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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 HD Hyundai Construction Equipment 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 HD Hyundai Construction Equipment distributors.

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

Filing method

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

   2 - 3
   - 2 : Item number (2. Structure and Function)
   - 3 : 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 55 mm into inches.

(1) Locate the number 50 in 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 550 mm into inches.

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

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

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

Millimeters to inches

ⓑ

1 mm = 0.03937 in

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

Millimeters to inches

1 mm = 0.03937 in

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

Kilogram to Pound

1 kg = 2.2046 lb

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

Liter to U.S. Gallon

1 ℓ = 0.2642 U.S.Gal

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

Liter to U.K. Gallon

1 ℓ = 0.21997 U.K.Gal

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

kgf · m to lbf · ft

1 kgf · m = 7.233 lbf · ft

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

kgf/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 Hints 1-1
Group 2 Specifications 1-9

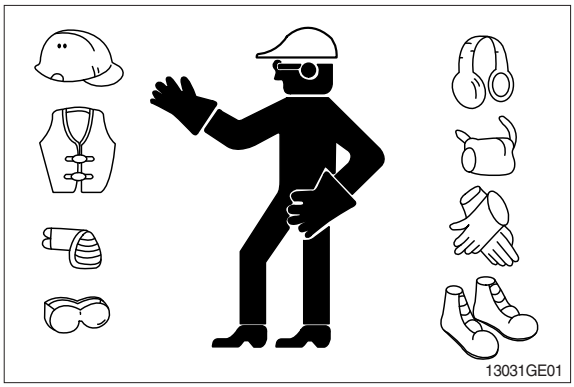
GROUP 1 SAFETY

FOLLOW SAFE PROCEDURE

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

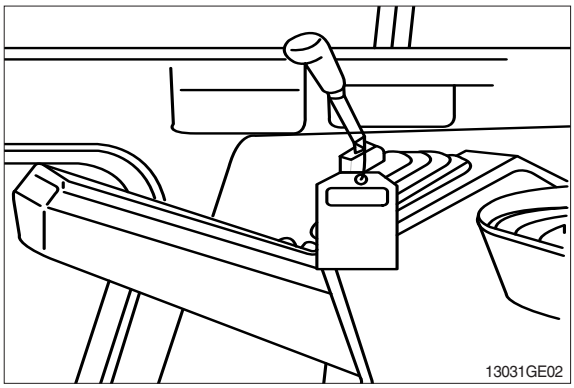
WEAR PROTECTIVE CLOTHING

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



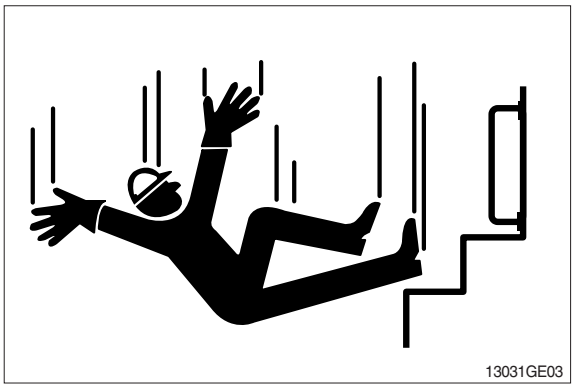
WARN OTHERS OF SERVICE WORK

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



USE HANDHOLDS AND STEPS

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

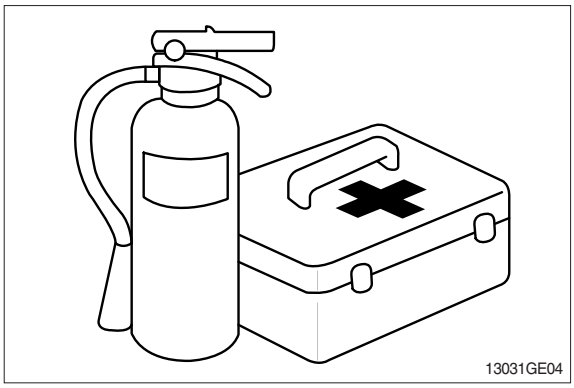


PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

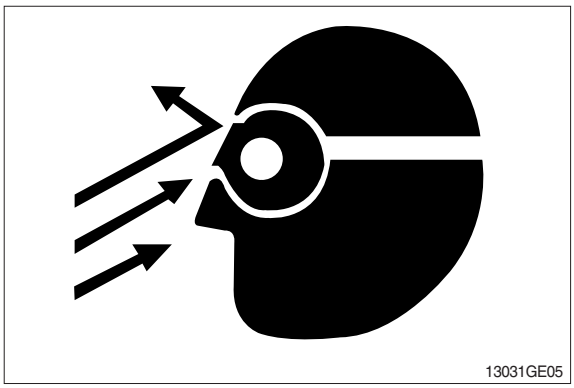
Keep a first aid kit and fire extinguisher handy.

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



PROTECT AGAINST FLYING DEBRIS

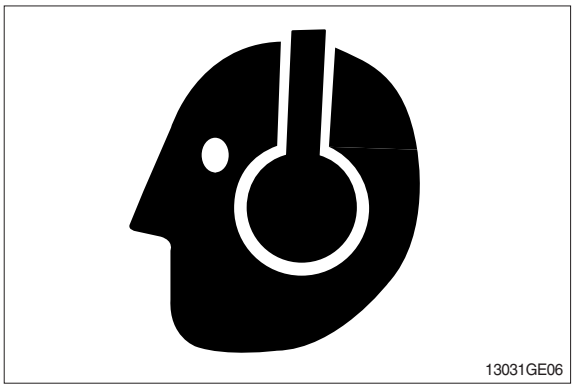
Guard against injury from flying pieces of metal or debris; wear goggles or safety glasses.



PROTECT AGAINST NOISE

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

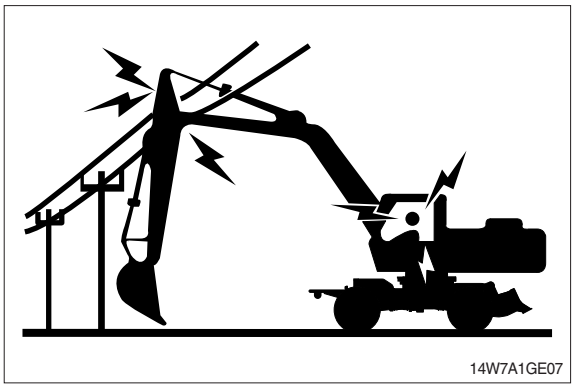
Wear a suitable hearing protective device such as ear-
muffs or earplugs to protect against objectionable or uncomfortable loud noises.



AVOID POWER LINES

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

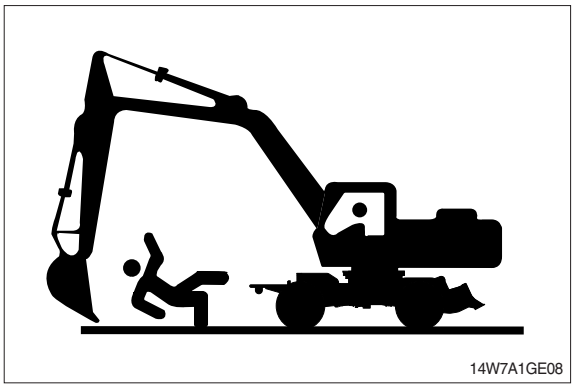
Never move any part of the machine or load closer to electric line than 3m(10ft) plus twice the line insulator length.



KEEP RIDERS OFF EXCAVATOR

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

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

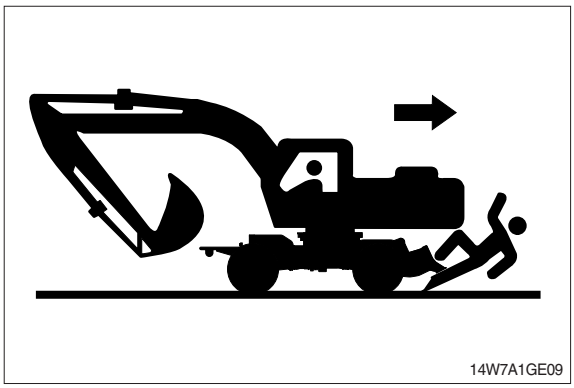


MOVE AND OPERATE MACHINE SAFELY

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

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

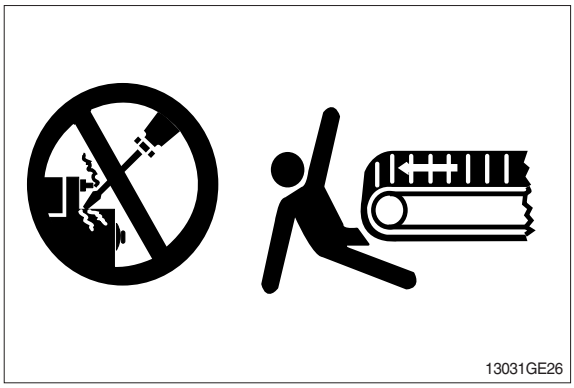
Use a signal person when moving, swinging, or operating the machine in congested areas. Coordinate hand signals before starting the excavator.



OPERATE ONLY FORM OPERATOR'S SEAT

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

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



PARK MACHINE SAFELY

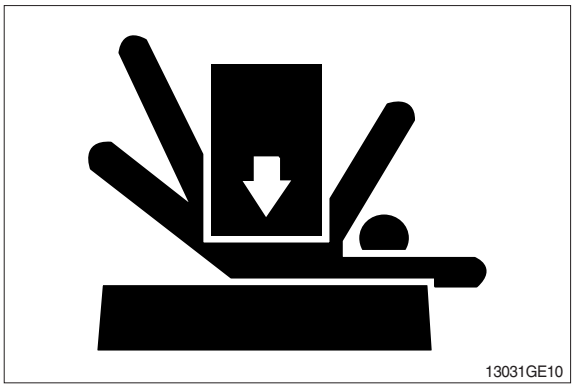
Before working on the machine:

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

SUPPORT MACHINE PROPERLY

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

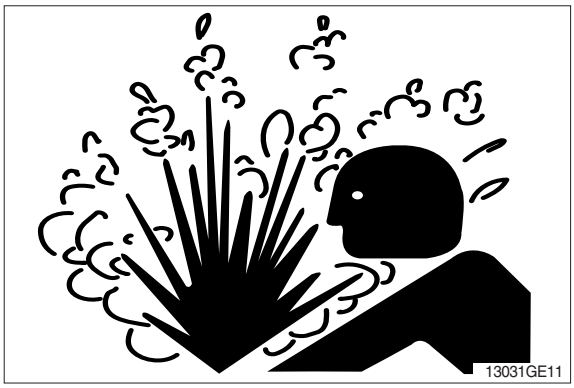
Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load.
Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.



SERVICE COOLING SYSTEM SAFELY

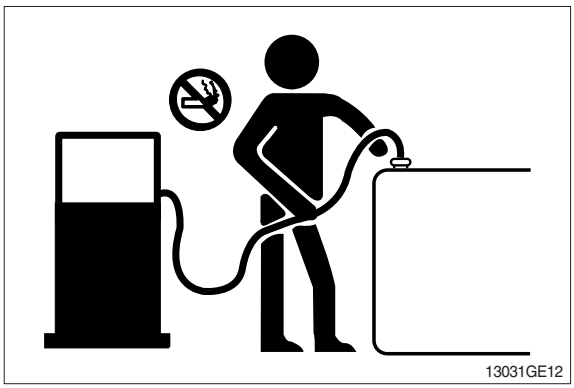
Explosive release of fluids from pressurized cooling system can cause serious burns.

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



HANDLE FLUIDS SAFELY-AVOID FIRES

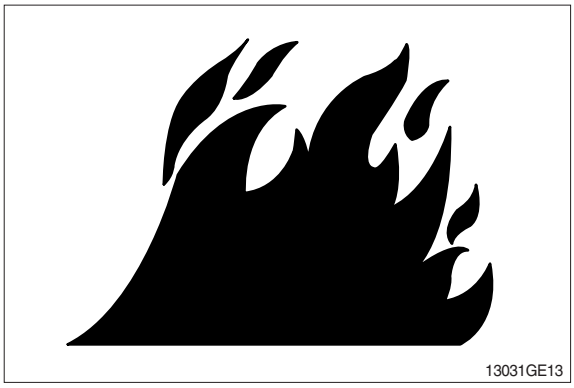
Handle fuel with care; it is highly flammable. Do not refuel the machine while smoking or when near open flame or sparks. Always stop engine before refueling machine.
Fill fuel tank outdoors.



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

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

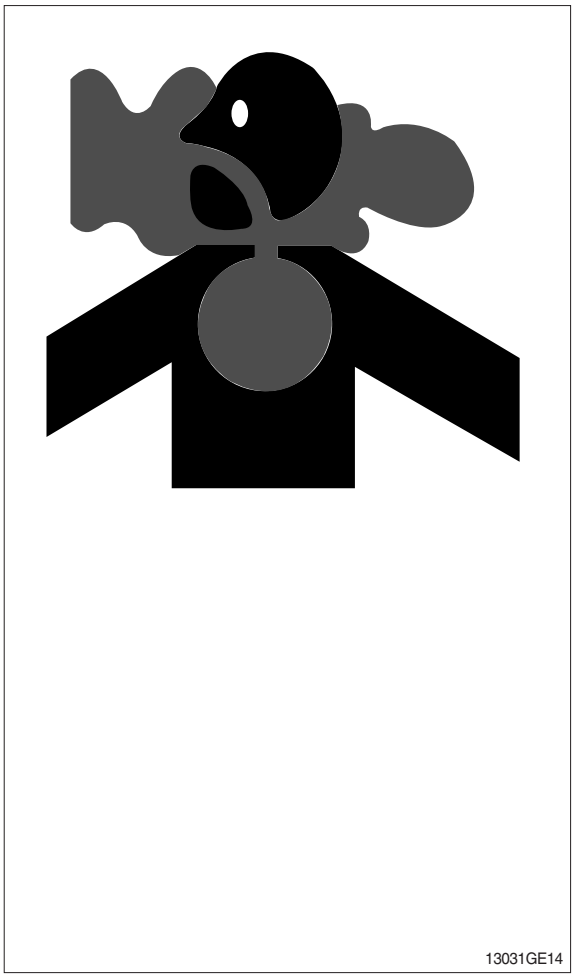
Do not store oily rags ; they can ignite and burn spontaneously.



BEWARE OF EXHAUST FUMES

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

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



REMOVE PAINT BEFORE WELDING OR HEATING

Avoid potentially toxic fumes and dust.

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

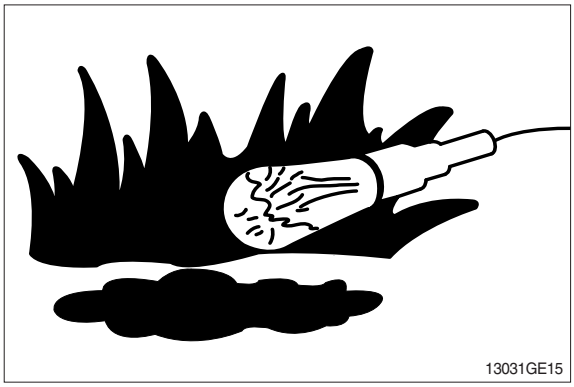
Do all work outside or in a well ventilated area. Dispose of paint and solvent properly.

Remove paint before welding or heating:

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

ILLUMINATE WORK AREA SAFELY

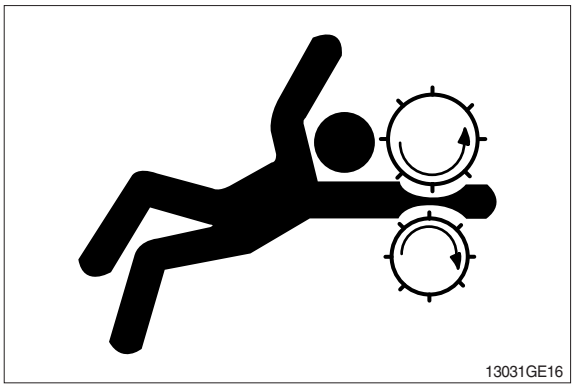
Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.



SERVICE MACHINE SAFELY

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

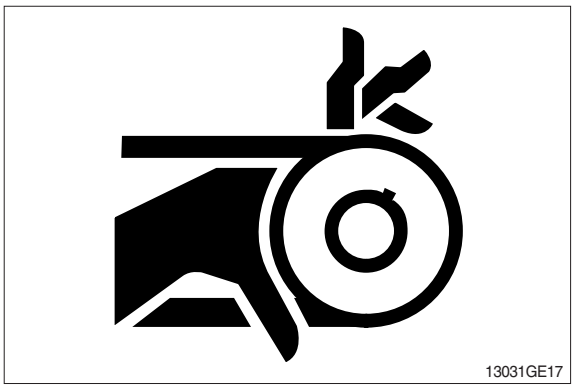
Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

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



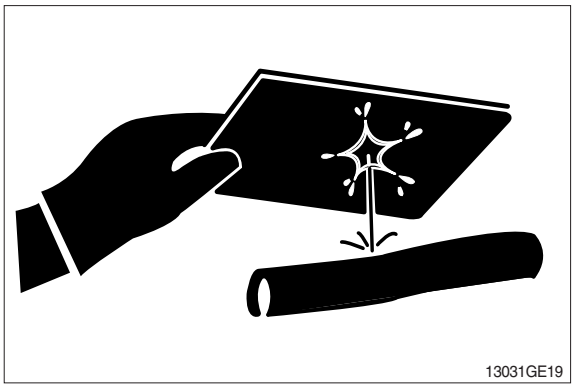
AVOID HIGH PRESSURE FLUIDS

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

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

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

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



AVOID HEATING NEAR PRESSURIZED FLUID LINES

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

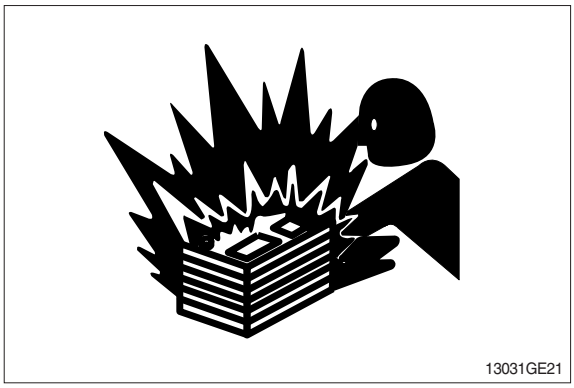
Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area. Install fire resisting guards to protect hoses or other materials.

PREVENT BATTERY EXPLOSIONS

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

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

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



PREVENT ACID BURNS

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

Avoid the hazard by:

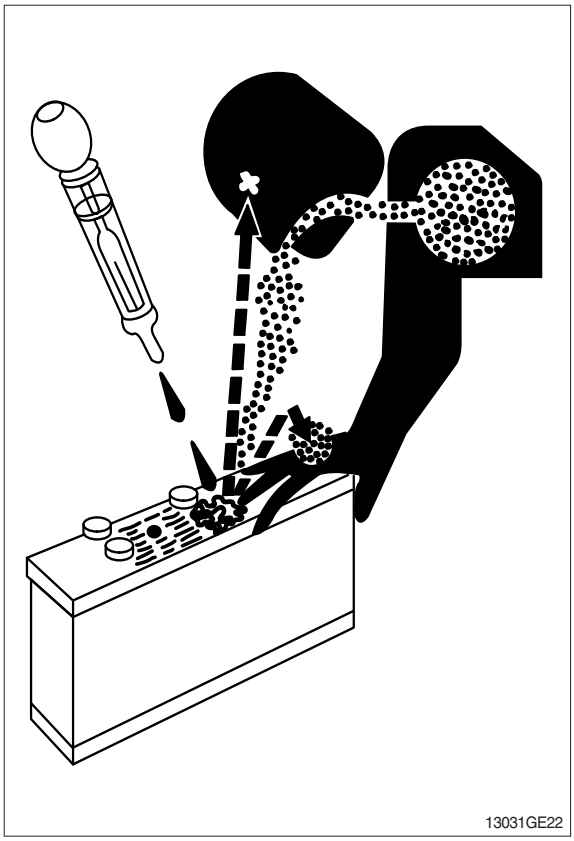
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling of dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

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

If acid is swallowed:

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



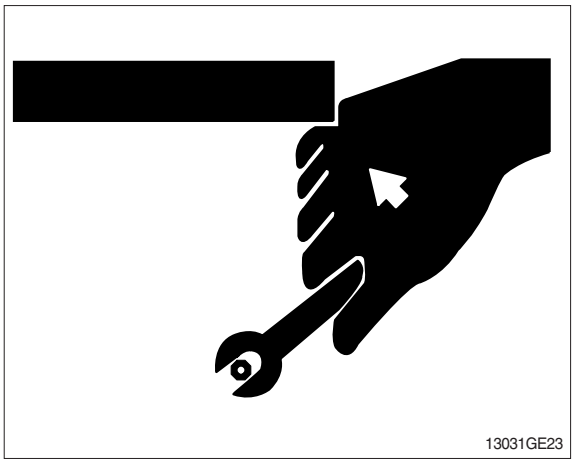
USE TOOLS PROPERLY

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

Use power tools only to loosen threaded tools and fasteners.

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

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

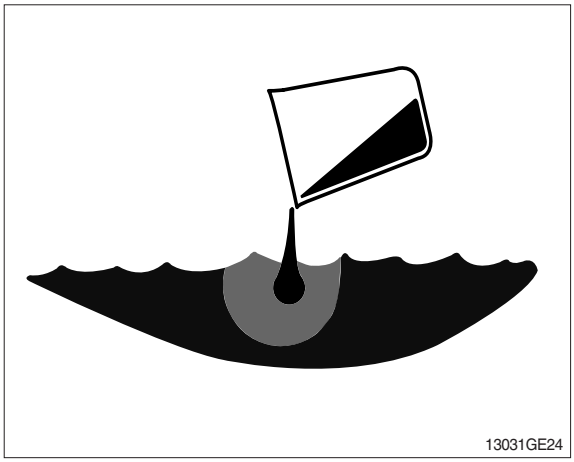


DISPOSE OF FLUIDS PROPERLY

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.

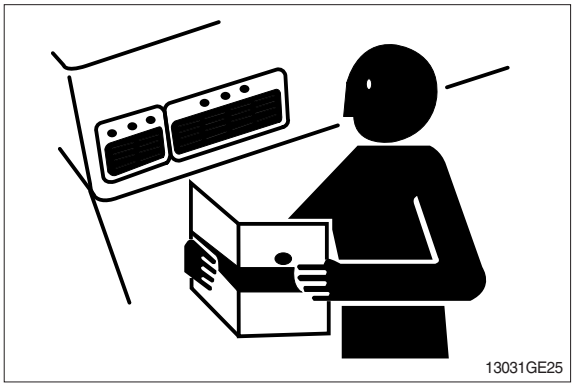
Use proper containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

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.

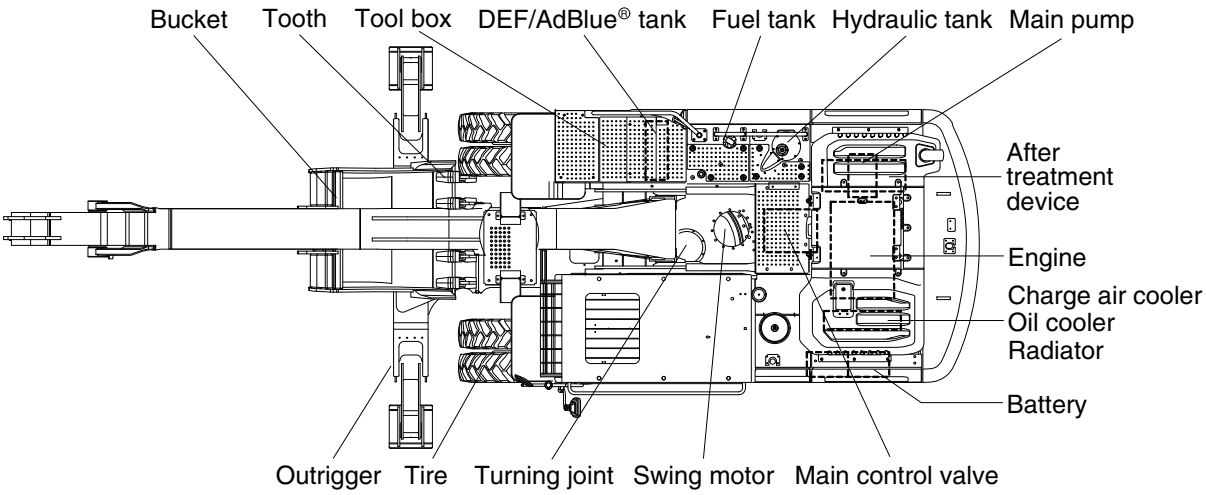


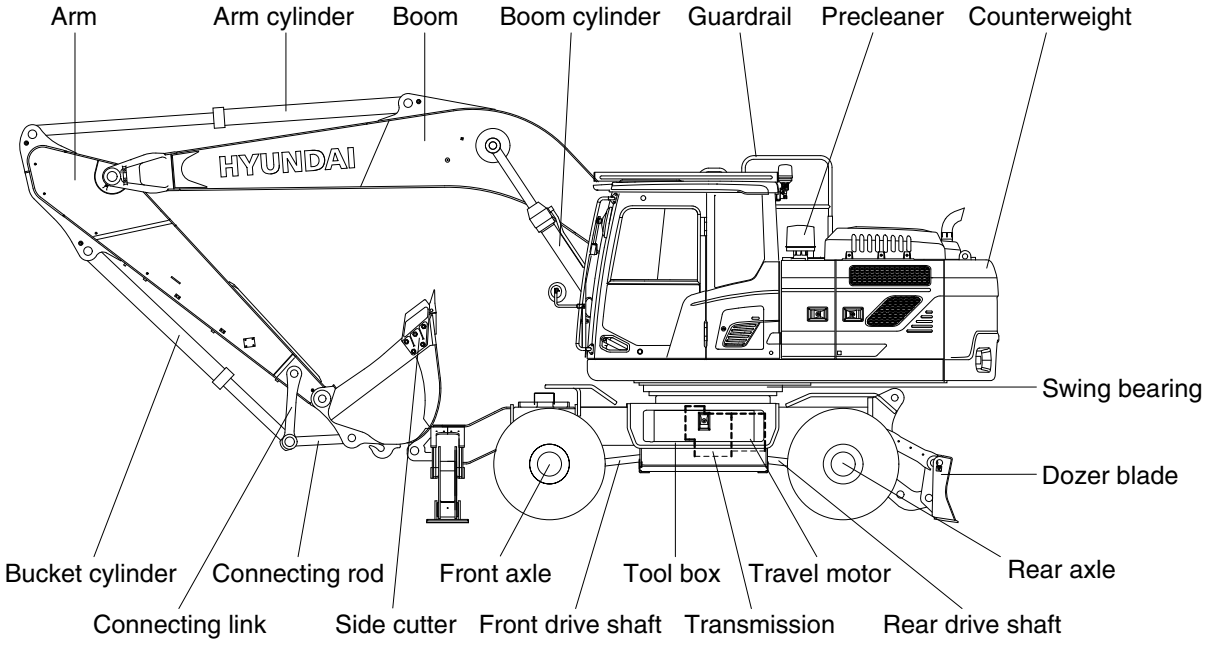
LIVE WITH SAFETY

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

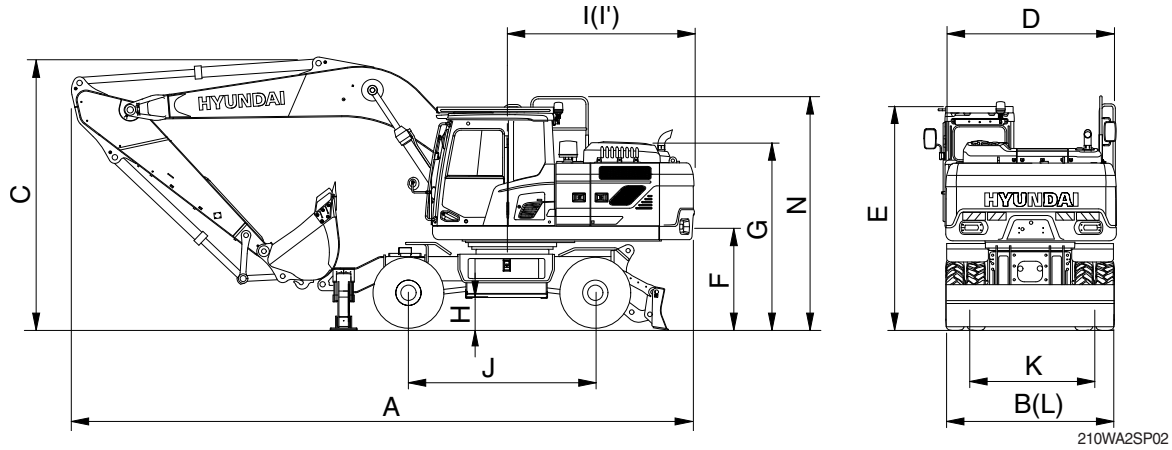




210WA2SP01

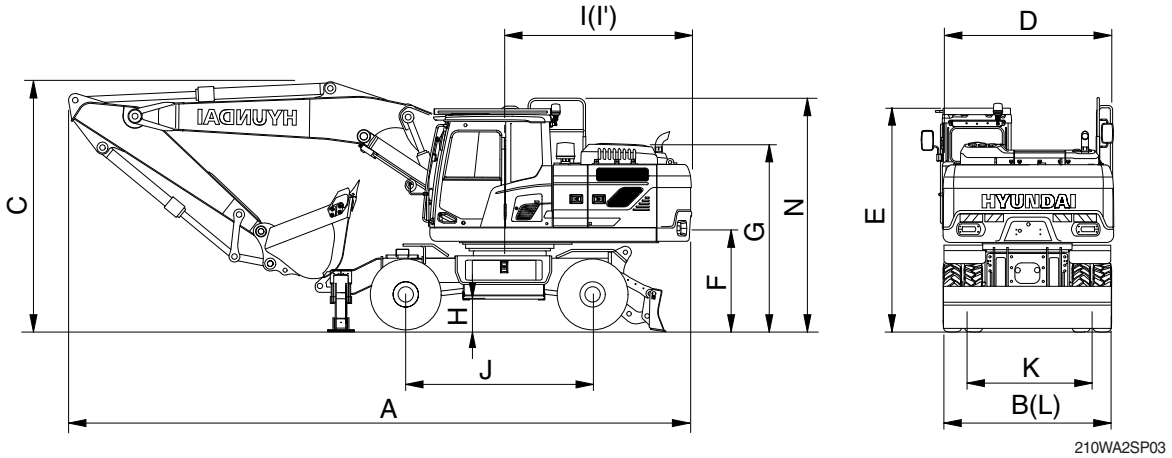
2. SPECIFICATIONS

1) 5.65 m (18' 6") MONO BOOM



Description			Unit		Specification		
			m (ft-in)	Boom	5.65 (18' 6")		
				Arm	2.92 (9' 7")	2.40 (7' 10")	2.70 (8' 10")
Operating weight			kg (lb)		21180 (46690)	21090 (46500)	21080 (46470)
Bucket capacity (SAE heaped), standard			m^3 (yd^3)		0.80 (1.05)	0.80 (1.05)	0.80 (1.05)
Overall length (traveling)		A	mm (ft-in)		9380 (30' 9")	9590 (31' 6")	9540 (31' 4")
Overall length (shipping)					9500 (31' 2")	9680 (31' 9")	9570 (31' 5")
Overall width		B			2530 (8' 4")	2530 (8' 4")	2530 (8' 4")
Overall height of boom (traveling)		C			4020 (13' 2")	3720 (12' 2")	3650 (12' 0")
Overall height of boom (shipping)					3150 (10' 4")	3350 (11' 0")	3240 (10' 8")
Upperstructure width		D			2530 (8' 4")	2530 (8' 4")	2530 (8' 4")
Cab height		E			3260 (10' 8")	3260 (10' 8")	3260 (10' 8")
Ground clearance of counterweight		F			1295 (4' 3")	1295 (4' 3")	1295 (4' 3")
Engine cover height		G			2770 (9' 1")	2770 (9' 1")	2770 (9' 1")
Clearance to mission cover		H			347 (1' 2")	347 (1' 2")	347 (1' 2")
Rear-end distance		I			2733 (9' 0")	2733 (9' 0")	2733 (9' 0")
Rear-end swing radius		I'			2740 (9' 0")	2740 (9' 0")	2740 (9' 0")
Wheel base		J			2800 (9' 2")	2800 (9' 2")	2800 (9' 2")
Tread	Std axle	K			1914 (6' 3")	1914 (6' 3")	1914 (6' 3")
	Wide axle				2114 (6' 11")	2114 (6' 11")	2114 (6' 11")
Dozer blade width		L			2490 (8' 2")	2490 (8' 2")	2490 (8' 2")
Overall height of guardrail		N			3330 (10' 11")	3330 (10' 11")	3330 (10' 11")
Travel speed		Low	km/hr (mph)		9.5 (5.9)	9.5 (5.9)	9.5 (5.9)
		High			38.4 (23.9)	38.4 (23.9)	38.4 (23.9)
Swing speed			rpm		10.7	10.7	10.7
Gradeability			Degree (%)		30 (70)	30 (70)	30 (70)
Max traction force			kg (lb)		12106 (26689)	12106 (26689)	12106 (26689)

2) 5.40 m (17' 9") 2-PIECE BOOM

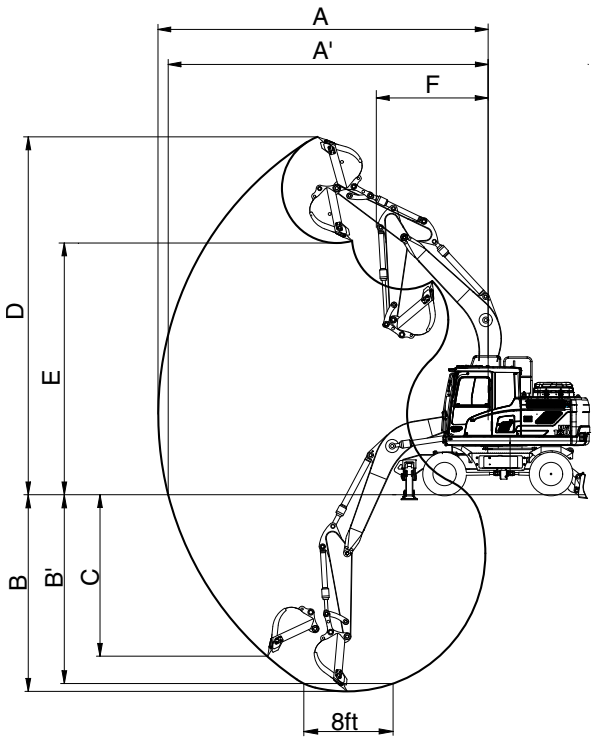


210WA2SP03

Description			Unit		Specification		
			m (ft-in)	Boom	5.40 (17' 9")		
				Arm	2.92 (9' 7")	2.40 (7' 10")	2.70 (8' 10")
Operating weight			kg (lb)		22510 (49630)	22420 (49430)	22410 (49410)
Bucket capacity (SAE heaped), standard			m^3 (yd^3)		0.80 (1.05)	0.80 (1.05)	0.80 (1.05)
Overall length (traveling)		A	mm (ft-in)		6980 (22' 11")	7090 (23' 3")	7060 (23' 2")
Overall length (shipping)					9230 (30' 3")	9240 (30' 4")	9250 (30' 4")
Overall width		B			2530 (8' 4")	2530 (8' 4")	2530 (8' 4")
Overall height of boom (traveling)		C			3990 (13' 1")	3990 (13' 1")	3990 (13' 1")
Overall height of boom (shipping)					3180 (10' 5")	3170 (10' 5")	3150 (10' 4")
Upperstructure width		D			2530 (8' 4")	2530 (8' 4")	2530 (8' 4")
Cab height		E			3260 (10' 8")	3260 (10' 8")	3260 (10' 8")
Ground clearance of counterweight		F			1295 (4' 3")	1295 (4' 3")	1295 (4' 3")
Engine cover height		G			2770 (9' 1")	2770 (9' 1")	2770 (9' 1")
Clearance to mission cover		H			347 (1' 2")	347 (1' 2")	347 (1' 2")
Rear-end distance		I			2733 (9' 0")	2733 (9' 0")	2733 (9' 0")
Rear-end swing radius		I'			2740 (9' 0")	2740 (9' 0")	2740 (9' 0")
Wheel base		J			2800 (9' 2")	2800 (9' 2")	2800 (9' 2")
Tread	Std axle	K			1914 (6' 3")	1914 (6' 3")	1914 (6' 3")
	Wide axle				2114 (6' 11")	2114 (6' 11")	2114 (6' 11")
Dozer blade width		L			2490 (8' 2")	2490 (8' 2")	2490 (8' 2")
Overall height of guardrail		N			3330 (10' 11")	3330 (10' 11")	3330 (10' 11")
Travel speed		Low	km/hr (mph)		9.5 (5.9)	9.5 (5.9)	9.5 (5.9)
		High			38.4 (23.9)	38.4 (23.9)	38.4 (23.9)
Swing speed			rpm		10.7	10.7	10.7
Gradeability			Degree (%)		30 (70)	30 (70)	30 (70)
Max traction force			kg (lb)		12106 (26689)	12106 (26689)	12106 (26689)

3. WORKING RANGE AND DIGGING POWER

1) 5.65 m (18' 6") MONO BOOM

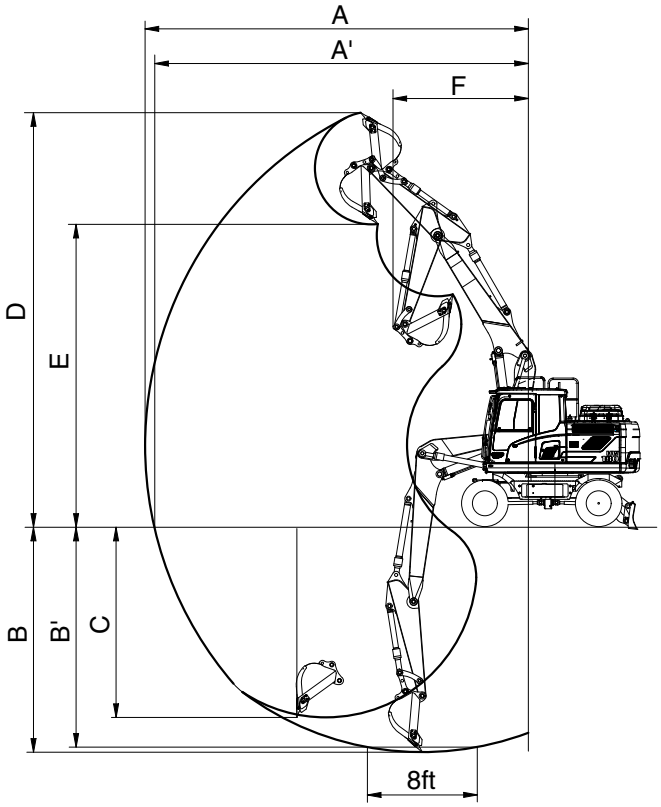


180WF2SP04

Description		2.92 m (9' 7") Arm	2.40 m (7' 10") Arm	2.70 m (8' 10") Arm
Max digging reach	A	9970 (32' 9")	9480 (31' 1")	9760 (32' 0")
Max digging reach on ground	A'	9770 (32' 1")	9270 (30' 5")	9550 (31' 4")
Max digging depth	B	6430 (21' 1")	5860 (19' 3")	6210 (20' 4")
Max digging depth (8 ft level)	B'	6210 (20' 4")	5660 (18' 7")	5980 (19' 7")
Max vertical wall digging depth	C	6110 (20' 1")	5510 (18' 1")	5830 (19' 2")
Max digging height	D	10020 (32' 10")	9710 (31' 10")	9870 (32' 5")
Max dumping height	E	7160 (23' 6")	6860 (22' 6")	7010 (23' 0")
Min swing radius	F	3460 (11' 4")	3520 (11' 7")	3490 (11' 5")
Bucket digging force	SAE	130.4 [141.6]	130.4 [141.6]	130.4 [141.6]
		13300 [14440]	13300 [14440]	13300 [14440]
		29320 [31830]	29320 [31830]	29320 [31830]
	ISO	151.0 [164.0]	151.0 [164.0]	151.0 [164.0]
		15400 [16720]	15400 [16720]	15400 [16720]
		33950 [36860]	33950 [36860]	33950 [36860]
Arm digging force	SAE	102.0 [110.7]	120.6 [130.9]	108.9 [118.2]
		10400 [11290]	12300 [13350]	11100 [12050]
		22930 [24890]	27120 [29430]	24470 [26570]
	ISO	106.9 [116.0]	126.5 [137.4]	113.8 [123.5]
		10900 [11830]	12900 [14010]	11600 [12590]
		24030 [26080]	28440 [30890]	25570 [27760]

[ ] : Power boost

2) 5.40 m (17' 9") 2-PIECE BOOM



180WF2SP05

Description		2.92 m (9' 7") Arm	2.40 m (7' 10") Arm	2.70 m (8' 10") Arm
Max digging reach	A	9810 (32' 2")	9310 (30' 7")	9600 (31' 6")
Max digging reach on ground	A'	9610 (31' 6")	9100 (29' 10")	9400 (30' 10")
Max digging depth	B	6090 (20' 0")	5570 (18' 3")	5870 (19' 3")
Max digging depth (8 ft level)	B'	6000 (19' 8")	5470 (17' 11")	5770 (18' 11")
Max vertical wall digging depth	C	4730 (15' 6")	4630 (15' 2")	4580 (15' 0")
Max digging height	D	10690 (35' 1")	10300 (33' 10")	10520 (34' 6")
Max dumping height	E	7750 (25' 5")	7370 (24' 2")	7590 (24' 11")
Min swing radius	F	2860 (9' 5")	3030 (9' 11")	2870 (9' 5")
Bucket digging force	SAE	130.4 [141.6]	130.4 [141.6]	130.4 [141.6]
		13300 [14440]	13300 [14440]	13300 [14440]
		29320 [31830]	29320 [31830]	29320 [31830]
	ISO	151.0 [164.0]	151.0 [164.0]	151.0 [164.0]
		15400 [16720]	15400 [16720]	15400 [16720]
		33950 [36860]	33950 [36860]	33950 [36860]
Arm digging force	SAE	102.0 [110.7]	120.6 [130.9]	108.9 [118.2]
		10400 [11290]	12300 [13350]	11100 [12050]
		22930 [24890]	27120 [29430]	24470 [26570]
	ISO	106.9 [116.0]	126.5 [137.4]	113.8 [123.5]
		10900 [11830]	12900 [14010]	11600 [12590]
		24030 [26080]	28440 [30890]	25570 [27760]

[ ] : Power boost

4. WEIGHT

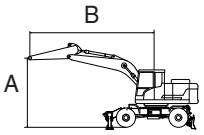
Item	HW210A	
	kg	lb
Upperstructure assembly	9485	20910
· Main frame weld assembly	1710	3770
· Engine assembly	583	1290
· Aftertreatment assembly	75	170
· Main pump assembly	140	310
· Main control valve assembly	220	490
· Swing motor assembly	254	560
· Hydraulic oil tank WA	190	420
· Fuel tank WA	171	380
· Counterweight	3400	7500
· Cab assembly	495	1090
Lower chassis assembly	7125	15710
· Lower frame weld assembly	2410	5310
· Swing bearing	284	630
· Travel motor assembly (2EA)	77	170
· Turning joint	118	260
· Transmission assembly	135	300
· Front axle assembly	749	1650
· Front axle assembly (wide)	770	1700
· Rear axle assembly	592	1310
· Rear axle assembly (wide)	623	1370
· Dozer blade assembly (front)	730	1610
· Dozer blade assembly (rear)	980	2160
· Outrigger assembly (front)	395	870
· Outrigger assembly (rear)	1095	2410
Front attachment assembly (5.65 m boom, 2.92 m arm, 0.80 m^3 SAE heaped bucket)	4570	10080
· 5.65 m boom assembly	834	1840
· 5.40 m 2pcs boom assembly	468	1030
· 2.40 m arm assembly	240	530
· 2.70 m arm assembly	150	330
· 2.92 m arm assembly	100	220
· 0.92 m^3 SAE heaped bucket assembly	817	1800
· 0.80 m^3 SAE heaped bucket assembly	777	1710
· 1.20 m^3 SAE heaped bucket assembly	920	2030
· 1.34 m^3 SAE heaped bucket assembly	990	2180
· 0.86 m^3 SAE heaped bucket assembly	732	1610
· 0.85 m^3 SAE heaped bucket assembly	845	1860
· 1.00 m^3 SAE heaped bucket assembly	912	2010
· 1.15 m^3 SAE heaped bucket assembly	991	2180
· Bucket control link assembly	369	810
· Boom cylinder assembly (2EA)	360	790
· 2-piece boom cylinder assembly (2EA)	324	710
· Arm cylinder assembly	278	610
· Bucket cylinder assembly	171	380
· Adjustment cylinder assembly	215	470
· Dozer cylinder assembly (2EA)	150	330
· Outrigger cylinder assembly (front) (2EA)	206	450

5. LIFTING CAPACITIES

1) 5.65 m MONO BOOM+3400 kg COUNTERWEIGHT

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5650	2400	3400	-	310	-	Down	-	Down

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg									*4820	*4820	5.72
	lb									*10630	*10630	(18.8)
6.0 m (19.7 ft)	kg					*5520	*5520			*4400	*4400	6.89
	lb					*12170	*12170			*9700	*9700	(22.6)
4.5 m (14.8 ft)	kg			*7190	*7190	*5960	5830	*5130	4080	*4300	4000	7.59
	lb			*15850	*15850	*13140	12850	*11310	8990	*9480	8820	(24.9)
3.0 m (9.8 ft)	kg			*8800	8590	*6640	5580	*5630	3990	*4390	3650	7.94
	lb			*19400	18940	*14640	12300	*12410	8800	*9680	8050	(26.1)
1.5 m (4.9 ft)	kg			*10000	8130	*7260	5360	*5870	3890	*4680	3540	8.00
	lb			*22050	17920	*16010	11820	*12940	8580	*10320	7800	(26.2)
0.0 m (0.0 ft)	kg			*10280	7930	*7540	5210	*5900	3830	*5240	3650	7.76
	lb			*22660	17480	*16620	11490	*13010	8440	*11550	8050	(25.5)
-1.5 m (-4.9 ft)	kg	*11990	*11990	*9780	7920	*7290	5180			*5710	4050	7.21
	lb	*26430	*26430	*21560	17460	*16070	11420			*12590	8930	(23.7)
-3.0 m (-9.8 ft)	kg	*11220	*11220	*8410	8050	*6070	5290			*5610	5020	6.25
	lb	*24740	*24740	*18540	17750	*13380	11660			*12370	11070	(20.5)

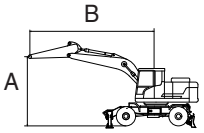
Note 1. Lifting capacity are based on ISO 10567.
2. Lifting capacity of the HX series does not exceed 75% of tipping load with the machine on firm, level ground or 87% of full hydraulic capacity.
3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates load limited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

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

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

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5650	2400	3400	-	310	-	Up	-	Up

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg									*4820	4740	5.72
	lb									*10630	10450	(18.8)
6.0 m (19.7 ft)	kg					*5520	4400			*4400	3460	6.89
	lb					*12170	9700			*9700	7630	(22.6)
4.5 m (14.8 ft)	kg			*7190	6560	*5960	4240	4350	2960	4260	2900	7.59
	lb			*15850	14460	*13140	9350	9590	6530	9390	6390	(24.9)
3.0 m (9.8 ft)	kg			*8800	6010	6000	4010	4260	2880	3890	2620	7.94
	lb			*19400	13250	13230	8840	9390	6350	8580	5780	(26.1)
1.5 m (4.9 ft)	kg			8910	5590	5770	3800	4150	2780	3780	2530	8.00
	lb			19640	12320	12720	8380	9150	6130	8330	5580	(26.2)
0.0 m (0.0 ft)	kg			8710	5410	5620	3670	4090	2720	3900	2600	7.76
	lb			19200	11930	12390	8090	9020	6000	8600	5730	(25.5)
-1.5 m (-4.9 ft)	kg	*11990	10180	8690	5400	5590	3640			4330	2880	7.21
	lb	*26430	22440	19160	11900	12320	8020			9550	6350	(23.7)
-3.0 m (-9.8 ft)	kg	*11220	10390	*8410	5520	5700	3740			5400	3560	6.25
	lb	*24740	22910	*18540	12170	12570	8250			11900	7850	(20.5)

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

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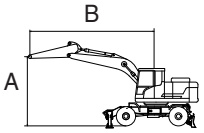
⚠ Failure to comply to the rated load can cause surious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5650	2400	3400	-	310	-	Down	Down	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
7.5 m (24.6 ft)	kg									*4820	*4820	5.72
	lb									*10630	*10630	(18.8)
6.0 m (19.7 ft)	kg					*5520	*5520			*4400	*4400	6.89
	lb					*12170	*12170			*9700	*9700	(22.6)
4.5 m (14.8 ft)	kg			*7190	*7190	*5960	5550	*5130	3880	*4300	3800	7.59
	lb			*15850	*15850	*13140	12240	*11310	8550	*9480	8380	(24.9)
3.0 m (9.8 ft)	kg			*8800	8140	*6640	5310	*5630	3790	*4390	3460	7.94
	lb			*19400	17950	*14640	11710	*12410	8360	*9680	7630	(26.1)
1.5 m (4.9 ft)	kg			*10000	7680	*7260	5080	*5870	3690	*4680	3360	8.00
	lb			*22050	16930	*16010	11200	*12940	8140	*10320	7410	(26.2)
0.0 m (0.0 ft)	kg			*10280	7480	*7540	4940	*5900	3630	*5240	3460	7.76
	lb			*22660	16490	*16620	10890	*13010	8000	*11550	7630	(25.5)
-1.5 m (-4.9 ft)	kg	*11990	*11990	*9780	7470	*7290	4910			*5710	3840	7.21
	lb	*26430	*26430	*21560	16470	*16070	10820			*12590	8470	(23.7)
-3.0 m (-9.8 ft)	kg	*11220	*11220	*8410	7600	*6070	5010			*5610	4760	6.25
	lb	*24740	*24740	*18540	16760	*13380	11050			*12370	10490	(20.5)

Note 1. Lifting capacity are based on ISO 10567.

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5650	2400	3400	-	310	-	Up	Up	-

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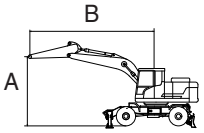

Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg									*4820	4670	5.72
	lb									*10630	10300	(18.8)
6.0 m (19.7 ft)	kg					*5520	4330			*4400	3410	6.89
	lb					*12170	9550			*9700	7520	(22.6)
4.5 m (14.8 ft)	kg			*7190	6460	*5960	4180	4330	2910	4240	2850	7.59
	lb			*15850	14240	*13140	9220	9550	6420	9350	6280	(24.9)
3.0 m (9.8 ft)	kg			*8800	5920	5980	3950	4250	2830	3870	2580	7.94
	lb			*19400	13050	13180	8710	9370	6240	8530	5690	(26.1)
1.5 m (4.9 ft)	kg			8890	5500	5750	3730	4140	2730	3760	2480	8.00
	lb			19600	12130	12680	8220	9130	6020	8290	5470	(26.2)
0.0 m (0.0 ft)	kg			8680	5320	5600	3600	4070	2670	3890	2550	7.76
	lb			19140	11730	12350	7940	8970	5890	8580	5620	(25.5)
-1.5 m (-4.9 ft)	kg	*11990	10010	8660	5310	5570	3570			4320	2830	7.21
	lb	*26430	22070	19090	11710	12280	7870			9520	6240	(23.7)
-3.0 m (-9.8 ft)	kg	*11220	10230	*8410	5420	5680	3670			5380	3500	6.25
	lb	*24740	22550	*18540	11950	12520	8090			11860	7720	(20.5)

Note 1. Lifting capacity are based on ISO 10567.
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3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates load limited by hydraulic capacity.

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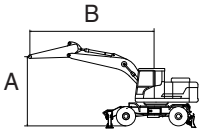
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5650	2400	3400	-	310	-	-	Down	Down

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg lb									*4820 *10630	*4820 *10630	5.72 (18.8)
6.0 m (19.7 ft)	kg lb					*5520 *12170	*5520 *12170			*4400 *9700	*4400 *9700	6.89 (22.6)
4.5 m (14.8 ft)	kg lb			*7190 *15850	*7190 *15850	*5960 *13140	*5960 *13140	*5130 *11310	4570 10080	*4300 *9480	*4300 *9480	7.59 (24.9)
3.0 m (9.8 ft)	kg lb			*8800 *19400	*8800 *19400	*6640 *14640	6310 13910	*5630 *12410	4490 9900	*4390 *9680	4100 9040	7.94 (26.1)
1.5 m (4.9 ft)	kg lb			*10000 *22050	9380 20680	*7260 *16010	6070 13380	*5870 *12940	4380 9660	*4680 *10320	3980 8770	8.00 (26.2)
0.0 m (0.0 ft)	kg lb			*10280 *22660	9170 20220	*7540 *16620	5920 13050	*5900 *13010	4320 9520	*5240 *11550	4120 9080	7.76 (25.5)
-1.5 m (-4.9 ft)	kg lb	*11990 *26430	*11990 *26430	*9780 *21560	9160 20190	*7290 *16070	5890 12990			*5710 *12590	4570 10080	7.21 (23.7)
-3.0 m (-9.8 ft)	kg lb	*11220 *24740	*11220 *24740	*8410 *18540	*8410 *18540	*6070 *13380	6000 13230			*5610 *12370	*5610 *12370	6.25 (20.5)

Note 1. Lifting capacity are based on ISO 10567.
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4. *Indicates load limited by hydraulic capacity.

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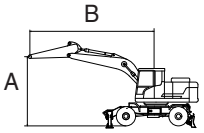
⚠ Failure to comply to the rated load can cause surious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5650	2400	3400	-	310	-	Up	Up	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg									*4820	4660	5.72
	lb									*10630	10270	(18.8)
6.0 m (19.7 ft)	kg					*5520	4330			*4400	3400	6.89
	lb					*12170	9550			*9700	7500	(22.6)
4.5 m (14.8 ft)	kg			*7190	6450	*5960	4170	4330	2900	4240	2840	7.59
	lb			*15850	14220	*13140	9190	9550	6390	9350	6260	(24.9)
3.0 m (9.8 ft)	kg			*8800	5900	5980	3940	4240	2820	3870	2570	7.94
	lb			*19400	13010	13180	8690	9350	6220	8530	5670	(26.1)
1.5 m (4.9 ft)	kg			8890	5490	5750	3730	4140	2730	3760	2480	8.00
	lb			19600	12100	12680	8220	9130	6020	8290	5470	(26.2)
0.0 m (0.0 ft)	kg			8680	5310	5600	3600	4070	2670	3890	2550	7.76
	lb			19140	11710	12350	7940	8970	5890	8580	5620	(25.5)
-1.5 m (-4.9 ft)	kg	*11990	9990	8660	5300	5570	3570			4320	2820	7.21
	lb	*26430	22020	19090	11680	12280	7870			9520	6220	(23.7)
-3.0 m (-9.8 ft)	kg	*11220	10210	*8410	5410	5680	3660			5380	3490	6.25
	lb	*24740	22510	*18540	11930	12520	8070			11860	7690	(20.5)

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

※ Lifting capacities are based upon a standard machine conditions.
Lifting capacities will vary with different work tools, ground conditions and attachments.
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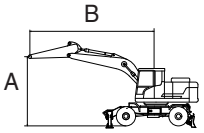
Consult with your local HD Hyundai Construction Equipment dealer regarding the lifting capacities for specific work tools and attachments.

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

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5650	2700	3400	-	310	Down	-	-	Down

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
7.5 m (24.6 ft)	kg					*4180	*4180			*3620	*3620	6.10
	lb					*9220	*9220			*7980	*7980	(20.0)
6.0 m (19.7 ft)	kg					*5270	*5270			*3330	*3330	7.21
	lb					*11620	*11620			*7340	*7340	(23.6)
4.5 m (14.8 ft)	kg			*6840	*6840	*5750	*5750	*5240	4130	*3260	*3260	7.88
	lb			*15080	*15080	*12680	*12680	*11550	9110	*7190	*7190	(25.8)
3.0 m (9.8 ft)	kg			*8500	*8500	*6480	5650	*5510	4030	*3330	*3330	8.22
	lb			*18740	*18740	*14290	12460	*12150	8880	*7340	*7340	(27.0)
1.5 m (4.9 ft)	kg			*9840	8230	*7170	5410	*5820	3920	*3540	3390	8.27
	lb			*21690	18140	*15810	11930	*12830	8640	*7800	7470	(27.1)
0.0 m (0.0 ft)	kg	*6270	*6270	*10320	7980	*7540	5250	*5940	3840	*3950	3490	8.05
	lb	*13820	*13820	*22750	17590	*16620	11570	*13100	8470	*8710	7690	(26.4)
-1.5 m (-4.9 ft)	kg	*11690	*11690	*9980	7930	*7410	5190	*4870	3840	*4700	3830	7.51
	lb	*25770	*25770	*22000	17480	*16340	11440	*10740	8470	*10360	8440	(24.6)
-3.0 m (-9.8 ft)	kg	*12050	*12050	*8810	8030	*6470	5260			*5530	4640	6.59
	lb	*26570	*26570	*19420	17700	*14260	11600			*12190	10230	(21.6)
-4.5 m (-14.8 ft)	kg			*6090	*6090					*5010	*5010	5.08
	lb			*13430	*13430					*11050	*11050	(16.7)

Note 1. Lifting capacity are based on ISO 10567.

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

3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).

4. *Indicates load limited by hydraulic capacity.

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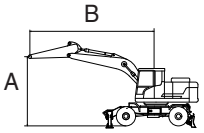
⚠ Failure to comply to the rated load can cause surious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5650	2700	3400	-	310	Up	-	-	Up

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg					*4180	*4180			*3620	*3620	6.10
	lb					*9220	*9220			*7980	*7980	(20.0)
6.0 m (19.7 ft)	kg					*5270	4470			*3330	3260	7.21
	lb					*11620	9850			*7340	7190	(23.6)
4.5 m (14.8 ft)	kg			*6840	6670	*5750	4300	4400	3010	*3260	2760	7.88
	lb			*15080	14700	*12680	9480	9700	6640	*7190	6080	(25.8)
3.0 m (9.8 ft)	kg			*8500	6130	6070	4070	4300	2920	*3330	2510	8.22
	lb			*18740	13510	13380	8970	9480	6440	*7340	5530	(27.0)
1.5 m (4.9 ft)	kg			9020	5680	5820	3850	4180	2810	*3540	2430	8.27
	lb			19890	12520	12830	8490	9220	6190	*7800	5360	(27.1)
0.0 m (0.0 ft)	kg	*6270	*6270	8760	5460	5650	3700	4100	2730	3720	2490	8.05
	lb	*13820	*13820	19310	12040	12460	8160	9040	6020	8200	5490	(26.4)
-1.5 m (-4.9 ft)	kg	*11690	10150	8710	5420	5590	3650	4100	2730	4090	2730	7.51
	lb	*25770	22380	19200	11950	12320	8050	9040	6020	9020	6020	(24.6)
-3.0 m (-9.8 ft)	kg	*12050	10350	8810	5500	5660	3710			4980	3300	6.59
	lb	*26570	22820	19420	12130	12480	8180			10980	7280	(21.6)
-4.5 m (-14.8 ft)	kg			*6090	5760					*5010	4900	5.08
	lb			*13430	12700					*11050	10800	(16.7)

Note 1. Lifting capacity are based on ISO 10567.

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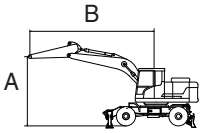
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5650	2700	3400	-	310	-	Down	Down	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg lb					*4180 *9220	*4180 *9220			*3620 *7980	*3620 *7980	6.10 (20.0)
6.0 m (19.7 ft)	kg lb					*5270 *11620	*5270 *11620			*3330 *7340	*3330 *7340	7.21 (23.6)
4.5 m (14.8 ft)	kg lb			*6840 *15080	*6840 *15080	*5750 *12680	5620 12390	*5240 *11550	3930 8660	*3260 *7190	*3260 *7190	7.88 (25.8)
3.0 m (9.8 ft)	kg lb			*8500 *18740	8270 18230	*6480 *14290	5370 11840	*5510 *12150	3830 8440	*3330 *7340	3320 7320	8.22 (27.0)
1.5 m (4.9 ft)	kg lb			*9840 *21690	7780 17150	*7170 *15810	5130 11310	*5820 *12830	3720 8200	*3540 *7800	3220 7100	8.27 (27.1)
0.0 m (0.0 ft)	kg lb	*6270 *13820	*6270 *13820	*10320 *22750	7540 16620	*7540 *16620	4970 10960	*5940 *13100	3640 8020	*3950 *8710	3310 7300	8.05 (26.4)
-1.5 m (-4.9 ft)	kg lb	*11690 *25770	*11690 *25770	*9980 *22000	7490 16510	*7410 *16340	4920 10850	*4870 *10740	3640 8020	*4700 *10360	3630 8000	7.51 (24.6)
-3.0 m (-9.8 ft)	kg lb	*12050 *26570	*12050 *26570	*8810 *19420	7580 16710	*6470 *14260	4980 10980			*5530 *12190	4400 9700	6.59 (21.6)
-4.5 m (-14.8 ft)	kg lb			*6090 *13430	*6090 *13430					*5010 *11050	*5010 *11050	5.08 (16.7)

Note 1. Lifting capacity are based on ISO 10567.
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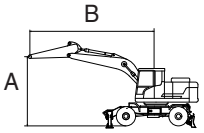
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5650	2700	3400	-	310	-	Up	Up	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg					*4180	*4180			*3620	*3620	6.10
	lb					*9220	*9220			*7980	*7980	(20.0)
6.0 m (19.7 ft)	kg					*5270	4400			*3330	3210	7.21
	lb					*11620	9700			*7340	7080	(23.6)
4.5 m (14.8 ft)	kg			*6840	6580	*5750	4240	4390	2960	*3260	2710	7.88
	lb			*15080	14510	*12680	9350	9680	6530	*7190	5970	(25.8)
3.0 m (9.8 ft)	kg			*8500	6040	6050	4000	4290	2870	*3330	2470	8.22
	lb			*18740	13320	13340	8820	9460	6330	*7340	5450	(27.0)
1.5 m (4.9 ft)	kg			8990	5590	5800	3780	4170	2760	*3540	2380	8.27
	lb			19820	12320	12790	8330	9190	6080	*7800	5250	(27.1)
0.0 m (0.0 ft)	kg	*6270	*6270	8730	5370	5630	3630	4090	2680	3700	2440	8.05
	lb	*13820	*13820	19250	11840	12410	8000	9020	5910	8160	5380	(26.4)
-1.5 m (-4.9 ft)	kg	*11690	9990	8680	5330	5580	3580	4080	2680	4080	2680	7.51
	lb	*25770	22020	19140	11750	12300	7890	8990	5910	8990	5910	(24.6)
-3.0 m (-9.8 ft)	kg	*12050	10180	8780	5410	5640	3640			4960	3240	6.59
	lb	*26570	22440	19360	11930	12430	8020			10930	7140	(21.6)
-4.5 m (-14.8 ft)	kg			*6090	5670					*5010	4820	5.08
	lb			*13430	12500					*11050	10630	(16.7)

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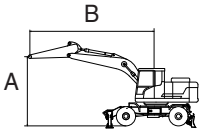
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5650	2700	3400	-	310	-	-	Down	Down

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg lb					*4180 *9220	*4180 *9220			*3620 *7980	*3620 *7980	6.10 (20.0)
6.0 m (19.7 ft)	kg lb					*5270 *11620	*5270 *11620			*3330 *7340	*3330 *7340	7.21 (23.6)
4.5 m (14.8 ft)	kg lb			*6840 *15080	*6840 *15080	*5750 *12680	*5750 *12680	*5240 *11550	4630 10210	*3260 *7190	*3260 *7190	7.88 (25.8)
3.0 m (9.8 ft)	kg lb			*8500 *18740	*8500 *18740	*6480 *14290	6370 14040	*5510 *12150	4530 9990	*3330 *7340	*3330 *7340	8.22 (27.0)
1.5 m (4.9 ft)	kg lb			*9840 *21690	9490 20920	*7170 *15810	6120 13490	*5820 *12830	4410 9720	*3540 *7800	*3540 *7800	8.27 (27.1)
0.0 m (0.0 ft)	kg lb	*6270 *13820	*6270 *13820	*10320 *22750	9230 20350	*7540 *16620	5960 13140	*5940 *13100	4330 9550	*3950 *8710	3920 8640	8.05 (26.4)
-1.5 m (-4.9 ft)	kg lb	*11690 *25770	*11690 *25770	*9980 *22000	9180 20240	*7410 *16340	5900 13010	*4870 *10740	4320 9520	*4700 *10360	4320 9520	7.51 (24.6)
-3.0 m (-9.8 ft)	kg lb	*12050 *26570	*12050 *26570	*8810 *19420	*8810 *19420	*6470 *14260	5970 13160			*5530 *12190	5250 11570	6.59 (21.6)
-4.5 m (-14.8 ft)	kg lb			*6090 *13430	*6090 *13430					*5010 *11050	*5010 *11050	5.08 (16.7)

Note 1. Lifting capacity are based on ISO 10567.

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5650	2700	3400	-	310	-	-	Up	Up

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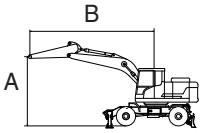

Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg					*4180	*4180			*3620	*3620	6.10
	lb					*9220	*9220			*7980	*7980	(20.0)
6.0 m (19.7 ft)	kg					*5270	4390			*3330	3200	7.21
	lb					*11620	9680			*7340	7050	(23.6)
4.5 m (14.8 ft)	kg			*6840	6570	*5750	4230	4390	2960	*3260	2710	7.88
	lb			*15080	14480	*12680	9330	9680	6530	*7190	5970	(25.8)
3.0 m (9.8 ft)	kg			*8500	6030	6050	4000	4290	2860	*3330	2460	8.22
	lb			*18740	13290	13340	8820	9460	6310	*7340	5420	(27.0)
1.5 m (4.9 ft)	kg			8990	5580	5800	3770	4170	2750	*3540	2380	8.27
	lb			19820	12300	12790	8310	9190	6060	*7800	5250	(27.1)
0.0 m (0.0 ft)	kg	*6270	*6270	8730	5360	5630	3630	4090	2680	3700	2440	8.05
	lb	*13820	*13820	19250	11820	12410	8000	9020	5910	8160	5380	(26.4)
-1.5 m (-4.9 ft)	kg	*11690	9970	8680	5320	5580	3580	4080	2680	4080	2670	7.51
	lb	*25770	21980	19140	11730	12300	7890	8990	5910	8990	5890	(24.6)
-3.0 m (-9.8 ft)	kg	*12050	10160	8780	5400	5640	3640			4960	3240	6.59
	lb	*26570	22400	19360	11900	12430	8020			10930	7140	(21.6)
-4.5 m (-14.8 ft)	kg			*6090	5660					*5010	4810	5.08
	lb			*13430	12480					*11050	10600	(16.7)

Note 1. Lifting capacity are based on ISO 10567.
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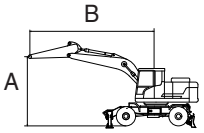
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5650	2920	3400	-	310	Down	-	-	Down

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m (24.6 ft)	kg							*4680	*4680			*3140	*3140	6.39
	lb							*10320	*10320			*6920	*6920	(21.0)
6.0 m (19.7 ft)	kg							*5020	*5020			*2900	*2900	7.45
	lb							*11070	*11070			*6390	*6390	(24.5)
4.5 m (14.8 ft)	kg					*6500	*6500	*5520	*5520	*5030	4110	*2840	*2840	8.10
	lb					*14330	*14330	*12170	*12170	*11090	9060	*6260	*6260	(26.6)
3.0 m (9.8 ft)	kg					*8160	*8160	*6270	5620	*5340	4000	*2890	*2890	8.43
	lb					*17990	*17990	*13820	12390	*11770	8820	*6370	*6370	(27.7)
1.5 m (4.9 ft)	kg					*9580	8190	*6990	5360	*5680	3870	*3070	*3070	8.49
	lb					*21120	18060	*15410	11820	*12520	8530	*6770	*6770	(27.8)
0.0 m (0.0 ft)	kg			*6650	*6650	*10180	7900	*7420	5180	*5850	3780	*3400	3300	8.27
	lb			*14660	*14660	*22440	17420	*16360	11420	*12900	8330	*7500	7280	(27.1)
-1.5 m (-4.9 ft)	kg	*7190	*7190	*11250	*11250	*9980	7830	*7370	5110	*5620	3760	*4010	3600	7.75
	lb	*15850	*15850	*24800	*24800	*22000	17260	*16250	11270	*12390	8290	*8840	7940	(25.4)
-3.0 m (-9.8 ft)	kg	*11870	*11870	*12450	*12450	*8950	7910	*6600	5160			*5240	4310	6.86
	lb	*26170	*26170	*27450	*27450	*19730	17440	*14550	11380			*11550	9500	(22.5)
-4.5 m (-14.8 ft)	kg			*9040	*9040	*6580	*6580					*4960	*4960	5.43
	lb			*19930	*19930	*14510	*14510					*10930	*10930	(17.8)

Note 1. Lifting capacity are based on ISO 10567.

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

3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).

4. *Indicates load limited by hydraulic capacity.

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Lifting capacities will vary with different work tools, ground conditions and attachments.
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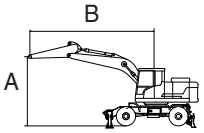
⚠ Failure to comply to the rated load can cause surious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5650	2920	3400	-	310	Up	-	-	Up

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m (24.6 ft)	kg							*4680	4480			*3140	*3140	6.39
	lb							*10320	9880			*6920	*6920	(21.0)
6.0 m (19.7 ft)	kg							*5020	4460			*2900	*2900	7.45
	lb							*11070	9830			*6390	*6390	(24.5)
4.5 m (14.8 ft)	kg					*6500	*6500	*5520	4290	4380	2980	*2840	2600	8.10
	lb					*14330	*14330	*12170	9460	9660	6570	*6260	5730	(26.6)
3.0 m (9.8 ft)	kg					*8160	6130	6040	4040	4260	2880	*2890	2370	8.43
	lb					*17990	13510	13320	8910	9390	6350	*6370	5220	(27.7)
1.5 m (4.9 ft)	kg					8990	5640	5770	3800	4130	2760	*3070	2280	8.49
	lb					19820	12430	12720	8380	9110	6080	*6770	5030	(27.8)
0.0 m (0.0 ft)	kg			*6650	*6650	8680	5380	5590	3630	4040	2670	*3400	2330	8.27
	lb			*14660	*14660	19140	11860	12320	8000	8910	5890	*7500	5140	(27.1)
-1.5 m (-4.9 ft)	kg	*7190	*7190	*11250	9960	8600	5310	5510	3570	4020	2650	3850	2550	7.75
	lb	*15850	*15850	*24800	21960	18960	11710	12150	7870	8860	5840	8490	5620	(25.4)
-3.0 m (-9.8 ft)	kg	*11870	*11870	*12450	10160	8690	5390	5560	3610			4630	3050	6.86
	lb	*26170	*26170	*27450	22400	19160	11880	12260	7960			10210	6720	(22.5)
-4.5 m (-14.8 ft)	kg			*9040	*9040	*6580	5620					*4960	4370	5.43
	lb			*19930	*19930	*14510	12390					*10930	9630	(17.8)

Note 1. Lifting capacity are based on ISO 10567.
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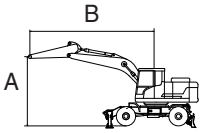
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5650	2920	3400	-	310	-	Down	Down	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m (24.6 ft)	kg lb							*4680 *10320	*4680 *10320			*3140 *6920	*3140 *6920	6.39 (21.0)
6.0 m (19.7 ft)	kg lb							*5020 *11070	*5020 *11070			*2900 *6390	*2900 *6390	7.45 (24.5)
4.5 m (14.8 ft)	kg lb					*6500 *14330	*6500 *14330	*5520 *12170	*5520 *12170	*5030 *11090	3910 8620	*2840 *6260	*2840 *6260	8.10 (26.6)
3.0 m (9.8 ft)	kg lb					*8160 *17990	*8160 *17990	*6270 *13820	5340 11770	*5340 *11770	3800 8380	*2890 *6370	*2890 *6370	8.43 (27.7)
1.5 m (4.9 ft)	kg lb					*9580 *21120	7740 17060	*6990 *15410	5080 11200	*5680 *12520	3670 8090	*3070 *6770	3050 6720	8.49 (27.8)
0.0 m (0.0 ft)	kg lb			*6650 *14660	*6650 *14660	*10180 *22440	7460 16450	*7420 *16360	4910 10820	*5850 *12900	3580 7890	*3400 *7500	3120 6880	8.27 (27.1)
-1.5 m (-4.9 ft)	kg lb	*7190 *15850	*7190 *15850	*11250 *24800	*11250 *24800	*9980 *22000	7380 16270	*7370 *16250	4840 10670	*5620 *12390	3560 7850	*4010 *8840	3410 7520	7.75 (25.4)
-3.0 m (-9.8 ft)	kg lb	*11870 *26170	*11870 *26170	*12450 *27450	*12450 *27450	*8950 *19730	7460 16450	*6600 *14550	4880 10760			*5240 *11550	4090 9020	6.86 (22.5)
-4.5 m (-14.8 ft)	kg lb			*9040 *19930	*9040 *19930	*6580 *14510	*6580 *14510					*4960 *10930	*4960 *10930	5.43 (17.8)

Note 1. Lifting capacity are based on ISO 10567.

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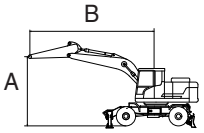
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5650	2920	3400	-	310	-	Up	Up	-

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m (24.6 ft)	kg lb							*4680 *10320	4420 9740			*3140 *6920	*3140 *6920	6.39 (21.0)
6.0 m (19.7 ft)	kg lb							*5020 *11070	4400 9700			*2900 *6390	*2900 *6390	7.45 (24.5)
4.5 m (14.8 ft)	kg lb					*6500 *14330	*6500 *14330	*5520 *12170	4220 9300	4370 9630	2930 6460	*2840 *6260	2550 5620	8.10 (26.6)
3.0 m (9.8 ft)	kg lb					*8160 *17990	6040 13320	6030 13290	3970 8750	4250 9370	2830 6240	*2890 *6370	2320 5110	8.43 (27.7)
1.5 m (4.9 ft)	kg lb					8960 19750	5550 12240	5760 12700	3730 8220	4120 9080	2710 5970	*3070 *6770	2240 4940	8.49 (27.8)
0.0 m (0.0 ft)	kg lb			*6650 *14660	*6650 *14660	8650 19070	5290 11660	5570 12280	3570 7870	4030 8880	2620 5780	*3400 *7500	2290 5050	8.27 (27.1)
-1.5 m (-4.9 ft)	kg lb	*7190 *15850	*7190 *15850	*11250 *24800	9790 21580	8570 18890	5220 11510	5500 12130	3500 7720	4000 8820	2600 5730	3840 8470	2500 5510	7.75 (25.4)
-3.0 m (-9.8 ft)	kg lb	*11870 *26170	*11870 *26170	*12450 *27450	9990 22020	8660 19090	5290 11660	5550 12240	3550 7830			4610 10160	3000 6610	6.86 (22.5)
-4.5 m (-14.8 ft)	kg lb			*9040 *19930	*9040 *19930	*6580 *14510	5520 12170					*4960 *10930	4290 9460	5.43 (17.8)

Note 1. Lifting capacity are based on ISO 10567.

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5650	2920	3400	-	310	-	-	Down	Down

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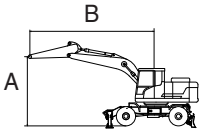

Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m (24.6 ft)	kg							*4680	*4680			*3140	*3140	6.39
	lb							*10320	*10320			*6920	*6920	(21.0)
6.0 m (19.7 ft)	kg							*5020	*5020			*2900	*2900	7.45
	lb							*11070	*11070			*6390	*6390	(24.5)
4.5 m (14.8 ft)	kg					*6500	*6500	*5520	*5520	*5030	4610	*2840	*2840	8.10
	lb					*14330	*14330	*12170	*12170	*11090	10160	*6260	*6260	(26.6)
3.0 m (9.8 ft)	kg					*8160	*8160	*6270	*6270	*5340	4490	*2890	*2890	8.43
	lb					*17990	*17990	*13820	*13820	*11770	9900	*6370	*6370	(27.7)
1.5 m (4.9 ft)	kg					*9580	9450	*6990	6080	*5680	4360	*3070	*3070	8.49
	lb					*21120	20830	*15410	13400	*12520	9610	*6770	*6770	(27.8)
0.0 m (0.0 ft)	kg			*6650	*6650	*10180	9150	*7420	5890	*5850	4270	*3400	*3400	8.27
	lb			*14660	*14660	*22440	20170	*16360	12990	*12900	9410	*7500	*7500	(27.1)
-1.5 m (-4.9 ft)	kg	*7190	*7190	*11250	*11250	*9980	9070	*7370	5820	*5620	4240	*4010	*4010	7.75
	lb	*15850	*15850	*24800	*24800	*22000	20000	*16250	12830	*12390	9350	*8840	*8840	(25.4)
-3.0 m (-9.8 ft)	kg	*11870	*11870	*12450	*12450	*8950	*8950	*6600	5870			*5240	4880	6.86
	lb	*26170	*26170	*27450	*27450	*19730	*19730	*14550	12940			*11550	10760	(22.5)
-4.5 m (-14.8 ft)	kg			*9040	*9040	*6580	*6580					*4960	*4960	5.43
	lb			*19930	*19930	*14510	*14510					*10930	*10930	(17.8)

Note 1. Lifting capacity are based on ISO 10567.

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

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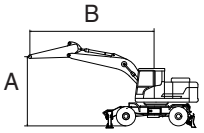
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	MONO BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5650	2920	3400	-	310	-	-	Up	Up

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



Lift-point height (A)		Lift-point radius (B)										At max. reach		
		1.5 m (4.9 ft)		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
														m (ft)
7.5 m (24.6 ft)	kg lb							*4680 *10320	4410 9720			*3140 *6920	*3140 *6920	6.39 (21.0)
6.0 m (19.7 ft)	kg lb							*5020 *11070	4390 9680			*2900 *6390	*2900 *6390	7.45 (24.5)
4.5 m (14.8 ft)	kg lb					*6500 *14330	*6500 *14330	*5520 *12170	4220 9300	4370 9630	2930 6460	*2840 *6260	2550 5620	8.10 (26.6)
3.0 m (9.8 ft)	kg lb					*8160 *17990	6030 13290	6020 13270	3970 8750	4250 9370	2820 6220	*2890 *6370	2320 5110	8.43 (27.7)
1.5 m (4.9 ft)	kg lb					8960 19750	5540 12210	5750 12680	3730 8220	4120 9080	2700 5950	*3070 *6770	2240 4940	8.49 (27.8)
0.0 m (0.0 ft)	kg lb			*6650 *14660	*6650 *14660	8650 19070	5280 11640	5570 12280	3560 7850	4030 8880	2620 5780	*3400 *7500	2280 5030	8.27 (27.1)
-1.5 m (-4.9 ft)	kg lb	*7190 *15850	*7190 *15850	*11250 *24800	9770 21540	8570 18890	5210 11490	5500 12130	3490 7690	4000 8820	2590 5710	3840 8470	2490 5490	7.75 (25.4)
-3.0 m (-9.8 ft)	kg lb	*11870 *26170	*11870 *26170	*12450 *27450	9970 21980	8660 19090	5280 11640	5550 12240	3540 7800			4610 10160	2990 6590	6.86 (22.5)
-4.5 m (-14.8 ft)	kg lb			*9040 *19930	*9040 *19930	*6580 *14510	5510 12150					*4960 *10930	4290 9460	5.43 (17.8)

Note 1. Lifting capacity are based on ISO 10567.
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3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
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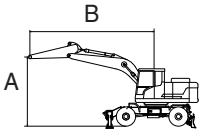
2) 5.40 m 2-PIECE BOOM+4100 kg COUNTERWEIGHT

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5400	2400	4100	-	310	Down	-	-	Down

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg			*4680	*4680					*5110	*5110	5.48
	lb			*10320	*10320					*11270	*11270	(18.0)
6.0 m (19.7 ft)	kg			*4810	*4810	*4800	*4800			*4720	*4720	6.69
	lb			*10600	*10600	*10580	*10580			*10410	*10410	(22.0)
4.5 m (14.8 ft)	kg	*7890	*7890	*5910	*5910	*5170	*5170			*4510	*4510	7.41
	lb	*17390	*17390	*13030	*13030	*11400	*11400			*9940	*9940	(24.3)
3.0 m (9.8 ft)	kg			*7600	*7600	*5920	*5920	*5290	4400	*4520	4150	7.77
	lb			*16760	*16760	*13050	*13050	*11660	9700	*9960	9150	(25.5)
1.5 m (4.9 ft)	kg			*9200	9010	*6740	5920	*5660	4310	*4740	4050	7.83
	lb			*20280	19860	*14860	13050	*12480	9500	*10450	8930	(25.7)
0.0 m (0.0 ft)	kg			*10120	8790	*7360	5790	*5950	4260	*5210	4200	7.59
	lb			*22310	19380	*16230	12760	*13120	9390	*11490	9260	(24.9)
-1.5 m (-4.9 ft)	kg	*12480	*12480	*10310	8780	*7570	5760			*6130	4680	7.02
	lb	*27510	*27510	*22730	19360	*16690	12700			*13510	10320	(23.0)

Note 1. Lifting capacity are based on ISO 10567.

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

※ Lifting capacities are based upon a standard machine conditions.
Lifting capacities will vary with different work tools, ground conditions and attachments.
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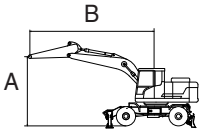
⚠ Failure to comply to the rated load can cause surious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5400	2400	4100	-	310	Up	-	-	Up

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg			*4680	*4680					*5110	*5110	5.48
	lb			*10320	*10320					*11270	*11270	(18.0)
6.0 m (19.7 ft)	kg			*4810	*4810	*4800	*4800			*4720	3990	6.69
	lb			*10600	*10600	*10580	*10580			*10410	8800	(22.0)
4.5 m (14.8 ft)	kg	*7890	*7890	*5910	*5910	*5170	4680			*4510	3340	7.41
	lb	*17390	*17390	*13030	*13030	*11400	10320			*9940	7360	(24.3)
3.0 m (9.8 ft)	kg			*7600	6720	*5920	4470	4700	3220	4430	3040	7.77
	lb			*16760	14820	*13050	9850	10360	7100	9770	6700	(25.5)
1.5 m (4.9 ft)	kg			*9200	6300	6390	4270	4610	3130	4320	2950	7.83
	lb			*20280	13890	14090	9410	10160	6900	9520	6500	(25.7)
0.0 m (0.0 ft)	kg			9670	6110	6240	4140	4560	3090	4490	3040	7.59
	lb			21320	13470	13760	9130	10050	6810	9900	6700	(24.9)
-1.5 m (-4.9 ft)	kg	*12480	11370	9650	6090	6220	4120			5020	3390	7.02
	lb	*27510	25070	21270	13430	13710	9080			11070	7470	(23.0)

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

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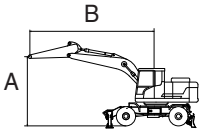
⚠ Failure to comply to the rated load can cause surious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5400	2400	4100	-	310	-	Down	Down	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg			*4680	*4680					*5110	*5110	5.48
	lb			*10320	*10320					*11270	*11270	(18.0)
6.0 m (19.7 ft)	kg			*4810	*4810	*4800	*4800			*4720	*4720	6.69
	lb			*10600	*10600	*10580	*10580			*10410	*10410	(22.0)
4.5 m (14.8 ft)	kg	*7890	*7890	*5910	*5910	*5170	*5170			*4510	4330	7.41
	lb	*17390	*17390	*13030	*13030	*11400	*11400			*9940	9550	(24.3)
3.0 m (9.8 ft)	kg			*7600	*7600	*5920	5850	*5290	4190	*4520	3960	7.77
	lb			*16760	*16760	*13050	12900	*11660	9240	*9960	8730	(25.5)
1.5 m (4.9 ft)	kg			*9200	8540	*6740	5640	*5660	4100	*4740	3860	7.83
	lb			*20280	18830	*14860	12430	*12480	9040	*10450	8510	(25.7)
0.0 m (0.0 ft)	kg			*10120	8330	*7360	5500	*5950	4050	*5210	3990	7.59
	lb			*22310	18360	*16230	12130	*13120	8930	*11490	8800	(24.9)
-1.5 m (-4.9 ft)	kg	*12480	*12480	*10310	8310	*7570	5480			*6130	4460	7.02
	lb	*27510	*27510	*22730	18320	*16690	12080			*13510	9830	(23.0)

Note 1. Lifting capacity are based on ISO 10567.

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

3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).

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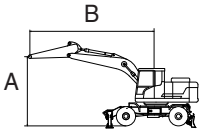
⚠ Failure to comply to the rated load can cause surious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5400	2400	4100	-	310	-	Up	Up	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg			*4680	*4680					*5110	*5110	5.48
	lb			*10320	*10320					*11270	*11270	(18.0)
6.0 m (19.7 ft)	kg			*4810	*4810	*4800	4750			*4720	3930	6.69
	lb			*10600	*10600	*10580	10470			*10410	8660	(22.0)
4.5 m (14.8 ft)	kg	*7890	*7890	*5910	*5910	*5170	4620			*4510	3290	7.41
	lb	*17390	*17390	*13030	*13030	*11400	10190			*9940	7250	(24.3)
3.0 m (9.8 ft)	kg			*7600	6620	*5920	4410	4680	3170	4420	2990	7.77
	lb			*16760	14590	*13050	9720	10320	6990	9740	6590	(25.5)
1.5 m (4.9 ft)	kg			*9200	6210	6370	4210	4590	3080	4310	2900	7.83
	lb			*20280	13690	14040	9280	10120	6790	9500	6390	(25.7)
0.0 m (0.0 ft)	kg			9640	6010	6220	4080	4540	3040	4470	2990	7.59
	lb			21250	13250	13710	8990	10010	6700	9850	6590	(24.9)
-1.5 m (-4.9 ft)	kg	*12480	11210	9620	6000	6200	4060			5000	3340	7.02
	lb	*27510	24710	21210	13230	13670	8950			11020	7360	(23.0)

Note 1. Lifting capacity are based on ISO 10567.
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3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).
4. *Indicates load limited by hydraulic capacity.

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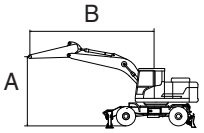
⚠ Failure to comply to the rated load can cause surious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5400	2400	4100	-	310	-	-	Down	Down

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg			*4680	*4680					*5110	*5110	5.48
	lb			*10320	*10320					*11270	*11270	(18.0)
6.0 m (19.7 ft)	kg			*4810	*4810	*4800	*4800			*4720	*4720	6.69
	lb			*10600	*10600	*10580	*10580			*10410	*10410	(22.0)
4.5 m (14.8 ft)	kg	*7890	*7890	*5910	*5910	*5170	*5170			*4510	*4510	7.41
	lb	*17390	*17390	*13030	*13030	*11400	*11400			*9940	*9940	(24.3)
3.0 m (9.8 ft)	kg			*7600	*7600	*5920	*5920	*5290	4920	*4520	*4520	7.77
	lb			*16760	*16760	*13050	*13050	*11660	10850	*9960	*9960	(25.5)
1.5 m (4.9 ft)	kg			*9200	*9200	*6740	6690	*5660	4830	*4740	4540	7.83
	lb			*20280	*20280	*14860	14750	*12480	10650	*10450	10010	(25.7)
0.0 m (0.0 ft)	kg			*10120	*10120	*7360	6550	*5950	4780	*5210	4710	7.59
	lb			*22310	*22310	*16230	14440	*13120	10540	*11490	10380	(24.9)
-1.5 m (-4.9 ft)	kg	*12480	*12480	*10310	10120	*7570	6520			*6130	5270	7.02
	lb	*27510	*27510	*22730	22310	*16690	14370			*13510	11620	(23.0)

Note 1. Lifting capacity are based on ISO 10567.

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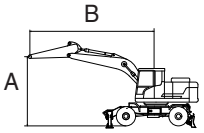
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5400	2400	4100	-	310	-	-	Up	Up

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
7.5 m (24.6 ft)	kg			*4680	*4680					*5110	*5110	5.48
	lb			*10320	*10320					*11270	*11270	(18.0)
6.0 m (19.7 ft)	kg			*4810	*4810	*4800	4740			*4720	3920	6.69
	lb			*10600	*10600	*10580	10450			*10410	8640	(22.0)
4.5 m (14.8 ft)	kg	*7890	*7890	*5910	*5910	*5170	4610			*4510	3280	7.41
	lb	*17390	*17390	*13030	*13030	*11400	10160			*9940	7230	(24.3)
3.0 m (9.8 ft)	kg			*7600	6610	*5920	4400	4680	3160	4420	2980	7.77
	lb			*16760	14570	*13050	9700	10320	6970	9740	6570	(25.5)
1.5 m (4.9 ft)	kg			*9200	6190	6370	4200	4590	3080	4310	2890	7.83
	lb			*20280	13650	14040	9260	10120	6790	9500	6370	(25.7)
0.0 m (0.0 ft)	kg			9640	6000	6220	4070	4540	3030	4470	2990	7.59
	lb			21250	13230	13710	8970	10010	6680	9850	6590	(24.9)
-1.5 m (-4.9 ft)	kg	*12480	11190	9620	5990	6200	4050			5000	3330	7.02
	lb	*27510	24670	21210	13210	13670	8930			11020	7340	(23.0)

Note 1. Lifting capacity are based on ISO 10567.

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

3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).

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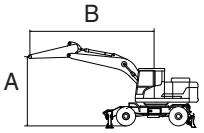
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5400	2700	4100	-	310	Down	-	-	Down

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
9.0 m (29.5 ft)	kg									*5310	*5310	3.87
	lb									*11710	*11710	(12.7)
7.5 m (24.6 ft)	kg									*4030	*4030	5.87
	lb									*8880	*8880	(19.3)
6.0 m (19.7 ft)	kg			*4450	*4450	*4510	*4510			*3610	*3610	7.02
	lb			*9810	*9810	*9940	*9940			*7960	*7960	(23.0)
4.5 m (14.8 ft)	kg	*7030	*7030	*5540	*5540	*4940	*4940	*4820	4520	*3460	*3460	7.71
	lb	*15500	*15500	*12210	*12210	*10890	*10890	*10630	9960	*7630	*7630	(25.3)
3.0 m (9.8 ft)	kg			*7250	*7250	*5720	*5720	*5100	4440	*3480	*3480	8.05
	lb			*15980	*15980	*12610	*12610	*11240	9790	*7670	*7670	(26.4)
1.5 m (4.9 ft)	kg			*8940	*8940	*6580	5970	*5530	4330	*3640	*3640	8.11
	lb			*19710	*19710	*14510	13160	*12190	9550	*8020	*8020	(26.6)
0.0 m (0.0 ft)	kg	*6490	*6490	*10010	8850	*7270	5820	*5890	4270	*3990	*3990	7.88
	lb	*14310	*14310	*22070	19510	*16030	12830	*12990	9410	*8800	*8800	(25.8)
-1.5 m (-4.9 ft)	kg	*12120	*12120	*10360	8790	*7590	5770			*4660	4410	7.33
	lb	*26720	*26720	*22840	19380	*16730	12720			*10270	9720	(24.1)
-3.0 m (-9.8 ft)	kg			*9890	8900							
	lb			*21800	19620							

Note 1. Lifting capacity are based on ISO 10567.

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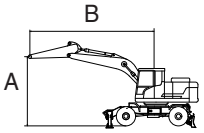
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5400	2700	4100	-	310	Up	-	-	Up

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
9.0 m (29.5 ft)	kg									*5310	*5310	3.87
	lb									*11710	*11710	(12.7)
7.5 m (24.6 ft)	kg									*4030	*4030	5.87
	lb									*8880	*8880	(19.3)
6.0 m (19.7 ft)	kg			*4450	*4450	*4510	*4510			*3610	*3610	7.02
	lb			*9810	*9810	*9940	*9940			*7960	*7960	(23.0)
4.5 m (14.8 ft)	kg	*7030	*7030	*5540	*5540	*4940	4750	4820	3330	*3460	3170	7.71
	lb	*15500	*15500	*12210	*12210	*10890	10470	10630	7340	*7630	6990	(25.3)
3.0 m (9.8 ft)	kg			*7250	6830	*5720	4530	4740	3250	*3480	2900	8.05
	lb			*15980	15060	*12610	9990	10450	7170	*7670	6390	(26.4)
1.5 m (4.9 ft)	kg			*8940	6390	6430	4320	4630	3160	*3640	2820	8.11
	lb			*19710	14090	14180	9520	10210	6970	*8020	6220	(26.6)
0.0 m (0.0 ft)	kg	*6490	*6490	9720	6160	6270	4170	4560	3090	*3990	2900	7.88
	lb	*14310	*14310	21430	13580	13820	9190	10050	6810	*8800	6390	(25.8)
-1.5 m (-4.9 ft)	kg	*12120	11360	9660	6110	6220	4130			*4660	3200	7.33
	lb	*26720	25040	21300	13470	13710	9110			*10270	7050	(24.1)
-3.0 m (-9.8 ft)	kg			9770	6200							
	lb			21540	13670							

Note 1. Lifting capacity are based on ISO 10567.

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

3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).

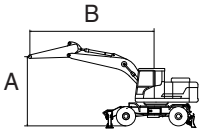
4. *Indicates load limited by hydraulic capacity.

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

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

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5400	2700	4100	-	310	-	Down	Down	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
9.0 m (29.5 ft)	kg									*5310	*5310	3.87
	lb									*11710	*11710	(12.7)
7.5 m (24.6 ft)	kg									*4030	*4030	5.87
	lb									*8880	*8880	(19.3)
6.0 m (19.7 ft)	kg			*4450	*4450	*4510	*4510			*3610	*3610	7.02
	lb			*9810	*9810	*9940	*9940			*7960	*7960	(23.0)
4.5 m (14.8 ft)	kg	*7030	*7030	*5540	*5540	*4940	*4940	*4820	4310	*3460	*3460	7.71
	lb	*15500	*15500	*12210	*12210	*10890	*10890	*10630	9500	*7630	*7630	(25.3)
3.0 m (9.8 ft)	kg			*7250	*7250	*5720	*5720	*5100	4230	*3480	*3480	8.05
	lb			*15980	*15980	*12610	*12610	*11240	9330	*7670	*7670	(26.4)
1.5 m (4.9 ft)	kg			*8940	8630	*6580	5680	*5530	4130	*3640	*3640	8.11
	lb			*19710	19030	*14510	12520	*12190	9110	*8020	*8020	(26.6)
0.0 m (0.0 ft)	kg	*6490	*6490	*10010	8380	*7270	5530	*5890	4060	*3990	3800	7.88
	lb	*14310	*14310	*22070	18470	*16030	12190	*12990	8950	*8800	8380	(25.8)
-1.5 m (-4.9 ft)	kg	*12120	*12120	*10360	8330	*7590	5480			*4660	4200	7.33
	lb	*26720	*26720	*22840	18360	*16730	12080			*10270	9260	(24.1)
-3.0 m (-9.8 ft)	kg			*9890	8430							
	lb			*21800	18580							

Note 1. Lifting capacity are based on ISO 10567.

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3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).

4. *Indicates load limited by hydraulic capacity.

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Lifting capacities will vary with different work tools, ground conditions and attachments.
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⚠ Failure to comply to the rated load can cause surious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5400	2700	4100	-	310	-	Up	Up	-

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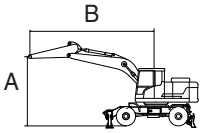

Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
9.0 m (29.5 ft)	kg									*5310	*5310	3.87
	lb									*11710	*11710	(12.7)
7.5 m (24.6 ft)	kg									*4030	*4030	5.87
	lb									*8880	*8880	(19.3)
6.0 m (19.7 ft)	kg			*4450	*4450	*4510	*4510			*3610	*3610	7.02
	lb			*9810	*9810	*9940	*9940			*7960	*7960	(23.0)
4.5 m (14.8 ft)	kg	*7030	*7030	*5540	*5540	*4940	4680	4810	3280	*3460	3130	7.71
	lb	*15500	*15500	*12210	*12210	*10890	10320	10600	7230	*7630	6900	(25.3)
3.0 m (9.8 ft)	kg			*7250	6740	*5720	4460	4720	3200	*3480	2860	8.05
	lb			*15980	14860	*12610	9830	10410	7050	*7670	6310	(26.4)
1.5 m (4.9 ft)	kg			*8940	6290	6410	4250	4620	3110	*3640	2770	8.11
	lb			*19710	13870	14130	9370	10190	6860	*8020	6110	(26.6)
0.0 m (0.0 ft)	kg	*6490	*6490	9690	6060	6250	4110	4550	3040	*3990	2850	7.88
	lb	*14310	*14310	21360	13360	13780	9060	10030	6700	*8800	6280	(25.8)
-1.5 m (-4.9 ft)	kg	*12120	11190	9630	6010	6200	4060			*4660	3150	7.33
	lb	*26720	24670	21230	13250	13670	8950			*10270	6940	(24.1)
-3.0 m (-9.8 ft)	kg			9740	6110							
	lb			21470	13470							

Note 1. Lifting capacity are based on ISO 10567.

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

3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).

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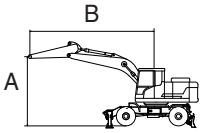
⚠ Failure to comply to the rated load can cause surious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5400	2700	4100	-	310	-	-	Down	Down

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
9.0 m (29.5 ft)	kg									*5310	*5310	3.87
	lb									*11710	*11710	(12.7)
7.5 m (24.6 ft)	kg									*4030	*4030	5.87
	lb									*8880	*8880	(19.3)
6.0 m (19.7 ft)	kg			*4450	*4450	*4510	*4510			*3610	*3610	7.02
	lb			*9810	*9810	*9940	*9940			*7960	*7960	(23.0)
4.5 m (14.8 ft)	kg	*7030	*7030	*5540	*5540	*4940	*4940	*4820	*4820	*3460	*3460	7.71
	lb	*15500	*15500	*12210	*12210	*10890	*10890	*10630	*10630	*7630	*7630	(25.3)
3.0 m (9.8 ft)	kg			*7250	*7250	*5720	*5720	*5100	4960	*3480	*3480	8.05
	lb			*15980	*15980	*12610	*12610	*11240	10930	*7670	*7670	(26.4)
1.5 m (4.9 ft)	kg			*8940	*8940	*6580	*6580	*5530	4860	*3640	*3640	8.11
	lb			*19710	*19710	*14510	*14510	*12190	10710	*8020	*8020	(26.6)
0.0 m (0.0 ft)	kg	*6490	*6490	*10010	*10010	*7270	6580	*5890	4790	*3990	*3990	7.88
	lb	*14310	*14310	*22070	*22070	*16030	14510	*12990	10560	*8800	*8800	(25.8)
-1.5 m (-4.9 ft)	kg	*12120	*12120	*10360	10130	*7590	6530			*4660	*4660	7.33
	lb	*26720	*26720	*22840	22330	*16730	14400			*10270	*10270	(24.1)
-3.0 m (-9.8 ft)	kg			*9890	*9890							
	lb			*21800	*21800							

Note 1. Lifting capacity are based on ISO 10567.

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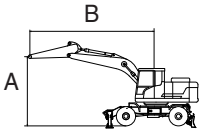
⚠ Failure to comply to the rated load can cause surious injury, death, or property damage. Make adjustments to the rated load as necessory for non-standard configurations.

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5400	2920	4100	-	310	-	-	Up	Up

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
9.0 m (29.5 ft)	kg									*5310	*5310	3.87
	lb									*11710	*11710	(12.7)
7.5 m (24.6 ft)	kg									*4030	*4030	5.87
	lb									*8880	*8880	(19.3)
6.0 m (19.7 ft)	kg			*4450	*4450	*4510	*4510			*3610	*3610	7.02
	lb			*9810	*9810	*9940	*9940			*7960	*7960	(23.0)
4.5 m (14.8 ft)	kg	*7030	*7030	*5540	*5540	*4940	4670	4810	3280	*3460	3120	7.71
	lb	*15500	*15500	*12210	*12210	*10890	10300	10600	7230	*7630	6880	(25.3)
3.0 m (9.8 ft)	kg			*7250	6730	*5720	4460	4720	3200	*3480	2850	8.05
	lb			*15980	14840	*12610	9830	10410	7050	*7670	6280	(26.4)
1.5 m (4.9 ft)	kg			*8940	6280	6410	4240	4620	3100	*3640	2770	8.11
	lb			*19710	13850	14130	9350	10190	6830	*8020	6110	(26.6)
0.0 m (0.0 ft)	kg	*6490	*6490	9690	6050	6250	4100	4550	3040	*3990	2850	7.88
	lb	*14310	*14310	21360	13340	13780	9040	10030	6700	*8800	6280	(25.8)
-1.5 m (-4.9 ft)	kg	*12120	11170	9630	6000	6200	4050			*4660	3140	7.33
	lb	*26720	24630	21230	13230	13670	8930			*10270	6920	(24.1)
-3.0 m (-9.8 ft)	kg			9740	6100							
	lb			21470	13450							

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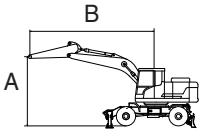
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5400	2920	4100	-	310	Down	-	-	Down

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
9.0 m (29.5 ft)	kg									*4500	*4500	4.31
	lb									*9920	*9920	(14.2)
7.5 m (24.6 ft)	kg					*4450	*4450			*3510	*3510	6.17
	lb					*9810	*9810			*7740	*7740	(20.3)
6.0 m (19.7 ft)	kg					*4230	*4230			*3160	*3160	7.27
	lb					*9330	*9330			*6970	*6970	(23.9)
4.5 m (14.8 ft)	kg			*5190	*5190	*4680	*4680	*4560	4500	*3030	*3030	7.93
	lb			*11440	*11440	*10320	*10320	*10050	9920	*6680	*6680	(26.0)
3.0 m (9.8 ft)	kg			*6890	*6890	*5480	*5480	*4890	4400	*3040	*3040	8.27
	lb			*15190	*15190	*12080	*12080	*10780	9700	*6700	*6700	(27.1)
1.5 m (4.9 ft)	kg			*8620	*8620	*6370	5930	*5350	4290	*3180	*3180	8.33
	lb			*19000	*19000	*14040	13070	*11790	9460	*7010	*7010	(27.3)
0.0 m (0.0 ft)	kg	*6800	*6800	*9780	8770	*7100	5750	*5750	4200	*3470	*3470	8.10
	lb	*14990	*14990	*21560	19330	*15650	12680	*12680	9260	*7650	*7650	(26.6)
-1.5 m (-4.9 ft)	kg	*11610	*11610	*10240	8690	*7480	5690	*5030	4200	*4010	*4010	7.57
	lb	*25600	*25600	*22580	19160	*16490	12540	*11090	9260	*8840	*8840	(24.8)
-3.0 m (-9.8 ft)	kg			*9920	8780	*7230	5750					
	lb			*21870	19360	*15940	12680					

Note 1. Lifting capacity are based on ISO 10567.

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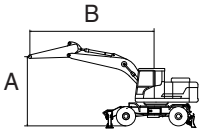
Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5400	2920	4100	-	310	Up	-	-	Up

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
9.0 m (29.5 ft)	kg									*4500	*4500	4.31
	lb									*9920	*9920	(14.2)
7.5 m (24.6 ft)	kg					*4450	*4450			*3510	*3510	6.17
	lb					*9810	*9810			*7740	*7740	(20.3)
6.0 m (19.7 ft)	kg					*4230	*4230			*3160	*3160	7.27
	lb					*9330	*9330			*6970	*6970	(23.9)
4.5 m (14.8 ft)	kg			*5190	*5190	*4680	*4680	*4560	3310	*3030	2990	7.93
	lb			*11440	*11440	*10320	*10320	*10050	7300	*6680	6590	(26.0)
3.0 m (9.8 ft)	kg			*6890	6830	*5480	4500	4700	3220	*3040	2740	8.27
	lb			*15190	15060	*12080	9920	10360	7100	*6700	6040	(27.1)
1.5 m (4.9 ft)	kg			*8620	6350	*6370	4270	4590	3110	*3180	2660	8.33
	lb			*19000	14000	*14040	9410	10120	6860	*7010	5860	(27.3)
0.0 m (0.0 ft)	kg	*6800	*6800	9650	6080	6210	4110	4500	3030	*3470	2730	8.10
	lb	*14990	*14990	21270	13400	13690	9060	9920	6680	*7650	6020	(26.6)
-1.5 m (-4.9 ft)	kg	*11610	11170	9560	6010	6140	4050	4500	3030	*4010	3000	7.57
	lb	*25600	24630	21080	13250	13540	8930	9920	6680	*8840	6610	(24.8)
-3.0 m (-9.8 ft)	kg			9650	6080	6210	4110					
	lb			21270	13400	13690	9060					

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Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5400	2920	4100	-	310	-	Down	Down	-

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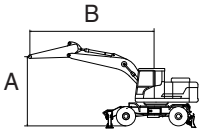


Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
9.0 m (29.5 ft)	kg									*4500	*4500	4.31
	lb									*9920	*9920	(14.2)
7.5 m (24.6 ft)	kg					*4450	*4450			*3510	*3510	6.17
	lb					*9810	*9810			*7740	*7740	(20.3)
6.0 m (19.7 ft)	kg					*4230	*4230			*3160	*3160	7.27
	lb					*9330	*9330			*6970	*6970	(23.9)
4.5 m (14.8 ft)	kg			*5190	*5190	*4680	*4680	*4560	4290	*3030	*3030	7.93
	lb			*11440	*11440	*10320	*10320	*10050	9460	*6680	*6680	(26.0)
3.0 m (9.8 ft)	kg			*6890	*6890	*5480	*5480	*4890	4190	*3040	*3040	8.27
	lb			*15190	*15190	*12080	*12080	*10780	9240	*6700	*6700	(27.1)
1.5 m (4.9 ft)	kg			*8620	8600	*6370	5640	*5350	4080	*3180	*3180	8.33
	lb			*19000	18960	*14040	12430	*11790	8990	*7010	*7010	(27.3)
0.0 m (0.0 ft)	kg	*6800	*6800	*9780	8300	*7100	5470	*5750	4000	*3470	*3470	8.10
	lb	*14990	*14990	*21560	18300	*15650	12060	*12680	8820	*7650	*7650	(26.6)
-1.5 m (-4.9 ft)	kg	*11610	*11610	*10240	8220	*7480	5400	*5030	4000	*4010	3950	7.57
	lb	*25600	*25600	*22580	18120	*16490	11900	*11090	8820	*8840	8710	(24.8)
-3.0 m (-9.8 ft)	kg			*9920	8310	*7230	5470					
	lb			*21870	18320	*15940	12060					

Note 1. Lifting capacity are based on ISO 10567.

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

3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).

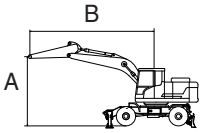
4. *Indicates load limited by hydraulic capacity.

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

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

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5400	2920	4100	-	310	-	Up	Up	-

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
9.0 m (29.5 ft)	kg									*4500	*4500	4.31
	lb									*9920	*9920	(14.2)
7.5 m (24.6 ft)	kg					*4450	*4450			*3510	*3510	6.17
	lb					*9810	*9810			*7740	*7740	(20.3)
6.0 m (19.7 ft)	kg					*4230	*4230			*3160	*3160	7.27
	lb					*9330	*9330			*6970	*6970	(23.9)
4.5 m (14.8 ft)	kg			*5190	*5190	*4680	4670	*4560	3260	*3030	2940	7.93
	lb			*11440	*11440	*10320	10300	*10050	7190	*6680	6480	(26.0)
3.0 m (9.8 ft)	kg			*6890	6740	*5480	4440	4690	3170	*3040	2700	8.27
	lb			*15190	14860	*12080	9790	10340	6990	*6700	5950	(27.1)
1.5 m (4.9 ft)	kg			*8620	6260	*6370	4210	4570	3060	*3180	2620	8.33
	lb			*19000	13800	*14040	9280	10080	6750	*7010	5780	(27.3)
0.0 m (0.0 ft)	kg	*6800	*6800	9620	5990	6190	4040	4490	2980	*3470	2690	8.10
	lb	*14990	*14990	21210	13210	13650	8910	9900	6570	*7650	5930	(26.6)
-1.5 m (-4.9 ft)	kg	*11610	11010	9530	5910	6120	3980	4490	2980	*4010	2950	7.57
	lb	*25600	24270	21010	13030	13490	8770	9900	6570	*8840	6500	(24.8)
-3.0 m (-9.8 ft)	kg			9620	5990	6190	4040					
	lb			21210	13210	13650	8910					

Note 1. Lifting capacity are based on ISO 10567.

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

3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).

4. *Indicates load limited by hydraulic capacity.

※ Lifting capacities are based upon a standard machine conditions.
Lifting capacities will vary with different work tools, ground conditions and attachments.
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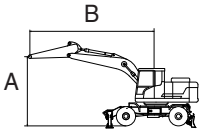
Consult with your local HD Hyundai Construction Equipment dealer regarding the lifting capacities for specific work tools and attachments.

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

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5400	2920	4100	-	310	-	-	Down	Down

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
9.0 m (29.5 ft)	kg									*4500	*4500	4.31
	lb									*9920	*9920	(14.2)
7.5 m (24.6 ft)	kg					*4450	*4450			*3510	*3510	6.17
	lb					*9810	*9810			*7740	*7740	(20.3)
6.0 m (19.7 ft)	kg					*4230	*4230			*3160	*3160	7.27
	lb					*9330	*9330			*6970	*6970	(23.9)
4.5 m (14.8 ft)	kg			*5190	*5190	*4680	*4680	*4560	*4560	*3030	*3030	7.93
	lb			*11440	*11440	*10320	*10320	*10050	*10050	*6680	*6680	(26.0)
3.0 m (9.8 ft)	kg			*6890	*6890	*5480	*5480	*4890	*4890	*3040	*3040	8.27
	lb			*15190	*15190	*12080	*12080	*10780	*10780	*6700	*6700	(27.1)
1.5 m (4.9 ft)	kg			*8620	*8620	*6370	*6370	*5350	4810	*3180	*3180	8.33
	lb			*19000	*19000	*14040	*14040	*11790	10600	*7010	*7010	(27.3)
0.0 m (0.0 ft)	kg	*6800	*6800	*9780	*9780	*7100	6520	*5750	4730	*3470	*3470	8.10
	lb	*14990	*14990	*21560	*21560	*15650	14370	*12680	10430	*7650	*7650	(26.6)
-1.5 m (-4.9 ft)	kg	*11610	*11610	*10240	10030	*7480	6450	*5030	4730	*4010	*4010	7.57
	lb	*25600	*25600	*22580	22110	*16490	14220	*11090	10430	*8840	*8840	(24.8)
-3.0 m (-9.8 ft)	kg			*9920	*9920	*7230	6520					
	lb			*21870	*21870	*15940	14370					

Note 1. Lifting capacity are based on ISO 10567.

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

※ Lifting capacities are based upon a standard machine conditions.
Lifting capacities will vary with different work tools, ground conditions and attachments.
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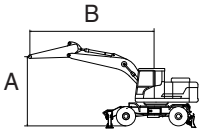
Consult with your local HD Hyundai Construction Equipment dealer regarding the lifting capacities for specific work tools and attachments.

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

Model	Type	Boom	Arm	Counterweight	Shoe	Wheel	Dozer		Outrigger	
HW210A	2-PIECE BOOM	Length [mm]	Length [mm]	weight [kg]	width [mm]	width [mm]	Front	Rear	Front	Rear
		5400	2920	4100	-	310	-	-	Up	Up

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



Lift-point height (A)		Lift-point radius (B)								At max. reach		
		3.0 m (9.8 ft)		4.5 m (14.8 ft)		6.0 m (19.7 ft)		7.5 m (24.6 ft)		Capacity		Reach
												m (ft)
9.0 m (29.5 ft)	kg									*4500	*4500	4.31
	lb									*9920	*9920	(14.2)
7.5 m (24.6 ft)	kg					*4450	*4450			*3510	*3510	6.17
	lb					*9810	*9810			*7740	*7740	(20.3)
6.0 m (19.7 ft)	kg					*4230	*4230			*3160	*3160	7.27
	lb					*9330	*9330			*6970	*6970	(23.9)
4.5 m (14.8 ft)	kg			*5190	*5190	*4680	4660	*4560	3250	*3030	2940	7.93
	lb			*11440	*11440	*10320	10270	*10050	7170	*6680	6480	(26.0)
3.0 m (9.8 ft)	kg			*6890	6730	*5480	4430	4690	3160	*3040	2690	8.27
	lb			*15190	14840	*12080	9770	10340	6970	*6700	5930	(27.1)
1.5 m (4.9 ft)	kg			*8620	6250	*6370	4200	4570	3050	*3180	2610	8.33
	lb			*19000	13780	*14040	9260	10080	6720	*7010	5750	(27.3)
0.0 m (0.0 ft)	kg	*6800	*6800	9620	5980	6190	4040	4490	2980	*3470	2680	8.10
	lb	*14990	*14990	21210	13180	13650	8910	9900	6570	*7650	5910	(26.6)
-1.5 m (-4.9 ft)	kg	*11610	10990	9530	5900	6120	3980	4490	2980	*4010	2940	7.57
	lb	*25600	24230	21010	13010	13490	8770	9900	6570	*8840	6480	(24.8)
-3.0 m (-9.8 ft)	kg			9620	5980	6190	4040					
	lb			21210	13180	13650	8910					

Note 1. Lifting capacity are based on ISO 10567.

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

3. The Lift-point is bucket pivot mounting pin on the arm (without bucket mass).

4. *Indicates load limited by hydraulic capacity.

※ Lifting capacities are based upon a standard machine conditions.
Lifting capacities will vary with different work tools, ground conditions and attachments.
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6. BUCKET SELECTION GUIDE

1) FRONT DOZER UP, REAR OUTRIGGER UP
(counterweight : mono boom-3400 kg, 2-piece boom-4100 kg)

General bucket

Heavy duty

Type	Capacity		Width	Weight	Tooth	MONO			2-PIECE		
						Recommendation mm (ft-in)					
	SAE Heaped	CECE heaped	Without side cutter			5.65 m (18' 6") Boom			5.40 m (17' 9") Boom		
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.4 m (7' 10') Arm	2.7 m (8' 10') Arm	2.92 m (9' 7") Arm	2.4 m (7' 10') Arm	2.7 m (8' 10') Arm	2.92 m (9' 7") Arm
General bucket	0.80 (1.05)	0.70 (0.92)	1070 (42.1")	770 (1700)	5	●	●	◐	●	●	●
	0.86 (1.12)	0.75 (0.98)	1140 (44.9")	740 (1630)	5	◐	◐	■	●	●	●
	0.92 (1.20)	0.80 (1.05)	1190 (46.9")	820 (1810)	5	◐	◐	■	●	●	◐
	1.20 (1.57)	1.05 (1.37)	1390 (54.7")	920 (2030)	5	▲	▲	▲	■	■	▲
	1.34 (1.75)	1.17 (1.53)	1525 (60.0")	990 (2180)	6	▲	X	X	■	▲	▲
Heavy duty	0.85 (1.11)	0.76 (0.99)	960 (37.8")	860 (1900)	4	◐	◐	■	●	●	●
	1.00 (1.31)	0.89 (1.16)	1110 (43.7")	950 (2090)	5	■	■	▲	◐	◐	■
	1.15 (1.50)	1.01 (1.32)	1260 (49.6")	1030 (2270)	6	▲	▲	▲	■	■	▲

● Applicable for materials with density of 2100 kg/m^3 (3500 lb/yd^3) or less
◐ Applicable for materials with density of 1800 kg/m^3 (3000 lb/yd^3) or less
■ Applicable for materials with density of 1500 kg/m^3 (2500 lb/yd^3) or less
▲ Applicable for materials with density of 1200 kg/m^3 (2000 lb/yd^3) or less
X Not recommended

※ These recommendations are for general conditions and average use.
Work tools and ground conditions have effects on machine performance.
Select an optimum combination according to the working conditions and the type of work that is being done.
Consult your HD Hyundai Construction Equipment dealer for information on selecting the correct boom−arm−bucket combination.

2) FRONT DOZER DOWN, REAR OUTRIGGER DOWN
(counterweight : mono boom-3400 kg, 2-piece boom-4100 kg)

General bucket

Heavy duty

Type	Capacity		Width	Weight	Tooth	MONO			2-PIECE		
						Recommendation mm (ft-in)					
	SAE Heaped	CECE heaped	Without side cutter			5.65 m (18' 6") Boom			5.40 m (17' 9") Boom		
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.4 m (7' 10') Arm	2.7 m (8' 10') Arm	2.92 m (9' 7") Arm	2.4 m (7' 10') Arm	2.7 m (8' 10') Arm	2.92 m (9' 7") Arm
General bucket	0.80 (1.05)	0.70 (0.92)	1070 (42.1")	770 (1700)	5	●	●	●	●	●	●
	0.86 (1.12)	0.75 (0.98)	1140 (44.9")	740 (1630)	5	●	●	●	●	●	●
	0.92 (1.20)	0.80 (1.05)	1190 (46.9")	820 (1810)	5	●	●	●	●	●	●
	1.20 (1.57)	1.05 (1.37)	1390 (54.7")	920 (2030)	5	●	◐	◐	●	●	●
	1.34 (1.75)	1.17 (1.53)	1525 (60.0")	990 (2180)	6	◐	◐	●	●	●	◐
Heavy duty	0.85 (1.11)	0.76 (0.99)	960 (37.8")	860 (1900)	4	●	●	●	●	●	●
	1.00 (1.31)	0.89 (1.16)	1110 (43.7")	950 (2090)	5	●	●	●	●	●	●
	1.15 (1.50)	1.01 (1.32)	1260 (49.6")	1030 (2270)	6	●	◐	◐	●	●	●

● Applicable for materials with density of 2100 kg/m^3 (3500 lb/yd^3) or less
◐ Applicable for materials with density of 1800 kg/m^3 (3000 lb/yd^3) or less
■ Applicable for materials with density of 1500 kg/m^3 (2500 lb/yd^3) or less
▲ Applicable for materials with density of 1200 kg/m^3 (2000 lb/yd^3) or less
X Not recommended

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Work tools and ground conditions have effects on machine performance.
Select an optimum combination according to the working conditions and the type of work that is being done.
Consult your HD Hyundai Construction Equipment dealer for information on selecting the correct boom−arm−bucket combination.

3) FRONT OUTRIGGER UP, REAR OUTRIGGER UP
(counterweight : mono boom-3400 kg, 2-piece boom-4100 kg)

General bucket

Heavy duty

Type	Capacity		Width	Weight	Tooth	MONO			2-PIECE		
						Recommendation mm (ft-in)					
	SAE Heaped	CECE heaped	Without side cutter			5.65 m (18' 6") Boom			5.40 m (17' 9") Boom		
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.4 m (7' 10') Arm	2.7 m (8' 10') Arm	2.92 m (9' 7") Arm	2.4 m (7' 10') Arm	2.7 m (8' 10') Arm	2.92 m (9' 7") Arm
General bucket	0.80 (1.05)	0.70 (0.92)	1070 (42.1")	770 (1700)	5	●	◐	◐	●	●	●
	0.86 (1.12)	0.75 (0.98)	1140 (44.9")	740 (1630)	5	◐	◐	■	●	●	◐
	0.92 (1.20)	0.80 (1.05)	1190 (46.9")	820 (1810)	5	◐	■	■	●	●	◐
	1.20 (1.57)	1.05 (1.37)	1390 (54.7")	920 (2030)	5	▲	▲	X	■	■	▲
	1.34 (1.75)	1.17 (1.53)	1525 (60.0")	990 (2180)	6	▲	X	X	▲	▲	▲
Heavy duty	0.85 (1.11)	0.76 (0.99)	960 (37.8")	860 (1900)	4	◐	◐	■	●	●	◐
	1.00 (1.31)	0.89 (1.16)	1110 (43.7")	950 (2090)	5	■	■	▲	◐	◐	■
	1.15 (1.50)	1.01 (1.32)	1260 (49.6")	1030 (2270)	6	▲	▲	X	■	■	▲

● Applicable for materials with density of 2100 kg/m^3 (3500 lb/yd^3) or less
◐ Applicable for materials with density of 1800 kg/m^3 (3000 lb/yd^3) or less
■ Applicable for materials with density of 1500 kg/m^3 (2500 lb/yd^3) or less
▲ Applicable for materials with density of 1200 kg/m^3 (2000 lb/yd^3) or less
X Not recommended

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Work tools and ground conditions have effects on machine performance.
Select an optimum combination according to the working conditions and the type of work that is being done.
Consult your HD Hyundai Construction Equipment dealer for information on selecting the correct boom−arm−bucket combination.

4) FRONT OUTRIGGER DOWN, REAR OUTRIGGER DOWN
(counterweight : mono boom-3400 kg, 2-piece boom-4100 kg)

General bucket

Heavy duty

Type	Capacity		Width	Weight	Tooth	MONO			2-PIECE		
						Recommendation mm (ft-in)					
	SAE Heaped	CECE heaped	Without side cutter			5.65 m (18' 6") Boom			5.40 m (17' 9") Boom		
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.4 m (7' 10') Arm	2.7 m (8' 10') Arm	2.92 m (9' 7") Arm	2.4 m (7' 10') Arm	2.7 m (8' 10') Arm	2.92 m (9' 7") Arm
General bucket	0.80 (1.05)	0.70 (0.92)	1070 (42.1")	770 (1700)	5	●	●	●	●	●	●
	0.86 (1.12)	0.75 (0.98)	1140 (44.9")	740 (1630)	5	●	●	●	●	●	●
	0.92 (1.20)	0.80 (1.05)	1190 (46.9")	820 (1810)	5	●	●	●	●	●	●
	1.20 (1.57)	1.05 (1.37)	1390 (54.7")	920 (2030)	5	●	●	●	●	●	●
	1.34 (1.75)	1.17 (1.53)	1525 (60.0")	990 (2180)	6	●	◐	◐	●	●	●
Heavy duty	0.85 (1.11)	0.76 (0.99)	960 (37.8")	860 (1900)	4	●	●	●	●	●	●
	1.00 (1.31)	0.89 (1.16)	1110 (43.7")	950 (2090)	5	●	●	●	●	●	●
	1.15 (1.50)	1.01 (1.32)	1260 (49.6")	1030 (2270)	6	●	●	●	●	●	●

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◐ Applicable for materials with density of 1800 kg/m^3 (3000 lb/yd^3) or less
■ Applicable for materials with density of 1500 kg/m^3 (2500 lb/yd^3) or less
▲ Applicable for materials with density of 1200 kg/m^3 (2000 lb/yd^3) or less
X Not recommended

※ These recommendations are for general conditions and average use.
Work tools and ground conditions have effects on machine performance.
Select an optimum combination according to the working conditions and the type of work that is being done.
Consult your HD Hyundai Construction Equipment dealer for information on selecting the correct boom−arm−bucket combination.

5) FRONT DOZER UP, REAR DOZER UP
(counterweight : mono boom-3400 kg, 2-piece boom-4100 kg)

General bucket

Heavy duty

Type	Capacity		Width	Weight	Tooth	MONO			2-PIECE		
						Recommendation mm (ft-in)					
	SAE Heaped	CECE heaped	Without side cutter			5.65 m (18' 6") Boom			5.40 m (17' 9") Boom		
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.4 m (7' 10') Arm	2.7 m (8' 10') Arm	2.92 m (9' 7") Arm	2.4 m (7' 10') Arm	2.7 m (8' 10') Arm	2.92 m (9' 7") Arm
General bucket	0.80 (1.05)	0.70 (0.92)	1070 (42.1")	770 (1700)	5	●	●	◐	●	●	●
	0.86 (1.12)	0.75 (0.98)	1140 (44.9")	740 (1630)	5	◐	◐	■	●	●	●
	0.92 (1.20)	0.80 (1.05)	1190 (46.9")	820 (1810)	5	◐	■	■	●	●	◐
	1.20 (1.57)	1.05 (1.37)	1390 (54.7")	920 (2030)	5	▲	▲	▲	■	■	▲
	1.34 (1.75)	1.17 (1.53)	1525 (60.0")	990 (2180)	6	▲	X	X	■	▲	▲
Heavy duty	0.85 (1.11)	0.76 (0.99)	960 (37.8")	860 (1900)	4	◐	◐	■	●	●	●
	1.00 (1.31)	0.89 (1.16)	1110 (43.7")	950 (2090)	5	■	■	▲	◐	◐	■
	1.15 (1.50)	1.01 (1.32)	1260 (49.6")	1030 (2270)	6	▲	▲	▲	■	■	▲

● Applicable for materials with density of 2100 kg/m^3 (3500 lb/yd^3) or less
◐ Applicable for materials with density of 1800 kg/m^3 (3000 lb/yd^3) or less
■ Applicable for materials with density of 1500 kg/m^3 (2500 lb/yd^3) or less
▲ Applicable for materials with density of 1200 kg/m^3 (2000 lb/yd^3) or less
X Not recommended

※ These recommendations are for general conditions and average use.
Work tools and ground conditions have effects on machine performance.
Select an optimum combination according to the working conditions and the type of work that is being done.
Consult your HD Hyundai Construction Equipment dealer for information on selecting the correct boom−arm−bucket combination.

6) FRONT DOZER DOWN, REAR DOZER DOWN
(counterweight : mono boom-3400 kg, 2-piece boom-4100 kg)

General bucket

Heavy duty

Type	Capacity		Width	Weight	Tooth	MONO			2-PIECE		
						Recommendation mm (ft-in)					
	SAE Heaped	CECE heaped	Without side cutter			5.65 m (18' 6") Boom			5.40 m (17' 9") Boom		
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.4 m (7' 10') Arm	2.7 m (8' 10') Arm	2.92 m (9' 7") Arm	2.4 m (7' 10') Arm	2.7 m (8' 10') Arm	2.92 m (9' 7") Arm
General bucket	0.80 (1.05)	0.70 (0.92)	1070 (42.1")	770 (1700)	5	●	●	●	●	●	●
	0.86 (1.12)	0.75 (0.98)	1140 (44.9")	740 (1630)	5	●	●	●	●	●	●
	0.92 (1.20)	0.80 (1.05)	1190 (46.9")	820 (1810)	5	●	●	◐	●	●	●
	1.20 (1.57)	1.05 (1.37)	1390 (54.7")	920 (2030)	5	■	■	▲	◐	◐	■
	1.34 (1.75)	1.17 (1.53)	1525 (60.0")	990 (2180)	6	▲	▲	▲	■	■	■
Heavy duty	0.85 (1.11)	0.76 (0.99)	960 (37.8")	860 (1900)	4	●	●	◐	●	●	●
	1.00 (1.31)	0.89 (1.16)	1110 (43.7")	950 (2090)	5	◐	◐	■	●	●	◐
	1.15 (1.50)	1.01 (1.32)	1260 (49.6")	1030 (2270)	6	■	■	▲	◐	◐	■

●	Applicable for materials with density of 2100 kg/m^3 (3500 lb/yd^3) or less
◐	Applicable for materials with density of 1800 kg/m^3 (3000 lb/yd^3) or less
■	Applicable for materials with density of 1500 kg/m^3 (2500 lb/yd^3) or less
▲	Applicable for materials with density of 1200 kg/m^3 (2000 lb/yd^3) or less
X	Not recommended

※ These recommendations are for general conditions and average use.
Work tools and ground conditions have effects on machine performance.
Select an optimum combination according to the working conditions and the type of work that is being done.
Consult your HD Hyundai Construction Equipment dealer for information on selecting the correct boom−arm−bucket combination.

7) REAR DOZER UP

(counterweight : mono boom-3400 kg, 2-piece boom-4100 kg)

General bucket

Heavy duty

Type	Capacity		Width	Weight	Tooth	MONO			2-PIECE		
						Recommendation mm (ft-in)					
	SAE Heaped	CECE heaped	Without side cutter			5.65 m (18' 6") Boom			5.40 m (17' 9") Boom		
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.4 m (7' 10') Arm	2.7 m (8' 10') Arm	2.92 m (9' 7") Arm	2.4 m (7' 10') Arm	2.7 m (8' 10') Arm	2.92 m (9' 7") Arm
General bucket	0.80 (1.05)	0.70 (0.92)	1070 (42.1")	770 (1700)	5	●	◐	◐	●	●	●
	0.86 (1.12)	0.75 (0.98)	1140 (44.9")	740 (1630)	5	●	■	■	●	●	◐
	0.92 (1.20)	0.80 (1.05)	1190 (46.9")	820 (1810)	5	■	■	■	●	◐	◐
	1.20 (1.57)	1.05 (1.37)	1390 (54.7")	920 (2030)	5	▲	▲	X	■	■	▲
	1.34 (1.75)	1.17 (1.53)	1525 (60.0")	990 (2180)	6	X	X	X	▲	▲	▲
Heavy duty	0.85 (1.11)	0.76 (0.99)	960 (37.8")	860 (1900)	4	◐	■	■	●	●	◐
	1.00 (1.31)	0.89 (1.16)	1110 (43.7")	950 (2090)	5	■	▲	▲	◐	◐	■
	1.15 (1.50)	1.01 (1.32)	1260 (49.6")	1030 (2270)	6	▲	▲	X	■	■	▲

● Applicable for materials with density of 2100 kg/m^3 (3500 lb/yd^3) or less

◐ Applicable for materials with density of 1800 kg/m^3 (3000 lb/yd^3) or less

■ Applicable for materials with density of 1500 kg/m^3 (2500 lb/yd^3) or less

▲ Applicable for materials with density of 1200 kg/m^3 (2000 lb/yd^3) or less

X Not recommended

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Work tools and ground conditions have effects on machine performance.
Select an optimum combination according to the working conditions and the type of work that is being done.
Consult your HD Hyundai Construction Equipment dealer for information on selecting the correct boom−arm−bucket combination.

8) REAR DOZER DOWN

(counterweight : mono boom-3400 kg, 2-piece boom-4100 kg)

General bucket

Heavy duty

Type	Capacity		Width	Weight	Tooth	MONO			2-PIECE		
						Recommendation mm (ft-in)					
	SAE Heaped	CECE heaped	Without side cutter			5.65 m (18' 6") Boom			5.40 m (17' 9") Boom		
	m^3 (yd^3)	m^3 (yd^3)	mm (in)	kg (lb)	EA	2.4 m (7' 10') Arm	2.7 m (8' 10') Arm	2.92 m (9' 7") Arm	2.4 m (7' 10') Arm	2.7 m (8' 10') Arm	2.92 m (9' 7") Arm
General bucket	0.80 (1.05)	0.70 (0.92)	1070 (42.1")	770 (1700)	5	●	◐	◐	●	●	●
	0.86 (1.12)	0.75 (0.98)	1140 (44.9")	740 (1630)	5	●	◐	◐	●	●	●
	0.92 (1.20)	0.80 (1.05)	1190 (46.9")	820 (1810)	5	◐	■	■	●	●	◐
	1.20 (1.57)	1.05 (1.37)	1390 (54.7")	920 (2030)	5	▲	▲	▲	■	■	■
	1.34 (1.75)	1.17 (1.53)	1525 (60.0")	990 (2180)	6	▲	X	X	■	▲	▲
Heavy duty	0.85 (1.11)	0.76 (0.99)	960 (37.8")	860 (1900)	4	●	◐	◐	●	●	●
	1.00 (1.31)	0.89 (1.16)	1110 (43.7")	950 (2090)	5	■	■	▲	●	◐	◐
	1.15 (1.50)	1.01 (1.32)	1260 (49.6")	1030 (2270)	6	▲	▲	▲	■	■	■

●	Applicable for materials with density of 2100 kg/m^3 (3500 lb/yd^3) or less
◐	Applicable for materials with density of 1800 kg/m^3 (3000 lb/yd^3) or less
■	Applicable for materials with density of 1500 kg/m^3 (2500 lb/yd^3) or less
▲	Applicable for materials with density of 1200 kg/m^3 (2000 lb/yd^3) or less
X	Not recommended

※ These recommendations are for general conditions and average use.
Work tools and ground conditions have effects on machine performance.
Select an optimum combination according to the working conditions and the type of work that is being done.
Consult your HD Hyundai Construction Equipment dealer for information on selecting the correct boom−arm−bucket combination.

7. SPECIFICATIONS FOR MAJOR COMPONENTS

1) ENGINE

Item	Specification
Maker / Model	CUMMINS / B6.7
Type	4-cycle, turbocharged, charge air cooled, electronic controlled diesel engine
Cooling method	Water cooled
Number of cylinders and arrangement	6 cylinders, in-line
Firing order	1-5-3-6-2-4
Combustion chamber type	Direct injection type
Cylinder bore × stroke	107 × 124 mm (4.21" × 4.88")
Displacement	6.7 ℓ (408 cu in)
Compression ratio	17.3 : 1
Gross power	173 Hp (129 kW) at 2200 rpm
Net power	170 Hp (127 kW) at 2200 rpm
Max. power	195 Hp (145 kW) at 2000 rpm
Peak Torque	881 N · m (650 lb · ft) at 1300 rpm
Engine oil quantity	24.4 ℓ (6.4 U.S. gal)
Wet weight or Dry weight	583 kg (1285 lb)
Starter motor	24 V-4.8 kW
Alternator	24 V-95 A
Battery	2 × 12 × 100 Ah

2) MAIN PUMP

Item	Specification
Type	Variable displacement piston pump
Capacity	2 × 130 cc/rev
Maximum pressure	350 kgf/cm^2 (4980 psi) [380 kgf/cm^2 (5400 psi)]
Rated oil flow	2 × 208 ℓ/min (55.0 U.S. gpm / 45.8 U.K. gpm)
Rated speed	1600 rpm

[ ]: Power boost

3) GEAR PUMP

Item	Specification
Type	Fixed displacement gear pump single stage
Capacity	10cc/rev
Maximum pressure	40 kgf/cm^2 (570 psi)
Rated oil flow	16 ℓ /min (4.2 U.S. gpm/3.5 U.K. gpm)

4) MAIN CONTROL VALVE

Item	Specification
Type	9 spools two-block
Operating method	Hydraulic pilot system
Main relief valve pressure	350 kgf/cm^2 (4980 psi) [380 kgf/cm^2 (5400 psi)]
Overload relief valve pressure	400 kgf/cm^2 (5690 psi)
Overload relief valve pressure (dozer & outrigger only)	280 kgf/cm^2 (3980 psi)

[ ]: Power boost

5) SWING MOTOR

Item	Specification
Type	Fixed displacement axial piston motor
Capacity	142.8 cc/rev
Relief pressure	265 kgf/cm^2 (3769 psi)
Braking system	Automatic, spring applied hydraulic released
Braking torque	Above 76.8 kgf · m (555.5 lbf · ft)
Brake release pressure	21.2~35.7 kgf/cm^2 (301~508 psi)
Reduction gear type	-

6) TRAVEL MOTOR

Item	Specification
Type	Variable displacement bent-axis axial piston motor
Relief pressure	380 kgf/cm^2 (5400 psi)
Counter balance valve	Applied
Capacity (max/min)	160/61 cc/rev

7) POWER TRAIN

Item	Description		Specification
Transmission	Type		2 speed power shift transmission
	Gear ratio	1st	4.87
		2nd	1.20
	Clutch pressure		30~32 kgf /cm^2 (427~455 psi)
Parking brake	Type		Multi disc brake integrated in transmission
	Maximum braking torque		3286 kgf · m (23768 lbf · ft)
Axle	Type		4 wheel drive with differential
	Gear ratio		16.0
	Brake		Multi disc brake
	Brake pressure		81.6 kgf /cm^2 (1160 psi)
	Steering pressure		180 kgf /cm^2 (2560 psi)

8) POWER TRAIN GEAR PUMP

Item	Description
Capacity	Steering + brake : 19.4 + 8.2 cc / rev (engine PTO) Steering + brake & rotating : 22.4 + 8.2 cc / rev (engine PTO)
Rated flow	Steering + brake : 31.0 + 13.1 L/min (engine PTO) [8.1 + 3.5 U.S.gpm / 6.8 + 2.8 U.K.gpm] Steering + brake & rotating : 35.8 + 13.1 L/min (engine PTO) [9.5 + 3.5 U.S.gpm / 7.9 + 2.8 U.K.gpm]

9) CYLINDER

Item		Specification
Boom cylinder	Bore dia × Rod dia × Stroke	Ø120× Ø85×1275 mm
	Cushion	Extend only
Arm cylinder	Bore dia × Rod dia × Stroke	Ø140× Ø100×1510 mm
	Cushion	Extend and retract
Bucket cylinder	Bore dia × Rod dia × Stroke	Ø120× Ø85×1055 mm
	Cushion	Extend only
Dozer cylinder (front, rear)	Bore dia × Rod dia × Stroke	Ø125× Ø75×252 mm
	Cushion	-
Outrigger cylinder	Bore dia × Rod dia × Stroke	Ø130× Ø80×436 mm
	Cushion	-
Adjust cylinder	Bore dia × Rod dia × Stroke	Ø170× Ø105×720 mm
	Cushion	-
2-piece boom cylinder	Bore dia × Rod dia × Stroke	Ø120× Ø85×1080 mm
	Cushion	Extend only

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

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

8. RECOMMENDED OILS

HD Hyundai Construction Equipment genuine lubricating oils have been developed to offer the best performance and service life for your equipment. These oils have been tested according to the specifications of HD Hyundai Construction Equipment and, therefore, will meet the highest safety and quality requirements.
We recommend that you use only HD Hyundai Construction Equipment genuine lubricating oils and grease officially approved by HD Hyundai Construction Equipment.

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	24.4 (6.4)	★SAE 0W-40 ★SAE 5W-30
Transmission case	Engine oil	2.5 (0.66)	SAE 5W-40 SAE 15W-40
DEF/ AdBlue® tank	Mixture of urea and deionized water	47.5 (12.5)	ISO 22241, High-purity urea + deionized water (32.5:67.5)
Swing drive	Gear oil	6.2 (1.6)	★SAE 75W−90 SAE 80W−90
Front axle casing	Gear oil	Std : 9.6 (2.54) Wide : 13.5 (3.46)	SAE 85W-90 LSD or UTTO
Rear axle casing	Gear oil	Std : 11.0 (2.91) Wide : 15.0 (3.96)	
Hub casing	Gear oil	2.5 (0.66)×2	
Hydraulic tank	Hydraulic oil	Tank: 165 (43.6) System: 340 (89.8)	★ISO VG 15 ISO VG 32 ISO VG 46, HBHO★3 ISO VG 68
Fuel tank	Diesel fuel★1	310 (81.9)	★ASTM D975 NO.1 ASTM D975 NO.2
Fitting (Grease nipple)	Grease	As required	★NLGI NO.1 NLGI NO.2
Radiator (Reservoir tank)	Mixture of antifreeze and soft water★2	40 (10.6)	Ethylene glycol base permanent type (50 : 50) ★Ethylene glycol base permanent type (60 : 40)

SAE : Society of Automotive Engineers
API : American Petroleum Institute
ISO : International Organization for Standardization
NLGI : National Lubricating Grease Institute
ASTM : American Society of Testing and Materia
DEF : Diesel Exhaust Fluid, DEF compatible with AdBlue®

★ : Cold region (Russia, CIS, Mongolia)
★1 : Ultra low sulfur diesel
- sulfur content ≤ 10 ppm

★2 : Soft water
City water or distilled water

★3 : HD Hyundai Construction Equipment Bio Hydraulic Oil

※ Using any lubricating oils other than HD Hyundai Construction Equipment genuine products may lead to a deterioration of performance and cause damage to major components.
※ Do not mix HD Hyundai Construction Equipment 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 HD Hyundai Construction Equipment genuine lubricating oils and grease for use in regions with extremely low temperatures, please contact your local HD Hyundai Construction Equipment dealers.

SECTION 2 STRUCTURE AND FUNCTION

Group 1 Pump Device 2-1
Group 2 Main Control Valve 2-15
Group 3 Swing Device 2-46
Group 4 Travel Motor 2-57
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Group 7 Brake Device 2-71
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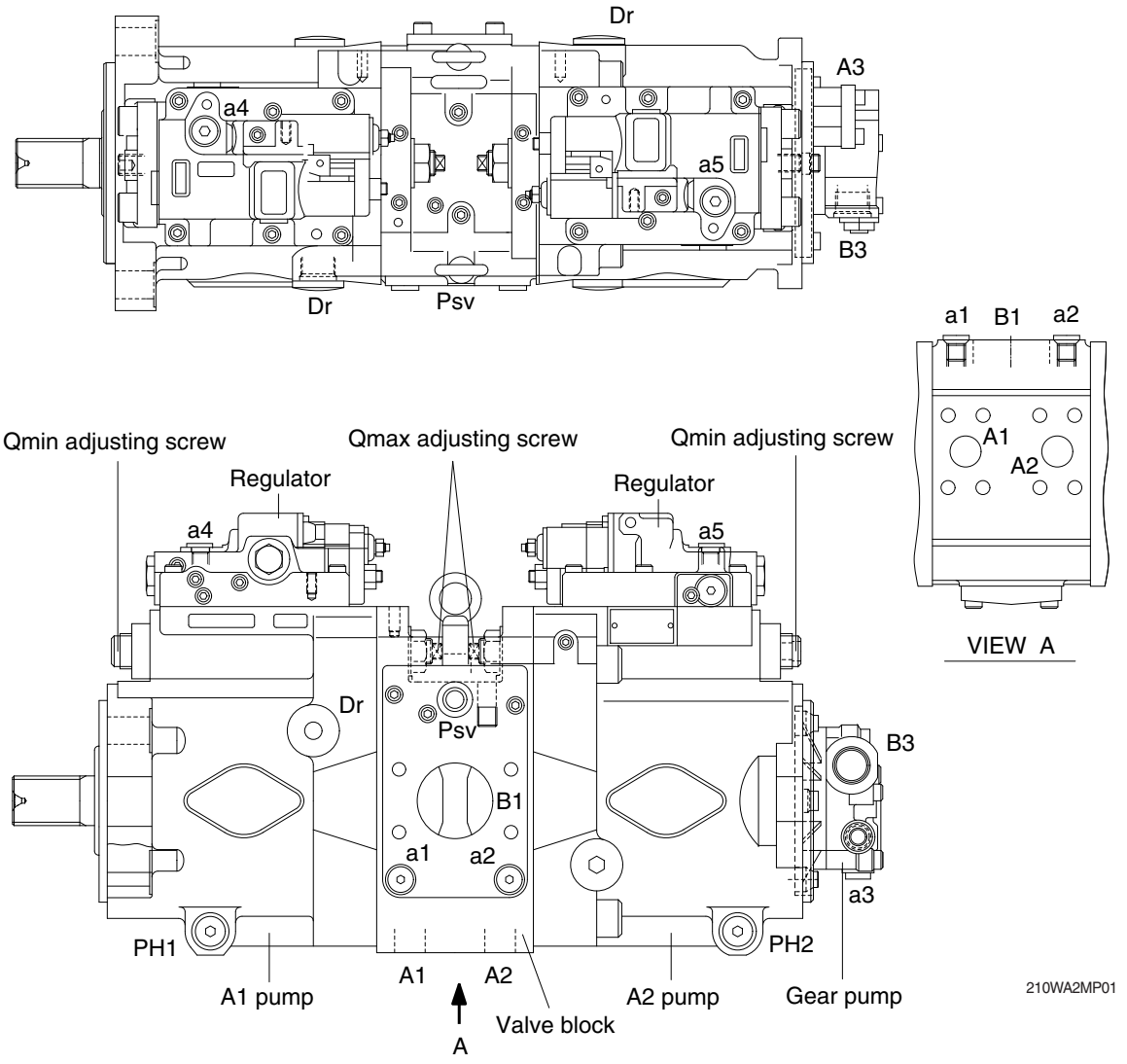
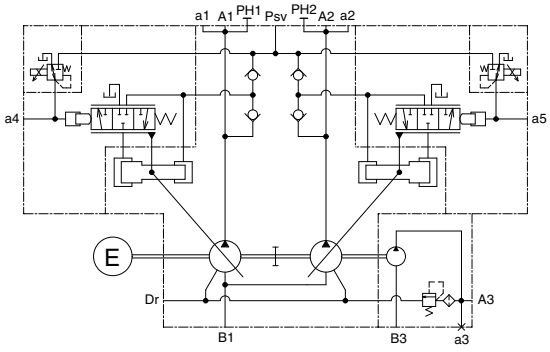
Group 10 Steering Valve 2-82
Group 11 Axle 2-84

GROUP 1 PUMP DEVICE

1. STRUCTURE

The pump device consists of main pump, regulator, gear pump and EPPR valve assy.

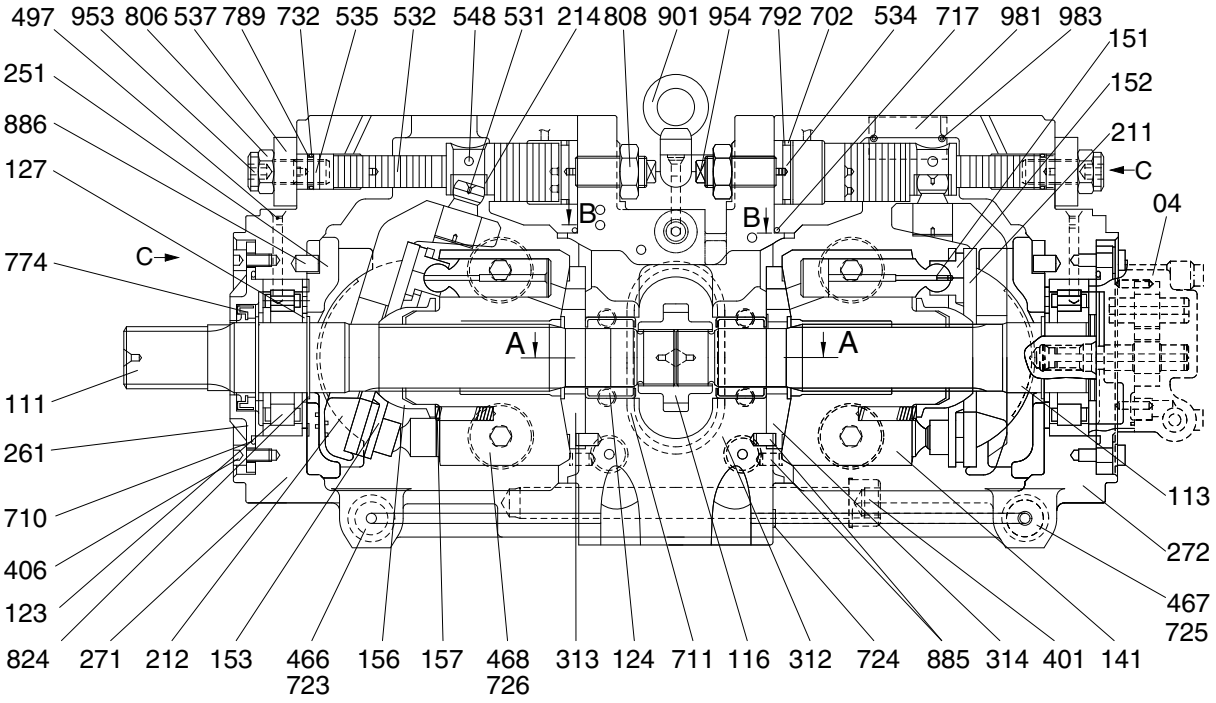




Port	Port name	Port size
A1,2	Delivery port	SAE 6000 psi 1"
B1	Suction port	SAE 2500 psi 2 1/2"
Dr	Drain port	PF 3/4-20
Psv	Servo assist port	PF 3/8-17
PH1,2	Pressure sensor port	PF 3/8-17
a1,2	Gauge port	PF 1/4-15
a3	Gauge port	PF 1/4-14
a4,5	Gauge port	PF 1/4-15
A3	Gear pump delivery port	PF 1/2-19
B3	Gear pump suction port	PF 3/4-20.5

1) MAIN PUMP (1/2)

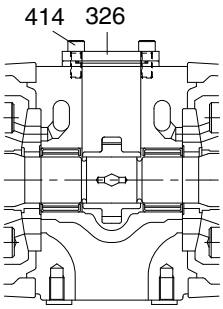
The main pump consists of two piston pumps (front & rear) and valve block.



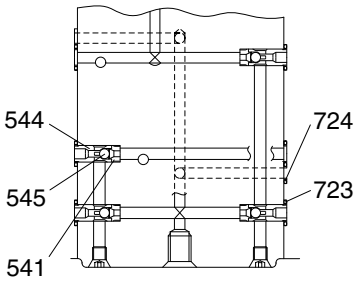
※ Section A-A, B-B, view C : see next page.

04	Gear pump	272	Pump casing (R)	723	O-ring
111	Drive shaft (F)	312	Valve block B	724	Square ring
113	Drive shaft (R)	313	Valve plate (R)	725	O-ring
116	1st gear	314	Valve plate (L)	726	O-ring
123	Roller bearing	401	Hexagon socket bolt	732	O-ring
124	Needle bearing	406	Hexagon socket bolt	774	Oil seal
127	Bearing spacer	466	Plug	789	Back up ring
141	Cylinder block	467	Plug	792	Back up ring
151	Piston	468	Plug	806	Hexagon head nut
152	Shoe	497	Plug	808	Hexagon head nut
153	Set plate	531	Tilting pin	824	Snap ring
156	Spherical bushing	532	Servo piston	885	Pin
157	Cylinder spring	534	Stopper (L)	886	Pin
211	Shoe plate	535	Stopper (S)	901	Eye bolt
212	Swash plate	537	Servo cover	953	Hexagon socket set screw
214	Tilting bushing	548	Feedback pin	954	Set screw
251	Support	702	O-ring	981	Name plate
261	Seal cover (F)	710	O-ring	983	Pin
271	Pump casing (F)	711	O-ring		
		717	O-ring		

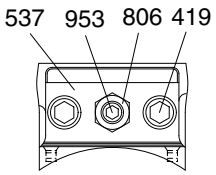
MAIN PUMP (2/2)



SECTION A-A



SECTION B-B

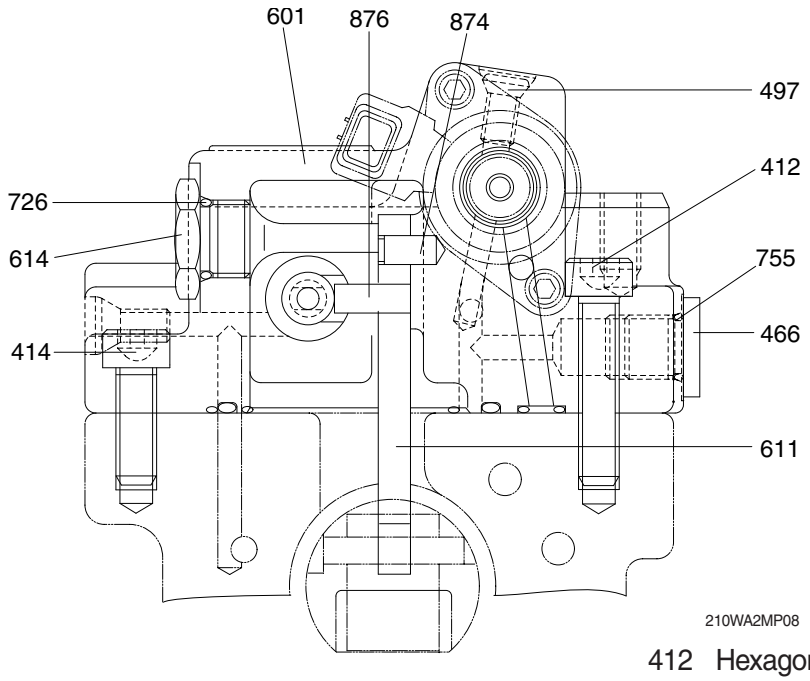


VIEW C

210WA2MP06

326	Cover	541	Seat	724	Square ring
414	Hexagon socket bolt	544	Stopper 1	806	Hexagon head nut
419	Hexagon socket bolt	545	Steel ball	953	Hexagon set screw
537	Servo cover	723	O-ring		

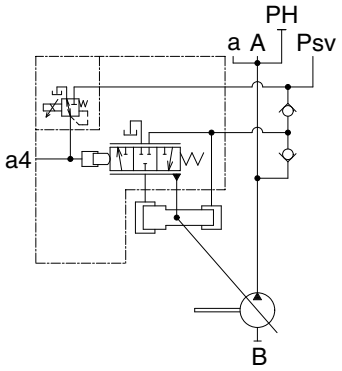
2) REGULATOR (1/2)



210WA2MP08

SECTION A-A

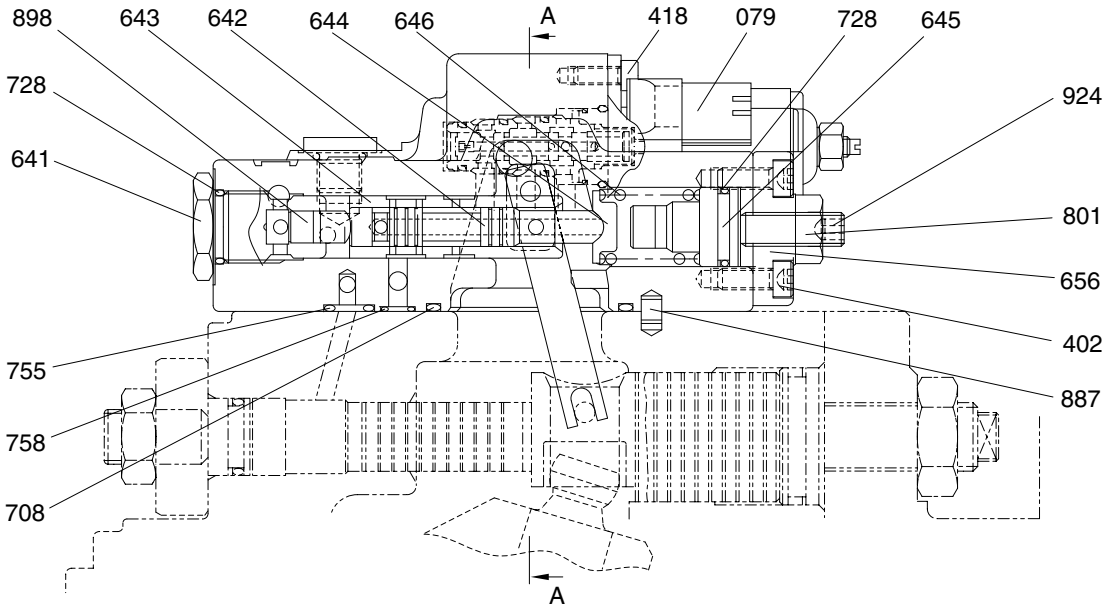
See next page



412 Hexagon socket screw
414 Hexagon socket screw
466 Plug
497 Plug
601 Regulator casing
611 Feed back lever
614 Adjust plug
726 O-ring
755 O-ring
874 Pivot pin
876 Pin

Port	Port name	Port size
A	Delivery port	SAE 6000 psi 1"
B	Suction port	SAE 2500 psi 2 1/2"
Psv	Servo assist port	PF 3/8-17
a, a4	Gauge port	PF 1/4-15
PH	Pressure sensor port	PF 3/8-17

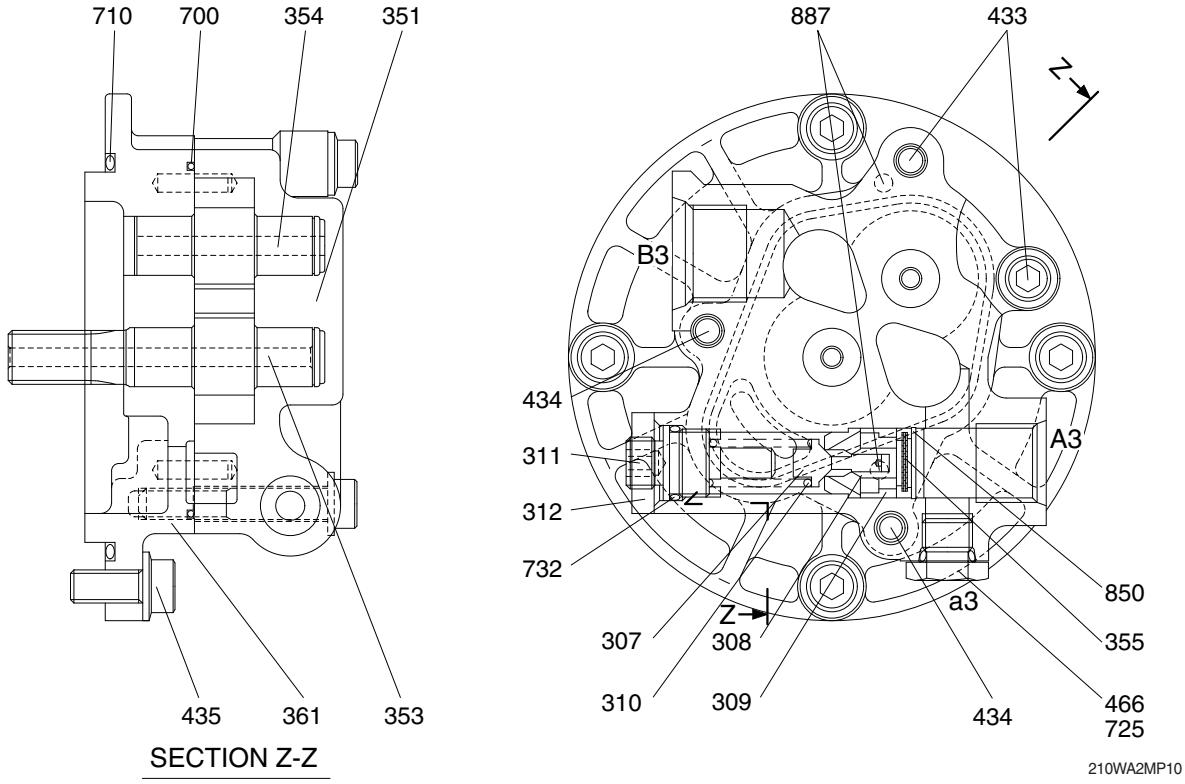
REGULATOR (2/2)



210WA2MP09

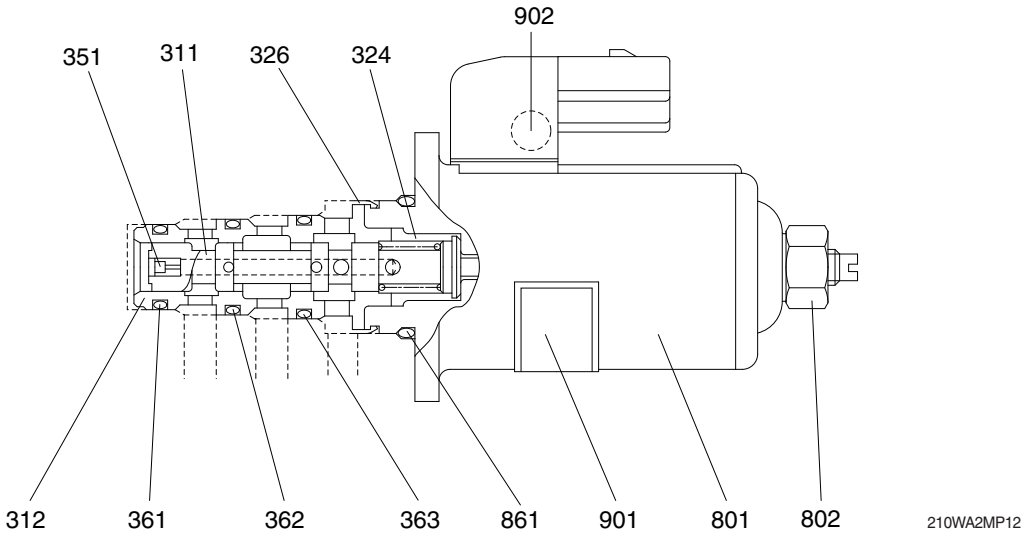
079	EPPR valve	644	Spring seat (Q)	755	O-ring
402	Hexagon socket screw	645	Adjust stem (Q)	758	Square ring
418	Hexagon socket screw	646	Pilot spring	801	Nut
641	Pilot plug	656	Cover	887	Pin
642	Pilot spool	708	O-ring	898	Piston piston
632	Pilot sleeve	728	O-ring	924	Hexagon socket set screw

3) GEAR PUMP



307	Poppet	353	Drive gear	466	Plug
308	Seat	354	Driven gear	700	Ring
309	Ring	355	Filter	710	O-ring
310	Spring	361	Front case	725	O-ring
311	Adjusting screw	433	Flange socket bolt	732	O-ring
312	Lock nut	434	Flange socket bolt	850	Snap ring
351	Gear case	435	Flange socket bolt	887	Pin

4) EPPR VALVE ASSY



311	Spool	361	O-ring	802	Seal nut
312	Sleeve	362	O-ring	861	O-ring
324	Spring	363	O-ring	901	Name plate
326	Retaining ring	801	Solenoid	902	Function name plate
351	Orifice				

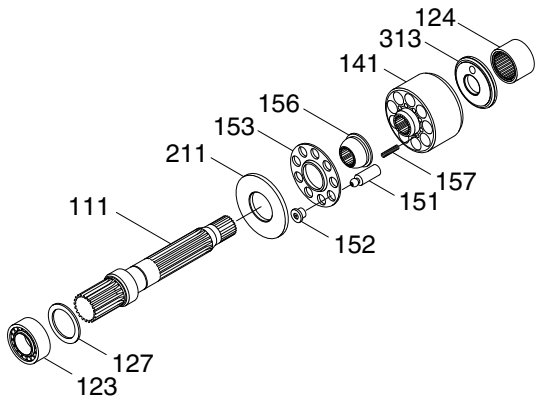
2. MAIN PUMP

The pumps may be classified roughly into the rotary group performing a rotary motion and working as the major part of the whole pump function: the swash plate group that varies the delivery flow: and the valve block group that changes over oil suction and discharge.

1) ROTARY GROUP

The rotary group consists of drive shaft (F) (111), bearing spacers (127), cylinder block (141), piston shoes (151, 152), set plates (153), spherical bushings (156) and cylinder springs (157). The drive shaft is supported by bearings (123, 124) at its both ends.

The shoe is caulked to the piston to form a spherical joint for lessening thrust force generated by load pressure and has grooves to slide on the shoe plate (211) smoothly and hydraulically balanced. The piston-shoe sub group is pushed onto the shoe plate by the cylinder springs through the set plate and spherical bushing for enabling smooth sliding on the shoe plate. Similarly, the cylinder block is pushed onto the valve plate (313, 314) by the cylinder springs (157).



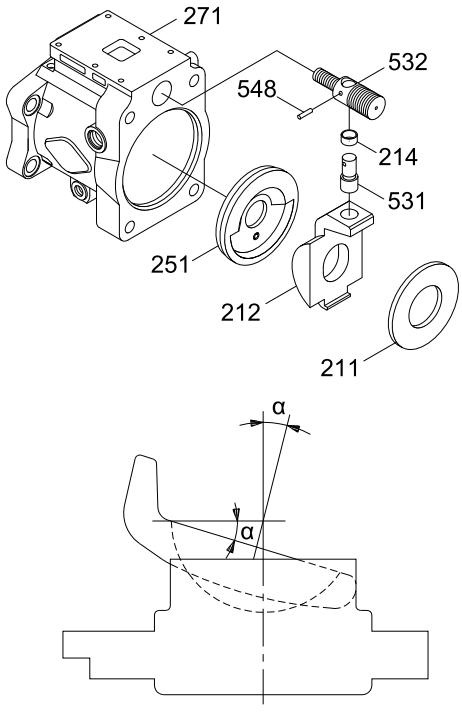
220S2MP13

2) SWASH PLATE GROUP

The swash plate group consists of pump casing (271), swash plate (212), shoe plate (211), swash plate support (251), tilting bushing (214), tilting pin (531) and servo piston (532).

The swash plate is supported by the swash plate support at the cylindrical portion formed on the opposite side of the shoe sliding face.

When the servo piston is moved to the left or right by introducing the hydraulic force controlled by the regulator into the hydraulic chamber provided on both ends of the servo piston, the swash plate slides over the swash plate support through the spherical portion of the tilting pin and can vary the tilting angle (α).



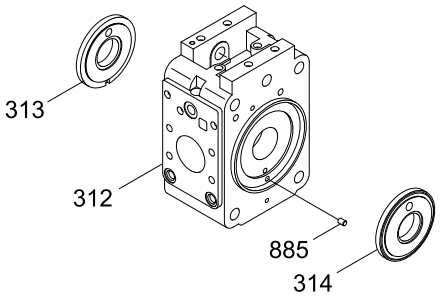
210WA2MP14

3) VALVE BLOCK GROUP

The valve block group consists of the valve block (312), valve plate (313, 314) and valve plate pin (885).

The valve plate having two arc ports is attached to the valve block and feeds and collects oil to and from the cylinder block.

The oil exchanged by the valve plate is connected to an external piping through the valve block.



210WA2MP15

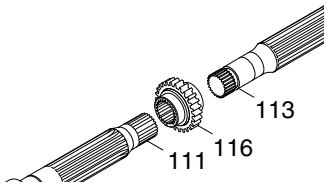
4) PTO GROUP

The PTO group is composed of the 1st gear (116), 2nd gear (111) and 3rd gear (113).

The 2nd gear (111) and 3rd gear (113) are supported by the bearings, respectively and attached to the valve block.

Now, suppose the drive shaft is rotated by the motor or engine, the cylinder block is also rotated through the spline conection. If the swash plate is tilted, the pistons arranged inside the cylinder reciprocate relatively to the cylinder, rotating with the cylinder block. Accordingly, if a piston is focused on, its motion is separating from the valve plate (oil suction process) for 180 degrees, and approaching the valve plate (oil delivery process) for the remaining 180 degrees. When the swash plate has a tilting angle of zero, the piston makes no stroke and discharges no oil.

In the meantime, the rotation of the drive shaft is picked up by the 1st gear (116), transmitted to the 3rd gear (113) through the 2nd gear (111), and drives the auxiliary pump connected to the 3rd gear (113).



220F2MP11

3. REGULATOR

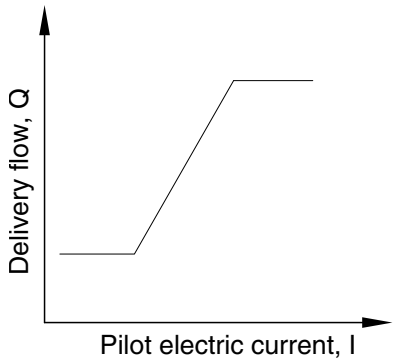
1) OUTLINE

The regulator for the K7V series axial piston pump has various models to satisfy various kinds of specifications required.

Electric flow control

By changing the pilot electric current I for proportional reducing valve, the pump tilting angle (delivery flow) is controlled arbitrarily, as shown in the figure.

This regulator has the positive flow control in which the delivery flow Q increases as the pilot electric current I increases. With this commanded, the pump discharges the required flow only, and so it does not consume the power uselessly.

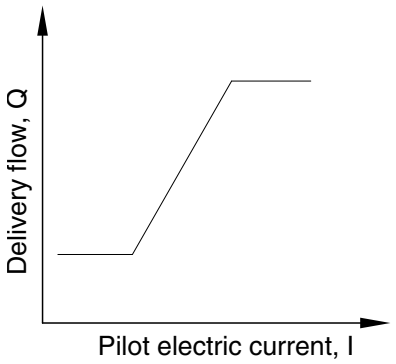


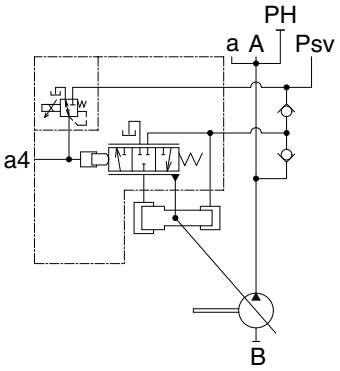
220F2MP16

2) FUNTION

(1) Flow control

By changing the pilot electric current I, the pump tilting angle (delivery flow) is regulated arbitrarily, as shown in the figure.





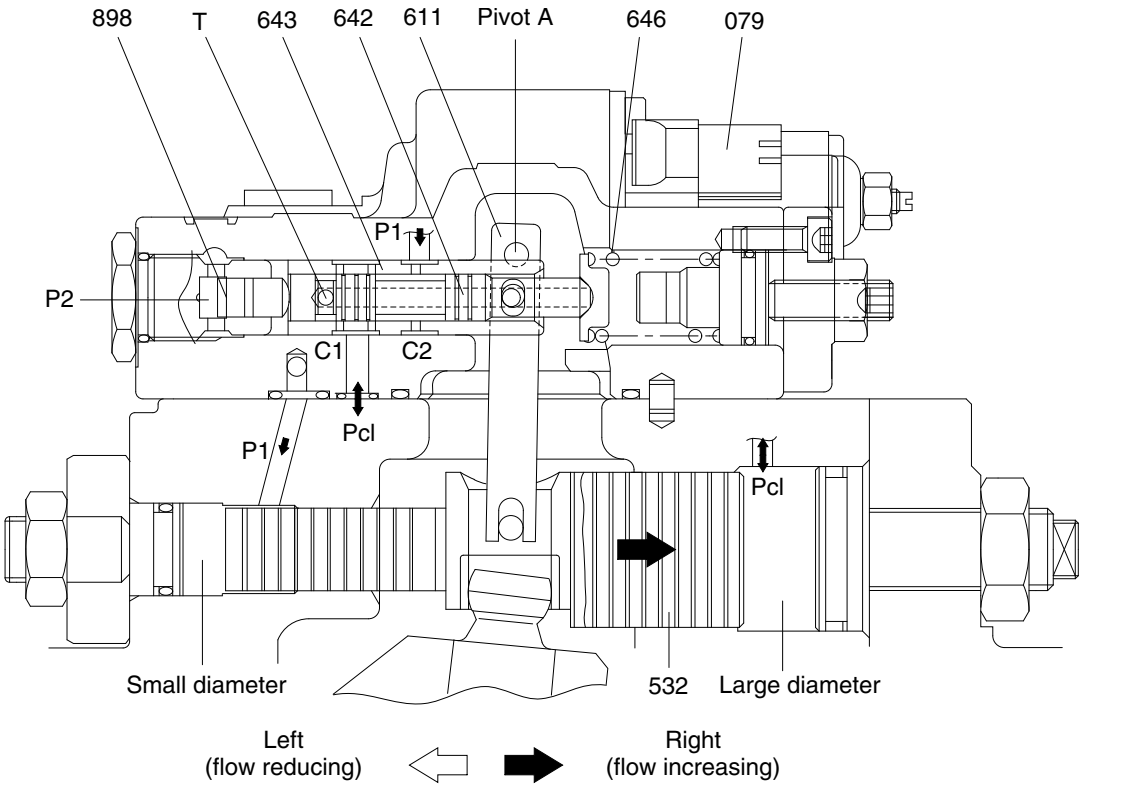
220F2MP17

① **Flow increasing funtion**

As the pilot electric current I increases, the secondary pressure of the proportional pressure reducing valve (079) increases too. Then the pilot spool (642) through the pilot piston (898) moves to the right to position where the force of the pilot spring (646) balances with the hydraulic force.

The movement of the pilot spool (642) causes the port C1 connects to the tank port (T). This deprives the pressure of the large-diameter section of the servo piston (532) and moves the servo piston (532) to the right by the discharge pressure P1 in the small-diameter section, resulting in the flow rate increase.

The feedback lever (611) links both the servo piston (532) and the pilot sleeve (643). When the servo piston (532) moves, the feedback lever (611) rotates around the pivot A, and the pilot sleeve (643) moves to the left. This causes the opening between the pilot sleeve (643) and the pilot spool (642) to close slowly, and the servo piston (532) comes to being stop completely when the port C1 closes completely.

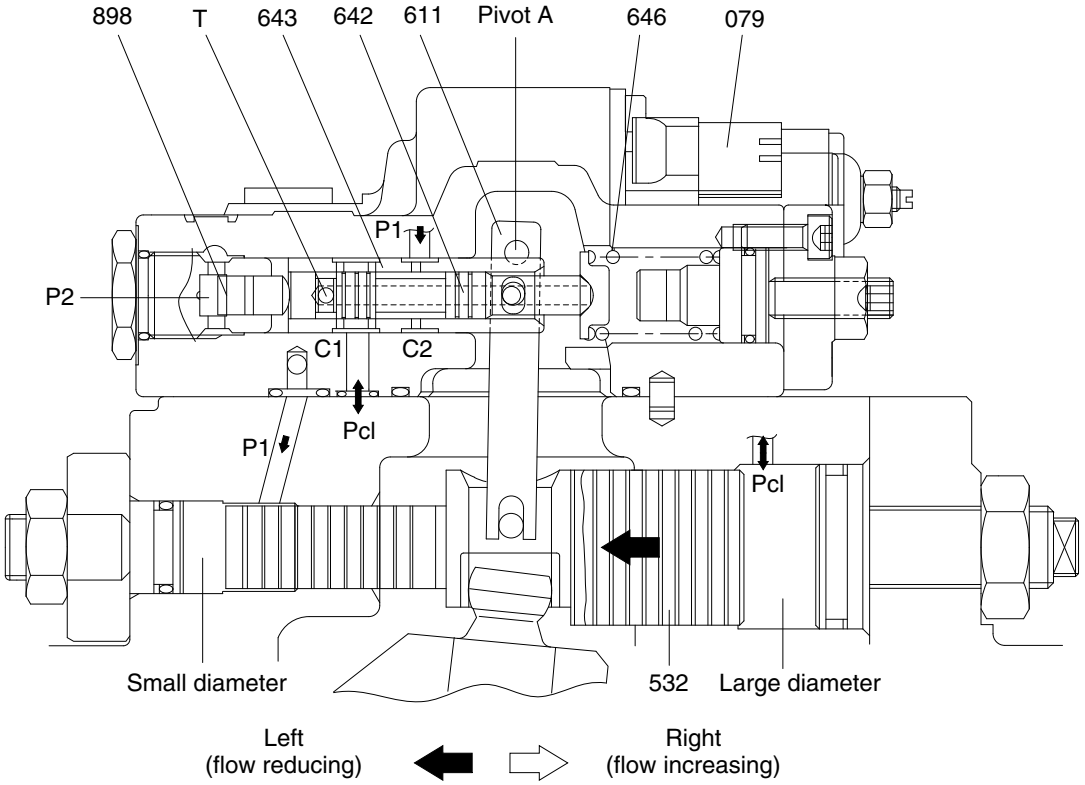


② **Flow reducing function**

As the pilot electric current I decreases, the secondary pressure of the proportional pressure reducing valve (079) decreases too, the pilot spool (642) moves to the left by action of the pilot spring (646).

The movement of the pilot spool (642) causes the delivery pressure P1 to connects to the port C2 through the pilot spool (642) and to be admitted to the large-diameter section of the servo piston (532). Although the delivery pressure P1 is constantly admitted to the small-diameter section of servo piston (532), the servo piston (532) moves to the left because of its difference of the area between large and small-diameter section. As a result, the tilting angle is decreased.

As the servo piston (532) moves, the feedback lever (611) rotates around the pivot A, and the pilot sleeve (643) moves to the right till the opening between the pilot spool (642) and pilot sleeve (643) being closed.



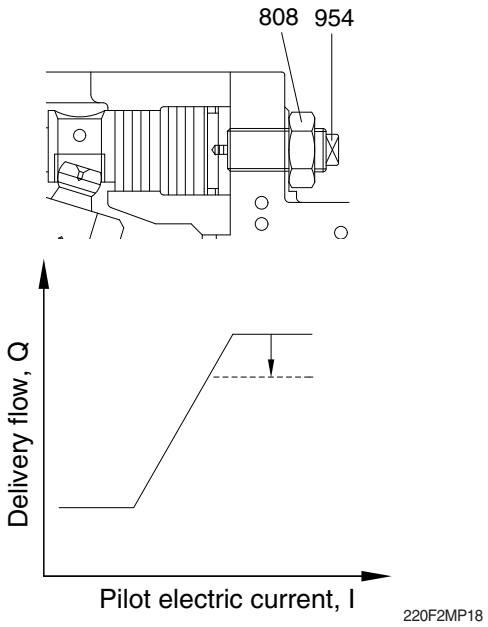
210WA2MP26

4. ADJUSTMENT OF MAXIMUM AND MINIMUM FLOWS

The maximum flow and minimum flow can be adjusted with the adjusting screws (954, 953) of the pump. The flow control characteristics can be adjusted with the hexagon socket set screw (924). The maximum flow and minimum flow can be adjusted with the adjusting screws of the pump.

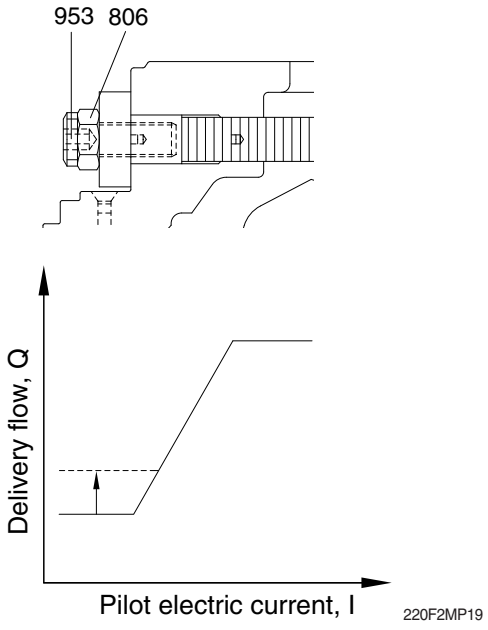
1) ADJUSTMENT OF MAXIMUM FLOW (MAIN PUMP SIDE)

Adjust it by loosening the hexagon nut (808) and by tightening (or loosening) the adjust screw (954). Only the maxinum flow is adjusted without changing other control characteristics.

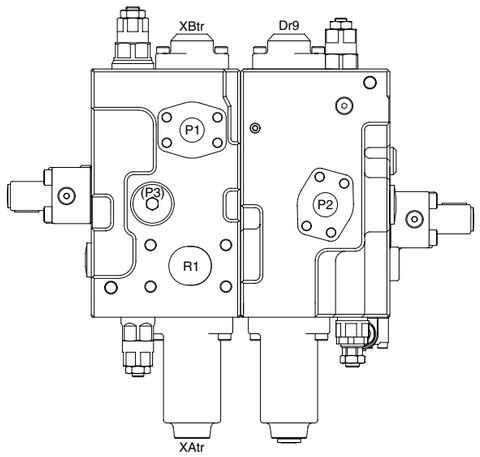


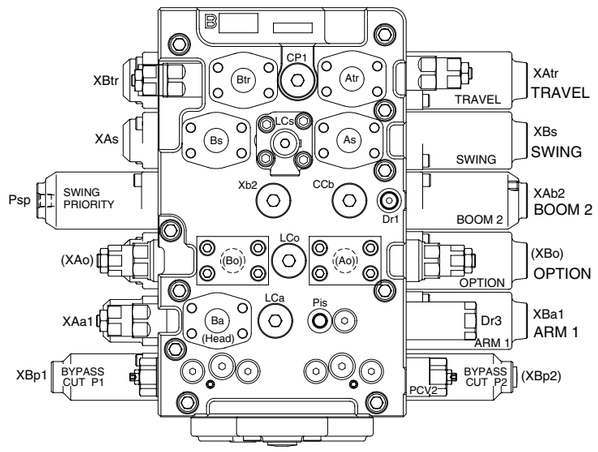
2) ADJUSTMENT OF MINIMUM FLOW (MAIN PUMP SIDE)

Adjust it by loosening the hexagon nut (806) and by tightening (or loosening) the hexagon socket head set screw (953). Similarly to the adjustment of the maximum flow, other characteristics are not changed. However, remember that, if tightened too much, the required horsepower at the maximum delivery pressure (or during relieving) may increase.

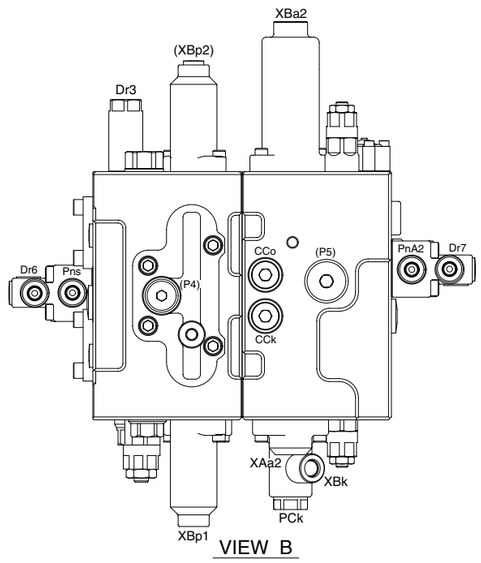


1. STRUCTURE



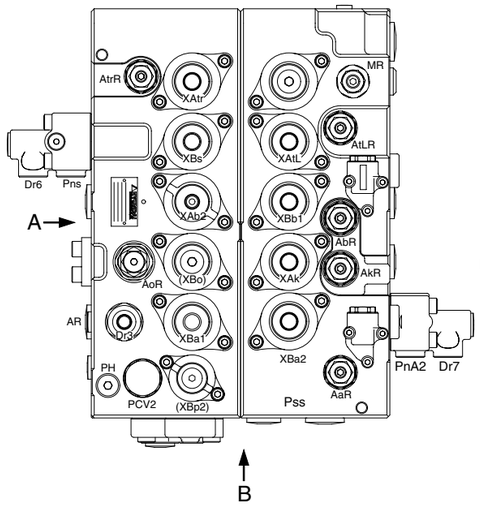


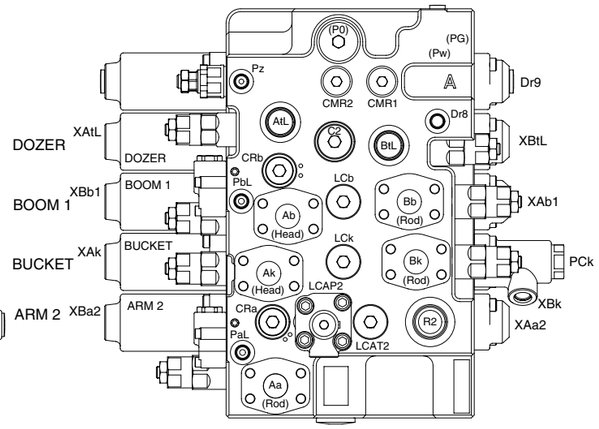
VIEW A

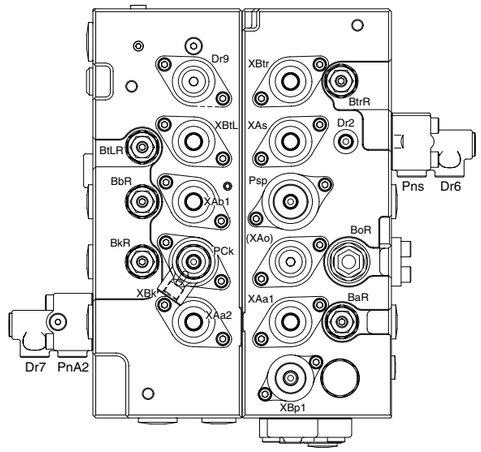


VIEW B

Mark	Port name	Port size	Tightening torque
R2	Make up port for swing	PF 1	20~25 kgf · m (115~180 lbf · ft)
XAtr XBtr (XAo) (XBo) XAk XBk XAb1 XBb1 XAa2 XBa2 XAtL XBtL XAs XBs XAa1 XBa1 Dr1 Dr9	Travel forward pilot port Travel reverse pilot port Optional pilot port Optional pilot port Bucket in pilot port Bucket out pilot port Boom up pilot port Boom down pilot port Arm out confluence pilot port Arm in confluence pilot port Dozer down pilot port Dozer up pilot port Swing right pilot port Swing left pilot port Arm out pilot port Arm in pilot port Drain port Drain port	PF 3/8	7~8 kgf · m (50.6~57.8 lbf · ft)
(Pw) Dr8 Pz (PG) Dr3 Dr6 Dr7 Pns PaL PbL XAb2 Psp XBp1 (XBp2) PCk Pis PnA2	Pressure port for auto idle signal Drain port Main relief set pressure up pilot pressure port Pilot pressure port Drain port Drain port Drain port Swing logic valve pilot port Lock valve pilot port (arm rod side) Lock valve pilot port (boom head side) Boom up confluence pilot port Swing priority pilot port Bypass cut spool pilot port (P1 side) Bypass cut spool pilot port (P2 side) Bucket in stroke limiter pilot port Arm regeneration cut pilot port Arm 2 logic valve pilot port	PF 1/4	3.5~3.9 kgf · m (25.3~28.2 lbf · ft)
Atr Btr (Ao) (Bo) Ak Bk Ab Bb As Bs Aa Ba P1 P2	Travel forward port Travel reverse port Optional port Optional port Bucket cylinder head side port Bucket cylinder rod side port Boom cylinder head side port Boom cylinder rod side port Swing motor right port Swing motor left port Arm cylinder rod side port Arm cylinder head side port Pump port (P1 side) Pump port (P2 side)	M10	5~6.6 kgf · m (36.1~47.7 lbf · ft)
R1	Return port	M12	8.5~11.2 kgf · m (61.5~81.1 lbf · ft)
AtL BtL (P0) (P3) (P5)	Dozer cylinder head side port Dozer cylinder rod side port Quick clamp solenoid valve supply port - -	PF 3/4	15.3~18.4 kgf · m (110.6~133 lbf · ft)
(P4)	-	PF 1/2	10~12.2 kgf · m (72.3~88.2 lbf · ft)

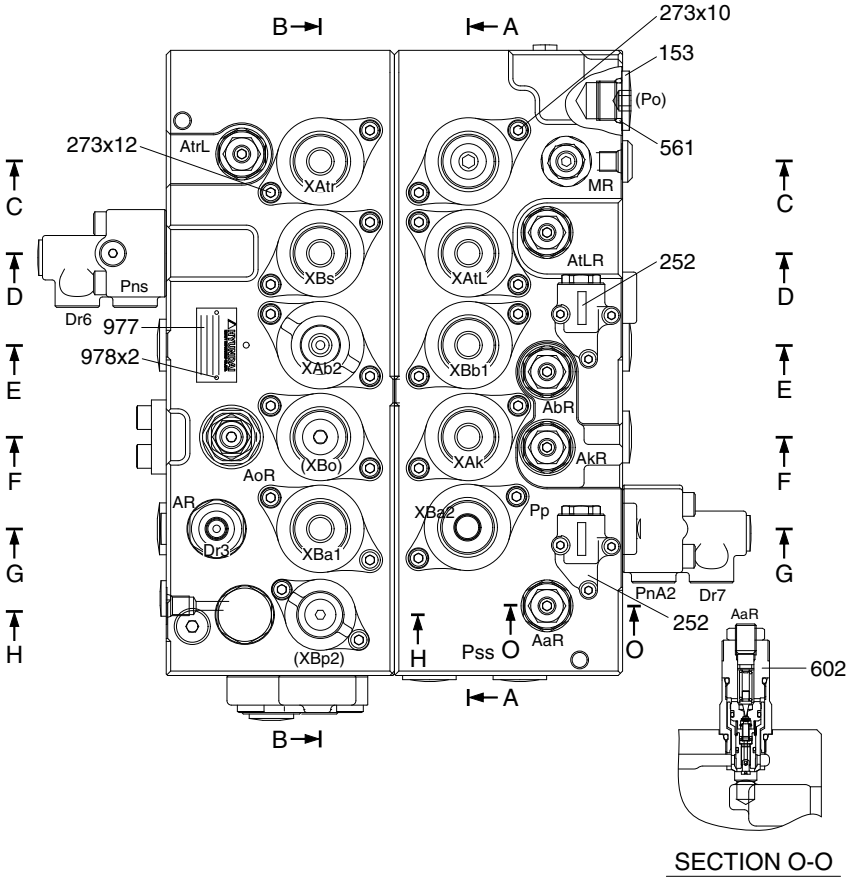






210WF2MC01

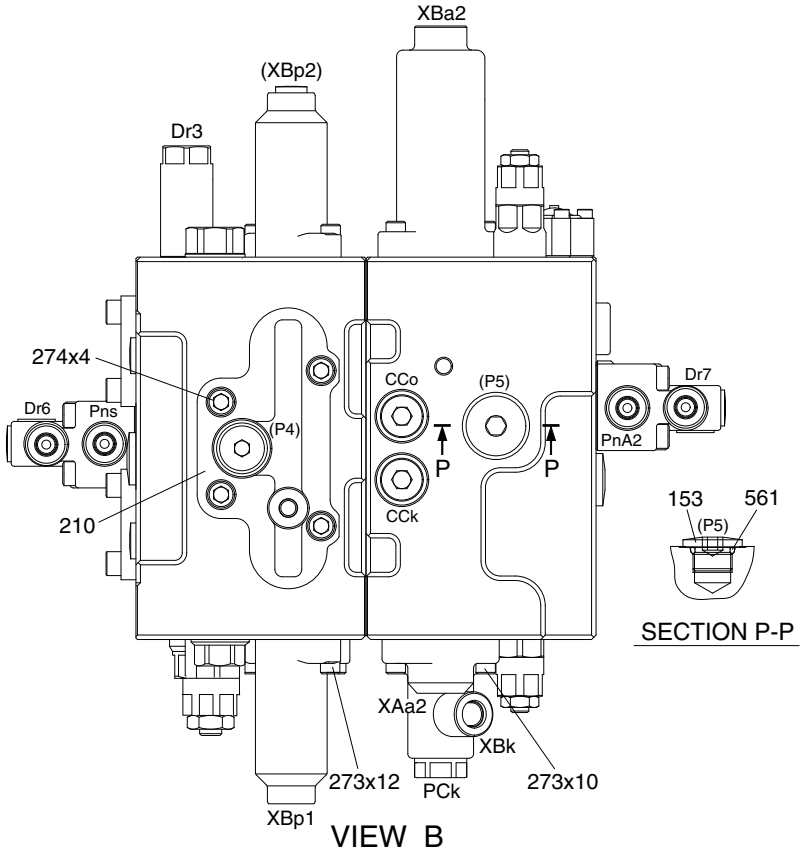
1) RELIEF VALVE SIDE VIEW



210WA2MC02

153 Plug
252 Lock valve selector sub assy
273 Socket screw
561 O-ring
602 Port relief valve assy
977 Name plate
978 Pin

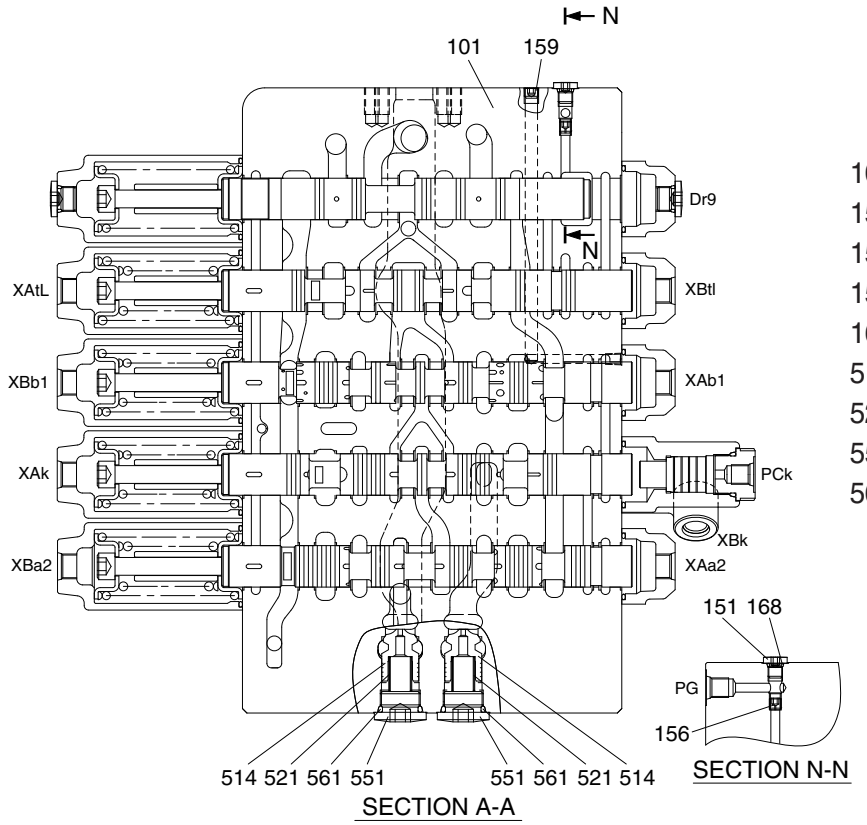
2) BYPAS CUT SPOOL SIDE VIEW



210WA2MC03

153 Plug
210 Plate
273 Socket screw
274 Socket screw
561 O-ring

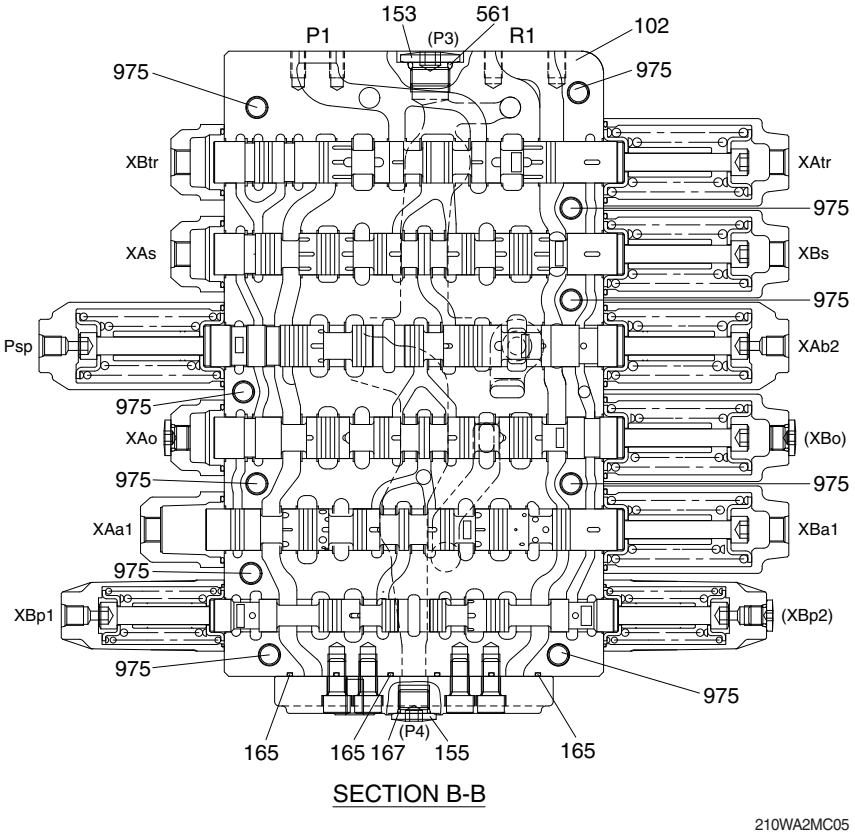
3) CASING A SPOOL SECTION



101 Casing A
151 Plug
156 Plug
159 Plug
168 O-ring
514 Poppet
521 Spring
551 Plug
561 O-ring

210WA2MC04

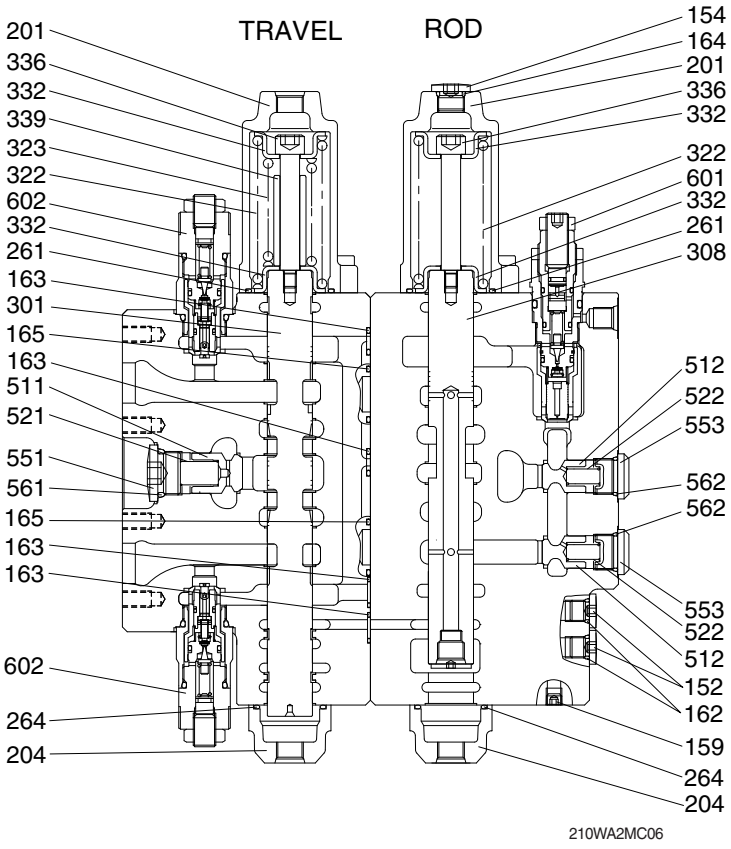
4) CASING B SPOOL SECTION



102 Casing B
153 Plug
155 Plug
165 O-ring
167 O-ring
561 O-ring
975 Socket screw

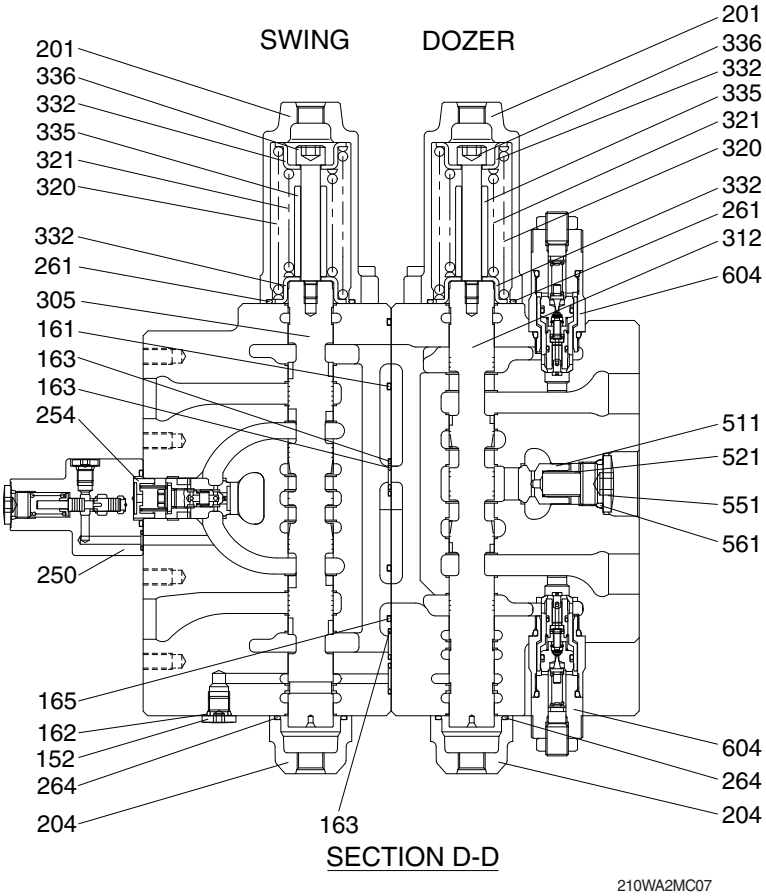
210WA2MC05

5) TRAVEL AND ROD SECTION



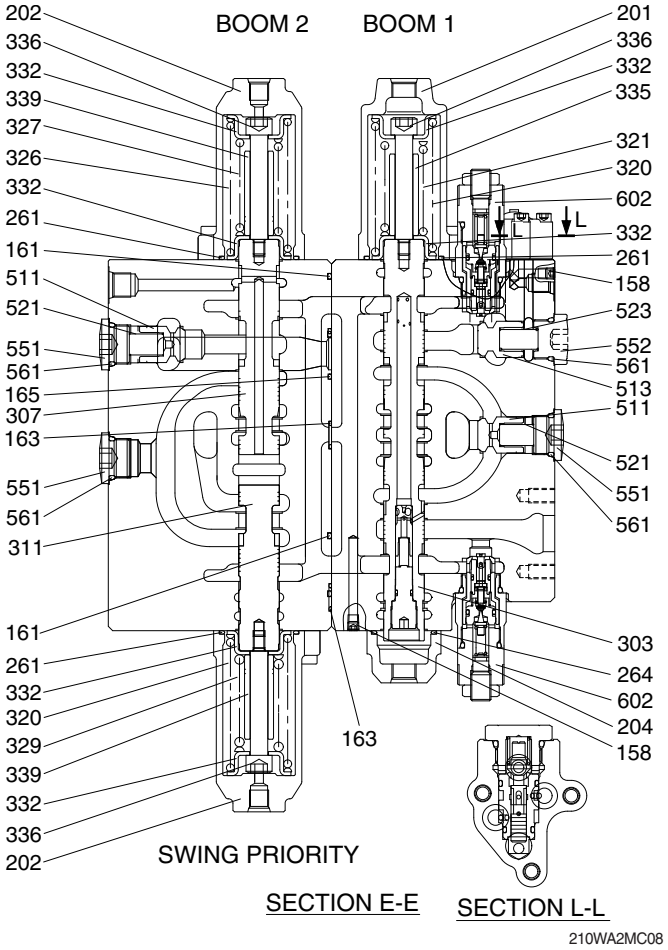
152 Plug
154 Plug
159 Plug
162 O-ring
163 O-ring
164 O-ring
165 O-ring
201 Spring cover
204 Spool cover
261 O-ring
264 Square ring
301 Travel spool
308 Rod spool assy
322 Spring
323 Spring
332 Spring seat
336 Spacer bolt
339 Stopper
511 Poppet
512 Poppet
521 Spring
522 Spring
551 Plug
553 Plug
561 O-ring
562 O-ring
601 Main relief valve assy
602 Port relief valve assy

6) SWING AND DOZER SECTION



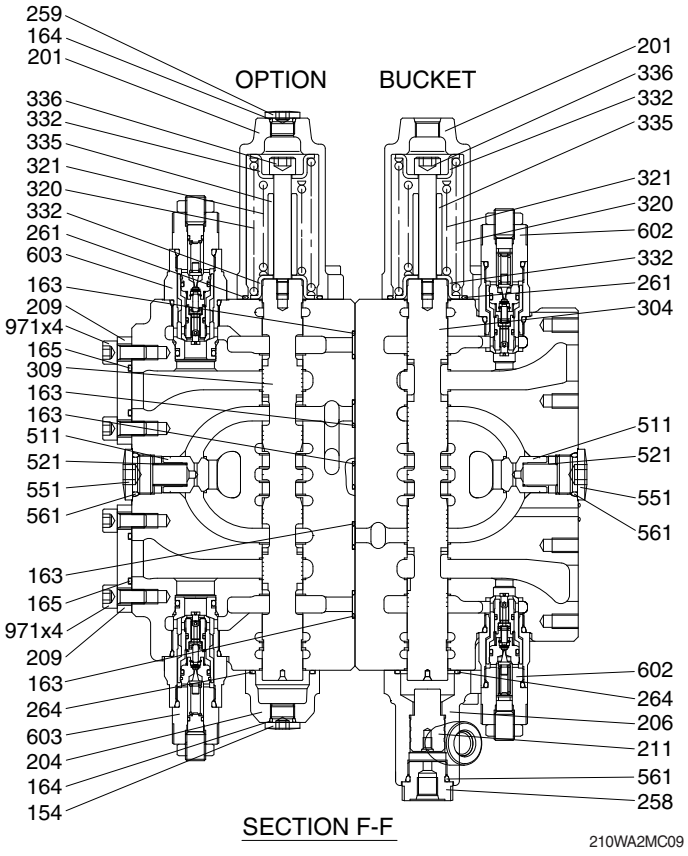
152 Plug
161 O-ring
162 O-ring
163 O-ring
165 O-ring
201 Spring cover
204 Spool cover
250 Logic control valve assy
254 Swing Logic poppet assy
261 O-ring
264 Square ring
305 Swing spool
312 Dozer spool
320 Spring
321 Spring
322 Spring
323 Spring
332 Spring seat
335 Stopper
336 Spacer bolt
511 Poppet
521 Spring
551 Plug
561 O-ring
604 Port relief valve assy

7) BOOM 1 AND BOOM 2 SECTION



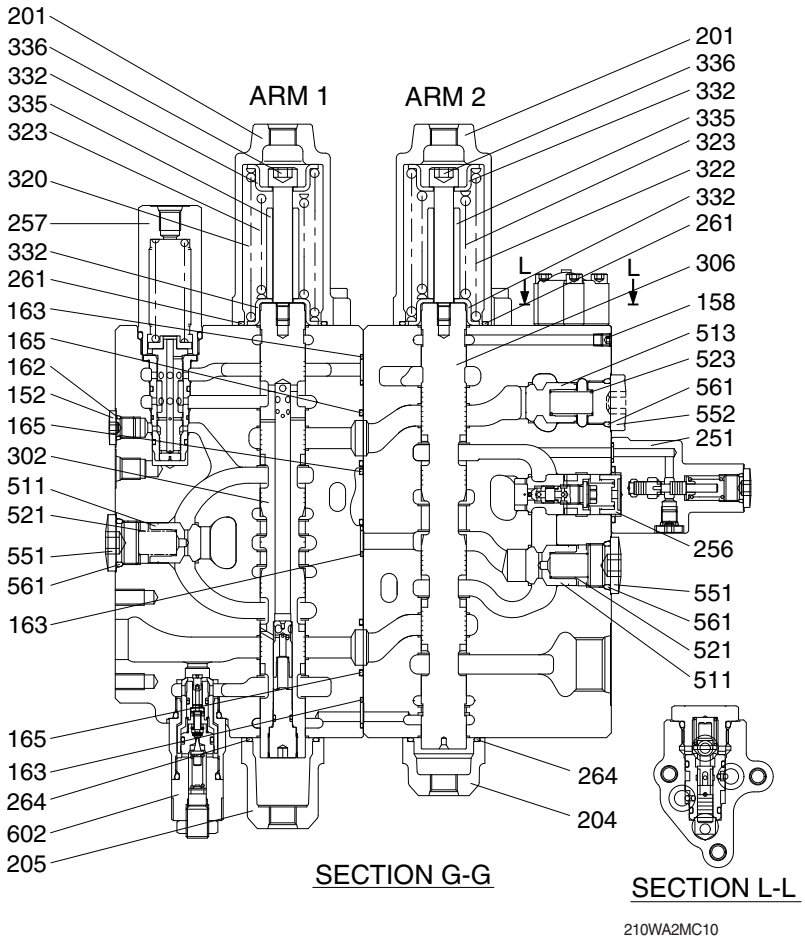
158 Plug
161 O-ring
163 O-ring
165 O-ring
201 Spring cover
202 Spring cover
204 Spool cover
261 O-ring
264 Square ring
303 Boom 1 spool sub assy
307 Boom 2 spool
311 Swing priority spool
320 Spring
321 Spring
326 Spring
327 Spring
329 Spring
332 Spring seat
335 Stopper
336 Spacer bolt
339 Stopper
511 Poppet
513 Poppet
521 Spring
523 Spring
551 Plug
552 Plug
561 O-ring
602 Port relief valve assy

8) BUCKET AND OPTION SECTION



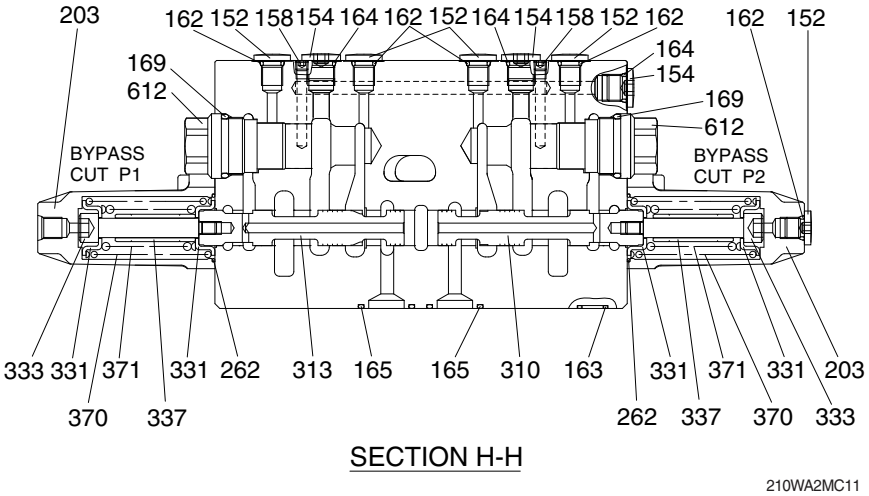
154 Plug
163 O-ring
164 O-ring
165 O-ring
201 Spring cover
204 Spool cover
206 Spool cover
209 Flange
211 Piston
258 Plug
259 Plug
261 O-ring
264 Square ring
304 Bucket spool
309 Option spool
320 Spring
321 Spring
332 Spring seat
335 Stopper
336 Spacer bolt
511 Poppet
521 Spring
551 Plug
561 O-ring
602 Port relief valve assy
603 Port relief valve assy
971 Socket screw

9) ARM 1 AND ARM 2 SECTION



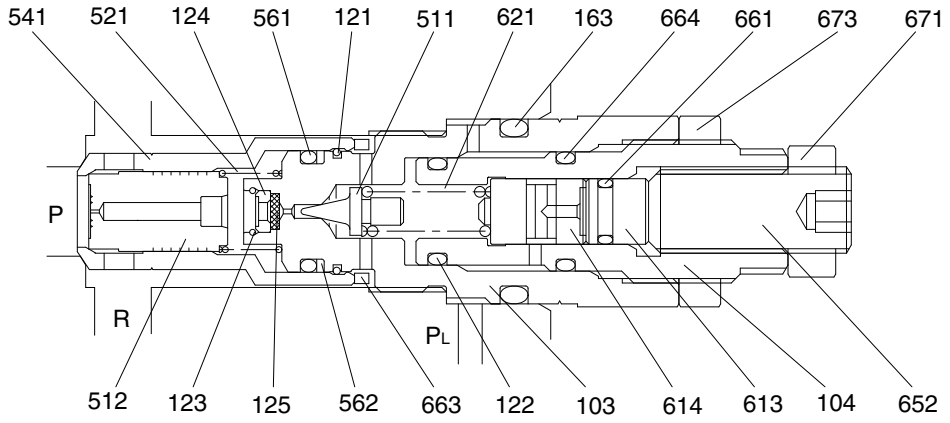
152 Plug
158 Plug
162 O-ring
163 O-ring
165 O-ring
201 Spring cover
204 Spool cover
205 Spool cover
251 Logic control valve assy
256 Arm 2 Logic poppet assy
257 Arm regeneration cut sub assy
261 O-ring
264 Square ring
302 Arm 1 spool sub assy
306 Arm 2 spool
320 Spring
322 Spring
323 Spring
332 Spring seat
335 Stopper
336 Spacer bolt
511 Poppet
513 Poppet
521 Spring
523 Spring
551 Plug
552 Plug
561 O-ring
602 Port relief valve assy

10) BYPASS CUT SECTION



152 Plug
154 Plug
158 Plug
162 O-ring
163 O-ring
164 O-ring
165 O-ring
169 O-ring
203 Spring cover
262 O-ring
310 Bypass cut spool
313 Bypass cut spool
331 Spring seat
333 Spring seat
337 Stopper
370 Spring
371 Spring
612 Plug

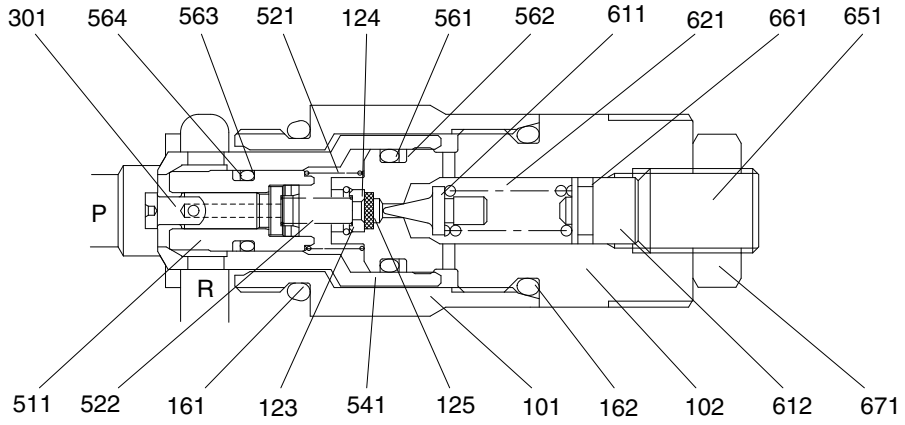
11) MAIN RELIEF VALVE (601)



220F2MC70

103	Plug	512	Plunger	621	Spring
104	Adjust plug	521	Spring	652	Adjust screw
121	C-ring	541	Seat	661	O-ring
122	Spacer	561	O-ring	663	O-ring
123	C-ring	562	Back-up ring	664	O-ring
124	Filler stopper	611	Poppet	671	Lock nut
125	Filler	613	Stopper	673	Lock nut
163	O-ring	614	Piston		

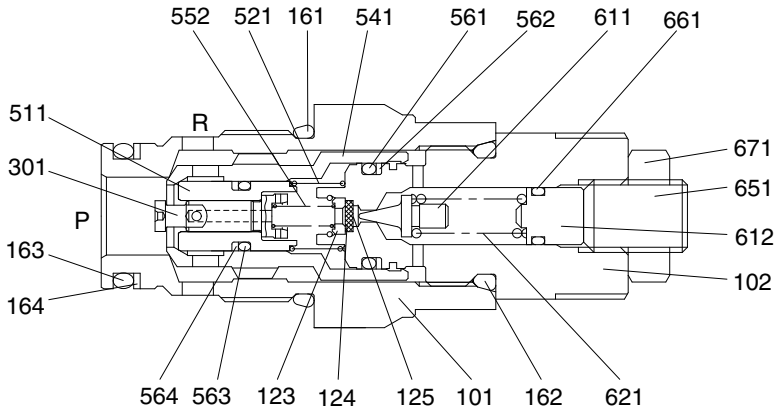
12) PORT RELIEF VALVE (602)



220F2MC71

101	Body	511	Plunger	564	Back-up ring
102	Plug	521	Spring	611	Poppet
161	O-ring	522	Spring	612	Spring seat
162	O-ring	541	Seat	621	Spring
123	O-ring	561	O-ring	651	Adjust screw
124	Filler stopper	562	Back-up ring	661	O-ring
125	Filler	563	O-ring	671	Lock nut

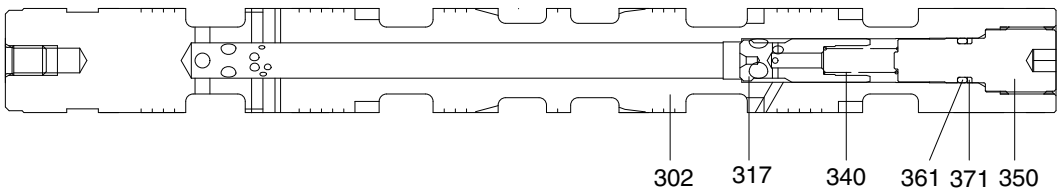
13) PORT RELIEF VALVE (603)



220F2MC72

101	Body	301	Piston	564	Back-up ring
102	Plug	511	Plunger	611	Poppet
123	C-ring	521	Spring	612	Spring seat
124	Filler stopper	522	Spring	621	Spring
125	Filler	541	Seat	651	Adjust screw
161	O-ring	561	O-ring	661	O-ring
162	O-ring	562	Back-up ring	671	Lock nut
163	O-ring	563	O-ring		

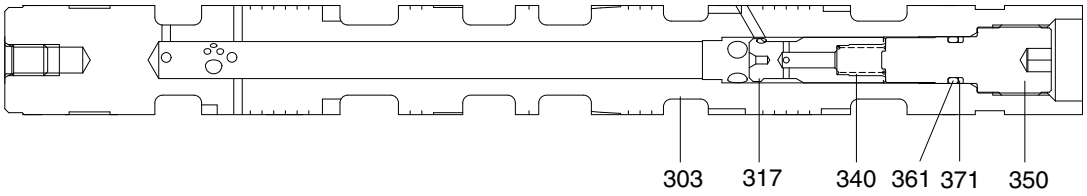
14) ARM 1 SPOOL ASSY (302)



210WA2MC12

302	Spool	340	Spring	361	O-ring
317	Plunger	350	Plug	371	Back-up ring

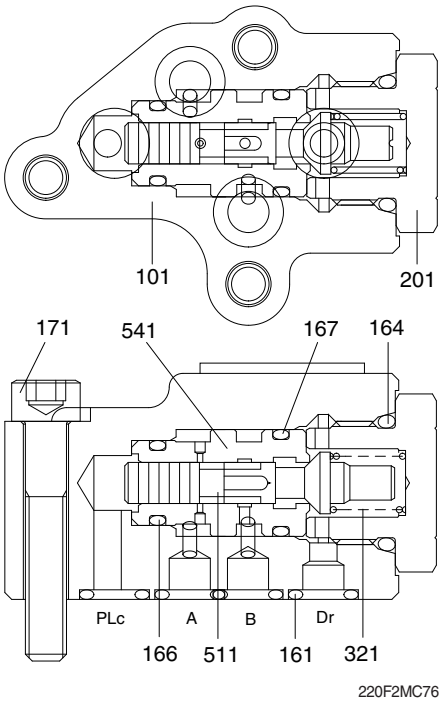
15) BOOM 1 SPOOL ASSY (303)



210WA2MC13

303	Spool	340	Spring	361	O-ring
317	Plunger	350	Plug	371	Back-up ring

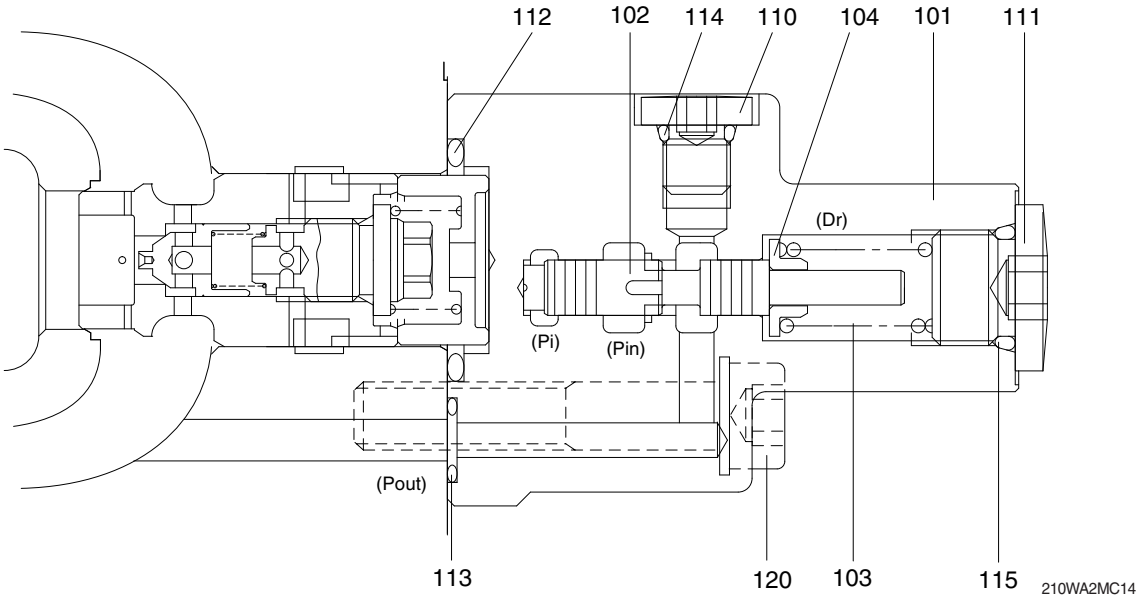
16) LOCK VALVE SELECTOR SUB ASSY (252)



220F2MC76

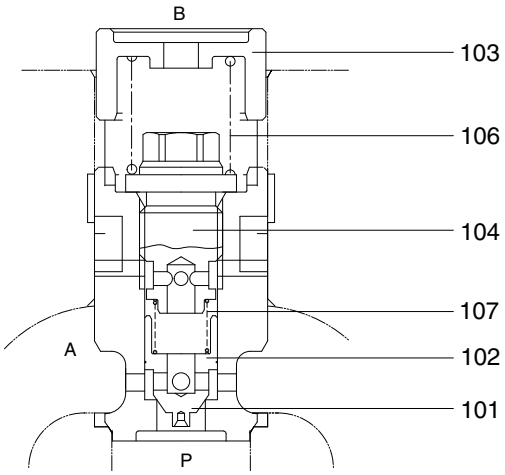
101 Casing
161 O-ring
164 O-ring
166 O-ring
167 O-ring
171 Hex socket head cap screw
201 Plug
321 Spring
511 Spool
541 Sleeve

17) LOGIC CONTROL VALVE ASSY (250, 251)



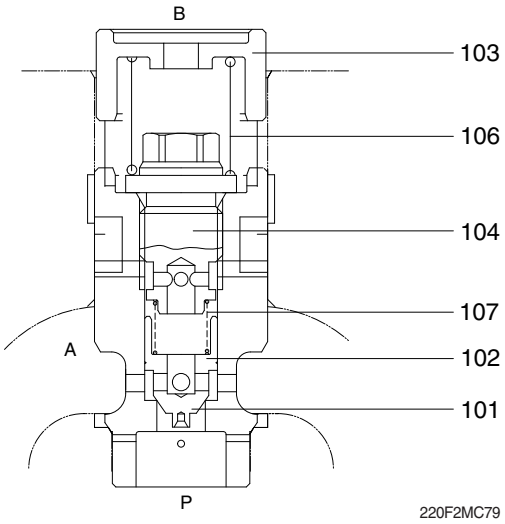
101	Casing	110	Plug	114	O-ring
102	Spool	111	Plug	115	O-ring
103	Spring	112	O-ring	120	Hex socket head cap screw
104	Spring seat	113	O-ring		

18) SWING LOGIC POPPET ASSY (254)



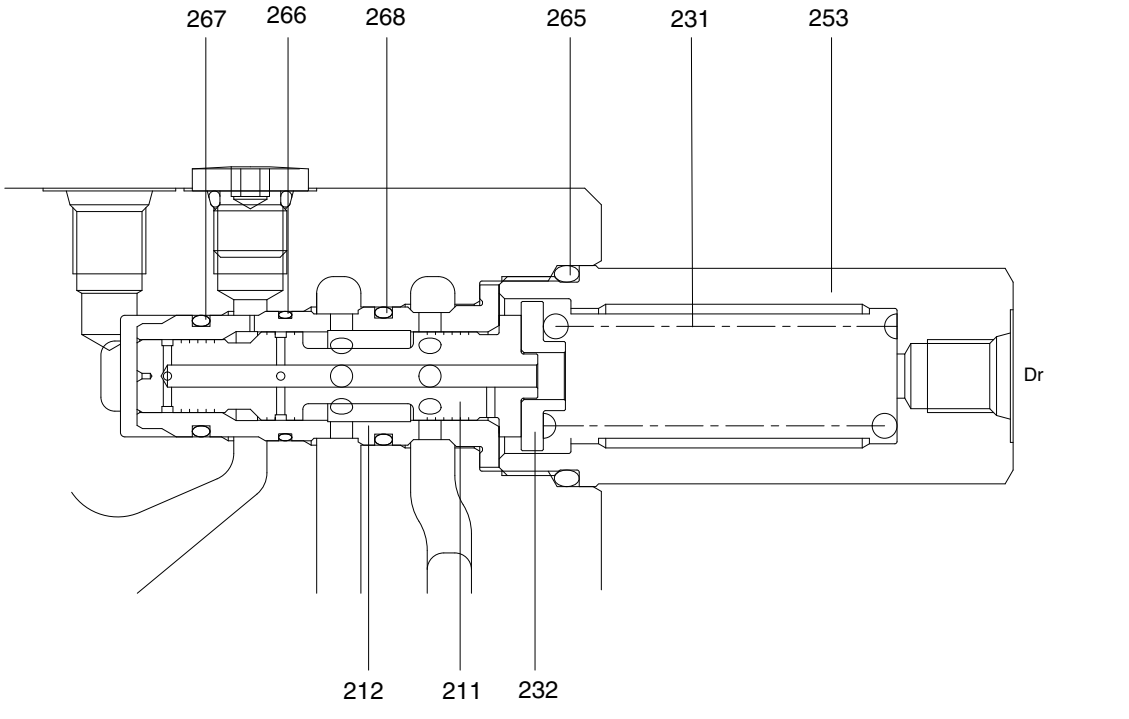
101	Logic poppet
102	Poppet
103	Spring seat
104	Plug
106	Spring
107	Spring

19) ARM 2 LOGIC POPPET ASSY (256)



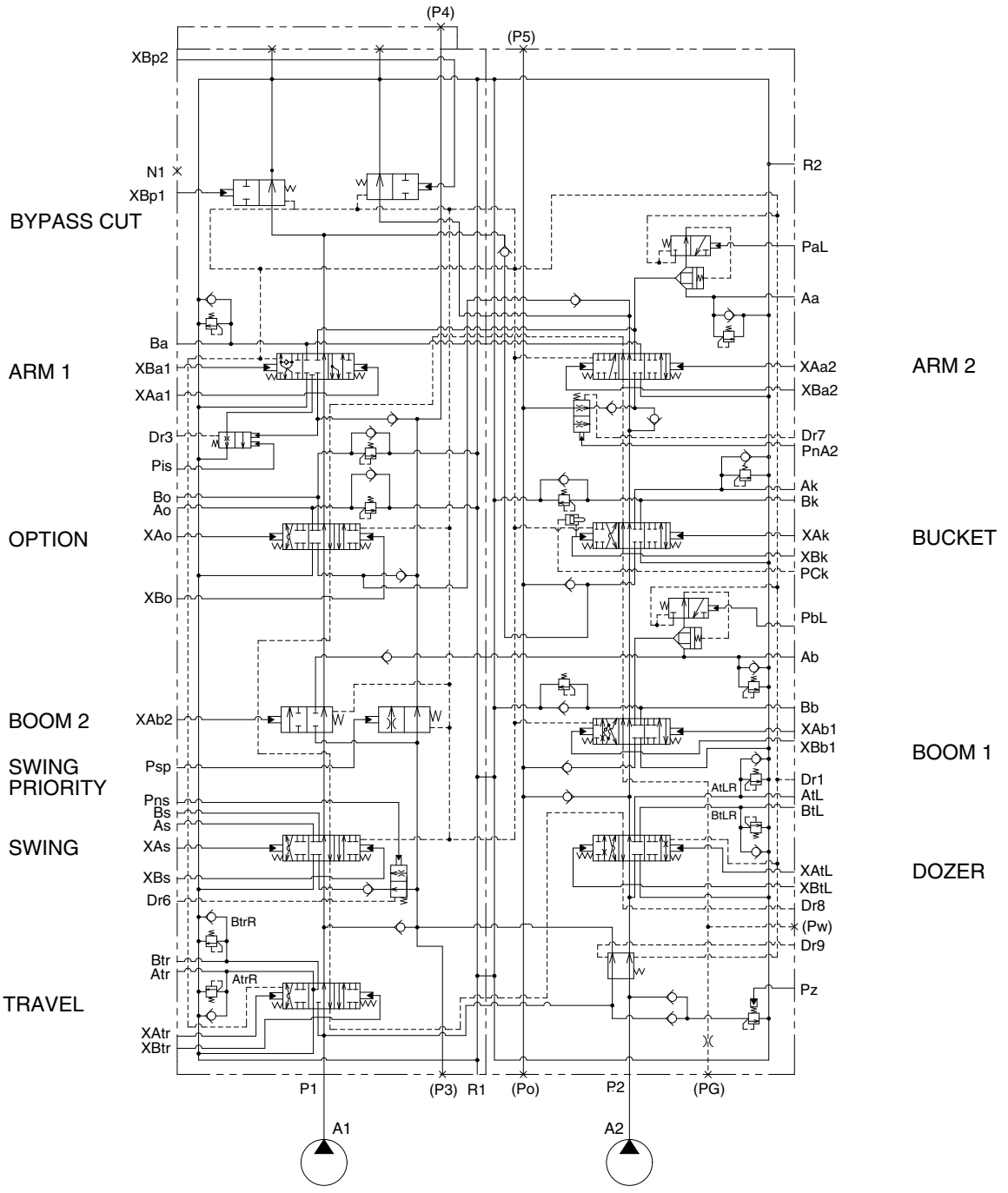
101 Logic poppet
102 Poppet
103 Spring seat
104 Plug
106 Spring
107 Spring

20) ARM REGENERATION CUT SUB ASSY (257)



211 Spool
212 Sleeve
231 Spring
232 Spring seat
253 Plug
265 O-ring
266 O-ring
267 O-ring
268 O-ring

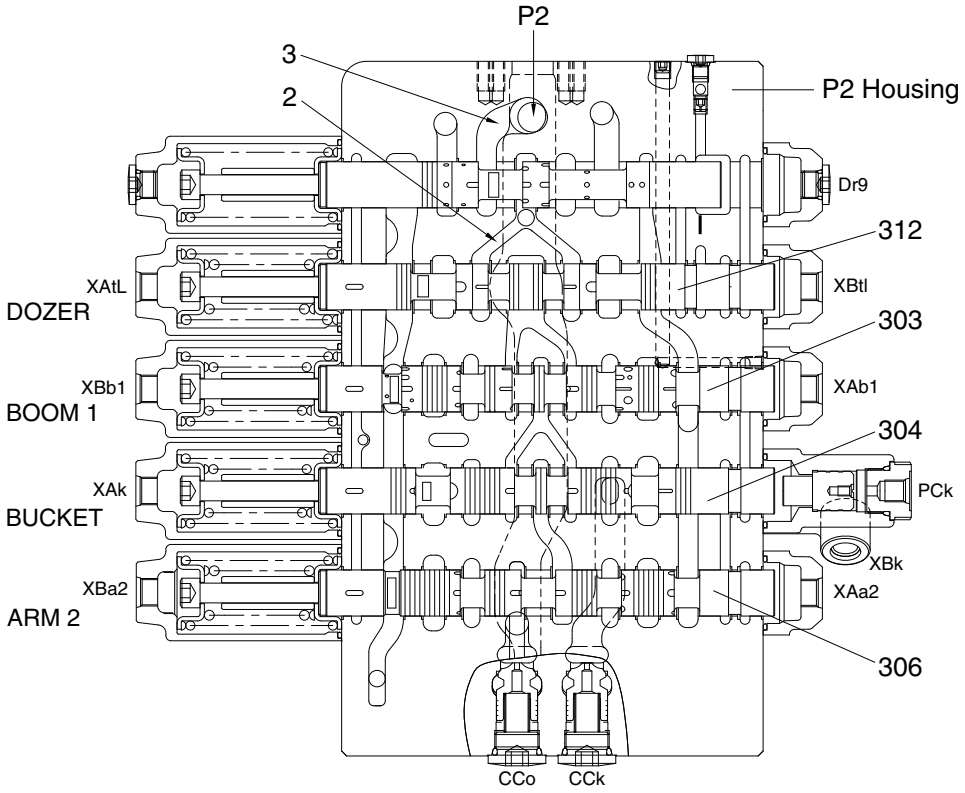
2. HYDRAULIC CIRCUIT



210WA2MC16

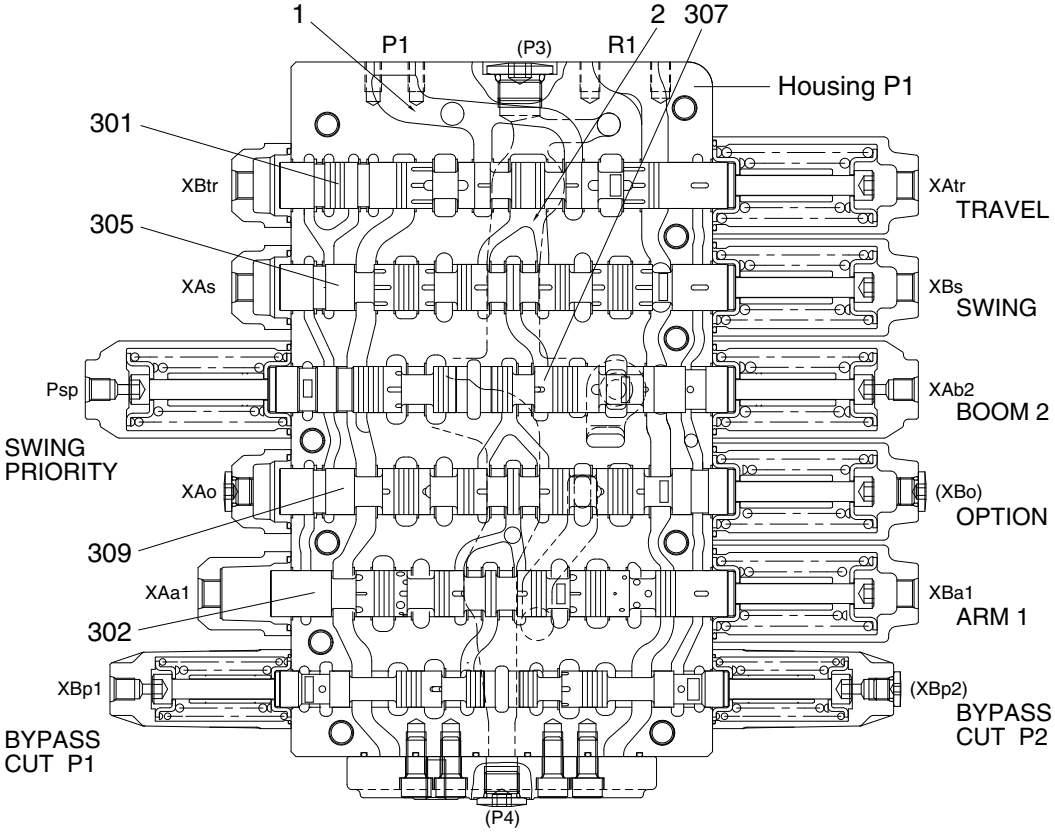
3. FUNCTION

1) CONTROL IN NEUTRAL POSITION



SPOOL SECTION (P2)

210WA2MC20



SPOOL SECTION(P1)

210WA2MC21

When all spools are in the neutral positions, the pressurized oil discharged from the hydraulic pump (A1) passes through Port P1, the main path (1), the bypass circuit (2) passing the spools for travel (301), swing (305), boom confluence (boom 2; 307), option (309) and arm 1 (302), and returns to the hydraulic oil tank through the tank port (R1).

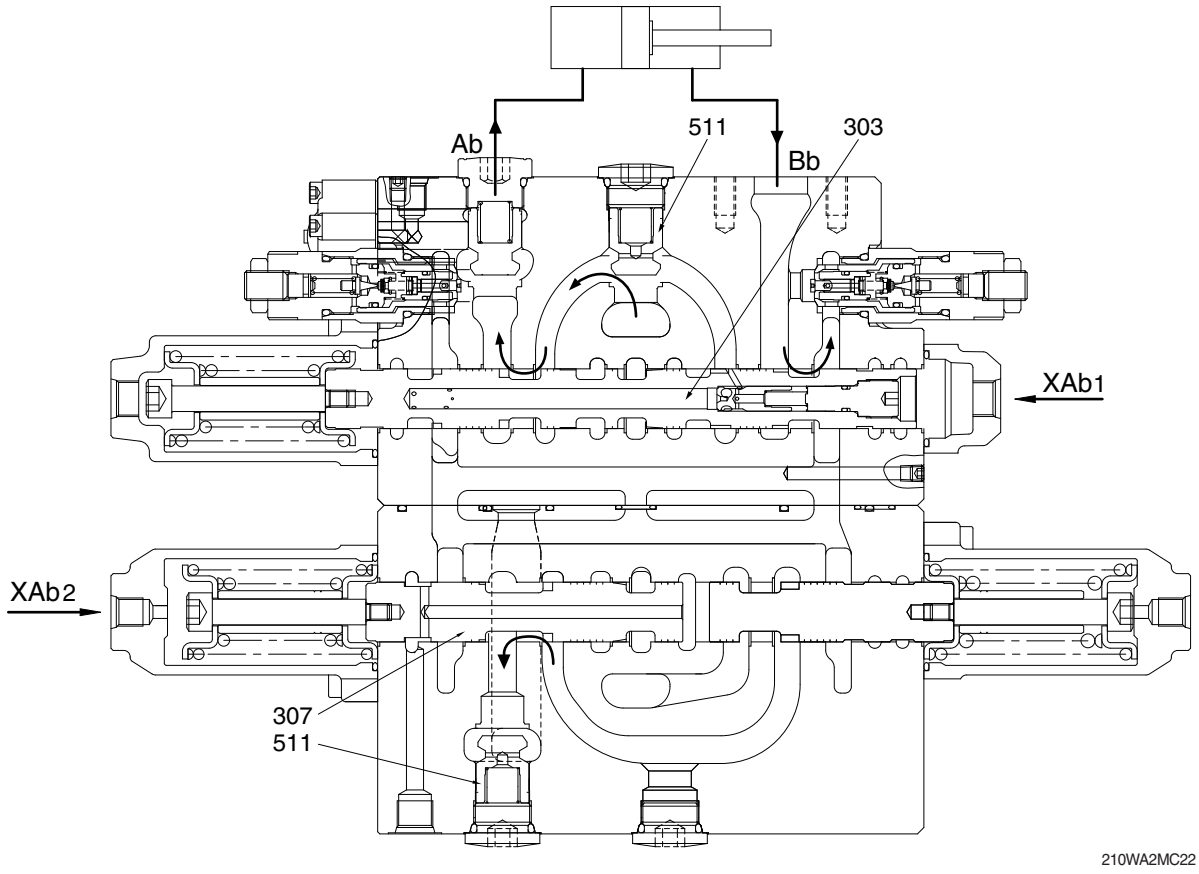
The oil discharged from the hydraulic pump (A2) passes through Port P2, the main path (3), the bypass circuit (2) passing the spools for dozer (312), boom 1 (303), bucket (304) and arm 2 (306), and returns to the hydraulic oil tank through the tank port (R1).

The discharge oil of the pump is reduced by controlling electrically the regulator with 2nd pressure of the RCV when all spools are in the neutral positions.

2) EACH SPOOL OPERATION

(1) Boom control

① Boom up operation

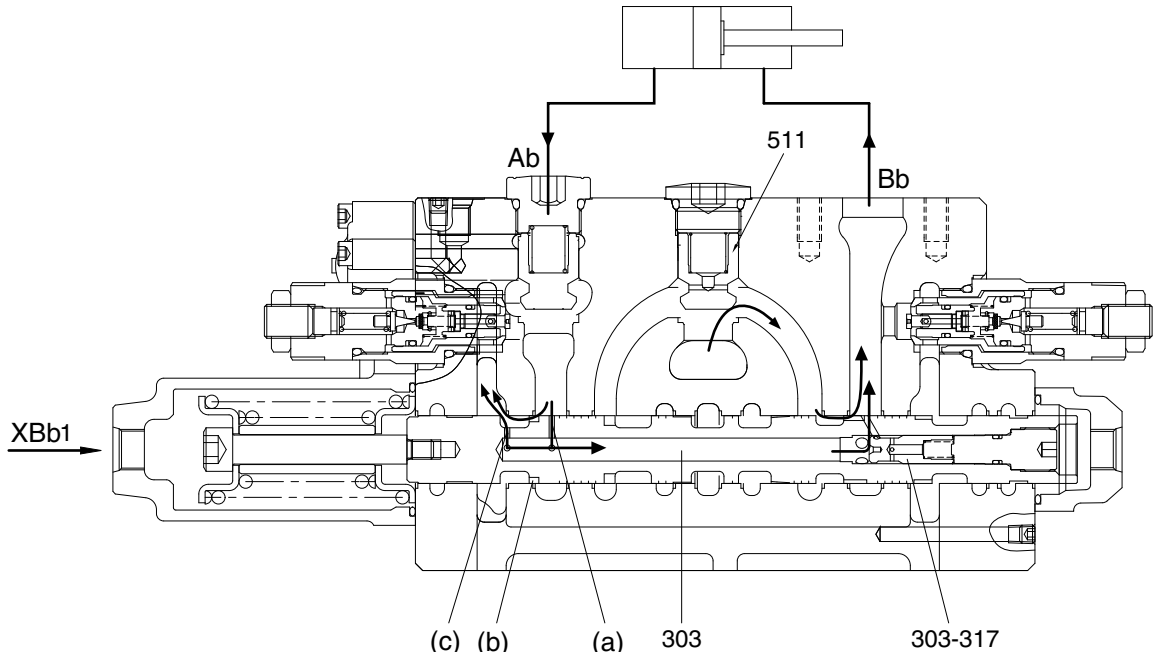


During the boom up operation, the pilot pressure enters through Port XAb1 and moves the boom 1 spool (303) in the left direction. The pressurized oil entering through Port P2 passes through the main path (3) and flows to the bypass circuit (2), but the bypass circuit (2) is shut off due to transfer of the boom 1 spool (303). Therefore, the pressurized oil flows into the parallel circuit, pushes open the check valve (511), and flows through the U-shaped path to the boom 1 spool (303). Then, it flows around the periphery of the boom 1 spool (303) to Port Ab, and is supplied to the boom cylinder head side.

At the same time, the pilot pressure enters also through Port XAb2 to transfer the boom 2 spool (307) in the right direction. Though the pressurized oil enters into Port P1, the bypass circuit (2) is shut off due to transfer of the boom 2 spool (307). Therefore, the hydraulic oil flows in the parallel circuit and flows through the U-shaped path to the boom 2 spool (307). Then, the hydraulic oil passes through the periphery of the boom 2 spool (307), pushes open the check valve (511), joins into Port Ab in the inside path, and is supplied to the boom cylinder head side. (Boom confluent flow)

On the other hand, the return oil from the boom cylinder rod side enters through Port Bb and returns to the hydraulic oil tank through the tank port (R1).

② **Boom down operation**



21092MC12

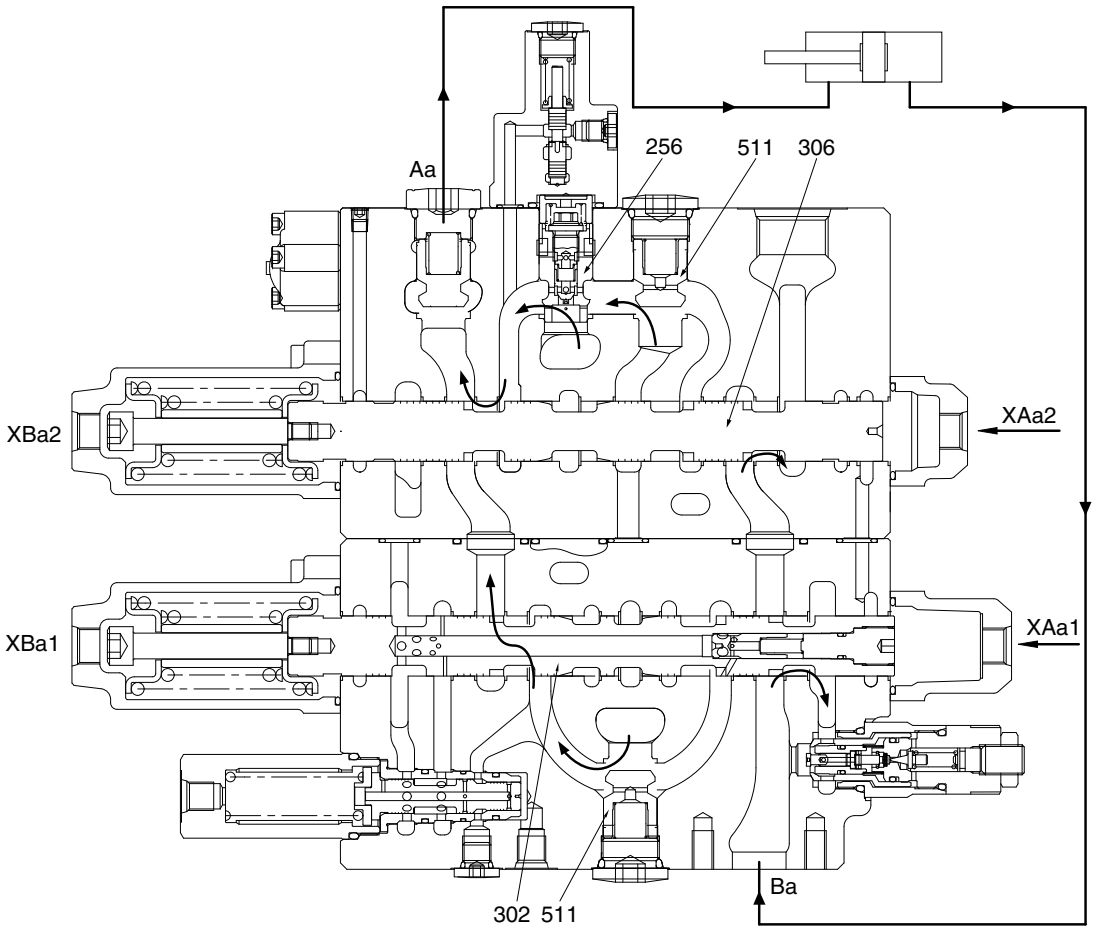
During the boom down operation, the pilot pressure enters through Port XBb1 and transfers the boom 1 spool (303) in the right direction. The pilot pressure enters also through port PbL and the release signal is sent to the lock valve. The pressurized oil entering through Port P2 passes through the main path (3) and flows to the bypass circuit (2), but the bypass circuit (2) is shut off due to transfer of the boom 1 spool (303). Therefore, the pressurized oil flows into the parallel circuit, pushes open the check valve (511), and flows through the U-shaped path to the boom 1 spool (303). Then, it flows around the periphery of the boom 1 spool (303) to Port Bb and is supplied to the boom cylinder rod side.

On the other hand, the return oil from the boom cylinder head side passes to the holes (a) and the notches (b) of the boom 1 spool (303).

Since this return oil has a sufficient pressure caused by the weight of the boom, it passes through the path inside the spool, pushes the poppet (303-317) in the spool in the right direction, flows around the outside of the spool. Then, it is supplied again to the boom cylinder rod side as hydraulic oil to lower the boom. (Boom regeneration)
Besides, a part of the return oil from the boom cylinder flows from the hole (c) into the tank.

(2) Arm control

① Arm out operation



During the arm out operation, the pilot pressure enters through Ports XAa1 and XAa2. When the pressure enters through Port XAa1 and XAa2, the spools transfer in the left direction. The hydraulic oil entering through Port P1 passes through the main path (1) and flows to the bypass circuit (2), but the bypass circuit is shut off due to transfer of the arm 1 spool (302).

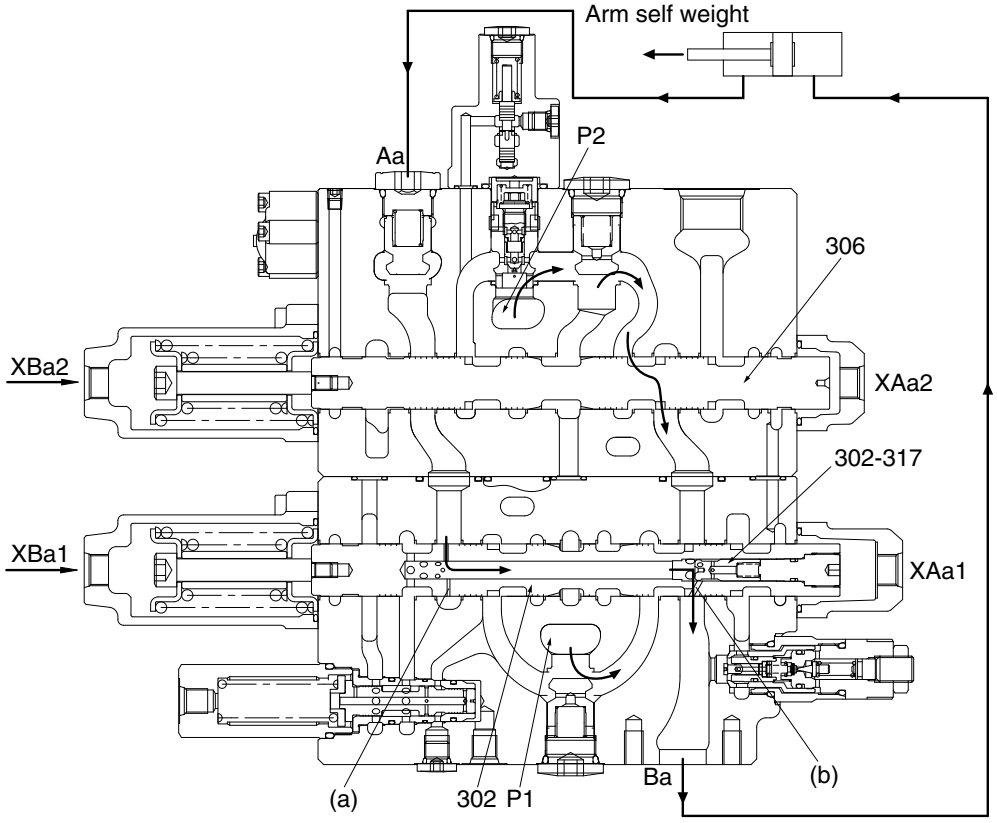
Therefore, the hydraulic oil from the parallel circuit pushes open the check valve (511) and flows through the U-shaped path to the arm 1 spool (302). Then, it flows around the periphery of the arm 1 spool (302) and the arm 2 spool (306) to Port Aa, and is supplied to the arm cylinder rod side.

On the other hand, the hydraulic oil entering through Port P2 passes in the main path (3), and flows into the bypass circuit (2), and the bypass circuit is shut off due to transfer of the arm 2 spool (306). The hydraulic oil from the parallel circuit pushes open the logic poppet (256) and the hydraulic oil from the bypass circuit (2) pushes open the check valve (511) and flows through the U-shaped path to the arm 2 spool (306). Then, it flows around the periphery of the arm 2 spool (306) in the inside path and joins into Port Aa.

Besides, the return oil from the arm cylinder head side passes through Port Ba, flows into tank line in arm 1 side and in arm 2 side, and returns to the hydraulic oil tank through the tank port (R1).

② Arm in operation

· During light load only



210WA2MC24

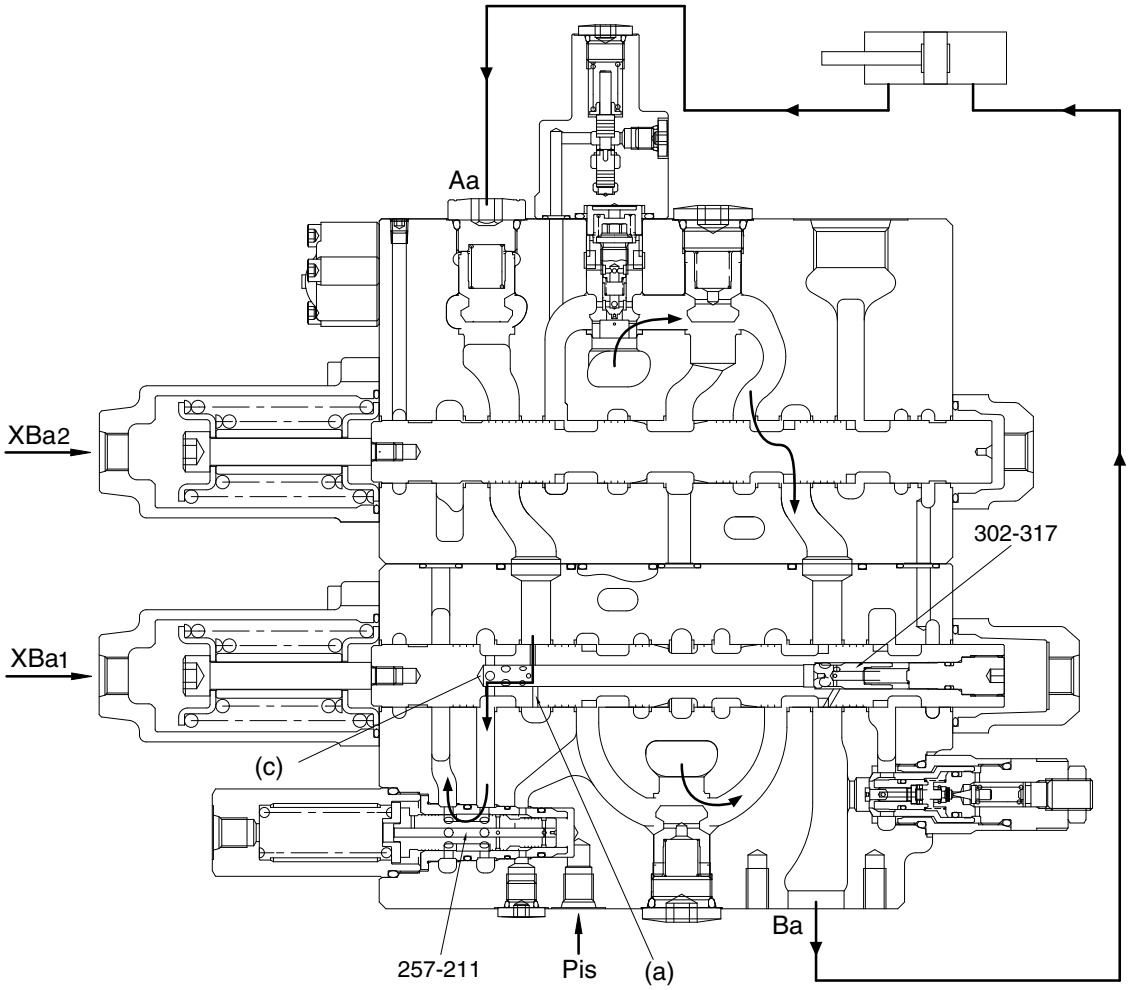
Main circuit

During the arm in operation, the pilot pressure enters through Ports XBa1 and XBa2. When the pressure enters through Port XBa1 and Port XBa2, the spools transfer in the right direction. The pilot pressure enters also through Port PbL and the release signal is sent to the lock valve. The hydraulic oil entering through Port P1 passes through the main path (1) and flows to the bypass circuit (2), but the bypass circuit is shut off due to transfer of the arm 1 spool (302). Therefore, the hydraulic oil from the parallel circuit pushes open the check valve (511) and flows through the U-shaped path to the arm 1 spool (302). Then, it flows around the periphery of the arm 1 spool (302) to Port Ba, and is supplied to the arm cylinder head side.

On the other hand, the hydraulic oil entering through Port P2 passes in the main path (3), and flows into the bypass circuit (2), and the bypass circuit is shut off due to transfer of the arm 2 spool (306). The hydraulic oil from the parallel circuit pushes open the logic poppet (256) and the hydraulic oil from the bypass circuit (2) pushes open the check valve (511) and flows through the U-shaped path to the arm 2 spool (306). Then, it flows around the periphery of the arm 2 spool (306) and the arm 1 spool (302) in the inside path and joins into Port Ba.

Besides, the return oil from the arm cylinder rod side is pressurized by self-weight of the arms and so on, and returns to Port Aa. The pressurized oil returning to Port Aa enters into the spool through the periphery hole (a) of the arm 1 spool (302). During a light load only, it pushes open the check valve (302-317) and joins into Port Ba from the spool hole (b). The rest of oil returns to the hydraulic oil tank through the tank port (R1). This is called the arm regeneration function.

· The pressure in the arm cylinder head side increases

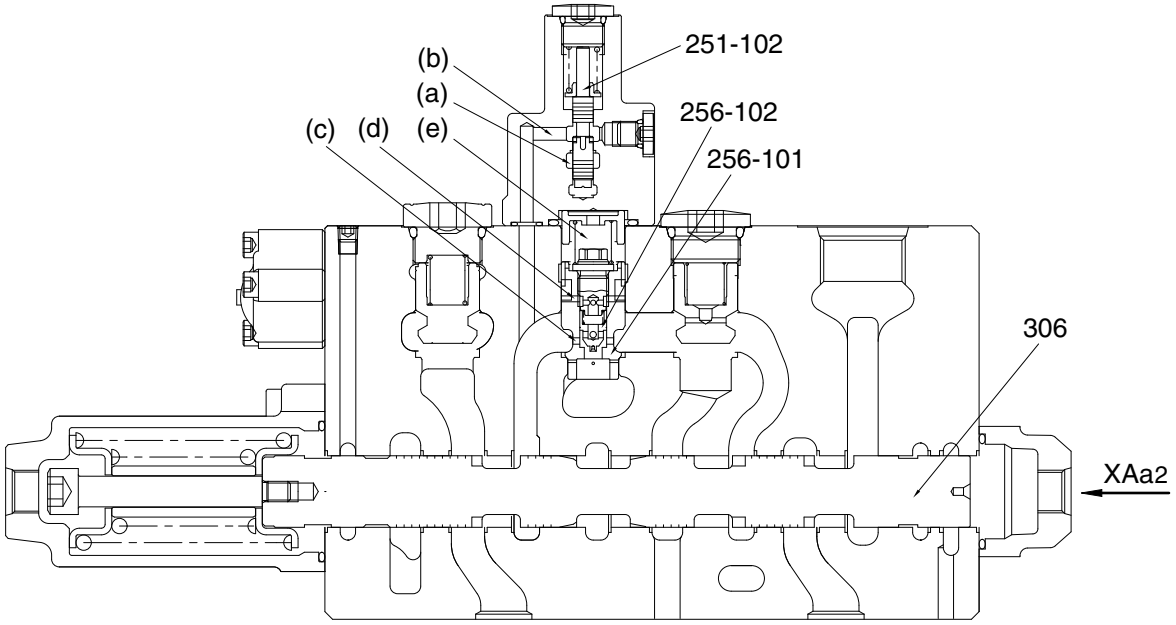


210WA2MC25

When the pressure in the arm cylinder head side and the U-shaped path increases, the arm regeneration cut spool (257-211) is transferred in the left direction, and at the same time the check valve (302-317) is closed by its back pressure. This shuts off the arm regeneration function, and the return oil from the arm cylinder rod side enters from Port Aa through the periphery hole (a) of the arm 1 spool (302) into the spool, flows to the arm regeneration cut valve (257) through the periphery hole (c) of the arm 1 spool (302), and returns through the tank port (R1) to the hydraulic oil tank.

When the Pilot Port Pis of the arm regeneration cut spool (257-211) is pressurized, a part of the return oil from the arm cylinder rod side flows to the arm regeneration cut valve (257) and returns through the tank port (R1) to the hydraulic oil tank. (Variable arm regeneration)

③ **Arm 2 logic control valve operation**



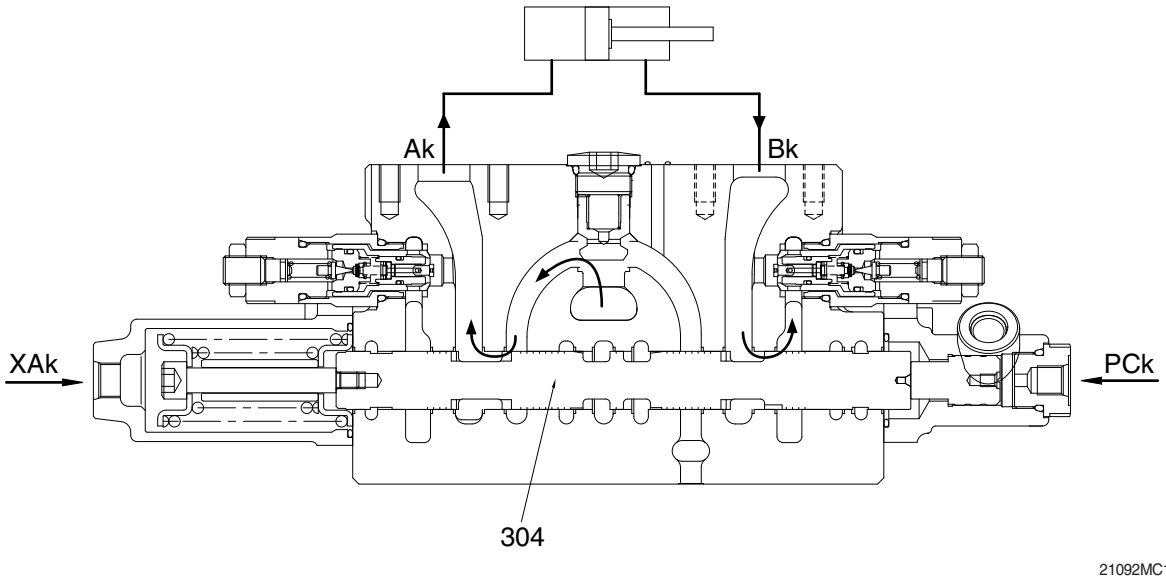
210WA2MC26

During both the arm in operation and the boom up operation, the pilot pressure enters through Ports XBa1, XBa2, XAb1, XAb2, PaL and PnA2. The pressure PnA2 transfers the spool (251-102) in the arm 2 logic control valve to the top direction, and the path from (a) to (b) is closed. Hereby, the pressurized oil pushes open the poppet (256-102), passes in the path (c) and (d), enters into the chamber (e), and the poppet (256-101) is pushed to the casing seat. Therefore, the most of pressurized oil entering through Port P2 flows to the boom 1 spool (303) than the arm 2 spool (306) to make the boom hoisting operation most preferential.

On the other hand, in the independent arm in operation, the pilot pressure does not enter through Ports PnA2, and the path from (a) to (b) is not closed, and the hydraulic oil of the chamber (e) flows to the path (a) and (b). The pressurized oil entering through Port P2 pushes open the poppet (256-101) and flows to the arm 2 spool (306).

(3) Bucket control

① Bucket in operation



During the bucket in operation, the pilot pressure enters through Port XAk and transfers the bucket spool (304) in the right direction. The pressurized oil entering through Port P2 passes through the main path (3) and flows through the bypass circuit (2), but the bypass circuit (2) is shut off due to transfer of the bucket spool (304). Therefore, the pressurized oil flows into the parallel circuit, pushes open the check valve (511), and flows through the U-shaped path to the bucket spool (304). Then, it flows through the periphery of the spool to Port Ak and is supplied to the bucket cylinder head side.

On the other hand, the return oil from the bucket cylinder rod side enters through Port Bk, passes around the periphery of the spool, and returns to the hydraulic oil tank through the tank port (R1).

During both the boom up operation and bucket in operation, the pilot pressure enters through Port PCk and the bucket spool transfers in the half stroke not full stroke. Therefore, the most of pressurized oil entering through Port P2 flows to the boom 1 spool (303) than the bucket spool (304) to make the boom up operation most preferential.

② Bucket in confluence

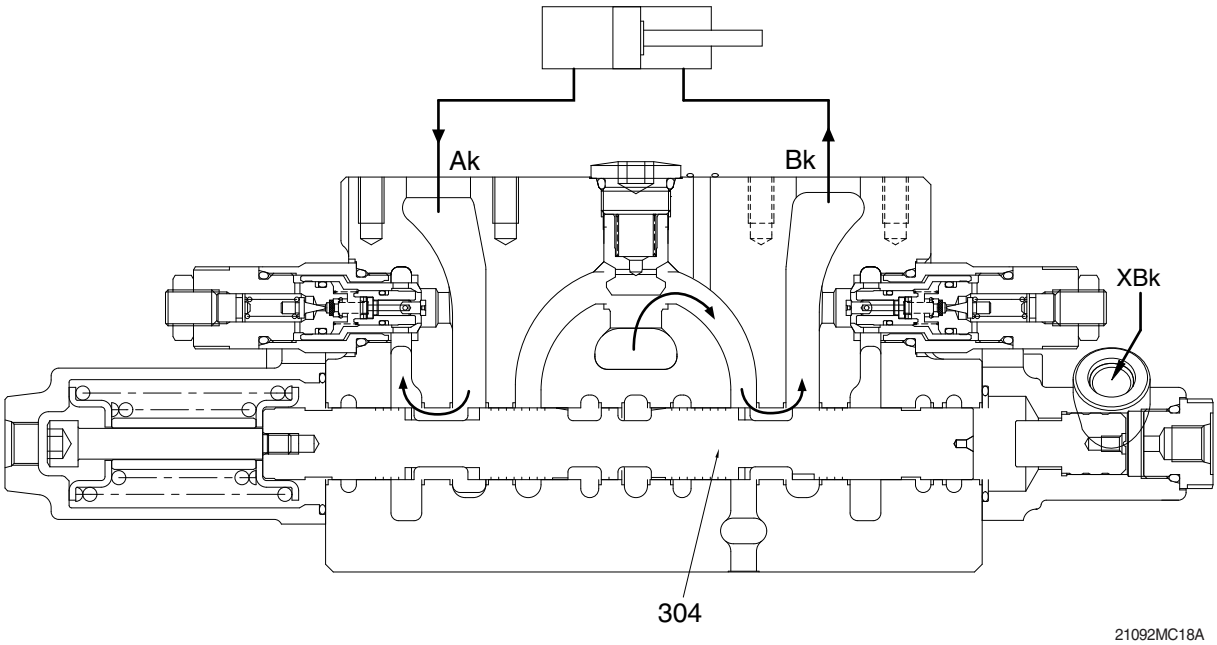
During the bucket out operation, the pilot pressure enters also through Port XBp1 and transfers the bypass-cut spool.

The pressurized oil entering through Port P1 passes through the main path (1) and flows through the bypass circuit (2), but the bypass circuit (2) is shut off due to transfer of the bypass-cut spool (313). Therefore, the pressurized oil pushes open the check valve (514), and flows through inside path and the U-shaped path to the bucket spool (304).

③ **Bucket out operation**

During the bucket out operation, the pilot pressure enters through Port XBk and transfers the bucket spool (304) in the left direction. The pressurized oil entering through Port P2 passes through the main path (3) and flows through the bypass circuit (2), but the bypass circuit (2) is shut off due to transfer of the bucket spool (304). Therefore, the pressurized oil flows into the parallel circuit, pushes open the check valve (511), and flows through the U-shaped path to the bucket spool (304). Then, it flows through the periphery of the spool to Port Bk and is supplied to the bucket cylinder rod side.

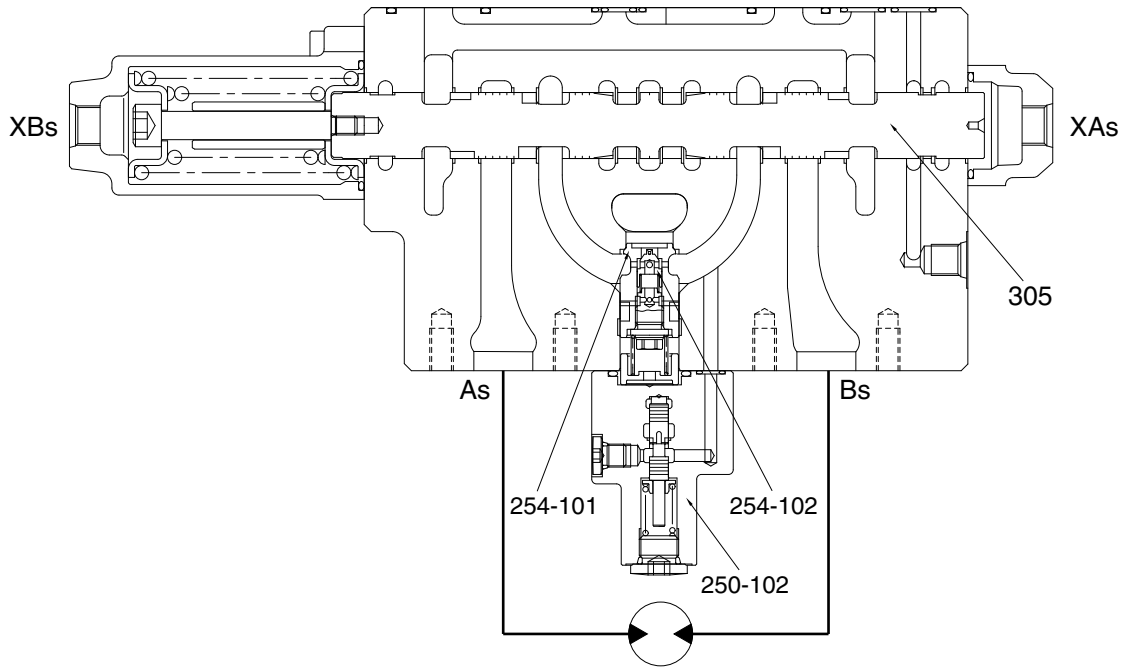
On the other hand, the return oil from the bucket cylinder head side enters through Port Ak, passes around the periphery of the spool, and returns to the hydraulic oil tank through the tank port (R1).



④ **Bucket in confluence**

During the bucket in operation, the pilot pressure enters also through Port XBp1 and transfers the bypass-cut spool (313). The pressurized oil entering through Port P1 passes through the main path (1) and flows through the bypass circuit (2), but the bypass circuit (2) is shut off due to transfer of the bypass-cut spool (313). Therefore, the pressurized oil pushes open the check valve (514), and flows through inside path and the U-shaped path to the bucket spool (304).

(4) Swing control



① **Swing operation**

During the swing operation, the pilot pressure enters through Port XAs (or XBs) and transfers the swing spool (305). The pressurized oil entering through Port P1 passes through the main path (1) and flows through the bypass circuit (2), but the bypass circuit (2) is shut off due to transfer of the swing spool (305). Therefore, the pressurized oil flows into the parallel circuit, pushes open the check valve (511), and flows through the U-shaped path to the swing spool (305). Then, it flows through the periphery of the spool to Port As (or Bs) and is supplied to the swing motor.

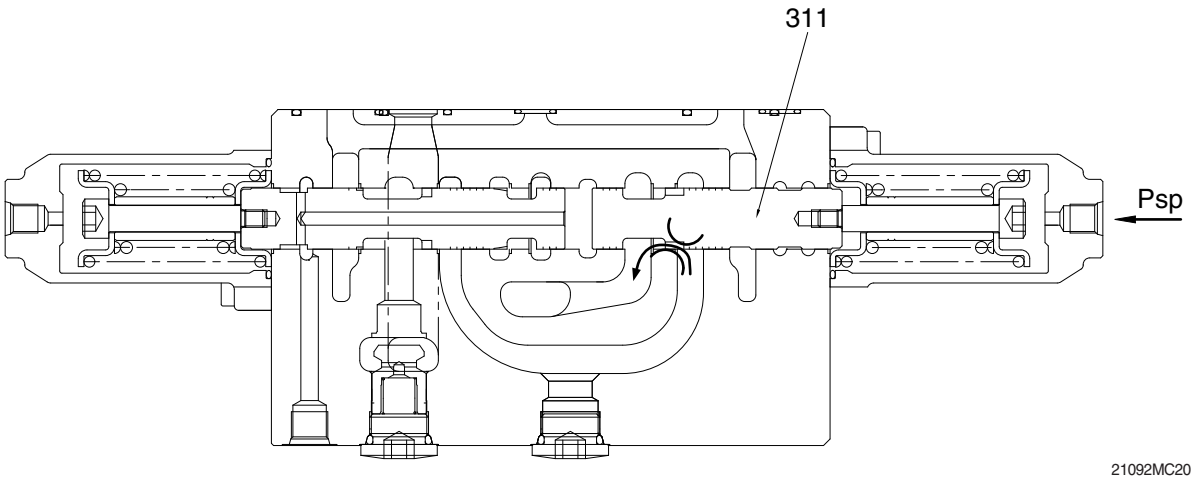
On the other hand, the return oil from the swing motor enters Port Bs (or As) and returns to the hydraulic oil tank through the tank port (R1).

② **Swing logic control valve operation**

During both the swing operation and the boom up operation, the pilot pressure enters through Ports XBs (or XAs), XAb1, XAb2 and Pns. The pressure Pns transfers the spool (250-102) in swing logic control valve. Hereby, the pressurized oil pushes open the poppet (254-102), and the poppet (254-101) is pushed to the casing seat. Therefore, the most of pressurized oil entering through Port P1 flows to the boom 2 spool (307) than the swing spool (305) to make the boom up operation most preferential.

On the other hand, in the independent swing operation, the pilot pressure does not enter through Ports Pns. The pressurized oil entering through Port P1 pushes open the poppet (254-101) and flows to the swing spool (305).

③ Swing operation preference function



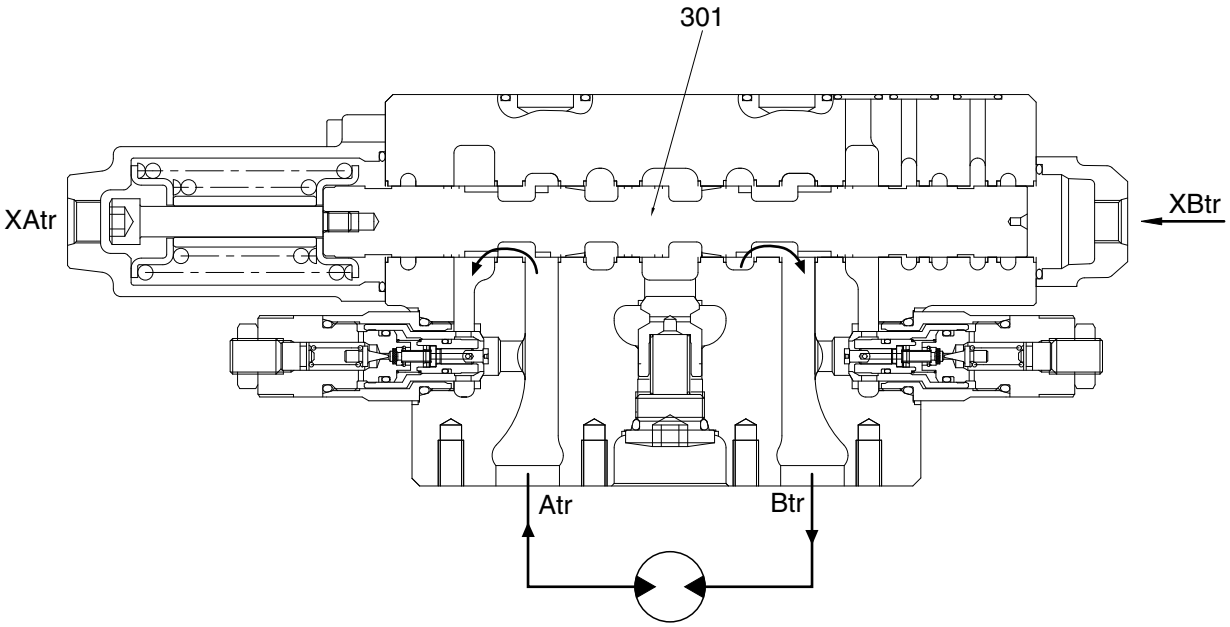
Pilot circuit

The pilot pressure enters through Port Psp to transfer the swing priority spool (311).

Main circuit

Due to transfer of the swing priority spool (311), the open area of the swing priority spool decreases, and the most of the pressurized oil entering through Port P1 flows to the swing side to make the swing operation most preferential.

(5) Travel control

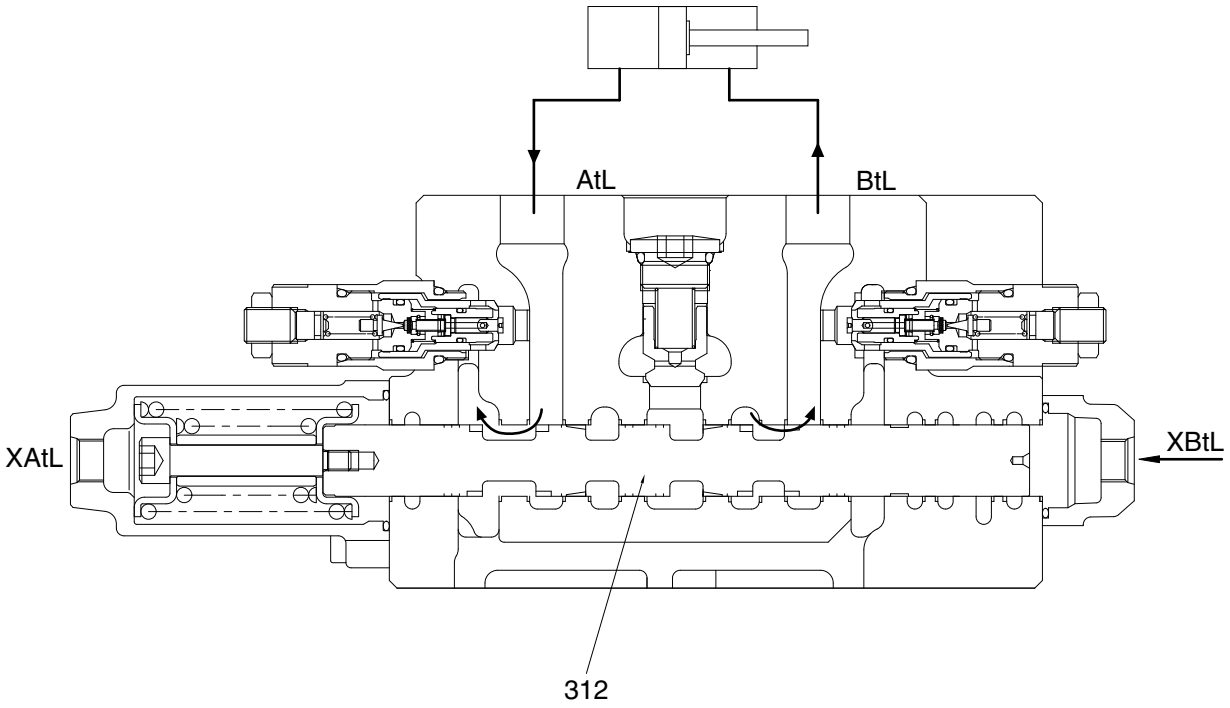


210WA2MC27

When Pilot Port XBtr of the travel spool (301) is pressurized, the bypass circuit (2) in the arm 1 side is shut off and the working fluid discharged from the hydraulic pump (A1) through Port Btr and flows to the travel motor.

On the other hand, the return oil from the travel motor passes flows from Port Atr to the travel spool (301) and returns to the hydraulic oil tank through the tank port (R1).
In the case of the opposite operation (when the pilot pressure is applied to Ports XAtr of the control valve), the operation is similar.

(6) Dozer operation



210WA2MC28

When Pilot Port XBtL of the dozer spool (312) is pressurized, the bypass circuit (2) in the boom 1 side is shut off and the working fluid discharged from the hydraulic pump (A2) through Port BtL and flows to the dozer cylinder rod side.

On the other hand, the return oil from the dozer cylinder rod side passes flows from Port AtL to the dozer spool (312) and returns to the hydraulic oil tank through the tank port (R1).
In the case of the opposite operation (when the pilot pressure is applied to Ports XAtL of the control valve), the operation is similar.

3) FUNCTION OF LOCK VALVE

The lock valve (252) is fitted between the arm cylinder rod side and the arm 2 spool (306). It decreases the leakage by the pressure of the cylinder.

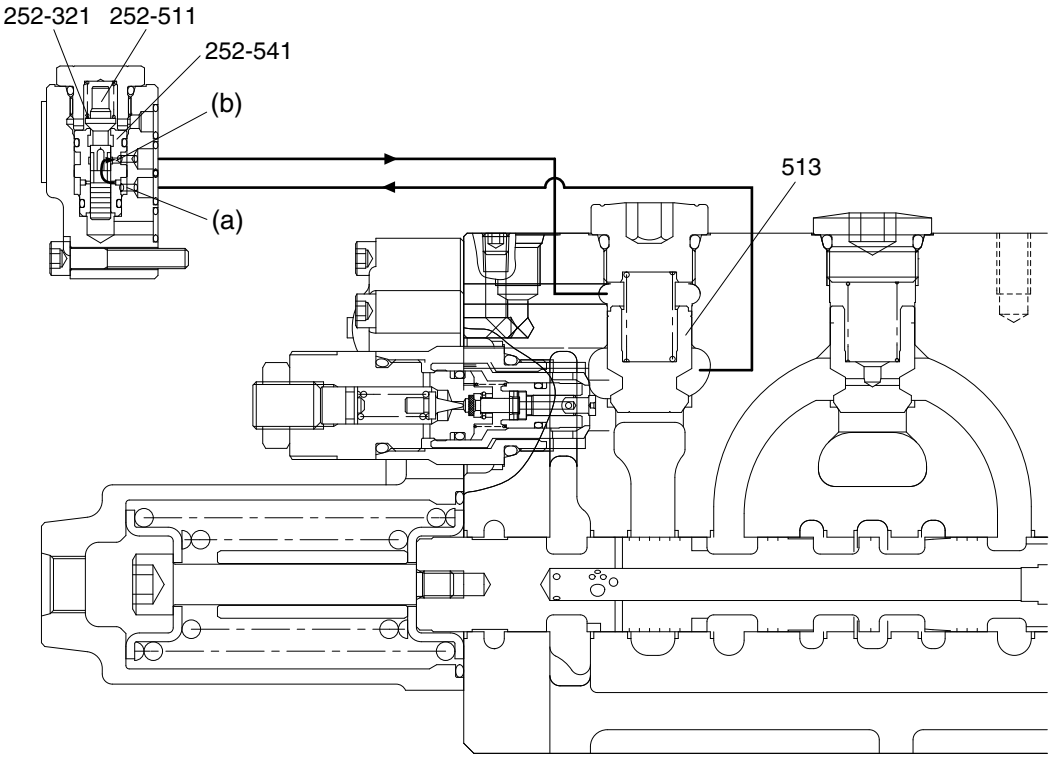
Another lock valve (252) is similarly fitted between the boom cylinder head side and the boom 1 spool (303). It decreases the leakage by the pressure of the cylinder.

(1) Neutral positions of spools

The following is the case of the boom 1 spool (303). (The case of the arm 2 spool (306) is in the same way.)

During the boom 1 spool (303) is in the neutral position, the lock valve (252) is kept in the position shown in figure. The spool (252-511) in the lock valve is pushed to the seat of the sleeve (252-541) by the force of the spring (252-321).

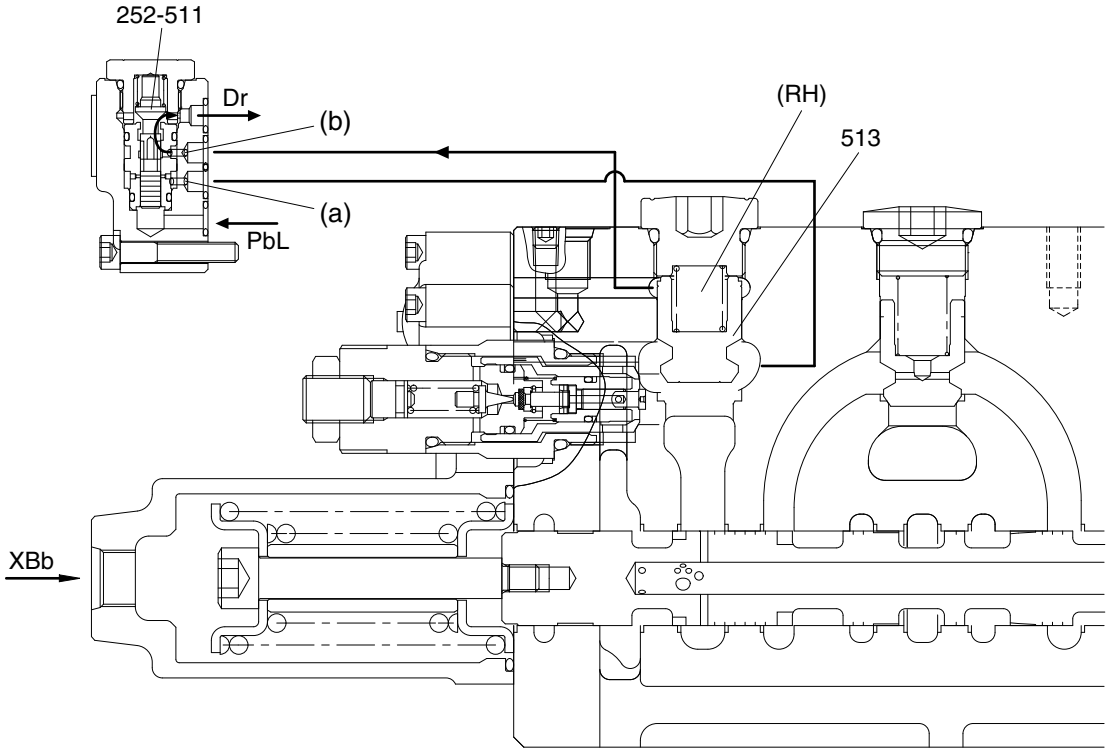
In this position, the pressurized oil from the boom cylinder head side enters through the hole (a), the periphery of the spool (252-511) in the lock valve and the hole (b), and it pushes the poppet (513) to the casing seat, and the leakage is decreased.



210WA2MC29

(2) Boom down operation

During the boom down operation, the pilot pressure enters through Port PbL and XBb1. The pilot pressure transfers the spool (252-511) in the lock valve assy in the top direction. By the transfer of the spool (252-511), firstly the hole (a) is blocked and the pressurized oil from the boom cylinder head side does not enter to the spring chamber (RH). Secondly, the oil in the spring chamber (RH) enters through the hole (b) and flows to drain circuit. Therefore, the poppet (513) is lifted by the pressure of the boom cylinder head side and the function of the lock valve (252) is released.



210WA2MC30

(3) Boom up operation

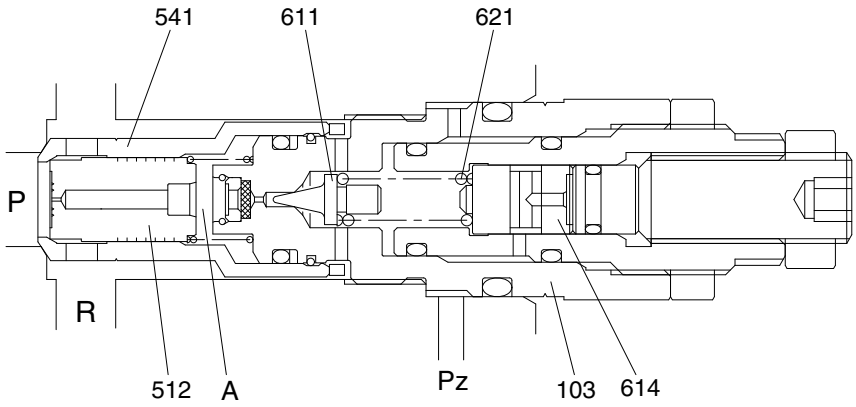
During the boom up operation, the pilot pressure enters through Port XAb1. The oil flowing from the boom 1 spool pushes open the poppet (513) and flows to Port Ab.

4) CIRCUIT PRESSURE PROTECTION

The control valve has two kinds of relief valve to limit the pressure in a circuit.

(1) Main relief valve

The main relief valve is fitted in the P2 housing and functions as follows.



21092MC25

① The hydraulic oil is filled up in the inside space chamber (A) from the path (P) through a hole of the seat (541) and a restriction of the plunger (512), and seats the plunger (512) against the seat (541) securely.

② When the pressure in the path (R) becomes equal to the set load of the spring (621), the poppet (611) opens to make the hydraulic oil flow through a hole of the plug (103), around the poppet (611) and into the low pressure path (R).

③ Opening of the poppet (611) causes the pressure in the chamber (A) to fall and the plunger (512) to open. As the result the pressurized oil in the path (R) runs into the low pressure path (R) directly.

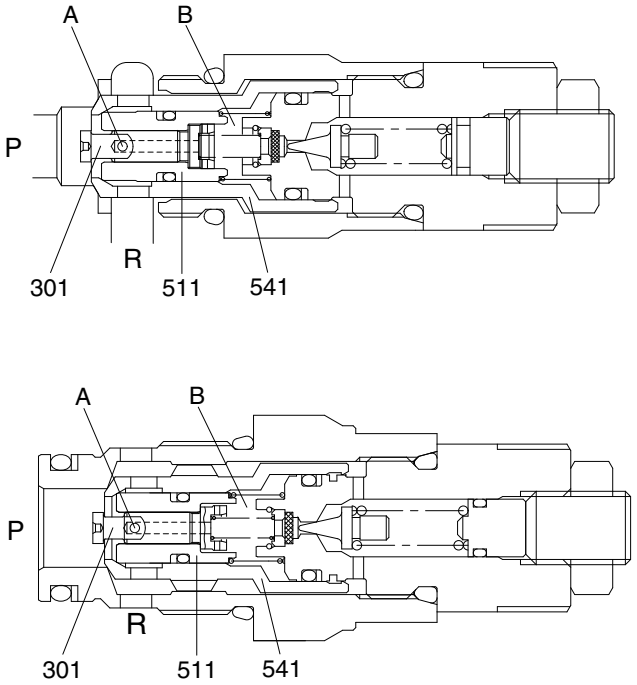
④ When the pressurized oil higher than pressure 30 kgf/cm^2 enters through the port Pz, it pushes the piston (614) to change the relief set pressure of the spring (621) to the high pressure.

(2) Port relief valve

The port relief valve is fitted between the cylinder port and low-pressure path. In addition to the relief valve, this serves also as an anti-cavitation check valve, and functions as follows:

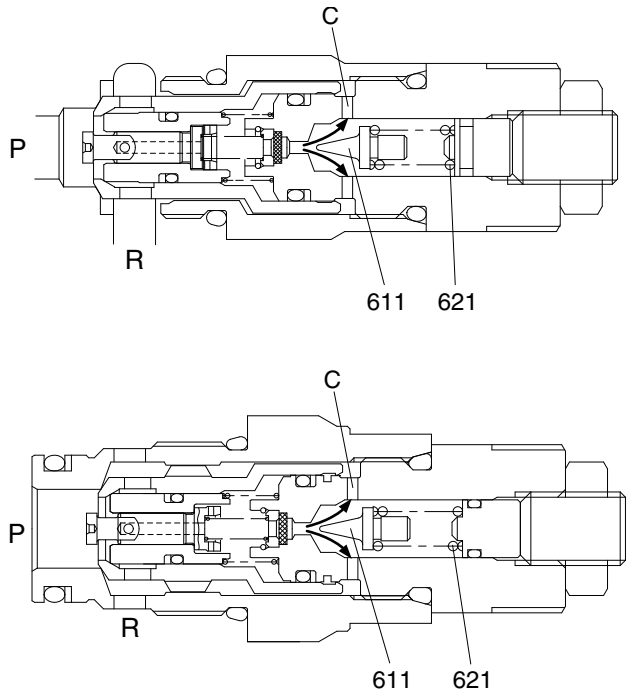
① Function as relief valve

a. The pressurized oil passes through Hole A of the piston (301), is filled up in Chamber B of the inside space, and seat the plunger (511) against the seat (541) securely.



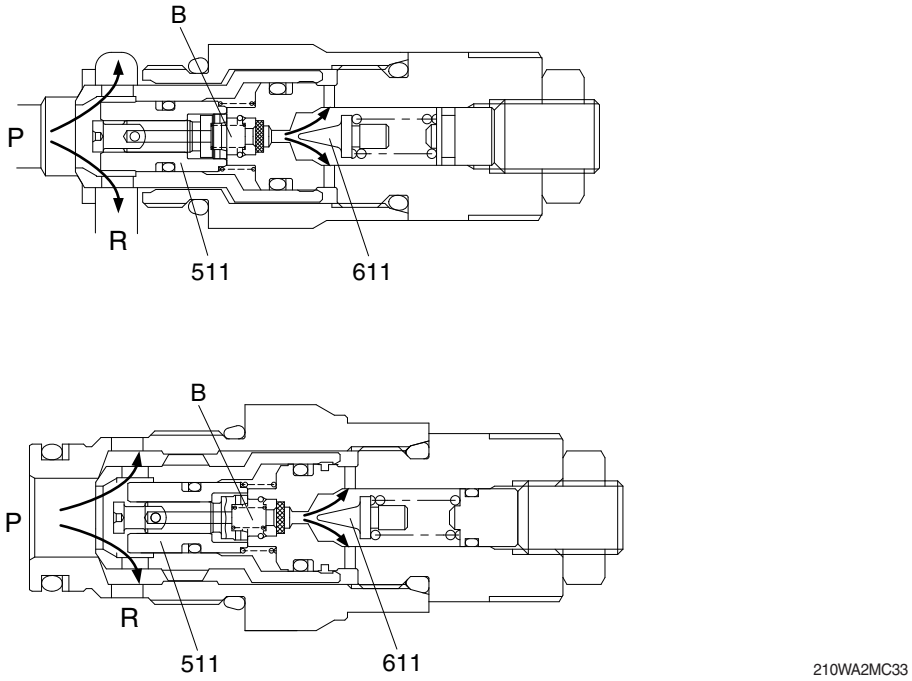
210WA2MC31

b. When the pressure in the path (P) becomes equal to the set pressure of the spring (621 or 622), the pressurized oil pushes open the poppet (611), flows around it, and flows to the low pressure path (R) through hole C.



210WA2MC32

c. Opening of the poppet (611) causes the pressure in Chamber B to fall and the plunger (511) to open. As the result the pressurized oil in the path (P) runs into the low pressure path (R) directly.

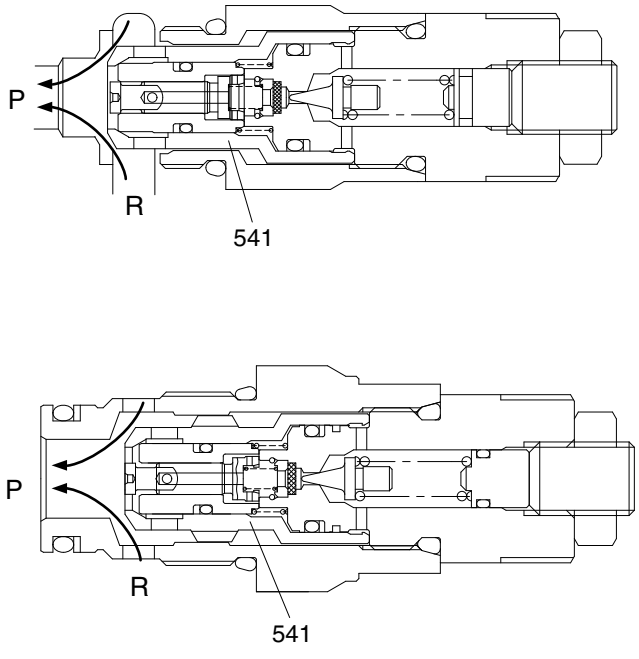


210WA2MC33

d. When the pressurized oil higher than pressure 25 kgf/cm^2 enters through the port PL, it pushes the piston (624) to change the relief set pressure of the spring (622) to the high pressure.

② **Function as Anti-Cavitation Check Valve**

When any negative pressure exists in the path (P), the oil is supplied through the path (R). When the pressure at (R) becomes higher than that in the path (P), the seat (541) moves in the right direction. Then, sufficient oil passes around the seat (541) from the path (R) to the path (P) and prevents cavitation.



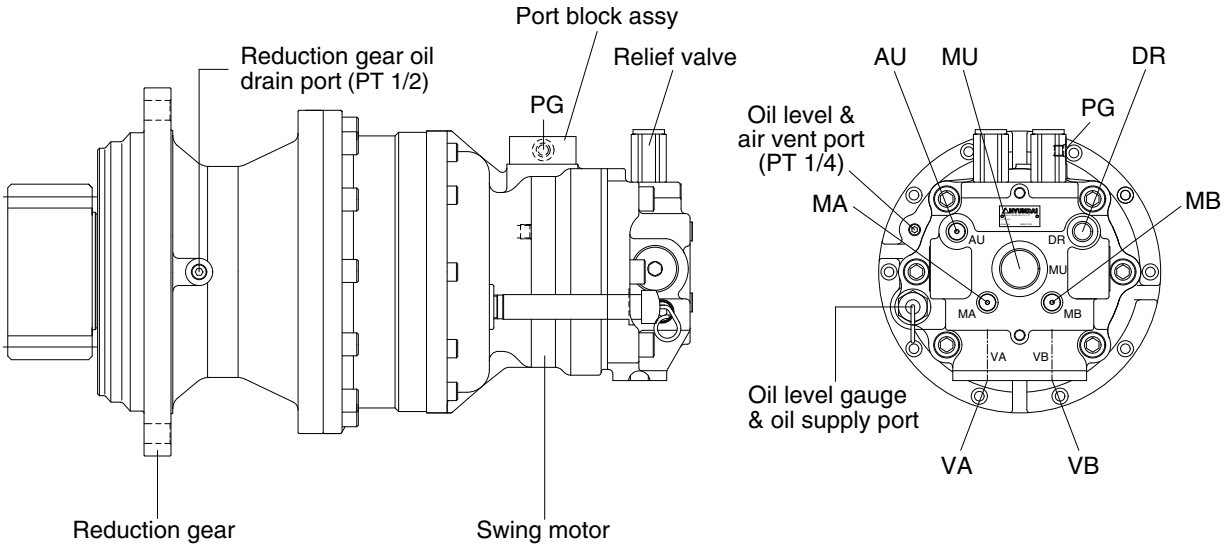
210WA2MC34

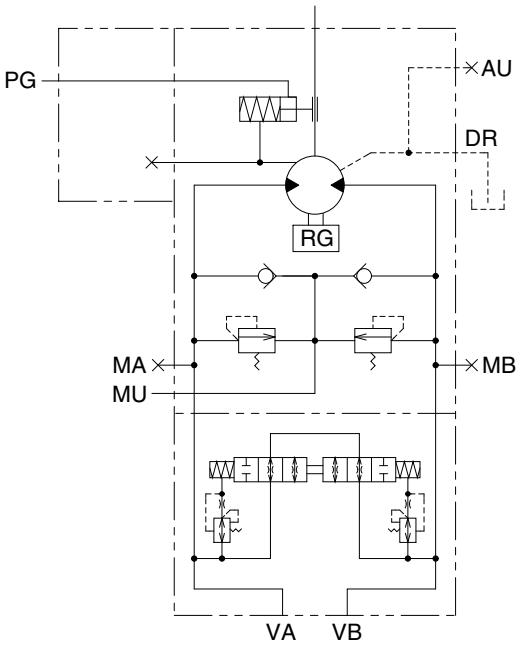
GROUP 3 SWING DEVICE

1. STRUCTURE

Swing device consists swing motor and swing reduction gear.

Swing motor include mechanical parking valve, relief valve, make up valve and port block assy.



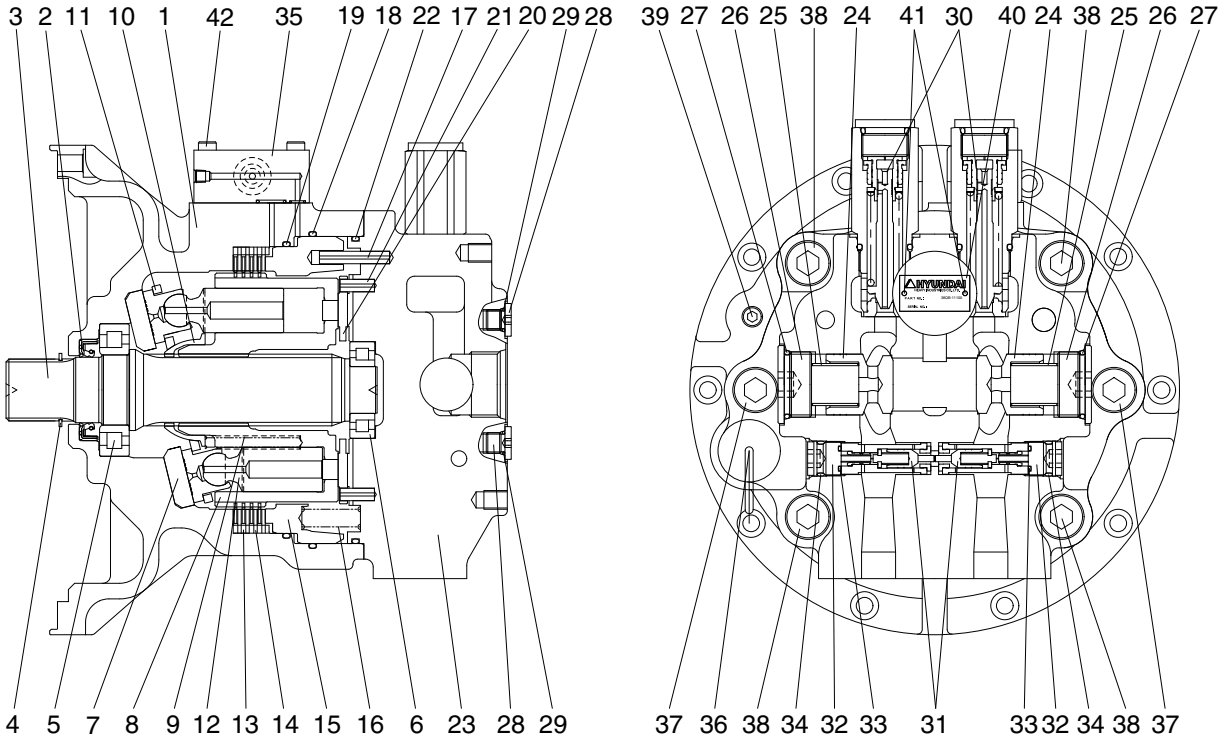


Hydraulic circuit

Port	Port name	Port size
VA	Main port	Ø20
VB	Main port	Ø20
DR	Drain port	PF 1/2
MU	Make up port	PF 1 1/4
PG	Stand by port	PF 1/4
MA, MB	Gauge port	PF 1/4
AU	Air vent port	PF 1/4

210WA2SM01

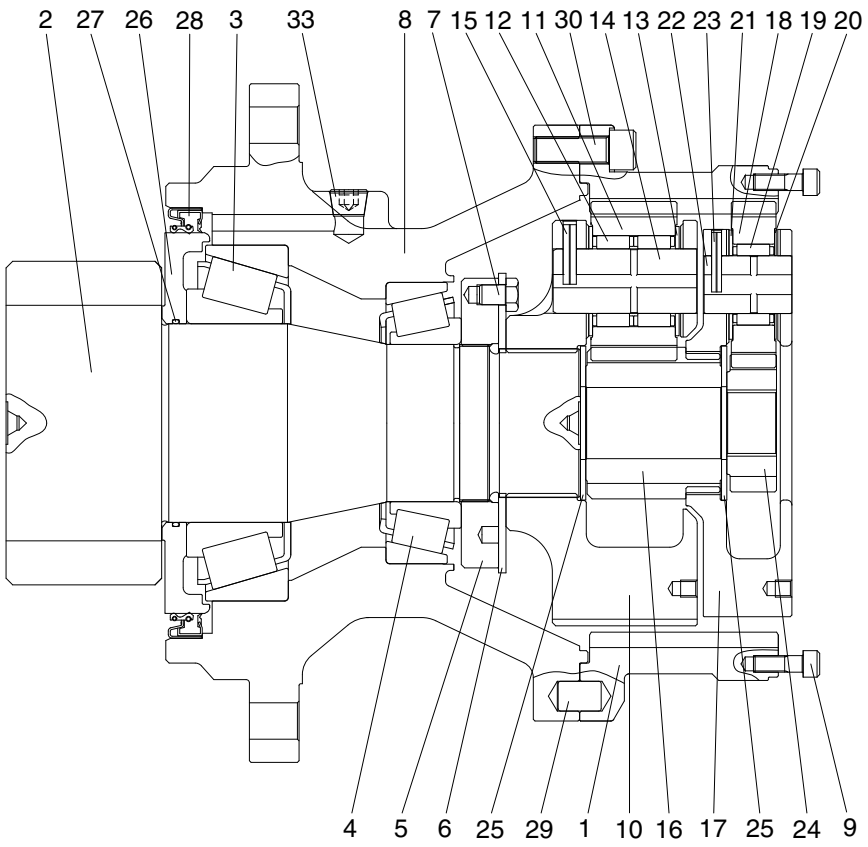
1) SWING MOTOR



210WA2SM02

1	Casing	15	Parking piston	29	O-ring
2	Oil seal	16	Brake spring	30	Relief valve assy
3	Shaft	17	Spring pin	31	Anti-rotating valve assy
4	Retainer ring	18	O-ring	32	Plug
5	Roller bearing	19	O-ring	33	O-ring
6	Roller bearing	20	Valve plate	34	O-ring
7	Swash plate	21	Spring pin	35	Port block assy
8	Rotary block	22	O-ring	36	Level gauge assy
9	Spring	23	Valve casing	37	Socket bolt
10	Ball guide	24	Check valve	38	Socket bolt
11	Retainer plate	25	Spring	39	Plug
12	Piston assy	26	Plug	40	Name plate
13	Friction plate	27	O-ring	41	Rivet
14	Separate plate	28	Plug	42	Socket bolt

2) REDUCTION GEAR



210WF2SM03

1	Ring gear	12	Needle bearing	23	Spring pin
2	Drive shaft	13	Thrust washer	24	Sun gear 1
3	Taper roller bearing	14	Carrier pin 2	25	Thrust plate
4	Taper roller bearing	15	Spring pin	26	Sleeve
5	Ring nut	16	Sun gear 2	27	O-ring
6	Lock plate	17	Carrier 1	28	Oil seal
7	Hexagon bolt	18	Planetary gear 1	29	Parallel pin
8	Casing	19	Needle bearing	30	Socket bolt
9	Socket bolt	20	Thrust washer	33	Plug
10	Carrier 2	21	Thrust washer		
11	Planetary gear 2	22	Carrier pin 1		

2. PRINCIPLE OF DRIVING

1) GENERATING THE TURNING FORCE

The high hydraulic supplied from a hydraulic pump flows into a rotary block (8) through valve casing of motor (23), and valve plate (20).

The high hydraulic is built as flowing on one side of Y-Y line connected by the upper and lower sides of piston (12).

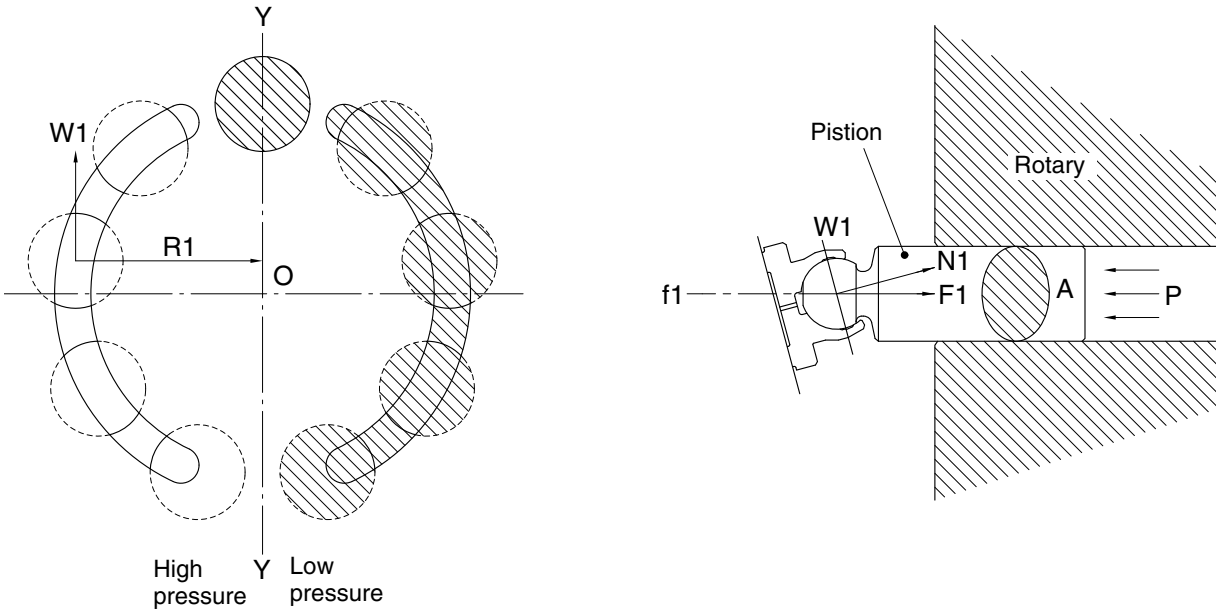
The high hydraulic can generate the force, F1=P×A (P : supplied pressure, A : water pressure area), like following pictures, working on a piston.

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

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

The sum of torque (ΣW1×R1), generated from each piston (4~5 pieces) on the side of a high hydraulic, generates the turning force.

This torque transfers the turning force to a rotaty (8) through a piston; because a rotary is combined with a turning axis and spline, a turning axis rotates and a turning force is sent.



210WA8SM05

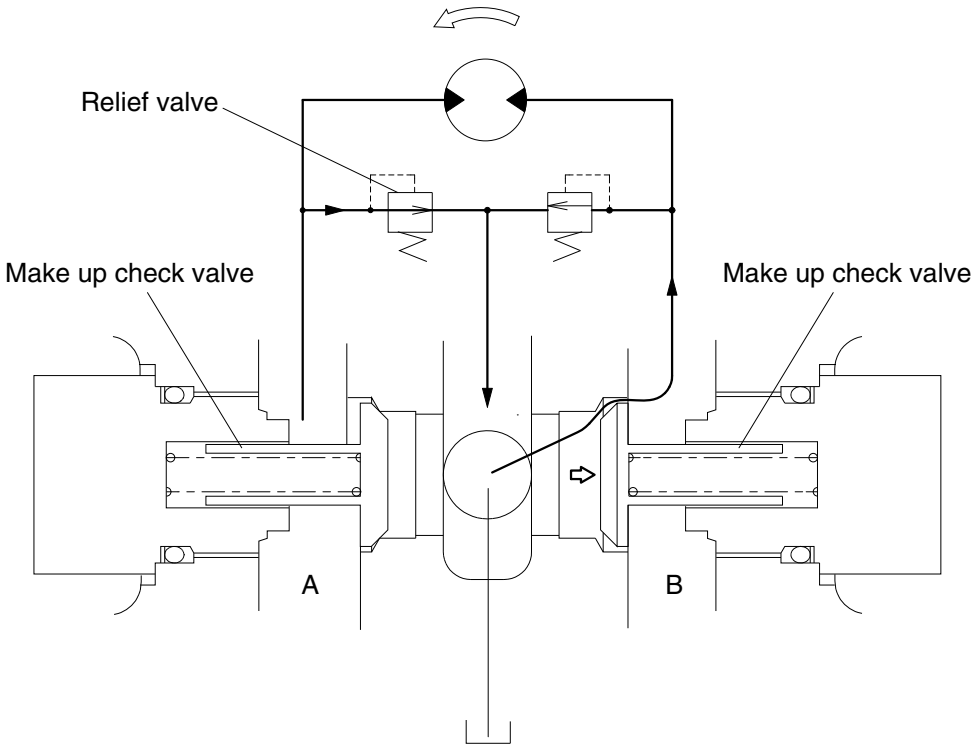
2) MAKE UP VALVE

In the system using this type of motor, there is no counter balance functioning valve and there happens the case of revolution exceeding hydraulic supply of motor. To prevent the cavitation caused by insufficient oil flow there is a make up valve to fill up the oil insufficiency.

A make up valve is provided immediately before the port leading to the hydraulic oil tank to secure feed pressure required when the hydraulic motor makes a pumping action. The boost pressure acts on the hydraulic motor's feed port via the make up valve.

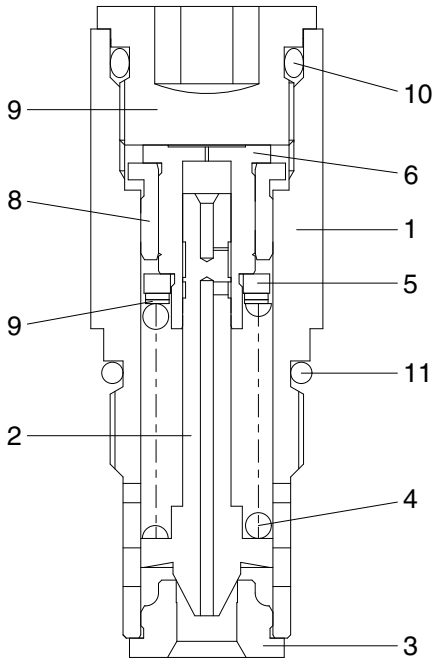
Pressurized oil into the port B, the motor rotate counterclockwise.

If the plunger of MCV moves neutral position, the oil in the motor is drain via left relief valve, the drain oil run into motor via right make up valve, which prevent the cavitation of motor.



21092SM04

3) RELIEF VALVE



2209A2SM25

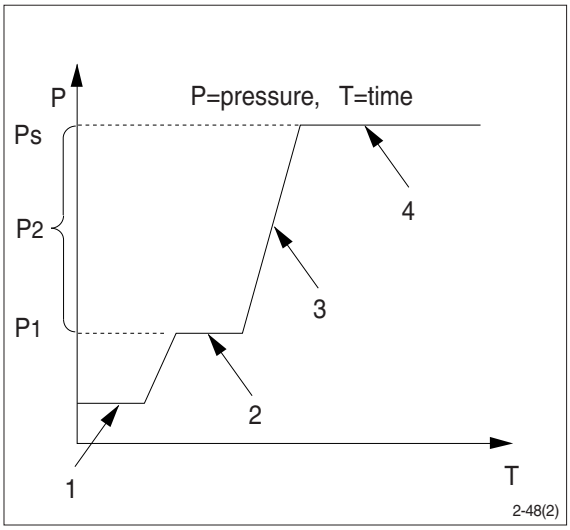
1	Sleeve
2	Poppet
3	Poppet seat
4	Spring
5	Spring seat
6	Shim
7	Piston
8	Stopper
9	Plug
10	O-ring
11	O-ring

(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.

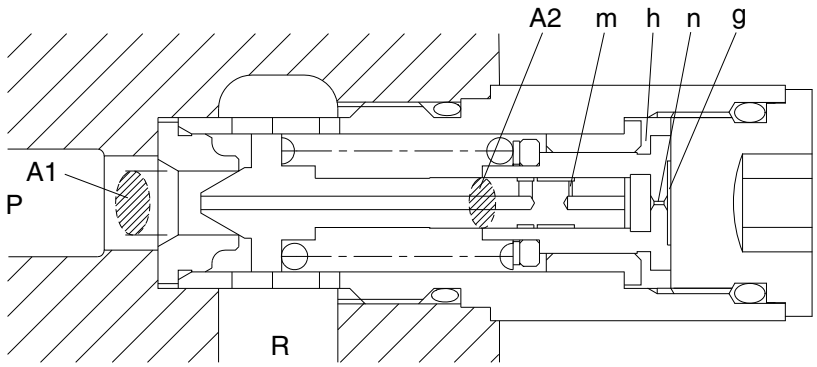
(2) Function of relief valve

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.



2-48(2)

① Ports (P,R) at tank pressure.

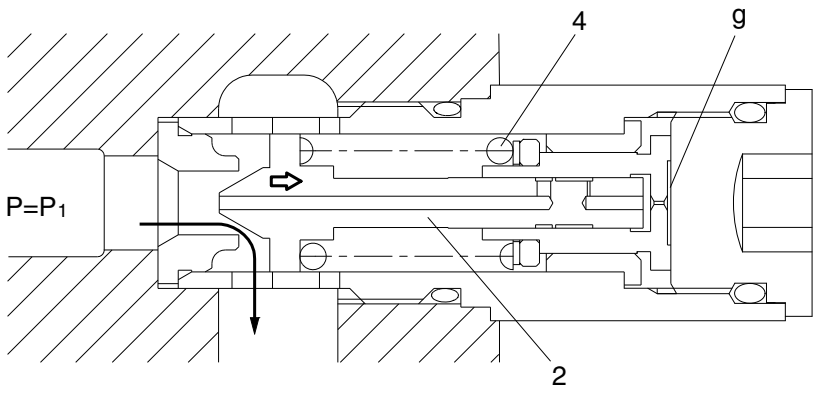


2209A2SM26

② When hydraulic oil pressure ($P \times A_1$) reaches the preset force (F_{SP}) of spring (4), the plunger (2) moves to the right as shown.

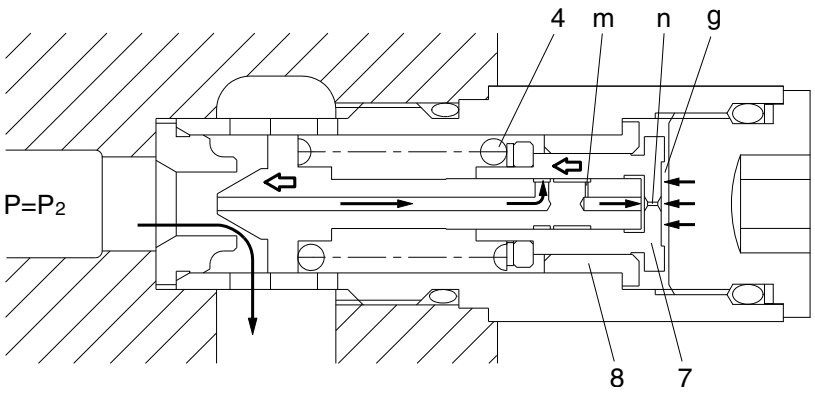
$P_1 \times A_1 = Fsp + Pg \times A_2$

$$P_1 = \frac{Fsp + Pg \times A_2}{A_1}$$



2209A2SM27

③ The oil flow chamber g via orifice m and n. When the pressure of chamber g reaches the preset force (F_{SP}) of spring (4), the piston (7) moves left and stop the piston (7) hits the bottom of bushing (8).

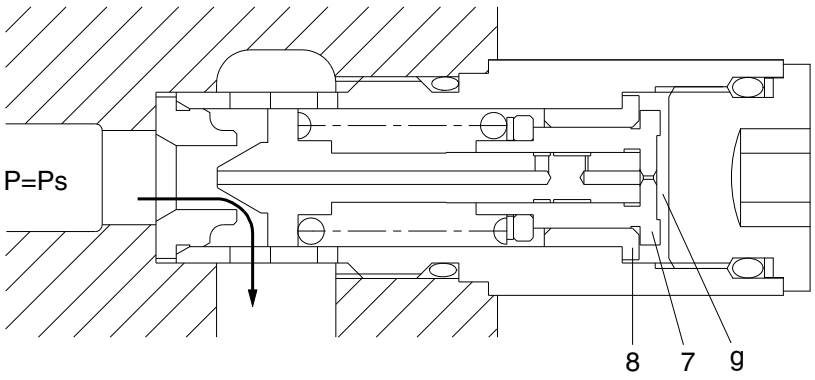


2209A2SM28

④ When piston (7) hits the bottom of bushing (8), it stops moving to the left any further. As the result, the pressure in chamber (g) equals (Ps).

$Ps \times A_1 = Fsp + Ps \times A_2$

$$Ps = \frac{Fsp}{A_1 - A_2}$$



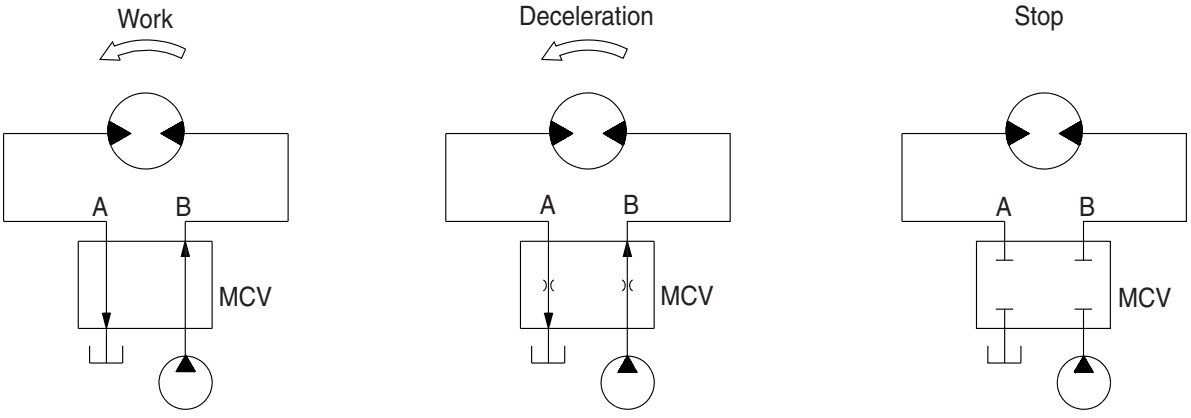
2209A2SM29

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

2-48(1)

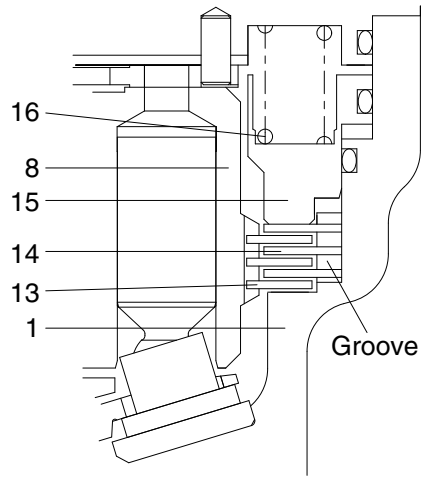
(2) Mechanical swing parking brake system

This is function as a parking brake only when any one of the swing, arm in and boom up function is not operated.

① Brake assembly

Circumferential rotation of separate plate (14) is constrained by the groove located at casing (1). When housing is pressed down by brake spring (16) through friction plate (13), separate plate (14) and parking piston (15), friction force occurs there.

Rotary block (8) is constrained by this friction force and brake acts, while brake releases when hydraulic force exceeds spring force.



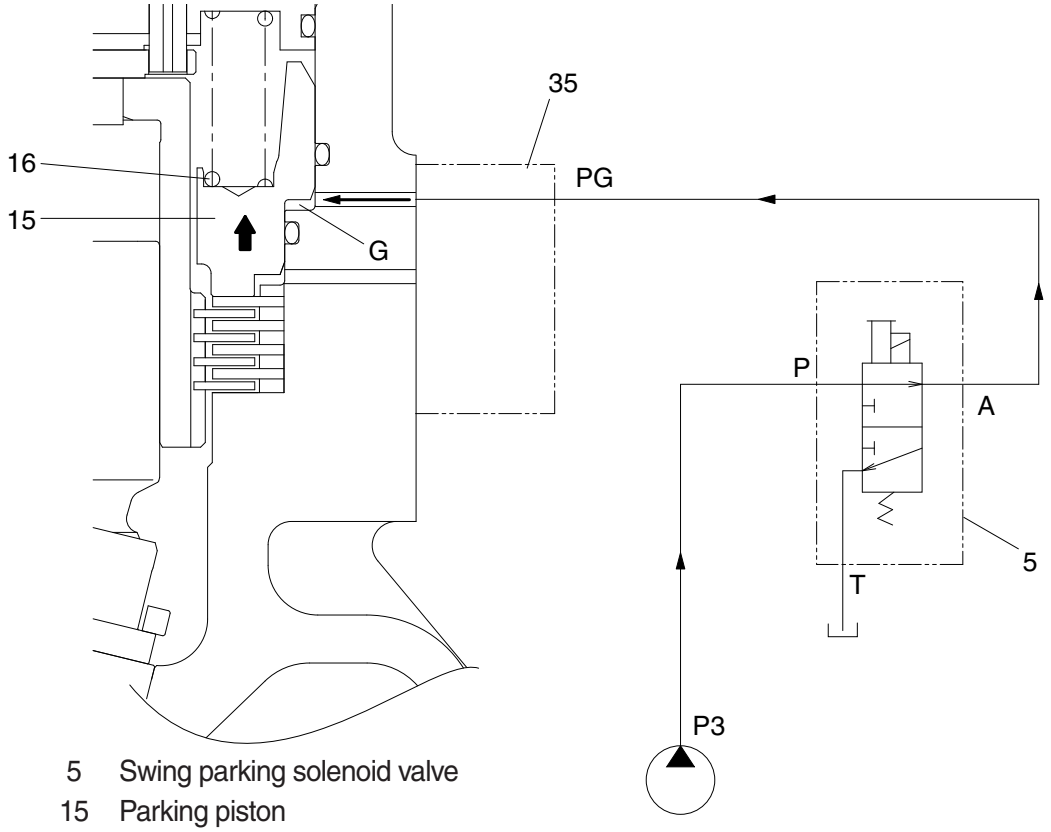
2209A2SM35

1	Casing	14	Separate plate
8	Rotary block	15	Parking piston
13	Friction plate	16	Brake spring

② Operating principle

a. When any of the swing, arm in, travel and boom up function is operated, the swing parking solenoid valve (5) is shifted to the swing position, so pilot pump charged oil (P3) goes to the chamber G through port PG.
This pressure is applied to move the brake piston (15) to the upward against the force of the brake spring (16). Thus, it releases the brake force.

b. Stop operation and a few second has been elapsed, the swing parking solenoid valve (5) is shifted to the swing parking position and swing brake works.



5 Swing parking solenoid valve
15 Parking piston
16 Brake spring
35 Port block assy

210WA2SM10

③ Electric control swing prarking system

a. A safety is ensured by recognizing the swing operation and canceling the swing parking only under specific conditions by releasing parking electronically.

b. After receiving the RCV pressure, the MCU applies the parking release signal.

c. Depending on each RCV operation, there is a time difference between re-entry into swing parking.

Mode	Fine swing switch	RCV operation	Parking delay time
Work mode	ON or OFF (No condition)	Swing	5 sec
		Arm in	1 sec
	ON	Boom up	2 sec
		Travel	3 sec
	OFF	Boom up / Travel	Not applied

④ **Manual override function**

When the swing parking solenoid valve or related electric system is malfunction, the swing parking brake is not released even if the swing lever is operated.

To release the swing parking brake, the manual override function is needed.

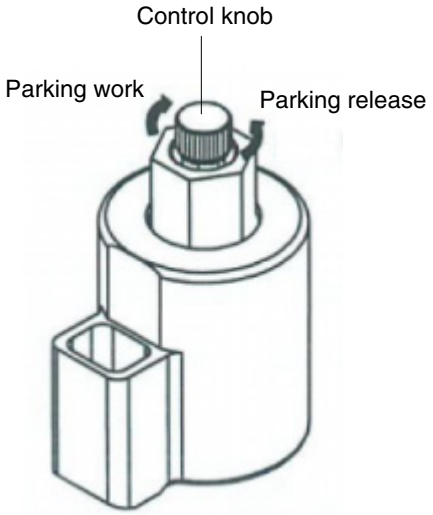
※ **Manual override solenoid valve**

a. Use hand only to turn the control knob (do not use a tool).

b. **Parking brake release**
Turn the control knob to counterclockwise fully (about 2.5 mm)

c. **Parking brake work**
Turn the control knob to clockwise fully.

※ **Be careful not damage the control knob by using a tool or tightening forcibly.**
It can cause malfunction of the solenoid valve.



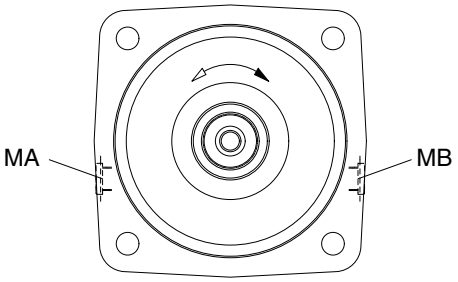
Swing parking solenoid valve

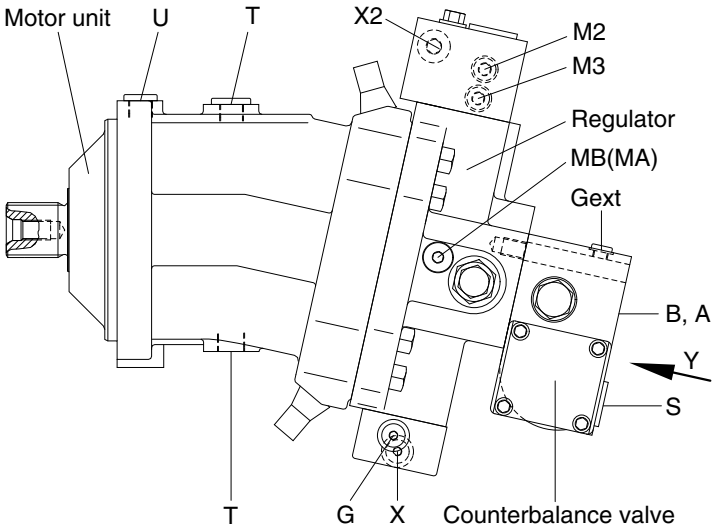
160A2SM11

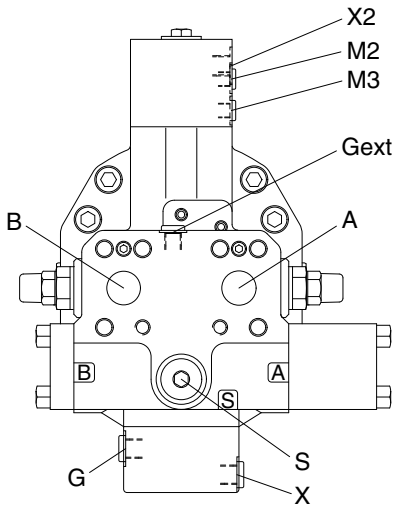
GROUP 4 TRAVEL MOTOR

1. CONSTRUCTION

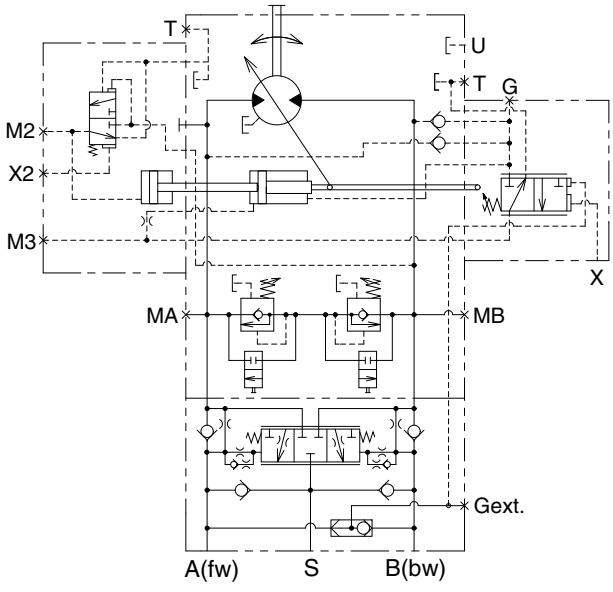
Travel motor consists motor unit, regulator and counterbalance valve.







VIEW Y



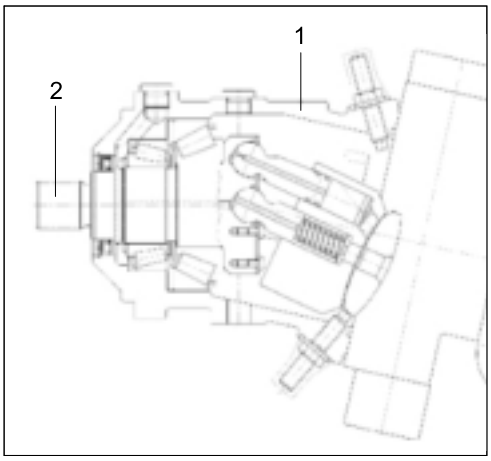
Hydraulic circuit

210WA2TR01

Port	Port name	Port size
A, B	Main port	SAE 1 1/4"
G	Plugged	M14×1.5 - 12
X	Pilot pressure port	M14×1.5 - 12
X2	Pilot pressure port	M14×1.5 - 12
T	Drain port	PF 3/4 - 18
U	Flushing port	PF 1/2 - 17
S	Make up port	M27×2.0 - 16
M_A, M_B	Gauge port	M18×1.5 - 12
M2, M3	Gauge port	M10×1.0 - 8
Gext	Brake release port	M12×1.5 - 12.5

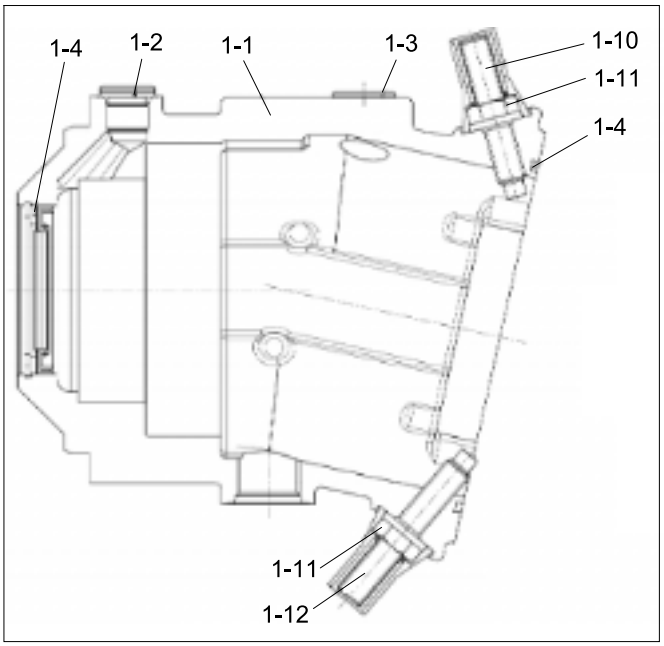
1) PARTS LIST (1/3)

MOTOR ASSY

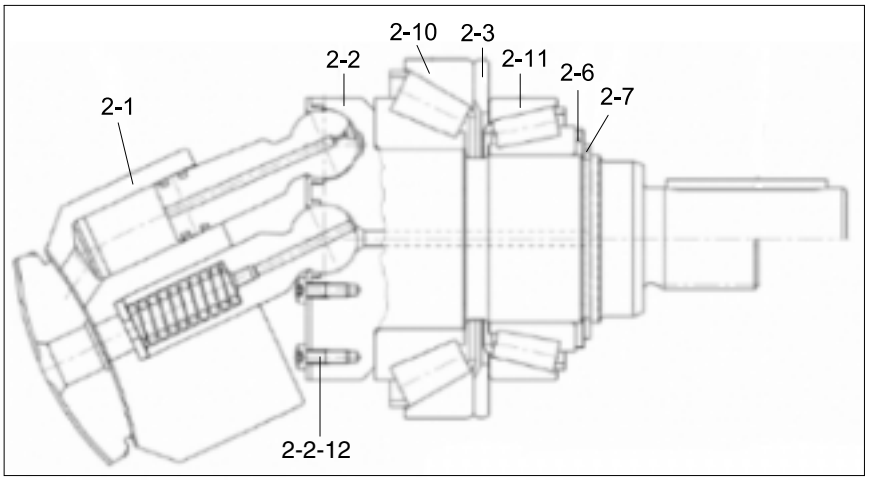


1 Motor housing assy
2 Rotary kit

ITEM 1



ITEM 2

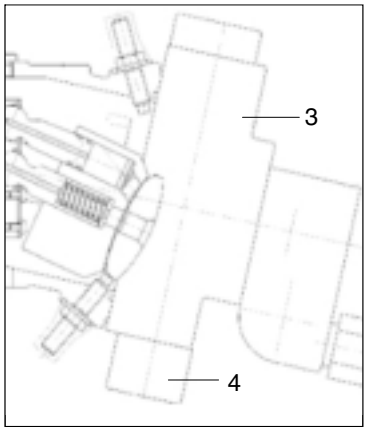


140WA2TR10

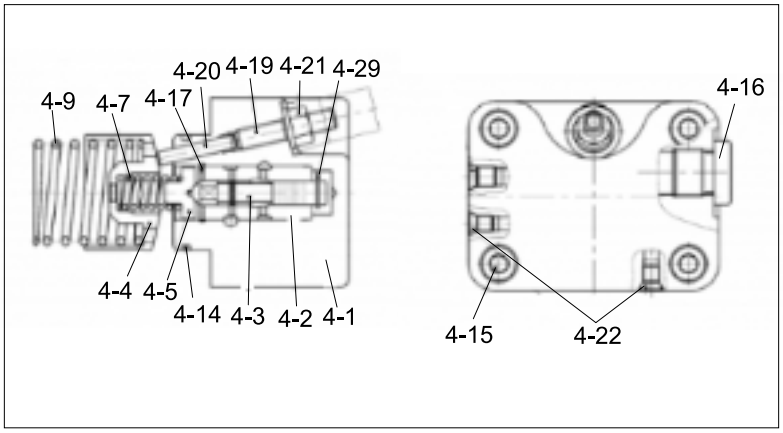
1-1	Housing	1-11	Sealing nut	2-3	Shim
1-2	Lock screw	1-12	Threaded pin	2-6	Backup plate
1-3	Lock screw	2-1	Hydraulic rotary section	2-7	Retainer ring
1-4	Motor seal kit	2-2	Drive shaft	2-10	Roller bearing
1-10	Threaded pin	2-2-12	Screw	2-11	Roller bearing

PARTS LIST (2/3)

MOTOR ASSY

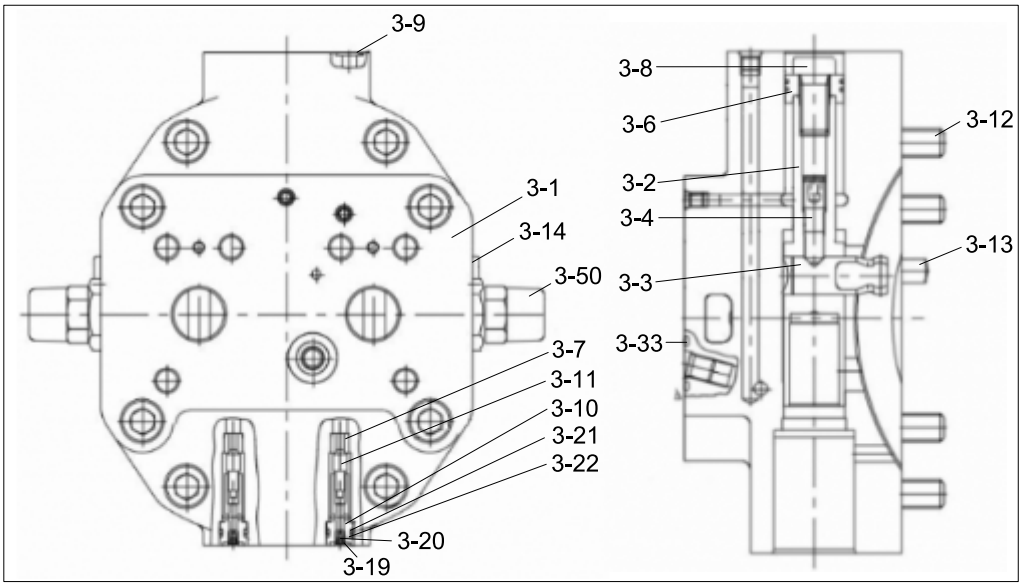


ITEM 4



3 Port plate assy
4 Control unit

ITEM 3

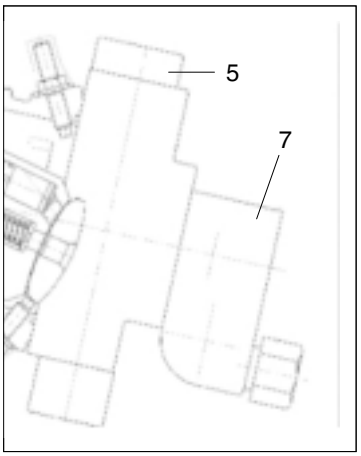


210WA2TR12

3-1	Port plate	3-14	Locking screw	4-7	Pressure spring
3-2	Positioning piston	3-19	O-ring	4-9	Pressure spring
3-3	Positioning trunnion	3-20	Throttle screw	4-14	O-ring
3-4	Threaded pin	3-21	O-ring	4-15	Socket screw
3-6	Piston ring	3-22	Back up ring	4-16	Locking screw
3-7	Bushing	3-33	O-ring	4-17	Retainer ring
3-8	Socket screw	3-50	Relief valve	4-19	Thread pin
3-9	O-ring	4-1	Control housing	4-20	Cylinder pin
3-10	Valve guide	4-2	Control bushing	4-21	Seal lock nut
3-11	Socket bolt	4-3	Control piston	4-22	Break pin
3-12	Socket screw	4-4	Adjust bushing	4-29	Retainer disc
3-13	Cylinder pin	4-5	Spring collar		

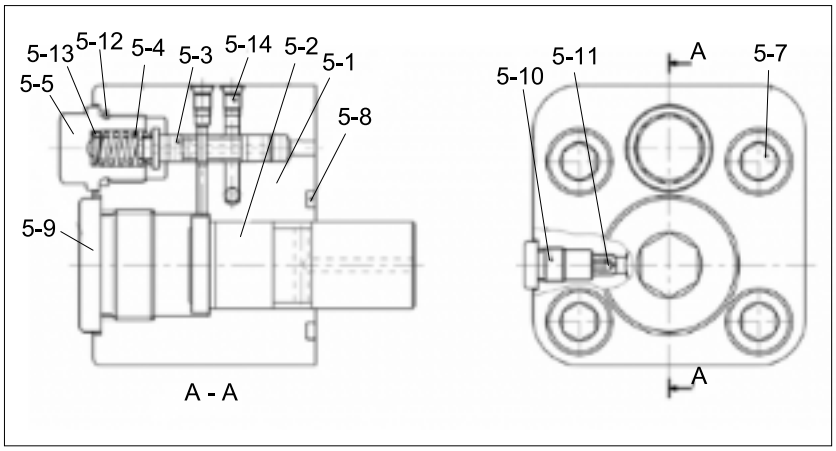
PARTS LIST (3/3)

MOTOR ASSY

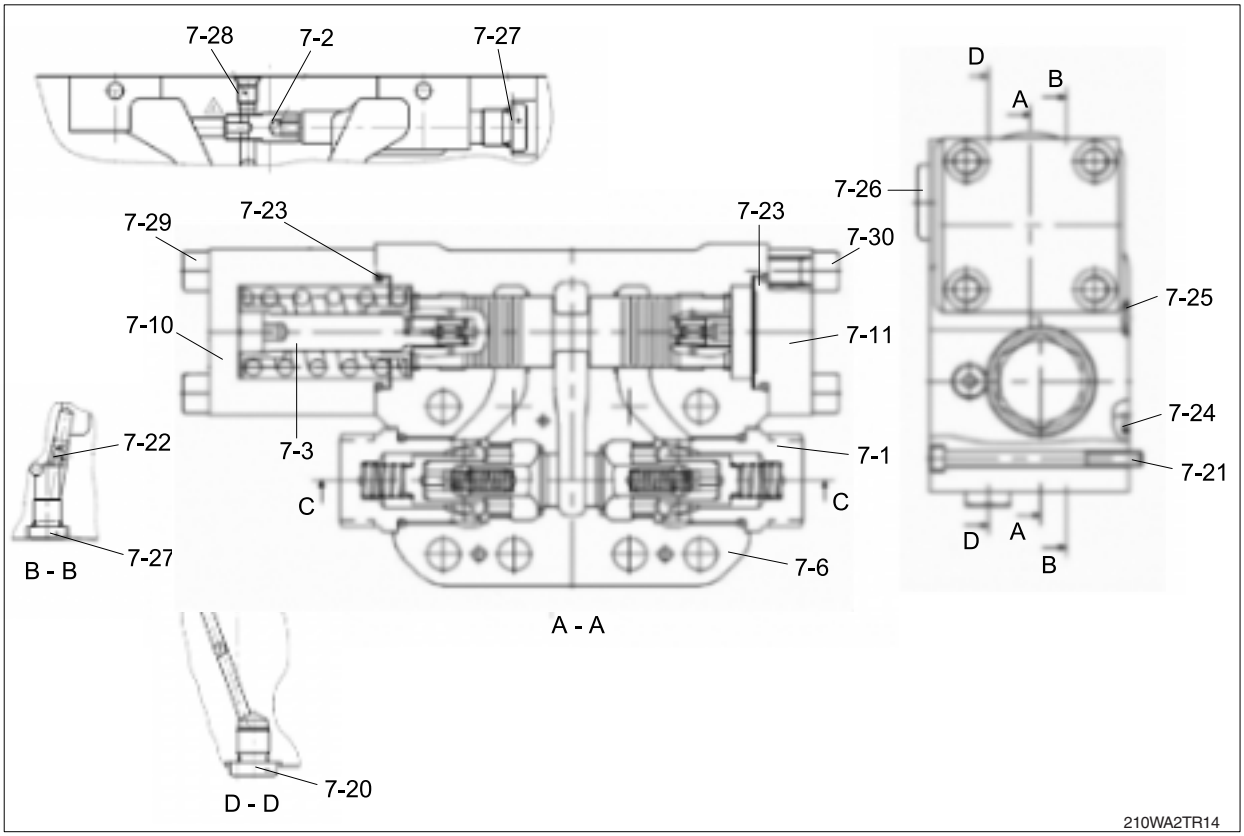


5 Hydraulic stroke limiter
7 Motion control valve assy

ITEM 5

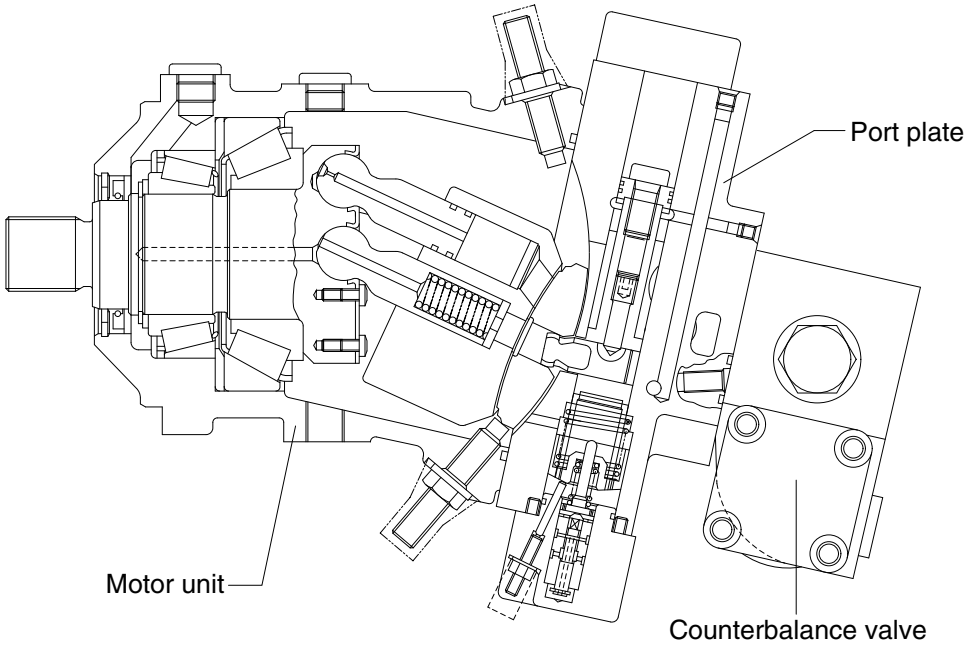


ITEM 7



5-1	Limiter housing	5-12	O-ring	7-21	Socket screw
5-2	Piston	5-13	Shim	7-22	Plug
5-3	Control piston	5-14	Break pin	7-23	O-ring
5-4	Pressure spring	7-1	Control valve assy	7-24	O-ring
5-5	Lock screw	7-2	Shuttle valve	7-25	O-ring
5-7	Cap screw	7-3	Brake piston assy	7-26	Locking serew
5-8	O-ring	7-6	Housing	7-27	Locking screw
5-9	Lock screw	7-10	Cover	7-28	Break pin
5-10	Lock screw	7-11	Cover	7-29	Socket serew
5-11	Orifice	7-20	Locking screw		

2. FUNCTION



160WA2TR05

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

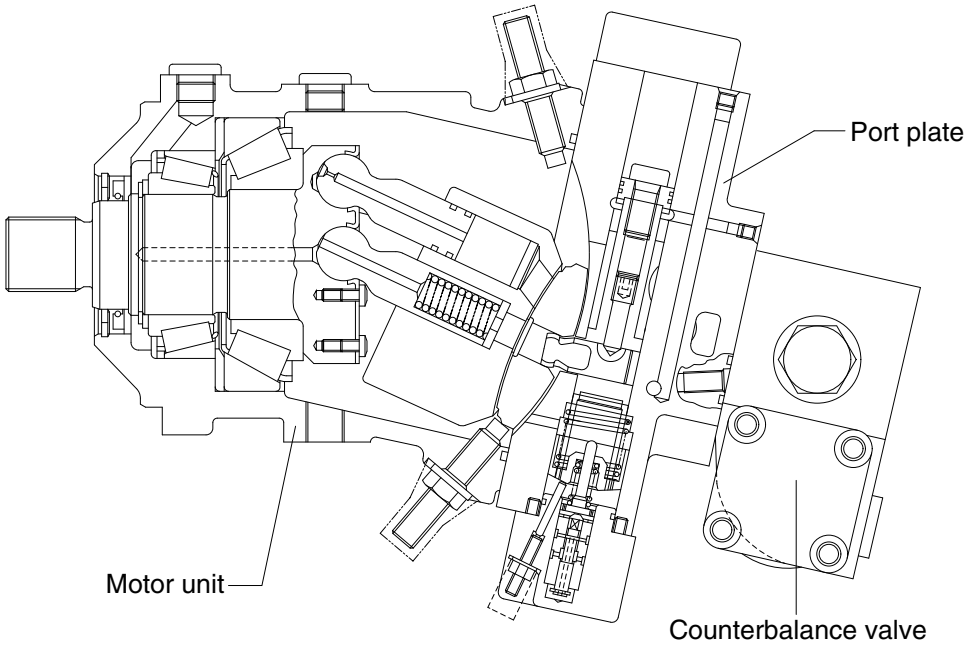
The max swivel angle is 25°, the min swivel angle is 0°.

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.

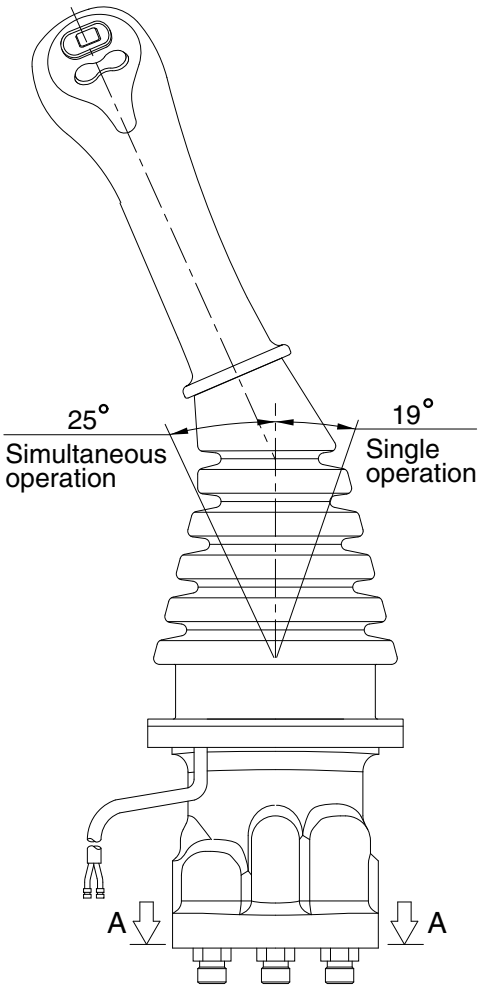
GROUP 5 RCV LEVER

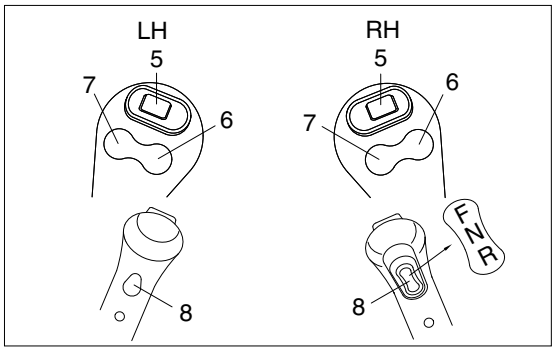
1. STRUCTURE

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.

※ Refer to the parts manual for the types of the RCV lever.

1) TYPE M6

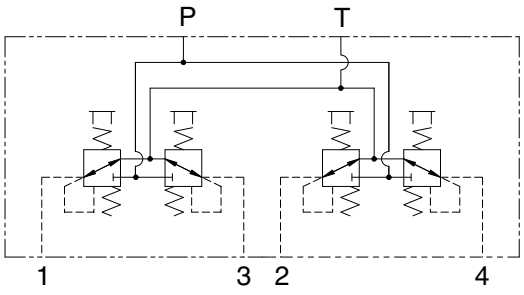




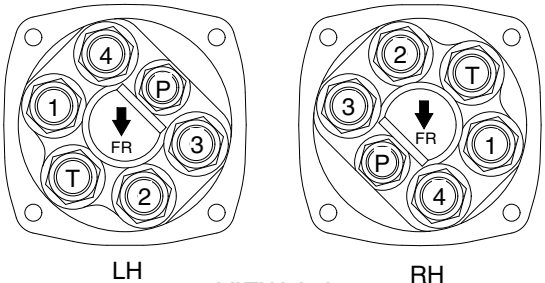
TYPE M6

Switches

Type	No.	LH	RH
M6	5	N.A	Breaker
	6	One touch decel	Quick coupler
	7	Ram lock	Horn
	8	Power max	FNR switch



Hydraulic circuit



LH RH

VIEW A-A

Pilot ports

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

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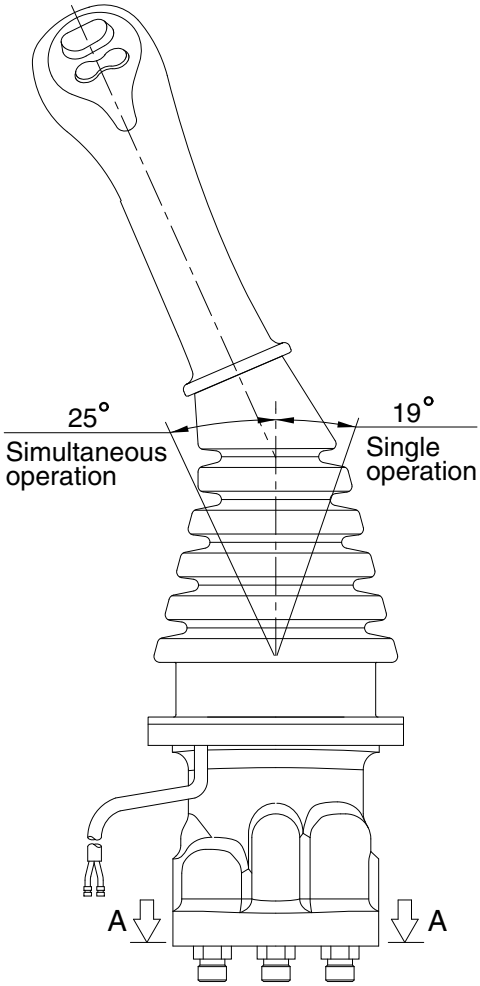
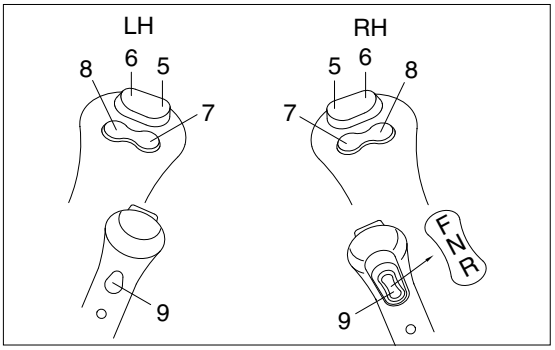
2) TYPE M26

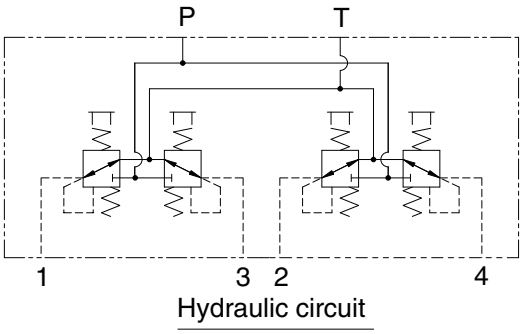




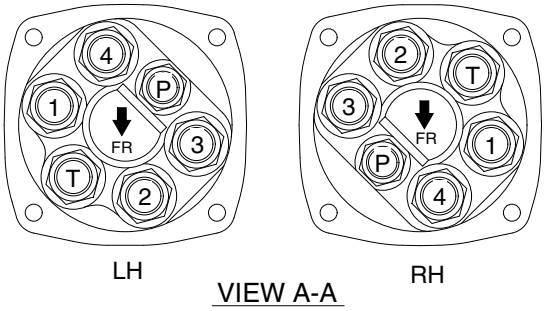
TYPE M26

Switches

Type	No.	LH	RH
M26	5	Rotating-CW	2-way clamp
	6	Rotating-CCW	2-way release
	7	One touch decel	Quick coupler
	8	Ram lock	Horn
	9	Power max	FNR switch



Hydraulic circuit



LH RH

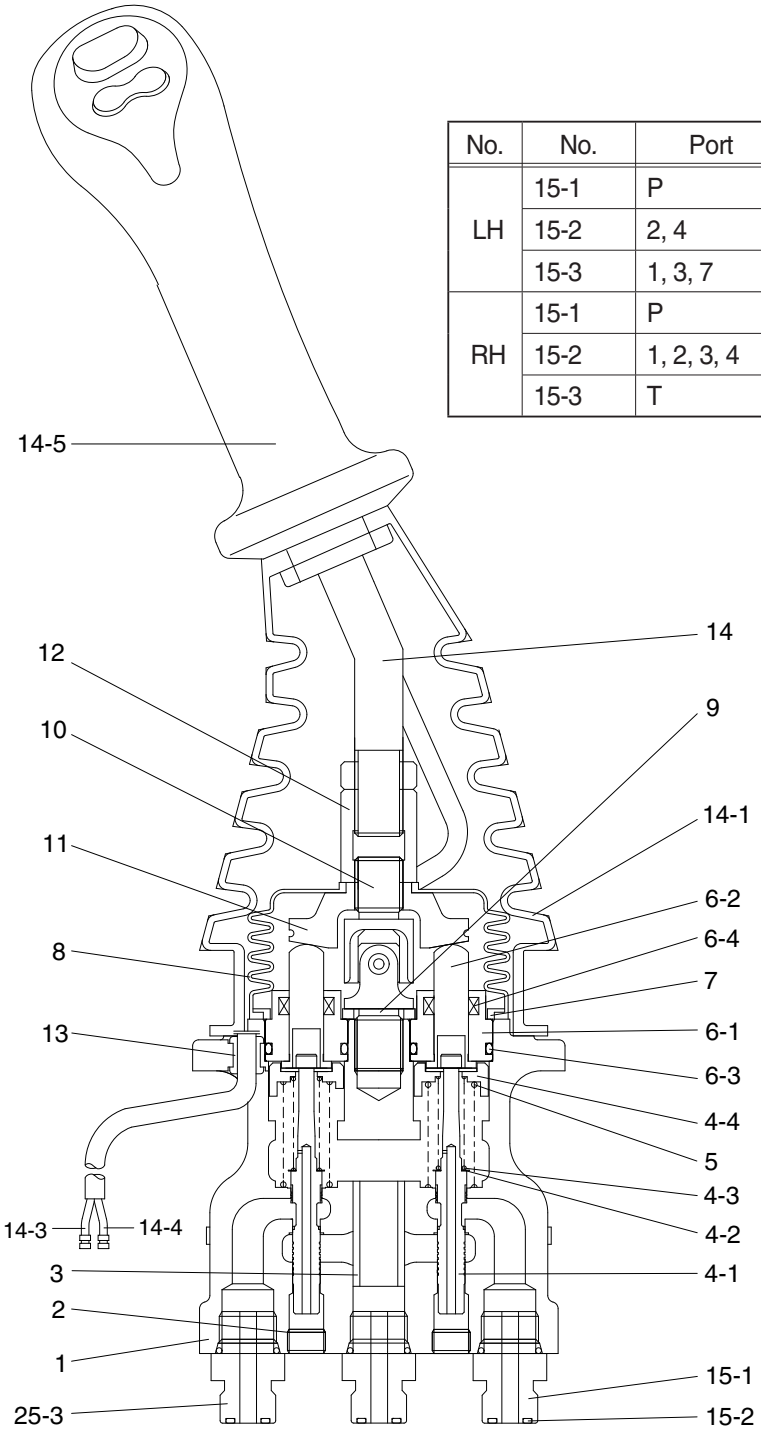
VIEW A-A

Pilot ports

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

210WA2RL02

3) CROSS SECTION



No.	No.	Port
LH	15-1	P
	15-2	2, 4
	15-3	1, 3, 7
RH	15-1	P
	15-2	1, 2, 3, 4
	15-3	T

1 Case
2 Plug
3 Bushing
4-1 Spool
4-2 Shim
4-3 Spring
4-4 Spring seat
5 Spring
6-1 Plug
6-2 Push rod
6-3 O-ring
6-4 Rod seal
7 Spacer
8 Boot
9 Spacer
10 Joint Assy
11 Swash plate
12 Adjusting nut
13 Bushing
14-1 Boot
14-2 Spring pin
14-3 Housing
14-4 Housing
14-5 Handle
15-1 Filter
15-2 Connector
15-3 Connector

140WA2RL06

Item numbers are based on the type M6.

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 (4-1), spring (4-3) for setting secondary pressure, return spring (5), spring seat (4-4) and shim (4-2). 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 (6-2) 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.

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

Item numbers are based on the type M6.

The functions of the spool (4-1) 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 (4-3) works on this spool to determine the output pressure.

The change the deflection of this spring, the push rod (6-2) is inserted and can slide in the plug (6-1).

For the purpose of changing the displacement of the push rod through the swash plate (11) and adjusting nut (12) are provided the handle (14-5) that can be tilted in any direction around the fulcrum of the universal joint (10) center.

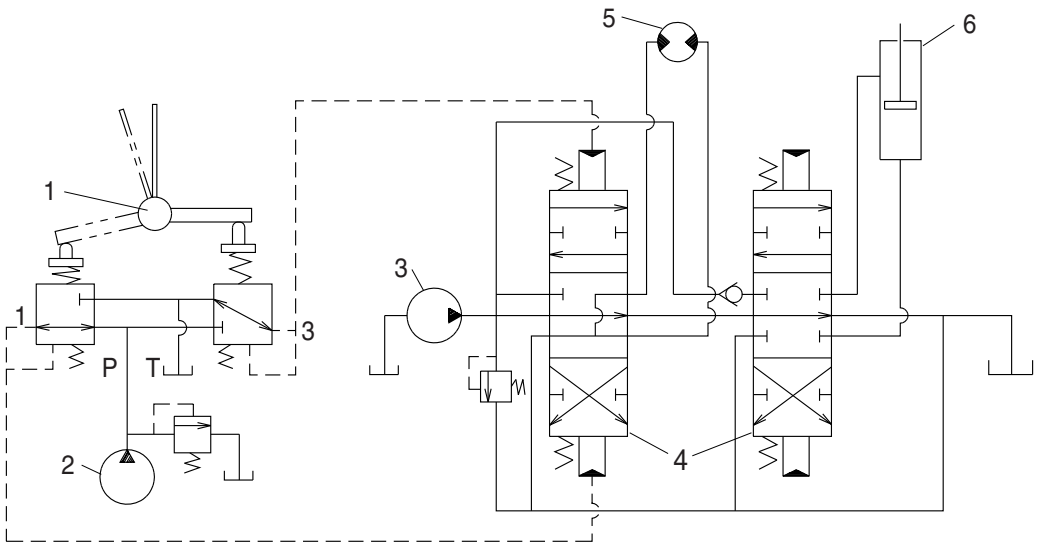
The spring (5) works on the case (1) and spring seat (4-4) and tries to return the push rod (6-2) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

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.

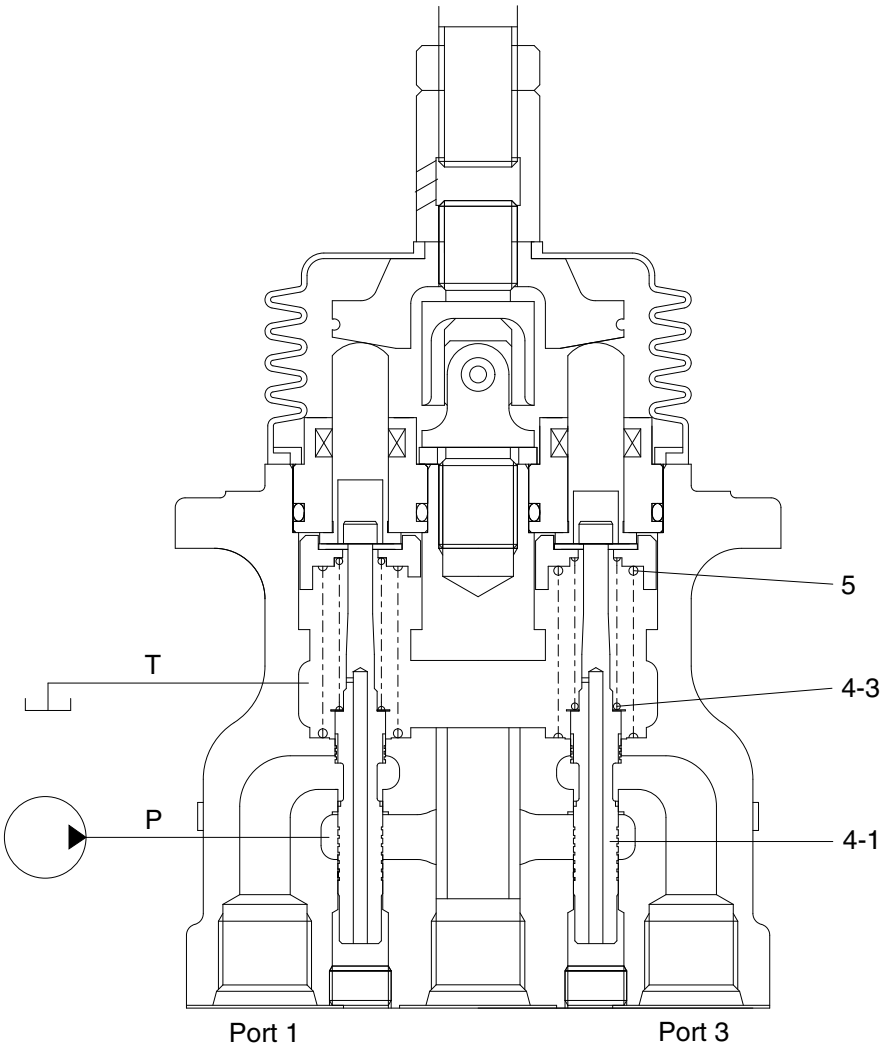
The diagram shown below is the typical application example of the pilot valve.



2-70

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

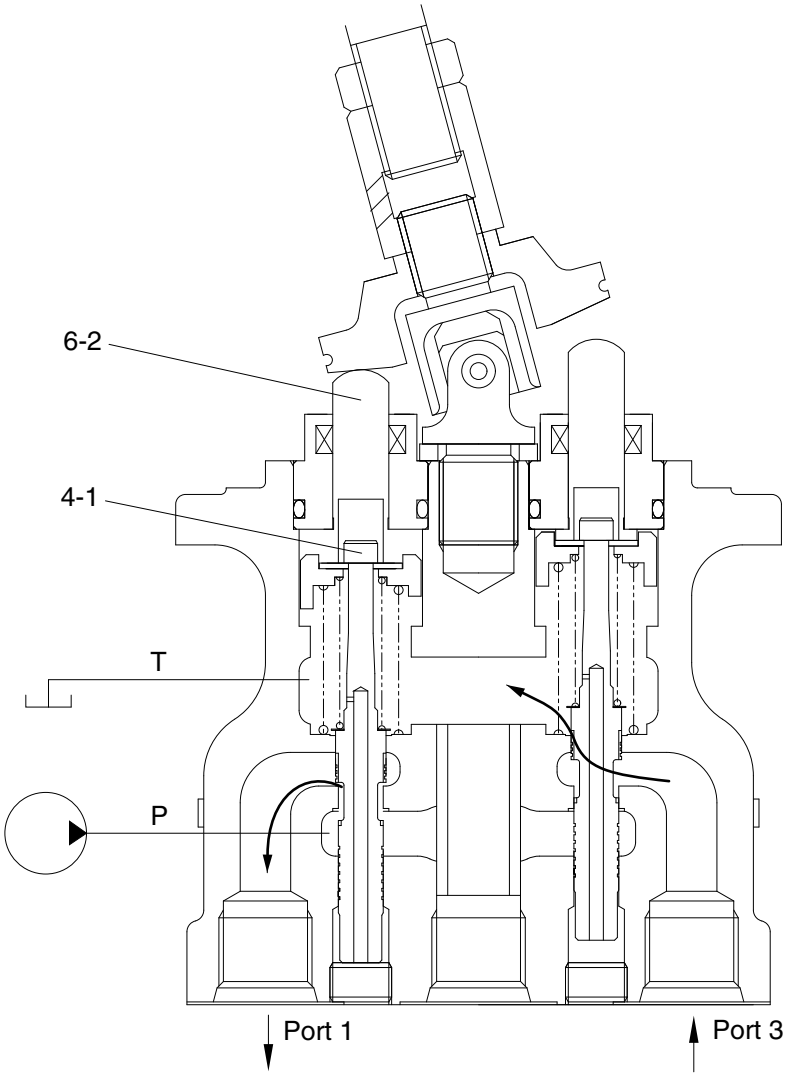
(1) Case where handle is in neutral position



140WAL2RL06

The force of the spring (4-3) that determines the output pressure of the pilot valve is not applied to the spool (4-1). Therefore, the spool is pushed up by the spring (5) 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



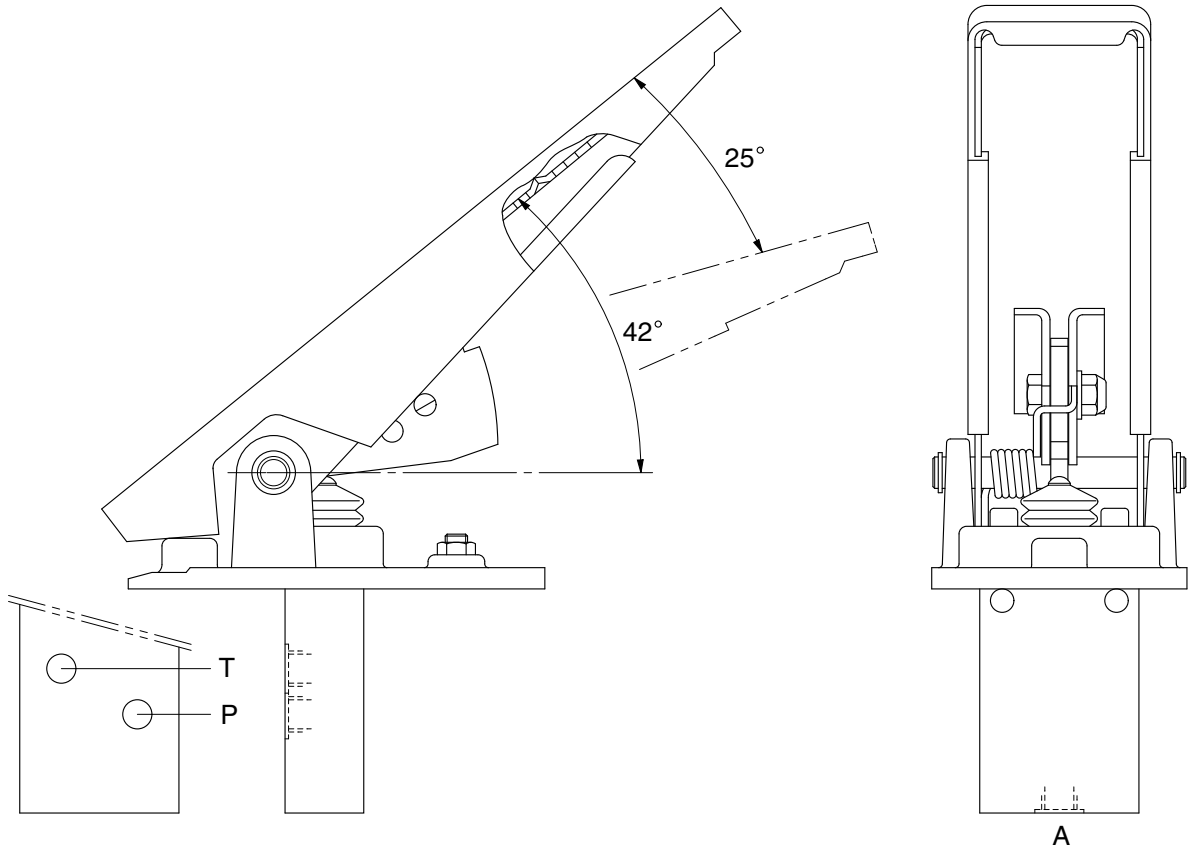
140WAL2RL07

When the push rod (6-2) is stroked, the spool (4-1) moves downwards.
Then port P is connected with port (1) and the oil supplied from the brake 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.



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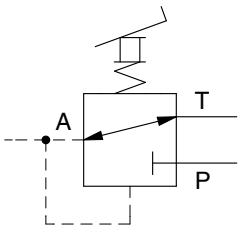


Hydraulic circuit

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

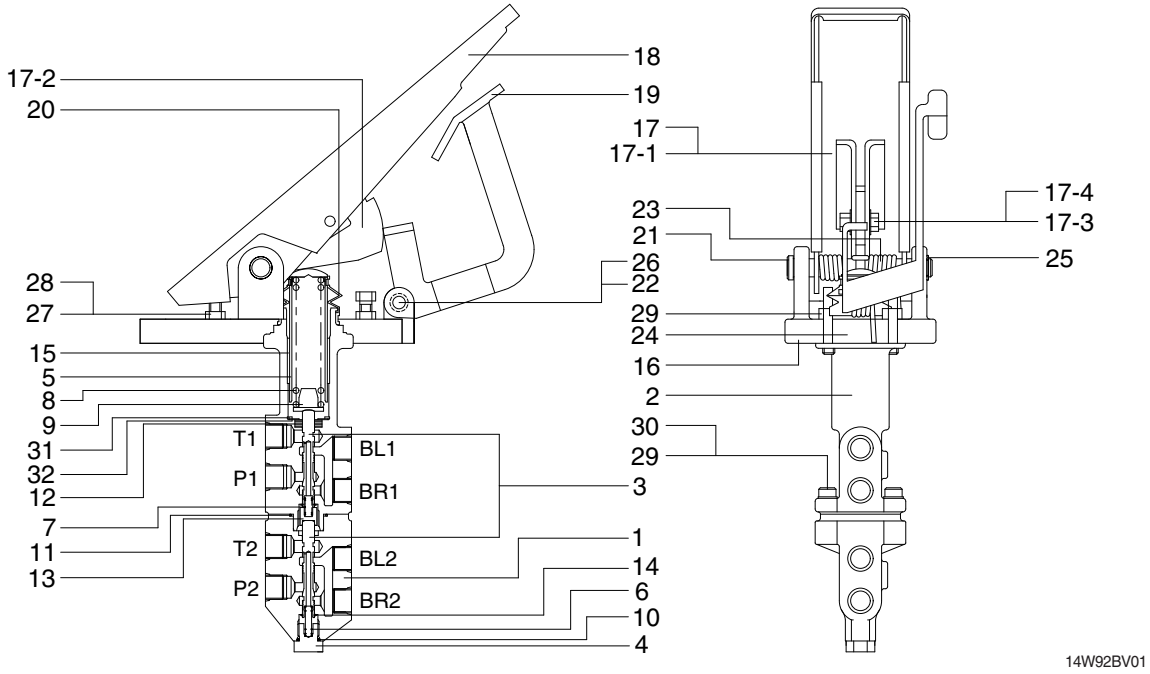
17032RP01(2)

GROUP 7 BRAKE DEVICE

■ BRAKE VALVE

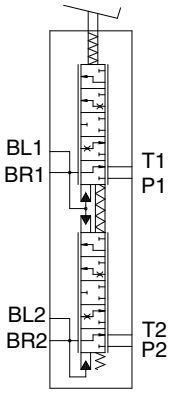
1. STRUCTURE

The body has the oil inlet port P1, P2 (primary pressure), and the oil outlet port T1, T2 (tank). In addition the secondary pressure is taken out through brake cylinder port BR1 (front axle) and BR2 (rear axle).



14W92BV01

1	Lower body	13	Spring guide	21	Lock pin 1
2	Upper body	14	Snap ring	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	Retainer ring
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	Plain washer	29	Socket head bolt
10	O-ring	18	Pedal cover	30	Spring washer
11	O-ring	19	Latch	31	Plate washer
12	Oil seal	20	Rubber cover	32	Retainer ring



14W72BV02

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

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 main spring (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 main spring (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 (17-1) 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 socket bolt (29) on pedal plate (16) below pedal assy (17) is used to limit the braking pressure.

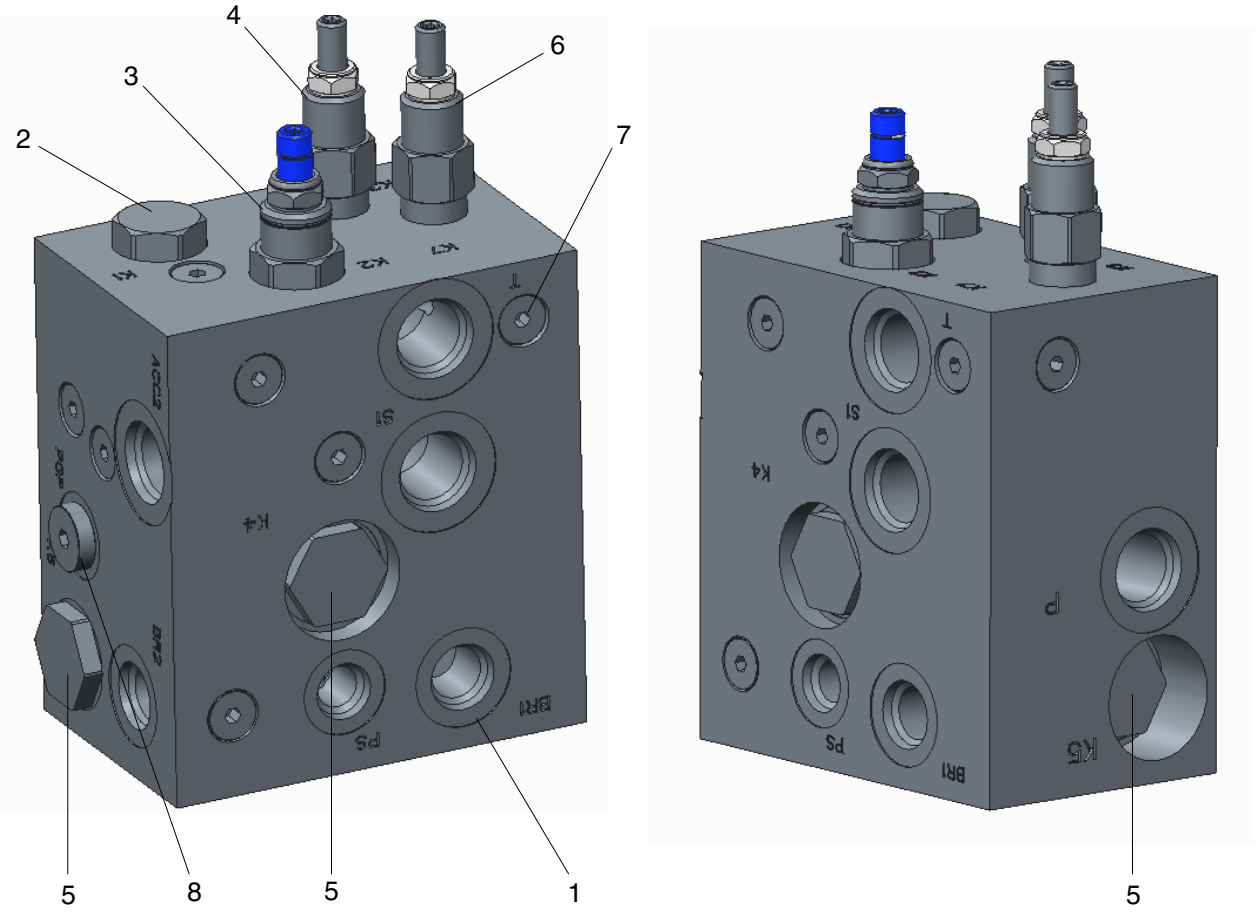
6) FAILURE OF A CIRCUIT

In the event of the lower circuit failing, the upper circuit will remain operational. Main spring (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 main spring (8) and spool (3).

■ BRAKE SUPPLY VALVE

1. STRUCTURE

The brake supply valve consists of the following parts.



Item	Part name	Size	Qty	Remark
1	Manifold block	-	1	-
2	Logic valve	-	1	K1 port
3	Unloading valve	-	1	K2 port
4	Relief valve	-	1	K3 port
5	Check valve	-	3	K4, 5, 6 ports
6	Relief valve	-	1	K7 port
7	Plug	PF 1/8"	9	-
8	Plug	PF 1/4"	1	PGP port

2. FUNCTION

1) ASSEMBLY

This brake supply valve has the following functions.

(1) Brake pump overload prevention function - energy saving function

(2) Safety device function of brake braking system

(3) Brake braking pressure supply function

2) FUNCTION FOR EACH VALVE

Symbol	Valve name	Description	Remark
K1	Logic valve	This valve is operated by remote control according to the set pressure value of the unloading valve (K2).	
K2	Unloading valve	This valve switches the operation of the pump to a no-load state by bypassing the pressure and flow rate discharged from the pump to the tank when a load occurs in the braking system.	Set pressure - Cut-in set value 112±5 kgf/cm^2 - Cut-out set value 142±5 kgf/cm^2
K3	Relief valve	This valve functions to maintain the pressure of the flow flowing into the “S1” port at the set pressure.	Set pressure 8 l/min @ 32+2 kgf/cm^2
K4	Check valve	This valve prevents reverse flow against the pressure and flow rate formed in the braking system of the brake.	
K5, K6	Check valve	This valve prevents the loss of pressure and flow accumulated in the accumulators installed in the ACC1 and ACC2 ports. In other words, it prevents the back flow of pressure and flow accumulated in the accumulator.	
K7	Relief valve	This valve functions as a safety device to prevent breakage or damage to the system when overload or abnormal pressure occurs within the brake system.	Set pressure 30 l/min @ 173+2 kgf/cm^2

3) DETAIL FUNCTION AND USAGEE

(1) Brake pump overload prevention function - energy saving

① The pressure and flow discharged from the brake pump are supplied to the brake device through the brake supply valve.

② When the engine rotation (rpm) of the machine increases, the rotation of the brake pump increases, increasing the discharge pressure and flow rate.

③ This increased pressure and flow rate causes loss of pump power source and fluid energy. This valve prevents energy loss by reducing power source and fluid energy loss.

④ When the braking system pressure of the brake exceeds the set pressure value of the unloading valve (K2), the pilot spool of the unloading valve is activated and the flow formed in the drain line of the logic valve (K1) is bypassed to the “T” line.

⑤ Therefore, when the flow rate of the drain line of the logic valve is bypassed, the spool of the logic valve is pushed and the pressure and flow rate discharged from the brake pump are bypassed to the tank, thereby converting the pump's operating state to a no-load state.

⑥ Also, when the brake system pressure falls below the set pressure value of the unloading valve, the pilot spool of the unloading valve is closed.

⑦ As the pilot spool of the unloading valve closes, a flow rate is formed in the drain line of the logic valve, and the spool of the logic valve also closes. When the spool of this logic valve is closed, the pressure and flow discharged from the pump are supplied to the brake braking device.

⑧ The discharge pressure and flow rate of the pump are called cut-out when bypassed to the tank, and cut-in when supplied to the brake device.

⑨ When this valve is shipped, the unloading valve setting value is as follows.

Unit : kgf/cm^2

Flow rate	Reference value		Set value	
	Cut-in	Cut-off	Cut-in	Cut-off
30 l/min	112±5	142±5	112±5	142±5

(2) Safety device function of brake braking device

① If an overload occurs within the brake system due to an external force, an abnormal pressure rise may occur, which may cause damage or breakage to various brake systems.

② To prevent such machine problems, a relief valve (K7) is installed.

③ If the system pressure within the brake system exceeds the set pressure value of the relief valve, the relief valve operates to maintain the set pressure value of the relief valve.

④ In other words, the pressure above the set pressure value of the relief valve is returned to the tank to relieve the abnormal rise in pressure caused by overload within the system, thereby preventing damage and breakage of various devices within the system.

⑤ When this valve is shipped, the relief valve setting value is as follows.

Flow rate	Reference value	Set value	Remark
30 l/min	173±2 kgf/cm^2	173±2 kgf/cm^2	-

(3) Brake braking pressure supply function

① When the brake pedal is pressed, the pressure accumulated in the accumulator falls below the cut-in set pressure value of the unloading valve.
At this time, the pilot spool of the unloading valve is closed.

② As the pilot spool of the unloading valve closes, flow is formed in the drain line of the logic valve and the spool of the logic valve also closes.

③ When the spool of this logic valve is closed, the pressure and flow discharged from the pump are supplied to the accumulator and brake device.

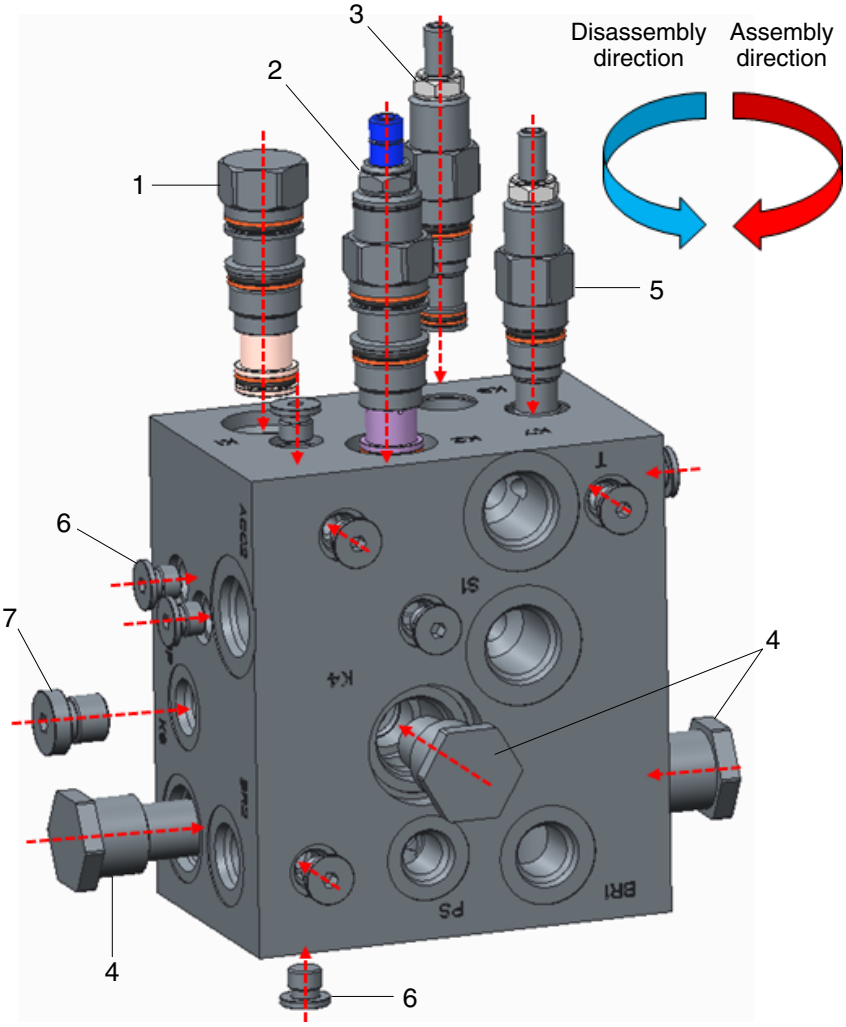
④ Also, when the brake pressure is formed and exceeds the cut-out pressure value of the unloading valve, the logic valve and unloading valve operate to bypass the pressure and flow rate discharged from the pump to the tank, thereby maintaining the no-load start of the pump and prevents rise the pressure within the brake system.

⑤ Check valves (K5, K6) separate each brake circuit (front, rear) so that they do not affect the opposite brake and maintain each brake function.

3. ASSEMBLY DRAWING AND WORK TOOLS

See below for assembly, disassembly, and work tools for the brake supply valve.

※ **The designated tools and tightening torque must be observed.**



140WA2BSV02

No.	Part name	Screw spec	Torque (kg · cm)	Assembly tool
1	Logic valve	M20×1.5	480	Torque wrench/7/8" hex socket
2	Unloading valve	M20×1.5	480	Torque wrench/7/8" hex socket
3	Relief valve	M16×1.5	350	Torque wrench/3/4" hex socket
4 (3ea)	Check valve	UNF7/8-14"	400	Torque wrench/1" hex socket
5	Relief valve	M16×1.5	350	Torque wrench/3/4" hex socket
6 (9ea)	Plug	PF 1/8	100	Torque wrench/4 mm wrench socket
7	Plug	PF 1/4	300	Torque wrench/6 mm wrench socket

4. PRECAUTION WHEN DISASSEMBLING AND ASSEMBLING

1) Before assembling and disassembling, clean the surrounding area thoroughly to ensure there are no contaminants.

2) When disassembling and assembling parts, be sure to use the assembly torque and tools specified on the previous page.

3) Refer to the picture on the previous page for assembly and disassembly directions.

4) When reassembling after disassembly and inspection, be careful to prevent contaminants from entering the valve.

5) When disassembling and assembling all parts, be sure to wash them and then reassemble them.

5. INSPECTION ITEMS AND DETAILS FOR EACH PART WHEN AN ERROR OCCURS

Problem	Inspection item	Inspection detail and method	Repair
Brake pressure is not supplied	1. Check whether foreign substances and contaminants have entered the logic valve.	1. Disassemble the logic valve and check whether contaminants such as foreign matter or sludge have entered between the spool and body.	Removing foreign substances, cleaning, and assembling
	2. Check whether foreign substances and contaminants enter the relief valve.	2. Disassemble the relief valve and check whether contaminants such as foreign matter or sludge have entered between the poppet and body.	Removing foreign substances, cleaning, and assembling
	3. Check the discharge amount and discharge pressure of the brake pump	3. Install a pressure gauge on the “PGP” port to check the pressure value discharged from the brake pump. - Check at engine low speed - Check with the unloading valve fully closed. - Reference set value; 173±2 kgf/cm^2	Repair or replacement
Brake warning lamp comes ON	1. Check the unloading valve cut-in pressure value	1. Check the cut-in pressure value of the unloading valve (K2) - Install a pressure gauge on the “PGP” port to measure the pressure value at cut-in. - Reference set value; 112±5 kgf/cm^2	Readjust pressure value
	2. Check pressure switch operation	2. If the pressure measurement value in item 1 above is normal but the brake warning lamp continues to come on, check the contact status of the pressure switch.	Repair or replacement
	3. Check the degree of contamination of the brake filter element.	3. Check the element screen in the brake filter for contamination by foreign substances.	Cleaning or replacement
	4. Check whether foreign substances and contaminants are entering the logic valve and relief valve.	4. Refer to paragraphs 1 and 2 of “Brake pressure is not supplied” above.	Removing foreign substances, cleaning, and assembling

Problem	Inspection item	Inspection detail and method	Repair
The cycle of cut-in and cut-out is fast	1. Check whether the O-ring and back-up ring installed on each check valve are damaged.	1. After disassembling each check valve (K4, K5, K6), check whether the O-ring and back-up ring are damaged.	Replace check valve
	2. Check foot brake valve leakage	2. Remove the hydraulic hose installed at the outlet port (BR1, BR2) of the foot brake valve and check the amount of oil leakage. - Check without pressing the brake pedal-Neutral state - Reference set value; Refer to foot brake valve leakage management standards	Replace foot brake valve

6. CHECK BRAKE PRESSURE IN CASE OF ABNORMALITY

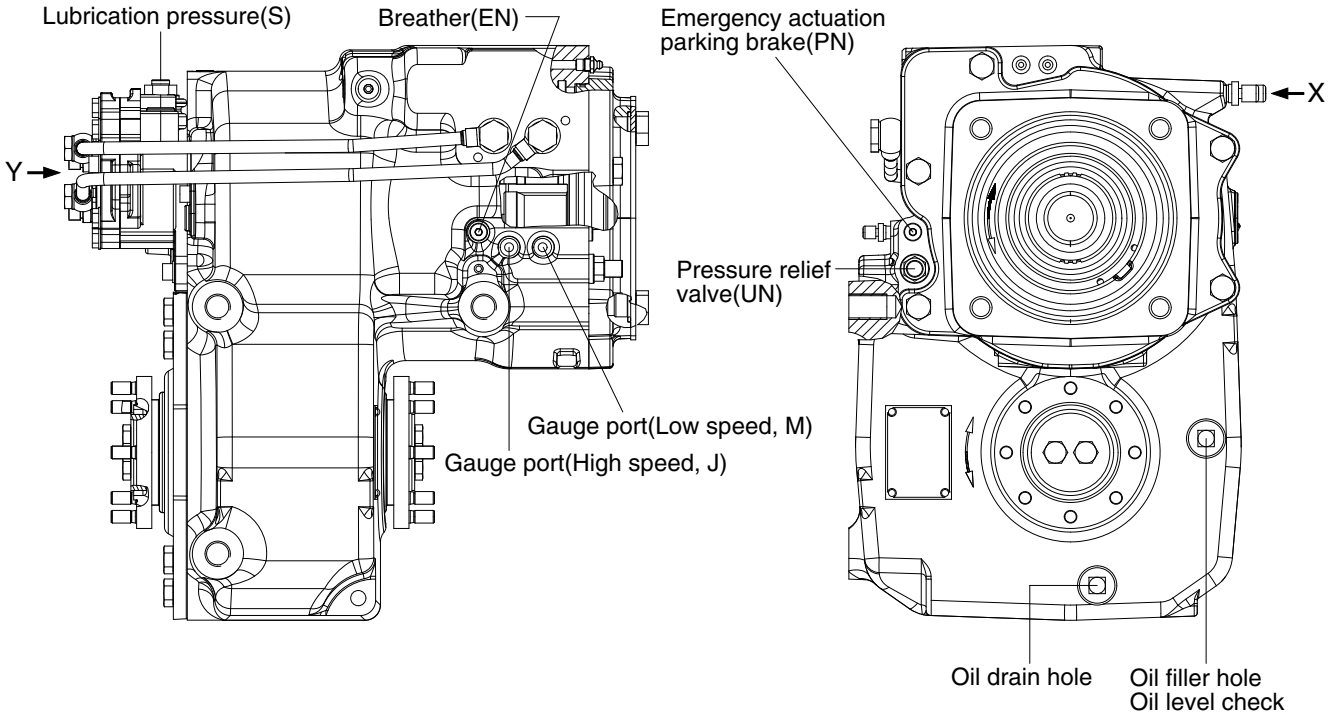
1) INSTALLATION OF PRESSURE GAUAGE

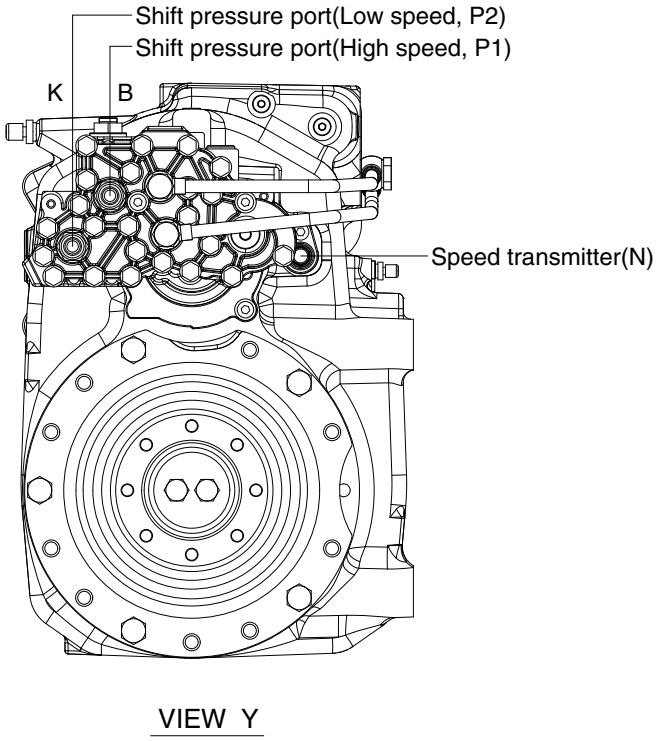
Pressure gauge installation port	Screw	Remark
PGP	PF1/4" O-ring boss	-

2) CHECK PRESSURE VALUE DURING INSPECTION

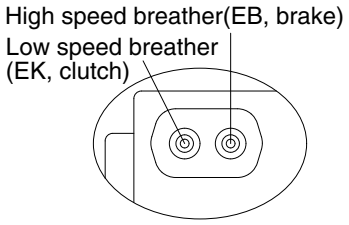
Pressure value confirmation port	Unloading valve operating status	
	Cut-in	Cut-off
PGP	112±5 kgf/cm^2	142±5 kgf/cm^2

1. STRUCTURE





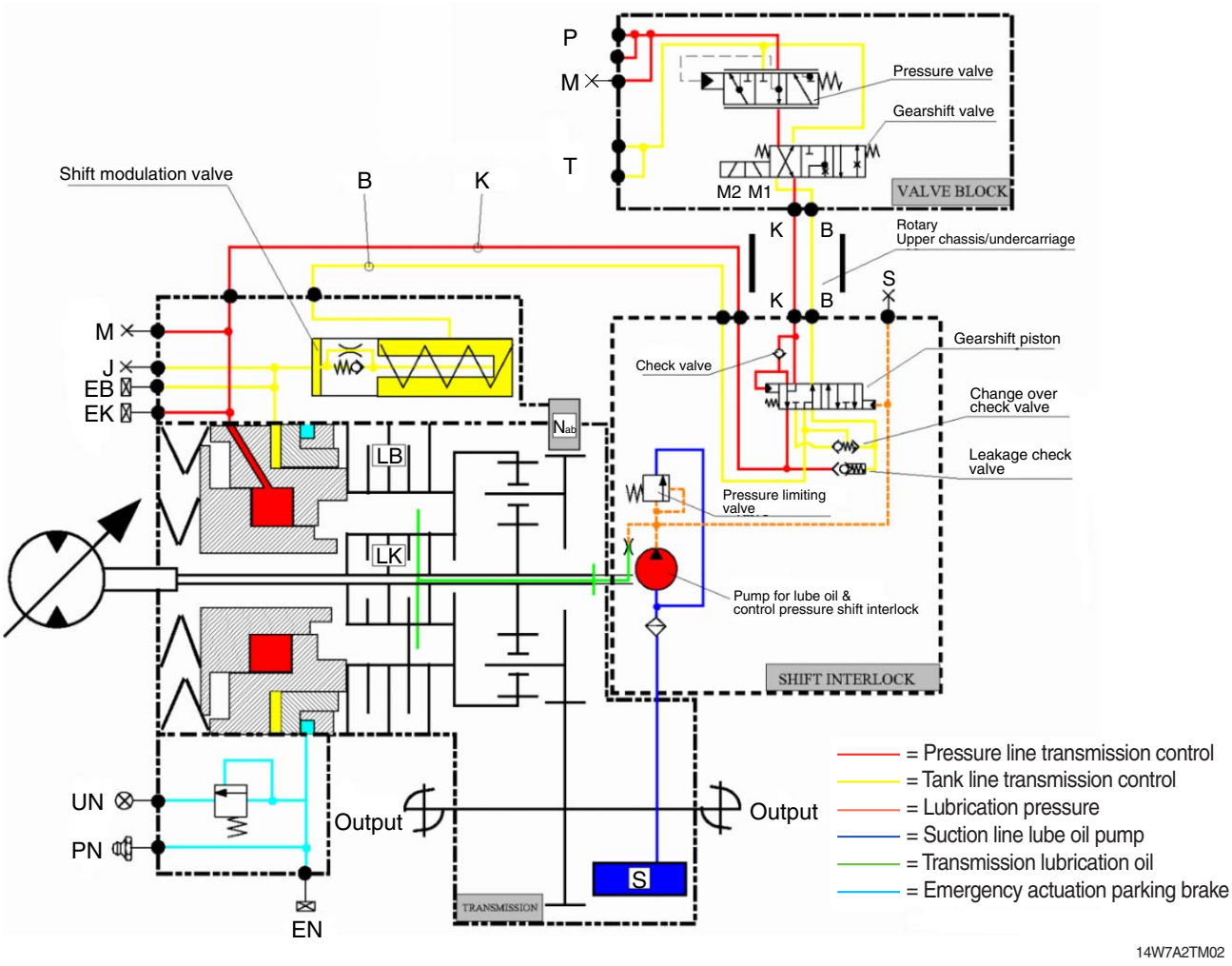
VIEW Y



VIEW X

180W9A2TM01

2. TRANSMISSION DIAGRAM



Measuring points-Transmission/Shift interlock :
J : High speed (brake)
M : Low speed (clutch)
S : Lubrication pressure

Connections-Transmission/Shift interlock :
B : Brake
K : Clutch
PN : Emergency actuation parking brake

Measuring points-Valve block :
M : System pressure transmission control

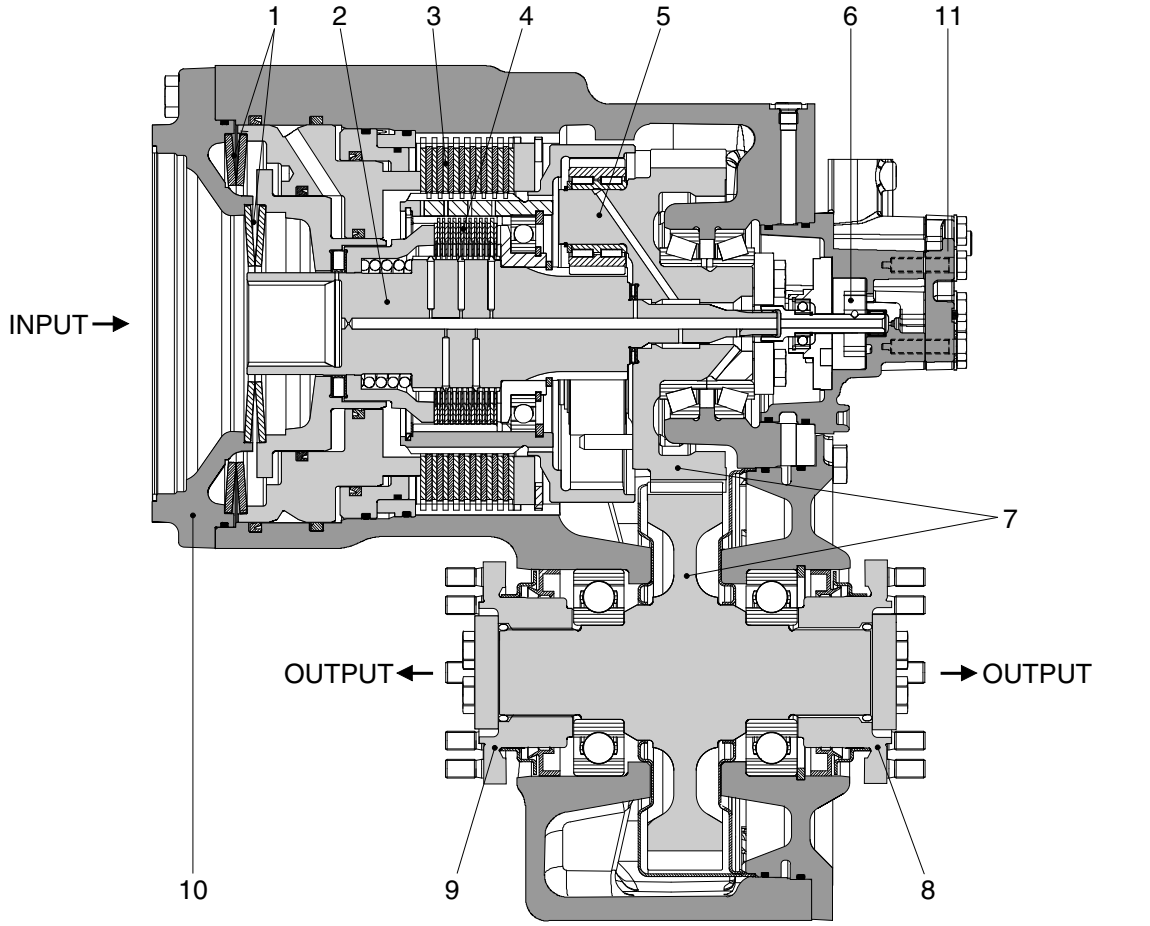
Connections-Valve block :
P : System pressure transmission control
T : Tank
B : Brake
K : Clutch

Solenoid valves-valve block :
M1 : Solenoid valve (low speed)
M2 : Solenoid valve (high speed)

Port	Name	Size	Port	Name	Size
P1 (B)	Shift pressure, High speed	M16×1.5	M	Gauge port, Low speed	M10×1.0
P2 (K)	Shift pressure, Low speed	M16×1.5	S	Lubrication pressure port	M10×1.0
J	Gauge port, High speed	M10×1.0	PN	Parking brake lubricant	Grease nipple

3. OPERATION OF TRANSMISSION

1) DESCRIPTION



1	Cup spring	5	Planetary drive	9	Output flange-Front axle
2	Input shaft	6	Lub oil pump	10	Travel motor attachment
3	Disk brake	7	Spur gear drive	11	Shift interlock
4	Disk clutch	8	Output flange-Rear axle		

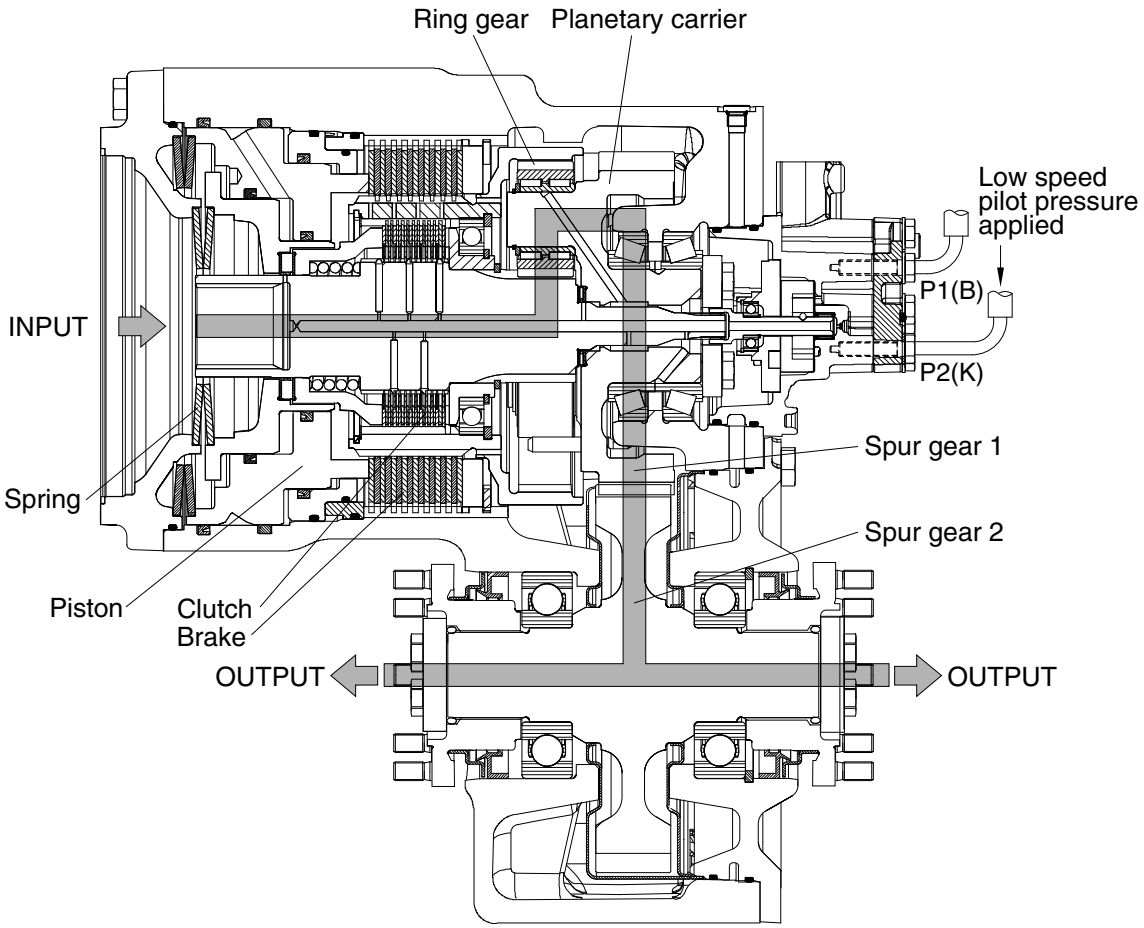
Coaxially-mounted variable displacement travel motor (10) with specific displacement 107 cm^3/rev.

The 2-speed powershift transmission comprises a planetary drive (5), a 2 shaft spur gear drive (7) with output flanges to front and rear axle.

The powershift mechanism for the planet drive comprises a rotating multi-disk clutch (4) underneath a multi-disk brake (3) rigidly connected to the housing. Both are closed by spring pressure (2) and released hydraulically.

The shift interlock (11) prevents downshifts at high machine speeds and thus prevents over-rotation of the travel motor. If the low speed gear is selected while the high speed gear is engaged and input speed is above approx. 1000 rpm, the low speed gear shift is inhibited and only performed if input speed is below this limit. With higher viscosity oil (cold starting), the downshift is performed at a lower input speed. Upshifts are always possible.The speed-dependent interlock is effective in both directions. It does not prevent the possibility of over-rotation when the machine is coasting. For this, a drive brake valve should be fitted to the travel motor.

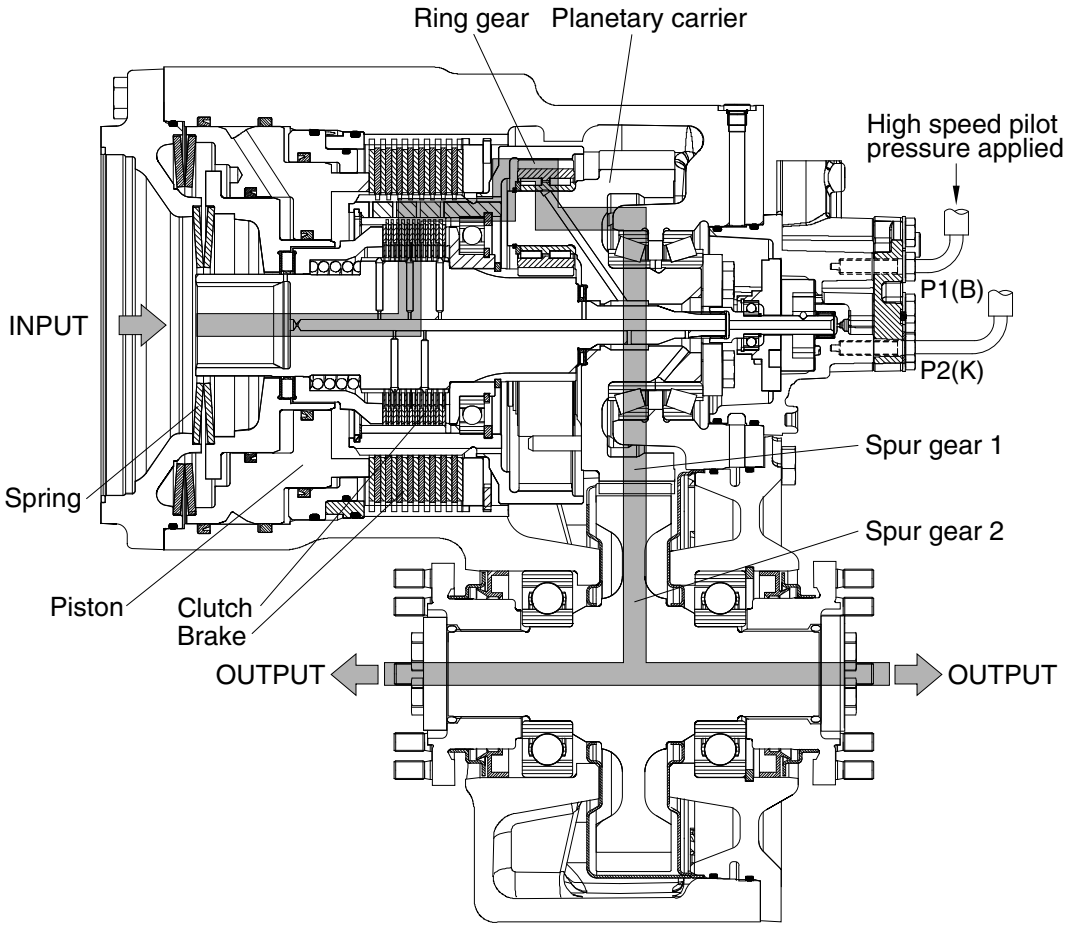
2) LOW SPEED (forward & reverse)



14W7A2TM04

In low speed operation, the internal gear of the planetary drive is backing upon the closed, case-rigid brake. In this speed the piston chamber of the brake is unpressurized, so that the elastic force and additionally the hydraulic pressure of the clutch piston is acting upon the disk pack.
At this time the clutch is open, i.e. the hydraulic released.

3) HIGH SPEED (forward & reverse)



14W7A2TM05

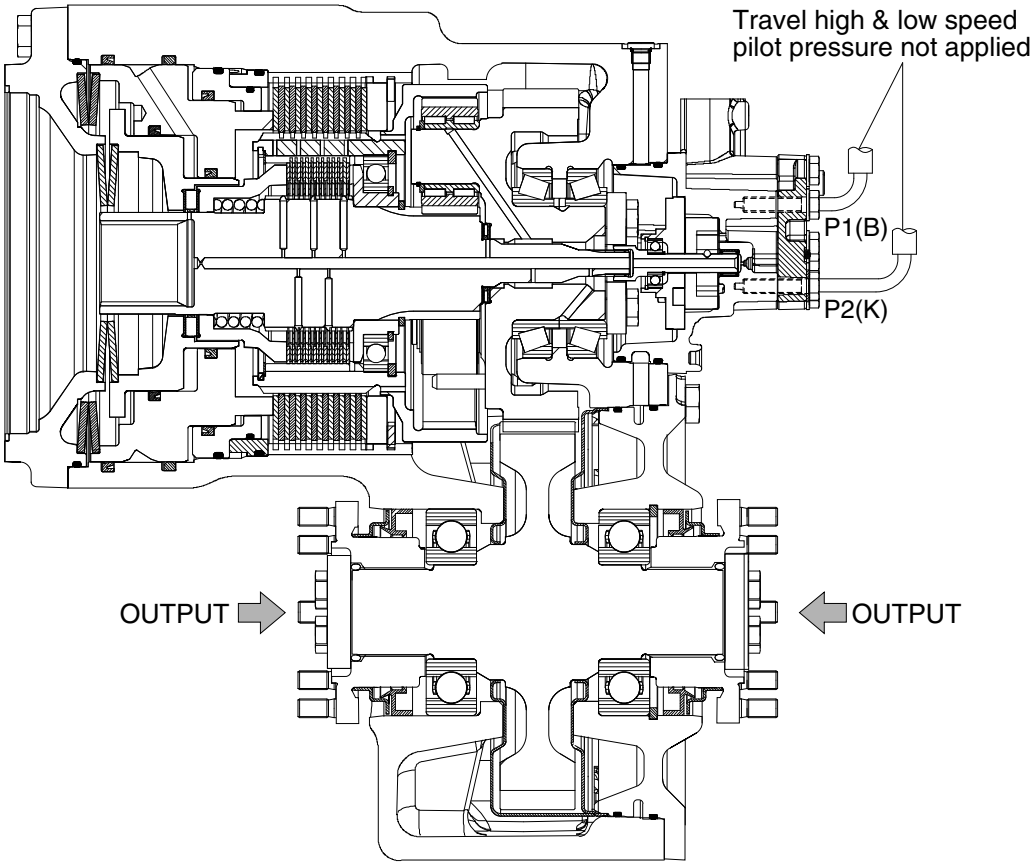
In high speed operation, the clutch is held closed under spring pressure and the brake is hydraulically opened.

When a gear shift occurs-for example from high speed to low speed gear- the oil from the brake piston space is fed back to the tank through a restrictor (change over check valve) due to the spring pressure acting on the brake piston. At the same time the clutch is filled with oil and opened. Required oil flow is necessary for the transmission control to ensure the clutch is open before the brake begins to transmit torque.

A shift modulation valve is also integrated in the transmission. This modulates the pressure sequence at the brake during a upshift in order to achieve good shift quality.

The gear shift equipment also has the function of a parking brake. When the brake is operated-for example with high speed gear engaged-the clutch is closed and is statically loaded.

4) BRAKES



14W7A2TM06

When the travel high/low speed pilot pressure is not applied in the piston space, the piston compress against the multi disk pack due to the spring force. Thus the parking brake is engaged.

4. TECHNICAL DATA

1) GENERAL DATA

(1) Max input power : 110 kW

(2) Max input torque : 78.5 kgf · m

(3) Max output speed : 3500 rpm

(4) Hydraulic motor : 140 cm^3/rev

(5) Transmission ratio
Gear step : 4.06
· Low speed gear : 4.87
· High speed gear : 1.20

(6) Shift interlock
Downshift possible at operating temperature with input speed 1000 rpm (downshift point lower when oil temperature cold).

(7) Disconnection device
For towing away machine auxiliary release device for parking brake.

(8) Brake
Parking brake. Necessary brake deceleration by controlled locking of planetary drive. Braking torque depends on opening pressure set at brake valve (13 bar).

(9) Output flange
Bolts for propshaft connection : M10 × 1.0 (class 10.9)

(10) Transmission weight : 135 kg (300 lb)

2) TRANSMISSION CONTROL

Following data are valid for oil temperature 30˚C to 40˚C in hydraulic tank, measured at connections at powershift transmission (see structure and diagram).

(1) Control pressure
① At connection P1 and P2 at Low/High engine speed : 33+1 kgf/cm^2
② Definition of lubricants : API GL-5, SAE 10W-30, 15W-40

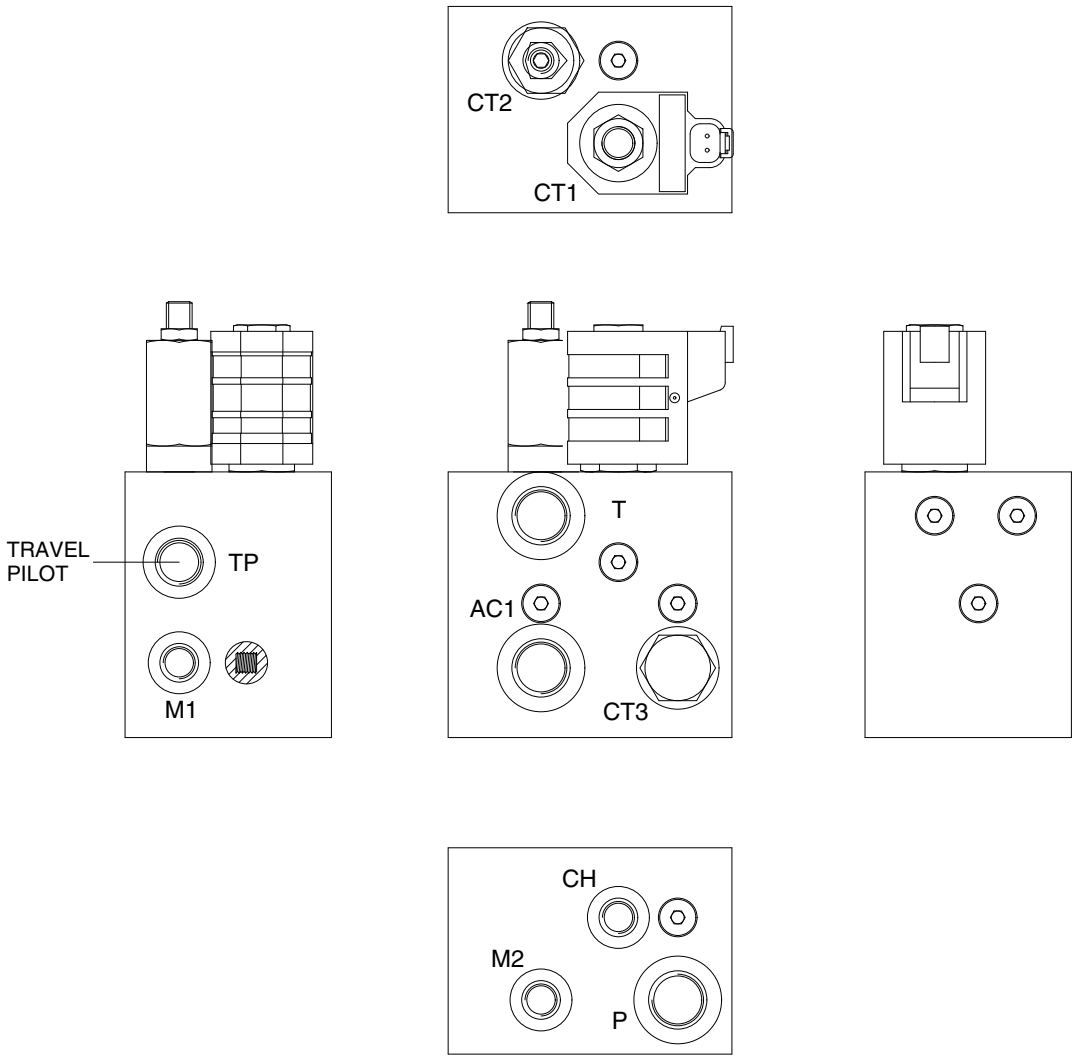
(2) Oil flow
① Min oil flow at 24+1 kgf/cm^2 counter pressure (low engine speed) : 5.5 ℓ/min
② Max oil flow : 25 ℓ/min

(3) Residual pressure
① Max residual pressure in control line to tank connection P1 and P2 : 1.0 kgf/cm^2

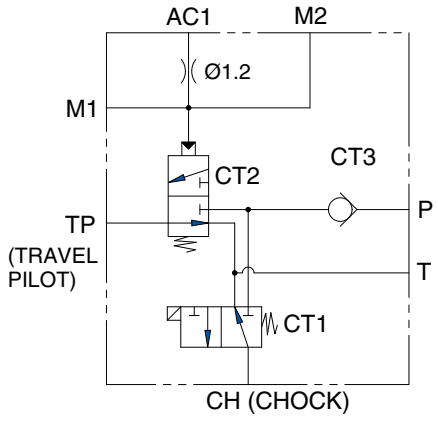
(4) Leakage oil transmission control
① Pressure in input housing connection (E) max : 1.0 kgf/cm^2
② Max oil flow (low speed actuated) : 1 ℓ/min

GROUP 9 TRAVEL CONTROL VALVE

1. STRUCTURE



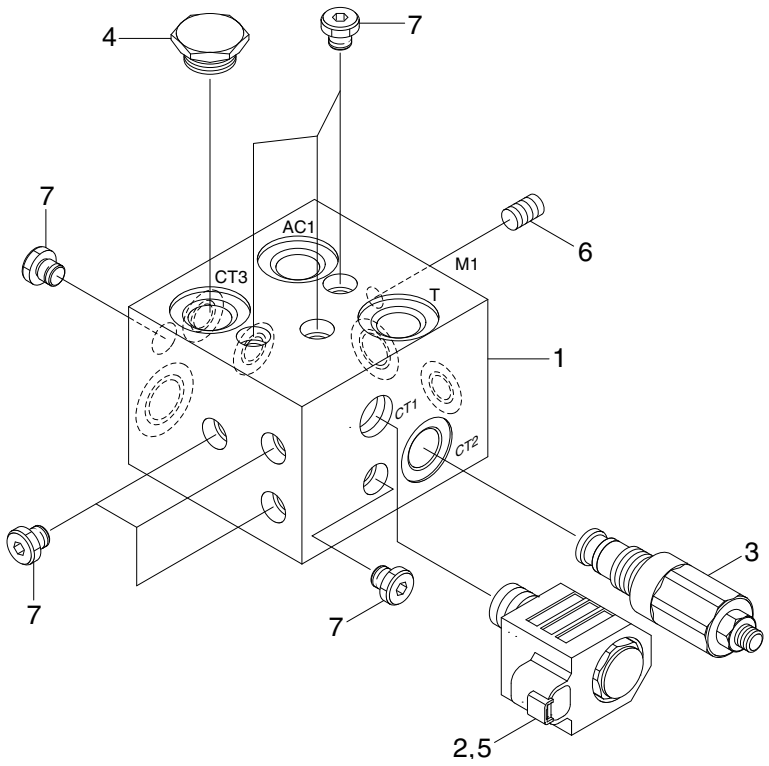
14W7A2TCV02



Hydraulic circuit

Port name	Port size
P, T, AC1	PF 1/2
TP	PF 3/8
M1, M2, CH	PF 1/4

2. COMPONENT

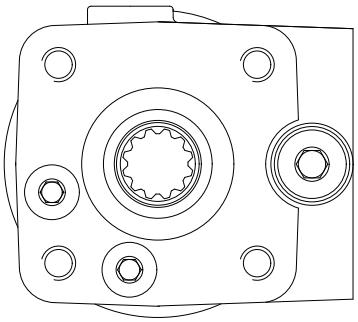


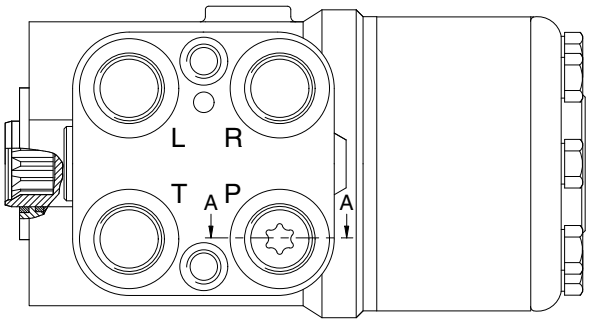
14W7A2TCV01

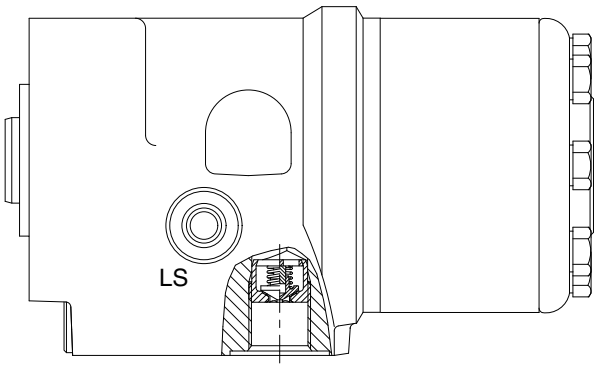
1	Body	5	Coil
2	Solenoid valve	6	Orifice
3	POD valve	7	Plug
4	Check valve		

1. STRUCTURE

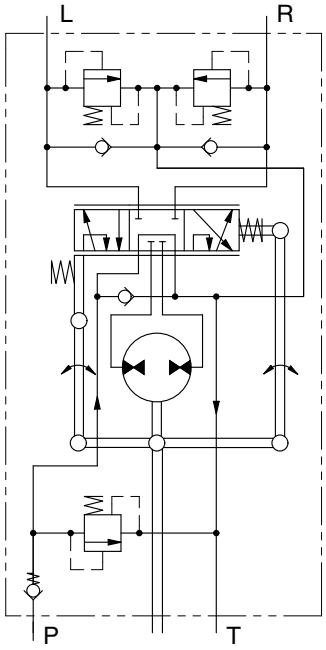
1) TYPE 1 (With PTO)







SECTION A-A

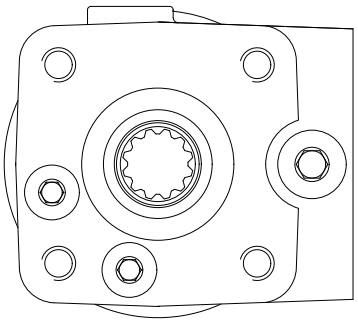


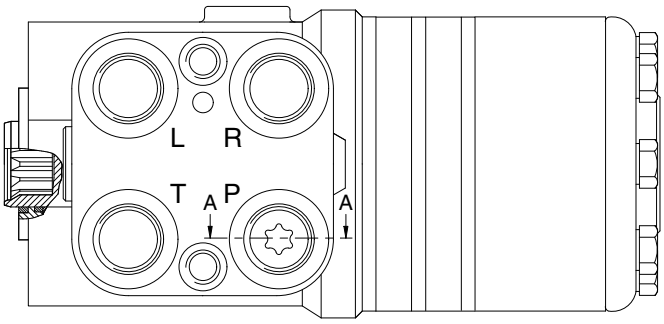
Hydraulic circuit

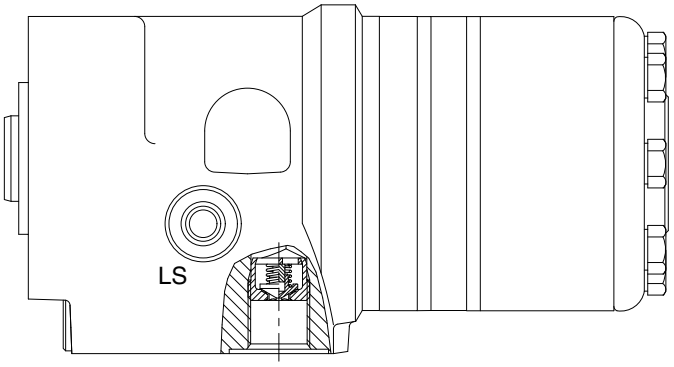
Port	Port name	Port size
L	Left port	3/4-16UNF
R	Right port	
T	Tank port	
P	Pump port	

81E4-0006-E

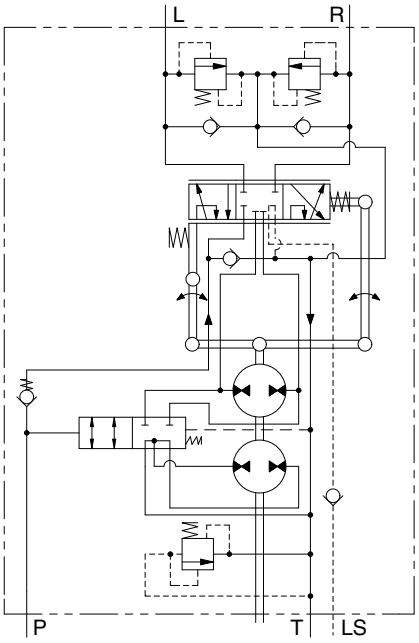
2) TYPE 2 (Without PTO)







SECTION A-A

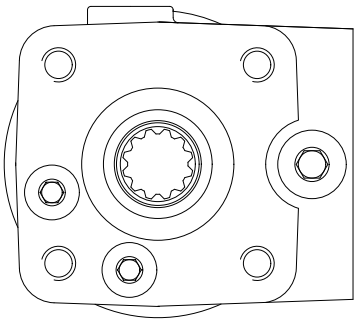


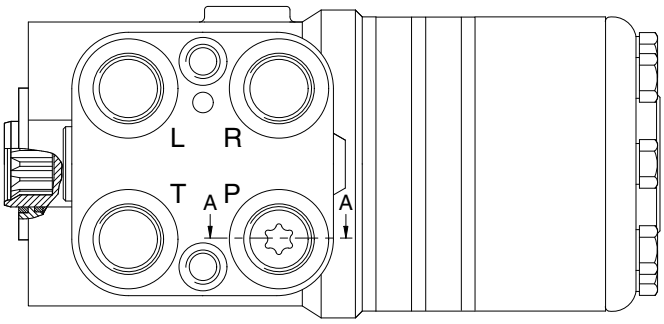
Hydraulic circuit (Standard)

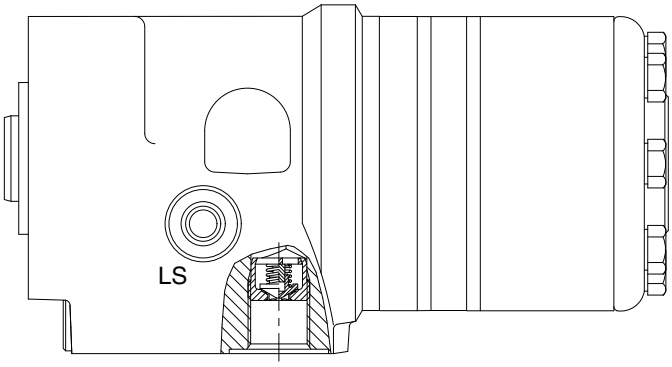
Port	Port name	Port size
L	Left port	3/4-16UNF
R	Right port	
T	Tank port	
P	Pump port	
LS	Load sensing port	7/16-20UNF

81Q6-00030-E

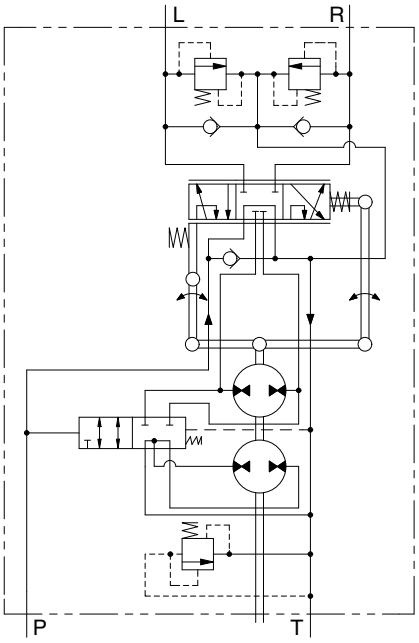
3) TYPE 3 (Emergency steering)







SECTION A-A

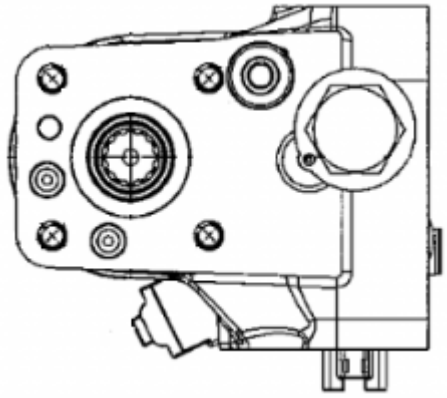


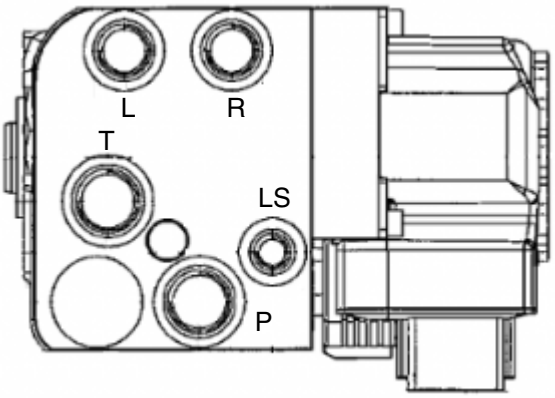
Hydraulic circuit

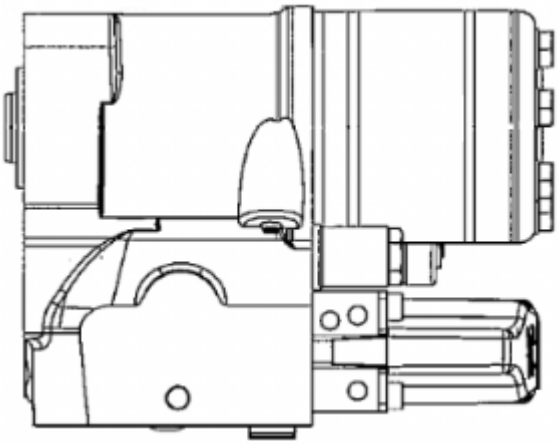
Port	Port name	Port size
L	Left port	3/4-16UNF
R	Right port	
T	Tank port	
P	Pump port	

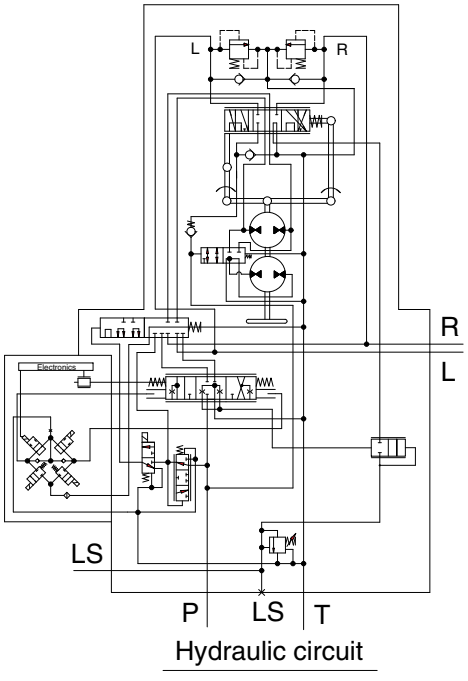
81Q6-00010-E

4) TYPE 4 (Joystick steering)









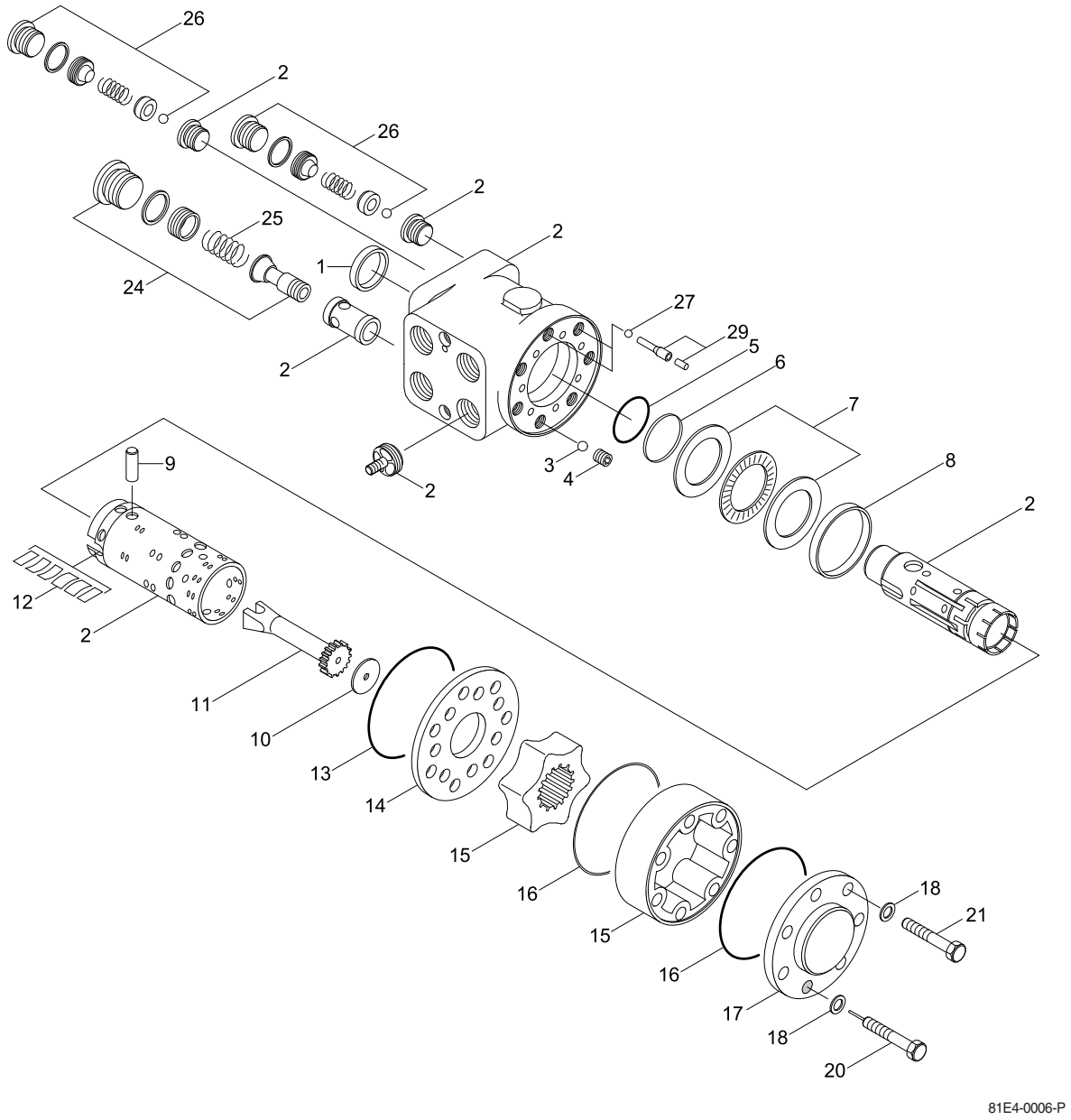
Hydraulic circuit

Port	Port name	Port size
L	Left port	M18x1.5
R	Right port	M18x1.5
T	Tank port	M22x1.5
P	Pump port	M22x1.5
LS	Load sensing port	M12x1.5

81K5-00040-E

2. COMPONENTS

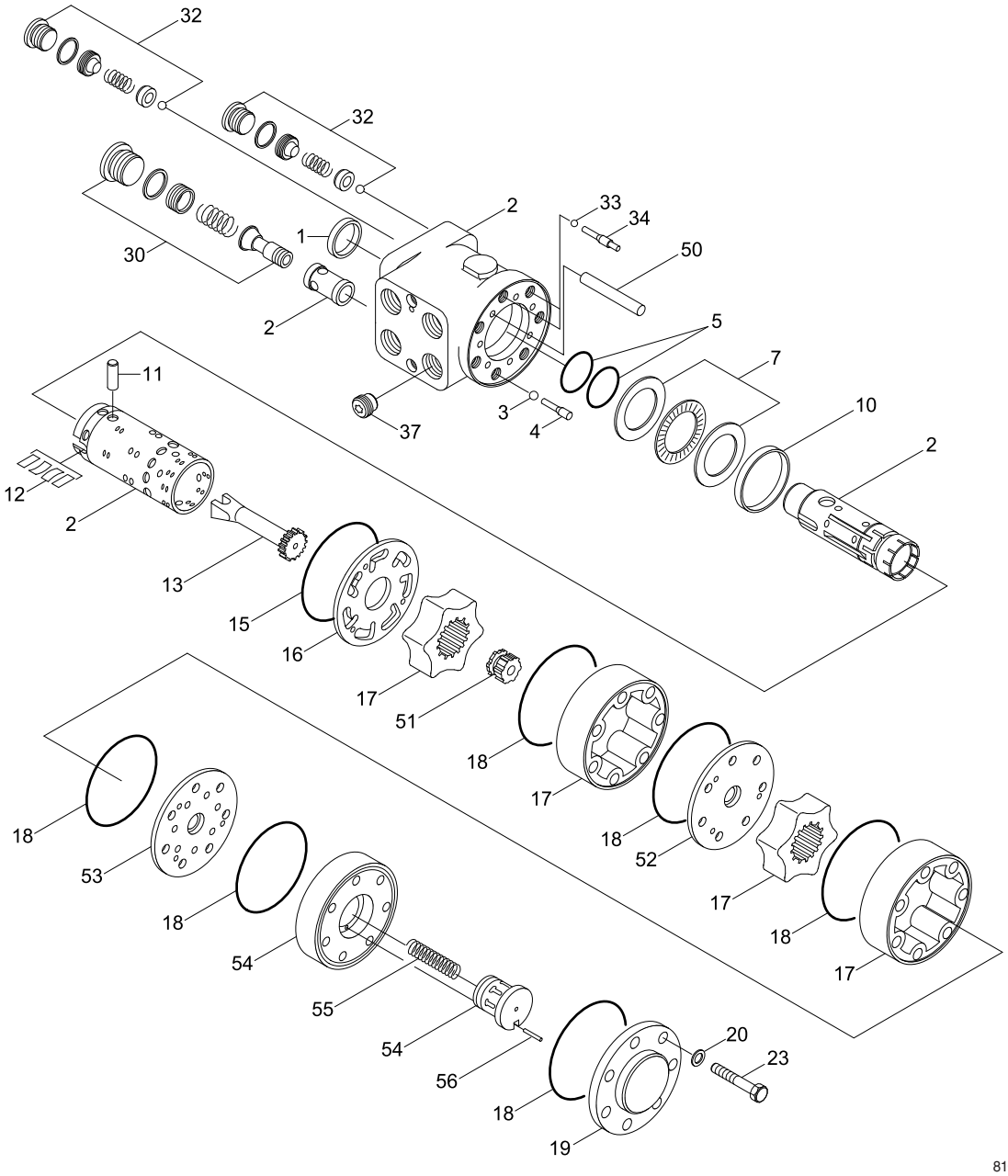
1) TYPE 1 (With PTO)



81E4-0006-P

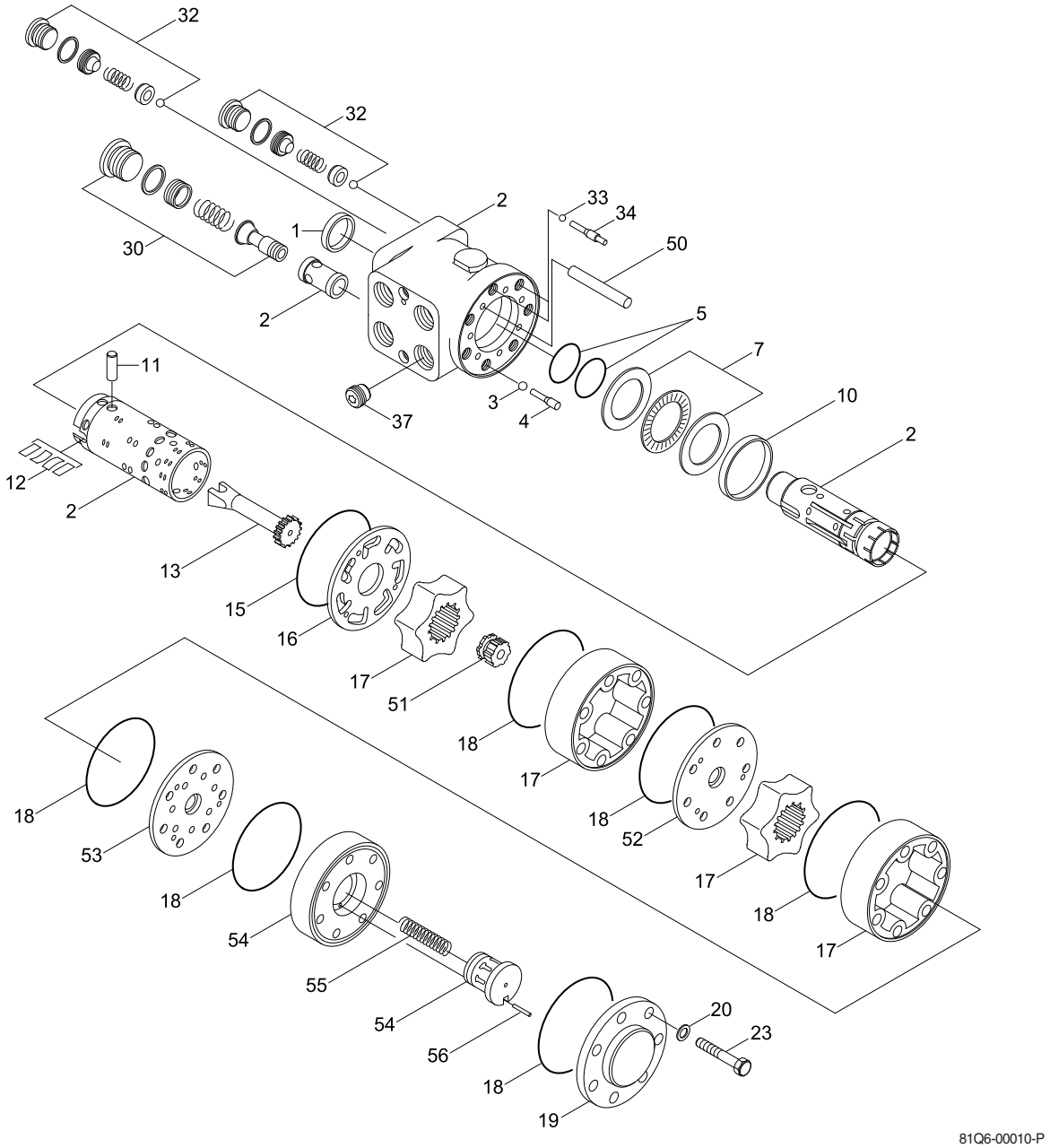
1	Dust seal	10	Spacer	20	Pin screw
2	Housing, spool, sleeve	11	Shaft	21	Screw
3	Ball	12	Spring set	24	Relief valve assy
4	Bushing	13	O-ring	25	Wire spring
5	O-ring	14	Distributor plate	26	Shock valve
6	King ring	15	Gear wheel set	27	Ball
7	Bearing assy	16	O-ring	29	Bushing
8	Ring	17	End cover		
9	Cross pin	18	Washer		

2) TYPE 2 (Without PTO)



1	Dust seal	13	Shaft	31	Relief valve assy
2	Housing, spool, sleeve	16	Distributor plate	32	Shock valve
3	Ball	17	Gear wheel set	33	Ball
4	Ball	18	O-ring	34	Bushing
5	O-ring	19	End cover	37	Check valve
7	Bearing assy	20	Washer	50	Mounting pin
10	Ring	23	Screw	51	Cardan shaft
11	Cross pin	24	name plate	54	Valve and housing
12	Spring set	30	Relief valve assy		

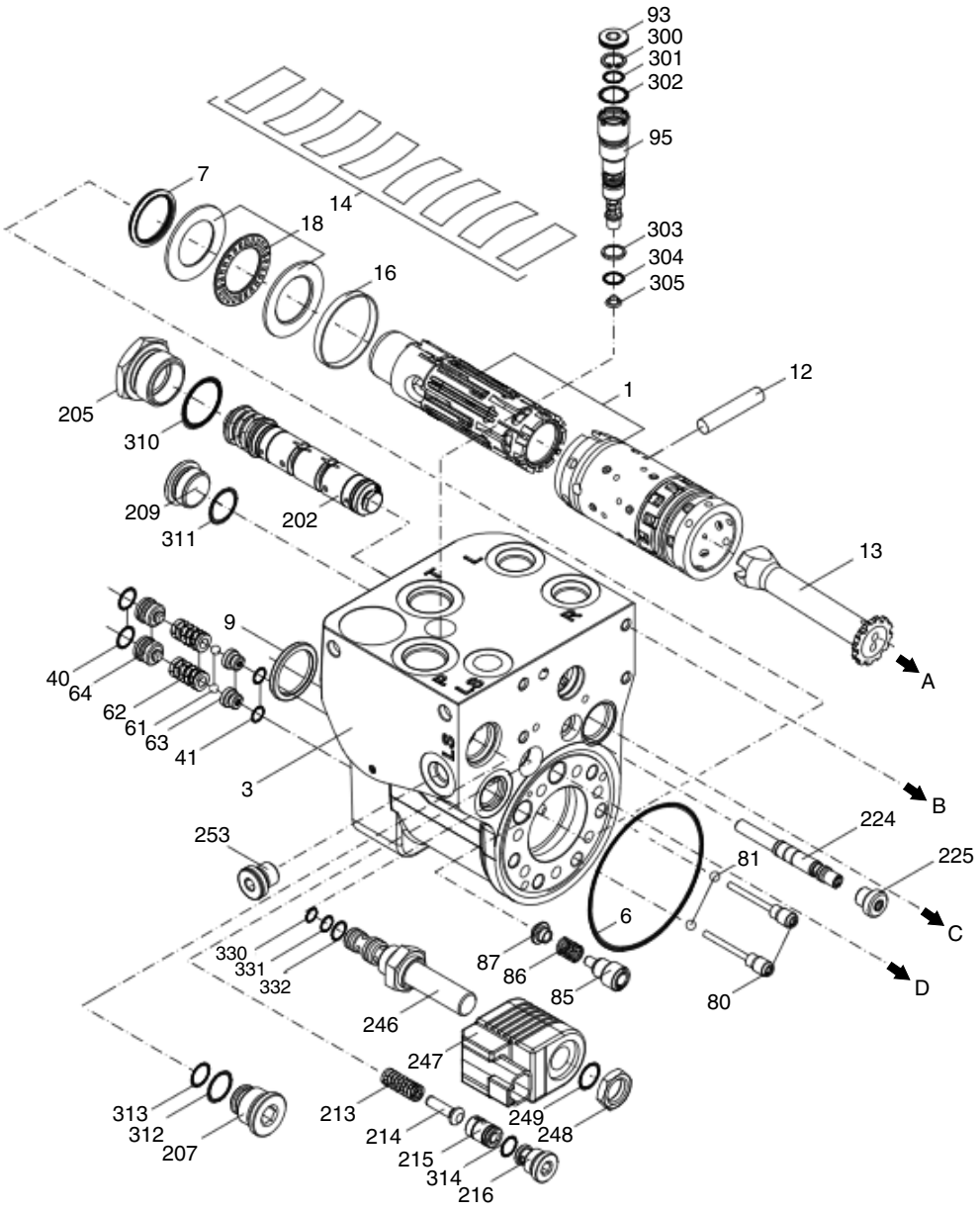
3) TYPE 3 (Emergency steering)



81Q6-00010-P

1	Dust seal	15	O-ring	34	Bushing
2	Housing, spool, sleeve	16	Distributor plate	50	Mounting pin
3	Ball	17	Gear wheel set	51	Cardan shaft
4	Bushing	18	O-ring	52	Distributor plate
5	O-ring	19	End cover	53	Distributor plate
7	Bearing assy	20	Washer	54	Valve & housing
10	Ring	23	Screw	55	Spring
11	Cross pin	30	Relief valve assy	56	Guide pin
12	Spring set	32	Shock valve	57	Check valve
13	Cardan shaft	33	Ball		

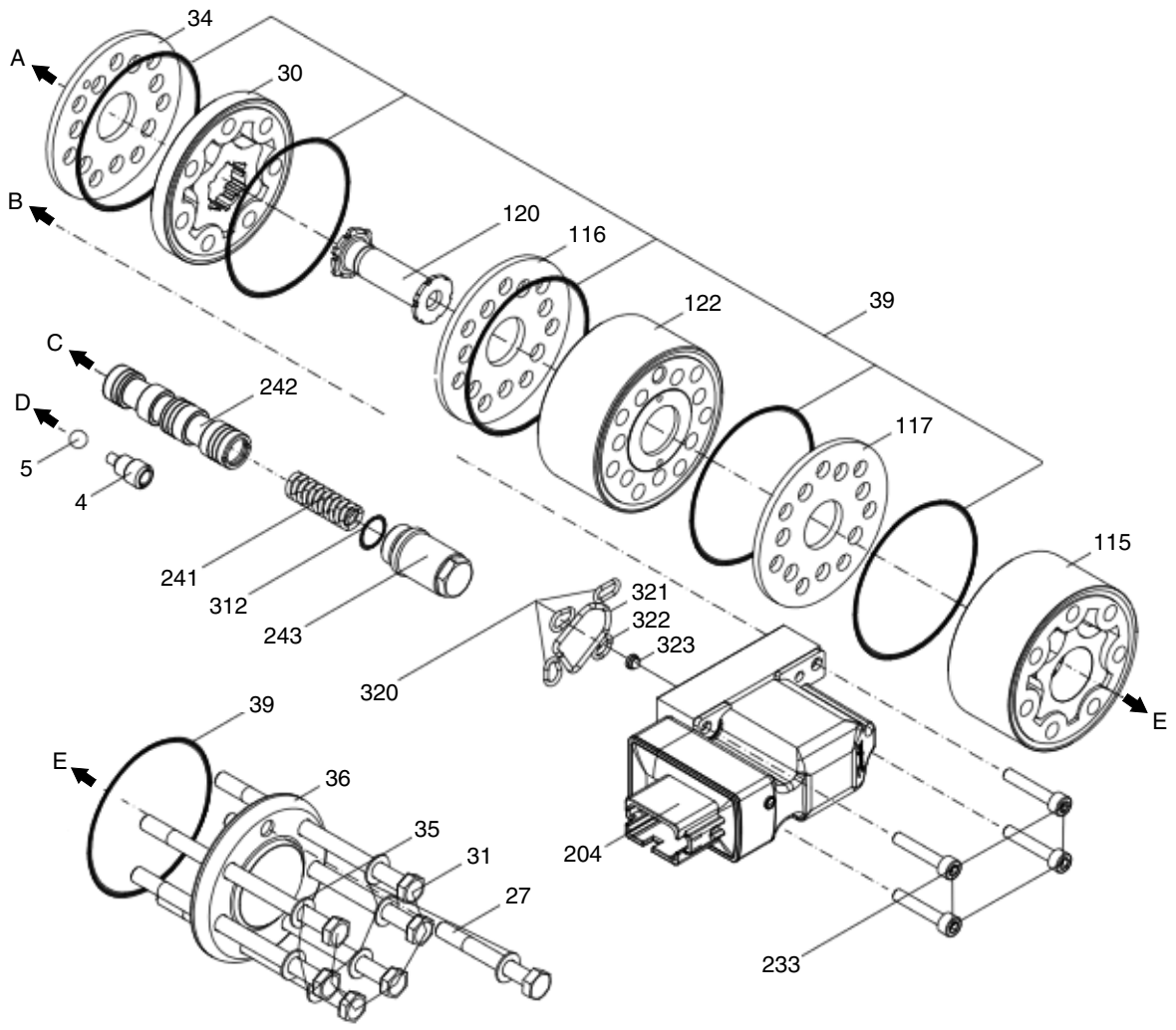
4) TYPE 4 (Joystick steering, 1/2)



81K5-00040-P1

1	Spool/sleeve set	81	Ball	247	Coil
3	Housing	85	Screw	248	Nut
6	O-ring	86	Spring	249	O-ring
7	Shaft seal	87	Valve cone	253	Plug
9	Dust seal ring	93	Plug	300	Lock ring
12	Cross pin	95	Port relief valve cartridge	301	O-ring
13	Shaft	202	Spool	302	O-ring
14	Spring set	205	Plug	303	Backup ring
16	Ring	207	Plug	305	Filter
18	Bearing	209	Plug	310	O-ring
40	O-ring	213	Spring	311	O-ring
41	O-ring	214	Cone pilot supply	312	O-ring
61	Ball	215	Spool pilot supply	313	O-ring
62	Spring	216	Plug	314	O-ring
63	Valve seat	224	Spool	330	O-ring
64	Adjust screw	225	Plug	331	O-ring
80	Pin	246	Spool	332	O-ring

TYPE 4 (Joystick steering, 2/2)



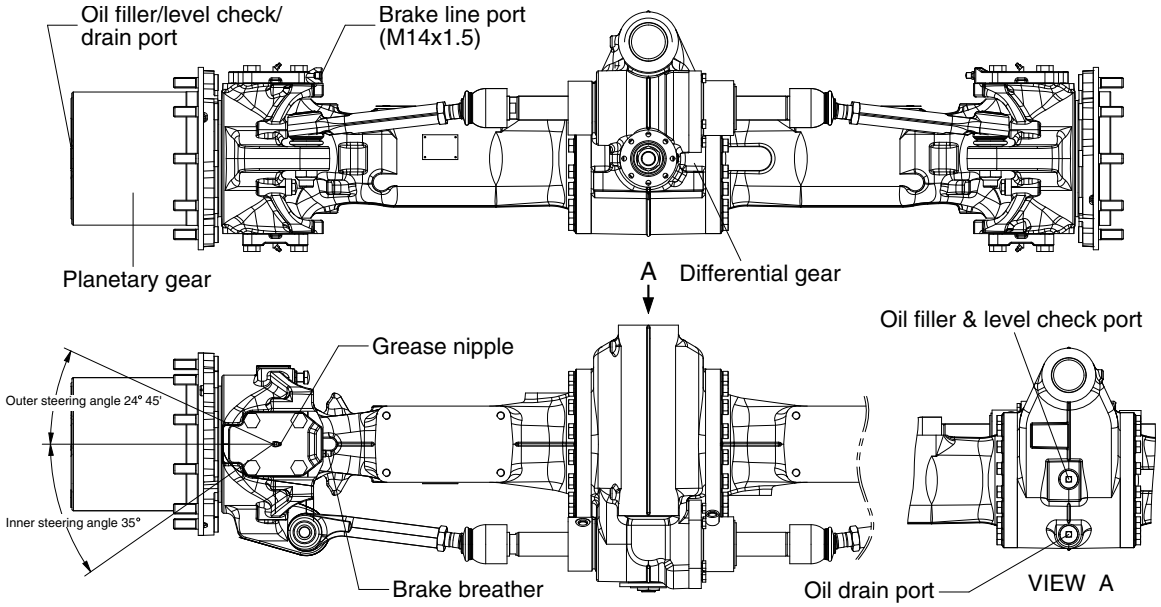
81K5-00040-P2

4	Screw	39	O-ring	241	Spring
5	Ball	115	Gear set	242	Spool
27	Short screw	116	Valve plate	243	Plug
30	Gear set	117	Valve plate	320	O-ring
31	Screw	120	Shaft	321	O-ring
34	Valve plate	122	Valve housing	322	O-ring
35	Washer	204	PVE	323	O-ring
36	End cover	233	Plug		

1. OPERATION

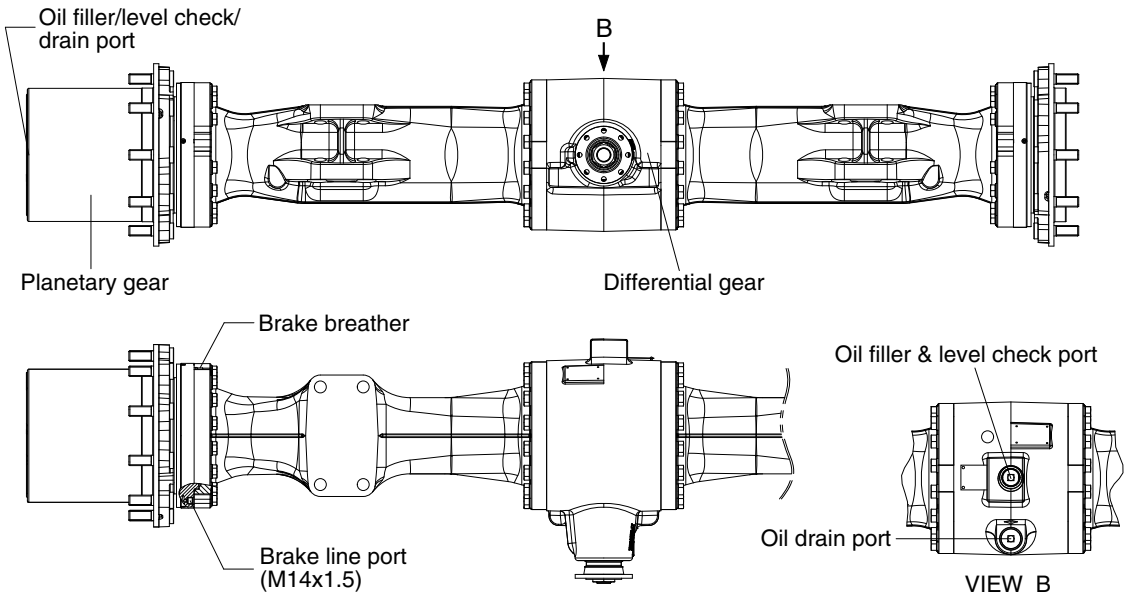
· The power from the engine passes through main pump, travel motor and transmission and drive shafts, and is then sent to the front and rear axles.
Inside the axles, the power passes from the bevel pinion to the bevel gear and is sent at right angles.
· At the same time, the speed is reduced and passes 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



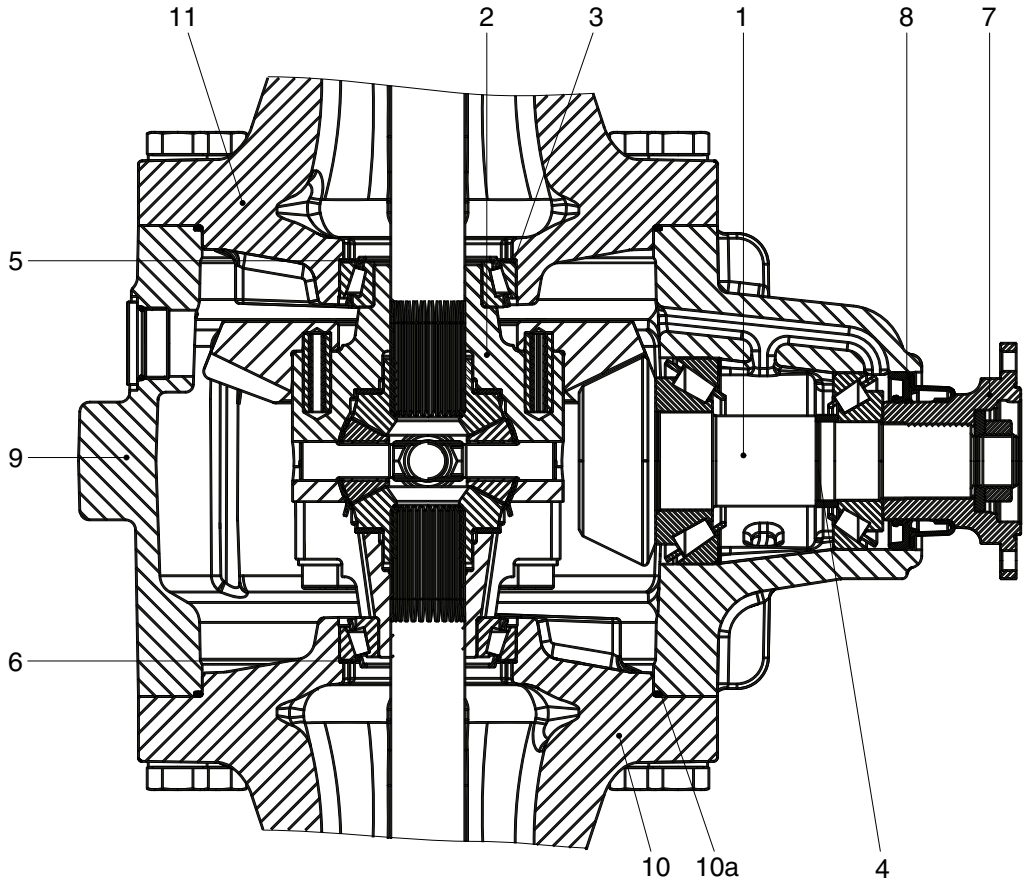
210WA2AX01

2) REAR AXLE



20W7A2AX01A

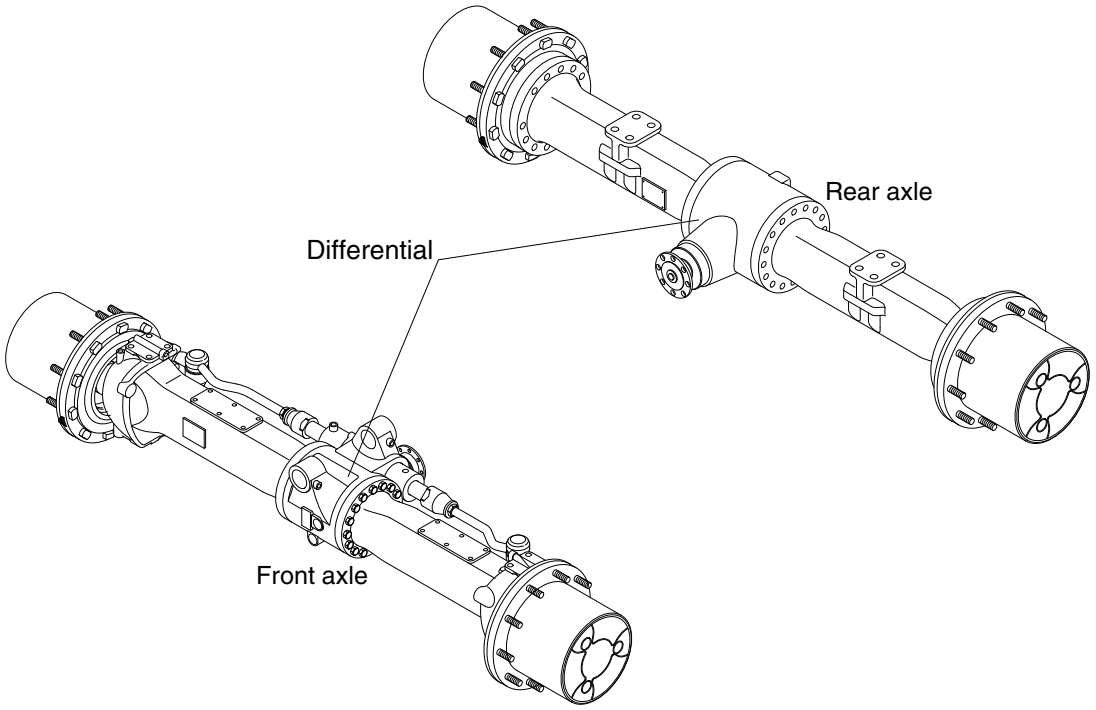
2. SECTION OF DIFFERENTIAL



17W7A2AX02

1 Drive pinion
2 Differential (with crown wheel)
3 Shim for contact pattern (bevel gear set)
4 Spacer ring (bearing rolling moment / pinion bearing)
5 Shim for backlash
6 Shim (bearing rolling moment / differential bearing)
7 Input flange
8 Seal ring
9 Axle drive housing
10 Axle housing
10a O-ring
11 Axle housing (crown wheel side)

3. DIFFERENTIAL



17W7A2AX03

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.

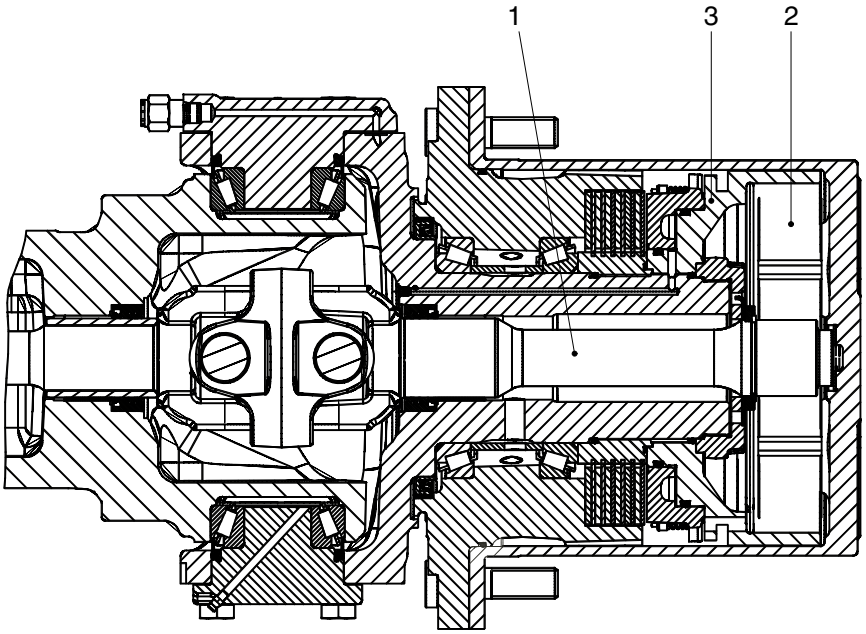
In addition, the differential also servers as an equalizer when going around curves. If the mechanical connection from the transmission to the universal drive shaft, differential, shaft, and planetary gears to the wheels would be rigid, every steering movement would strain the axle construction and would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



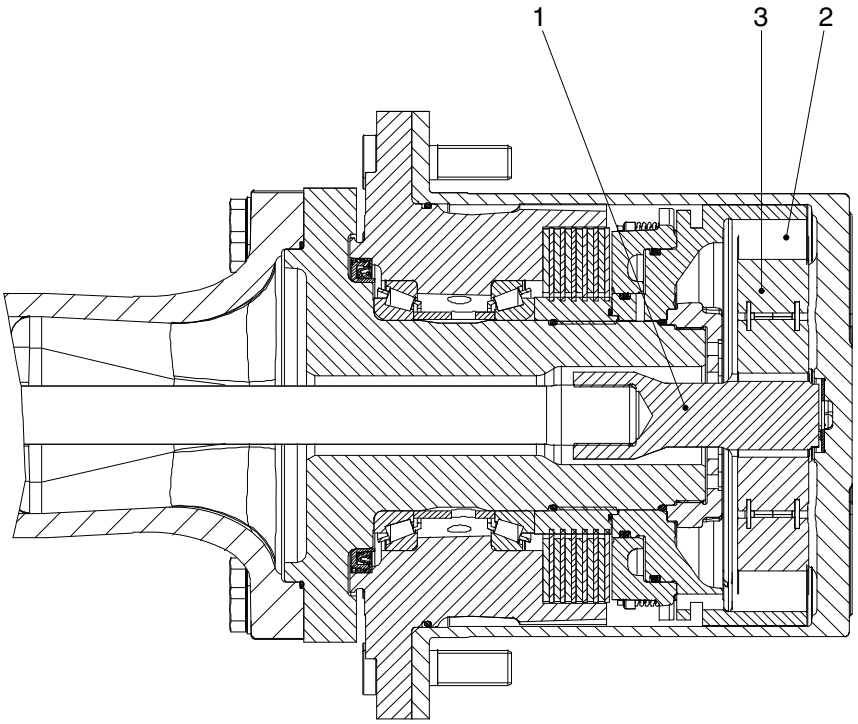
17W7A2AX04

1 Joint fork 2 Planetary 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 joint fork (1) is transmitted to planetary gear (2). The planetary 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



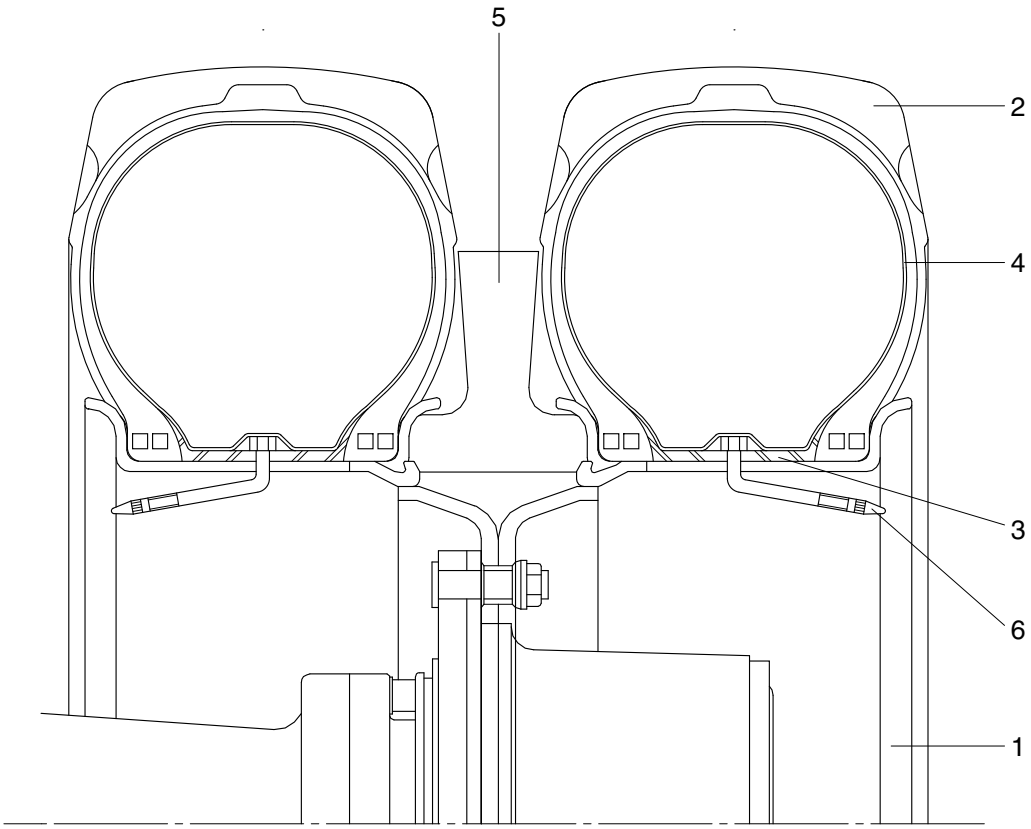
17W7A2AX05

1 Sun gear shaft 2 Planetary 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 sun gear shaft (1) is transmitted to planetary gear (2). The planetary 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.

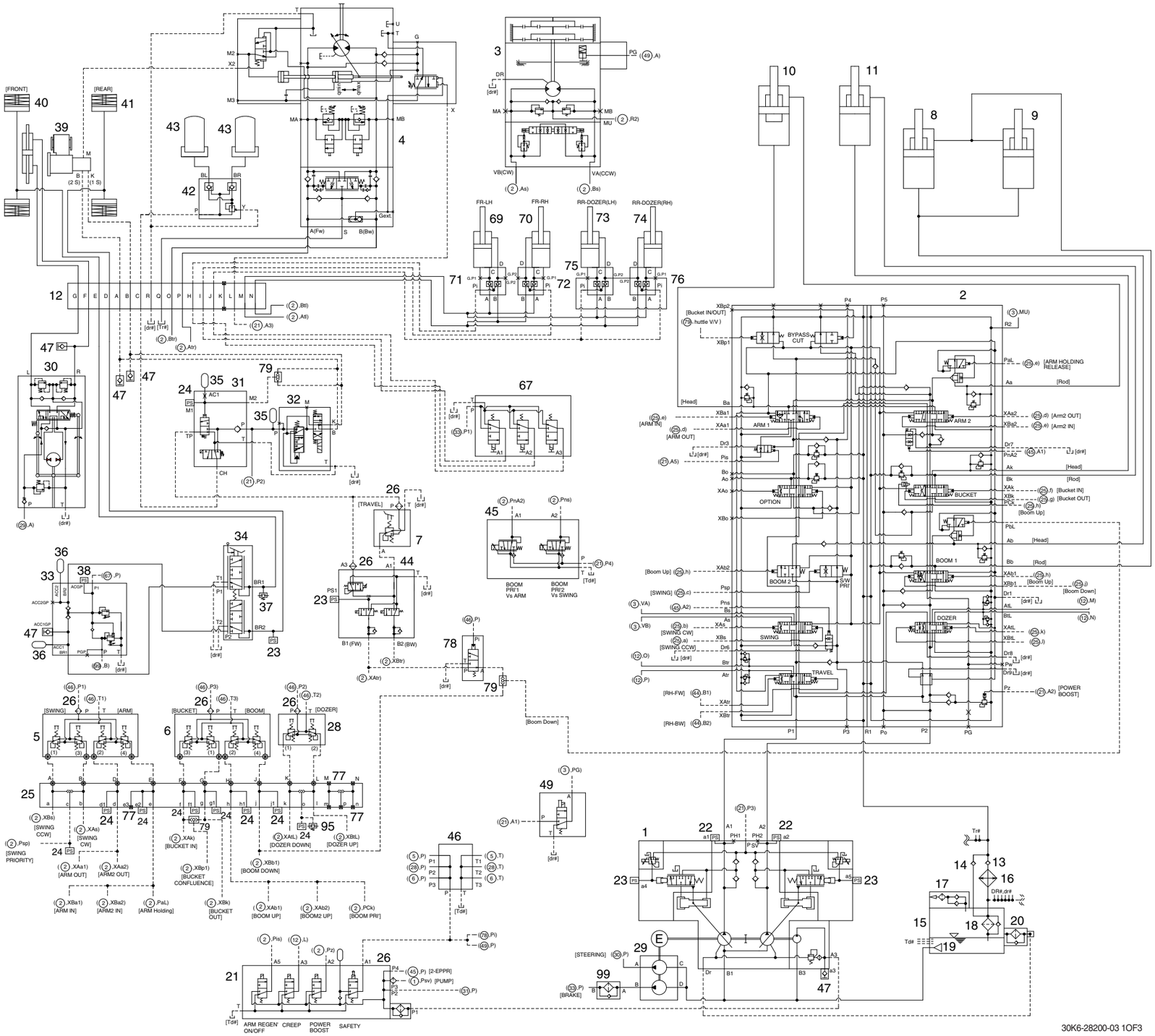
2) Various types of tires are available to suit the purpose. Therefore it is very important to select the correct tires for the type of work and bucket capacity.

SECTION 3 HYDRAULIC SYSTEM

Group 1 Hydraulic Circuit ····· 3-1
Group 2 Main Circuit ····· 3-4
Group 3 Pilot Circuit ····· 3-7
Group 4 Single Operation ····· 3-18
Group 5 Combined Operation ····· 3-33

GROUP 1 HYDRAULIC CIRCUIT

1. HYDRAULIC CIRCUIT (1/3)

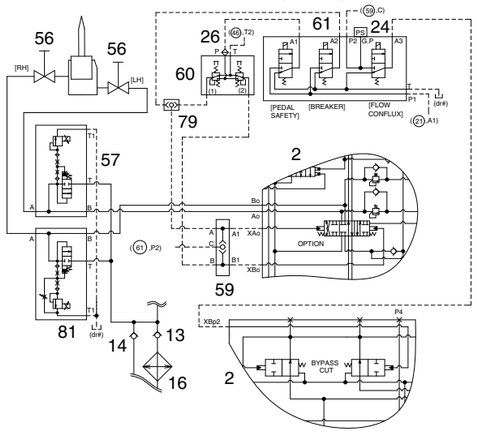


30K6-28200-03 1OF3

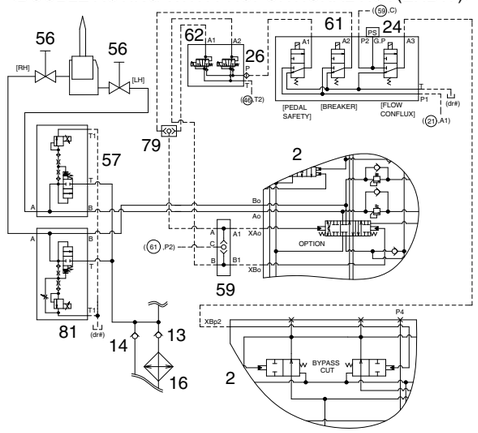
1 Main pump
2 Main control valve
3 Swing motor
4 Travel motor
5 RCV lever (LH)
6 RCV lever (RH)
7 RCV pedal
8 Boom cylinder (LH)
9 Boom cylinder (RH)
10 Arm cylinder
11 Bucket cylinder
12 Turning joint
13 Check valve
14 Check valve
15 Hydraulic tank
16 Oil cooler
17 Air breather
18 Return filter w/bypass valve
19 Strainer
20 Drain filter
21 4-cartridge valve
22 Pressure sensor
23 Pressure sensor
24 Pressure sensor
25 Terminal block
26 Last guard filter
28 RCV dozer lever
29 Power train pump
30 Steering valve
31 Travel control valve
32 Transmission control valve
33 Brake supply valve
34 Brake valve
35 Accumulator
36 Accumulator
37 Pressure switch
38 Pressure sensor
39 Transmission
40 Front axle
41 Rear axle
42 Locking valve
43 Oscillating cylinder
44 3-cartridge valve
45 2-EPPR cartridge valve
46 Cross assy
47 Screw coupling
49 Solenoid valve
67 3-cartridge valve
69 Outrigger cylinder-L
70 Outrigger cylinder-R
71 DPC valve-outrigger-L
72 DPC valve-outrigger-R
73 Dozer cylinder-L
74 Dozer cylinder-R
75 DPC valve-dozer-L
76 DPC valve-dozer-R
77 Plug
78 Pilot selector valve
79 Shuttle tee
95 Pressure switch
99 Pressure filter

2. HYDRAULIC CIRCUIT (2/3)

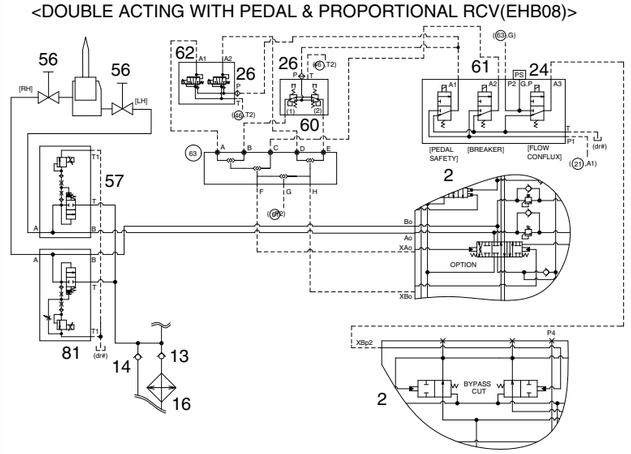
<DOUBLE ACTING with PEDAL(EHB07)>



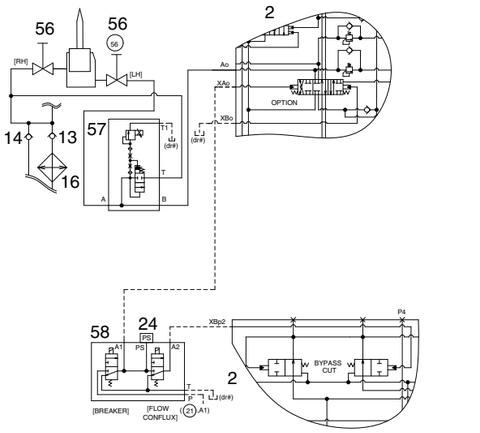
<DOUBLE ACTING WITH PROPORTIONAL RCV(EHB17)>



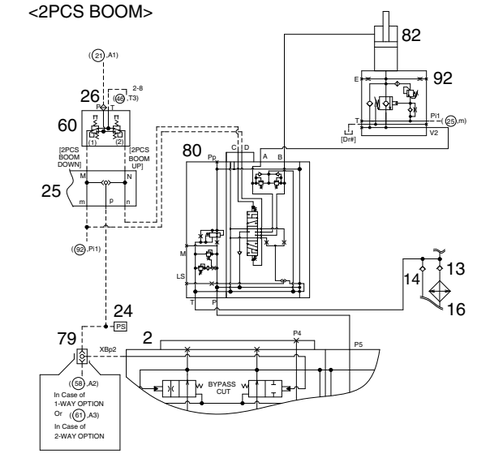
<DOUBLE ACTING WITH PEDAL & PROPORTIONAL RCV(EHB08)>



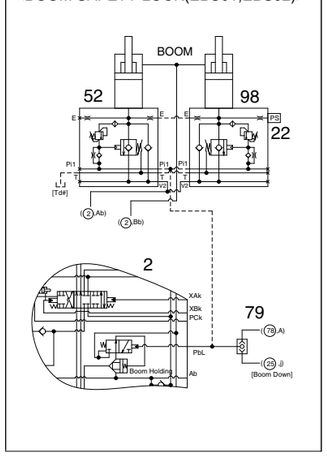
<SINGLE ACTING(EHB01)>



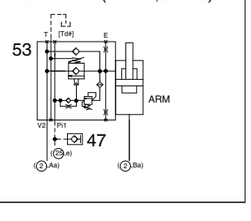
<2PCS BOOM>



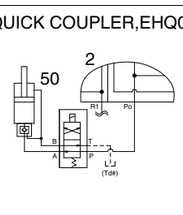
<BOOM SAFETY LOCK(EBS01,EBS02)>



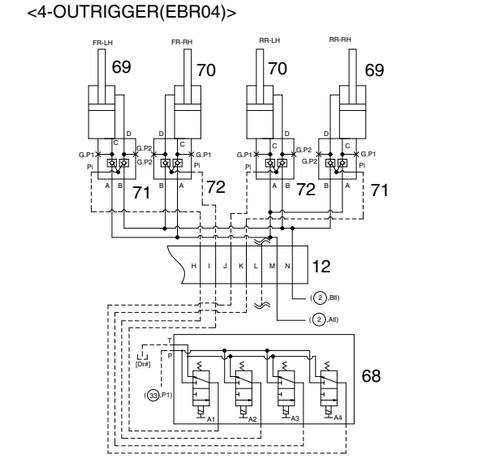
<ARM SAFETY LOCK(EAS01,EAS02)>



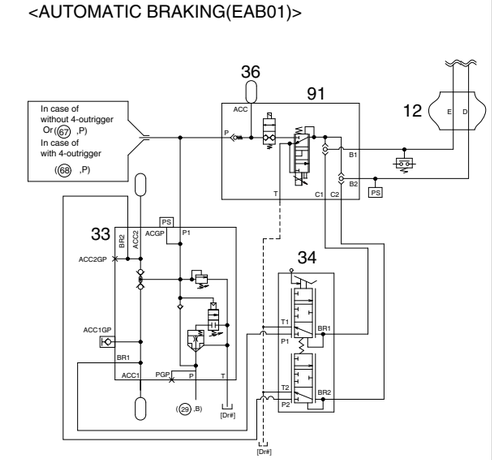
<QUICK COUPLER,EHQ01>



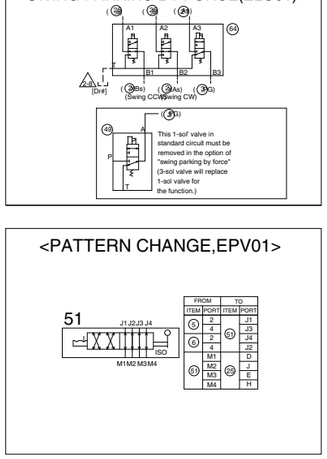
<4-OUTRIGGER(EBR04)>



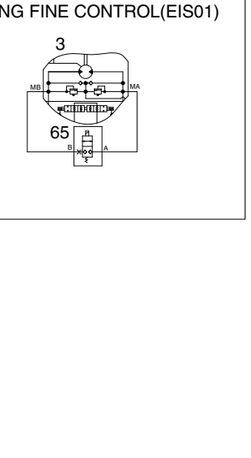
<AUTOMATIC BRAKING(EAB01)>



<SWING PARKING BY FORCE(ELO01)>



<SWING FINE CONTROL(EIS01)

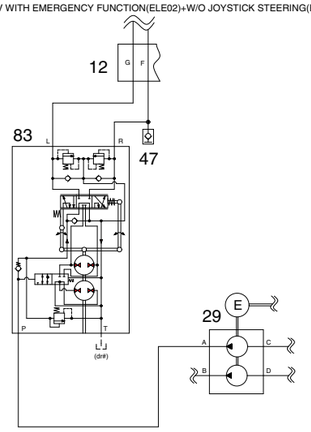


<PATTERN CHANGE,EPV01>

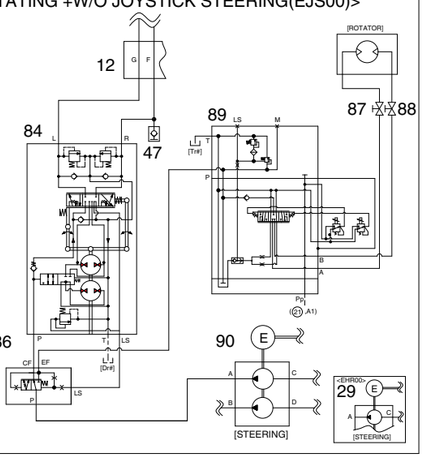
2	Main control valve
12	Turning joint
13	Check valve
14	Check valve
16	Oil cooler
22	Pressure sensor
24	Pressure sensor
25	Terminal block
26	Last guard filter
36	Accumulator
47	Screw coupling
50	Solenoid valve
51	Pattern change valve
52	Boom cylinder valve-LH
53	Arm cylinder valve
56	Stop valve
57	Pro relief valve
58	Soleniod vavle
59	Shuttle valve
60	2-way opt pedal
61	Solenoid valve
62	2-EPPR valve
63	Shuttle block
64	Solenoid valve
65	Solenoid valve
68	4-cartridge valve
69	Outrigger cylinder-L
70	Outrigger cylinder-R
71	DPC valve-L
72	DPC valve-R
79	Shuttle tee
80	Control valve
81	Pro relief valve
82	2 piece boom cylinder
91	Auto brake valve
92	2 pcs boom cyl safety valve
98	Boom cylinder valve-RH

3. HYDRAULIC CIRCUIT (3/3)

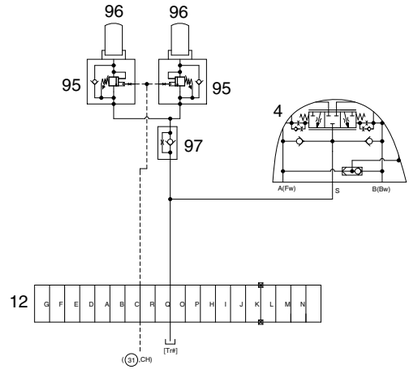
<STEERING V/V WITH EMERGENCY FUNCTION(ELE02)+W/O JOYSTICK STEERING(EJS00)>



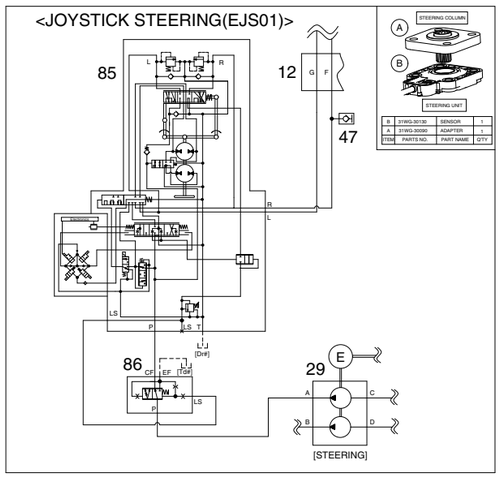
<ROTATING +W/O JOYSTICK STEERING(EJS00)>



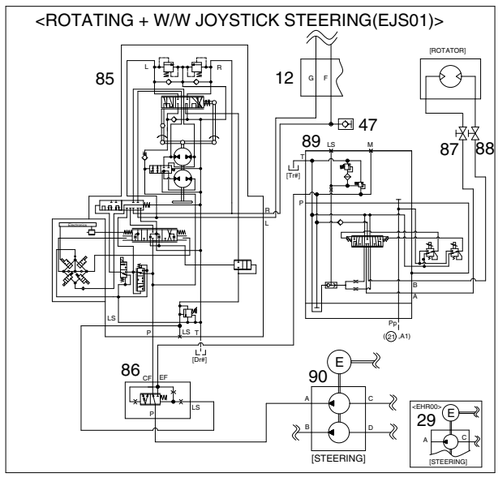
<OSCILLATING LOCK OPTION, (EOC02)>



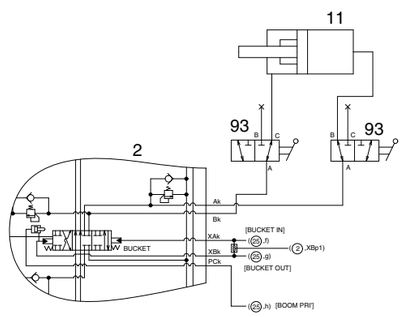
<JOYSTICK STEERING(EJS01)>



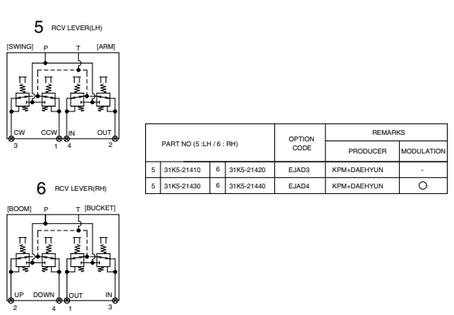
<ROTATING + W/W JOYSTICK STEERING(EJS01)>



<3-WAY BUCKET LINE(EKL01)>



<RCV LEVER(LH/RH)>



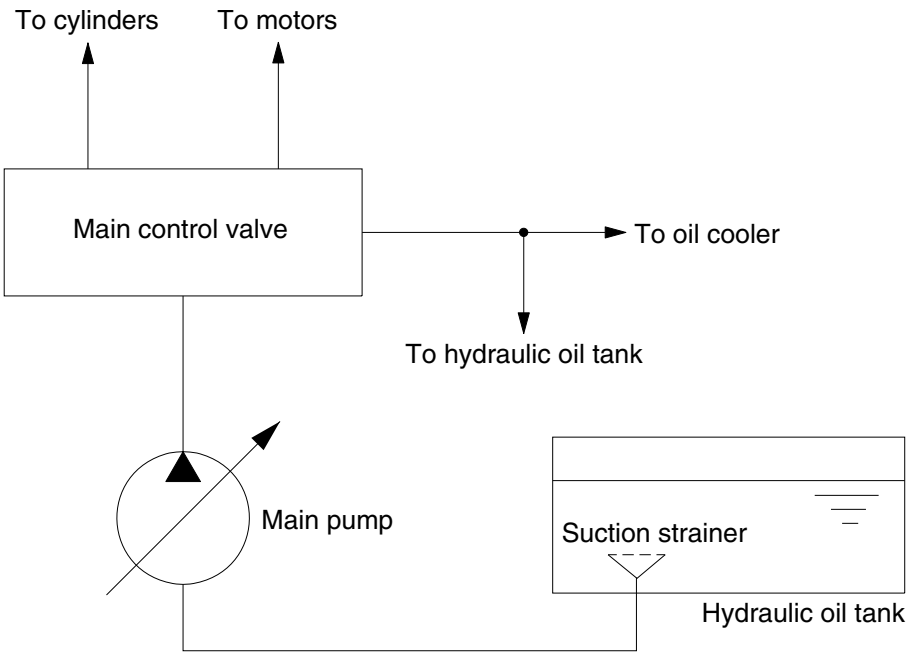
PART NO (5 :LH / 6 : RH)				OPTION CODE	REMARKS	
					PRODUCER	MODULATION
5	31K5-21410	6	31K5-21420	EJAD3	KPM+DAEHYUN	-
5	31K5-21430	6	31K5-21440	EJAD4	KPM+DAEHYUN	○

4 Travel motor
5 RCV lever-LH
6 RCV lever-RH
11 Bucket cylinder
12 Turning joint
29 Power train pump
47 Screw coupling
83 Steering valve-ele
85 Steering valve-JS steering
86 Priority valve
87 Stop valve
88 Stop valve
89 Proportional valve
90 Power train pump
93 3-way valve
95 Locking valve
96 Oscilating cylinder
97 Orifice and check valve

GROUP 2 MAIN CIRCUIT

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

1. SUCTION AND DELIVERY CIRCUIT

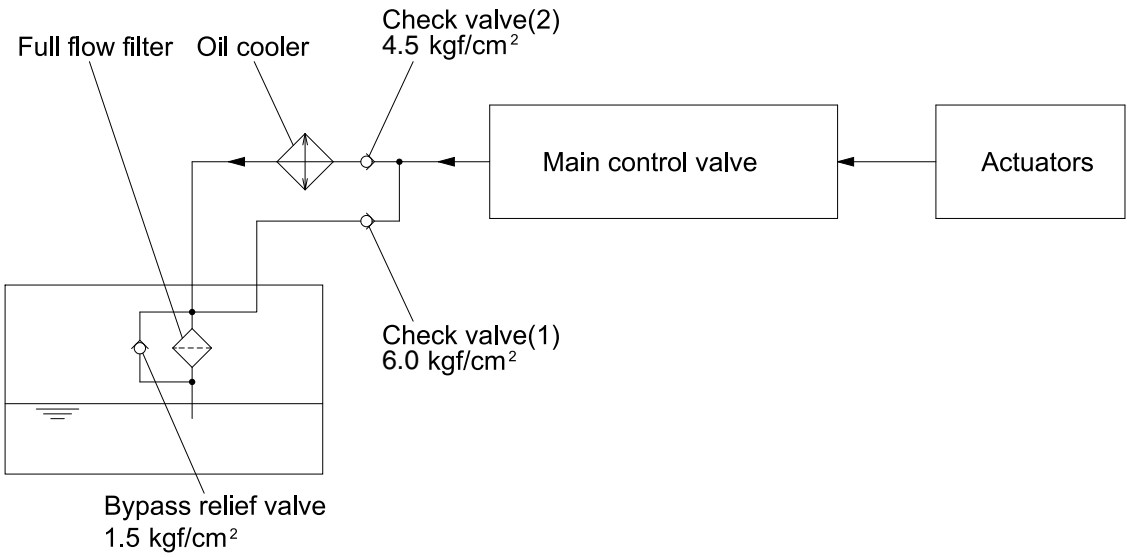


140L3CI01

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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

2. RETURN CIRCUIT

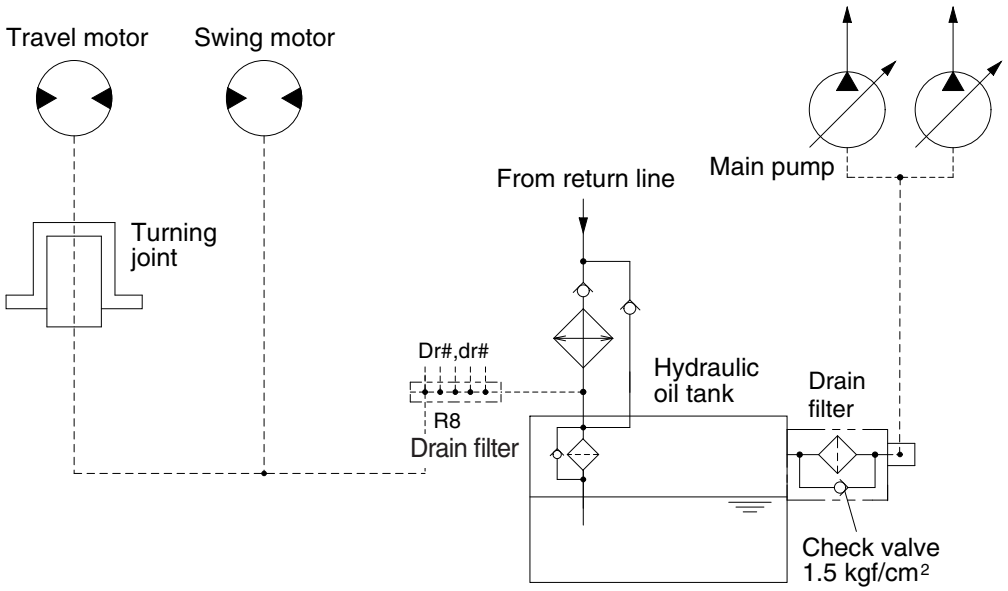


210WA3CI02

All oil 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 4.5 kgf/cm² (64 psi) and 6.0 kgf/cm² (85 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 6.0 kgf/cm² (85 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 return 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 return 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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

3. DRAIN CIRCUIT



210WA3CI03

Besides internal leaks from the motor, transmission, front and rear axle the oil for lubrication circulates. The main pump drain oil have to be fed to the hydraulic tank passing through drain filter. When the drain oil pressure exceed 1.5 kgf/cm^2 (21 psi), the oil returns to the hydraulic tank directly.

1) TRAVEL MOTOR DRAIN CIRCUIT

Oil leaking from the travel motor comes out of the drain ports provided in the respective motor casing and joins with each other. This oil passes through turning joint and join with oil leak line of the swing motor and returns to the hydraulic tank after being filtered by the return filter.

2) SWING MOTOR DRAIN CIRCUIT

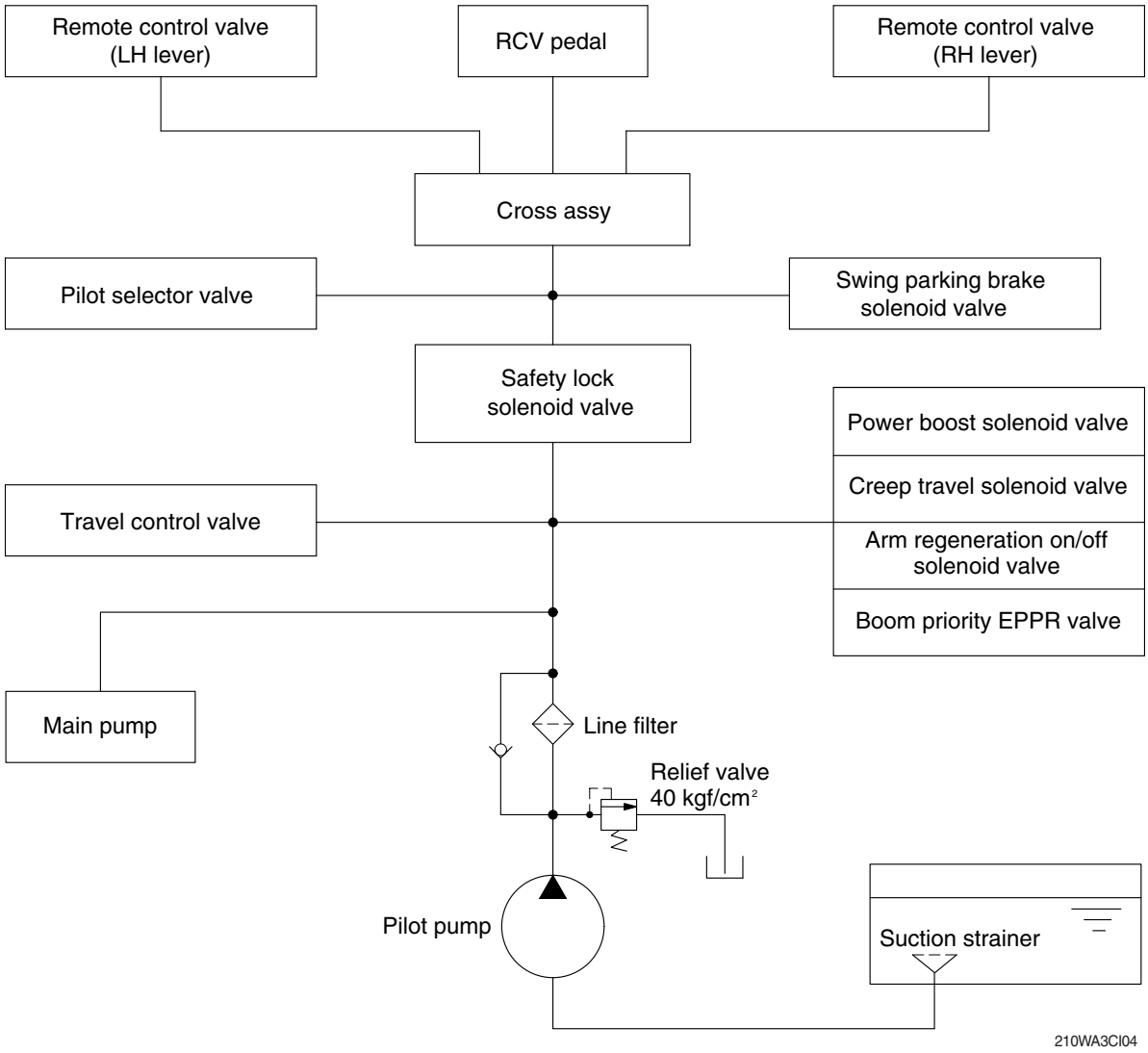
Oil leaking from the swing motor comes out and return to the hydraulic tank passing through the return filter.

3) MAIN PUMP DRAIN CIRCUIT

Oil leaking from main pump come out and return to the hydraulic tank passing through drain filter.

※ The circuit diagram may differ from the equipment, so please check before a repair.

GROUP 3 PILOT CIRCUIT



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

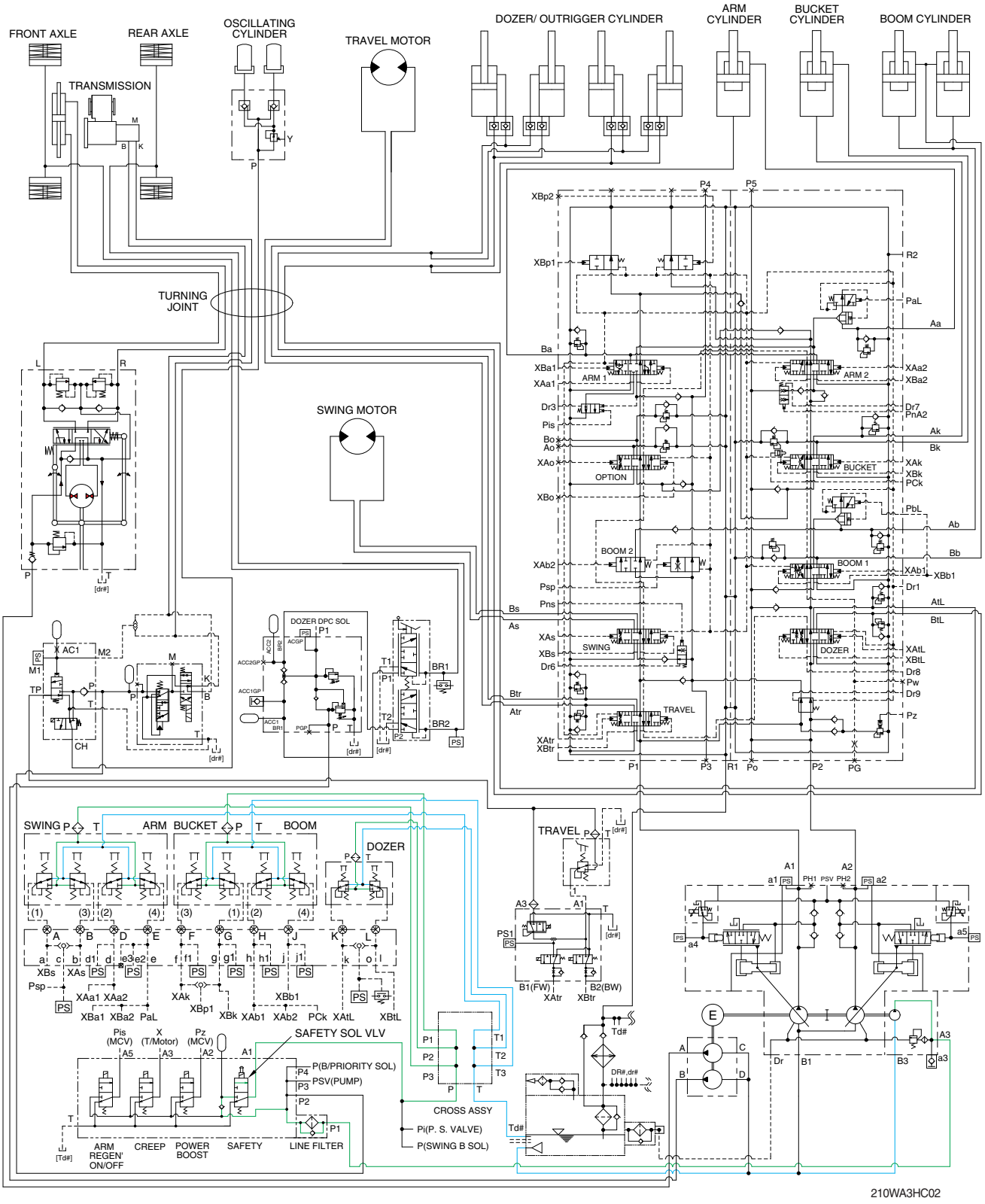
The pilot pump is provided with relief valve, receives the oil from the hydraulic tank through the suction filter.

The discharged oil from the pilot pump flows to the remote control valve, pilot selector valve, swing parking brake solenoid valve through the line filter, safety solenoid valve and/or cross assy.

Also, it flows to the solenoid valve assemblies, travel control valve and main pump through the line filter.

※ The circuit diagram may differ from the equipment, so please check before a repair.

1. SUCTION, DELIVERY AND RETURN CIRCUIT



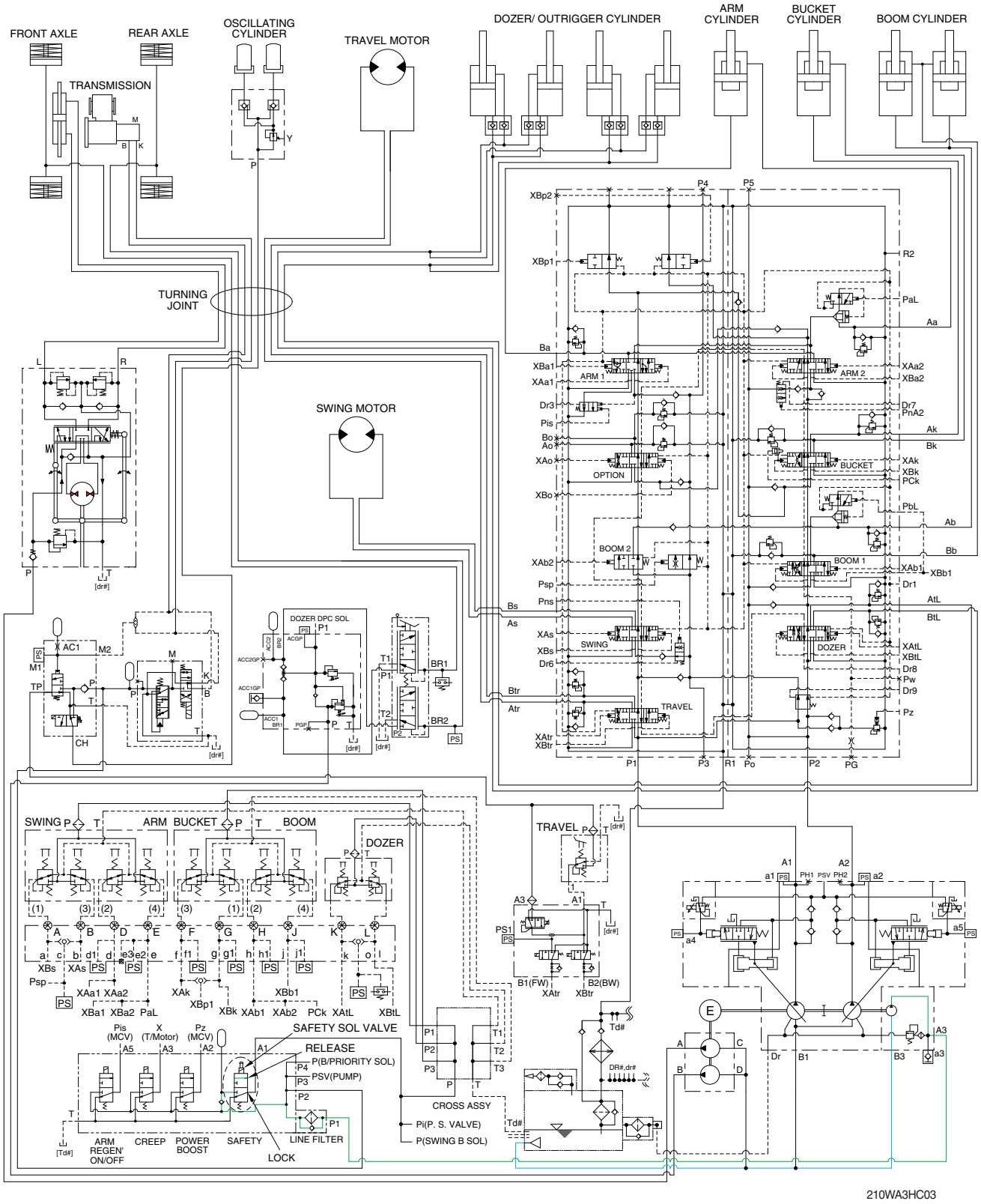
The pilot pump receives oil from the hydraulic tank. The discharged oil from the pilot pump flows to the safety solenoid valve through the line filter. The oil is filtered by the line filter. The pilot relief valve is provided in the pilot pump for limiting the pilot circuit pressure.

The oil filtered by line filter flows remote control valve through safety solenoid valve and cross assy.

The return oil from remote control valve flows into the hydraulic tank through the cross assy.

※ The circuit diagram may differ from the equipment, so please check before a repair.

2. SAFETY SOLENOID VALVE (SAFETY KNOB)

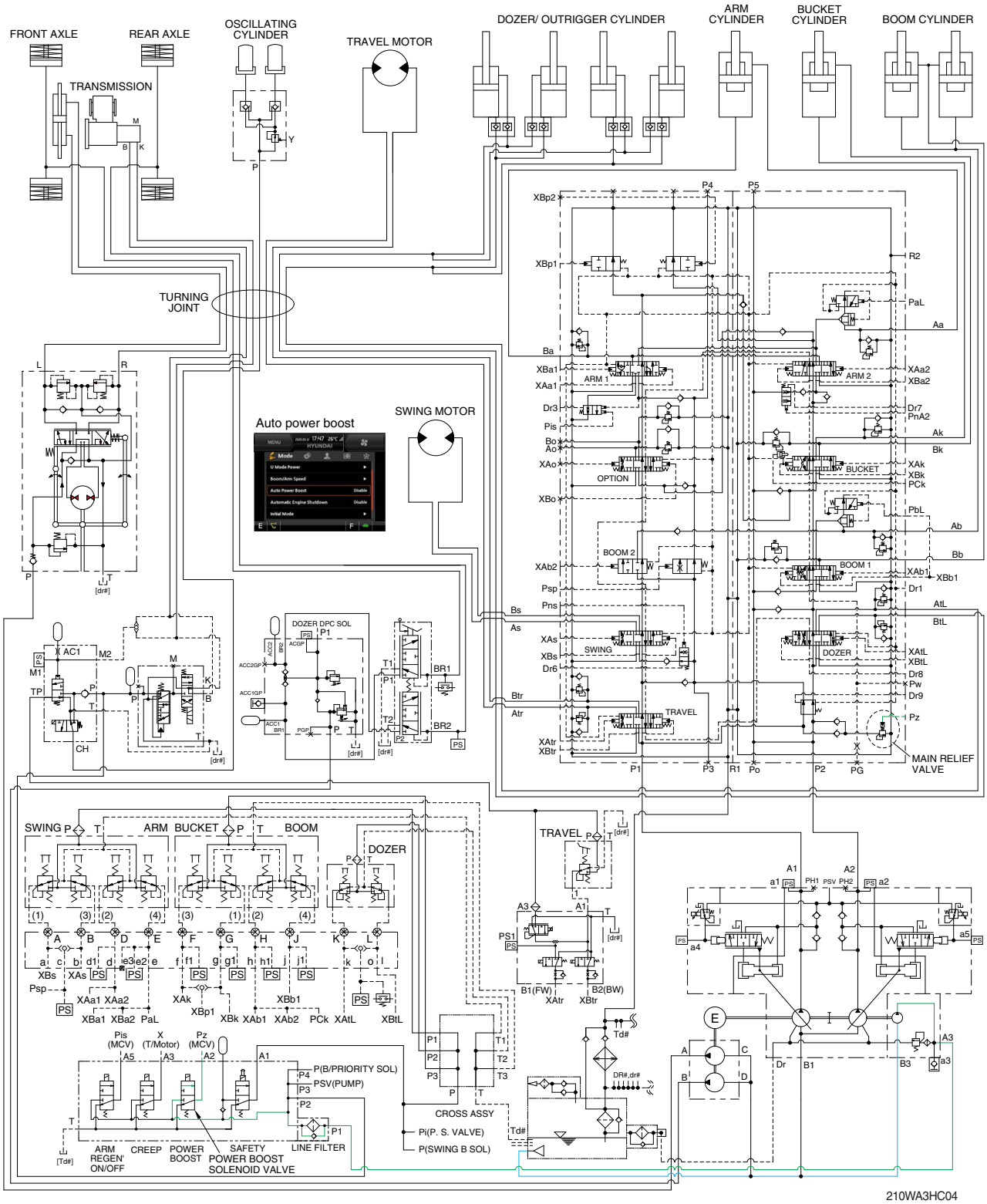


When the knob of the safety solenoid valve is in the release position, oil flows into the remote control valve through the line filter, safety solenoid valve and cross assy.

When the knob of the safety solenoid valve is in the lock position, oil does not flows into the remote control valve, because of blocked port.

※ The circuit diagram may differ from the equipment, so please check before a repair.

3. MAIN RELIEF PRESSURE CHANGE SYSTEM

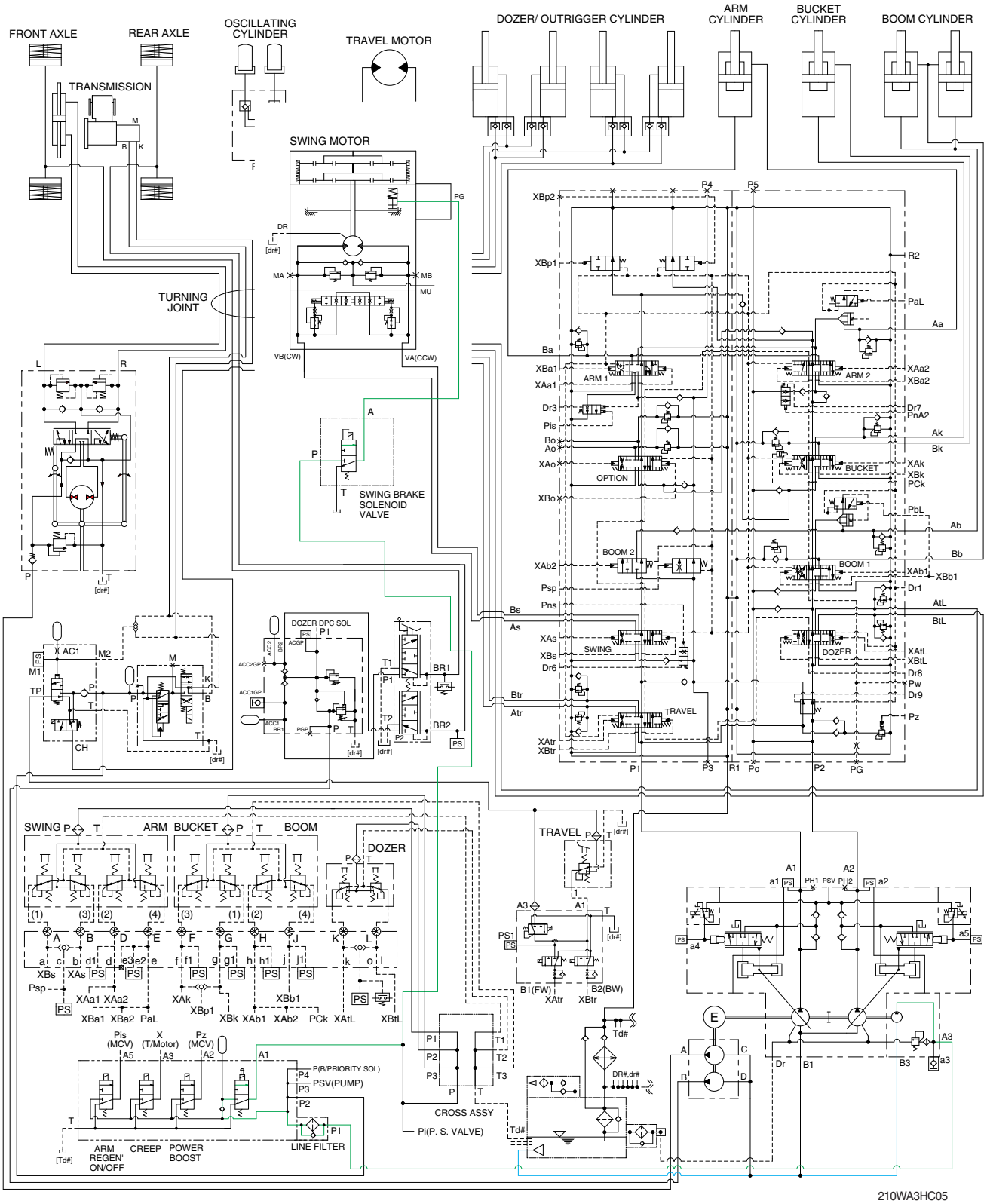


When the power boost switch on the left control lever is pushed ON, the power boost solenoid valve is actuated, the discharged oil from the pilot pump flows into **Pz** port of the main relief valve in main control valve ; then the setting pressure of the main relief valve is raises from 350 kgf/cm^2 to 380 kgf/cm^2 for increasing the digging power. And even when press continuously, it is canceled after 8 seconds.

When the auto power boost function is selected to enable on the cluster, the pressure of the main relief pressure is automatically increased to 380 kgf/cm^2 as working condition by the MCU. It is also operated max 8 seconds.

※ The circuit diagram may differ from the equipment, so please check before a repair.

4. SWING PARKING BRAKE RELEASE



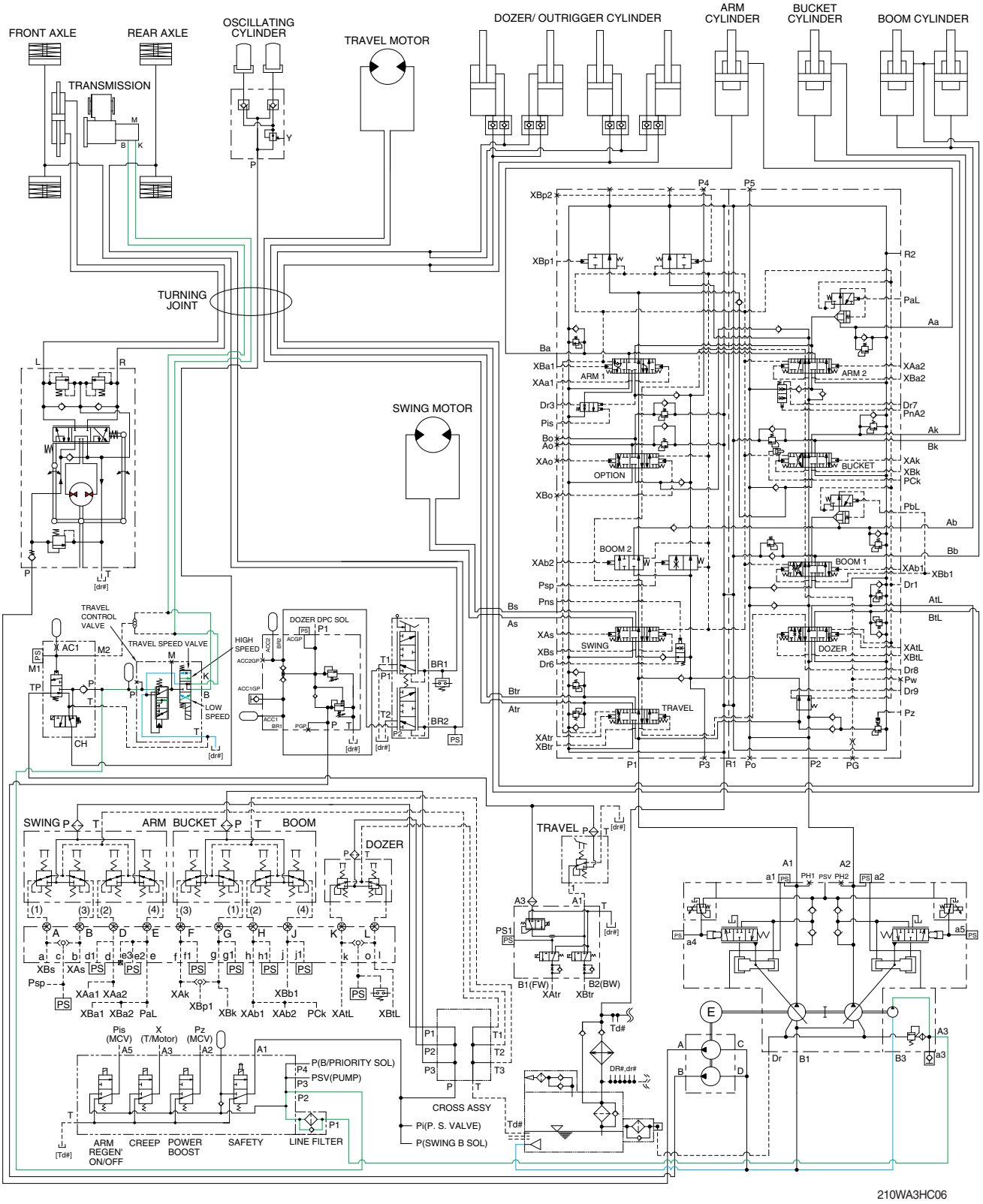
When any one of the swing, arm in or boom up lever is tilted, the swing brake solenoid valve is shifted to the down ward by the MCU that senses the pilot pressure of the swing control lever.

The discharged oil from pilot pump flows to swing motor PG port through the swing brake solenoid valve. This pressure is applied to swing motor disc, thus the brake is released.

When the swing, arm in and boom up lever are set in the neutral position, the swing brake solenoid valve is shifted to the up ward, oil in the swing motor disc cylinder is drained through the the swing brake solenoid valve, thus the brake is applied.

※ The circuit diagram may differ from the equipment, so please check before a repair.

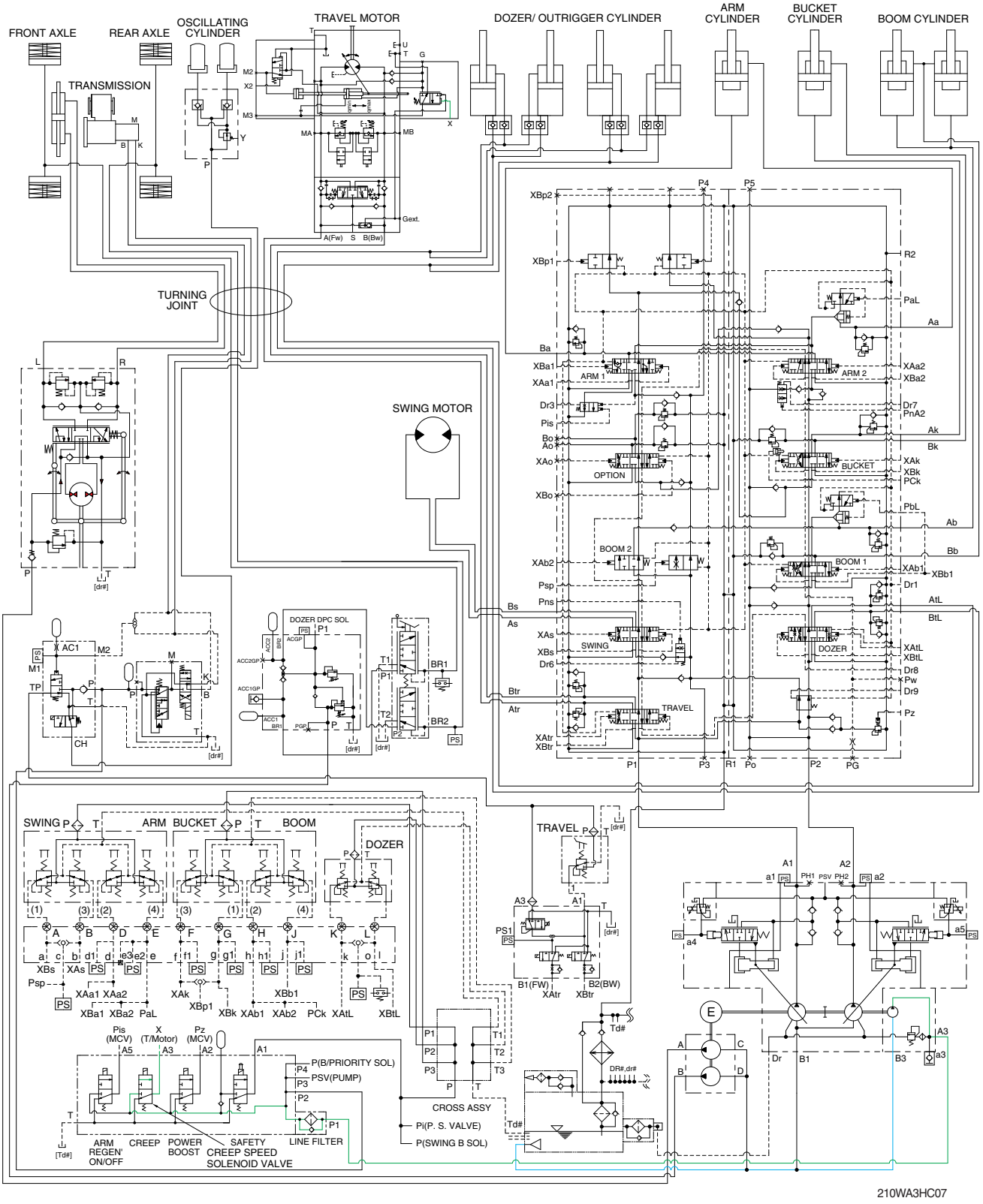
5. TRAVEL SPEED SELECTION SYSTEM



When LH multifunction switch was placed in high or low speed position, the pressure oil from pilot pump flows to travel speed solenoid valve through travel control valve, thus the transmission is changed into high (B) or low (K) speed condition.

※ The circuit diagram may differ from the equipment, so please check before a repair.

6. CREEP TRAVEL SYSTEM



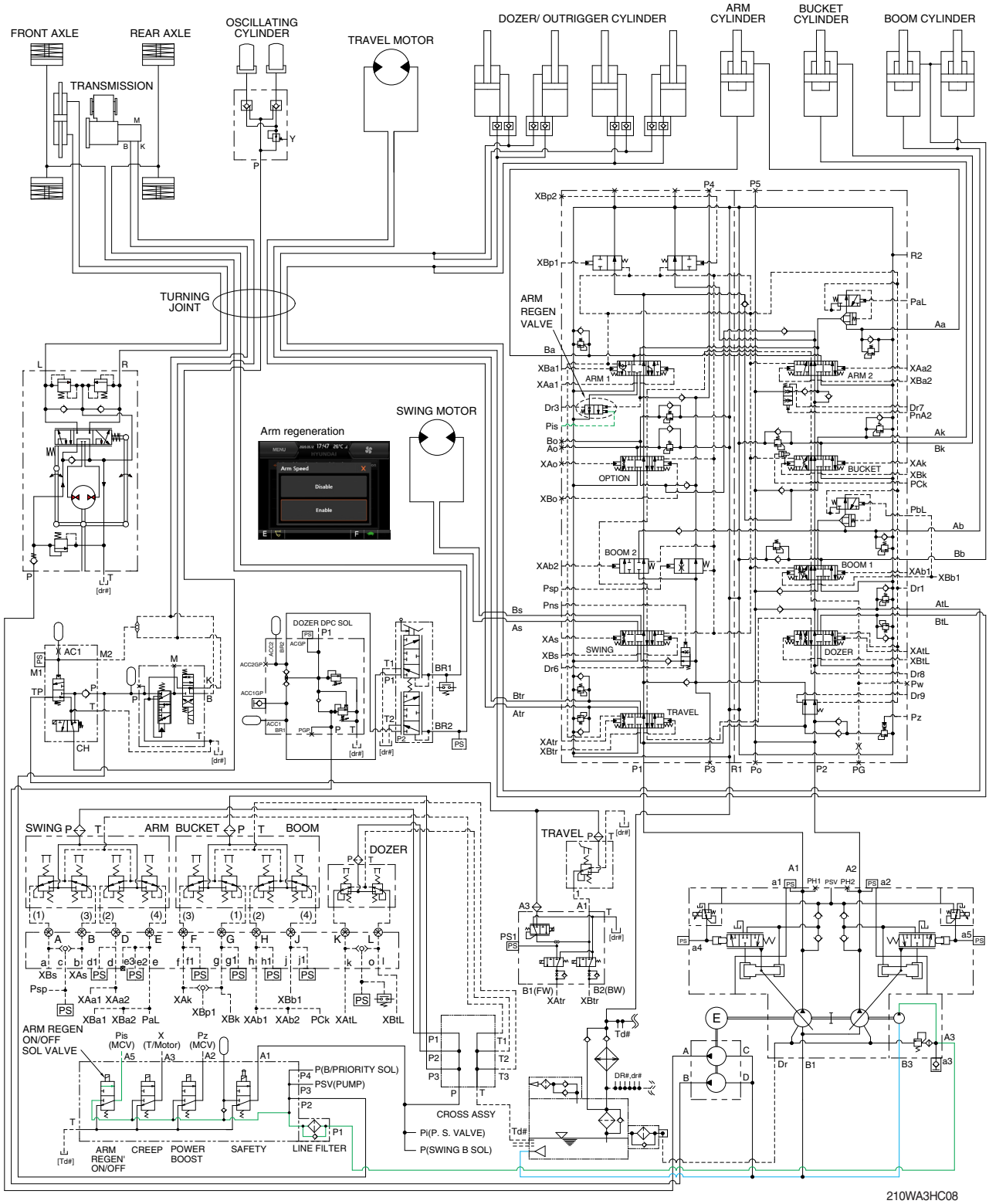
When the creep button on the dashboard of the steering column is pushed ON, the creep travel solenoid valve is actuated.

The discharged oil from the pilot pump flows into **X** port of travel motor through solenoid valve.

Then, the machine speed is very low travelling more than 1st speed.

※ The circuit diagram may differ from the equipment, so please check before a repair.

7. ARM REGENERATION CUT SYSTEM



When the arm regeneration is selected to disable on the cluster, the arm regeneration solenoid valve is activated. The pilot oil from pilot pump flows into **Pis** port in main control valve through solenoid valve and the arm regeneration spool is shifted to left.

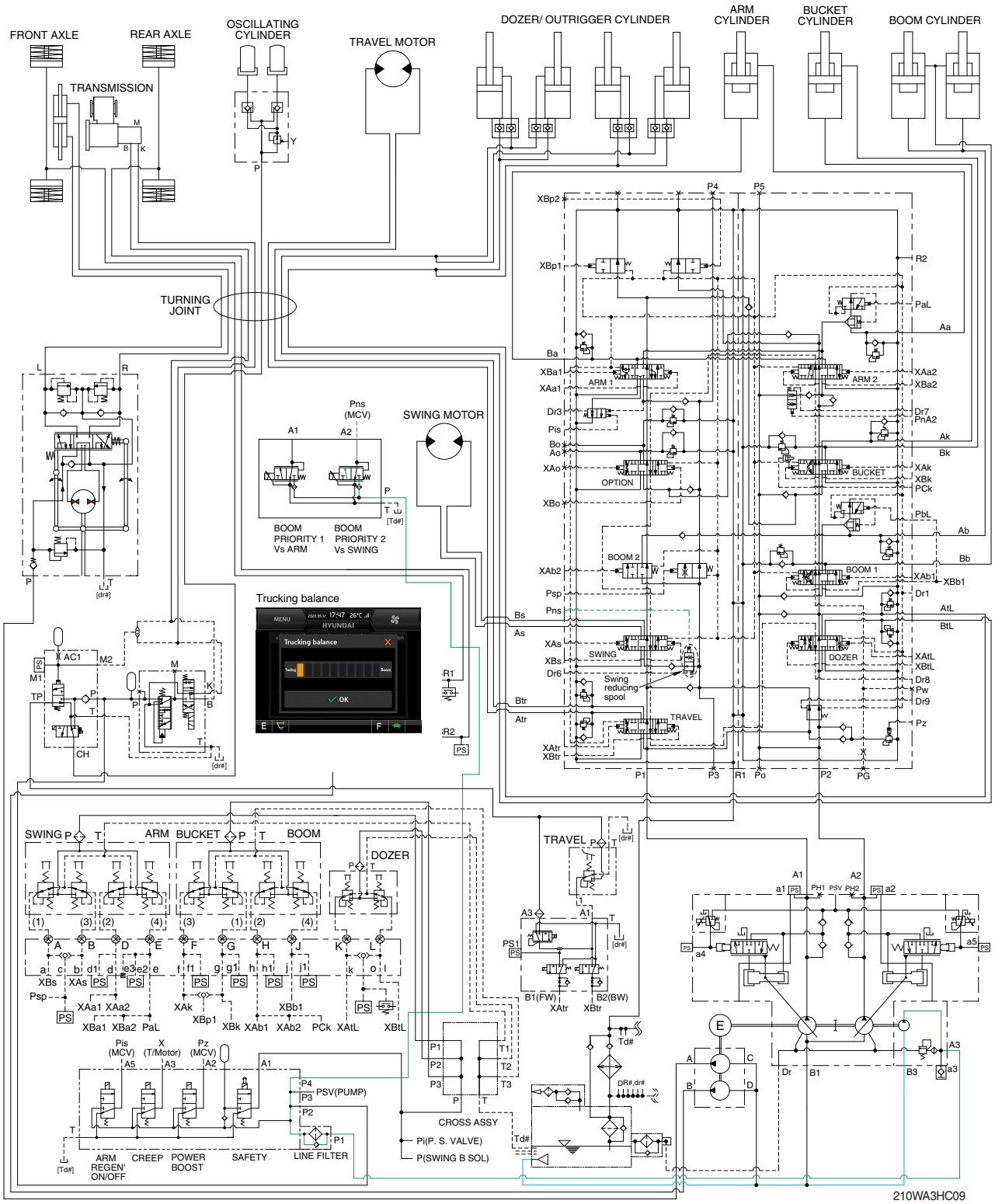
Then, the oil from arm regeneration passage returns to tank and the arm regeneration function is deactivated.

When the arm regeneration is selected to enable on the cluster, the arm regeneration function is activated and arm in operation speed is increased.

Refer to page 2-32 for the arm regeneration function.

※ The circuit diagram may differ from the equipment, so please check before a repair.

8. BOOM PRIORITY SYSTEM



When carrying out the combined operation of swing and boom up, the boom up operating speed is lowered then normal operation.

To increase working efficiency, swing speed reducing system is used.

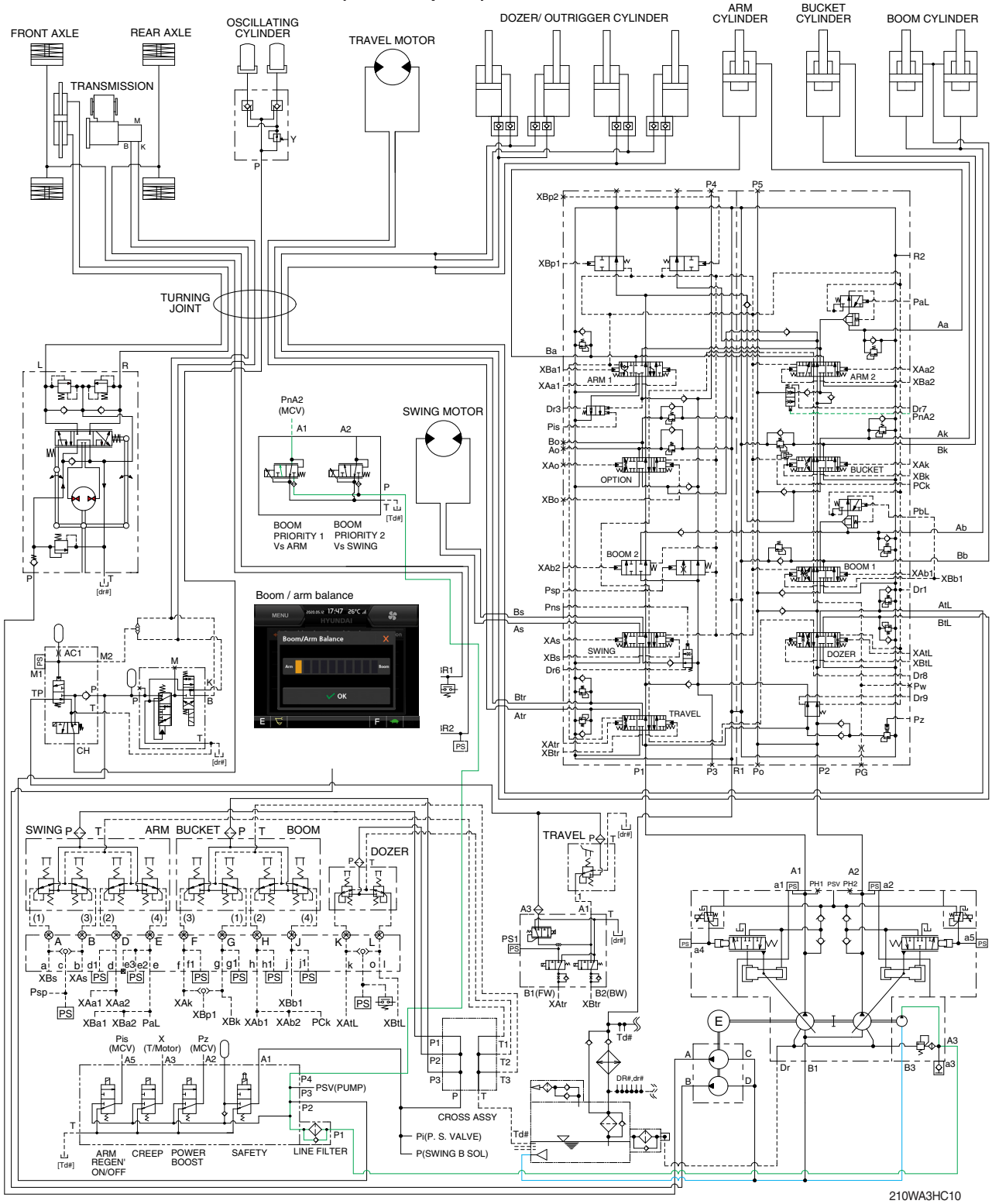
The pilot oil from pilot pump flow into **Pns** port in main control valve through boom priority EPPR valve. **Pns** oil pressure moves swing reducing spool to upper position and oil flow rate to the swing motor decreased.

Then, the boom up speed is increased. This is called the boom priority system.

The boom up and swing speed can be adjusted by the cluster. Refer to page 3-27 of the operator's manual.

※ The circuit diagram may differ from the equipment, so please check before a repair.

9. BOOM PRIORITY SYSTEM (vs arm speed)



When carrying out the combined operation of boom up and arm in, the boom up operating speed is lowered then normal operation.

To increase working efficiency, arm in speed reducing system is used.

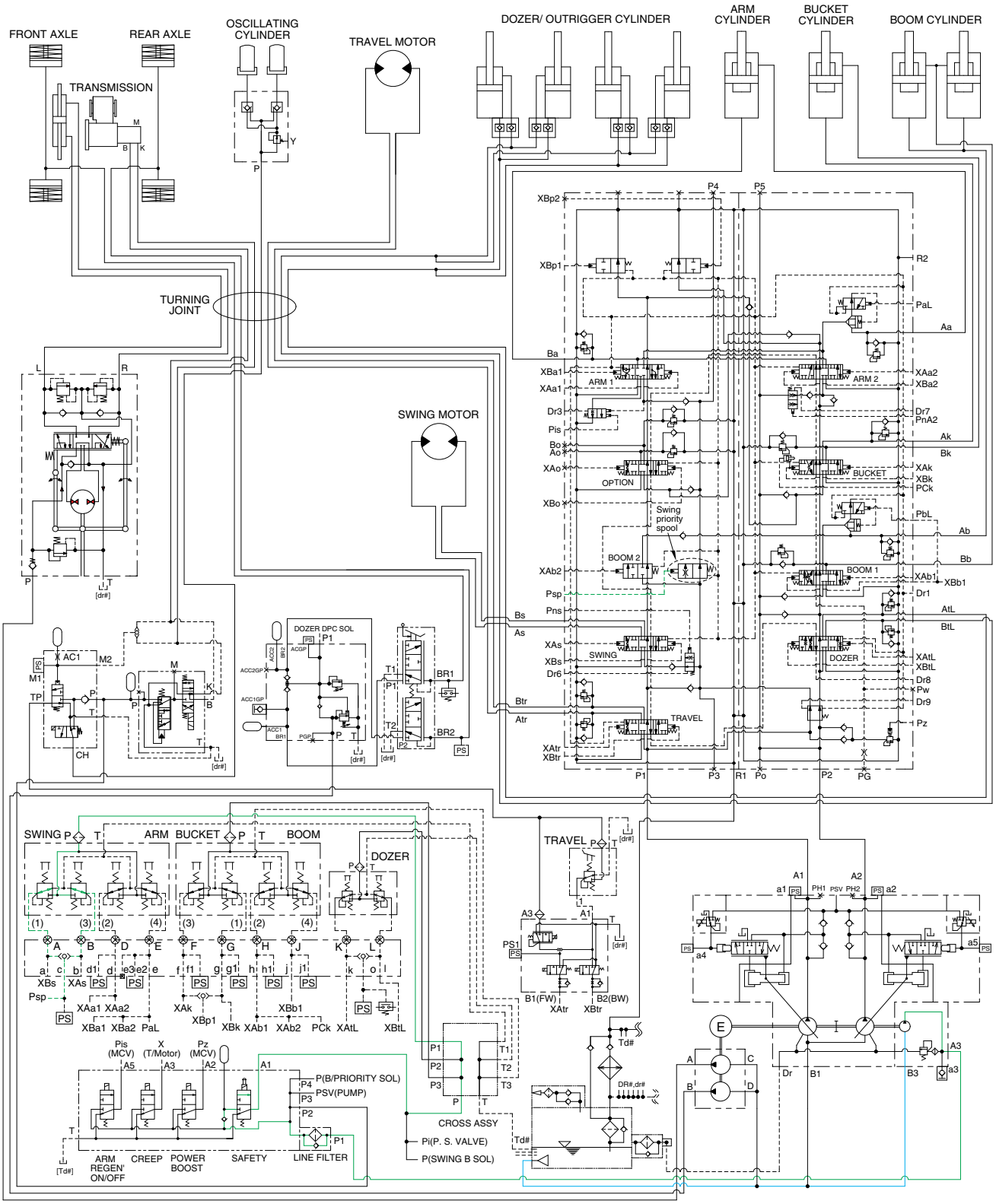
The pilot oil from pilot pump flow into PnA2 port in main control valve through boom priority (vs arm) EPPR valve. PnA2 oil pressure moves the arm 2 logic control valve to up position and the oil flow rate to the arm cylinder decreased.

Then, the boom up speed is increased. This is called the boom priority system (boom/arm balance).

The boom/arm balance can be adjusted by the cluster. Refer to page 5-95-1.

※ The circuit diagram may differ from the equipment, so please check before a repair.

10. SWING PRIORITY SYSTEM



When carrying out the combined operation of swing and arm of the left control valve, the swing speed can be lowered than arm speed.

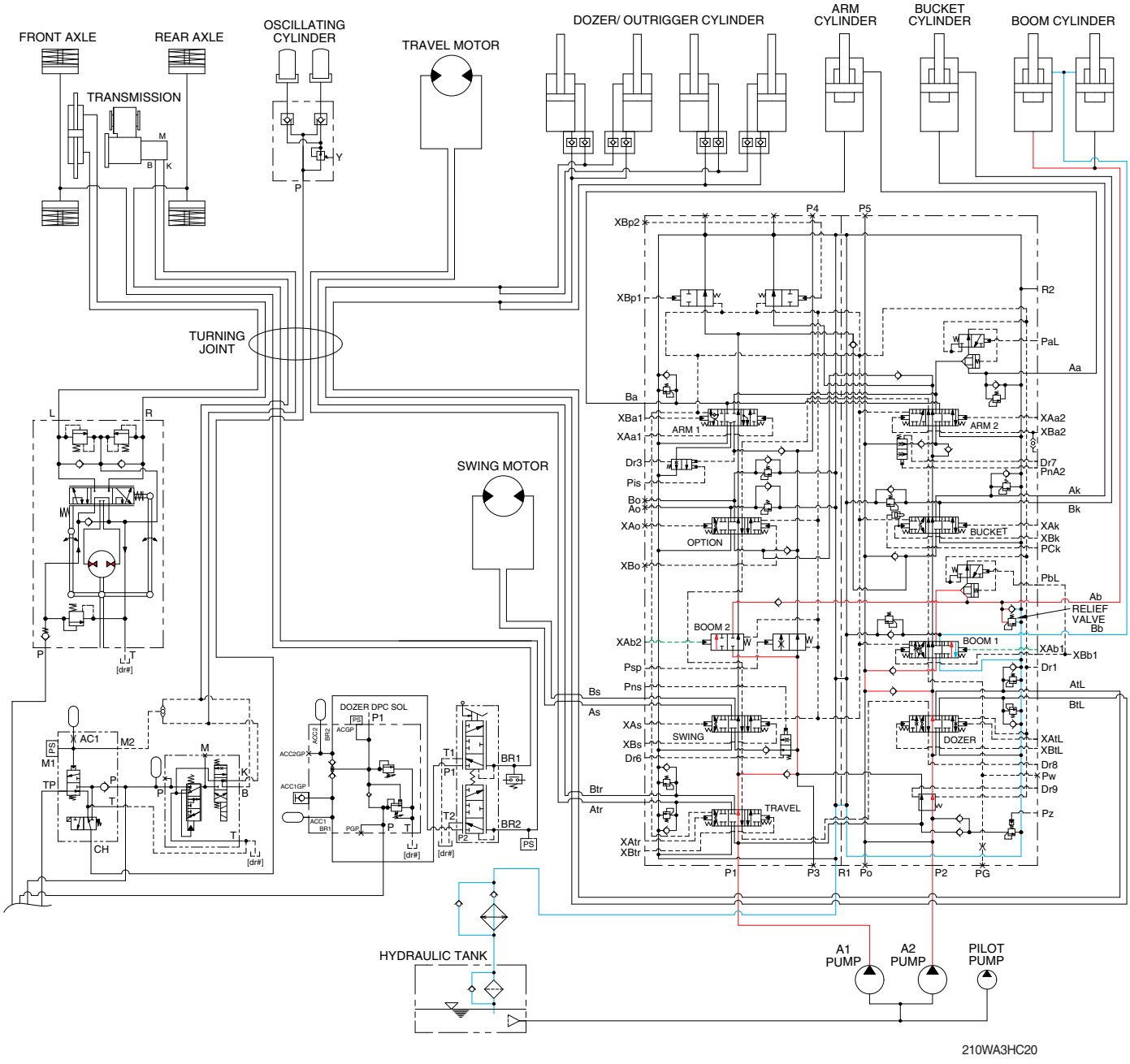
Psp pressure from the swing shuttle block changes the swing priority spool and then the oil flow rate is decreased to the next section to make the swing operation most preferential.

This is called the swing priority system. For details, refer to page 2-38.

※ The circuit diagram may differ from the equipment, so please check before a repair.

GROUP 4 SINGLE OPERATION

1. BOOM UP OPERATION

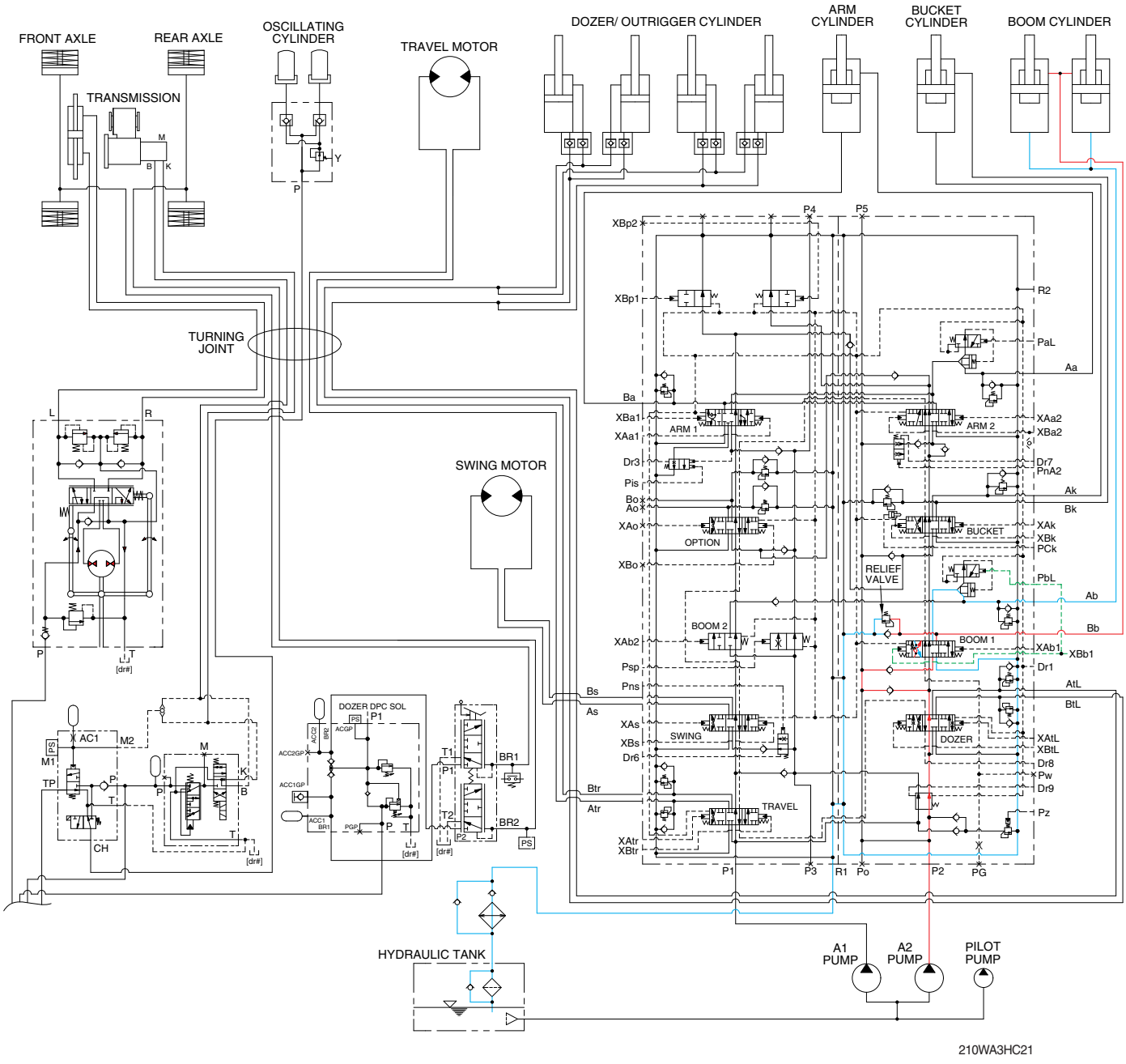


When the right control lever is pulled back, the boom spools in the main control valve are moved to the up position by the pilot oil pressure (XAb1, XAb2) from the remote control valve.

The oil from the A1 and A2 pump flows into the main control valve and then goes to the large chamber of boom cylinders. At the same time, the oil from the small chamber of boom cylinders returns to the hydraulic oil tank through the boom 1 spool in the main control valve. When this happens, the boom goes up. The excessive pressure in the boom cylinder head side 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 head side of the boom cylinder is closed by the boom holding valve. This prevents the hydraulic drift of boom cylinder.

※ The circuit diagram may differ from the equipment, so please check before a repair.

2. BOOM DOWN OPERATION



When the right control lever is pushed forward, the boom 1 spool in the main control valve is moved to the down position by the pilot oil pressure (XBb1) from the remote control valve.

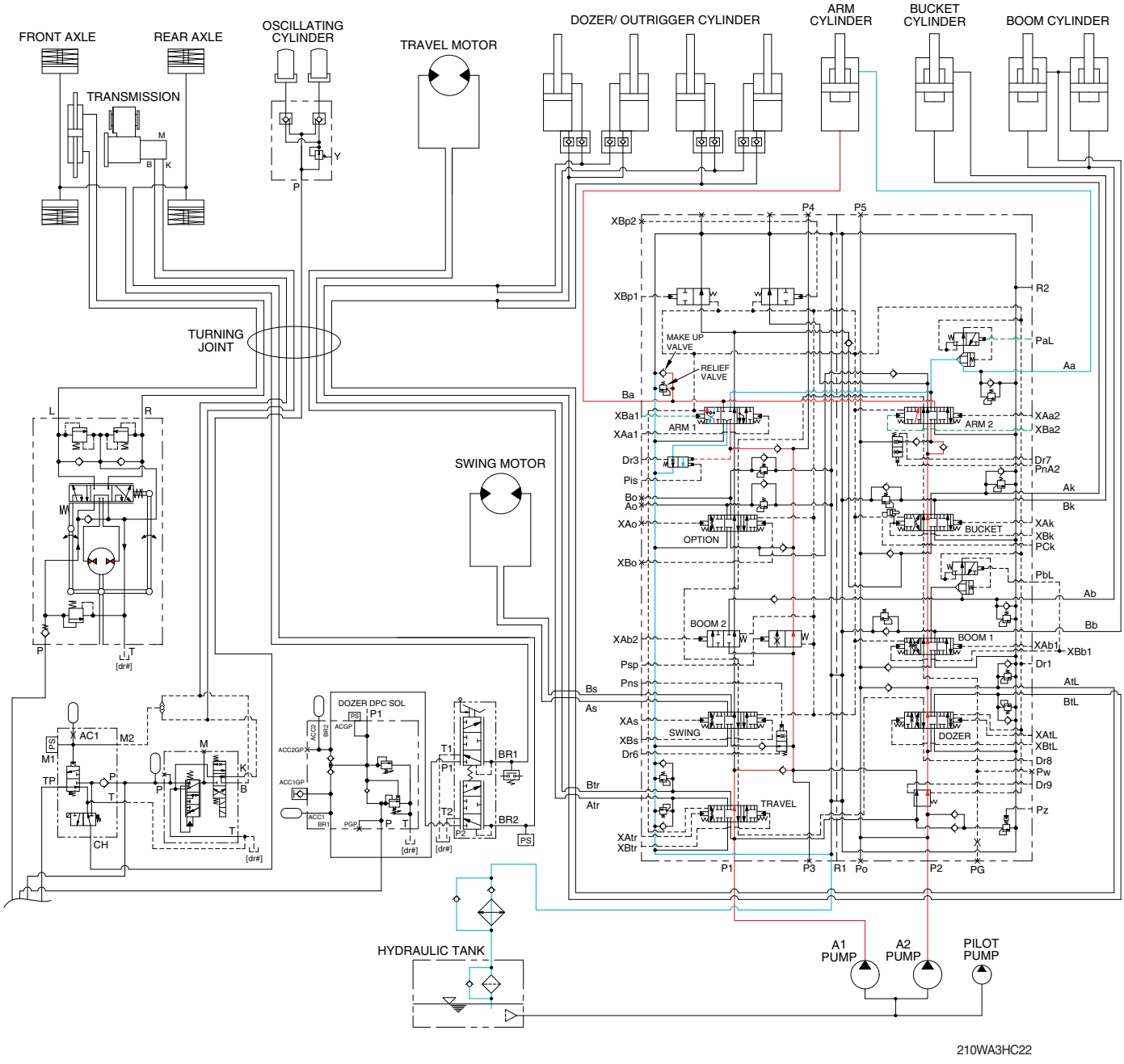
The oil from the A1 pump flows into the main control valve and then goes to the small chamber of boom cylinders. At the same time, the oil from the large chamber of boom cylinders returns to the hydraulic tank through the boom 1 spool in the main control valve.

When the down speed of boom is faster, the oil returned from the large chamber of boom cylinder combines with the oil from the A1 pump, and flows into the small chamber of the cylinder.

This prevents cylinder cavitation by the negative pressure when the A1 pump flow can not match the boom down speed. And the excessive pressure in the boom cylinder rod side is prevented by the relief valve.

※ The circuit diagram may differ from the equipment, so please check before a repair.

3. ARM IN OPERATION



When the left control lever is pulled back, the arm spools in the main control valve are moved to the arm in position by the pilot oil pressure (XBa1, XBa2) 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 arm cylinder.

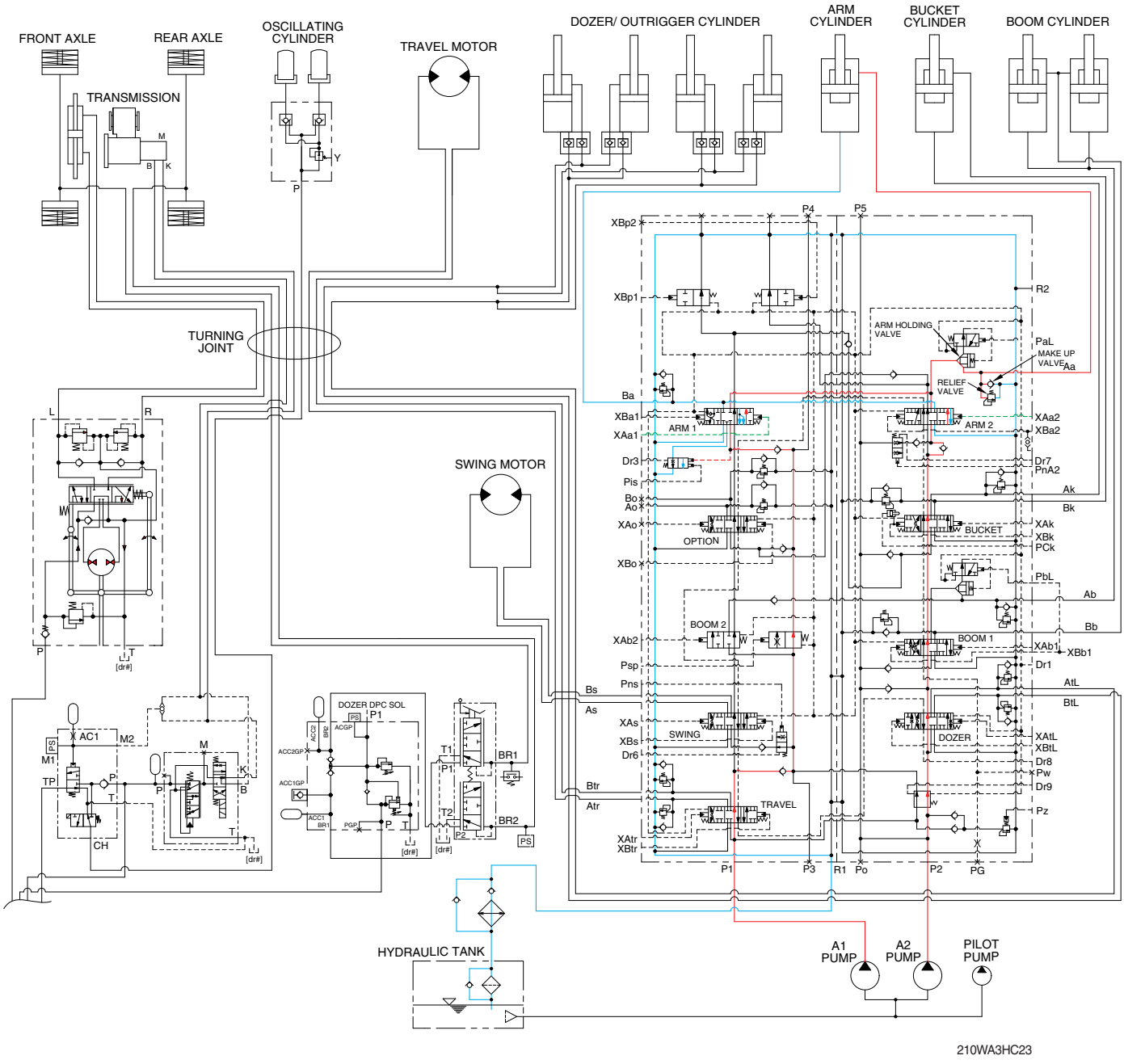
At the same time, the oil from small chamber of arm cylinder returns to the hydraulic oil tank through the arm 1 spool in the main control valve. When this happens, the arm rolls in.

The excessive pressure in the arm cylinder head side is prevented by relief valve.

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

※ The circuit diagram may differ from the equipment, so please check before a repair.

4. ARM OUT OPERATION

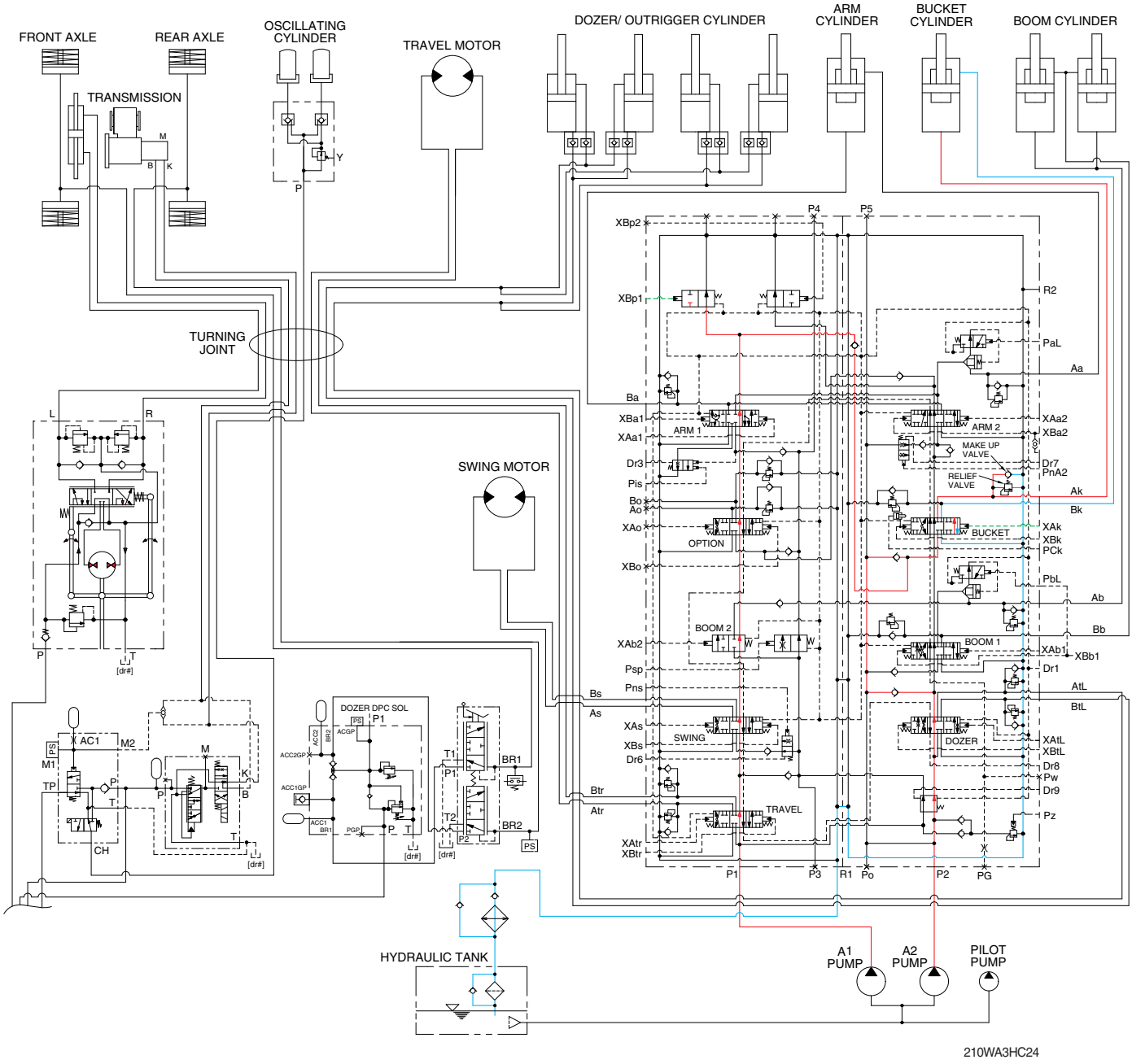


When the left control lever is pushed forward, the arm spools in the main control valve are moved to the arm out position by the pilot oil pressure (XAa1, XAa2) from the remote control valve.

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 spools in the main control valve. When this happens, the arm rolls out. The excessive pressure in the arm cylinder rod side is prevented by relief valve. When the arm is roll out and the control lever is returned to neutral position, the circuit for the holding pressure at the rod side of the arm cylinder is closed by the arm holding valve. This prevent the arm drift of arm cylinder. The cavitation which will happen to the rod side of the arm cylinder is also prevented by the make-up valve in the main control valve.

※ The circuit diagram may differ from the equipment, so please check before a repair.

5. BUCKET IN OPERATION



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 (XAk) from the remote control valve.

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

The oil from the A2 pump flows into the large chamber of bucket cylinder through confluence oil passage in the main control valve by bypass cut pilot pressure (XBp1).

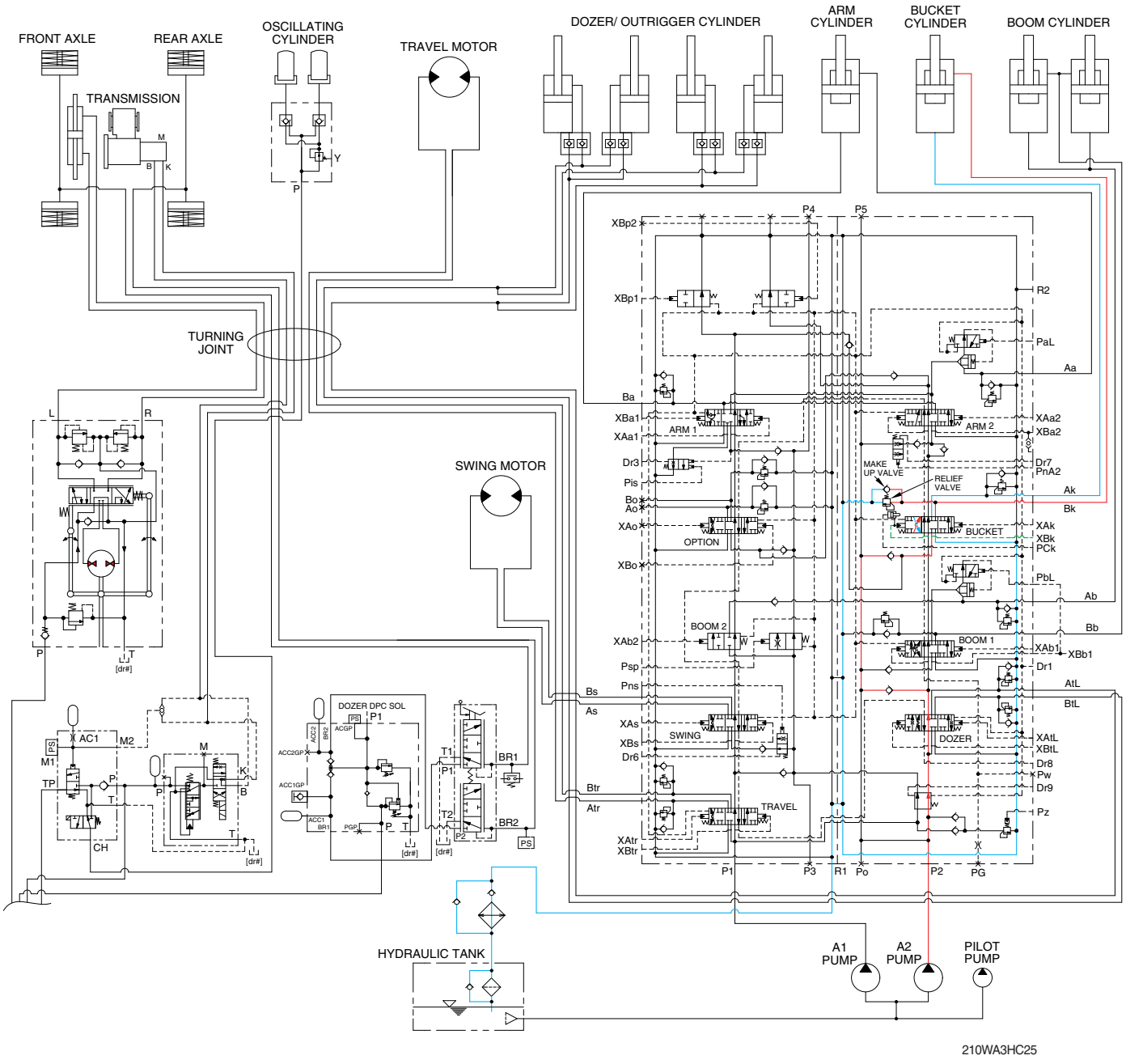
At the same time, the oil from the small chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls in.

The excessive pressure in the bucket cylinder head side is prevented by relief valve.

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

※ The circuit diagram may differ from the equipment, so please check before a repair.

6. BUCKET OUT OPERATION



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

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

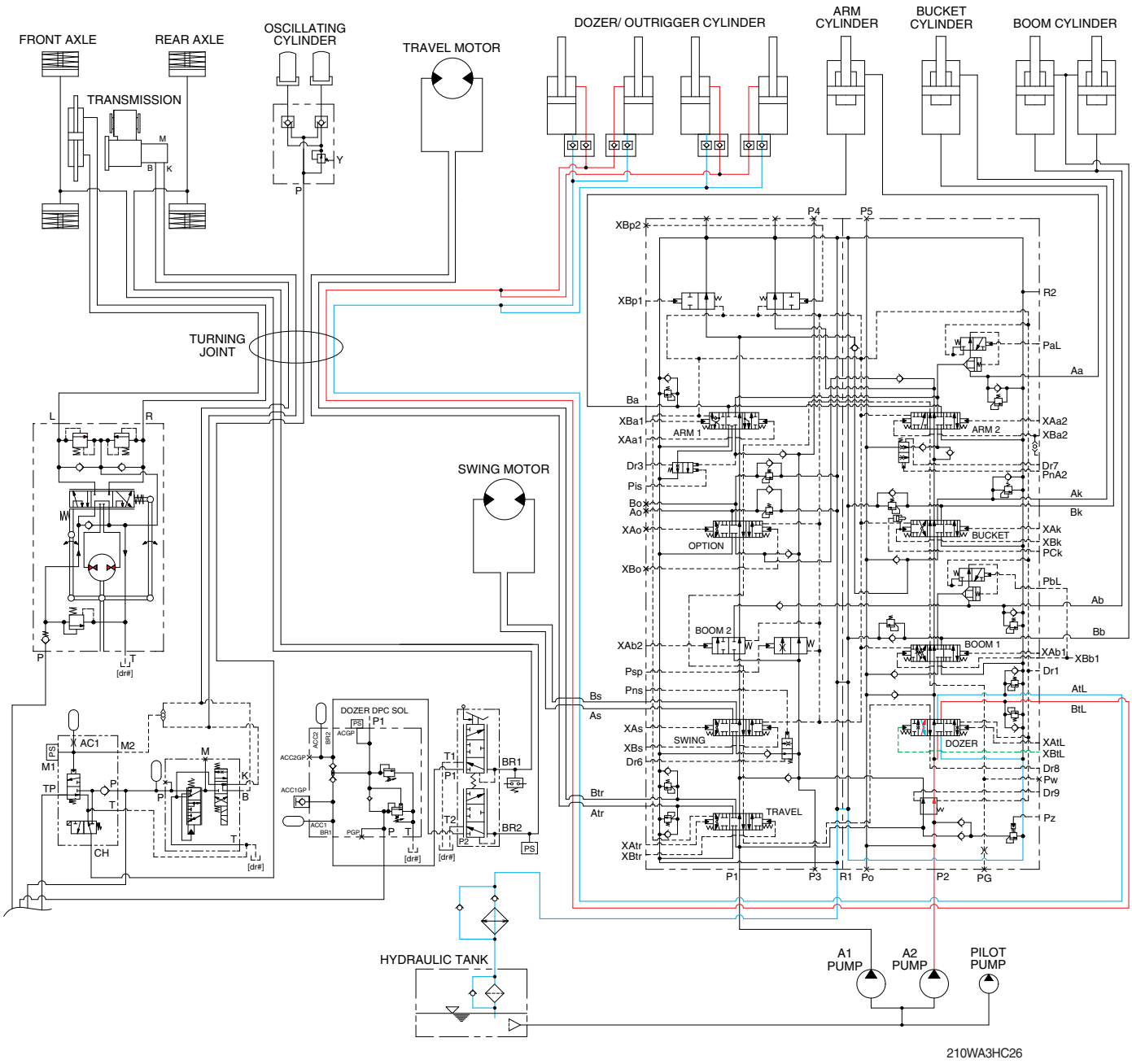
At the same time, the oil from the large chamber of bucket cylinder returns to the hydraulic oil tank through the bucket spool in the main control valve. When this happens, the bucket rolls out.

The excessive pressure in the bucket cylinder rod side is prevented by relief valve.

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

※ The circuit diagram may differ from the equipment, so please check before a repair.

7. DOZER/OUTRIGGER UP OPERATION



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 (XBtL) from the remote control valve.

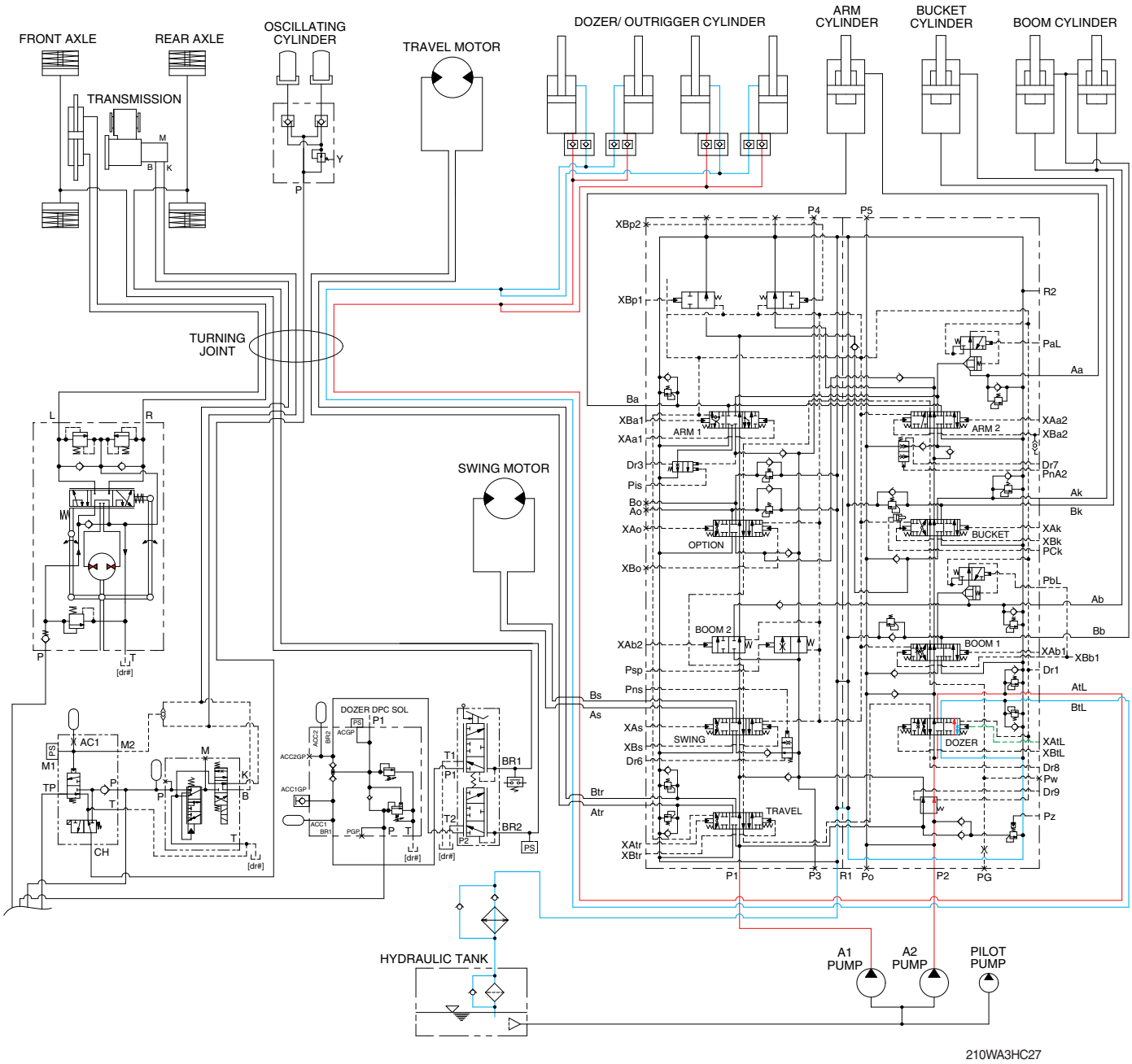
The oil from the A1 pump flows into the main control valve and then goes to the small chamber of rear actuator cylinder (dozer or outrigger).

The other case, the oil flows into the small chamber of front actuator cylinder (dozer or outrigger).

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

※ The circuit diagram may differ from the equipment, so please check before a repair.

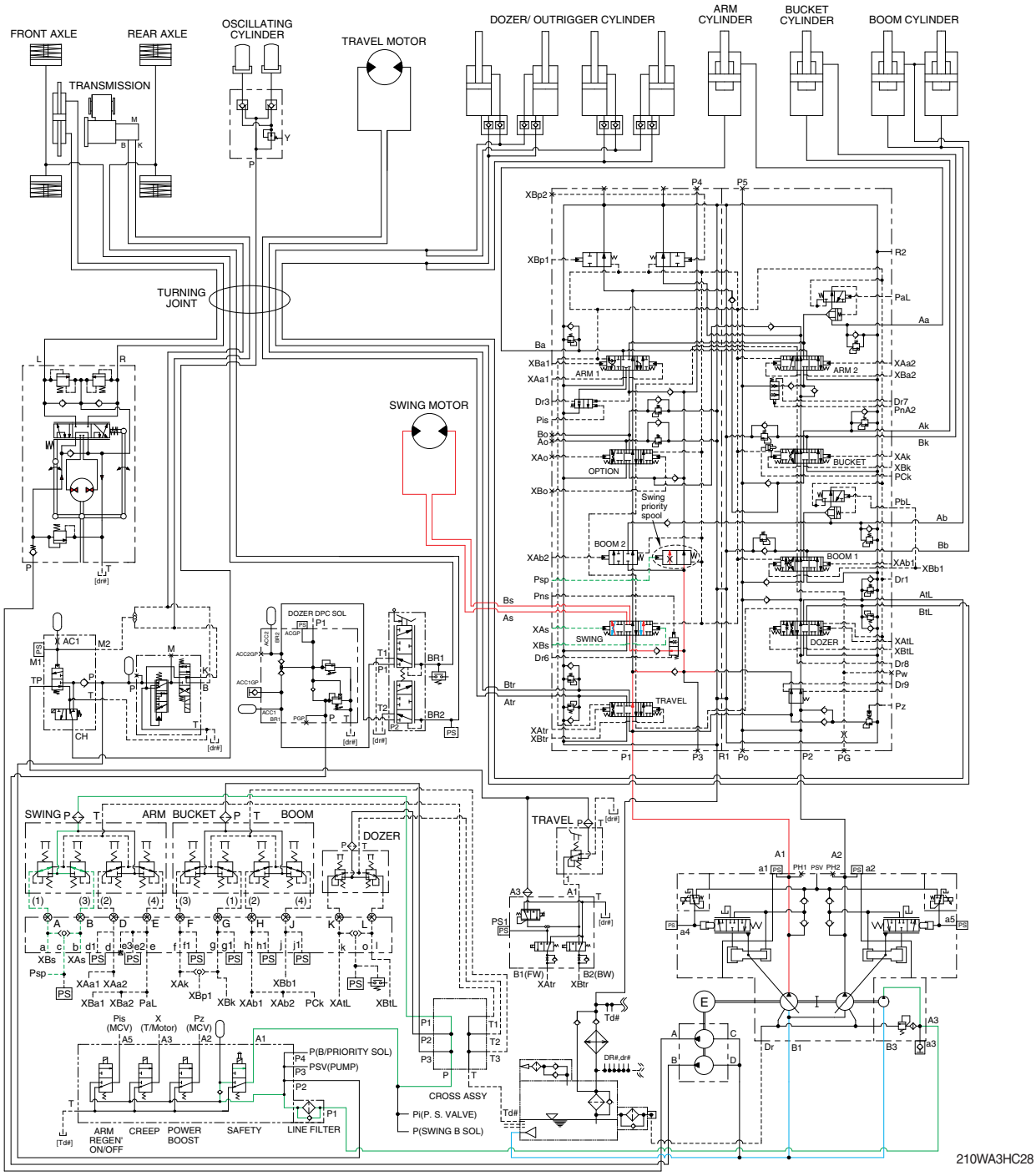
8. DOZER/OUTRIGGER DOWN OPERATION



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 (XAtL) from the remote control valve.
The oil from the A1 pump flows into the main control valve and then goes to the large chamber of rear actuator cylinder (dozer or outrigger).
The other case, the oil flows into the large chamber of front actuator cylinder (dozer or outrigger).
At the same time, the oil from the small chamber of dozer (outrigger) cylinders returns to the hydraulic oil tank through the dozer spool in the main control valve. When this happens, the dozer (outrigger) goes down.

※ The circuit diagram may differ from the equipment, so please check before a repair.

9. SWING OPERATION



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. Also the swing operation preference function is operated by the pilot pressure **Psp** (refer to page 3-17).

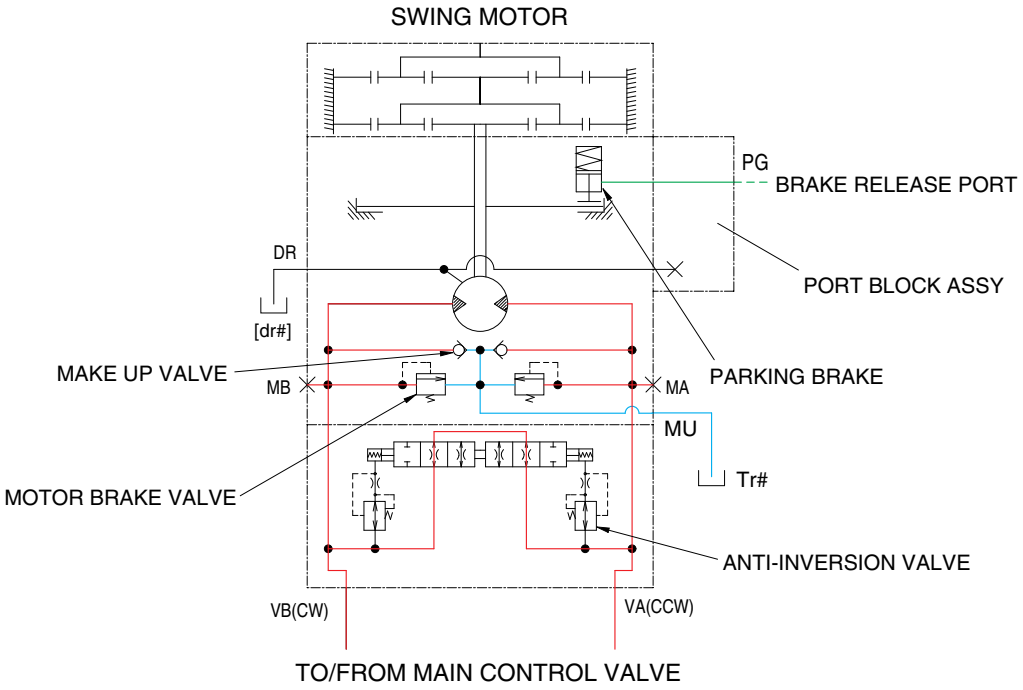
The oil from the A2 pump flows into the main control valve and then goes to the swing motor.

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 upper structure swings to the left or right.

The swing parking brake, make up valve and the motor brake 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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

SWING CIRCUIT OPERATION



210WA3HC29

1) MOTOR BRAKE VALVE

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

2) MAKE UP VALVE

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

3) PARKING BRAKE

This is function as a parking brake only when the swing, arm in and boom up control lever are not operated.

PARKING BRAKE "OFF" OPERATION

When any of the swing, arm in or boom up control lever is tilted, the swing solenoid valve is energized by the MCU that senses the pilot oil pressure of the swing control lever.
The discharged oil from pilot pump flows to swing motor PG port through the swing solenoid valve. This pressure is applied to swing parking brake piston, thus the brake is released.

PARKING BRAKE "ON" OPERATION

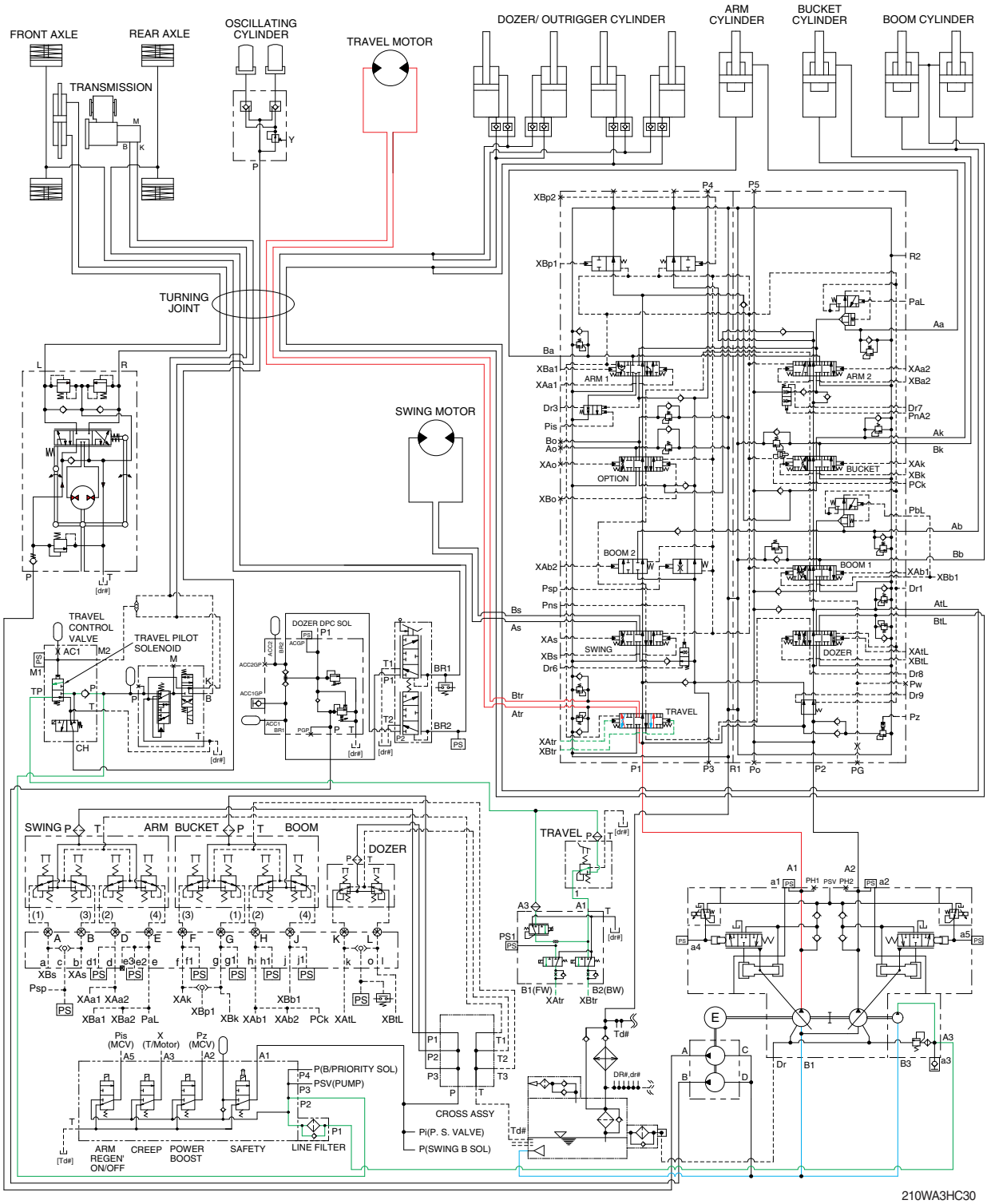
When the swing, arm in and boom up control levers are set in the neutral position, the swing solenoid valve is de-energized, oil in the swing parking brake chamber is drained through the the swing solenoid valve, thus the brake is applied by spring force.

4) ANTI-INVERSION VALVE

This anti-inversion valve absorbs shocks produced as swing motion stops and reduced oscillation cause by swing motion.

※ The circuit diagram may differ from the equipment, so please check before a repair.

10. TRAVEL FORWARD AND REVERSE OPERATION



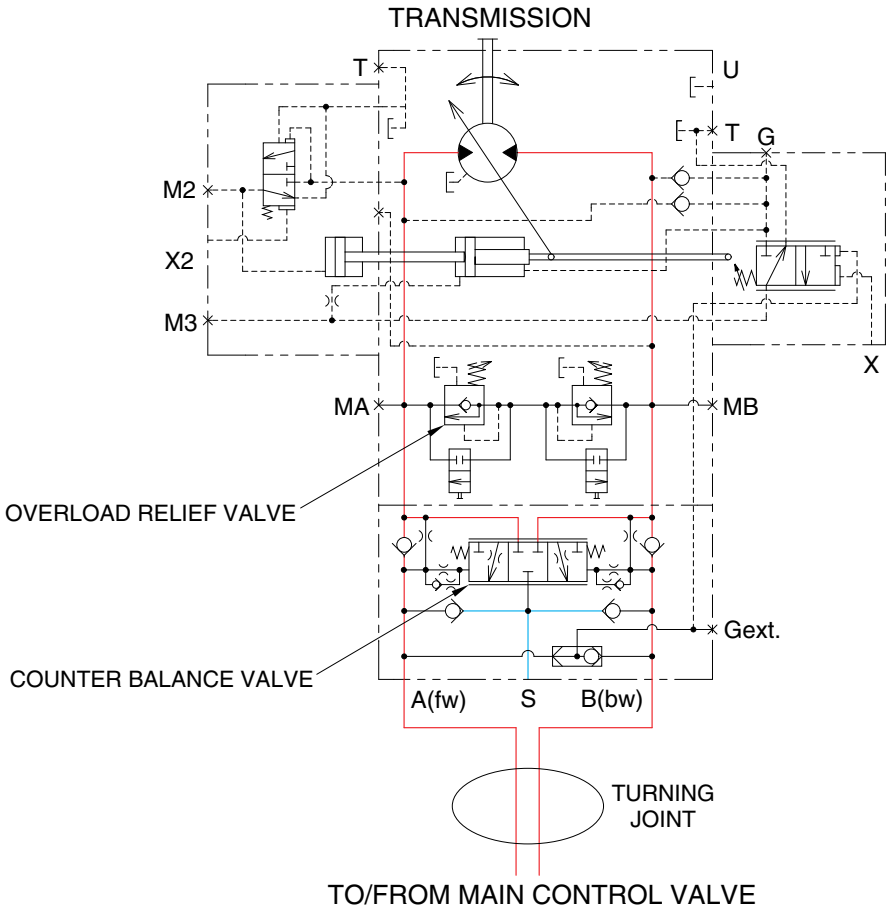
When the FNR switch of the RH RCV lever is placed in forward or reverse position, the travel spool in the main control valve is moved to the forward or reverse position by the pilot oil pressure (XAtr, XBtr) from pilot pump through the travel pilot solenoid of travel control valve. The oil from the A1 pump 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 spool in the main control valve.

When this happens, the machine moves forward or reverse.

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

※ The circuit diagram may differ from the equipment, so please check before a repair.

TRAVEL CIRCUIT OPERATION



210WA3HC31

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

1) COUNTER BALANCE VALVE

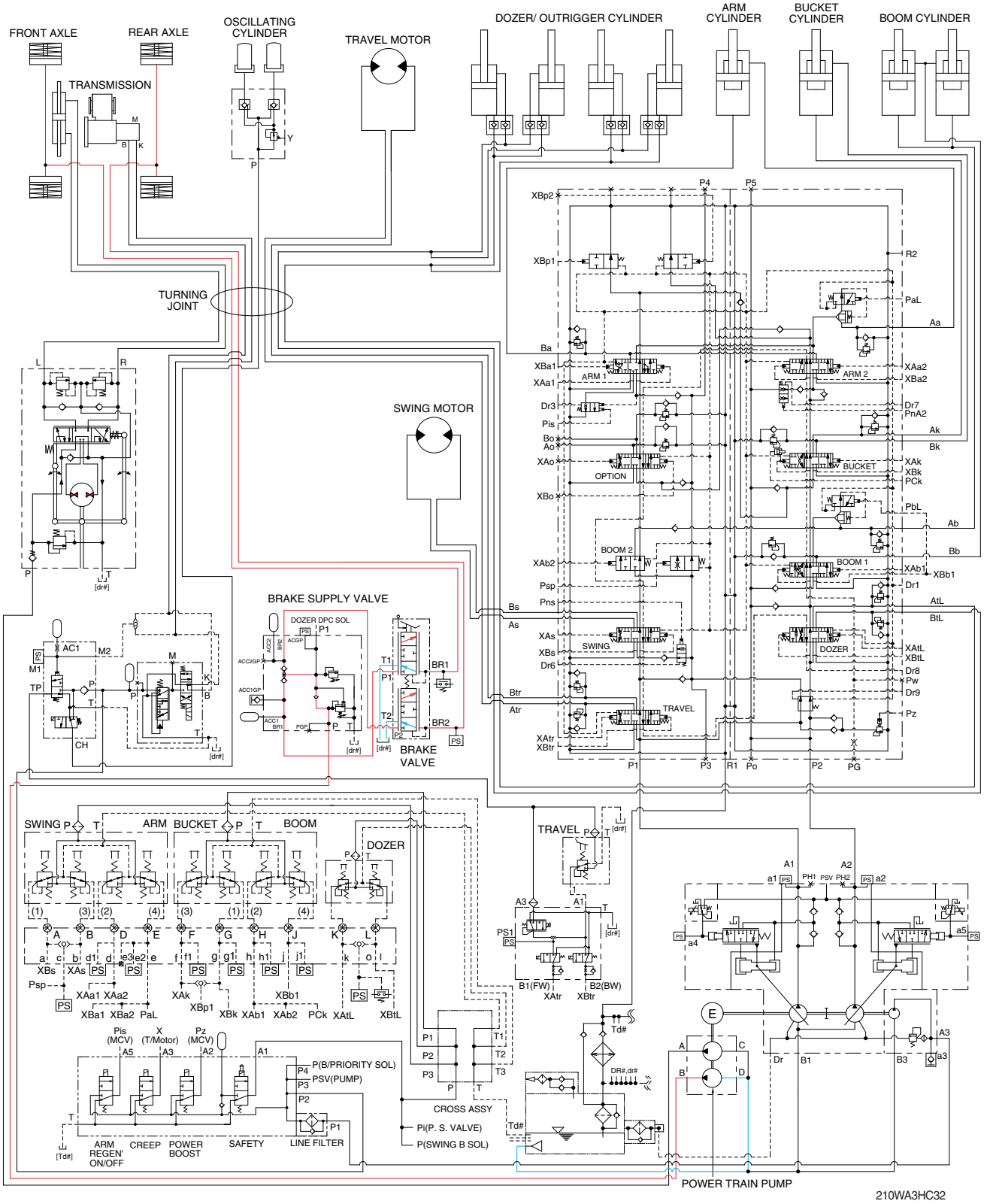
When stopping the motor on a slope descending, this valve prevents the motor from over running.

2) OVERLOAD RELIEF VALVE

Relief valve limits the circuit pressure below 380 kgf/cm^2 to prevent high pressure from being generated at the time of stopping the machine. When stopping the motor, this valve sucks the oil from lower pressure passage for preventing the negative pressure and the cavitation of the motor.

※ The circuit diagram may differ from the equipment, so please check before a repair.

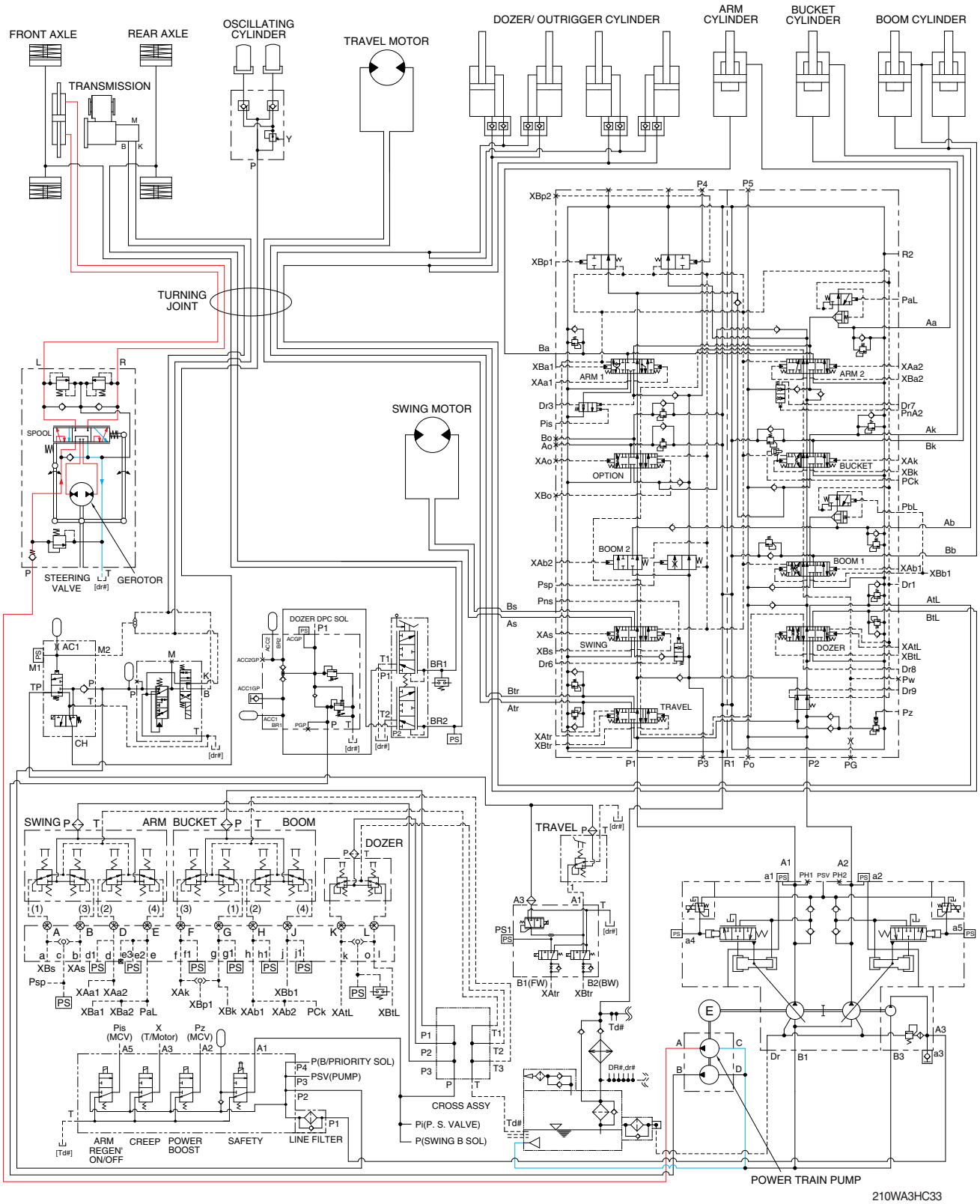
11. SERVICE BRAKE SYSTEM



When the brake pedal (valve) is pushed, the discharged oil from the power train pump (B) flows into the front and rear axle brake disc through the solenoid valve of brake supply valve.
This pressure is applied to axle brake disc, thus the brake is applied.

※ The circuit diagram may differ from the equipment, so please check before a repair.

12. STEERING CIRCUIT OPERATION



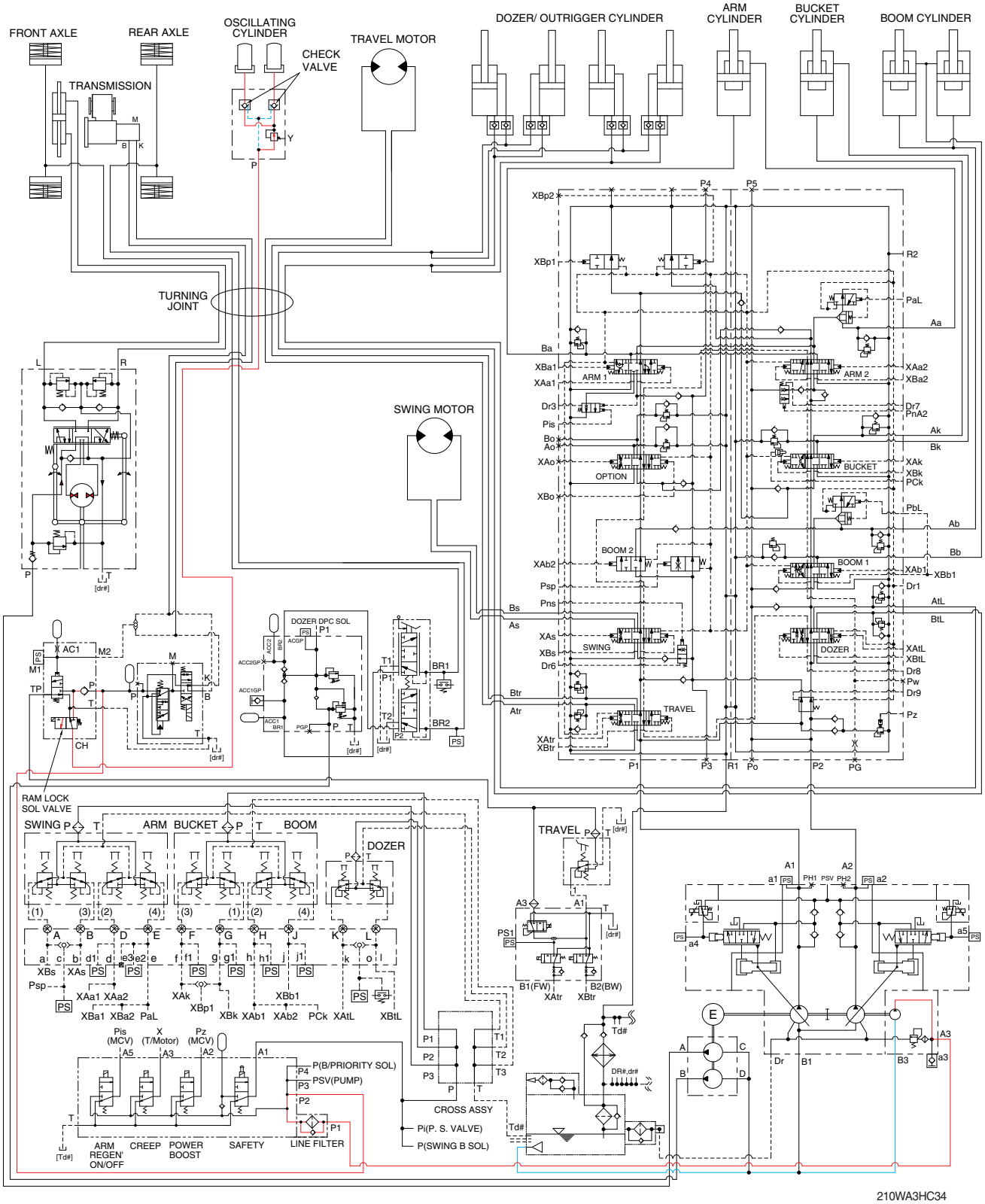
When the steering wheel is turned to the left or right, the spool within the steering valve turns left or right hand direction : Because the spool is connected with steering column.

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

Then the steering direction is applied.

※ The circuit diagram may differ from the equipment, so please check before a repair.

13. RAM LOCK CIRCUIT OPERATION



When the ram lock switch on the dashboard of the steering column is selected to OFF position, the ram lock solenoid is changed over.

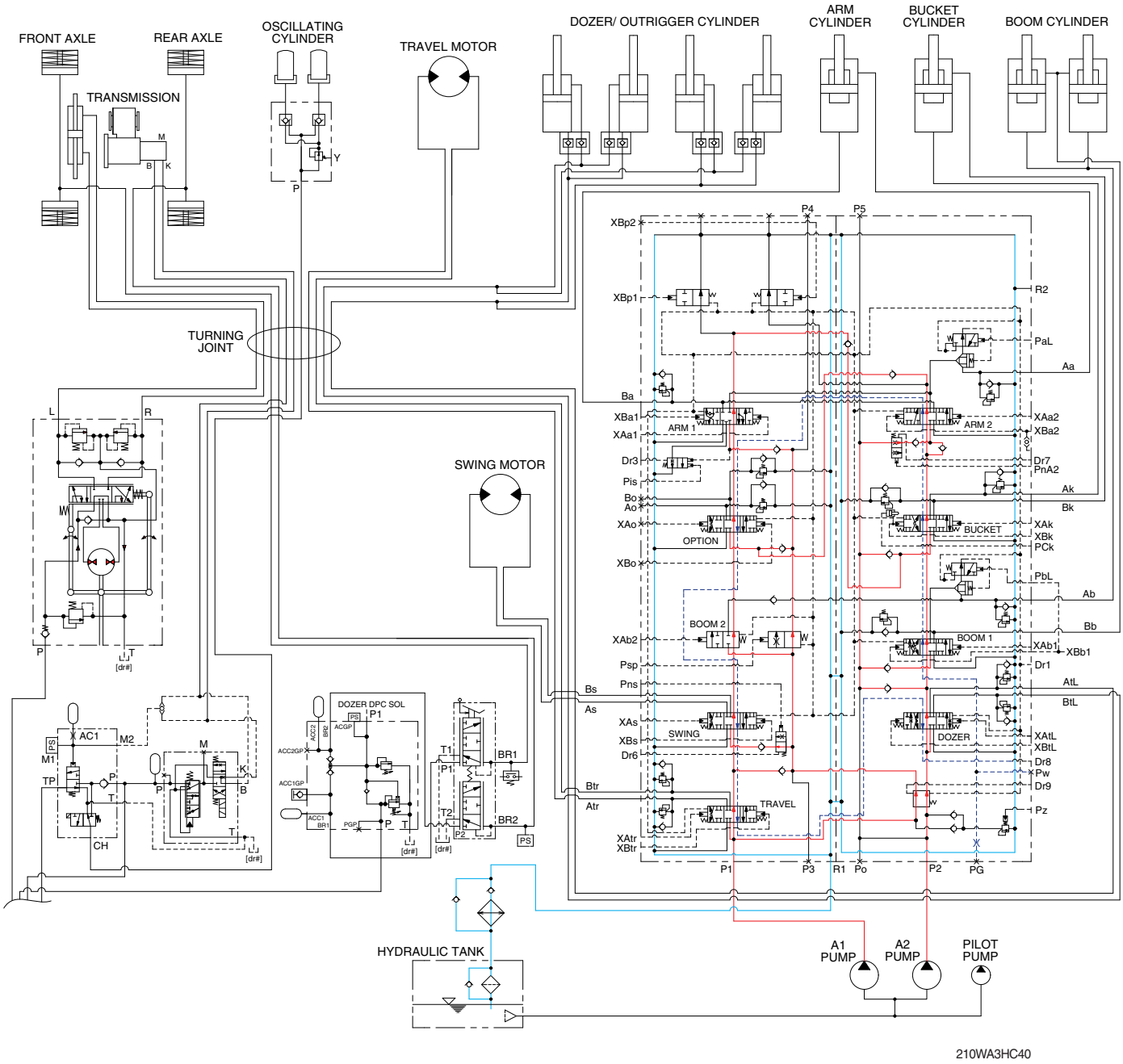
Thus, the oil discharged from the pilot pump flows into oscillating cylinder through ram lock solenoid and locking valve.

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

※ The circuit diagram may differ from the equipment, so please check before a repair.

GROUP 5 COMBINED OPERATION

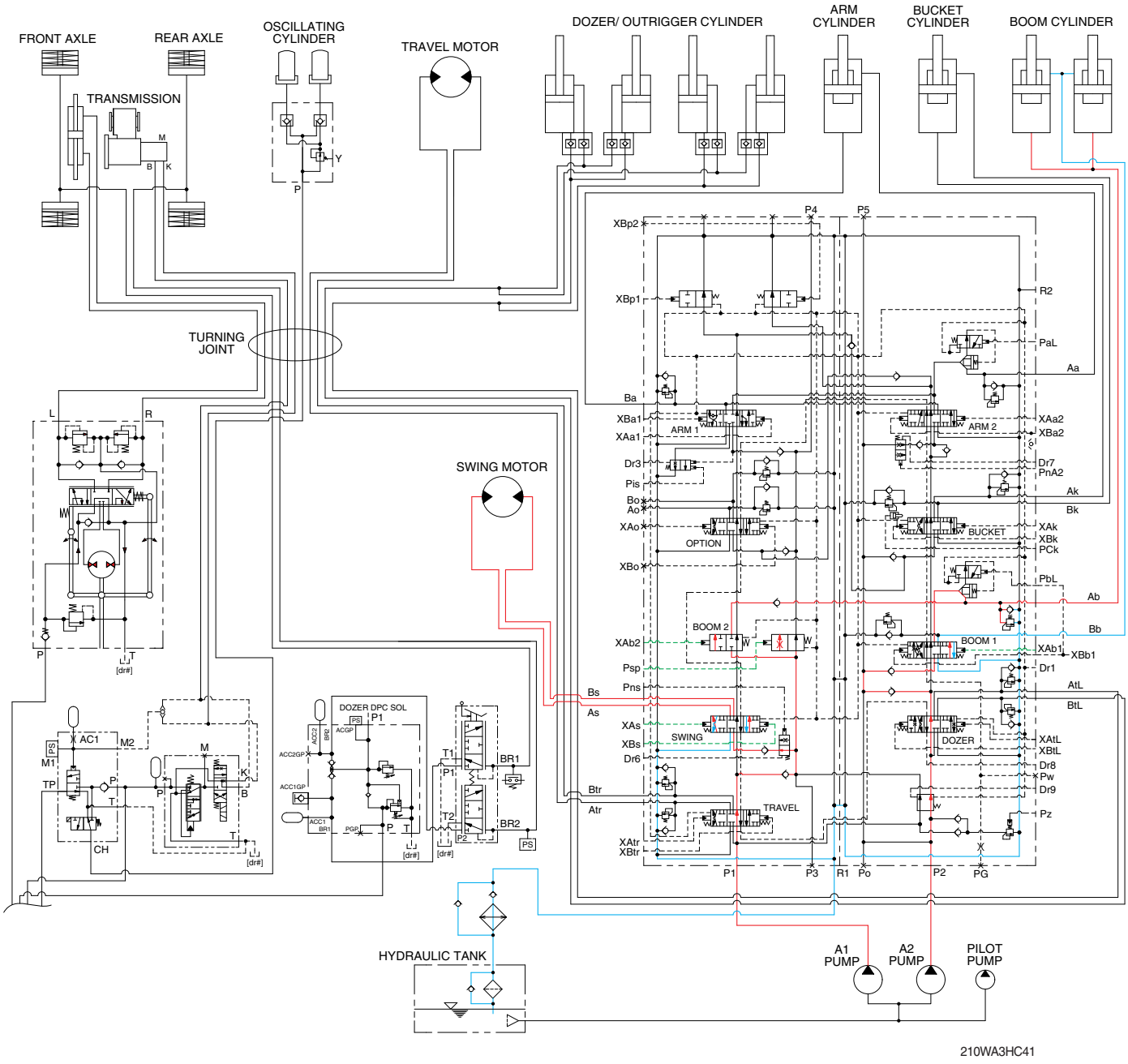
1. OUTLINE



The oil from the A1 and A2 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.

※ The circuit diagram may differ from the equipment, so please check before a repair.

2. COMBINED SWING AND BOOM UP OPERATION



When the swing and boom up 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 (XAs, XBs, XAb1, XAb2) from the remote control valve.

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

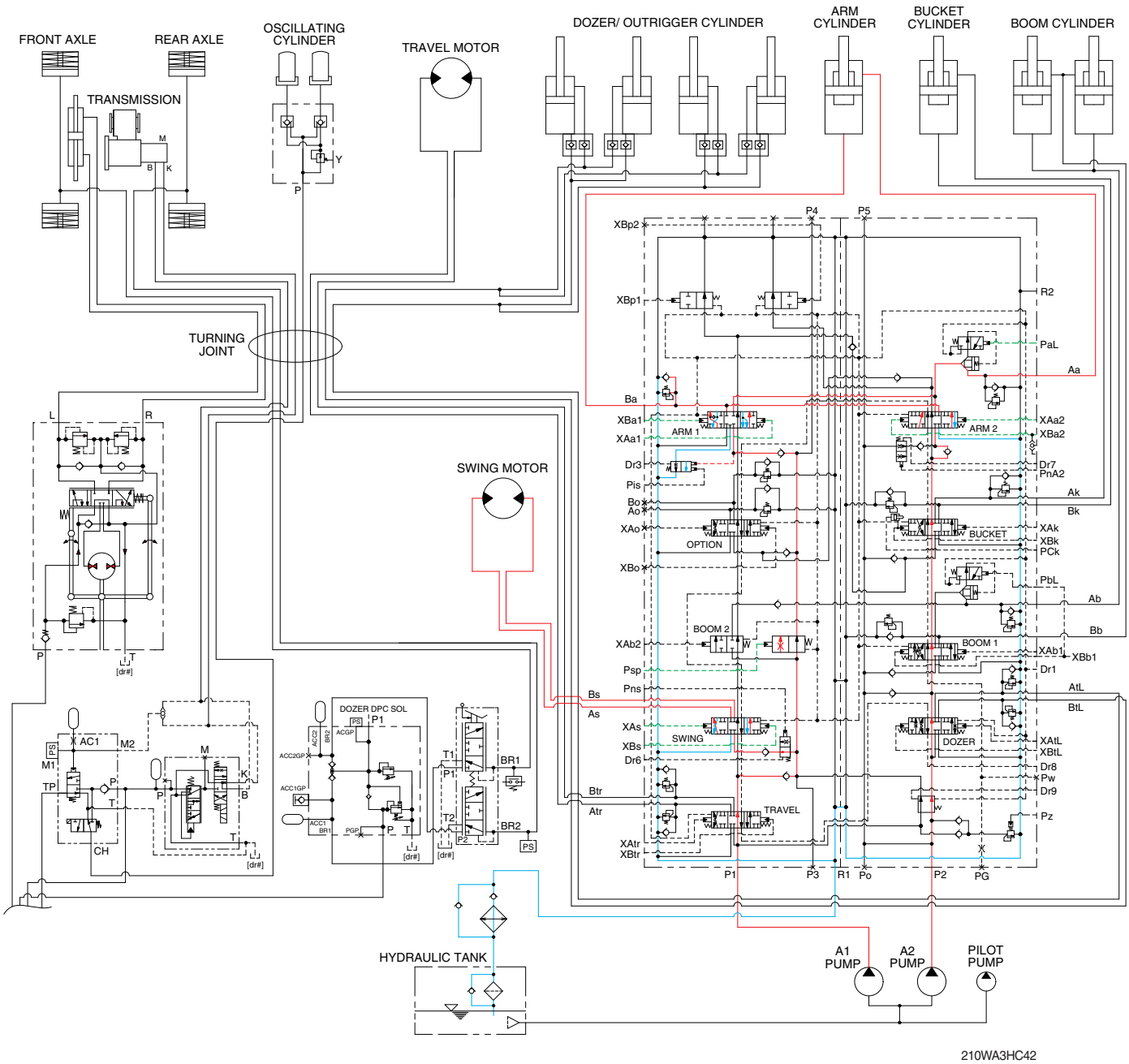
The oil from the A1 pump flows into the boom cylinders through the boom 1 spool in the right control valve.

The super structure swings and the boom is operated.

Refer to page 3-15 for the boom priority system.

※ The circuit diagram may differ from the equipment, so please check before a repair.

3. COMBINED SWING AND ARM OPERATION



When the swing and arm functions are operated simultaneously, the swing spool and arm spools in the main control valve are moved to the functional position by the pilot oil pressure (XAs, XBs, XBa1, XBa2, XAa1, XAa2) from the remote control valve.

The oil from the A2 pump flows into the swing motor through swing spool and the arm cylinder through arm 1 spool.

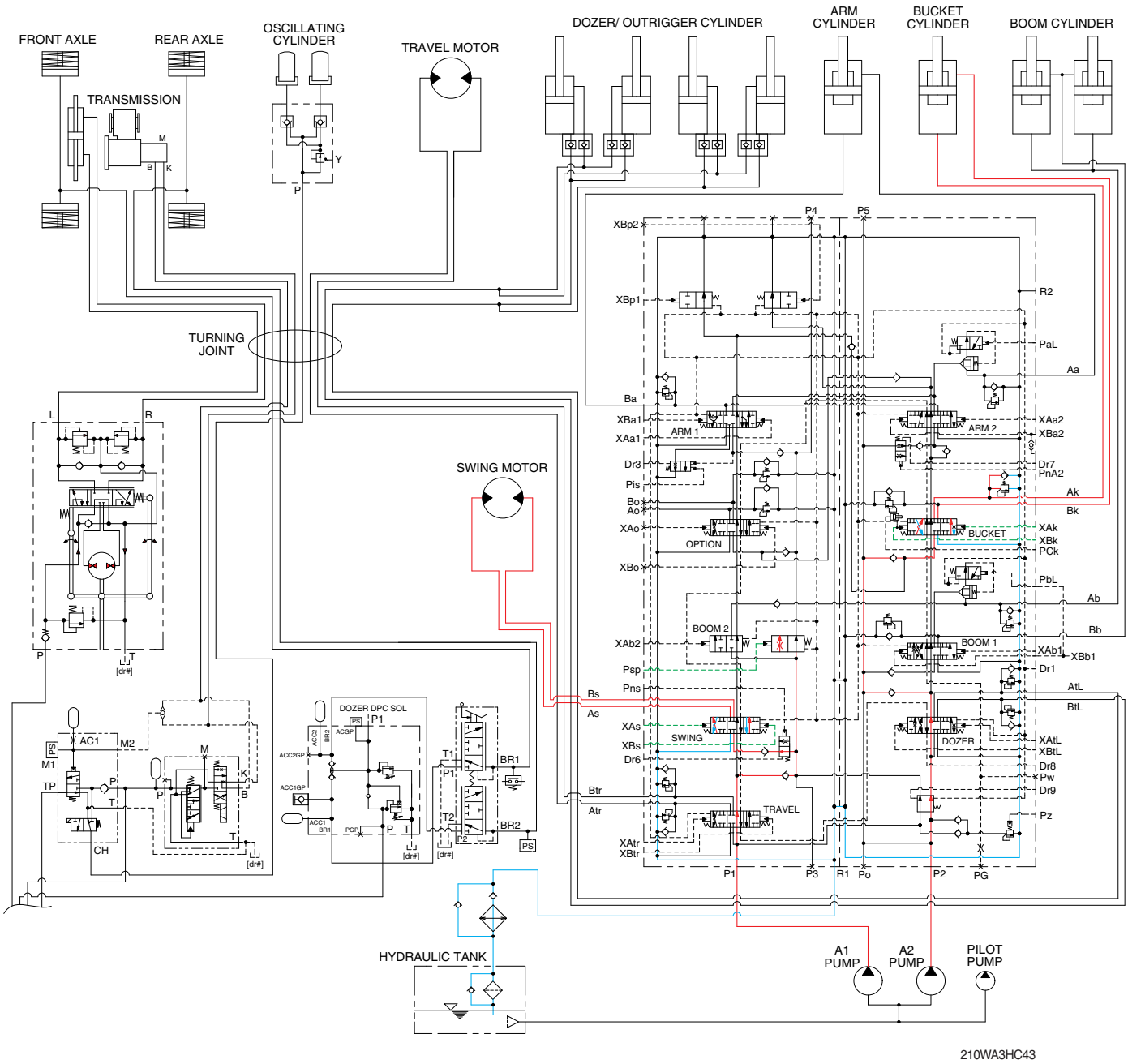
The oil from the A1 pump flows into the arm cylinder through the arm 2 spool of the right control valve.

The super structure swings and the arm is operated.

Refer to page 3-17 for the swing operation preference function.

※ The circuit diagram may differ from the equipment, so please check before a repair.

4. COMBINED SWING AND BUCKET OPERATION



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 (XAs, XBs, XAk, XBk) from the remote control valve.

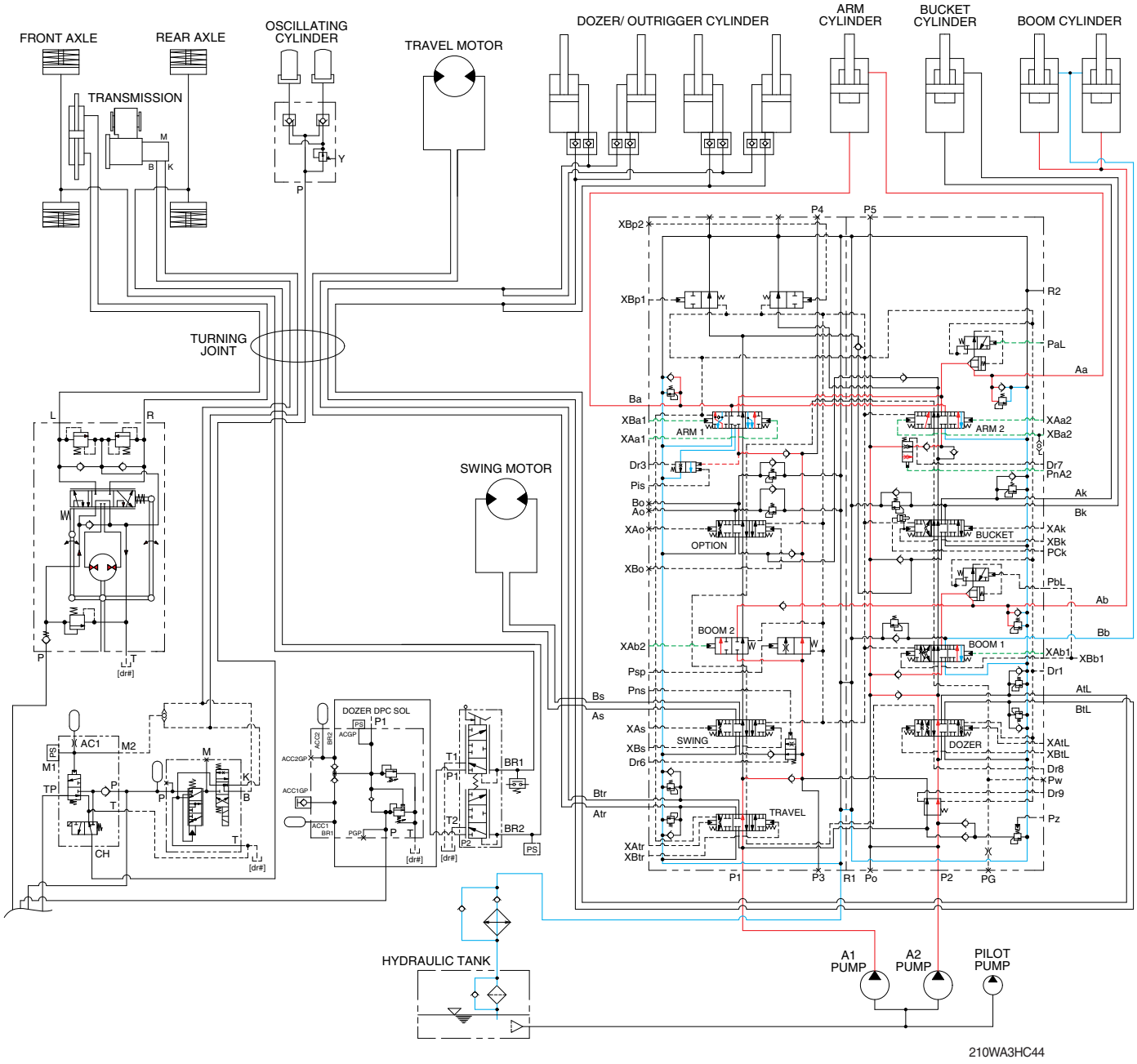
The oil from the A2 pump flows into the swing motor through the swing spool in the left control valve.

The oil from the A1 pump flows into the bucket cylinder through the bucket spool in the right control valve.

The super structure swings and the bucket is operated.

※ The circuit diagram may differ from the equipment, so please check before a repair.

5. COMBINED BOOM UP AND ARM OPERATION



When the boom up and arm functions are operated simultaneously, the boom spools and arm spools in the main control valve are moved to the functional position by the pilot oil pressure (XAb1, XAb2, XBa1, XBa2, XAa1, XAa2) from the remote control valve.

The oil from the A2 pump flows into the boom cylinders and the arm cylinder through the boom 2 spool and arm 1 spool in the left control valve.

The oil from the A1 pump flows into the boom cylinders and arm cylinder through the boom 1 spool and arm 2 spool and the parallel and confluence oil passage in the right control valve.

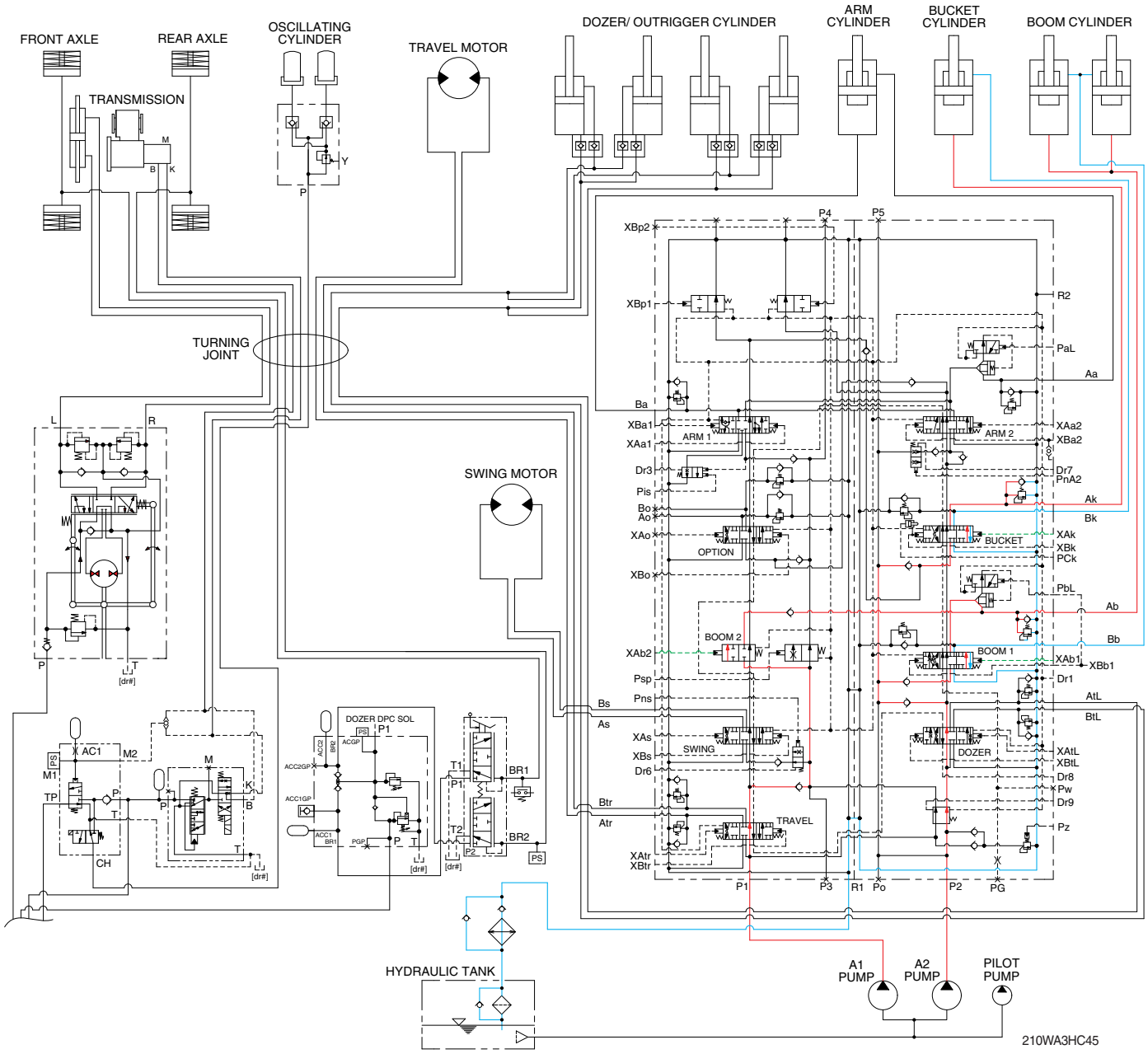
During the boom up and arm in or out functions are operated simultaneously, the pilot oil pressure PnA2 transfers the arm 2 logic spool to the up direction.

Therefore, the most of pressurized oil from the A1 pump flows into boom 1 spool than the arm 2 spool to make the boom up operation more preferential. This is called the boom up operation preference function.

The boom up and arm are operated.

※ The circuit diagram may differ from the equipment, so please check before a repair.

6. COMBINED BOOM UP AND BUCKET IN OPERATION



When the boom up and bucket in functions are operated simultaneously, the boom spools and bucket spool in the main control valve are moved to the functional position by the pilot oil pressure (XAb1, XAb2, XAk) from the remote control valve.

The oil from the A2 pump flows into the boom cylinders through the boom 2 spool in the left control valve.

The oil from the A1 pump flows into the boom cylinders and bucket cylinder through the boom 1 spool and bucket spool and the parallel and confluence oil passage in the right control valve.

During the boom up and bucket in functions are operated simultaneously, the pilot pressure flows into the bucket spool limit piston through port PCk. This transfers the bucket spool in the half stroke not full stroke.

Therefore, the most of pressurized oil from the A1 pump flows into boom 1 spool than the bucket spool to make the boom up operation more preferential. This is called the boom up operation preference function.

The boom up and bucket in are operated.

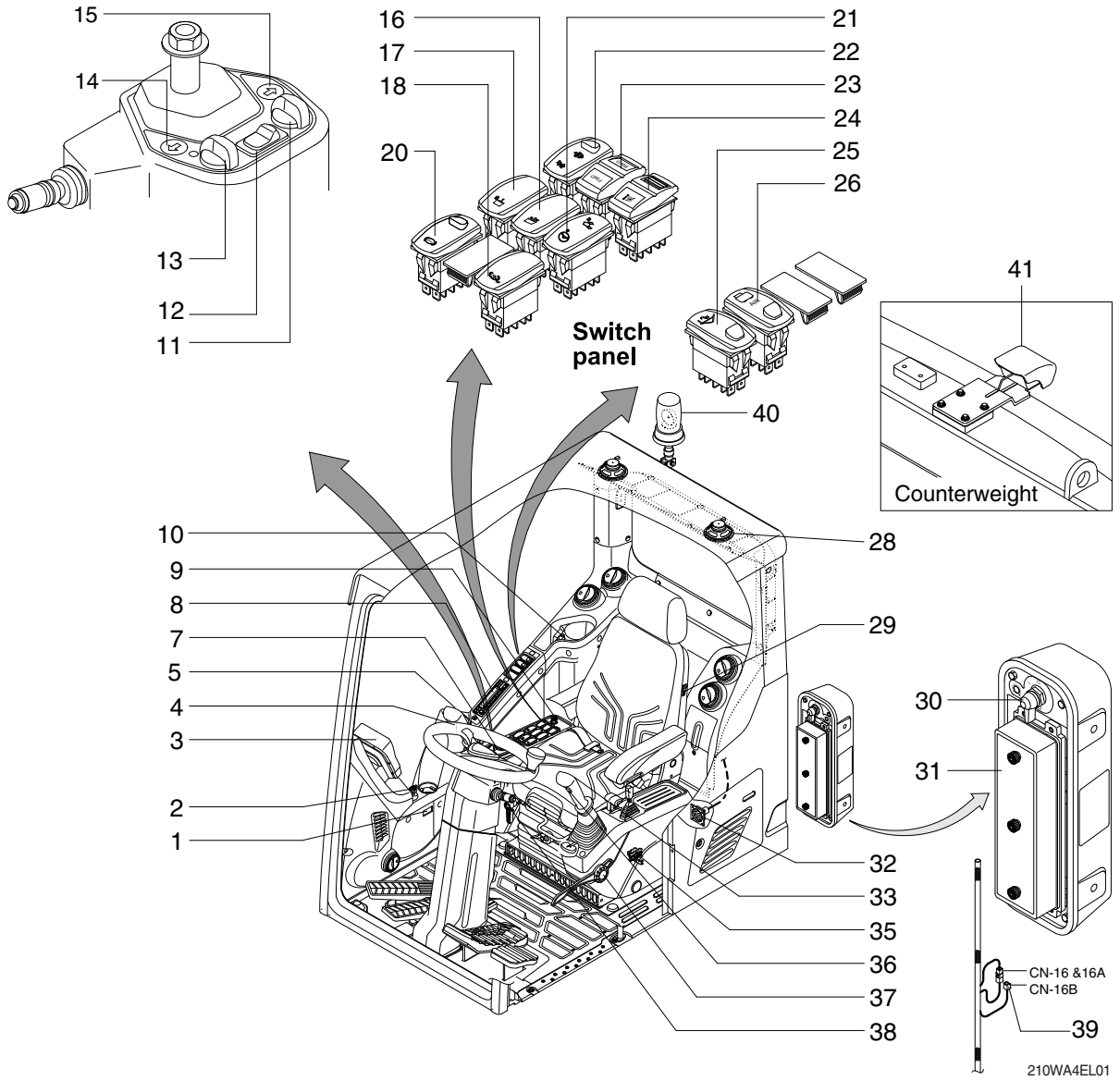
※ The circuit diagram may differ from the equipment, so please check before a repair.

SECTION 4 ELECTRICAL SYSTEM

Group 1 Component Location 4-1
Group 2 Electrical Circuit 4-3
Group 3 Electrical Component Specification 4-25
Group 4 Connectors 4-37

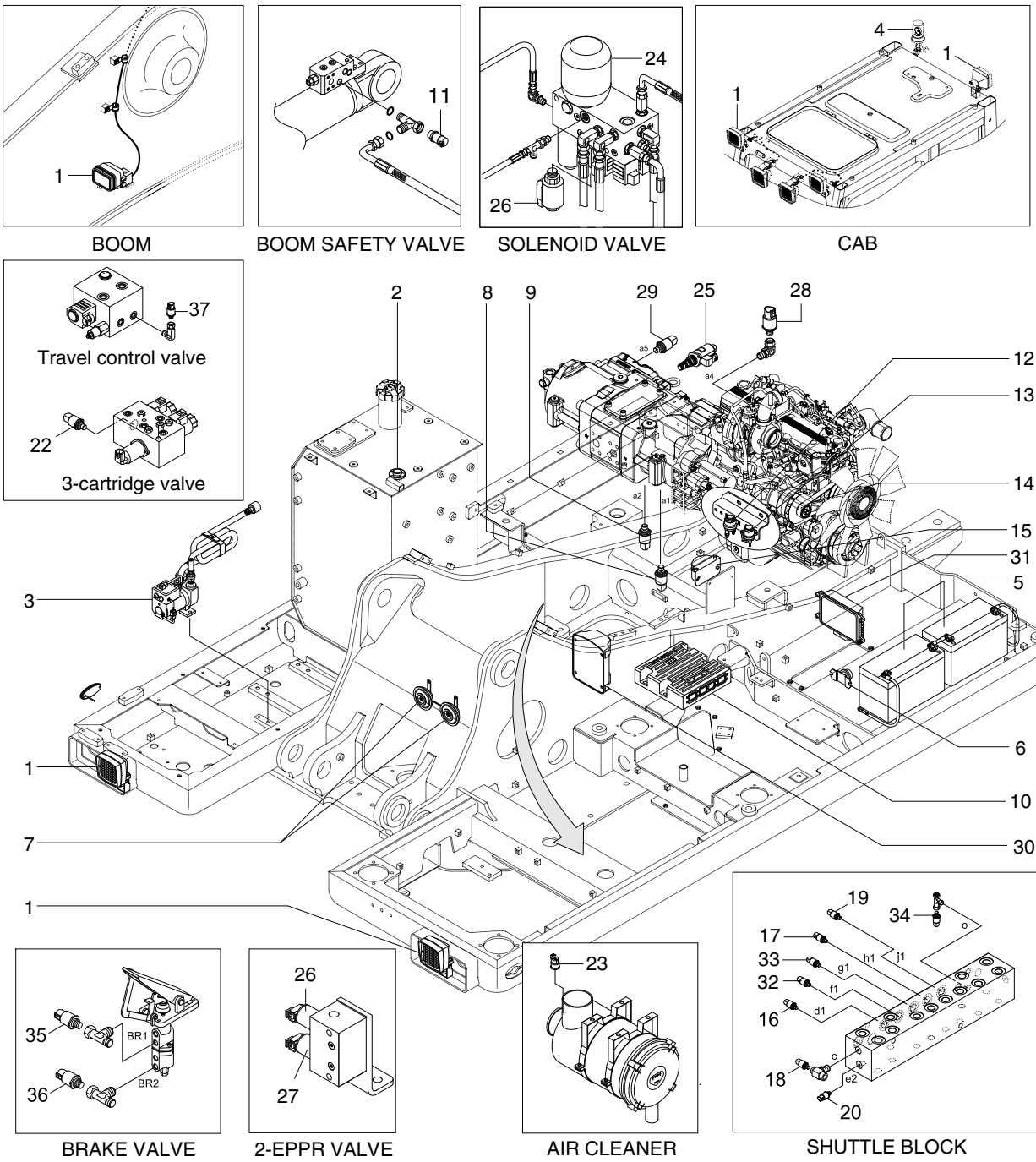
GROUP 1 COMPONENT LOCATION

1. LOCATION 1



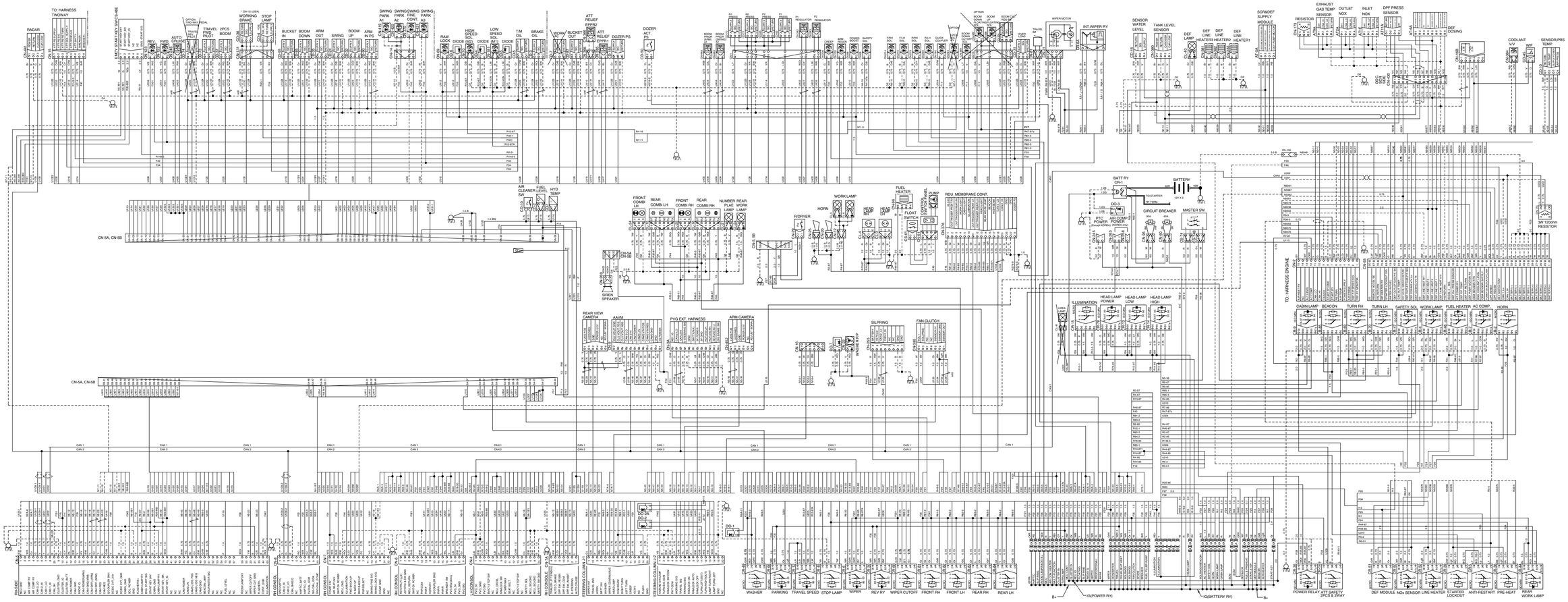
1	Service meter	14	Left turn pilot lamp	30	Master switch
2	Start switch	15	Right turn pilot lamp	31	Fuse & relay box
3	Cluster	16	Free/fine swing switch	32	RS232 & J1939 service socket
4	FNR switch	17	Swing lock switch	33	One touch decel switch
5	Horn switch	18	Auto cruise switch	33	Ram lock switch
5	Quick clamp switch	20	Auto brake switch	35	Emergency engine stop switch
5	Breaker operation switch	21	E/steering & crusher switch	36	Power max switch
7	Jog dial module	22	Exhaust system cleaning switch	37	Safety knob
8	Radio & USB player	23	FNR switch (emergency)	38	Multi function switch (LH)
9	Cigar lighter	24	FNR select switch (emergency)	39	Emergency engine speed control connector
10	Socket assy	25	Quick clamp switch		
11	Ram lock rotary switch	26	Air compressor switch	40	Beacon lamp
12	Hazard switch	28	Speaker	41	Rear view camera
13	Select rotary switch	29	Seat heater switch	42	Socket assy

2. LOCATION 2



1	Lamp	13	Heater relay	26	Boom priority EPPR valve (swing)
2	Fuel sender	14	Alternator	27	Boom priority EPPR valve (arm)
3	Fuel filler pump	15	Travel alarm buzzer	28	P1 EPPR pressure sensor
4	Beacon lamp	16	Arm out pressure sensor	29	P2 EPPR pressure sensor
5	Battery	17	Boom up pressure sensor	30	RMCU
6	Battery relay	18	Swing pressure sensor	31	AAVM controller
7	Horn	19	Boom down pressure sensor	32	Bucket in pressure sensor
8	P1 pressure sensor	20	Arm in pressure sensor	33	Bucket out pressure sensor
9	P2 pressure sensor	22	Travel pressure sensor	34	Dozer pressure sensor
10	MCU	23	Air cleaner sensor	35	Brake pilot lamp pressure switch
11	Overload pressure sensor	24	Solenoid valve	36	Brake pressure sensor
12	Start relay	25	Pump EPPR valve	37	Travel control pressure sensor

· ELECTRICAL CIRCUIT (1/3)



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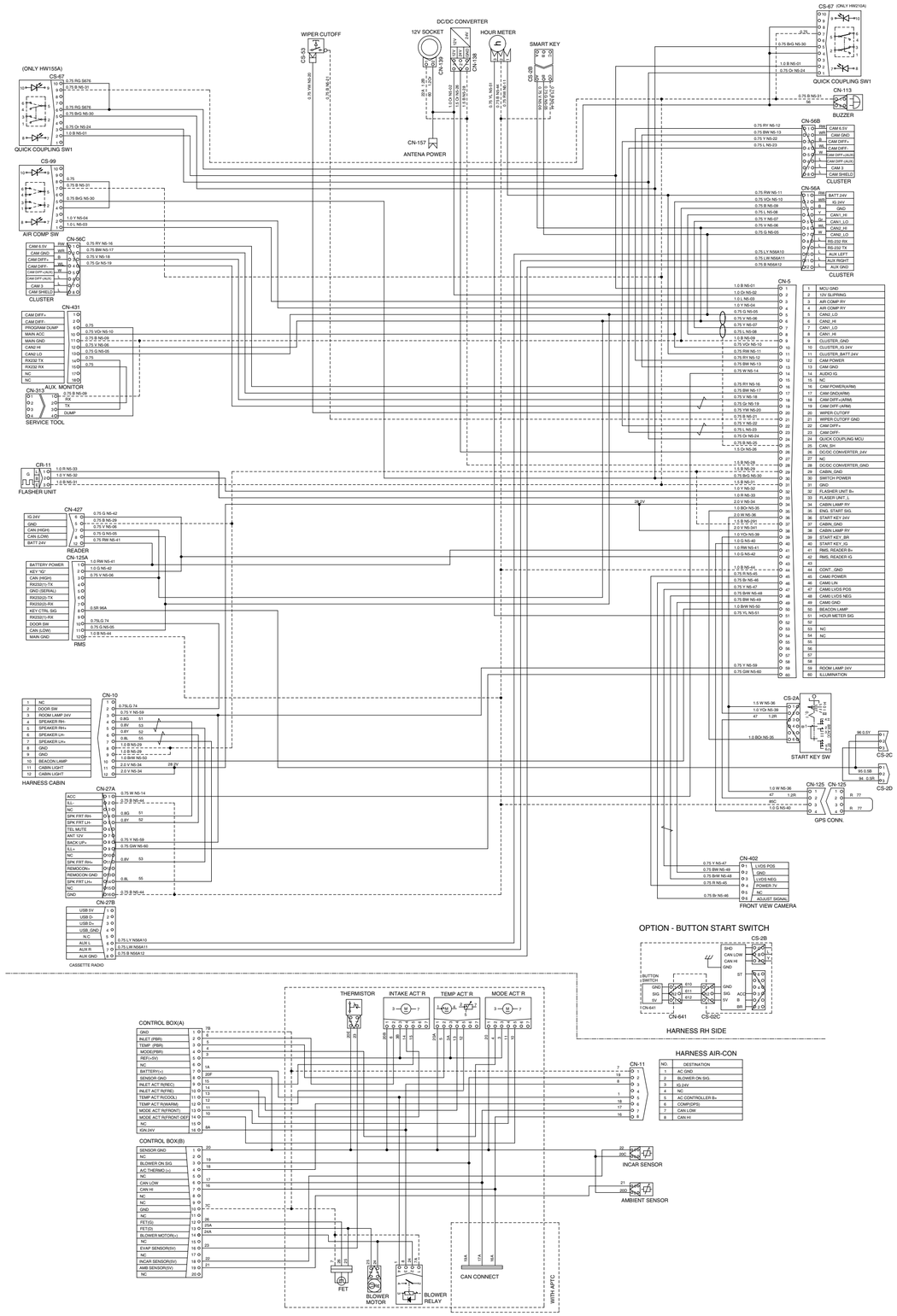
· ELECTRICAL CIRCUIT (2/3, 1OF2)



NO.	DESTINATION
1	MCU GND
2	12V SUPPING
3	AIR COMP 9V
4	AIR COMP 9V
5	CAN2_LO
6	CAN2_HI
7	CAN1_LO
8	CAN1_HI
9	CLUSTER_GND
10	CLUSTER_IG 24V
11	CLUSTER_BATT 24V
12	CAM POWER
13	CAM GND
14	AUDIO IG
15	NC
16	CAM POWER(ARM)
17	CAM GND(ARM)
18	CAM DIFF+(ARM)
19	CAM DIFF-(ARM)
20	WIPER CUTOFF
21	WIPER CUTOFF GND
22	CAM DIFF+
23	CAM DIFF-
24	QUICK COUPLING MCU
25	CAN_SH
26	DC/DC CONVERTER_24V
27	NC
28	DC/DC CONVERTER_GND
29	CABIN_GND
30	SWITCH POWER
31	GND
32	FLASHER UNIT B+
33	FLASER UNIT L
34	CABIN LAMP 9V
35	ENG. START SIG.
36	START KEY 24V
37	CABIN_GND
38	CABIN LAMP 9V
39	START KEY_BR
40	START KEY_IG
41	RMS_READER B+
42	RMS_READER IG
43	
44	CONT._GND
45	CAM2 POWER
46	CAM2 LIN
47	CAM2 LVDS POS
48	CAM2 LVDS NEG
49	CAM2 GND
50	BEACON LAMP
51	HOUR METER SIG
52	
53	NC
54	NC
55	
56	
57	
58	
59	ROOM LAMP 24V
60	ILLUMINATION

NO.	DESTINATION
1	NC
2	DOOR SW
3	FUSE
4	CASSETTE_RH+
5	CASSETTE_RH-
6	CASSETTE_LH-
7	CASSETTE_LH+
8	GND
9	GND
10	BEACON SW
11	CABIN LIGHT RY
12	CABIN LIGHT SW

HARNESS CABIN

NO.	DESTINATION
1	PWG.5V
2	PWG_RETURN
3	PWG_DIAL SIG
4	EMCY STOP SW
5	NC
6	MCU_SIG.GND
7	MCU_DIEGL
8	MCU_SIG.GND
9	RAMLOCK SW
10	POWER MAX
11	MCU_SEAT BELT
12	
13	EMCY STOP SW
14	GND
15	NC
16	SAFETY SOL

HARNESS LH,CONSOLE

NO.	DESTINATION
1.	GND
2	CAN_HI
3	CAN_LO
4	CAN_SHIELD
5	NC
6	POWER_BATT
7	POWER_IG
8	5V_ECM
9	SIG_ECM
10	GND_ECM

NO.	DESTINATION
1	NC
2	CIGARLIGHT IGN
3	CIGARLIGHT_GND
4	FWD BACK UP
5	N_BACK UP
6	RWD BACK UP
7	FNR SELECT
8	SWITCH / SOL POWER
9	AIR SHEAT POWER
10	MCU_GND
11	NC
12	NC
13	FINE SWING SIG
14	GND
15	SWING LOCK SIG

HARNESS RH,CONSOLE

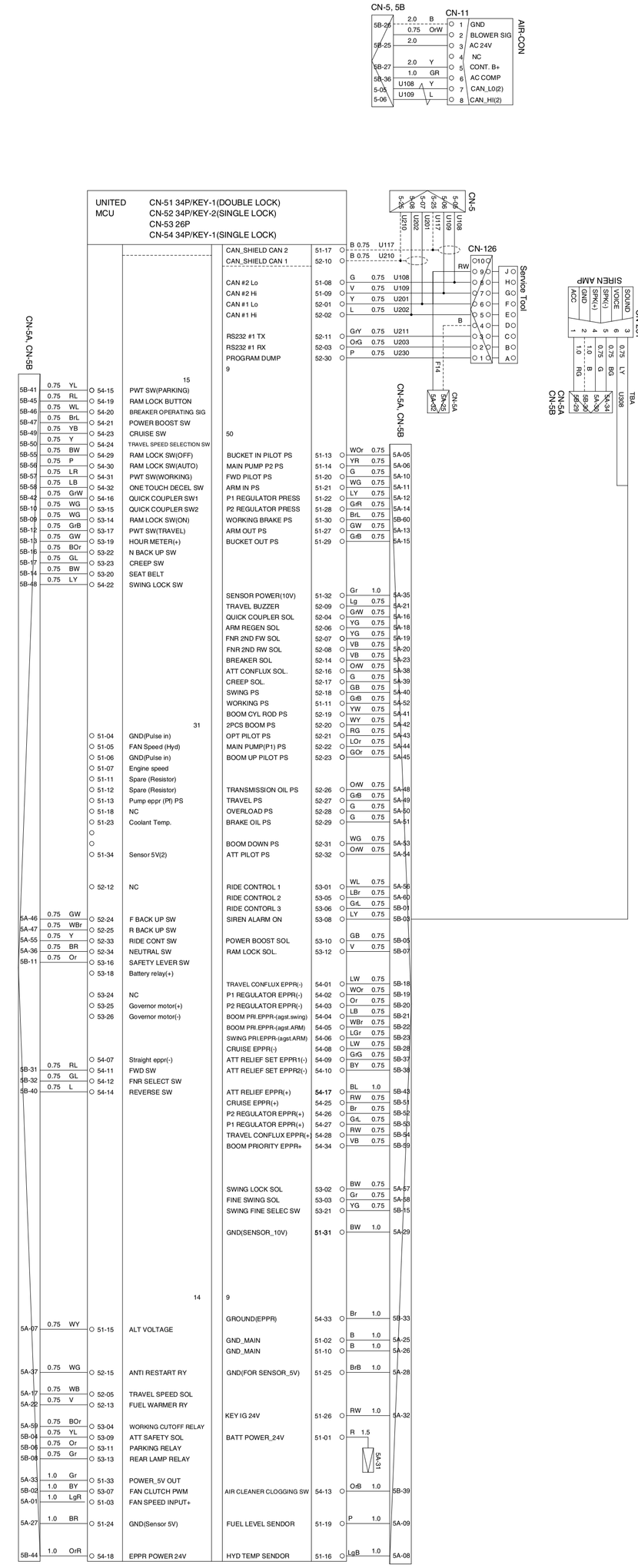
NO.	DESTINATION
1	NC
2	E.STEERING
3	NC
4	NC
5	AUTO D_BRAKE
6	NC
7	AUTO CRUISE
8	NC
9	DPF SW_REGEN
10	DPF SW_COM
11	DPF SW_INHIBIT
12	NC

AMP 174662-2

NO.	DESTINATION
1	RD CTRL
2	MCU_GND
3	SWITCH POWER
4	NC
5	PVG 5V
6	PVG SIG
7	GND
8	PVG SIG(DUAL)
9	HORN RY
10	G/COUPLER SW2
11	PVG GND
12	FNR COM
13	FNR F
14	FNR N
15	FNR R
16	BREAKER SW

HARNESS RH,CONSOLE

20K6-92415-01 1OF2


CN-5, 5B
CN-11
AIR-CON
5B-26
5B-25
5B-27
5B-36
5-05
5-06
2.0 B
0.75 O/W
2.0
2.0 Y
1.0 GR
U108 Y
U109 L
1 GND
2 BLOWER SIG
3 AC 24V
4 NC
5 CONT. B+
6 AC COMP
7 CAN_L0(2)
8 CAN_HI(2)
UNITED MCU
CN-51 34P/KEY-1(DOUBLE LOCK)
CN-52 34P/KEY-2(SINGLE LOCK)
CN-53 26P
CN-54 34P/KEY-1(SINGLE LOCK)
CN-5
CN-126
Service Tool
SIREN AMP
CN-261
CN-5A
CN-5B
CN-5A, CN-5B
B 0.75 U117
B 0.75 U210
RW
G 0.75 U108
V 0.75 U109
Y 0.75 U201
L 0.75 U202
B
GrY 0.75 U211
O/G 0.75 U203
P 0.75 U230
F14
SOUND
VOICE
SPK(-)
SPK(+)
GND
ACC
0.75 LY
0.75 BG
0.75 G
1.0 B
1.0 RG
TBA
U308
CAN_SHIELD CAN 2 51-17
CAN_SHIELD CAN 1 52-10
CAN #2 Lo 51-08
CAN #2 Hi 51-09
CAN #1 Lo 52-01
CAN #1 Hi 52-02
RS232 #1 TX 51-11
RS232 #1 RX 52-03
PROGRAM DUMP 52-30
9
15
50
31
14
5B-41 0.75 YL 54-15 PWT SW(PARKING)
5B-45 0.75 RL 54-19 RAM LOCK BUTTON
5B-46 0.75 WL 54-20 BREAKER OPERATING SIG
5B-47 0.75 BrL 54-21 POWER BOOST SW
5B-49 0.75 YB 54-23 CRUISE SW
5B-50 0.75 Y 54-24 TRAVEL SPEED SELECTION SW
5B-55 0.75 BW 54-29 RAM LOCK SW(OFF)
5B-56 0.75 P 54-30 RAM LOCK SW(AUTO)
5B-57 0.75 LR 54-31 PWT SW(WORKING)
5B-58 0.75 LB 54-32 ONE TOUCH DECEL SW
5B-42 0.75 GrW 54-16 QUICK COUPLER SW1
5B-10 0.75 WG 53-15 QUICK COUPLER SW2
5B-09 0.75 WG 53-14 RAM LOCK SW(ON)
5B-12 0.75 GrB 53-17 PWT SW(TRAVEL)
5B-13 0.75 GW 53-19 HOUR METER(+)
5B-16 0.75 BOr 53-22 N BACK UP SW
5B-17 0.75 GL 53-23 CREEP SW
5B-14 0.75 BW 53-20 SEAT BELT
5B-48 0.75 LY 54-22 SWING LOCK SW
51-04 GND(Pulse in)
51-05 FAN Speed (Hyd)
51-06 GND(Pulse in)
51-07 Engine speed
51-11 Spare (Resistor)
51-12 Spare (Resistor)
51-13 Pump eppr (Pf) PS
51-18 NC
51-23 Coolant Temp.
51-34 Sensor 5V(2)
52-12 NC
5A-46 0.75 GW 52-24 F BACK UP SW
5A-47 0.75 WBr 52-25 R BACK UP SW
5A-55 0.75 Y 52-33 RIDE CONT SW
5A-36 0.75 BR 52-34 NEUTRAL SW
5B-11 0.75 Or 53-16 SAFETY LEVER SW
53-18 Battery relay(+)
53-24 NC
53-25 Governor motor(+)
53-26 Governor motor(-)
54-07 Straight eppr(-)
5B-31 0.75 RL 54-11 FWD SW
5B-32 0.75 GL 54-12 FNR SELECT SW
5B-40 0.75 L 54-14 REVERSE SW
5A-07 0.75 WY 51-15 ALT VOLTAGE
5A-37 0.75 WG 52-15 ANTI RESTART RY
5A-17 0.75 WB 52-05 TRAVEL SPEED SOL
5A-22 0.75 V 52-13 FUEL WARMER RY
5A-59 0.75 BOr 53-04 WORKING CUTOFF RELAY
5B-04 0.75 YL 53-09 ATT SAFETY SOL
5B-06 0.75 Or 53-11 PARKING RELAY
5B-08 0.75 Gr 53-13 REAR LAMP RELAY
5A-33 1.0 Gr 51-33 POWER_5V OUT
5B-02 1.0 BY 53-07 FAN CLUTCH PWM
5A-01 1.0 LgR 51-03 FAN SPEED INPUT+
5A-27 1.0 BR 51-24 GND(Sensor 5V)
5B-44 1.0 OrR 54-18 EPPR POWER 24V
CAN_SHIELD CAN 2 51-17
CAN_SHIELD CAN 1 52-10
CAN #2 Lo 51-08
CAN #2 Hi 51-09
CAN #1 Lo 52-01
CAN #1 Hi 52-02
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BUCKET IN PILOT PS 51-13
MAIN PUMP P2 PS 51-14
FWD PILOT PS 51-20
ARM IN PS 51-21
P1 REGULATOR PRESS 51-22
P2 REGULATOR PRESS 51-28
WORKING BRAKE PS 51-30
ARM OUT PS 51-27
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QUICK COUPLER SOL 52-04
ARM REGEN SOL 52-06
FNR 2ND FW SOL 52-07
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BREAKER SOL 52-14
ATT CONFLUX SOL. 52-16
CREEP SOL. 52-17
SWING PS 52-18
WORKING PS 51-11
BOOM CYL ROD PS 52-19
2PCS BOOM PS 52-20
OPT PILOT PS 52-21
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BOOM UP PILOT PS 52-23
TRANSMISSION OIL PS 52-26
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RIDE CONTROL 1 53-01
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SIREN ALARM ON 53-08
POWER BOOST SOL 53-10
RAM LOCK SOL. 53-12
TRAVEL CONFLUX EPPR(-) 54-01
P1 REGULATOR EPPR(-) 54-02
P2 REGULATOR EPPR(-) 54-03
BOOM PRI.EPPR-(agst.swing) 54-04
BOOM PRI.EPPR-(agst.ARM) 54-05
SWING PRI.EPPR-(agst.ARM) 54-06
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ATT RELIEF SET EPPR1(-) 54-09
ATT RELIEF SET EPPR2(-) 54-10
ATT RELIEF EPPR(+) 54-17
CRUISE EPPR(+) 54-25
P2 REGULATOR EPPR(+) 54-26
P1 REGULATOR EPPR(+) 54-27
TRAVEL CONFLUX EPPR(+) 54-28
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SWING LOCK SOL 53-02
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GND_MAIN 51-02
GND_MAIN 51-10
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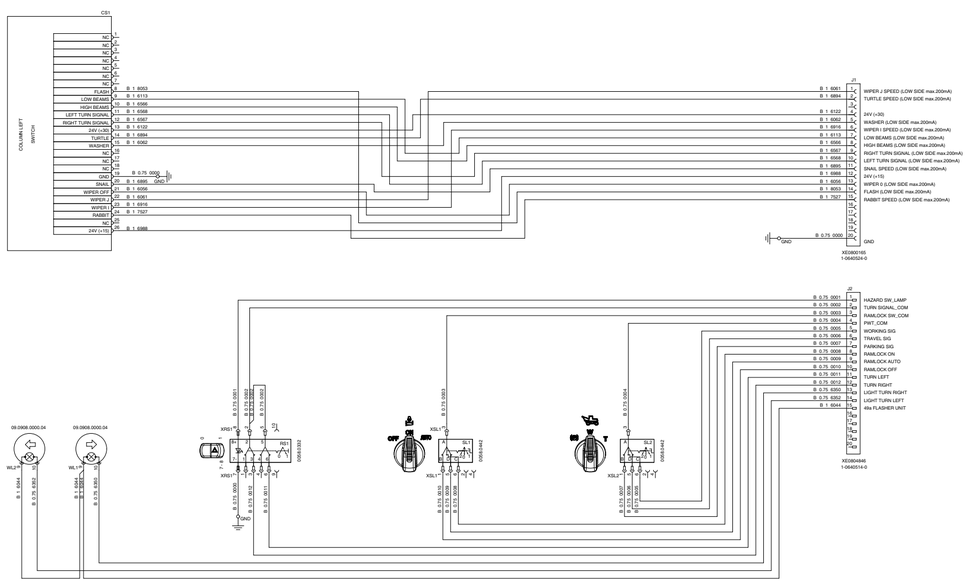
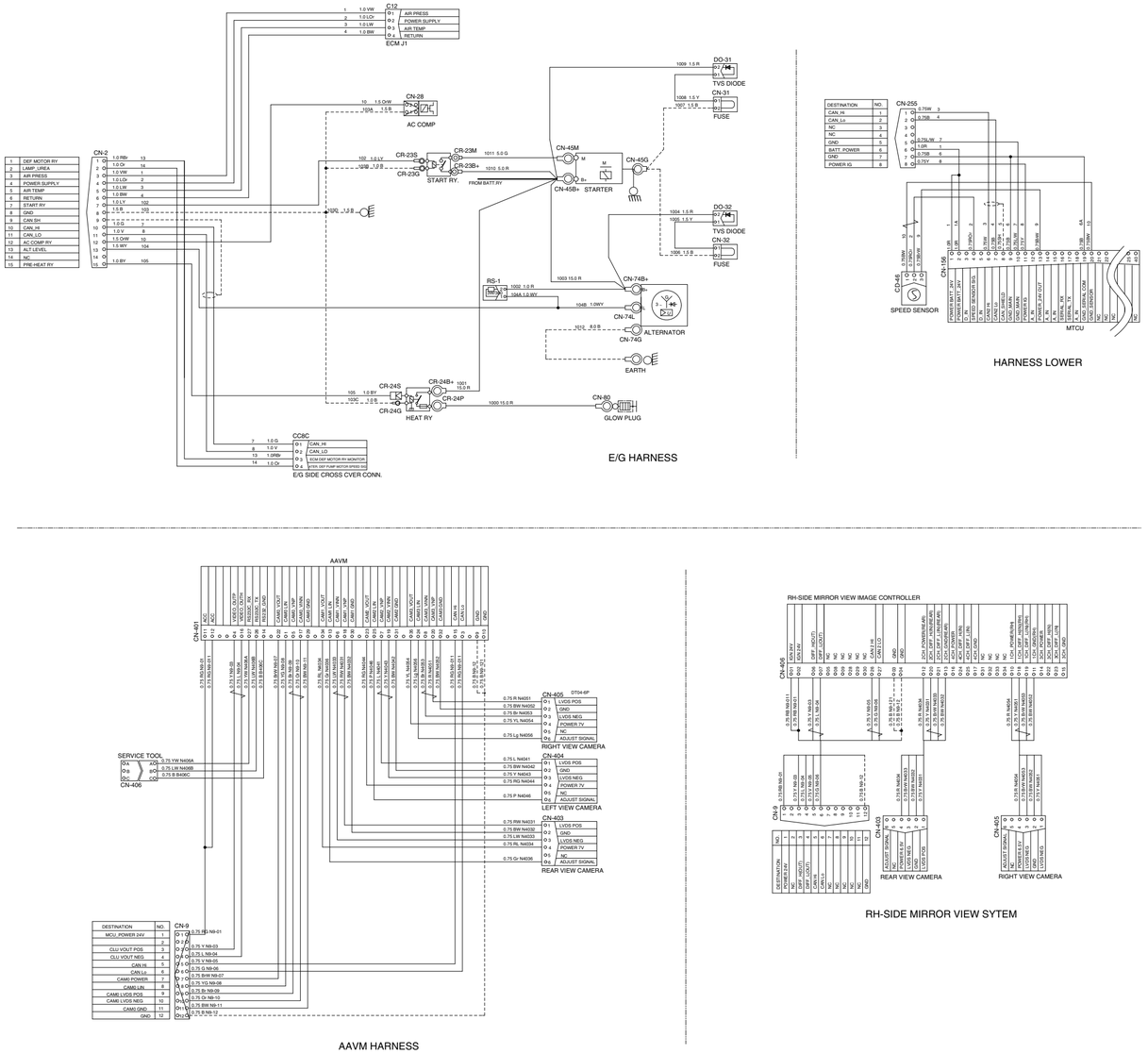
BATT POWER_24V 51-01
AIR CLEANER CLOGGING SW 54-13
FUEL LEVEL SENDOR 51-19
HYD TEMP SENDOR 51-16
WOr 0.75 5A-05
YR 0.75 5A-06
G 0.75 5A-10
WG 0.75 5A-11
LY 0.75 5A-12
GrR 0.75 5A-14
BrL 0.75 5B-60
GW 0.75 5A-13
GrB 0.75 5A-15
Gr 1.0 5A-35
Lg 0.75 5A-21
GrW 0.75 5A-16
YG 0.75 5A-18
YG 0.75 5A-19
VB 0.75 5A-20
VB 0.75 5A-23
O/W 0.75 5A-38
G 0.75 5A-39
GB 0.75 5A-40
GrB 0.75 5A-52
YW 0.75 5A-41
WY 0.75 5A-42
RG 0.75 5A-43
LOr 0.75 5A-44
GOr 0.75 5A-45
O/W 0.75 5A-48
GrB 0.75 5A-49
G 0.75 5A-50
G 0.75 5A-51
WG 0.75 5A-53
O/W 0.75 5A-54
WL 0.75 5A-56
LBr 0.75 5A-60
GrL 0.75 5B-01
LY 0.75 5B-03
GB 0.75 5B-05
V 0.75 5B-07
LW 0.75 5B-18
WOr 0.75 5B-19
Or 0.75 5B-20
LB 0.75 5B-21
WBr 0.75 5B-22
LGr 0.75 5B-23
LW 0.75 5B-28
GrG 0.75 5B-37
BY 0.75 5B-38
BL 1.0 5B-43
RW 0.75 5B-51
Br 0.75 5B-52
GrL 0.75 5B-53
RW 0.75 5B-54
VB 0.75 5B-59
BW 0.75 5A-57
Gr 0.75 5A-58
YG 0.75 5B-15
BW 1.0 5A-29
Br 1.0 5B-33
B 1.0 5A-25
B 1.0 5A-26
BrB 1.0 5A-28
RW 1.0 5A-32
R 1.5
5A-33
O/B 1.0 5B-39
P 1.0 5A-09
LgB 1.0 5A-08

· ELECTRICAL CIRCUIT (3/3)



STEERING COLUMN HARNESS

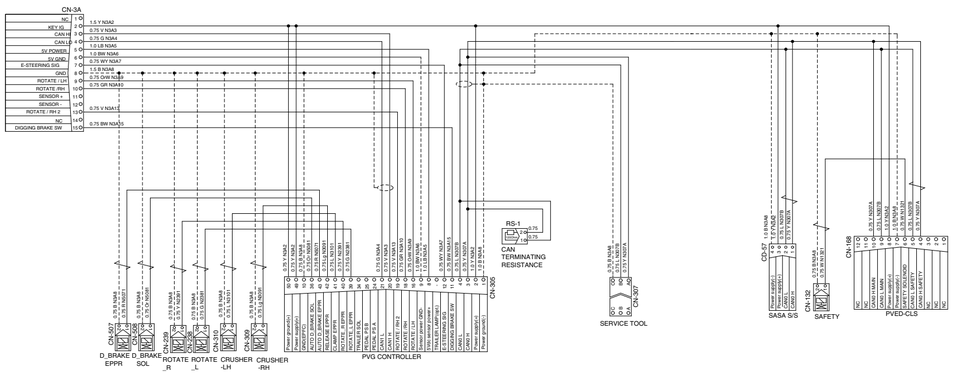


E/G HARNESS

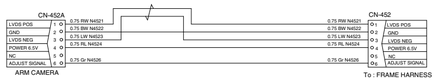
HARNESS LOWER

AAVM HARNESS

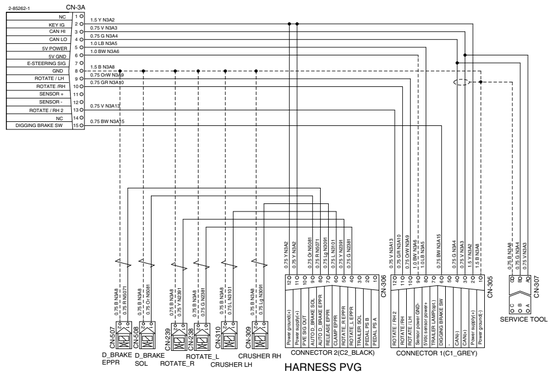
RH-SIDE MIRROR VIEW SYTEM



HARNESS PVG E/STEERING



HARNESS ARM CAMERA (ONLY 2PCS BOOM)



HARNESS PVG

MEMORANDUM

1. POWER CIRCUIT

The negative terminal of battery is grounded to the machine chassis directly.
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 [CR-1] → Circuit breaker [CN-60] → Master switch [CS-74]

- → Fuse box [No.1] → MCU [CN-54 (18)]
- → Fuse box [No.2] → I/conn [CN-8 (6)] → Jog dial module [CN-363 (2)]
- → Fuse box [No.3] → Engine ECM [CN-93 (1, 25, 26, 27, 28)]
- → Fuse box [No.4] → Slipring [CN-255 (6)] → MTCU [CN-156 (1, 2)]
- → Fuse box [No.5] → NOx sensor relay [CR-50 (30)]
- → Fuse box [No.6] → I/conn [CN-5 (59)]
  - I/conn [CN-10 (3)] → Room lamp [CL-1 (2)]
  - → Door switch [CS-1]
  - Radio & USB player [CN-27A (8)]
- → Fuse box [No.7] → MCU [CN-51 (1)]
- → Fuse box [No.8]
  - Master switch [CS-74B (2)→(1)] → I/conn [CN-5 (36)]
    - Start switch [CS-2A (1)]
    - GPS connection [CN-125 (1)]
    - RMS [CN-125A (1)]
    - Reader [CN-427 (12)]
  - Power relay [CR-35 (30)]
- → Fuse box [No.9] → I/conn [CN-11 (5)]
  - A/C & heater control box A (7)
  - A/C & heater blower relay (4)
- → Fuse box [No.10] → Multifunction sw [J-1 (4)]
- → Fuse box [No.11] → I/conn [CN-5 (11)]
  - Hour meter [CN-48 (1)]
  - Cluster [CN-56A (1)]
- → Fuse box [No.12]
  - I/conn [CN-5 (32)] → Flasher unit [CR-11 (2)]
  - LH turn relay [CR-70 (1)]
  - RH turn relay [CR-69 (1)]
- → Fuse box [No.13]
  - DEF/AdBlue® relay [CR-51 (3)]
  - DEF/AdBlue® fill up lamp [CL-40 (1)]

I/conn : Intermediate connector

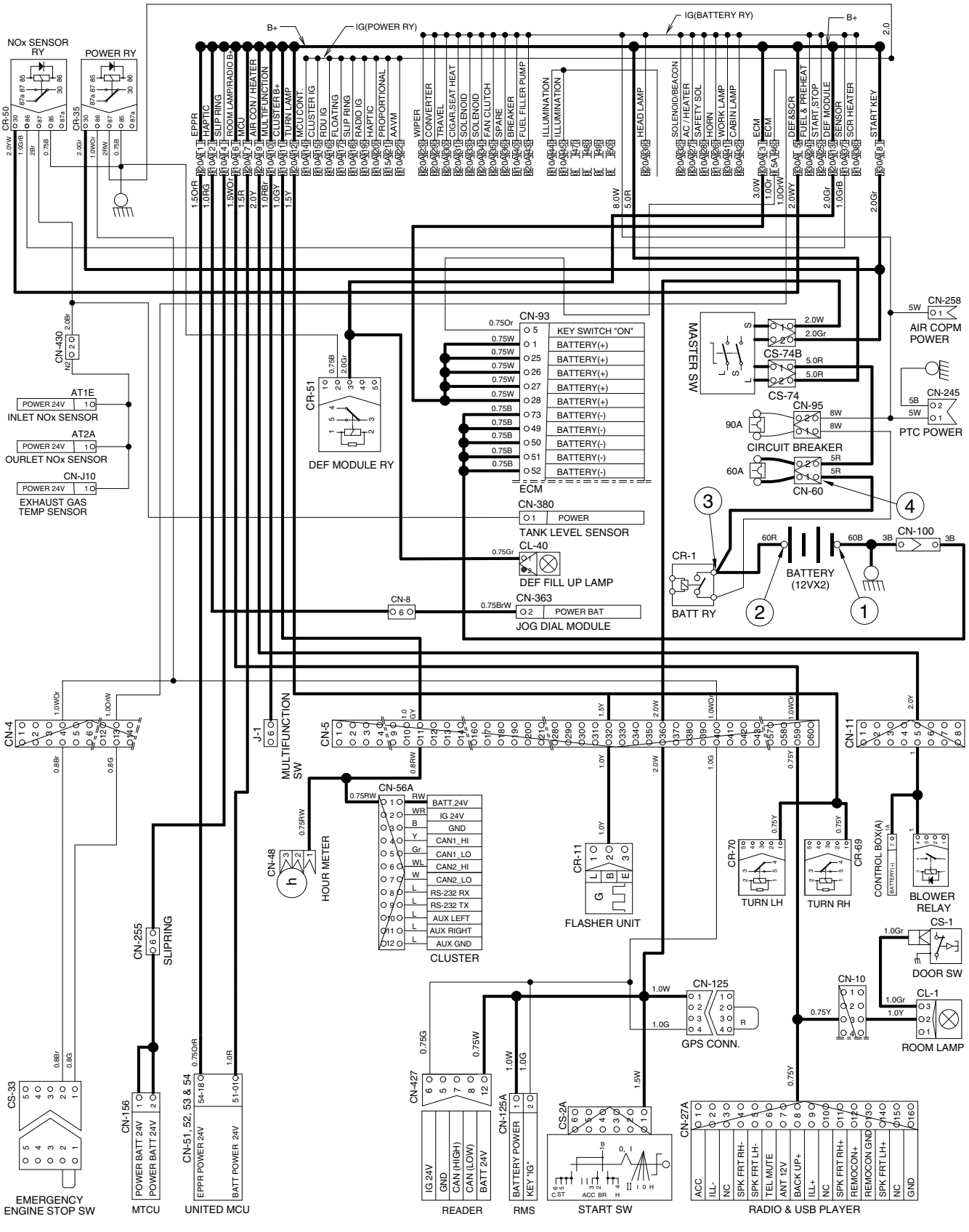
2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	OFF	① - GND (battery 1EA)	10~12.5 V
		② - GND (battery 2EA)	20~25 V
		③ - GND (battery relay 2EA)	20~25 V
		④ - GND (circuit breaker)	20~25 V

※ GND : Ground

※ The circuit diagram may differ from the equipment, so please check before a repair.

POWER CIRCUIT



210WA4EL03

※ The circuit diagram may differ from the equipment, so please check before a repair.

2. STARTING CIRCUIT

1) OPERATING FLOW

Battery (+) terminal → Battery relay [CR-1] → Circuit breaker [CN-60] → Master switch [CS-74]
→ Fuse box [No.8] → Master switch [CS-74B] → I/conn [CN-5 (36)] → Start switch [CS-2A (1)]
→ Power relay [CR-35 (30)]

(1) When start key switch is in ON position

→ Start switch ON [CS-2A (2)] → I/conn [CN-5 (39)] → Battery relay [CR-1]
→ Battery relay operating (all power is supplied with the electric component)
→ Start switch ON [CS-2A (3)] → GPS conn [CN-125 (2)→(4)] → RMS [CN-125A (2)]
→ Reader [CN-427 (6)]
→ I/conn [CN-5 (40)]
→ Power relay [CR-35 (86) → (87)] → Fuse box [No.14]
→ MCU [CN-51 (26)]
→ I/conn [CN-4 (4)] → Emergency engine stop sw [CS-33 (2) → (1)]
→ I/conn [CN-4 (13)] → Fuse box [No. 46] → ECM [CN-93 (5)]

(2) When start key switch is in START position

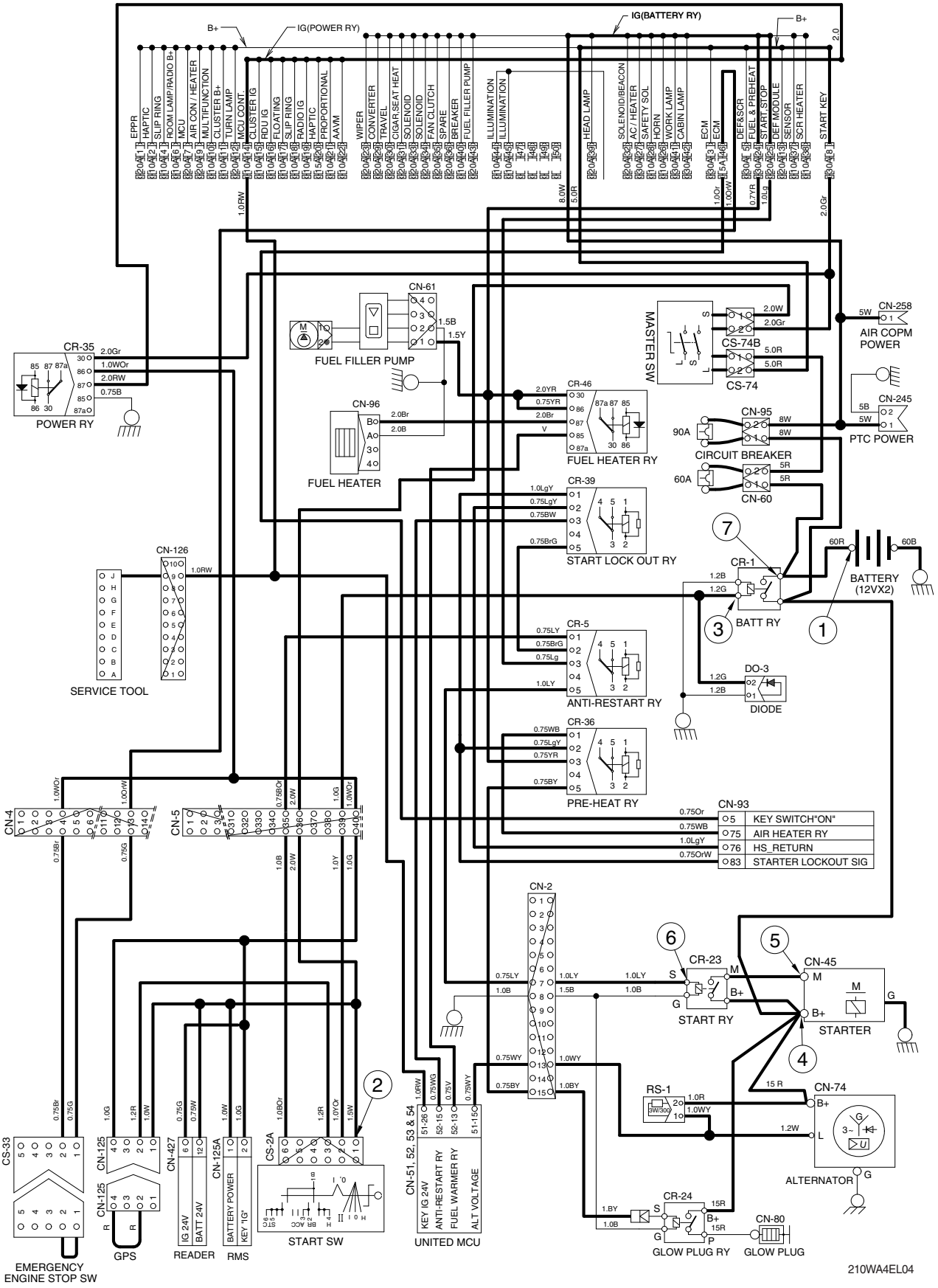
Start switch START [CS-2A (6)] → I/conn [CN-5 (35)] → Anti-restart relay [CR-5 (1) → (5)]
→ I/conn [CN-2 (7)] → Start relay [CR-23 (S)] → Starter motor operating

2) CHECK POINT

Engine	Start switch	Check point	Voltage
OPERATING	START	① - GND (battery) ② - GND (start key) ③ - GND (battery relay M4) ④ - GND (starter B^+) ⑤ - GND (starter M) ⑥ - GND (start relay G) ⑦ - GND (battery relay M8)	20~25V

※ The circuit diagram may differ from the equipment, so please check before a repair.

STARTING CIRCUIT



※ The circuit diagram may differ from the equipment, so please check before a repair.

3. CHARGING CIRCUIT

When the starter is activated and the engine is started, the operator releases the start 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 [CN-74 (L)] → I/conn [CN-2 (13)] → MCU alternator level [CN-51 (15)] →
Cluster charging warning lamp (via CAN interface)

(2) Charging flow

Alternator [CN-74 (B^+)] → Starter [CN-45 (B^+) → Battery relay (M8)

- Battery (+) terminal
- Circuit breaker [CN-60] → Master switch [CS-74] → Fuse box [B^+]
- Circuit breaker [CN-95]
  - Fuse box [IG, battery]
  - PTC power [CN-245 (1)]
  - Air comp power [CN-258 (1)]

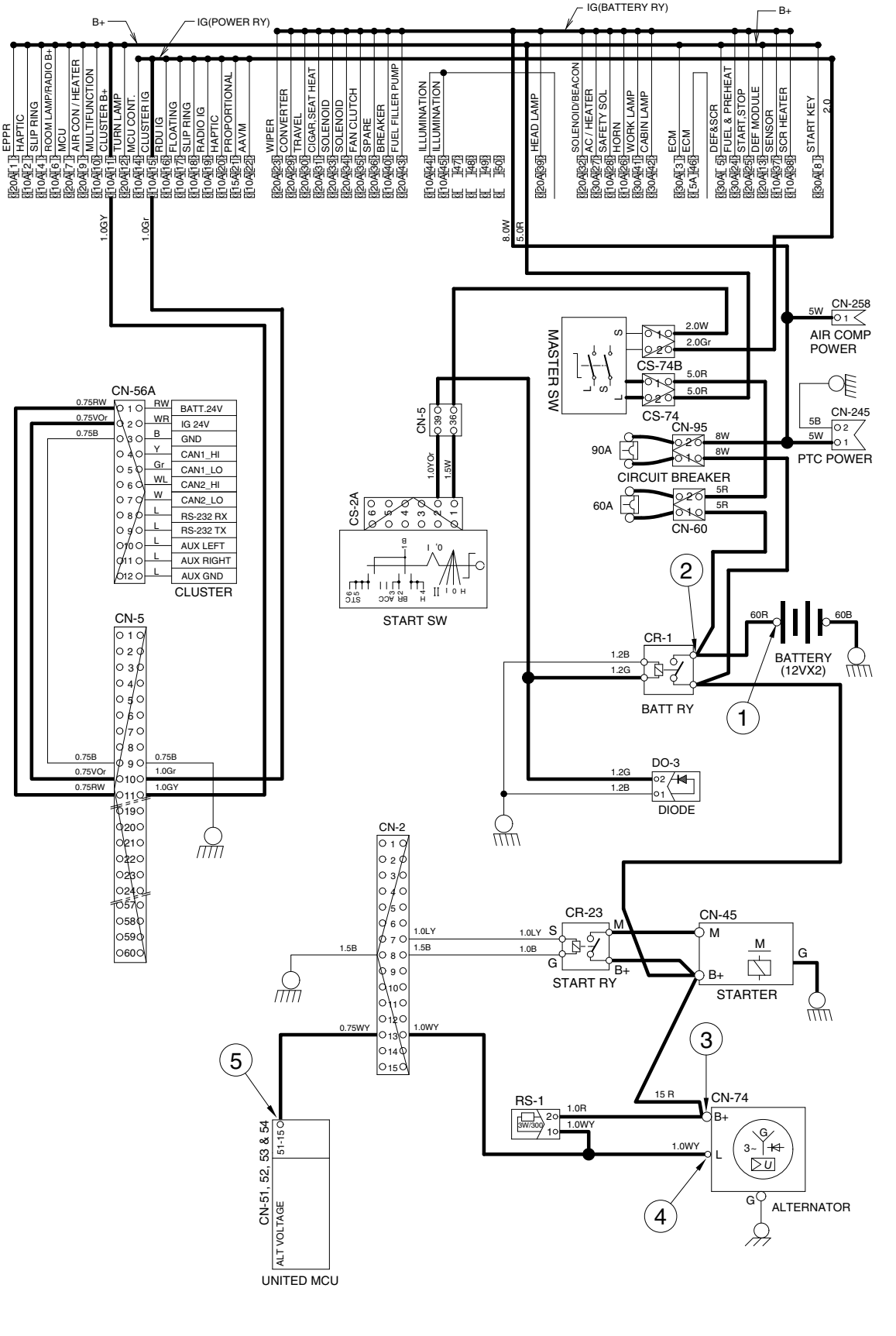
2) CHECK POINT

Engine	Start switch	Check point	Voltage
Run	ON	① - GND (battery voltage) ② - GND (battery relay) ③ - GND (alternator B^+ terminal) ④ - GND (alternator L terminal) ⑤ - GND (MCU)	20~30 V

※ GND : Ground

※ The circuit diagram may differ from the equipment, so please check before a repair.

CHARGING CIRCUIT



※ The circuit diagram may differ from the equipment, so please check before a repair.

4. HEAD AND WORK LIGHT CIRCUIT

1) OPERATING FLOW

Fuse box (No.39) → Head light low relay [CR-13 (30, 86)]
→ Head light high relay [CR-14 (30, 86)]
→ Head light power relay [CR-78 (86)]
→ Illumination relay [CR-15 (3)]

Fuse box (No.41) → Work light relay [CR-3 (30, 86)]
→ Rear work light relay [CR-44 (30, 86)]

Fuse box (No.16) → Membrane controller [CN-376 (1)]

(1) Head light switch ON

→ Head light switch ON [CN-376 (13)]
→ Head light power relay [CR-78 (85) → (87)]
→ Head light low relay [CR-13 (85) → (87)] → Head light ON [CL-3 (1)], CL-4 (1)]

(2) Work light switch ON

Work light switch ON [CN-376 (4)] → Work light relay [CR-3 (85) → (87)]
→ I/conn [CN-12 (1)] → Work light ON [CL-5 (2), CL-6 (2)]

(3) Rear work light switch ON

Work light switch ON [CN-376 (14)] → Rear work light relay [CR-44 (85) → (87)]
→ Rear work light ON [CL-24 (1)]

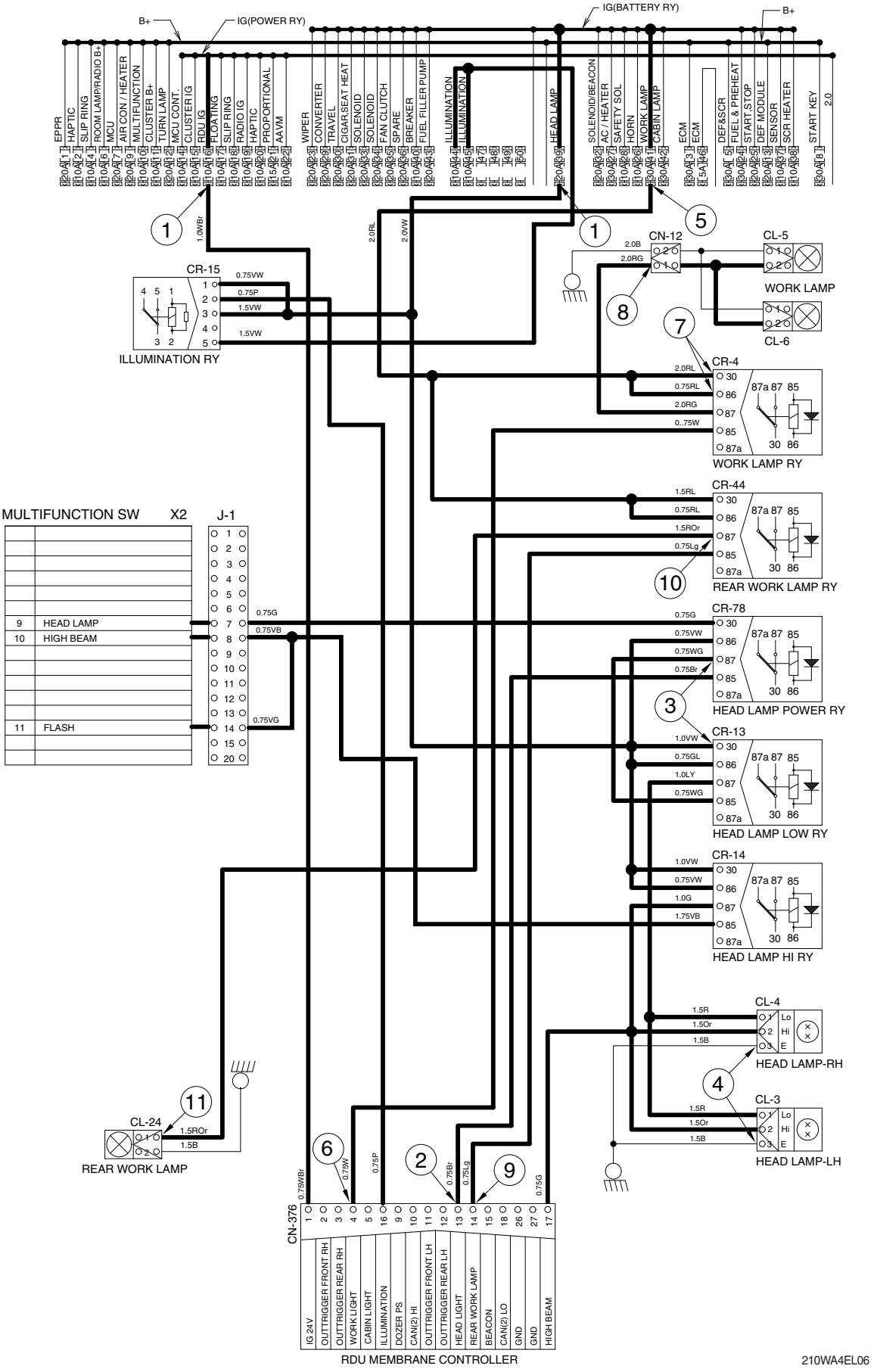
2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box) ② - GND (switch power output) ③ - GND (head light relay) ④ - GND (head light) ⑤ - GND (fuse box) ⑥ - GND (switch power output) ⑦ - GND (work light relay) ⑧ - GND (work light) ⑨ - GND (switch power output) ⑩ - GND (rear work light relay) ⑪ - GND (rear work light)	20~30 V

※ GND : Ground

※ The circuit diagram may differ from the equipment, so please check before a repair.

HEAD AND WORK LIGHT CIRCUIT



※ The circuit diagram may differ from the equipment, so please check before a repair.

5. BEACON LAMP AND CAB LIGHT CIRCUIT

1) OPERATING FLOW

Fuse box (No.32) → Beacon lamp relay [CR-85 (2, 3)]
Fuse box (No.42) → Cab light relay [CR-9 (30, 86)]
Fuse box (No.16) → Membrane controller [CN-376 (1)]

(1) Beacon lamp switch ON

Beacon lamp switch ON [CN-376 (15)] → Beacon light relay [CR-85 (2) → (5)]
→ I/conn [CN-5 (50)] → I/conn [CN-10 (10)] → Beacon lamp ON [CL-7]

(2) Cab light switch ON

Cab light switch ON [CN-376 (5)] → Cab lamp relay [CR-9 (85) → (87)]
→ I/conn [CN-5 (34, 38)] → I/conn [CN-10 (11)] → Cab light ON [CL-8 (2)]
→ I/conn [CN-10 (12)] → Cab light ON [CL-9 (2), CL-10 (2)]

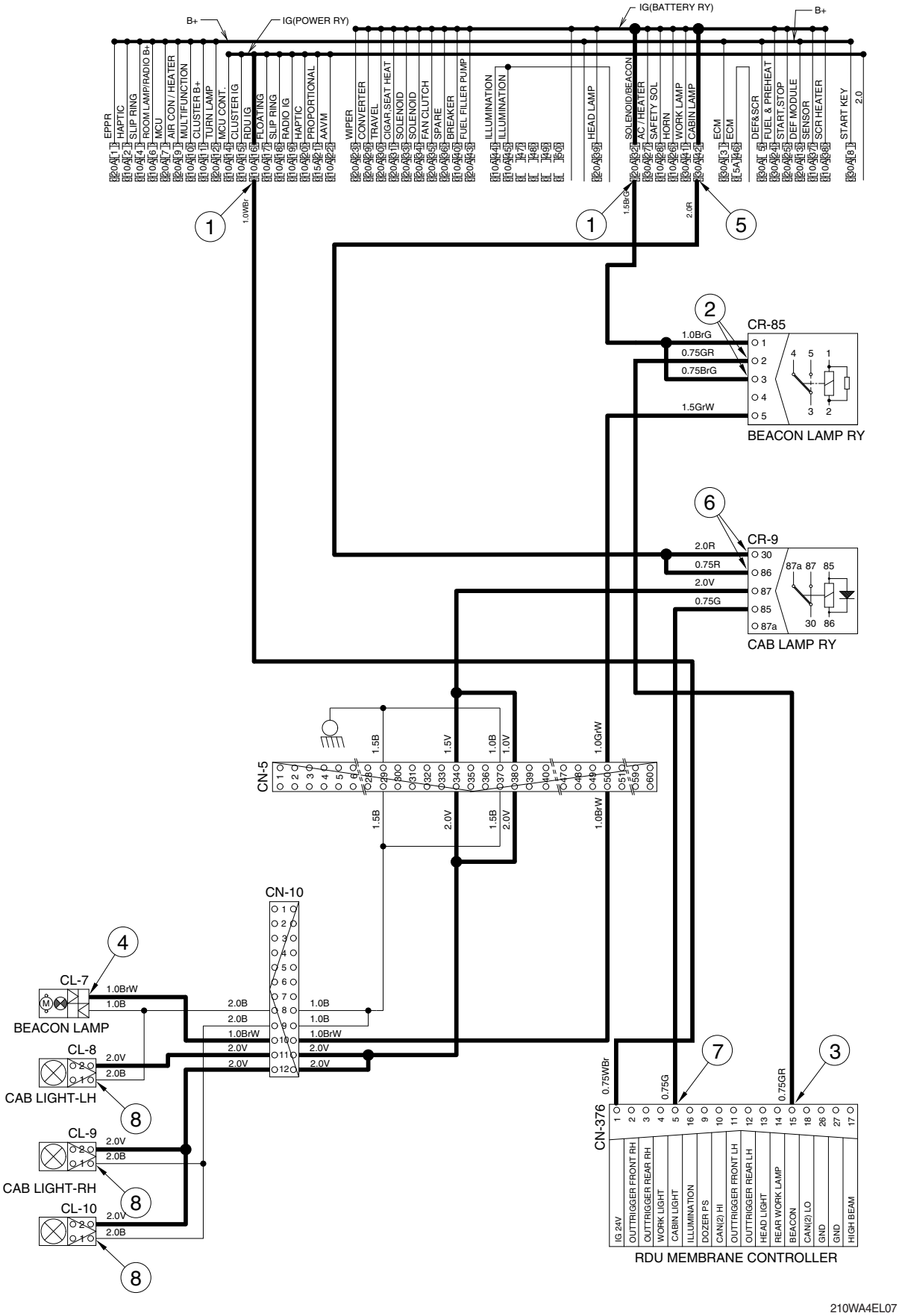
2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box) ② - GND (beacon lamp relay) ③ - GND (switch power output) ④ - GND (beacon lamp) ⑤ - GND (fuse box) ⑥ - GND (cab light relay) ⑦ - GND (switch power output) ⑧ - GND (cab light)	20~25 V

※ GND : Ground

※ The circuit diagram may differ from the equipment, so please check before a repair.

BEACON LAMP AND CAB LIGHT CIRCUIT



210WA4EL07

※ The circuit diagram may differ from the equipment, so please check before a repair.

6. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

(1) Key switch ON

Fuse box (No.11) → I/conn [J-1 (4)] → Multifunction sw [15]

Fuse box (No.23) → I/conn [J-1 (12)] → Multifunction sw [16]
- → Wiper motor [CN-21 (1)]
- → Washer pump relay [CR-49 (1, 3)]
- → Int wiper relay [CR-6A (3)]
- → Wiper relay [CR-6 (86, 87)]

(2) Wiper switch ON : 1st step

Wiper switch ON [Multifunction sw (9)] → I/conn [J-1 (6)] → Int wiper relay [CR-6A (1)→(2)] → Wiper relay [CR-6 (85)→ (87a)] → Wiper motor intermittently operating [CN-21 (3)]

(3) Wiper switch ON : 2nd step

Wiper switch ON [Multifunction sw (10)] → I/conn [J-1 (1)] → Int wiper relay [CR-6 (4)→(3)] → Wiper relay [CR-6 (87)→(30)] → Wiper motor operating [CN-21 (2)]

(4) Washer switch ON

Washer switch ON [Multifunction sw (7)] → I/conn [J-1 (5)]
- → Washer pump relay [CR-49 (2)→(5)] → Washer pump [CN-22 (2)] → Washer operating
- → Diode [DO-1 (2)→(1)] → Int wiper relay [CR-6 (4)→(3)] → Wiper relay [CR-6 (87)→(30)] → Wiper motor operating [CN-21 (2)]

(5) Auto parking (when switch OFF)

Switch OFF [Multifunction sw OFF position] → Wiper motor parking position by control unit.

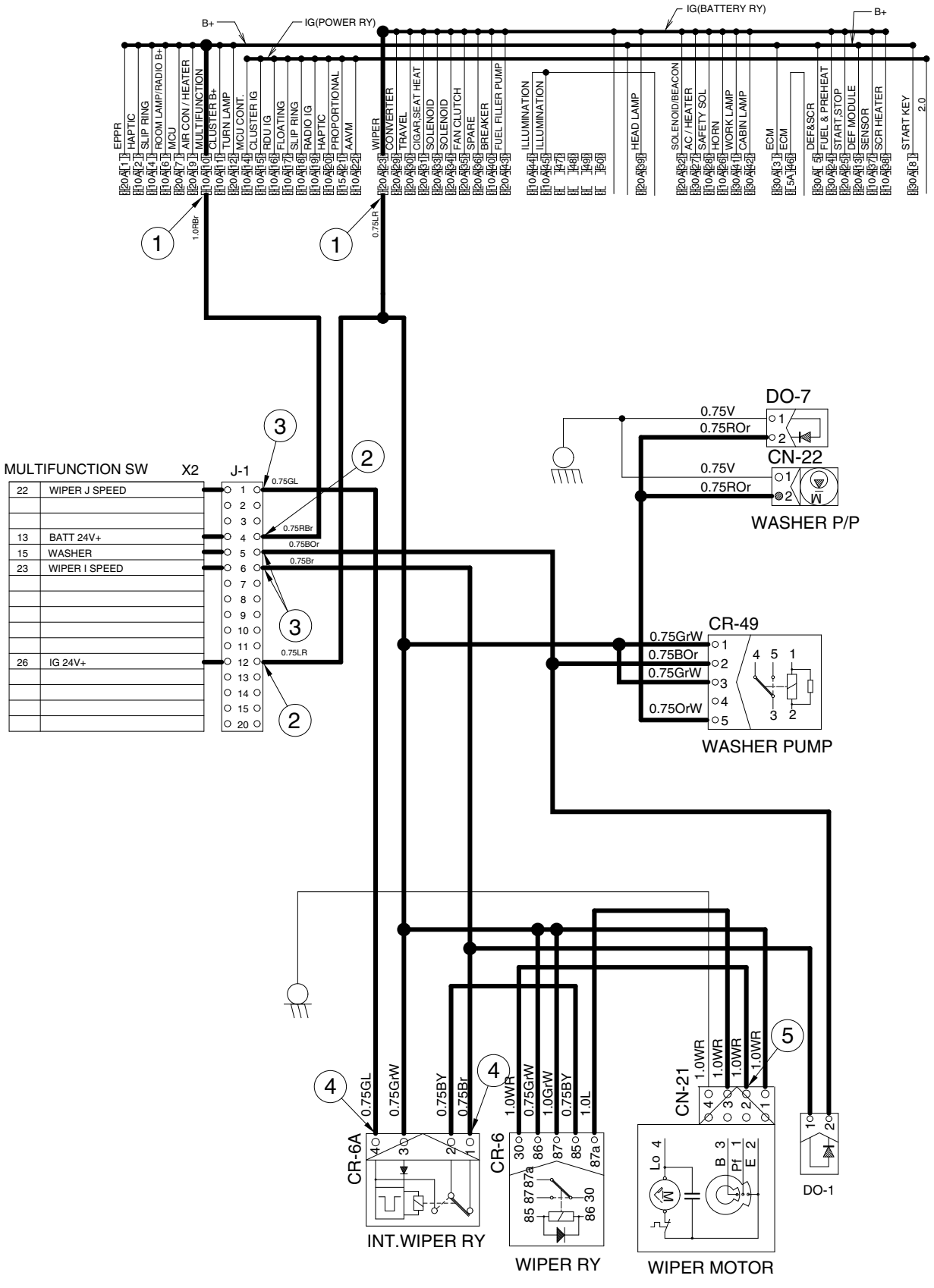
2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box) ② - GND (switch power input)	20~25 V
		③ - GND (switch power output) ④ - GND (Inter wiper relay input)	0~5 V
		⑤ - GND (wiper motor)	0 or 24 V

※ GND : Ground

※ The circuit diagram may differ from the equipment, so please check before a repair.

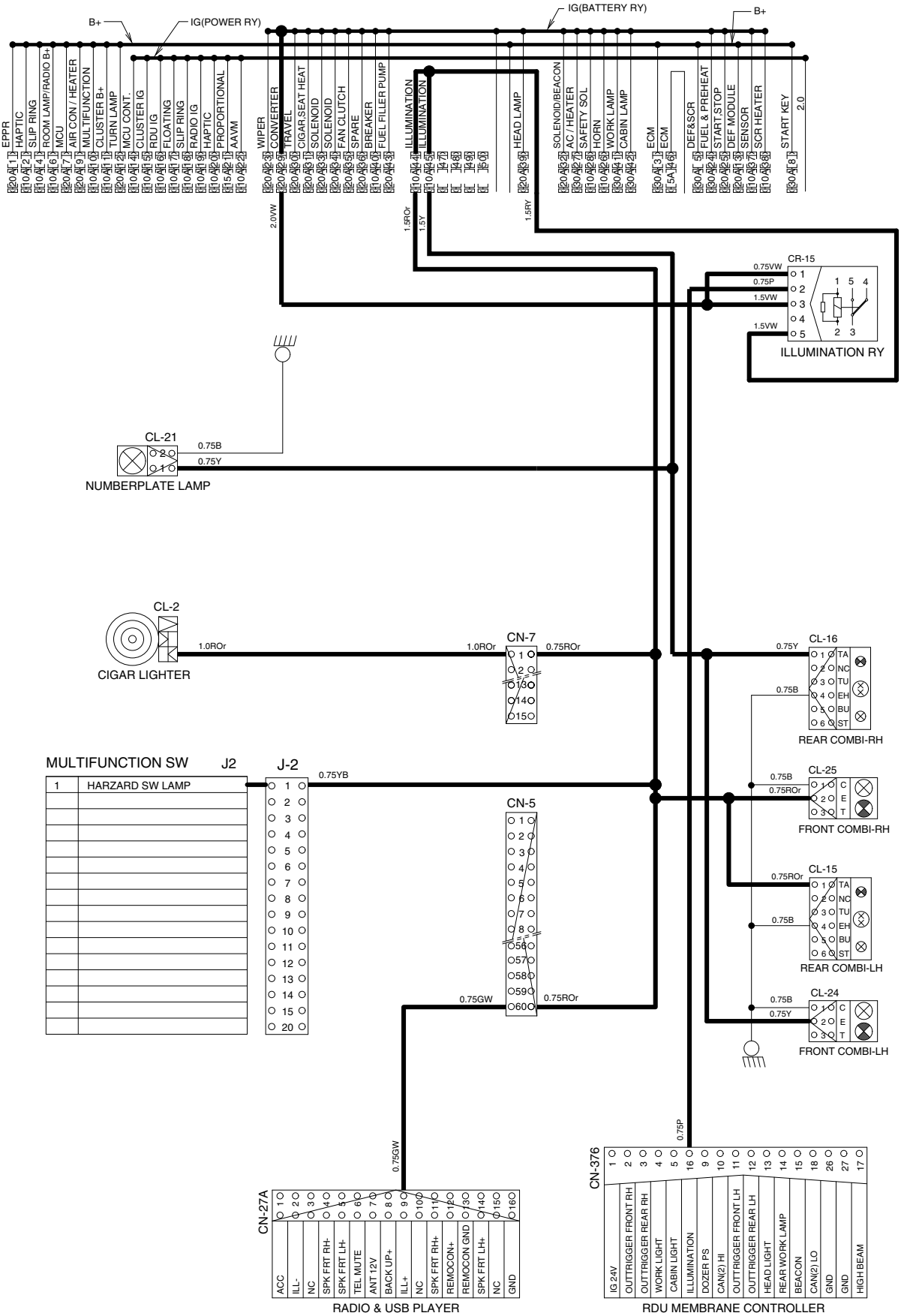
WIPER AND WASHER CIRCUIT



210WA4EL08

※ The circuit diagram may differ from the equipment, so please check before a repair.

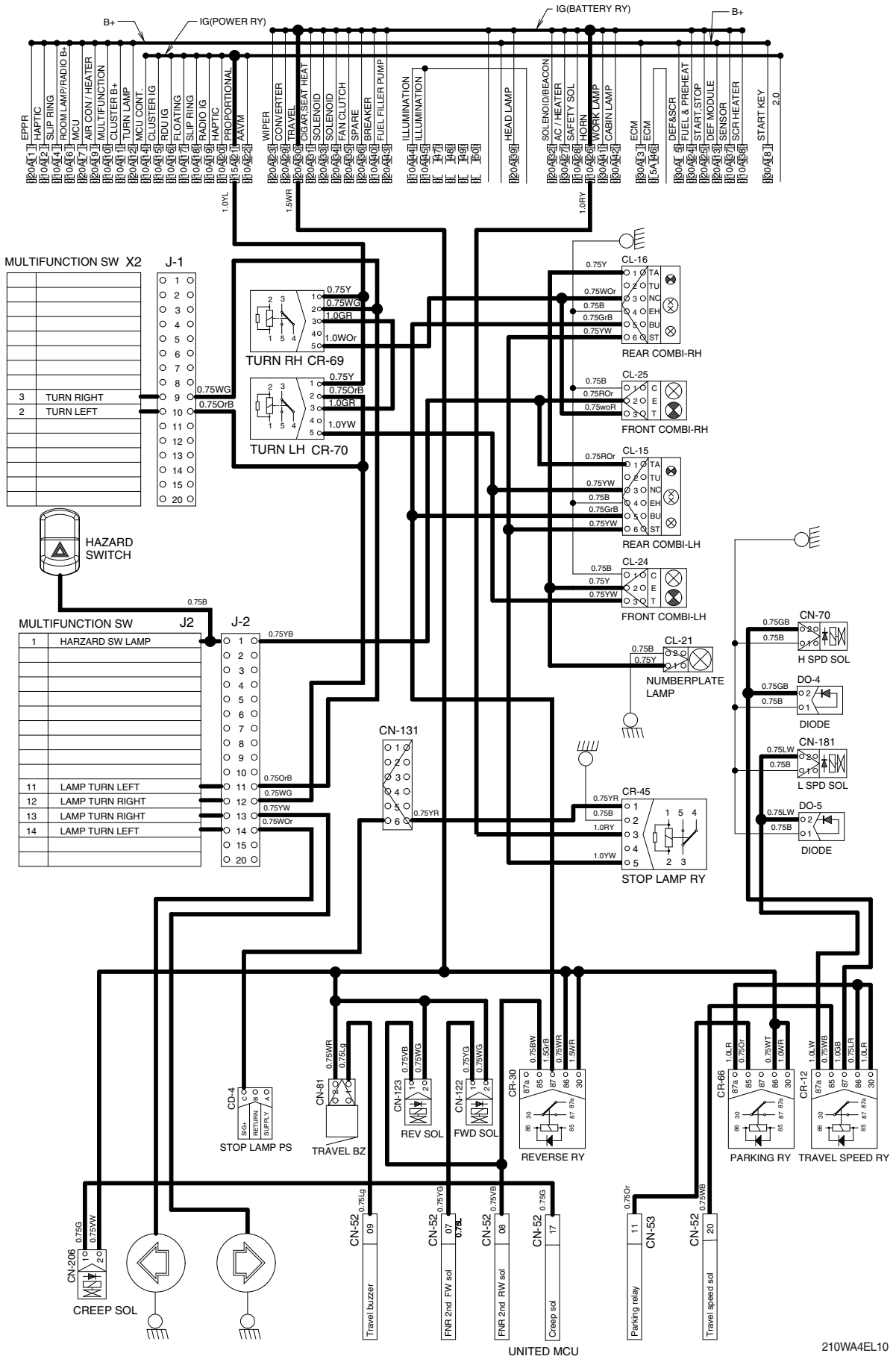
7. ILLUMINATION CIRCUIT



210WA4EL09

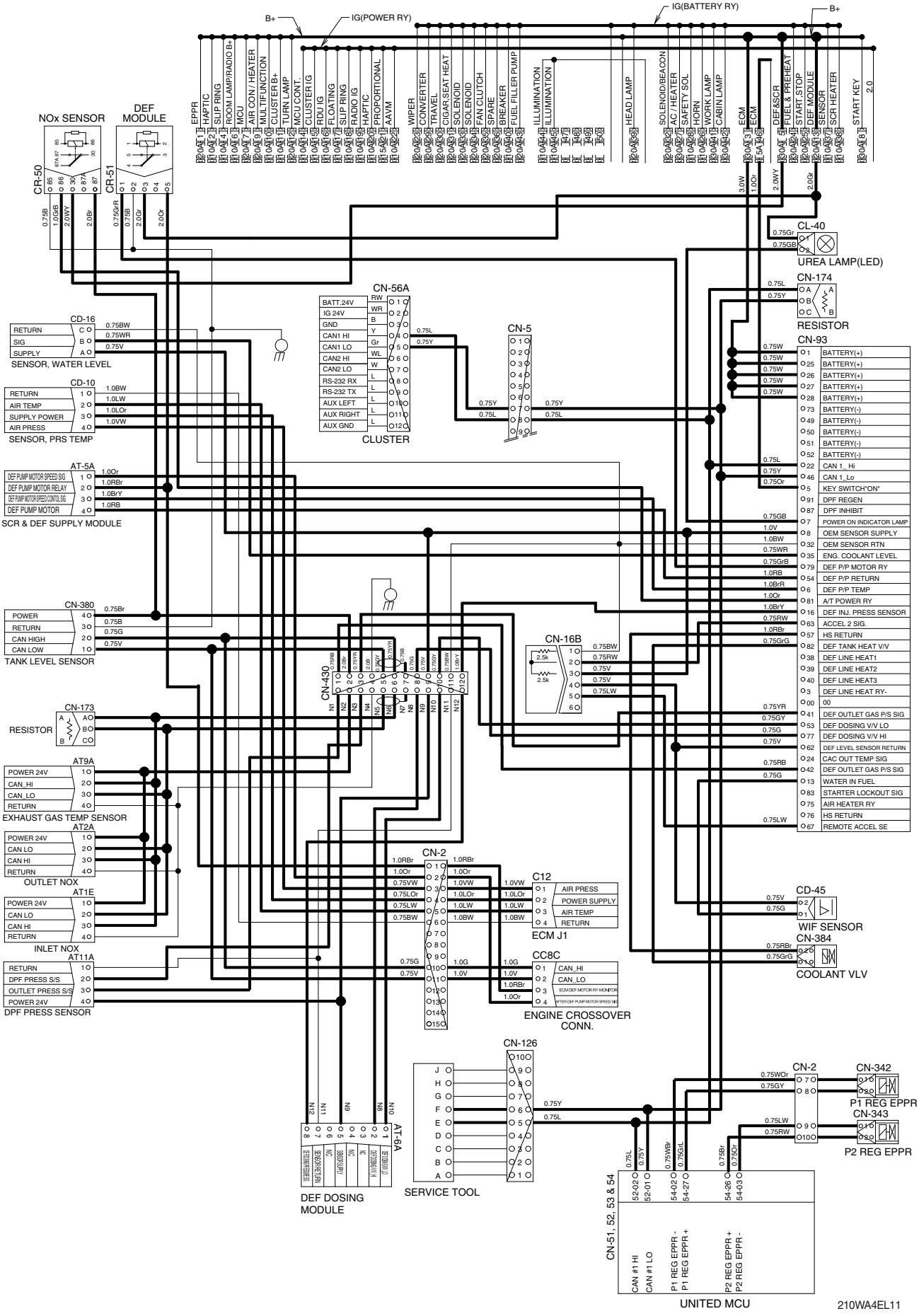
※ The circuit diagram may differ from the equipment, so please check before a repair.

8. COMBINATION LAMP CIRCUIT



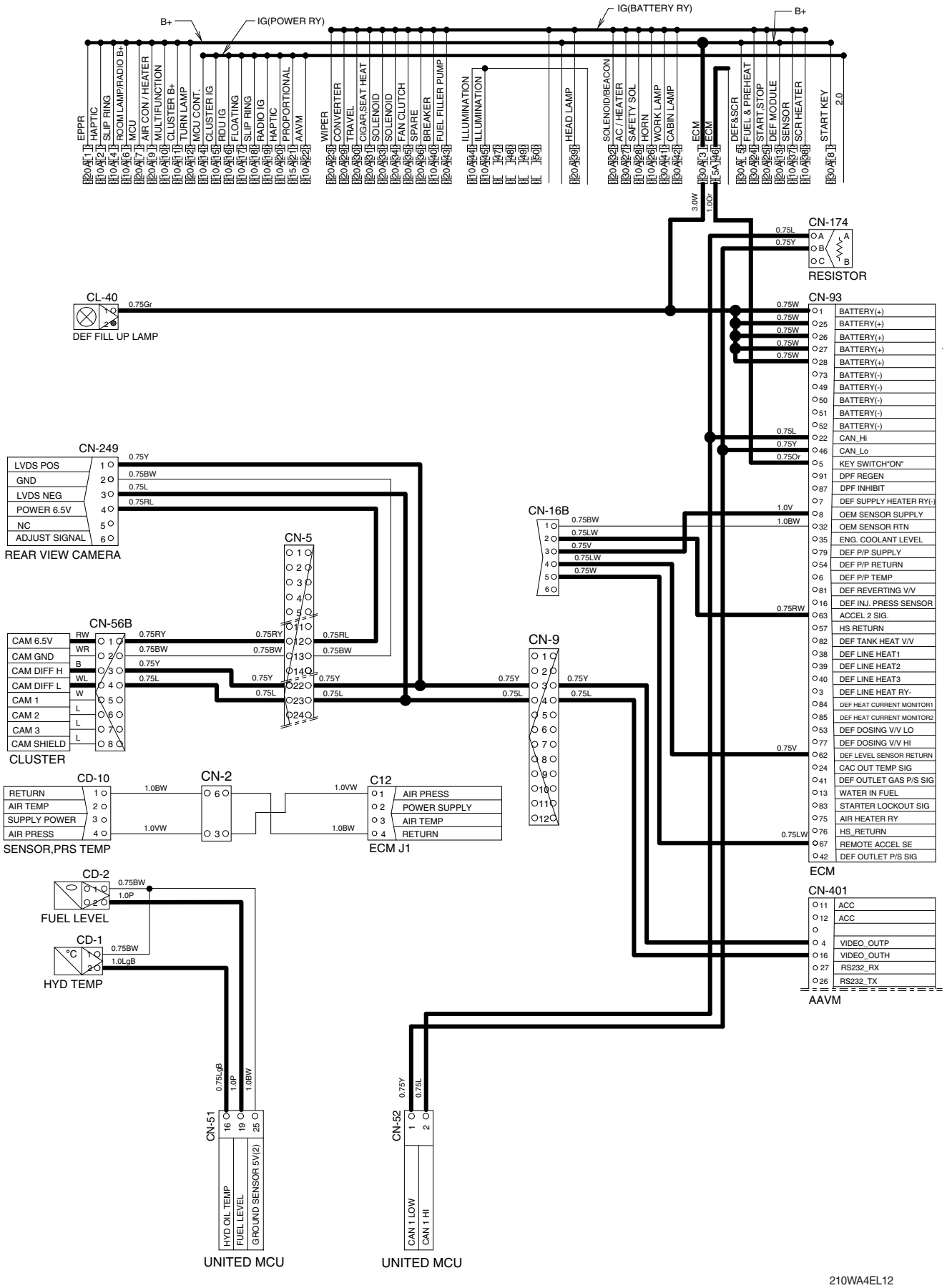
※ The circuit diagram may differ from the equipment, so please check before a repair.

9. CONTROLLER CIRCUIT



※ The circuit diagram may differ from the equipment, so please check before a repair.

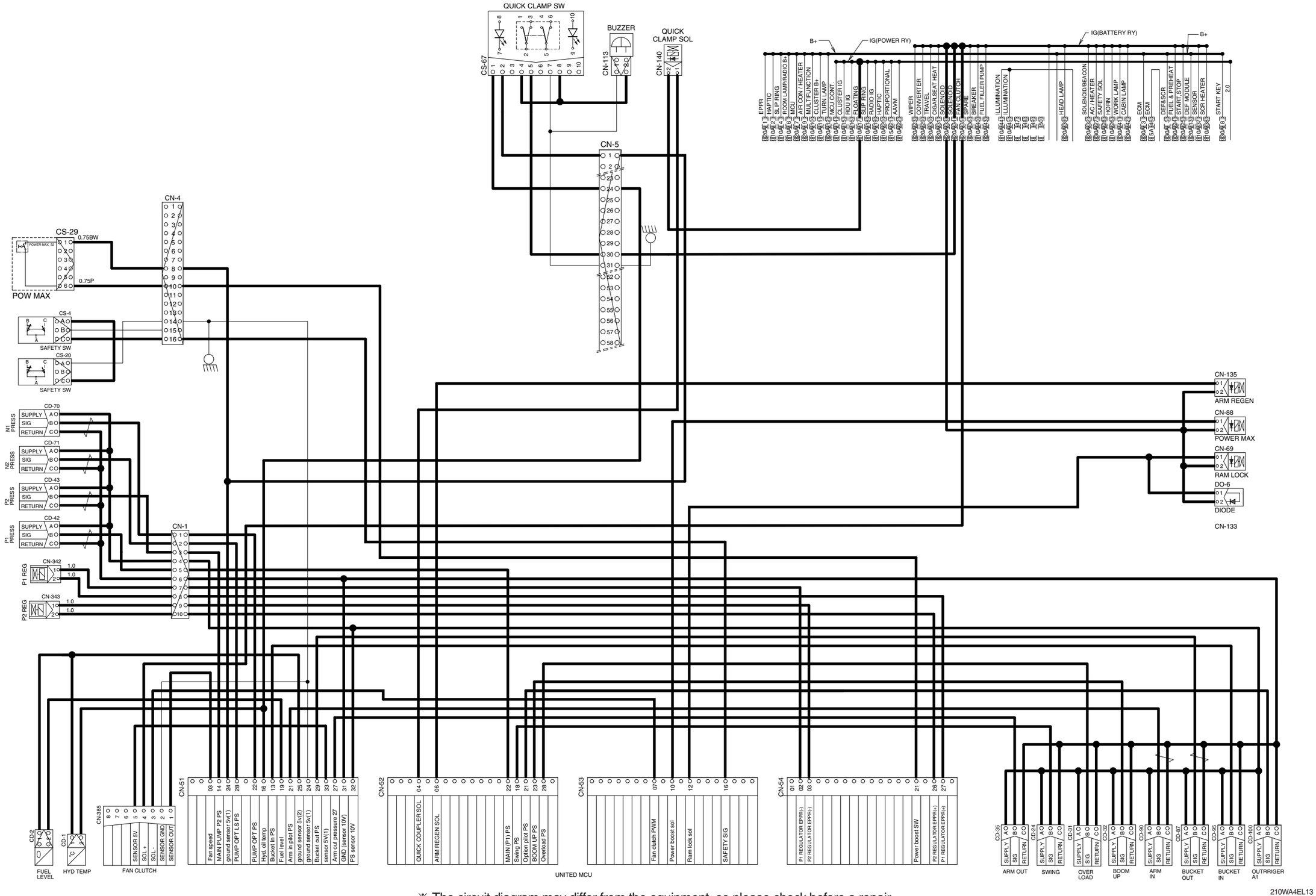
10. MONITORING CIRCUIT



210WA4EL12

※ The circuit diagram may differ from the equipment, so please check before a repair.

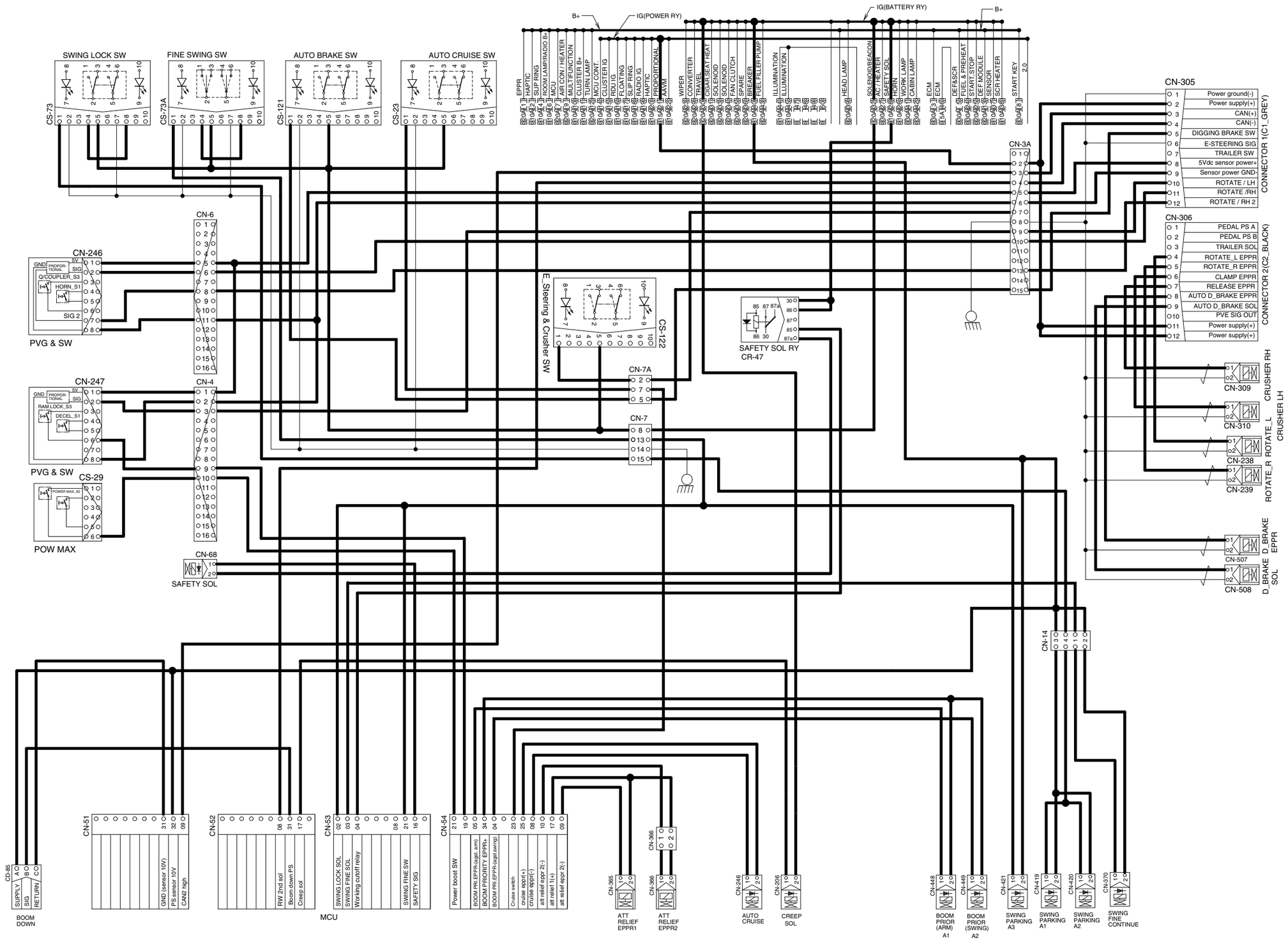
11. ELECTRIC CIRCUIT FOR HYDRAULIC (1/2)



※ The circuit diagram may differ from the equipment, so please check before a repair.

210WA4EL13

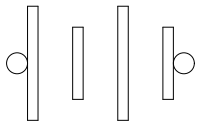
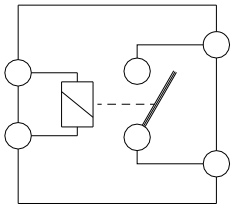
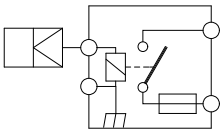
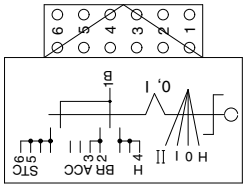
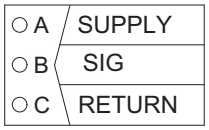
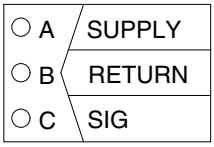
12. ELECTRIC CIRCUIT FOR HYDRAULIC (2/2)

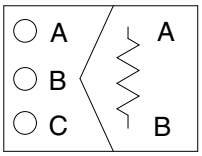
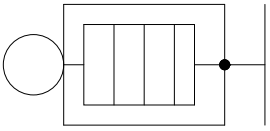
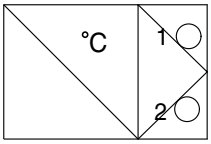
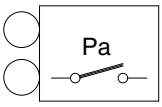
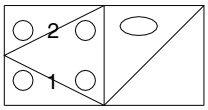
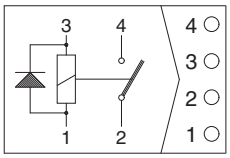


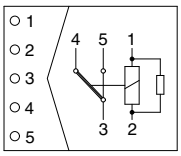
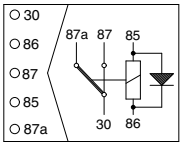
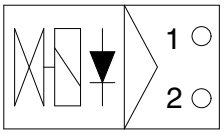
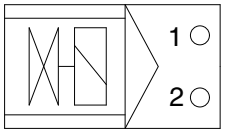
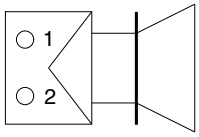
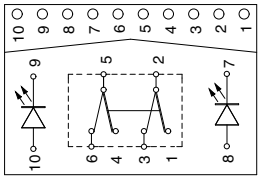
※ The circuit diagram may differ from the equipment, so please check before a repair.

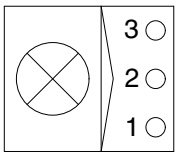
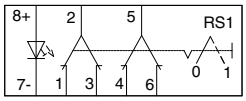
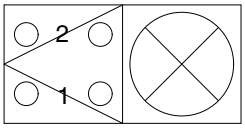
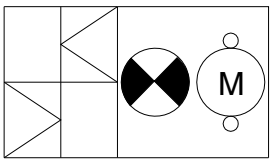
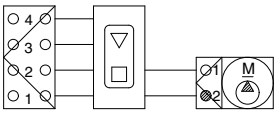
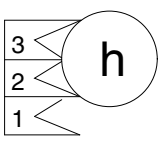
210WA4EL14

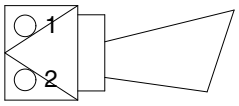
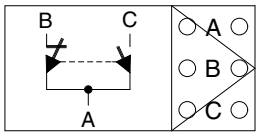
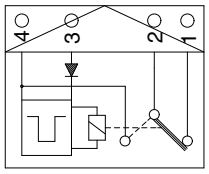
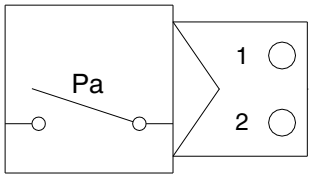
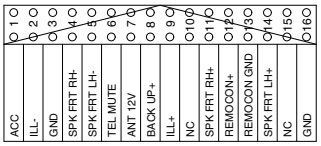
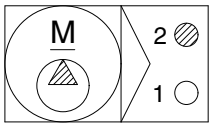
GROUP 3 ELECTRICAL COMPONENT SPECIFICATION

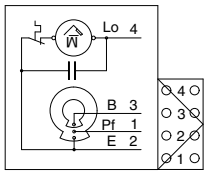
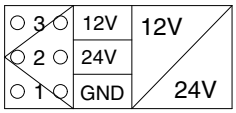
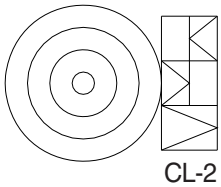
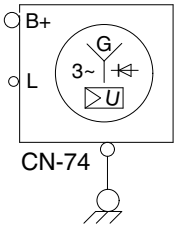
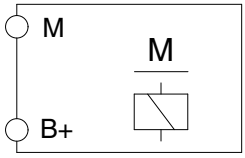
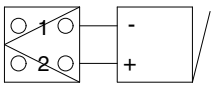
Part name	Symbol	Specifications	Check
Battery		12V × 100Ah (2EA)	※ Check specific gravity 1.280 over : Over charged 1.280 ~ 1.250 : Normal 1.250 below : Recharging
Battery relay	 CR-1	Rated load : 24V 100A (continuity) 1000A (30 seconds)	※ Check coil resistance(M4 to M4) Normal : About 50Ω ※ Check contact Normal : ∞Ω
Glow plug relay	 CR-24	24V 200A	※ Check contact Normal : 0.942Ω (For terminal 1-GND)
Start key	 CS-2A	B-BR : 24V 1A B-ACC : 24V 10A B-ST : 24V 40A	※ Check contact OFF : ∞Ω (for each terminal) ON : 0Ω (for terminal 1-3 and 1-2) START : 0Ω (for terminal 1-6)
Pressure sensor	 CD-3 CD-5 CD-16 CD-24 CD-31 CD-32 CD-35 CD-37 CD-38 CD-43 CD-70 CD-155	8~30V	※ Check contact Normal : 0.1Ω
Stop lamp pressure sensor	 CD-4	8~30V	※ Check contact Normal : 0.1Ω

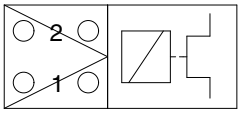
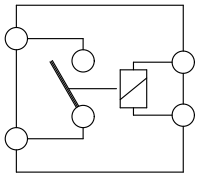
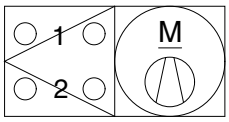
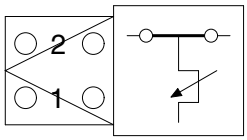
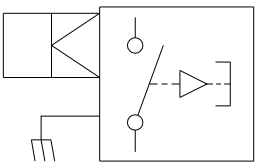
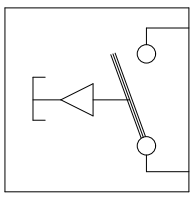
Part name	Symbol	Specifications	Check
Resistor	 CN-173 CN-174	3W	※ Check resistance A-B : 120Ω
Glow plug	 CN-80	24V 200A	※ Check resistance 0.25~0.12Ω
Temperature sensor (hydraulic)	 CD-1	-	※ Check resistance 50˚C : 804Ω 80˚C : 310Ω 100˚C : 180Ω
Air cleaner switch	 CD-10	N.O type	※ Check contact Normal : ∞Ω
Fuel level sender	 CD-2	-	※ Check resistance Full : 50Ω 6/12 : 350Ω 11/12 : 100Ω 5/12 : 400Ω 10/12 : 150Ω 4/12 : 450Ω 9/12 : 200Ω 3/12 : 500Ω 8/12 : 250Ω 2/12 : 550Ω 7/12 : 300Ω 1/12 : 600Ω Empty warning : 700Ω
Relay (air con blower)		24V 16A	※ Check resistance Normal : About 200Ω (for terminal 1-3) 0 Ω (for terminal 2-4)

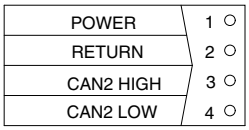
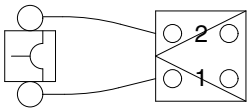
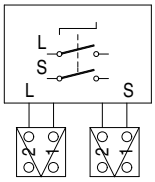
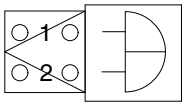
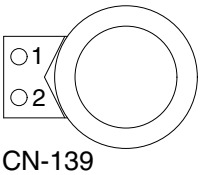
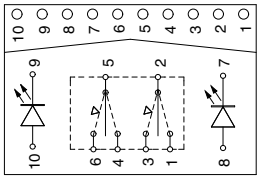
Part name	Symbol	Specifications	Check
Relay	 CR-2 CR-5 CR-15 CR-36 CR-39 CR-45 CR-49 CR-51 CR-69 CR-70 CR-81 CR-82 CR-83 CR-84 CR-85 CR-149	24V 16A	※ Check resistance Normal : About 160 Ω (for terminal 1-2) 0 Ω (for terminal 3-4) ∞ Ω (for terminal 3-5)
Relay	 CR-4 CR-6 CR-7 CR-9 CR-12 CR-13 CR-14 CR-30 CR-35 CR-44 CR-46 CR-47 CR-50 CR-52 CR-66	24V 16A	※ Check resistance Normal : About 160 Ω (for terminal 85-86) 0 Ω (for terminal 30-87a) ∞ Ω (for terminal 30-87)
Solenoid valve	 CN-68 CN-69 CN-70 CN-88 CN-122 CN-123 CN-135 CN-140 CN-181 CN-206 CN-214 CN-216 CN-218 CN-220 CN-370 CN-419 CN-420 CN-421	24V 1A	※ Check resistance Normal : 15~25 Ω (for terminal 1-2)
EPPR valve	 CN-132 CN-238 CN-239 CN-246 CN-309 CN-310 CN-342 CN-343 CN-365 CN-366 CN-448 CN-449 CN-507 CN-508	700mA	※ Check resistance Normal : 15~25 Ω (for terminal 1-2)
Speaker	 CN-23(LH) CN-23(RH)	20W	※ Check resistance Normal : A few Ω
Switch (locking type)	 CS-23 CS-67 CS-73 CS-73A CS-121 CS-122 CS-125	24V 1.5A	※ Check contact Normal ON : 0 Ω (for terminal 2-3, 5-6) ∞ Ω (for terminal 1-2, 4-5) OFF : ∞ Ω (for terminal 2-3, 5-6) 0 Ω (for terminal 1-2, 4-5)

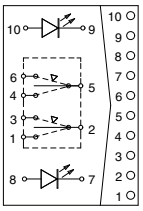
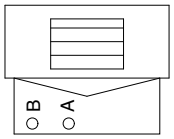
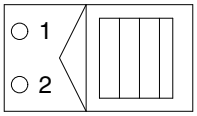
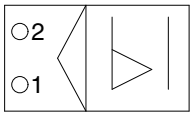
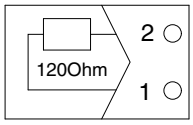
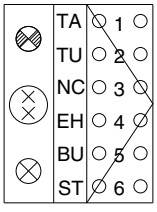
Part name	Symbol	Specifications	Check
Room lamp	 CL-1	24V 10W	※ Check disconnection Normal : 1.0Ω ON : 0Ω(For terminal 1-2) ∞Ω(For terminal 1-3) OFF : ∞Ω(For terminal 1-2) 0Ω(For terminal 1-3)
Hazard switch		24V 1.5A	※ Check contact Normal ON : 0Ω(For terminal 2-3, 5-6) OFF : ∞Ω(For terminal 2-3, 5-6)
Work lamp, Cab lamp, Number plate lamp	 CL-5 CL-6 CL-8 CL-9 CL-10 CL-21 CL-24	24V 65W (H3 Type)	※ Check disconnection Normal : 1.2Ω
Beacon lamp	 CL-7	21V 70W (H1 Type)	※ Check disconnection Normal : A few Ω
Fuel filler pump		24V 10A 35 ℓ /min	※ Check resistance Normal : 1.0Ω
Hour meter	 CN-48	16~32V	※ Check operation Supply power(24V) to terminal No.2 and connect terminal No.1 and ground

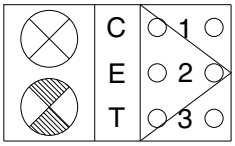
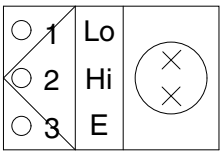
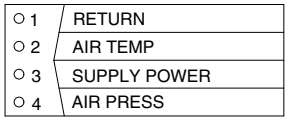
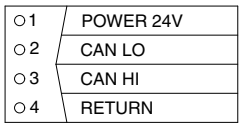
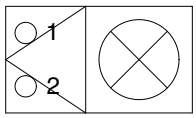
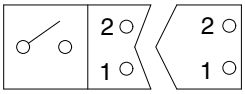
Part name	Symbol	Specifications	Check
Horn	 CN-20 CN-25	DC22~28V 2A	※ Check operation Supply power (24V) to each terminal and connect ground.
Safety switch	 CS-4 CS-20	24V 15A (N.C TYPE)	※ Check contact Normal : 1.0Ω ON : 0Ω(for terminal A-B) ∞Ω(for terminal A-C) OFF : ∞Ω(for terminal A-B) 0Ω(for terminal A-C)
Int wiper relay	 CR-6A	-	-
Receiver dryer	 CN-29	24V 2.5A	※ Check contact Normal : ∞Ω
Radio & USB player	 CN-27A	24V 2A	※ Check voltage 20~25V (for terminal 1-3, 3-8)
Washer pump	 CN-22	24V 3.8A	※ Check contact Normal : 10.7Ω(for terminal 1-2)

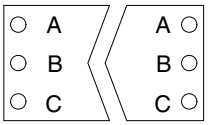
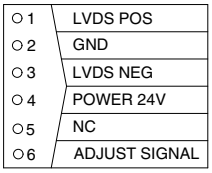
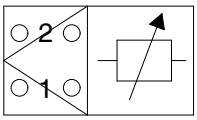
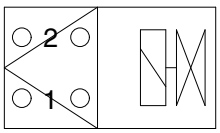
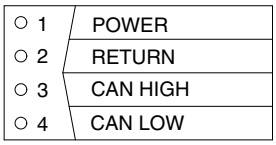
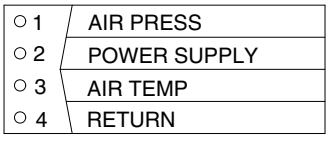
Part name	Symbol	Specifications	Check
Wiper motor	 CN-21	24V 2A	※ Check disconnection Normal : 7Ω (for terminal 2-4)
DC/DC converter	 CN-138	12V 3A	※ Check voltage 24V (for terminal 1-2) 12V (for terminal 1-3)
Cigar lighter	 CL-2	24V 5A 1.4W	※ Check coil resistance Normal : About 1MΩ ※ Check contact Normal : ∞Ω Operating time : 5~15sec
Alternator	 CN-74	24V 95A	※ Check contact Normal : 0Ω (for terminal B^+-L) Normal : 24~27.5V
Starter	 CN-45	24V 4.8kW	※ Check contact Normal : 0.1Ω
Travel alarm	 CN-81	24V 0.5A	※ Check contact Normal : 5.2Ω

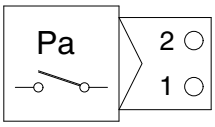
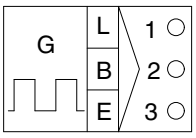
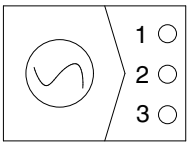
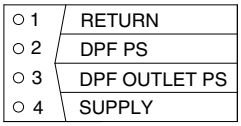
Part name	Symbol	Specifications	Check
Air conditioner compressor	 CN-28	24V 79W	※ Check contact Normal : 13.4Ω
Start relay	 CR-23	24V 300A	※ Check contact Normal : 0.94Ω (for terminal 1-2)
Blower motor		24V 9.5A	※ Check resistance Normal : 2.5Ω (for terminal 1-2)
Duct sensor (switch)		1˚C OFF 4˚C ON	※ Check resistance Normal : 0Ω (for terminal 1-2), the atmosphere temp : Over 4˚C
Door switch	 CS-1	24V 2W	※ Check resistance Normal : About 5MΩ
Switch (power max, one touch decel, horn, breaker)		24V 6A	※ Check resistance Normal : ∞Ω

Part name	Symbol	Specifications	Check
Radar	 CN-441	-	-
Circuit breaker	 CN-60 CN-95	CN-60 : 60A CN-95 : 90A	※ Check disconnection Normal : 0Ω (connect ring terminal and check resist between terminal 1 and 2)
Master switch	 CS-74 CS-74B	6-36V	※ Check disconnection Normal : 0.1Ω
Quick clamp buzzer	 CN-113	24V 200mA 107±4dB	-
Socket	 CN-139	12V 10A	-
SCR switch	 CS-100	24V 8A	※ Check contact Normal OFF : ∞Ω(for terminal 2-1, 2-3, 4-5, 5-6)

Part name	Symbol	Specifications	Check
Select switch	 CS-100	24V 8A	※ Check contact Normal 0 or : ∞Ω(for terminal 2-1, 2-3, 4-5, 5-6)
Fuel heater	 CN-96	-	-
DEF/AdBlue® line heater	 CN-381 CN-382 CN-383	-	-
WIF sensor	 CD-45	-	※ Check disconnection Normal : 68.8~4.94Ω
CAN terminating resistance	 RS-1	-	※Check resistance Normal : 120Ω (for terminal 1-2)
Rear combination lamp-LH,RH	 CL-15 CL-16	24V 21W×2 LED	※Check resistance Normal : 4.8Ω (For terminal 1-4) Normal : 2.1Ω (For terminal 2-4, 4-5, 4-6)

Part name	Symbol	Specifications	Check
Front combination lamp-LH, RH	 CL-24 CL-25	24V 21W 24V 10W	※Check resistance Normal : 4.8Ω (For terminal 1-2) Normal : 2.1Ω (For terminal 2-3)
Head lamp -LH, RH	 CL-3 CL-4	24V 75/70W	※Check resistance Normal : 1.0Ω (For terminal 1-3, 2-3) Normal : 1.5Ω (For terminal 1-2)
Pressure temperature sensor	 CD-10	5.0V 0.2A	※ Check contact Normal 0Ω(for terminal 1-2, 47.5Ω) ∞Ω(for terminal 3-1, 1kΩ) ∞Ω(for terminal 4-1, 1kΩ)
Sensor (NOx)	 AT1E AT2A AT9A AT11A	-	-
DEF/AdBlue® fill up warning lamp (LED)	 CL-40	-	-
Seat belt switch	 CS-250	-	-

Part name	Symbol	Specifications	Check
Smart button	 CS-2B	-	-
Camera	 CN-249 CN-402 CN-403 CN-404 CN-405	-	-
Air conditioner temperature sensor (incar, ambient)		-	-
EPPR valve	 CN-384 CN-J31	24V 700mA	※Check resistance Normal : 15~25Ω (For terminal 1-2)
DEF/AdBlue® tank level senosr	 CN-380	-	-
TBAP	 C12	-	-

Part name	Symbol	Specifications	Check
Dozer act pressure switch	 CD-50	N.O type	※Check resistance Normal : ∞Ω(open)
Flasher unit	 CR-11	24V 85~190 C/M 50dB	-
Speed sensor	 CD-46	-	-
DPF pressure sensor	 AT11A	-	-

GROUP 4 CONNECTORS

1. CONNECTOR DESTINATION

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-1	TYCO	10	I/conn (Frame harness-Engine harness)	S816-010002	S816-110002
CN-2	DELPHI	15	I/conn (Frame harness-Engine harness)	2-85262-1	368301-1
CN-3A	AMP/TYCO	15	I/conn (Frame harness-PVG harness)	2-85262-1	368301-1
CN-4	AMP	16	I/conn (Console harness LH-Frame harness)	368047-1	S816-116002
CN-5	DEUTSCH	60	I/conn (Side harness RH-Frame harness)	DRB16-60SAE-L018	DRB12-60PAE-L018
CN-6	AMP	16	I/conn (Console harness RH-Frame harness)	368047-1	S816-116002
CN-7	AMP	15	I/conn (Console harness RH-Frame harness)	2-85262-1	368301-1
CN-7A	AMP	12	I/conn (Console harness RH-Frame harness)	174661-2	368537-1
CN-8	AMP	10	I/conn (Console harness RH-Frame harness)	S816-010002	S816-110002
CN-9	DEUTSCH	12	I/conn (Frame harness-AAVM harness)	DT06-12S	DT04-12PA-E005
CN-10	DEUTSCH	12	I/conn (Cab harness-Side harness RH)	DT06-12S-EP06	DT04-12PA-P021
CN-11	DEUTSCH	8	Air conditioner harness	DT06-8S-EP06	-
CN-12	DEUTSCH	2	I/conn (Frame harness-Boom wire harness)	DT06-2S-EP06	DT04-2P-E005
CN-14	AMP	4	I/conn (Frame harness-swing parking harness)	174257-2	174984-2
CN-15	AMP	8	I/conn (Frame harness-1 way harness)	S810-008002	174984-2
CN-16	AMP	6	Emergency engine start & speed control	S816-006002	-
CN-16A, B	AMP	6	Emergency engine start & speed control	S816-006002	S816-106002
CN-20	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-21	DEUTSCH	4	Wiper motor	DT06-4S-EP06	-
CN-22	KET	2	Washer pump	MG640605	-
CN-23	KET	2	Speaker-LH	MG610070	-
CN-24	KET	2	Speaker-RH	MG610070	-
CN-25	DEUTSCH	2	Horn	DT06-2S-EP06	-
CN-27A	KUM	16	Radio & USB player	PK145-16017	-
CN-27B	AMP	8	USB player	-	174984-2
CN-28	KET	2	Aircon compressor	MG610320	-
CN-29	KET	2	Receiver dryer	MG640795	-
CN-31	-	2	Fuse 1	-	174352-2
CN-32	-	2	Fuse 1	-	-
CN-45	RING-TERM	-	Starter motor B^+ /G terminal	S820-410000	-
CN-45	RING-TERM	-	Starter motor M terminal	ST710246-2	-
CN-48	KET	1	Service meter	2-520193-2	-
CN-51	TE	34	United MCU	2-1437285-3	-
CN-52	TE	34	United MCU	4-1437290-1	-
CN-53	TE	26	United MCU	1473416-1	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-54	TE	34	United MCU	4-1437290-0	-
CN-56A	AMP	12	Cluster	-	174663-2
CN-56B	AMP	8	Cluster	-	174984-2
CN-56C	AMP	8	Cluster	-	174984-2
CN-60	YAZAKI	2	Circuit breaker	-	7222-4220-30
CN-61	DEUTSCH	4	Fuel filler pump	DT06-4S-EP06	DT04-4P
CN-68	DEUTSCH	2	Safety solenoid	DT06-2S-EP06	-
CN-69	DEUTSCH	2	Ram lock solenoid	DT06-2S-EP06	-
CN-70	DEUTSCH	2	Travel high solenoid	DT06-2S-EP06	-
CN-74	RING-TERM	1	Alternator "L" terminal	MG820-105000	-
CN-74	RING-TERM	1	Alternator "B+" terminal	MG820-108000	-
CN-74	RING-TERM	1	Alternator "G" terminal	MG820-306000	-
CN-74	RING-TERM	1	Alternator "EG" terminal	MG820-312008	-
CN-80	RING-TERM	-	Glow plug	S820-406001	-
CN-81	DEUTSCH	2	Travel buzzer solenoid	DT06-2S-EP06	-
CN-88	DEUTSCH	2	Power max solenoid	DT06-2S-EP06	-
CN-93	DELPHI	96	To ECU	13964577	-
CN-95	YAZAKI	2	Circuit breaker	-	722-4220-30
CN-96	DELPHI	2	Fuel warmer	1530 0027	-
CN-100	KET	1	Battery earth	MG640994-5	-
CN-113	KET	2	Quick clamp buzzer	MG651205-5	-
CN-122	DEUTSCH	2	Forward solenoid	DT06-2S-EP06	-
CN-123	DEUTSCH	2	Reverse solenoid	DT06-2S-EP06	-
CN-125	Econoseal J	4	GPS connector	S816-004002	S816-104002
CN-125A	DEUTSCH	12	GPS	DT06-12S-P021	DT04-12PA-P021
CN-125B	DEUTSCH	8	RMS	DT06-8S	DT04-8P
CN-126	AMP	10	Service tool	S816-010002	S816-110002
CN-126A	DEUTSCH	4	RMS service tool	DT06-4S	DT04-4P
CN-131	-	6	I/conn (Stop lamp harness-Frame harness)	S816-006002	S816-106002
CN-132	DEUTSCH	2	Safety solenoid	DT06-2S-EP06	-
CN-135	DEUTSCH	2	Arm regen solenoid	DT06-2S-EP06	-
CN-138	FASTEN	3	DC/DC Converter	S810-003202	-
CN-139	FASTEN	2	12V socket	172434-2	-
CN-140	DEUTSCH	2	Quick clamp solenoid	DT06-2S-EP06	DT04-2P-E005
CN-156	DEUTSCH	60	MTCU	DRC26-40SA	-
CN-156	AMP	2	Air seat	-	S822-114002
CN-157	AMP	1	Antena power	S822-014002	-
CN-168	DEUTSCH	12	PVED-CLS	DT06-12S	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-173	DEUTSCH	3	Resistor	DT06-3S-EP06	DT04-3P-EP10
CN-174	DEUTSCH	3	Resistor	DT06-3S-EP06	-
CN-181	DEUTSCH	2	Travel low speed solenoid	DT06-2S-EP06	-
CN-206	DEUTSCH	2	Creep solenoid	DT06-2S-EP06	-
CN-214	DEUTSCH	2	Front outrigger solenoid - RH	DT06-2S-EP06	DT04-2P-E005
CN-216	DEUTSCH	2	Front outrigger solenoid - LH	DT06-2S-EP06	DT04-2P-E005
CN-218	DEUTSCH	2	Rear outrigger solenoid - RH	DT06-2S-EP06	DT04-2P-E005
CN-220	DEUTSCH	2	Rear outrigger solenoid - LH	DT06-2S-EP06	DT04-2P-E005
CN-238	DEUTSCH	2	Rotate-LH (A1)	DT06-2S-EP06	DT04-2P
CN-239	DEUTSCH	2	Rotate-RH (A2)	DT06-2S-EP06	DT04-2P
CN-246	DEUTSCH	2	Cruise solenoid	DT06-2S-EP06	-
CN-246	DEUTSCH	8	PVG switch	DT06-8S	-
CN-247	DEUTSCH	8	PVG signal	DT06-8S	-
CN-249	DEUTSCH	6	Rear view camera	DT06-6S-EP06	DT04-6P-E005
CN-255	DEUTSCH	8	Slipring	DT06-8S-EP06	DT04-8P-E003
CN-255A	DEUTSCH	8	Trailer hitch	DT06-8S	DT04-8P
CN-258	KET	1	Air compressor power	MG640994-5	MG650943-5
CN-260	-	2	Siren speaker	S816-002002	S816-102002
CN-261	KET	6	Siren AMP	MG610049	-
CN-263	DEUTSCH	2	Air compressor	DT06-2S-EP06	DT04-2P-E005
CN-305	DEUTSCH	50	PVG connector	DRC26-50S01	-
CN-305	DEUTSCH	12	PVG connector	DTM06-12SA	-
CN-306	DEUTSCH	12	PVG connector	DTM06-12SB	-
CN-307	DEUTSCH	3	Service tool	DT06-3S-EP06	DT04-3P-E005
CN-309	DEUTSCH	2	2 way clamp	DT06-2S-EP06	-
CN-310	DEUTSCH	2	2 way release	DT06-2S-EP06	-
CN-313	DEUTSCH	4	Service tool	DT06-4S	-
CN-342	AMP	2	P1 EPPR valve	E816-002002	-
CN-343	AMP	2	P2 EPPR valve	E816-002002	-
CN-363	-	12	Jog dial module	174045-2	-
CN-365	DEUTSCH	2	Attachment relief EPPR valve 1	DT06-2S-EP06	DT04-2P-E005
CN-366	DEUTSCH	2	Attachment relief EPPR valve 2	DT06-2S-EP06	DT04-2P-E005
CN-370	DEUTSCH	2	Swing fine control solenoid	DT06-2S-EP06	DT04-2P-E005
CN-376	TYCO	34	RDU membrane controller	4-1437290-1	-
CN-380	DEUTSCH	4	DEF/AdBlue® tank level sensor	DT06-4S-EP06	-
CN-381	DEUTSCH	2	DEF/AdBlue® line heater 1	DT06-2S-EP06	-
CN-382	DEUTSCH	2	DEF/AdBlue® line heater 2	DT06-2S-EP06	-
CN-383	DEUTSCH	2	DEF/AdBlue® line heater 3	DT06-2S-EP06	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-384	TYCO	2	Coolant valve	1-967325-3	-
CN-385	DELPHI	7	Fan clutch	965570	-
CN-401	TE	35	AAVM controller	776164-1	-
CN-402	DEUTSCH	6	Front view camera	DT06-6S-P021	DT04-6P-P021
CN-403	DEUTSCH	6	Rear view camera	-	DT04-6P-E005
CN-404	DEUTSCH	6	Left view camera	-	DT04-6P-E005
CN-405	DEUTSCH	6	Right view camera	-	DT04-6P-E005
CN-406	DEUTSCH	3	RS 232	DT06-3S-E005	DT04-3P-E005
CN-419	DEUTSCH	2	Swing parking A1	DT06-2S-EP06	-
CN-420	DEUTSCH	2	Swing parking A2	DT06-2S-EP06	-
CN-421	DEUTSCH	2	Swing parking A3	DT06-2S-EP06	-
CN-427	MOLEX	12	Reader	5557-12R	39301120
CN-430	DEUTSCH	12	I/conn (Side harness RH-Aftertreatment harness)	DT06-12S	DT06-12P-E005
CN-431	KET	20	Aux monitor	MG653026	-
CN-441	DEUTSCH	4	Radar	DT06-4S-EP06	DT04-4P
CN-448	DEUTSCH	2	Boom priority EPPR 1 (arm)	DT06-2S-EP06	-
CN-449	DEUTSCH	2	Boom priority EPPR 2 (swing)	DT06-2S-EP06	-
CN-452	DEUTSCH	6	Arm camera	DT06-6S-EP06	DT04-6P-E005
CN-507	DEUTSCH	2	Digging brake EPPR	DT06-2S-EP06	-
CN-508	DEUTSCH	2	Digging brake solenoid	DT06-2S-EP06	-
AT-1E	TYCO	4	DEF NOx sensor (imlet)	2-1418390-1	-
AT-2A	TYCO	4	NOx sensor (outlet)	1-1418390-1	-
AT-5A	TYCO	4	SCR supply module	2-1418390-1	-
AT-6A	TYCO	8	DEF dosing module	1-1418479-1	-
AT-9A	TYCO	4	SCR temp sensor	4-1418390-1	-
AT-11A	FRAMATOME	4	Diff pressure sensor	54200410	-
CC8C	DEUTSCH	4	Engine side crossover connector	DT06-4S-EP06	-
C12	FCI	4	TBAP	54200419	-
J-1	TE	20	Multifunction switch	-	1-0640514-0
J-2	TE	20	Multifunction switch	1-0640524-0	-
· Relay					
CR-1	RING-TERM	1	Battery relay B+/IG terminal	ST710285-2	-
CR-2	-	5	Horn relay	-	-
CR-3	-	5	Working lamp relay	-	-
CR-5	-	5	Anti restart relay	-	-
CR-6	-	5	Wiper relay	-	-
CR-6A	TE	4	Int wiper relay	174202-1	-
CR-7	-	5	Aircon compressor relay	-	-

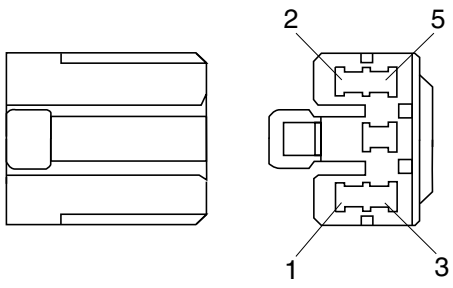
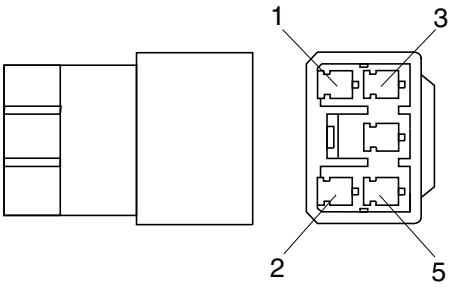
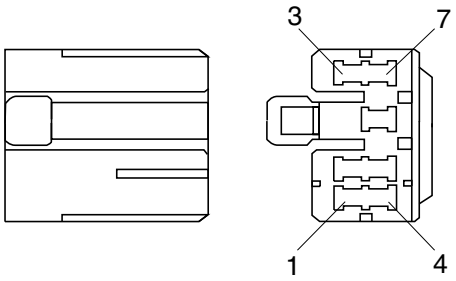
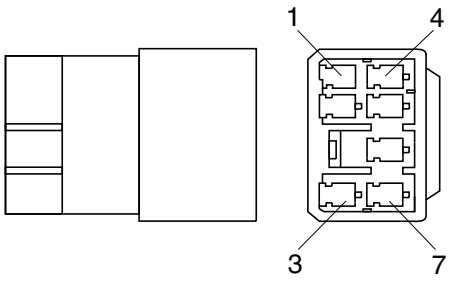
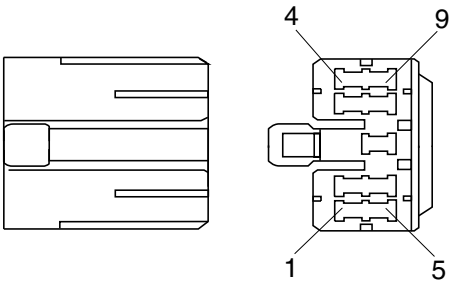
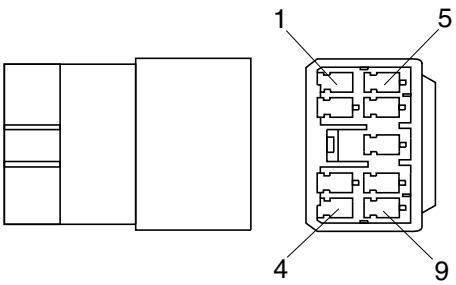
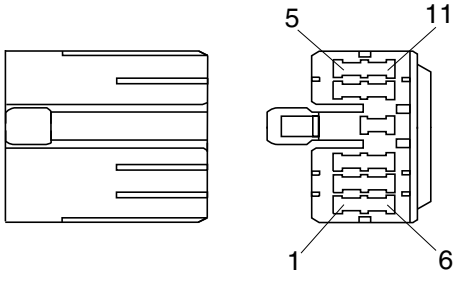
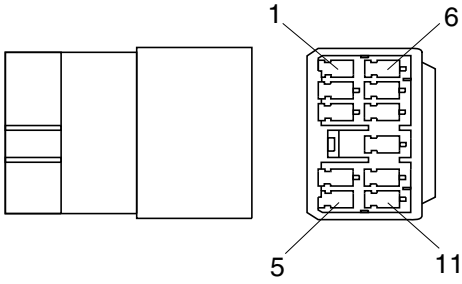
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CR-9	-	5	Cabin lamp relay	-	-
CR-11	-	3	Flasher unit relay	S810-003702	-
CR-12	-	5	Travel speed relay	-	-
CR-13	-	5	Head lamp low relay	-	-
CR-14	-	5	Head lamp high relay	-	-
CR-15	-	5	Illumination relay	-	-
CR-23	RINGTERM	1	Start relay S/G terminal	ST712089-2	-
CR-23	RINGTERM	1	Start relay B+/M terminal	ST710384-2	-
CR-24	RING TERM	1	Preheat relay B+/P terminal	S820-406000	-
CR-24	RING TERM	1	Preheat relay G terminal	S820-108000	-
CR-24	-	1	Preheat relay S terminal	S822-014000	-
CR-30	-	5	Travel reverse relay	-	-
CR-35	-	5	Power relay	-	-
CR-36	-	5	Preheat relay	-	-
CR-39	-	5	Starter lockout relay	-	-
CR-44	-	5	Rear work lamp relay	-	-
CR-45	-	5	Stop lamp relay	-	-
CR-46	-	5	Fuel warmer relay	-	-
CR-47	-	5	Safety solenoid relay	-	-
CR-49	-	5	Washer relay	-	-
CR-50	-	5	NOx sensor relay	-	-
CR-51	-	5	DEF module relay	-	-
CR-52	-	5	Line heater relay	-	-
CR-62	-	5	Breaker relay	-	-
CR-66	-	5	Parking relay	-	-
CR-78	-	5	Head lamp power relay	-	-
CR-81	-	5	Front outrigger relay - RH	-	-
CR-82	-	5	Front outrigger relay - LH	-	-
CR-83	-	5	Rear outrigger relay - RH	-	-
CR-84	-	5	Rear outrigger relay - LH	-	-
CR-85	-	5	Beacon lamp relay	-	-
CR-149	-	5	Attach safety relay	-	-
· Switch					
CS-1	SHUR	1	Door switch	S822-014002	-
CS-2A	WP	6	Start key switch	S814-006100	-
CS-2B	DEUTSCH	3	Smart key	DT06-3S-EP06	DT04-3P-E005
CS-2C	KET	3	BKCU	MG651032	-
CS-2D	KET	3	Button key	-	MG641035

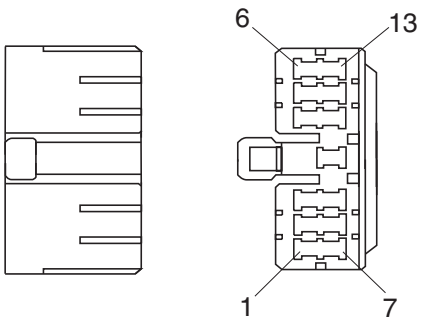
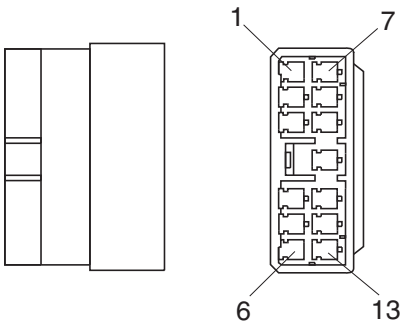
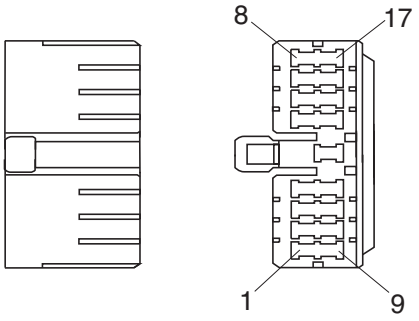
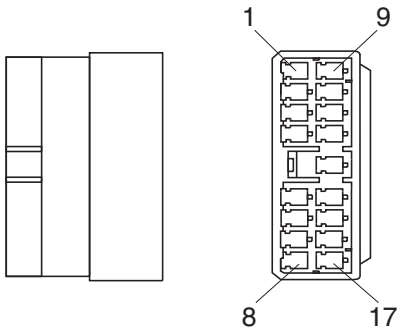
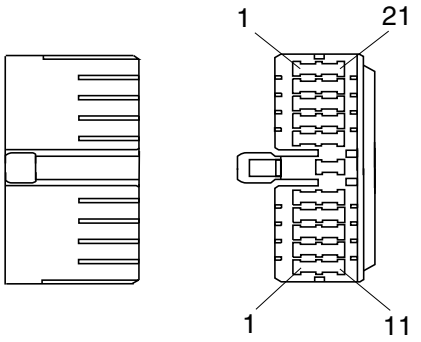
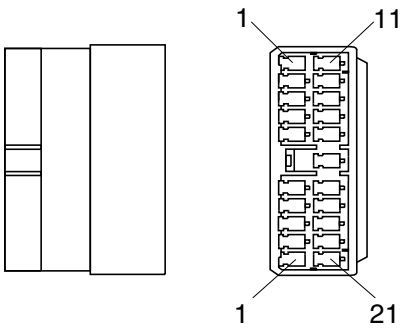
Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CS-4	DEUTSCH	3	Safety switch	DT06-3S	-
CS-10	DEUTSCH	6	FNR switch	DT06-6S	-
CS-20	AMP	3	Safety switch	-	DT04-3P
CS-23	CARLING	10	Auto cruise switch	VC2-01	-
CS-29	DEUTSCH	6	Power max switch	DT06-6S	-
CS-33	-	6	Emergency engine stop switch	S816-006002	S816-106002
CS-61	-	2	Boom floating switch	174352-2	S816-102002
CS-67	CARLING	10	Quick clamp switch	VC2-01	-
CS-73	CARLING	10	Swing lock switch	VC2-01	-
CS-73A	CARLING	10	Fine swing switch	VC2-01	-
CS-74	AMP	2	Master switch	S813-030201	-
CS-74B	DEUTSCH	2	Master switch	DT06-2S-EP06	-
CS-99	CARLING	10	Air compressor switch	VC2-01	-
CS-100	CARLING	10	SCR switch	VC2-01	-
CS-120	CARLING	10	Trailer lift switch	VC2-01	-
CS-121	CARLING	10	Auto digging brake switch	VC2-01	-
CS-122	CARLING	10	E steeing & crusher switch	VC2-01	-
CS-123	CARLING	10	Boom float & ride control switch	VC2-01	-
CS-124	CARLING	10	FNR emergency switch	VC2-01	-
CS-125	CARLING	10	FNR select switch	VC2-01	-
CS-250	-	2	Seat belt switch	-	-
· Light					
CL-1	KET	3	Room lamp	MG651032	-
CL-2	AMP	1	Cigar lighter	S822-014002	S822-114002
CL-2	AMP	1	Cigar lighter	S816-002002	-
CL-3	-	3	Head lamp-LH	S810-003702	-
CL-4	-	3	Head lamp-RH	S810-003702	-
CL-5	DEUTSCH	2	Work lamp-LH	DT06-2S-EP06	-
CL-6	DEUTSCH	2	Work lamp-RH	DT06-2S-EP06	-
CL-7	DEUTSCH	2	Beacon lamp	DT06-2S-EP06	DT04-2P
CL-8	DEUTSCH	2	Cab light-LH	DT06-2S-EP06	DT04-2P
CL-9	DEUTSCH	2	Cab light-rear	DT06-2S-EP06	DT04-2P
CL-10	DEUTSCH	2	Cab light-RH	DT06-2S-EP06	DT04-2P
CL-15	AMP	6	Rear combination lamp-LH	PB625-06027	-
CL-16	AMP	6	Rear combination lamp-RH	PB625-06027	-
CL-21	KET	2	Number plate lamp	S814-002001	S814-102002
CL-24	AMP	3	Front combination lamp-LH	S816-003002	-
CL-24	DEUTSCH	2	Rear work lamp	DT06-2S-EP06	DT04-2P-E005

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CL-25	AMP	3	Front combination lamp-RH	S816-003002	-
CL-40	DEUTSCH	2	DEF/AdBlue® lamp	DT06-2S-EP06	-
· Sensor, sendor					
CD-1	AMP	2	Hydraulic oil temp sender	85202-1	-
CD-2	DEUTSCH	2	Fuel level sender	DT06-2S-EP06	-
CD-3	DEUTSCH	3	Brake oil pressure sensor	DT06-3S-EP06	-
CD-4	DEUTSCH	3	Stop lamp pressure sensor	DT06-3S-EP06	-
CD-5	DEUTSCH	3	Transmission oil pressure sensor	DT06-3S-EP06	-
CD-10	SUMITOMO	4	Pressure temperature sensor	6098-0144	-
CD-16	AMP	3	Water level sensor	1211-0293	-
CD-24	DEUTSCH	3	Swing pressure sensor	DT06-3S-EP06	-
CD-31	DEUTSCH	3	Overload pressure sensor	DT06-3S-EP06	DT04-3P
CD-32	DEUTSCH	3	Boom up pressure sensor	DT06-3S-EP06	-
CD-35	DEUTSCH	3	Arm out pressure sensor	DT06-3S-EP06	-
CD-37	DEUTSCH	3	2 piece pressure sensor	DT06-3S-EP06	DT04-3P
CD-38	DEUTSCH	3	Work brake pressure sensor	DT06-3S-EP06	-
CD-42	DEUTSCH	3	P1 pressure sensor	DT06-3S-EP06	-
CD-43	DEUTSCH	3	P2 pressure sensor	DT06-3S-EP06	-
CD-45	DEUTSCH	2	WIF sensor	DT06-2S-EP06	-
CD-46	AMP	3	Speed sensor	282087	-
CD-50	KET	2	Outrigger action pressure sensor	MG640975	-
CD-57	DEUTSCH	4	SASA S/S	DT06-4S	-
CD-70	DEUTSCH	3	P1 regulator pressure sensor	DT06-3S-EP06	-
CD-71	DEUTSCH	3	P2 regulator pressure sensor	DT06-3S-EP06	-
CD-73	DEUTSCH	3	Travel forward pressure sensor	DT06-3S-EP06	-
CD-85	DEUTSCH	3	Boom down pressure sensor	DT06-3S-EP06	-
CD-87	DEUTSCH	3	Bucket out pressure sensor	DT06-3S-EP06	-
CD-90	DEUTSCH	3	Arm in pressure sensor	DT06-3S-EP06	-
CD-95	DEUTSCH	3	Bucket in pressure sensor	DT06-3S-EP06	-
CD-155	DEUTSCH	3	Dozer pressure sensor	DT06-3S-EP06	-

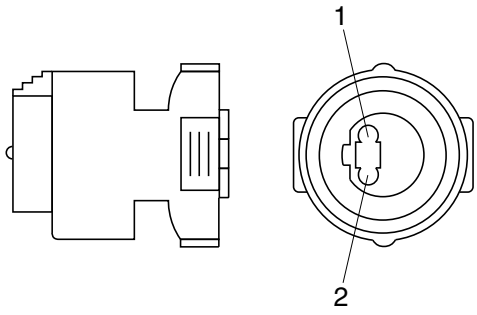
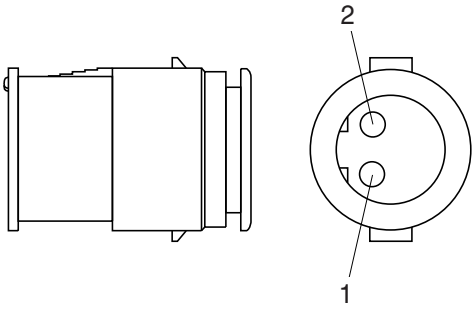
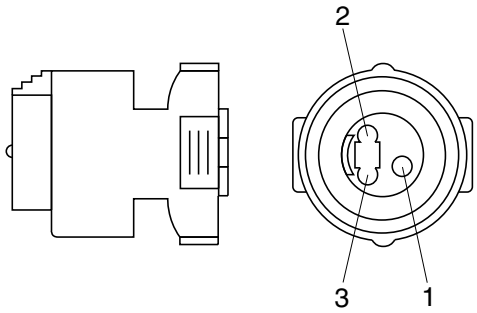
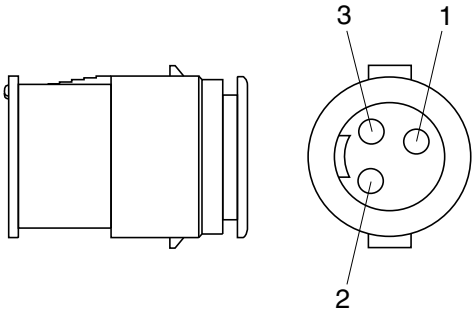
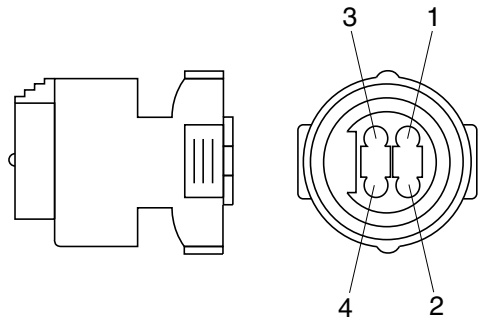
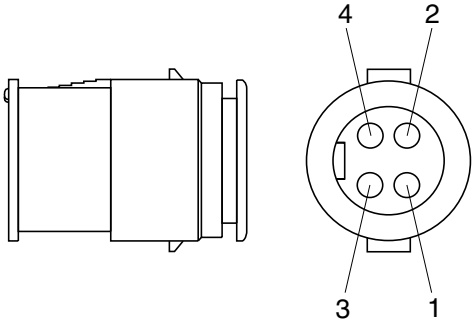
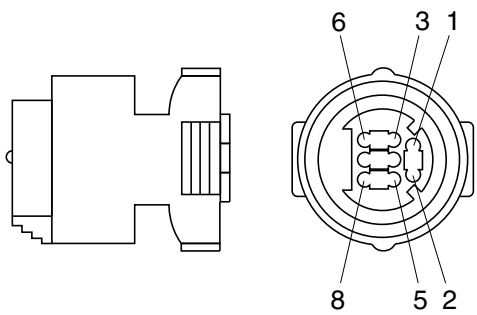
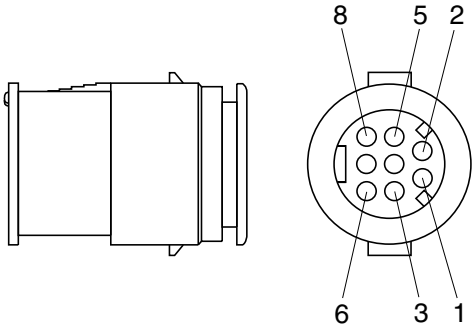
2. CONNECTION TABLE FOR CONNECTORS

1) PA TYPE CONNECTOR

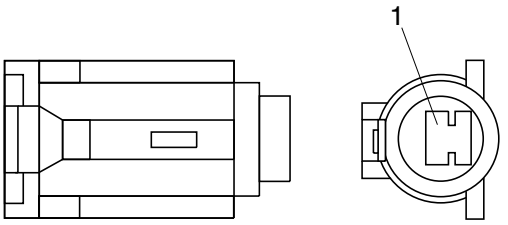
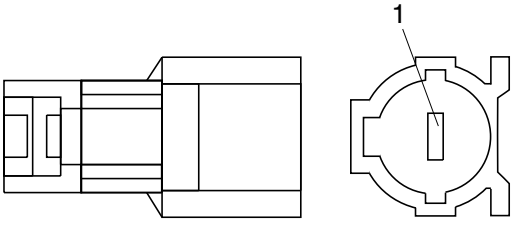
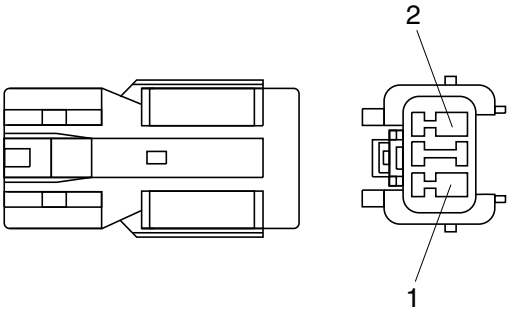
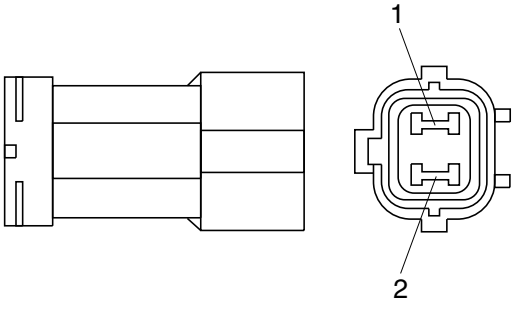
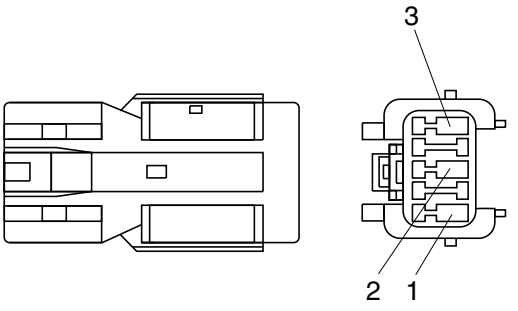
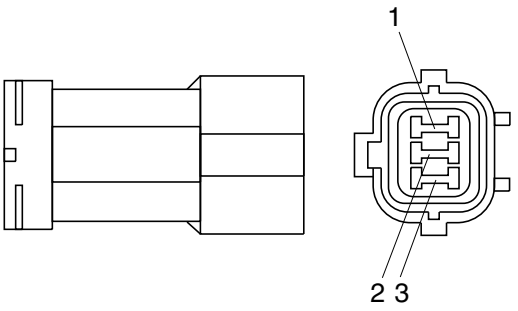
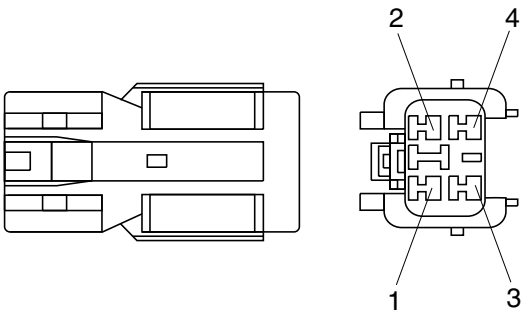
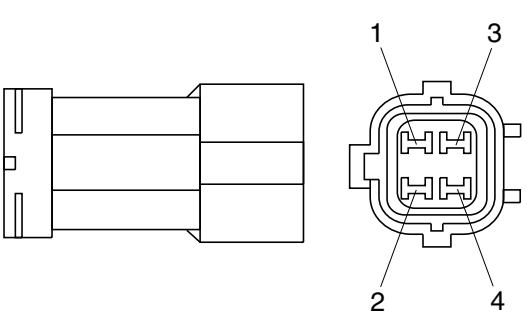
No. of pin	Receptacle connector (female)	Plug connector (male)
5	 S811-005002	 S811-105002
7	 S811-007002	 S811-107002
9	 S811-009002	 3S811-109002
11	 S811-011002	 S811-111002

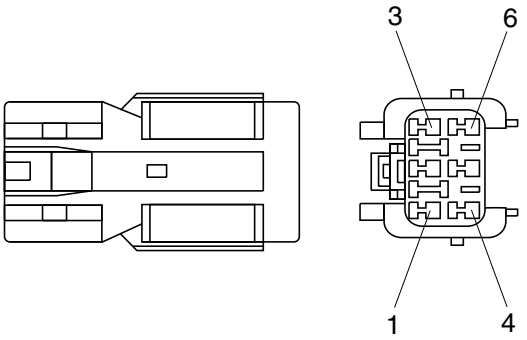
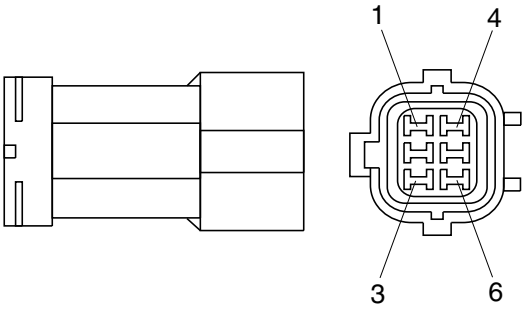
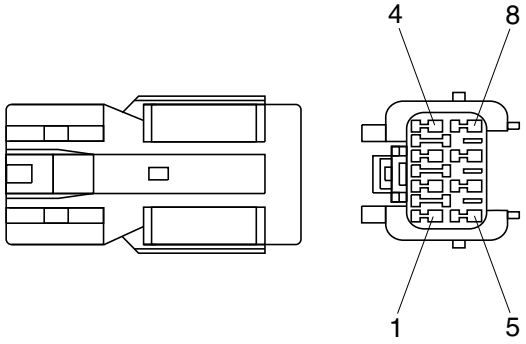
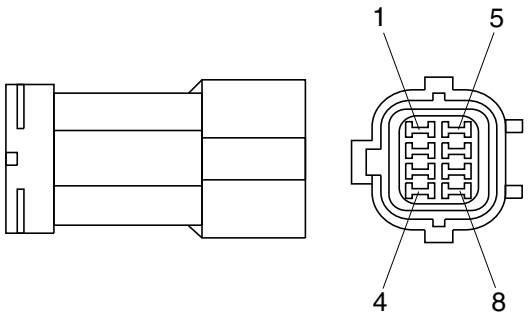
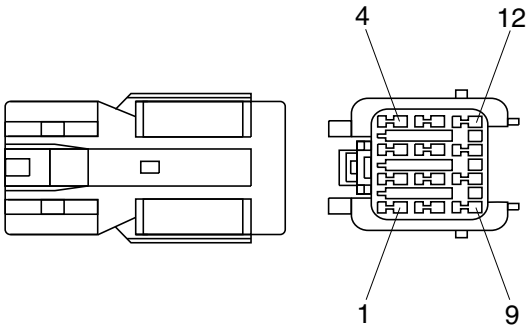
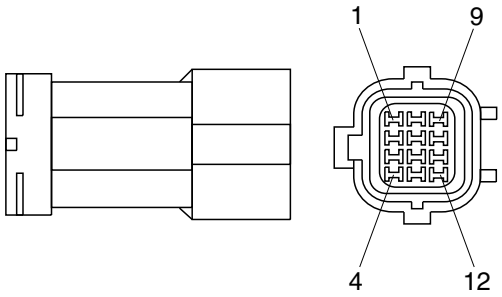
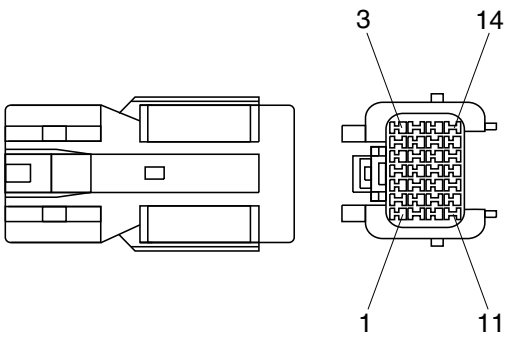
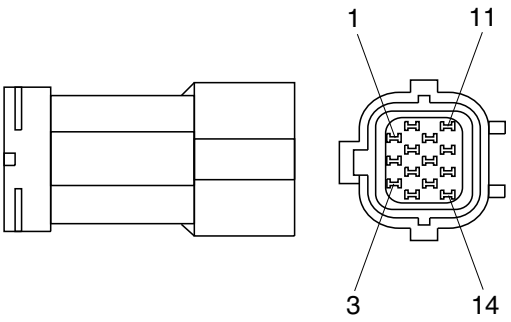
No. of pin	Receptacle connector (female)	Plug connector (male)
13	 S811-013002	 S811-113002
17	 S811-017002	 S811-117002
21	 S811-021002	 S811-121002

2) J TYPE CONNECTOR

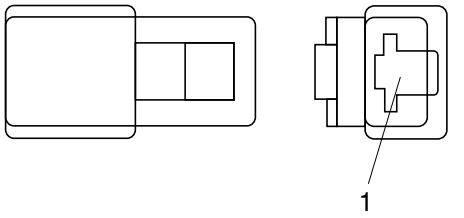
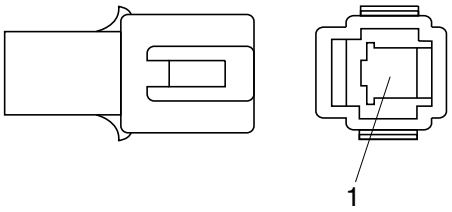
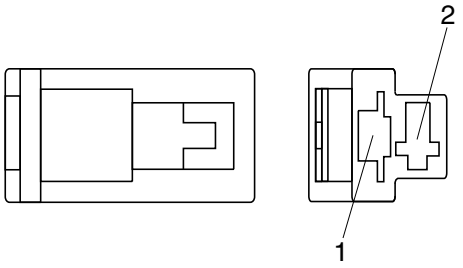
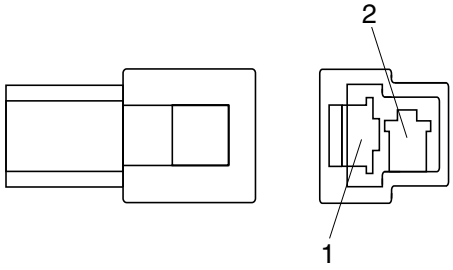
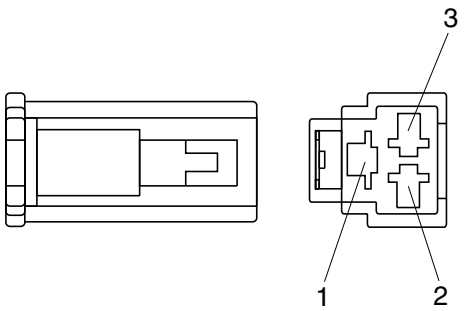
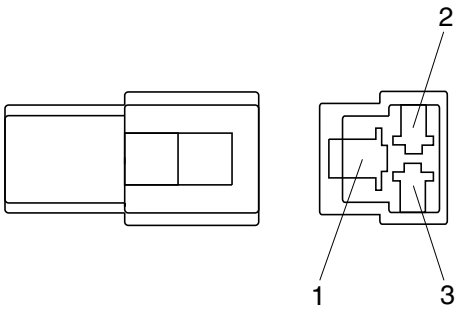
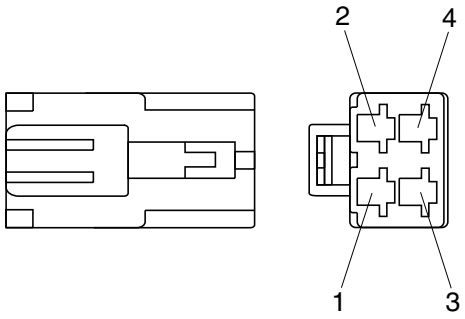
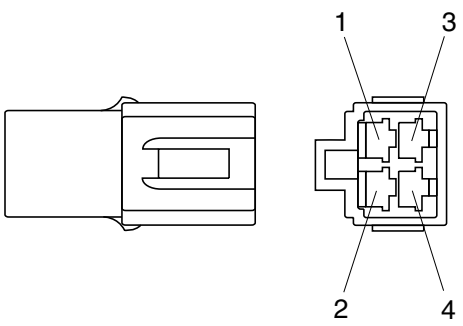
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 S816-002001	 S816-102001
3	 S816-003001	 S816-103001
4	 S816-004001	 S816-104001
8	 S816-008001	 S816-108001

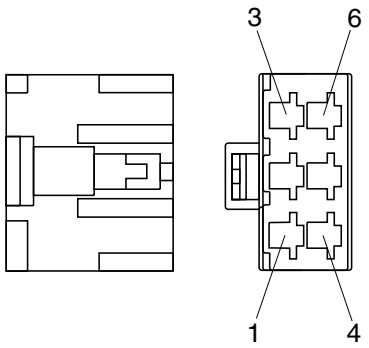
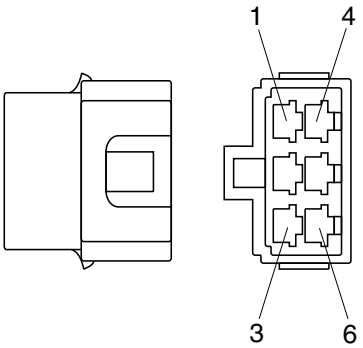
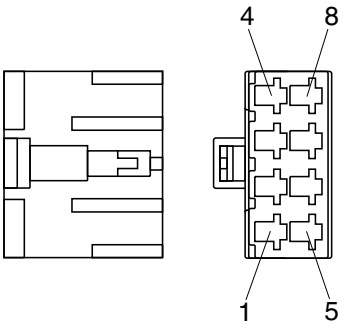
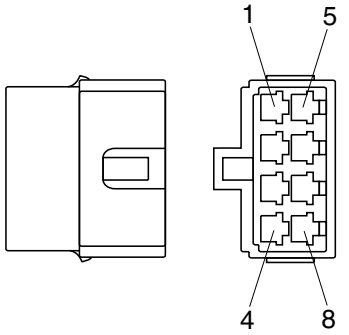
3) SWP TYPE CONNECTOR

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

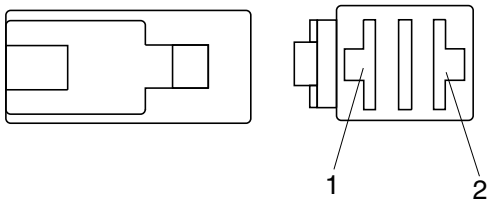
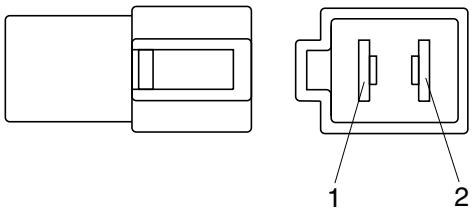
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S814-006000	 S814-106000
8	 S814-008000	 S814-108000
12	 S814-012000	 S814-112000
14	 S814-014000	 S814-114000

4) CN TYPE CONNECTOR

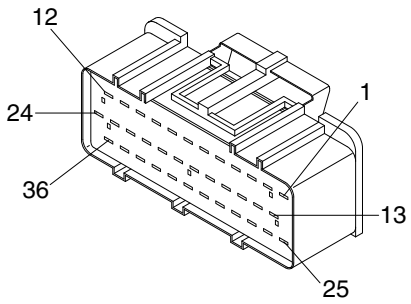
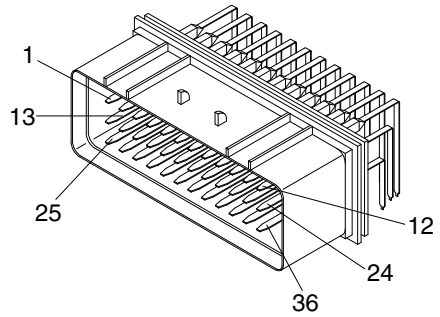
No. of pin	Receptacle connector (female)	Plug connector (male)
1	 S810-001202	 S810-101202
2	 S810-002202	 S810-102202
3	 S810-003202	 S810-103202
4	 S810-004202	 S810-104202

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

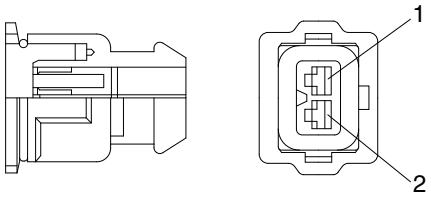
5) 375 FASTEN TYPE CONNECTOR

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

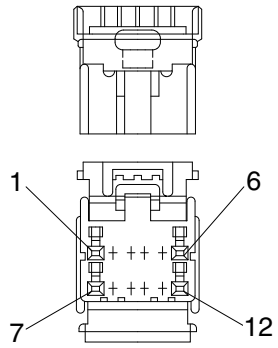
6) AMP ECONOSEAL CONNECTOR

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

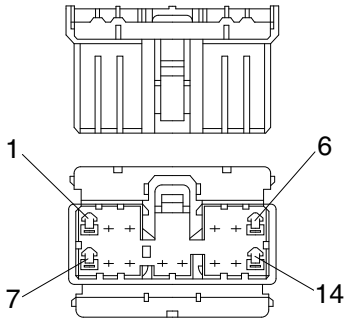
7) AMP TIMER CONNECTOR

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

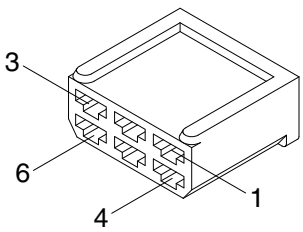
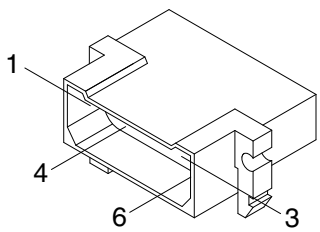
8) AMP 040 MULTILOCK CONNECTOR

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

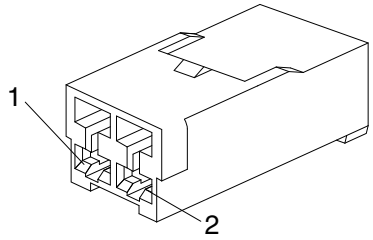
9) AMP 070 MULTILOCK CONNECTOR

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

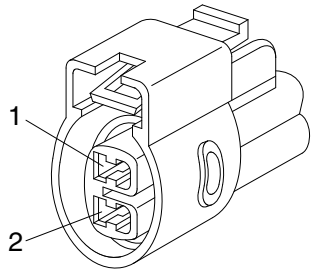
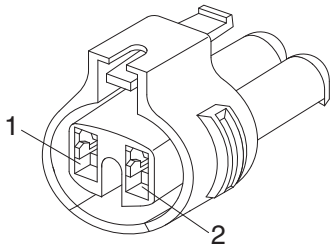
10) AMP FASTIN - FASTON CONNECTOR

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

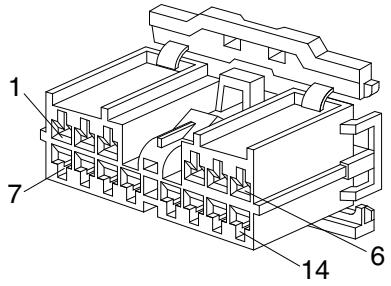
11) KET 090 CONNECTOR

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

12) KET 090 WP CONNECTORS

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

13) KET SDL CONNECTOR

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

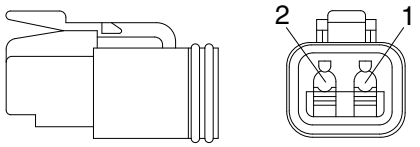
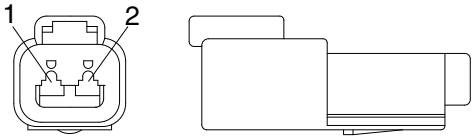
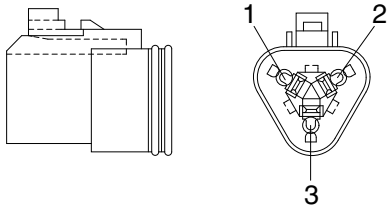
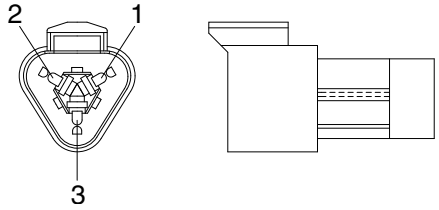
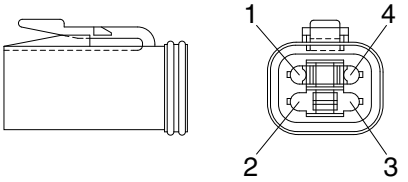
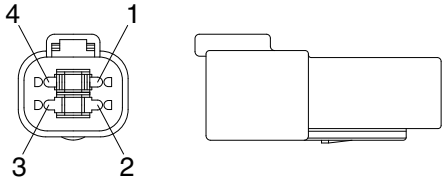
14) DEUTSCH DT CONNECTORS

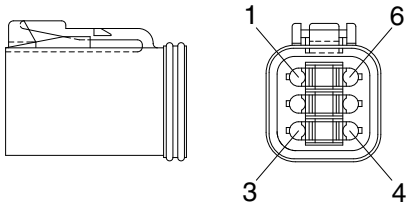
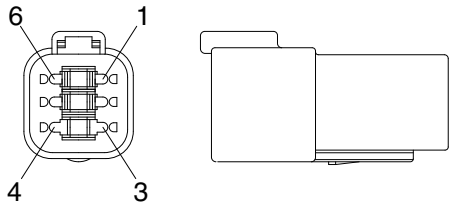
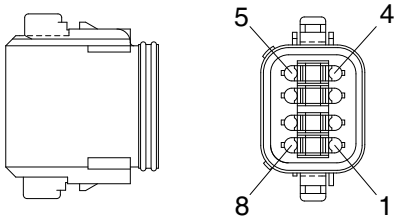
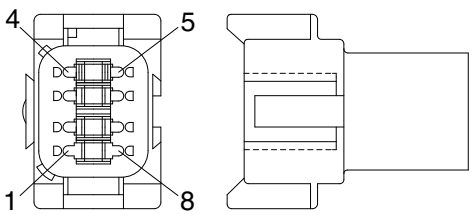
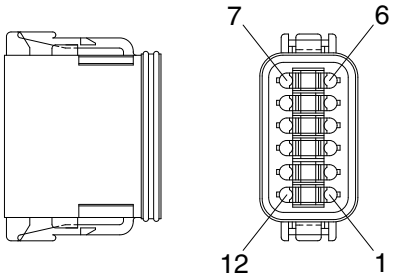
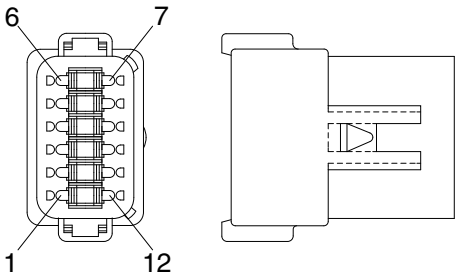
DT 06 - 3S - ★★★★

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

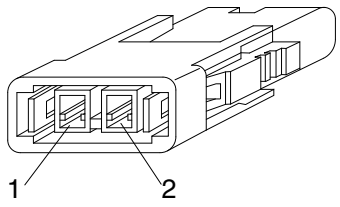
※ Modification

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

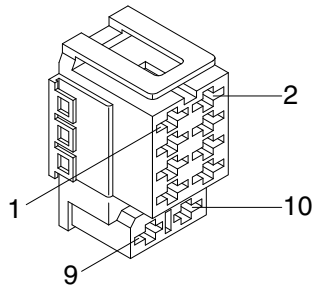
No. of pin	Receptacle connector (female)	Plug connector (male)
2	 DT06-2S	 DT04-2P
3	 DT06-3S	 DT04-3P
4	 DT06-4S	 DT04-4P

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

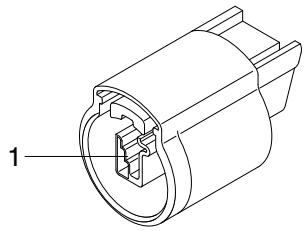
15) MOLEX 2CKTS CONNECTOR

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

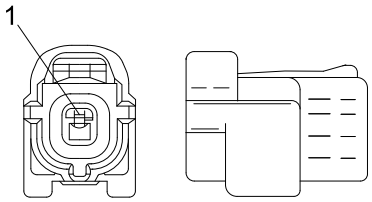
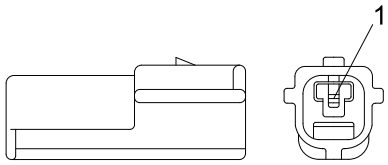
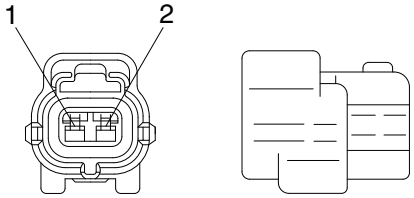
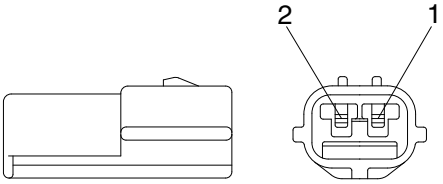
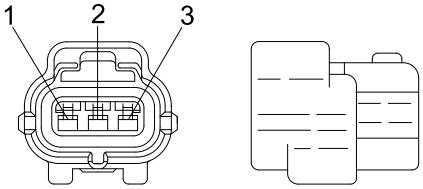
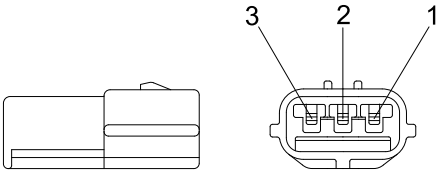
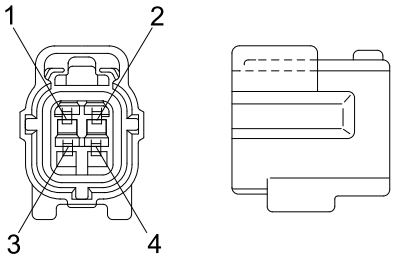
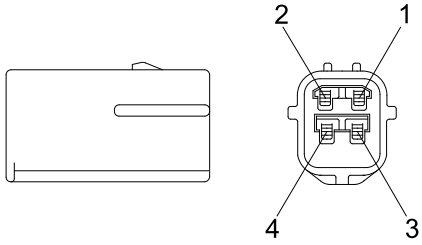
16) ITT SWF CONNECTOR

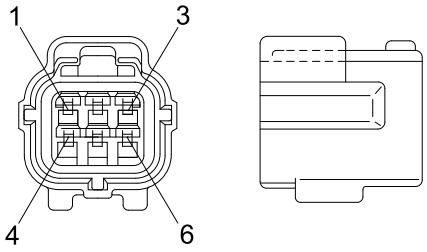
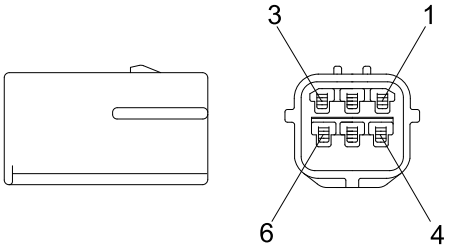
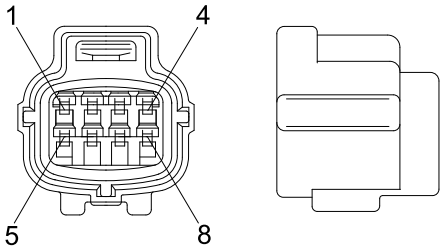
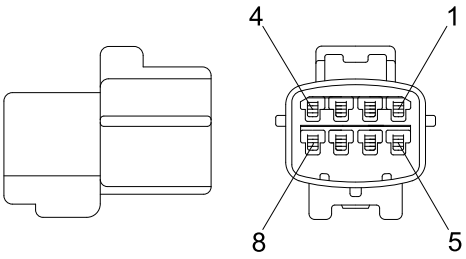
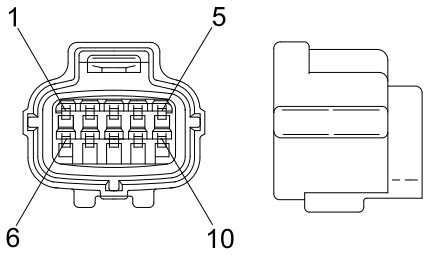
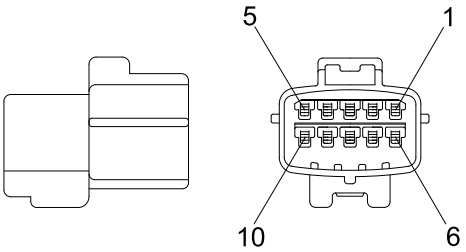
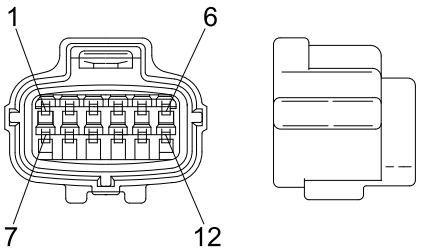
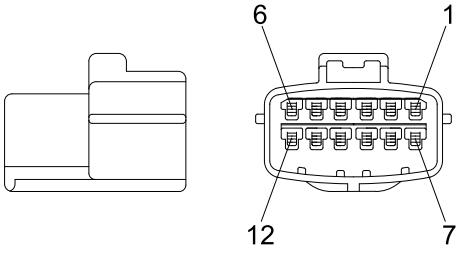
No. of pin	Receptacle connector (female)	Plug connector (male)
10	 SWF593757	

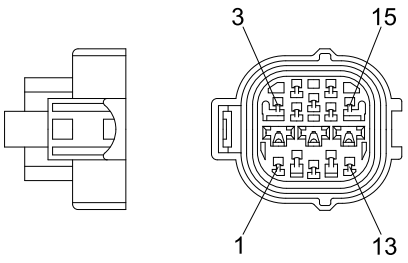
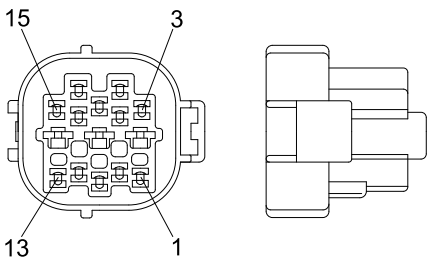
17) MWP NMWP CONNECTOR

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

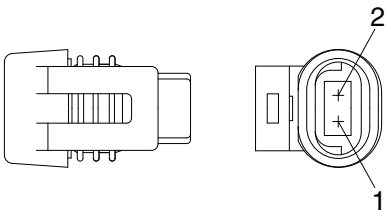
18) ECONOSEAL J TYPE CONNECTORS

No. of pin	Receptacle connector (female)	Plug connector (male)
1	 S816-001002	 S816-101002
2	 S816-002002	 S816-102002
3	 S816-003002	 S816-103002
4	 S816-004002	 S816-104002

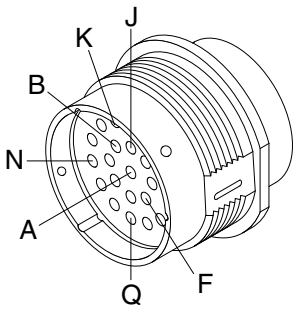
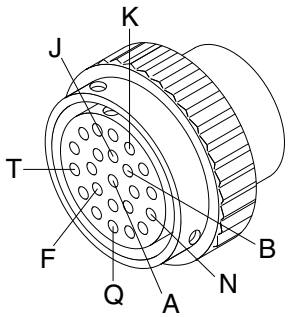
No. of pin	Receptacle connector (female)	Plug connector (male)
6	 S816-006002	 S816-106002
8	 S816-008002	 S816-108002
10	 S816-010002	 S816-110002
12	 S816-012002	 S816-112002

No. of pin	Receptacle connector (female)	Plug connector (male)
15	 368301-1	 2-85262-1

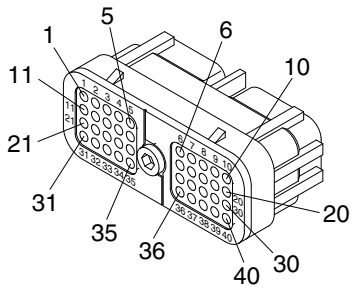
19) METRI-PACK TYPE CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
2	 12040753	

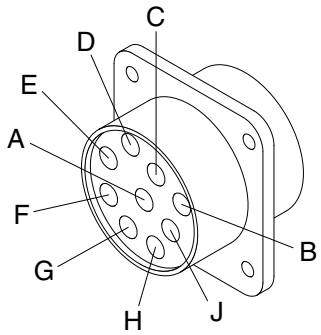
20) DEUTSCH HD30 CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
23	 HD36-24-23SN	 HD34-24-23PN

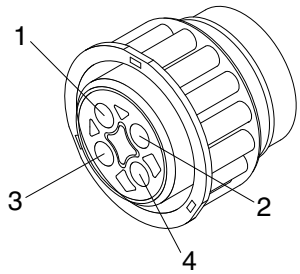
21) DEUTSCH MCU CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
40	 DRC26-40SA/B	

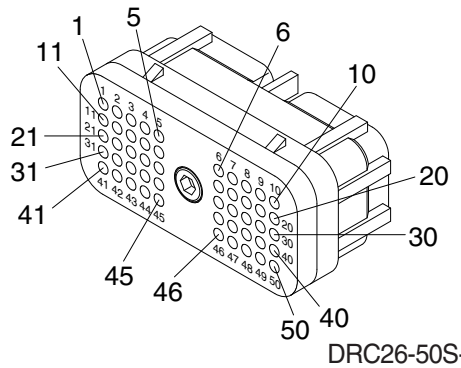
22) DEUTSCH SERVICE TOOL CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
9	 HD10-9-96P	

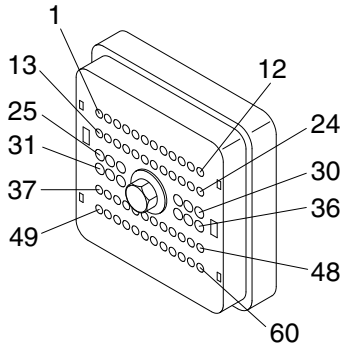
23) AMP FUEL WARMER CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
4	 2-967325-3	

24) DEUTSCH ENGINE ECM CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
50	 DRC26-50S-04	

25) DEUTSCH INTERMEDIATE CONNECTOR

No. of pin	Receptacle connector (female)	Plug connector (male)
60	 DRB16-60SAE-L018	

SECTION 5 MECHATRONICS SYSTEM

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Group 4 Power Boost System 5-7
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Group 8 Variable Power Control System 5-11
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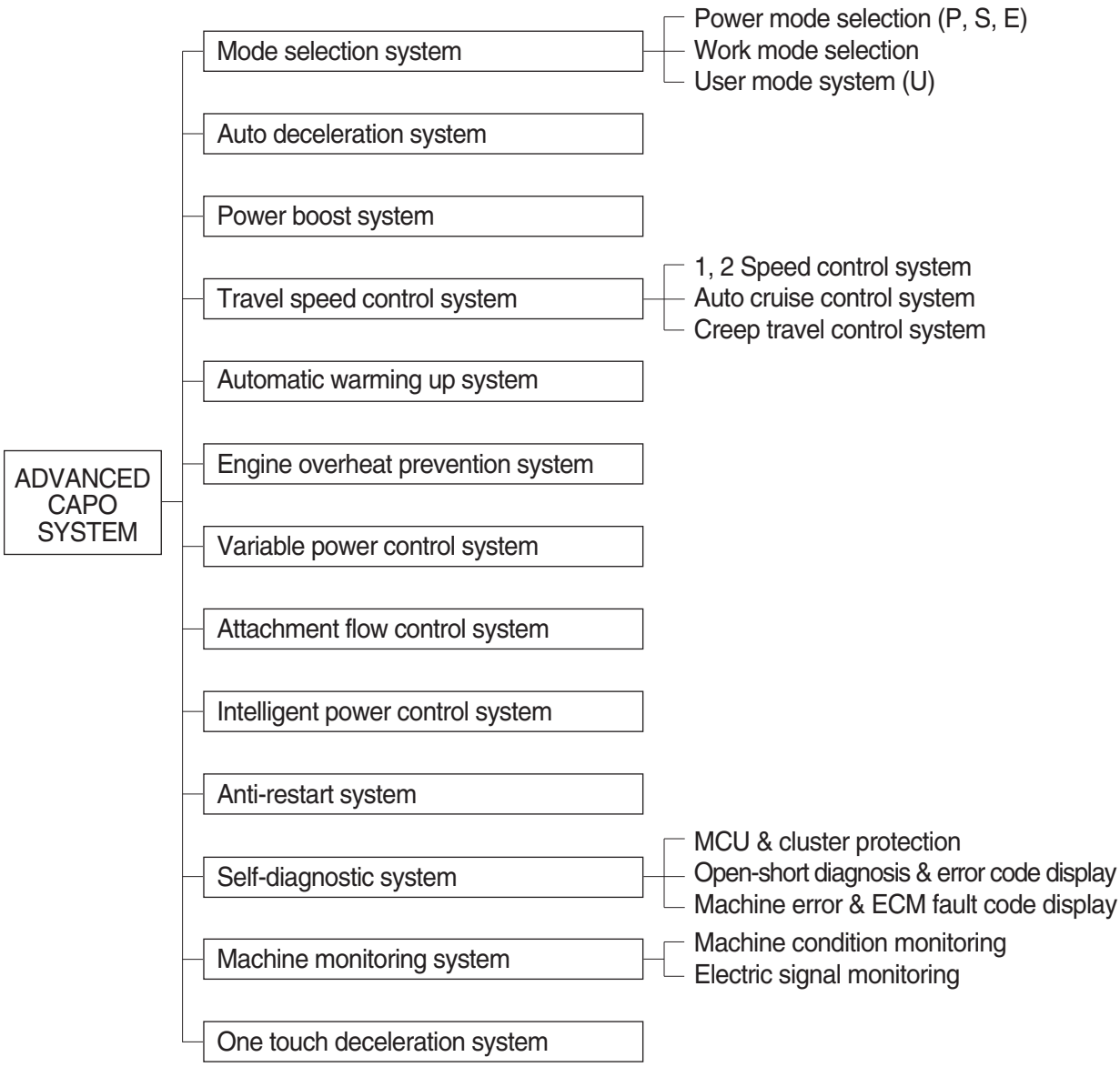
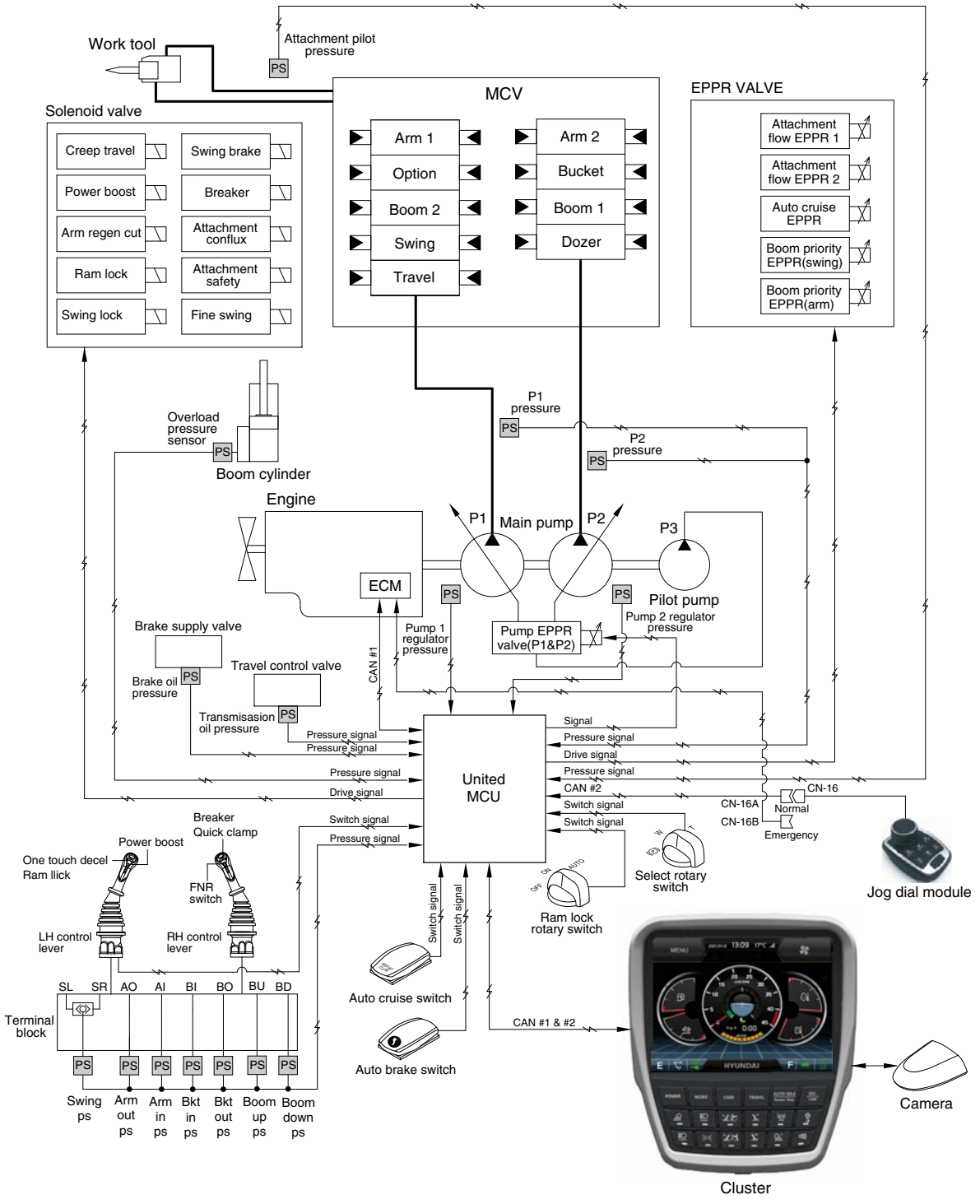
SECTION 5 MECHATRONICS SYSTEM

GROUP 1 OUTLINE

The ADVANCED CAPO (Computer Aided Power Optimization) system controls engine and pump mutual power at an optimum and less fuel consuming state for the selected work by mode selection, auto-deceleration, power boost function, etc. It monitors machine conditions, for instance, engine speed, coolant temperature, hydraulic oil temperature, and hydraulic oil pressure, etc.
It consists of a MCU, a cluster, an ECM, EPPR valves, and other components. The MCU and the cluster protect themselves from over-current and high voltage input, and diagnose malfunctions caused by short or open circuit in electric system, and display error codes on the cluster.



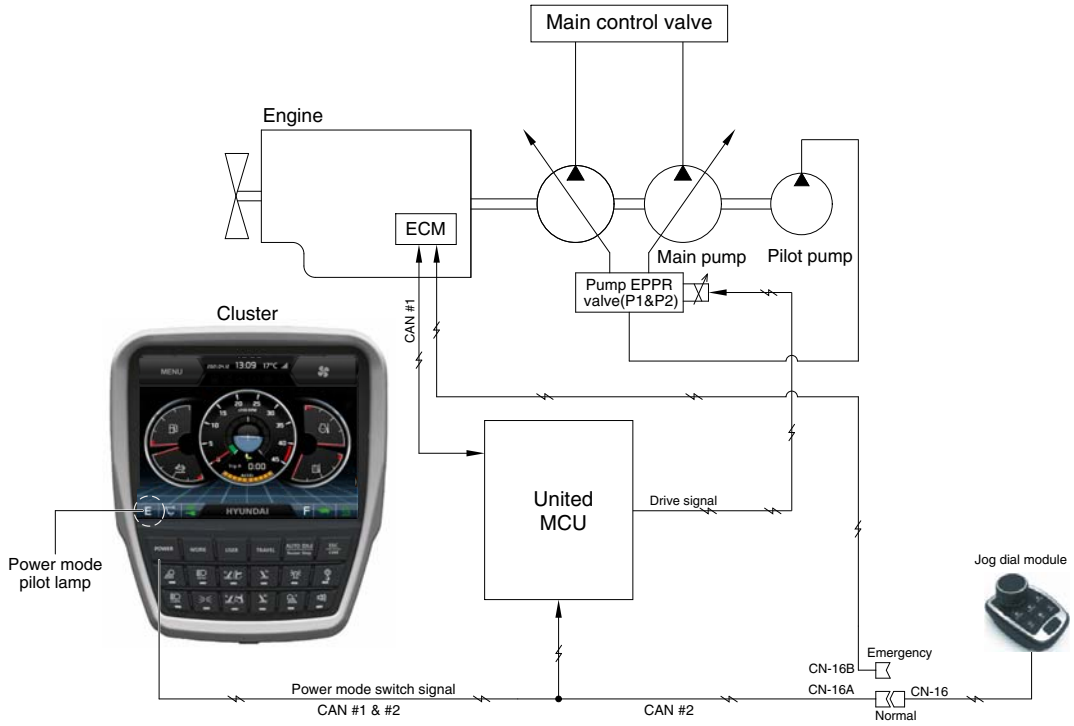
SYSTEM DIAGRAM



210WA5MS01

GROUP 2 MODE SELECTION SYSTEM

1. POWER MODE SELECTION SYSTEM



210WA5MS02

Mode selection system (micro computer based electro-hydraulic pump and engine mutual control system) optimizes the engine and pump performance.

The combination of 3 power modes (P, S, E) and acceleration mode (10 set) of haptic controller makes it possible to use the engine and pump power more effectively corresponding to the work conditions from a heavy and great power requesting work to a light and precise work.

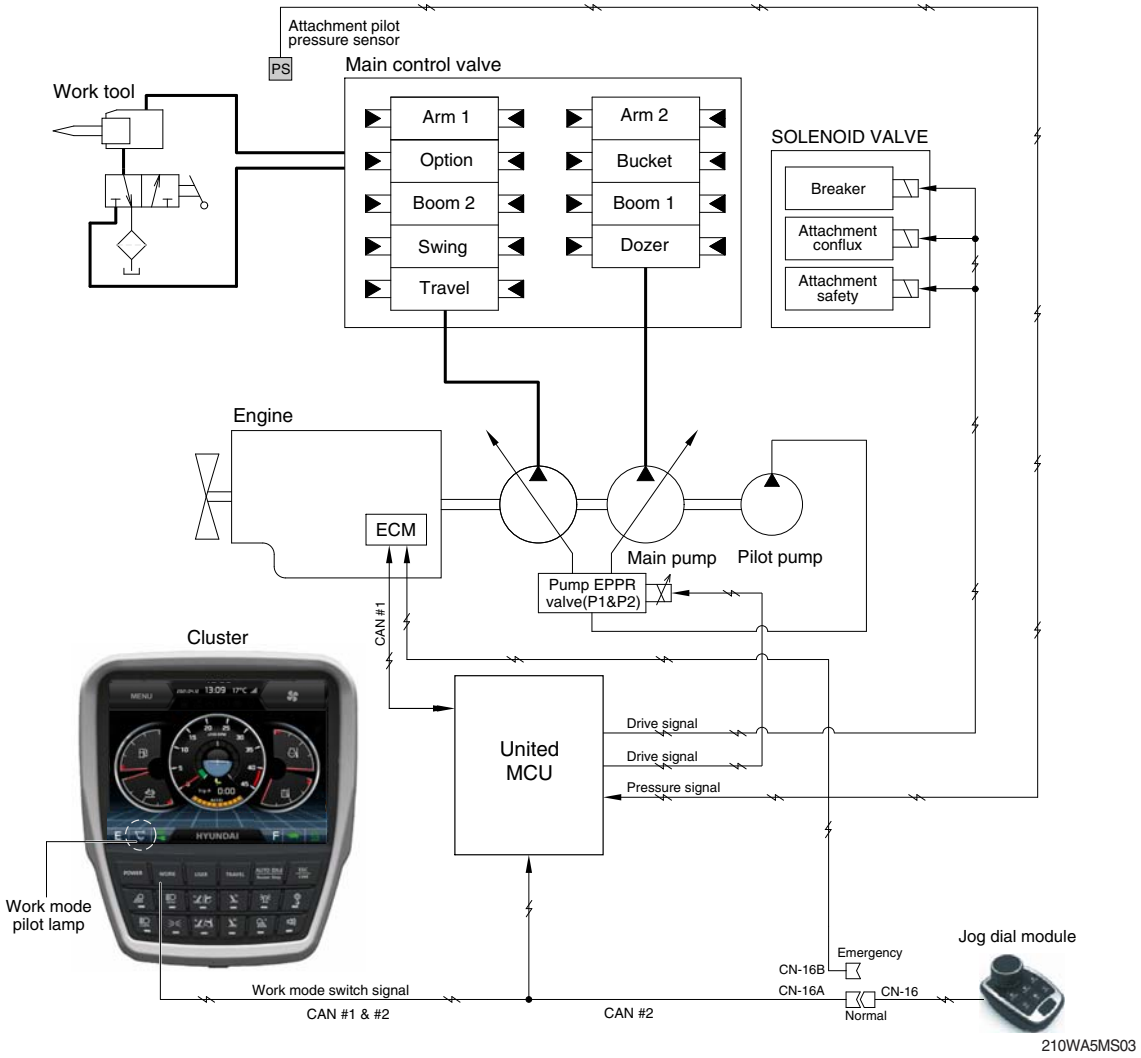
Power mode	Application	Engine rpm			
		Standard		Option	
		Unload	Load	Unload	Load
P	Heavy duty power	1600±50	1600±50	1600±50	1600±50
S	Standard power	1500±50	1500±50	1500±50	1500±50
E	Economy operation	1400±50	1400±50	1400±50	1400±50
AUTO DECEL	Engine deceleration	1000±100	-	1000±100	-
One touch decel	Engine quick deceleration	850±100	-	850±100	-
KEY START	Key switch start position	850±100	-	850±100	-

※ Power shift (Standard/Option) can be changed by "Service menu" in "Management" on the cluster.

※ (~*) : Load

2. WORK MODE SELECTION SYSTEM

Work mode consists of the general operation (bucket) and the optional attachment (breaker, crusher).



1) GENERAL WORK MODE (bucket)

This mode is used to general digging work.

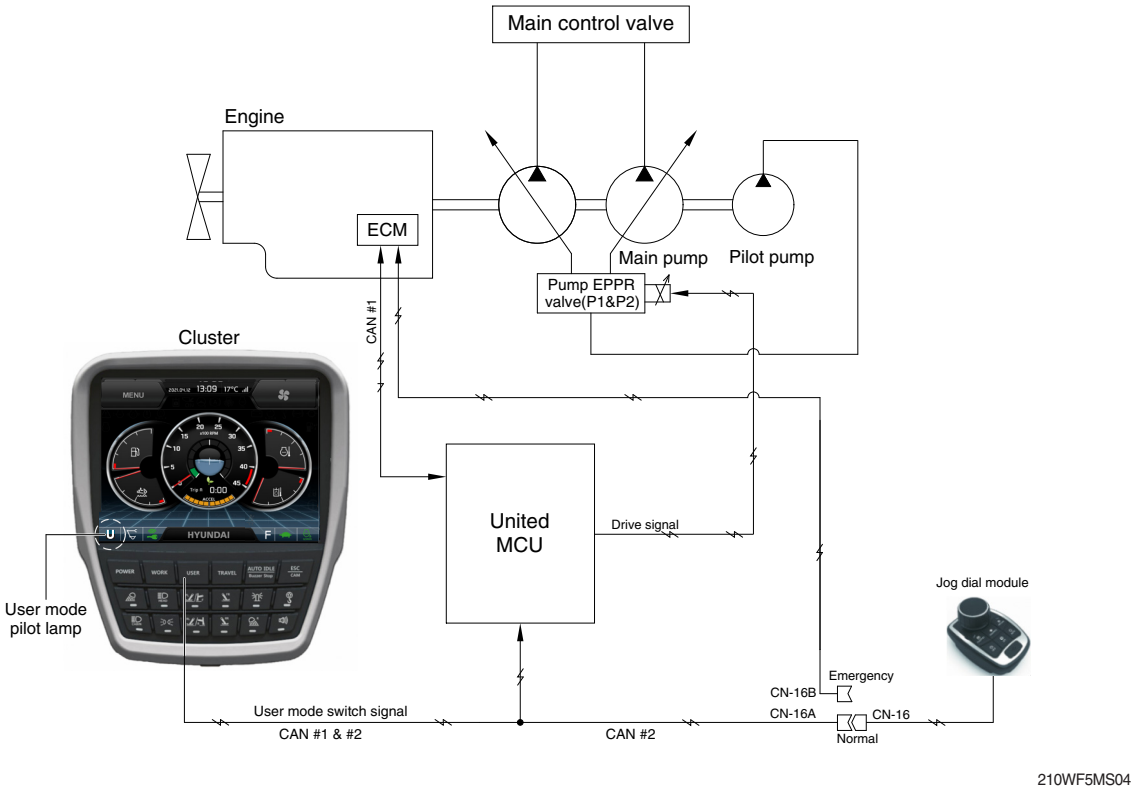
2) ATT WORK MODE (breaker, crusher)

It controls the pump flow and system pressure according to the operation of breaker or crusher.

Description	General mode	Work tool	
	Bucket	Breaker	Crusher
Attachment safety solenoid	OFF	-	ON
Attachment conflux solenoid	OFF	ON/OFF	ON/OFF
Attachment flow EPPR current	100 mA	100~700 mA	100~700 mA
Breaker solenoid★	OFF	ON	-

★ When breaker operating button is pushed.

3. USER MODE SELECTION SYSTEM



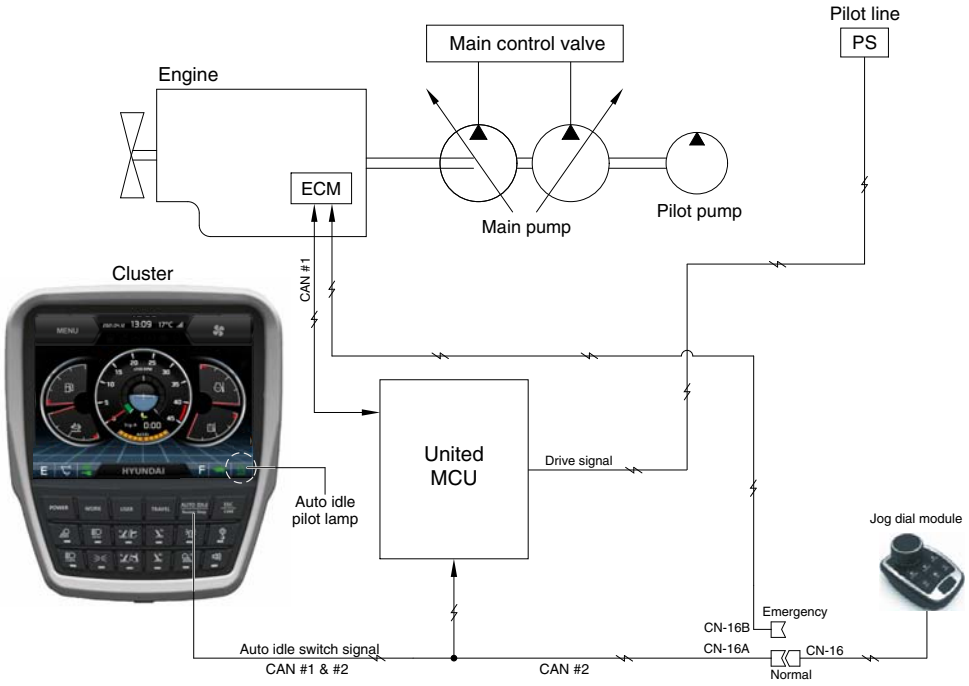
1) High idle rpm, auto idle rpm and EPPR pressure can be adjusted and memorized in the U-mode.

2) LCD segment vs parameter setting

Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift
1	1400	750	10%
2	1450	800	20%
3	1500	850	30%
4	1550	900	40%
5	1600	950	50%
6	1650	1000 (auto decel)	60%
7	1700	1050	70%
8	1750	1100	80%
9	1800	1150	85%
10	1900	1200	90%

※ Refer to page 5-95.

GROUP 3 AUTOMATIC DECELERATION SYSTEM

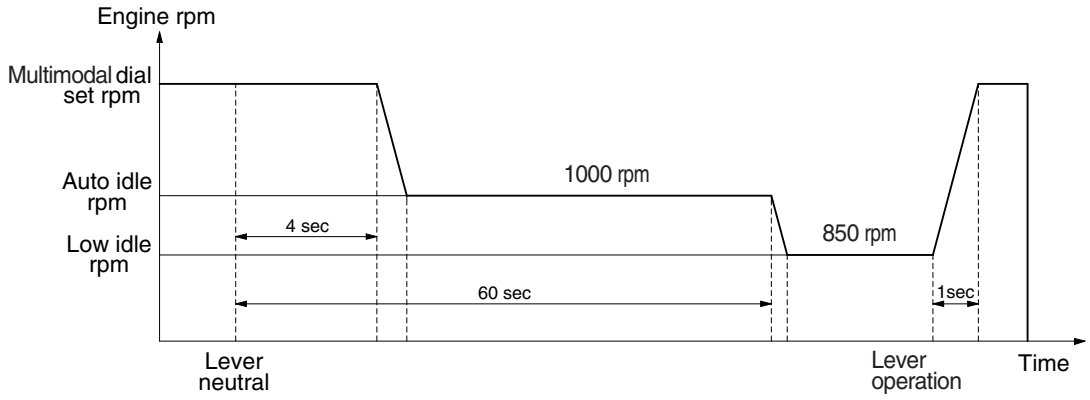


210WA5MS05

1. WHEN AUTO IDLE PILOT LAMP ON

When all of the work equipment control levers including swing and travel levers are at neutral for 4 seconds, MCU sends throttle command to ECM to reduce the engine speed to 1000 rpm. If the control levers are at neutral for 1 minute, MCU reduces the engine speed to 850 rpm. As the result of reducing the engine speed, fuel consumption and noise are effectively cut down during non-operation of the control levers.

When the Auto idle pilot lamp is turned off by pressing the switch or any control lever is operated, the reduced engine speed rises upto the speed before deceleration in a second.



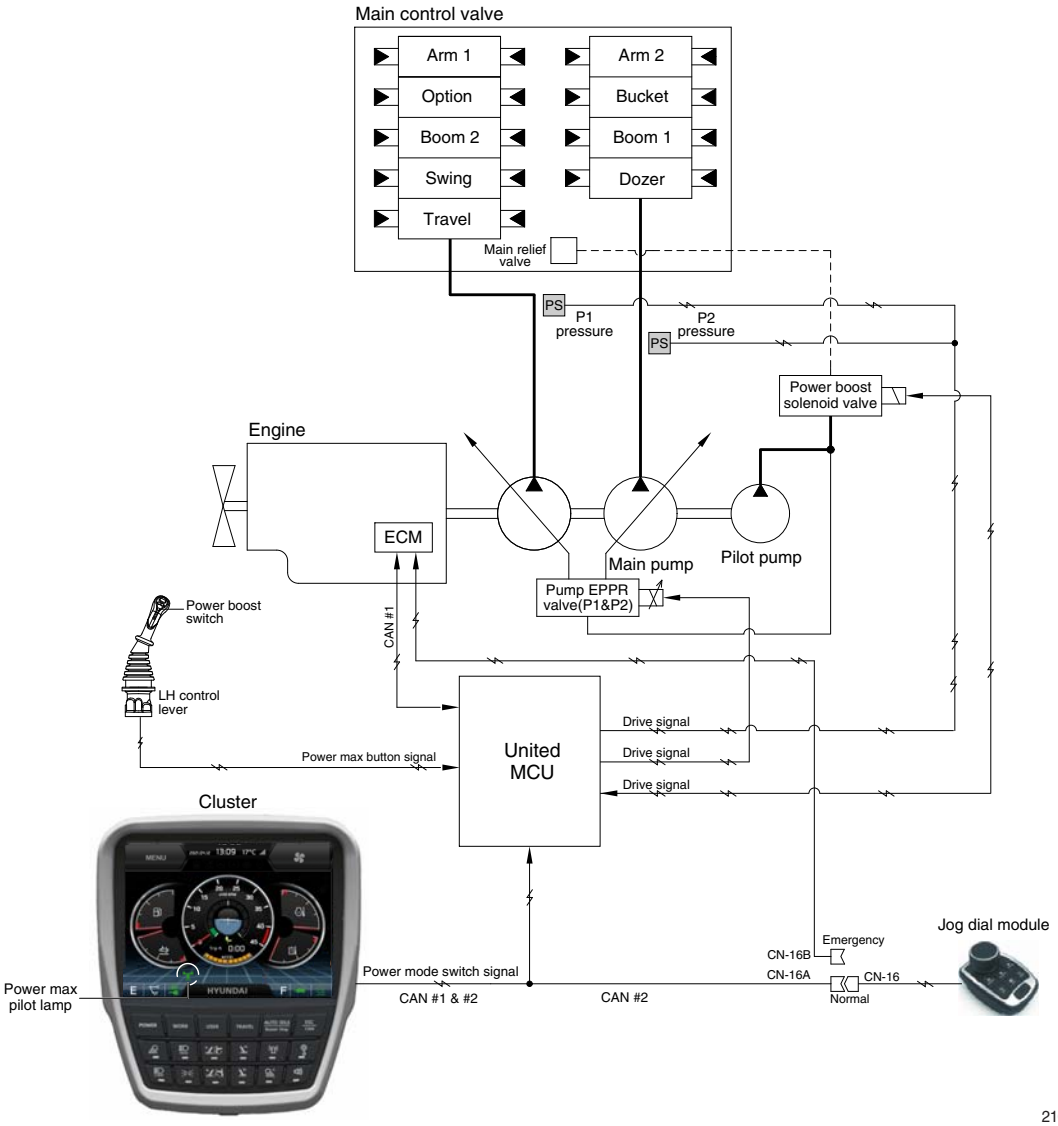
21095MS05

2. WHEN AUTO IDLE PILOT LAMP OFF

The engine speed can be set as desired using the accel dial switch, and even if the control levers are neutral, the engine speed is not reduced.

※ Auto idle function can be activated when accel dial position is over 4.

GROUP 4 POWER BOOST SYSTEM



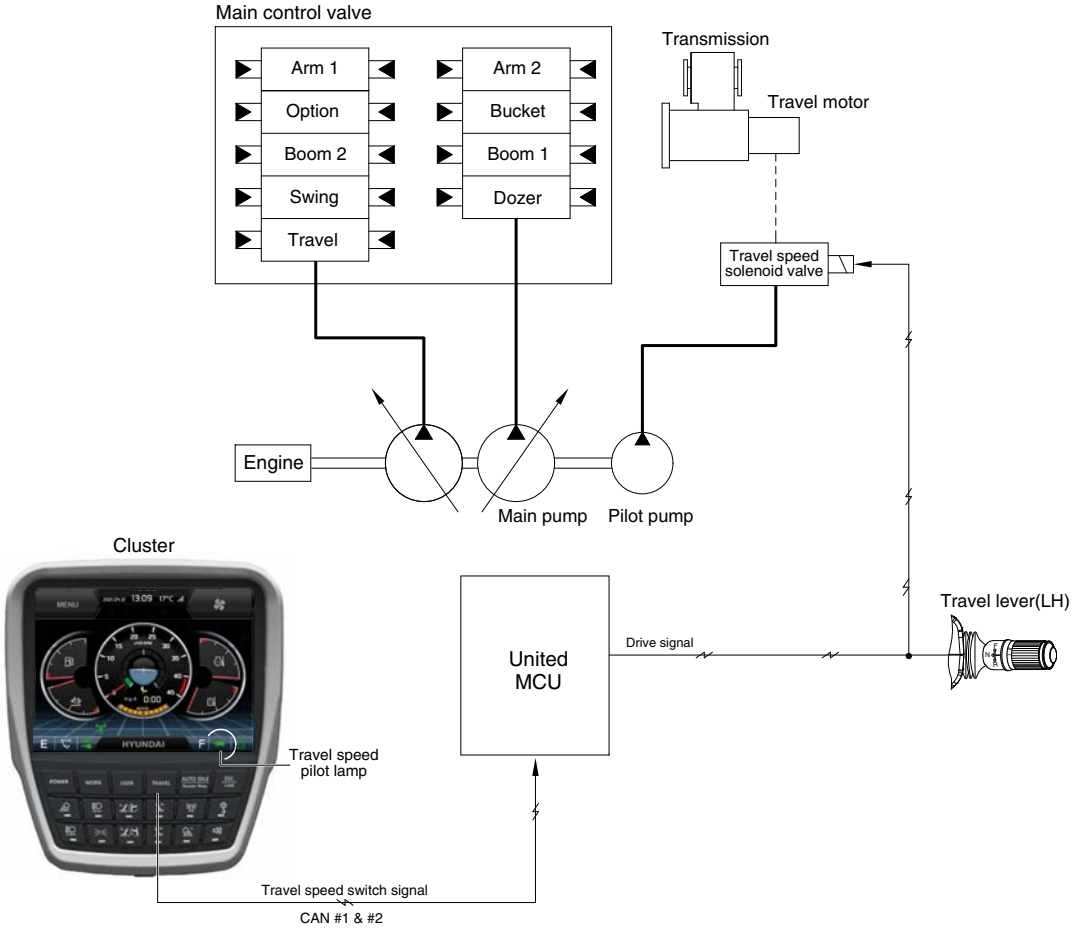
· When the power boost switch on the left control lever knob is pushed ON, the power mode is set P mode and maximum digging power is increased by 10 %.

· When the power boost function is activated, the power boost solenoid valve pilot pressure raises the set pressure of the main relief valve to increase the digging power.

Description	Condition	Function
Activated	Power boost switch : ON Accel dial : over 8	- Power mode : P - Accel dial power : 9 - Power boost solenoid : ON - Power boost pilot lmap : ON - Operating time : max 8 seconds
Canceled	Power boost switch : OFF	- Pre-set power mode - Power boost solenoid : OFF - Power boost pilot lamp : OFF

※ When the auto power boost is set to Enable and power mode is set to P mode on the cluster, the digging power is automatically increased as working conditions by the MCU. It is operated max 8 seconds.

GROUP 5 TRAVEL SPEED CONTROL SYSTEM



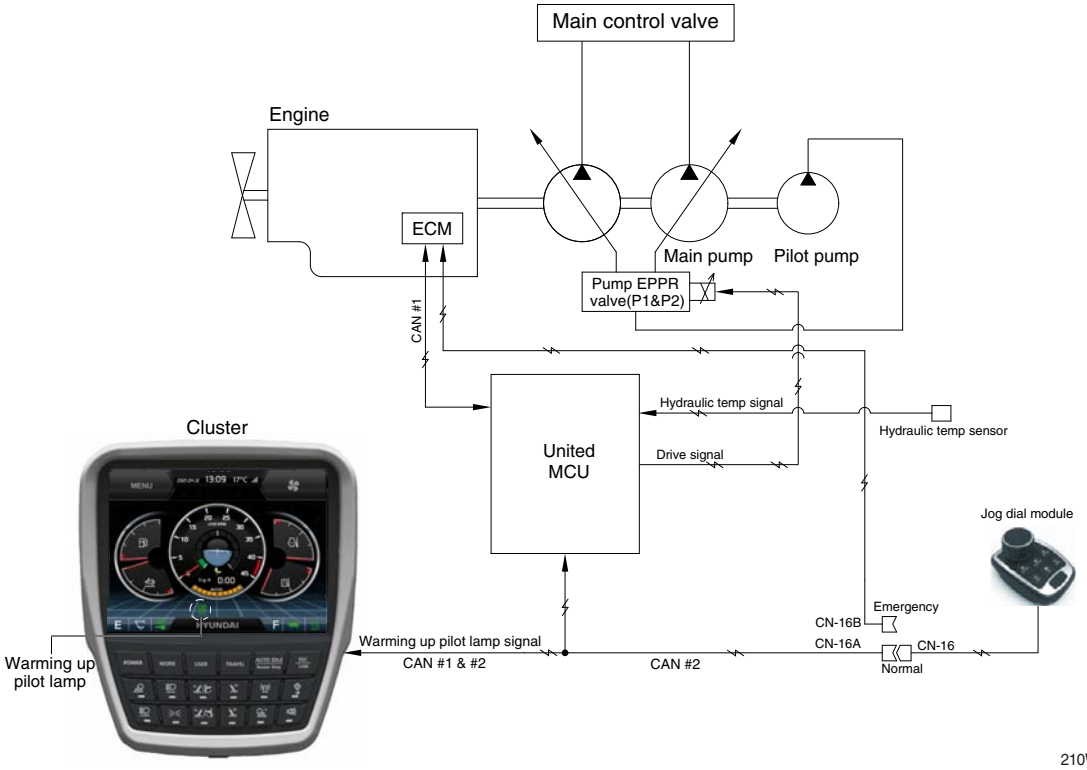
210WA5MS07

Travel speed can be switched manually by pressing the travel speed switch on the cluster.

Speed	Travel speed solenoid valve	Lamp on cluster	Operation
Low	OFF	Turtle	Low speed, high driving torque in the travel motor
High	ON	Rabbit	High speed, low driving torque in the travel motor

※ Default : Turtle (Low)

GROUP 6 AUTOMATIC WARMING UP SYSTEM



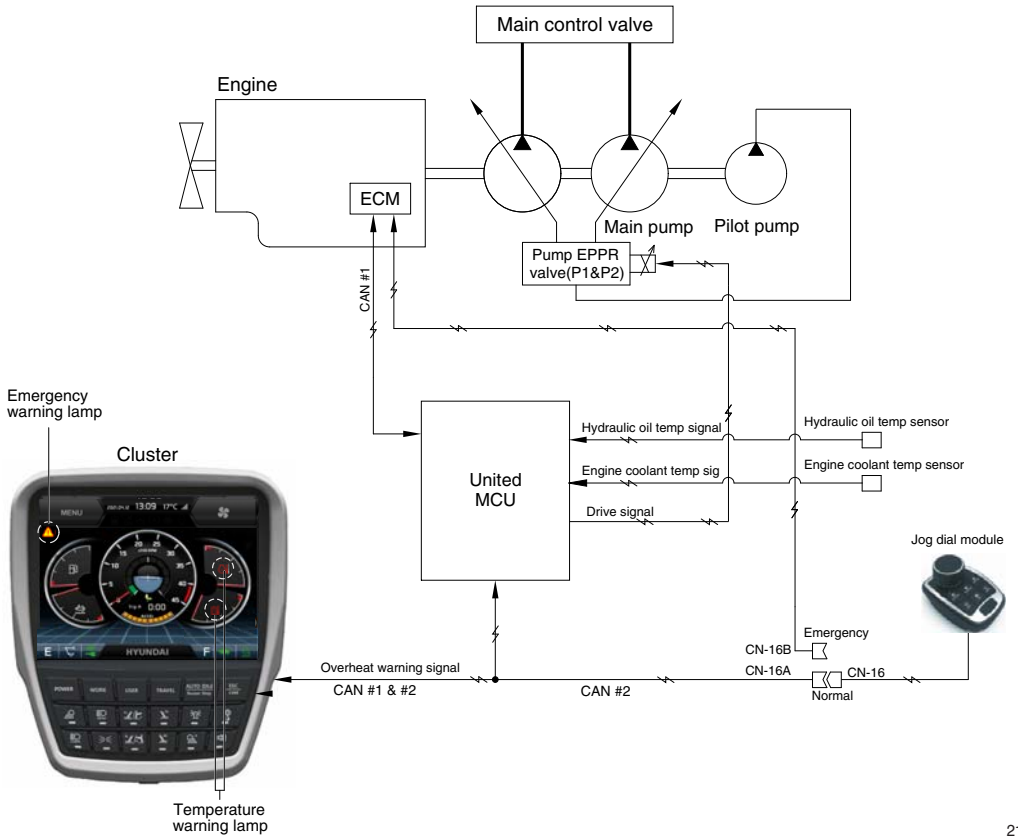
1. The MCU receives the engine coolant temperature from the ECM, and if the coolant temperature is below 30˚C, it increases the engine speed from key start rpm to 1000 rpm. At this time the mode does not change. If the coolant temperature sensor has fault, the hydraulic oil temperature signal is substituted.

2. In case of the coolant temperature increases up to 30˚C, the engine speed is decreased to key start speed. And if an operator changes power mode set during the warming up function, the MCU cancels the automatic warming up function.

3. LOGIC TABLE

Description	Condition	Function
Actuated	- Coolant temperature : below 30˚C (after engine run)	- Power mode : Default (E mode) - Warming up time : 10 minutes (max) - Warming up pilot lamp : ON
Canceled	- Coolant temperature : Above 30˚C - Warming up time : Above 10 minutes - Changed power mode set by operator - RCV lever or pedal operating - Auto idle cancel ※ If any of the above conditions is applicable, the automatic warming up function is canceled	- Power mode : set mode - Warming up pilot lamp : OFF

GROUP 7 ENGINE OVERHEAT PREVENTION SYSTEM

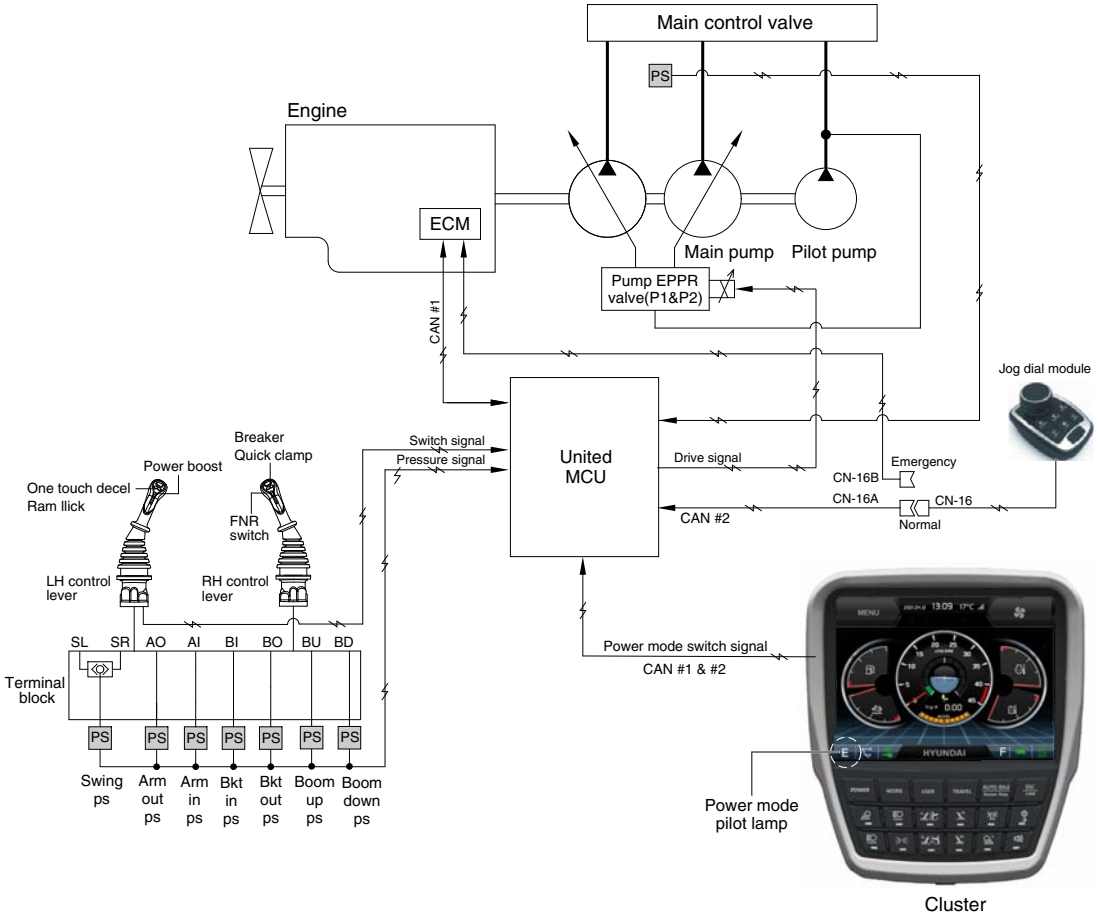


1. If the engine coolant temperature is overheated over 103˚C or the hydraulic oil temperature is overheated over 100˚C, the warning lamp is ON and the pump input torque or the engine speed is reduced as below logic table.

2. LOGIC TABLE

Description		Condition	Function
First step warning	Activated	- Coolant temperature : Above 103˚C - Hydraulic oil temperature : Above 100˚C	- Warning lamp : ON , buzzer : OFF - Pump input torque is reduced.
			- Warning lamp & buzzer : ON - Pump input torque is reduced.
	Canceled	- Coolant temperature : Less than 100˚C - Hydraulic oil temperature : Less than 95˚C	- Return to pre-set the pump absorption torque.
Second step warning	Activated	- Coolant temperature : Above 107˚C - Hydraulic oil temperature : Above 105˚C	- Emergency warning lamp pops up on the center of LCD and the buzzer sounds. - Engine speed is reduced after 10 seconds.
	Canceled	- Coolant temperature : Less than 103˚C - Hydraulic oil temperature : Less than 100˚C	- Return to pre-set the engine speed. - Hold pump absorption torque on the first step warning.

GROUP 8 VARIABLE POWER CONTROL SYSTEM



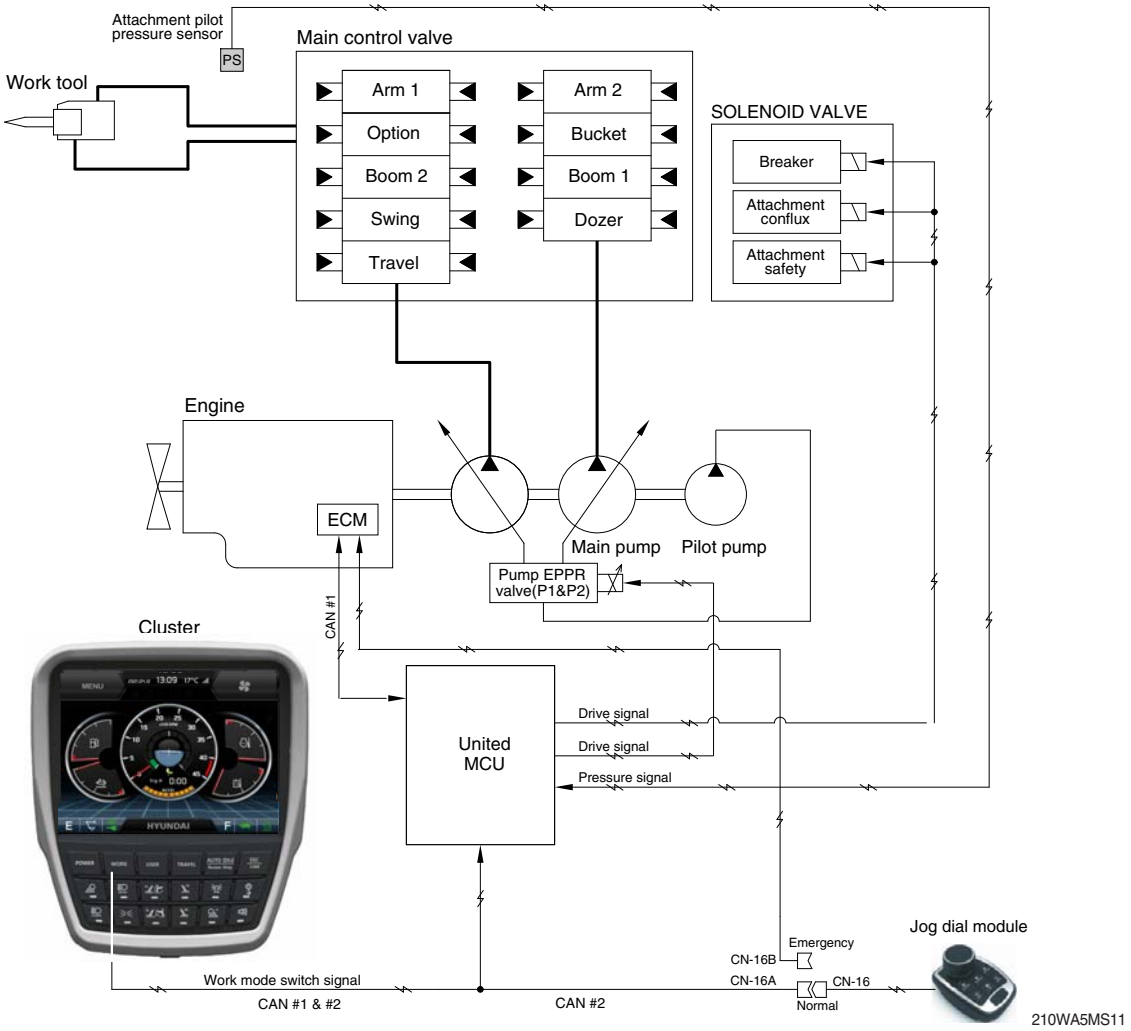
210WA5MS10

· The variable power control system controls the engine and pump mutual power according to RCV lever stroke and pump load.
It makes fuel saving and smooth control at precise work.

Description	Working condition
Power mode	P, S, E
Work mode	General (bucket)
Pressure sensor	Normal

※ The variable power control function can be activated when the power mode is set to all power mode.

GROUP 9 ATTACHMENT FLOW CONTROL SYSTEM



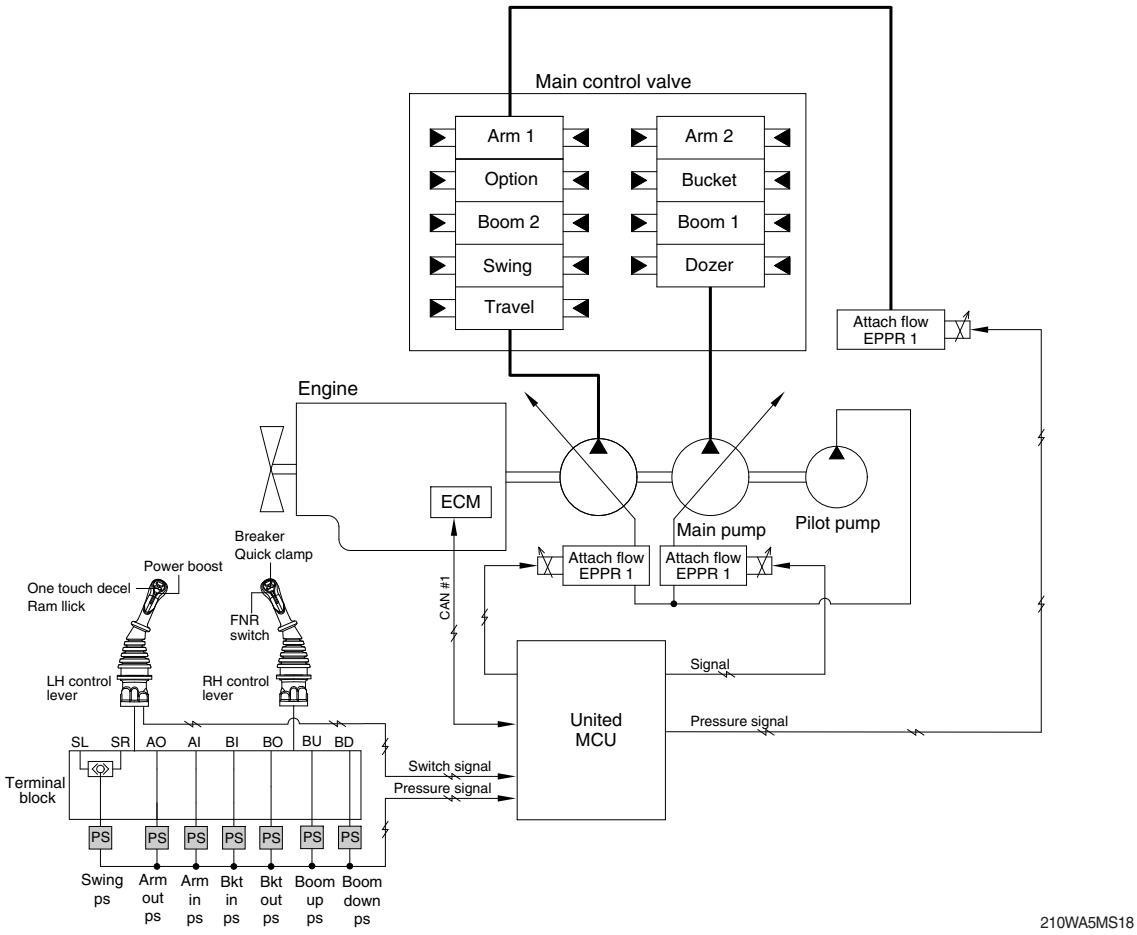
· The system is used to control the pump delivery flow according to set of the work tool on the cluster by the attachment flow EPPR valve.

Description	Work tool	
	Breaker	Crusher
Flow level	100 ~ 180 lpm	100 ~ 440 lpm
Attach safety solenoid	-	ON
Attach conflux solenoid	ON/OFF	ON/OFF
Breaker solenoid★	ON	-

※ Refer to the page 5-95 for the attachment kinds and max flow.

★ When breaker operating button is pushed.

GROUP 10 INTELLIGENT POWER CONTROL SYSTEM



1. When the requirement of pump flow rate is low, IPC mode controls pump flow rate to improve fuel efficiency. The function works only in Balance or Efficiency mode.

Condition	Function
Arm in with boom up	Limitation of pump flow rate : Activated
Boom down with other actuator	
None of upper condition	Limitation of pump flow rate : Canceled

1) ARM IN WITH BOOM UP

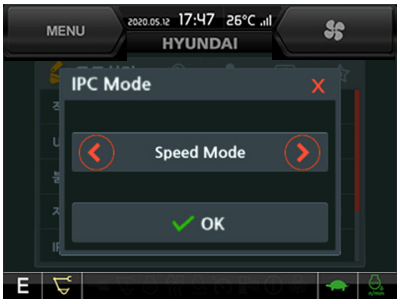
A fuel efficiency is improved by maximizing arm regeneration by reducing pump flow rate during boom up and arm in combination operation.

2) BOOM DOWN WITH OTHER ACTUATOR

The flow for boom-down is replaced with regeneration-flow as much as possible, and fuel consumption is reduced by reducing the flow rate of the pump.

2. IPC MODE SELECTION

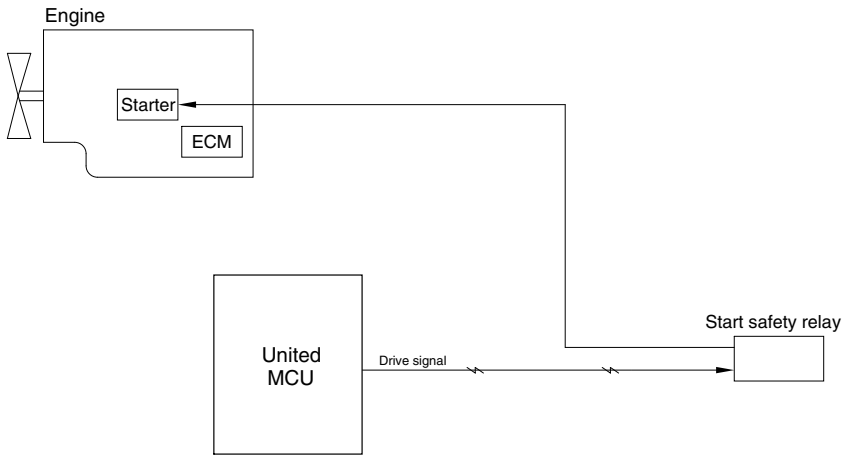
The levels of flow rate limit depends on at IPC mode.



300A3CD52A

IPC mode	Description
Balance mode	Fuel eifficiency ON, limit level 1
Efficiency mode	Fuel eifficiency ON, limit level 2
Speed mode	Fuel eifficiency OFF

GROUP 11 ANTI-RESTART SYSTEM



210WA5MS12

1. ANTI-RESTART FUNCTION

After a few seconds from the engine starts to run, MCU turns off the start safety relay to protect the starter from inadvertent restarting.

GROUP 12 SELF-DIAGNOSTIC SYSTEM

1. OUTLINE

When any abnormality occurs in the ADVANCED CAPO system caused by electric parts malfunction and by open or short circuit, the MCU diagnoses the problem and sends the error codes to the cluster and also stores them in the memory.

2. MONITORING

1) Active fault

140WA3CD80

140WA3CD81

140WA3CD82

· The active faults of the MCU, engine ECM, FATC, AAVM (option) can be checked by this menu.

2) Logged fault

140WA3CD83

140WA3CD84

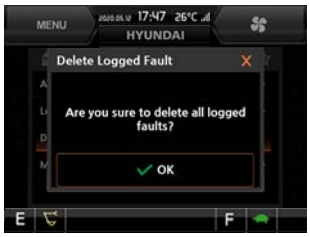
140WA3CD85

· The logged faults of the MCU, engine ECM, FATC, AAVM (option) can be checked by this menu.

3) Delete logged fault

140WA3CD86

140WA3CD87



140WA3CD88

· The logged faults of the MCU, engine ECM, FATC, AAVM (option) can be deleted by this menu.

3. MACHINE ERROR CODES TABLE

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
101	3	10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage > 3.8V	●		
	4	10 seconds continuous, Hydraulic Oil Temp. Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Hydraulic oil temperature display failure 2. Control Function – Fan revolutions control failure (Checking list) 1. CD-1 (#2) - CN-51 (#16) Checking Open/Short 2. CD-1 (#1) - CN-51 (#25) Checking Open/Short				
105 (N.A)	0	10 seconds continuous, Working Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Working Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Working Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Working Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure (Checking list) 1. CD-7 (#B) – CN-52 (#37) Checking Open/Short 2. CD-7 (#A) – CN-51 (#3) Checking Open/Short 3. CD-7 (#C) – CN-51 (#13) Checking Open/Short				
108 (N.A)	0	10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage > 5.2V		●	
	1	10 seconds continuous, 0.3V ≤ Travel Oil Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Travel Oil Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Travel Oil Press. display failure 2. Control Function – Auto Idle operation failure, Engine variable horse power control operation failure, IPC operation failure, Driving alarm operation failure (Checking list) 1. CD-6 (#B) – CN-52 (#38) Checking Open/Short 2. CD-6 (#A) – CN-51 (#3) Checking Open/Short 3. CD-6 (#C) – CN-51 (#13) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
120	0	10 seconds continuous, Main Pump 1 (P1) Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V ≤ Main Pump 1 (P1) Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Main Pump 1 (P1) Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) . Monitor – Main Pump 1 (P1) Press. display failure 2. Control Function – Automatic voltage increase operation failure, Overload at compensation control failure (Checking list) 1. CD-42 (#B) – CN-52 (#22) Checking Open/Short 2. CD-42 (#A) – CN-51 (#32) Checking Open/Short 3. CD-42 (#C) – CN-51 (#31) Checking Open/Short				
121	0	10 seconds continuous, Main Pump 2 (P2) Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V ≤ Main Pump 2 (P2) Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, P2 pump delivery pressure sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Main Pump 2 (P2) Press. display failure 2. Control Function – Automatic voltage increase operation failure, Overload at compensation control failure (Checking list) 1. CD-43 (#B) – CN-51 (#14) Checking Open/Short 2. CD-43 (#A) – CN-51 (#32) Checking Open/Short 3. CD-43 (#C) – CN-51 (#31) Checking Open/Short				
122	1	(when you had conditions mounting pressure sensor) 10 seconds continuous, 0.3V ≤ Overload Press. Sensor Measurement Voltage < 0.8V	●		
	4	(when you had conditions mounting pressure sensor) 10 seconds continuous, Overload Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Overload Press. display failure 2. Control Function – Overload warning alarm failure (Checking list) 1. CD-31 (#B) – CN-52 (#28) Checking Open/Short 2. CD-31 (#A) – CN-51 (#32) Checking Open/Short 3. CD-31 (#C) – CN-51 (#31) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
123	0	10 seconds continuous, Negative 1 Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Negative 1 Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Negative 1 Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Negative 1 Press. display failure 2. Control Function – IPC operation failure, Option attachment flow control operation failure (Checking list) 1. CD-70 (#B) – CN-51 (#22) Checking Open/Short 2. CD-70 (#A) – CN-51 (#32) Checking Open/Short 3. CD-70 (#C) – CN-51 (#31) Checking Open/Short				
124	0	10 seconds continuous, Negative 2 Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Negative 2 Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Negative 2 Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Negative 2 Press. display failure 2. Control Function – Option attachment flow control operation failure (Checking list) 1. CD-71 (#B) – CN-51 (#28) Checking Open/Short 2. CD-71 (#A) – CN-51 (#32) Checking Open/Short 3. CD-71 (#C) – CN-51 (#31) Checking Open/Short				
127	0	10 seconds continuous, Boom Up Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Boom Up Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Boom Up Pilot Press. Sensor Measurement < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Boom Up Pilot Press. display failure 2. Control Function – Engine/Pump variable horse power control operation failure, IPC operation failure, Boom first operation failure (Checking list) 1. CD-32 (#B) – CN-52 (#23) Checking Open/Short 2. CD-32 (#A) – CN-51 (#32) Checking Open/Short 3. CD-32 (#C) – CN-51 (#31) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
128	0	(when you had conditions mounting pressure sensor) 10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	(when you had conditions mounting pressure sensor) 10 seconds continuous, 0.3V≤ Boom Down Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	(when you had conditions mounting pressure sensor) 10 seconds continuous, Boom Down Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Boom Down Pilot Press. display failure 2. Control Function – Boom floating operation failure (Checking list) 1. CD-85 (#B) – CN-52 (#31) Checking Open/Short 2. CD-85 (#A) – CN-51 (#32) Checking Open/Short 3. CD-85 (#C) – CN-51 (#31) Checking Open/Short				
129	0	10 seconds continuous, Arm In Pilot Press. Sensor Measurement Voltage > 4.8V	●		
	1	10 seconds continuous, 0.3V≤ Arm In Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Arm In Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Arm In Pilot Press. display failure 2. Control Function – IPC operation failure (Checking list) 1. CD-90 (#B) – CN-51 (#21) Checking Open/Short 2. CD-90 (#A) – CN-51 (#32) Checking Open/Short 3. CD-90 (#C) – CN-51 (#31) Checking Open/Short				
130	0	10 seconds continuous, Arm Out Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Arm Out Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Arm Out Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Arm Out Pilot Press. display failure 2. Control Function – Engine variable horse power control operation failure (Checking list) 1. CD-35 (#B) – CN-51 (#27) Checking Open/Short 2. CD-35 (#A) – CN-51 (#32) Checking Open/Short 3. CD-35 (#C) – CN-51 (#31) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
135	0	10 seconds continuous, Swing Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Swing Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Swing Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Swing Pilot Press. display failure 2. Control Function – IPC operation, Boom first operation failure (Checking list) 1. CD-24 (#B) – CN-52 (#18) Checking Open/Short 2. CD-24 (#A) – CN-51 (#32) Checking Open/Short 3. CD-24 (#C) – CN-51 (#31) Checking Open/Short				
138 (N.A)	0	Monitor – Select Attachment(breaker / crusher) 10 seconds continuous, Attachment Pilot Press. Sensor Measurement Voltage > 5.2V	●		
	1	Monitor – Select Attachment(breaker / crusher) 10 seconds continuous, 0.3V≤ Attachment Pilot Press. Sensor Measurement Voltage < 0.8V	●		
	4	Monitor – Select Attachment(breaker / crusher) 10 seconds continuous, Attachment Pilot Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Attachment Pilot Press. display failure 2. Control Function – Option attachment flow control operation failure (Checking list) 1. CD-69 (#B) – CN-52 (#14) Checking Open/Short 2. CD-69 (#A) – CN-53 (#3) Checking Open/Short 3. CD-69 (#C) – CN-53 (#13) Checking Open/Short				
139 (N.A)	1	10 seconds continuous, 0.3V≤ Option Pilot Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Option Pilot Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Option Pilot Press. display failure 2. Control Function – Auto Idle operation failure (Checking list) 1. CD-100 (#B) – CN-52 (#21) Checking Open/Short 2. CD-100 (#A) – CN-51 (#3) Checking Open/Short 3. CD-100 (#C) – CN-1 (#6) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
140	5	(Detection) (When Pump regulator EPPR Current is more than 10 mA) 10 seconds continuous, Pump EPPR drive current < 0 mA (Cancellation) (When Pump EPPR Current is more than 10 mA) 3 seconds continuous, Pump EPPR drive current ≥10 mA	●		
	6	(Detection) 10 seconds continuous, Pump EPPR drive current > 1.0A (Cancellation) 3 seconds continuous, Pump EPPR drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Pump horse power setting specification difference (Fuel efficiency/speed specification failure) (Checking list) 1. CN-342 or 343 (#2) – CN-54 (#27) or 54 (#26) Checking Open/Short 2. CN-342 or 343 (#1) – CN-54 (#02) or 54 (#03) Checking Open/Short				
141 (N.A)	5	(Model Parameter) mounting Boom Priority EPPR (Detection) (When Boom Priority EPPR Current is more than 10 mA) 10 seconds continuous, Boom Priority EPPR drive current < 0 mA (Cancellation) (When Boom Priority EPPR Current is more than 10 mA) 3 seconds continuous, Boom Priority EPPR drive current ≥ 10 mA	●		
	6	(Detection) 10 seconds continuous, Boom Priority EPPR drive current > 1.0 A (Cancellation) 3 seconds continuous, Boom Priority EPPR drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Boom first control operation failure (Checking list) 1. CN-448 (2) or 449 (#2) – CN-54 (#34) or 54 (#34) Checking Open/Short 2. CN-448 (1) or 449 (#1) – CN-54 (#05) or 54 (#04) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
143	5	(Detection) (When Travel EPPR Current is more than 10 mA) 10 seconds continuous, Travel EPPR drive current = 0 mA (Cancellation) (When Travel EPPR Current is more than 100 mA) 3 seconds continuous, Travel EPPR drive current ≥ 10 mA			●
	6	(Detection) 10 seconds continuous, Travel EPPR drive current > 1.0 A (Cancellation) 3 seconds continuous, Travel EPPR drive current ≤ 1.0 A			●
	(Results / Symptoms) 1. Control Function – cruise control operation failure (Checking list) 1. CN-246 (#2) – CN-54 (#25) Checking Open/Short 2. CN-246 (#1) – CN-54 (#08) Checking Open/Short				
145 (N.A)	5	(Model Parameter) mounting Remote Cooling Fan EPPR (Detection) (When Remote Cooling Fan EPPR Current is more than 10 mA) 10 seconds continuous, Remote Cooling Fan EPPR drive current = 0 mA (Cancellation) (When Remote Cooling Fan EPPR Current is more than 10 mA) 3 seconds continuous, Remote Cooling Fan EPPR drive current ≥ 10 mA	●		
	6	(Detection) 10 seconds continuous, Remote Cooling Fan EPPR drive current > 1.0 A (Cancellation) 3 seconds continuous, Remote Cooling Fan EPPR drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Remote fan control operation failure (Checking list) 1. CN-52 (#1) – CN-51 (#9) Checking Open/Short 2. CN-52 (#2) – CN-51 (#14) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
164 (N.A)	4	(Detection) (When Working Cutoff Relay is Off) 10 seconds continuous, Working Cutoff Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Working Cutoff Relay is Off) 3 seconds continuous, Working Cutoff Relay drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Working Cutoff Relay is On) 10 seconds continuous, Working Cutoff Relay drive current > 6.5 A (Cancellation) (When Working Cutoff Relay is On) 3 seconds continuous, Working Cutoff Relay drive current ≤ 6.5 A			●
	(Results / Symptoms) 1. Control Function – (Wheel Excavator) In driving mode, attachment hydraulic pilot pressure cut off failure (Checking list) 1. CR-47 (#85) – CN-53 (#04) Checking Open/Short 2. CR-47 (#30, #86) – Fuse box (#28) Checking Open/Short				
166	4	(Detection) (When Power Max Solenoid is Off) 10 seconds continuous, Power Max Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Power Max Solenoid is Off) 3 seconds continuous, Power Max Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Power Max Solenoid is On) 5 seconds continuous, Power Max Solenoid drive current > 4.5 A (Cancellation) (When Power Max Solenoid is On) 3 seconds continuous, Power Max Solenoid drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – Voltage increase operation failure (Checking list) 1. CN-88 (#1) – CN-53 (#10) Checking Open/Short 2. CN-88 (#2) – Fuse box (#33) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
167	4	(Detection) (When Travel Speed Solenoid is Off) 10 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Travel Speed Solenoid is Off) 3 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage > 3.0V		●	
		(When Parking mode is not) (Detection) (When Travel High Speed Solenoid is Off) 10 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Travel Speed Solenoid is Off) 3 seconds continuous, Travel Speed Solenoid drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Travel High Speed Solenoid is On) 10 seconds continuous, Travel Speed Solenoid drive current > 4.5 A (Cancellation) (When Travel Speed Solenoid is On) 3 seconds continuous, Travel Speed Solenoid drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – driving in 1/2 transmission operation failure (Checking list) 1. CN-70 (#1) – CN-52 (#05) Checking Open/Short 2. CN-70 (#2) – GND Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
169 (N.A)	4	Monitor – Selecting attachment(breaker / crusher) (Detection) (When Attachment Conflux Solenoid is Off) 10 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Attachment Conflux Solenoid is Off) 3 seconds continuous, Attachment Conflux Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Attachment Conflux Solenoid is On) 10 seconds continuous, Attachment Conflux Solenoid drive Current > 6.5 A (Cancellation) (When Attachment Conflux Solenoid is On) 3 seconds continuous, Attachment Conflux Solenoid drive Current ≤ 6.5 A	●		
	(Results / symptoms) 1. Control Function – Option attachment flow control – Joining operation failure (Eco breaker mode, crusher mode) (Checking list) 1. CN-237 (#1) – CN-53 (#7) Checking Open/Short 2. CN-237 (#2) – CR-35 (#87) Checking Open/Short				
170	4	(Model Parameter) mounting Arm Regenerating Solenoid (Detection) (When Arm Regeneration Solenoid is Off) 10 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Arm Regeneration Solenoid is Off) 3 seconds continuous, Arm Regeneration Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Arm Regeneration Solenoid is On) 10 seconds continuous, Arm Regeneration Solenoid drive current > 4.5 A (Cancellation) (When Arm Regeneration Solenoid is On) 3 seconds continuous, Arm Regeneration Solenoid drive current ≤ 4.5 A	●		
	(Results / symptoms) 1. Control Function – Arm regeneration operation failure (Checking list) 1. CN-135 (#1) – CN-52 (#06) Checking Open/Short 2. CN-135 (#2) – Fuse box (#33) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
171 (N.A)	4	Monitor – Selecting attachment(crusher) (Detection) (When Attachment Safety Solenoid is Off) 10 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Attachment Safety Solenoid is Off) 3 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Attachment Safety Solenoid is On) 10 seconds continuous, Attachment Safety Solenoid drive current > 6.5 A (Cancellation) (When Attachment Safety Solenoid is On) 3 seconds continuous, Attachment Safety Solenoid drive current ≤ 6.5 A	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control – Option spool pilot pressure cut off failure (crusher mode) (Checking list) 1. CN-149 (#1) – CN-53 (#09) Checking Open/Short 2. CN-149 (#2) – Fuse box (#19) Checking Open/Short				
179 (N.A)	4	Monitor – Selecting attachment(breaker / crusher) (Detection) (When Breaker Operating Solenoid is Off) 10 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Breaker Operating Solenoid is Off) 3 seconds continuous, Attachment Safety Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Breaker Operating Solenoid is On) 10 seconds continuous, Attachment Safety Solenoid drive current > 6.5 A (Cancellation) (When Breaker Operating Solenoid is On) 3 seconds continuous, Attachment Safety Solenoid drive current ≤ 6.5 A	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control – Breaker operation failure (breaker mode) (Checking list) 1. CD-66 (#1) – CN-53 (#9) Checking Open/Short 2. CD-66 (#2) – CN-45 (#B+ term) Checking Open/Short 3. CD-66 (#C) – CN-51 (#13) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
181 (N.A)	4	(Model Parameter) mounting Reverse Cooling Fan Solenoid (Detection) (When Reverse Cooling Fan Solenoid is Off) 10 seconds continuous, Reverse Cooling Fan Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Reverse Cooling Fan Solenoid is Off) 3 seconds continuous, Reverse Cooling Fan Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Reverse Cooling Fan Solenoid is On) 10 seconds continuous, Reverse Cooling Fan Solenoid drive current > 4.5 A (Cancellation) (When Reverse Cooling Fan Solenoid is On) 3 seconds continuous, Reverse Cooling Fan Solenoid drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – Cooling Fan reverse control operation failure (not applicable)				
188	5	(Detection) (When Attachment Flow EPPR 1 current is equal or more than 300 mA) 10 seconds continuous, Attachment Flow EPPR drive current < 100 mA (Cancellation) (When Attachment Flow EPPR 1 current is equal or more than 300 mA) 3 seconds continuous, Attachment Flow EPPR drive current ¸ 100 mA	●		
	6	(Detection) 10 seconds continuous, Attachment Flow EPPR 1 drive current > 1.0 A (Cancellation) 3 seconds continuous, Attachment Flow EPPR 1 drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – IPC operation failure, Option attachment flow control operation failure (Checking list) 1. CN-365 (#2) – CN-54 (#17) Checking Open/Short 2. CN-365 (#1) – CN-54 (#09) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
189 (N.A)	5	(Detection) (When Attachment Flow EPPR 2 current is equal or more than 300 mA) 10 seconds continuous, Attachment Flow EPPR drive current < 100 mA (Cancellation) (When Attachment Flow EPPR 2 current is equal or more than 300 mA) 3 seconds continuous, Attachment Flow EPPR drive current ¡Ý 100 mA	●		
	6	(Detection) 10 seconds continuous, Attachment Flow EPPR 2 drive current > 1.0 A (Cancellation) 3 seconds continuous, Attachment Flow EPPR 2 drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control operation failure (Checking list) 1. CN-243 (#2) – CN-52 (#6) Checking Open/Short 2. CN-243 (#1) – CN-52 (#7) Checking Open/Short				
196	0	HW145 10 seconds continuous, Attachment flow control EPPR 1 press. Sensor Measurement Voltage > 5.2V			
	1	HW145 10 seconds continuous, 0.3V≤ Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.8V			
	4	HW145 10 seconds continuous, Attachment flow control EPPR 1 press. Sensor Measurement Voltage < 0.3V			
	(Results / Symptoms) 1. Control Function – Driving second pump joining function operation failure (Checking list) 1. CD-33 (#B) – CN-52 (#11) Checking Open/Short 2. CD-33 (#A) – CN-51 (#3) Checking Open/Short 3. CD-33 (#C) – CN-51 (#13) Checking Open/Short				
200 (N.A)	0	10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage > 5.2V	●		
	1	10 seconds continuous, 0.3V≤ Pump EPPR Press. Sensor Measurement Voltage < 0.8V	●		
	4	10 seconds continuous, Pump EPPR Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Pump EPPR Press. display failure 2. Control Function – Pump input horse power control failure, Overload at compensation control operation failure (Checking list) 1. CD-44 (#B) – CN-52 (#32) Checking Open/Short 2. CD-44 (#A) – CN-51 (#3) Checking Open/Short 3. CD-44 (#C) – CN-51 (#13) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
205 (N.A)	0	(Mounting pressure sensor) 10 seconds continuous, Boom Cylinder Rod Press. Sensor Measurement Voltage > 5.2V	●		
	1	(Mounting pressure sensor) 10 seconds continuous, 0.3V≤ Boom Cylinder Rod Press. Sensor Measurement Voltage < 0.8V	●		
	4	(Mounting pressure sensor) 10 seconds continuous, Boom Cylinder Rod Press. Sensor Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Boom Cylinder Rod Press. display failure 2. Control Function – Boom floating control operation failure (Checking list) 1. CD-124 (#B) – CN-53 (#5) Checking Open/Short 2. CD-124 (#A) – CN-53 (#3) Checking Open/Short 3. CD-124 (#C) – CN-53 (#13) Checking Open/Short				
218 (N.A)	4	Mounting pressure sensor (HCESPN128 or HCESPN 205) (Detection) (When Boom Up Floating Solenoid is Off) 10 seconds continuous, Boom Up Floating Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Boom Up Floating Solenoid is Off) 3 seconds continuous, Boom Up Floating Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Boom Up Floating Solenoid is On) 10 seconds continuous, Boom Up Floating Solenoid drive current > 6.5 A (Cancellation) (When Boom Up Floating Solenoid is On) 3 seconds continuous, Boom Up Floating Solenoid drive current ≤ 6.5 A	●		
	(Results / Symptoms) 1. Control Function – Boom floating control operation failure (Checking list) 1. CN-368 (#1) – CN-53 (#20) Checking Open/Short 2. CN-368 (#2) – CN-35 (#87) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
220 (N.A)	4	Mounting pressure sensor (HCESPN 128 or 205) (Detection) (When Boom Down Pilot Pressure Cutoff Solenoid is Off) 10 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Boom Down Pilot Pressure Cutoff Solenoid is Off) 3 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Boom Down Pilot Pressure Cutoff Solenoid is On) 10 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive current > 6.5 A (Cancellation) (When Boom Down Pilot Pressure Cutoff Solenoid is On) 3 seconds continuous, Boom Down Pilot Pressure Cutoff Solenoid drive current ≤ 6.5 A	●		
	(Results / Symptoms) 1. Control Function – Boom floating control operation failure (Checking list) 1. CN-369 (#1) – CN-53 (#35) Checking Open/Short 2. CN-369 (#2) – CR-35 (#87) Checking Open/Short				
221	5	Monitor – Selecting attachment(breaker / crusher) (Detection) (When ATT Relief Setting EPPR 1 Current is equal or more than 10 mA) 10 seconds continuous, ATT Relief Setting EPPR 1 drive current = 0 mA (Cancellation) ATT Relief Setting EPPR 1 Current is equal or more than 10 mA) 3 seconds continuous, ATT Relief Setting EPPR 1 drive current ≥ 10 mA	●		
	6	(Detection) 10 seconds continuous, ATT Relief Setting EPPR 1 drive current > 1.0 A (Cancellation) 3 seconds continuous, ATT Relief Setting EPPR 1 drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control – P1 relief pressure setting failure (Checking list) 1. CN-365 (#2) – CN-54 (#17) Checking Open/Short 2. CN-365 (#1) – CN-54 (#09) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
222	5	Monitor – Selecting attachment(crusher) (Detection) (When ATT Relief Setting EPPR 2 Current is equal or more than 10 mA) 10 seconds continuous, ATT Relief Setting EPPR 2 drive current = 0 mA (Cancellation) (When ATT Relief Setting EPPR 2 Current is equal or more than 10 mA) 3 seconds continuous, ATT Relief Setting EPPR 2 drive current ≥ 10mA	●		
	6	(Detection) 10 seconds continuous, ATT Relief Setting EPPR 2 drive current > 1.0 A (Cancellation) 3 seconds continuous, ATT Relief Setting EPPR 2 drive current ≤ 1.0 A	●		
	(Results / Symptoms) 1. Control Function – Option attachment flow control – P2 relief pressure setting failure (Checking list) 1. CN-366 (#2) – CN-54 (#17) Checking Open/Short 2. CN-366 (#1) – CN-54 (#10) Checking Open/Short				
301	3	10 seconds continuous, Fuel Level Measurement Voltage > 3.8V	●		
	4	10 seconds continuous, Fuel Level Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Fuel remaining display failure (Checking list) 1. CD-2 (#2) – CN-52 (#26) Checking Open/Short 2. CD-2 (#1) – CN-51 (#5) Checking Open/Short				
325	4	(Model Parameter) mounting Fuel Warmer Relay (Detection) (When Fuel Warmer Relay is Off) 10 seconds continuous, Fuel Warmer Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Fuel Warmer Relay is Off) 3 seconds continuous, Fuel Warmer Relay drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Fuel Warmer Relay is On) 10 seconds continuous, Fuel Warmer Relay drive current > 4.5 A (Cancellation) (When Fuel Warmer Relay is On) 3 seconds continuous, Fuel Warmer Relay drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – Fuel warmer operation failure (Checking list) 1. CR-46 (#30, #86) – CN-52 (#13) Checking Open/Short 2. CR-46 (#30, #86) – Fuse box (#24) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
501	0	10 seconds continuous, Transmission Oil Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V≤ Transmission Oil Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Transmission Oil Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Transmission Oil Press. display failure, Transmission Oil low pressure warning failure (Checking list) 1. CD-5 (#B) – CN-52 (#28) Checking Open/Short 2. CD-5 (#A) – CN-51 (#32) Checking Open/Short 3. CD-5 (#C) – CN-51 (#31) Checking Open/Short				
503	0	10 seconds continuous, Brake Oil Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V≤ Brake Oil Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Brake Oil Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Brake Oil Press. display failure, Brake Oil low pressure warning failure (Checking list) 1. CD-3 (#B) – CN-52 (#29) Checking Open/Short 2. CD-3 (#A) – CN-51 (#32) Checking Open/Short 3. CD-3 (#C) – CN-51 (#31) Checking Open/Short				
505	0	10 seconds continuous, Working Brake Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V≤ Working Brake Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Working Brake Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Working Brake Oil Press. display failure, Working Brake Oil low pressure warning failure (Checking list) 1. CD-38 (#B) – CN-51 (#30) Checking Open/Short 2. CD-38 (#A) – CN-51 (#32) Checking Open/Short 3. CD-38 (#C) – CN-51 (#31) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
514	4	(Detection) (When Parking Relay is Off) 10 seconds continuous, Parking Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Parking Relay is Off) 3 seconds continuous, Parking Relay drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Parking Relay is On) 10 seconds continuous, Parking Relay drive current > 6.5 A (Cancellation) (When Parking Relay is On) 3 seconds continuous, Parking Relay drive current ≤ 6.5 A			●
	(Results / Symptoms) 1. Control Function – Parking Relay operation failure (Checking list) 1. CR-66 (#85) – CN-53 (#11) Checking Open/Short 2. CR-66 (#30, #86) – Fuse box (#30) Checking Open/Short				
517	4	(Detection) (When Traveling Cutoff Relay is Off) 10 seconds continuous, Traveling Cutoff Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Traveling Cutoff Relay is Off) 3 seconds continuous, Traveling Cutoff Relay drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Traveling Cutoff Relay is On) 10 seconds continuous, Traveling Cutoff Relay drive current > 6.5 A (Cancellation) (When Traveling Cutoff Relay is On) 3 seconds continuous, Traveling Cutoff Relay drive current ≤ 6.5 A			●
	(Results / Symptoms) 1. Control Function – Traveling Cutoff Relay operation failure (Checking list) 1. CR-47 (#30, #86) – CN-53 (#04) Checking Open/Short 2. CR-47 (#30, #86) – Fuse box (#28) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
525	4	(Detection) (When Ram Lock Solenoid is Off) 10 seconds continuous, Ram Lock Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Ram Lock Solenoid is Off) 3 seconds continuous, Ram Lock Solenoid drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Ram Lock Solenoid is On) 10 seconds continuous, Ram Lock Solenoid drive current > 6.5 A (Cancellation) (When Ram Lock Solenoid is On) 3 seconds continuous, Ram Lock Solenoid drive current ≤ 6.5 A			●
	(Results / Symptoms) 1. Control Function – Ram lock control operation failure (Checking list) 1. CN-69 (#1) – CN-53 (#12) Checking Open/Short 2. CN-69 (#2) – Fuse box (#33) Checking Open/Short				
527 (N.A)	4	(Detection) (When Creep Solenoid is Off) 10 seconds continuous, Creep Solenoid drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Creep Solenoid is Off) 3 seconds continuous, Creep Solenoid drive unit Measurement Voltage > 3.0V			●
	6	(Detection) (When Creep Solenoid is On) 10 seconds continuous, Creep Solenoid drive current > 6.5 A (Cancellation) (When Creep Solenoid is On) 3 seconds continuous, Creep Solenoid drive current ≤ 6.5 A			●
	(Results / Symptoms) 1. Control Function – Creep mode operation failure (Checking list) 1. CN-206 (#1) – CN-52 (#17) Checking Open/Short 2. CN-206 (#2) – Fuse box (#30) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
530	0	10 seconds continuous, Travel Forward Press. Sensor Measurement Voltage > 5.2V			●
	1	10 seconds continuous, 0.3V≤ Travel Forward Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Travel Forward Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Travel Forward Press. display failure 2. Control Function – Driving interoperability power control operation failure (Checking list) 1. CD-73 (#B) – CN-51 (#20) Checking Open/Short 2. CD-73 (#A) – CN-51 (#32) Checking Open/Short 3. CD-73 (#C) – CN-51 (#31) Checking Open/Short				
531 (N.A)	1	10 seconds continuous, 0.3V≤ Travel Reverse Press. Sensor Measurement Voltage < 0.8V			●
	4	10 seconds continuous, Travel Reverse Press. Sensor Measurement Voltage < 0.3V			●
	(Results / Symptoms) 1. Monitor – Travel Reverse Press. display failure 2. Control Function – Driving interoperability power control operation failure (Checking list) 1. CD-74 (#B) – CN-54 (#23) Checking Open/Short 2. CD-74 (#A) – CN-54 (#3) Checking Open/Short 3. CD-74 (#C) – CN-54 (#13) Checking Open/Short				
705	0	10 seconds continuous, Battery input Voltage > 35V	●		
	1	10 seconds continuous, Battery input Voltage < 18V	●		
	(Results / Symptoms) 1. Control Function – Startup impossibility (Checking list) 1. CS-74A (#1) – CN-51 (#1) Checking Open/Short				
707	1	(When Engine is equal or more than 400 rpm) 10 seconds continuous, Alternator Node I Measurement Voltage < 18V (In case 12v goods, Alternator Node L Measurement Voltage < 9V)	●		
	(Results / Symptoms) 1. Control Function – Battery charging circuit failure (Checking list) 1. CS-74A (#1) – CN-51 (#15) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
714 (N.A)	3	(Model Parameter) Mounting Acc. Dial 10 seconds continuous, Acc. Dial Measurement Voltage > 5.2V	●		
	4	(Model Parameter) Mounting Acc. Dial 10 seconds continuous, Acc. Dial Measurement Voltage < 0.3V	●		
	(Results / Symptoms) 1. Monitor – Acc. Dial Voltage display failure 2. Control Function – Engine rpm control failure (Checking list) 1. CN-7 (#15) – CN-52 (#33) Checking Open/Short				
722	4	(Detection) (When Travel Alarm (Buzzer) Sound is Off) 10 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive unit Measurement Voltage ≤ 3.0V (Cancellation) (When Travel Alarm (Buzzer) Sound Relay is Off) 3 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive unit Measurement Voltage > 3.0V	●		
	6	(Detection) (When Travel Alarm (Buzzer) Sound is On) 10 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive current > 4.5 A (Cancellation) (When Travel Alarm (Buzzer) Sound is On) 3 seconds continuous, Travel Alarm (Buzzer) Sound Relay drive current ≤ 4.5 A	●		
	(Results / Symptoms) 1. Control Function – Driving alarm operation failure (Checking list) 1. CN-81 (#1) – CN-52 (#09) Checking Open/Short 2. CN-81 (#2) – Fuse box (#30) Checking Open/Short				
831	2	(When mounting the A/C Controller) 60 seconds continuous, A/C Controller Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – A/C Controller operation failure (Checking list) 1. CN-11 (#8) – CN-51 (#09) Checking Open/Short 2. CN-11 (#7) – CN-51 (#08) Checking Open/Short				
840	2	60 seconds continuous, Cluster Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – Cluster operation failure (Checking list) 1. CN-56A (#7) – CN-51 (#08) Checking Open/Short 2. CN-56A (#6) – CN-51 (#09) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
841	2	10 seconds continuous, ECM Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – ECM operation failure (Checking list) 1. CN-93 (#22) – CN-52 (#02) Checking Open/Short 2. CN-93 (#46) – CN-52 (#01) Checking Open/Short				
848	2	(When mounting the Jog Dial Module) 60 seconds continuous, Jog Dial Module Communication Data Error	●		
	(Results / Symptoms) 1. Control Function – Jog Dial Module operation failure (Checking list) 1. CN-8 (#2) – CN-51 (#09) Checking Open/Short 2. CN-8 (#3) – CN-51 (#08) Checking Open/Short				
850	2	(When mounting the RMCU) 60 seconds continuous, RMCU communication Data Error	●		
	(Resuluts / Symptoms) 1. Control Function – RMCU operation failure (Checking list) 1. CN-125A (#3) – CN-51 (#09) Checking Open/Short 2. CN-125A (#11) – CN-51 (#08) Checking Open/Short				
866	2	(When mounting the AAVM) 60 seconds continuous, AAVM communication Data Error	●		
	(Results / Symptoms) 1. Control Function – AAVM operation failure (Checking list) 1. CN-401 (#3) – CN-51 (#09) Checking Open/Short 2. CN-401 (#15) – CN-51 (#08) Checking Open/Short				
867	2	60 seconds continuous, RDU communication Data Error	●		
	(Results / Symptoms) 1. Control Function – RDU operation failure (Checking list) 1. CN-376 (#10) – CN-51 (#09) Checking Open/Short 2. CN-376 (#18) – CN-51 (#08) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

DTC		Diagnostic Criteria	Application		
HCESPN	FMI		G	C	W
868	2	60 seconds continuous, Switch Controller communication Data Error	●		
	(Results / Symptoms) 1. Control Function – Switch Controller operation failure (Checking list) 1. CN-56A (#7) – CN-51 (#08) Checking Open/Short 2. CN-56A (#6) – CN-51 (#09) Checking Open/Short				
869	2	(When mounting the BKCU) 60 seconds continuous, BKCU communication Data Error	●		
	(Results / Symptoms) 1. Control Function – BKCU operation failure (Checking list) 1. CS-2B (#A) – CN-51 (#09) Checking Open/Short 2. CS-2B (#B) – CN-51 (#08) Checking Open/Short				

※ Some error codes are not applied to this machine.

G : General C : Crawler Type W : Wheel Type

4. ENGINE FAULT CODE

Fault code J1939 SPN J1939 FMI	Item	Description
111 629 12	Engine control module critical internal failure	Bad intelligent device or component
122 102 3	Intake manifold 1 pressure sensor circuit	Voltage above normal, or shorted to high source
123 102 4	Intake manifold 1 pressure sensor circuit	Voltage below normal, or shorted to low source
133 974 3	Remote accelerator pedal or lever position sensor 1 circuit	Voltage above normal, or shorted to high source
134 974 4	Remote accelerator pedal or lever position sensor 1 circuit	Voltage below normal, or shorted to low source
135 100 3	Engine oil rifle pressure 1 sensor circuit	Voltage above normal, or shorted to high source
141 100 4	Engine oil rifle pressure 1 sensor circuit	Voltage below normal, or shorted to low source
143 100 18	Engine oil rifle pressure	Data valid but below normal operating range - moderately severe level
144 110 3	Engine coolant temperature 1 sensor circuit	Voltage above normal, or shorted to high source
145 110 4	Engine coolant temperature 1 sensor circuit	Voltage below normal, or shorted to low source
146 110 16	Engine coolant temperature	Data valid but above normal operating range - moderately severe level
147 91 1	Accelerator pedal or lever position 1 sensor circuit frequency	Data valid but below normal operating range
148 91 0	Accelerator pedal or lever position sensor 1	Data valid but above normal operational range - most severe level
151 110 0	Engine coolant temperature	Data valid but above normal operational range - most severe level
153 105 3	Intake manifold 1 temperature sensor circuit	Voltage above normal, or shorted to high source
154 105 4	Intake manifold 1 temperature sensor circuit	Voltage below normal, or shorted to low source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
187 3510 4	Sensor supply 2 circuit	Voltage below normal, or shorted to low source
197 111 18	Coolant level	Data valid but below normal operating range - moderately severe level
227 3510 3	Sensor supply 2 circuit	Voltage above normal, or shorted to high source
234 190 0	Engine crankshaft speed/position	Data valid but above normal operational range - most severe level
235 111 1	Coolant level	Data valid but below normal operational range - most severe level
237 644 2	External speed command input (Multiple unit synchronization)	Data erratic, intermittent or incorrect
238 3511 4	Sensor supply 3 circuit	Voltage below normal, or shorted to low source
239 3511 3	Sensor supply 3 circuit	Voltage above normal, or shorted to high source
241 84 2	Wheel-based vehicle speed	Data erratic, intermittent or incorrect
242 84 10	Wheel-based vehicle speed sensor circuit tampering has been detected	Abnormal rate of change
271 1347 4	Engine fuel pump pressurizing assembly 1 circuit	Voltage below normal, or shorted to low source
272 1347 3	Engine fuel pump pressurizing assembly 1 circuit	Voltage above normal, or shorted to high source
285 639 9	SAE J1939 multiplexing pgn timeout error	Abnormal update rate
286 639 13	SAE J1939 multiplexing configuration error	Out of calibration
288 974 19	SAE J1939 multiplexing remote accelerator pedal or lever position sensor system	Received network data in error
293 441 3	Auxiliary temperature sensor input 1 circuit	Voltage above normal, or shorted to high source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
294 441 4	Auxiliary temperature sensor input 1 circuit	Voltage below normal, or shorted to low source
297 1388 3	Auxiliary pressure sensor input 2 circuit	Voltage above normal, or shorted to high source
298 1388 4	Auxiliary pressure sensor input 2 circuit	Voltage below normal, or shorted to low source
322 651 5	Injector solenoid driver cylinder 1 circuit	Current below normal or open circuit
323 655 5	Injector solenoid driver cylinder 5 circuit	Current below normal or open circuit
324 653 5	Injector solenoid driver cylinder 3 circuit	Current below normal or open circuit
325 656 5	Injector solenoid driver cylinder 6 circuit	Current below normal or open circuit
331 652 5	Injector solenoid driver cylinder 2 circuit	Current below normal or open circuit
332 654 5	Injector solenoid driver cylinder 4 circuit	Current below normal or open circuit
334 110 2	Engine coolant temperature	Data erratic, intermittent or incorrect
343 629 12	Engine control module warning internal hardware failure	Bad intelligent device or component
349 191 16	Transmission output shaft speed	Data valid but above normal operating range - moderately severe level
351 3597 12	Injector power supply	Bad intelligent device or component
352 3509 4	Sensor supply 1 circuit	Voltage below normal, or shorted to low source
386 3509 3	Sensor supply 1 circuit	Voltage above normal, or shorted to high source
415 100 1	Engine oil rifle pressure	Data valid but below normal operational range - most severe level

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
418 97 15	Water in fuel indicator	Data valid but above normal operating range - least severe level
428 97 3	Water in fuel indicator sensor circuit	Voltage above normal, or shorted to high source
429 97 4	Water in fuel indicator sensor circuit	Voltage below normal, or shorted to low source
431 558 2	Accelerator pedal or lever idle validation switch	Data erratic, intermittent or incorrect
432 558 13	Accelerator pedal or lever idle validation switch circuit	Out of calibration
435 100 2	Engine oil rifle pressure	Data erratic, intermittent or incorrect
451 157 3	Injector metering rail 1 pressure sensor circuit	Voltage above normal, or shorted to high source
452 157 4	Injector metering rail 1 pressure sensor circuit	Voltage below normal, or shorted to low source
483 1349 3	Injector metering rail 2 pressure sensor circuit	Voltage above normal, or shorted to high source
484 1349 4	Injector metering rail 2 pressure sensor circuit	Voltage below normal, or shorted to low source
488 105 16	Intake manifold 1 temperature	Data valid but above normal operating range - moderately severe level
489 191 18	Transmission output shaft speed	Data valid but below normal operating range - moderately severe level
497 1377 2	Multiple unit synchronization switch	Data erratic, intermittent or incorrect
515 3514 3	Sensor supply 6 circuit	Voltage above normal, or shorted to high source
516 3514 4	Sensor supply 6 circuit	Voltage below normal, or shorted to low source
527 702 3	Auxiliary input/output 2 circuit	Voltage above normal, or shorted to high source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
529 703 3	Auxiliary input/output 3 circuit	Voltage above normal, or shorted to high source
553 157 16	Injector metering rail 1 pressure	Data valid but above normal operating range - moderately severe level
555 101 16	Crankcase pressure	Data valid but above normal operating range - moderately severe level
556 101 0	Crankcase pressure	Data valid but above normal operational range - most severe level
559 157 18	Injector metering rail 1 pressure	Data valid but below normal operating range - moderately severe level
584 677 3	Starter relay driver circuit	Voltage above normal, or shorted to high source
585 677 4	Starter relay driver circuit	Voltage below normal, or shorted to low source
595 103 16	Turbocharger 1 speed	Data valid but above normal operating range - moderately severe level
599 640 14	Auxiliary commanded dual output shutdown	Special instructions
611 1383 31	Engine shut down hot	Condition exists
649 1378 31	Engine oil change interval	Condition exists
687 103 18	Turbocharger 1 speed	Data valid but below normal operating range - moderately severe level
689 190 2	Engine crankshaft speed/position	Data erratic, intermittent or incorrect
691 1172 3	Turbocharger 1 compressor intake temperature circuit	Voltage above normal, or shorted to high source
692 1172 4	Turbocharger 1 compressor intake temperature circuit	Voltage below normal, or shorted to low source
693 1172 7	Turbocharger 1 compressor intake temperature	Data erratic, intermittent or incorrect

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
731 723 7	Engine speed / position camshaft and crankshaft misalignment	Mechanical system not responding or out of adjustment
741 1176 3	Turbocharger 1 compressor intake pressure circuit	Voltage above normal, or shorted to high source
742 1176 4	Turbocharger 1 compressor intake pressure circuit	Voltage below normal, or shorted to low source
743 1176 2	Turbocharger 1 compressor intake pressure	Data erratic, intermittent or incorrect
769 597 3	Brake switch circuit	Voltage above normal, or shorted to high source
771 597 4	Brake switch circuit	Voltage below normal, or shorted to low source
778 723 2	Engine camshaft speed / position sensor	Data erratic, intermittent or incorrect
1117 3597 2	Power supply lost with ignition on	Data erratic, intermittent or incorrect
1239 2623 3	Accelerator pedal or lever position sensor 2 circuit	Voltage above normal, or shorted to high source
1241 2623 4	Accelerator pedal or lever position sensor 2 circuit	Voltage below normal, or shorted to low source
1242 91 2	Accelerator pedal or lever position sensor 1	Data erratic, intermittent or incorrect
1358 91 3	Accelerator pedal or lever position sensor 1 circuit	Voltage above normal, or shorted to high source
1359 91 4	Accelerator pedal or lever position sensor 1 circuit	Voltage below normal, or shorted to low source
1515 91 19	SAE J1939 multiplexed accelerator pedal or lever sensor system	Received network data in error
1539 1387 3	Auxiliary pressure sensor input 1 circuit	Voltage above normal, or shorted to high source
1621 1387 4	Auxiliary pressure sensor input 1 circuit	Voltage below normal, or shorted to low source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
1668 1761 4	Aftertreatment 1 diesel exhaust fluid tank level sensor circuit	Voltage below normal, or shorted to low source
1669 1761 3	Aftertreatment 1 diesel exhaust fluid tank level sensor circuit	Voltage above normal, or shorted to high source
1673 1761 1	Aftertreatment 1 diesel exhaust fluid tank level	Data valid but below normal operational range -most severe level
1677 3031 4	Aftertreatment 1 diesel exhaust fluid tank temperature sensor	Voltage below normal, or shorted to low source
1678 3031 3	Aftertreatment 1 diesel exhaust fluid tank temperature sensor	Voltage above normal, or shorted to high source
1679 3031 2	Aftertreatment 1 diesel exhaust fluid tank temperature	Data erratic, intermittent or incorrect
1682 3362 31	Aftertreatment 1 diesel exhaust fluid dosing unit input lines	Condition exists
1685 3364 4	Aftertreatment diesel exhaust fluid quality sensor circuit	Voltage below normal, or shorted to low source
1686 3364 3	Aftertreatment diesel exhaust fluid quality sensor circuit	Voltage above normal, or shorted to high source
1695 3513 3	Sensor supply 5	Voltage above normal, or shorted to high source
1696 3513 4	Sensor supply 5	Voltage below normal, or shorted to low source
1713 3363 16	Aftertreatment 1 diesel exhaust fluid tank heater	Data valid but above normal operating range - moderately severe level
1714 3364 13	Aftertreatment diesel exhaust fluid quality	Out of calibration
1715 3364 11	Aftertreatment diesel exhaust fluid quality	Root cause not known
1843 101 3	Crankcase pressure circuit	Voltage above normal, or shorted to high source
1844 101 4	Crankcase pressure circuit	Voltage below normal, or shorted to low source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
1852 97 16	Water in fuel indicator	Data valid but above normal operating range - moderately severe level
1879 3251 3	Aftertreatment diesel particulate filter differential pressure sensor circuit	Voltage above normal
1881 3251 4	Aftertreatment diesel particulate filter differential pressure sensor circuit	Voltage below normal
1883 3251 2	Aftertreatment diesel particulate filter differential pressure sensor	Data erratic, intermittent or incorrect
1885 3216 4	Aftertreatment 1 intake NOx sensor circuit	Voltage below normal, or shorted to low source
1887 3226 4	Aftertreatment 1 outlet NOx sensor circuit	Voltage below normal, or shorted to low source
1898 641 13	VGT actuator controller	Out of calibration
1921 3251 16	Aftertreatment diesel particulate filter differential pressure	Data valid but above normal operating range
1922 3251 0	Aftertreatment diesel particulate filter differential pressure	Data valid but above normal operating range
1976 641 15	VGT actuator driver over temperature (calculated)	Data valid but above normal operating range - least severe level
1993 4795 31	Aftertreatment 1 diesel particulate filter missing	Condition exists
2185 3512 3	Sensor supply 4 circuit	Voltage above normal, or shorted to high source
2186 3512 4	Sensor supply 4 circuit	Voltage below normal, or shorted to low source
2198 641 11	VGT actuator driver circuit	Root cause not known
2311 633 31	Electronic fuel injection control valve circuit	Condition exists
2321 190 2	Engine crankshaft speed/position	Data erratic, intermittent or incorrect

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
2322 723 2	Engine camshaft speed / position sensor	Data erratic, intermittent or incorrect
2373 1209 3	Exhaust gas pressure sensor 1 circuit	Voltage above normal, or shorted to high source
2374 1209 4	Exhaust gas pressure sensor 1 circuit	Voltage below normal, or shorted to low source
2387 641 7	VGT actuator driver circuit (motor)	Mechanical system not responding or out of adjustment
2448 111 17	Coolant level	Data valid but below normal operating range - least severe level
2468 190 16	Engine speed	Engine crankshaft speed/position - data valid but above normal operating range - moderately severe level
2554 1209 2	Exhaust gas pressure 1	Data erratic, intermittent or incorrect
2557 697 3	Auxiliary PWM driver 1 circuit	Voltage above normal, or shorted to high source
2558 697 4	AuxiliaryPWM driver 1 circuit	Voltage below normal, or shorted to low source
2571 2630 3	Engine charge air cooler outlet temperature	Voltage above normal, or shorted to high source
2572 2630 4	Engine charge air cooler outlet temperature	Voltage below normal, or shorted to low source
2634 641 12	VGT actuator controller	Bad intelligent device or component
2636 641 9	VGT actuator driver circuit	Abnormal update rate
2638 5298 17	Aftertreatment 1 diesel oxidation catalyst conversion efficiency	Data valid but below normal operating range - moderately severe level
2639 3251 15	Aftertreatment diesel particulate filter differential pressure	Data valid but above normal operating range
2771 3226 9	Aftertreatment 1 outlet NOx sensor	Abnormal update rate

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
2778 3481 16	Aftertreatment fuel rate	Data valid but above normal operating range - moderately severe level
2973 102 2	Intake manifold 1 pressure	Data erratic, intermittent or incorrect
3133 3610 3	Aftertreatment 1 diesel particulate filter outlet pressure sensor circuit	Voltage above normal, or shorted to high source
3134 3610 4	Aftertreatment 1 diesel particulate filter outlet pressure sensor circuit	Voltage below normal, or shorted to low source
3135 3610 2	Aftertreatment 1 diesel particulate filter outlet pressure	Data erratic, intermittent or incorrect
3139 3667 3	Engine air shutoff circuit	Voltage above normal, or shorted to high source
3141 3667 4	Engine air shutoff circuit	Voltage below normal, or shorted to low source
3142 4360 3	Aftertreatment 1 SCR intake temperature sensor circuit	Voltage above normal, or shorted to high source
3144 4360 2	Aftertreatment 1 SCR intake temperature sensor	Data erratic, intermittent or incorrect
3146 4363 3	Aftertreatment 1 SCR outlet temperature sensor circuit	Voltage above normal, or shorted to high source
3147 4363 4	Aftertreatment 1 SCR outlet temperature sensor circuit	Voltage below normal, or shorted to low source
3148 4363 2	Aftertreatment 1 SCR outlet temperature sensor	Data erratic, intermittent or incorrect
3151 4974 31	Aftertreatment 1 SCR catalyst system missing	Condition exists
3165 4363 0	Aftertreatment 1 SCR outlet temperature	Data valid but above normal operational range - most severe
3232 3216 9	Aftertreatment 1 intake NOx sensor	Abnormal update rate
3235 4363 16	Aftertreatment 1 SCR outlet temperature	Data valid but above normal operating range - moderately severe level

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
3251 4765 16	Aftertreatment 1 diesel oxidation catalyst intake temperature	Data valid but above normal operating range
3253 3242 16	Aftertreatment 1 diesel particulate filter intake temperature	Data valid but above normal operating range
3255 3246 16	Aftertreatment 1 diesel particulate filter outlet temperature	Data valid but above normal operating range
3311 3242 0	Aftertreatment 1 diesel particulate filter intake temperature	Data valid but above normal operation
3312 3246 0	Aftertreatment 1 diesel particulate filter outlet temperature	Data valid but above normal operation
3313 4765 4	Aftertreatment 1 diesel oxidation catalyst intake temperature sensor circuit	Voltage below normal, or shorted to low source
3314 4765 3	Aftertreatment 1 diesel oxidation catalyst intake temperature sensor circuit	Voltage above normal, or shorted to high source
3315 4765 2	Aftertreatment 1 diesel oxidation catalyst intake temperature	Data erratic, intermittent or incorrect
3316 3242 4	Aftertreatment 1 diesel particulate filter intake temperature sensor circuit	Voltage below normal, or shorted to low source
3317 3242 3	Aftertreatment 1 diesel particulate filter intake temperature sensor circuit	Voltage above normal, or shorted to high source
3318 3242 2	Aftertreatment 1 diesel particulate filter intake temperature	Data erratic, intermittent or incorrect
3319 3246 3	Aftertreatment 1 diesel particulate filter outlet temperature sensor circuit	Voltage above normal, or shorted to high source
3321 3246 4	Aftertreatment 1 diesel particulate filter outlet temperature sensor circuit	Voltage below normal, or shorted to low source
3322 3246 2	Aftertreatment 1 diesel particulate filter outlet temperature	Data erratic, intermittent or incorrect
3326 91 9	SAE J1939 multiplexed accelerator pedal or lever sensor system	Abnormal update rate
3341 107 16	Engine air filter differential pressure - data valid but above normal operating range	Moderately severe level

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
3375 5397 31	Aftertreatment diesel particulate filter regeneration too frequent	Condition exists
3376 5319 31	Aftertreatment diesel particulate filter incomplete regeneration	Condition exists
3419 5125 3	Sensor supply 7 circuit	Voltage above normal, or shorted to high source
3421 5125 4	Sensor supply 7 circuit	Voltage below normal, or shorted to low source
3497 1761 17	Aftertreatment 1 diesel exhaust fluid tank level	Data valid but below normal operating range - least severe level
3498 1761 18	Aftertreatment 1 diesel exhaust fluid tank level	Data valid but below normal operating range - moderately severe level
3527 558 19	Accelerator pedal or lever idle validation switch	Received network data in error
3528 558 9	Accelerator pedal or lever idle validation switch	Abnormal update rate
3542 51 2	Engine intake throttle actuator position sensor	Data erratic, intermittent, or incorrect
3545 3226 31	Aftertreatment 1 outlet NOx sensor	Abnormal rate of change
3547 4096 31	Aftertreatment diesel exhaust fluid tank empty	Condition exists
3558 3361 3	Aftertreatment 1 diesel exhaust fluid dosing unit	Voltage above normal, or shorted to high source
3559 3361 4	Aftertreatment 1 diesel exhaust fluid dosing unit	Voltage below normal, or shorted to low source
3565 5394 3	Aftertreatment 1 diesel exhaust fluid dosing valve 1 circuit	Voltage above normal or shorted to high source
3567 5394 5	Aftertreatment diesel exhaust fluid dosing valve	Current below normal or open circuit
3568 5394 7	Aftertreatment diesel exhaust fluid dosing valve	Mechanical system not responding or out of adjustment

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
3571 4334 3	Aftertreatment 1 diesel exhaust fluid pressure sensor	Voltage above normal, or shorted to high source
3572 4334 4	Aftertreatment 1 diesel exhaust fluid pressure sensor	Voltage below normal, or shorted to low source
3574 4334 18	Aftertreatment 1 diesel exhaust fluid pressure sensor	Data valid but below normal operating range
3575 4334 16	Aftertreatment 1 diesel exhaust fluid pressure sensor	Data valid but above normal operating range
3583 5031 10	Aftertreatment 1 outlet nox sensor heater	Abnormal rate of change
3596 4334 2	Aftertreatment 1 diesel exhaust fluid pressure sensor	Data erratic, intermittent or incorrect
3641 748 9	Transmission output retarder	Abnormal update rate
3649 5024 10	Aftertreatment 1 intake NOx sensor heater	Abnormal rate of change
3681 3228 2	Aftertreatment 1 outlet NOx sensor power supply	Data erratic, intermittent or incorrect
3682 3218 2	Aftertreatment 1 intake NOx sensor power supply	Data erratic, intermittent or incorrect
3697 630 12	Engine control module calibration memory	Bad intelligent device or component
3712 5246 0	Aftertreatment SCR operator inducement	Data valid but above normal operational range - most severe level
3714 1569 31	Engine protection torque derate	Condition exists
3725 3216 10	Aftertreatment 1 intake NOx sensor	Abnormal rate of change
3727 5571 7	High pressure common rail fuel pressure relief valve	Mechanical system not responding or out of adjustment
3737 1675 31	Engine starter mode overcrank protection	Condition exists

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
3741 5571 0	High pressure common rail fuel pressure relief valve	Data valid but above normal operational range
3748 3216 20	Aftertreatment 1 intake NOx sensor	Data not rational - drifted high
3765 442 3	Auxiliary temperature sensor input 2 circuit	Voltage above normal, or shorted to high source
3766 442 4	Auxiliary temperature sensor input 2 circuit	Voltage below normal, or shorted to low source
3838 2978 9	Estimated engine parasitic losses - percent torque	Abnormal update rate
3841 596 2	Cruise control enable switch	Data erratic, intermittent or incorrect
3843 5603 9	Cruise control disable command	Abnormal update rate
3845 5603 31	Cruise control disable command	Condition exists
3866 3364 1	Aftertreatment diesel exhaust fluid quality	Data valid but below normal operational range - most severe level
3868 3364 9	Aftertreatment diesel exhaust fluid quality	Abnormal update rate
3878 3364 2	Aftertreatment diesel exhaust fluid quality	Data erratic, intermittent or incorrect
4151 5742 9	Aftertreatment diesel particulate filter temperature sensor module	Abnormal update rate
4152 5743 9	Aftertreatment selective catalytic reduction temperature sensor module	Abnormal update rate
4158 5742 12	Aftertreatment diesel particulate filter temperature sensor module	Bad intelligent device or component
4159 5743 12	Aftertreatment selective catalytic reduction temperature sensor module	Bad intelligent device or component
4161 5742 3	Aftertreatment diesel particulate filter temperature sensor module	Voltage above normal, or shorted to high source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
4162 5742 4	Aftertreatment diesel particulate filter temperature sensor module	Voltage below normal, or shorted to low source
4163 5742 16	Aftertreatment diesel particulate filter temperature sensor module	Data valid but above normal operating range
4164 5743 3	Aftertreatment selective catalytic reduction temperature sensor module	Voltage above normal, or shorted to high source
4165 5743 4	Aftertreatment selective catalytic reduction temperature sensor module	Voltage below normal, or shorted to low source
4166 5743 16	Aftertreatment selective catalytic reduction temperature sensor module	Data valid but above normal
4259 5742 11	Aftertreatment diesel particulate filter temperature sensor module	Root cause not known
4261 5743 11	Aftertreatment selective catalytic reduction temperature sensor module	Root cause not known
4262 5571 3	High pressure common rail fuel pressure relief valve	Voltage above normal, or shorted to high source
4263 5571 4	High pressure common rail fuel pressure relief valve	Voltage below normal, or shorted to low source
4265 5571 11	High pressure common rail fuel pressure relief valve	Root cause not known
4277 3364 10	Aftertreatment diesel exhaust fluid quality	Abnormal rate of change
4284 5793 9	Desired engine fueling state	Abnormal update rate
4452 3226 7	Aftertreatment 1 outlet NOx sensor closed loop operation	Condition exists
4484 3667 7	Engine air shutoff	Mechanical system not responding or out of Adjustment
4526 521 2	Brake pedal position	Data erratic, intermittent or incorrect
4572 3031 9	Aftertreatment 1 diesel exhaust fluid tank temperature	Abnormal update rate

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
4584 3936 14	Aftertreatment diesel particulate filter system	Special instructions
4585 4792 14	Aftertreatment 1 SCR catalyst system	Special instructions
4677 1761 9	SAE J1939 multiplexing pgn timeout error	Abnormal update rate
4724 702 5	Auxiliary input/output 2 circuit	Current below normal or open circuit
4725 702 6	Auxiliary input/output 2 circuit	Current above normal or grounded circuit
4731 3031 13	Aftertreatment 1 diesel exhaust fluid tank temperature sensor	Out of calibration
4734 701 14	Auxiliary input/output 1	Special instructions
4737 3031 11	Aftertreatment 1 diesel exhaust fluid tank temperature	Root cause not known
4739 1761 11	Aftertreatment 1 diesel exhaust fluid tank level sensor	Root cause not known
4747 3217 20	Aftertreatment intake oxygen sensor	Data not rational - drifted high
4748 3217 21	Aftertreatment intake oxygen sensor	Data not rational - drifted low
4749 3227 20	Aftertreatment outlet oxygen	Data not rational - drifted high
4751 3227 21	Aftertreatment outlet oxygen	Data not rational - drifted low
4768 3521 11	Aftertreatment 1 diesel exhaust fluid property	Root cause not known
4769 1761 10	Aftertreatment 1 diesel exhaust fluid tank level sensor	Abnormal rate of change
4842 3364 15	Aftertreatment diesel exhaust fluid quality	Data valid but above normal operating range - Least severe level

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
4863 5245 31	Aftertreatment diesel exhaust fluid tank low level indicator	-
4867 5571 31	High pressure common rail fuel pressure relief valve	Condition exists
4953 3353 3	Alternator 1 status	Voltage above normal, or shorted to high source
4954 3353 4	Alternator 1 status	Voltage below normal, or shorted to low source
4956 6713 13	Variable geometry turbocharger actuator software	Out of calibration
4957 6713 31	Variable geometry turbocharger actuator software	Condition exists
5177 6713 9	VGT actuator driver circuit	Abnormal update rate
5248 1623 13	Tachograph output shaft speed	Out of calibration
5292 520809 31	Excessive time since last engine air shutoff maintenance test	Condition exists
5383 3720 15	Aftertreatment 1 diesel particulate filter ash load percent	Data valid but above normal operating range - least severe level
5576 107 15	Engine air filter differential pressure	Data valid but above normal operating range - least severe level
5632 6918 31	SCR system cleaning inhibited due to inhibit switch	Condition exists
5652 1209 15	Exhaust pressure 1	Data valid but above normal operating range - least severe level
5653 6881 9	SCR operator inducement override switch	Abnormal update rate
5654 6881 13	SCR operator inducement override switch	Out of calibration
5655 4364 31	Aftertreatment 1 scr conversion efficiency	Condition exists

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
5689 3226 11	Aftertreatment 1 outlet nox sensor	Root cause not known
5715 3521 10	Aftertreatment 1 diesel particulate filter differential pressure	Abnormal rate of change
5716 3610 10	Aftertreatment 1 diesel particulate filter outlet pressure	Abnormal rate of change
5864 4375 3	Aftertreatment 1 diesel exhaust fluid pump command circuit	Voltage above normal or shorted to high source
5865 4375 4	Aftertreatment 1 diesel exhaust fluid pump command circuit	Voltage below normal or shorted to low source
5866 520953 3	Aftertreatment diesel exhaust fluid dosing unit relay feedback	Voltage above normal or shorted to high source
5867 520953 4	Aftertreatment diesel exhaust fluid dosing unit relay feedback	Voltage below normal or shorted to low source.
5868 4339 7	Aftertreatment 1 scr feedback control status	Mechanical system not responding or out of adjustment
5879 3464 3	Electronic throttle control actuator driver circuit	Voltage above normal or shorted to high source
5881 3464 4	Electronic throttle control actuator driver circuit	Voltage below normal or shorted to low source
5935 4334 7	Aftertreatment 1 diesel exhaust fluid pressure	Mechanical system not responding or out of adjustment
5936 4334 15	Aftertreatment 1 diesel exhaust fluid pressure	Data valid but above normal operating range - least severe level
5938 3750 14	Aftertreatment 1 diesel particulate filter conditions not met for active regeneration	Special instructions
5939 520968 9	Machine constrained operation	Abnormal update rate. No communication or an Invalid data transfer rate has been detected on the J1939 data link between the ECM and the machine
5941 520968 19	Machine constrained operation	Received network data in error. The received J1939 datalink message was not valid.
6256 168 15	Battery 1 voltage	Data valid but below normal operating range - moderately severe level

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
6257 168 17	Battery 1 voltage	Data valid but below normal operating range - moderately severe level
6263 647 3	Fan control circuit	Voltage above normal, or shorted to high source
6264 647 4	Fan control circuit	Voltage below normal, or shorted to low source
6456 5484 3	Engine fan clutch 2 control circuit	Voltage above normal, or shorted to high source
6457 5484 4	Engine fan clutch 2 control circuit	Voltage below normal, or shorted to low source
6467 1639 15	Fan speed	Data valid but above normal operational range - most severe level
6468 1639 17	Fan speed	Data valid but below normal operational range - most severe level
6471 6799 3	Fan blade pitch position sensor circuit	Voltage above normal, or shorted to high source
6472 6799 4	Fan blade pitch position sensor circuit	Voltage below normal, or shorted to low source
6475 3363 7	Aftertreatment 1 diesel exhaust fluid tank heater	Mechanical system not responding or out of adjustment
6476 3363 18	Aftertreatment 1 diesel exhaust fluid tank heater	Data valid but below normal operating range - moderately severe level
6477 5491 3	Aftertreatment diesel exhaust fluid line heater relay	Voltage above normal, or shorted to high source
6478 5491 4	Aftertreatment diesel exhaust fluid line heater relay	Voltage below normal, or shorted to low source
6479 3363 3	Aftertreatment 1 diesel exhaust fluid tank heater	Voltage above normal, or shorted to high source
6481 3363 4	Aftertreatment 1 diesel exhaust fluid tank heater	Voltage below normal, or shorted to low source
6497 51 3	Engine intake throttle actuator position sensor circuit	Voltage above normal, or shorted to high source

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
6498 51 4	Engine intake throttle actuator position sensor circuit	Voltage above normal, or shorted to low source
6499 3597 17	ECU power output supply voltage 1	Data valid but below normal operating range - moderately severe level
6511 6655 3	Maintain ECM power lamp	Voltage above normal, or shorted to high source
6512 6655 4	Maintain ECM power lamp	Voltage below normal, or shorted to low source
6522 111 3	Coolant level sensor 1 circuit	Voltage above normal, or shorted to high source
6523 111 4	Coolant level sensor 1 circuit	Voltage below normal, or shorted to low source
6526 1761 13	Aftertreatment 1 diesel exhaust fluid tank level sensor	Out of calibration
6531 4340 3	Aftertreatment 1 diesel exhaust fluid line heater 1 circuit	Voltage above normal, or shorted to high source
6532 4340 4	Aftertreatment 1 diesel exhaust fluid line heater 1 circuit	Voltage below normal, or shorted to low source
6533 4342 3	Aftertreatment 1 diesel exhaust fluid line heater 2 circuit	Voltage above normal, or shorted to high source
6534 4342 4	Aftertreatment 1 diesel exhaust fluid line heater 2 circuit	Voltage below normal, or shorted to low source
6535 4344 3	Aftertreatment diesel exhaust fluid line heater 3 circuit	Voltage above normal, or shorted to high source
6536 4344 4	Aftertreatment diesel exhaust fluid line heater 3 circuit	Voltage below normal, or shorted to low source
6556 729 3	Engine intake air heater 1 circuit	Voltage above normal, or shorted to high source
6557 729 4	Engine intake air heater 1 circuit	Voltage below normal, or shorted to low source
6563 976 2	Auxiliary intermediate (PTO) speed switch validation	Data erratic, intermittent or incorrect

※ Some fault codes are not applied to this machine.

Fault code J1939 SPN J1939 FMI	Item	Description
6568 3695 2	Aftertreatment regeneration inhibit switch	Data erratic, intermittent or incorrect
6583 441 14	Auxiliary temperature sensor input 1	Special instructions
6584 1388 14	Auxiliary pressure sensor input 2	Special instructions
6595 190 11	Engine speed	Root cause not known
6596 3713 31	Diesel particulate filter active regeneration inhibited due to system timeout	Condition exists
6599 521002 31	Engine cranks slowly	Condition exists
6611 6385 3	Engine starter motor relay control circuit	Voltage above normal or shorted to high source
6612 6385 4	Engine starter motor relay control circuit	Voltage below normal or shorted to low source
6613 5842 14	SCR monitoring system malfunction	Special instructions
6618 70 2	Parking brake switch	Data erratic, intermittent, or incorrect
6619 3515 10	Aftertreatment 1 diesel exhaust fluid temperature 2	Abnormal rate of change
6726 4796 31	Aftertreatment 1 diesel oxidation catalyst missing	Condition exists
6752 3364 18	Aftertreatment diesel exhaust fluid quality	Data valid but below normal operating range - moderately severe level
6771 521032 14	Aftertreatment system assembly	Special instructions
6938 5793 9	Desired engine fueling state	Abnormal update rate
6939 7745 9	Engine start request	Abnormal update rate

※ Some fault codes are not applied to this machine.

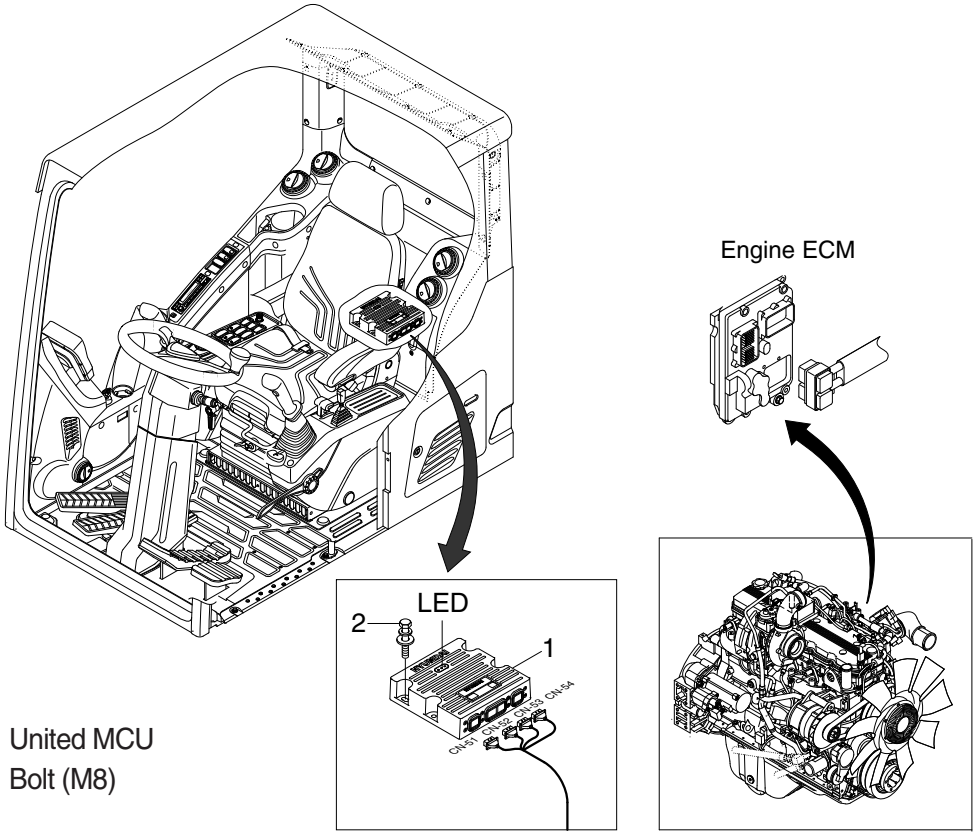
Fault code J1939 SPN J1939 FMI	Item	Description
7133 7745 13	Engine start request	Out of calibration
7134 7746 13	Engine start consent	Out of calibration
7135 103 15	Engine turbocharger speed	Data valid but above normal operating range - least severe level
7745 1569 14	Engine protection torque derate	Special instructions
7393 7745 9	Engine start request	Abnormal update rate
7453 3242 15	Aftertreatment 1 diesel particulate filter intake temperature	Data valid but above normal operating range - least severe level
7454 3246 15	Aftertreatment 1 diesel particulate filter outlet temperature	Data valid but above normal operating range - least severe level

※ Some fault codes are not applied to this machine.

5. AAVM FAULT CODE

Fault Code	Description
A01	AAVM Communication Error -AAVM
A02	AAVM Communication Error -Front Camera
A03	AAVM Communication Error -Rear Camera
A04	AAVM Communication Error -Left Camera
A05	AAVM Communication Error -Right Camera
A06	Manual Setting Fail
A07	No MCU CID
A08	MCU CID Format Error
A09	AAVM Hardware Error -AAVM
A10	AAVM Hardware Error -Front Camera
A11	AAVM Hardware Error -Rear Camera
A12	AAVM Hardware Error -Left Camera
A13	AAVM Hardware Error -Right Camera
A14	MCU CID Model is not registered
A15	MCU CID Model can’t be applied

1. MCU and Engine ECM (Electronic Control Module)



1 United MCU
2 Bolt (M8)

210WA5MS13

2. UNITED MCU ASSEMBLY

1) To match the pump absorption torque with the engine torque, united MCU varies EPPR valve output pressure, which control pump discharge amount whenever feedbacked engine speed drops under the reference rpm of each mode set.

2) Three LED lamps on the united MCU display as below.

LED lamp	Trouble	Service
G is turned ON	Normal	-
G and R are turned ON	Trouble on united MCU	· Change the united MCU
G and Y are turned ON	Trouble on serial communication line	· Check if serial communication lines between united MCU and cluster are disconnected
Three LED are turned OFF	Trouble on united MCU power	· Check if the input power wire (24 V, GND) of united MCU is disconnected · Check the fuse

G : green, R : red, Y : yellow

GROUP 14 EPPR VALVE

1. PUMP EPPR VALVE

1) COMPOSITION

EPPR (Electro Proportional Pressure Reducing) valve consists of electro magnet and spool valve installed at main pump.

(1) Electro magnet valve

Receive electric current from united MCU and move the spool proportionally according to the specific amount of electric current value.

(2) Spool valve

Is the two way direction control valve for pilot pressure to reduce main pump flow.
When the electro magnet valve is activated, pilot pressure enters into flow regulator of main pump.

2) HOW TO SWITCH THE POWER SHIFT (STANDARD ↔ OPTION) ON THE CLUSTER

You can switch the EPPR valve pressure set by selecting the power shift (standard ↔ option).

- Management
  · Service menu

140WA3CD127

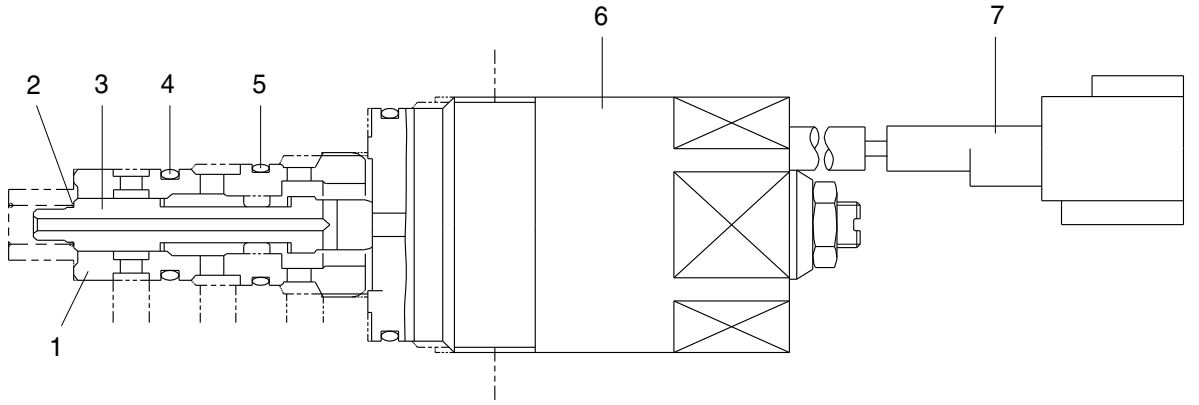
Enter the password 140WA3CD128

140WA3CD129

· Power shift (standard/option) : Power shift pressure can be set by option menu.

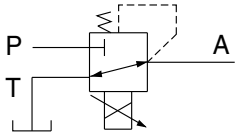
3) OPERATING PRINCIPLE (pump EPPR valve)

(1) Structure



5-22(1)

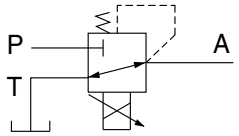
1	Sleeve	4	O-ring	6	Solenoid valve
2	Spring	5	O-ring	7	Connector
3	Spool				

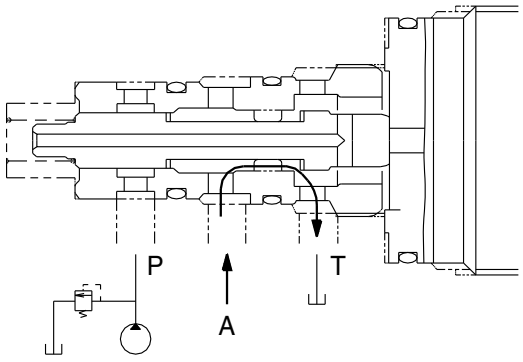


P Pilot oil supply line (pilot pressure)
T Return to tank
A Secondary pressure to flow regulator at main pump

(2) Neutral

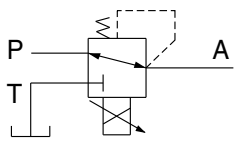
Pressure line is blocked and A oil returns to tank.

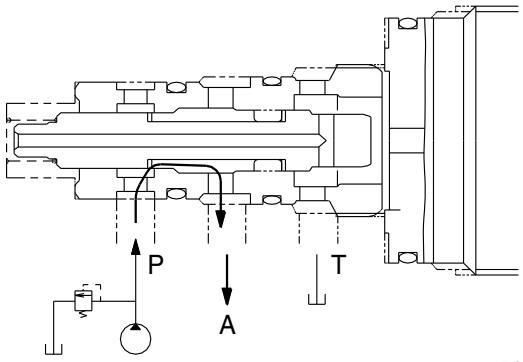




(3) Operating

Secondary pressure enters into A.





5-22(2)

4) EPPR VALVE CHECK PROCEDURE

(1) Check electric current value at EPPR valve

① Disconnect connector CN-342 (or 343) from EPPR valve.

② Insert the adapter to CN-342 (or 343) and install multimeter as figure.

③ Start engine.

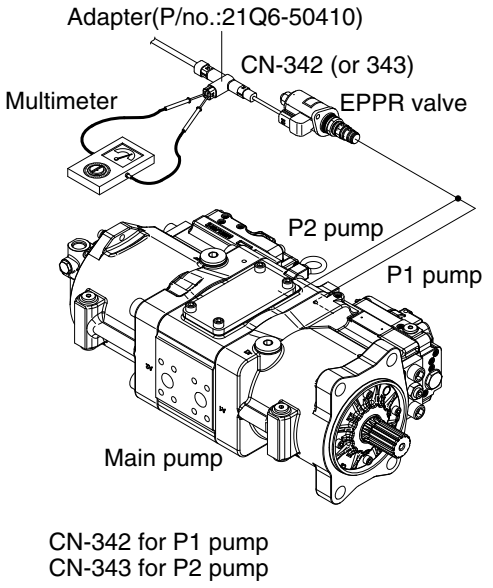
④ Set S-mode and cancel auto decel mode.

⑤ Position the multimodal dial at 10.

⑥ If rpm display show approx 1500±50 rpm check electric current at bucket circuit relief position.

⑦ Check electric current at bucket circuit relief position.

Spec : 100~700 mA



CN-342 for P1 pump
CN-343 for P2 pump

210WA5MS21

(2) Check pressure at EPPR valve

① Remove plug and connect pressure gauge as figure.
- Gauge capacity : 0 to 50 kgf/cm² (0 to 725 psi)

② Start engine.

③ Set S-mode and cancel auto decel mode.

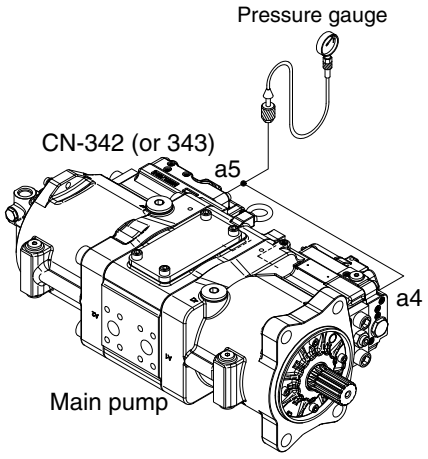
④ Position the multimodal dial at 10.

⑤ If tachometer show approx 1500±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.

⑥ If pressure is not correct, adjust it.

⑦ After adjust, test the machine.

Spec : 2~25 kgf/cm² (30~350 psi)



a4 for P1 pump
a5 for P2 pump

210WA5MS22

2. BOOM PRIORITY EPPR VALVE

1) COMPOSITION

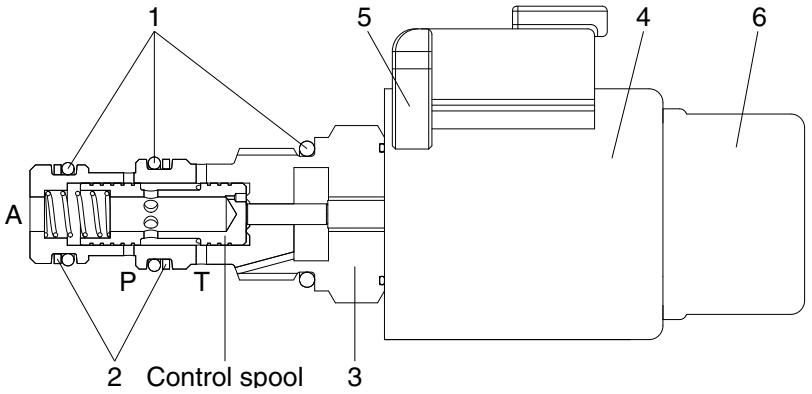
The boom priority EPPR valve is built in a manifold and mainly consisting of valve body and coil. This EPPR valve installed under the solenoid valve.

2) CONTROL

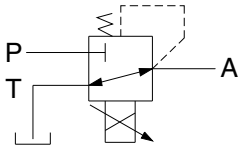
The boom priority EPPR valve has to be controlled by a specific electronic amplifier card, which is supplying the coil with a current 580 mA at 30Ω and 24 V.

3) OPERATING PRINCIPLE

(1) Structure



21095MS14



P : Pilot supply line
T : Return to tank
A : Secondary pressure to flow MCV

1	O-ring	3	Valve body	5	Connector
2	Support ring	4	Coil	6	Cover cap

(2) Operation

In de-energized mode the inlet port (P) is closed and the outlet port (A) is connected to tank port (T).

In energized mode the solenoid armature presses onto the control spool with a force corresponding to the amount of current. This will set a reduced pressure at port A. The setting is proportional to the amount of current applied.

(3) Maximum pressure relief

If a pressure from outside is applied on port A the valve may directly switch to tank port (T) and protect the system before overload.

2) EPPR VALVE CHECK PROCEDURE

(1) Check electric current value at EPPR valve

① Disconnect connector CN-133 from EPPR valve.

② Insert the adapter to CN-448 (or 449) and install multimeter as figure.

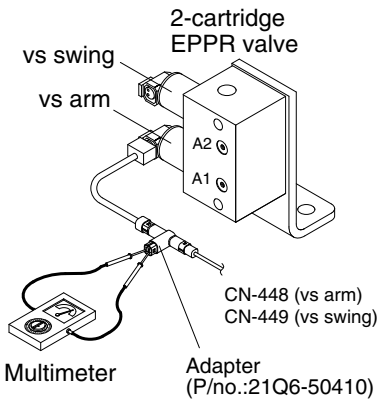
③ Start engine.

④ Set S-mode and cancel auto decel mode.

⑤ If rpm display approx 1500±50 rpm disconnect one wire harness from EPPR valve.

⑥ Check electric current in case of combined boom up and swing operation.

Spec : 400~600 mA
(combined boom up and swing operation)



210WA5MS15

(2) Check pressure at EPPR valve

① Remove hose from A1 (or A2) port and connect pressure gauge as figure.
· Gauge capacity : 0 to 50 kgf/cm² (0 to 725 psi)

② Start engine.

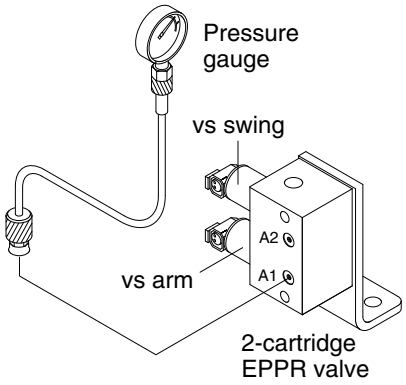
③ Set S-mode and cancel auto decel mode.

④ If rpm display approx 1500±50 rpm check pressure (In case of combined boom up and swing operation).

⑤ If pressure is not correct, adjust it.

⑥ After adjust, test the machine.

Spec : 12~37 kgf/cm² (170~530 psi)
(combined boom up and swing operation)



210WA5MS16

GROUP 15 MONITORING SYSTEM

1. OUTLINE

Monitoring system consists of the monitor part and switch part.

The monitor part gives warnings when any abnormality occurs in the machine and informs the condition of the machine. Also, monitor part is to set and display for modes, monitoring and utilities with the switches.

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

210WA5MS25

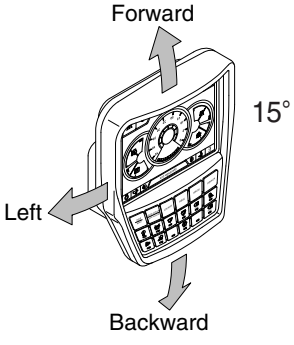
※ The warning lamp pops up and/or blinks and the buzzer sounds when the machine has a problem.

The warning lamp lights up or blinks until the problem is cleared. Refer to page 5-75 for details.

※ This cluster is adjustable.

· Vertical (forward/backward) : each 15°

· Horizontal (left only) : 15°



290F3CD47

2) CLUSTER CHECK PROCEDURE

(1) Start key : ON

① Check monitor

a. Buzzer sounding for 4 seconds with HYUNDAI logo on cluster.

※ If the ESL mode is set to the enable, enter the password to start engine.

② After initialization of cluster, the operating screen is displayed on the LCD.
Also, self diagnostic function is carried out.

a. Engine rpm display : 0 rpm
b. Engine coolant temperature gauge : White range
c. Hydraulic oil temperature gauge : White range
d. Fuel level gauge : White range
e. DEF/AdBlue® Level gauge : White range

③ Indicating lamp state

a. Power mode pilot lamp : E mode or U mode
b. Work mode pilot lamp : General operation mode (bucket)
c. Travel speed pilot lamp : Low (turtle)

(2) Start of engine

① Check machine condition

a. RPM display indicates at present rpm
b. Gauge and warning lamp : Indicate at present condition.

※ When normal condition : All warning lamp OFF

c. Work mode selection : General work
d. Power mode selection : E mode or U mode
e. Travel speed pilot lamp : Low (turtle)

② When warming up operation

a. Warming up pilot lamp : ON
b. After engine started, engine speed increases to1000 rpm.

※ Others same as above.

③ When abnormal condition

a. The warning lamp pops up and the buzzer sounds.
b. If BUZZER STOP switch is pressed, buzzer sound is canceled but the warning lamp lights up or blinks until normal condition.

※ The pop-up warning lamp moves to the original position and warning lamp lights up or blinks when the buzzer stop switch is pushed. Also the buzzer stops.

※ Refer to page 5-90 for details.

3) CLUSTER CONNECTOR

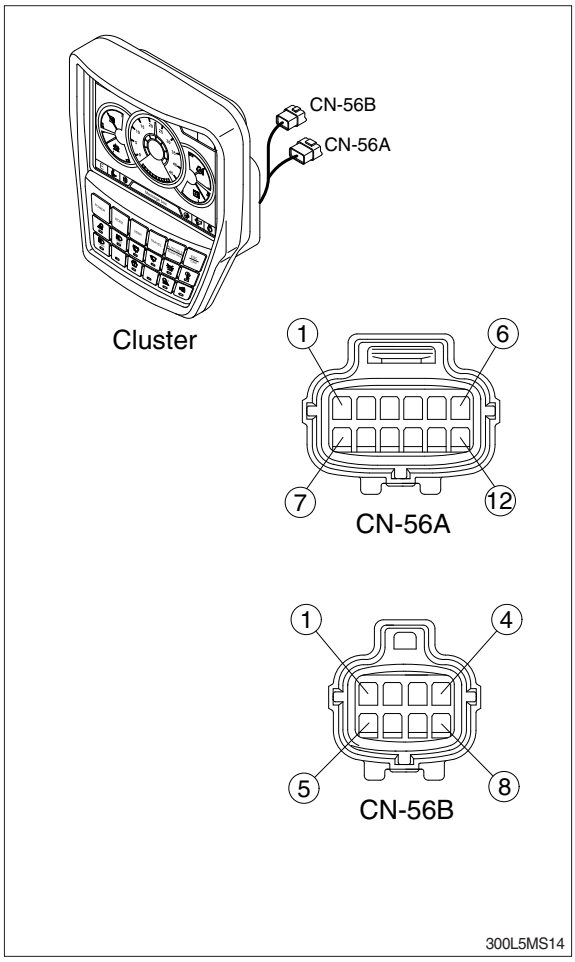
(1) CN-56A

No.	Name	Signal
1	Battery 24V	20~32V
2	Power IG (24V)	20~32V
3	GND	-
4	CAN 1 (H)	0~5V
5	CAN 1 (L)	0~5V
6	CAN 2 (H)	0~5V
7	CAN 2 (L)	20~32V
8	N.C	-
9	N.C	-
10	Aux left	0~5V
11	Aux right	0~5V
12	Aux GND	-

(2) CN-56B

No.	Name	Signal
1	CAM 6.5V	6.3~6.7V
2	CAM GND	-
3	CAM DIFF (H)	0~5V
4	CAM DIFF (L)	0~5V
5	CAM 1	NTSC SIG
6	CAM 2	NTSC SIG
7	CAM 3	NTSC SIG
8	CAM SHIELD	0~5V

NTSC : National Television System Committee



4) GAUGE

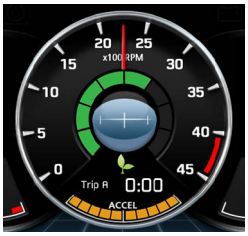
(1) Operation screen

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

140WA3CD11

1	RPM / Speed gauge	5	DEF/AdBlue® level gauge
2	Engine coolant temperature gauge	6	Tripmeter display
3	Hydraulic oil temperature gauge	7	Eco guage
4	Fuel level gauge	8	Accel dial gauge

(2) RPM / Speed gauge



300A3CD22

① This displays the engine speed.

140WA3CD22

② When traveling, the speed gauge is displayed.

(3) Engine coolant temperature gauge

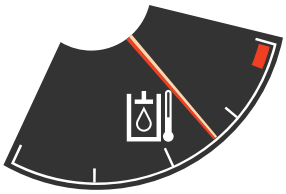
290F3CD53

① This gauge indicates the temperature of coolant.
- White range : 40-107˚C (104-225˚F)
- Red range : Above 107˚C (225˚F)

② If the indicator is in the red range or lamp pops up and the buzzer sounds, turn OFF the engine and check the engine cooling system.

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

(4) Hydraulic oil temperature gauge



290F3CD54

① This gauge indicates the temperature of hydraulic oil.
- White 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 pops up and the buzzer sounds 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 blinks in red even though the machine is in the normal condition range, check the electric device as this can be caused by poor connection of electricity or sensor.**

(5) Fuel level gauge

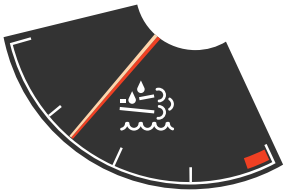
290F3CD55

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

② Fill the fuel when in the red range, or lamp pops up and the buzzer sounds.

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

(6) DEF/AdBlue® Level gauge



290F3CD57

① This gauge indicates the amount of liquid in the DEF/AdBlue® tank.

② Fill the DEF/AdBlue® when in the red range, or lamp pops up and the buzzer sounds.

③ Do not overfull DEF/AdBlue®.

※ **Refer to page 5-80.**

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

(7) Tripmeter display

290F3CD56

① This displays the engine the tripmeter.

※ **Refer to page 5-109 for details.**

(8) Eco gauge

290F3CD58

① This gauge indicates the fuel consumption rate and machine load status so that the operators can operate the machine efficient in regards to fuel consumption.

② Fuel consumption rate or machine load is higher if the number of segments are increased.

③ The color of Eco gauge indicates operation status.

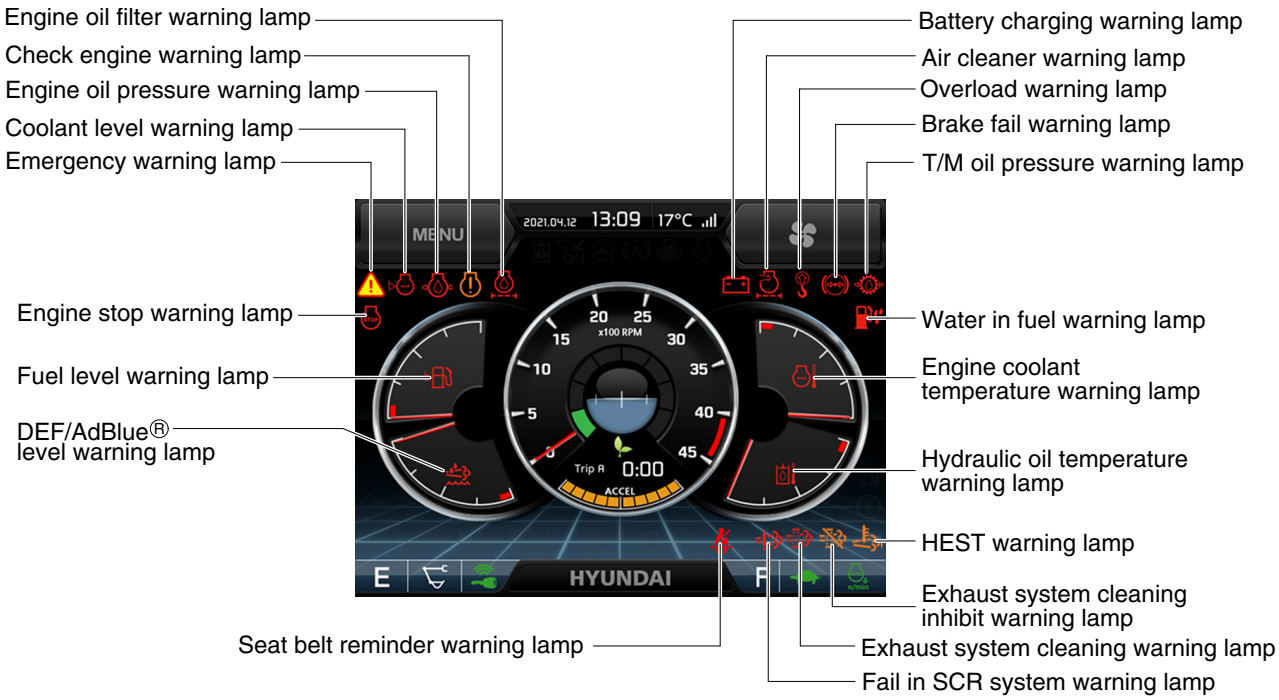
- White : Idle operation
- Green : Economy operation
- Yellow : Non-economy operation at a medium level.
- Red : Non-economy operation at a high level.

(9) Accel dial gauge

290F3CD59

① This gauge indicates the level of accel dial.

5) WARNING LAMPS



140WA3CD20

※ **Warning lamps and buzzer**

Warnings	When error happened	Lamps and buzzer
All warning lamps except below	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position, blinks and the buzzer stops when; - the buzzer stop switch AUTO IDLE Buzzer Stop is pushed - the knob of the jog dial module is pushed - the lamp of the LCD is touched
	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position, lights up or blinks and the buzzer stops when; - the buzzer stop switch AUTO IDLE Buzzer Stop is pushed - the knob of the jog dial module is pushed - the lamp of the LCD is touched **※ Refer to page 5-80 for details.**
	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position, lights up and the buzzer stops after 2 seconds elapses.
	Warning lamp pops up on the center of the LCD and the buzzer sounds	· The pop-up warning lamp moves to the original position, blinks and the buzzer stops after 2 seconds elapses.
	Warning lamp pops up on the center of the LCD and the buzzer sounds	· Cluster displays this pop-up when it has communication error with MCU. · If communication with MCU become normal state, it will disappear automatically.
	Warning lamp pops up on the center of the LCD and the buzzer sounds	**※ Refer to page 5-76 for details.**
	Warning lamp lights up and the buzzer sounds	**※ Refer to page 5-80 for details.**

※ **Refer to page 5-90 for the buzzer stop switch AUTO IDLE Buzzer Stop and the operator's manual page 3-77 for the jog dial module.**

(1) Engine coolant temperature warning lamp

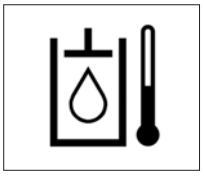
290F3CD61

① Engine coolant temperature warning is indicated in 2 steps.
- 103˚C over : The lamp pops up and the buzzer sounds.
- 107˚C over : The lamp pops up and the buzzer sounds.

② The pop-up , lamps move to the original position and blinks when the buzzer stop switch AUTO IDLE Buzzer Stop is pushed. The buzzer will stop and , lamps will blink.

③ Check the cooling system when the lamps keep blinking.

(2) Hydraulic oil temperature warning lamp



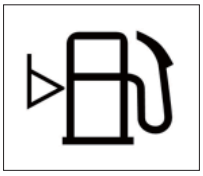
290F3CD62

① Hydraulic oil temperature warning is indicated in 2 steps.
- 100˚C over : The lamp pops up and the buzzer sounds.
- 105˚C over : The lamp pops up and the buzzer sounds.

② The pop-up , lamps move to the original position and blinks when the buzzer stop switch AUTO IDLE Buzzer Stop is pushed. The buzzer will stop and , lamps will blink.

③ Check the hydraulic oil level and hydraulic cooling system.

(3) Fuel level warning lamp



290F3CD63

① This warning lamp pops up and the buzzer sounds when the fuel level is below 58 ℓ (15.3 U.S. gal).

② Fill the fuel immediately after the lamp blinks.

(4) Emergency warning lamp

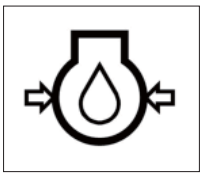
290F3CD64

① This warning lamp pops up and the buzzer sounds when each of the below warnings occurs.
- Engine coolant overheating (over 107˚C)
- Hydraulic oil overheating (over 105˚C)
- MCU input voltage abnormal
- Cluster communication data error
- Engine ECM communication data error

※ The pop-up warning lamp moves to the original position and blinks when the buzzer stop swit AUTO IDLE Buzzer Stop is pushed. The buzzer will stop.

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

(5) Engine oil pressure warning lamp



290F3CD65

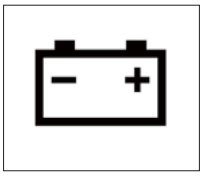
① This warning lamp pops up and the buzzer sounds when the engine oil pressure is low.
② If the lamp lights ON, shut OFF the engine immediately. Check oil level.

(6) Check engine warning lamp

290F3CD66

① This warning lamp pops up and the buzzer sounds when the communication between MCU and engine ECM is abnormal, or if the cluster received specific fault code from the engine ECM.
② Check the communication line between the two.
If the communication line is OK, then check the fault codes on the cluster.

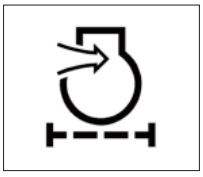
(7) Battery charging warning lamp



290F3CD67

① This warning lamp pops up and the buzzer sounds when the battery charging voltage is low.
② Check the battery charging circuit when this lamp blinks.

(8) Air cleaner warning lamp



290F3CD68

① This warning lamp pops up and the buzzer sounds when the air cleaner is clogged.
② Check, clean or replace filter.

(9) Overload warning lamp (opt)

290F3CD69

① When the machine is overloaded, the overload warning lamp pops up and the buzzer sounds when the overload switch is ON. (if equipped)
② Reduce the machine load.

(10) Engine stop warning lamp

290F3CD252

① This warning lamp pops up and the buzzer sounds after 30 minutes of run time elapses, when the DEF/AdBlue® tank has reached it's minimum level. Stop engine immediately and check actual DEF/AdBlue® level.

② Fill the DEF/AdBlue® immediately.

※ Refer to page 5-80.

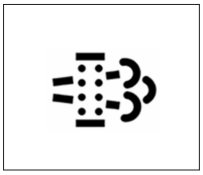
③ This lamp pops up and the buzzer sounds when the maual (stationary) exhuast system cleaning is not performed.

※ Refer to page 5-78.

※ Please contact your HD Hyundai Construction Equipment service center or local dealer.

※ "Engine shutdown" cluster message pops up when the exhaust gas temperature reaches above 800℃.

(11) Exhaust system cleaning warning lamp

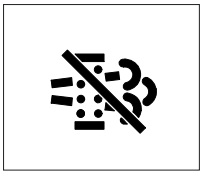


290F3CD70A

① This warning lamp lights up or blinks when exhaust system cleaning is needed as seen in the table below.

Warning lamp			Description
Exhaust 	Check engine 	Stop engine 	
Off	Off	Off	· Automatic exhaust system cleaning
Blink	Off	Off	· The status of a manual (stationary) exhaust system cleaning when the exhaust system cleaning switch has been activated. ※ Refer to page 5-79.
On	On	Off	· The aftertreatment exhaust system needs to be cleaned immediately. · Engine power will be reduced automatically if action is not taken. ※ The exhaust system cleaning can be accomplished by: - Changing to a more challenging duty cycle. - Performing a manual (stationary) exhaust system cleaning.
On	On	On	· These lamps will be ON when a manual (stationary) exhaust system cleaning is not performed. · Stop the engine immediately. · Please contact your HD Hyundai Construction Equipment service center or local dealer.

(12) Exhaust system cleaning inhibit warning lamp

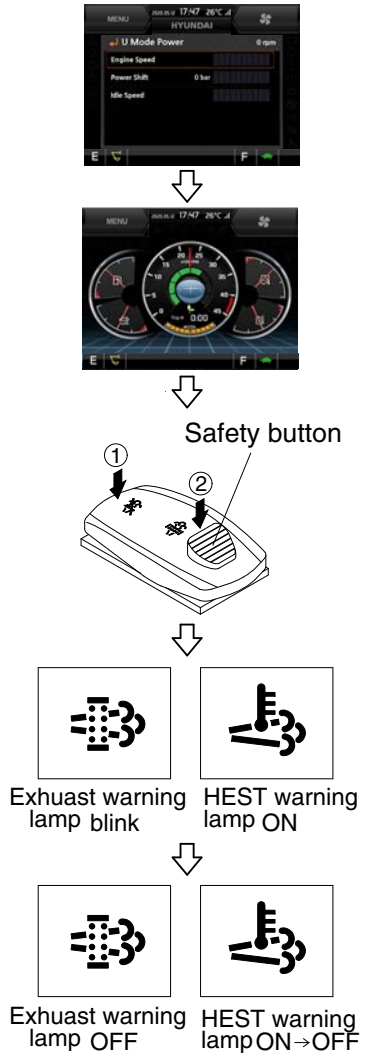


2609A3CD201

① This warning lamp indicates the exhaust system cleaning switch is pushed to the inhibit position, therefore automatic and manual exhaust system cleaning can not occur.

※ Refer to the operator's manual page 3-46 for the exhaust system cleaning switch.

※ Manual exhaust system cleaning



140WA3CD202

※ Manual exhaust system cleaning must be operated in a fireproof area.

※ To stop a manual exhaust system cleaning before it has completed, set to the exhaust system cleaning switch to the inhibit position or turn OFF the engine.

① Stop and park the machine.

② Pull the safety button and push the switch to position ② to initiate the manual exhaust system cleaning.

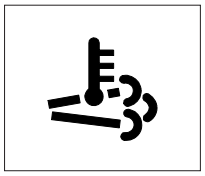
※ Refer to the operator's manual page 3-47 for the exhaust system cleaning switch operation.

※ The engine speed may increase to 950~1050 rpm and exhaust system cleaning begins and it will take approximately 20~30 minutes.

③ The exhaust system cleaning warning lamp will blink and HEST warning lamp will light up during the exhaust system cleaning operation.

④ The exhaust system cleaning and/or HEST warning lamp light will go off when the exhaust system cleaning is completed.

(13) HEST (High exhaust system temperature) warning lamp



2609A3CD211A

① This warning lamp indicates, when illuminated, that exhaust temperatures are high due to exhaust system cleaning.

② The lamp will also illuminate during a manual exhaust system cleaning.

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 800˚C [1500˚F], which is hot enough to ignite or melt common materials, and to burn people.

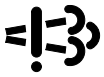
※ The lamp does not signify the need for any kind of equipment or engine service; It merely alerts the equipment operator to high exhaust temperatures. It is common for the lamp to illuminate on and off during normal equipment operation as the engine completes exhaust system cleaning cycles.

(14) DEF/AdBlue® level warning lamp

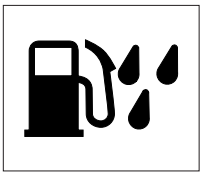
290F3CD257A

① This warning lamp when ON or blinking, indicates that the DEF/AdBlue® level is low as per the table below.

※ **It is recommended that the DEF/AdBlue® tank be filled completely full of the DEF/AdBlue® in order to correct any fault conditions.**

Warning lamp				Description
Fail in SCR system 	DEF/AdBlue® level 	Check engine 	Stop engine 	
On	On	Off	Off	· The DEF/AdBlue® level has fallen below the initial warning level (10%).
On	On	On	Off	· The DEF/AdBlue® level has fallen below the initial derate level (2.5%). · The engine power will be limited automatically.
On	Blink	On	On	· This happens when 30 minutes has elapsed with empty conditions (0%) of the DEF/AdBlue® tank. · The engine will enter the final derate level which may include low idle lock or engine shutdown with restart limitations. · In order to remove the final derate, the DEF/AdBlue® tank must be filled to above 10% gauge reading.

(15) Water in fuel warning lamp



300A3CD24A

① This warning lamp lights up and the buzzer sounds when the water separator is full of water or malfunctioning.

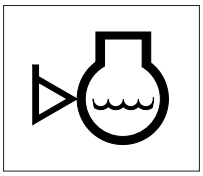
※ **When this lamp lights up, stop the machine and drain water from the separator.**

(16) Seat belt reminder warning lamp

300A3CD25

① When operator does not fasten the operator's the seat belt, the seat belt reminder warning lamp pops up and the buzzer
② sounds.
Fasten the seat belt.

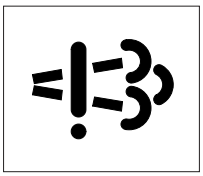
(17) Coolant level warning lamp



760F3CD58

① This warning lamp indicates lack of coolant.
② Check and refill coolant.

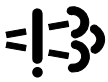
(18) Fail in SCR system warning lamp



300A3CD15

① This warning lamp indicates there are faults related to SCR system.
② The lamp lights up when each of the below warnings is happening.
a. Low DEF/AdBlue® level
b. Poor quality of DEF/AdBlue®
c. Tempering or malfunction in the aftertreatment system
③ Once the lamp lights up, the engine will derate soon.

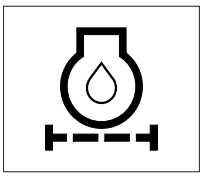
※ Please contact your HD Hyundai Construction Equipment service center or local dealer.

Warning lamp		Torque reduction
	Time	
On	Fault detected	-
On	After 2 h 30 min	· Torque is reduced to 75% of the highest torque.
Blink	After 3 h 45 min	· Torque is reduced to 50% of the highest torque.
Blink rapidly	After 4 hours	· Torque is reduced to 0% (low idling) of the hightest torque within 2~10 min.

※ If a new fault ocuurs within 40 hours of operation since the first fault, the warning lamp will light up. After 3 hours of operation, the warning lamp will blink rapidly and torque will be reduced to 0% (low idling) within 2~10 minutes.

※ Once the fault has been remedied and the engine control unit has received an indication that it is working, torque returns to the normal level.

(19) Eninge oil filter warning lamp



300A3CD306

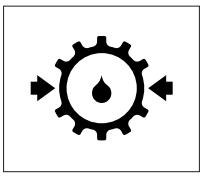
① This warning lamp pops up and the buzzer sounds when the filter of eninge oil is clogged.
② Check, clean or replace filter.

(20) Brake fail warning lamp

140WA3CD95

① This lamp blinks when the oil pressure of service brake drops below the normal range.
② Stop the engine and check for its cause.
※ Do not operate until any problems are corrected.

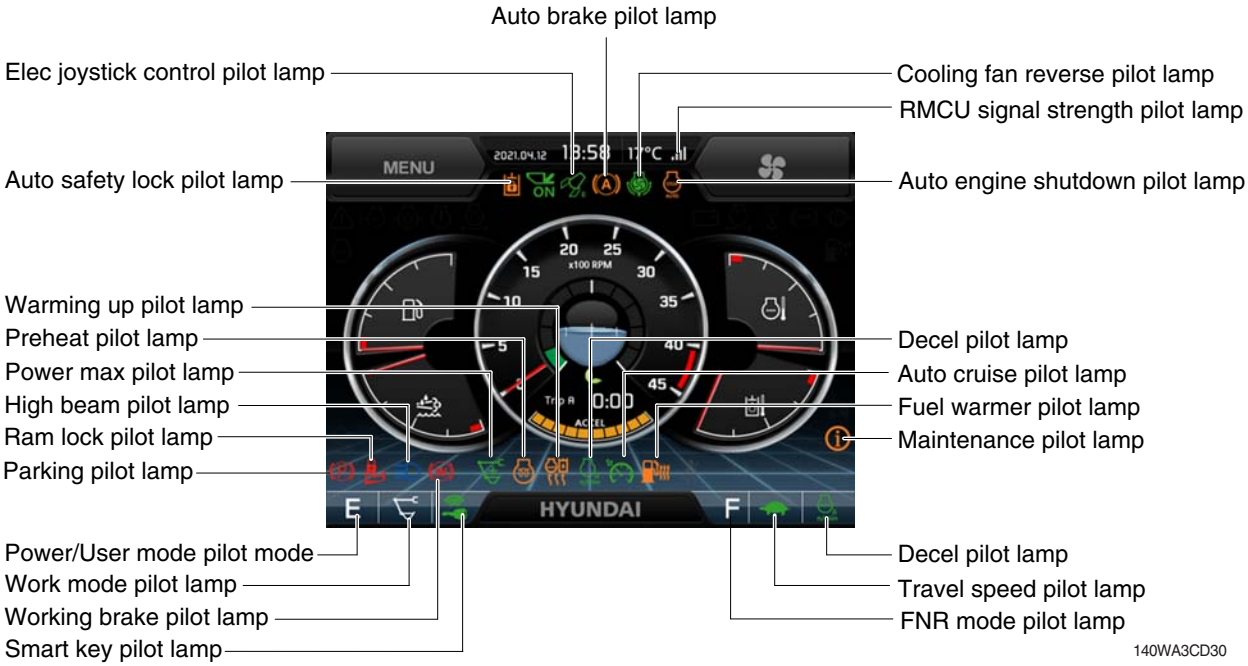
(21) T/M oil pressure warning lamp



140WA3CD96

① This lamp blinks when the oil pressure of the transmission drops.
② Stop the engine and check the transmission system.

6) PILOT LAMPS



(1) Mode pilot lamps

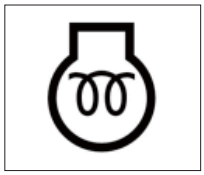
No	Mode	Pilot lamp	Selected mode
1	Power mode	P	Heavy duty power work mode
		S	Standard power mode
		E	Economy power mode
2	User mode	U	User preferable power mode
3	Work tool mode		General operation - IPC speed mode
			General operation - IPC balance mode
			General operation - IPC efficiency mode
			Breaker operation mode
			Crusher operation mode
			Lifting mode
4	Travel mode		Creep mode traveling
			Low speed traveling
			High speed traveling
5	Auto idle mode		Auto idle

(2) Power max pilot lamp

300A3CD32

① The lamp will be ON when pushing power max switch on the LH RCV lever.
② The power max function operates for a max period of 8 seconds.
※ **Refer to the operator's manual page 3-53 for power max function.**

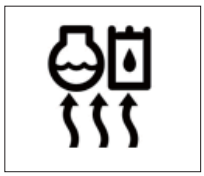
(3) Preheat pilot lamp



290F3CD79

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

(4) Warming up pilot lamp



290F3CD80

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

(5) Decel pilot lamp

300A3CD33

① Operating one touch decel switch on the RCV lever makes the lamp light up.
② Also, the lamp will light up and engine speed will be reduced automatically to save fuel when all levers and pedals are in the neutral position, and the auto idle function is selected.
③ If it follows the case below, decel goes off in the idle state.
- Auto idle button off
- Working/Travel
- One touch decel button off
- Safety knob unlock

※ **Refer to the operator's manual page 3-53.**

(6) Fuel warmer pilot lamp

300A3CD34

① This lamp lights up when the coolant temperature is below 10℃ (50°F) or the hydraulic oil temperature is 20℃ (68°F).
② The automatic fuel warming is cancelled when the engine coolant temperature is above 60℃ (140°F), and the hydraulic oil temperature is above 45℃ (113°F) since the start switch was ON position.

(7) Maintenance pilot lamp

300A3CD35

① This lamp lights up when consumable parts are in need of replacement. It means that the change or replacement interval of parts is 30 hours from the required change interval.

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

※ **Refer to page 5-102.**

(8) RMCU signal strength pilot lamp (mobile only)

220A3CD200

① This lamp indicates RMCU signal strength as below.

- : Searching
- : Bad
- : Normal
- : Good
- : Excellent

(9) Smart key pilot lamp (opt)

300A3CD36A

① This lamp lights up when the engine is started by the start button.

② This lamp is red when the a authentication fails, it will be green when it authentication is successful.

※ **Refer to the page 5-103.**

(10) Auto safety lock pilot lamp

140WA3CD37

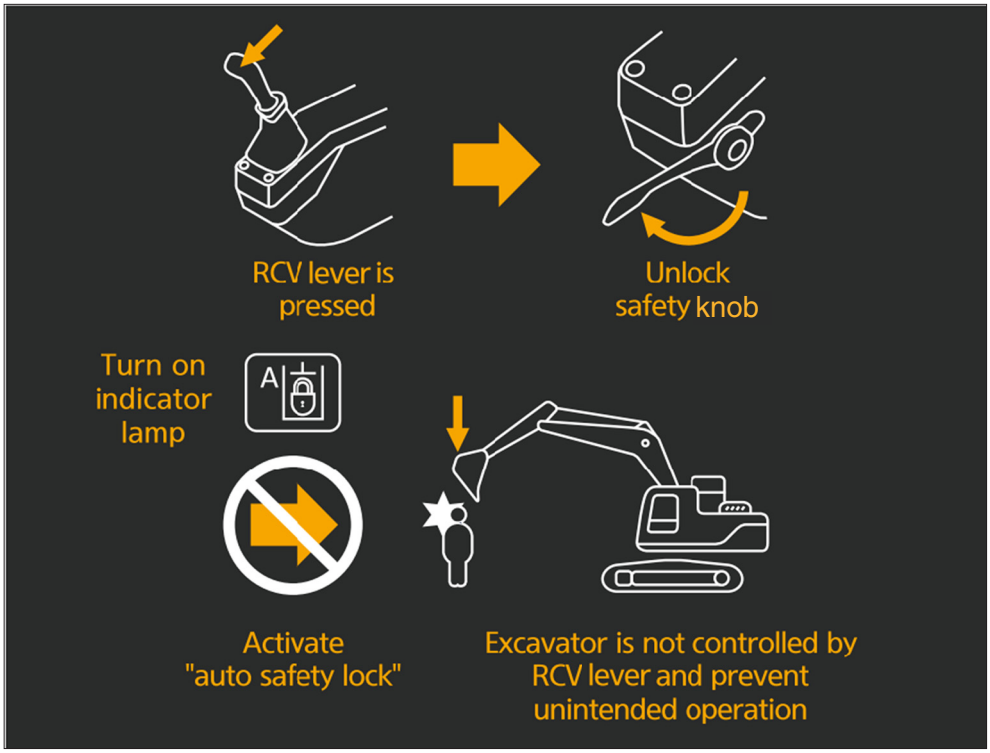
① Auto safety lock system prevents unintended operation of the machine in order to improve safety.

② Engine will only start if safety knob is locked.

③ If operator unlocks safety knob when RCV lever is pressed, machine is not controlled by RCV lever.

⚠ **If operator unlocks safety knob while any control/function is being operated, the machine will move violently. This could cause serious injury, death or damage to property.**

④ The function is released only by turning the safety knob to the UNLOCK position and the LOCK position again.



300A3CD38A

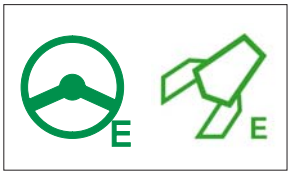
(11) Auto engine shutdown pilot lamp

220A3CD202A

① This lamp lights up when the auto engine shutdown is activated.

※ **Refer to page 5-97.**

(12) Elec joystick control pilot lamp



140WA3CD649 140WA3CD637

① This lamp lights up when the joystick steering is ready to operate.

※ **Refer to the operator's manual page 3-59.**

(13) Auto brake pilot lamp

140WA3CD33

① This lamp lights up in amber when the auto digging brake is ready to operate.

② This lamp lights up in green when the auto digging brake is operating.

※ **Refer to the operator's manual page 3-49.**

(14) Cooling fan reverse pilot lamp

140WA3CD647

① This lamp lights up when the cooling fan reverse function is activated.

※ **Refer to page 5-98.**

(15) FNR mode pilot lamp

140WA3CD631

① This lamp indicates the selection of the FNR switch on the RH RCV lever.

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

(16) FNR mode pilot lamp (emergency)

140WA3CD634

① This lamp indicates the selection of the FNR switch on the switch board when when the FNR switch on the RH RCV lever is failed.

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

(17) Ram lock pilot lamp

210WF3CD04

① This lamp lights up when the ram lock switch is set to the LOCK position.

※ **Refer to the operator's manual page 3-52.**

(18) Parking pilot lamp

210WF3CD05

① This lamp lights up when the the parking switch is set to the parking position.

※ **Refer to the operator's manual page 3-52.**

(19) High beam pilot lamp

210WF3CD06

① The lamp lights up when the head lamp switch is set to the high beam position.

② When passing other machines ahead, this lamp must be used for a few seconds to give other machines warning for a few seconds.

(20) Working brake pilot lamp

210WF3CD07

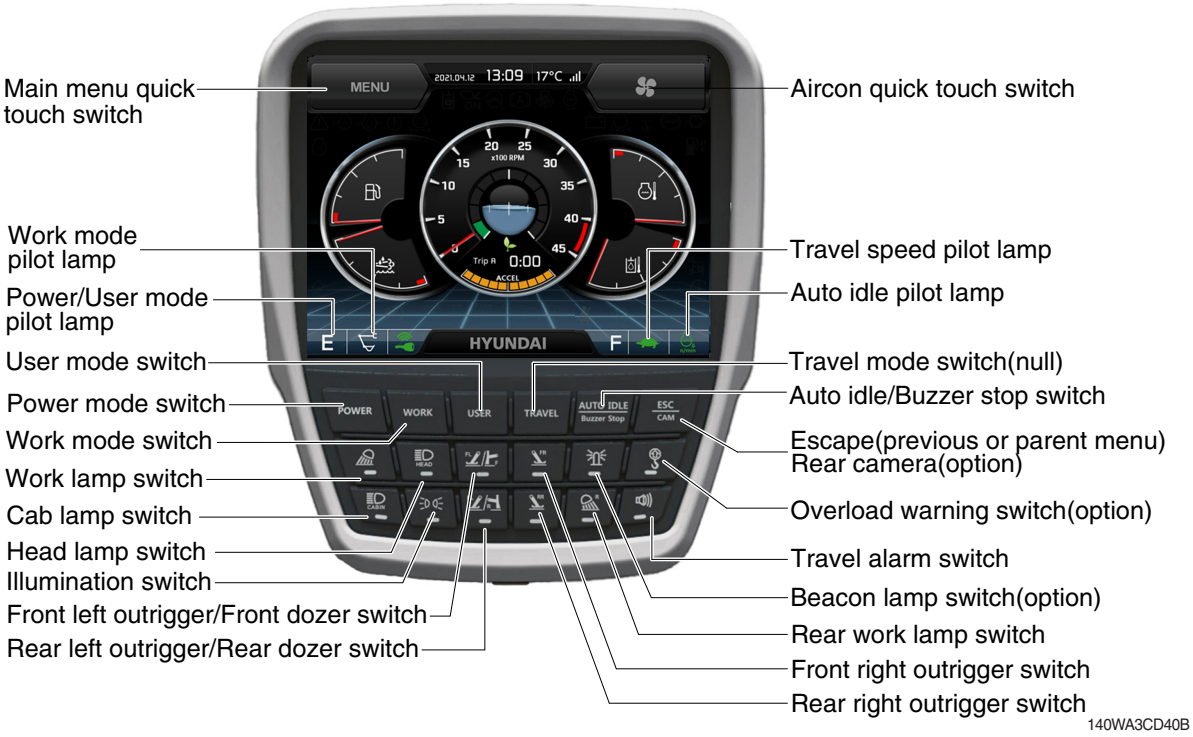
① This lamp lights up when the working brake switch is set to working position.

※ **Refer to the operator's manual page 3-52.**

(21) Engine rpm state

Function	Safety Knob	Auto Idle Mode 	One Touch Decel 	RPM State
State 1	Unlock	OFF	OFF	High rpm
State 2	Unlock	OFF	**ON**	Low rpm
State 3	Unlock	**ON**	OFF	Auto Idle rpm
State 4	Lock	**ON**	OFF	Low rpm
State 5	Lock	OFF	**ON**	Low rpm
State 6	Unlock	**ON**	**ON**	Low rpm
State 7	Lock → Unlock	**ON**	**ON**	Low → High → Low rpm (few seconds later)
State 8	Lock	**ON**	OFF	Low rpm
State 9	Lock	**ON**	**ON**	Low rpm

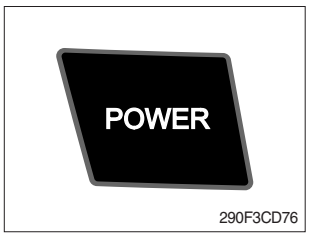
7) SWITCHES



140WA3CD40B

※ **When some of the switches are selected, the pilot lamps are displayed on the LCD. Refer to page 5-83 for details.**

(1) Power mode switch

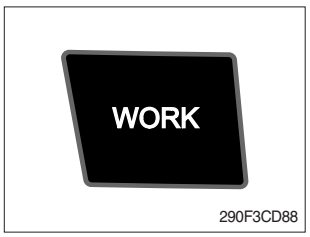


290F3CD76

① This switch is to select the machine power mode and when pressed, the power mode pilot lamp will be displayed on the section of the monitor.
- P : Heavy duty power work.
- S : Standard power work.
- E : Economy power work.

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

(2) Work mode switch



290F3CD88

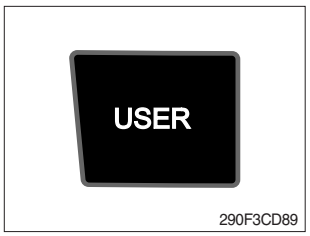
① This switch is to select the machine work mode, which shifts from general operation mode to optional attachment operation mode.
- : General operation mode
- : Breaker operation mode (if equipped)
- : Crusher operation mode (if equipped)
- : Lifting mode
- Not installed : Breaker or crusher is not installed.

※ **Refer to the operator's manual page 2-7 for details.**

300A3CD168

② If you press this switch for a time (1 second), quick pop-up will appear. When you select an attachment from the popup, the operation mode will immediately switch to selected attachment.

(3) User mode switch



① This switch is used to select the user mode.
② Refer to page 5-95 for another set of the user mode.

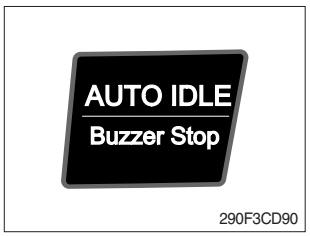
(4) Travel speed switch (null)

① This switch is used to select the travel speed alternatively.
- : Low speed
- : High speed

※ Do not change the setting of the travel speed switch while machine is moving. Machine stability may be adversely affected.

⚠ Serious injury or death can result from sudden changes in machine stability.

(5) Auto idle/ buzzer stop switch



① This switch is used to activate or cancel the auto idle function.
- Pilot lamp ON : Auto idle function is activated.
- Pilot lamp OFF : Auto idle function is cancelled.

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.

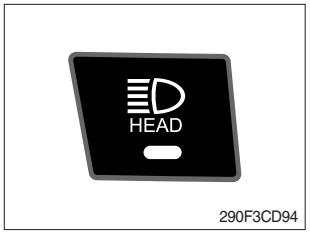
(6) Escape/Camera switch

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 5-109 for the camera.
③ If the camera is not installed, this switch is used only ESC function.

(7) Work light switch

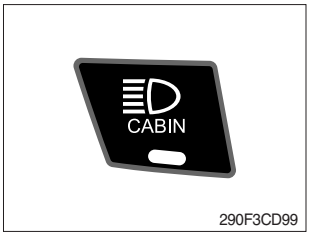
① This switch is used to operate the work light.
② The pilot lamp lights up when this switch is pressed.

(8) Head light switch



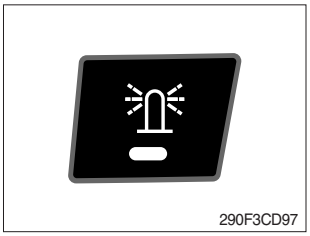
① This switch is used to operate the head light.
② The pilot lamp lights up when this switch is pressed.

(9) Cab light switch



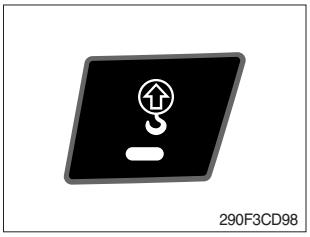
① This switch turns on the cab light.
② The pilot lamp lights up when this switch is pressed.

(10) Beacon switch (opt)



① This switch activates the rotary light on the cab.
② The pilot lamp lights up when this switch is pressed.

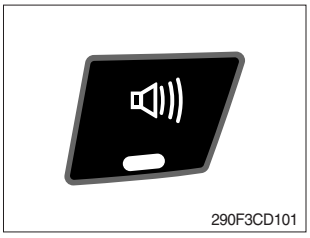
(11) Overload switch (opt)



① When this switch is activated, buzzer makes sound and overload warning lamp lights up in the event that the machine is or becomes in an overloaded situation.
② When the switch is inactivated, buzzer stops and warning lamp goes off.

⚠ Overloading the machine could impact the machines stability which could result in tipover hazard. A tipover hazard could result in serious injury or death. Always activate the overload warning device before you handle or lift objects.

(12) Travel alarm switch



① This switch is to activate travel alarm function surrounding when the machine travels.
- ON : When the machine travels, the travel alarm function is activated.
- OFF : When the FNR switch is positioned on R, the travel alarm function is activated.

(13) Air conditioner quick touch switch


290F3CD216A

① This switch used to select air conditioner control mode.

※ **Refer to page 5-113.**

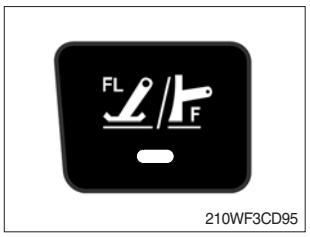
(14) Main menu quick touch switch

290F3CD217A

① This switch is to activate the main menu in the cluster.

※ **Refer to page 5-94.**

(15) Front left outrigger/Front dozer switch



210WF3CD95

① This switch is used to select the front left outrigger or front dozer blade operation.

② The pilot lamp lights up when this switch is pressed.

※ **Please check the installed equipment (outrigger or dozer) on your machine before selecting the switch.**

※ **Refer to the operator's manual page 3-56 for the dozer and outrigger lever.**

(16) Front right outrigger switch

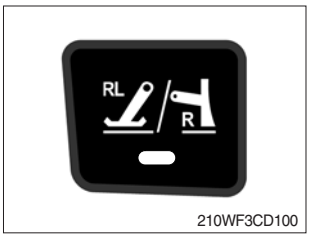
210WF3CD96

① This switch is used to select the front right outrigger operation if equipped.

② The pilot lamp lights up when this switch is pressed.

※ **Refer to the operator's manual page 3-56 for the dozer and outrigger lever.**

(17) Rear left outrigger/Rear dozer switch



210WF3CD100

① This switch is used to select the rear left outrigger or rear dozer blade operation.

② The pilot lamp lights up when this switch is pressed.

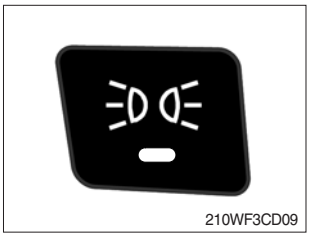
※ **Please check the installed equipment (outrigger or dozer) on your machine before selecting the switch.**

※ **Refer to the operator's manual page 3-56 for the dozer and outrigger lever.**

(18) Rear right outrigger switch

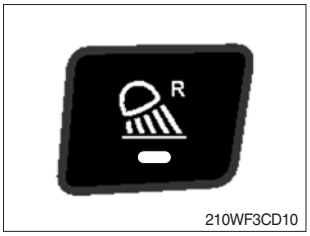
① This switch is used to select the rear right outrigger operation if equipped.
② The pilot lamp lights up when this switch is pressed.
※ **Refer to operator's manual page 3-56 for the dozer and outrigger lever.**

(19) Illumination switch



① This switch is used to operate on the clearance lamp and all panel lamps.
② The pilot lamp lights up when this switch is pressed.

(20) Rear work lamp switch



① This switch is used to operate the rear work lamp.
② The pilot lamp lights up when this switch is pressed.

8) MAIN MENU

※ You can select or set the menu by the jog dial module or touch screen.
On the operation screen, tap MENU to access the main menu screen.
On the sub menu screen, you can tap the menu bar to access functions or applications.

· Operation screen

140WA3CD50

※ Please refer to the jog dial module, the operator's manual page 3-77 for selection and change of menu and input value.

(1) Structure

No	Main menu	Sub menu	Description
1	 Mode 290F3CD103	Work tool U mode power Combination speed setting Auto power boost IPC mode Auto engine shutdown Initial mode Emergency mode	Breaker, Crusher, Not installed User mode only Load sensitivity, Trucking balance, Boom/Arm balance, Arm speed Enable, Disable Speed mode, Balance mode, Efficiency mode One time, Always, Disable Key on initial mode / initial work mode, Accel initial mode / step Switch function
2	 Monitoring 290F3CD104	Active fault Logged fault Delete logged fault Monitoring	MCU, Engine ECM, FATC, AAVM (option) MCU, Engine ECM, FATC, AAVM (option) All logged fault delete, Initialization canceled Machine information, Switch status, Output status,
3	 Management 290F3CD105	Fuel rate information Maintenance information Machine security Machine information Contact Service menu Clinometer Update	General record, Hourly, Daily, Mode record Replacement, Change interval oils and filters ESL mode setting, Password change Model, MCU, Monitor, jog dial module, switch controller, RMCU, Relay drive unit, FATC, AAVM (option) A/S phone number, A/S phone number change Power shift, Operating hour, Breaker mode pump acting, EPPR current level, Overload pressure, Optional piping pressure removal, Fine swing Clinometer setting Cluster, ETC device
4	 Display 290F3CD106	Display item Clock Brightness Unit setup Language selection Screen type	Engine speed, Tripmeter A, Tripmeter B, Tripmeter C Clock Manual, Auto Temperature, Pressure, Flow, Distance, Date format Korean, English, ETC A type, B type
5	 Utilities 290F3CD107	Tripmeter Camera Auto idle time setting	3 kinds (A, B, C) Camera setting, Auto mode (travel) Time setting

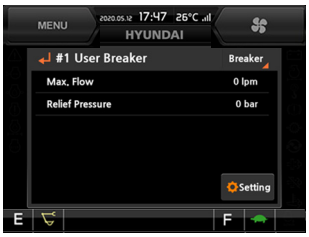
(2) Mode setup

① Work mode

140WA3CD51

140WA3CD52

A



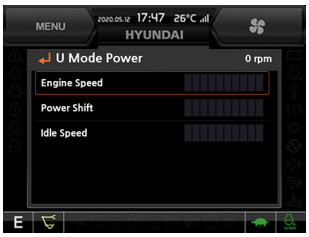
140WA3CD53

B

· Select installed optional attachment
  - A : It can set the user's attachment.
    It is available in setting #1~#10.
  - B : Max flow - Set the maximum flow for the attachment.
    Relief pressure - Set the relief pressure.

② U mode power

140WA3CD54



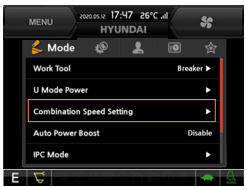
300A3CD45B

· Engine high idle rpm, auto idle rpm and pump torque (power shift) can be modulated and memorized separately in U-mode.
· U-mode can be activated by user mode switch.

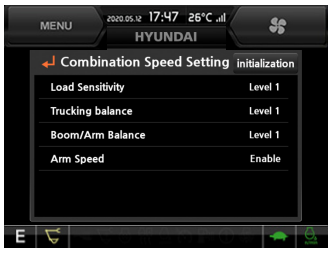
Step (▮)	Engine speed (rpm)	Idle speed (rpm)	Power shift
1	1400	750	10%
2	1450	800	20%
3	1500	850	30%
4	1550	900	40%
5	1600	950	50%
6	1650	1000 (auto decel)	60%
7	1700	1050	70%
8	1750	1100	80%
9	1800	1150	85%
10	1900	1200	90%

※One touch decel & low idle : 850 rpm

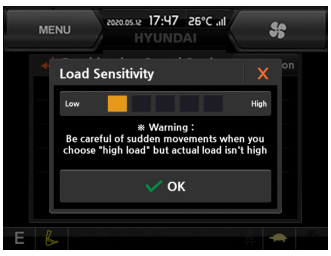
③ Combination speed setting



220A3CD300A



220A3CD301A



220A3CD302A

· **Load sensitivity**
  - It changes fine control sensitivity. (boom up or arm out operation)
  - When the segment is close to high, the fine operation speed is increased. (Load sensitivity is high.)
  - It is reccomended to set high segment when lifting heavy duty equipment or load.

⚠ The fine control speed is able to be unexpectedly fast by high setting and load condition. Do use the function through fine control test considering the condition.

· **Trucking balance**

This is control the swing and boom up speed when the combined operation is activated.

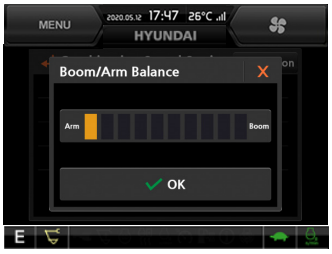
- It adjusts the ratio of relative speed in the boom up and swing combination operation.
- The segment is close to swing, the swing speed has a priority.
- The segment of swing is recommended for use in work environments that require high swing speed and acceleration, some slow boom up, and more than 45 degrees.
- The segments are close to boom, the boom up speed has a priority.
- The segment of boom is mainly used in work environments that require high boom up work at a short swing angle of about 45 degrees.

220A3CD303A

· **Boom / Arm balance**

This is control the boom up and arm in speed when the combined operation is activated. It is effective in work place mainly for leveling work.

- When the level is closer to arm, arm in operation speed has more priority than boom up operation.
- When the level is closer to boom, boom up operation speed has more priority than arm in operation.

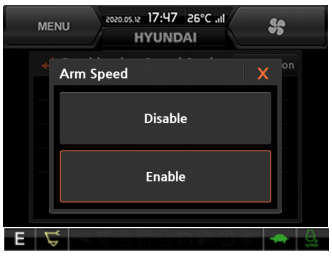


220A3CD304A

· **Arm speed**

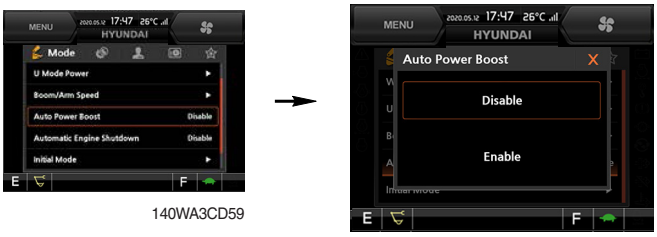
This provides ON and OFF of the regeneration function of the arm in operation.

- Enable means that regeneration is ON, and an energy can be used efficiently through automatic regeneration according to the load.
- Disable means that regeneration is always OFF, and it can be effective for heavy digging work.



220A3CD305A

④ Auto power boost



140WA3CD59

140WA3CD60

· The power boost function can be activated or cancelled.
  - Enable : The digging power is automatically increased as working conditions by the MCU. It is operated max 8 seconds
  - Disable : Not operated.

※ **The auto power boost function is activated in P mode. It does not work in S mode and E mode.**

⑤ IPC mode

140WA3CD61 140WA3CD62 140WA3CD63

140WA3CD64 140WA3CD65

140WA3CD66 140WA3CD67

· The operator can improve fuel consumption and working speed through IPC mode.
· IPC mode is working by using inertial energy in specific case.
· The IPC mode can be selected by this menu.
  - Speed mode / Balance mode / Efficiency mode
· The effect of IPC mode is different at power mode. The fuel efficiency is about 5% in P mode and about 3% in E mode based on Balance mode against Speed mode.
· The manufacturer recommends using the balance mode in IPC mode.

※ **The effect is the result of the standard operation. Depending on the operator's working conditions and machine options, the results could be different.**

※ **Please update the cluster programs if this mode is not displayed in the mode setup menu. Refer to page 5-105.**

⑥ Automatic engine shutdown

140WA3CD68

140WA3CD69

140WA3CD70

· The automatic engine shutdown function can be set by this menu.
  - One time
  - Always
  - Disable
  - Wait time setting : Max 40 minutes, min 2 minutes

⑦ Initial mode

140WA3CD71

140WA3CD72

· **Key on initial mode**
  - Selected the power mode is activated when the engine is started.

· **Key on initial work mode**
  - Not installed
  - Last setting
  - Work mode

· **Accel initial mode**
  - Last setting value
  - User setting value

· **Accel initial step**
  - 0~9 step

⑧ Emergency mode

140WA3CD73

140WA3CD74

· This mode can be used when the switches are abnormal on the cluster.
· The cluster switches can be selected by touching each icon.

⑨ Cooling fan reverse mode

140WA3CD75

140WA3CD76

140WA3CD77

· Manual : Rotate the fan with reverse direction while pressing the button "Excute".
· Automatic : Rotate the fan with reverse direction by preset cycle.
  - Interval : 30 minutes ~ 5 hours
  - Time : 30 seconds ~ 5 minutes

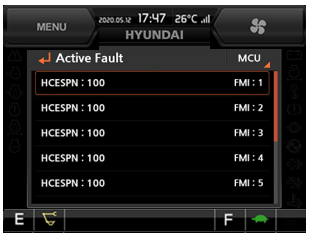
※ **Default : interval (60 minutes), time (120 seconds)**

(3) Monitoring

① Active fault

140WA3CD80

140WA3CD81

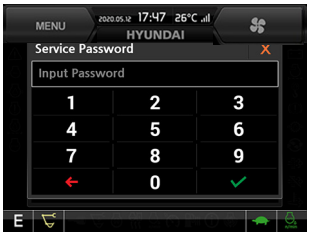


140WA3CD82

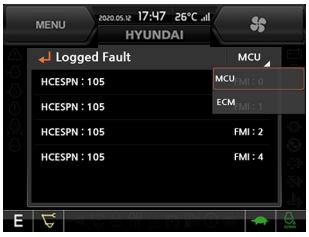
· The active faults of the MCU, ECM, FATC, AAVM (option) can be checked by this menu.

② Logged fault

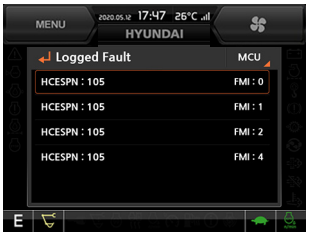
300A3CD68A



300A3CD72A



300A3CD69A

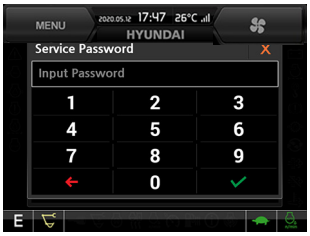


300A3CD70A

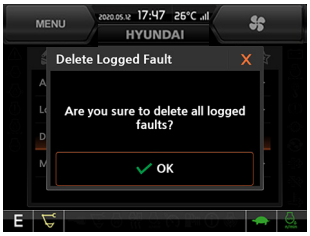
· The logged faults of the MCU, ECM, FATC, AAVM (option) can be checked by this menu.

③ Delete logged fault

300A3CD71A



300A3CD72A

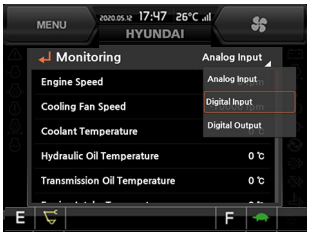


300A3CD73A

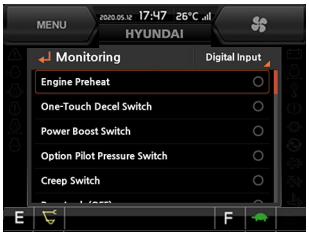
· The logged faults of the MCU, ECM, FATC, AAVM (option) can be deleted by this menu.

④ Monitoring

140WA3CD89



140WA3CD90



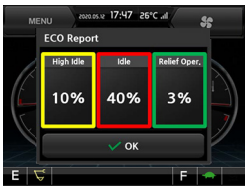
140WA3CD91

- The machine status such as the engine rpm, oil temperature, voltage and pressure etc. can be checked by this menu (Analog input).
- The switch status or output status can be confirmed by this menu (Digital input & Digital output).
- The activated switch or output pilot lamps ● will light up.

(4) Management

① ECO report

This reports the machine's inefficient operation status in order to improve operator's improper working habit.



140WA3CD100

High idle

140WA3CD101

- Shows a breakdown of high idle, idle and relief operation when monitor is on.
- Gives a daily usage breakdown record for a 7 day period and an overall accumulated record from the first operation.

Idle

140WA3CD102

Relief operation

140WA3CD103

② Fuel rate information

140WA3CD104

140WA3CD105

A

· **General record (A)**
  - Average fuel rate (left) (from "Reset" to now)
    Fuel consumption divided by engine run time (service meter time).
  - A days fuel used (right)
    Fuel consumption from 24:00 (or "Reset" time) to now (MCU real time).

140WA3CD106

B

· **Hourly record (B)**
  - Hourly fuel rates for past 12 hours (service meter time).
  - No record during key-off time.
  - One step shift to the right for every one hour.
  - Automatic deletion of data from 12 hours and earlier.
  - "Reset" deletes all hourly records.

140WA3CD107

C

· **Daily record (C)**
  - Daily fuel consumption for past seven days (MCU real time).
  - No record during key-off time.
  - One step shift to the right at 24:00 for every day.
  - Automatically deletes data from 7 days and earlier.
  - All daily records deletion by "Reset".

140WA3CD108

D

· **Mode record (D)**
  - Average fuel rate for each power mode/accel dial (at least 7) from "Reset" till present.
  - No record during idle.
  - All records can be deleted by "Reset".

140WA3CD109

③ Maintenance information

140WA3CD110

140WA3CD111

140WA3CD112

- Alarm lamp (●) is ON when oil or filter needs to be changed or replaced.
- Replacement : The elapsed time will be reset to zero (0).
- Change interval : The change intervals can be changed in hour increments of 50.

※ **Refer to section, Maintenance chart for further information of maintenance interval.**

④ Machine security

300A3CD90A

300A3CD91A

300A3CD92A

· **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.
- When you Enable the ESL mode, the password will be required when the starting switch is turned to the on position.
- **Machine security**

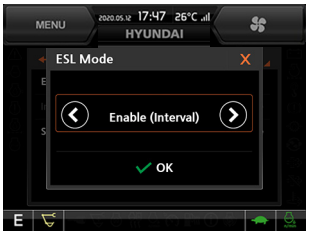
  Disable : ESL function is disabled and password is not required to start engine.

  Enable (always) : The password is required whenever the operator starts engine.
- **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 to a maximum 4 hours.

※ **Default password : 00000 + ✔**

※ **Password length : (5~10 digits) + ✔**

- **Smart key** (option) : Refer to next page.



300A3CD93A

300A3CD94A

· **Password change**

- The password is 5~10 digits.

300A3CD95A

300A3CD96A

300A3CD91A

Enter the current password

300A3CD99A

Enter the new password

300A3CD98A

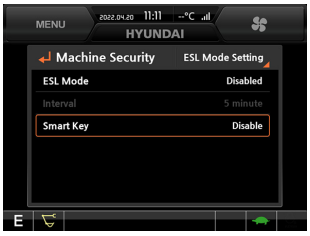
Enter the new password again

※ **Before first use, please set user password and owner password in advance for machine security.**

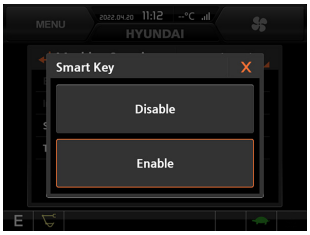
- Smart key

300A3CD90A

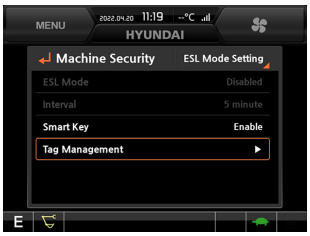
300A3CD91A



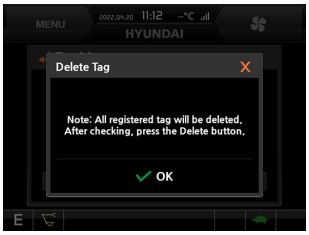
300A3CD001



300A3CD002

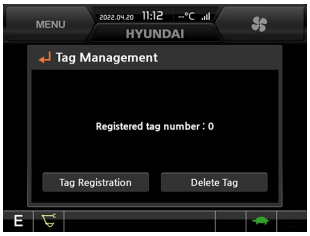


300A3CD003



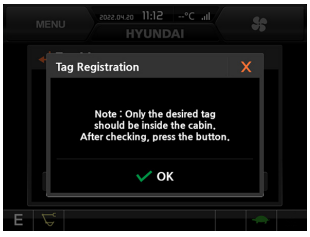
300A3CD006

Deleting



300A3CD004

Registering



300A3CD005

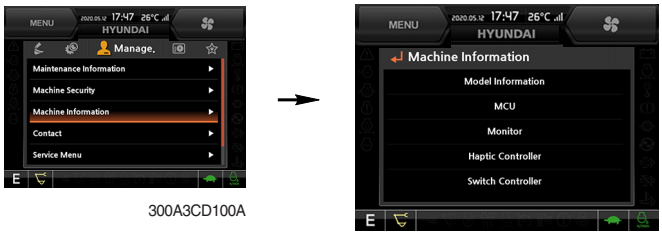
· Smart key is registered when equipped with optional smart key. If smart key is not inside of the cabin, authentication process fails and the password is needed.
· Tag management menu is activated when the Smart key menu is Enabled.
You can register and delete the tags.

- Tag management
· When registering a tag : Only the tag you want to register must be in the cabin.
· When deleting a tag : All registered tags are deleted.

· Engine Starting Condition

Case	ESL Mode	Smart Key	Condition
1	Disable	Disable	- With registered tag : Engine can be started without password input. - Without registered tag : Engine can be started without password input.
2	Disable	Enable	If Smart Key is enabled, ESL Mode is automatically enabled. This Case 2 work the same as the Case 4.
3	Enable	Disable	- With registered tag : Engine can be started with password input. - Without registered tag : Engine can be started with password input.
4	Enable	Enable	- With registered tag : Engine can be started without password input. - Without registered tag : Engine can be started with password input.

⑤ Machine Information



300A3CD100A

300A3CD101A

· This can confirm the identification of the model information (ECU), MCU, monitor, jog dial module, switch controller, RMCU, relay driver unit, FATC (air conditioner controller), AAVM (opt).

⑥ Contact (A/S phone number)

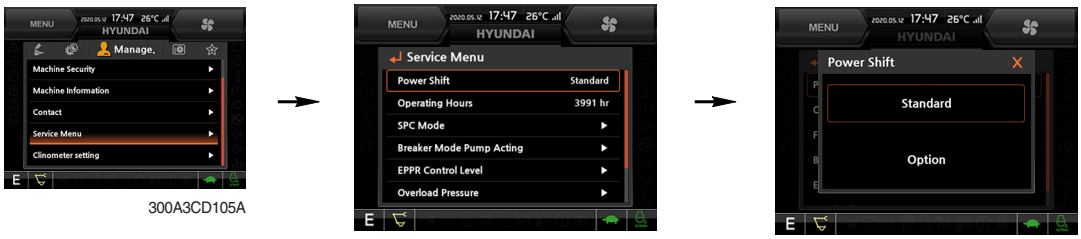
300A3CD102A

300A3CD103A

300A3CD104A

Enter the new A/S phone number

⑦ Service menu



300A3CD105A

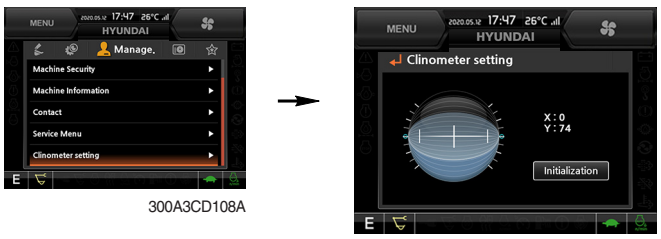
300A3CD106A

300A3CD107A

※ This menu can be used only HCE service man and can not be accessible by the owner and the operator.

· Power shift (standard / option) : Power shift pressure can be set by option menu.
· Operating hours : Operating hours since the machine line out can be checked by this menu.
· Breaker mode pump acting (1 pump / 2 pump)
· EPPR current level (attach flow EPPR 1 & 2, boom priority EPPR, attach relief pressure EPPR 1& 2)
· Overload pressure : 100 ~ 350 bar
· Opitonal piping pressure removal (Disable / Enable)
It is removing the residual pressure remaining in the option line when the quick coupler is operated.
· Fine swing (Disable / Enable)

⑧ Clinometer

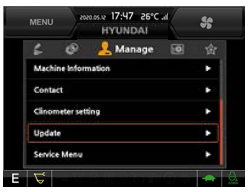


300A3CD108A

300A3CD109A

· When the machine is on the flatland, if you touch "initialization" on cluster, the values of X, Y will reset to "O".
· You can confirm tilt of machine in cluster's operating screen.

⑧ Update (cluster & ETC devices)

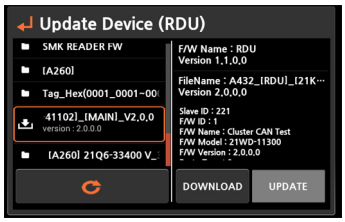


300A3CD110A

300A3CD111A

300A3CD112A

300A3CD114A



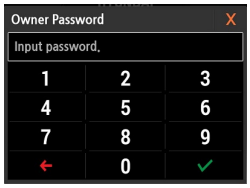
380F3CD06

- ETC devices and cluster can be updated through CAN 2 network.
- Insert USB memory stick which includes program files, start download.

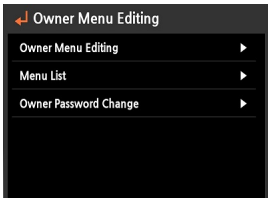
⑨ OME (owner menu editing)

The owner of machine can restrict operator access to set functions.

300A3CD115A



300A3CD115B



300A3CD115C

- **Owner can set the status of the function.**
  - Enable
  - Disable
- **In the menu, owner can set the list of functions in which they would like to lock or leave unlocked.**
- **Owner password (default password : 11111)**
  - Owner can manage and change the password.
  - Necessary to input the password to access function menu.

300A3CD116A

300A3CD117A

300A3CD118A

(5) Display

① Display item

140WA3CD150

140WA3CD151

140WA3CD152

- The center display type of the LCD can be selected by this menu.
- The engine speed or the tripmeter menu (A,B,C) is displayed on the center display.

② Clock

140WA3CD153

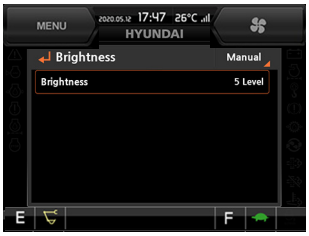
140WA3CD154

- The first row of boxes indicate Year/Month/Day.
- The second row shows the current time. (0:00~23:59)

③ Brightness

140WA3CD155

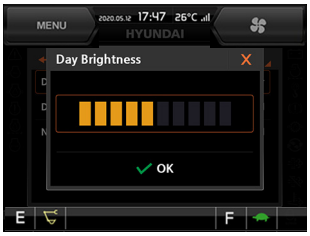
140WA3CD156



140WA3CD157

140WA3CD158

140WA3CD159

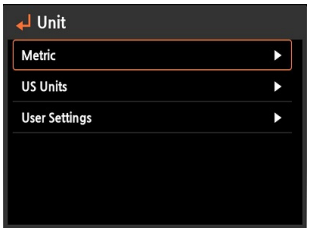


140WA3CD160

· If "Auto" is chosen, brightness for day and night can be set accordingly. Also by using the bar in lower side, users can define which an operation interval belongs to day and night. (in bar figure, white area represents night time while orange shows day time)

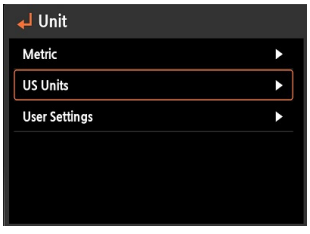
④ Unit

300A3CD130A

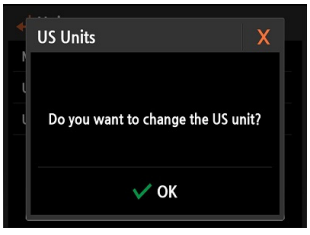


300A3CD130B

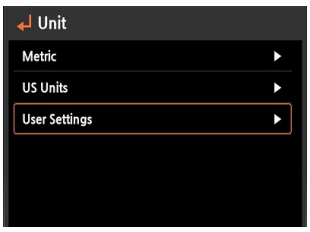
300A3CD130C



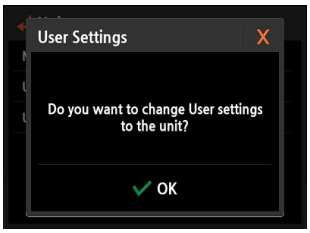
300A3CD130D



300A3CD130E

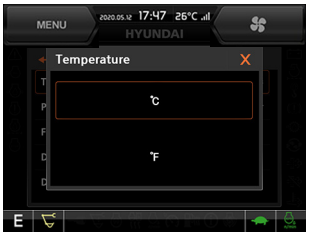


300A3CD130F



300A3CD130G

300A3CD131A



300A3CD132A

- Temperature : ˚C ↔ ˚F
- Pressure : bar ↔ MPa ↔ kgf/cm²
- Volume : ℓ ↔ gal
- Flow : lpm ↔ gpm
- Distance : km ↔ mile
- Date format : yy/mm/dd ↔ mm/dd/yy ↔ dd-mm-yy

⑤ Language

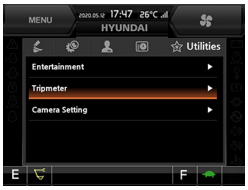
140WA3CD164

140WA3CD165

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

(6) Utilities

① Tripmeter



140WA3CD170

140WA3CD171

- A maximum of 3 types of tripmeters can be used at the same time.
- Each tripmeter can be turned on by choosing "Start". It can be turned off by choosing "Stop".
- If the tripmeter icon is activated in the operation screen, it can be controlled directly in this screen.

② Camera setting

- If the rear camera is not installed on the machine, set disable.
- If the rear camera is installed on the machine, set enable.

300A3CD145A

300A3CD146B

300A3CD147A

- Auto Mode (Travel) : Enable
  The cluster will automatically shows camera view while machine is traveling.
- In the operation screen, rear camera screen show up when ESC/CAM switch is pushed.

300A3CD97A

290F3CD221

③ Auto idle time setting

300A3CD166

300A3CD167

- The auto idle time is can be set by this menu.
- Time : 3~30 seconds

④ **AAVM** (Advanced Around View Monitoring, option)

· The AAVM switchs of the cluster consist of ESC/CAM and AUTO IDLE/Buzzer stop.

140WA3CD176

- **Escape switch**

· Activates AAVM mode from the beginning if AAVM is installed.

· While in the AAVM mode, select the ESC switch to return to the home screen.

140WA3CD175

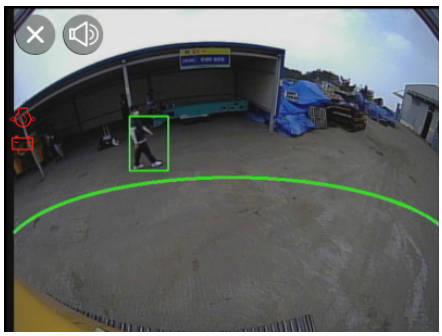
Home screen

AAVM mode 235SA3CD222A

- **Buzzer stop switch**

· AAVM mode detects surrounding pedestrians or objects and the warning buzzer sounds.

· User can turn OFF the warning sound by pressing the buzzer stop switch.



220A3CD246

· When a worker/pedestrian reaches the green line, which is an external danger area equipped on the cluster, warning buzzer sounds and it displays a green rectangular box recognizing the worker/pedestrian.
Stop work immediately. Stop the buzzer by pressing the buzzer stop switch. Then resume work after you confirm that the area is safe and clear of workers/objects.

220A3CD247

· When a worker/pedestrian reaches the red line, which is an internal danger area equipped on the cluster, warning buzzer sounds and it displays a red rectangular box recognizing the worker/pedestrian.
Stop work immediately. Stop the buzzer by pressing the buzzer stop switch. Then resume work after you confirm that the area is safe and clear of workers/objects.

⚠ Failure to comply may result in serious injury or death.

※ In AAVM mode, a touch screen of the LCD is available only. The multimodal dial of the jog dial module is not available.

⑤ Mirror / RH view camera UI setting (opt)

· The mirror / RH view camera mode can be set by the main cluster.

Escape switch

140WA3CD174K

- **Escape switch**

· Activate mirror / RH mode from the beginning if the option is installed.

· While in that mode, select the ESC switch to return to the home screen.

140WA3CD175

Home screen

140WA3CD176K

Cam image control (CIC) mode

- **Cam image control (CIC) mode**

※ Type A / Type B are divided by equipment camera option.

- Type A. RH view option.

· Touch ⓐ (rear), ⓑ (RH) button on screen to set single-view camera mode.

· Touch ⓓ (2CH split-view) button to set split-view camera mode.

- Type B. mirror view option.

· Touch ⓐ (rear), ⓒ (mirror) button on screen to set single-view camera mode.

· Touch ⓓ (2CH split-view) button to set split-view camera mode.

※ ⓐ (rear), ⓒ (mirror) camera image is inverted for a mirror effect.

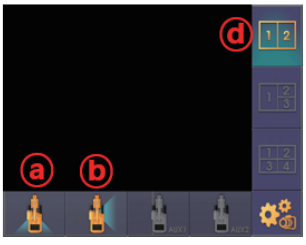
ⓐ (Rear)

ⓑ (RH)

ⓒ (Mirror)

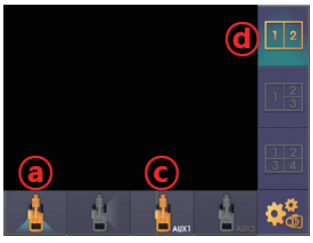
ⓓ (2CH split-view)

140WA3CD177K



140WA3CD178K

Type A. RH view opt



140WA3CD179K

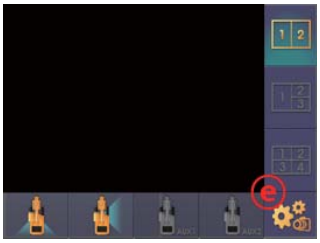
Type B. mirror view opt

- **Split-view camera order setting**

· Touch ⓔ (camera setting) button to set split-view camera order.

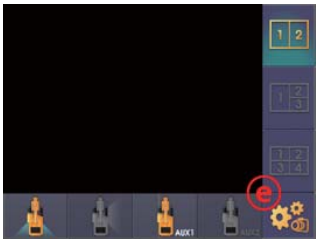
140WA3CD180K

Camera setting



140WA3CD181K

Type A. RH view option



140WA3CD182K

Type B. mirror view option

· You can change split-view camera order on display order menu.

140WA3CD183K

Type A (RH view) default setting

1st rear / 2nd right

140WA3CD184K

Type B (mirror view) default setting

1st rear / 2nd Aux1

- **With 2nd camera monitor option.**

※ You can set camera view on maun cluster.

140WA3CD185K

Set camera view on main cluster

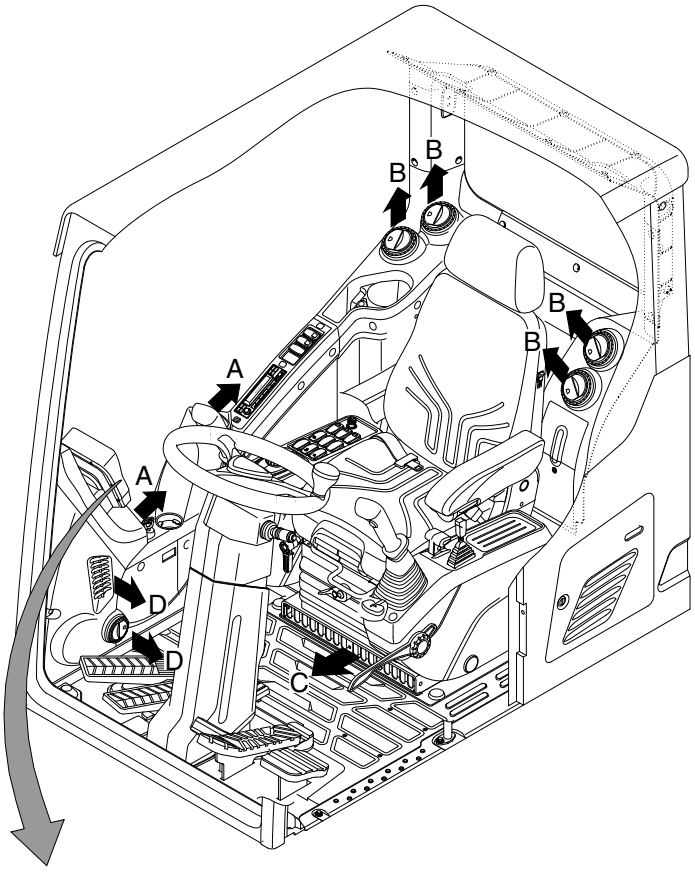
→

140WA3CD186K

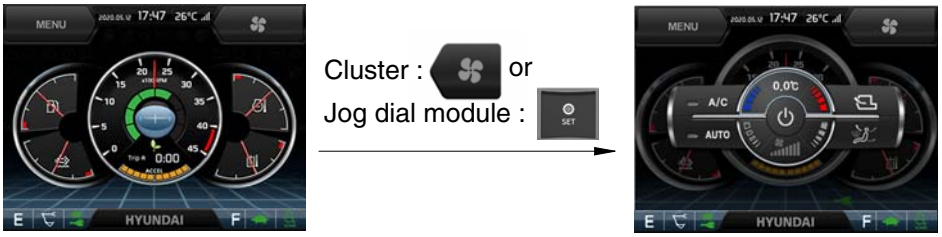
9) AIR CONDITIONER AND HEATER

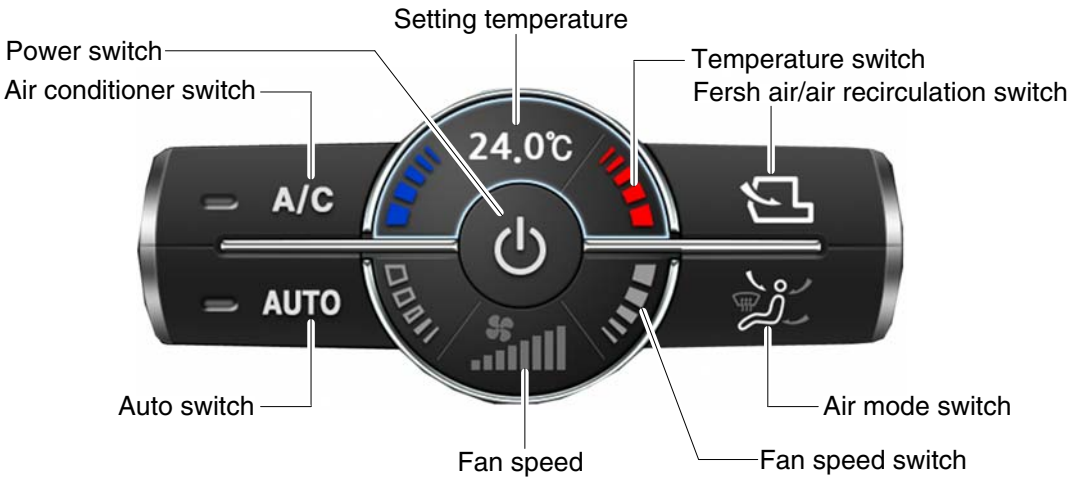
Full auto air conditioner and heater system automatically keeps the optimum condition in accordance with operator's temperature configuration, sensing ambient and cabin inside temperature.

· **Location of air flow ducts**



Cluster LCD





140WA3CD201

※ **Jog dial module : Refer to the operator's manual page 3-77.**

(1) Power switch

① This switch turns the system ON and OFF.
Just before powering OFF, set values are stored.
② Default setting values

Function	Air conditioner	In/outlet	LCD	Temperature	Mode
Value	OFF	Inlet	OFF	Previous sw OFF	Previous sw OFF

(2) Air conditioner switch

① This switch turns the compressor ON/OFF.
※ Air conditioner operates to remove vapor and drains water through a drain hose. Water can be sprayed into the cab in case that the drain cock at the ending point of drain hose has a problem.
In this case, exchange the drain cock.

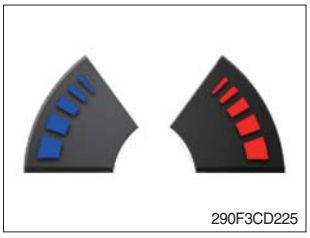
(3) Auto switch

① Auto air conditioner and heater system automatically keeps the optimum condition in accordance with operator's temperature configuration sensing ambient and cabin inside temperature.

(4) Setting temperature

① Displays the temperature setting.

(5) Temperature switch

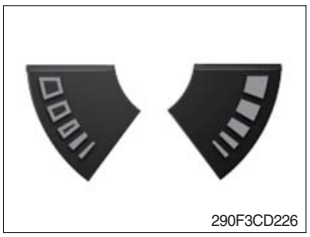


① Setting temperature indication
· Lo (17˚C), 17.5~31.5˚C, Hi (32˚C)
② Max cool and max warm beeps 5 times.
③ The max cool or the max warm position operates per the following table.

Temperature	Compressor	Fan speed	In/outlet	Mode
Max cool	ON	Hi (8 step)	Recirculation	Face
Max warm	OFF	Hi (7 step)	Fresh	Def/Foot

④ Temperature unit can be changed between celsius (˚C) and fahrenheit (˚F)
a. Default status (˚C)
b. The temperature unit can be changed (℃ ↔ ℉) by pressing temperature switchs (Up/Down) simultaneously for more than 5 seconds.

(6) Fan speed switch



① Fan speed is controlled automatically by set temperature.
② This switch controls fan speed manually.
- There are 8 up/down steps to control fan speed.
- The maximum step or the minimum step beeps 5 times.

(7) Fan speed

① Steps 1 through 8 to display the amount of air being circulated.

(8) Fresh air/air recirculation switch

① It is possible to change the air-inlet method.
a. **Fresh air ( )**
Inhaling air from the outside.
b. **Air recirculation ( )**
It recycles the heated or cooled air to increase the energy efficiency.
※ **Change air occasionally when using recirculation for a long periods of time.**
※ **Check condition of fresh air filter and recirculation filter periodically to maintain good efficiency of the system.**

(9) Air mode switch

① Operating this switch, it beeps and displays symbol of each mode in the following order. (Face → Face/Rear → Face/Rear/Foot → Foot → Def/Foot)

Mode switch		Face	Face/Rear	Face/Rear/Foot	Foot	Def/Foot
Outlet	A	●	●	●		
	B		●	●		
	C			●	●	●
	D					●

② When operating defroste, FRESH AIR/AIR RECIRCULATION switch turns to FRESH AIR mode and air conditioner switch turns ON.

(10) Self Diagnosis Function

① Diagnostic methods : Diagnostic information window, select

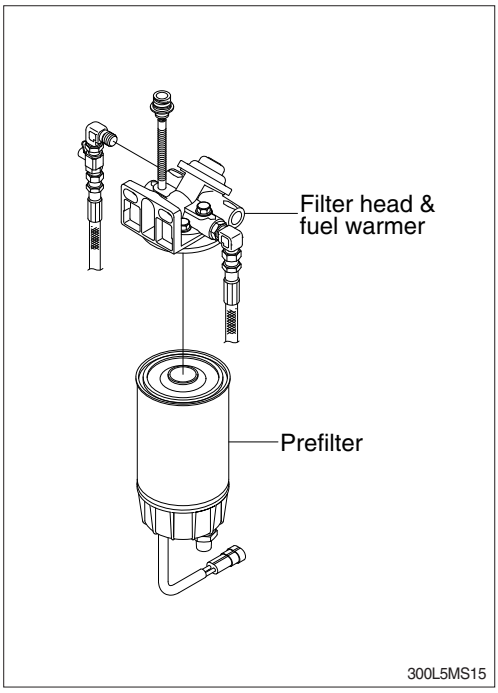
② Diagnostic indication (Displays fault)

Fault code	Description	Fail safe function
F01	Ambient temperature sensor open	20˚C alternate value control
F02	Ambient temperature sensor short	
F03	Cab inside temperature sensor open	25˚C alternate value control
F04	Cab inside temperature sensor short	
F05	Evaporate temperature sensor open	0˚C alternate value control
F06	Evaporate temperature sensor short	
F07	Null	-
F08	Null	-
F09	Mode 1 actuator open/short	The alternate value is face
F10	Mode 1 actuator drive circuit malfunction	If not, the alternate value is Def/Foot
F11	Intake actuator open/short	The alternate value is air recirculation
F12	Intake actuator drive circuit malfunction	The alternate fresh air
F13	Temperature actuator open/short	If opening amount is 0 %, the alternate value is 0 %
F14	Temperature actuator drive circuit malfunction	If not, the alternate value is 100 %
F15	Null	-
F16	Null	-

GROUP 17 FUEL WARMER SYSTEM

1. SPECIFICATION

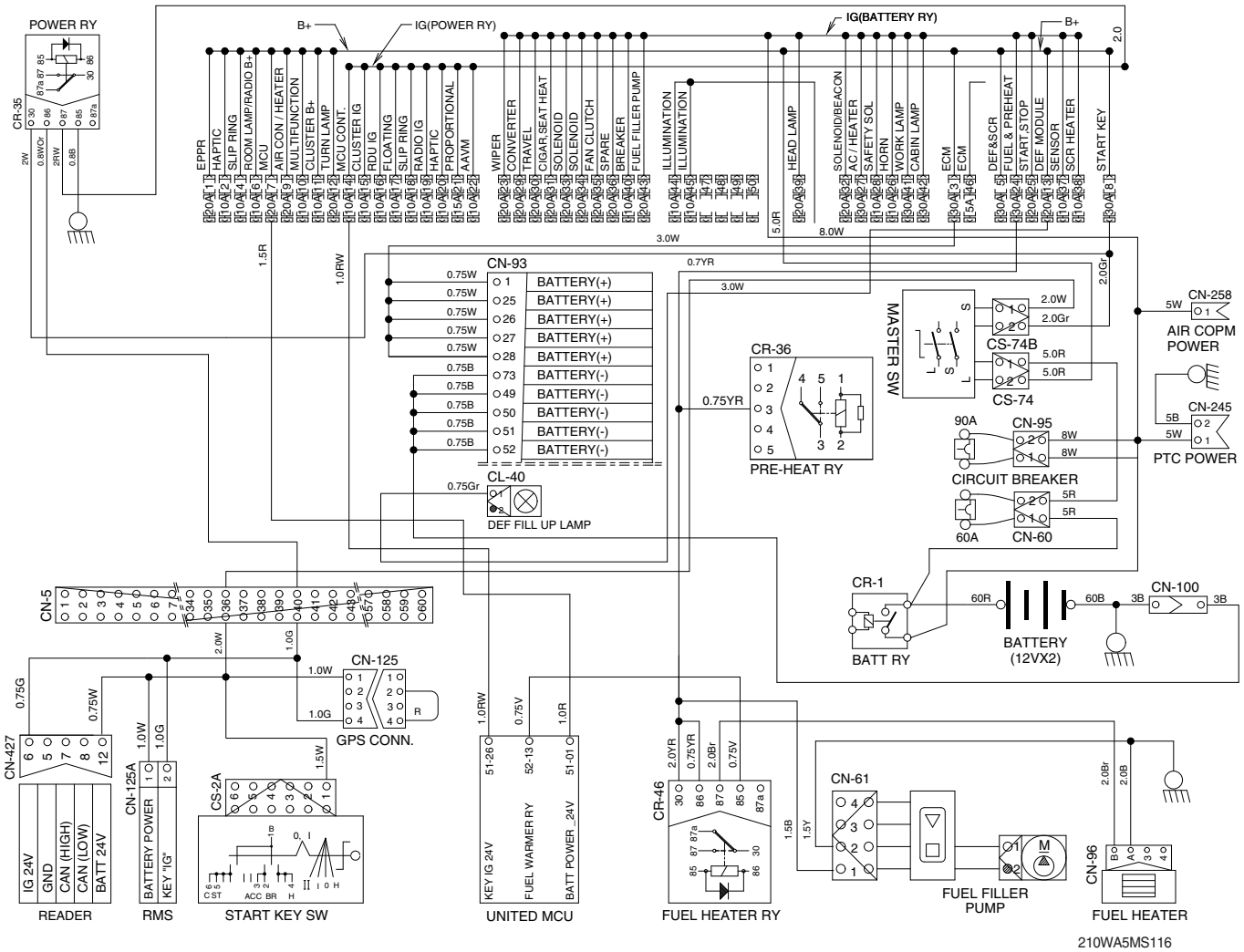
1) Operating voltage : 24±4 V
2) Power : 350±50 W
3) Current : 15 A



2. OPERATION

1) The current of fuel warmer system is automatically controlled without thermostat according to fuel temperature.
2) At the first state, the 15 A current flows to the fuel warmer and engine may be started in 1~2 minutes.
3) If the fuel starts to flow, ceramic-disk in the fuel warmer heater senses the fuel temperature to reduce the current as low as 1.5 A.
   So, fuel is protected from overheating by this mechanism.

3. ELECTRIC CIRCUIT



210WA5MS116

GROUP 18 1 or 2-WAY OPTIONAL PIPING PRESSURE REMOVAL SYSTEM

1. OUTLINE

This system can be removed the residual pressure of the optional attachment hydraulic piping when the quick coupler is operated by the switch of the RCV lever and then the oil quick function of the optional attachment is performed.

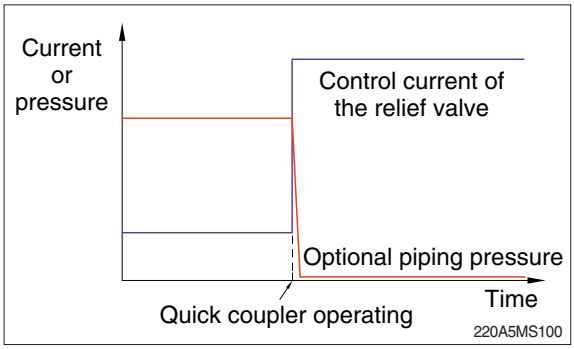
※ Oil quick function

In a convention work, the optional attachments such as breaker or grab are installed on the machine and needed to connect hydraulic piping additionally.

But currently, the hydraulic piping connection is not needed by the work man. The attachment is installed on the machine and the hydraulic pipings are connected by a coupler that is built in the quick coupler automatically and the attachment can be ready to operate immediately. This is called the oil quick function.

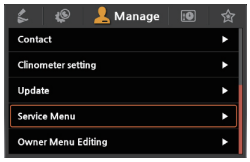
2. OPERATING PRINCIPLE

This is operated by controlling the setting pressure of the electric type relief valve when you operate the quick coupler with the switch of the RCV lever.

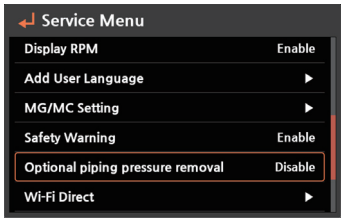


220A5MS100

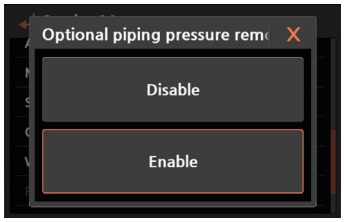
3. SETTING METHOD



220A5MS101



220A5MS102



220A5MS103

1) Optional piping pressure removal is set to Disable in the factory.
2) Optional piping pressure removal is set to Enable then the oil quick function is operated. Also, the caution letter is display on the lower side of the cluster.
3) The setting condition is saved even if shut the engine off.

220A5MS104

4. CAUTION

1) When the oil quick function is used, the hydraulic drift and etc can be occurred as the modified equipment specification.
2) The status of the cluster must be changed by a manager that is well-acquainted with the function and the operator must be well-informed of the oil quick function and safety work.

SECTION 6 TROUBLESHOOTING

Group 1 Before Troubleshooting ····· 6-1
Group 2 Hydraulic and Mechanical System ····· 6-4
Group 3 Electrical System ····· 6-26
Group 4 Mechatronics System ····· 6-42
Group 5 Air conditioner and Heater System ····· 6-78

SECTION 6 TROUBLESHOOTING

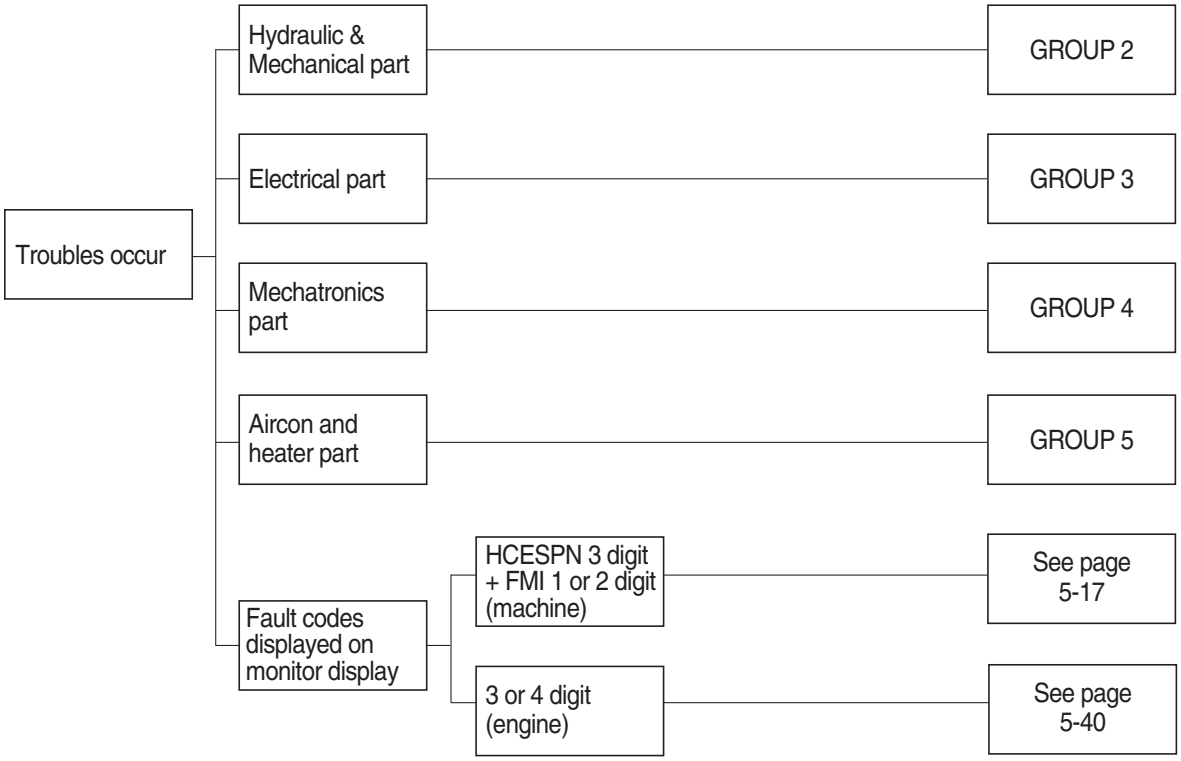
GROUP 1 BEFORE TROUBLESHOOTING

1. INTRODUCTION

When a trouble is occurred in the machine, this section will help an service man to repair the machine with easy.

The trouble of machine is parted Hydraulic & Mechanical system, Electrical system and Mechatronics system. At each system part, an service man can check the machine according to the troubleshooting process diagram.

※ **Before carring out troubleshooting procedure, check monitoring menu in the cluster.**

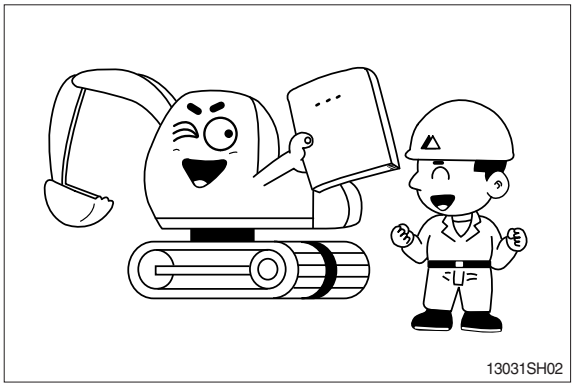


2. DIAGNOSING PROCEDURE

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

STEP 1. Study the machine system

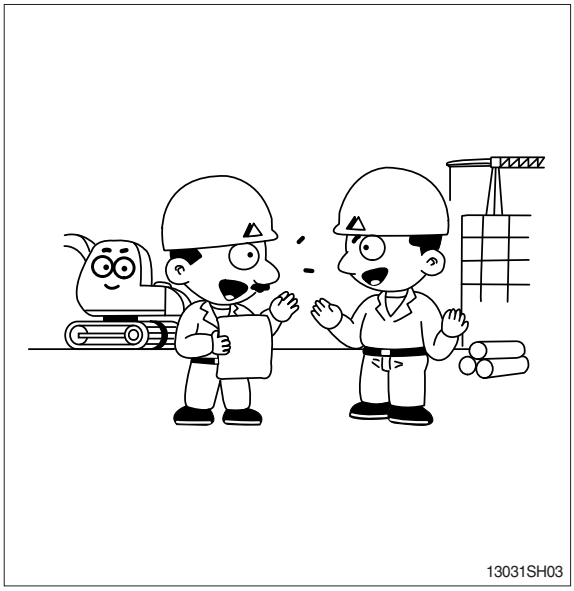
Study and know how the machine is operating, how the system is composing, what kinds of function are installed in the machine and what are specifications of the system components by the machine service manual.
Especially, deepen the knowledge for the related parts of the trouble.


13031SH02

STEP 2. Ask the operator

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

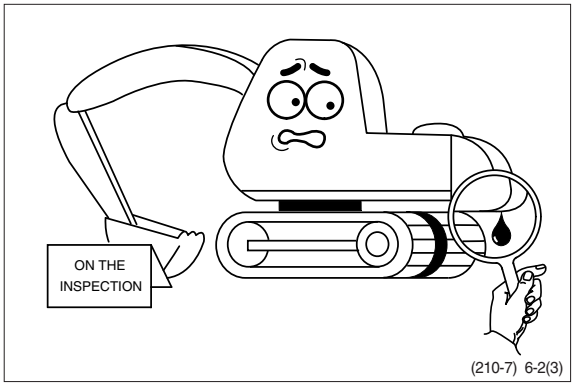
1) How the machine is used and when it is serviced?
2) When the trouble was noticed and what work the machine was doing at that time?
3) What is the phenomenon of the trouble? Was the trouble getting worse, or did it come out suddenly for the first time?
4) Did the machine have any troubles previously?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


13031SH03

STEP 3. Inspect the machine

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

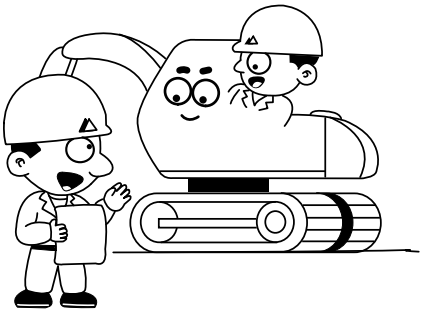
And also check the electrical system including batteries, as the troubles in the electrical system such as low battery voltage, loose connections and blown out fuses will result in malfunction of the controllers causing total operational failures of the machine.



(210-7) 6-2(3)

STEP 4. Inspect the trouble actually on the machine

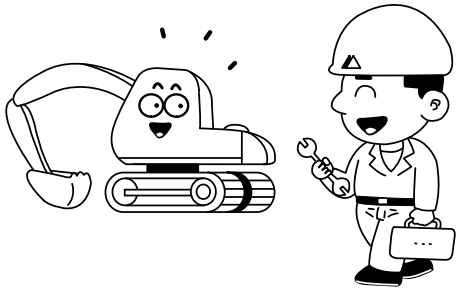
In case that some trouble cannot be confirmed, obtain the details of the malfunction from the operator.
Also, check if there are any in complete connections of the wire harnesses are or not.



(210-7) 6-3(1)

STEP 5. Perform troubleshooting

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

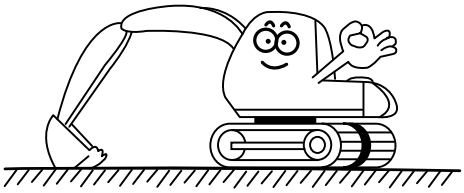


13031SH05

STEP 6. Trace a cause

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

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



(210-7) 6-3(3)

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) MACHINE STATUS MONITORING ON THE CLUSTER

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

Analog 1 Analog 2

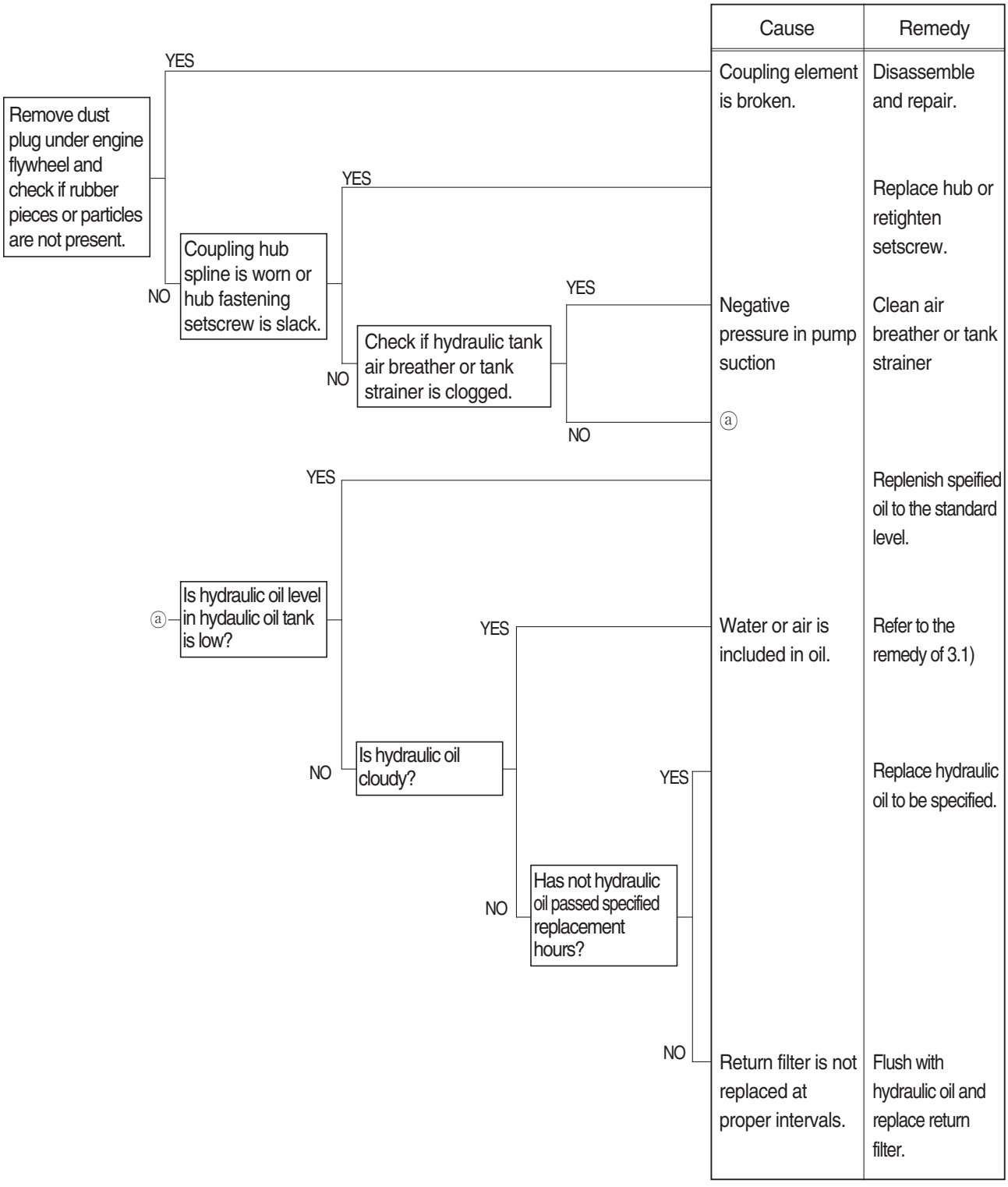
140WA6HS01

(2) Specification

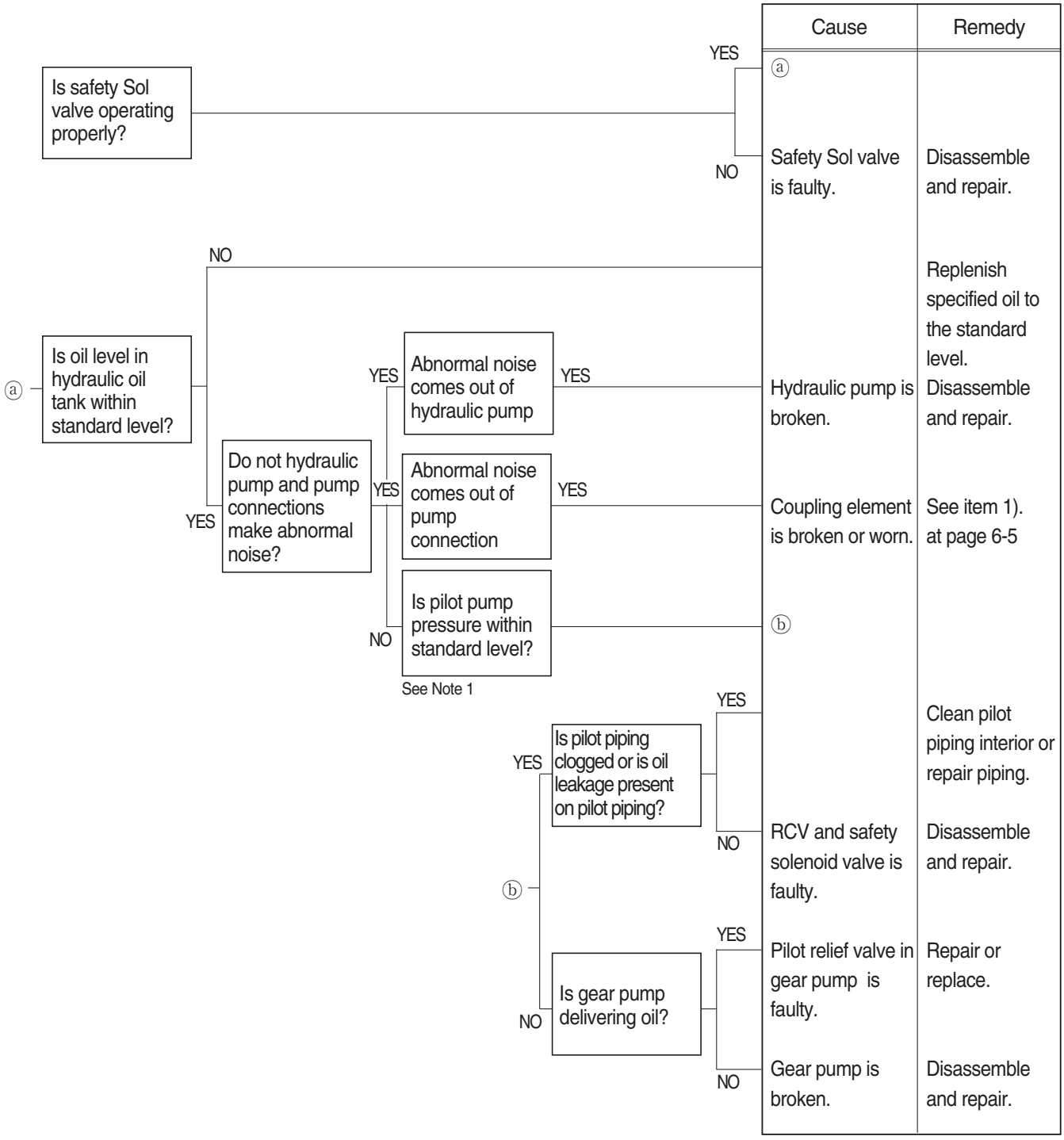
No.	Description	Specification
Note 1	Work pilot pressure	40^{+2}_{0} bar
Note 2	Swing pilot pressure	0~40 bar
Note 3	Boom up pilot pressure	0~40 bar
Note 4	Arm/bucket pilot pressure	0~40 bar
Note 5	Pump 1 regulator pressure	0~50 bar
Note 6	Pump 2 regulator pressure	0~50 bar
Note 7	Pump 1 pressure	350 bar
Note 8	Brake oil pressure	60±3 bar

2. DRIVE SYSTEM

1) UNUSUAL NOISE COMES OUT OF PUMP CONNECTION



2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL

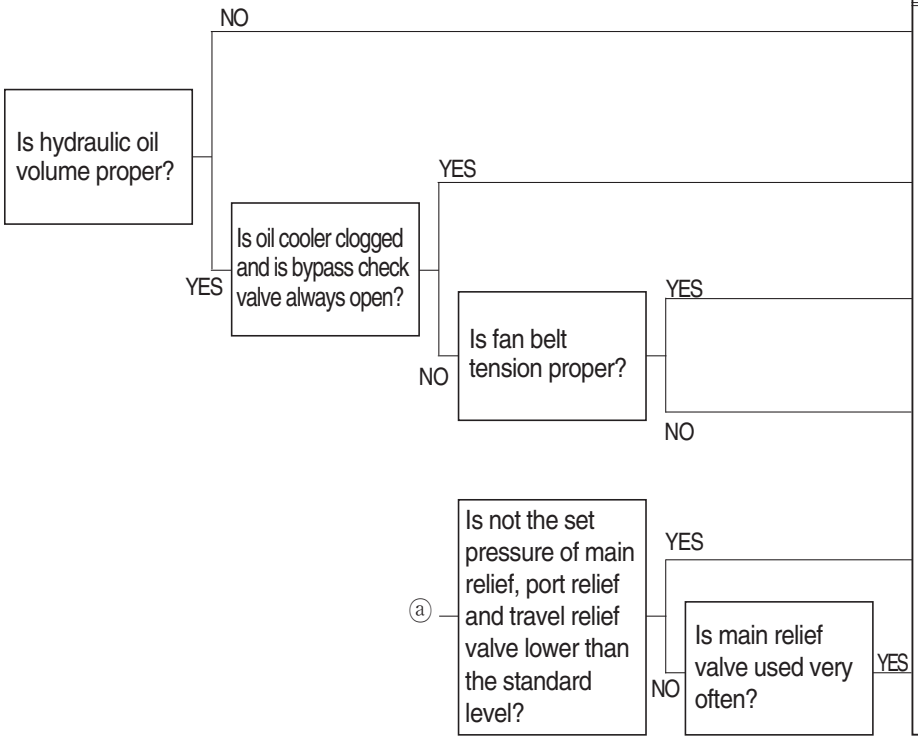


3. HYDRAULIC SYSTEM

1) HYDRAULIC OIL IS CLOUDY

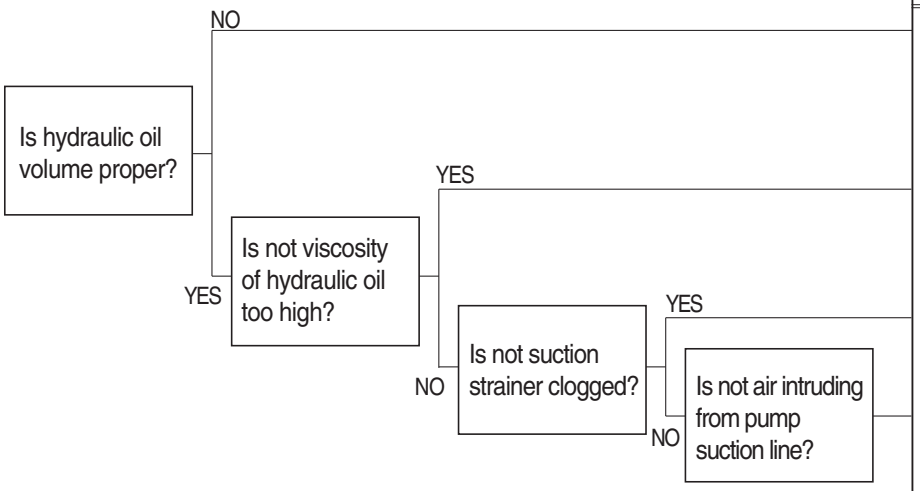
Cause	Remedy
Water is mixed.	Put hydraulic oil still, separate water and dispose it or replace hydraulic oil.
Air is intruded.	Check suction line and return line and eliminate the air intruding source.

2) HYDRAULIC OIL TEMPERATURE HAS RISEN ABNORMALLY



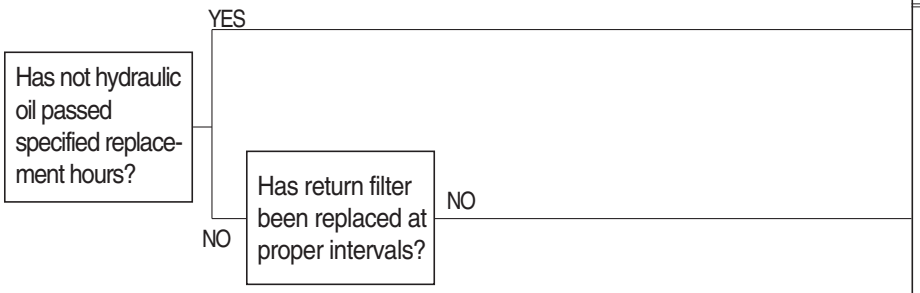
Cause	Remedy
Oil cooler clogged. Bypass check valve is defective. ⓐ	Replenish specified oil to the standard level. Clean oil cooler. Replace
	Adjust belt tension or replace belt.
	Readjust set pressure.
	Reduce load.

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.

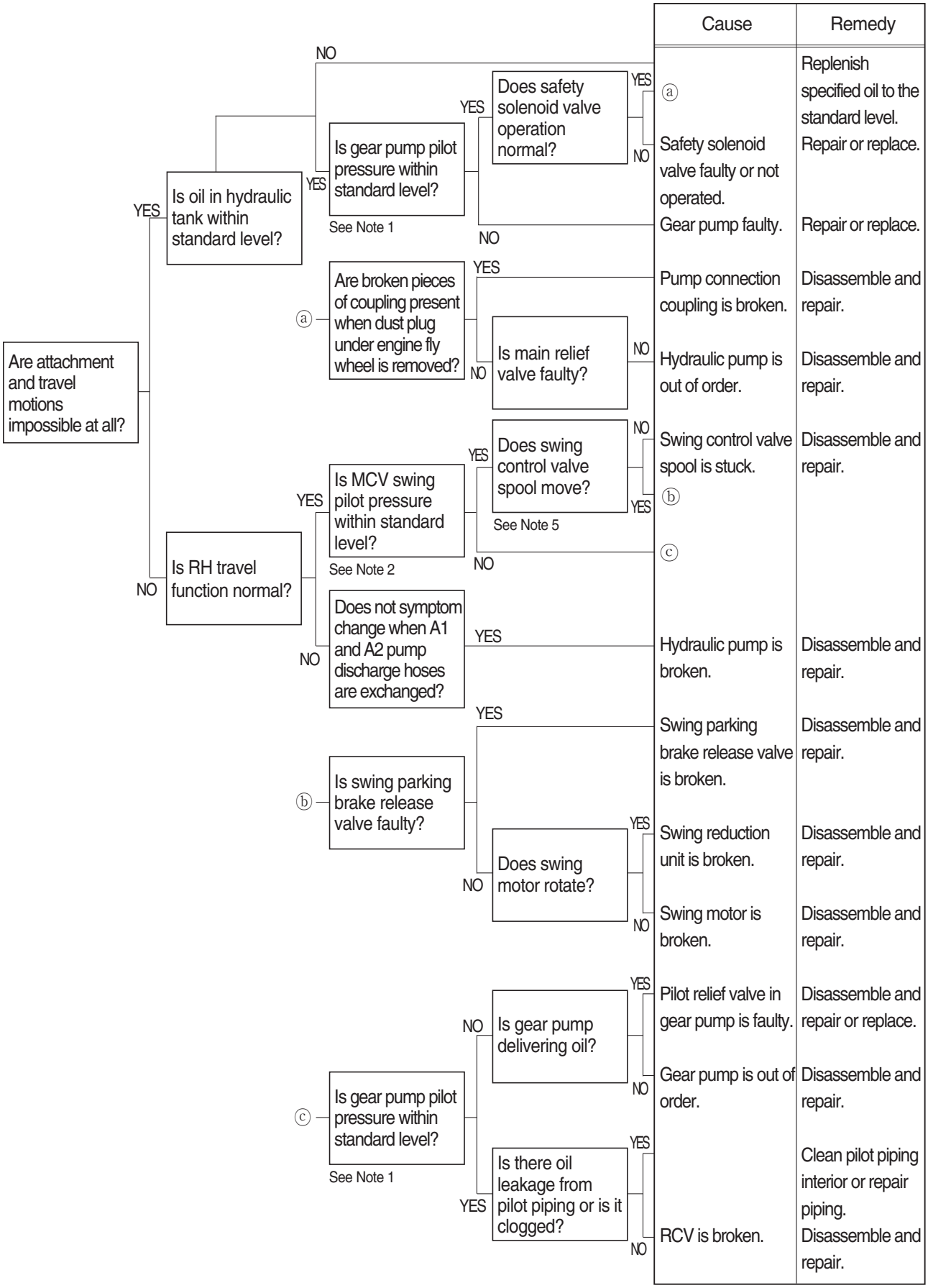
4) HYDRAULIC OIL IS CONTAMINATED



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

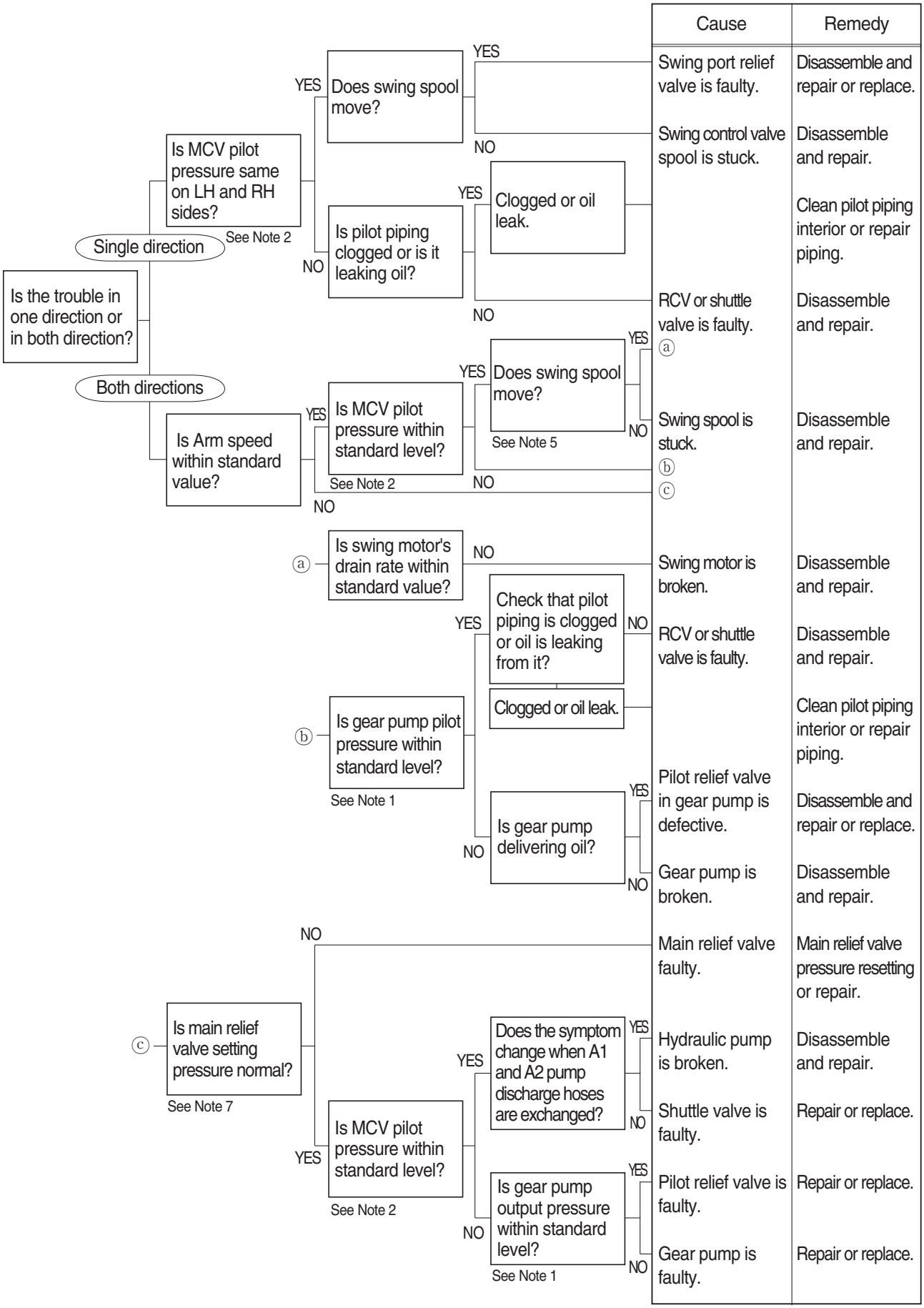
4. SWING SYSTEM

1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE

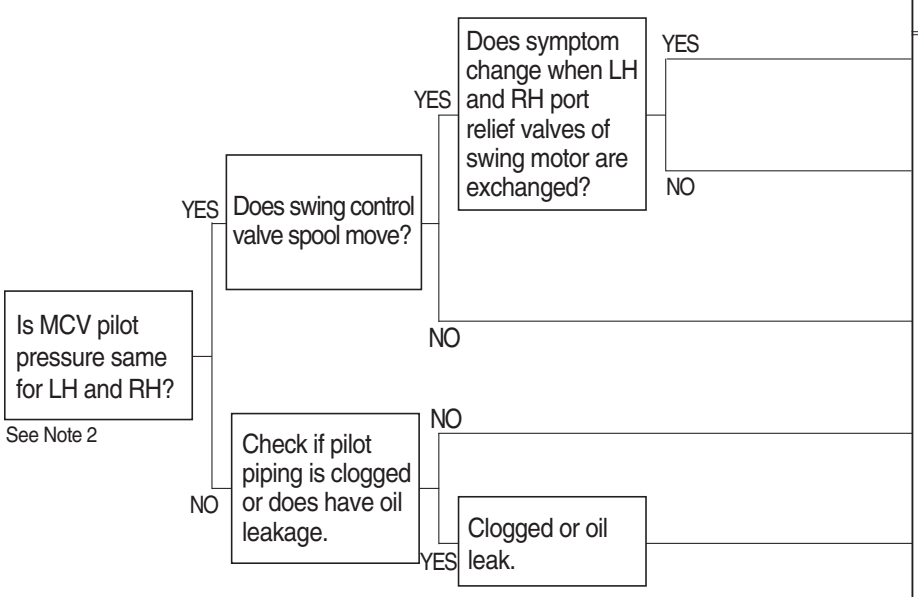


Cause	Remedy
ⓐ	Replenish specified oil to the standard level.
Safety solenoid valve faulty or not operated.	Repair or replace.
Gear pump faulty.	Repair or replace.
Pump connection coupling is broken.	Disassemble and repair.
Hydraulic pump is out of order.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
ⓑ	
ⓒ	
Hydraulic pump is broken.	Disassemble and repair.
Swing parking 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 in gear pump is faulty.	Disassemble and repair or replace.
Gear pump is out of order.	Disassemble and repair.
	Clean pilot piping interior or repair piping.
RCV is broken.	Disassemble and repair.

2) SWING SPEED IS LOW

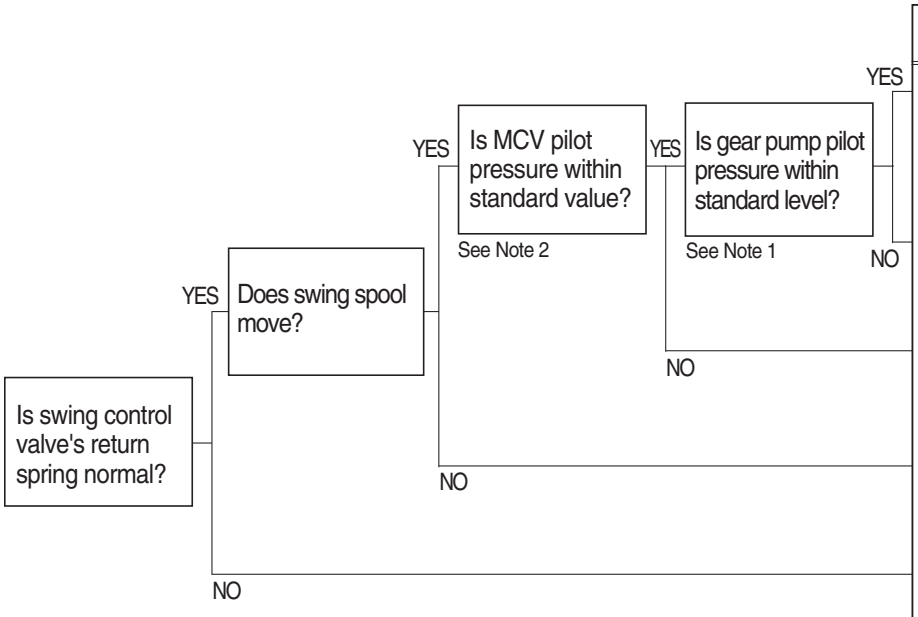


3) SWING MOTION IS IMPOSSIBLE IN ONE DIRECTION



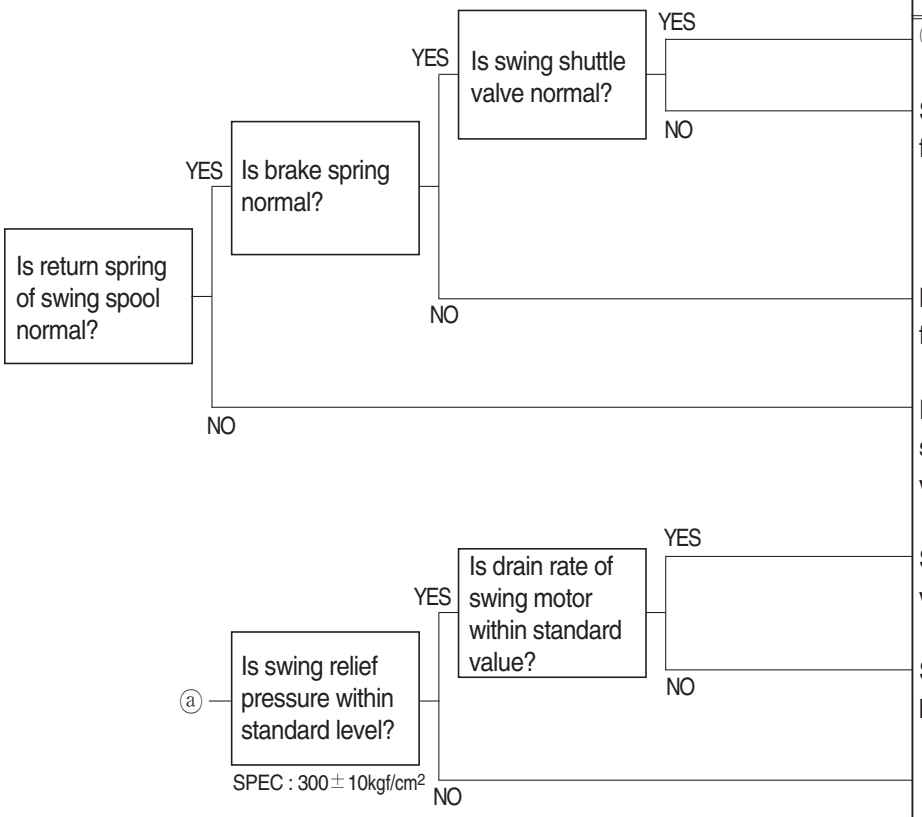
Cause	Remedy
Swing port relief valve is faulty.	Disassemble and repair.
Shuttle valve is faulty.	Disassemble and repair.
Swing control valve spool is stuck.	Disassemble and repair.
RCV is faulty.	Disassemble and repair.
	Clean pilot piping interior or repair piping.

4) MACHINE SWINGS BUT DOES NOT STOP



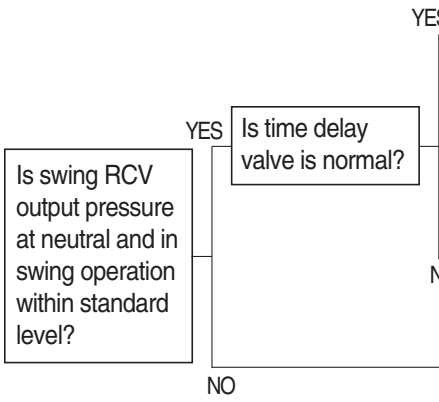
Cause	Remedy
Pilot relief valve is faulty.	Disassemble and repair or replace.
Gear pump is broken.	Disassemble and repair.
RCV is faulty.	Disassemble and repair.
Swing spool is stuck.	Disassemble and repair.
Return spring is faulty.	Disassemble and replace.

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



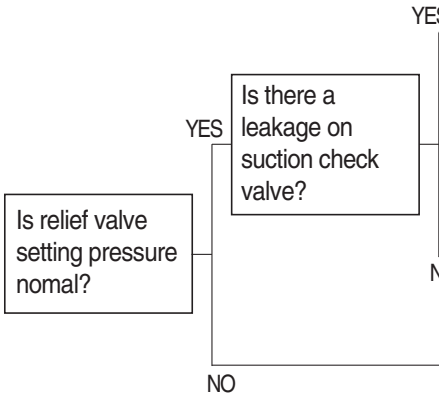
Cause	Remedy
ⓐ	
Shuttle valve is faulty.	Disassemble and replace.
Brake spring is faulty.	Disassemble and replace.
Return spring of swing control valve is faulty.	Disassemble and replace.
Swing port relief valve is faulty.	Disassemble and repair or replace.
Swing motor is broken.	Disassemble and repair.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

6) LARGE SHOCK OCCURS WHEN STOP SWINGING



Cause	Remedy
Swing motor is broken.	Disassemble and repair.
Time delay valve is faulty.	Disassemble and repair or replace.
Malfunction of swing RCV	Disassemble and repair.

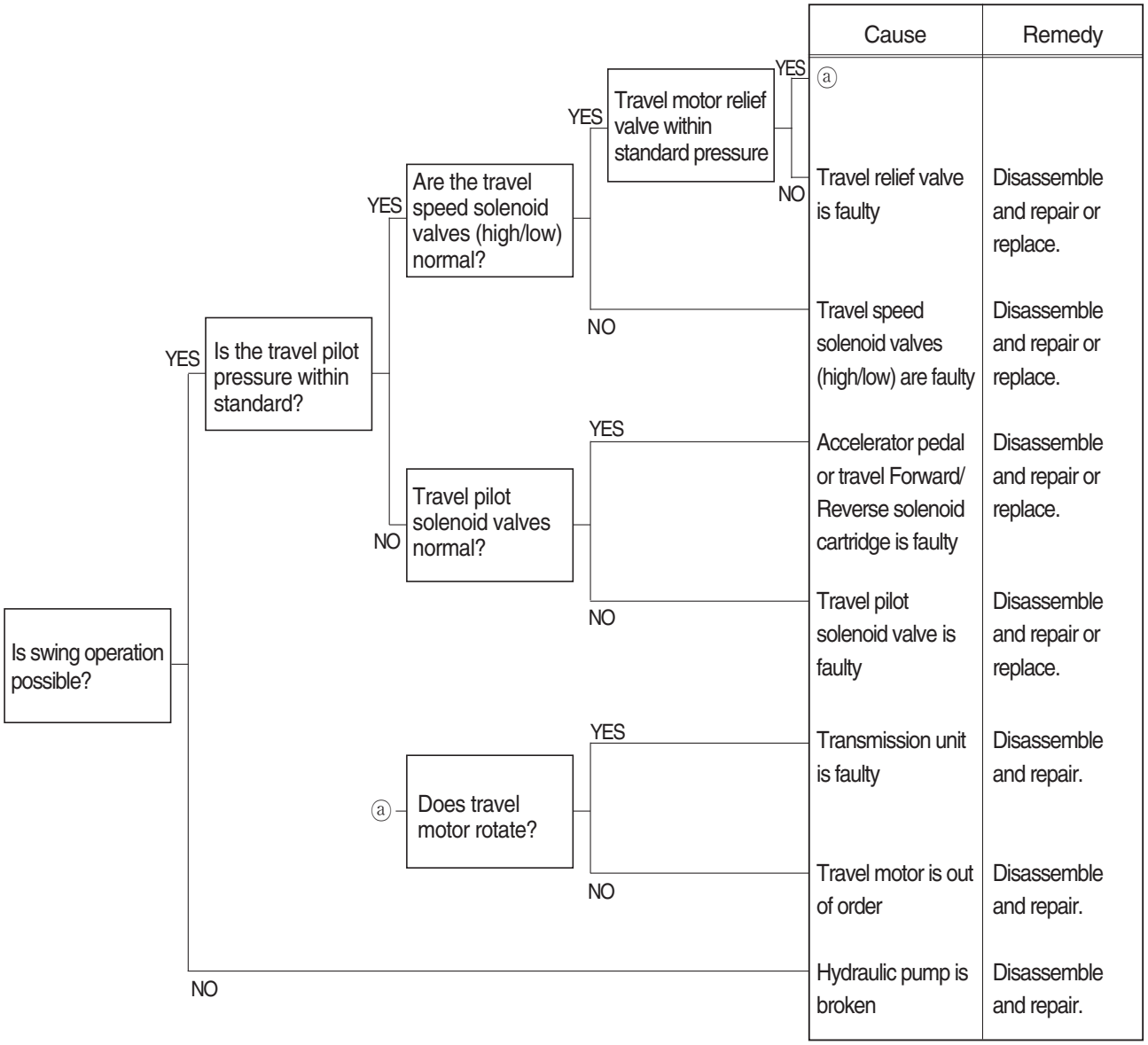
7) LARGE SOUND OCCURS WHEN STOP SWINGING



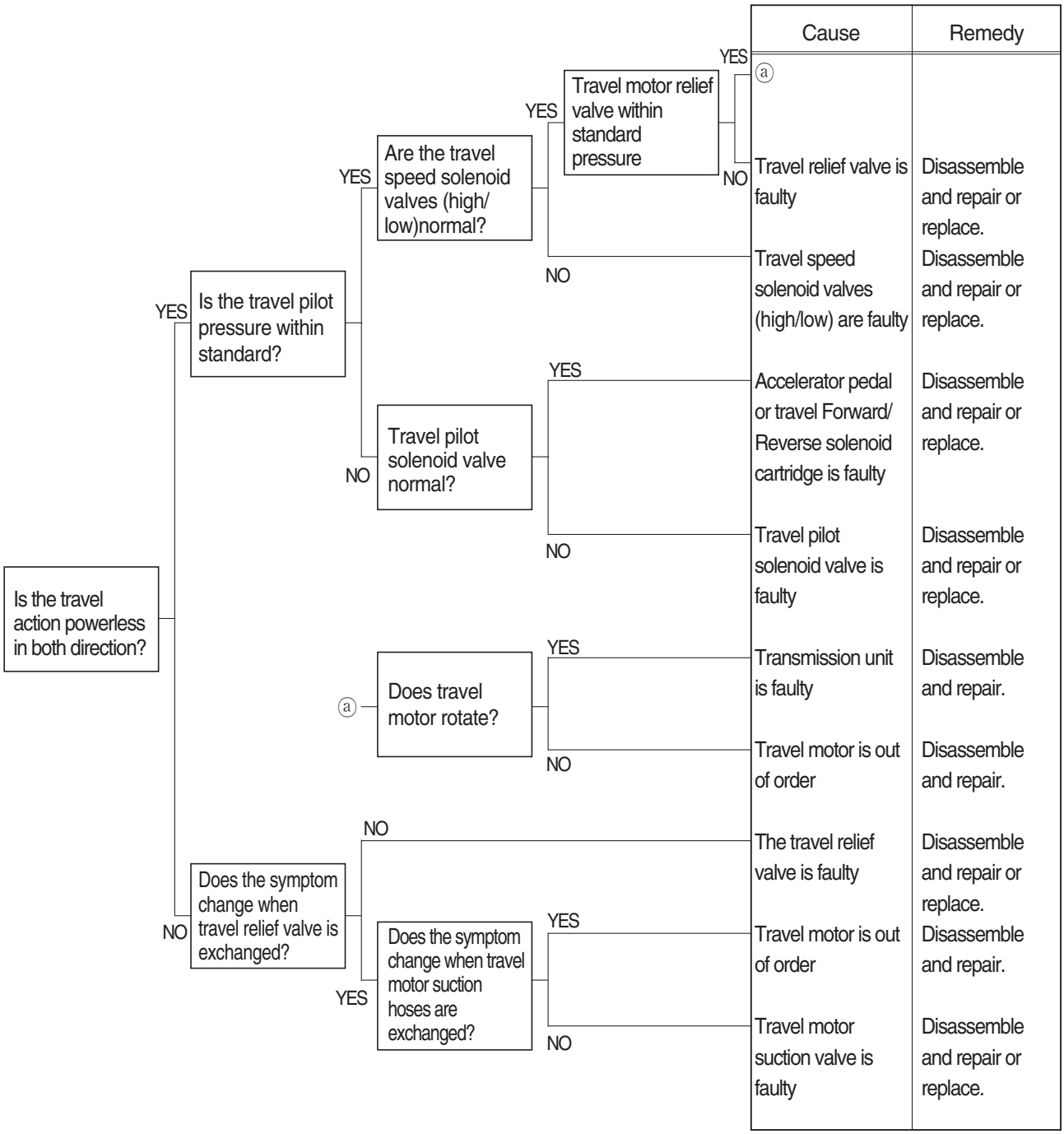
Cause	Remedy
Seal of suction valve is faulty.	Disassemble and repair.
Internal defect of swing motor.	Disassemble and repair.
Malfunction of relief valve.	Adjust swing relief valve pressure or replace swing relief valve.

5. TRAVEL SYSTEM

1) TRAVEL DOES NOT FUNCTION



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-avitation 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.

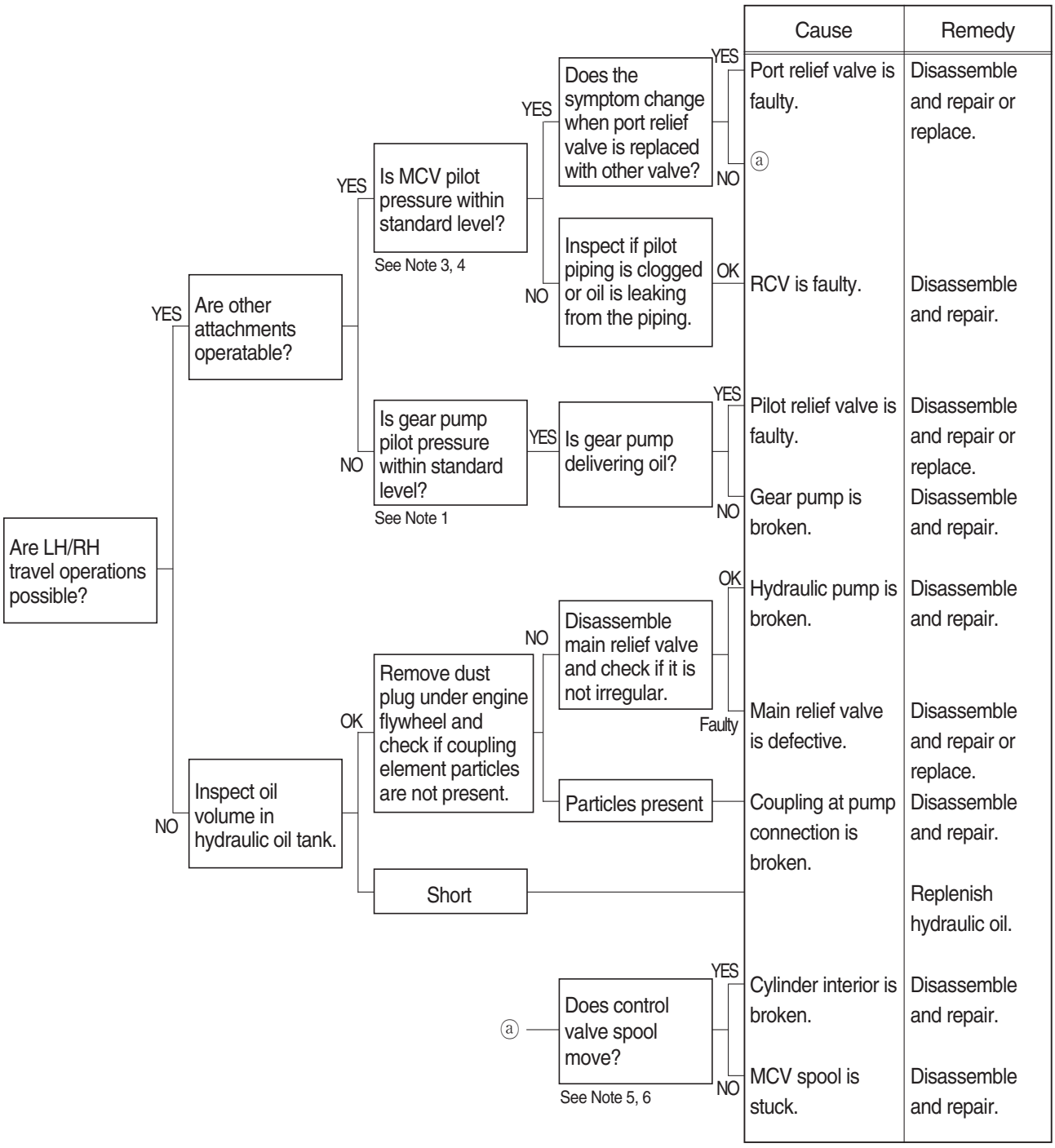
6) EXTRAORDINARY NOISE IS HEARD WHEN SUDDENLY REDUCING THE SPEED FROM THE HIGH-SPEED MODE

It takes time to accelerate the motor

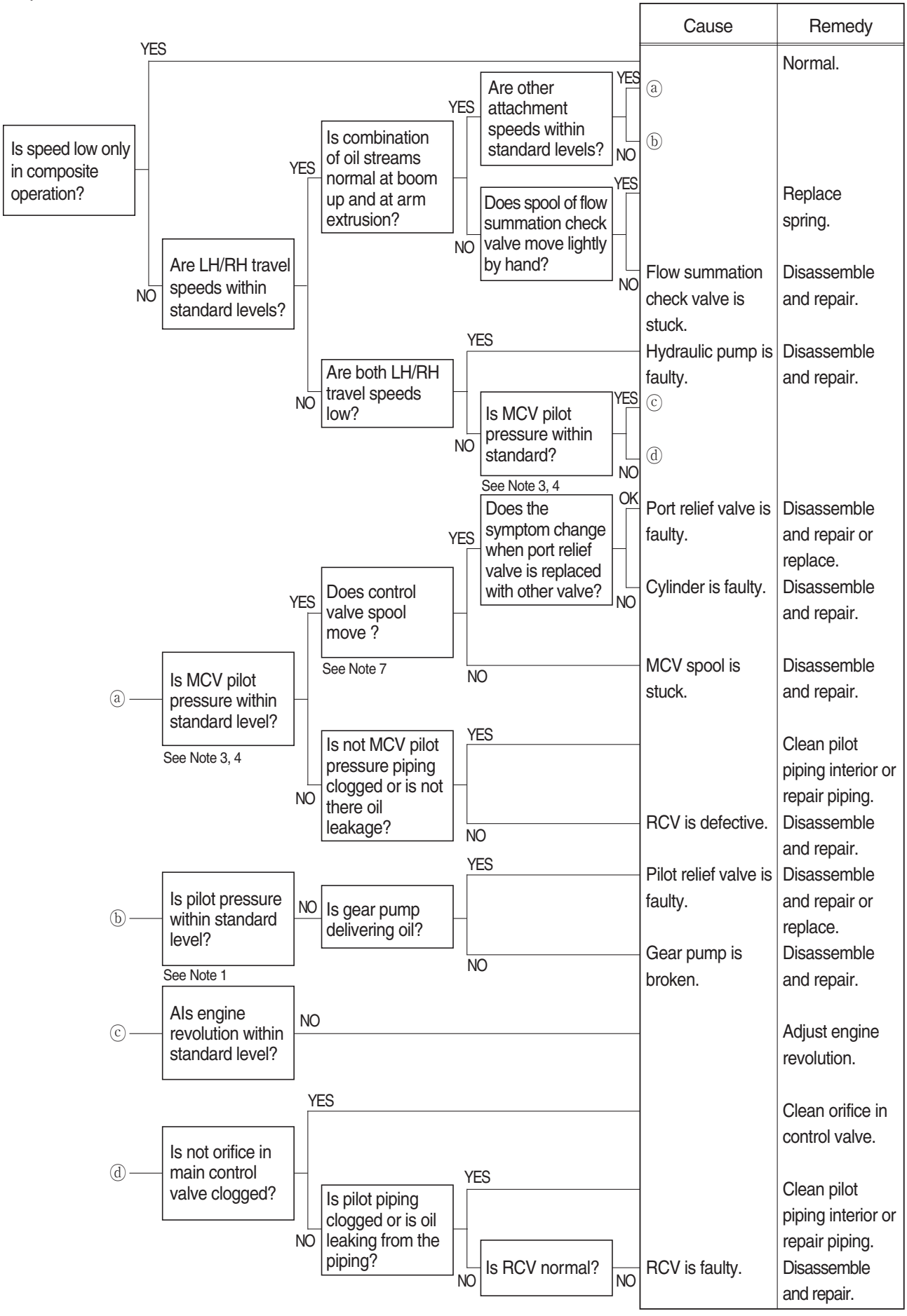
Cause	Remedy
The anti-cavitation valve does not not work properly.	Screw the fitting bolts one more time with correct tightening torque. If the valve turns out to be damaged, is should be repaired.

6. ATTACHMENT SYSTEM

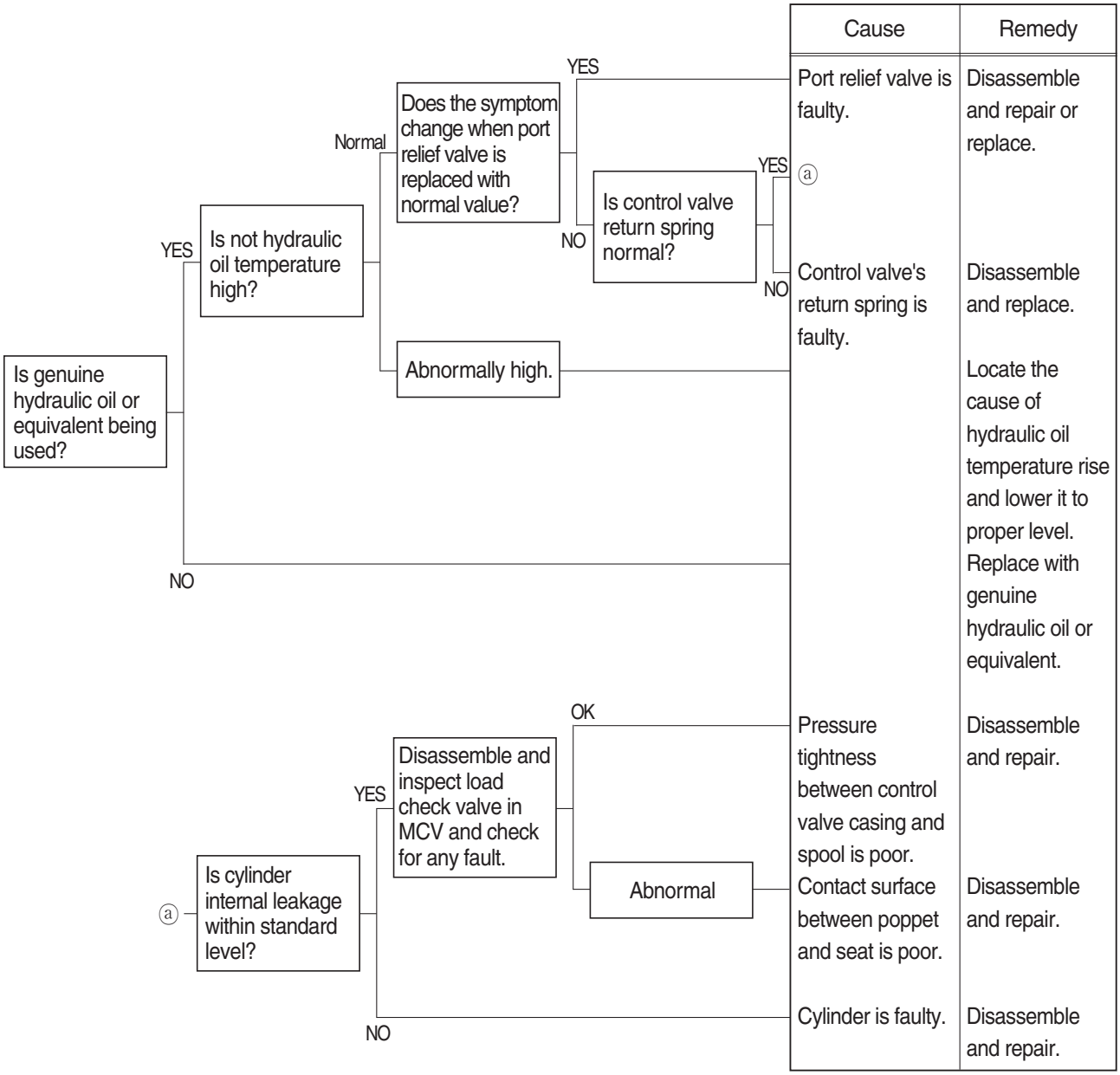
1) BOOM OR ARM ACTION IS IMPOSSIBLE AT ALL



2) BOOM, ARM OR BUCKET SPEED IS LOW

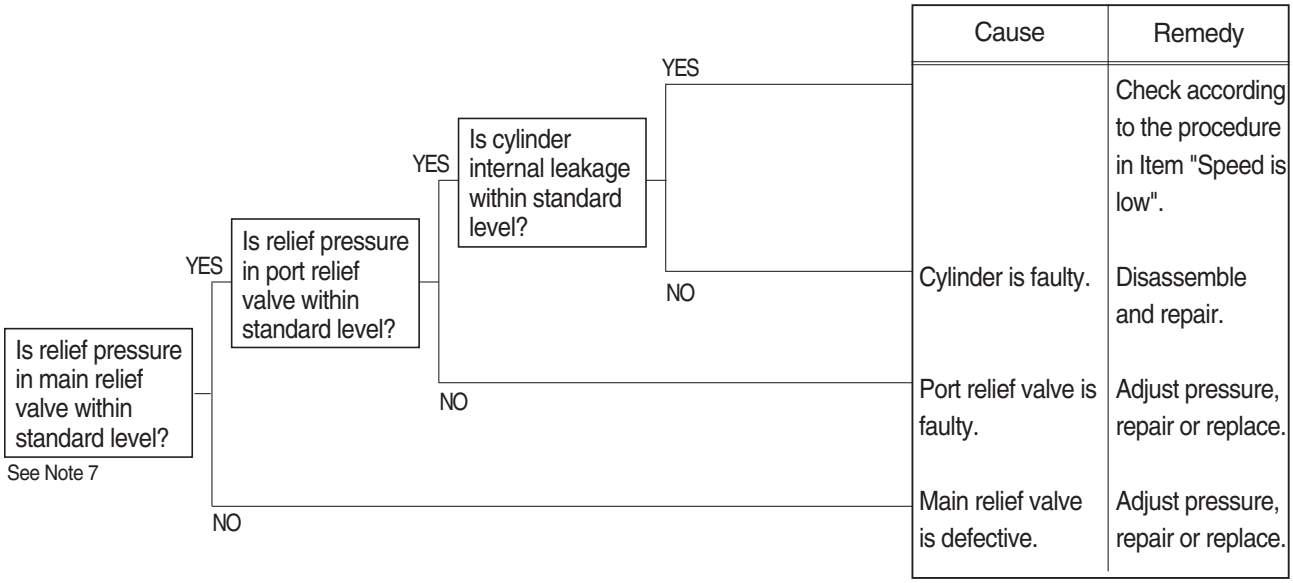


3) BOOM, ARM OR BUCKET CYLINDER EXTENDS OR CONTRACTS ITSELF AND ATTACHMENT FALLS



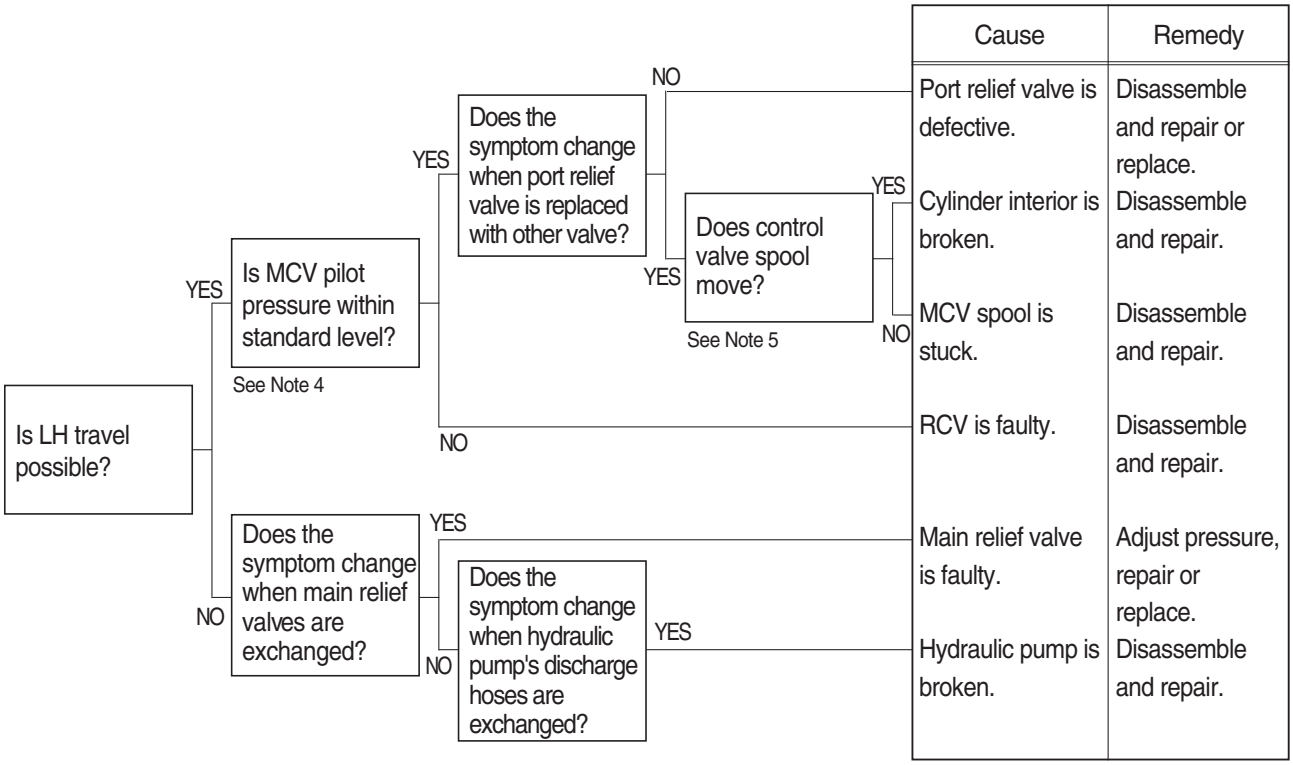
Cause	Remedy
Port relief valve is faulty.	Disassemble and repair or replace.
ⓐ	
Control valve's return spring is faulty.	Disassemble and replace.
	Locate the cause of hydraulic oil temperature rise and lower it to proper level. Replace with genuine hydraulic oil or equivalent.
Pressure tightness between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

4) BOOM, ARM OR BUCKET POWER IS WEAK



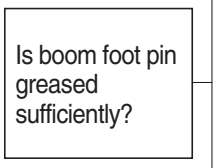
Cause	Remedy
Cylinder is faulty.	Check according to the procedure in Item "Speed is low". Disassemble and repair.
Port relief valve is faulty.	Adjust pressure, repair or replace.
Main relief valve is defective.	Adjust pressure, repair or replace.

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.
MCV spool is stuck.	Disassemble and repair.
RCV is faulty.	Disassemble and repair.
Main relief valve is faulty.	Adjust pressure, repair or replace.
Hydraulic pump is broken.	Disassemble and repair.

6) BOOM MAKES A SQUEAKING NOISE WHEN BOOM IS OPERATED

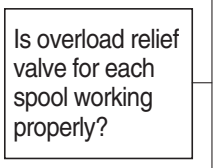


YES

NO

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

7) TIME LAG OF MACHINE WORKING IS LARGE.



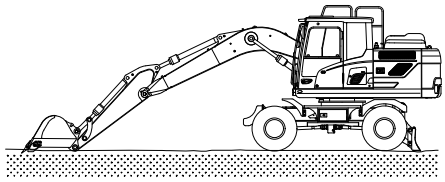
YES

NO

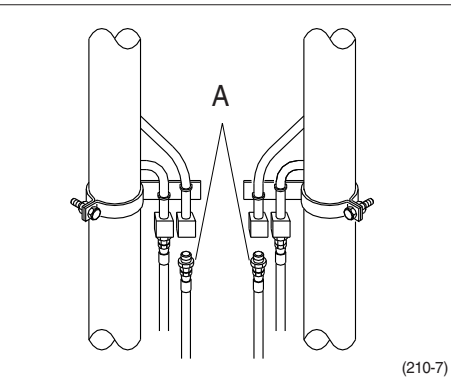
Cause	Remedy
	Refer to 2)
Overload relief valve is faulty.	Disassemble and repair.

※ HOW TO CHECK INTERNAL BOOM CYLINDER LEAKAGE

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

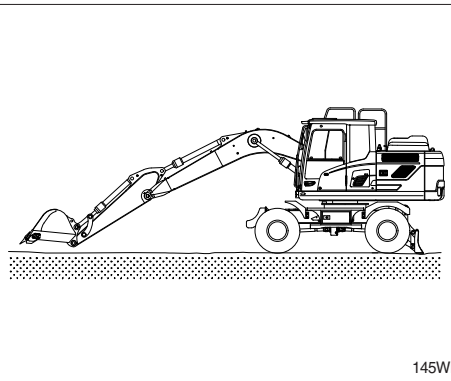


2. Disconnect hose (A) from rod side of boom cylinder and drain oil from cylinders and hose. (put cups on piping and hose ends)



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

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



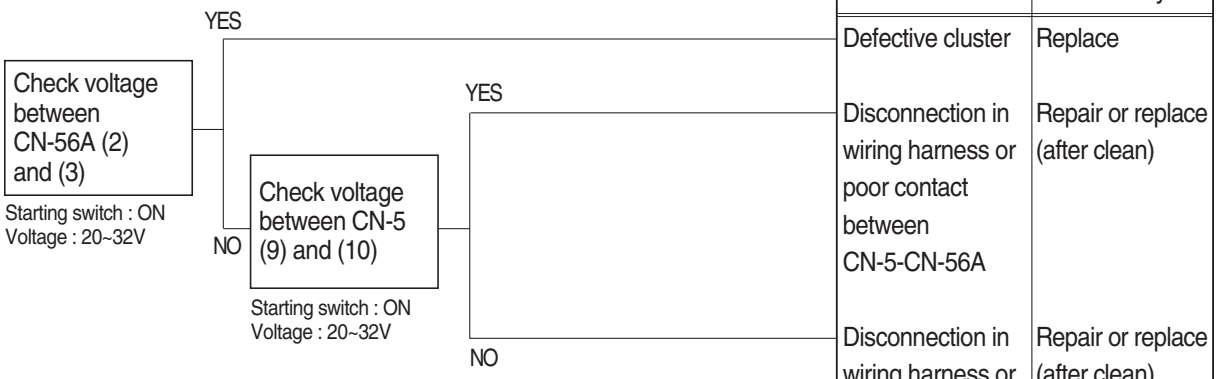
7. FRONT AXLE AND REAR AXLE

Problem	Cause	Correction
Insufficient braking	1. Incorrect adjustment	Inspect disc thickness and if discs are usable readjust brakes to the specifications in the manual.
	2. Brake discs worn out	Inspect disc thickness and replace if necessary.
	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 housings. 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 “overheating” problem.
Soft brake pedal	6. Air in brake circuit	Bleed air in brake circuit.
Ineffective safety brake	7. Incorrect adjustment	See correction No.1.
	8. Brake disc worn out	See correction No.2.
Overheating	9. Oil level wrong	Drain, flush and refill oil to proper level.
	10. Too small of a brake gap	Readjust brakes to the specifications.
	11. Park brake dragging	Unlock the brake and adjust the correct gap.
	12. Incorrect brake fluid in system	See correction No.3.
	13. No free-pedal at master cylinder	Readjust brake pedal.
	14. Restriction in brake lines	Inspect for and replace damage lines.
	15. 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.
	16. Incorrect lubricant	Change the retaining rings of the brake circuit and brake pump.
Diff-lock inoperative	17. If manual control, loose or misadjusted linkage	Inspect and correct linkage and readjust.
	18. If hydraulic control, problems in the hydraulic or electrical circuits of the machine.	Refer to the hydraulic or electrical section in this manual.
	19. If hydraulic control problems in actuating cylinder(noteable through loss of hydraulic oil or increase of the oil level in axle)	Rebuilt cylinder.
	20. If with limit slip differential, worn discs	Replace discs.

Problem	Cause	Correction
Oil coming out of breather	21. Leak in internal brake system	See correction No.2 and No.3.
	22. Leak in diff-lock actuating cylinder	See correction No.19.
Nospin indexing noise when driving straight ※With nospin, fatigue damage can occur on the side with the larger tire.	23. Unequal tire pressure left and right	Inflate tires to the recommended pressure in this manual, or until the rolling radius is equal.
	24. Different style, size or brand of tires between left and right hand side	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	25. Wheel bearings damaged	Replace and adjust
Noise under power greater than during coast	26. Low oil level	Refill oil to proper level
	27. Incorrect lubricant	See correction No.16.
	28. Ring and pinion worn	Inspect through top cover. Replace and adjust.
	29. Worn ring and pinion bearings	Replace and adjust
	30. Worn planetary gears or bearings	Replace.
Noise during coast greater than under power	31. Loose pinion nut	Inspect ring, pinion and pinion bearings. If undamaged, retighten nut.
	32. Only pinion bearing damaged	See correction No.29.
Noise during turn (Without nospin)	33. Worn spider and/or side gears	Replace.
A stick slip noise when going from forward to reverse	34. Worn or damaged cardan shaft	Inspect and replace.
	35. Loose wheel	Inspect for wheel and wheel stud damage. Replace if needed and retorque lugnuts.
	36. Articulation box joint and achsel shaft damaged	Inspect and replace.
	37. Spider pins loose in diff-carrier	Inspect through top cover. Replace.
	38. Damaged or missing spider and/or side gear washers	See correction No.33.

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

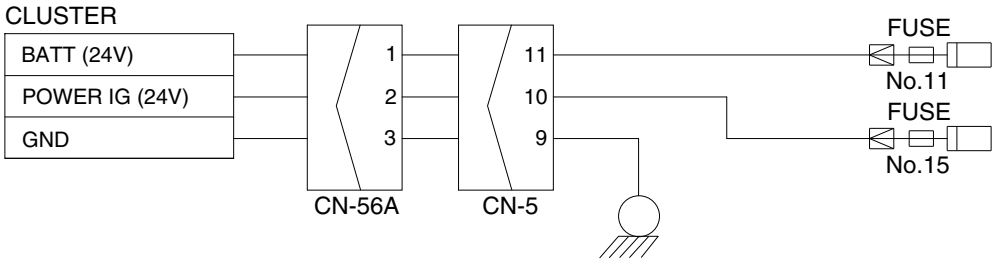
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 11, 15.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective cluster	Replace
Disconnection in wiring harness or poor contact between CN-5-CN-56A	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CN-5 (9) -GND or fuse No. 11, 15	Repair or replace (after clean)

Check voltage

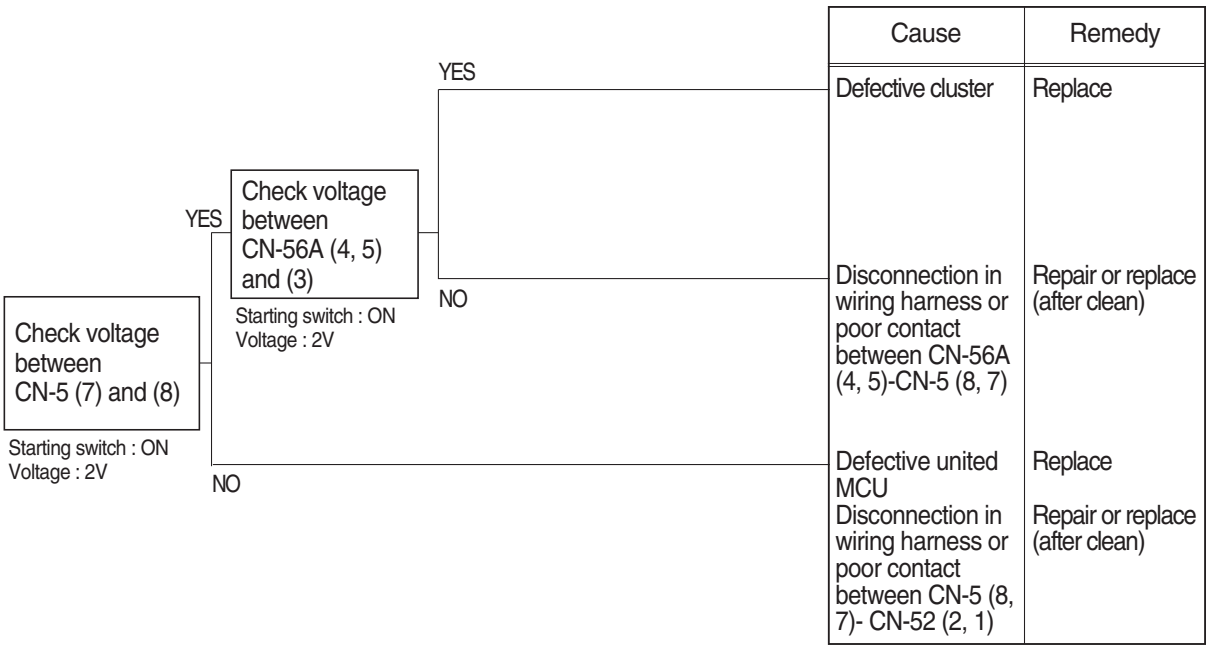
YES	20~32V
NO	0V



210WA6ES01

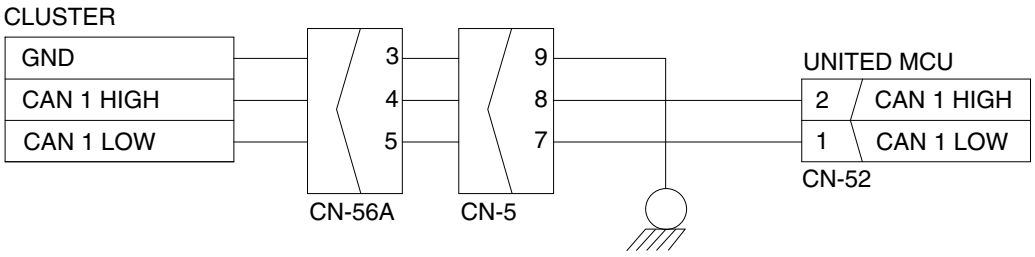
2. ⚠ COMMUNICATION ERROR FLASHES ON THE CLUSTER (HCESPN 840, FMI 2)

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



Check voltage

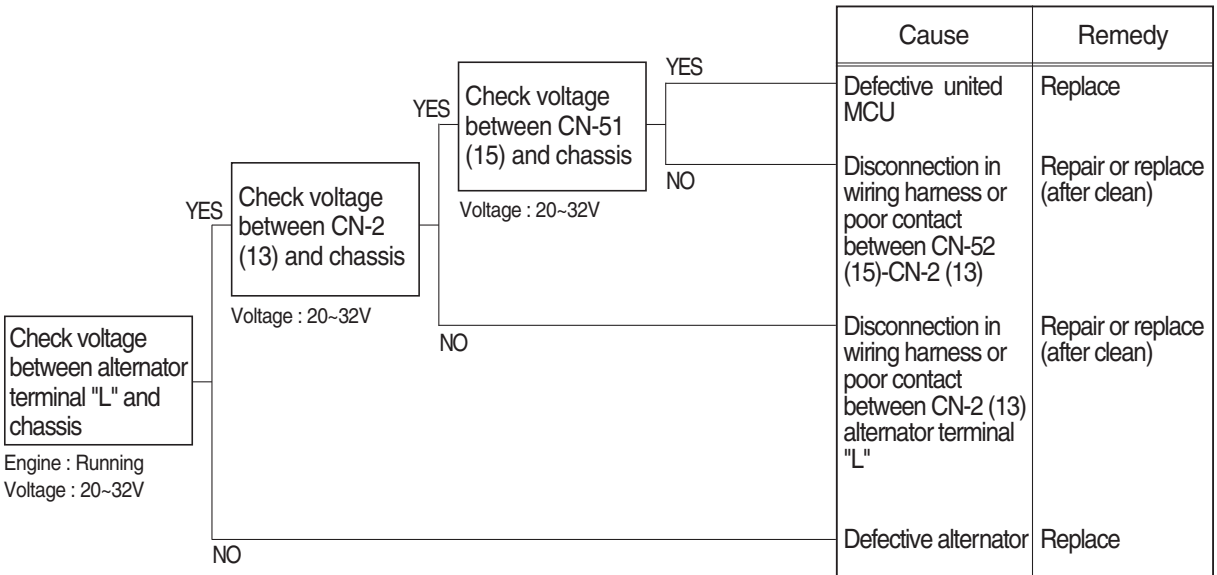
YES	2V
NO	0V



210WA6ES02

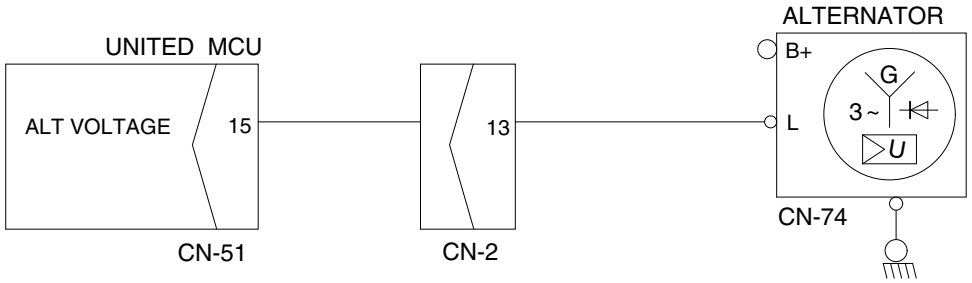
3. BATTERY CHARGING WARNING LAMP LIGHTS UP (Starting switch : ON)

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



Check voltage

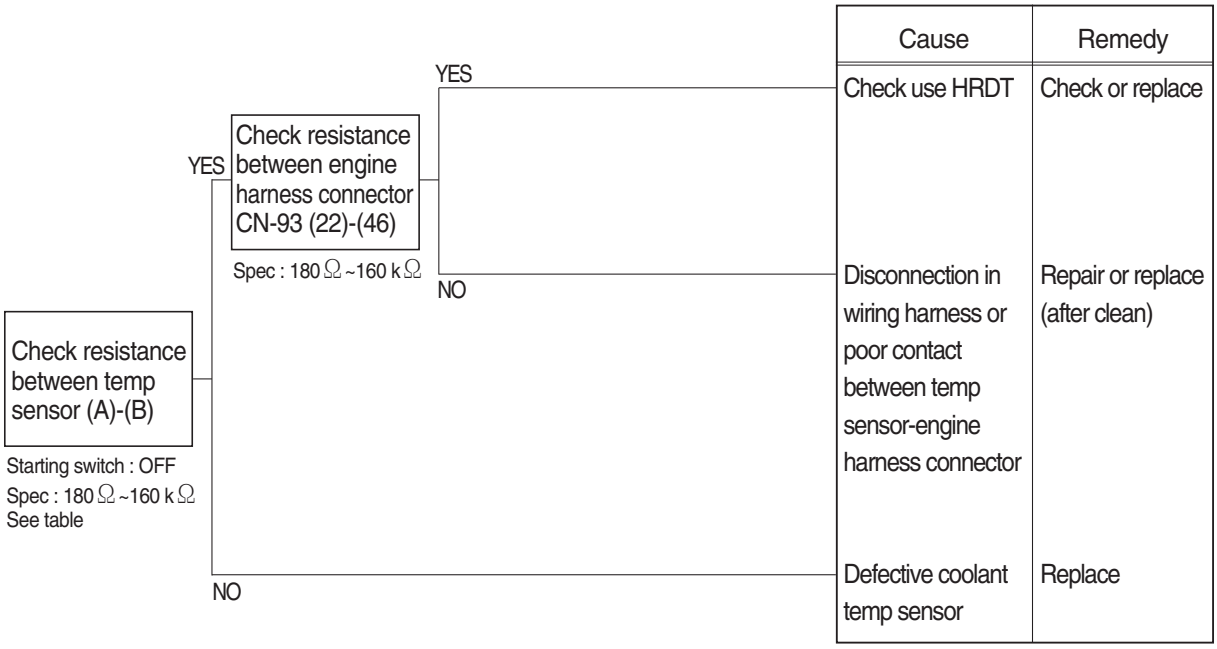
YES	20~32V
NO	0V



210WA6ES03

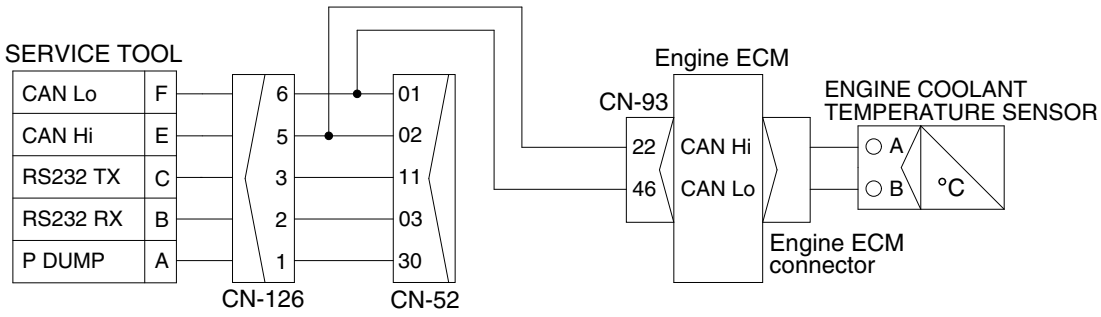
4. WHEN COOLANT OVERHEAT WARNING LAMP LIGHTS UP (engine is started)

· 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.



Check Table

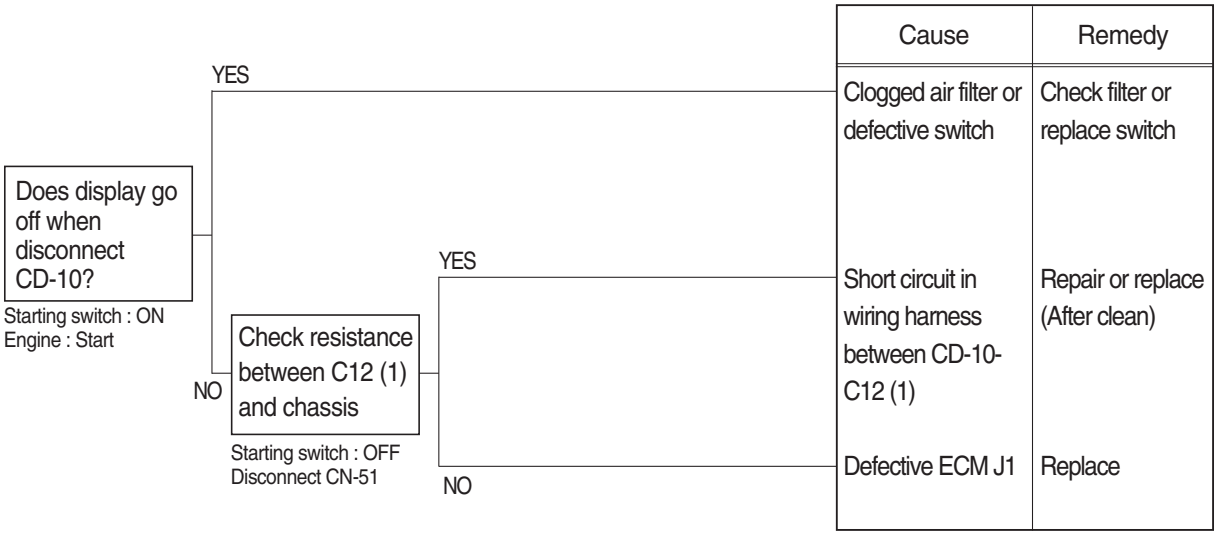
Temperature (˚C)	0	25	50	80	95
Resistance (kΩ)	30~37	9.3~10.7	3.2~3.8	1.0~1.3	0.7~0.8



210WA6ES04

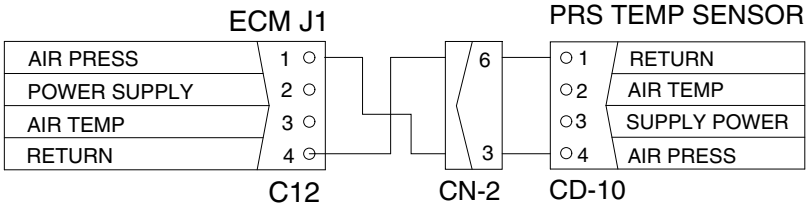
5. WHEN AIR CLEANER WARNING LAMP LIGHTS UP (engine is started)

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



Check resistance

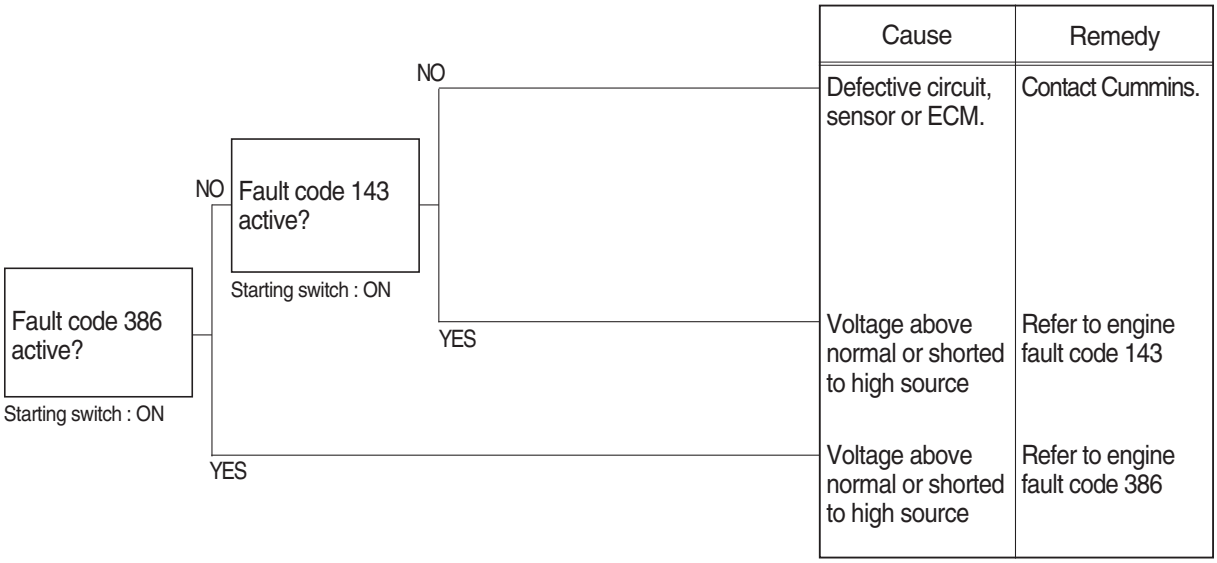
YES	MAX 1Ω
NO	MIN 1MΩ

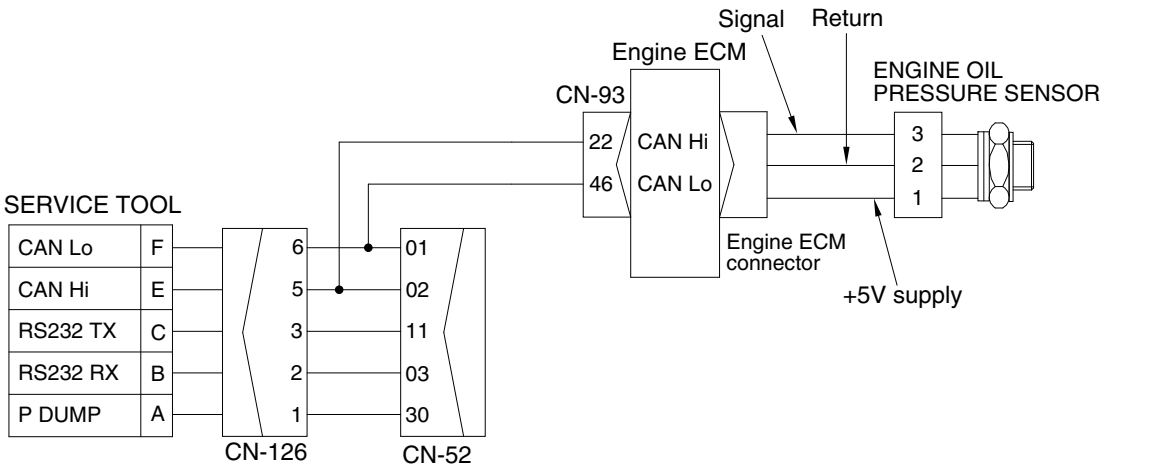


210WA6ES06

6. 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.

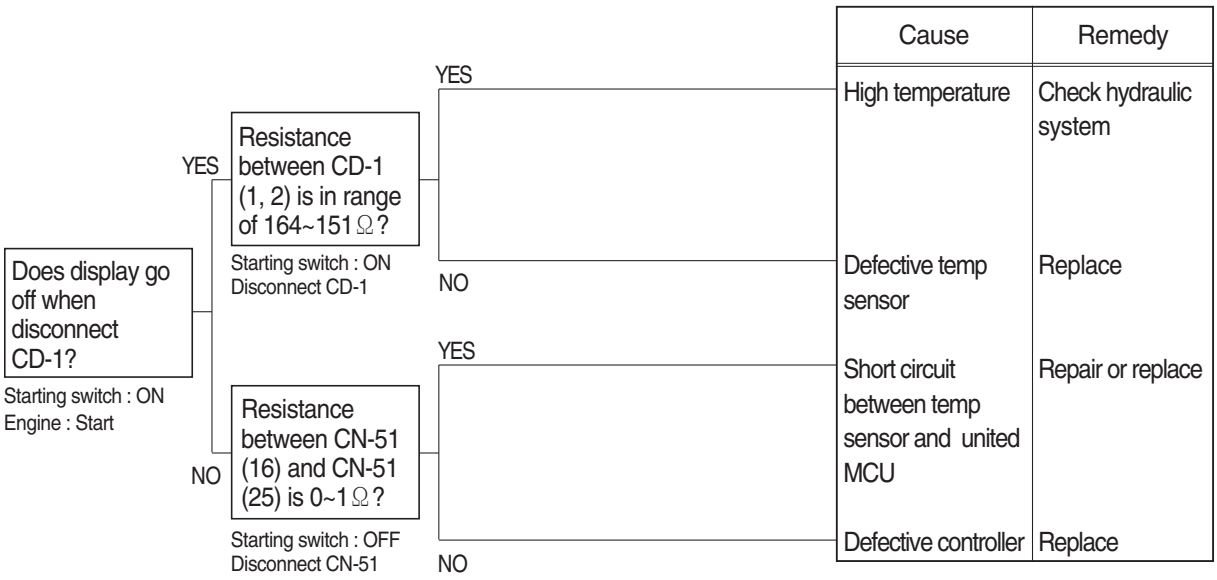


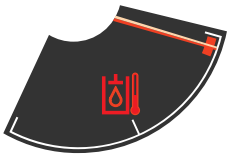


210WA6ES07

7. WHEN HYDRAULIC OIL TEMPERATURE WARNING LAMP LIGHTS UP (engine is started)

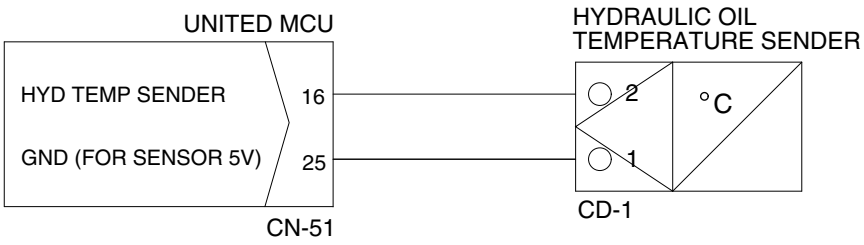
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

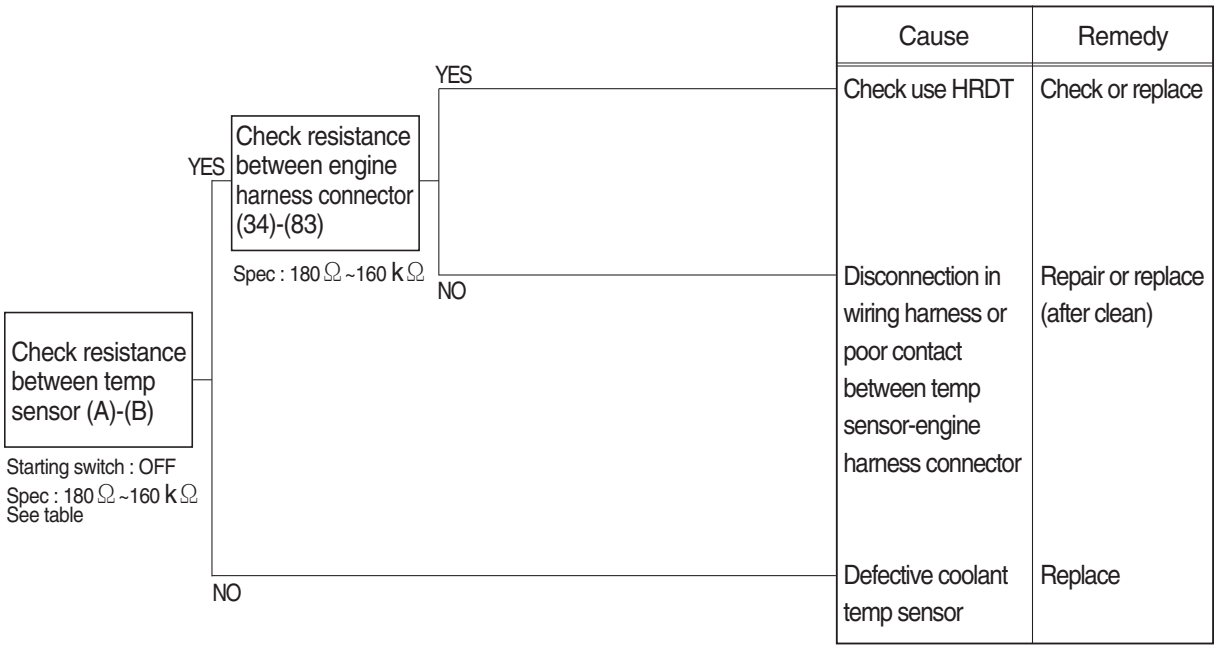
Temperature (˚C)	~ -30	~ -10	~ 0	~ 40	~ 70	~ 80	~ 90	~ 100	105~
Resistance (kΩ)	22.22 ~31.78	8.16 ~10.74	5.18 ~ 6.6	1.06 ~1.28	0.39 ~0.476	0.322 ~0.298	0.243 ~0.219	0.185 ~0.167	0.164 0.151



210WA6ES08

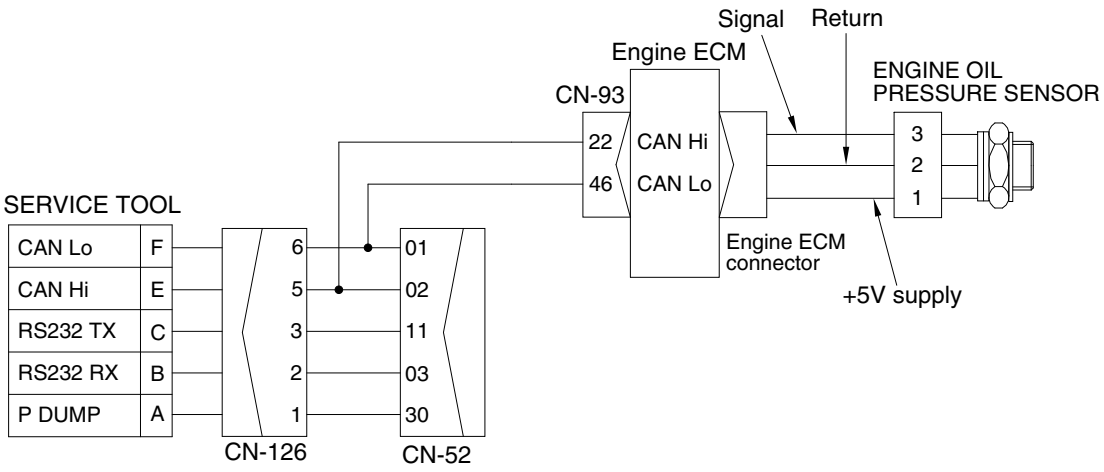
8. WHEN COOLANT TEMPERATURE GAUGE DOES NOT OPERATE (HCESPN 304, FMI 3 or 4)

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



Check Table

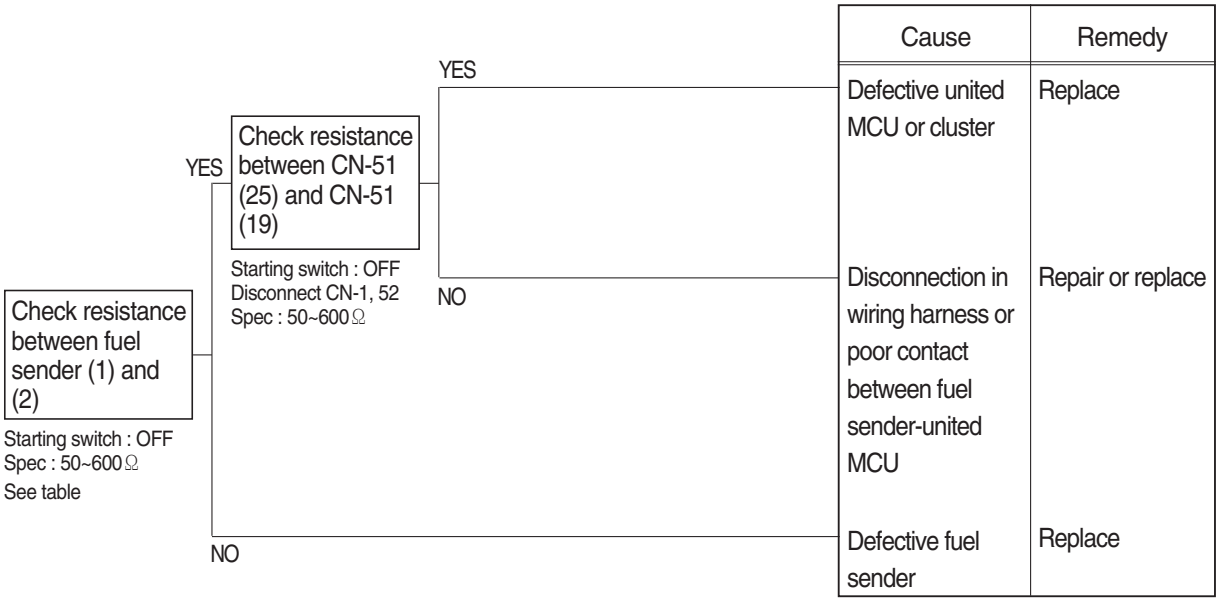
Temperature (˚C)	0	25	50	80	95
Resistance (kΩ)	30~37	9.3~10.7	3.2~3.8	1.0~1.3	0.7~0.8

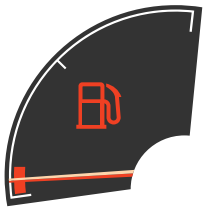


210WA6ES07

9. WHEN FUEL GAUGE DOES NOT OPERATE (HCESPN 301, FMI 3 or 4)

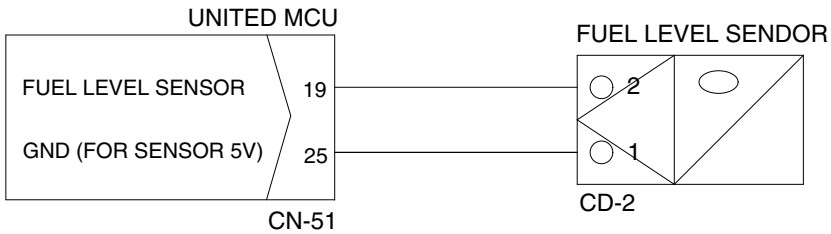
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.





Check Table

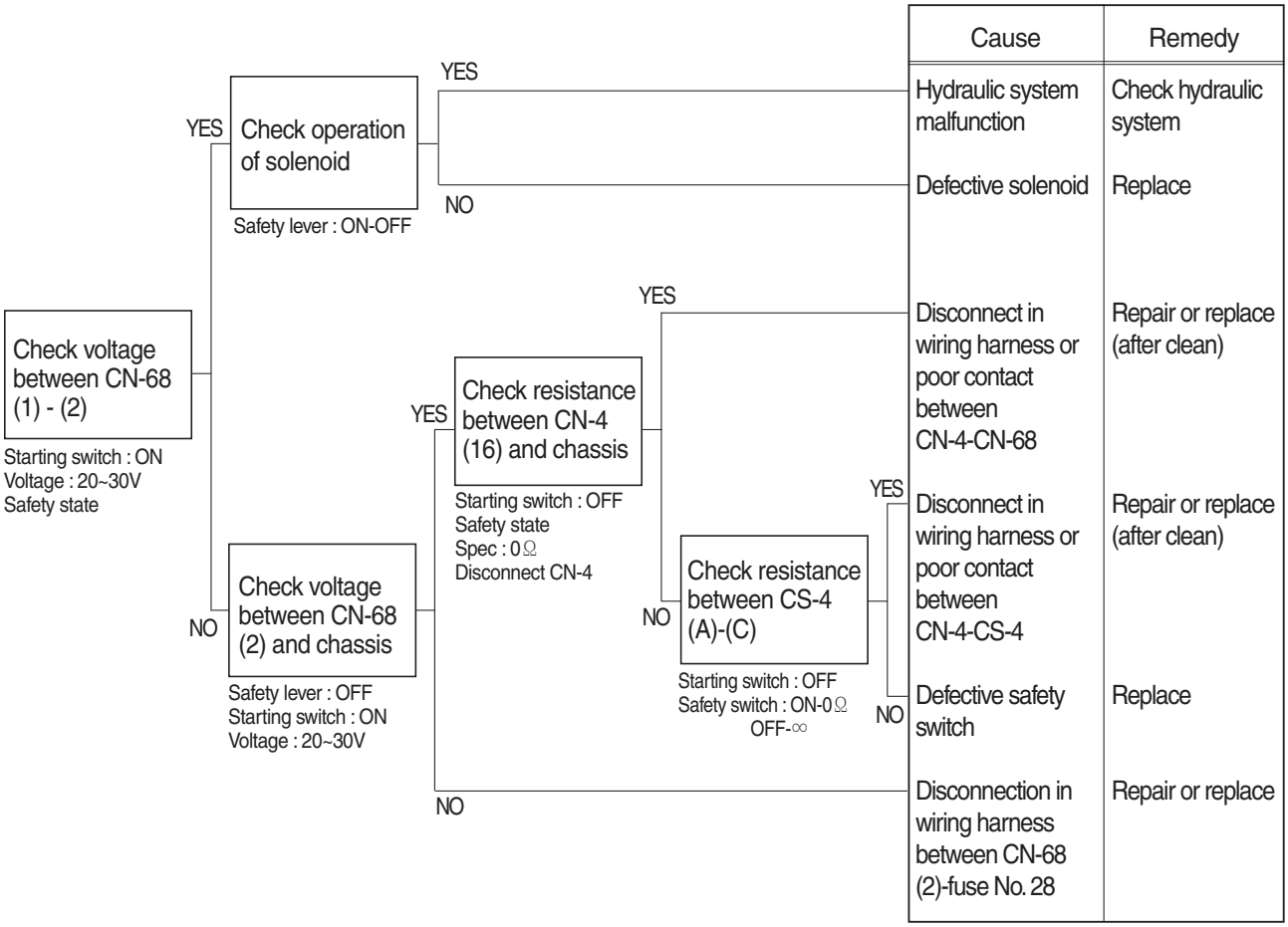
Range	Resistance (Ω)	Range	Resistance (Ω)
Full	50	5/12	400
11/12	100	4/12	450
10/12	150	3/12	500
9/12	200	2/12	550
8/12	250	1/12	600
7/12	300	Empty warning	700
6/12	350	-	-

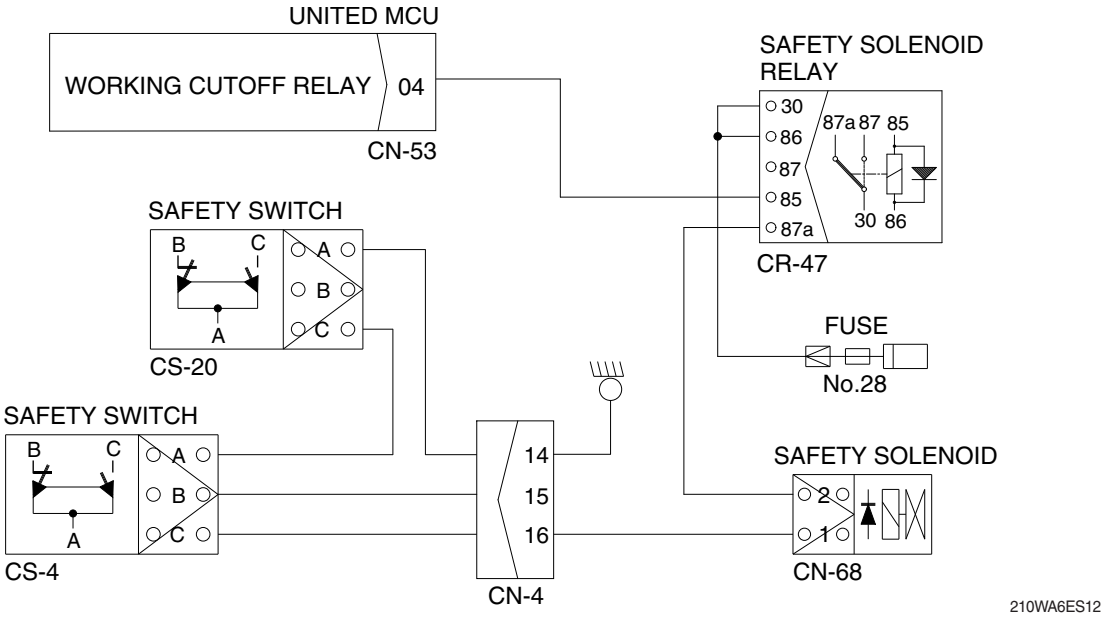


210WA6ES10

10. 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. 28.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.
· Auto safety lock function execution condition : When the RCV pilot pressure increases above certain pressure within the standard time after changing the safety knob LOCK → UNLOCK
· Under the above conditions, the electric current is turned off to the safety solenoid, and the function of RCV and pedal is disabled.

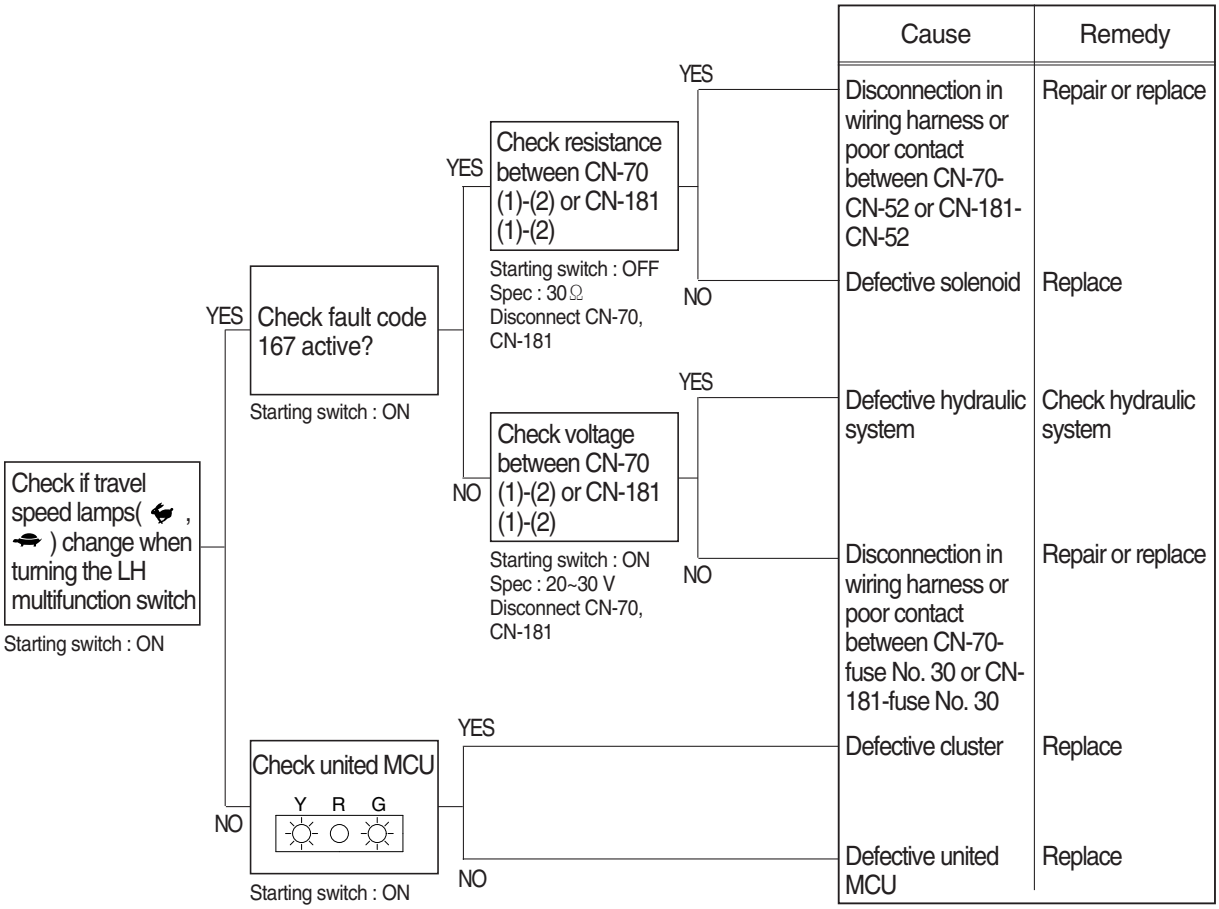


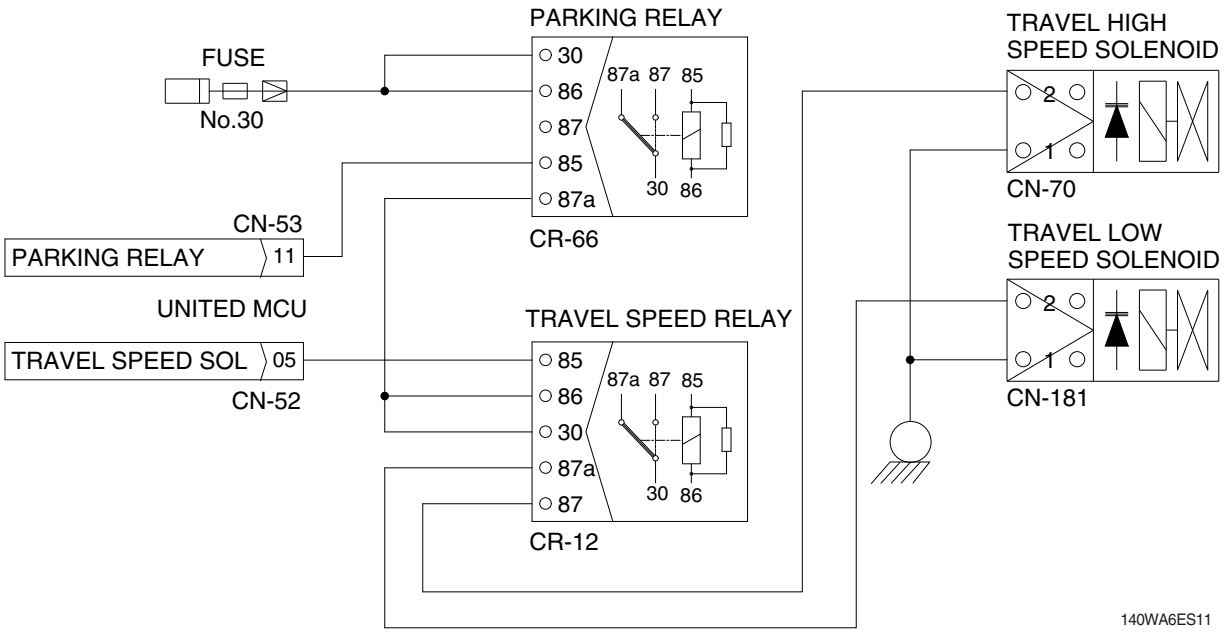


210WA6ES12

11. WHEN TRAVEL SPEED 1, 2 DOES NOT OPERATE (HCESPN 167, FMI 4 or 6)

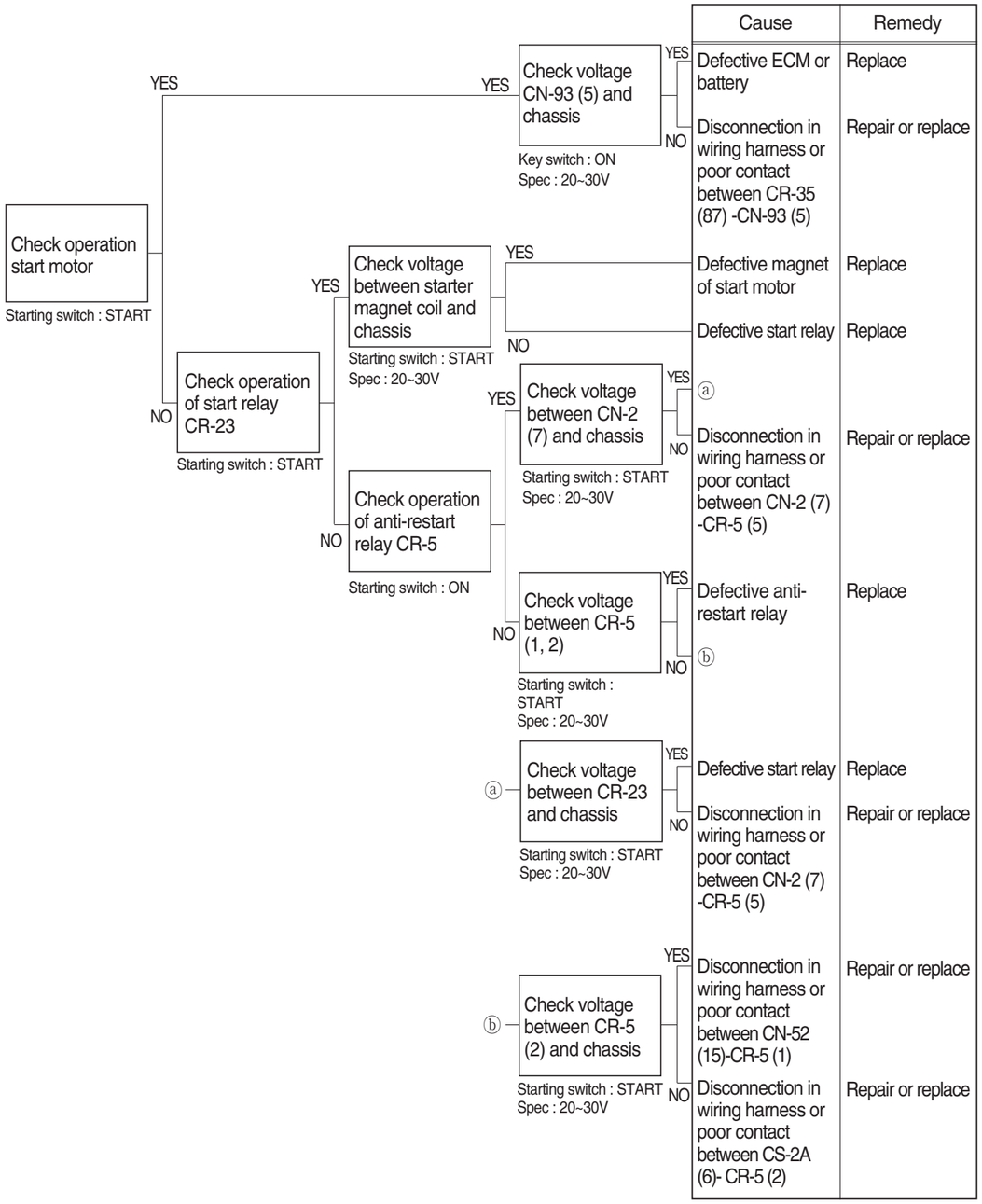
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 30.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



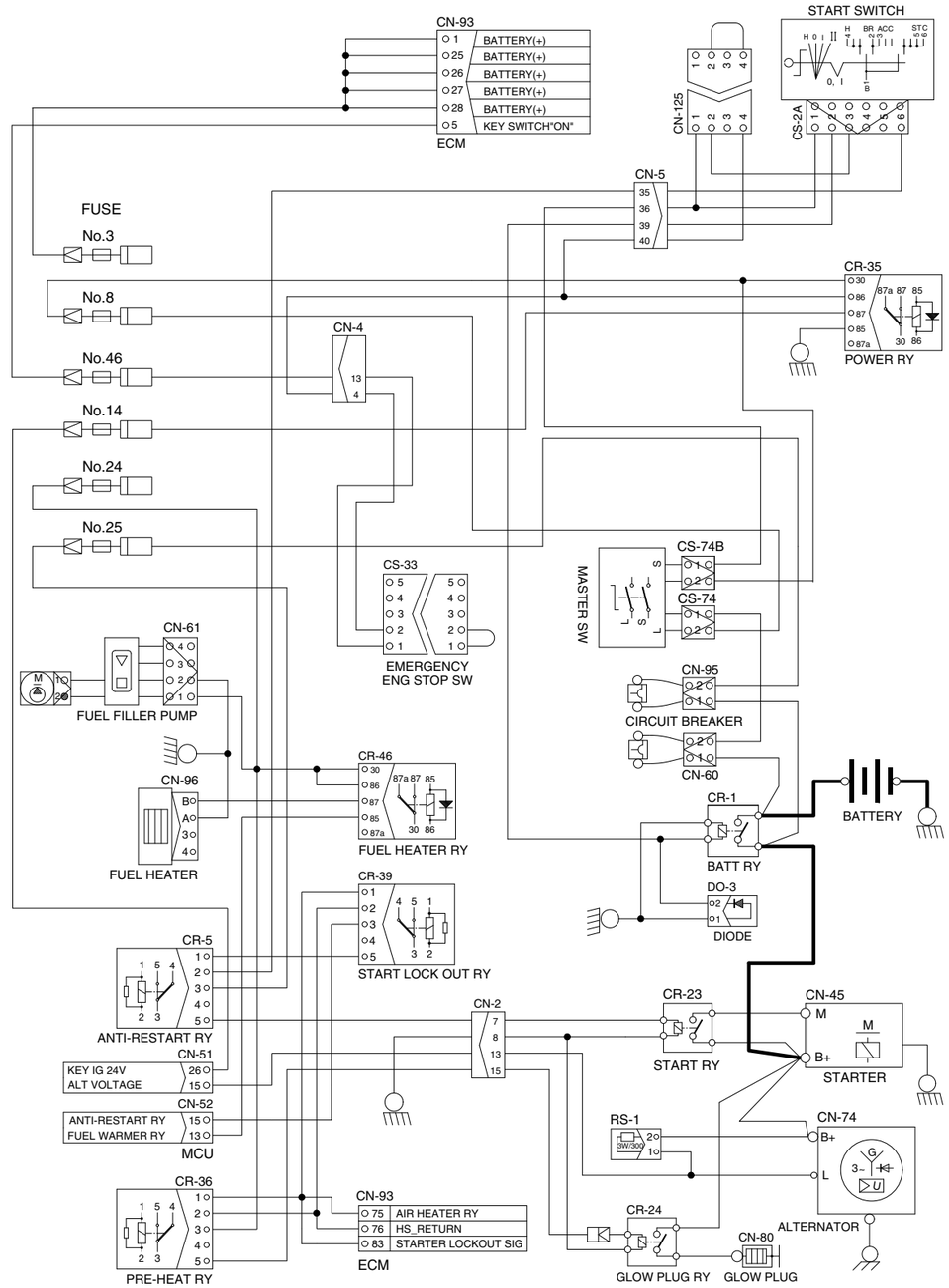


12. WHEN ENGINE DOES NOT START (lights up condition)

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No. 3, 8, 14, 24, 25, 46.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



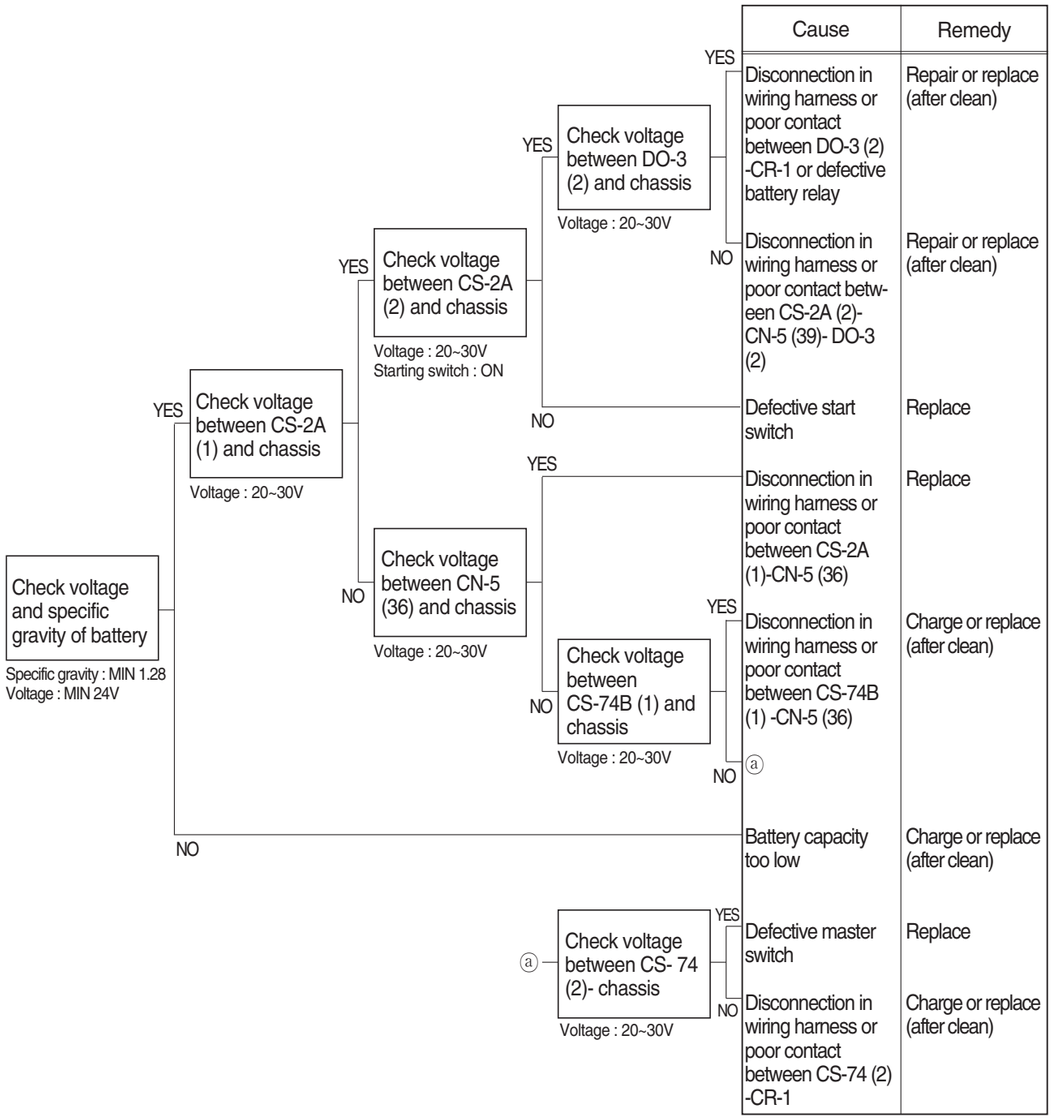
Cause	Remedy
Defective ECM or battery	Replace
Disconnection in wiring harness or poor contact between CR-35 (87) -CN-93 (5)	Repair or replace
Defective magnet of start motor	Replace
Defective start relay	Replace
ⓐ	
Disconnection in wiring harness or poor contact between CN-2 (7) -CR-5 (5)	Repair or replace
Defective anti-restart relay	Replace
ⓑ	
Defective start relay	Replace
Disconnection in wiring harness or poor contact between CN-2 (7) -CR-5 (5)	Repair or replace
Disconnection in wiring harness or poor contact between CN-52 (15)-CR-5 (1)	Repair or replace
Disconnection in wiring harness or poor contact between CS-2A (6)- CR-5 (2)	Repair or replace

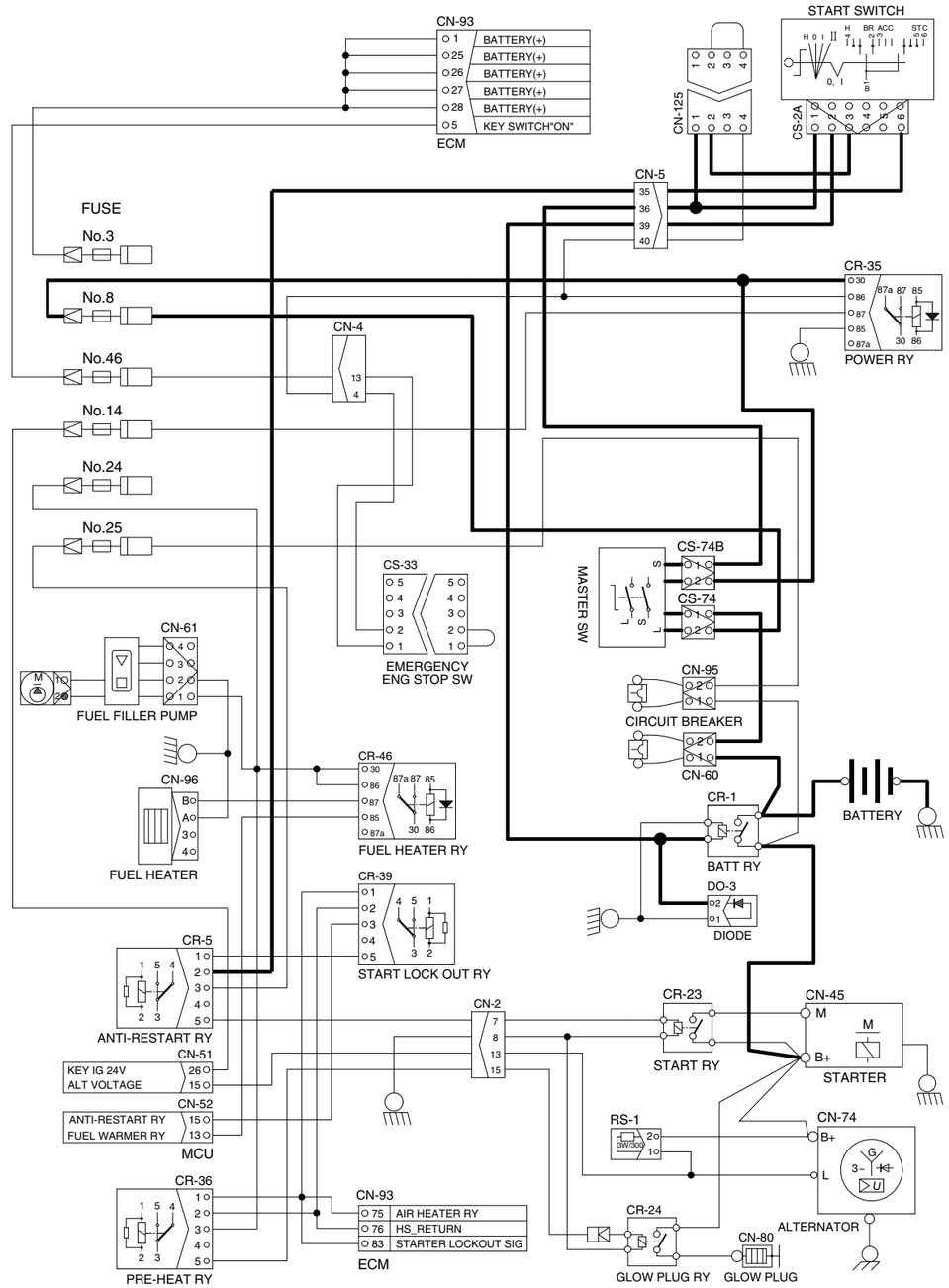


210WA6ES14

13. 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, master switch ON and check open circuit of circuit breaker (CN-60, CN-95).
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

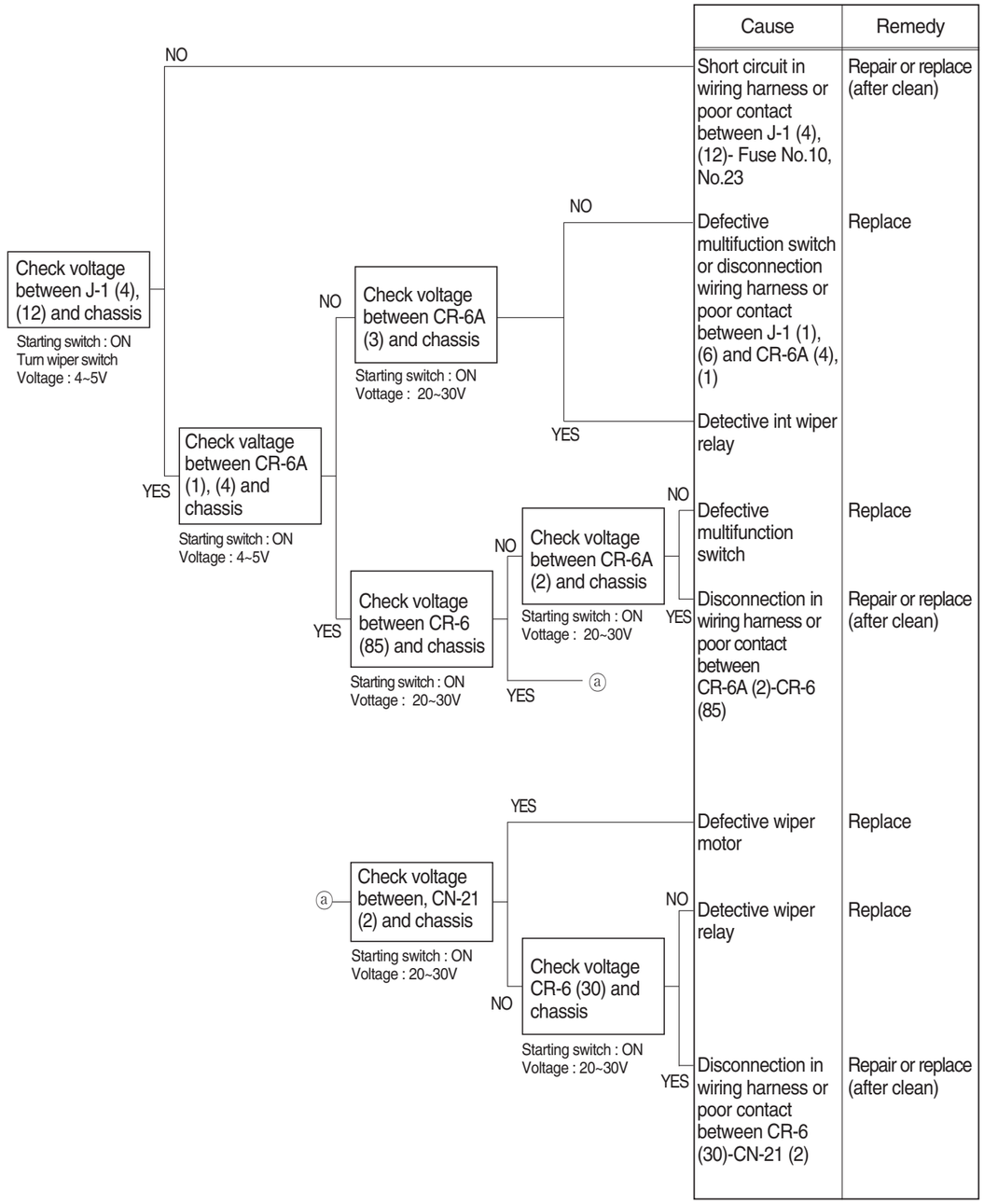


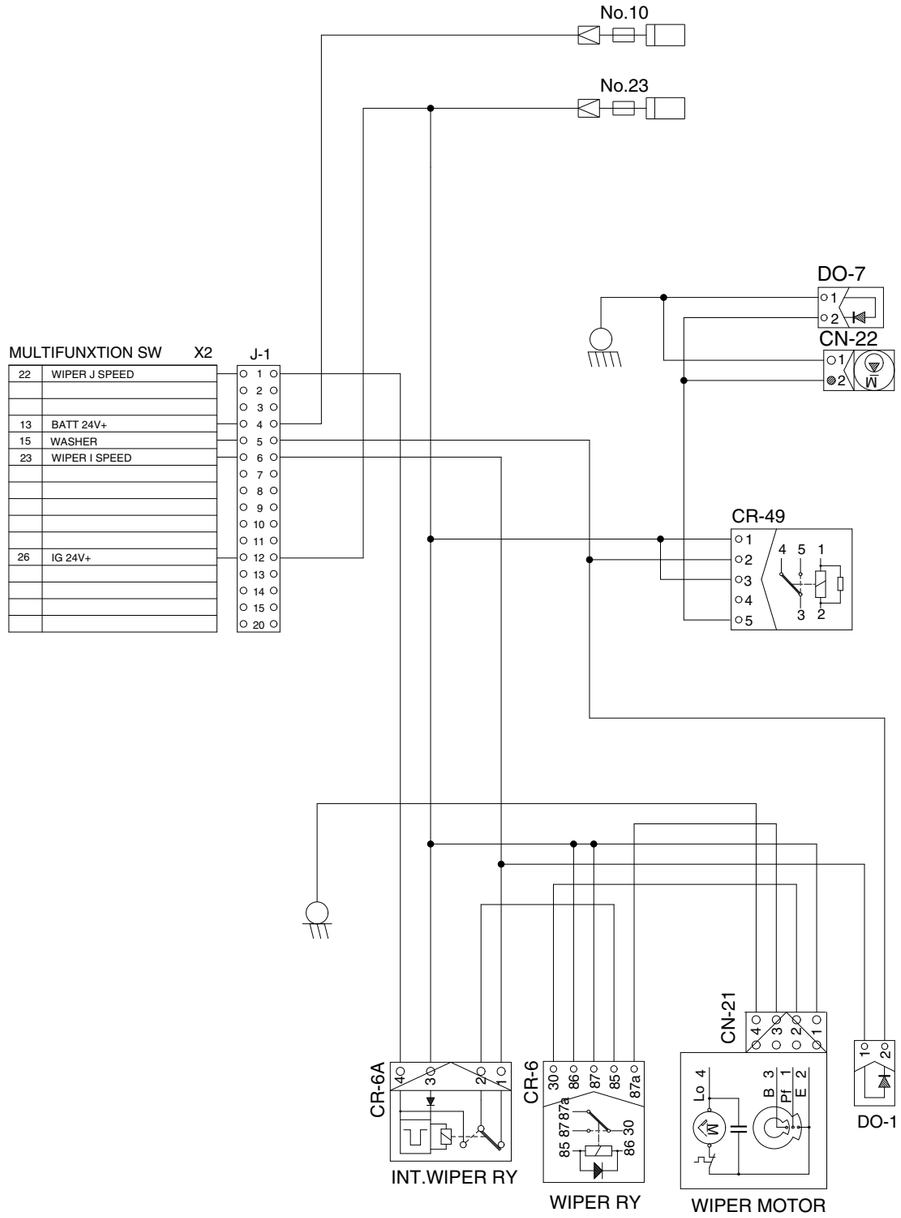


210WA6ES15

14. 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. 10 and 23 is not blown out.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

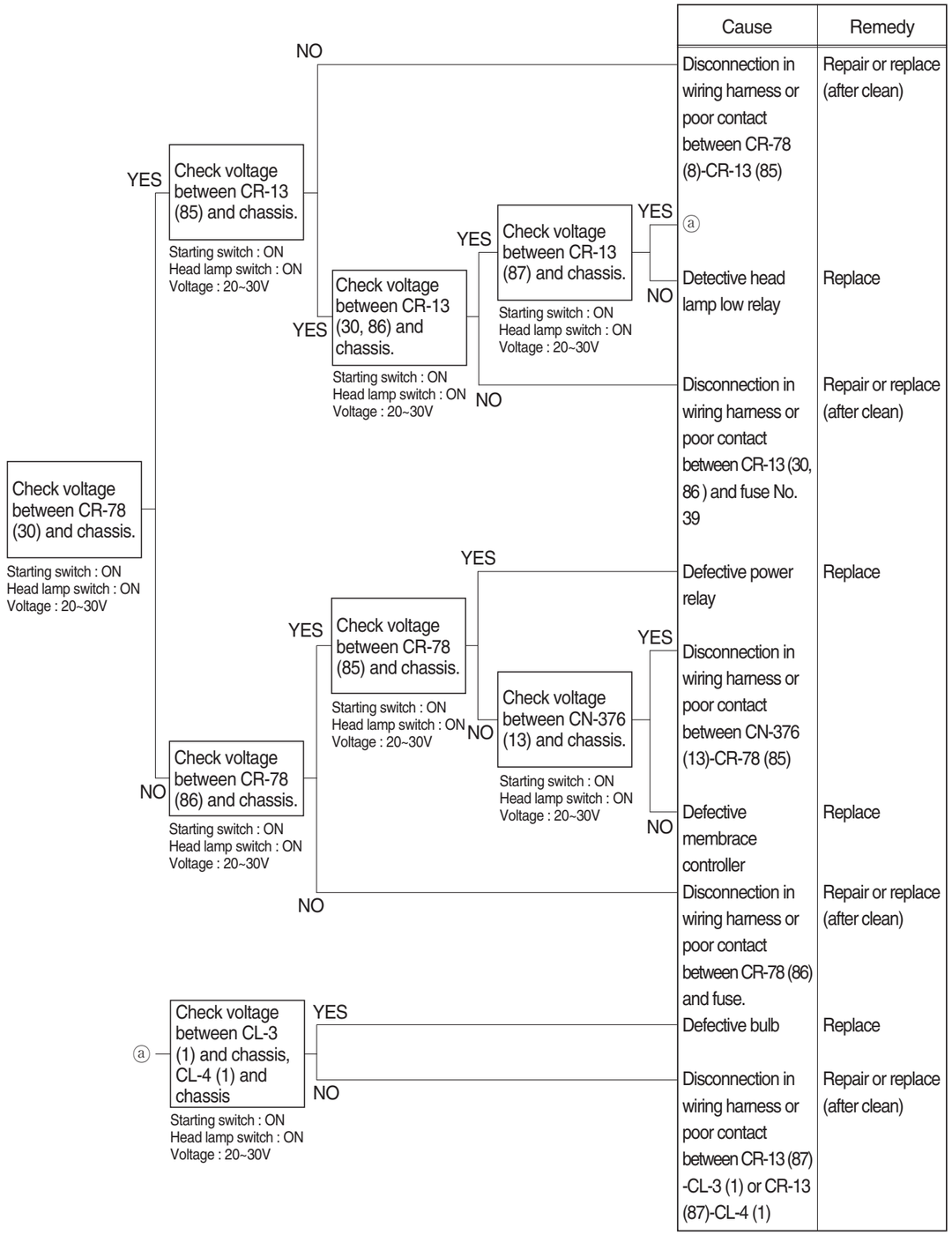


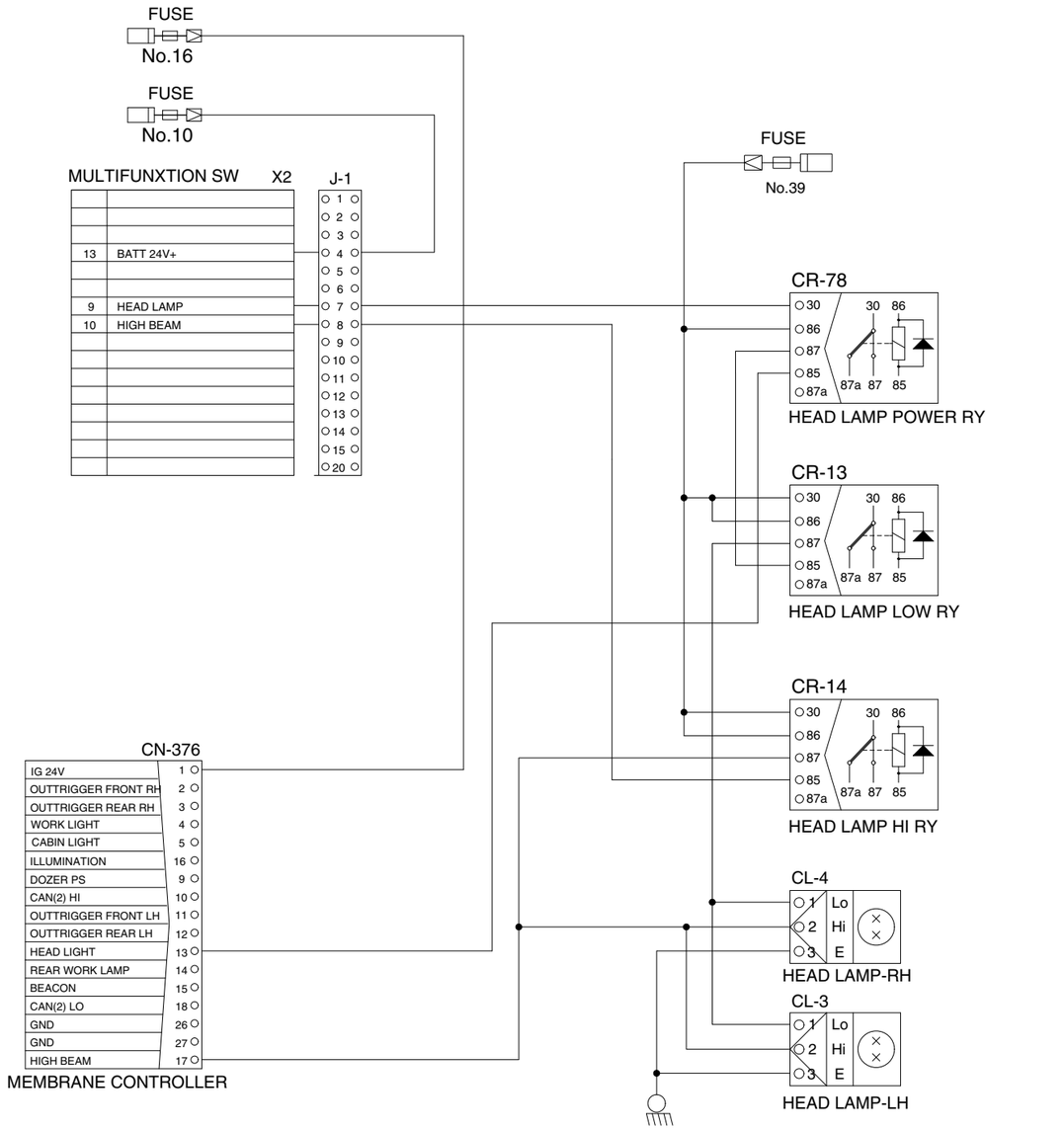


210WA6ES16

15. 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, 16, 39.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.

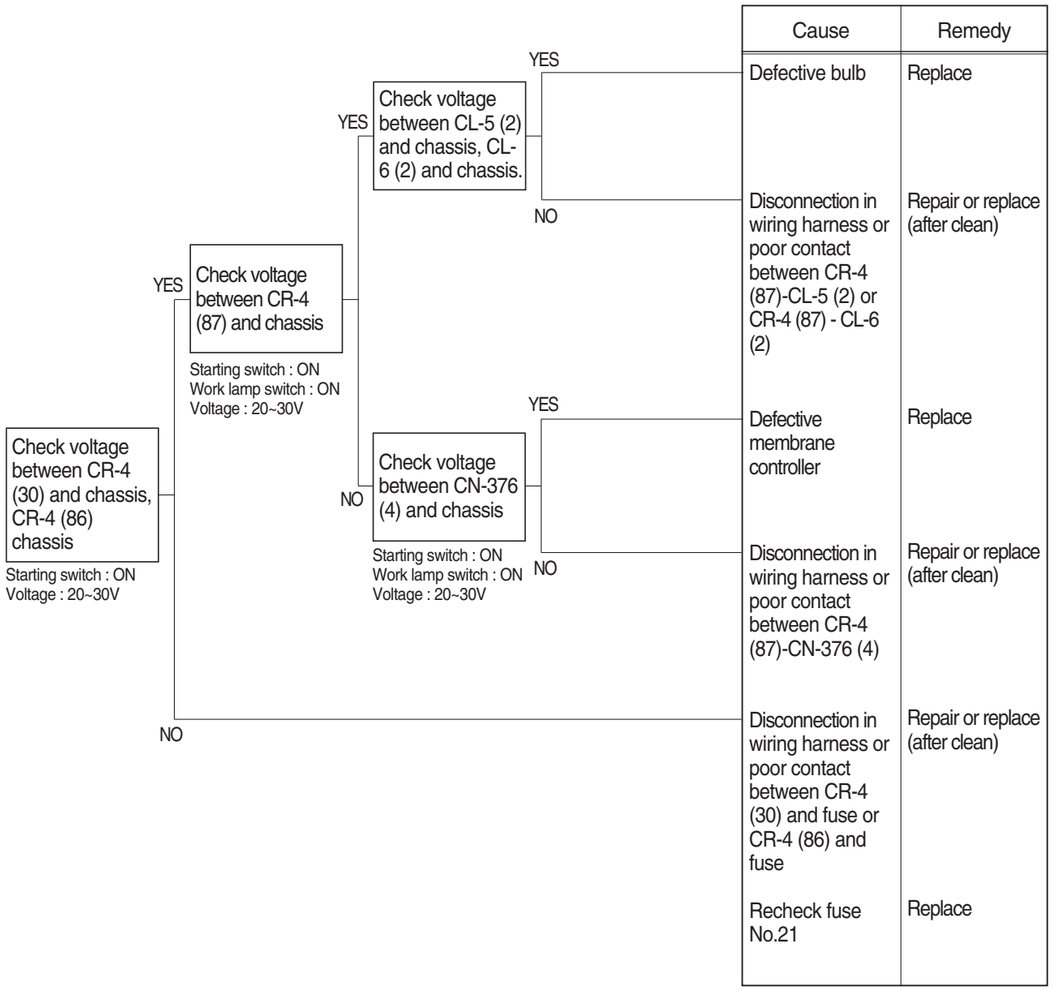




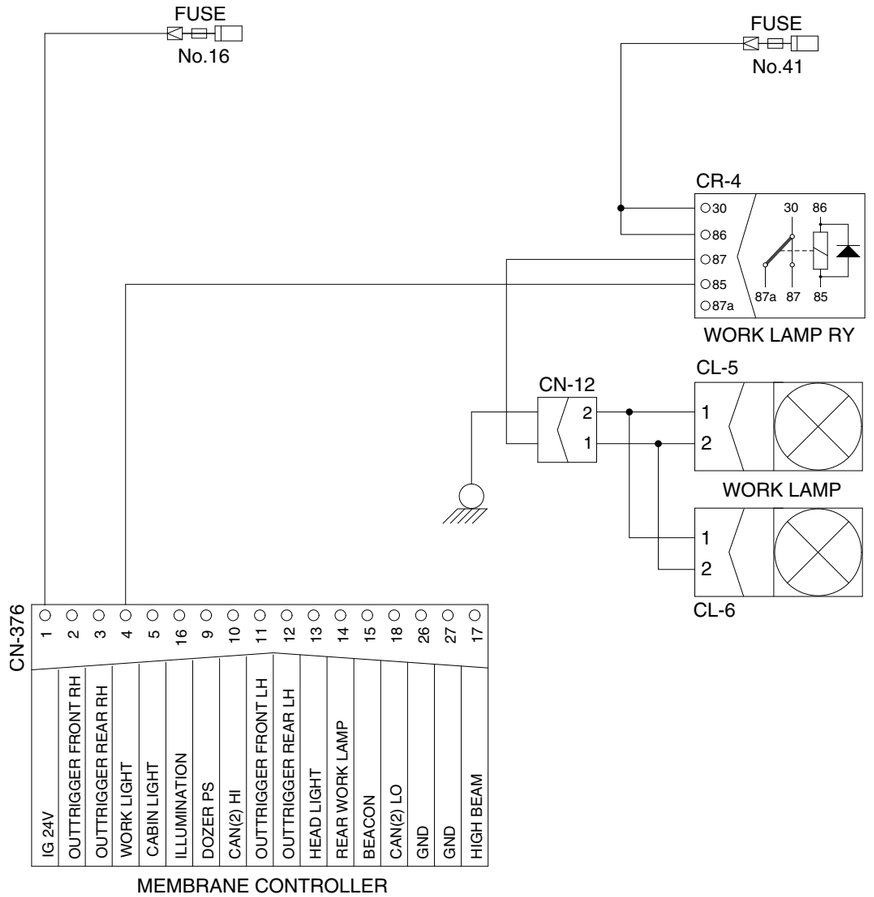
210WA6ES17

16. 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. 16, 41.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.



Cause	Remedy
Defective bulb	Replace
Disconnection in wiring harness or poor contact between CR-4 (87)-CL-5 (2) or CR-4 (87) - CL-6 (2)	Repair or replace (after clean)
Defective membrane controller	Replace
Disconnection in wiring harness or poor contact between CR-4 (87)-CN-376 (4)	Repair or replace (after clean)
Disconnection in wiring harness or poor contact between CR-4 (30) and fuse or CR-4 (86) and fuse	Repair or replace (after clean)
Recheck fuse No.21	Replace

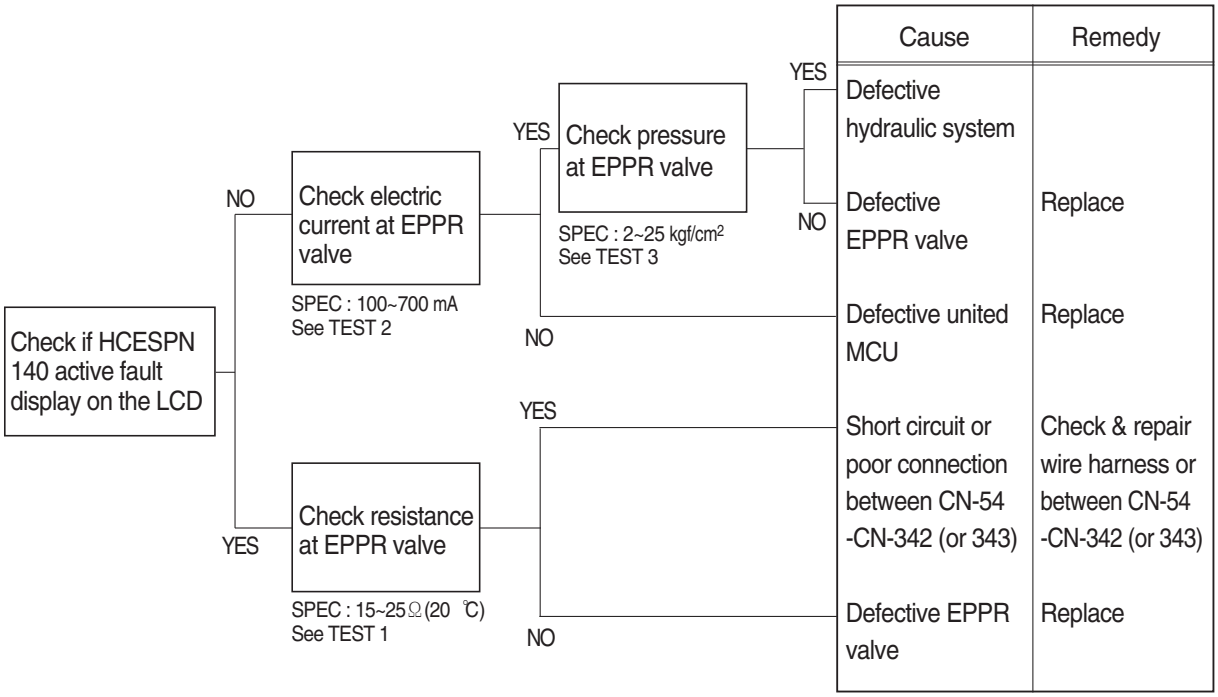


210WA6ES18

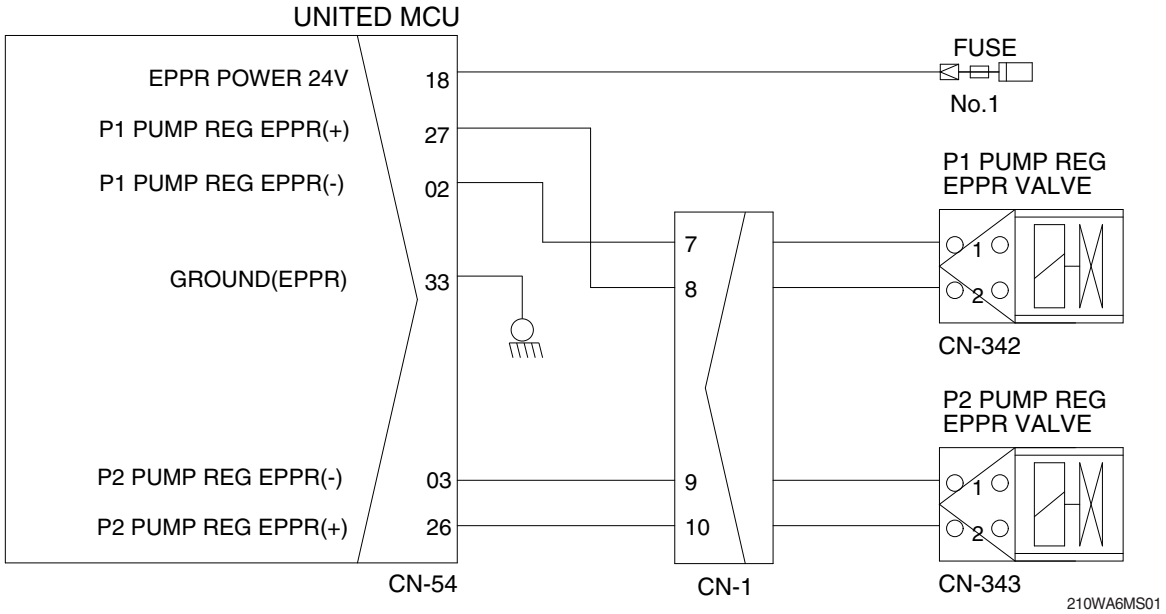
1. ALL ACTUATORS SPEED ARE SLOW

※ Boom, Arm, Bucket, Swing and travel speed are slow, but engine speed is good.
※ Spec : P-mode 1600 ± 50 rpm S -mode 1500 ± 50 rpm E-mode 1400 ± 50 rpm
※ Before carrying out below procedure, check all the related connectors are properly inserted and fault code on the cluster.

1) INSPECTION PROCEDURE



Wiring diagram



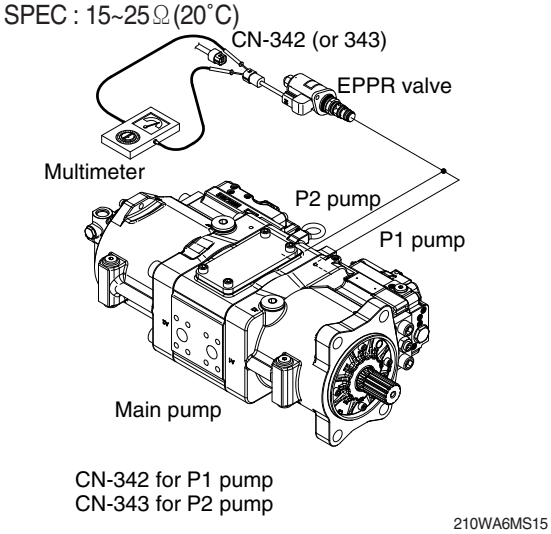
2) TEST PROCEDURE

(1) Test 1 : Check resistance at connector CN-342 (or 343).

① Starting switch OFF.

② Disconnect connector CN-342 (or 343) from EPPR valve at main hydraulic pump.

③ Check resistance between 2 lines as figure.



(2) Test 2 : Check electric current at EPPR valve.

① Disconnect connector CN-342 (or 343) from EPPR valve.

② Insert the adapter to CN-342 (or 343) and install multimeter as figure.

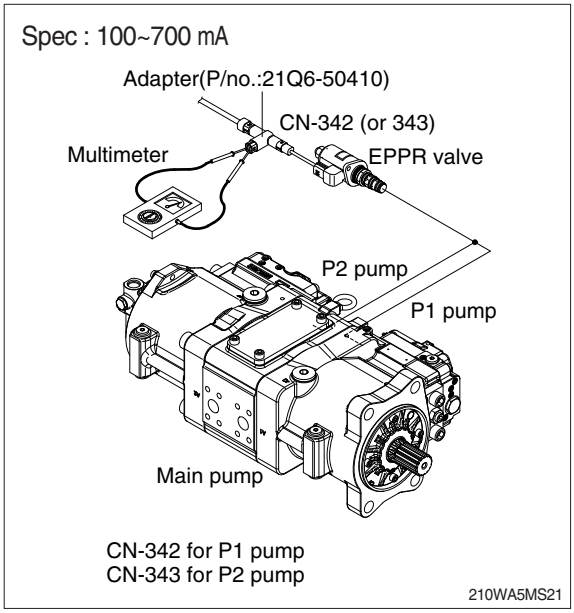
③ Start engine.

④ Set S-mode and cancel auto decel mode.

⑤ Position the multimodal dial at 10.

⑥ If tachometer show approx 1500±50 rpm disconnect one wire harness from EPPR valve.

⑦ Check electric current at bucket circuit relief position.



(3) Test 3 : Check pressure at EPPR valve.

① Remove plug and connect pressure gauge as figure.

· Gauge capacity : 0 to 50 kgf/cm² (0 to 725 psi)

② Start engine.

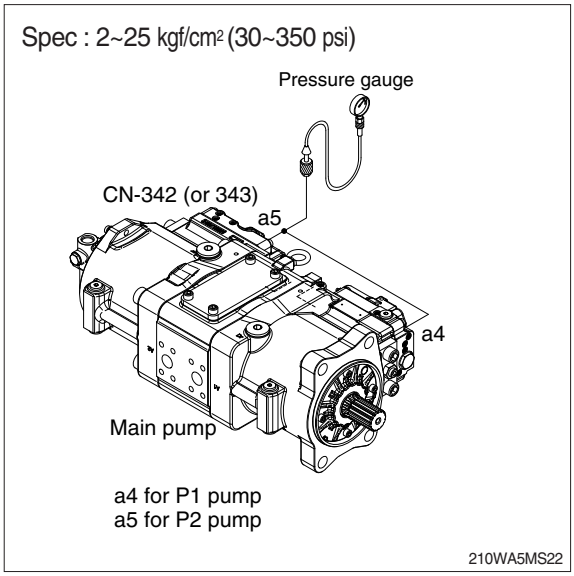
③ Set S-mode and cancel auto decel mode.

④ Position the multimodal dial at 10.

⑤ If tachometer show approx 1500±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.

⑥ If pressure is not correct, adjust it.

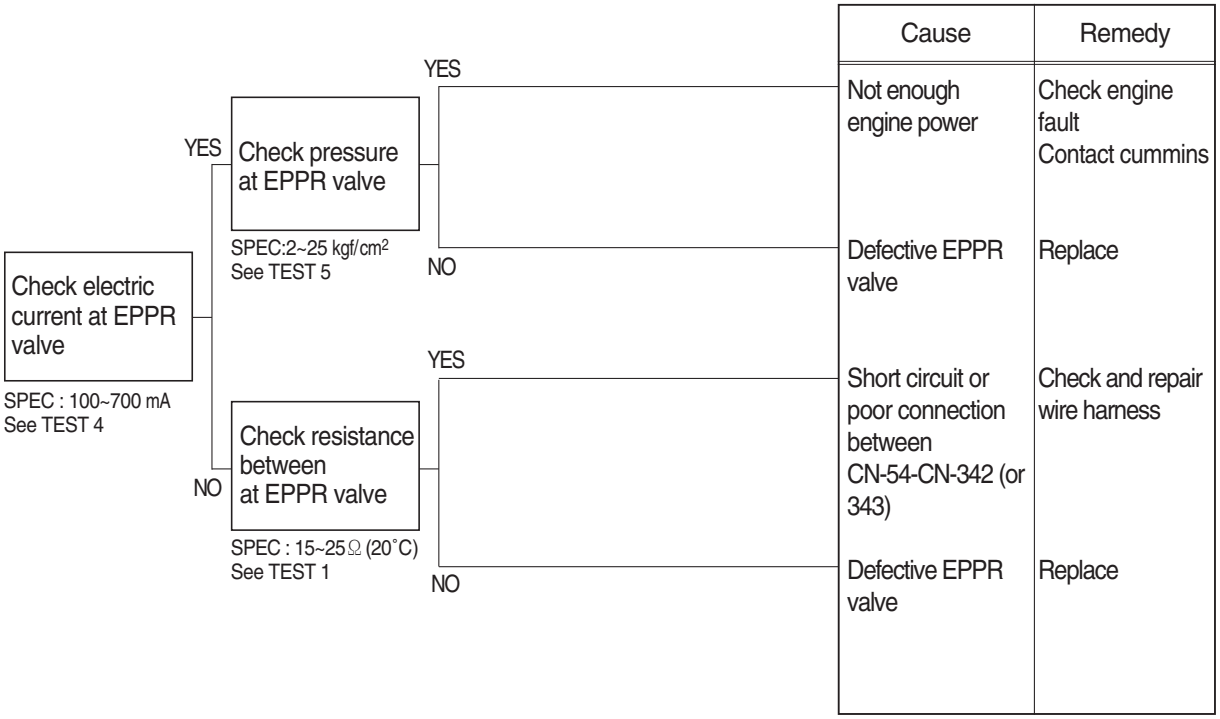
⑦ After adjust, test the machine.



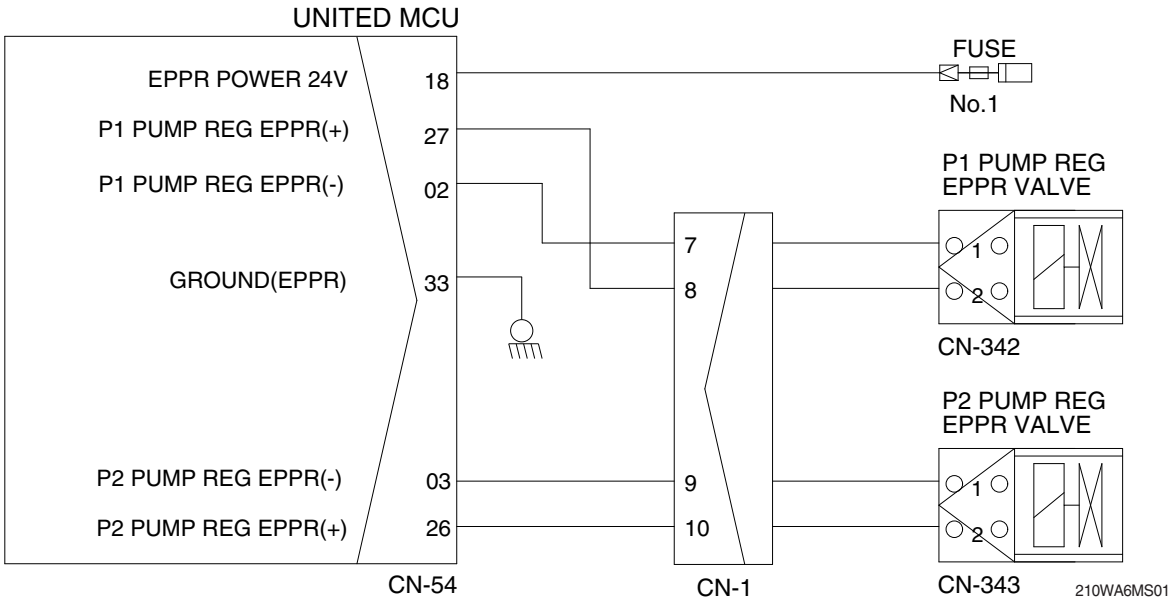
2. ENGINE STALL

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



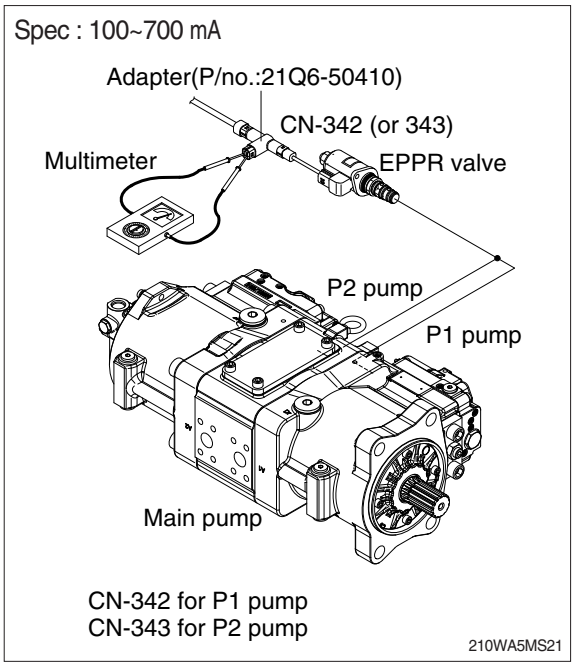
Wiring diagram



2) TEST PROCEDURE

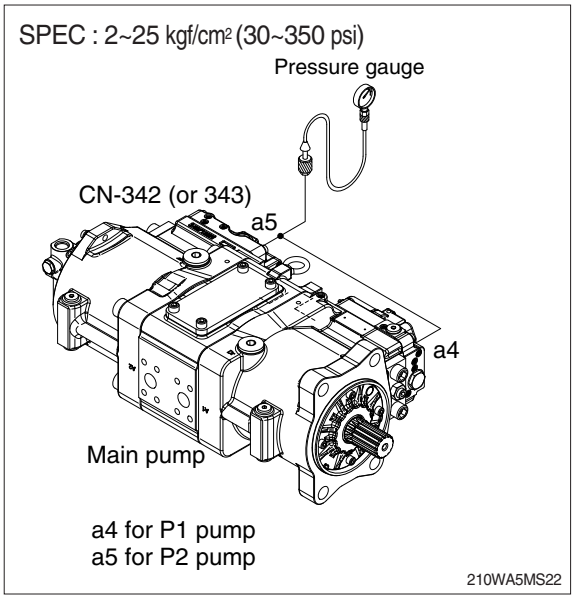
(1) Test 4 : Check electric current at EPPR valve.

① Disconnect connector CN-342 (or 343) from EPPR valve.
② Insert the adapter to CN-342 (or 343) and install multimeter as figure.
③ Start engine.
④ Set S-mode and cancel auto decel mode.
⑤ Position the multimodal dial at 10.
⑥ If rpm show approx 1500±50 rpm disconnect one wire harness from EPPR valve.
⑦ Check electric current at bucket circuit relief position.



(2) Test 5 : Check pressure at EPPR valve.

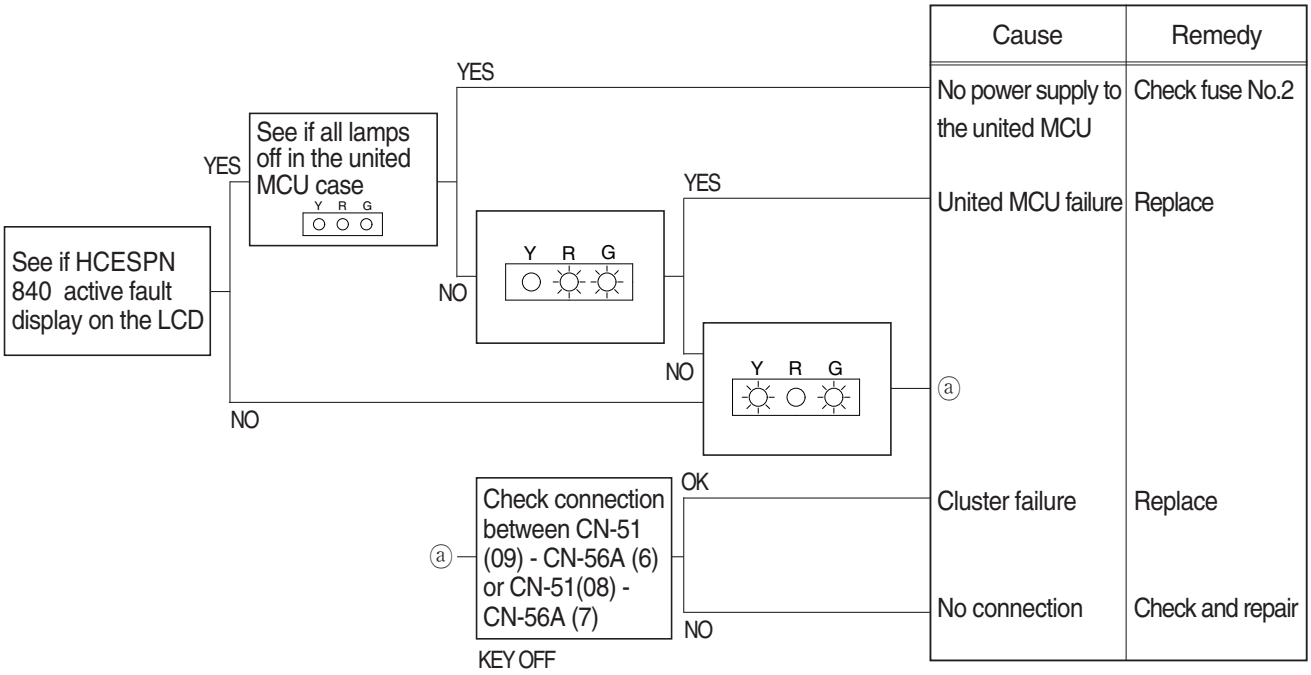
① Remove plug and connect pressure gauge as figure.
· Gauge capacity : 0 to 50 kgf/cm² (0 to 725 psi)
② Start engine.
③ Set S-mode and cancel auto decel mode.
④ Position the multimodal dial at 10.
⑤ If rpm show approx 1500±50 rpm check pressure at relief position of bucket circuit by operating bucket control lever.
⑥ If pressure is not correct, adjust it.
⑦ After adjust, test the machine.



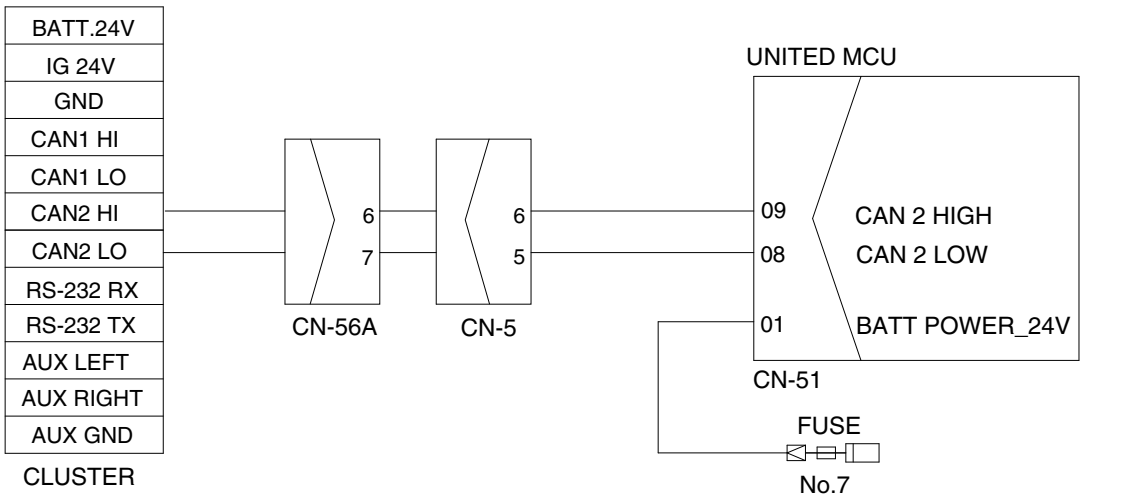
3. MALFUNCTION OF CLUSTER OR MODE SELECTION SYSTEM

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram



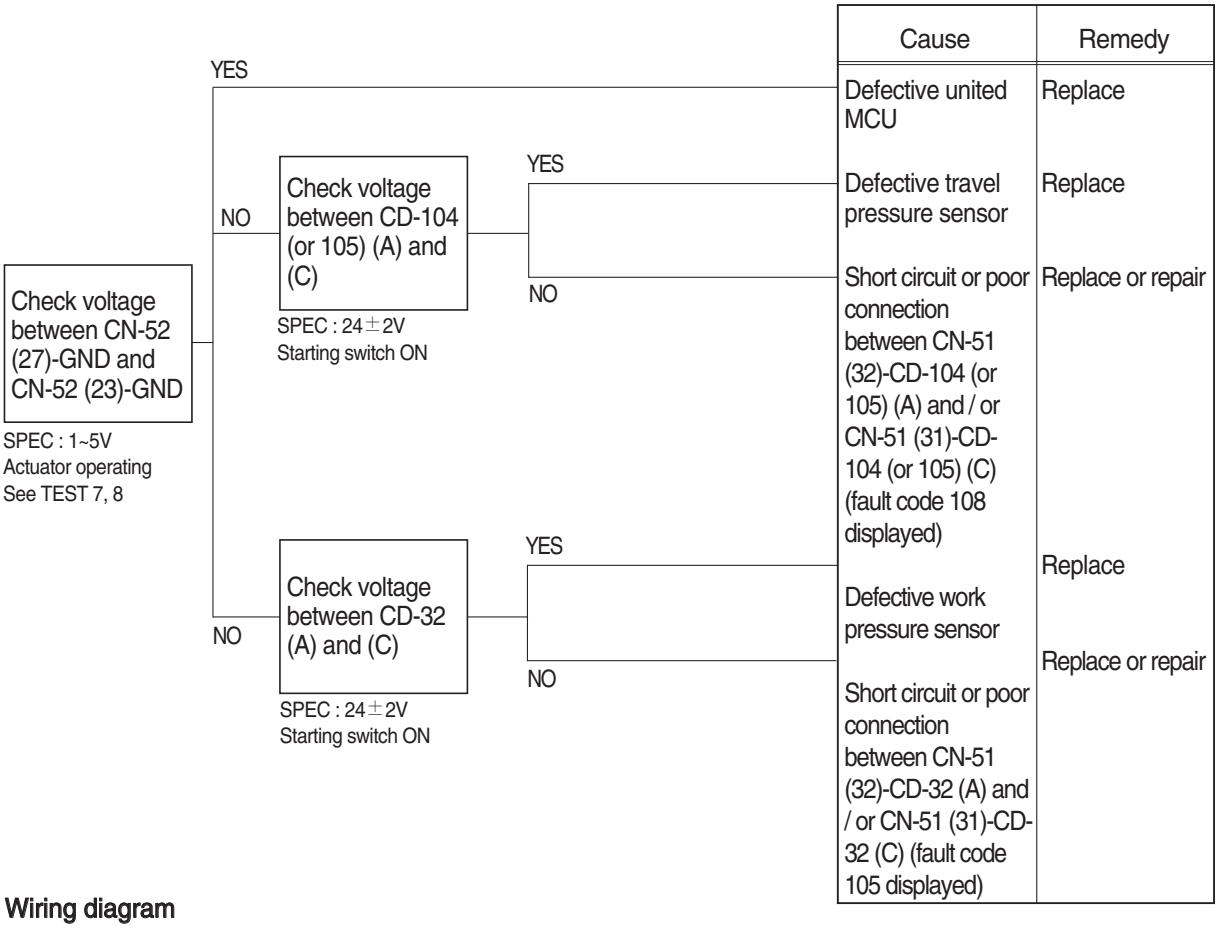
210WA6MS02

4. AUTO DECEL SYSTEM DOES NOT WORK (N.A)

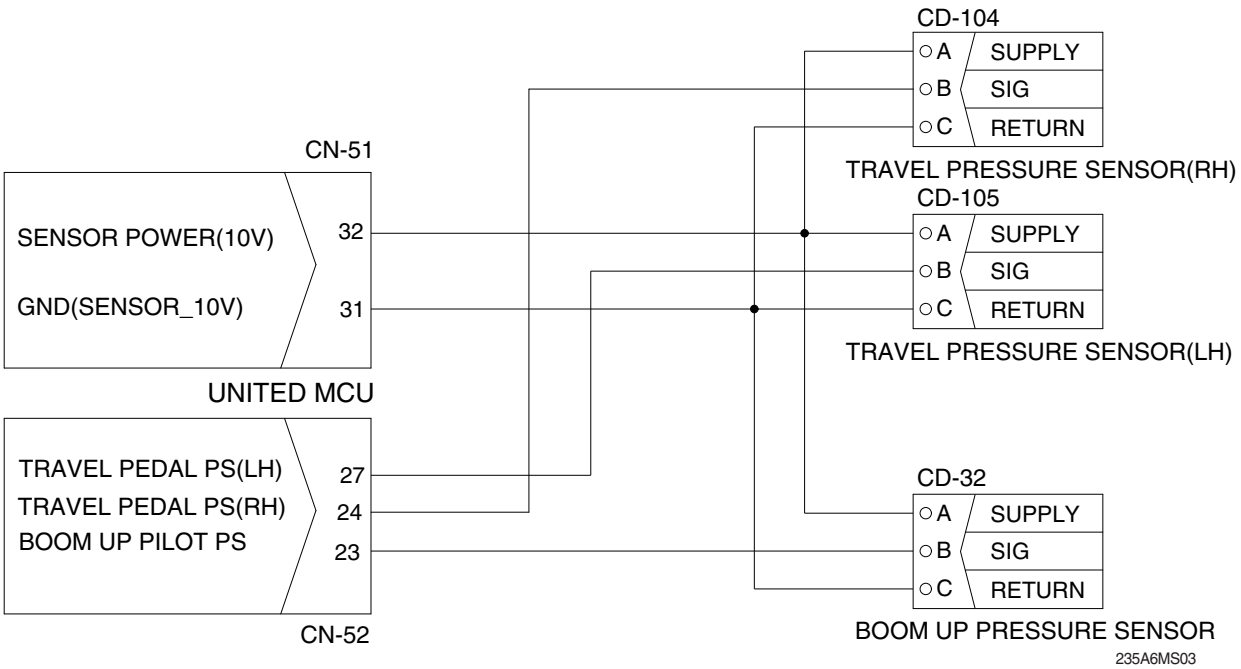
· Fault code : HCESPN 105, FMI 0~4 (work pressure sensor)
HCESPN 108, FMI 0~4 (travel oil pressure sensor)

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram



2) TEST PROCEDURE (N.A)

(1) Test 7 : Check voltage at CN-52 (24 or 27) and ground.

① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (24 or 27) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

(2) Test 8 : Check voltage at CN-52 (19) and ground.

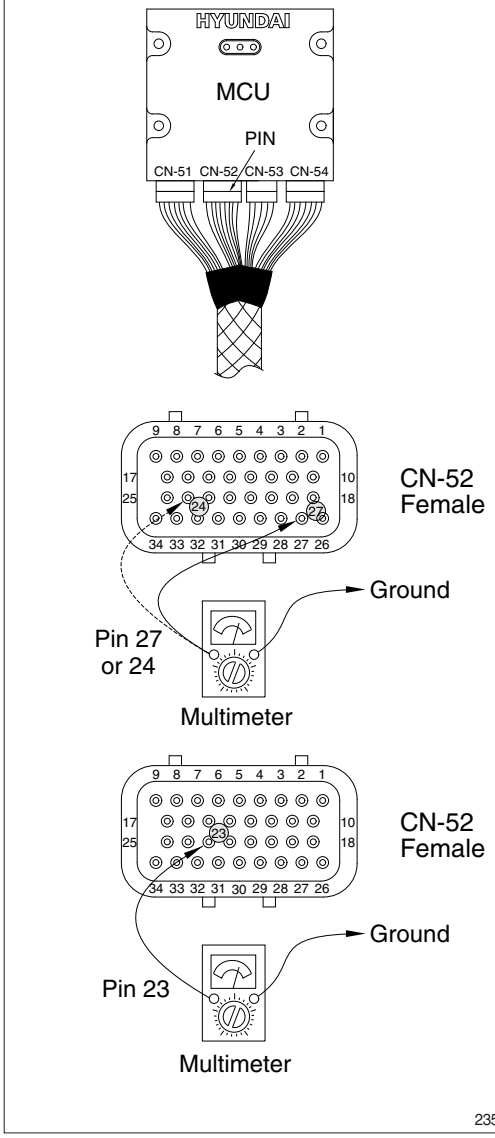
① Prepare 1 piece of thin sharp pin, steel or copper

② Insert prepared pin to rear side of connectors : One pin to (23) of CN-52.

③ Starting key ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



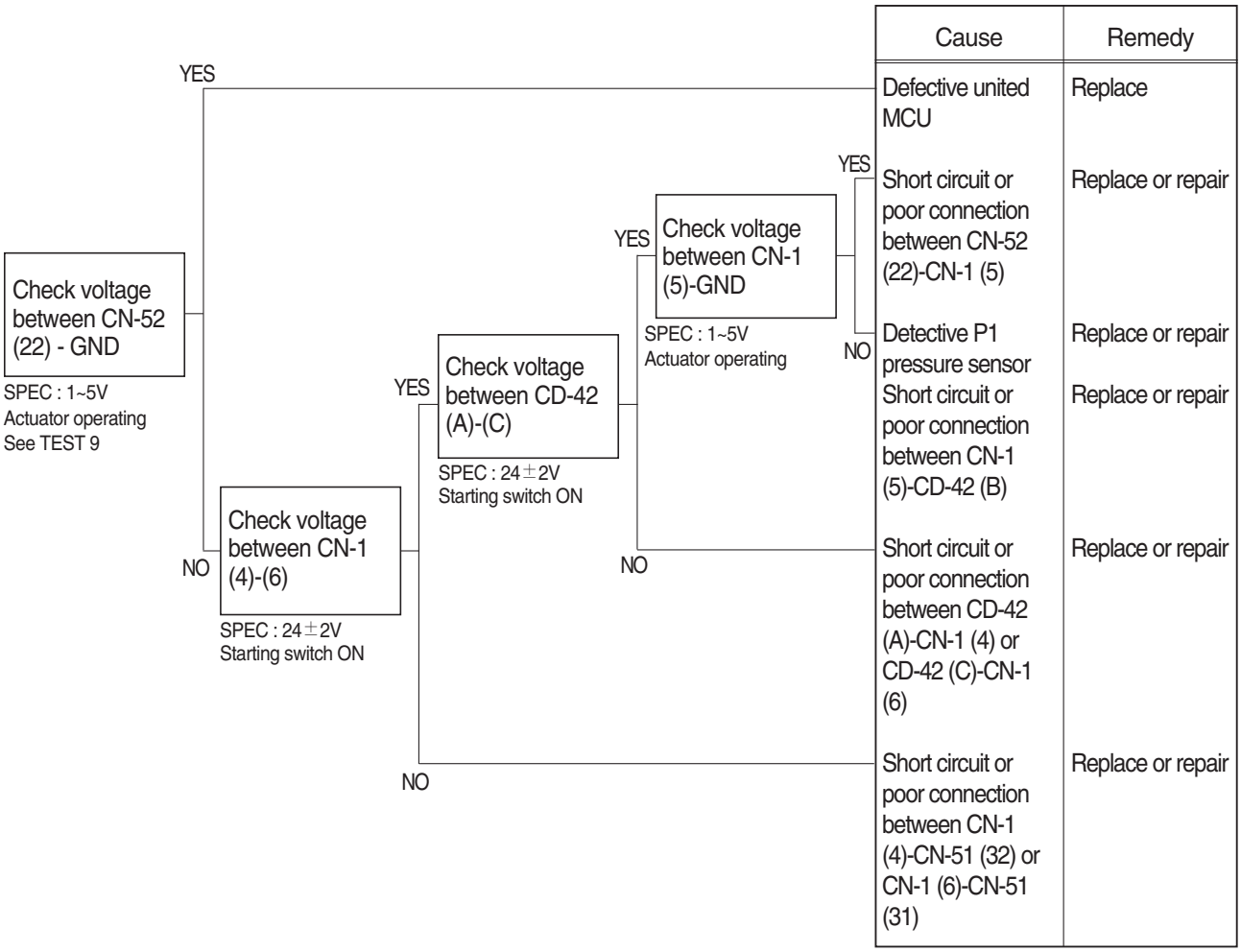
235A6MS104

5. MALFUNCTION OF PUMP 1 PRESSURE SENSOR

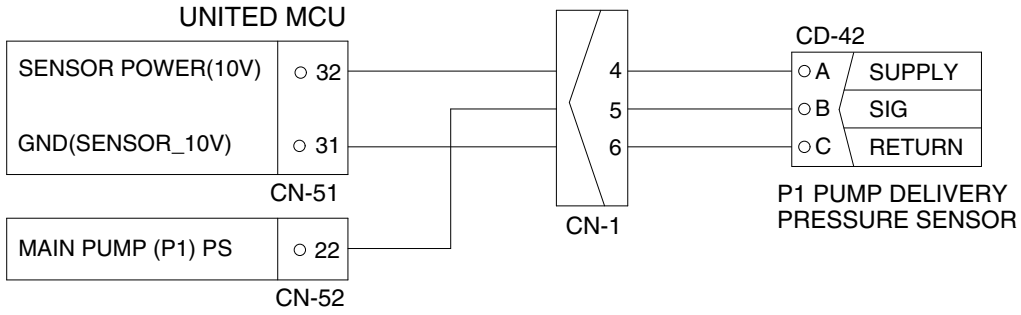
· Fault code : HCESPN 120, FMI 0~4

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram



220A6MS105

2) TEST PROCEDURE

(1) Test 9 : Check voltage at CN-52 (22) and ground.

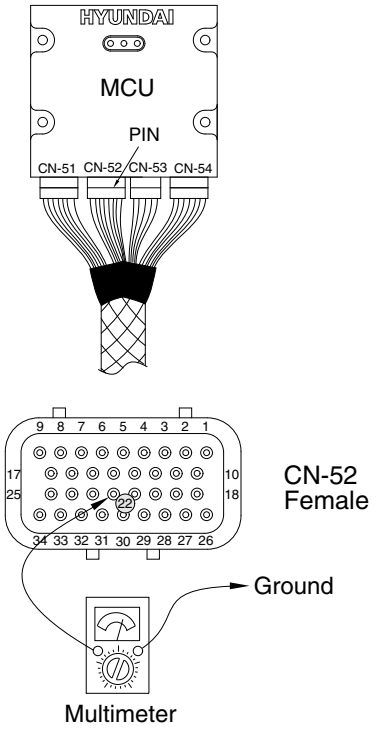
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (22) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



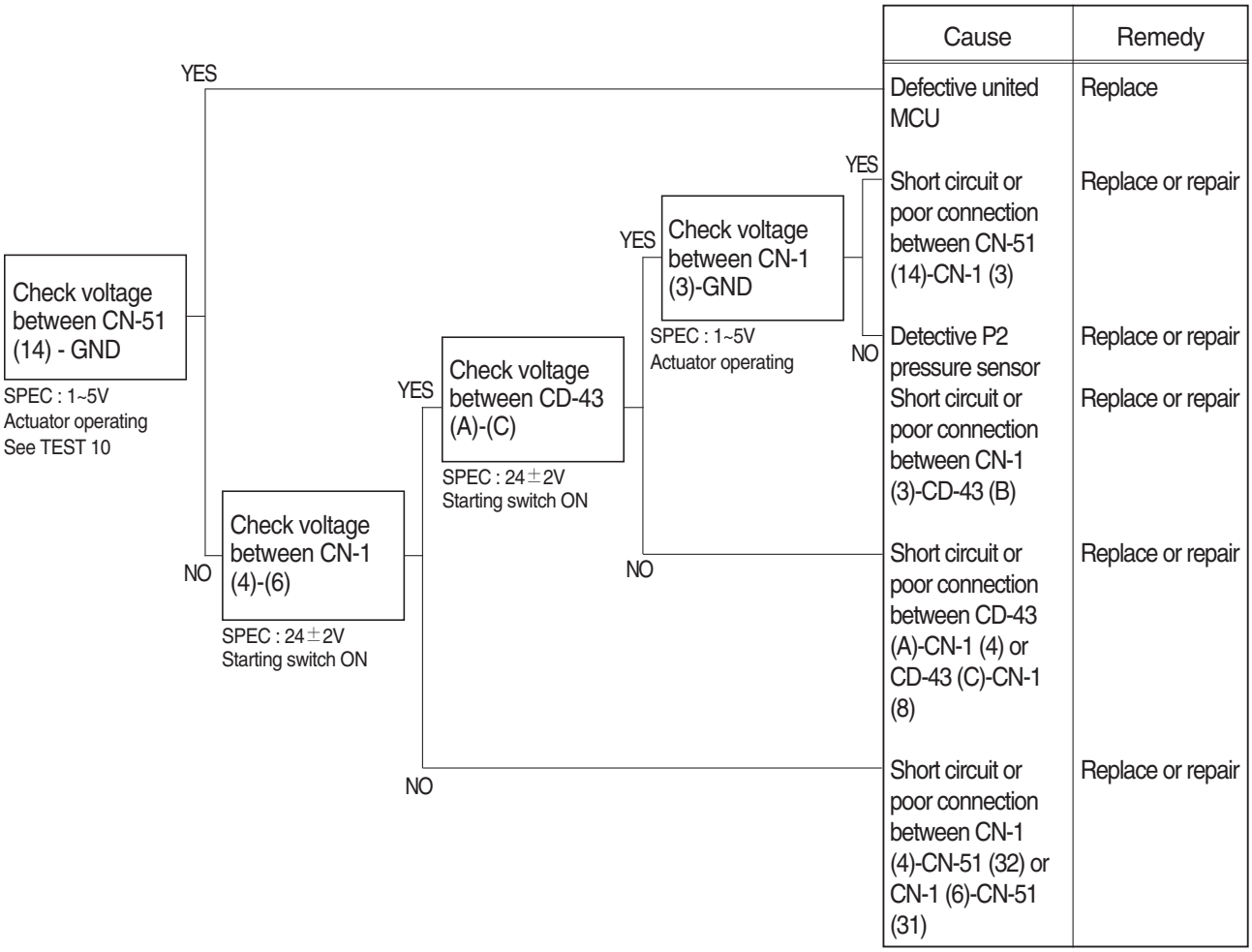
220A6MS106

6. MALFUNCTION OF PUMP 2 PRESSURE SENSOR

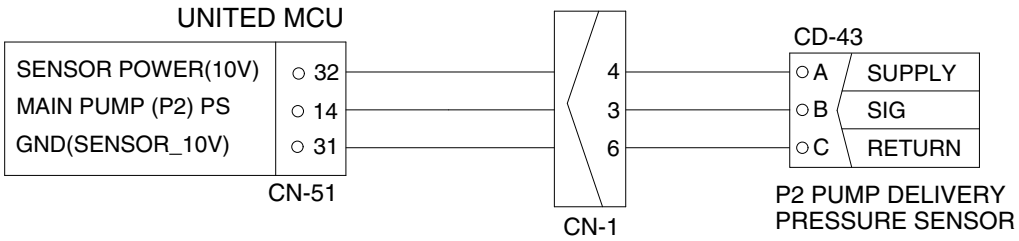
· Fault code : HCESPN 121, FMI 0~4

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram



220A6MS107

2) TEST PROCEDURE

(1) Test 10 : Check voltage at CN-51 (14) and ground.

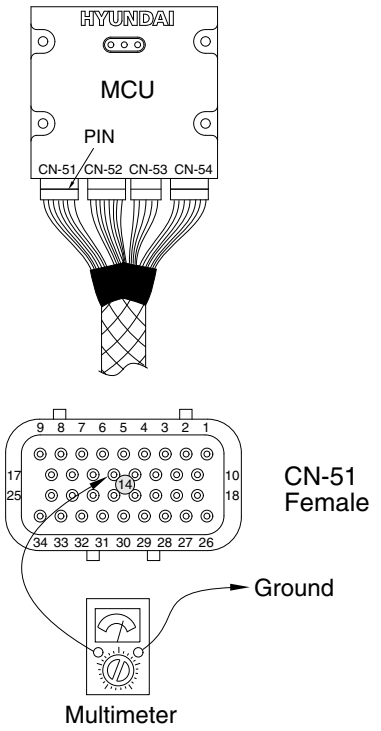
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (14) of CN-51.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



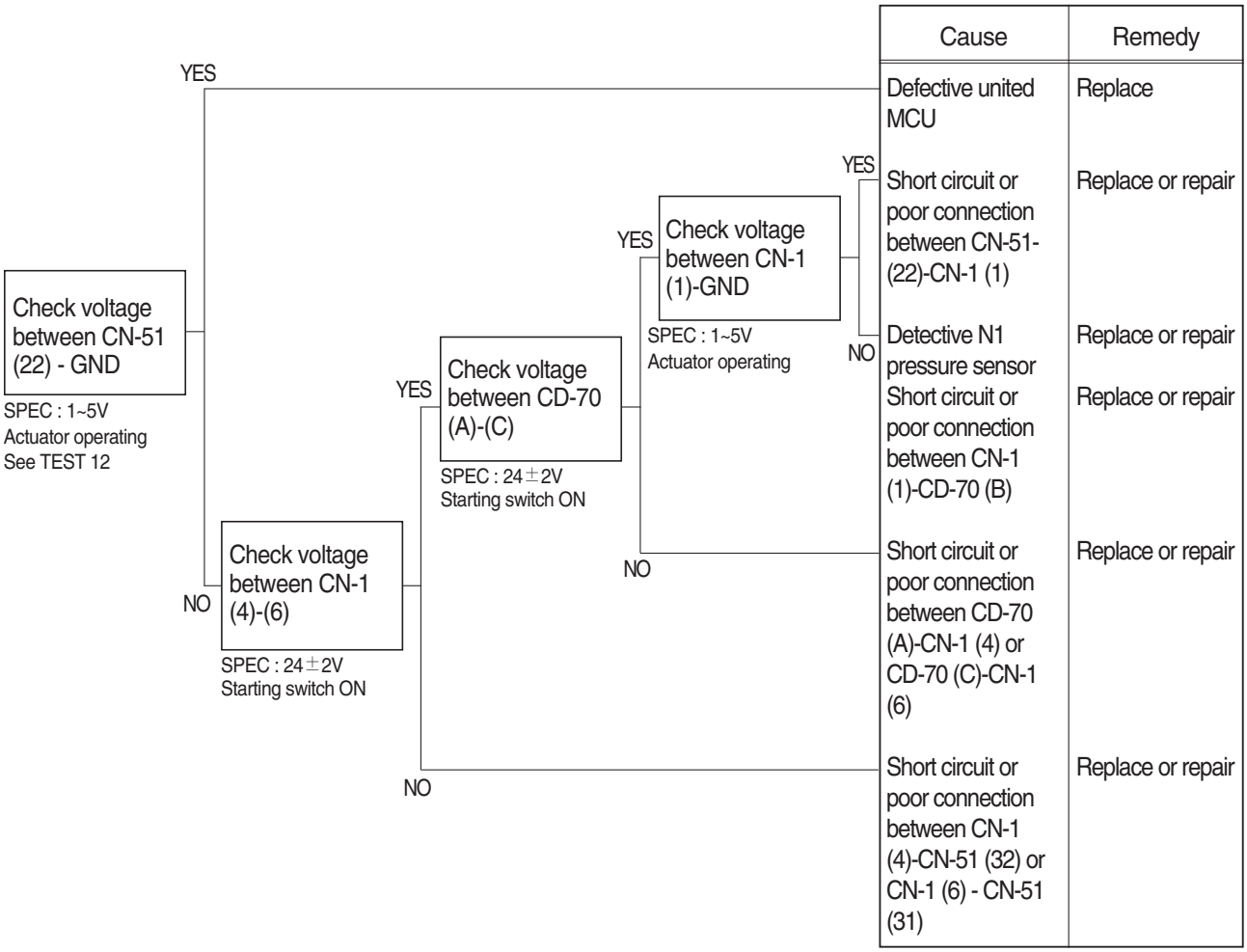
220A6MS108

7. MALFUNCTION OF NEGATIVE 1 PRESSURE SENSOR

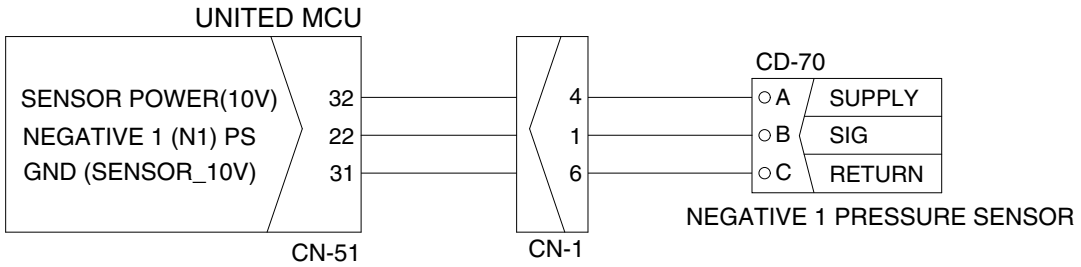
· Fault code : HCESPN 123, FMI 0~4

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram



260A6MS111

2) TEST PROCEDURE

(1) Test 12 : Check voltage at CN-51 (22) and ground.

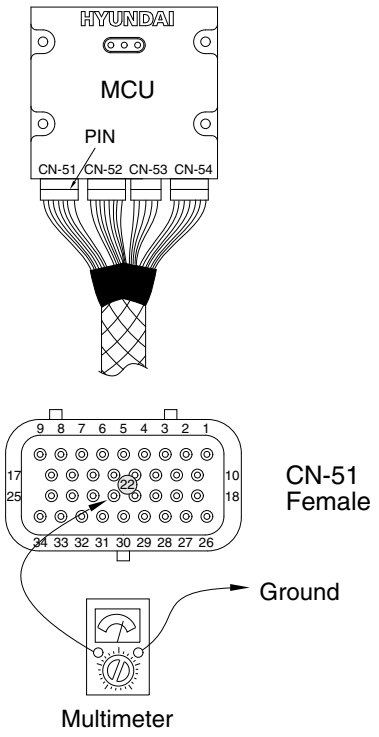
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (22) of CN-51.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



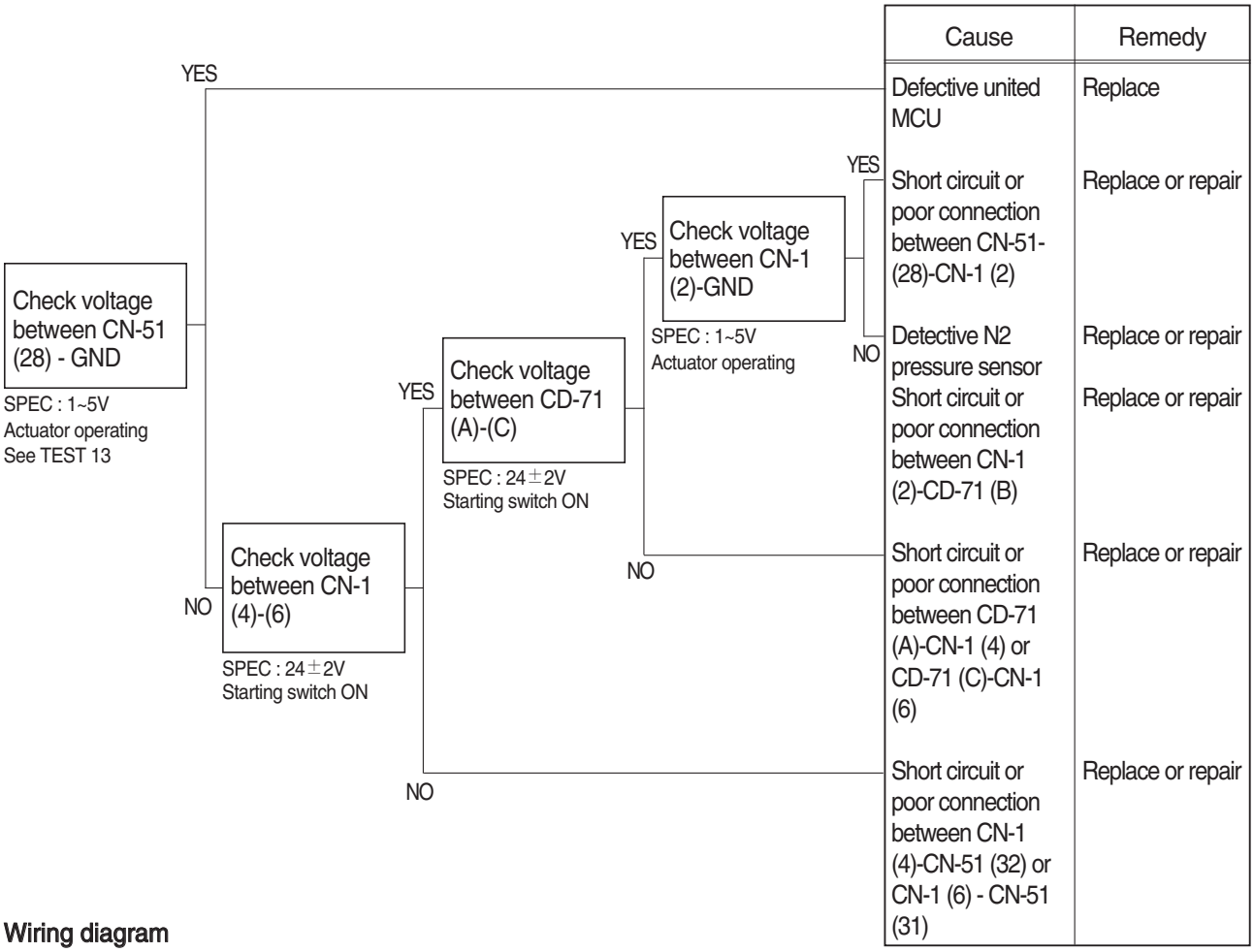
140L6MS112

8. MALFUNCTION OF NEGATIVE 2 PRESSURE SENSOR

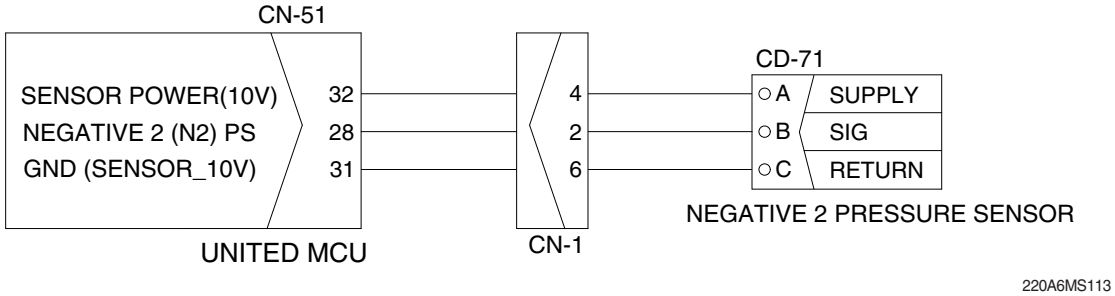
· Fault code : HCESPN 124, FMI 0~4

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram



2) TEST PROCEDURE

(1) Test 13 : Check voltage at CN-51 (28) and ground.

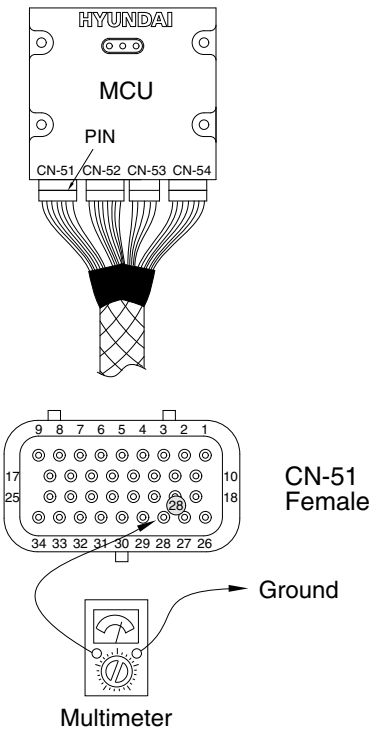
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (28) of CN-51.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



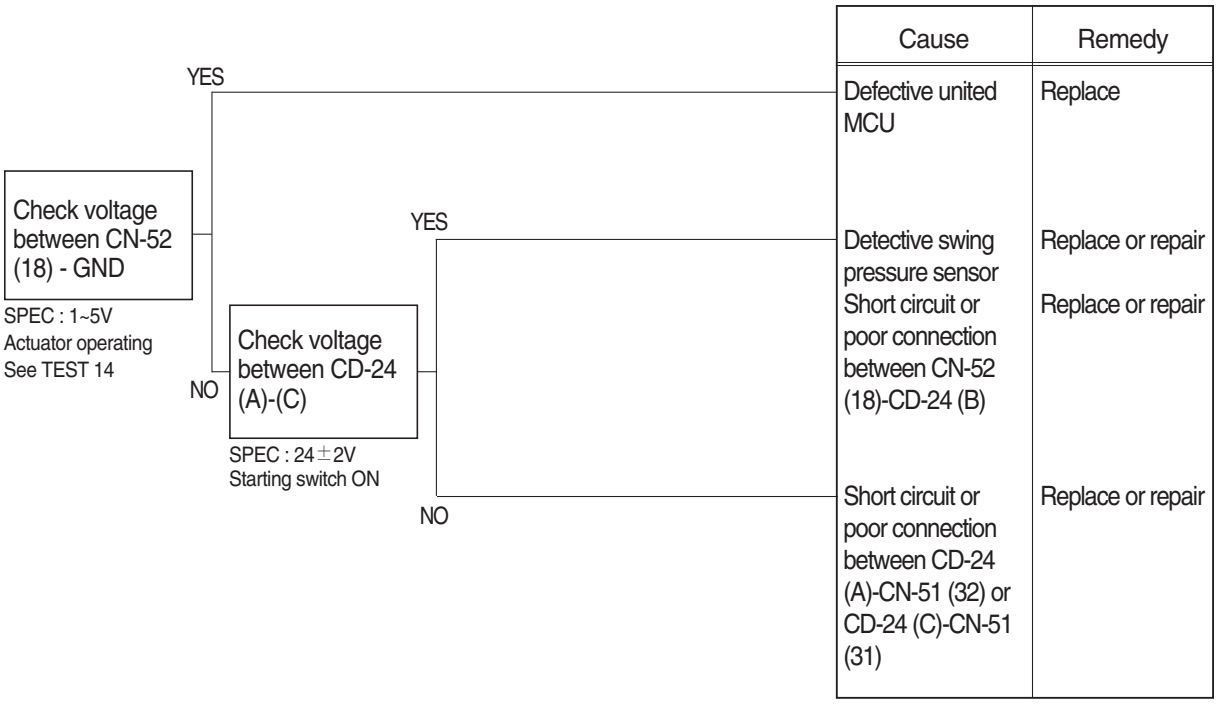
140L6MS114

9. MALFUNCTION OF SWING PRESSURE SENSOR

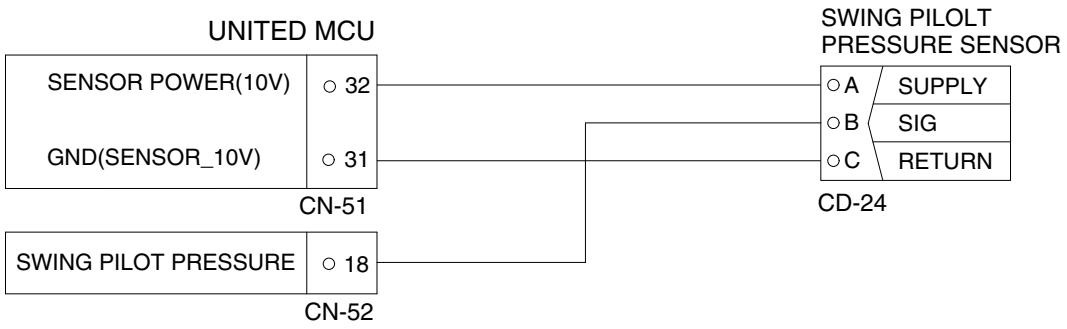
· Fault code : HCESPN 135, FMI 0~4

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram



220A6MS114

2) TEST PROCEDURE

(1) Test 14 : Check voltage at CN-52 (18) and ground.

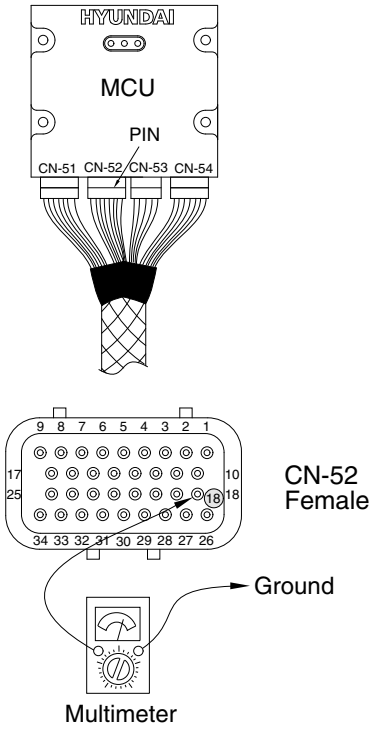
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (18) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



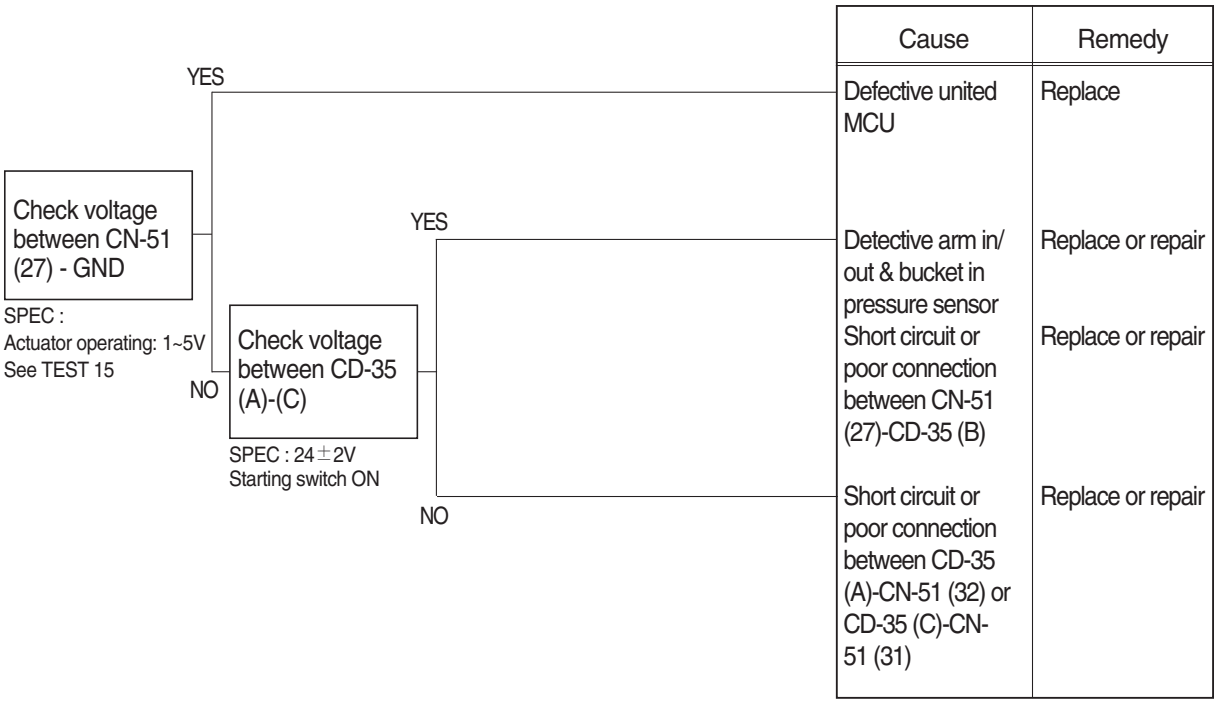
220A6MS116

10. MALFUNCTION OF ARM OUT PRESSURE SENSOR

· Fault code : HCESPN 133, FMI 0~4

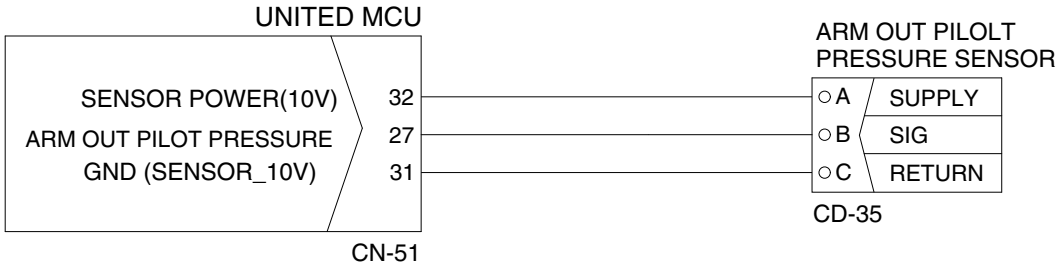
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective united MCU	Replace
Detective arm in/ out & bucket in pressure sensor	Replace or repair
Short circuit or poor connection between CN-51 (27)-CD-35 (B)	Replace or repair
Short circuit or poor connection between CD-35 (A)-CN-51 (32) or CD-35 (C)-CN-51 (31)	Replace or repair

Wiring diagram



210WA6MS17

2) TEST PROCEDURE

(1) Test 15 : Check voltage at CN-51 (27) and ground.

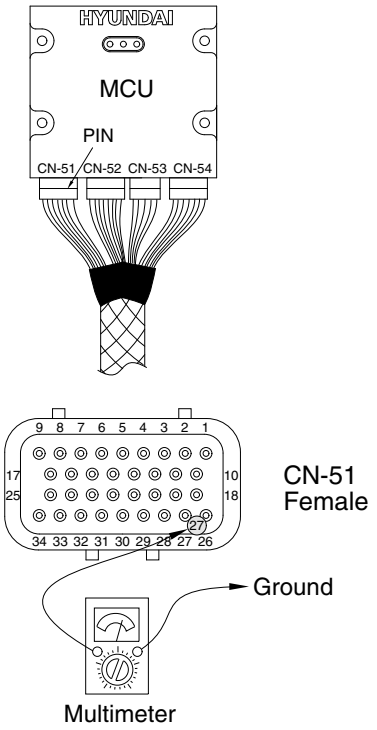
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (27) of CN-51.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



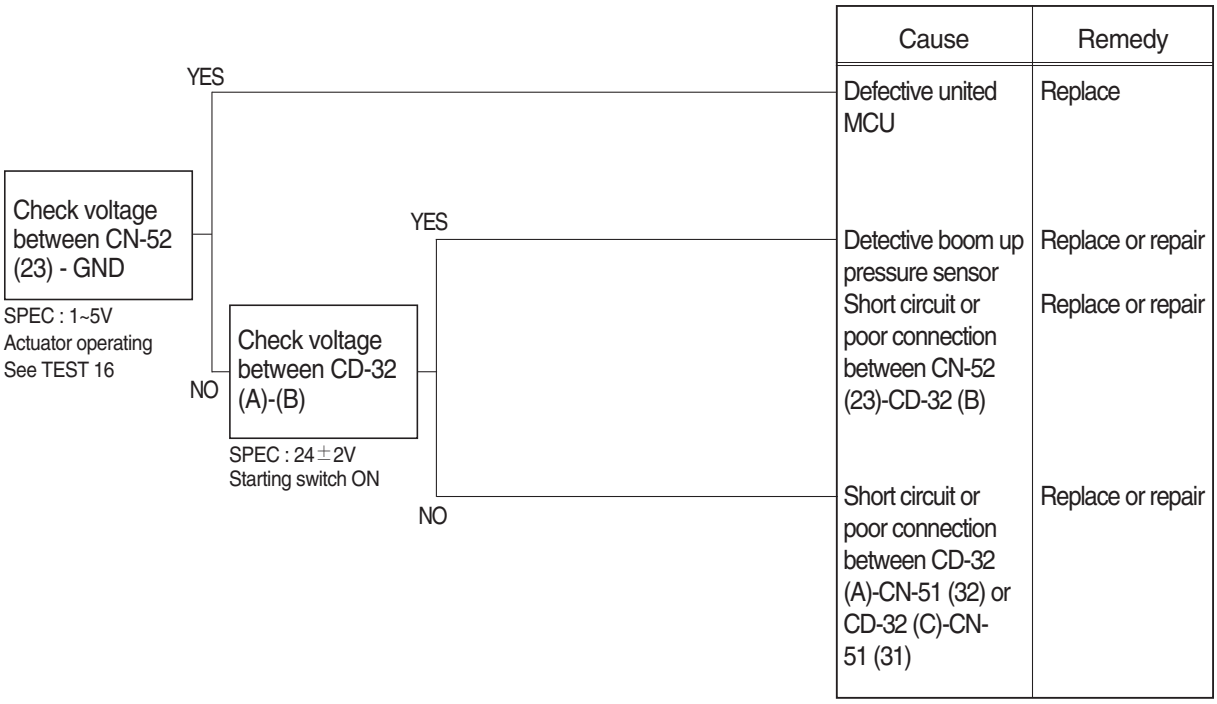
220A6MS118

11. MALFUNCTION OF BOOM UP PRESSURE SENSOR

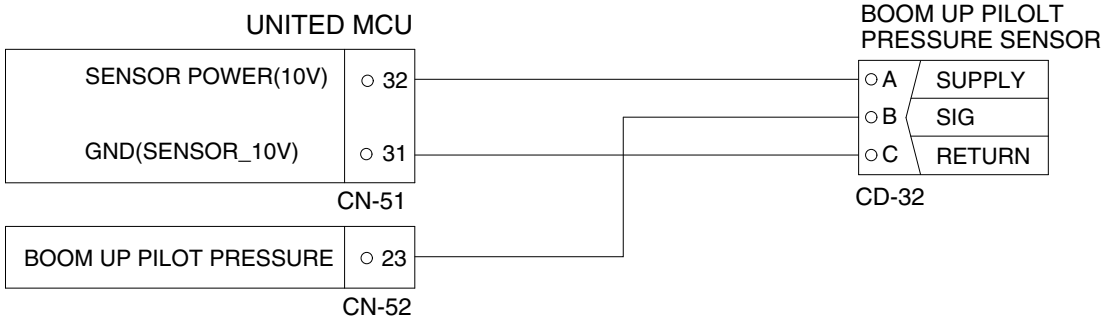
· Fault code : HCESPN 127, FMI 0~4

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram



220A6MS119

2) TEST PROCEDURE

(1) Test 16 : Check voltage at CN-52 (23) and ground.

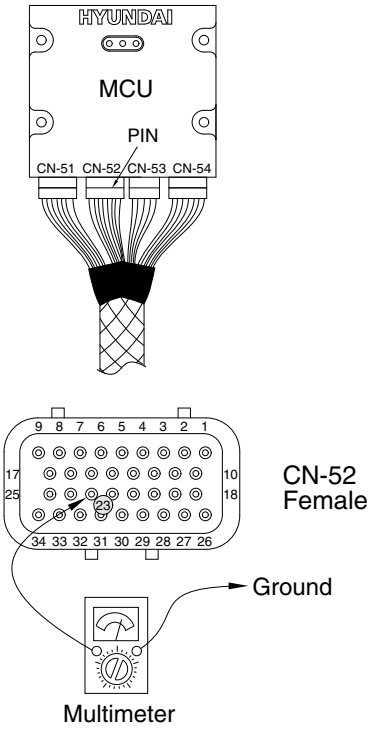
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (23) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



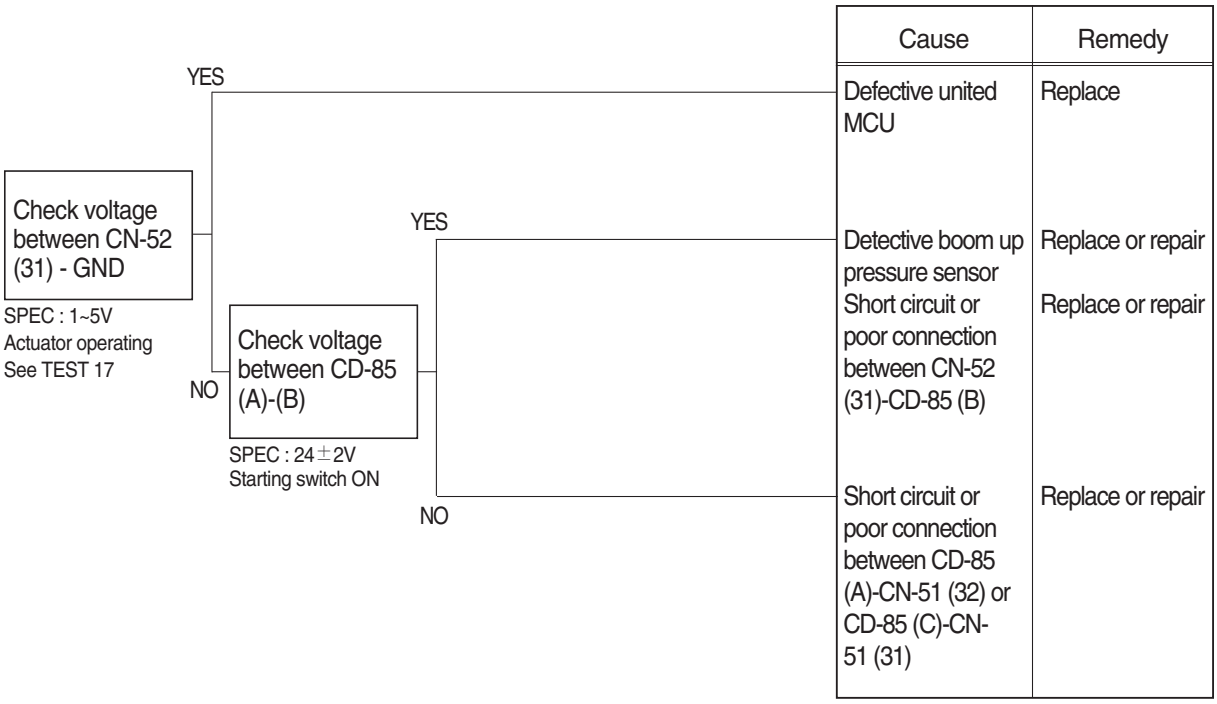
220A6MS120

12. MALFUNCTION OF BOOM DOWN PRESSURE SENSOR

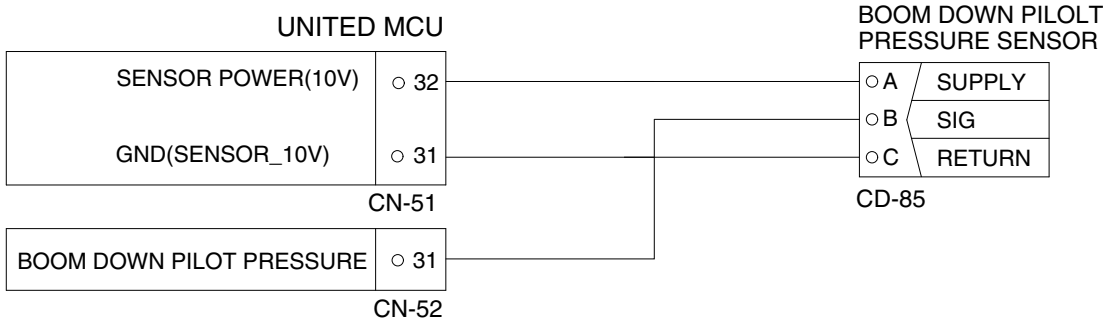
· Fault code : HCESPN 128, FMI 0~4

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram



220A6MS121

2) TEST PROCEDURE

(1) Test 17 : Check voltage at CN-52 (31) and ground.

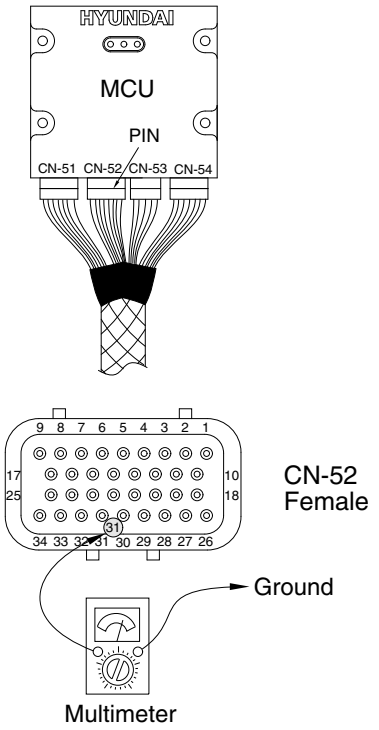
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (31) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



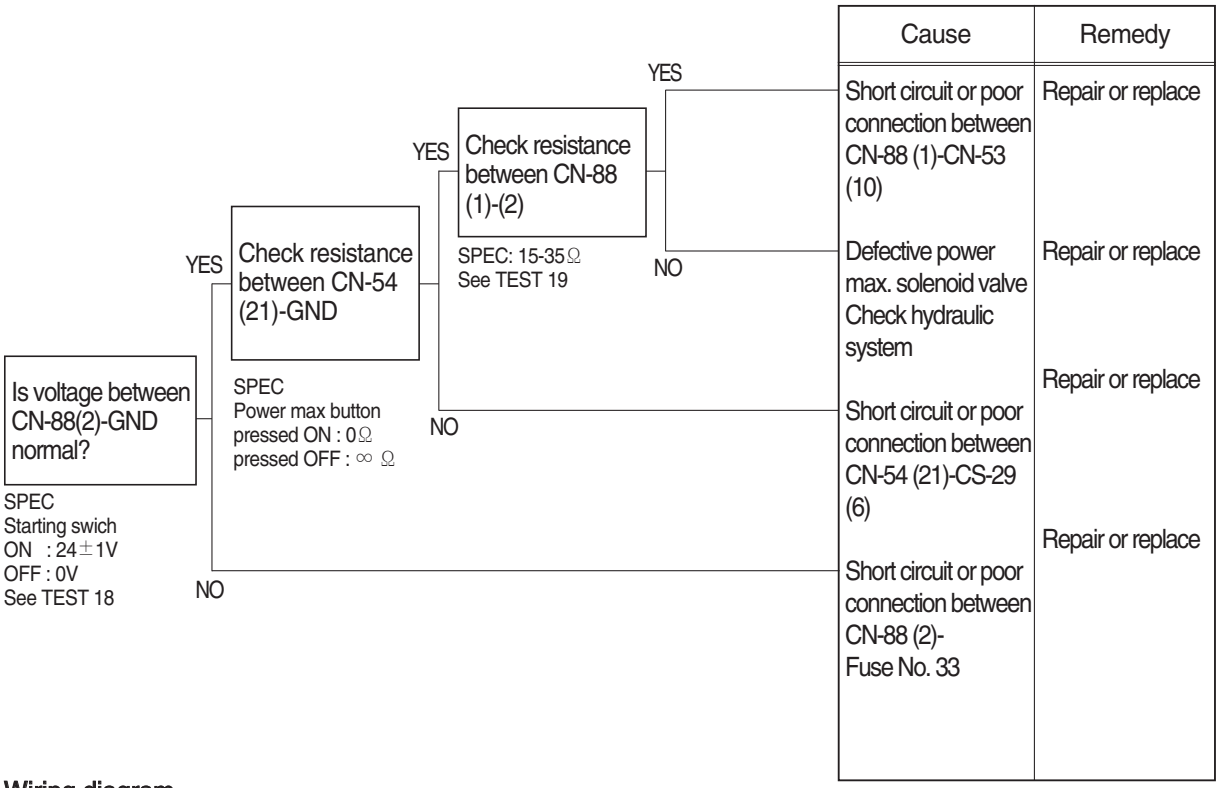
220A6MS122

13. MALFUNCTION OF POWER MAX

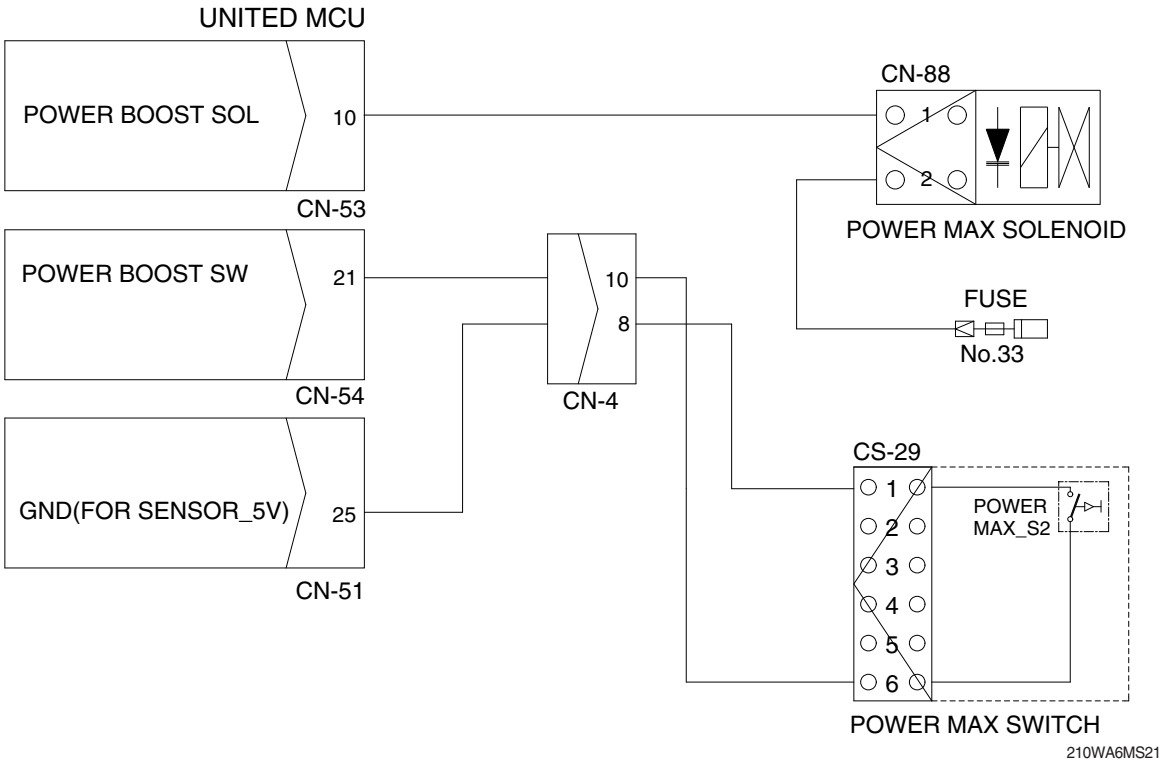
· Fault code : HCESPN 166, FMI 4 or 6

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram



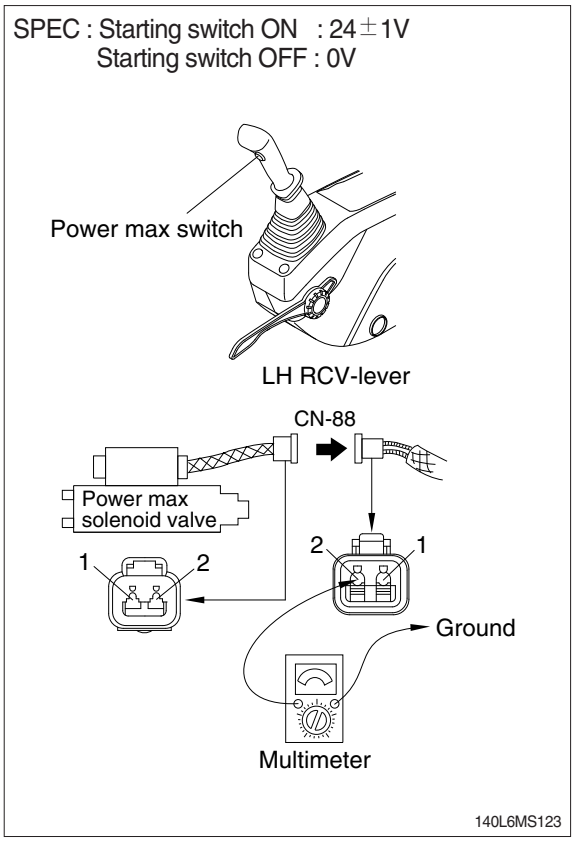
2) TEST PROCEDURE

(1) Test 18: Check voltage between connector CN-88 (2) - GND.

① Disconnect connector CN-88 from power max solenoid valve.

② Start switch ON.

③ Check voltage as figure.

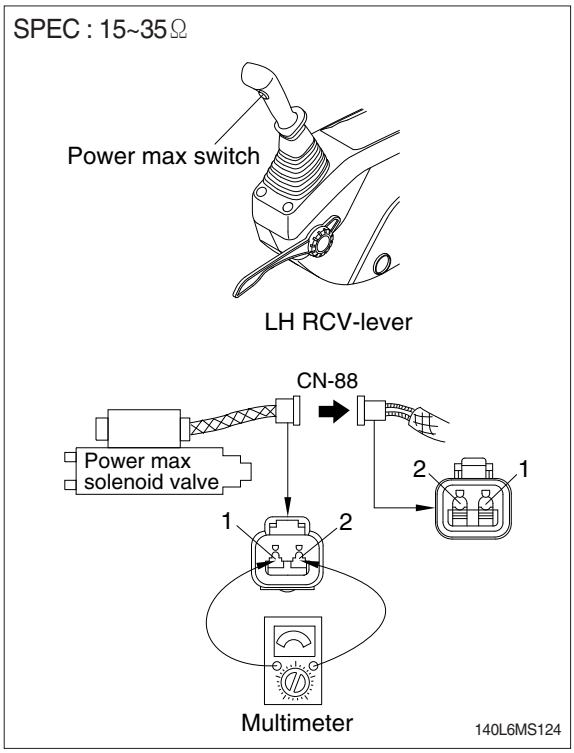


(2) Test 19: Check resistance of the solenoid valve between CN-88 (1)-(2).

① Starting switch OFF.

② Disconnect connector CN-88 from power max solenoid valve.

③ Check resistance as figure.



14. MALFUNCTION OF BOOM PRIORITY EPPR VALVE

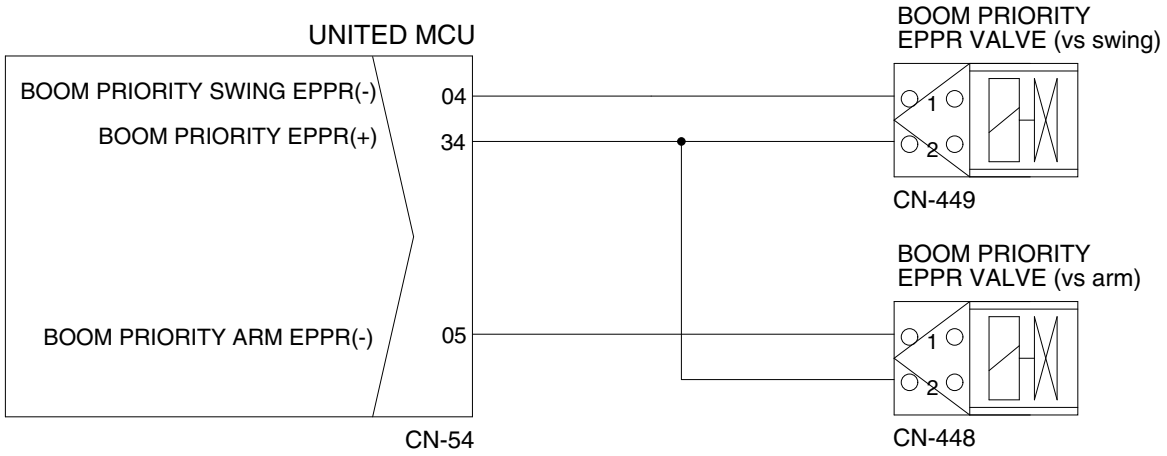
· Fault code : HCESPN 141, FMI 5 or 6

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE

Cause	Remedy
Short circuit or poor connection between CN-54 (04)-CN-448 (1) or CN-54 (34)-CN-448 (2) or CN-54 (05)-CN-449 (1) or CN-54 (34)-CN-449 (2)	Repair or replace
Defective EPPR valve	Repair or replace

Wiring diagram



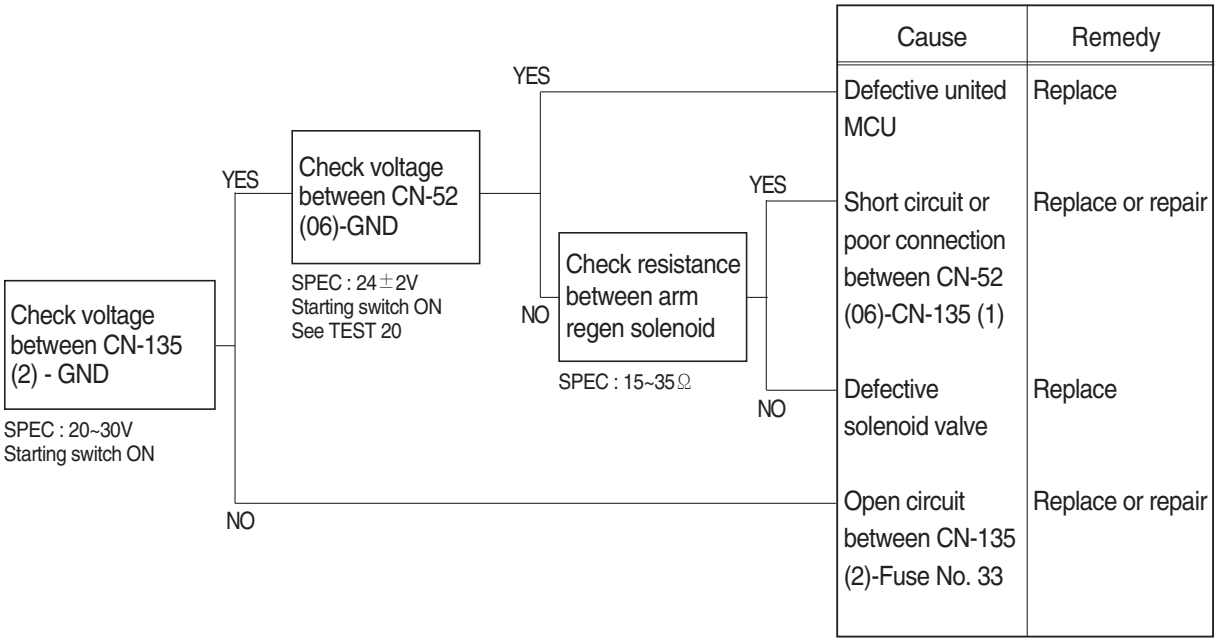
210WA6MS23

15. MALFUNCTION OF ARM REGENERATION SOLENOID

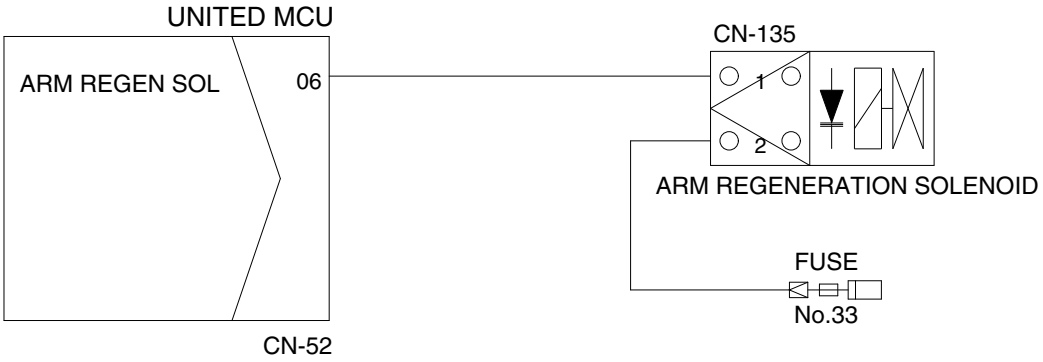
· Fault code : HCESPN 170, FMI 4 or 6

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram



210WA6MS27

2) TEST PROCEDURE

(1) Test 20 : Check voltage at CN-52 (06) and ground.

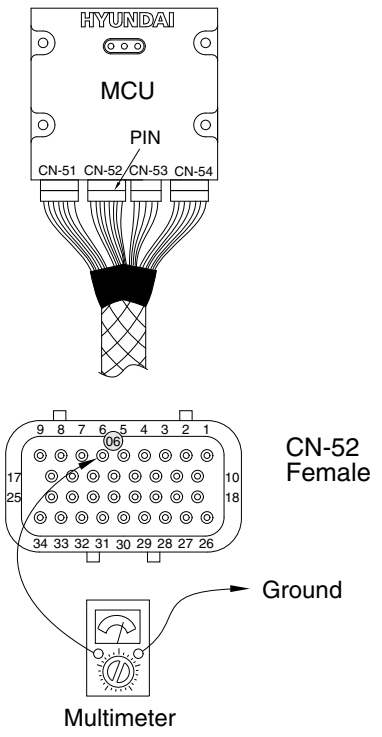
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (06) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Key ON : 24±2 V



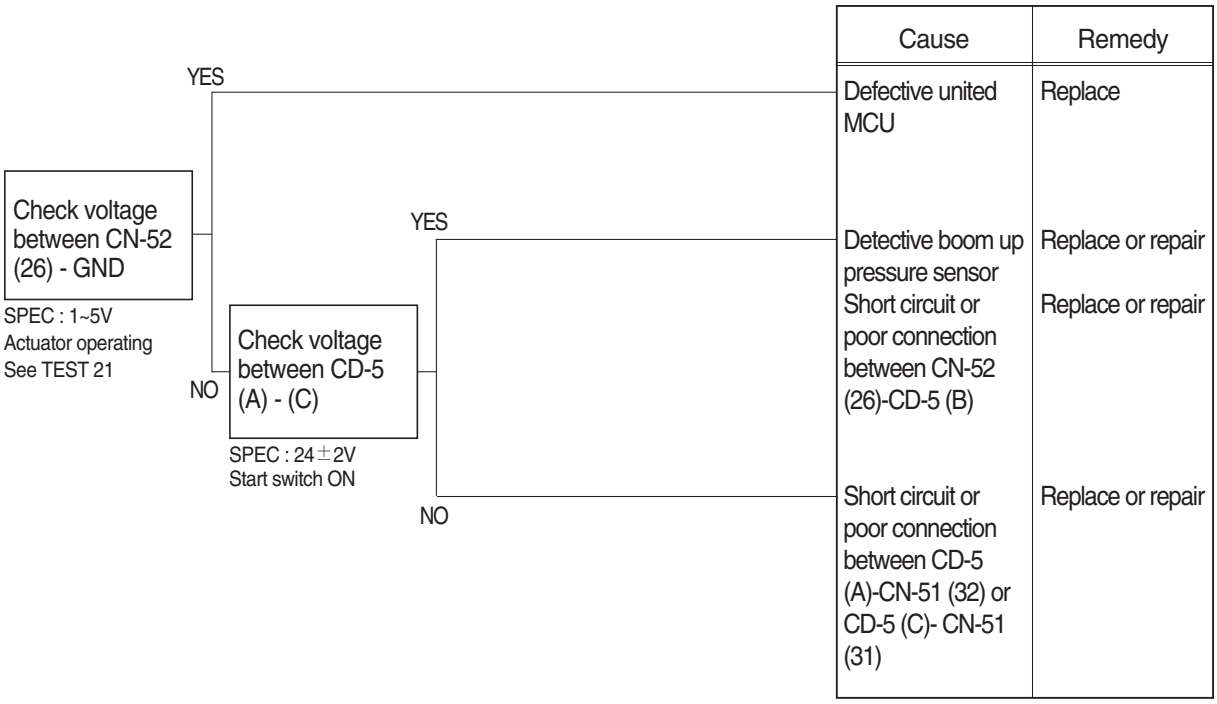
210WA6MS28

16. MALFUNCTION OF TRANSMISSION OIL PRESSURE SENSOR

· Fault code : HCESPN 501, FMI 0~4

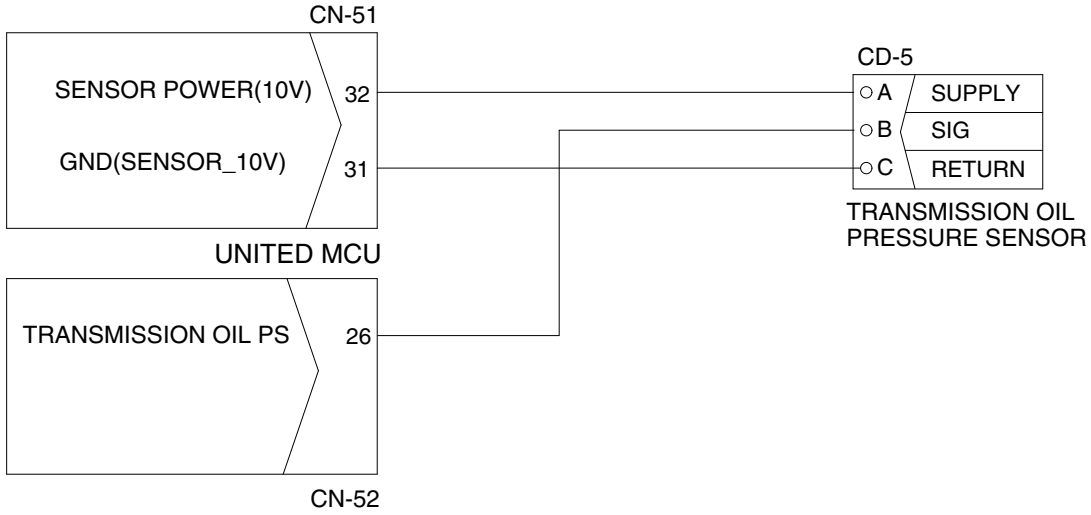
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective united MCU	Replace
Detective boom up pressure sensor	Replace or repair
Short circuit or poor connection between CN-52 (26)-CD-5 (B)	Replace or repair
Short circuit or poor connection between CD-5 (A)-CN-51 (32) or CD-5 (C)- CN-51 (31)	Replace or repair

Wiring diagram



210WA6MS60

2) TEST PROCEDURE

(1) Test 21 : Check voltage at CN-52 (26) and ground.

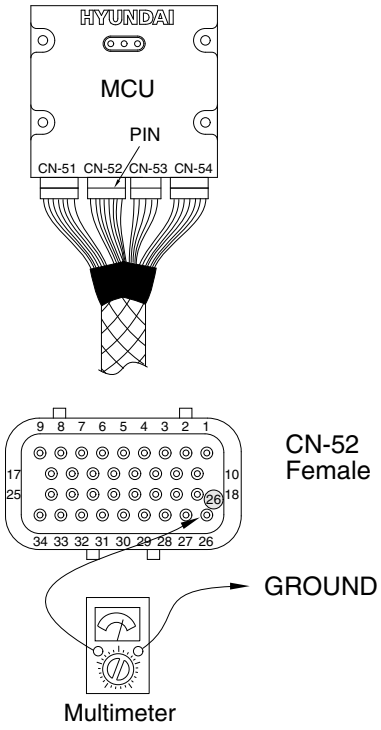
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (26) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



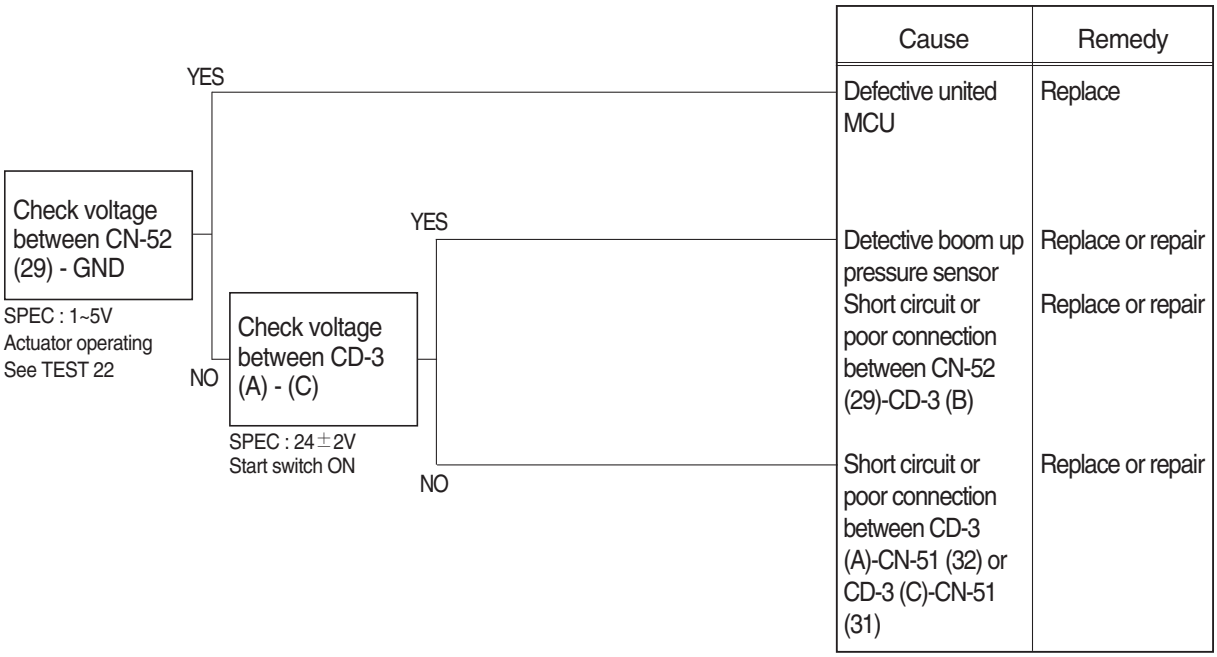
140WF6MS161

17. MALFUNCTION OF BRAKE OIL PRESSURE SENSOR

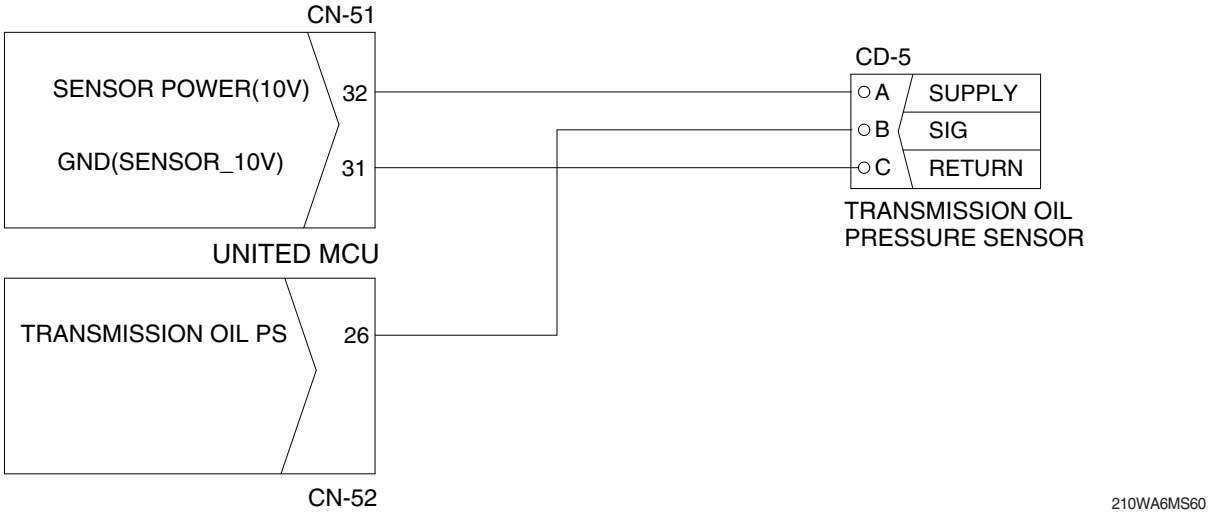
· Fault code : HCESPN 503, FMI 0~4

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram



2) TEST PROCEDURE

(1) Test 22 : Check voltage at CN-52 (29) and ground.

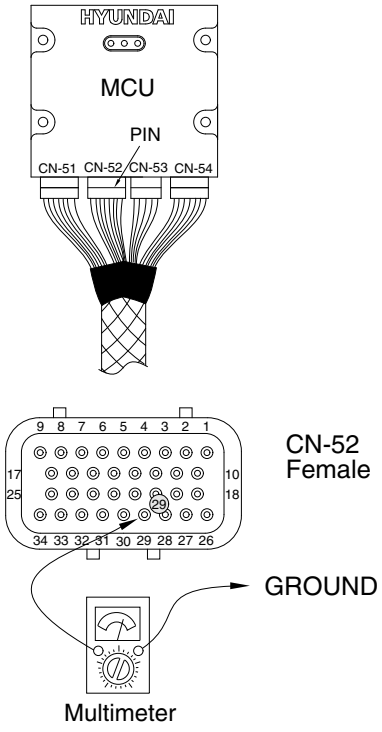
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (29) of CN-52.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



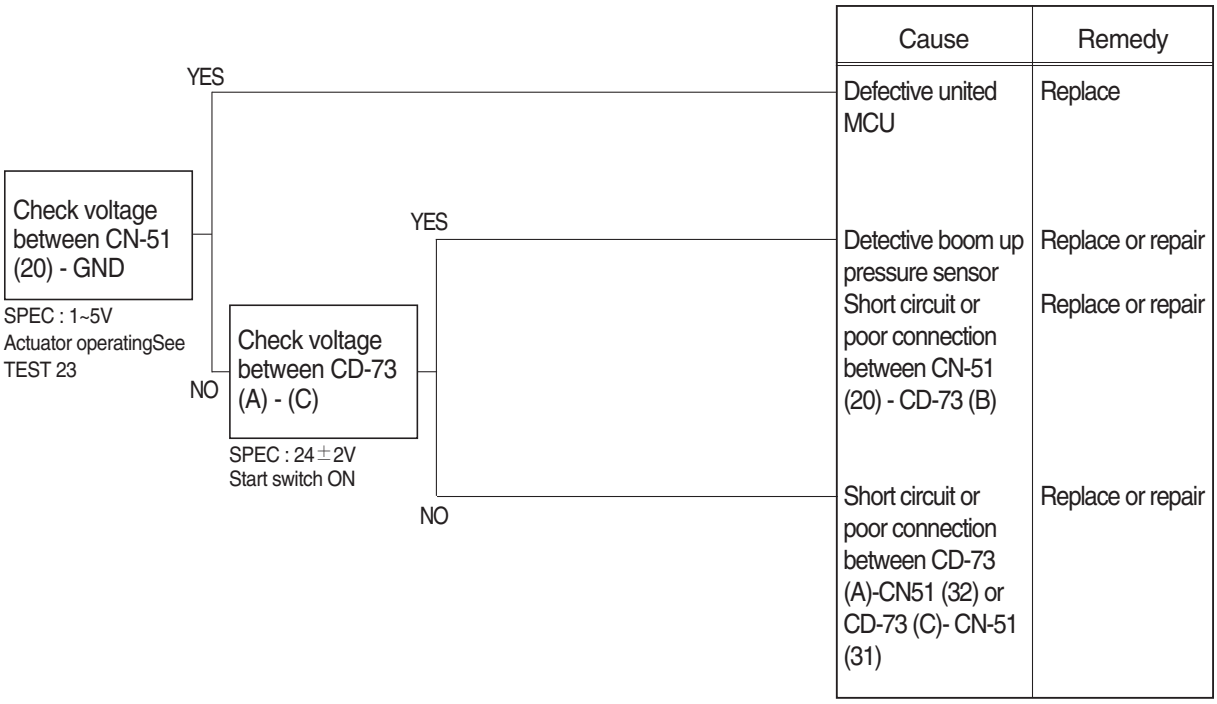
140WF6MS163

18. MALFUNCTION OF TRAVEL FORWARD PRESSURE SENSOR

· Fault code : HCESPN 530, FMI 0~4

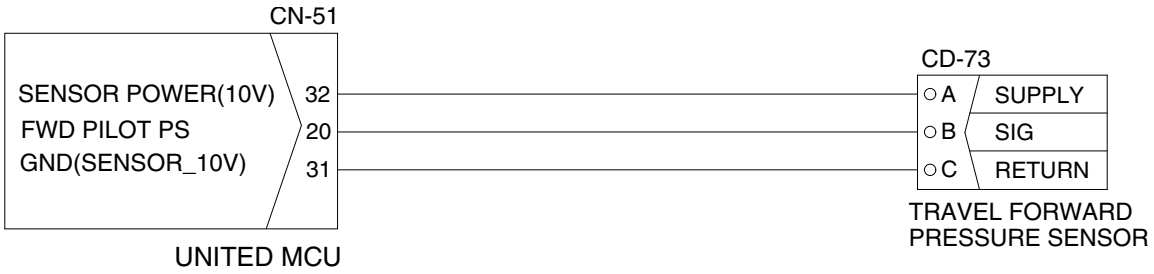
※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Cause	Remedy
Defective united MCU	Replace
Detective boom up pressure sensor	Replace or repair
Short circuit or poor connection between CN-51 (20) - CD-73 (B)	Replace or repair
Short circuit or poor connection between CD-73 (A)-CN51 (32) or CD-73 (C)- CN-51 (31)	Replace or repair

Wiring diagram



210WA6MS64

2) TEST PROCEDURE

(1) Test 23 : Check voltage at CN-51 (20) and ground.

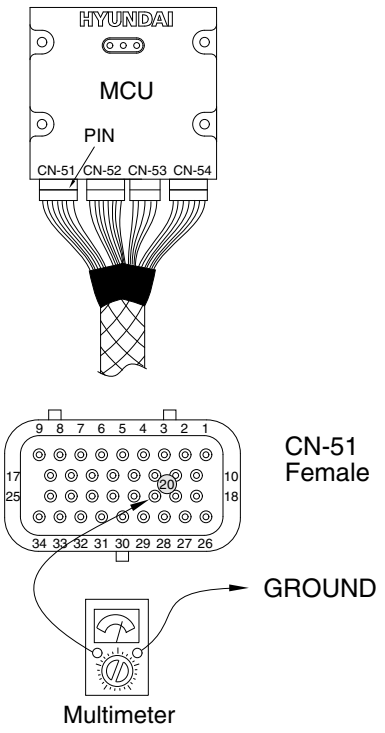
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (20) of CN-51.

③ Starting switch ON.

④ Check voltage as figure.

SPEC : Actuator operating : 1~5 V



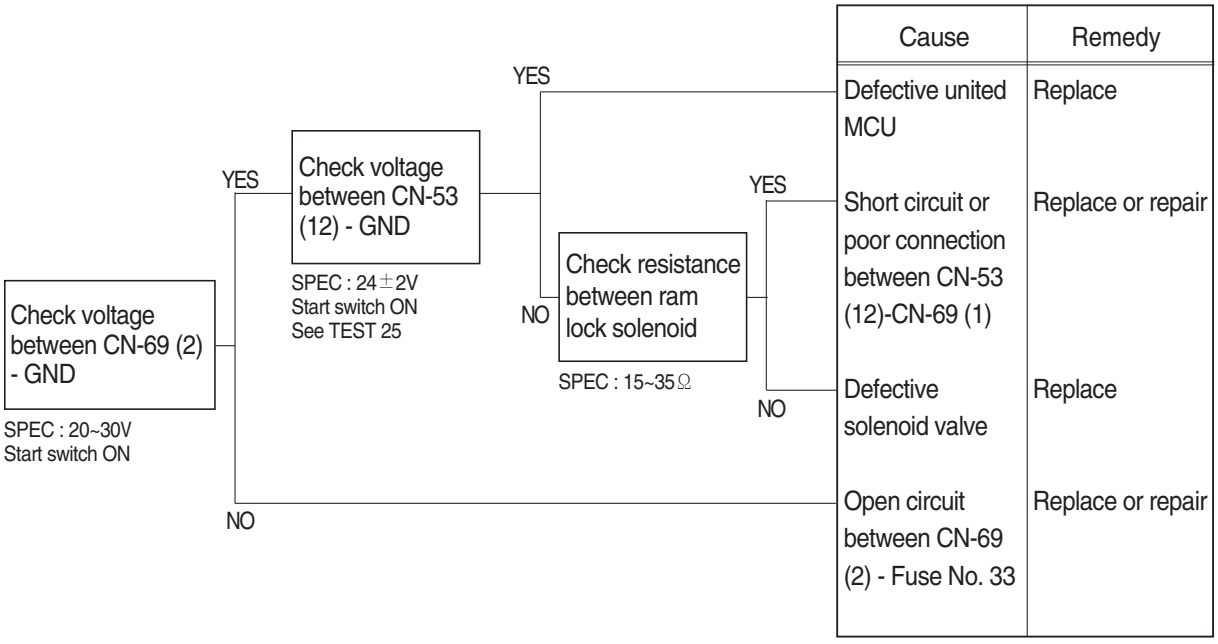
140WF6MS165

19. MALFUNCTION OF RAM LOCK SOLENOID

· Fault code : HCESPN 525, FMI 4 or 6

※ Before carrying out below procedure, check all the related connectors are properly inserted.

1) INSPECTION PROCEDURE



Wiring diagram

210WA6MS68

2) TEST PROCEDURE

(1) Test 25 : Check voltage at 53 (12) and ground.

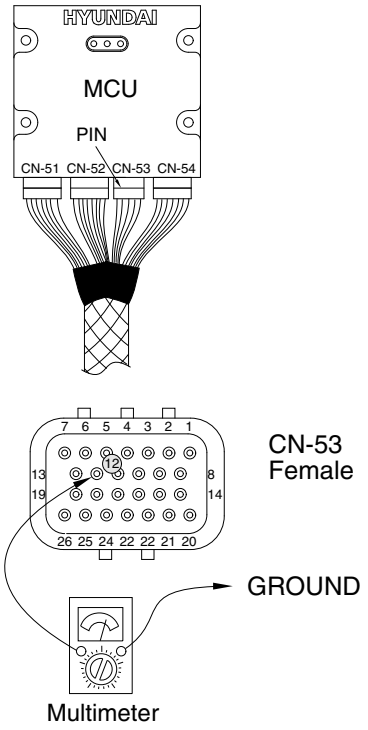
① Prepare 1 piece of thin sharp pin, steel or copper.

② Insert prepared pin to rear side of connectors : One pin to (12) of CN-53.

③ Starting switch ON.

④ Check voltage as figure.

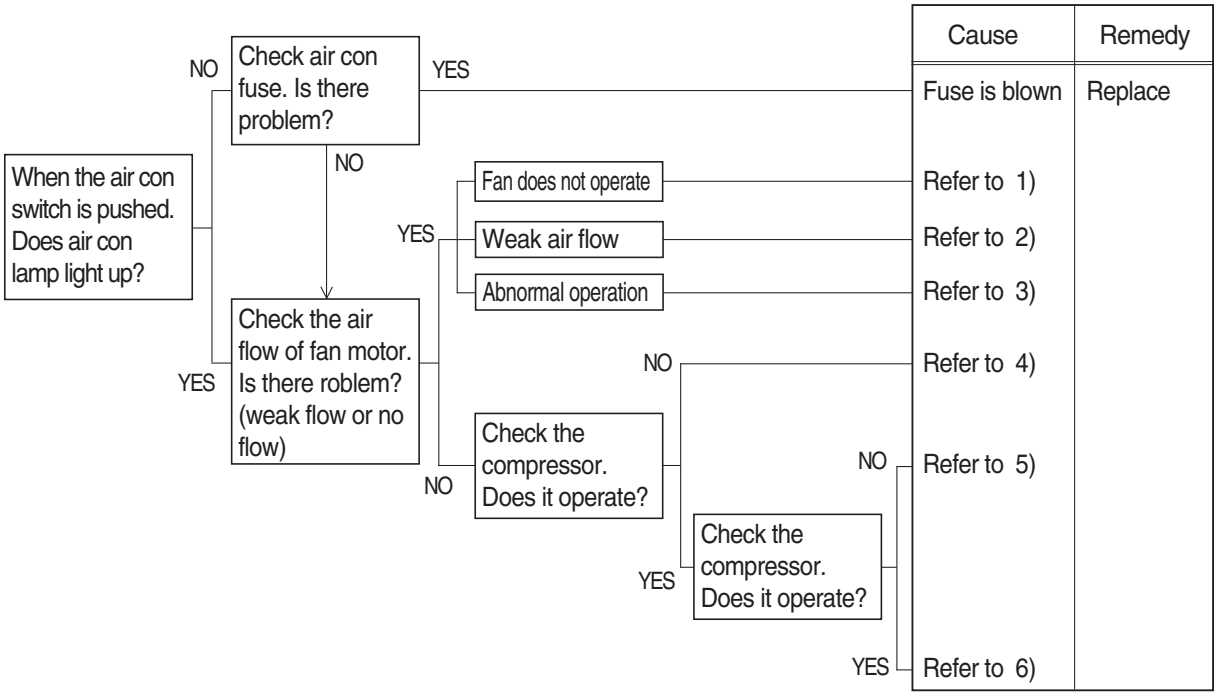
SPEC : Key ON : 24±2 V



140WF6MS169

GROUP 5 AIR CONDITIONER & HEATER SYSTEM

1. AIR CONDITIONER DOES NOT OPERATE



1) FAN DOES NOT OPERATE

Cause	Check	Remedy
Fuse is blown or abnormal relay operation	* Fuse * Does relay normally operate?	Replace
Harness short or poor contact	Check any harness short or abnormal contact of connnector	Repair shortage
Fan motor failure	Supply 24V to 2 lead wire from motor and check the operation	Replace
Resistor is broken	Check current flow of resistor with tester	Replace
Fan switch failure	Push fan switch by turn and check the operation	Replace

2) WEAK AIR FLOW FROM FAN MOTOR

Cause	Check	Remedy
Clogged evaporator or obstacles around air inlet	Check if evaporator is contaminated	Clean
Leakage of air flow	Check HVAC case assembly	Adjust
Duct sensor failure	Check if evaporator is frozen	Replace

3) ABNORMAL OPERATION OF FAN MOTOR

Cause	Check	Remedy
Abnormal operation of each step of control	4 step only operate	Replace resistor
	1 or 2 step does not operate	Replace control
	3 or 4 step does not operate	Replace relay

4) COMPRESSOR DOES NOT ROTATE OR HARDLY ROTATE

Cause	Check	Remedy
Loose belt	Belt shaking is severe	Adjust tension
Failure of compressor itself	Belt slip	Repair or Replace
Low voltage of battery	Slip when rotate	Charge battery
Fieldcoil short	Slip when rotate	Replace magnetic clutch
Oily clutch face	Contamination around clutch	Replace magnetic clutch, clean
Fieldcoil is broken	Magnetic clutch does not operate or "∞" resistance	Replace compressor
Leakage of refrigerant or oil inside	Check if wet with oil	Replace compressor Charge refrigerant

5) COMPRESSOR OPERATE NORMALLY AND AIR FLOW IS NORMAL

Cause	Check	Remedy
Shortage of refrigerant	When air con operate during 5~10 min small temperature difference between high and low pressure pipes.	Repair leakage joint Charge refrigerant
Overcharge of refrigerant	*Magnetic clutch on/off rapidly *High pressure over specification *Lukewarm air from nozzle	Recharge refrigerant following specification
Lower pressure than normal condition at low side	Shortage of refrigerant	Make up refrigerant
	Clogged receive dryer	Replace receive dryer
	Clogged expansion valve	Replace expansion valve
	Clogged or crushed pipe	Replace pipe or clean
	Failure of duct sensor	Replace duct sensor

6) COMPRESSOR OPERATE NORMALLY AND AIR FLOW IS NORMAL

Cause	Check	Remedy
Lower pressure than normal condition at low side	Failure of duct sensor Magnetic clutch off before air temperature sufficiently down	Replace duct sensor or adjust location
	Defective compressor gasket When compressor off, high and low pressure balance immediatly	Repair compressor or Replace
Higher pressure than normal condition at high side	Failure of condensing Contamination on condenser or insufficient air flow from fan	Clean the condenser Repair fan
	Overcharge of refrigerant	Adjust refrigerant
	Entrained air	Vacuum and recharge
Lower pressure than normal condition at high side	Shortage of refrigerant	Make up refrigerant

SECTION 7 MAINTENANCE STANDARD

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Group 2 Major Components ····· 7-19
Group 3 Work Equipment ····· 7-28

SECTION 7 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 HD Hyundai Construction Equipment spec.

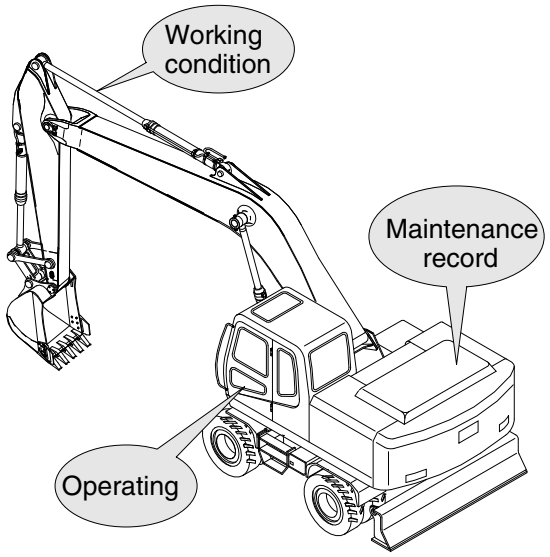
2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

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.

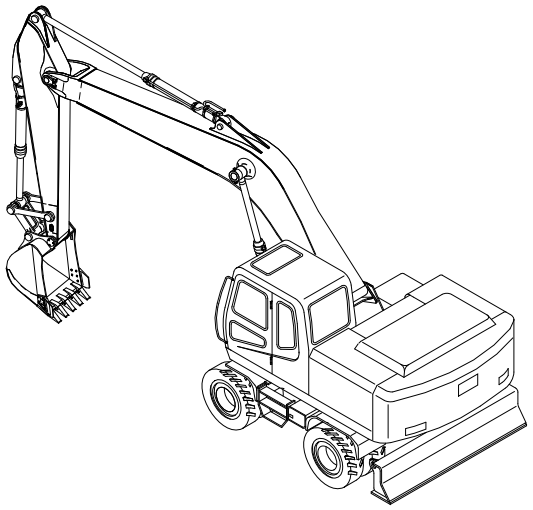


14W77MS01

2. TERMINOLOGY

1) STANDARD

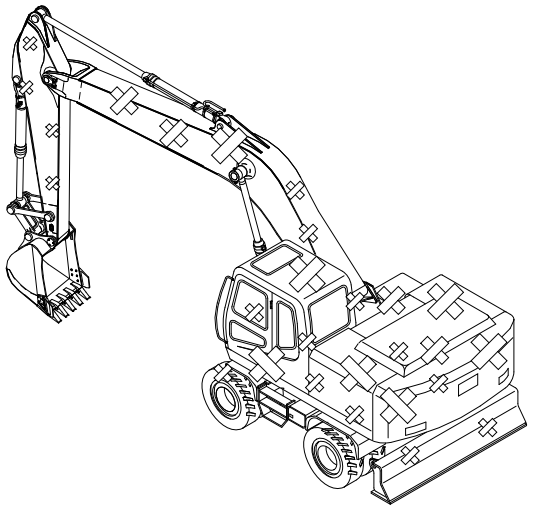
Specifications applied to the brand-new machine, components and parts.



140W77MS02

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.



140W77MS03

3. OPERATION FOR PERFORMANCE TESTS

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

The machine

(1) 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.

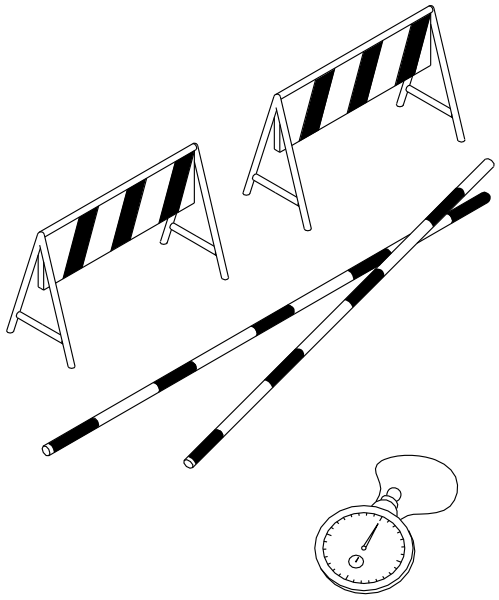
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

(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.



(290-7TIER) 7-3

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

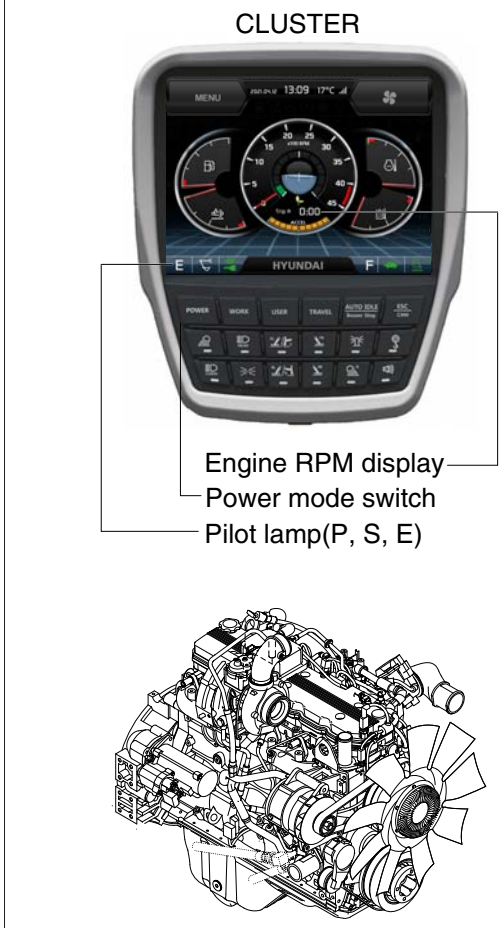
① Start the engine. The engine will run at start idle speed. Measure engine speed with a engine rpm display.

② Measure and record the engine speed at each mode (P, S, E).

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.



(4) Evaluation

The measured speeds should meet the following specifications.

Unit : rpm

Model	Engine speed	Standard	Remarks
HW210A	Start idle	850±50	
	P mode	1600±50	
	S mode	1500±50	
	E mode	1400±50	
	Auto decel	1000±100	
	One touch decel	850±50	

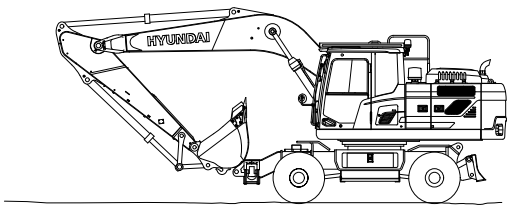
Condition : Set the accel dial at 10 (max) position.

3) TRAVEL SPEED

(1) Measure the time require for the excavator to travel a 50 m at high speed and a 20 m at low speed test run.

(2) Preparation

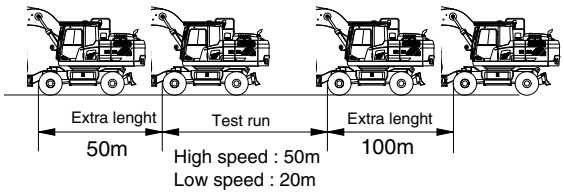
① Prepare a flat and solid test track 50m in length, with extra length of 150m for machine acceleration.
② Set the traveling position as figure.
③ Keep the hydraulic oil temperature at 50±5˚C.



210WA7MS02

(3) Measurement

① Measure both the low and high speeds of the machine.
② Before starting either the low or high speed tests, adjust the RH multifunction switch to the speed to be tested, then select the following switch position.
· Power mode switch : P mode
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 50 m 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.



210WA7MS05

(4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds

Model	Travel speed	Standard	Maximum allowable	Remarks
HW210A	Low speed	7.3	9.3	Seconds / 20 m
	High speed	5.1	6.4	Seconds / 50 m

4) SWING SPEED

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

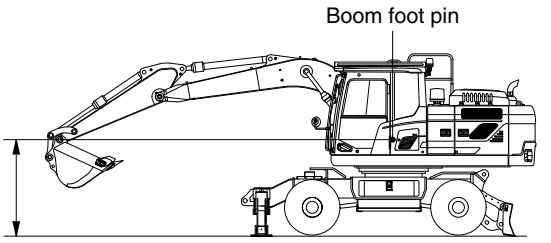
(2) Preparation

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

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



210WA7MS06

(3) Measurement

① Select the following switch positions.

· Power mode switch : P mode

② Operate swing control lever fully.

③ Swing 1 turn and measure time taken to swing next 3 revolutions.

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

(4) Evaluation

The time required for 3 swings should meet the following specifications.

Unit : Seconds / 3 revolutions

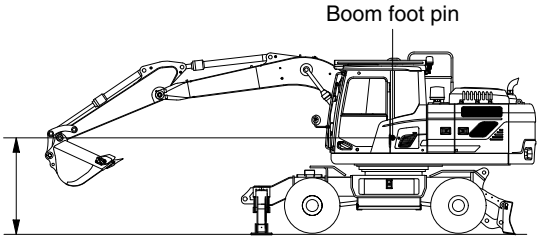
Model	Power mode switch	Standard	Maximum allowable
HW210A	P mode	16.6±1.5	21.2

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

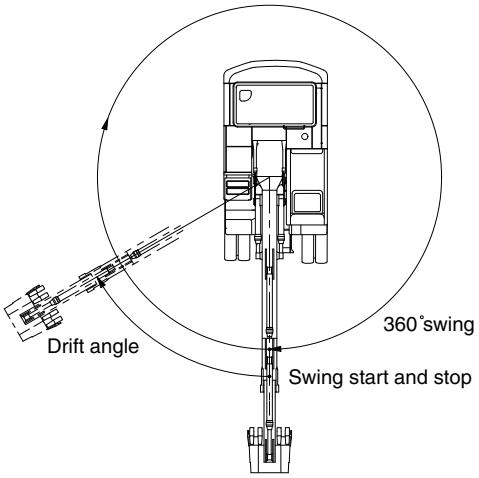
① Check the lubrication of the swing gear and swing bearing.
② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.
③ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. The bucket must be empty.
④ Make two chalk marks: one on the swing bearing and one directly below it on the track frame.
⑤ Swing the upperstructure 360˚.
⑥ Keep the hydraulic oil temperature at 50±5˚C.



210WA7MS06

(3) Measurement

① Conduct this test in the M mode.
② Select the following switch positions.
· Power mode switch : P mode
③ 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˚.
④ Measure the distance between the two marks.
⑤ Align the marks again, swing 360˚, then test the opposite direction.
⑥ Repeat steps ④ and ⑤ three times each and calculate the average values.



20W77MS04

(4) Evaluation

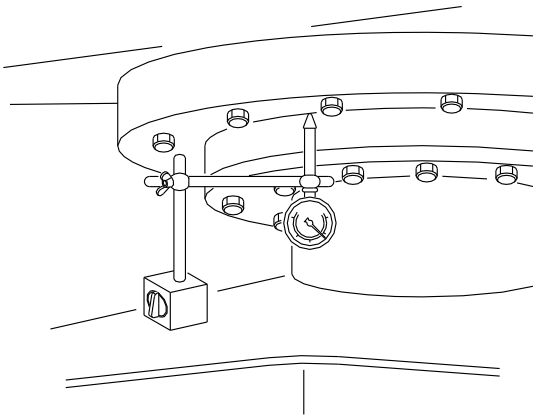
The measured drift angle should be within the following specifications.

Unit : Degree

Model	Power mode switch	Standard	Maximum allowable	Remarks
HW210A	P mode	90 below	157.5	

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

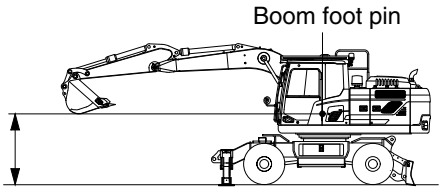
(2) Preparation

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 idlers.
⑤ Position the dial gauge so that its needle point comes into contact with the bottom face of the bearing outer race.
⑥ Bucket should be empty.

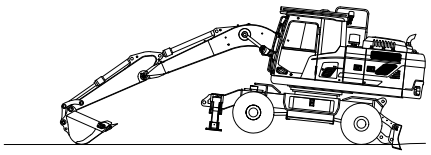
(3) Measurement

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

Measurement : (h1)



Measurement : (h2)



210WA7MS08

(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Standard	Maximum allowable	Remarks
HW210A	0.5 ~ 1.5	3.0	

7) HYDRAULIC CYLINDER CYCLE TIME

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

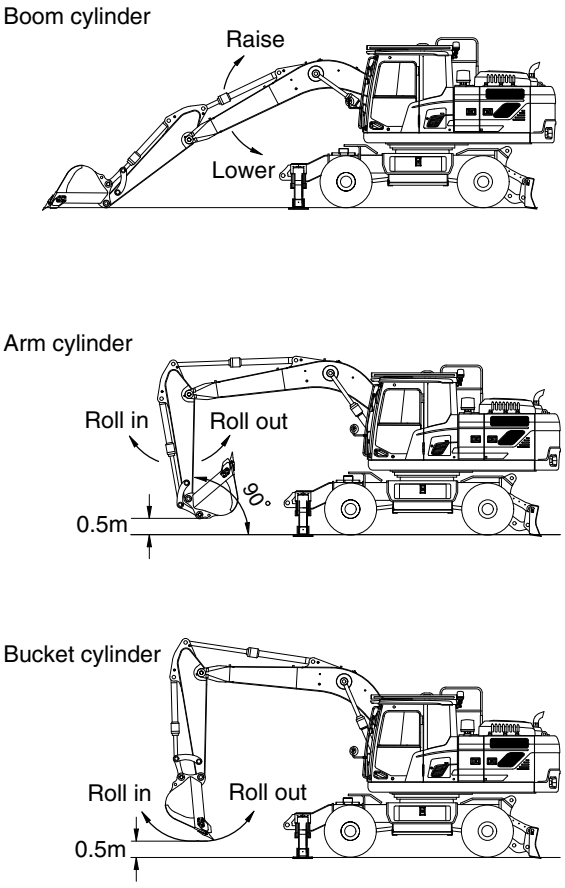
(2) Preparation

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

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

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

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



210WA7MS09

(3) Measurement

① Select the following switch positions.
· Power mode switch : P mode

② To measure cylinder cycle times.
- Boom cylinders.
Measure the time it takes to raise the boom, and the time it takes to lower the boom. To do so, position the boom at one stroke end then move the control lever to the other stroke end as quickly as
- possible.
Arm cylinder.
Measure the time it takes to roll in the arm, and the time it takes to roll out the arm. To do so, position the bucket at one stroke end, then move the control lever to the other stroke end as quickly as possible.

- Bucket cylinder.
  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
HW210A	Boom raise		3.3±0.4	4.0	
	Boom lower		2.6±0.4	3.2	
	Arm in	Regen ON	3.0±0.4	3.6	
		Regen OFF	3.4±0.4	4.1	
	Arm out		2.9±0.3	3.5	
	Bucket load		2.5±0.4	3.0	
	Bucket dump		2.1±0.3	2.6	

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.

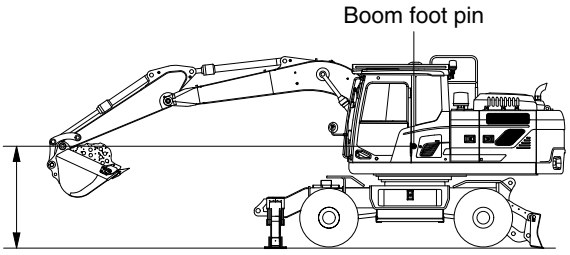
· $W=M^3 \times 1.5$
Where :
M^3 = Bucket heaped capacity (m^3)
1.5 = Soil specific gravity

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

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

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

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



210WA7MS10

(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 / 5 min

Model	Drift to be measured	Standard	Maximum allowable	Remarks
HW210A	Boom cylinder	10 below	20	
	Arm cylinder	10 below	20	
	Bucket cylinder	40 below	60	

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 Select the following switch positions.
· Power mode switch: P mode
③ Operate each boom, arm, bucket and swing lever at full stroke and measure the maximum operating force for each.
④ Lower the bucket to the ground to raise one track off the ground. Operate the travel lever at full stroke and measure the maximum operating force required. When finished, lower the track and then jack-up the other track.
⑤ Repeat steps ③ and ④ 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
HW210A	Boom lever	1.3 or below	1.7	
	Arm lever	1.3 or below	1.7	
	Bucket lever	1.3 or below	1.7	
	Swing lever	1.3 or below	1.7	

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.

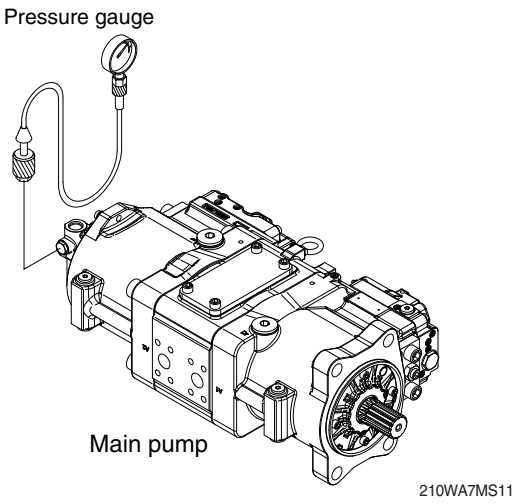
(4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

Model	Kind of lever	Standard	Maximum allowable	Remarks
HW210A	Boom lever	90±10	112	
	Arm lever	90±10	112	
	Bucket lever	90±10	112	
	Swing lever	90±10	112	

11) PILOT PRIMARY PRESSURE



(1) Preparation

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

(2) Measurement

① Select the following switch positions.

- Power mode switch : P mode
- Auto decel switch : OFF

② Measure the attached gear pump pressure to the measuring instrument through the screw coupling.

(3) Evaluation

The average measured pressure should meet the following specifications:

Unit : kgf / cm²

Model	Kind of lever	Standard	Maximum allowable	Remarks
HW210A	P mode	Over 34	-	

12) FOR TRAVEL SPEED SELECTING PRESSURE

(1) Preparation

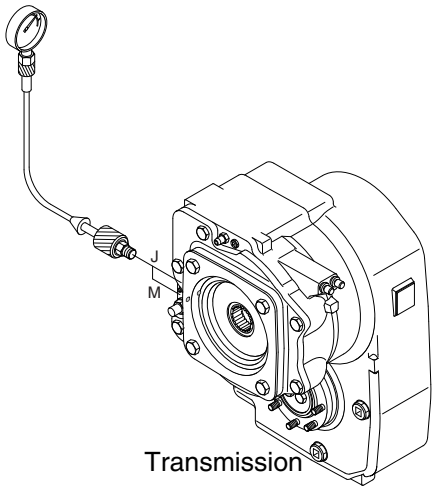
① Stop the engine.

② Loosen the cap and relieve the pressure in the hydraulic tank by pushing the top of the air breather.

③ To measure the speed selecting pressure : Install a connector and pressure gauge assembly to transmission J, M port as shown the figure.

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

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



14W97MS13

(2) Measurement

① Lower the bucket and dozer blade to the ground to raise the tires off the ground.

② Select the following switch position.

· Parking switch : OFF

· Power mode switch : P mode

③ Operate the travel speed switch turns to the high or lower position and measure the port J or M pressure.

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

(3) Evaluation

The average measured pressure should be within the following specifications.

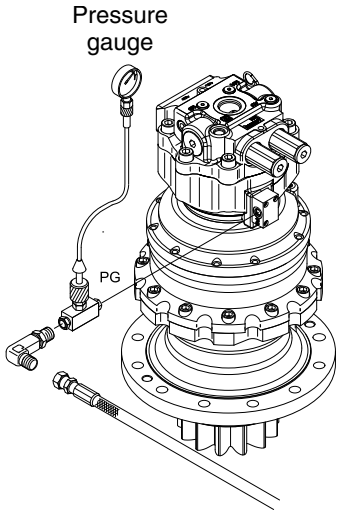
Unit : kgf / cm²

Model	Travel speed mode	Standard		Allowable limits		Remarks
		J port	M port	J port	M port	
HW210A	Low Speed	-	33+2	-	30~35	
	High Speed	33+2	-	30~35	-	

13) SWING PARKING BRAKE RELEASING PRESSURE

(1) Preparation

① Stop the engine.
② Loosen the cap and relieve the pressure in the hydraulic tank by pushing the top of the air breather.
③ Install a connector and pressure gauge assembly to swing motor PG 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.



210WA7MS13

(2) Measurement

① Select the following switch positions.
· Power mode switch : P mode
② 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.
③ Repeat step ② 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	Allowable limits	Remarks
HW210A	Brake disengaged	30	Over 4	
	Brake applied	0	-	

14) MAIN PUMP DELIVERY PRESSURE

(1) Preparation

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

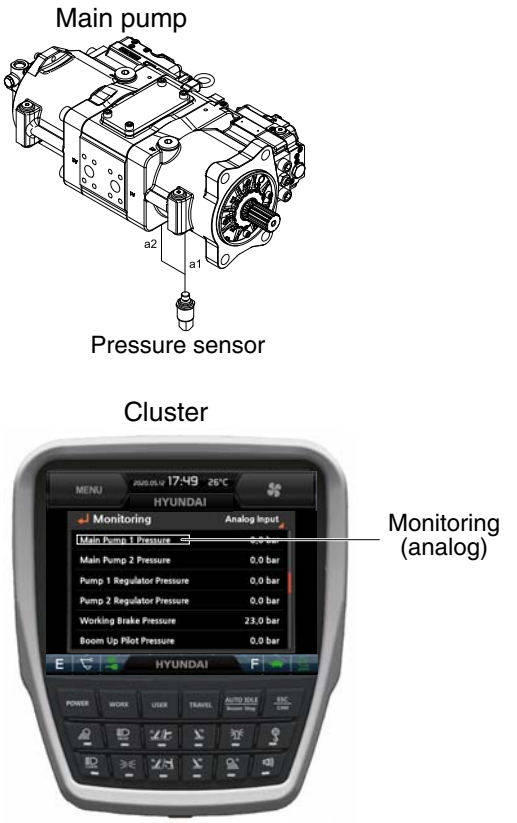
(2) Measurement

① Select the following switch positions.

· Power mode switch : P mode

② Measure the main pump delivery pressure in the P mode (high idle).

※ Do not operate any of the RCV levers and pedal.



210WA7MS15

(3) Evaluation

The average measured pressure should meet the following specifications.

Unit : kgf / cm²

Model	Engine speed	Standard	Allowable limits	Remarks
HW210A	High idle	40^{+2}_{0}	-	

15) SYSTEM PRESSURE REGULATOR RELIEF SETTING

(1) Preparation

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

(2) Measurement

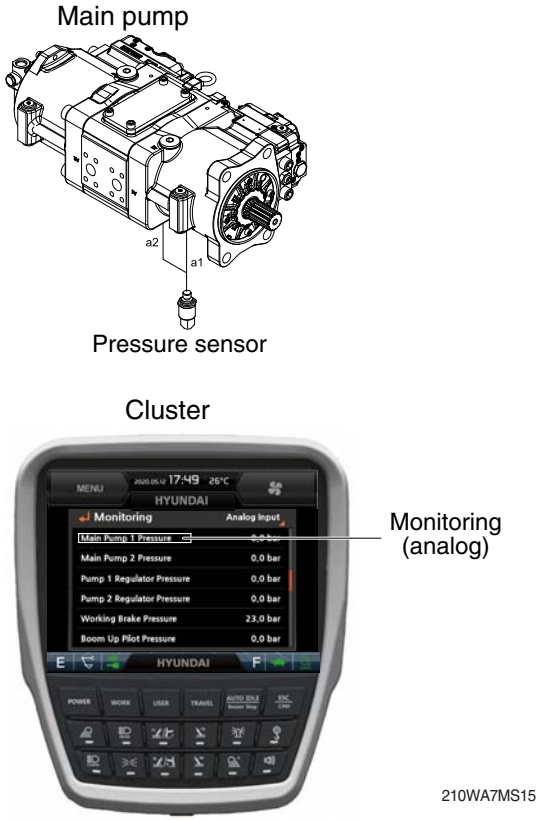
① Select the following switch positions.

· Power mode switch : P mode

② Slowly operate each control lever of boom, arm and bucket functions at full stroke over relief and measure the pressure.

③ In the swing function, place bucket against an immovable object and measure the relief pressure.

④ In the travel function, lock undercarriage with an immovable object and measure the relief pressure.



(3) Evaluation

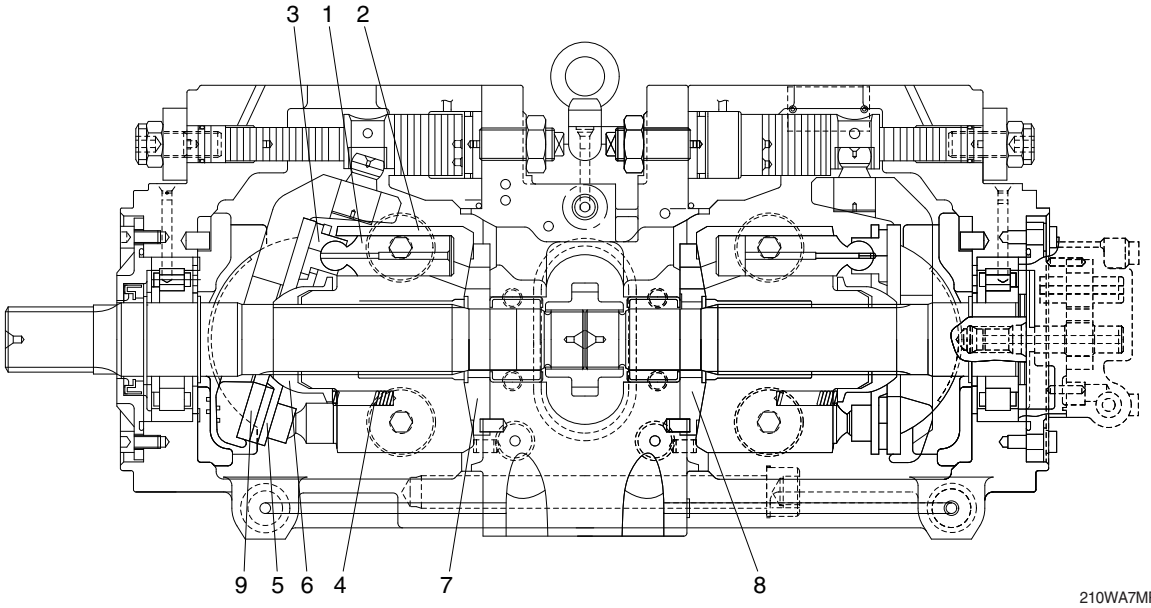
The average measured pressure should be within the following specifications.

Unit : kgf / cm²

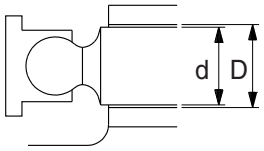
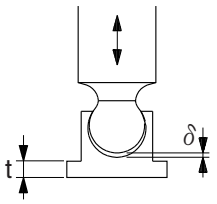
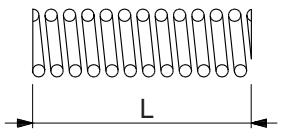
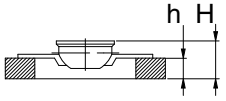
Model	Function to be tested	Standard	Port relief setting at 20lpm
HW210A	Boom, Arm, Bucket	350 (380)±10	400±10
	Travel	380±10	-
	Swing	305±10	-
	Doze, outrigger	280±10	-

( ) : Power boost

1. MAIN PUMP



210WA7MP01

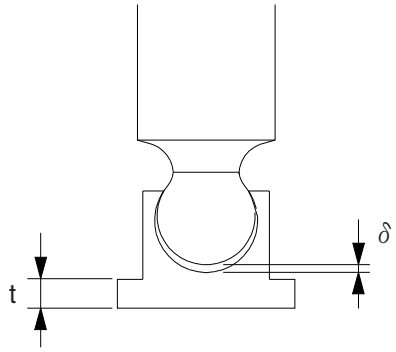
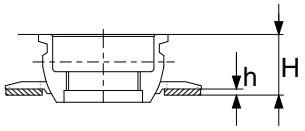
Part name & inspection item		Standard dimension	Recommended replacement value	Counter measures
Clearance between piston (1) & cylinder bore (2) (D-d)		0.039	0.067	Replace piston or cylinder.
Play between piston (1) & shoe caulking section (3) (δ)		0-0.1	0.3	Replace assembly of piston & shoe.
Thickness of shoe (t)		4.9	4.7	
Free height of cylinder spring (4) (L)		41.1	40.3	Replace cylinder spring.
Combined height of set plate (5) & spherical bushing (6) (H-h)		23.0	22.0	Replace retainer or set plate.
Surface roughness for valve plate (sliding face) (7,8), swash plate (shoe plate area) (9), & cylinder (2) (sliding face)	Surface roughness necessary to be corrected	3z		Lapping
	Standard surface roughness (corrected value)	0.4z or lower		

2. MAIN CONTROL VALVE

Part name	Inspection item	Criteria & measure
Casing	· Existence of scratch, rust or corrosion.	· In case of damage in following section, replace part. - Sliding sections of casing hole and spool, especially land sections applied with held pressure. - Seal pocket section where spool is inserted. - Sealing section of port where O-ring contacts. - Sealing section of each relief valve for main, travel, and port. - Sealing section of the plug. - Other damage that may causes for losing normal function.
Spool	· Existence of scratch, gnawing, rusting or corrosion.	· Replacement when its outside sliding section has scratch (especially on seals-contacting section).
	· Both ends of O-ring seal sections.	· Replacement when its sliding section has scratch.
	· Insert spool in casing hole, rotate and reciprocate it.	· Correction or replacement when the O-ring is damaged or when the spool does not move smoothly.
Poppet	· Damage of the spring	· Replacement
	· Damage of poppet	· Correction or replacement when sealing is incomplete.
	· Insert the poppet into the casing and operate it.	· Normal when it can function lightly and smoothly without sticking.
Spring and related parts	· Rusting, corrosion, deformation or breaking of the spring, spring seat, plug or cover.	· Replacement for significant damage.
Around seal for thd spool	· External oil leakage.	· Correction or replacement.
	· Rusting, corrosion or deformation of the seal plate.	· Correction or replacement.
Main relief valve, port relief valve	· External rusting or damage.	· Replacement.
	· Contacting face of the valve seat.	· Replacement in case of damage.
	· Contacting face of the poppet.	· Replacement in case of damage.
	· Defect of the spring.	· Replacement.
	· O-rings and back up rings.	· Replacement in principle.

3. SWING DEVICE

1) WEARING PARTS

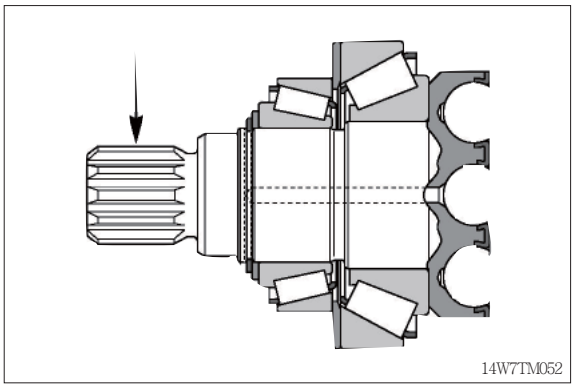
Inspection item	Standard dimension	Recommended replacement value	Counter measures
Clearance between piston and cylinder block bore	0.041	0.060	Replace piston or cylinder block
Thickness of valve plate	6	5.88	Replace
Play between piston and shoe caulking section (δ)	0.025	0.1	Replace assembly of piston and shoe
Thickness of shoe (t)	6.6	6.5	Replace assembly of piston and shoe
Combined height of retainer plate and spherical bushing (H-h)	17.6	17.3	Replace set of retainer plate and sperical bushing
Thickness of friction plate	2.94	2.7	Replace
 140W77MS12		 2609A7MS01	

2) SLIDING PARTS

Part name	Standard roughness	Allowable roughness	Remark
Shoe	Rmax=1S (Ra=0.2a) (LAPPING)	4S (Ra=0.1a)	
Shoe plate	Rmax=0.4S (Ra=0.1a) (LAPPING)	3S (Ra=0.8a)	
Cylinder	Rmax=0.4S (Ra=0.1a) (LAPPING)	3S (Ra=0.8a)	
Valve plate	Rmax=0.4S (Ra=0.1a) (LAPPING)	2S (Ra=0.5a)	

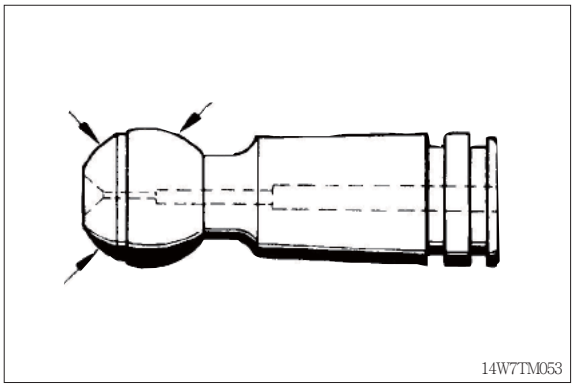
4. TRAVEL MOTOR

1) Free of corrosion, erosion or fretting; no damage to splines or keyways.



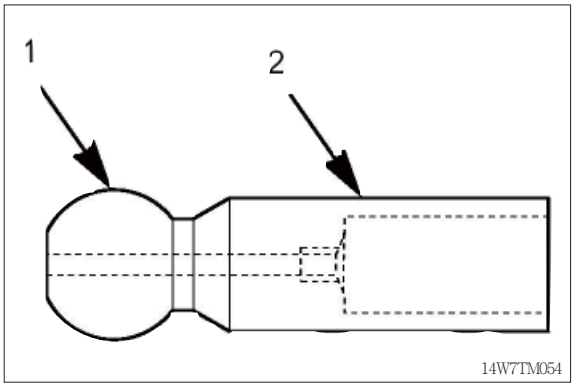
2) Pistons

No scoring and no pittings.



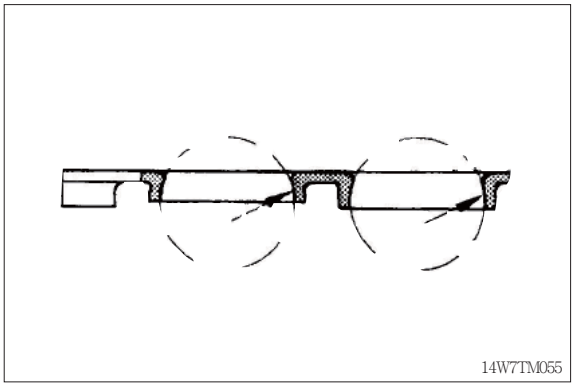
3) Center pin

No scoring and no pittings.



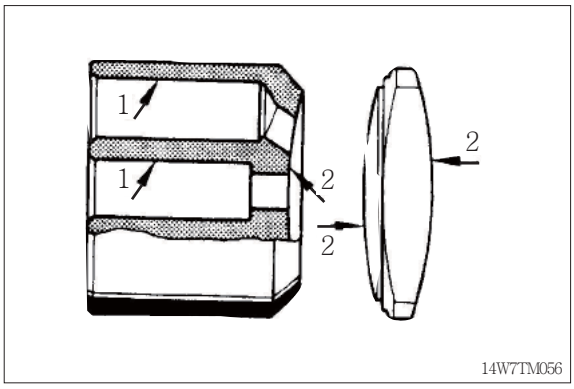
4) Retaining plate

No scoring and no evidence of wear.



5) Cylinder block/control lens

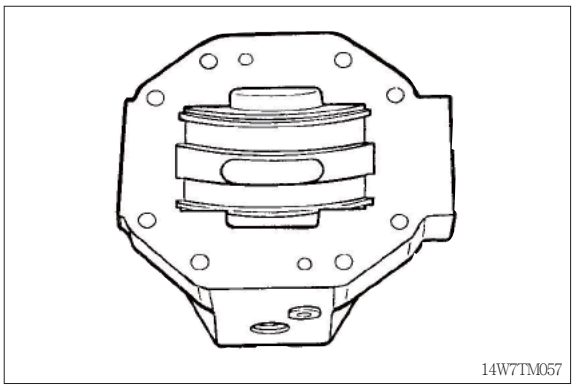
① Bores free of scoring, no evidence of
② wear.
Faces smooth and even, free of cracks and scoring.



14W7TM056

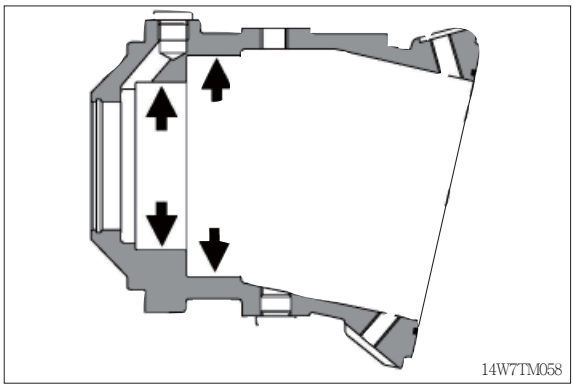
6) Control housing

Sliding surface and side guides free of scoring and no wear.

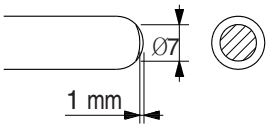

14W7TM057

7) Visual check

Bearing areas free of scoring and no evidence of wear.


14W7TM058

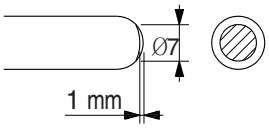
5. RCV LEVER

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 : 40 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 1 mm.	
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.

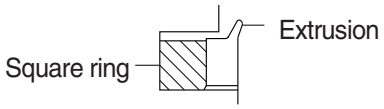
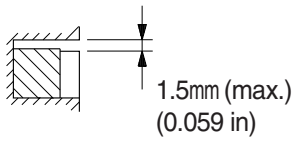
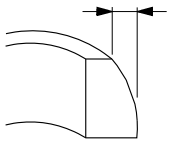
2. When loosening the hexagon socket head cap screw (125), replace the seal washers (121) without fail.

6. RCV 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 : 40 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 1 mm.	
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.	

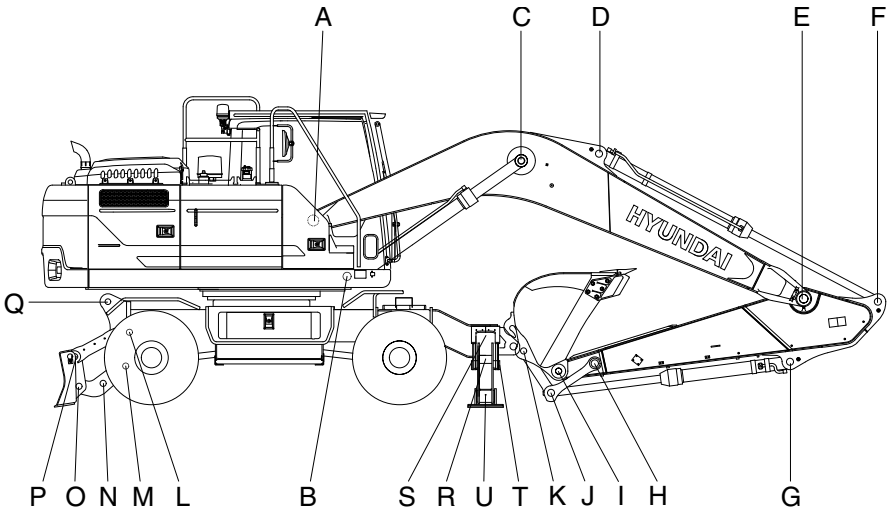
Notes 1. It is desirable to replace seal materials, such as O-rings, every disassembling. However, they may be reused, after being confirmed to be free of damage.

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
	· Bushing at mounting part	· Wear of I.D.	· Replace
Cylinder tube	· Weld on bottom	· Presence of crack	· Replace
	· Weld on head	· Presence of crack	· Replace
	· Weld on hub	· Presence of crack	· Replace
	· Tube interior	· Presence of faults	· Replace if oil leak is seen
	· Bushing at mounting part	· Wear on inner surface	· Replace
Gland	· Bushing	· Flaw on inner surface	· Replace if flaw is deeper than coating



210WA7MS30

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	90	89	88.5	90.5	91	Replace
B	Boom cylinder head	80	79	78.5	80.5	81	〃
C	Boom cylinder rod	80	79	78.5	80.5	81	〃
D	Arm cylinder head	80	79	78.5	80.5	81	〃
E	Boom front	90	89	88.5	90.5	91	〃
F	Arm cylinder rod	80	79	78.5	80.5	81	〃
G	Bucket cylinder head	80	79	78.5	80.5	81	〃
H	Arm link	70	69	68.5	70.5	71	〃
I	Bucket and arm link	80	79	78.5	80.5	81	〃
J	Bucket cylinder rod	80	79	78.5	80.5	81	〃
K	Bucket link	80	79	78.5	80.5	81	〃
L	Dozer link (B)	70	69	68.5	70.5	71	〃
M	Dozer link (A)	70	69	68.5	70.5	71	〃
N	Dozer cylinder rod	70	69	68.5	70.5	71	〃
O	Dozer link (A)	70	69	68.5	70.5	71	〃
P	Dozer link (B)	70	69	68.5	70.5	71	〃
Q	Dozer cylinder head	70	69	68.5	70.5	71	〃
R	Outrigger cylinder head	80	79	78.5	80.5	81	〃
S	Outrigger cylinder rod	80	79	78.5	80.5	81	〃
T	Outrigger cylinder leg	80	79	78.5	80.5	81	〃
U	Outrigger cylinder foot	80	79	78.5	80.5	81	〃

SECTION 8 DISASSEMBLY AND ASSEMBLY

Group 1 Precautions 8-1
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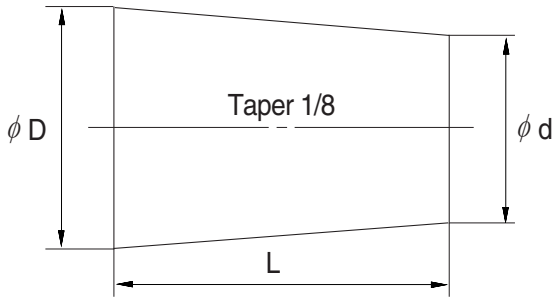
SECTION 8 DISASSEMBLY AND ASSEMBLY

GROUP 1 PRECAUTIONS

1. REMOVAL WORK

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

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



2. INSTALL WORK

1) Tighten all bolts and nuts (sleeve nuts) to the specified torque.
2) Install the hoses without twisting or interference.
3) Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.
4) Bend the cotter pin or lock plate securely.
5) When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with 2-3 drops of adhesive.
6) When coating with gasket sealant, clean the surface and remove all oil and grease, check that there is no dirt or damage, then coat uniformly with gasket sealant.
7) Clean all parts, and correct any damage, dents, burrs, or rust.
8) Coat rotating parts and sliding parts with engine oil.
9) When press fitting parts, coat the surface with antifriction compound (LM-P).
10) After installing snap rings, check that the snap ring is fitted securely in the ring groove (check that the snap ring moves in the direction of rotation).
11) When connecting wiring connectors, clean the connector to remove all oil, dirt, or water, then connect securely.
12) When using eyebolts, check that there is no deformation or deterioration, and screw them in fully.
13) When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.
14) When operating the hydraulic cylinders for the first time after repairing and reassembling the hydraulic cylinders, pumps, or other hydraulic equipment or piping, always bleed the air from the hydraulic cylinders as follows:
    (1) Start the engine and run at low idling.
    (2) Operate the control lever and actuate the hydraulic cylinder 4-5 times, stopping 100㎜ before the end of the stroke.
    (3) Next, operate the piston rod to the end of its stroke to relieve the circuit. (The air bleed valve is actuated to bleed the air.)
    (4) After completing this operation, raise the engine speed to the normal operating condition.

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

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

3. COMPLETING WORK

1) If the coolant has been drained, tighten the drain valve, and add water to the specified level. Run the engine to circulate the water through the system. Then check the water level again.
2) If the hydraulic equipment has been removed and installed again, add engine oil to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
3) If the piping or hydraulic equipment, such as hydraulic cylinders, pumps, or motors, have been removed for repair, always bleed the air from the system after reassembling the parts.
4) Add the specified amount of grease (molybdenum disulphied grease) to the work equipment related parts.

GROUP 2 TIGHTENING TORQUE

1. MAJOR COMPONENTS

No.	Descriptions		Bolt size	Torque	
				kgf · m	lbf · ft
1	Engine	Engine mounting bolt (bracket-frame, FR)	M20 × 2.5	52.1±5.0	370±36.2
2		Engine mounting bolt (bracket-frame, RR)	M20 × 2.5	52.1±5.0	370±36.2
3		Engine mounting bolt (engine-bracket)	M12 × 1.75	11.5±1.0	83.2±7.2
4		Radiator mounting bolt, nut	M16 × 2.0	29.7±4.5	215±32.5
5		Coupling mounting bolt	M18 × 2.5	32.0±1.0	231±7.2
6	Hydraulic system	Main pump housing mounting bolt	M10 × 1.5	6.5±0.7	47.0±5.1
7		Main pump mounting socket bolt	M20 × 2.5	57.9±8.7	418±62.9
8		Main control valve mounting bolt	M12 × 1.75	12.8±3.0	92.6±21.7
9		Travel motor mounting bolt	M16 × 2.0	35.6±7.1	257±51.4
10		Fuel tank mounting bolt	M20 × 2.5	46±5.1	333±36.9
11		Hydraulic oil tank mounting bolt	M20 × 2.5	46±5.1	333±36.9
12		Turning joint mounting bolt, nut	M12 × 1.75	12.8±3.0	92.6±21.7
13		Swing motor mounting bolt	M20 × 2.5	57.9±8.7	419±62.9
14	Power train system	Swing bearing upper mounting bolt	M20 × 2.5	57.9±6.0	419±43.4
15		Swing bearing lower mounting bolt	M20 × 2.5	57.9±6.0	419±43.4
16		Real axle mounting bolt, nut	M24 × 2.0	100±10.7	723±77.4
			M24 × 3.0	100±10.7	723±77.4
17		Transmission bracket mounting bolt	M20 × 2.5	39±4.2	282±30.4
18		Transmission mounting bolt	M20 × 2.5	44±2.0	318±14.5
19		Oscillating cylinder mounting bolt	M22 × 1.5	69.4±10.4	502±75.2
20		Oscillating cylinder support bolt	M16 × 2.0	29.7±4.5	215±32.5
21		Wheel nut	M22 × 1.5	60	433
22		Front drive shaft mounting bolt, nut	M10 × 1.0	5.9±0.6	42.7±4.3
23		Rear drive shaft mounting bolt, nut	M10 × 1.0	5.9±0.6	42.7±4.3
24	Others	Counterweight mounting bolt	M36 × 3.0	337±33	2440±72.3
25		Cab mounting bolt, nut	M12 × 1.75	12.8±3.0	92.6±21.7
26		Operator's seat mounting bolt	M 8 × 1.25	4.05±0.8	29.3±5.8
27		Under cover mounting bolt	M12 × 1.75	12.8±3.0	92.6±21.7

※ For tightening torque of engine and hydraulic components, see engine maintenance guide and service manual.

2. TORQUE CHART

The torques given are standard figures. Any figures specifically described in this manual has priority.

1) BOLT AND NUT

(1) Coarse thread

Bolt size	8T		10T	
	kg · m	lb · ft	kg · m	lb · ft
M 6 × 1.0	0.9 ~ 1.3	6.5 ~ 9.4	1.1 ~ 1.7	8.0 ~ 12.3
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 ~ 60.0
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	130.2
1"	41	21	151.9
1-1/4"	50	35	253.2

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	130.2
1-7/16-12	41	21	151.9
1-11/16-12	50	35	253.2

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	130.2
1"	41	21	151.9
1-1/4"	50	35	253.2

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) Remove the wirings for the pressure sensors and so on.

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

· Hydraulic tank quantity : 160 ℓ

(6) Remove socket bolts (25) and disconnect pipe (7, 8).

(7) Disconnect pilot line hoses (2, 3, 4, 5, 6, 7).

(8) Remove socket bolts (24) and disconnect pump suction tube (1).

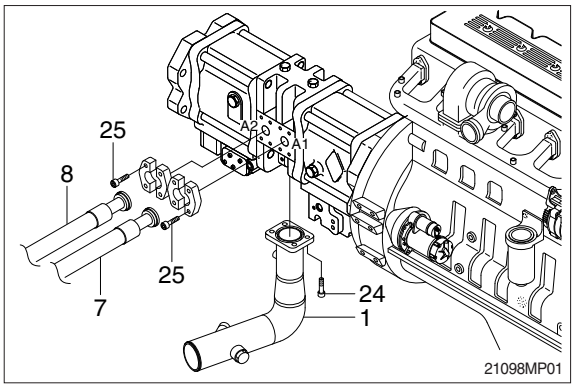
※ When pump suction tube is disconnected, the oil inside the piping will flow out, so catch it in oil pan.

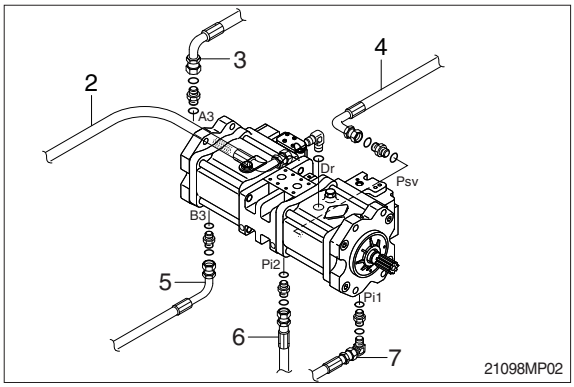
(9) Sling the pump assembly and remove the pump mounting bolts.

· Weight : 140 kg (310 lb)

· Tightening torque : 57.9 ± 8.7 kgf·m (419 ± 62.9 lbf·ft)

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





2) INSTALL

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

(2) Remove the suction strainer and clean it.

(3) Replace return filter with new one.

(4) Remove breather and clean it.

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

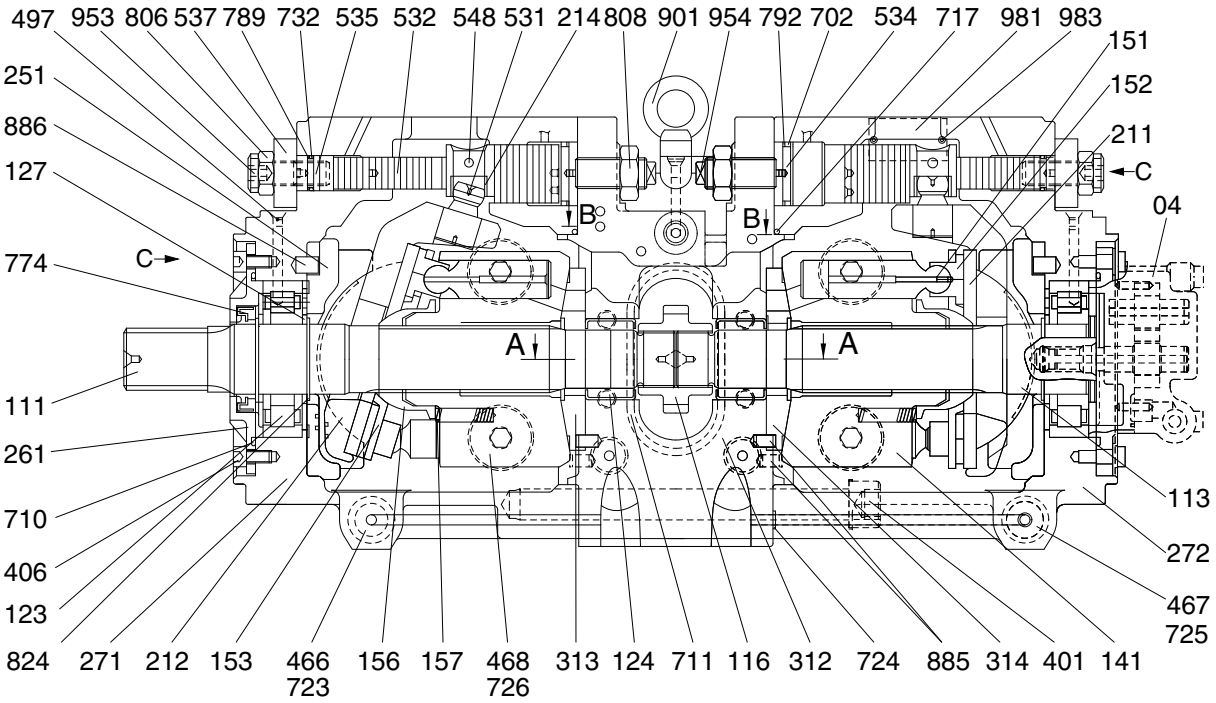
(6) Bleed the air from the hydraulic pump.
① Remove the air vent plug (2EA).
② Tighten plug lightly.
③ Start the engine, run at low idling, and check oil come out from plug.
④ Tighten plug.

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

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

2. MAIN PUMP (1/2)

1) STRUCTURE

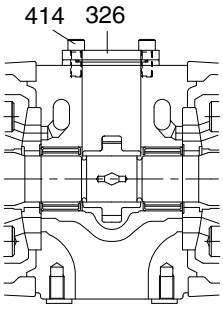


※ Section A-A, B-B, view C : see next page.

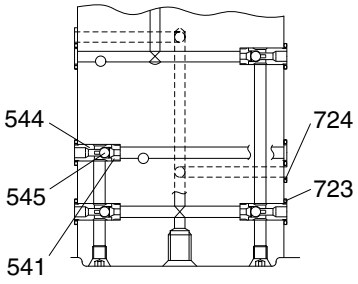
210WA2MP05

04	Gear pump	272	Pump casing (R)	723	O-ring
111	Drive shaft (F)	312	Valve block B	724	Square ring
113	Drive shaft (R)	313	Valve plate (R)	725	O-ring
116	1st gear	314	Valve plate (L)	726	O-ring
123	Roller bearing	401	Hexagon socket bolt	732	O-ring
124	Needle bearing	406	Hexagon socket bolt	774	Oil seal
127	Bearing spacer	466	Plug	789	Back up ring
141	Cylinder block	467	Plug	792	Back up ring
151	Piston	468	Plug	806	Hexagon head nut
152	Shoe	497	Plug	808	Hexagon head nut
153	Set plate	531	Tilting pin	824	Snap ring
156	Spherical bushing	532	Servo piston	885	Pin
157	Cylinder spring	534	Stopper (L)	886	Pin
211	Shoe plate	535	Stopper (S)	901	Eye bolt
212	Swash plate	537	Servo cover	953	Hexagon socket set screw
214	Tilting bushing	548	Feedback pin	954	Set screw
251	Support	702	O-ring	981	Name plate
261	Seal cover (F)	710	O-ring	983	Pin
271	Pump casing (F)	711	O-ring		
		717	O-ring		

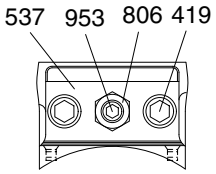
MAIN PUMP (2/2)



SECTION A-A



SECTION B-B



VIEW C

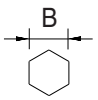
210WA2MP06

326	Cover	541	Seat	724	Square ring
414	Hexagon socket bolt	544	Stopper 1	806	Hexagon head nut
419	Hexagon socket bolt	545	Steel ball	953	Hexagon set screw
537	Servo cover	723	O-ring		

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

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

Tool name & size		Part name		
Name	B	Hexagon socket head bolt	ROH, VP plug (Parallel thread)	Hexagon socket head setscrew
Allen wrench 	6	M 8	PF 1/4	M12, M14
	8	M10	PF 3/8	M16, M18
	10	M12	PF 1/2	M20
	14	M16, M18	PF 3/4	-
	17	M20, M22	PF 1	-
Adjustable angle wrench		Medium size, 1 set		
Screw driver		Minus type screw driver, Medium size, 2 pieces		
Hammer		Plastic hammer, 1 pieces		
Pliers		For snap ring, TSR-160		
Torque wrench		Capable of tightening with the specified torques		

(2) Tightening torque

Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt (Material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 8	3.0	21.7	0.24	6
	M10	5.8	42.0	0.31	8
	M12	10.0	72.3	0.39	10
	M14	16.3	118	0.47	12
	M16	23.5	170	0.55	14
	M18	33.7	244	0.55	14
	M20	43.8	317	0.67	17
ROH Plug PF 3/8 or under : S45C PF 1/2 or over : SCM435	PF 1/4	3.0	21.7	0.24	6
	PF 3/8	7.5	54.2	0.31	8
	PF 1/2	10.0	72.3	0.39	10
	PF 3/4	15.3	111	0.47	12

3) DISASSEMBLY

For disassembling the pump, read this section thoughly and then disassemble it in the following sequence. The figures in parentheses after part names show the item in structure drawing.

(1) Select place suitable to disassembling.

※ Select clean place.

※ Spread rubber sheet, cloth or so on overhaul workbench top to prevent parts from being damaged.

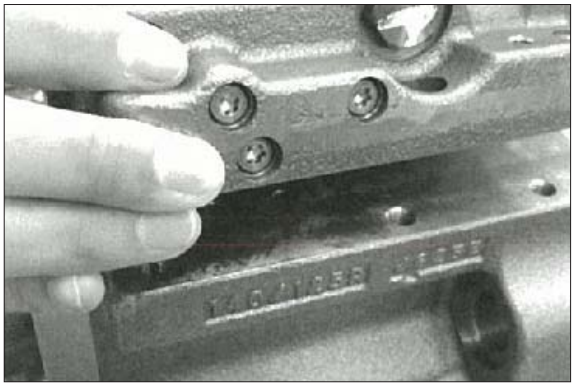
(2) Remove dust, rust, etc, from pump surfaces with cleaning oil or so on.

(3) Remove drain port plug (468) and let the oil out from pump casing (271, 272).

※ For tandem type pump, remove plugs of both front and rear pumps.

(4) Remove hexagon socket head bolts (412) and remove regulator.

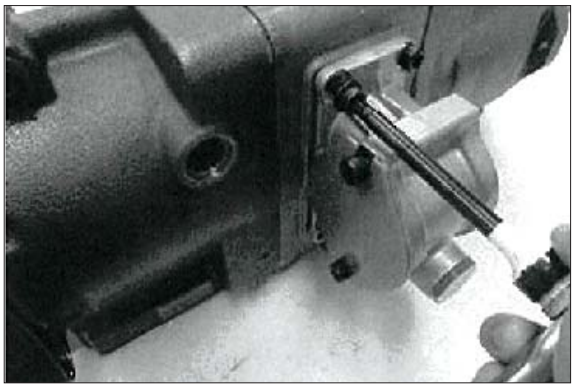
※ Refer to page 8-28 for disassemble regulator.



220F8MP11

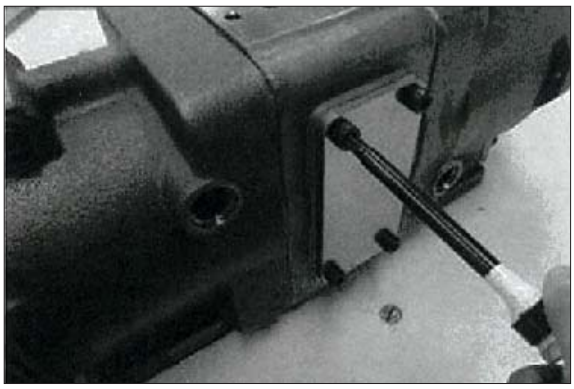
(5) Place the pump horizontally on workbench with its regulator-fitting surface down, and remove PTO unit from valve block (if equipped).

※ Before bringing regulator-fitting surface down, spread rubber sheet on workbench to avoid damaging the surface.



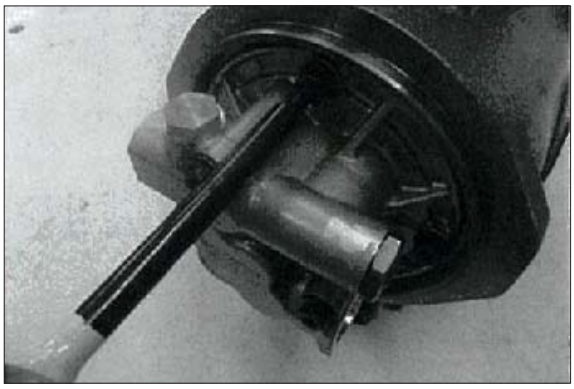
220S8MP13

※ In case the pump is provided without PTO unit, remove the cover (326) with the hexagon socket head cap screws.



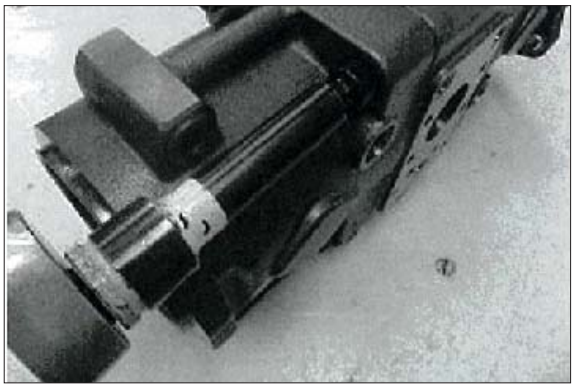
220S8MP14

(6) Remove flange sockets (435) and the gear pump (04).



220S8MP15

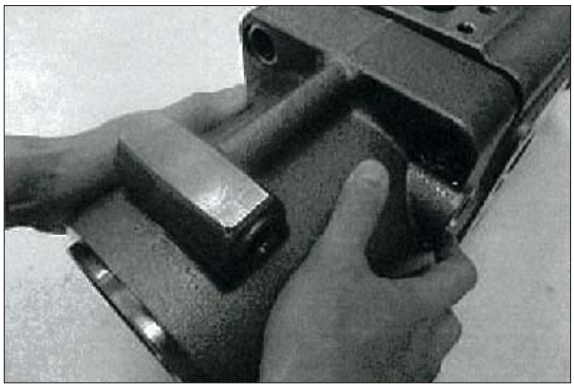
(7) Loosen hexagon socket head bolts (401) which tighten pump casing (F, 271) pump casing (R, 272), and valve block (312).



220S8MP16

(8) Separate pump casing (F, 271), pump casing (272), from valve block (312)

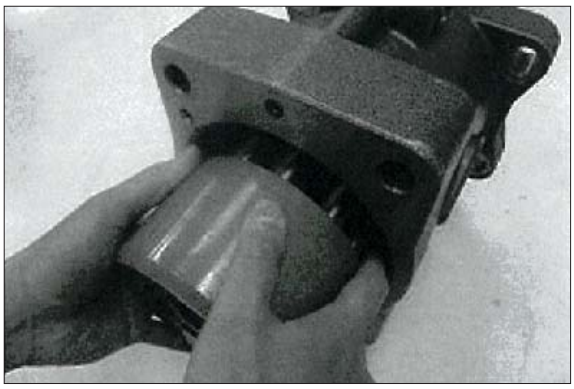
※ Remove the 1st gear (116), when pump casings are separated from valve block.



220S8MP17

(9) Pull out cylinder block (141), piston-shoes (011), set plate (153), spherical bushng (156), and cylinder springs (157) simultaneously from pump casing (F, 271) and (R, 272), straightly over drive shaft (111, 113)

※ Take care not to damage sliding surface of cylinder block (141), spherical bushing (156), piston-shoes (011), swash plate (212), drive shaft (111, 113), etc.

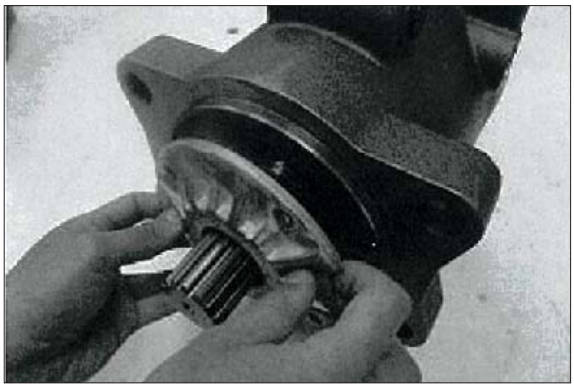


220S8MP18

(10) Remove hexagon socket head bolts (406) and seal cover (F, 261).

※ In the case it is difficult to remove, put flat-blade screwdriver into the notch of seal cover. Then the cover can be removed easily.

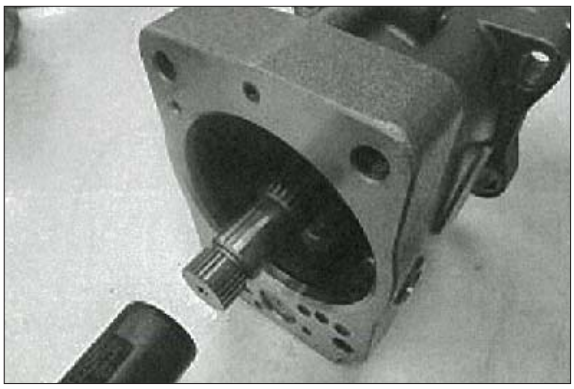
※ Since oil seal is fitted on seal cover (F, 261), take care not to damage it while removing cover.



220S8MP19

(11) Remove the drive shafts (111, 113) from the pump casing (271, 272), lightly with plastic hammer, remove them from pump casing (271, 272)

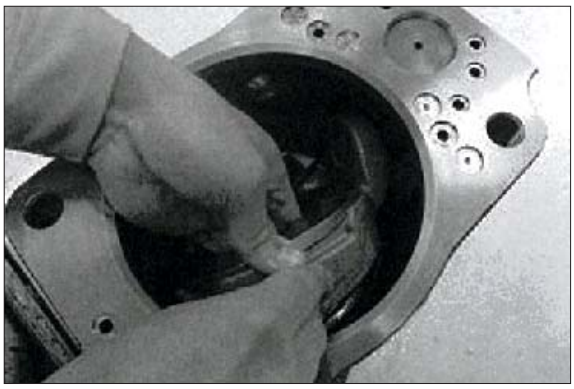
※ In the case it is difficult to remove, tap the end of the drive shaft lightly with plastic hammer.



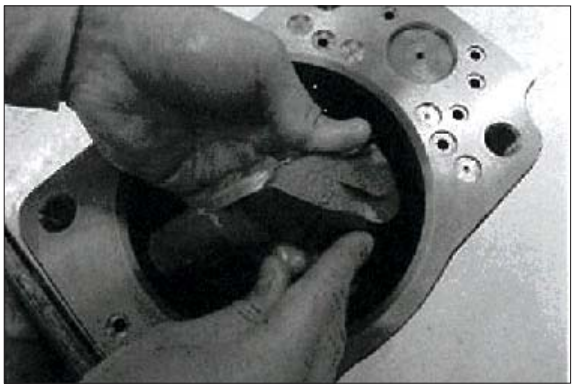
220F8MP20

(12) Remove the swash plates (212) and shoe plates (211) from swash plate support (251), and pull out the swash plates with turning shown in this picture from casing.

220S8MP21



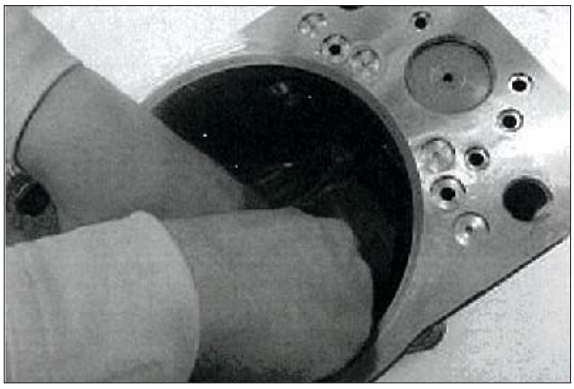
220S8MP22



220S8MP23

(13) Remove swash plate supports (251) from pump casing.

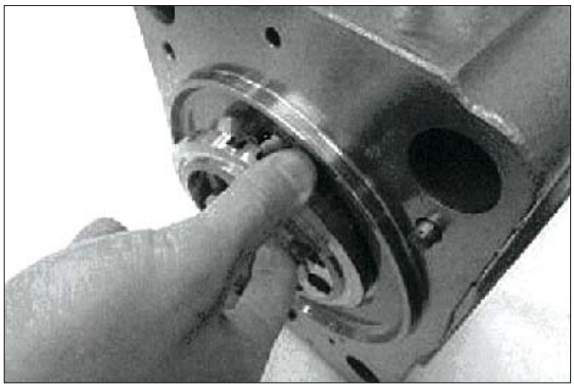
※ In the case it is difficult to remove, tap the opposite side of the swash plate support (251) with plastic hammer to remove it from pump casing easily.



220S8MP24

(14) Remove valve plates (313, 314) from valve block (312)

※ There may be removed in work (7).



220S8MP25

(15) If necessary, remove the servo covers (537), stopper (L, 534), stopper (S, 535), and servo piston sub (530) from pump casing (271, 272).

※ Do not remove needle bearing (124) as far as possible, except the case that the bearing is considered to be out of its life-time.

※ Do not loosen hexagon nuts of valve block (312) and servo cover (537). If loosened, flow setting will be changed.

4) REASSEMBLY

(1) For reassembling reverse the disassembli-ng procedures, paying attention to the following.

① Do not fail to repair the parts damaged during dissassembling, and repair replacement part in advance.

② Clean each part fully with cleaning oil and dry it with compressed air.

③ Apply clean working oil to sliding sections, bearings, etc. before assembling them.

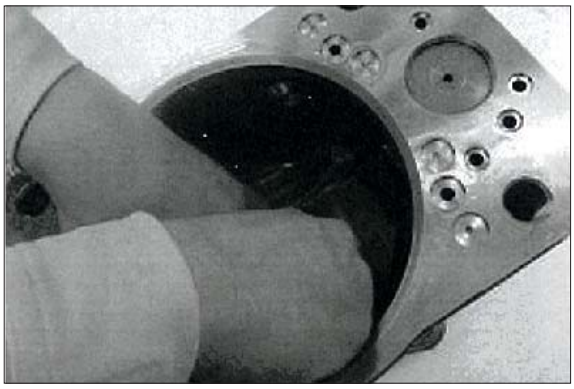
④ In general rule, replace the sealing parts, such as O-ring, oil seal, etc.

⑤ For fitting bolts, plug, etc. prepare a torque wrench or so on, and tighten them with torque shown at page 8-12.

⑥ For the tandem type pump, take care not to mix up parts of the front pump with those of the rear pump

(2) Insert swash plate supports (251) into the casing (F, 271) and (R, 272) with fitting.

※ If the servo piston, stopper (L), stopper (S), and servo cover are removed, fit them to pump casing in advance for reassembling.



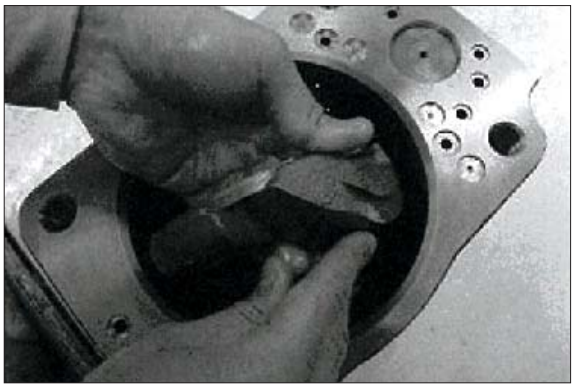
220S8MP24

(3) Attach shoe plate (211) to swash plate (212) and insert tilting pin (531) to tilting bushing (214) of servo piston (532). As shown in the right figure, attach to swash plate support (251) correctly, leaning swash plate and shoe plate.

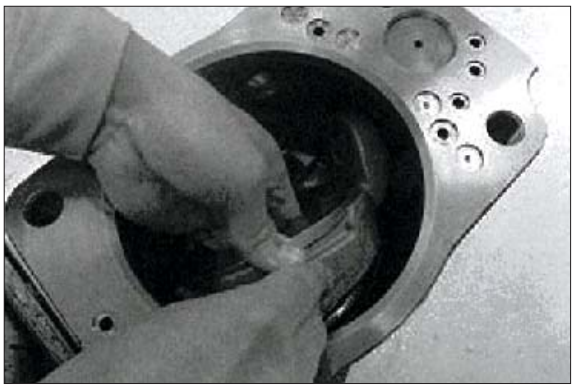
※ Confirm with fingers of both hands that swash plate can moved smoothly.

※ Apply grease to sliding sections of swash plate and swash plate support, to assemble the drive shaft easily.

※ Take care not to damage the sliding surface of the shoe plate.



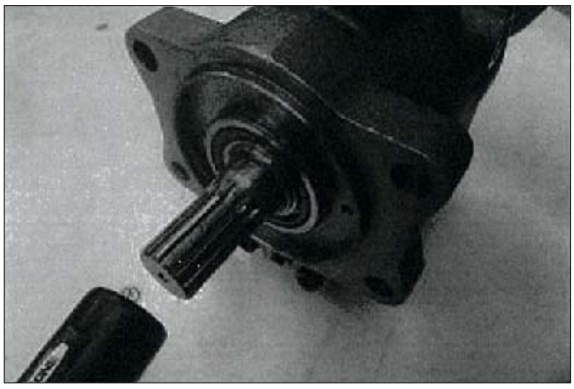
220S8MP23



220S8MP22

220S8MP21

(4) Fit drive shaft (111, 113) where bearing (123), bearing spacer (127), snap ring (824) were set to pump casing (271, 272).

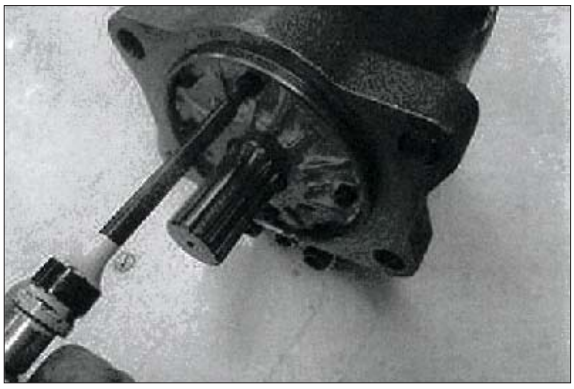


220S8MP20

(5) Assemble seal cover (F, 261) to pump casing (271) and fix it with hexagon socket head bolts (406).

※ Apply grease lightly to oil seal in seal cover (F).

※ Assemble oil seal, taking full care not to damage it.

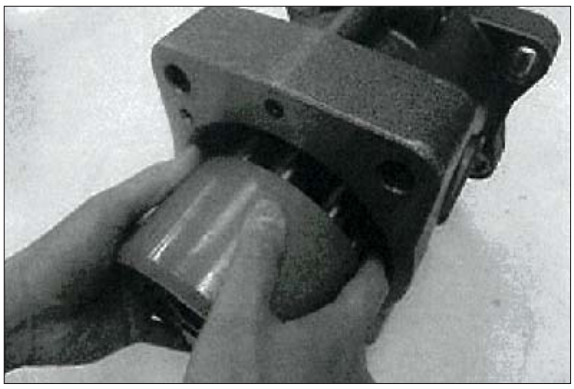


220S8MP26

(6) Assemble piston cylinder sub assembly [cylinder (141), piston sub assembly (151, 152), set plate (153), spherical bushing (156) and cylinder spring (157)].

※ Fit spline phases of spherical bushing and cylinder.

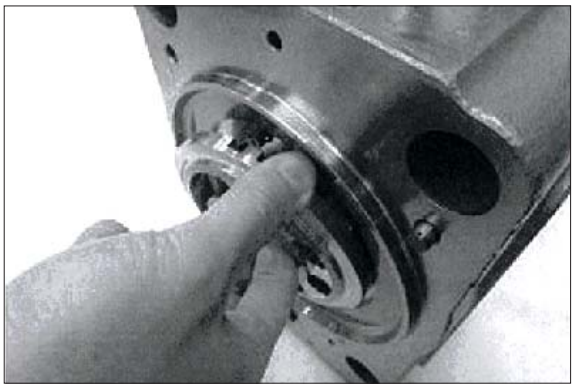
※ Then, insert piston cylinder subassembly into pump casing.



220S8MP18

(7) Fit valve plate (313) to valve block (312) according to pin (885).

※ Take care not to mistake suction/delivery directions of valve plate.



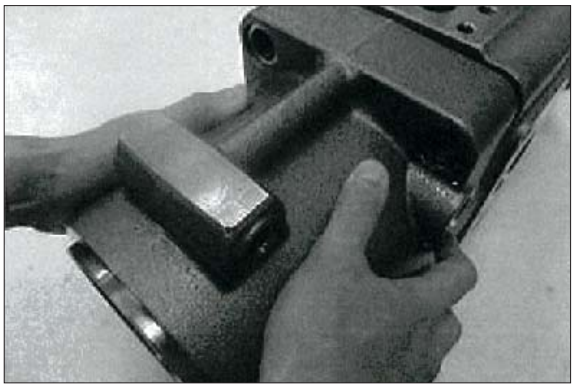
220S8MP27

(8) Place pump horizontally on workbench with its regulator-fitting surface down, and attach pump casing (271) to valve block (312).

※ Before bringing regulator-fitting surface down, spread rubber sheet on workbench and do not damage this surface.

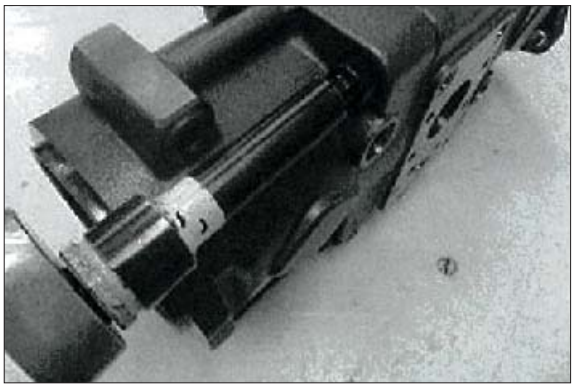
※ Take care not to mistake direction of valve block. [clockwise rotation (viewed from input shaft side)]. Fit the valve block with suction flange left when regulator side below, viewed from front side.

※ Fit 1st gear simultaneously.



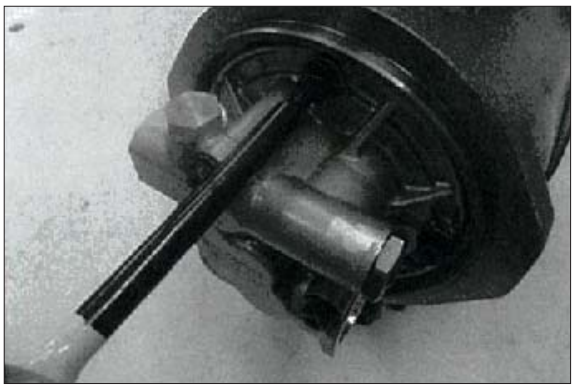
220S8MP17

(9) Fit valve block (312) to pump casing (271, 272) with hexagon socket head bolts (401, 402).



220S8MP16

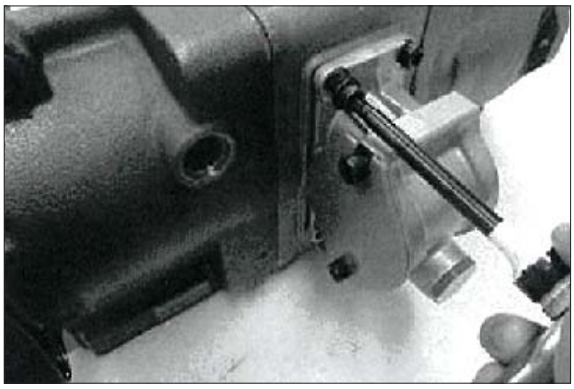
(10) Fit gear pump (04) to pump casing (271) with hexagon socket head bolts.



220S8MP15

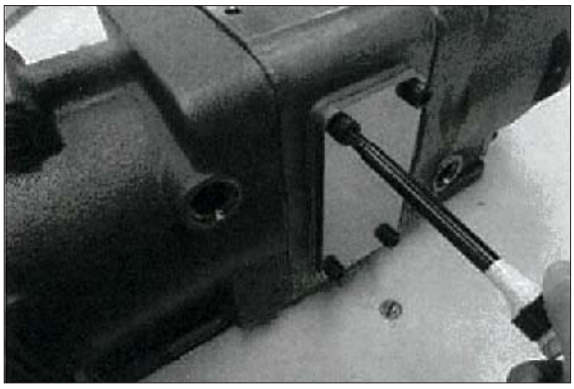
(11) Attach the PTO unit (05) by fastening the flange socket to the valve block (312).

※ Be careful about the attaching direction of the PTO unit.



220S8MP13

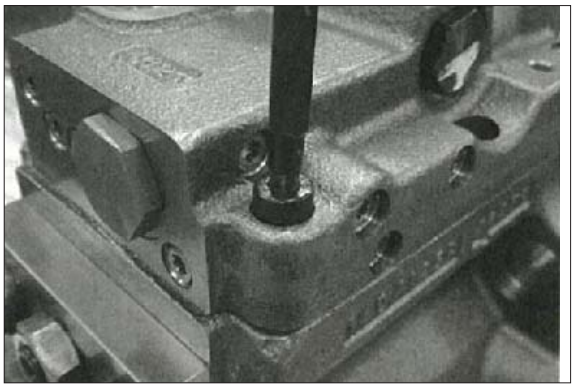
In case the pump is not provided with the PTO unit (05), attach the cover (326) with the hexagon socket head cap screws (414).



220S8MP14

(12) Putting feedback lever of regulator into feedback pin (548) of tilting pin (531), fit regulator with hexagon socket head bolts.

※ Take care not to mix up regulator of front pump with another.



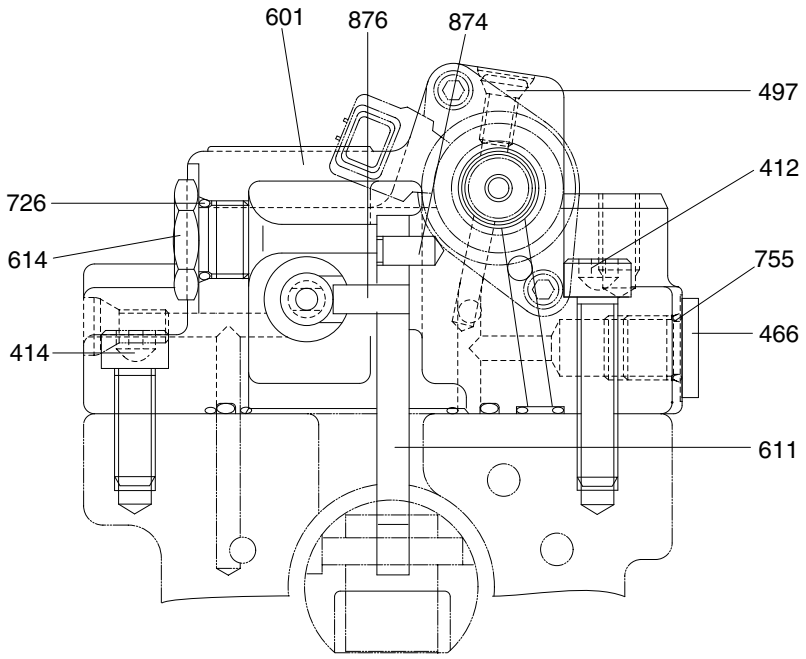
220F8MP28

(13) Fit drain port plug (467).

This is the end of reassembling procedure.

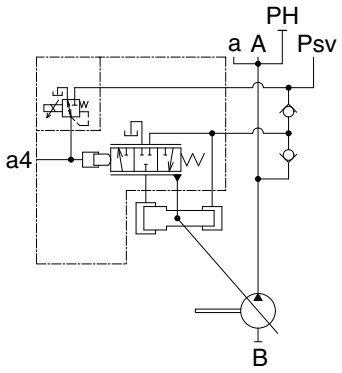
3. REGULATOR

1) STRUCTURE (1/2)



SECTION A-A

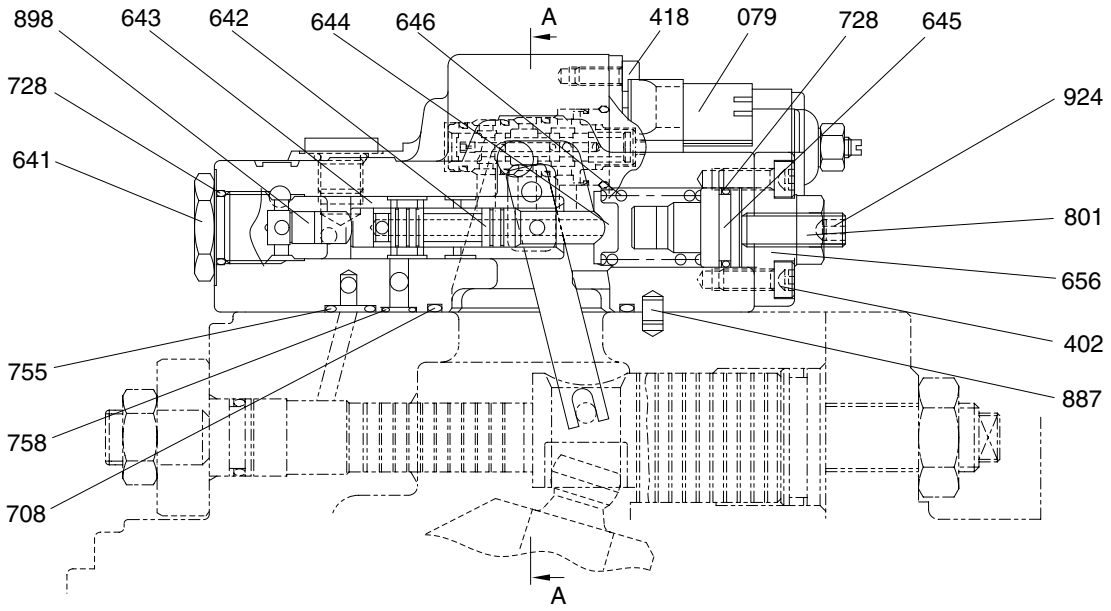
See next page



210WA2MP08

412	Hexagon socket screw	601	Regulator casing	755	O-ring
414	Hexagon socket screw	611	Feedback lever	874	Pivot pin
466	Plug	614	Adjust plug	876	Pin
497	Plug	726	O-ring		

STRUCTURE (2/2)



SECTION A-A

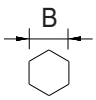
210WA2MP09

079	EPPR valve	644	Spring seat (Q)	755	O-ring
402	Hexagon socket screw	645	Adjust stem (Q)	758	Square ring
418	Hexagon socket screw	646	Pilot spring	801	Nut
641	Pilot plug	656	Cover	887	Pin
642	Pilot spool	708	O-ring	898	Pilot piston
632	Pilot sleeve	728	O-ring	924	Hexagon socket set screw

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

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

Tool name & size		Part name		
Name	B	Hexagon socket head cap screw	Pressure plug (taper thread)	Hexagon socket head set screw
Allen wrench Spanner 	4	M 5	-	M8
	5	M 6	-	M10
	6	M 8	ROH 1/4	M12, M14
	22	-	VP 3/8	-
	27	M18	VP 1/2	-
Adjustable angle wrench		Medium size, 1 set		
Torque wrench		Capable of tightening with the specified torques		
Hexagon socket head cap screw		M4, Length : 50 ㎜		

(2) Tightening torque

Part name	Bolt size	Torque		Wrench size	
		kgf · m	lbf · ft	in	mm
Hexagon socket head bolt (Material : SCM435)	M 5	0.7	5.1	0.16	4
	M 6	1.2	8.7	0.20	5
	M 7	3.0	21.7	0.24	6
	M 8	5.8	42	0.31	8
	M 9	10.0	72.3	0.39	10
	M14	16.3	118	0.47	12
	M16	23.5	170	0.55	14
	M18	33.7	244	0.55	14
	M20	43.8	317	0.67	17
	M22	64.2	464	0.67	17
PT Plug (Material : S45C) ※Wind a seal tape 1 1/2 to 2 turns round the plug	PT 1/8	1.2	8.7	0.20	5
	PT 1/4	2.2	15.9	0.24	6
	PT 3/8	4.5	32.5	0.31	8
	PT 1/2	6.6	47.7	0.39	10
ROH Plug PF 3/8 or under : S45C PF 1/2 or over : SCM435	PF 1/4	3.5	25.3	0.24	6
	PF 3/8	7.5	54.2	0.31	8
	PF 1/2	11.2	81.0	0.39	10
	PF 3/4	17.3	125	0.55	14

3) DISASSEMBLY

(1) Preparation for disassembling

① Since the regulator consists of small, precision, and well-finished parts, disassembling and assembling are rather complicated. For this reason, replacement of a regulator assembly is recommended, unless there is a special reason. If in case disassembling is necessary for an unavoidable special reason, read thro-ugh this manual to the end before starti-ng disassembling.

② Since the regulators on the front pump and the rear pump are set at different pressure and flow values, mark each of them so as not to mix up one of front pump with another.

③ For reason that regulator contain two parts which are tightened with large torque, prepare a vise to hold the regulator stable.

④ The numbers in parentheses after part names represent those in the cross-sectional drawings (on page 8-23, 24)

(2) Select a place for disassembling.

※ Select clean place.

※ Spread rubber sheet or cloth to cover the workbench to prevent parts from being damaged.

(3) Remove dust, rust, etc. from surfaces of regulator with clean oil.

(4) Remove hexagon socket head cap screws (412, 414) and remove regulator from the pump.

※ If the pump is disassembled, check the page 7-21 for this axial piston pump.

※ Take care not to lose O-ring while removing regulator.

(5) Remove hexagon socket head cap screws (418) and remove the proportion reducing valve.

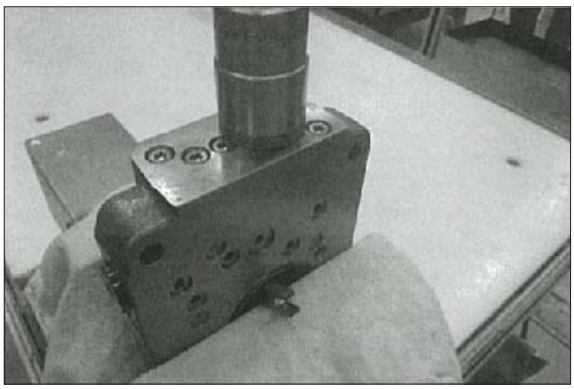
※ Do not damage to the proportional reducing valve's connector.

(6) Loosen the pilot plug (641).

※ Do not remove the pilot plug (641). If it is removed, the pilot spring (646) and the spring stem (Q, 644) will fall from casing.

※ Be careful not to damage regulator casing (601) while loosening the pilot plug (641).

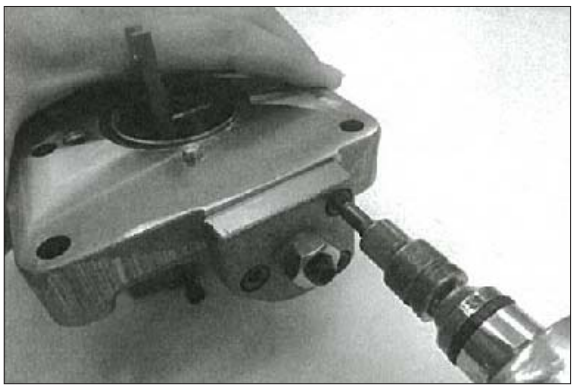
※ Do not damage to the regulator casing while using a vise.



220F8MP30

(7) Remove hexagon socket head cap screws (402) and remove cover (656)

※ Cover (656) is fixed with adjusting screw (924), hexagon nut (801). Do not loosen screw and nut. If they are loosened, adjusted pressure-flow setting will be changed.

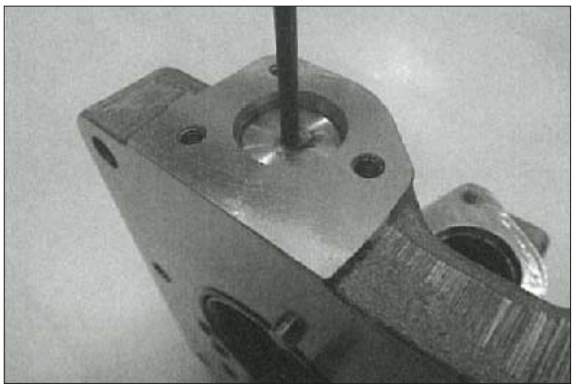


220F8MP31

(8) Remove the adjusting stem (Q, 645), the pilot spring (646), and the spring seat (Q, 644) from regulator.

※ Adjusting stem (Q, 645) can easily be drawn out with M4 screw.

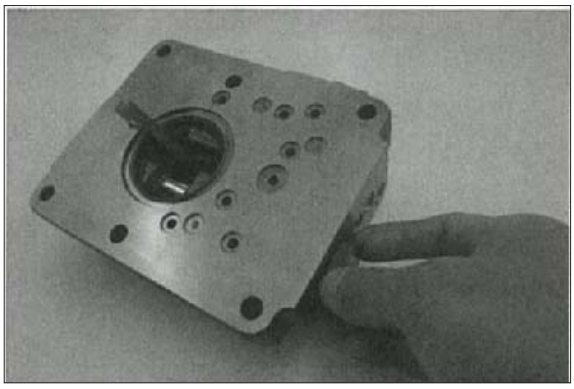
※ Take care not to lose the pilot spring (646) and the spring stem (Q, 644) which they fall from casing when the adjusting stem (Q, 645) is removed.



220F8MP32

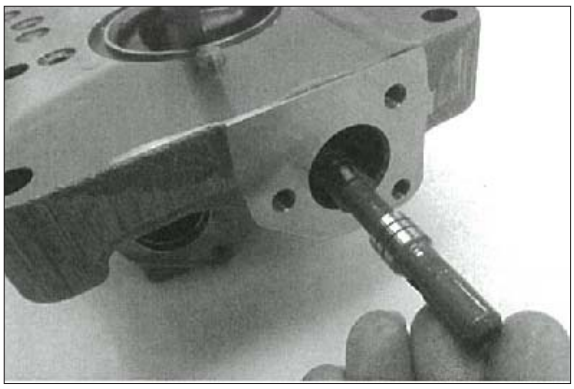
(9) Remove the pilot plug (641) and the pilot piston (898).

※ Take care not to lose the pilot piston (898) because of its smallness.



220F8MP33

(10) Remove the pilot spool (642) from pilot section.

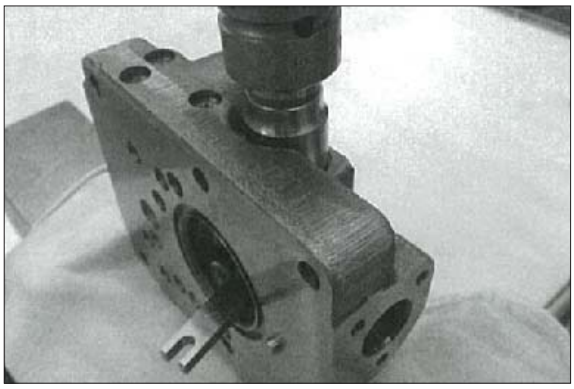


220F8MP34

(11) Remove the adjusting plug (614) and feedback lever (611) from the casing.

※ Be careful not to damage regulator casing (601) while loosening the adjusting plug (614).

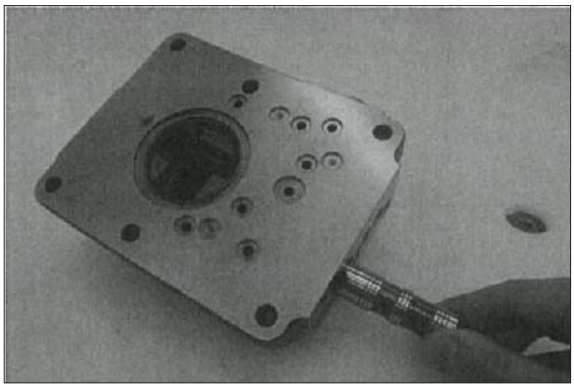
※ Do not remove the pin (876) from the feedback lever (611).



220F8MP35

(12) Remove the pilot sleeve (643).

※ This completes operation.



220F8MP36

※ Since component part are small, take care not to them.

4) REASSEMBLY

(1) For assembling, reverse disassembling procedures. But pay attention to the following.

① Repair parts that were damaged at disassembling.
Prepare replacement parts beforehand.

② Contamination will cause malfunction.
Therefore, wash parts well with cleaning oil, let them dry with jet air and handle them in clean place.

③ Tighten screws, plugs, etc. with their specified torques.

④ Replace seals such as O-ring with new ones as a general rule.

(2) Select a place for assembling.

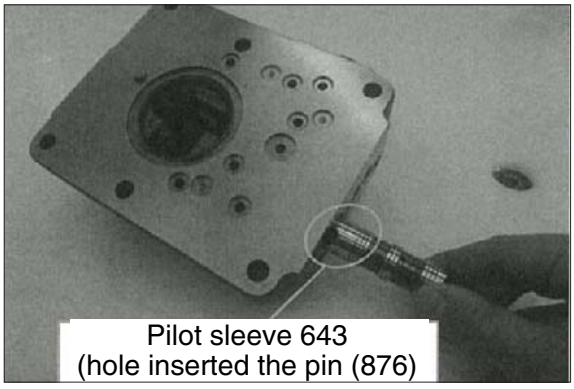
※ Select clean place.

※ Spread rubber sheet or cloth to cover the workbench to prevent parts from being damaged.

(3) Fit the pilot sleeve (643) into pilot section of the casing (601).

※ Be careful not to fit the pilot sleeve (643) with the wrong way.

※ Confirm the the sleeve slides smoothly in casing without sticking.

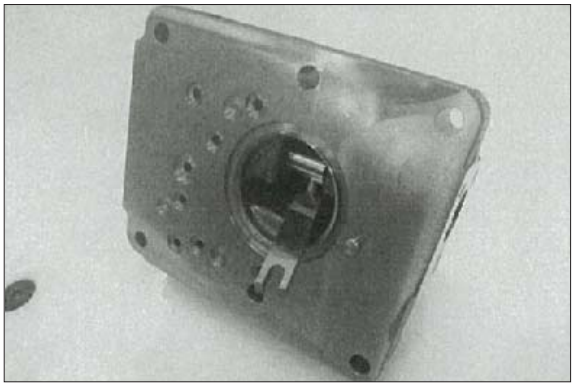


Pilot sleeve 643
(hole inserted the pin (876)

220F8MP37

(4) Insert the pin (876) fixed on feedback lever (611) to the oval shaped hole of the sleeve (643) and fit the hole of the feedback lever to the pin (874) fixed inside the casing (601).

※ If the pilot spool (642) is in the pilot sleeve (643), the pin (876) can not be inserted to the pilot sleeve.

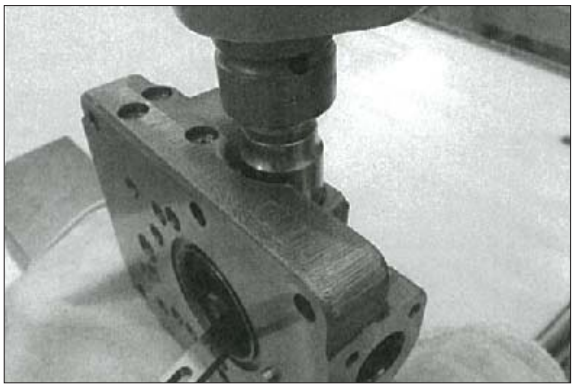


220F8MP38

(5) Tighten the adjusting plug (614) to the casing (601).

※ Be careful not to damage regulator casing (601) while tightening the adjusting plug (614).

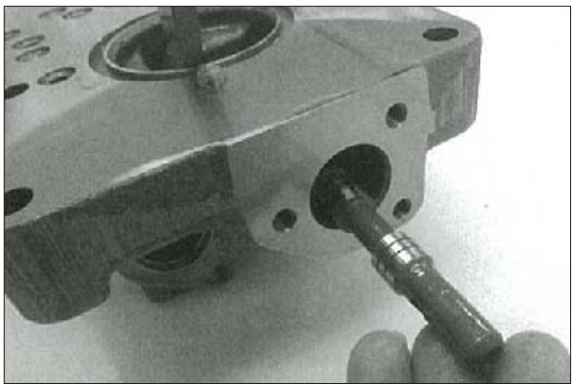
※ Confirm that the sleeve slides smoothly in casing without sticking or excess play among parts.



220F8MP39

(6) Fit the pilot spool (642) into the pilot sleeve (643).

※ Be careful not to fit the pilot spool (642) with the wrong way.

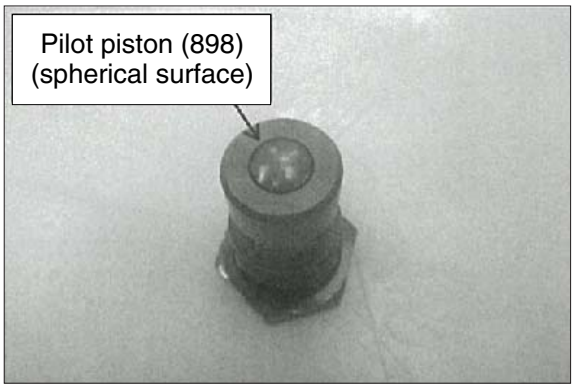


220F8MP40

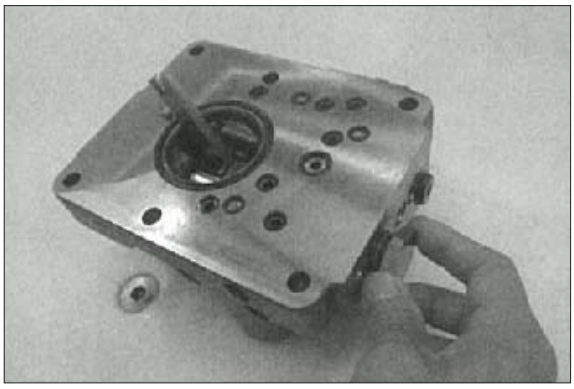
(7) After the pilot piston (898) is fitted into the pilot plug (641), put the plug to the casing (601).

※ Be careful not to fit the pilot piston (898) with the wrong way.

※ At the present stage, it is no need to tighten the pilot plug (641) with recommended torque.



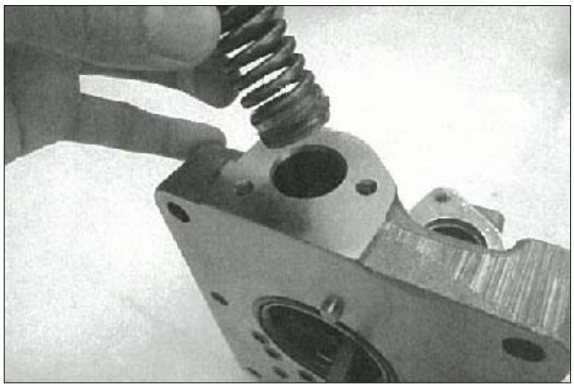
220F8MP41



220F8MP42

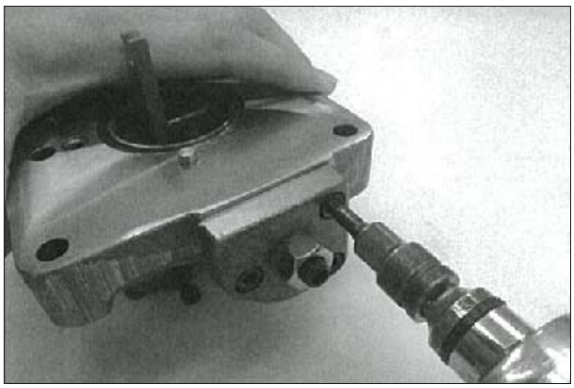
(8) Put the spring seat (Q, 644) and the pilot spring (646) into the pilot section of the casing (601).

※ Be careful not to fall the spring seat (Q). Recommended to apply grease to the spring seat to prevent falling.



220F8MP43

(9) Put the adjusting stem (Q, 645), and tighten the cover (656) with the adjusting screw (924) and the hexagon nut (801) with hexagon socket head cap screws (402).

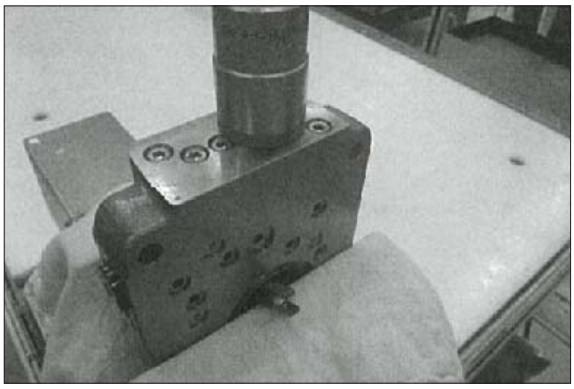


220F8MP44

(10) Tight the pilot plug (641) to the casing (601).

※ Be careful not to damage regulator casing (601) while tightening the pilot plug (641).

※ Do not damage to the regulator casing while using a vise.



220F8MP45

(11) Tighten the proportional reducing valve with hexagon socket head cap screw (418).

※ This completes assembling.

GROUP 4 MAIN CONTROL VALVE

1. REMOVAL AND INSTALL OF MOTOR

1) REMOVAL

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

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

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

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

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

(4) Remove the wirings for the pressure sensor and so on.

(5) Remove bolts and disconnect pipe.

(6) Disconnect pilot line hoses.

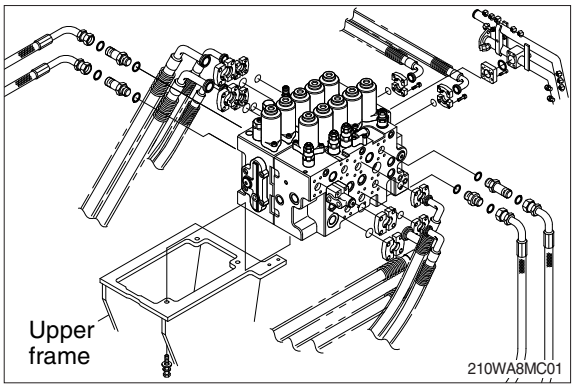
(7) Disconnect pilot piping.

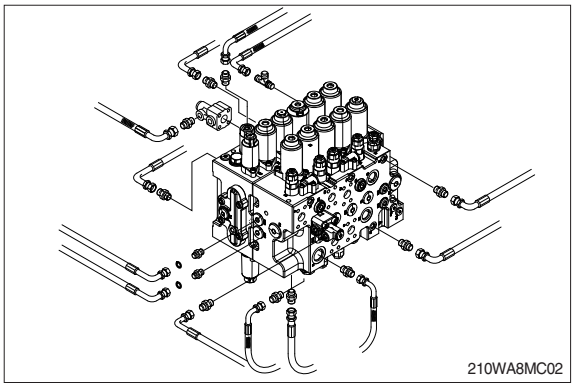
(8) Sling the control valve assembly and remove the control valve mounting bolt and bracket.

· Weight : 220 kg (485 lb)

· Tightening torque : 12.8 ± 3.0 kgf·m (92.6 ± 21.7 lbf·ft)

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





2) INSTALL

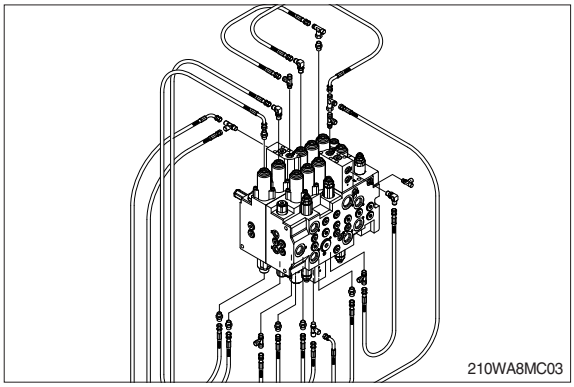
(1) Carry out installation in the reverse order to removal.

(2) Bleed the air from below items.

① Cylinder (boom, arm, bucket)
② Swing motor
③ Travel motor

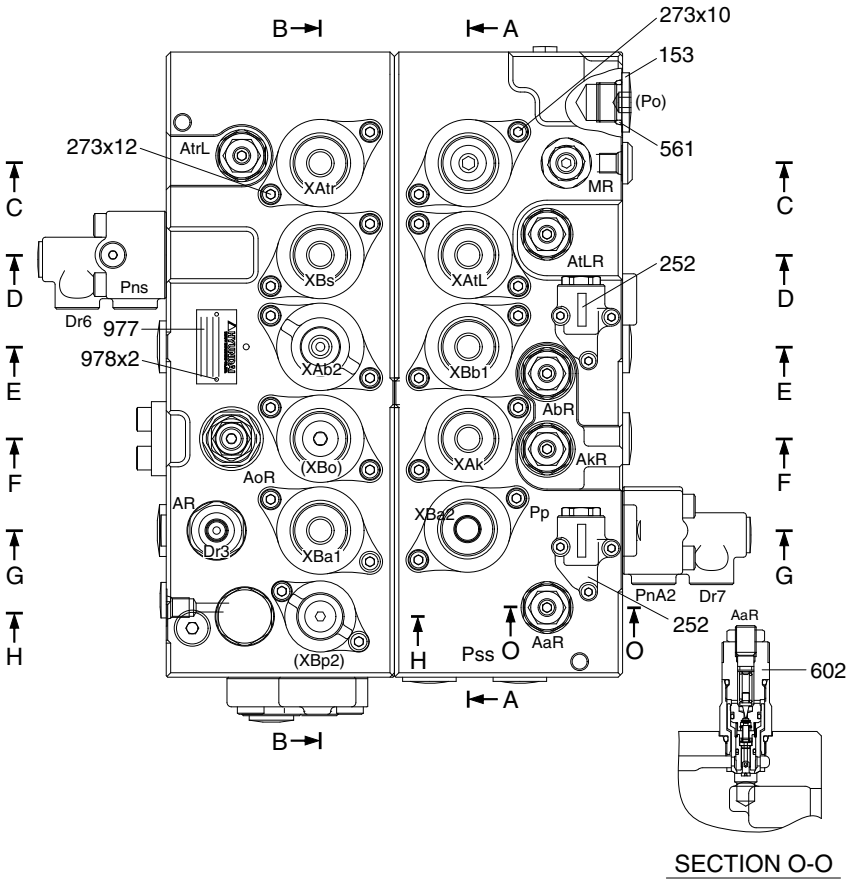
※ See each item removal and install.

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



2. STRUCTURE

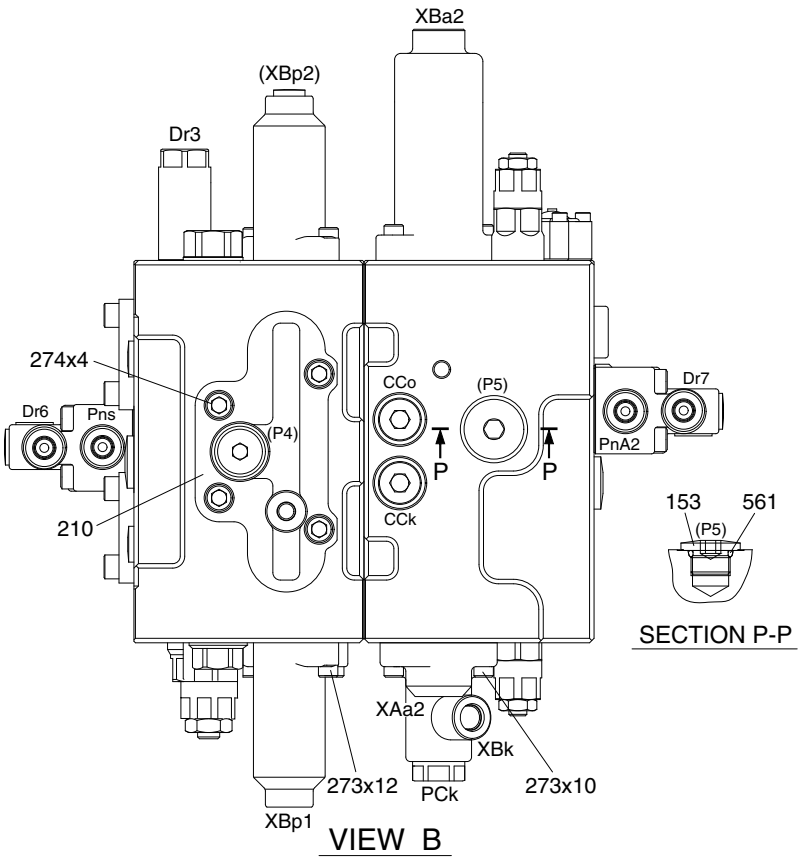
1) RELIEF VALVE SIDE VIEW



210WA2MC02

153 Plug
252 Lock valve selector sub assy
273 Socket screw
561 O-ring
602 Port relief valve assy
977 Name plate
978 Pin

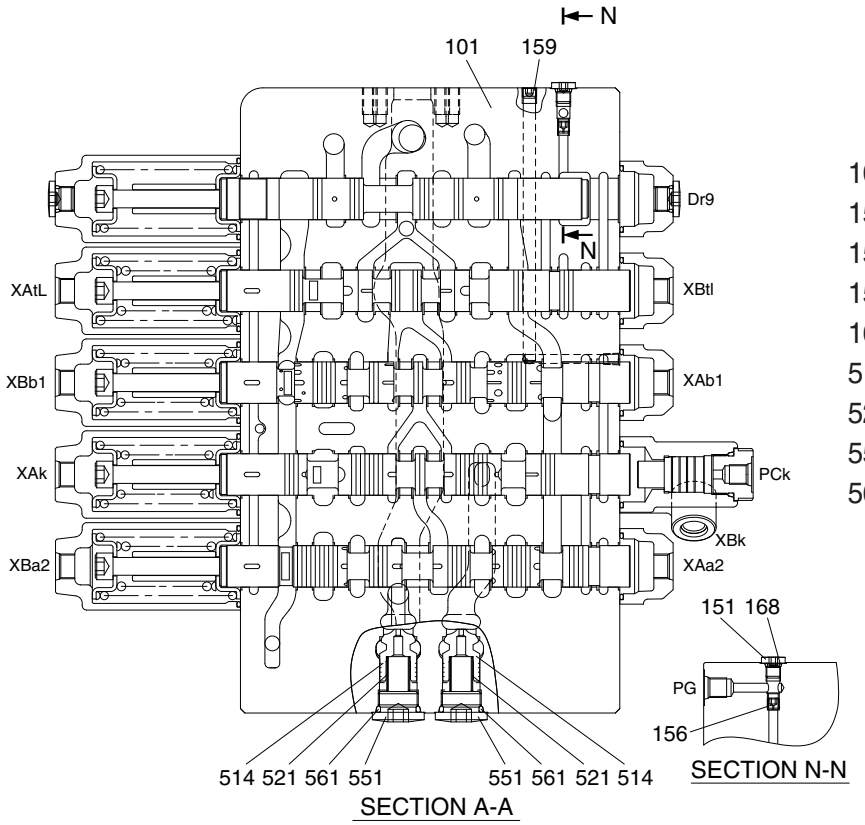
2) BYPAS CUT SPOOL SIDE VIEW



210WA2MC03

153 Plug
210 Plate
273 Socket screw
274 Socket screw
561 O-ring

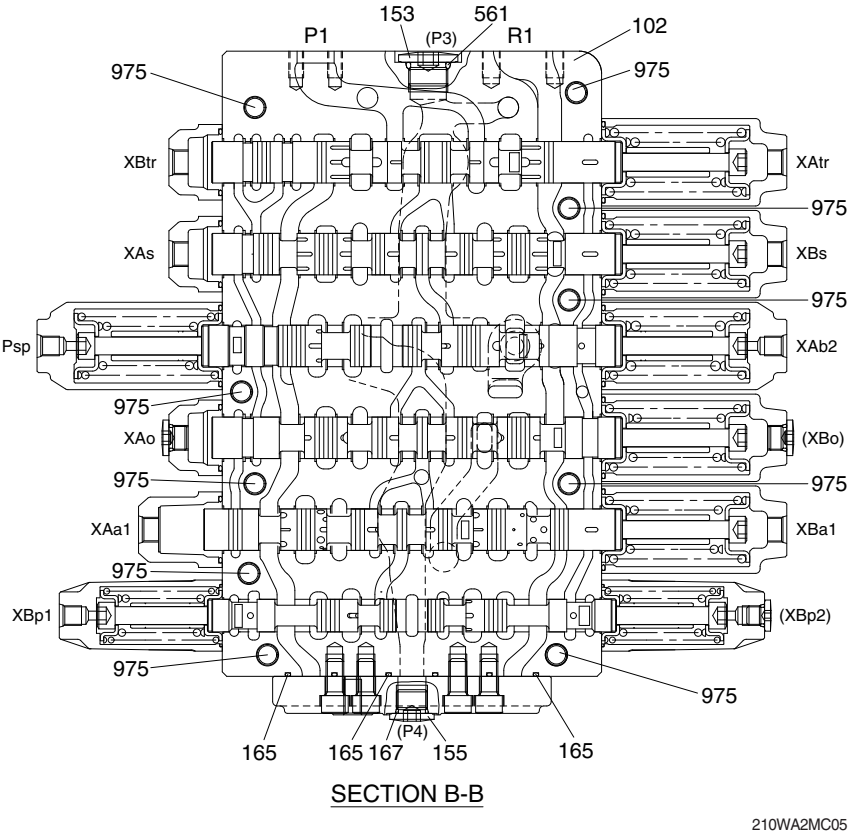
3) CASING A SPOOL SECTION



101 Casing A
151 Plug
156 Plug
159 Plug
168 O-ring
514 Poppet
521 Spring
551 Plug
561 O-ring

210WA2MC04

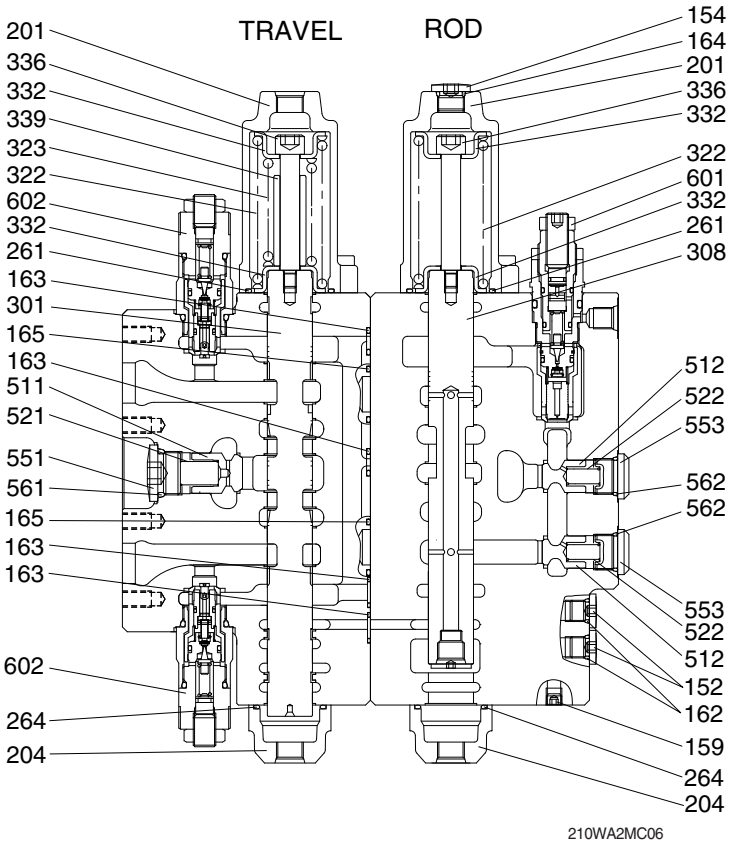
4) CASING B SPOOL SECTION



102 Casing B
153 Plug
155 Plug
165 O-ring
167 O-ring
561 O-ring
975 Socket screw

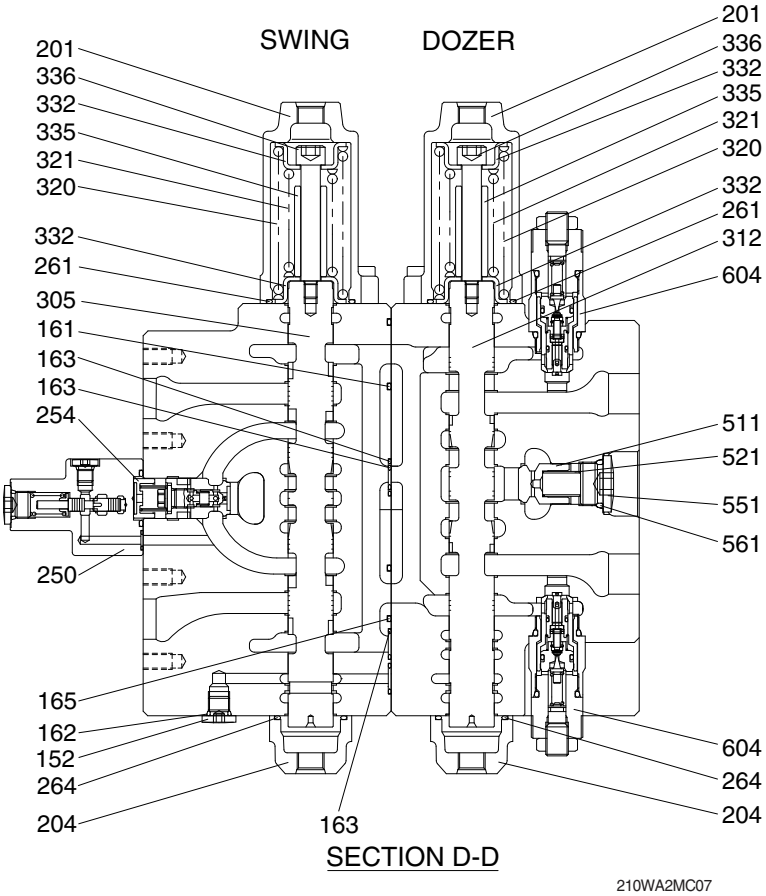
210WA2MC05

5) TRAVEL AND ROD SECTION



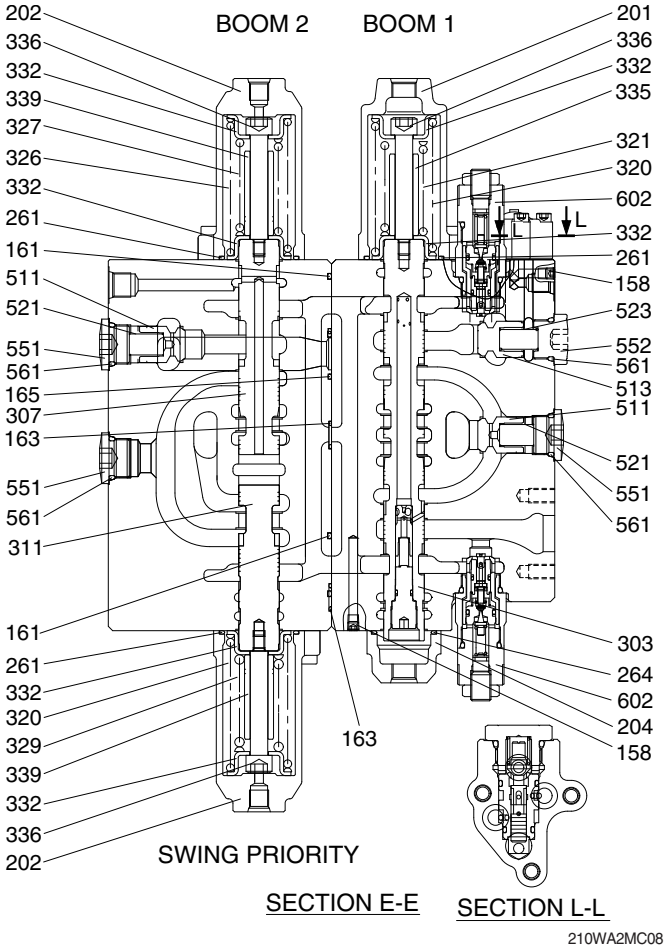
152 Plug
154 Plug
159 Plug
162 O-ring
163 O-ring
164 O-ring
165 O-ring
201 Spring cover
204 Spool cover
261 O-ring
264 Square ring
301 Travel spool
308 Rod spool assy
322 Spring
323 Spring
332 Spring seat
336 Spacer bolt
339 Stopper
511 Poppet
512 Poppet
521 Spring
522 Spring
551 Plug
553 Plug
561 O-ring
562 O-ring
601 Main relief valve assy
602 Port relief valve assy

6) SWING AND DOZER SECTION



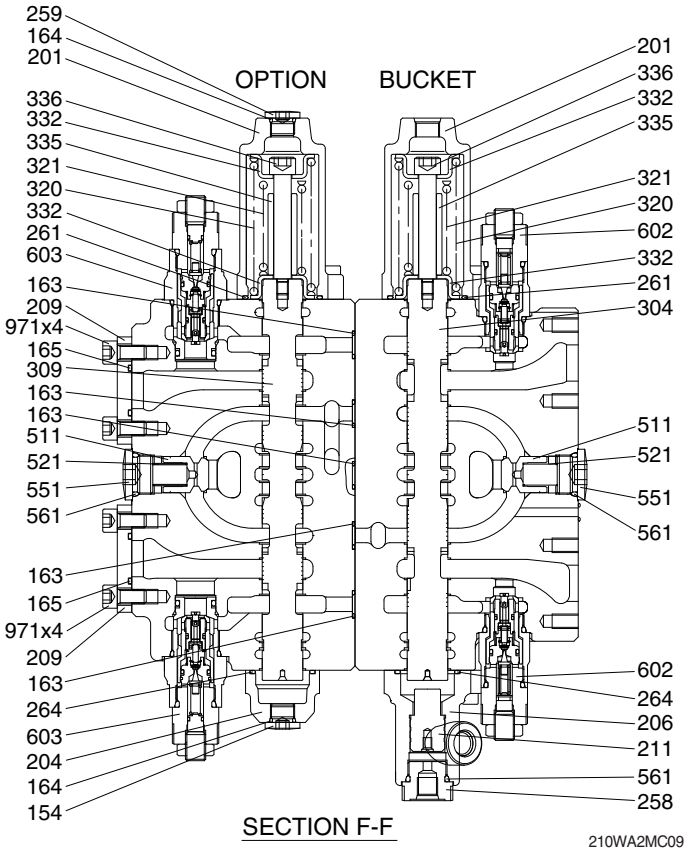
152 Plug
161 O-ring
162 O-ring
163 O-ring
165 O-ring
201 Spring cover
204 Spool cover
250 Logic control valve assy
254 Swing Logic poppet assy
261 O-ring
264 Square ring
305 Swing spool
312 Dozer spool
320 Spring
321 Spring
322 Spring
323 Spring
332 Spring seat
335 Stopper
336 Spacer bolt
511 Poppet
521 Spring
551 Plug
561 O-ring
604 Port relief valve assy

7) BOOM 1 AND BOOM 2 SECTION



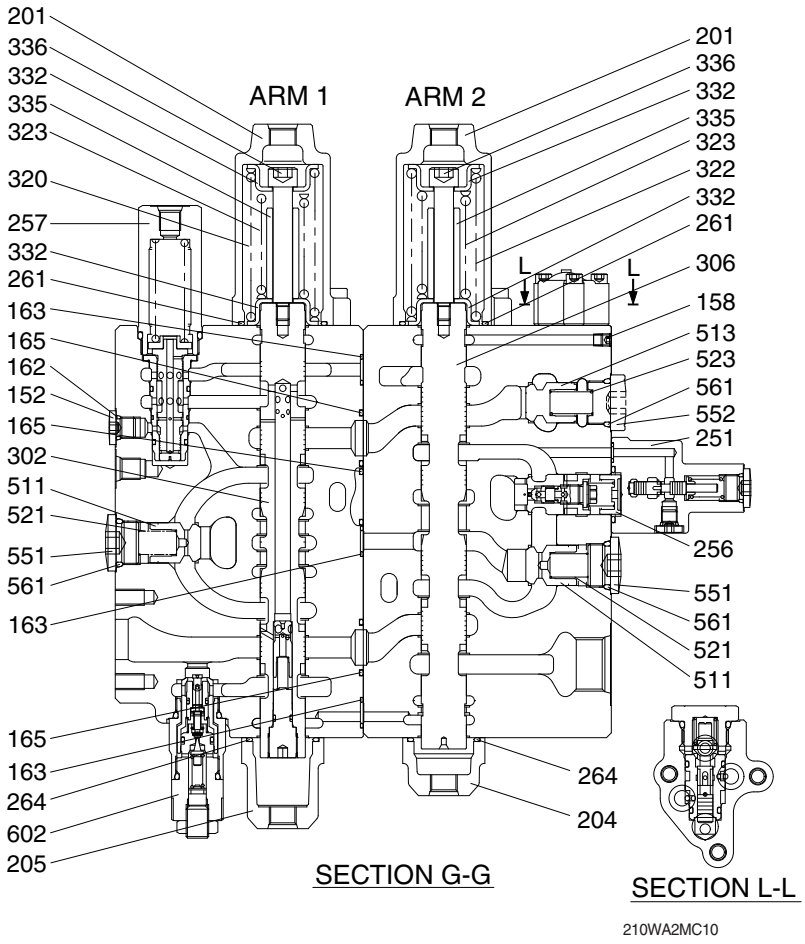
158 Plug
161 O-ring
163 O-ring
165 O-ring
201 Spring cover
202 Spring cover
204 Spool cover
261 O-ring
264 Square ring
303 Boom 1 spool sub assy
307 Boom 2 spool
311 Swing priority spool
320 Spring
321 Spring
326 Spring
327 Spring
329 Spring
332 Spring seat
335 Stopper
336 Spacer bolt
339 Stopper
511 Poppet
513 Poppet
521 Spring
523 Spring
551 Plug
552 Plug
561 O-ring
602 Port relief valve assy

8) BUCKET AND OPTION SECTION



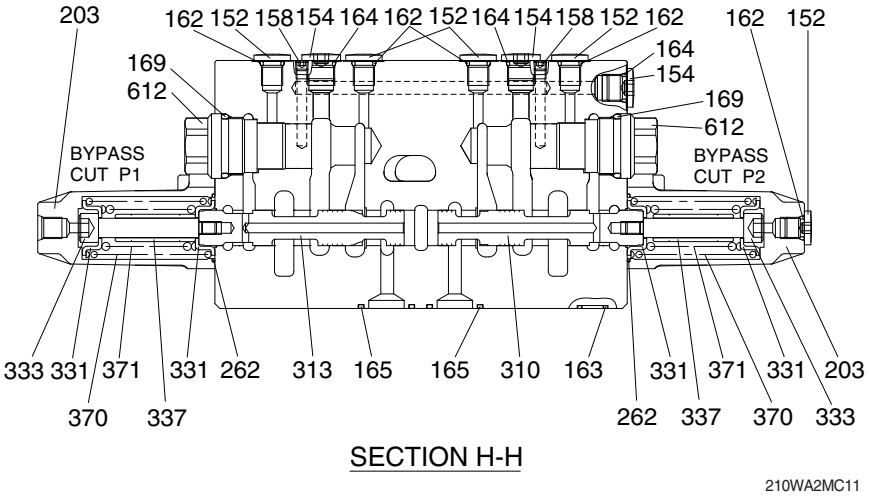
154 Plug
163 O-ring
164 O-ring
165 O-ring
201 Spring cover
204 Spool cover
206 Spool cover
209 Flange
211 Piston
258 Plug
259 Plug
261 O-ring
264 Square ring
304 Bucket spool
309 Option spool
320 Spring
321 Spring
332 Spring seat
335 Stopper
336 Spacer bolt
511 Poppet
521 Spring
551 Plug
561 O-ring
602 Port relief valve assy
603 Port relief valve assy
971 Socket screw

9) ARM 1 AND ARM 2 SECTION



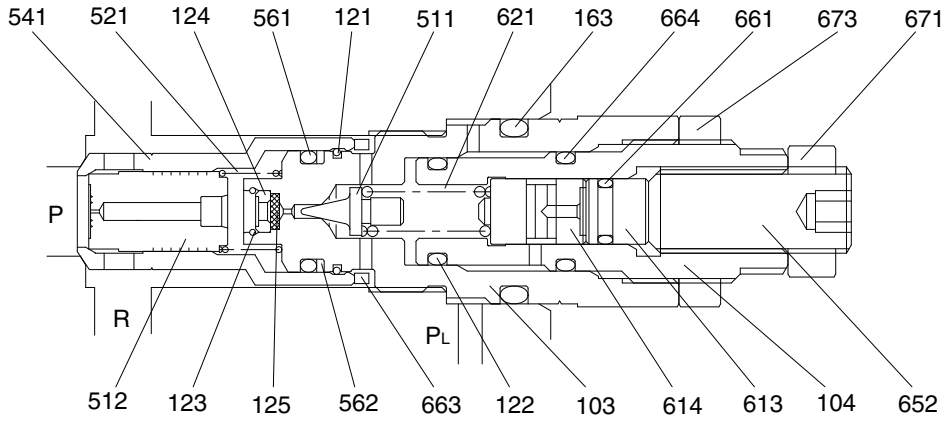
152 Plug
158 Plug
162 O-ring
163 O-ring
165 O-ring
201 Spring cover
204 Spool cover
205 Spool cover
251 Logic control valve assy
256 Arm 2 Logic poppet assy
257 Arm regeneration cut sub assy
261 O-ring
264 Square ring
302 Arm 1 spool sub assy
306 Arm 2 spool
320 Spring
322 Spring
323 Spring
332 Spring seat
335 Stopper
336 Spacer bolt
511 Poppet
513 Poppet
521 Spring
523 Spring
551 Plug
552 Plug
561 O-ring
602 Port relief valve assy

10) BYPASS CUT SECTION



152 Plug
154 Plug
158 Plug
162 O-ring
163 O-ring
164 O-ring
165 O-ring
169 O-ring
203 Spring cover
262 O-ring
310 Bypass cut spool
313 Bypass cut spool
331 Spring seat
333 Spring seat
337 Stopper
370 Spring
371 Spring
612 Plug

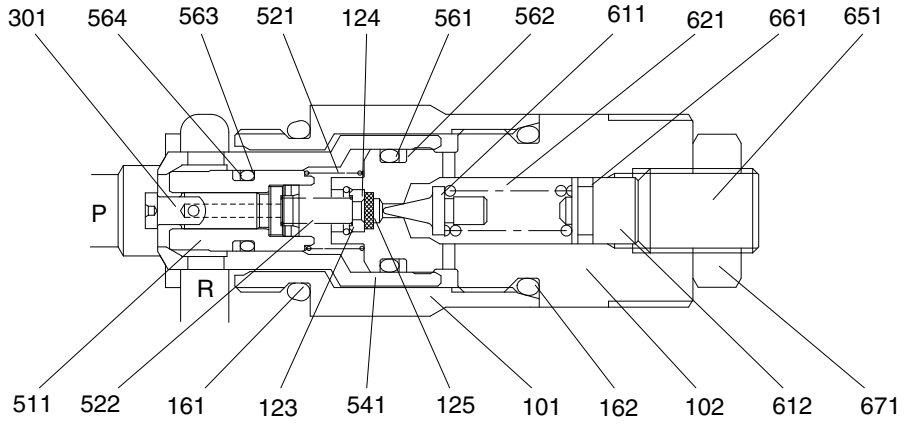
11) MAIN RELIEF VALVE (601)



220F2MC70

103	Plug	512	Plunger	621	Spring
104	Adjust plug	521	Spring	652	Adjust screw
121	C-ring	541	Seat	661	O-ring
122	Spacer	561	O-ring	663	O-ring
123	C-ring	562	Back-up ring	664	O-ring
124	Filler stopper	611	Poppet	671	Lock nut
125	Filler	613	Stopper	673	Lock nut
163	O-ring	614	Piston		

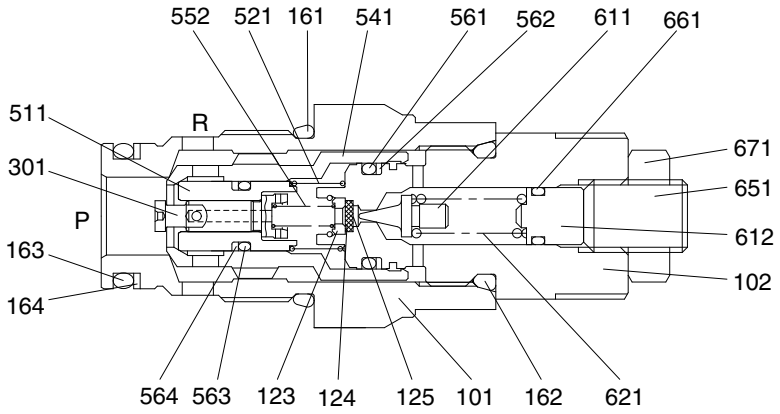
12) PORT RELIEF VALVE (602)



220F2MC71

101	Body	511	Plunger	564	Back-up ring
102	Plug	521	Spring	611	Poppet
161	O-ring	522	Spring	612	Spring seat
162	O-ring	541	Seat	621	Spring
123	O-ring	561	O-ring	651	Adjust screw
124	Filler stopper	562	Back-up ring	661	O-ring
125	Filler	563	O-ring	671	Lock nut

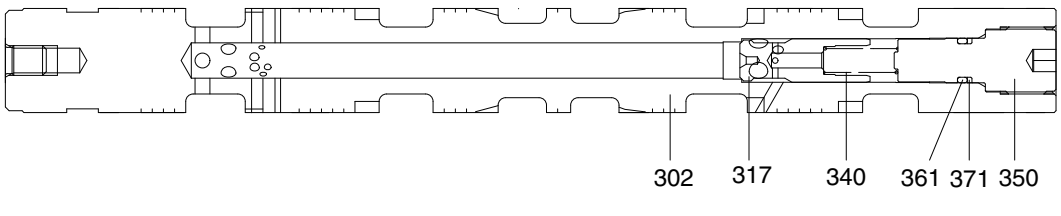
13) PORT RELIEF VALVE (603)



220F2MC72

101	Body	301	Piston	564	Back-up ring
102	Plug	511	Plunger	611	Poppet
123	C-ring	521	Spring	612	Spring seat
124	Filler stopper	522	Spring	621	Spring
125	Filler	541	Seat	651	Adjust screw
161	O-ring	561	O-ring	661	O-ring
162	O-ring	562	Back-up ring	671	Lock nut
163	O-ring	563	O-ring		

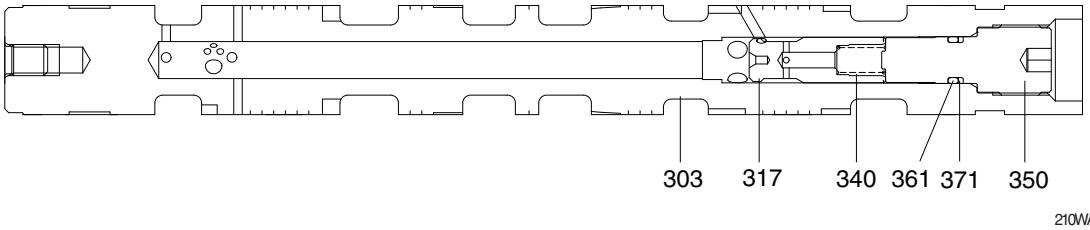
14) ARM 1 SPOOL ASSY (302)



210WA2MC12

302	Spool	340	Spring	361	O-ring
317	Plunger	350	Plug	371	Back-up ring

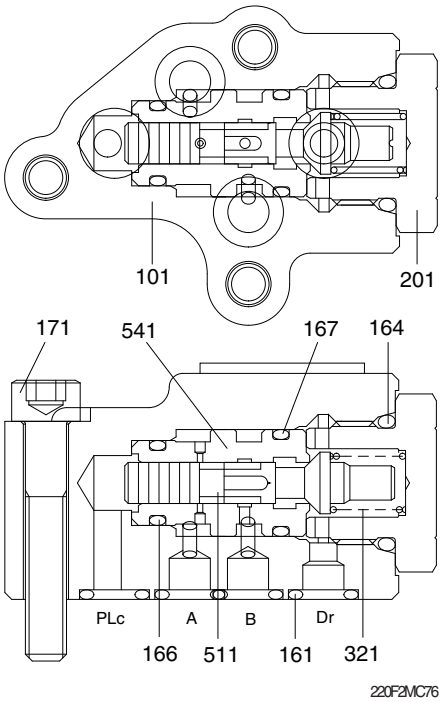
15) BOOM 1 SPOOL ASSY (303)



210WA2MC13

303	Spool	340	Spring	361	O-ring
317	Plunger	350	Plug	371	Back-up ring

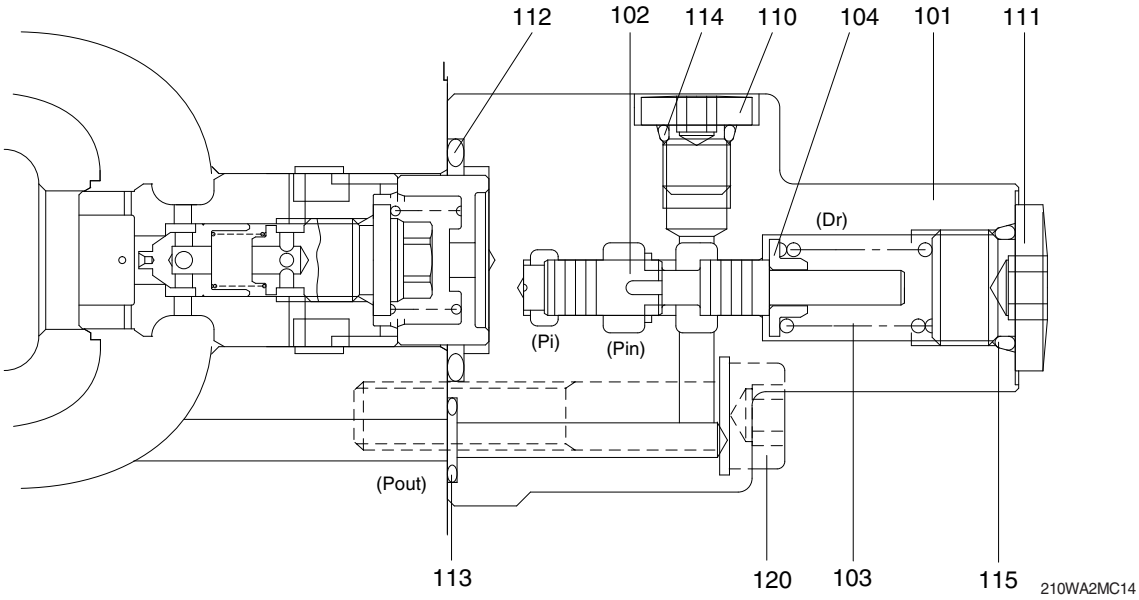
16) LOCK VALVE SELECTOR SUB ASSY (252)



220F2MC76

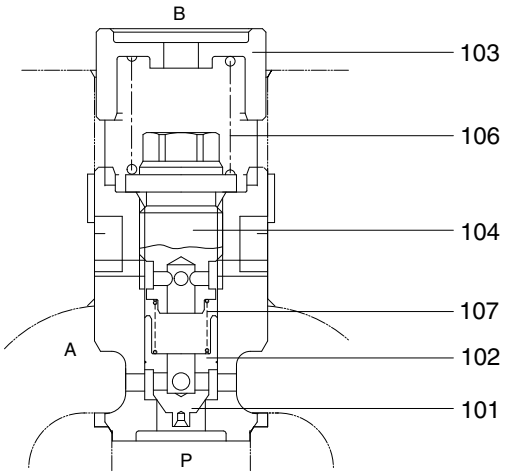
101 Casing
161 O-ring
164 O-ring
166 O-ring
167 O-ring
171 Hex socket head cap screw
201 Plug
321 Spring
511 Spool
541 Sleeve

17) LOGIC CONTROL VALVE ASSY (250, 251)



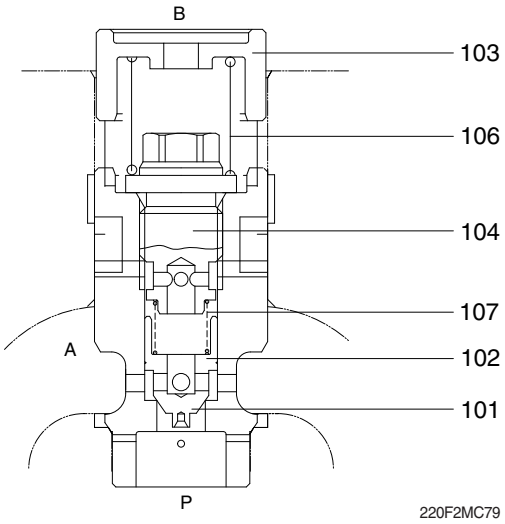
101	Casing	110	Plug	114	O-ring
102	Spool	111	Plug	115	O-ring
103	Spring	112	O-ring	120	Hex socket head cap screw
104	Spring seat	113	O-ring		

18) SWING LOGIC POPPET ASSY (254)



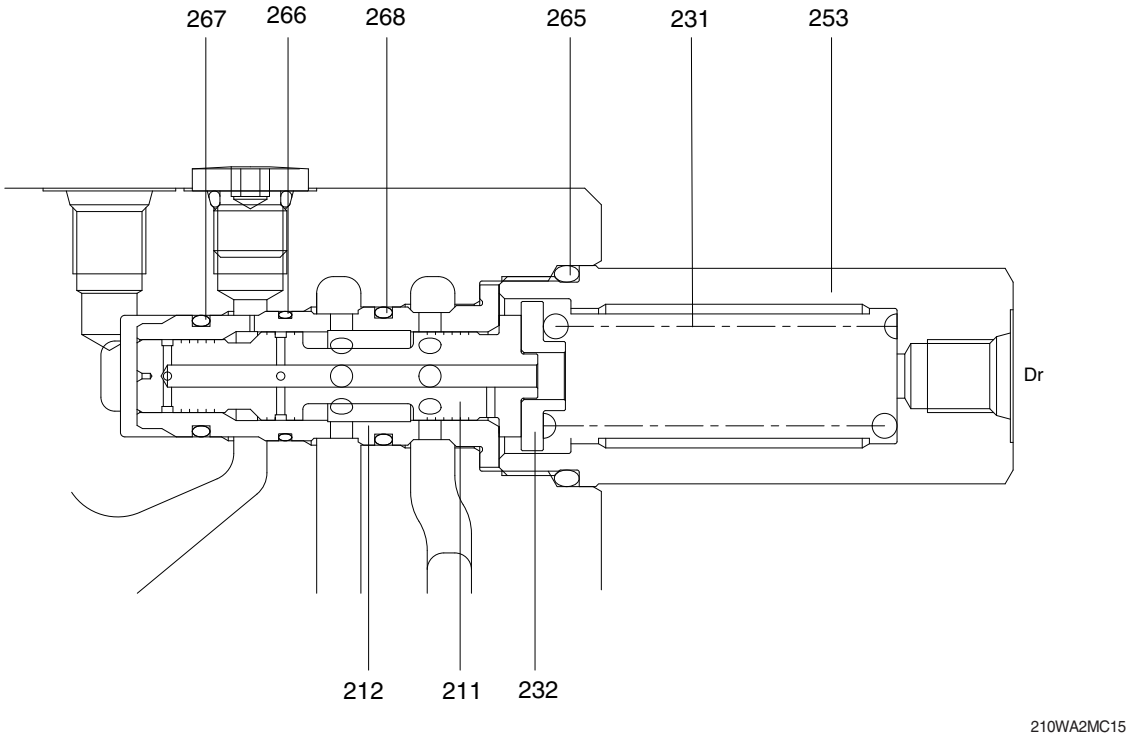
101	Logic poppet
102	Poppet
103	Spring seat
104	Plug
106	Spring
107	Spring

19) ARM 2 LOGIC POPPET ASSY (256)



101 Logic poppet
102 Poppet
103 Spring seat
104 Plug
106 Spring
107 Spring

20) ARM REGENERATION CUT SUB ASSY (257)



211 Spool
212 Sleeve
231 Spring
232 Spring seat
253 Plug
265 O-ring
266 O-ring
267 O-ring
268 O-ring

3. DISASSEMBLY AND ASSEMBLY

1) GENERAL PRECAUTIONS

(1) All hydraulic components must be worked with precision working. Then, 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 a paper or rubber mat on the bench, and disassemble the valve on it.

(4) Support the body section carefully when carrying or transferring the control valve. Be sure not to hold it by the lever, 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 the 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	
Box wrench	Each 1 piece	24, 32, 36
Hexagon key wrench	Each 1 piece	4, 5, 6, 8, 10 and 12
Loctite #262	1 piece	-
Spanner	Each 1 piece	32 (main relief valve, 601) 32 (port relief valve, 602, 604) 36 (port relief valve, 603)

3) DISASSEMBLY

The figure in ( ) shown after the part name in the explanation sentence shows its number in the structure figures (8-34~43).

(1) Place control valve on a working bench.

※ Disassemble it in a clean place and take care not to damage flange faces and plate faces.

21098MC37

(2) Disassembling of main spools

· Travel (301), dozer (312), bucket (304), swing (305), option (309), arm 2 (306), boom 2 (307), swing priority (311).

① Loosen the hexagon the socket head bolts (273) and remove the spring cover (201, 202) and the O-ring (261).

· Hexagon key wrench : 6 ㎜

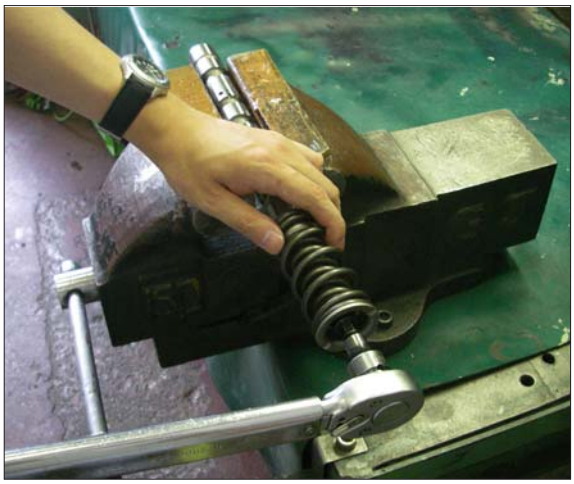
21098MC38

② Pull out the spool, spring, spring seats (322), stopper (335 or 339) and spacer bolt (336) in the spool assembly condition from the casing.

※ When pulling out the spool assembly from housing, take care not to damage the housing.

21078MC11

③ Hold the spool in the mouthpiece-attached vise applying a protection plate (aluminum plate etc.) in between. Remove the spacer bolt (336) and disassemble the stopper (335 or 339) and spring seats (332).
· Hexagon key wrench : 10 ㎜



21098MC40

(3) Disassembling of boom 1 spool (303):

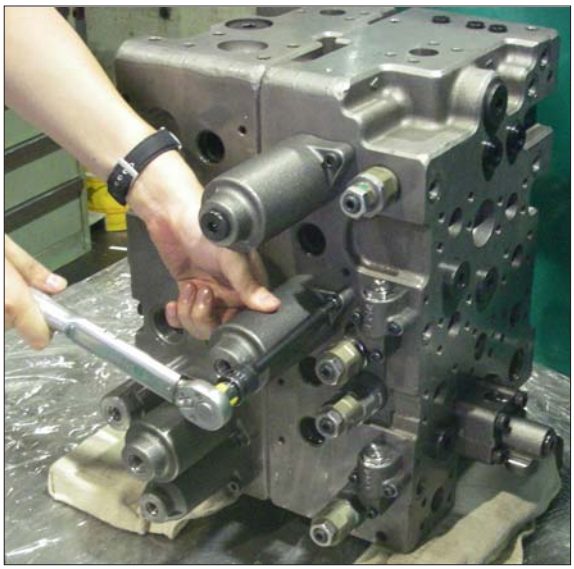
① Loosen the hexagon socket head bolts (273), and remove the spring cover (201) and the O-ring (261).
· Hexagon key wrench : 6 ㎜

② Pull out the boom 1 spool (303), spring (320, 321), spring seats (332), stopper (335) and spacer bolt (336) in the spool assembly condition from the P2 housing (101).

※ When pulling out the spool assembly from P2 housing (101), take care not to damage housing.

③ Hold the boom1 spool (303) in a mouthpiece-attached vise applying a protection plate (aluminum plate etc.) in between. Remove the spacer bolt (336), and disassemble the spring (320, 321), spring seats (332) and stopper (335).
· Hexagon key wrench : 10 ㎜

④ In addition to ③ above, do not disassemble the boom 1 spool (303) any further.



21098MC41

(4) Disassembling of arm 1 spool (302):

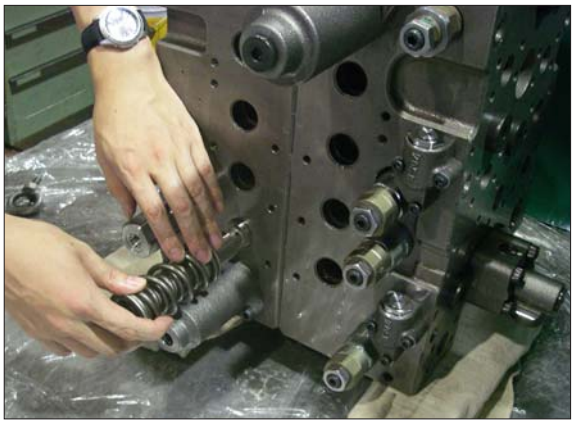
① Loosen the hexagon socket head bolts (273), and remove the spring cover (201) and the O-ring (261).
· Hexagon key wrench : 6 ㎜

② Pull out the arm 1 spool (302), spring (320, 321), spring seats (332), stopper (335) and spacer bolt (336) in the spool assembly condition from the P1 housing (102).

※ When pulling out the spool assembly from P1 housing(102), take care not to damage housing.

③ Hold the arm 1 spool (302) in the mouthpiece-attached vise applying a protection plate (aluminum plate etc.) in between. Remove the spacer bolt (336), and disassemble the spring (320, 321), spring seats (332) and stopper (335).
· Hexagon key wrench : 10 ㎜

④ In addition to ③ above, do not disassemble the arm 1 spool (302) any further.



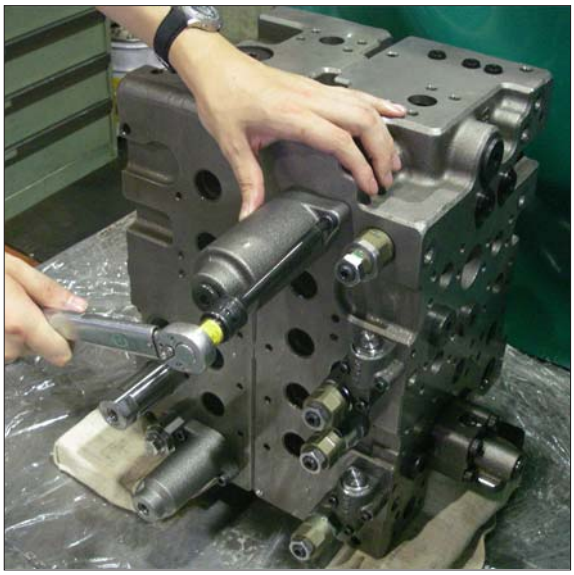
21098MC42

(5) Disassembling of rod spool (308):

① Loosen the hexagon socket head bolts (273), and remove the spring cover (201) and the O-ring (261).
· Hexagon key wrench : 6 ㎜

② Pull out the rod spool (308), spring (322, 323), spring seat (332), stopper (335) and spacer bolt (336) in the spool assembly condition from the P2 housing (101).

※ When pulling out the spool assembly from P2 housing (101), take care not to damage housing.



21098MC43

③ Hold the rod spool (308) in the mouth-piece attached vise applying a protection plate (aluminum plate etc.) in between. Remove the spacer bolt (336) and disassemble the spring(322, 323), spring seats(332) and stopper (335).
· Hexagon key wrench : 10 ㎜

(6) Disassembling of bypass cut spool (310, 313):

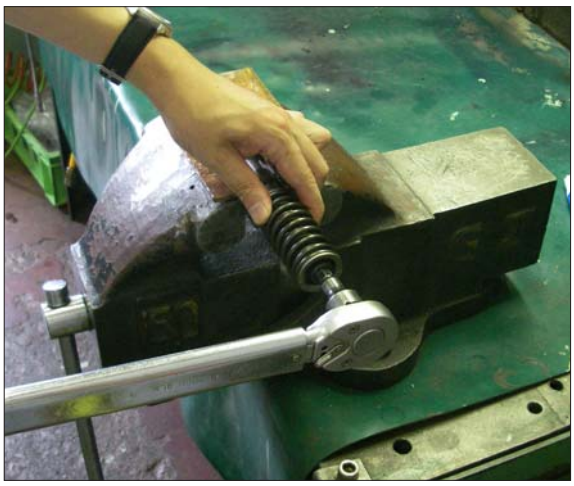
① Loosen the hexagon socket head bolts (273), and remove the spring cover (203) and the O-ring (262).
· Hexagon key wrench : 6 ㎜

② Pull out the bypass cut spool (310, 313), spring (370, 371), spring seats (331), stopper (337) and spacer bolt (333) in the spool assembly condition from the P1 housing.

※ When pulling out the spool assembly from P1 housing (102), take care not to damage housing.

21098MC44

③ Hold the bypass cut spool (310,313) in the mouthpiece-attached vise applying a protection plate (aluminum plate etc.) in between. Remove the spacer bolt (333) and disassemble the spring (370, 371), spring seats (331) and stopper (337).
· Hexagon key wrench : 10 ㎜

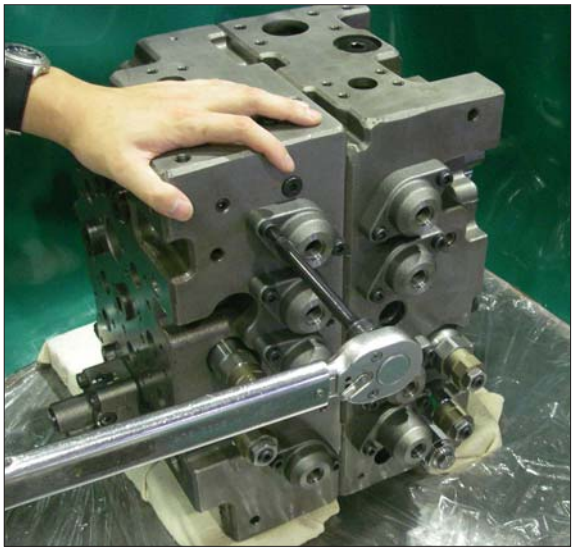


21098MC45

(7) Disassembling of spool covers (204, 205, 206):

① Remove the hexagon socket head bolts (273), and remove the spool cover (204, 205, 206) and the O-ring (264).
· Hexagon key wrench : 6 mm

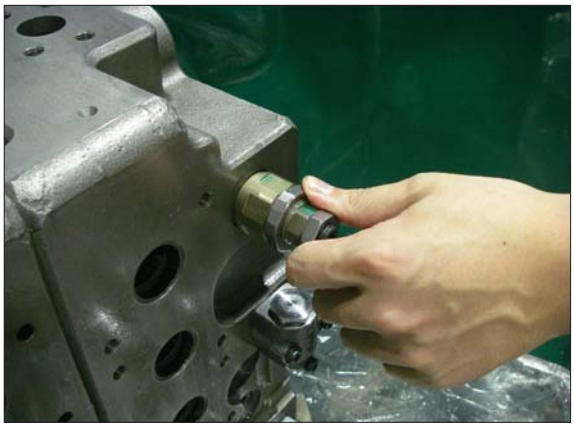
② In case of removing the bucket spool cover (206), at first loosen the plug (258) before it is removed from the P1 housing (102). After removing the bucket spring cover (206) remove the plug (551), and take out the piston (211).
· Box wrench : 32 mm



21098MC46

(8) Removal of main relief valve (601) port relief valves (602, 603, 604) :

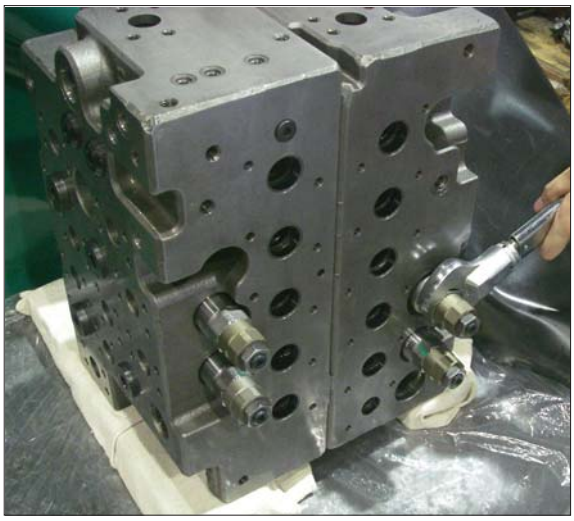
① Remove the main relief valve (601) and the port relief valves (602, 603, 604) from the housing.
Main relief valve (601) : spanner 32 mm
Port relief valve (602, 604) : spanner or box wrench 32 mm
Port relief valve (603) : spanner 36 mm



21098MC47

② In addition to the above, do not disassemble the relief valves any further.

21098MC48



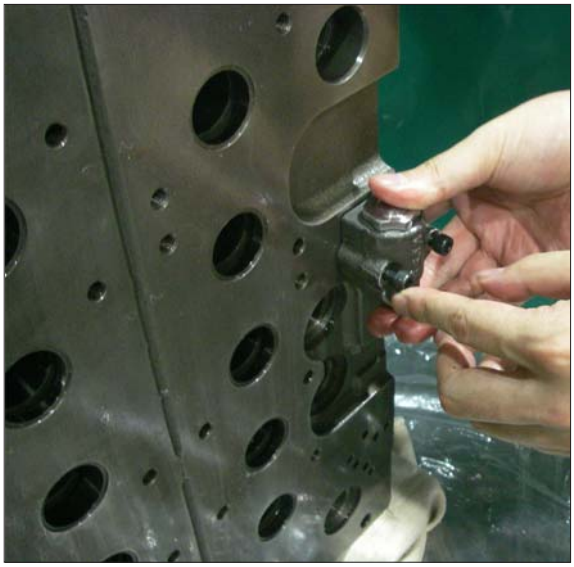
21098MC49

(9) Removal of lock valve selector (252):

① Loosen the hexagon socket head cap screws (252-171) and remove the lock valve selector (252) and the O-rings (252-161).

· Hexagon key wrench : 5 ㎜

② In addition to the above, do not disassemble the lock valve selector (252) any further.



21098MC50

(10) Removal of arm regeneration cut valve (257):

① Remove the plug (257-353), spring (257-331), spool (257-211), and sleeve (257-392) from the P1 housing (102).

· Box wrench : 36 ㎜

② In addition to the above, do not disassemble the arm regeneration cut valve (257) any further.

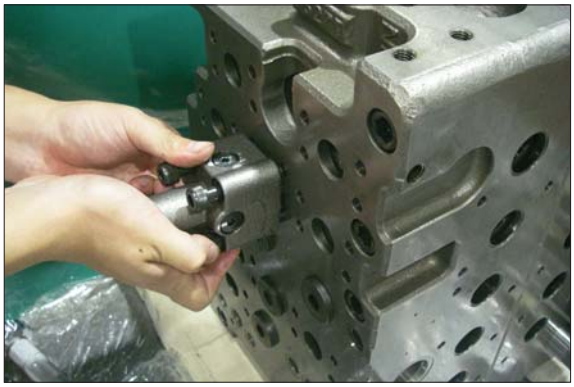
21098MC52

(11) Disassembly of logic control valve (250, 251) and logic poppet (254, 256):

① Loosen the hexagon socket head bolts (250-120, 251-120) and remove the logic control valve (250, 251) and the O-rings (250-112 and 113, 251-112 and 113).
· Hexagon key wrench : 8 ㎜

② Pull out the logic poppet (254, 256), spring (254-106, 256-106) and spring seat (254-103, 256-103) from the housing.

③ In addition to the above, do not disassemble the logic control valve and the logic poppet any further.



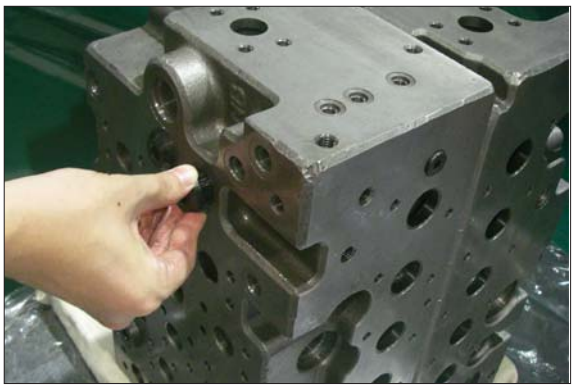
21098MC53

21098MC54

(12) Disassembly of check valve :

① CP1, C2, CCb, LCb, LCo, LCk, LCa, LCAT2
Remove the plug (551) and take out the poppet (511) and the spring (521).
· Hexagon key wrench : 12 ㎜

② CMR1, CMR2
Remove the plug (553) and take out the poppet (512) and the spring (522).
· Hexagon key wrench : 10 ㎜

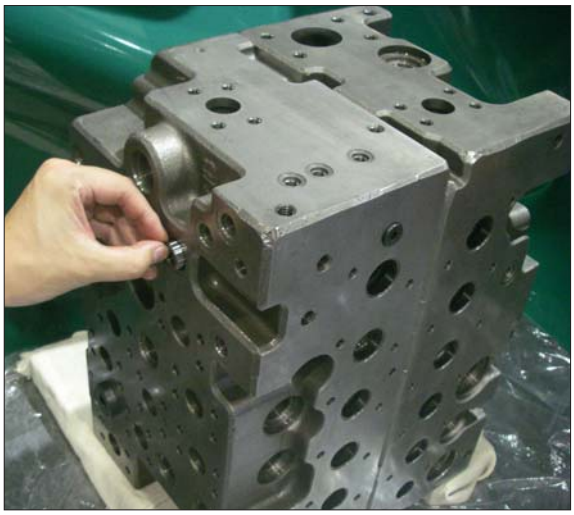


21098MC55

③ CRa, CRb

Remove the plug (552) and take out the poppet (513) and the spring (523).

· Hexagon key wrench : 12 ㎜



21098MC56

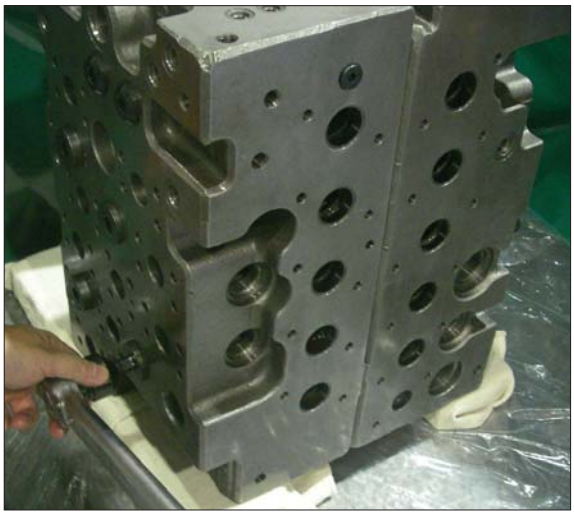
④ CCk, CCo

Remove the plug (551) and take out poppet (514) and the spring (521).

· Hexagon key wrench : 12 ㎜

⑤ Remove the plug (550) and take out the ball (541), spring (543) and spring seat (542).

· Hexagon key wrench : 6 ㎜



21098MC57

(13) Disassembly of flanges (209) :

Loosen the hexagon socket head bolts (971) and remove the flange (209) and the O-ring (165).

· Hexagon key wrench : 8 ㎜

(14) Disassembly of plate (210) :

Loosen the hexagon socket head bolts (274) and remove the plate (210) and the O-rings (165).

· Hexagon key wrench : 10 ㎜

(15) Disassembly of orifices for signal line :

Do not disassemble the plug (151) and orifice (156), except in special cases.

(16) Disassembly of casing :

① Except in special cases, do not disassemble the tie bolts (975) of the P1 housing.

② Regarding the plugs not described in above disassembling procedures, the blind plugs for sacrifice holes and for the housing sanitation, do not disassemble them, except in special cases.

21098MC58

(17) Inspection after disassembling

Thoroughly clean all the disassembled parts with clean mineral oil, and dry them with compressed air.

Then, place them on clean paper or cloth for inspection.

① Control valve

a. Check surfaces of all parts for burrs, scratches, notches and other defects.
b. Confirm that the seal groove faces of the housing and the covers are smooth and free of dust, dent, rust etc.
c. Correct dents and damages on check seat faces of housing, if any, by lapping.
※ Pay attention not to leave lapping agent in the housing.
d. Confirm that all sliding and fitting parts can be moved manually and that all grooves and paths are free from 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, as per the disassembly and assembly instructions.
g. Replace all the 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 have uniform 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 etc.
d. Confirm that the orifices of the main poppet and seat section are not clogged with foreign matter.
e. Replace all O-rings with new ones.
f. When any light damage is found in inspections, correct it by lapping.
g. When any abnormal part is found, replace it with a relief valve assembly.

4) ASSEMBLY

① Figure in ( ) shown after part name in explanation sentence shows number in structure figure.

② Cautions in assembling O-rings

a. Take care avoid defects when forming O-rings and damage to the rings when handling them.

b. Apply grease, hydraulic oil on to O-rings and seal-fitting sections for full lubrication.

c. Do not stretch O-rings so much to deform them permanently.

d. In fitting O-ring, take care not to roll it into its position. In addition, twisted O-ring cannot have the twist removed naturally with ease after being fitted, and causes oil leakage.

e. Tighten the bolts in each section with a torque wrench to their respective tightening torques.

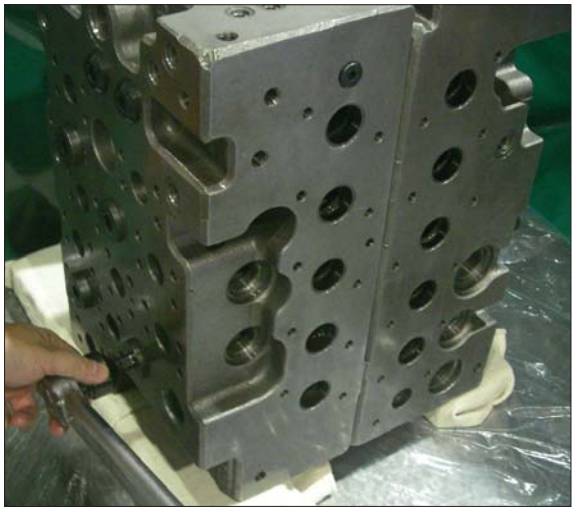
(1) Assembly of the check valve :

① Assemble the poppets (511, 512, 513, 514) and the springs (521, 522, 523) : Put the O-rings (561) onto the plugs (551, 552). Put the O-rings (562) onto the plugs (553). Tighten the plugs (551, 552, 553) with their specified torques.

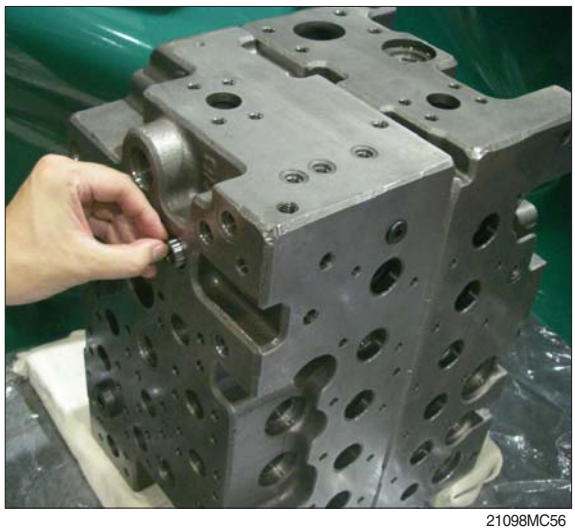
※ Use the poppets, springs and plugs in the following groups.

Poppet	Spring	Plug	Mounting positions
511	521	551	511 in 8 positions
512	522	553	512 in 2 positions
513	523	552	513 in 2 positions
514	521	551	514 in 2 positions

Plug	Hexagon key wrench (mm)	Tightening torque (kgf·m)
551	12	23.5 ~ 26.5
552	12	23.5 ~ 26.5
553	10	13.3 ~ 15.3



21098MC57



21098MC56

(2) Assembly of the plate (210) :

Fit the O-rings (165) to the P1 housing (102), and tighten the hexagon socket head bolts (274) with specified torque.

- Hexagon key wrench : 10 mm
- Tightening torque : 10.0 ~ 12.2 kgf·m (72.3~88.2 lbf·ft)

If this plate face looks downward, turn the control valve.

(3) Assembly of the flange (209) :

Fit the O-rings (165) to the flange (209), and tighten the hexagon socket head bolts (971) with specified torque.

- Hexagon key wrench : 8 mm
- Tightening torque : 5.0 ~ 6.6 kgf·m (36.2~47.7 lbf·ft)

(4) Assembly the of logic control valve :

① Put the O-ring (250-115, 251-115) onto the plug (250-111, 251-111).

21098MC53

② Assemble the spool (250-102, 251-102), spring seat (250-104, 251-104) and spring (251-105, 251-105) into the casing (250-101, 251-101) of the logic control valve, and tighten the plug (250-111, 251-111) with specified torque.

· Hexagon key wrench : 8 mm

· Tightening torque : 7.0 ~ 8.1 kgf·m (50.6~58.6 lbf·ft)

③ Assemble the logic poppet (254; poppet, spring, spring seat) into the housing of the control valve.

④ Fit the O-rings (250-112 and 113, 251-112 and 113) to the casing (250-101, 251-101) of the logic control valve, and tighten the hexagon socket head bolts (250-120, 251-120) with specified torque.

· Hexagon key wrench : 8 mm

· Tightening torque : 5.0 ~ 6.6 kgf·m (36.2~47.7 lbf·ft)

21098MC54

(5) Assembly of the arm regeneration cut valve (257) :

Assemble the sleeve (257-212), spool (257-211), and spring (257-231) into the P1 housing (102). Put the O-ring (265) onto the plug (257-253), and tighten with specified torque.

· Box wrench : 36 mm

· Tightening torque : 7.0 ~ 8.0 kgf·m (50.6~57.9 lbf·ft)

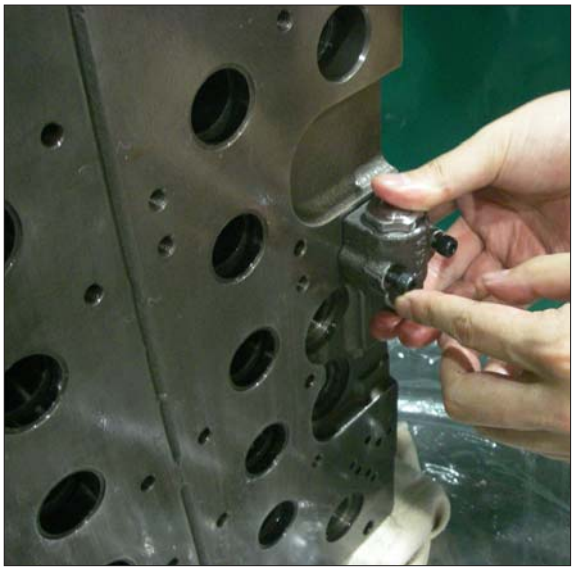
21098MC52

(6) Assembly of the lock valve selector (252) :

Fit the O-rings (252-161) to the lock valve selector (252) and tighten the hexagon socket head bolts (252-171) with specified torque.

· Hexagon key wrench : 5 mm

· Tightening torque : 1.0 ~ 1.4 kgf·m (7.2~10.1 lbf·ft)

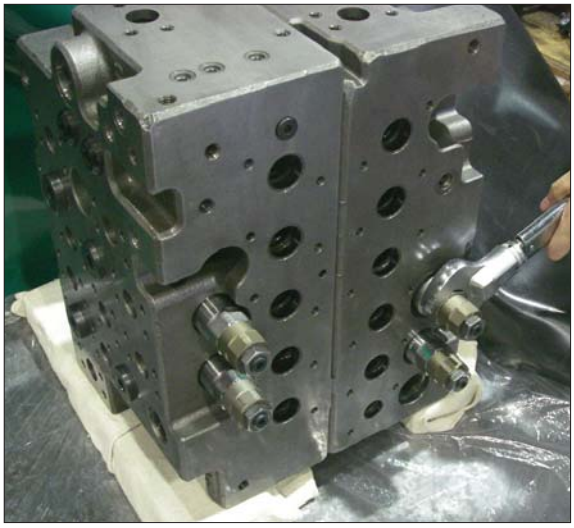


21098MC50

(7) Assembly of the main relief valve (601) and the port relief valve (602, 603, 604) :

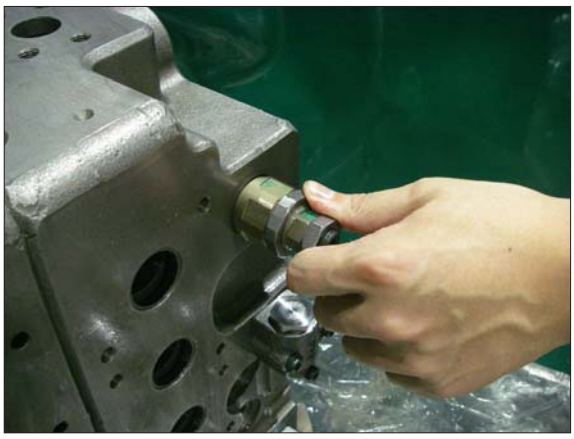
Assemble the main relief valve (601) and the port relief valves (602, 603, 604) to the housing, and tighten them with specified torque.

Item	Tool	Tightening torque (kgf·m)
Main relief valve (601)	Spanner 32	7.0 ~ 8.1
Port relief valve (602, 604)	Spanner 32 or box wrench 32	7.0 ~ 8.1
Port relief valve (603)	Spanner 36	12.2 ~14.3



21098MC49

21098MC48



21098MC47

(8) Assembly of the rod spool (308) :

① Hold the middle of the travel straight spool (308) in the mouthpiece-attached vise applying a protection plate (aluminum plate etc.) in between. Attach the spring seats (332), springs (320) and stopper (335), and tighten the spacer bolt (336) with specified torque.

※ Before tightening the spacer bolt (336), apply loctite #262 to it.

· Hexagon key wrench : 10 mm

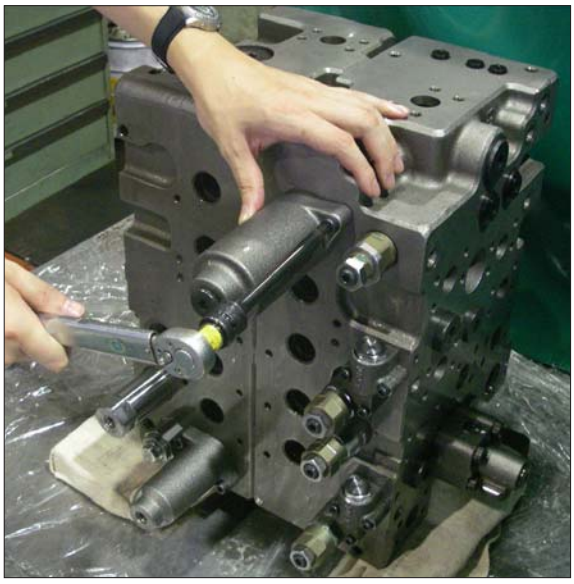
· Tightening torque : 1.6 ~ 1.8 kgf·m
(11.6~13.0 lbf·ft)

※ Take care not to fasten the vise excessively to the shape of the rod spool (308) is deformed.

② Insert the spool assemblies of items ① above into the P2 housing (101).

※ Assemble the spool assembly into P2 housing (101) carefully and slowly.

※ Do not push them forcibly.



21098MC43

(9) Assembly of the boom 1 spool (303) :

① Hold the middle of the boom1 spool (303) in the mouthpiece-attached vise applying a protection plate (aluminum plate etc.) in between. Attach the spring seats (332), springs (320, 321) and stopper (335), and tighten the spacer bolt (336) with specified torque.

※ Before tightening the spacer bolt (336), apply loctite #262 to it.

· Hexagon key wrench : 10 mm

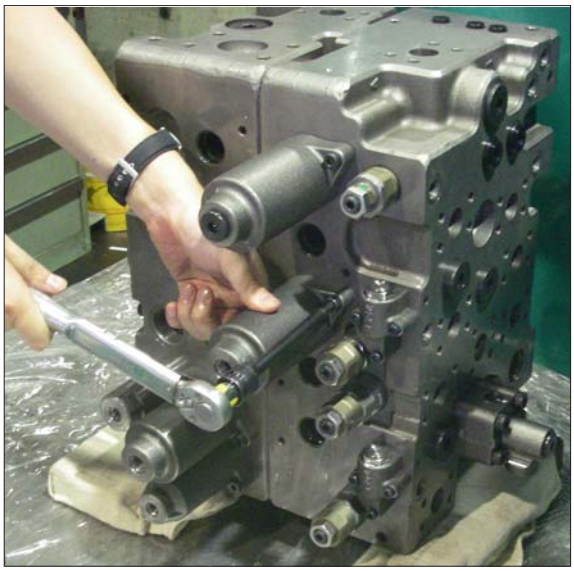
· Tightening torque : 1.6 ~ 1.8 kgf·m (11.6~13.0 lbf·ft)

※ Take care not to fasten the vise so much that the shape of the boom 1 spool (303) is deformed.

② Insert the spool assembly of items ① above into the P2 housing (101).

※ Assemble the spool assembly into the P2 housing (101) carefully and slowly.

※ Do not push them forcibly.



21098MC41

(10) Assembly of the arm 1 spool (302) :

① Hold the middle of the arm 1 spool (302) in the mouthpiece-attached vise applying a protection plate (aluminum plate etc.) in between. Attach the spring seats (332), springs (320, 323) and stopper (335) and tighten the spacer bolt (336) with specified torque.

※ Before tightening the spacer bolt (336), apply loctite #262 to it.

· Hexagon key wrench : 10 mm

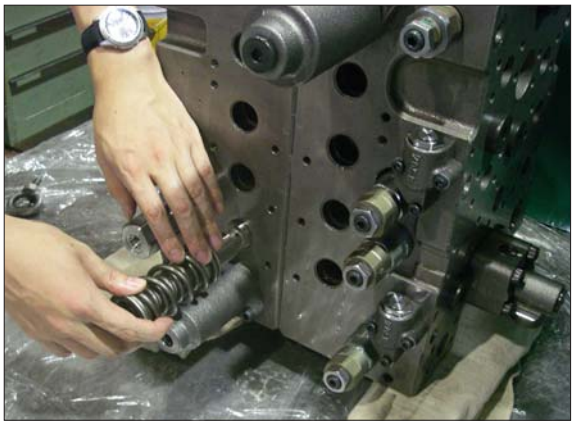
· Tightening torque : 1.6 ~ 1.8 kgf·m (11.6~13.0 lbf·ft)

※ Take care not to fasten the vise so much that the shape of the arm 1 spool (302) is deformed.

② Insert the spool assemblies of items ① above into the P1 housing (102).

※ Assemble the spool assembly into the P1 housing (102) carefully and slowly.

※ Do not push them forcibly.



21098MC42

(11) Assembly of the main spool (travel (301), dozer (312), bucket (304), swing (305), option (309), arm 2 (306), boom 2 (307), swing priority (311)):

① Hold the middle of each spool in the mouthpiece-attached vise applying a protection plate (aluminum plate etc.) in between. Attach the spring seats (332), springs and stopper (335 or 339) and tighten the spacer bolt (336) with specified torque.

※ Before tightening the spacer bolt (336), apply loctite #262 to it.

· Hexagon key wrench : 10 mm

· Tightening torque : 1.6 ~ 1.8 kgf·m (11.6~13.0 lbf·ft)

※ Take care not to fasten the vise so much that the shape of the spool is deformed.

② Insert the spool assemblies of Items ① above into the P2 housing (101) or P1 housing (102).

※ Assemble the spool assemblies into P2 housing (101) or P1 housing (102) carefully and slowly.

※ Do not push them forcibly.

21098MC39

21098MC38

(12) Assembly of the bypass cut spool (310, 313) :

① Hold the middle of each spool in the mouthpiece-attached vise applying a protection plate (aluminum plate etc.) in between. Attach the spring seats (331), springs (370, 371) and stopper (337) and tighten the spacer bolt (333) with specified torque.

※ Before tightening the spacer bolt (333), apply loctite #262 to it.

· Hexagon key wrench : 10 mm

· Tightening torque : 1.6 ~ 1.8 kgf·m (11.6~13.0 lbf·ft)

※ Take care not to fasten the vise so much that the shape of the bypass cut spool (310, 313) is deformed.

② Insert the spool assemblies of Items ① above into the P1 housing (102).

※ Assemble the spool assemblies into the P1 housing (102) carefully and slowly.

※ Do not push them forcibly.

21098MC44

(13) Assembly of the covers :

① Fit the square rings (264) to the spool covers (204, 205, 206) in reverse sides to the spring sides of spools, and tighten the hexagon socket head bolts (273) with specified torque.

※ Confirm that square rings (264) have been fitted to the spool covers (204, 205, 206).

· Hexagon key wrench : 6 mm

· Tightening torque : 2.5 ~ 3.5 kgf·m (18.1~25.3 lbf·ft)

② Bucket spool cover (206) : Assemble piston (211) into bucket spool cover (206). Put O-ring (561) onto plug (258) and tighten it with specified torque.

· Box wrench : 32 mm

· Tightening torque : 15.3 ~ 18.4 kgf·m (111~133 lbf·ft)

③ Fit the O-rings (261, 262) to spring covers (201, 202, 203) on the spring sides of spools, and tighten the hexagon socket head bolts (273) with specified torque.

※ Confirm that O-rings (261,262) have been fitted to spring covers (204, 205, 206).

· Hexagon key wrench : 6 mm

· Tightening torque : 2.5 ~ 3.5 kgf·m (18.1~25.3 lbf·ft)

21098MC46

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.

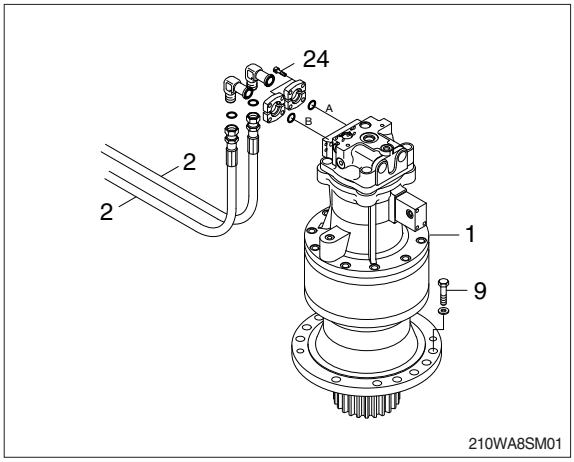
(4) Disconnect hose assembly (2).

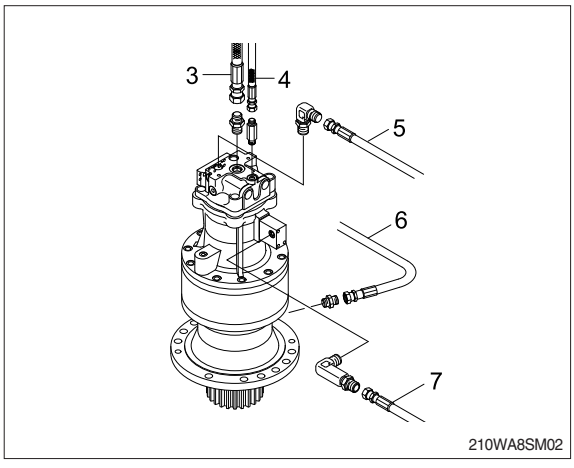
(5) Disconnect pilot line hoses (3, 4, 5, 6, 7, 8).

(6) Sling the swing motor assembly (1) and remove the swing motor mounting socket bolts (9).
- Weight : 254 kg (560 lb)
- Tightening torque : 12.8 ± 3.0 kgf·m (92.6 ± 21.7 lbf·ft)

(7) Remove the swing motor assembly.

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





2) INSTALL

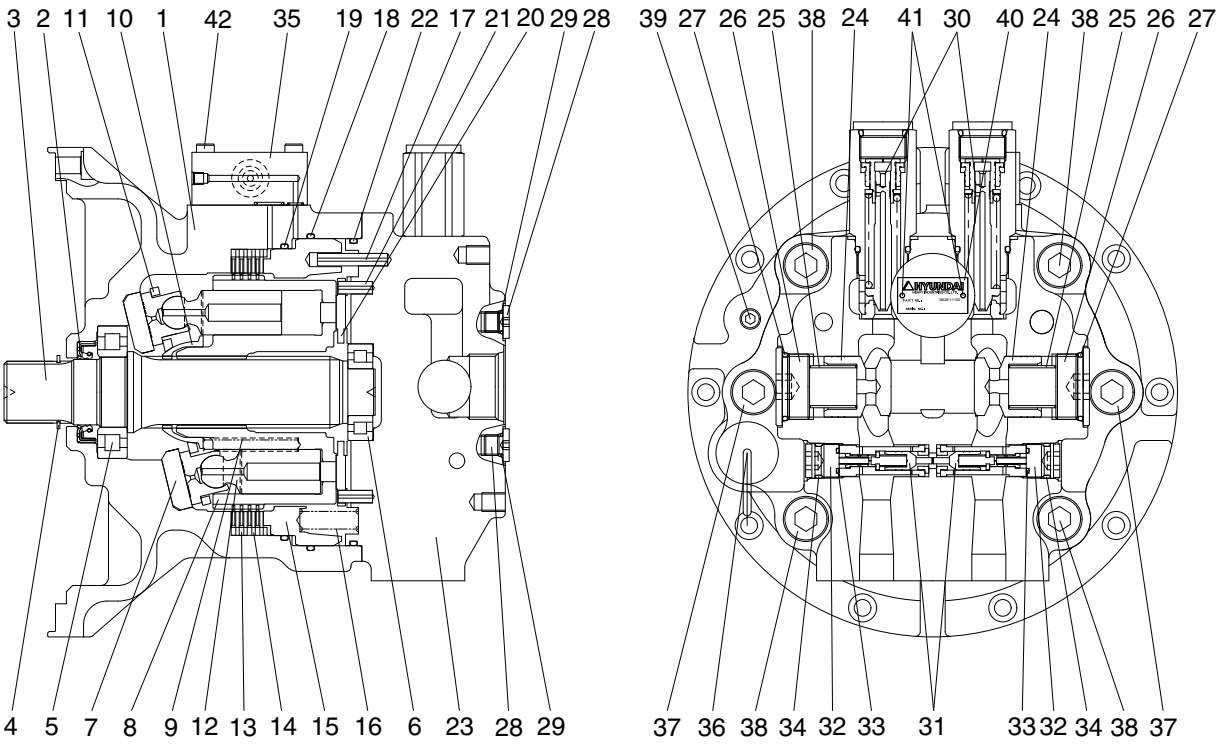
(1) Carry out installation in the reverse order to removal.

(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



210WA2SM02

1	Casing	15	Parking piston	29	O-ring
2	Oil seal	16	Brake spring	30	Relief valve assy
3	Shaft	17	Spring pin	31	Anti-rotating valve assy
4	Retainer ring	18	O-ring	32	Plug
5	Roller bearing	19	O-ring	33	O-ring
6	Roller bearing	20	Valve plate	34	O-ring
7	Swash plate	21	Spring pin	35	Port block assy
8	Rotary block	22	O-ring	36	Level gauge assy
9	Spring	23	Valve casing	37	Socket bolt
10	Ball guide	24	Check valve	38	Socket bolt
11	Retainer plate	25	Spring	39	Plug
12	Piston assy	26	Plug	40	Name plate
13	Friction plate	27	O-ring	41	Rivet
14	Separate plate	28	Plug	42	Socket bolt

2) DISASSEMBLY

(1) Disassemble drive shaft

① Unloosing socket bolt (port block assy, 42) and disassemble port block assy (35) from casing (1).

2209A8SM51

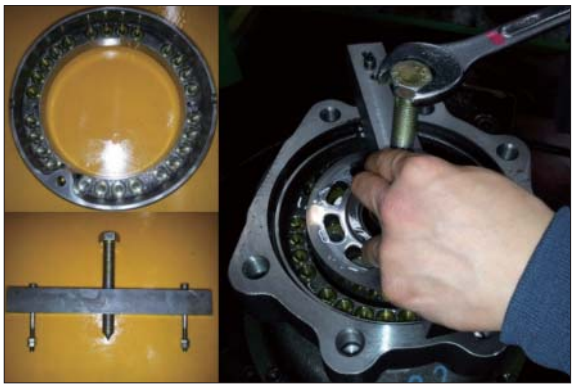
② Disassemble level gauge assy (36) from casing (1).

2209A8SM52

③ Hang valve casing (23) on hoist, unloose socket bolt (37, 38) and disassemble from casing (1).

2209A8SM53

④ Disassemble brake spring (16) and using a jig, disassemble parking piston (15) from casing (1).



2209A8SM54

⑤ Disassemble respectively rotary block sub (8), friction plate (13), separate plate (14) from casing (1).

2209A8SM55

⑥ Disassemble swash plate (7) from casing (1).

2209A8SM56

⑦ Using a plier jig, disassemble retainer ring (4) from casing (1).

2209A8SM57

⑧ Disassemble shaft (3), oil seal (2) and O-ring (18, 22) from casing (1).

2209A8SM58

(2) Disassemble rotary block sub

① Disassemble piston assy (12) from rotary block (8).

2209A8SM59

② Disassemble ball guide (10) and spring (rotary block, 9) from rotary block (8).

- Ball guide × 1EA
- Spring × 9EA

2209A8SM60

(3) Disassemble valve casing sub

① Disassemble spring pin (17, 21), valve plate (20), O-ring (22) from valve casing (23).

2209A8SM61

② Using a torque wrench, disassemble relief valve assy (30) from valve casing (23).

2209A8SM62

③ Using a torque wrench, disassemble plug (32) from valve casing (23) and disassemble O-ring (33, 34) and anti-rotating valve assy (31).

2209A8SM63

④ Using a torque wrench, disassemble check valve (24) from valve casing (23).

2209A8SM64

⑤ Disassemble plug (28), O-ring (29) from valve casing (23).

2209A8SM65

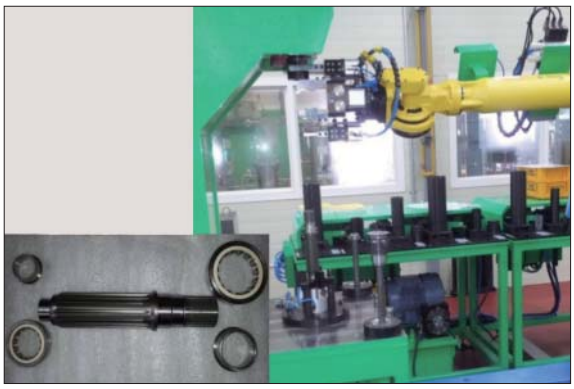
3) ASSEMBLING

(1) Assemble shaft sub

① Put roller bearing (5) on preheater and provide heat to inner race.
(Temperature in conveyor : 120°C for 3~5 minutes)

2209A8SM66

② Using a robot machine, assemble and press preheated roller bearing (5) into shaft (3).



2209A8SM67

(2) Assemble rotary block sub

① Assemble 9 springs (rotary block, 9) into rotary block (8).
· Spring × 9EA

2209A8SM68

② Assemble ball guide (10) into rotary block (8).
· Ball guide × 1EA

2209A8SM69

③ Assemble 9 piston assy (12) into retainer plate (11).

- Piston assy × 9EA
- Retainer plate × 1EA

2209A8SM70

④ Assemble parts of procedure ② and ③.

2209A8SM71

(3) Assemble valve casing sub

① **Assemble make up check valve sub**

Assemble check valve (24), O-ring (27), plug (26) in that order and then screw it torque wrench.

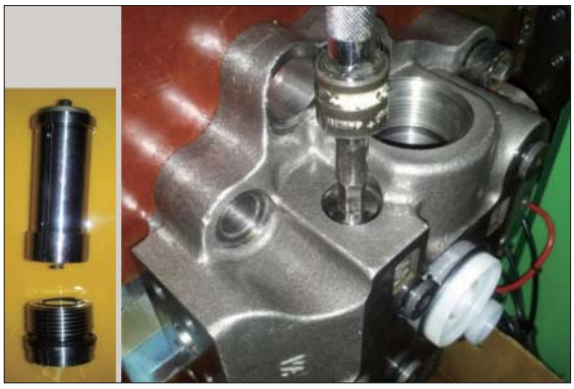
- Make up check valve × 2EA
- Spring × 2EA
- Plug × 2EA
- O-ring × 2EA

2209A8SM72

② **Assemble anti-rotating valve assy**

Assemble anti-rotating valve assy (31), plug (32), O-ring (33, 34) in that order and then screw it a torque wrench.

- Anti-rotating valve assy (31) × 2EA
- Plug (32) × 2EA
- O-ring (33, 34) × 2EA



2209A8SM73

③ Using a torque wrench, assemble relief valve assy (30) 2 sets into valve casing (23).

· Relief valve assy (30) × 2EA

2209A8SM74

④ Assemble plug (28) and O-ring (27) into valve casing (23).

· Plug (28) × 3EA

· O-ring (27) × 3EA

2209A8SM75

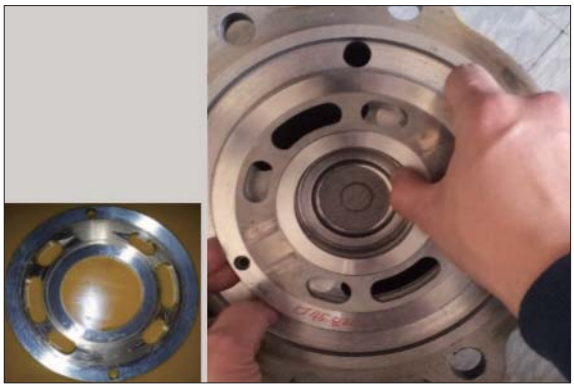
⑤ Assemble roller bearing (6) into valve casing (23) and assemble spring pin (17, 21) into valve casing (23).

· Roller bearing (6) × 1EA

· Spring pin (17, 21) × 1EA

2209A8SM76

⑥ Apply some grease valve plate (20) and assemble it into valve casing (23).



2209A8SM77

(4) Assemble drive shaft sub

① Using a jig, assemble oil seal (2) into casing (1).

2209A8SM78

② Fit shaft sub (shaft+roller bearing) into casing (1).

2209A8SM79

③ Using a plier jig, assemble retainer ring (4) to shaft (3).

· Retainer ring × 1EA

2209A8SM80

④ Apply some grease swash plate (7) and assemble it into casing (1).

· Swash plate × 1EA

2209A8SM81

⑤ Insert O-ring (18, 19) into casing (1).
- O-ring (18)×1EA
- O-ring (19)×1EA

2209A8SM82

⑥ Assemble rotating block (8) into casing (1).

2209A8SM83

⑦ Assemble separate plate (14) and friction plate (13) 4 sets into casing (1) and fit parking piston (15) into casing (1) by a jig or a press.
- Separate plate×4EA
- Friction plate×4EA
- Parking piston×1EA

2209A8SM84

⑧ Assemble spring (parking piston, 16) into parking piston (15).
- Spring×26EA

2209A8SM85

⑨ Lift up valve casing (23) on casing (1) by a crane and assemble it with socket bolts (37, 38).

2209A8SM86

⑩ Assemble level gauge assy (36) and plug (39) into casing (1).

2209A8SM87

⑪ Assemble port block assy (35) into valve casing (23) with socket bolt (42).

- Port block assy × 1EA
- Socket bolt × 3EA

2209A8SM88

⑫ **Air pressing test**

Be sure of leakage, after press air into assembled motor and put it in water for 1 minute (pressure : 2 kgf/cm^2).

2209A8SM89

⑬ **Leakage check**

Place motor on a bench tester and after cleaning motor by color check No.1, paint No.3 and be sure of leakage.

2209A8SM90

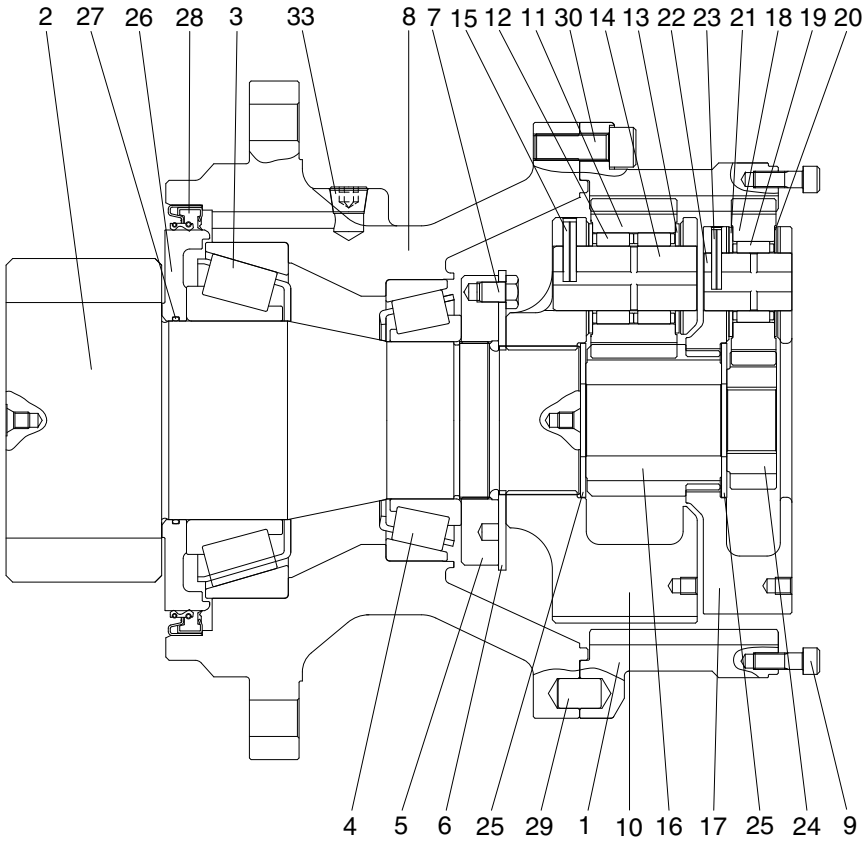
⑭ **Mount test bench**

Mounting motor a test bench, test the availability of each part.

2209A8SM91

3. DISASSEMBLY AND ASSEMBLY OF REDUCTION GEAR

1) STRUCTURE



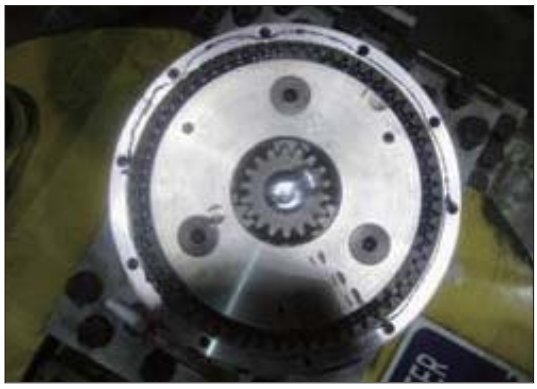
220L2SM03

1	Ring gear	11	Planetary gear 2	21	Thrust washer
2	Drive shaft	12	Needle bearing	22	Carrier pin 1
3	Taper bearing	13	Thrust washer	23	Spring pin
4	Taper bearing	14	Carrier pin 2	24	Sun gear 1
5	Ring nut	15	Spring pin	25	Thrust plate
6	Lock plate	16	Sun gear 2	26	Sleeve
7	Hexagon bolt	17	Carrier 1	27	O-ring
8	Casing	18	Planetary gear 1	29	Parallel pin
9	Socket bolt	19	Needle bearing	30	Socket bolt
10	Carrier 2	20	Thrust washer	33	Plug

2) DISASSEMBLY

(1) Preparation

① The reduction gear removed from machine is usually covered with mud.
Wash out side of reduction gear and dry it.
② Setting reduction gear on work stand for disassembling.
③ Mark for mating
Put marks on each mating parts when disassembling so as to reassemble correctly as before.
⚠ Take great care not to pinch your hand between parts while disassembling not let fall parts on your foot while lifting them.



2209A8SM01

(2) Disassembly

① Remove every “Socket bolt (M10)” that secure swing motor and reduction gear.
② Removing carrier sub assy & sun gear
a. Removing No.1 sun gear from No.1 carrier sub assy.
※ Be sure maintaining it vertical with ground when disassembling No.1 sun gear.

2209A8SM02

b. Removing No.1 carrier sub assy screwing I-bolt to tab hole (M10) in No.1 carrier.
Lifting it gradually maintaining it vertical with ground.

※ It’s impossible to disassemble No.1 spring pin. If No.1 spring pin has problem, change whole No.1 carrier sub assy.

2209A8SM03

c. Removing No.2 sun gear from No.2 carrier sub assy.

※ Be sure maintaining it vertical with ground when disassembling No.2 sun gear.

2209A8SM04

d. Removing No.2 carrier sub assy screwing I-bolt to tab hole (M10) in No.2 carrier. Lifting it gradually maintaining it vertical with ground.

※ It's impossible to disassemble No.2 spring pin. If No.2 spring pin has problem, change whole No.2 carrier sub assy.

2209A8SM05

③ **Removing ring gear**

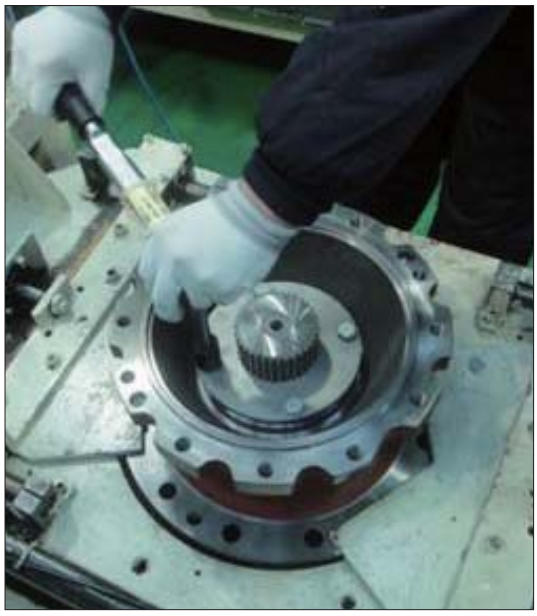
After unscrewing every socket bolt (M16), remove ring gear from casing.

※ Because of liquid gaskets between ring gear and casing, put sharp punch between ring gear and casing and tapping it to remove them.

2209A8SM06

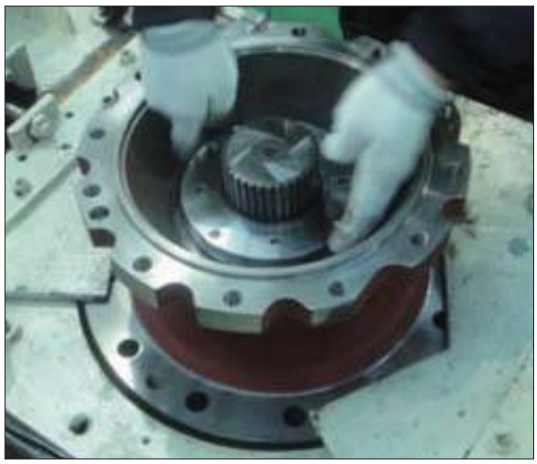
④ **Removing drive shaft sub assy**

a. Unscrew every hex head bolt (M12) to remove lock plate.



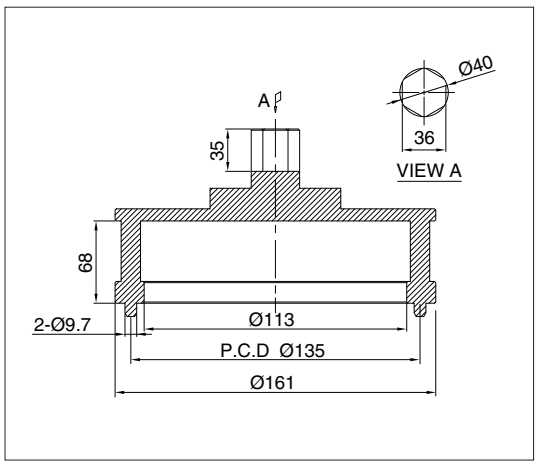
2209A8SM07

b. Rolling ring nut for removing them from drive shaft sub assy.



2209A8SM08

※ Use special tool to roll ring nut to counter clockwise.



220L8SM01

c. Remove drive shaft sub assy from casing.

※ Set a rack for flange of casing, and remove drive shaft sub assy from casing by using press.

2209A8SM09

d. Remove oil seal & taper bearing (small) from casing.

※ Do not re-use oil seal. It is impossible to disassemble drive shaft sub assy.

2209A8SM10

2209A8SM11

4. ASSEMBLY REDUCTION UNIT

1) GENERAL NOTES

(1) Clean every part by kerosene and dry them in a cool and dry place.

(2) Loctite on surface must be removed by solvent.

(3) Check every part for any abnormal.

(4) Each hexagon socket head bolt should be used with loctite #242 applied on its threads.

(5) Apply gear oil slightly on each part before assembling.

⚠ Take great care not to pinch your hand between parts or tools while assembling nor let fall parts on your foot while lifting them.
Inspection before assembling.

Thrust washer

- Check the seizure, abnormal wear or uneven wear.
- Check the unallowable wear.

Gear

- Check the pitting or seizure on tooth surface.
- Check the cracks on the root of tooth.

Bearing

- Rotate it by hands to check such noise or uneven rotation.

2) ASSEMBLING NO.1 CARRIER SUB ASSY

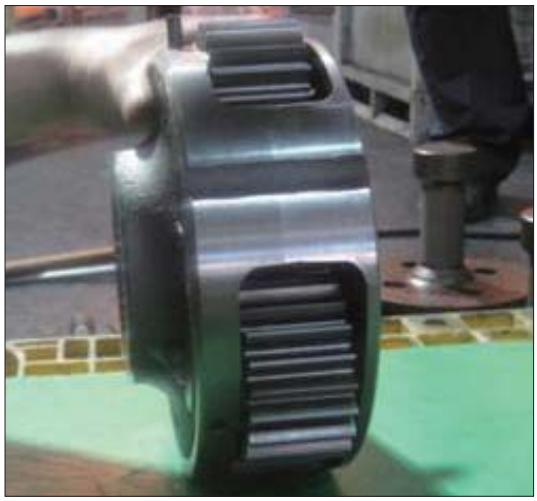
(1) Put thrust plate firmly in No.1 carrier.

(2) After assembling No.1 needle bearing to No.1 planetary gear, put a pair of No.1 thrust washer on both sides of bearing and install them to No.1 carrier.

2209A8SM12

2209A8SM13

(3) Make of spring pin hole No.1 pin and No.1 carrier of spring pin hole in line, press No.1 spring pin into the holes.
Make No.1 spring pin hole head for No.1 planetary gear.



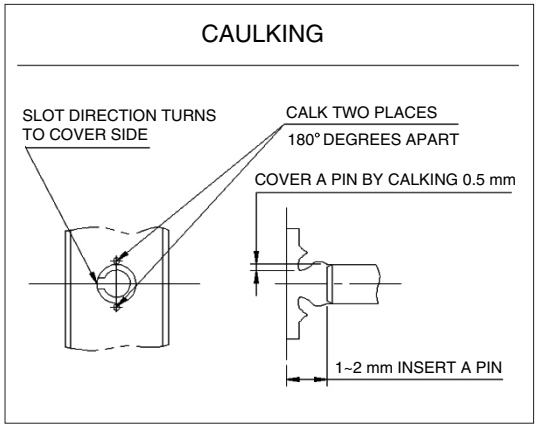
2209A8SM14

(4) Caulk carrier holes to make No.1 spring pin settle down stably.

2209A8SM15

※ Refer to “Caulking details”

Use paint marker for marking after caulking.



220SA8TM147

3) ASSEMBLING NO.2 CARRIER SUB ASSY

(1) Put thrust plate in firmly No.2 carrier.

2209A8SM17

(2) After assembling No.2 needle bearing to No.2 planetary gear, put 2 pieces of No.2 thrust washer on both sides of bearing and install them to No.2 carrier.

2209A8SM18

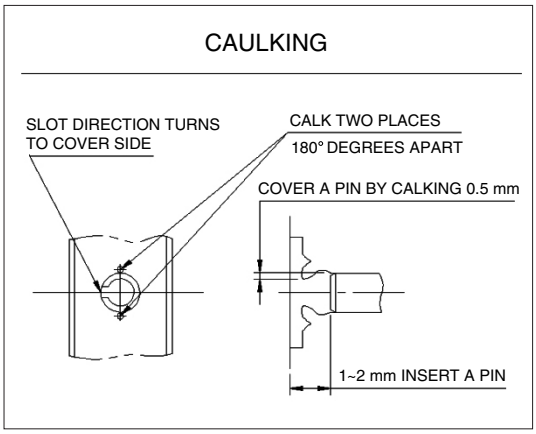
(3) Align No.2 spring pin hole and No.2 carrier spring pin hole, put No.2 spring pin into the holes.
Make No.2 spring pin cutting line face to No.2 planetary gear.

2209A8SM19

(4) Caulk carrier holes to make No.2 spring pin settle down stably.

※ Refer to “Caulking details”

Use paint marker for marking after caulking.



220SA8TM147

4) ASSEMBLING PINION GEAR SUB ASSY

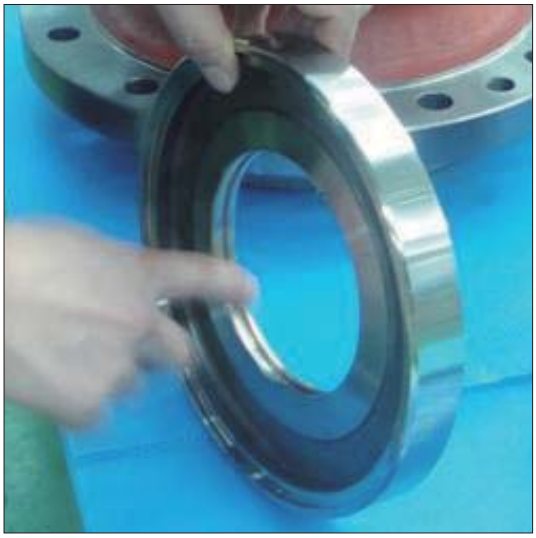
(1) Prepare drive shaft pinion gear vertical with ground.

2209A8SM21

(2) Fully apply grease (albania EP02) to O-ring groove of sleeve.

※ Be sure to maintain it vertical with ground when assembling it.

(3) Put O-ring into O-ring groove of sleeve.
Fully apply grease on O-ring.



2209A8SM22

(4) Assemble taper bearing and sleeve into drive shaft using press jig.
Use special jig for pressing. Leave no space between sleeve and taper bearing.

2209A8SM23

2209A8SM24

5) ASSEMBLING BEARING CUP & OIL SEAL (PRESSING)

(1) Put top, bottom bearing cup into casing.
Use special jig for pressing. Pay attention to foreign materials while assembling bearing cup.

※ Flip over casing to assemble oil seal.

2209A8SM25

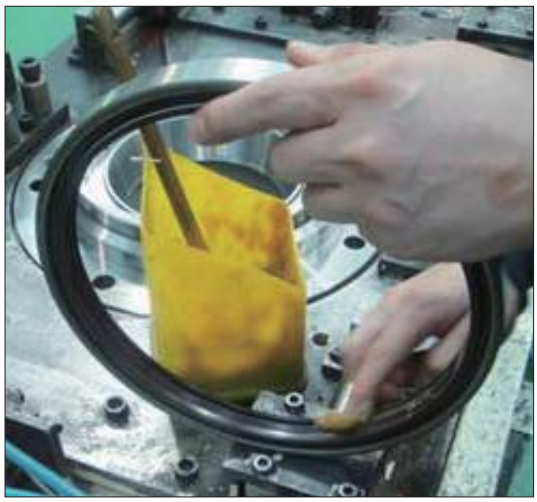
2209A8SM26

(2) Assemble oil seal to casing.
Use special jig for pressing. Pay attention to direction of dust seal and dent.

2209A8SM27

※WHILE ASSEMBLING OIL SEAL

1. Be sure to set dust seal to gear oil.
2. Before assembling, charge enough grease in oil seal.
3. Before assembling, apply enough grease inside and outside of oil seal.



2209A8SM28

6) ASSEMBLING SHAFT SUB ASSY & RING NUT

(1) After assembling casing & drive shaft sub assy, flip it over.

2209A8SM29

(2) Put drive shaft sub assy into casing.

※ Be sure to maintain it vertical with ground when assembling it.

2209A8SM30

(3) Put taper bearing into it.

Rotate bearing by hands for checking after assembly.

2209A8SM31

(4) Put ring nut into drive shaft sub assy by using special jig.

The tightening torque (M95) = 3.5±0.4 kgf·m
(25.3±2.9 lbf·ft)

2209A8SM32

※ Apply enough loctite #242 before screwing bolts.

2209A8SM33

(5) Align bolt screw of ring nut with lock plate's hole.
In case of misalign between bolt screw ring nut and lock plate's hole, put lock plate as near as possible to hole of bolt screw of ring nut and make it in line by increasing tightening torque.

2209A8SM34

2209A8SM35

(6) Screw 4 bolts (M12×16) to connect ring nut and lock plate by using torque wrench.
Bolt (M12, 4EA) = 10.9T
The tightening torque = 8.8±0.9 kgf·m
(63.7±6.5 lbf·ft)

※ Apply enough loctite #242 before screwing bolts.

2209A8SM36

(7) Use paint marker for checking surplus parts after assembling.

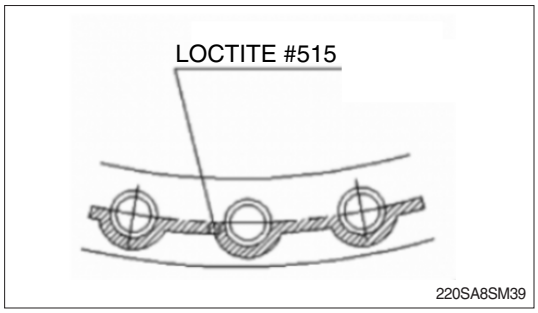
2209A8SM37

7) ASSEMBLING RING GEAR

(1) Apply loctite #515 bottom of casing sub assy contacting with ring gear without disconnection.

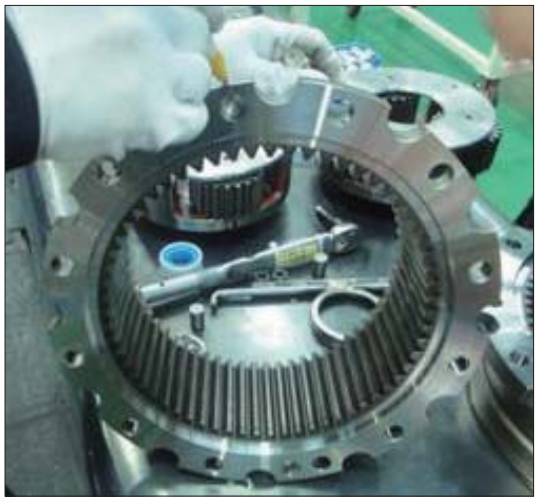
2209A8SM38

Refer to loctite detail.



220SA8SM39

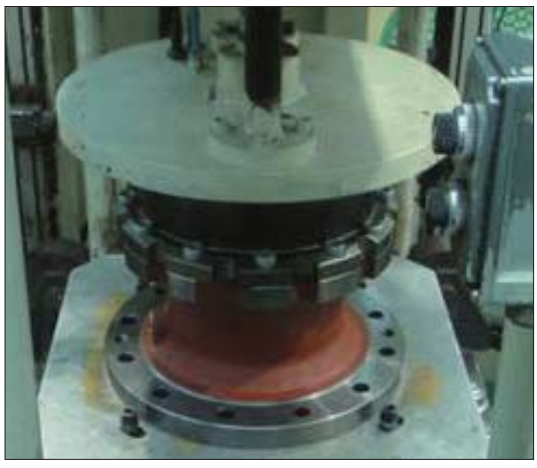
(2) Put parallel pin into hole of casing sub assy. Mark parallel pin position using paint marker.



2209A8SM40

(3) Align ring gear with parallel pin to put them into casing sub assy.

※ Be sure to maintain them vertical with ground while using press.



2209A8SM41

(4) Screw 12 bolts (M16×45) to connect casing sub assy and ring gear (01) by using torque wrench.
Bolt (M16, 12EA) = 12.9T
The tightening torque = 27±2.7 kgf·m
(195±19.5 lbf·ft)

※ Apply enough loctite #242 before screwing bolts.

2209A8SM42

(5) Use paint marker for checking surplus parts after assembling.

2209A8SM43

2209A8SM44

8) ASSEMBLING CARRIER SUB ASSY & SUN GEAR

(1) Put No.2 carrier sub assy along spline of drive shaft spline.

- Screw M10 I-bolt to No.2 carrier sub assy.
- Lifting up No.2 carrier sub assy and align planetary gear and tooth of ring gear by rotating planetary gear by hands.
- Rotate No.2 carrier sub assy by hands to fit No.2 carrier sub assy into drive shaft spline.

2209A8SM45

(2) Put No.2 sun gear into No.2 carrier sub assy.

2209A8SM46

(3) Put No.1 carrier sub assy into No.2 sun gear along spline.
- Screw M10 I-bolt to No.1 carrier sub assy.
- Lifting up No.1 carrier sub assy and align planetary gear and tooth of ring gear by rotating planetary gear by hands.
- Rotate No.1 carrier sub assy by hands to fit No.1 carrier into No.2 sun gear spline.

2209A8SM47

(4) Put No.1 sun gear into No.1 carrier sub assy. Be sure to maintain it vertical with ground. And align with No.1 planetary gear spline.

(5) Rotate No.1 carrier sub assy by hands to check noise.

2209A8SM48

9) MEASURING CLEARANCE & ASSEMBLING NAME PLATE

(1) Check the clearance between ring gear and No.1 sun gear using a tool with dial gauge.

Check the clearance
Dial gauge = -0.3 ~ +2.95

2209A8SM49

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) and remove the pipes (2).

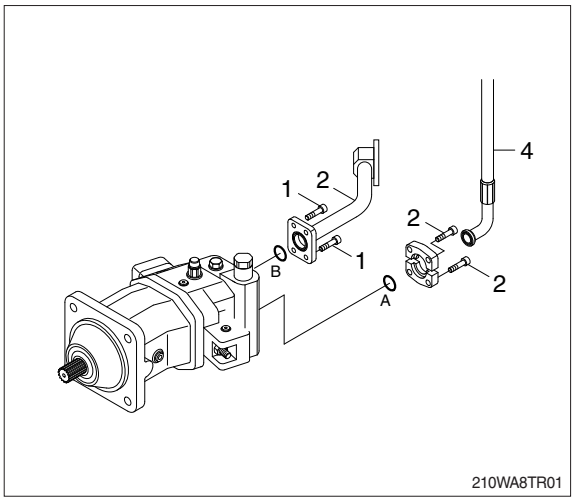
(5) Disconnect hoses (3, 4, 5, 6, 7, 8).

(6) Loosen the socket bolt (9) and remove travel motor (10).

· Weight : 77 kg (170 lb)

· Tightening torque : 35.6 ± 7.1 kgf·m (257 ± 51.4 lbf·ft)

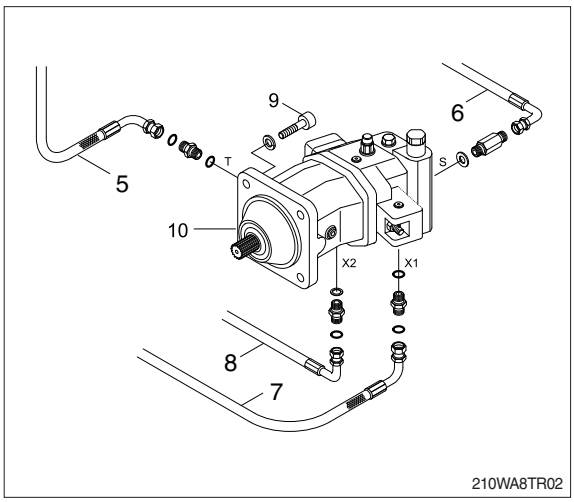
※ When removing the travel motor assembly, check that all the hoses have been disconnected.



2) INSTALL

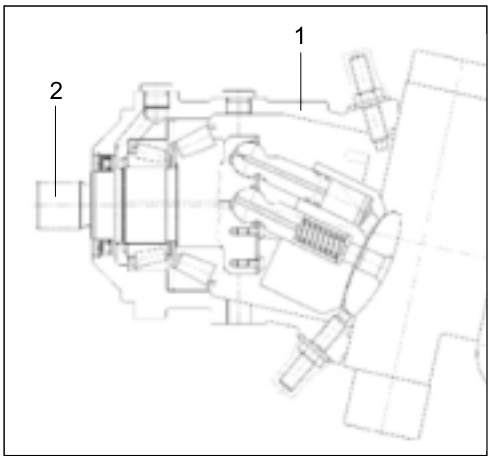
(1) Carry out installation in the reverse order to removal.

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



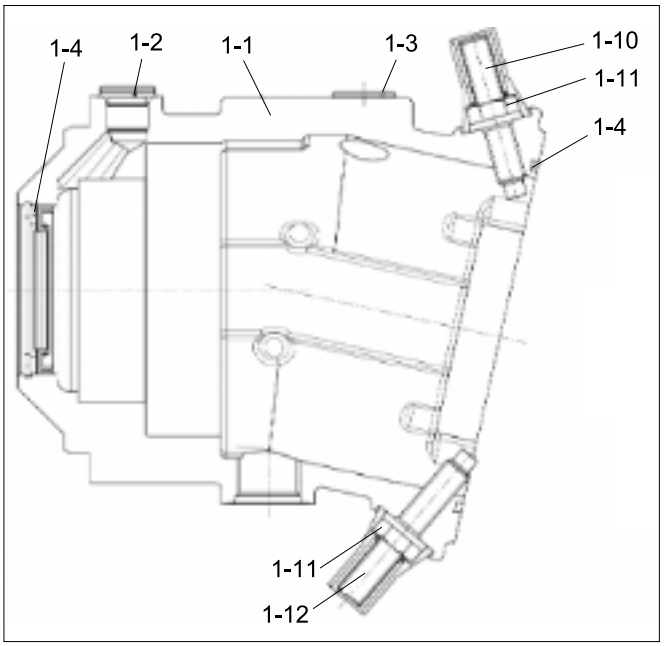
2. PARTS LIST (1/3)

MOTOR ASSY

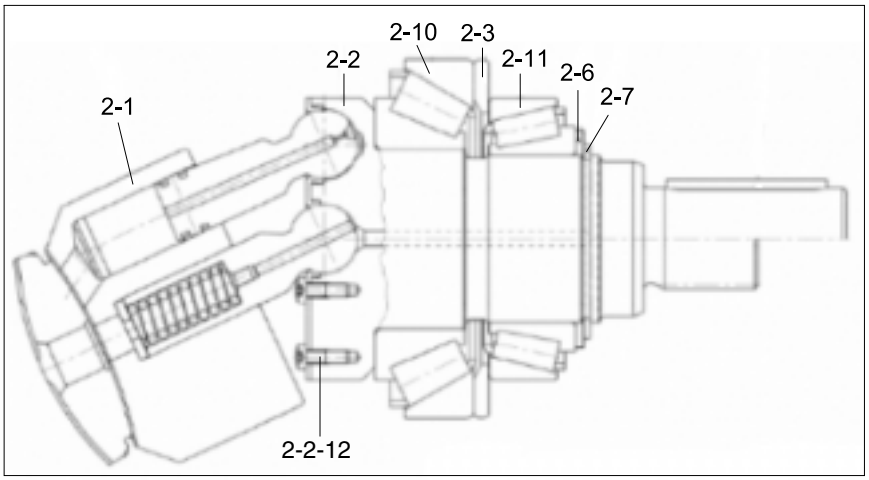


1 Motor housing assy
2 Rotary kit

ITEM 1



ITEM 2

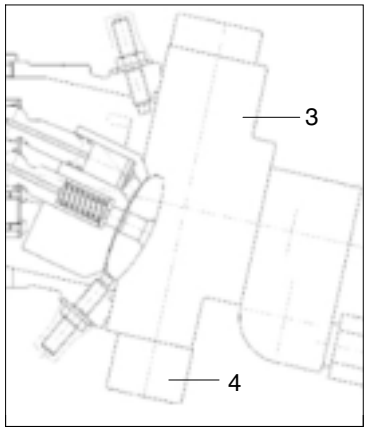


140WA2TR10

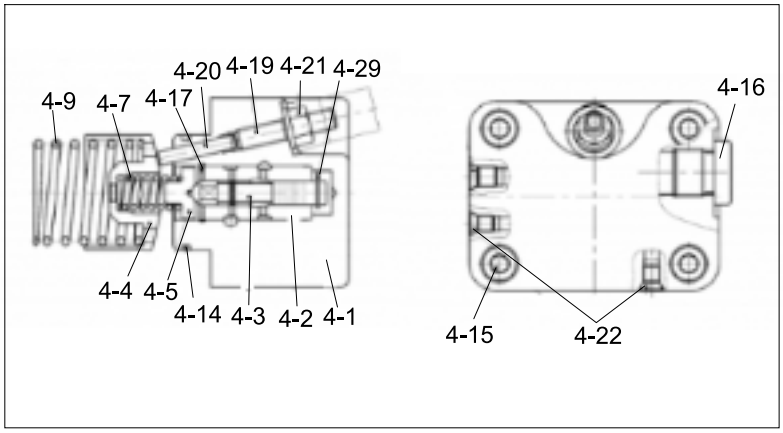
1-1	Housing	1-11	Sealing nut	2-3	Shim
1-2	Lock screw	1-12	Threaded pin	2-6	Backup plate
1-3	Lock screw	2-1	Hydraulic rotary section	2-7	Retainer ring
1-4	Motor seal kit	2-2	Drive shaft	2-10	Roller bearing
1-10	Threaded pin	2-2-12	Screw	2-11	Roller bearing

PARTS LIST (2/3)

MOTOR ASSY

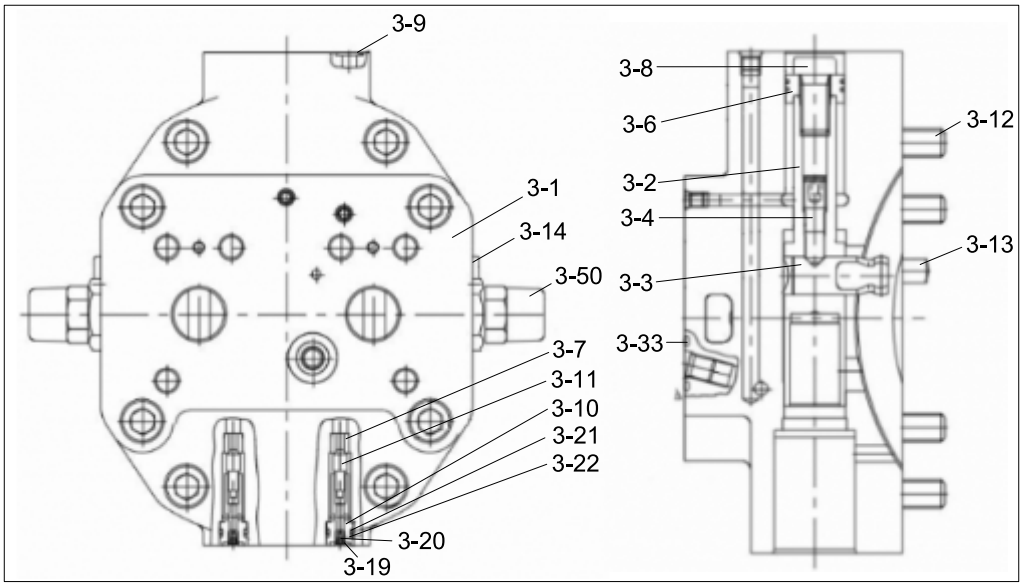


ITEM 4



3 Port plate assy
4 Control unit

ITEM 3

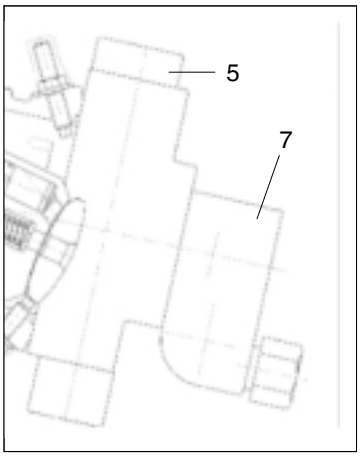


210WA2TR12

3-1	Port plate	3-14	Locking screw	4-7	Pressure spring
3-2	Positioning piston	3-19	O-ring	4-9	Pressure spring
3-3	Positioning trunnion	3-20	Throttle screw	4-14	O-ring
3-4	Threaded pin	3-21	O-ring	4-15	Socket screw
3-6	Piston ring	3-22	Back up ring	4-16	Locking screw
3-7	Bushing	3-33	O-ring	4-17	Retainer ring
3-8	Socket screw	3-50	Relief valve	4-19	Thread pin
3-9	O-ring	4-1	Control housing	4-20	Cylinder pin
3-10	Valve guide	4-2	Control bushing	4-21	Seal lock nut
3-11	Socket bolt	4-3	Control piston	4-22	Break pin
3-12	Socket screw	4-4	Adjust bushing	4-29	Retainer disc
3-13	Cylinder pin	4-5	Spring collar		

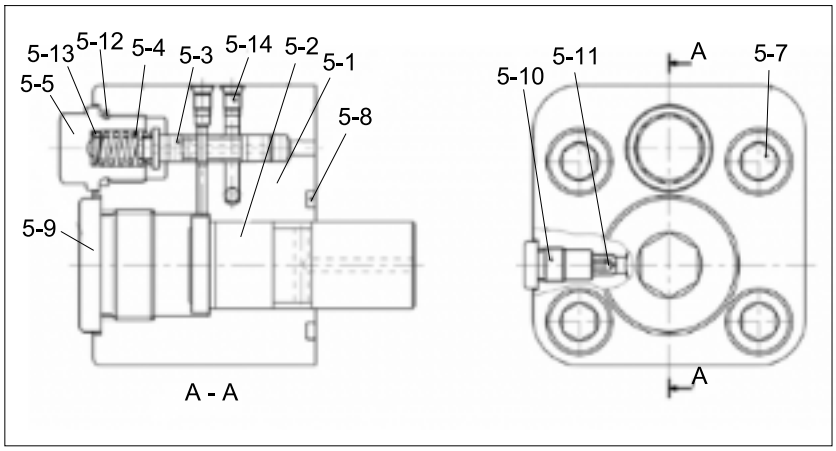
PARTS LIST (3/3)

MOTOR ASSY

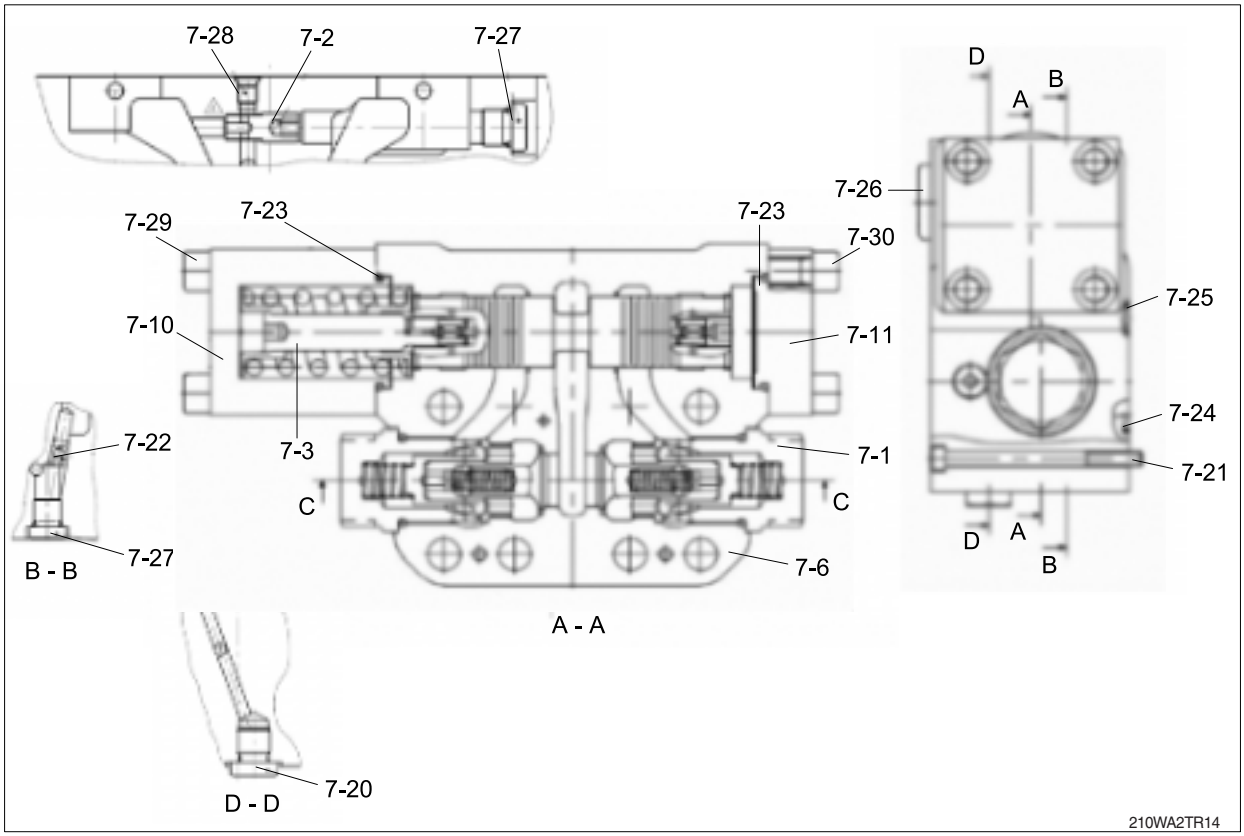


5 Hydraulic stroke limiter
7 Motion control valve assy

ITEM 5



ITEM 7



5-1	Limiter housing	5-12	O-ring	7-21	Socket screw
5-2	Piston	5-13	Shim	7-22	Plug
5-3	Control piston	5-14	Break pin	7-23	O-ring
5-4	Pressure spring	7-1	Control valve assy	7-24	O-ring
5-5	Lock screw	7-2	Shuttle valve	7-25	O-ring
5-7	Cap screw	7-3	Brake piston assy	7-26	Locking serew
5-8	O-ring	7-6	Housing	7-27	Locking screw
5-9	Lock screw	7-10	Cover	7-28	Break pin
5-10	Lock screw	7-11	Cover	7-29	Socket serew
5-11	Orifice	7-20	Locking screw		

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
8-94	1-2	M22 × 1.5	6.1	44
	1-3	M26 × 1.5	7.1	51
	1-11	M12	7.0	50.9
	2-2-12	M 6 × 20	1.4	10.3

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.

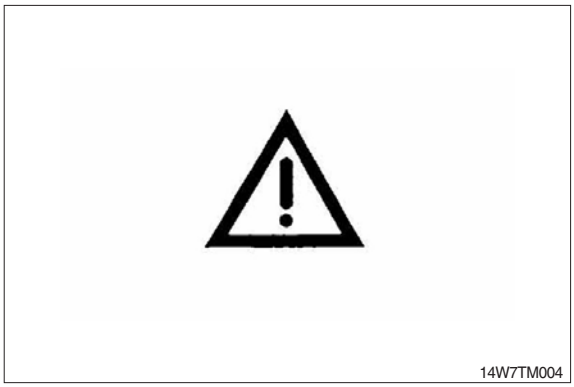
⑤ Wash all parts thoroughly in a suitable solvent.
Dry thoroughly with compressed air.
Do not use the cloths.

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)

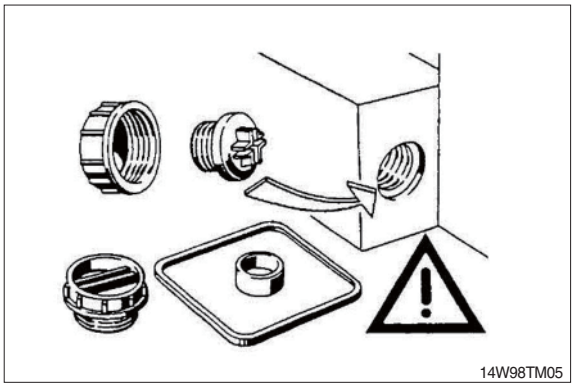
⑦ Use a torque wrench to tighten bolts and plugs, to the torque specified as follows.

2) SEAL KITS AND COMPONENT GROUPS

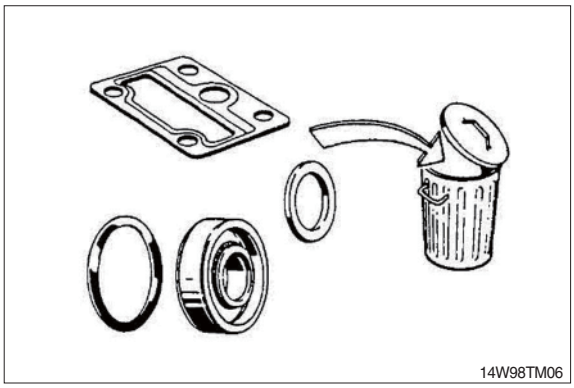
Observe the following notices when carrying out repair work at hydraulic aggregates.



(1) Close all ports of the hydraulic aggregates.

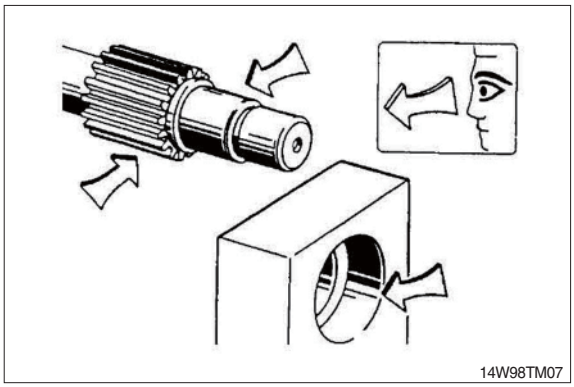


(2) Replace all seals.
Use only original spare parts.



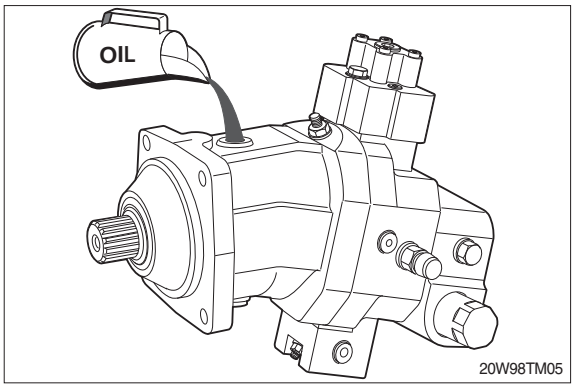
(3) Check all seal and sliding surfaces for wear.

※ Rework of sealing area f.ex. with abrasive paper can damage surface.

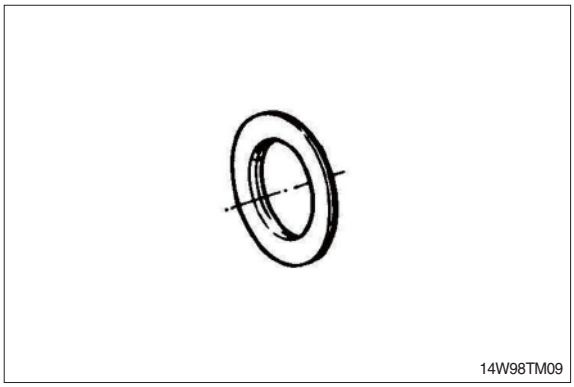


(4) Fill up hydraulic aggregates with hydraulic oil before start up.

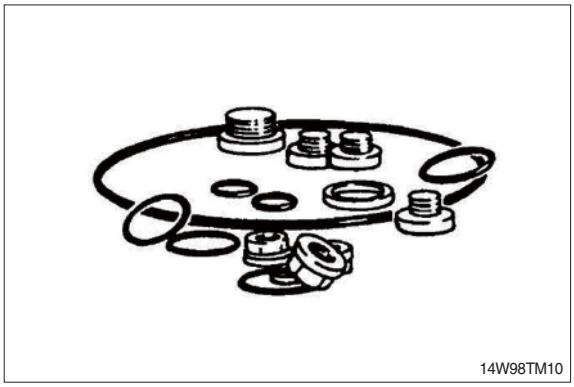
※ Without fill up bearing damage happens!



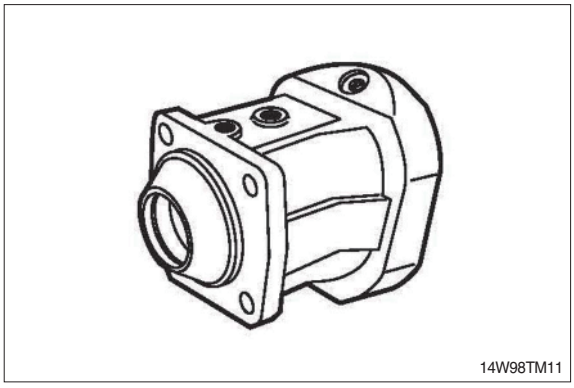
(5) Seal kit for drive shaft



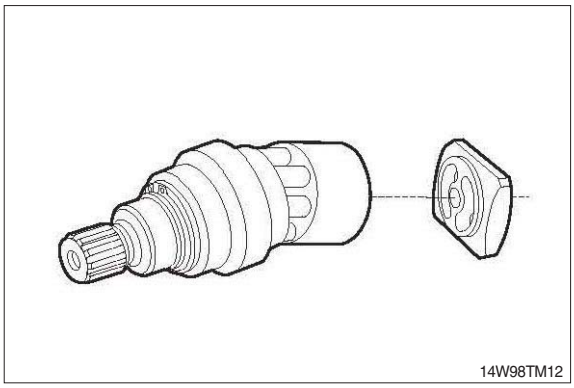
(6) External seal kit.



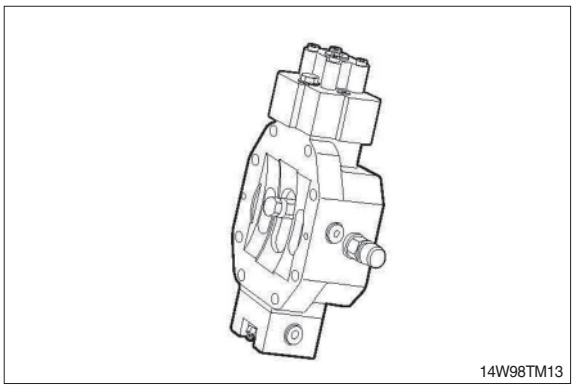
(7) Housing.



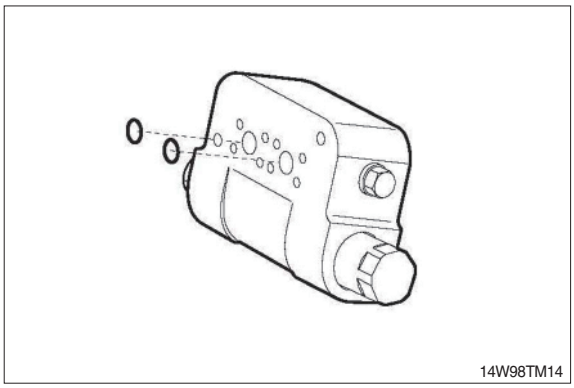
(8) Complete rotary group.



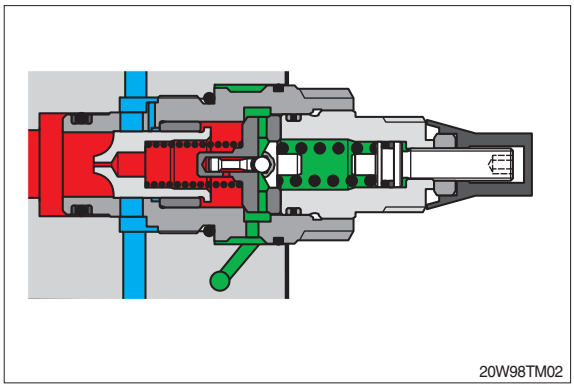
(9) Port plate with control piston.



(10) Counter balance valve.

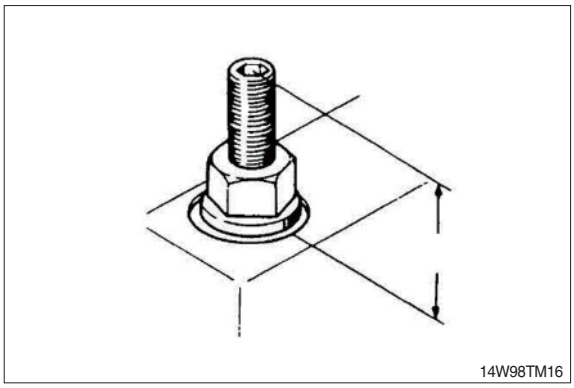


(11) Relief valve.

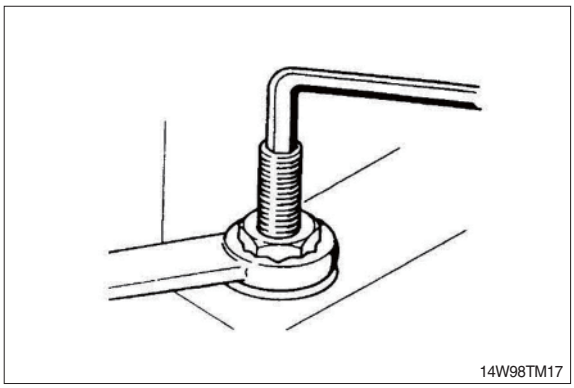


3) SEAL NUT

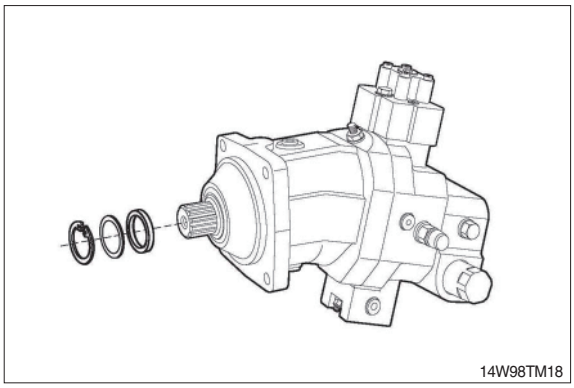
(1) Replace seal nut.
First measure and record setting height.



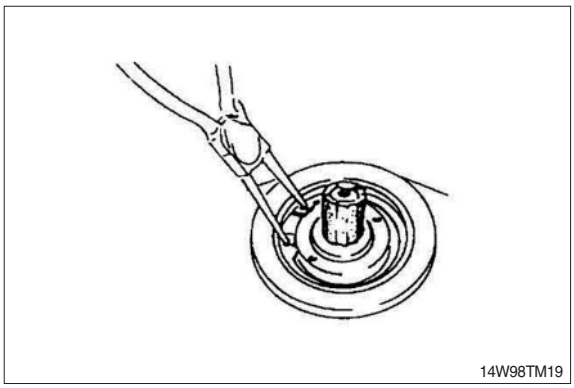
(2) When tightening, counterhold setting screw, then check setting height.



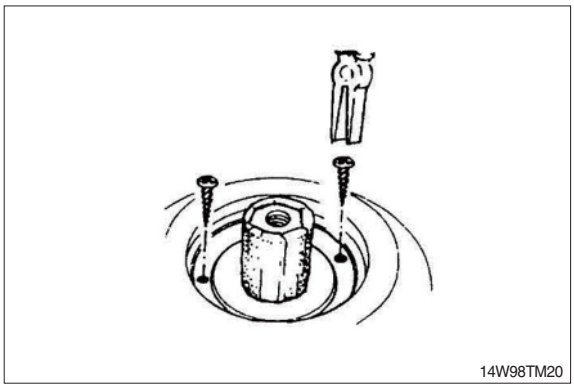
4) SEALING THE DRIVE SHAFT



(1) Protecting the drive shaft.
Remove retaining ring and shim.



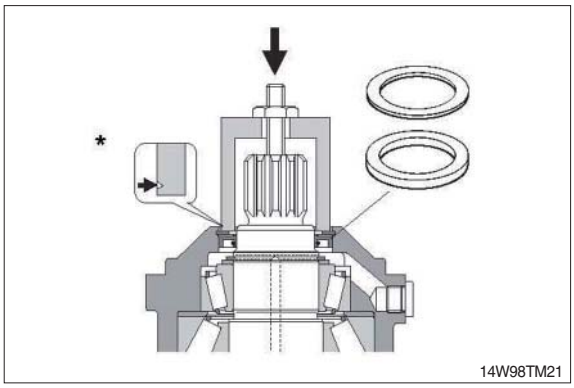
(2) Screw in sheet metal screw into the holes fitted with rubber.
Pull out seal with pliers.



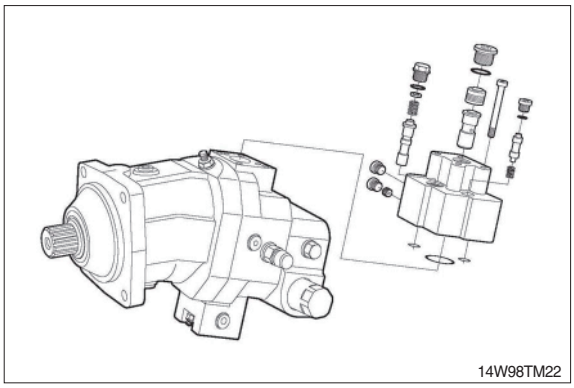
(3) Press in shaft seal and shim with bush to stop.

⚠ **Pay attention to pressing depth.**

* Mark for pressing depth.
Assemble retaining ring.

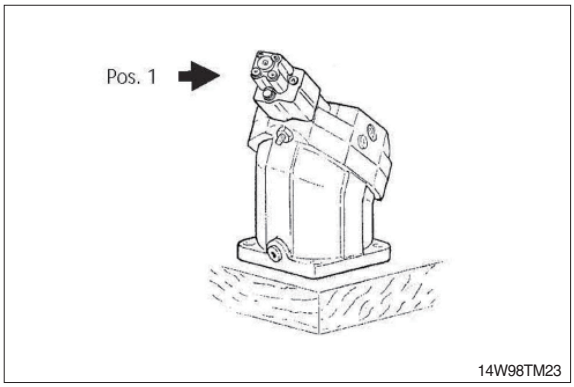


5) SEALING OF THE CONTROL PARTS



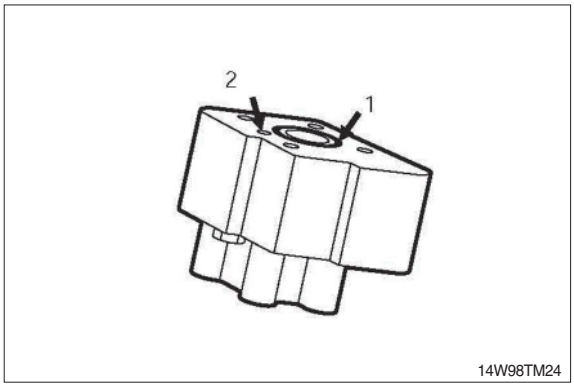
(1) Disassembly position

Remove cover pos.1.

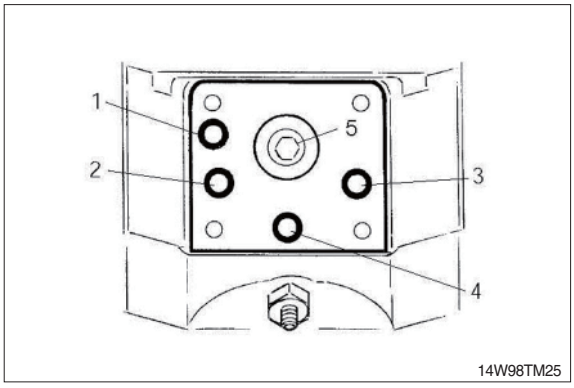


1 O-ring
2 Input flow of oil control

※ Installation position differs according to the control components.

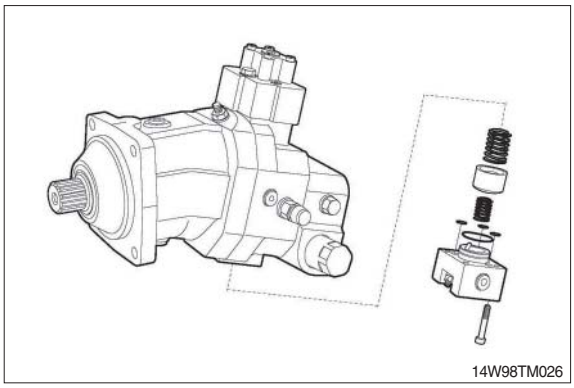


1 Input flow of oil control
2 High pressure / Low pressure
3 High pressure / Low pressure
4 Leakage oil
5 Control piston

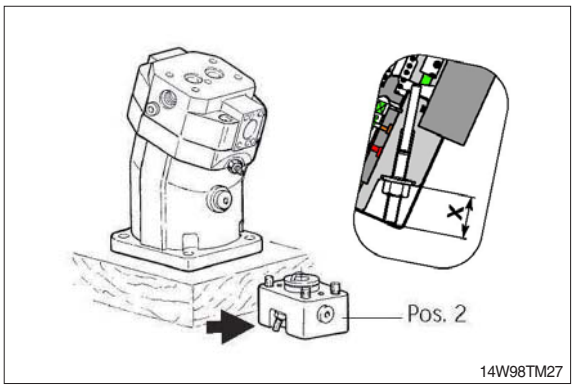


(2) Disassembly position : Remove cover 2.

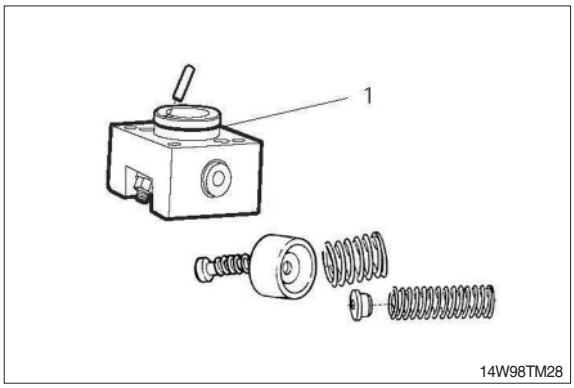
※ Attention spring load.



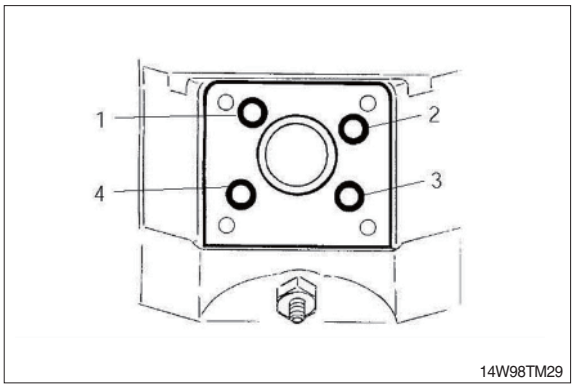
※ Dimension X : Note dimension (begin of regulation)



1 Check of O-ring

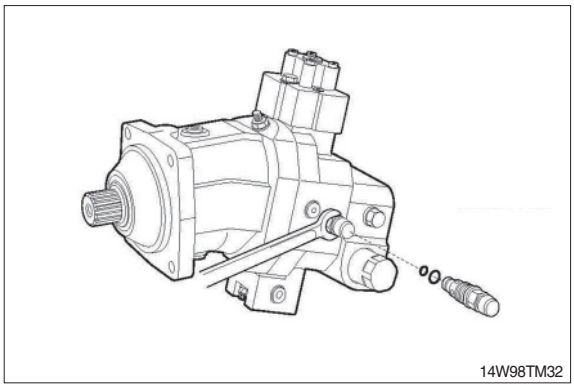


1 O-ring / High pressure-small control position side
2 O-ring / Control pressure
3 O-ring / High pressure-check valve
4 O-ring / High pressure-check valve

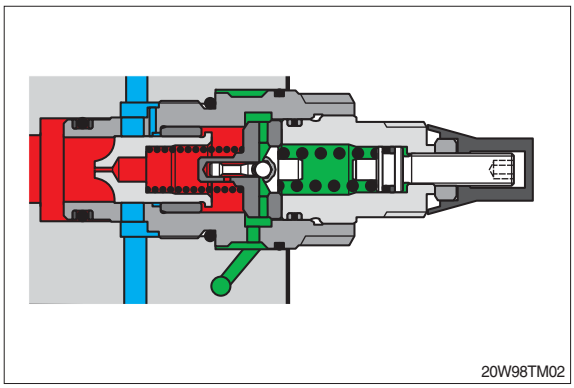


6) SEALING OF THE RELIEF VALVE / COUNTER BALANCE VALVE

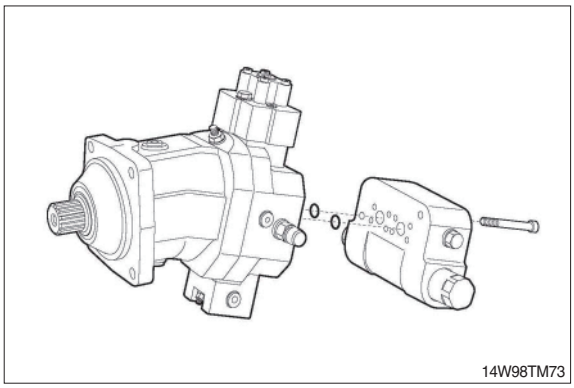
(1) Remove relief valve.



(2) Inspect
O-ring



(3) Remove counter-balance valve.
Inspect
O-ring



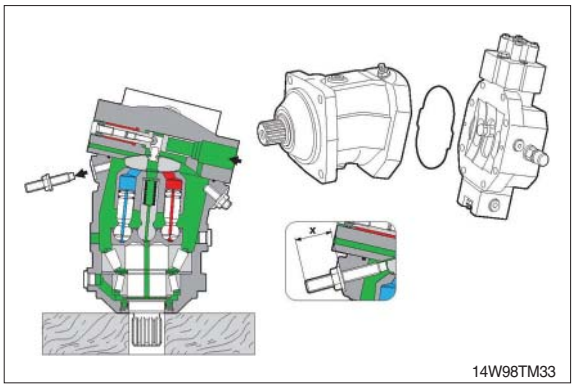
7) DISASSEMBLY OF THE PORT PLATE

· Note dimension X

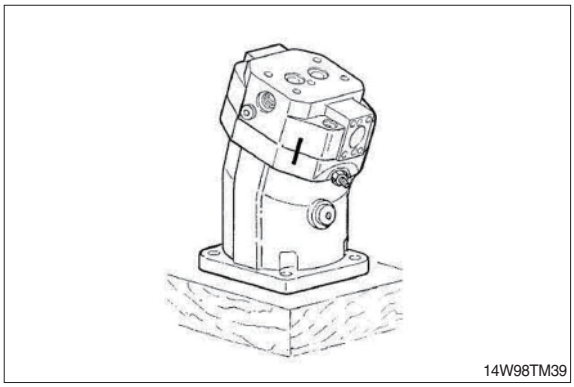
· Remove Q_{min} screw

· Swivel rotary group to zero P

※ For disassembly of the port plate, swivel always rotary group to zero position. Piston rings to hang out of the cylinder boring.

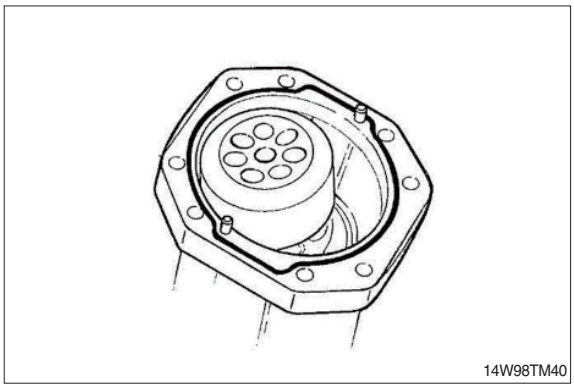


(1) Port plate.
Mark position. Loosen screws.
Removal.

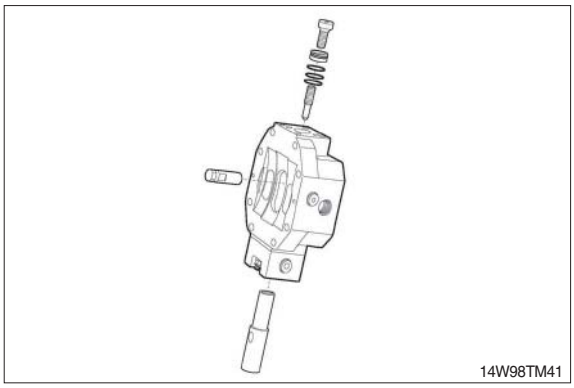


(2) Check O-ring.

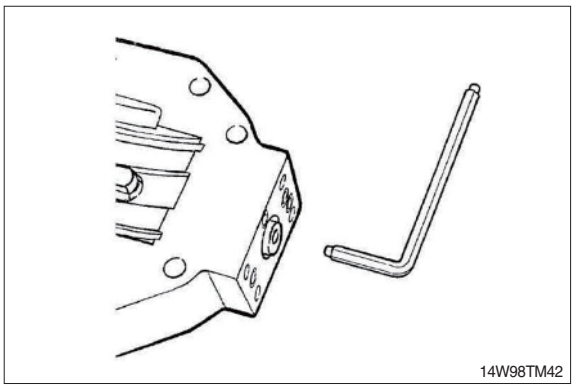
※ Stick new O-ring with some grease.
Do not swivel rotary group.
Piston rings to hang out from the cylinder boring.



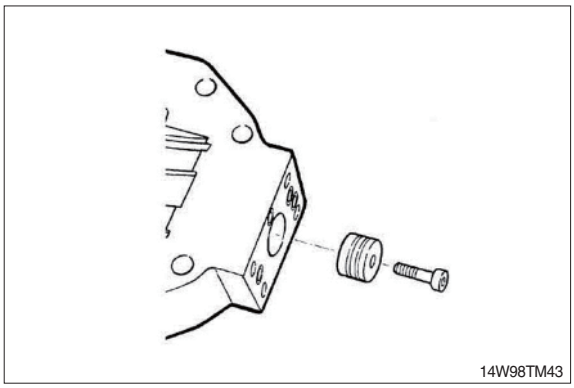
8) REMOVE OF THE POSITIONING PISTON



(1) Loosen fixing screw.
Use only socket wrench.

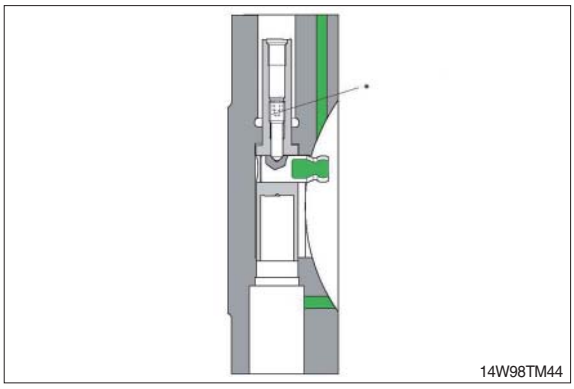


(2) Remove piston with piston ring.

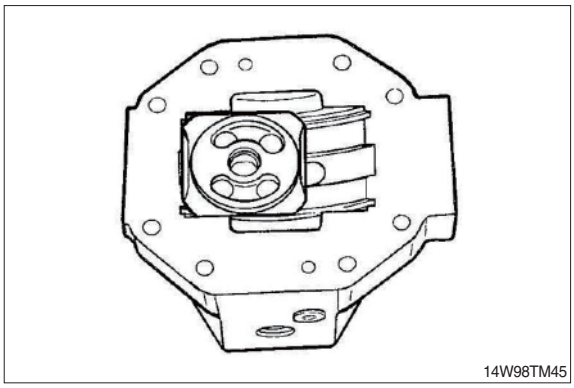


(3) Warm up fixation screw * for positioning plug via boring (screw glued-to turn out).

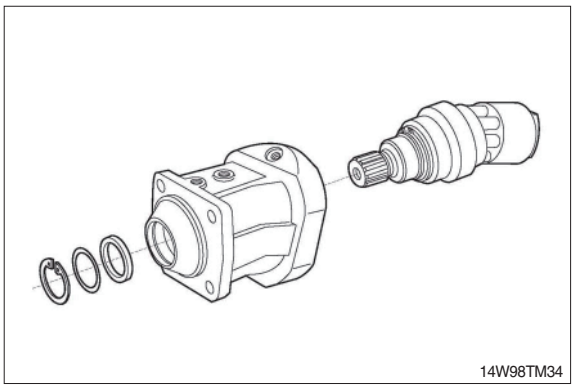
※ Use new screw.
Precote coating.
Note tightening torque.



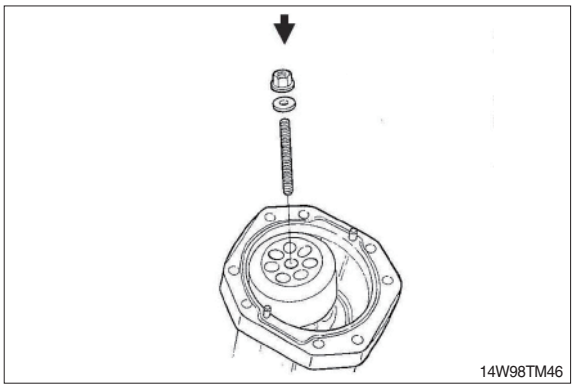
※ Stick control lens in sliding surface with grease. Assembly in reversal order. Mount port plate.
※ Rotary group vertical.


14W98TM45

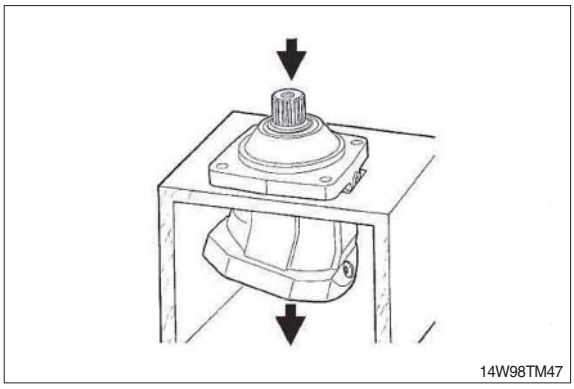
9) REMOVE ROTARY GROUP


14W98TM34

(1) Screw in threaded pin into center pin. Fix the cylinder with disc and locknut. M8×105 ℓ

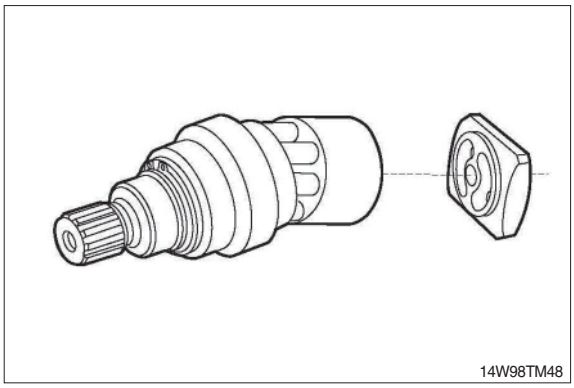

14W98TM46

(2) Press out rotary group.
※ If the bearings are used again do not hit on the drive shaft.

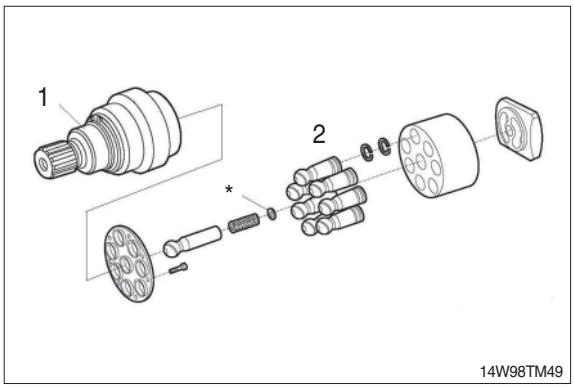

14W98TM47

10) EXCHANGING OF THE ROTARY GROUP

※ Complete rotary group
Setting of hydraulic part necessary.

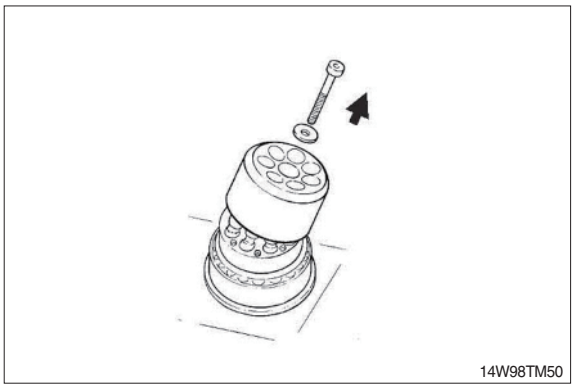

14W98TM48

Rotary group
1 Mechanical part : Adjust drive shaft with bearing
2 Hydraulic part : Adjustment necessary

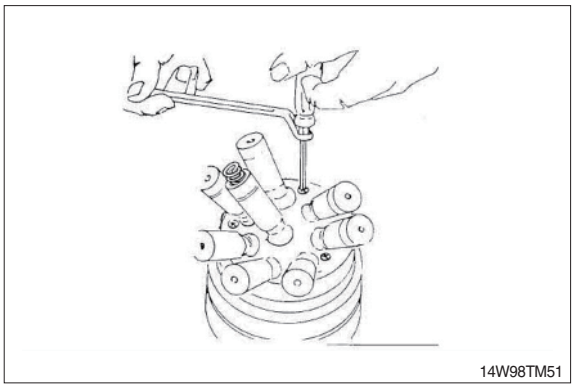


14W98TM49

(1) Remove fixing screw (cylinder).
Remove cylinder.

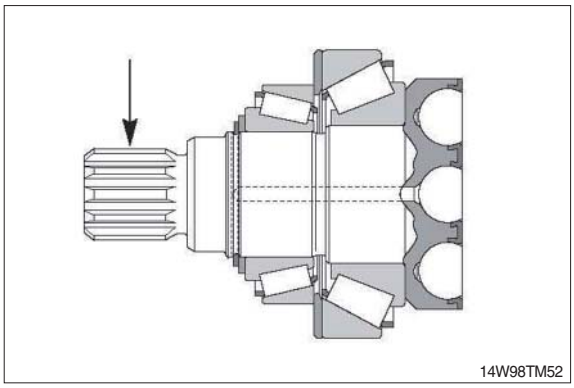

14W98TM50

(2) Disassemble retaining plate.
※ Screws are glued.
Use Torx tools.


14W98TM51

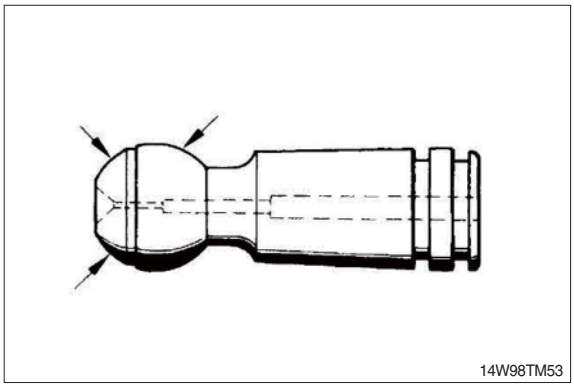
11) INSPECTION INSTRUCTIONS

(1) Free of corrosion, erosion or fretting; No damage to splines or keyways.



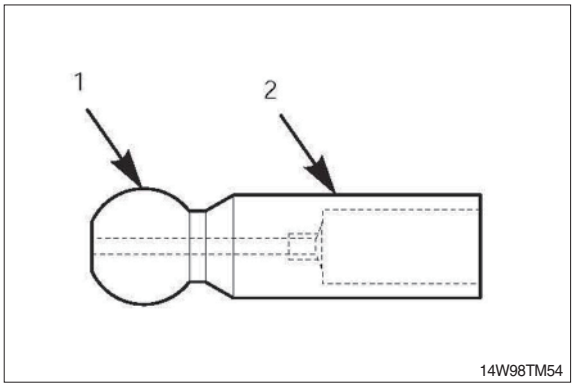
(2) Pistons

No scoring and no pittings.



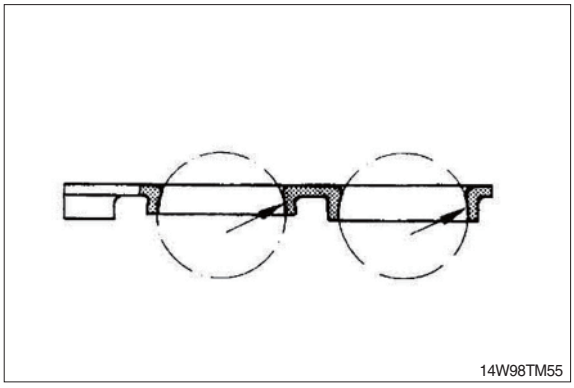
(3) Center pin

No scoring and no pittings.



(4) Retaining plate

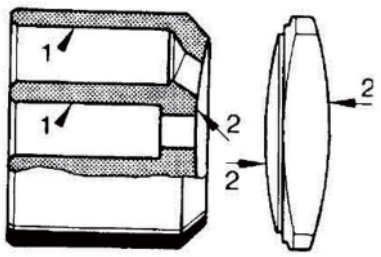
No scoring and no evidence of wear.



(5) Cylinder block / Control lens

1 Bores free of scoring, no evidence of wear

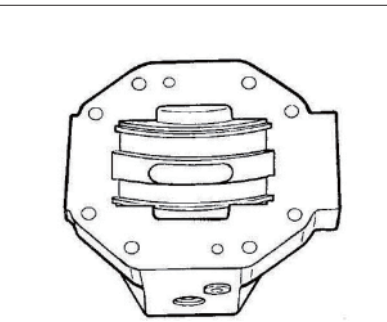
2 Faces smooth and even, free of cracks and scoring



14W98TM56

(6) Control housing

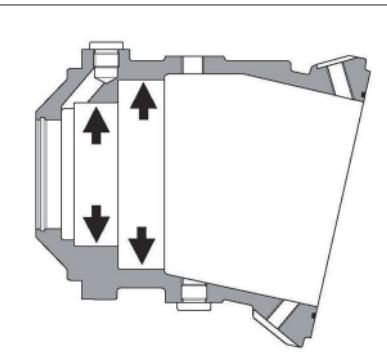
Sliding surface and side guides free of scoring and no wear.



14W98TM57

(7) Visual check

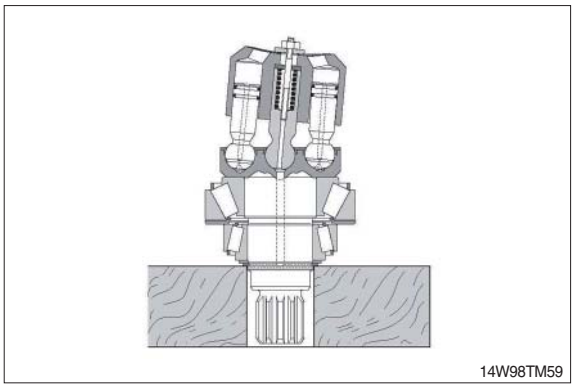
Bearing areas free of scoring and no evidence of wear.



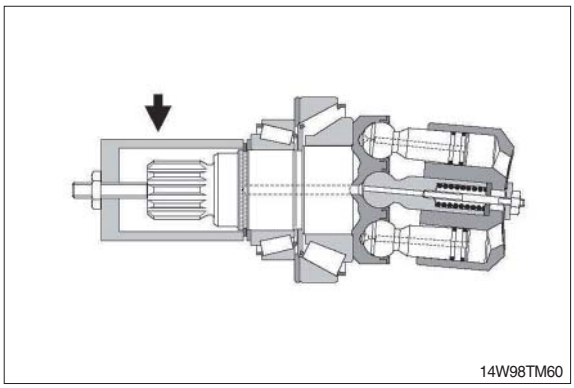
14W98TM58

12) ROTARY GROUP ASSEMBLY

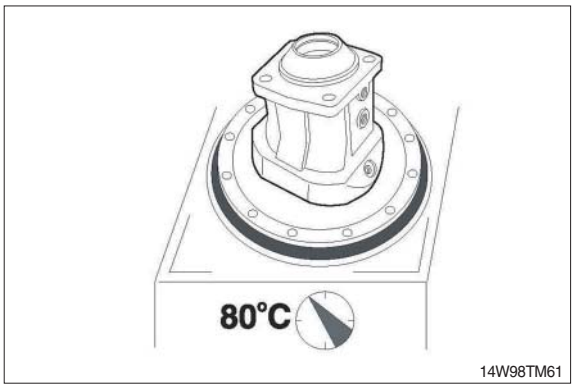
(1) Rotary group completely assembled ready for assembly.



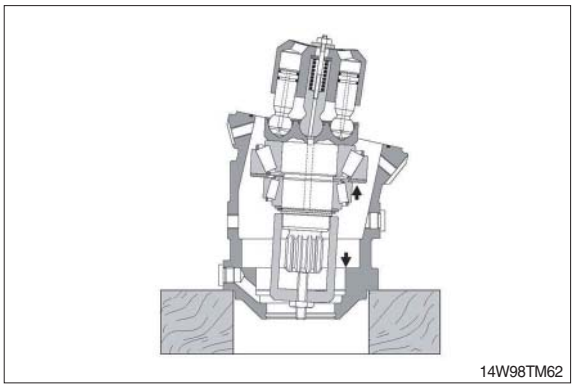
(2) Place assembly sleeve.



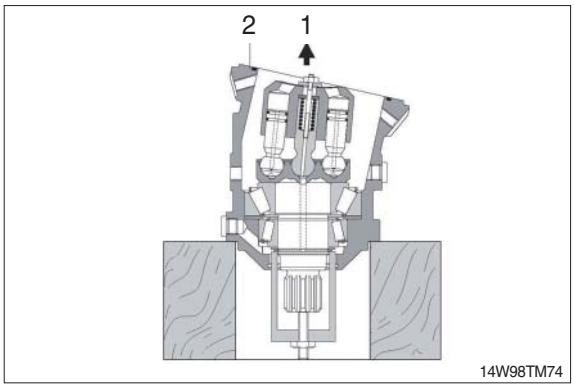
(3) Warm up housing to 80˚C.



(4) Insert rotary group into housing to seat position.

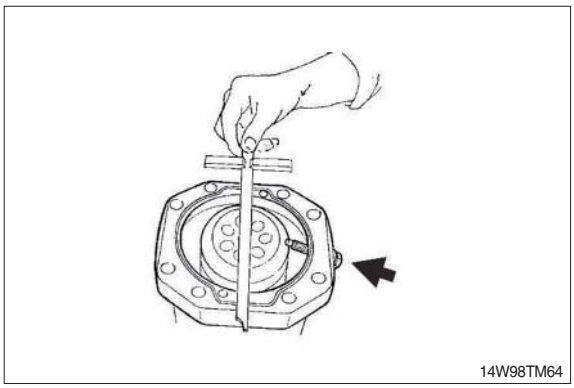


(5) Fix zero position of cylinder with Q_{max} screw.
1 Disassemble cylinder fixing screw
2 Insert O-ring

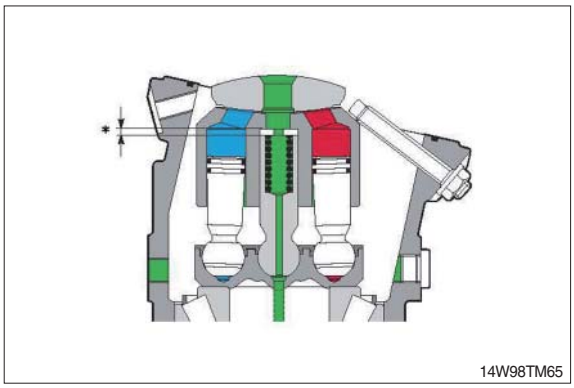


13) ROTARY GROUP ADJUSTMENT

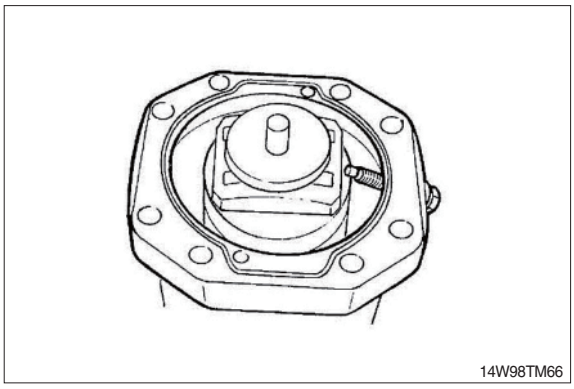
(1) Determine cylinder swivel range to max angle with screw.



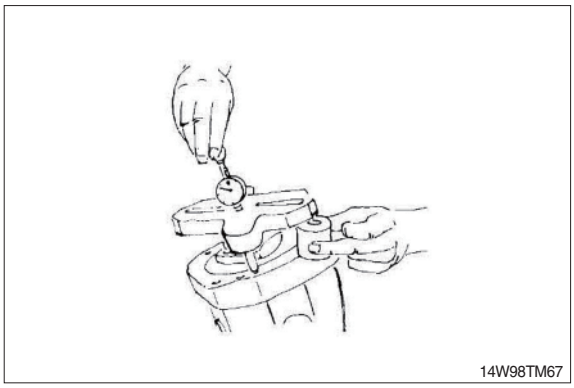
(2) * Disc



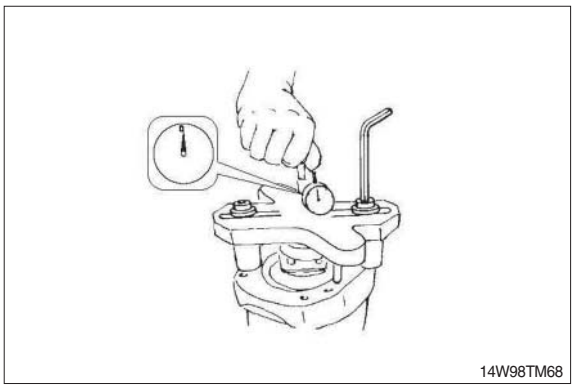
(3) Place centering disc.



(4) Mount measuring device.



(5) Check dimension X.



14) ASSEMBLY OF THE PORT PLATE

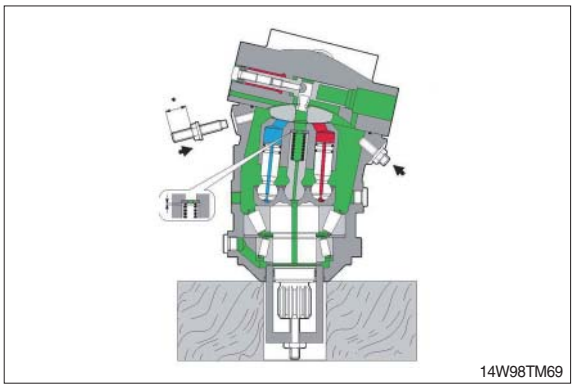
(1) Assemble port plate.

※ Take care of assembly design.
Tighten fixing screws with torque.

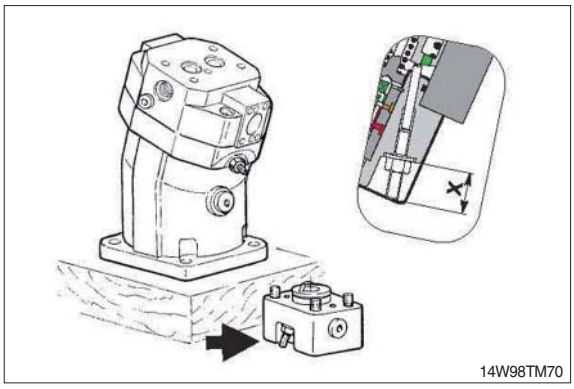
(2) Set Q_{min} screw to dimension(*).

(3) Assemble plug.

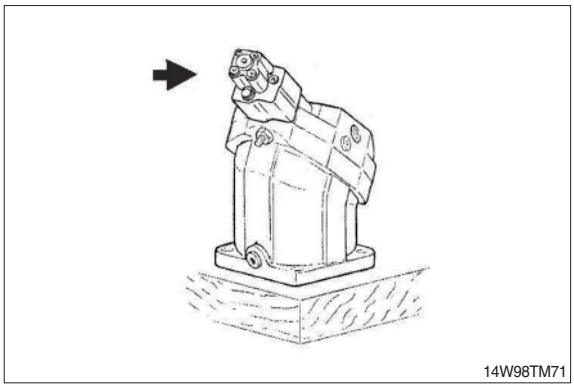
(4) Remove assembly sleeve.



(5) Assemble control components.

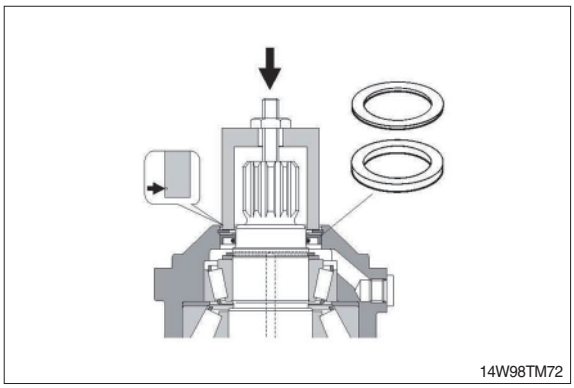


(6) Assemble cover.

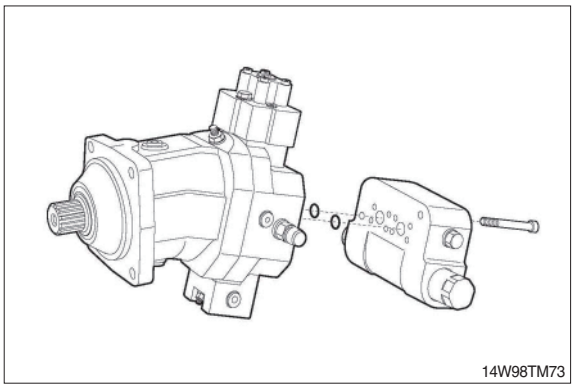


(7) Assemble shaft seal, disc and safety ring.
Press in with assembly sleeve.

※ 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.

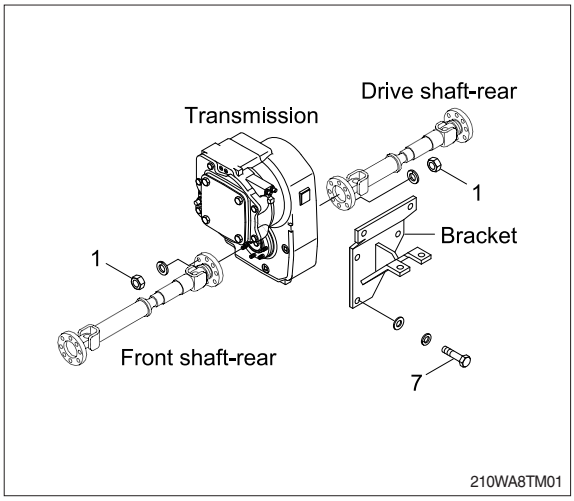
(4) Loosen the mounting bolt (5) and remove the transmission guard.
- Tightening torque : 29.7±4.5 kgf · m (215±32.5 lbf · ft)

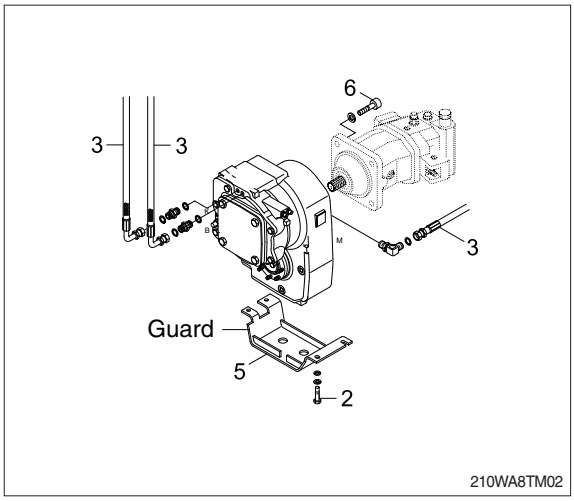
(5) Remove the propeller shaft mounting nuts (1).
- Tightening torque : 5.9±0.6 kgf · m (42.7±4.3 lbf · ft)

(6) Remove the travel motor mounting bolt (2).
- Tightening torque : 35.6±7.1 kgf · m (257±51.4 lbf · ft)

(7) Remove the hoses (3).
Fit blind plugs to the disconnected hoses.

(8) Remove the mounting bolts (4), then remove the transmission device assembly.
- Weight : 135 kg (298 lb)
- Tightening torque : 44±2.0 kgf · m (318±14.5 lbf · ft)





2) INSTALL

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

(2) Bleed the air from the transmission.
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. GENERAL INSTRUCTIONS

1) GENERAL WORKING INSTRUCTIONS

(1) This manual has been developed for the skilled serviceman, trained by manufacturer.

(2) During all operations, pay attention to cleanliness and skilled working.
Therefore,transmission removed from the machine must be cleaned prior to open them.

(3) We assume that the special tools, specified by manufacturer, will be used.
The special tools are available from manufacturer.

(4) After the disassembly, all components must be cleaned, especially corners, cavities and recesses of housing and covers.

(5) The old sealing compound must be carefully removed.

(6) Check lubricating holes, grooves and pipes for free passage. They must be free of residues, foreign material or protective compounds.

(7) The latter refers especially to new parts.

(8) Parts which have been inevitably damaged in a disassembly operation, must be generally replaced by new ones, e.g. rotary seal rings, O-rings, U-section rings, cap boots, protective caps etc..

(9) Components such as roller bearings, thrust washers, synchronizing parts etc. which are subject to normal wear in automotive operation, must be checked by the skilled Serviceman.
He will decide if the parts can be reused.

(10) For the heating of bearings etc., hot plates, rod heaters or heating furnaces must be used.

(11) Never heat parts directly with the flame. An auxiliary solution would be to immerse the bearing in a vessel filled with oil, which is then heated with the flame.
In this way, damage to the bearings could be avoided.

(12) Ball bearings, covers, flanges and parts like that must be heated to about 90 to 100˚C.

(13) Hot-mounted parts must be reset after cooling in order to assure a proper contact.

(14) Before pressing shafts, bearings etc. in position, both parts must be lubricated.

(15) During to reassembly, all specified adjustment values, testing specifications and tightening torque must be respected.

(16) After the repair, units are filled up with oil.

(17) After the oil filling, the oil level plugs and oil drain plugs must be tightened to the specified tightening torque.

2) IMPORTANT INSTRUCTIONS CONCERNING THE LABOUR SAFETY

(1) In principle, repairers are themselves responsible for the labour safety.

(2) The observance of all valid safety regulations and legal rules is a precondition to prevent damage to individuals and products during the maintenance and repair operations.

(3) Before starting the work, the repairers have to make themselves familiar with these regulations.

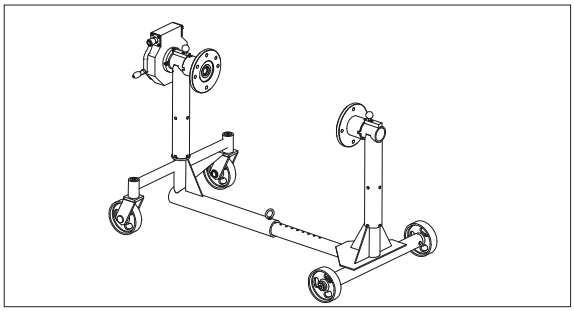
(4) The proper repair of these products requires especially trained personnel.

(5) The repairer himself is obliged to provide for the training.

3. SPECIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

1) Assembly truck assy with tilting device

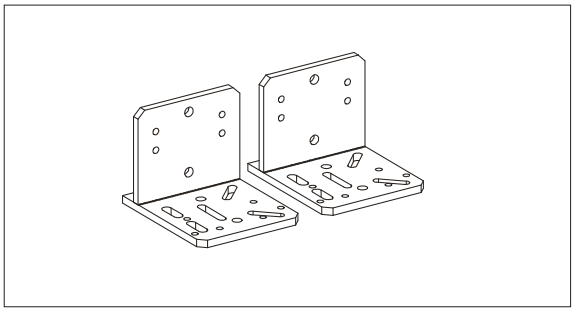
5870 350 000



14WF8TM01

2) Supporting bracket

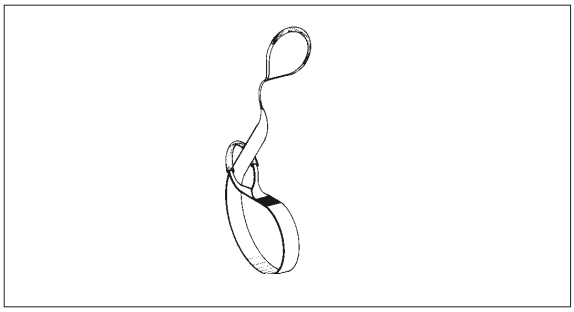
5870 350 106



14WF8TM02

3) Lifting strap

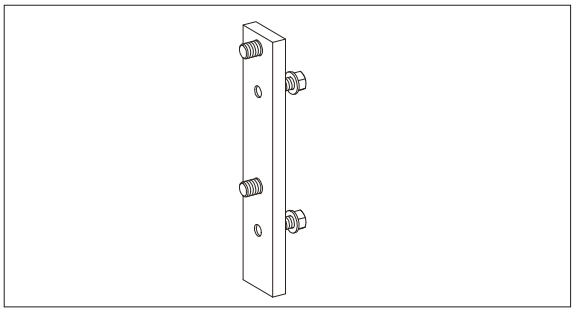
5870 281 026



14WF8TM03

4) Fixture

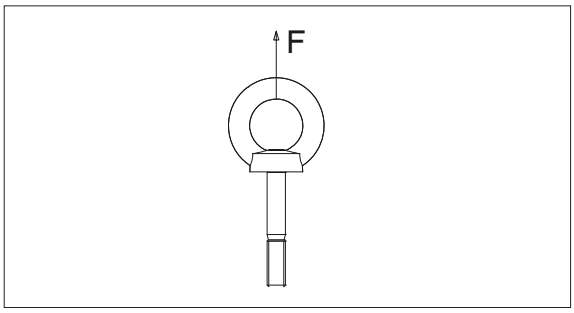
5870 350 079



14WF8TM04

5) Eye bolt assortment

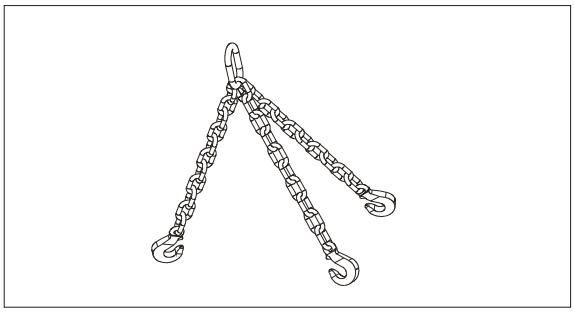
5870 204 002



14WF8TM05

6) Lifting chain

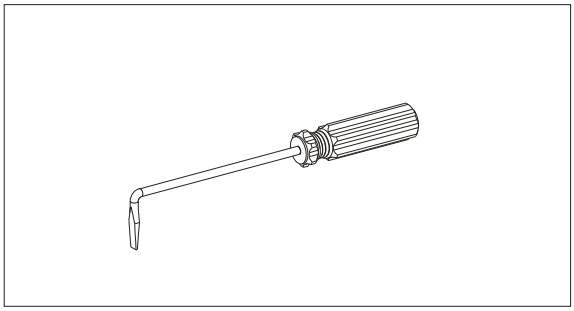
5870 221 047



14WF8TM06

7) Resetting device

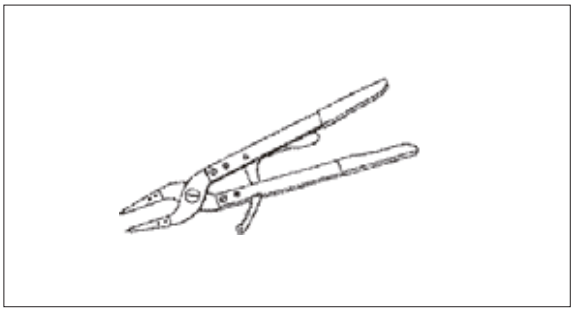
5870 400 001



14WF8TM07

8) Clamping pliers

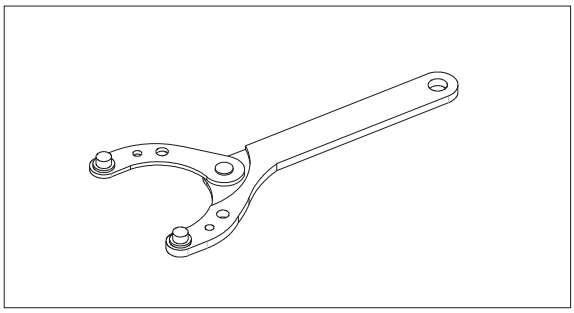
5870 900 021



14WF8TM08

9) Clamping fork

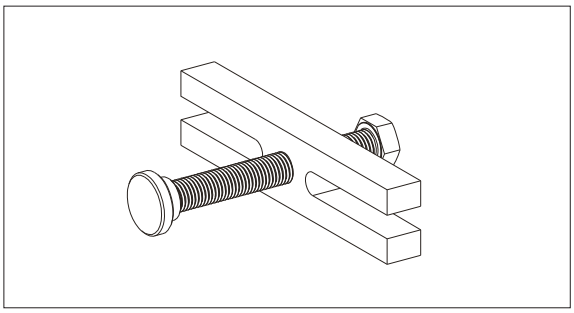
5870 240 025



14WF8TM09

10) Extractor

5870 000 017



14WF8TM10

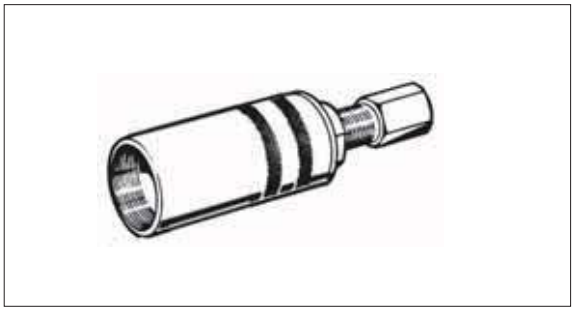
11) Rapid grip

5873 012 021

14WF8TM11

12) Basic tool

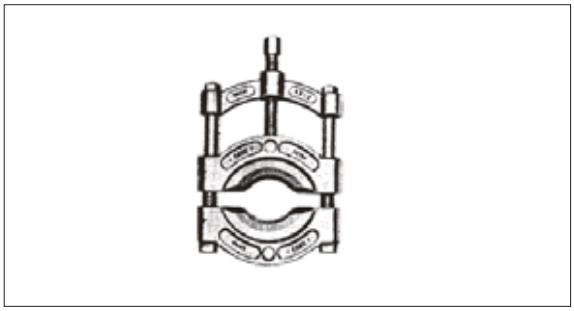
5873 002 001



14WF8TM12

13) Cut-off device

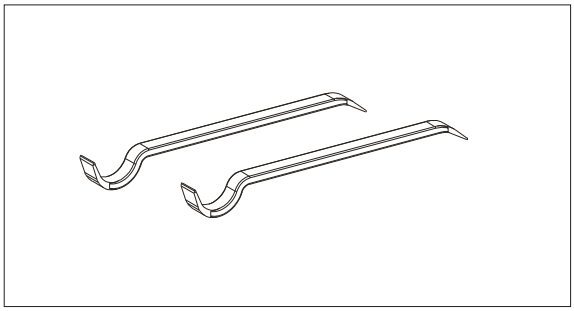
5870 300 028



14WF8TM13

14) Assembly lever

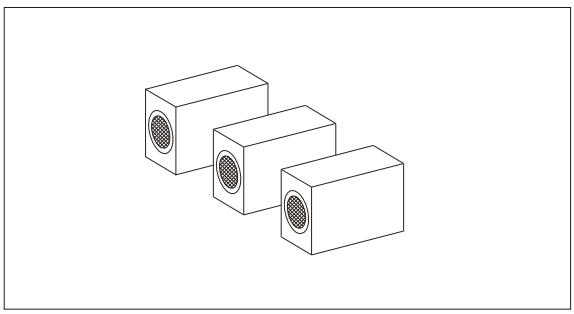
5870 345 036



14WF8TM14

15) Solenoid block

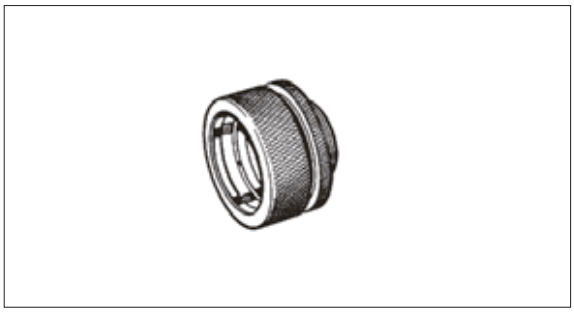
5870 450 003



14WF8TM15

16) Grab sleeve

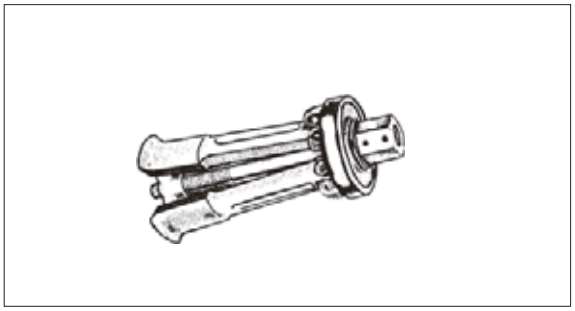
5873 001 037



14WF8TM16

17) Inner extractor

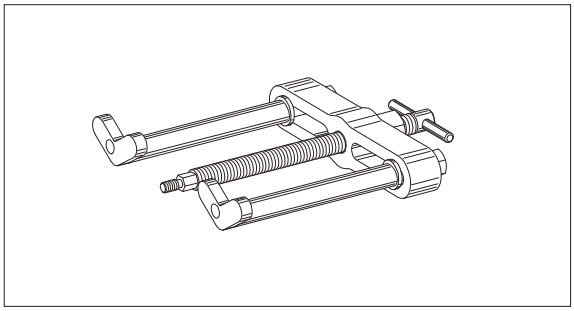
5870 300 019



14WF8TM17

18) Counter support

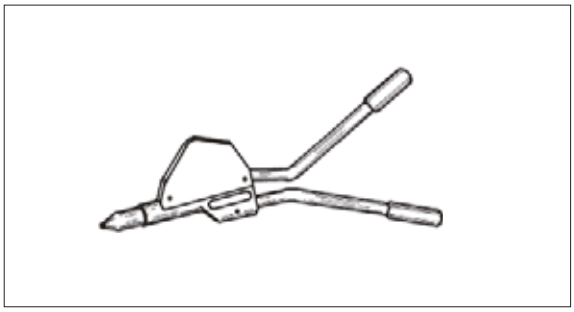
5870 300 020



14WF8TM18

19) Lever riveting tongs

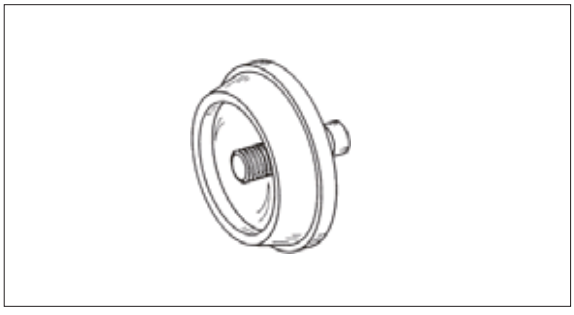
5870 320 016



14WF8TM19

20) Driver tool

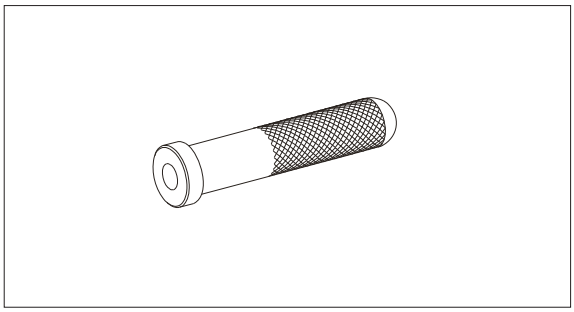
5870 058 073



14WF8TM20

21) Handle

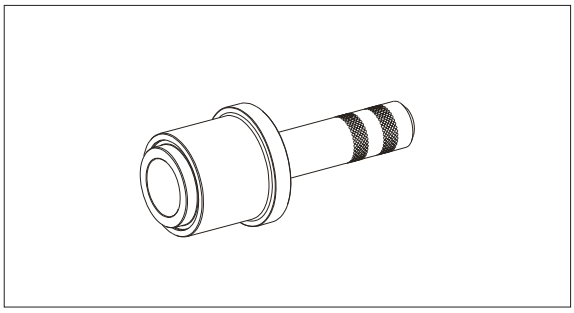
5870 260 002



14WF8TM21

22) Driver tool

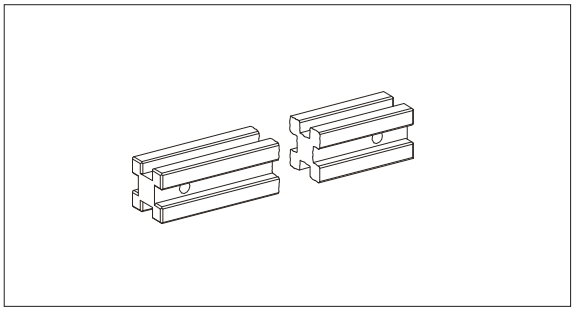
5870 048 281



14WF8TM22

23) Straightedge

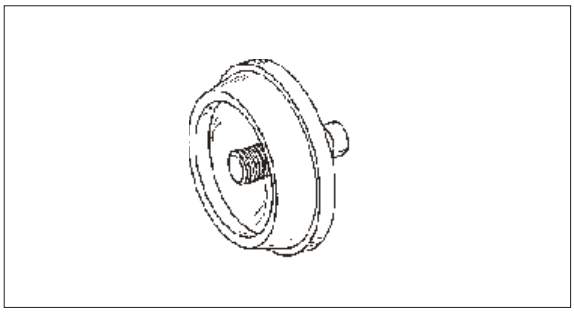
5870 200 108



14WF8TM23

24) Driver tool

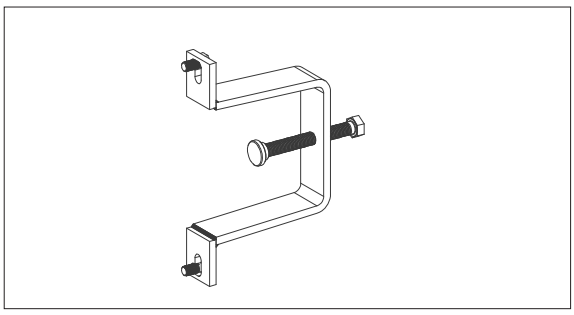
5870 058 078



14WF8TM24

25) Clamping bar

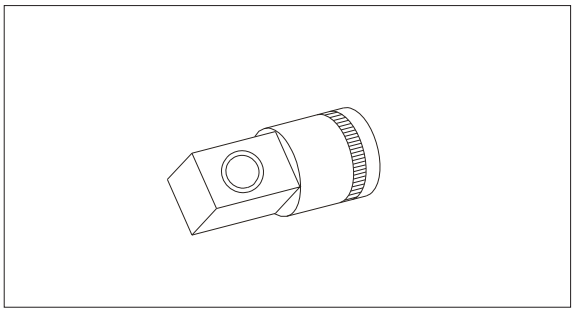
5870 654 049



14WF8TM25

26) Reduction

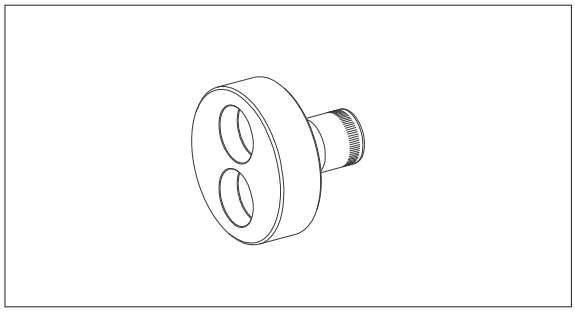
5870 656 056



14WF8TM26

27) Plug insert

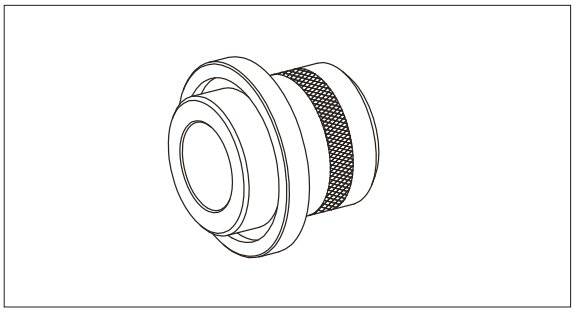
AA00 392 461



14WF8TM27

28) Driver tool

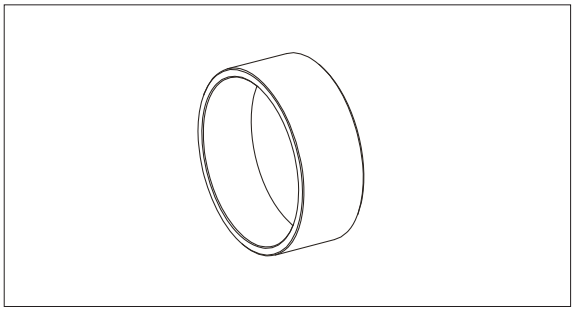
5870 048 279



14WF8TM28

29) Pressure piece

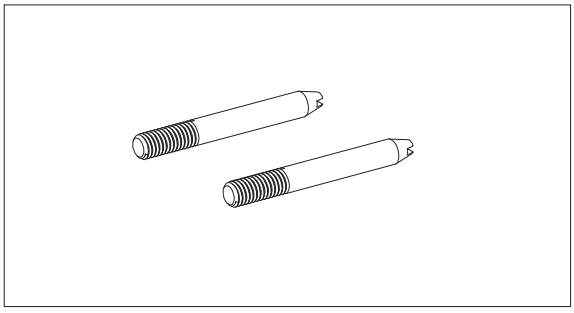
5870 506 150



14WF8TM29

30) Adjusting screws (M12)

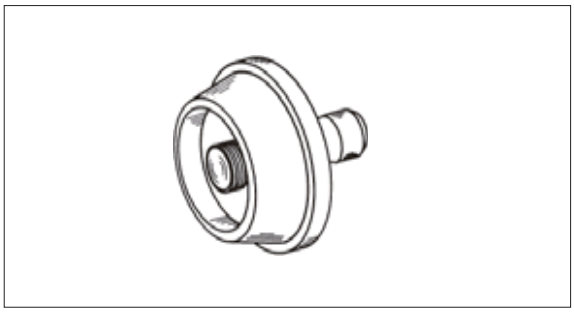
5870 204 021



14WF8TM30

31) Driver tool

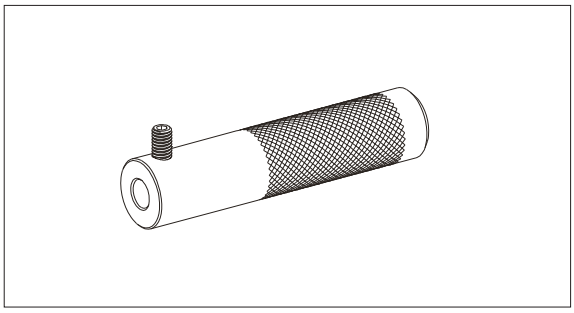
5870 058 051



14WF8TM31

32) Press-fit mandrel

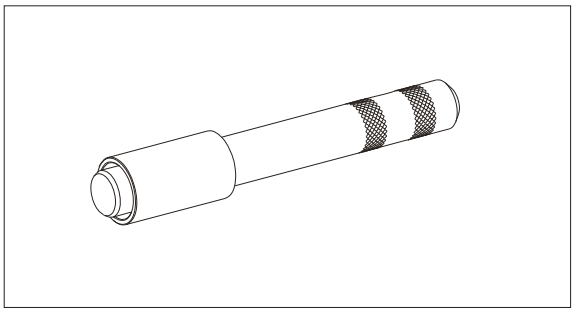
AA00 392 151



14WF8TM32

33) Driver tool

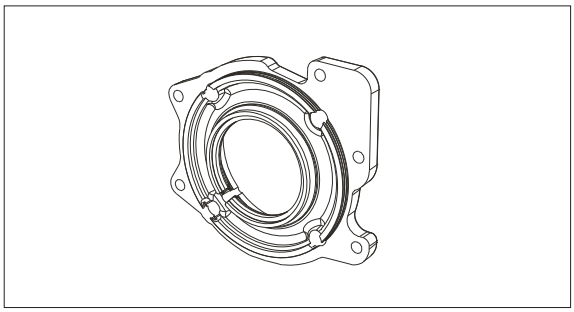
5870 048 283



14WF8TM33

34) Measuring device

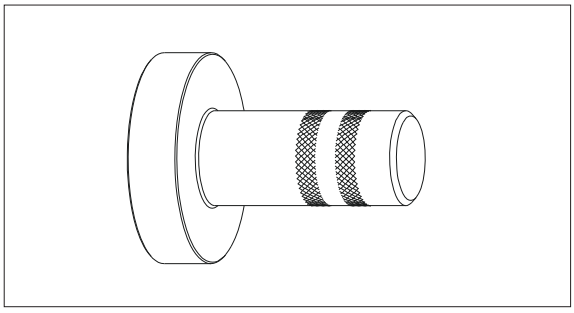
5870 200 131



14WF8TM34

35) Driver tool

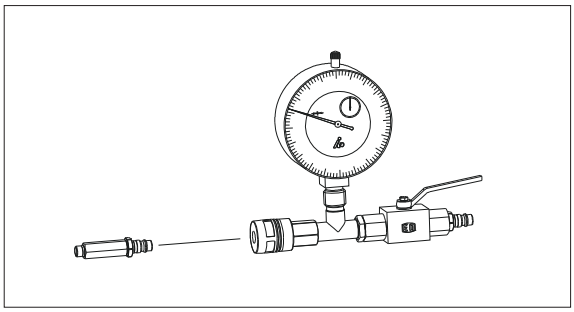
5870 506 161



14WF8TM35

36) Air connection

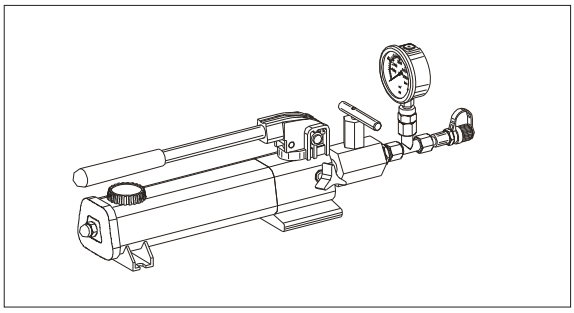
5870 505 012



14WF8TM36

37) HP pump

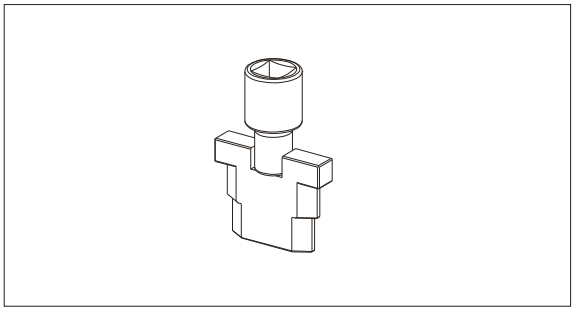
5870 287 007



14WF8TM37

38) Spline mandrel

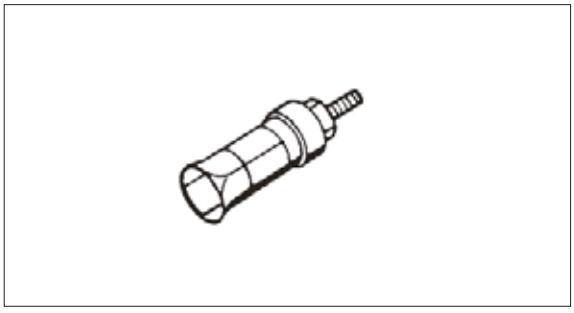
5870 510 039



14WF8TM38

39) Inner extractor

5870 300 012



14WF8TM39

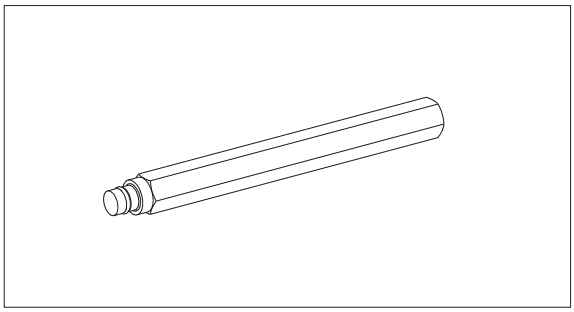
40) Counter support

5870 300 011

14WF8TM40

41) Driver tool

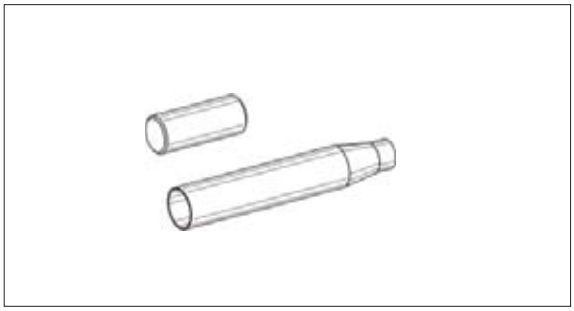
5870 705 003



14WF8TM41

42) Inner installer

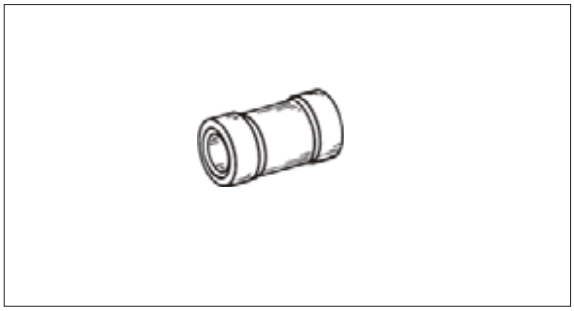
5870 651 055



14WF8TM42

43) Calibrating mandrel

5870 651 056



14WF8TM43

4. COMMERCIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

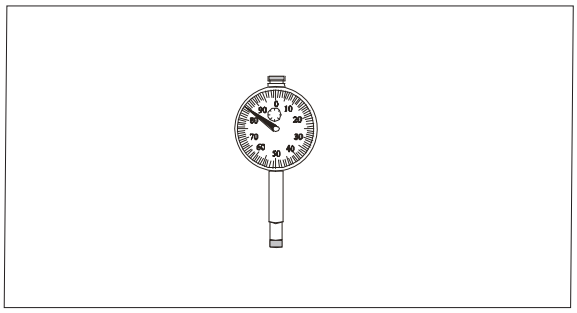
1) Magnetic stand

5870 200 055

14WF8TM44

2) Dial indicator

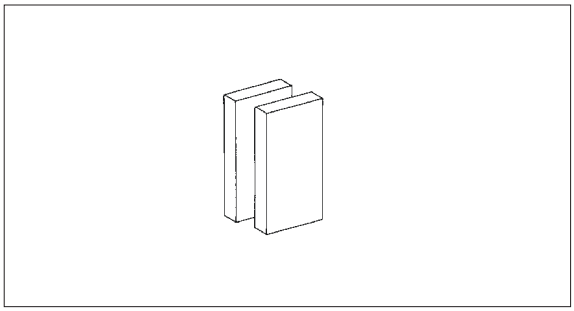
5870 200 057



14WF8TM45

3) Gauge blocks

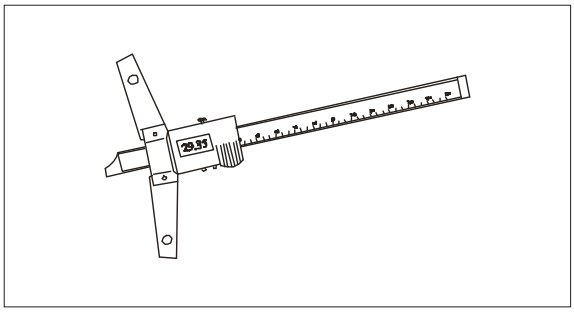
5870 200 066	70 mm
5870 200 067	100 mm



14WF8TM46

4) Digital depth gauge

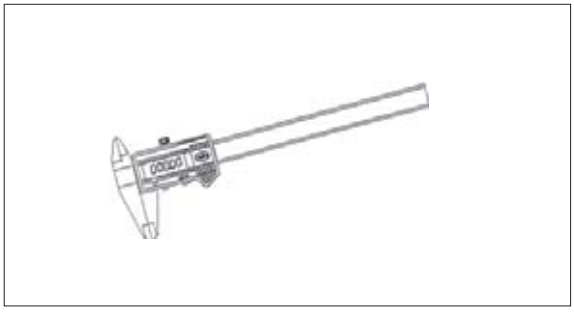
5870 200 072	200 mm
5870 200 114	300 mm



14WF8TM47

5) Digital caliper gauge

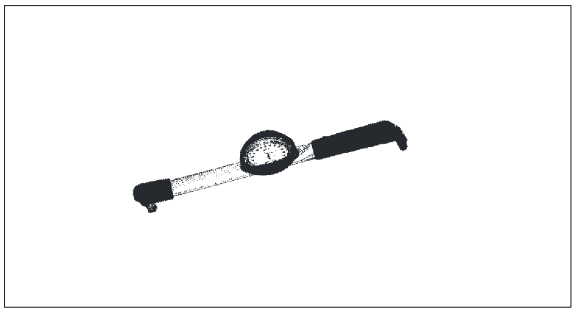
5870 200 109	150 mm



14WF8TM48

6) Torque wrench

5870 203 030	0.6 -6.0 Nm
5870 203 031	1.0 – 12 Nm
5870 203 032	3.0 – 23 Nm
5870 203 033	5.0 – 45 Nm
5870 203 034	10 – 90 Nm
5870 203 039	80 – 400 Nm
5870 203 016	140 – 750 Nm
5870 203 011	750 - 2000 Nm

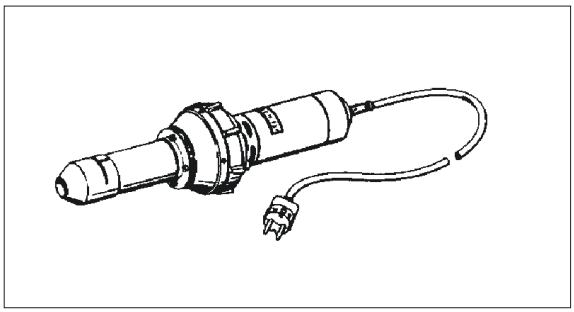


14WF8TM49

14WF8TM50

7) Hot air blower

5870 221 500	230 V
5870 221 501	115 V



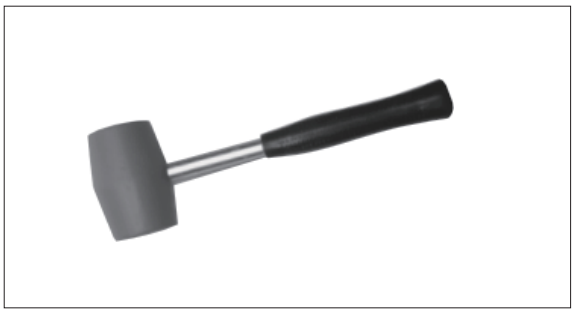
14WF8TM51

8) Plastic hammer

5870 280 004	Ø 60 mm

Substitute nylon insert

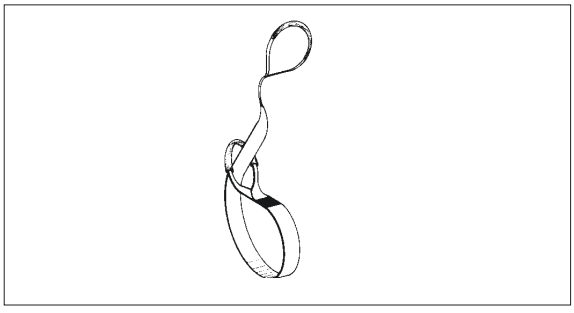
5870 280 006



14WF8TM52

9) Lifting strap

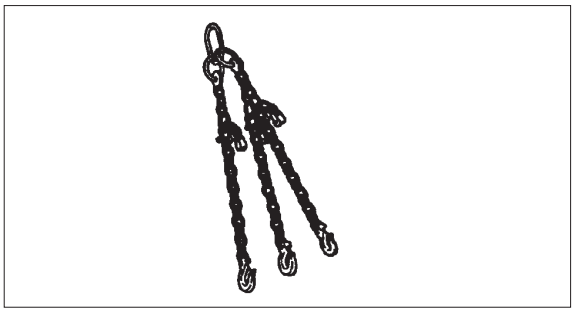
5870 281 026



14WF8TM53

10) Lifting chain

5870 281 047



14WF8TM54

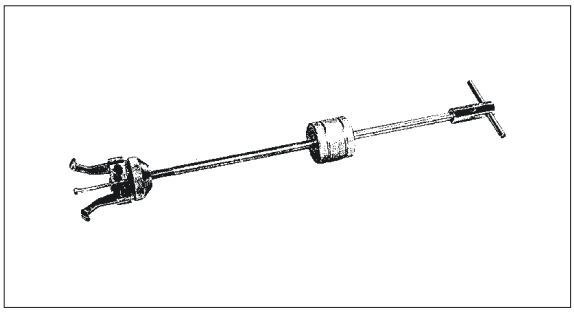
11) Pry bar

5870 345 071

14WF8TM55

12) Striker

5870 650 004



14WF8TM56

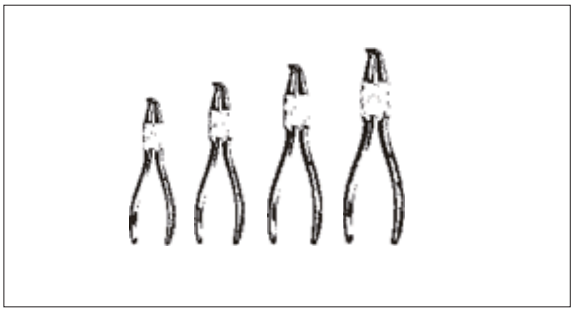
13) Set of internal pliers
I1-I2-I3-I4

5870 900 013

14WF8TM57

14) Set of internal pliers
I11-I21-I31-I41 90˚

5870 900 014



14WF8TM58

15) Set of external pliers
A1-A2-A3-A4

5870 900 015

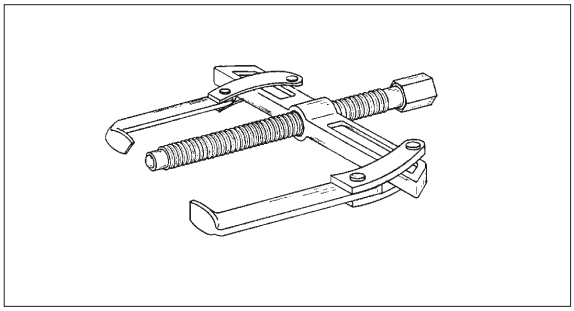
14WF8TM59

16) Set of external pliers
A01-A02-A03-A04 90˚

5870 900 016

14WF8TM60

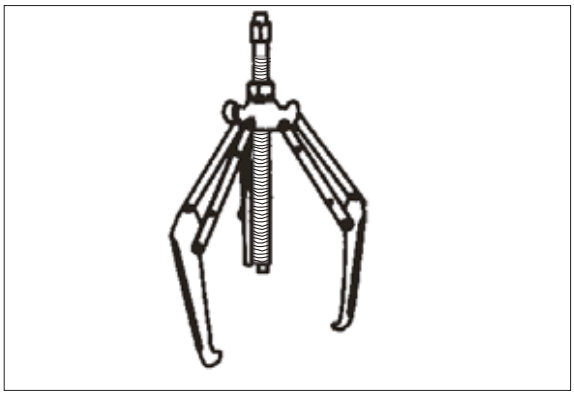
17) Two-armed puller



14WF8TM61

5870 970 001	
Jaw width	80 mm
Throat depth	100 mm
5870 970 002	
Jaw width	120 mm
Throat depth	125 mm
5870 970 003	
Jaw width	170 mm
Throat depth	125 mm
5870 970 004	
Jaw width	200 mm
Throat depth	175 mm
5870 970 006	
Jaw width	350 mm
Throat depth	250 mm
5870 970 007	
Jaw width	520 mm
Throat depth	300 - 500 mm
5870 970 026	
Jaw width	250 mm
Throat depth	200 mm
5870 970 028	
Jaw width	380 mm
Throat depth	200 mm

18) Three armed puller



14WF8TM62

5870 971 001	
Jaw width	85 mm
Throat depth	65 mm
5870 971 002	
Jaw width	130 mm
Throat depth	105 mm
5870 971 003	
Jaw width	230 mm
Throat depth	150 mm
5870 971 004	
Jaw width	295 mm
Throat depth	235 mm
5870 971 005	
Jaw width	390 mm
Throat depth	230 mm
5870 971 006	
Jaw width	640 mm
Throat depth	290 mm

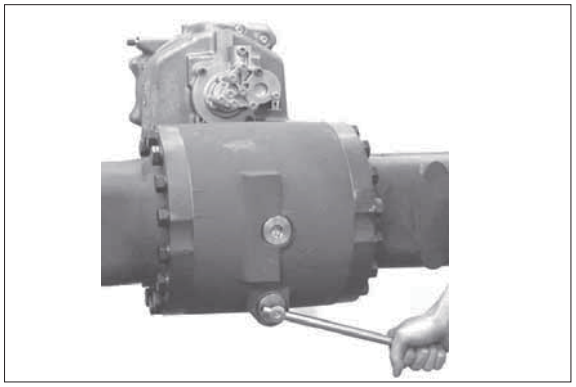
5. SEPARATE TRANSMISSION FROM AXLE HOUSING

(only for version Axle attachment)

1) Drain oil from axle housing – use a suitable oil reservoir.

(S) Assembly truck 5870 350 000
(S) Clamping fork 5870 350 106

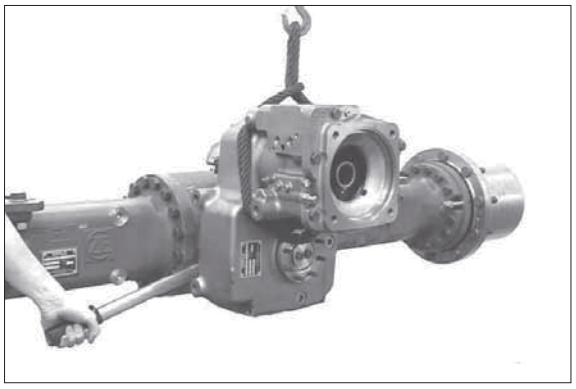
⚠ **Waste oil to be disposed of ecologically.**



14WF8TM63

2) Pick-up Transmission by means of lifting tackle, loosen threaded joint and separate complete Transmission from axle housing.

(S) Lifting strap 5870 281 026

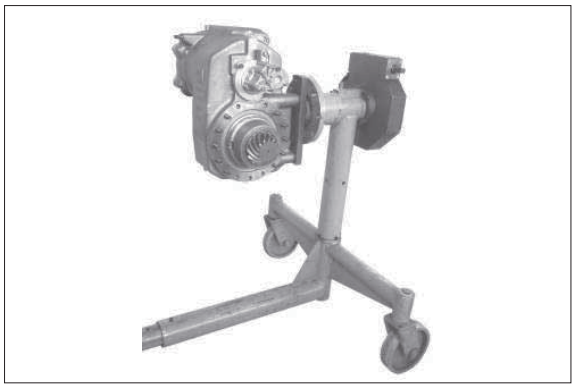


14WF8TM64

6. DISASSEMBLY – BRAKE / CLUTCH / PLANETARY CARRIER

1) Mount transmission to assembly truck.

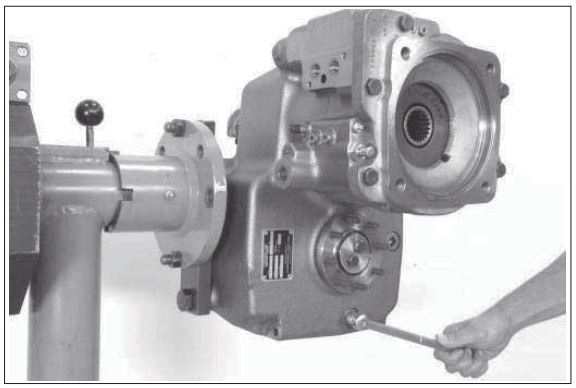
(S) Assembly truck assy. 5870 350 000 (S)
Fixture 5870 350 079



14WF8TM65

2) Loosen screw plug and drain oil – use a suitable oil reservoir.

⚠ **Waste oil to be disposed of ecologically.**

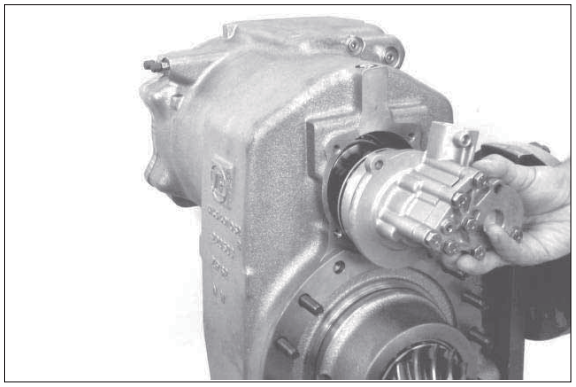


14WF8TM66

Lubrication pump

3) Remove lubrication pump or shift interlock (depending on version, Illustration shows version with Lubrication pump).

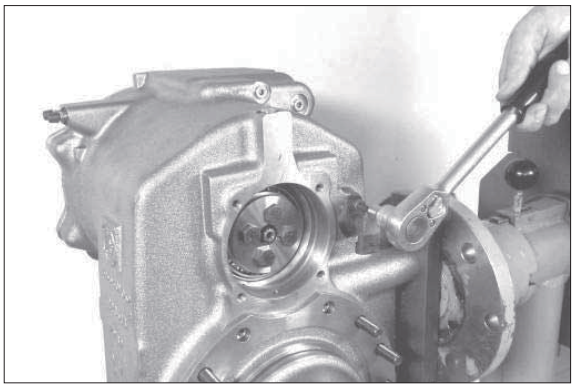
※ Complete disassembly of lubrication pump / shift interlock – see page 8-164.



14WF8TM67

Speed sensor

4) Loosen screw and pull off speed sensor.

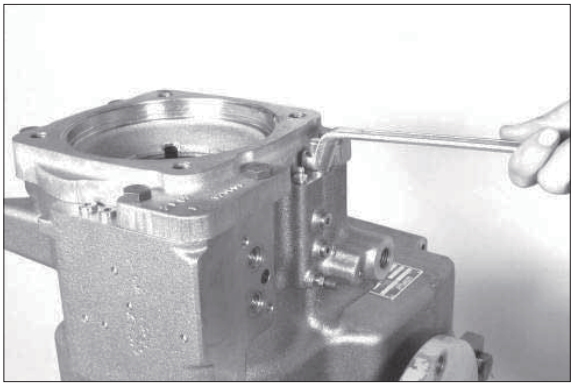


14WF8TM68

Emergency release (Parking brake)

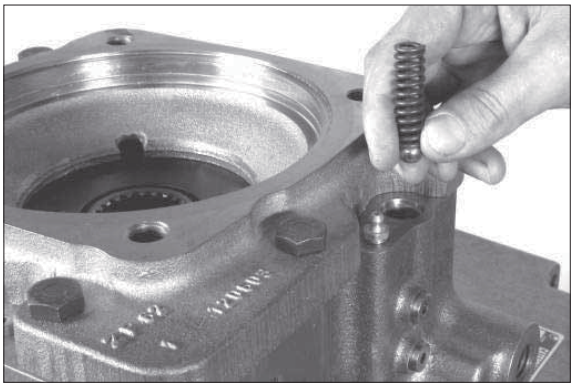
5) Remove breather.
(Illustration 14WF8TM69~14WF8TM72 shows version transmission installation position "Vertical")

※ Position of single connections or breather valves /lubrication nipples etc. as to version transmission installation position Horizontal - see 14WF8TM265.



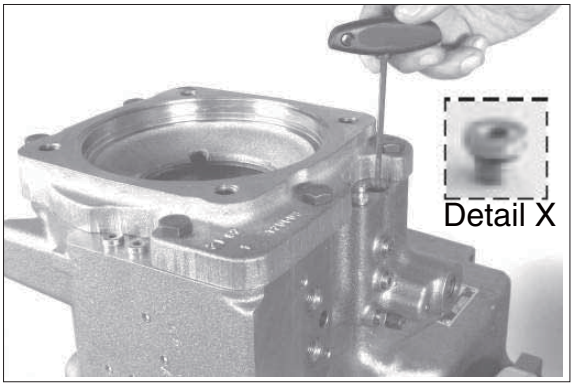
14WF8TM69

6) Remove compression spring and ball.



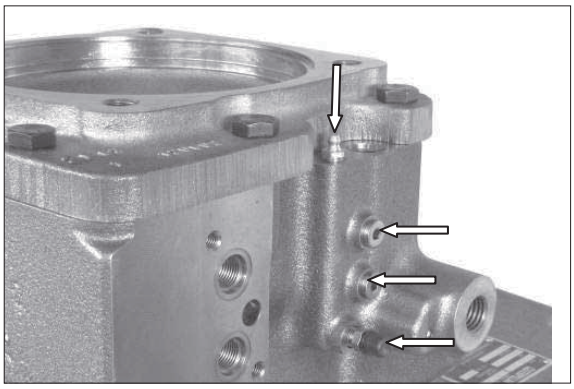
14WF8TM70

7) Remove threaded element (see Detail X) with O-ring from hole.



14WF8TM71

8) Remove lubrication nipple, both screw plugs and breather valve – see arrow.

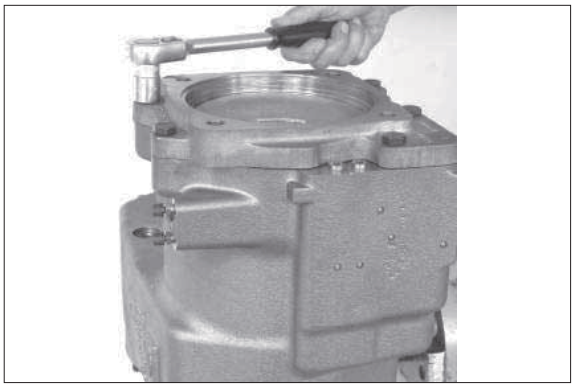


14WF8TM72

Input housing and modulation valve

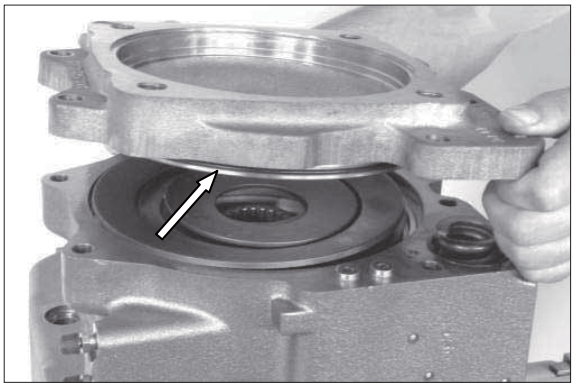
9) Loosen threaded joint of input housing evenly.

※ Input housing is subject to cup spring and compression spring preload.



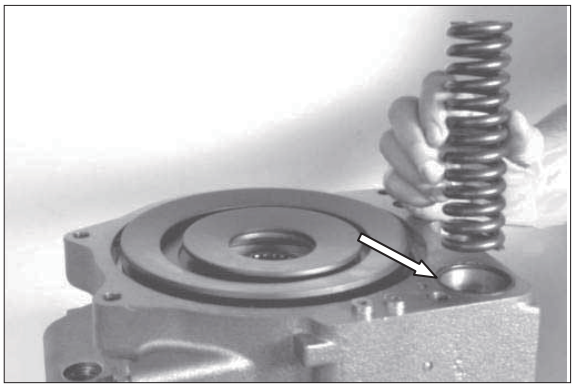
14WF8TM73

10) Take off input housing and remove O-ring (arrow).



14WF8TM74

11) Remove compression spring and O-ring (arrow).



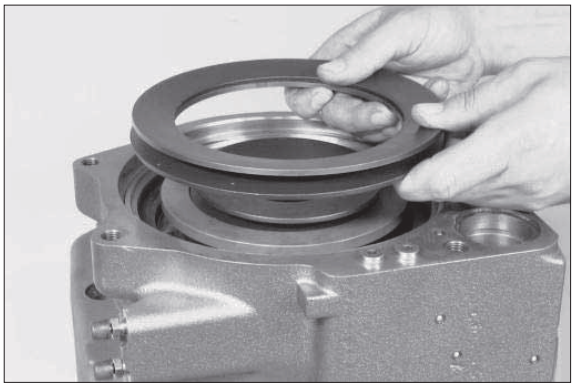
14WF8TM75

12) Pull complete piston out of hole.

14WF8TM76

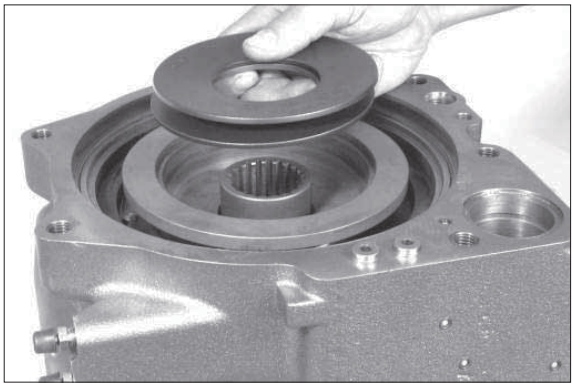
Brake and clutch

13) Remove cup springs from brake.



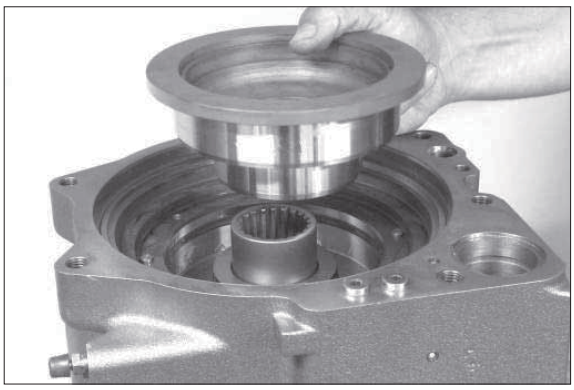
14WF8TM77

14) Remove cup springs from clutch.



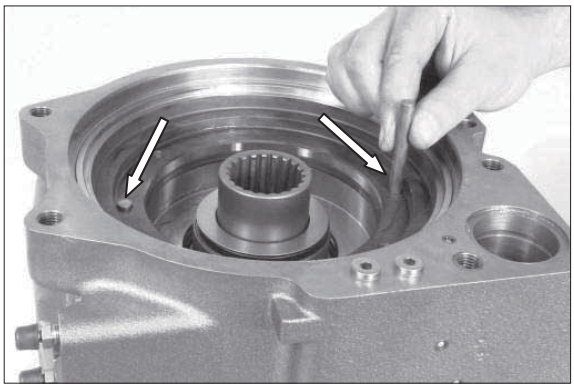
14WF8TM78

15) Remove piston.



14WF8TM79

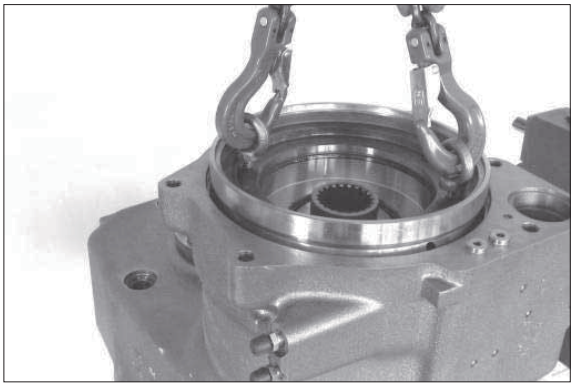
16) Pull off both cyl. pins (arrows).



14WF8TM80

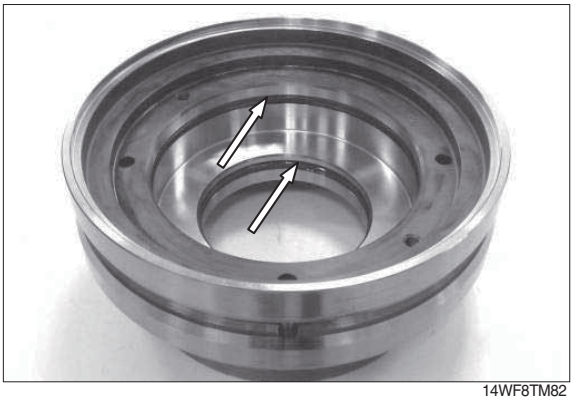
17) Attach 2 (two) eyebolts and pull piston cautiously out of housing – risk of damage.

(S) Eyebolt assortment 5870 204 002
(S) Lifting chain 5870 281 047



14WF8TM81

18) Remove both seals (arrows) from piston.

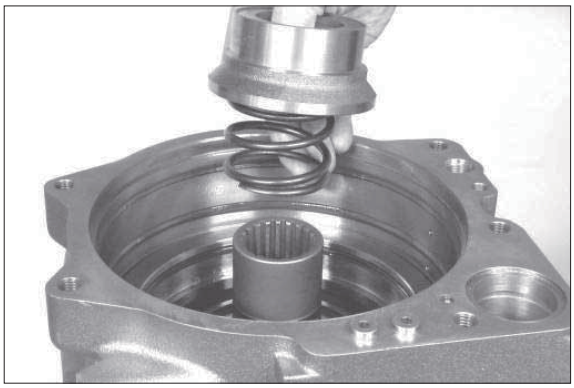


14WF8TM82

19) Remove axial roller cage with both thrust washers.

14WF8TM83

20) Remove pressure piece and compression spring.

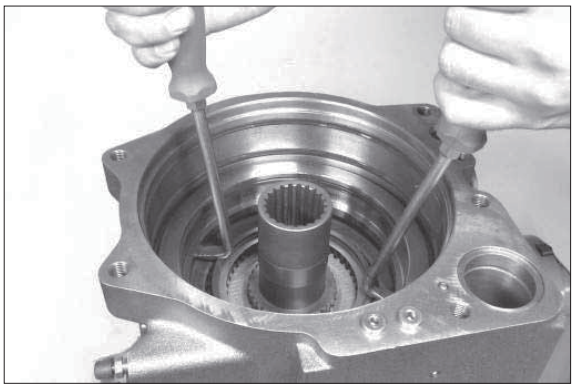


14WF8TM84

21) Remove pressure ring with ring – also see 14WF8TM86 – cautiously with lever – risk of damaging sealing surfaces.

(S) Resetting device 5870 400 001

※ Ring may also remain in housing during disassembly – disassemble ring separately.



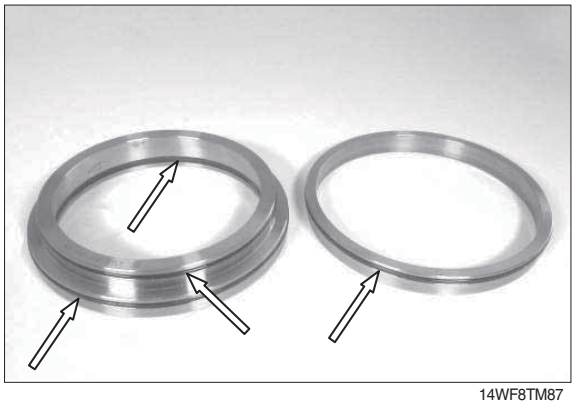
14WF8TM85

22) Remove pressure ring from ring cautiously with lever – risk of damaging sealing surfaces .

(S) Resetting device 5870 400 001

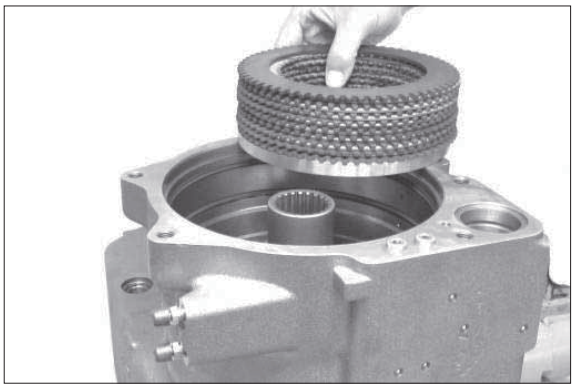
14WF8TM86

23) Remove seal and O-rings (see arrows) from pressure ring and ring.



14WF8TM87

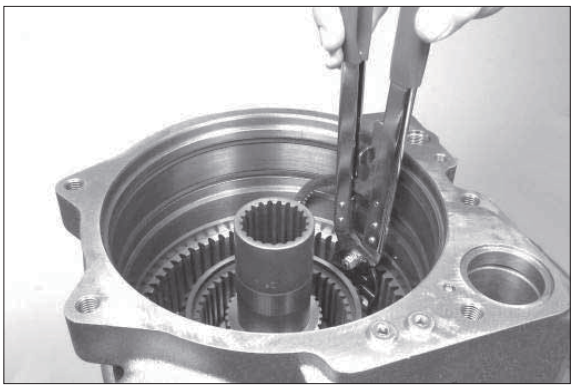
24) Take disk package of brake with end plate(s) out of housing.



14WF8TM88

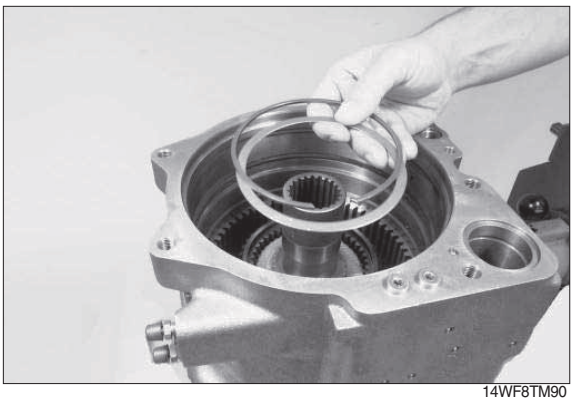
25) Disengage retaining ring.

(S) Clamping pliers 5870 900 021



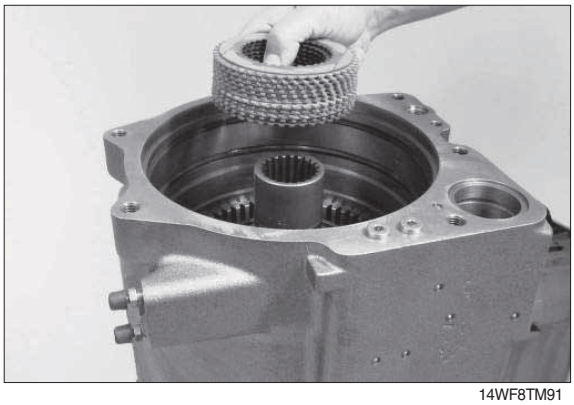
14WF8TM89

26) Remove snap ring and shim.



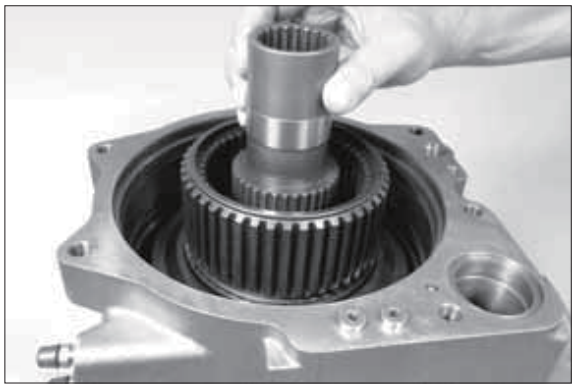
14WF8TM90

27) Take disk package of clutch with end plate(s) out of ring gear.



14WF8TM91

28) Remove cpl. input shaft with ring gear from housing.

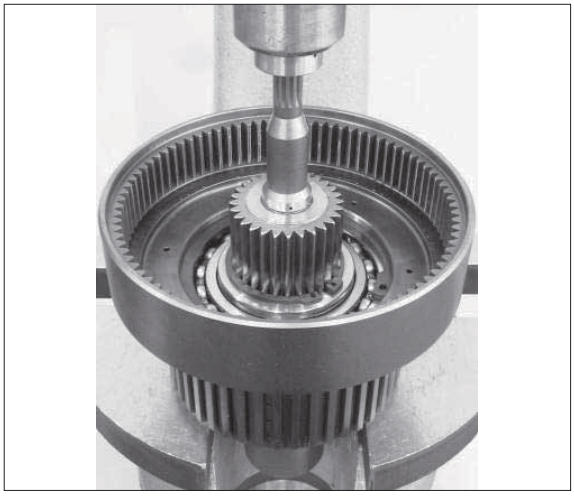


14WF8TM92

29) Unsnap retaining ring.

14WF8TM93

30) Press input shaft out of ball bearing/ring gear.



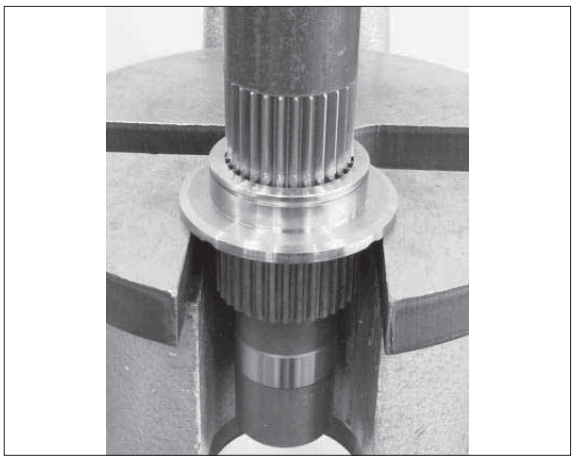
14WF8TM94

31) Unsnap retaining ring.

14WF8TM95

32) Press centering disk from input shaft.

※ In case of extreme press fit – heat centering disk.



14WF8TM96

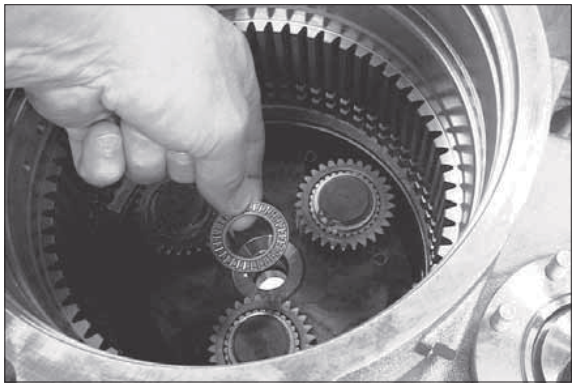
33) Unsnap retaining ring and remove ball bearing.

(S) Clamping pliers 5870 900 021

14WF8TM97

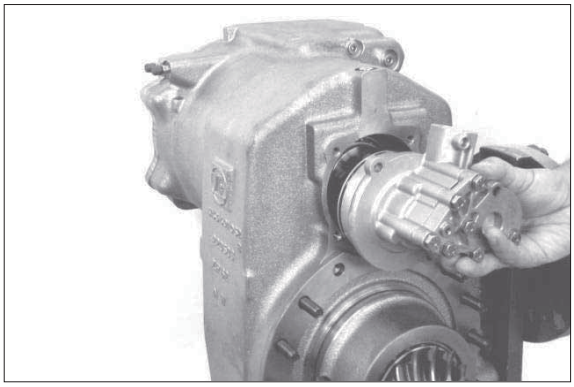
Planetary carrier

34) Remove axial needle cage.



14WF8TM98

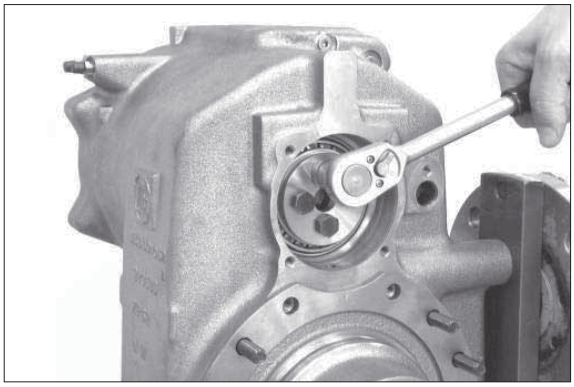
35) If not yet disassembled previously – remove lubrication pump or shift interlock (depending on version).
(Illustration shows version - Lubrication pump).



14WF8TM99

36) Loosen threaded joint and remove disk – fasten output flange by means of clamping fork.

(S) Clamping fork 5870 240 025

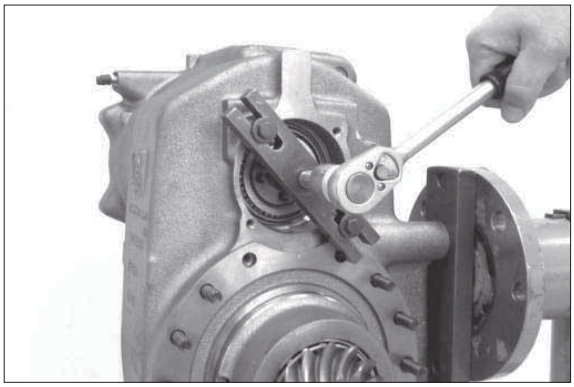


14WF8TM100

37) Press cpl. planetary carrier out of roller bearing.

(S) Extractor 5870 000 017

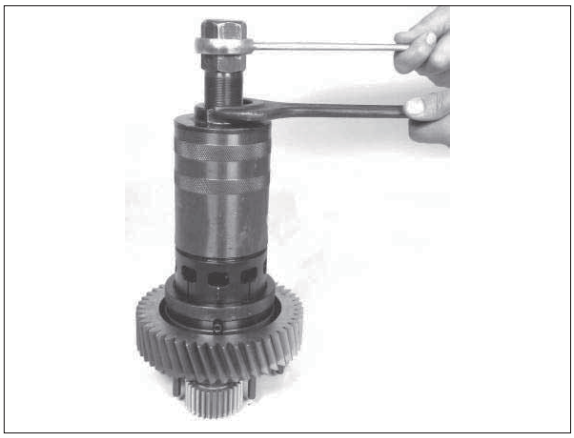
※ Pay attention to releasing planetary carrier and bearing inner ring.



14WF8TM101

38) Pull second bearing inner ring from planetary carrier.

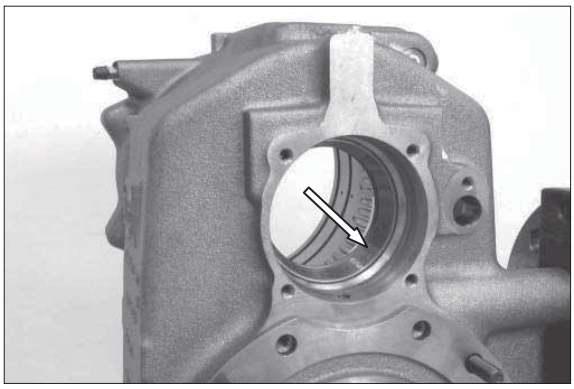
(S) Rapid grip 5873 012 021
(S) Basic tool 5873 002 001



14WF8TM102

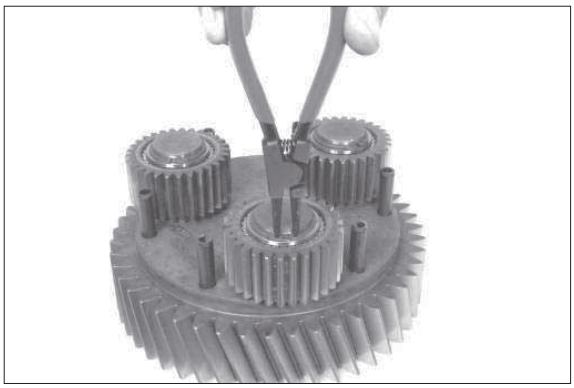
39) If required – force both bearing outer rings (arrow) out of bearing hole.

※ When reusing tapered roller bearings – pay attention to bearing allocation, i.e. respective bearing inner ring to bearing outer ring.



14WF8TM103

40) Unsnap retaining ring.

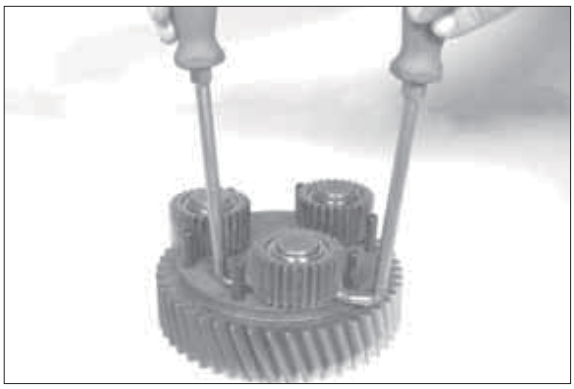


14WF8TM104

41) Lift planetary gear with resetting device – then disassemble with two armed puller .

(S) Resetting device 5870 400 001

※ If necessary, force out slotted pins (6x).

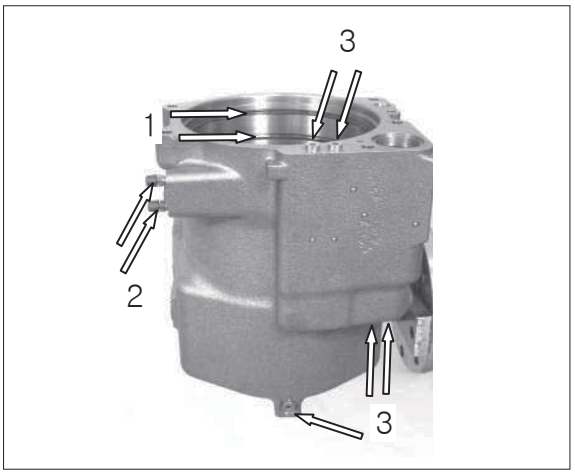


14WF8TM105

42) Remove both seals (1).

Remove breather valves (2) and all screw plugs (3) with seal and O-ring.

※ Illustration shows positions for transmission version Installation position "Vertical".

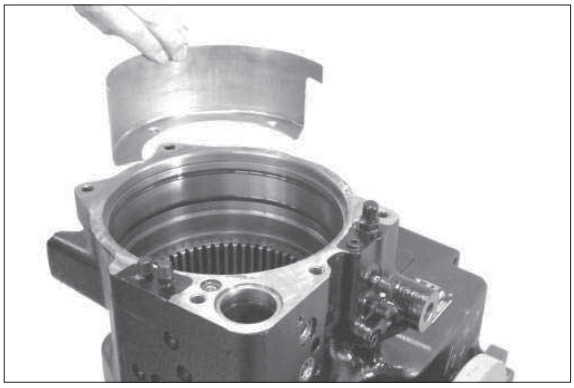


14WF8TM106

43) Only for version
Transmission installation position "Horizontal" :

Loosen countersunk screws and remove screen sheet.

※ Countersunk screws are installed with locking compound (loctite). If necessary, heat for disassembly .



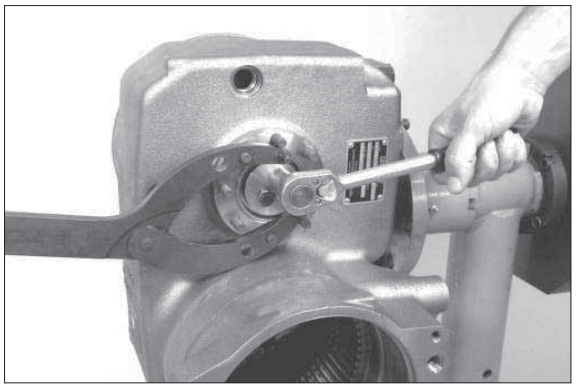
14WF8TM107

7. DISASSEMBLY - OUTPUT

Version "Axle attachment"

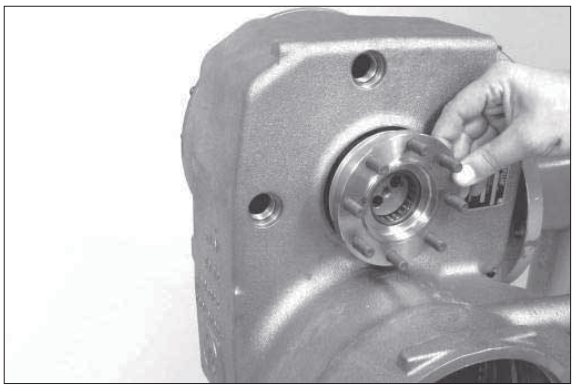
1) Loosen threaded joint, remove cover and O-ring.

※ (S) Clamping fork 5870 240 025



14WF8TM108

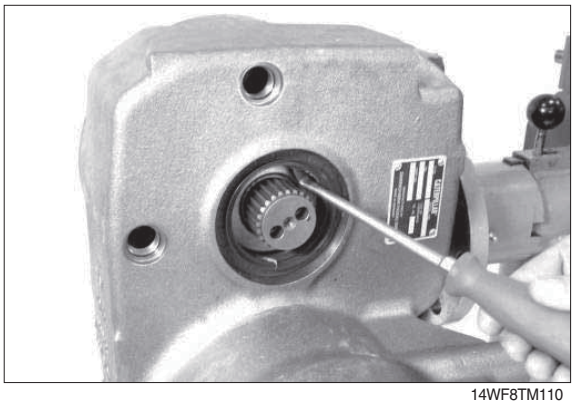
2) Pull off flange.



14WF8TM109

3) Remove shaft seal with a lever.

※ (S) Resetting device 5870 400 001

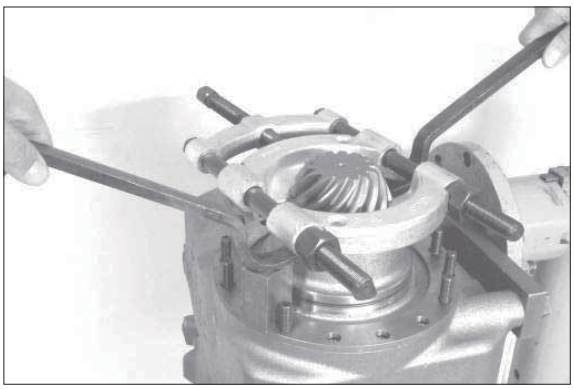


14WF8TM110

4) Fix pinion with fixture and press off.

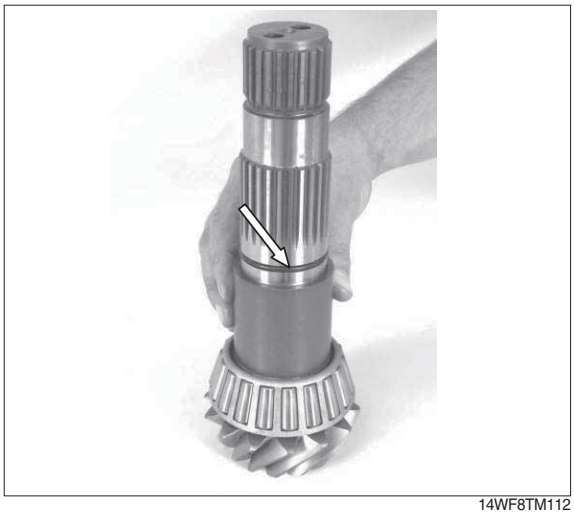
(S) Cut-off device 5870 300 028
(S) Assembly lever 5870 345 036
(S) Solenoid block 5870 450 003

※ Pay attention to releasing bearing inner ring and adjusting ring (rolling torque/pinion bearing) behind.



14WF8TM111

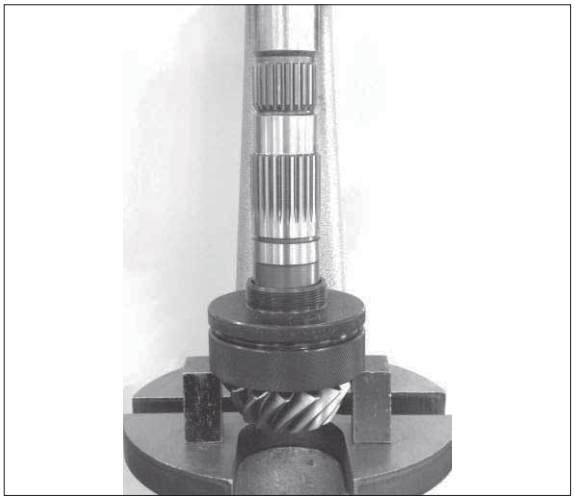
5) Remove O-ring (see arrow) and bush from pinion.



14WF8TM112

6) Press-off bearing inner ring from pinion shaft.

(S) Grab sleeve	5873 001 037
(S) Solenoid block	5870 450 003

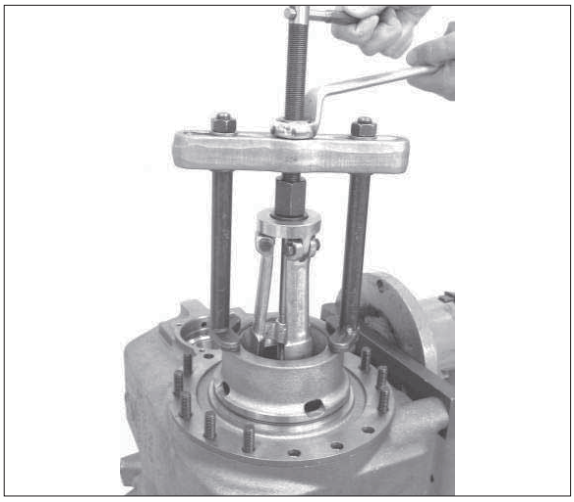


14WF8TM113

7) Pull bearing outer ring out of bearing cover.

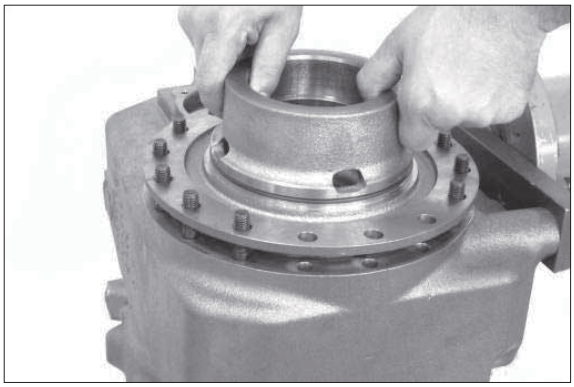
(S) Inner extractor	5870 300 019
(S) Counter support	5870 300 020

※ Pay attention to shim behind (pinion gap setting).



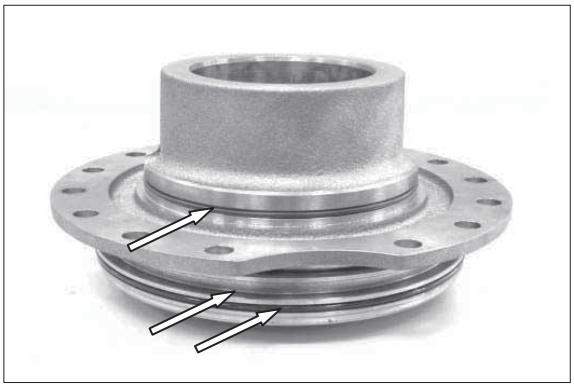
14WF8TM114

8) Pull off bearing cover.



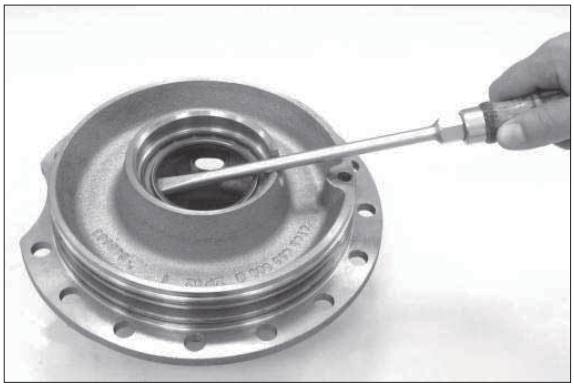
14WF8TM115

9) Remove O-rings (arrows).



14WF8TM116

10) Remove shaft seal.

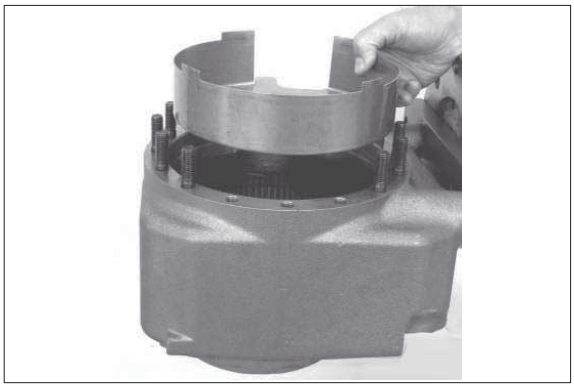


14WF8TM117

11) Lift output gear with oil screen sheet out of housing. Remove oil screen sheet from output gear.

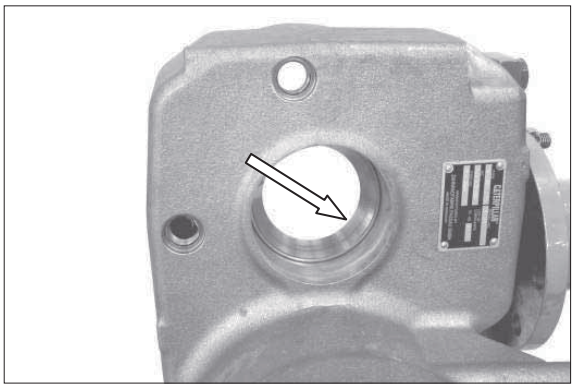
14WF8TM118

12) Remove screen sheet.



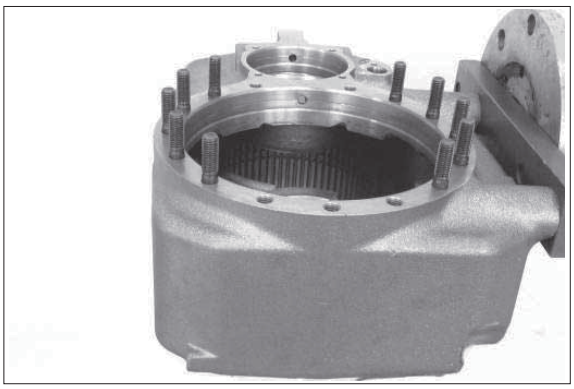
14WF8TM119

13) Disassemble bearing outer ring from housing hole (see arrow).



14WF8TM120

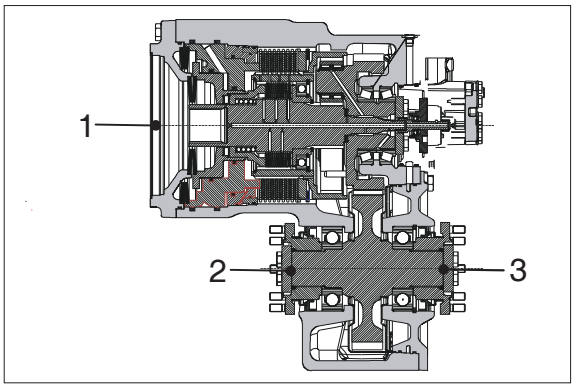
14) If necessary, remove stud bolts.



14WF8TM121

Version "Separate installation"

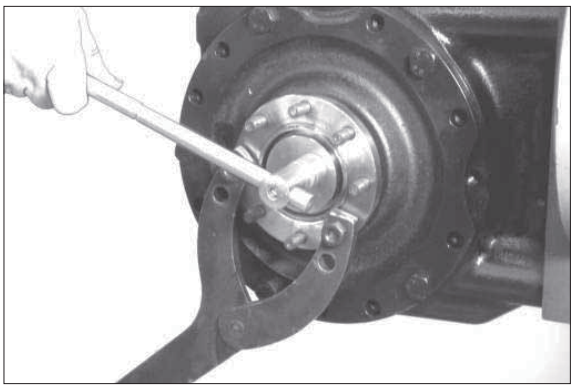
15) 1 = Input
2 = Output – front axle
3 = Output – rear axle



14WF8TM122

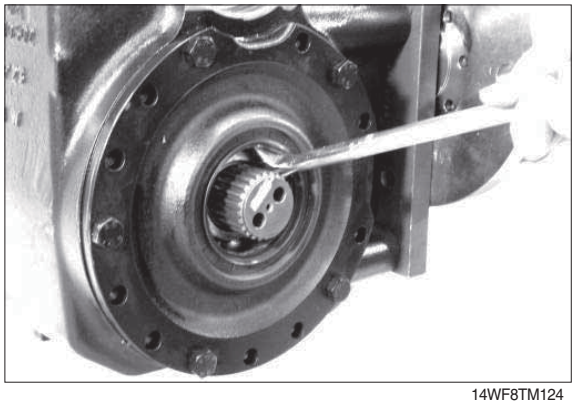
16) Use clamping fork to fix output flange. Loosen threaded joint, pull off disk, O-ring and flange.

(S) Clamping fork 5870 240 025

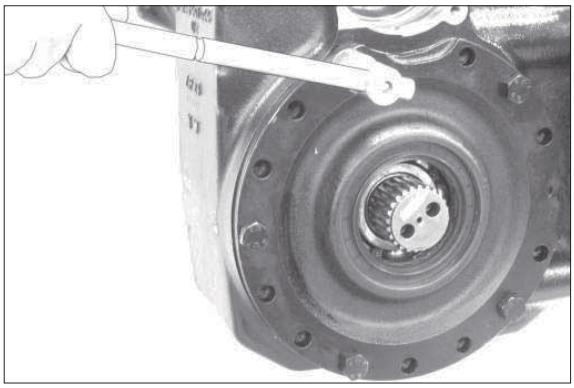

14WF8TM123

17) Remove shaft seal with a lever.

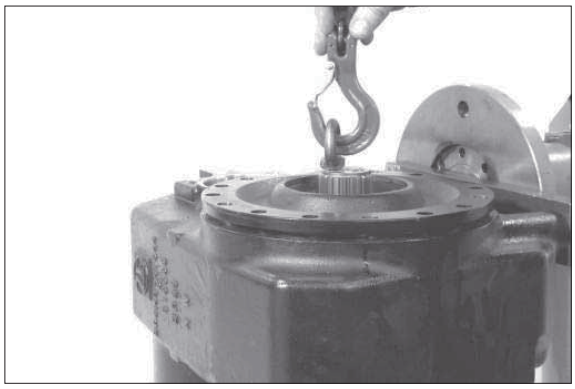
※ Disassemble second output flange and shaft seal analogously.


14WF8TM124

18) Loosen threaded joint.

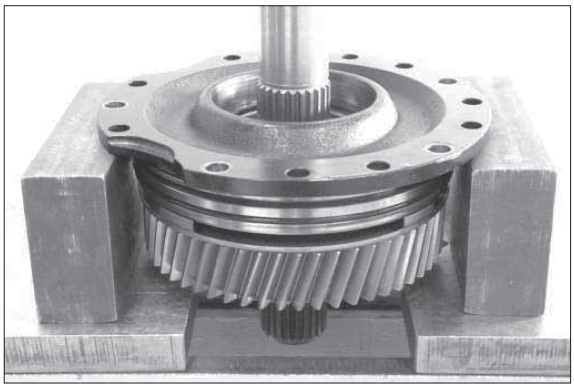

14WF8TM125

19) Use lifting tackle to separate output gear with cover from transmission housing.



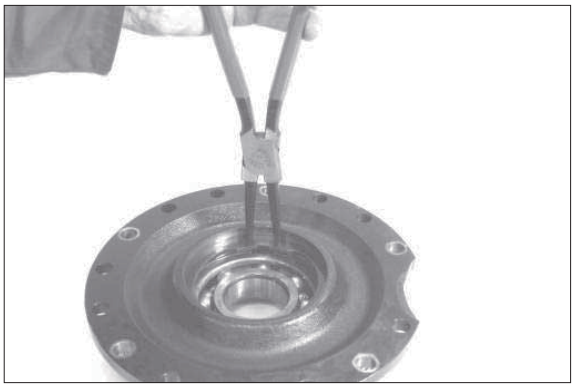
14WF8TM126

20) Press output gear out of ball bearing/cover – remove releasing oil screen sheet.



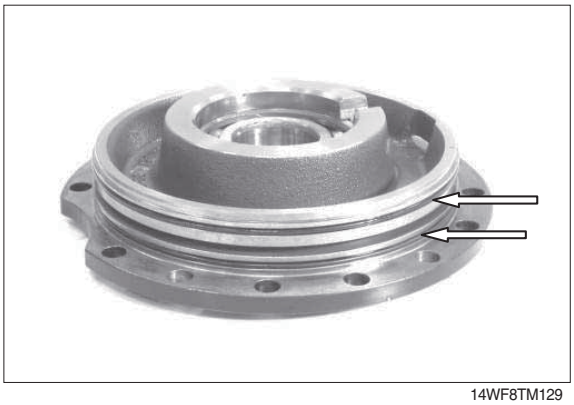
14WF8TM127

21) Unsnap retaining ring and disassemble ball bearing from cover.



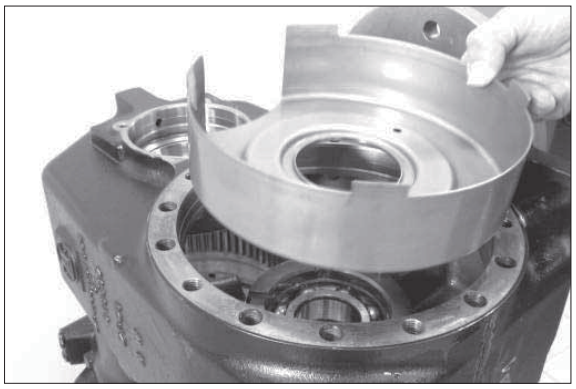
14WF8TM128

22) Remove O-rings (see arrows) from cover.



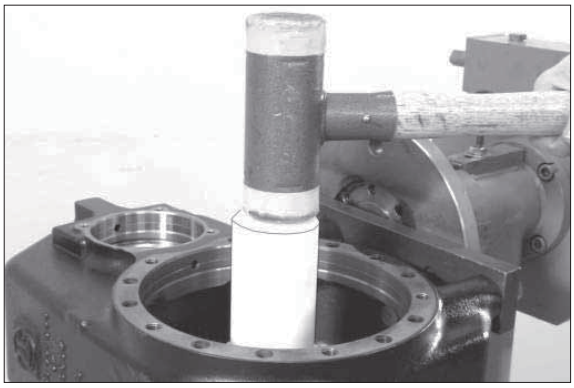
14WF8TM129

23) Remove screen sheet from transmission housing.



14WF8TM130

24) Disassemble ball bearing from housing hole.

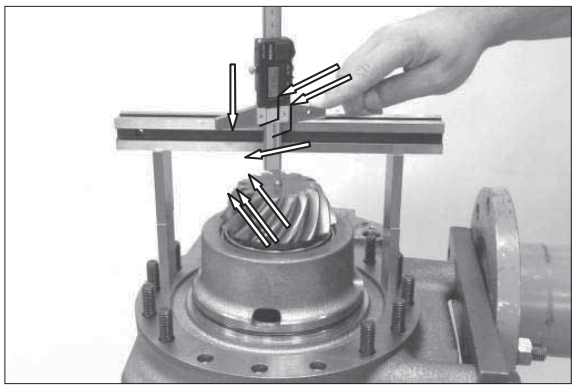


14WF8TM131

8. REASSEMBLY - OUTPUT

1) Seal finished holes (8x) of oil supply holes with screw plugs.

   (S) Lever riveting tongs 5870 320 016



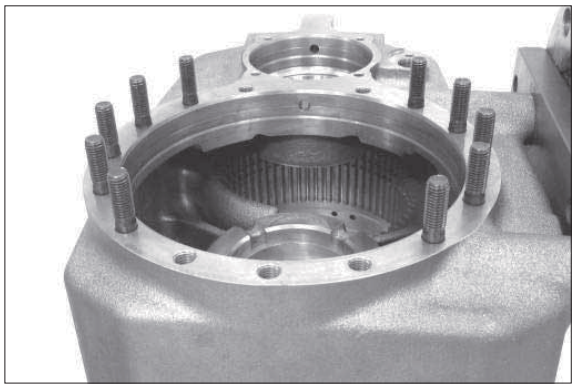
14WF8TM132

Version "Axle attachment"

2) Install stud bolts.

   Tightening torque M_A = 27 Nm

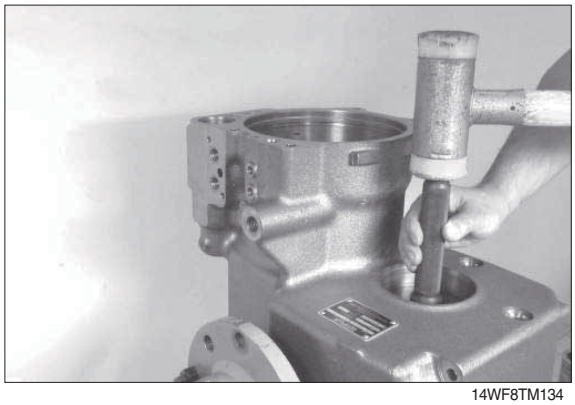
※ Pay attention to installation position.



14WF8TM133

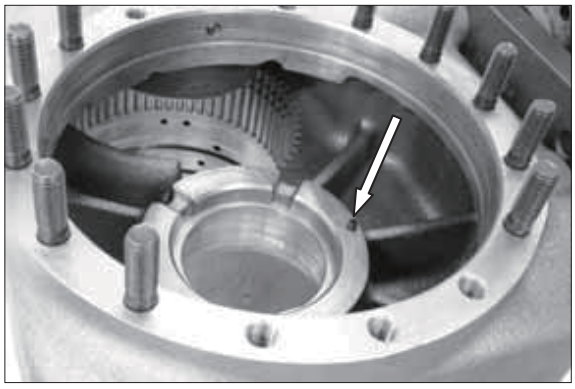
3) Install bearing outer ring until contact.

   (S) Driver tool 5870 058 073
   (S) Handle 5870 260 002



14WF8TM134

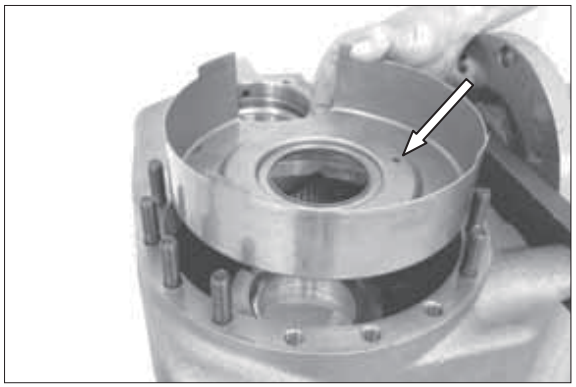
4) Insert slotted pin (see arrow) to the bottom.



14WF8TM135

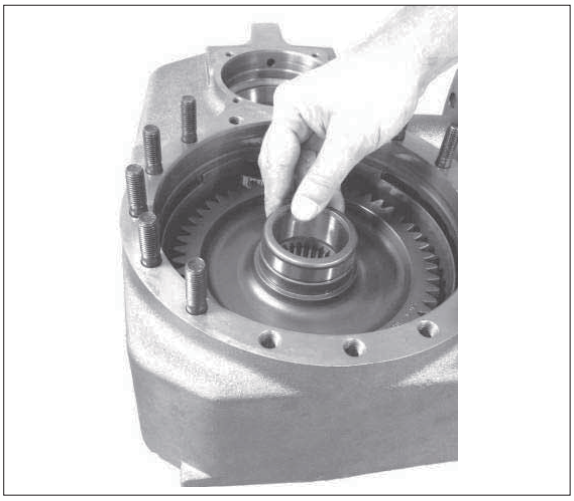
5) Position screen sheet – with slotted pin (see 14WF8TM135) into fixing hole (arrow).

※ Pay attention to installation position, slotted pin = radial fixing of screen sheet.



14WF8TM136

6) Insert output gear with the short collar showing downwards.



14WF8TM137

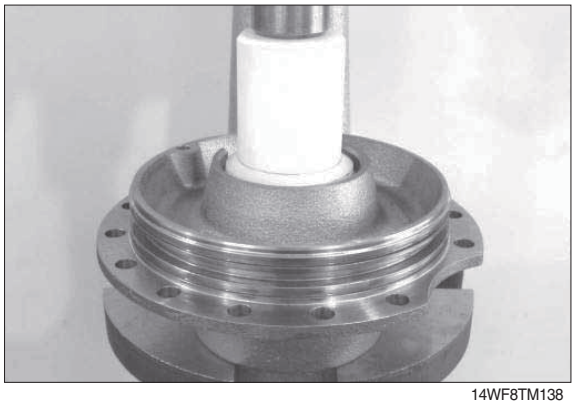
7) Press shaft seal into bearing cover.

(S) Driver tool 5870 048 281

※ For installation wet shaft seal on outer diameter with spirit.

※ Installation position of shaft seal, pay attention that seal lip is showing to oil sump (see 14WF8TM139).

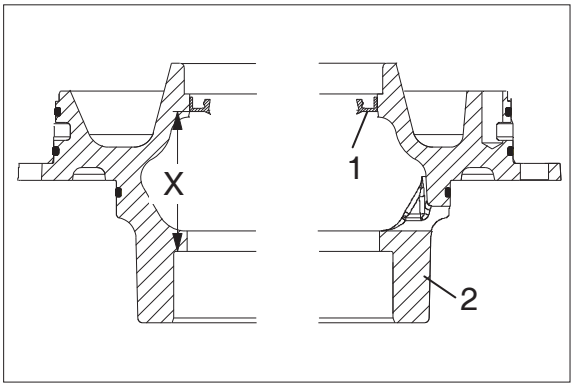
※ Use of specified driver ensures exact installation position of shaft seal.



14WF8TM138

8) 1 = Shaft seal
2 = Bearing cover

X = Installation dimension



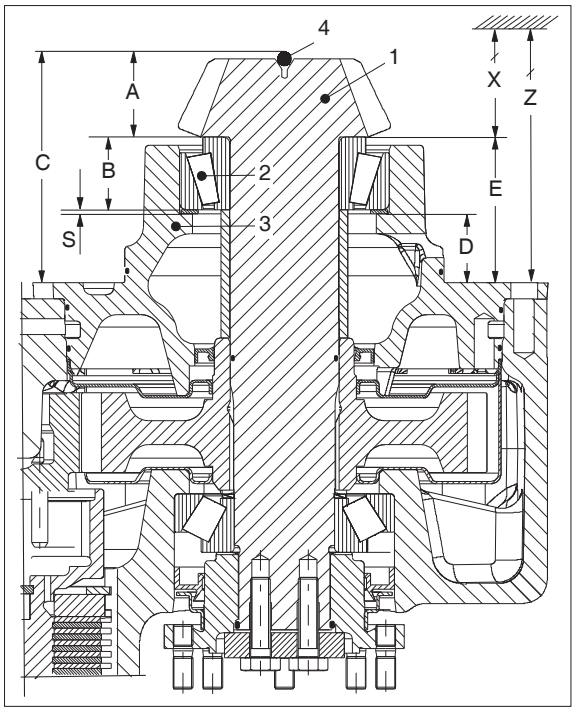
14WF8TM139

Determine shim for pinion gap

9) 1 = Pinion
2 = Roller bearing
3 = Bearing cover
4 = Ball (Ø = 7 mm)

A = Auxiliary dimension
B = Bearing width
C = Reference dimension
D = Contact surface/bearing cover to contact/bearing hole
E = 73.0 mm (constant value)
X = Pinion dimension (stamped into pinion)
Z = 189.0 mm
(contact surface/bearing cover to center/axle housing)

※ For correct installation and positioning of pinion, following steps must be carried out as precisely as possible .



14WF8TM140

10) Determine auxiliary dimension A.

Position ball (Ø = 7 mm) into centering hole of pinion and determine dim. A, from contact surface/pinion shoulder to ball.

Auxiliary dimension A = e.g. 42.56 mm

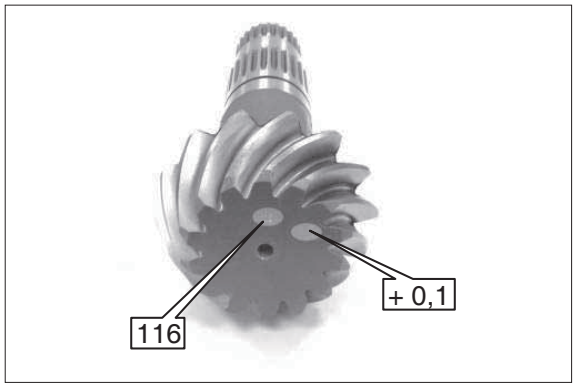
※ Auxiliary dimension A is obligatory to determine reference dimension C – on installed pinion (Fig. 14WF8TM168).

(S) Straightedge 5870 200 108


14WF8TM141

11) Read pinion dim. X on pinion (see arrow) or measure it in case of manufacturing-specific + or – deviation from pinion dim. (relating value is marked by hand on pinion e.g. + 0.1).

Pinion dim. X (without + or – deviation) = 116.0 mm
Pinion dim. X with an indicated deviation + 0.1 = 116.1 mm
Pinion dim. X with an indicated deviation - 0.1 = 115.9 mm

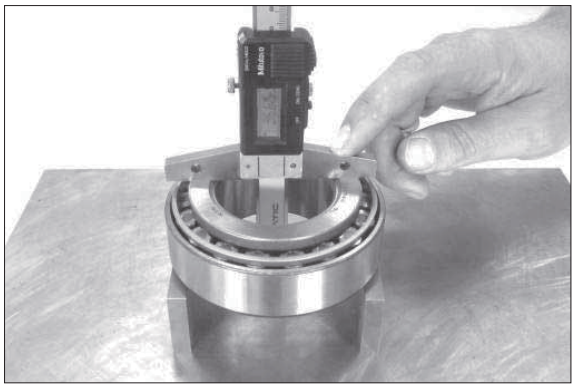


14WF8TM142

12) Determine dim. B bearing width, paying attention that rollers are seated without clearance (roller setting – rotate bearing inner ring in both directions several times).

※ Since installed roller bearing is subject to preload in installation position, deduction of empirical value of – 0.1 mm must be considered.

Dim. B = e.g. 36.65 mm - 0.1 mm → 36.55 mm

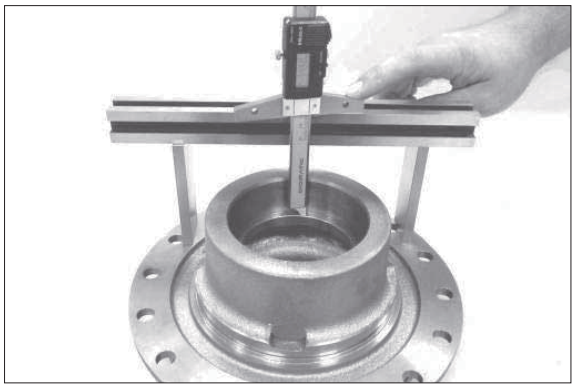


14WF8TM143

13) Determine dim. D (contact surface/bearing cover to contact/bearing hole).

Dim. D = e.g. 35.10 mm

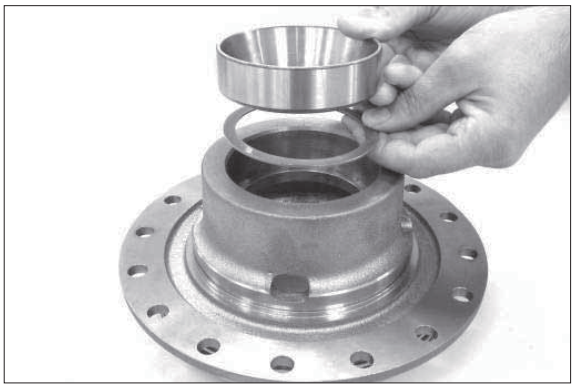
(S) Straightedge (2 sets) 5870 200 066



14WF8TM144

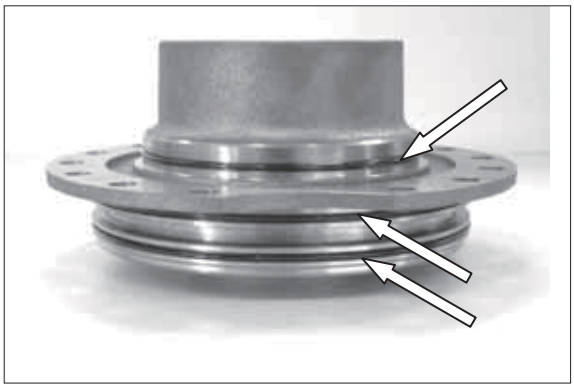
14) Insert determined shim(s) S = e.g. 1.35 mm and install bearing outer ring until contact.

(S) Driver tool 5870 058 078
(S) Handle 5870 260 002



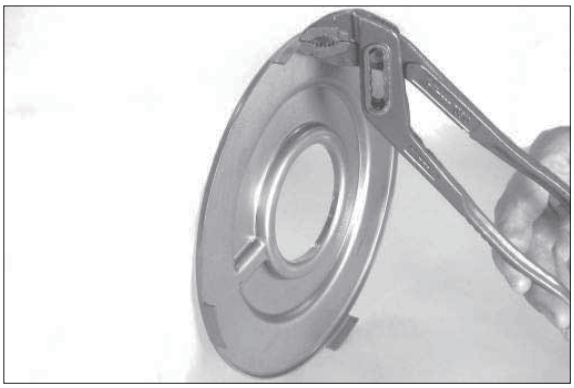
14WF8TM145

15) Oil O-rings (arrows) and insert them into annular grooves of bearing cover.



14WF8TM146

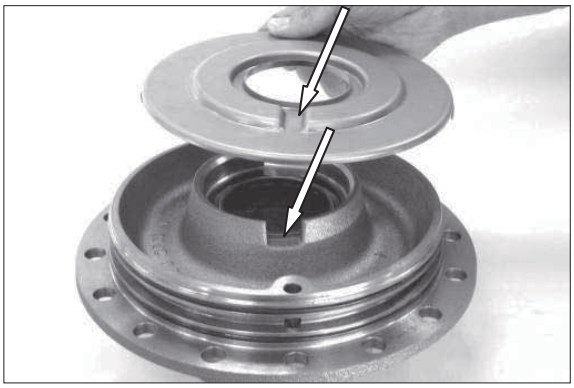
16) Bend edges of fixing straps of oil screen sheet slightly – assembly aid (sheet is fixed to bearing cover – see 14WF8TM148).



14WF8TM147

17) Mount oil screen sheet on bearing cover.

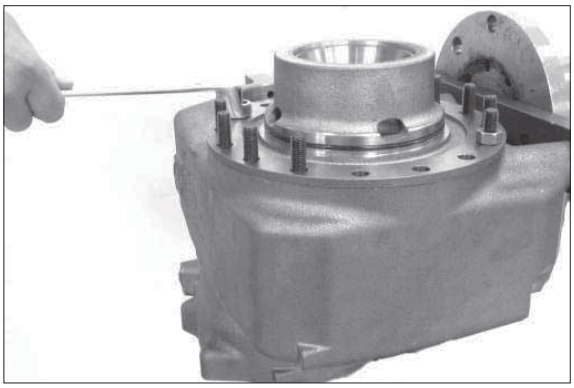
※ Pay attention to installation position – place locating tab of oil screen sheet into recess of bearing cover (see arrow).



14WF8TM148

18) Mount preassembled bearing cover and locate equally with hexagon nuts until contact. Then remove hexagon nuts again.

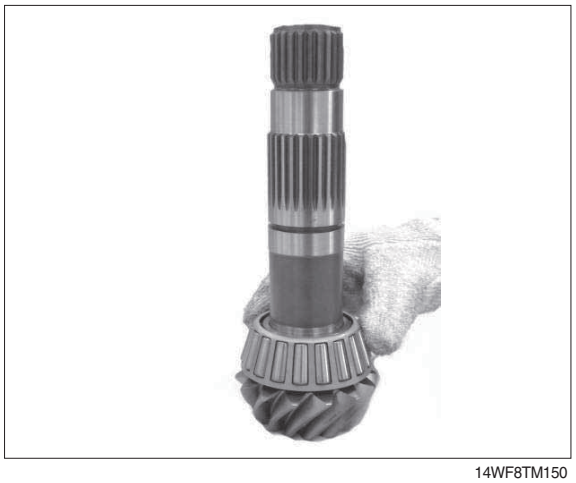
※ Oil contact face/oil screen sheet/housing (assembly aid).



14WF8TM149

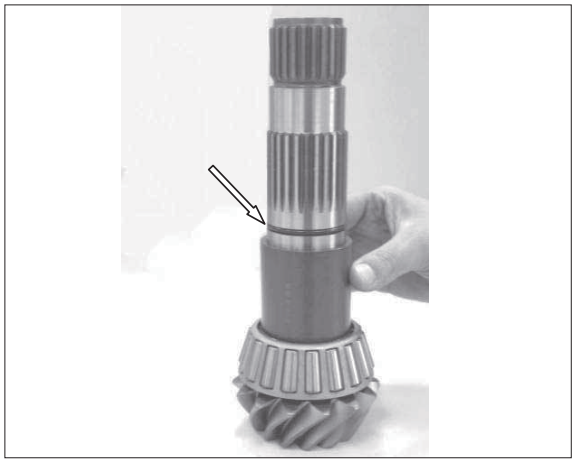
19) Install heated bearing inner ring until contact.

※ Adjust bearing inner ring after cooing down.



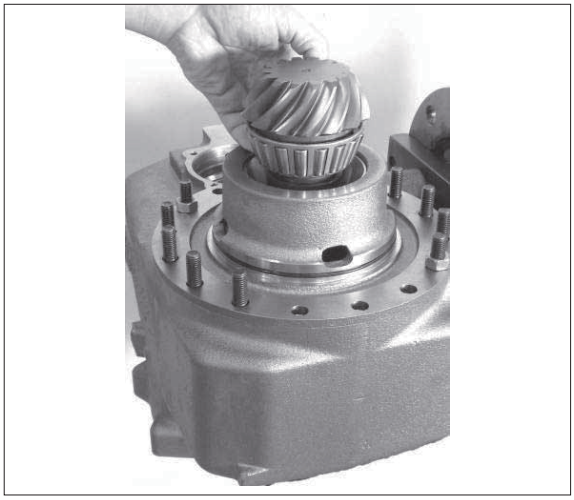
14WF8TM150

20) Mount bush, oil O-ring (arrow) and put it into annular groove.



14WF8TM151

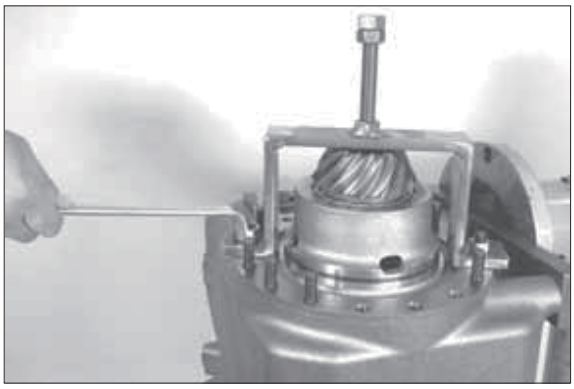
21) Mount preassembled pinion.



14WF8TM152

22) Fix pinion with clamping bar.

(S) Clamping bar 5870 654 049



14WF8TM153

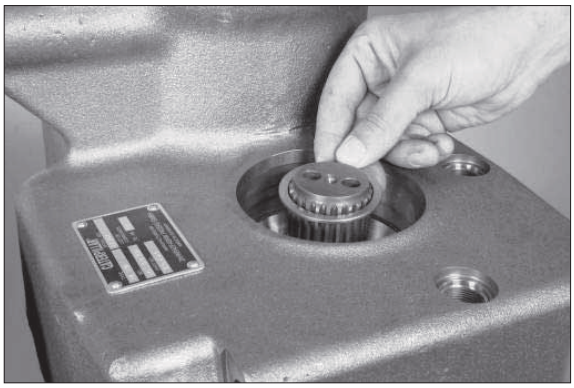
Determine adjusting ring for rolling torque/pinion bearing :

23) Rotate transmission by 180˚.

Mount adjusting ring (s = optional).

※ It is recommended to reinstall the adjusting ring (e.g. s = 1.35 mm) removed during disassembly, if however the required rolling torque of 1.5~4.0 Nm (without shaft seal) is not obtained – see bearing rolling torque check Fig. 14WF8TM159 – bearing rolling torque is to be corrected with an adequate adjusting ring.

※ When shaft seal is installed, try to achieve upper rolling torque value.



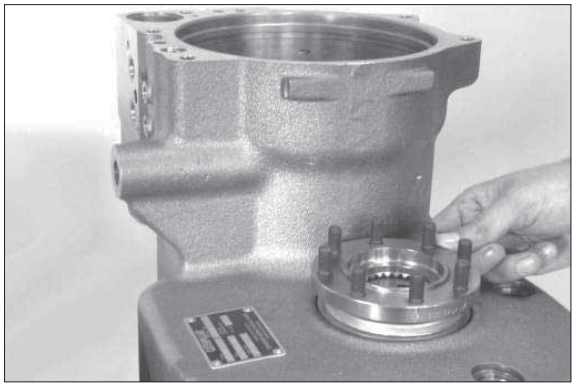
14WF8TM154

24) Insert heated bearing inner ring until contact.

※ Adjust bearing inner ring after cooling down.

14WF8TM155

25) Mount flange.

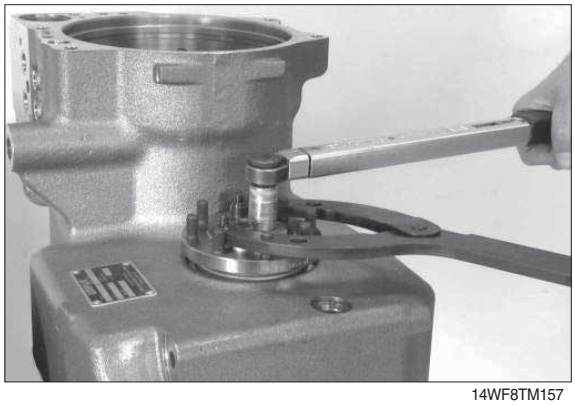


14WF8TM156

26) Place shim and fix flange with hexagon screws.

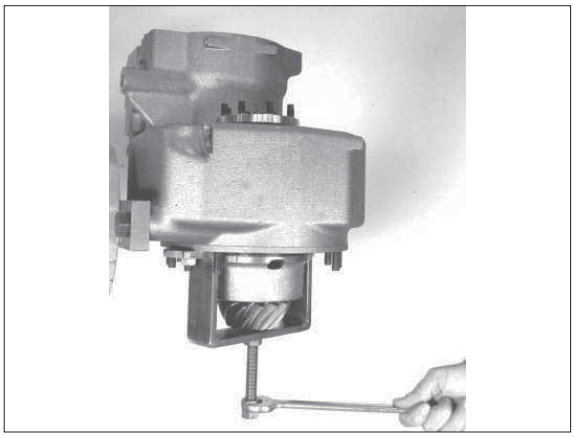
Tightening torque (M 10/10.9) M_A = 68 Nm
(S) Clamping fork 5870 240 025

※ Rotate pinion – when tightening – in both directions (roller setting) several times .



14WF8TM157

27) Turn back pinion fastening / remove clamping bar.



14WF8TM158

Check rolling torque of pinion bearing

28) Bearing rolling torque (without shaft seal) 1.5~4.0 Nm

※ When using new roller bearings /for mounted shaft seal, try to achieve the upper value.

※ If the required rolling torque deviates, it must be corrected with an adequate adjusting ring (see 14WF8TM154).

(S) Reduction ½ -¼	5870 656 056
(S) Plug insert	AA00 392 461

14WF8TM159

29) Disassemble flange again.

14WF8TM160

Shaft seal output flange

30) Install new shaft seal.

(S) Driver tool 5870 048 279

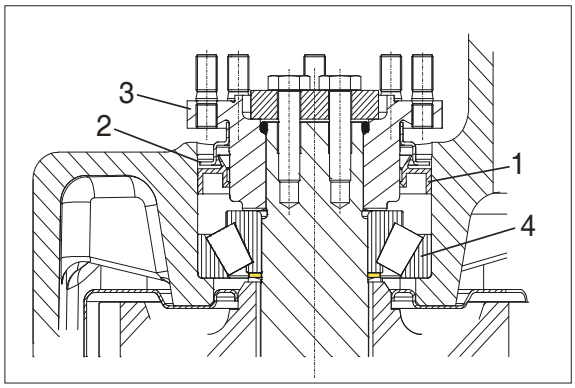
※ For reassembly wet shaft seal on outer diameter with spirit.

※ Pay attention to installation position of shaft seal, seal lip showing to oil sump (see 14WF8TM162).

※ Use of specified driver tool ensures exact installation position of shaft seal.

14WF8TM161

31) 1 = Shaft seal
2 = Metal sheet
3 = Output flange
4 = Roller bearing

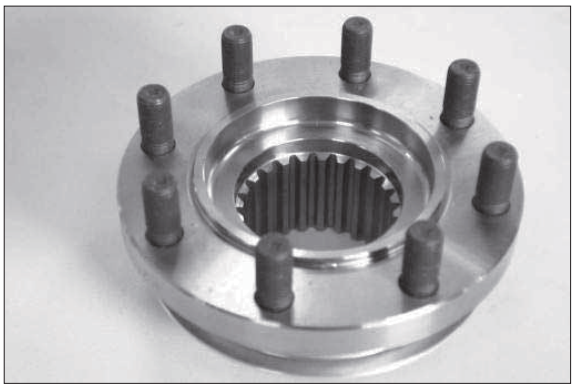


14WF8TM162

32) Install stud bolts.

Tightening torque (M10 × 1) M_A = 20 Nm

※ Pay attention to installation position.
Install stud bolts with short thread length into flange.

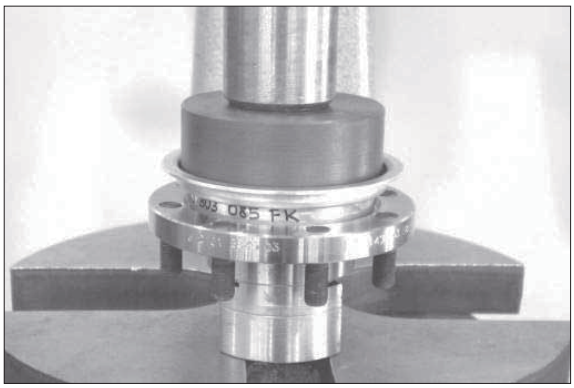


14WF8TM163

33) Install screen sheet (see 14WF8TM162).

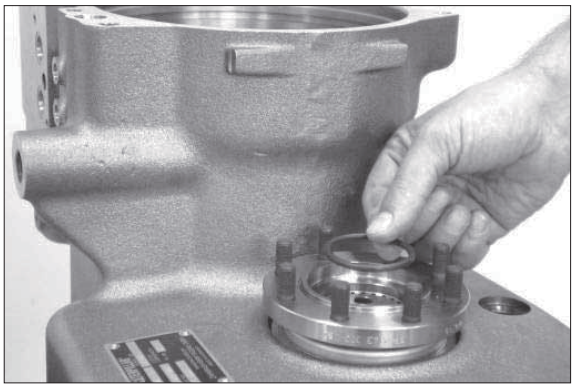
(S) Pressure piece 5870 506 150

※ Use of specified driver tool ensures exact installation position of screen sheet.



14WF8TM164

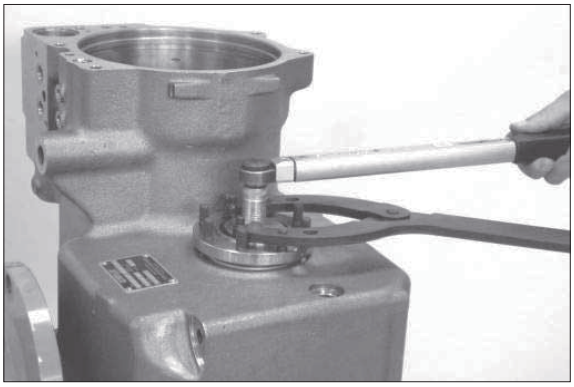
34) Mount preassembled flange and put O-ring into recess.



14WF8TM165

35) Place disk and fix it with hexagon screws.

Tightening torque (M 10/10.9)	M_A = 68 Nm
(S) Clamping fork	5870 240 025

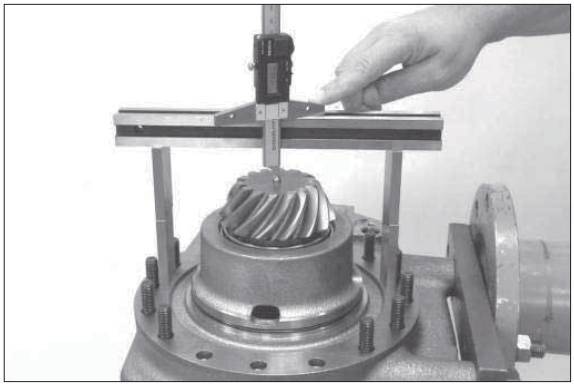


14WF8TM166

Check pinion gap

36) Position ball [use Ø = 7 mm → ball Ø like for determination of auxiliary dimension A into centering hole of the pinion and determine dim. C (see 14WF8TM140), from contact surface/bearing cover to ball.

(S) Straightedge	5870 200 108



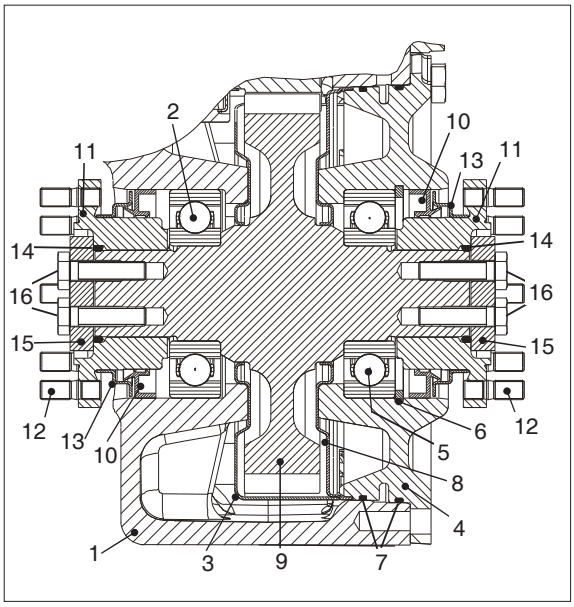
14WF8TM167

⚠ If the constant value of dimensionE = 73.00±0.05 mm

If the constant value of Dim. E = 73.00 ±0.05 mm is not achieved, correct with an adequate shim/pinion gap (see 14WF8TM145).

For a correction of the shim/pinion gap, a counter correction of adjusting ring of rolling moment/ pinion gap – Fig. 14WF8TM154 must also be considered.

37) 1 = Transmission housing
2 = Ball bearing
3 = Screen sheet
4 = Bearing cover
5 = Ball bearing
6 = Retaining ring
7 = O-ring
8 = Oil screen sheet
9 = Output gear
10 = Shaft seal
11 = Output flange
12 = Stud bolt
13 = Metal sheet
14 = O-ring
15 = Disk
16 = Hexagon screw

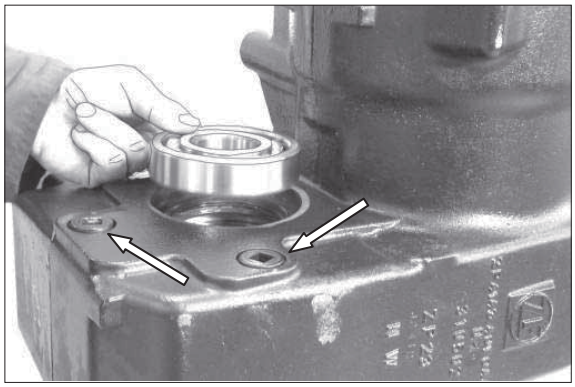


14WF8TM168

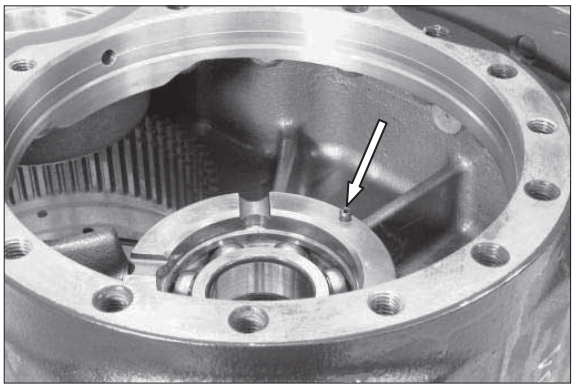
38) Provide screw plugs (see arrows) with new O-ring and install it.

Tightening torque M_A = 80 Nm

※ Then insert ball bearing (2) until contact.

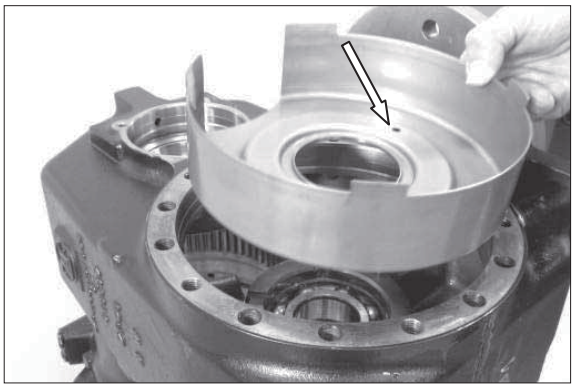

14WF8TM169

39) Rotate transmission by 180˚.
Insert slotted pin (see arrow) to the bottom.


14WF8TM170

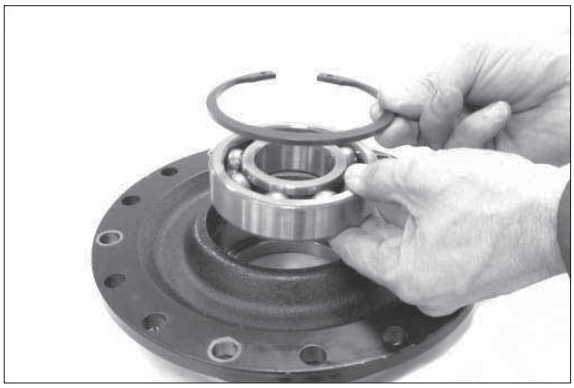
40) Position screen sheet – with slotted pin into fixing hole (arrow).

※ Observe installation position –slotted pin = radial fixing of screen sheet.



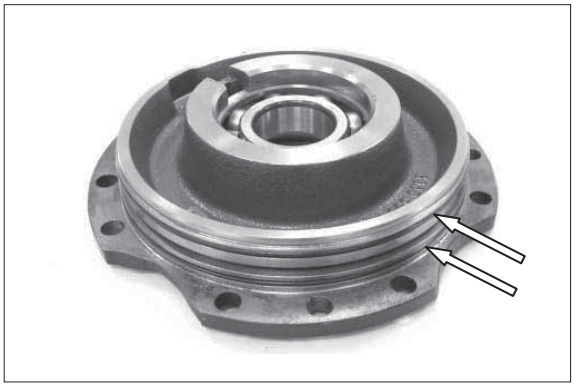
14WF8TM171

41) Insert ball bearing into cover and fix with retaining ring.



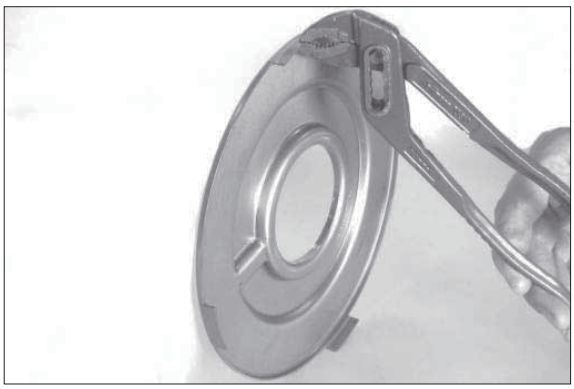
14WF8TM172

42) Oil both O-rings (arrows) and insert them into annular grooves of planetary carrier.



14WF8TM173

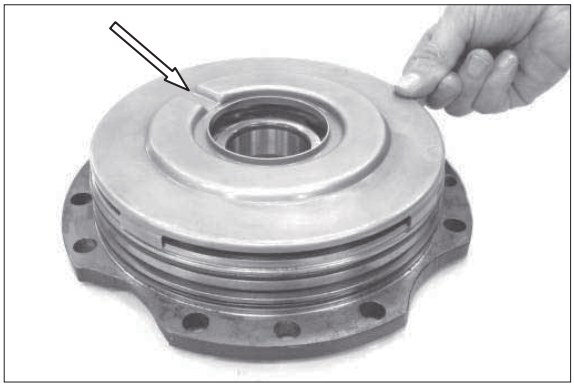
43) Bend edges of fixing straps of oil screen sheet slightly. Assembly aid screen sheet is fixed to bearing cover – see 14WF8TM176).



14WF8TM174

44) Insert oil screen sheet onto bearing cover

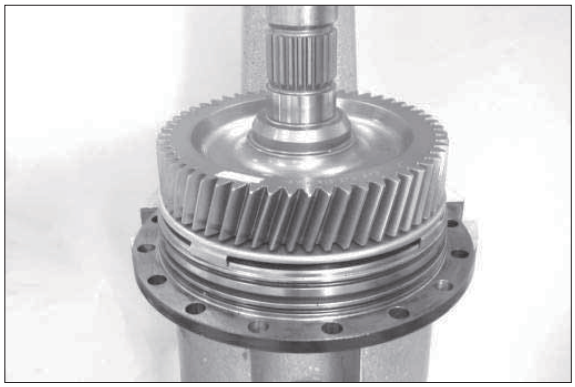
※ Observe installation position - place locating tab (see arrow) into recess of bearing cover (radial fixing).



14WF8TM175

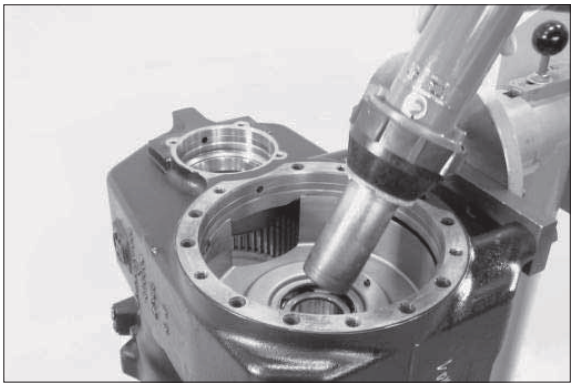
45) Press output gear into ball bearing/bearing cover.

※ Support ball bearing onto bearing inner ring.



14WF8TM176

46) Heat bearing inner ring of ball bearing.

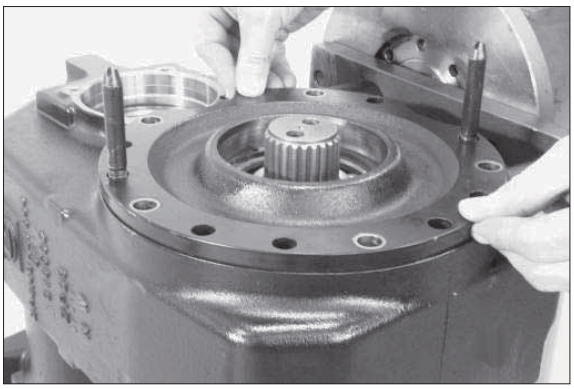


14WF8TM177

47) Attach two adjusting screws and mount preassembled bearing cover/output gear until contact.

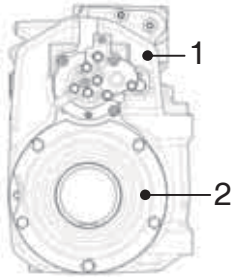
(S) Adjusting screws (M12) 5870 204 021

※ Observe installation position of bearing cover (2) in transmission (1) – transmission installation VERTICAL or HORIZONTAL - see detailed sketches below:

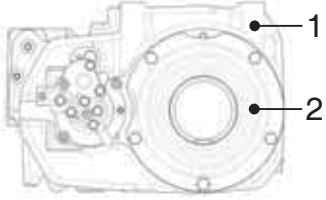


14WF8TM178

<VERTICAL>

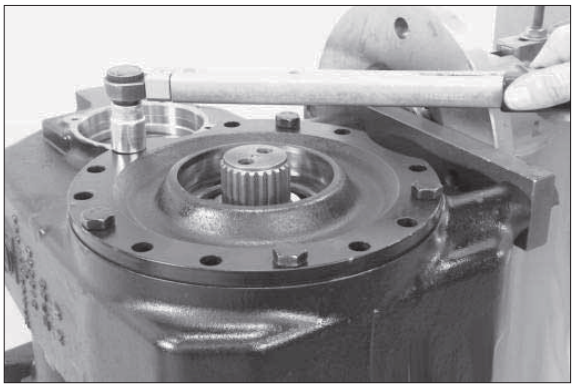


<HORIZONTAL>



48) Fix bearing cover by means of hexagon screws.

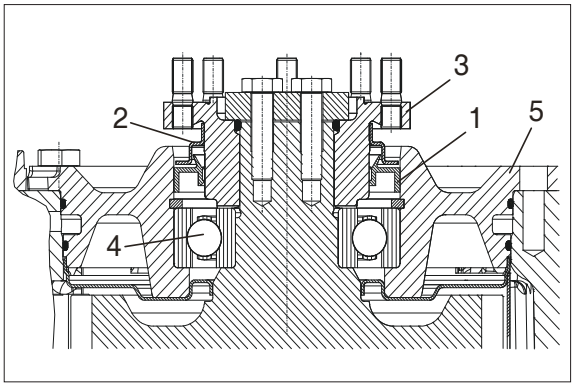
Tightening torque (M 12/8.8) M_A = 80 Nm



14WF8TM181

Shaft seal output flange

49) 1 = Shaft seal
2 = Metal sheet
3 = Output flange
4 = Ball bearing
5 = Bearing cover

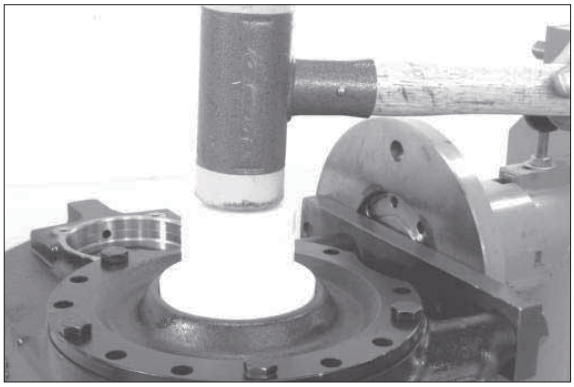


14WF8TM182

50) Install new shaft seal.

(S) Driver tool 5870 048 279

※ For reassembly wet shaft seal on outer diameter with spirit.
※ Pay attention to installation position of shaft seal, seal lip showing to oil sump.
※ Use of specified driver tool ensures exact installation position of shaft seal.

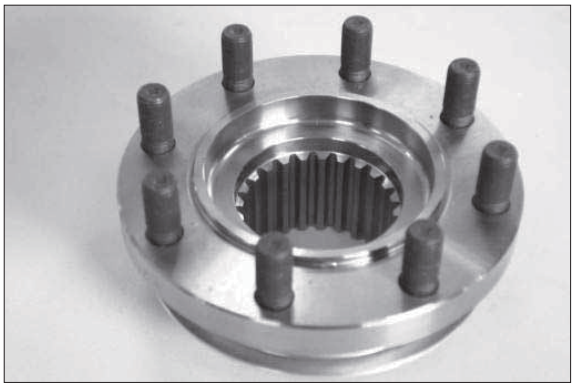


14WF8TM183

51) Install stud bolts.

Tightening torque (M10 × 1) M_A = 20 Nm

※ Pay attention to installation position.
Install stud bolts with short thread length into flange.

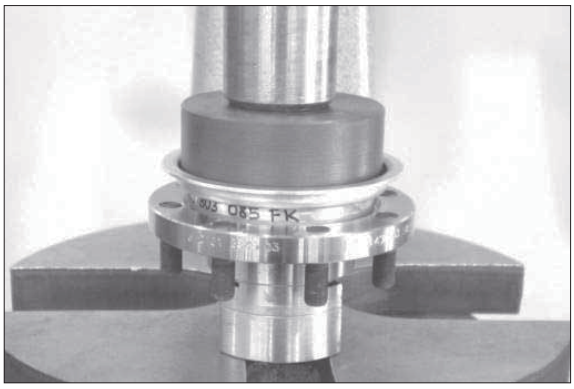


14WF8TM184

52) Install screen sheet (see 14WF8TM183).

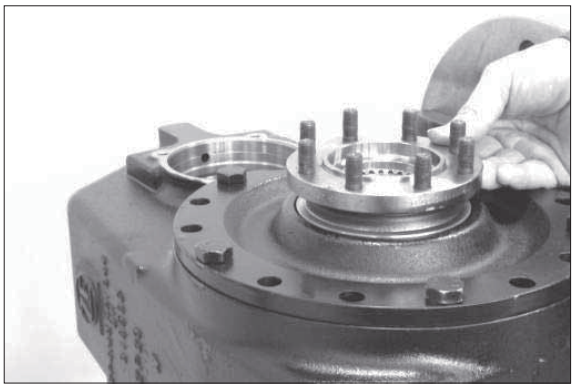
(S) Pressure piece 5870 506 150

※ Use of specified driver tool ensures exact installation position of screen sheet.



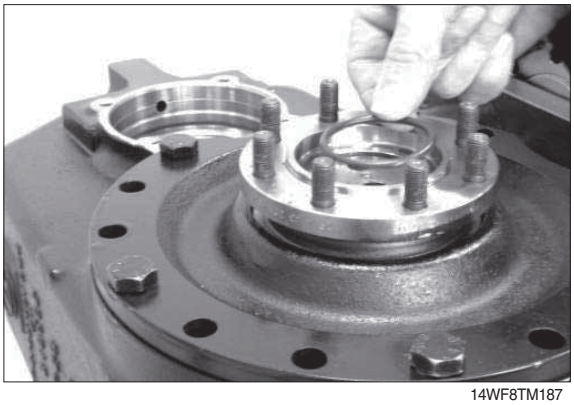
14WF8TM185

53) Install preassembled output flange.



14WF8TM186

54) Insert O-ring.

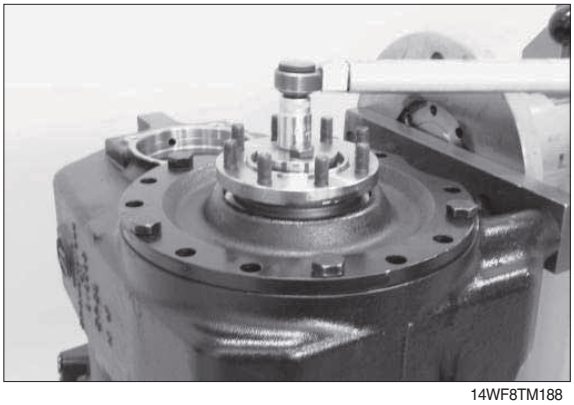


14WF8TM187

55) Position disk and fix output flange by means of hexagon screws.

Tightening torque (M10/10.9) M_A = 68 Nm

※ Install second shaft seal/output flange (front axle output) analogously.



14WF8TM188

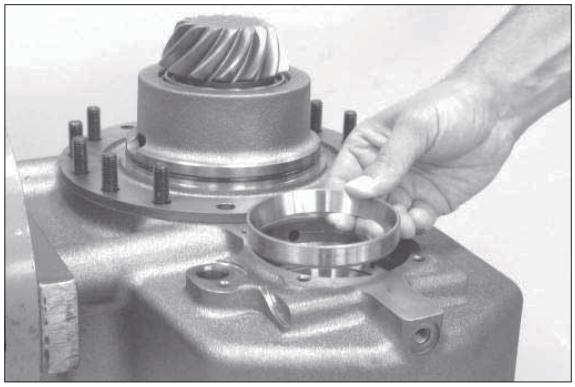
9.REASSEMBLY - BRAKE / CLUTCH / PLANETARY CARRIER

Planetary carrier

1) Install bearing outer ring until contact.

(S) Driver tool	5870 058 051
(S) Handle	5870 260 002

※ Observe bearing allocation – bearing inner ring to bearing outer ring – also see instructions for disassembly, 14WF8TM103.

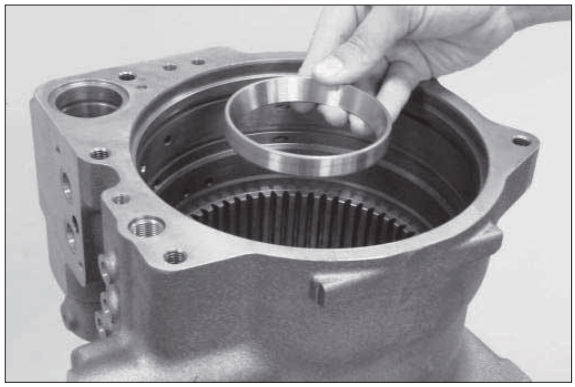


14WF8TM189

2) Rotate transmission by 180˚.
Install second bearing outer ring until contact.

(S) Driver tool	5870 058 051
(S) Handle	5870 260 002

※ Observe bearing allocation – bearing inner ring to bearing outer ring – also see instructions for disassembly 14WF8TM103.



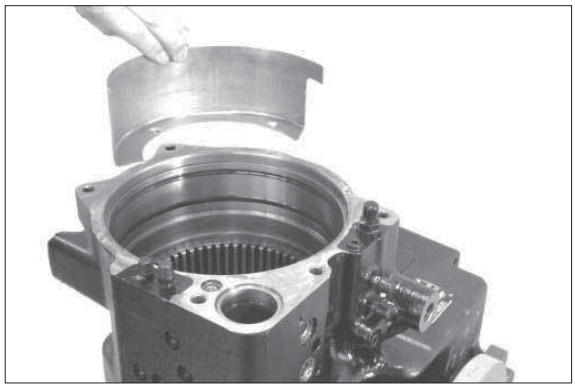
14WF8TM190

3) **Only for version transmission installation position**

※ Insert screen sheet and fasten with countersunk screws.

Tightening torque (M 6/8.8) M_A = 7.4 Nm

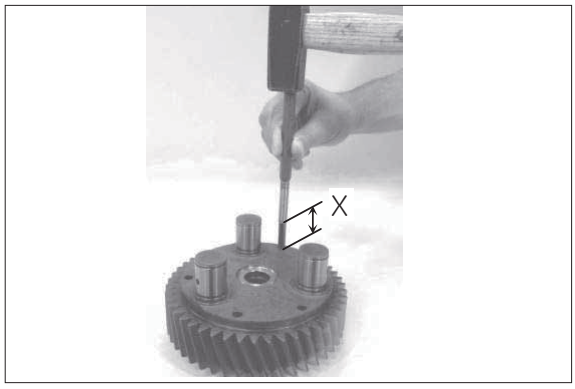
Wet countersunk screws with Loctite type no.243.



14WF8TM191

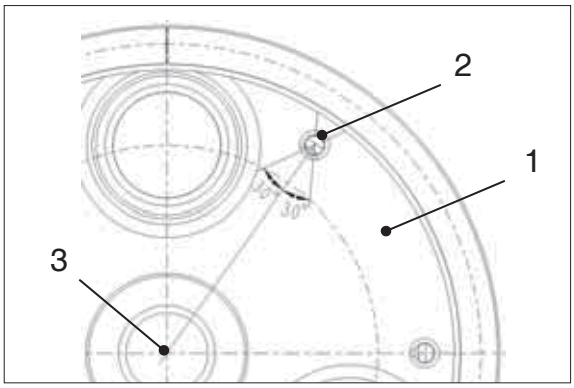
4) Install slotted pins (2) considering installation dimension X and installation position, see 14WF8TM193 (groove showing to center).

(S) Press-fit mandrel	AA00 392 151



14WF8TM192

5) 1 = Planetary carrier
2 = Slotted pin (6x)
3 = Center (planetary carrier)

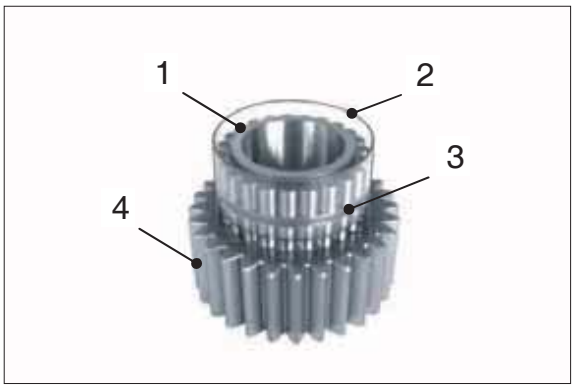


14WF8TM193

6) Insert cylindrical roller bearing into planetary gear. Press cylindrical roller bearing through packaging sleeve until snap ring engages into annular groove of planetary gear.

※ Use packaging sleeve to facilitate assembly.

1 = Cylindrical roller bearing
2 = Packaging sleeve
3 = Snap ring
4 = Planetary gear

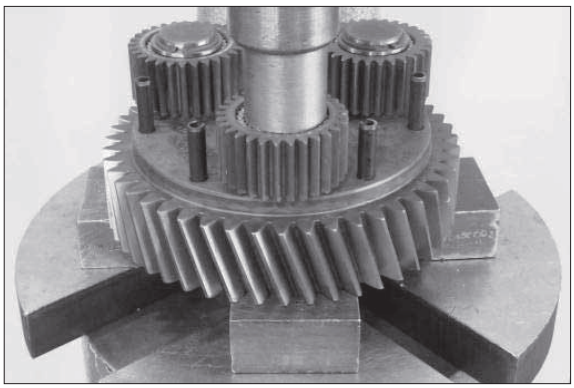


14WF8TM194

7) Press on planetary gear over bearing inner ring until contact.

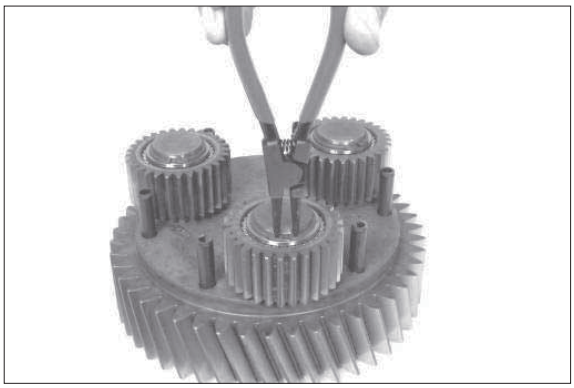
(S) Driver tool 5870 048 283

※ Install planetary gears with large radius on cylindrical roller bearing (downwards) towards planetary carrier.

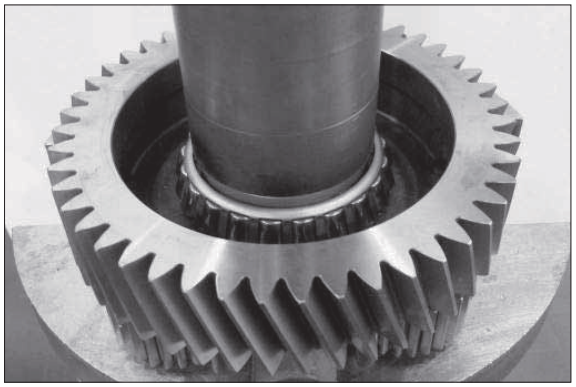

14WF8TM195

8) Engage retaining ring.

※ Adjust retaining ring until contact with groove base.


14WF8TM196

9) Press bearing inner ring onto planetary carrier until contact.



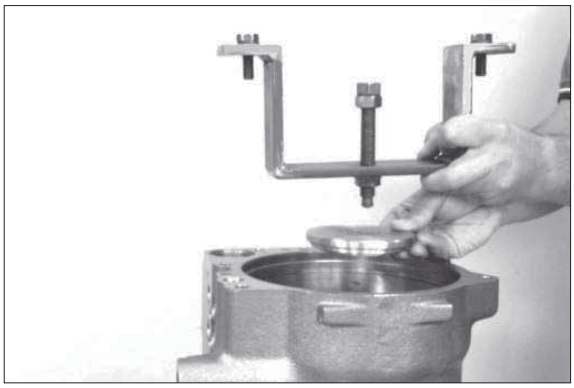
14WF8TM197

10) Insert preassembled planetary carrier.

14WF8TM198

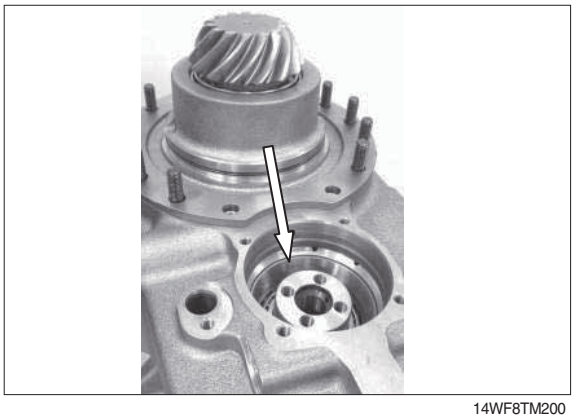
11) Fix planetary carrier with pressure plate and clamping bar.

(S) Clamping bar 5870 654 049



14WF8TM199

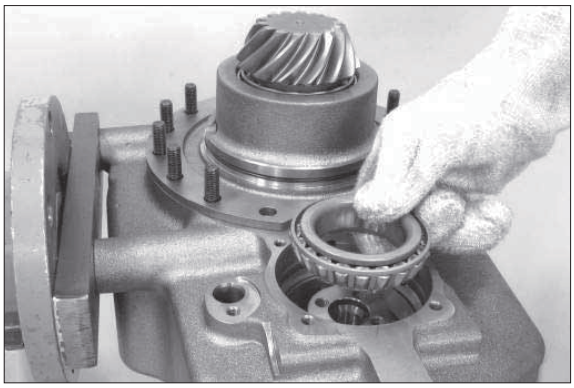
12) Rotate transmission by 180˚.
Check contact of bearing outer ring (see arrow). Reassembly of bearing outer ring, see 14WF8TM189.



14WF8TM200

13) Install heated bearing inner ring until contact.

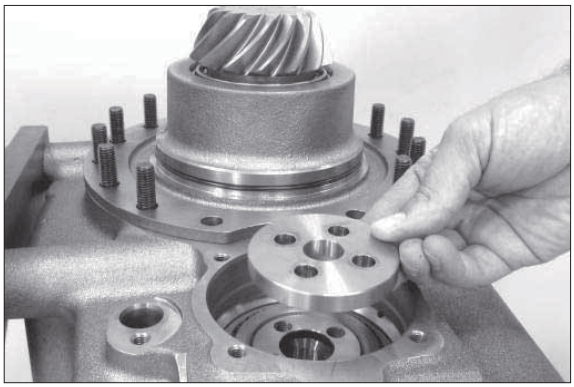
※ Adjust bearing inner ring after cooling down.



14WF8TM201

14) Position disk and manually turn in hexagon screws (fix planetary carrier).

Then remove clamping bar, see 14WF8TM199.

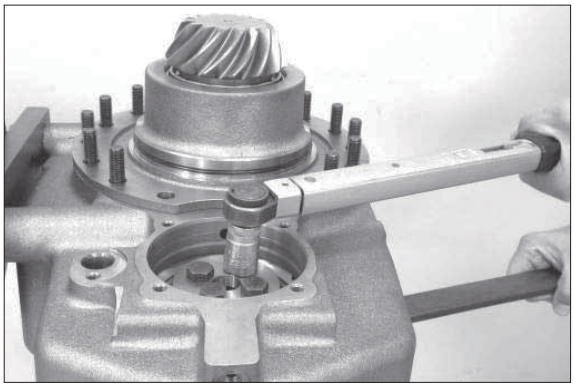


14WF8TM202

15) Fix clamping fork to output flange.
Tighten hexagon screws evenly – risk of strain.

Tightening torque (M 10/10.9)	M_A = 46 Nm
(S) Clamping fork	5870 240 025

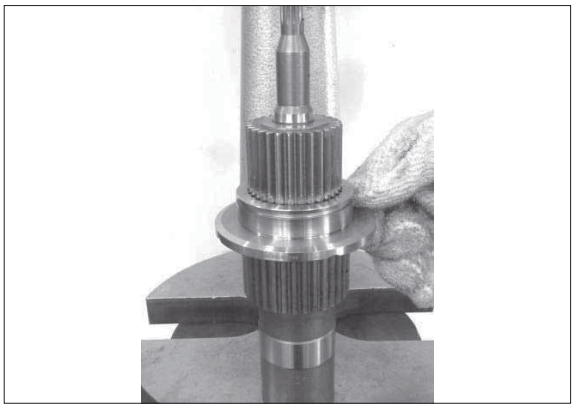
※ While tightening hexagon screws, rotate planetary carrier several times in both directions (roller setting).



14WF8TM203

Brake and clutch

16) Mount heated centering disk and press it until contact.



14WF8TM204

17) Fix centering disk by engaging retaining ring into annular groove of input shaft.

14WF8TM205

18) Insert ball bearing into ring gear and fasten it by engaging retaining ring into annular groove of ring gear.

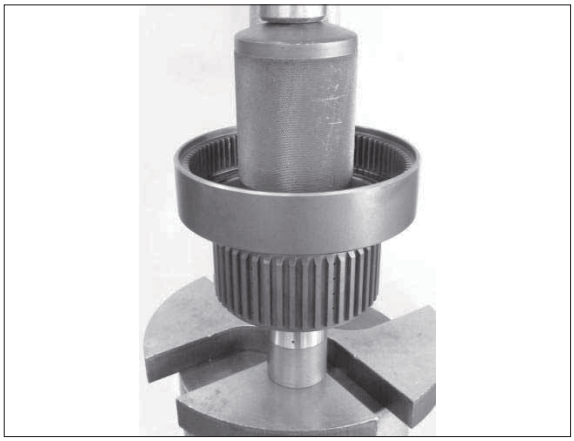
(S) Clamping pliers 5870 900 021

14WF8TM206

19) Heat bearing inner ring of ball bearing.

14WF8TM207

20) Mount preassembled ring gear to input shaft until contact.



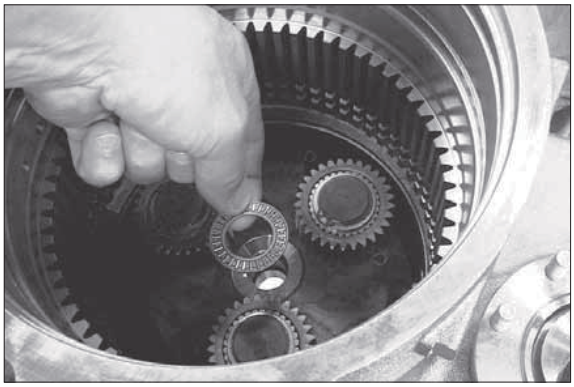
14WF8TM208

21) Engage retaining ring into annular groove of input shaft.

14WF8TM209

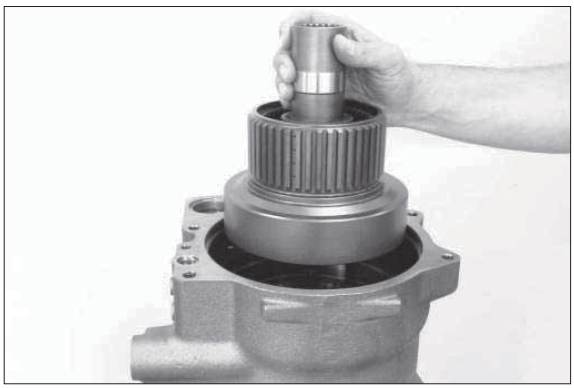
22) Rotate transmission by 180˚.
Insert axial needle cage into recess of planetary carrier.

※ Oil axial needle cage for reassembly.



14WF8TM210

23) Insert preassembled input shaft (with ring gear).

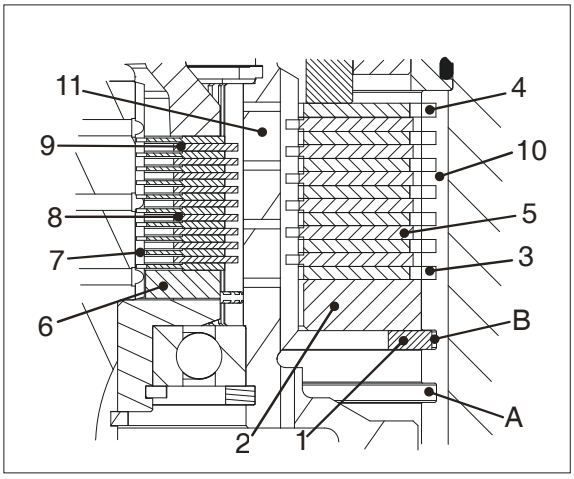


14WF8TM211

Disk components brake and clutch

24) A = Lower annular groove (Item retaining ring-1)
B = Upper annular groove (Item retaining ring-1)

1 = Retaining ring
2 = End plate/Brake (1 pc)
3 = Outer disk/Brake (6 pcs.)
4 = Outer disk/Brake optional (1 pc)
5 = Inner disk/Brake (6 pcs.)
6 = End plate/Clutch (1 pc)
7 = Lining disk/Clutch (10 pcs.)
8 = Outer disk/Clutch (8 pcs.)
9 = Outer disk/Clutch optional (1 pc)
10 = Transmission housing
11 = Disk carrier / Ring gear



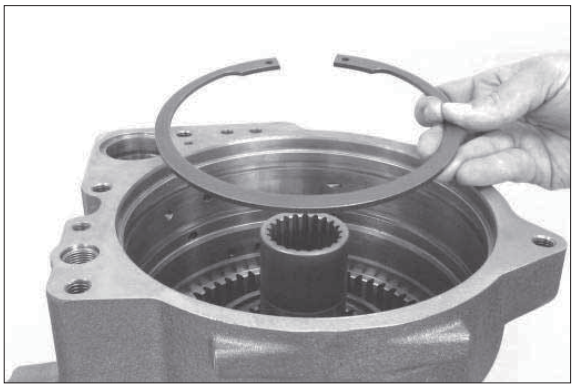
14WF8TM213

Reassembly brake :

25) Engage retaining ring (1) into annular groove (A).

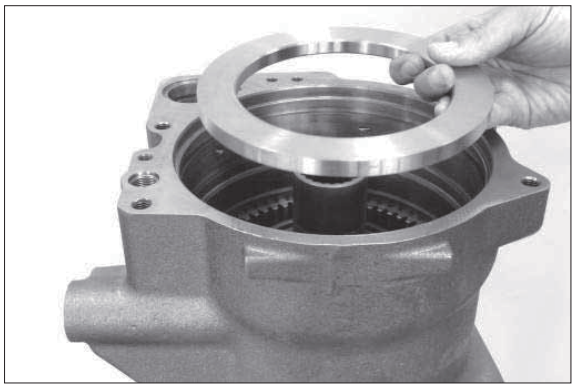
(S) Clamping pliers 5870 900 021

※ Observe installation position of retaining ring (1).



14WF8TM215

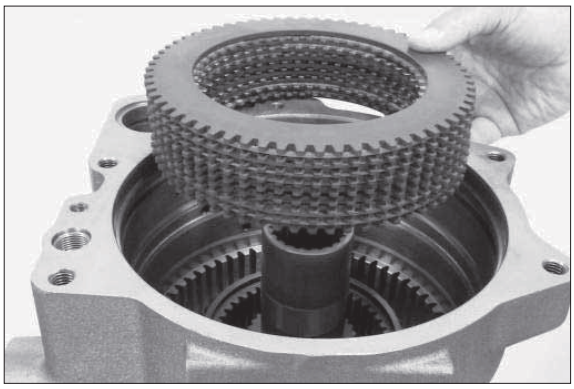
26) Insert end plate (2).



14WF8TM216

27) Insert disk package alternately, beginning with an outer disk.

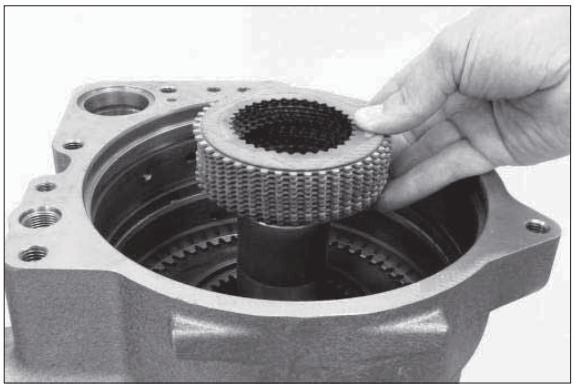
※ Position outer disk (1 pc) s = variable 2.8 ~ 3.7 mm to top of disk package (piston side). With outer disk s = variable, disk clearance/ piston stroke is adjusted - see 14WF8TM229.



14WF8TM217

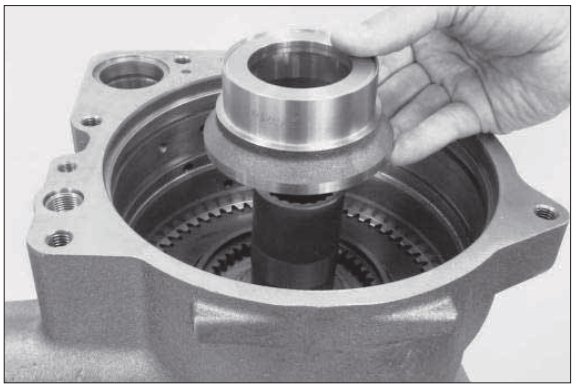
28) Insert disk package alternately, beginning with a lining disk.

※ Position outer disk (1 pc) s = variable 1.2 ~1.6 mm to top of disk package (pressure piece side).
With outer disk s = variable, disk clearance / piston stroke is adjusted – see 14WF8TM228.



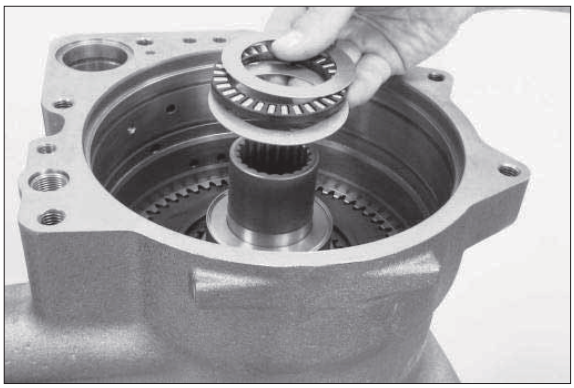
14WF8TM218

29) Mount pressure piece (without compression spring).



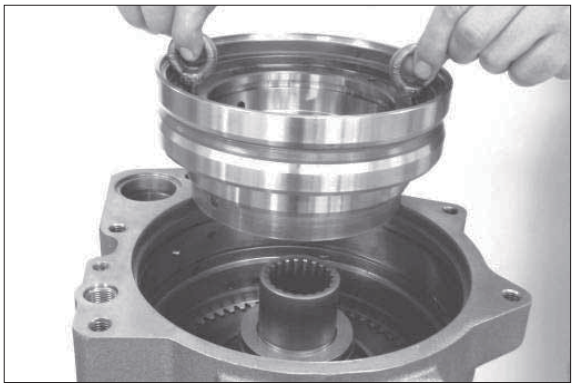
14WF8TM219

30) Oil axial roller cage and mount it with both axial washers (1x each, positioned underneath and onto axial needle cage).



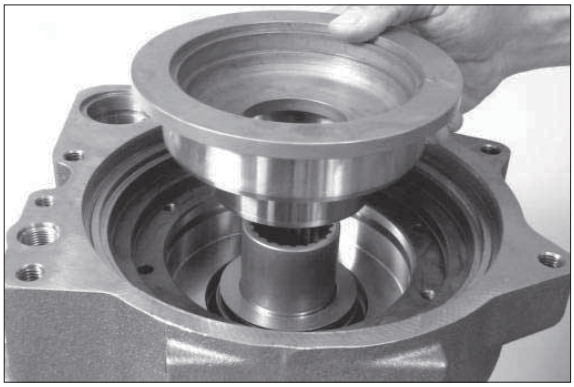
14WF8TM220

31) Insert piston (brake) – without mounted sealing elements.



14WF8TM221

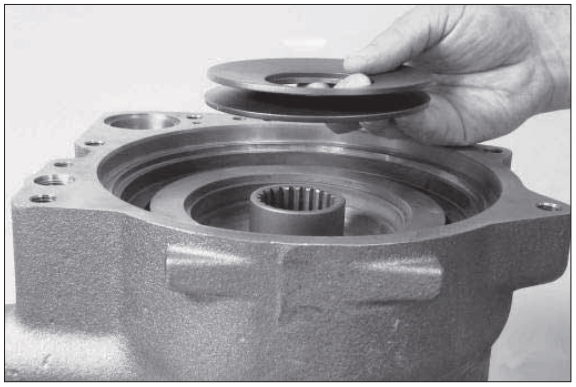
32) Insert piston (clutch) – without mounted sealing elements.



14WF8TM222

33) Insert both cup springs/clutch.

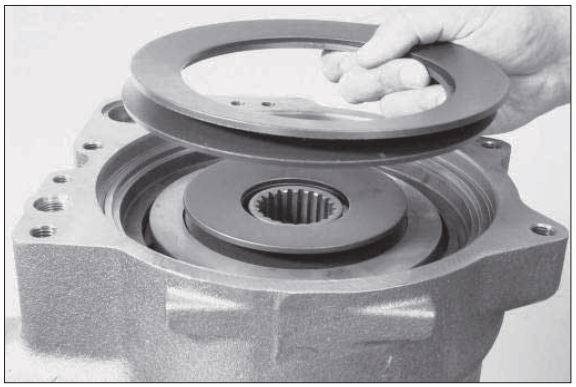
※ Fix cup springs with grease and position them centrically.
※ Observe installation position, see 14WF8TM225.



14WF8TM223

34) Insert both cup springs/brake.

※ Fix cup springs with grease and position them centrically.
※ Observe installation position, see 14WF8TM225.



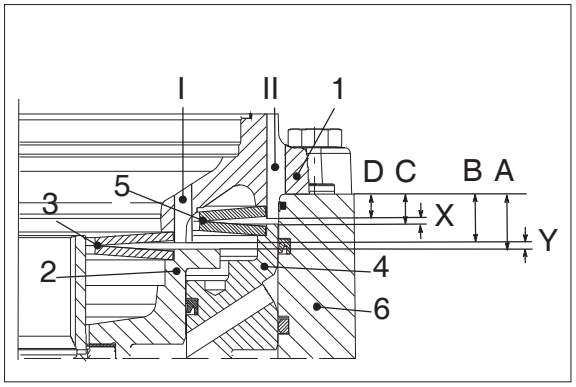
14WF8TM224

35) 1 = Measuring device
2 = Piston/clutch
3 = Cup springs/Clutch
4 = Piston/Brake
5 = Cup springs/Brake
6 = Transmission housing

I = Measuring hole (disk clearance / clutch)
II = Measuring hole (disk clearance / brake)

A = Mounting face/Housing – Front face/Piston
B = Mounting face/Housing – Piston contact/Housing
C = Mounting face/Housing – Front face/Piston
D = Mounting face/Housing – Piston contact/Housing

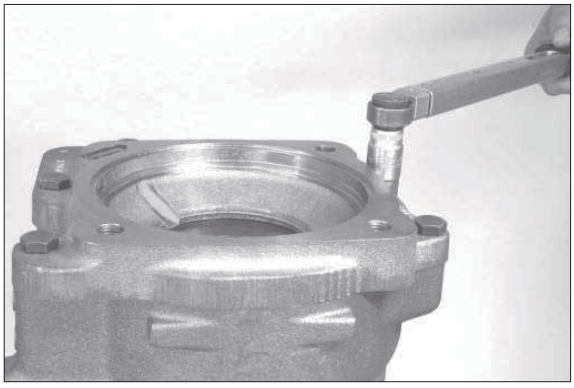
Y = Disk clearance/Clutch → 2.4 +0.3 mm (piston stroke)
X = Disk clearance/Brake → 1.8 + 0.3 mm (piston stroke)



14WF8TM225

36) Locate measuring device evenly with hexagon screws (risk of breakage) until contact.

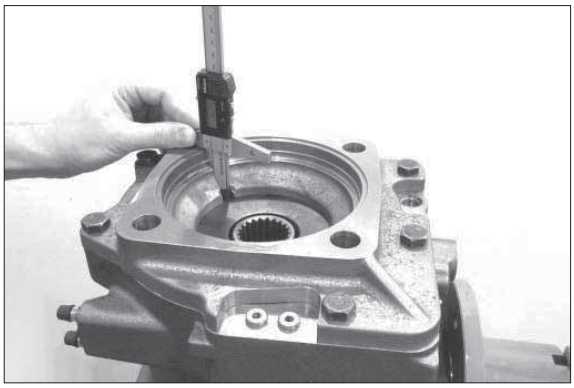
Tightening torque (M 12/8.8) M_A = 80 Nm
(S) Measuring device 5870 200 131



14WF8TM226

37) Determine dim. A (Measuring hole I) from mounting face/housing to front face/piston (clutch).

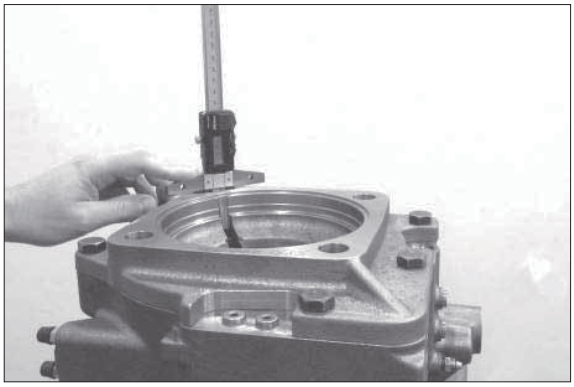
Dim. A e.g. = 22.45 mm
(S) Straightedge 5870 200 108



14WF8TM227

38) Determine Dim. C (Measuring hole II) from mounting face/housing to front face/piston (brake).

Dim. C e.g. = 11.85 mm



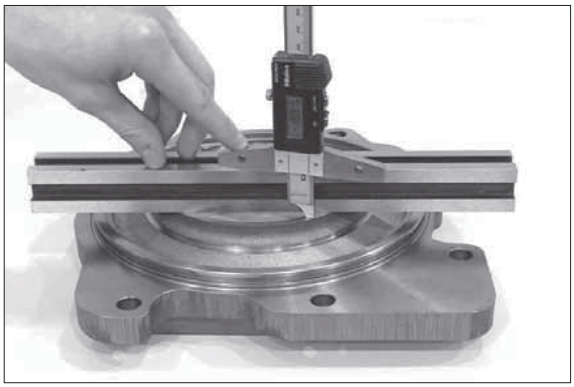
14WF8TM228

39) Determine Dim. B from mounting face/housing to clutch piston contact/housing.

Dim. B e.g. = 19.95 mm
A-B = 2.50 mm (disk clearance)

Clutch disk clearance (piston stroke) = $2.4^{+0.3}$ mm

⚠ **If the required disk clearance (piston stroke) is not obtained, correct with a suitable outer disk – see 14WF8TM218.**



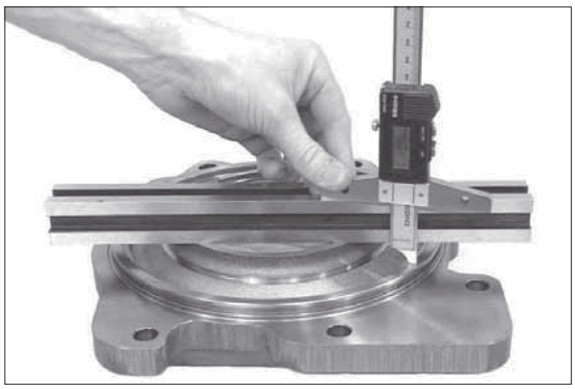
14WF8TM229

40) Determine Dim. D from mounting face/housing to brake piston contact/housing.

Dim. D e.g. = 9.95 mm
C-D = 1.90 mm (disk clearance)

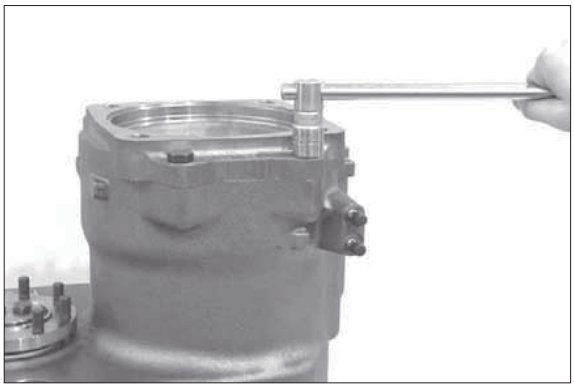
Disk clearance (piston stroke) Brake = $1.8^{+0.3}$ mm

⚠ **If the required disk clearance (piston stroke) is not obtained, correct with a suitable outer disk – see 14WF8TM217.**



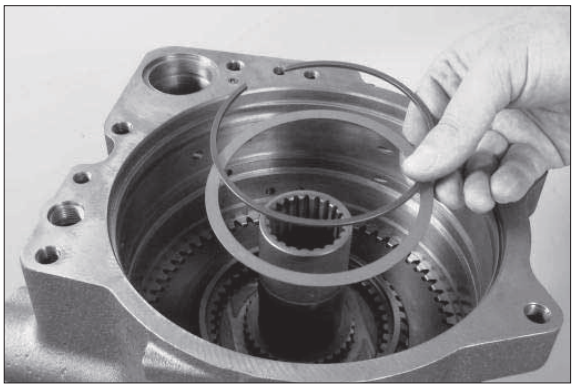
14WF8TM230

41) Remove measuring device again – loosen screws evenly.
Remove all cup springs, both pistons, axial roller cage with axial washers and pressure piece.



14WF8TM231

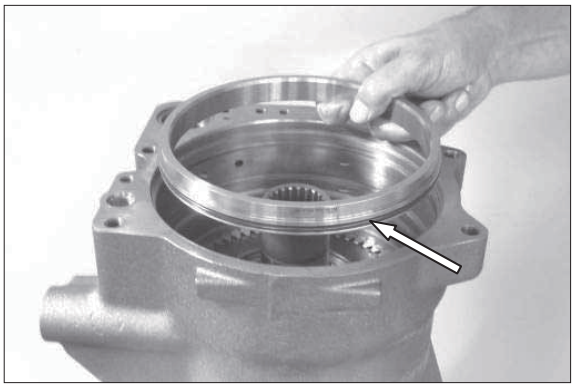
42) Insert shim into ring gear and fix by engaging snap ring into annular groove of ring gear.



14WF8TM232

43) Place O-ring (see arrow) into groove and insert ring.

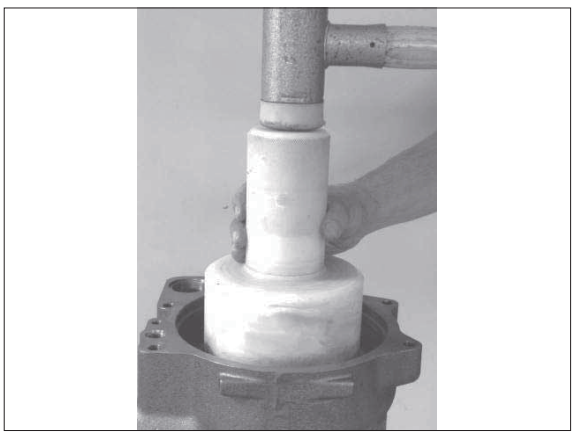
※ Oil sealing surfaces in housing and O-ring for reassembly.
※ Observe installation position



14WF8TM233

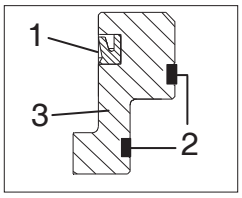
44) Mount ring with driver tool until contact.

(S) Driver tool 5870 506 161

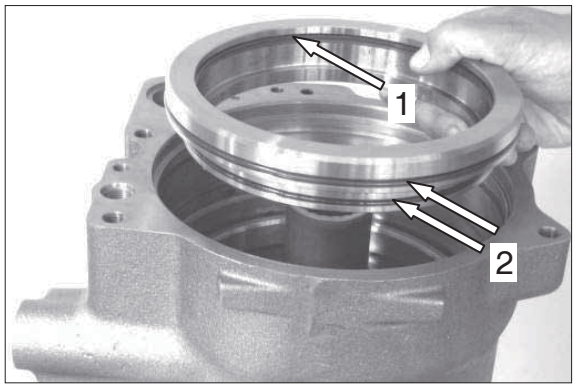


14WF8TM234

45) Oil sealing surfaces in housing and sealing elements. Insert seal (1) with sealing lip showing to oil sump – also see detail sketch.



Put both O-rings (2) into annular grooves of pressure ring (3) and insert preassembled pressure ring into housing.



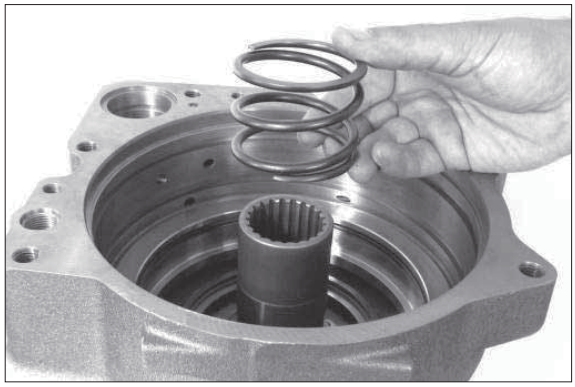
14WF8TM235

46) Bring pressure ring with driver tool into contact position.

(S) Driver tool 5870 506 161

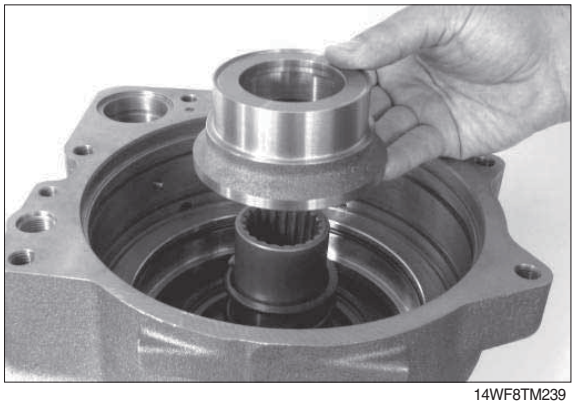
14WF8TM237

47) Insert compression spring until contact.



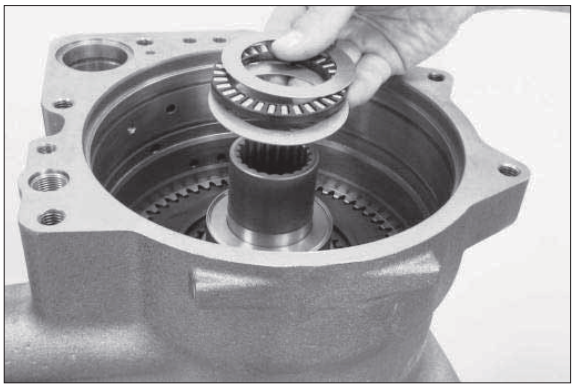
14WF8TM238

48) Insert pressure piece over compression spring until contact.



14WF8TM239

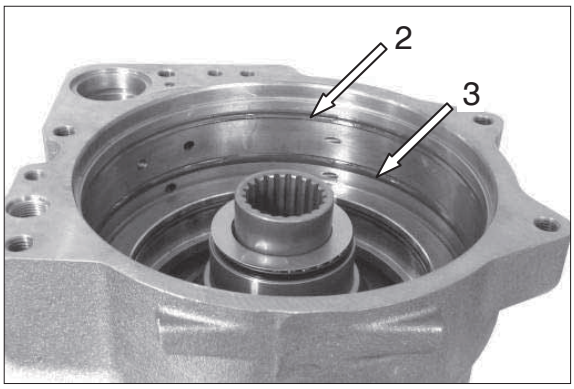
49) Oil axial roller cage and mount it with both axial washers (1x each to be positioned underneath and onto axial needle cage).



14WF8TM240

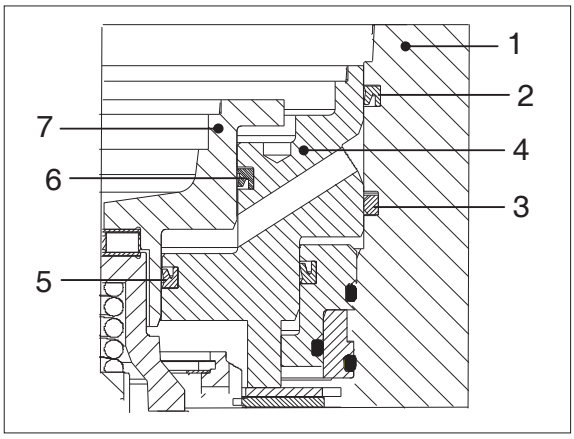
50) Insert seal (2, with sealing lip showing to oil sump) and seal (3) – see 14WF8TM242 into housing (1).

※ Oil sealing elements and sealing surfaces on piston for reassembly.



14WF8TM241

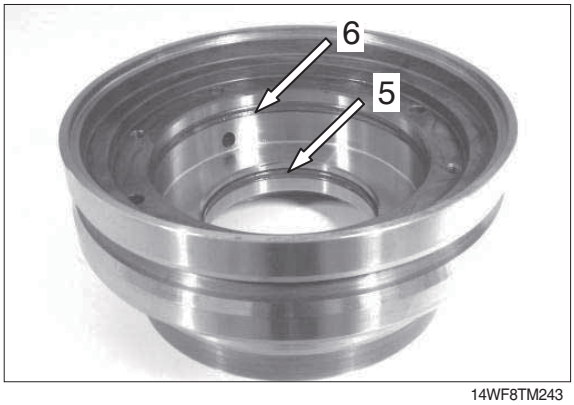
51) 1 = Housing
2 = Seal (with sealing lip)
3 = Seal
4 = Piston / Brake
5 = Seal (with sealing lip)
6 = Seal (with sealing lip)
7 = Piston / Clutch



14WF8TM242

52) Insert seals (5 and 6, see 14WF8TM247), with sealing lips showing to oil sump into piston / brake (4).

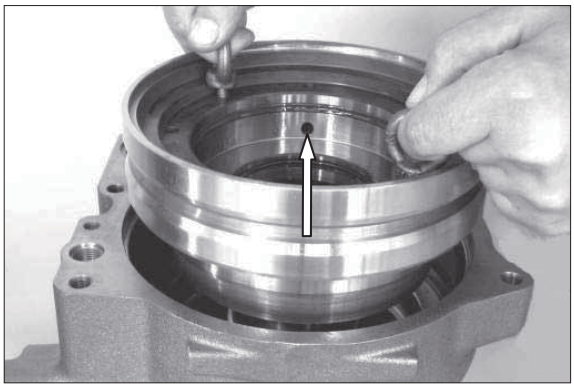
※ Oil sealing surfaces on piston and sealing elements for reassembly.



14WF8TM243

53) Insert preassembled piston/brake until contact.

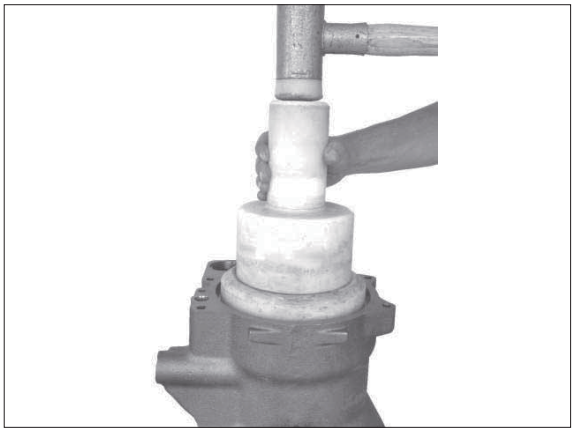
※ Position piston in such a way that oil supply hole (see arrow) is at 12.00 o'clock position. Observe version as to transmission installation position HORIZONTAL – VERTICAL.



14WF8TM244

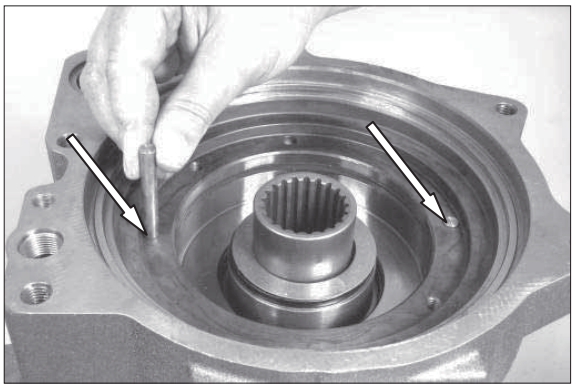
54) Use driver tool to bring piston into contact position.

(S) Driver tool 5870 506 161



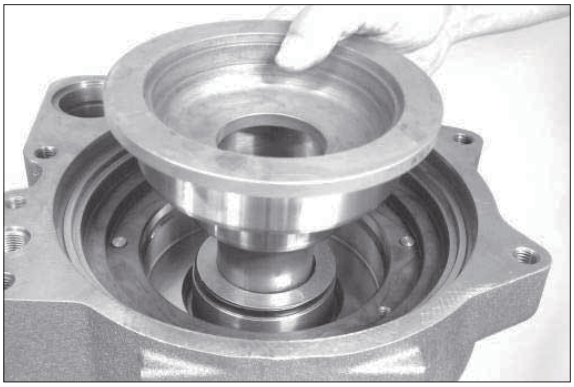
14WF8TM245

55) Insert both cyl. pins (arrow).



14WF8TM246

56) Insert piston/clutch until contact.

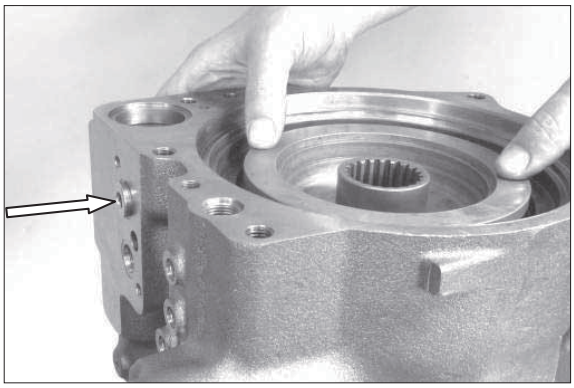


14WF8TM247

57) Press piston axially, against compression spring preload.
Provide screw plug with new O-ring and seal pressure oil supply hole (see arrow).

Tightening torque M_A = 40 Nm

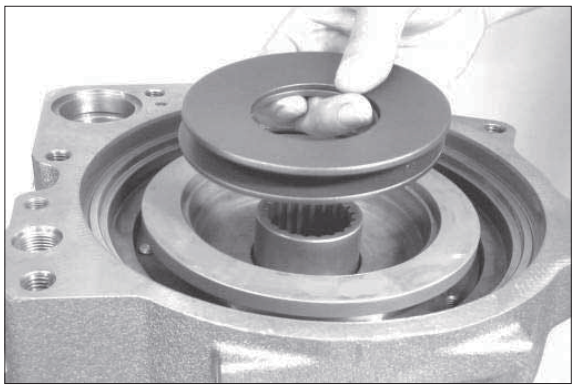
※ Axial position of piston is maintained (Facilitate assembly for installation of input housing, see 14WF8TM254~ 14WF8TM255).



14WF8TM248

58) Insert both cup springs/clutch.

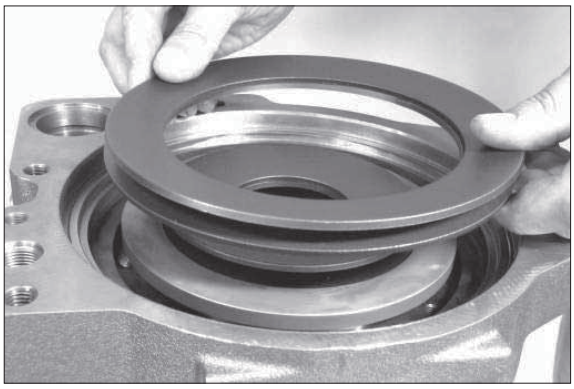
※ Observe installation position, see also 14WF8TM225.



14WF8TM249

59) Insert both cup springs/brake.

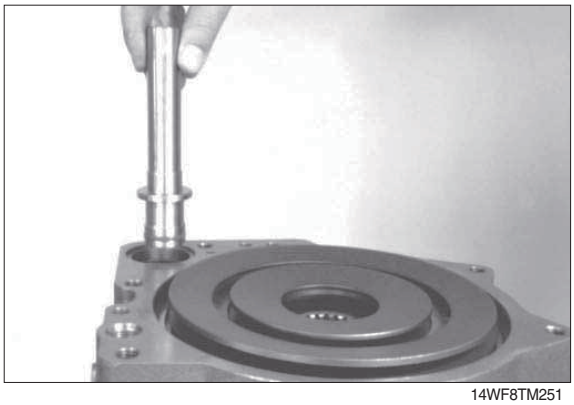
※ Observe installation position – see also 14WF8TM225.



14WF8TM250

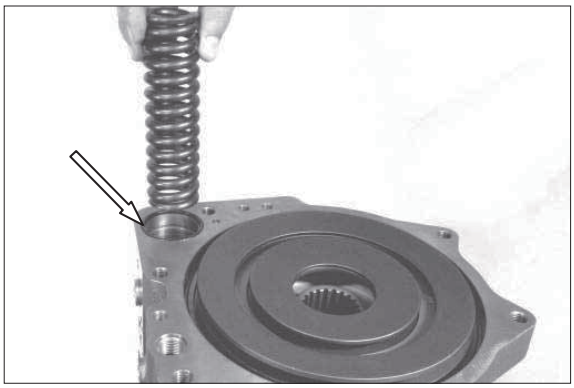
Install modulation valve and input housing

60) Insert piston (modulation valve cpl. – can only be replaced as unit).



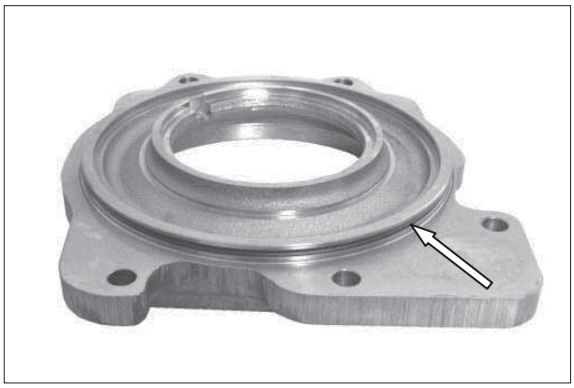
14WF8TM251

61) Place O-ring (see arrow) into annular groove of housing and insert compression spring.



14WF8TM252

62) Oil O-ring and insert it into annular groove of input housing.

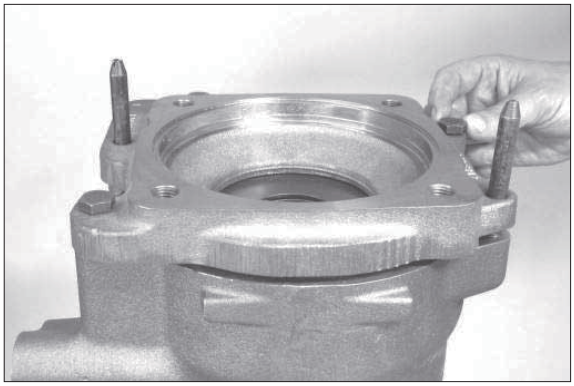


14WF8TM253

63) Insert two adjusting screws (M 12), mount input housing and fix it with hexagon screws.

(S) Adjusting screws (M12) 5870 204 021

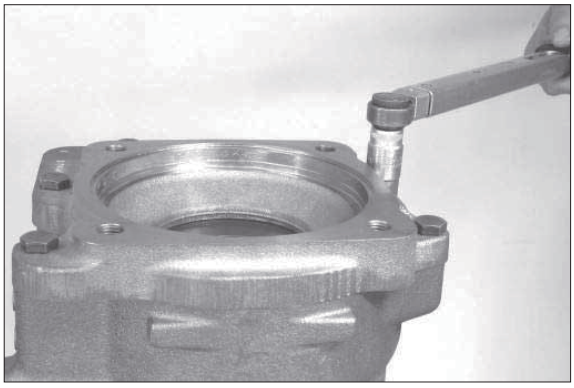
※ For installation of input housing align cup springs centrically.



14WF8TM254

64) Locate input housing evenly with hexagon screws (risk of breakage) until contact.

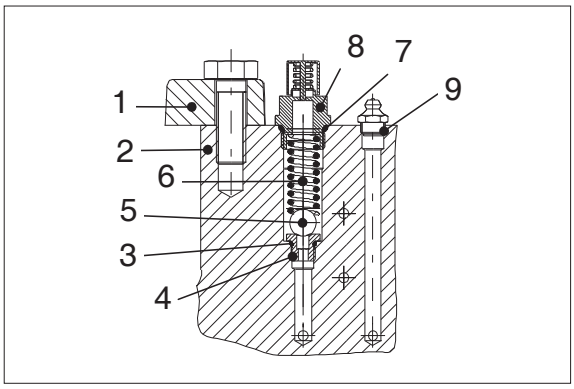
Tightening torque (M 12/8.8) M_A = 80 Nm



14WF8TM255

Emergency release (parking brake)

65) 1 = Input housing
2 = Housing
3 = O-ring
4 = Threaded element (orifice)
5 = Ball
6 = Compression spring
7 = O-ring
8 = Breather
9 = Position of lubrication nipple for version Transmission installation position Vertical



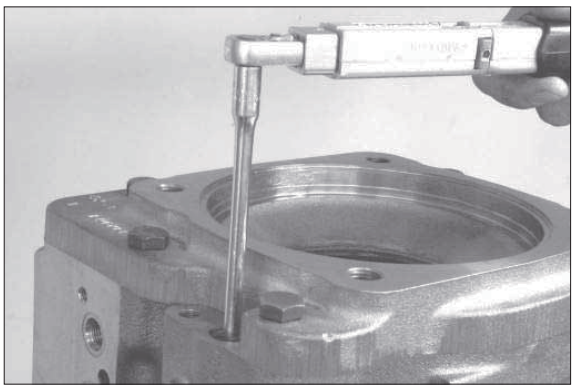
14WF8TM256

※ Position of lubrication nipple for version transmission installation position Horizontal, see 14WF8TM261.

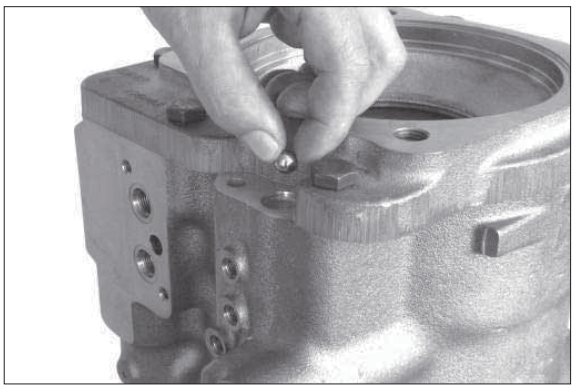
※ Remove protective cap of lubrication nipple only if emergency release is required.

66) Install threaded element (4) with new O-ring (3).

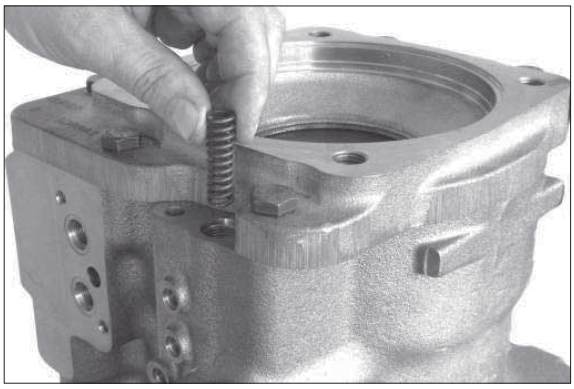
Tightening torque (M 10×1) M_A = 15 Nm


14WF8TM257

67) Insert ball (5).


14WF8TM258

68) Insert compression spring (6).


14WF8TM259

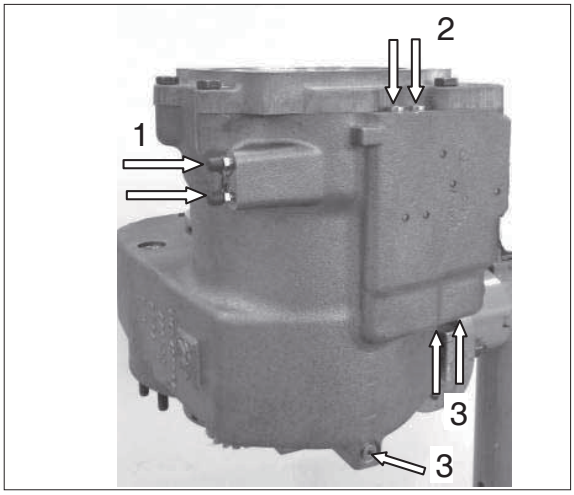
Check emergency release for leak tightness

69) Illustration shows version transmission installation position Vertical.

※ For version transmission installation position Horizontal connections and positions of breather valves/lubrication nipple etc. must be considered as shown on illustration of 14WF8TM261.

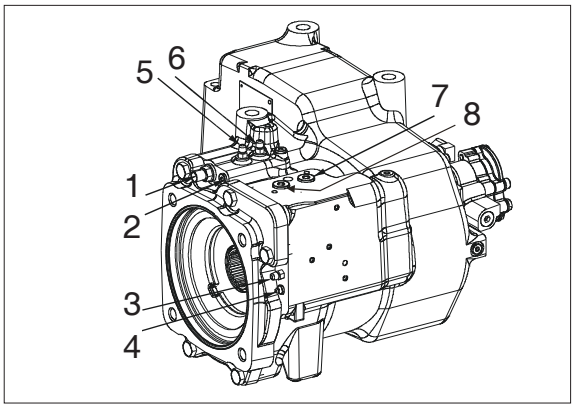
Install both breather valves (1), screw plugs (2) with new seal rings and screw plugs (3) with new O-rings.

Breather valve (M 10×1) M_A = 15 Nm
Screw plug (M 10×1 with seal ring) M_A = 20 Nm
Screw plug (M 10×1 with O-ring) M_A = 20 Nm



14WF8TM260

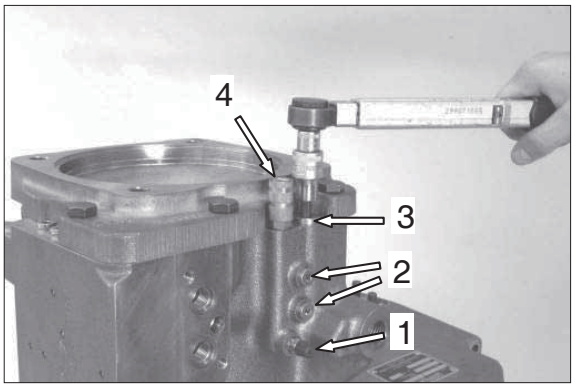
70) 1 = Breather/Pressure relief-valve
(emergency release –parking brake)
2 = Screw plug
3 = Breather valve
(emergency release – parking brake)
4 = Lubrication nipple
(emergency release – parking brake)
5 = Breather valve (multi-disk clutch)
6 = Breather valve (mulit-disk brake)
7 = Pressure oil connection – multi-disk brake
8 = Pressure oil connection – multi-disk clutch



14WF8TM261

71) Install breather valve (1), screw plugs (2), screw plug (3) with new O-ring and compressed air connection piece (4).

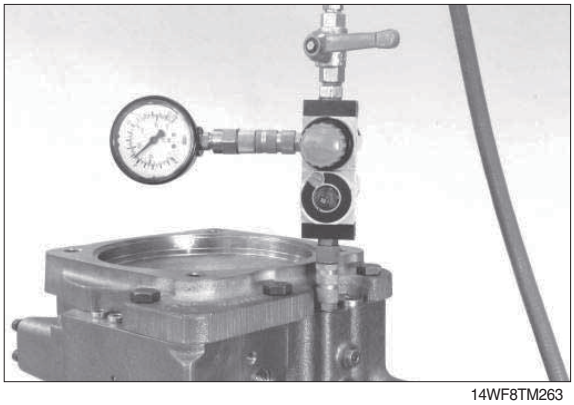
Breather valve (M 10×1) M_A = 15 Nm
Screw plug (M 10×1 with O-ring) M_A = 20 Nm
Screw plug (M 18×1.5 with O-ring) M_A = 35 Nm
Compressed air connect. piece (M 10×1) with seal ring M_A = 20 Nm



14WF8TM262

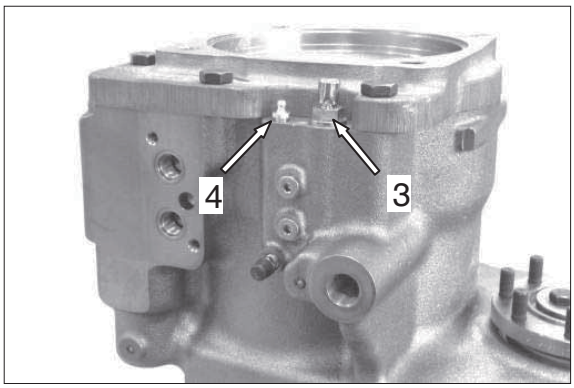
72) Pressurize emergency release with compressed air p = 5 + 1bar and close shut-off valve. During a test duration of 3 minutes no pressure drop is allowed.

(S) Air connection 5870 505 012


14WF8TM263

73) Remove screw plug and compressed air connection piece (see 14WF8TM262).
Install breather (3) with new O-ring and lubrication nipple (4).

Lubrication nipple (M 10×1) M_A = 15 Nm
Breather (M 18×1.5) M_A = 22 Nm



14WF8TM264

Check multi-disk brake and clutch for leak tightness as wells as closing pressure

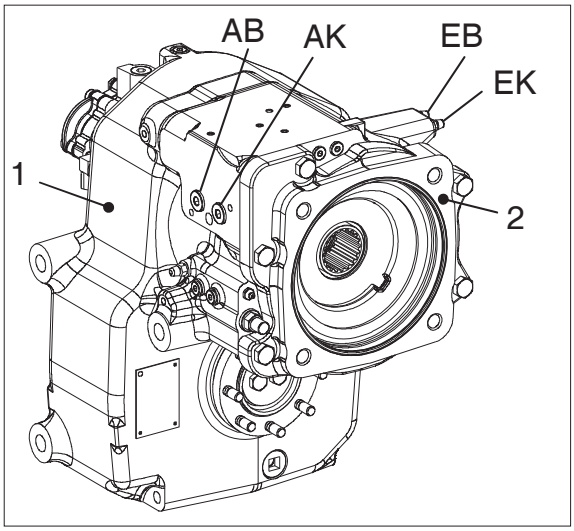
74) 1 = Transmission housing
2 = Input housing

AB = Pressure oil connection – multi-disk brake
AK = Pressure oil connection – multi-disk clutch

EB = Breather valve – multi-disk brake
EK = Breather valve – multi-disk clutch

※ Illustration shows version transmission installation position Vertical.

※ For version Transmission installation position Horizontal, connections and positions of breather valves/lubrication nipple etc. according to illustration in 14WF8TM261 must be considered.

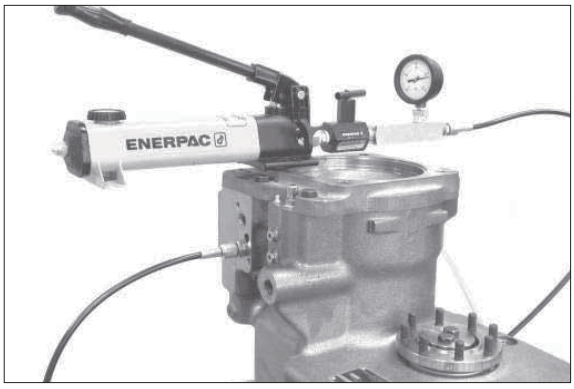


14WF8TM265

Multi-disk brake

75) Connect HP pump (AB – see 14WF8TM265 and 14WF8TM261) and build up pressure of p = 30 (max. 35 bar).
- Bleed pressure chamber several times. Close shut-off valve.
During a test duration of 3 minutes no measurable pressure drop is allowed.

(S) HP pump 5870 287 007



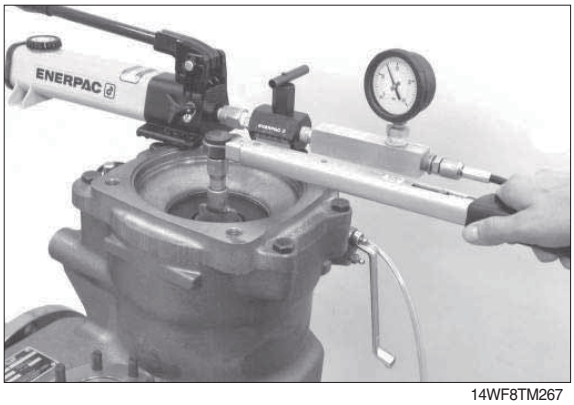
14WF8TM266

Closing pressure test (Cup spring preloading force)

76) When measuring closing pressure, valve block may not be attached to transmission due to by-pass function between brake and clutch.
Connection AK (see 14WF8TM265 and 14WF8TM261) open (not closed and tank connection).

Reduce pressure slowly, when pressure range 12~9 bar (closing pressure) is reached, input shaft must be locked at a tightening torque of 35 Nm.

(S) Spline mandrel 5870 510 039

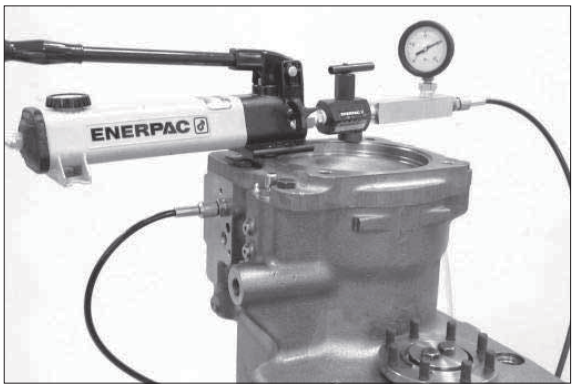


14WF8TM267

Multi-disk clutch

77) Connect HP-pump (AK see 14WF8TM265 and 14WF8TM261), build up pressure of p = 30~max. 35 bar.
- Relieve pressure chamber several times. Close shut-off valve.
During a test duration of 3 minutes no measurable pressure drop is allowed.

(S) HP-pump 5870 287 007

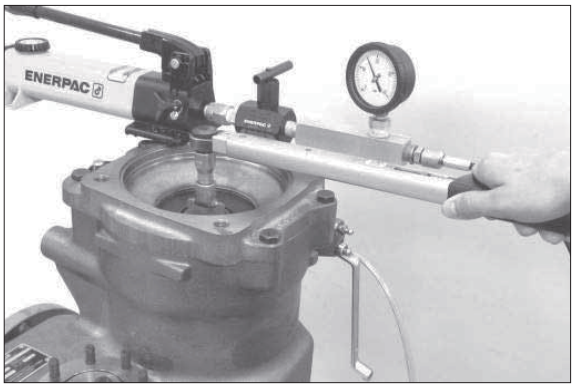


14WF8TM268

Closing pressure test (Cup spring preloading force)

78) When measuring closing pressure, valve block (only for version with mounted valve block) may not be attached to transmission due to by-pass function between brake and clutch.
Connection AB (see 14WF8TM265 and 14WF8TM261) open (not closed and tank connection).
Reduce pressure slowly, when pressure range 17~13 bar (closing pressure) is reached, input shaft must be locked at a tightening torque of 35 Nm.

(S) Spline mandrel 5870 510 039

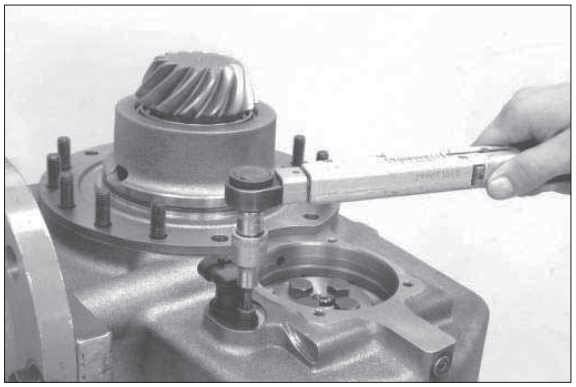


14WF8TM269

Speed sensor

79) Install speed sensor with new O-ring.

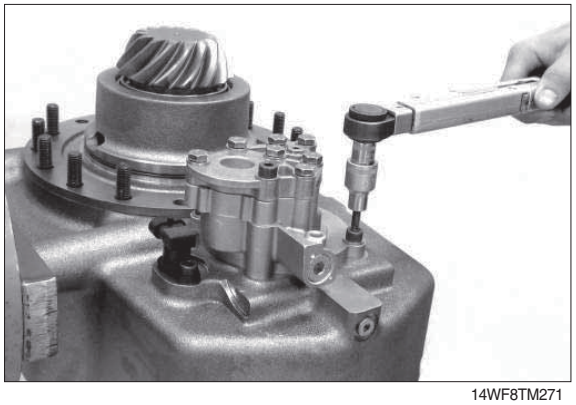
Tightening torque (M 8/8.8) M_A = 23 Nm


14WF8TM270

Lubrication pump/shift interlock

80) Install lubrication pump (with O-rings) or shift interlock – depending on version – (Illustration shows – Lubrication Pump).

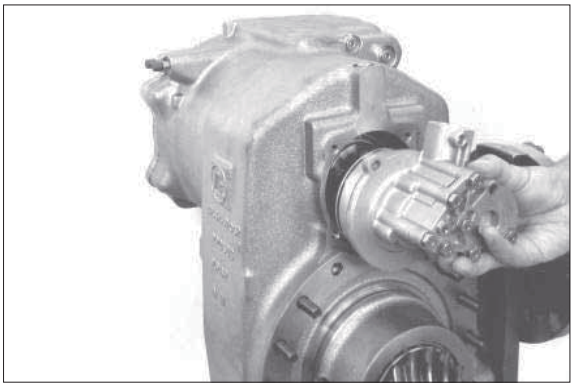
Tightening torque (M 8/10.9) M_A = 23 Nm


14WF8TM271

10.DISASSEMBLY - LUBRICATION PUMP/ SHIFT INTERLOCK and VALVE BLOCK

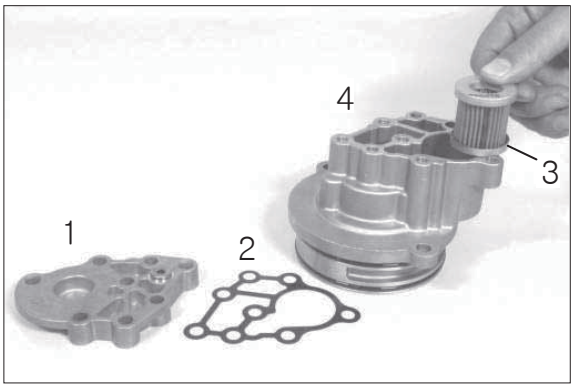
Lubrication pump version

1) Loosen threaded joint and pull off cpl. lubrication pump.



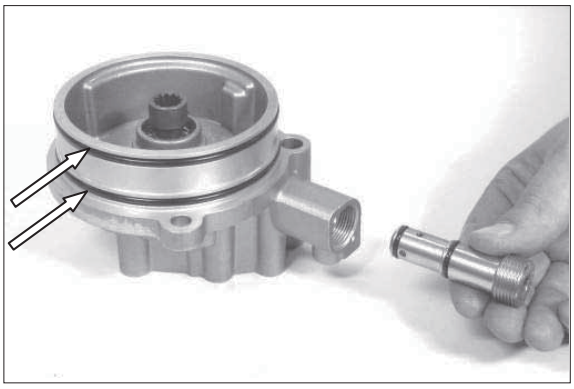
14WF8TM272

2) Loosen cover screws, remove cover (1) with seal (2) and filter (3) from housing (4).



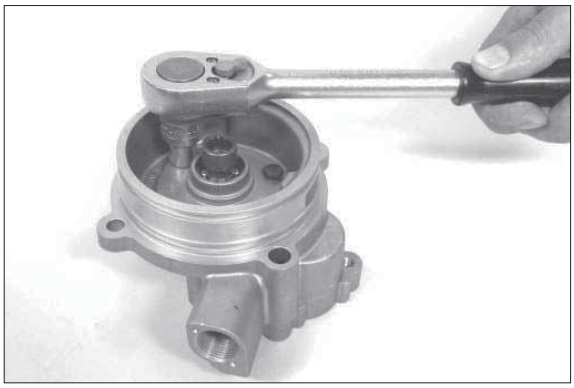
14WF8TM273

3) Remove cpl. pressure limiting valve and both O-rings (arrows).



14WF8TM274

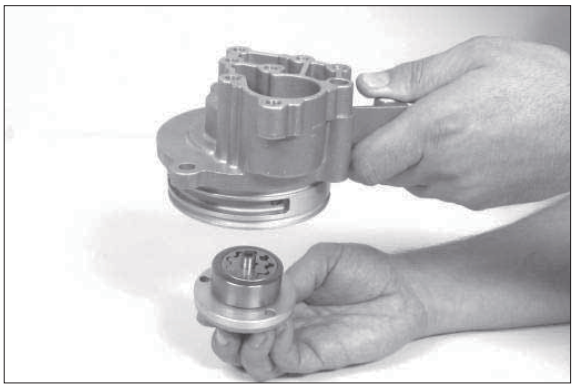
4) Keep housing in vertical position, while loosening pump cover screws.



14WF8TM275

※ Maintain contact position of pump and rotate by 180˚- disassembly aid.

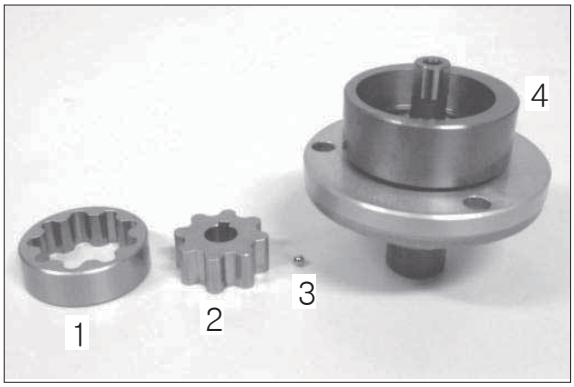
5) Then pull pump in vertical position out of housing – pay attention to possibly releasing balls and compression springs.



14WF8TM276

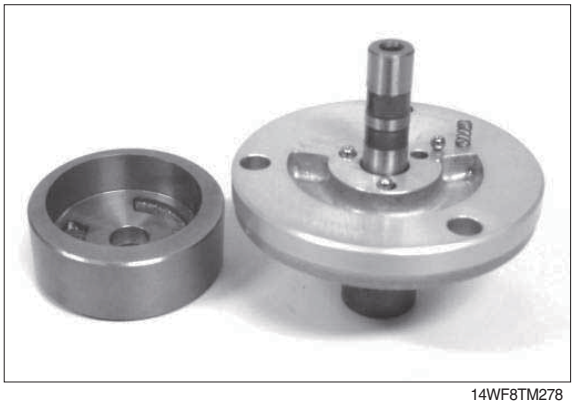
6) Remove outer (1) and inner rotor (2) and take releasing ball [(3) driver] out of control housing (4).

※ Outer, inner rotor and control housing = rotor set



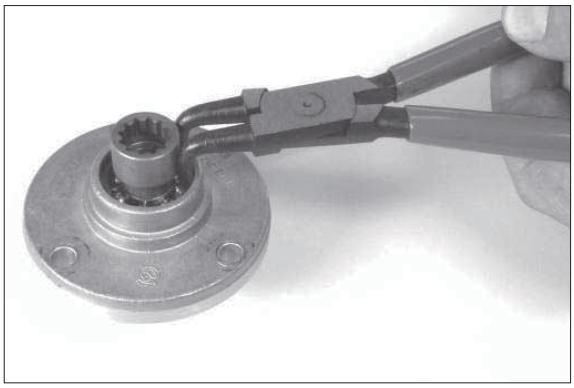
14WF8TM277

7) Remove control housing and releasing balls and compression springs (3 pcs. each).



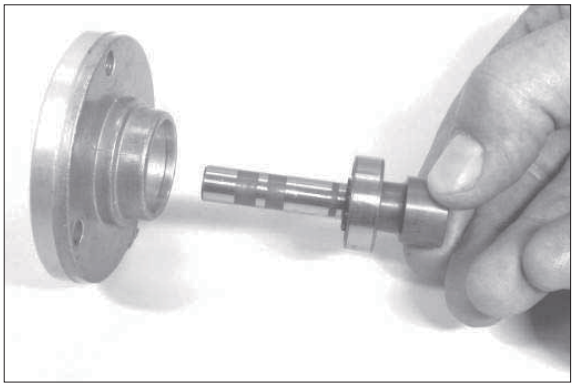
14WF8TM278

8) Unsnap retaining ring.



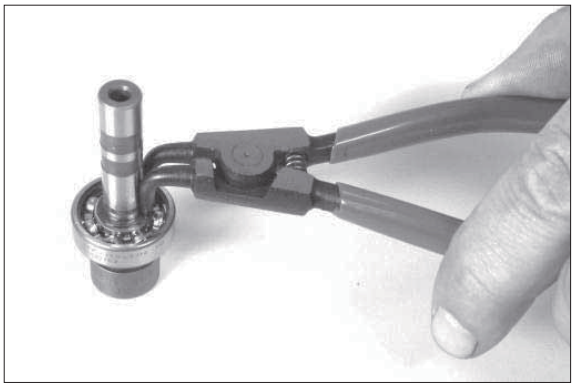
14WF8TM279

9) Pull cpl. pump shaft out of pump cover.



14WF8TM280

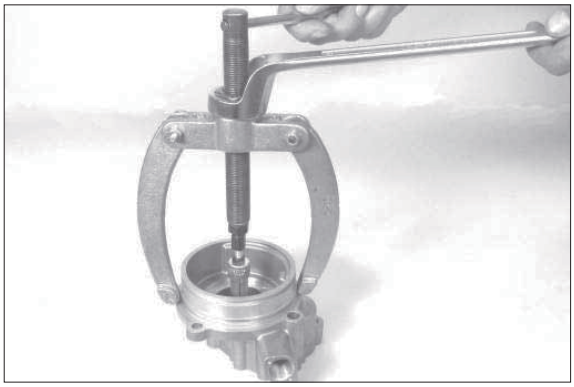
10) Unsnap retaining ring and press ball bearing from shaft.



14WF8TM281

11) Pull needle sleeve out of housing hole.

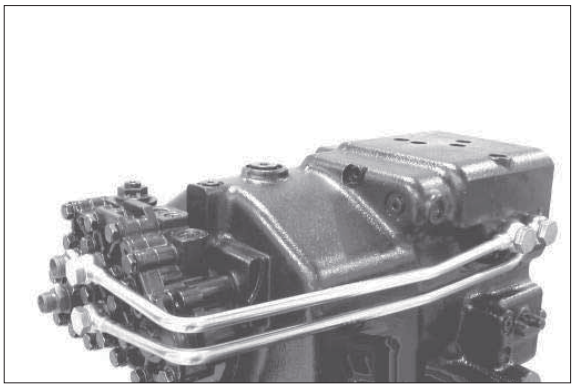
(S) Inner extractor	5870 300 012
(S) Counter support	5870 300 011



14WF8TM282

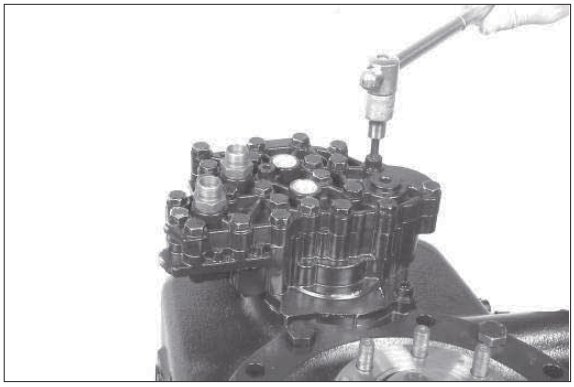
Shift interlock version

12) Disassemble both oil tubes.



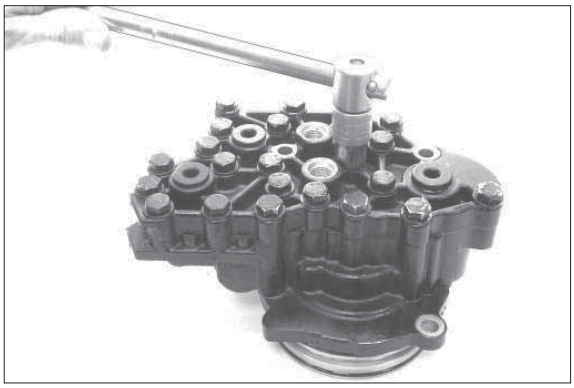
14WF8TM283

13) Loosen threaded joint of shift interlock (3 x cylindrical screws) and remove cpl. shift interlock.



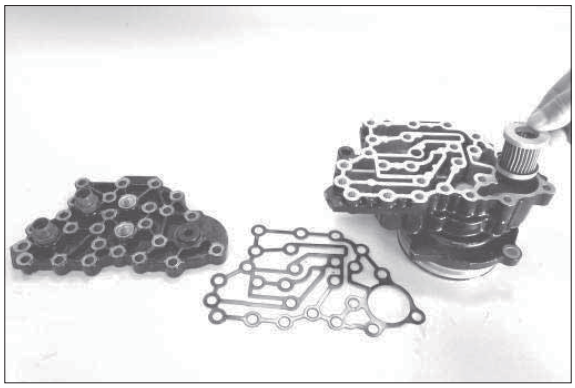
14WF8TM284

14) Loosen cover screws, remove cover and gasket (see also 14WF8TM286).



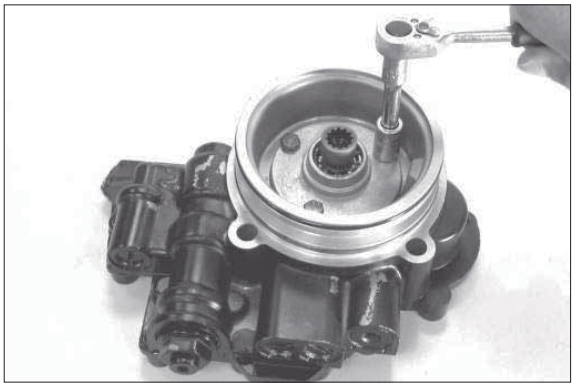
14WF8TM285

15) Take filter out of housing.



14WF8TM286

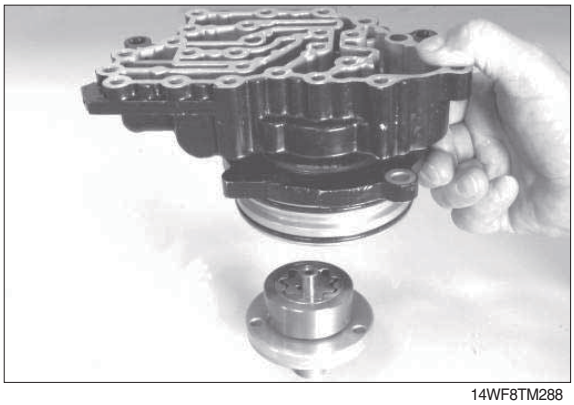
16) Loosen cover screws of pump.



14WF8TM287

※ Maintain contact position of pump and rotate it by 180˚ – disassembly aid.

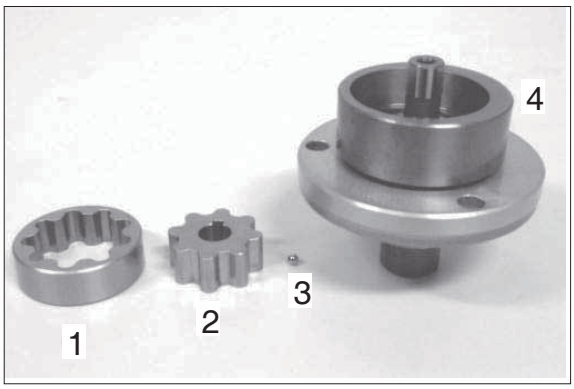
17) Then pull pump in vertical position out of housing – pay attention to possibly releasing balls and compression springs (see 14WF8TM289 and 14WF8TM290).



14WF8TM288

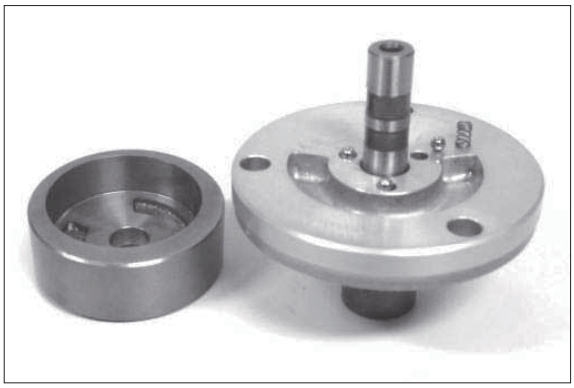
18) Remove outer (1) and inner rotor (2) and take releasing ball [(3) driver] out of control housing (4).

※ Outer, inner rotor and control housing = rotor set



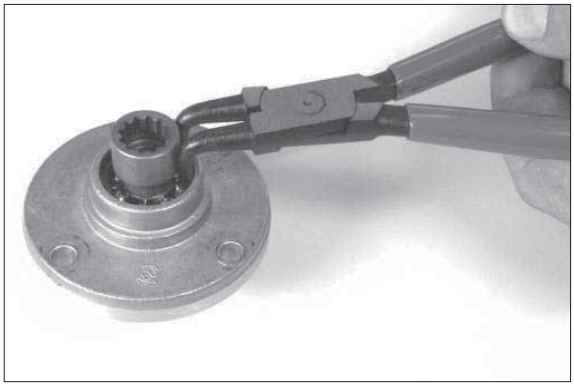
14WF8TM289

19) Remove control housing and releasing balls and compression springs (3 pcs. each).



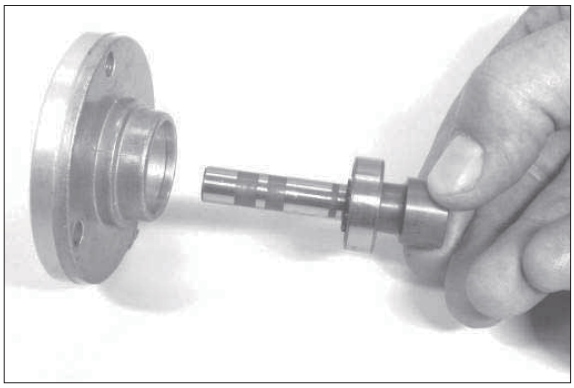
14WF8TM290

20) Unsnap retaining ring.



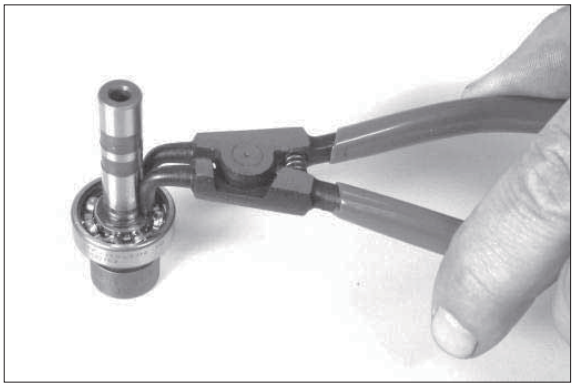
14WF8TM291

21) Pull cpl. pump shaft out of pump cover.



14WF8TM292

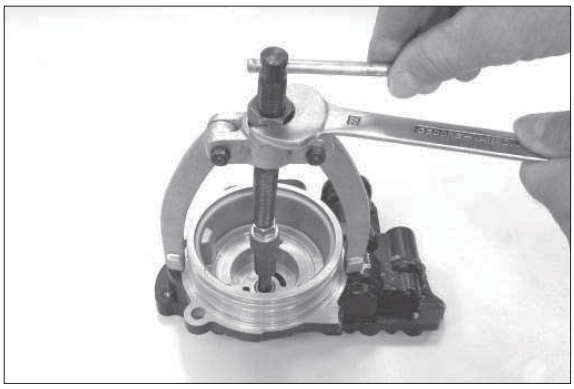
22) Unsnap retaining ring and press ball bearing from shaft.



14WF8TM293

23) Pull needle sleeve out of housing hole.

(S) Inner extractor 5870 300 012
(S) Counter support 5870 300 011

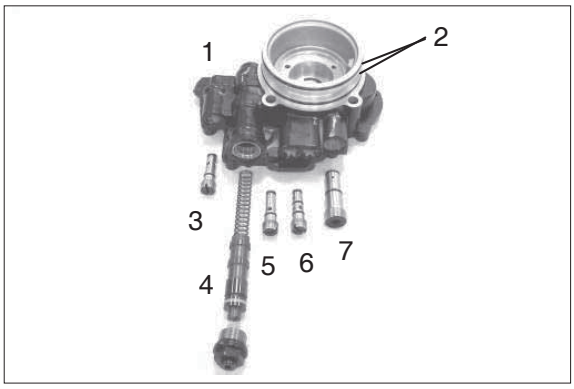


14WF8TM294

24) Remove O-rings and all single parts, remove valves.

1 = Housing
2 = O-rings
3 = Check valve (010)
4 = Shift piston
5 = Check valve (009)
6 = Check valve (008)
7 = Pressure relief valve

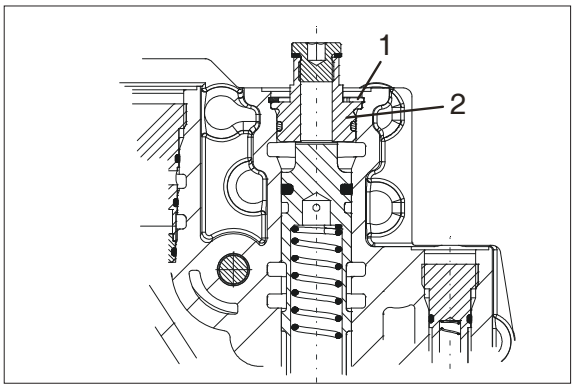
Position 4 (shift piston) shows version with screw plug.



14WF8TM295

25) In sketch 14WF8TM296 version II is shown with plug (2) and retaining ring (1).

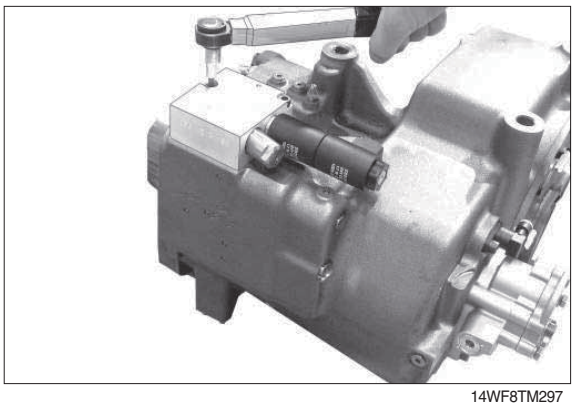
⚠ **When disengaging retaining ring – Pay attention to spring preload. Protect against movement.**



14WF8TM296

Disassemble valve block

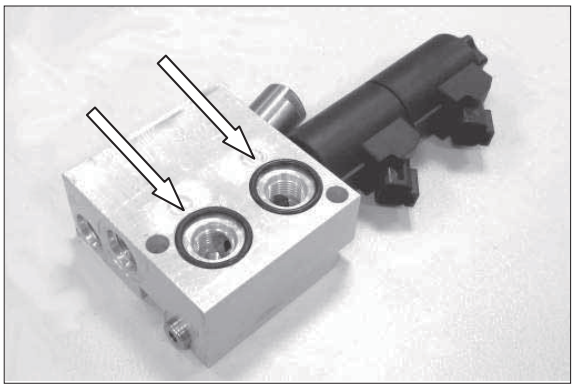
26) Loosen fixing screws and remove cpl. valve block.



14WF8TM297

27) Remove both O-rings (see arrows).

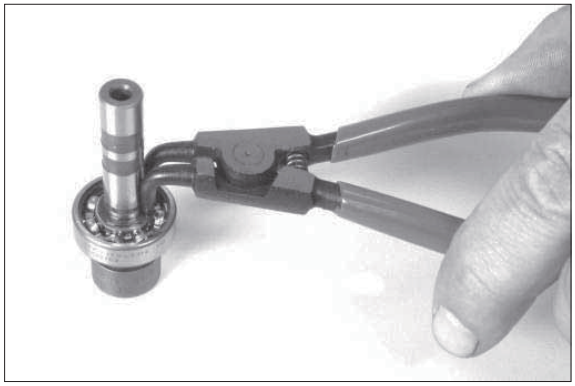
※ Do not further disassemble. Valve block may only be replaced as component.



14WF8TM298

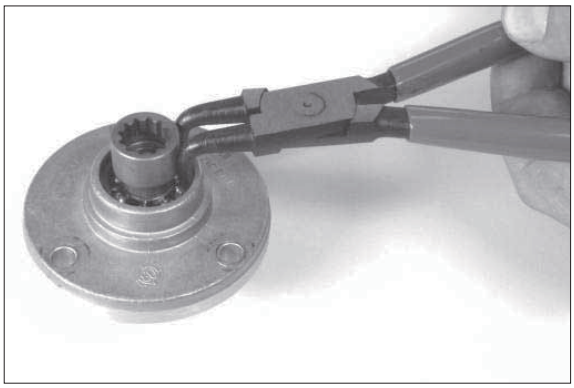
11. REASSEMBLY LUBRICATION PUMP

1) Mount ball bearing onto pump shaft and fix it by engaging retaining ring into annular groove of pump shaft.



14WF8TM299

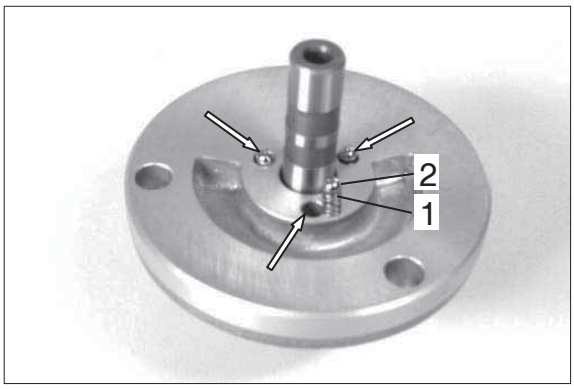
2) Press preassembled pump shaft into pump cover and fix it by engaging retaining ring into annular groove of pump cover.



14WF8TM300

3) Insert compression springs (1) and ball (2) into holes (see arrows - 3x).

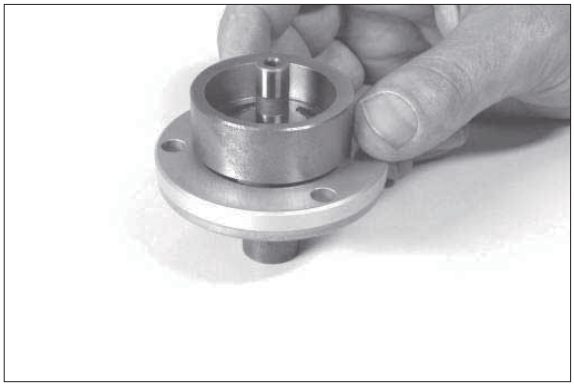
※ Keep preassembled single parts in vertical position–pay attention to position of inserted balls and compression springs (see work steps 14WF8TM301~14WF8TM307).



14WF8TM301

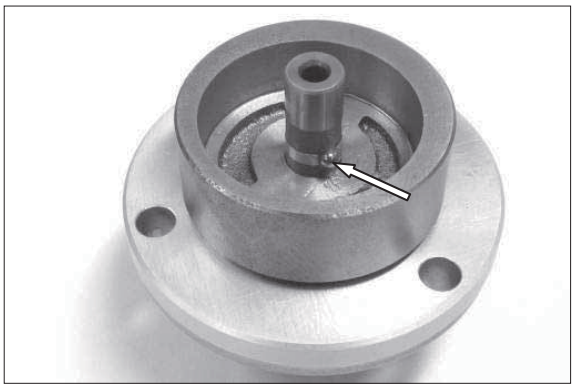
4) Mount control housing.

※ Control housing, inner and outer rotor = rotor set



14WF8TM302

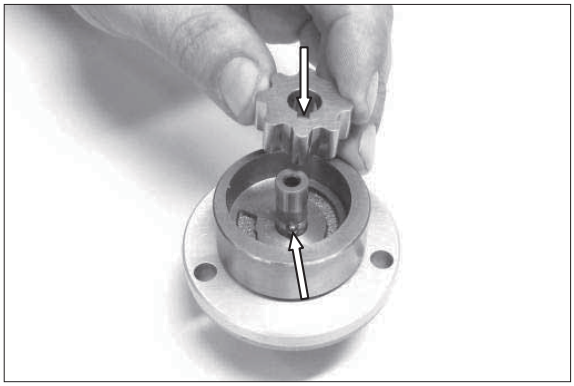
5) Position ball – (see arrow, engagement for inner rotor) with grease into countersink of pump shaft.



14WF8TM303

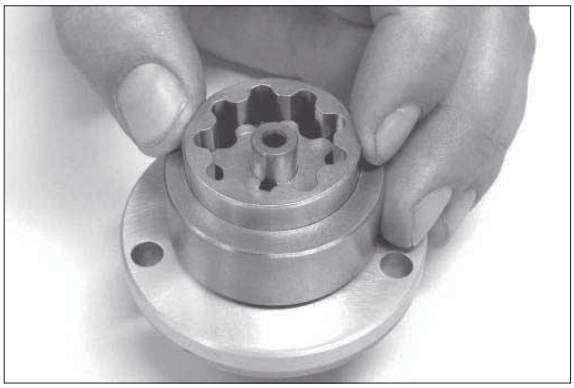
6) Mount inner rotor.

※ Place groove of inner rotor over ball (see arrows).



14WF8TM304

7) Mount outer rotor



14WF8TM305

8) Insert needle sleeve to installation dimension X into housing.

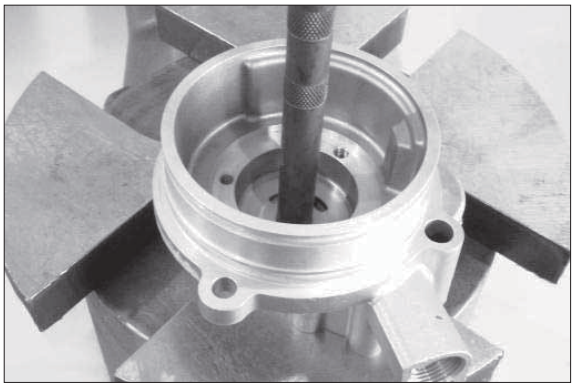
X = 0.2~0.7 mm below plane face / housing

(S) Driver tool 5870 705 003

※ Use of specified driver tool ensures exact installation position.

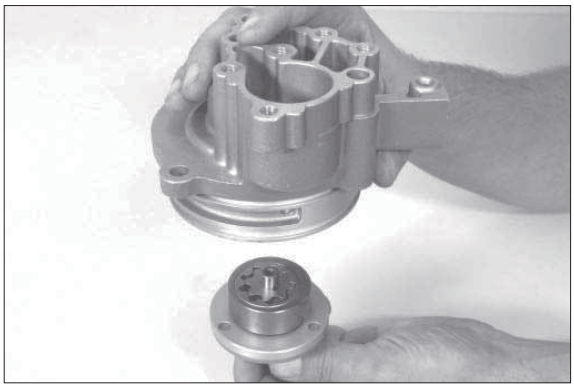
※ Insert needle sleeve with marked front face showing upwards.

※ Check opening of orifice / oil hole in housing bottom.



14WF8TM306

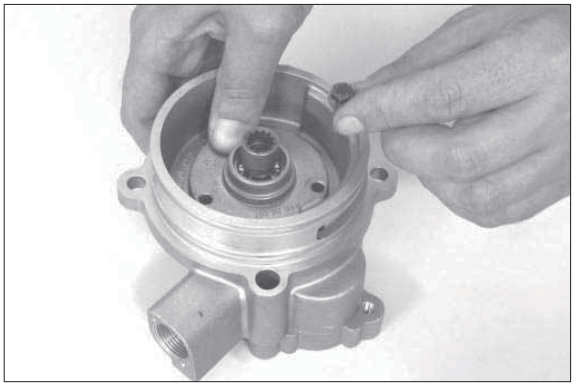
9) Maintain pump in vertical position while inserting housing with mounted needle sleeve onto preassembled pump.



14WF8TM307

10) Rotate housing by 180˚ and fix pump with hexagon screws.

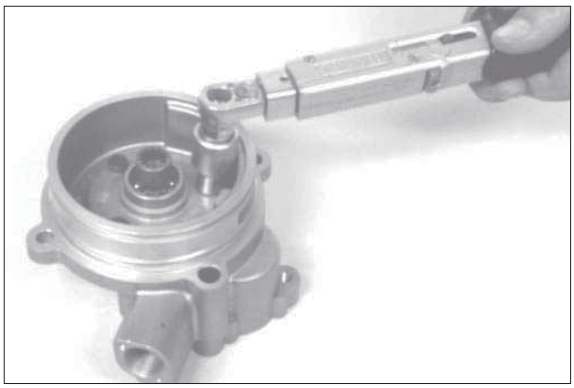
※ Maintain contact position of inserted pump.



14WF8TM308

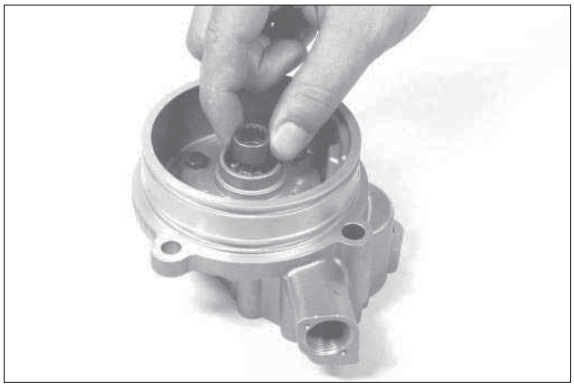
11) Fix pump.

Tightening torque (M6/8.8) M_A = 9.5 Nm



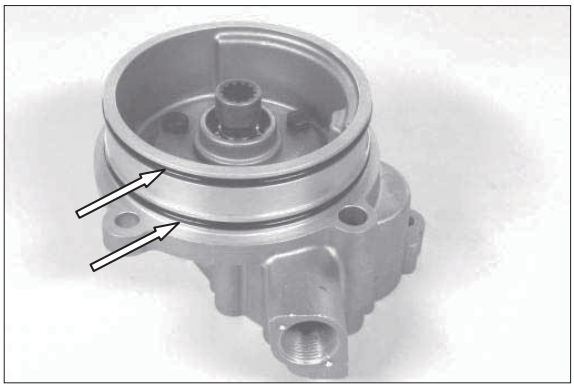
14WF8TM309

12) With counter-turning motions on pump shaft, swiveling of control housing (stop LH/RH in pump cover) is audible.



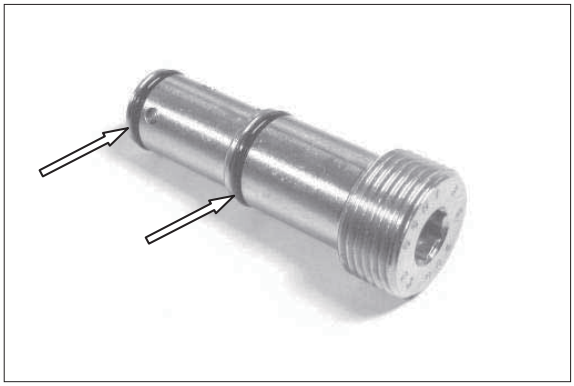
14WF8TM310

13) Oil both O-rings (arrows) and put them into annular groove of housing.



14WF8TM311

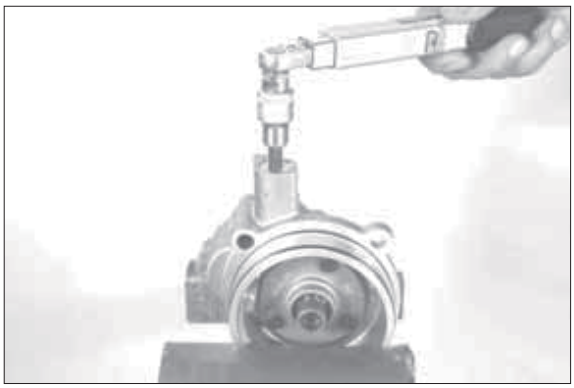
14) Insert O-rings (see arrows) into annular grooves of pressure relief valve.



14WF8TM312

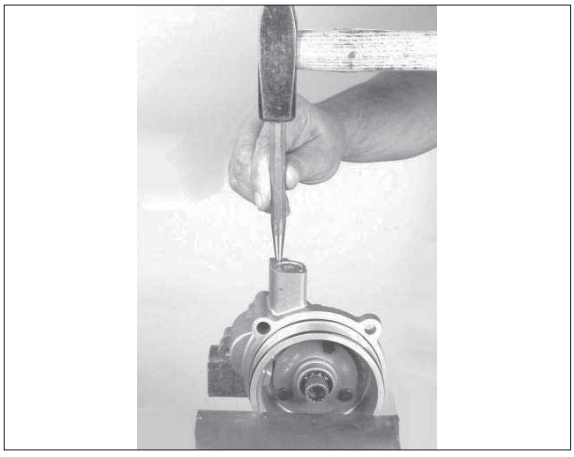
15) Mount pressure relief valve.

Tightening torque M_A = 10 Nm



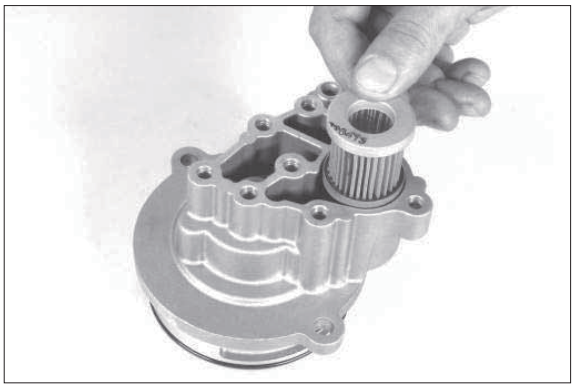
14WF8TM313

16) Secure pressure relief valve by center punch marks (2x).



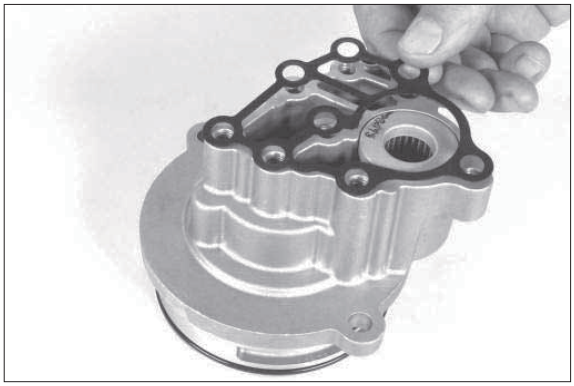
14WF8TM314

17) Insert filter.



14WF8TM315

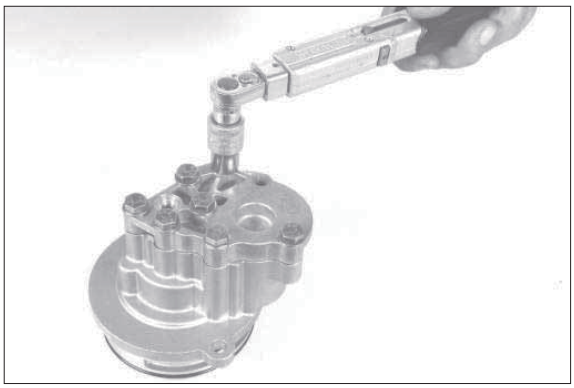
18) Place gasket.



14WF8TM316

19) Place cover and fix it with hexagon screws and disks.

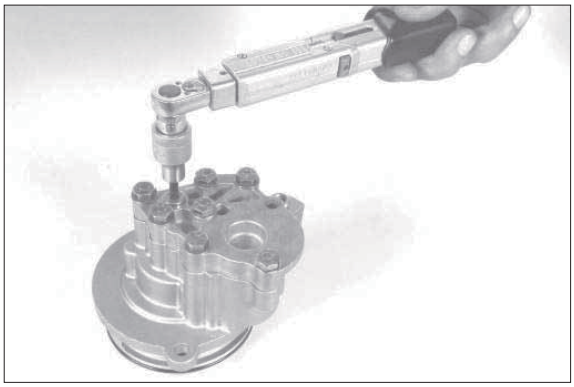
Tightening torque (M8/8.8) M_A = 23 Nm



14WF8TM317

20) Insert screw plug with new O-ring.

Tightening torque (M10 × 1) M_A = 15 Nm

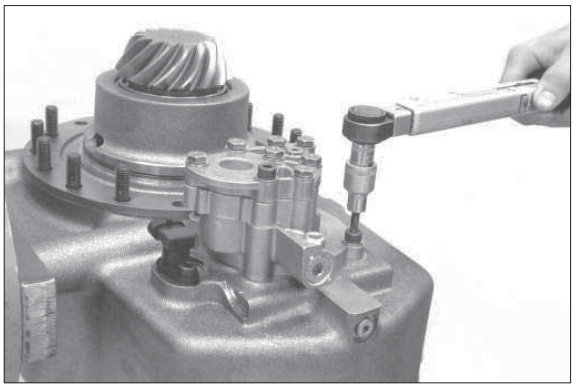


14WF8TM318

21) Mount cpl. lubrication pump and fasten it with cylindrical screws and disks.

Tightening torque (M8/10.9) M_A = 23 Nm

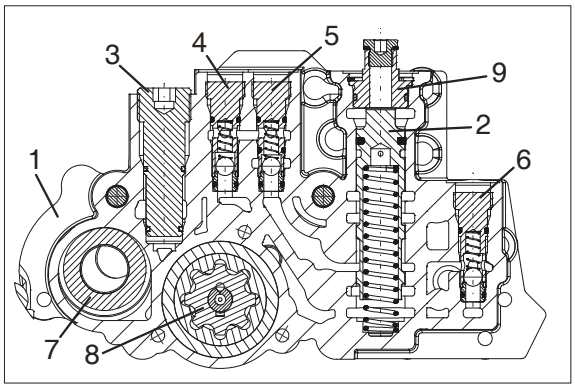
※ Prior to putting the unit into operation, observe the specifications and regulations.



14WF8TM319

12. REASSEMBLY SHIFT INTERLOCK

1) 1 = Housing
   2 = Shift piston
   3 = Pressure relief valve
   4 = Check valve (008)
   5 = Check valve (009)
   6 = Check valve (010)
   7 = Filter
   8 = Lubrication pump
   9 = Plug

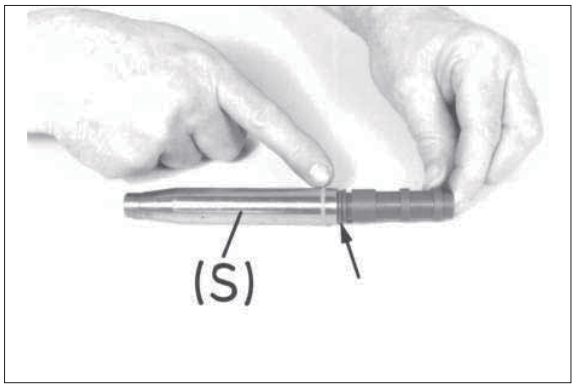


14WF8TM320

2) Put O-ring (see arrow) into annular groove of piston.
   Lead plastic ring by means of inner installer (S) over piston and position it at O-ring.

   (S) Inner installer 5870 651 055

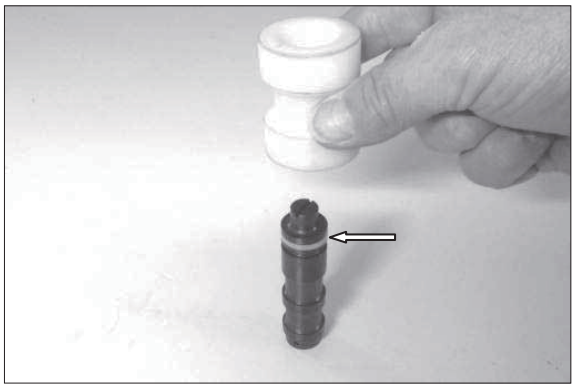
※ Seal consists of plastic ring and O-ring (see 14WF8TM321~14WF8TM322).



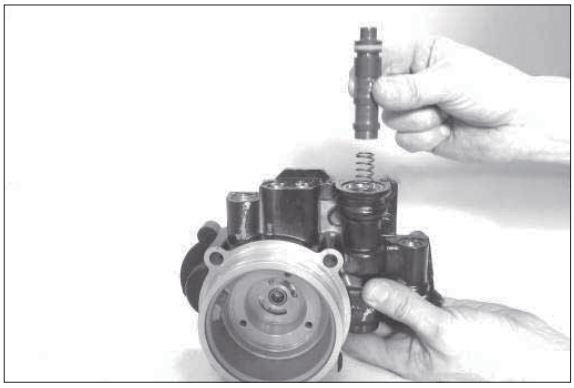
14WF8TM321

3) Center plastic ring (see arrow) with calibrating mandrel.

   (S) Calibrating mandrel 5870 651 056


14WF8TM322

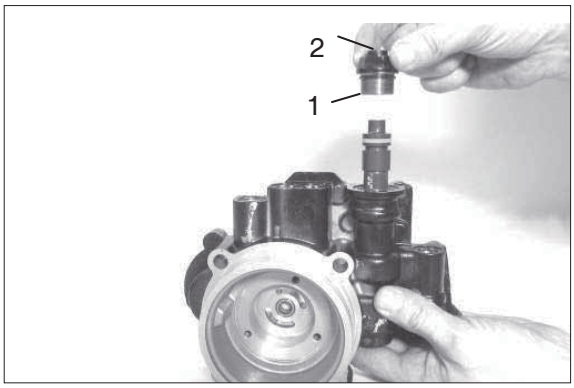
4) Insert compression spring, oil preassembled piston and install.


14WF8TM323

Version I :

5) Fix piston with screw plug (1- with O-ring). Install screw plug (2 – with seal ring).

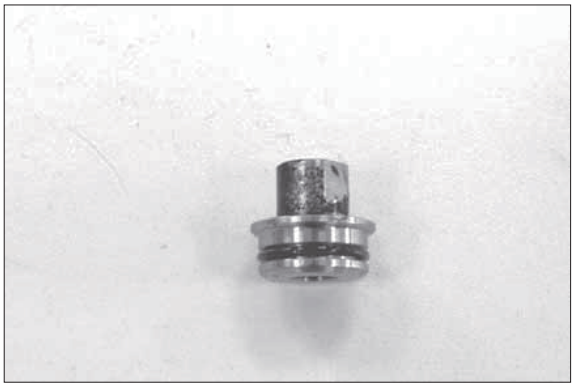
Screw plug (M24 × 1.5) M_A = 50 Nm
Screw plug (M10 × 1) M_A = 15 Nm



14WF8TM324

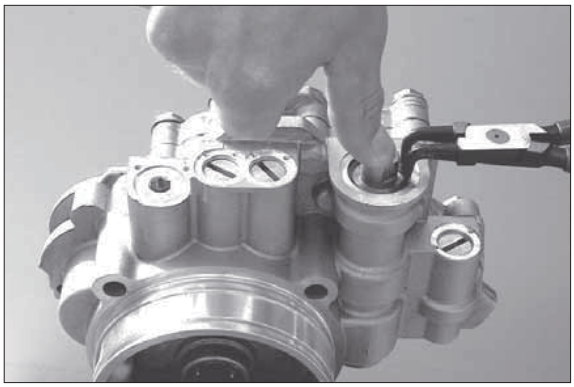
Version II (14WF8TM325 ~ 14WF8TM327) :

6) Oil O-ring and insert it into annular groove of plug.


14WF8TM325

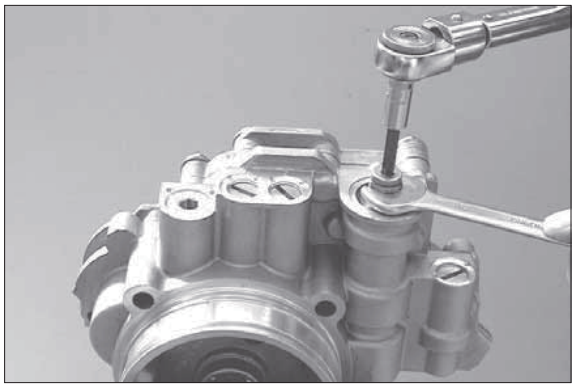
7) Fix plug by engaging retaining ring into annular groove of housing.

※ Pay attention to spring preload – protect against movement.


14WF8TM326

8) Mount screw plug with seal.

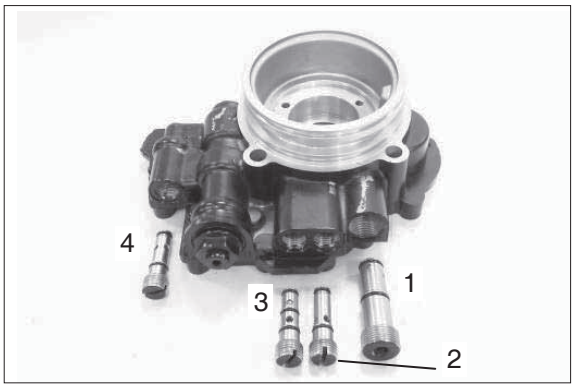
Tightening torque (M10 × 1) M_A = 15 Nm


14WF8TM327

9) Install single parts according to adjacent illustration.

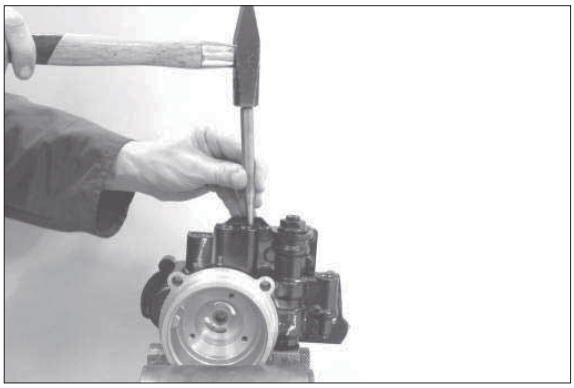
1 = Pressure relief valve cpl. M_A = 10 Nm
2 = Check valve cpl. M_A = 10 Nm
3 = Check valve cpl. M_A = 10 Nm
4 = Check valve cpl. M_A = 10 Nm

※ Observe installation position of the different check valves (see also 14WF8TM320).



14WF8TM328

10) Secure check valves and pressure relief valves with two center punch marks each.

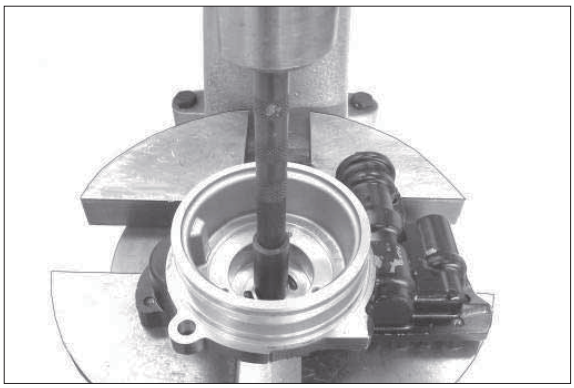

14WF8TM329

11) Insert needle sleeve to installation dimension X into housing.

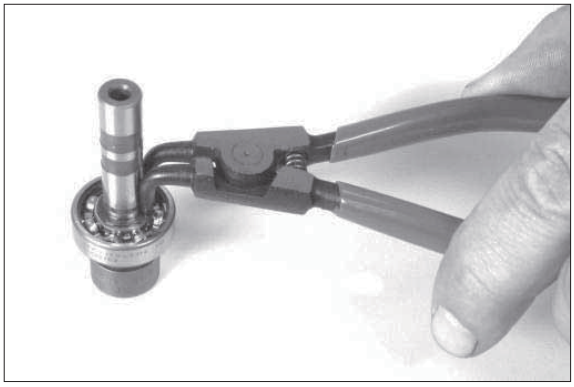
X = 0.2~0.7 mm below plane face/housing

(S) Driver tool 5870 705 003

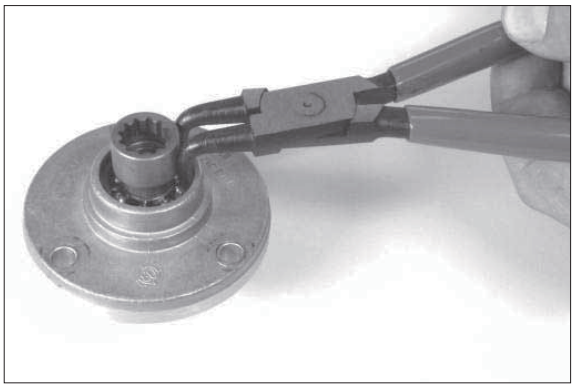
※ Use of specified driver ensures exact installation position.
※ Insert needle sleeve with marked front face showing upwards.
※ Check opening of orifice / oil hole in housing bottom.


14WF8TM330

12) Insert ball bearing onto pump shaft and fix it by engaging retaining ring into annular groove of pump shaft.


14WF8TM331

13) Press preassembled pump shaft into pump cover and fix it by engaging retaining ring into annular groove of pump cover.

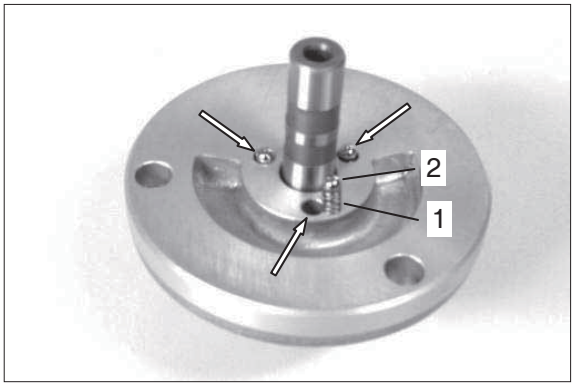


14WF8TM332

14) Insert compression springs (1) and ball (2) into holes (see arrows - 3x).

⚠ **Prior to installation, oil single parts of pump/ rotor set (control housing, inner and outer rotor) – use oil (lubrication)**

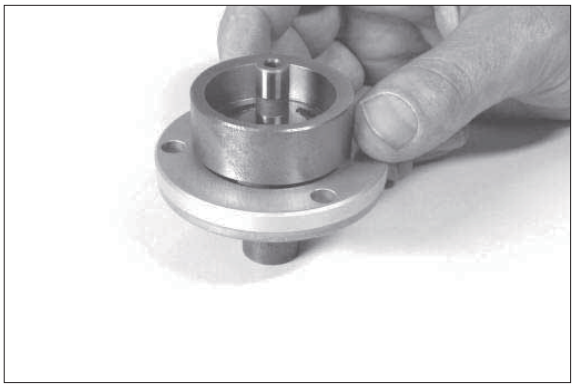
※ Keep preassembled single parts in vertical position – pay attention to position of inserted balls and compression springs (see work steps 14WF8TM333 ~14WF8TM338).



14WF8TM333

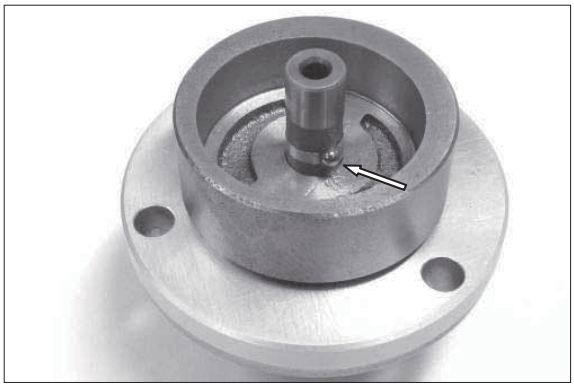
15) Mount control housing.

※ Control housing, inner and outer rotor = rotor set



14WF8TM334

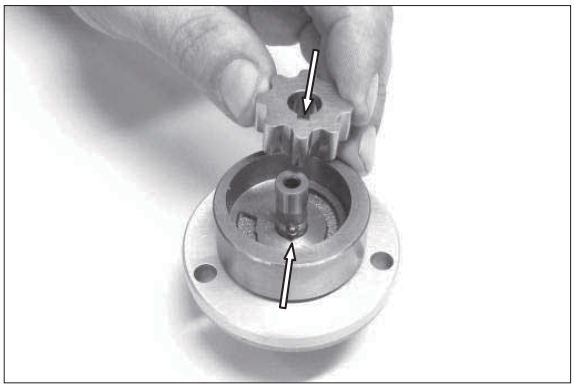
16) Position ball – (see arrow –engagement for inner rotor) with grease into countersink of pump shaft



14WF8TM335

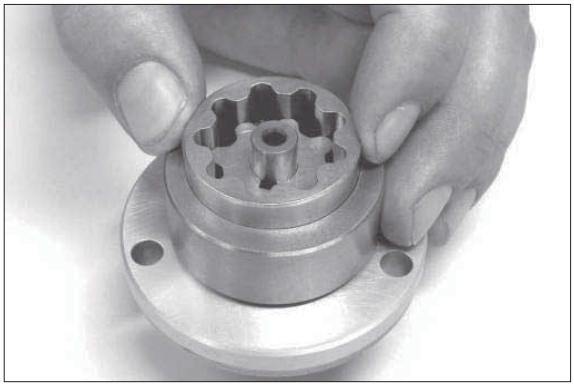
17) Mount inner rotor.

※ Place groove of inner rotor over ball (see arrows).



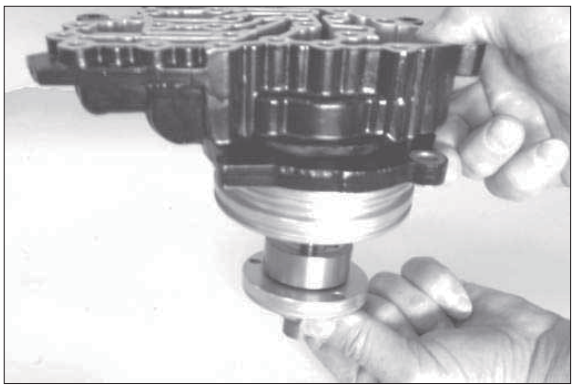
14WF8TM336

18) Mount outer rotor.



14WF8TM337

19) Maintain pump in vertical position while inserting housing with mounted needle sleeve onto preassembled pump.

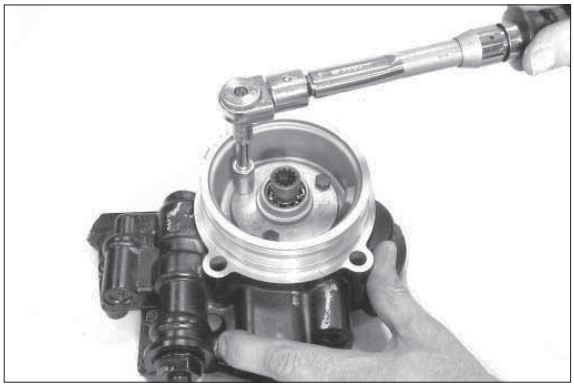


14WF8TM338

20) Rotate housing by 180˚ and fix pump with hexagon screws.

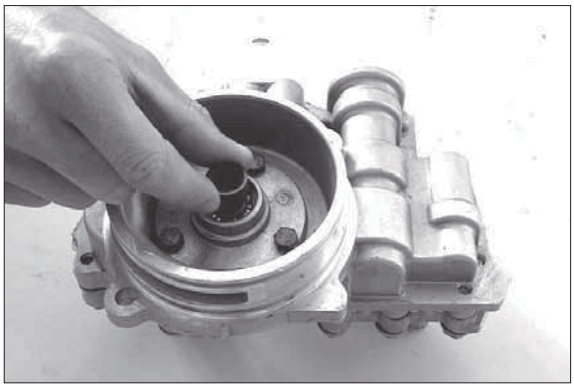
Tightening torque (M6/8.8) M_A = 9.5 Nm

※ Maintain contact position of inserted pump.



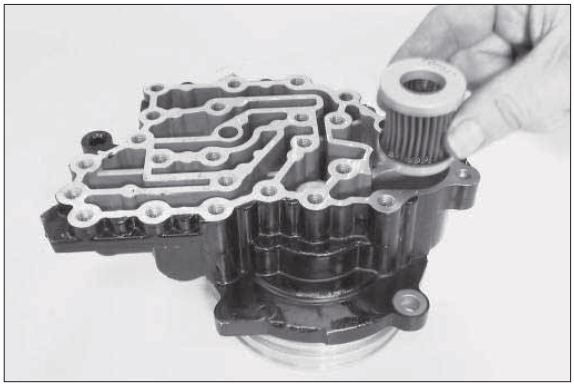
14WF8TM339

21) With counter-turning motions on pump shaft, swiveling of control housing (stop LH/ RH in pump cover) is audible.



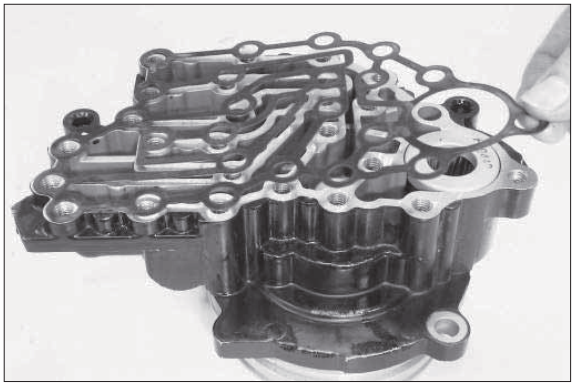
14WF8TM340

22) Insert screen filter.



14WF8TM341

23) Place gasket.

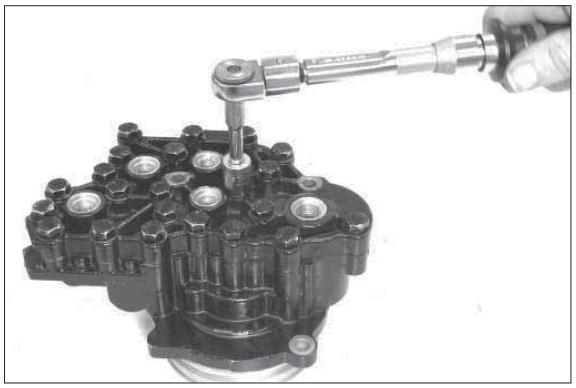


14WF8TM342

24) Place cover and fix with hexagon screws and disks.

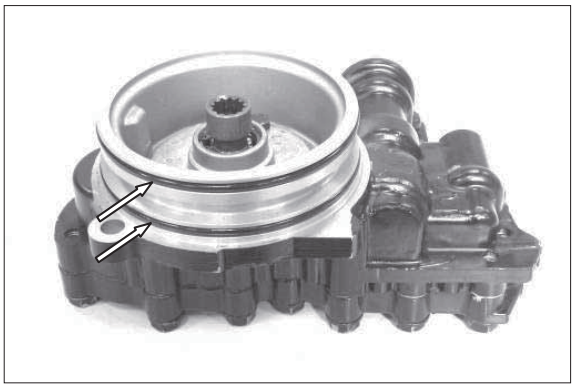
Tightening torque (M8/8.8) M_A = 23 Nm

※ Pay attention to different screw length.



14WF8TM343

25) Oil both O-rings (arrows) and put them into annular groove of housing.

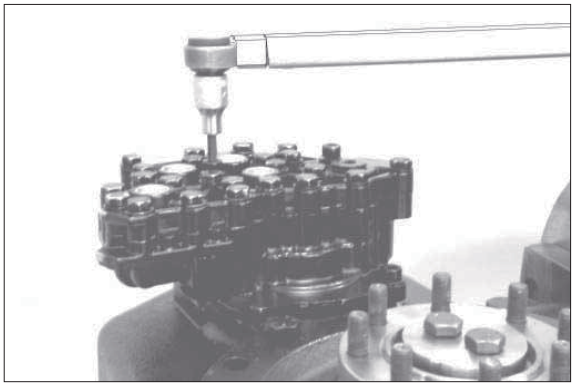


14WF8TM344

26) Insert cpl. shift interlock and fix with cylindrical screws with disks.

Tightening torque (M8/10.9) M_A = 23 Nm

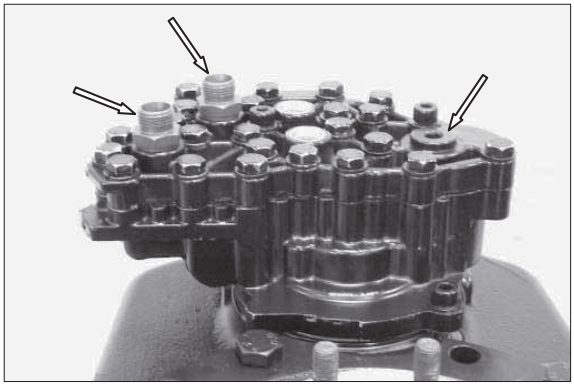
※ Pay attention to different screw length.



14WF8TM345

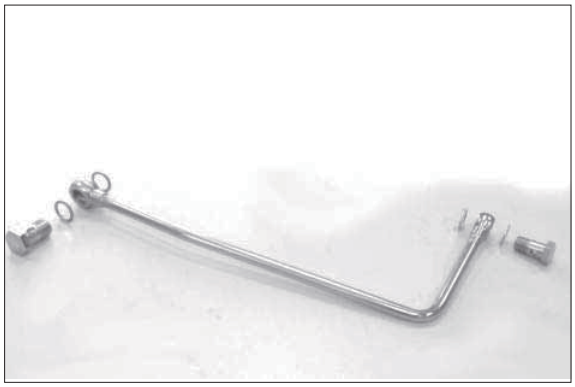
27) Install both screw-in sleeves and screw plug (see arrow) with O-rings.

Screw-in sleeve (M 16×1.5) M_A = 30 Nm
Screw plug (M 18×1.5) M_A = 35 Nm



14WF8TM346

28) 1 = Oil tube
2 = Hollow screw (M16×1.5)
3 = Seal ring
4 = Hollow screw (M14×1.5)
5 = Seal ring

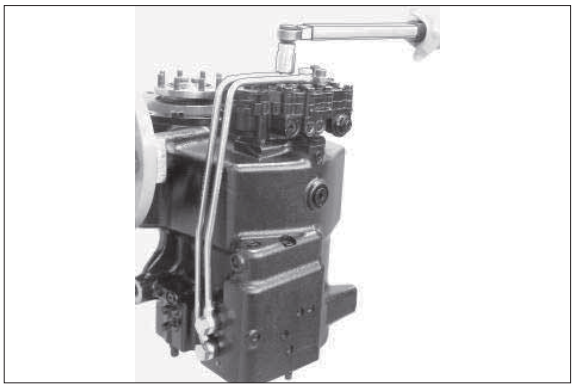


14WF8TM347

29) Mount oil tubes.

Hollow screw (M14×1.5) M_A = 40 Nm
Hollow screw (M16×1.5) M_A = 40 Nm

※ Prior to putting the unit into operation, observe the specifications and regulations.

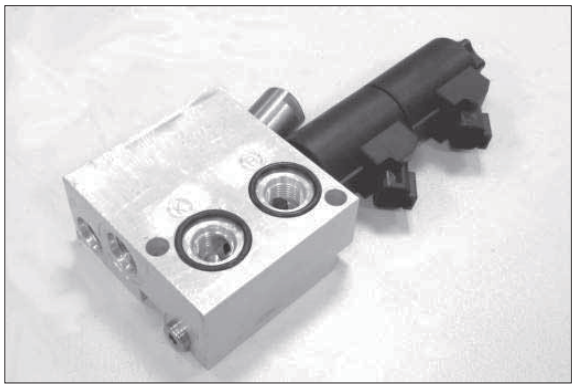


14WF8TM3428

13. VALVE BLOCK (shifting low gear – high gear)

1) Insert O-rings (see arrows) into countersinks of valve block.

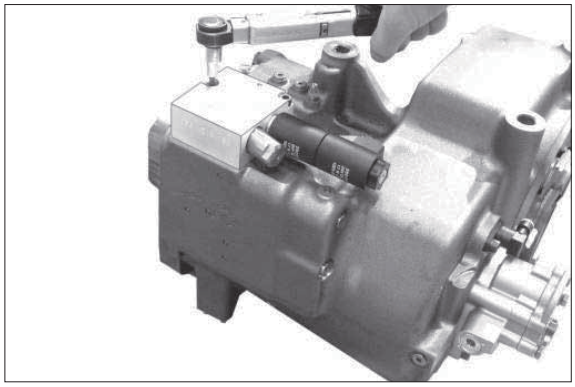
※ Use grease as assembly aid.



14WF8TM349

2) Fix cpl. valve block with cylindrical screws.

Tightening torque (M8/10.9) M_A = 23 Nm

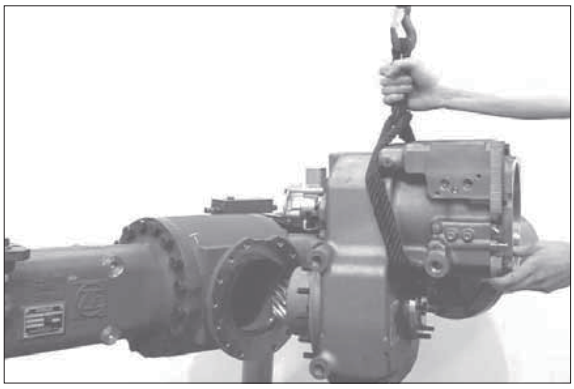


14WF8TM350

14. Mount TRANSMISSION to AXLE (only for version axle attachment)

1) Position complete transmission to axle.

(S) Lifting strap 5870 281 026

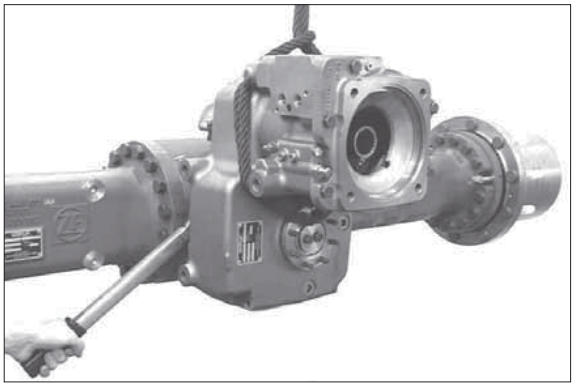


14WF8TM351

2) Fix transmission to axle with hexagon screws and nuts.

Tightening torque (M12/8.8) M_A = 79 Nm

※ Prior to putting the unit into operation, observe the specifications and regulations.



14WF8TM352

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.

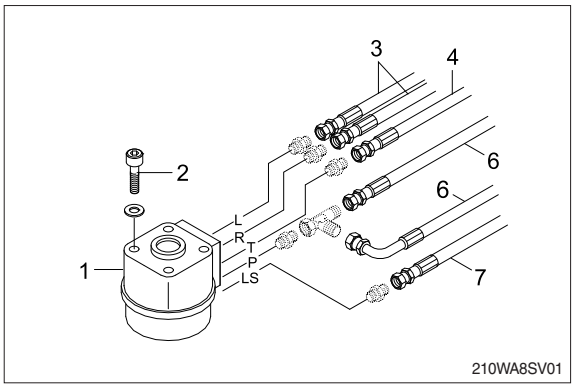
(3) Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

(4) Disconnect steering line hoses (3, 4, 5, 6).

(5) Loosen the socket bolt (2) and remove the steering valve assembly (1).

· Tightening torque : 8.27± 1.7 kgf · m
(59.8± 12.3 lbf · ft)



2) INSTALL

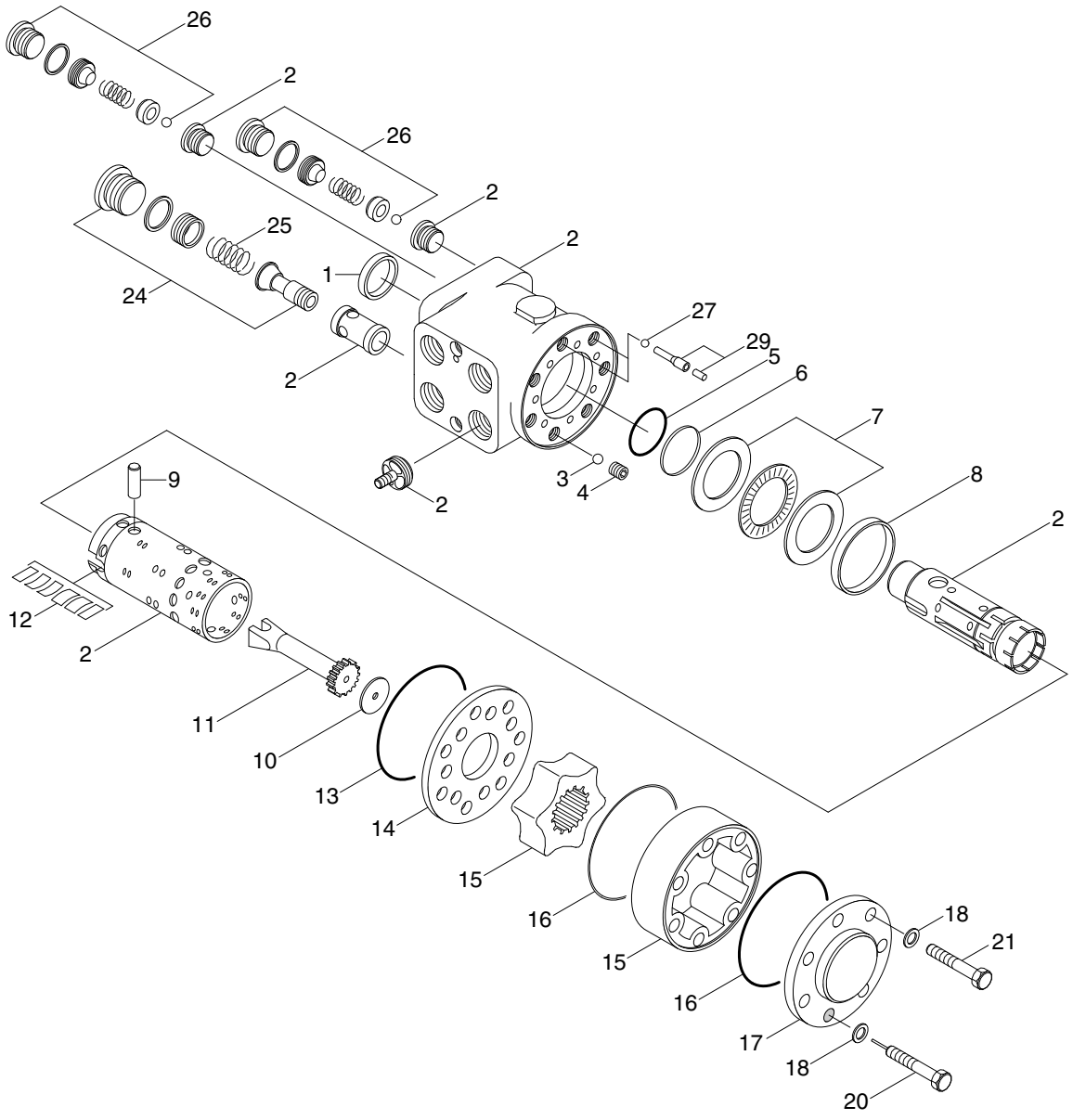
(1) Carry out installation in the reverse order to removal.

(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

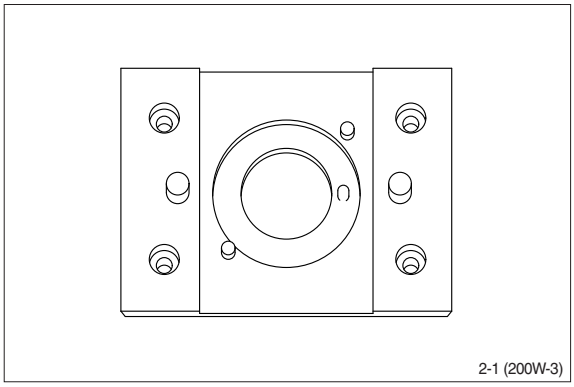


20W72STV01

1	Dust seal	10	Spacer	18	Washer
2	Housing, spool, sleeve	11	Shaft	20	Pin screw
3	Ball	12	Spring set	21	Screw
4	Bushing	13	O-ring	24	Pressure relief valve
5	O-ring	14	Distributor plate	25	Wire spring
7	Bearing assy	15	Gear wheel set	26	Shock valve
8	Ring	16	O-ring	27	Ball
9	Cross pin	17	End cover	29	Bushing

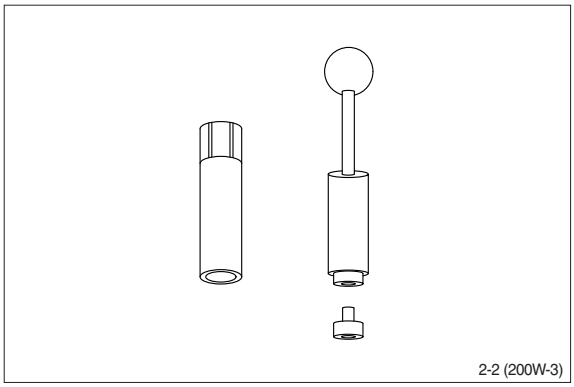
2) TOOLS

(1) Holding tool.



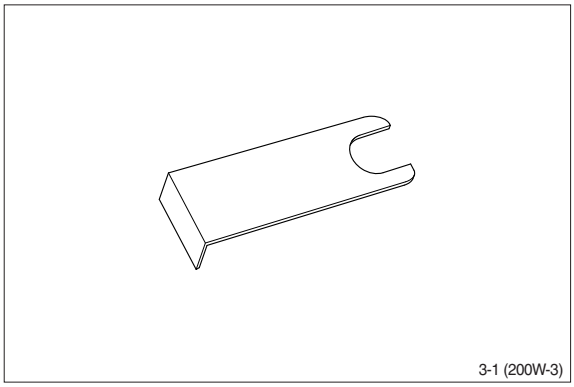
2-1 (200W-3)

(2) Assembly tool for O-ring (5,13,16) and kin-ring (6).



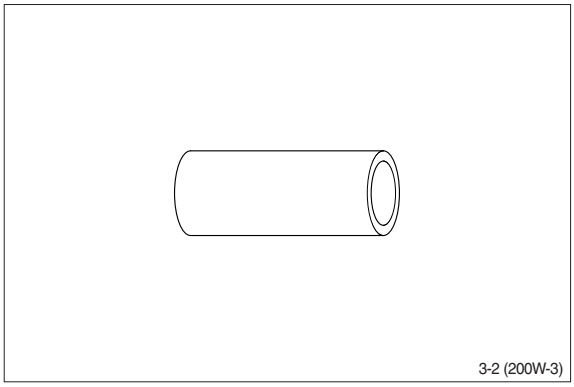
2-2 (200W-3)

(3) Assembly tool for cardan shaft (11).



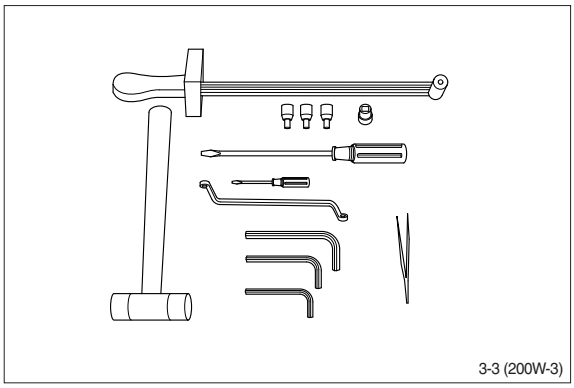
3-1 (200W-3)

(4) Assembly tool for dust seal (1).



3-2 (200W-3)

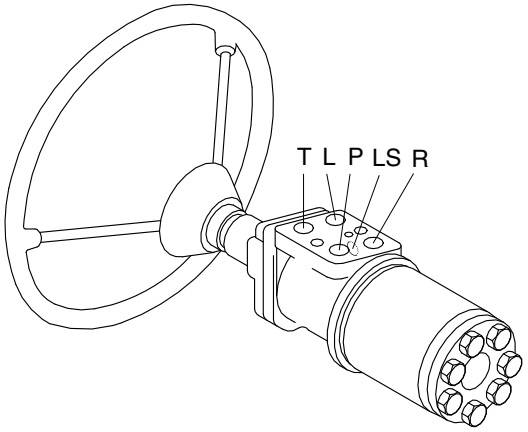
(5) Torque wrench : 0~7.1 kgf · m
(0~54.4 lbf · ft)
13 mm socket spanner.
6, 8 mm and 12 mm hexagon sockets.
12 mm screwdriver.
2 mm screwdriver.
13 mm ring spanner.
6,8 mm and 12 mm hexagon socket spanners.
Plastic hammer.
Tweezers.



3-3 (200W-3)

3) TIGHTENING TORQUE AND HYDRAULIC CONNECTIONS

(1) Hydraulic connections



L : Left port
R : Right port
T : Tank
P : Pump

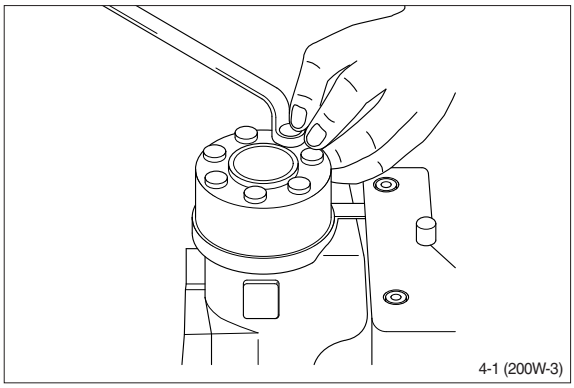
140WA8SV03

(2) Tightening torque

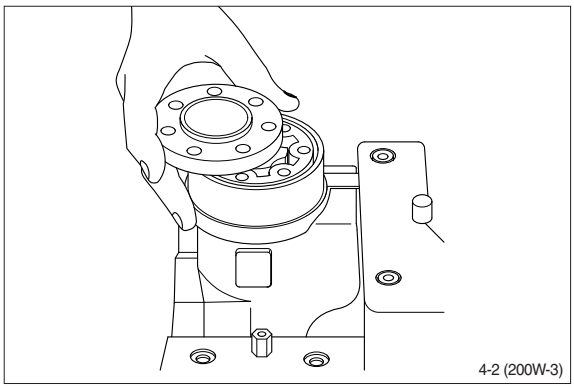
Screwed connection	Max. tightening torque kgf · m (lbf · ft)			
	With cutting edge	With copper washer	With aluminum washer	With O-ring
1.4 BSP.F	4.1 (29.7)	2.0 (14.5)	3.1 (22.4)	-
3/8 BSP.F	6.1 (44.1)	2.0 (14.5)	5.1 (36.9)	-
1/2 BSP.F	10.2 (73.8)	3.1 (22.4)	8.2 (59.3)	-
7/16-20 UNF	-	-	-	2.0 (14.5)
3/4-16 UNF	-	-	-	6.1 (44.1)
M12×1.5	4.1 (29.7)	2.0 (14.5)	3.1 (22.4)	2.0 (14.5)
M18×1.5	7.1 (51.4)	2.0 (14.5)	5.1 (36.9)	5.1 (36.9)
M22×1.5	10.2 (73.8)	3.1 (22.4)	8.2 (59.3)	7.1 (51.4)

4) DISASSEMBLY

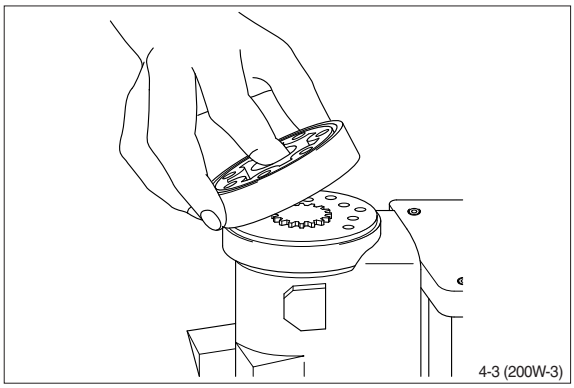
(1) Dissemble steering column from steering valve and place the steering valve in the holding tool.
Screw out the screws in the end cover (6-off plus one special screw).


4-1 (200W-3)

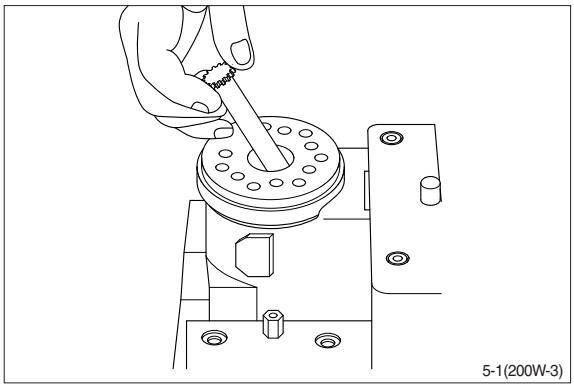
(2) Remove the end cover, sideways.


4-2 (200W-3)

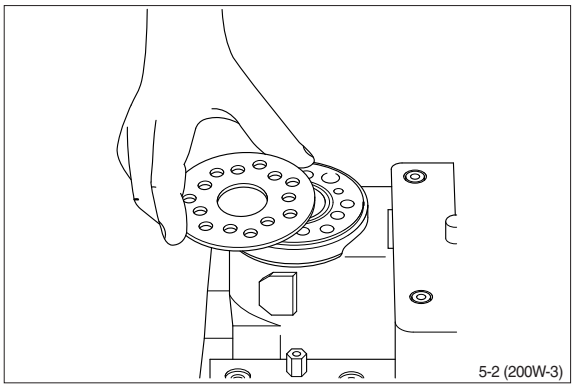
(3) Lift the gearwheel set (with spacer if fitted) off the unit.
Take out the two O-rings.


4-3 (200W-3)

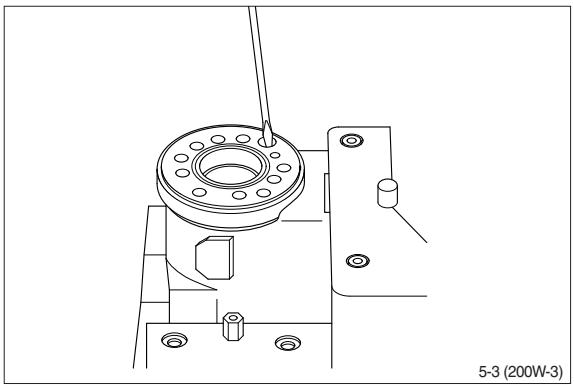
(4) Remove cardan shaft.


5-1(200W-3)

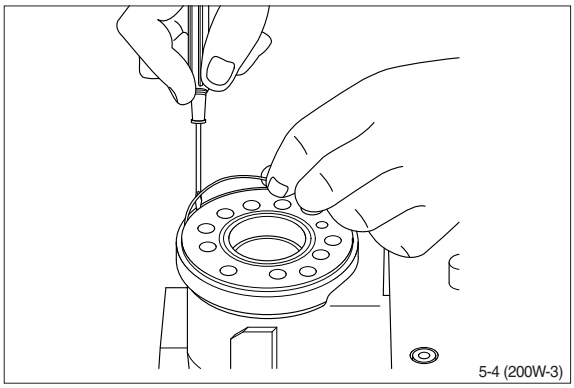
(5) Remove distributor plate.


5-2 (200W-3)

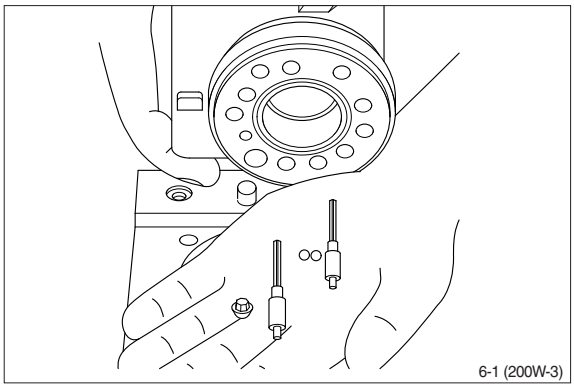
(6) Screw out the threaded bushing over the check valve.


5-3 (200W-3)

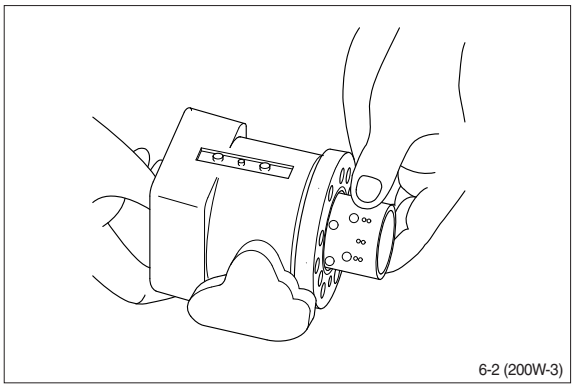
(7) Remove O-ring.


5-4 (200W-3)

(8) Shake out the check valve ball and suction valve pins and balls.

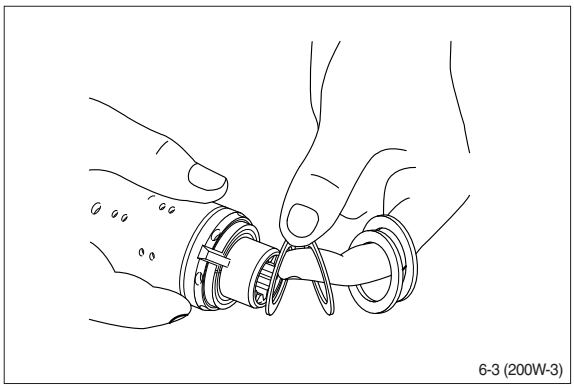

6-1 (200W-3)

(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.



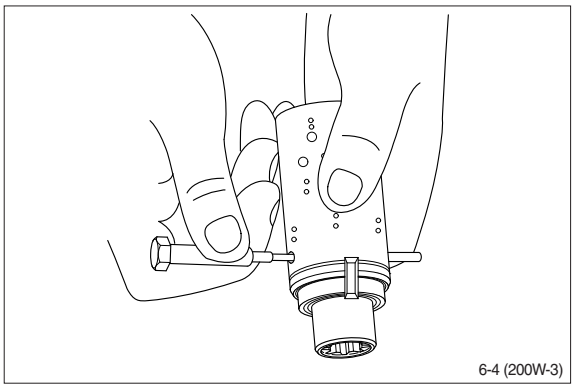
6-2 (200W-3)

(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.



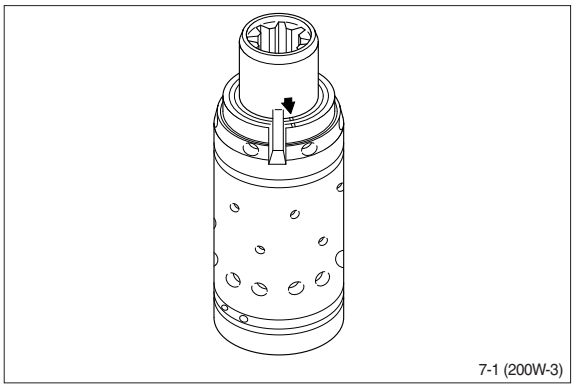
6-3 (200W-3)

(11) Press out the cross pin. Use the special screw from the end cover.



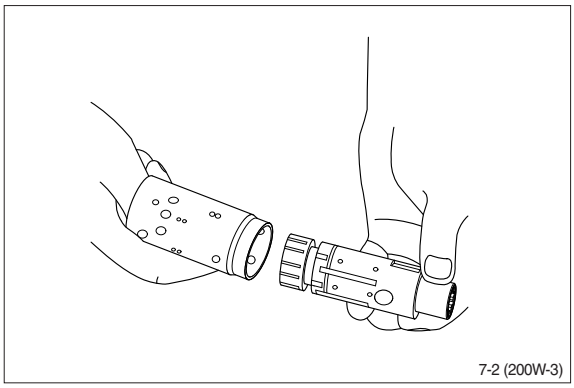
6-4 (200W-3)

※ 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.



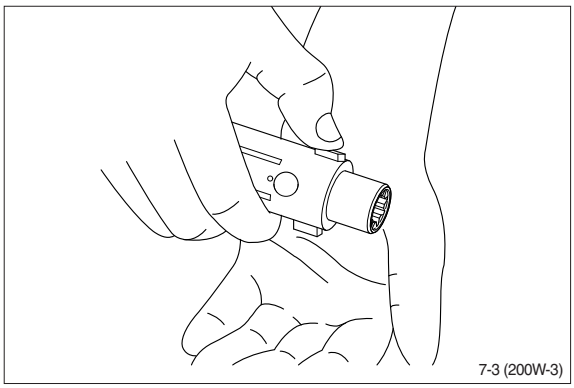
7-1 (200W-3)

(12) Carefully press the spool out of the sleeve.



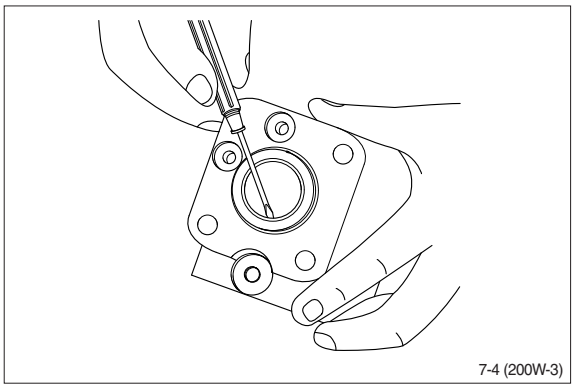
7-2 (200W-3)

(13) Press the neutral position springs out of their slots in the spool.



7-3 (200W-3)

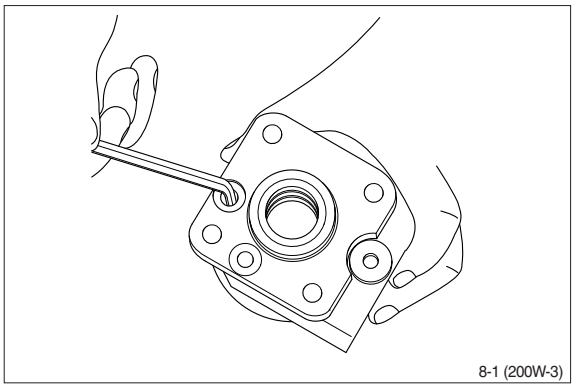
(14) Remove dust seal and O-ring.



7-4 (200W-3)

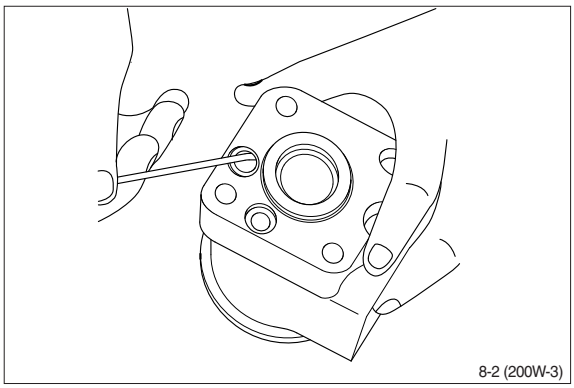
(15) Disassemble the dual shock valve

① Remove plugs from shock valves using a 6㎜ hexagon socket spanner.



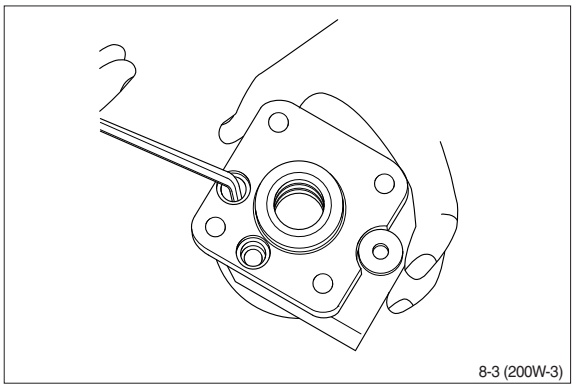
8-1 (200W-3)

② Remove seal washers (2-off).



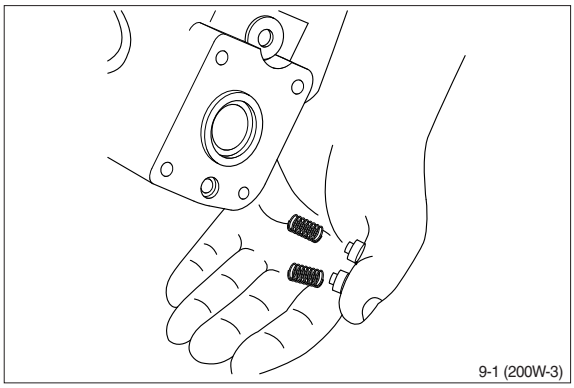
8-2 (200W-3)

③ Unscrew the setting screws using a 6 ㎜ hexagon socket spanner.



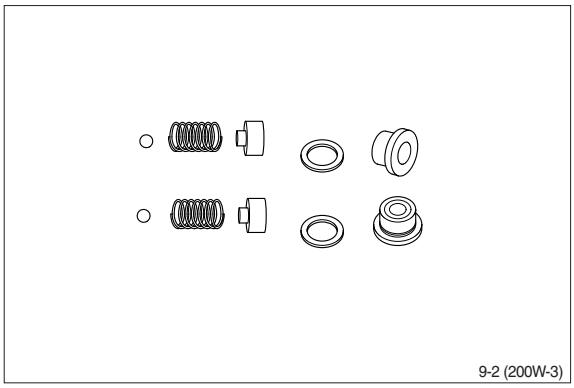
8-3 (200W-3)

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)

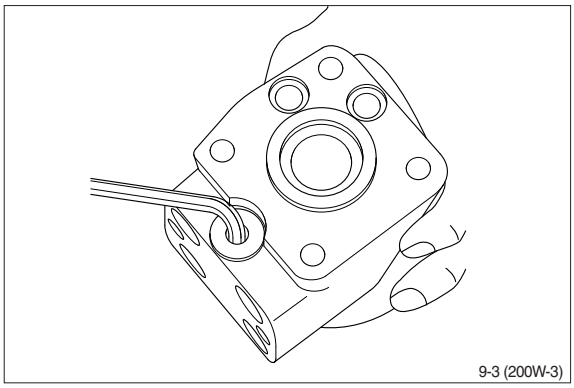
⑤ The dual shock valves are now disassembled.



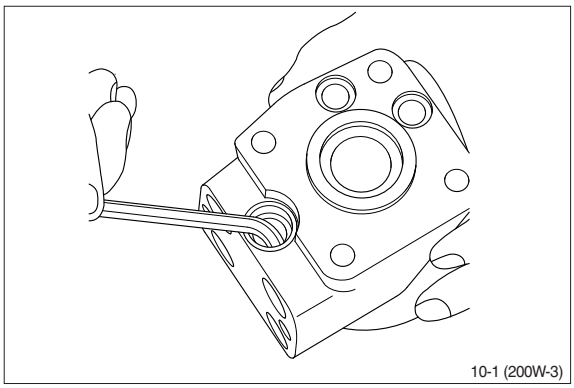
9-2 (200W-3)

(16) Disassemble the pressure relief valve (cartridge)

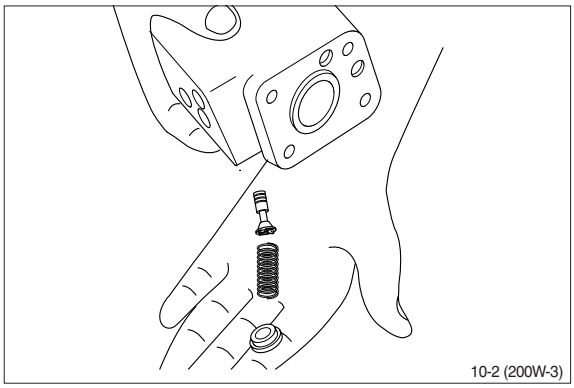
① Screw out the plug using an 8 mm hexagon socket spanner. Remove seal washers.


9-3 (200W-3)

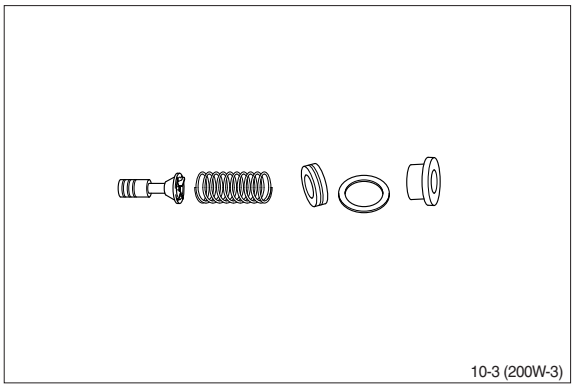
② Unscrew the setting screw using an 8mm hexagon socket spanner.


10-1 (200W-3)

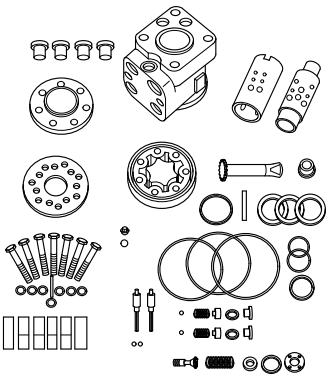
③ Shake out spring and piston. The valve seat is bonded into the housing and cannot be removed.


10-2 (200W-3)

④ The pressure relief valve is now disassembled.


10-3 (200W-3)

⑤ The steering valve is now completely disassembled.



12-1 (200W-3)

※ **Cleaning**

Clean all parts carefully in shellsol K or the like.

※ **Inspection and replacement**

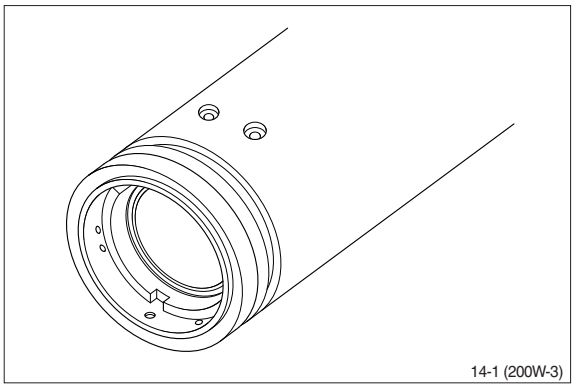
Replace all seals and washers. Check all parts carefully and make any replacements necessary.

※ **Lubrication**

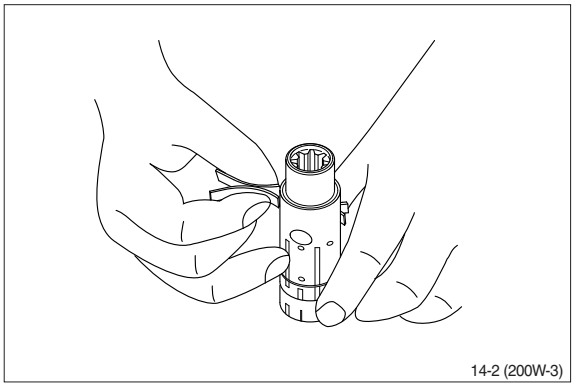
Before assembly, lubricate all parts with hydraulic oil.

5) ASSEMBLY

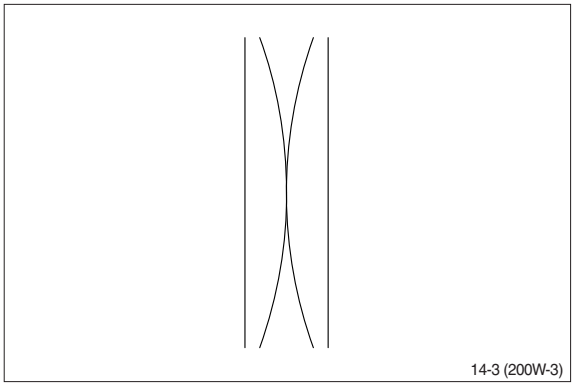
(1) Assemble spool and sleeve.
When assembling spool and sleeve only one of two possible ways of positioning the spring slots is correct. There are three slots in the spool and three holes in the sleeve in the end of the spool / sleeve opposite to the end with spring slots.
Place the slots and holes opposite each other so that parts of the holes in the sleeve are visible through the slots in the spool.


14-1 (200W-3)

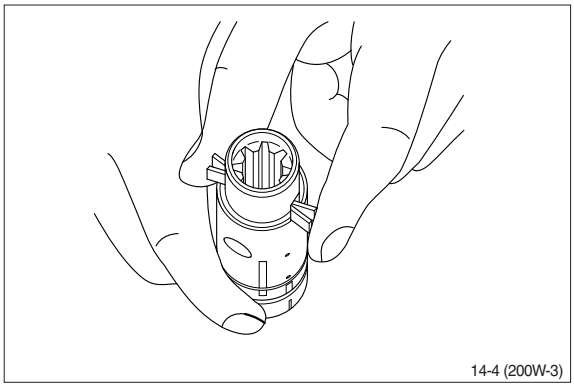
(2) Place the two flat neutral position springs in the slot.
Place the curved springs between the flat ones and press them into place (see assembly pattern).


14-2 (200W-3)

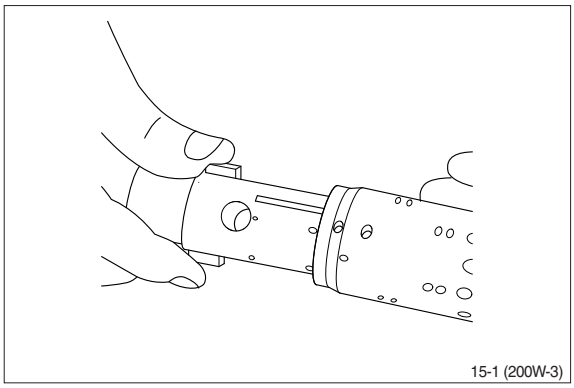
※ Assembly pattern.
· Part no : 150N4035


14-3 (200W-3)

(3) Line up the spring set.

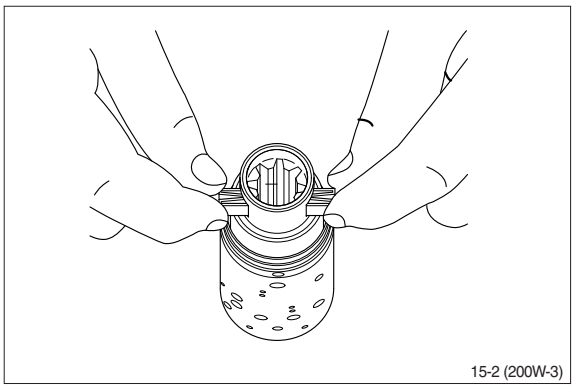

14-4 (200W-3)

(4) Guide the spool into the sleeve. Make sure that spool and sleeve are placed correctly in relation to each other.



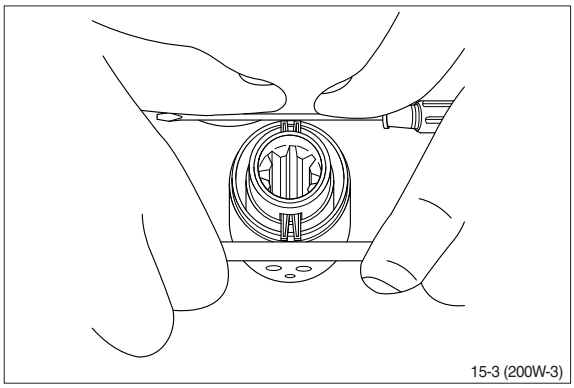
15-1 (200W-3)

(5) Press the springs together and push the neutral position springs into place in the sleeve.



15-2 (200W-3)

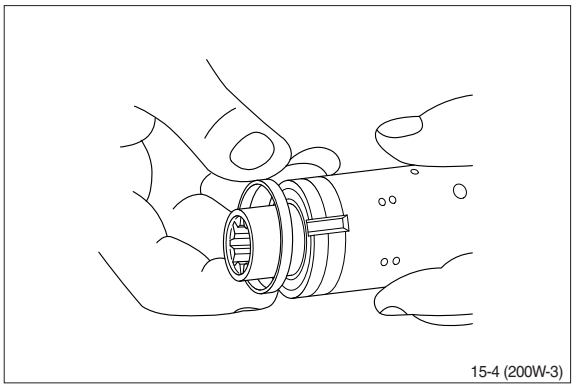
(6) Line up the springs and center them.



15-3 (200W-3)

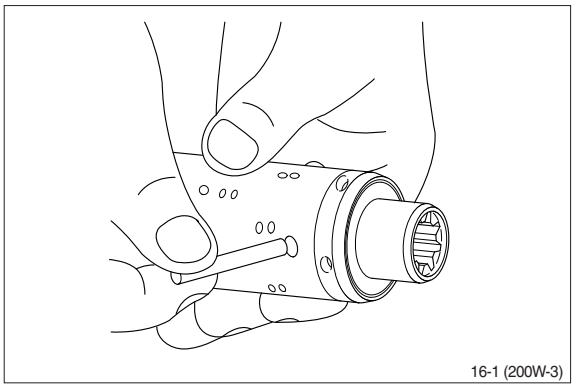
(7) Guide the ring down over the sleeve.

※ The ring should be able to rotate free of the springs.



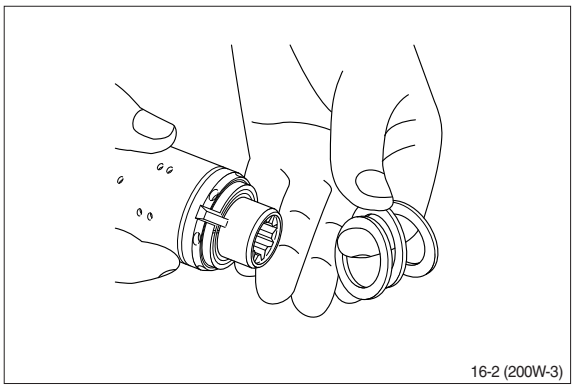
15-4 (200W-3)

(8) Fit the cross pin into the spool / sleeve.



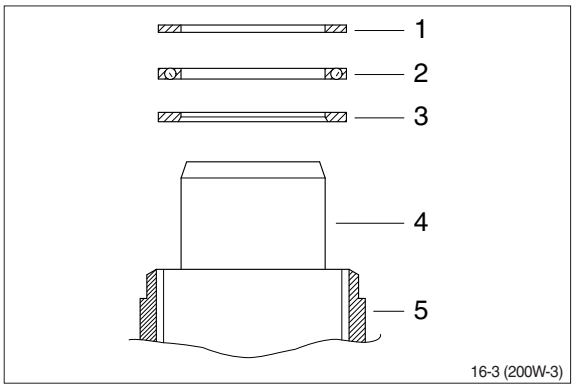
16-1 (200W-3)

(9) Fit bearing races and needle bearing as shown on below drawing.



16-2 (200W-3)

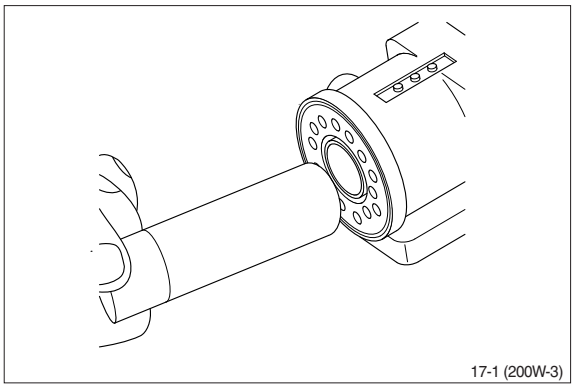
※ Assembly patted for standard bearings
1 Outer bearing race
2 Needle bearing
3 Inner bearing race
4 Spool
5 Sleeve



16-3 (200W-3)

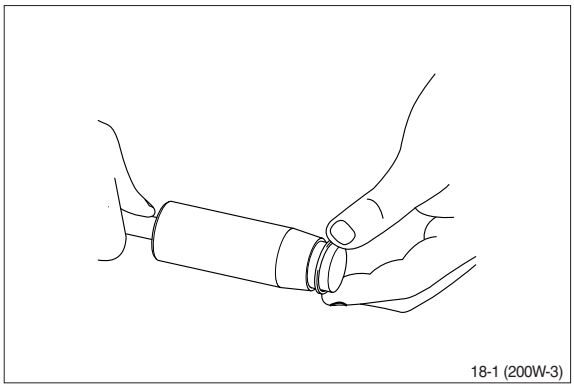
Installation instruction for O-ring

(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.

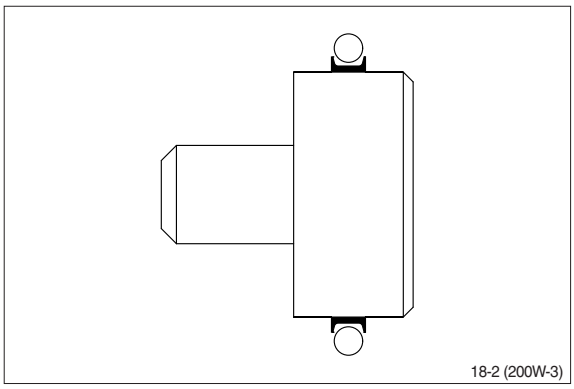


17-1 (200W-3)

(11) Grease O-ring with hydraulic oil and place them on the tool.

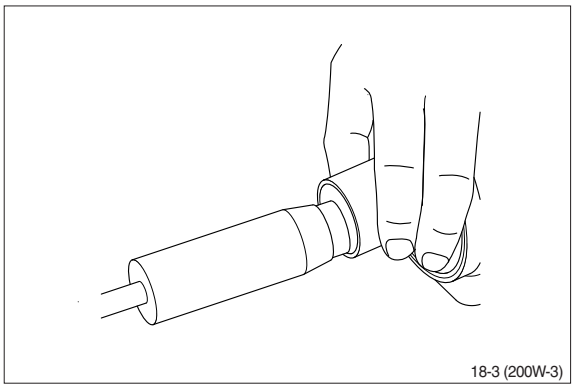


18-1 (200W-3)



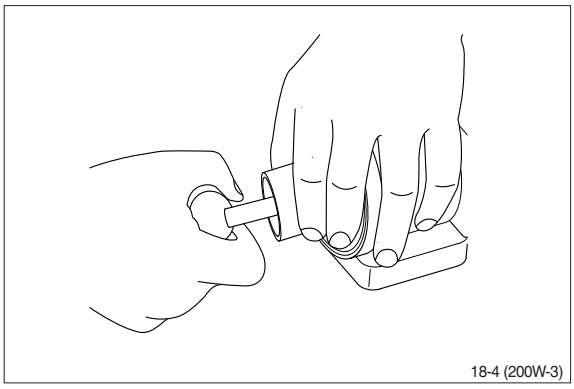
18-2 (200W-3)

(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.



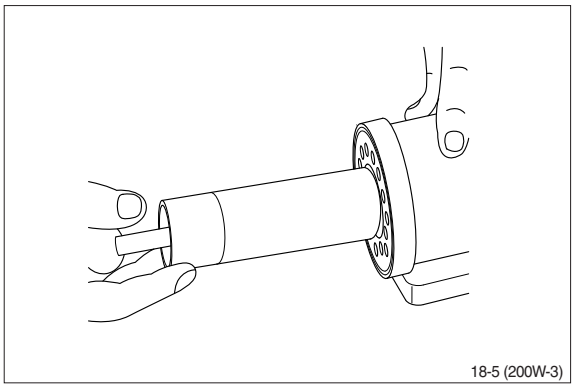
18-3 (200W-3)

(13) Press and turn the O-ring into position in the housing.



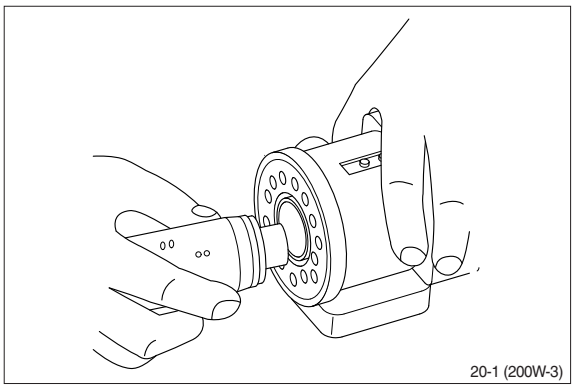
18-4 (200W-3)

(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.

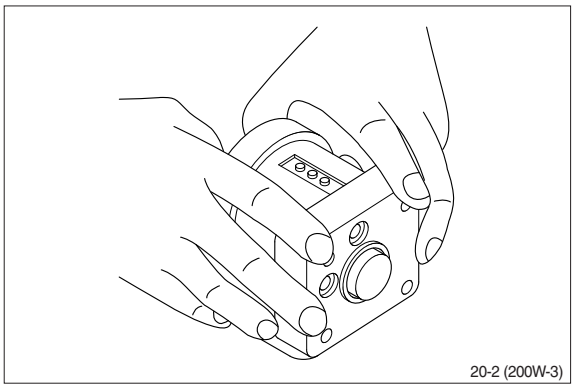

18-5 (200W-3)

(15) With a light turning movement, guide the spool and sleeve into the bore.

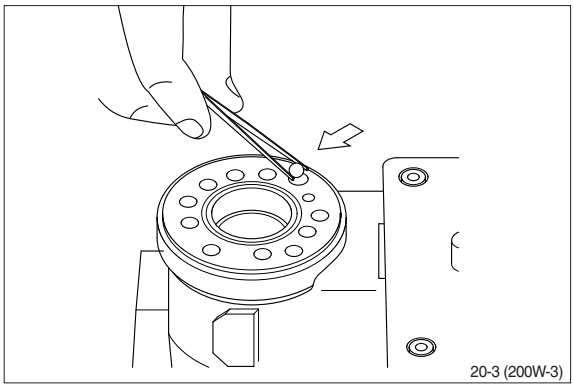
※ Fit the spool set holding the cross pin horizontal.


20-1 (200W-3)

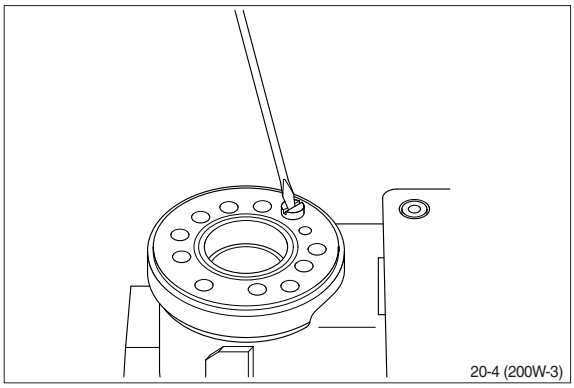
(16) The spool set will push out the assembly tool guide. The O-ring is now in position.


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.

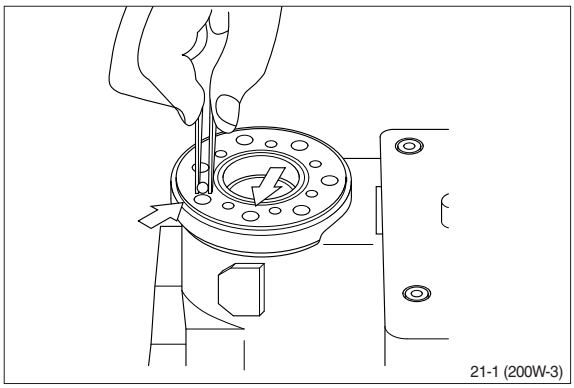

20-3 (200W-3)

(18) Screw the threaded bush lightly into the check valve bore. The top of the bushing must lie just below the surface of the housing.

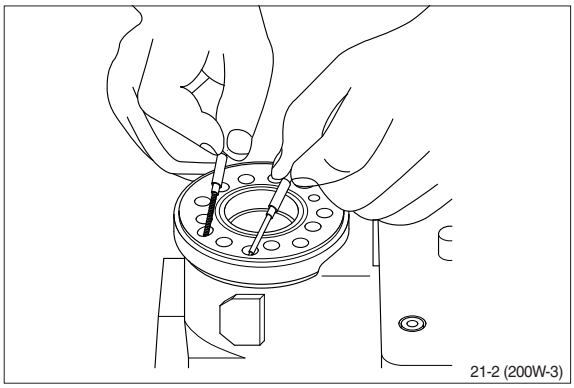

20-4 (200W-3)

Assembly of the two suction valve

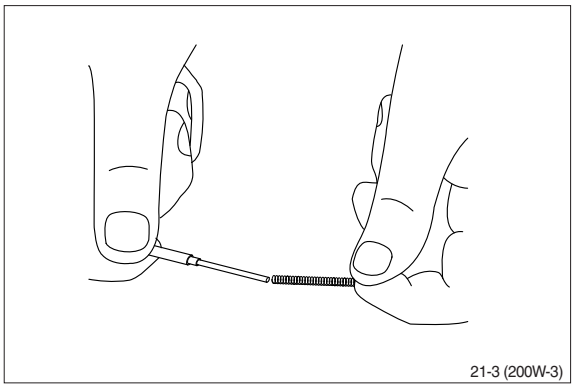
(19) Place a ball in the two holes indicated by the arrows.


21-1 (200W-3)

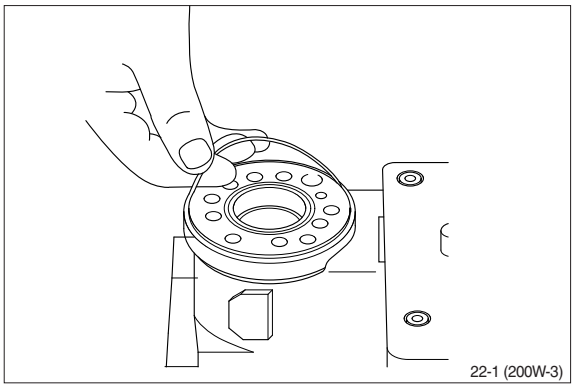
(20) Place a pin in the same two holes.


21-2 (200W-3)

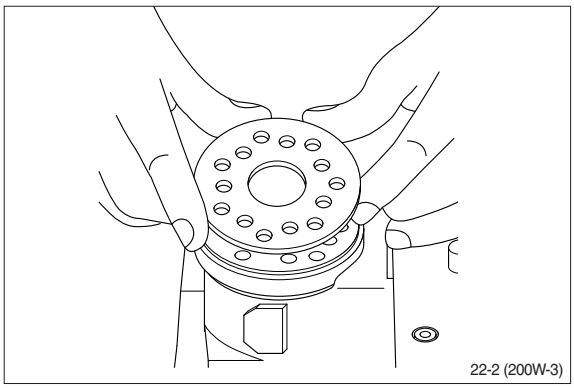
(21) In some cases a spring has to be fitted on the pin before it is placed in the housing.


21-3 (200W-3)

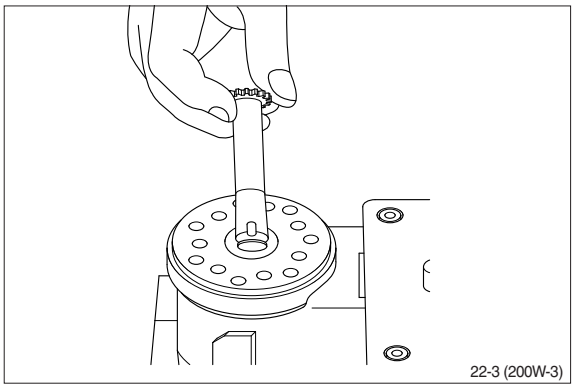
(22) Grease the O-ring with mineral oil approx viscosity 500 cST at 20˚C.


22-1 (200W-3)

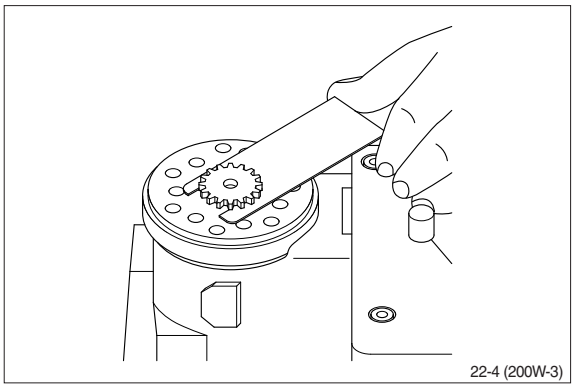
(23) Place the distributor plate so that the channel holes match the holes in the housing.


22-2 (200W-3)

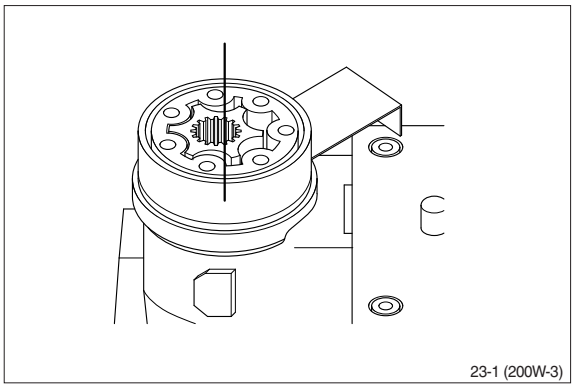
(24) Guide the cardan shaft down into the bore so that the slot is parallel with the connection flange.


22-3 (200W-3)

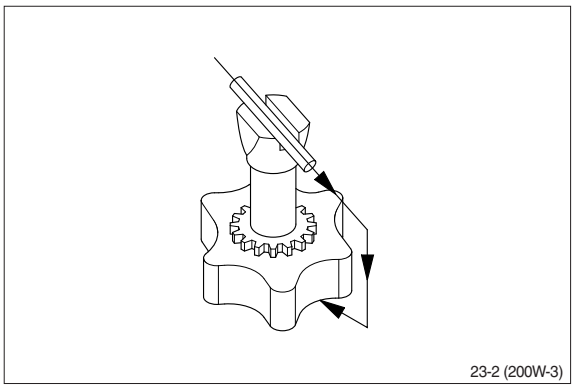
(25) Place the cardan shaft as shown so that it is held in position by the mounting fork.


22-4 (200W-3)

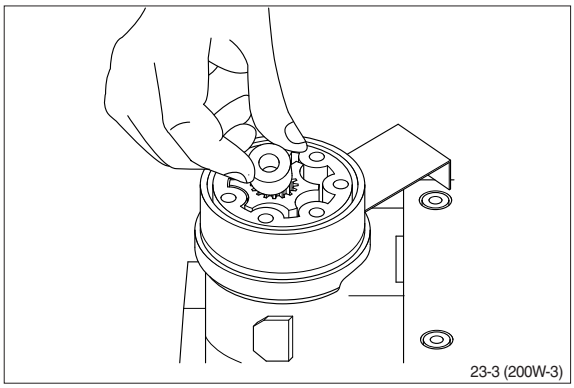
(26) Grease the two O-rings with mineral oil approx. viscosity 500 cST at 20˚C and place them in the two grooves in the gear rim. Fit the gearwheel and rim on the cardan shaft.


23-1 (200W-3)

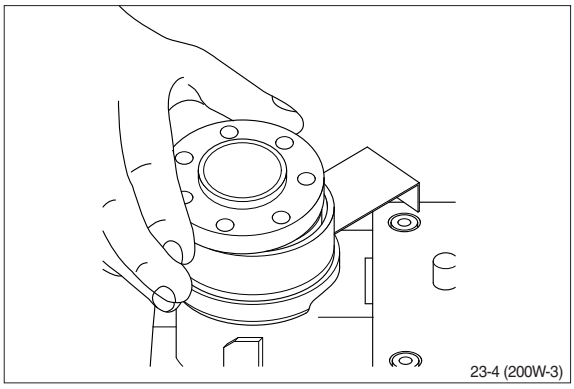
(27) Fit the gearwheel (rotor) and cardan shaft so that a tooth base in the rotor is positioned in relation to the shaft slot as shown. Turn the gear rim so that the seven through holes match the holes in the housing.


23-2 (200W-3)

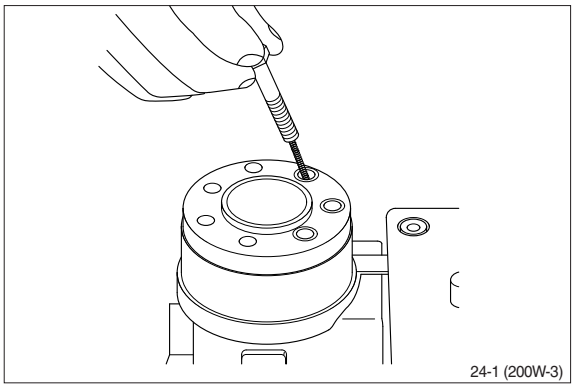
(28) Fit the spacer, if any.


23-3 (200W-3)

(29) Place the end cover in position.

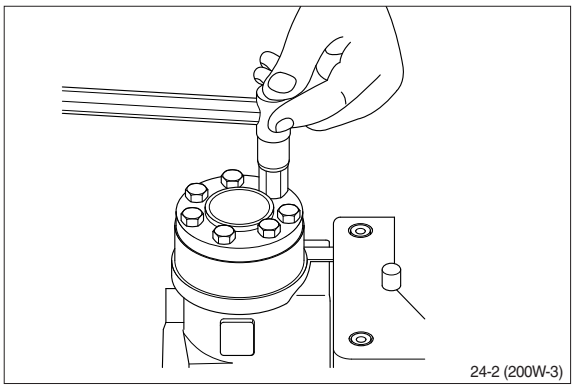

23-4 (200W-3)

(30) Fit the special screw with washer and place it in the hole shown.

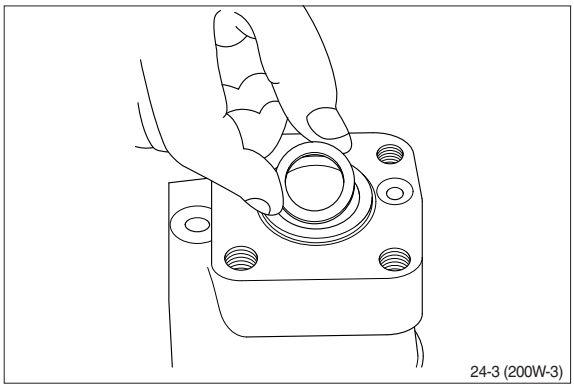

24-1 (200W-3)

(31) Fit the six screws with washers and insert them. Cross-tighten all the screws and the rolled pin.

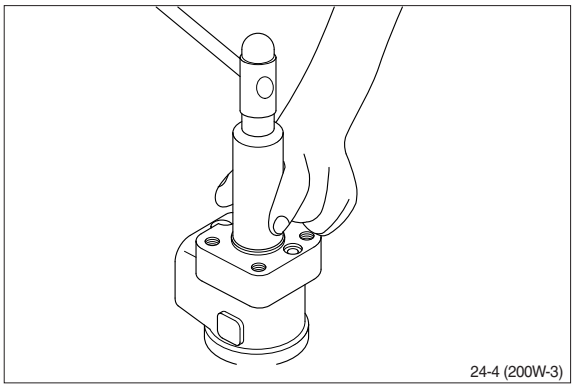
· Tightening torque : 3.0±0.6 kgf · m
(22.4±4.3 lbf · ft)


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.

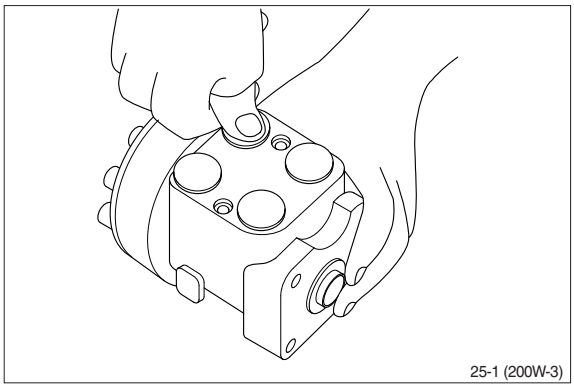

24-3 (200W-3)

(33) Fit the dust seal ring in the housing.


24-4 (200W-3)

(34) Press the plastic plugs into the connection ports.

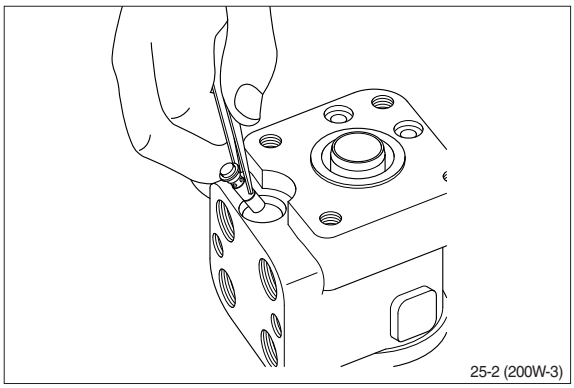
※ Do not use a hammer!



25-1 (200W-3)

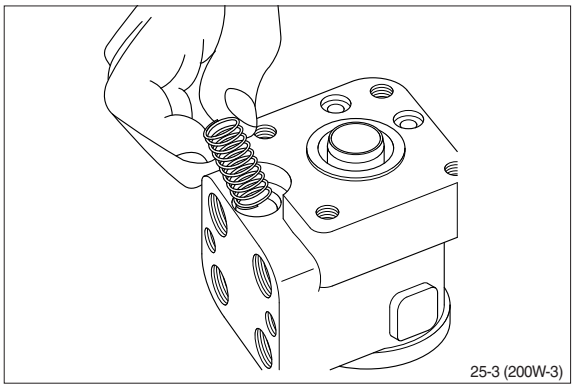
Assembly of the pressure relief valve

(35) Fit the piston.



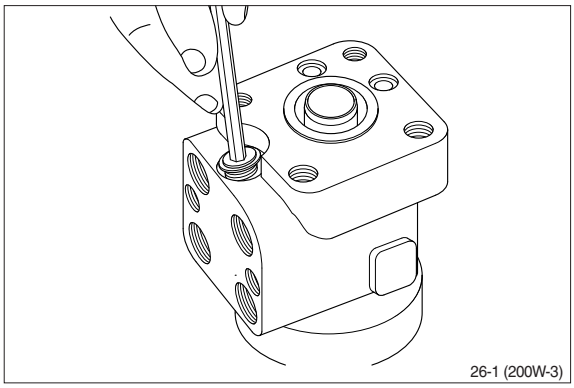
25-2 (200W-3)

(36) Fit the spring.



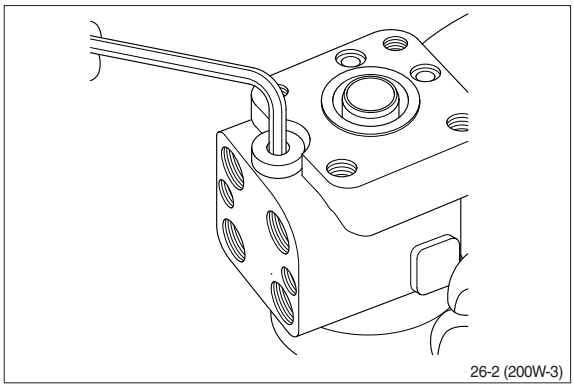
25-3 (200W-3)

(37) Screw in the setting screw with an 8㎜ hexagon socket spanner. Make the pressure setting on a panel or the machine.



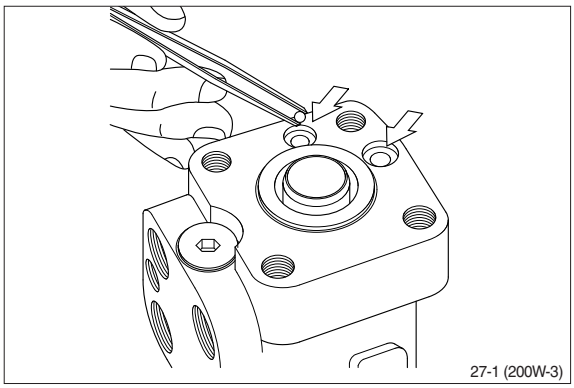
26-1 (200W-3)

(38) Screw plug with dust seal into the housing using an 8㎜ hexagon socket spanner.
· Tightening torque : 5.1±1.0 kgf · m
(36.9±7.2 lbf · ft)

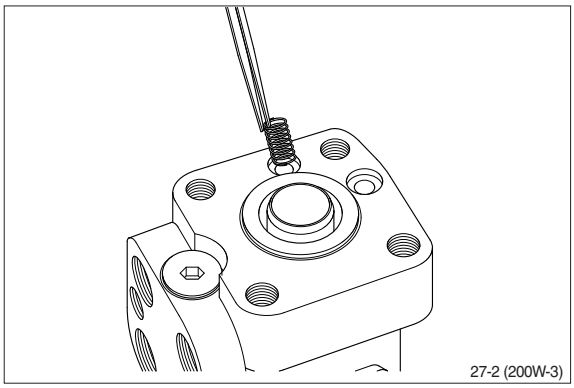

26-2 (200W-3)

Assembly of the dual shock valve

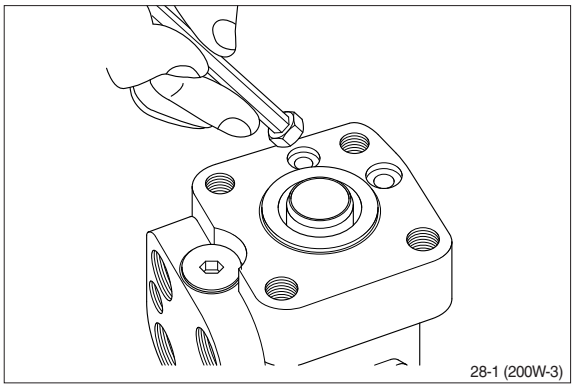
(39) Put a ball in the two holes indicated by the arrows.


27-1 (200W-3)

(40) Place springs and valve cones over the two balls.

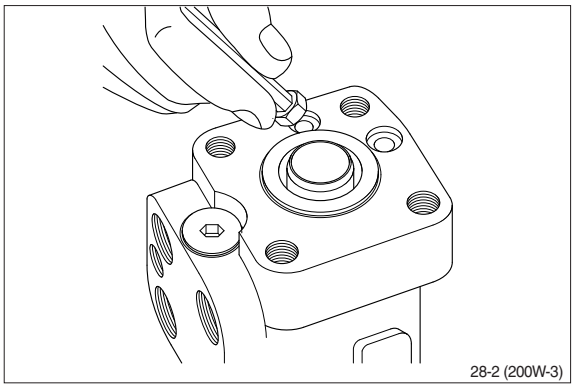

27-2 (200W-3)

(41) Screw in the two setting screws using a 6㎜ hexagon socket spanner. Make the pressure setting on a panel or the machine.


28-1 (200W-3)

(42) Screw plug with seal ring into the two shock valves using a 6㎜ hexagon socket spanner.

· Tightening torque : 3.1 kgf · m
(22.4 lbf · ft)


28-2 (200W-3)

Steering valve is now assembled.

GROUP 9 FRONT AXLE

1. REMOVAL FRONT AXLE

1) Propeller shaft mounting bolt (1, M10)
   · Tightening torque : 5.9±0.6 kgf · m
   (42.7±4.3 lbf · ft)

2) Wheel nut (2, M22)
   · Tightening torque : 60 kgf · m
   (433 lbf · ft)

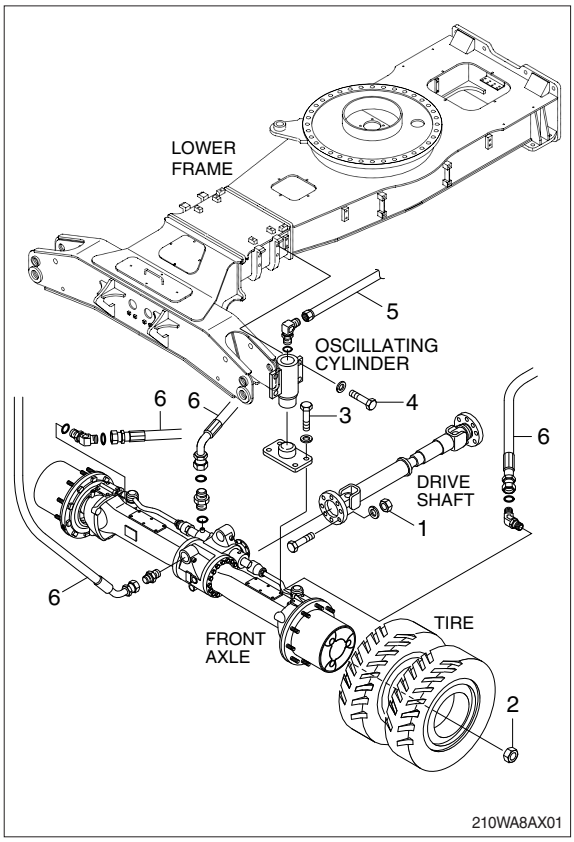
3) Oscillating cylinder supporting mounting bolt (3, M16)
   · Tightening torque : 29.7±4.5 kgf · m
   (215±32.5 lbf · ft)

4) Oscillating cylinder mounting bolt (4, M22)
   · Tightening torque : 69.4±10.4 kgf · m
   (502±75.2 lbf · ft)

5) Pipe assy (5)

6) Hose assy (6)

7) Front axle weight : 749 kg (1651 lb)



3. GENERAL INSTRUCTIONS

1) GENERAL WORKING INSTRUCTIONS

(1) This manual has been developed for the skilled serviceman, trained by the ZF-Passau.

(2) During all operations, pay attention to cleanliness and skilled working.
Therefore, axle removed from the machine, must be cleaned prior to open them.

(3) We assume that the special tools, specified by ZF, will be used.
The special tools are available from ZF-Passau.

(4) After the disassembly, all components must be cleansed, especially corners, cavities and recesses of housing and covers.

(5) The old sealing compound must be carefully removed.

(6) Check lubricating holes, grooves and pipes for free passage. They must be free of residues, foreign material or protective compounds.

(7) The latter refers especially to new parts.

(8) Parts which have been inevitably damaged in a disassembly operation, must be generally replaced by new ones, e.g. rotary seal rings, O-rings, U-section rings, cap boots, protective caps etc..

(9) Components such as roller bearings, thrust washers, synchronizing parts etc. which are subject to normal wear in automotive operation, must be checked by the skilled Serviceman.
He will decide if the parts can be reused.

(10) For the heating of bearings etc., hot plates, rod heaters or heating furnaces must be used.

(11) Never heat parts directly with the flame. An auxiliary solution would be to immerse the bearing in a vessel filled with oil, which is then heated with the flame.
In this way, damage to the bearings could be avoided.

(12) Ball bearings, covers, flanges and parts like that must be heated to about 90 to 100˚C.

(13) Hot-mounted parts must be reset after cooling in order to assure a proper contact.

(14) Before pressing shafts, bearings etc. in position, both parts must be lubricated.

(15) During to reassembly, all specified adjustment values, testing specifications and tightening torque must be respected.

(16) After the repair, units are filled up with oil.

(17) After the oil filling, the oil level plugs and oil drain plugs must be tightened to the specified tightening torque.

2) IMPORTANT INSTRUCTIONS CONCERNING THE LABOUR SAFETY

(1) In principle, repairers are themselves responsible for the labour safety.

(2) The observance of all valid safety regulations and legal rules is a precondition to prevent damage to individuals and products during the maintenance and repair operations.

(3) Before starting the work, the repairers have to make themselves familiar with these regulations.

(4) The proper repair of these products requires especially trained personnel.

(5) The repairer himself is obliged to provide for the training.

3) LUBRICANT SPECIFICATIONS

(1) Gear oils with limited - slip additives.

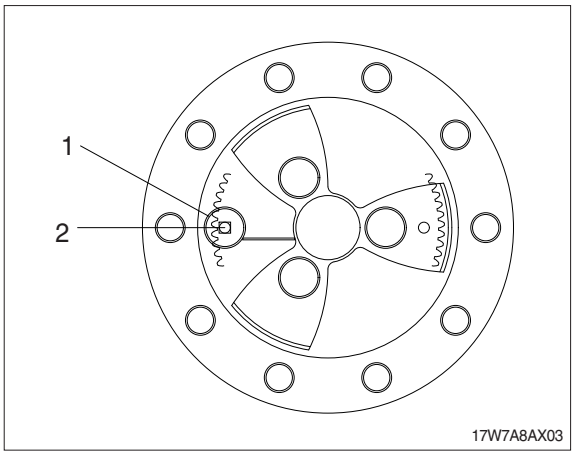
(2) API GL-5

(3) MIL-L-2105D (SAE 85W-90, 85W-140 with LS-Additive)

4) BRAKE LINING WEARING TEST

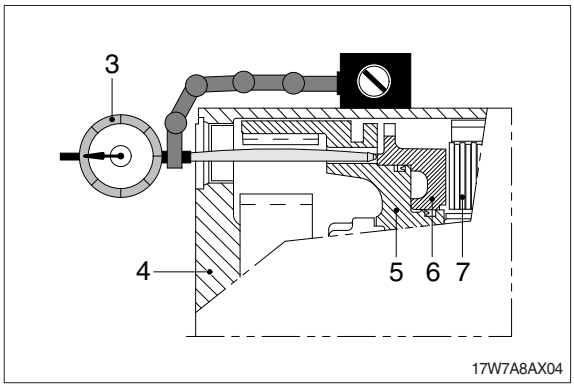
(1) The measurement of wear on the multi-disc brake only gives limited information on the total state of the plate pack without disassembling the output.
Make measurement of lining wear at least once per year, in particular, however, in case of a different braking behaviour, like :
- Braking noises
- Reduced braking power
- Different deceleration
- Different brake oil level
- Different braking pressure

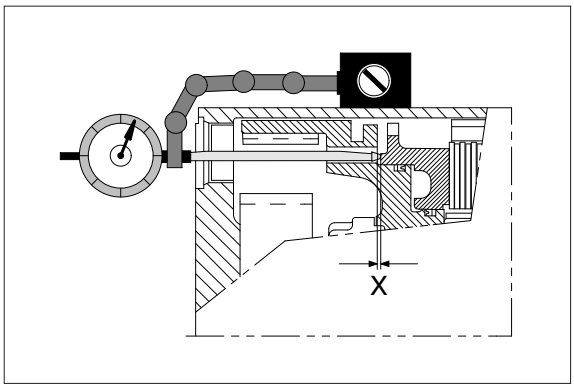
※ To avoid injury when opening the oil drain/ oil filler plug (1), due to a possible pressure build-up in the planetary carrier bring drain hole to topmost position (12 o'clock) and carefully unscrew oil drain and filler plug (1).



(2) Then turn output until oil filler / oil drain hole (2) is on 9 o'clock position.

1 = Oil filler-/oil drain hole
2 = Gauge hole (∅=10 ㎜) in ring gear
9 o'clock position
3 = Dial indicator with solenoid support
4 = Planetary carrier
5 = Ring gear
6 = Piston
7 = Plate pack
X = Piston stroke



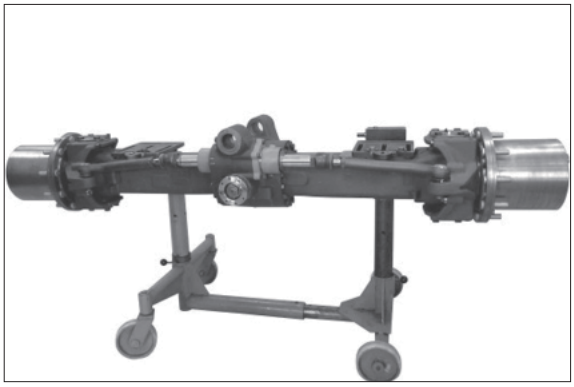


3. DISASSEMBLY

1) STEERING

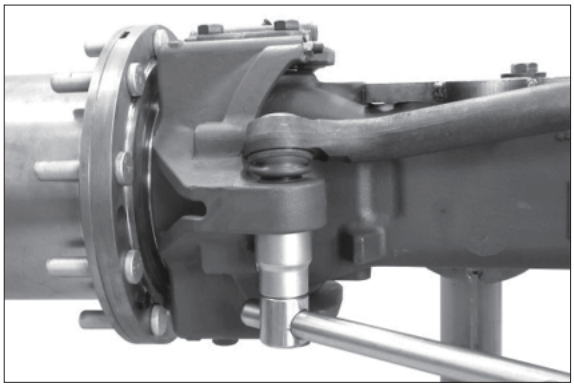
(1) Fix the axle to the assembly truck.

(S) Assembly truck 5870 350 000
(S) Support 5870 350 106



17W98FA001

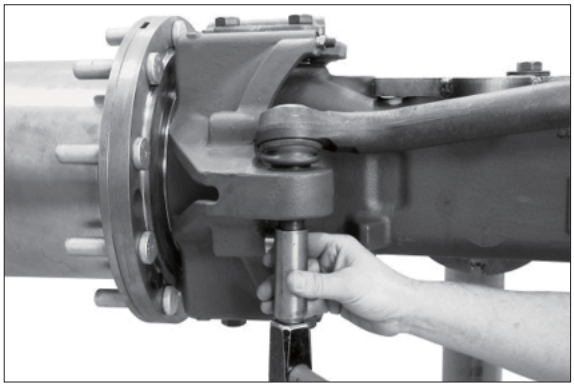
(2) Loosen locknut.



17W98FA002

(3) Force out tie rod from bevel seat.

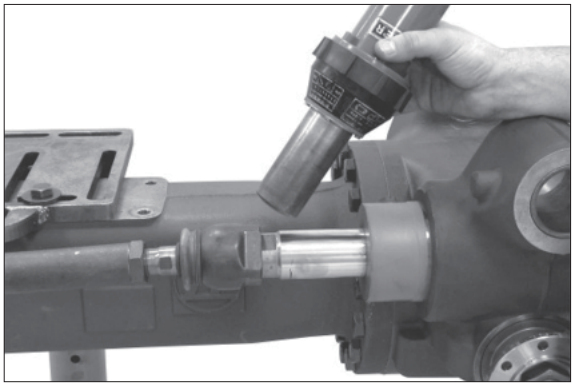
※ Use suitable mandrel (brass or aluminum).



17W98FA003

(4) Warm up piston rod by means of hot air blower.

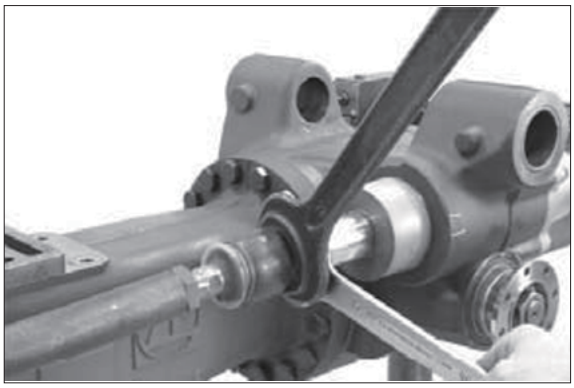
※ Axial joint is installed with Loctite no. 243.



17W98FA004

(5) Separate both tie rods from piston rod.

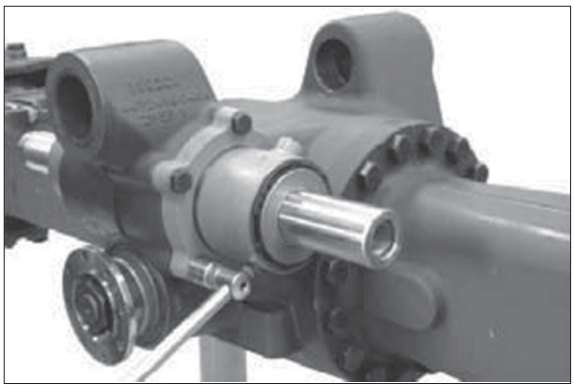
※ If work is just to be done on piston rod, guide or sealing elements, no disassembly of the steering cylinder assy is required.



17W98FA005

(6) Loosen hexagon screws.

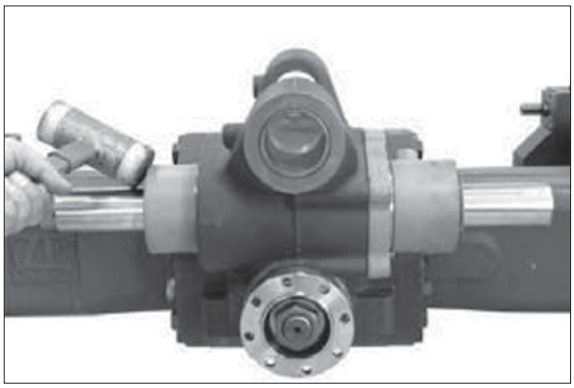
※ Mark radial installation position of steering cylinder to axle housing – assembly aid.



17W98FA006

(7) Drive out steering cylinder assy from axle housing hole.

※ Use a plastic hammer.



17W98FA007

(8) Unsnap the retaining ring and remove the releasing flange.

17W98FA008

(9) Unsnap retaining ring.

17W98FA009

(10) Push/force the brake head into the cylinder tube, until the retaining ring (see figure FA011) can be removed.

17W98FA010

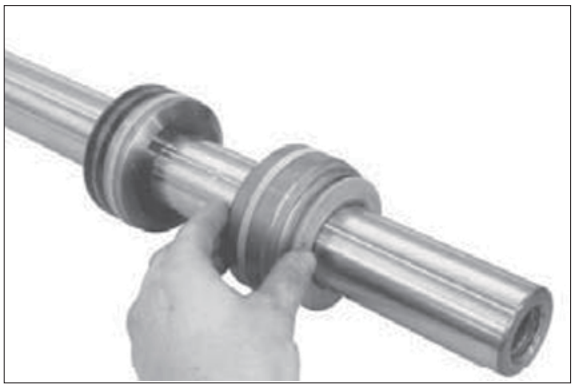
(11) Unsnap retaining ring.

Then drive out piston rod together with brake head from cylinder tube.

17W98FA011

(12) Pull off brake head from the piston rod.

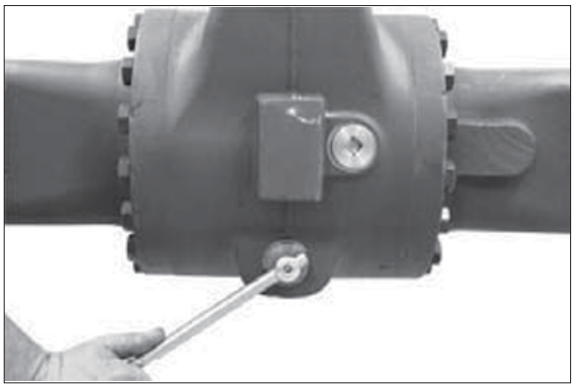
Then remove all sealing elements from piston rod, brake head and cylinder tube.



17W98FA012

2) OUTPUT

(1) Loosen screw plug and drain oil from the axle.

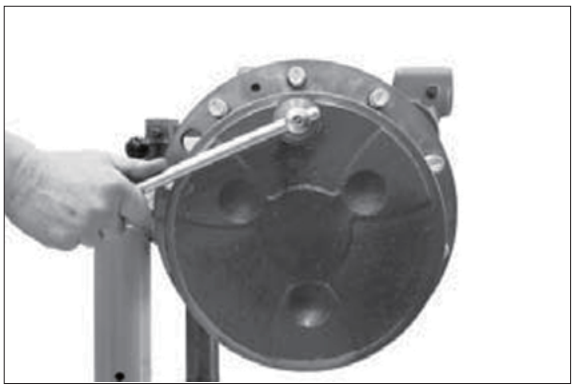


17W98FA013

(2) Loosen screw plug and drain oil from the planetary carrier.

※ To avoid injury due to a possible pressure build-up in the oil system of the planetary carrier, bring oil filler and control plug to 12 o'clock position and carefully unscrew. Then bring drain hole to 6 o'clock position and drain oil.

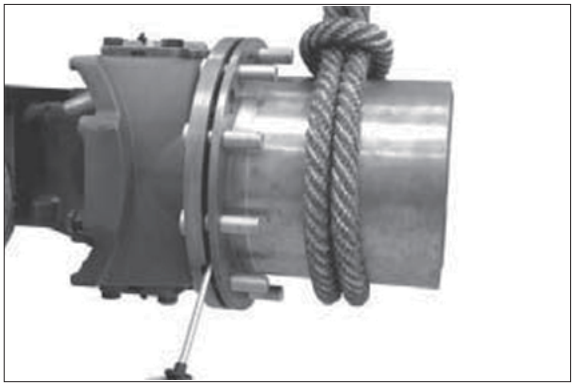
※ Use suitable collecting basin environmental protection.



17W98FA014

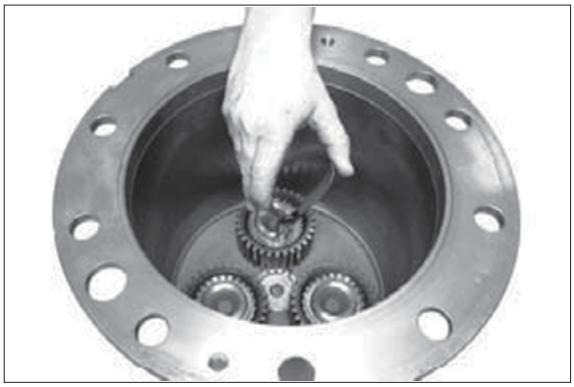
(3) Planetary carrier

Loosen both hexagon screws and separate planetary carrier from hub.



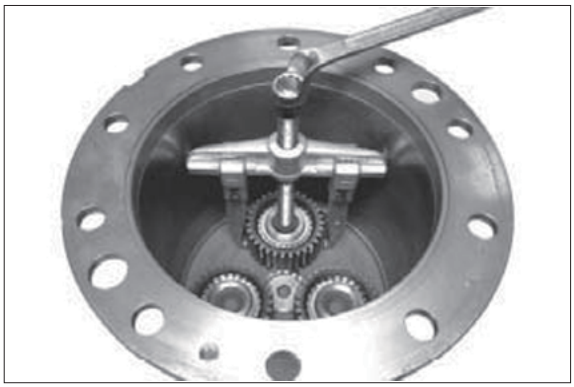
17W98FA015

(4) Unsnap retaining ring.



17W98FA016

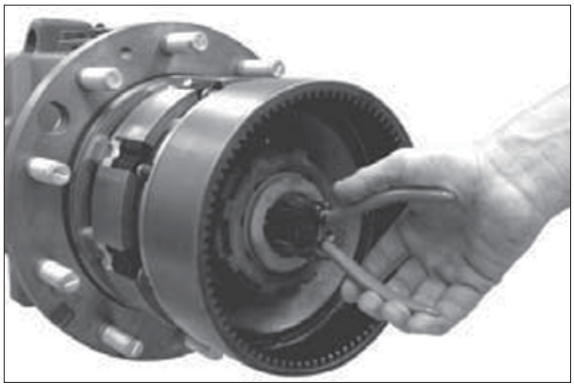
(5) Pull off planetary gear together with cylindrical roller bearing.



17W98FA017

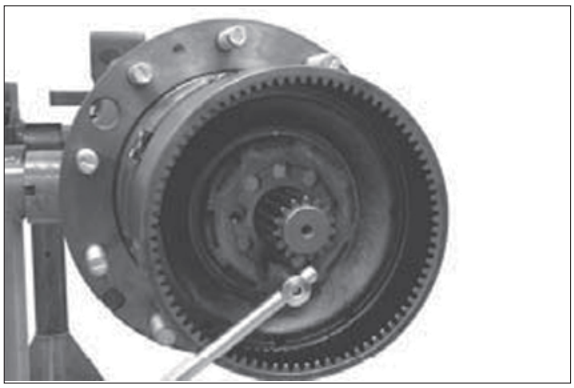
(6) Brake

Unsnap retaining ring and remove both thrust washers.



17W98FA018

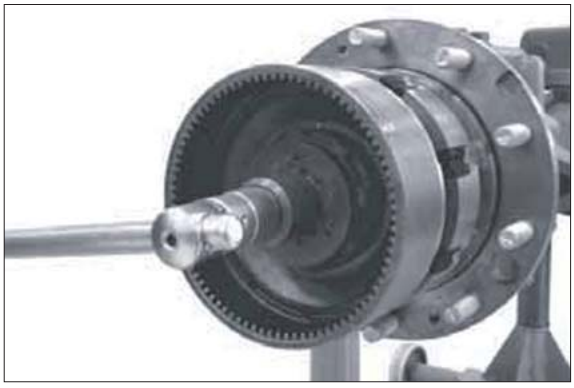
(7) Loosen cylindrical screw (slotted nut fixing).



17W98FA019

(8) Loosen slotted nut.

(S) Socket wrench 5870 656 097

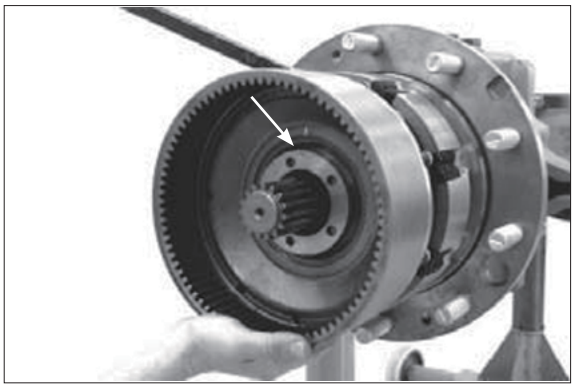


17W98FA020

(9) Press off ring gear together with piston from joint housing.

(S) Assembly lever 5870 345 036

※ Pay attention to releasing O-ring (arrow).



17W98FA021

(10) Loosen hexagon screws and remove releasing spring sleeves and compression springs.

17W98FA022

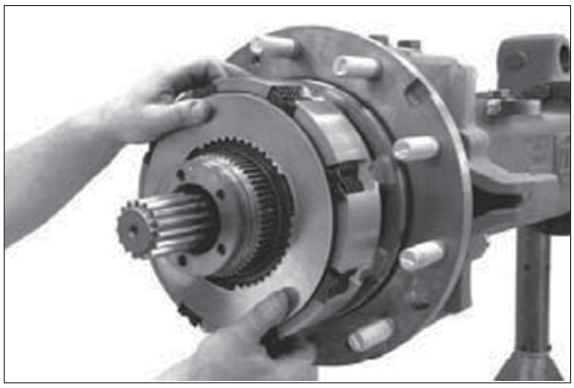
(11) Press off piston from ring gear.

17W98FA023

(12) Remove sealing elements from the annular grooves (see arrows) of the ring gear.

17W98FA024

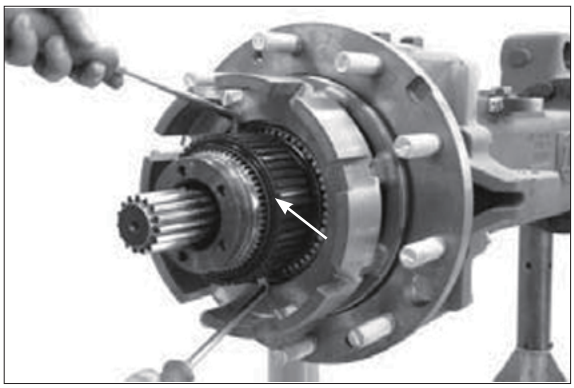
(13) Remove disk package.



17W98FA025

(14) Remove O-ring (see arrow) and lift off disk carrier from the joint housing.

(S) Adjusting device 5870 400 001



17W98FA026

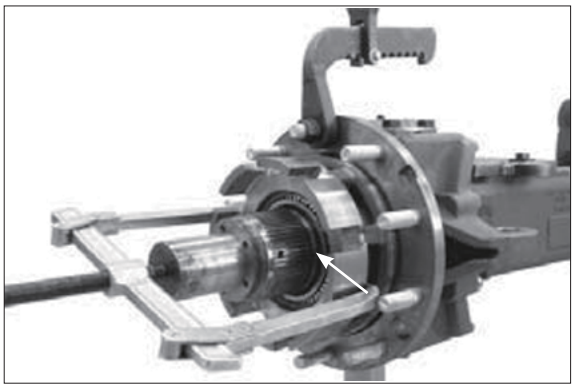
(15) Hub

Remove O-ring (see arrow).

Secure hub with lifting bracket (S) and pull from joint housing by means of a two armed puller.

(S) Lifting bracket 5870 281 043
(S) Pressure piece 5870 100 067

※ Pay attention to releasing bearing inner ring.

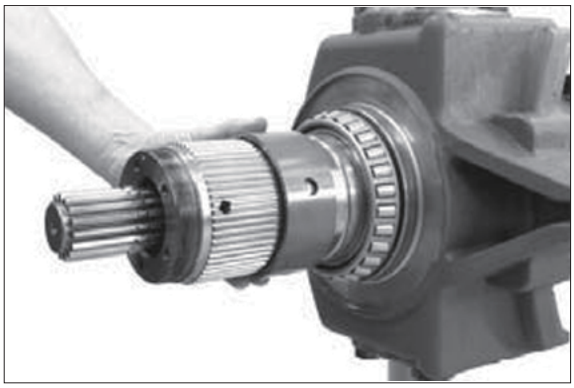


17W98FA027

(16) Use a lever to lift-off shaft seal ring (see arrow) from hub hole and force both bearing outer rings out of the hub.

17W98FA028

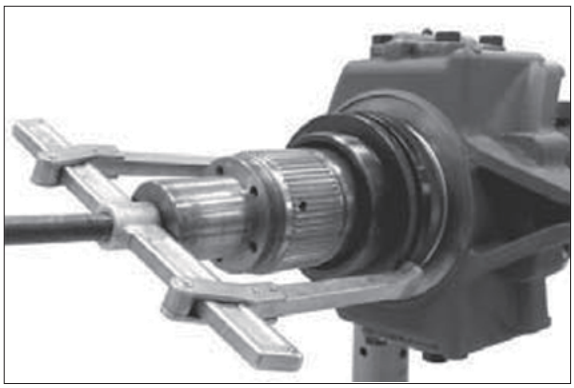
(17) Remove spacer bushing.



17W98FA029

(18) Pull tapered roller bearing from joint housing.

(S) Grab sleeve 5873 004 022
(S) Pressure piece 5870 100 067



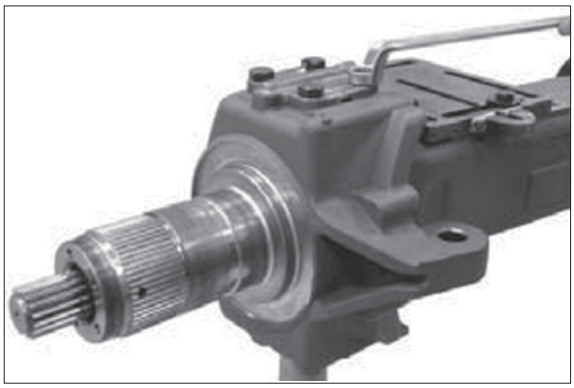
17W98FA030

(19) Knuckle housing

Loosen threaded joint and remove upper bearing pin.

※ Pay attention to releasing O-ring.

※ Remove lower bearing pin only after securing the knuckle housing (see figure FA032).



17W98FA031

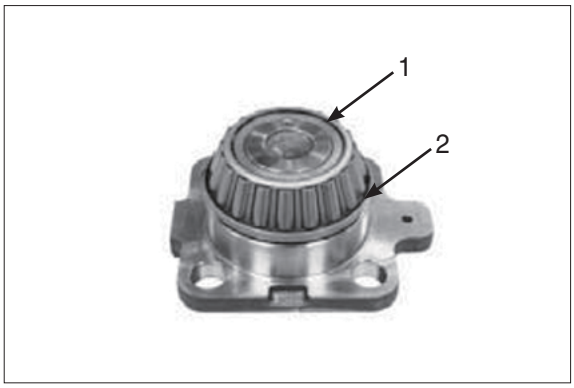
(20) Secure knuckle housing by means of lifting tackle.

Then loosen threaded joint and remove lower bearing pin.

(S) Eyebolts (M 20) 0636 804 003

17W98FA032

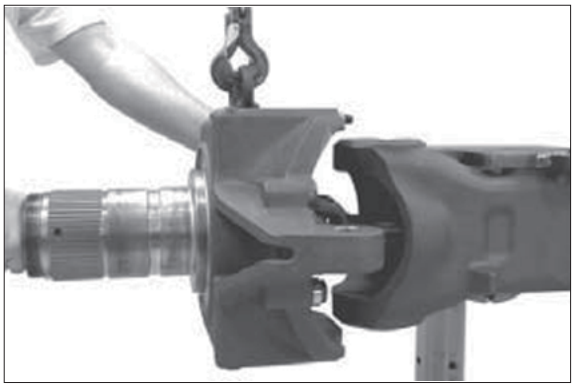
(21) Use lever to remove tapered roller bearing (1) from bearing pin, remove releasing sealing cap (2) and the O-ring lying behind.



17W98FA033

(22) Separate knuckle housing with double u-joint shaft from the axle housing.

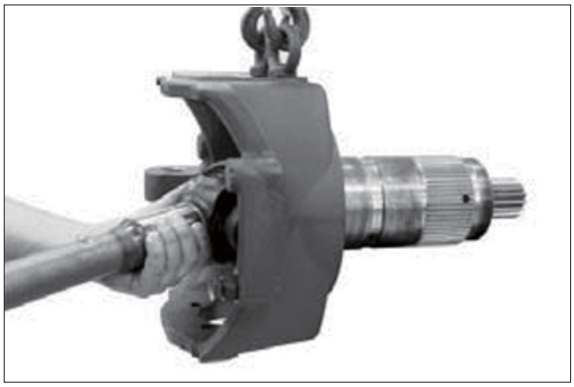
※ Pay attention to shaft seal ring in the axle housing risk of damage.



17W98FA034

(23) Pull out double u-joint shaft from knuckle housing.

※ Pay attention to shaft seal ring in the knuckle housing risk of damage.



17W98FA035

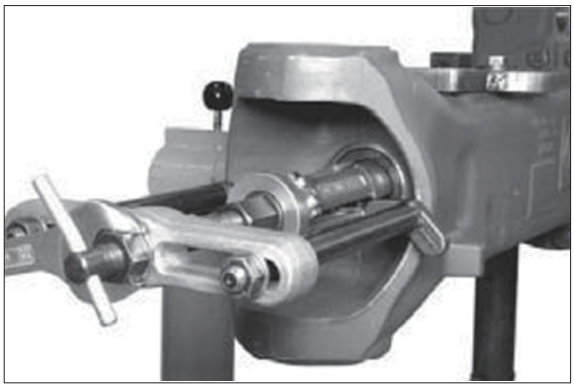
(24) Pull out shaft seal ring and afterwards the bushing behind from the axle housing.

(S) Internal extractor 5870 300 017
(S) Counter support 5870 300 020

17W98FA036

(25) Pull out shaft seal ring and afterwards the bushing behind from the axle housing.

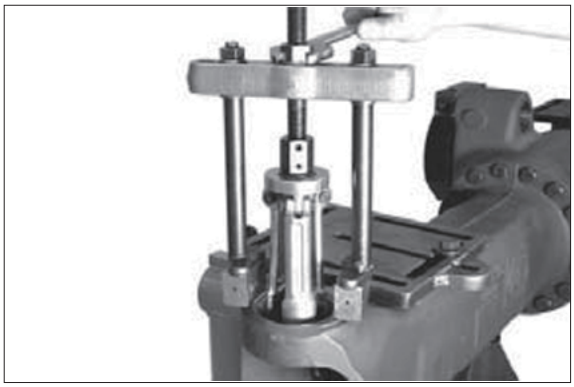
(S) Internal extractor 5870 300 017
(S) Counter support 5870 300 020



17W98FA037

(26) Pull out both bearing outer rings from the pivot bearing holes.

(S) Internal extractor 5870 300 019
(S) Counter support 5870 300 020



17W98FA038

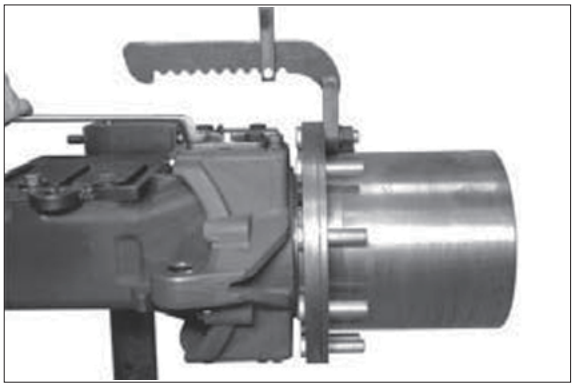
(27) Output assy

※ If work is required on the differential or pinion, you may disassembly the output as complete unit (operation FA039 and FA040).

Secure output assy by means of lifting tackle (S).

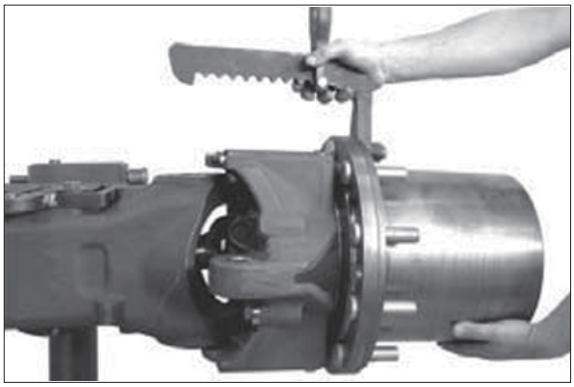
(S) Lifting bracket 5870 281 043

Then loosen threaded joints of both bearing pins.



17W98FA039

(28) Remove both bearing pins and separate the output assy from the axle housing.

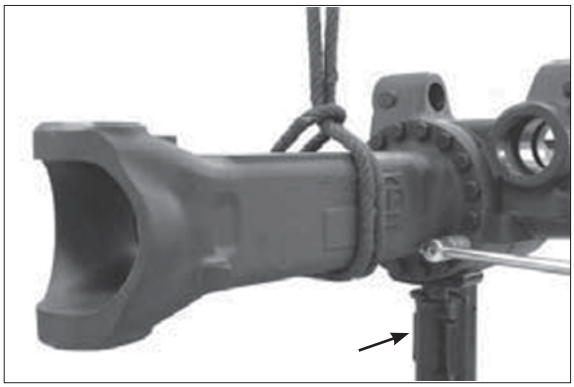


17W98FA040

3) INPUT

(1) Support axle to axle drive housing (see arrow).
Then secure axle housing (crown wheel side) by means of lifting tackle and loosen threaded joint.
Then separate axle housing from axle drive housing.

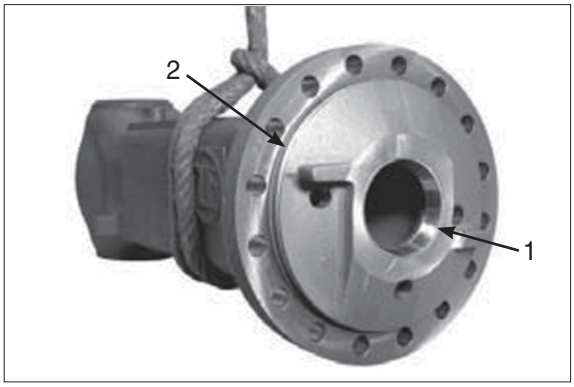
※ Pay attention to possibly releasing differential.



17W98FA041

(2) Pull bearing outer ring (arrow 1) from the bearing hole and remove releasing shim.
Then remove O-ring (arrow 2).

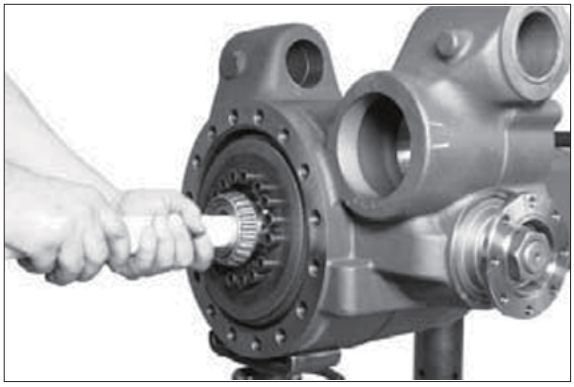
(S) Striker 5870 650 004



17W98FA042

(3) Lift differential out of the axle drive housing.

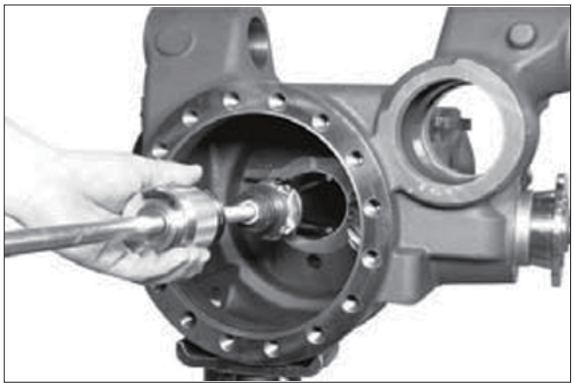
※ Disassembly of the differential is described as of page 8-259.



17W98FA043

(4) Use striker (S) to pull bearing outer ring out of the bearing hole (axle housing) and remove releasing shim.

(S) Striker 5870 650 004

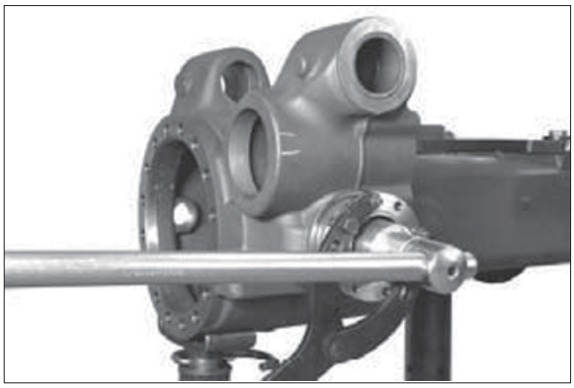


17W98FA044

(5) Warm up hexagon nut by means of hot air blower.
Then loosen hexagon nut and remove the releasing shim.

(S) Clamping fork 5870 240 025

※ Hexagon nut is installed with Loctite no. 262.



17W98FA045

(6) Pull input flange from pinion.
If necessary, remove screen sheet from flange.

17W98FA046

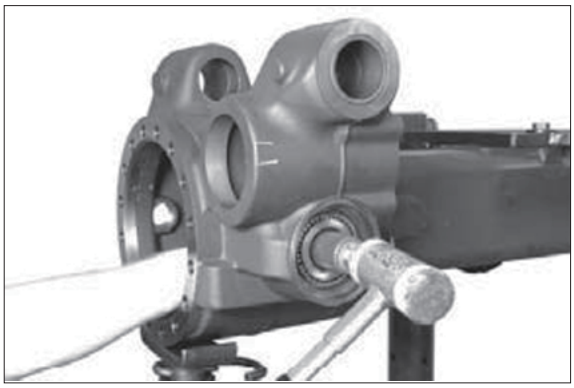
(7) Use a lever to remove the shaft seal ring from the housing hole.

17W98FA047

(8) Force out input pinion and remove releasing roller bearing.

※ Use plastic hammer.

※ If tapered roller bearings should not be replaced, pay attention that the outer bearing inner ring with all its rolls is in contact with bearing outer ring when forcing out the input pinion.



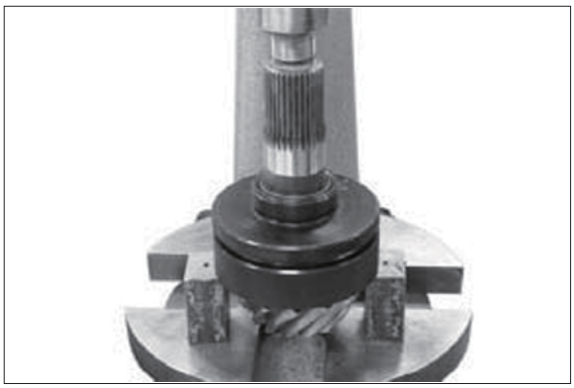
17W98FA048

(9) Remove spacer ring.

17W98FA049

(10) Press roller bearing from input pinion.

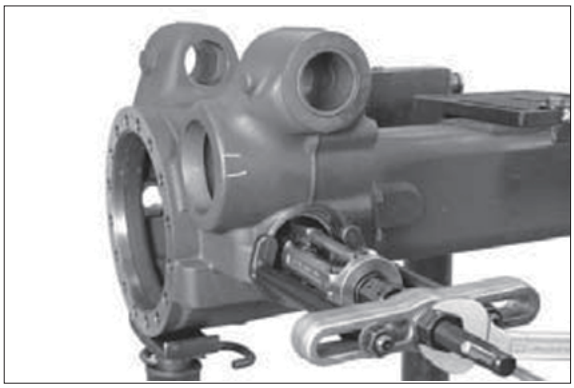
(S) Grab sleeve 5873 001 037



17W98FA050

(11) Pull off outer bearing outer ring from bearing hole.

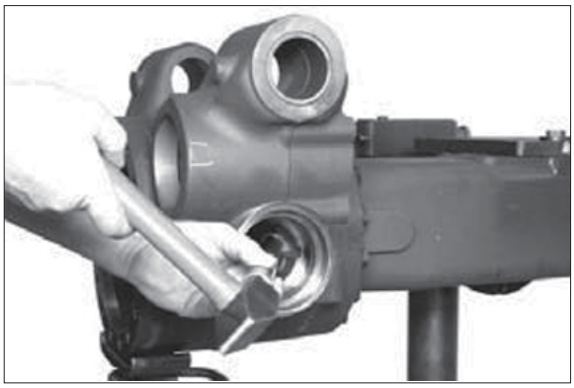
(S) Internal extractor 5870 300 019
(S) Counter support 5870 300 020



17W98FA051

(12) Force out bearing outer ring from the inner bearing hole pay attention to the shim behind.

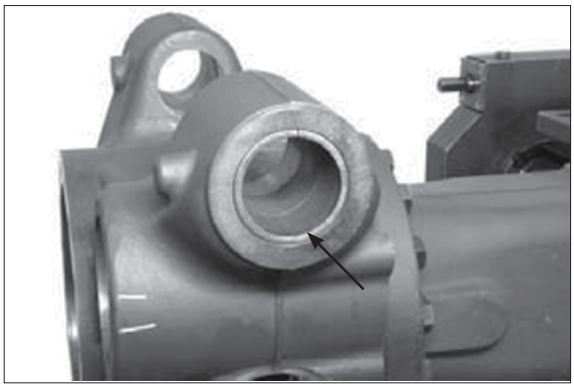
※ Mark shim (with regard to position/bearing allocation) assembly aid.



17W98FA052

(13) If necessary, provide bushings with a separating slot (see arrow) and remove from holes.

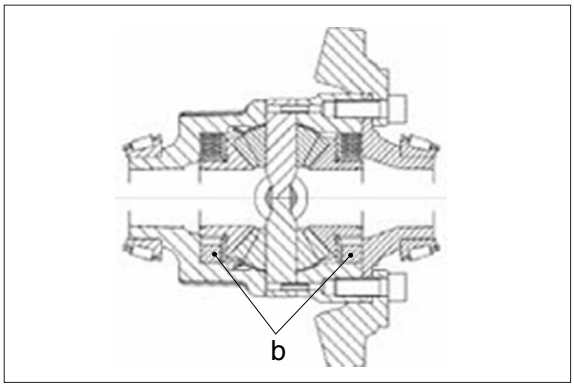
※ Bushings are destroyed by this.



17W98FA053

4) DIFFERENTIAL

(1) Differential - versions:
b = Constant spacers



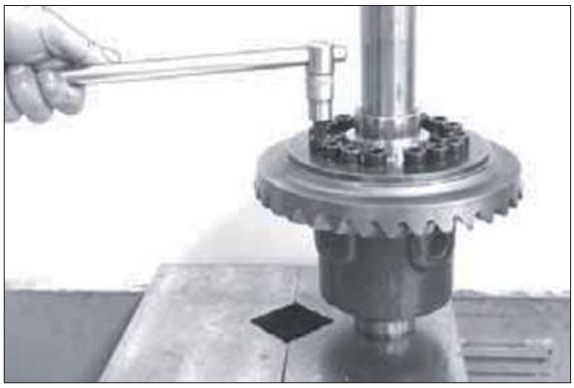
17W98FA054

(2) Pull both tapered roller bearings from differential carrier.

(S) Grab sleeve	5873 011 019
(S) Basic tool	5873 001 000
(S) Pressure piece	5870 100 009

17W98FA055

(3) Use press to fix differential and loosen threaded joint crown wheel / differential carrier.



17W98FA056

(4) Press crown wheel from differential.

17W98FA057

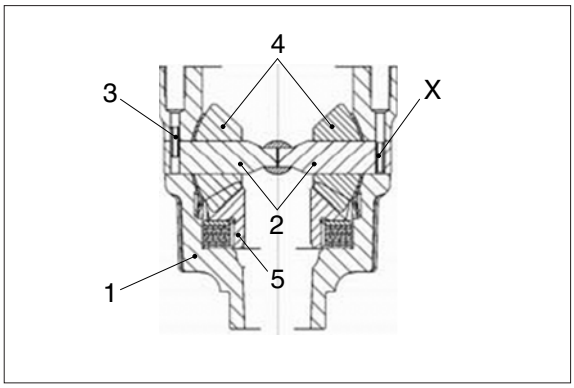
(5) Remove single parts.
Remove axle bevel gear together with thrust washer and constant spacer from the differential carrier.

17W98FA058

(6) Force slotted pins (considering position "X", see subsequent sketch FA060) into the spider shafts.

17W98FA059

(7) Comment on sketch:
1 = Differential carrier
2 = Spider shafts (short)
3 = Slotted pins
4 = Differential bevel gears
5 = Axle bevel gear
X = Position of the slotted pin to force out the spider shafts



17W98FA060

(8) Force out both spider shafts (short).

17W98FA061

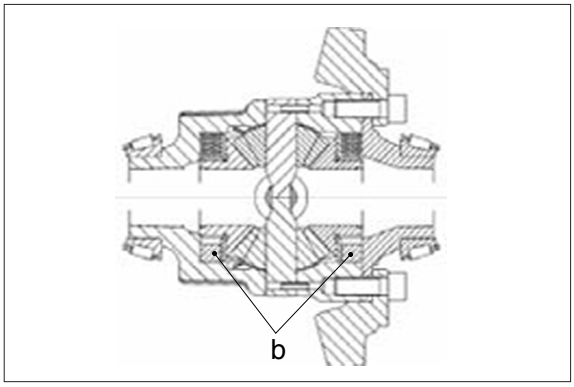
(9) Remove all single parts.

17W98FA062

4. REASSEMBLY

1) DIFFERENTIAL

(1) b = Constant spacers

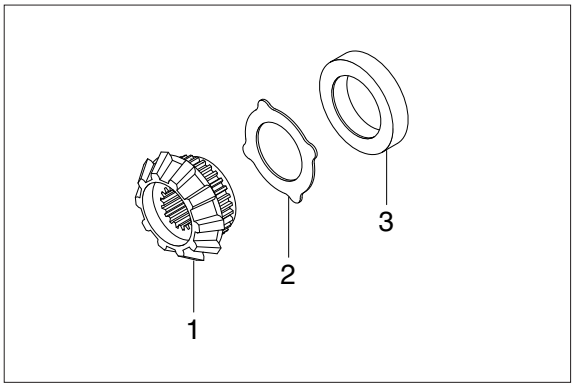


17W98FA054

(2) All outer and inner disks are replaced by a constant spacer (see figure FA066).

1 = Axle bevel gear
2 = Pressure disk
3 = Constant ring

※ No measuring / setting of the axial play of the two axle bevel gears is required, therefore single parts can be immediately oiled.



17W98FA065

(3) Insert premounted axle bevel gear into the differential carrier.

17W98FA066

(4) Insert differential bevel gears (1) with thrust washers (2) and fix with spider shafts (3 and 4).

※ Pay attention to radial installation position of the thrust washers.

17W98FA067

(5) Check axial play of the axle bevel gear 0.0 ~ 0.15 mm.

※ If the axial play is not within the specified tolerance, correct with the corresponding outer disks.

After the setting procedure separate the single parts again.

Then oil and reassemble all single parts again.

※ Make sure that thickness and arrangement of the second disk package are identical (figure FA071).

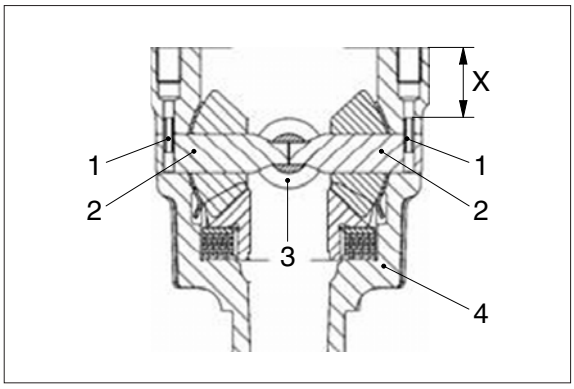
17W98FA068

(6) Fix both spider shafts (short) by means of slotted pins (considering installation dimension, see sketch FA070).

17W98FA069

(7) Comment on sketch:

1 = Slotted pin
2 = Spider shaft (short)
3 = Spider shaft
4 = Differential carrier
X = Installation dimension 34±0.5 mm



17W98FA070

(8) Mount second axle bevel gear with thrust washer and constant spacer (see also figure FA065).

※ Mount the pressure disk with the coated surface showing to the outer disk.

※ Thickness and arrangement of the disk package must be identical on both sides of the differential gear.

17W98FA071

(9) Check axial play of the second axle bevel gear 0.0~0.15 ㎜.

※ If the axial play is not within the specified tolerance, correct with the corresponding outer disks.

After the resetting procedure remove the second axle bevel gear together with the disk package from the differential carrier.

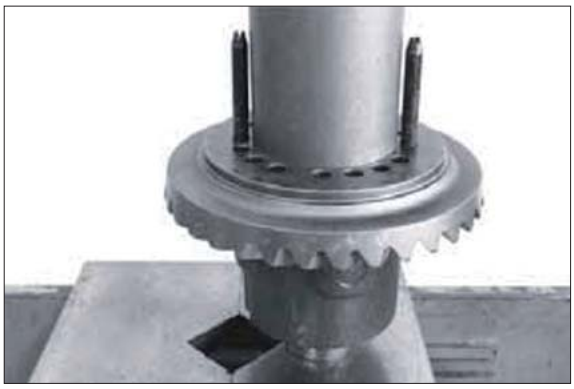
Then oil and reassemble all single parts.

17W98FA072

(10) Mount two adjusting screws (S) and insert cover.
(S) Adjusting screws (M12×1.5)
5870 204 027

17W98FA073

(11) Press crown wheel onto the cover / differential carrier until contact position is obtained.



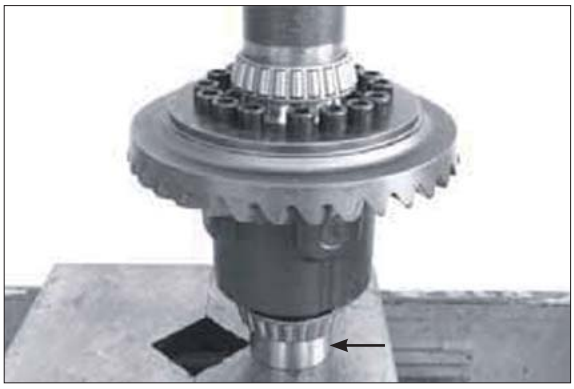
17W98FA074

(12) Fix differential with press and tighten crown wheel with cylindrical screws.
Tightening torque (M12×1,5/12.9) . . . . . MA = 145 Nm

17W98FA075

(13) Press on both bearing inner rings until contact is obtained.

※ Use an appropriate support (arrow) differential may not be supported on the bearing cage.



17W98FA076

2) INPUT

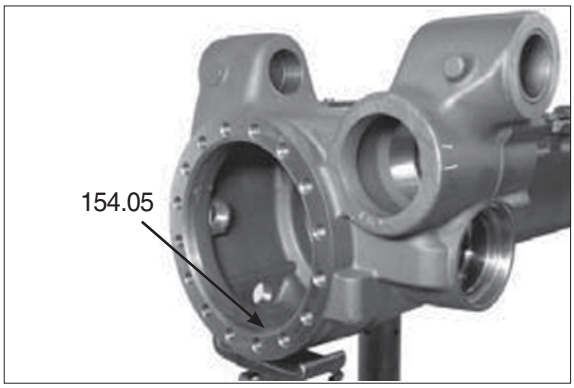
(1) Input pinion

※ The following measuring procedures must be carried out with utmost accuracy. Inaccurate measurements lead to an incorrect contact pattern and another disassembly and reassembly of the input pinion is required.

(2) Determine thickness of the shim to obtain a correct contact pattern

Read dimension I from the axle drive housing.

Dimension I e.g . . . . . 154.05 mm



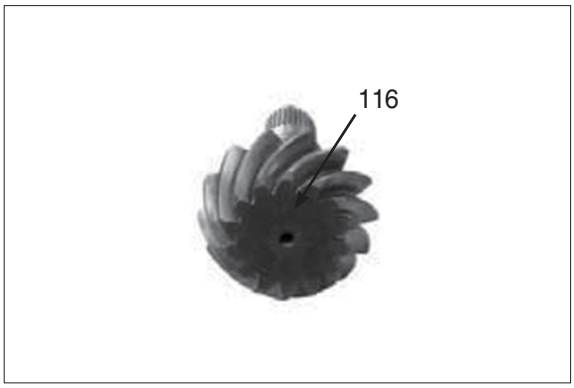
17W98FA077

(3) Read dimension II (pinion dimension).

Dimension II e.g. . . . . 116.00 mm

In case of a + or – deviation of the pinion dimension for production reasons the relevant value is marked by hand on the pinion.

Pinion dimension (without + or – deviation) = 116.0 mm
Pinion dimension with an indicated + 0.1 deviation = 116.1 mm
Pinion dimension with an indicated – 0.1 deviation = 115.9 mm



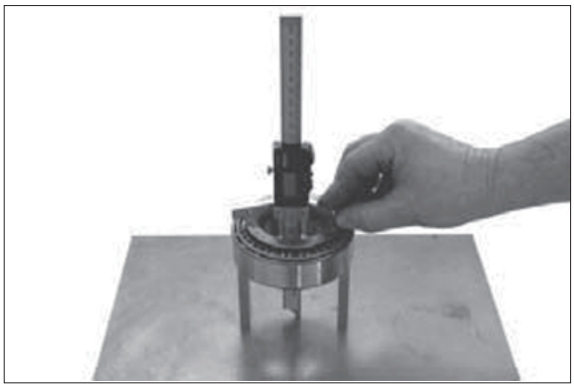
17W98FA078

(4) Determine dimension III (bearing width).

※ Make sure that the rollers are located without any play (rotate bearing g inner ring several times in both directions roller setting).

Since the installed roller bearing is subject to a pre-load in installation position, consider an experience deduction of 0.1 mm.

Dimension III, e.g. 36.60 mm – 0.1 mm . . . . . = 36.50 mm

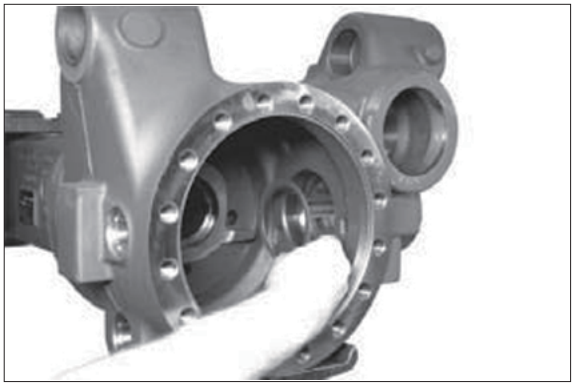


17W98FA079

(5) Calculation example "B" :

Dimension I . . . . . 154.05 mm
Dimension X . . . . . - 152.50 mm
Difference = shim s = 1.55 mm

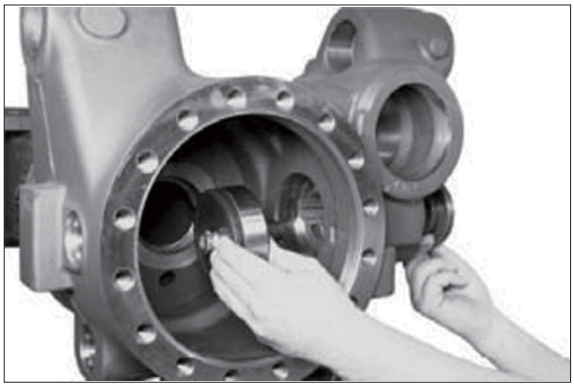
Insert the determined shim (e.g. s = 1.55 mm) into the inner bearing hole.



17W98FA080

(6) Undercool bearing outer ring (see arrow) and bring into contact position in the bearing hole by using the assembly fixture (S).

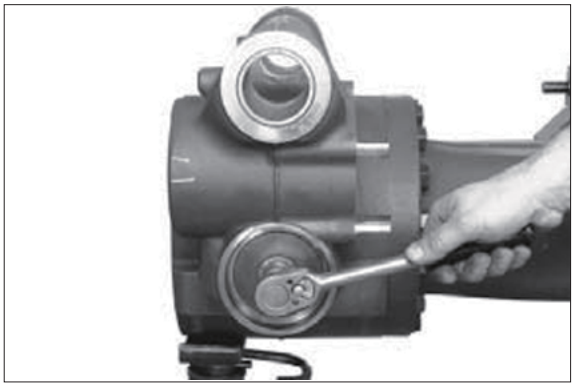
(S) Assembly fixture 5870 345 049
(S) Pressure ring 5870 345 056



17W98FA081

(7) Undercool outer bearing outer ring and insert into bearing hole until contact is obtained.

(S) Assembly fixture 5870 345 049
(S) Pressure ring 5870 345 056

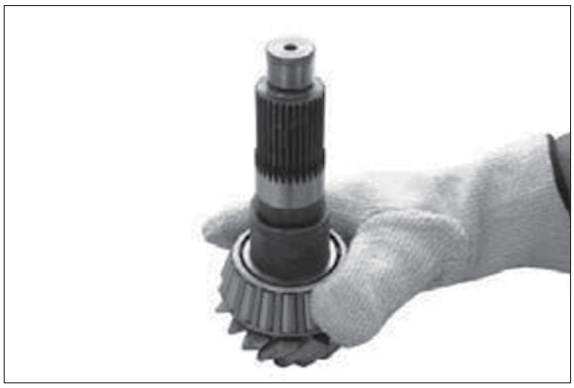


17W98FA082

(8) Setting of rolling torque of the input pinion bearing 1.0 ... 3.0 Nm (without shaft seal ring)

Warm up roller bearing and insert until contact is obtained.

※ Adjust bearing after cooling down.



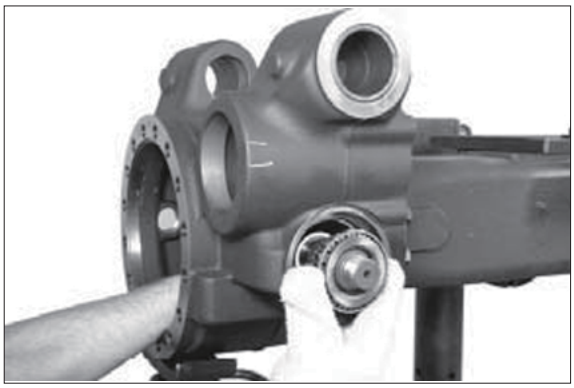
17W98FA083

(9) Insert spacer ring (e.g. s = 16.96 mm).

※ According to our experience, the necessary rolling torque is obtained when reusing the spacer ring which has been removed during disassembly (e.g. s = 16.96 mm).
A later check of the rolling torque, however, is absolutely necessary.

17W98FA084

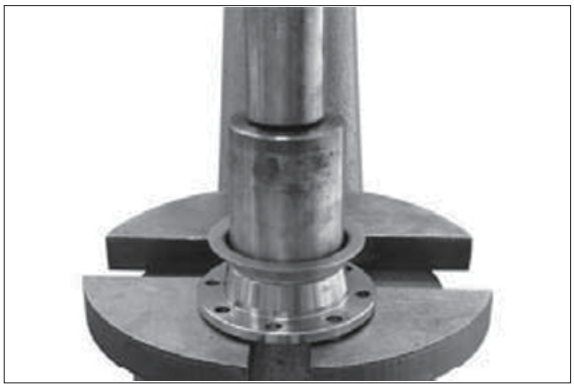
(10) Insert the preassembled input pinion into the axle housing and mount the heated roller bearing until contact is obtained.



17W98FA085

(11) Press screen sheet (see arrow) onto the input flange until contact is obtained.

※ The shaft seal ring is mounted only after contact pattern check.



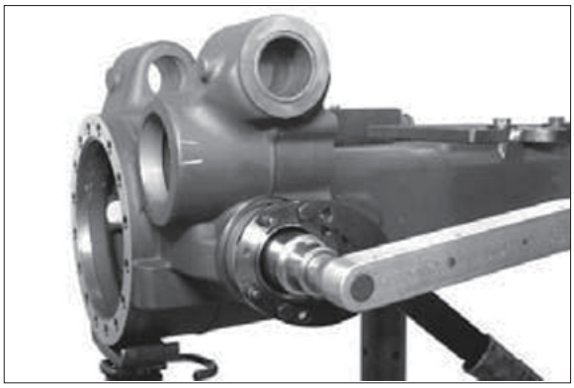
17W98FA086

(12) Mount input flange, fix with disk and hexagon nut.

Tightening torque (M30 x 1,5) .....
..... MA = 600 Nm

(S) Clamping fork 5870 240 025

※ During the tightening process rotate the input pinion several times in both directions.



17W98FA087

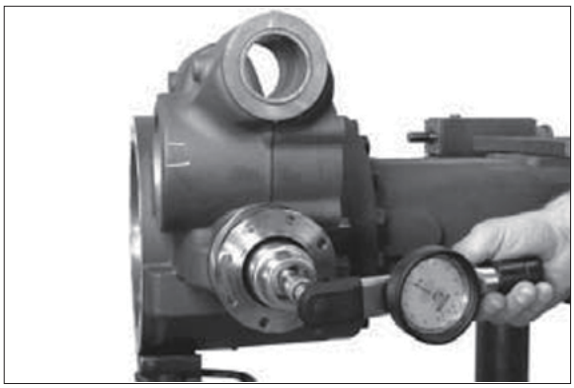
(13) Check rolling torque (1.0 ... 3.0 Nm without shaft seal ring).

※ When installing new bearings try to achieve the upper value of the rolling torque.

※ In case of deviations from the necessary rolling torque correct with a corresponding spacer ring (figure FA084) as specified below.

Insufficient rolling torque
install thinner spacer ring

Excessive rolling torque
install thicker spacer ring.

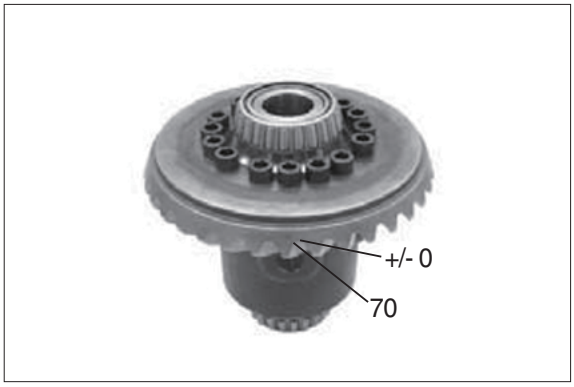


17W98FA088

(14) Determine shim for setting the bearing rolling torque (differential bearing) and backlash (bevel gear set).

※ The required shims must be determined on the basis of the read value (test dimension / crown wheel) and the corresponding specifications of the table next page : (KRS – SET – RIGHT) :
Read test dimension from crown wheel rear.

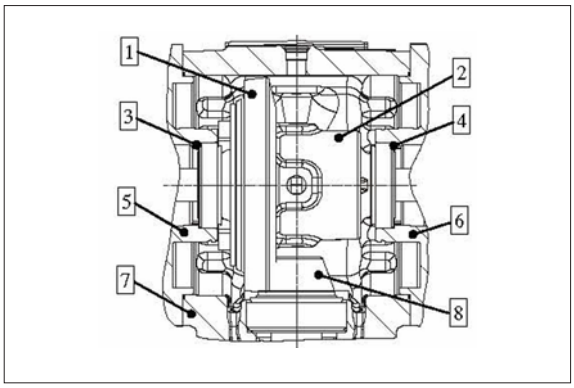
※ Test dimension "70" is stamped into the crown wheel rear. Without + or deviation specification, this corresponds to test dimension / Actual value "70" in the table below.
According to this value the necessary shims are allocated in the table next page.



17W98FA089

※ In case of + or – deviation of the test dimension for production reasons, it is additionally signed on the crown wheel rear (e.g. - 20 or - 10 . 10 or 20) .

※ In accordance with this deviation the necessary shims are allocated in the below table.



17W98FA090

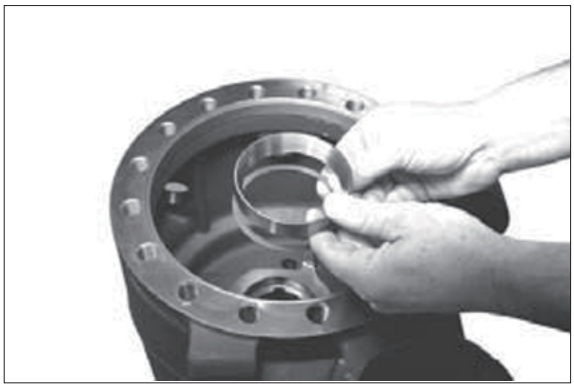
(15) Comment on sketch:

1 = Crown wheel 2 = Differential carrier
3 = Shim (crown wheel side) 4 = Shim (diff. carrier side)
5 = Axle housing 6 = Axle housing
7 = Axle drive housing 8 = Input pinion

Setting disks for differential					
Test dimension/Marking of crown wheel 70 and deviation	-20	-10	0	10	20
Result → Test dimension / Act. value	69.80	69.90	70.0	70.10	70.20
Shim/Diff. carrier side Required disk thickness	0.95	1.05	1.15	1.25	1.35
Shim no.	0730 006 518	0730 006 519	0730 006 521	0730 006 522	0730 006 524
Shim/Crown wheel side Required disk thickness	1.35	1.25	1.15	1.05	0.95
Shim no.	0730 006 524	0730 006 522	0730 006 521	0730 006 519	0730 006 518

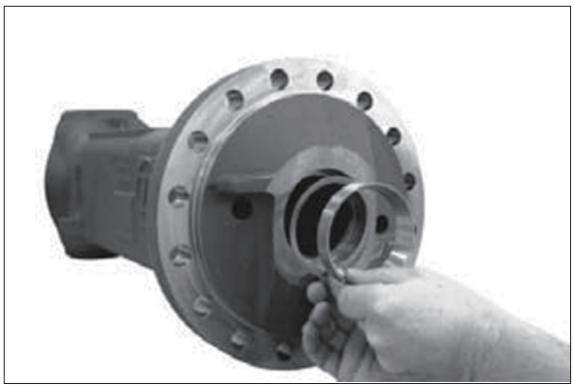
(16) Insert the determined shim (e.g. s = 1.15 mm) and the bearing outer ring into the hole of the axle housing on the differential carrier side.

※ Pivot axle housing 90˚.



17W98FA091

(17) Insert the determined shim (e.g. s = 1.15 mm) and the bearing outer ring into the hole of the axle housing on the crown wheel side.



17W98FA092

(18) Check the contact pattern of the bevel gear set

Wet some drive and coast flanks of the crown wheel with marking ink.

17W98FA093

(19) Insert the preassembled differential into the axle drive housing.

(S) Internal extractor 5870 300 005

17W98FA094

(20) Use lifting tackle to mount the axle housing (crown wheel side) and preliminarily fix with hexagon screws.

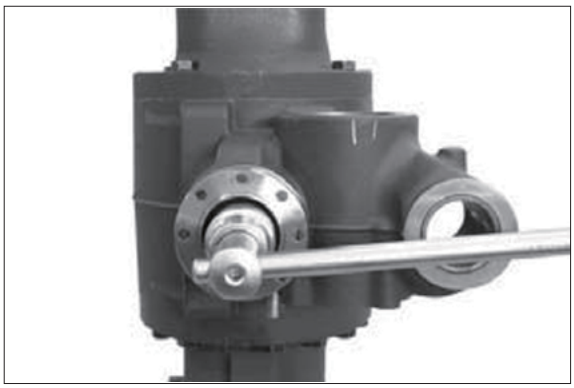
Tightening torque (M18/10.9) . . . . . MA = 390 Nm

※ Preliminarily fix axle housing without O-ring.

17W98FA095

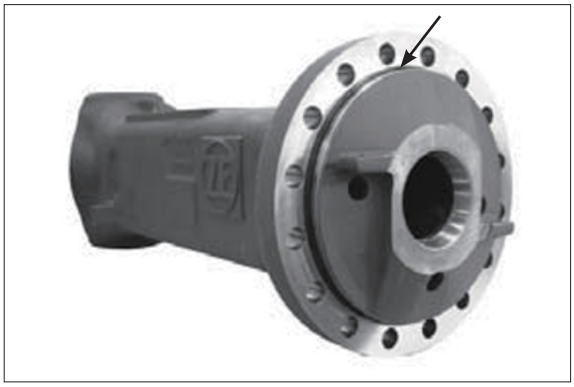
(21) Roll the crown wheel by rotation on the input flange several times in both directions over the input pinion.
Then remove axle housing again and lift differential out of the axle drive housing.
Compare the obtained contact pattern with contact pattern example page 0/4 and 0/5.

※ In case of a contact pattern deviation a measuring mistake was made when determining the shim (figure FA080), which must be absolutely corrected.



17W98FA096

(22) Grease O-ring (see arrow) and mount to axle housing.



17W98FA097

(23) Use lifting tackle to mount the axle housing (part II), finally tighten with hexagon screws.

Tightening torque (M18/12.9) . . . . . MA = 440 Nm

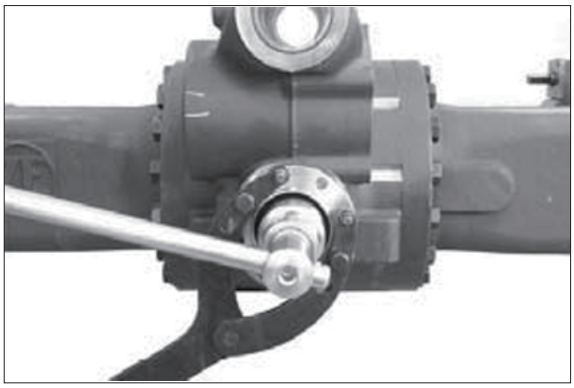
Then bring axle into horizontal position and reassemble the second clamping angle (S) (see also figure FA001).

17W98FA098

(24) Mount shaft seal ring (input flange)

Loosen hexagon nut and pull the input flange from the input pinion.

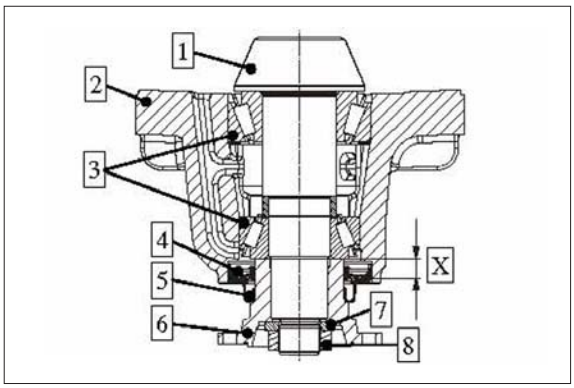
(S) Clamping fork 5870 240 025



17W98FA099

(25) Comment on sketch:

1 = Input pinion
2 = Axle drive housing
3 = Tapered roller bearing
4 = Shaft seal ring
5 = Screen sheet
6 = Input flange
7 = Disk
8 = Hexagon nut
X = Installation dimension → 13.5 +0, 2 mm



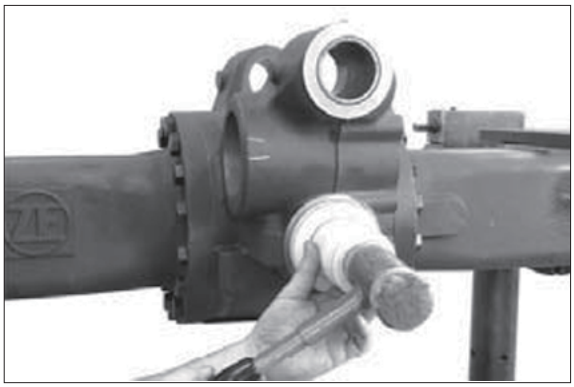
17W98FA100

(26) Mount shaft seal ring with the seal lip showing to the oil chamber.

(S) Driver tool 5870 048 286

※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.

※ Just before fitting, wet contact face shaft seal ring/axle drive housing with lubricant. Apply grease on seal and dust lip of the shaft seal ring.



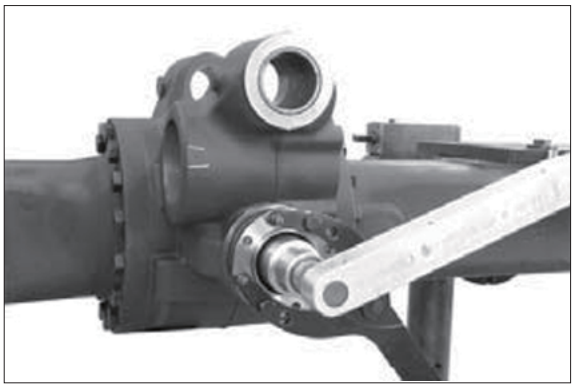
17W98FA101

(27) Mount input flange, finally tighten with disk and hexagon nut.

Tightening torque (M30x1.5) . . . . . MA = 600 Nm

(S) Clamping fork 5870 240 025

※ Wet thread of the hexagon nut with Loctite no. 262.



17W98FA102

3) OUTPUT

(1) Preassembly axle housing

Insert bushing into hole of axle housing considering installation dimension “B” and installation position "Y" (see also sketch FA104 and FA106).

(S) Driver tool	5870 055 090
(S) Handle	5870 260 002

17W98FA103

(2) Comment on sketch:

1 = Axle housing

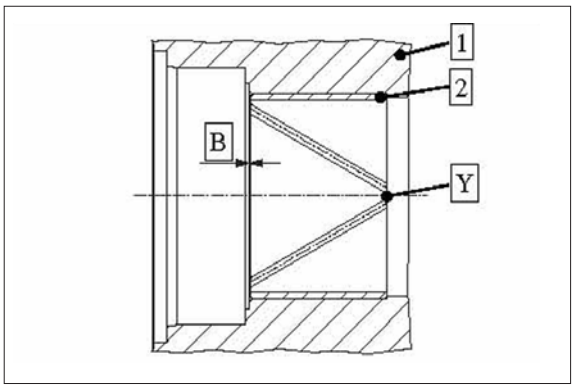
2 = Bushing

B = Installation dimension 1.0±0.3 mm

Y = Installation position / lubrication groove outlet of bushing (top view)

※ Lubrication groove outlet (V-point) must be mounted in 6 o’clock position (bottom) and showing to the oil chamber side.

※ Use of the specified driver tool (S) ensures the exact installation depth of the bushing.

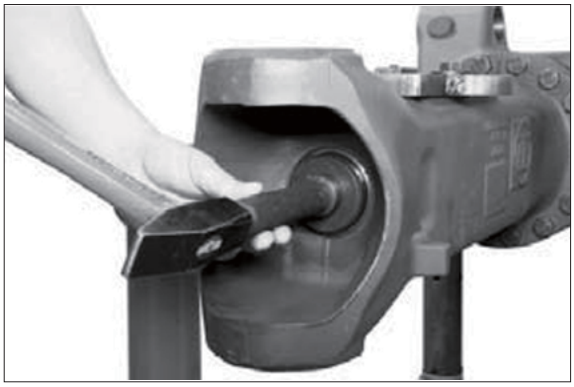


17W98FA104

(3) Flush-mount seal ring with the seal lip showing to the oil chamber (see sketch FA106) into the axle housing hole.

(S) Driver tool	5870 055 090
(S) Handle	5870 260 002

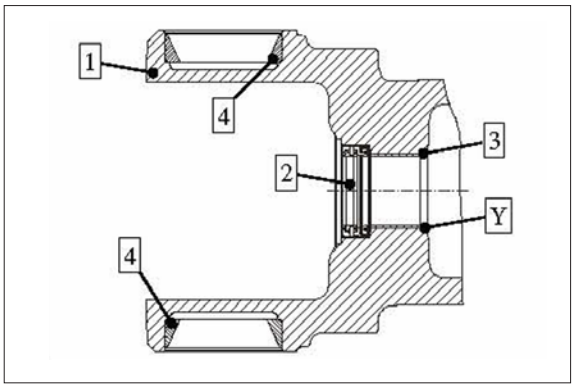
※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.



17W98FA105

※ Just before fitting wet the contact face shaft seal ring/axle drive housing with lubricant.
Apply grease on seal and dust lip of the shaft seal ring.

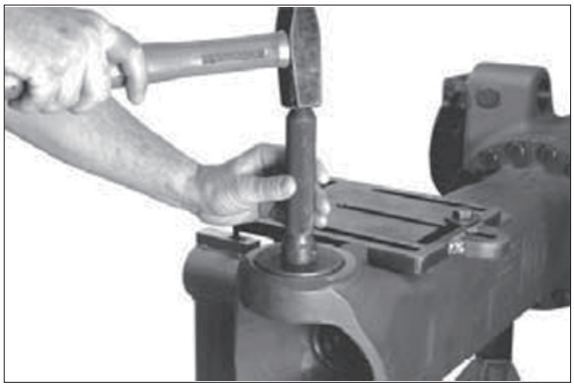
(4) Comment on sketch:
1 = Axle housing
2 = Shaft seal ring
3 = Bushing
4 = Bearing outer rings (pivot bearing)
Y = Lubrication groove outlet (V-point – in 6 o'clock position and on oil chamber side)



17W98FA106

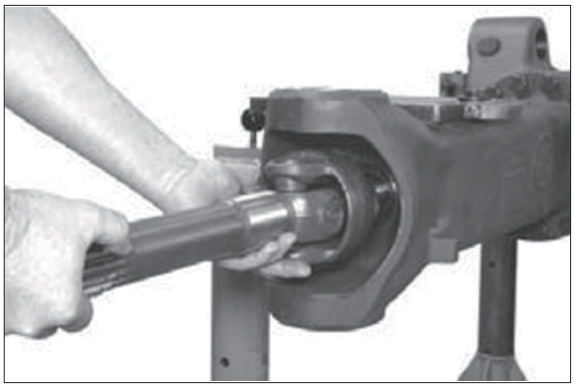
(5) Insert both bearing outer rings into the pivot bearing holes of the axle housing.

(S) Driver tool	5870 058 078
(S) Handle	5870 260 002


17W98FA107

(6) Install the u-joint shaft by inserting the u-joint shaft into the axle bevel gear teeth.

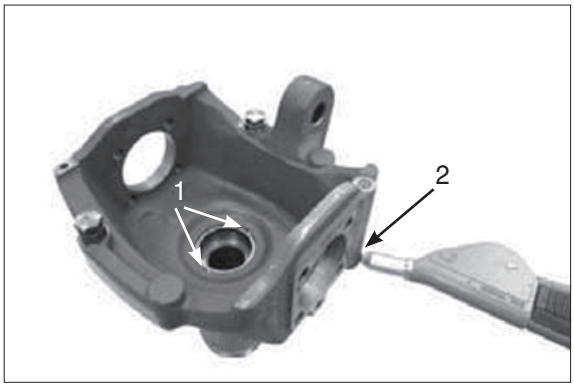
※ Pay attention to shaft seal ring in the axle housing risk of damage.


17W98FA108

(7) Knuckle housing (pivot bearing-SET-RIGHT)
Seal machining openings of oil supply holes – position 1 and 2 with plugs.

(S) Lever riveting tongs	5870 320 016

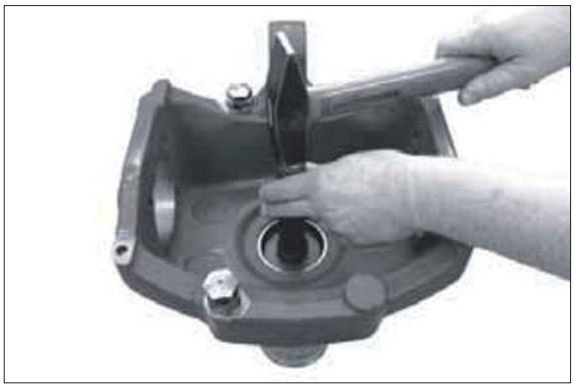
※ Operation is only required when using a new knuckle housing.



17W98FA109

(8) Insert bushing into the hole of the knuckle housing considering the installation dimension "B" and installation position "Y" (see also sketch FA111 and FA113).

(S) Driver tool 5870 055 090
(S) Handle 5870 260 002



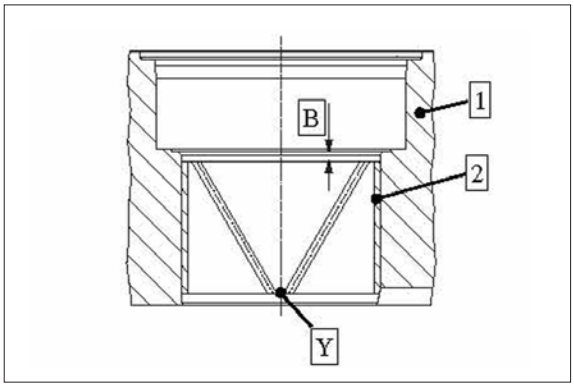
17W98FA110

(9) Comment on sketch:

1 = Knuckle housing
2 = Bushing
B = Installation dimension . . . 2.0±0.2 mm
Y = Installation position / lubrication groove outlet of the bushing

※ Lubrication groove outlet (V-point) must be mounted in 6 o'clock position (bottom) and showing to the oil chamber side (referred to the axle fitted into the vehicle).

※ Use of the specified driver tool (S) ensures the exact installation depth of the bushing.



17W98FA111

(10) Insert shaft seal ring into the hole of the knuckle housing with the seal lip showing to the oil chamber – considering the installation dimension "W" (see also sketch below).

(S) Driver tool 5870 055 090
(S) Handle 5870 260 002

※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.

17W98FA112

(11) Comment on sketch:

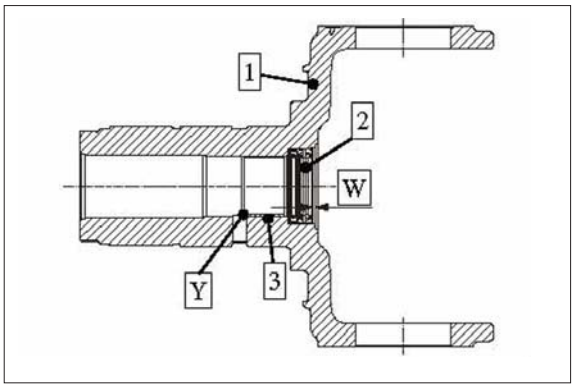
1 = Knuckle housing

2 = Shaft seal ring

3 = Bushing

W = Installation dimension – shaft seal ring ..... 3.5±0.2 mm

Y = Lubrication groove outlet (V-point) must be mounted in 6 o'clock position and showing to the oil chamber side (referred to the axle fitted into the vehicle)



17W98FA113

※ Just before fitting wet contact face shaft seal ring / knuckle housing with sealing agent.

Apply grease on seal and dust lip of the seal ring.

(12) Grease O-ring (see arrow) and insert it into the groove of the bearing pin.

17W98FA114

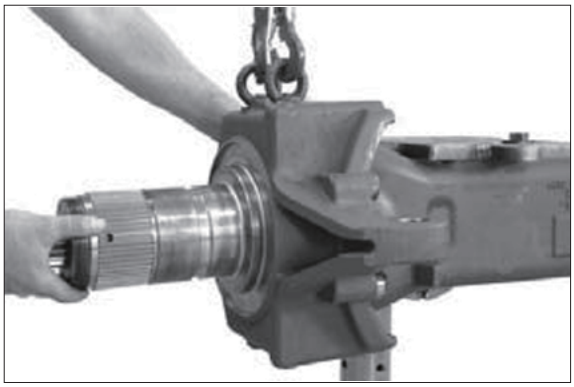
(13) Place sealing cap (see arrow) and mount the tapered roller bearing until contact position is obtained.

17W98FA115

(14) Locate pre-assembled knuckle housing on axle housing and carefully mount u-joint shaft.

(S) Eyebolts (M 20) 0636 804 003

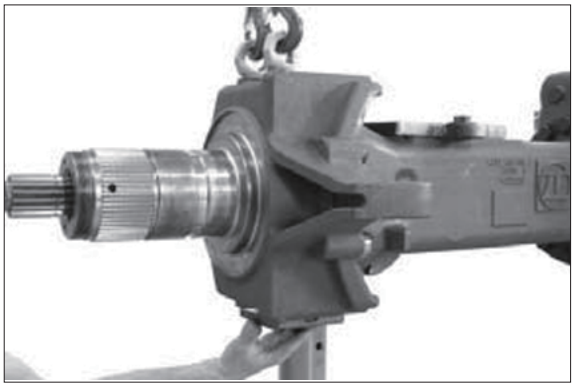
※ Pay attention to shaft seal ring in the knuckle housing risk of danger.



17W98FA116

(15) Insert the pre-assembled lower bearing pin and preliminarily fix with hexagon screws.

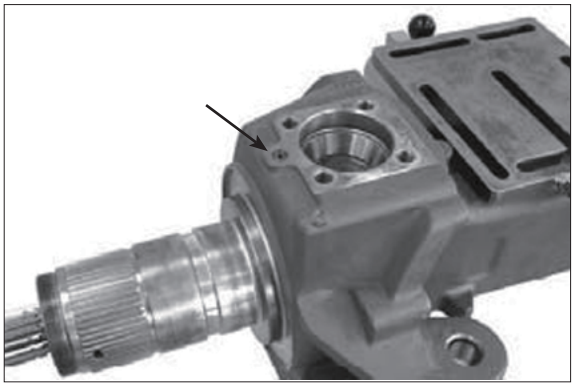
※ Pay attention to installation position mount bearing pin with lubrication nipple showing to axle centre.



17W98FA117

(16) Insert O-ring (see arrow) or O-rings into countersink of the knuckle housing.

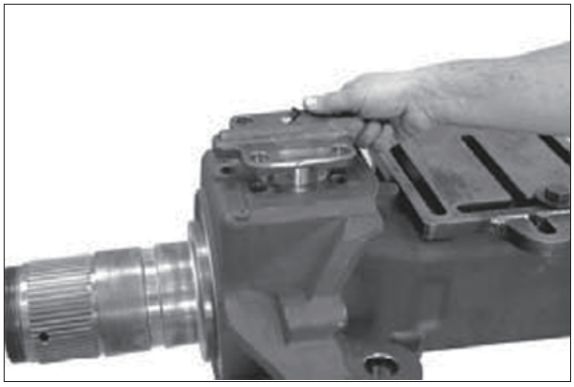
1 ps for version with breather valve in the knuckle housing
2 pcs for version with breather valve in the bearing pin



17W98FA118

(17) Insert pre-assembled upper bearing pin.

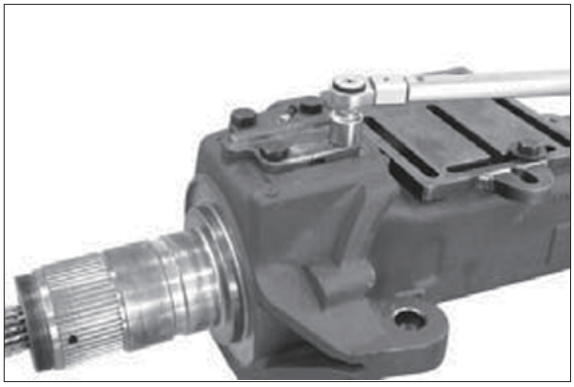
※ Observe installation position mount bearing pin with oil supply holes showing to axle centre.



17W98FA119

(18) Fix both bearing pins definitely.

※ Tightening torque (M 20/10.9) . . . . . MA = 560 Nm



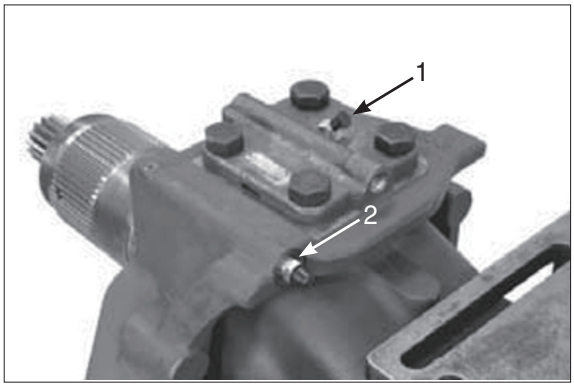
17W98FA120

(19) Mount lubrication nipple in both bearing pins (arrow 1 showing to the axle centre) and apply grease to the pivot bearing.

Tightening torque (M 10 × 1) . . . . . MA = 3 Nm

Mount breather valve (arrow 2, position depending on version : integrated in the knuckle housing or in the bearing lid) and provide with dust cap.

Tightening torque (M 14 × 1,5) . . . . . MA = 20 Nm



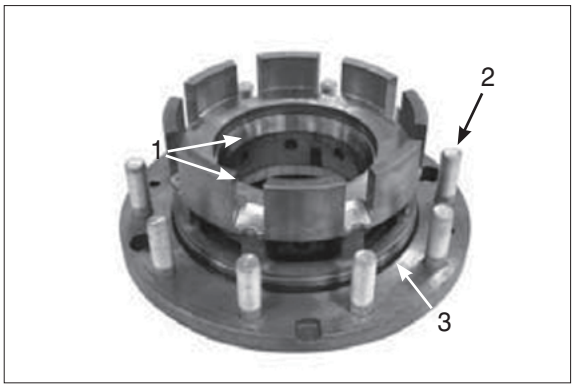
17W98FA121

4) HUB (Hub bearing-SET-RIGHT)

(1) Insert both bearing outer rings (1) of the hub bearing until contact position is obtained.

Press wheel bolts (2) into the hub until contact position is obtained.

Oil O-ring (3) and locate in annular groove of hub.



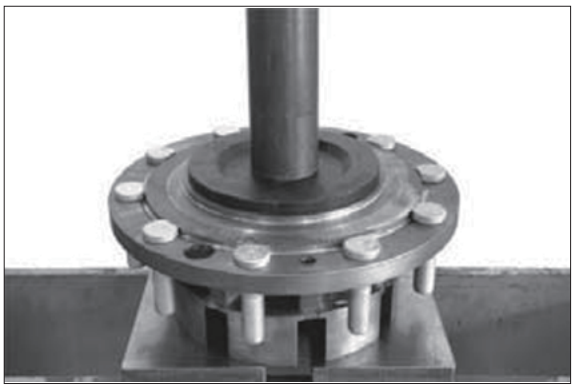
17W98FA122

(2) Press shaft seal ring with the marking "OUT SIDE" showing outside (upwards) into the hub.

(S) Driver tool 5870 051 068

※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.

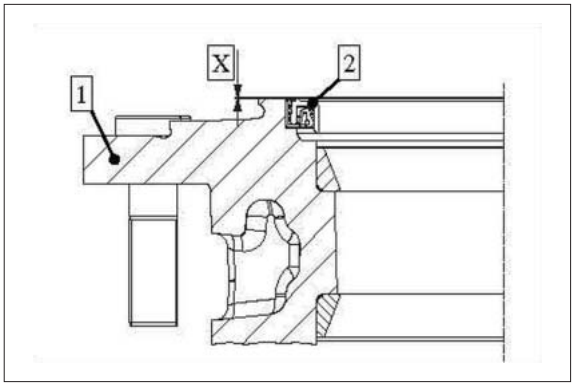
※ Wet the outer diameter of the shaft seal ring with Loctite no. 574.



17W98FA123

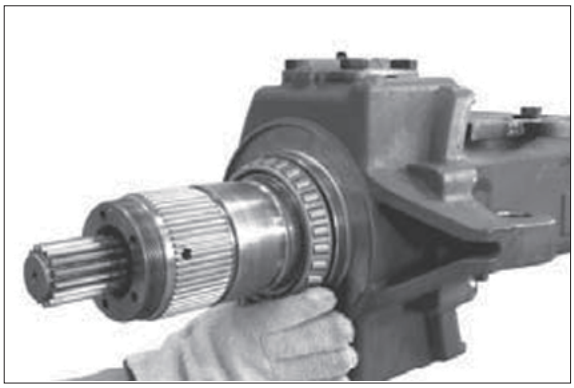
(3) Comment on sketch:

1 = Hub
2 = Shaft seal ring
X = Installation dimension – Shaft seal ring
..... 2.5 + 0.5 mm



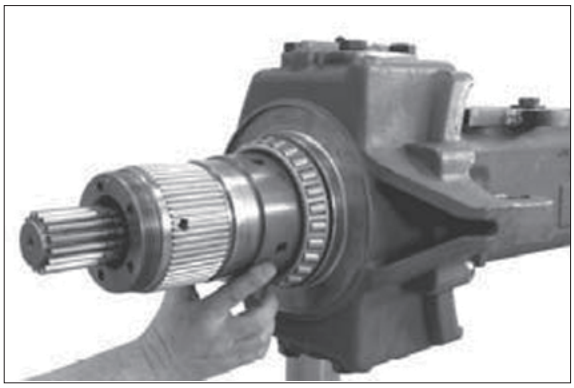
17W98FA124

(4) Heat the tapered roller bearing and mount until contact position with the knuckle housing is obtained.



17W98FA125

(5) Insert spacer bushing.



17W98FA126

(6) Install preassembled hub until contact is obtained and fix with heated tapered roller bearing.

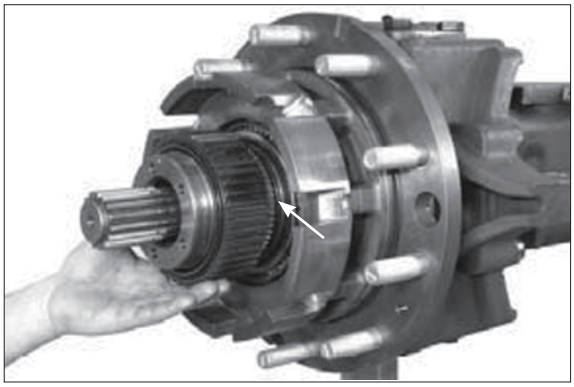
(S) Lifting bracket 5870 281 043

※ Just before fitting wet the seal lips of the shaft seal ring with lubricant.

17W98FA127

(7) Oil O-ring and insert it into the annular groove (see arrow) of the knuckle housing.

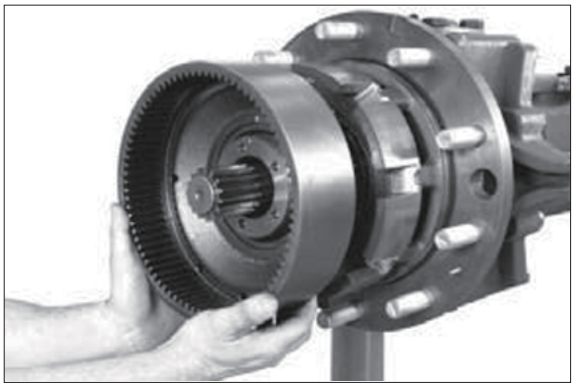
Then install disk carrier.



17W98FA128

(8) Bring disk carrier and hub bearing into contact position (figure FA129 and FA130)

Install ring gear (without sealing elements).



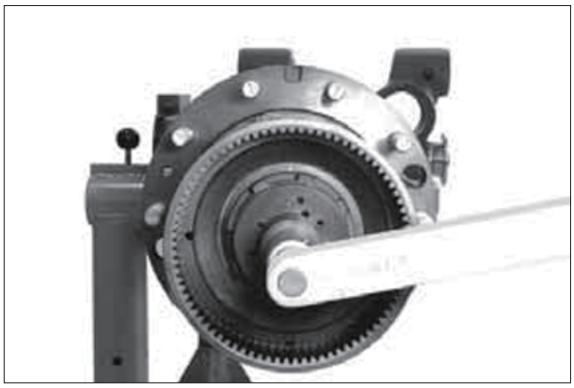
17W98FA129

(9) Bring hub bearing into contact position for this purpose tighten slotted nut with a tightening torque of max. 1400 Nm.

(S) Socket wrench 5870 656 097

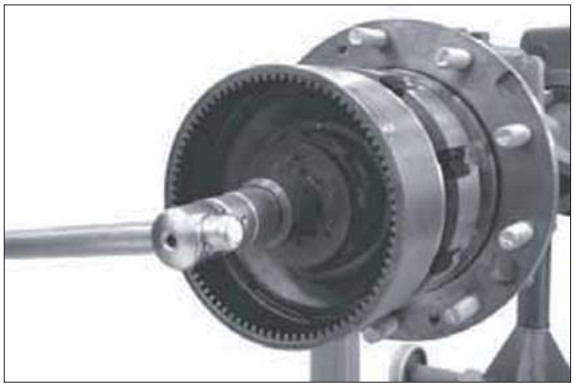
※ While tightening the slotted nut rotate hub in both directions several times roller setting.

※ Apply lubricant to thread knuckle housing / slotted nut.



17W98FA130

(10) Loosen slotted nut again and remove ring gear.



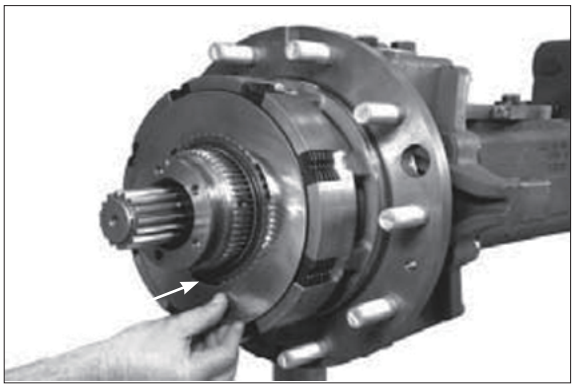
17W98FA131

5) DISK BRAKE

(1) Install disk package alternately starting with an outer disk.

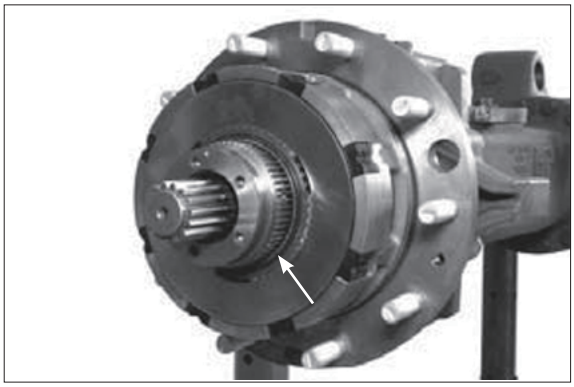
※ Take the actually required disk fitting / arrangement from the corresponding spare parts list.

※ Bring inner clutch disks in a position where one of the tooth recesses (see arrow) is in 6 o'clock position with axle being installed in the vehicle.



17W98FA132

(2) Oil O-ring and locate in annular groove of disk carrier.



17W98FA133

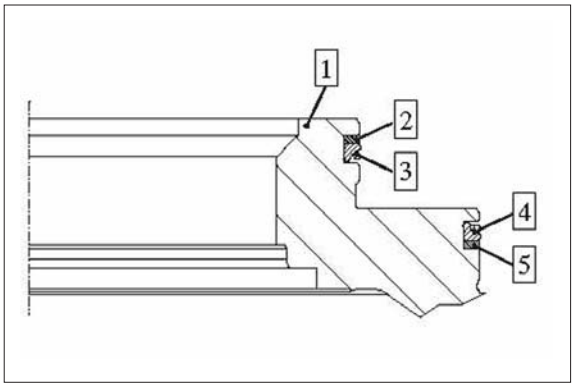
(3) Oil U- and support rings and insert them into the annular grooves of the ring gear.

※ Observe installation position, see sketch below.

17W98FA134

(4) Comment on sketch:

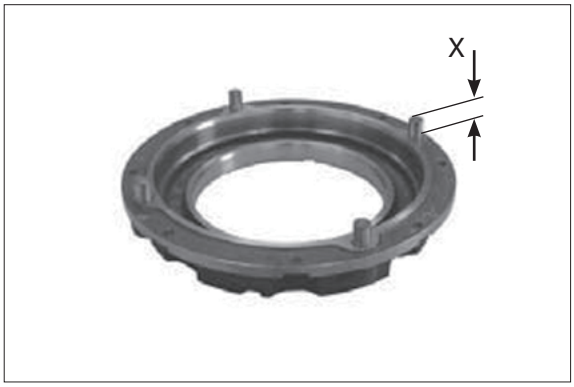
1 = Ring gear
2 = Support ring
3 = U-ring
4 = U-ring
5 = Support ring



17W98FA135

(5) Mount cylindrical pins into piston, considering installation dimension "X".

X = Installation dimension . . . . . 16.00 mm



17W98FA136

(6) Install piston on ring gear.

17W98FA137

(7) Fix piston with "new" hexagon screws (1), spring sleeves (2) and compression springs (3 and 4).

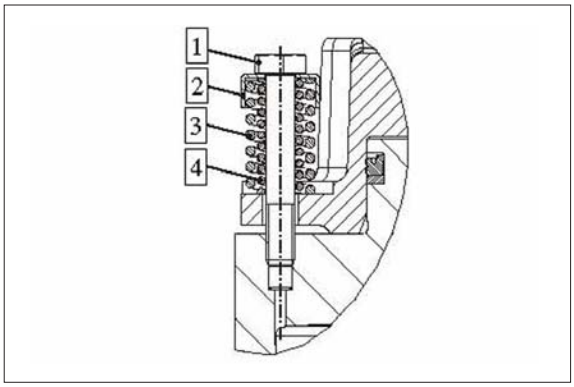
Tightening torque (M 6/8.8) . . . . . MA = 8 Nm

※ Use hexagon screws just once.

17W98FA138

(8) Comment on sketch:

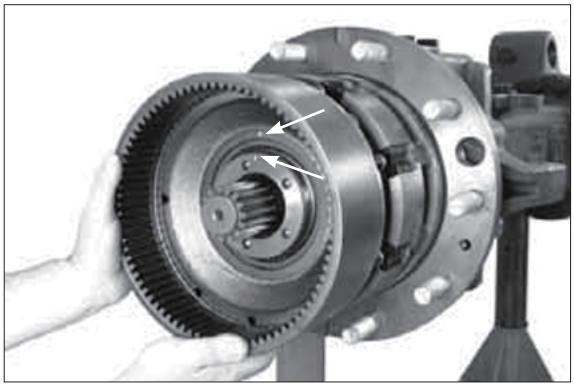
1 = Hexagon screw (special version)
2 = Spring sleeve
3 = Compression spring
4 = Compression spring



17W98FA139

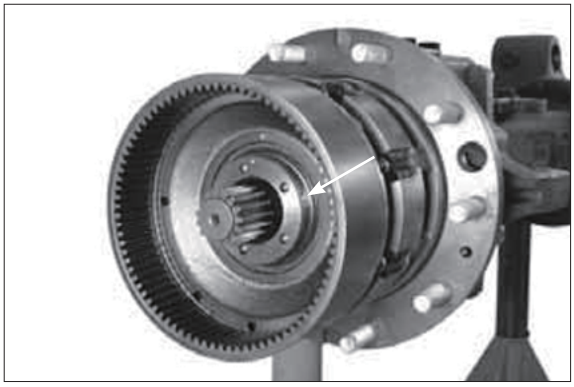
(9) Mount preassembled ring gear considering the installation position (markings O in 12 o'clock position - see arrows).

※ Ensure exact toothing position of oil supply holes knuckle housing / ring gear (pressure oil supply to brake piston).



17W98FA140

(10) Oil O-ring and insert in recess (see arrow).



17W98FA141

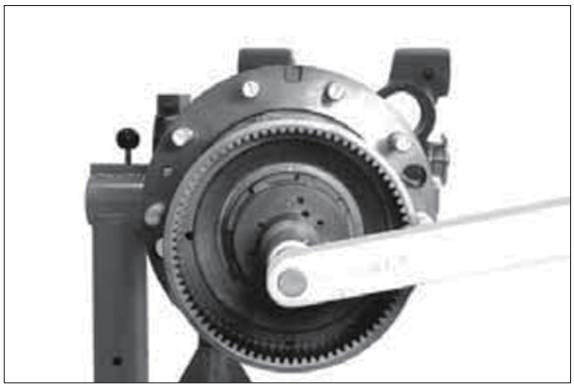
(11) Fix ring gear with slotted nut.

Tightening torque:
(M 110 x 1.5) ..... MA = 1400 $^{+600}$ Nm

(S) Socket wrench 5870 656 097

※ First tighten slotted nut with 1400 Nm, then retighten slotted nut until a fixing hole overlaps a threaded hole in the knuckle housing.
While tightening the slotted nut rotate hub in both directions several times roller setting.

※ Wet thread knuckle housing / slotted nut with lubricant.



17W98FA142

(12) Make leakage test of multi-disk brake

Mount threaded coupling (S) and connect HP pump.

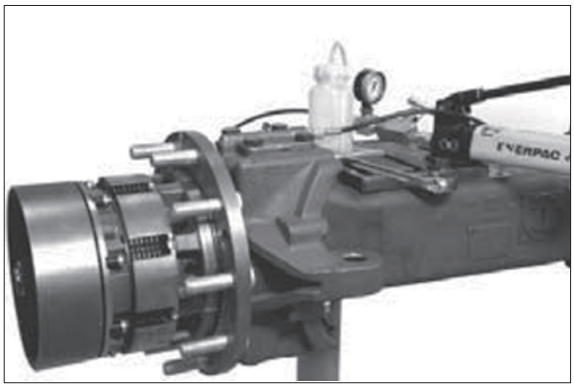
(S) HP pump 5870 287 007
(S) Threaded coupling (M14x1.5) 5870 950 102
(S) Breather bottle 5870 286 072

※ Breathe brake completely before starting the test.

Test media :
Motor oils SAE-10W

High-pressure test:
Build up test pressure p = 100 bar and close locking valve of HP pump.
A pressure drop by max. 3 bar is permissible during a 5-minute test duration.

Low pressure test:
Reduce test pressure p = 5 bar and close locking valve.
No pressure drop is allowed during a 5-minute testing duration.



17W98FA143

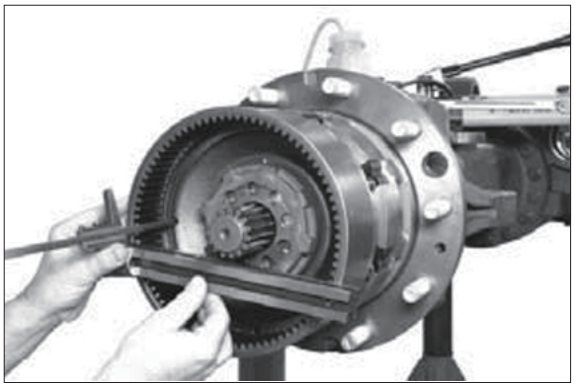
(13) **Adjust and check piston stroke**

Piston stroke / disk clearance = 0.7 ..... 1.3 mm
Build up braking pressure (100 bar) and close locking valve of the HP pump.

Determine dimension "A", from face of the ring gear (1) through measuring hole (see also sketch FA145) to the face of the piston (3).

Dimension "A" e.g. . . . . 83.10 mm

※ Breathe brake completely before starting the measuring operation.

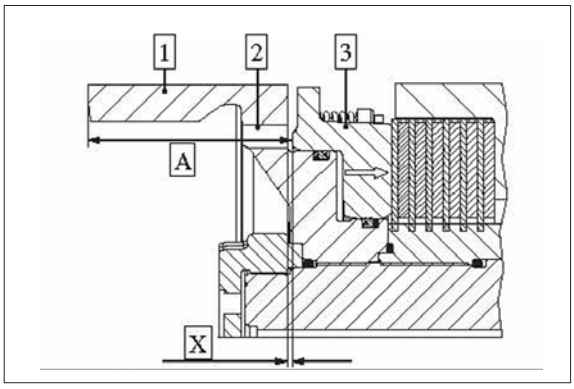


17W98FA144

(14) Then open locking valve of the HP pump and release pressure from brake (reset piston through compression springs).

Determine dimension "B", from the face of the ring gear (1) through the measuring hole (see also sketch FA146) to the face of the piston (3).

Dimension "B" e.g. . . . . 82.10 mm



17W98FA145

(15) CALCULATION EXAMPLE:

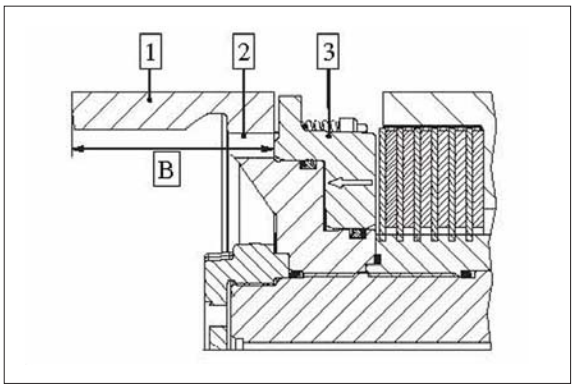
Dimension "A" e.g. . . . . 83.10 mm
Dimension "B" e.g. . . .. - 82.10 mm
Difference = Piston stroke = 1.00 mm

※ If the required piston stroke (0.7 ... 1.3 mm) is not achieved, correct it with the corresponding inner clutch disk (s) – refer to corresponding spare parts list.

Then remove HP pump (S), breather bottle (S) and threaded coupling (S).

Comment on sketch 43 and 44:
1 = Ring gear
2 = Measuring hole
3 = Piston
X = Piston stroke / disk clearance

(S) Straightedge 5870 200 022



17W98FA146

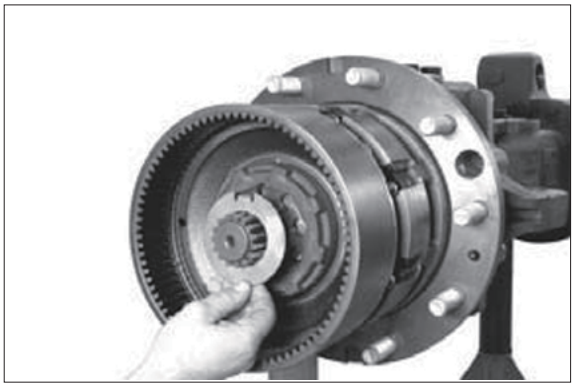
(16) Secure slotted nut with cylindrical screw (please also refer to figure FA142)

Tightening torque (M 10/8.8) . . . . . MA = 32 Nm

17W98FA147

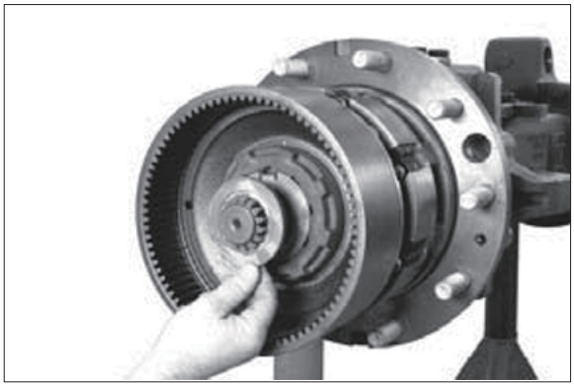
(17) Insert thrust washer.

※ Observe installation position ensure that both lugs of the thrust washer are engaged each in a spare fixing hole of the slotted nut.



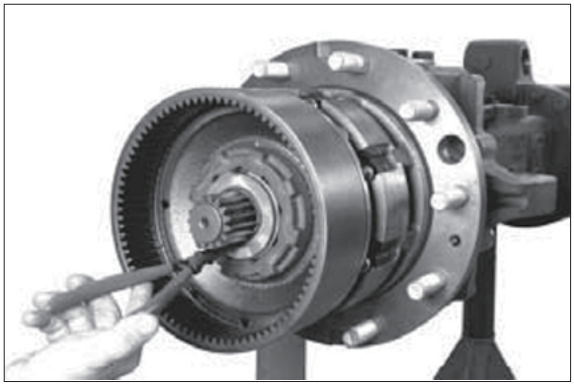
17W98FA148

(18) Mount thrust washer with shoulder showing to the retaining ring (outwards).



17W98FA149

(19) Fix thrust washers by using a retaining ring.



17W98FA150

6) PLANETARY CARRIER

(1) Press thrust washer into the planetary carrier until contact position is obtained.

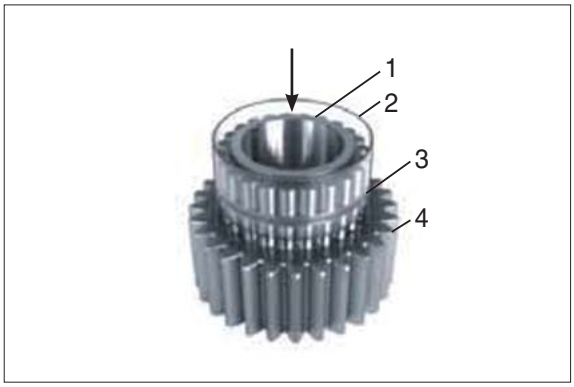
(S) Driver tool 5870 048 263

17W98FA151

(2) Insert the cylindrical roller bearing into the planetary gear for this purpose press the cylindrical roller bearing through the packaging sleeve until the snap ring engages into the annular groove of the planetary gear.

※ Use packaging sleeve to facilitate assembly.

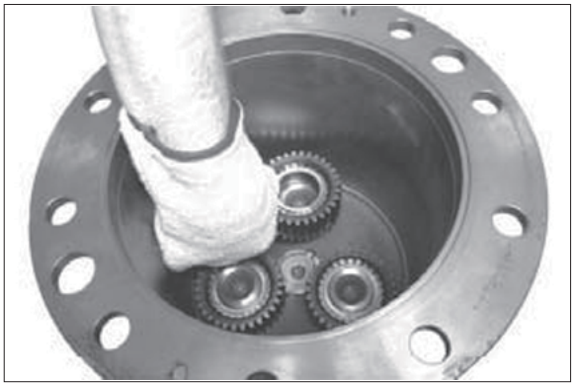
1 = Cylindrical roller bearing
2 = Packaging sleeve
3 = Snap ring
4 = Planetary gear



17W98FA152

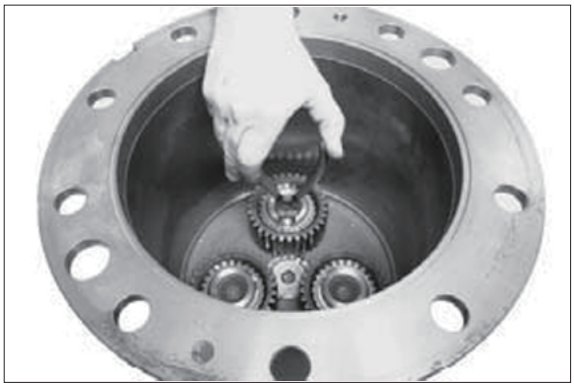
(3) Warm up bearing inner ring and install pre-assembled planetary gear until contact is obtained.

※ Mount bearing inner ring with large radius, showing to the planetary carrier (downwards).



17W98FA153

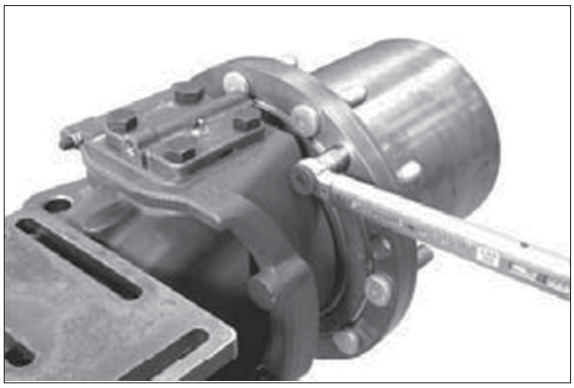
(4) Fix planetary gear by means of retaining ring.



17W98FA154

(5) Install preassembled planetary carrier and fix with hexagon screws.

Tightening torque (M12/8.8) . . . . . MA = 55 Nm



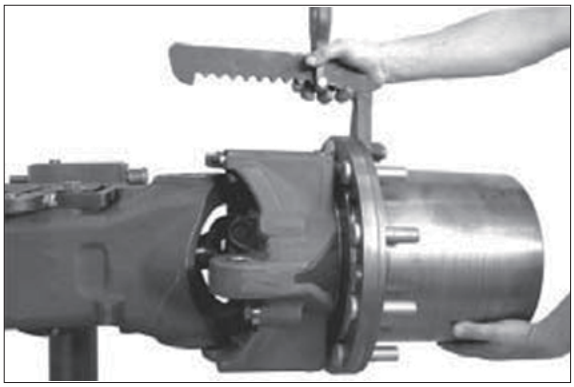
17W98FA155

(6) Output assy

Locate output assy on the axle by means of the lifting bracket (S) by installing the u-joint shaft in the axle bevel gear toothing.

(S) Lifting bracket 5870 281 043

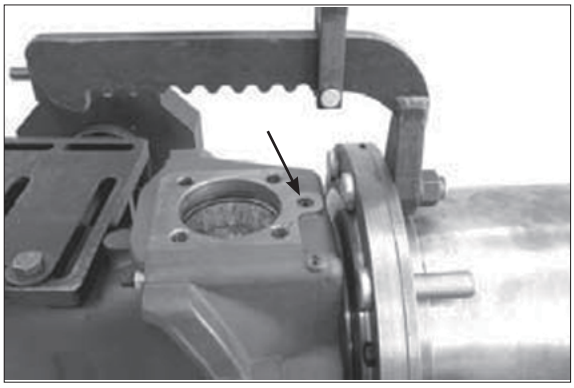
※ Pay attention to shaft seal ring in the axle housing risk of damage.



17W98FA156

(7) Insert O-ring (see arrow) or O-rings into the countersink (s) of the knuckle housing.

1 pc for version with breather valve in knuckle housing.
2 pcs. for version with breather valve in bearing pin.

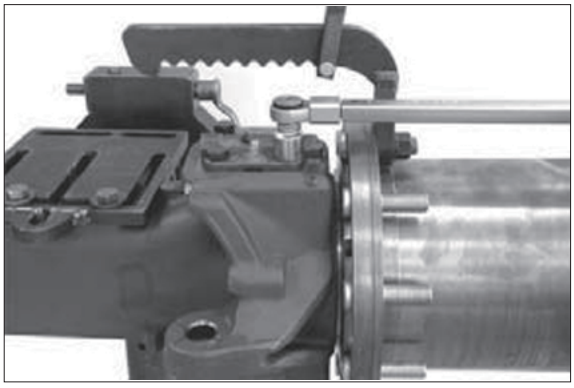


17W98FA157

(8) Mount both bearing pins and fix with hexagon screws or locking screws.

Tightening torque (M 20/10.9) . . . . . MA = 560 Nm

※ Observe installation position, mount upper bearing pin with oil supply holes showing to axle centre.



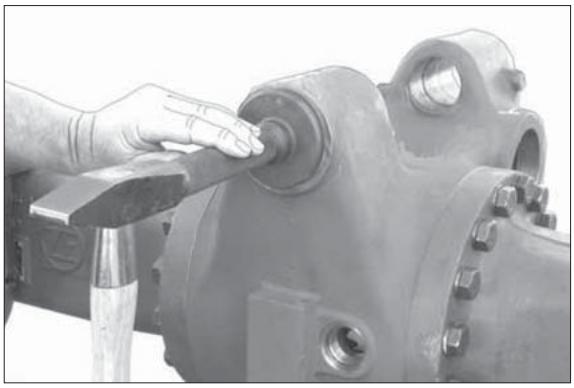
17W98FA158

(9) Pivot bearing

Super-cool bushings and insert into the heated pivot bearing hole until contact is obtained.

※ Observe installation position for bushing version with slot, insert bushings with slot in 12 o'clock position.

※ Prior to putting the axle into operation, fill in oil.

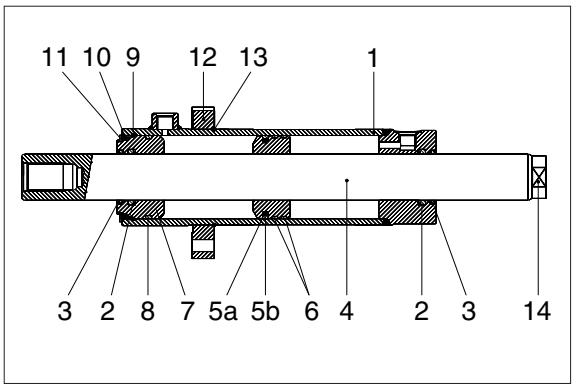


17W98FA159

7) STEERING

(1) Comment on sketch:

1 = Steering cylinder
2 = Grooved ring
3 = Scraper
4 = Piston rod
5a = O-ring
5b = Form seal ring 〉Piston sealing
6 = Guide ring
7 = Brake head
8 = Dual ring
9 = Retaining ring
10 = O-Ring (only for version "with" O-ring)
11 = Retaining ring
12 = Flange
13 = Retaining ring
14 = Wrench point of attack (piston rod)



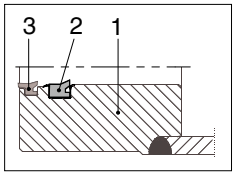
17W98FA160

(2) Preassemble steering

Mount U-ring (2) and scraper (3) in the steering cylinder (1).

※ Observe installation position – see detailed sketch.

Detailed sketch:

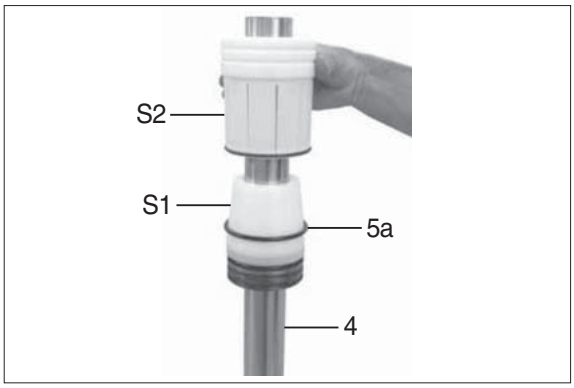


17W98FA161

(3) Position inner installer (S1) on piston rod (4).

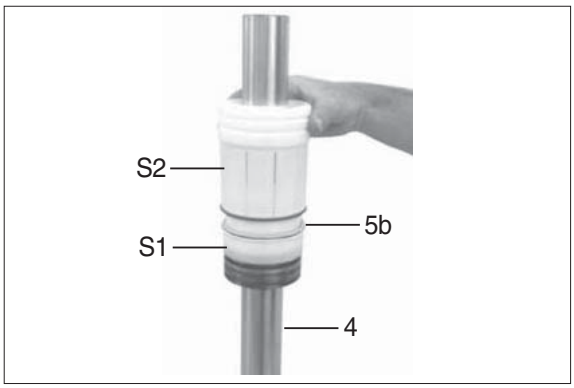
Mount O-ring (5a) and press with inner installer (S2) into annular groove (arrow) of the piston (4).

(S) Inner installer (S1) 5870 651 088
(S) Inner installer (S2) 5870 651 089



17W98FA162

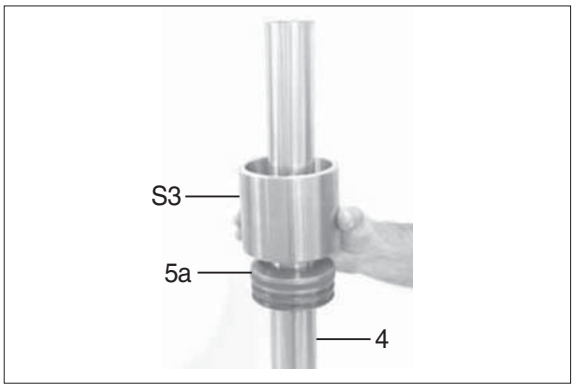
(4) Install form seal ring (5b) and press with inner installer (S2) into the annular groove of the piston (4).



17W98FA163

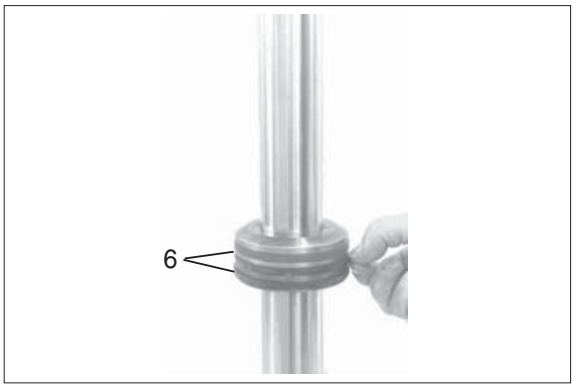
(5) Calibrate form seal ring (5b) with calibration bushing (S3).

(S) Calibration bushing (S3) 5870 651 091



17W98FA164

(6) Place both guide rings (6) into the annular grooves of the piston rod.

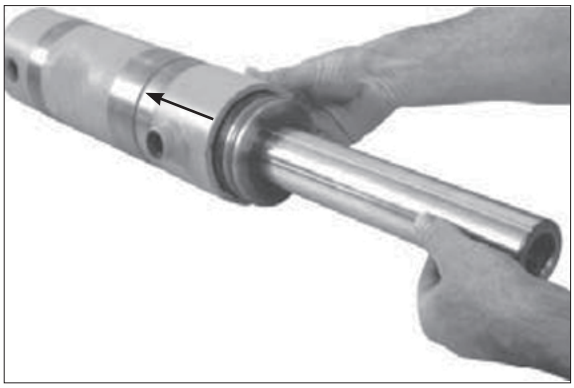


17W98FA165

(7) Insert preassembled piston rod into the steering cylinder.

※ Slightly oil all sealing elements before installing the piston rod.

※ Observe installation position, insert piston rod with wrench point of attack (14, see also sketch FA160) showing in direction of arrow.

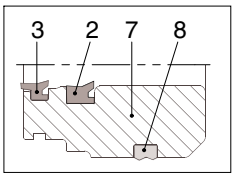


17W98FA166

(8) Insert U-ring (2), scraper (3) and dual ring (8) into the grooves of the brake head (7).

※ Observe installation position in this connection refer to detailed sketch.

Detailed sketch:



17W98FA167

(9) Push preassembled brake head into the steering cylinder so that the retaining ring (see figure FA169) can be mounted.

※ Slightly oil all sealing elements before inserting the brake head.

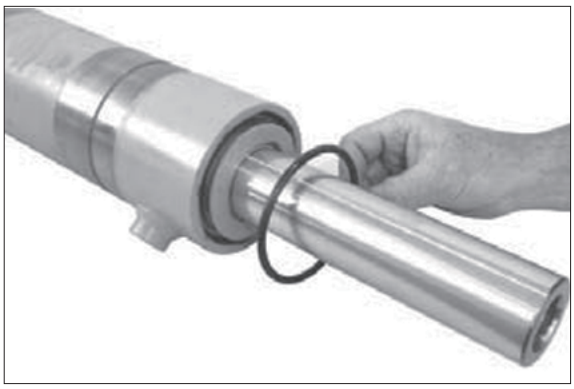
17W98FA168

(10) Engage retaining ring (9) into the groove of the cylinder tube.

17W98FA169

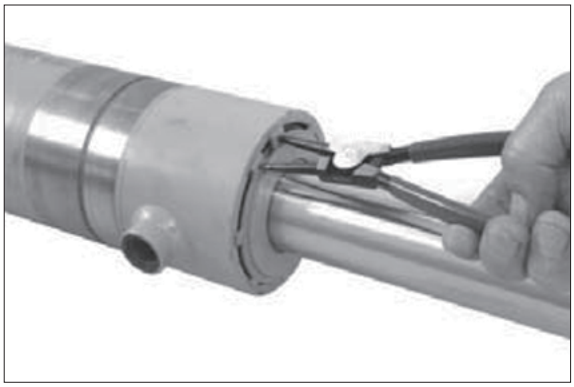
(11) Position the inserted brake head (7) on the snap ring (9) until contact is obtained (arrow).

Only for version with O-ring (see corresponding spare parts list) : Oil O-ring (10) and place into the recess.



17W98FA170

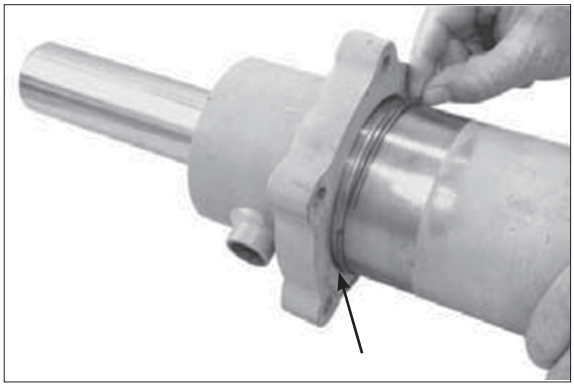
(12) Fix brake head (7) with retaining ring (11).



17W98FA171

(13) Install flange (12) and engage retaining ring (13).

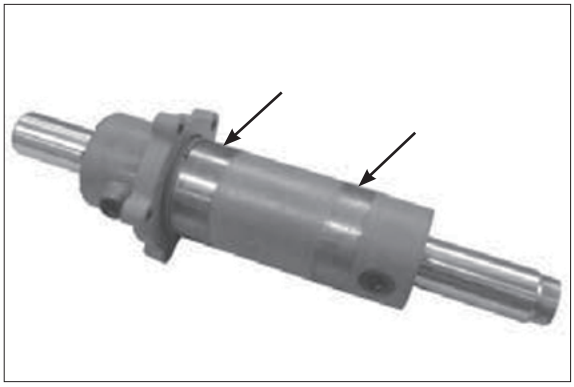
※ Observe installation position of flange mount flange with chamfer (see arrow) showing to the snap ring.



17W98FA172

(14) Mount steering

Apply anti-corrosive agent (Weicon Anti-Seize) on contact faces (cylinder tube / axle housing, see arrow).



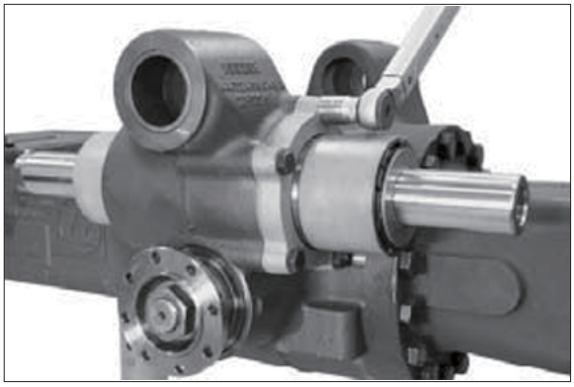
17W98FA173

(15) Insert preassembled steering cylinder into axle housing and fix with hexagon screws.

Tightening torque (M 12/8.8) . . . . . MA = 79 Nm

※ The radial installation position of the steering cylinder (position of the hydr. connections) is customer specific see also disassembly instructions figure FA018.

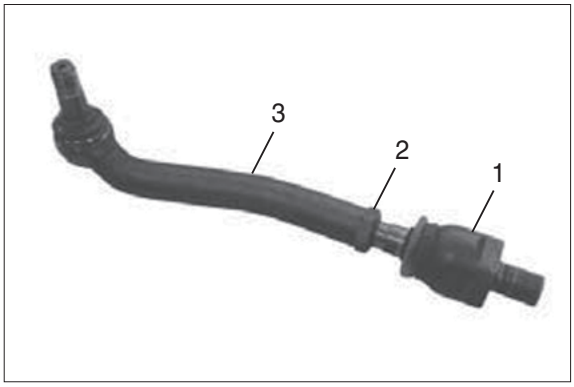
※ Wet the thread of the hexagon screws with Loctite no. 243.



17W98FA174

(16) Bolt hexagon nut (2) and ball joint (3) to axial joint (1).

※ Do not tighten hexagon nut before setting the track.



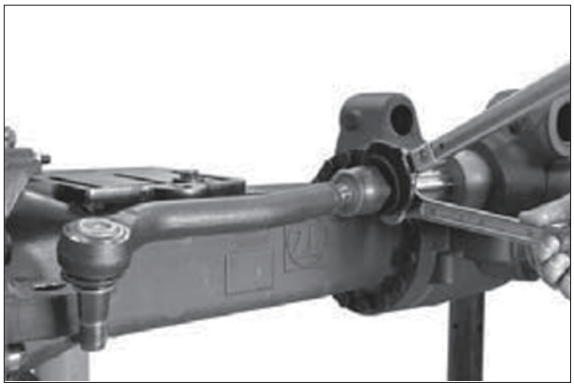
17W98FA175

(17) Fix both tie rods to piston rod (with offset showing to the axle housing).

Tightening torque (M30 × 1.5) . . . . . MA = 600 Nm

(S) Socket wrench (SW 55) 5870 656 099

※ Wet thread of the axial joint with Loctite no. 243.

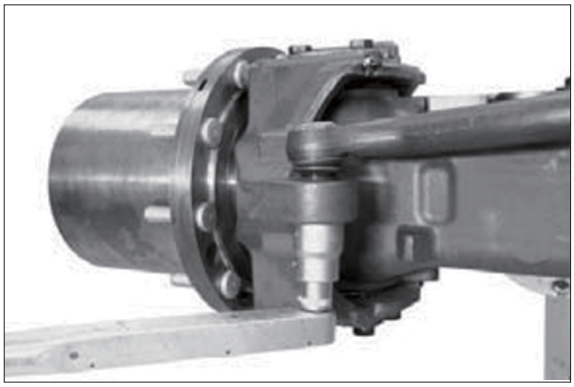


17W98FA176

(18) Install tie rod into knuckle housing and fix with "new" locking nut.

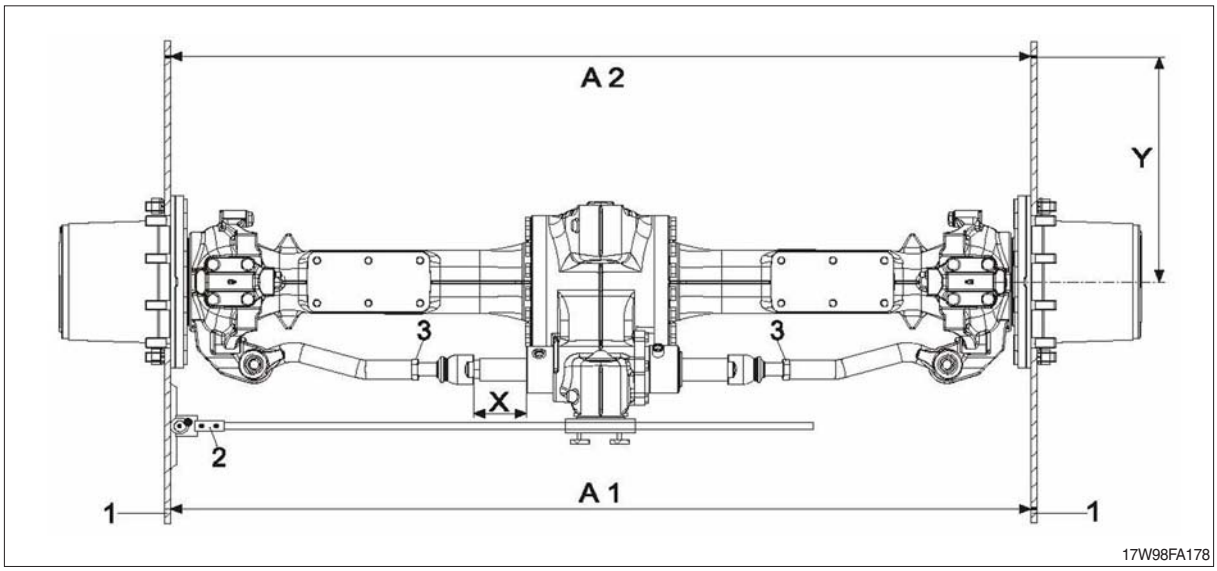
Tightening torque (M 30 × 1.5) . . . . . MA = 800 Nm

※ Use locking screws just once.



17W98FA177

(19) Steering setting and checking



1 = (S) Straightedge 5870 200 029
2 = (S) Measuring device 5870 200 033
3 = Hexagon nut
X = Installation dimension (central position – piston rod)
Y = Distance – wheel center to rim flange

(20) Basic track setting

Bring piston rod in central position.
Dimension X = 124 mm (measured from front face/steering cylinder to front face/axial joint).

※ Do not change axial position of piston rod any more during track setting.

Mount straightedge (1) in horizontal and central axis position.
Fix measuring device (2) to yoke.
Loosen hexagon nut (3) and set length of tie rod (axial joint) until the measuring device (2) indicates 0˚ (corresponds to a track setting of zero mm).

※ For a toe-in and toe-out setting, which might be required, stick to the vehicle manufacturer's specification.

※ Make setting on both output sides.

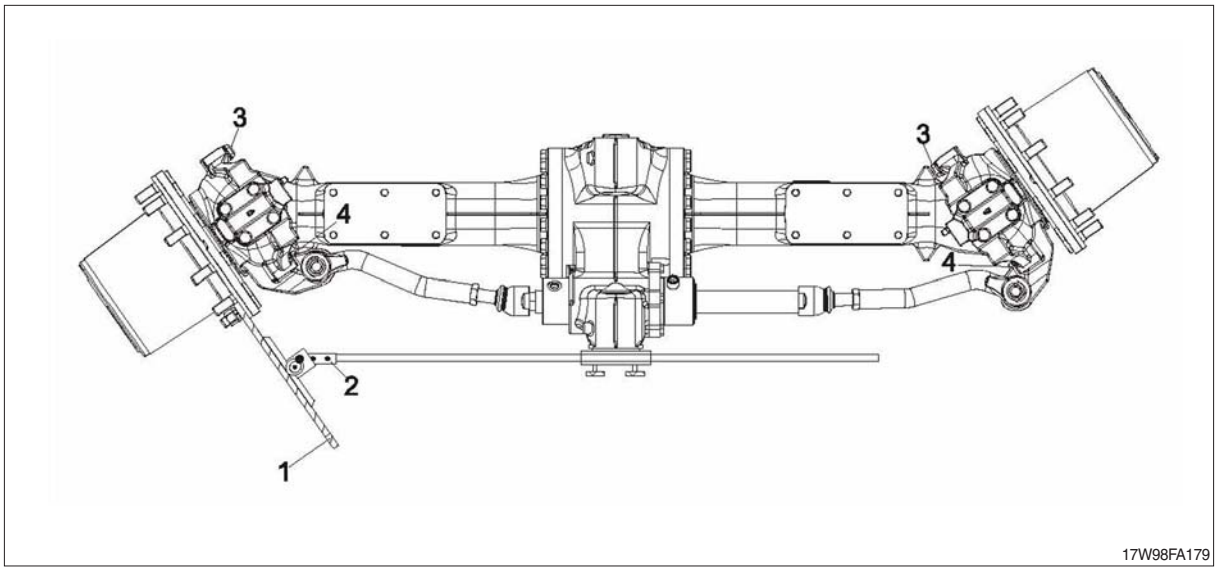
Check track setting (0˚):
Determine dimension A1.
Rotate both outputs by 180˚ – dimension A2 must equal dimension A1.
Dimension "Y" = distance between rim center and rim flange.

Then fix both tie rods (axial joint) by means of hexagon nut (3).

Tightening torque . . . . . MA = 400 - 450 Nm

(21) Steering angle setting

※ When track setting is required, steering angle setting may only be carried out after track setting has been completed.



1 = (S) Straightedge 5870 200 029
2 = (S) Measuring device 5870 200 033
3 = Stop screw with stop washer (optional)
4 = Stop screw with hexagon nut

Mount straightedge (1) in horizontal and central axis position.
Fix measuring device (2) to yoke.
Pivot output until the required steering angle (e.g. 35˚) is indicated on the measuring device (2).

※ Take the value of the steering angle to be set from the vehicle manufacturer's specifications.

Bring the stop screw (4) on the axle housing in contact position and lock with hexagon nut.
Tightening torque (M18/10.9) . . . . . MA = 300 Nm

Then set inner stop by means of stop screw (3) and stop washer (s = optional).
Tightening torque (M18/10) . . . . . MA = 390 Nm

※ Make setting on both output sides.

(22) Check leakage of steering

Make leakage test of steering in both steering directions by means of HP pump.

Test pressure: 200 bar
Test medium: Engine oils SAE 10W

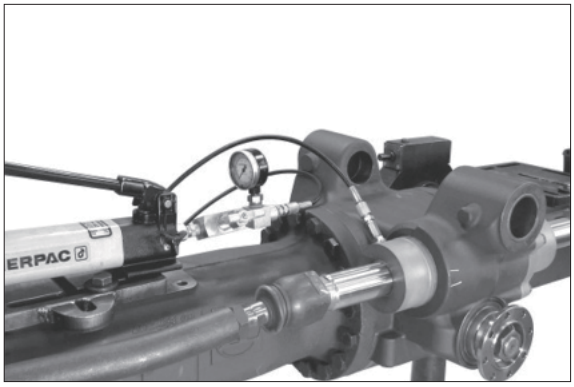
Test pressure p = Build up 200 bar (bleed pressure chamber).

Then close connection to HP pump by means of locking valve.

A 5 bar pressure drop is permissible during a test duration of 20 sec.

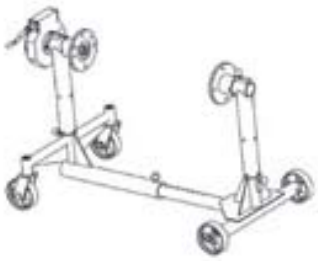
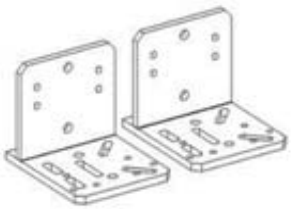
(S) HP pump	5870 287 007
(S) Reduction	5870 950 161
(S) Clutch	0501 207 939

※ Prior to putting the axle into operation fill it with oil.

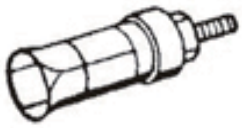
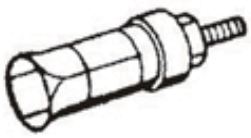


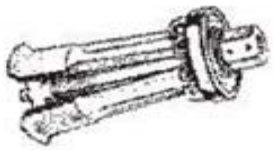
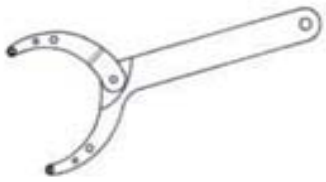
17W98FA180

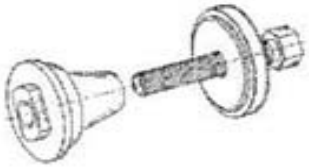
5. SPECIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

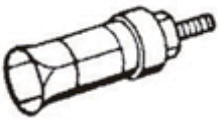
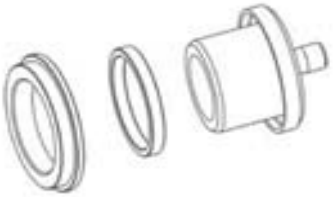
No.	Figure	Designation order no.	Qty	Page
1	 180W9A8FA501	Assembly truck assy with tilting device 5870 350 000	1	8-243 8-314
2	 180W9A8FA502	Supporting bracket 5870 350 106	1	8-243 8-314
3	 180W9A8FA503	Socket wrench 5870 656 097	1	8-247 8-315
4	 180W9A8FA504	Assembly lever 5870 345 036	1	8-248 8-316
5	 180W9A8FA505	Adjusting device 5870 400 001	2	8-249 8-317

No.	Figure	Designation order no.	Qty	Page
6	 180W9A8FA506	Lifting bracket 5870 281 043	1	8-249, 252, 277, 285 8-317, 319, 343, 351
7	 180W9A8FA507	Pressure piece 5870 100 067 (FR axle) 5870 100 063 (RR axle)	1 1	8-249, 250 8-317, 318
8	FR axle  180W9A8FA508-1 RR axle  180W9A8FA508-2	Grab sleeve 5873 003 022 (Not used) 5873 013 015 (Not used)	1	-
9	 180W9A8FA509	Grab sleeve 5873 004 026	1	8-318
10	 180W9A8FA510	Grab sleeve 5873 004 022	1	8-250

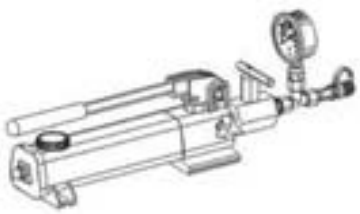
No.	Figure	Designation order no.	Qty	Page
11	 180W9A8FA511	Eyebolts (FR axle) 0636 804 001 (M16) (Not used)	2	-
12	 180W9A8FA512	Eyebolts (FR axle) 5870 204 085 (M18) (Not used)	2	-
13	 180W9A8FA513	Eyebolts (FR axle) 0636 804 003 (M20)	2	8-250, 274
14	 180W9A8FA514	Inner installer (FR axle) 5870 300 007 (Ø 46 ~ 56 mm) (Not used)	1	-
15	 180W9A8FA515	Inner installer (FR axle) 5870 300 017 (Ø 56 ~ 70 mm)	1	8-251, 252

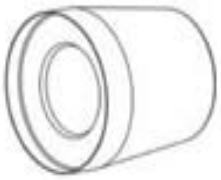
No.	Figure	Designation order no.	Qty	Page
16	 180W9A8FA516	Counter support 5870 300 020	1	8-251, 252, 255 8-323
17	 180W9A8FA517	Inner installer 5870 300 019 (Ø 56 - 110 mm)	1	8-252, 255 8-323
18	 180W9A8FA518	Striker 5870 650 004	1	8-253 8-320, 321, 322
19	 180W9A8FA519	Clamping fork 5870 240 025	1	8-254, 265, 269 8-322, 337, 341
20	 180W9A8FA520	Grab sleeve 5873 001 037	1	8-255 8-323

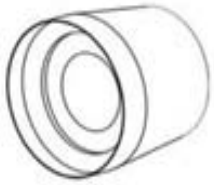
No.	Figure	Designation order no.	Qty	Page
21	 180W9A8FA521	Grab sleeve 5873 011 019	1	8-256 8-324
22	 180W9A8FA522	Basic tool 5873 001 000	1	8-256 8-324
23	 180W9A8FA523	Pressure piece 5870 100 009	1	8-256 8-324
24	 180W9A8FA524	Adjusting screws 5870 204 027 (M12×1.5)	1	8-261 8-329
25	 180W9A8FA525	Assembly fixture 5870 345 049	1	8-263 8-336

No.	Figure	Designation order no.	Qty	Page
26	 180W9A8FA526	Pressure ring 5870 345 056	1	8-263 8-336
27	 180W9A8FA527	Internal extractor 5870 300 005 (Ø 36 ~ 46 mm)	1	8-267 8-332
28	 180W9A8FA528	Driver tool (FR axle) 5870 048 286	1	8-269
29	 180W9A8FA529	Driver tool (FR axle) 5870 055 081 (Not used)	1	-
30	 180W9A8FA530	Driver tool (FR axle) 5870 055 090	1	8-270, 272

No.	Figure	Designation order no.	Qty	Page
31	 180W9A8FA531	Handle (FR axle) 5870 260 002	1	8-270, 271, 272
32	 180W9A8FA532	Driver tool 5870 058 058 (Not used)	1	-
33	 180W9A8FA533	Driver tool 5870 058 022 (Not used)	1	-
34	 180W9A8FA534	Driver tool (FR axle) 5870 058 078	1	8-271
35	 180W9A8FA535	Lever riveting tongs (RR axle) 5870 320 016	1	8-271 8-342

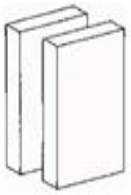
No.	Figure	Designation order no.	Qty	Page
36	 180W9A8FA536	Driver tool 5870 051 035 (Not used)	1	-
37	 180W9A8FA537	Driver tool 5870 051 068	1	8-276 8-343
38	 180W9A8FA538	HP pump 5870 287 007	1	8-281, 293 8-348
39	 180W9A8FA539	Threaded coupling 5870 950 102 (M14×1.5)	1	8-281 8-348
40	 180W9A8FA540	Breather bottle 5870 286 072	1	8-281 8-348

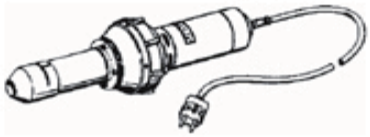
No.	Figure	Designation order no.	Qty	Page
41	 180W9A8FA541	Straightedge 5870 200 022	1	8-282 8-349
42	 180W9A8FA542	Driver tool 5870 048 245 (Not used)	1	-
43	 180W9A8FA543	Driver tool 5870 048 263	1	8-284 8-350
44	 180W9A8FA544	Inner installer (FR axle) 5870 651 086 (Not used)	1	-
45	 180W9A8FA545	Inner installer (FR axle) 5870 651 087 (Not used)	1	-

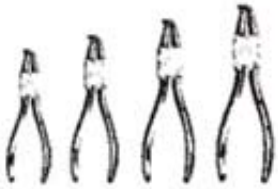
No.	Figure	Designation order no.	Qty	Page
46	 180W9A8FA546	Inner installer (FR axle) 5870 651 088	1	8-287
47	 180W9A8FA547	Inner installer 5870 651 089	1	8-287
48	 180W9A8FA548	Calibration bushing 5870 651 090 (Not used)	1	8-264
49	 180W9A8FA549	Calibration bushing 5870 651 091	1	8-287
50	 180W9A8FA550	Socket wrench (FR axle) 5870 656 097	1	8-247, 278, 281 8-315, 344, 348

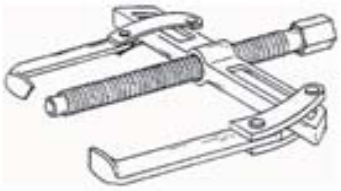
No.	Figure	Designation order no.	Qty	Page
51	 180W9A8FA551	Socket wrench (FR axle) 5870 656 099 (SW 75)	1	8-290
52	 180W9A8FA552	Straightedges (FR axle) 5870 200 029	1	8-291, 292
53	 180W9A8FA553	Measuring device (FR axle) 5870 200 033	1	8-291, 292
54	 180W9A8FA554	Reduction (FR axle) 5870 950 161	1	8-293
55	 180W9A8FA555	Clutch (FR axle) 0501 207 939	1	8-293

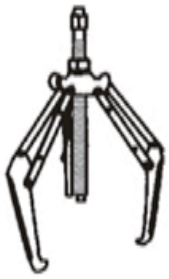
6. COMMERCIAL TOOLS FOR DISASSEMBLY AND REASSEMBLY

No.	Figure	Designation order no.	Qty	Remark
1	 180W9A8FA556	Magnetic stand 5870 200 055	1	Universal
2	 180W9A8FA557	Dial indicator 5870 200 057	1	Universal
3	 180W9A8FA558	Gauge blocks 5870 200 066 (70 mm) 5870 200 067 (100 mm)	1	Universal 8-268
4	 180W9A8FA559	Digital depth gauge 5870 200 072 (200 mm) 5870 200 114 (300 mm)	1	Universal
5	 180W9A8FA560	Digital caliper gauge 5870 200 109 (150 mm)	1	Universal

No.	Figure	Designation order no.	Qty	Remark
6	 180W9A8FA561	Torque wrench 5870 203 030 0.6 ~ 6.0 Nm 5870 203 031 1.0 ~ 12 Nm 5870 203 032 3.0 ~ 23 Nm 5870 203 033 5.0 ~ 45 Nm 5870 203 034 10 ~ 90 Nm 5870 203 039 80 ~ 400 Nm 5870 203 016 140 ~ 750 Nm 5870 203 011 750 ~ 2000 Nm	1	Universal
7	 180W9A8FA562	Hot air blower 5870 221 500 230 V 5870 221 501 115 V	1	Universal
8	 180W9A8FA563	Plastic hammer 5870 280 004 Ø 60 mm Substitute nylon insert 5870 280 006	1	Universal
9	 180W9A8FA564	Lifting strap 5870 281 026	1	Universal

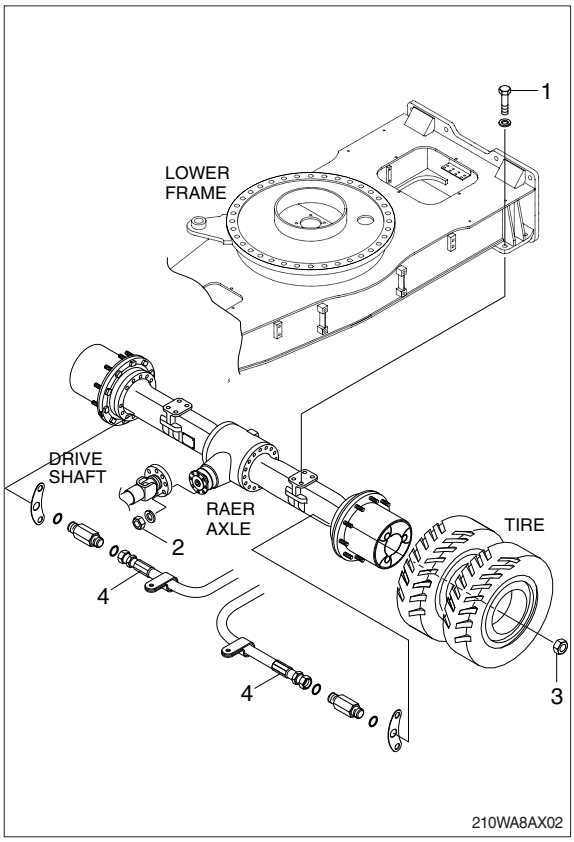
No.	Figure	Designation order no.	Qty	Remark
10	 180W9A8FA565	Lifting chain 5870 281 047	1	Universal
11	 180W9A8FA566	Pry bar 5870 345 071	1	Universal
12	 180W9A8FA567	Striker 5870 650 004	1	Universal
13	 180W9A8FA568	Set of internal pliers I1-I2-I3-I4 5870 900 013	1	Universal
14	 180W9A8FA569	Set of internal pliers I11-I21-I31-I41 90° 5870 900 014	1	Universal

No.	Figure	Designation order no.	Qty	Remark
15	 180W9A8FA570	Set of external pliers A1-A2-A3-A4 5870 900 015	1	Universal
16	 180W9A8FA571	Set of external pliers A01-A02-A03-A04 90° 5870 900 016	1	Universal
17	 180W9A8FA572	Two-armed puller 5870 970 001 Jaw width 80 mm Throat depth 100 mm 5870 970 002 Jaw width 120 mm Throat depth 125 mm 5870 970 003 Jaw width 170 mm Throat depth 125 mm 5870 970 004 Jaw width 200 mm Throat depth 175 mm 5870 970 006 Jaw width 350 mm Throat depth 250 mm 5870 970 007 Jaw width 520 mm Throat depth 300 ~ 500 mm 5870 970 026 Jaw width 250 mm Throat depth 200 mm 5870 970 028 Jaw width 380 mm Throat depth 200 mm	1	Universal

No.	Figure	Designation order no.	Qty	Remark
18	 180W9A8FA573	Two-armed puller 5870 971 001 Jaw width 85 mm Throat depth 65 mm 5870 971 002 Jaw width 130 mm Throat depth 105 mm 5870 971 003 Jaw width 230 mm Throat depth 150 mm 5870 971 004 Jaw width 295 mm Throat depth 235 mm 5870 971 005 Jaw width 390 mm Throat depth 270 mm 5870 971 006 Jaw width 640 mm Throat depth 300 mm	1	Universal

1. REMOVAL FRONT AXLE

1) Rear axle mounting nut (1, M24)
   · Tightening torque : 100±10 kgf · m
   (723±72.3 lbf · ft)
2) Propeller shaft mounting bolt (2, M10)
   · Tightening torque : 5.9±0.6 kgf · m
   (42.7±4.3 lbf · ft)
3) Wheel nut (3, M22)
   · Tightening torque : 60 kgf · m
   (434 lbf · ft)
4) Hose assy (4)
5) Axle weight : 592 kg (1305 lb)



2. GENERAL INSTRUCTIONS

1) GENERAL WORKING INSTRUCTIONS

(1) This manual has been developed for the skilled serviceman, trained by the ZF-Passau.

(2) During all operations, pay attention to cleanliness and skilled working.
Therefore, axle removed from the machine, must be cleaned prior to open them.

(3) We assume that the special tools, specified by ZF, will be used.
The special tools are available from ZF-Passau.

(4) After the disassembly, all components must be cleansed, especially corners, cavities and recesses of housing and covers.

(5) The old sealing compound must be carefully removed.

(6) Check lubricating holes, grooves and pipes for free passage. They must be free of residues, foreign material or protective compounds.

(7) The latter refers especially to new parts.

(8) Parts which have been inevitably damaged in a disassembly operation, must be generally replaced by new ones, e.g. rotary seal rings, O-rings, U-section rings, cap boots, protective caps etc..

(9) Components such as roller bearings, thrust washers, synchronizing parts etc. which are subject to normal wear in automotive operation, must be checked by the skilled Serviceman.
He will decide if the parts can be reused.

(10) For the heating of bearings etc., hot plates, rod heaters or heating furnaces must be used.

(11) Never heat parts directly with the flame. An auxiliary solution would be to immerse the bearing in a vessel filled with oil, which is then heated with the flame.
In this way, damage to the bearings could be avoided.

(12) Ball bearings, covers, flanges and parts like that must be heated to about 90 to 100˚C.

(13) Hot-mounted parts must be reset after cooling in order to assure a proper contact.

(14) Before pressing shafts, bearings etc. in position, both parts must be lubricated.

(15) During to reassembly, all specified adjustment values, testing specifications and tightening torque must be respected.

(16) After the repair, units are filled up with oil.

(17) After the oil filling, the oil level plugs and oil drain plugs must be tightened to the specified tightening torque.

2) IMPORTANT INSTRUCTIONS CONCERNING THE LABOUR SAFETY

(1) In principle, repairers are themselves responsible for the labour safety.

(2) The observance of all valid safety regulations and legal rules is a precondition to prevent damage to individuals and products during the maintenance and repair operations.

(3) Before starting the work, the repairers have to make themselves familiar with these regulations.

(4) The proper repair of these products requires especially trained personnel.

(5) The repairer himself is obliged to provide for the training.

3) LUBRICANT SPECIFICATIONS

(1) Gear oils with limited - slip additives.

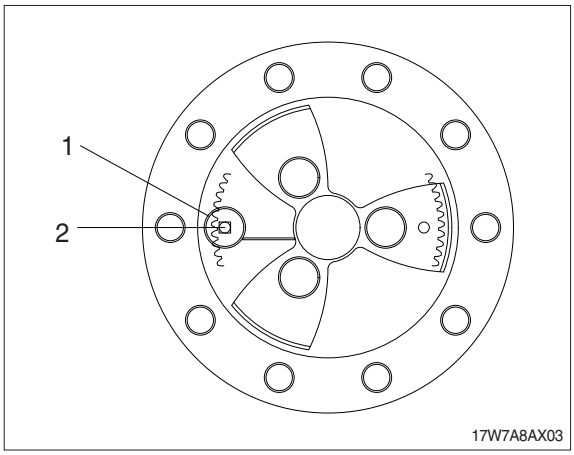
(2) API GL-5

(3) MIL-L-2105D (SAE 85W-90, 85W-140 with LS-Additive)

4) BRAKE LINING WEARING TEST

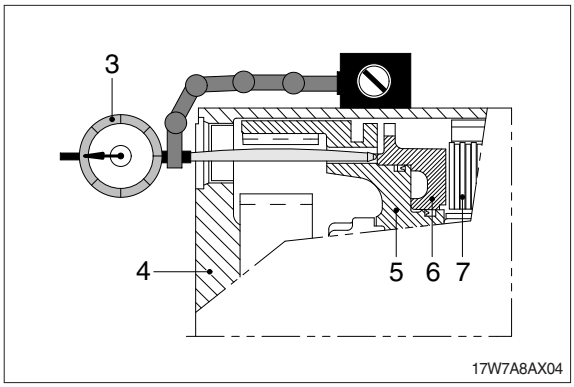
(1) The measurement of wear on the multi-disc brake only gives limited information on the total state of the plate pack without disassembling the output.
Make measurement of lining wear at least once per year, in particular, however, in case of a different braking behaviour, like :
- Braking noises
- Reduced braking power
- Different deceleration
- Different brake oil level
- Different braking pressure

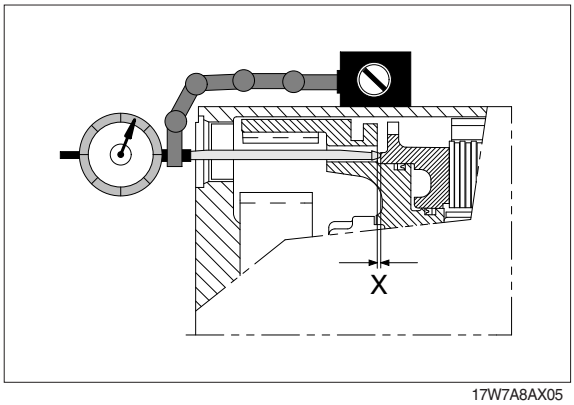
※ To avoid injury when opening the oil drain/ oil filler plug (1), due to a possible pressure build-up in the planetary carrier bring drain hole to topmost position (12 o'clock) and carefully unscrew oil drain and filler plug (1).



(2) Then turn output until oil filler / oil drain hole (2) is on 9 o'clock position.

1 = Oil filler-/oil drain hole
2 = Gauge hole (∅=10 ㎜) in ring gear
9 o'clock position
3 = Dial indicator with solenoid support
4 = Planetary carrier
5 = Ring gear
6 = Piston
7 = Plate pack
X = Piston stroke



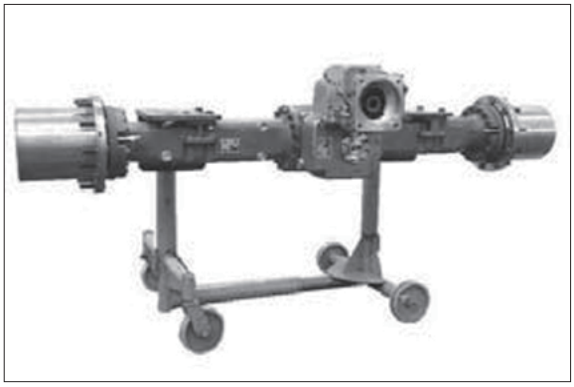


3. DISASSEMBLY

1) OUTPUT

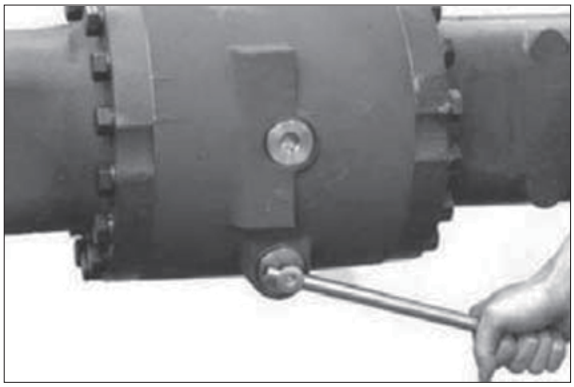
(1) Attach axle to the assembly truck.

(S) Assembly truck 5870 350 000
(S) Supporting bracket 5870 350 106



17W98RA001

(2) Loosen screw plug and drain oil from the axle.

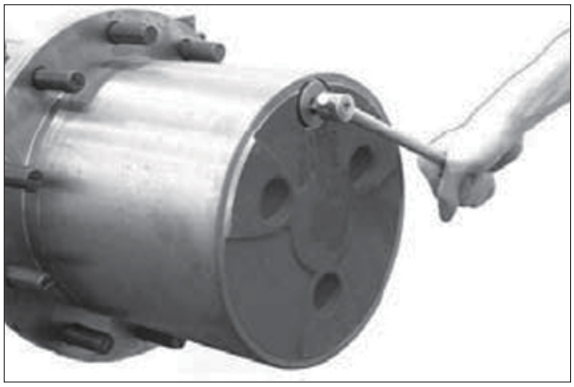


17W98RA002

(3) Loosen screw plug and drain oil from the planetary carrier.

※ To avoid any risk of injury due to a possible pressure buildup in the oil system of the planetary carrier, bring oil filler / level check plug to the uppermost position (12 o'clock) and turn it out carefully.
Then bring drain hole to 6 o'clock position and drain oil.

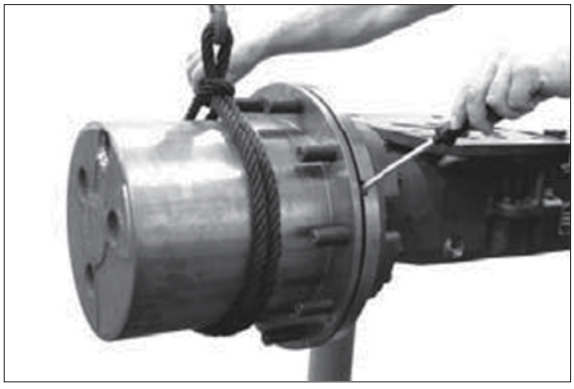
※ Use suitable oil reservoir environmental protection.



17W98RA003

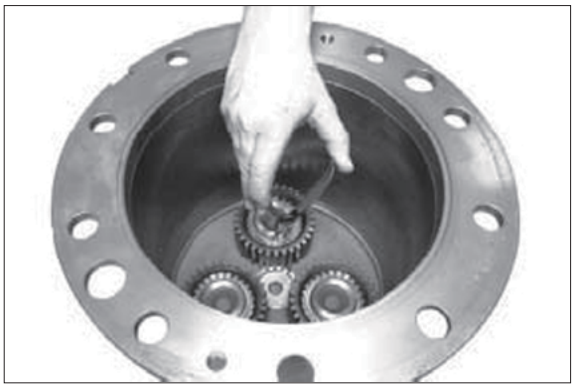
(4) Planetary carrier

Loosen both hexagon screws and separate planetary carrier from the hub.



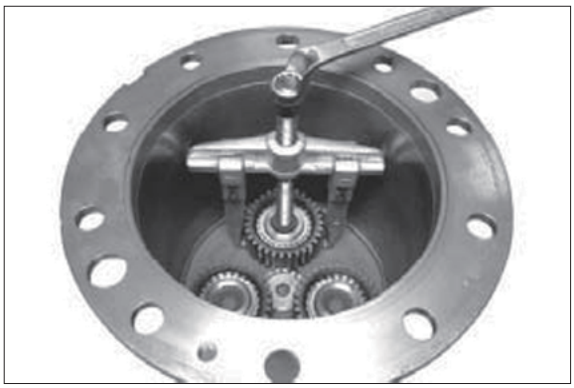
17W98RA004

(5) Snap out retaining ring.



17W98RA005

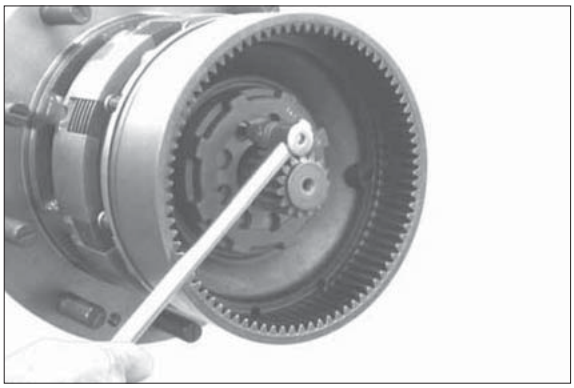
(6) Pull off planetary gear together with cylindrical roller bearing.



17W98RA006

(7) Brake

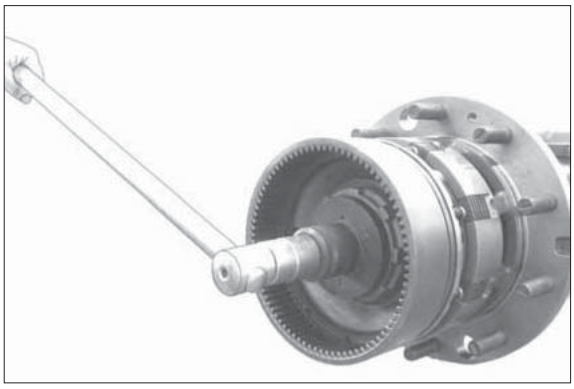
Loosen cylindrical screw (slotted nut fixing).



17W98RA007

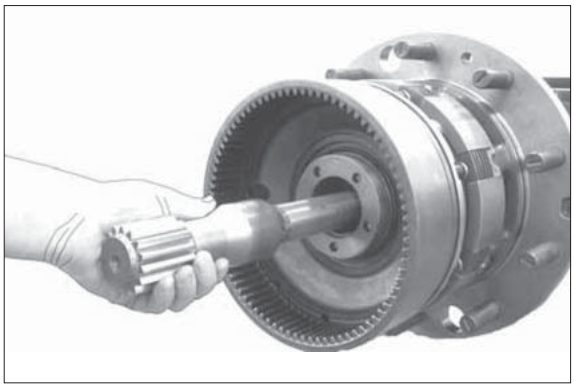
(8) Loosen slotted nut.

(S) Socket wrench 5870 656 097



17W98RA008

(9) Pull sun gear together with stub shaft out of the axle housing.

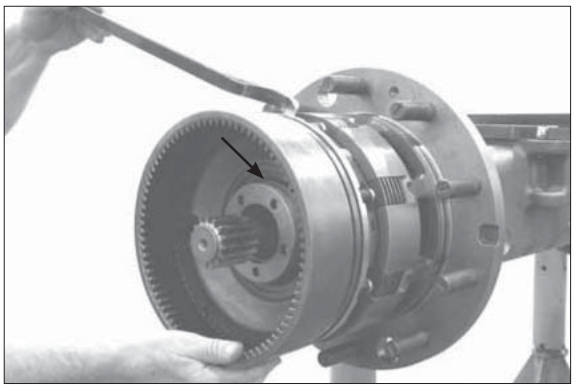


17W98RA009

(10) Press ring gear together with piston off the hub carrier.

(S) Assembly lever 5870 345 036

※ Pay attention so that the O-ring (arrow) does not drop.



17W98RA010

(11) Loosen hexagon screws and remove releasing spring sleeves and compression springs.

17W98RA011

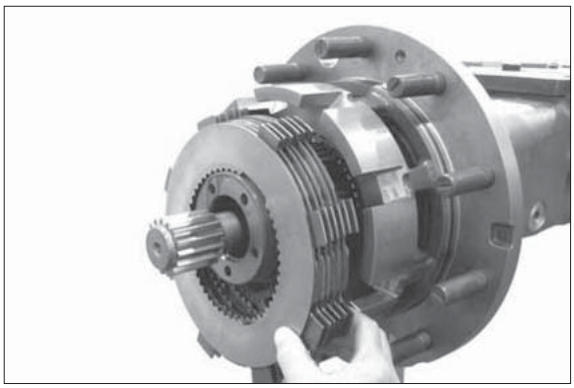
(12) Press piston off the ring gear.

17W98RA012

(13) Remove sealing elements from the annular grooves (see arrows) of the ring gear.

17W98RA013

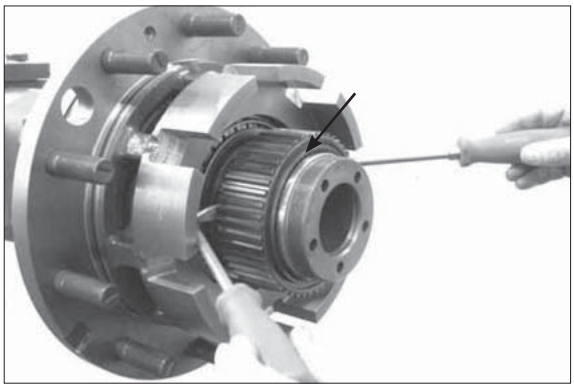
(14) Remove disk package.



17W98RA014

(15) Remove O-ring (seee arrow) and use a lever to remove disk carrier from hub carrier.

(S) Resetting device 5870 400 001



17W98RA015

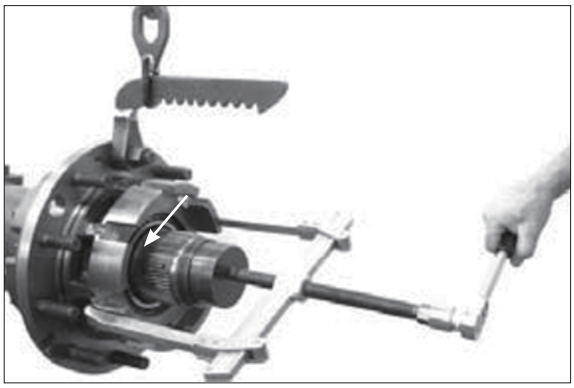
(15) Hub

Remove O-ring (see arrow).

Secure hub with lifting bracket (S) and pull it off the hub carrier by means of a two armed puller.

(S) Lifting bracket 5870 281 043
(S) Pressure piece 5870 100 063

※ Pay attention that the releasing bearing inner ring does not drop.

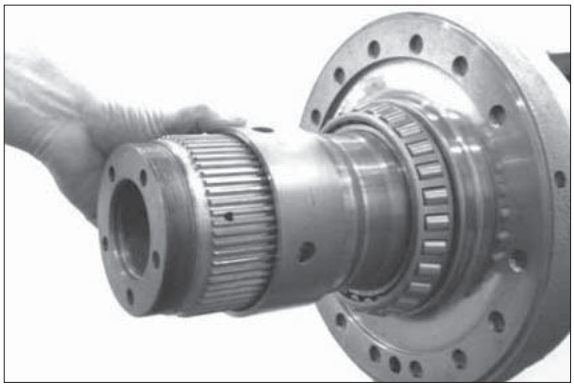


17W98RA016

(17) Use a lever to remove the shaft seal ring (see arrow) from the hub hole and force both bearing outer rings out of the hub.

17W98RA017

(18) Remove spacer bush.



17W98RA018

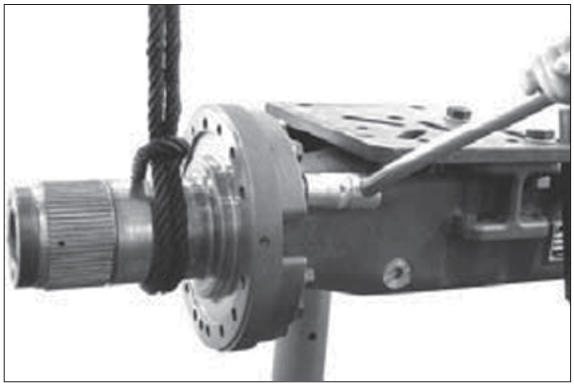
(19) Pull tapered roller bearing off the hub.

(S) Grab sleeve	5873 004 026
(S) Pressure piece	5870 100 063

17W98RA019

(20) Secure hub carrier with lifting tackle, loosen threaded joint and separate hub carrier from the axle housing.

Then remove single parts such as screw neck, breather valve and O-ring from the hub carrier.



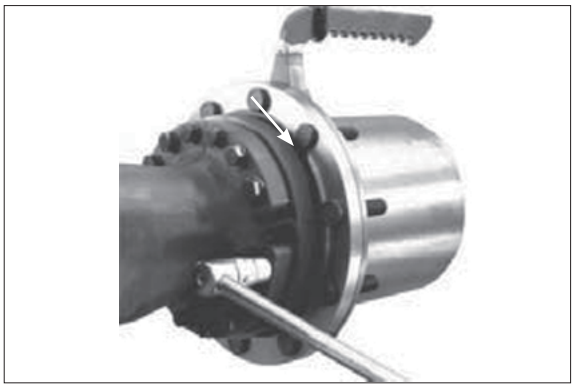
17W98RA020

(21) Output assy

※ If work is to be done on the differential or pinion, you may remove the output as a complete unit (operations figure RA021 and RA022).

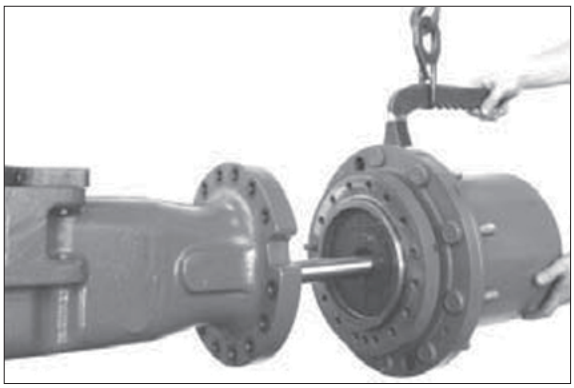
Secure output by means of lifting tackle (S) and loosen threaded joint.

(S) Lifting bracket 5870 281 043



17W98RA021

(22) Separate output assy from the axle housing and pull out stub shaft.



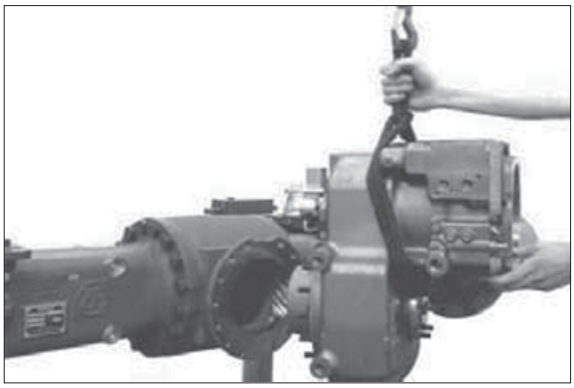
17W98RA022

2) INTPUT

(1) Secure transmission with lifting tackle and loosen threaded joint (transmission/axle drive housing).

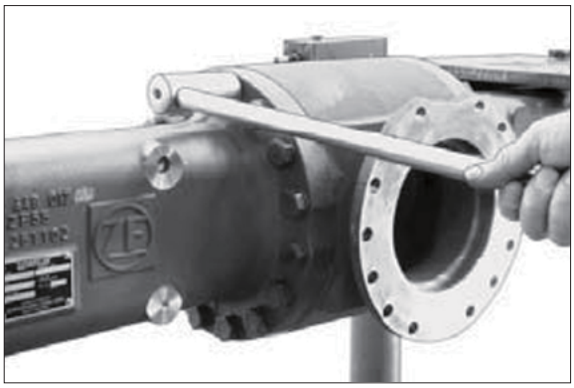
17W98RA023

(2) Separate transmission from the axle.



17W98RA024

(3) Secure axle housing (on crown wheel side) by means of lifting tackle and loosen threaded joint.

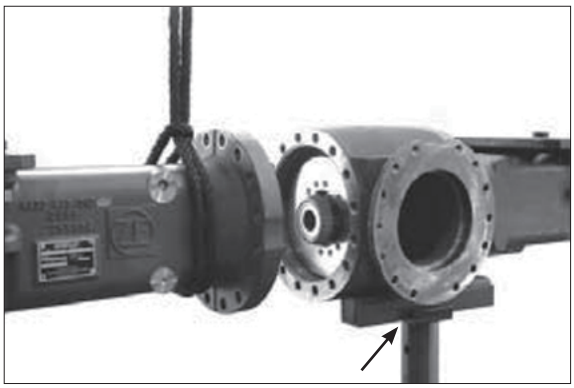


17W98RA025

(4) Support axle at the axle drive housing (see arrow).

Then separate axle housing from the axle drive housing.

※ Pay attention that the differential does not drop.

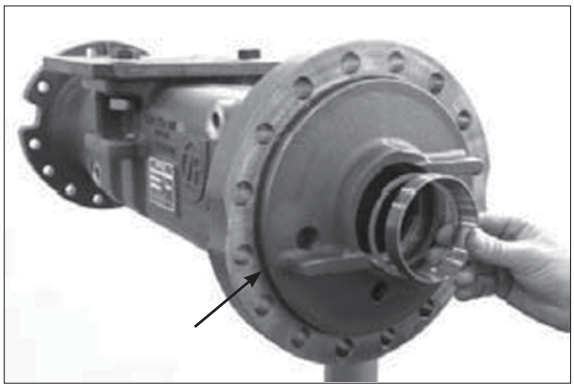


17W98RA026

(5) Pull bearing outer ring out of the bearing hole and remove the releasing shim.

Then remove O-ring (see arrow).

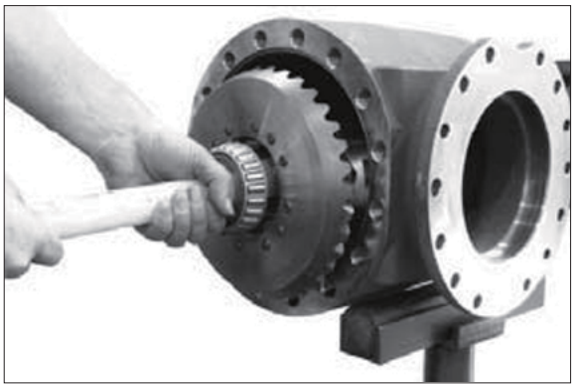
(S) Striker 5870 650 004



17W98RA027

(6) Lift differential out of the axle drive housing.

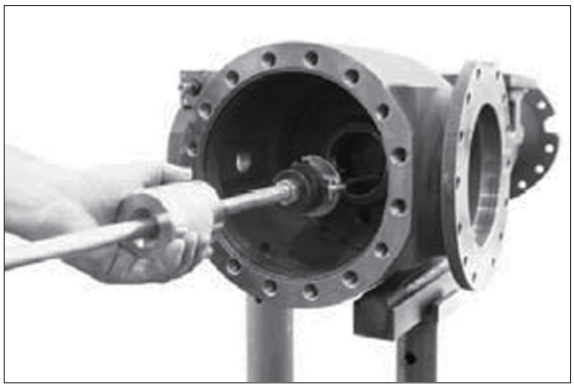
※ Disassembly of the differential see description on page 8-324 and following.



17W98RA028

(7) Use striker (S) to pull bearing outer ring out of the bearing hole (axle housing) and remove the releasing shim.

(S) Striker 5870 650 004

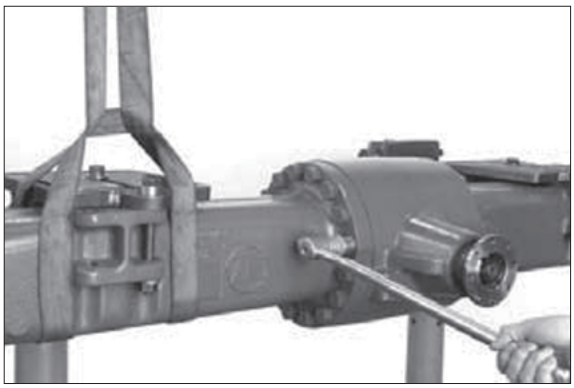


17W98RA029

(8) Secure axle housing (on crown wheel side, part II) by means of lifting tackle and loosen threaded joint.

Then separate axle housing (part II) from the axle drive housing.

※ Pay attention that the differential does not drop.

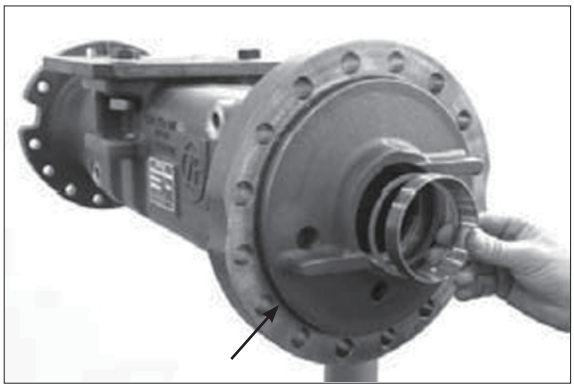


17W98RA030

(9) Pull bearing outer ring out of the bearing hole and remove the releasing shim.

Then remove O-ring (see arrow).

(S) Striker 5870 650 004

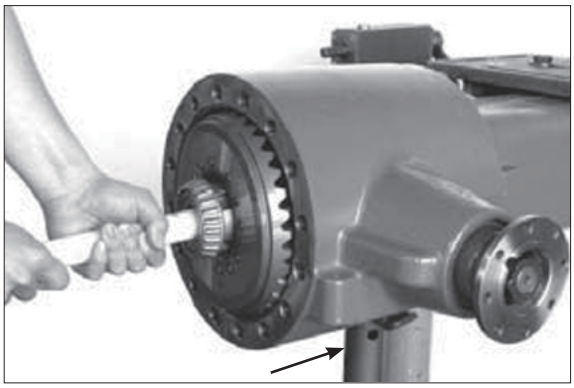


17W98RA031

(10) Support axle at the axle drive housing (see arrow).

Then lift differential out of the axle drive housing.

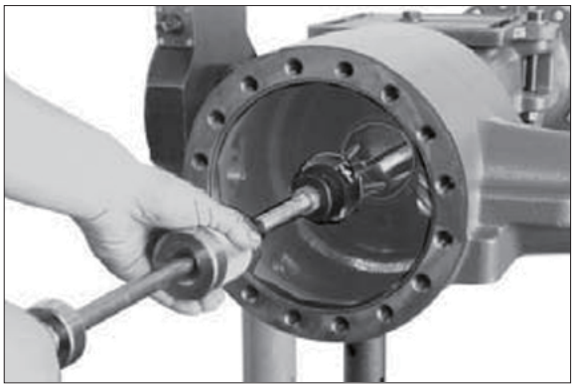
※ Disassembly of the differential see description on page 8-324 and following.



17W98RA032

(11) Use striker (S) to pull bearing outer ring out of the bearing hole (axle housing) and remove the releasing shim.

(S) Striker 5870 650 004



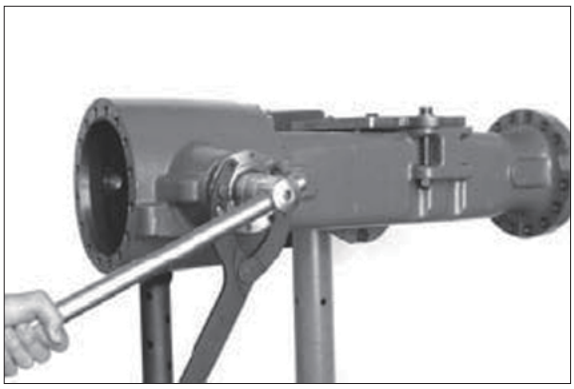
17W98RA033

(12) Heat up hexagon nut with hot-air blower.

Then loosen hexagon nut and remove the releasing washer.

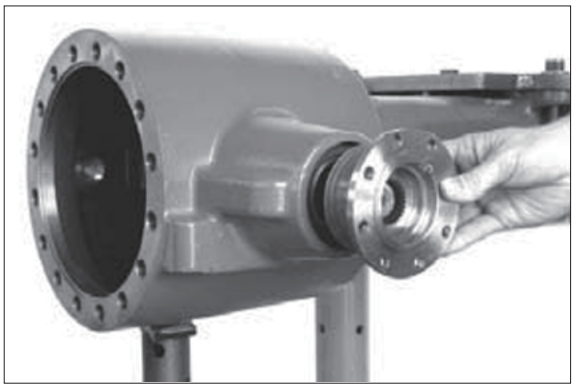
(S) Clamping fork 5870 240 025

※ Hexagon nut is secured with Loctite no. 262.



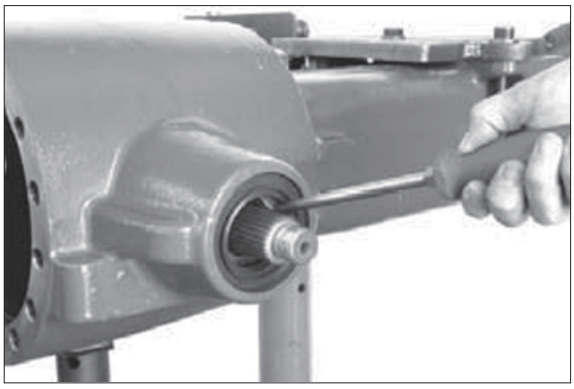
17W98RA034

(13) Pull input flange off the pinion.
If required, remove screen sheet from the flange.



17W98RA035

(14) Use a lever to remove the shaft seal ring out of the housing hole.

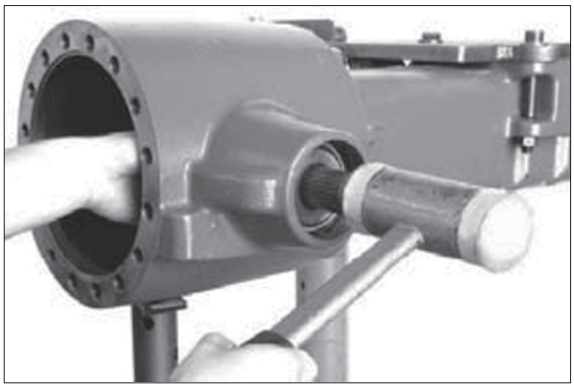


17W98RA036

(15) Force out input pinon and remove the releasing roller bearing.

※ Use a plastic hammer.

※ If the tapered roller bearings are not replaced, pay attention that all the rollers of the outer bearing inner ring are always in contact with the bearing outer ring when forcing out the input pinion.



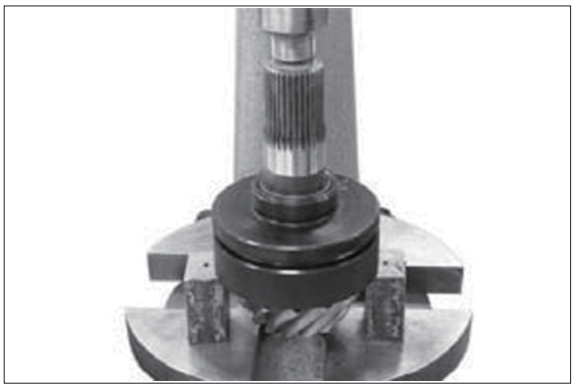
17W98RA037

(16) Remove spacer ring.

17W98RA038

(17) Press roller bearing off the input pinion.

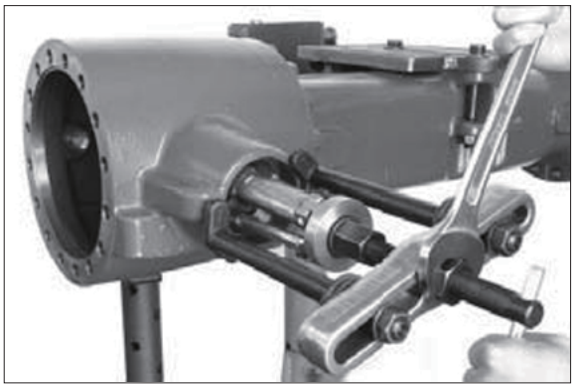
(S) Grab sleeve 5873 001 037



17W98RA039

(18) Pull external bearing outer ring out of the bearing hole.

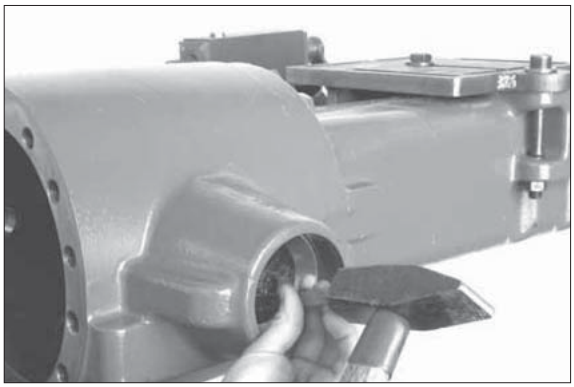
(S) Internal extractor 5870 300 019
(S) Counter support 5870 300 020



17W98RA040

(19) Force bearing outer ring off the inner bearing hole pay attention to the shim behind.

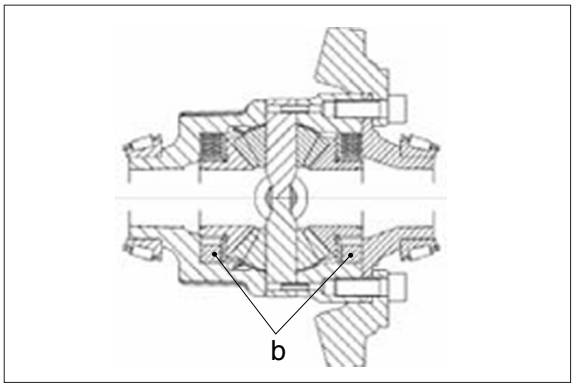
※ Mark shim regarding position/bearing allocation reassembly aid.



17W98RA041

3) DIFFERENTIAL

(1) b = Constant spacers



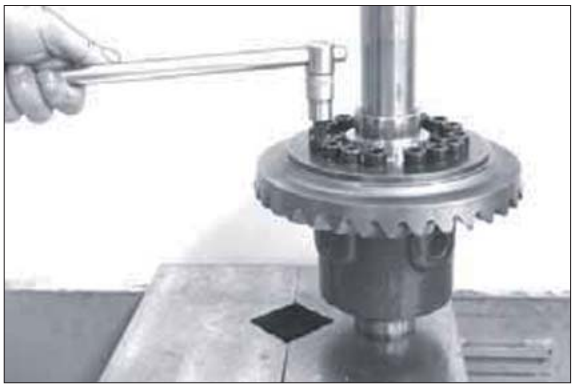
17W98RA042

(2) Pull both tapered roller bearings from differential carrier.

(S) Grab sleeve	5873 011 019
(S) Basic tool	5873 001 000
(S) Pressure piece	5870 100 009

17W98RA043

(3) Use press to fix differential and loosen threaded joint crown wheel / differential carrier.



17W98RA044

(4) Press crown wheel from differential.

17W98RA045

(5) Remove single parts.

Remove axle bevel gear together with thrust washer and constant spacer from the differential carrier.

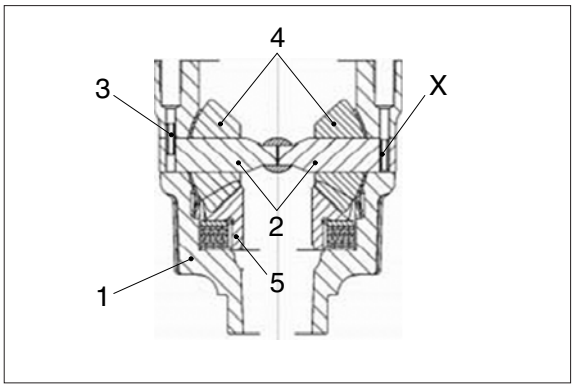
17W98RA046

(6) Force slotted pins (considering position "X", see subsequent sketch) into the spider shafts.

17W98RA047

(7) Comment on sketch:

1 = Differential carrier
2 = Spider shafts (short)
3 = Slotted pins
4 = Differential bevel gears
5 = Axle bevel gear
X = Position of the slotted pin to force out the spider shafts



17W98RA048

(8) Force out both spider shafts (short).

17W98RA049

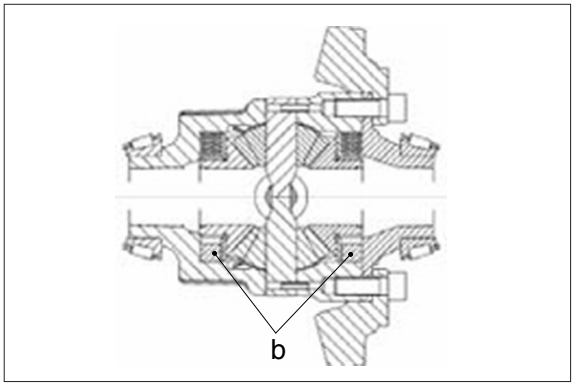
(9) Remove all single parts.

17W98RA050

4. REASSEMBLY

1) DIFFERENTIAL

(1) b = Constant spacers

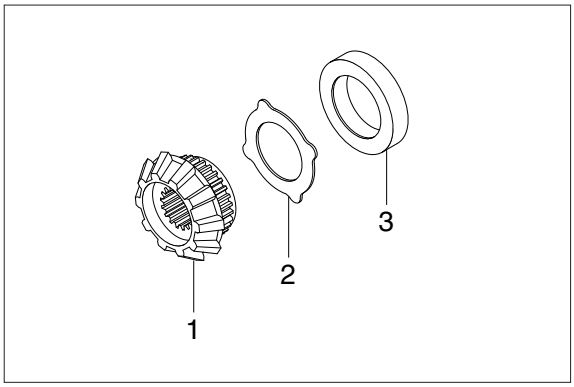


17W98RA042

(2) All outer and inner disks are replaced by a constant spacer (see figure FA054).

1 = Axle bevel gear
2 = Pressure disk
3 = Constant ring

※ No measuring / setting of the axial play of the two axle bevel gears is required, therefore single parts can be immediately oiled.



17W98RA053

(3) Insert premounted axle bevel gear into the differential carrier.

17W98RA054

(4) Insert differential bevel gears (1) with thrust washers (2) and fix with spider shafts (3 and 4).

※ Pay attention to radial installation position of the thrust washers.

17W98RA055

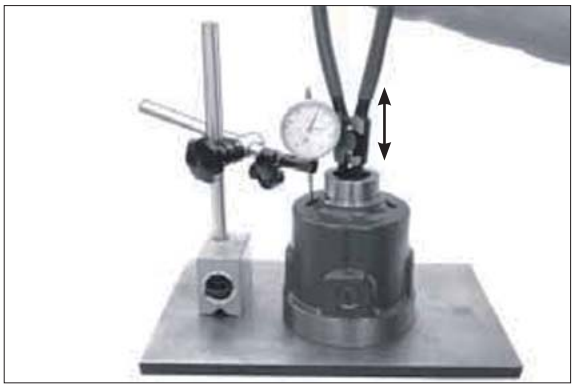
(5) Check axial play of the axle bevel gear 0.0 … 0.15 mm.

※ If the axial play is not within the specified tolerance, correct with the corresponding outer disks.

After the setting procedure separate the single parts again.

Then oil and reassemble all single parts again.

※ Make sure that thickness and arrangement of the second disk package are identical (figure RA059).



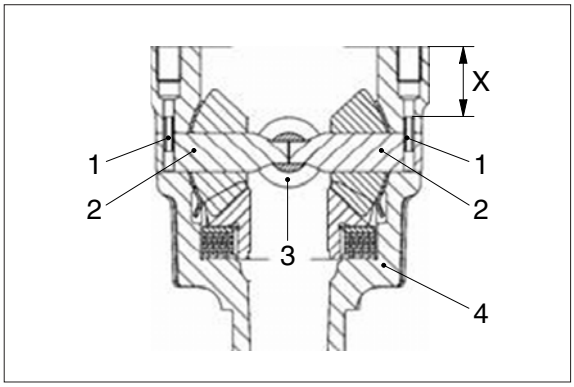
17W98RA056

(6) Fix both spider shafts (short) by means of slotted pins (considering installation dimension, see sketch RA058).

17W98RA057

(7) Comment on sketch:

1 = Slotted pin
2 = Spider shaft (short)
3 = Spider shaft
4 = Differential carrier
X = Installation dimension 34 ± 0.5 mm



17W98RA058

(8) Mount second axle bevel gear with thrust washer and constant spacer (see also figure RA053).

※ Mount the pressure disk with the coated surface showing to the outer disk.

※ Thickness and arrangement of the disk package must be identical on both sides of the differential gear.

17W98RA059

(9) Check axial play of the second axle bevel gear 0.0 … 0.15 mm.

※ If the axial play is not within the specified tolerance, correct with the corresponding outer disks.

After the resetting procedure remove the second axle bevel gear together with the disk package from the differential carrier.

Then oil and reassemble all single parts.

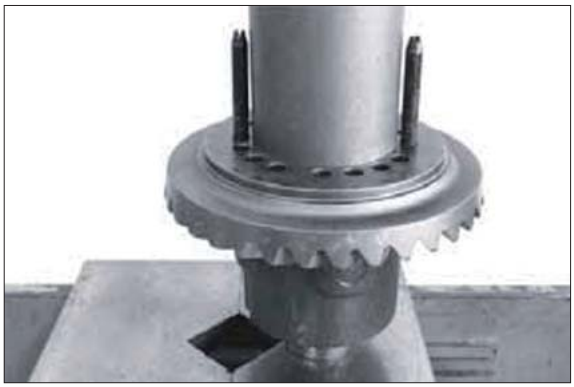
17W98RA060

(10) Mount two adjusting screws (S) and insert cover.

(S) Adjusting screws (M12 × 1.5)
5870 204 027

17W98RA061

(11) Press crown wheel onto the cover / differential carrier until contact position is obtained.



17W98RA062

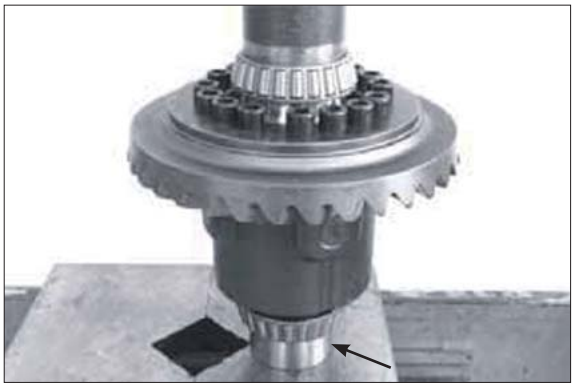
(12) Fix differential with press and tighten crown wheel with cylindrical screws.

Tightening torque (M12×1.5/12.9) . . . . . MA = 145 Nm

17W98RA063

(13) Press on both bearing inner rings until contact is obtained.

※ Use an appropriate support (arrow) differential may not be supported on the bearing cage.

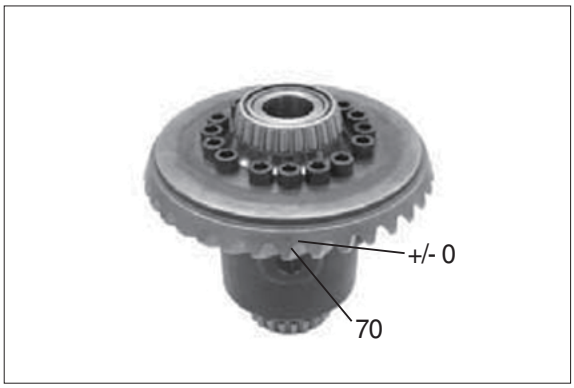


17W98RA064

2) INPUT

(1) Determination of shims for setting the bearing rolling torque (differential bearing) and the backlash (bevel gear set).

※ Determine the required shims on basis of the read value (test dimension/ crown wheel) and the corresponding specifications of the table next page : (KRS – SET – RIGHT) (KRS = bevel gear set)

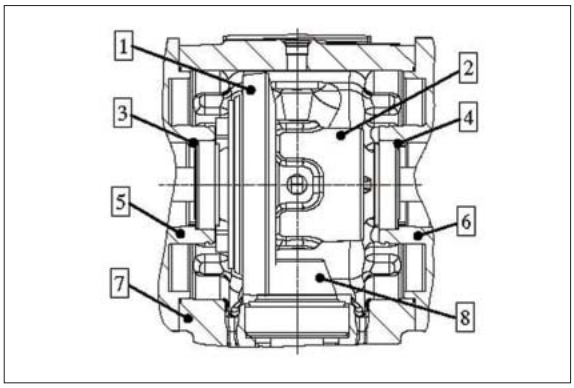


17W98RA065

(2) Test dimension see crown wheel rear side.

※ The test dimension "70" is stamped into the crown wheel rear side. If no + or deviation is indicated, this value corresponds with the test dimension/ actual value "70" in the table below. According to this value, the required shims are allocated in the table below.

Any + or - deviation of the test dimension caused by production is also marked on the crown wheel rear side (e.g. 20 or – 10 / 10 or 20) . In accordance with this deviation, the required shims are allocated in the table below.



17W98RA066

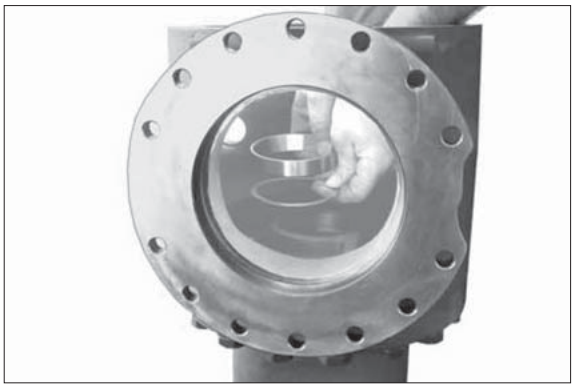
· Legend to sketch:

1 = Crown wheel
2 = Differential carrier
3 = Shim (crown wheel side)
4 = Shim (diff. carrier side)
5 = Axle housing
6 = Axle housing
7 = Axle drive housing
8 = Input pinion

Setting disks for differential					
Test dimension/crown wheel marking 70 and deviation	-20	-10	0	10	20
results in → test dim. / actual value	69.80	69.90	70.0	70.10	70.20
Shim/ diff. carrier side Required shim thickness	0.95	1.05	1.15	1.25	1.35
Shim No.	0730 006 518	0730 006 519	0730 006 521	0730 006 522	0730 006 524
Shim/crown wheel side Required shim thickness	1.35	1.25	1.15	1.05	0.95
Shim No.	0730 006 524	0730 006 522	0730 006 521	0730 006 519	0730 006 518

(3) Place determined shim (e.g. thickness = 1.15 mm) and bearing outer ring into the hole of the axle housing on differential carrier side.

※ Rotate axle housing by 90˚.



17W98RA067

(4) Place determined shim (e.g. thickness = 1.15 mm) and bearing outer ring into the hole of the axle housing on crown wheel side.

17W98RA068

(5) Contact pattern check of bevel gear set

Cover some drive and coast flanks of the crown wheel with marking ink.

17W98RA069

(6) Place preassembled differential into the axle drive housing.

(S) Internal extractor 5870 300 005

17W98RA070

(7) Use lifting tackle to mount the axle housing (crown wheel side) and preliminarily fix it with hexagon screws.

Tightening torque (M18/12.9) . . . . . MA = 440 Nm

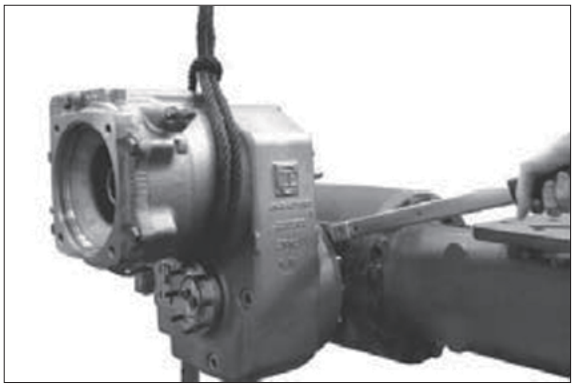
※ Preliminarily fix axle housing without O-ring.

17W98RA071

(8) Rotate axle by 90˚ and support it.

Use lifting tackle to bring HL transmission into contact position with the axle housing and fix it.

Tightening torque . . . . . MA = 79 Nm



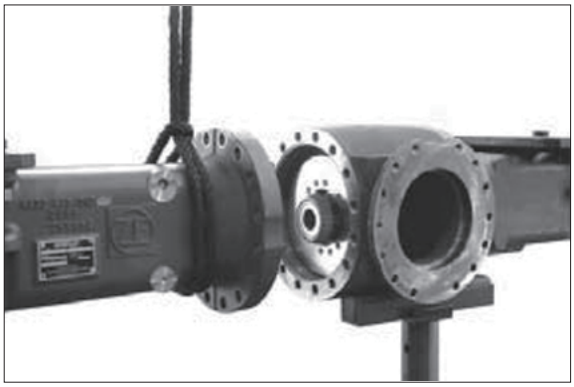
17W98RA072

(9) By rotating the input flange, roll crown wheel over the input pinion in both directions several times.

Then remove transmission and axle housing and lift differential out of the axle drive housing.

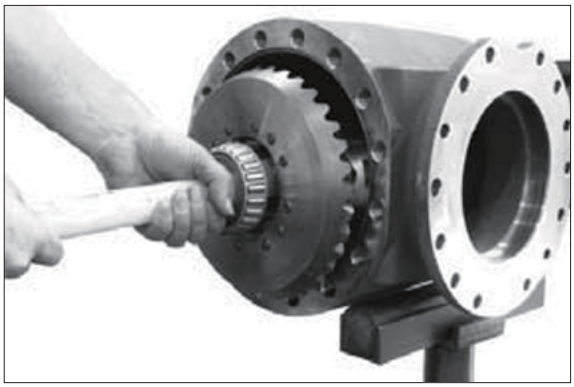
Compare the obtained contact pattern.

※ In case of a contact pattern deviation, check the pinion shimming of the transmission.



17W98RA073

(10) After contact pattern check, place differential into the axle drive housing.



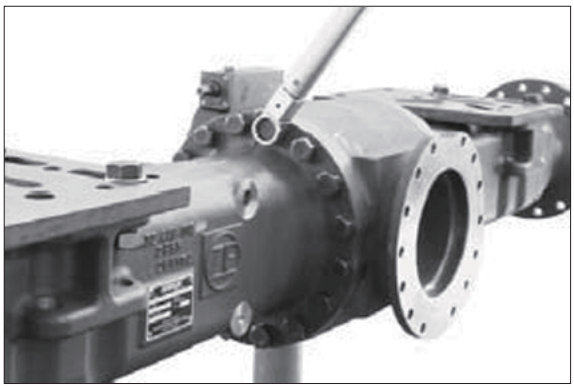
17W98RA074

(11) Grease O-ring (see arrow) and mount it to axle housing.

17W98RA075

(12) Use lifting tackle to mount the axle housing and finally tighten it with hexagon screws.

Tightening torque (M18/12.9) . . . . . MA = 440 Nm



17W98RA076

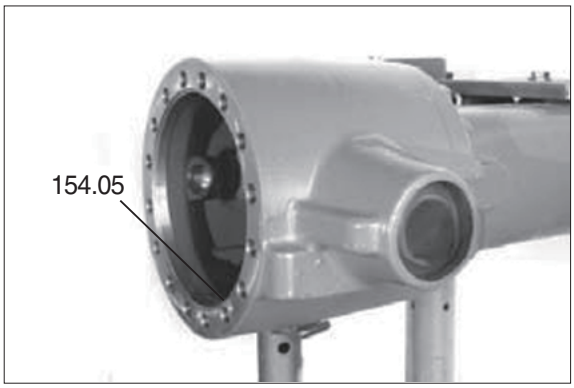
3) INPUT PINION

The following measuring operations must be carried out with utmost accuracy.
Inaccurate measurements lead to an incorrect contact pattern and require an additional disassembly and reassembly of the input pinion.

(1) Determination of shim thickness to obtain a correct contact pattern

Read dimension I from the axle drive housing.

Dim. I e.g. . . . . 154.05 mm



17W98RA077

(2) Read dimension II (pinion dimension).

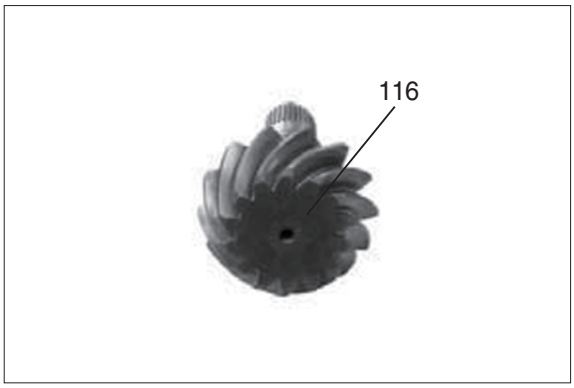
Dim. II e.g. . . . . 116.00 mm

In case of a + or - deviation of the pinion dimension for production reasons, the respective value is marked by hand on the pinion.

Pinion dim. (without + or – deviation) = 116.0 mm

Pinion dim. with + 0.1 deviation value = 116.1 mm

Pinion dim. with - 0.1 deviation value = 115.9 mm



17W98RA078

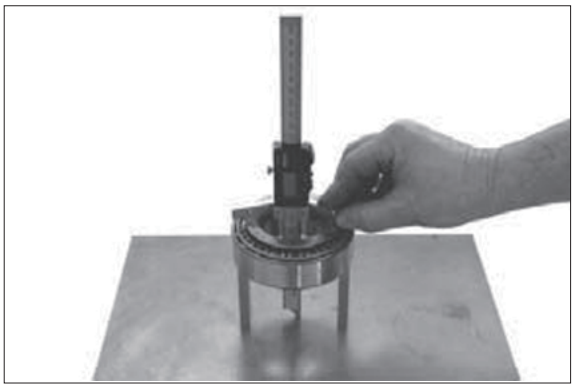
(3) Determine dimension III (bearing width).

※ Make sure that the rollers are located without any play (rotate bearing inner ring several times in both directions roller setting).

Since the installed roller bearing is subject to a preload in installation position, deduct an experience value of 0.1 mm.

Dimension III, e.g. 36.60 mm - 0.1 mm = 36.50 mm

(S) Gage blocks 5870 200 066

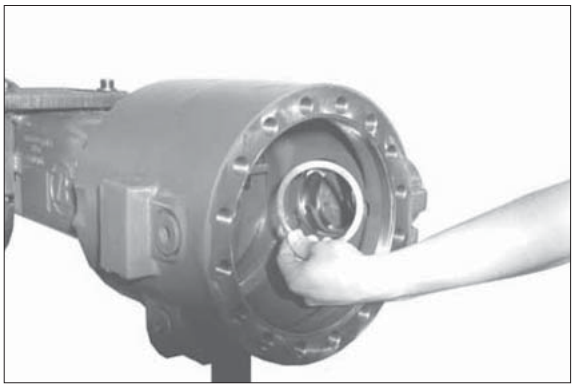


17W98RA079

(4) Calculation example :

Dimension I . . . . . 154.05 mm
Dimension X . . . . . - 152.50 mm
Difference = shim s = 1.55 mm

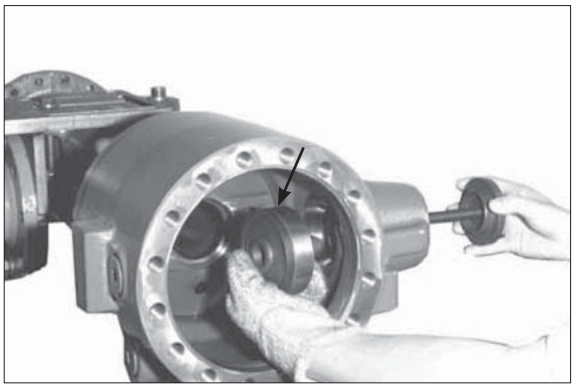
Place the determined shim (e.g. thickness = 1.55 mm) into the inner bearing hole.



17W98RA080

(5) Undercool bearing outer ring (see arrow) and bring it into contact position in the bearing hole by using the assembly fixture (S).

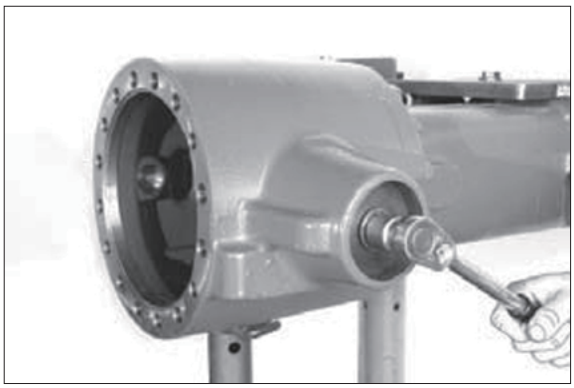
(S) Assembly fixture 5870 345 049
(S) Pressure ring 5870 345 056



17W98RA081

(6) Undercool external bearing outer ring and insert it into the bearing hole until contact is obtained.

(S) Assembly fixture 5870 345 049
(S) Pressure ring 5870 345 056

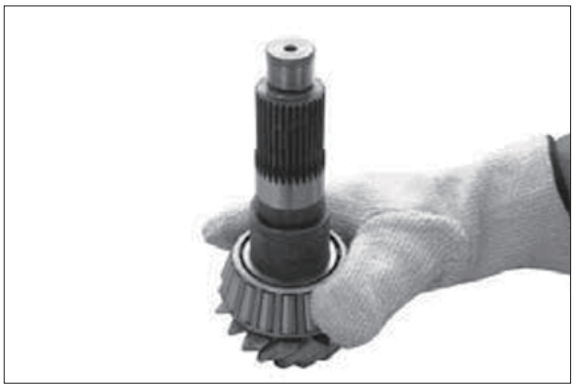


17W98RA082

(7) Adjustment of the rolling torque of input pinion bearing 1.0 ... 3.0 Nm (without shaft seal ring)

Heat up roller bearing and install it until contact is obtained.

※ Adjust bearing after cooling-down.



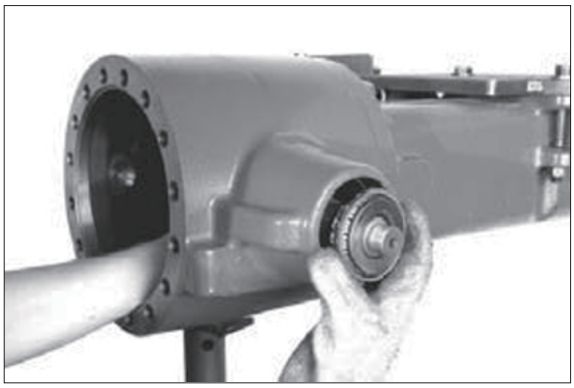
17W98RA083

(8) Mount spacer ring (e.g. thickness = 16.96 mm).

※ According to our experience, the necessary rolling torque is obtained when reusing the spacer ring which has been removed during disassembly (e.g. thickness = 16.96 mm).
A later check of the rolling torque, however, is absolutely necessary.

17W98RA084

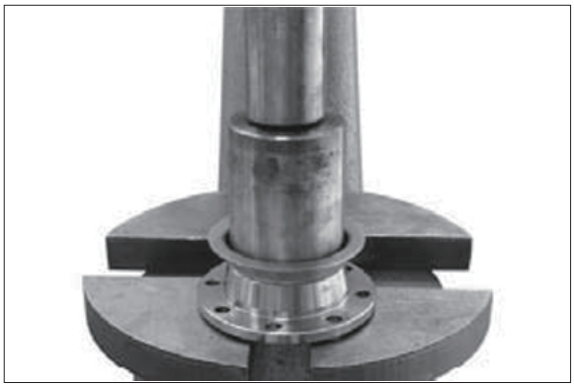
(9) Place the preassembled input pinion into the axle housing and mount the heated roller baring until contact is obtained.



17W98RA085

(10) Press screen sheet (see arrow) onto the input flange until contact is obtained.

※ Do not fit the shaft seal ring until the contact pattern has been checked.



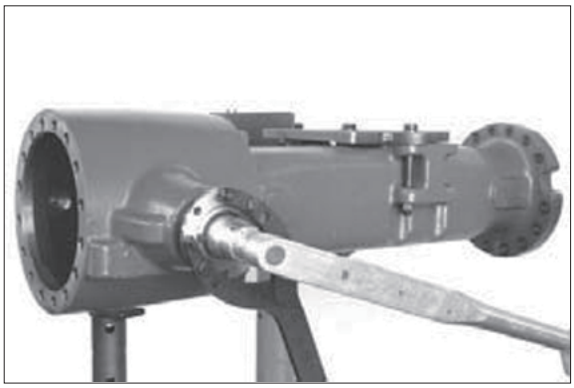
17W98RA086

(11) Mount input flange and fix it with washer and hexagon nut.

Tightening torque (M30 x 1.5) . . . . . MA = 600 Nm

(S) Clamping fork 5870 240 025

※ While tightening, rotate the input pinion in both directions several times.



17W98RA087

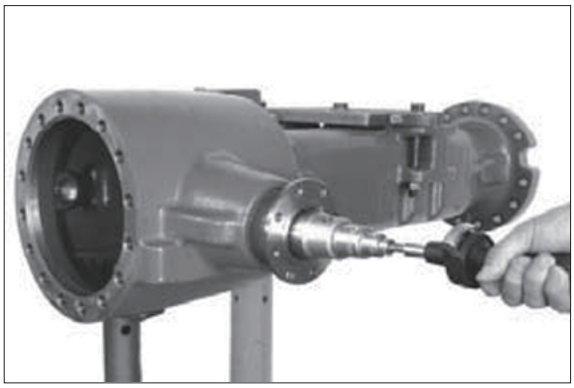
(12) Check rolling torque (1.0 ... 3.0 Nm without shaft seal ring).

※ When installing new bearings, try to achieve the upper value of the rolling torque.

※ Any deviation from the required rolling torque must be corrected with an appropriate spacer ring (figure RA110) as specified below.

Insufficient rolling torque - install thinner spacer ring.

Excessive rolling torque - install thicker spacer ring.



17W98RA088

(13) Determination of shims for setting the bearing rolling torque (differential bearing) and the backlash (bevel gear set)

※ Determine the required shims on basis of the read value (test dimension/crown wheel) and the corresponding specifications of the table below:
(KRS – SET – RIGHT) (KRS = bevel gear set) : Test dimension see crown wheel rear side.

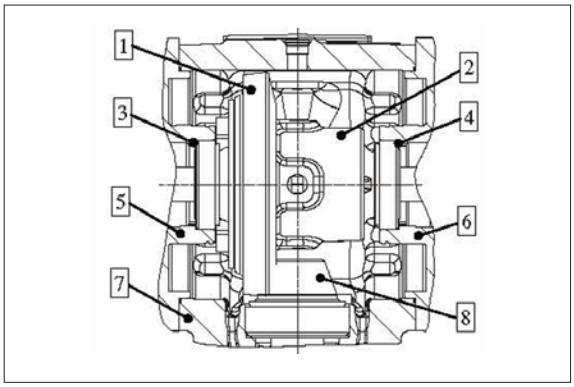
※ The test dimension "70" is stamped into the crown wheel rear side. If no + or deviation is indicated, this value corresponds with the test dimension/ actual value "70" in the table below. According to this value, the required shims are allocated in the table below.

※ Any + or – deviation of the test dimension caused by production is also marked on the crown wheel rear side (e.g. – 20 or – 10 / 10 or 20) . In accordance with this deviation, the required shims are allocated in the table below.

17W98RA089

(14) Legend to sketch:

1 = Crown wheel
2 = Differential carrier
3 = Shim (crown wheel side)
4 = Shim (diff. carrier side)
5 = Axle housing
6 = Axle housing
7 = Axle drive housing
8 = Input pinion

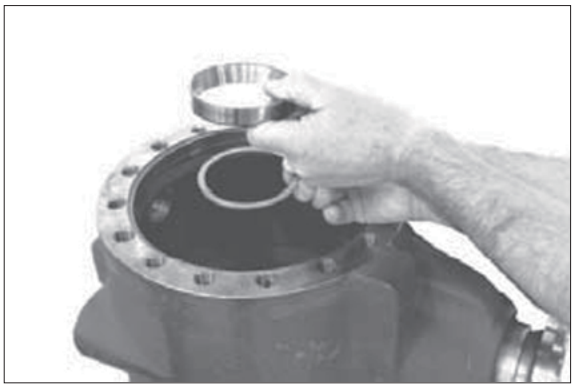


17W98RA090

Shims for differential					
Test dimension/crown wheel marking 70 and deviation	-20	-10	0	10	20
results in → test dim. / actual value	69.80	69.90	70.0	70.10	70.20
Shim/ diff. carrier side Required shim thickness	0.95	1.05	1.15	1.25	1.35
Shim No.	0730 006 518	0730 006 519	0730 006 521	0730 006 522	0730 006 524
Shim/crown wheel side Required shim thickness	1.35	1.25	1.15	1.05	0.95
Shim No.	0730 006 524	0730 006 522	0730 006 521	0730 006 519	0730 006 518

(15) Place determined shim (e.g. thickness = 1.15 ㎜) and bearing outer ring into the hole of the axle housing on differential carrier side (part I).

※ Rotate axle housing by 90˚.



17W98RA091

(16) Place determined shim (e.g. thickness = 1.15 ㎜) and bearing outer ring into the hole of the axle housing on crown wheel side (part II).

17W98RA092

(17) Contact pattern check of bevel gear set

Cover some drive and coast flanks of the crown wheel with marking ink.

17W98RA093

(18) Place preassembled differential into the axle drive housing.

17W98RA094

(19) Use lifting tackle to mount the axle housing (crown wheel side, part II) and preliminarily fix it with hexagon screws.

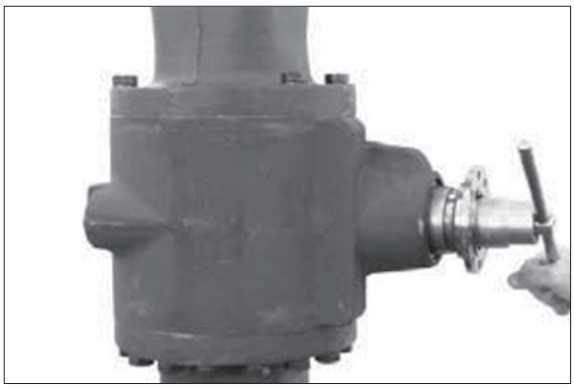
Tightening torque (M18/12.9) . . . . . MA = 440 Nm

※ Preliminarily fix axle housing without O-ring.

17W98RA095

(20) By rotating the input flange, roll crown wheel over the input pinion in both directions several times.
Then remove axle housing and lift differential out of the axle drive housing.
Compare the obtained contact pattern with contact pattern.

※ In case of a contact pattern deviation it is imperative to correct the measuring error which was made when determining the shim (figure RA080).



17W98RA096

(21) After contact pattern check, place differential into the axle drive housing.

Grease O-ring (see arrow) and mount it to the axle housing.

17W98RA097

(22) Use lifting tackle to mount the axle housing and finally fix it with hexagon screws.

Tightening torque (M18/12.9) . . . . . MA = 440 Nm

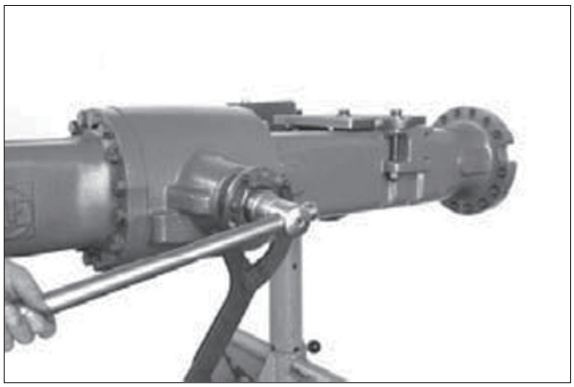
Then bring axle into horizontal position and reassemble the second supporting bracket (S) (see also figure RA001).

17W98RA098

(23) Fitting of shaft seal ring (input flange)

Loosen hexagon nut and pull input flange off the input pinion.

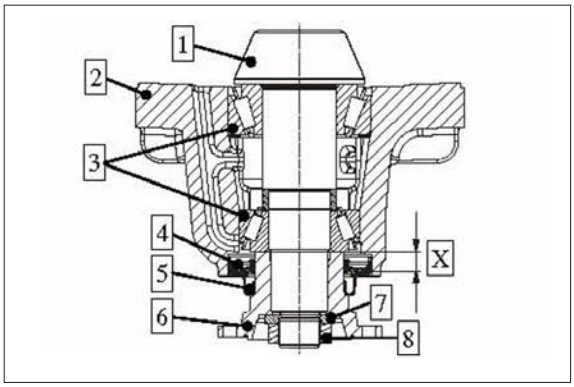
(S) Clamping fork 5870 240 025



17W98RA099

(24) Legend to sketch:

1 = Input pinion
2 = Axle drive housing
3 = Tapered roller bearing
4 = Shaft seal ring
5 = Screen sheet
6 = Input flange
7 = Washer
8 = Hexagon nut
X = Installation dimension → 13.5 +0. 2 mm



17W98RA100

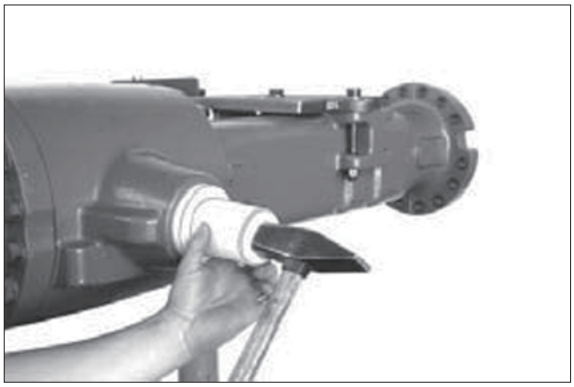
(25) Mount shaft seal ring with the sealing lip facing the oil chamber.

(S) Driver tool 5870 048 286

※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.

※ Just before fitting, apply lubricant to the contact face of shaft seal ring/axle drive housing.

Apply grease to seal and dust lip of the shaft seal ring.



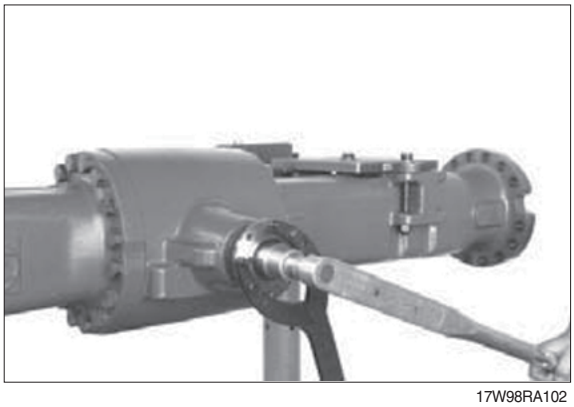
17W98RA101

(26) Mount input flange and finally fix it with washer and hexagon nut.

Tightening torque (M30 x 1.5) . . . . . MA = 600 Nm

(S) Clamping fork 5870 240 025

※ Wet thread of hexagon nut with Loctite no. 262.



17W98RA102

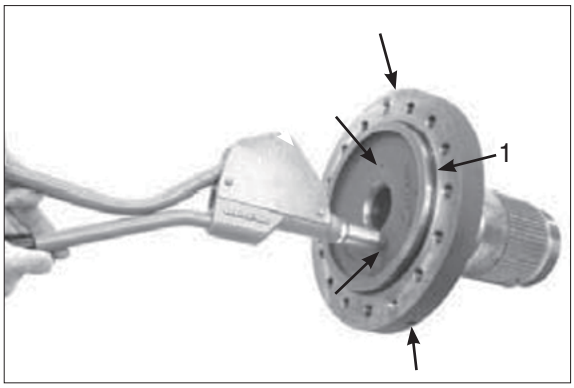
4) OUTTPUT

(1) Hub carrier

Grease O-ring (1) and mount it to hub carrier.

The following operation is only required when fitting a new hub carrier :
Seal machining openings (arrows) of oil supply holes with plugs.

(S) Lever riveting tongs 5870 320 016

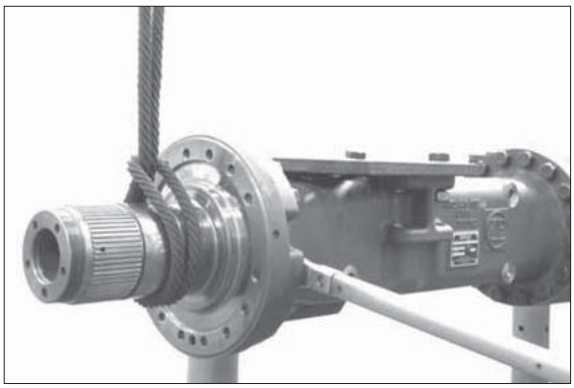


17W98RA103

(2) Mount preassembled hub carrier to the axle housing, considering the installation position, and fix it with hexagon screws.

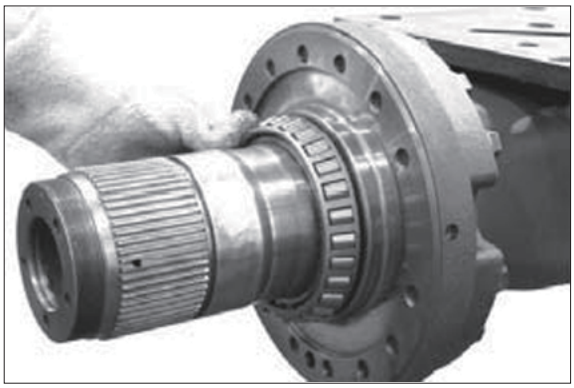
Tightening torque (M 16/10.9) . . . . . MA = 280 Nm

※ Ensure radial installation position. Stamped circle (see arrow) must be in uppermost (12 o'clock) position.



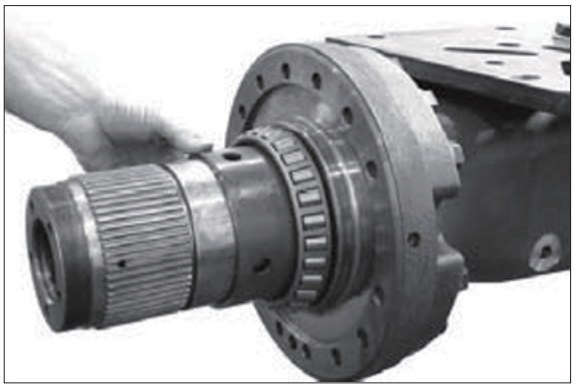
17W98RA104

(3) Hub (Hub bearing SET-RIGHT)
Heat up tapered roller bearing and mount it to hub carrier until contact is obtained.



17W98RA105

(4) Mount spacer bushing.

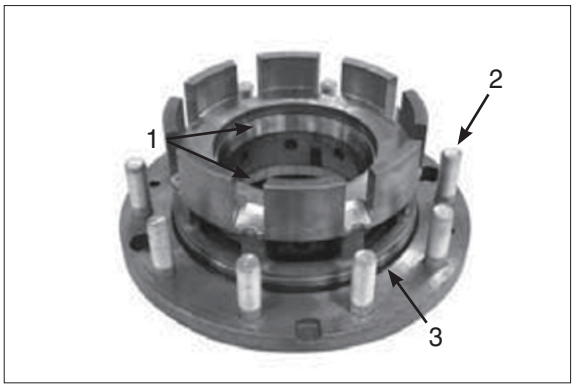


17W98RA106

(5) Insert both bearing outer rings (1) of the hub bearing until contact position is obtained.

Press wheel bolts (2) into the hub until contact position is obtained.

Grease O-ring (3) and place it into the annular groove of the hub.



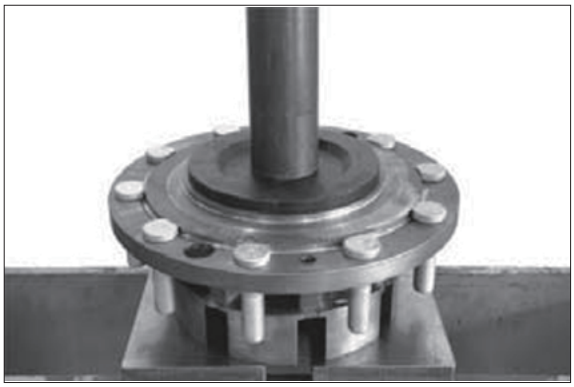
17W98RA107

(6) Press shaft seal ring into the hub, with the marking "OUT SIDE" showing outwards (facing up):

(S) Driver tool 5870 051 068

※ Use of the specified driver tool (S) ensures the exact installation position of the shaft seal ring.

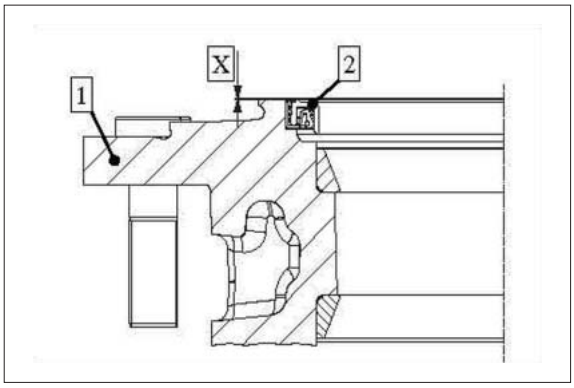
※ Wet outer diameter of the shaft seal ring with Loctite no. 574.



17W98RA108

(7) Legend to sketch:

1 = Hub
2 = Shaft seal ring
X = Installation dimension – shaft seal ring
..... $2.5^{+0.5}$ mm

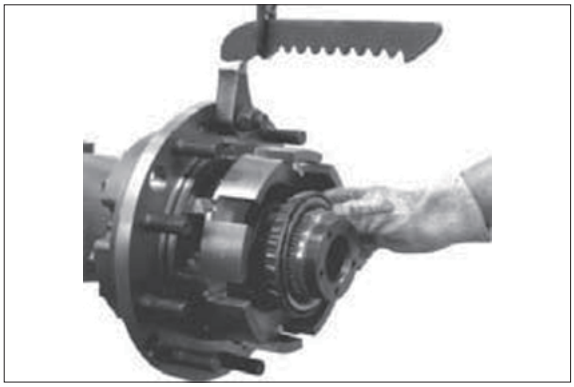


17W98RA109

(8) Mount preassembled hub until contact is obtained and fix it with heated tapered roller bearing.

(S) Lifting bracket 5870 281 043

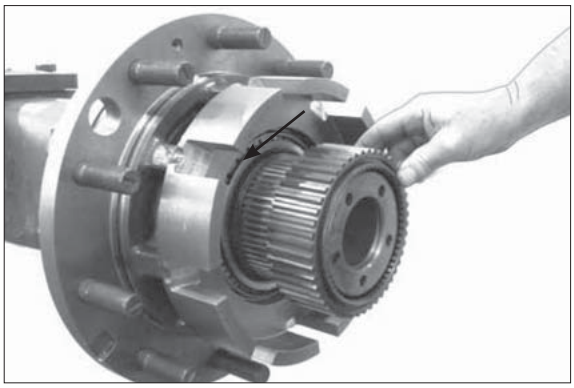
※ Just before fitting, wet sealing lips of shaft seal ring with lubricant.



17W98RA110

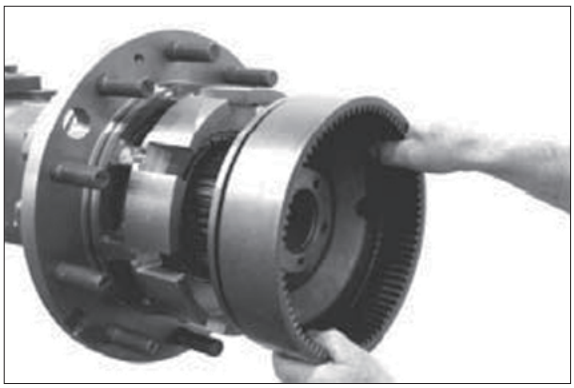
(9) Oil O-ring and insert it into the annular groove (see arrow) of the hub carrier.

Then mount disk carrier.



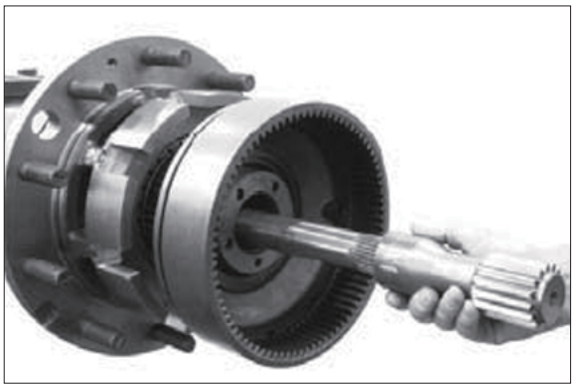
17W98RA111

(10) Bring disk carrier and hub bearing into contact position (figure no. RA112 ... RA115) :
Mount ring gear (without sealing elements).



17W98RA112

(11) Insert stub shaft and sun gear shaft for supporting the socket wrench (see following figure).



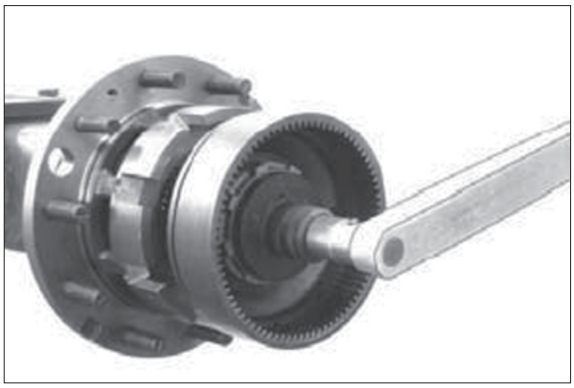
17W98RA113

(12) Bring hub bearing into contact position for this purpose tighten slotted nut with a tightening torque of 1400 Nm max.

(S) Socket wrench 5870 656 097

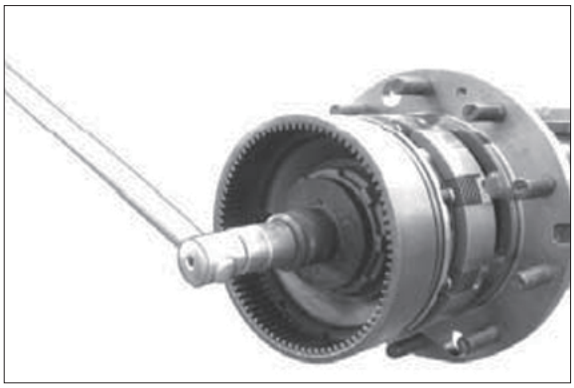
※ While tightening the slotted nut rotate hub in both directions several times roller setting.

※ Apply lubricant to thread of knuckle housing/slotted nut.



17W98RA114

(13) Loosen slotted nut and remove ring gear.

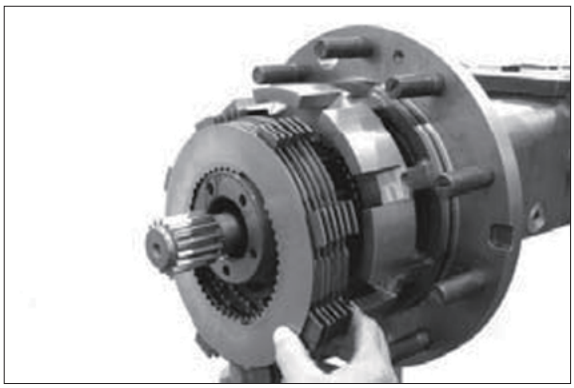


17W98RA115

(14) Multi-disk brake

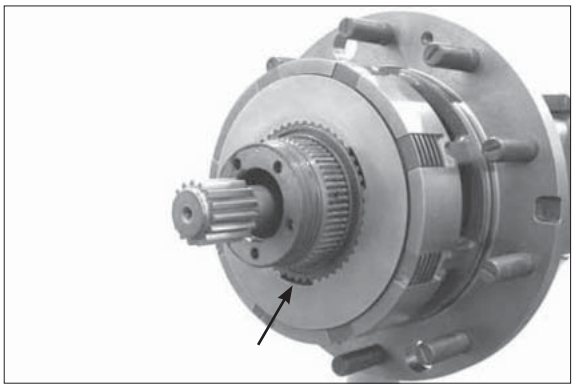
Mount outer and inner disks of the disk package alternately, starting with an outer disk.

※ For the actually required disk fitting/ arrangement please refer to the corresponding spare parts list.



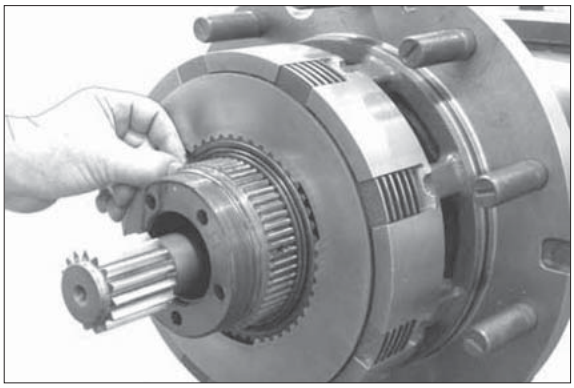
17W98RA116

(15) Bring inner clutch disks into a position where one of the tooth recesses is in 6 o'clock position after installation of the axle into the vehicle.



17W98RA117

(16) Oil O-ring and place it into the annular groove of the disk carrier.



17W98RA118

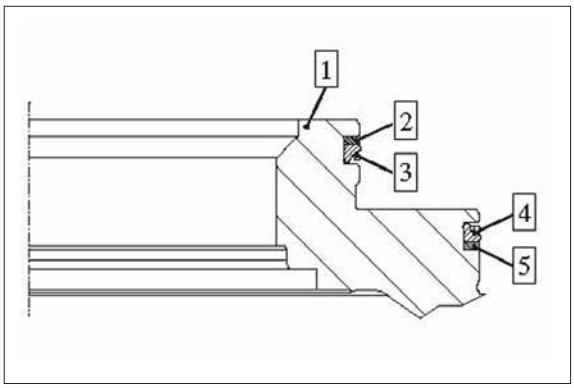
(17) Oil grooved and back-up rings and insert them into the annular grooves of the ring gear.

※ Observe installation position, see sketch below.

17W98RA119

(18) Legend to sketch:

1 = Ring gear
2 = Back-up ring
3 = Grooved ring
4 = Grooved ring
5 = Back-up ring



17W98RA120

(19) Fit cylindrical pins into the piston, considering the installation dimension "X".

X = Installation dimension . . . . . .16.00 mm

17W98RA121

(20) Mount piston onto ring gear.

17W98RA122

(21) Fix piston with "new" hexagon screws (1), spring sleeves (2) and compression springs (3 and 4).

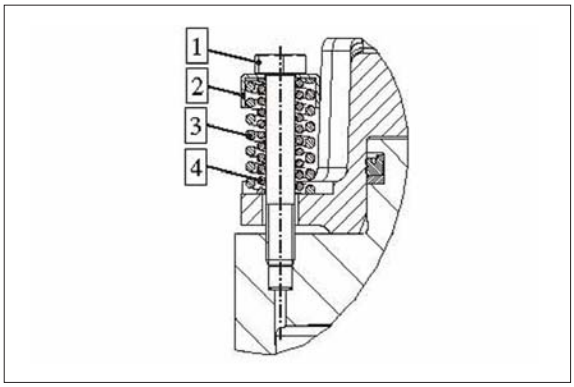
Tightening torque (M 6/8.8) . . . . . MA = 8 Nm

※ Use hexagon screws just once.

17W98RA123

(22) Legend to sketch:

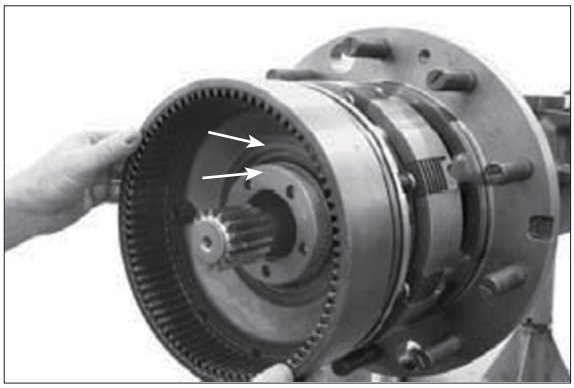
1 = Hexagon screw (special version)
2 = Spring sleeve
3 = Compression spring
4 = Compression spring



17W98RA124

(23) Mount preassembled ring gear, considering the installation position (markings O in 12 o'clock position – see arrows).

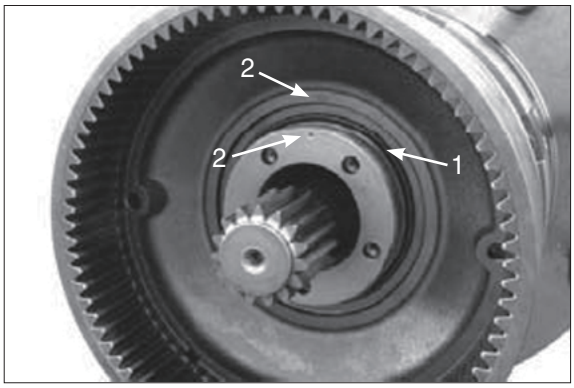
※ Ensure exact toothing position of oil supply holes – hub carrier/ring gear (pressure oil supply to brake piston).



17W98RA125

(24) Oil O-ring and insert it into the recess (see arrow 1).

※ Arrows (2) show once more the markings O and the installation position of hub carrier and ring gear.



17W98RA126

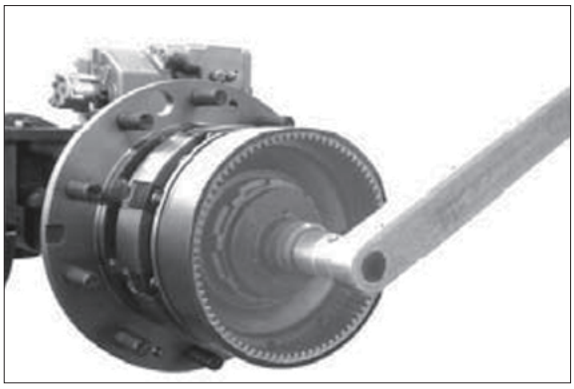
(25) Fix ring gear with slotted nut.

Tightening torque (M110 × 1.5) . . . . . MA = 1400 + 600 Nm

(S) Socket wrench 5870 656 097

※ Pretighten slotted nut with 1400 Nm, then continue tightening the slotted nut until a fixing hole overlaps a threaded hole in the knuckle housing.
While tightening the slotted nut rotate hub in both directions several times – roller setting.

※ Apply lubricant to thread of knuckle housing/slotted nut.



17W98RA127

(26) Leakage test of multi-disk brake

Fit breather (arrow) and threaded coupling (S), then connect HP pump.

(S) HP pump 5870 287 007
(S) Threaded coupling (M14 × 1.5) 5870 950 102
(S) Breather bottle 5870 286 072

※ Breathe brake completely before starting the test.

Test media :
Motor oils SAE-10W

High-pressure test:
Build up test pressure p = 100 bar and close shut-off valve of HP pump.
A maximum pressure drop of 3 bar is permissible during a 5-minute test.

Low-pressure test:
Reduce test pressure to p = 5 bar and close shut-off valve.
No pressure drop is allowed during a 5-minute test.

17W98RA128

(27) Adjustment and check of piston stroke

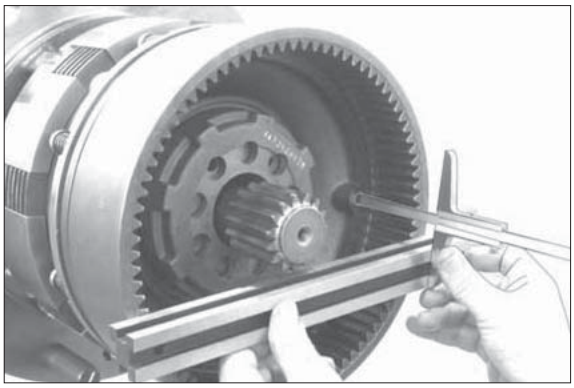
Piston stroke / disk clearance =
0.7 ... 1.3 mm

Build up brake pressure (100 bar) and close shut-off valve of HP pump.

Determine dimension "A", from face of the ring gear (1) through the measuring hole (see also sketch 43) to the face of the piston (3).

Dim. "A" e.g. . . . . 83.10 mm

※ Breathe brake completely before starting the measuring operation.

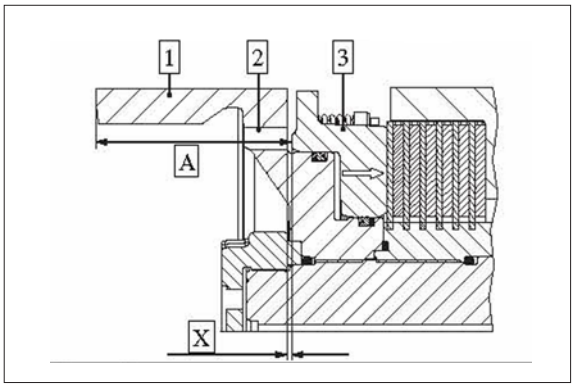


17W98RA129

(28) Then open shut-off valve of HP pump and release pressure from brake (piston return via compression springs).

Determine dimension "B", from the face of the ring gear (1) through the measuring hole (see also sketch RA131) to the face of the piston (3).

Dimension "B" e.g . . . . . 82.10 mm



17W98RA130

(29) Calculation example :

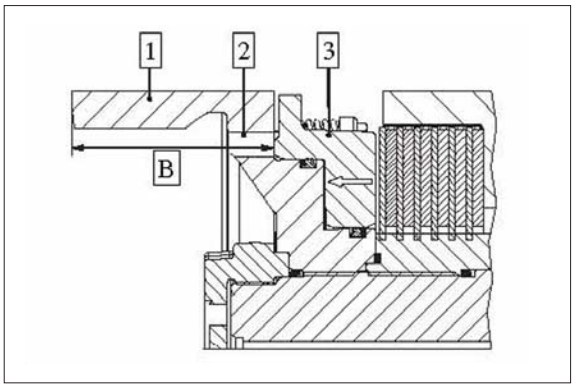
Dimension „A“ e.g. . . . . 83.10 mm
Dimension „B“ e.g. . . . . - 82.10 mm
Difference = piston stroke = 1.00 mm

※ If the required piston stroke (0.7 ... 1.3 mm) is not achieved, correct it with (a) corresponding inner clutch disk(s) – see respective spare parts list.

Then remove HP pump (S), breather bottle (S) and threaded coupling (S).

Legend to sketches RA130 and RA131:
1 = Ring gear
2 = Measuring hole
3 = Piston
X = Piston stroke/disk clearance

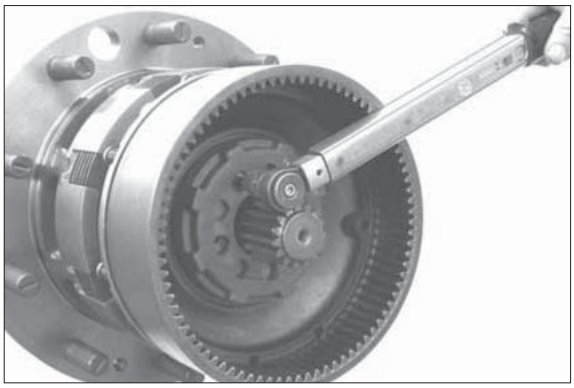
(S) Straightedge 5870 200 022



17W98RA131

(30) Secure slotted nut with cylindrical screw (see also figure RA127).

Tightening torque (M 10/8.8) . . . . . MA = 32 Nm



17W98RA132

(31) Planetary carrier

Press thrust washer into the planetary carrier until contact is obtained.

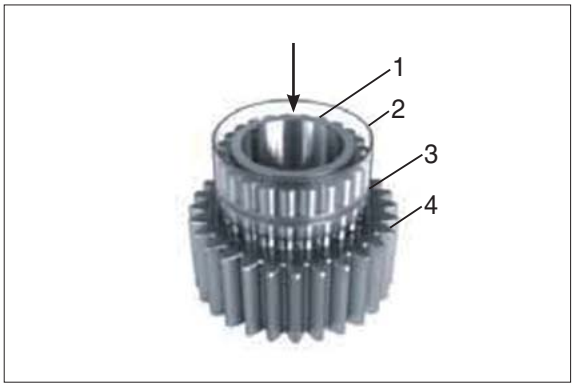
(S) Driver tool 5870 048 263

17W98RA133

(32) Insert the cylindrical roller bearing into the planetary gear – for this purpose press the cylindrical roller bearing through the packaging sleeve until the snap ring engages into the annular groove of the planetary gear.

※ Use packaging sleeve to facilitate assembly.

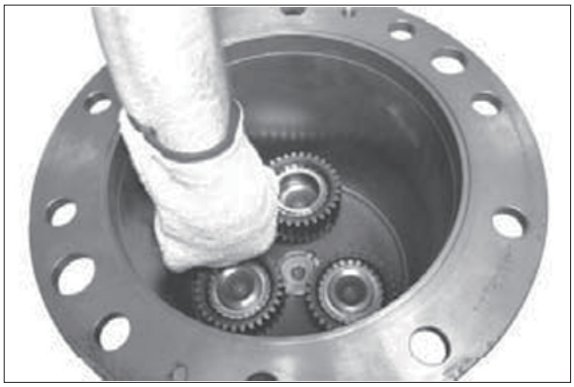
1 = Cylindrical roller bearing
2 = Packaging sleeve
3 = Snap ring
4 = Planetary gear



17W98RA134

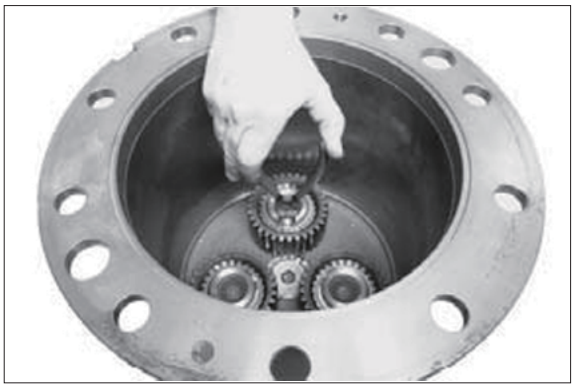
(33) Heat up bearing inner ring and mount preassembled planetary gear until contact is obtained.

※ Mount bearing inner ring with the large radius facing the planetary carrier (downwards).



17W98RA135

(34) Fix planetary gear by means of retaining ring.



17W98RA136

(35) Mount preassembled planetary carrier and fix it with hexagon screws.

Tightening torque (M12/8.8) . . . . . MA = 55 Nm

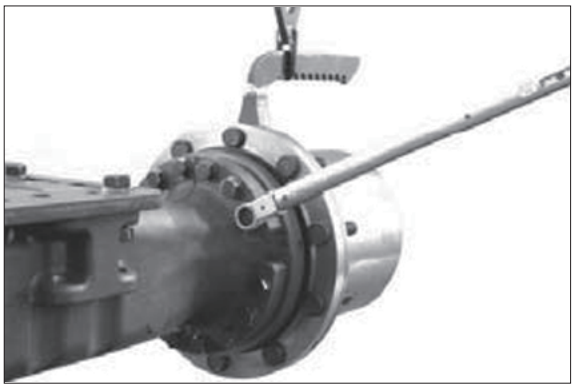
17W98RA137

(36) Output assy

Use lifting tackle (S) to locate the output assy at the axle, mount stub shaft into the teeth of the axle bevel gear and fix output assy with hexagon screws.

Tightening torque (M16/10.9) . . . . . MA = 280 Nm

(S) Lifting bracket 5870 281 043



17W98RA138

※ Prior to putting the axle into operation, fill in oil.

Observe the vehicle manufacturer's instructions and specifications for the installation and commissioning of the unit.

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.

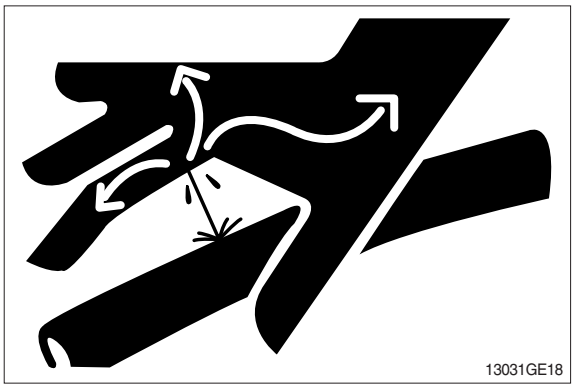
(4) Loosen the socket bolt (1).
Tightening torque : 1.05 ± 0.2 kgf · m
(7.6 ± 1.45 lbf · ft)

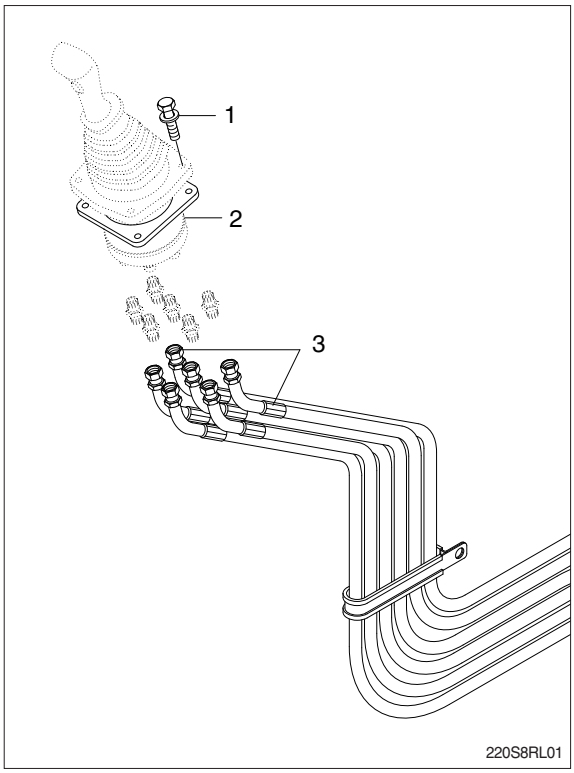
(5) Remove the cover of the console box.

(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.





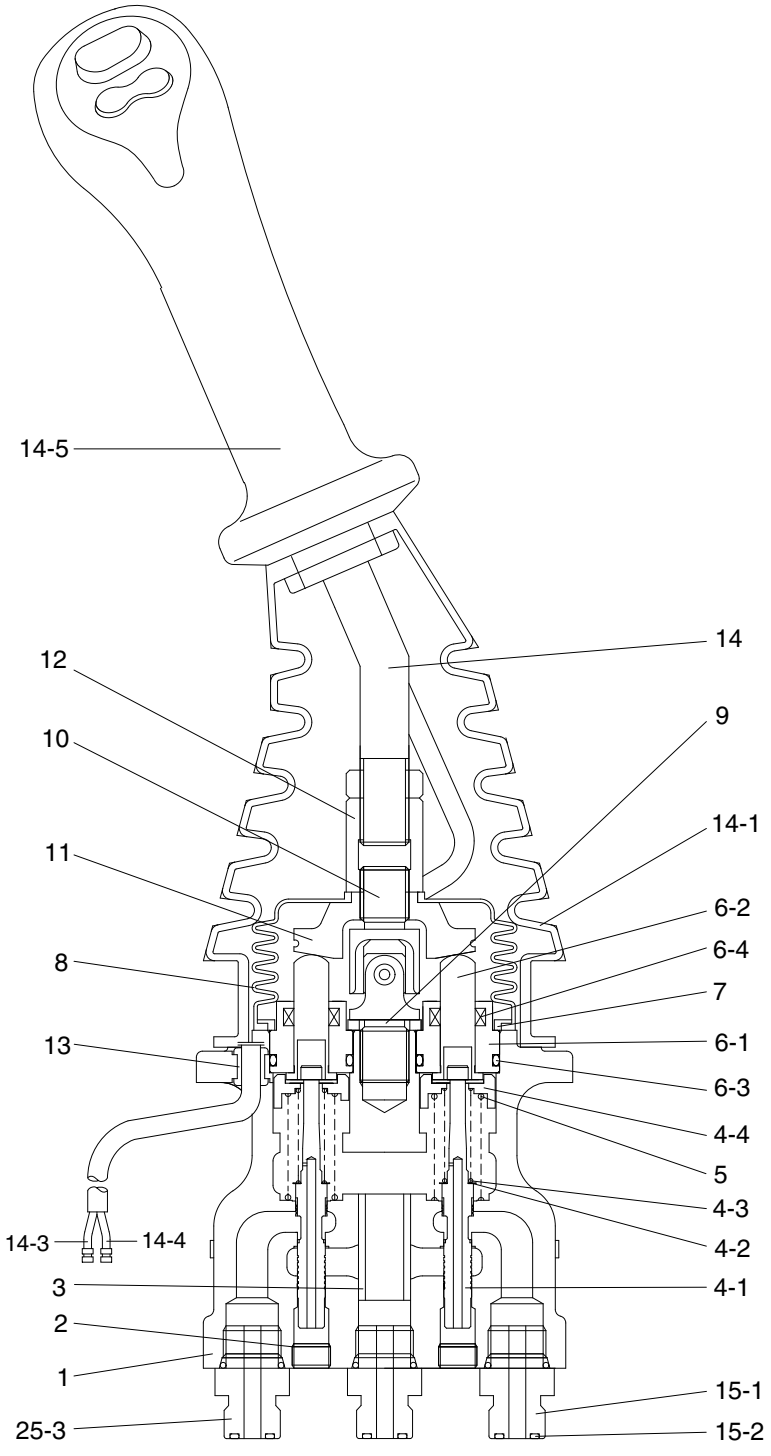
2) INSTALL

(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

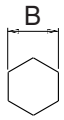


140WA2RL06

1	Case	5	Spring	9	Spacer	14-3	Housing
2	Plug	6-1	Plug	10	Joint Assy	14-4	Housing
3	Bushing	6-2	Push rod	11	Swash plate	14-5	Handle
4-1	Spool	6-3	O-ring	12	Adjusting nut	14-6	Lock nut
4-2	Shim	6-4	Rod seal	13	Bushing	15-1	Filter
4-3	Spring	7	Spacer	14-1	Boot	15-2	Connector
4-4	Spring seat	8	Boot	14-2	Spring pin	15-3	Connector

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tool name	Remark	
Allen wrench	6	
Spanne	22	
	27	
(+) Driver	Length 150	
(-) Driver	Width 4~5	
Torque wrench	Capable of tightening with the specified torques	

(2) Tightening torque

Part name	Item	Size	Torque	
			kgf · m	lbf · ft
Joint	10	M14	3.5	25.3
Swash plate	11	M14	5.0±0.35	36.2±2.5
Adjusting nut	12	M14	5.0±0.35	36.2±2.5
Lock nut	14-6	M14	5.0±0.35	36.2±2.5

3) DISASSEMBLY

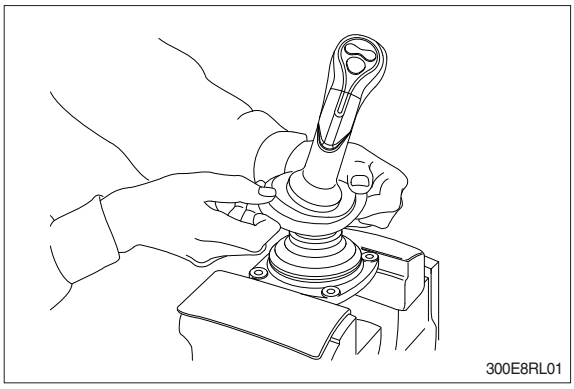
※ Procedures are based on the type M25.

(1) Clean pilot valve with kerosene.

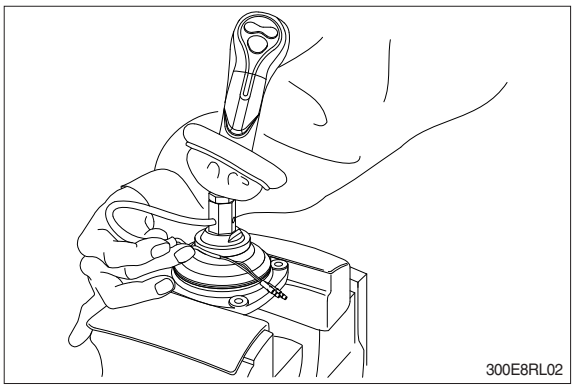
※ Put blind plugs into all ports

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

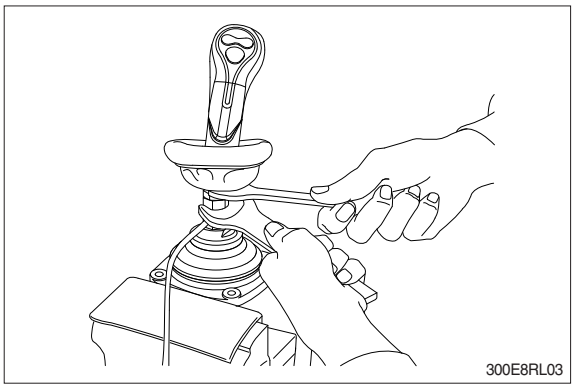
(3) Remove end of boot (14-1) from case (1) and take it out upwards.



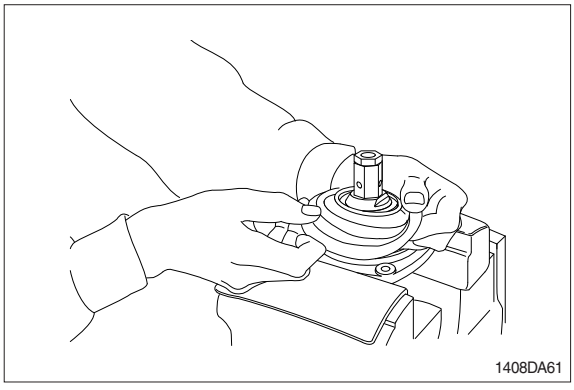
※ For valve with switch, remove cord also through hole of casing.



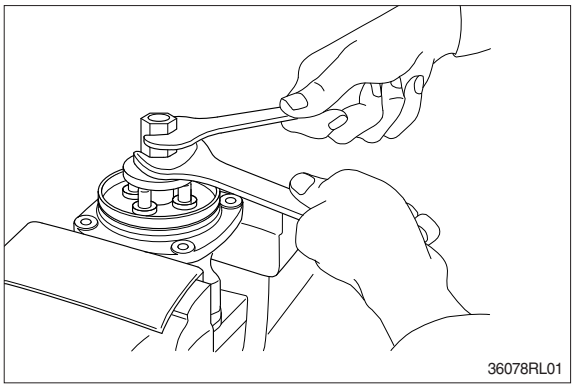
(4) Loosen lock nut (14-6) and adjusting nut (12) with spanners on them respectively, and take out handle section as one body.

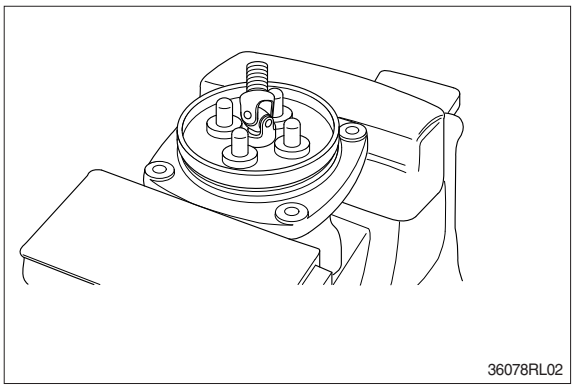


(5) Remove the boot (8).



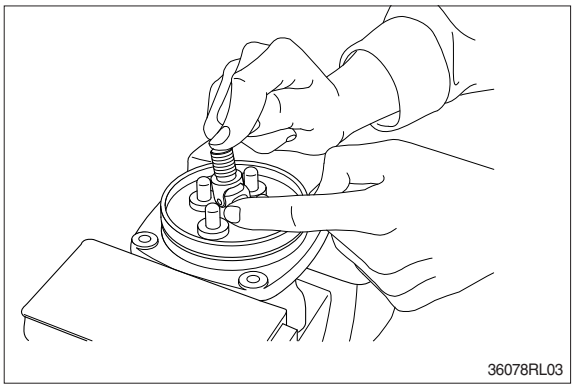
(6) Loosen adjusting nut (12) and swash plate (11) with spanners on them respectively, and remove them.

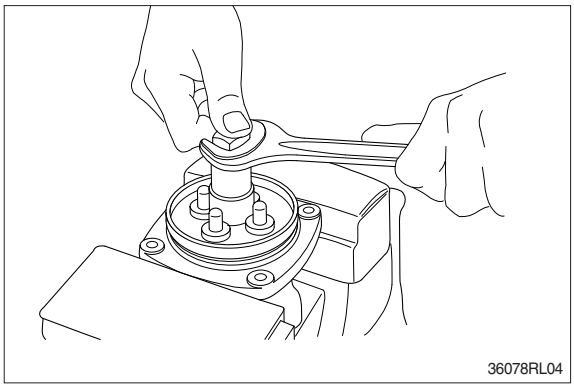




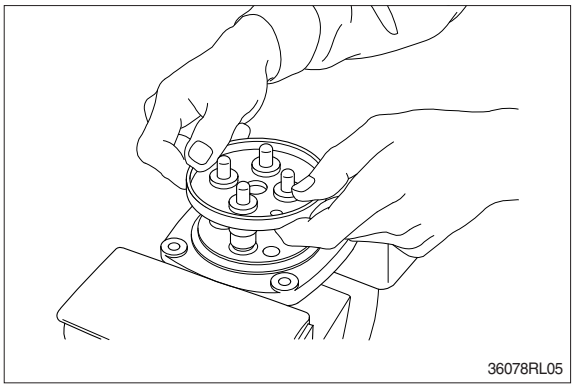
(7) Turn joint anticlockwise to loosen it, utilizing jig (Special tool).

※ When return spring (5) is strong in force, plate (7), plug (6-1) and push rod (6-2) will come up on loosening joint.
Pay attention to this.





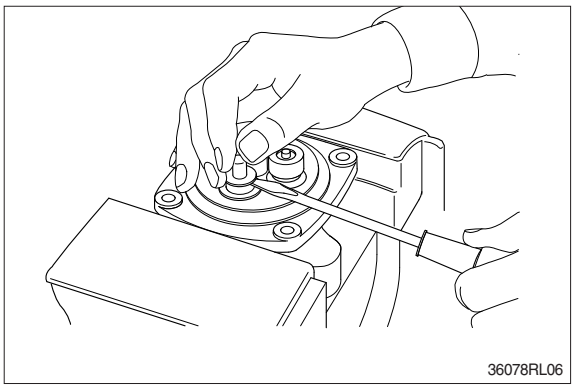
(8) Remove plate (7-1).



(9) When return spring (5) is weak in force, plug (6-1) stays in casing because of sliding resistance of O-ring.

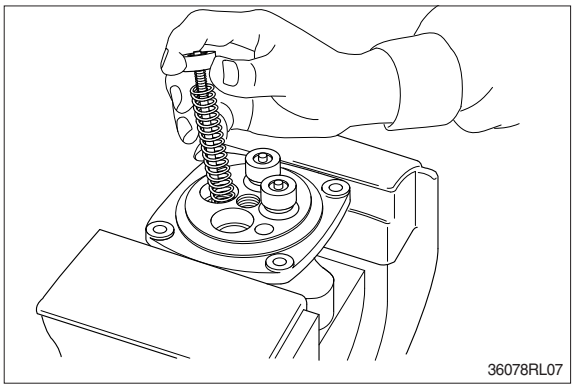
※ Take it out with minus screwdriver.
Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.

※ During taking out, plug may jump up due to return spring (5) force.
Pay attention to this.



(10) Remove reducing valve subassembly and return spring (5) out of casing.

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

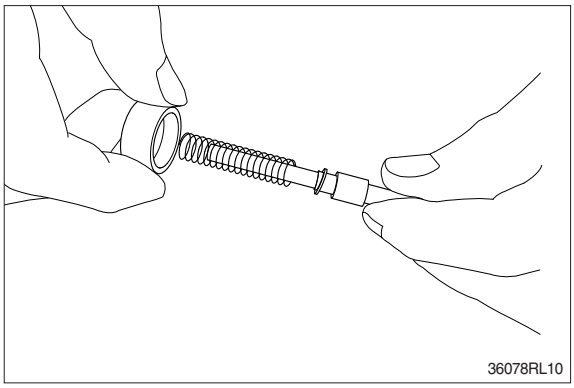


(11) Separate spool (4-1), spring seat (4-4), spring (4-3) and shim (4-2) individually.

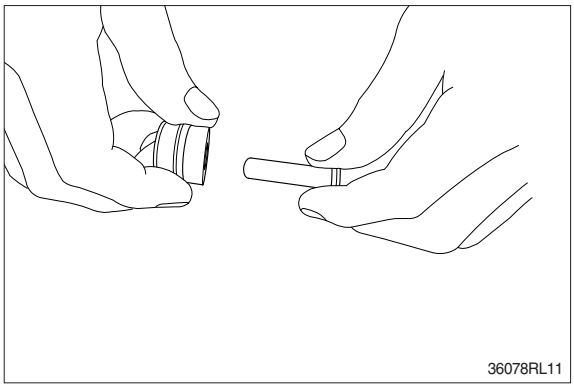
※ Pay attention not to damage spool surface.

※ Record original position of spring seat (4-4).

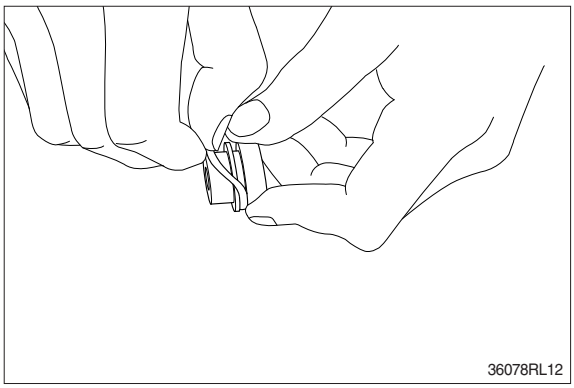
※ Until being assembled, they should be handled as one subassembly group.

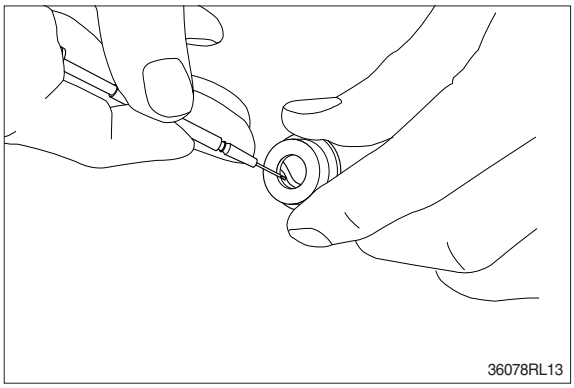


(12) Take push rod (6-2) out of plug (6-1).

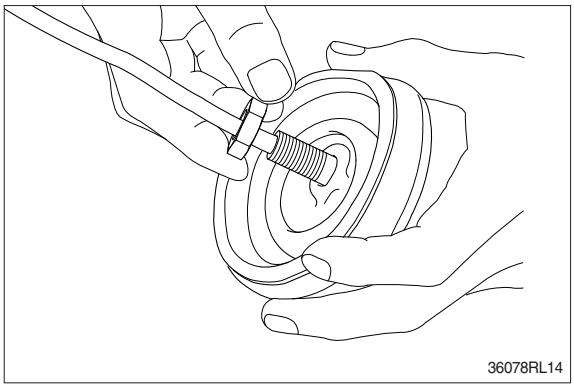


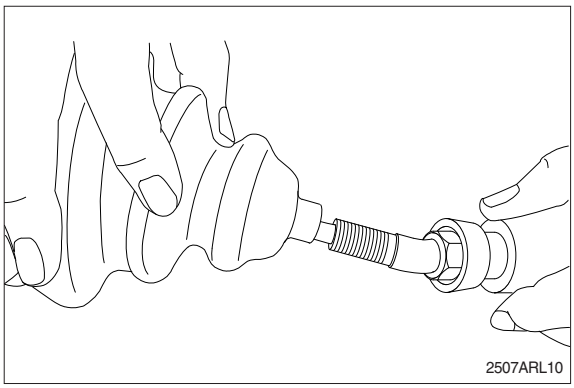
(13) Remove O-ring (8-3) and seal (6-4) from plug (6-1).
Use small minus screwdriver or so on to remove this seal.





(14) Remove lock nut (14-6) and then boot (14-1).





(15) 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.

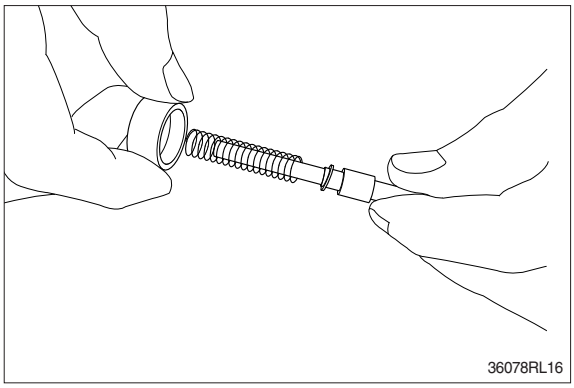
(16) Rust prevention of parts

Apply rust-preventives to all parts.

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

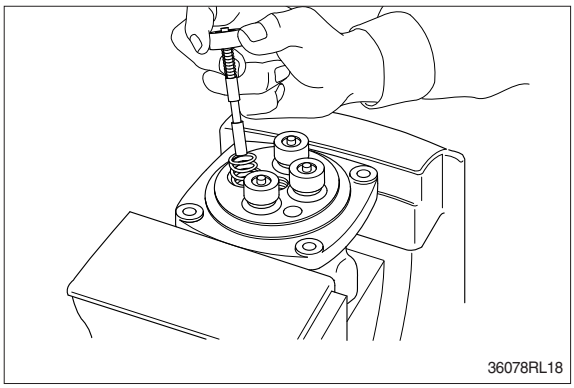
4) ASSEMBLY

(1) Put shim (4-2), springs (4-3) and spring seat (4-4) onto spool (3) in this order.

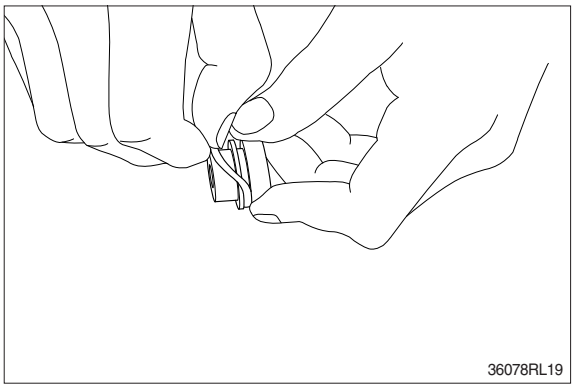


(2) Assemble spring (5) into casing (1). Assemble reducing valve subassembly into casing.

※ Assemble them to their original positions.

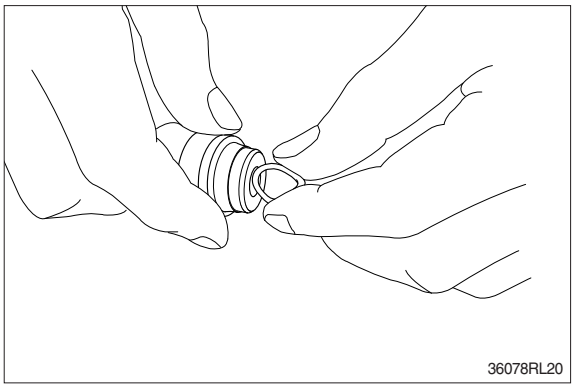


(3) Assemble O-ring (8-3) onto plug (6-1).

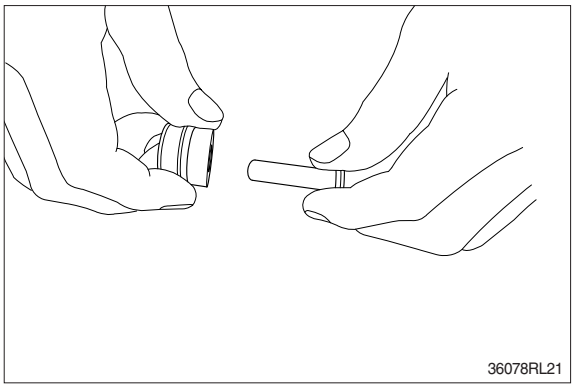


(4) Assemble seal (6-4) to plug (6-1).

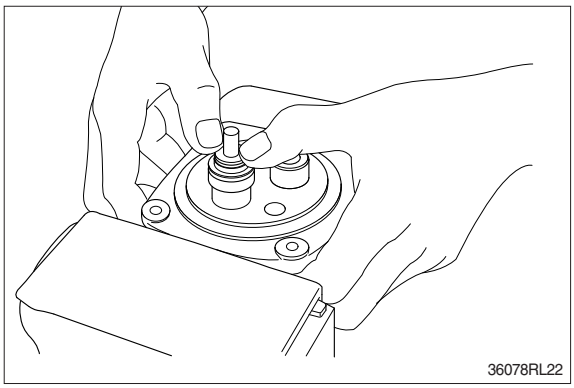
※ Assemble seal in such lip direction as shown below.



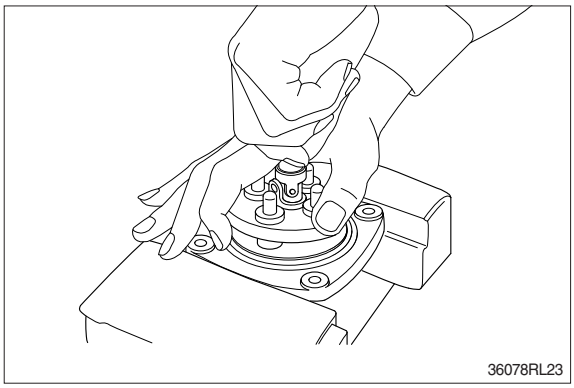
(5) Assemble push rod (6-2) to plug (6-1).
※ Apply working oil on push-rod surface.



(6) Assemble plug subassembly to casing.
※ When return spring is weak in force, subassembly stops due to resistance of O-ring.

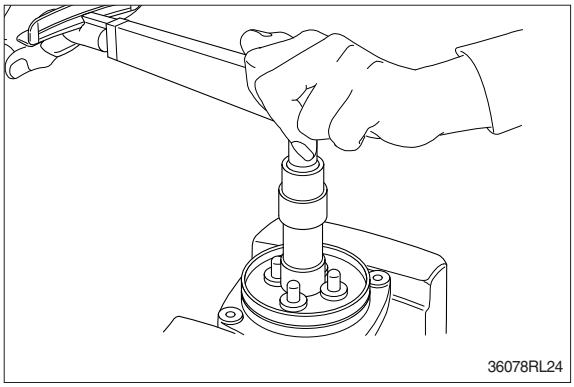


(7) When return spring is strong in force, assemble 4 sets at the same time, utilizing plate (7), and tighten joint (10) temporarily.



(8) Fit plate (7).

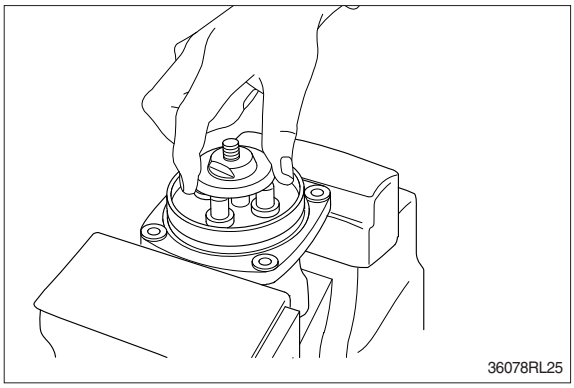
(9) Tighten joint (10) with the specified torque to casing, utilizing jig.



(10) Assemble swash plate (11) to joint (10).

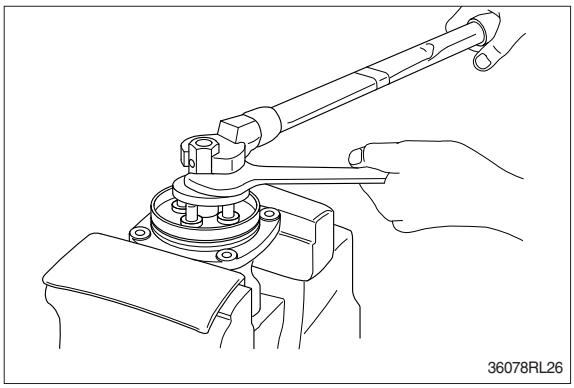
※ Screw it to position that it contacts with 4 push rods evenly.

※ Do not screw it over.

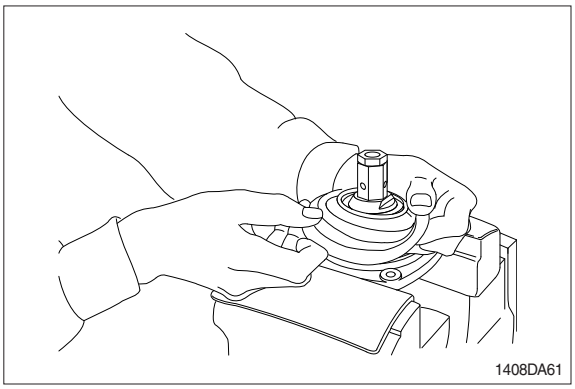


(11) Assemble adjusting nut (12), apply spanner to width across flat of plate (11) to fix it, and tighten adjusting nut to the specified torque.

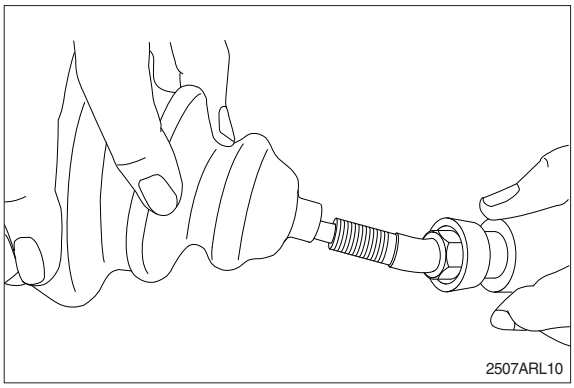
※ During tightening, do not change position of disk.

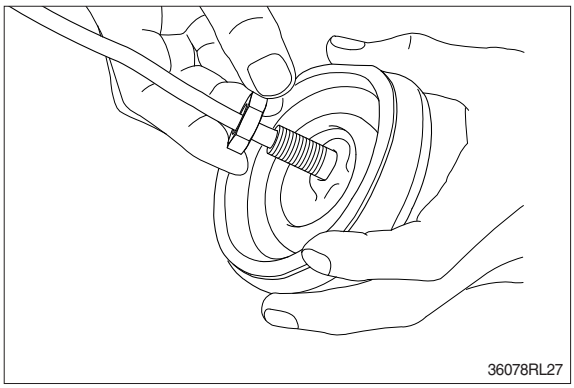


(12) Fit boot (8) to plate.

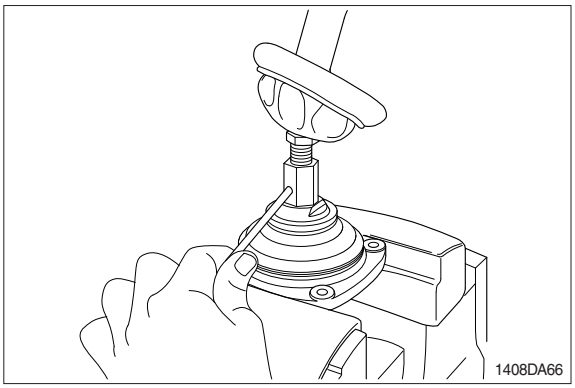


(13) Fit boot (14-1) and lock nut (14-6), and handle subassembly is assembled completely.



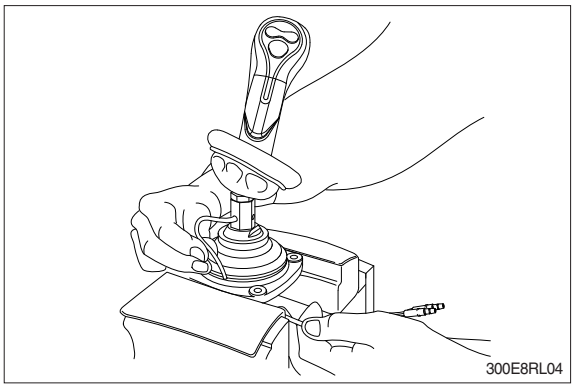


(14) Pull out cord and tube through adjusting nut hole provided in direction 60 ° to 120 ° from casing hole.

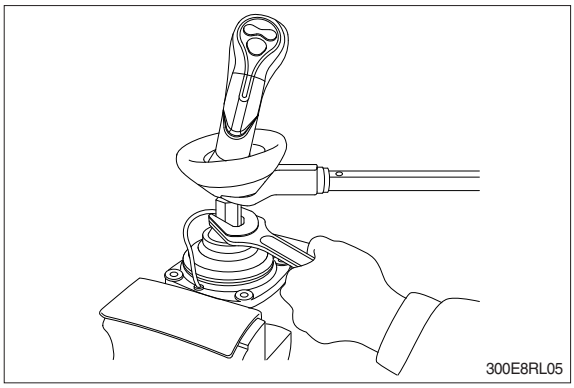


(15) Assemble bushing (13) to plate and pass cord and tube through it.

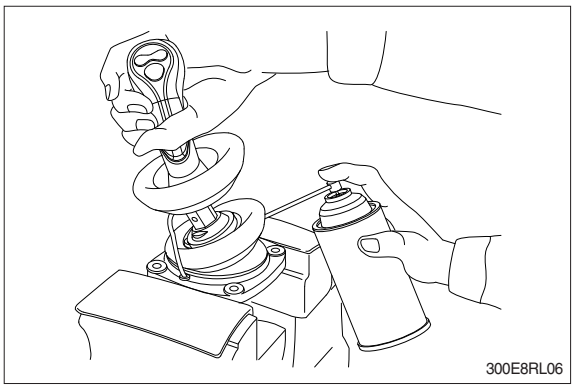
※ Provide margin necessary to operation.



(16) Determine handle direction, tighten lock nut (14-6) to specified torque to fix handle.

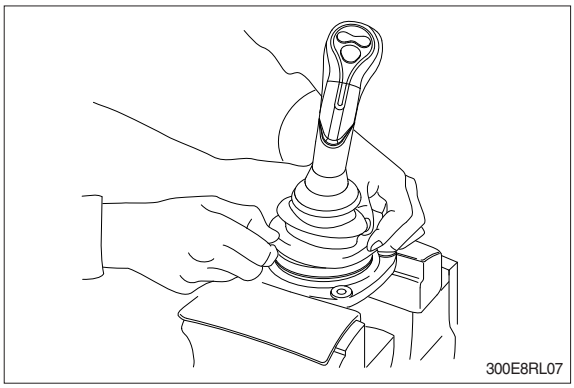


(17) Apply grease to rotating section of joint and contacting faces of disk and push rod.



(18) Assemble lower end of bellows to casing.

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



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.

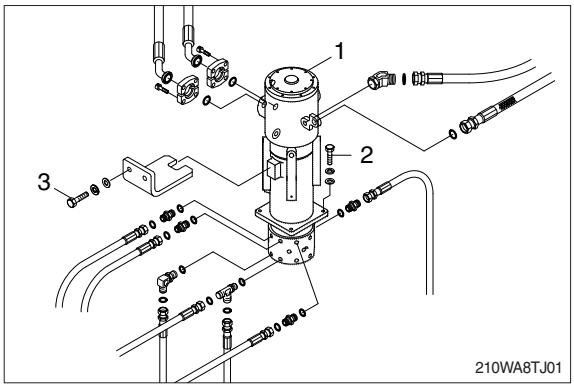
(4) Disconnect all hoses.

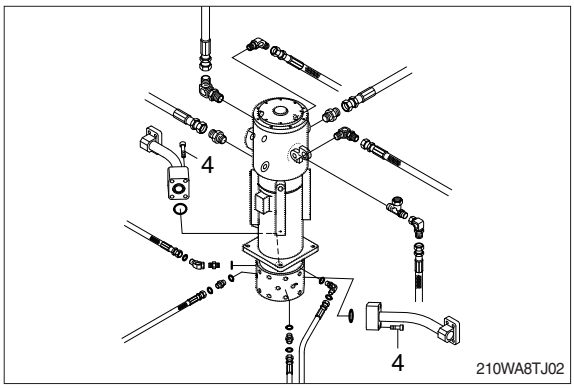
(5) Sling the turning joint assembly (1) and remove the mounting bolt (2, 3).
- Weight : 118 kg (260 lb)
- Tightening torque : 12.8 ± 3.0 kgf · m (92.6 ± 21.7 lbf · ft)

(6) Loosen the socket bolts (4) and remove the pipes.

(7) Remove the turning joint (1) assembly.

※ When removing the turning joint, check that all the hoses have been disconnected.





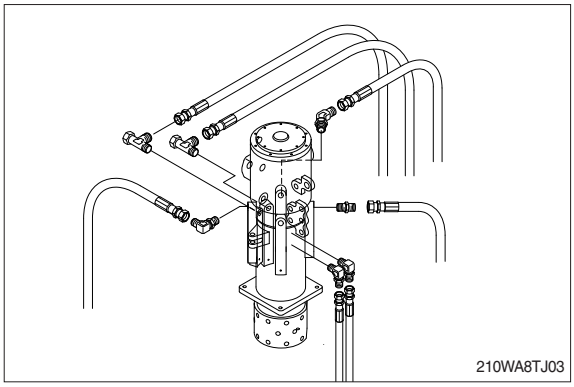
2) INSTALL

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

※ Take care of turning joint direction.

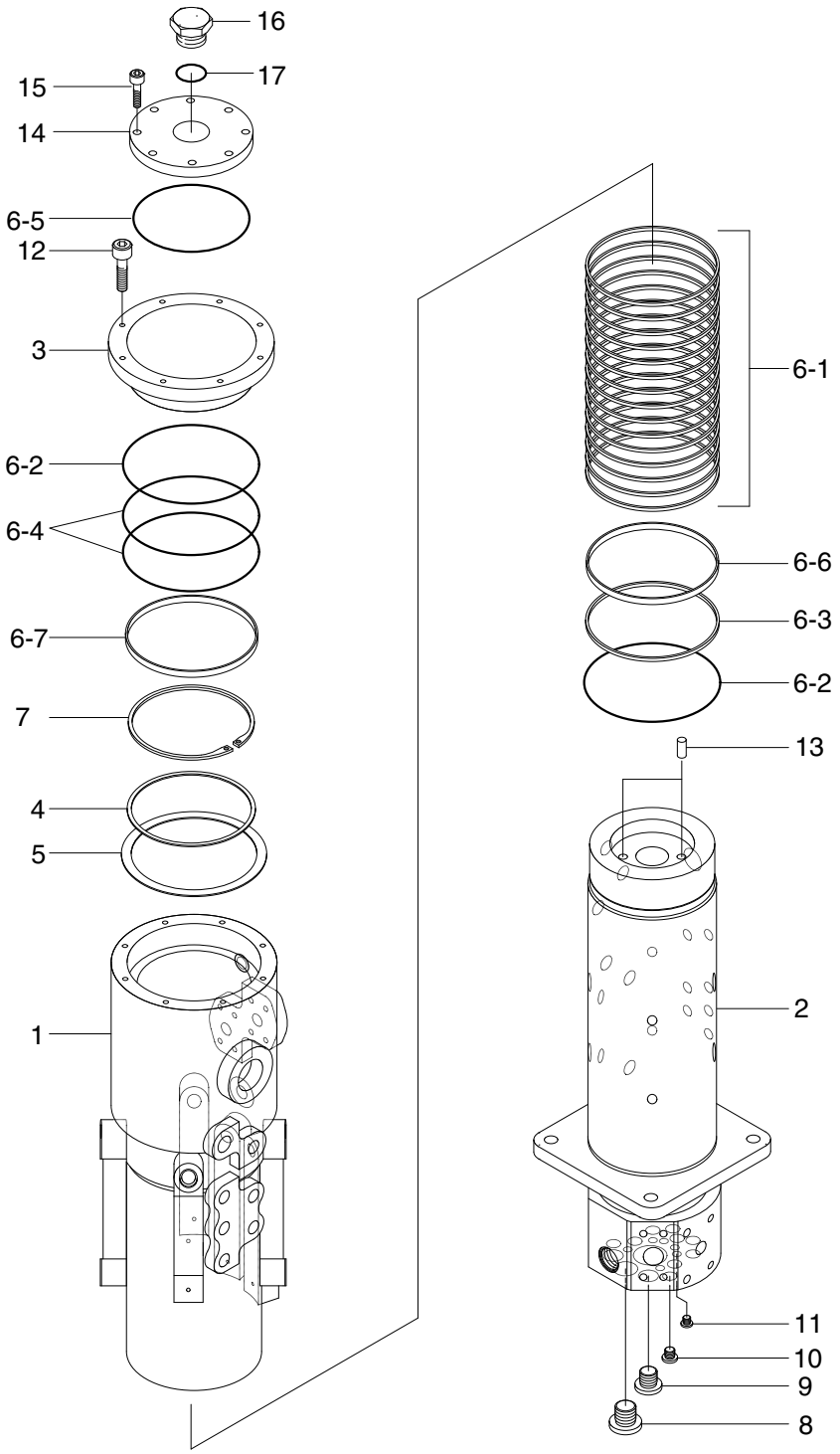
※ Assemble hoses to their original positions.

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



2. DISASSEMBLY AND ASSEMBLY

1) STRUCTURE



210WA8TJ04

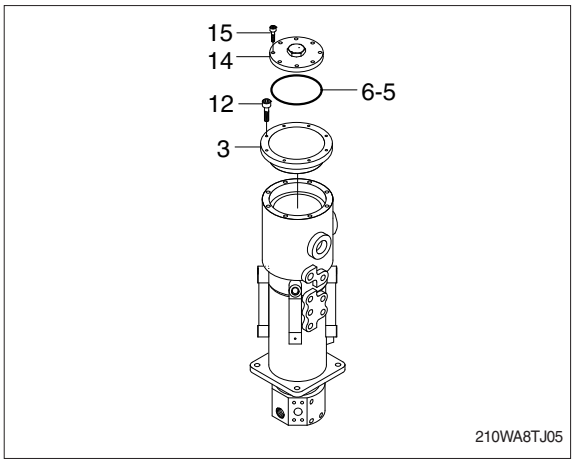
1	Hub	6-4	O-ring	11	Plug
2	Shaft	6-5	O-ring	12	Socket bolt
3	Cover	6-6	Wear ring	13	Spring pin
4	Spacer	6-7	Wear ring	14	Cover
5	Shim	7	Retainer ring	15	Bolt
6-1	Slipper seal	8	Plug	16	Plug
6-2	O-ring	9	Plug	17	O-ring
6-3	O-ring	10	Plug		

2) DISASSEMBLY

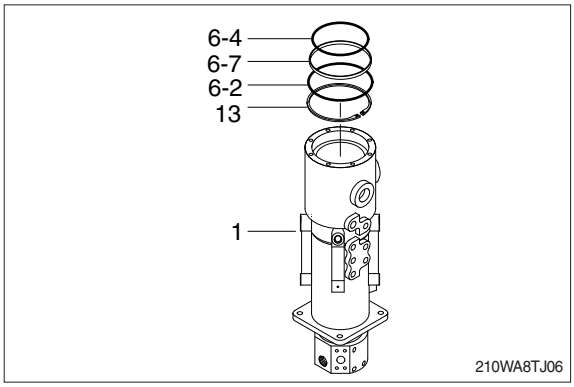
※ Before the disassembly, clean the turning joint.

(1) Loosen the hexagon bolt (15) and remove cover (14) and O-ring (6-5).

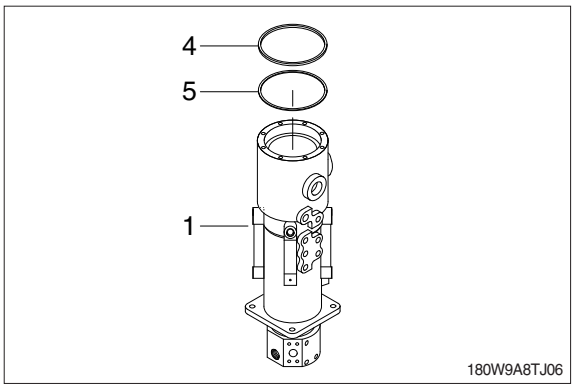
(2) Loosen the socket bolt (12) and remove cover (3).



(3) Remove O-ring (6-4), wear ring (6-7), O-ring (6-2) and retainer ring (7) from hub (1).



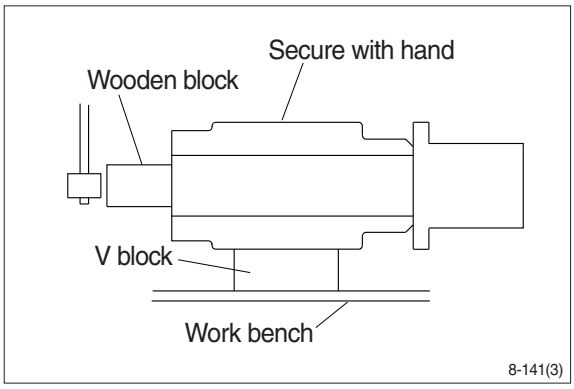
(4) Remove spacer (4) and shim (5) from hub (1).



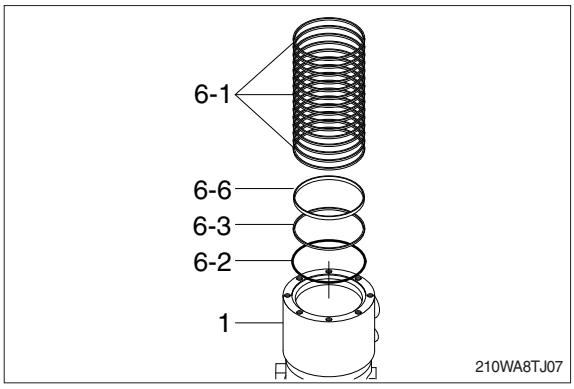
(5) Place hub (1) on a V-block and by using a wood buffer at the shaft end, hit out shaft (2) to about 1/2 from the hub with a hammer.

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

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



(6) Remove seventeen slipper seal (6-1), O-ring (6-2, 6-3) and wear ring (6-6) from hub (1).

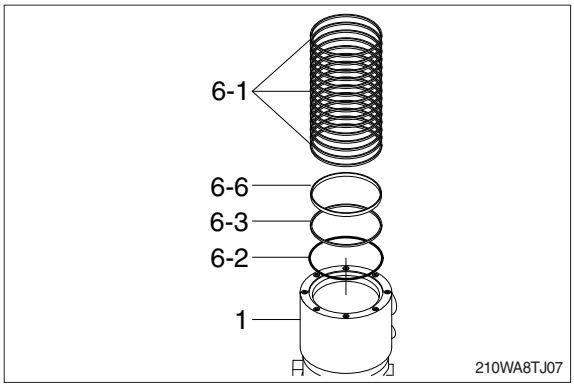


3) ASSEMBLY

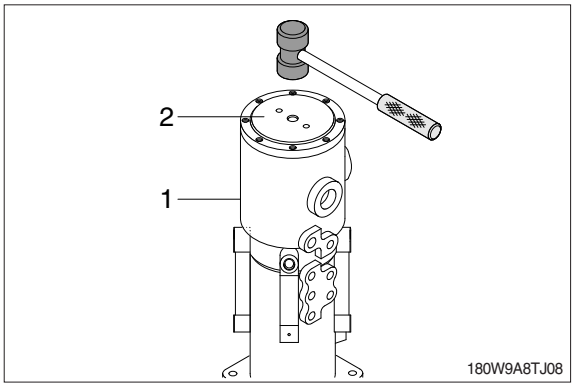
※ Clean all parts.
※ As a general rule, replace oil seals and O-ring.
※ Coat the sliding surfaces of all parts with engine oil or grease before installing.

(1) Fit O-ring (6-3), seventeen slipper seal (6-1), and wear ring (6-6).

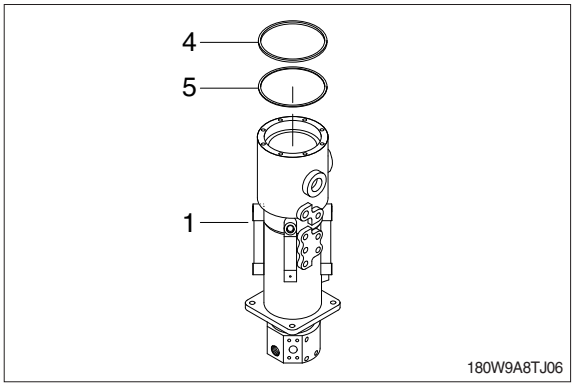
(2) Fit O-ring (6-2) to hub (1).



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

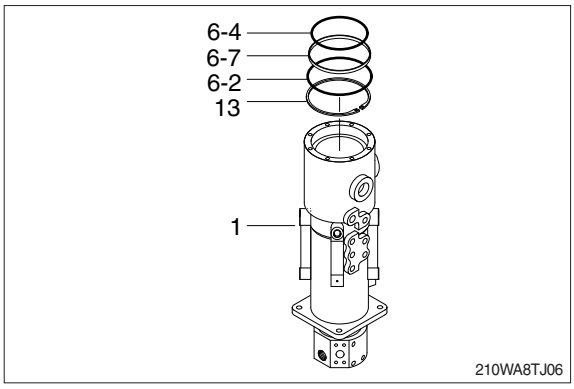


(4) Fit shim (5), and spacer (4) to hub (1) of turning joint upside.



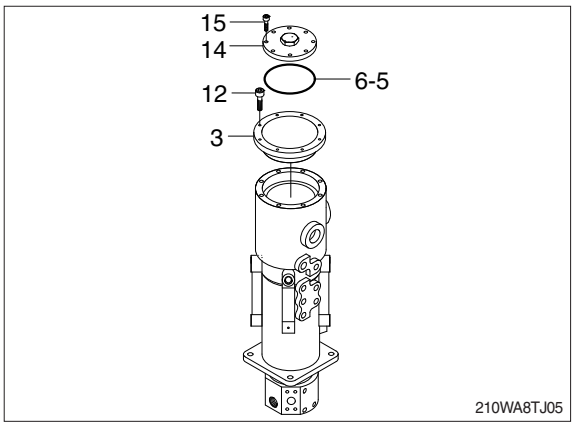
(5) Fit retainer ring (7), O-ring (6-2) and wear ring (6-7) to hub (1).

(6) Fit O-ring (6-4) to hub (1).



(7) Install cover (3) to hub and tighten bolts (12).
· Torque : 2.5~3.55 kgf · m
(18.1~25.3 lbf · ft)

(8) Attach O-ring (6-5) to the cover (14) and tighten the bolts (15).
· Torque : 0.7~1.1 kgf · m
(5.1~8.0 lbf · ft)



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.

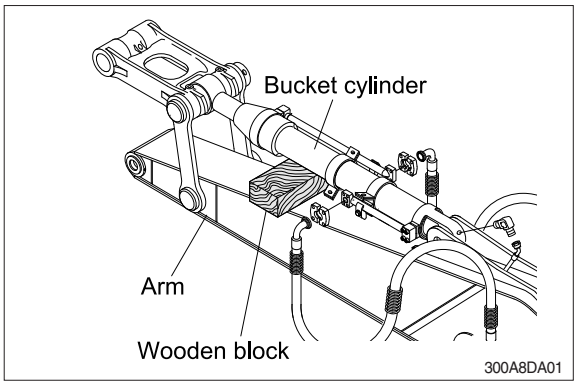
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

※ 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.

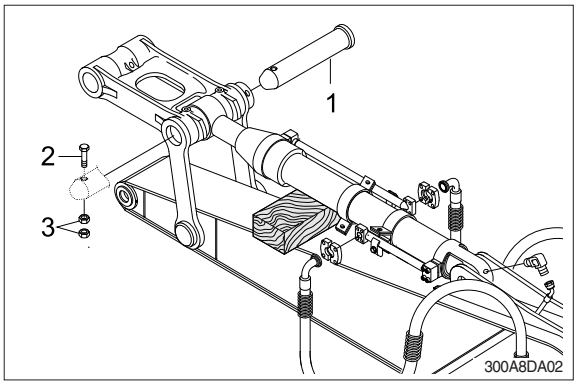
① Set block between bucket cylinder and arm.



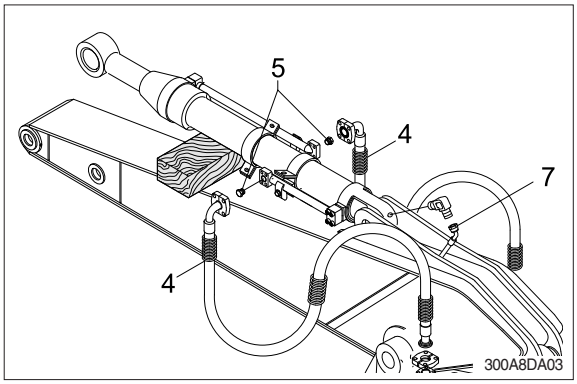
② Remove bolt (2), nut (3) and pull out pin (1).

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

· Tightening torque (2) : 57.9±8.7 kgf · m (419±62.9 lbf · ft)



③ Disconnect bucket cylinder hoses (4), grease line hose (7) and put plugs (5) on cylinder pipe.

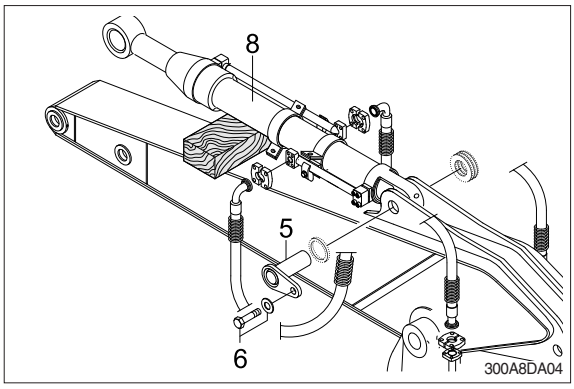


④ Sling bucket cylinder assembly (8) and remove bolt (6) then pull out pin (5).

· Tightening torque (6) : 29.7±4.5 kgf · m (215±32.5 lbf · ft)

⑤ Remove bucket cylinder assembly (8).

· Weight : 171 kg (380 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.

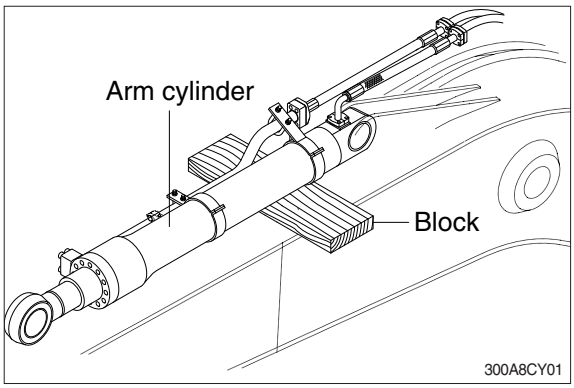
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

※ 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.

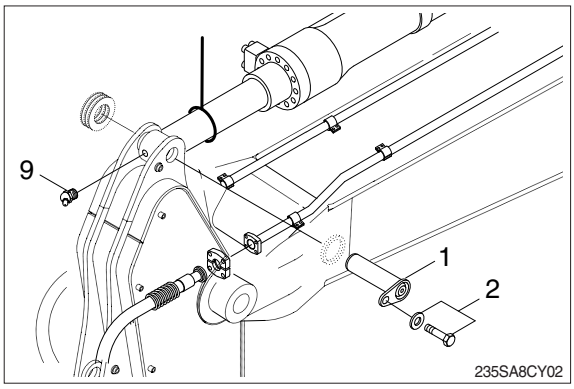


② Loosen grease nipple (9).

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

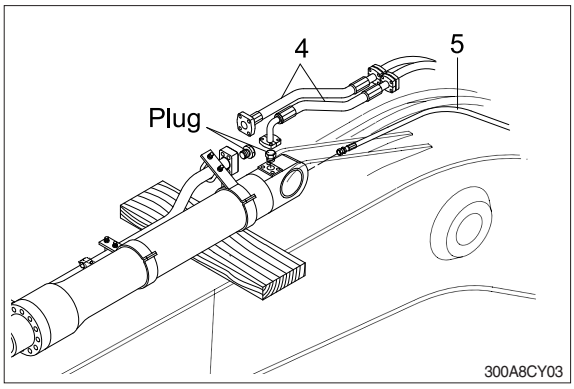
※ Tie the rod with wire to prevent it from coming out.

· Tightening torque (2) : 29.7±4.5 kgf · m (215±32.5 lbf · ft)



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

⑤ Disconnect greasing pipings (5).

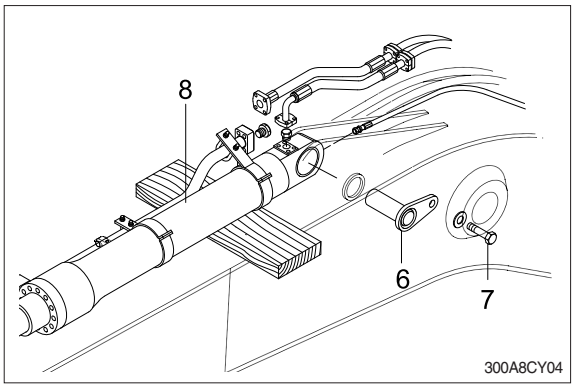


⑥ Sling arm cylinder assembly(8) and remove bolt (7) then pull out pin (6).

· Tightening torque (7) : 29.7±4.5 kgf · m (215±32.5 lbf · ft)

⑦ Remove arm cylinder assembly (8).

· Weight : 278 kg (613 lb)



(2) Install

① Carry out installation in the reverse order to removal.

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

※ Bleed the air from the arm cylinder.

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

3) BOOM CYLINDER

(1) Removal

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

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

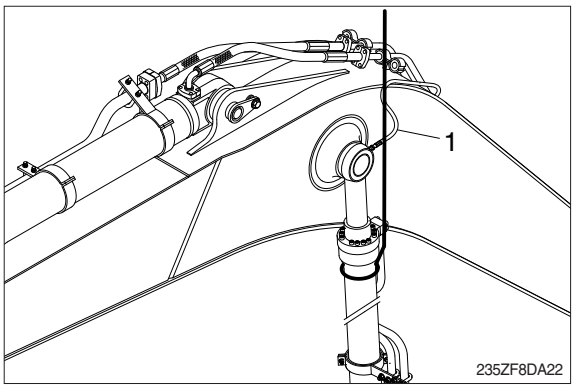
※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

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

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

① Disconnect greasing hoses (1).

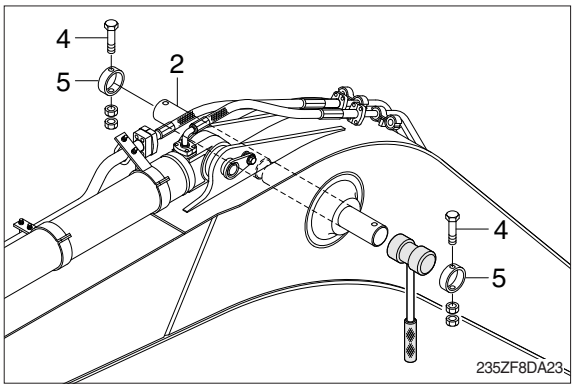
② Sling boom cylinder assembly.



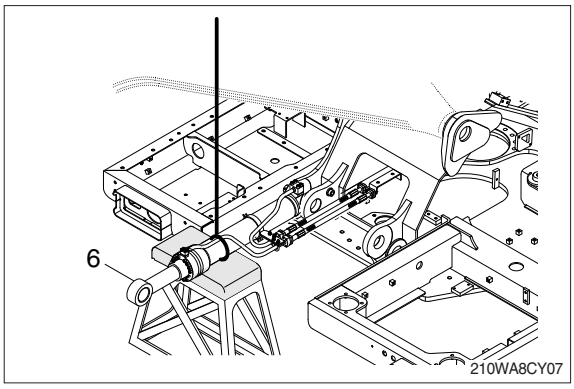
③ Remove bolt (4), stopper (5) and pull out pin (2).

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

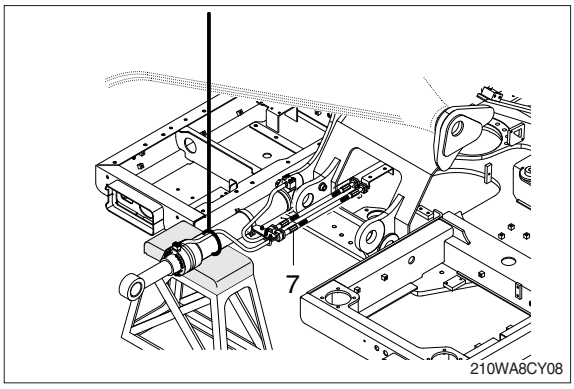
· Tightening torque (4) : 29.7±4.5 kgf · m (215±32.5 lbf · ft)



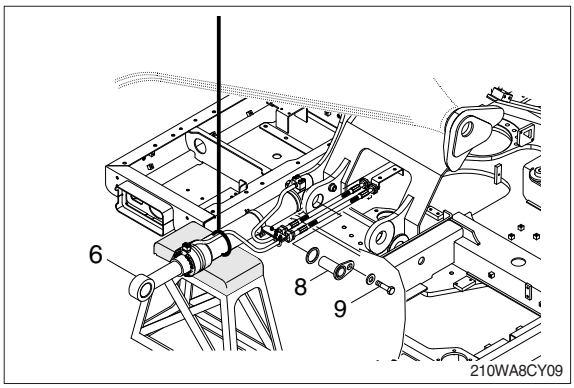
④ Lower the boom cylinder assembly (6) on a stand.



⑤ Disconnect boom cylinder hoses (7) and put plugs on cylinder pipe.



⑥ Remove bolt (9) and pull out pin (8).
· Tightening torque (9) : 29.7±4.5 kgf · m (215±32.5 lbf · ft)
⑦ Remove boom cylinder assembly (6).
· Weight : 180 kg (397 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.

4) DOZER CYLINDER

(1) Removal

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

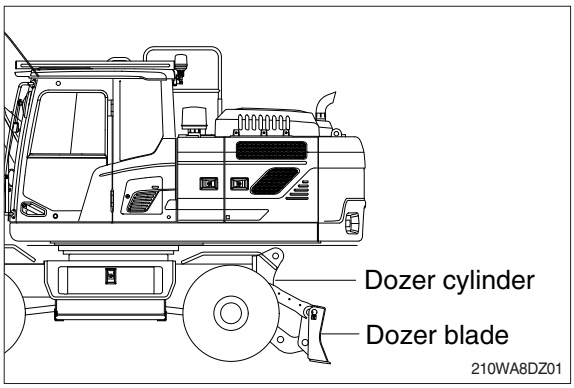
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

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

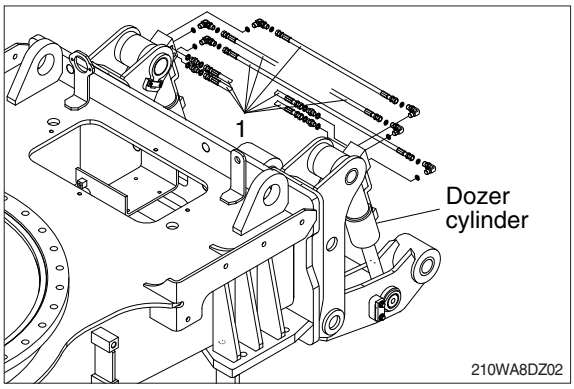
⚠ Escaping fluid under pressure can penetrate the skin causing serious injury.

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

① Lower the dozer blade to the ground.



② Disconnect dozer cylinder hoses (1), and put plugs on cylinder pipe.

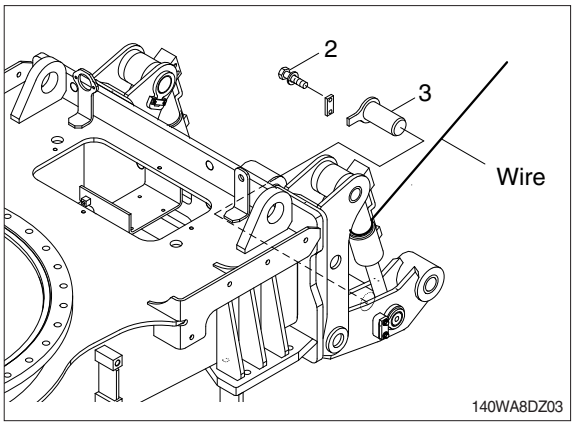


③ Sling dozer cylinder assembly.

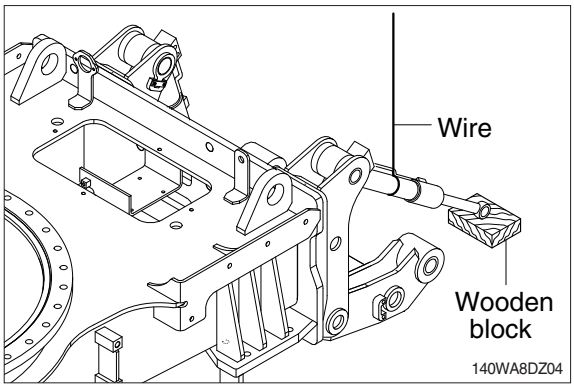
④ Remove bolt (2) and pull out pin (3).

· Tightening torque (2) : 12.8±3.0 kgf · m (92.6±21.7 lbf · ft)

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

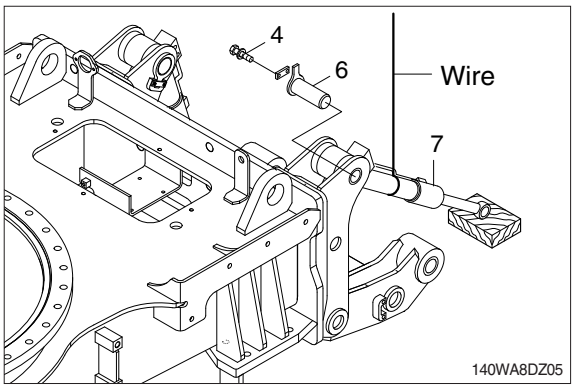


⑤ Lower the dozer cylinder rod side on a wooden block.



⑥ Loosen the bolt (4) and nut (5), and pull out pin (6).
· Tightening torque (4) : 12.8± 3.0 kgf · m (92.6± 21.7 lbf · ft)

⑦ Remove the dozer cylinder assy (7).
· Weight : 75 kg (165 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 dozer cylinder.

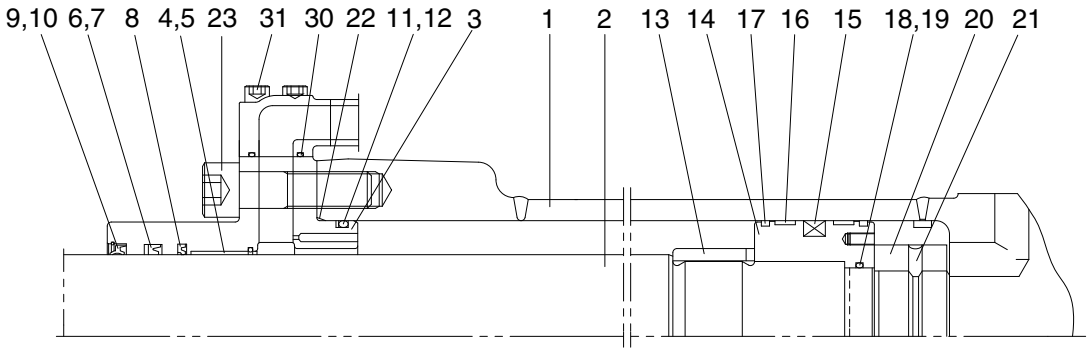
※ Confirm the hydraulic oil level and check the hydraulic oil leak or not.

2. DISASSEMBLY AND ASSEMBLY

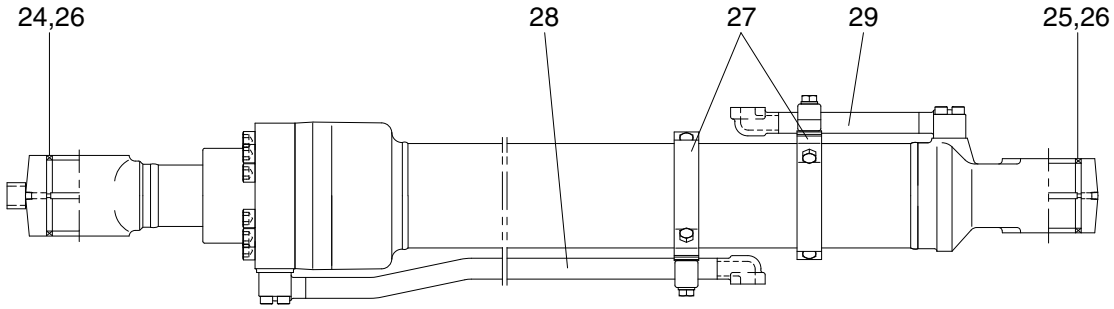
1) STRUCTURE

(1) Bucket cylinder

① Standard (CHANGZHOU)



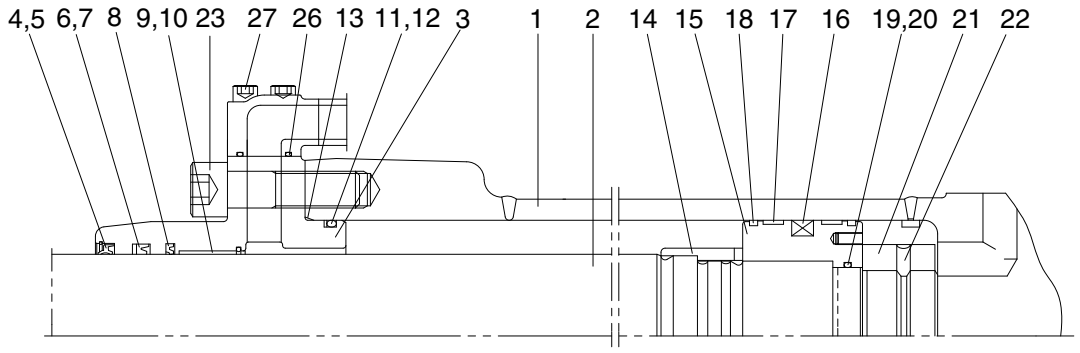
Internal detail



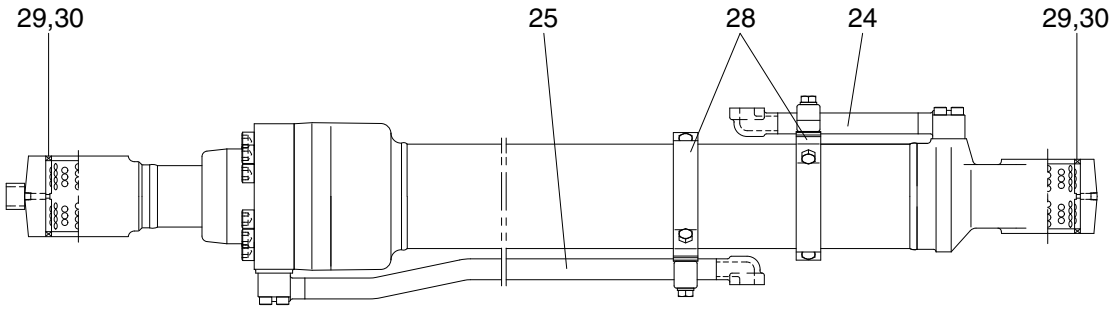
31Q6-60111CGG

1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Dimple bushing
3	Gland	14	Piston	25	Dimple bushing
4	DD2 bushing	15	Piston seal	26	Dust seal
5	Snap ring	16	Wear ring	27	Band assembly
6	Rod seal	17	Dust ring	28	Pipe assembly-R
7	Back up ring	18	O-ring	29	Pipe assembly-B
8	Buffer ring	19	Back up ring	30	O-ring
9	Dust wiper	20	Lock nut	31	Hexagon socket head bolt
10	Snap ring	21	Hex socket headless set screw		
11	O-ring	22	O-ring		

Standard (SHPAC)



Internal detail

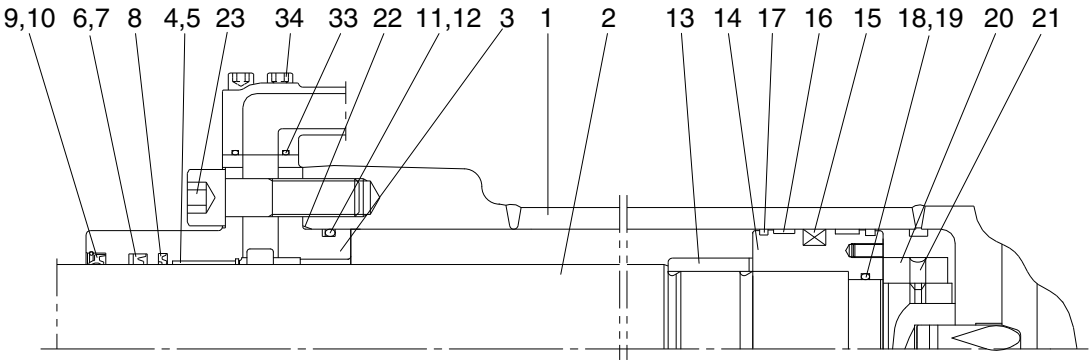


31Q6-60111EGG

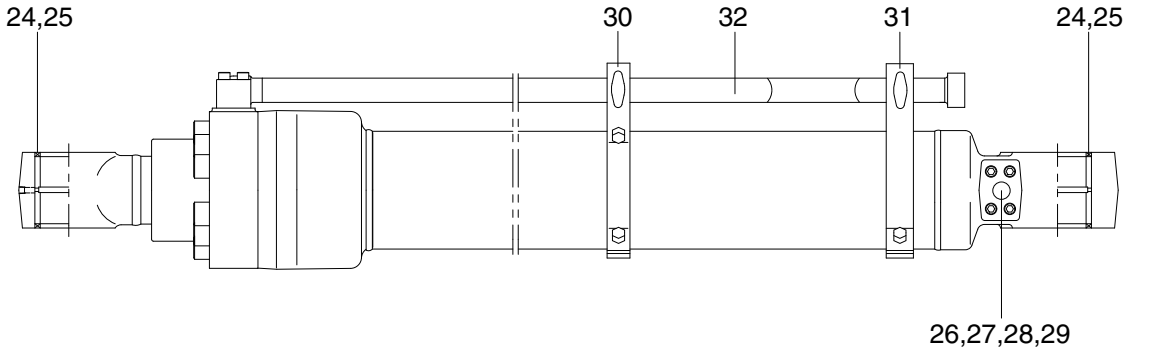
1	Tube assembly	11	O-ring	21	Lock nut
2	Rod assembly	12	Back up ring	22	Hex socket headless set screw
3	Gland	13	O-ring	23	Hexagon socket head bolt
4	Dust wiper	14	Cushion ring	24	Pipe assembly-B
5	Retaining ring	15	Piston	25	Pipe assembly-R
6	Rod seal	16	Piston seal	26	O-ring
7	Back up ring	17	Wear ring	27	Hexagon socket head bolt
8	Buffer ring	18	Dust ring	28	Band assembly
9	Dry bearing	19	O-ring	29	Dimple bushing
10	Retaining ring	20	Back up ring	30	Dust seal

(2) Arm cylinder

① Standard (CHANGZHOU)



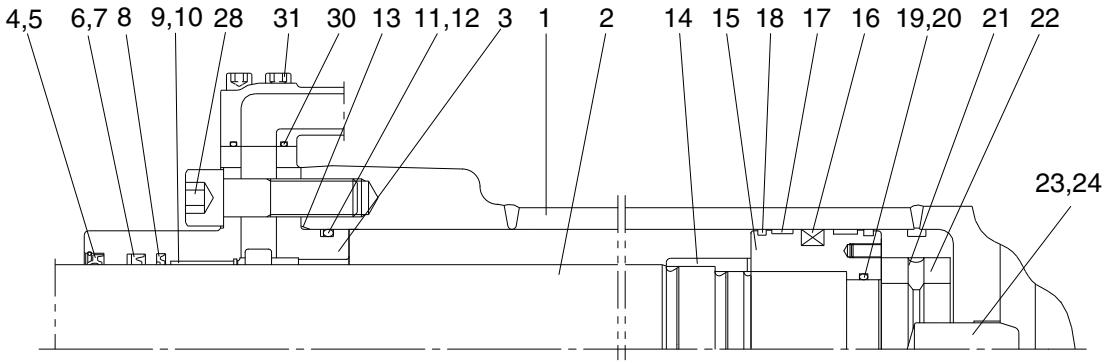
Internal detail



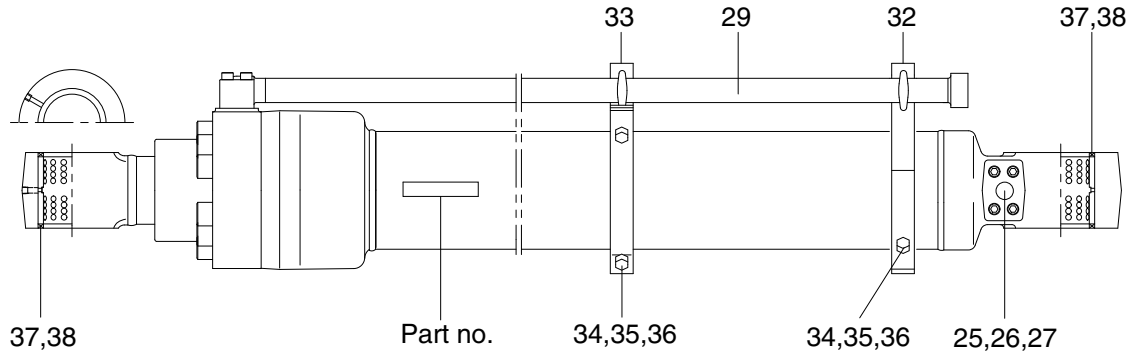
31Q6-50132CGG

1	Tube assembly	13	Cushion ring	25	Dust seal
2	Rod assembly	14	Piston	26	Check valve
3	Gland	15	Piston seal	27	Coil spring
4	DD2 bushing	16	Wear ring	28	O-ring
5	Snap ring	17	Dust ring	29	Plug
6	Rod seal	18	O-ring	30	Band assembly-R
7	Back up ring	19	Back up ring	31	Band assembly-B
8	Buffer ring	20	Lock nut	32	Pipe assembly-R
9	Dust wiper	21	Hex socket headless set screw	33	O-ring
10	Snap ring	22	O-ring	34	Hexagon socket head bolt
11	O-ring	23	Hexagon socket head bolt		
12	Back up ring	24	Dimple bushing		

Standard (SHPAC)



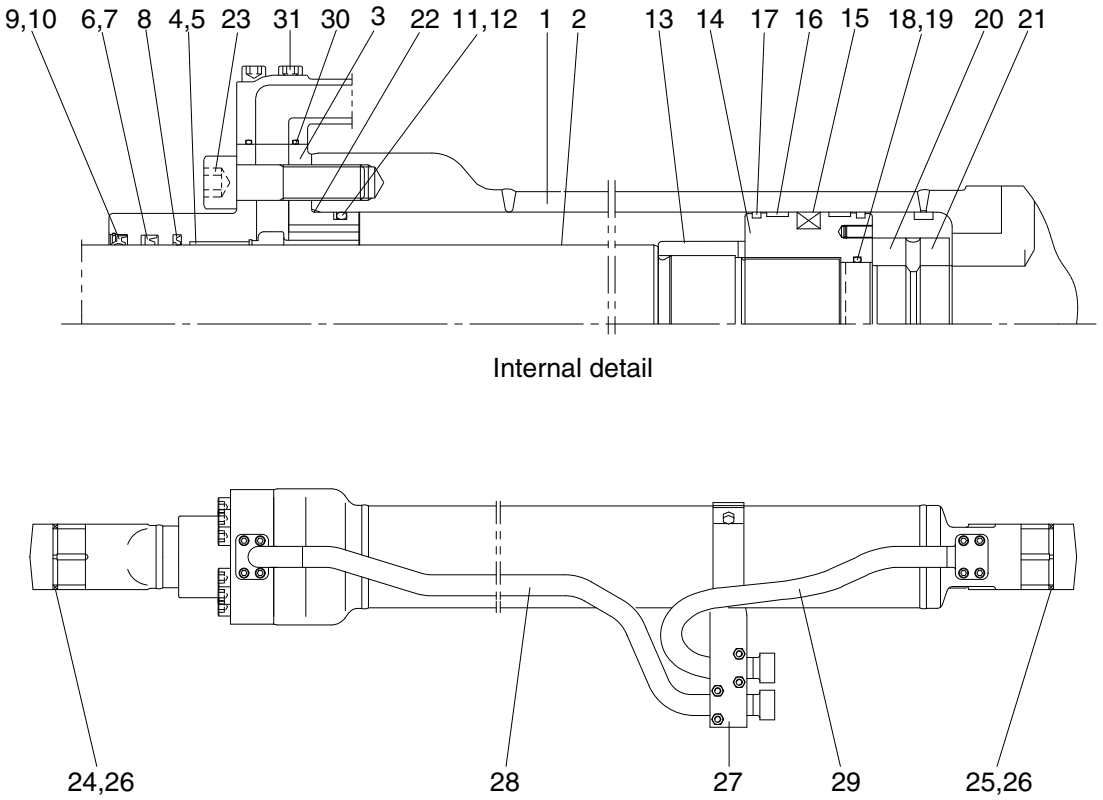
Internal detail



31Q6-50132EGG

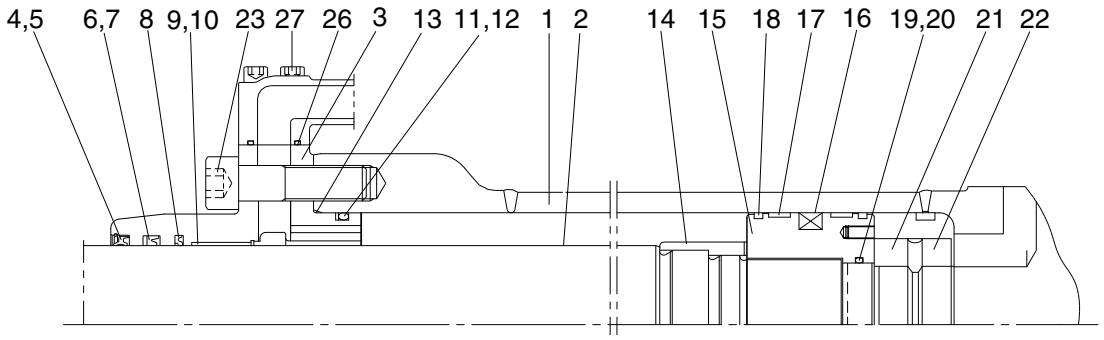
1	Tube assembly	14	Cushion ring	27	Plug
2	Rod assembly	15	Piston	28	Hexagon socket head bolt
3	Gland	16	Piston seal	29	Pipe assembly-R
4	Dust wiper	17	Wear ring	30	O-ring
5	Retaining ring	18	Dust ring	31	Hexagon socket head bolt
6	Rod seal	19	O-ring	32	Band assembly-B
7	Back up ring	20	Back up ring	33	Band assembly-R
8	Buffer ring	21	Lock nut	34	U-bolt
9	Dry bearing	22	Hex socket headless set screw	35	Hexagon nut
10	Retaining ring	23	Cushion plunger	36	Spring washer
11	O-ring	24	Stop ring	37	Dimple bushing
12	Back up ring	25	Check valve	38	Dust seal
13	O-ring	26	Coil spring		

(3) Boom cylinder (CHANGZHOU, type 1)

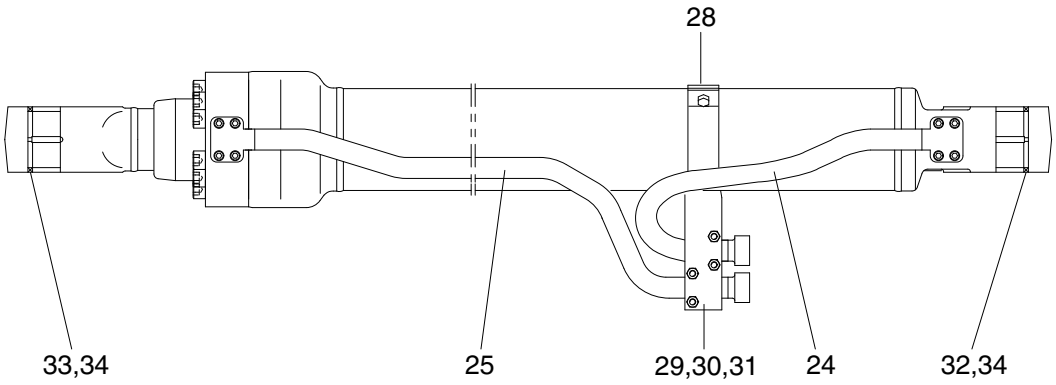


1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Pin bushing
3	Gland	14	Piston	25	Pin bushing
4	DD2 bushing	15	Piston seal	26	Dust seal
5	Snap ring	16	Wear ring	27	Band assembly
6	Rod seal	17	Dust ring	28	Pipe assembly-R
7	Back up ring	18	O-ring	29	Pipe assembly-B
8	Buffer ring	19	Back up ring	30	O-ring
9	Dust wiper	20	Lock nut	31	Hexagon socket head bolt
10	Snap ring	21	Hex socket headless set screw		
11	O-ring	22	O-ring		

Boom cylinder (SHPAC)



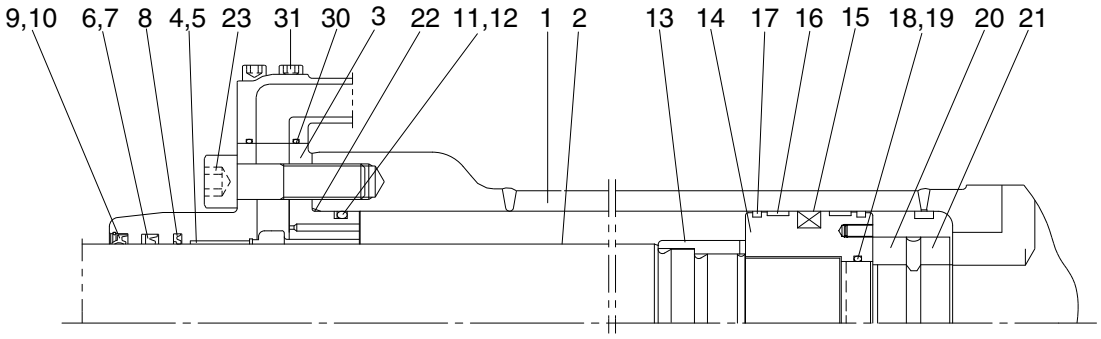
Internal detail



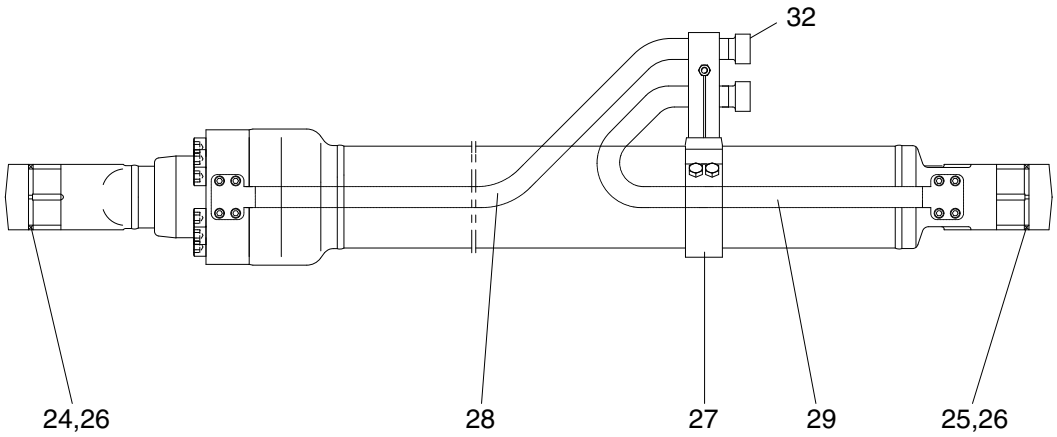
32K6-53110GG

1	Tube assembly	13	O-ring	25	Pipe assembly-R
2	Rod assembly	14	Cushion ring	26	O-ring
3	Gland	15	Piston	27	Hexagon socket head bolt
4	Dust wiper	16	Piston seal	28	Band assembly
5	Retaining ring	17	Wear ring	29	U-bolt
6	Rod seal	18	Dust ring	30	Hexagon nut
7	Back up ring	19	O-ring	31	Spring washer
8	Buffer ring	20	Back up ring	32	Dimple bushing
9	Dry bearing	21	Lock nut	33	Dimple bushing
10	Retaining ring	22	Hex socket headless set screw	34	Dust seal
11	O-ring	23	Hexagon socket head bolt		
12	Back up ring	24	Pipe assembly-B		

Boom cylinder (CHANGZHOU, type 2)



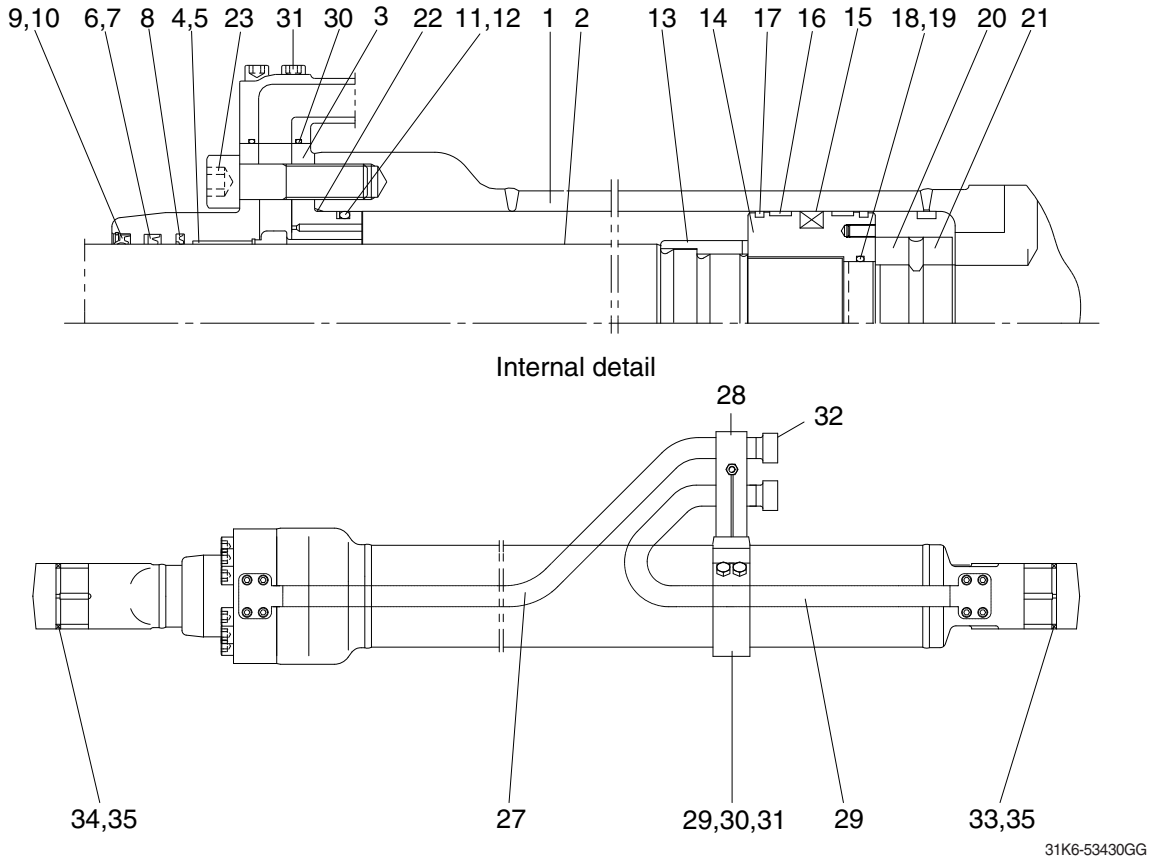
Internal detail



HCK6-53430GG

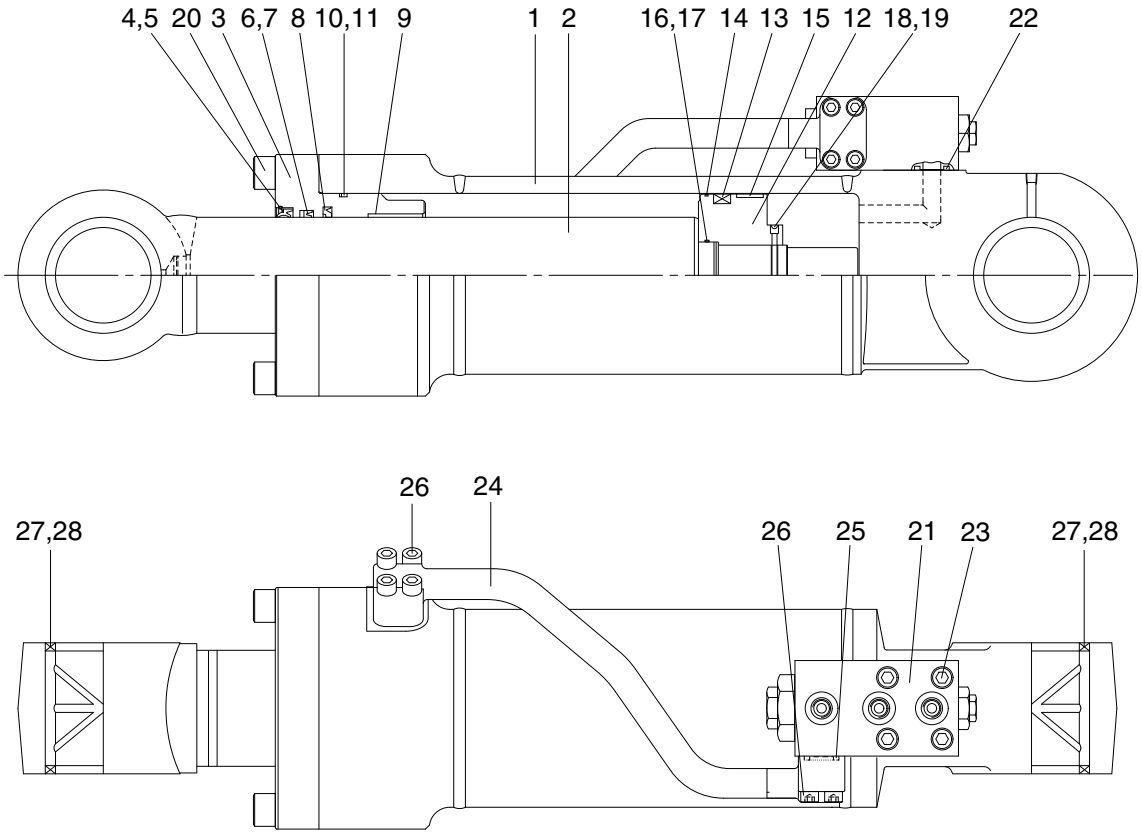
1	Tube assembly	12	Back up ring	23	Hexagon socket head bolt
2	Rod assembly	13	Cushion ring	24	Dimple bushing
3	Gland	14	Piston	25	Dimple bushing
4	DU bushing	15	Piston seal	26	Dust seal
5	Snap ring	16	Wear ring	27	Band assembly
6	Rod seal	17	Dust ring	28	Pipe assembly-R
7	Back up ring	18	O-ring	29	Pipe assembly-B
8	Buffer ring	19	Back up ring	30	O-ring
9	Dust wiper	20	Lock nut	31	Hexagon socket head bolt
10	Snap ring	21	Hex socket headless set screw	32	O-ring
11	O-ring	22	O-ring		

Boom cylinder (SHPAC, 2-piece)



1	Tube assembly	13	O-ring	25	Pipe assembly-R
2	Rod assembly	14	Cushion ring	26	O-ring
3	Gland	15	Piston	27	Hexagon socket head bolt
4	Dust wiper	16	Piston seal	28	Band assembly
5	Retaining ring	17	Wear ring	29	U-bolt
6	Rod seal	18	Dust ring	30	Hexagon nut
7	Back up ring	19	O-ring	31	Spring washer
8	Buffer ring	20	Back up ring	32	O-ring
9	Dry bearing	21	Lock nut	33	Dimple bushing
10	Retaining ring	22	Hex socket headless set screw	34	Dimple bushing
11	O-ring	23	Hexagon socket head bolt	35	Dust seal
12	Back up ring	24	Pipe assembly-B		

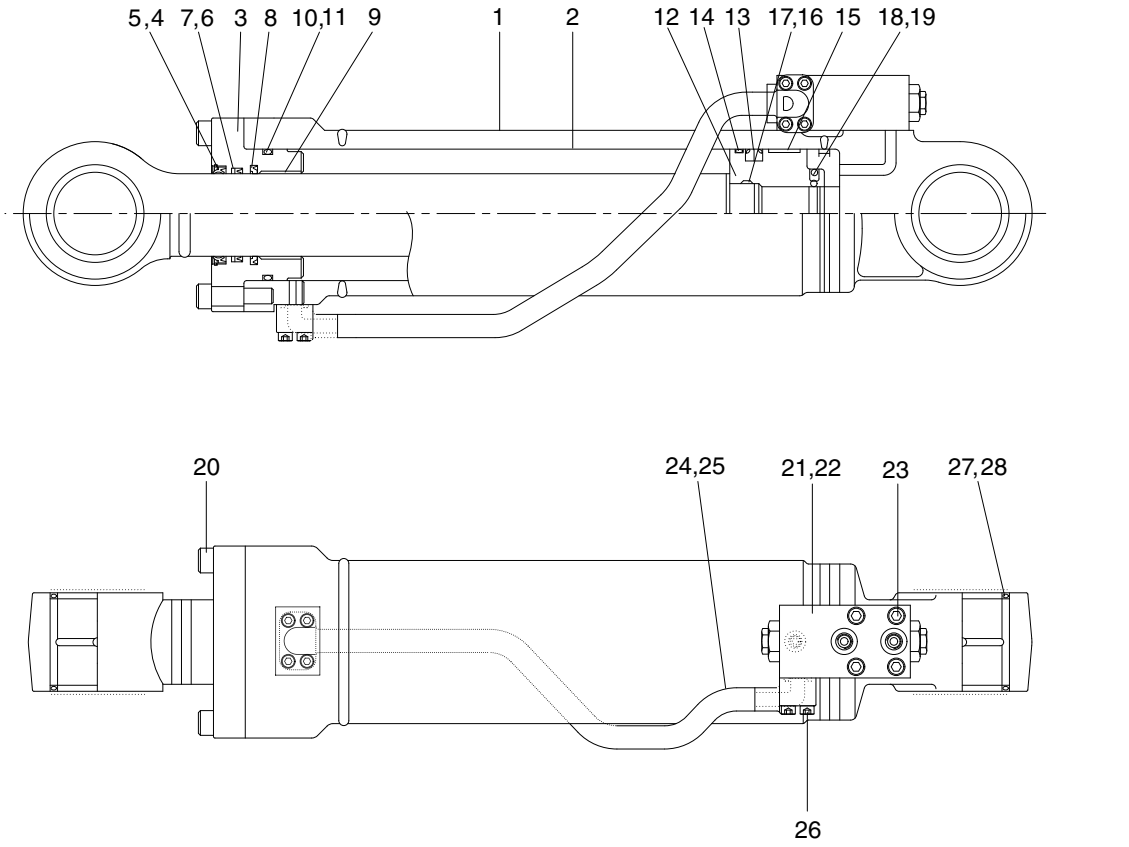
(4) Dozer cylinder



31Q6-70013

1	Tube assembly	11	Back up ring	21	Pilot check valve
2	Rod assembly	12	Piston	22	O-ring
3	Gland	13	Piston seal	23	Hexagon socket bolt
4	Dust wiper	14	Dust ring	24	Pipe assembly
5	Retainer ring	15	Wear ring	25	O-ring
6	Rod seal	16	O-ring	26	Hexagon socket bolt
7	Back up ring	17	Back up ring	27	Pin bushing
8	Buffer ring	18	Steel ball	28	Dust seal
9	Dry bushing	19	Set screw		
10	O-ring	20	Hexagon socket bolt		

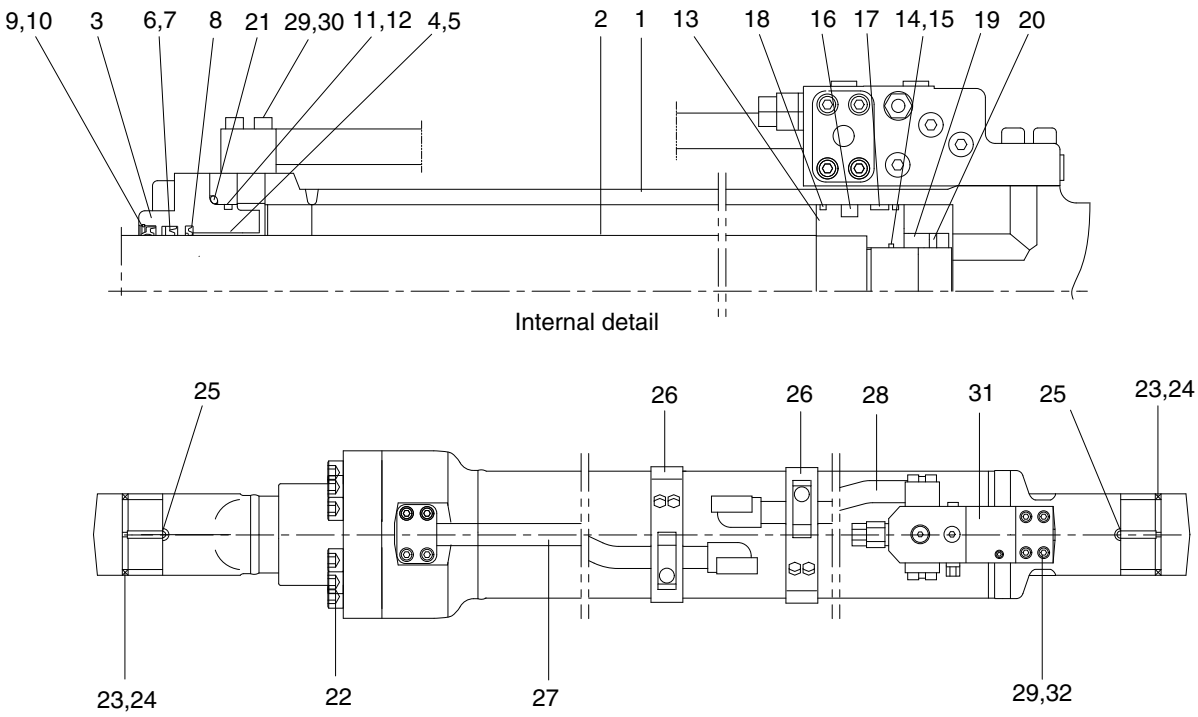
(5) Outrigger cylinder



31Q6-70032

1	Tube assembly	11	Back up ring	21	Pilot check valve
2	Rod assembly	12	Piston	22	O-ring
3	Gland	13	Piston seal	23	Hexagon socket bolt
4	Dust wiper	14	Dust ring	24	Pipe assembly
5	Retainer ring	15	Wear ring	25	O-ring
6	Rod seal	16	O-ring	26	Hexagon socket bolt
7	Back up ring	17	Back up ring	27	Pin bushing
8	Buffer ring	18	Steel ball	28	Dust seal
9	Dry bushing	19	Set screw		
10	O-ring	20	Hexagon socket bolt		

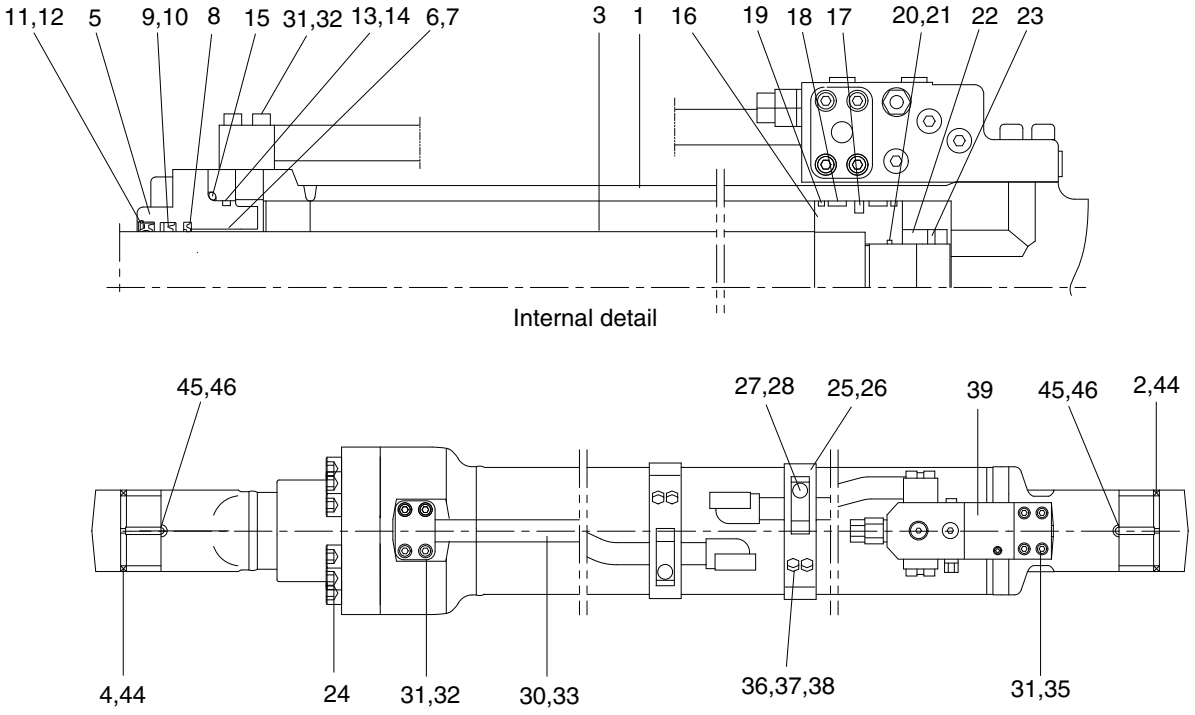
(6) Adjust cylinder (CHANGZHOU)



HCK6-54460GG

1	Tube assembly	12	Retaining ring	23	Dimple bushing
2	Rod assembly	13	Piston	24	Dust seal
3	Gland	14	O-ring	25	Grease nipple
4	DU bushing	15	Back up ring	26	Band assy
5	Snap ring	16	Piston seal	27	Pipe assy-R
6	Rod seal	17	Wear ring	28	Pipe assy-B
7	Back up ring	18	Dust ring	29	O-ring
8	Buffer ring	19	Lock nut	30	Hexagon socket head bolt
9	Dust wiper	20	Hex socket headless set screw	31	Safety lock valve
10	Snap ring	21	O-ring	32	Hexagon socket head bolt
11	O-ring	22	Hexagon socket head bolt		

Adjust cylinder (SHPAC)

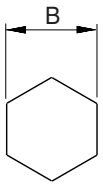


31K6-54460GG

1	Tube assembly	16	Piston	31	Spring washer
2	Dimple bushing	17	Piston seal	32	Hexagon socket head bolt
3	Rod assembly	18	Wear ring	33	Pipe assembly
4	Dimple bushing	19	Dust ring	34	Spacer
5	Rod cover	20	O-ring	35	Hexagon socket head bolt
6	Rod bushing	21	Back up ring	36	Clamp
7	Retaining ring	22	Piston nut	37	Spring washer
8	Buffer seal	23	Hex socket headless set screw	38	Hexagon bolt
9	U-packing	24	Hexagon socket head bolt	39	Lock valve
10	Back up ring	25	Band assembly	40	Hexagon socket head bolt
11	Dust wiper	26	Pipe band	42	Dust cover
12	Retaining ring	27	Spring washer	43	Hexagon bolt
13	O-ring	28	Hexagon bolt	44	Pin wiper
14	Back up ring	29	Pipe assembly	45	Grease nipple
15	O-ring	30	O-ring	46	Cap

2) TOOLS AND TIGHTENING TORQUE

(1) Tools

Tools		Remark
Allen wrench	6	
	8	
	10	
	12	
	14	
	17	
Spanner	7	
	8	
(-) 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
Socket head bolt	Bucket cylinder	23★1★3	M16	23.0±2.0	166±14.5
		23★1★4	M16	26.7±2.7	193±19.5
		23★1★6	M16	23.0±2.0	166±14.5
		23★1★4★5	M16	26.7±2.7	193±19.5
		31★3	M10	5.4±0.5	39.1±3.6
		27★4	M10	6.5±0.7	47.0±5.1
		31★6	M10	5.4±0.5	39.1±3.6
		23★4★5	M10	6.5±0.7	47.0±5.1
	Boom cylinder	23★1★3	M16	23.0±2.0	166±14.5
		23★1★4	M16	26.7±2.7	193±19.5
		31★3	M10	5.4±0.5	39.1±3.6
		27★4	M10	6.5±0.7	47.0±5.1
	Arm cylinder	23★1★3	M18	32.0±3.0	232±21.7
		28★1★4	M18	38.0±3.8	275±27.5
		34★3	M12	9.4±1.0	68.0±7.2
		31★4	M12	11.3±1.1	81.7±8.0
	Dozer cylinder	20★1★4	M16	26.7±2.7	193±19.5
		23★4	M10	6.5±0.7	47.0±5.1
		26★4	M8	3.3±0.3	23.9±2.2
	Outtrigger cylinder	20★1★4	M16	26.7±2.7	193±19.5
		23★4	M10	6.5±0.7	47.0±5.1
		26★4	M8	3.3±0.5	23.9±2.2

★1 : Apply loctite #243 on the thread of bolt.
★3 : CHANGZHOU, type 1
★4 : SHPAC
★5 : 2-piece boom
★6 : CHANGZHOU, type 2

Part name		Item	Size	Torque	
				kgf · m	lbf · ft
Socket head bolt	Adjust cylinder	22★1★3	M20	150±15.0	1085±108
		24★1★7	M20	58.0±4.0	420±28.9
		30★3	M10	5.4±0.5	39.1±3.6
		32★3	M10	5.4±0.5	39.1±3.6
		32★7	M10	5.5~6.0	39.8~43.4
		35★7	M10	5.5~6.0	39.8~43.4
Lock nut	Bucket cylinder	20★3	-	100±10.0	723±72.3
		21★4	M62	100±10.0	723±72.3
		20★6	M56	100±10.0	723±72.3
		21★4★5	M56	100±10.0	723±72.3
	Boom cylinder	20★3	-	100±10.0	723±72.3
		21★4	M56	100±10.0	723±72.3
	Arm cylinder	20★3	-	150±15.0	1085±108
		21★4	M70	150±15.0	1085±108
	Adjust cylinder	13★3	M85	100±10.0	723±72.3
		22★7	M82	190±19.0	1374±137
Piston	Bucket cylinder	14★3	-	150±15.0	1085±108
		15★4	M75	150±15.0	1085±108
	Boom cylinder	14★3	-	150±15.0	1085±108
		15★4	M75	150±15.0	1085±108
		14★6	M75	150±15.0	1085±108
		15★4★5	M56	150±15.0	1085±108
	Arm cylinder	14★3	-	200±20.0	1447±145
		15★4	M90	200±20.0	1447±145
	Dozer cylinder	12★4	M56	140±14.0	1013±101
	Outtrigger cylinder	12★4	M56	140±14.0	1013±101
	Adjust cylinder	13★3	M100	150±15.0	1085±108
		16★7	M95	100±10.0	723±72.3
Set screw	Bucket cylinder	21★3	M8	2.7±0.3	19.5±2.2
		22★4	M8	1.7±0.2	12.3±1.4
	Boom cylinder	21★3	M8	2.7±0.3	19.5±2.2
		22★4	M8	1.7±0.2	12.3±1.4
		21★6	M8	2.7±0.3	19.5±2.2
		22★4★5	M8	1.7±0.2	12.3±1.4
	Arm cylinder	21★3	M10	5.4±0.5	39.1±3.6
		22★4	M10	2.5±0.3	18.1±2.2
	Dozer cylinder	19★4	M8	1.7±0.2	12.3±1.4
	Outtrigger cylinder	19★4	M8	1.7±0.2	12.3±1.4
	Adjust cylinder	23★7	M8	5.0	36.2

★1 : Apply loctite #243 on the thread of bolt.
★3 : CHANGZHOU, type 1
★4 : SHPAC
★5 : 2-piece boom
★6 : CHANGZHOU, type 2
★7 : DY POWER

3) DISASSEMBLY

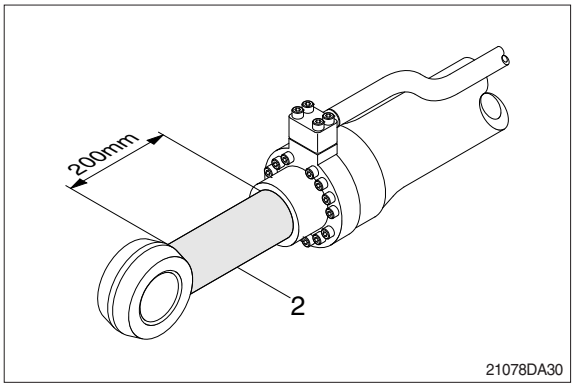
(1) Remove cylinder head and piston rod

※ Procedures are based on the bucket cylinder. (CHANGZHOU type)

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

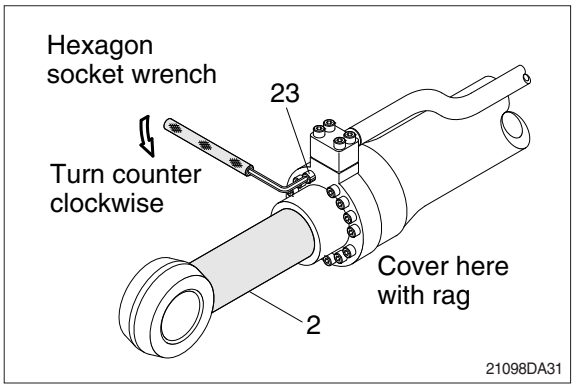
※ Use mouth pieces so as not to damage the machined surface of the cylinder tube. Do not make use of the outside piping as a locking means.

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



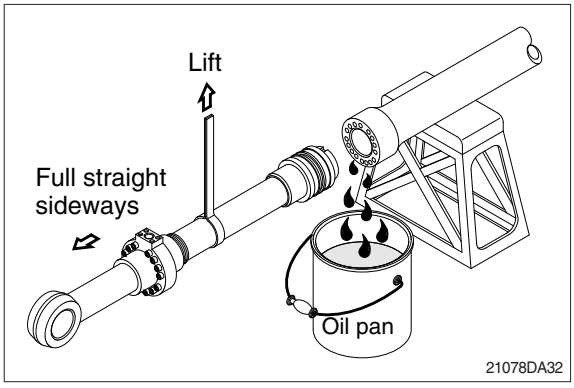
③ Loosen and remove socket bolts (23) of the gland in sequence.

※ Cover the extracted rod assembly (2) with rag to prevent it from being accidentally damaged during operation.



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

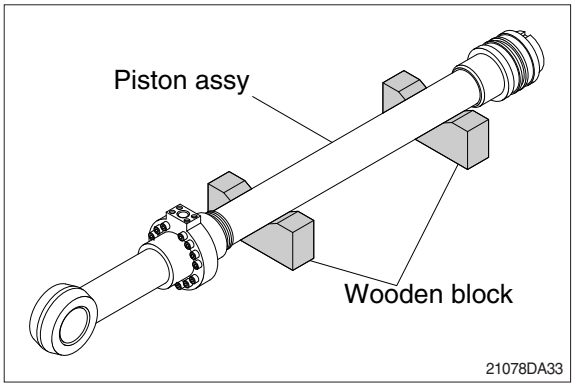
※ Since the rod assembly is heavy in this case, lift the tip of the rod assembly (2) with a crane or some means and draw it out. However, when rod assembly (2) has been drawn out to approximately two thirds of its length, lift it in its center to draw it completely.



Note that the plated surface of rod assembly (2) is to be lifted. For this reason, do not use a wire sling and others that may damage it, but use a strong cloth belt or a rope.

⑤ Place the removed rod assembly on a wooden V-block that is set level.

※ Cover a V-block with soft rag.



(2) Remove piston and cylinder head

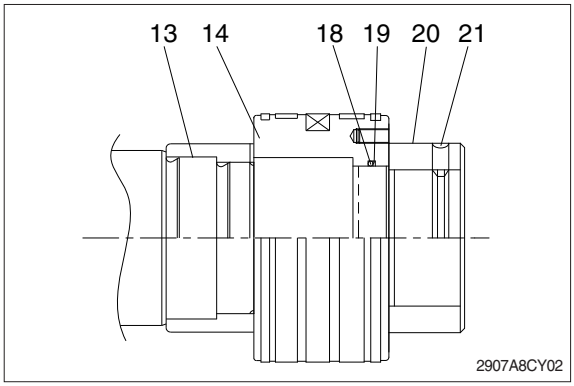
① Remove set screw (21).

② Remove lock nut (20).

※ Since piston (14) and lock nut (20) are tightened to a high torque, use a hydraulic and power wrench that utilizers a hydraulic cylinder, to remove the piston (14) and lock nut (20).

③ Remove piston assembly (14), back up ring (19), and O-ring (18).

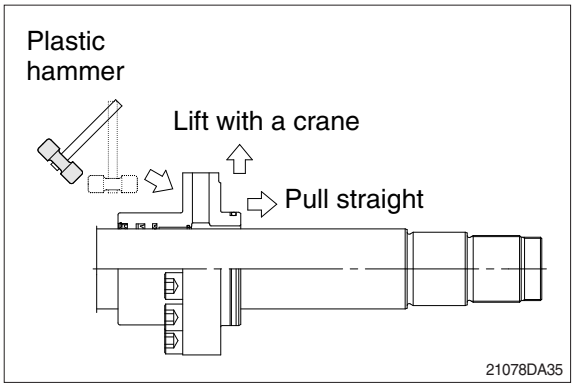
④ Remove cushion ring (13).



⑤ Remove the cylinder head assembly from rod assembly (2).

※ If it is too heavy to move, move it by striking the flanged part of cylinder head 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 rod bushing (4) and packing (5,6,7,8,9,10) by the threads of rod assembly (2).

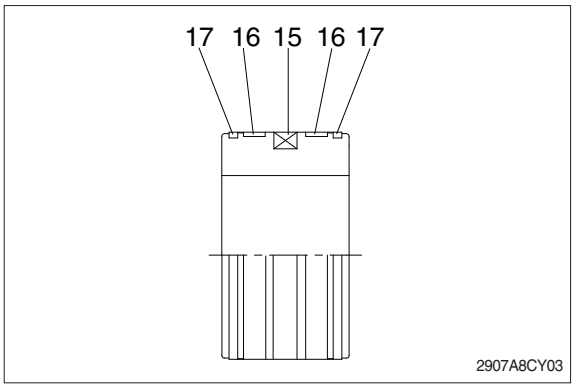


(3) Disassemble the piston assembly

① Remove wear ring (16).

② Remove dust ring (17) and piston seal (15).

※ Exercise care in this operation not to damage the grooves.



(4) Disassemble cylinder head assembly

① Remove back up ring (12), O-ring (11) and O-ring (22).

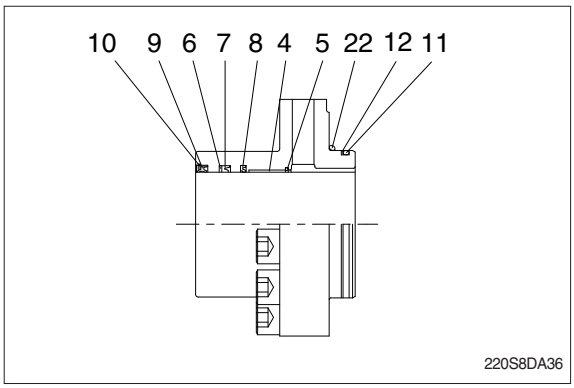
② Remove snap ring (10), dust wiper (9).

③ Remove back up ring (7), rod seal (6) and buffer ring (8).

※ Exercise care in this operation not to damage the grooves.

※ Do not remove seal and ring, if does not damaged.

※ Do not remove bushing (4).

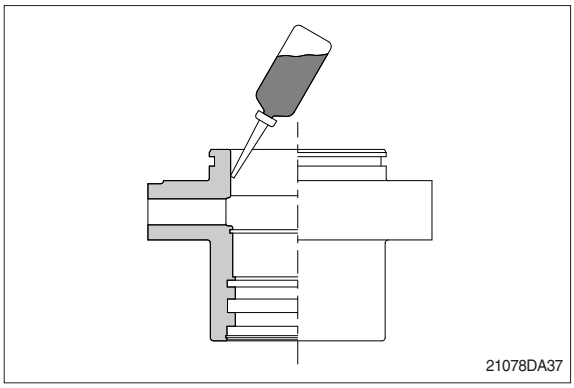


4) ASSEMBLY

(1) Assemble cylinder head assembly

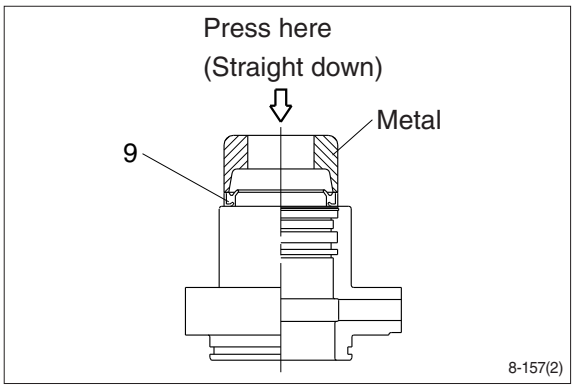
※ Check for scratches or rough surfaces if found smooth with an oil stone.

① Coat the inner face of gland (3) with hydraulic oil.



② Coat dust wiper (9) with grease and fit dust wiper (9) to the bottom of the hole of dust seal.
At this time, press a pad metal to the metal ring of dust seal.

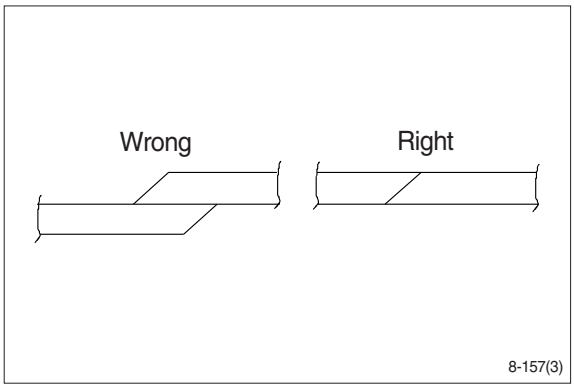
③ Fit snap ring (10) to the stop face.



④ Fit back up ring (7), rod seal (6) and buffer ring (8) to corresponding grooves, in that order.

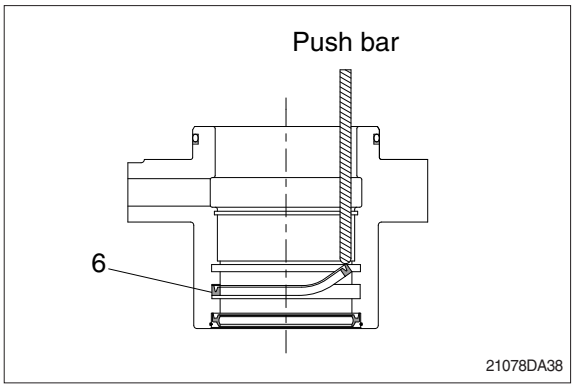
※ Coat each packing with hydraulic oil before fitting it.

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



※ Rod seal (6) has its own fitting direction. Therefore, confirm it before fitting them.

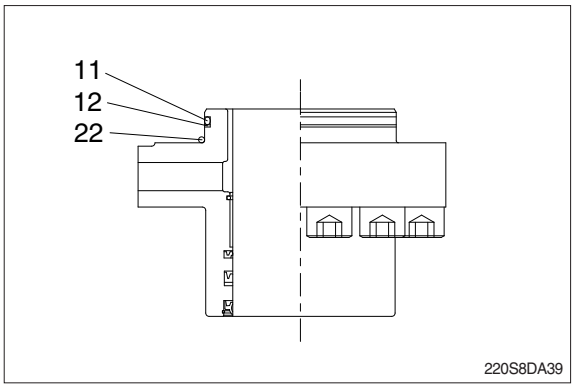
※ Fitting rod seal (6) upside down may damage its lip. Therefore check the correct direction that is shown in fig.



⑤ Fit back up ring (12) to gland (3).

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

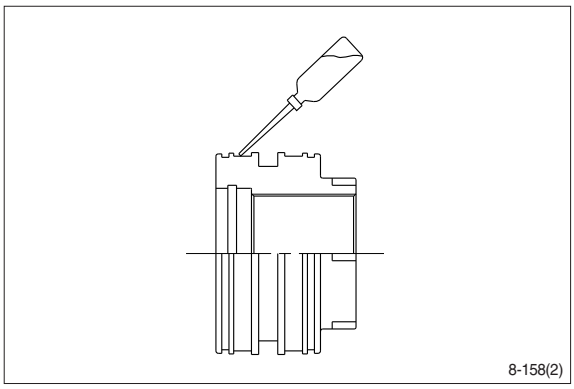
⑥ Fit O-ring (11) and O-ring (22) to gland (3).



(2) Assemble piston assembly

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

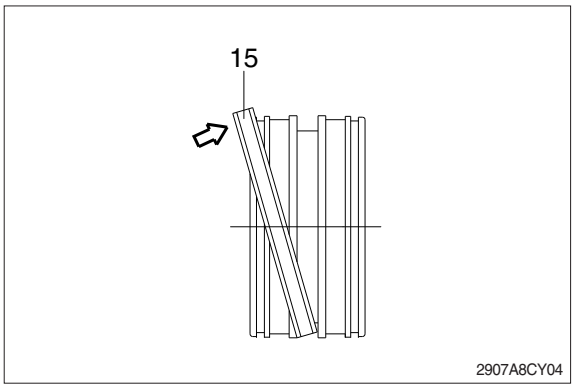
① Coat the outer face of piston (14) with hydraulic oil.



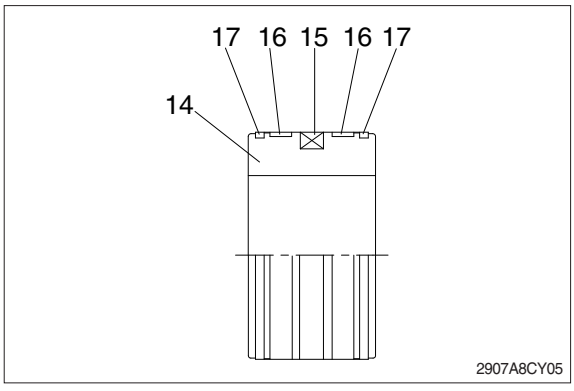
② Fit piston seal (15) to piston.

※ 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 (16) and dust ring (17) to piston (14).

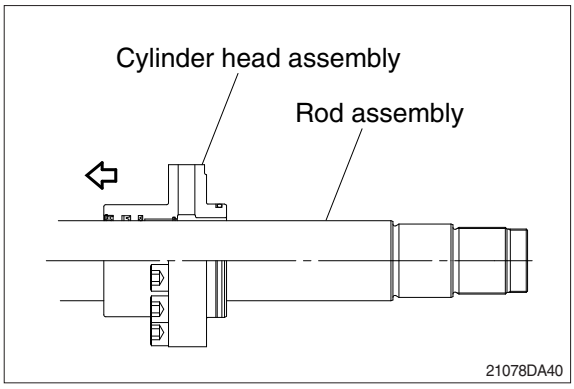


(3) Install piston and cylinder head

① Fix the rod assembly to the work bench.

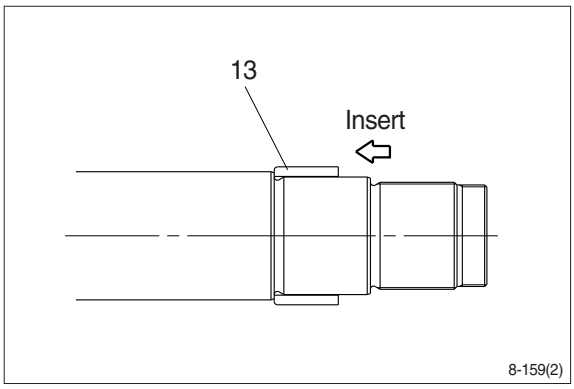
② Apply hydraulic oil to the outer surface of rod assembly (2), the inner surface of piston and cylinder head.

③ Insert cylinder head assembly to rod assembly.



④ Insert cushion ring (13) to rod assembly.

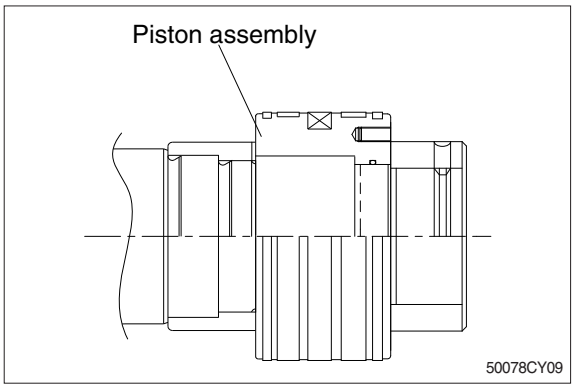
※ Note that cushion ring (13) has a direction in which it should be fitted.



⑤ Fit piston assembly to rod assembly.

· Tightening torque : 150±15.0 kgf · m (1085±108 lbf · ft)

※ Refer to page 8-392.



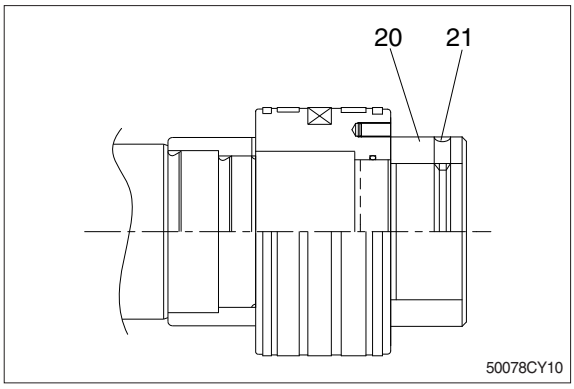
⑥ Fit lock nut (20) and tighten the screw (21).

· Tightening torque :

Item 20 : 100±10.0 kgf·m (723±72.3 lbf·ft)

Item 21 : 2.7±0.3 kgf·m (19.5±2.2 lbf·ft)

※ Refer to page 8-392.



(3) Overall assemble

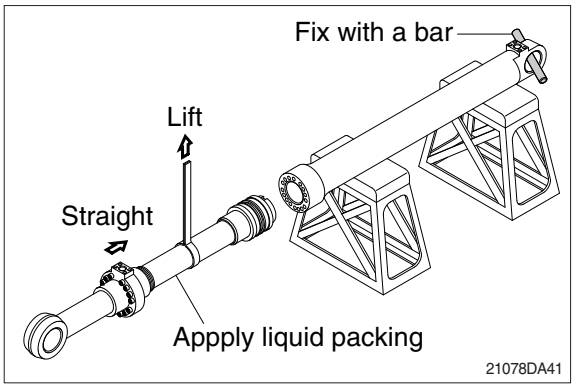
① Place a V-block on a rigid work bench. Mount the tube assembly (1) on it and fix the assembly by passing a bar through the clevis pin hole to lock the assembly.

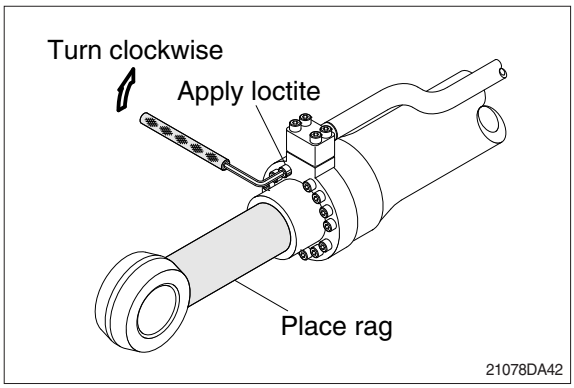
② Insert the rod assembly in to the tube assembly, while lifting and moving the rod assembly with a crane.

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

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

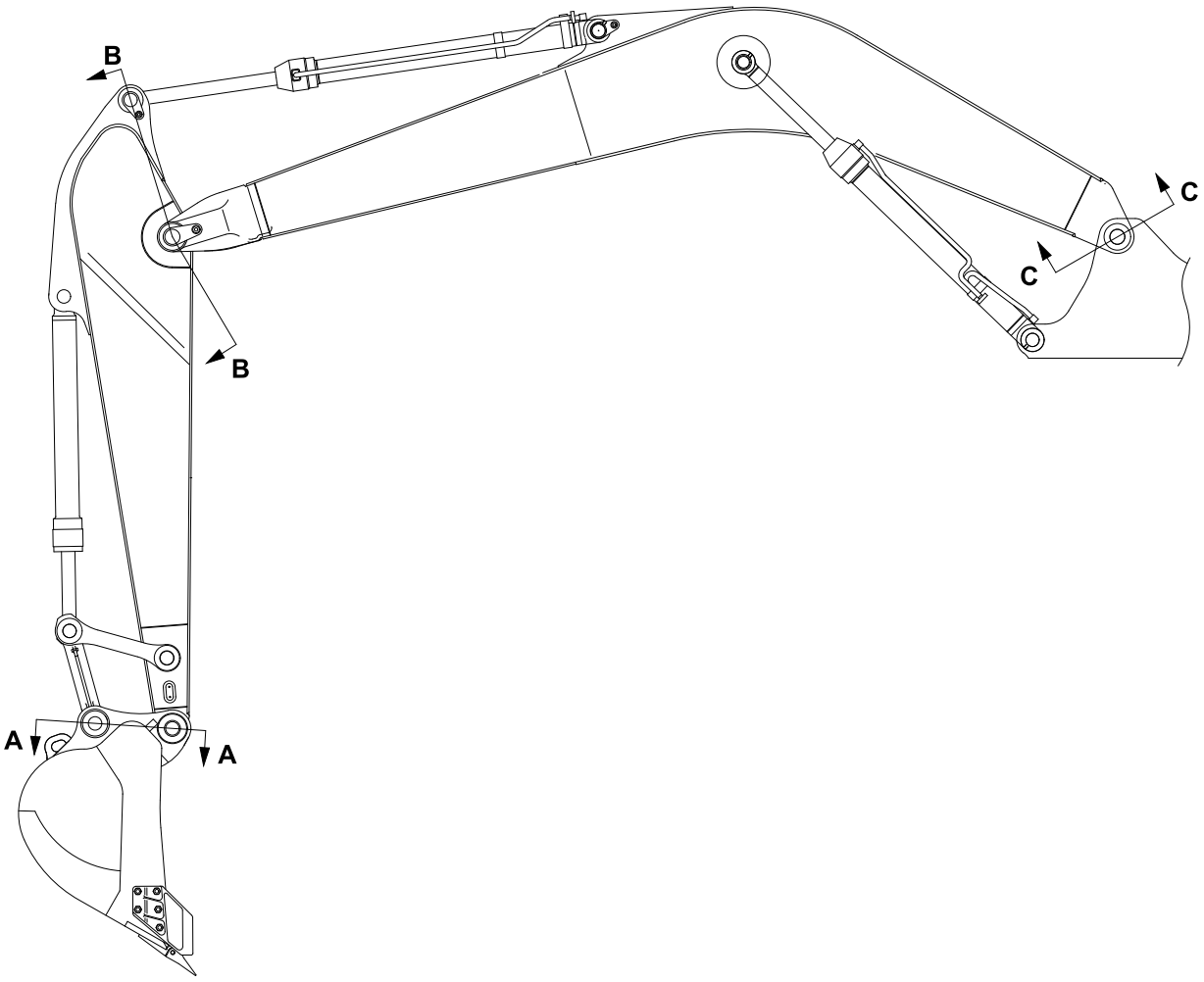
※ Refer to the table of tightening torque.

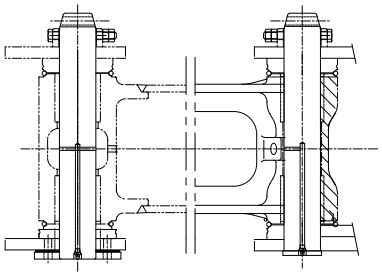




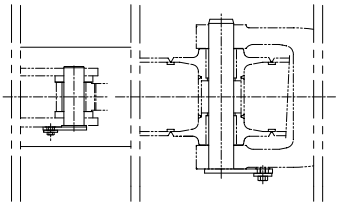
GROUP 14 WORK EQUIPMENT

1. STRUCTURE

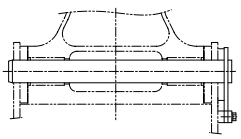




SECTION A



SECTION B



SECTION C

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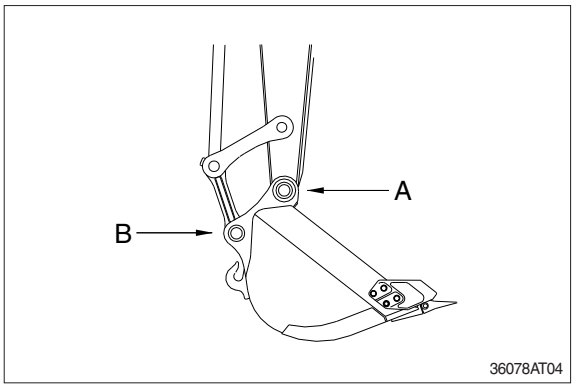
2. REMOVAL AND INSTALL

1) BUCKET ASSEMBLY

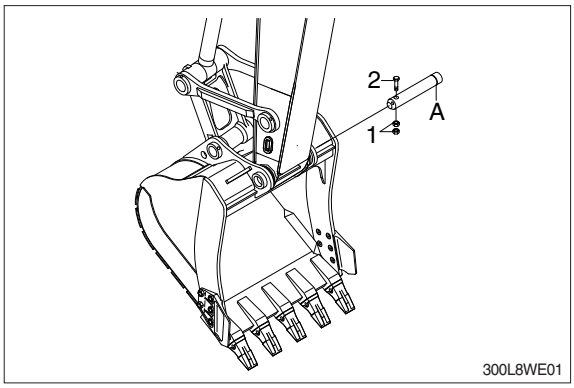
(1) Removal

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 (A).

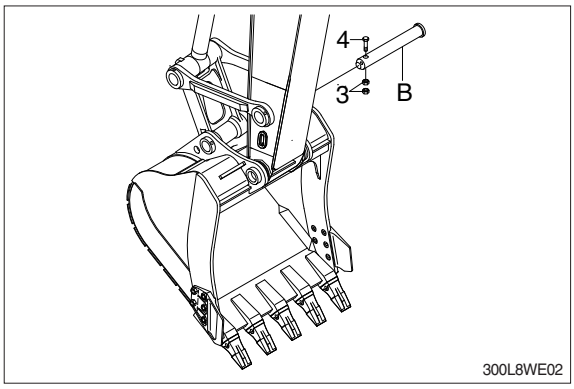
· Tightening torque (1) : 57.9±8.7 kgf·m (419±62.9 lbf·ft)



③ Remove nut (3), bolt (4) and draw out the pin (B).

· Tightening torque (3) : 57.9±8.7 kgf·m (419±62.9 lbf·ft)

· Weight : 817 kg (1801 lb)

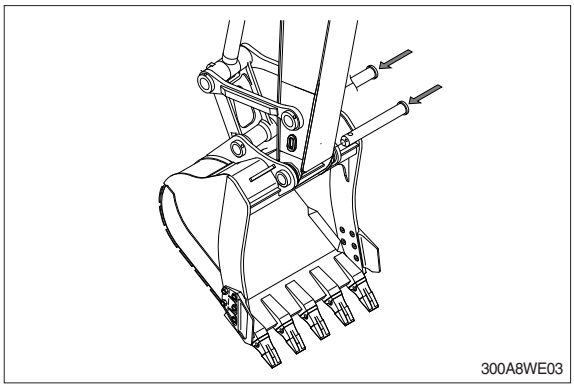


(2) Install

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 (1).

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

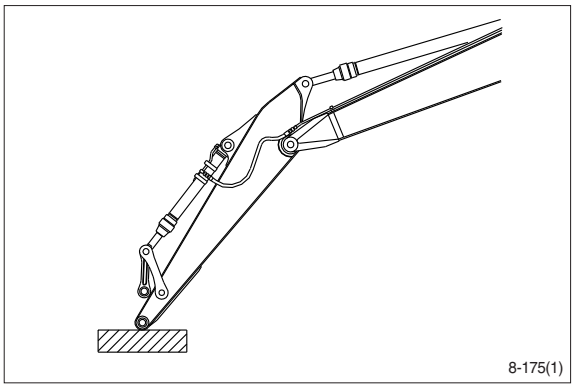
③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

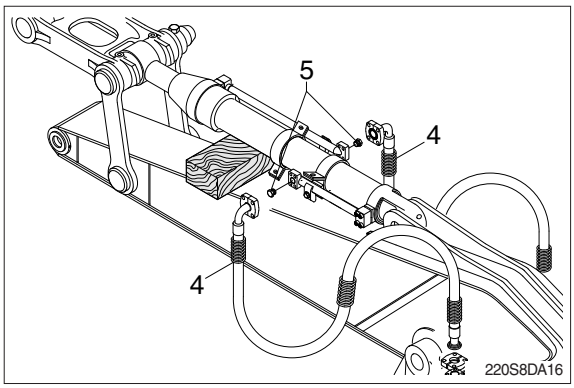
※ Tie the rod with wire to prevent it from coming out.

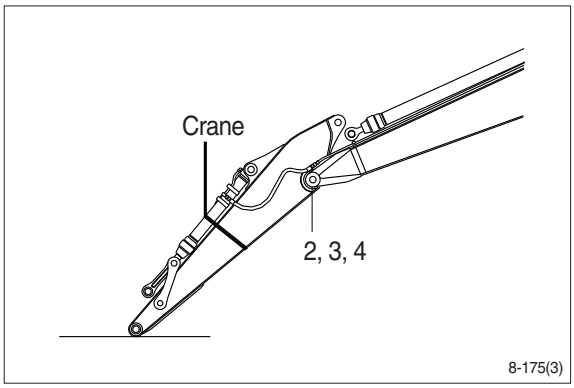
④ For details, see removal of arm cylinder assembly.
Place a wooden block under the cylinder and bring the cylinder down to it.

⑤ Remove bolt (2), plate (3) and pull out the pin (4) then remove the arm assembly.
· Weight : 1360 kg (2998 lb)
· Tightening torque (2) : 29.7±45 kgf·m (215± 32.5 lbf·ft)

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


8-175(1)





(2) Install

① Carry out installation in the reverse order to removal.

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

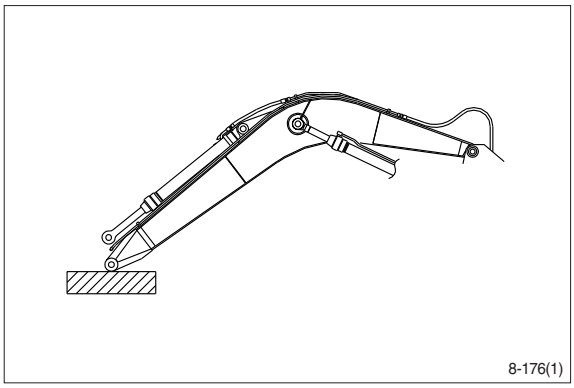
※ Bleed the air from the cylinder.

3) BOOM ASSEMBLY

(1) Removal

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

② Remove boom cylinder assembly from boom.
For details, see removal of boom cylinder assembly.

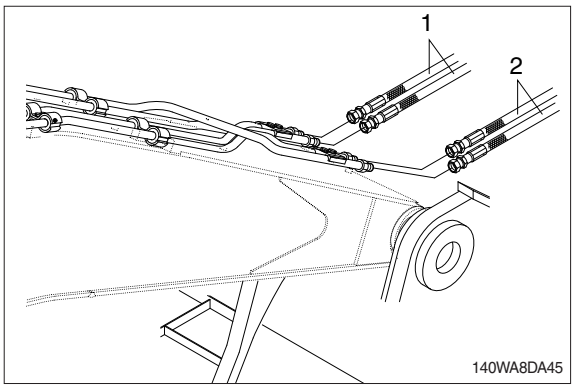


③ Disconnect head lamp wiring.

④ Disconnect bucket cylinder hose (2) and arm cylinder hose (1).

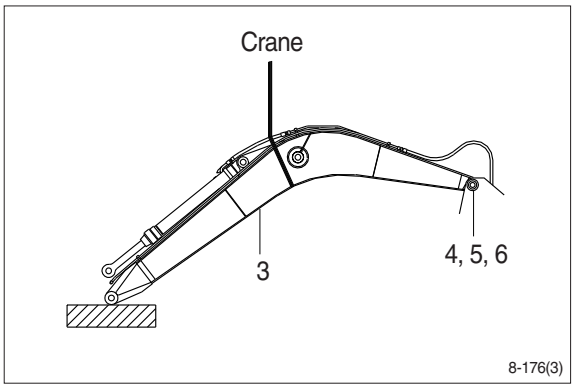
※ When the hose are disconnected, oil may spurt out.

⑤ Sling boom assembly (3).



⑥ Remove bolt (4), plate (5) and pull out the pin (6) then remove boom assembly.
- Weight :1960 kg (4321 lb)
- Tightening torque (4) : 29.7±45 kgf·m (215± 32.5 lbf·ft)

※ 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.