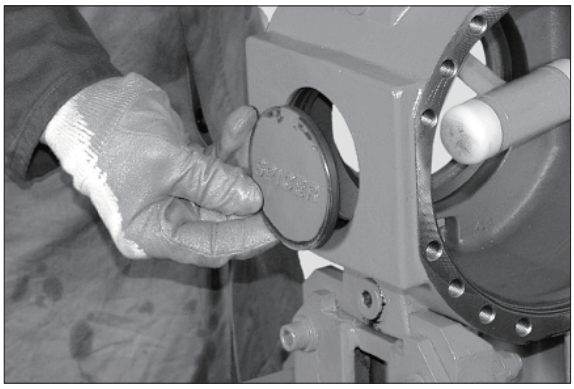
55W9NAX230

⑧ Remove the snap ring (15).



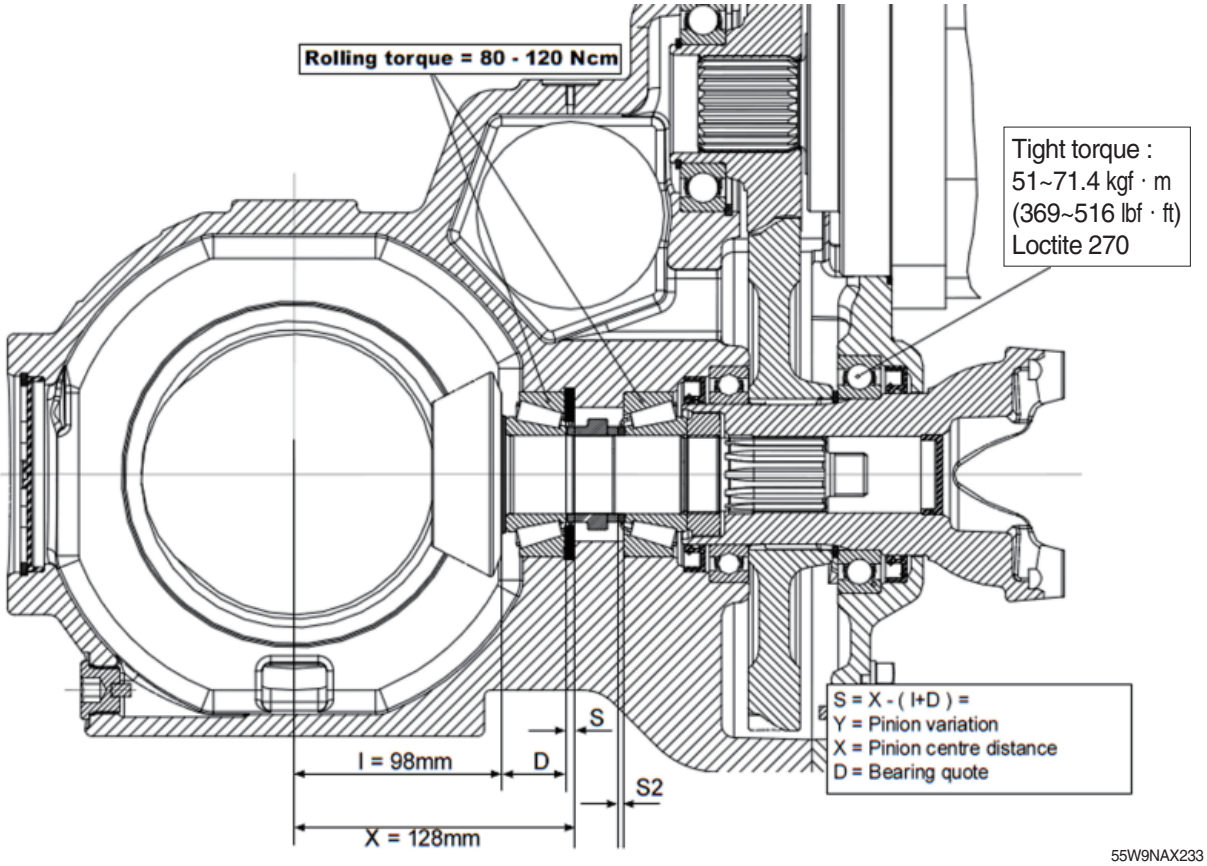
55W9NAX231

⑨ Remove the cap (14).



55W9NAX232

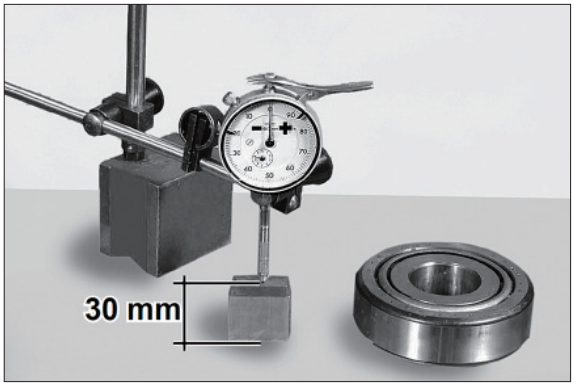
(2) Assembly



55W9NAX233

Calculating pinion center distance

① Using a faceplate, reset a centesimal comparator “DG” on a calibrated block (whose known thickness is 30 ㎜). Preload the comparator by about 3 ㎜.

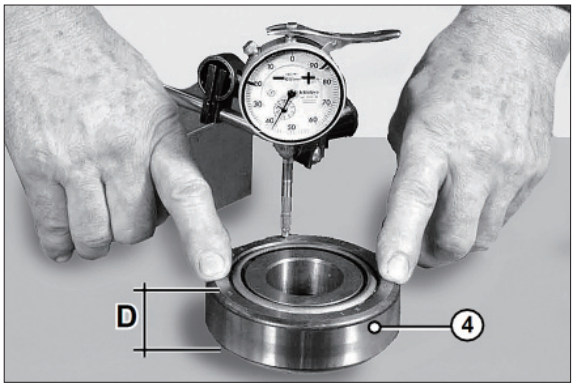


55W9NAX234

② Bring inner bearing (4), complete with thrust block, under comparator “DG”.

※ Press the thrust block centrally and carry out several measurements by rotating the thrust block.

Example : 30 - 0.55 = 29.45 = “D”.

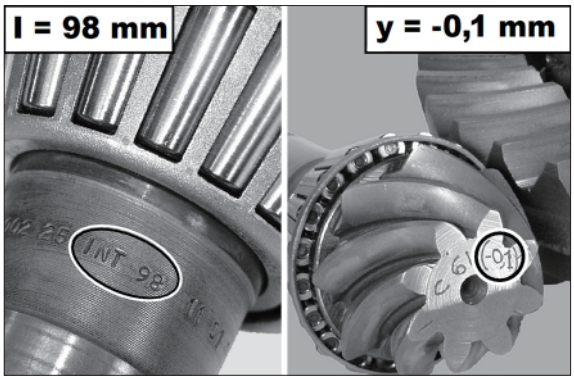


55W9NAX235

③ Check nominal dimension “I” as marked on the pinion. Add up to or subtract from “I” the variation indicated as “Y” to obtain the actual centre distance “I”.

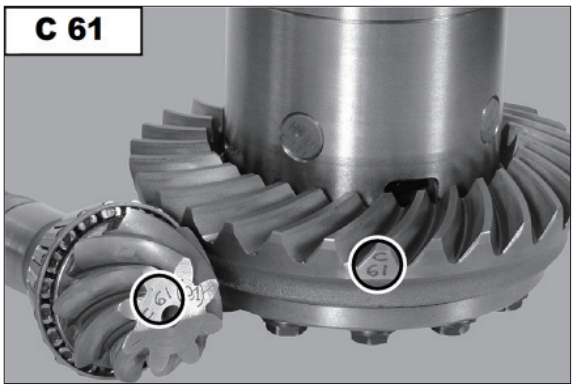
Example : I=INT±Y=98 - 0.1=97.9 ㎜

※ C61 = Match part number



55W9NAX236

④ C61=bevel gear set matching number
(-0.1)=Y variation from the theorical I =98

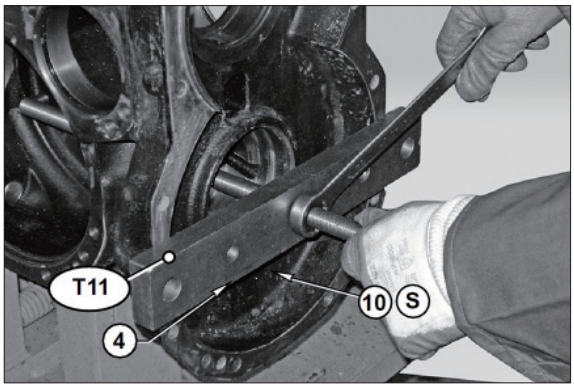


55W9NAX237

⑤ Calculate shims “S” for insertion under the thrust block of the inner bearing using the following formula :
S = X-(I+D) where : X = fixed dimension
I = actual pinion center distance
D = Total bearing thickness ;
Example :
S = 128 - (97.9+29.45) = 0.65 ㎜

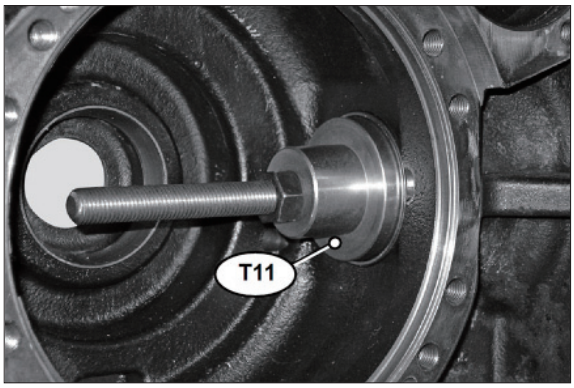
55W9NAX238

⑥ Using special tool T11.
Insert the thrust block of the bearings (4) and shims (10).



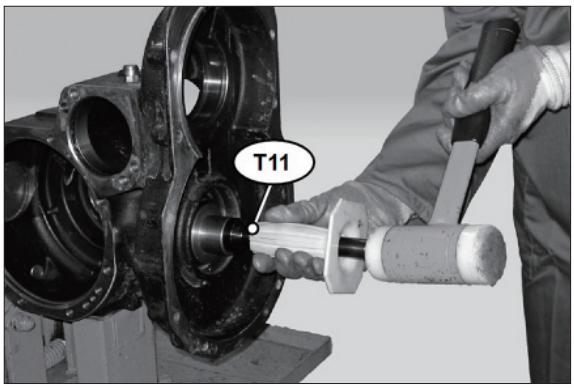
55W9NAX239

※ Before starting the next stage, make sure that the thrust block has been completely inserted into its seat.



55W9NAX240

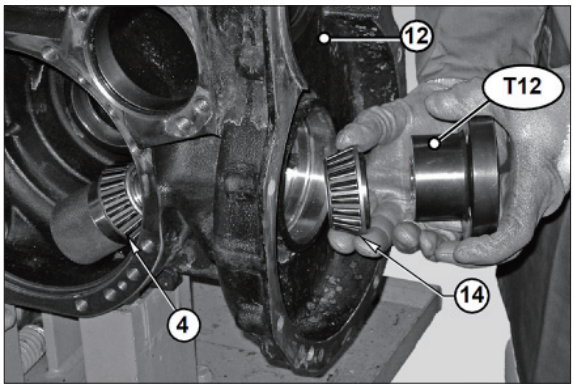
⑦ Using special tool T11.
Insert the thrust block of the bearings (4) and shims (10).



55W9NAX241

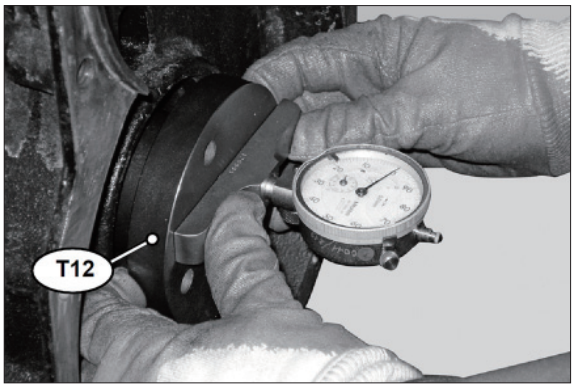
Calculating pinion bearings rolling torque

⑧ Introduce tool T12 complete with bearings (4) and (14) into the main body (12); tighten by hand until a rolling torque is definitely obtained.

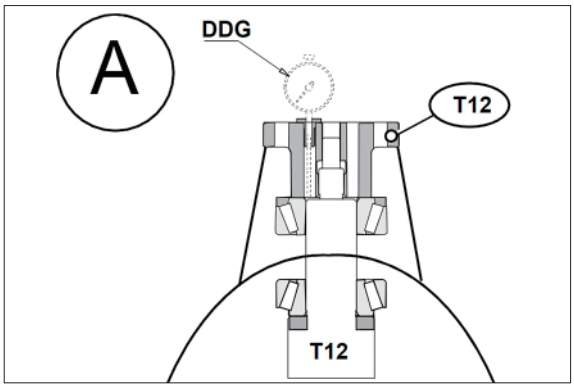


55W9NAX242

⑨ Introduce the tracer of a depth comparator “DDG” into either side hole of tool T12.
Reset the comparator with a preload of about 3 mm.

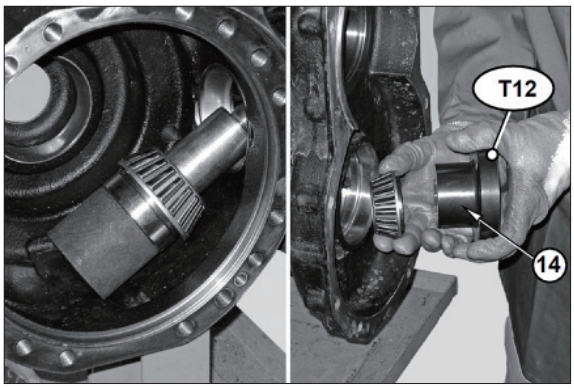


55W9NAX243



55W9NAX244

⑩ Remove the comparator and take out tool T12 and bearing kits from the main body.
Reinstall every part, also introducing a distance piece between bearings (4) and (14). Tighten the entire pack by hand.

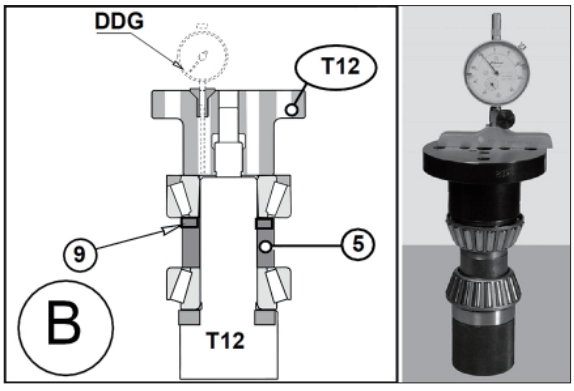


55W9NAX245

⑪ Assemble on top of the tool T12 and between the two bearings the shim (5) and the largest calibrated shim (9).

55W9NAX246

⑫ Measure the difference H using a dial gauge DDG.
・Example : H = A - B = 2.93 mm

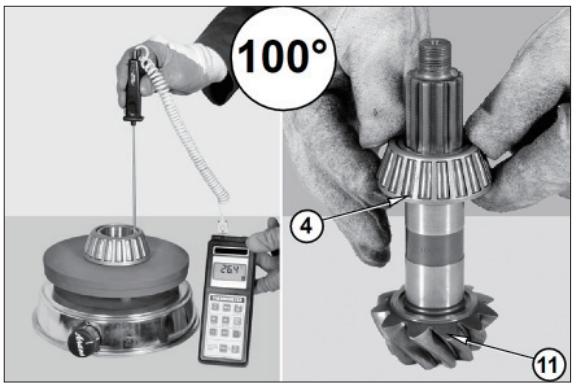


55W9NAX247

⑬ Calculate the shim S2 to be inserted.
Example : S2 = H + X1 = 3.01 ㎜
where X1 = fixed value to obtain =
0.07~0.08 ㎜

55W9NAX248

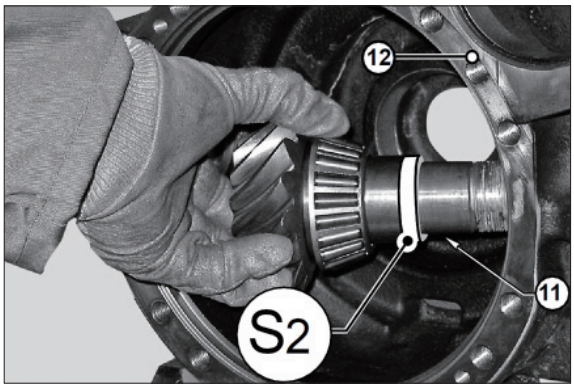
⑭ Heat the bearing to 100˚C and assemble it to the pinion shaft.



55W9NAX249

⑮ Fit the pinion (11), shim “S2” (10) and distance piece (5) (9) in the main body (12).

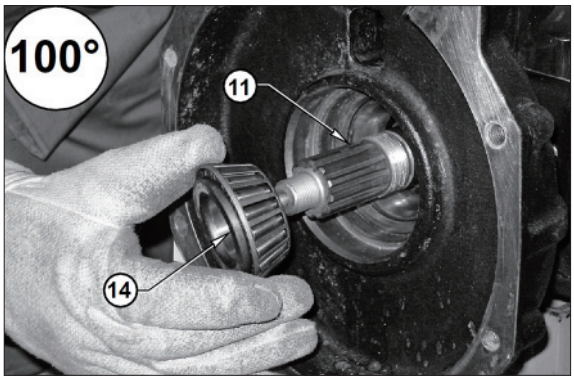
※ The finer shims must be placed in-between the thicker ones.



55W9NAX250

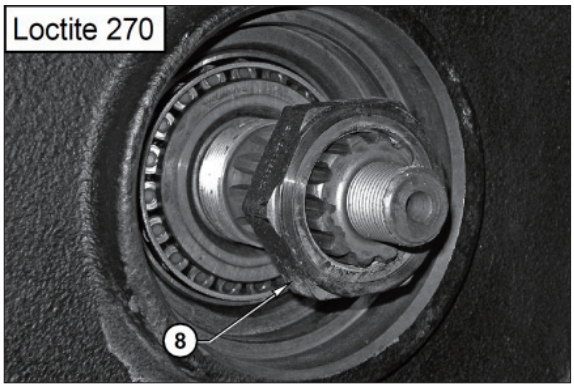
⑯ Heat the external bearing (14) to a temperature of about 100˚C and fit it on to the pinion (11) so as to complete the pack as shown in the figure.

※ Lightly lubricate bearing with SAE85W90 oil.



55W9NAX251

⑰ Apply loctite 270 to the thread of the ring nut (8) and screw the nut onto the pinion.



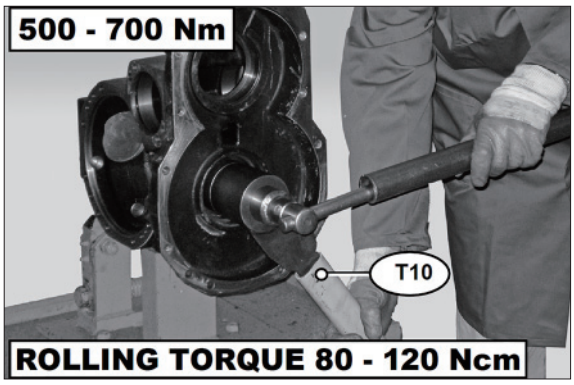
55W9NAX252

⑱ Apply onto the pinion (11) the bar-hold and with the help of a torque meter, check the torque of the pinion (11).

・Torque : 50.9~71.4 kgf · m
(368~516 lbf · ft)

※ If torque exceeds the maximum value, then the size of shim “S1” (4) between the bearing (9) and the distance piece (3) needs to be increased. If torque does not reach the set value, increase the torque setting of the ring nut (10) in different stages to obtain a maximum value of 50.9 kgf · m (368 lbf · ft).

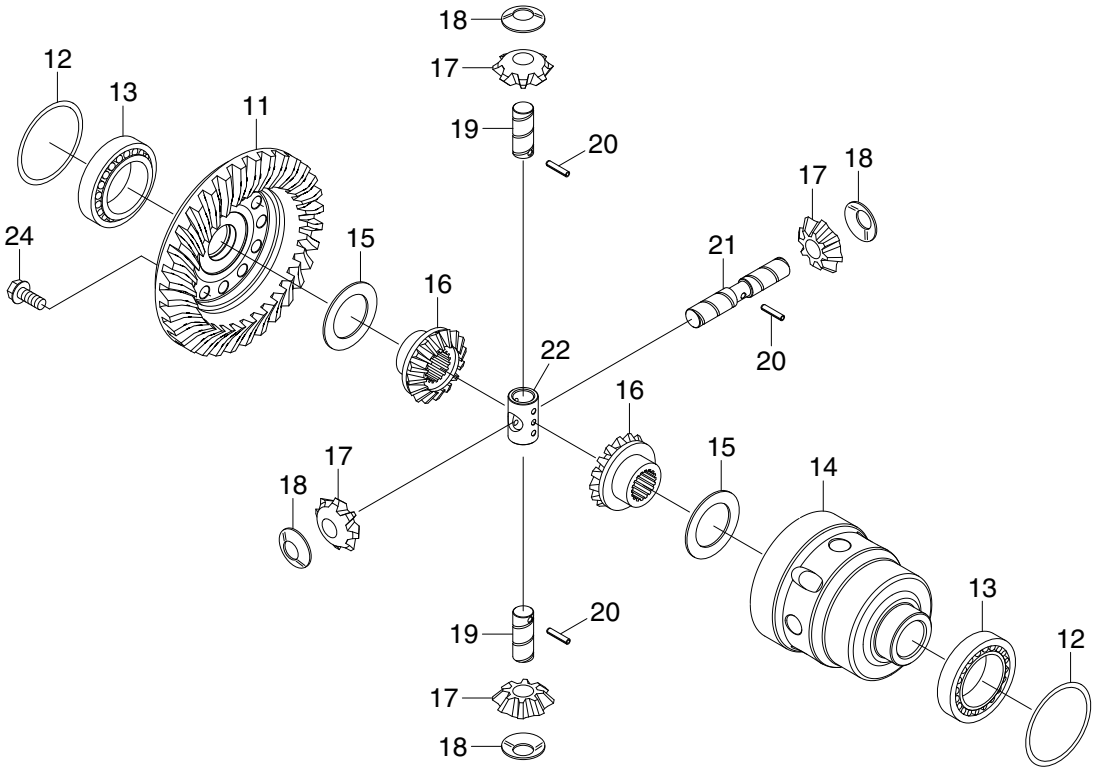
※ If torque does not reach the minimum value, then the size of shim “S1” (4) needs to be reduced.



55W9NAX253

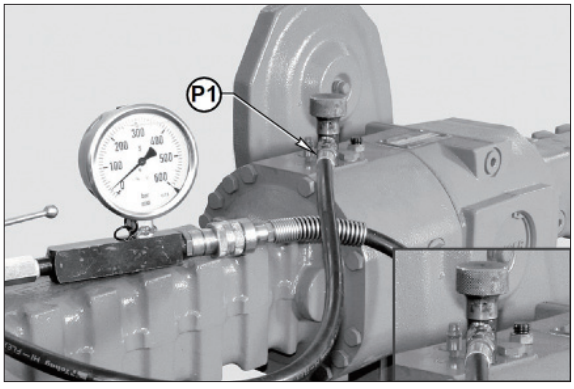
5) DIFFERENTIAL UNIT

(1) Disassembly



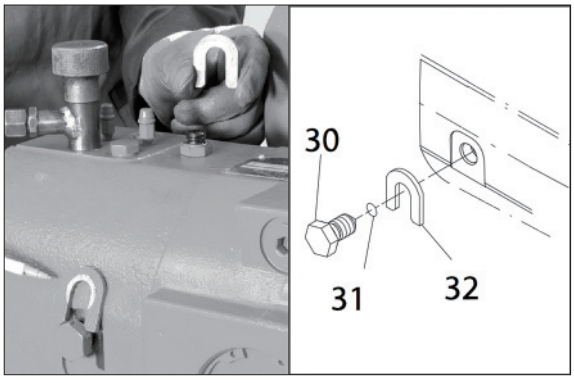
55W9NAX254

① Connect an external pump to the union piece “P1” of the negative brake and introduce a pressure of 15±30 bar to eliminate the pressure of the belleville washers.



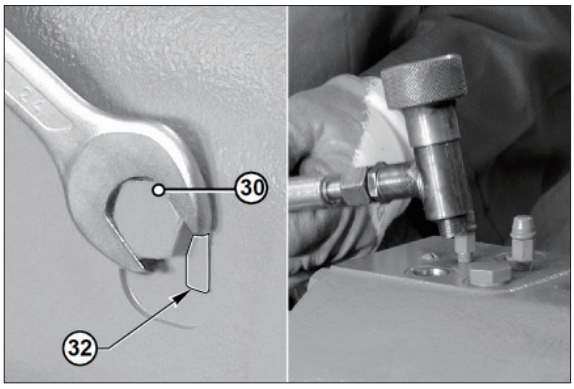
55W9NAX255

② Loosen the unlocking screws (30) and remove both stop washers (32).



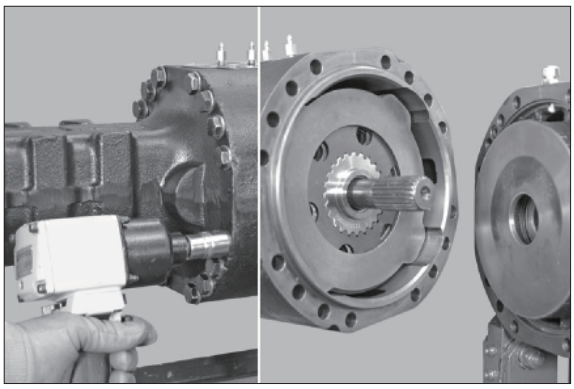
55W9NAX256

③ Insert block screws to end stroke and release pression.



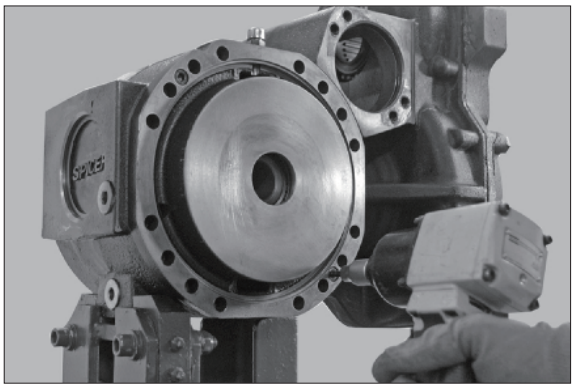
55W9NAX257

④ Remove the brake side arm and the brake discs pack.
Sling the arm to be removed and connect it to a hoist, remove screws of the crown wheel side arm.
Remove the arm together with the pack of the braking disks.
Place the arm on a bench.



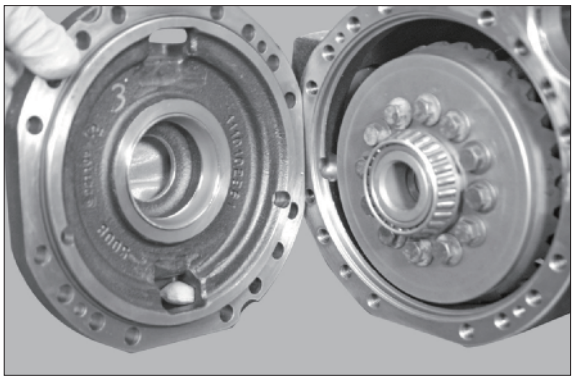
55W9NAX258

⑤ Remove the fitting screws from the middle cover.



55W9NAX259

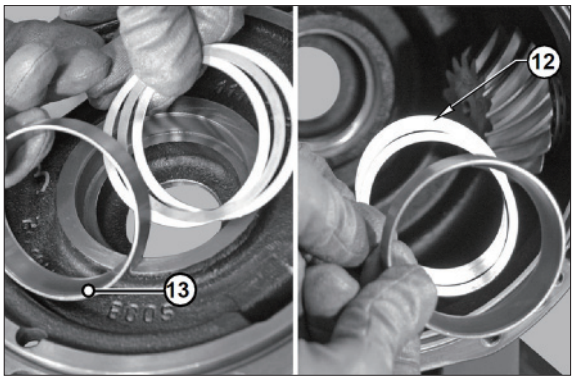
⑥ Insert a screw-driver in the opposing slots then force and remove the middle cover.



55W9NAX260

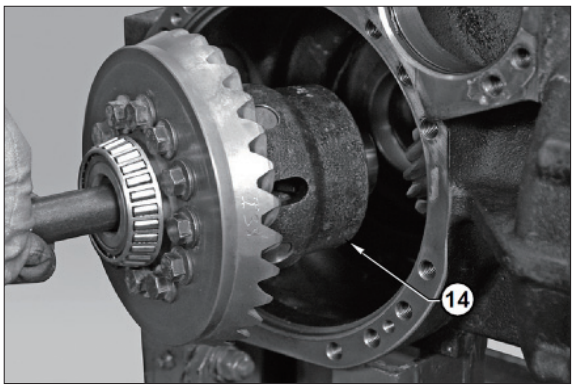
⑦ If the bearings need replacing (13), extract the external thrust blocks of the bearings (13) from middle cover and central body.

※ Accurately check the O-ring.



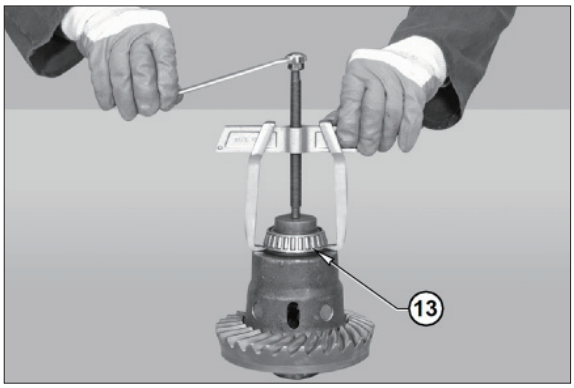
55W9NAX261

⑧ Pull out the differental (14).



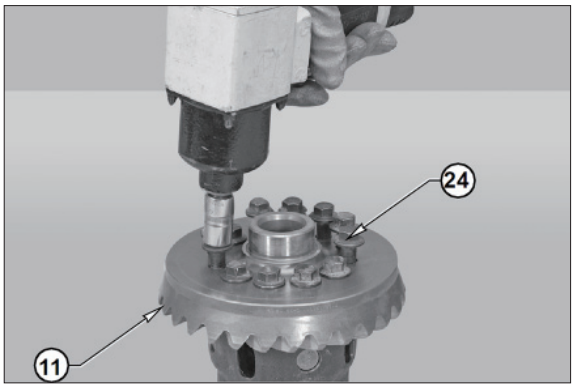
55W9NAX262

⑨ If the bearing need replacing, extract the bearing (13) from the differential carrier.



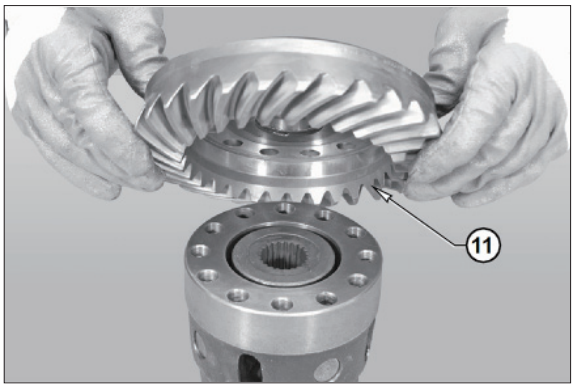
55W9NAX263

⑩ Remove fixing screws (24) of the crown wheel (11); exchange each time when removed.



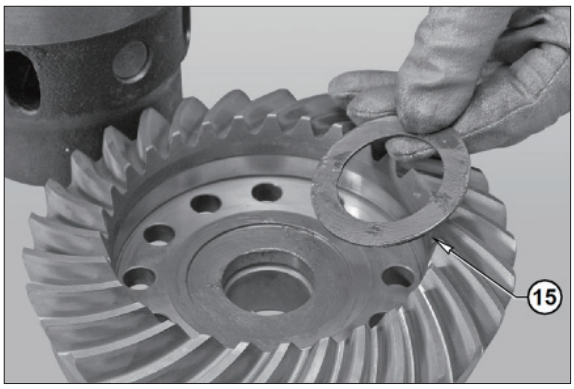
55W9NAX264

⑪ Extract the crown wheel (11).



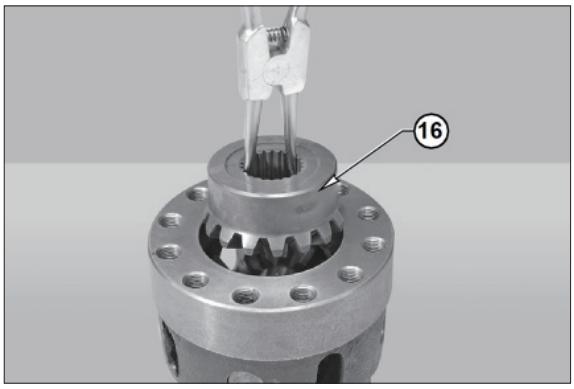
55W9NAX265

⑫ Remove the shim washer (15).



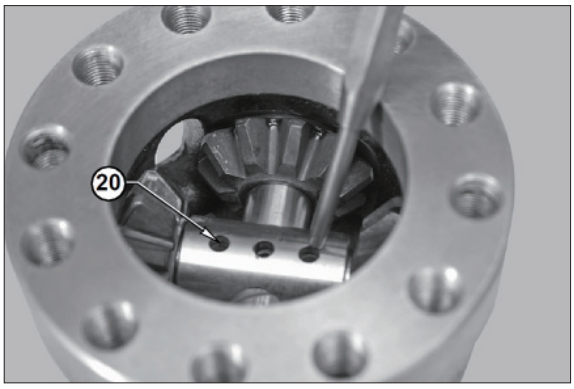
55W9NAX266

⑬ Remove the planetary gear (16).



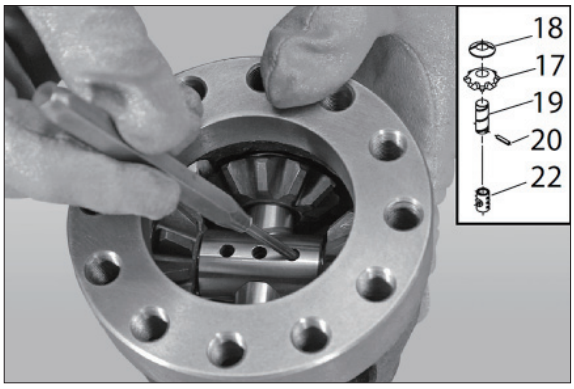
55W9NAX267

⑭ Remove the three spider blocking pins (20) by using a pin driver.



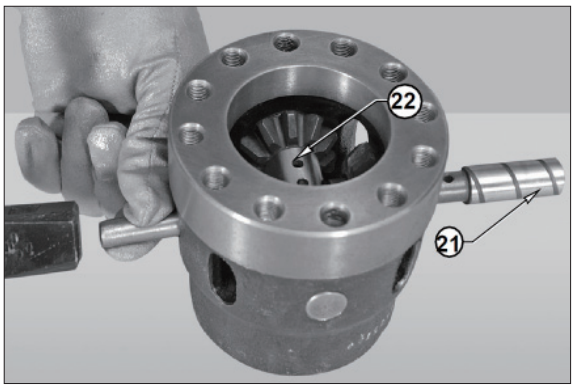
55W9NAX268

⑮ Move the two opposite mounted short bolts (19) to the outside of the box using the same pin driver.



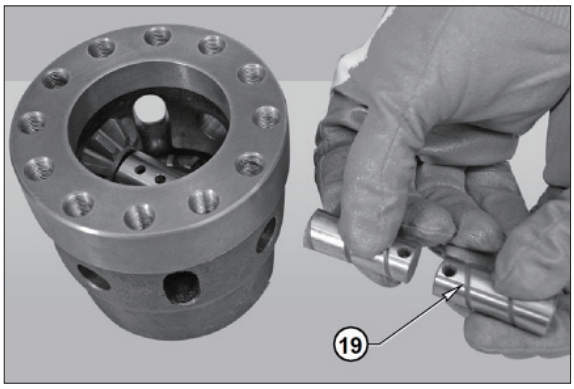
55W9NAX269

⑯ Drive out the long bolt (21) and pull out the spider (22) from the center.



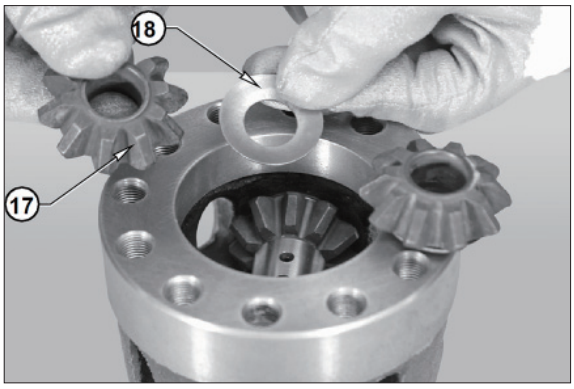
55W9NAX270

⑰ Remove the two half bolts (19), spherical washers and satellite wheels.



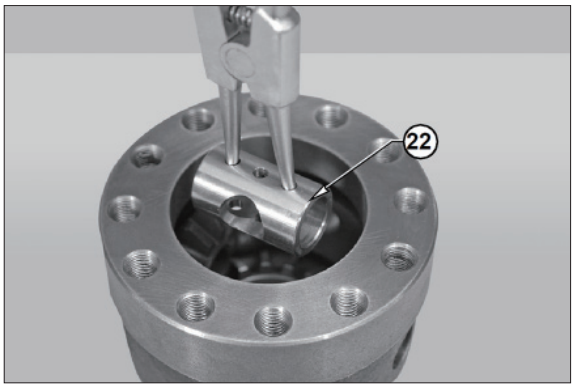
55W9NAX271

⑱ Remove long bolt, spherical washers (18) and satellite wheels (17).



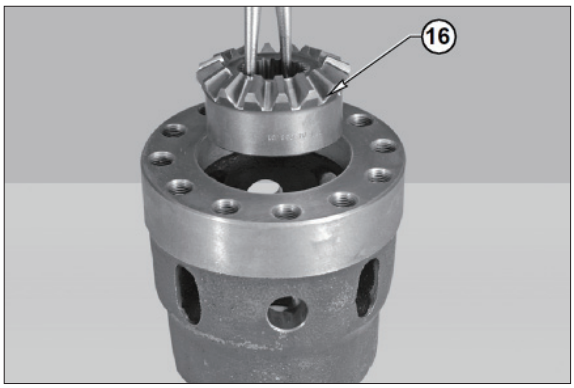
55W9NAX272

⑲ Pull out the spider (22) from the center.



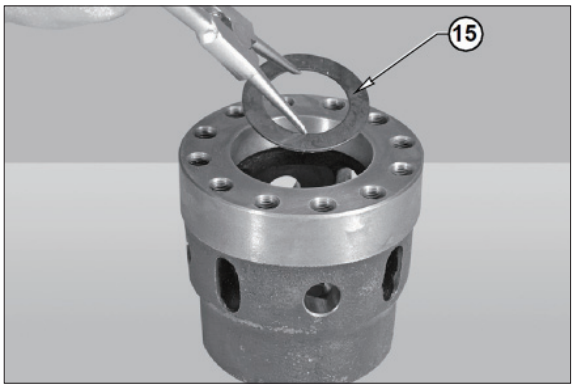
55W9NAX273

⑳ Remove the planetary gear (16).



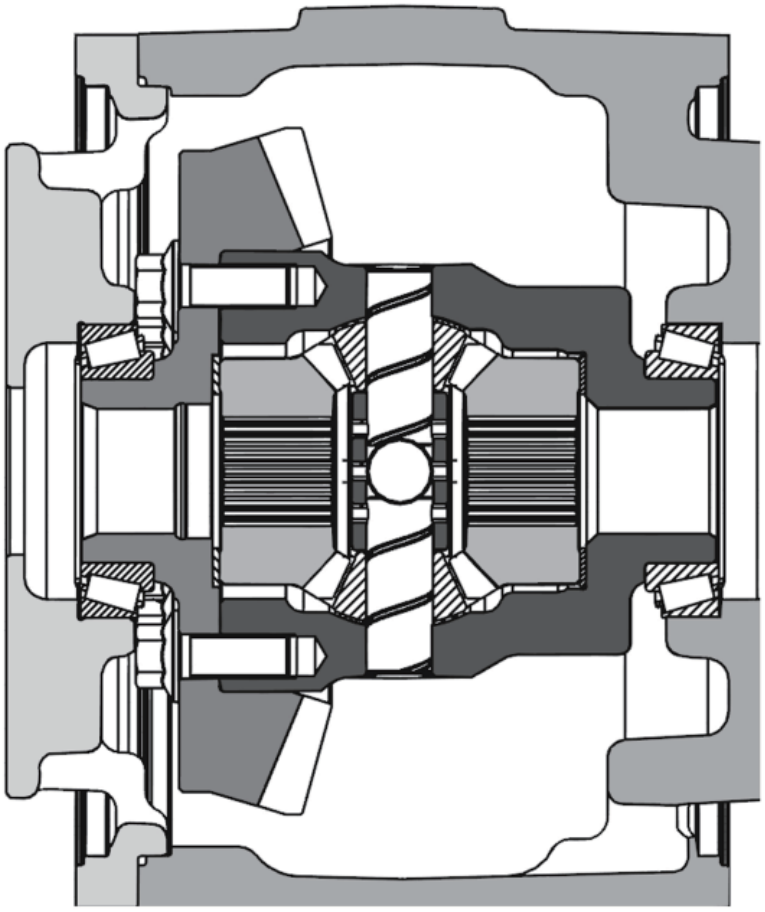
55W9NAX274

㉑ Remove the shim washer (15).



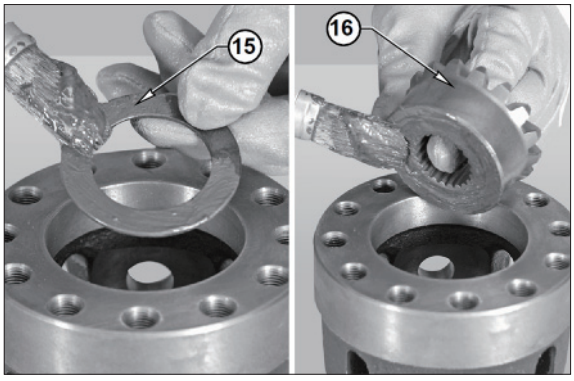
55W9NAX275

(2) Assembly

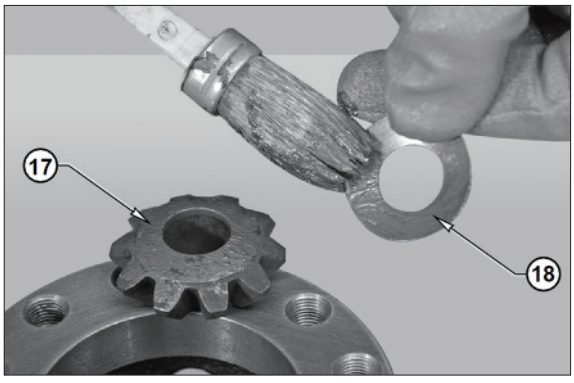


55W9NAX276

① Lubricate and insert washer (15) and plantary wheel (16).

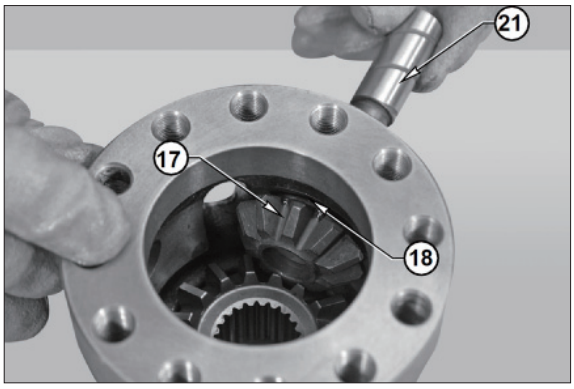


55W9NAX277



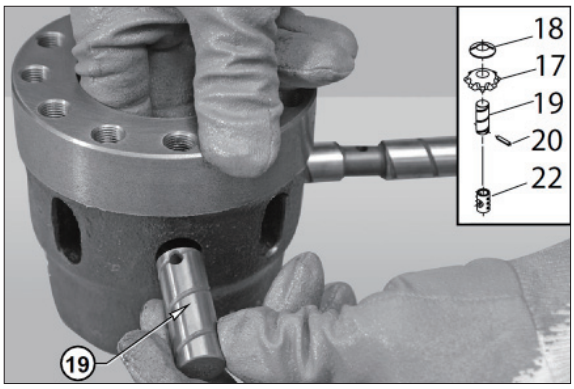
55W9NAX278

② Partially insert the long bolt (21), satellite wheels (17) and spherical washers (21).



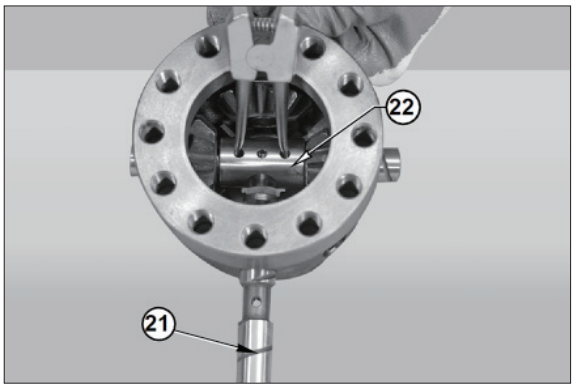
55W9NAX279

③ Insert the two half bolts (19), spherical washers (18) and satellite wheels (17).



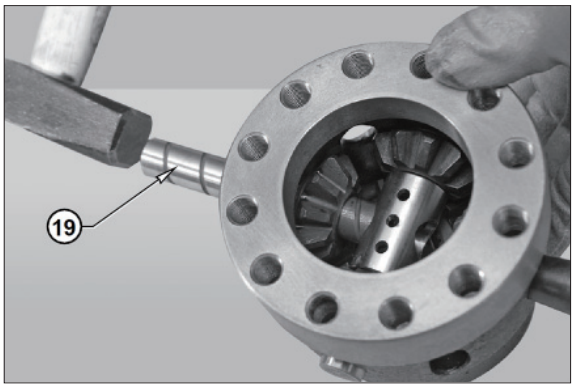
55W9NAX280

④ Insert spider (22) and completely insert the long bolt (21).



55W9NAX281

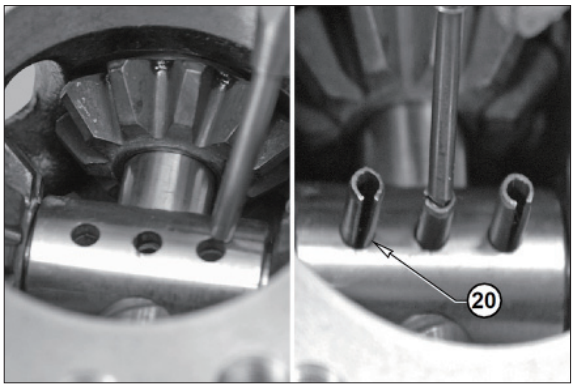
⑤ Insert completely the bolts (19).



55W9NAX282

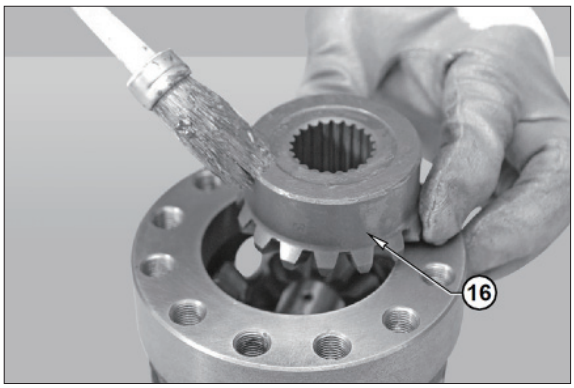
⑥ Center the pin holes and insert the 3V pins (20).

※ Check the free rotation of the satellite wheels on the bolts.



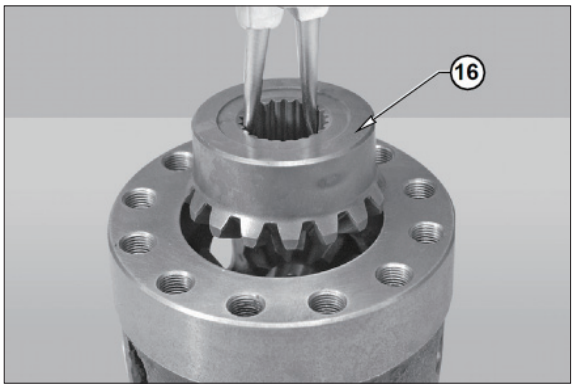
55W9NAX283

⑦ Lubricate wheel (16).



55W9NAX284

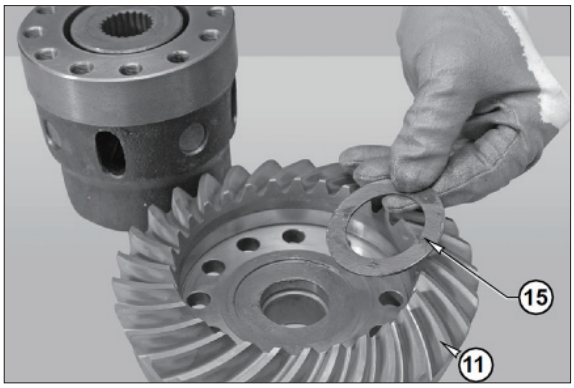
⑧ Insert planetary gear wheel (16).



55W9NAX285

⑨ Position the shim washer (15) on the crown (11).

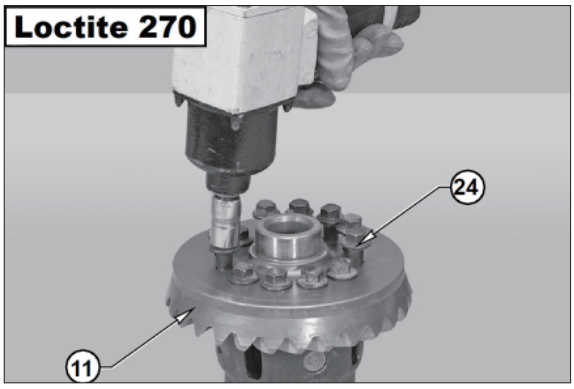
※ In order to hold the shim washer (15) in position, apply grease to it.



55W9NAX286

⑩ Position the crown (11) on the differential carrier and lock it with screws (24) applied with loctite 270.

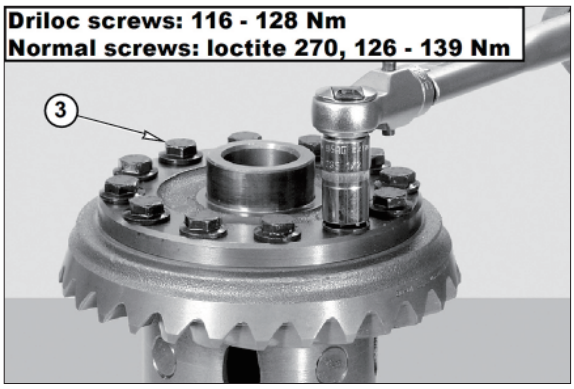
※ Secure the screws using the cross-tightening method.



55W9NAX287

⑪ Tighten screws with a torque wrench : see table.

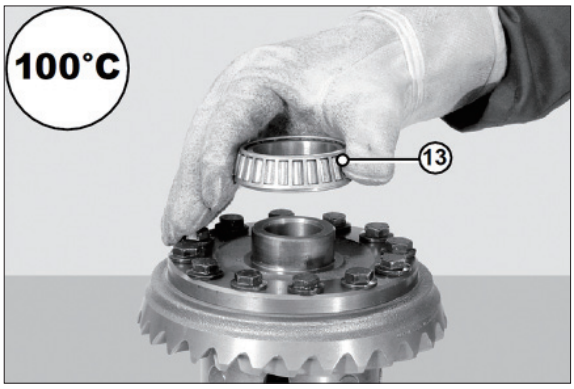
※ Always use new screws to fix the crown wheel. In case the screws are not thread locking pretreated, use loctite 270.



55W9NAX288

⑫ Assemble the bearing (13).

※ Heat the bearing to 100˚C before assembling.



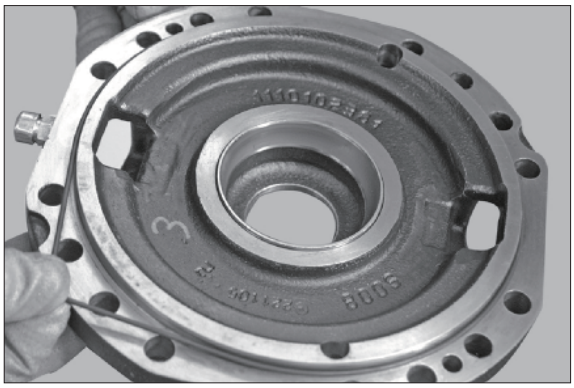
55W9NAX289

⑬ If the bearings are replaced, insert the external thrust blocks in the middle cover and in the central body.

55W9NAX290

⑭ Position the differential unit in the central body with the help of a bar and fit the middle cover.

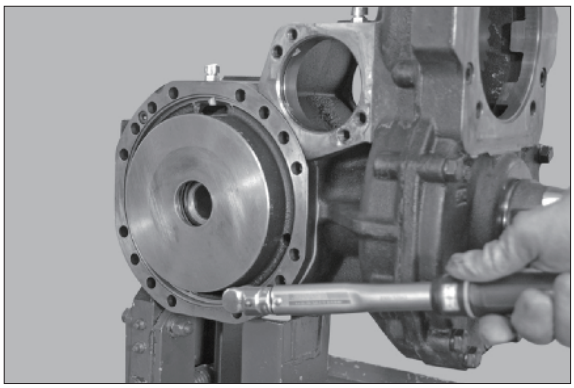
※ Thoroughly check the state of the O-ring and make sure that the cover is fitted with the oil discharge in the lower position.



55W9NAX291

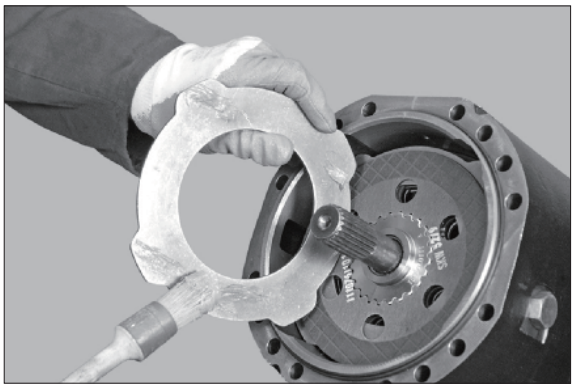
⑮ Lock the middle cover with screws.

· Torque wrench setting for screw :
2.43~2.67 kgf · m (17.6~19.3 lbf · ft)



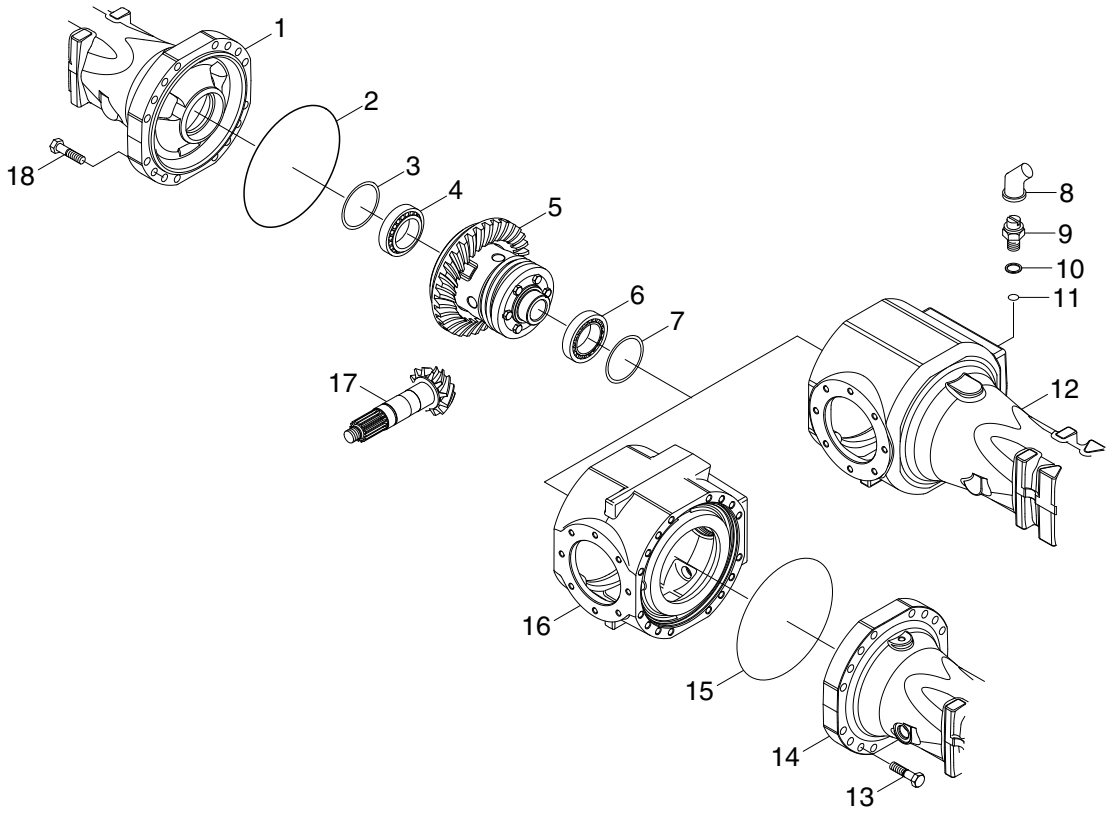
55W9NAX292

⑯ Check that the positioning of the sealing ring on the arm is intact; install the complete arm. Lock it into position using two facing screws and washers.



55W9NAX293

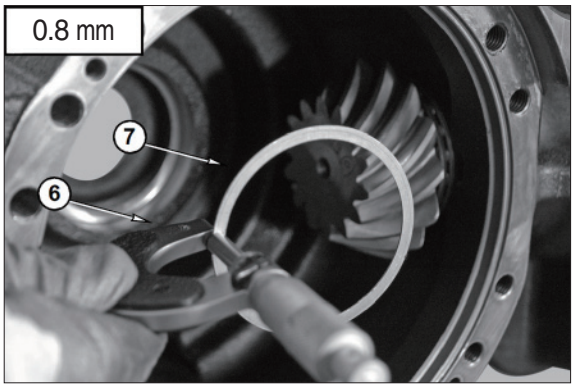
6) RING AND PINION ADJUSTING



55W9NAX294

Setting of the crown wheel and pinion

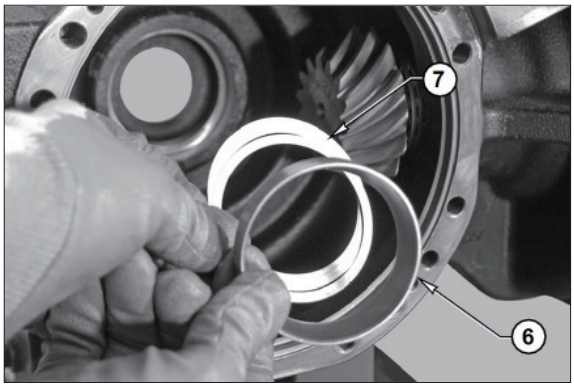
(1) Insert the thrust block of the bearing (6) opposit side of the crown wheel shims (Sb) (7) of an initial thickness of about 0.8 mm.



55W9NAX295

(2) Insert the thrust block (6) and the shims (Sb) (7) into the arm.

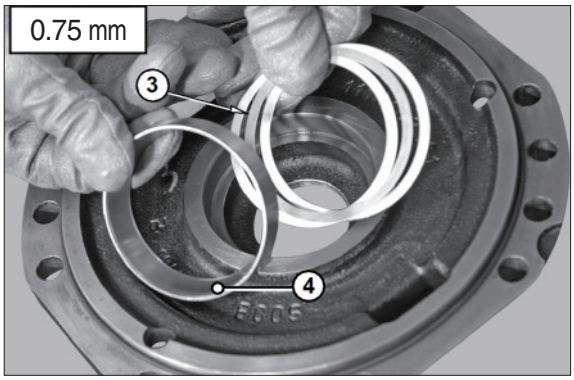
※ Check to be at end of stroke.



55W9NAX296

(3) Insert thrust block (4) of the bearing shims (Sc) (3) of an initial thickness of about 0.75 mm.
Insert the thrust block and the shims into the arm.

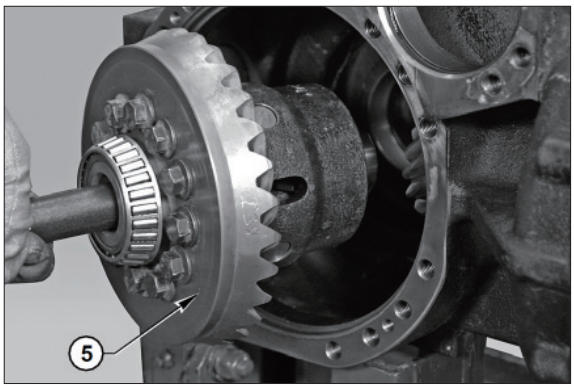
※ Check to be at end of stroke.



55W9NAX297

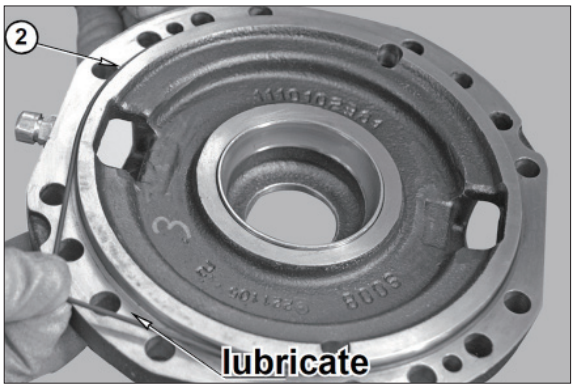
(4) Insert complete differential (5).

※ Do not damage the seat of the O-ring with the gearwheel.



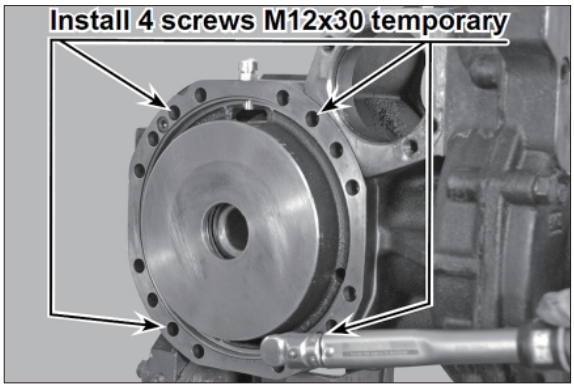
55W9NAX298

(5) Check the O-ring (2) and grease.



55W9NAX299

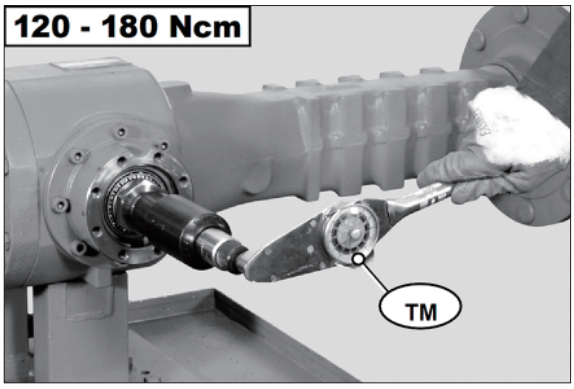
(6) Lock the middle cover (5) with screws (4).
· Torque wrench setting for screw :
2.43~2.67 kgf · m (17.6~19.3 lbf · ft)



55W9NAX300

(7) Apply torque meter TM to pinion nut and check that torque will increase by 0.04~0.06 kgf · m (0.29~0.43 lbf · ft) as a result of differential bearing preload.

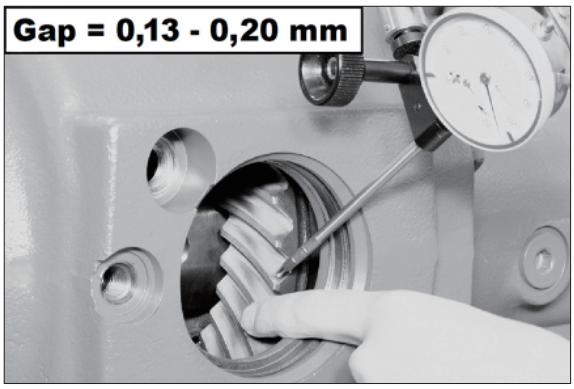
Example : pinion torque :
0.08~0.12 kgf · m (0.59~0.87 lbf · ft)
Pinion + differential torque :
0.12~0.18 kgf · m (0.87~1.3 lbf · ft)



55W9NAX301

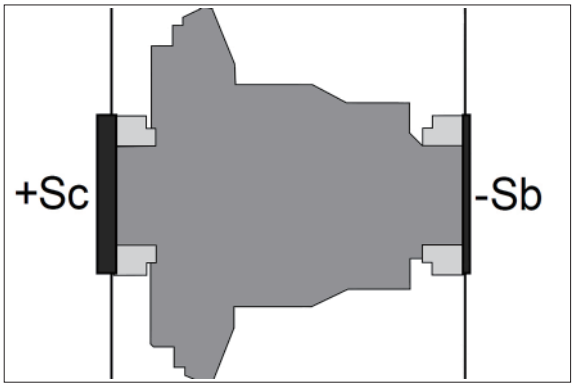
(8) Position comparator on the center of one of the crown teeth, preset it to 1 mm and reset it to zero.
Manually move the crown in both directions to check the existing clearance between pinion and crown.

Gap = 0.13~0.20 mm



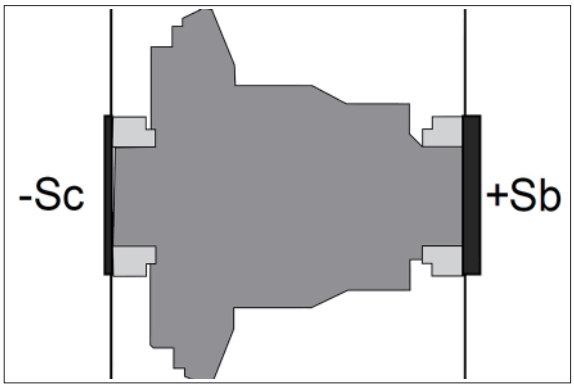
55W9NAX302

(9) + Sc (3) - Sb (7) = reduction gap ring and pinion



55W9NAX303

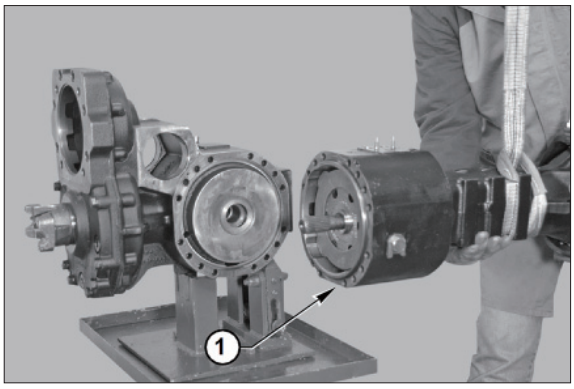
(10) - Sc (3) + Sb (7) = increase gap ring and pinion



55W9NAX304

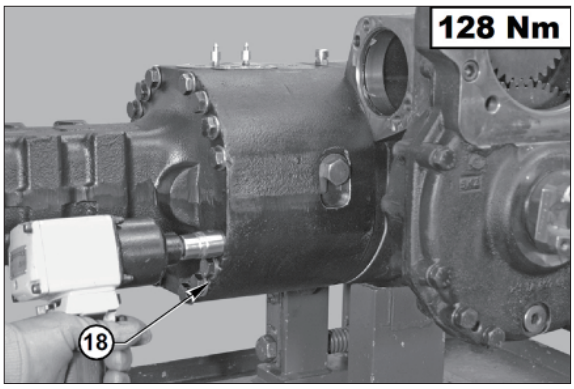
(11) Install the crown wheel side arm (1) without half-axle.

※ To check the torque of the differential, neither of both half-axles must be installed.



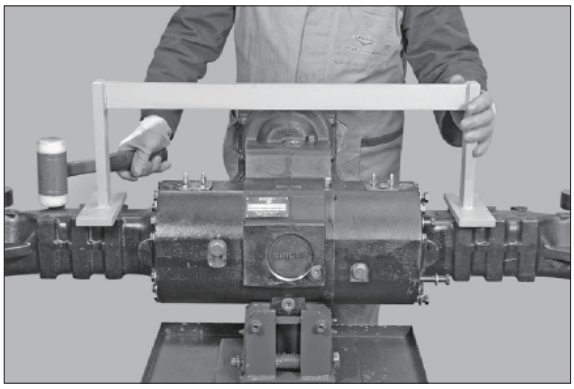
55W9NAX305

(12) Temporarily insert all screws of the arm (18).



55W9NAX306

(13) Check the flatness of the arms; then lock the arms into their final position,using screws adequately coated with loctite 242.

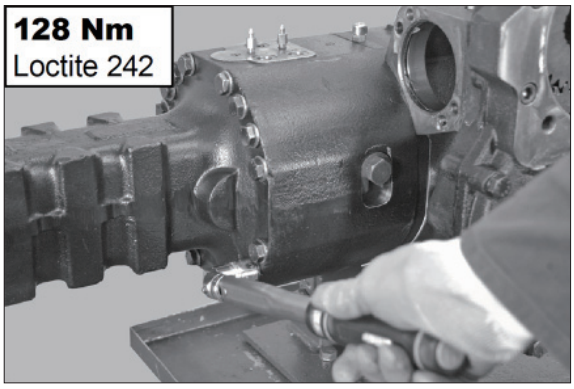


55W9NAX308

(14) Torque wrench setting :

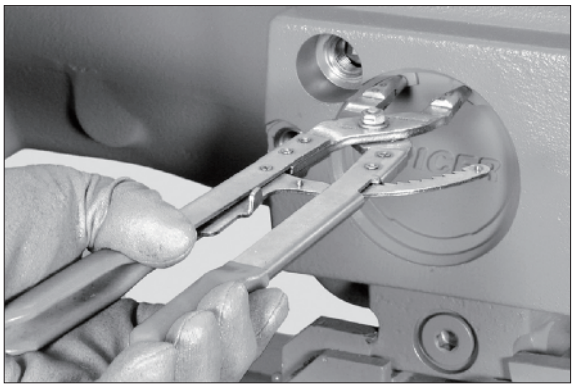
13.1 kgf · m (94.4 lbf · ft)

※ Tighten using the criss-cross method.



55W9NAX309

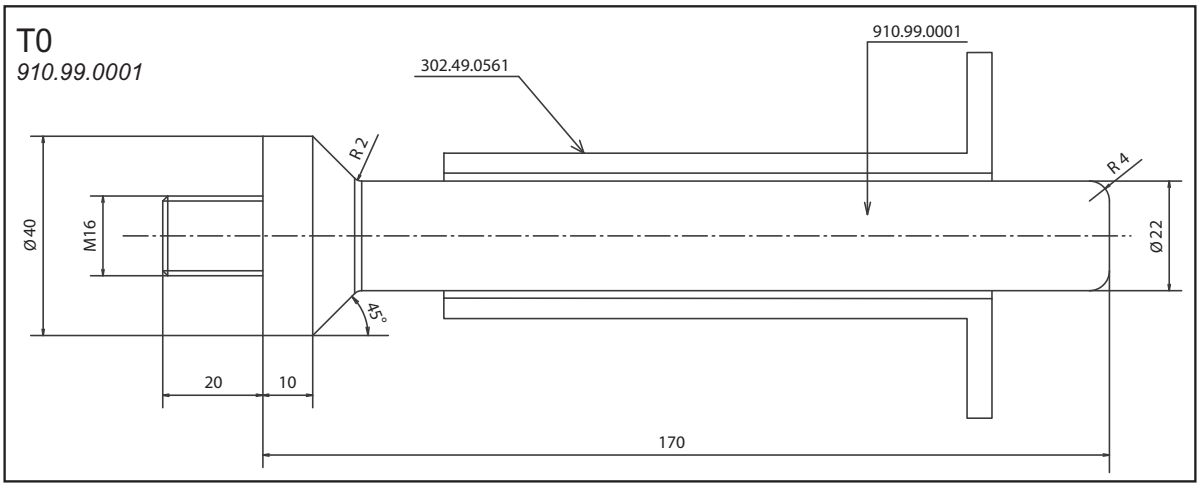
(15) Using a driver, fit the cap and position it in its seat with the snap ring.



55W9NAX310

7) SPECIAL TOOLS

T0
910.99.0001



55W9NAX311-1

T1
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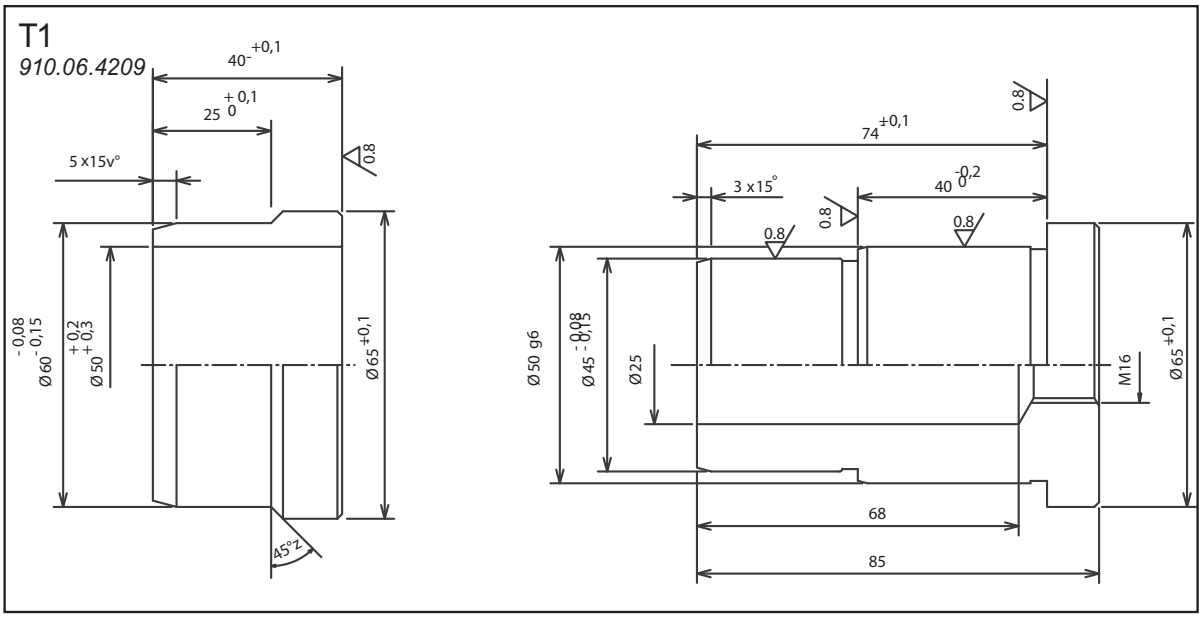

55W9NAX311-2

T2
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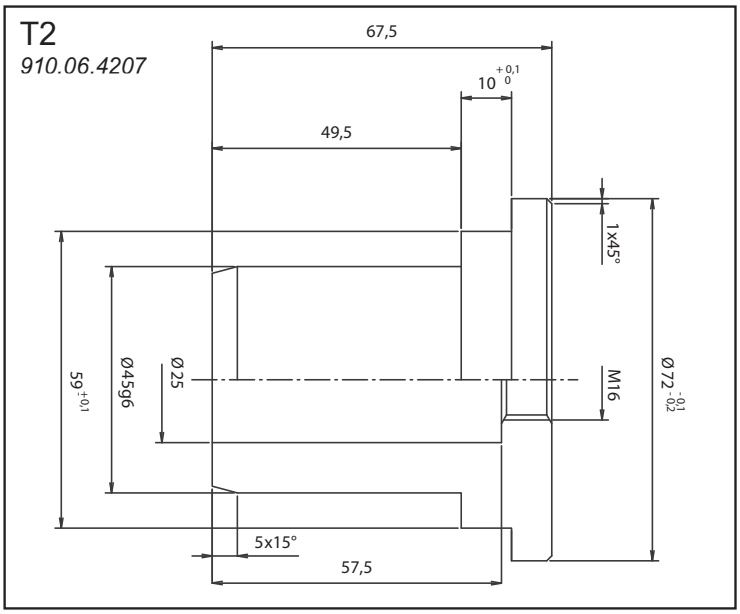
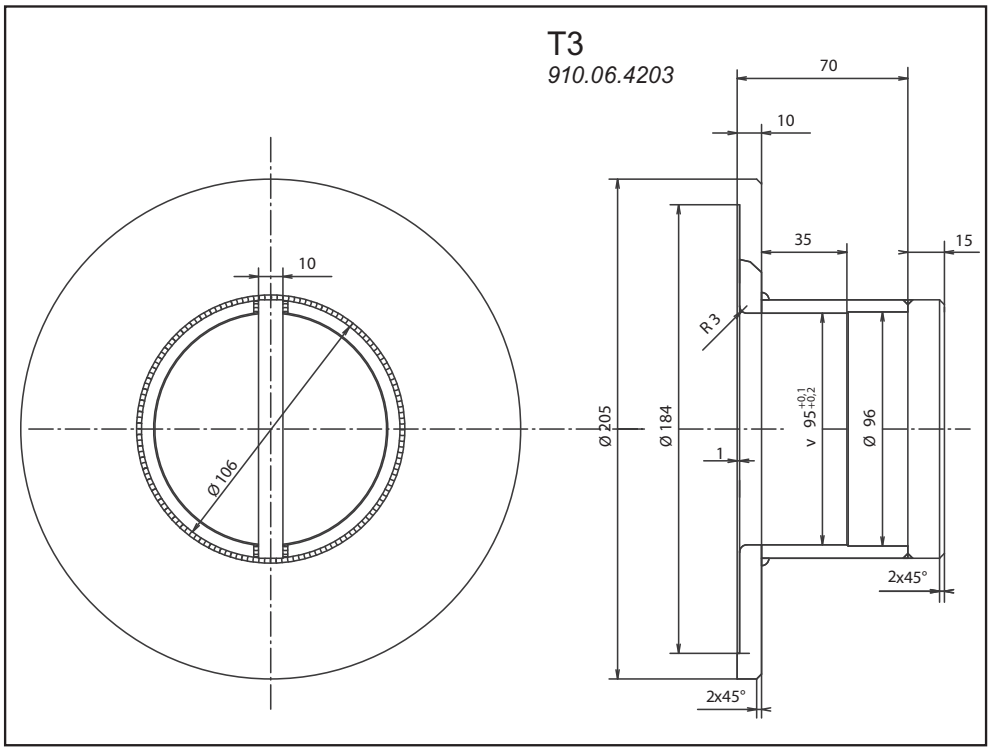
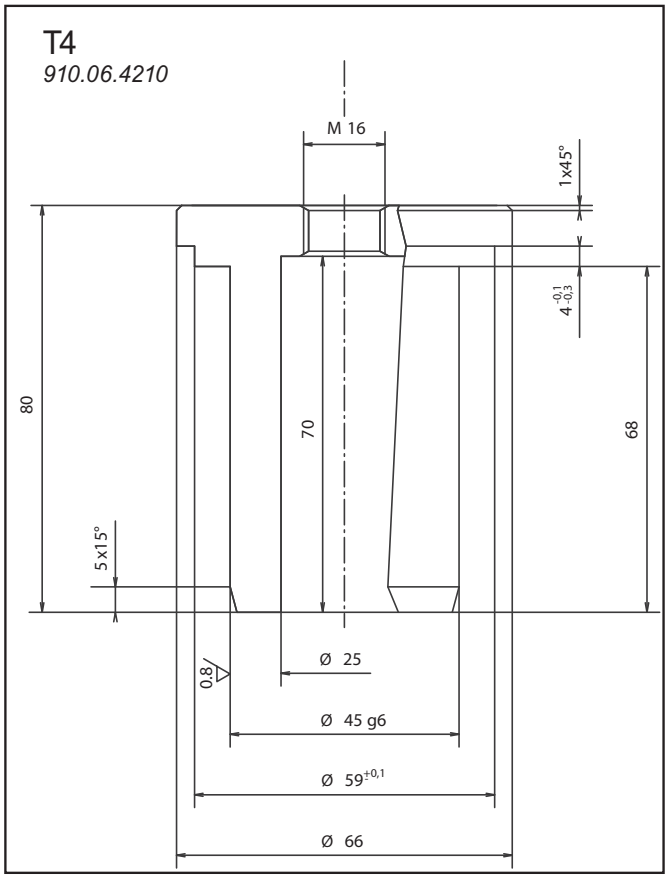


55W9NAX311-3



55W9NAX312-1



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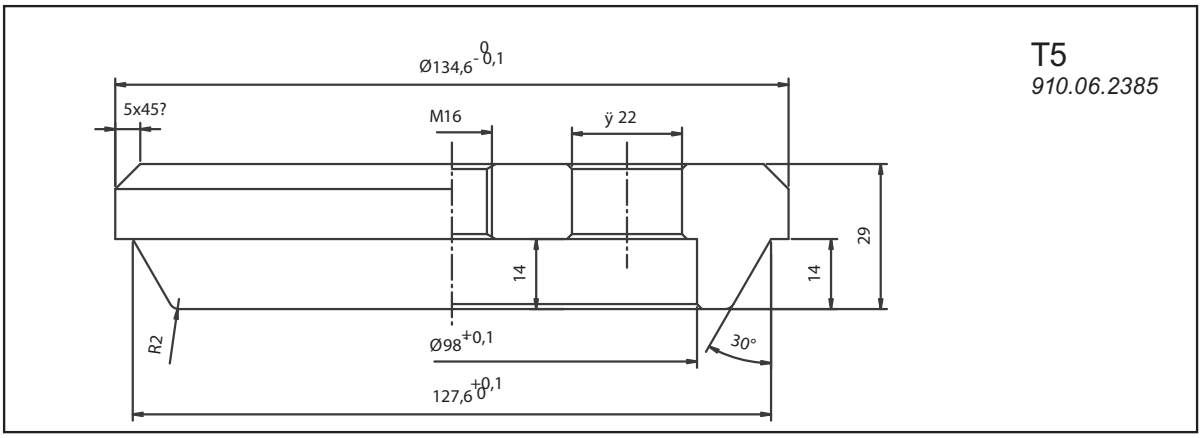
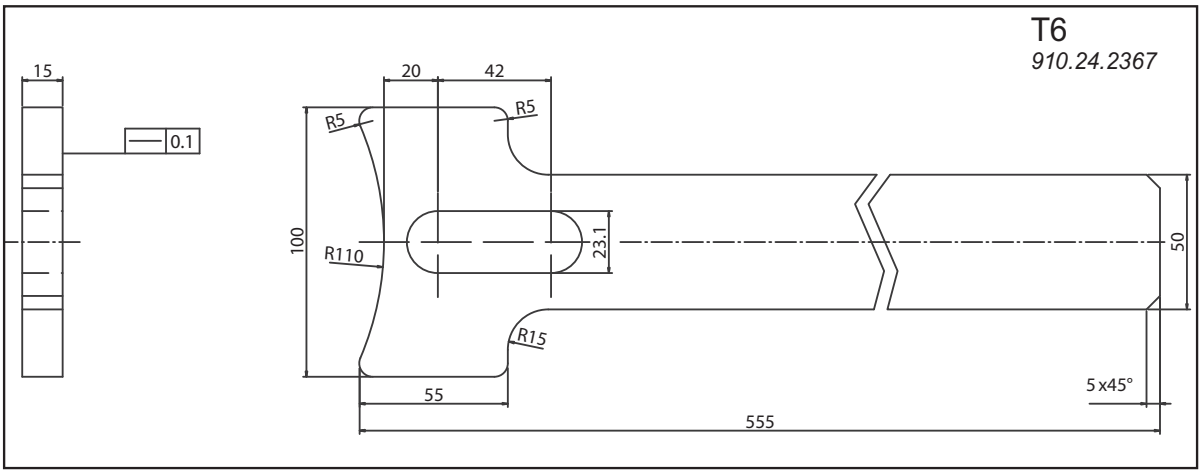
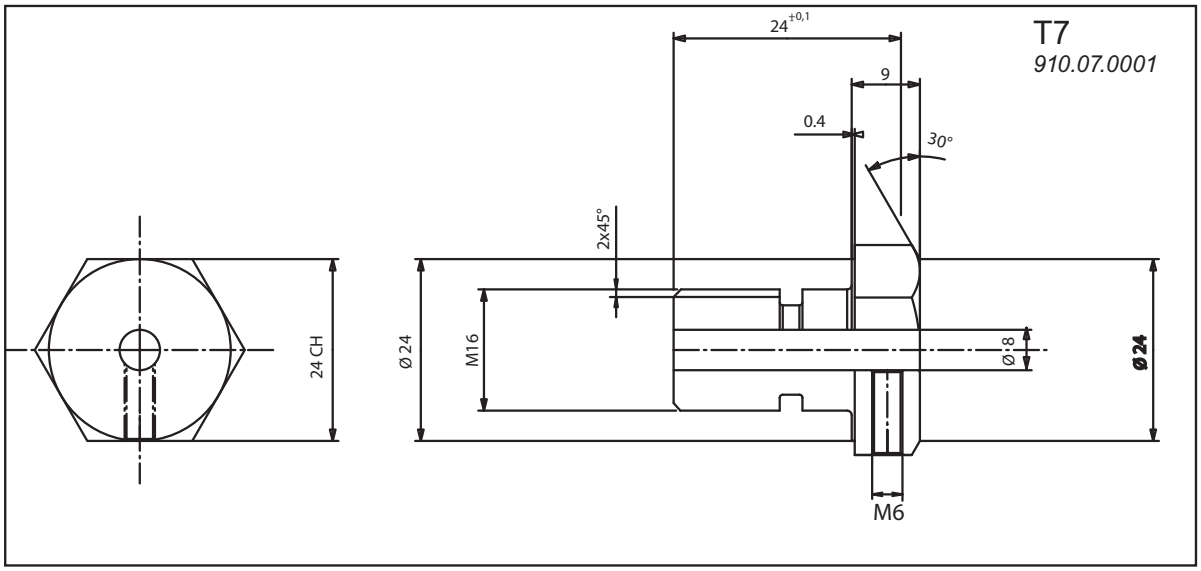


55W9NAX313-1



55W9NAX313-2



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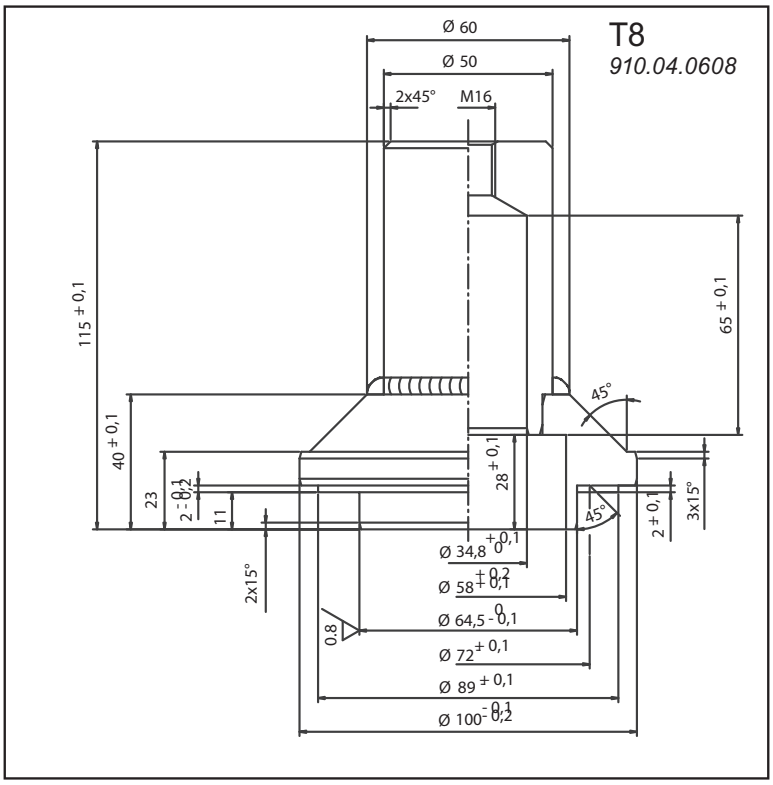

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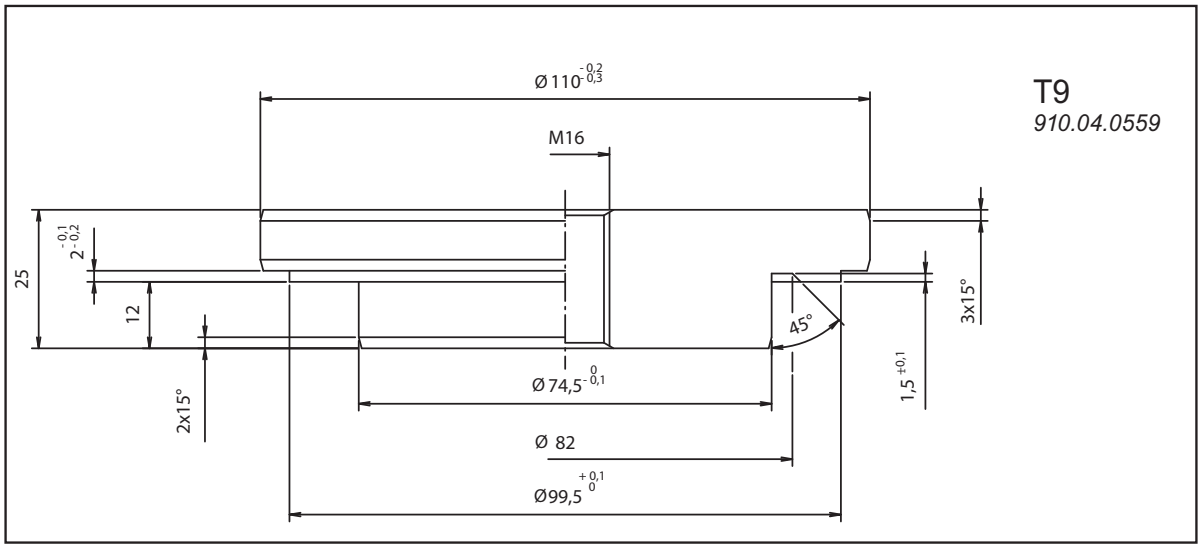

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T10

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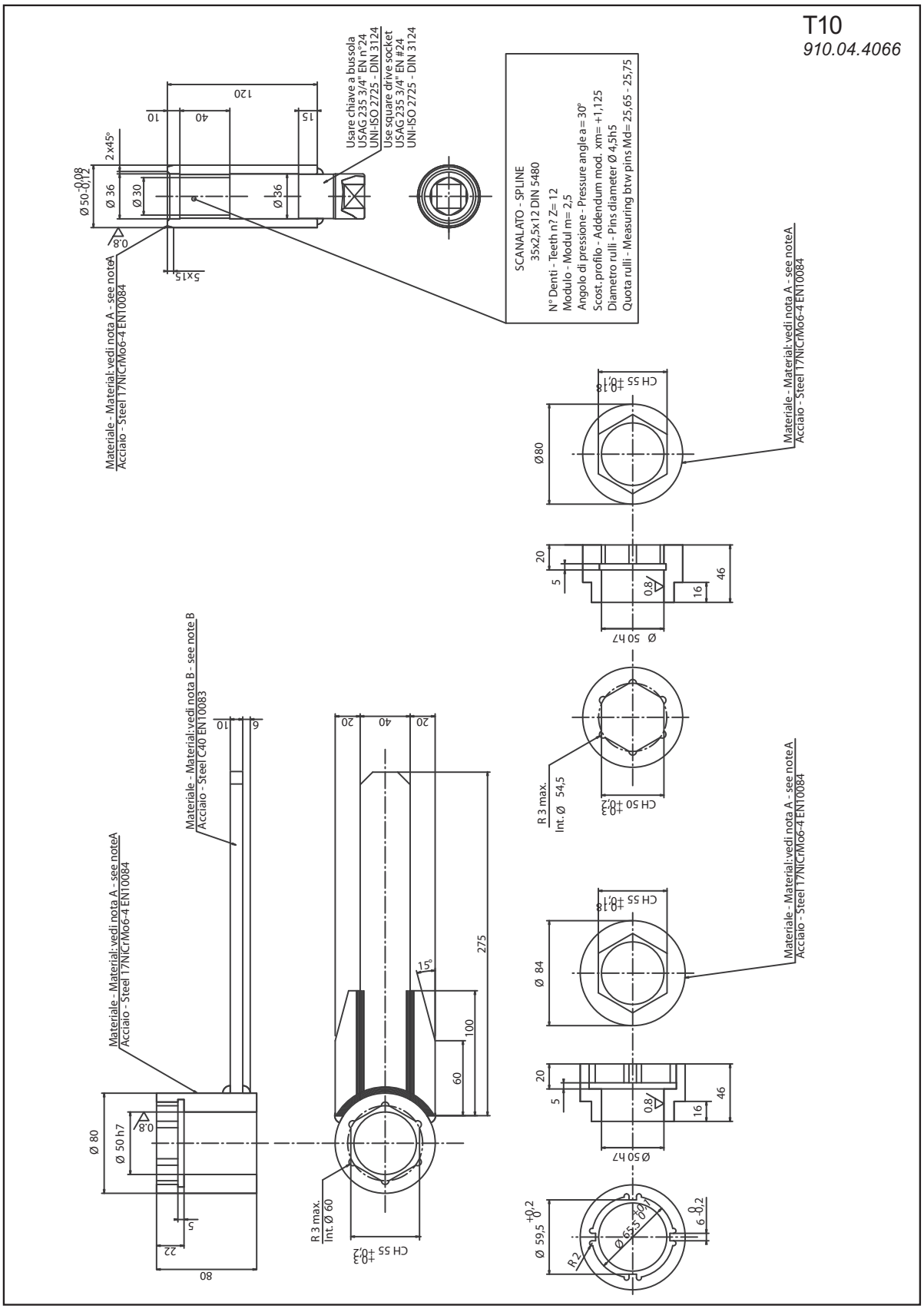

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T11

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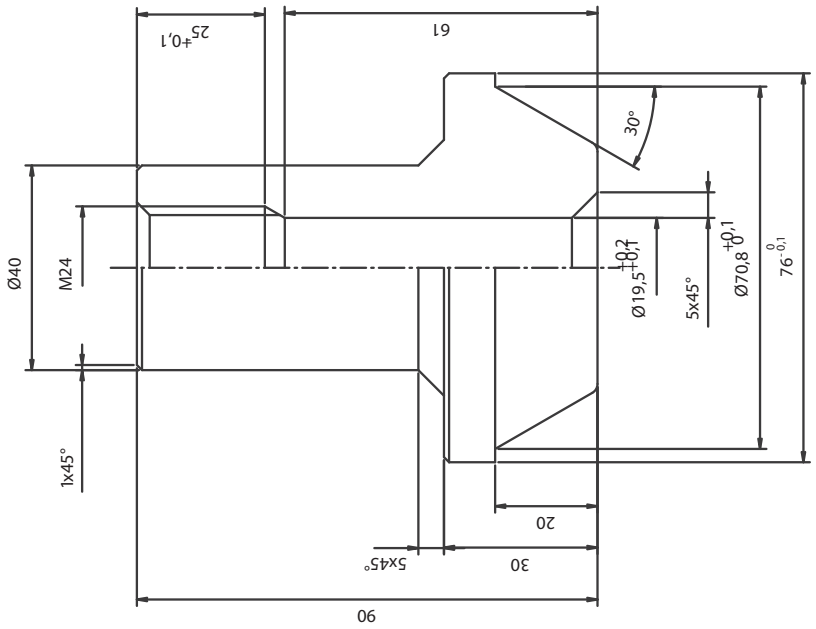

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T12

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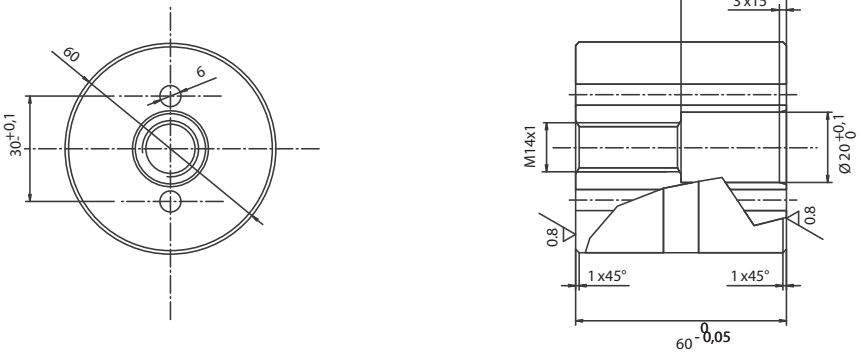
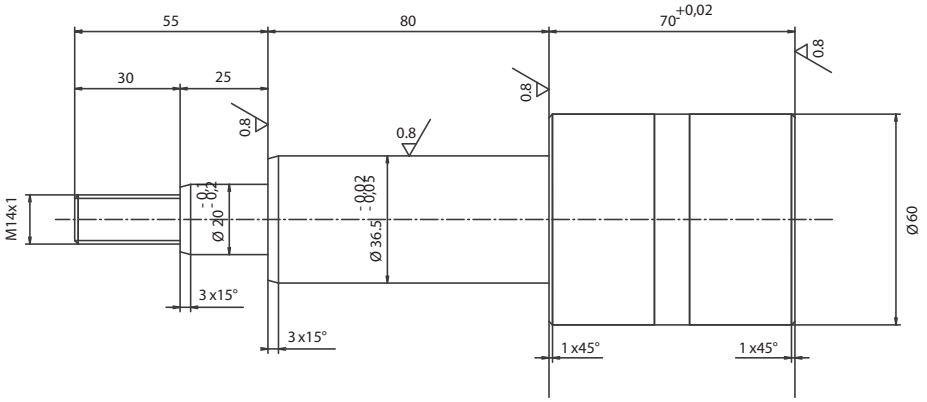


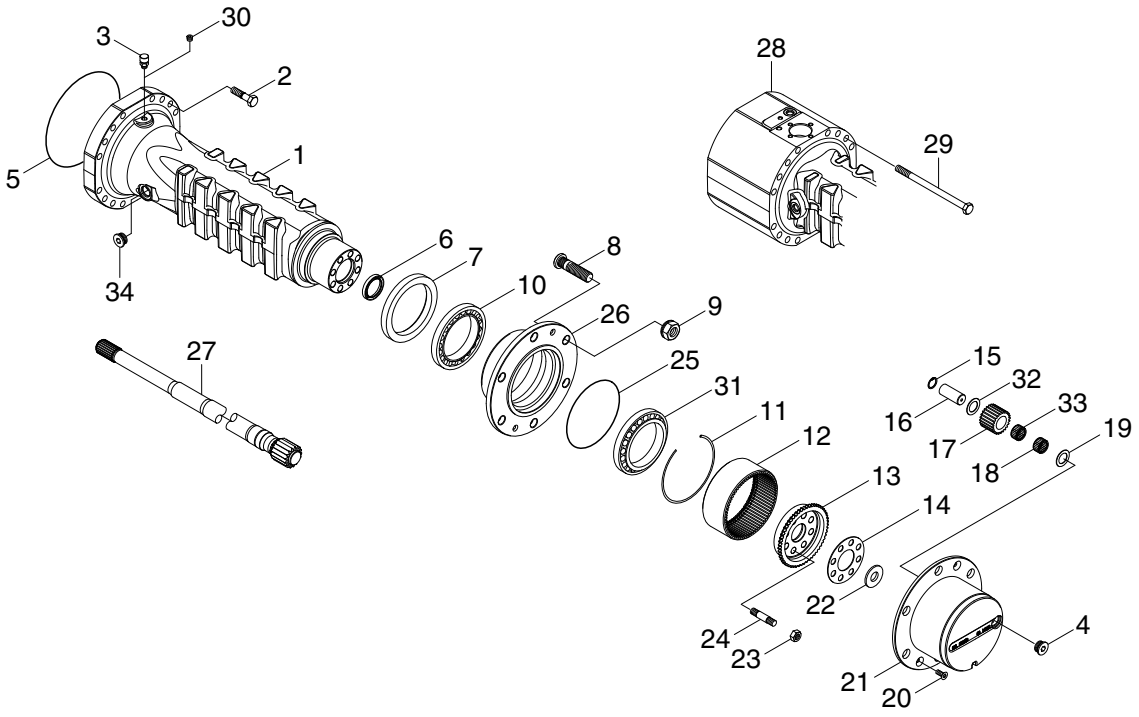


55W9NAX316-2

4. REAR AXLE

1) PLANETARY REDUCTION GEAR

(1) Assembly diagram

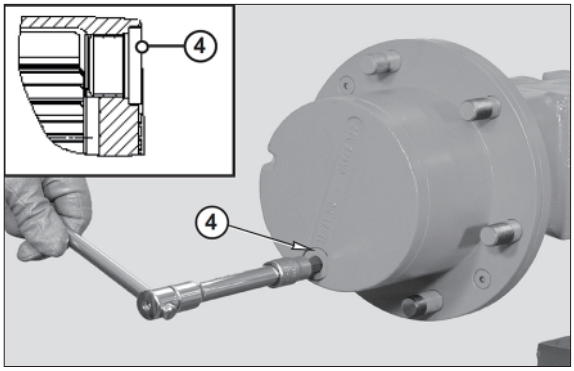


55W9NAX441

(2) Disassembly

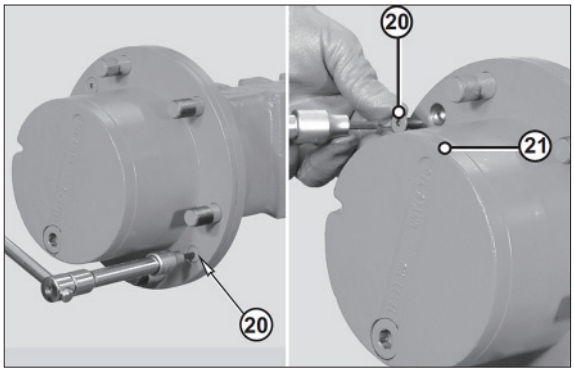
※ Perform all operations on both arms.

① Remove the oil level plug (4).



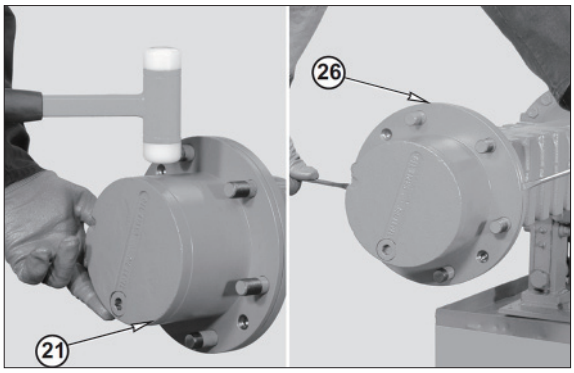
55W9NAX442

② Remove the securing screws (20) from the spider cover (21).



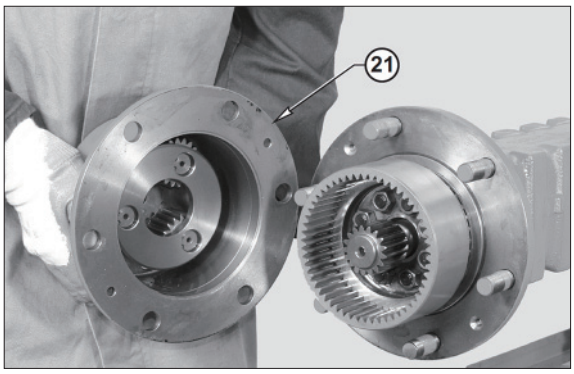
55W9NAX443

③ Disjoin the spider cover (21) from the hub (26) by alternatively forcing a screwdriver into the appropriate slots.



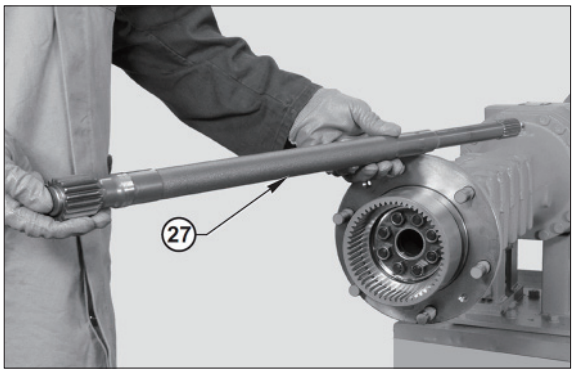
55W9NAX444

④ Remove the complete planetary carrier cover (21).



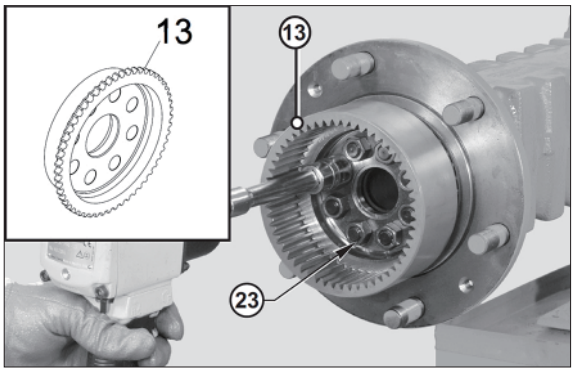
55W9NAX445

⑤ Remove the complete axle-shaft (27).



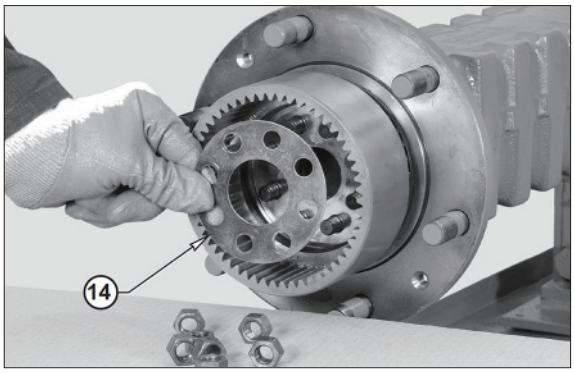
55W9NAX446

⑥ Unloose and remove the tightening nuts (23) from the crown flange (13).



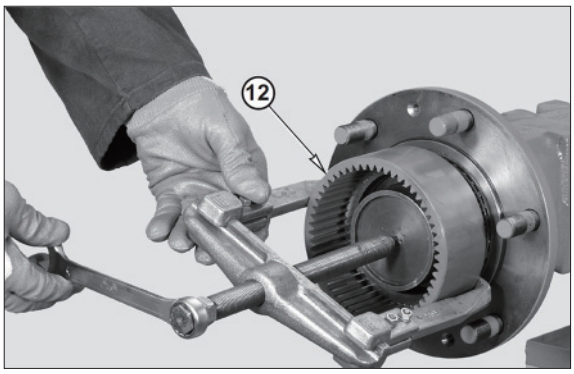
55W9NAX447

⑦ Remove the safety flange (14).



55W9NAX448

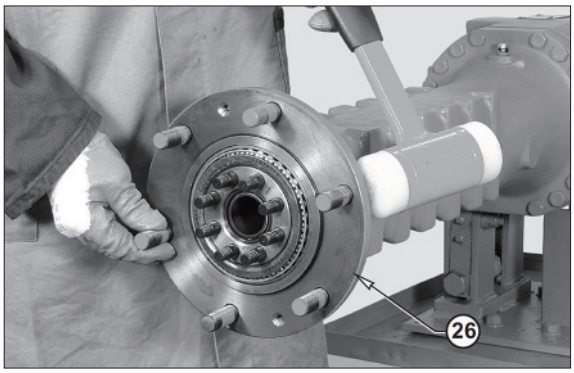
⑧ Remove the crown (12).



55W9NAX449

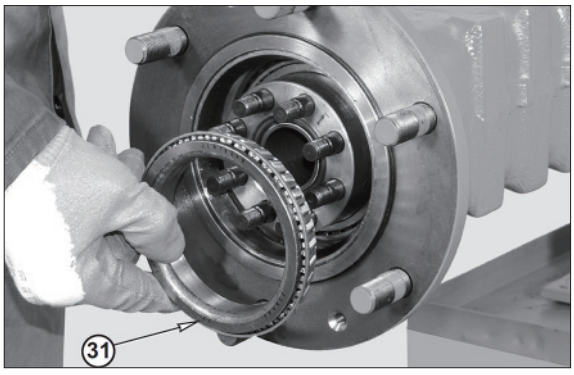
⑨ Partially extract the hub (26) using a plastic hammer.

※ Alternately hammer on several equidistant points.



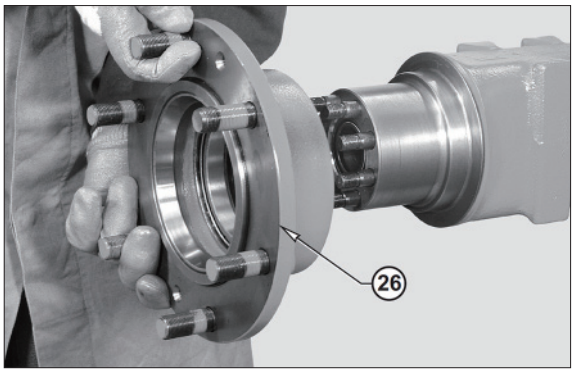
55W9NAX450

⑩ Remove the external bearing (31).



55W9NAX451

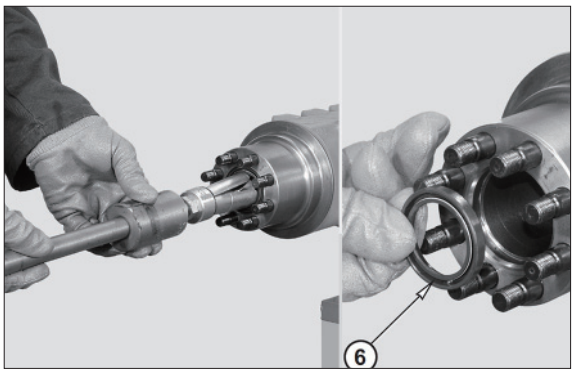
⑪ By hand remove complete hub (26).



55W9NAX452

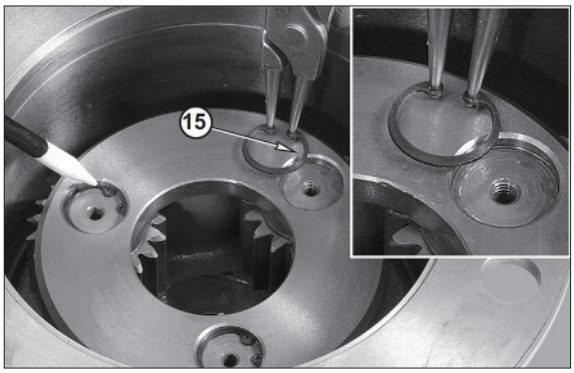
⑫ Using an extractor, remove the seal ring (6).

※ Note down the direction of assembly of snap ring.



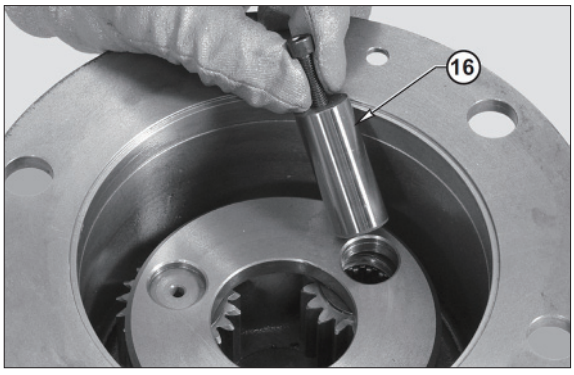
55W9NAX453

⑬ Remove snap ring (15).



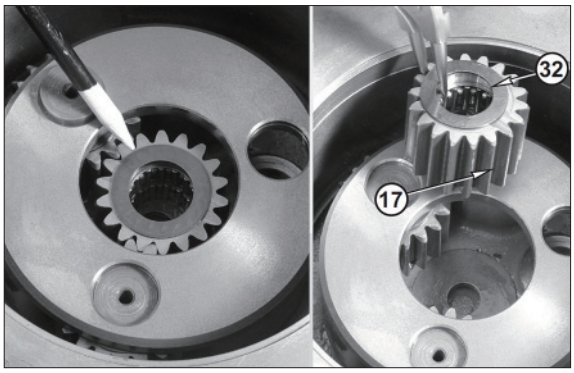
55W9NAX454

⑭ Using a screw M6 remove all bolts (16).



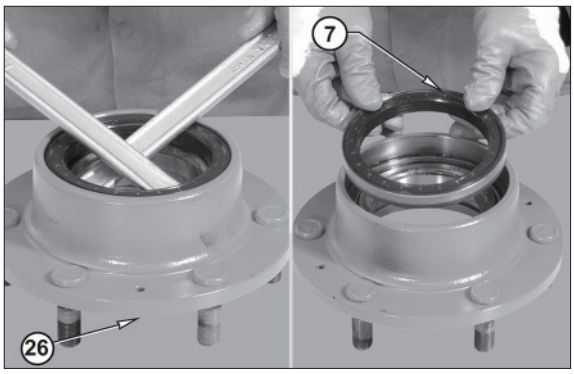
55W9NAX455

⑮ Positioning the planet wheel gear (17) in center of the spider cover and remove.



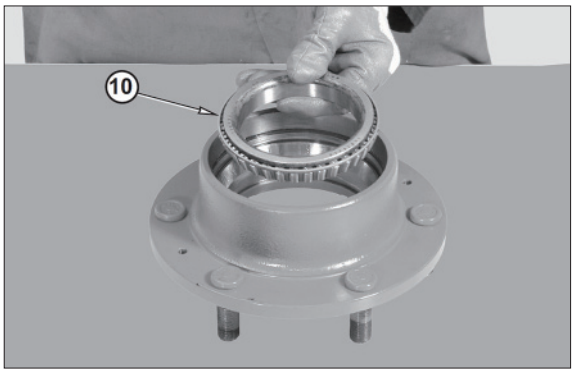
55W9NAX456

⑯ Remove the sealing ring (7) from the hub (26).



55W9NAX457

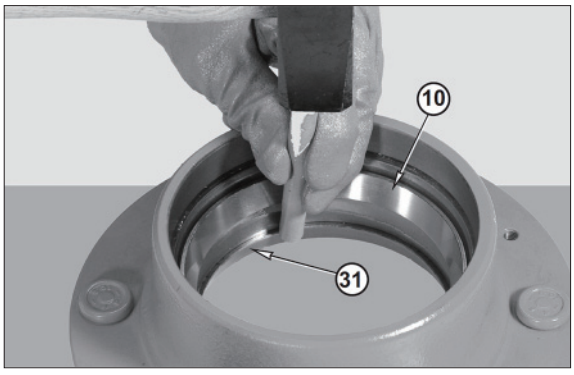
⑰ Remove the internal bearing (10).



55W9NAX458

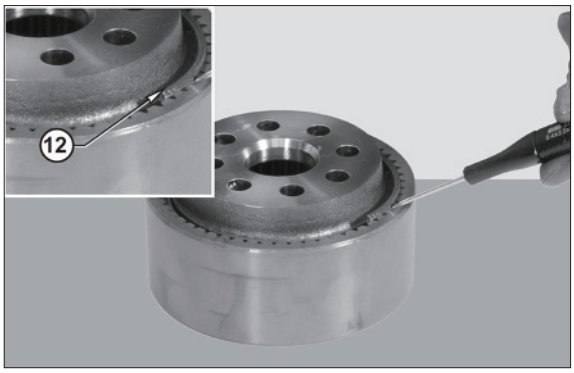
⑱ Remove the thrust blocks (10) (31) from the bearings and forcing a pin-driver into the appropriate slots on the hub.

※ Hammer in an alternate way so as to avoid crawling or deformation of the thrust blocks.



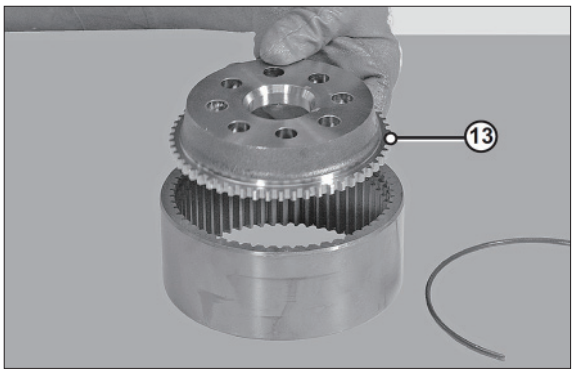
55W9NAX459

⑲ Remove the snap ring (12) from the crown (13).



55W9NAX460

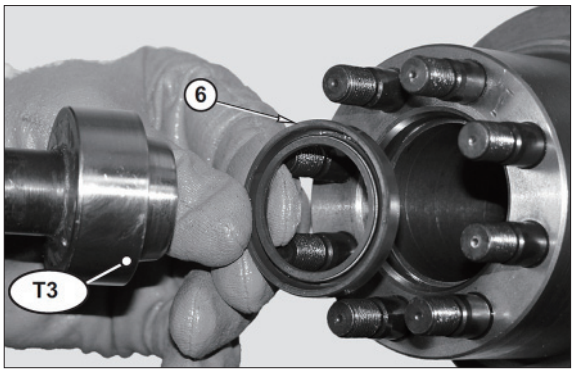
⑳ Remove the crown flange (13).



55W9NAX461

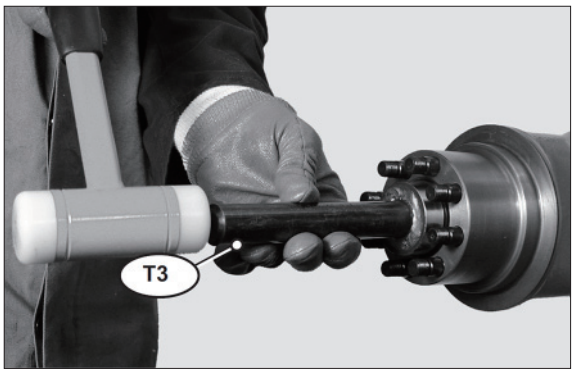
(3) ASSEMBLY

① Lubricate and fit the sealing ring (6) onto tool T3; install the rings into the arm.



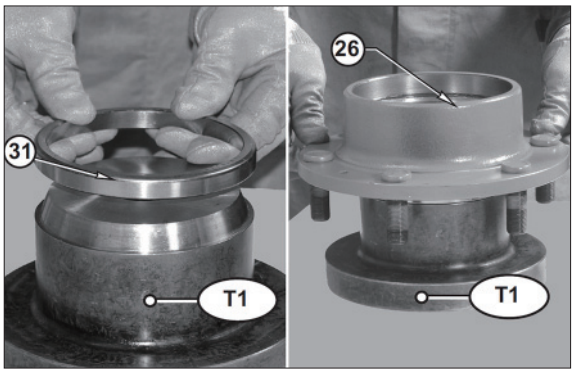
55W9NAX462

※ Pay particular attention to the direction of assembly of the rings.



55W9NAX463

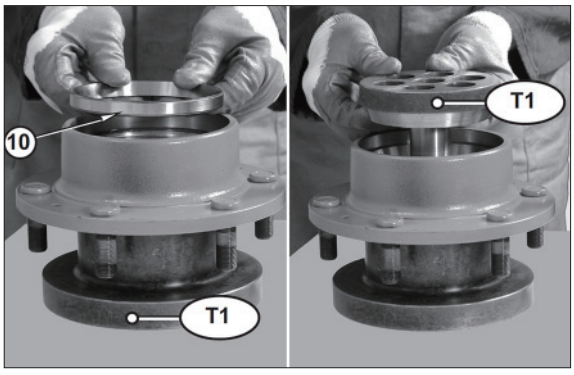
② Position the lower part of tool T1 and the thrust block of the external bearing (31).



55W9NAX464

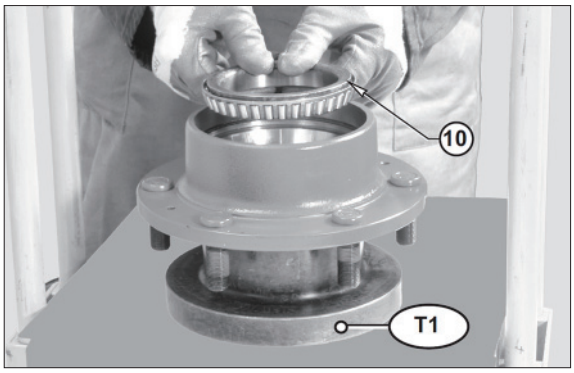
③ Lubricate the seats of the bearings and position the hub on tool T1; position the thrust block of the internal bearing (10).

Check that the thrust block is correctly oriented.



55W9NAX465

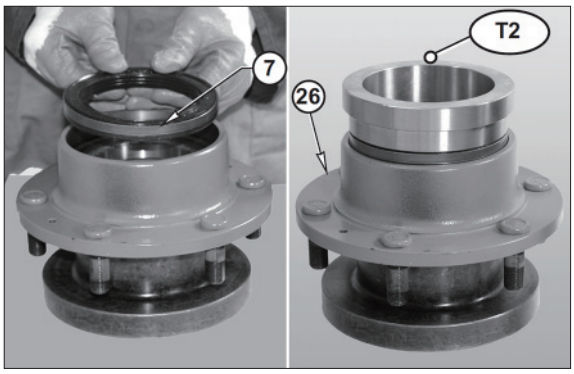
④ Fit the bearing (10) into the internal thrust block.



55W9NAX466

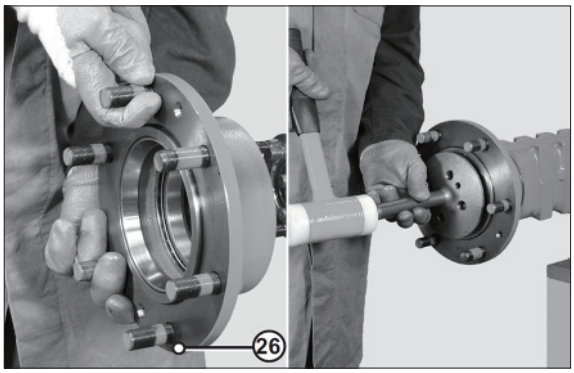
⑤ Using special tool T2 apply a repositionable jointing compound for seals to the outer surface of the sealing ring (7).
Position the sealing ring (7) in the hub (26).

※ Check that the ring (7) is correctly oriented.



55W9NAX467

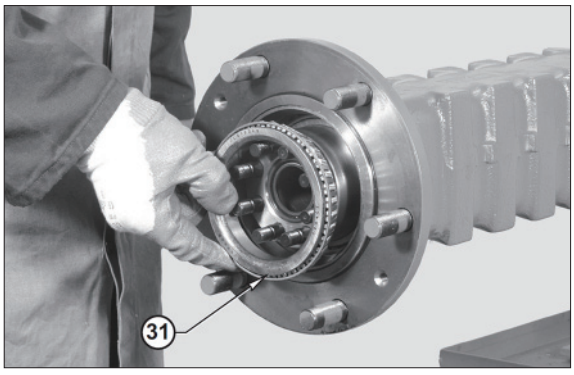
⑥ Install the wheel hub (26).



55W9NAX468

⑦ Install the external bearing (31).

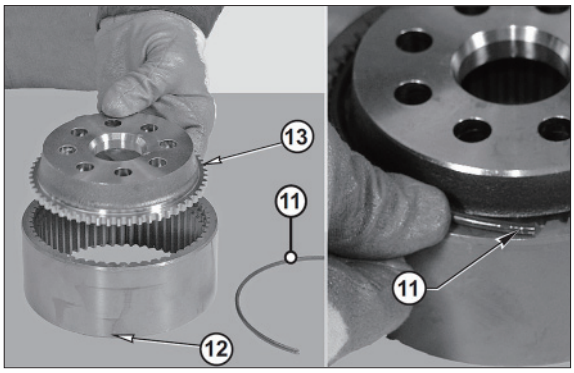
※ Move the bearing to the limit stop by hammering lightly all around the edge.



55W9NAX469

⑧ Install the crown wheel (12).
Insert the snap ring (11) in order to fix the flange (13) in the crown (12).

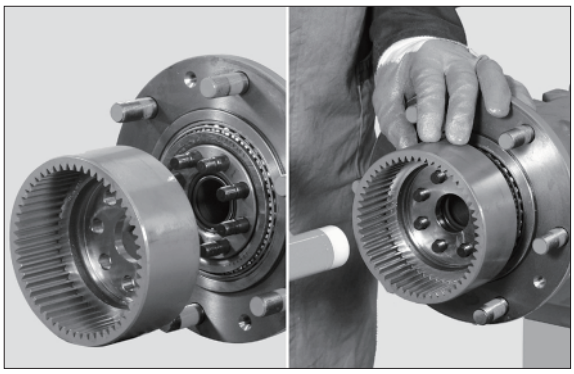
※ Carefully check that ring (11) is properly inserted in the slot of the crown (12).



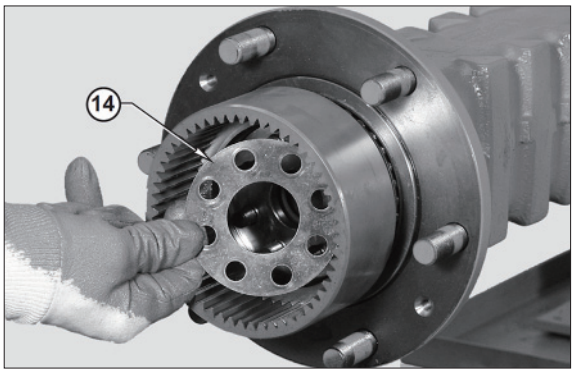
55W9NAX470

⑨ Fit the complete crown flange.

※ In order to fasten the flange, use a plastic hammer and alternately hammer on several equidistant points.

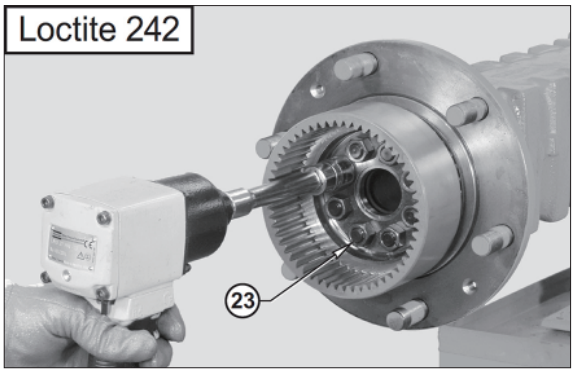

55W9NAX471

⑩ Install the security flange (14).



55W9NAX472

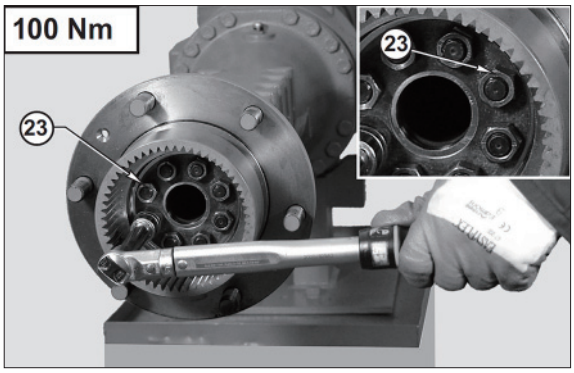
⑪ Coat the nuts (23) with loctite 242 and screw them.



55W9NAX473

⑫ Tighten nuts (23) in two stages, using the criss-cross method.

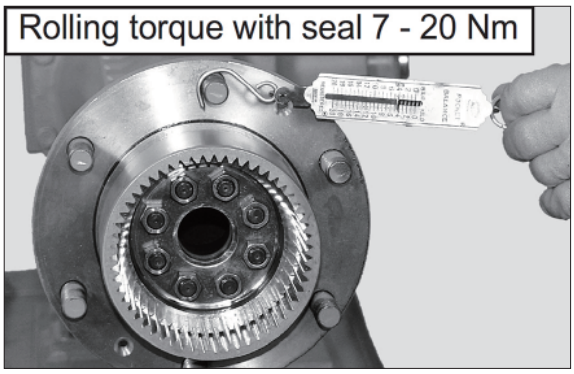
- Initial torque wrench setting :
  9.18 kgf · m (66.4 lbf · ft)
- Final torque wrench setting :
  10.2 kgf · m (73.8 lbf · ft)



55W9NAX474

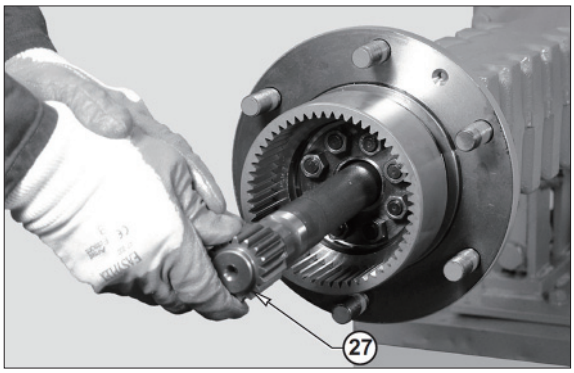
⑬ Check the continuous rolling torque on the hub.

- Torque : 0.71~2.04 kgf · m
  (5.14~14.8 lbf · ft)



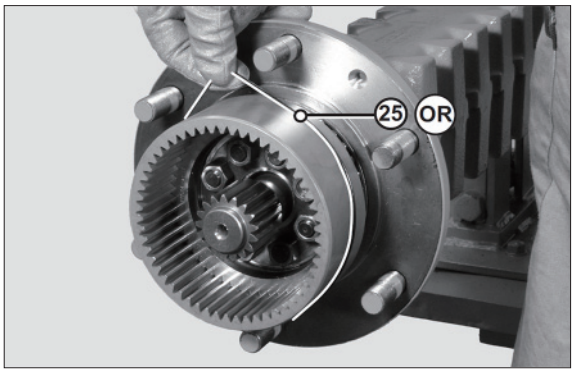
55W9NAX475

⑭ Install the axle shaft (27), making sure that it is properly inserted into braking disks and differential unit.



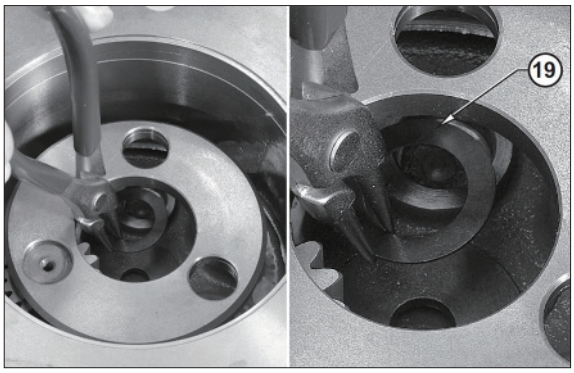
55W9NAX476

※ Check the condition and position of the O-ring (25).



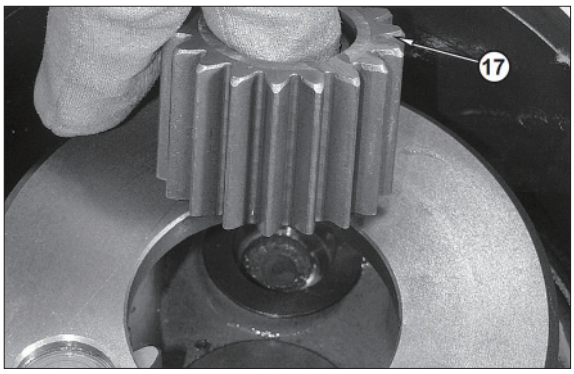
55W9NAX477

⑮ Install the spherical washer (19).



55W9NAX478

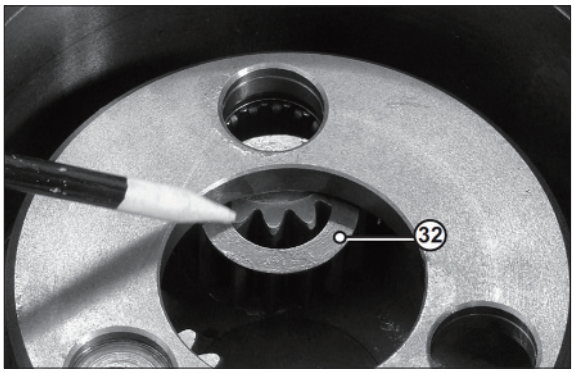
⑯ Install planetary gears complete with roller bearing (17).



55W9NAX479

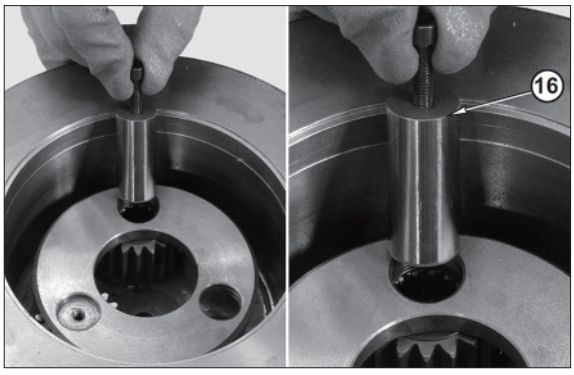
⑰ Install the others friction washers.

Two friction washers for every planetary gear.



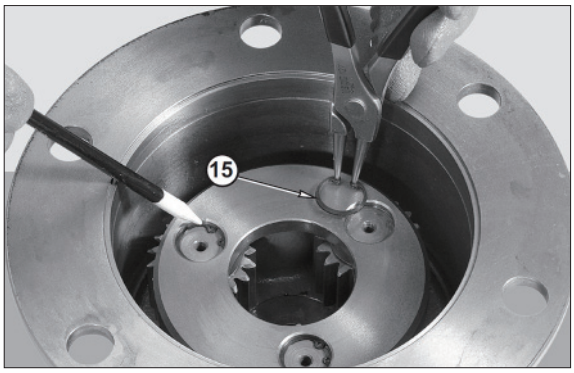
55W9NAX480

⑱ Check the concentricity of the planetary gear, the seat and friction washers.
Using a screw M6 install the pin (16).



55W9NAX481

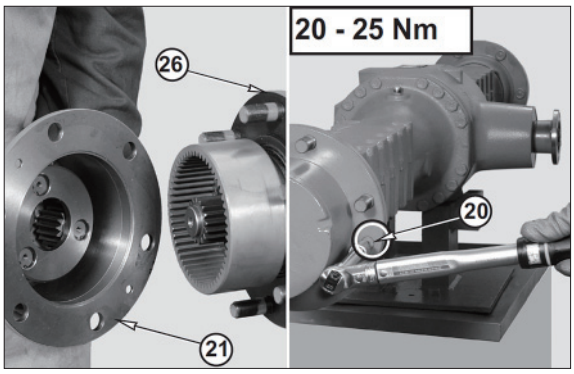
⑲ Carefully check that pin is completely inserted and install the snap rings (15).



55W9NAX482

⑳ Fit the planetary gear cover (21) onto the wheel hub (26).

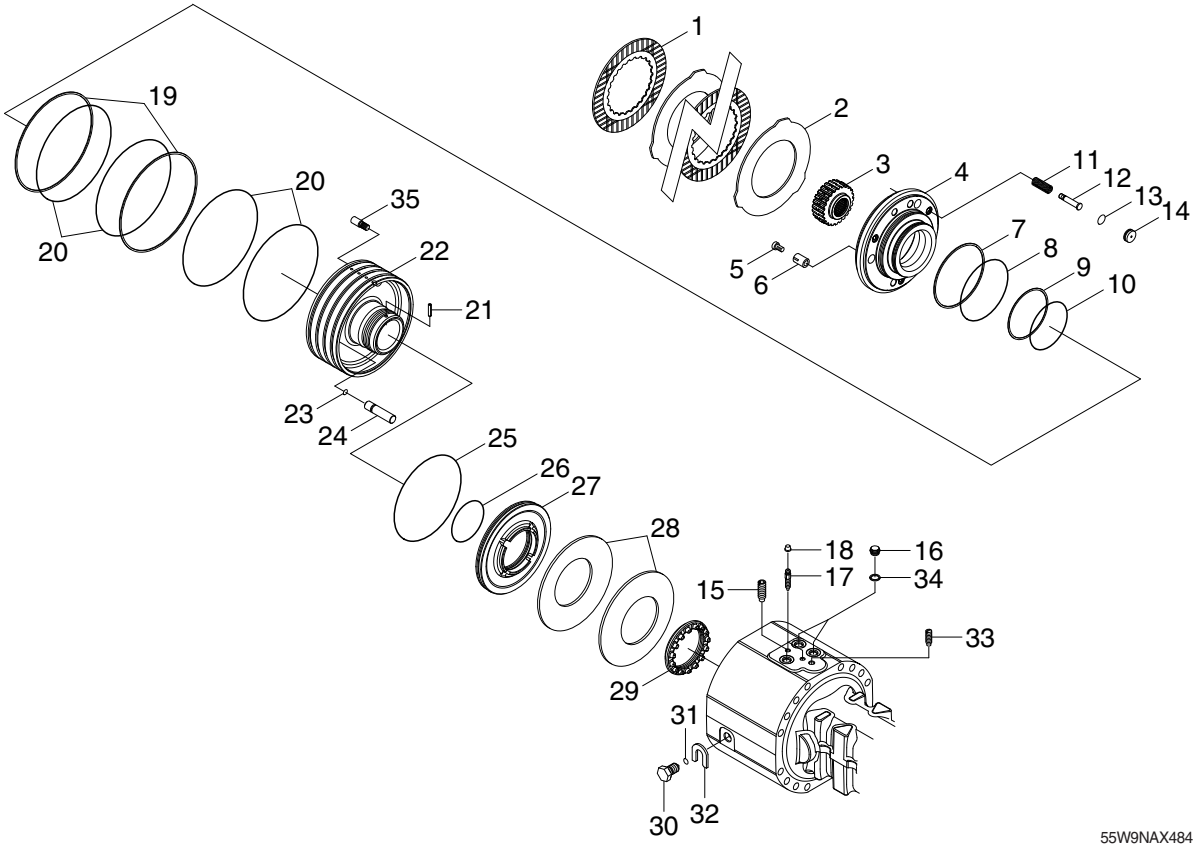
- Torque wrench : 2.04~2.55 kgf · m (14.8~18.4 lbf · ft)



55W9NAX483

2) SERVICE AND NEGATIVE BRAKE

(1) Assembly diagram

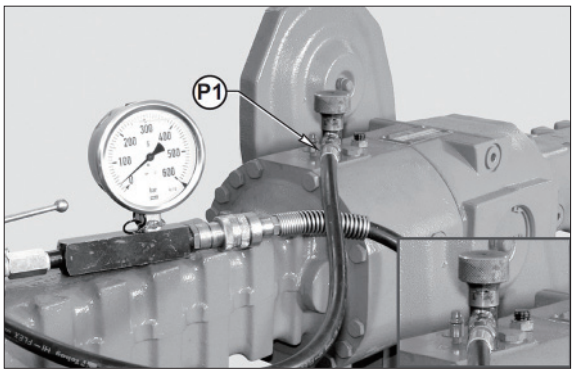


55W9NAX484

(2) Disassembly

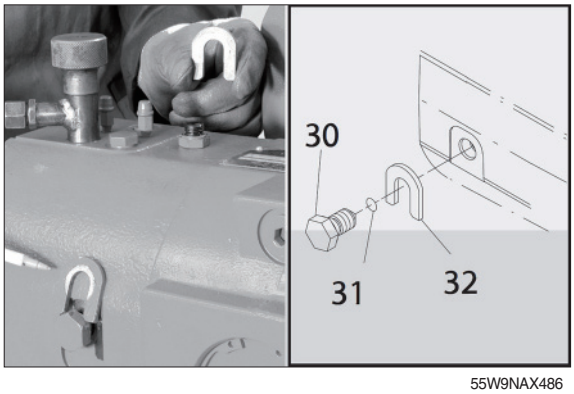
① Connect an external pump to the union piece “P1” of the negative brake and introduce a pressure of 15~30 bar to eliminate the pressure of the belleville washers.

※ Perform all operations on both arms.



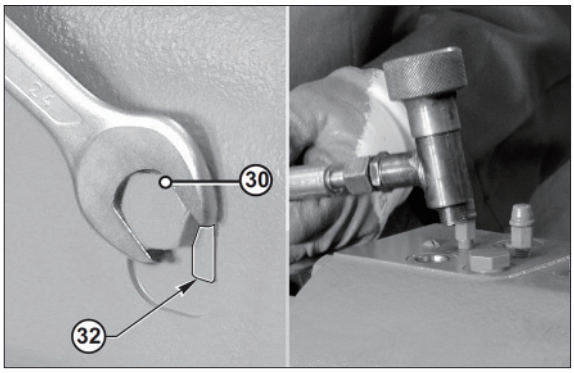
55W9NAX485

② Loosen the unlocking screws (30) and remove both stop washers (32).



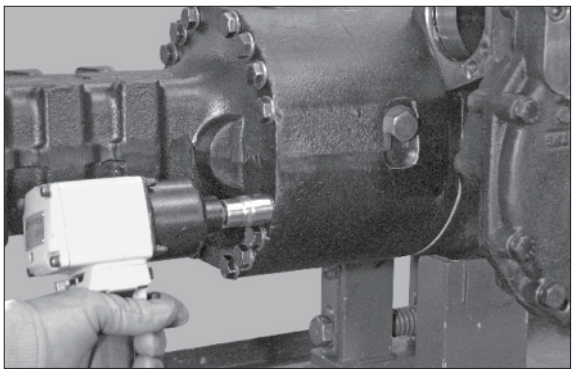
55W9NAX486

③ Insert block screws to end stroke and release pression.



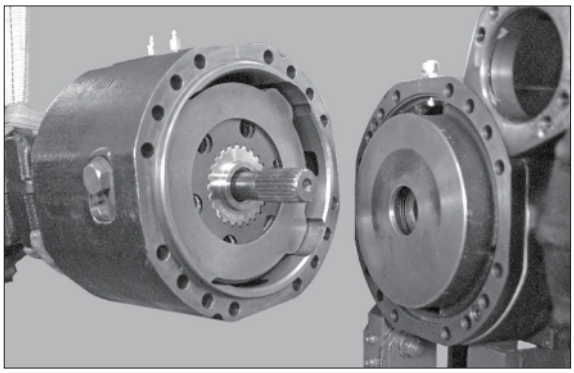
55W9NAX487

④ Sling the arm to be removed and connect it to a hoist, remove screws.



55W9NAX488

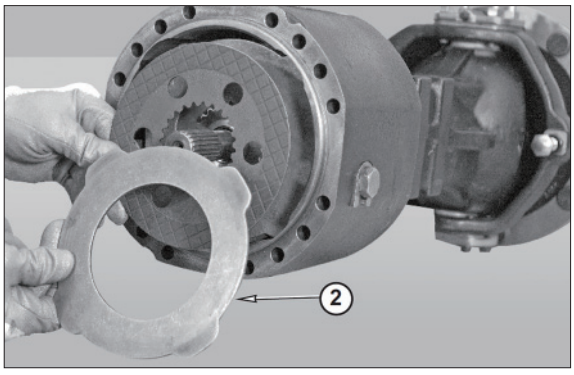
⑤ Take off the arm and lay it down vertically.



55W9NAX489

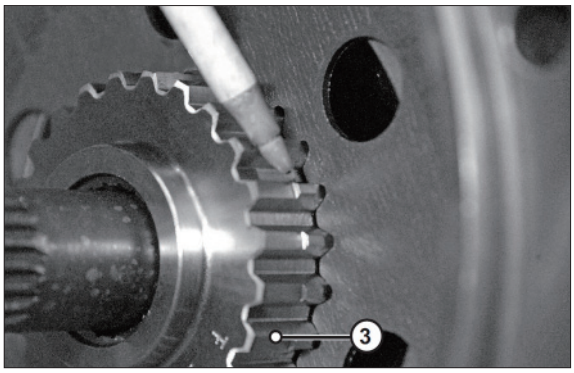
⑥ Remove the brake discs one after the other (2).

※ If they are not to be substituted, do not mix up the sequence.



55W9NAX490

⑦ Remove the flange (3) complete with the discs.

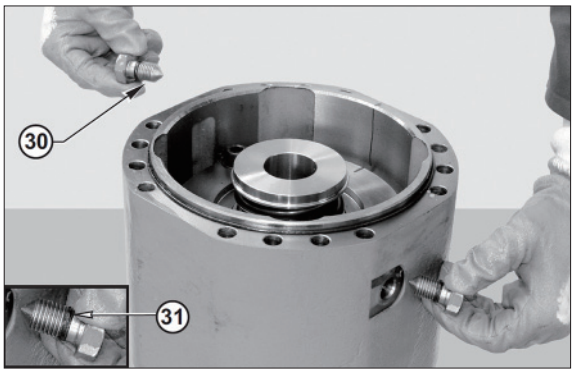


55W9NAX491

⑧ In order to keep the disc springs of the negative brake preloaded, screw down the screws with washers to the end stop.

55W9NAX492

⑨ Remove the negative brake locking screws (30).
Always exchange the O-ring (31).

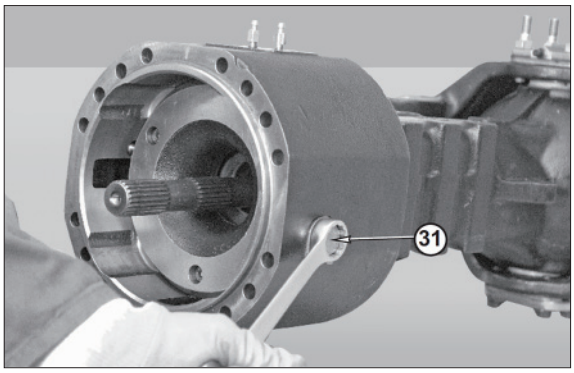


55W9NAX493

⑩ Loosen the before installed provisional screws in the same sequence and same measure.

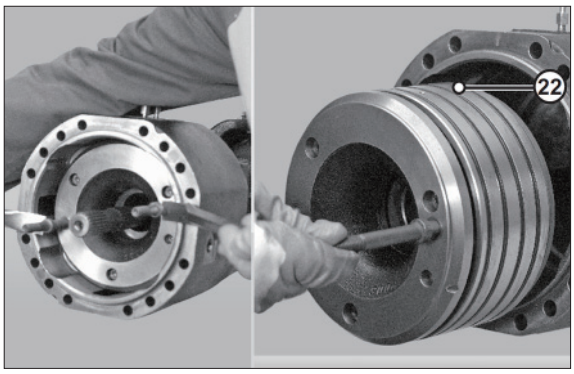
55W9NAX494

⑪ Remove the negative brake locking screws (30). Always exchange the O-ring (31).



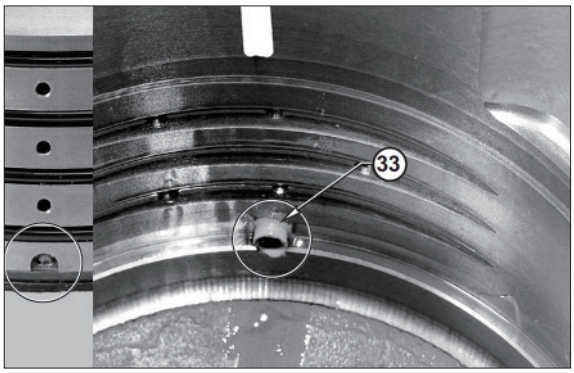
55W9NAX495

⑫ Pull out brake piston assembly module (22).



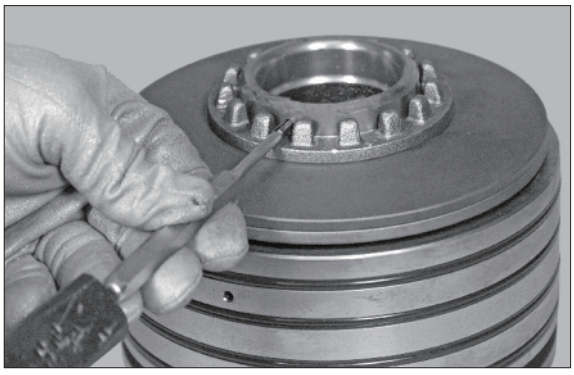
55W9NAX496

※ Check locking screw (33) of the brake piston module.



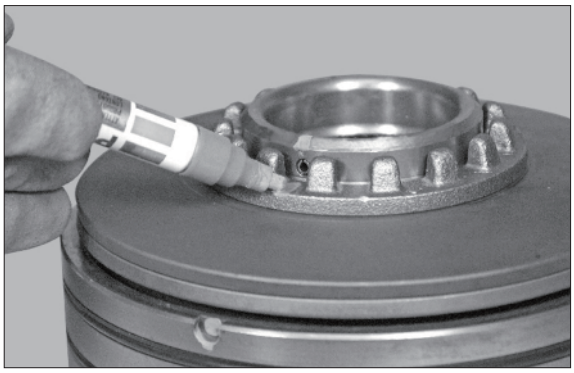
55W9NAX497

⑬ Turn upside down the brake module and with a pin driver remove the locking pin of the slotted nut.



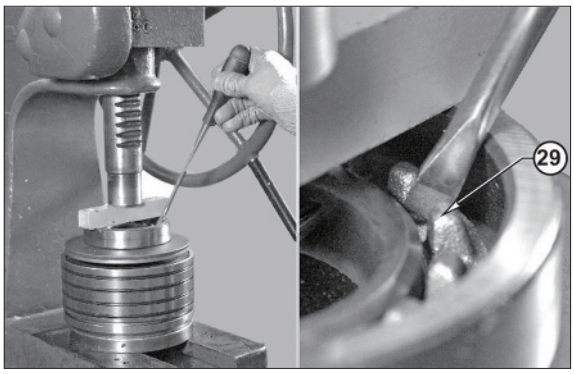
55W9NAX498

⑭ Sign the position of the slotted nut.



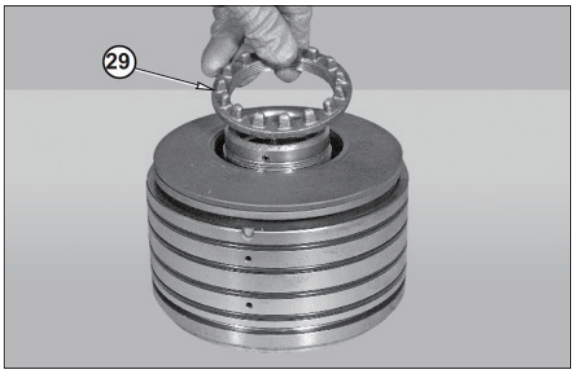
55W9NAX499

⑮ Bring the piston group below a press, compress the cup springs and loosen the metal ring.



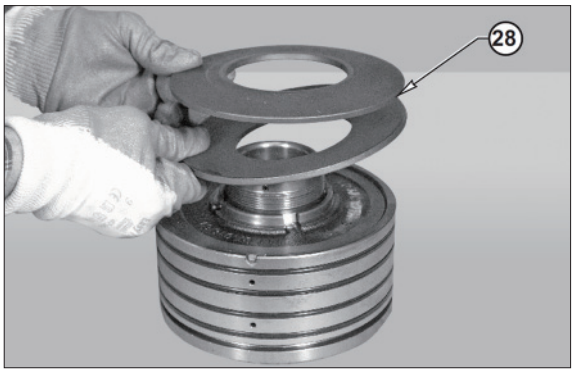
55W9NAX500

⑯ Remove nut (29).



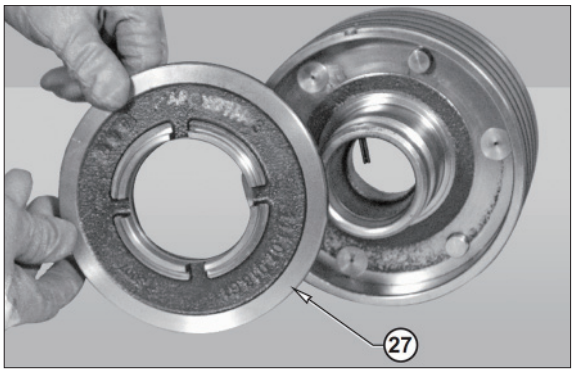
55W9NAX501

⑰ Remove the disc springs (28).



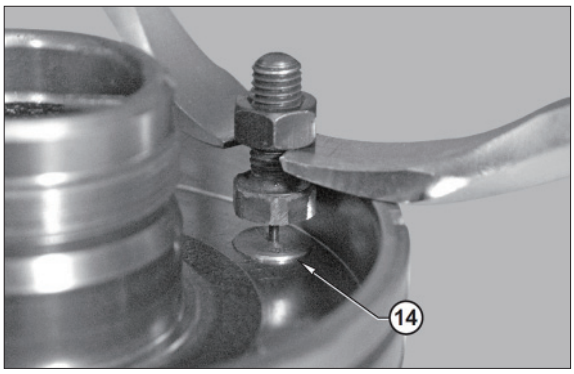
55W9NAX502

⑱ Applying air pressure, remove the piston (27) of the negative brake.



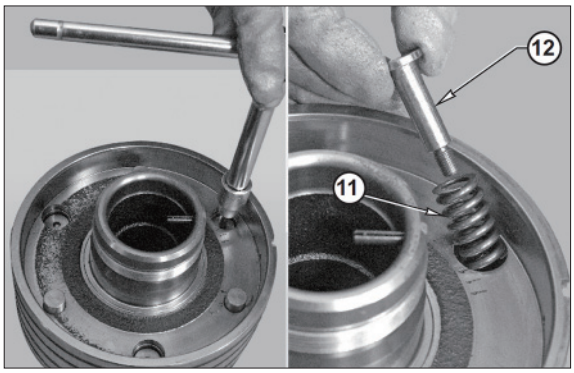
55W9NAX503

⑲ Using a new screw remove the pressure seal caps.



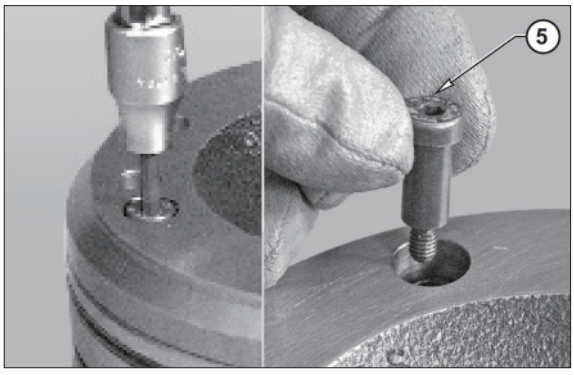
55W9NAX504

⑳ Remove the reversal springs (11).



55W9NAX505

㉑ Remove the adjusting screws (5).

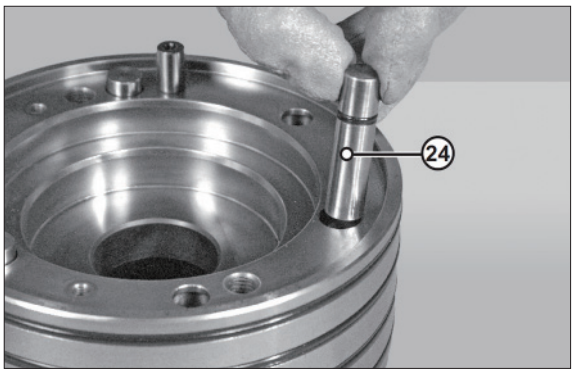


55W9NAX506

㉒ Remove the service brake piston (4).

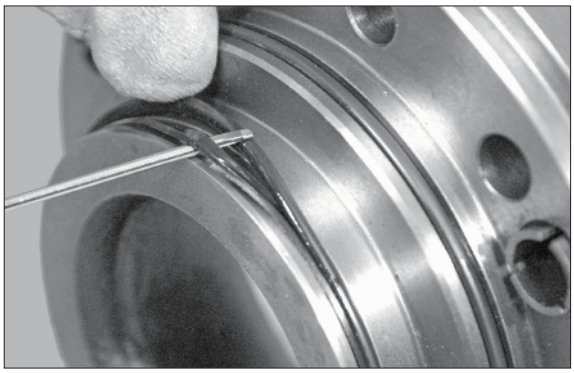
55W9NAX507

㉓ Remove the three bolts (24).



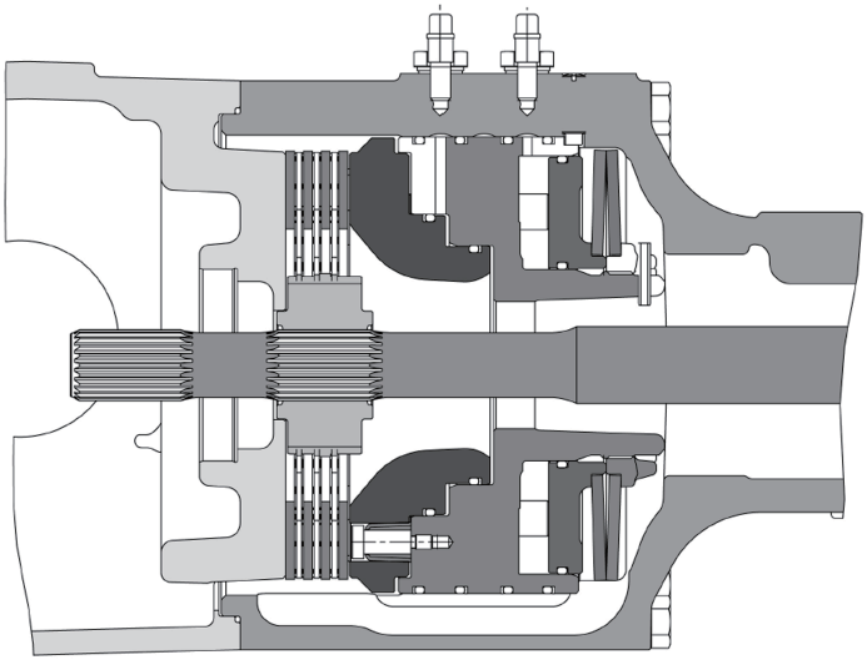
55W9NAX508

㉔ Remove the O-rings and the anti-extrusions rings from the service brake, the negative brake piston and from the piston.



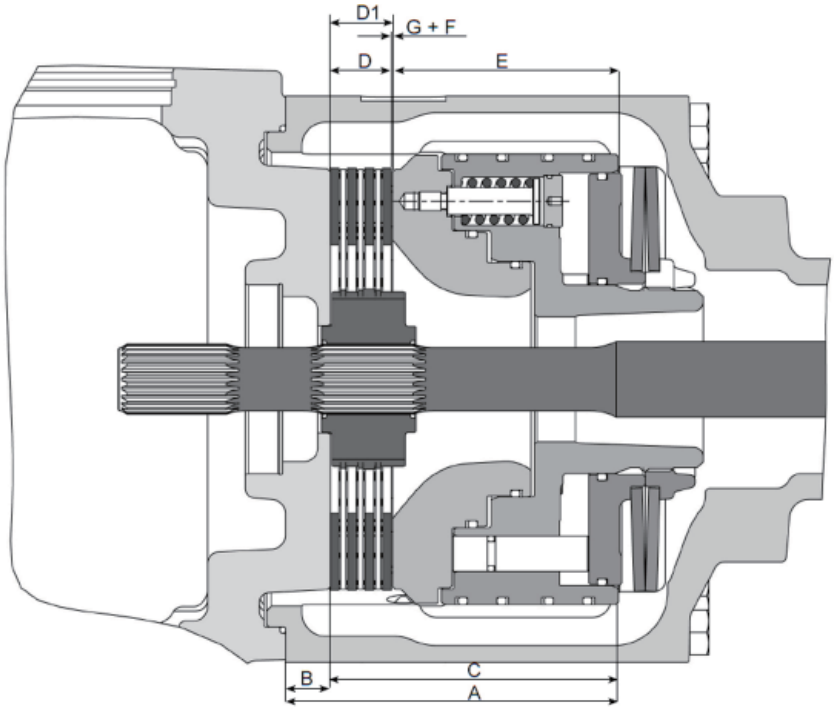
55W9NAX509

(3) Assembly



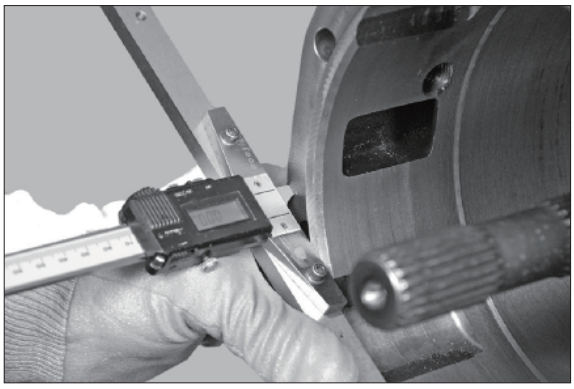
55W9NAX149

C = A - B
141.0 - 19.0 = 122 mm
C = arm quote
D1 = D + G + F
26.0 + 0.75 + 0.2 = 26.95 mm
D = tickness of discs pack
G = brake discs gap
F = fix quote
E = C - D1
122 - 26.95 = 95.05 mm
E = piston pack quote



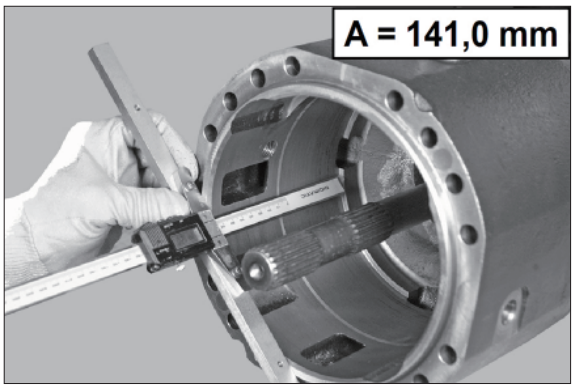
55W9NAX511

① Zero the centesimal calibre between the support plane and the centring arm.



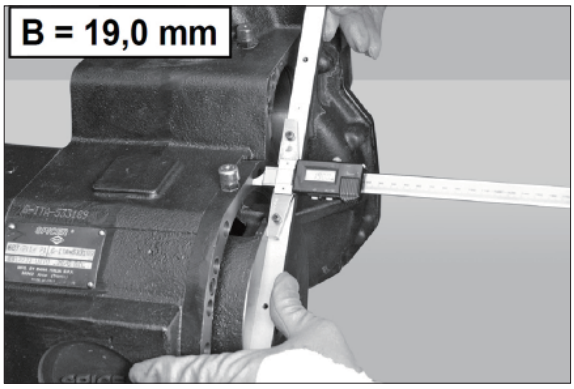
55W9NAX512

② Then measure the distance between the arm support plane and the piston pack stop.



55W9NAX513

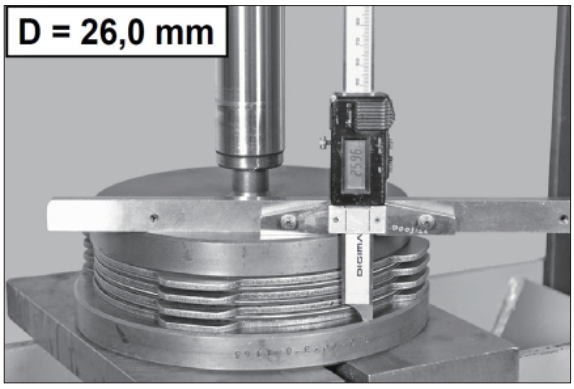
③ Measure the distance between the disk support plane and the arm support plane.
Subtract the value “B” from the value “A” to obtain the effective dimension “C” of the arm containing the brake disks and the piston pack.



55W9NAX514

④ Bring the disk pack beneath a press, load with 1000 kg, then measure the dimension “D”.
Add the play “G” and the fixed value “F” (equal to 0.2 mm) to the value “D”.

※ Do not take into account the thickness between the press piston and the disks.



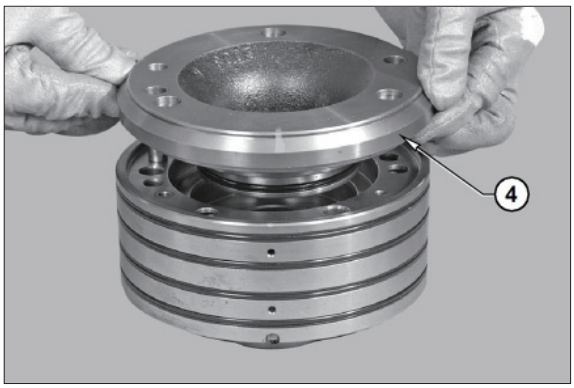
55W9NAX515

⑤ To determine the value “E” of the piston pack, subtract value “C” from value “D1”.

C = A - B
141,0 - 19,0 = 122 mm
C= arm quote
D1 = D + G + F
26,0 + 0,75 + 0,2 = 26,95 mm
D= tickness of discs pack
G= brake discs gap
F= fix quote
E = C - D1
122 - 26,95 = 95,05 mm
E = piston pack quote

55W9NAX516

⑥ Insert the service brake piston (4) hammering alternately with a plastic hammer.

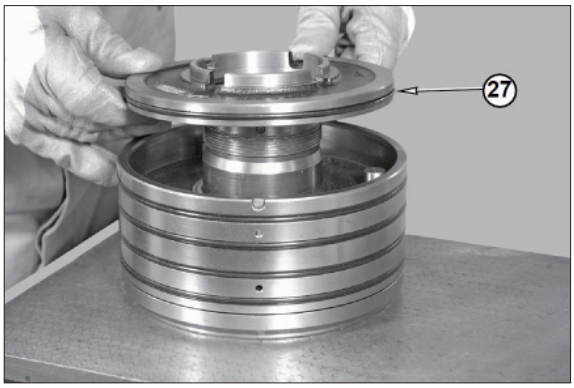


55W9NAX517

⑦ Insert the bolts (24).

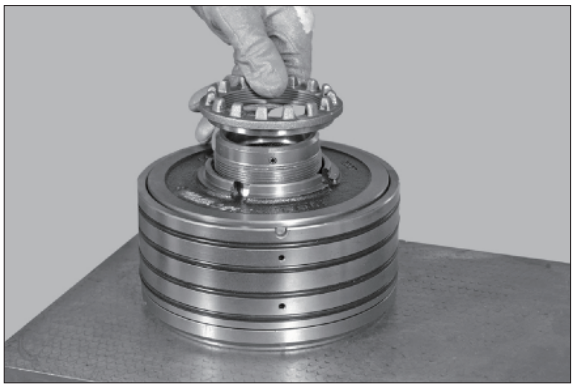
55W9NAX518

⑧ Turn upside down and insert the negative brake piston (27).



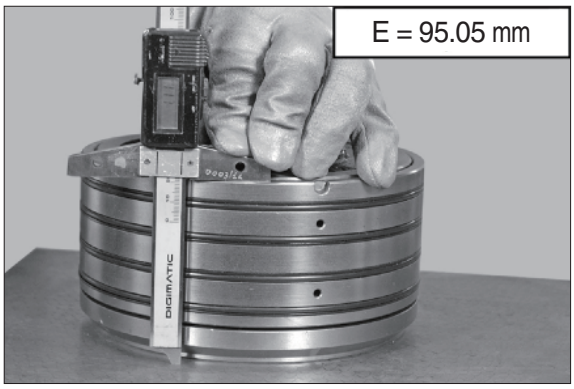
55W9NAX519

※ To determin the level “E” the slotted nut has to be operated without spring mounted.



55W9NAX520

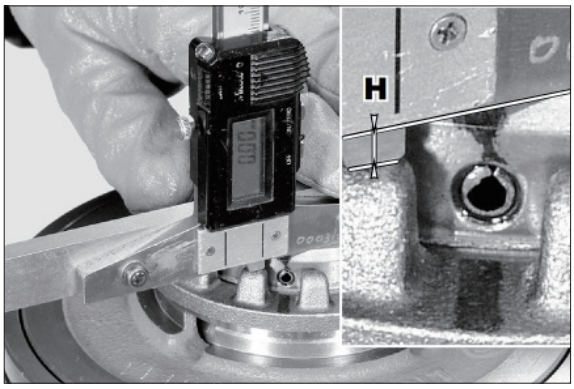
※ To define the level “E” adjust the slotted nut always to the smaller value by driving to the closer notch.



55W9NAX521

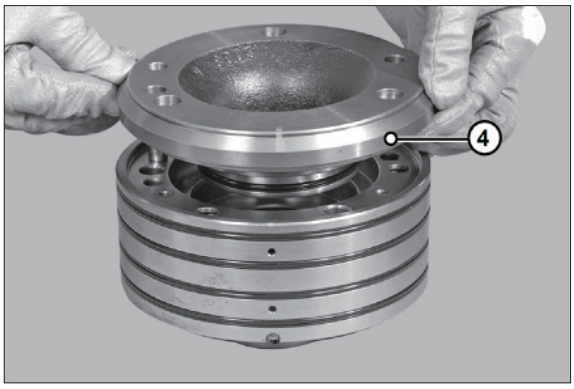
⑨ Before removing the slotted nut in order to insert the springs, note down the distance “H” from the plane to the tooth near the pin.

※ Sign.



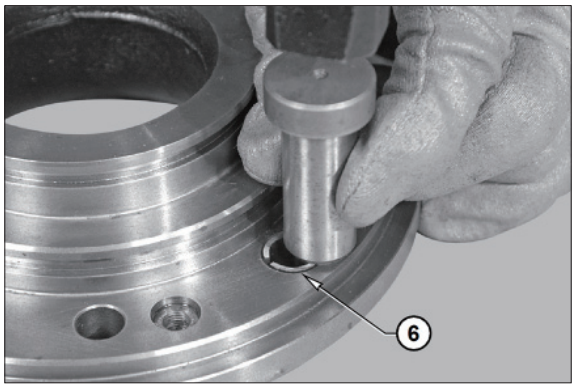
55W9NAX522

⑩ Remove the service brake piston (4).



55W9NAX523

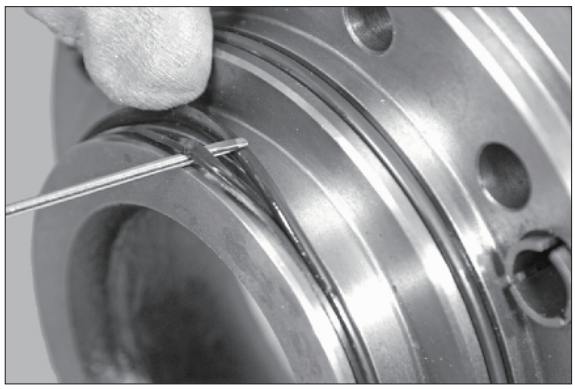
⑪ Insert the stroke automatic regulation springs (6); place them in line with the piston (4).



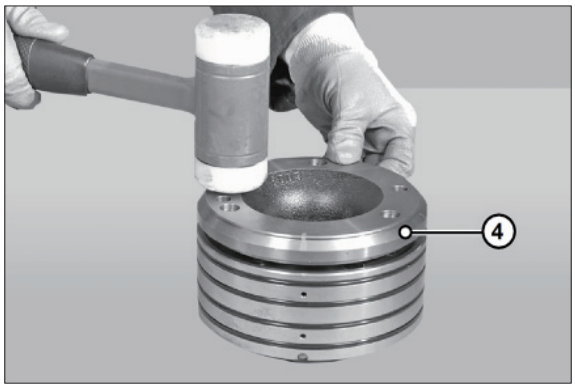
55W9NAX524

⑫ Complete the O-rings and anti-extrusion rings on all pistons.

※ The O-rings always have to be assembled from the pressure facing side.


55W9NAX525

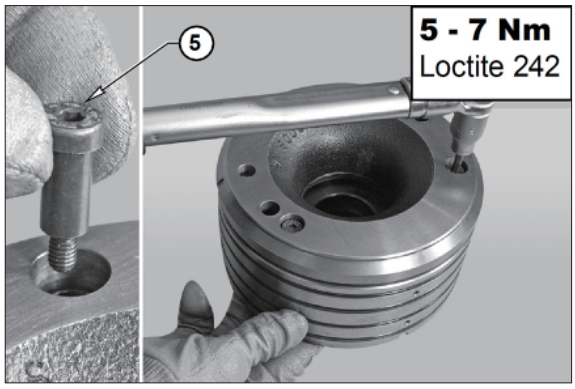
⑬ Insert the service brake piston (4) hammering alternately with a plastic hammer.



55W9NAX528

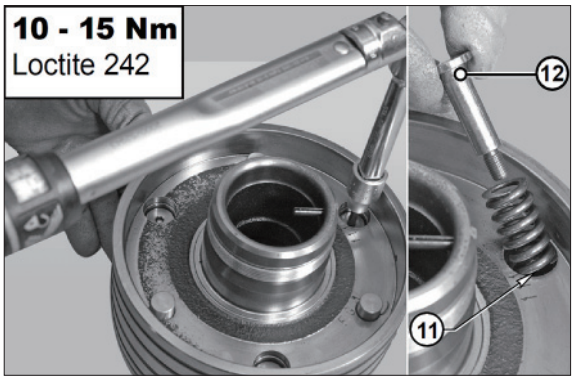
⑭ Fit the adjusting screws (5).
Apply loctite 242 to the thread.

· Torque wrench setting :
0.51~0.71 kgf · m (3.69~5.16 lbf · ft)



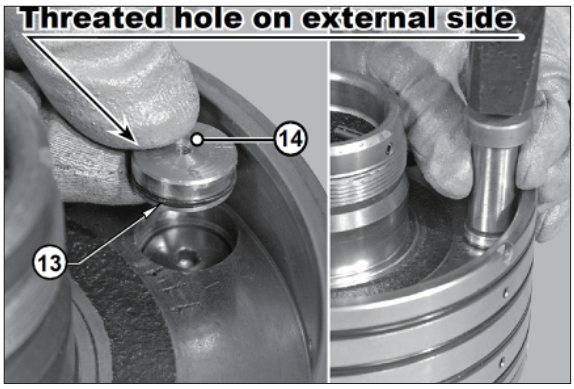
55W9NAX529

⑮ Fit the reversal springs (11) on the piston (4).
Apply loctite 242 to the thread of the adjustment screw.
Tighten with torque wrench setting of 1.02~1.53 kgf · m (7.38~11.1 lbf · ft)



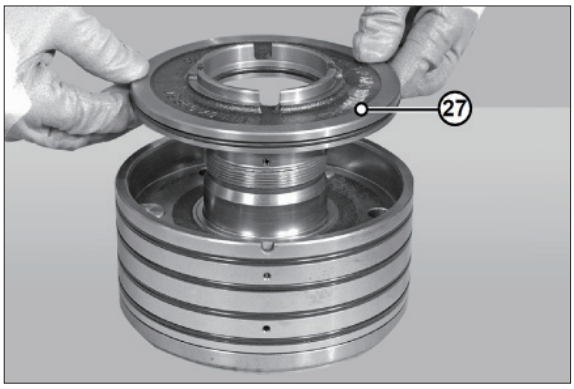
55W9NAX530

⑯ Insert the stroke end seal caps.



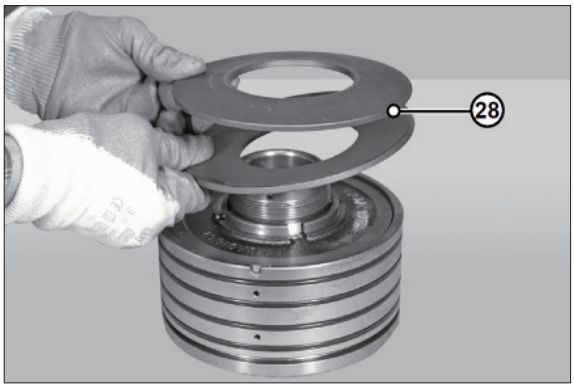
55W9NAX531

⑰ Insert the negative brake piston (27).



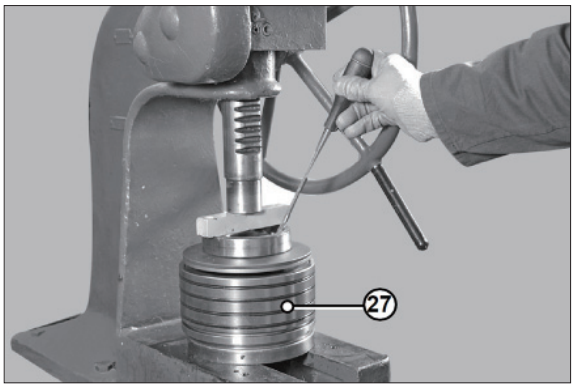
55W9NAX532

⑱ Insert the disc springs in the right position (28).



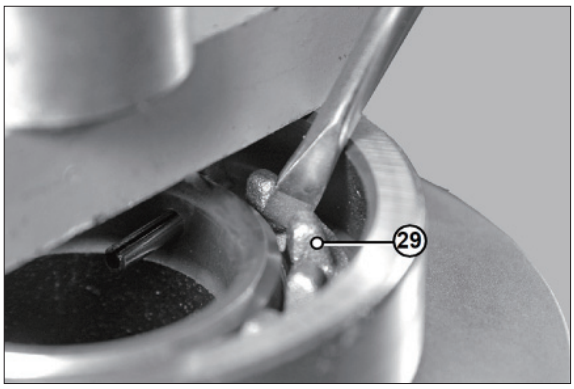
55W9NAX533

⑲ Insert at the bottom the piston of the negative brake (27) and screw up the slotted nut (29).



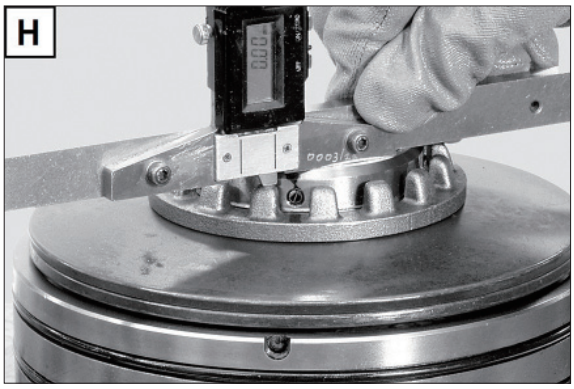
55W9NAX534

⑳ Screw down the slotted nut to the earlier determined position.



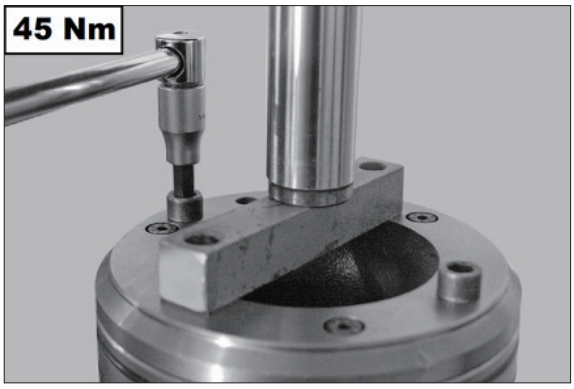
55W9NAX535

㉑ Check the earlier measured distance “H” from the plane to the tooth next to the pin.



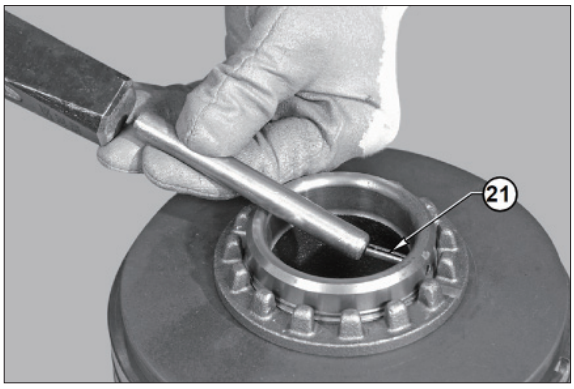
55W9NAX536

㉒ Alternately tighten with a torque wrench setting of maximum 4.59 kgf · m (33.2 lbf · ft).



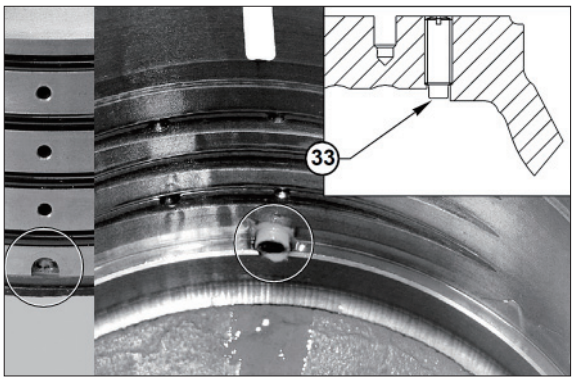
55W9NAX537

㉓ Put the pin in locking (21) position.



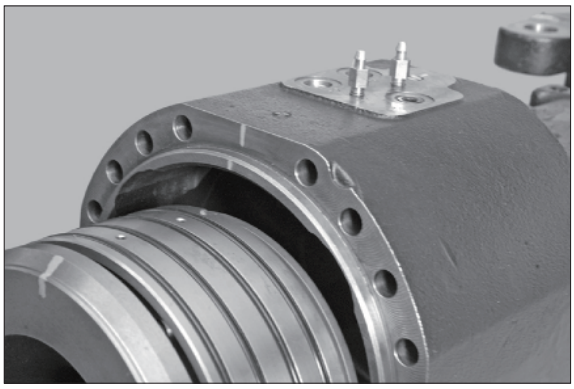
55W9NAX538

※ Check locking screw (33) of the brake piston module.



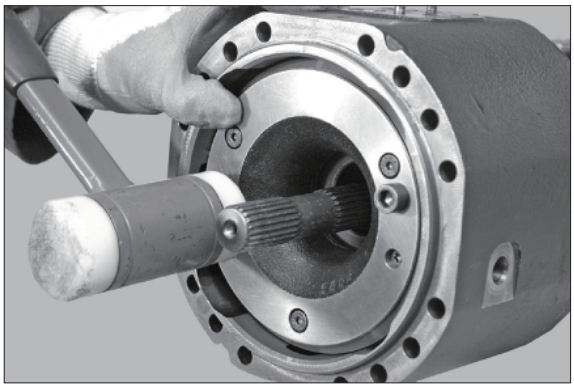
55W9NAX539

㉔ Insert the brake module facing the input holes to the top.



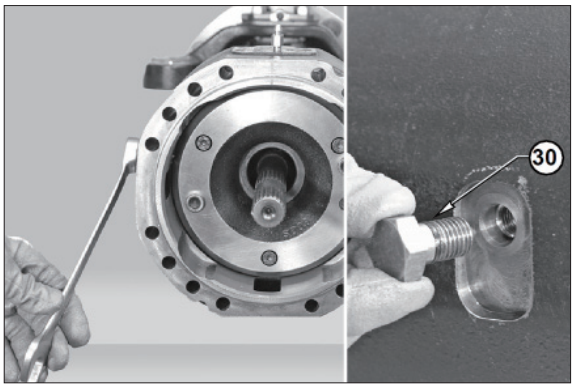
55W9NAX540

㉕ Insert the piston to the end stop by alternating light strokes and remove the screws.



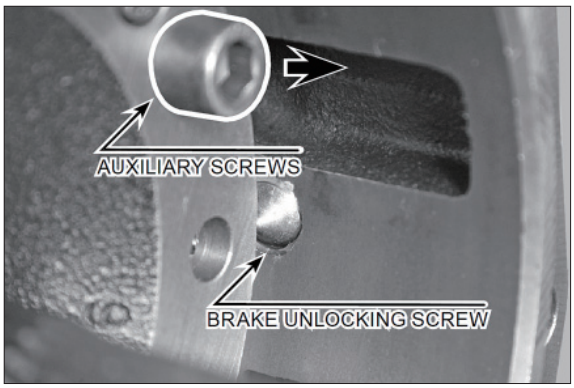
55W9NAX541

㉖ Insert the negative brake unlocking screw (30) up to the end stop.



55W9NAX542

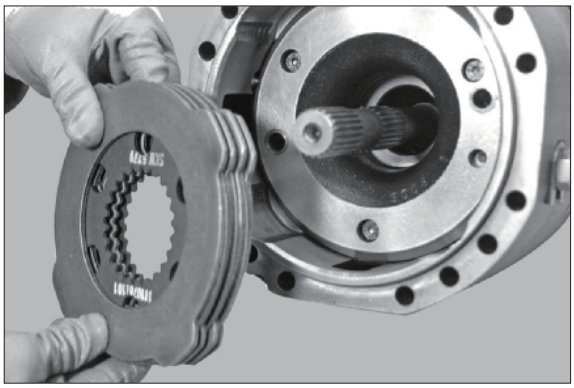
㉗ Remove the two auxiliary screws.



55W9NAX543

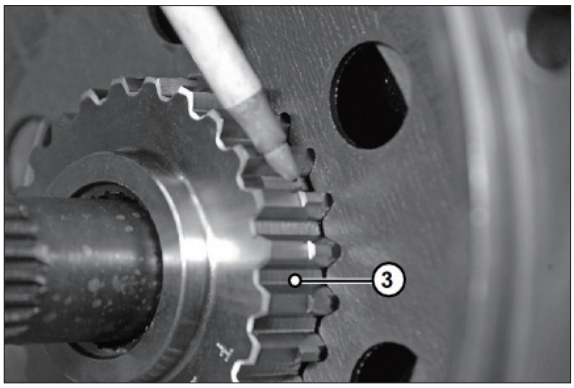
㉘ Insert the brake discs (1) (2) in the right sequence.

※ The first brake disc to be inserted must be of friction material.



55W9NAX544

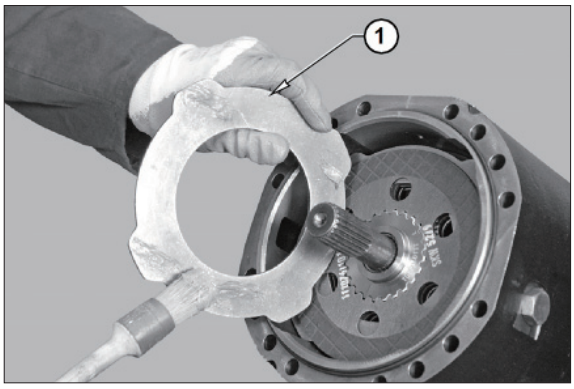
㉙ Install the flange (3) on the arm.



55W9NAX545

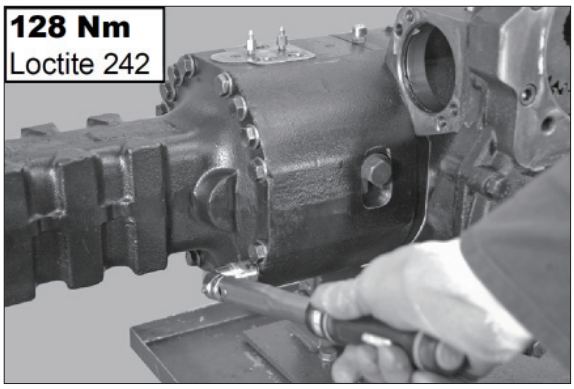
㉚ Insert the brake discs (1) (2) in the right sequence.

※ The last brake disc to be inserted must be of metal material.



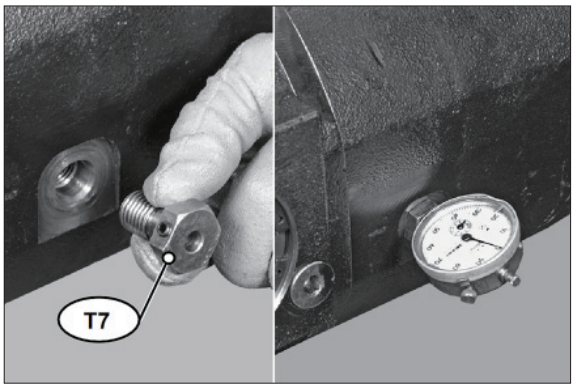
55W9NAX546

㉛ Insert the screws and tighten them alternately.



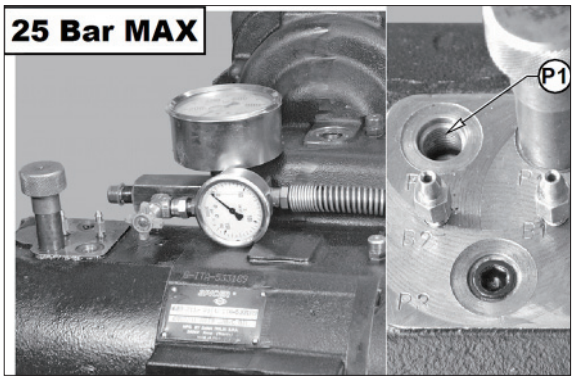
55W9NAX547

㉜ Remove the negative brake locking screws (30).
Fit the special tool T4 into the seat of the manual release of the screws, insert a comparator and pre-load it with 1 ㎜.



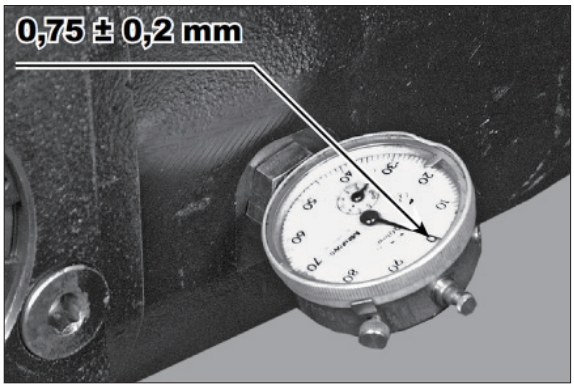
55W9NAX548

㉝ Introduce a pressure of maximum 25 bar.



55W9NAX549

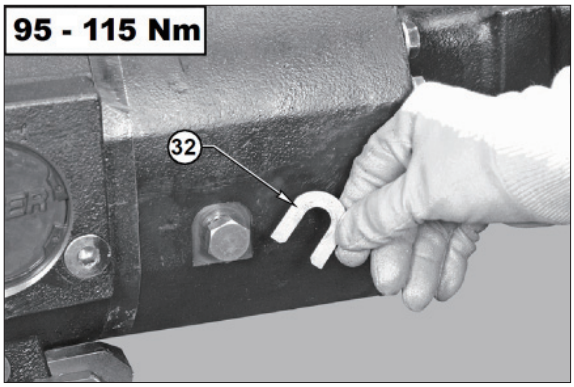
㉞ Once the pressure is inserted into the circuit the comparator must give a measurement equal to play X (0.75 mm).



55W9NAX550

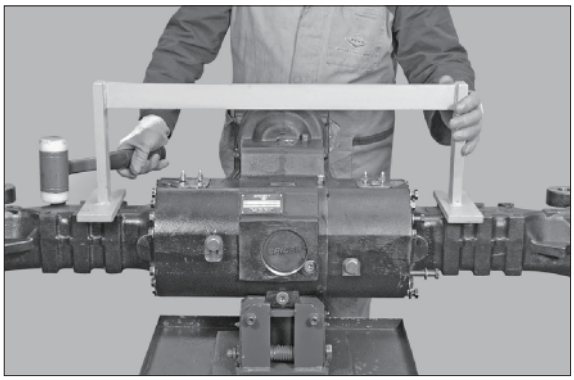
㉟ Insert the two “U”-shaped shims and tighten the screws with a torque wrench setting of 9.69~11.7 kgf · m (70.1~84.6 lbf · ft).

※ The position of the negative brake is unlocked.



55W9NAX551

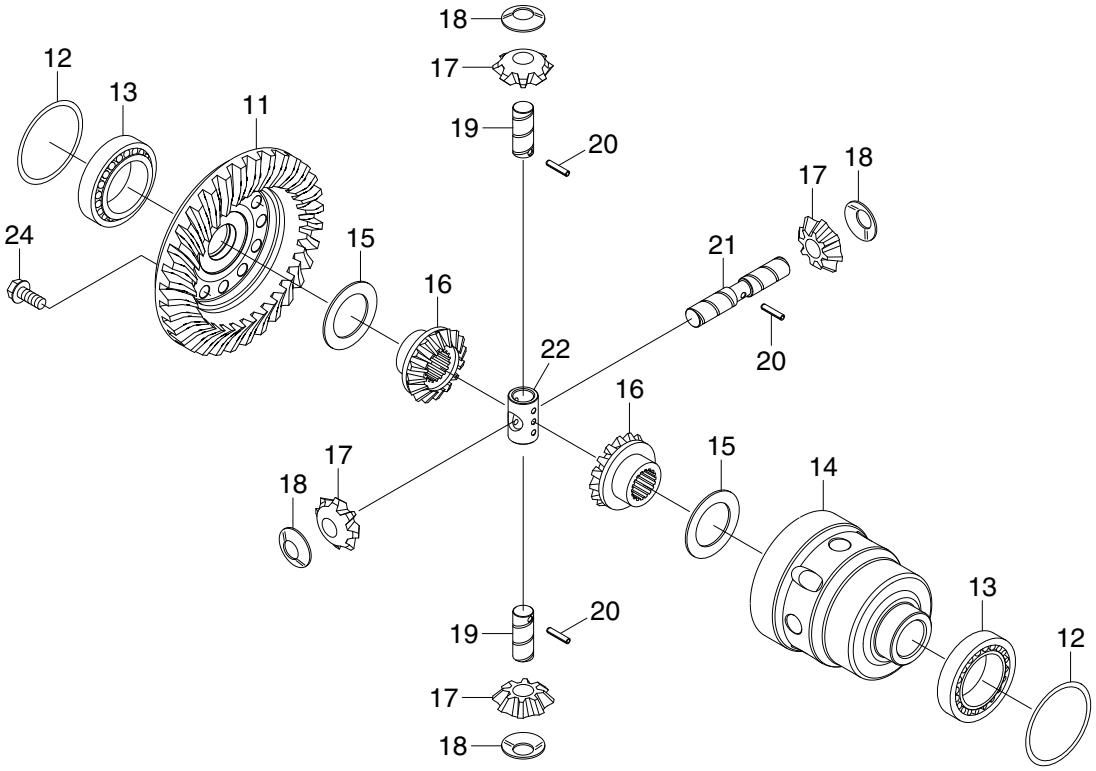
㊱ Check the flatness of the arms and finally lock the arms with the screws (4) and the washer (5) using the crosstightening method.



55W9NAX552

4) NORMAL DIFFERENTIAL

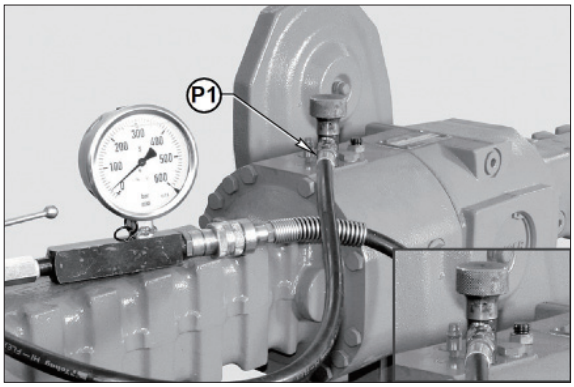
(1) Assembly diagram



55W9NAX553

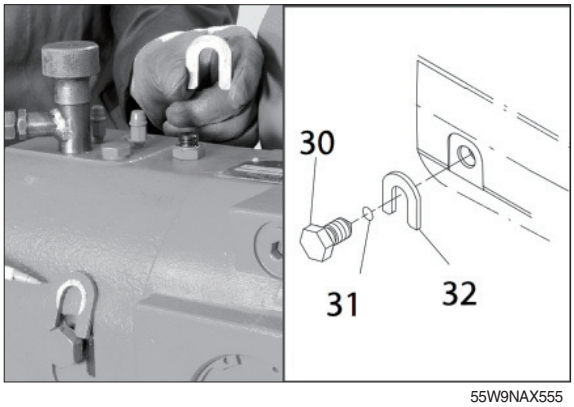
(2) DISASSEMBLY

① Connect an external pump to the union piece “P1” of the negative brake and introduce a pressure of 15~30 bar to eliminate the pressure of the belleville washers.



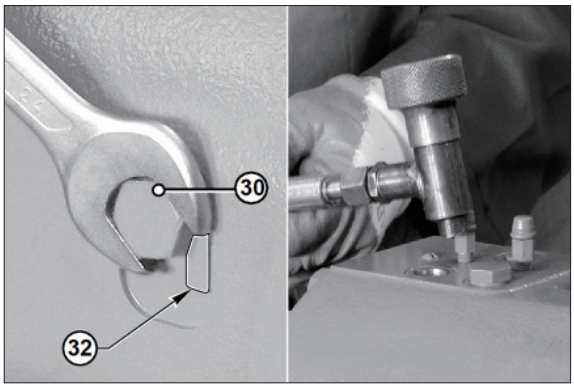
55W9NAX554

② Loosen the unlocking screws (30) and remove both stop washers (32).



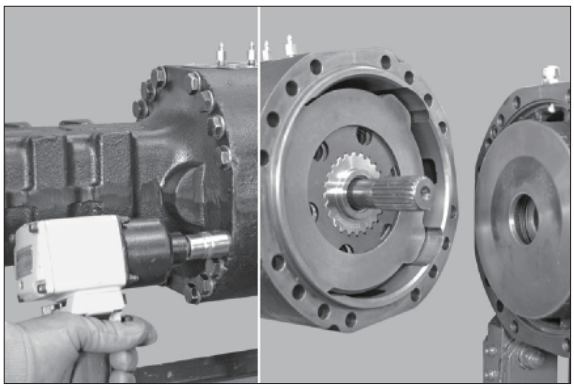
55W9NAX555

③ Insert block screws to end stroke and release pression.



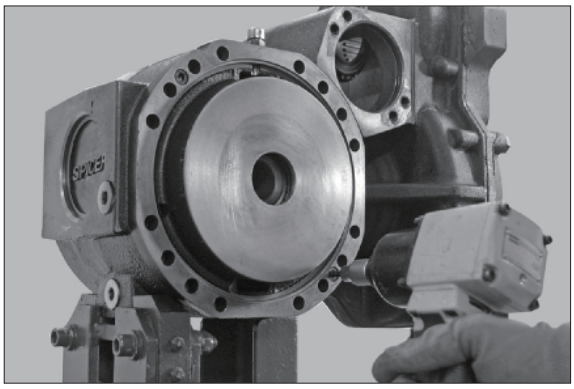
55W9NAX556

④ Remove the brake side arm and the brake discs pack.
Sling the arm to be removed and connect it to a hoist, remove screws of the crown wheel side arm.
Remove the arm together with the pack of the braking disks.
Place the arm on a bench.



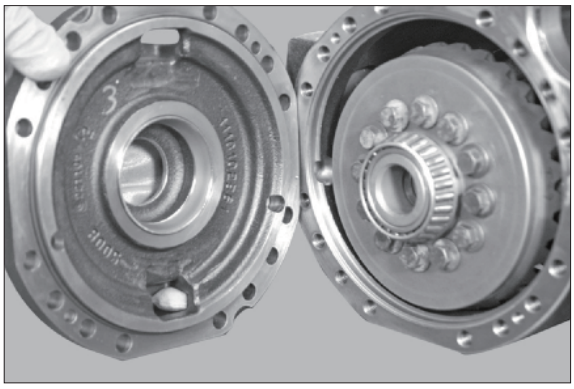
55W9NAX557

⑤ Remove the fitting screws from the middle cover.



55W9NAX558

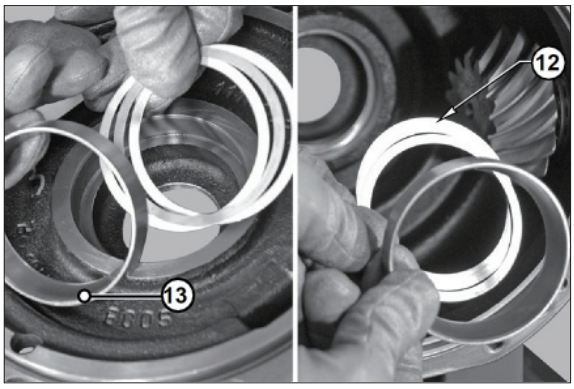
⑥ Insert a screw-driver in the opposing slots then force and remove the middle cover.



55W9NAX559

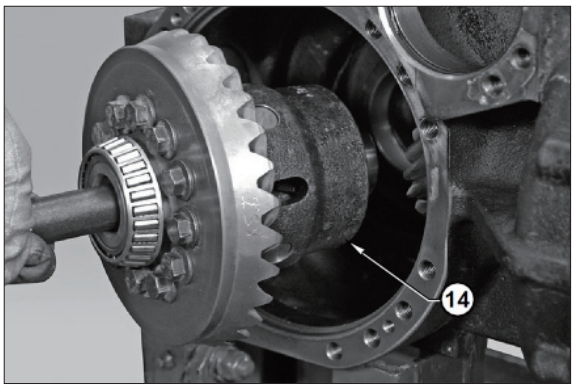
⑦ If the bearings need replacing (13), extract the external thrust blocks of the bearings (13) from middle cover and central body.

※ Accurately check the O-ring.



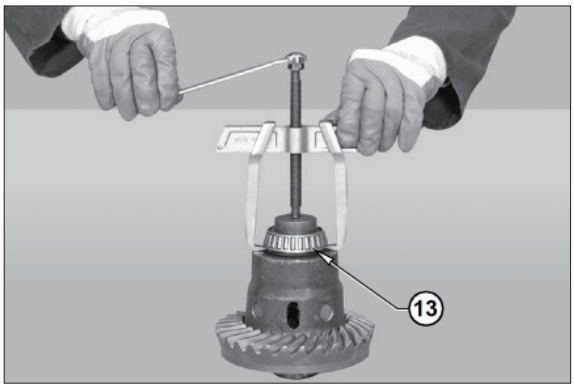
55W9NAX560

⑧ Pull out the differental (14).



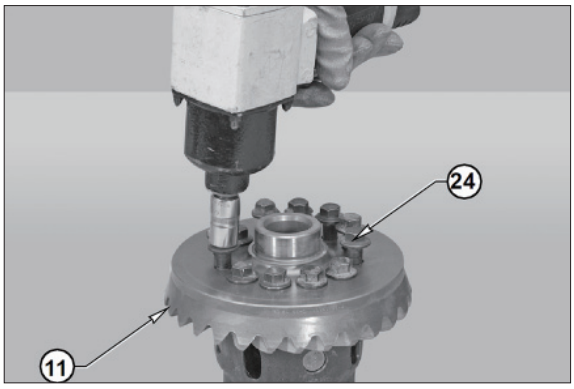
55W9NAX561

⑨ If the bearing need replacing, extract the bearing (13) from the differential carrier.



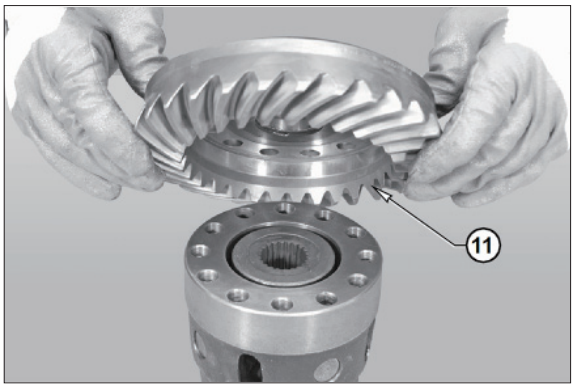
55W9NAX562

⑩ Remove fixing screws (24) of the crown wheel (11); exchange each time when removed.



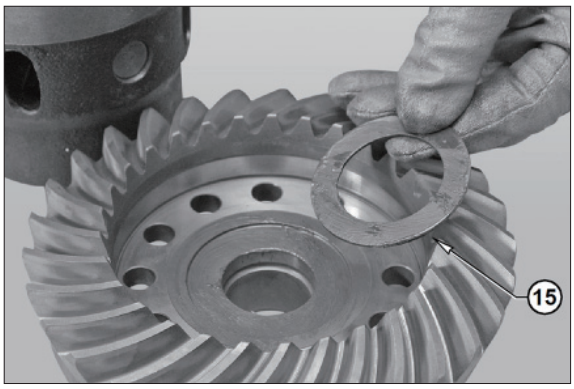
55W9NAX563

⑪ Extract the crown wheel (11).



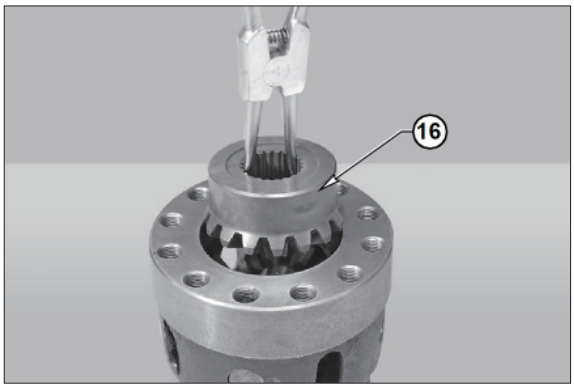
55W9NAX564

⑫ Remove the shim washer (15).



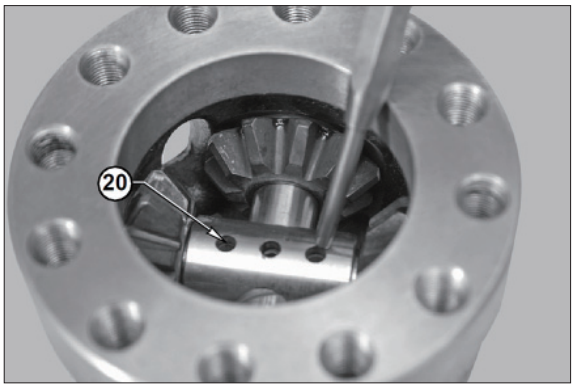
55W9NAX565

⑬ Remove the planetary gear (16).



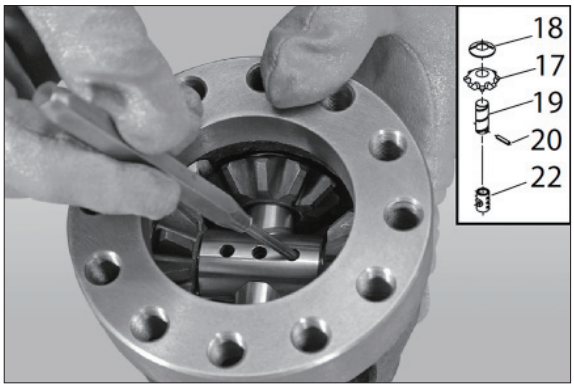
55W9NAX566

⑭ Remove the three spider blocking pins (20) by using a pin driver.



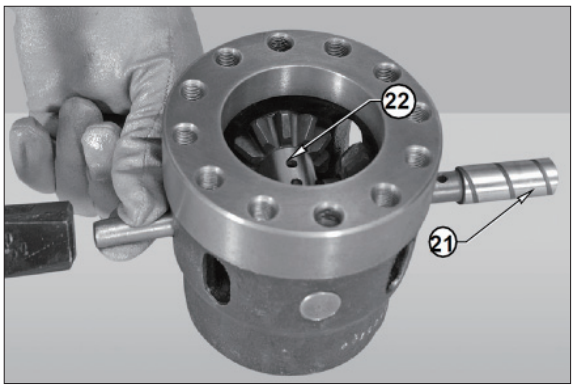
55W9NAX567

⑮ Move the two opposite mounted short bolts (19) to the outside of the box using the same pin driver.



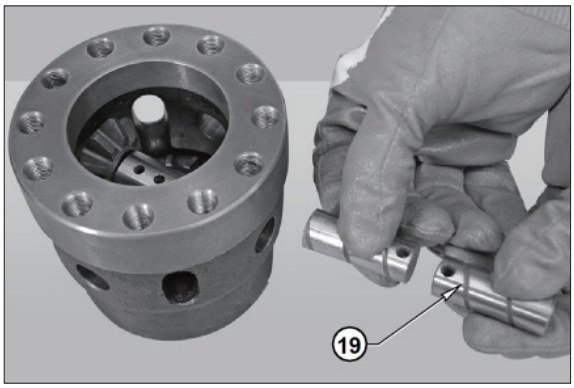
55W9NAX568

⑯ Drive out the long bolt (21) and pull out the spider (22) from the center.



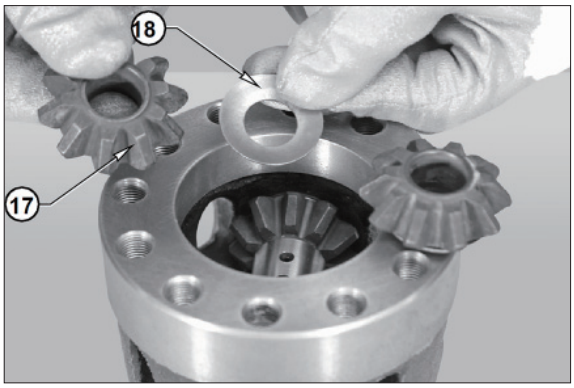
55W9NAX569

⑰ Remove the two half bolts (19), spherical washers and satellite wheels.



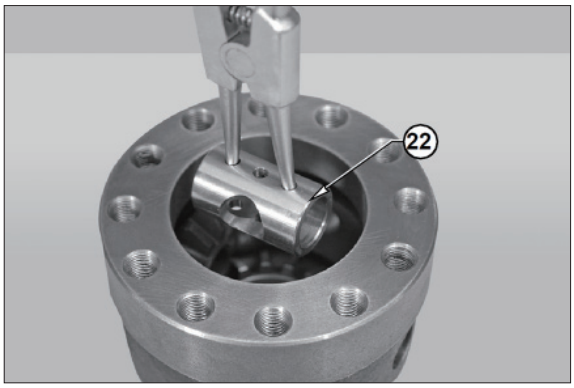
55W9NAX570

⑱ Remove long bolt, spherical washers (18) and satellite wheels (17).



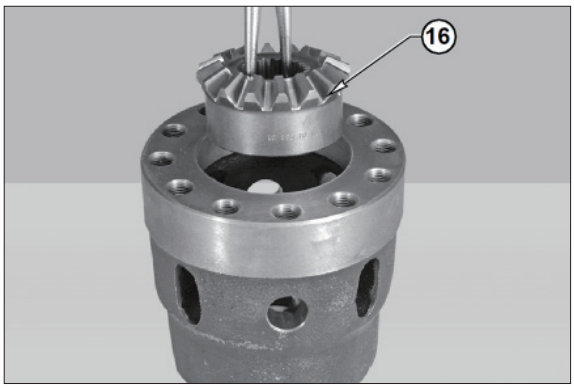
55W9NAX571

⑲ Pull out the spider (22) from the center.



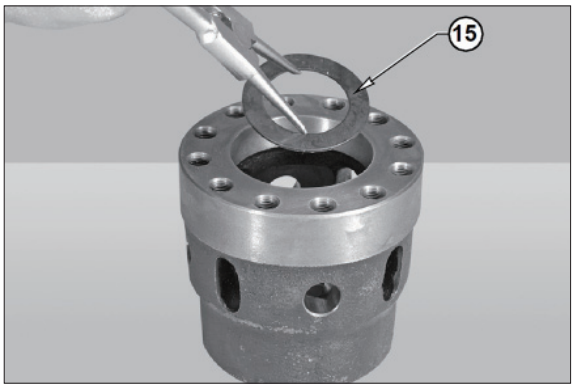
55W9NAX572

⑳ Remove the planetary gear (16).



55W9NAX573

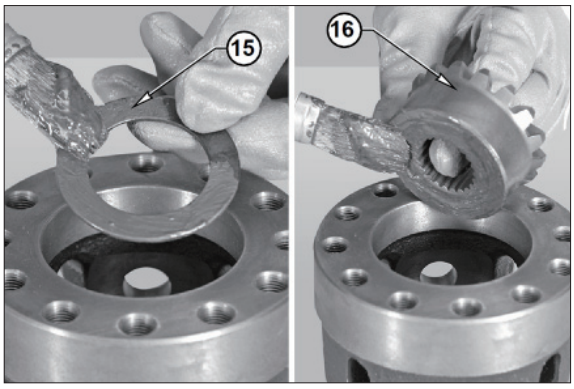
㉑ Remove the shim washer (15).



55W9NAX574

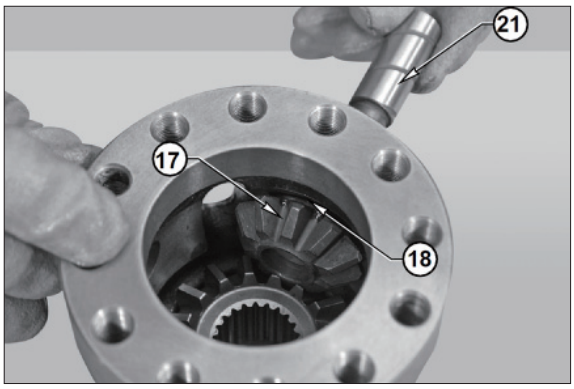
(3) ASSEMBLY

① Lubricate and insert washer (15) and plantary wheel (16).



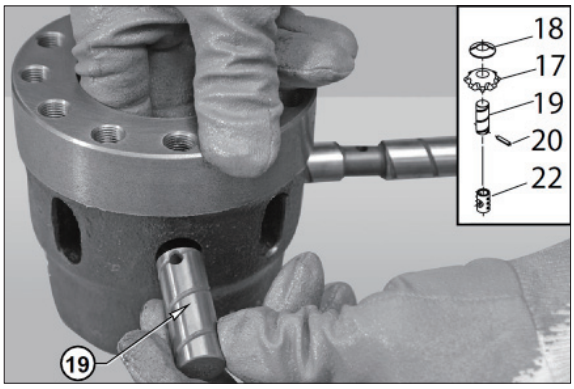
55W9NAX575

② Partially insert the long bolt (21), satellite wheels (17) and spherical washers (21).



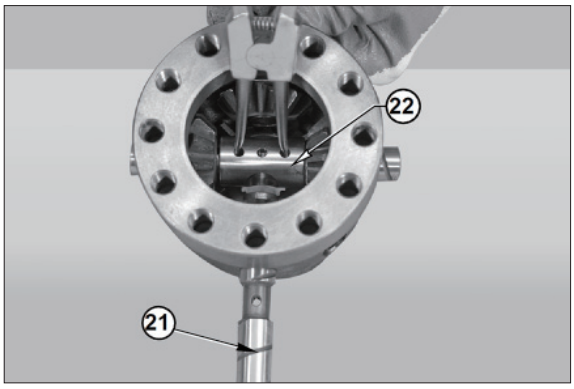
55W9NAX576

③ Insert the two half bolts (19), spherical washers (18) and satellite wheels (17).



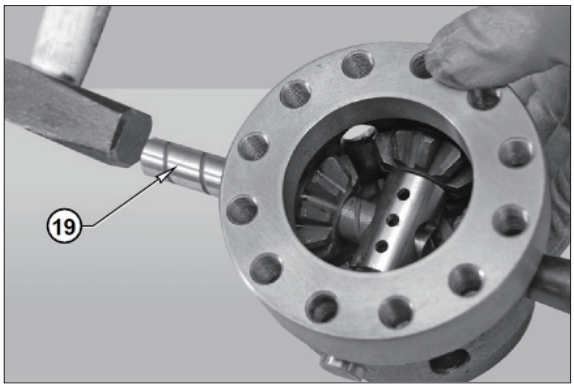
55W9NAX579

④ Insert spider (22) and completely insert the long bolt (21).



55W9NAX580

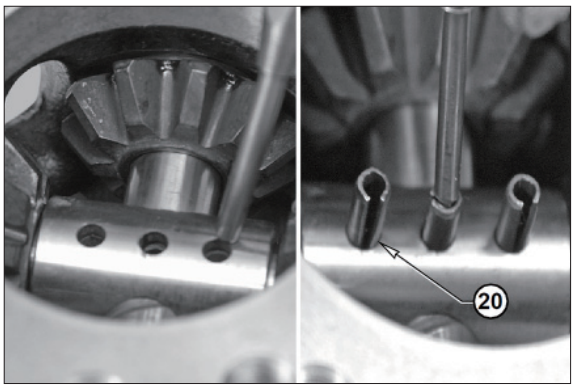
⑤ Insert completely the bolts (19).



55W9NAX581

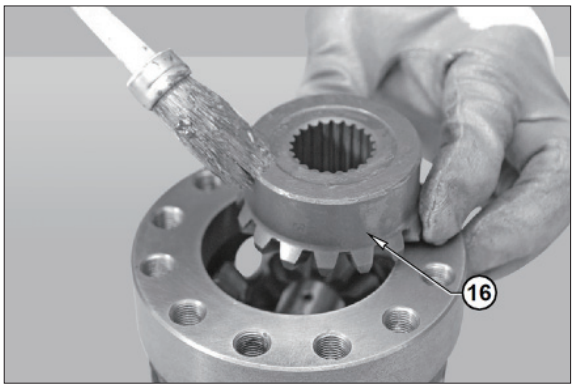
⑥ Center the pin holes and insert the 3V pins (20).

※ Check the free rotation of the satellite wheels on the bolts.



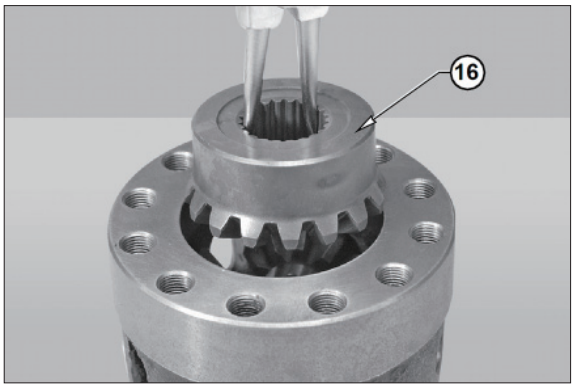
55W9NAX582

⑦ Lubricate wheel (16).



55W9NAX583

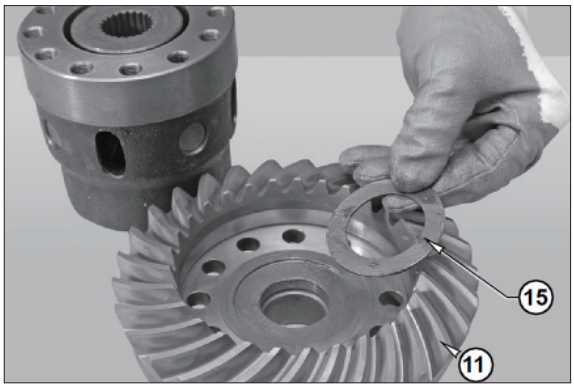
⑧ Insert planetary gear wheel (16).



55W9NAX584

⑨ Position the shim washer (15) on the crown (11).

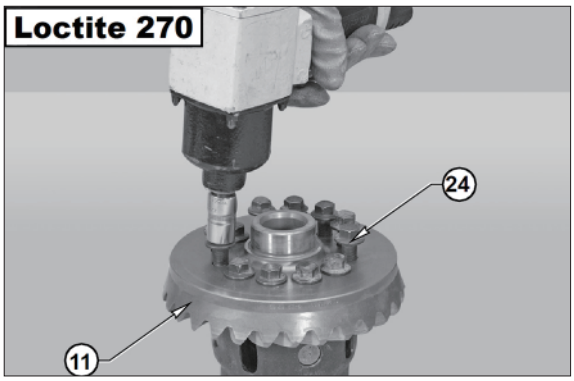
※ In order to hold the shim washer (15) in position, apply grease to it.



55W9NAX585

⑩ Position the crown (11) on the differential carrier and lock it with screws (24) applied with loctite 270.

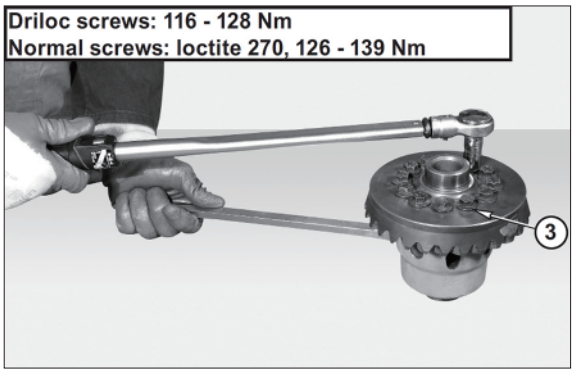
※ Secure the screws using the cross-tightening method.



55W9NAX586

⑪ Tighten screws with a torque wrench: see table.

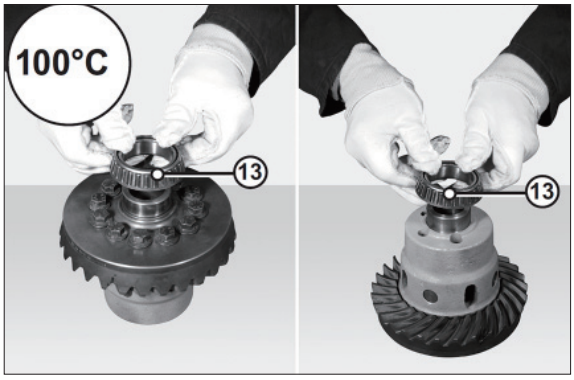
※ Always use new screws to fix the crown wheel. In case the screws are not thread locking pretreated, use loctite 270.



55W9NAX587

⑫ Assemble the bearing (13).

※ Heat the bearing to 100˚C before assembling.



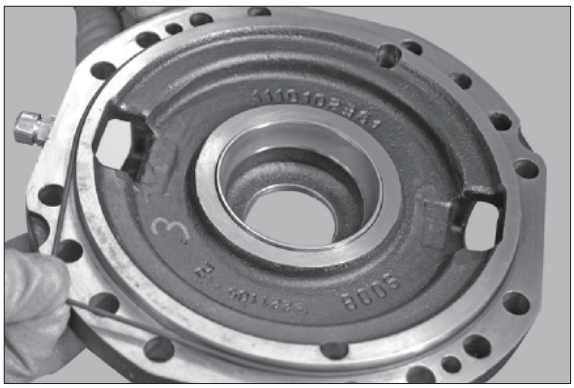
55W9NAX588

⑬ If the bearings are replaced, insert the external thrust blocks in the middle cover and in the central body.

55W9NAX589

⑭ Position the differential unit in the central body with the help of a bar and fit the middle cover.

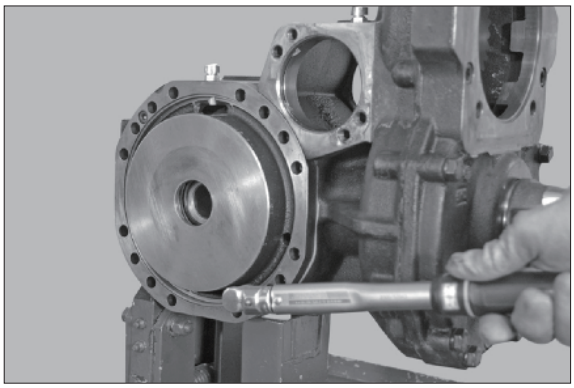
※ Thoroughly check the state of the O-ring and make sure that the cover is fitted with the oil discharge in the lower position.



55W9NAX590

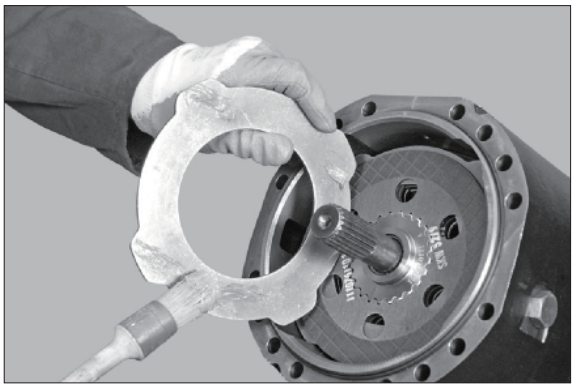
⑮ Lock the middle cover with screws.

· Torque wrench setting for screw :
2.47~2.67 kgf · m (17.9~19.3 lbf · ft)



55W9NAX591

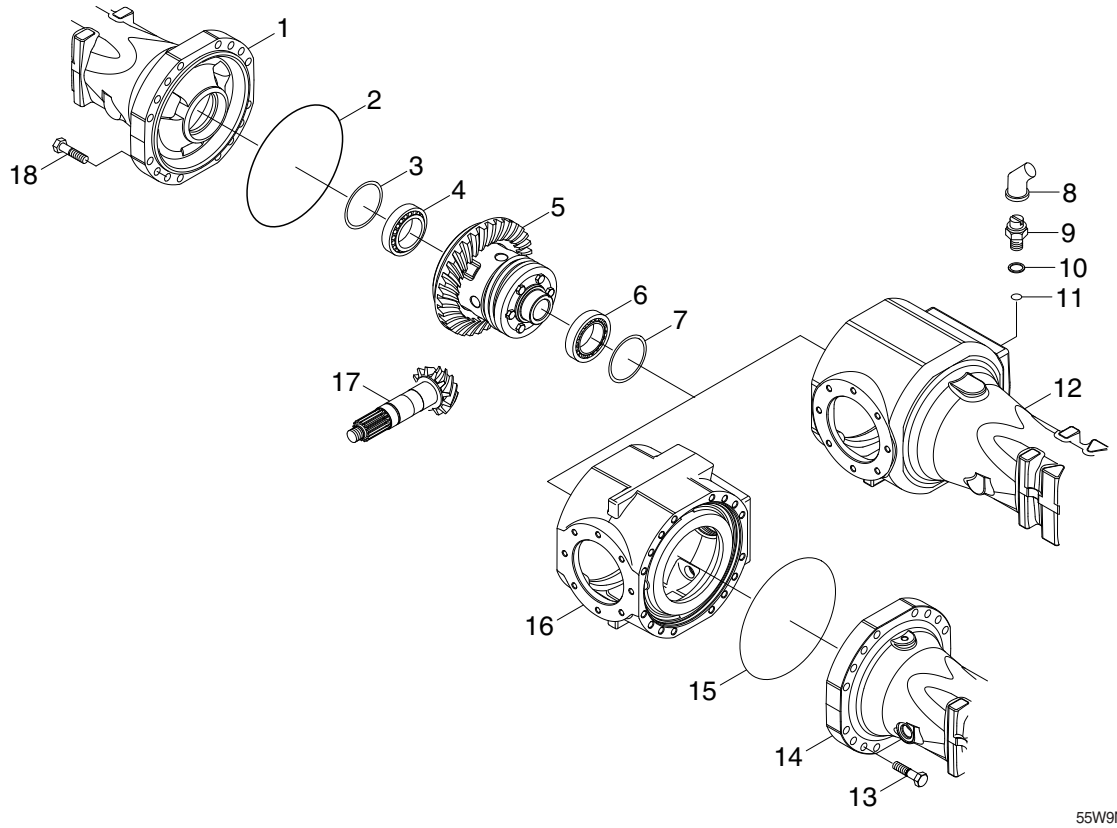
⑯ Check that the positioning of the sealing ring on the arm is intact; install the complete arm. Lock it into position using two facing screws and washers.



55W9NAX592

4) RING AND PINION ADJUSTING

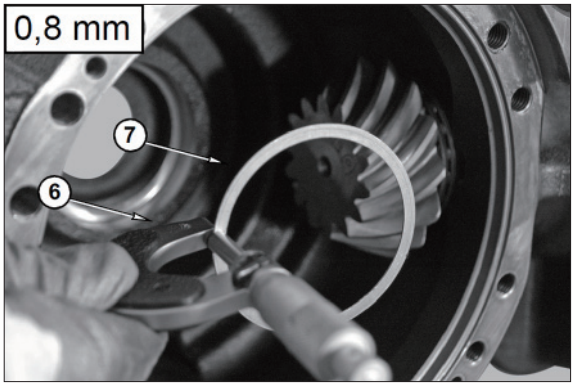
(1) Assembly diagram



55W9NAX593

(2) Adjusting

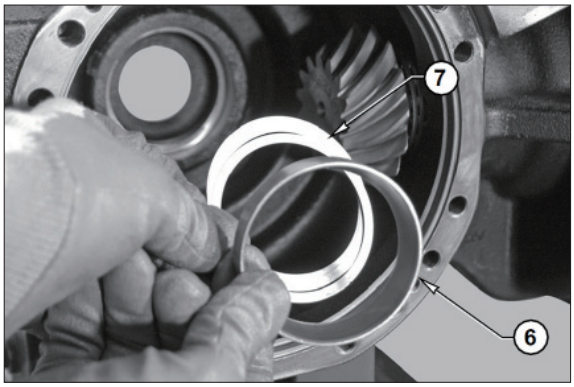
① **Setting of the crown wheel and pinion**
Insert the thrust block of the bearing (6) opposit side of the crown wheel shims (Sb) (7) of an initial thickness of about 0.8 mm.



55W9NAX595

② Insert the thrust block (6) and the shims (Sb) (7) into the arm.

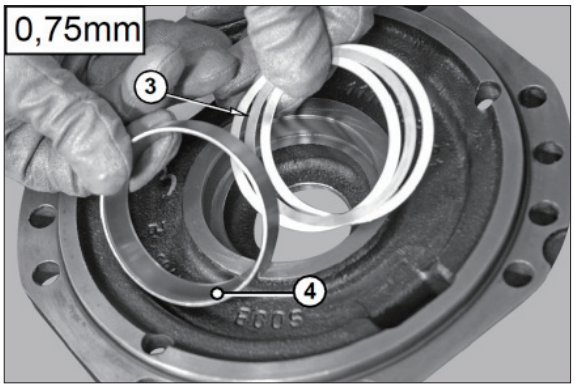
※ Check to be at end of stroke.



55W9NAX596

③ **Setting of the crown wheel and pinion**
Insert thrust block (4) of the bearing shims (Sc) (3) of an initial thickness of about 0.75 ㎜.
Insert the thrust block and the shims into the arm.

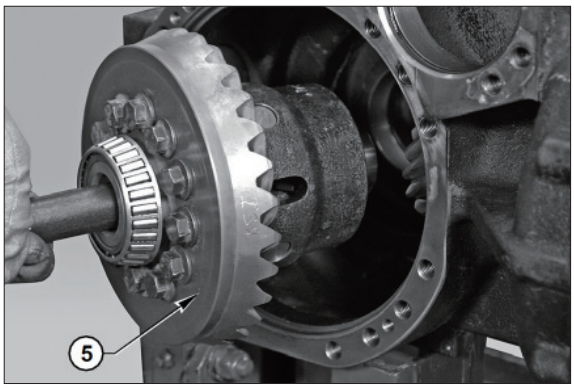
※ Check to be at end of stroke.



55W9NAX597

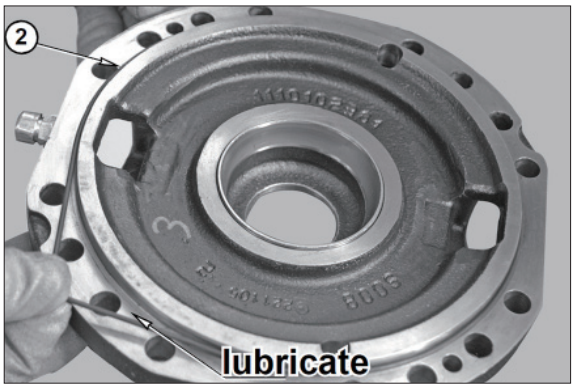
④ Insert complete differential (5).

※ Do not damage the seat of the O-ring with the gearwheel.



55W9NAX598

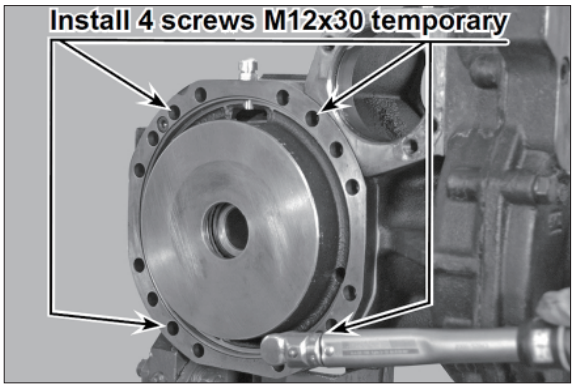
⑤ Check the O-ring (2) and grease.



55W9NAX599

⑥ Lock the middle cover (5) with screws (4).

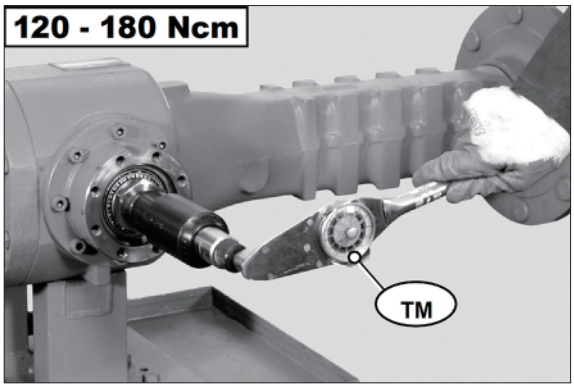
· Torque wrench setting for screw :
2.47~2.67 kgf · m (17.9~19.3 lbf · ft)



55W9NAX600

⑦ Apply torque meter TM to pinion nut and check that torque will increase by 0.04~0.06 kgf · m as a result of differential bearing preload.

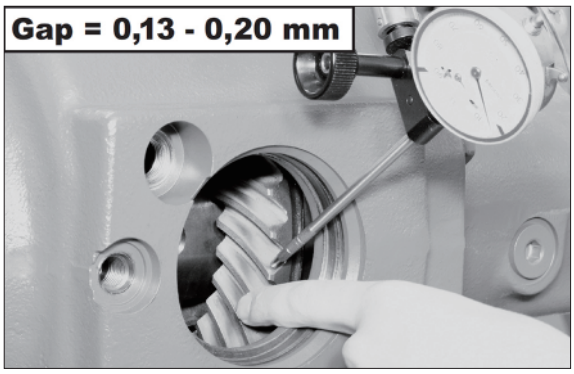
· Example : pinion torque :
0.08~0.12 kgf · m (0.58~0.87 lbf · ft)
· Pinion + differential torque :
0.12~0.18 kgf · m (0.87~1.3 lbf · ft)



55W9NAX601

⑧ Position comparator on the center of one of the crown teeth, preset it to 1 mm and reset it to zero.
Manually move the crown in both directions to check the existing clearance between pinion and crown.

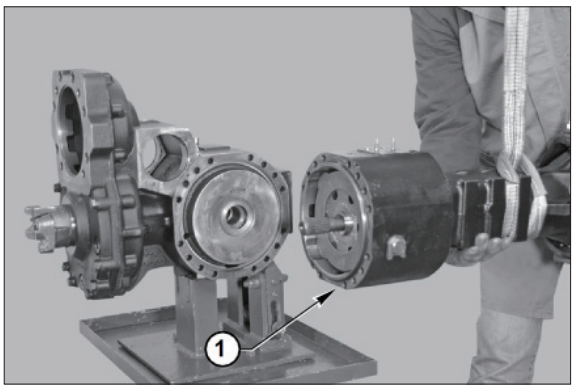
· Gap = 0.13~0.20 mm



55W9NAX602

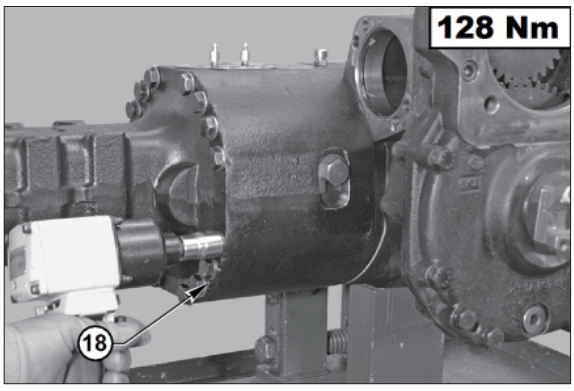
⑨ Install the crown wheel side arm (1) without half-axle.

※ To check the torque of the differential, neither of both halfaxles must be installed.



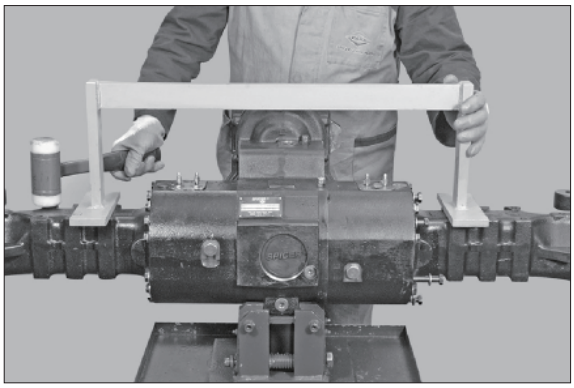
55W9NAX603

⑩ Temporarily insert all screws of the arm (18).



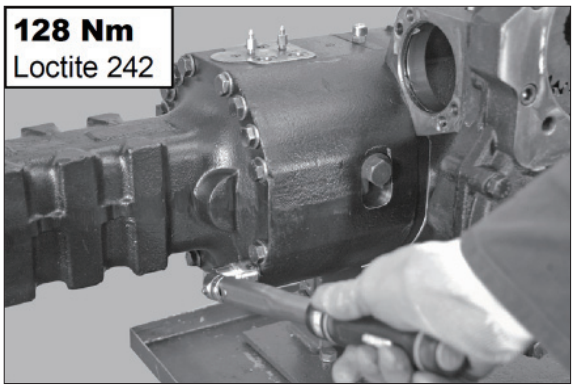
55W9NAX604

⑪ Check the flatness of the arms; then lock the arms into their final position, using screws adequately coated with loctite 242.



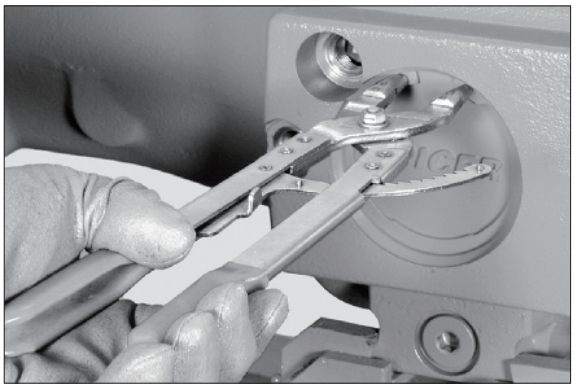
55W9NAX605

⑫ Torque wrench setting : 13.1 kgf · m
(94.4 lbf · ft)
Tighten using the criss-cross method.



55W9NAX606

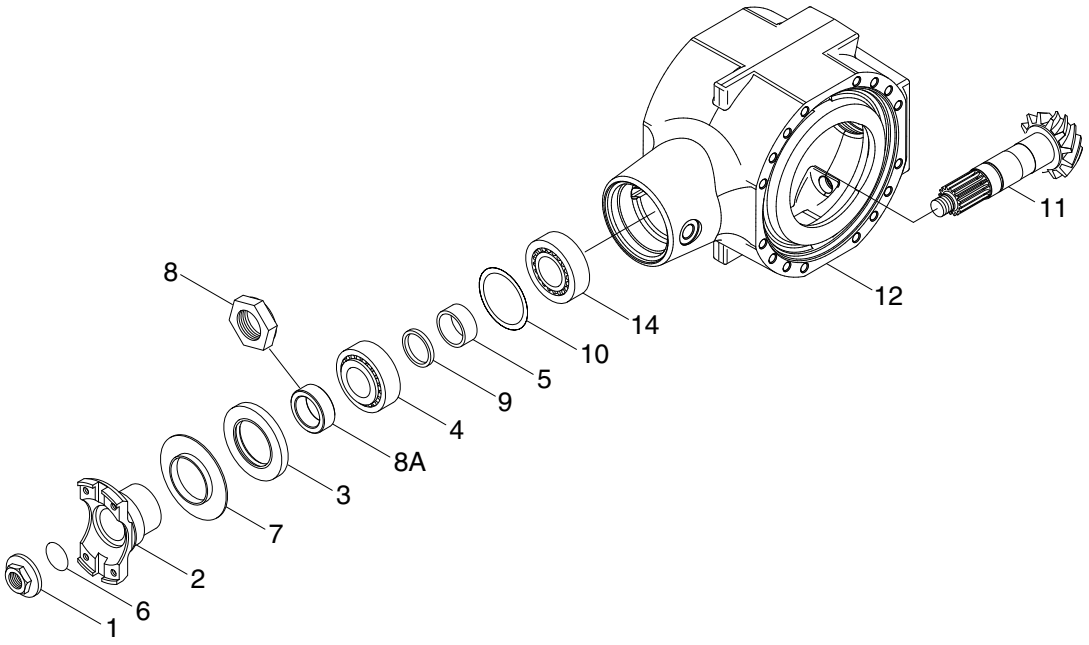
⑬ Using a driver, fit the cap and position it in its seat with the snap ring.



55W9NAX607

5) BEVEL PINION

(1) Assembly diagram

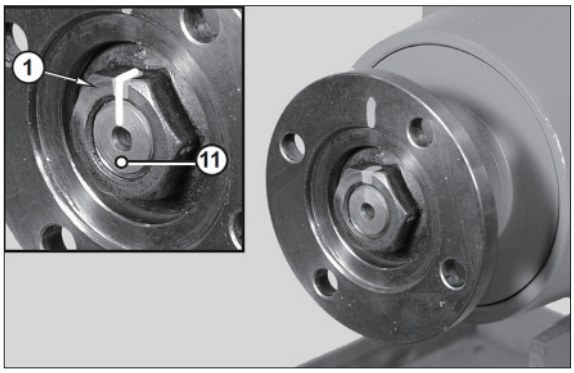


55W9NAX637

(2) Disassembly

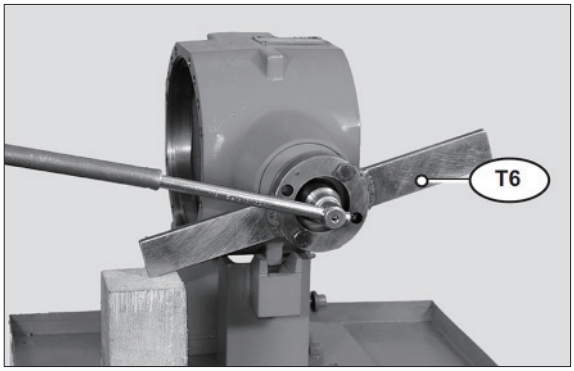
① Make positional marks across nut (1) and pinion (11) tang; If disassembly is awkward, heat the check nut (1) of the flange (2) at 80˚C.

※ Heating is meant to unloose the setting of loctite on the nut (1).



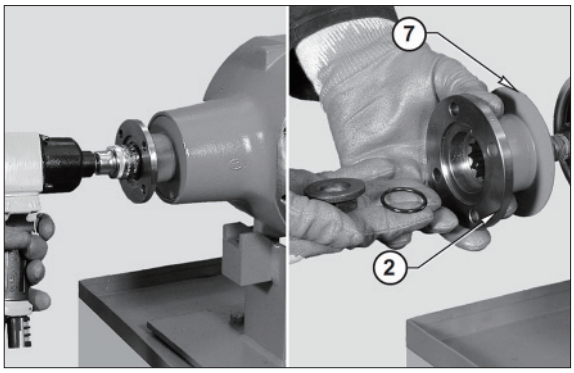
55W9NAX638

② Position tool T6, so as to avoid pinion rotation.
Unloose and remove the nut (1); also remove the O-ring (6).



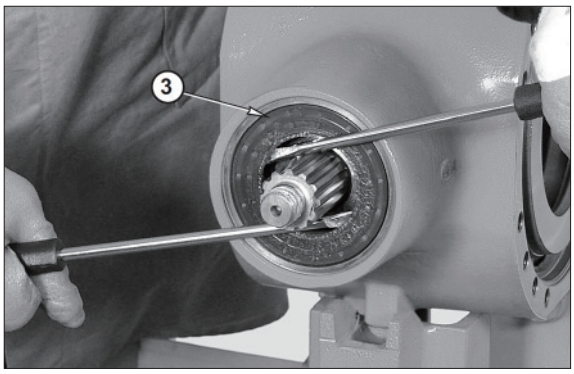
55W9NAX639

③ Remove the flange (2) complete with guard (7) by means of a puller.



55W9NAX640

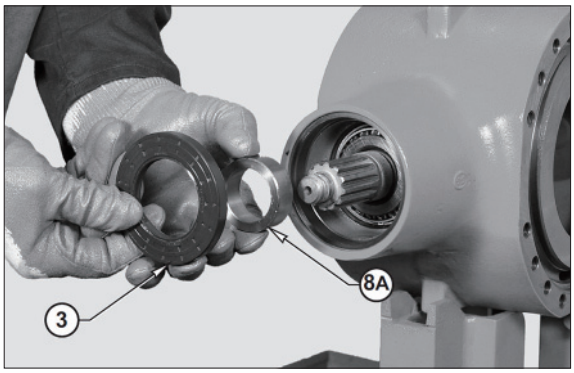
④ Remove the sealing ring (3).



55W9NAX641

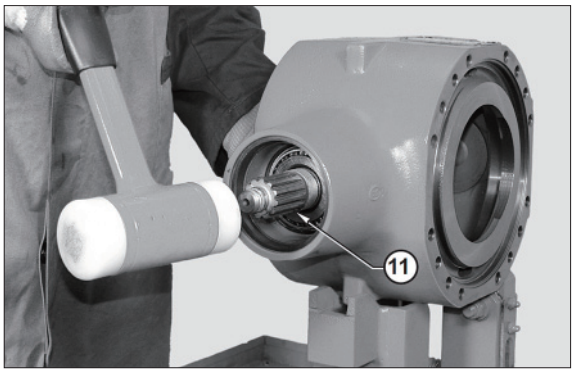
⑤ Remove the sealing ring (3) and spacer (8A).

※ Sealing rings (3) must be replaced each time the unit is disassembled.



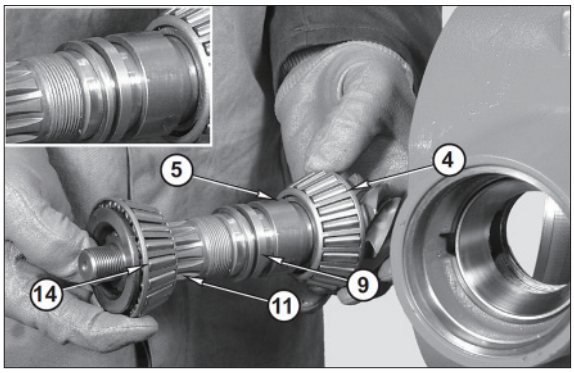
55W9NAX642

⑥ Remove the pinion (11), shims and distance piece.



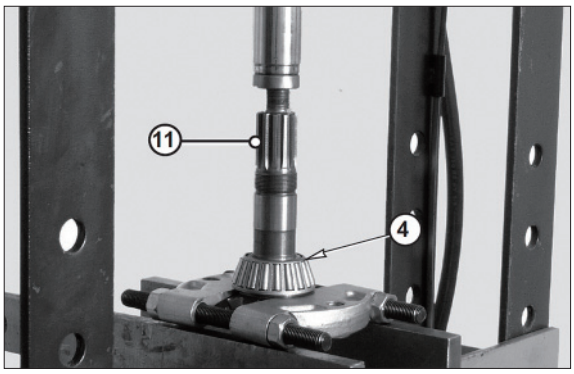
55W9NAX643

⑦ Refer and keep to the positions marked during disassembly.



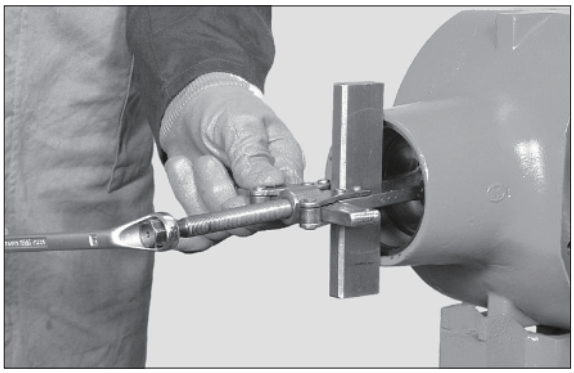
55W9NAX644

⑧ Using a puller and a press, remove the inner bearing (4) from the pinion (11).



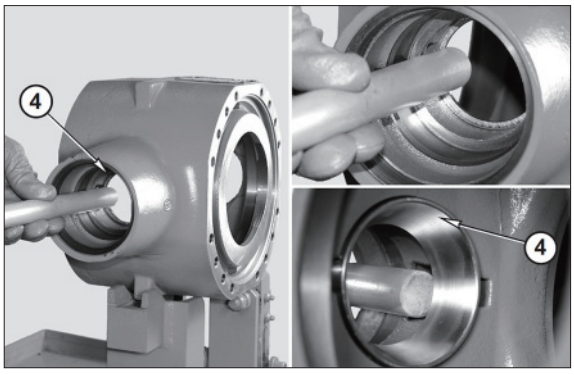
55W9NAX645

⑨ Remove the thrust block of the external bearing (14).



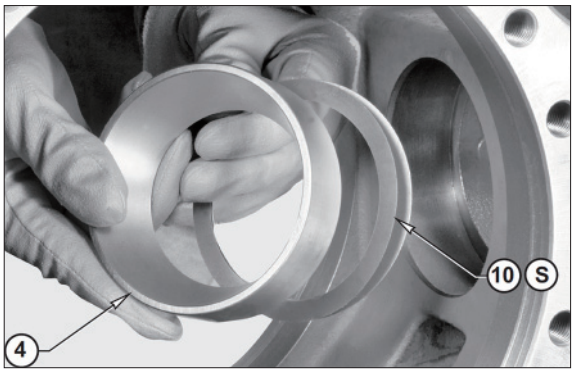
55W9NAX646

⑩ Insert a drift in the appropriate holes.



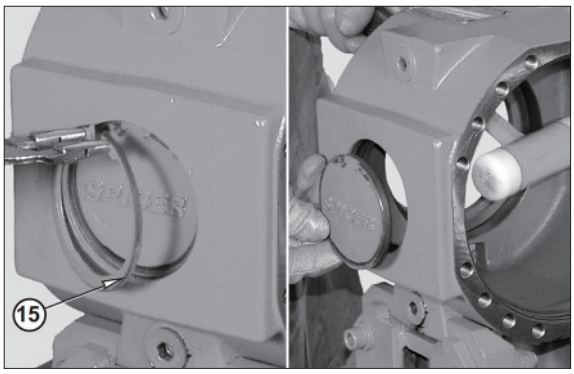
55W9NAX647

⑪ Remove the thrust block of the internal bearing (4) as well as the shim washers (10) (S).



55W9NAX648

⑫ Remove the snap ring (15). Remove the cap (14).

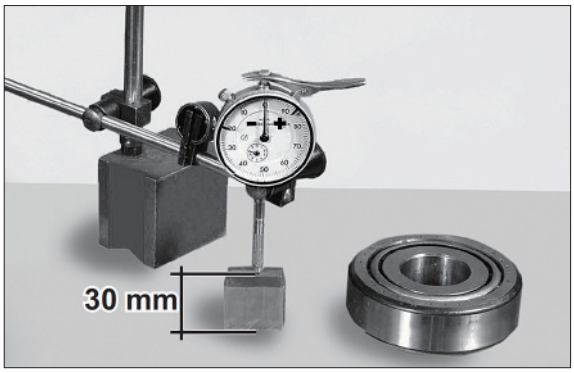


55W9NAX649

(3) Assembly

① **Calculating pinion center distance**

Using a faceplate, reset a centesimal comparator “DG” on a calibrated block (whose known thickness is 30 mm).
Preload the comparator by about 3 mm.

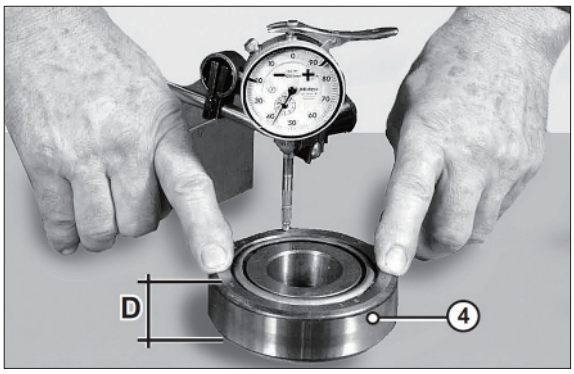


55W9NAX650

② Bring inner bearing (4), complete with thrust block, under comparator “DG”.

※ Press the thrust block centrally and carry out several measurements by rotating the thrust block.

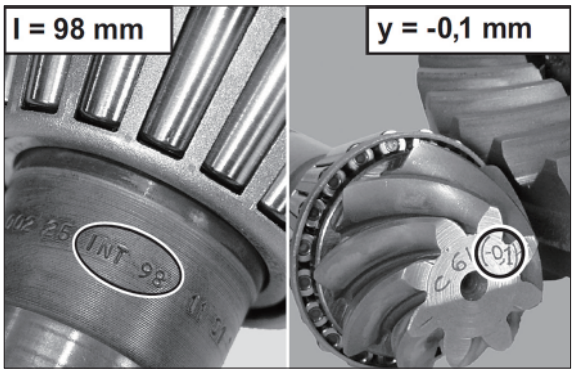
· Example : 30 - 0.55 = 29.45 = “D”



55W9NAX651

③ Check nominal dimension “I” as marked on the pinion. Add up to or subtract from “I” the variation indicated as “Y” to obtain the actual center distance “I”.

· Example : I=INT ± Y=98-0.1=97.9 mm



55W9NAX652

④ Calculate shims “S” for insertion under the thrust block of the inner bearing using the following formula :

S = X – (I + D) where :

X = Fixed dimension I = actual pinion center distance

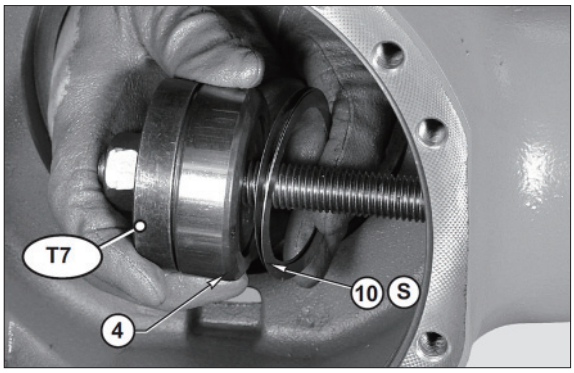
D = Total bearing thickness ;

Example :

S = 128 – (97.9 + 29.45) = 0.65 mm

55W9NAX653

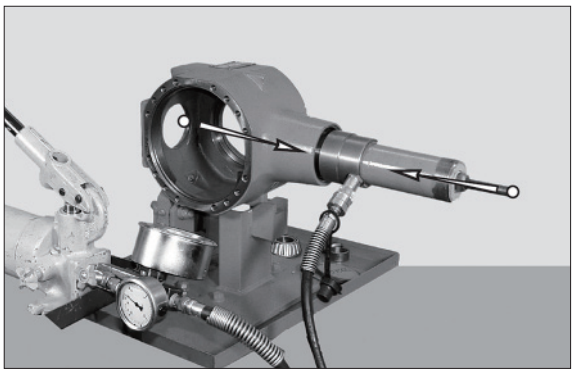
⑤ Using special tool T7.
Partially insert the thrust block of the bearings (4) and shims (10).



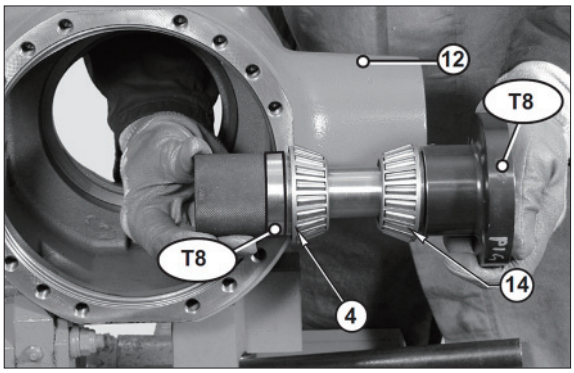
55W9NAX654

⑥ Connect the tension rod to the press and move the thrust block of bearings (4) (14) into the seats.
Disconnect the press and remove the tension rod.

※ Before starting the next stage, make sure that the thrust block has been completely inserted into its seat.

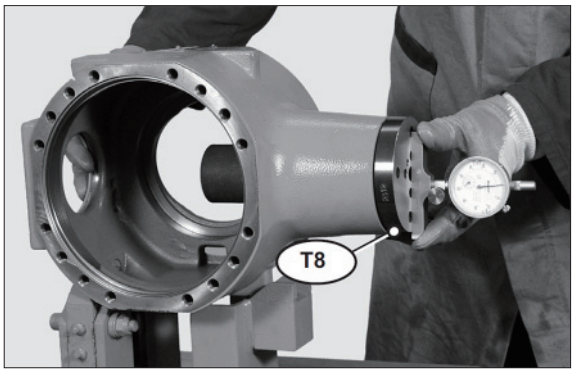

55W9NAX655

⑦ **Calculating pinion bearings rolling torque**
Introduce tool T8 complete with bearings (4) and (14) into the main body (12); tighten by hand until a rolling torque is definitely obtained.



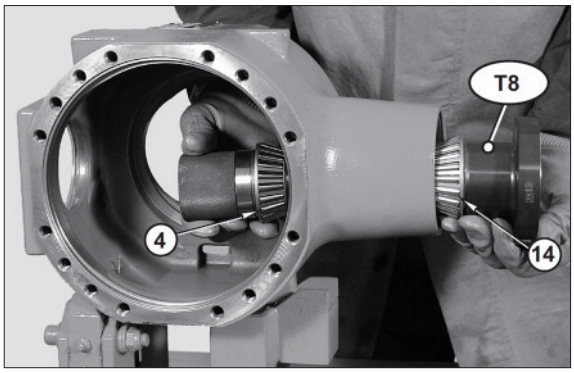
55W9NAX656

⑧ Introduce the tracer of a depth comparator “DDG” into either side hole of tool T8.
Reset the comparator with a preload of about 3 mm.



55W9NAX657

⑨ Remove the comparator and take out tool and bearing kits from the main body. Reinstall every part, also introducing a distance piece between bearings (4) and (14). Tighten the entire pack by hand.

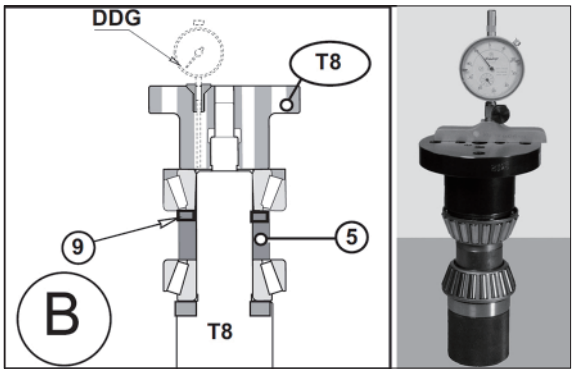


55W9NAX658

⑩ Assemble on top of the tool T8 and between the two bearings the shim (5) and the largest calibrated shim (9).

55W9NAX659

⑪ Measur the difference H using a dial gauge DDG.



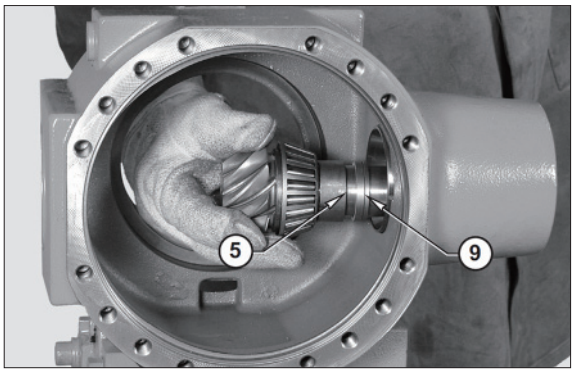
55W9NAX660

⑫ Calculate the shim S2 to be inserted.
E.g. S2 = H + X = 3.01 ㎜ where X = fixed value to obtain = 0.07~0.08 ㎜

55W9NAX661

⑬ Fit the pinion (11), shim “S1” (10) and distance piece (5), (9) in the main body (12).

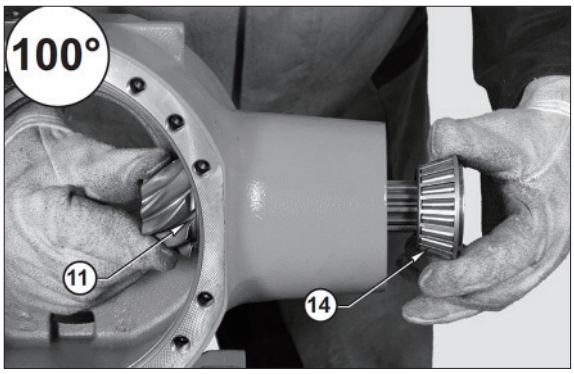
※ The finer shims must be placed in-between the thicker ones.



55W9NAX662

⑭ Heat the external bearing (14) to a temperature of about 100˚C and fit it on to the pinion (11) so as to complete the pack as shown in the figure.

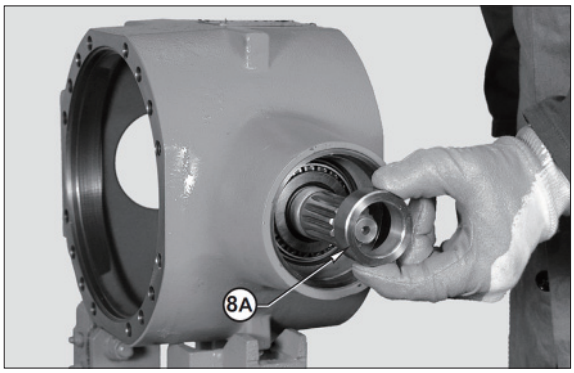
※ Lightly lubricate bearing with SAE85W90 oil.



55W9NAX663

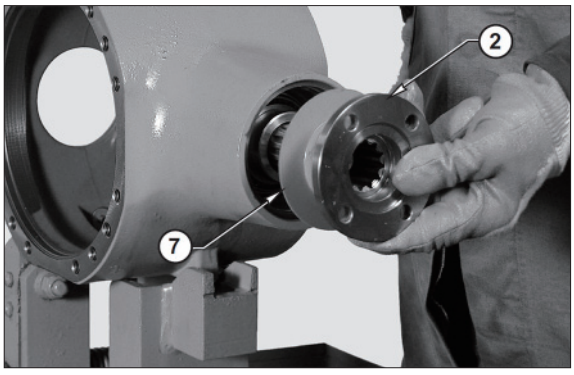
⑮ Insert the spacer (8A).

※ Check the using of the friction washers.



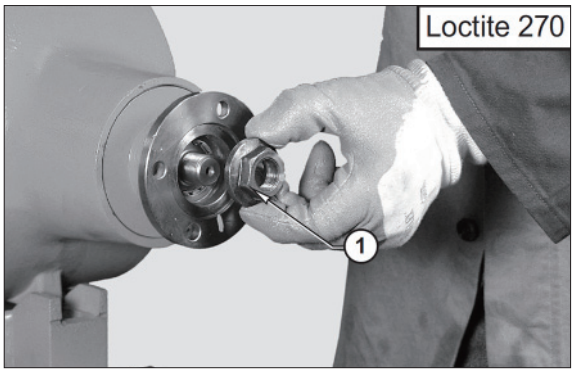
55W9NAX664

⑯ Install the flange (2) onto the pinion (11) without sealing ring.



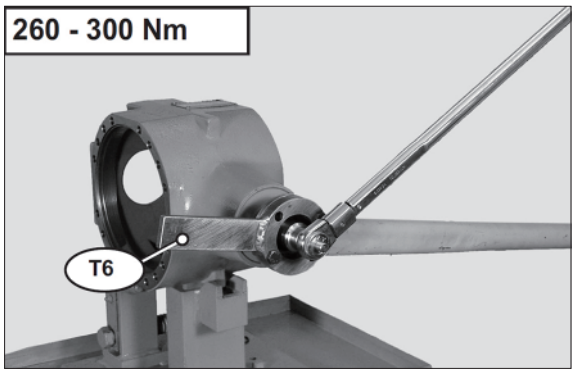
55W9NAX665

⑰ Install the nut (1) without loctite 270.



55W9NAX666

⑱ Lock the wrench T6, rotate the pinion using a dynamometric wrench, up to a minimum required torque setting of 26.5~30.6 kgf · m (192~221 lbf · ft).



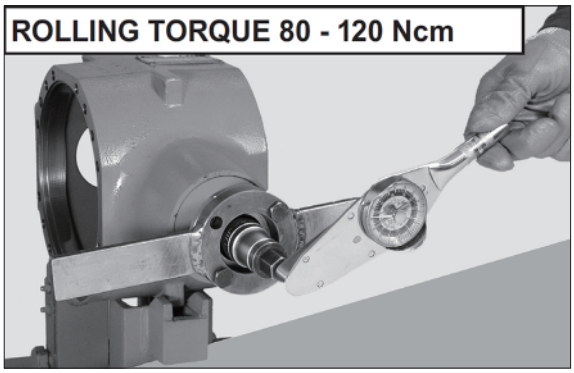
55W9NAX667

⑲ Apply onto the pinion (1) the bar-hold and with the help of a torque meter, check the torque of the pinion (1).

· Torque : 0.08~0.12 kgf · m
(0.58~0.87 lbf · ft)

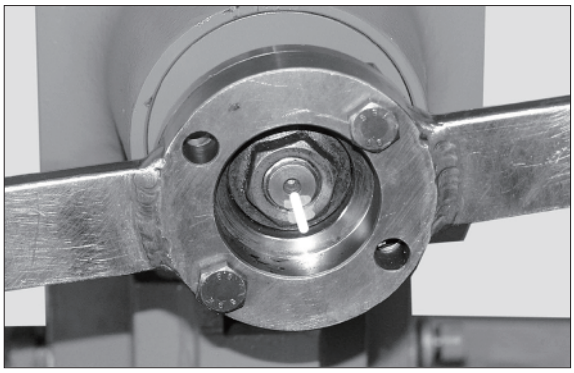
※ If torque exceeds the maximum value, then the size of shim “S1” (4) between the bearing (9) and the distance piece (3) needs to be increased. If torque does not reach the set value, increase the torque setting of the ring nut (10) in different stages to obtain a maximum value of 51 kgf · m (369 lbf · ft).

※ If torque does not reach the minimum value, then the size of shim “S1” (4) needs to be reduced. When calculating the increase or decrease in size of shim “S1”, bear in mind that a variation of shim of 0.01 mm corresponds to a variation of 0.06 kgf · m (0.44 lbf · ft) in the torque of the pinion (1).



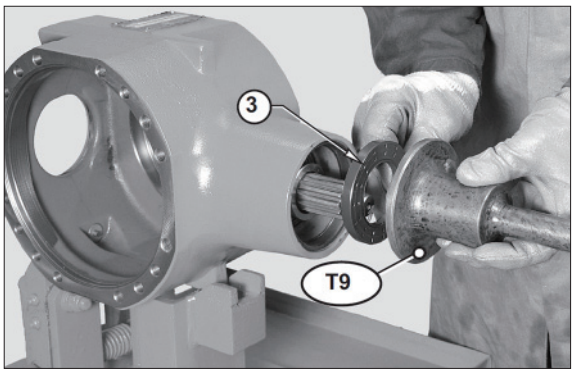
55W9NAX668

⑳ Make positional marks across nut (1) and pinion (11) tang; then remove nut and flange (2).



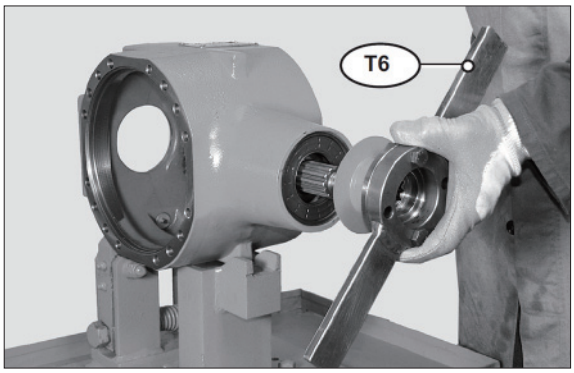
55W9NAX669

㉑ Apply Arexons rubber cement to the outer surface of the new seal ring (3) and fit ring in the main body (12) using driver T9.



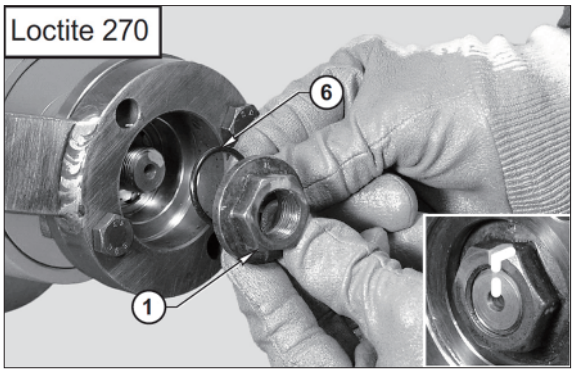
55W9NAX670

㉒ Oil seal ring lips and install flange (2). Mount O-ring (6) and apply loctite 270 to pinion tang; tighten nut (1).



55W9NAX671

㉓ Tighten the nut until the match marks made at stage “a” line up.

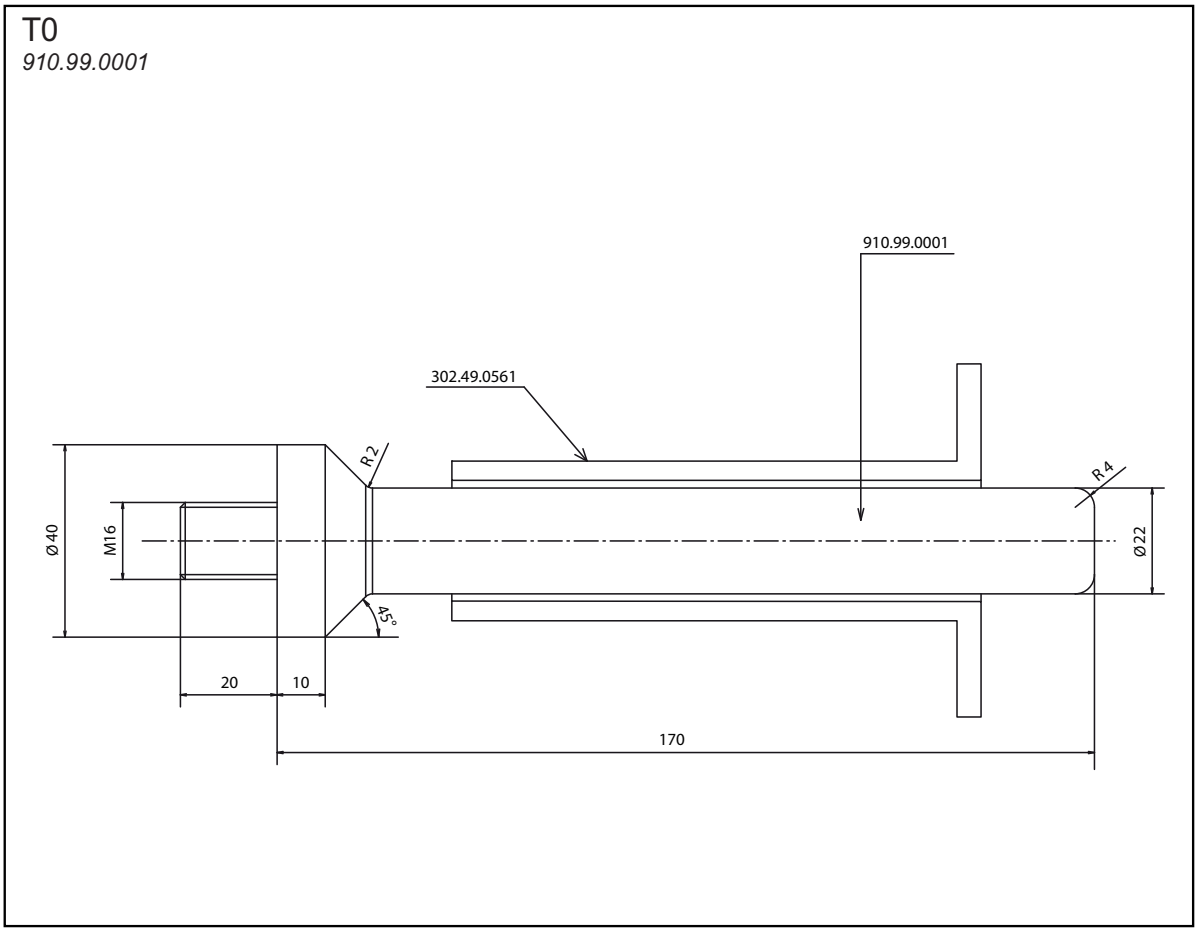


55W9NAX672

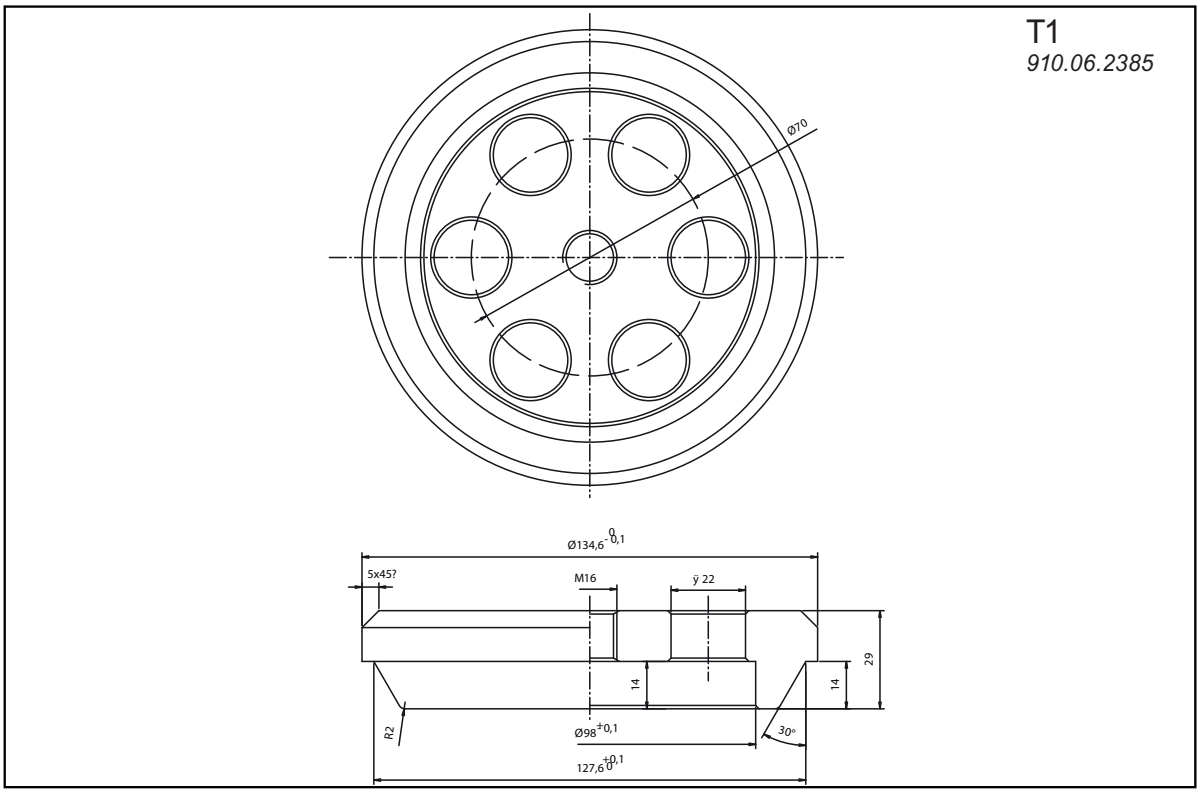
6) SPECIAL TOOLS

T0

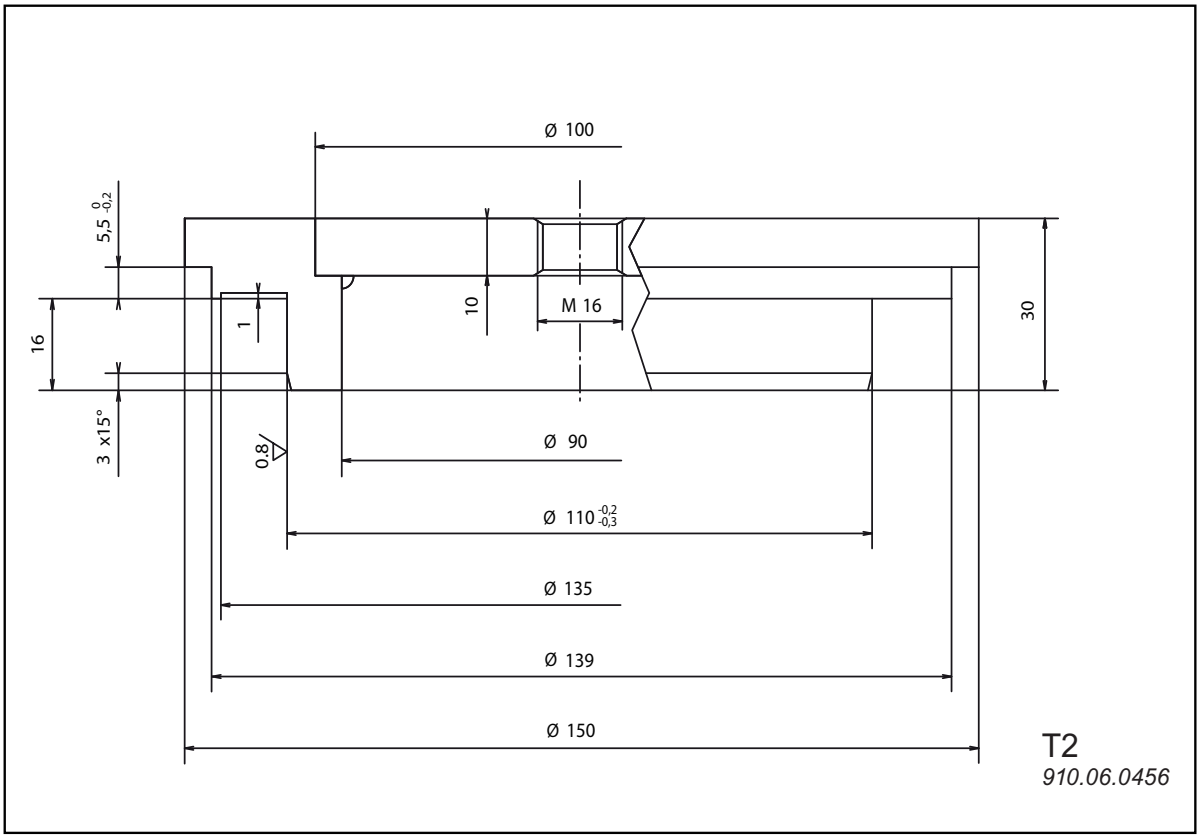
910.99.0001



55W9NAX673



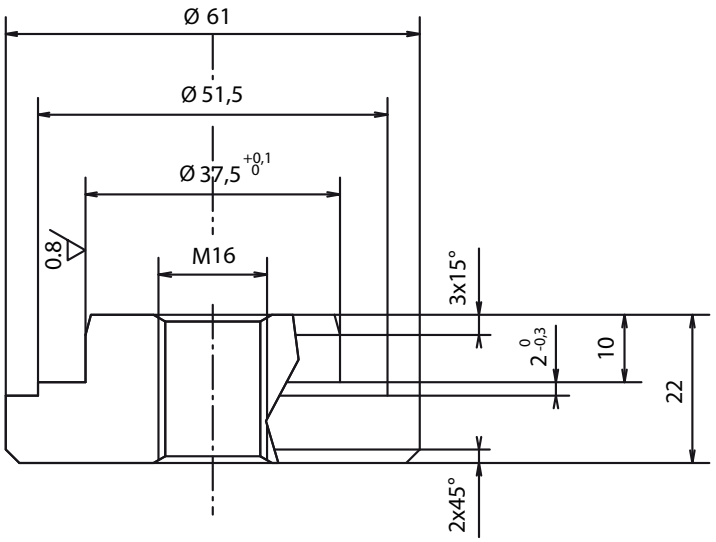
55W9NAX674-1



55W9NAX674-2

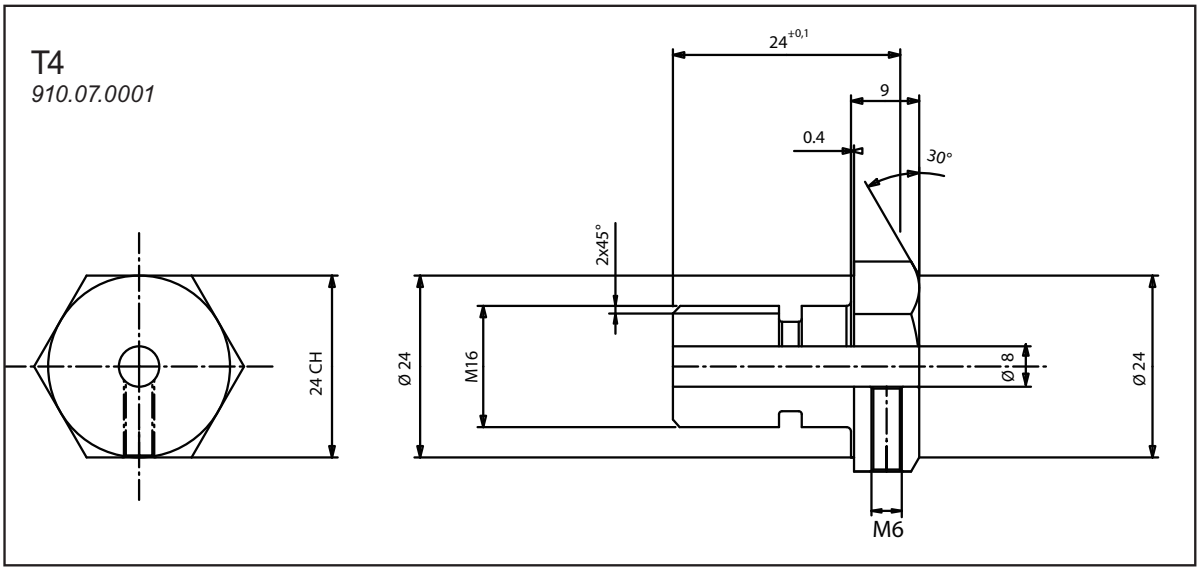
T3

910.06.4088



T4

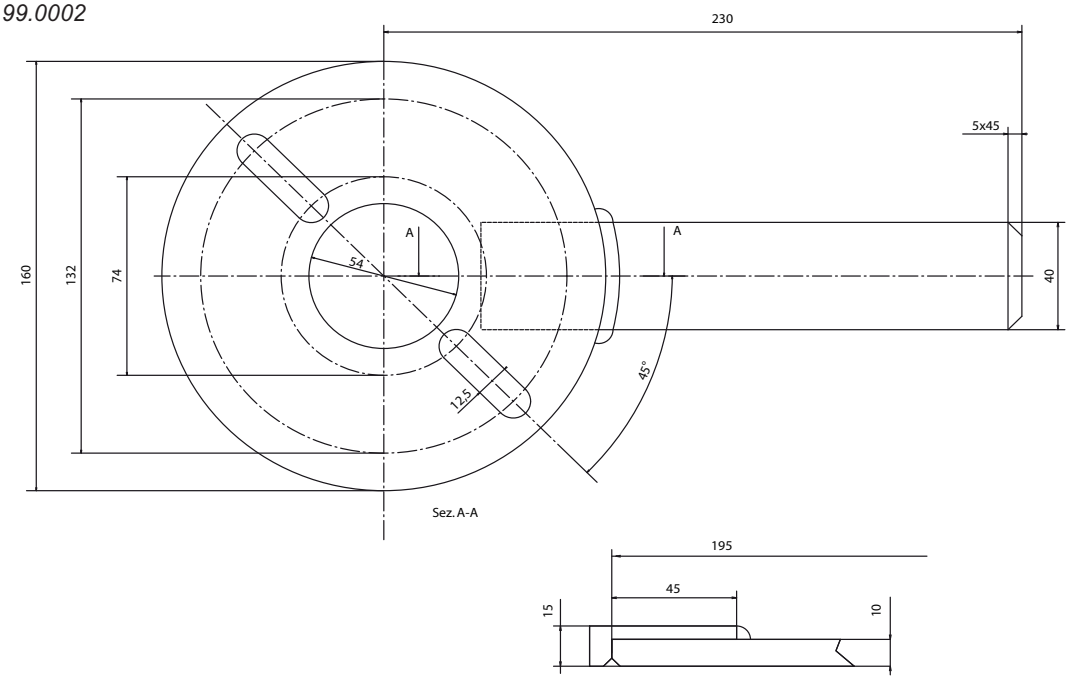
910.07.0001



55W9NAX675

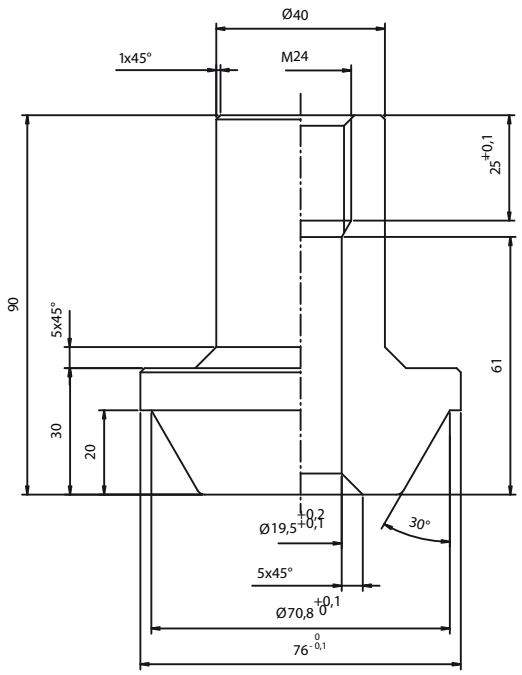
T6

910.99.0002



T7

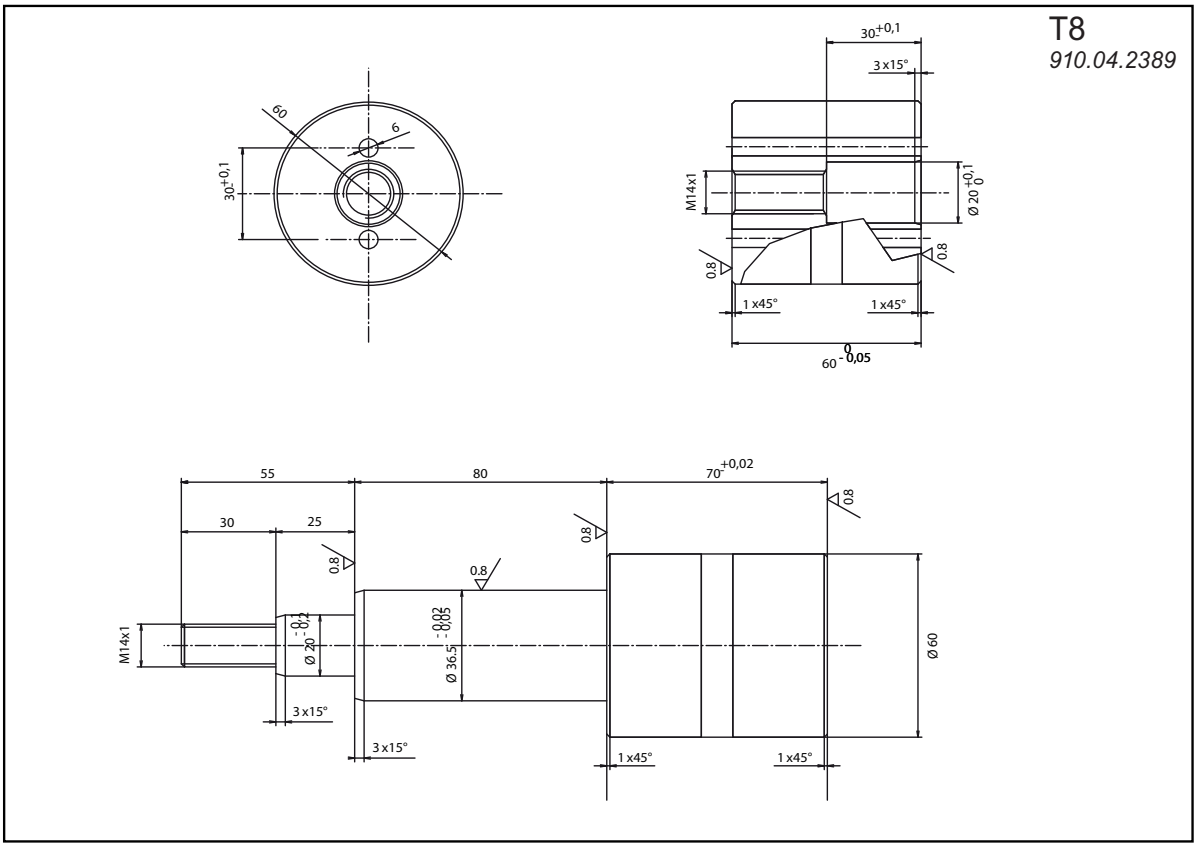
910.06.4069



55W9NAX676

T8

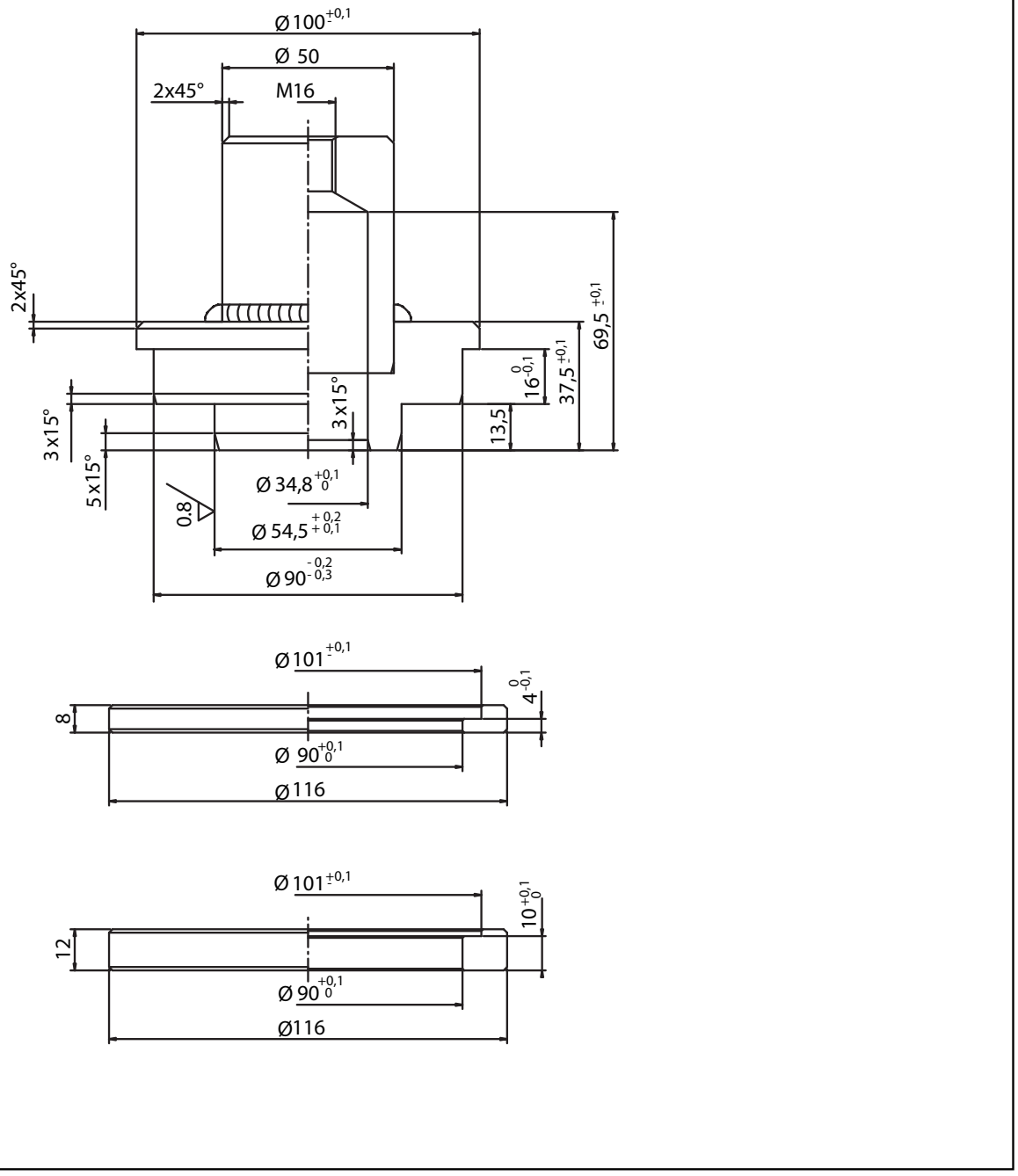
910.04.2389



55W9NAX677

T9

910.04.4214



55W9NAX678

GROUP 10 RCV LEVER

1. REMOVAL AND INSTALL

1) REMOVAL

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

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

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

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

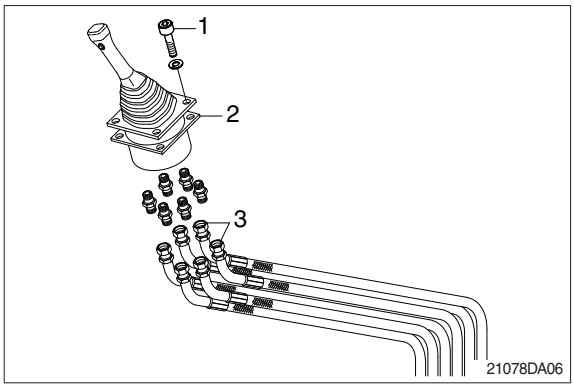
(4) Loosen the socket bolt (1).

(5) Remove the cover of the console box.

(6) Disconnect pilot line hoses (3).

(7) Remove the pilot valve assembly (2).

※ When removing the pilot valve assembly, check that all the hoses have been disconnected.



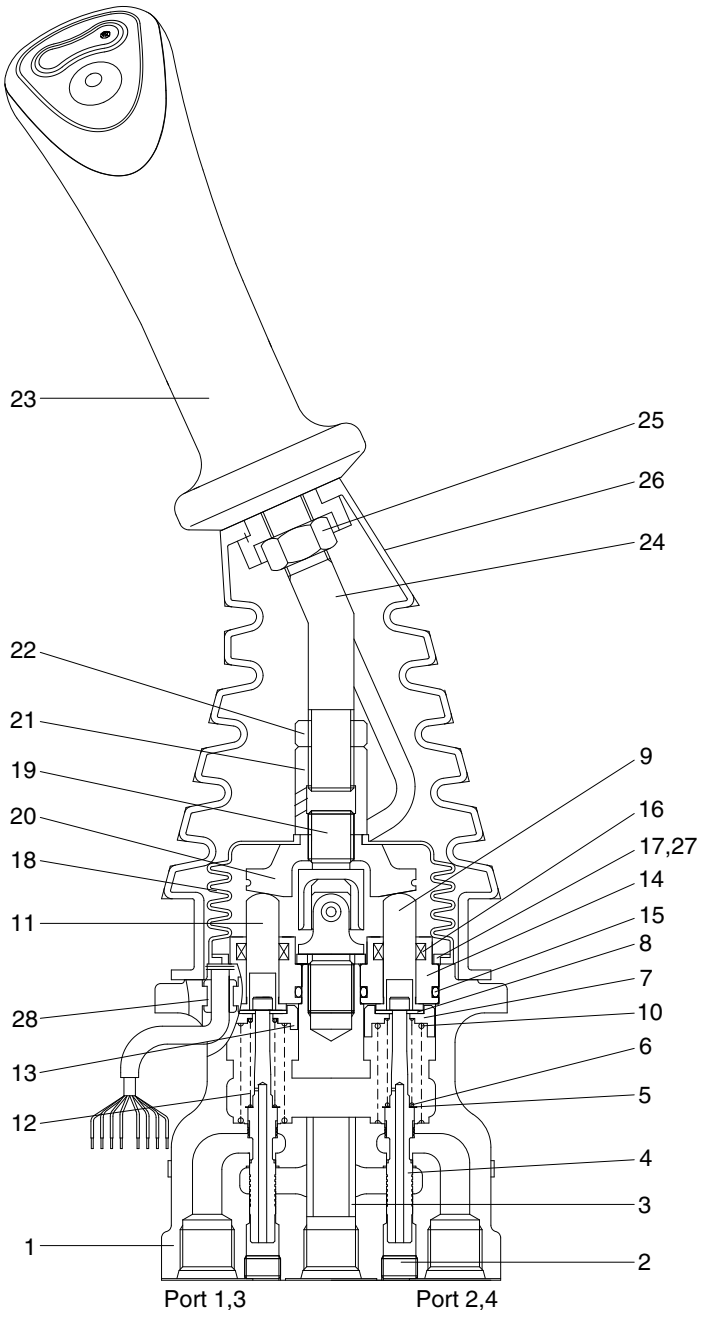
2) INSTALL

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

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

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



32092RL01

1	Case	11	Push rod	21	Adjusting nut
2	Plug	12	Spring	22	Lock nut
3	Bushing	13	Spring seat	23	Handle
4	Spool	14	Plug	24	Handle bar
5	Shim	15	O-ring	25	Nut
6	Spring	16	Rod seal	26	Boot
7	Spring seat	17	Plate	27	Spring pin
8	Stopper	18	Boot	28	Bushing
9	Push rod	19	Joint		
10	Spring	20	Swash plate		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Allen wrench	6	B 
Spanner	22	
	27	
(+) Driver	Length 150	
(-) Driver	Width 4~5	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Plug	2	PT 1/8	3.0	21.7
Joint	18	M14	3.5	25.3
Swash plate	19	M14	5.0±0.35	36.2±2.5
Adjusting nut	20	M14	5.0±0.35	36.2±2.5
Lock nut	21	M14	5.0±0.35	36.2±2.5

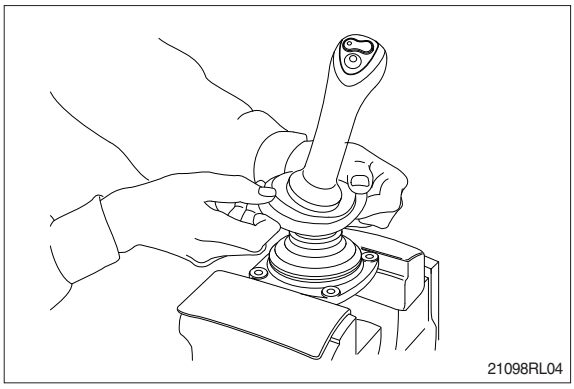
3) DISASSEMBLY

(1) Clean pilot valve with kerosene.

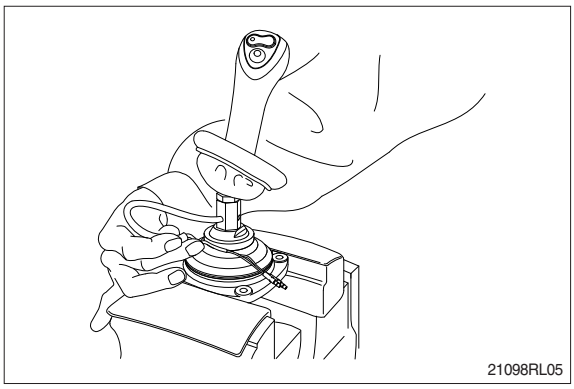
※ Put blind plugs into all ports

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

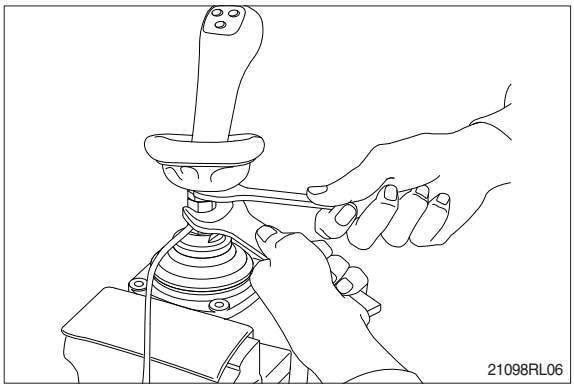
(3) Remove end of boot (26) from case (1) and take it out upwards.



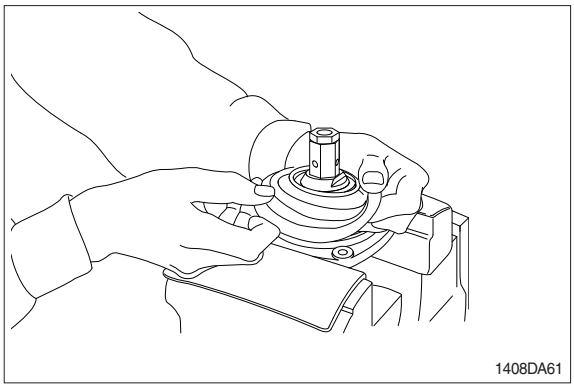
※ For valve with switch, remove cord also through hole of casing.



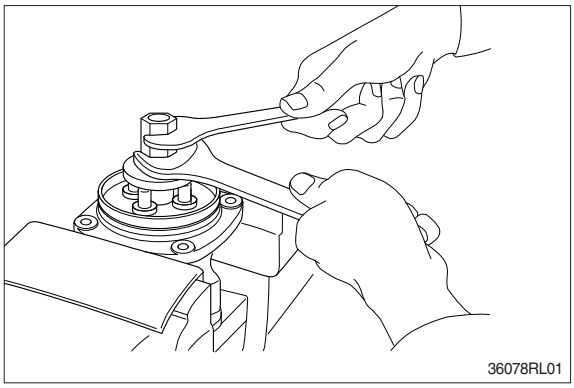
(4) Loosen lock nut (22) and adjusting nut (21) with spanners on them respectively, and take out handle section as one body.

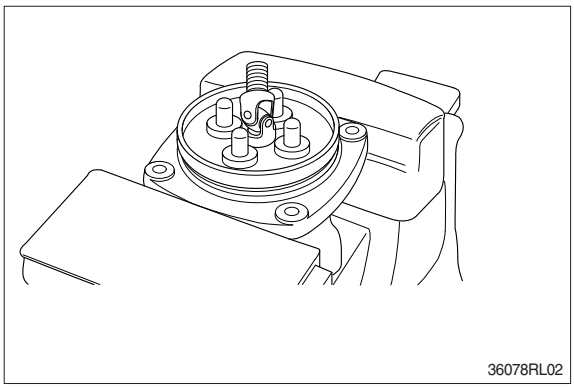


(5) Remove the boot (18).



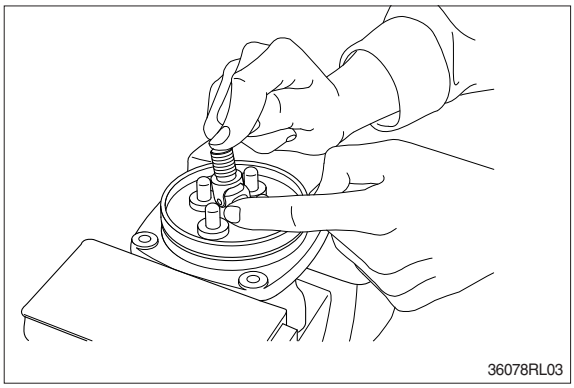
(6) Loosen adjusting nut (21) and plate (20) with spanners on them respectively, and remove them.

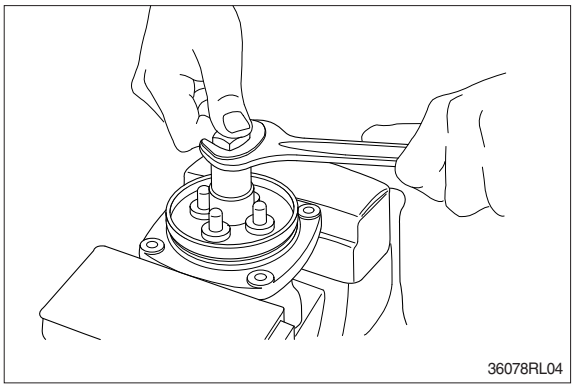




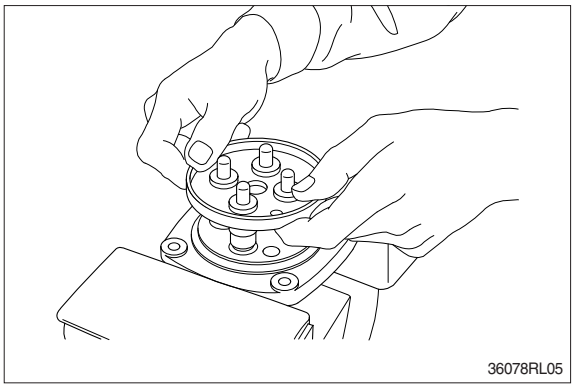
(7) Turn joint anticlockwise to loosen it, utilizing jig (special tool).

※ When return spring (10) is strong in force, plate (17), plug (14) and push rod (11) will come up on loosening joint.
Pay attention to this.





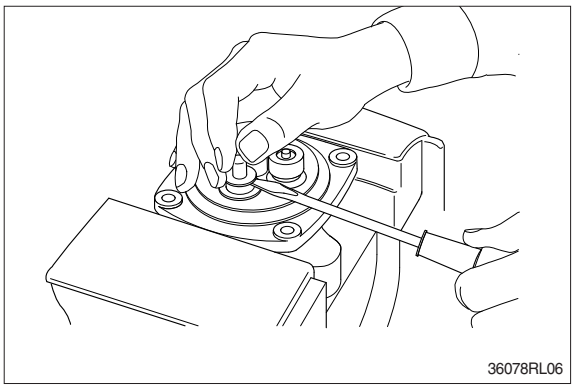
(8) Remove plate (17).



(9) When return spring (10) is weak in force, plug (14) stays in casing because of sliding resistance of O-ring.

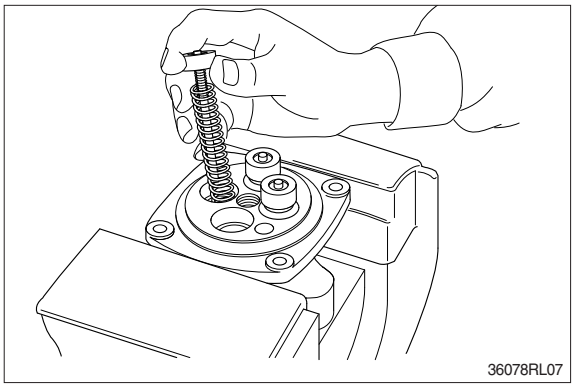
※ Take it out with minus screwdriver.
Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.

※ During taking out, plug may jump up due to return spring (10) force.
Pay attention to this.

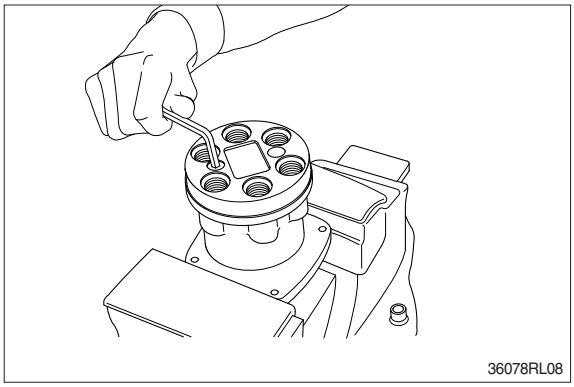


(10) Remove reducing valve subassembly and return spring (10) out of casing.

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



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

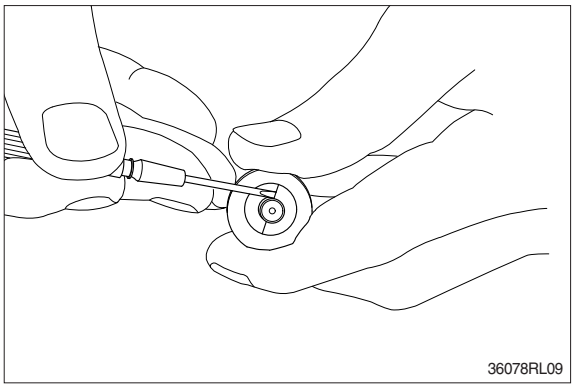


(12) For disassembling reducing valve section, stand it vertically with spool (4) bottom placed on flat workbench. Push down spring seat (7) and remove two pieces of semicircular stopper (8) with tip of small minus screwdriver.

※ Pay attention not to damage spool surface.

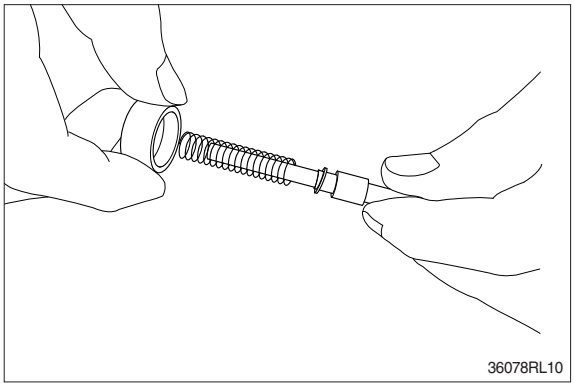
※ Record original position of spring seat (7).

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

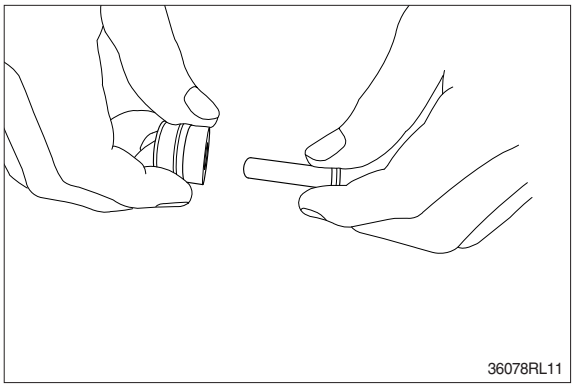


(13) Separate spool (4), spring seat (7), spring (6) and shim (5) individually.

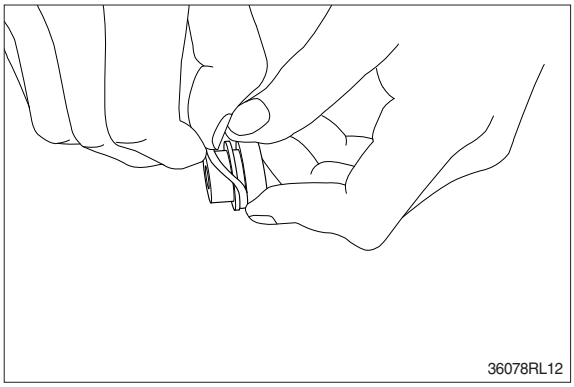
※ Until being assembled, they should be handled as one subassembly group.

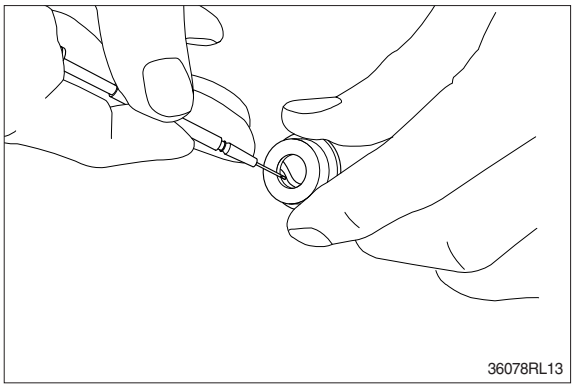


(14) Take push rod (14) out of plug (11).

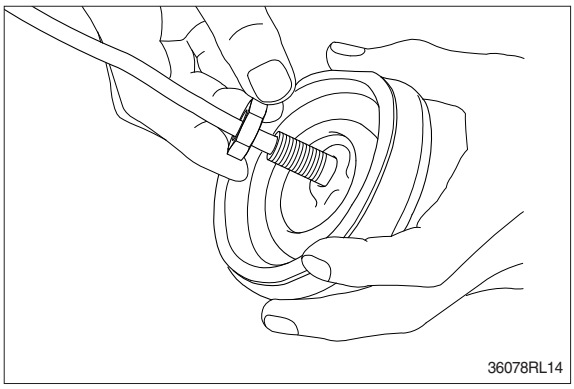


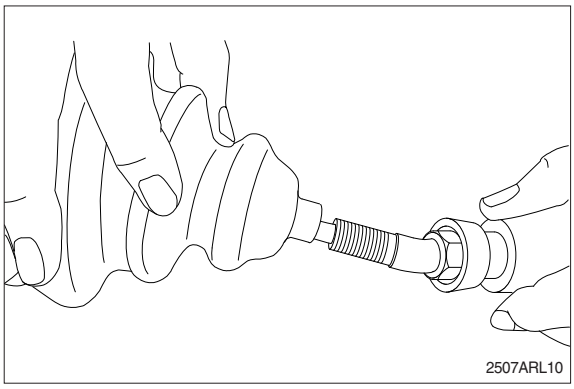
(15) Remove O-ring (15) and seal (16) from plug (14).
Use small minus screwdriver or so on to remove this seal.





(16) Remove lock nut (22) and then boot (26).





(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.

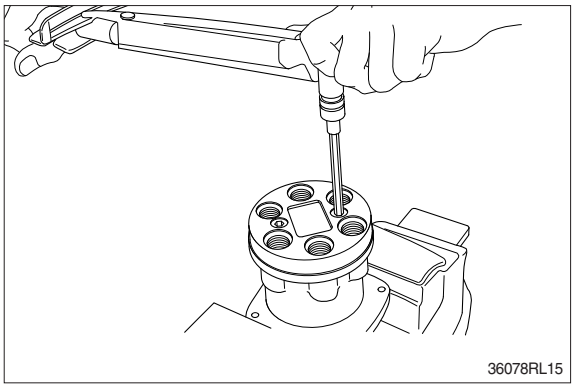
Apply rust-preventives to all parts.

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

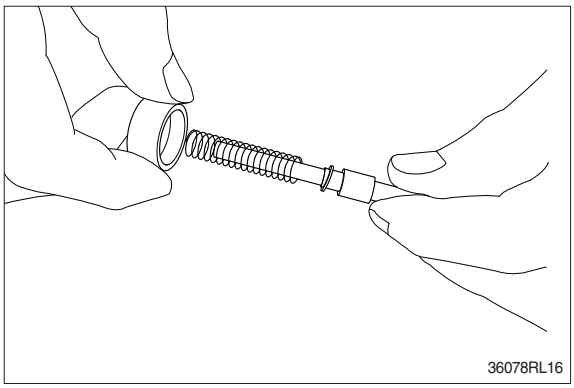
4) ASSEMBLY

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

※ Tighten two bolts alternately and slowly.

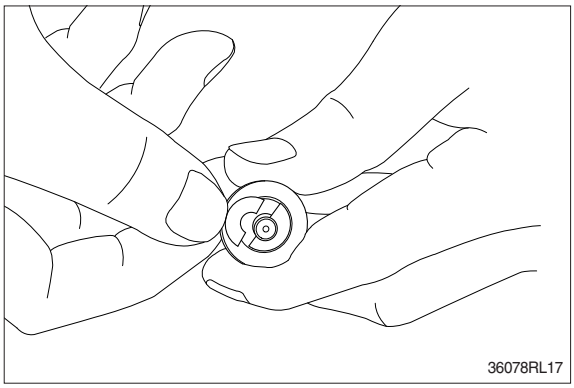


(2) Put shim (5), springs (6) and spring seat (7) onto spool (4) in this order.



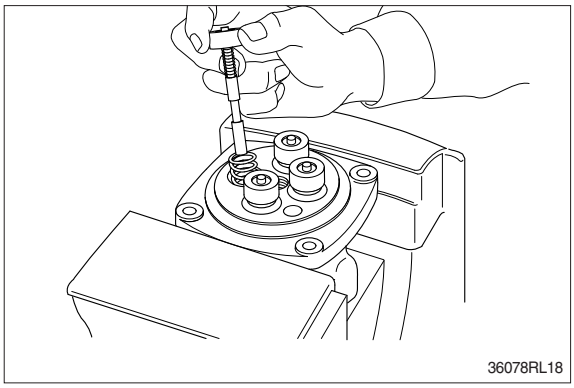
(3) Stand spool vertically with its bottom placed on flat workbench, and with spring seat pushed down, put two pieces of semicircular stopper (8) on spring seat without piling them on.

※ Assemble stopper (8) so that its sharp edge side will be caught by head of spool. Do not push down spring seat more than 6 mm.

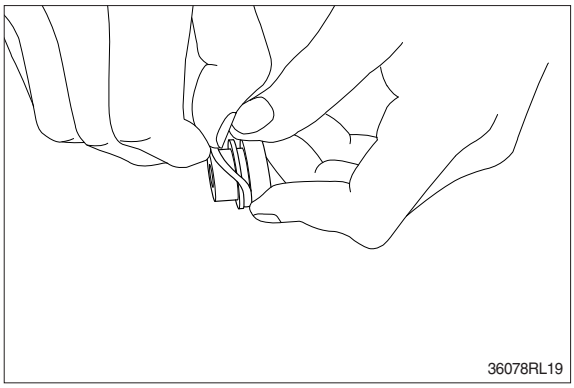


(4) Assemble spring (10) into casing (1). Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.

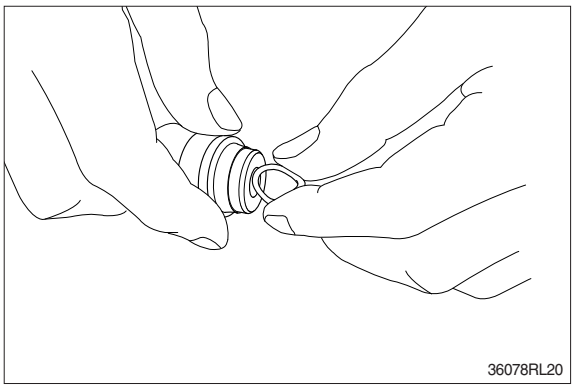


(5) Assemble O-ring (15) onto plug (14).



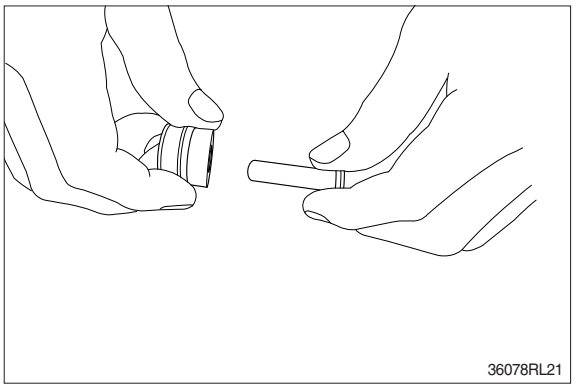
(6) Assemble seal (16) to plug (14).

※ Assemble seal in such lip direction as shown below.



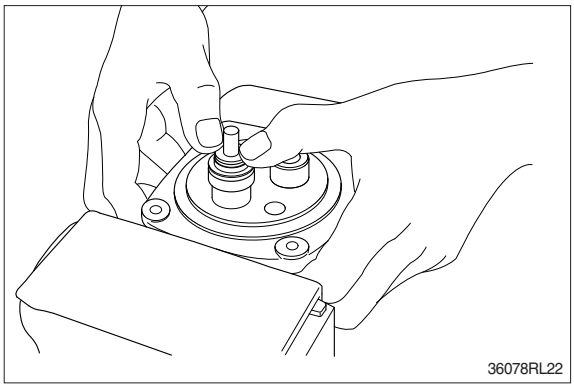
(7) Assemble push rod (11) to plug (14).

※ Apply working oil on push-rod surface.

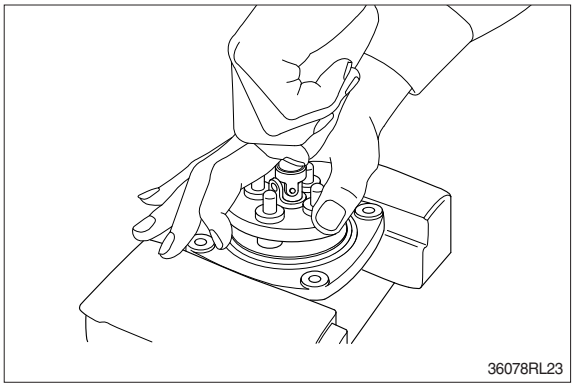


(8) Assemble plug subassembly to casing.

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

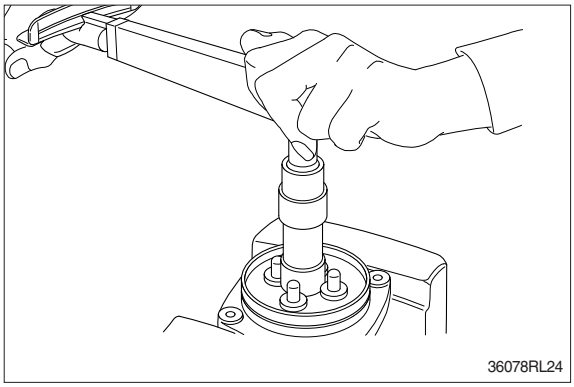


(9) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (17), and tighten joint (19) temporarily.



(10) Fit plate (17).

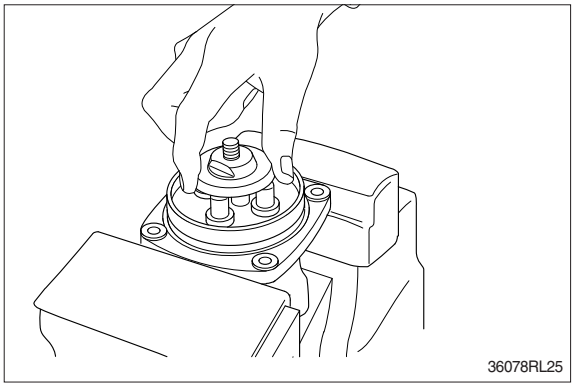
(11) Tighten joint (19) with the specified torque to casing, utilizing jig.



(12) Assemble plate (20) to joint (19).

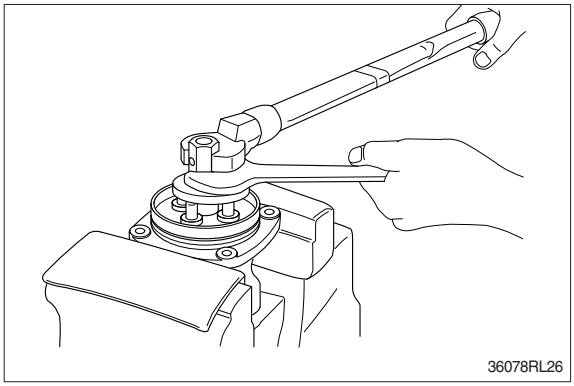
※ Screw it to position that it contacts with 4 push rods evenly.

※ Do not screw it over.

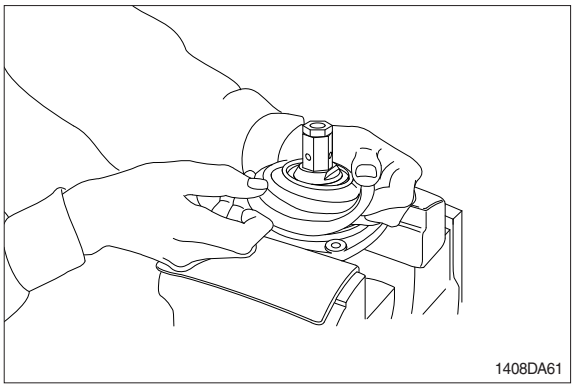


(13) Assemble adjusting nut (21), apply spanner to width across flat of swash plate (20) to fix it, and tighten adjusting nut to the specified torque.

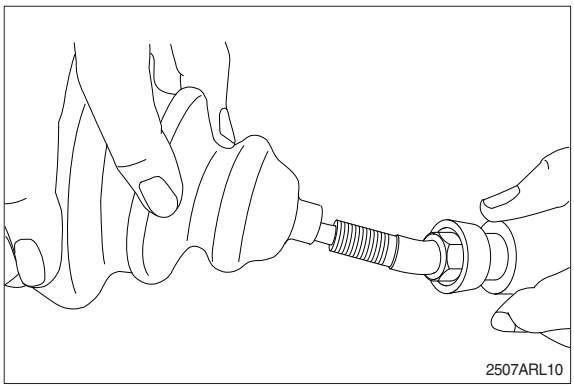
※ During tightening, do not change position of disk.

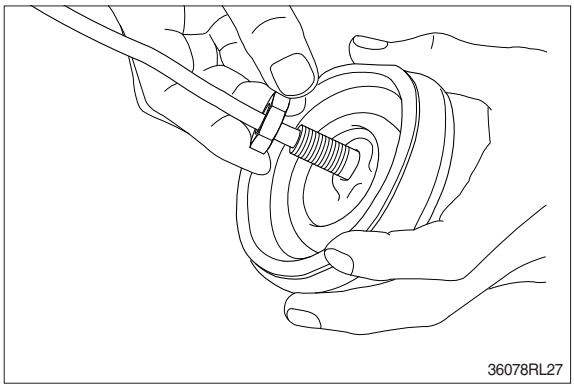


(14) Fit boot (18) to plate.

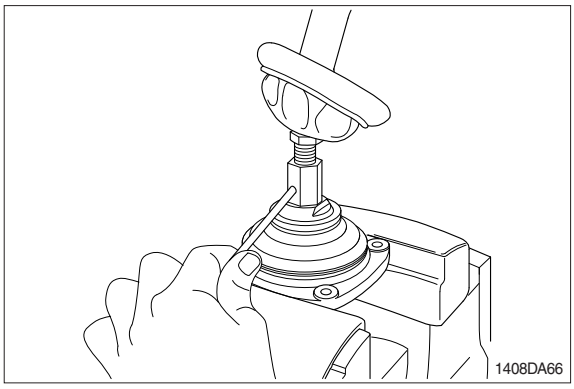


(15) Fit boot (26) and lock nut (22), and handle subassembly is assembled completely.



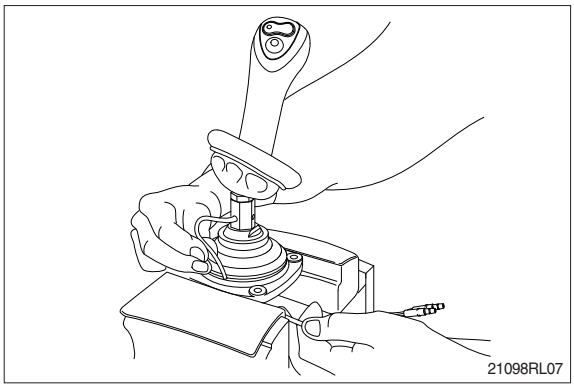


(16) Pull out cord and tube through adjusting nut hole provided in direction 60˚ to 120˚ from casing hole.

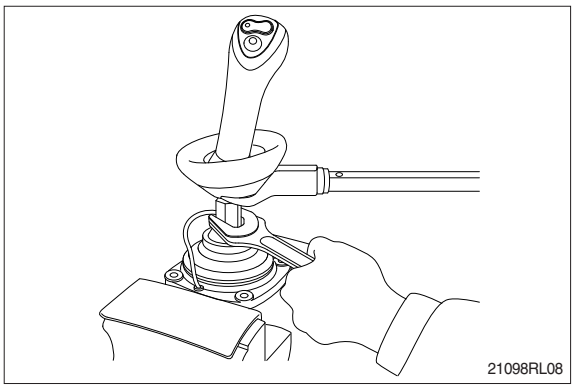


(17) Assemble bushing (27) to plate and pass cord and tube through it.

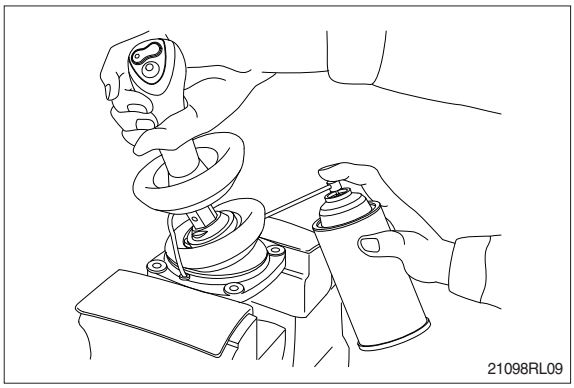
※ Provide margin necessary to operation.



(18) Determine handle direction, tighten lock nut (22) to specified torque to fix handle.

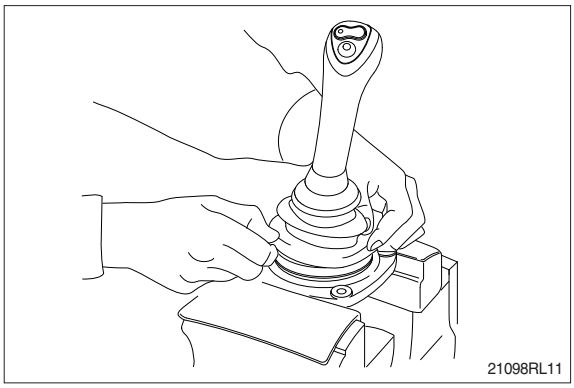


(19) Apply grease to rotating section of joint and contacting faces of disk and push rod.



(20) Assemble lower end of bellows to casing.

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



GROUP 11 TURNING JOINT

1. REMOVAL AND INSTALL

1) REMOVAL

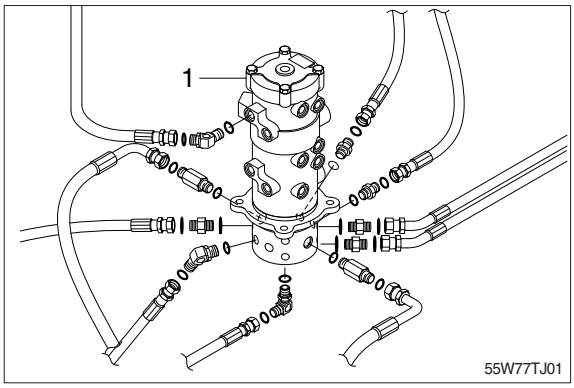
(1) Lower the work equipment to the ground and stop the engine.

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

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

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

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



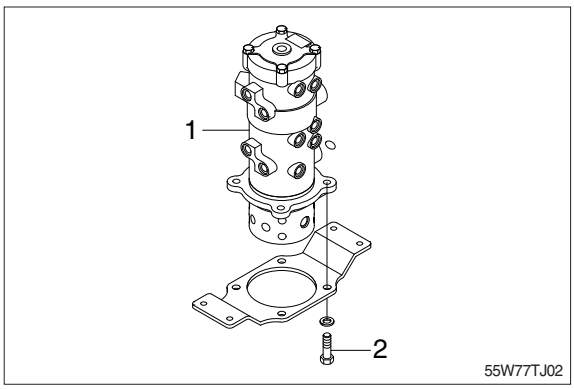
(4) Disconnect all hoses.

(5) Sling the turning joint assembly (1) and remove the mounting bolt (2).
- Weight : 30 kg (70 lb)
- Tightening torque : 14.7± 2.2 kgf · m (106± 15.9 lbf · ft)

(6) Remove the turning joint assembly.

※ When removing the turning joint, check that all the hoses have been disconnected.

2) INSTALL



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

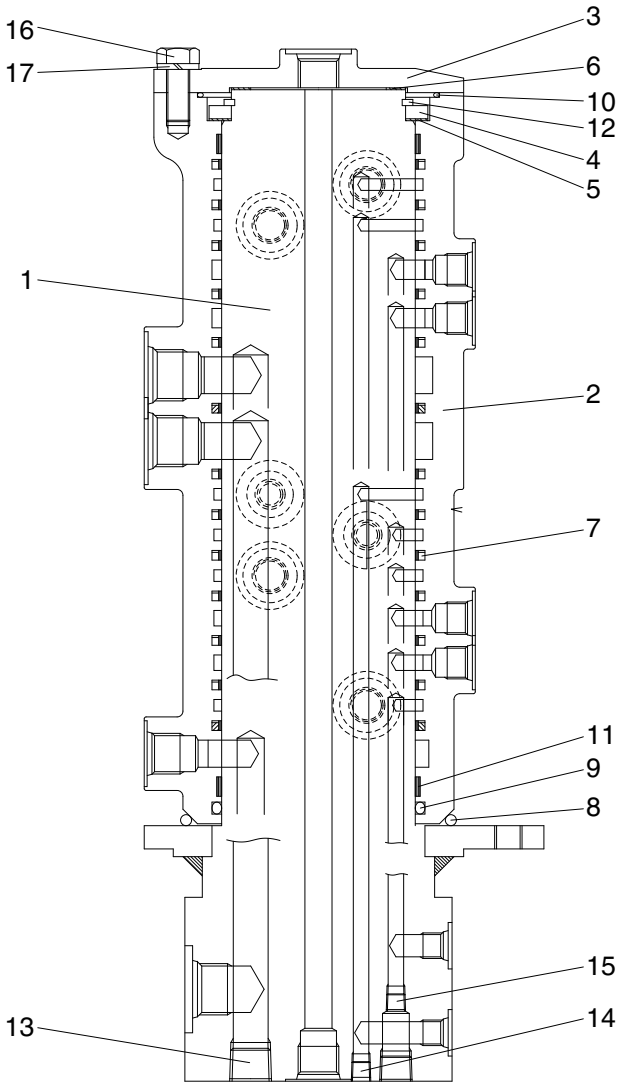
※ Take care of turning joint direction.

※ Assemble hoses to their original positions.

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

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



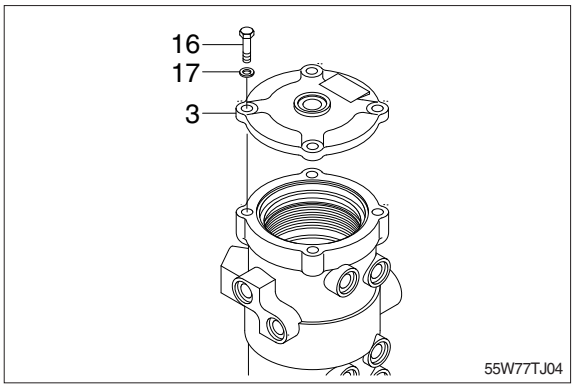
55W77TJ03

1	Shaft	7	Slipper seal	13	Plug
2	Hub	8	O-ring	14	Plug
3	Cover	9	O-ring	15	Plug
4	Spacer	10	O-ring	16	Hexagon bolt
5	Shim	11	Wear ring	17	Spring washer
6	Shim	12	Retainer ring		

2) DISASSEMBLY

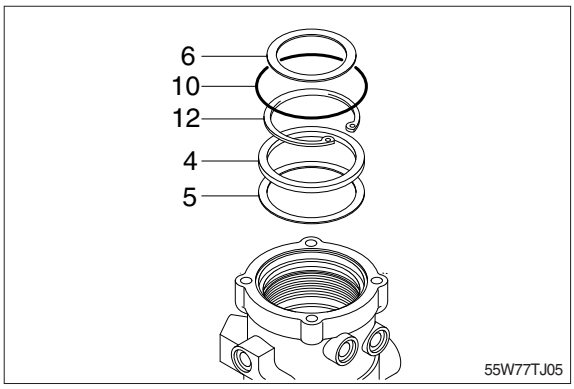
※ Before the disassembly, clean the turning joint.

(1) Loosen the bolts (16), washer (17) and remove cover (3).



(2) Remove shim (6) and O-ring (7).

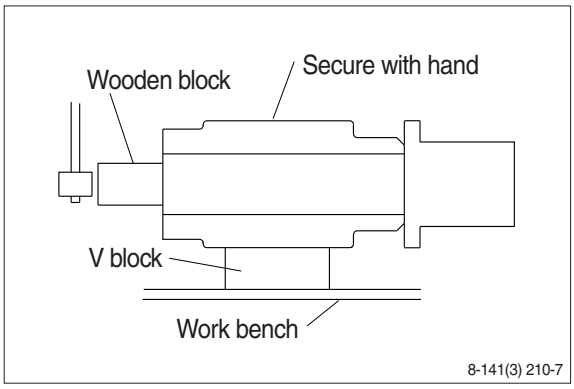
(3) Remove retainer ring (12), spacer (4) and shim (5).



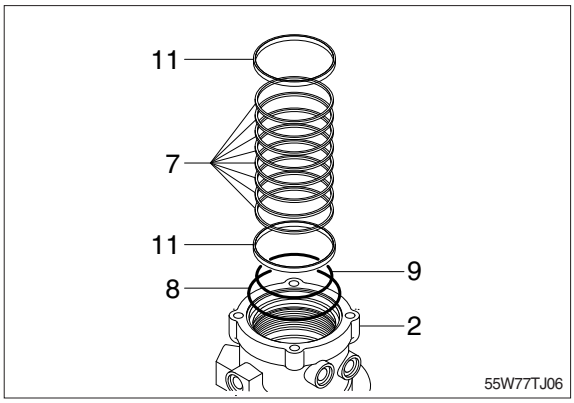
(4) Place hub (2) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the body with a hammer.

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

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



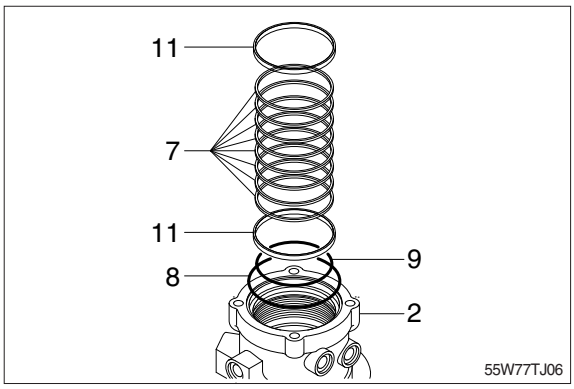
(5) Remove wear rings (11), thirteen slipper seals (7) and O-rings (8, 9) from hub (2).



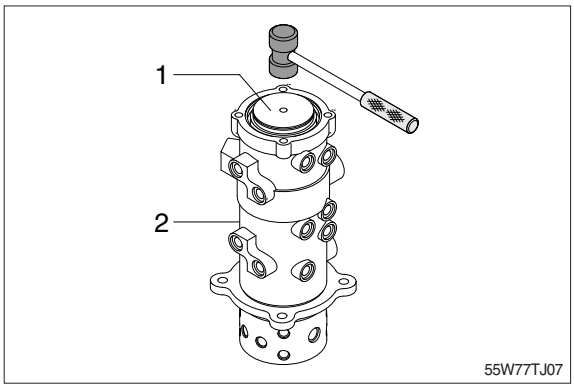
3) ASSEMBLY

※ 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 wear rings (11), thirteen slipper seals (7) and O-rings (8, 9) to hub (2).

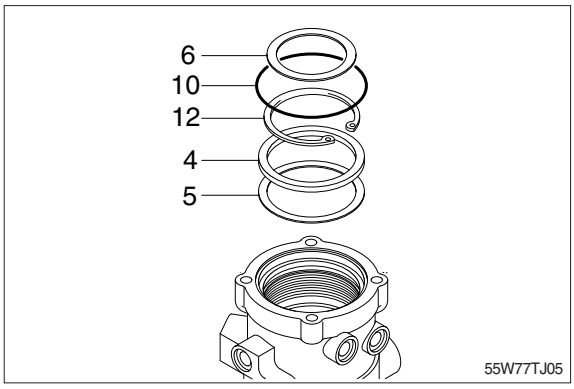


(2) Set shaft (1) on block, tap hub (2) with a plastic hammer to install.

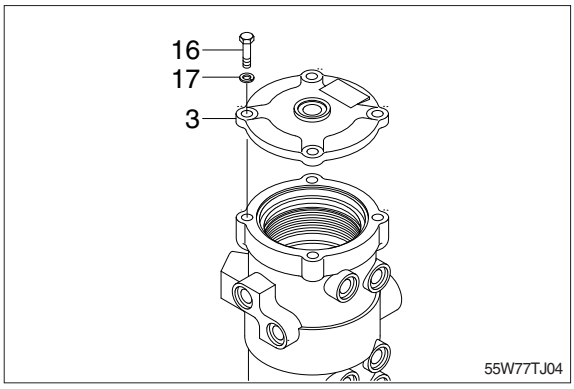


(3) Fit shim (5), spacer (4) and retainer ring (12) to shaft (11).

(4) Fit O-ring (7) to hub (2).



(5) Install cover (3) to hub (2) and tighten bolts (16) with washer (13).



1. REMOVAL AND INSTALL

1) BUCKET CYLINDER

(1) Removal

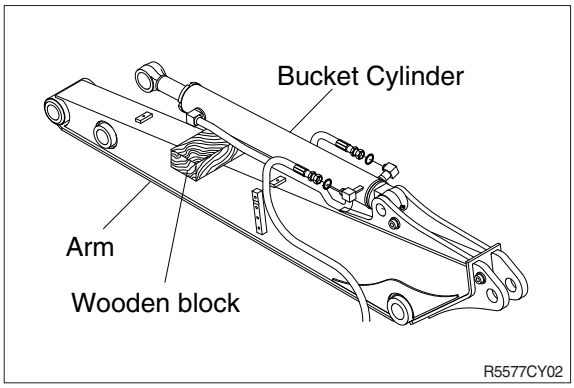
※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

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

⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank. Escaping fluid under pressure can penetrate the skin causing serious injury.

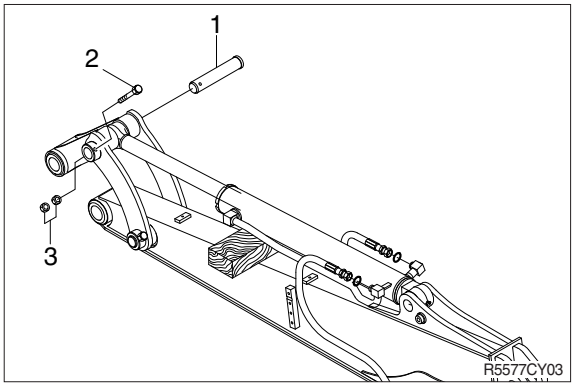
※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between bucket cylinder and arm.

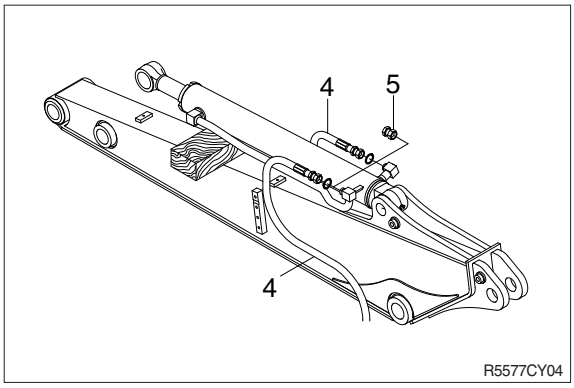


② Remove bolt (2), nut (3) and pull out pin (1).

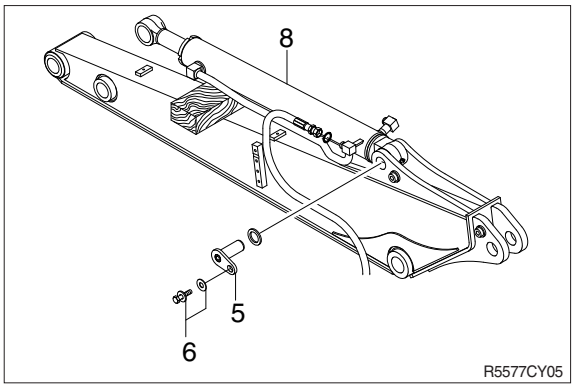
※ Tie the rod with wire to prevent it from coming out.



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



④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).
⑤ Remove bucket cylinder assembly (8).
・Weight : 30 kg (70 lb)



(2) Install

① Carry out installation in the reverse order to removal.

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

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

2) ARM CYLINDER

(1) Removal

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

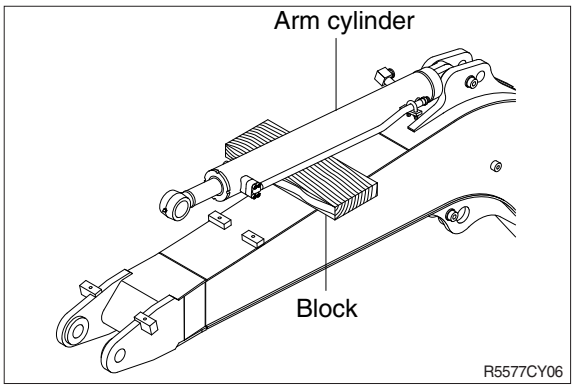
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

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

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

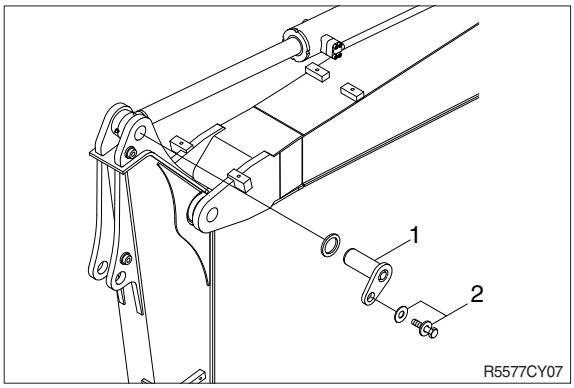
※ Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

① Set block between arm cylinder and boom.



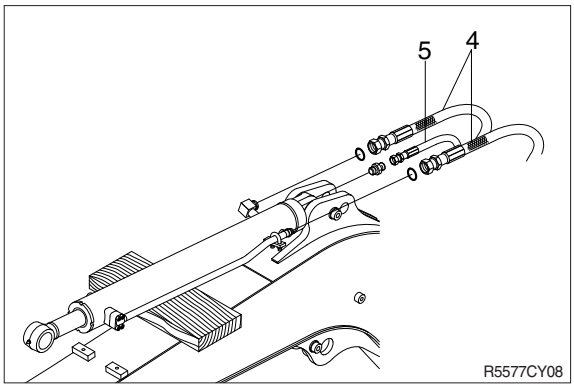
② Remove bolt (2) and pull out pin (1).

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



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

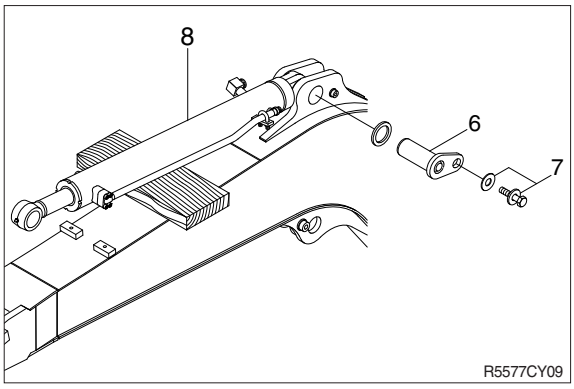
④ Disconnect greasing pipings (5).



⑤ Sling arm assembly (8) and remove bolt (7) then pull out pin (6).

⑥ Remove arm cylinder assembly (8).

· Weight : 50 kg (110 lb)



(2) Install

① Carry out installation in the reverse order to removal.

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

※ Bleed the air from the arm cylinder.

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

3) BOOM CYLINDER

(1) Removal

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

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

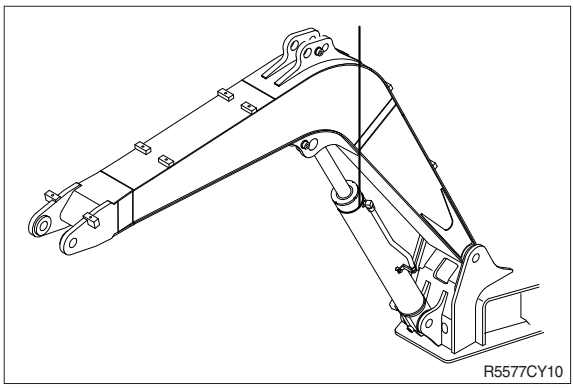
⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

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

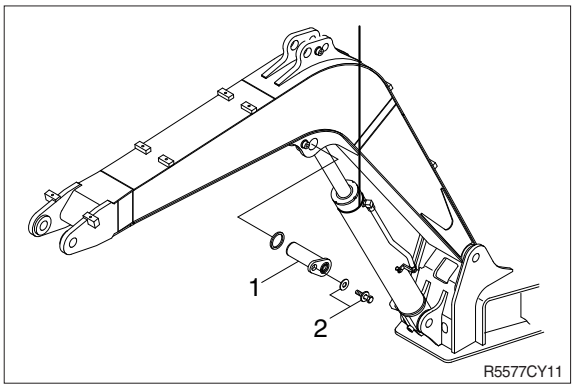
① Disconnet greasing hoses.

② Sling boom cylinder assembly.

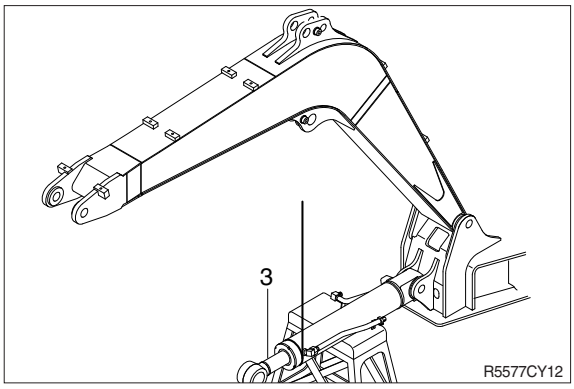


③ Remove bolt (2) and pull out pin (1).

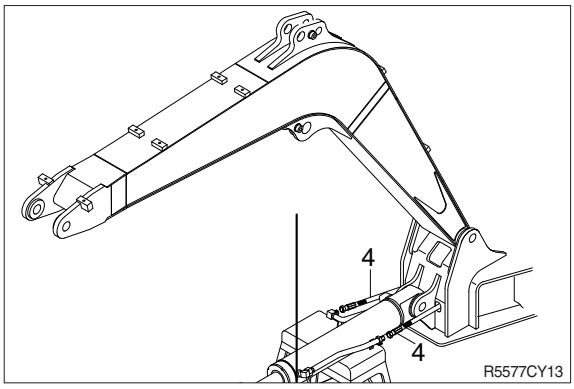
※ Tie the rod with wire to prevent it from coming out.



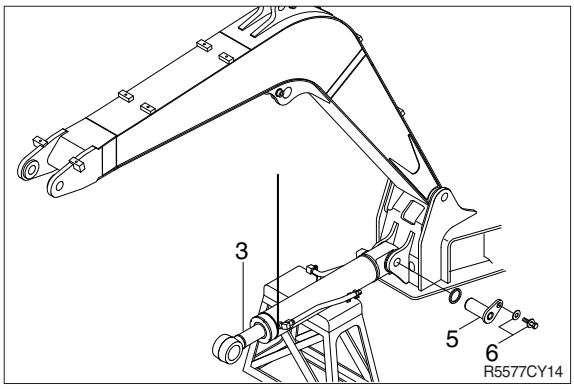
④ Lower the boom cylinder assembly (3) on a stand.



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



⑥ Remove bolt (6) and pull out pin (5).
⑦ Remove boom cylinder assembly (3).
· Weight : 60 kg (130 lb)



(2) Install

① Carry out installation in the reverse order to removal.

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

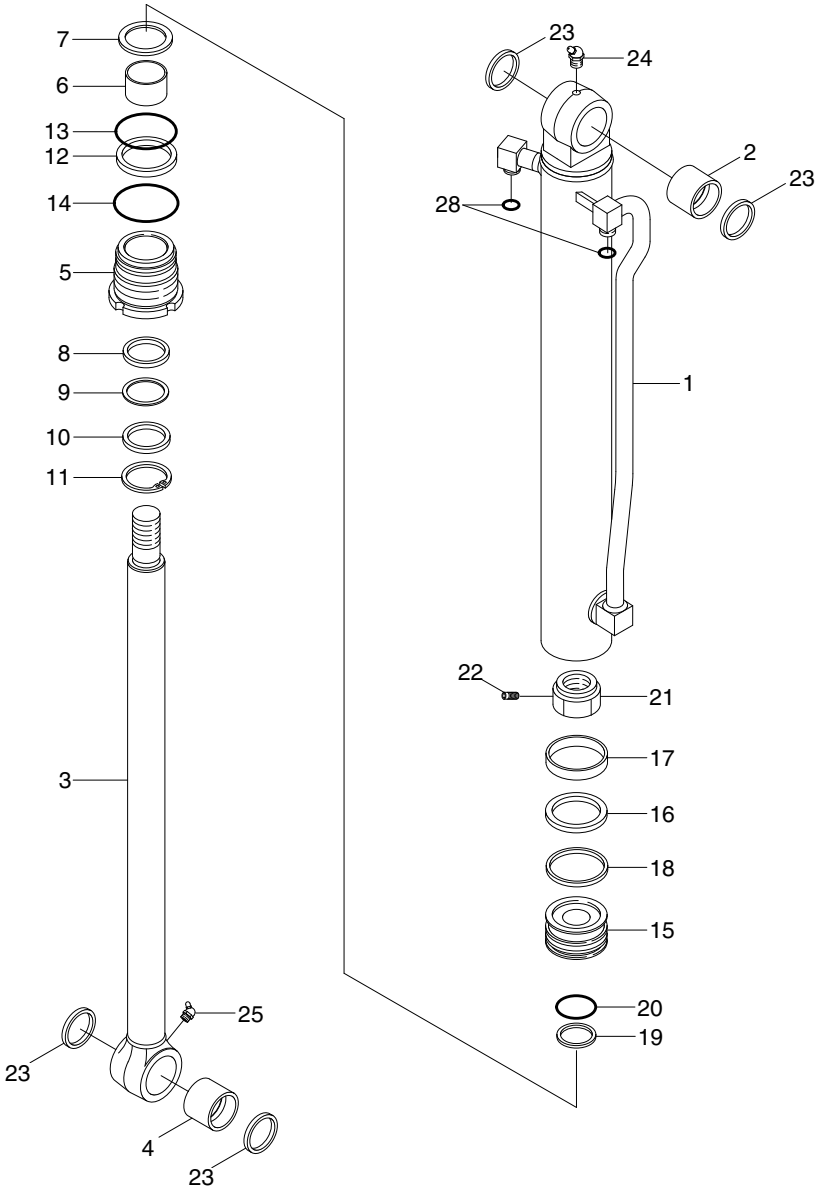
※ Bleed the air from the boom cylinder.

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

2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE

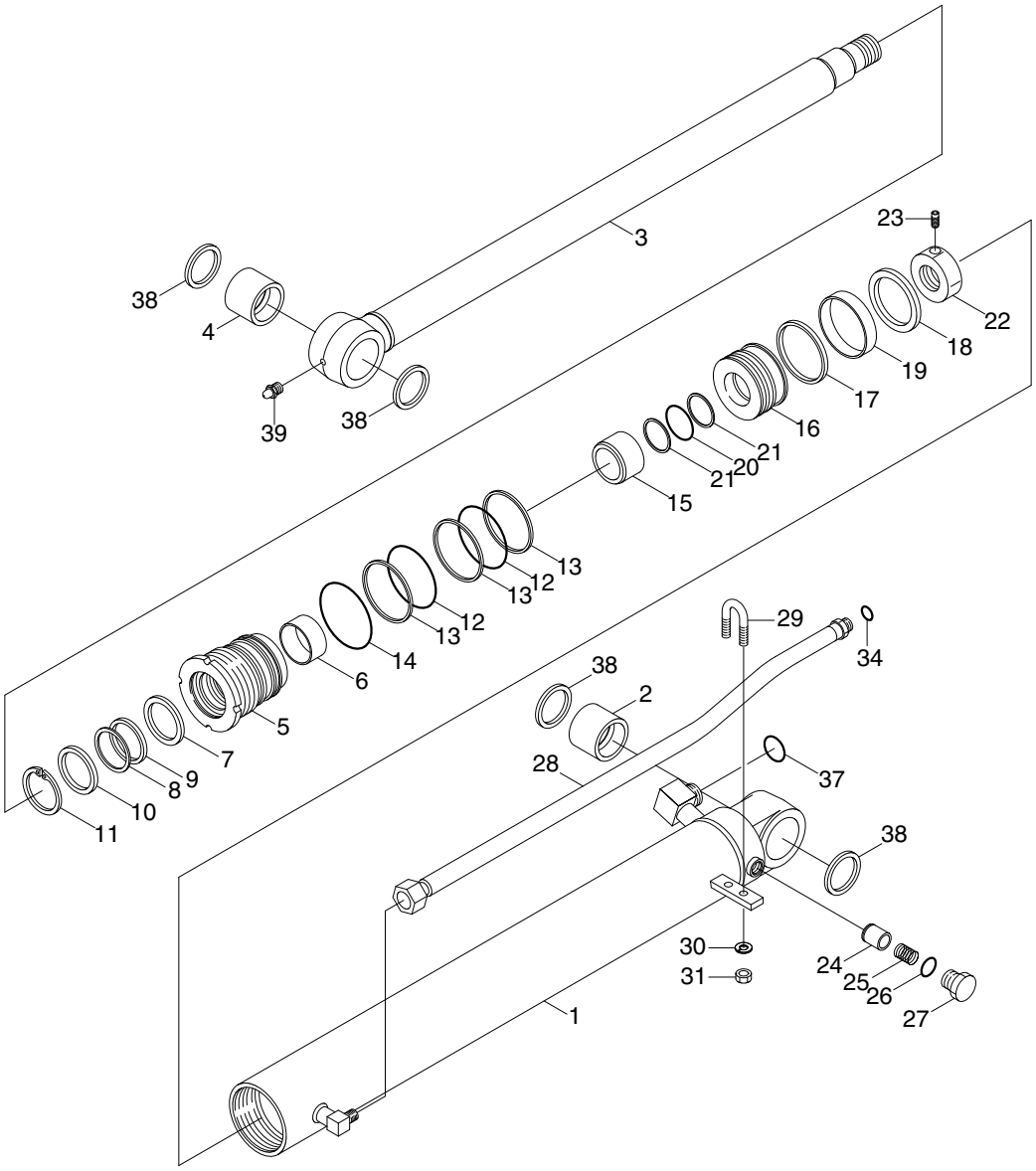
(1) Bucket cylinder



555C97CY22

1	Tube assembly	11	Retaining ring	21	Dust ring
2	Bushing	12	O-ring	22	O-ring
3	Bushing	13	Back-up ring	23	Back-up ring
4	Du bushing	14	O-ring	24	Piston nut
5	Rod cover	15	Back-up ring	25	Set screw
6	Rod bushing	16	O-ring	26	Dust seal
7	Buffer ring	17	Cushion ring	27	Grease nipple
8	U-packing	18	Piston	30	O-ring
9	Back-up ring	19	Piston seal		
10	Dust seal	20	Wear ring		

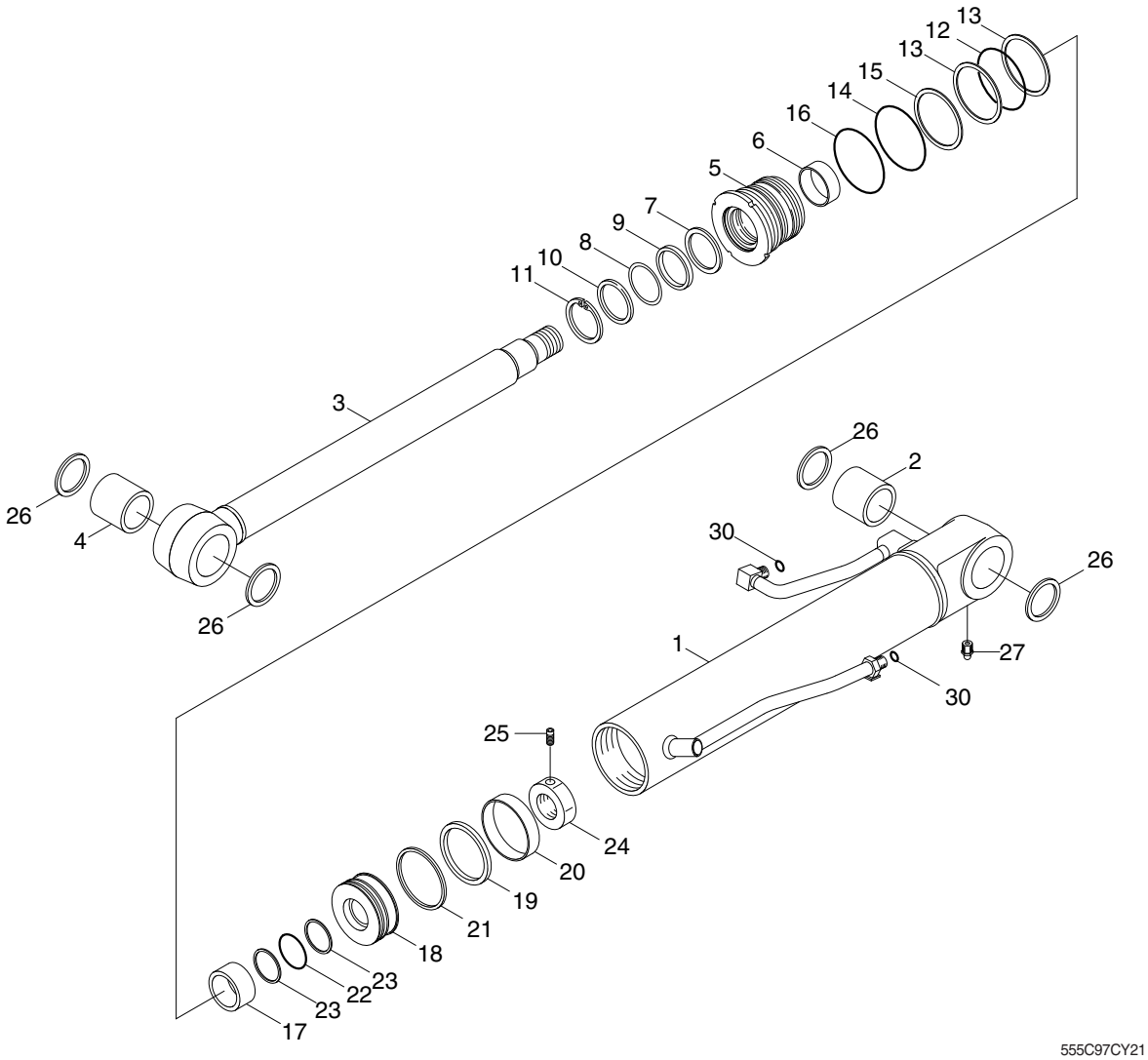
(2) Arm cylinder



555C97CY24

1	Tube assembly	9	DU bushing	17	O-ring
2	Rod assembly	10	O-ring	18	Back-up ring
3	Gland	11	Back-up ring	19	Steel ball
4	Dust wiper	12	O-ring	20	Set screw
5	Retaining ring	13	Piston	21	Bushing
6	Rod seal	14	Piston seal	22	Dust seal
7	Back-up ring	15	Dust ring	23	Grease nipple
8	Buffer ring	16	Wear ring	24	O-ring

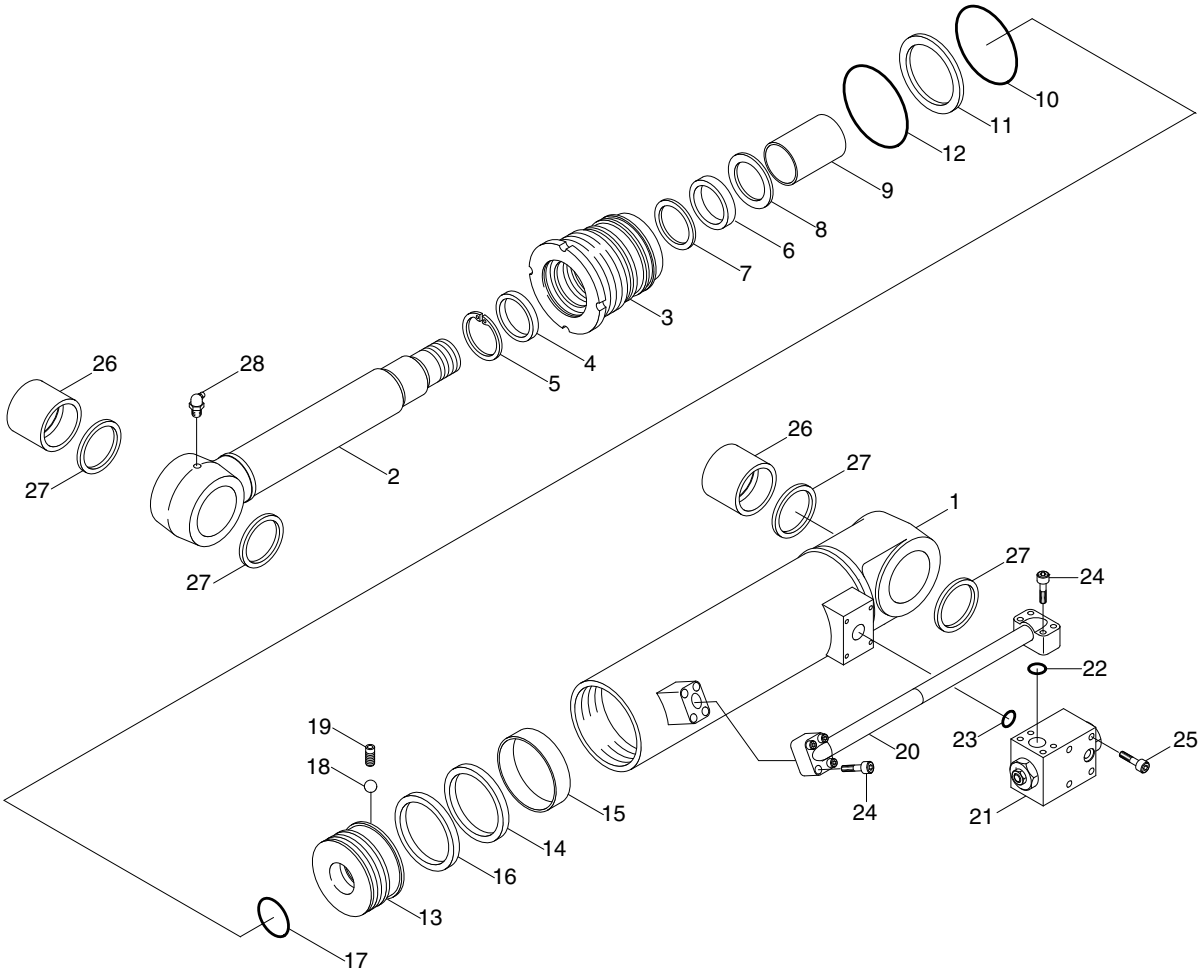
(3) Boom cylinder



555C97CY21

1	Tube assembly	9	O-ring	17	Back-up ring
2	Rod assembly	10	Buck-up ring	18	Steel ball
3	Gland	11	O-ring	19	Set screw
4	Dust wiper	12	Piston	20	Pin bushing
5	Retaining ring	13	Piston seal	21	Dust seal
6	DU bushing	14	Wear ring	22	Grease nipple
7	Rod seal	15	Dust ring	23	O-ring
8	Buck-up ring	16	O-ring		

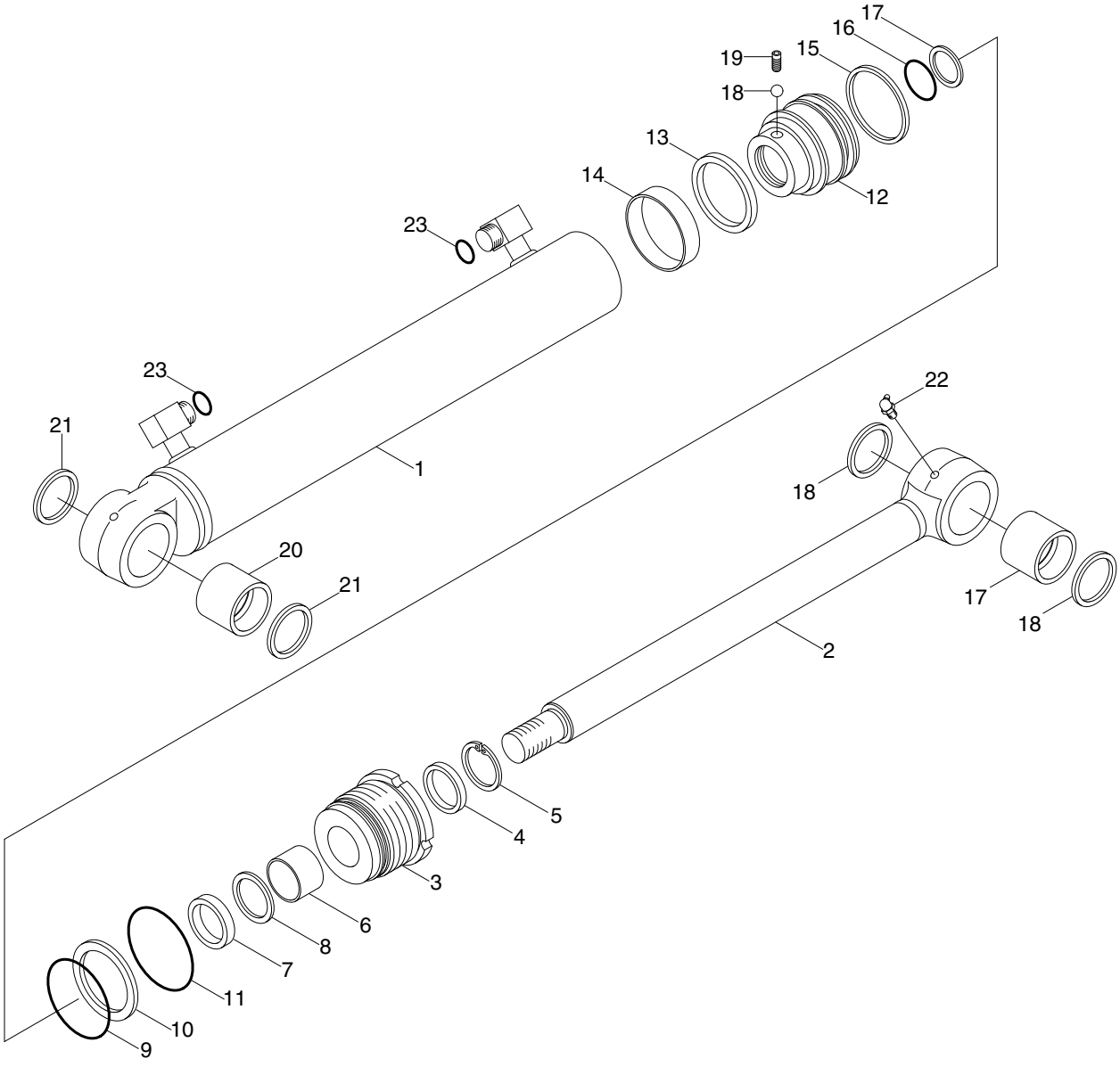
(4) Dozer cylinder



55W97CY01

1	Tube assembly	11	Buck-up ring	21	Check valve
2	Rod assembly	12	O-ring	22	O-ring
3	Gland	13	Piston	23	O-ring
5	Retaining ring	14	Piston seal	24	Socket head bolt
6	Rod seal	15	Wear ring	25	Socket head bolt
7	Buck-up ring	16	Dust ring	26	Pin bushing
4	Dust wiper	17	O-ring	27	Dust seal
8	Buffer ring	18	Steel ball	28	Grease nipple
9	DU bushing	19	Set screw		
10	O-ring	20	Pipe assembly (R)		

(5) Boom swing cylinder

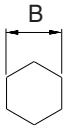


5596MC02

1	Tube assembly	9	O-ring	17	Back-up ring
2	Rod assembly	10	Buck-up ring	18	Steel ball
3	Gland	11	O-ring	19	Set screw
4	Dust wiper	12	Piston	20	Pin bushing
5	Retaining ring	13	Piston seal	21	Dust seal
6	DU bushing	14	Wear ring	22	Grease nipple
7	Rod seal	15	Dust ring	23	O-ring
8	Buck-up ring	16	O-ring		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Name	Specification	
Allen wrench	8	
	10	
Spanner	M22	
Hook spanner	Suitable size	
(-) Driver	Small and large sizes	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Gland	Boom cylinder	5	M115	70±9.7	506±70
	Arm cylinder	5	M95	70±8.7	506±63
	Bucket cylinder	5	M85	75±7.5	540±54
	Dozer cylinder	3	M105	70±7.0	506±51
	Boom swing cylinder	3	M100	70±7.0	506±51
Lock nut	Boom cylinder	22	M45	75±7.5	540±5.4
	Arm cylinder	21	M39	75±7.5	540±5.4
	Bucket cylinder	19	M36	75±7.5	540±5.4
	Dozer cylinder	13	M39	97.5±9.8	705±71
	Boom swing cylinder	16	M39	97.5±9.8	705±71

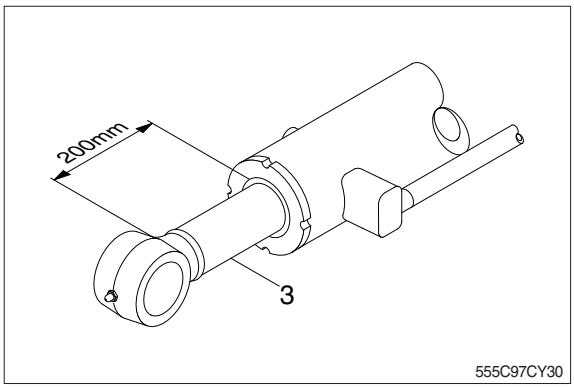
3) DISASSEMBLY

(1) Remove cylinder head and piston rod

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

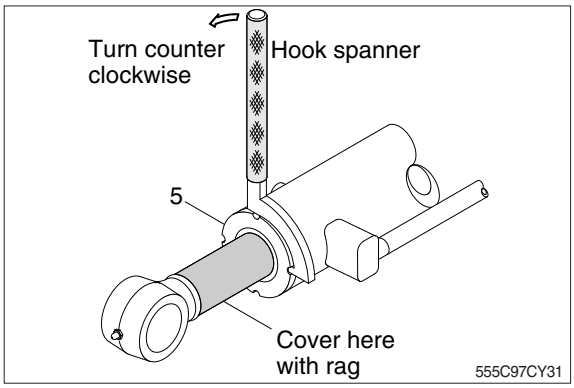
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

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



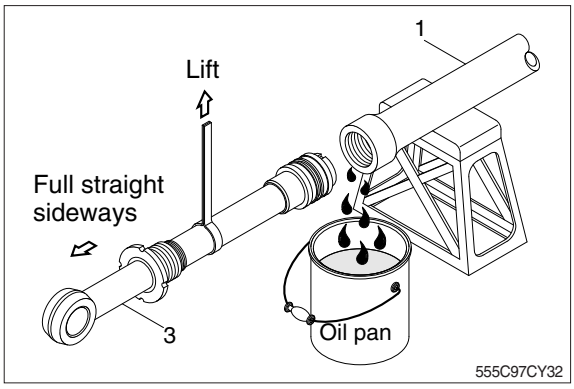
③ Remove rod cover (5) by hook spanner.

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



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

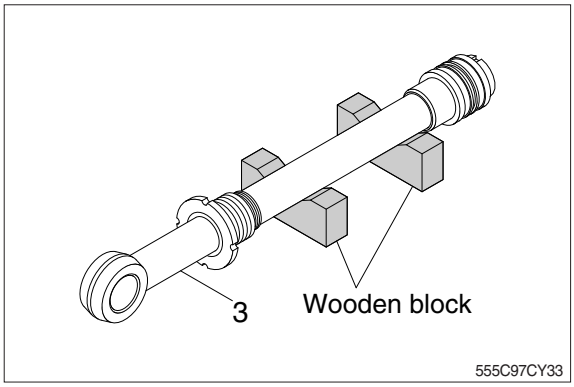
※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (3) with a crane or some means and draw it out. However, when rod assembly (3) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



Note that the plated surface of rod assembly (3) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

⑤ Place the removed rod assembly on a wooden V-block that is set level.

※ Cover a V-block with soft rag.

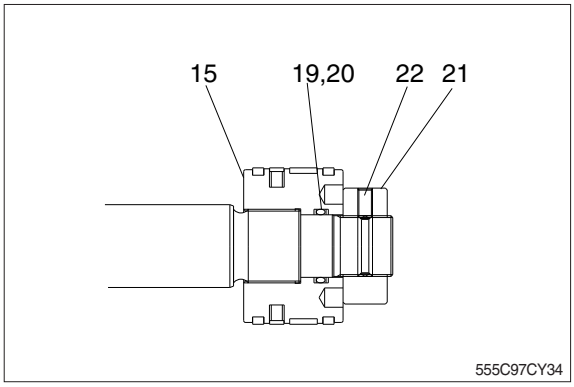


(2) Remove piston and rod cover

① Loosen set screw (22) and remove piston nut (21).

※ Since piston nut (21) is tightened to a high torque, use a hydraulic and power wrench that utilizers a hydraulic cylinder, to remove the piston nut (21).

② Remove piston assembly (15), back up ring (19), and O-ring (20).

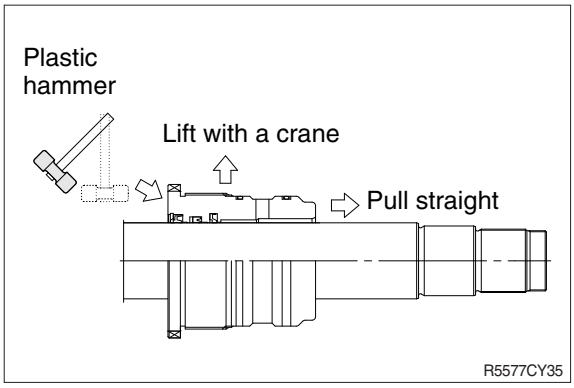


③ Remove the rod cover from rod assembly (3).

※ If it is too heavy to move, move it by striking the flanged part of gland with a plastic hammer.

※ Pull it straight with cylinder head assembly lifted with a crane.

Exercise care so as not to damage the lip of Du bushing (6) and packing (8, 9, 10, 11, 12, 13, 14) by the threads of rod assembly (3).

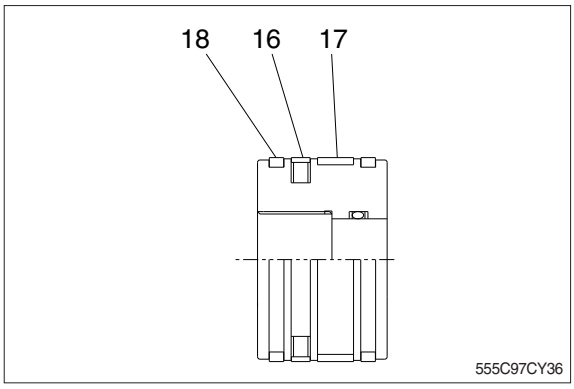


(3) Disassemble the piston assembly

① Remove wear ring (17).

② Remove dust ring (18) and piston seal (16).

※ Exercise care in this operation not to damage the grooves.



(4) Disassemble gland assembly

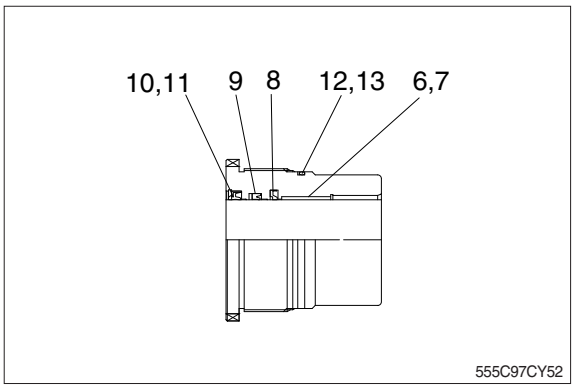
① Remove back up ring (12) and O-ring (13).

② Remove snap ring (11), dust wiper (10).

③ Remove U-packing (9) and buffer seal (8).

※ Exercise care in this operation not to damage the grooves.

※ Do not remove seal and ring, if does not damaged.

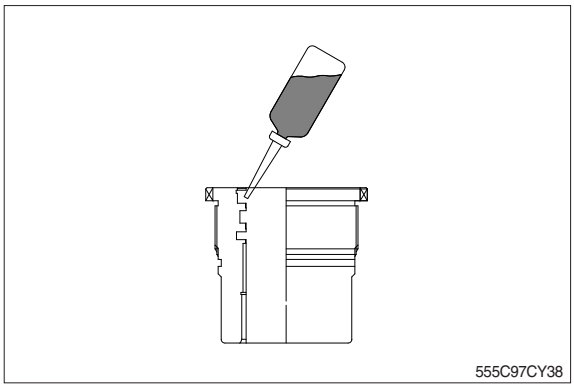


4) ASSEMBLY

(1) Assemble cylinder head assembly

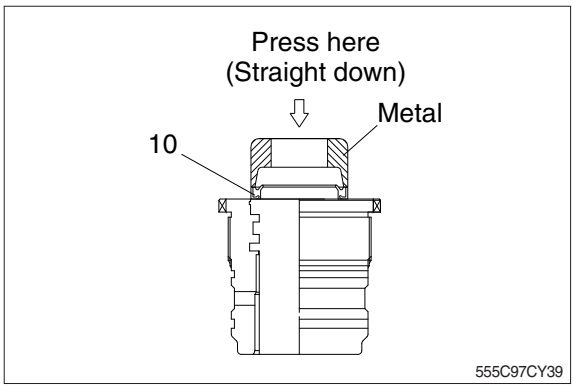
※ Check for scratches or rough surfaces if found smooth with an oil stone.

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



② Coat dust wiper (10) with grease and fit dust wiper (10) to the bottom of the hole of dust seal.
At this time, press a pad metal to the metal ring of dust seal.

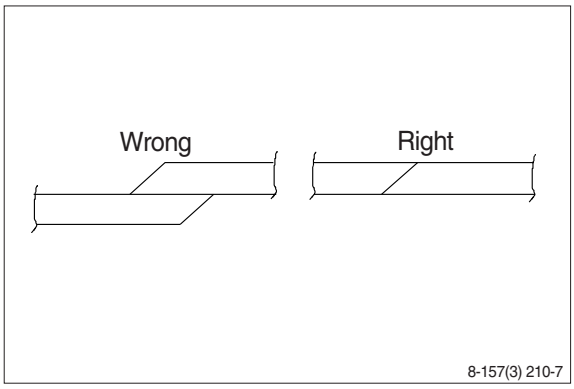
③ Fit snap ring (11) to the stop face.



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

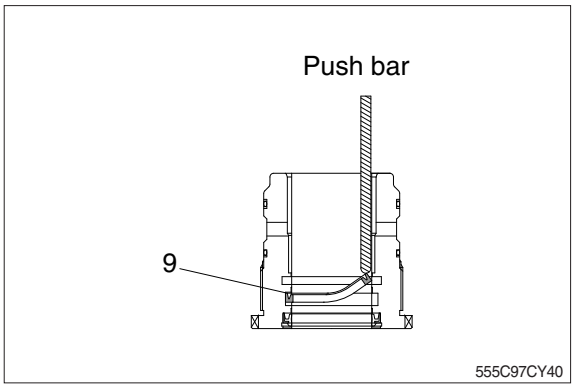
※ Coat each packing with hydraulic oil before fitting it.

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



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

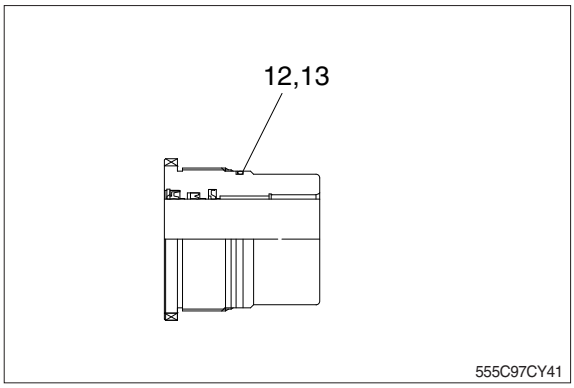
※ Fitting U-packing (9) upside down may damage its lip. Therefore check the correct direction that is shown in fig.



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

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

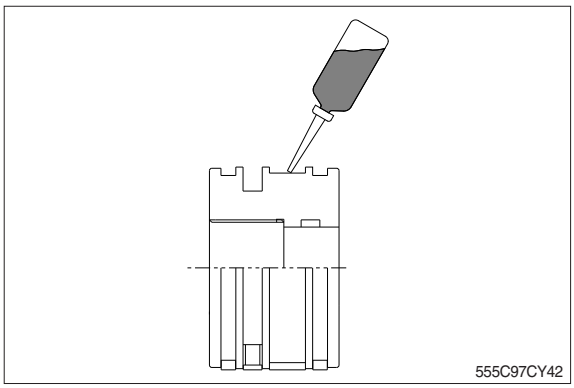
⑥ Fit O-ring (13) to rod cover (5).



(2) Assemble piston assembly

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

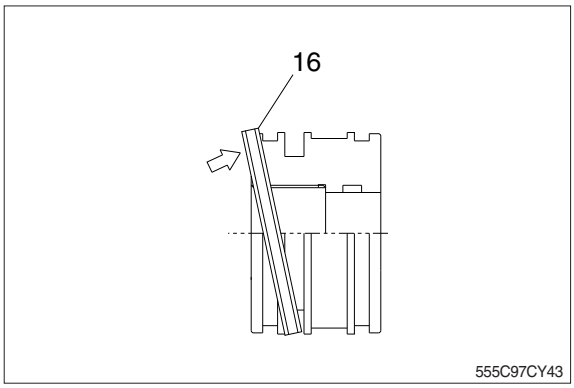
① Coat the outer face of piston (15) with hydraulic oil.



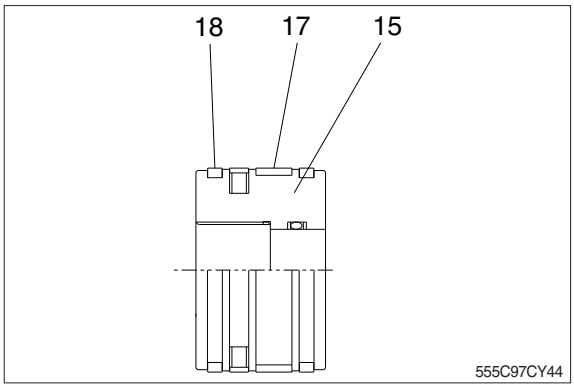
② Fit piston seal (16) to piston.

※ Put the piston seal in the warm water of 60~100˚C for more than 5 minutes.

※ After assembling the piston seal, press its outer diameter to fit in.



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

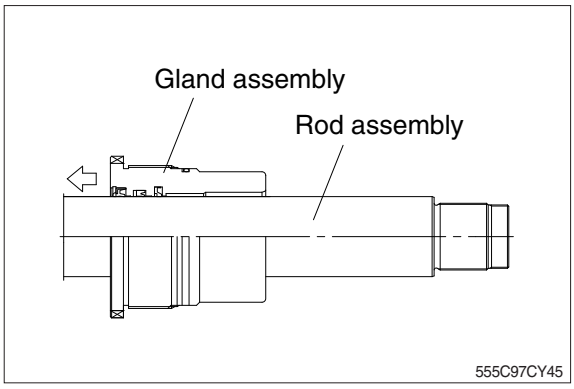


(3) Install piston and cylinder head

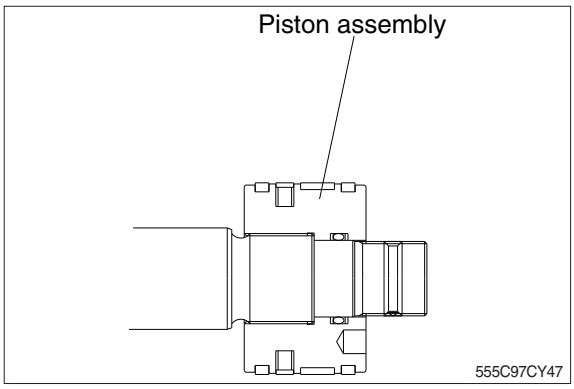
① Fix the rod assembly to the work bench.

② Apply hydraulic oil to the outer surface of rod assembly (3), the inner surface of piston and cylinder head.

③ Insert cylinder head assembly to rod assembly.



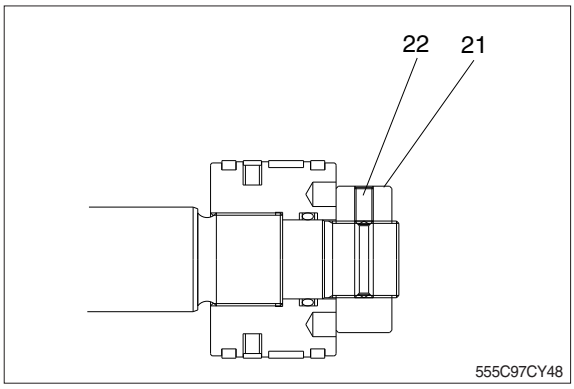
④ Fit piston assembly to rod assembly.



⑤ Fit piston nut (21) and tighten the set screw (22).

· Tightening torque :

Item		kgf · m	lbf · ft
Boom	22	75±7.5	540±54
Arm	21	75±7.5	540±54
Bucket	19	75±7.5	540±54
Dozer	16	97.5±9.8	705±71
Boom swing	16	97.5±9.8	705±71



(4) Overall assemble

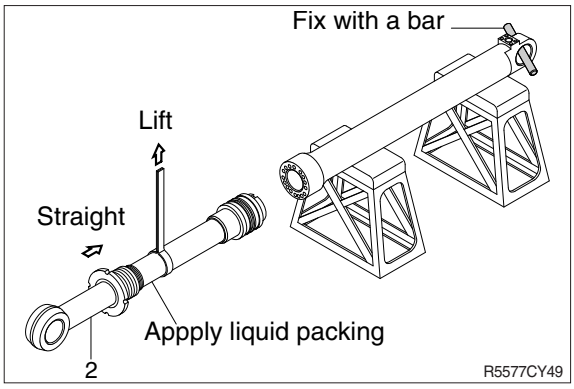
① Place a V-block on a rigid work bench. Mount the tube assembly (1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

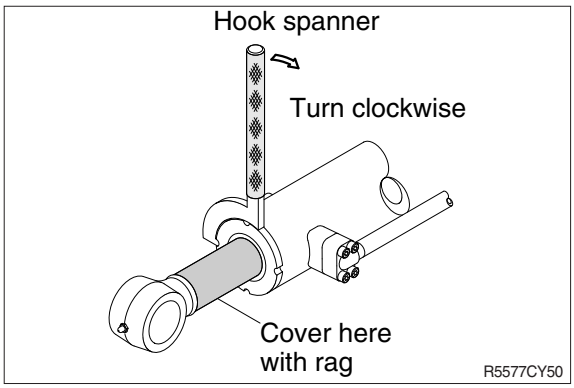
② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.

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

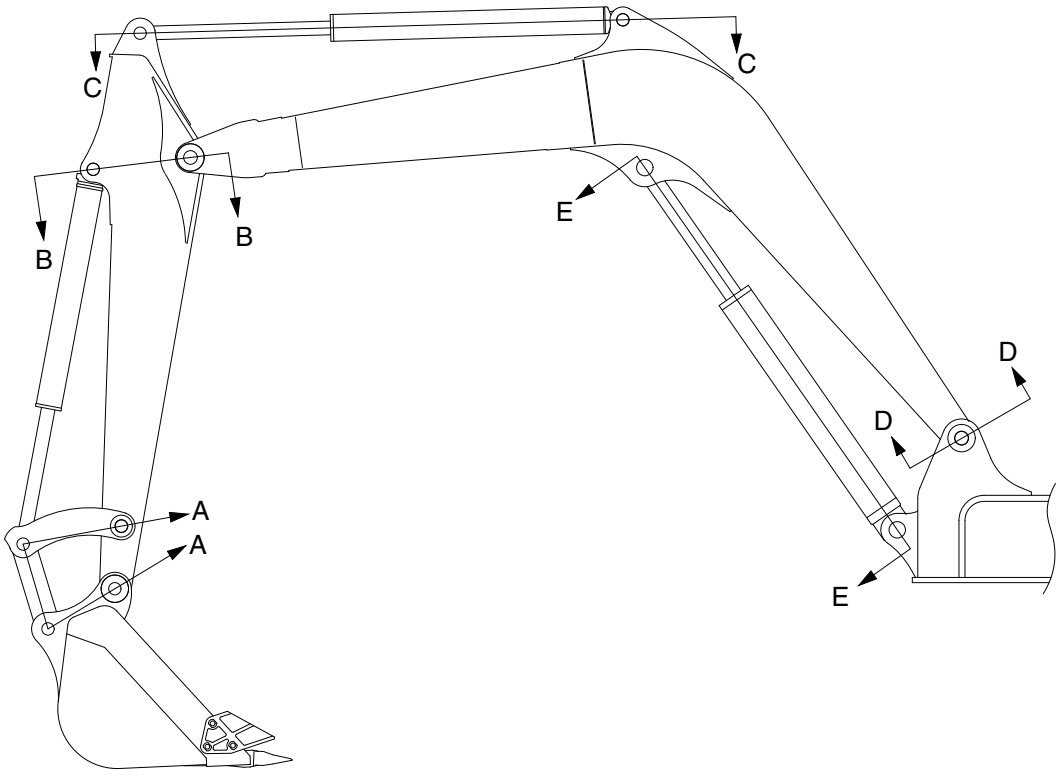
③ Match the bolt holes in the cylinder head flange to the tapped holes in the tube assembly and tighten socket bolts to a specified torque.

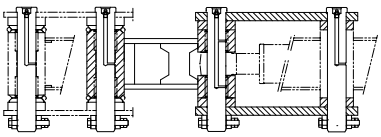
※ Refer to the table of tightening torque.



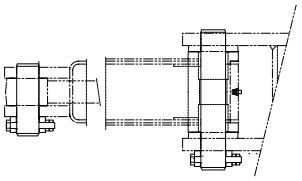


1. STRUCTURE

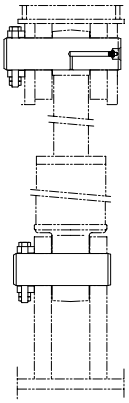




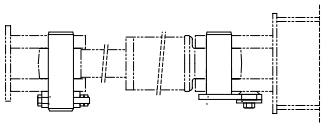
SECTION A-A



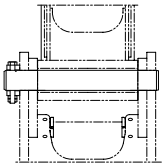
SECTION B-B



SECTION E-E



SECTION C-C



SECTION D-D

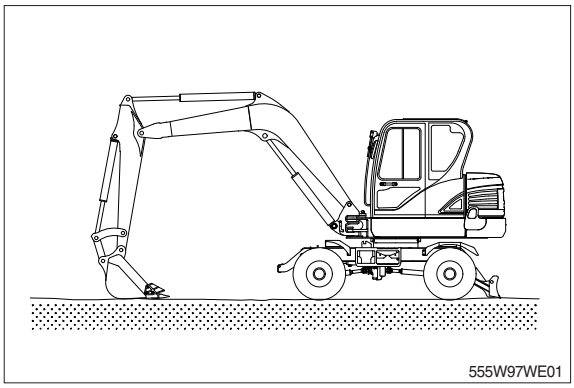
R5577AT01

2. REMOVAL AND INSTALL

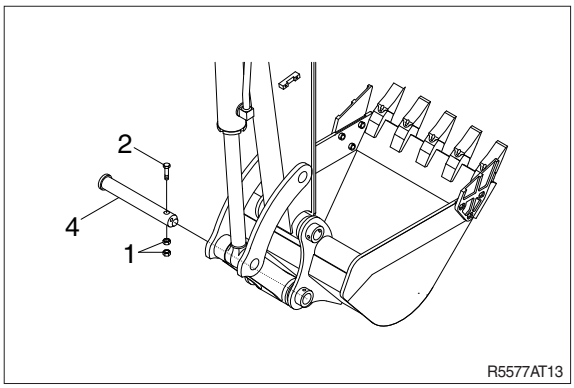
1) BUCKET ASSEMBLY

(1) Removal

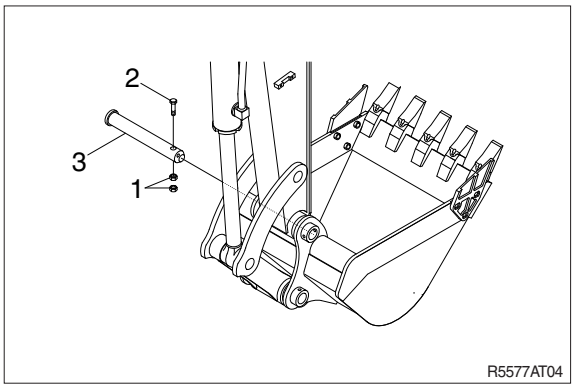
① Lower the work equipment completely to ground with back of bucket facing down.



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



③ Remove nut (1), bolt (2) and draw out the pin (3) then remove the bucket assembly.
- Weight : 170 kg (370 lb)

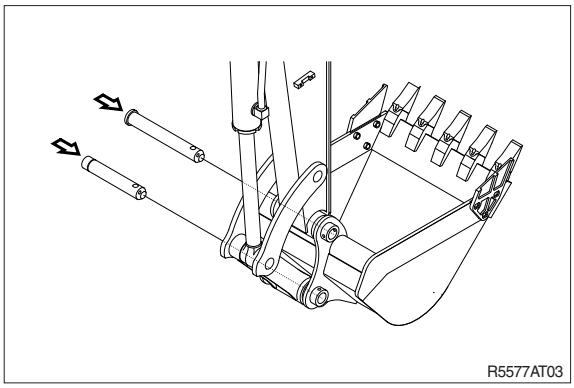


(2) Install

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.

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



2) ARM ASSEMBLY

(1) Removal

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

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

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

② Disconnect bucket cylinder hose (4).

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

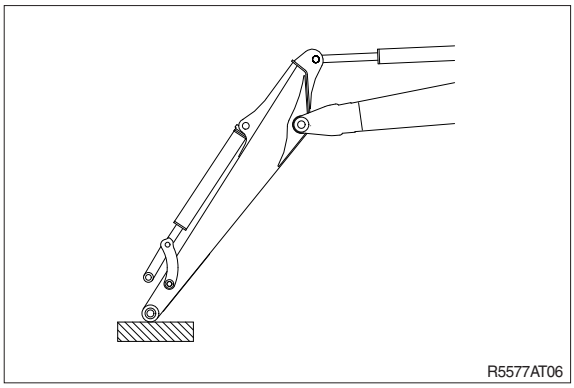
③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

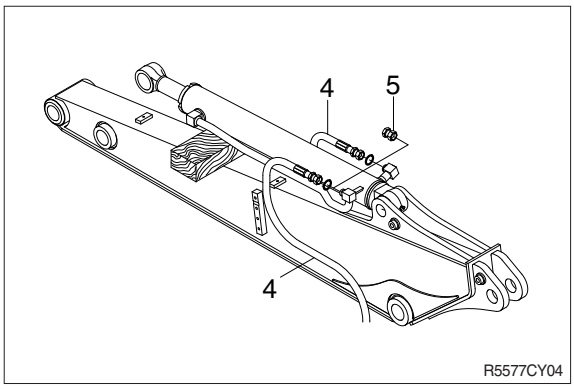
※ Tie the rod with wire to prevent it from coming out.

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

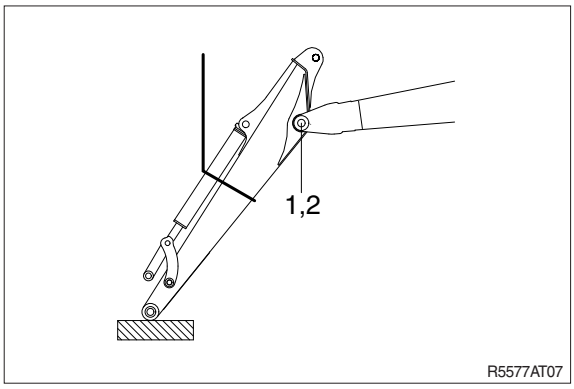
⑤ Remove bolt (1) and pull out the pin (2) then remove the arm assembly.
· Weight : 210 kg (470 lb)

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


R5577AT06



R5577CY04



R5577AT07

(2) Install

① Carry out installation in the reverse order to removal.

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

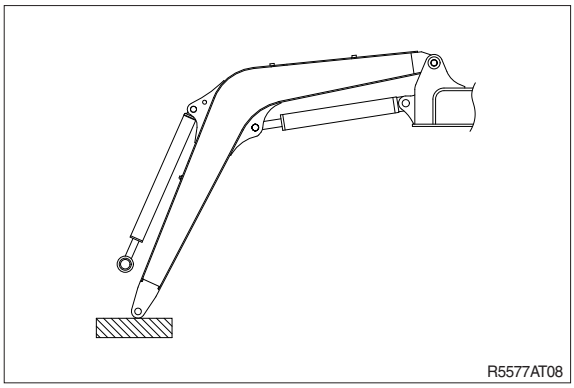
※ Bleed the air from the cylinder.

3) BOOM CYLINDER

(1) Removal

① Remove arm and bucket assembly.

② For details, see removal of arm and bucket assembly.
Remove boom cylinder assembly from boom.
For details, see removal of arm cylinder assembly.

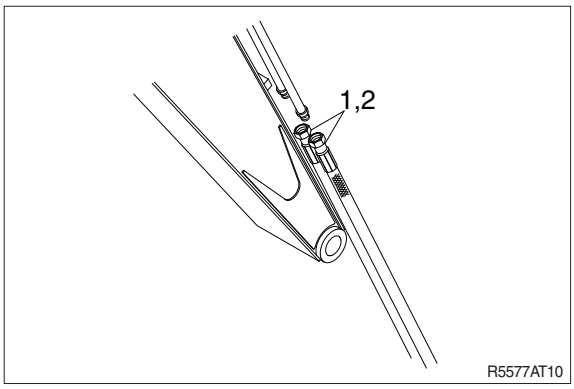


③ Disconnect head lamp wiring.

④ Disconnect bucket cylinder hose (2) and arm cylinder hose (1).

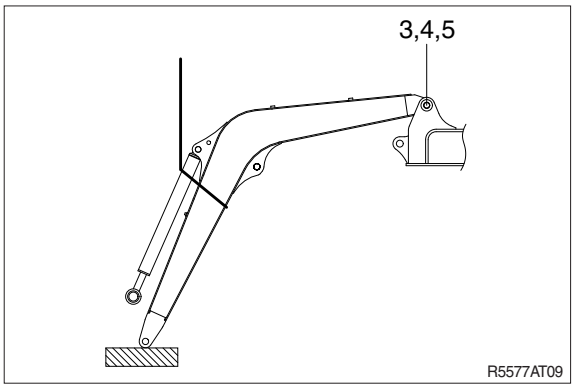
⚠ When the hose are disconnected, oil may spurt out.

⑤ Sling boom assembly (3).



⑥ Remove bolt (3), nut (4) and pull out the pin (5) then remove boom assembly.
· Weight : 310 kg (680 lb)

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

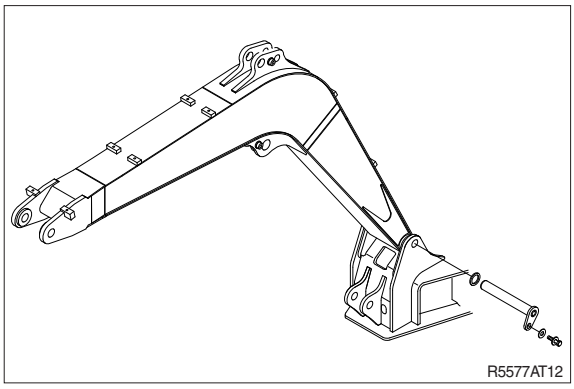


(2) Install

① Carry out installation in the reverse order to removal.

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

※ Bleed the air from the cylinder.



SECTION 8 COMPONENT MOUNTING TORQUE

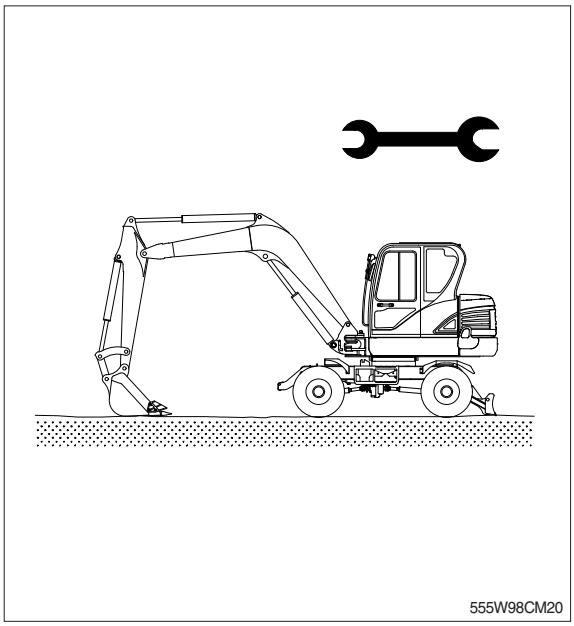
SECTION 8 COMPONENT MOUNTING TORQUE

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.

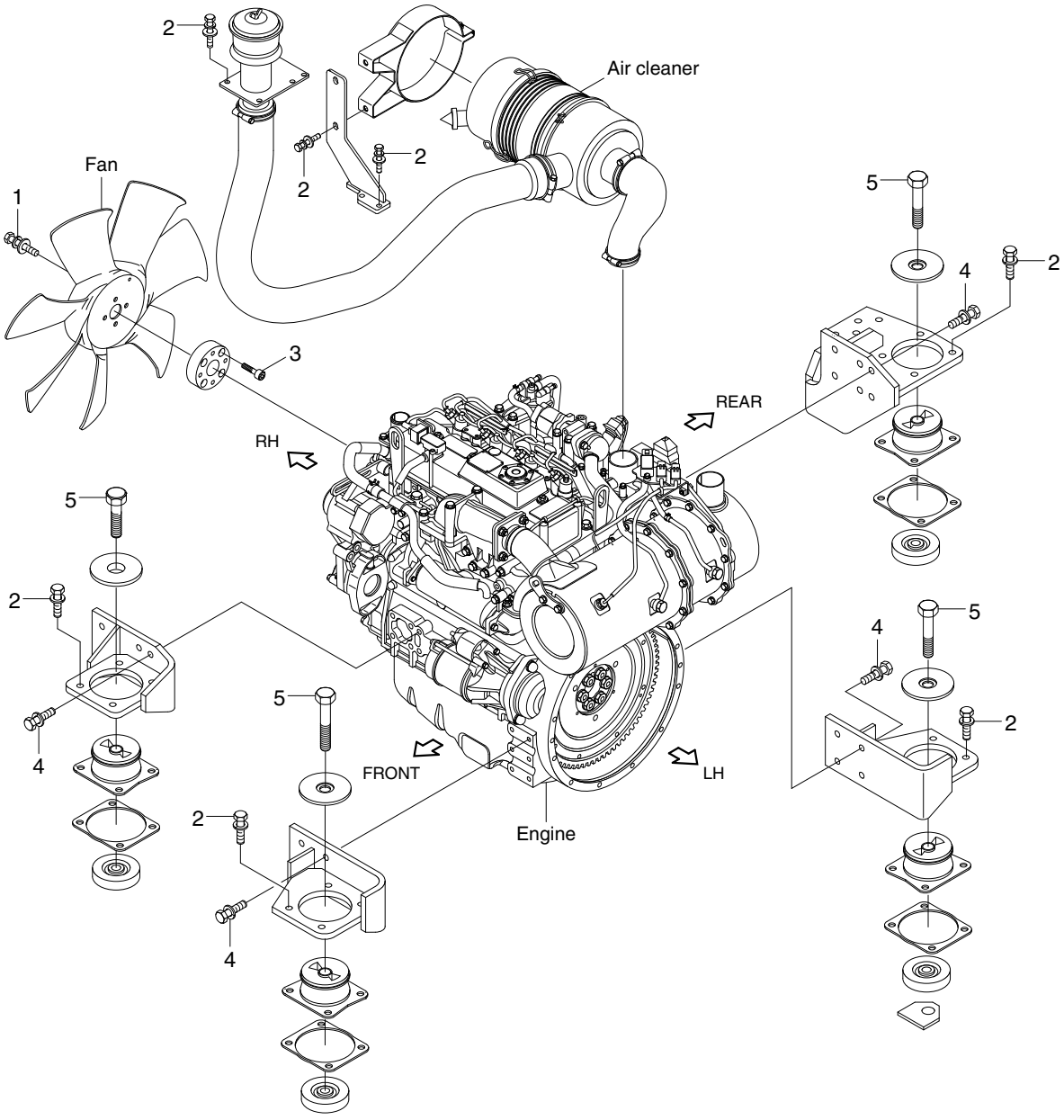
※ Only metric fasteners can be used and incorrect fasteners may result in machine damage or malfunction.

※ Before installation, clean all the components with a non-corrosive cleaner. Bolts and threads must not be worn or damaged.



GROUP 2 ENGINE SYSTEM

1. ENGINE AND ACCESSORIES MOUNTING



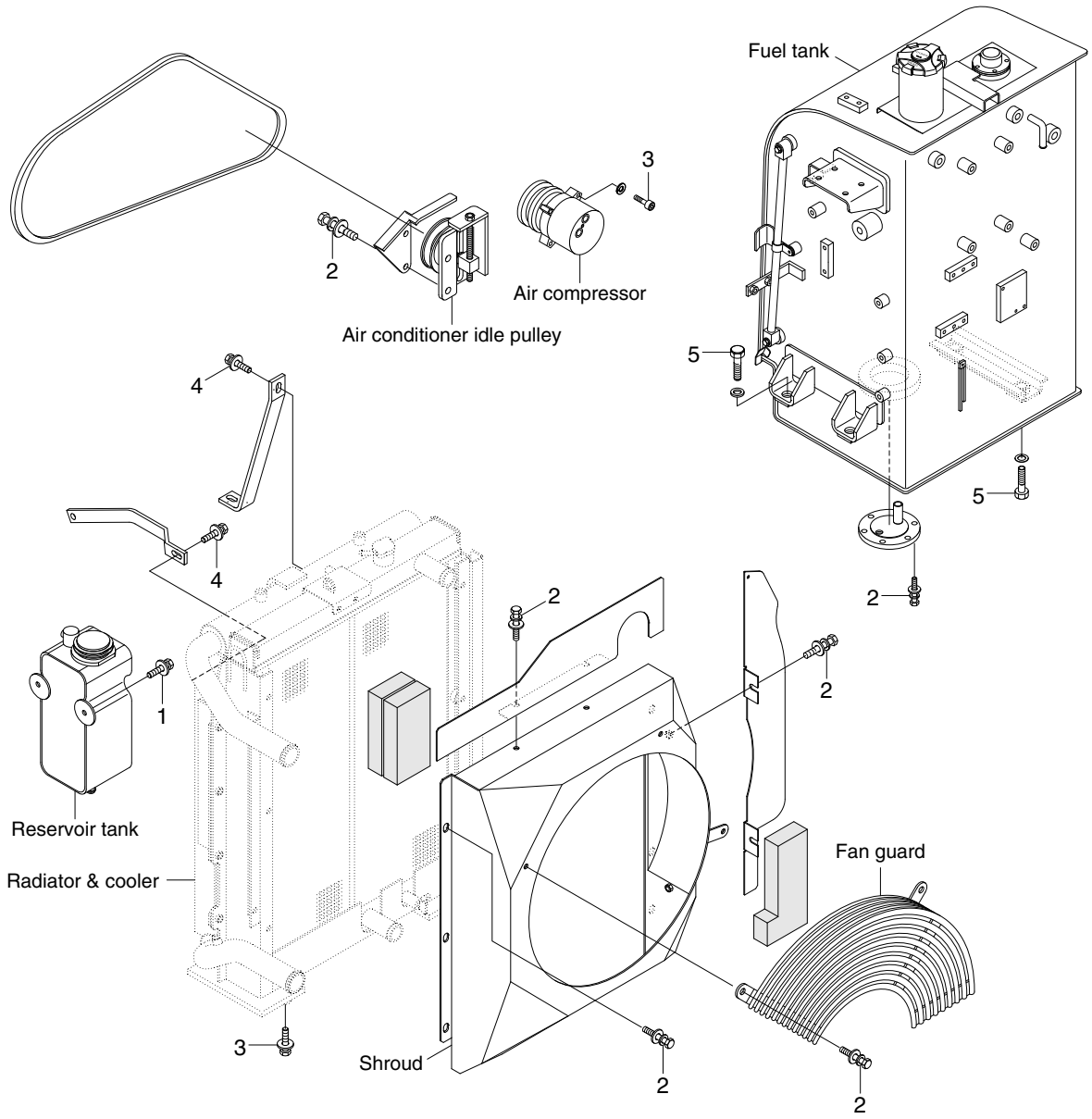
55W9A8CM01

·Tightening torque

Item	Size	kgf·m	lbf·ft
1	M 8×1.25	1.8±0.2	13.0±1.4
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M 8×1.25	3.0±0.2	21.7±1.4

Item	Size	kgf·m	lbf·ft
4	M10×1.5	6.9±1.0	49.9±7.2
5	M16×2.0	25±2.5	181±18

2. COOLING SYSTEM AND FUEL TANK MOUNTING



55W9A8CM02

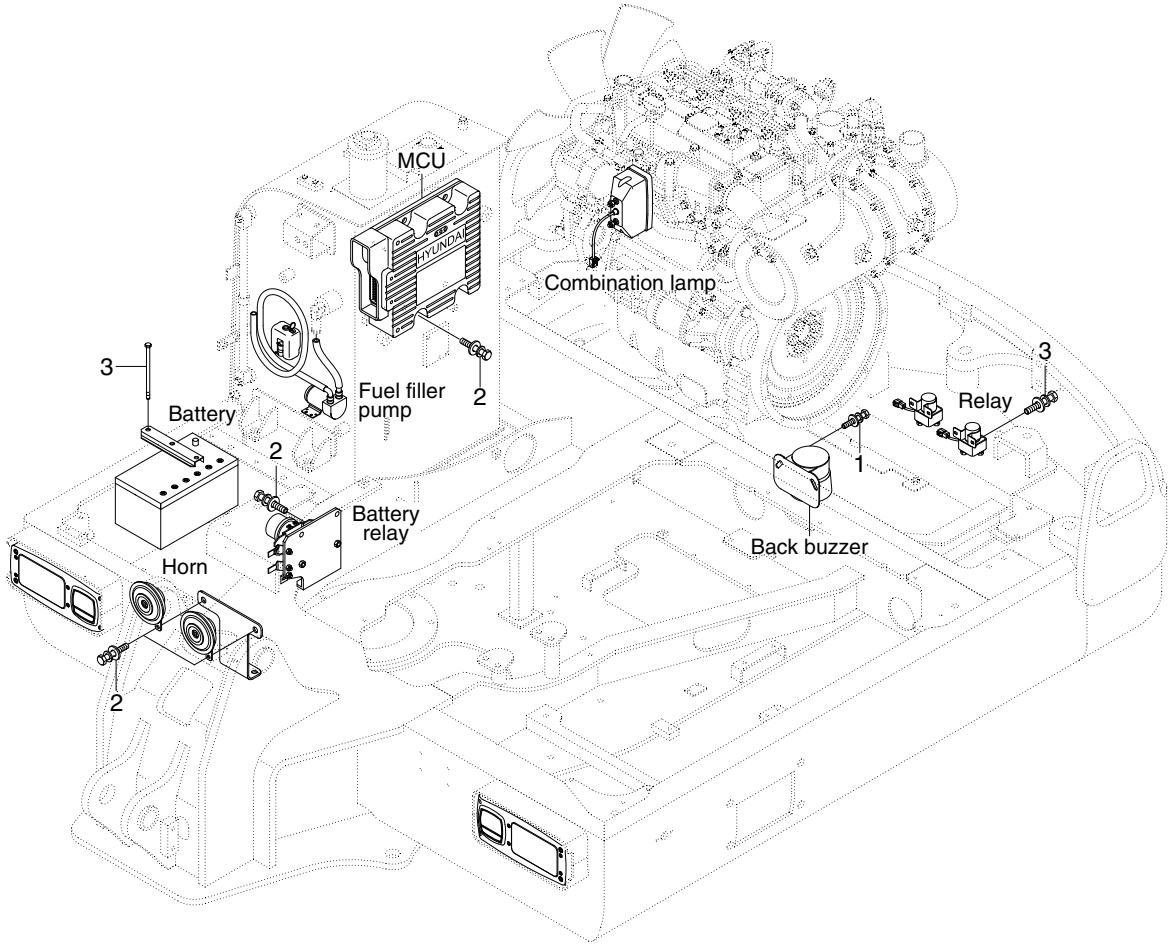
·Tightening torque

Item	Size	kgf·m	lbf·ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6
3	M10×1.25	6.9±1.4	49.9±10.1

Item	Size	kgf·m	lbf·ft
4	M12×1.75	12.8±3.0	92.6±21.7
5	M16×2.0	29.7±4.5	215±32.5

GROUP 3 ELECTRIC SYSTEM

1. ELECTRIC COMPONENTS MOUNTING 1



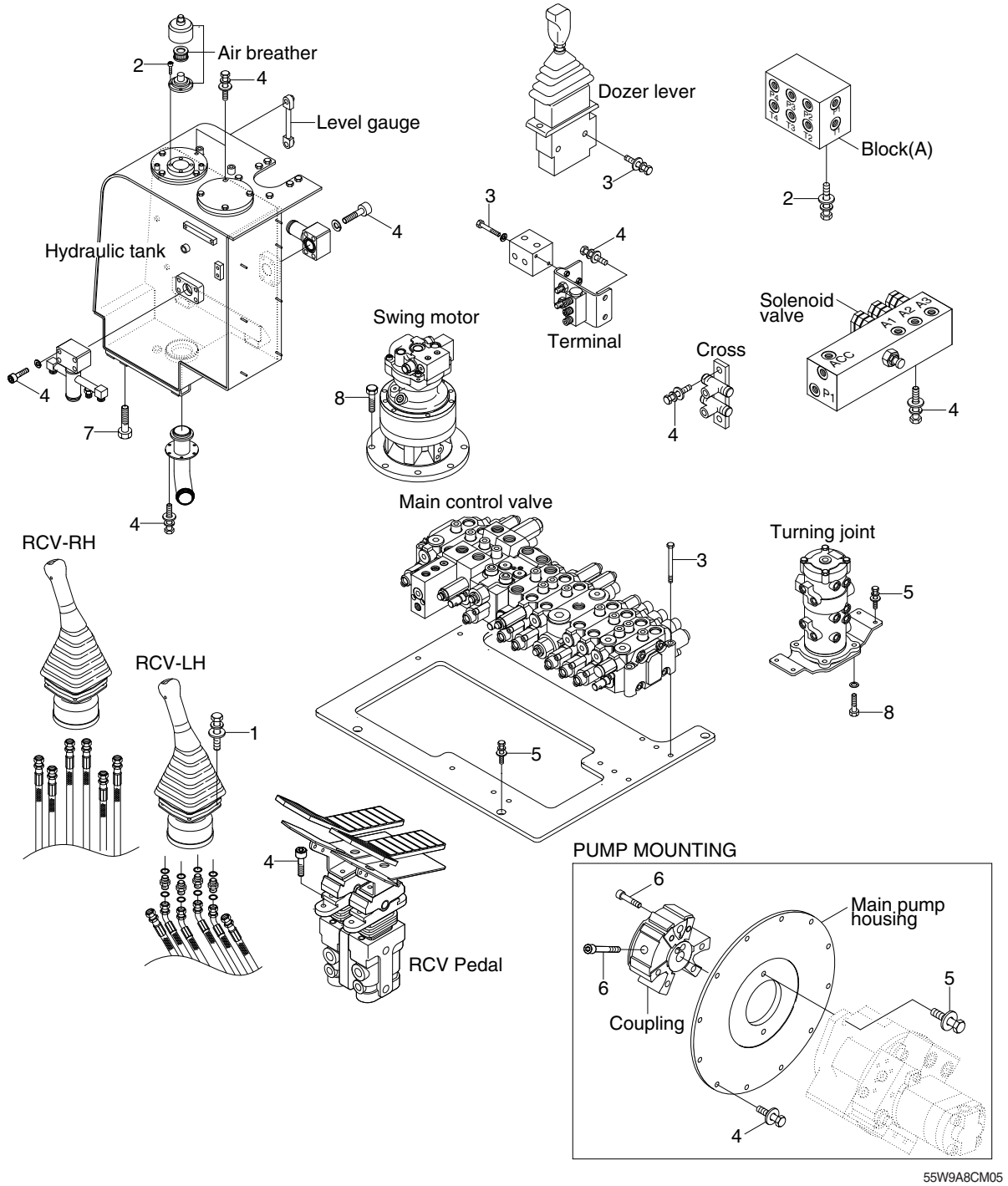
55W9A8CM03

·Tightening torque

Item	Size	kgf·m	lbf·ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 8×1.25	2.5±0.5	18.1±3.6

Item	Size	kgf·m	lbf·ft
3	M10×1.5	6.9±1.4	49.9±10.1
4	-	2.0±0.2	14.5±1.4

1. HYDRAULIC COMPONENTS MOUNTING 1

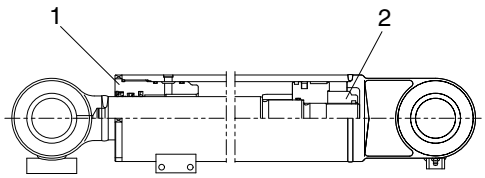


·Tightening torque

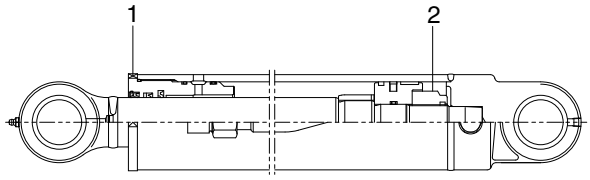
Item	Size	kgf·m	lbf·ft
1	M 6×1.0	1.05±0.2	7.6±1.45
2	M 6×1.0	1.44±0.3	10.4±2.2
3	M 8×1.25	2.5±0.5	18.1±3.6
4	M10×1.5	6.9±1.4	49.9±10.1

Item	Size	kgf·m	lbf·ft
5	M12×1.75	12.2±1.3	88.2±9.4
6	M14×2.0	14.0±1.0	101±7.2
7	M16×2.0	25.0±2.5	118±18.1
8	M16×2.0	29.7±4.5	215±33.0

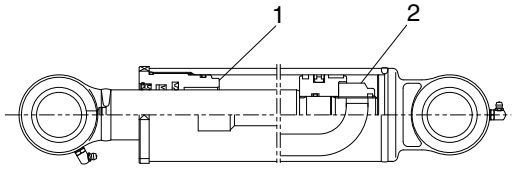
2. HYDRAULIC COMPONENTS MOUNTING 2



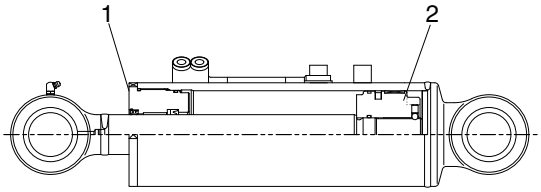
BOOM CYLINDER



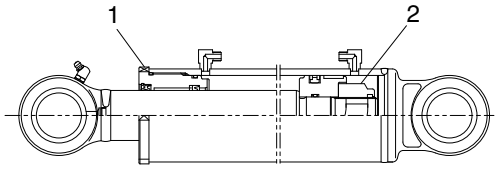
ARM CYLINDER



BUCKET CYLINDER



DOZER CYLINDER



BOOM SWING CYLINDER

55W98CM07

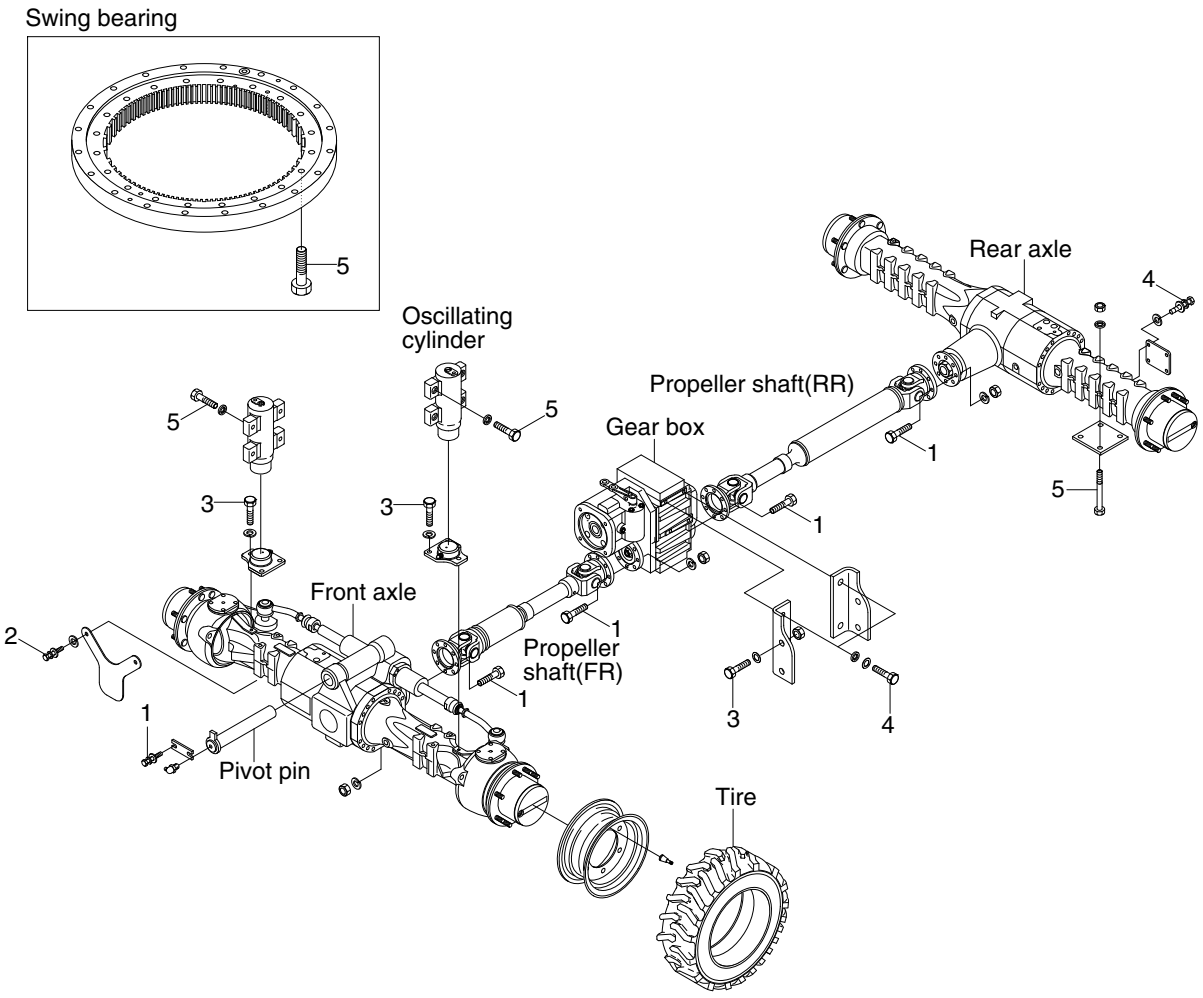
·Tightening torque

Gland (1)

Item	Size	kgf·m	lbf·ft
Boom cylinder	M115	70±7.0	506±51
Arm cylinder	M95	70±7.0	506±51
Bucket cylinder	M85	75±7.5	542±54
Dozer cylinder	M105	70±7.0	506±51
B/S cylinder	M100	70±7.0	506±51

Lock nut (2)

Item	Size	kgf·m	lbf·ft
Boom cylinder	M45	50±5.0	362±36
Arm cylinder	M39	75±7.5	542±54
Bucket cylinder	M36	75±7.5	542±54
Dozer cylinder	M39	97.5±9.8	705±71
B/S cylinder	M36	97.5±9.8	705±71

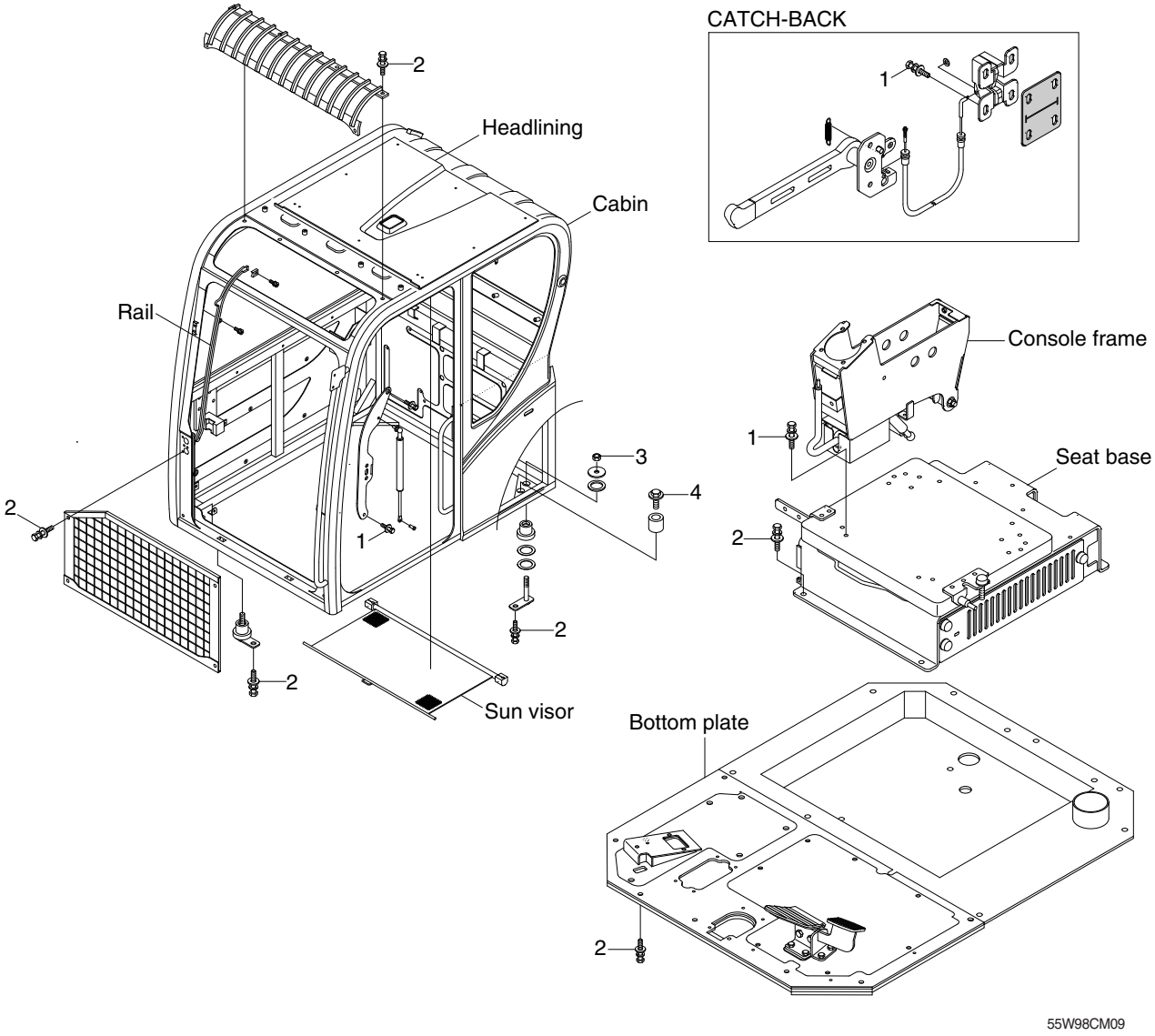


·Tightening torque

Item	Size	kgf·m	lbf·ft
1	M10×1.5	6.9±1.4	49.9±10.1
2	M10×1.5	12.3±2.5	89±18
3	M12×1.75	12.8±3.0	92.6±21.7

Item	Size	kgf·m	lbf·ft
4	M14×2.0	20.0±2.0	145±14.0
5	M16×2.0	29.7±4.5	215±32.5
6	M18×2.0	41.0±5.0	297±36.0

1. CAB AND ACCESSORIES MOUNTING

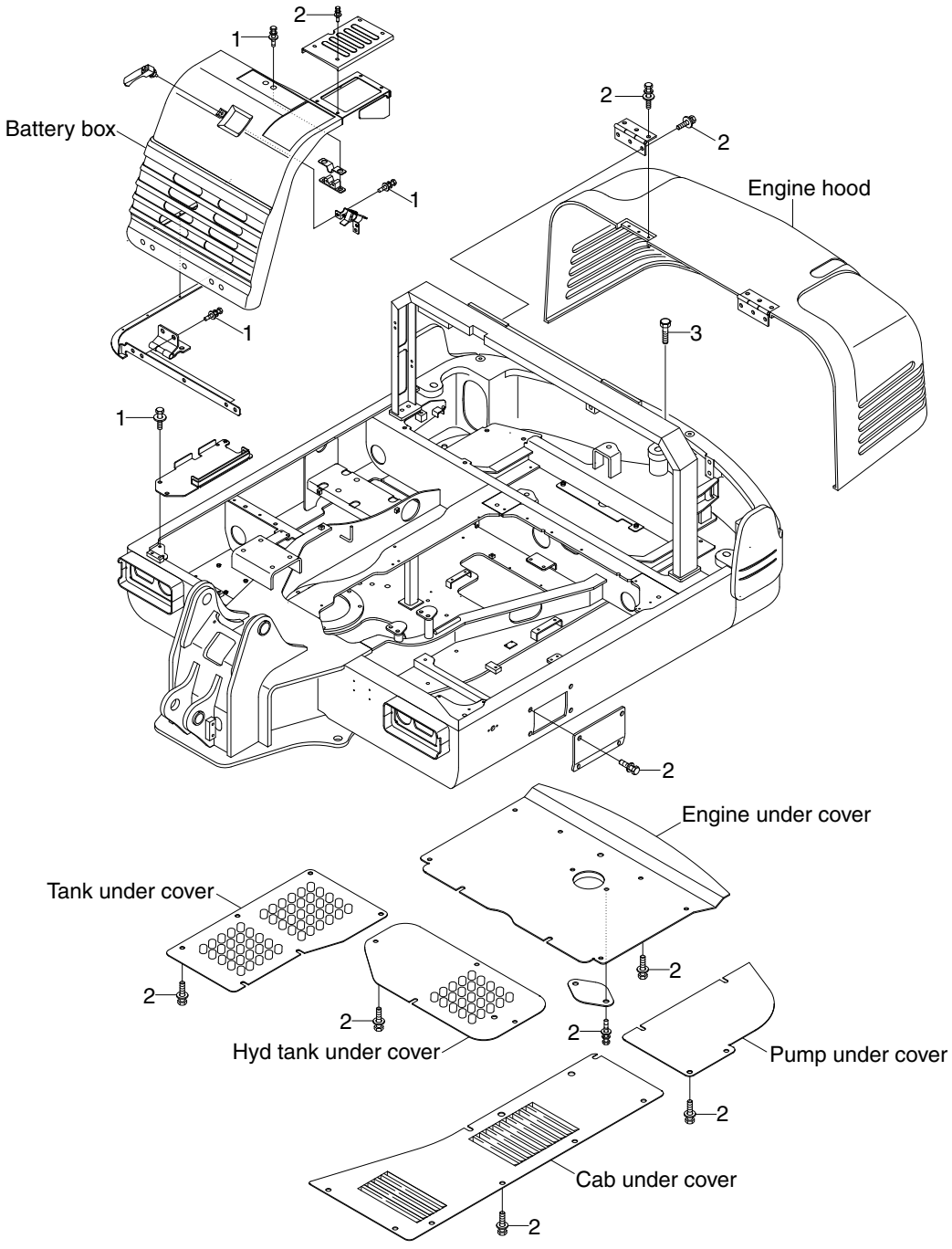


·Tightening torque

Item	Size	kgf·m	lbf·ft
1	M 8×1.25	2.5±0.5	18.1±3.6
2	M10×1.5	4.7±0.9	34.0±6.5

Item	Size	kgf·m	lbf·ft
3	M12×1.75	12.8±3.0	92.6±21.7
4	M16×2.0	29.7±4.5	215±32.5

2. COWLING MOUNTING



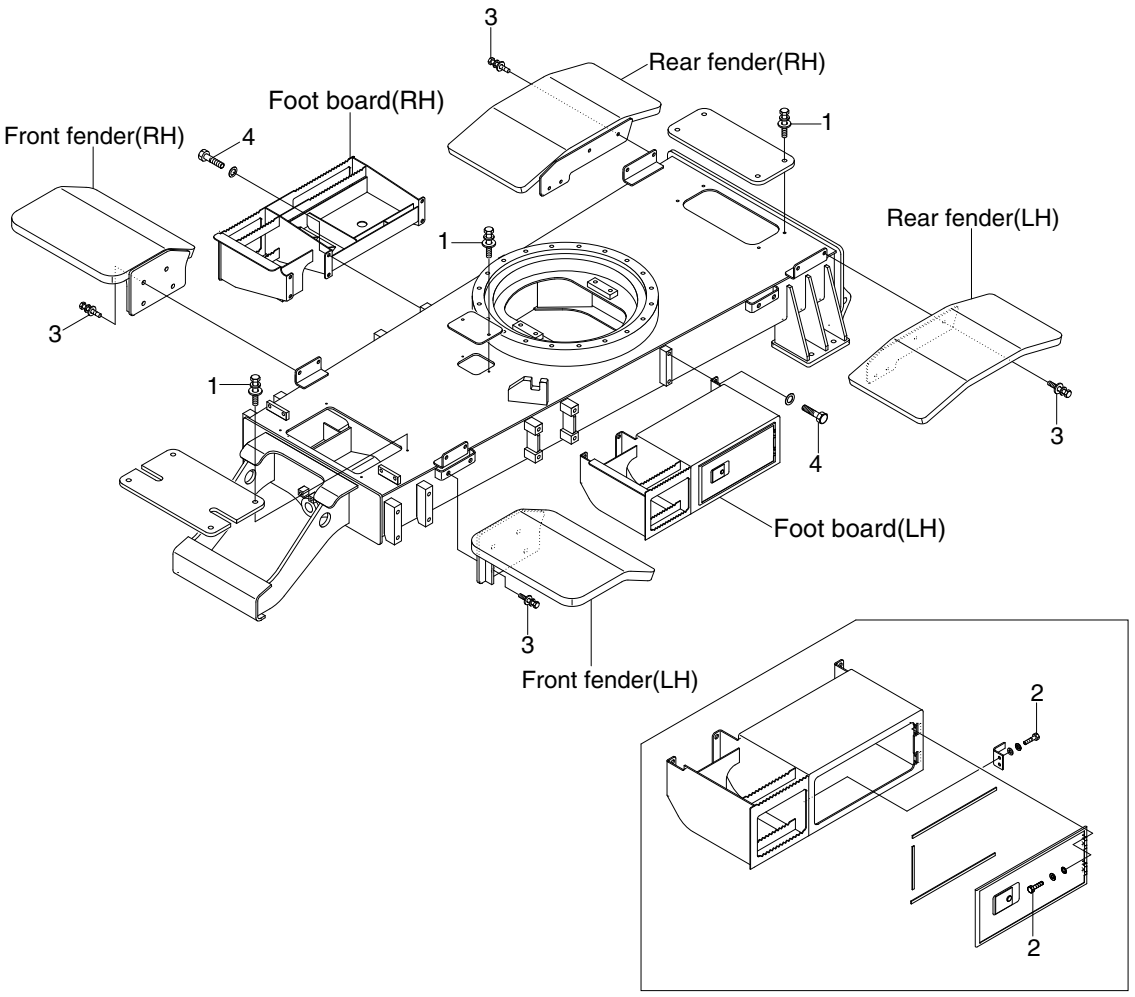
55W98CM10

·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	34.0±6.5

Item	Size	kgf·m	lbf·ft
3	M20×2.5	57.8±6.4	418±46.3

3. COVER AND FOOT BOARD

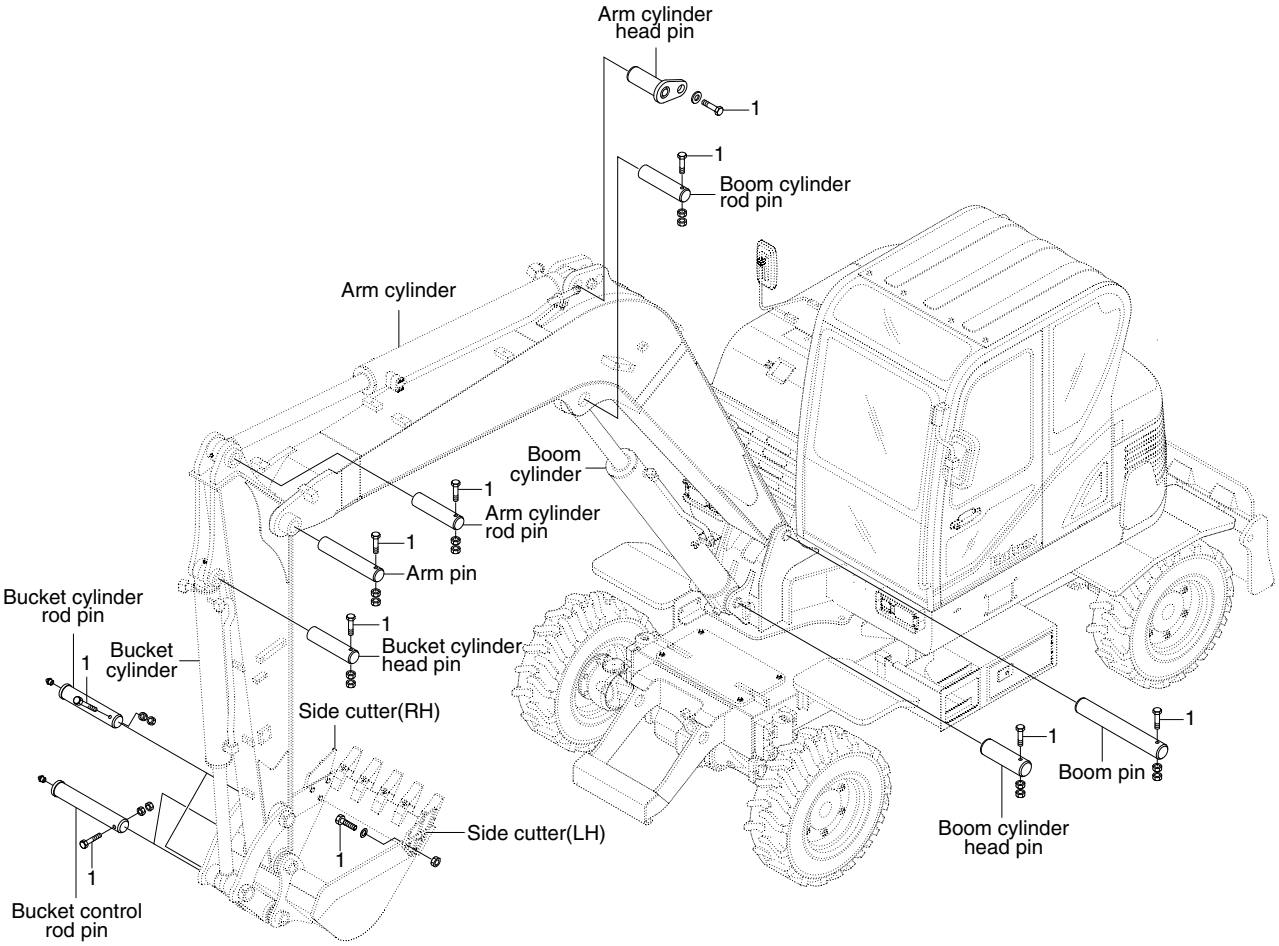


55W98CM06

·Tightening torque

Item	Size	kgf·m	lbf·ft
1	M 6×1.0	0.92±0.2	6.7±1.4
2	M 8×1.25	2.5±0.5	18.1±3.6

Item	Size	kgf·m	lbf·ft
1	M12×1.75	12.8±3.0	92.6±21.7
2	M16×2.0	29.6±3.2	214±23.1



55W98CM11

·Tightening torque

Item	Size	kgf·m	lbf·ft
1	M12×1.75	12.8±3.0	92.6±21.7

Item	Size	kgf·m	lbf·ft
2	M16×2.0	29.7±4.5	215±32.5