CONTENTS

SECTION 1 GENERAL

Group 1 Safety hints 1-1
Group 2 Specifications 1-5
Group 3 Periodic replacement 1-18

SECTION 2 REMOVAL & INSTALLATION

Group 1 Major components 2-1
Group 2 Removal and installation of unit 2-2
Group 3 Maintenance for hose 2-17

SECTION 3 POWER TRAIN SYSTEM (25/30D-9V, 35DN-9V)

Group 1 Structure and operation 3-1
Group 2 Disassembly and assembly 3-18
Group 3 Maintenance and troubleshooting 3-61

SECTION 3 POWER TRAIN SYSTEM (25/30D-9VS, 35DN-9VS)

Group 1 Structure and operation 3-74
Group 2 Disassembly and assembly 3-87
Group 3 Maintenance and troubleshooting 3-130

SECTION 4 BRAKE SYSTEM

Group 1 Structure and function 4-1
Group 2 Operational checks and troubleshooting 4-10
Group 3 Tests and adjustments 4-13

SECTION 5 STEERING SYSTEM

Group 1 Structure and function 5-1
Group 2 Operational checks and troubleshooting 5-13
Group 3 Disassembly and assembly 5-16

SECTION 6 HYDRAULIC SYSTEM

Group 1 Structure and function 6-1
Group 2 Operational checks and troubleshooting 6-31
Group 3 Disassembly and assembly 6-35

SECTION 7 ELECTRICAL SYSTEM

Group 1 Component location 7-1
Group 2 Electrical circuit 7-3
Group 3 Component Specification 7-23
Group 4 Connector Destination 7-24
Group 5 Troubleshooting 7-32

SECTION 8 MAST

Group 1 Structure 8-1
Group 2 Operational Checks and Troubleshooting 8-5
Group 3 Adjustment 8-8
Group 4 Removal and Installation 8-11

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 gives the general information of the machine and explains the safety hints for maintenance.

SECTION 2 REMOVAL & INSTALLATION OF UNIT
This section explains the procedures and techniques of removal and installation of each component.

SECTION 3 POWER TRAIN SYSTEM
This section explains the structure of the transmission as well as control valve and drive axle.

SECTION 4 BRAKE SYSTEM
This section explains the brake piping, each component and operation.

SECTION 5 STEERING SYSTEM
This section explains the structure of the steering unit, priority valve, trail axle as well as steering circuit and operation.

SECTION 6 HYDRAULIC SYSTEM
This section explains the structure of the gear pump, main control valve as well as work equipment circuit, each component and operation.

SECTION 7 ELECTRICAL SYSTEM
This section explains the electrical circuit and each component.
It serves not only to give an understanding electrical system, but also serves as reference material for troubleshooting.

SECTION 8 MAST
This section explains the structure of mast, carriage, backrest and forks.

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

2. HOW TO READ THE SERVICE MANUAL

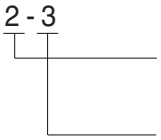
Distribution and updating

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

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

Filing method

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



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

   10 - 4
   10 - 4 - 1
   10 - 4 - 2] Added pages
   10 - 5

Revised edition mark (①②③…)

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

Revisions

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

Symbols

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

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

3. CONVERSION TABLE

Method of using the Conversion Table

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

Example

1. Method of using the Conversion Table to convert from millimeters to inches
   Convert 55 mm into inches.

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

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

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

2. Convert 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

1mm = 0.03937 in

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

Millimeters to inches

1mm = 0.03937in

	0	1	2	3	4	5	6	7	8	9
0		0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
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

1kg = 2.2046lb

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

Liter to U.S. Gallon

1 ℓ = 0.2642 U.S.Gal

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

Liter to U.K. Gallon

1 ℓ = 0.21997 U.K.Gal

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

kgf · m to lbf · ft

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

bar	kgf/cm^2	psi	MPa
1	1.02	14.504	0.1
88	90	1280	9
90	91	1300	9
92	94	1340	9
98	100	1420	10
110	112	1600	11
118	120	1710	12
120	122	1740	12
122	124	1770	12
127	129	1840	13
130	133	1890	13
132	135	1920	13
135	138	1960	14
140	143	2030	14
145	148	2100	14
147	150	2130	15
150	153	2180	15
157	160	2280	16
160	163	2320	16
162	165	2350	16
165	168	2390	16
167	170	2420	17
170	174	2470	17
172	176	2500	17
175	179	2540	18
177	181	2570	18
180	183	2610	18
185	188	2680	18
187	191	2710	19
190	194	2760	19
195	199	2830	20
197	200	2850	20
207	211	3000	21
210	214	3050	21
217	221	3150	22
220	224	3190	22
234	239	3400	23
414	422	6000	41

kgf/cm² to lbf/in²

1kgf / cm² = 14.2233lbf / in²

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

TEMPERATURE

Fahrenheit-Centigrade Conversion.

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

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

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

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

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

SECTION 1 GENERAL

Group 1 Safety hints 1-1
Group 2 Specifications 1-5
Group 3 Periodic replacement 1-18

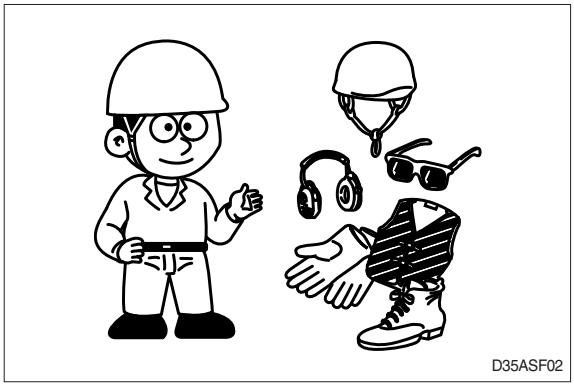
GROUP 1 SAFETY HINTS

Careless performing of the easy work may cause injuries.
Take care to always perform work safely, at least observing the following.

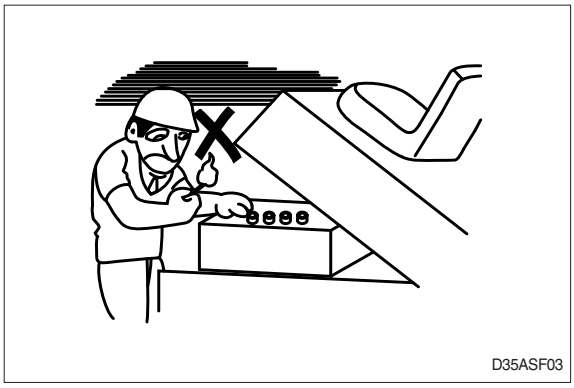
- Oil is a dangerous substance. Never handle oil, grease or oily clothes in places where there is any fire of flame.
  As preparation in case of fire, always know the location and directions for use of fire extinguishers and other fire fighting equipment.


D35ASF01

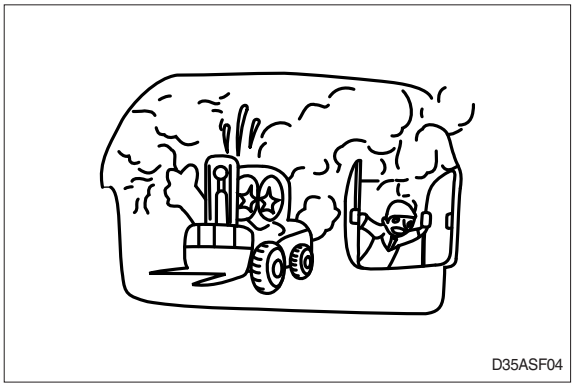
- Wear well-fitting helmet, safety shoes and working clothes. When drilling, grinding or hammering, always wear protective goggles.
  Always do up safety clothes properly so that they do not catch on protruding parts of machines. Do not wear oily clothes.
  When checking, always release battery plug.


D35ASF02

- Flames should never be used instead of lamps. Never use a naked flame to check leaks or the level of oil or electrolyte.

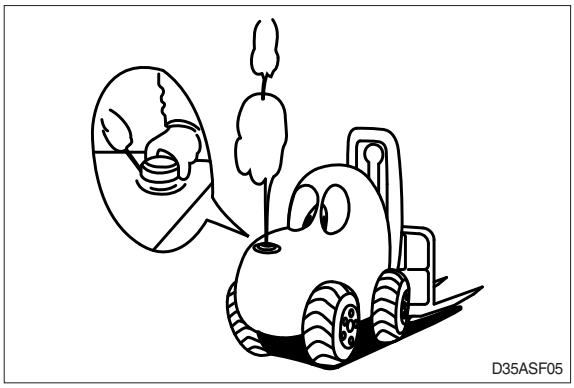

D35ASF03

- Exhaust gas is dangerous. Provide adequate ventilation when working a closed space.

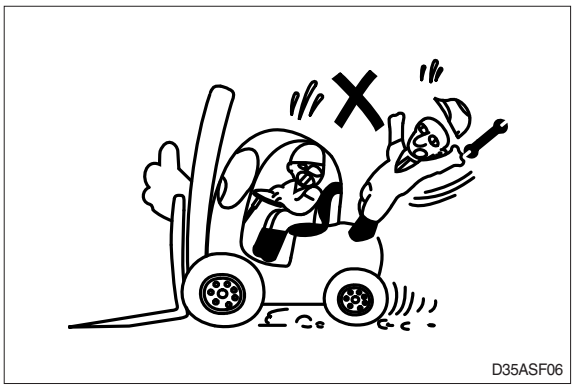

D35ASF04

⚠ Be particularly careful when removing the radiator cap and the hydraulic oil tank filler cap, if this is done immediately after using the machine, there is a danger that boiled oil may spurt out.

· The procedure for releasing the hydraulic pressure is as follows : lower the fork to the ground, and stop the engine (Motor), move the control levers to each position two or three times.

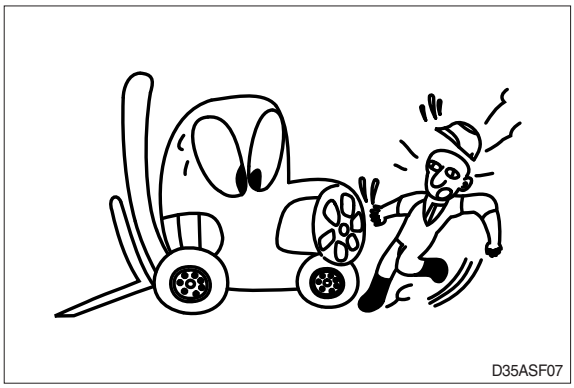

D35ASF05

· When working on top of the machine, be careful not to lose your balance and fall.


D35ASF06

· Hand a caution sign in the operator's compartment (For example **Do not start or Maintenance in progress**).
This will prevent anyone from starting or moving the machine by mistake.

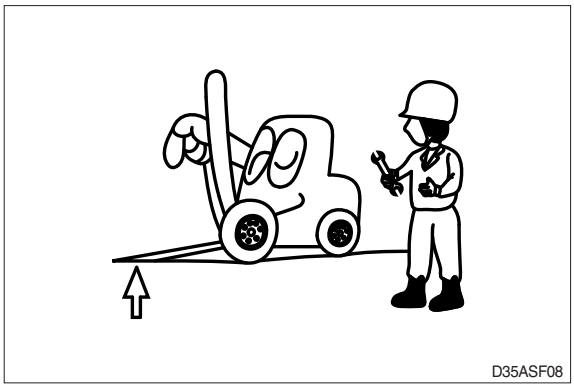
⚠ It is extremely dangerous to try to check the fan belt tension while he engine is running.


D35ASF07

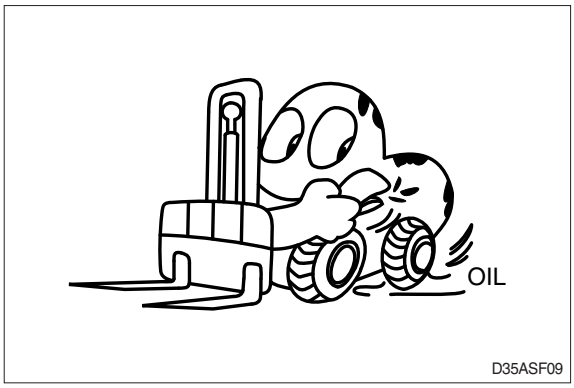
When inspecting the engine is running parts, or near such parts, always stop the engine first.

Before checking or servicing accumulator or piping, depress brake pedal repeatedly to release pressure.

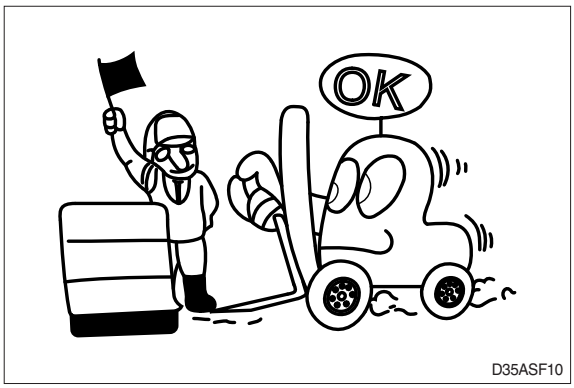
· Park the machine on firm, flat ground.
Lower the fork to the ground and stop the engine.
Return each lever to **NEUTRAL** and apply the brake lock.


D35ASF08

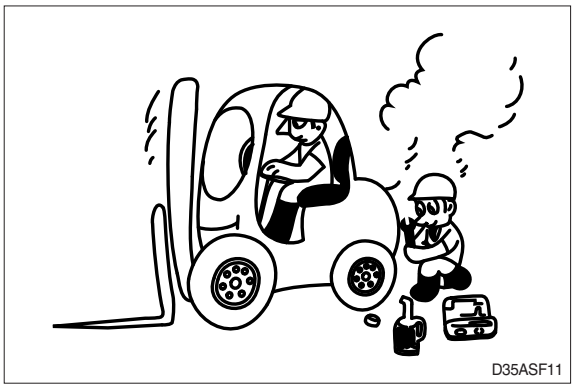
· Immediately remove any oil or grease on the floor of the operator's compartment, or on the handrail. It is very dangerous if someone slips while on the machine.



· When working with others, choose a group leader and work according to his instructions. Do not perform any maintenance beyond the agreed work.



· Always remember that the hydraulic oil circuit is under pressure. When feeding or draining the oil or carrying out inspection and maintenance, release the pressure first.



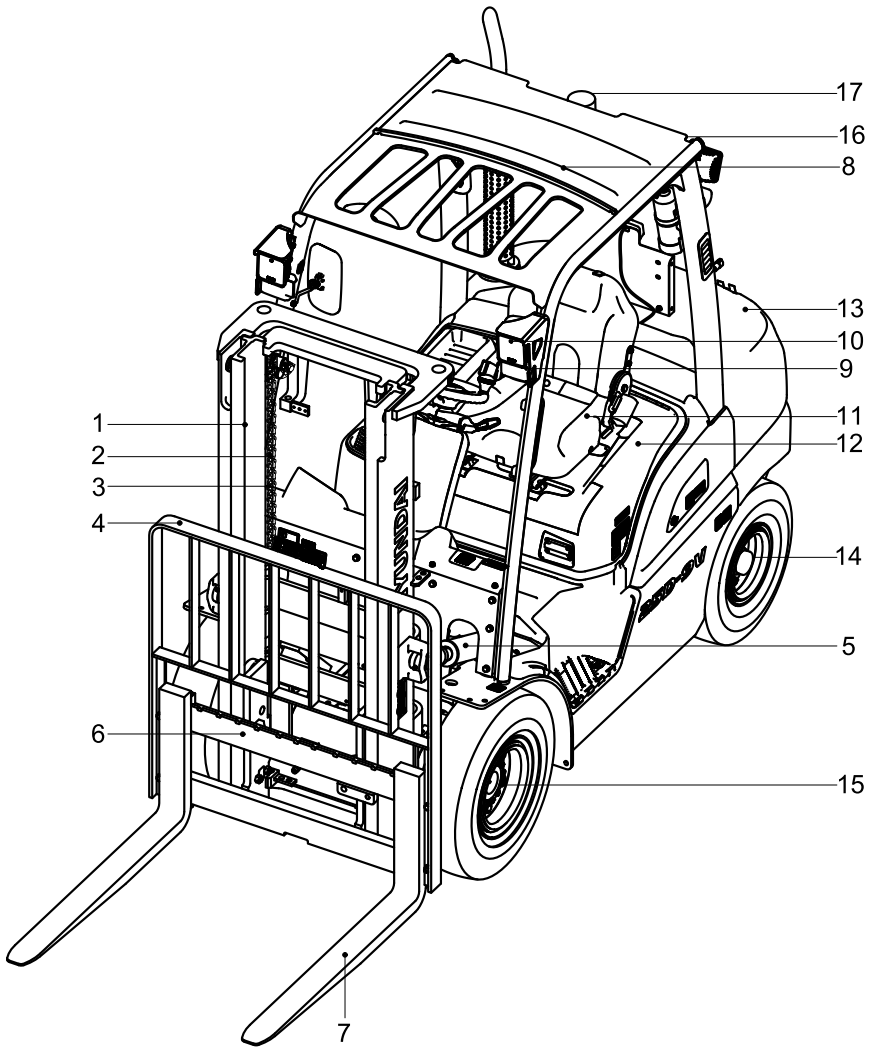
· Unless you have special instructions to the contrary, maintenance should always be carried out with the engine stopped. If maintenance is carried out with the engine running, there must be two men present : one sitting in the operator's seat and the other one performing the maintenance. In such a case, never touch any moving part.

- Thoroughly clean the machine. In particular, be careful to clean the filler caps, grease fittings and the area around the dipsticks. Be careful not to let any dirt or dust into the system.
- Always use HYUNDAI Forklift genuine parts for replacement.
- Always use the grades of grease and oil recommended by HYUNDAI Forklift.
  Choose the viscosity specified for the ambient temperature.
- Always use pure oil or grease, and be sure to use clean containers.
- When checking or changing the oil, do it in a place free of dust, and prevent any dirt from getting into the oil.
- Before draining the oil, warm it up to a temperature of 30 to 40°C.
- After replacing oil, filter element or strainer, bleed the air from circuit.
- When the strainer is located in the oil filler, the strainer must not be removed while adding oil.
- When changing the oil filter, check the drained oil and filter for any signs of excessive metal particles or other foreign materials.
- When removing parts containing O-ring, gaskets or seals, clean the mounting surface and replace with new sealing parts.
- After injecting grease, always wipe off the oil grease that was forced out.
- Do not handle electrical equipment while wearing wet places, as this can cause electric shock.
- During maintenance do not allow any unauthorized person to stand near the machine.
- Be sure you fully understand the contents of the operation. It is important to prepare necessary tools and parts and to keep the operating area clean.
- When checking an open gear case there is a risk of dropping things in. Before removing the covers to inspect such cases, empty everything from your pockets. Be particularly careful to remove wrenches and nuts.
- Way to use dipstick
  Push the dipstick fully into the guide, and then pull out.

  Carrying out other difficult maintenance work carelessly can cause unexpected accidents. If you consider the maintenance is too difficult, always request the HYUNDAI Forklift distributor to carry out it.

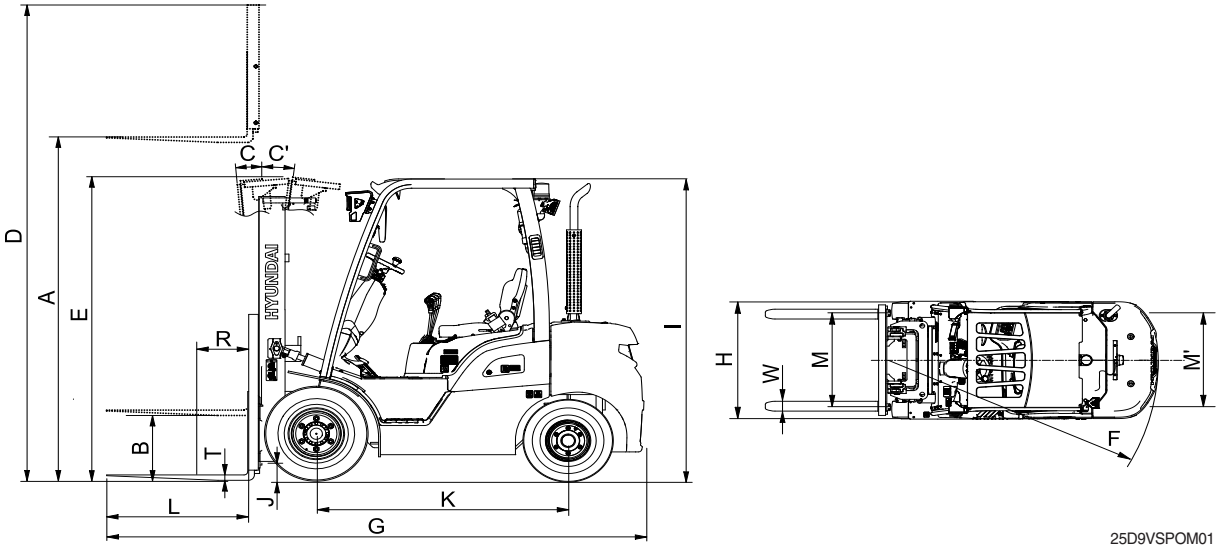
GROUP 2 SPECIFICATIONS

1. GENERAL LOCATIONS



1	Mast	7	Forks	13	Counterweight
2	Lift chain	8	Overhead guard	14	Rear wheel
3	Lift cylinder	9	Turn signal lamp	15	Front wheel
4	Backrest	10	Head lamp	16	Rear combination lamp
5	Tilt cylinder	11	Operator's seat	17	Rear camera
6	Lift bracket	12	Bonnet		

2. SPECIFICATIONS



25D9VSPOM01

Model				Unit	25D-9V/VS		30D-9V/VS	35DN-9V/VS
Load Capacity				kg (lb)	2500 (5000)		3000 (6000)	3500 (7000)
Load center			R	mm (in)	500 (24")		←	←
Service Weight				kg (lb)	3871 (85340)		4300 (9480)	4616 (10176)
Fork	Lifting height		A	mm (in)	3305 (130.11)		←	←
	Free lift		B	mm (in)	155 (6.1)		←	←
	Lifting speed (Unload/Load)	Brake, non-booster type		mm/sec (ft/min)	610/580 (120/114)		←	500/480 (98/94)
		Brake, Booster type		mm/sec (ft/min)	580/550 (114/108)		←	470/450 (93/89)
	Lowering speed (Unload/Load)			mm/sec (ft/min)	500/510 (99/101)		500/550 (99/109)	480/510 (95/101)
	L×W×T		L,W,T	mm (in)	1050×100×45 (41.3×3.9×1.8)		1050×122×45 (41.3×4.8×1.8)	←
Mast	Tilt angle (forward/backward)		C/C'	degree	6/10		←	←
	Max height		D	mm (in)	4485 (176.57)		←	←
	Min height		E	mm (in)	2175 (85.62)		2190 (86.22)	2260 (88.97)
Body	Travel speed (Loaded/Unloaded)			km/h	16.4/17.7		17.2/18.8	16.9/18.8
	Gradeability (Load/Unloaded)			%	42.7/21.5		34.1/20.1	30.6/17.7
	Min turning radius (Outside)		F	mm (in)	2352 (92.6)		2427 (95.6)	2480 (97.6)
ETC	System Set Pressure			bar (psi)	200 (2900)	★175 (2540)	200 (2900)	←
	Hydraulic oil tank			ℓ (usgal)	36 (9.5)		38 (10)	←
	Fuel tank			ℓ (usgal)	61(16.1)		←	←
Overall length			G	mm (in)	3672 (144.56)		3751 (147.67)	3816 (150.23)
Overall width			H	mm (in)	1200 (47.2)		1230 (48.4)	1230 (48.4)
Overhead guard height			I	mm (in)	2160 (85.0)		2180 (85.83)	2180 (85.83)
Ground clearance			J	mm (in)	130 (5.11)		145 (5.7)	←
Wheel base			K	mm (in)	1650 (65)		1700 (66.98)	←
Wheel tread front/rear			M/M'	mm (in)	999/980 (39.3/38.6)		1005/980 (3' 6"/3' 3")	←
MAX. Drawbar pull(Unlodaded/Loaded)				N	27,399/25,957		25,777/24,257	26,016/24,162

★ : EU, AN corporate sales equipment

3. SPECIFICATION FOR MAJOR COMPONENTS

※ ENGINE

Item	Unit	Specification
Model	–	HMC D4HB
Type	–	Vertical, water-cooled, 4-cycle diesel
Cooling Method	–	Water cooling
Number of cylinders and arrangement	–	4 cylinders, in-line
Firing order	–	1-3-4-2
Combustion type	–	Common Rail Direct Injection
Cylinder bore X stroke	mm (in)	85.4×96 (3.36 × 3.78)
Piston displacement	cc (cu in)	2199 (134.2)
Compression ratio	–	16
Rated gross horse power	ps/rpm	65/2300
Maximum gross torque at rpm	kgf · m/rpm	24.1/1600
Engine oil quantity	ℓ (U.S.gal)	★6.3 (1.66) 8.2 (2.16)
Dry weight	kg (lb)	210 (463)
High idling speed	rpm	2450
Low idling speed	rpm	850
Rated fuel consumption (2300rpm)	g/ps.hr	166.2
Starting motor	V-kW	12-2
Alternator	V-A	13.5-90
Battery	V-AH	12-72
CO2	g/kWh	750.4

★ : Machine serial No. 25D-9V : -#0029, 30D-9V : -#0028, 35DN-9V : -#0040

※ MAJOR HYDRAULIC COMPONENT

Item	Index			Unit	Specification	
Hydraulic pump	Type			-	External gear pump	
	Manufacture			-	Shimadzu	
	Capacity			cm^3/rev (in^3/rev)	30.6 (1.87)	
	Maximum operating pressure			bar (psi)	276	
	Rated speed (max./min.)			rpm	3000/500	
	Weight			kgf (lbf)	6 (13.2)	
Manual Control Valve (MCV)	Type			-	Mono-block (3spool / 4spool)	
	Manufacturer			-	Buchholz	
	Operating method			-	Manual (Hand lever)	
	Maximum flow rated (Lift/Tilt)			lpm (US.gpm)	76/30 (20/8)	
	Main relief valve set pressure (DV1)			bar (psi)	200 (2900)	★175 (2540)
	Attachment oil flow rated (Aux1/2)			lpm (US.gpm)	55/55 (14.5/14.5)	
	Attachment relief valve pressure (DV2)			bar (psi)	140~180 (2030~2610)	
	Weight			kgf (lbf)	3spool: 11 (24), 4spool: 13 (29)	
Fingertip Control Valve	Type			-	Mono-block (4 spool)	
	Manufacturer			-	Buchholz	
	Operating method			-	Electro-Hydraulic control	
	Maximum flow rated (Lift/Tilt)			lpm (US.gpm)	76/30 (20/8)	
	Main relief valve set pressure (DV1)			bar (psi)	200 (2900)	★175 (2540)
	Attachment oil flow rated (Aux1/2)			lpm (US.gpm)	45/45 (12/12)	
	Attachment relief valve pressure (DV2)			bar (psi)	140~180 (2030~2610)	
	Weight			kgf (lbf)	4spool: 14 (31)	
Cylinders	Main lift (V330)	2.5/ 3.0t	Tube bore dia x Rod dia x Stroke	mm x mm x mm [kgf / lbf]	50 x 40 x 163 [31 / 68]	
	Main lift (TF430)				50 x 40 x 139.7 [33 / 73]	
	Free lift (TF430)				75 x 50 x 73.3 [28 / 62]	
	Main lift (V330)	3.5t			55 x 45 x 163 [36 / 79]	
	Main lift (TF430)				55 x 45 x 137.5 [38 / 84]	
	Free lift (TF430)				85 x 60 x 73.3 [39 / 86]	
	Tilt (6/10 degree)				75 x 35 x 129 [20 / 44]	
	Steering				75 x 50 x 86 [17 / 37]	
Steering unit	Type			-	Load sensing, Non-load reaction	
	Manufacturer			-	Sauer Danfoss (VSP-125)	
	Capacity			cm^3/rev (in^3/rev)	125 (7.63)	
	Weight			kgf (lbf)	5.5 (12)	

★ : EU, AN corporate sales equipment (25D-9V/VS)

Item	Index	Unit	Specification
Priority Valve (Brake, non-booster type)	Type	-	Load sensing, Dynamic signal
	Manufacturer	-	Eaton (VLC-60)
	Rated input flow	lpm (US.gpm)	60 (16)
	Max. inlet and EF Pressure	bar (psi)	241 (3495)
	Max. CF Pressure	bar (psi)	190 (2755)
	Steering relief valve set pressure	bar (psi)	100 (1450)
	Weight	kgf (lbf)	5.5 (12)
Dual Flow Divider valve (Brake, booster type)	Type	-	Load sensing, Dynamic signal
	Manufacturer	-	Parker
	Rated input flow	lpm (US.gpm)	76 (20)
	Brake flow control	lpm (US.gpm)	4 (1)
	Max. inlet and EF Pressure	bar (psi)	241 (3495)
	Max. CF Pressure	bar (psi)	190 (2755)
	Steering relief valve set pressure	bar (psi)	100 (1450)
	Weight	kgf (lbf)	7 (15.4)

※ POWER TRAIN DEVICES

Item			Specification
Torque converter	Model		KAPEC 280 DJ
	Type		3 Element, 1 stage, 2 phase
	Stall ratio		2.87
Transmission	Type		Power shift
	Gear shift(FWD/REV)		1/1
	Control		Electric Proportional Solenoid Valve (Controlled by TCU) ★Electric On/Off Solenoid Valve
	Overhaul ratio	FWD	1.437
		REV	1.437
Axle	Type		Front-wheel drive type, fixed location
	Gear ratio		11.568 : 1
	Gear		Spiral bevel gear type
Wheels	Q'ty (FR/RR)		Single : 2/2, Double : 4/2
	Front (drive)	2.5 T	Single : 7.00-12-12 PR, Double : 6.00-15-10 PR(~#154), 7.00-12 12PR(#155~)
		3.0 T	Single : 8.15-15-14 PR Double : 6.00-15-10 PR(~#154), 7.00-12 12PR(#155~)
		3.5 T	
	Rear (steer)	2.5 T	6.50-10-12 PR
		3.0 T	
		3.5 T	
Brakes	Travel		Front wheel, wet disk brake
	Parking		Wet disk (negative brake)
Steering	Type		Full hydraulic, power steering
	Steering angle		78.9˚ to both right and left angle, respectively

★ : 25/30D-9VS, 35DN-9VS

4. TIGHTENING TORQUE FOR MAJOR COMPONENTS

No.	Items		Size	kgf · m	lbf · ft
1	Engine	Engine mounting nut (bracket-engine mount)	M12×1.25	9.7±1.9	70.0±13.7
2		Engine mounting bolt (engine-bracket)	M10×1.25	7.4±1.5	53.5±10.0
3		Radiator mounting nut	M10×1.5	5.0±1.0	36.2±7.2
4		Torque converter mounting bolt (8EA)	M10×1.25	7.4±1.5	53.5±10.0
5	Hydraulic system	Pump mounting bolt	M10×1.5	5.3±0.5	38.3±3.6
6		MCV mounting bolt	M8×1.25	2.5±0.5	18.1±3.6
7		PF valve mounting bolt	M8×1.25	2.5±0.5	18.1±3.6
8		Steering unit mounting bolt	M10×1.5	4.0±0.5	28.9±3.6
9		Priority valve mounting bolts/nuts	M8×1.25	2.5±0.5	18.1±3.6
10		Tilt cylinder; rod-end bolts/nuts	M12×1.75	9.5±0.5	68±13.7
11		Tilt cylinder pin; mounting bolts	M10×1.5	4.0±0.5	28.9±3.6
12	Power train system	Transmission mounting bolt, nut	M16×2.0	7.5	54.0
13		Drive axle mounting bolt, nut	M20×1.5	65.0±3.0	470±21.0
14		Steering axle mounting bolt	M20×2.5	58.0±8.5	420±61.0
15		Front wheel mounting nut	3/4-16UNF	40.0±10.0	289±72.0
16		Rear wheel mounting nut	M16×1.5	18.0±2.0	130±14.0
17	Others	Counterweight mounting bolt	M30×3.5	100±15.0	723±108.0
18		Operator's seat mounting nut	M 8×1.25	2.5±0.5	18.1±3.6
19		Head guard mounting bolt, nut	M12×1.75	12.3±1.2	89.0±8.7

5. TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT

(1) Coarse thread

Bolt size	8.8T		10.9T		12.9T	
	kgf · m	lbf · ft	kgf · m	lbf · ft	kgf · m	lbf · ft
M 6×1.0	0.8 ~ 1.2	5.8 ~ 8.6	1.2 ~ 1.8	8.7 ~ 13.0	1.5 ~ 2.1	10.9 ~ 15.1
M 8×1.25	2.0 ~ 3.0	14.5 ~ 21.6	2.8 ~ 4.2	20.3 ~ 30.4	3.4 ~ 5.0	24.6 ~ 36.1
M10×1.5	4.0 ~ 6.0	29.0 ~ 43.3	5.6 ~ 8.4	40.5 ~ 60.8	6.8 ~ 10.0	49.2 ~ 72.3
M12×1.75	6.8 ~ 10.2	50.0 ~ 73.7	9.6 ~ 14.4	69.5 ~ 104	12.3 ~ 16.5	89.0 ~ 119
M14×2.0	10.9 ~ 16.3	78.9 ~ 117	16.3 ~ 21.9	118 ~ 158	19.5 ~ 26.3	141 ~ 190
M16×2.0	17.9 ~ 24.1	130 ~ 174	25.1 ~ 33.9	182 ~ 245	30.2 ~ 40.8	141 ~ 295
M18×2.5	24.8 ~ 33.4	180 ~ 241	34.8 ~ 47.0	252 ~ 340	41.8 ~ 56.4	302 ~ 407
M20×2.5	34.9 ~ 47.1	253 ~ 340	49.1 ~ 66.3	355 ~ 479	58.9 ~ 79.5	426 ~ 575
M22×2.5	46.8 ~ 63.2	339 ~ 457	65.8 ~ 88.8	476 ~ 642	78.9 ~ 106	570 ~ 766
M24×3.0	60.2 ~ 81.4	436 ~ 588	84.6 ~ 114	612 ~ 824	102 ~ 137	738 ~ 991
M30×3.5	120 ~161	868 ~ 1164	168 ~ 227	1216 ~ 1641	202 ~ 272	1461 ~ 1967

(2) Fine thread

Bolt size	8.8T		10.9T		12.9T	
	kgf · m	lbf · ft	kgf · m	lbf · ft	kgf · m	lbf · ft
M 8×1.0	2.1 ~ 3.1	15.2 ~ 22.4	3.0 ~ 4.4	21.7 ~ 31.8	3.6 ~ 5.4	26.1 ~ 39.0
M10×1.25	4.2 ~ 6.2	30.4 ~ 44.9	5.9 ~ 8.7	42.7 ~ 62.9	7.0 ~ 10.4	50.1 ~ 75.2
M12×1.25	7.3 ~ 10.9	52.8 ~ 78.8	10.3 ~ 15.3	74.5 ~ 110	13.1 ~ 17.7	94.8 ~ 128
M14×1.5	12.4 ~ 16.6	89.7 ~ 120	17.4 ~ 23.4	126 ~ 169	20.8 ~ 28.0	151 ~ 202
M16×1.5	18.7 ~ 25.3	136 ~ 182	26.3 ~ 35.5	191 ~ 256	31.6 ~ 42.6	229 ~ 308
M18×1.5	27.1 ~ 36.5	196 ~ 264	38.0 ~ 51.4	275 ~ 371	45.7 ~ 61.7	331 ~ 446
M20×1.5	37.7 ~ 50.9	273 ~ 368	53.1 ~ 71.7	384 ~ 518	63.6 ~ 86.0	460 ~ 622
M22×1.5	51.2 ~ 69.2	370 ~ 500	72.0 ~ 97.2	521 ~ 703	86.4 ~ 116	625 ~ 839
M24×2.0	64.1 ~ 86.5	464 ~ 625	90.1 ~ 121	652 ~ 875	108 ~ 146	782 ~ 1056
M30×2.0	129 ~ 174	933 ~ 1258	181 ~ 245	1310 ~ 1772	217 ~ 294	1570 ~ 2126

2) PIPE AND HOSE (FLARE TYPE)

Hose size	Thread (PF)	Hex. across flat (mm)	Tightening torque	
			kgf·m	lbf·ft
1/4"	1/4	19	4	28.9
3/8"	3/8	22	5	36.2
1/2"	1/2	27	9.5	68.7
3/4"	3/4	36	18	130.2
1"	1	41	21	151.9
1-1/4"	1-1/14	50	35	253.2

3) PIPE AND HOSE (ORFS TYPE)

Hose size	Thread (UN/UNF/UNS)	Hex. across flat (mm)	Tightening torque	
			kgf·m	lbf·ft
1/4"	9/16-18	19	3	21.7
3/8"	11/16-16	22	5	36.2
1/2"	13/16-16	24	7	50.6
5/8"	1-14	30	12	86.8
3/4"	1-3/16-12	36	18	130.2
1"	1-7/16-12	41	23	166.4
1-1/4"	1-11/16-12	50	28	202.5
1-1/2"	2-12	58	32	231.1

4) FITTING (O-RING SEAL TYPE)

Hose size	Thread (UN/UNF)	Hex. across flat (mm)	Tightening torque	
			kgf·m	lbf·ft
1/4"	7/16-20	17	2	14.5
3/8"	9/16-18	19	3	21.7
1/2"	3/4-16	22	4	28.9
		24	6	43.4
5/8"	7/8-14	27	10	72.3
		30	12	86.8
3/4"	1-1/16-12	32	15	108.5
		36	18	130.2
1"	1-5/16-12	41	23	166.4
1-1/4"	1-5/8-12	50	28	202.5
1-1/2"	1-7/8-12	55	32	231.5

5) BAND CLAMP

Tag No.	Hose size (mm)	Band width (mm)	Tightening torque	
			kgf·m	lbf·ft
S20-15	8 ~ 14	9	0.3	2.17
S20-17	11 ~ 17			
S20-22	13 ~ 20		0.35	2.53
S20-25	15 ~ 24			
S20-28	19 ~ 28			
S20-32	22 ~ 32	12		
S20-40	26 ~ 38	9	0.42	3.04
S20-45	32 ~ 44			

6) BAND CLAMP (IDEAL, FLEX GEAR TYPE)

Tag No.	Hose size (mm)	Band width (mm)	Tightening torque	
			kgf·m	lbf·ft
41-212	32 ~ 54	15.9	1.1	8.0
41-262	45 ~ 67			
41-312	57 ~ 79			
41-362	40 ~ 92			
41-412	83 ~ 105			
41-462	95 ~ 117			
41-512	108 ~ 130			

6. WRENCH AND SPANEER CHART

No.	Wrench & Spanner			Thread			PIPE AND HOSE	
	inch		mm	UNF/UN	M	PF/G	ORFS (UNF/UN)	FLARE (PF)
1	-	0.050	1.3	-	-	-	-	-
2	-	0.059	1.5	-	-	-	-	-
3	1/16	0.063	1.6	-	-	-	-	-
4	5/64	0.078	2	-	-	-	-	-
5	3/32	0.094	2.4	-	-	-	-	-
6	-	0.098	2.5	-	-	-	-	-
7	7/64	0.109	2.8	-	-	-	-	-
8	-	0.118	3	-	-	-	-	-
9	1/8	0.125	3.2	-	-	-	-	-
10	9/64	0.141	3.5	-	-	-	-	-
11	5/32	0.156	4	-	-	-	-	-
12	-	0.177	4.5	-	-	-	-	-
13	3/16	0.188	4.8	-	-	-	-	-
14	-	0.197	5	-	-	-	-	-
15	13/64	0.203	5.2	-	-	-	-	-
16	7/32	0.219	5.5	-	-	-	-	-
17	15/64	0.234	6	-	-	-	-	-
18	1/4	0.250	6.4	-	-	-	-	-
19	17/64	0.266	6.8	-	-	-	-	-
20	9/32	0.281	7	-	-	-	-	-
21	5/16	0.313	8	-	-	-	-	-
22	11/32	0.344	8.7	-	-	-	-	-
23	-	0.354	9	-	-	-	-	-
24	3/8	0.375	9.5	-	-	-	-	-
25	-	0.394	10	-	-	-	-	-
26	-	-	11	-	-	-	-	-
27	7/16	0.438	11.1	-	-	-	-	-
28	15/32	0.469	12	-	-	-	-	-
29	1/2	0.500	12.7	-	-	-	-	-
30	-	-	13	-	-	-	-	-
31	17/32	0.53	13.5	-	-	-	-	-
32	-	0.55	14	7/16-20	-	-	-	-
33	9/16	0.56	14.3	-	-	-	-	-
34	19/32	0.59	15	-	-	-	-	-
35	5/8	0.63	15.9	-	-	-	-	-
36	-	-	16	-	-	-	-	-
37	21/32	0.66	16.7	-	-	-	-	-

No.	Wrench & Spanner			Thread			PIPE AND HOSE	
	inch		mm	UNF/UN	M	PF/G	ORFS (UNF/UN)	FLARE (PF)
38	-	-	17	-	M12	-	-	-
39	11/16	0.69	17.5	-	-	-	-	-
40	-	-	18	-	-	-	-	-
41	3/4	0.75	19	9/16-18	M14	G1/4	9/16-18	PF1/4
42	25/32	0.78	19.8	-	-	-	-	-
43	-	-	20	-	-	-	-	-
44	13/16	0.81	20.6	-	-	-	-	-
45	-	-	21	-	-	-	-	-
46	-	-	22	-	M16	G3/8	11/16-16	PF3/8
47	7/8	0.88	22.2	-	-	-	-	-
48	29/32	0.91	23	-	-	-	-	-
49	15/16	0.94	23.8	-	-	-	-	-
50	-	-	24	3/4-16	M18	-	13/16-16	-
51	31/32	0.97	26.4	-	-	-	-	-
52	-	-	25	-	-	-	-	-
53	1	1.00	25.4	-	-	-	-	-
54	-	-	26	-	-	-	-	-
55	1 1/16	1.06	27	7/8-14	M22	G1/2	-	PF1/2
56	-	-	28	-	-	-	-	-
57	1 1/8	1.13	28.6	-	-	-	-	-
58	-	-	29	-	-	-	-	-
59	-	-	30	-	-	-	1-14	-
60	1 3/16	1.19	30.2	-	-	-	-	-
61	-	-	31	-	-	-	-	-
62	1 1/4	1.25	31.8	-	-	-	-	-
63	-	-	32	1-1/16-12	M24	G3/4	-	-
64	-	-	33	-	-	-	-	-
65	1 5/16	1.31	33.3	-	-	-	-	-
66	-	-	34	-	-	-	-	-
67	1 3/8	1.38	35	-	-	-	-	-
68	-	-	36	1-3/16-12	M27	G3/4	1-3/16-12	PF3/4
69	1 7/16	1.44	37	-	-	-	-	-
70	1 1/2	1.50	38	-	-	-	-	-
71	-	-	39	-	-	-	-	-
72	1 9/16	1.56	39.7	-	-	-	-	-
73	-	-	40	-	-	-	-	-
74	-	-	41	1-5/16-12	M33	G1	1-7/16-12	PF1
75	1 5/8	1.63	41.3	-	-	-	-	-

No.	Wrench & Spanner			Thread			PIPE AND HOSE	
	inch		mm	UNF/UN	M	PF/G	ORFS (UNF/UN)	FLARE (PF)
76	1 11/16	1.69	43	-	-	-	-	-
77	1 3/4	1.75	44	-	-	-	-	-
78	1 13/16	1.81	46	-	-	-	-	-
79	1 7/8	1.88	47.6	-	-	-	-	-
80	-	-	48	-	-	-	1-11/16-12	-
81	1 15/16	1.94	49.2	-	-	-	-	-
82	-	-	50	1-5/8-12	-	G1-1/4	-	PF1-1/4
83	2	2.00	50.8	-	-	-	-	-
84	-	-	51	-	-	-	-	-
85	2 1/8	2.13	54	-	-	-	-	-
86	-	-	55	1-7-8-12	-	G1-1/2	-	PF1-1/2
87	-	-	57	-	-	-	2-12	-
88	2 1/4	2.25	57.2	-	-	-	-	-
89	-	-	60	-	-	-	-	-

7. RECOMMENDED LUBRICANTS

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

Service point	Kind of fluid	Capacity ℓ (U.S. gal)	Ambient temperature °C(°F) -50 (-58) -30 (-22) -20 (-4) -10 (14) 0 (32) 10 (50) 20 (68) 30 (86) 40 (104)
Engine oil pan	Engine oil	6.3 (1.66) 25D-9V : ~#29 30D-9V : ~#28 35DN-9V :~#40	★SAE 5W-40 SAE 30 SAE 10W
		8.2 (2.16) 25D-9V : #30~ 30D-9V : #29~ 35DN-9V : #41~	SAE 10W-30 SAE 15W-40
Torque converter transmission	Transmission oil	7 (1.8)	ATF DEXRON III
Axle	Gear oil	8.2 (2.2)	SHELL SPIRAX S4 XTM
Hydraulic tank	Hydraulic oil	38 (10)	★ISO VG 15 ISO VG 32 ISO VG 46 ISO VG 68
Fuel tank	Diesel fuel★1	60 (15.9)	★ASTM D975 NO.1 ASTM D975 NO.2
Fitting (Grease nipple)	Grease	-	★NLGI NO.1 NLGI NO.2
Brake reservoir tank	Brake oil	0.5 (0.13)	★AZOLLA ZS10 (Hydraulic oil, ISO VG10) AZOLLA ZS32 (Hydraulic oil, ISO VG32)
Radiator	Antifreeze : Water	13.5 (3.57)	Ethylene glycol base permanent type (50:50) ★Ethylene glycol base permanent type (60 : 40)

NOTES :

- Engine oil should be ACEA classification C2/C3.
- Change the type of engine oil according to the ambient temperature.
- When using oil of different brands from the previous one, be sure to drain all the previous oil before adding the new engine oil.

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

★ : Cold region
Russia, CIS, Mongolia

GROUP 3 PERIODIC REPLACEMENT

For operation safety, never fail to perform periodic maintenance or make periodic replacement of the consumable parts listed in the following.
These parts may deteriorate in time and are susceptible to wear. It is difficult to estimate the degree of wear at time of periodic maintenance; therefore, even if no apparent wear is found, always replace with new parts within the prescribed period of replacement (Or earlier if trouble is found).
Note that periodic replacement has nothing to do with guarantee service.

No.	Periodical replacement of safety parts	Interval
1	Hydraulic tank - air breather element	Every 1.5 month (harsh operation)
	Hydraulic tank - air breather element	Every 3 month (normal operation)
2	Hydraulic tank - return filter	Every 6 month
3	Hydraulic tank - suction strainer	Every 1 year
4	Hydraulic tank - oil (conventional hyd. oil)	Every 1 year
	Hydraulic tank - oil (HYUNDAI genuine long life hyd. oil)	Every 2.5 years
5	Master cylinder and wheel cylinder caps dust seals	Every 1 year
6	Lift cylinder hose	Every 1 year (harsh operation) Every 2 years (normal operation)
7	Tilt cylinder hose	
8	Side shift cylinder hose	
9	Brake hose or tube	
10	Hydraulic pump hose	Every 2 years
11	Power steering hose	
12	Coolant hose and clamps	
13	Fuel hose	Every 2 years (harsh operation) Every 4 years (normal operation)
14	Packing, seal, and O-ring of steering cylinder	
15	Lift chain	
16	Hydraulic pump seal kit	Every 3 years
17	Pressure sensor	Every 5 years
18	Mast accmulator (piston type)	Every 10 years

※ Replace the O-ring and gasket at the same time when replacing the hose.
※ Replace clamp at the same time if the hose clamp is cracked when checking and replacing hose.
※ Normal operation
- Eight hour material handling, mostly in buildings or in clean, open air on clean paved surfaces.

※ Harsh operation
- All harsh working environment
- Long term heavy load operation
- High and low temperature working environment
- Sudden change in temperature
- Dusty or sandy working environment
- Highly corrosive chemical working environment
- Damp working environment

SECTION 2 REMOVAL & INSTALLATION OF UNIT

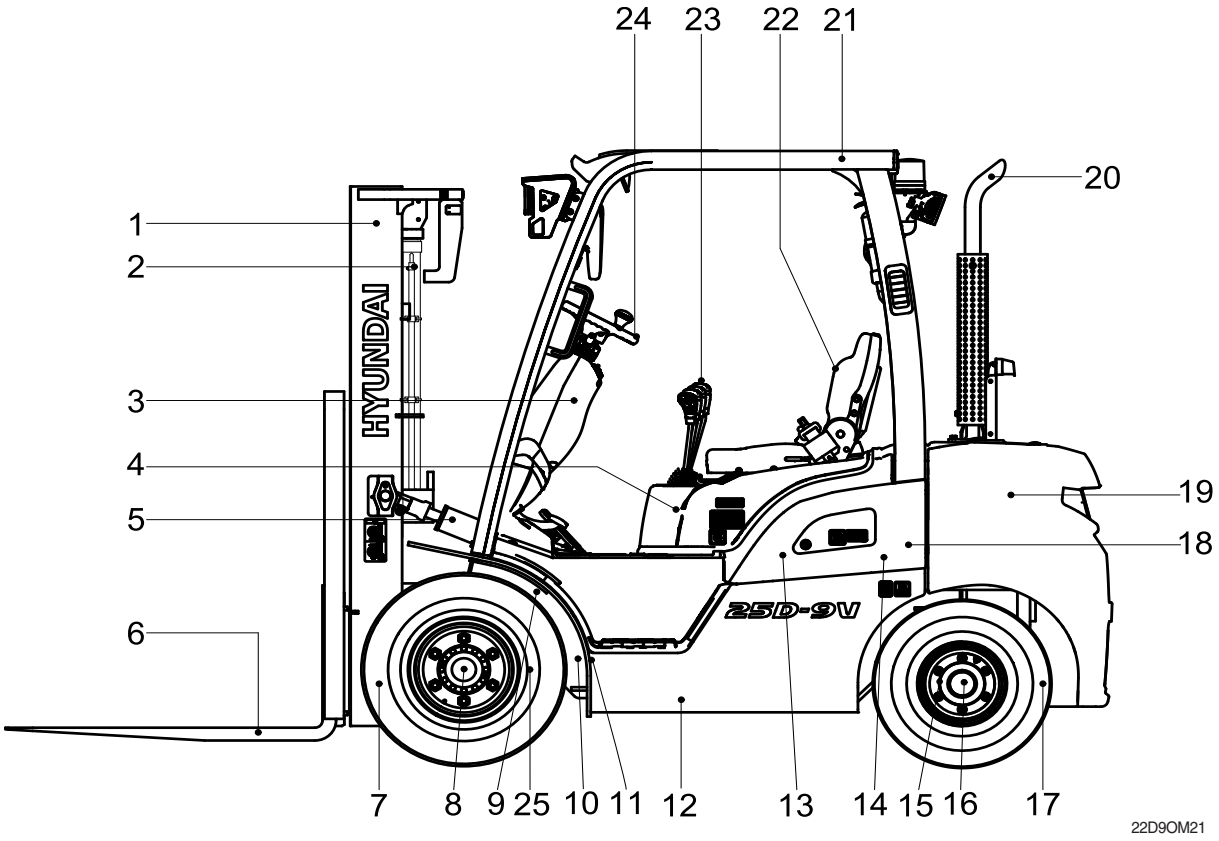
Group 1 Structure 2-1

Group 2 Removal and Installation of unit 2-2

Group 3 Maintenance for hose 2-17

SECTION 2 REMOVAL & INSTALLATION OF UNIT

GROUP 1 MAJOR COMPONENTS



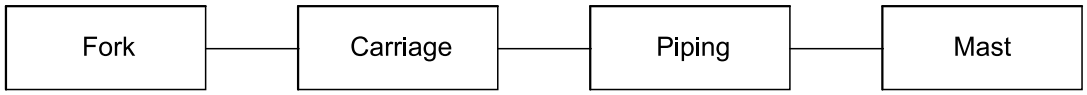
1	Mast	10	Transmission	19	DPF assy.
2	Lift cylinder	11	Torque converter	20	Silencer
3	Steering unit	12	Engine	21	Overhead guard
4	Control valve	13	Air cleaner	22	Seat
5	Tilt cylinder	14	Exhaust pipe	23	Control lever
6	Fork	15	Steering axle	24	Steering wheel
7	Front wheel	16	Steering cylinder	25	Drive shaft
8	Drive axle	17	Rear wheel		
9	Hydraulic pump	18	Radiator		

GROUP 2 REMOVAL AND INSTALLATION OF UNIT

Remove and install following units as explained in the flow chart.

1. MAST

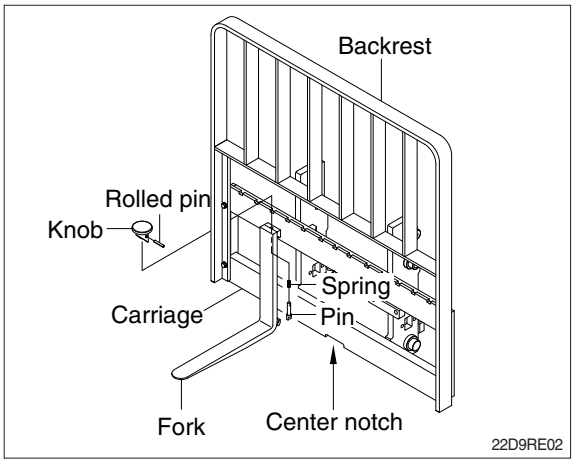
1) REMOVAL



L15C3RE001

(1) Forks

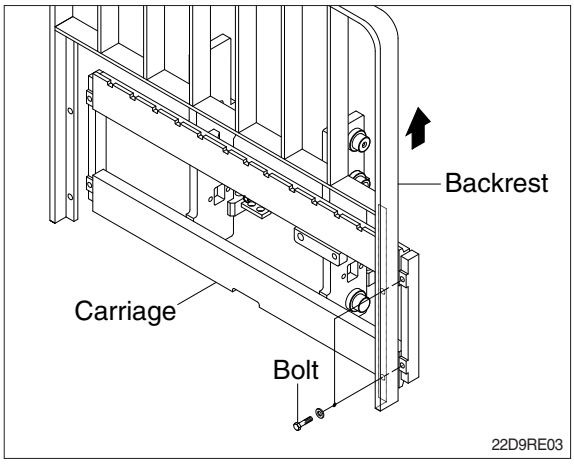
① Lower the fork carriage until the forks are approximately 25 mm (1 in) from the floor.
② Turn knob up and slide one fork at a time toward the center of the carriage where a notch has been cut in the bottom plate for easy removal.
③ Remove only one fork at a time.
※ On larger forks it may be necessary to use a block of wood.



22D9RE02

(2) Backrest (If necessary)

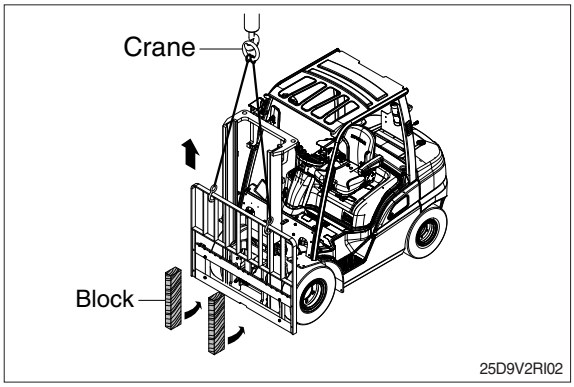
① Remove bolts securing backrest to fork carriage. Lift backrest straight up and remove it from carriage.



22D9RE03

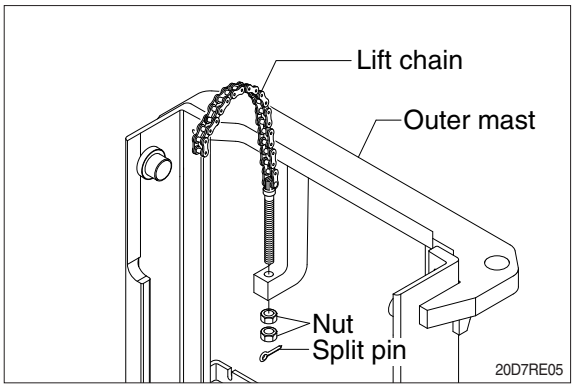
(3) Carriage

① With the mast vertical, raise the carriage high enough to place blocks under the load forks. This is done to create slack in the load chains when the carriage is lowered. Lower the carriage all the way down to the floor. Make sure the carriage is level, this will prevent any binding when the mast is raised.

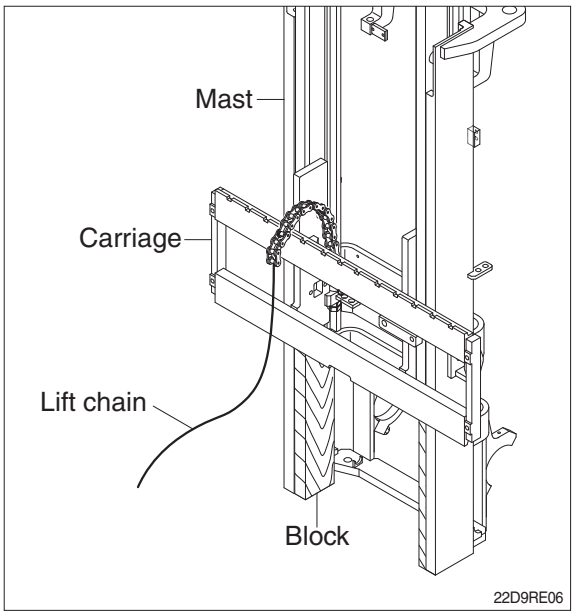


25D9V2RI02

② While supporting lift chains, remove nuts and split pin from the anchor bolt.



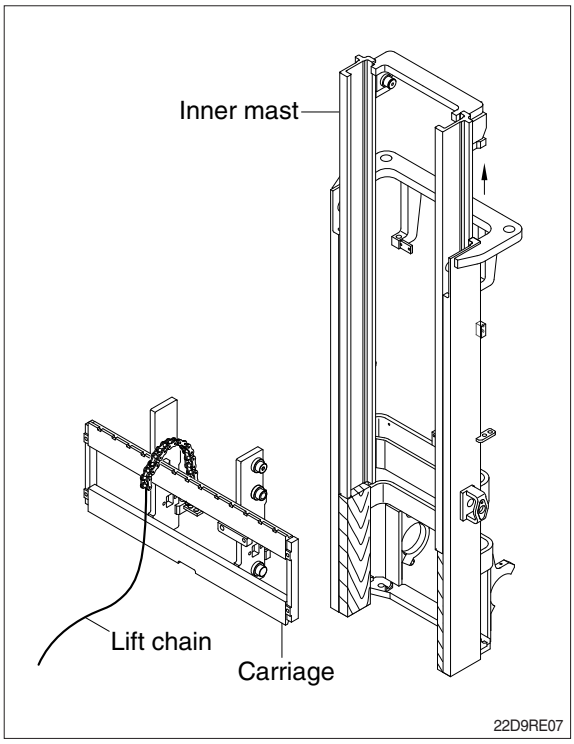
③ Pull the chains out of the sheaves and drape them over the front of the carriage.



④ Slowly raise inner mast upright until mast clears top of fork carriage. Move carriage to work area and lower the mast.

⚠ Make sure that carriage remains on floor and does not bind while mast is being raised.

※ Inspect all parts for wear or damage. Replace all worn or damaged parts.

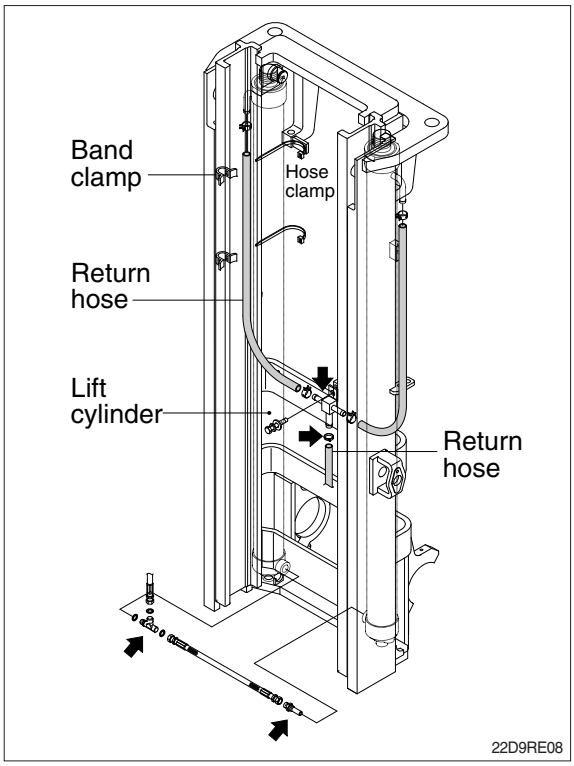


(4) Piping

① Remove the return hoses and clamps attached to the cylinder.

② Remove hose assembly, valve and tee from the lift cylinder.

※ Put blind plugs in the piping immediately after removing hoses.
This prevents the hydraulic oil from flowing out and also prevents dust and dirt from getting in.



(5) Lift cylinder

① Loosen hexagonal bolts and remove washers securing the lift cylinders to inner mast.

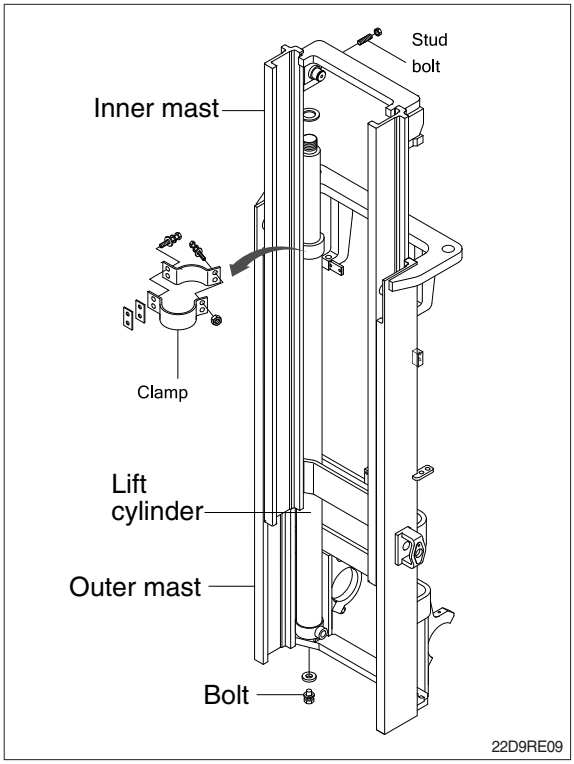
② Bind the lift cylinder with overhead hoist rope and pull up so that the rope has no slack or binding.

⚠ Make sure that the lift cylinder be tightened firmly for safety.

③ Loosen and remove hexagon nuts and clamp securing cylinder to outer mast.

④ Using an overhead hoist, slowly raise the inner mast high enough to clear lift cylinder.

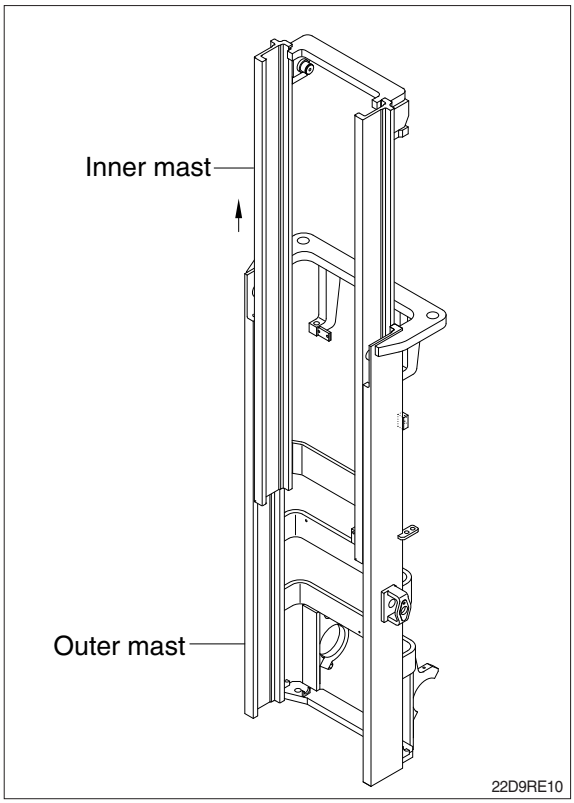
⑤ Using an overhead hoist, draw out lift cylinder carefully and put down on the work floor.



(6) Inner mast

① Using an overhead hoist raise the inner mast straight and carefully draw out of outer mast section.

⚠ Be careful the mast not to swing or fall.



(7) Tilt cylinder pin

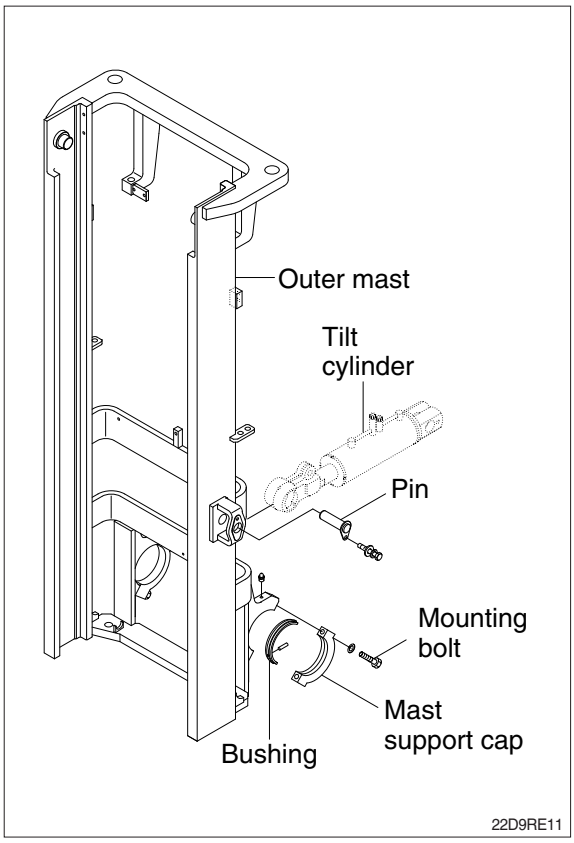
① Loosen the bolt and remove the tilt cylinder pin.

(8) Mast support cap

① Attach a crane to the stay at the top of the outer mast, and raise enough to sustain jacked up machine.

※ This operation is carried out from under the machine, so use a pit, or if there is no pit, jack up the machine and loosen with impact wrench.

② Remove the mounting bolts from the cap then slowly raise the outer mast.



2) INSTALLATION

After assembling mast components totally without piping connections, install mast assembly to the equipment.

※ Installation procedure for each of mast component is the reverse of the removal procedure.

(1) Mast support cap

① Check the mast support cap and spring pin for wear.

② Jack up the machine so that the front is raised and then using an overhead hoist assemble outer mast to drive axle unit.

③ Tighten mounting bolts to mast support cap. Apply lubrication oil GTP 600 or 1000 PASTE.

· Tightening torque : 35.6±7.1 kgf · m (257±51.4 lbf · ft)

(2) Tilt cylinder pin

Hold the mast with a crane, operate the tilt control lever and align the holes, then knock the pin.

(3) Lift cylinder installation and adjustment

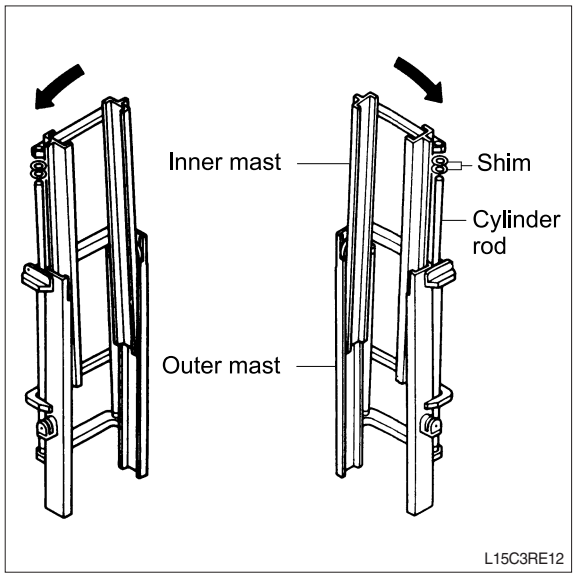
① Assemble the lift cylinder inside the outer mast, then tighten the stopper bolt. If the cylinder assembly has been replaced, adjust as follows so that the left and right cylinders are synchronized at the maximum lifting height.

② Assemble the cylinder rod to the inner mast, and check the left-to-right play of the mast at the maximum lifting height.

※ If play is to LEFT, install adjustment shim to LEFT cylinder.

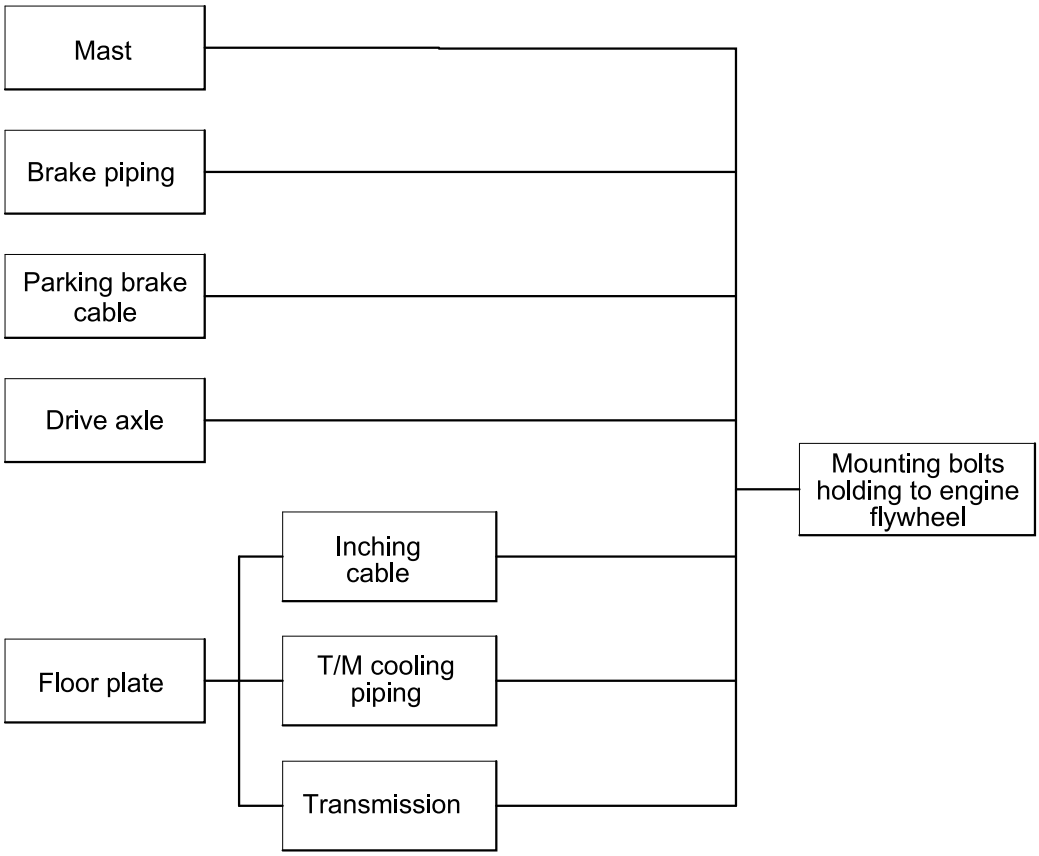
※ If play is to RIGHT, install adjustment shim to RIGHT cylinder.

· Shim thickness : 1.0 mm (0.04 in)



2. POWER TRAIN ASSEMBLY

1) REMOVAL



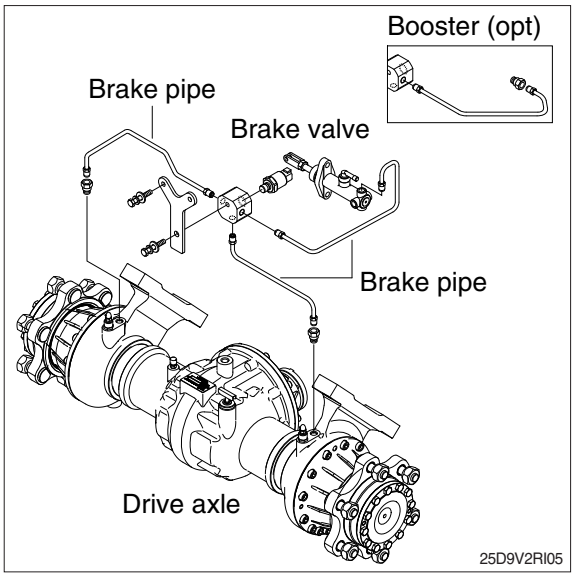
25D9V2RI17

(1) Mast

Refer to section on mast (Page 2-2)

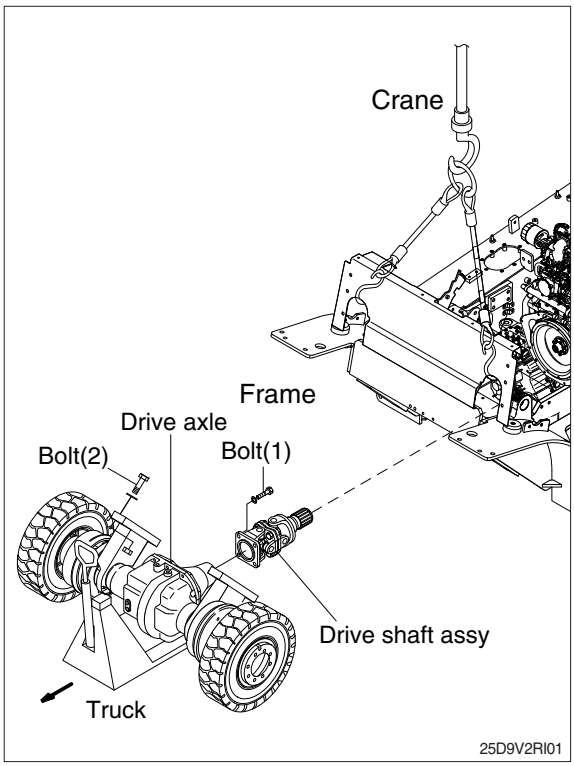
(2) Brake piping

Disconnect the brake piping from the brake housing of drive axle.



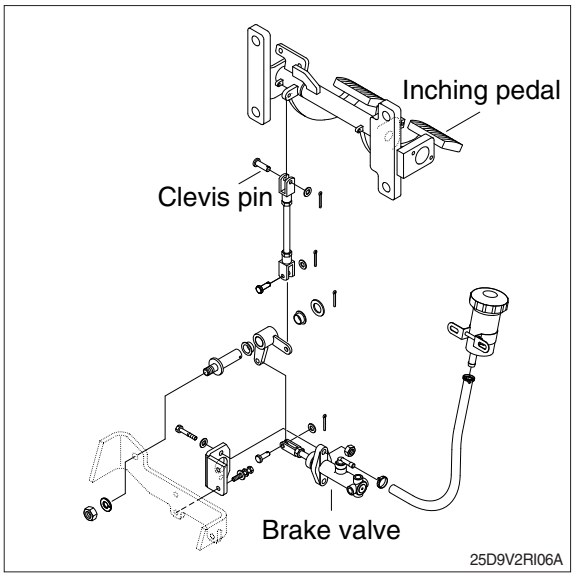
(3) Drive axle

① Attach a crane to the tilt cylinder notches on the dashboard and raise the machine.
② Loosen the bolts (1) mounted on the drive axle.
③ Put the block under the drive axle to support the truck.
④ Loosen the bolts (2) mounted on the frame. Then slowly pull out the drive axle forward.
⑤ Remove drive shaft assy from transmission.



(4) Inching linkage

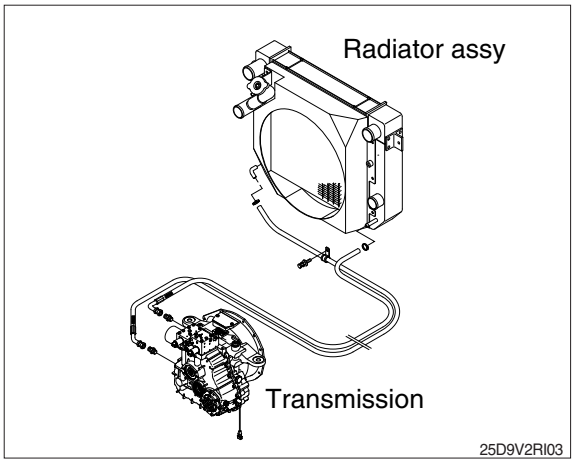
Remove the clevis pin from the brake valve.



(5) Transmission cooling piping

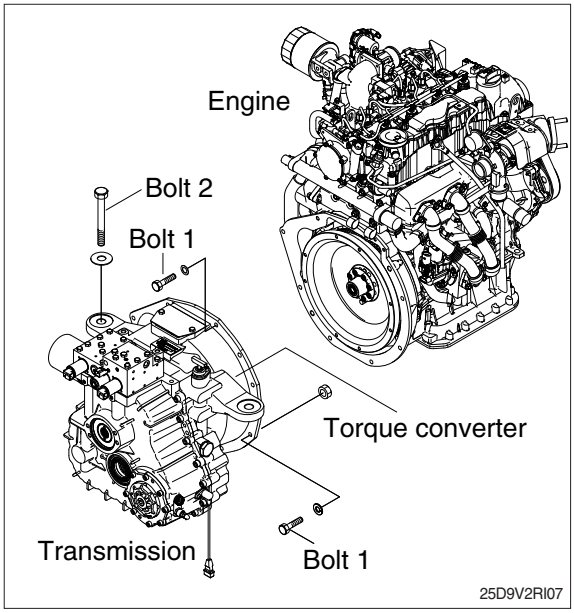
① Disconnect cooling hose from the transmission.

※ Make sure that the coolant be drained from the hose.

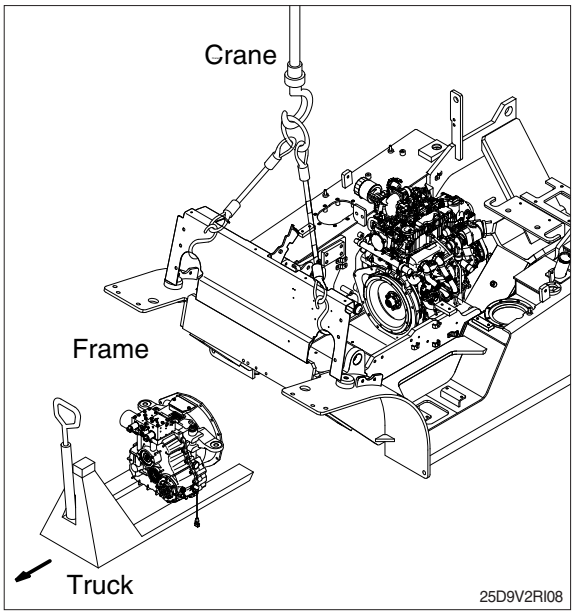


(6) Transmission assembly

① Remove the transmission assembly by loosening the bolts (1) mounted on the engine flywheel housing and the bolts (2) mounted on the main frame.



② Slowly pull out the transmission assembly forward.



2) INSTALLATION

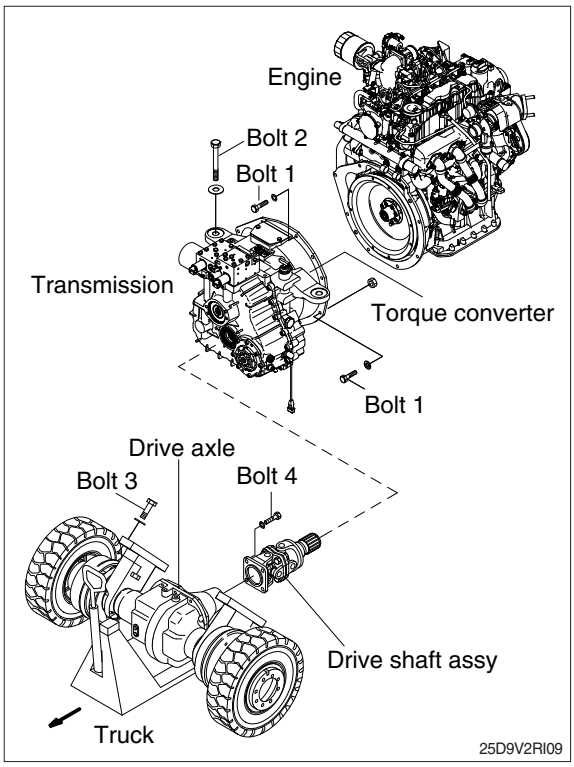
※ Do not remove the bolts unless necessary. Loctite is coated over the threads of bolt. So, once the bolts were removed, coat them with loctite (#243) when installing.

※ Before installing the bolts, loctite in the holes should be removed by a tap.

(1) Installation is the reverse order to removal, but be careful of the following points.

(2) Tightening torque

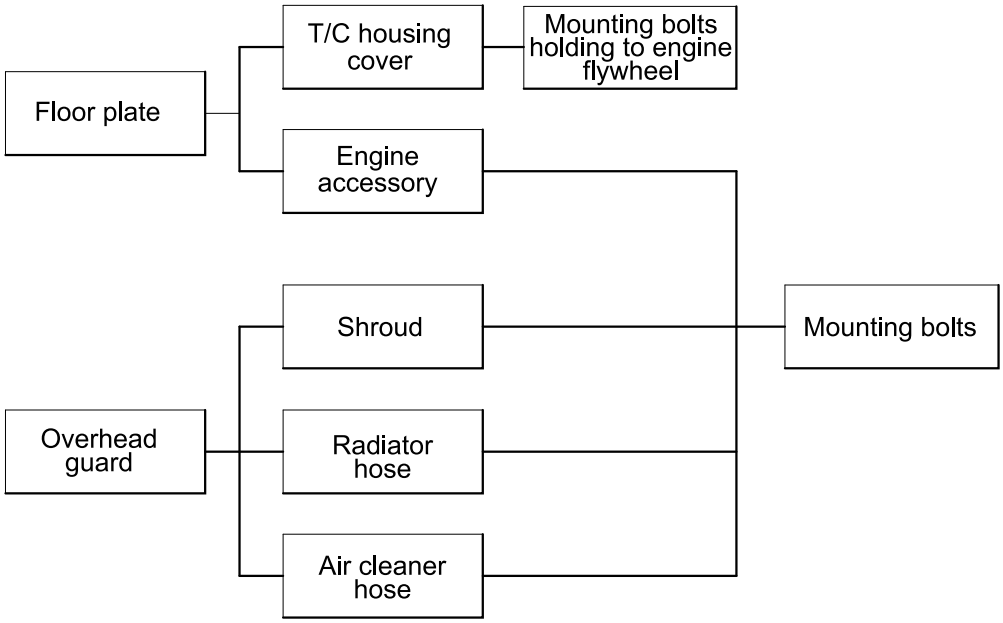
- Bolt (1) : 5.9~8.9 kgf·m (42.7~64.4 lbf·ft)
- Bolt (2) : 7.5 kgf·m (54.3 lbf·ft)
- Bolt (3) : 62~68 kgf·m (448~492 lbf·ft)
- Bolt (4) : 5.9~8.9 kgf·m (42.7~64.4 lbf·ft)



3. ENGINE

Remove the torque converter, transmission and front axle inside the frame, then remove the engine assembly.

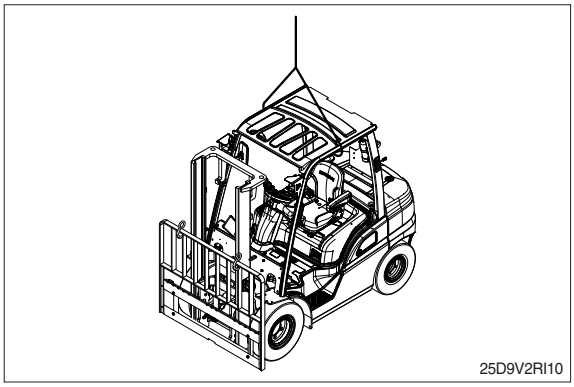
1) REMOVAL



D503RE25

(1) Overhead guard

Remove the wiring for rear combination lamp, working lamp, head lamp and flasher lamp on the stay of the overhead guard and then raise it together with the bonnet.



25D9V2RI10

(2) Loosen the bolts mounted on the engine flywheel housing. For details, see page 2-9.

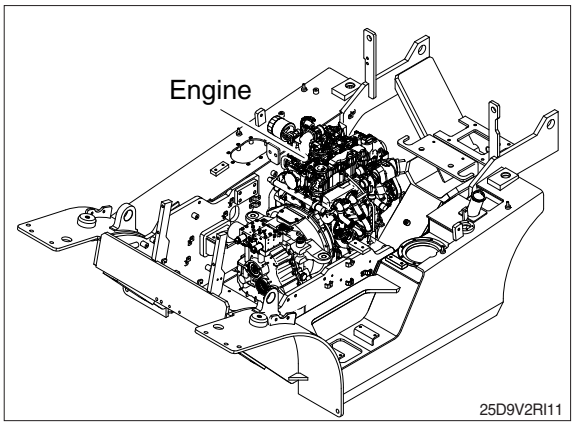
(3) Engine accessory

Remove all wiring harnesses, cables and hoses around the engine, dashboard and frame.

① Wiring harness to alternator and starter.

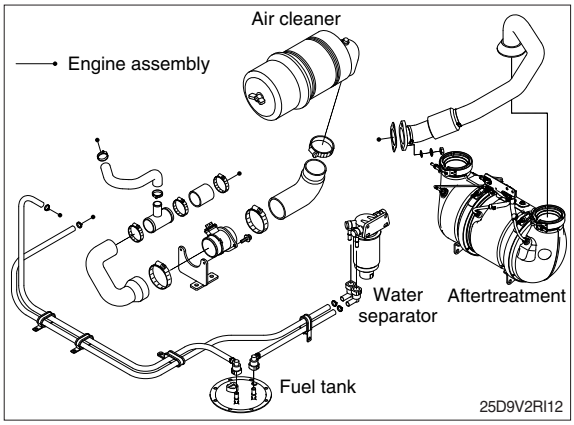
② Wiring harness for oil pressure and engine water temperature gauges.

③ Cables for meters, buttons and accelerator pedal.



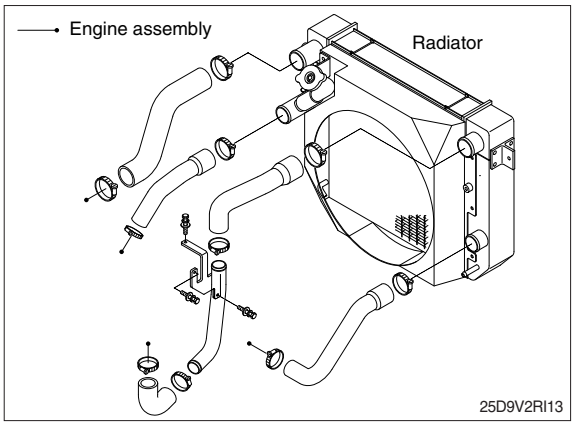
④ Hoses to the fuel tank and the water separator, pipes to the air cleaner

⑤ pipe to the aftertreatment



(4) Radiator hose

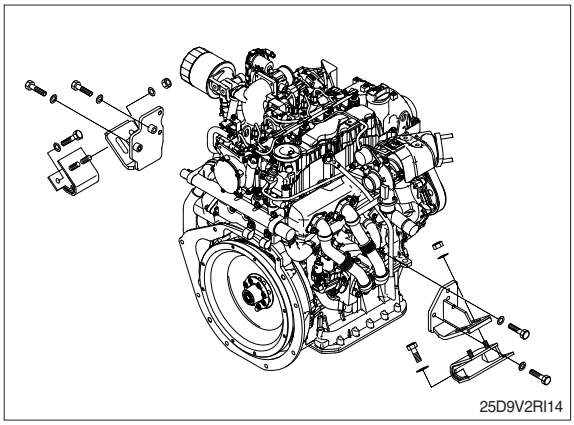
Open the drain valve of the radiator and drain the cooling water, then remove the radiator hose.



(5) Mounting bolt

Attach a crane to the engine hook and raise, then remove mounting bolts. Raise the engine slightly, slide towards the radiator, then lift up.

※ When sliding the engine, be careful of the collision with engine and radiator.



2) INSTALLATION

Installation is the reverse order of removal, but be careful of the following points.

※ Do not remove the bolts unless necessary. Loctite is coated over the threads of bolt. So, once the bolts were removed, coat them with loctite (#243) when installing.

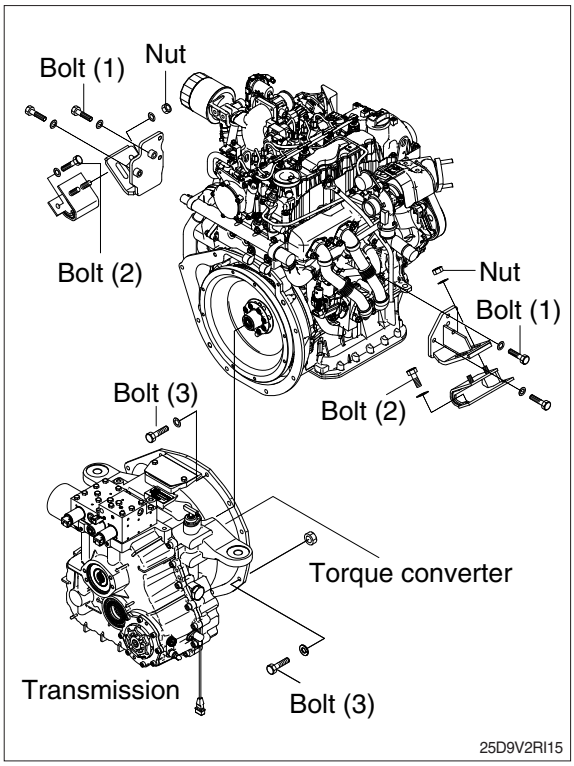
※ Before installing the bolts, loctite in the holes should be removed by a tap.

(1) Tighten the engine mounting bolts (1) and the engine mounting bracket bolts (2) and nuts.

- Bolt 1 : 5.9~8.9 kgf·m (42.7~64.4 lbf·ft)
- Bolt 2 : 9.8~15.8 kgf·m (70.9~114 lbf·ft)
- Nut : 7.8~11.6 kgf·m (56.4~83.9 lbf·ft)

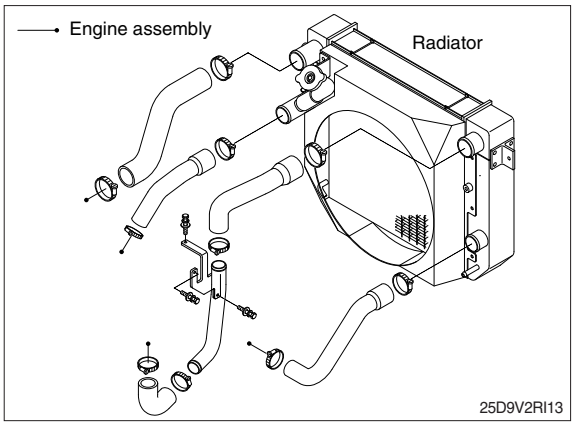
(2) Tightening torque of mounting bolt installing to torque converter housing.

- Bolt 3: 5.9~8.9 kgf · m (42.7~64.4 lbf · ft)



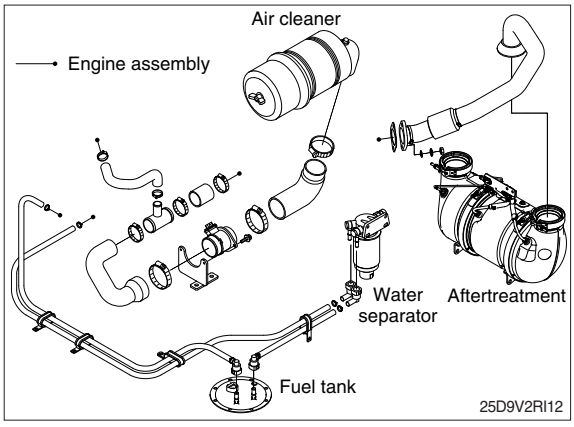
(3) Radiator hose

Insert the radiator hose securely and fit a clamp. Refer to page 1-12, 13 for a tightening torque.



(4) Other's hose and pipe

Insert securely hoses and pipes and fit a clamp. Refer to page 1-12, 13 for a tightening torque.

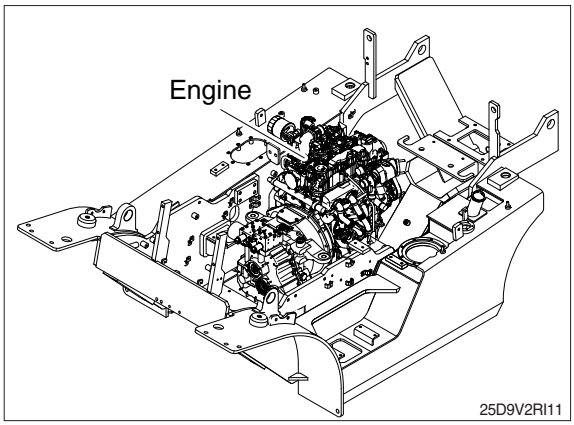


(5) Engine accessory

Install all wiring harnesses, cables and hoses around the engine, dashboard and frame.

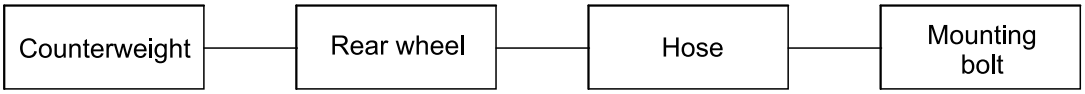
① Wiring harness to alternator and starter.

② Wiring harness for oil pressure and engine water temperature gauges.

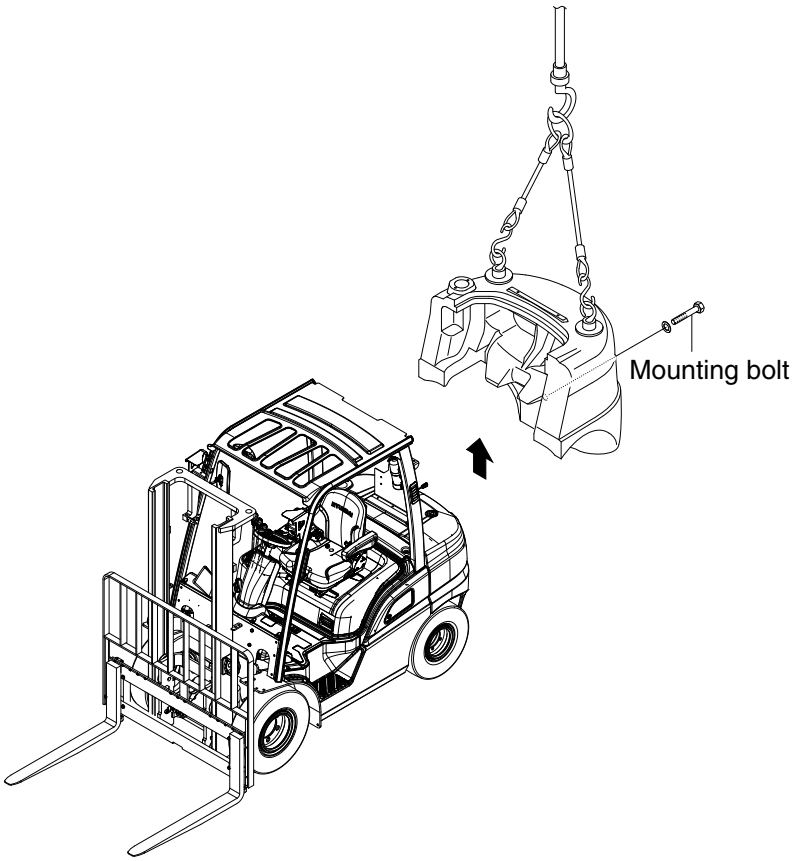


4. STEERING AXLE

1) REMOVAL



D503RE35



25D9V2RI16

(1) Counterweight

① Remove bolt caps and mount lifing eye bolts. Then, slightly raise the counterweight.

② Loosen the mounting bolt. Slowly raise and move the counterweight backward.

· Weight of counterweight (standard)

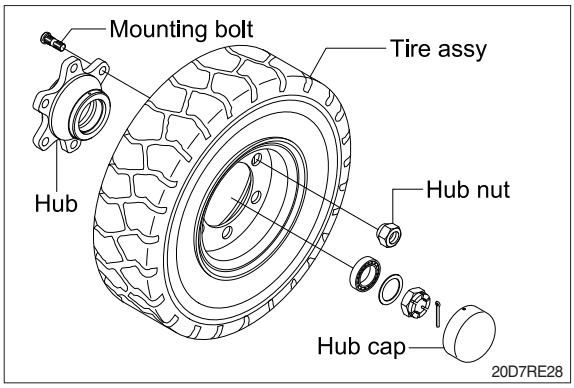
25D-9V/VS	1317 kg (2903 lb)
30D-9V/VS	1629 kg (3591 lb)
35DN-9V/VS	1931 kg (4257 lb)

· Tighteing torque : 100±15 kgf·m (723±108 lbf·ft)

⚠ **When raising the counterweight, only must use appropriate lifting appliances which should be had sufficient capacity for lifting of the counterweight.**

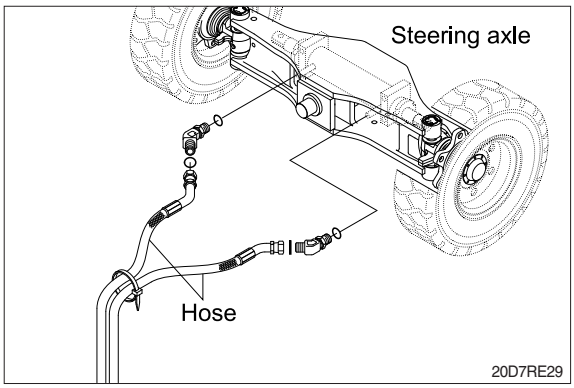
(2) Rear wheel

Remove mounting bolt and hub nut with socket wrench and then carefully take out the tire assembly.



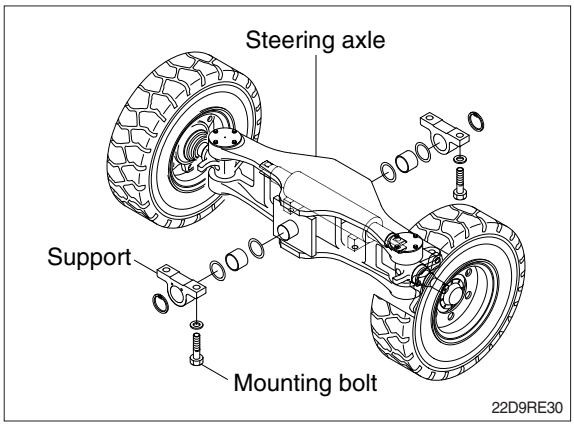
(3) Hose

Drain hydraulic oil in the hoses and cylinders before removing them. Remove the fitting and then disconnect the hoses.



(4) Mounting bolt

Put a block under the steering axle, support on a truck, an raise the frame with a crane. Remove the mounting bolts installing to the frame, and pull out to the rear. There are shims between the support and steering axle to prevent play.



GROUP 3 MAINTENANCE FOR HOSE

1) MAINTENANCE

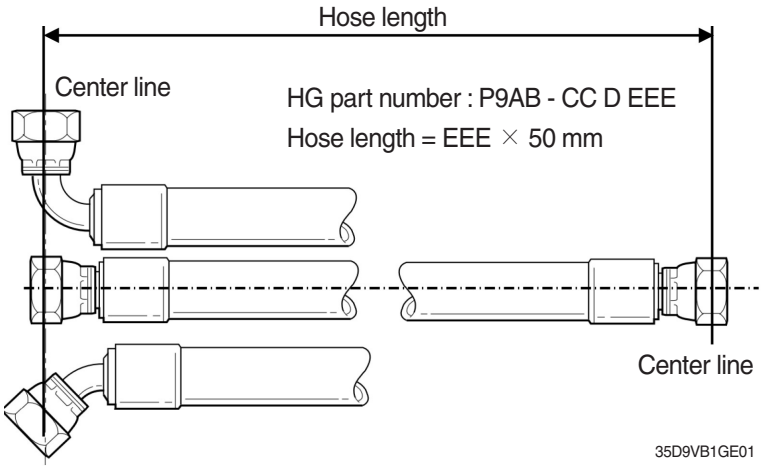
The function and service life of hydraulic components depend to a great extent on how clean the hydraulic oil is. Therefore, it is very important to prevent dirt from entering the hydraulic system. Some simple advice to keep the hydraulic system clean:

- Always clean the area around parts before starting work. If possible, it is better to wash the the truck.
- Plug hose connections immediately after disconnecting. If possible, use correct plugs for the connection type. If plugs are missing, use clean plastic bags and cable ties or tape to seal the connection.
- Never reuse oil that has been drained from the truck.
- If possible, filter the oil before pouring it into the truck, oil barrels often contain impurities.

2) HOSE LENGTH

Connected hoses have HG part number, but if they have no information the hoses are measured as follows:

- The hose length is measured on a laid-out hose between the sealing surfaces.
- On angled connections, measure from the sealing surface's center line according to the figure.



3) CAUTION FOR REPLACEMENT

When replacing hoses for maximum service life and functionality, the following must be observed:

- To avoid stress when connecting, a straight hose length must be secured after connection.
- Do not kink the hose. 7% twist reduces the service life by 90%.
- Do not use hoses that are too short. It may cause leakage or damage.
- Use the correct coupling to minimize the number of bends.
- Avoid sharp bending.
- When storing, keep the inside of the hose clean. When installing, keep the plug in place for as long as possible.

SECTION 3 POWER TRAIN SYSTEM
(25/30D-9V, 35DN-9V)

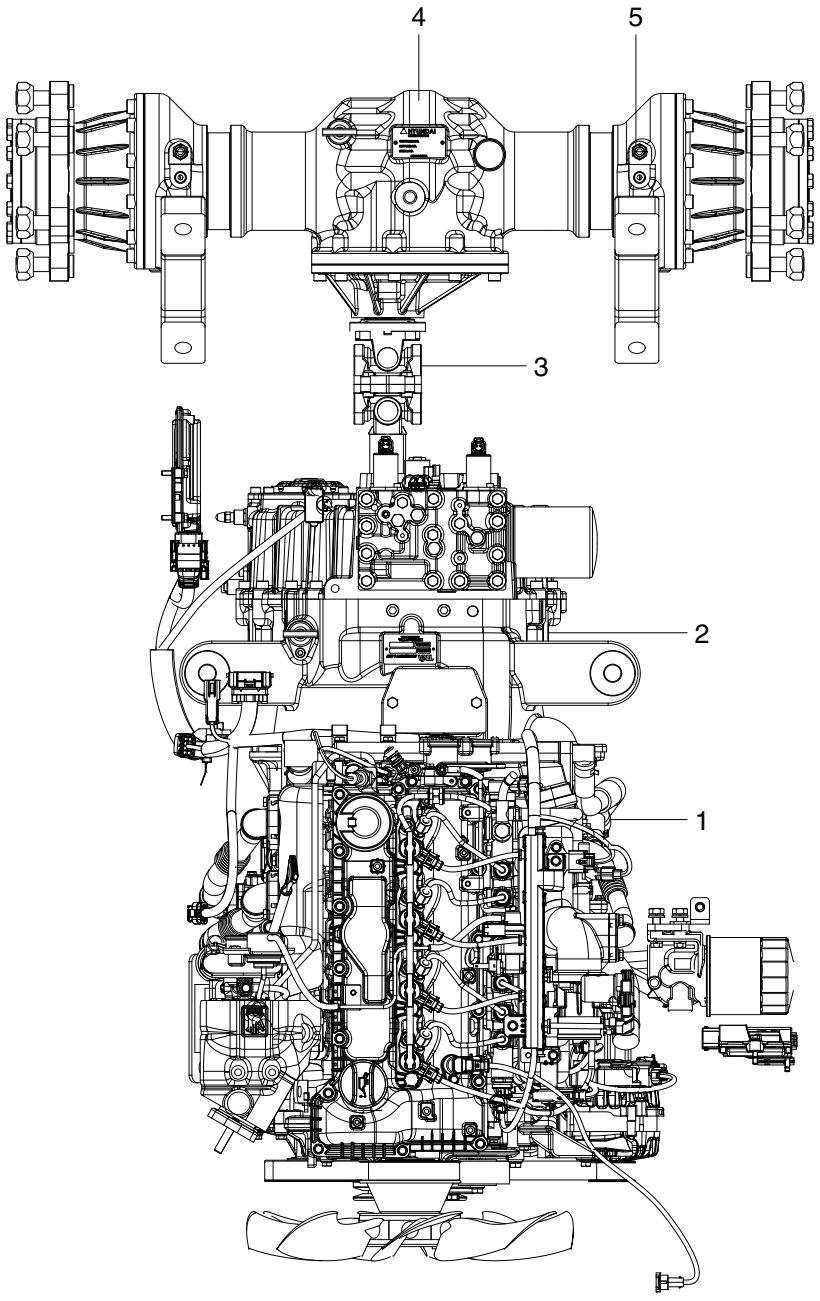
Group 1 Structure and operation 3-1
Group 2 Disassembly and assembly 3-18
Group 3 Maintenance and troubleshooting 3-61

SECTION 3 POWER TRAIN SYSTEM

GROUP 1 STRUCTURE AND OPERATION

1. POWER TRAIN DIAGRAM

1) STRUCTURE



25D9V3PS01

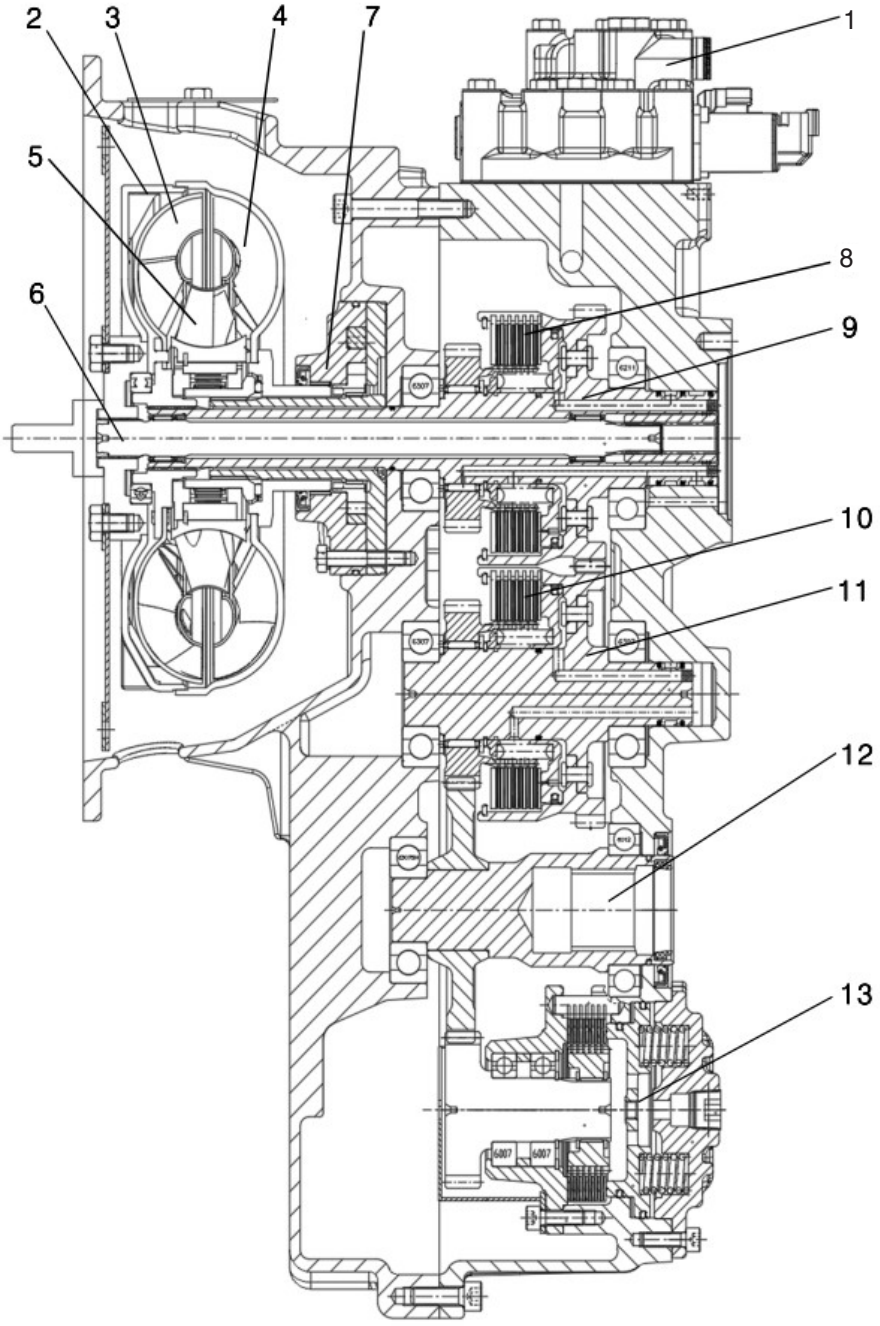
1	Engine	3	Drive shaft	5	Brake
2	Transmission	4	Drive axle		

2) SPECIFICATION

Item			Specification
Torque converter	Model		KAPEC 280 DJ
	Type		3 Element, 1 stage, 2 phase
	Stall ratio		2.87
Transmission	Type		Power shift
	Gear shift(FWD/REV)		1/1
	Control		Electric Proportional Solenoid Valve (Controlled by TCU)
	Overhaul ratio	FWD	1.437
		REV	1.437
Axle	Type		Front-wheel drive type, fixed location
	Gear ratio		11.568 : 1
	Gear		Spiral bevel gear type
Wheels	Q'ty (FR/RR)		Single : 2/2, Double : 4/2
	Front (drive)	2.5 T	Single : 7.00-12-12 PR, Double : 6.00-15-10 PR(~#154), 7.00-12 12PR(#155~)
		3.0 T	Single : 8.15-15-14 PR Double : 6.00-15-10 PR(~#154), 7.00-12 12PR(#155~)
		3.5 T	
	Rear (steer)	2.5 T	6.50-10-12 PR
		3.0 T	
		3.5 T	
Brakes	Travel		Front wheel, wet disk brake
	Parking		Wet disk (negative brake)
Steering	Type		Full hydraulic, power steering
	Steering angle		78.9˚ to both right and left angle, respectively

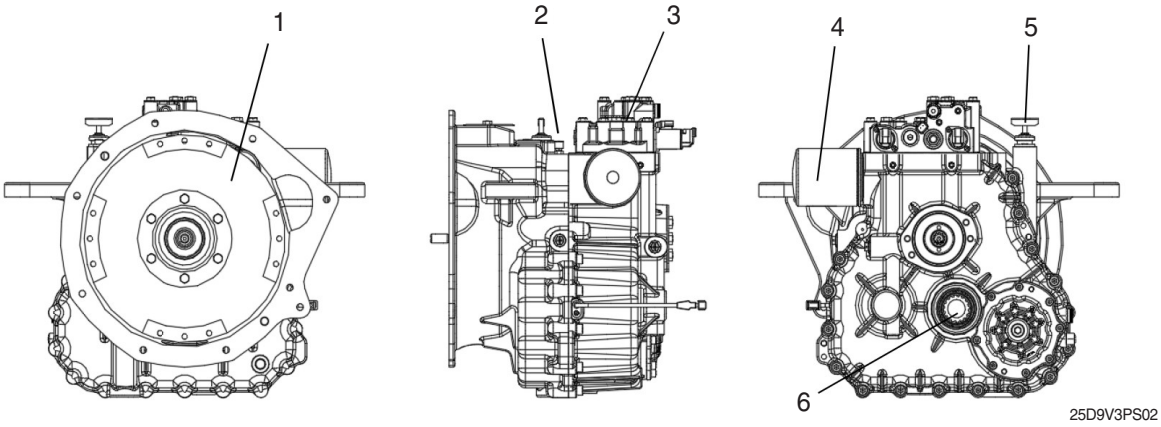
2. TRANSMISSION

1) STRUCTURE

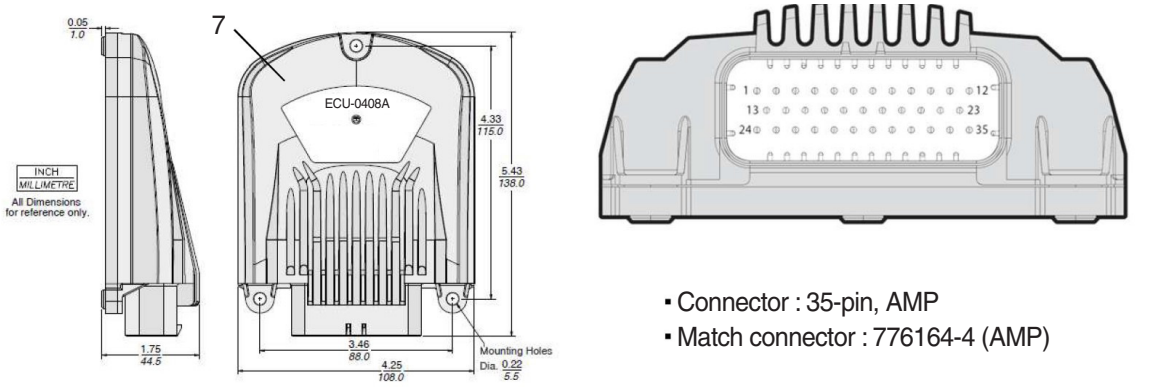


25D9V3PS174

1	Control valve	6	PTO shaft	11	Reverse clutch shaft
2	Torque converter	7	Oil pump	12	Output shaft
3	Turbine wheel	8	Forward clutch pack	13	Parking brake
4	Impeller wheel	9	Forward clutch shaft		
5	Stator	10	Reverse clutch pack		



25D9V3PS02



- Connector : 35-pin, AMP
- Match connector : 776164-4 (AMP)

25D9V3PS03

1 Torque converter
2 Air breather
3 Control valve
4 Oil filter
5 Oil level gauge and tube
6 Output (Universal joint link part)
7 TCU (Transmission Control Unit)

2) OPERATION

(1) Torque converter equipment

The torque converter is an automatic fluid drive.
It transmits engine torque by means of hydraulic force.
The torque converter leads and the power which is delivered rotated the charging pump.
Oil is drawn from the transmission reservoir by the charging pump.
The pump delivers its entire output to a full-flow oil filter for cleaning.
From the oil filter, the oil supply is sent to the control valve.

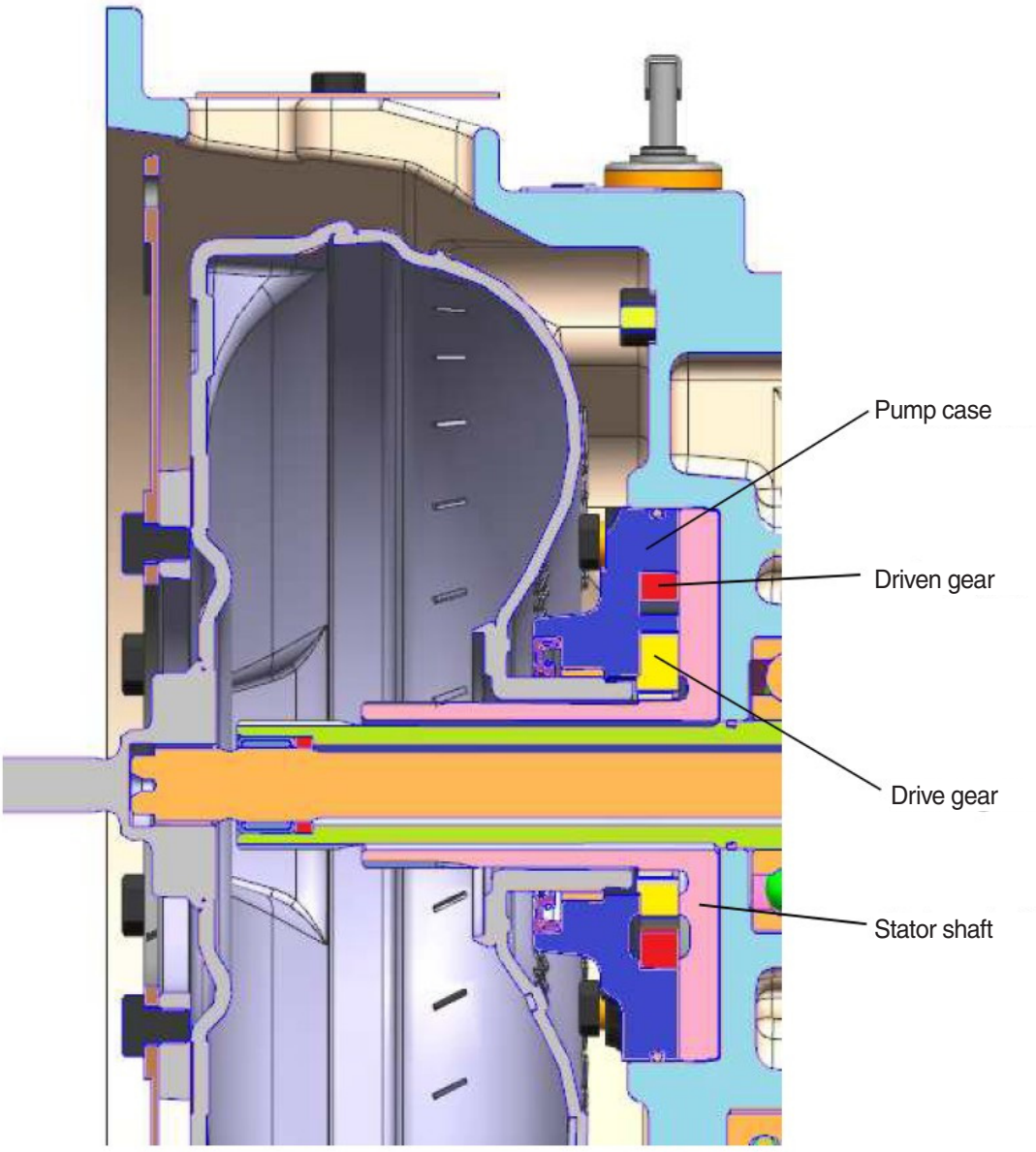
The main pressure regulator valve provides pressure for clutch pack, directs oil to the solenoid valve. Moving the solenoid valve allows oil to charge the selected (forward or reverse) clutch line and to engage that clutch.

The remaining oil appropriating clutch pressure flows into the torque converter,
A converter pressure regulator valve in the converter-in line limits the oil pressure there.
{The oil pressure input to the torque converter is adjusted 4 ~ 7 kgf/cm^2 (56.9 ~ 99.6 lbf/in^2).}
{The oil pressure output from the torque converter is adjusted below 2 ~ 4.5 kgf/cm^2 (28.4 ~ 49.8 lbf/in^2).}
The torque converter is continuously filled with oil during operation,
Rotation of the converter impeller imparts energy to the oil which, is turn, drives the turbines.
The oil then flows between the stator vanse which redirect it to the impeller.
At thist time, torque is increased.

The oil from the torque converter enters the cooler,
The cooler is a heat exchanger in which the oil flows through air cooled passages.
After refrigerated, it is in charge of clutch lubrication through the lubrication oil pach of the clutch shaft.
A lubrication valve between the cooler and lubrication system returns all excess oil to the transmission reservoir.

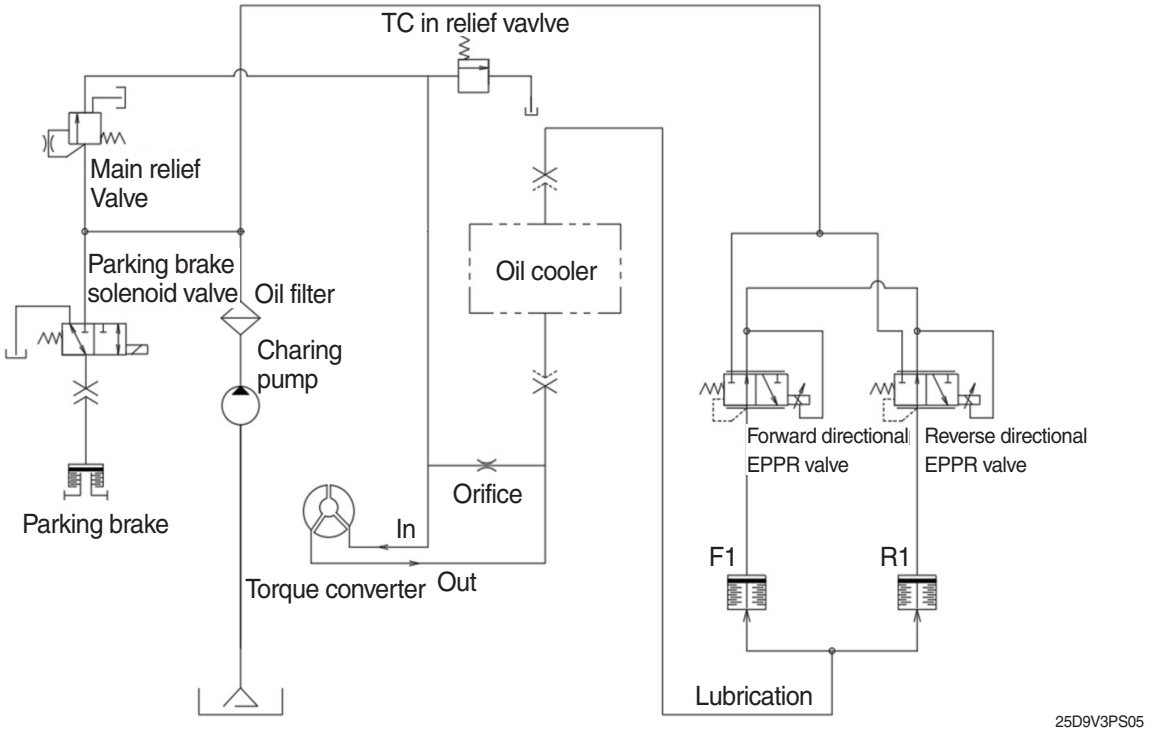
2) Pump drive device

There is pump device beside torque converter as below picture which is for charging pump of transmission and power take off (PTO).



25D9V3PS04

3) HYDRAULIC CIRCUIT



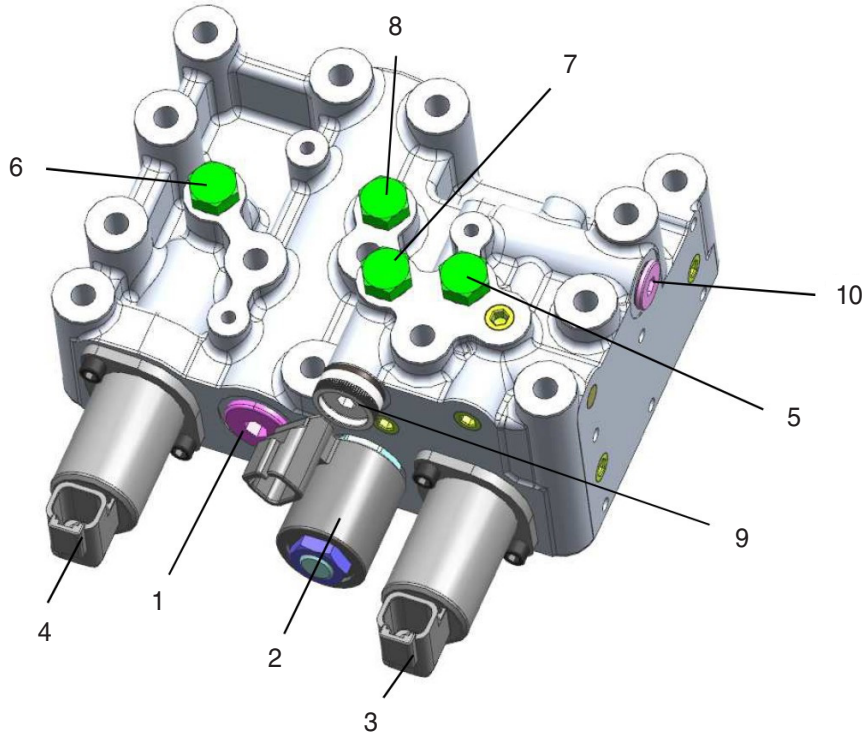
(1) The oil that is pumped up through the strainer from the oil pump of transmission by charging pump of transmission. And this oil is sent to torque converter through the relief valve for the main pressure of hydraulic clutches.

(2) The oil that is sent to torque converter flows between the turbine shaft and Inner race of free wheel, and flows into the circuit of converter through the space between stator wheel and turbine wheel.

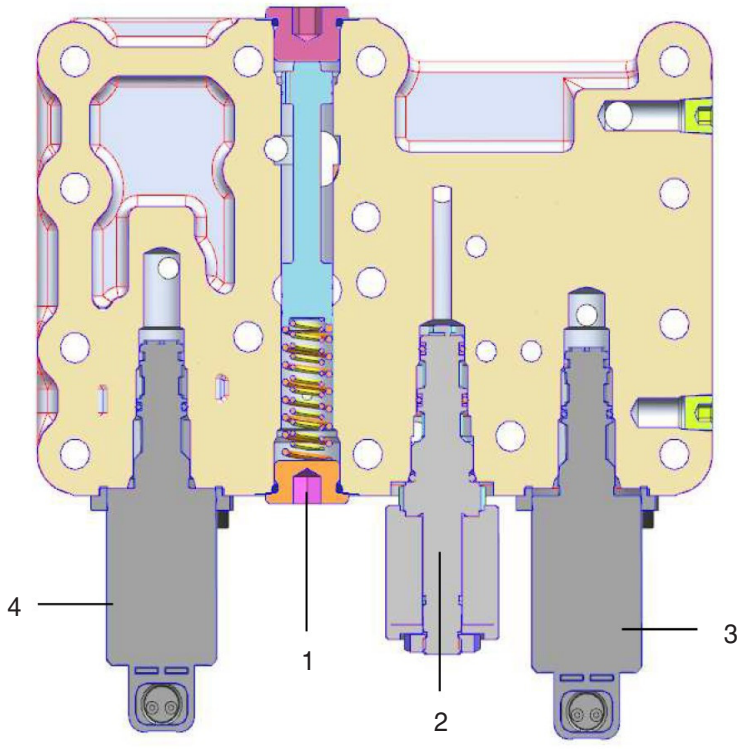
(3) The oil which is drained from torque converter is cooled by the external cooler of the truck. And this cooled oil lubricates and cools each parts of transmission like bearings, clutches and so on.

4) CONTROL VALVE

(1) Structure



25D9V3PS06



25D9V3PS07

1	Main relief	6	Reverse clutch pressure check port
2	Parking brake solenoid valve	7	Parking brake pressure check port
3	Forward directional EPPR valve	8	Main pressure check port
4	Revese directional EPPR valve	9	Outlet port for releasing parking brake
5	Forward clutch pressure check port	10	Clutch pressure / temperature sensor port

(2) Assembly

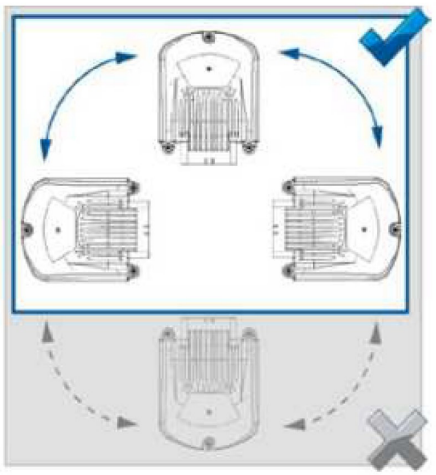
Control valve assassembly contains main relief valve for regulating pressure of hydraulic clutch assembly, forward & reverse directional EPPR Valve for adjusting clutch pressure and riging up clutch pressure smoothly, parking brake solenoid valves for controlling parking brake.

Strucutre	Opeartion
Main relief valve	This valve regulates the clutch pressure stably.
Forward & reverse directional EPPR valve	These valve control the oil flow for moving smoothly forward & reverse through propotional current signal which is given by direction selector and Potentio-meter.
Solenoid valve for parking	This valve control the oil flow for applying and releasing parking brake.

5) TCU

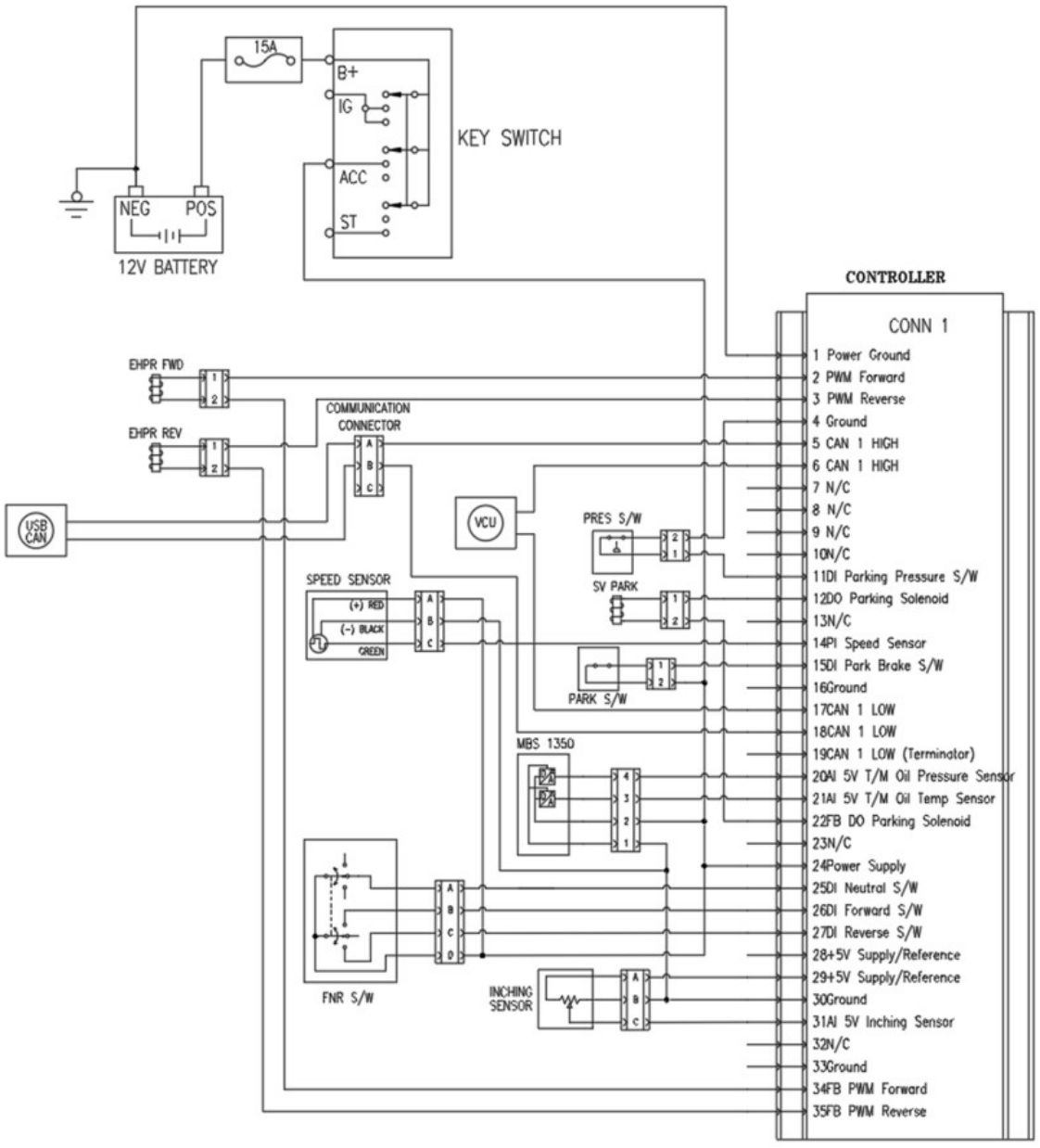
(1) TCU mounting

To help prevent water ingress, mount the TCU-0408A with the integral connector facting down or sideways. Do not mount with connector facing up.



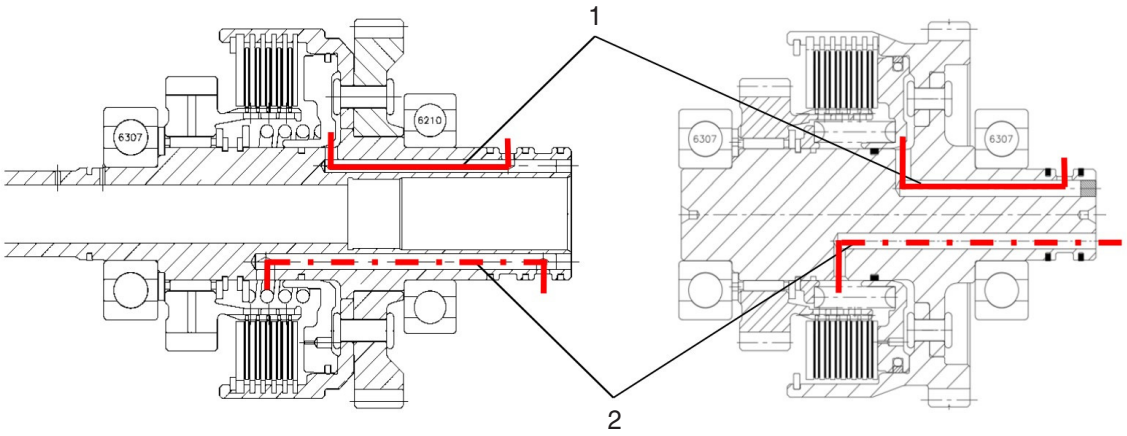
25D9V3PS08

(2) TCU wiring diagram



25D9V3PS09

6) CLUTCH



1 Pressure line (———)
2 Lubrication line (- · - · -)

25D9V3PS10

(1) Summary

① This transmission consists of the forward and reverse shift equipments which is the wet multipic disc type of hydraulic clutch.

② There are 6 discs per each clutch which is made by carbon paper.

(2) Clutch shifting

① The explain of shift is represented in case of the shift "N (neutral) → F or R" in the truck.
Forward & Reverse EPPR valve become "ON" by current signal which is given by gear selector
② on the truck.

③ Clutch is engaged smoothly by controlling EPPR valve and TCU. The shock by clutch engagement is reduced.

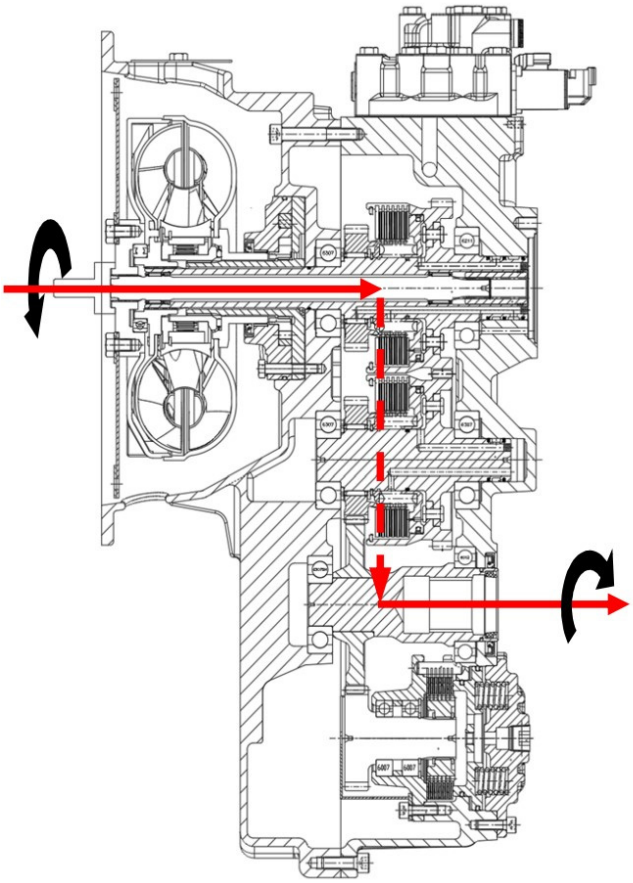
④ When the clutch engagement concludes and the hydraulic oil becomes regular pressure.

⑤ The hydraulic oil in the piston room presses the piston, and make the steel plates and the friction plates stick strongly against the force of the return spring.

⑥ Therefore the torque that is transmitted to the clutch shaft assembly transmits to the reduction gears.

7) POWER FLOW

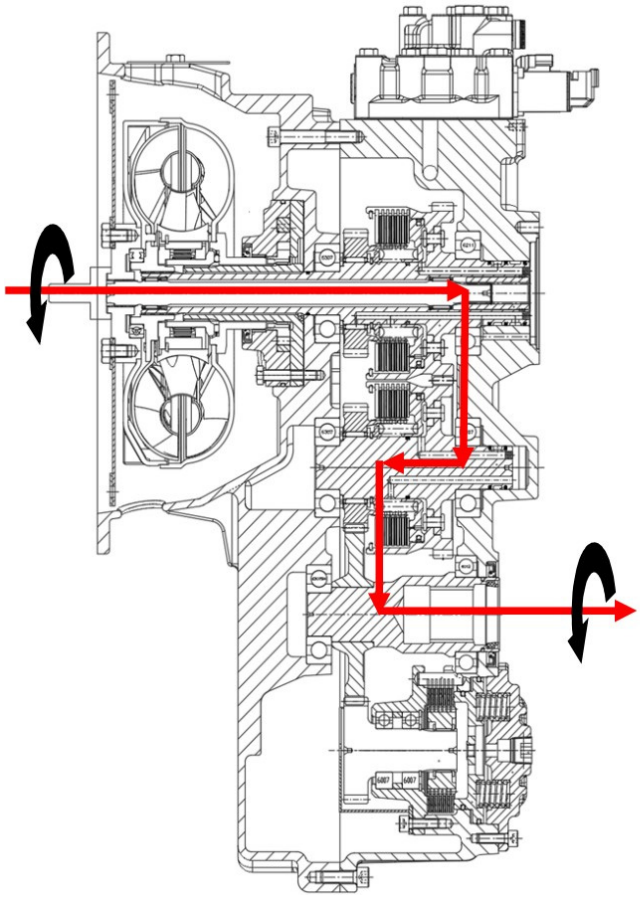
(1) Forward



Input
↓
Torque converter
↓
Forward clutch shaft
↓
Clutch gear
↓
Output gear
↓
Output

25D9V3PS11

(2) Reverse

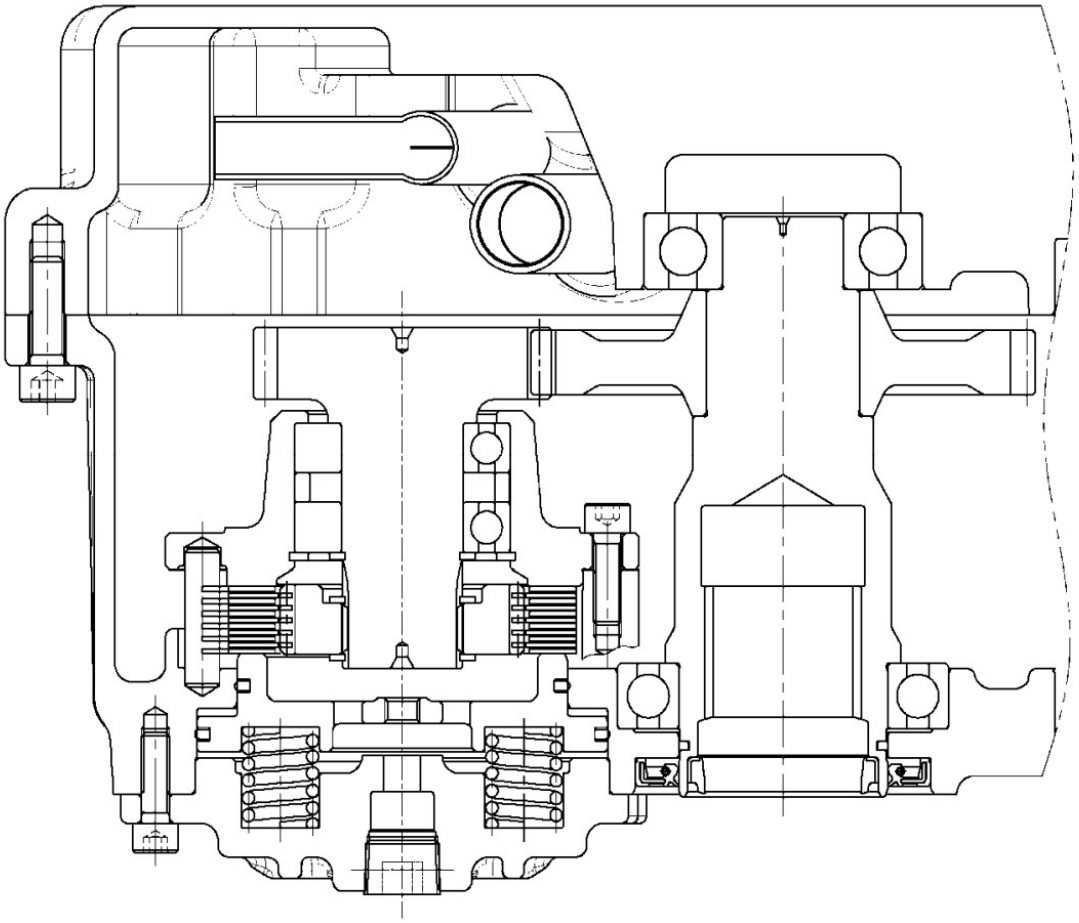


Input
↓
Torque converter
↓
Forward clutch shaft
↓
Forward drum gear
↓
Reverse drum gear
↓
Reverse clutch shaft
↓
Clutch gear
↓
Output gear
↓
Output

25D9V3PS12

8) PARKING BRAKE

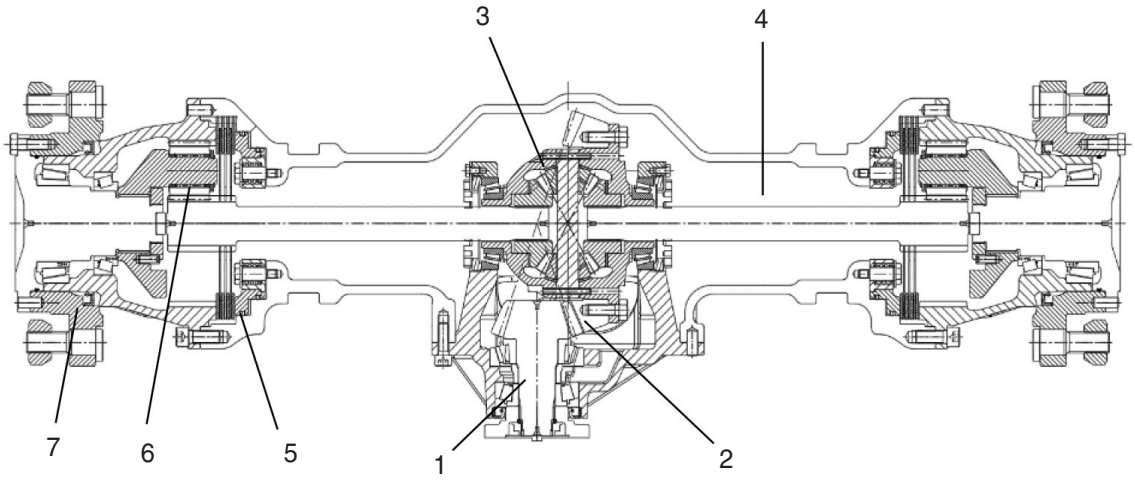
Transmission includes differential device and parking brake. Parking brake, like as traveling brake system is consists of several friction plate functions braking by sticking to each friction plate when parking brake switch is operated.



25D9V3PS13

3. DRIVE AXLE

1) STRUCTURE

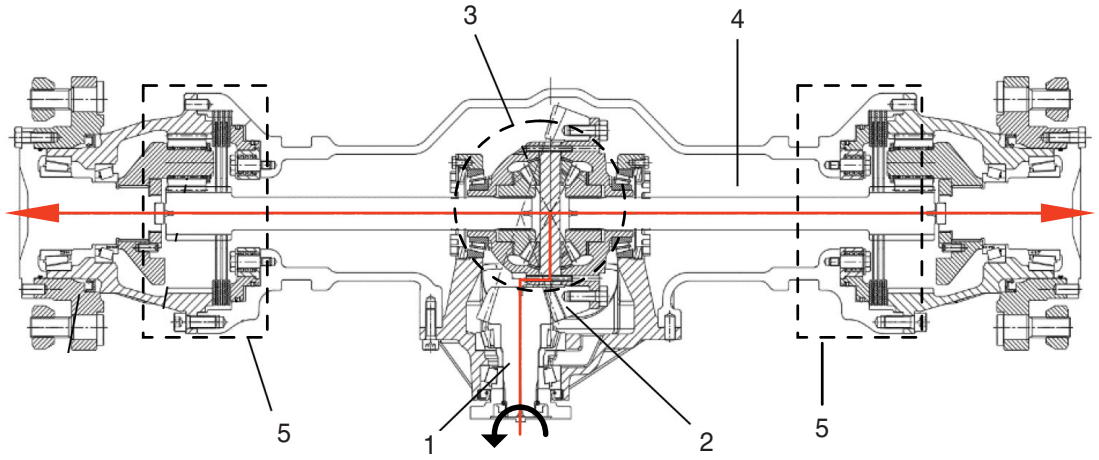


25D9V3PS102

1	Pinion shaft	4	Axle shaft	7	Hub
2	Ring gear	5	Service brake		
3	Differential device	6	Hub reduction		

2) OPERATION

The drive axle is connected with the transmission output gear by drive shaft assembly. The power transferred by the drive shaft assembly is connected to the pinion shaft of drive axle, the pinion shaft delivers the power to the differential device through the ring gear. The differential device deliver the power to hub reduction through axle shaft.

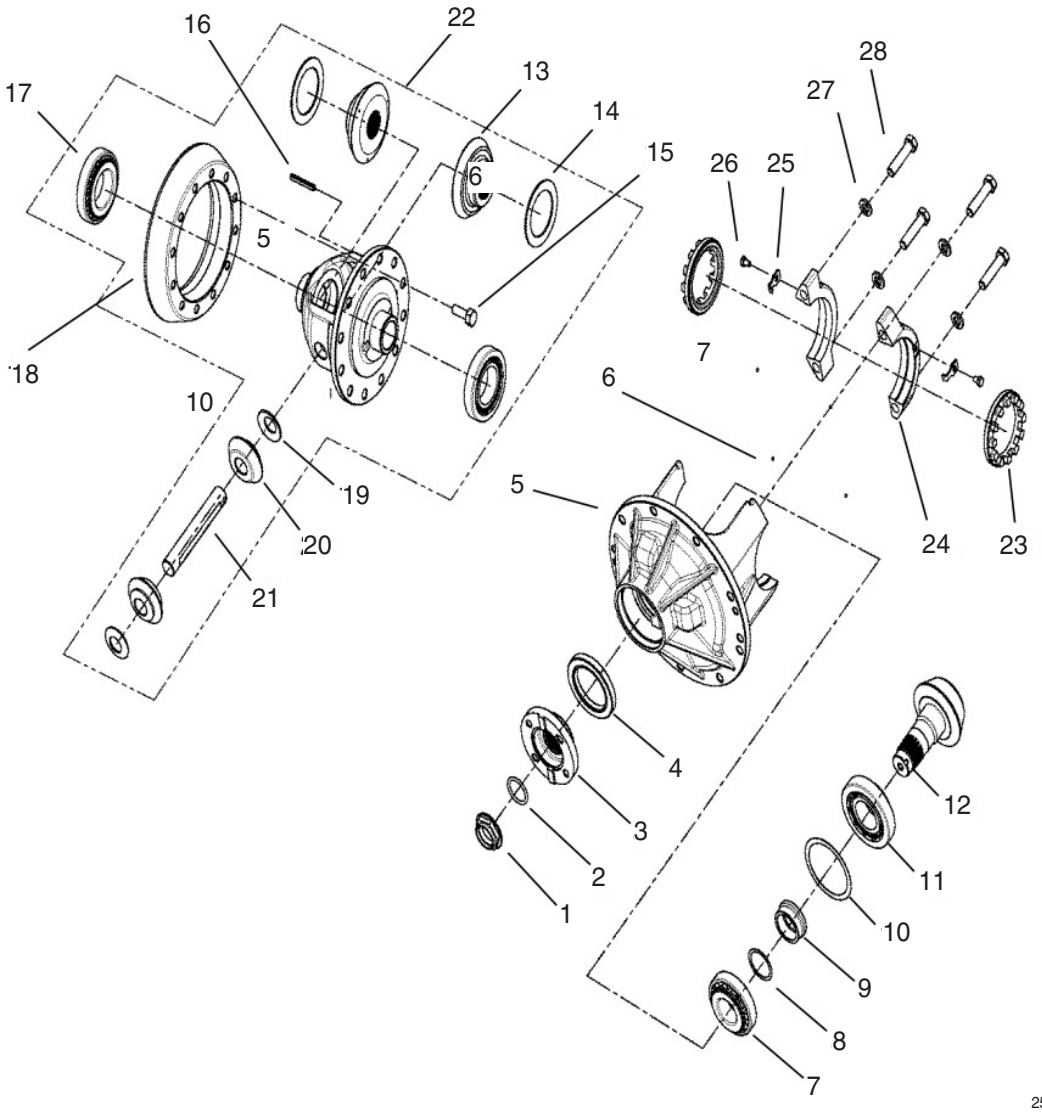


25D9V3PS103

1	Pinion shaft	3	Differential device	5	Hub reduction
2	Ring gear	4	Axle shaft	6	Service brake

3) Carrier sub assy

(1) Structure



25D9V3PS104

1	Lock nut	11	T/R bearing	21	Spider
2	O-ring	12	Pinion shaft	22	Diffsub assy
3	Flange yoke	13	Diff side gear	23	Adjust screw
4	Oil seal	14	Thrust washer	24	Carrier cap
5	Carrier case	15	Hex bolt	25	Lock plate
6	Steel ball	16	Spring pin	26	Hex bolt
7	T/R bearing	17	T/R bearing	27	Plain wahser
8	Shim	18	Ring gear	28	Hex bolt
9	Spacer	19	Thrust washer		
10	T/R bearing	20	Diff pinion gear		

(2) Performance property

Since the ring gear is linked with the right of the differential case and the bolt, the power transferred to the ring gear makes the differential device revolve.

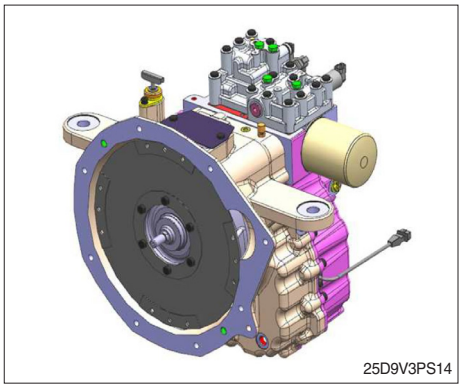
And also, the differential case are connected with the left and right of the axle shaft and the spline respectively, it delivers the power to the final drive.

If the load concerning in the left and right of the final drive is different, the shock is transferred to the drive axle, the differential gear in the differential device runs, the power transferred to the differential device adjusts the delivering rate to the left and right axle shaft. Consequently, it guarantees for safety of drivers.

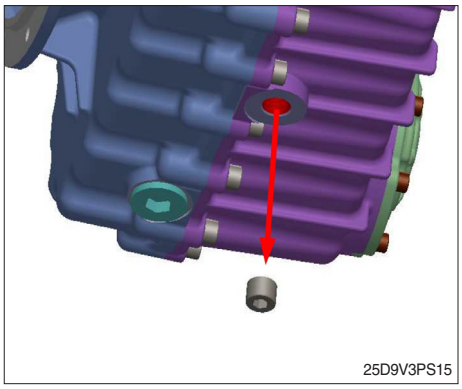
1. DISASSEMBLY OF TRANSMISSION

1) DISASSEMBLY OF TRANSMISSION ASSY

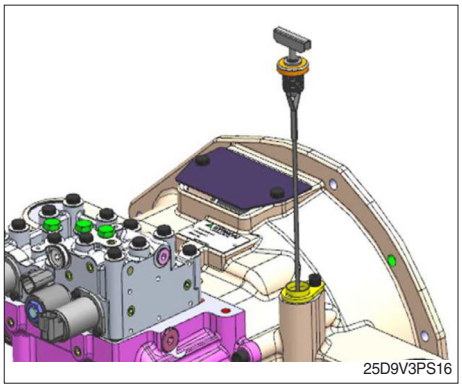
(1) Disassembly transmission assy.



(2) Discharge transmission oil. Disassemble drain plug of T/M case.

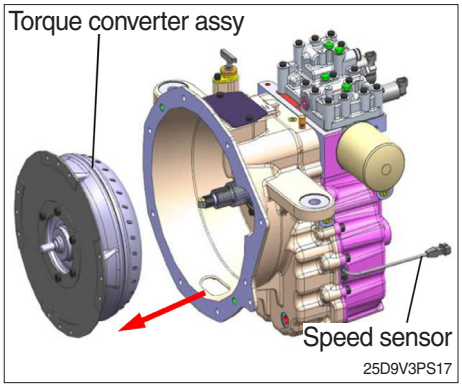


(3) Check oil residue in T/M.

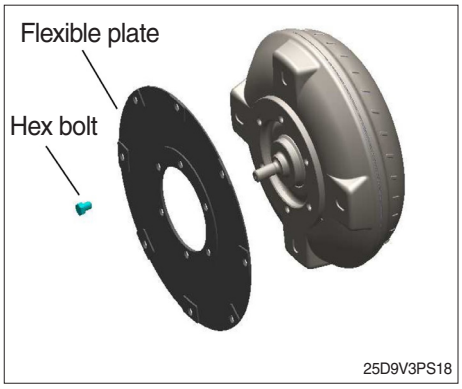


(4) Disassemble torque converter part.

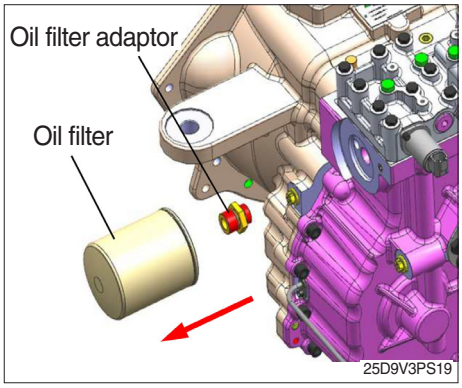
① Disassemble torque converter sub assy and speed sensor.



② Disassemble hex bolt and flexible plate.

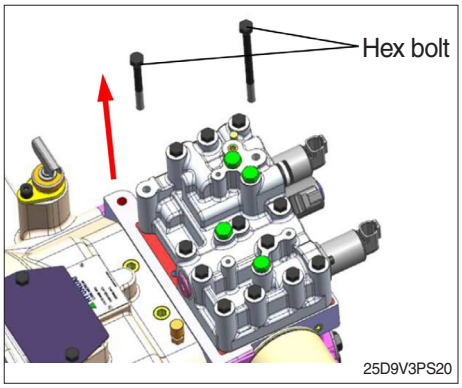


(5) Disassemble oil filter and oil filter adaptor.

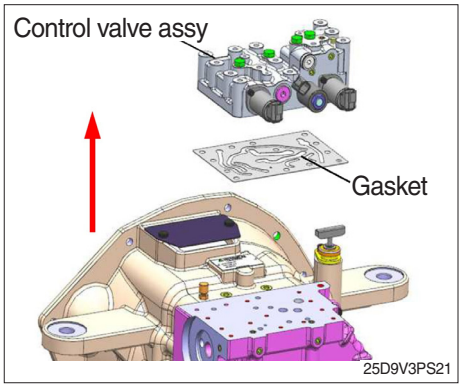


(6) Disassemble control valve part.

① Disassemble hex bolt.

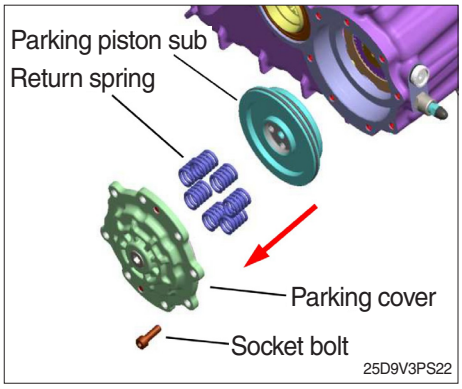


② Disassemble control valve assembly and gasket.

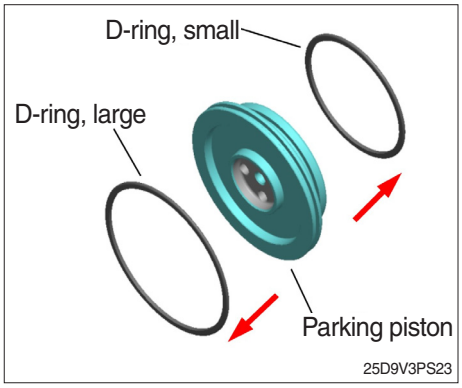


(7) Disassemble parking part.

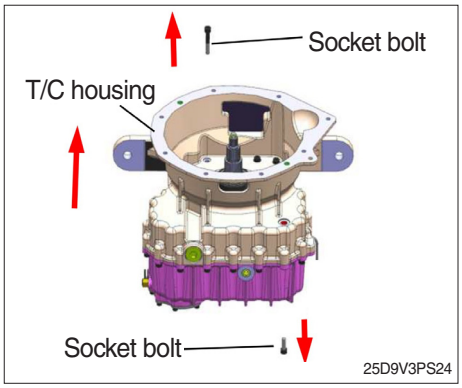
① Disassemble socket bolt and parking cover. After disassemble return spring and parking piston sub.



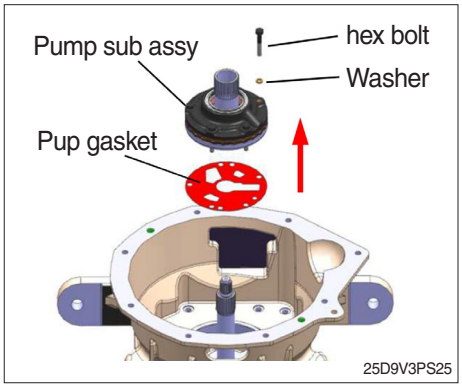
② Disassemble d-ring large and d-ring small.



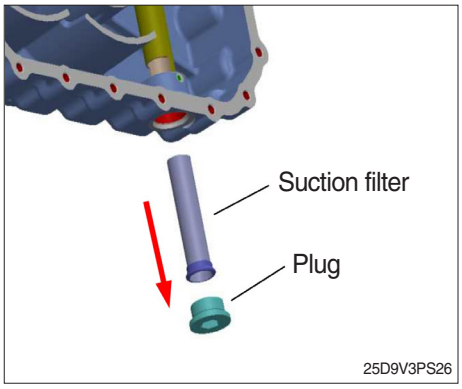
(8) Disassemble socket bolt and T/C housing.



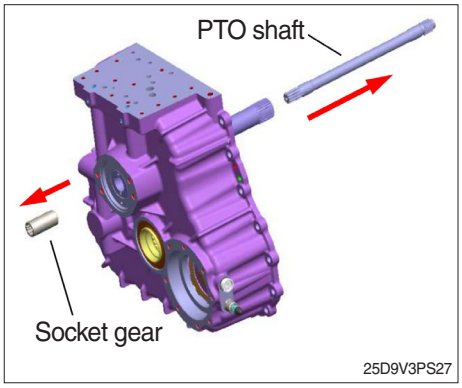
(9) Disassemble hex bolt and washer. After disassemble pump sub ass'y and gasket.



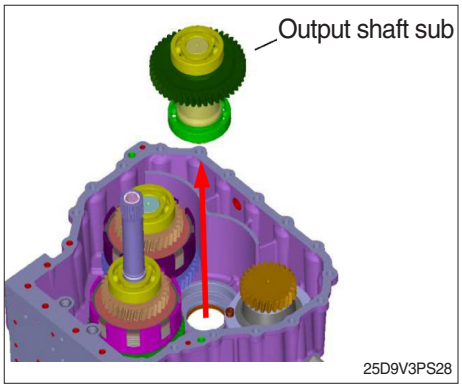
(10) Disassemble plug and suction filter.



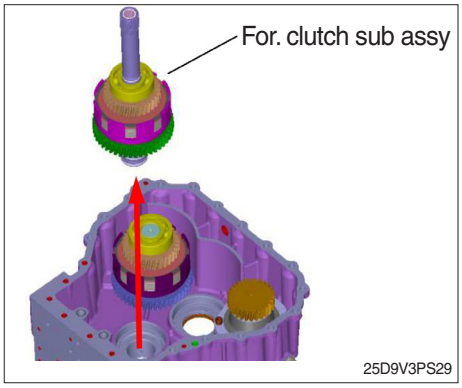
(11) Disassemble PTO shaft and socket gear.



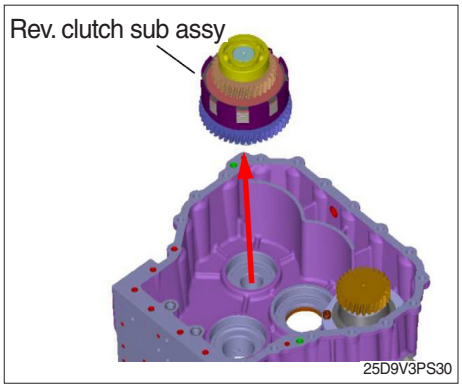
(12) Disassemble output shaft sub assy.



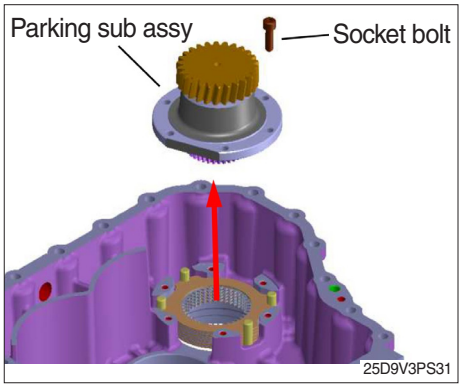
(13) Disassemble forward clutch sub assy.



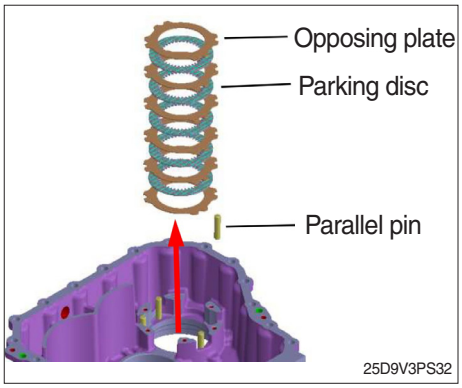
(14) Disassemble rev. clutch sub assy.



(15) Disassemble socket bolt and parking sub assy.

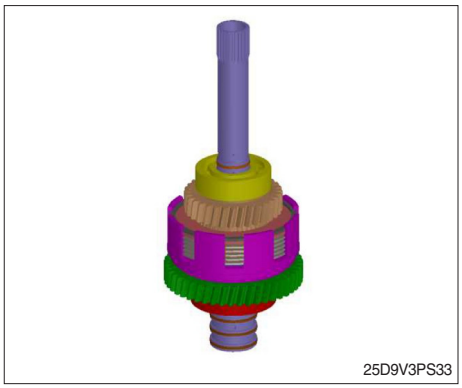


(16) Disassemble opposing plate and parking disc, after disassemble parallel pin.

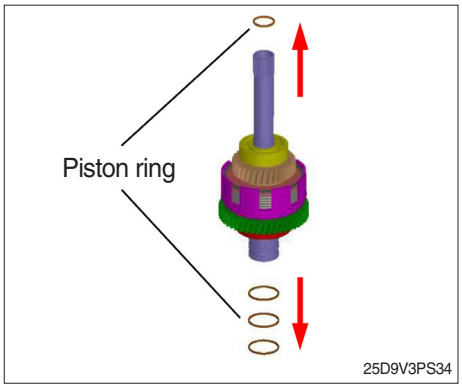


2) DISASSEMBLY OF CLUTCH SUB ASSY

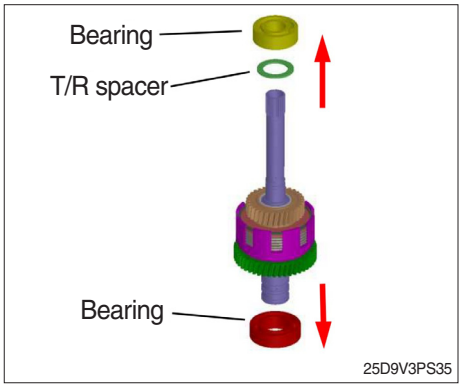
(1) Disassemble forward clutch sub assembly.



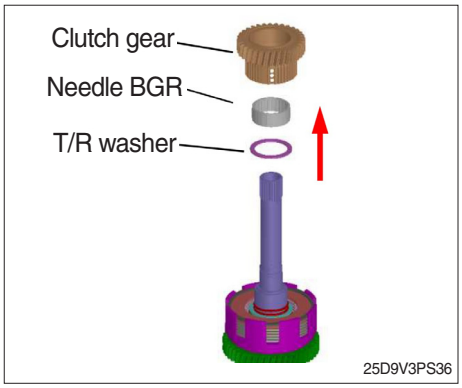
(2) Disassemble piston ring from groove of shaft.



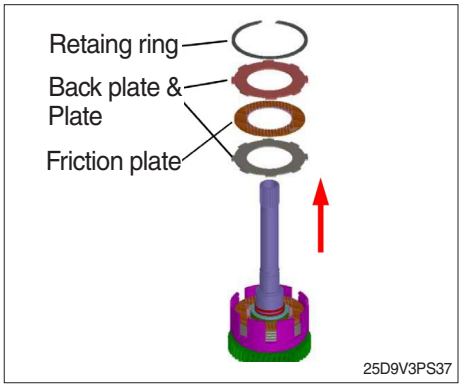
(3) Disassemble bearing and thrust spacer from shaft.



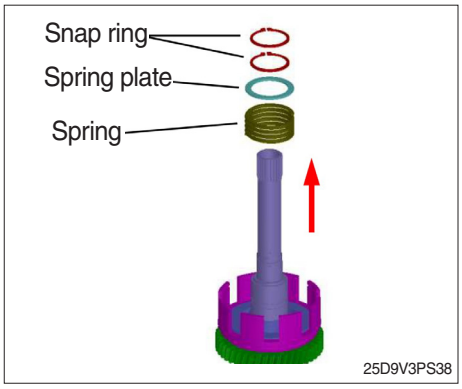
(4) Disassemble clutch gear, needle BRG and thrust washer from shaft.Disassemble clutch gear, needle BRG and thrust washer from shaft.



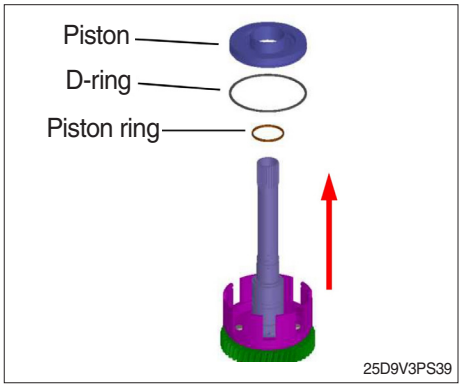
(5) Disassemble retaining ring, plate and friction plate from drum.



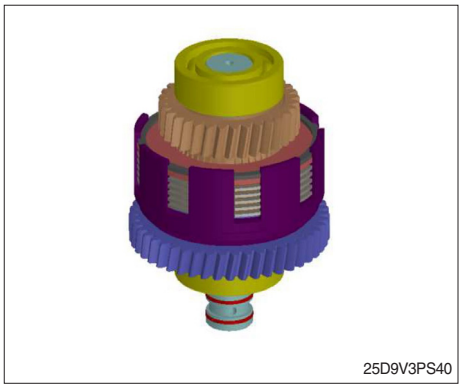
(6) Disassemble snap ring, spring plate and spring from shaft.



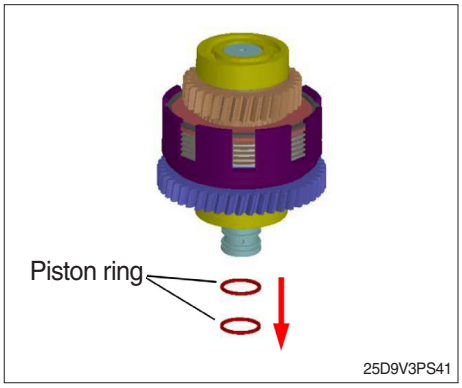
(7) Disassemble piston and piston ring. After disassemble D-ring from piston.



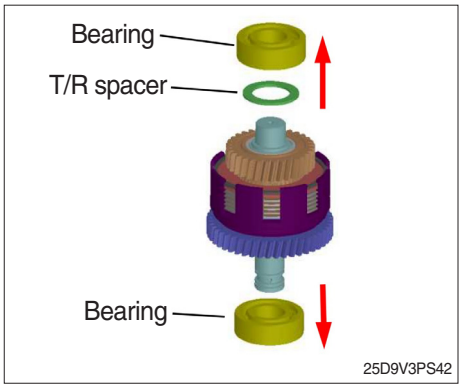
(8) Disassemble Rev. clutch sub assembly.



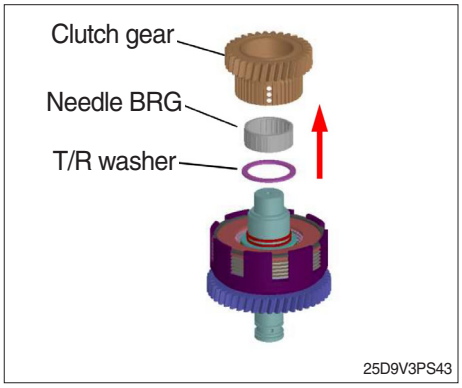
(9) Disassemble piston ring from groove of shaft.



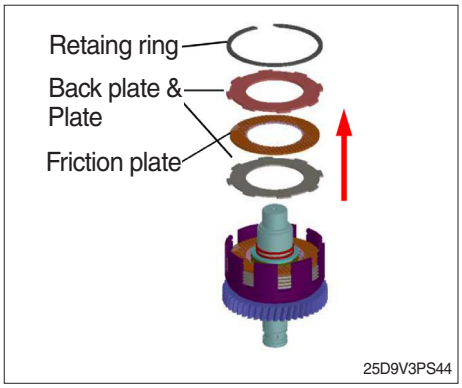
(10) Disassemble bearing & thrust spacer from shaft.



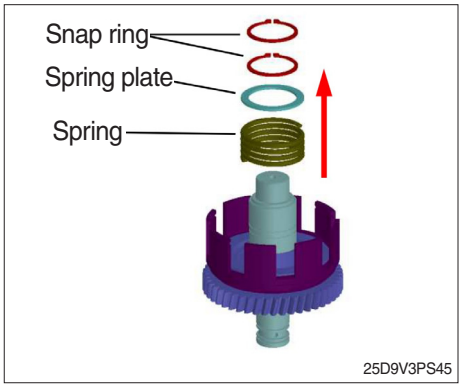
(11) Disassemble clutch gear, needle BRG & thrust washer.



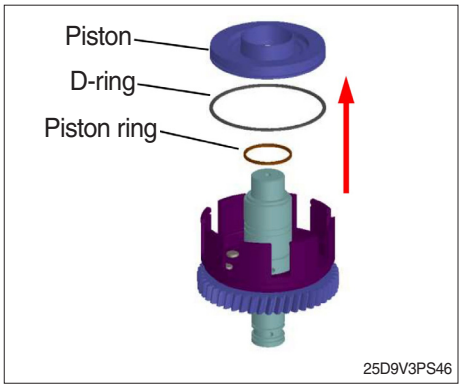
(12) Disassemble retaining ring, plate & friction plate from drum.



(13) Disassemble snap ring, spring plate and spring from shaft.

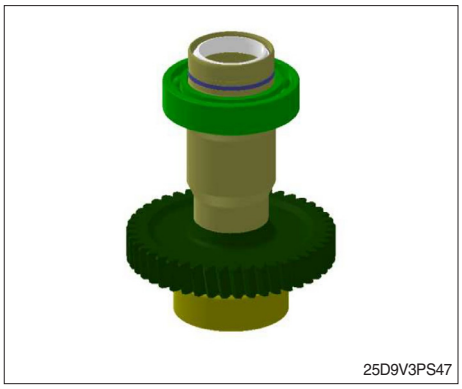


(14) Disaddemble piston and piston ring. After disassemble D-ring from clutch piston.

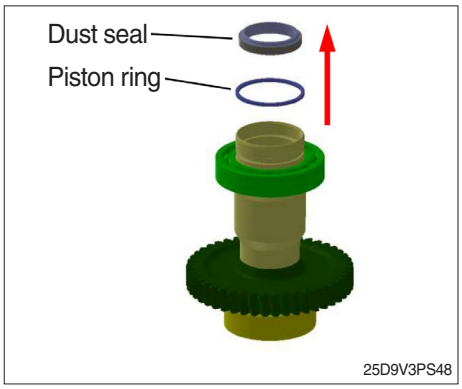


3) DISASSEMBLY OF OUTPUT SHAFT SUB ASSY

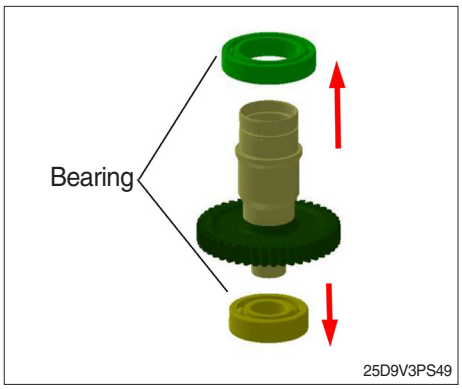
(1) Disassemble output shaft sub assembly.



(2) Disassemble dust seal and piston ring from shaft.

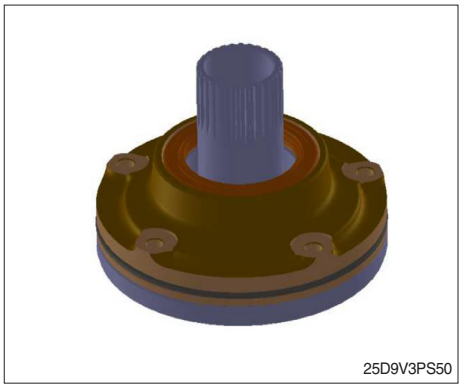


(3) Disassemble bearing from shaft.

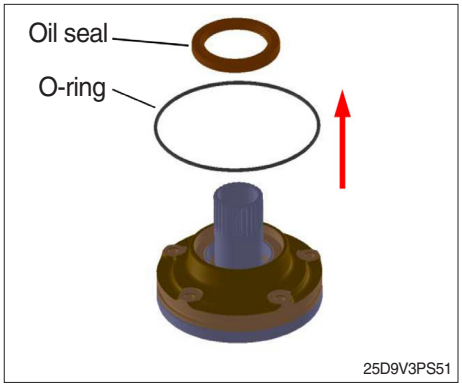


4) DISASSEMBLY OF PUMP SUB ASSY

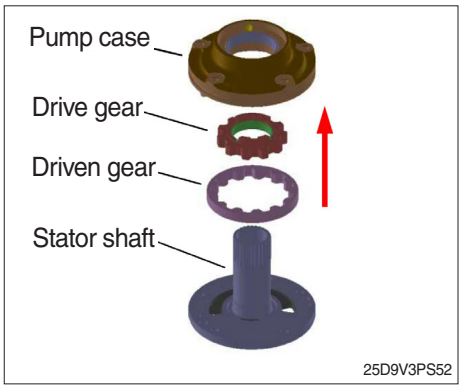
(1) Disassemble pump sub assembly.



(2) Disassemble oil seal and o-ring.

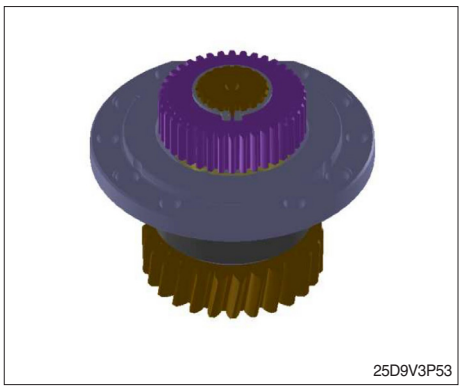


(3) Disassemble pump case, drive & driven gear from stator shaft.

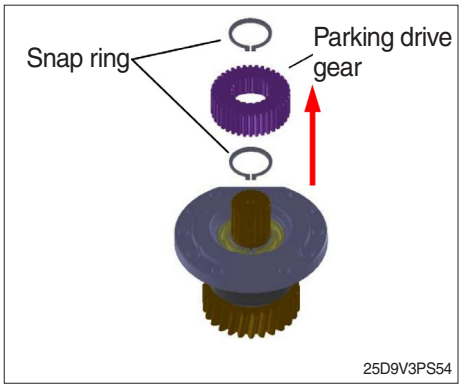


5) DISASSEMBLY OF PARKING SUB ASSY

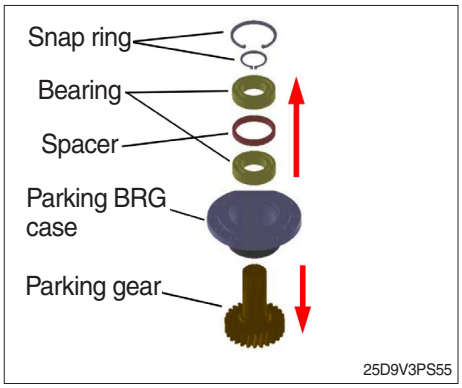
(1) Disassemble parking sub assembly.



(2) Disassemble snap ring and parking drive gear.



(3) Disassemble pump case, drive & driven gear from stator shaft.

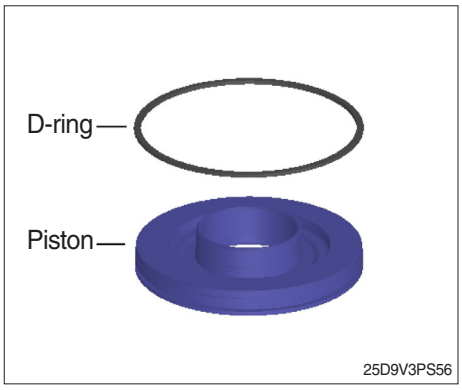


2. ASSEMBLY OF TRANSMISSION

1) SUB-ASSEMBLY OF CLUTCH

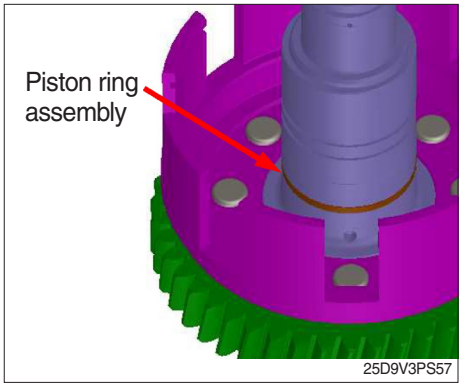
(1) Assemble d-ring at groove of piston.

※ **Spread T/M oil on d-ring.**

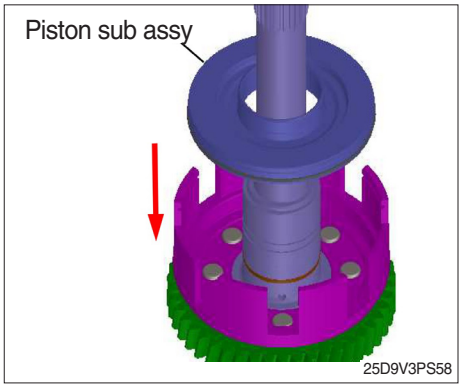


(2) Assemble piston ring at groove of clutch shaft.

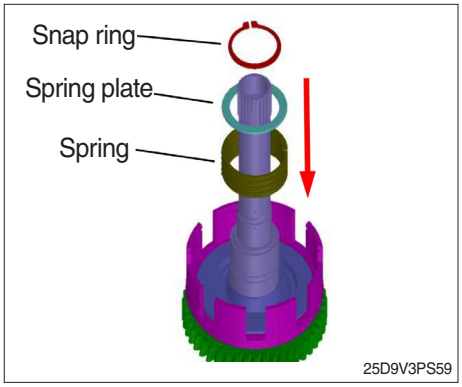
※ **Spread T/M oil on piston ring.**



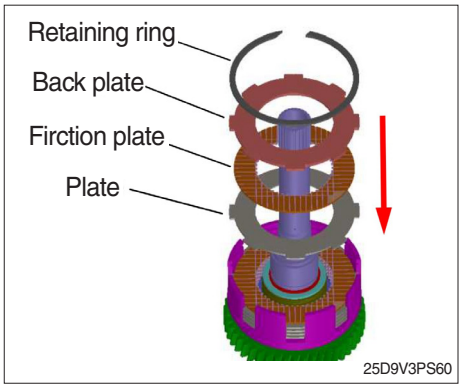
(3) Assemble piston sub assembly.



(4) Assemble spring, spring plate & snap ring.



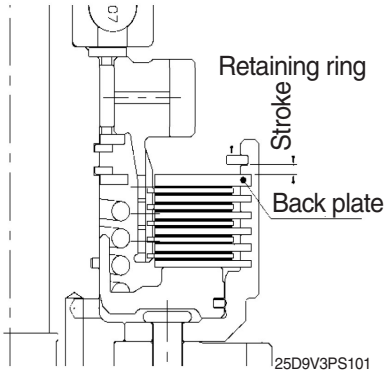
(5) Assemble plate, friction plate and back plate. After assemble retaining ring.

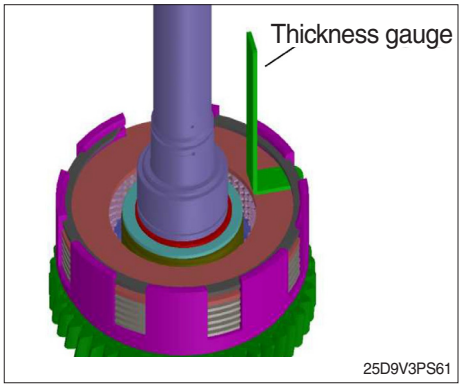


(6) Calculate the distance between back plate and retaining ring.

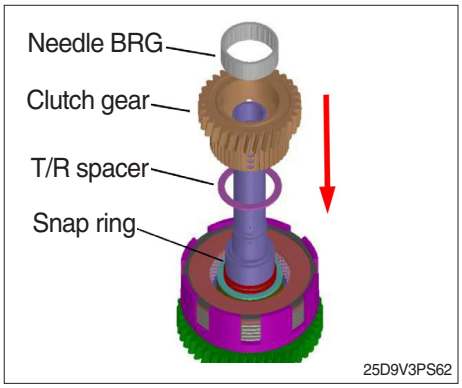
· Stroke : 2.2 ~ 2.6 mm (0.087 ~0.102 in)

※ **Use thickness gauge.**

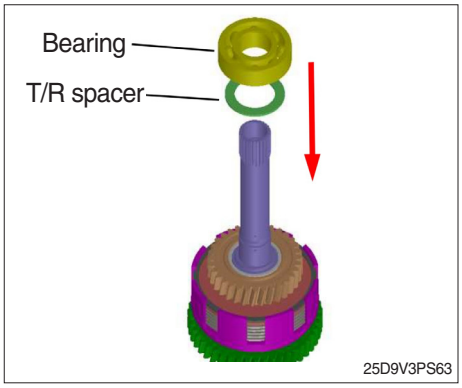




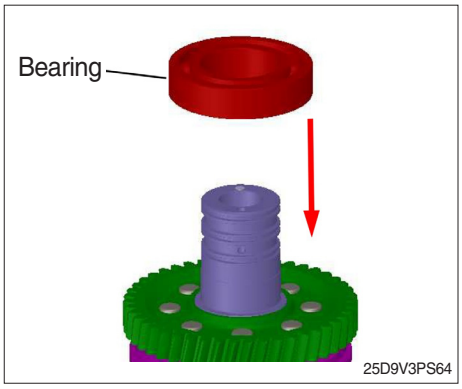
(7) Assemble forward clutch shaft sub assy. Assemble snap ring at groove of clutch shaft. After assemble thrust washer, clutch gear & needle bearing.



(8) Assemble thrust spacer and bearing.

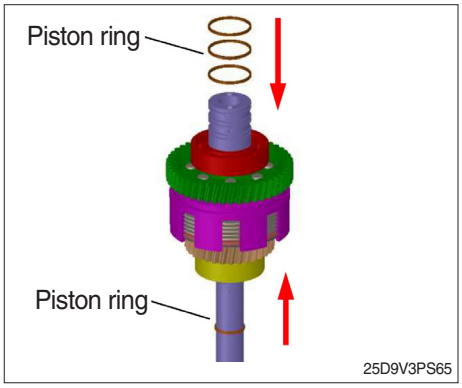


(9) Assemble bearing.

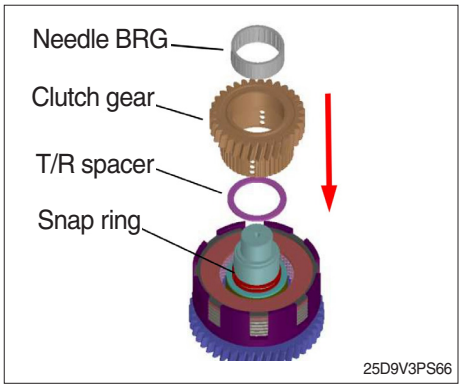


(10) Assemble piston ring at groove of clutch shaft.

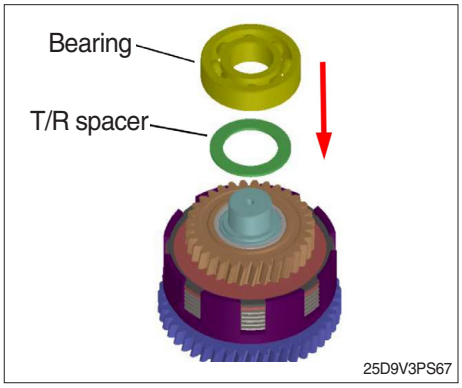
※ **Spread T/M oil on piston ring.**



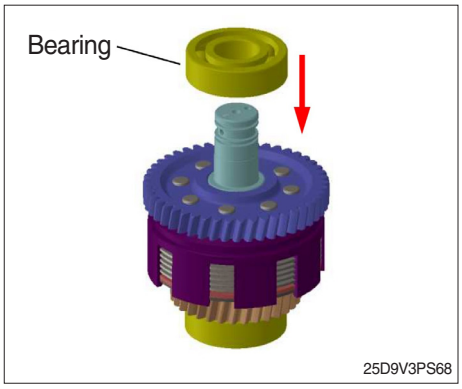
(11) Assemble Rev. clutch shaft sub assy. Assemble snap ring at groove of clutch shaft. After assemble thrust washer, clutch gear & needle bearing.



(12) Assemble thrust spacer and bearing.

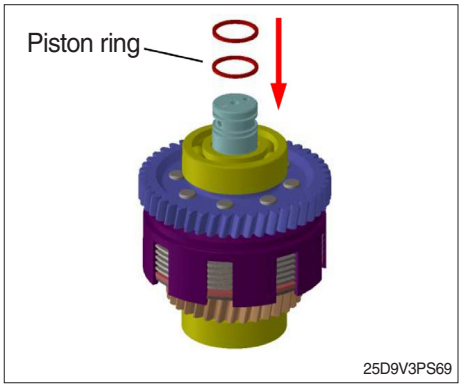


(10) Assemble bearing.



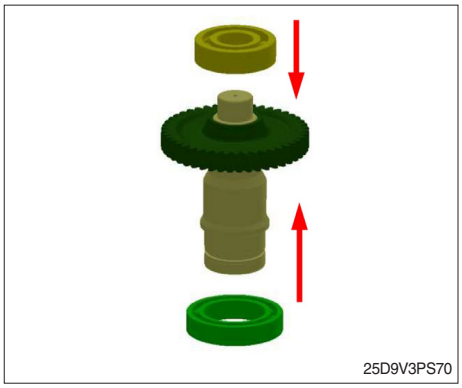
(11) Assemble piston ring at groove of clutch shaft.

※ **Spread T/M oil on piston ring.**

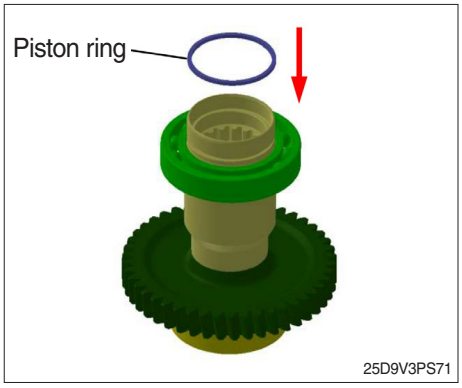


2) ASSEMBLY OF OUTPUT SHAFT

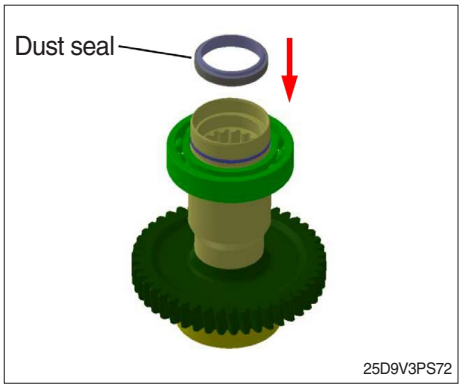
(1) Assemble bearing.



(2) Assemble piston ring at groove of shaft.



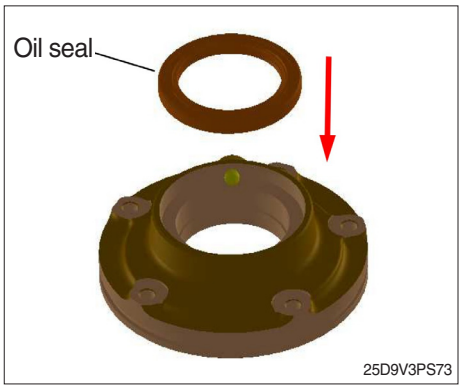
(3) Assemble dust seal.



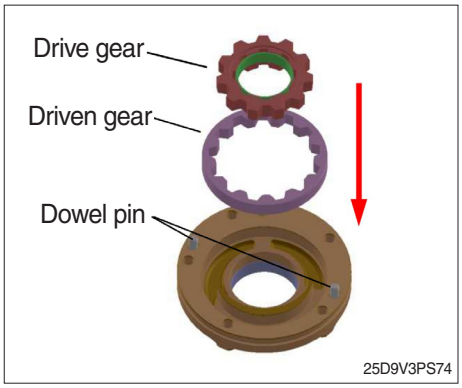
3) ASSEMBLY OF PUMP

(1) Press in oil seal.

※ **Cover Loctite #592 on outside of oil seal. Spread grease on inside of oil seal.**

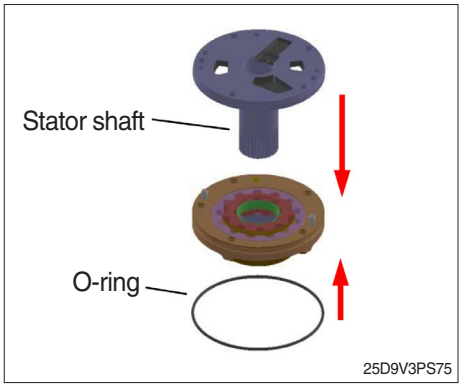


(2) Assemble dowel pin, driven & drive gear.



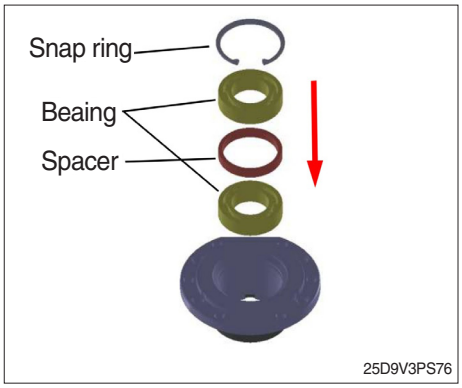
(3) Assemble stator shaft. After assemble o-ring at groove of pump case.

※ **Spread grease on inside of o-ring.**

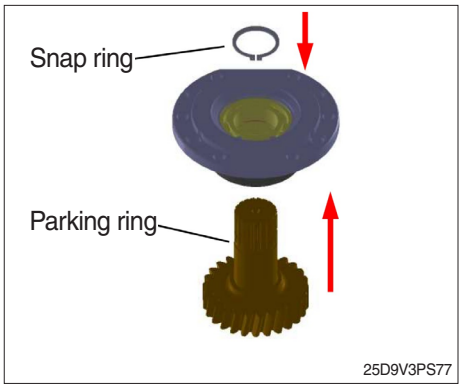


4) ASSEMBLY OF PARKING

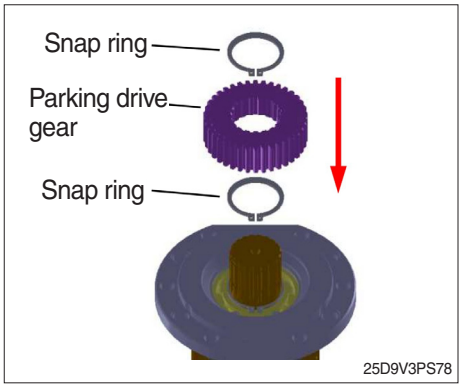
(1) Assemble bearing, spacer & snap ring.



(2) Assemble parking gear and snap ring.



(3) Assemble snap ring and parking drive gear.



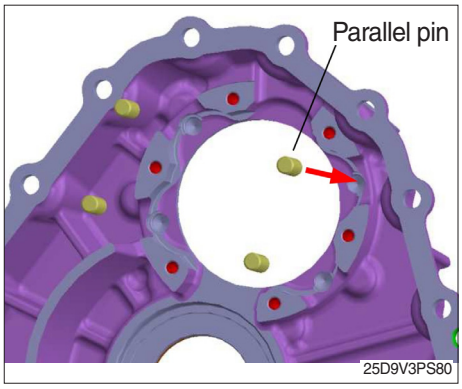
4) ASSEMBLY OF TRANSMISSION

(1) Press in oil seal.

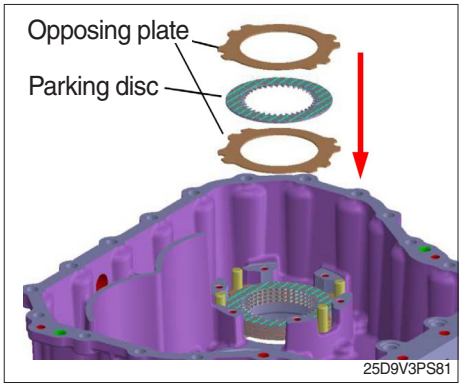
※ **Cover Loctite #592 on outside of oil seal. Spread grease on inside of oil seal.**



(2) Press in parallel pin. (4ea)



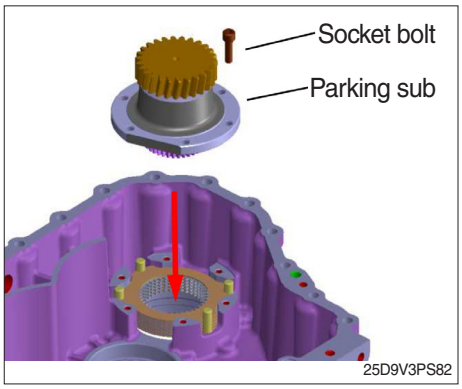
(3) Assemble parking disc and opposing plate.



(4) Assemble parking sub ass'y and socket bolt.

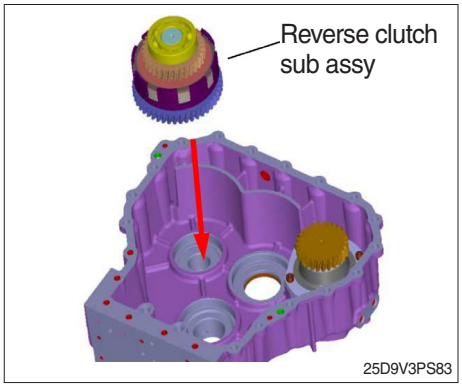
※ **Cover Loctite #277 on socket bolt.**

· Tightening torque : 3.1 ~ 3.6 kgf·m
(22.4 ~ 26.04 lbf·ft)



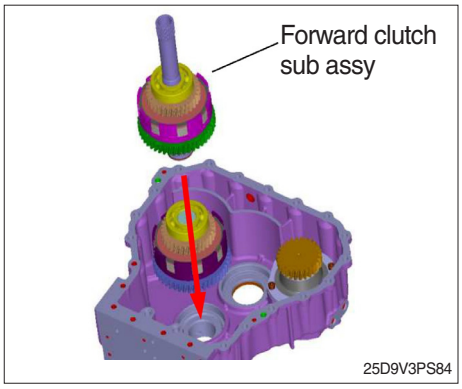
(5) Assemble reverse clutch sub assy. Press in slowly clutch sub assy.

※ **Spread grease on piston ring.**

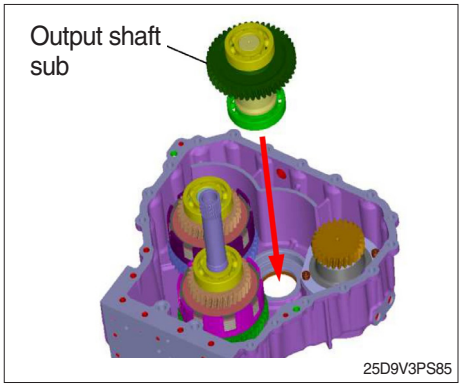


(6) Assemble forward clutch sub assy. Press in slowly clutch sub assy.

※ **Spread grease on piston ring.**

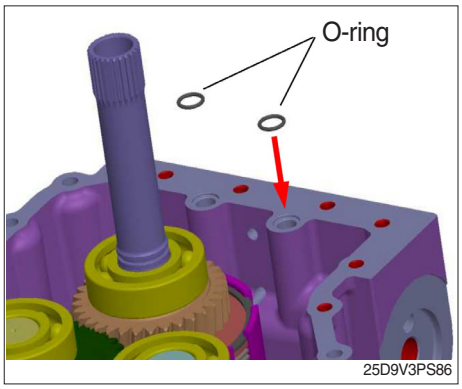


(7) Assemble output shaft sub assy. Press in slowly output shaft sub assy.

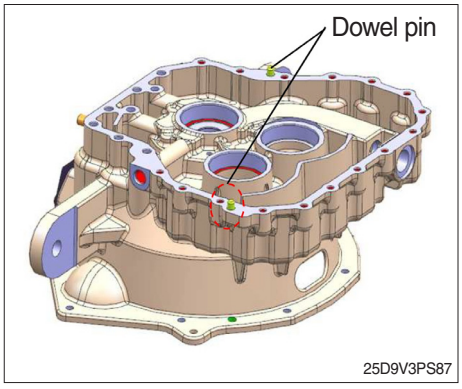


(8) Assemble o-rings.

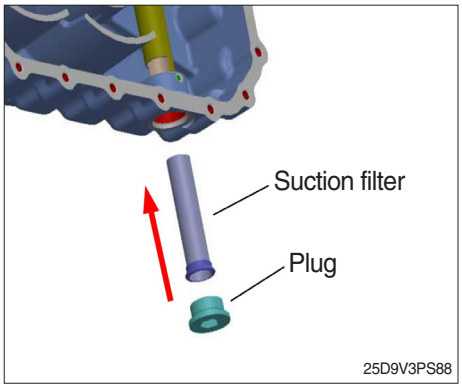
※ **Spread grease on o-ring.**



(9) Press in dowel pin. (2ea)



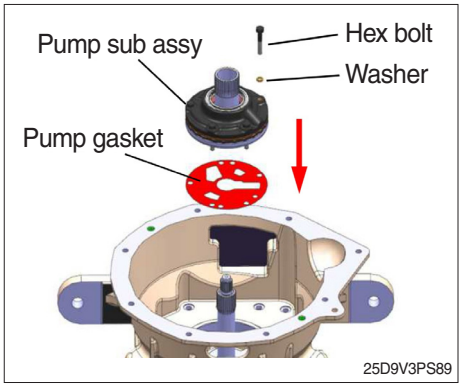
(10) Assemble suction filter and plug.



(11) Assemble pump gasket, pump sub assy and washer & hex Bolt.

※ **Cover Loctite #277 on hex bolt.**

· Tightening torque : 2.0 ~ 2.6 kgf·m
(14.5 ~ 18.8 lbf·ft)



(12) Assemble T/M case and T/C housing.

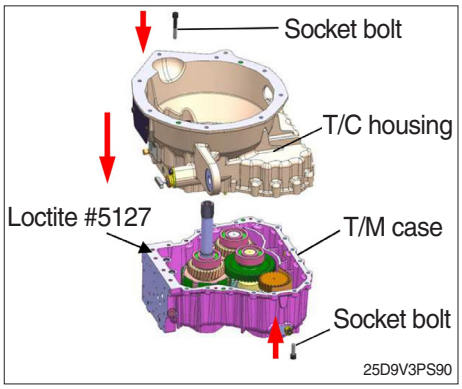
※ **Cover Loctite #5127 on T/M case.**

※ **When you assemble bolt, firstly tied up the opposites of bolt.**

Assemble socket bolt. (M10×1.5-30L : 16EA / M10×1.5-65L : 16EA)

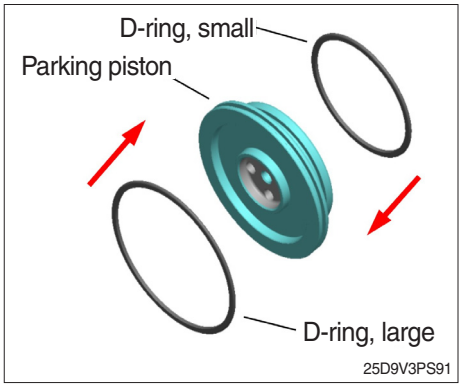
※ **Cover Loctite #277 on socket bolt.**

· Tightening torque : 7.1 ~ 7.7 kgf·m
(51.4 ~ 55.7 lbf·ft)



(13) Assemble d-ring at groove of parking piston.

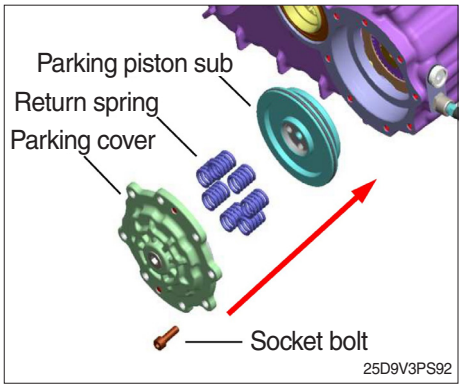
※ **Spread grease on d-ring.**



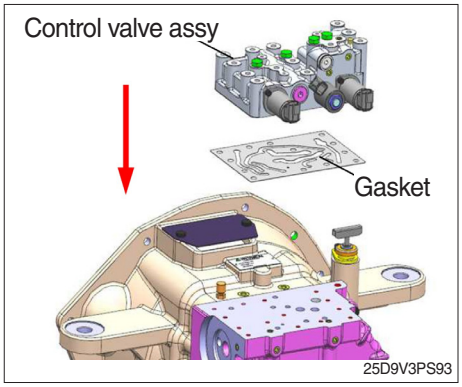
(14) Assemble parking piston sub ass'y, return spring, parking cover and socket bolt.

※ **Cover Loctite #277 on socket bolt.**

· Tightening torque : 3.1 ~ 3.6 kgf·m
(22.4 ~ 26.04 lbf·ft)



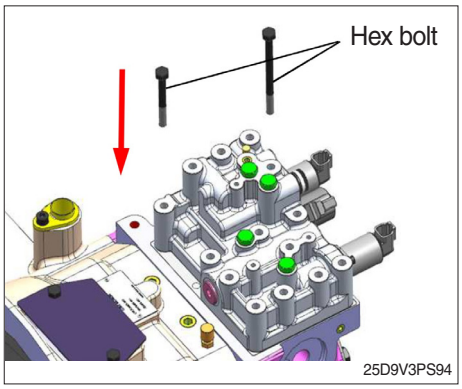
(15) Assemble valve gasket and control valve assy.



(16) Assemble hex bolt. (M8×1.25-65L : 10EA / M8×1.25-100L : 4EA)

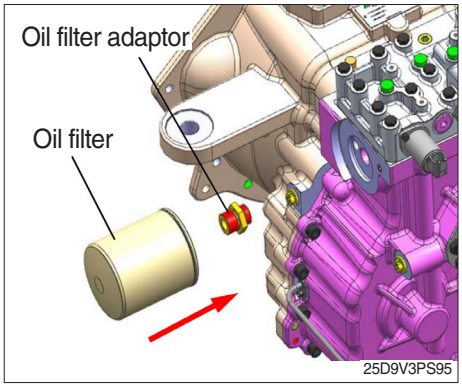
※ **Cover Loctite #277 on hex bolt.**

· Tightening torque : 3.1 ~ 3.6 kgf·m
(22.4 ~ 26.04 lbf·ft)

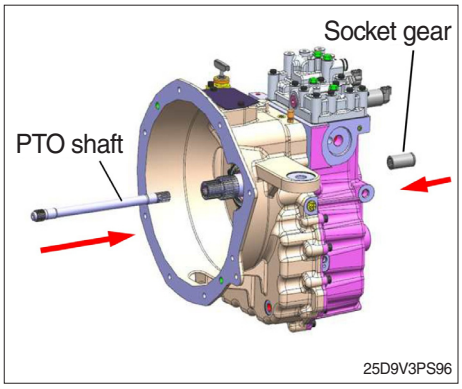


(17) Assemble oil filter adaptor and oil filter.

· Tightening torque : 4.6 ~ 5.1 kgf·m
(33.3 ~ 36.9 lbf·ft)



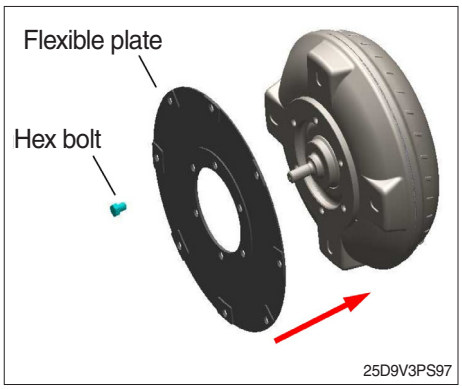
(18) Assemble PTO shaft and socket gear.



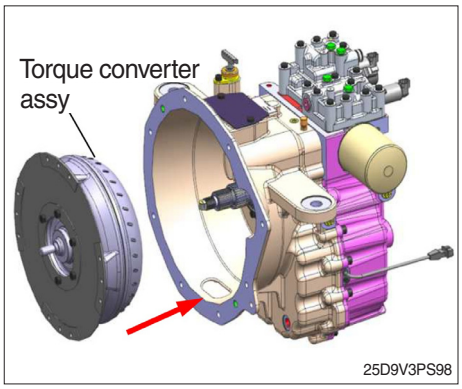
(19) Assemble flexible plate and hex bolt.

※ **Cover Loctite #277 on socket bolt.**

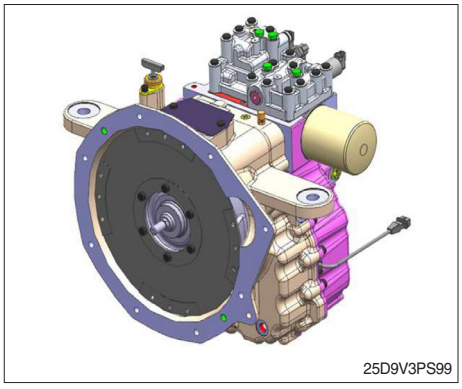
· Tightening torque : 4.6 ~ 5.1 kgf·m
(33.3 ~ 36.9 lbf·ft)



(20) Assemble torque converter assy.



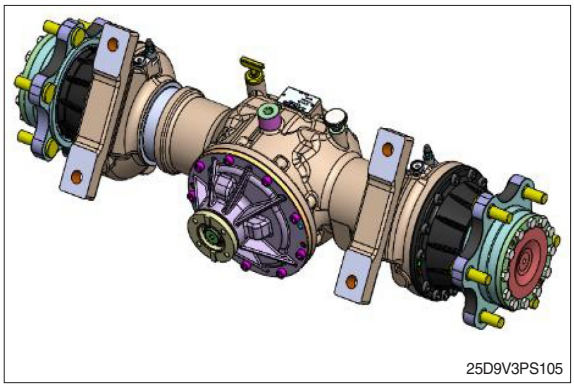
(21) Transmission assembly.



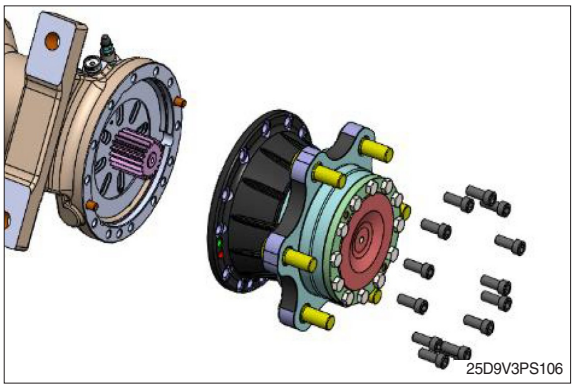
3. DISASSEMBLY OF DRIVE AXLE

1) DISASSEMBLY

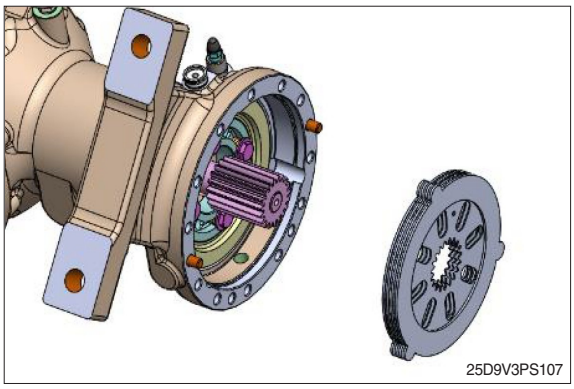
(1) Disassemble drive axle assy.



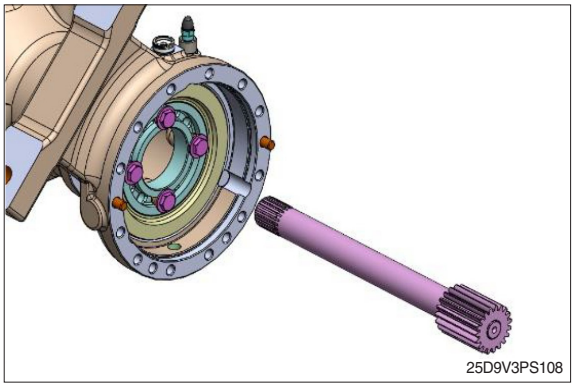
(2) Disassemble carrier hsg. sub assy.



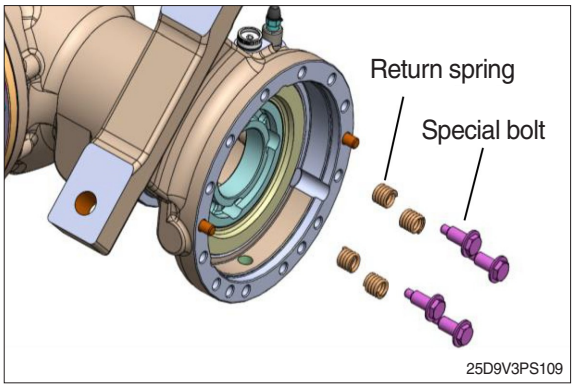
(3) Disassemble disc, opposing plate.



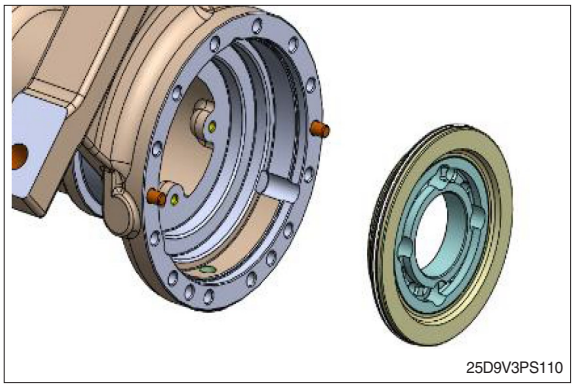
(4) Disassemble axle shaft.



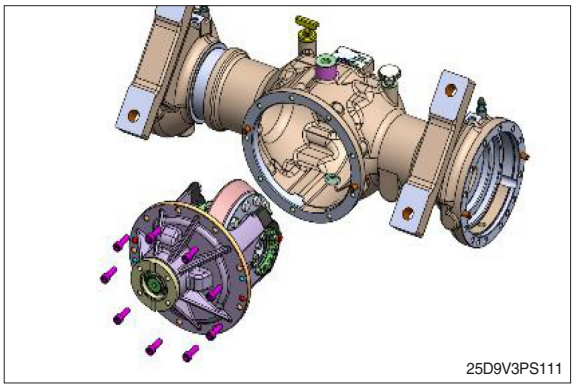
(5) Disassemble special bolt, return spring.



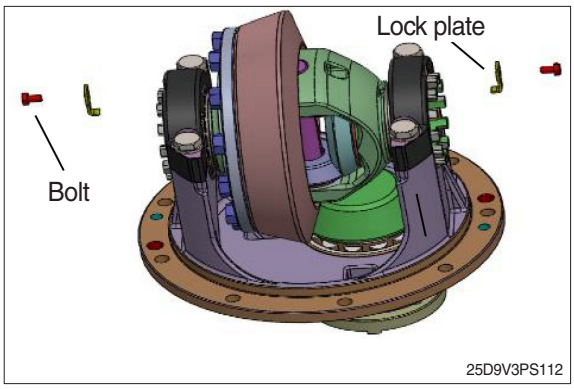
(6) Brake piston sub assy



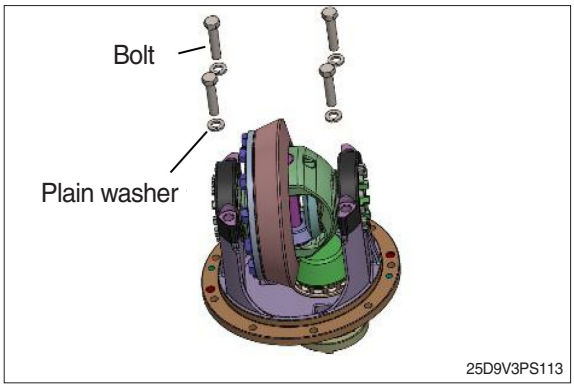
(7) Disassemble bolt, carrier sub assy.



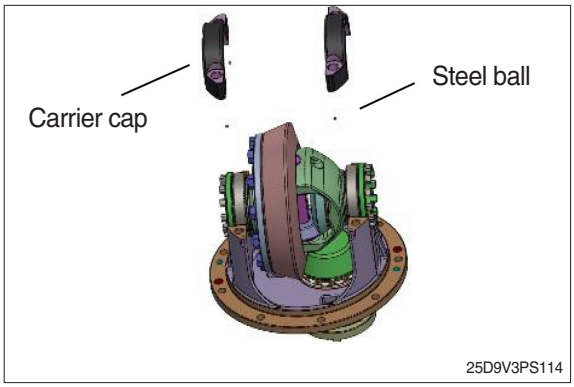
(8) Disassemble Bolt, lock plate.



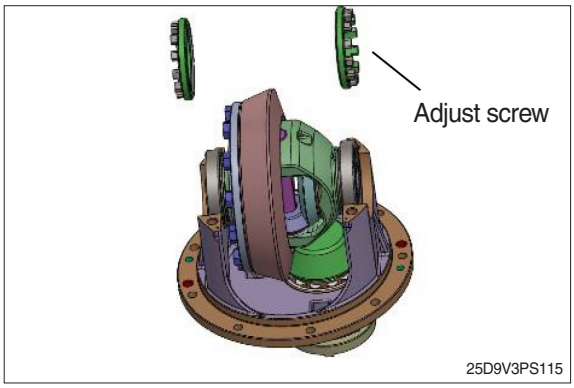
(9) Disassemble bolt, plain washer.



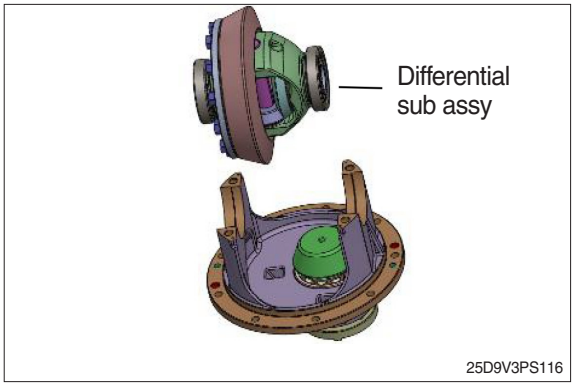
(10) Dissassemble carrier cap, steel ball.



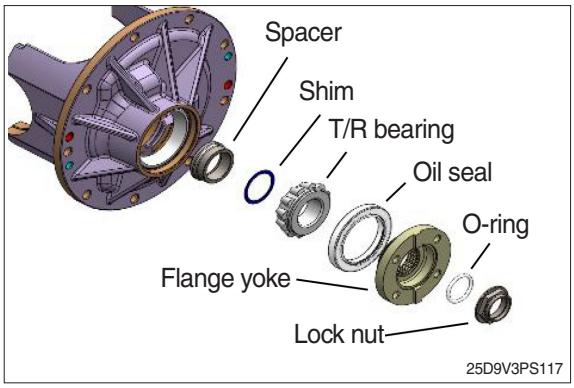
(11) Disassemble adjust screw.



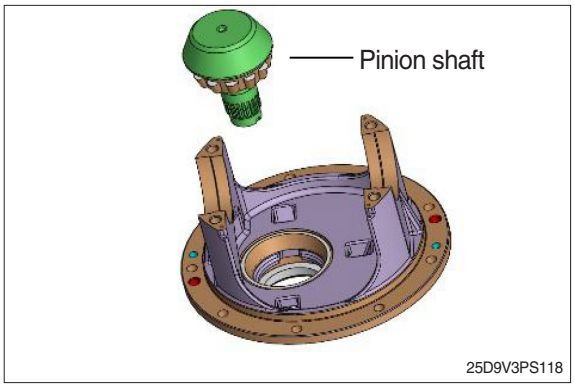
(12) Disassemble differential sub assy.



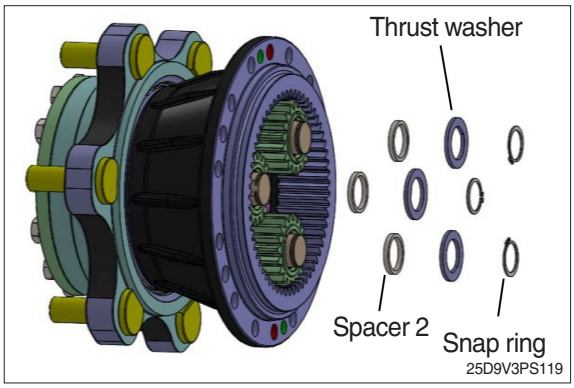
(13) Dissassemble carrier cap, steel ball.



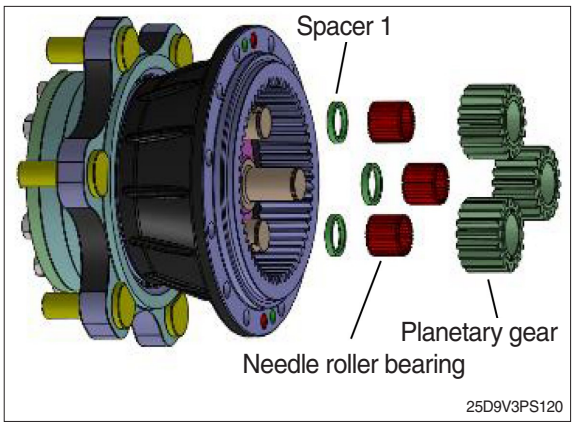
(14) The Lock nut from the decomposition order.



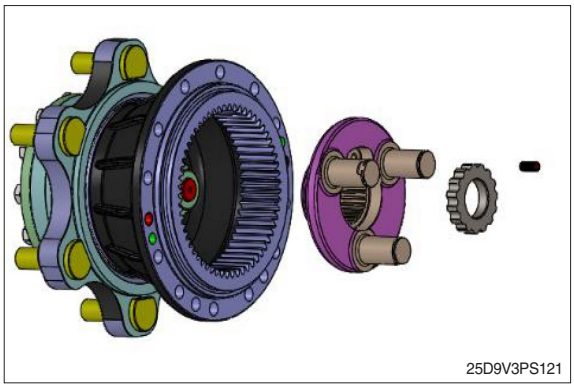
(15) Disassemble Pinion shaft.



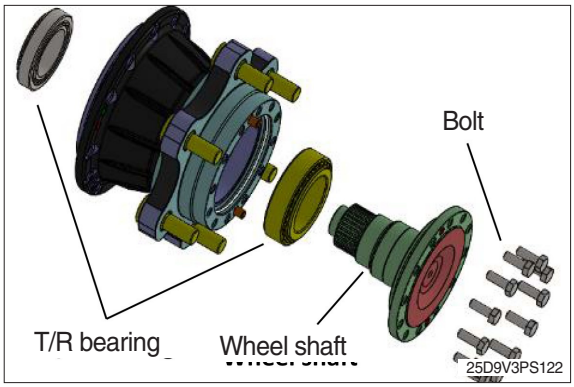
(16) Disassemble planetary gear, needle roller bearing (58EA × 3= 174EA), spacer 1.



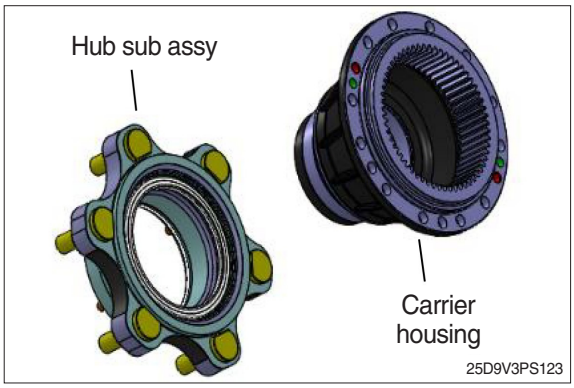
(17) Disassemble set screw, hub lock nut and PL carrier



(18) Disassemble bolt, wheel shaft and T/R bearing.



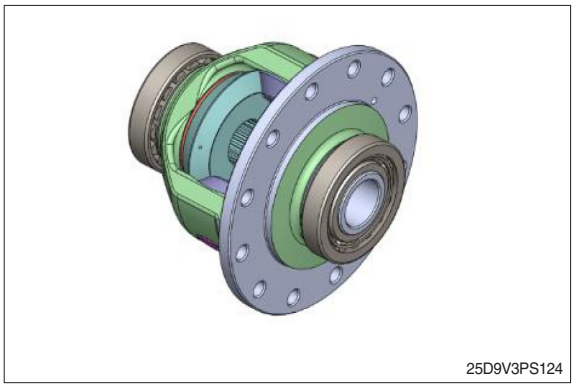
(19) Disassemble hub sub assy, carrier housing.



3.ASSEMBLY OF DRIVE AXLE

1) ASSEMBLY OF DIFFERENTIAL DEVICE

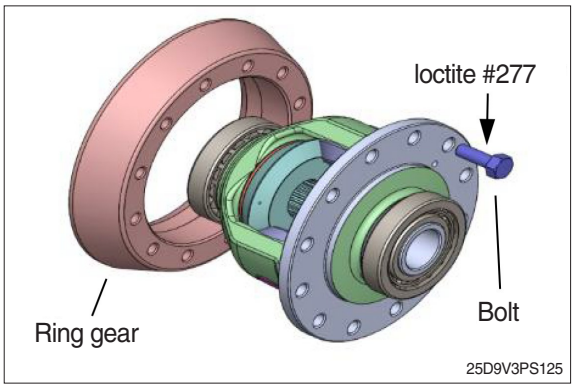
(1) Make preparation for diffdrential assembly.



(2) Assemble Ring gear by Bolt.

※ **Spread loctite #277.**

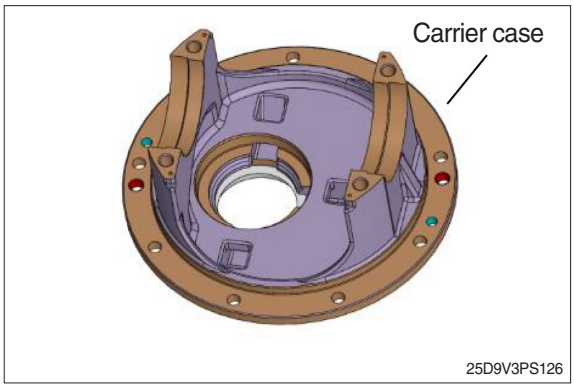
· Tightening torque : 10.2 ~ 11.2 kgf·m
(73.8 ~ 81.0 lbf·ft)

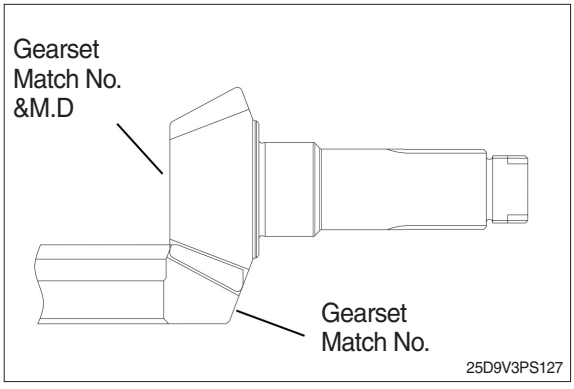


2) ASSEMBLY OF CONTROL OF SHIM & PINION

(1) Fix carrier case to jig.

※ **Before install gearset to carrier, you must recognize information. You always have tested the mark at gear set which each pair of gear suits it.**





(2) The THK of shim will be decided of measured value of gauge & machine.

① Dimensional drawings of the alphabet (mm)

a : 107 b : 25.25 c : Engraved value

d : 132.75 e : 33.75 f : 32.5 g : 1.75

② Basic shim thickness

"A" : 0.5 "B" : 0.5

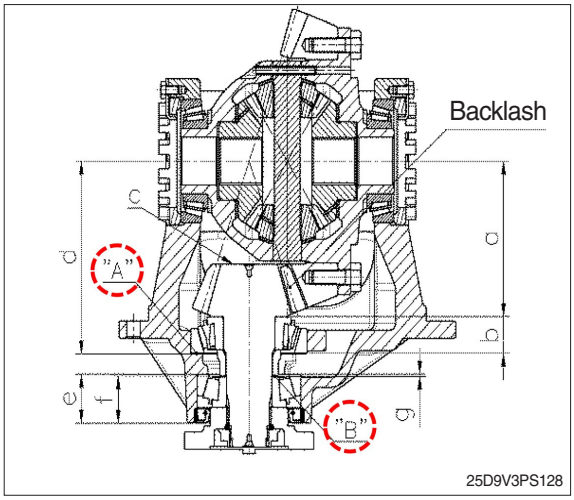
③ Shim thickness calculation

"A" : d-(a+b+c)

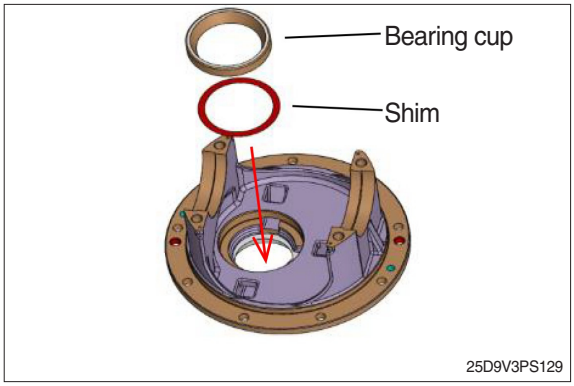
ex) 132.7 - { 106.9 + 25.22 + (-0.2) } = 0.83 → 0.85 mm

"B" : g-(e-f)

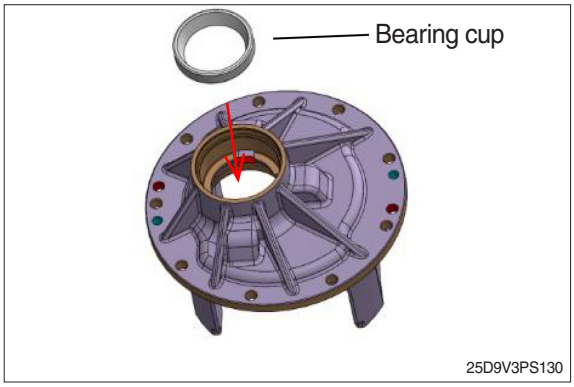
ex) 1.77 - (33.71 - 32.42) = 0.48 → 0.5 mm



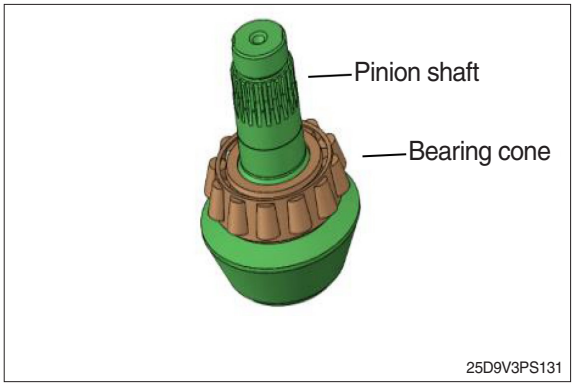
(3) Assemble shim. Sort of shim : 0.1, 0.15, 0.25, 0.5 mm. Press the bearing cup.



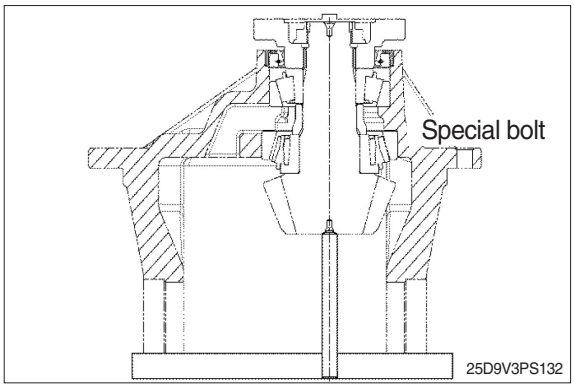
(4) Turn carrier case a on-eighty (180˚) and press bearing cup.



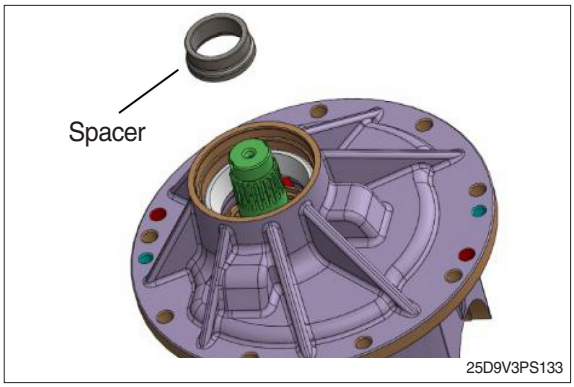
(5) Pressurize bearing cone on pinion shaft. Put into pinion shaft.



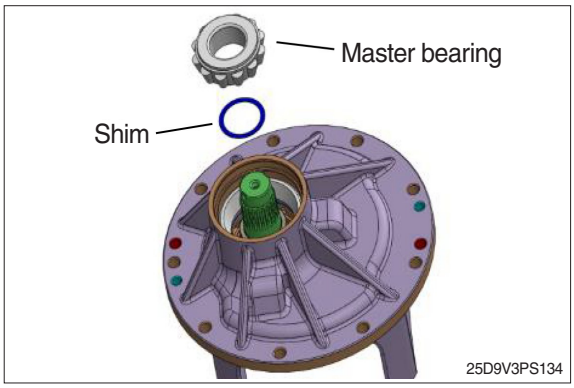
(6) Turn carrier case a one-eighty (180˚) and fix it on jig.



(7) Assemble pinion shaft on spacer.

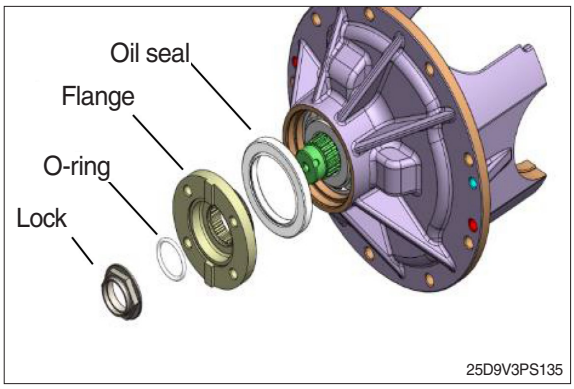


(8) Assemble pinion shaft, and assemble shim & master bearing sort of shim : 0.1, 0.15, 0.3 mm

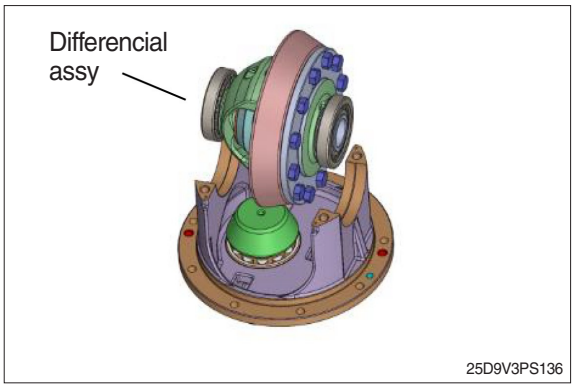


(9) Assemble oil seal, flange yoke, o-ring and lock nut.

· Tightening torque : 26.5 ~ 29.6 kgf·m
(192 ~ 214 lbf·ft)



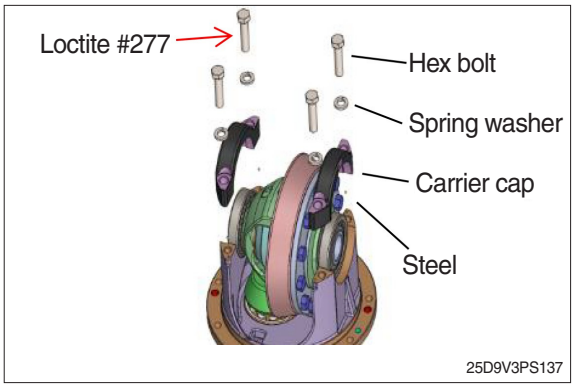
(10) Turn carrier case a one-eighty (180˚) and assemble differencial assembly on carrier case.



(11) Assemble hex bolt on carrier cap.

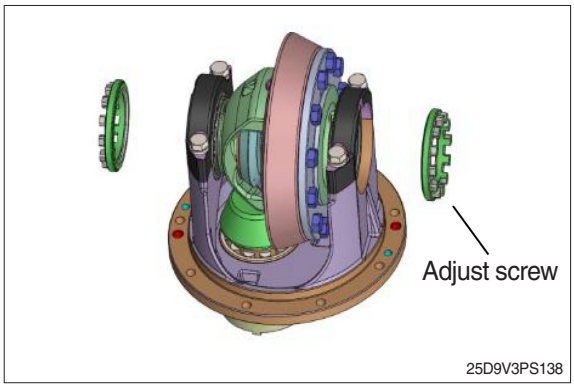
※ **Spread loctite #277 on the bolt.**

· Tightening torque : 11.7 ~ 12.5 kgf·m
(84.6 ~ 90.4 lbf·ft)

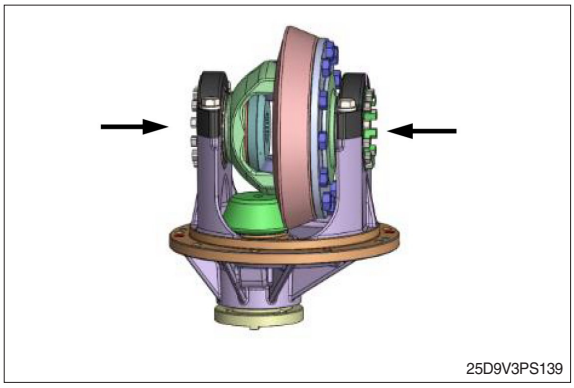


3) CONTROL OF GEARSET BACKLASH

(1) Assemble adjust screw on carrier case.



(2) Lock adjust screw.

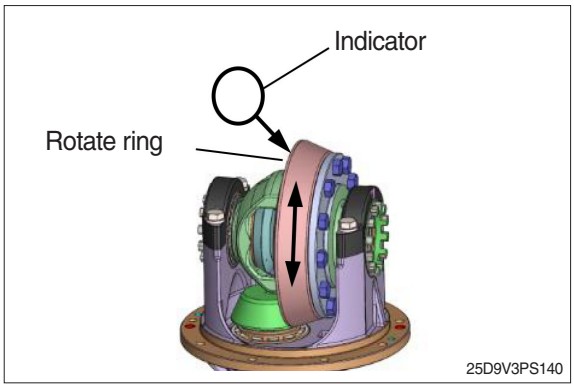


(3) Measure Backlash.

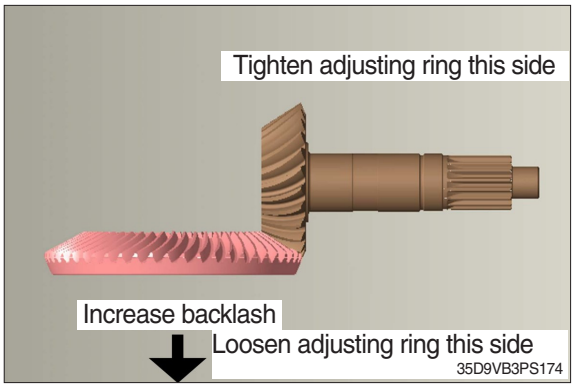
※ Backlash of pinion & ring gear : 0.18~0.23 mm

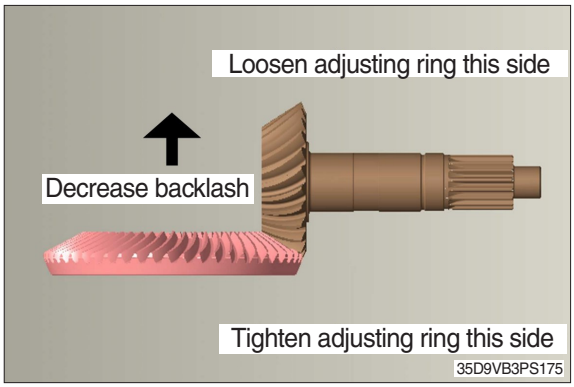
※ If it is wrong backlash, you can adjust value as moving each step.

※ If ring gear takes from pinion shaft far, the value of backlash will be increased. If ring gear takes from pinion shaft close, the value of backlash will be decreased.



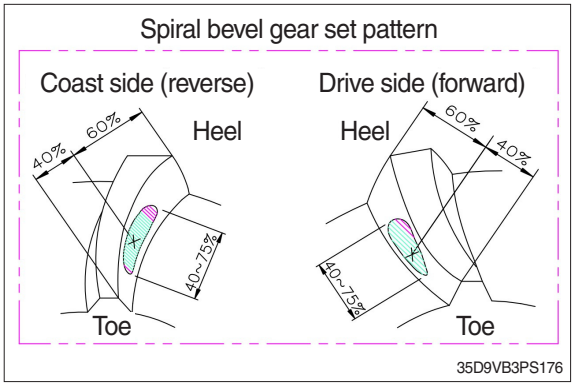
(4) If ring loosen same with one bolt screw side, you should ring tighten it. And if ring tighten it, you should loosen the adjusting ring.



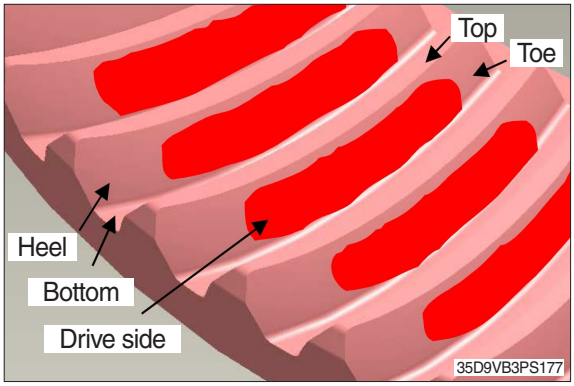


4) MEASUREMENT OF TOOTH CONTACT PATTERN

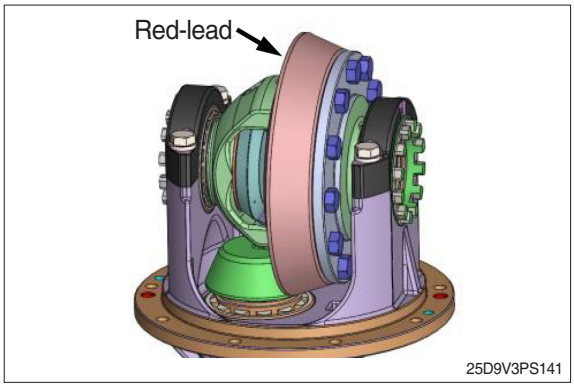
※ **After assemble , adjust pattern of the gear and pinion shaft figure. If pattern is not adjusted, take a measure as measuring backlash again and then reassemble.**



※ **Always check tooth contact pattern on the driving side of gear teeth.**

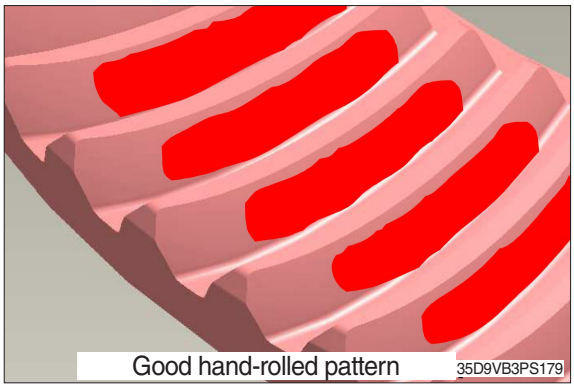


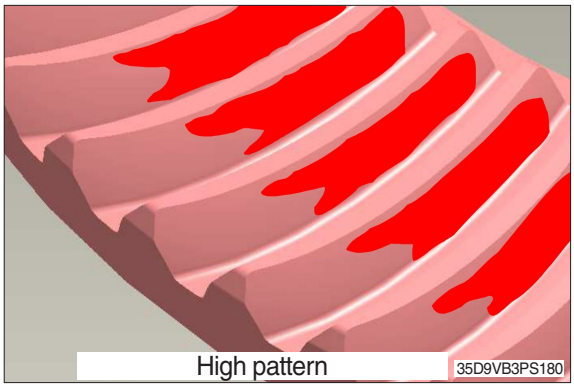
(1) Marking red-lead on 6 tooth surface of ring gear.
(2) Rotate ring gear forward and backward so that the 6 marked teeth go past the drive pinion six time to get a good contact pattern.

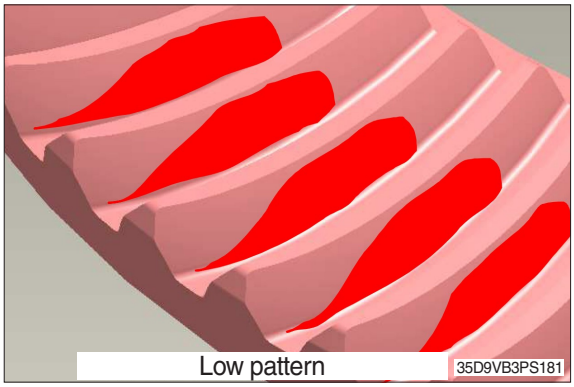


(3) Compare the contact pattern with illustrations.

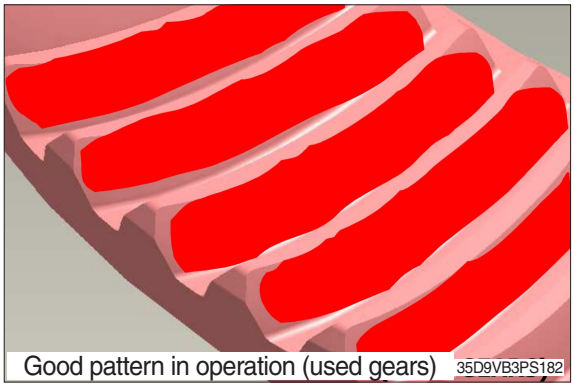
※ **The good contact pattern of gearset is appeared what the length of tooth has had.**







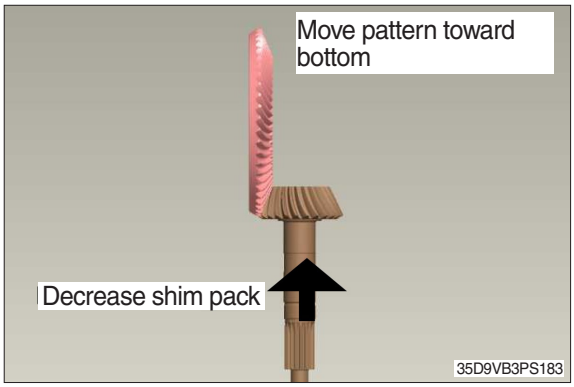
※ **The good contact pattern of used gearset is appeared what the length of tooth has had as wear pattern.**



(4) If you need control contact pattern to adjust THK of tooth (top/bottom), you should obey steps ①-②.
If you need control contact pattern to adjust THK of tooth (toe/heel), you should obey steps ③-④.

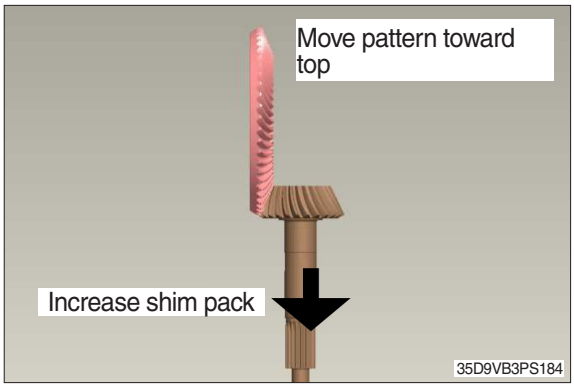
① High pattern

If A high contact pattern appear it which pinion was installed shallowly in carrier.
To modify, move the pinion toward the ring gear by decreasing the shim pack between pinion spigot and inner bearing cone.



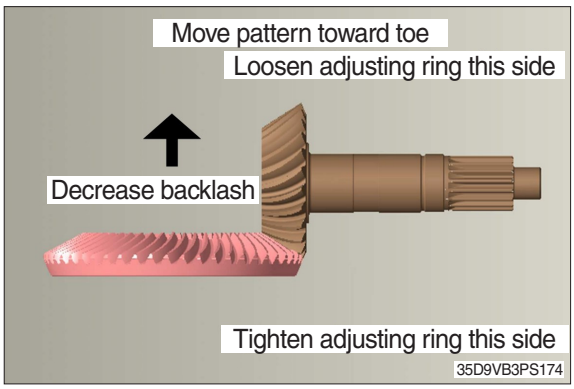
② Lower pattern

If A low contact pattern appear it which pinion was installed deeply in carrier.
To modify, move the pinion away from the ring gear by increasing the shim pack between pinion spigot and inner bearing cone.



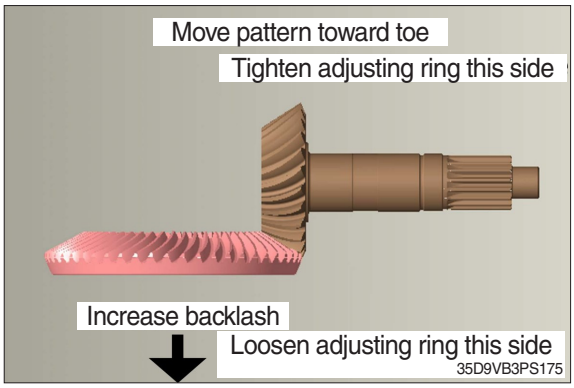
③ Heel pattern

Decrease the gearset backlash (within specified range) to move contact pattern toward toe and away from heel. Refer to " Adjusting the gearset backlash".

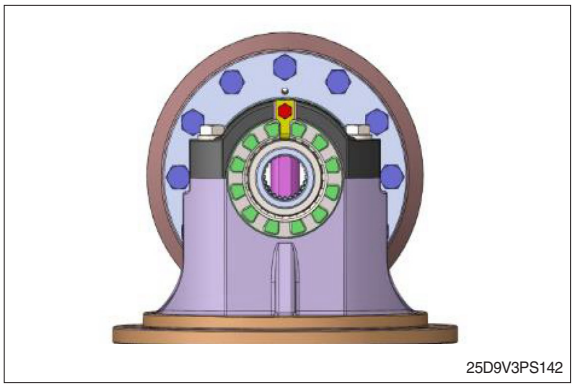


④ Toe pattern

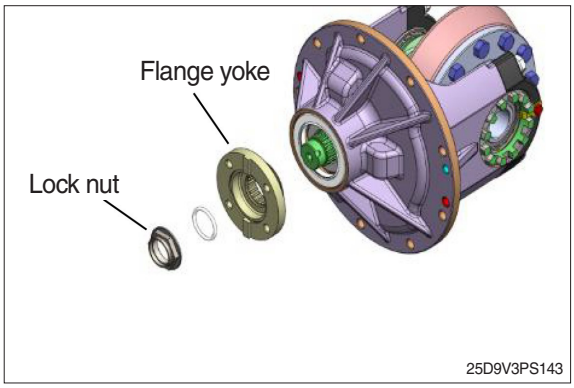
Increase the gearset backlash (within specified range) to move contact pattern toward heel and away from toe. Refer to "Adjusting the gearset back lash".



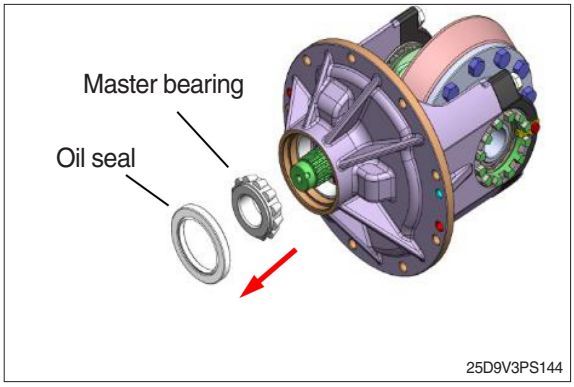
(5) Fix spring pin to adjusted Ring bearing. And then, assemble all of them.



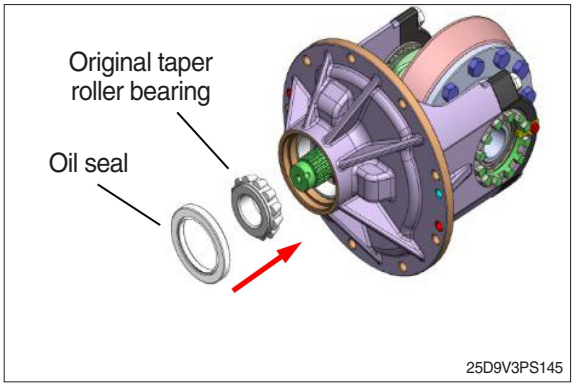
(6) Disassemble lock nut & o-ring & flange yoke.



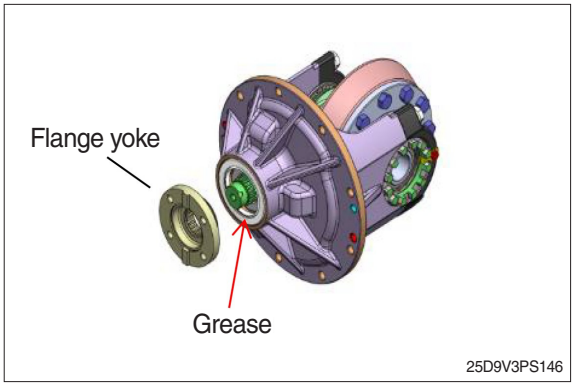
(7) Disassemble oil seal & master bearing.



(8) Assemble original taper roller bearing & oil seal.



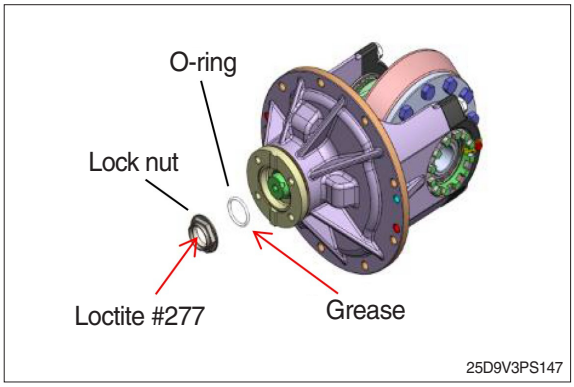
(9) Spread grease on seal rip and assemble flange yoke.



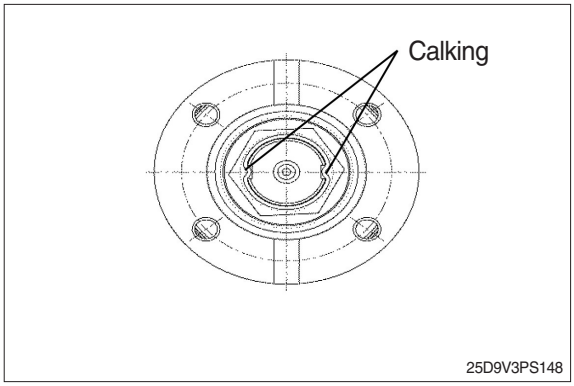
(10) spread grease on o-ring assemble o-ring and spread loctite #277 on lock nut and tighten it.

· Tightening torque : 46.9 ~ 50 kgf·m
(339 ~ 362 lbf·ft)

· Preload : 0.2 ~ 0.4 kgf·m
(1.4 ~ 2.9 lbf·ft)

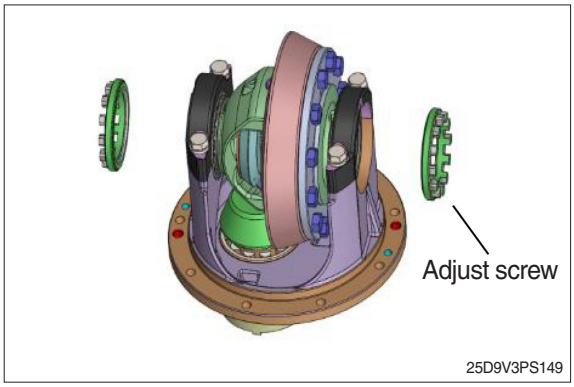


(11) Calking (2EA)



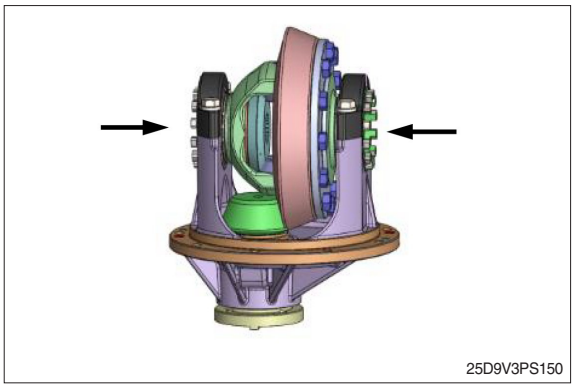
5) ASSEMBLY OF HUB

(1) Press hub bolt into hub.



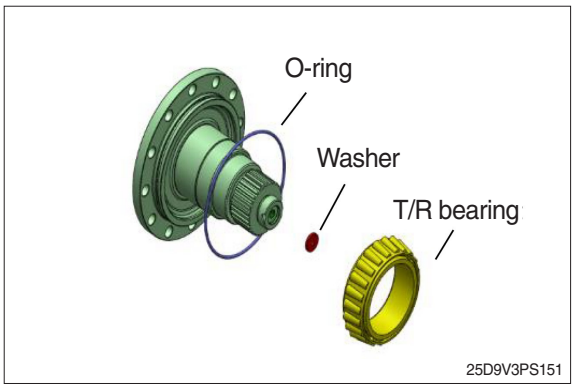
(2) Press hub outer oil seal. Before assemble, spread grease at inside hub.

※ **Grease : Shell Retinax 0434 - 60 ~ 80 % spread**



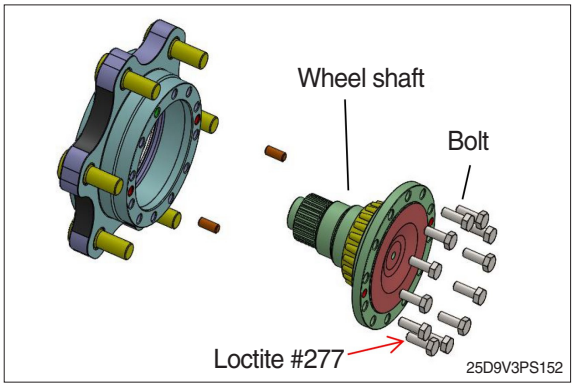
6) ASSEMBLY OF CARRIER HSG. SUB ASSY

(1) Cover grease on o-ring assemble o-ring and assemble washer & T/R bearing.

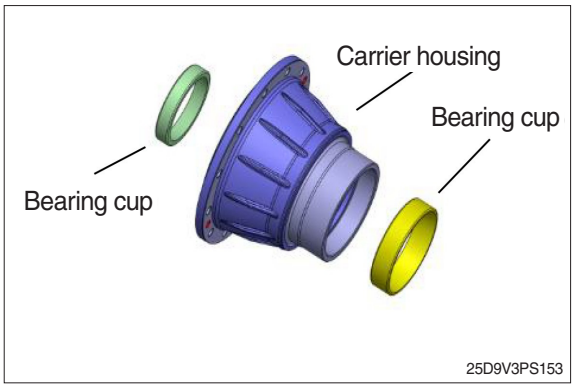


(2) Spread loctite #277 on socket bolt and assemble wheel shaft.

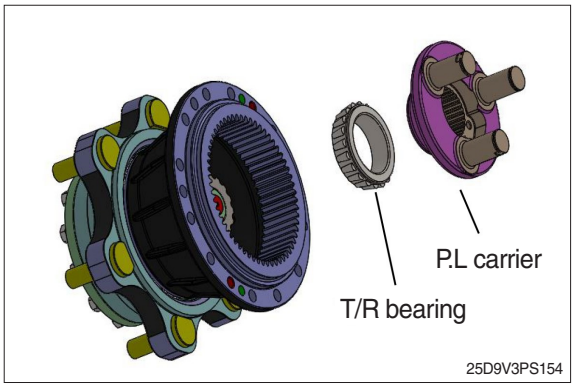
· Tightening torque : 0.69 ~ 0.73 kgf·m
(5.0 ~ 5.3 lbf·ft)



(3) Press bearing cup into carrier housing both side.



(4) Press T/R bearing and P.L carrier sub assy.



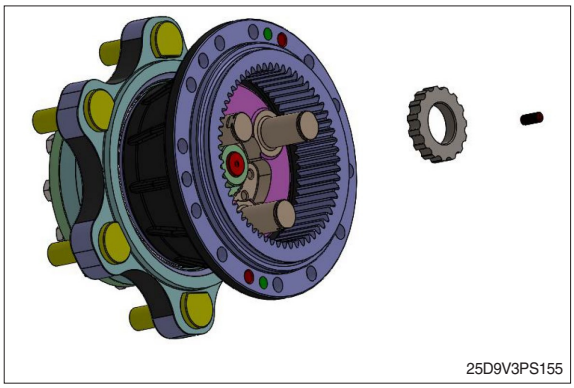
(5) Fastening hub lock nut and assemble the set screw.

※ **Spread loctite #277.**

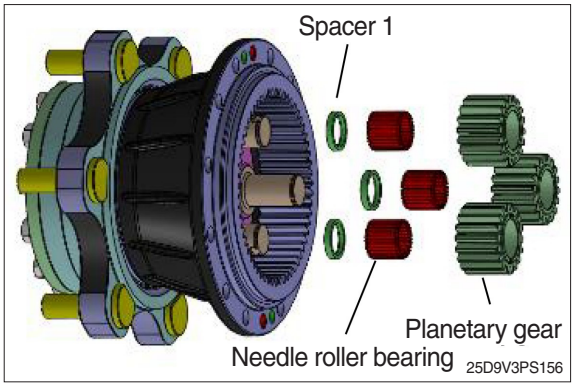
· lock nut tightening toruqe : 25.5 kgf·m (184 lbf·ft)

· Preload : 0.56 ~ 0.61 kgf·m (4.1 ~ 4.4 lbf·ft)

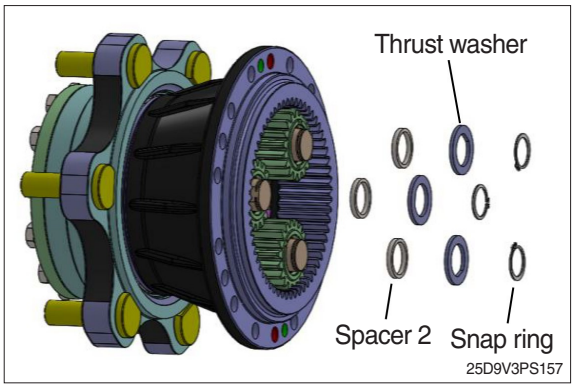
· set screw tightening toruqe : 1.3 kgf·m (9.4 lbf·ft)



(6) Assemble spacer 1, N.D roller bearing and planetary gear. Spread grease on N.D rooler bearing.

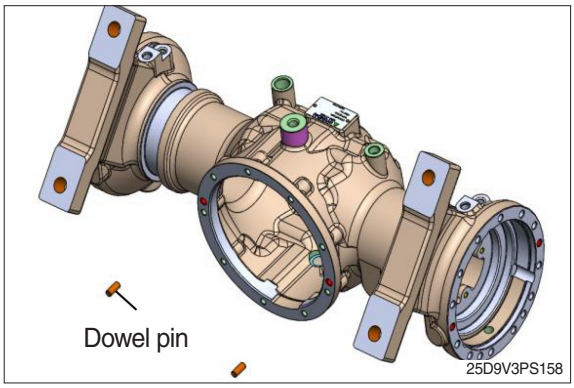


(7) Assemble spacer 2, thrust washer, snap ring.

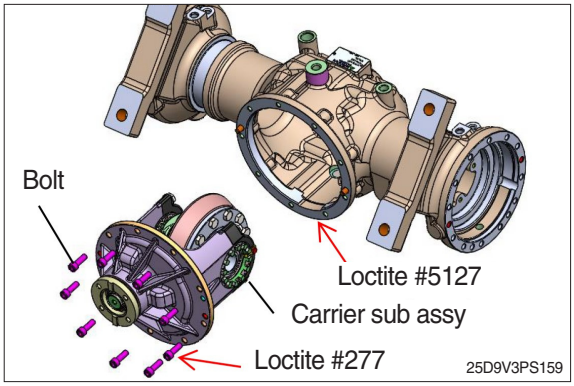


6) ASSEMBLY OF DRIVE AXLE

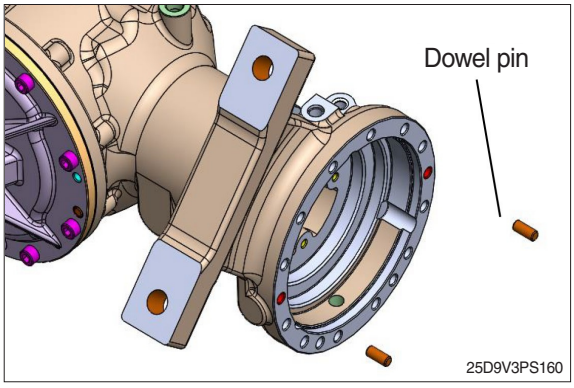
(1) Press dowel pin on axle housing.



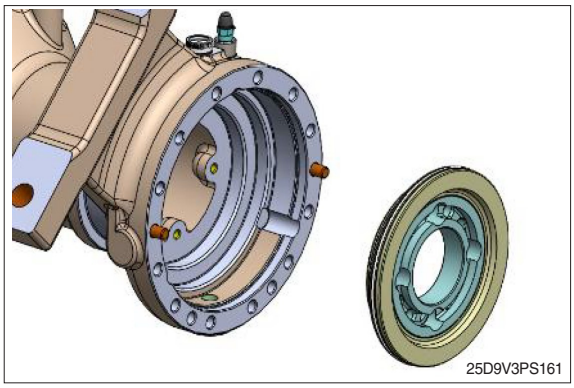
(2) Spread loctite #5127 on axle housing and assemble carrier sub assy. Spread loctite #277 on the bolt and assemble bolt.



(3) Assemble dowel pin on axle housing.



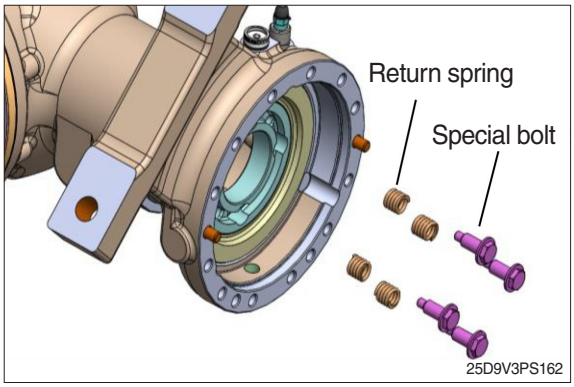
(4) Assemble piston sub.



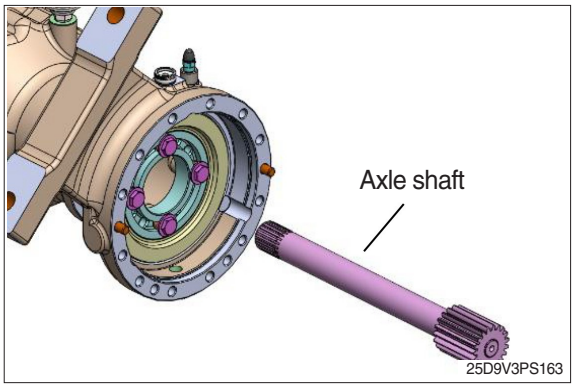
(5) Return spring, Sprecial bolt.

※ **Spread loctite #277 on the bolt.**

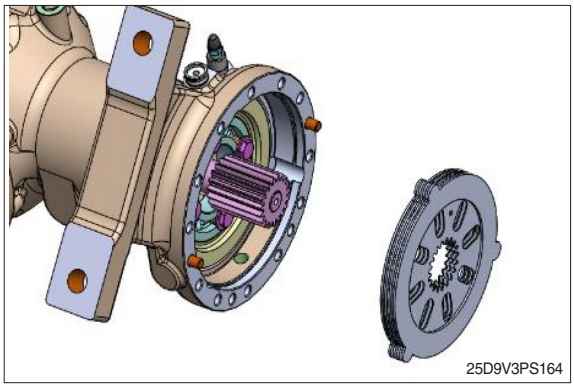
· Tightening torque : 3.1 ~ 3.5 kgf·m
(22.4 ~ 25.3 lbf·ft)



(6) Assemble axle shaft.



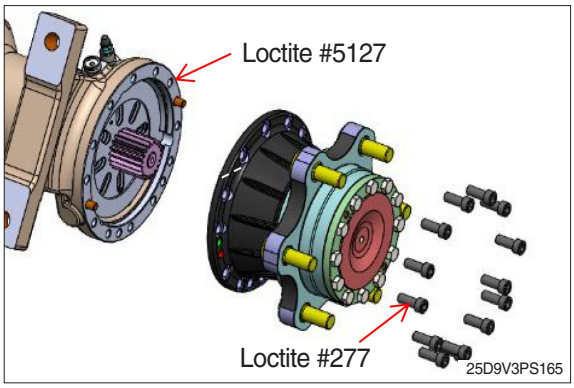
(7) Assemble brake disc pack



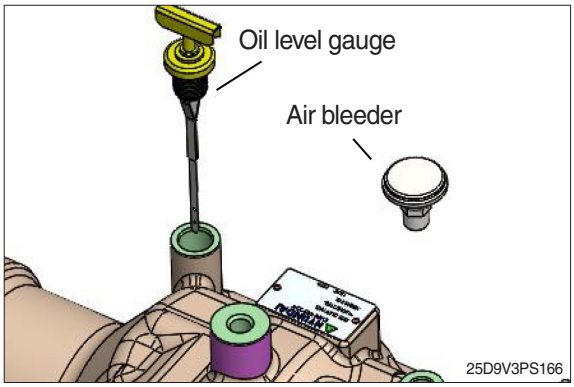
(8) Spread loctite #5127 on axle housing and assemble carrier hsg. sub assy.

※ **Spread loctite #277.**

· Tightening torque : 10.2 kgf·m (73.8 lbf·ft)

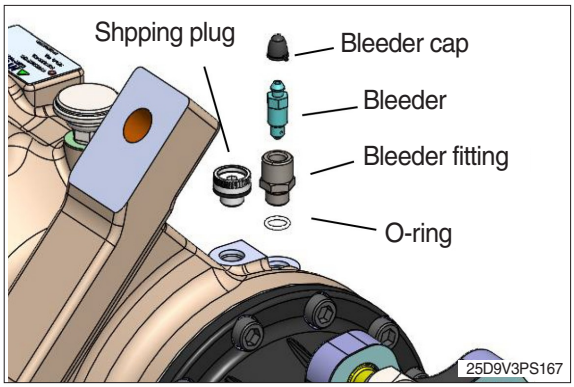


(9) Assemble oil level gauge & air breather on axle housing.



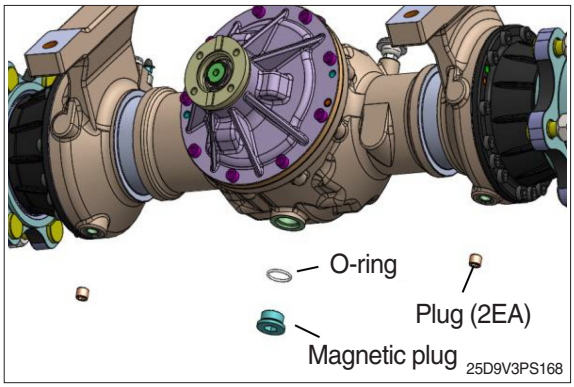
(10) Assemble o-ring, bleeder & bleeder fitting, bleeder cap.

· Tightening torque
Bleeder : 4.0 kgf·m (28.9 lbf·ft)
Bleeder fitting : 1.8 kgf·m (13.0 lbf·ft)

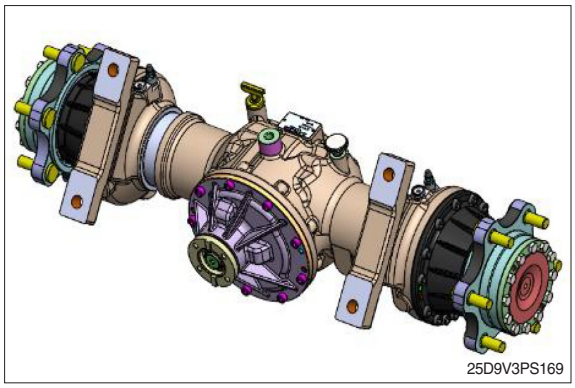


(11) Assemble o-ring, drain plug (magnetic), and plug.

· Tightening torque : 4.2 ~ 5.2 kgf·m (30.4 ~ 37.6 lbf·ft)



(12) Complete drive axle assembly.



GROUP 3 MAINTENANCE AND TROUBLESHOOTING

1. MAINTENANCE

1) TRANSMISSION

(1) Recommend oils

The property that needs for auto transmission oil.

- · It has suitable viscosity at the height temperature.
- · It has suitable fluidity at the low temperature.
- · It has excellent oxidation stability.
- · It has property which remove bubble, and property of lubricant.
- · Therefore please be sure to use following the oil when you supply or change oil. In addition, please use the same oil that you supplied already.

① Oil volume is approximately 6 liters (without torque converter).

② Suggested oil : ATF (Auto Transmission oil, Dexron type)

(2) Point of exchange oil

① Pulling out oil

a. Please take off the drain plug where under of the transmission, and then discharge the old oil.

b. Please take off the hose join part, and then discharge the old oil that remained in the oil cooler and in the hose.

※ Period of exchange oil filter : initial time 100 hr, and then every 1000 hr

② Oil supply

a. Please stop the engine (ok), then refuel the oil into transmission until 「HOT」 level of oil level gauge.

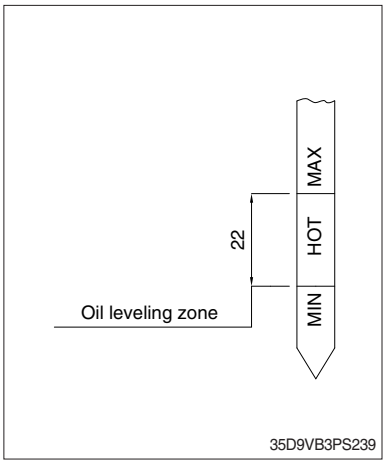
b. Please change lever "neutrality" position. Then please turn on the engine and keep low idle speed.

c. The oil reaches the hydraulic torque converter, cooler and pipe and so on, after start up the engine. Then oil level sink down.

d. Please drive the engine about 5 minutes at low idle speed, then refuel the oil gradually the oil level settle in regular position (between 「MAX」 and 「MIN」 position).

※ Please refuel the oil carefully, without get rubbish or water and so on in the oil.
Lack of oil or excess of oil becomes cause of breakdown. So please be careful.

※ Check the oil level, when the oil temperature is 50℃ ~ 60℃.
Amount of all oil : about 14 liters.



(3) Period of overaul

① As for the overhaul, we recommend either every 5 years or 7000 hours coming early to be done as a limit.

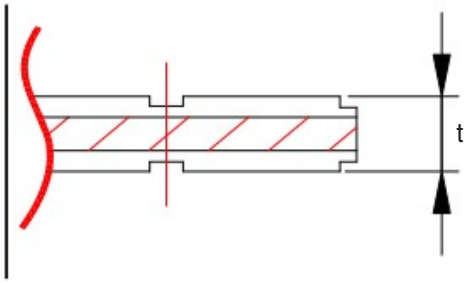
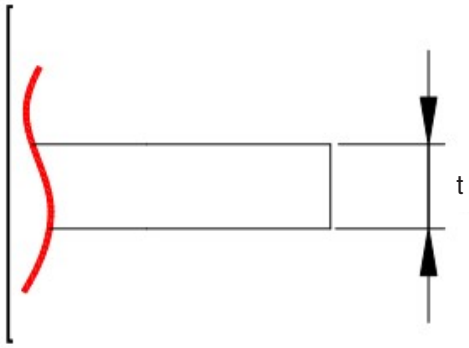
② Please change the oil seal, rubber such as o-ring, and gasket, copper gasket, if it has damaged.

③ Please check the part by your eyes which you disassembled whether they have the crack, the scar, abnormal wear and corrosion etc. If the parts have such abnormal condition, please change or repair.

④ Seal ring, snap ring, friction disc, plate → Change the part that exceeds the wear limits.

⑤ Bearing, bush → Check the bearing to see if it rotates freely. If in doubt about the wear or lack of lubrication, replace this bearing.

⑥ Gear, shaft → if it is abnormal you have to change.

	Item in the F&R clutch	Standard	Limit
Friction disk		2.4	1.9
Plate		1.8	1.65
Back plate		3	2.85

(4) Period of exchanging parts

time / Item name	Item in the F&R clutch	Standard
Oil seal	Please change all parts.	Please change all parts at every overhaul.
O-ring		
Gasket		
Copper gasket		
Oil seal ring	Please check the each part.	Please change all parts at 2nd and 4th time.
Seal ring race plane		Please change the part that exceeds the wear limit.
Sinter plate		
Stator free wheel part		Please change the part that exceeds the wear limit. Please change the abnormal leaf spring.
Sliding surfaces of oil seal		Please change the part that exceeds the wear limit.
Sliding seciton of clutch piston		
Inside diameter or bush		
Each bearing		
Spring		

(5) Standard of exchanging parts

Classfication	Contents	Object parts	Item name
A	The part that you should change the part to new one whenwever overhauling and for check cleaning.	Gasket, Rubber	Gasket, O-ring, Copper gasket, Oil seal
B	The part that wear of the part is extreme comparatively, so the change time is high frequency.	Seal ring, Clutch plate	Oil seal ring, Snap ring, Friction plate&steel plate in clutch
C	The part that you do not have to change every overhauling but it is abnormally when overhauling you have to change the part.	Bearings, Race side of seal ring	Bearing, Bush, Part of free wheel, Seal race
D	The part that you usually do not have to change to new part but when if it its abnormally you have to chage.	Gear, Shaft	Each gear, Clutch shaft, Turbine shaft, Flange

(6) Test

① **Operation check**

· Please change the change lever to 「N」 position and hold this position, then please change the engine speed from low idle to high idle, and check the below condition.

· The abnormal sound dose not occur.

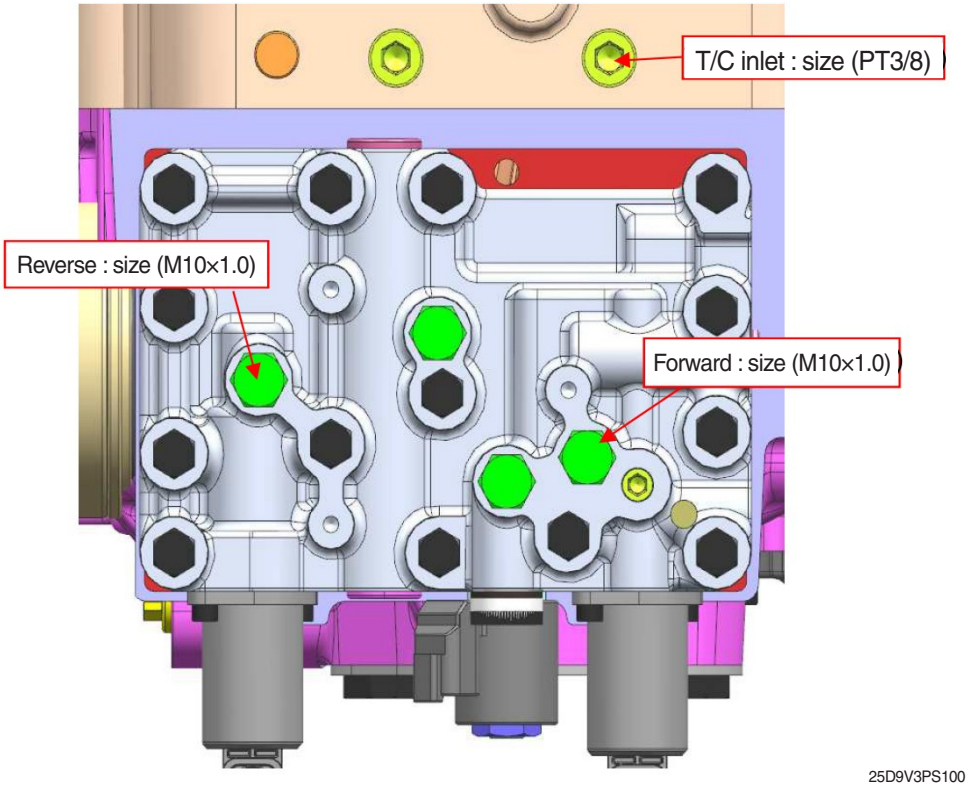
· The abnormal oscillation dose not occur.

· The oil is not leaking.

· Overheating, a strong odor of overheated oil is a major trouble sign.

② **Oil pressure measurement**

· If you measure each part pressure, remove the plug and then install the pressure gauge. (PT 3/8, M10×1.0)



a. Please warming up the engine until the torque converter oil temperature becomes about 50~60˚C.

b. Please measure the oil pressure of every required part as below under the low & high idle speed of engine.

c. When if you measure the individual pressure of clutch and pressure of lubricating. Please install the pressure gauge on the hole which take out the pressure then check the pressure while up the crane.

· Measure the oil pressure of clutch and T/C inlet at the 800 ~ 2400 rpm.

Description	Standard (MPa)	
	800 rpm	2400 rpm
Main relief	1.2±0.2	1.2±0.2
Forward	1.2±0.2	1.2±0.2
Reverse		
T/C inlet	0.1 ~ 0.4	0.3 ~ 0.7

③ **Stall torque output test**

· Please pay attention to the truck starts suddenly, because the torque converter generates largest torque.

※ **When the torque converter is stall condition, heat generate suddenly inside of the torque converter. So do not drive the engine when you drive over 30 seconds and the torque converter oil temperature is over 90℃.**

a. Please use the parking brake and service brake securely.

b. Please set the lever to F or R.

c. Please step on the accelerator pedal until limit position, then check the engine speed when the engine speed become constant.

d. Standard of engine maximum speed in stall condition is around 1,800~2,000 rpm. (depends on the standard performance of engine and torque converter)

2) DRIVE AXLE

(1) General information

Drive axles generate small metal wear particles during operating, especially hard particles are allowed to circulate in the lubricant, along with external moisture. In these case the internal components can be more faster damaged and the brake can be made a noise.

(2) Magnets and magnetic drain plugs

The axle has magnetic drain plugs which has minimum 0.5 kg of capacity for picking-up low carbon steel. This drain plug must be checked if there are metal particles at every oil change interval.

(3) Breather

Breathers release the air pressure inside and help to minimize the condensation of oil.

※ **Please clean the plug if it has particles on the surface. Cover the breather when steam cleaning the housing. If the breather is not covered, water can enter the housing and contaminate the oil.**

(4) Oil level

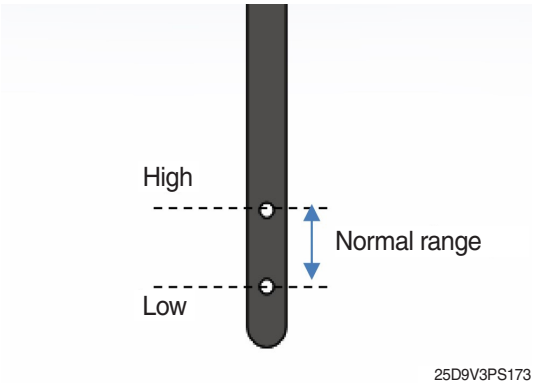
① **Check and adjust oil**

⚠ **To prevent serious eye injury, please always wear the glass for safe when you perform the truck maintenance or service.**

The part for oil filling and drain plugs are located in the axle housing.

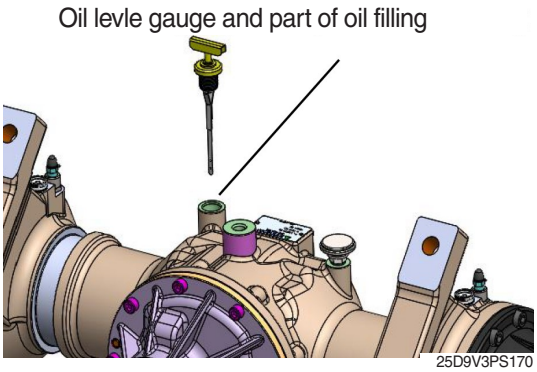
a. Park the truck on flat ground.

b. Pull out oil level gauge from axle, then check the height of oil.

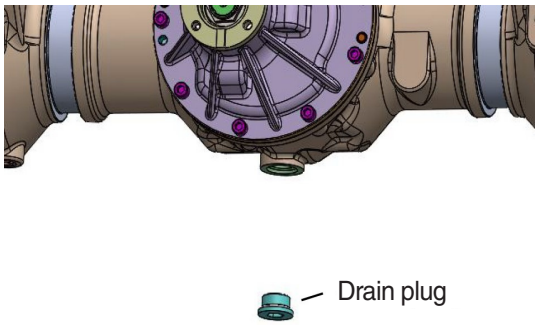


25D9V3PS173

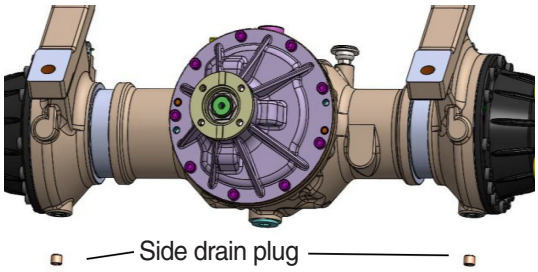
c. If the height of oil of level gauge is higher than the upper limit, drain the oil outby after loosening main drain plug , if the height of oil is lower than the lowest limit, replenish oil.



25D9V3PS170



25D9V3PS171



25D9V3PS172

② **Oil change**

⚠ **Park the truck on flat ground. Block the wheels to prevent the truck moving during maintenance. Do not work under the truck supported only jacks for safe. Because Jacks can slip and fall over.**

a. Make sure the vehicle is on level surface.

b. Raise lift of vehicle and drain oil by loosening main drain plug and 2 places of side plug.

c. After drain all oil, clean the magnetic plug.

d. Fill oil with checking the height of level with level gauge.

③ **Oil volume and available of list**

a. Oil volume is approximately 8.2 liters.

b. **Available oil list**

Manufacture name	Brand name
Mobil corporation	Mobil fluid 424
	Mobil Infilex33 85W90
Sheel oil corporation	Shell spriax S4 TXM
	Donax TD 10W30 (2009 ver.)

(5) Period of overhul

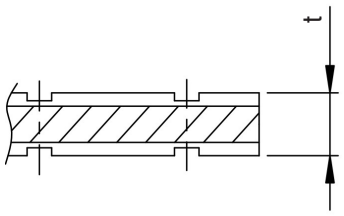
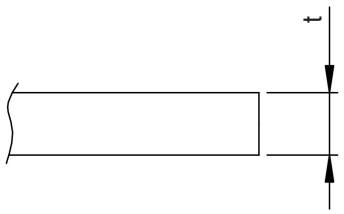
① Period of drive axle assy overhaul : Every 5 year or 7,000 hours.

② The Axle oil needs to be replaced per every 1,000 hrs, to prevent brake noise.

③ O-ring, oil seal, rubber, gasket : Change all parts at every overhaul.

※ Check internal leakage of brake system(Brake seal) : Every 2,000 hours, replace as necessary.

④ **Snap ring, disc, opposing plate : Change the part that exceeds the wear limits.**

Item		Part no.	Standard	Limit
Disc		HA30-60220 (Service brake)	t=2.5	t=2.2
Opposing plate		HA30-60200 (Service brake)	t=2.5	t=2.35

⑤ Bearing, spring : Check the release bearing the see if it rotates freely. If it has doubt for the wear or lack of lubrication, replace this bearing.

⑥ Gear, shaft : If it is abnormal you have to change.

2. TROUBLESHOOTING

1) TRANSMISSION

(1) Output does not go up

Locating fault and cause			Measures
Engine	The engine speed is abnormal.		When the gear is neutral position and torque converter is stall state, please measure the engine speed. Then if the engine speed does not become proper speed, please adjust the engine or repair it. (Please refer to page of stall test.)
Torque converter	Torque converter oil	The oil is in short supply.	Please replenish oil.
		The oil that is not regulated is used.	Please change the oil to regular oil.
		The air has mixed into oil.	Please tighten each joint coupling and the pipe further.
		The air bubble occurs because the torque converter pressure decrease.	Please check and adjust the torque converter pressure.
		The water has mixed into oil.	Please check the cooler, and change all oil.
		The oil filter is clogging.	Please wash the oil filter of change it.
	Main body of torque converter	The stator free wheel is broken.	Please change the stall revolution then if the revolution is extremely low, please change the free wheel inner race, free wheel cam and roller.
		The stator free wheel is sticking.	Please check the rise of the temperature of oil at no load. And please change the free wheel inner race, free wheel cam and roller when the temperature of oil rises abnormally.
		The wheel with blades is broken or it is touching other components.	Please check whether the aluminum powder and the like has mixed into torque converter oil. Please change the wheel with baldes if the aluminum powder and the like has mixed in.
	Charging pump	The pump dose not operates normally.	Please change the pump.
Transmission	Control valve assy	The clutch oil pressure has decreased because the spring is settling or break.	Please change the spring.
		The valve does not move with the valve opens.	Please repair or change the valve.

(2) Power is not transmitted

Locating fault and cause			Measures
Torque converter	The input plate wheel is broken.		Please change the input plate.
	The oil is in short supply.		Please replenish oil.
	The shaft and spline are worn.		Please change the shaft and the spline.
	The gear is broken.		Please change the gear.
	The charging pump does not operate normally.		Please change the charging pump.
Transmission	Torque converter oil	The oil is in short supply.	Please replenish oil.
	Clutch assembly	The clutch plate is worn and broken.	Please change the clutch plate.
		The clutch plate is sticking.	Please change the clutch plate.
		The clutch shaft spline is worn.	Please change the clutch shaft spline.
		The clutch pressure has decreased because the shaft end of the clutch and the oil seal ring of the clutch piston do not operate normally.	Please change the clutch assembly.
	Output shaft	The shaft spline is worn.	Please change the part which has worned spline.
		The gear is broken.	Please change the gear.
	Solenoid valve	The solenoid valve is broken.	Please change the solenoid.
		Spool does not operate normally.	Please change the solenoid valve.

(3) Oil temperature rises abnormally

Locating fault and cause			Measures
Torque converter	Main body of torque converter	The device of stator free wheel is broken.	Please check the stall speed, and then if the speed is out of regular valve, please change the stator assembly to new part.
		The wheel with blades are touching each other.	If the foreign material (the aluminum powder and the like) has entered in torque converter oil, please change the wheel with blades to new one.
		The bearings are worn or sticking.	Please repair the bearings or change them.
	Torque converter oil	Amount of oil is not appropriate.	Please check the oil level.
		The oil that is not regulated is used.	Please change the oil to regular oil.
		The air has mixed into oil.	Please tighten each joint coupling and the pipe further.
		The water has mixed into oil.	Please check the cooler and change the all oil.
	The piping resistance is large	The hose is bending, or it is broken.	Please repair the hose or change it.
		The oil cooler is sticking.	Please wash the oil cooler or change them.

Locating fault and cause			Measures
Transmission	The clutch is dragging	The clutch plate is sticking.	Please change the clutch plate.
		The clutch piston does not operate normally.	Please repair the clutch piston or change it.
		The pressure of clutch has decreased.	Please check the clutch pressure.
	The bearings are worn or sticking.		Please change the bearings.

(4) Clutch or converter oil pressure is too high

Locating fault and cause			Measures
Torque converter	Hose of outlet side is bending, and the hose is broken and the oil cooler is clogging.		Please repair or change the hose and oil filter, cooler
	Viscosity of oil is too high. (At cold time)		Please warm up the torque converter if the temperature of torque converter oil is below outside air temperature.
	The oil that is not regulated is used.		Please change the oil to regular oil.
Transmission	Control valve assembly	The valve does not operate normally because spring is broken or spools are sticked in the valve.	Please repair the valve assembly or change to new one.

(5) Clutch or converter oil pressure is too low

Locating fault and cause			Measures
Transmission	The oil is in short supply.		Please replenish oil.
	The oil that is not regulated is used.		Please change the oil to regular oil.
	The charging pump is worn and broken.		Please change the charging pump.
	The oil seal ring or o-ring is worn or damaged.		Please change the oil seal ring or the o-ring.
	The filter is clogging.		Please wash the oil filter or change it.
	control valve assembly	The spring is settling, and broken.	Please change the spring.
		The valve does not move with the valve opens.	Please repair the valves or change it.
		The restriction is clogging.	Please wash the restriction.
	The filter is clogging.	The end of the shaft and the seal ring of the clutch piston are damaged.	Please change the clutch piston.

(6) Noise occurs

Locating fault and cause		Measures
Torque converter	The input plate is broken.	Please change the input plate.
	The bearing is broken or bearings are worn.	Please change the bearing.
	The gear is broken.	Please change the gear.
	The wheel with blades are touching each other.	Please change the wheel with blades.
	The bolt and rivet are loosen or broken.	Please repair the bolt and rivet or change it.
	The spline is worn.	Please change the part which has worned spline.
	The pump does not operate normally.	Please change the pump.
Transmission	The clutch is sticking and dragging.	Please change the clutch.
	The bearings are sticking and worn.	Please change the bearing.
	The gear is broken.	Please change the gear.
	The spline is worn.	Please change the spline.
	The bolt is loosen or broken.	Please repair the bolt or change it.

(7) Shinfting is impossible

Locating fault and cause		Measures
Transmission	The clutch plate is sticking.	Please change the clutch plate.
	The solenoid valve does not operate normally.	Please repair the solenoid valve or change it.
	The gear is broken.	Please change the gear.

(8) DTC definition and reaction

No.	Fault	Critria	SPN	FMI	LAMP	FLASH	Required Reaction
1	Key Switch Battery Potential.	> 33 Vdc	158	0	Red Stop	Slow (1Hz)	TCU Shutdown (No Ouputs)
2		< 9 Vdc		1	Red Stop	Slow (1Hz)	TCU Shutdown (No Ouputs)
3	Transmission ECU Temperature	> 105℃	5912	0	Red Stop	Slow (1Hz)	TCU Shutdown (No Ouputs)
4		< -40℃		1	Red Stop	Slow (1Hz)	TCU Shutdown (No Ouputs)
5	Transmission 1 Forward Solenoid Valve	Short to Batt+	741	3	Red Stop	Slow (1Hz)	Neutral Mode
6		Short to GND		4	Protect	Slow (1Hz)	Neutral Mode
7		Open Circuit		5	Protect	Slow (1Hz)	Neutral Mode
8	Transmission 1 Reverse Solenoid Valve	Short to Batt+	4216	3	Red Stop	Slow (1Hz)	Neutral Mode
9		Short to GND		4	Protect	Slow (1Hz)	Neutral Mode
10		Open Circuit		5	Protect	Slow (1Hz)	Neutral Mode
11	Park Brake Actuator	Short to Batt+	619	3	Red Stop	Slow (1Hz)	Neutral Mode & Vehicle Stop
12		Open Circuit		5	Protect	Slow (1Hz)	Neutral Mode & Vehicle Stop
13	Transmission 1 Oil Pressure	Short to Batt+	127	3	Amber	Slow (1Hz)	Neutral Mode
14		Short to GND		4	Amber	Slow (1Hz)	Neutral Mode
15	Transmisstion Oil Temperature Sensor	Short to Batt+	177	3	Red Stop	Slow (1Hz)	Neutral Mode
16		Short to GND		4	Red Stop	Slow (1Hz)	Neutral Mode
17		> 120℃		16	Amber	Slow (1Hz)	Neutral Mode
18	Transmission Selected Gear OR Transmission Drive Selector (Requested value)(Physical Switch)	F= 0 + N = 0 + R = 0 F= 1 + N = 1 + R = 0 F= 1 + N = 0 + R = 1 F= 0 + N = 1 + R = 1 F= 1 + N = 1 + R = 1	525 or 3496	11	Red Stop	Slow (1Hz)	No Fwd/Rev by Default
19	Requested Percent Clutch Slip(Inching sensor)	Short to Batt+	684	3	Amber	Slow (1Hz)	No Action
20		Short to GND		4	Amber	Slow (1Hz)	No Action
21	J1939 Network #1, Primary Vehicle Network	No message 3x trans	639	9	Red Stop	Slow (1Hz)	Neutral Mode
22	Transmission Ouput Shaft Speed Sensor	Short to Batt+	191	11	Amber	Slow (1Hz)	Neutral Mode
23		Short to GND			Amber	Slow (1Hz)	Neutral Mode

※ Red Stop Lamp : This lamp is used to relay trouble code information that is of a severe enough condition that it warrants stopping the vehicle.

Amber Warning Lamp : This lamp is used to relay trouble code information that is reporting a problem with the vehicle system but the vehicle need not be immediately stopped.

Protect Lamp : This lamp is used to relay trouble code information that is reporting a problem with a vehicle system that is most probably not electronic subsystem related.

2) DRIVE AXLE

(1) Noise and vibration

Locating fault and cause		Measures
Drive axle	Shortage of oil	Check oil level or refill lubricating oil.
	Inappropriate oil	Replace the oil.
	Damaged wheel bearing	Replace the wheel bearing.
	Damaged ring gear and pinion shaft	Replace the ring gear and pinion shaft.
	Loosened or worn bearing of pinion shaft	Disassemble, check or replace the bearing.
Differencial	Loosened bolt for assembling ring gear	Disassemble, check and reassemble the ring gear.
	Damaged ring gear	Replace the ring gear.
	Loosened or worn differencial bearing	Disassemble, check, reassemble or replace the differencial bearing.
	Damaged bevel gear bearing	Replace the bevel gear bearing.
	Worn or damaged diff pinion and side gear.	Replace the diff pinion and side gear.
	Worn or damaged thrust washer.	Replace the thrust washer.
	Excessive backlash of diff pinion and side gear.	Replace the diff pinion and side gear.
Brake	Incorrect axle fluid and/or friction material used	Use only meritor specified or approved materials.
		Drain and flush fluid from axle. Replace with approved fluid.
		Replace all friction discs. Throughly clean or replace stationary discs.

(2) Oil leakage

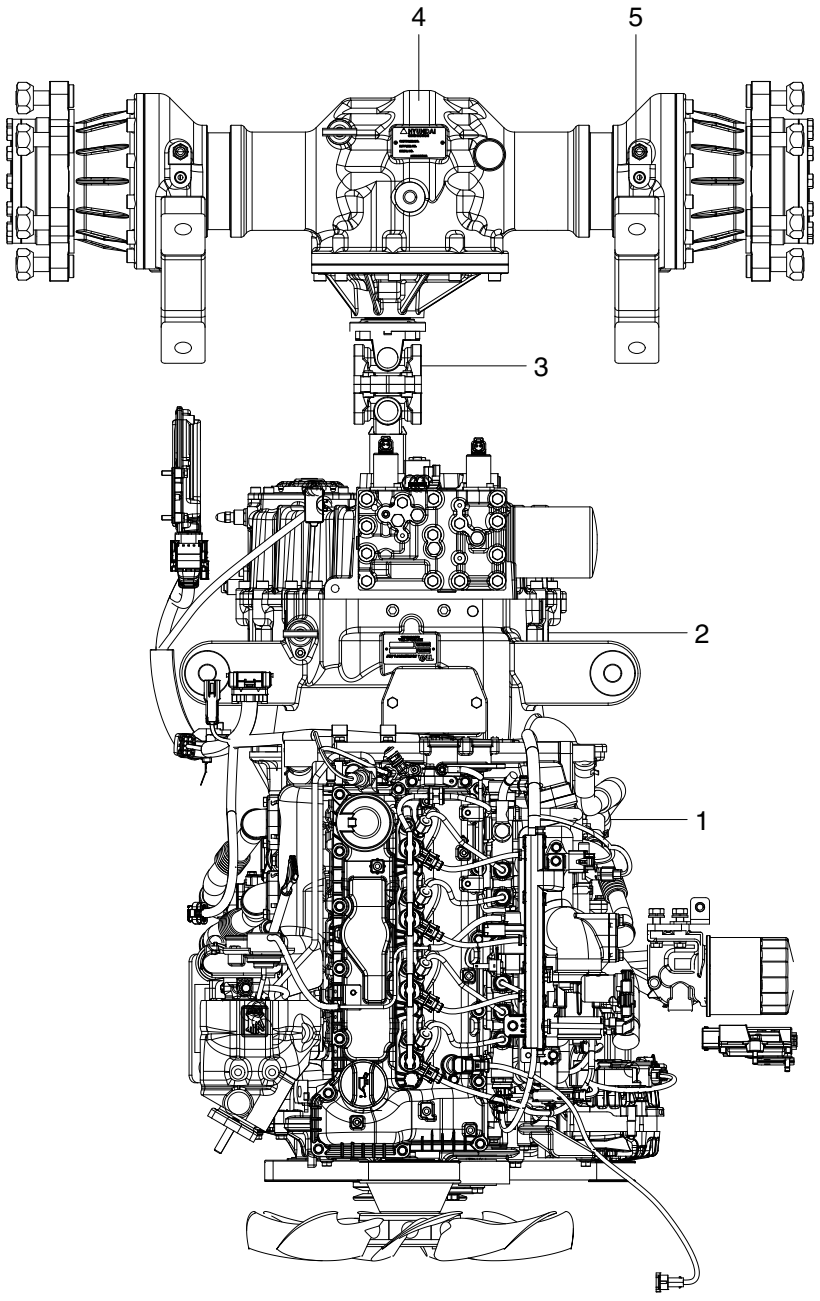
Locating fault and cause			Measures
External leakage	Excess supply of oil		Check oil level. set of oil amount.
	Inappropriate oil		Replace the oil.
	Blocking air breather		Cleaning, replace the air breather
	Damaged hub oil seal		Replace the hub oil seal.
	Worn or damaged bevel pinion shaft oil seal		Replace the oil seal.
	Loosened bleeder screw		Tighten bleeder screw.
	Losened brake inlet fitting and plugs		Tighten brake inlet fitting.
	Damaged brake inlet fitting, plug and o-ring		Replace the brake inlet fitting, plug and o-ring.
Brake	Internal leak : Fluid bypasses seals into axle and fills axle with fluid and blows out breather or empties brake fluid reservoir.	Worn or damaged piston seal	Replace the piston seals.
		Melted or extruded piston seals	Correct cause of overheating and replace seals.
		Corrosion, pitting, wear or other damage, marks scratches to piston and/or brake housing bore in area of seal/sealing lips	Clean, smooth, rework or replace affected parts.
	External leak	Loosened bleeder screw	Tighten bleeder screw to 2 ~ 2.7 kgf·m (14.5 ~ 19.6 lbf·ft).
		Loosened inlet fitting or plugs	Tighten inlet fitting to 3.4 ~ 4.8 kgf·m (24.7 ~ 34.8 lbf·ft).
		Damaged inlet fitting or plugs or damaged seats	Replace inlet fitting or plug and o-ring if used.

SECTION 3 POWER TRAIN SYSTEM
(25/30D-9VS, 35DN-9VS)

Group 1 Structure and operation ····· 3-74
Group 2 Disassembly and assembly ····· 3-87
Group 3 Maintenance and troubleshooting ····· 3-130

1. POWER TRAIN DIAGRAM

1) STRUCTURE



25D9V3PS01

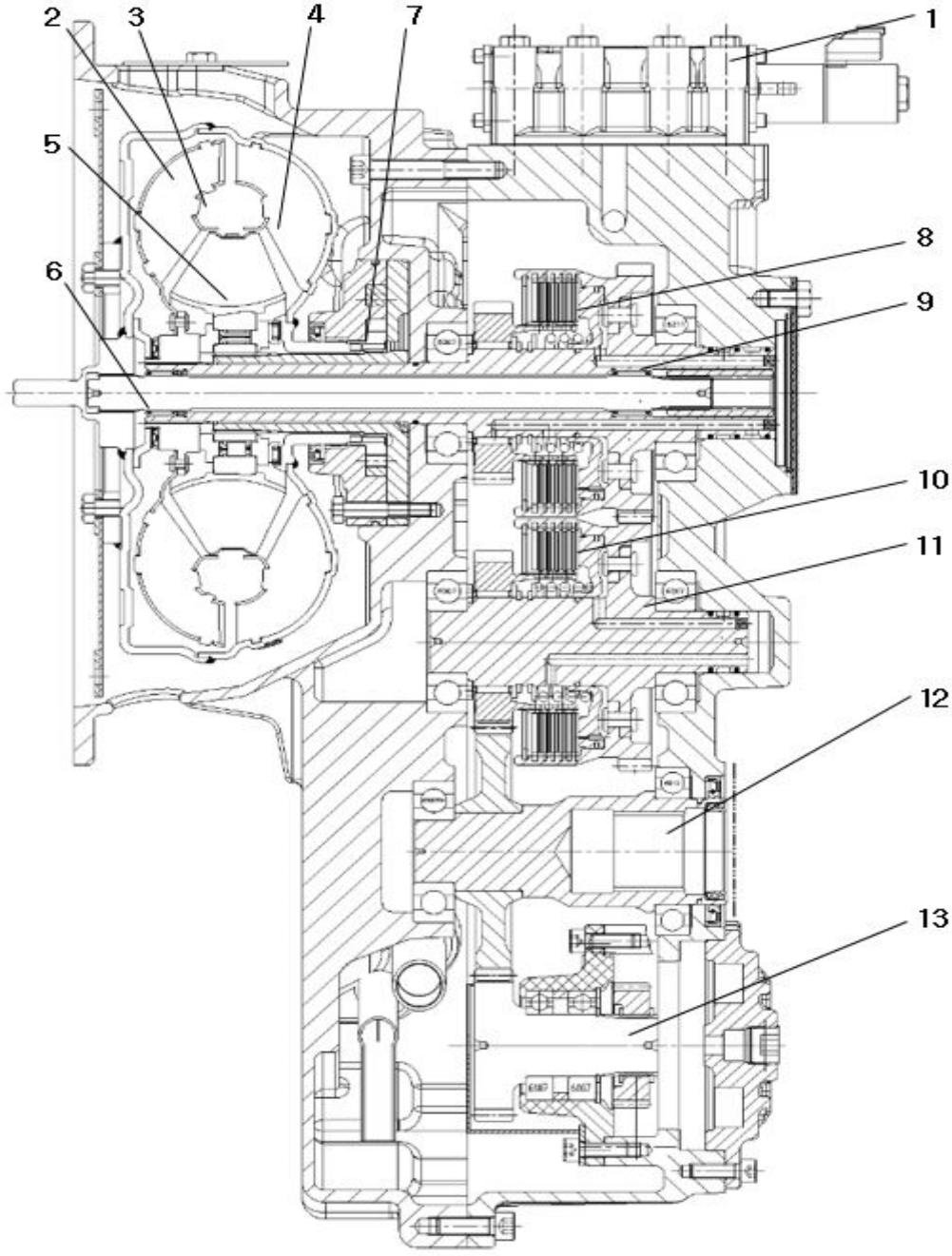
1	Engine	3	Drive shaft	5	Brake
2	Transmission	4	Drive axle		

2) SPECIFICATION

Item			Specification
Torque converter	Model		KAPEC 280 DJ
	Type		3 Element, 1 stage, 2 phase
	Stall ratio		2.87
Transmission	Type		Power shift
	Gear shift(FWD/REV)		1/1
	Control		Electric On/Off Solenoid Valve
	Overhaul ratio	FWD	1.437
		REV	1.437
Axle	Type		Front-wheel drive type, fixed location
	Gear ratio		11.568 : 1
	Gear		Spiral bevel gear type
Wheels	Q'ty (FR/RR)		Single : 2/2, Double : 4/2
	Front (drive)	2.5 T	Single/Double : 7.00-12-14 PR
		3.0 T	Single : 28×9-15-16 PR Double : 7.00-12-12 PR
		3.5 T	
	Rear (steer)	2.5 T	6.50-10-12 PR
		3.0 T	
		3.5 T	
Brakes	Travel		Front wheel, wet disk brake
	Parking		Wet disk (negative brake)
Steering	Type		Full hydraulic, power steering
	Steering angle		78.5˚ to both right and left angle, respectively

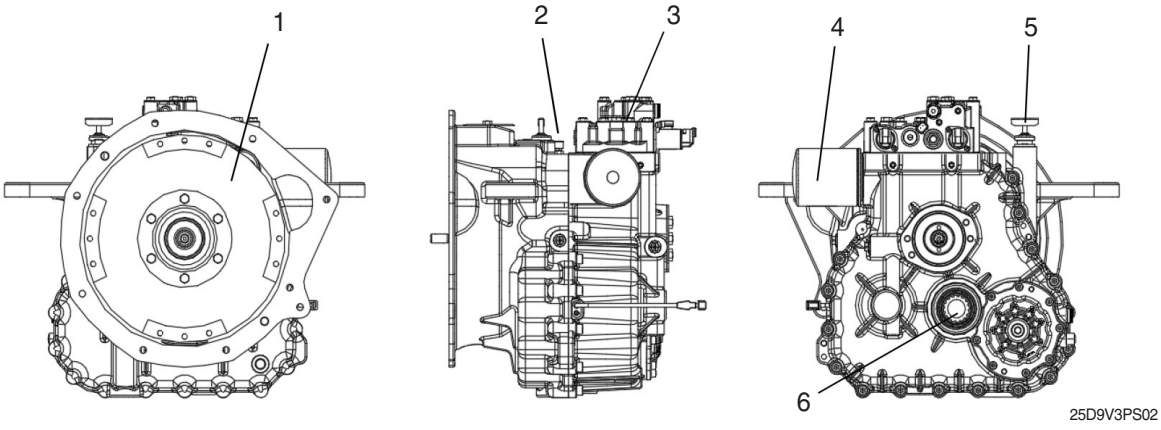
2. TRANSMISSION

1) STRUCTURE



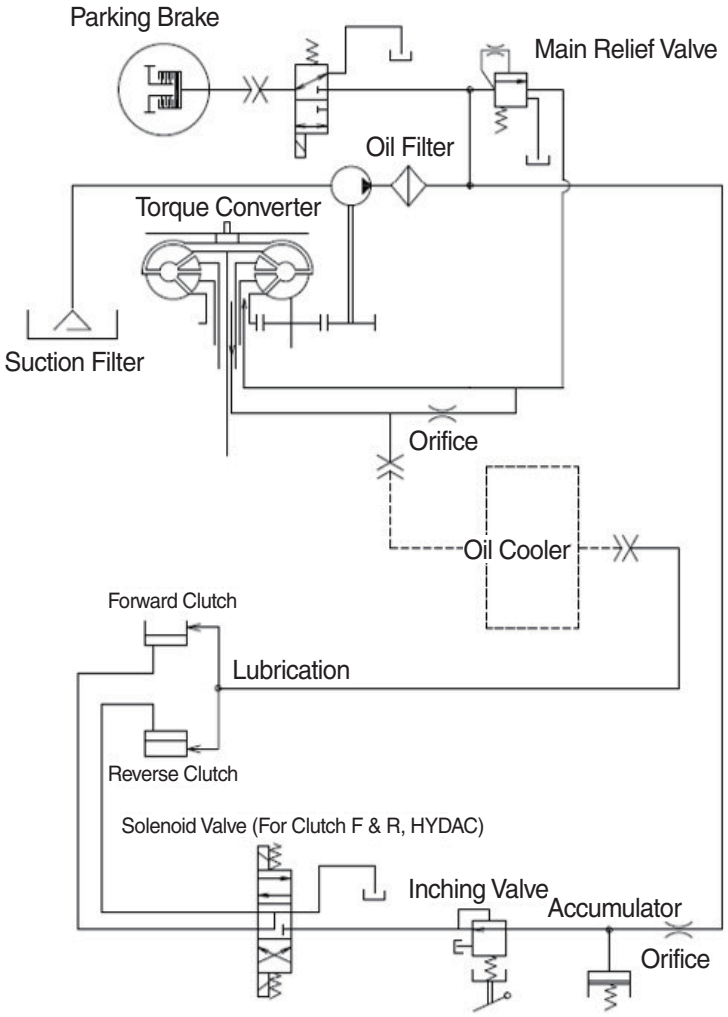
25D9HDI3PS174

1	Control valve	6	PTO shaft	11	Reverse clutch shaft
2	Torque converter	7	Oil pump	12	Output shaft
3	Turbine wheel	8	Forward clutch pack	13	Parking brake
4	Impeller wheel	9	Forward clutch shaft		
5	Stator	10	Reverse clutch pack		



1	Torque converter	3	Control valve	5	Oil level gauge and tube
2	Air breather	4	Oil filter	6	Output (Universal joint link part)

2) HYDRAULIC CIRCUIT



(1) The torque converter acts as a fluid coupling to smoothly transfer engine power to the transmission. It also increases the torque by the force applied to the stator while oil is circulating inside the torque converter.

(2) The engine power transferred through the flexible plate is then transferred to the impeller on the torque converter in order to drive the oil pump. The oil pump circulates oil to the oil filter by pumping the oil in the oil tank on the transmission. Oil from which foreign matter has been filtered is supplied to the control valve and the inside of the torque converter.

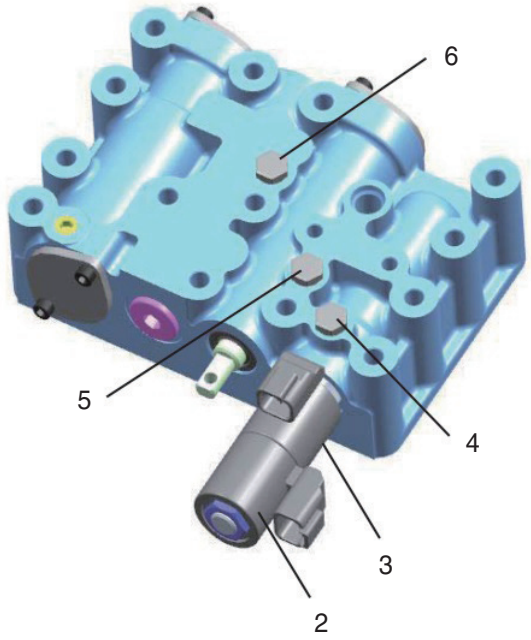
(3) The oil supplied to the control valve produces the level of pressure necessary to operate the clutch on the main relief valve. Pressure is applied to the forward/reverse clutch via operation of the solenoid valve using the electric signal delivered at the time of forward/reverse driving of the vehicle, and thus power can be transferred through the gear.

(4) The oil supplied to the torque converter is transferred to the turbine by rotation of the impeller, thus producing centrifugal force which becomes the driving force for rotating the turbine.

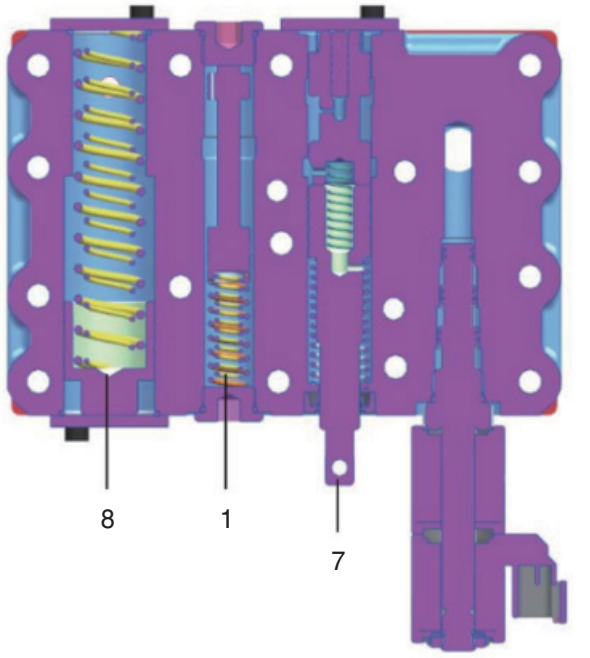
(5) The oil which rotates the turbine circulates, and the force of the reaction produced when it passes through the stator increases the torque. The oil that comes out of the torque converter enters the air cooled passage and, after cooling down, is supplied to the clutch shaft where it cools down the friction plate of the clutch, and returns to the transmission. The process described above proceeds continuously, completing the transmission operation.

3) CONTROL VALVE

(1) Structure



25D9HDI3PS06



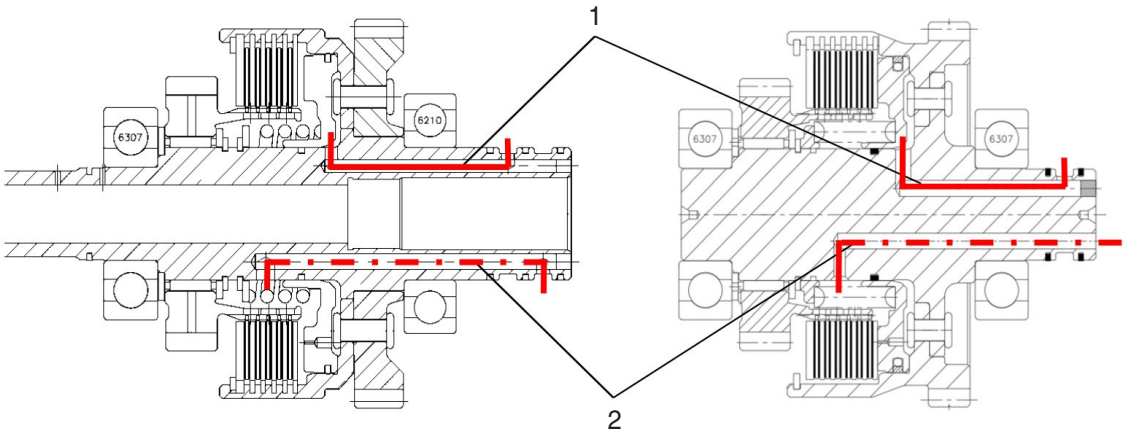
25LC93PS07

1	Main relief	5	Reverse clutch pressure check port
2	Forward solenoid valve	6	Main pressure check port
3	Reverse solenoid valve	7	Inching
4	Forward clutch pressure check port	8	Modulation

(2) Function

Item	Function
Main Relief	Main relief maintains constant clutch pressure.
Forward/Reverse Solenoid Valve	Receives an electric signal at time of forward and reverse gear shift and switches the oil passage direction to ensure that the main pressure is delivered to the clutch.
Inching	A function for increasing the engine speed temporarily in order to lift the mast quickly while maintaining a low travel speed by reducing forward/reverse clutch pressure.
Modulation	A function for softening the impact at the time of a gear shift through soft contact of the clutch friction plate by adjusting the flow rate and the speed of the oil supplied to the clutch during forward/ reverse gear shift.

4) CLUTCH



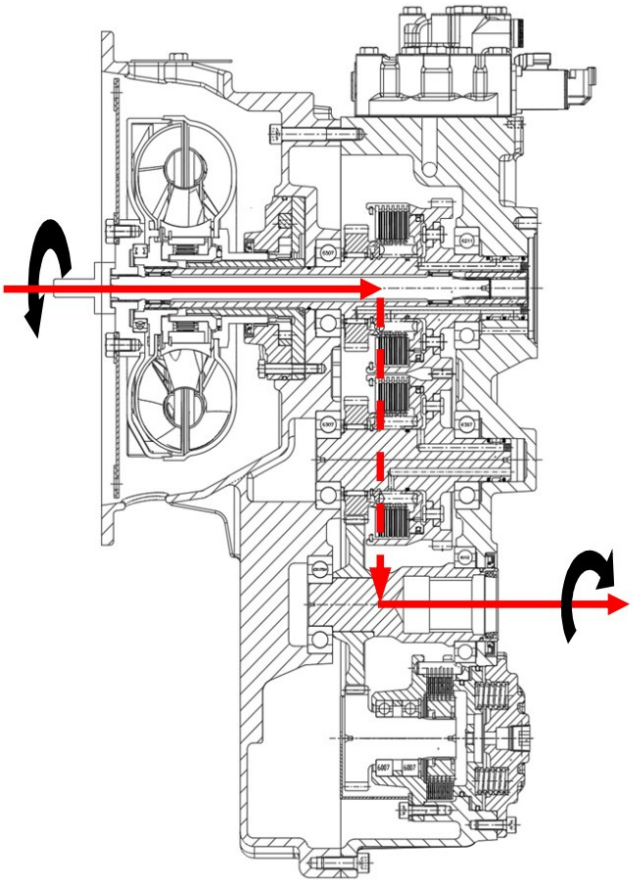
1 Pressure line (———)
2 Lubrication line (- - - -)

25D9V3PS10

(1) Gear shift refers to the action of shifting the vehicle from neutral to forward/reverse.
(2) When forward or reverse is decided by the vehicle's shift lever, the corresponding electric signal switches the forward/reverse solenoid to the ON state.
(3) The high-pressure oil produced in the main relief relieves the flow rate and oil speed before it is supplied to the clutch through the solenoid valve while passing through the orifice and modulation valve.
(4) Oil whose flow rate and speed have been relieved is slowly supplied to the piston of the corresponding clutch through the solenoid valve to prevent impact at the time of gear shift.
(5) As hydraulic oil applies pressure to the piston and the force of the return spring is exceeded, it compresses the friction plate and disk.
(6) When the clutch friction plate and disk are fully compressed, power is transferred to the gear connected to the friction plate through the spline.

5) POWER FLOW

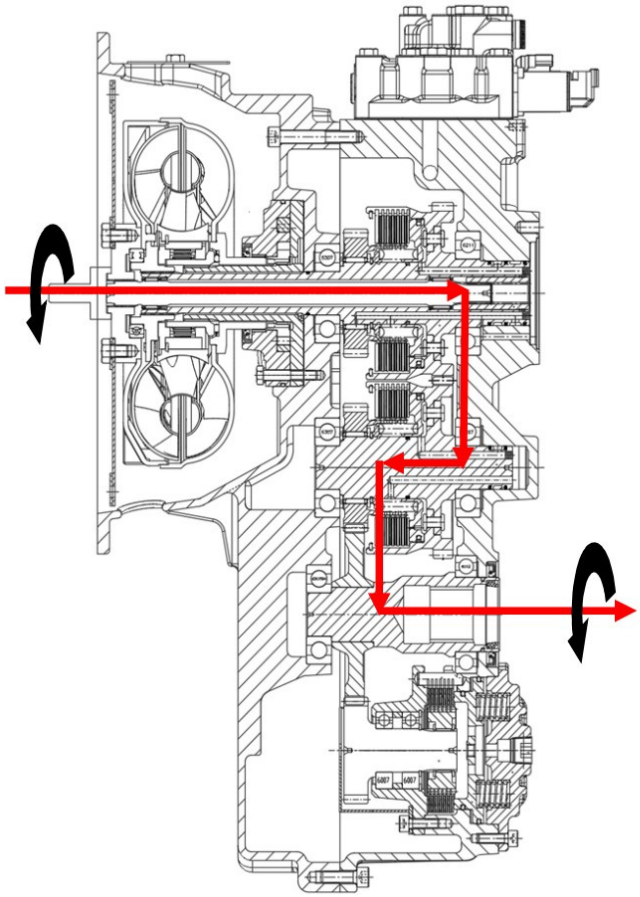
(1) Forward



Input
↓
Torque converter
↓
Forward clutch shaft
↓
Clutch gear
↓
Output gear
↓
Output

25D9V3PS11

(2) Reverse

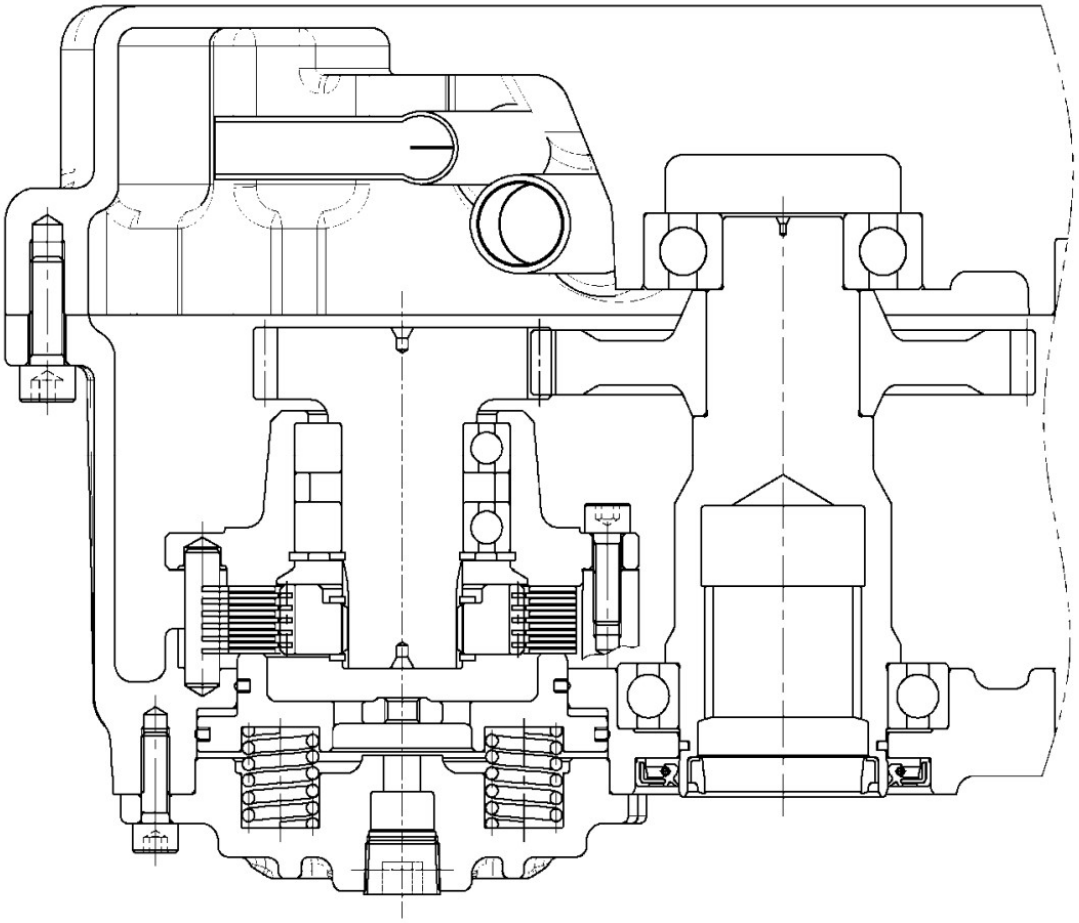


Input
↓
Torque converter
↓
Forward clutch shaft
↓
Forward drum gear
↓
Reverse drum gear
↓
Reverse clutch shaft
↓
Clutch gear
↓
Output gear
↓
Output

25D9V3PS12

6) PARKING BRAKE

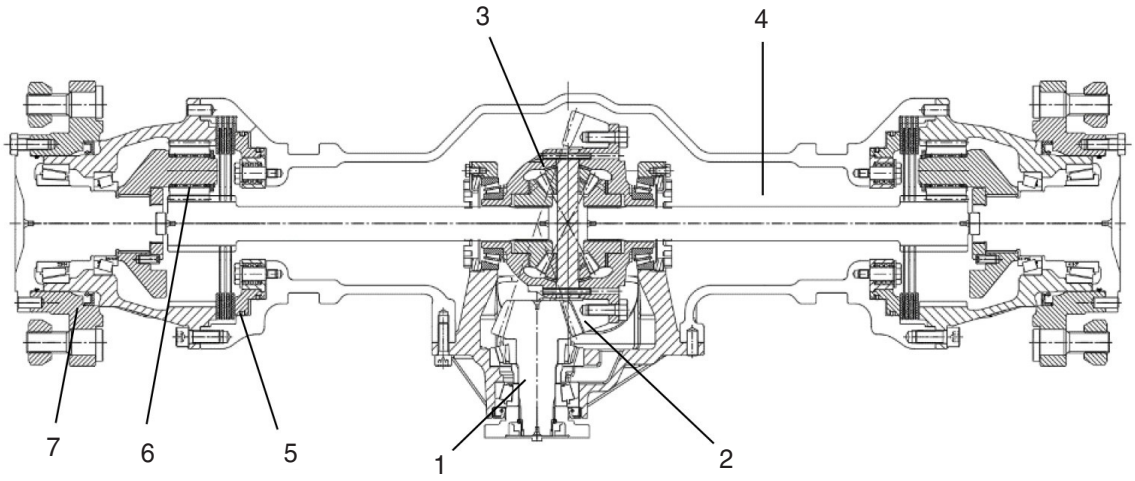
Transmission includes differential device and parking brake. Parking brake, like as traveling brake system is consists of several friction plate functions braking by sticking to each friction plate when parking brake switch is operated.



25D9V3PS13

3. DRIVE AXLE

1) STRUCTURE

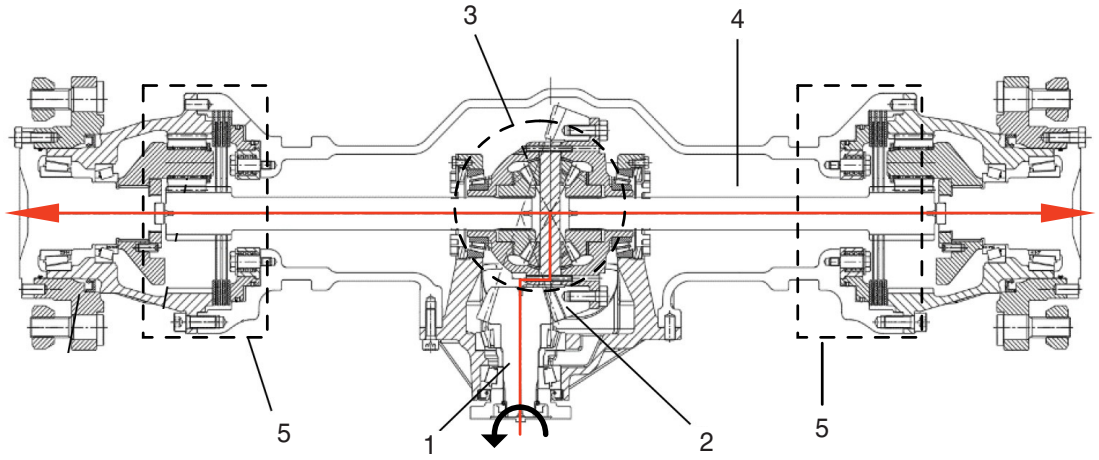


25D9V3PS102

1	Pinion shaft	4	Axle shaft	7	Hub
2	Ring gear	5	Service brake		
3	Differential device	6	Hub reduction		

2) OPERATION

The drive axle is connected with the transmission output gear by drive shaft assembly. The power transferred by the drive shaft assembly is connected to the pinion shaft of drive axle, the pinion shaft delivers the power to the differential device through the ring gear. The differential device deliver the power to hub reduction through axle shaft.

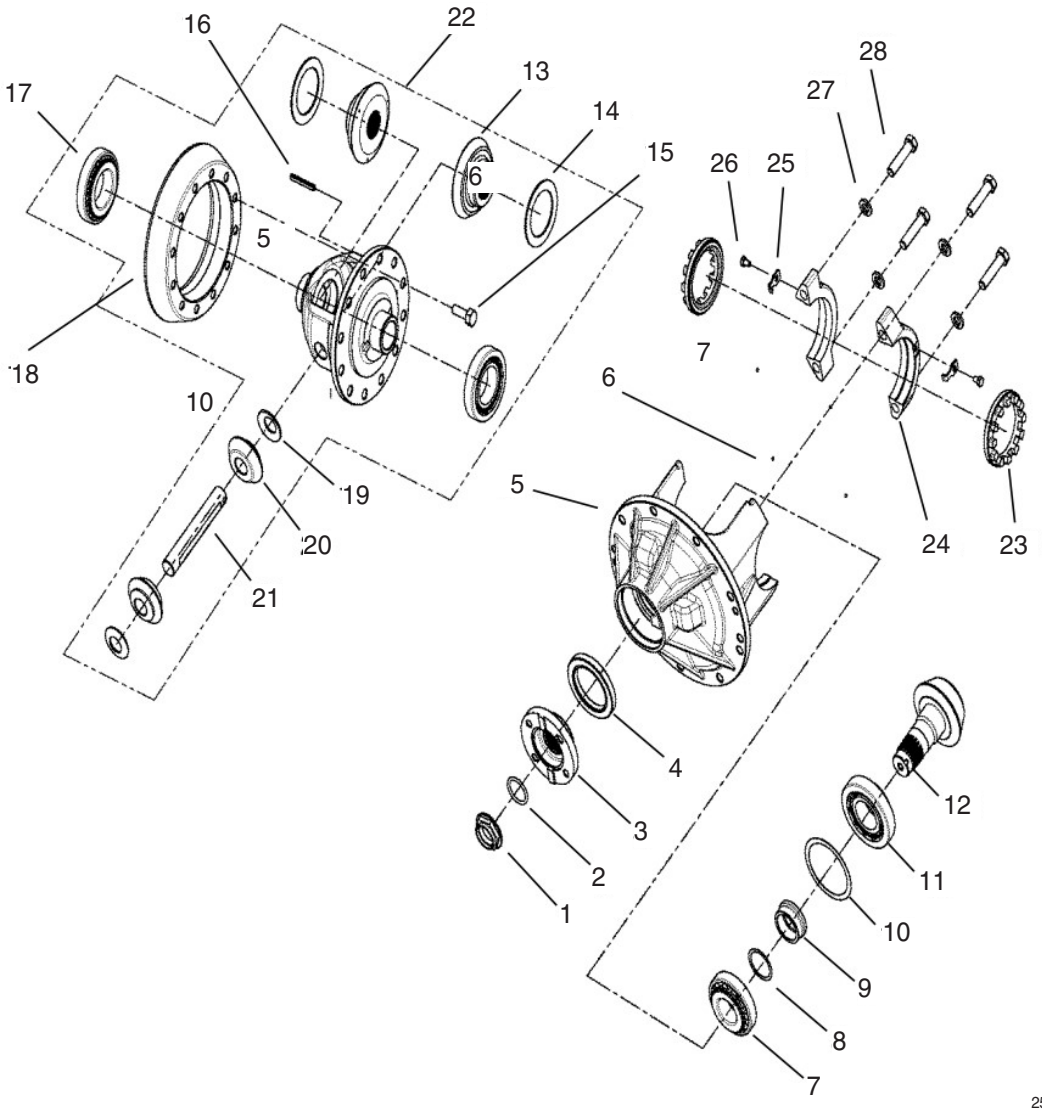


25D9V3PS103

1	Pinion shaft	3	Differential device	5	Hub reduction
2	Ring gear	4	Axle shaft	6	Service brake

3) Carrier sub assy

(1) Structure



25D9V3PS104

1	Lock nut	11	T/R bearing	21	Spider
2	O-ring	12	Pinion shaft	22	Diffsub assy
3	Flange yoke	13	Diff side gear	23	Adjust screw
4	Oil seal	14	Thrust washer	24	Carrier cap
5	Carrier case	15	Hex bolt	25	Lock plate
6	Steel ball	16	Spring pin	26	Hex bolt
7	T/R bearing	17	T/R bearing	27	Plain wahser
8	Shim	18	Ring gear	28	Hex bolt
9	Spacer	19	Thrust washer		
10	T/R bearing	20	Diff pinion gear		

(2) Performance property

Since the ring gear is linked with the right of the differential case and the bolt, the power transferred to the ring gear makes the differential device revolve.

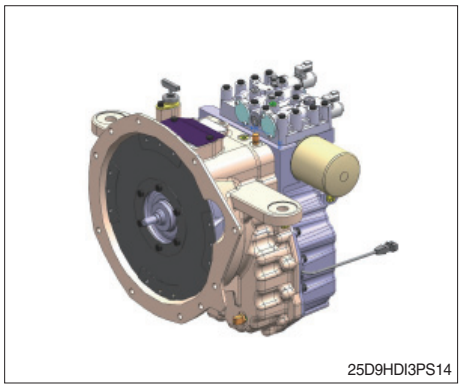
And also, the differential case are connected with the left and right of the axle shaft and the spline respectively, it delivers the power to the final drive.

If the load concerning in the left and right of the final drive is different, the shock is transferred to the drive axle, the differential gear in the differential device runs, the power transferred to the differential device adjusts the delivering rate to the left and right axle shaft. Consequently, it guarantees for safety of drivers.

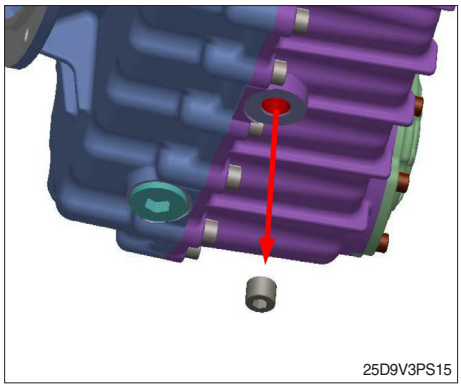
1. DISASSEMBLY OF TRANSMISSION

1) DISASSEMBLY OF TRANSMISSION ASSEMBLY

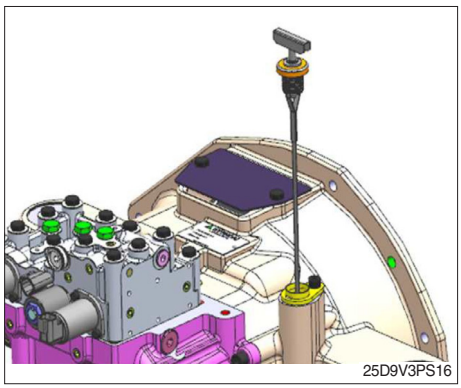
(1) Disassembly the transmission assy.



(2) Remove the drain plug and then drain the trasmission oil.

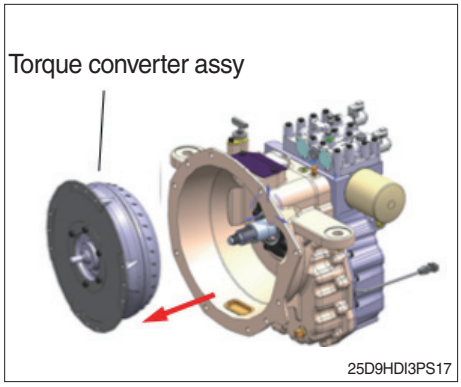


(3) Remove the oil level gauge.

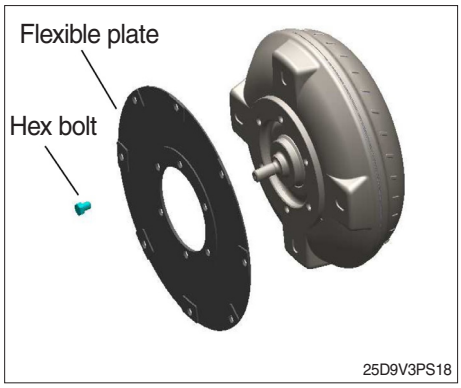


(4) Disassemble torque converter assy.

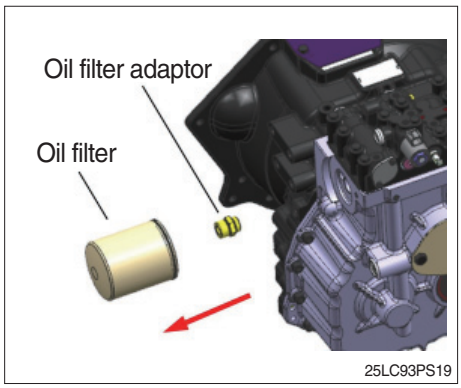
① Disassemble the torque converter assy.



② Loosen the hex bolts and separate the flexible plate.



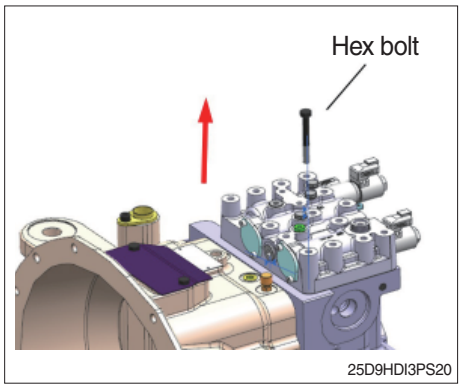
(5) Remove the oil filter and oil filter adaptor.



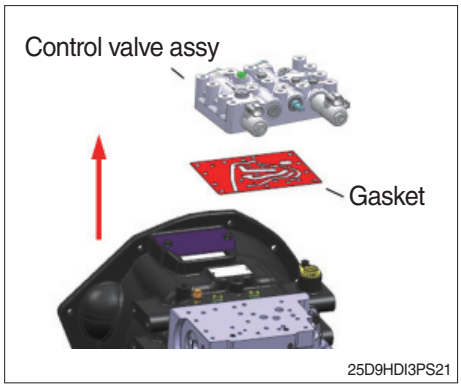
(6) Disassemble the control valve assy.

① Loosen hex bolt.

· M8×70 L : 14 EA



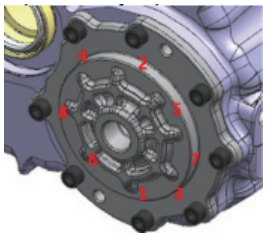
② Separate the control valve assy and gasket.

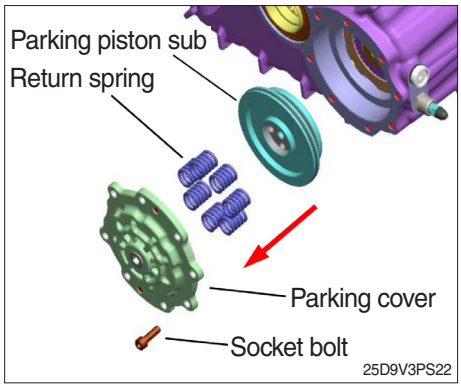


(7) Separate the parking brake parts.

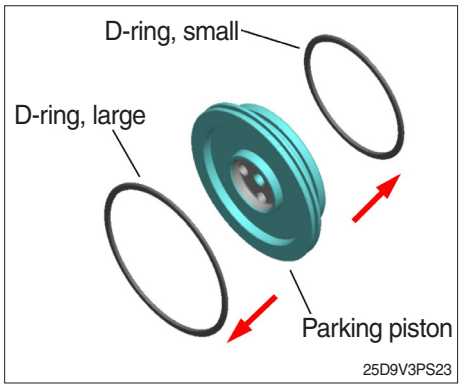
① Loosen the socket bolts (M8×25L, 8 EA).

※ Disassemble slowly and follow the number. It prevent to jump out the cover by return spring. Then remove the return springs and parking piston sub.





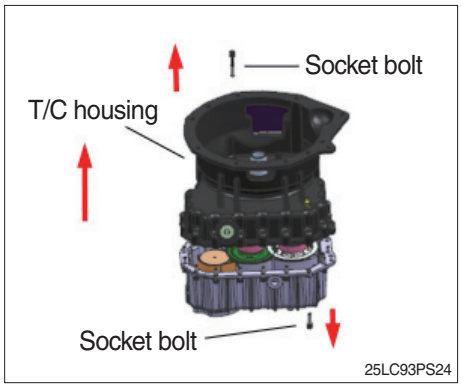
② Remove the large d-rings(large and small).



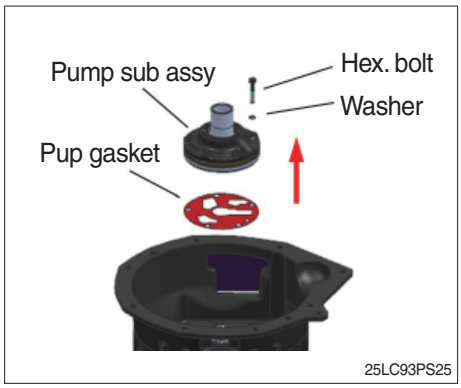
(8) Loosen the socket bolts. Then separate the T/C housing.

· M10×60 L : 6 EA

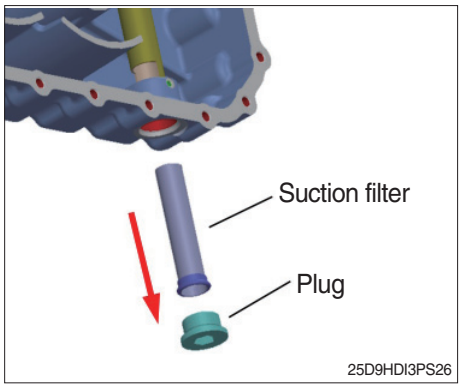
· M10×30 L : 16 EA



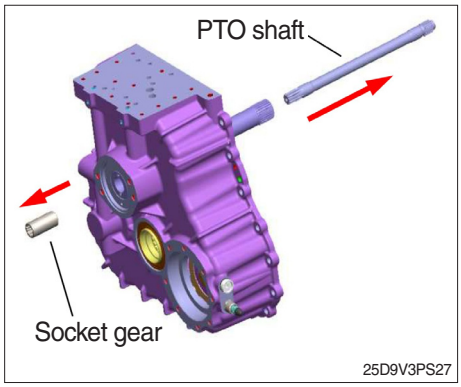
(9) Loosen the hex. bolts and remove washers. Then separate the pump sub assy and gasket.



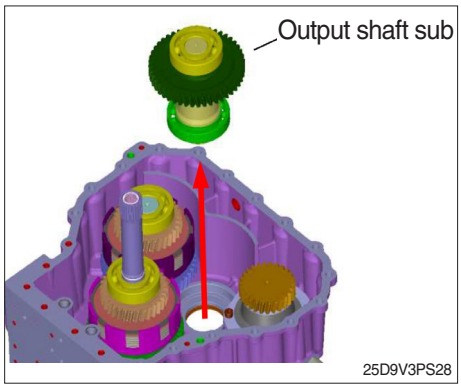
(10) Remove the plug, suction filter spring and suction filter.



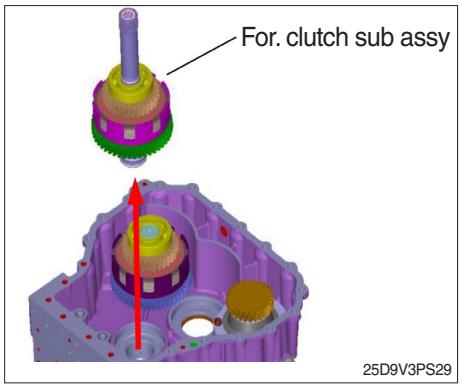
(11) Pull the PTO shaft and socket gear.



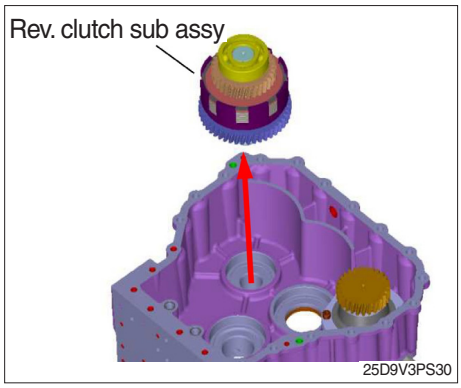
(12) Remove the output shaft sub assy.



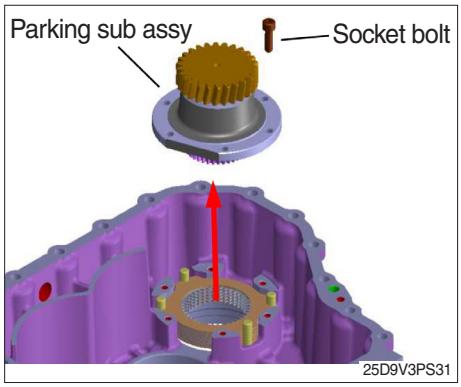
(13) Remove the for. clutch sub assy.



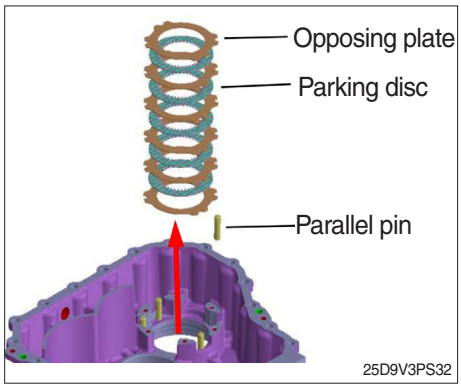
(14) Remove the rev. clutch sub assy.



(15) Disassemble socket bolt and parking sub assy.

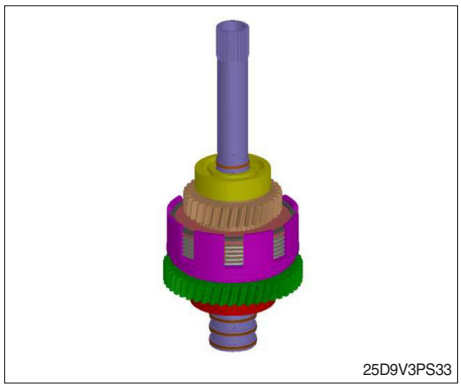


(16) Remove the opposing plates and parking discs. Then remove parallel pins.

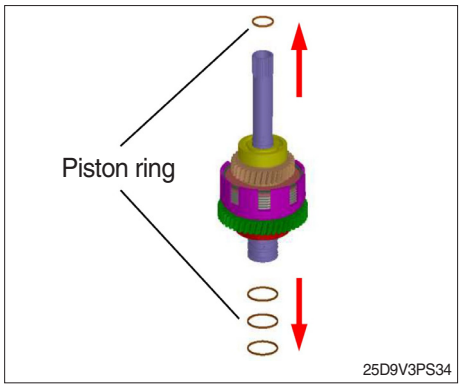


2) DISASSEMBLY OF CLUTCH SUB ASSEMBLY

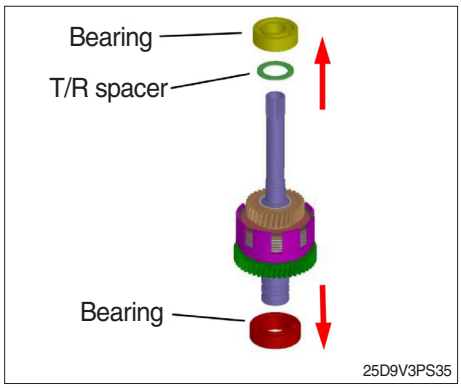
(1) Disassemble the For. clutch sub assembly.



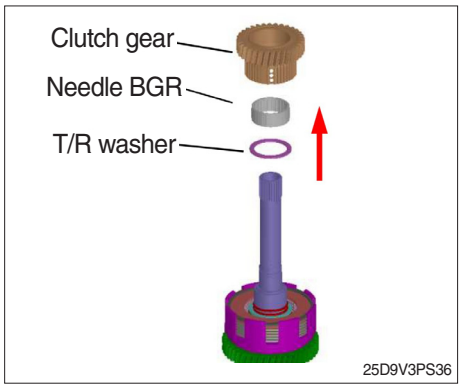
(2) Disengage the piston rings.



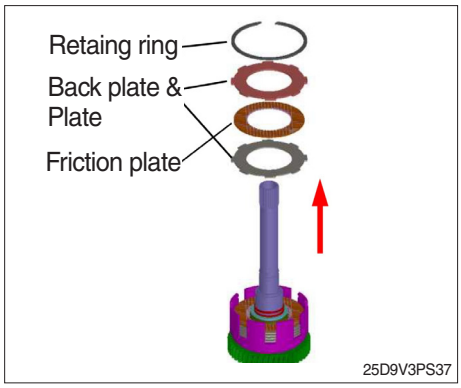
(3) Pull off the bearings and remove the thrust spacer.



(4) Remove the clutch gear, needle BRG and thrust washer.

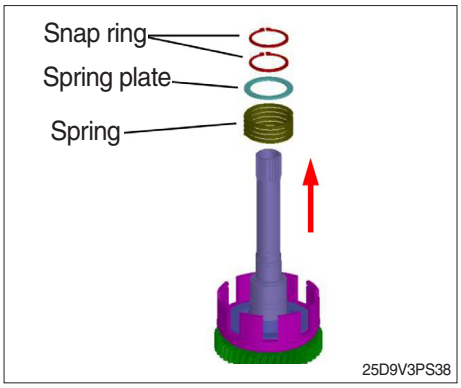


(5) Disengage the retaining ring. Then remove the back plate, opp. plates and friction plates.

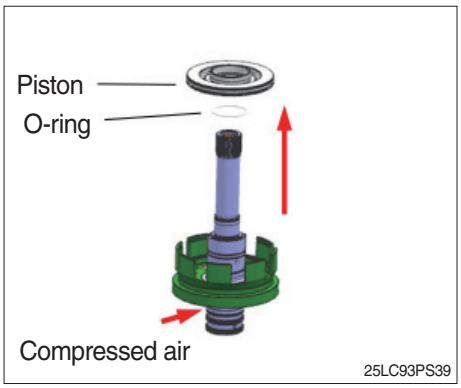


(6) Disassemble snap ring, spring plate and spring from shaft.

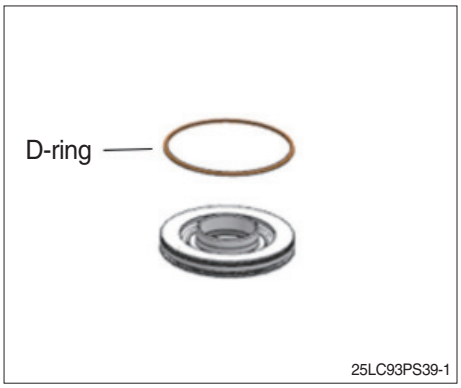
⚠ **When removing the snap ring, it may bounce off by spring force, so fix the spring firmly before removing it. Pay attention to safety when removing snap ring.**



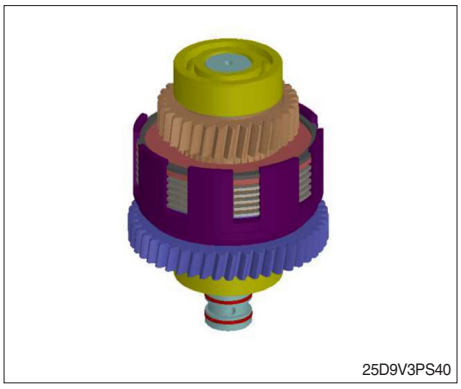
(7) By means of compresed air, press the piston off and remove it. Then remove the o-ring.



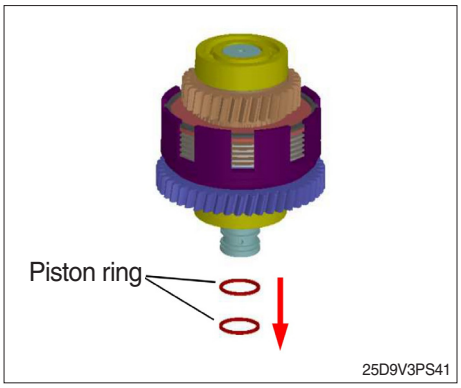
(8) Remve the D-ring.



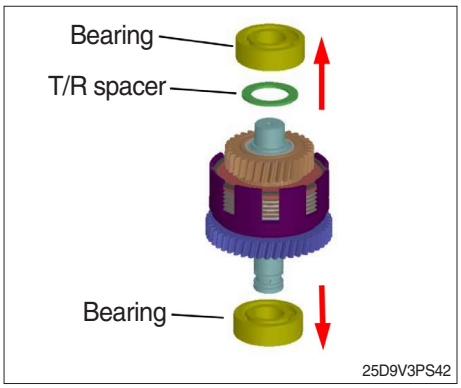
(9) Disassemble Rev. clutch sub assembly.



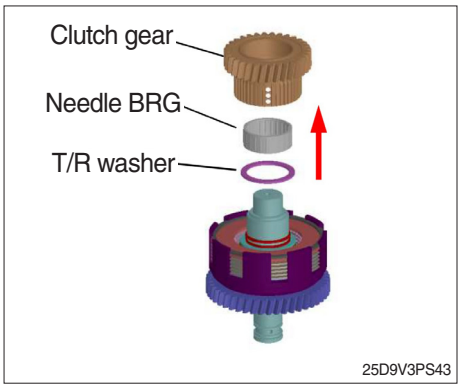
(10) Disengage the piston rings.



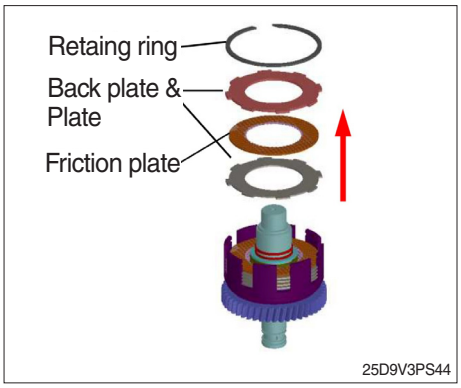
(11) Pull off the bearings and remove the thrust spacer.



(12) Remove the clutch gear, needle BRG and thrust washer.

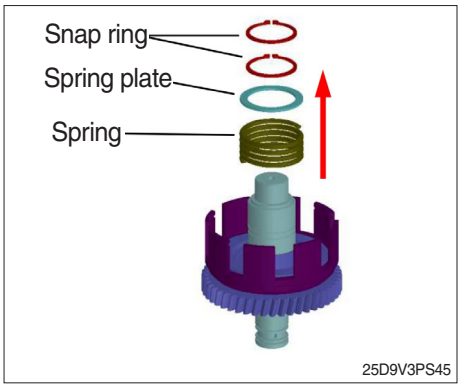


(13) Disengage the retaining ring. Then remove the back plate, opp. plates and friction plates.

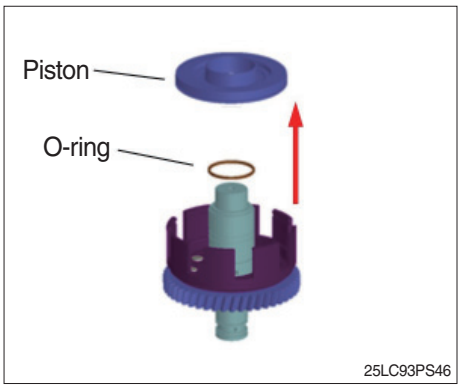


(14) Remove the snap rings, spring plate and spring.

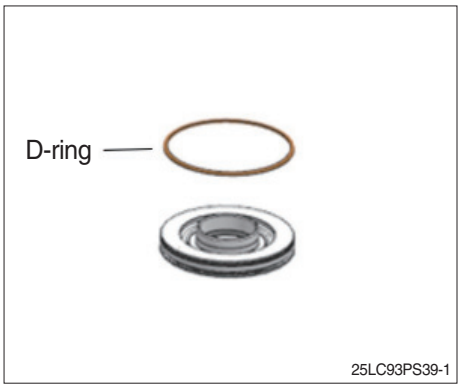
⚠ **When removing the snap ring, it may bounce off by spring force, so fix the spring firmly before removing it. Pay attention to safety when removing snap ring.**



(15) By means of compresed air, press the piston off and remove it. Then remove the o-ring.

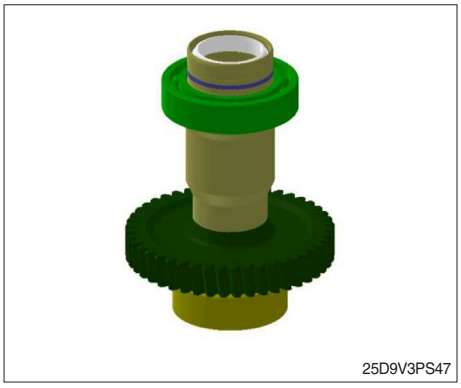


(16) Remve the D-ring.

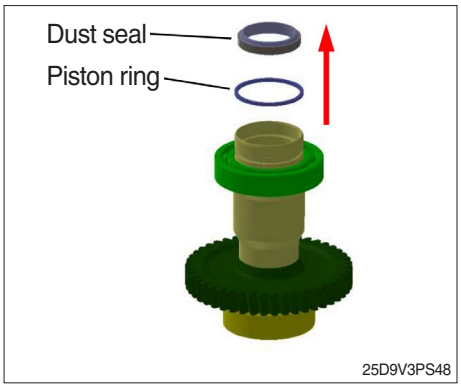


3) DISASSEMBLY OF OUTPUT SHAFT SUB ASSY

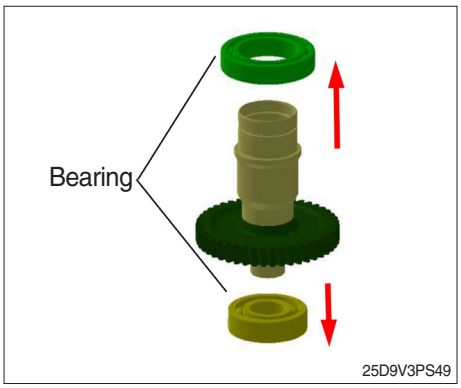
(1) Disassemble output shaft sub assembly.



(2) Remove the dust seal and piston ring.

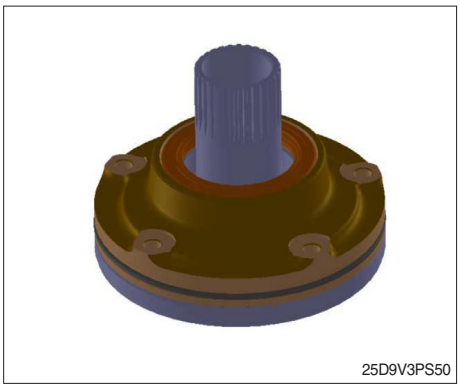


(3) Pull off the bearings.

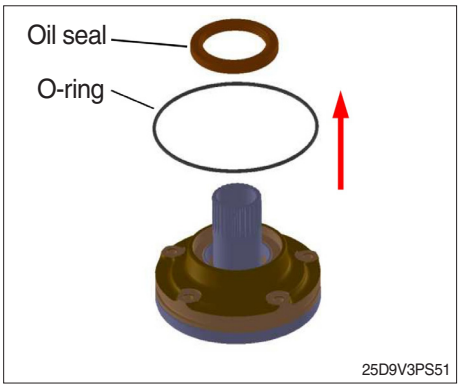


4) DISASSEMBLY OF PUMP SUB ASSY

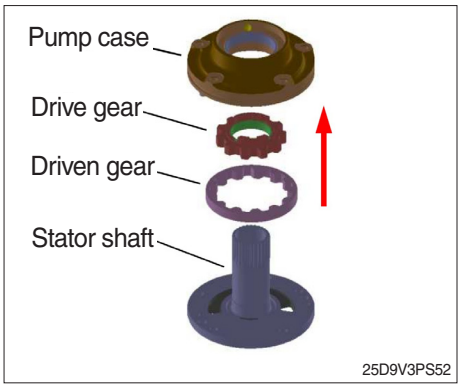
(1) Disassemble pump sub assembly.



(2) Remove the oil seal and o-ring.

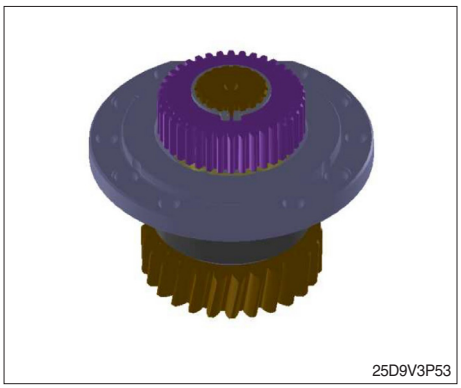


(3) Separate the pump case, drive and driven gear from the stator shaft.

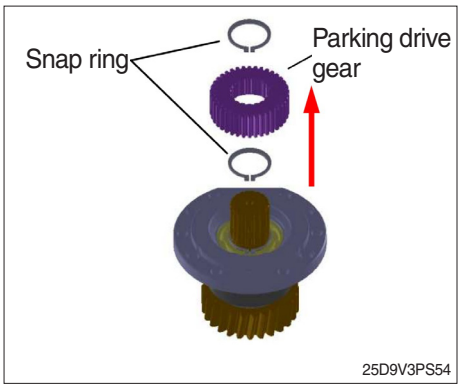


5) DISASSEMBLY OF PARKING SUB ASSEMBLY

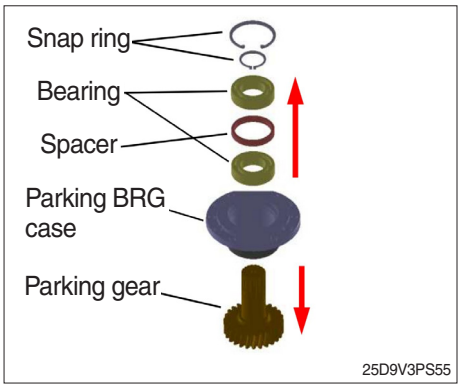
(1) Disassemble parking sub assembly.



(2) Remove the snap rings and parking drive gear.



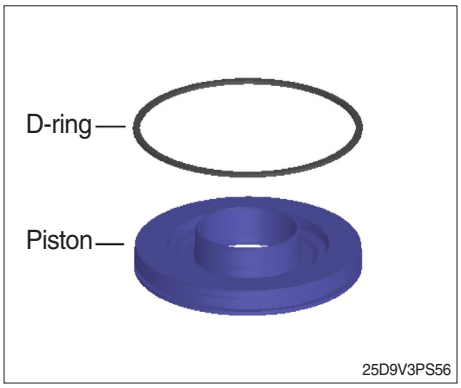
(3) Remove the snap rings, bearings, spacer, parking gear from the parking BRG case.



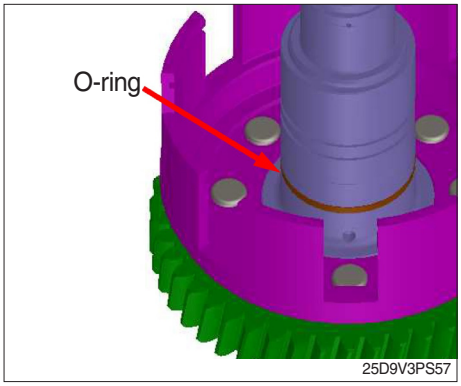
2. ASSEMBLY OF TRANSMISSION

1) SUB-ASSEMBLY OF CLUTCH

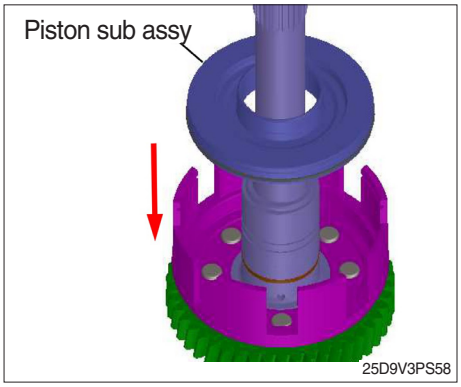
(1) Insert the d-ring into the piston groove and oil it.



(2) Insert the o-ring into the shaft groove and oil it.

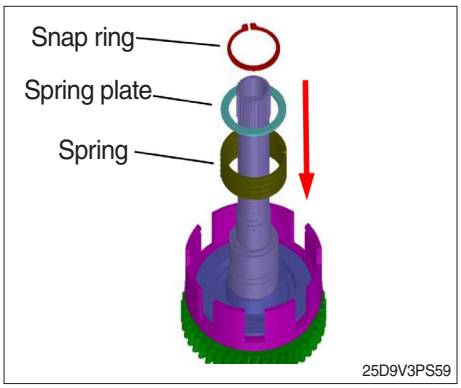


(3) Insert the piston sub assy into the drum gear.

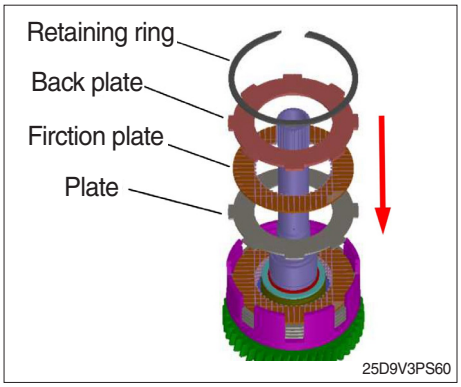


(4) Assemble spring, spring plate and snap ring.

⚠ **When removing the snap ring, it may bounce off by spring force, so fix the spring firmly before removing it. Pay attention to safety when removing snap ring.**

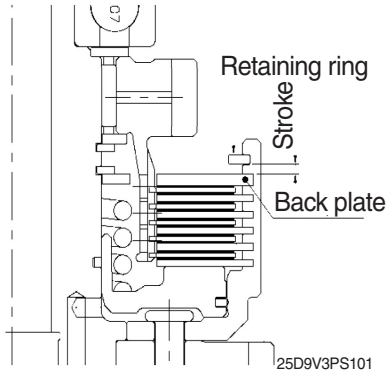


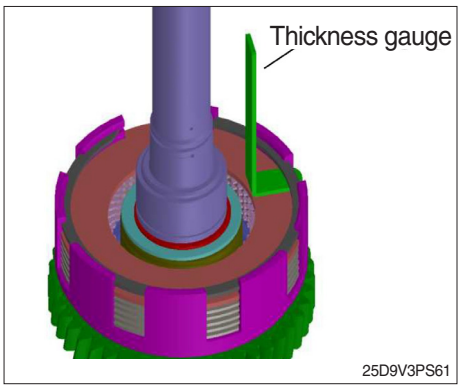
(5) Install the opp. plates and friction plates alternately into the drum gear. Then install the back plate and retaining ring.



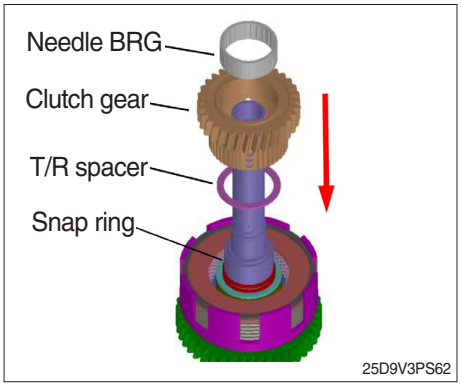
(6) Measure clearance between the back plate and retaining ring using thickness gauge.

※ **Calculate the distance between back plate and retaining ring. (Stroke : 2.2 ~ 2.6 mm)**
Use thickness gauge.

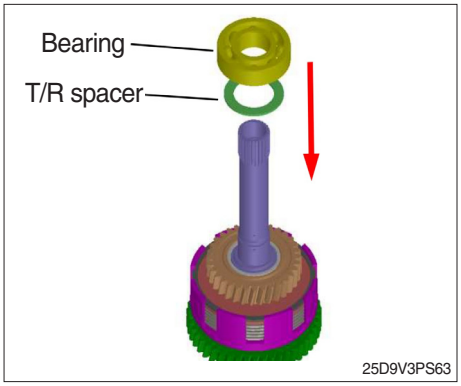




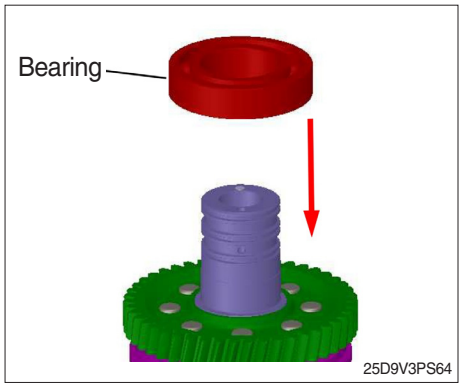
(7) Assemble the For. clutch shaft sub assy. Assemble the snap ring into the groove of clutch shaft. Mount the thrust washer and oil it. Mount the clutch gear until contact is obtained. Mount the needle bearing and oil it.



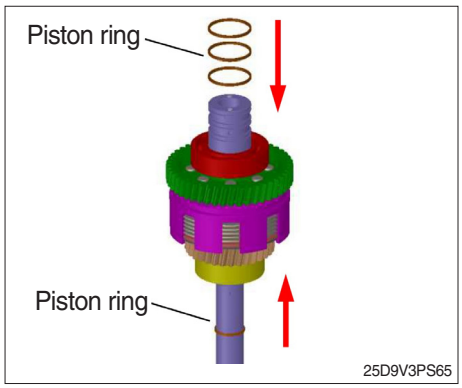
(8) Mount the thrust spacer and oil it. Press the bearing onto the forward clutch shaft.



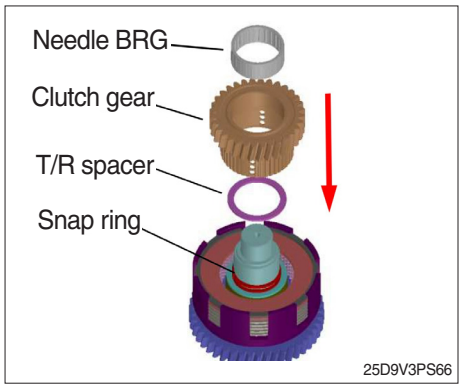
(9) Press the bearing onto the forward clutch shaft.



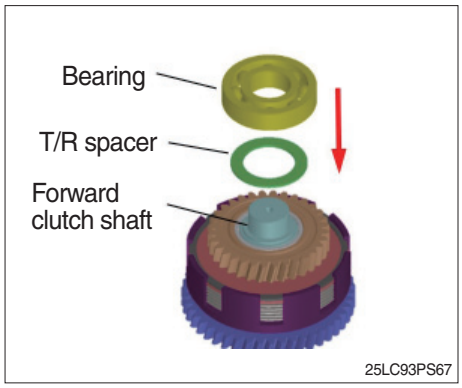
(10) Fit the piston rings at groove of clutch shaft and oil them.



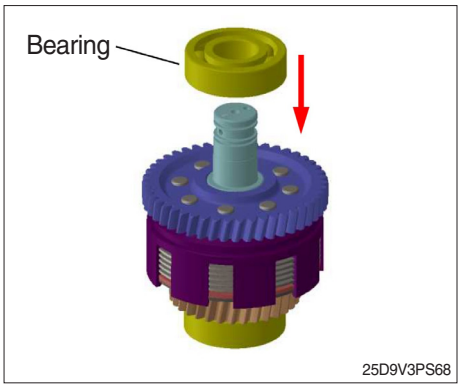
(11) Assemble the Rev. clutch shaft sub assy. Assemble the snap ring into the groove of clutch shaft. Mount the thrust washer and oil it. Mount the clutch gear until contact is obtained. Mount the needle bearing and oil it.



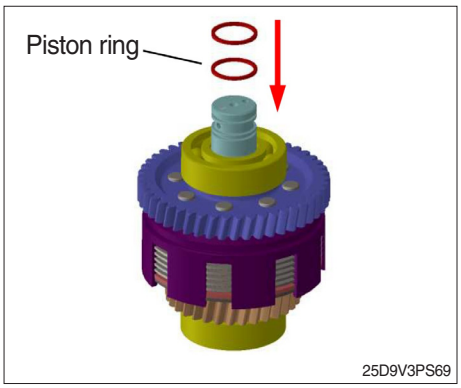
(12) Mount the thrust spacer and oil it. Press the bearing onto the reverse clutch shaft.



(10) Press the bearing onto the reverse clutch shaft.

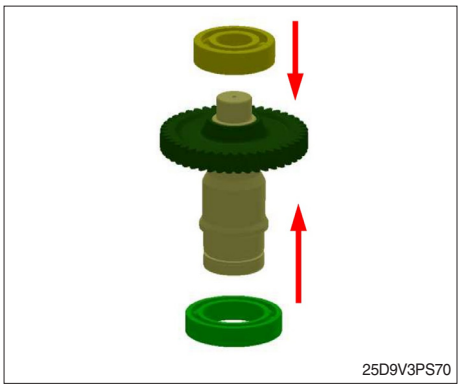


(11) Fit the piston rings at groove of clutch shaft and oil them.

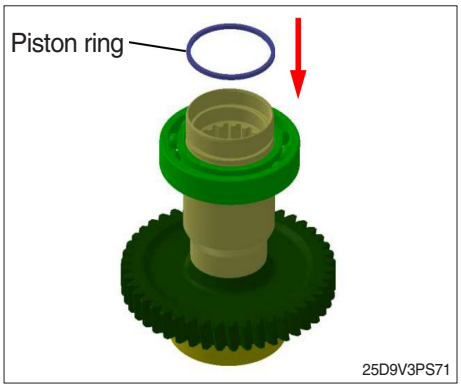


2) ASSEMBLY OF OUTPUT SHAFT

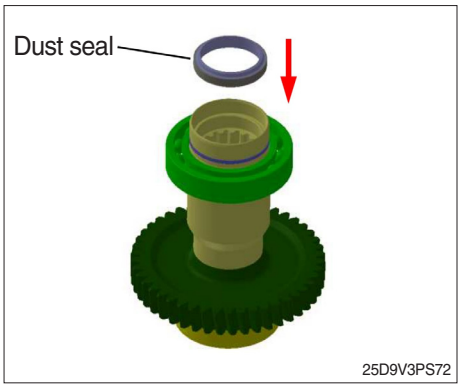
(1) Press the bearing onto the output shaft.



(2) Fit the piston ring at groove of output shaft and oil it.



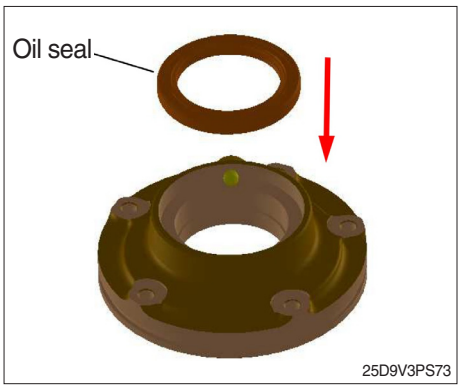
(3) Insert the dust seal into the output shaft.



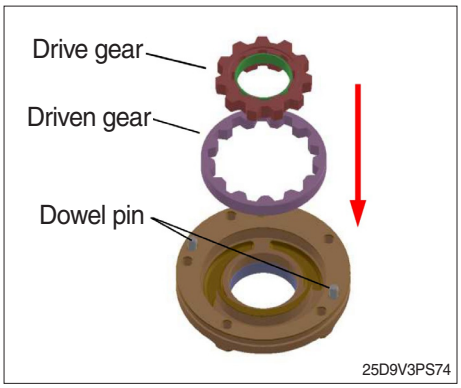
3) ASSEMBLY OF PUMP

(1) Insert the oil seal into the pump case.

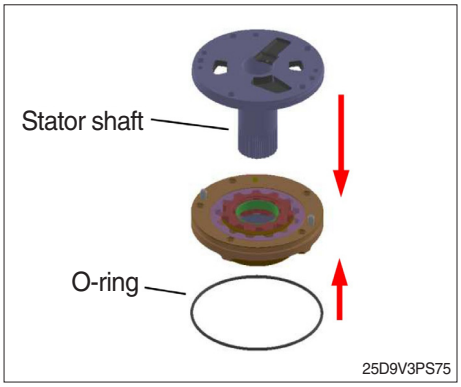
※ **Spread grease on the seal lip of oil seal**



(2) Mount the driven and drive gear and oil them.

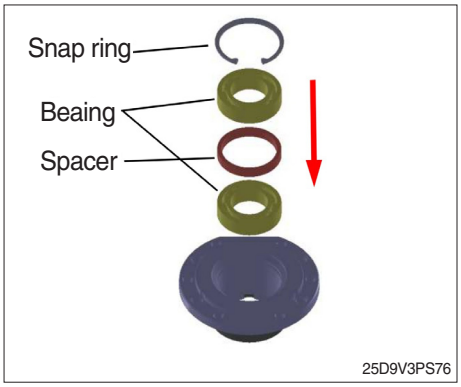


(3) Fit the stator shaft. Insert the o-ring at groove of pump case and oil it.

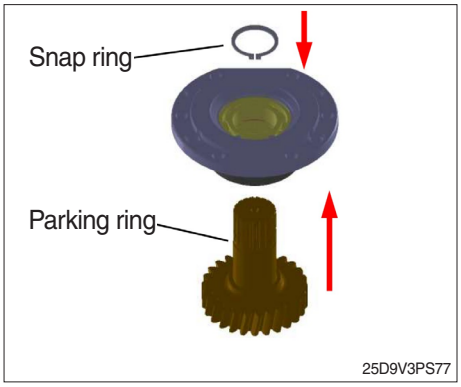


4) ASSEMBLY OF PARKING

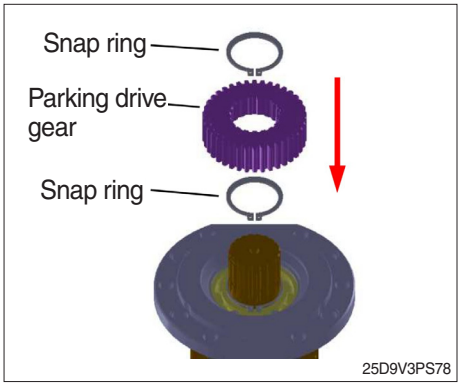
(1) Press the bearing 1 into the parking case. Mount spacer. Press the bearing 2 into the parking case. Install the snap ring into the groove of parking case.



(2) Fit the parking gear and install the snap ring onto the groove of parking gear.



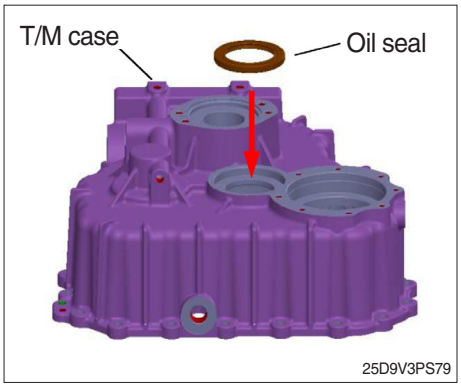
(3) Install snap the ring and parking drive gear.



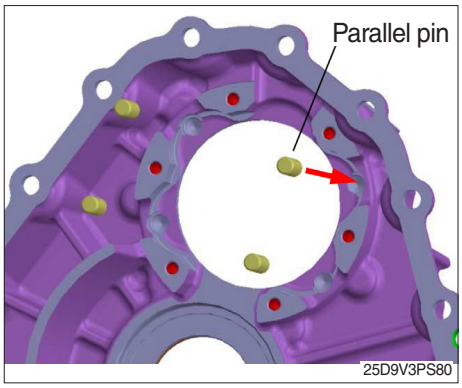
4) ASSEMBLY OF TRANSMISSION

(1) Insert the oil seal into the T/M case.

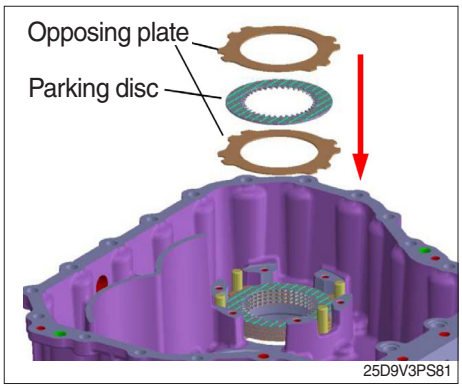
※ **Spread grease on the seal lip of oil seal.**



(2) Press in parallel pin. (4 EA)



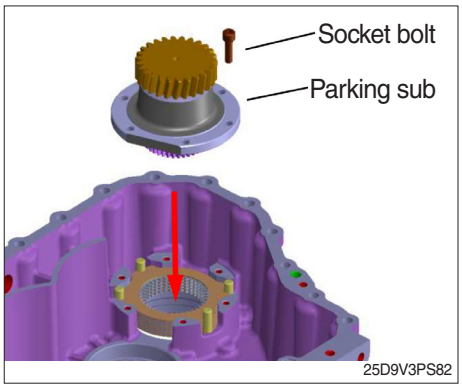
(3) Install the opposing plates and parking discs alternately into the T/M case.



(4) Install the parking sub ass'y and socket bolts (M8 ×25L, 6 EA).

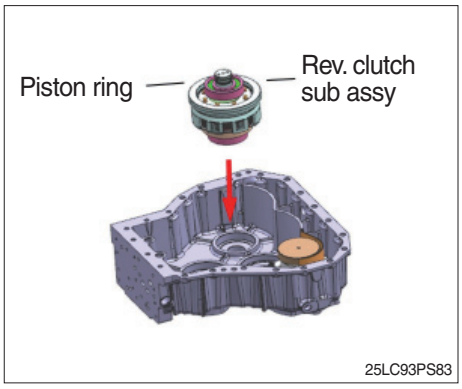
※ **Cover Loctite #277 on socket bolt.**

· Tightening torque : 3.1 ~ 3.6 kgf·m
(22.4 ~ 26.04 lbf·ft)



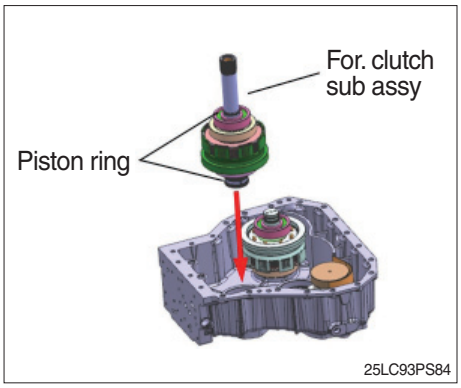
(5) Installl the rev. clutch sub assy.

※ **Align and grease piston rings.**



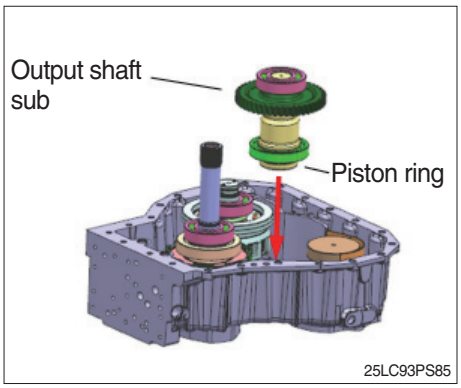
(6) Installl the for. clutch sub assy.

※ **Align and grease piston rings.**

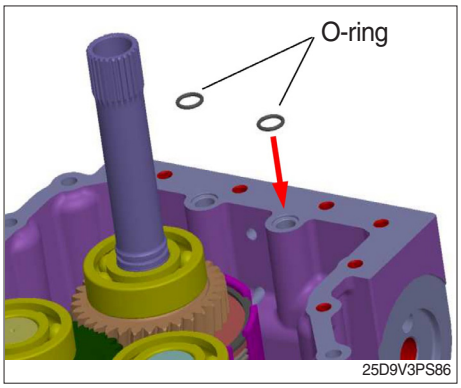


(7) Installe the output shaft sub assy.

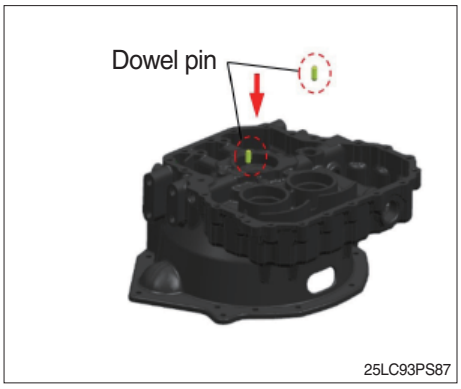
※ **Align and grease piston rings.**



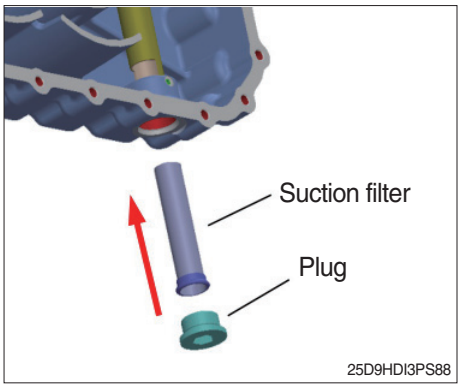
(8) Insert the o-rings and oil them.



(9) Press in dowel pin. (2 EA)



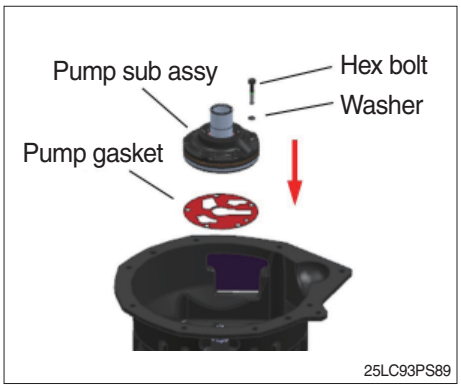
(10) Install the suction filter, suction filter spirng and plug.



(11) Mount the pump gasket and pump sub assy,

※ **Cover Loctite #277 on hex bolt.**

· Tightening torque : 2.0 ~ 2.6 kgf·m
(14.5 ~ 18.8 lbf·ft)

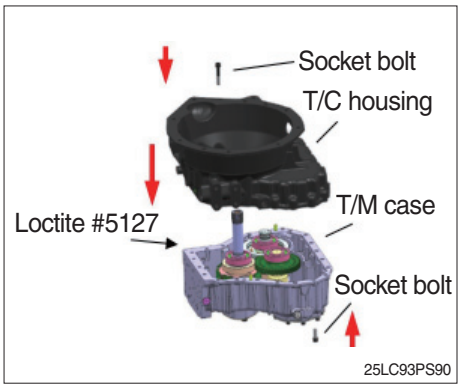


(12) Install the T/M case and T/C housing. Assemble socket bolt (M10×1.5-30L, 16EA / M10×1.5-65L, 16EA).

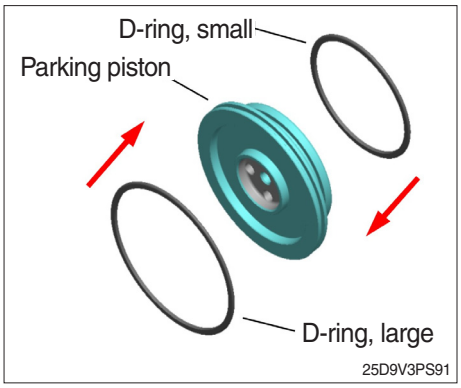
※ **Cover Loctite #5127 on the joint surface of T/M case. Do not apply to the bolt holes.**

※ **Cover Loctite #277 on socket bolt.**

· Tightening torque : 7.1 ~ 7.7 kgf·m
(51.4 ~ 55.7 lbf·ft)



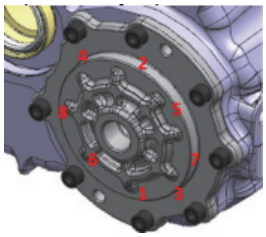
(13) Insert the d-rings (large and small) on the groove of parking piston and oil them.

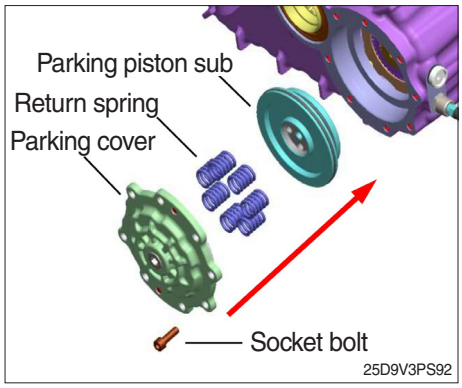


(14) Assemble parking piston sub assy, return spring, parking cover and socket bolts (M8×25L, 8 EA).

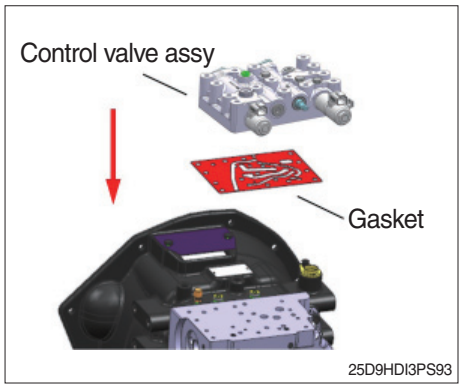
※ **Cover Loctite #277 on socket bolt.**

· Tightening torque : 3.1 ~ 3.6 kgf·m
(22.4 ~ 26.04 lbf·ft)





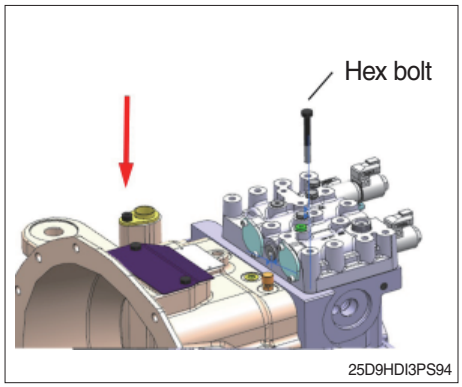
(15) Mount the valve gasket and control valve assy.



(16) Tighten the hex bolts. (M8×1.25-70L, 14 EA)

※ **Cover Loctite #277 on hex bolt.**

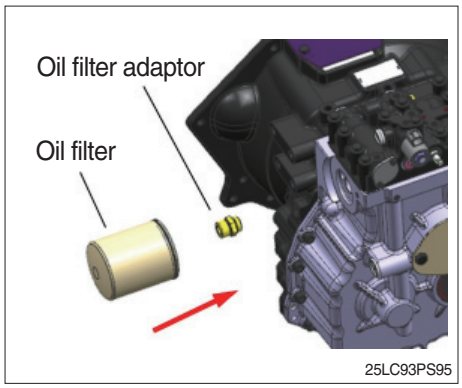
· Tightening torque : 3.1 ~ 3.6 kgf·m
(22.4 ~ 26.04 lbf·ft)



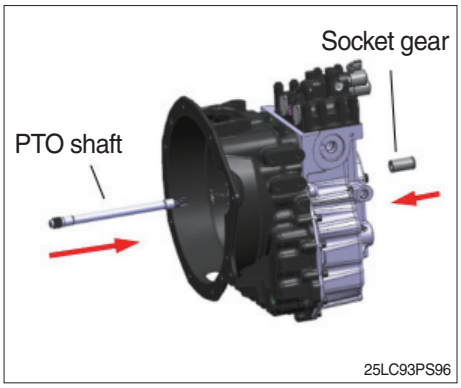
(17) Tighten the oil filter adaptor and assemble the oil filter.

※ **Slightly oil the seal on the oil filter. Turn in the oil filter until contact with the sealing surface is obtained, and then tighten it by band with approx. 1/3 to 1/2 rotation.**

· Tightening torque : 4.6 ~ 5.1 kgf·m
(33.3 ~ 36.9 lbf·ft)



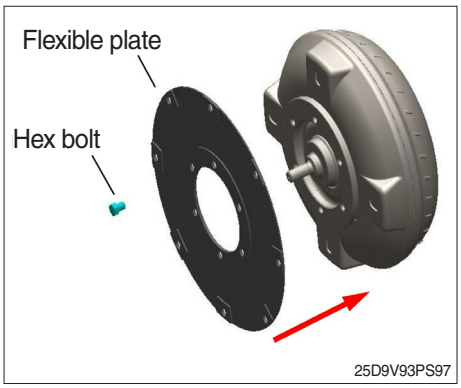
(18) Mount the PTO shaft and socket gear.



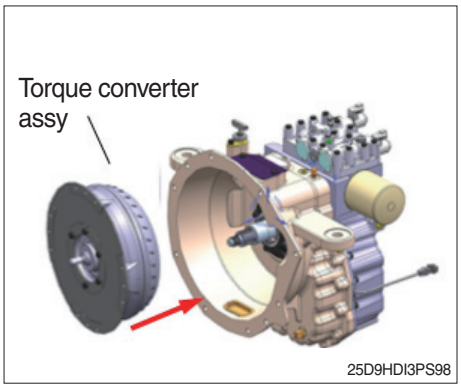
(19) Assemble the flexible plate and hex bolts (3/8-24-UNF, 6EA).

※ **Cover Loctite #277 on socket bolt.**

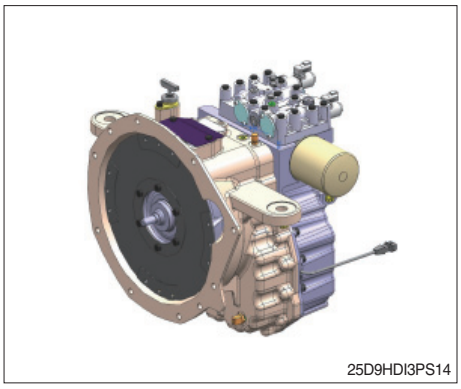
· Tightening torque : 4.6 ~ 5.1 kgf·m
(33.3 ~ 36.9 lbf·ft)



(20) Assemble the torque converter assy.



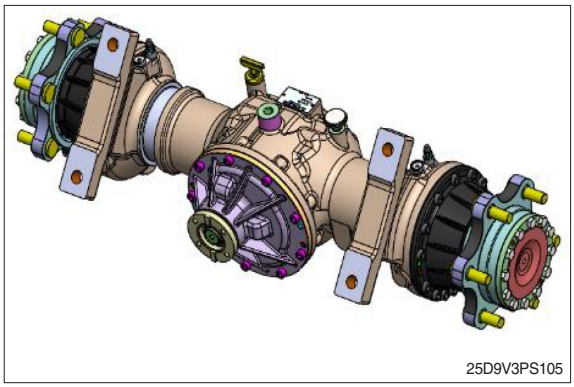
(21) Complete the transmission assembly.



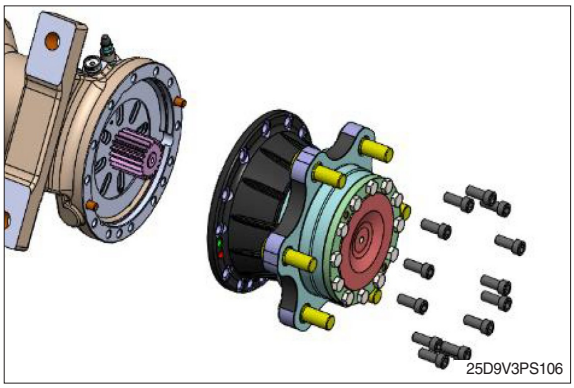
3. DISASSEMBLY OF DRIVE AXLE

1) DISASSEMBLY

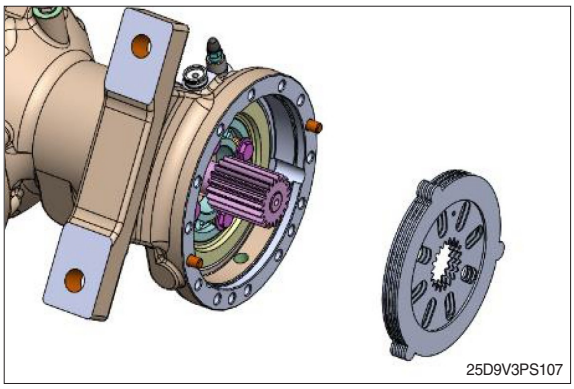
(1) Disassemble drive axle assy.



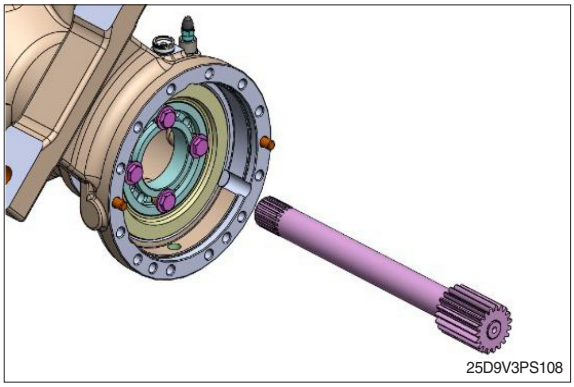
(2) Disassemble carrier hsg. sub assy.



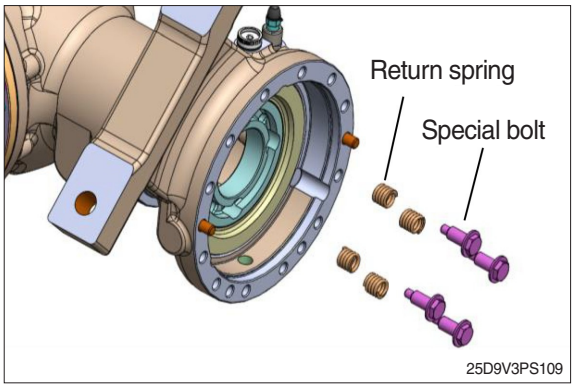
(3) Disassemble disc, opposing plate.



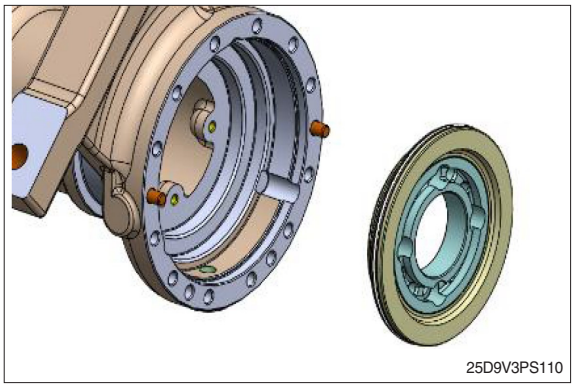
(4) Disassemble axle shaft.



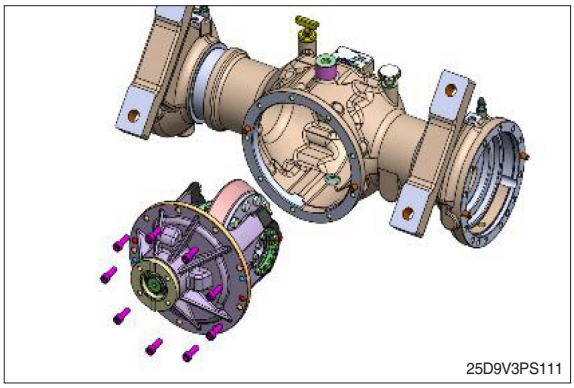
(5) Disassemble special bolt, return spring.



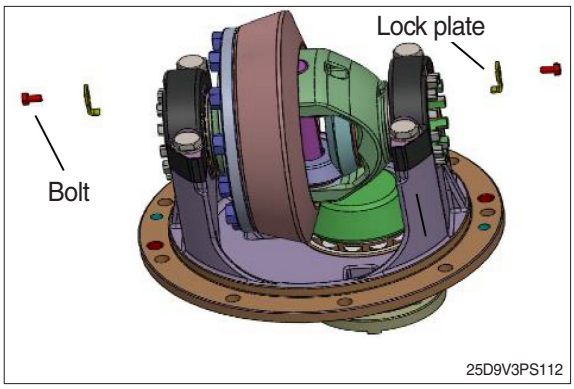
(6) Brake piston sub assy



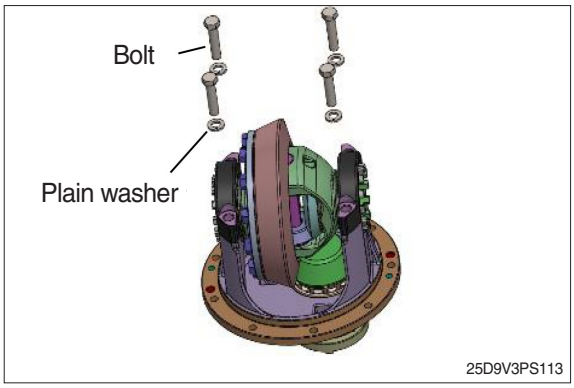
(7) Disassemble bolt, carrier sub assy.



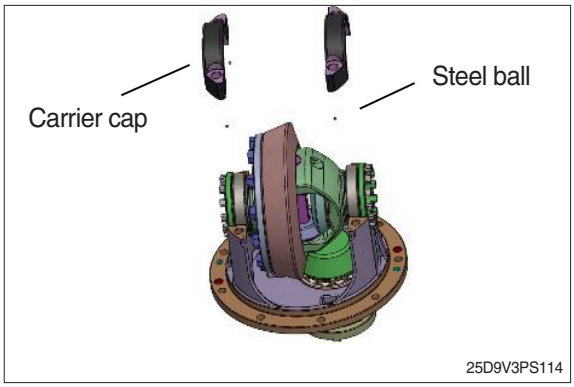
(8) Disassemble Bolt, lock plate.



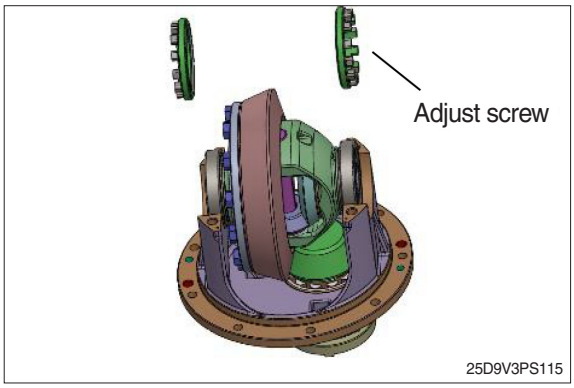
(9) Disassemble bolt, plain washer.



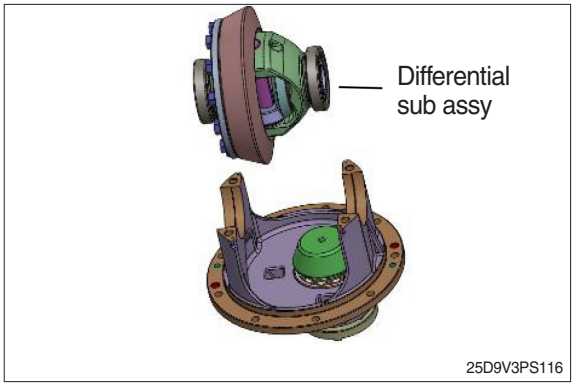
(10) Dissassemble carrier cap, steel ball.



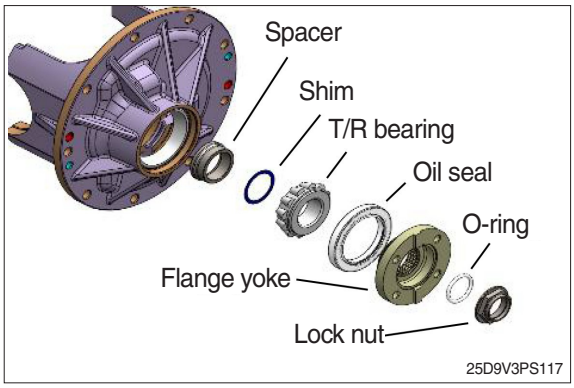
(11) Disassemble adjust screw.



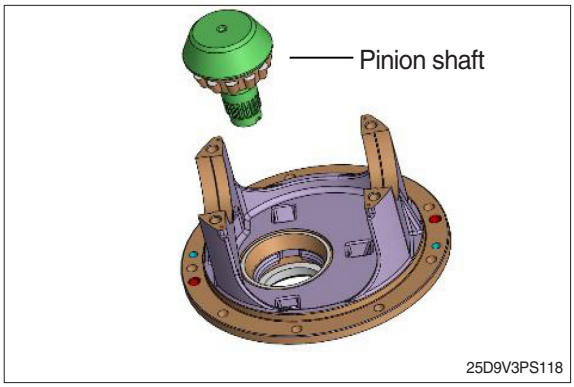
(12) Disassemble differential sub assy.



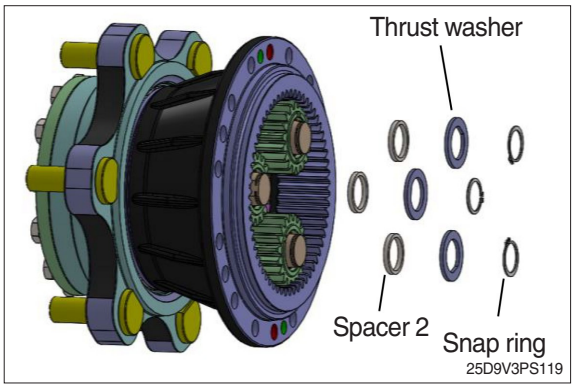
(13) Dissassemble carrier cap, steel ball.



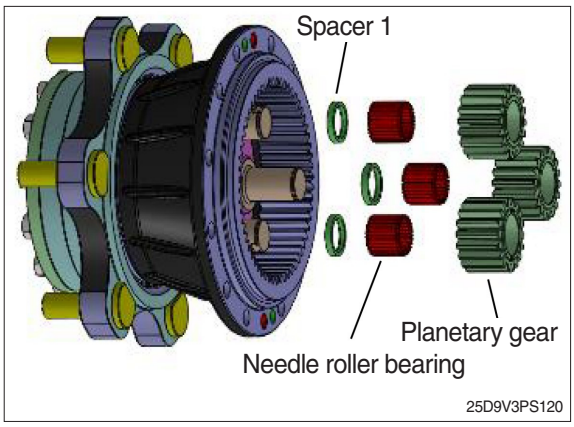
(14) The Lock nut from the decomposition order.



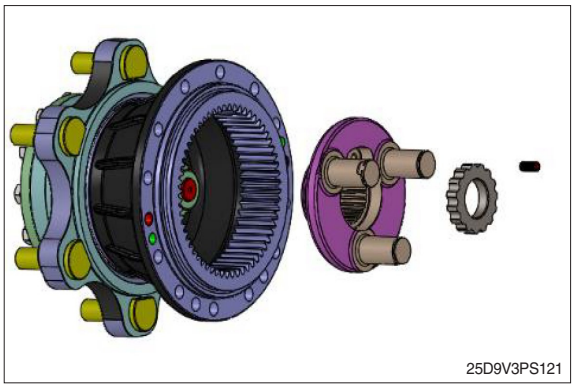
(15) Disassemble Pinion shaft.



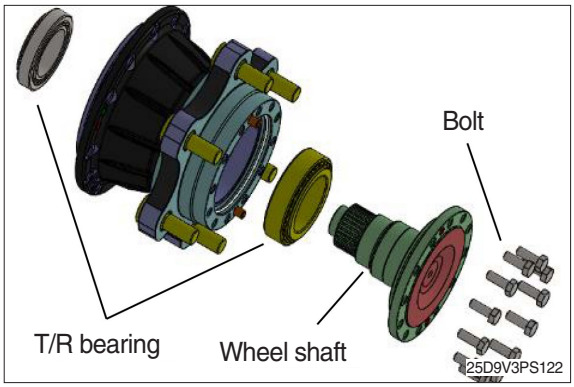
(16) Disassemble planetary gear, needle roller bearing (58EA × 3= 174EA), spacer 1.



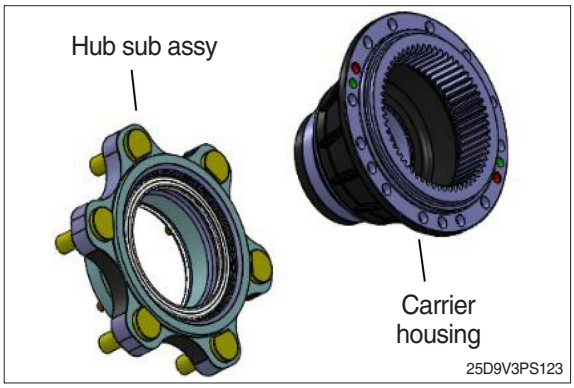
(17) Disassemble set screw, hub lock nut and PL carrier



(18) Disassemble bolt, wheel shaft and T/R bearing.



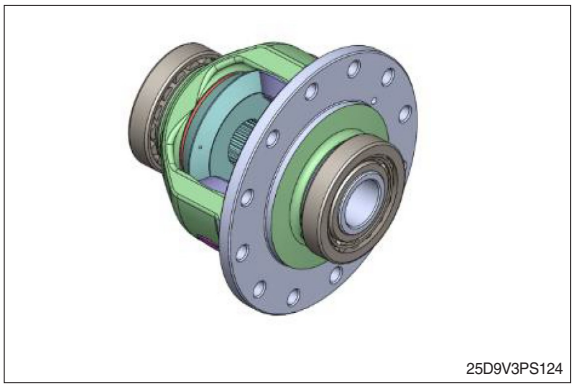
(19) Disassemble hub sub assy, carrier housing.



3.ASSEMBLY OF DRIVE AXLE

1) ASSEMBLY OF DIFFERENTIAL DEVICE

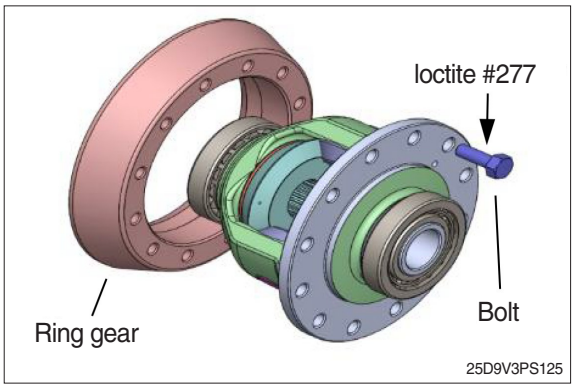
(1) Make preparation for diffdrential assembly.



(2) Assemble Ring gear by Bolt.

※ **Spread loctite #277.**

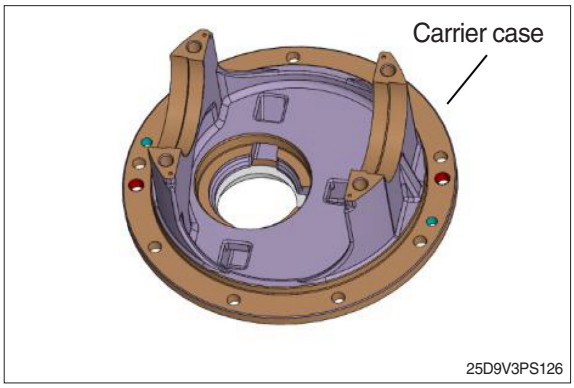
· Tightening torque : 10.2 ~ 11.2 kgf·m
(73.8 ~ 81.0 lbf·ft)

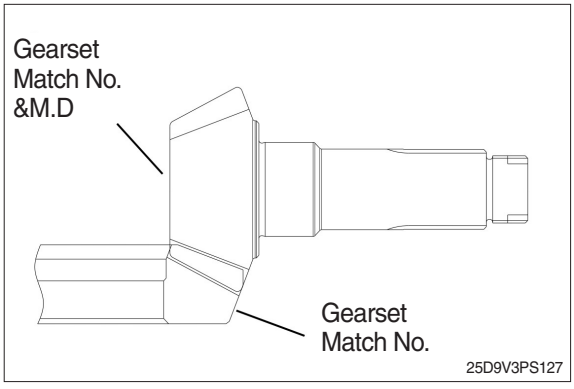


2) ASSEMBLY OF CONTROL OF SHIM & PINION

(1) Fix carrier case to jig.

※ **Before install gearset to carrier, you must recognize information. You always have tested the mark at gear set which each pair of gear suits it.**





(2) The THK of shim will be decided of measured value of gauge & machine.

① Dimensional drawings of the alphabet (mm)

a : 107 b : 25.25 c : Engraved value

d : 132.75 e : 33.75 f : 32.5 g : 1.75

② Basic shim thickness

"A" : 0.5 "B" : 0.5

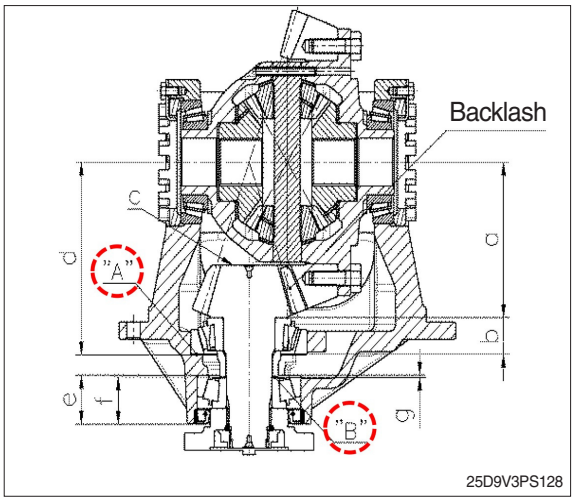
③ Shim thickness calculation

"A" : d-(a+b+c)

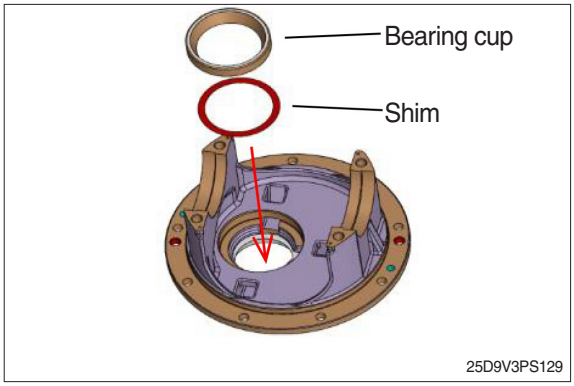
ex) 132.7 - { 106.9 + 25.22 + (-0.2) } = 0.83 → 0.85 mm

"B" : g-(e-f)

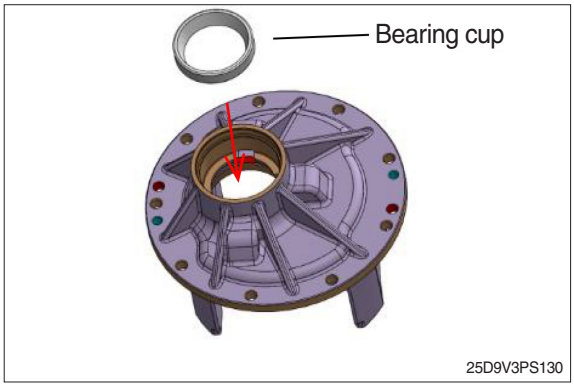
ex) 1.77 - (33.71 - 32.42) = 0.48 → 0.5 mm



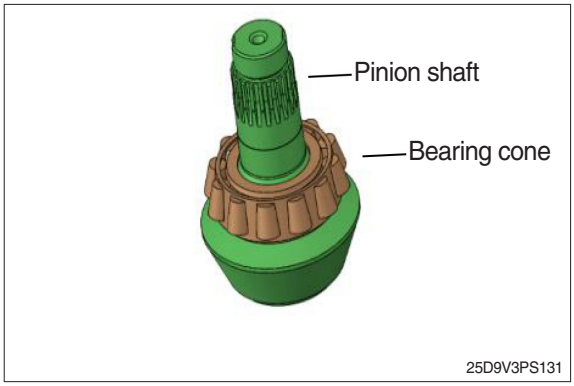
(3) Assemble shim. Sort of shim : 0.1, 0.15, 0.25, 0.5 mm. Press the bearing cup.



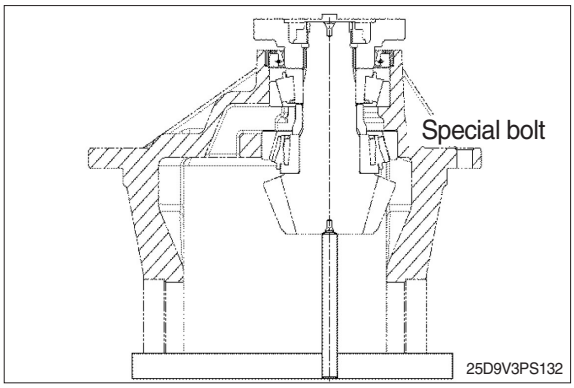
(4) Turn carrier case a on-eighty (180˚) and press bearing cup.



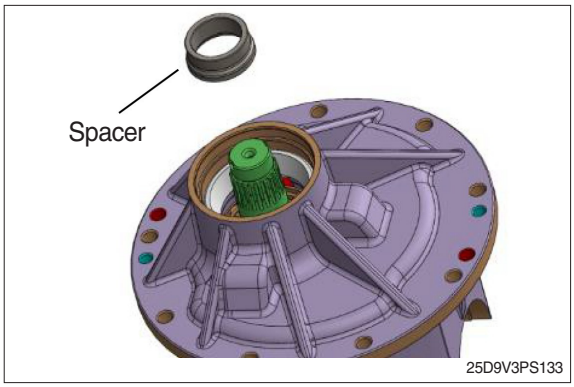
(5) Pressurize bearing cone on pinion shaft. Put into pinion shaft.



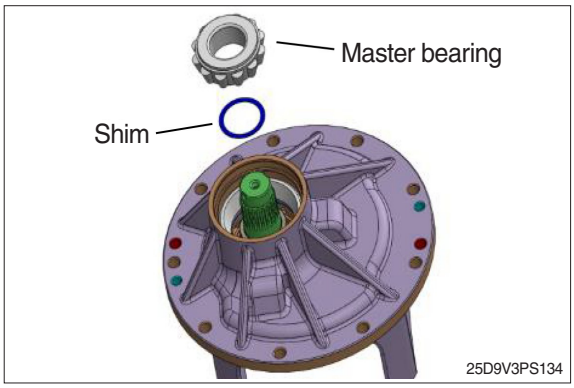
(6) Turn carrier case a one-eighty (180˚) and fix it on jig.



(7) Assemble pinion shaft on spacer.

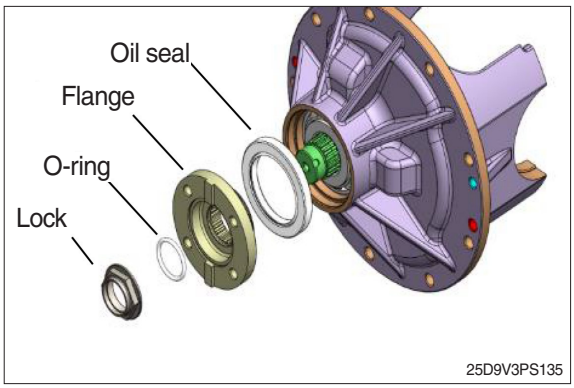


(8) Assemble pinion shaft, and assemble shim & master bearing sort of shim : 0.1, 0.15, 0.3 mm

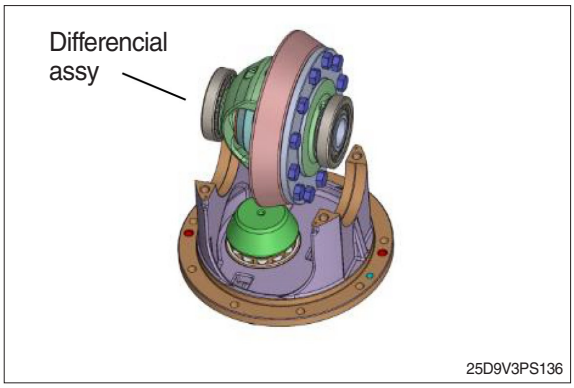


(9) Assemble oil seal, flange yoke, o-ring and lock nut.

· Tightening torque : 26.5 ~ 29.6 kgf·m
(192 ~ 214 lbf·ft)



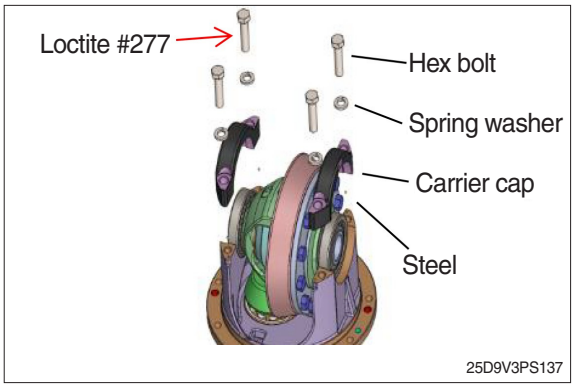
(10) Turn carrier case a one-eighty (180˚) and assemble differencial assembly on carrier case.



(11) Assemble hex bolt on carrier cap.

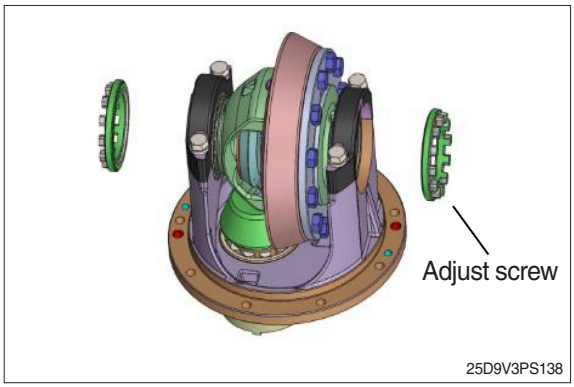
※ **Spread loctite #277 on the bolt.**

· Tightening torque : 11.7 ~ 12.5 kgf·m
(84.6 ~ 90.4 lbf·ft)

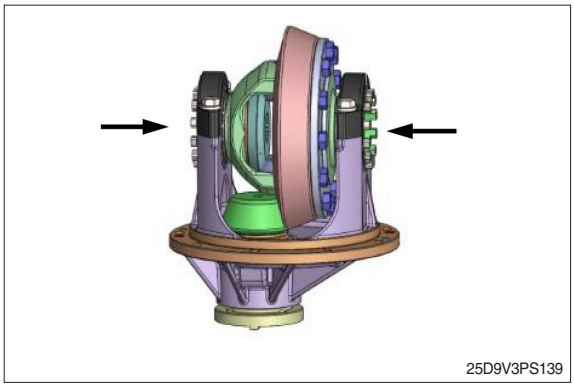


3) CONTROL OF GEARSET BACKLASH

(1) Assemble adjust screw on carrier case.



(2) Lock adjust screw.

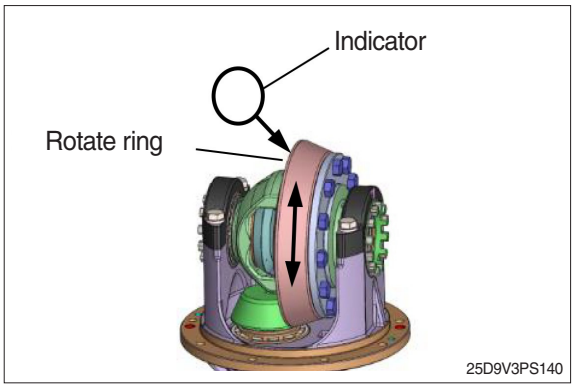


(3) Measure Backlash.

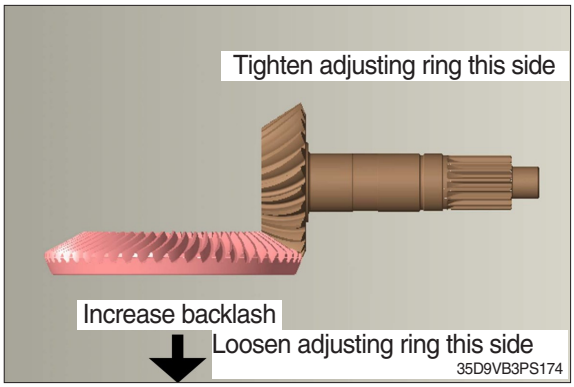
※ Backlash of pinion & ring gear : 0.18~0.23 mm

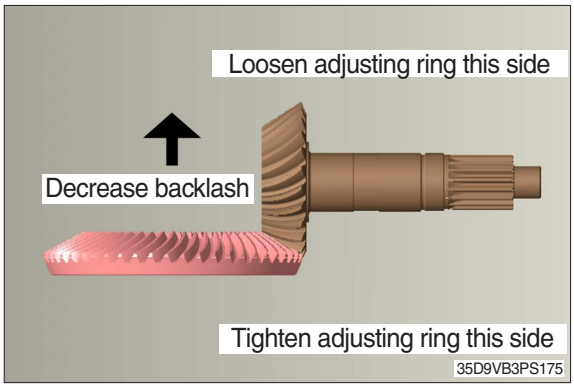
※ If it is wrong backlash, you can adjust value as moving each step.

※ If ring gear takes from pinion shaft far, the value of backlash will be increased. If ring gear takes from pinion shaft close, the value of backlash will be decreased.



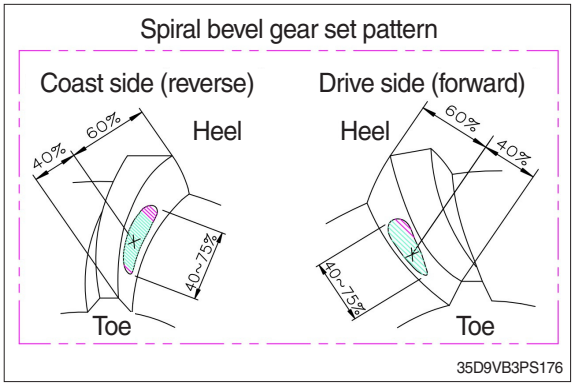
(4) If ring loosen same with one bolt screw side, you should ring tighten it. And if ring tighten it, you should loosen the adjusting ring.



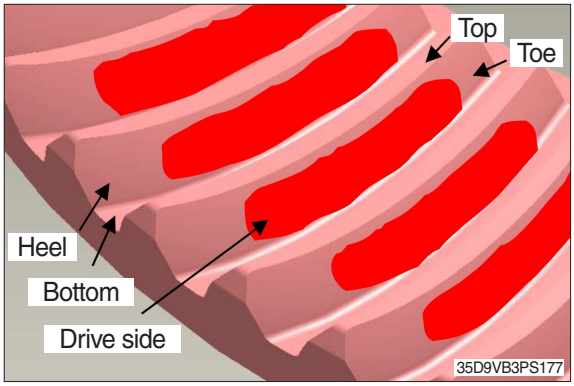


4) MEASUREMENT OF TOOTH CONTACT PATTERN

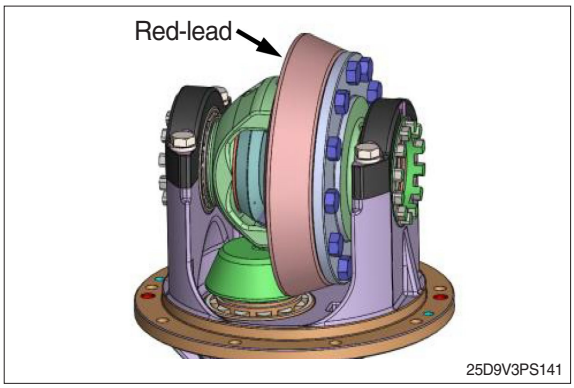
※ **After assemble , adjust pattern of the gear and pinion shaft figure. If pattern is not adjusted, take a measure as measuring backlash again and then reassemble.**



※ **Always check tooth contact pattern on the driving side of gear teeth.**

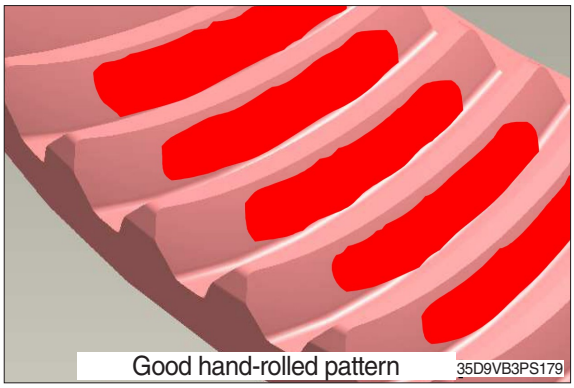


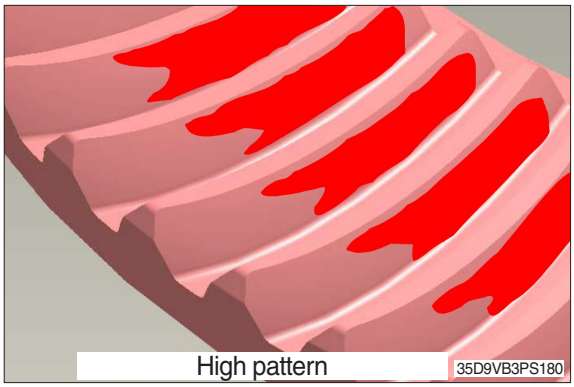
(1) Marking red-lead on 6 tooth surface of ring gear.
(2) Rotate ring gear forward and backward so that the 6 marked teeth go past the drive pinion six time to get a good contact pattern.

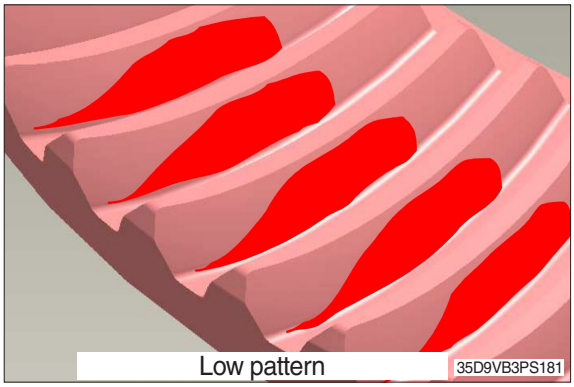


(3) Compare the contact pattern with illustrations.

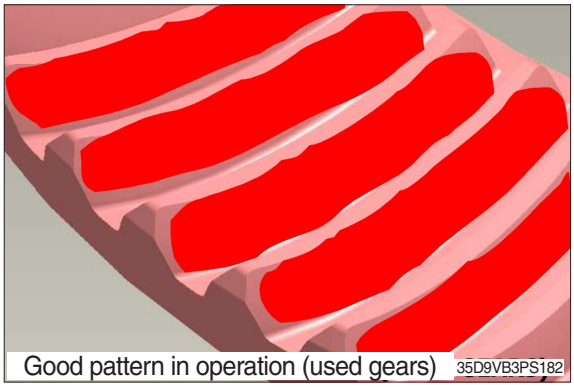
※ **The good contact pattern of gearset is appeared what the length of tooth has had.**







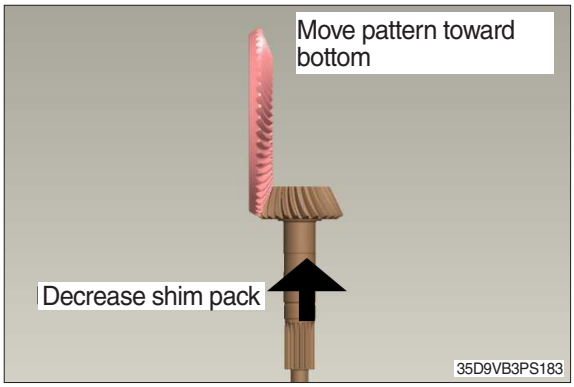
※ **The good contact pattern of used gearset is appeared what the length of tooth has had as wear pattern.**



(4) If you need control contact pattern to adjust THK of tooth (top/bottom), you should obey steps ①-②.
If you need control contact pattern to adjust THK of tooth (toe/heel), you should obey steps ③-④.

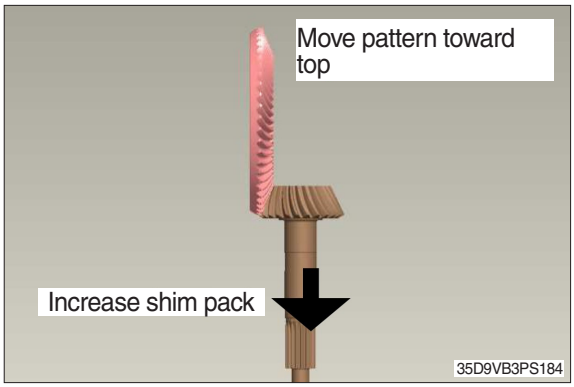
① High pattern

If A high contact pattern appear it which pinion was installed shallowly in carrier.
To modify, move the pinion toward the ring gear by decreasing the shim pack between pinion spigot and inner bearing cone.



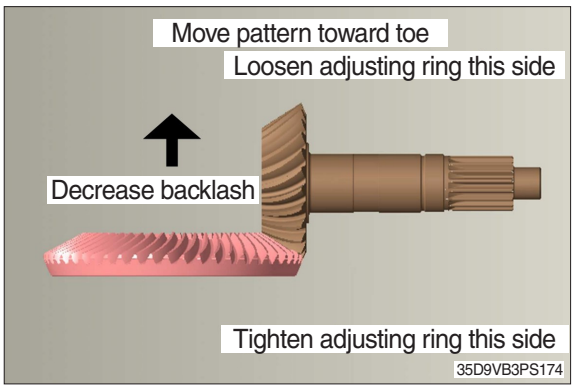
② Lower pattern

If A low contact pattern appear it which pinion was installed deeply in carrier.
To modify, move the pinion away from the ring gear by increasing the shim pack between pinion spigot and inner bearing cone.



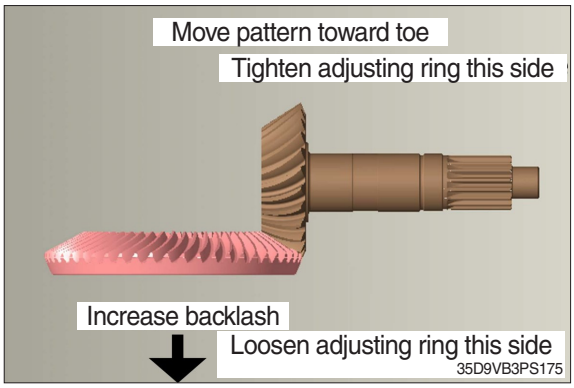
③ Heel pattern

Decrease the gearset backlash (within specified range) to move contact pattern toward toe and away from heel. Refer to " Adjusting the gearset backlash".

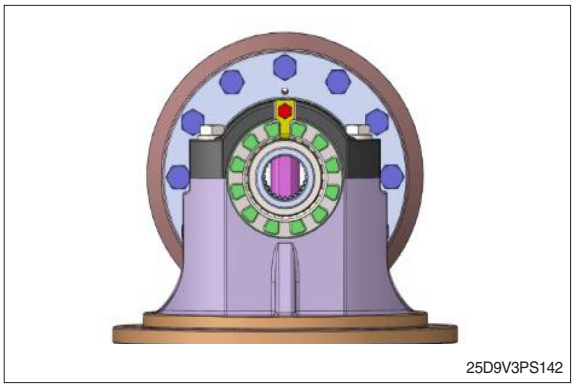


④ Toe pattern

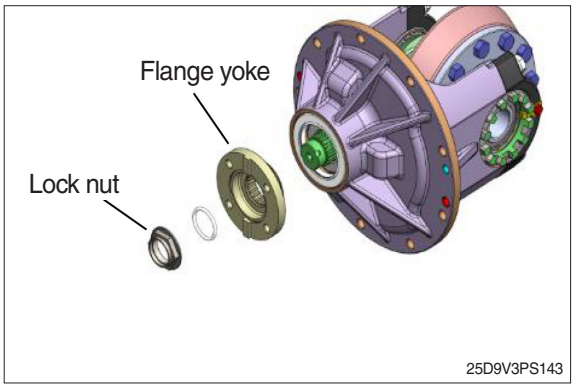
Increase the gearset backlash (within specified range) to move contact pattern toward heel and away from toe. Refer to "Adjusting the gearset back lash".



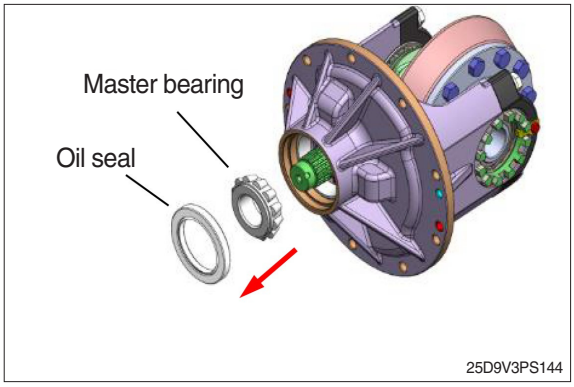
(5) Fix spring pin to adjusted Ring bearing. And then, assemble all of them.



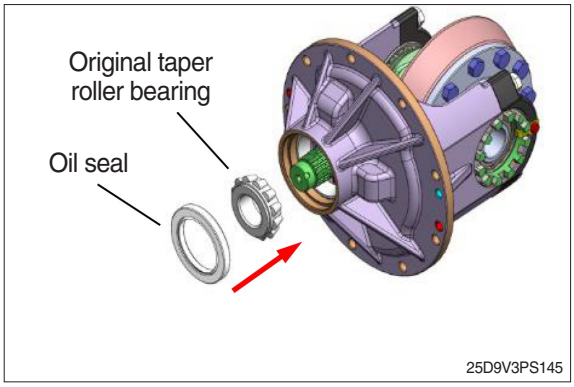
(6) Disassemble lock nut & o-ring & flange yoke.



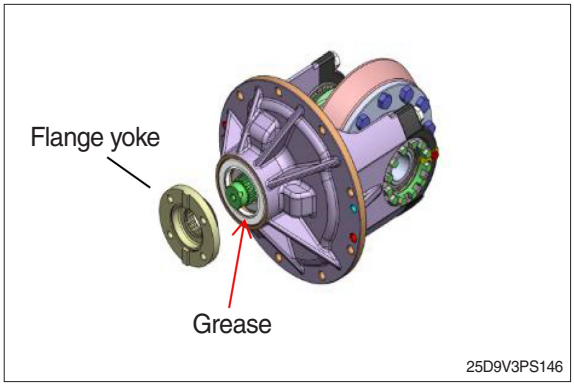
(7) Disassemble oil seal & master bearing.



(8) Assemble original taper roller bearing & oil seal.



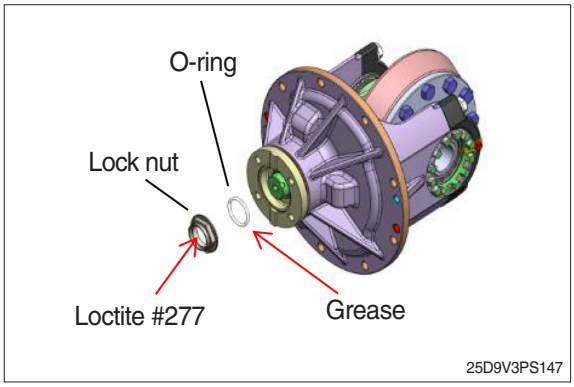
(9) Spread grease on seal rip and assemble flange yoke.



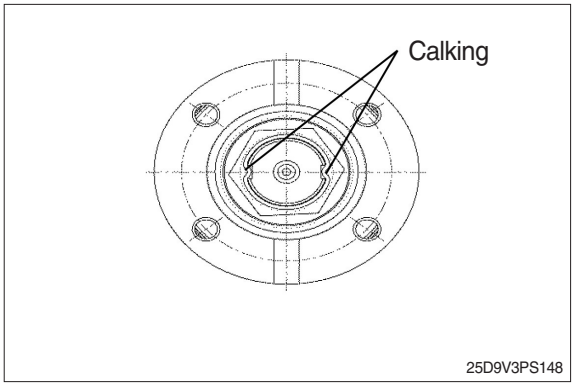
(10) spread grease on o-ring assemble o-ring and spread loctite #277 on lock nut and tighten it.

· Tightening torque : 46.9 ~ 50 kgf·m
(339 ~ 362 lbf·ft)

· Preload : 0.2 ~ 0.4 kgf·m
(1.4 ~ 2.9 lbf·ft)

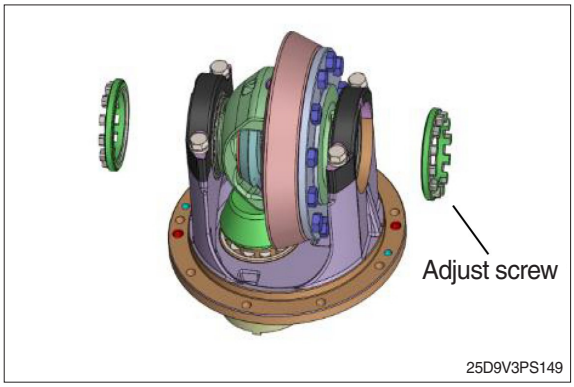


(11) Calking (2EA)



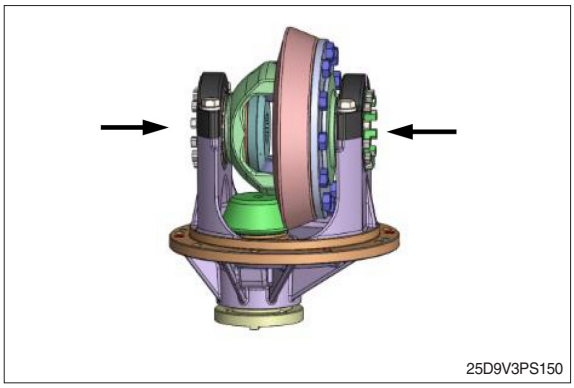
5) ASSEMBLY OF HUB

(1) Press hub bolt into hub.



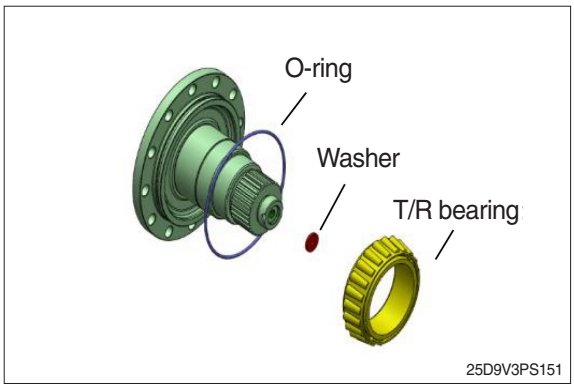
(2) Press hub outer oil seal. Before assemble, spread grease at inside hub.

※ **Grease : Shell Retinax 0434 - 60 ~ 80 % spread**



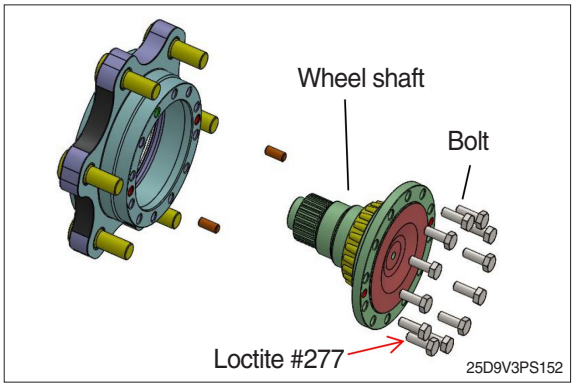
6) ASSEMBLY OF CARRIER HSG. SUB ASSY

(1) Cover grease on o-ring assemble o-ring and assemble washer & T/R bearing.

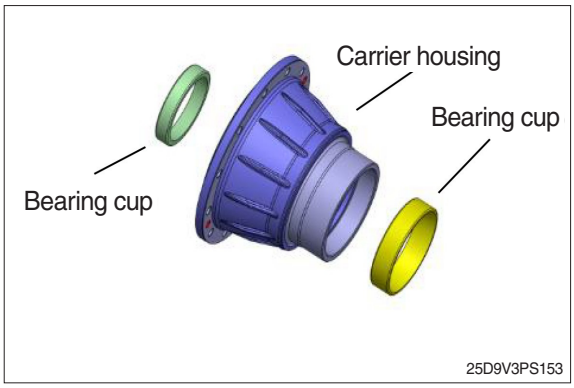


(2) Spread loctite #277 on socket bolt and assemble wheel shaft.

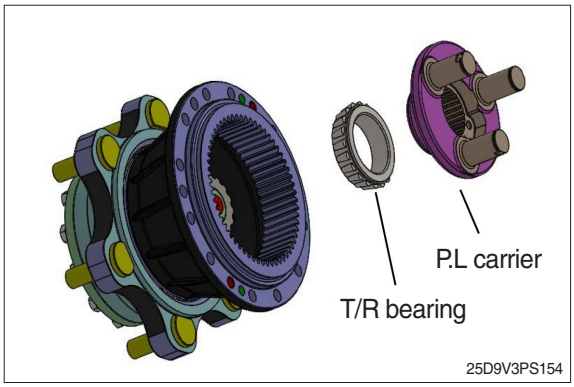
· Tightening torque : 0.69 ~ 0.73 kgf·m
(5.0 ~ 5.3 lbf·ft)



(3) Press bearing cup into carrier housing both side.



(4) Press T/R bearing and P.L carrier sub assy.



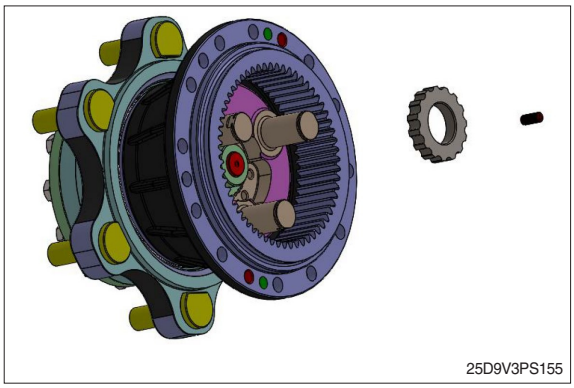
(5) Fastening hub lock nut and assemble the set screw.

※ **Spread loctite #277.**

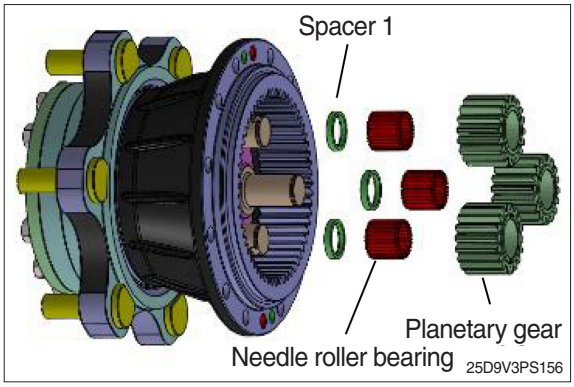
· lock nut tightening toruqe : 25.5 kgf·m (184 lbf·ft)

· Preload : 0.56 ~ 0.61 kgf·m (4.1 ~ 4.4 lbf·ft)

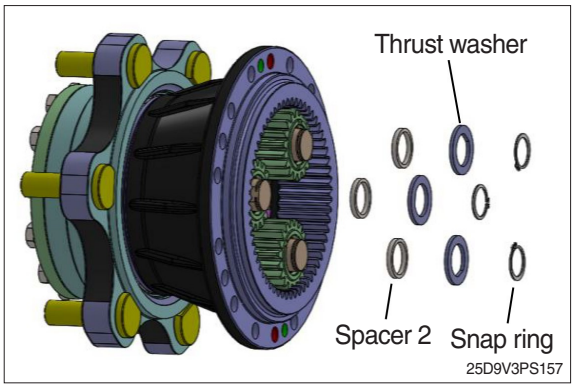
· set screw tightening toruqe : 1.3 kgf·m (9.4 lbf·ft)



(6) Assemble spacer 1, N.D roller bearing and planetary gear. Spread grease on N.D rooler bearing.

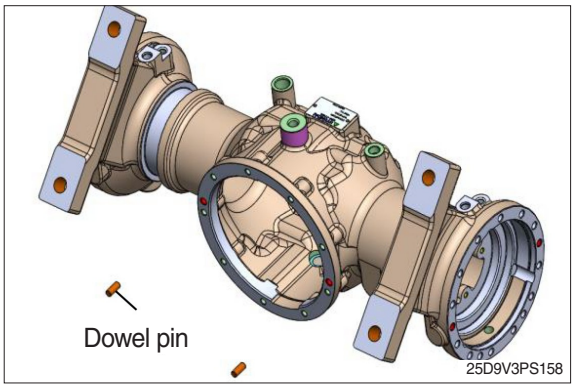


(7) Assemble spacer 2, thrust washer, snap ring.

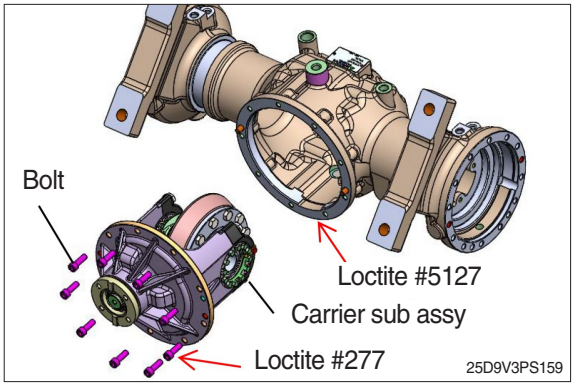


6) ASSEMBLY OF DRIVE AXLE

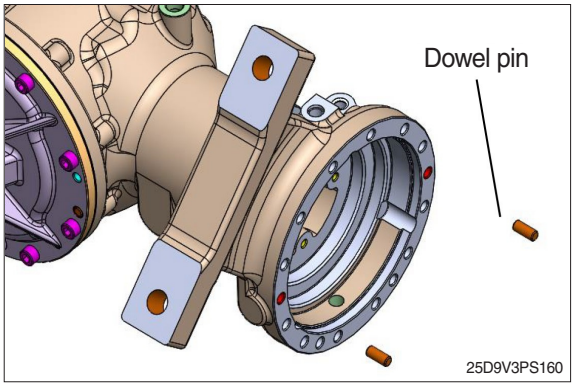
(1) Press dowel pin on axle housing.



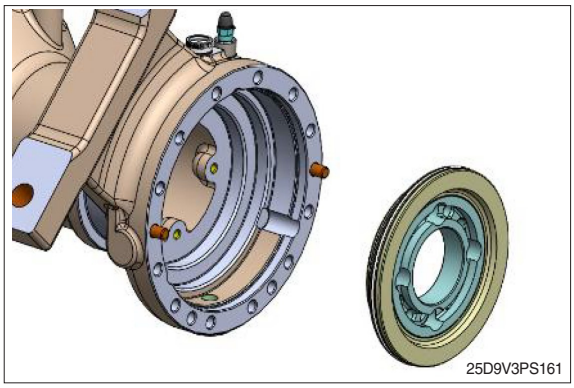
(2) Spread loctite #5127 on axle housing and assemble carrier sub assy. Spread loctite #277 on the bolt and assemble bolt.



(3) Assemble dowel pin on axle housing.



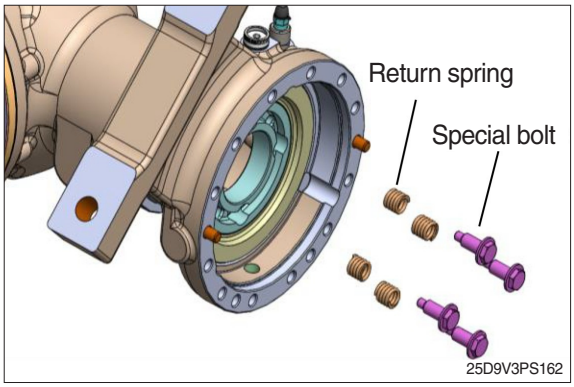
(4) Assemble piston sub.



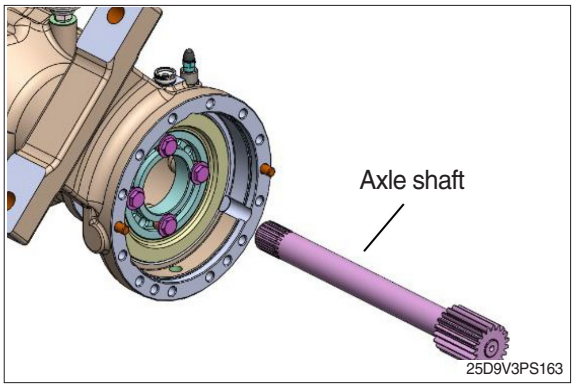
(5) Return spring, Sprecial bolt.

※ **Spread loctite #277 on the bolt.**

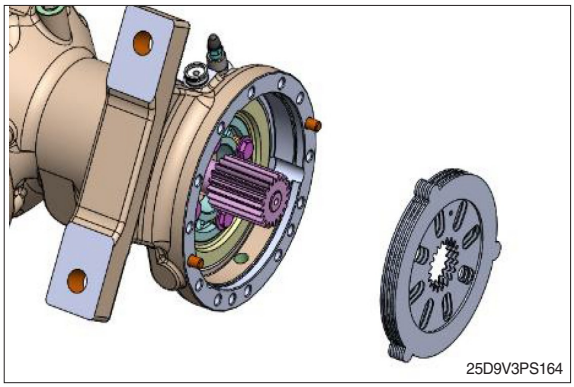
· Tightening torque : 3.1 ~ 3.5 kgf·m
(22.4 ~ 25.3 lbf·ft)



(6) Assemble axle shaft.



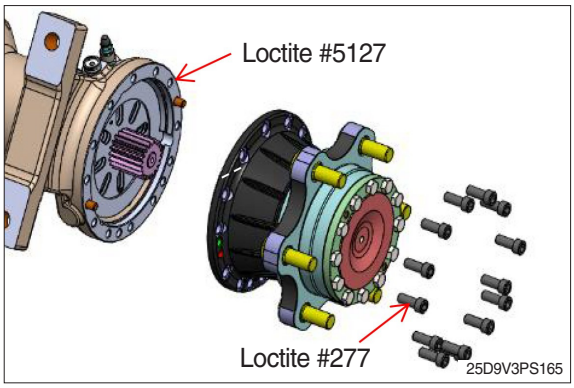
(7) Assemble brake disc pack



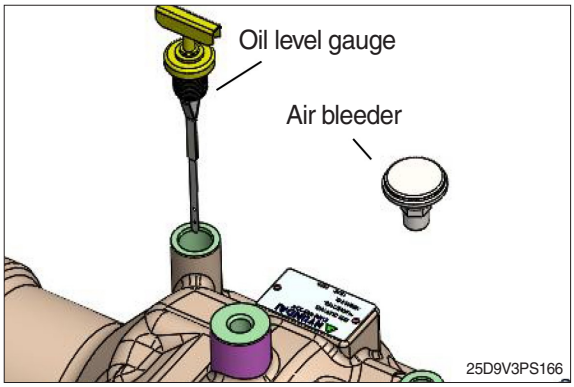
(8) Spread loctite #5127 on axle housing and assemble carrier hsg. sub assy.

※ **Spread loctite #277.**

· Tightening torque : 10.2 kgf·m (73.8 lbf·ft)

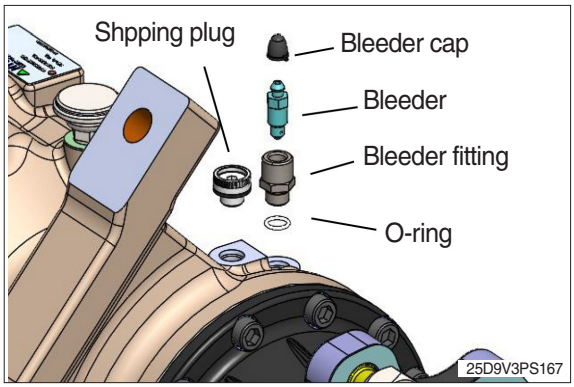


(9) Assemble oil level gauge & air breather on axle housing.



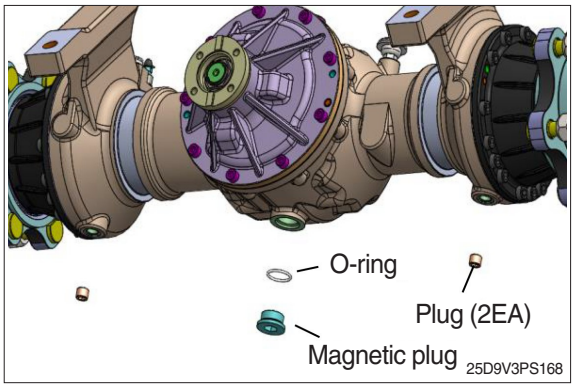
(10) Assemble o-ring, bleeder & bleeder fitting, bleeder cap.

· Tightening torque
Bleeder : 4.0 kgf·m (28.9 lbf·ft)
Bleeder fitting : 1.8 kgf·m (13.0 lbf·ft)

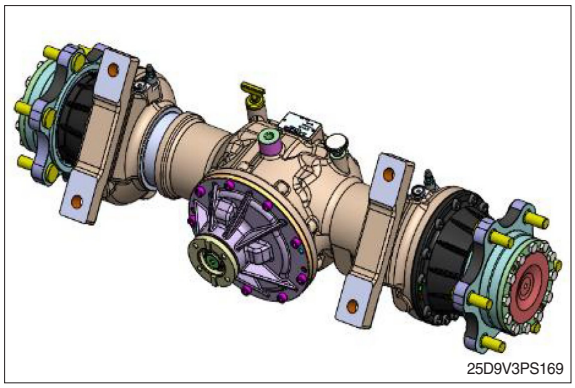


(11) Assemble o-ring, drain plug (magnetic), and plug.

· Tightening torque : 4.2 ~ 5.2 kgf·m (30.4 ~ 37.6 lbf·ft)



(12) Complete drive axle assembly.



GROUP 3 MAINTENANCE AND TROUBLESHOOTING

1. MAINTENANCE

1) TRANSMISSION

(1) Recommend oils

The property that needs for auto transmission oil.

- · It has suitable viscosity at the height temperature.
- · It has suitable fluidity at the low temperature.
- · It has excellent oxidation stability.
- · It has property which remove bubble, and property of lubricant.
- · Therefore please be sure to use following the oil when you supply or change oil. In addition, please use the same oil that you supplied already.

① Oil volume is approximately 8 liters (without torque converter).

② Suggested oil : ATF (Auto Transmission oil, Dexron type)

(2) Point of exchange oil

① Pulling out oil

a. Please take off the drain plug where under of the transmission, and then discharge the old oil.

b. Please take off the hose join part, and then discharge the old oil that remained in the oil cooler and in the hose.

※ Period of exchange oil filter : initial time 100 hr, and then every 1000 hr

② Oil supply

a. Please stop the engine (ok), then refuel the oil into transmission until 「HOT」 level of oil level gauge.

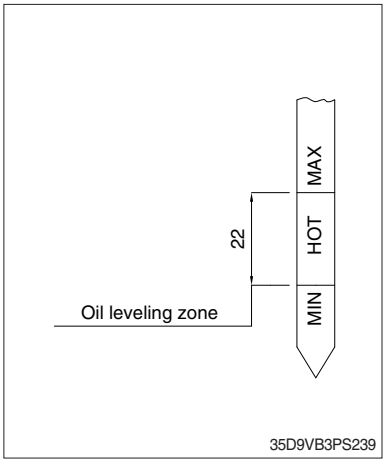
b. Please change lever "neutrality" position. Then please turn on the engine and keep low idle speed.

c. The oil reaches the hydraulic torque converter, cooler and pipe and so on, after start up the engine. Then oil level sink down.

d. Please drive the engine about 5 minutes at low idle speed, then refuel the oil gradually the oil level settle in regular position (between 「MAX」 and 「MIN」 position).

※ Please refuel the oil carefully, without get rubbish or water and so on in the oil.
Lack of oil or excess of oil becomes cause of breakdown. So please be careful.

※ Check the oil level, when the oil temperature is 50℃ ~ 60℃.
Amount of all oil : about 14 liters.



(3) Period of overaul

① As for the overhaul, we recommend either every 5 years or 7000 hours coming early to be done as a limit.

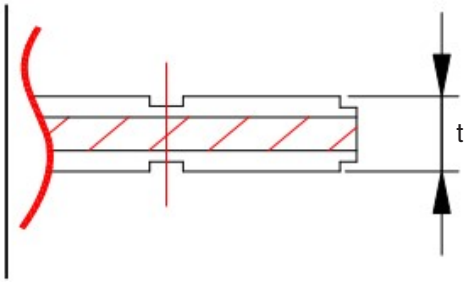
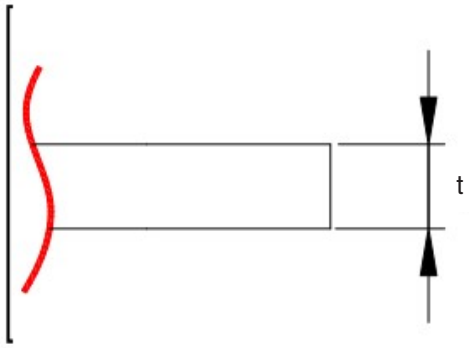
② Please change the oil seal, rubber such as o-ring, and gasket, copper gasket, if it has damaged.

③ Please check the part by your eyes which you disassembled whether they have the crack, the scar, abnormal wear and corrosion etc. If the parts have such abnormal condition, please change or repair.

④ Seal ring, snap ring, friction disc, plate → Change the part that exceeds the wear limits.

⑤ Bearing, bush → Check the bearing to see if it rotates freely. If in doubt about the wear or lack of lubrication, replace this bearing.

⑥ Gear, shaft → if it is abnormal you have to change.

	Item in the F&R clutch	Standard	Limit
Friction disk		2.4	1.9
Plate		1.8	1.65
Back plate		3	2.85

(4) Period of exchanging parts

time / Item name	Item in the F&R clutch	Standard
Oil seal	Please change all parts.	Please change all parts at every overhaul.
O-ring		
Gasket		
Copper gasket		
Oil seal ring	Please check the each part.	Please change all parts at 2nd and 4th time.
Seal ring race plane		Please change the part that exceeds the wear limit.
Sinter plate		
Stator free wheel part		Please change the part that exceeds the wear limit. Please change the abnormal leaf spring.
Sliding surfaces of oil seal		Please change the part that exceeds the wear limit.
Sliding seciton of clutch piston		
Inside diameter or bush		
Each bearing		
Spring		

(5) Standard of exchanging parts

Classfication	Contents	Object parts	Item name
A	The part that you should change the part to new one whenever overhauling and for check cleaning.	Gasket, Rubber	Gasket, O-ring, Copper gasket, Oil seal
B	The part that wear of the part is extreme comparatively, so the change time is high frequency.	Seal ring, Clutch plate	Oil seal ring, Snap ring, Friction plate&steel plate in clutch
C	The part that you do not have to change every overhauling but it is abnormally when overhauling you have to change the part.	Bearings, Race side of seal ring	Bearing, Bush, Part of free wheel, Seal race
D	The part that you usually do not have to change to new part but when if it its abnormally you have to chage.	Gear, Shaft	Each gear, Clutch shaft, Turbine shaft, Flange

(6) Test

① **Operation check**

· Please change the change lever to 「N」 position and hold this position, then please change the engine speed from low idle to high idle, and check the below condition.

· The abnormal sound dose not occur.

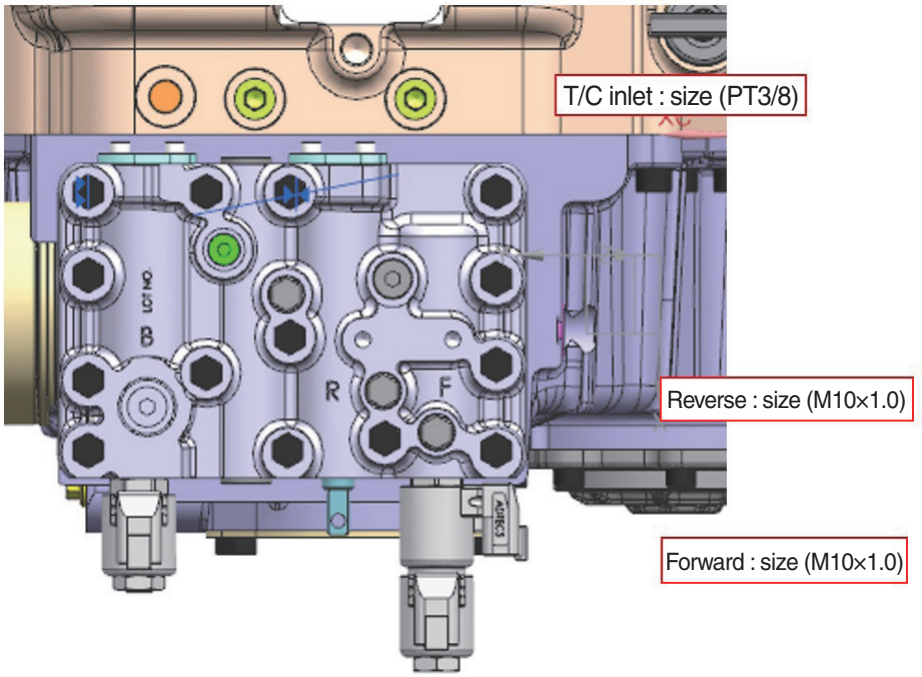
· The abnormal oscillation dose not occur.

· The oil is not leaking.

· Overheating, a strong odor of overheated oil is a major trouble sign.

② **Oil pressure measurement**

· If you measure each part pressure, remove the plug and then install the pressure gauge. (PT 3/8, M10×1.0)



25D9HDI3PS100

a. Please warming up the engine until the torque converter oil temperature becomes about 50~60˚C.

b. Please measure the oil pressure of every required part as below under the low & high idle speed of engine.

c. When if you measure the individual pressure of clutch and pressure of lubricating. Please install the pressure gauge on the hole which take out the pressure then check the pressure while up the crane.

· Measure the oil pressure of clutch and T/C inlet at the 800 ~ 2400 rpm.

Description	Standard (MPa)	
	800 rpm	2400 rpm
Main relief	1.2±0.2	1.2±0.2
Forward	1.2±0.2	1.2±0.2
Reverse		
T/C inlet	0.1 ~ 0.4	0.3 ~ 0.7

③ **Stall torque output test**

· Please pay attention to the truck starts suddenly, because the torque converter generates largest torque.

※ **When the torque converter is stall condition, heat generate suddenly inside of the torque converter. So do not drive the engine when you drive over 30 seconds and the torque converter oil temperature is over 90℃.**

a. Please use the parking brake and service brake securely.

b. Please set the lever to F or R.

c. Please step on the accelerator pedal until limit position, then check the engine speed when the engine speed become constant.

d. Standard of engine maximum speed in stall condition is around 1,800~2,000 rpm. (depends on the standard performance of engine and torque converter)

2) DRIVE AXLE

(1) General information

Drive axles generate small metal wear particles during operating, especially hard particles are allowed to circulate in the lubricant, along with external moisture. In these case the internal components can be more faster damaged and the brake can be made a noise.

(2) Magnets and magnetic drain plugs

The axle has magnetic drain plugs which has minimum 0.5 kg of capacity for picking-up low carbon steel. This drain plug must be checked if there are metal particles at every oil change interval.

(3) Breather

Breathers release the air pressure inside and help to minimize the condensation of oil.

※ **Please clean the plug if it has particles on the surface. Cover the breather when steam cleaning the housing. If the breather is not covered, water can enter the housing and contaminate the oil.**

(4) Oil level

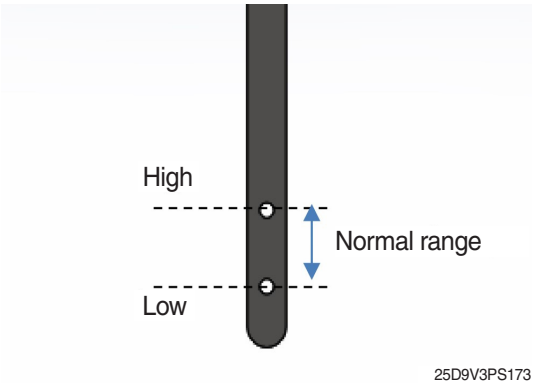
① **Check and adjust oil**

⚠ **To prevent serious eye injury, please always wear the glass for safe when you perform the truck maintenance or service.**

The part for oil filling and drain plugs are located in the axle housing.

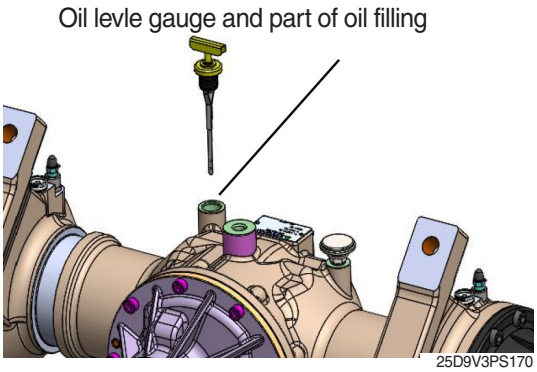
a. Park the truck on flat ground.

b. Pull out oil level gauge from axle, then check the height of oil.

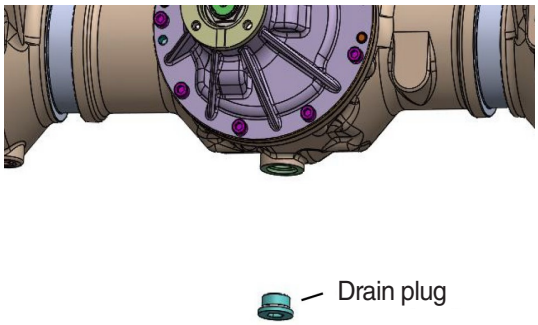


25D9V3PS173

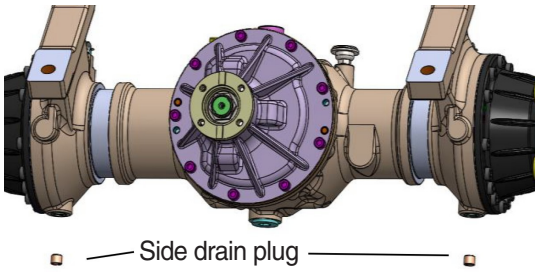
c. If the height of oil of level gauge is higher than the upper limit, drain the oil outby after loosening main drain plug , if the height of oil is lower than the lowest limit, replenish oil.



25D9V3PS170



25D9V3PS171



25D9V3PS172

② Oil change

⚠ Park the truck on flat ground. Block the wheels to prevent the truck moving during maintenance. Do not work under the truck supported only jacks for safe. Because Jacks can slip and fall over.

a. Make sure the vehicle is on level surface.

b. Raise lift of vehicle and drain oil by loosening main drain plug and 2 places of side plug.

c. After drain all oil, clean the magnetic plug.

d. Fill oil with checking the height of level with level gauge.

③ Oil volume and available of list

a. Oil volume is approximately 8.2 liters.

b. Available oil list

Manufacture name	Brand name
Mobil corporation	Mobil fluid 424
	Mobil Infilex33 85W90
Sheel oil corporation	Shell spriax S4 TXM
	Donax TD 10W30 (2009 ver.)

(5) Period of overhul

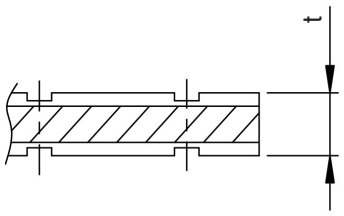
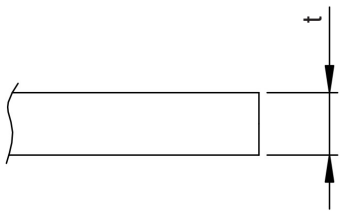
① Period of drive axle assy overhaul : Every 5 year or 7,000 hours.

② The Axle oil needs to be replaced per every 1,000 hrs, to prevent brake noise.

③ O-ring, oil seal, rubber, gasket : Change all parts at every overhaul.

※ Check internal leakage of brake system(Brake seal) : Every 2,000 hours, replace as necessary.

④ **Snap ring, disc, opposing plate : Change the part that exceeds the wear limits.**

Item		Part no.	Standard	Limit
Disc		HA30-60220 (Service brake)	t=2.5	t=2.2
Opposing plate		HA30-60200 (Service brake)	t=2.5	t=2.35

⑤ Bearing, spring : Check the release bearing the see if it rotates freely. If it has doubt for the wear or lack of lubrication, replace this bearing.

⑥ Gear, shaft : If it is abnormal you have to change.

2. TROUBLESHOOTING

1) TRANSMISSION

(1) Output does not go up

Locating fault and cause			Measures
Engine	The engine speed is abnormal.		When the gear is neutral position and torque converter is stall state, please measure the engine speed. Then if the engine speed does not become proper speed, please adjust the engine or repair it. (Please refer to page of stall test.)
Torque converter	Torque converter oil	The oil is in short supply.	Please replenish oil.
		The oil that is not regulated is used.	Please change the oil to regular oil.
		The air has mixed into oil.	Please tighten each joint coupling and the pipe further.
		The air bubble occurs because the torque converter pressure decrease.	Please check and adjust the torque converter pressure.
		The water has mixed into oil.	Please check the cooler, and change all oil.
		The oil filter is clogging.	Please wash the oil filter of change it.
	Main body of torque converter	The stator free wheel is broken.	Please change the stall revolution then if the revolution is extremely low, please change the free wheel inner race, free wheel cam and roller.
		The stator free wheel is sticking.	Please check the rise of the temperature of oil at no load. And please change the free wheel inner race, free wheel cam and roller when the temperature of oil rises abnormally.
		The wheel with blades is broken or it is touching other components.	Please check whether the aluminum powder and the like has mixed into torque converter oil. Please change the wheel with baldes if the aluminum powder and the like has mixed in.
	Charging pump	The pump dose not operates normally.	Please change the pump.
Transmission	Control valve assy	The clutch oil pressure has decreased because the spring is settling or break.	Please change the spring.
		The valve does not move with the valve opens.	Please repair or change the valve.

(2) Power is not transmitted

Locating fault and cause			Measures
Torque converter	The input plate wheel is broken.		Please change the input plate.
	The oil is in short supply.		Please replenish oil.
	The shaft and spline are worn.		Please change the shaft and the spline.
	The gear is broken.		Please change the gear.
	The charging pump does not operate normally.		Please change the charging pump.
Transmission	Torque converter oil	The oil is in short supply.	Please replenish oil.
	Clutch assembly	The clutch plate is worn and broken.	Please change the clutch plate.
		The clutch plate is sticking.	Please change the clutch plate.
		The clutch shaft spline is worn.	Please change the clutch shaft spline.
		The clutch pressure has decreased because the shaft end of the clutch and the oil seal ring of the clutch piston do not operate normally.	Please change the clutch assembly.
	Output shaft	The shaft spline is worn.	Please change the part which has worned spline.
		The gear is broken.	Please change the gear.
	Solenoid valve	The solenoid valve is broken.	Please change the solenoid.
		Spool does not operate normally.	Please change the solenoid valve.

(3) Oil temperature rises abnormally

Locating fault and cause			Measures
Torque converter	Main body of torque converter	The device of stator free wheel is broken.	Please check the stall speed, and then if the speed is out of regular valve, please change the stator assembly to new part.
		The wheel with blades are touching each other.	If the foreign material (the aluminum powder and the like) has entered in torque converter oil, please change the wheel with blades to new one.
		The bearings are worn or sticking.	Please repair the bearings or change them.
	Torque converter oil	Amount of oil is not appropriate.	Please check the oil level.
		The oil that is not regulated is used.	Please change the oil to regular oil.
		The air has mixed into oil.	Please tighten each joint coupling and the pipe further.
		The water has mixed into oil.	Please check the cooler and change the all oil.
	The piping resistance is large	The hose is bending, or it is broken.	Please repair the hose or change it.
		The oil cooler is sticking.	Please wash the oil cooler or change them.

Locating fault and cause			Measures
Transmission	The clutch is dragging	The clutch plate is sticking.	Please change the clutch plate.
		The clutch piston does not operate normally.	Please repair the clutch piston or change it.
		The pressure of clutch has decreased.	Please check the clutch pressure.
	The bearings are worn or sticking.		Please change the bearings.

(4) Clutch or converter oil pressure is too high

Locating fault and cause			Measures
Torque converter	Hose of outlet side is bending, and the hose is broken and the oil cooler is clogging.		Please repair or change the hose and oil filter, cooler
	Viscosity of oil is too high. (At cold time)		Please warm up the torque converter if the temperature of torque converter oil is below outside air temperature.
	The oil that is not regulated is used.		Please change the oil to regular oil.
Transmission	Control valve assembly	The valve does not operate normally because spring is broken or spools are sticked in the valve.	Please repair the valve assembly or change to new one.

(5) Clutch or converter oil pressure is too low

Locating fault and cause			Measures
Transmission	The oil is in short supply.		Please replenish oil.
	The oil that is not regulated is used.		Please change the oil to regular oil.
	The charging pump is worn and broken.		Please change the charging pump.
	The oil seal ring or o-ring is worn or damaged.		Please change the oil seal ring or the o-ring.
	The filter is clogging.		Please wash the oil filter or change it.
	control valve assembly	The spring is settling, and broken.	Please change the spring.
		The valve does not move with the valve opens.	Please repair the valves or change it.
		The restriction is clogging.	Please wash the restriction.
	The filter is clogging.	The end of the shaft and the seal ring of the clutch piston are damaged.	Please change the clutch piston.

(6) Noise occurs

Locating fault and cause		Measures
Torque converter	The input plate is broken.	Please change the input plate.
	The bearing is broken or bearings are worn.	Please change the bearing.
	The gear is broken.	Please change the gear.
	The wheel with blades are touching each other.	Please change the wheel with blades.
	The bolt and rivet are loosen or broken.	Please repair the bolt and rivet or change it.
	The spline is worn.	Please change the part which has worned spline.
	The pump does not operate normally.	Please change the pump.
Transmission	The clutch is sticking and dragging.	Please change the clutch.
	The bearings are sticking and worn.	Please change the bearing.
	The gear is broken.	Please change the gear.
	The spline is worn.	Please change the spline.
	The bolt is loosen or broken.	Please repair the bolt or change it.

(7) Shifting is impossible

Locating fault and cause		Measures
Transmission	The clutch plate is sticking.	Please change the clutch plate.
	The solenoid valve does not operate normally.	Please repair the solenoid valve or change it.
	The gear is broken.	Please change the gear.

2) DRIVE AXLE

(1) Noise and vibration

Locating fault and cause		Measures
Drive axle	Shortage of oil	Check oil level or refill lubricating oil.
	Inappropriate oil	Replace the oil.
	Damaged wheel bearing	Replace the wheel bearing.
	Damaged ring gear and pinion shaft	Replace the ring gear and pinion shaft.
	Loosened or worn bearing of pinion shaft	Disassemble, check or replace the bearing.
Differencial	Loosened bolt for assembling ring gear	Disassemble, check and reassemble the ring gear.
	Damaged ring gear	Replace the ring gear.
	Loosened or worn differencial bearing	Disassemble, check, reassemble or replace the differencial bearing.
	Damaged bevel gear bearing	Replace the bevel gear bearing.
	Worn or damaged diff pinion and side gear.	Replace the diff pinion and side gear.
	Worn or damaged thrust washer.	Replace the thrust washer.
	Excessive backlash of diff pinion and side gear.	Replace the diff pinion and side gear.
Brake	Incorrect axle fluid and/or friction material used	Use only meritor specified or approved materials.
		Drain and flush fluid from axle. Replace with approved fluid.
		Replace all friction discs. Throughly clean or replace stationary discs.

(2) Oil leakage

Locating fault and cause			Measures
External leakage	Excess supply of oil		Check oil level. set of oil amount.
	Inappropriate oil		Replace the oil.
	Blocking air breather		Cleaning, replace the air breather
	Damaged hub oil seal		Replace the hub oil seal.
	Worn or damaged bevel pinion shaft oil seal		Replace the oil seal.
	Loosened bleeder screw		Tighten bleeder screw.
	Losened brake inlet fitting and plugs		Tighten brake inlet fitting.
	Damaged brake inlet fitting, plug and o-ring		Replace the brake inlet fitting, plug and o-ring.
Brake	Internal leak : Fluid bypasses seals into axle and fills axle with fluid and blows out breather or empties brake fluid reservoir.	Worn or damaged piston seal	Replace the piston seals.
		Melted or extruded piston seals	Correct cause of overheating and replace seals.
		Corrosion, pitting, wear or other damage, marks scratches to piston and/or brake housing bore in area of seal/sealing lips	Clean, smooth, rework or replace affected parts.
	External leak	Loosened bleeder screw	Tighten bleeder screw to 2 ~ 2.7 kgf·m (14.5 ~ 19.6 lbf·ft).
		Loosened inlet fitting or plugs	Tighten inlet fitting to 3.4 ~ 4.8 kgf·m (24.7 ~ 34.8 lbf·ft).
		Damaged inlet fitting or plugs or damaged seats	Replace inlet fitting or plug and o-ring if used.

SECTION 4 BRAKE SYSTEM

Group 1 Structure and function 4-1
Group 2 Operational checks and troubleshooting 4-10
Group 3 Tests and adjustments 4-13

SECTION 4 BRAKE SYSTEM

GROUP 1 STRUCTURE AND FUNCTION

1. OUTLINE

There are two brake systems, the foot brake system and the parking brake system.

The foot brake adopts the brake system of oil type at drive axle.

Oil pressure is generated in maximum 60 kgf/cm^2 through brake oil input path of the left and right drive axle housing, this pressure allows the piston brake to advance and compresses a friction plate and a plate.

So when the transportation travels, it is possible to brake.

The parking brake works by the switch installed on steering column.

2. SPECIFICATION

1) DISK BRAKE

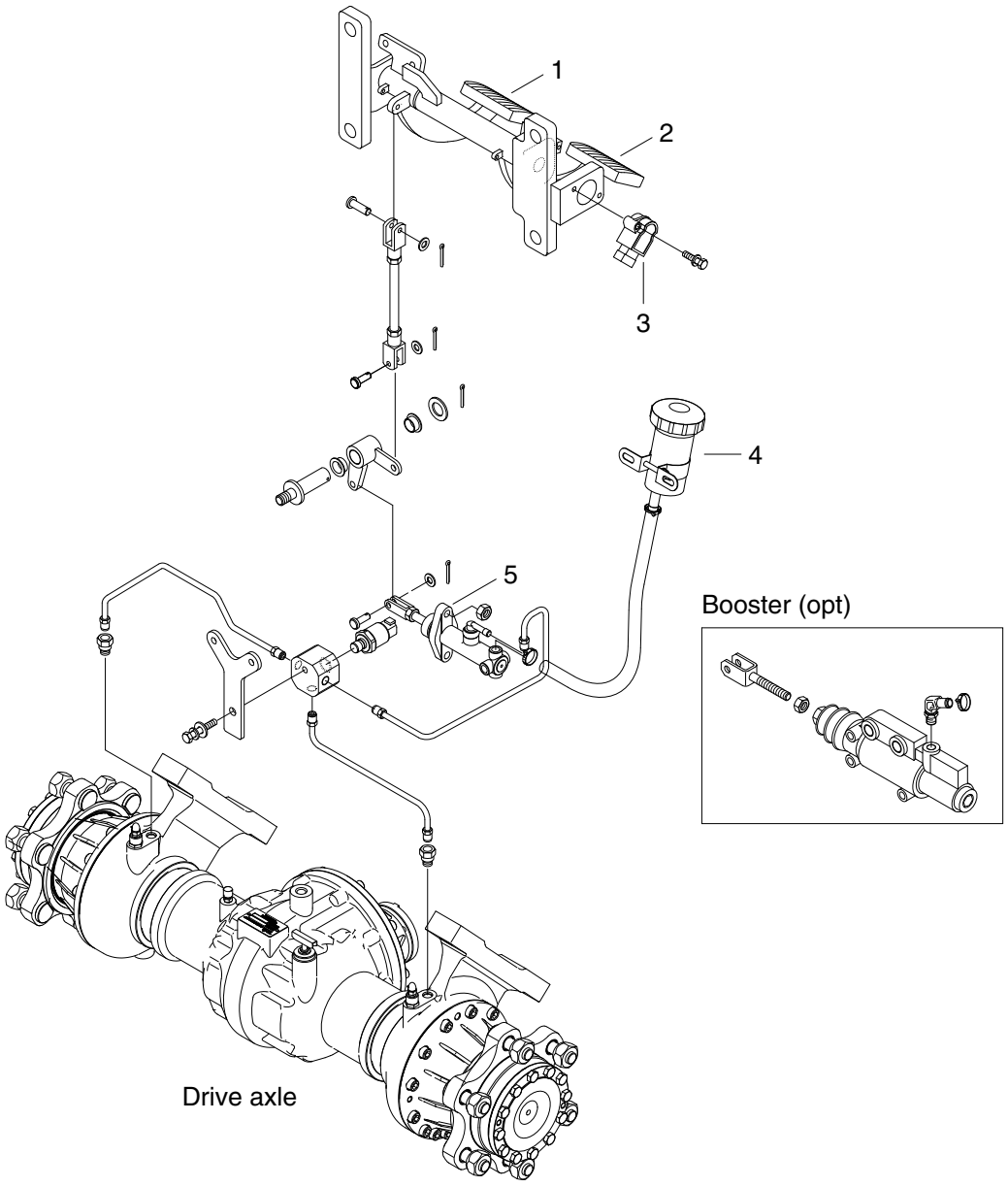
Item			Specification
Type			Wet disk brake
Piston bore diameter		Non-booster Booster (option)	33 mm (1.3 in) 22.23 mm (0.9 in)
Pedal adjustment	Height		118±2 mm (4.6±0.08 in)
	Play		2~4 mm (0.08~0.16 in)
Brake oil			Azolla ZS32 (ISO VG32 hydraulic oil)

2) PARKING BRAKE

Item	Specification
Type	Wet disk (negative brake)
Switch location	Steering column
Disc location	Transmission assembly

3. BRAKE PEDAL AND PIPING

1) STRUCTURE

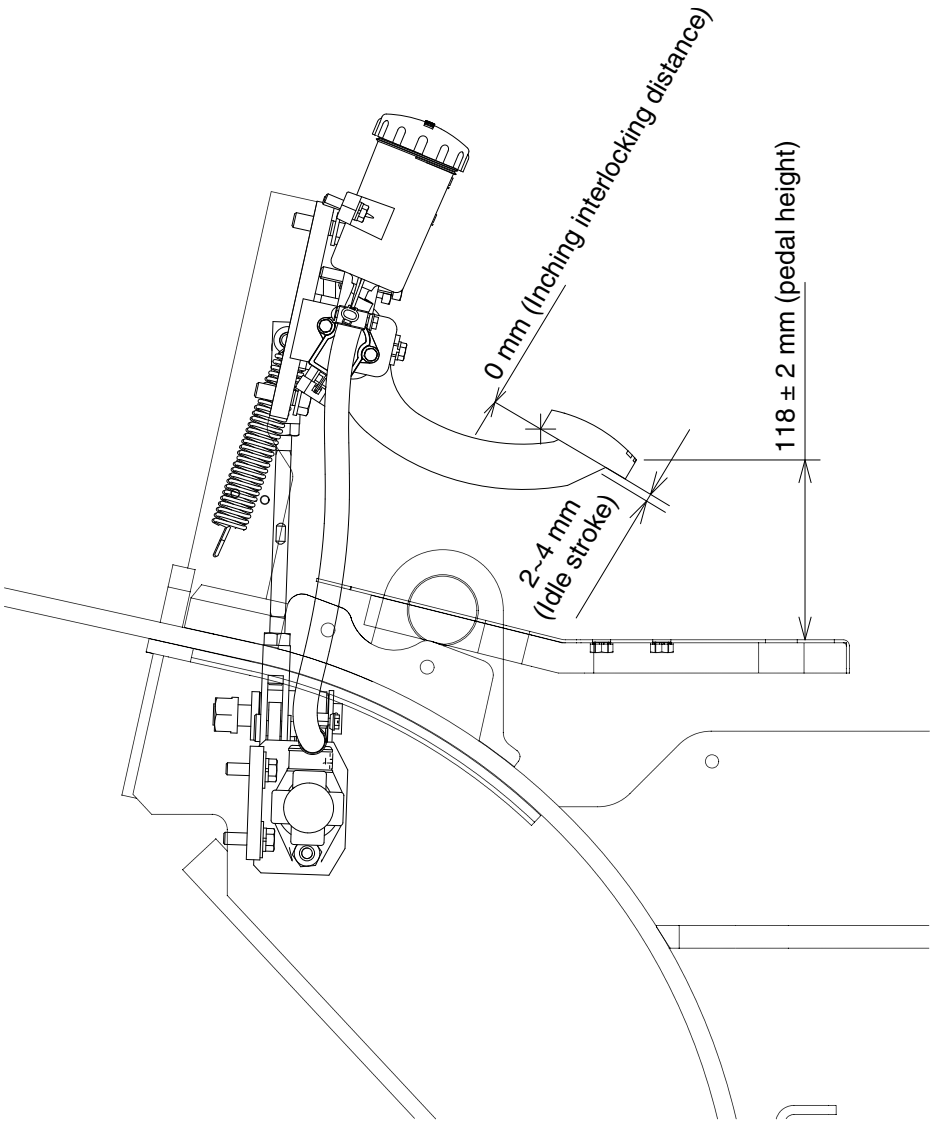


25D9V4BS01

1	Brake pedal	3	Inching sensor	5	Brake valve
2	Inching pedal	4	Reservior tank		

4. INCHING PEDAL AND LINKAGE

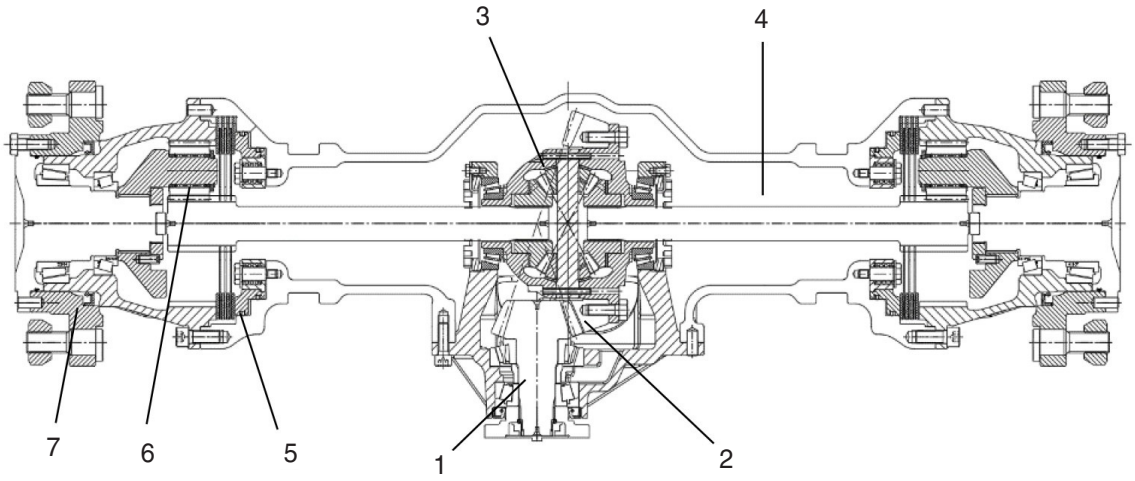
The brake pedal serves to actuate the hydraulic brakes on the drive axle. At the beginning of the inching pedal stroke, an angle of the inching sensor is changed. According to the change angle a voltage value is served to the TCU. The TCU shifts the hydraulic clutch to neutral by a voltage value and turns off the driving force. By treading the pedal further, the brake is applied.



25D9V4BS02

5. WET DISK BRAKE (SERVICE)

1) STRUCTURE

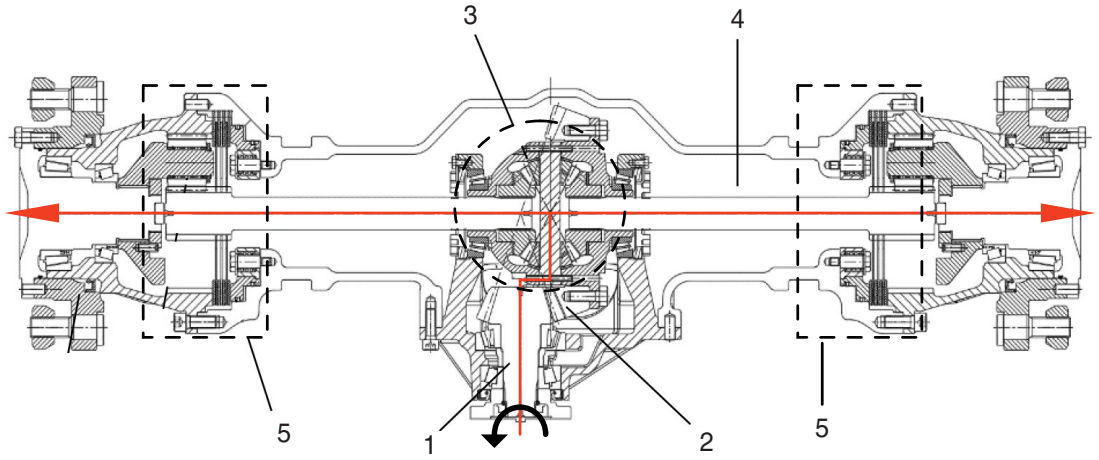


25D9V3PS102

1	Pinion shaft	4	Axle shaft	7	Hub
2	Ring gear	5	Service brake		
3	Differential device	6	Hub reduction		

2) OPERATION

The drive axle is connected with the transmission output gear by drive shaft assembly. The power transferred by the drive shaft assembly is connected to the pinion shaft of drive axle, the pinion shaft delivers the power to the differential device through the ring gear. The differential device deliver the power to hub reduction through axle shaft.

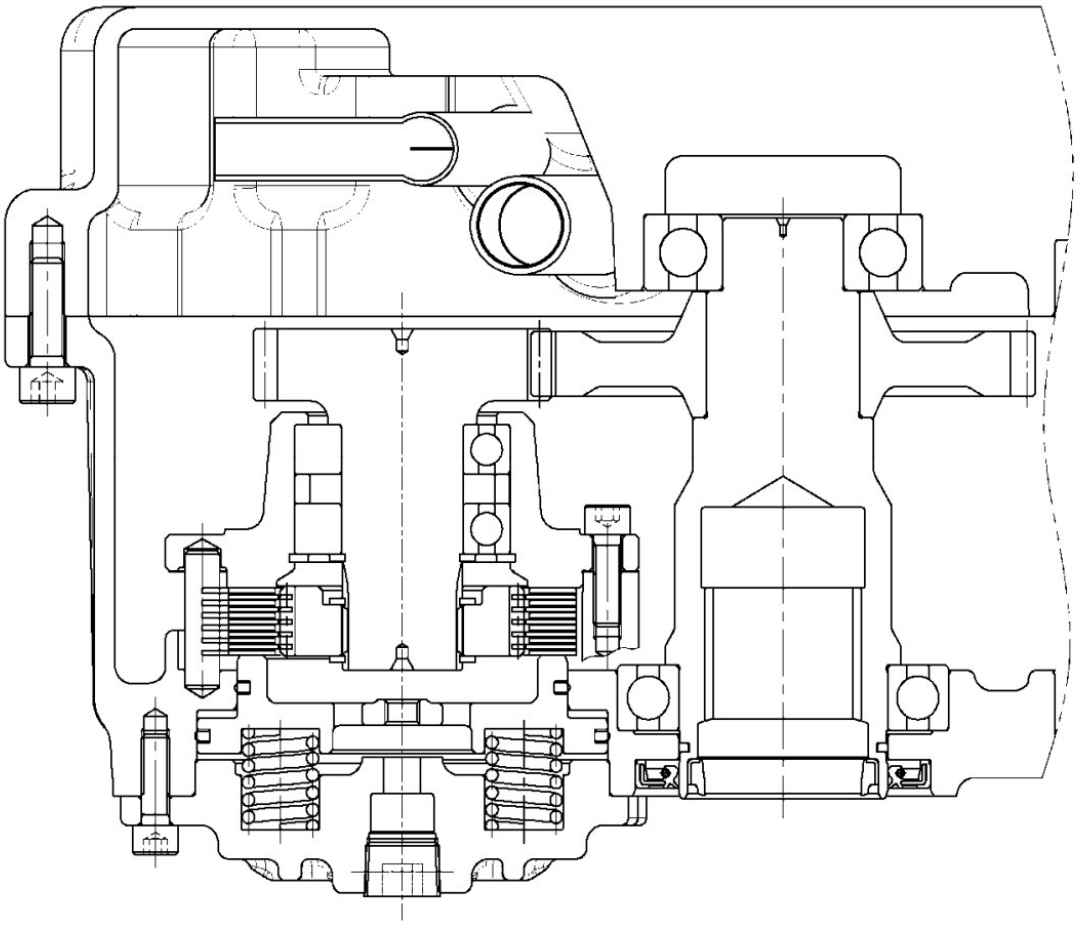


25D9V3PS103

1	Pinion shaft	3	Differential device	5	Hub reduction
2	Ring gear	4	Axle shaft	6	Service brake

6. PARKING BRAKE

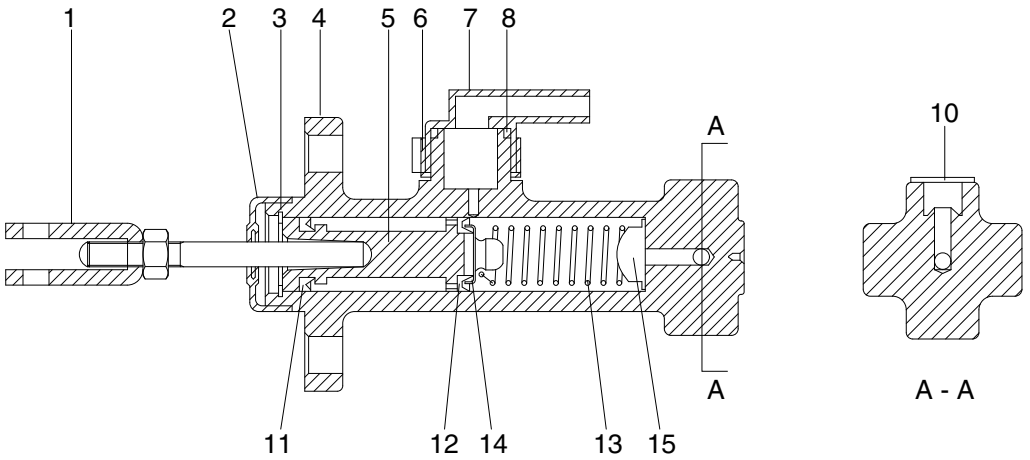
Transmission includes plates which friction braking parking brake. Parking brake, like as service brake system consists of several friction plate functions braking by sticking to each friction plate when parking brake switch is operated.



25D9V3PS13

7. BRAKE VALVE (NON-BOOSTER BRAKE)

1) STRUCTURE



22D9BS04

1	Rod assy	6	Union	13	Spring
2	Boot	7	Elbow	14	Spring seat
3	Snap ring	8	O-ring	15	Spring seat
4	Body	11	Secondary cup		
5	Piston	12	Primary cup		

2) DISASSEMBLY

(1) Remove the master cylinder boot (2) and remove the rod assy (1).

(2) Remove the snap ring (3) and take out the piston (5), the secondary cup (11), primary cup (12), spring (13) and spring seat (14, 15).

(3) Specification of master cylinder.

- Piston bore diameter : 22.23 mm (0.88")
- Piston stroke : 28 mm (1.1")
- Max operating pressure : 150 kgf/cm^2 (2130 psi)

3) INSPECTION

(1) Clean and check these components.

※ Use clean mineral oils.

(2) Inspect the inside wall of the master cylinder, and if any faults are found, replace the cylinder assembly.

(3) Replace the boot (2), the secondary cup (11), primary cup (12) and piston (5), if deformation or any other defect is found.

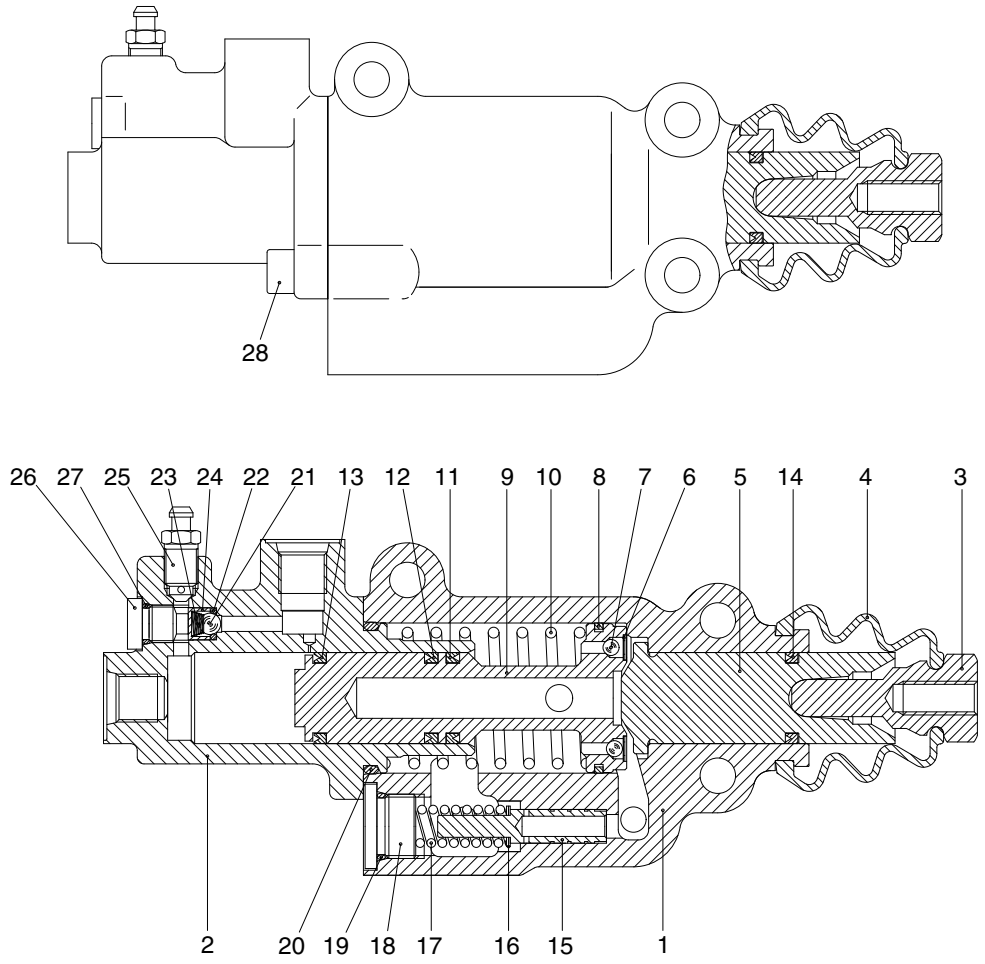
4) ASSEMBLY

※ Prior to assembly make sure again of no contaminant of the components. Apply a thin coat of brake oil to the components.

※ Assembly is in opposite order to disassembly.

8. BRAKE VALVE (BOOSTER BRAKE, OPTION)

1) STRUCTURE

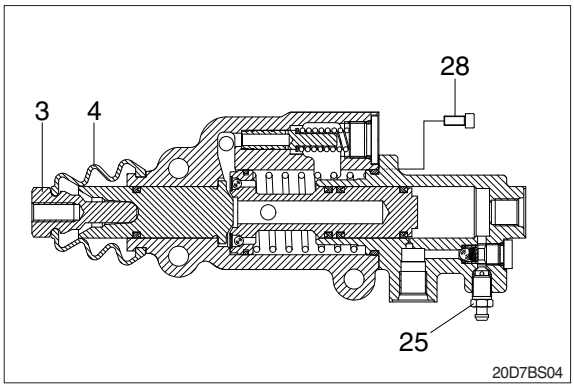


20D7BS03

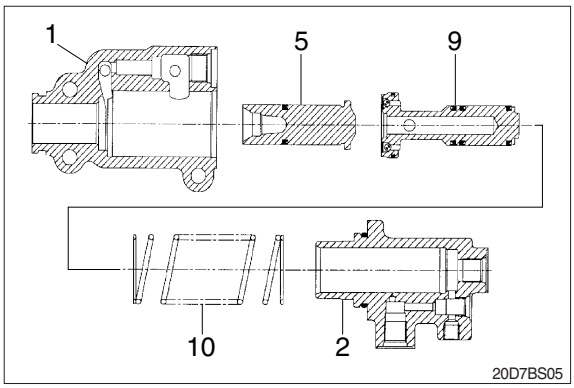
1	Front housing	11	Seal	21	Check ball
2	Rear housing	12	Seal	22	O-ring
3	Push rod	13	Seal	23	Check spring
4	Bellows	14	Seal	24	Cage
5	Master piston	15	Relief piston	25	Air bent
6	Lock washer	16	Shim	26	Check plug
7	Piston ball	17	Relief spring	27	O-ring
8	Piston ring	18	Relief plug	28	Bolt
9	Servo piston	19	O-ring		
10	Servo spring	20	O-ring		

2) DISASSEMBLY

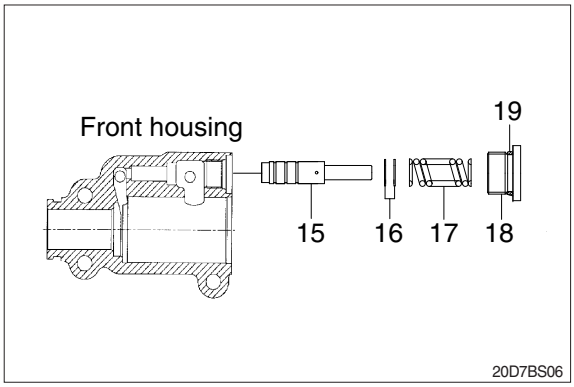
(1) Remove push rod (3), bellows (4), air vent (25) and bolt (28).



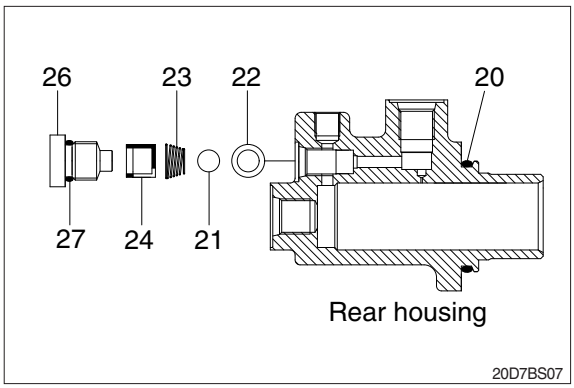
(2) Remove front housing (1), rear housing (2), servo spring (10), servo piston (9) and master piston (5).



(3) Remove relief plug (18) with O-ring (19), relief spring (17), shim (16) and relief piston (15).



(4) Remove O-ring (20), check plug (26) with O-ring (27), cage (24), check spring (23), check ball (21) and O-ring (22).



3) INSPECTION AND ASSEMBLY

(1) Clean all parts thoroughly and lubricate the parts either with mineral or with hydraulic oil, according to their use destination.

(2) All single parts are to be checked for damage and replaced, if required.

(3) Assembly is in opposite order to disassembly.

(4) Seal kit : XKAU-00176

⚠ Use only brake fluid (ZS 32, ISO VG 32) into the compensation reservoirs.

GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

1. OPERATIONAL CHECKS

1) BRAKE PIPING

(1) Check pipes, hoses and joints for damage, oil leakage or interference.

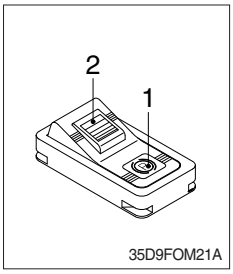
(2) Operate brake pedal and check operating force when pedal in depressed. Check also change in operating force, and change in position of pedal when pedal is kept depressed.

2) PARKING BRAKE

(1) Position 1
Parking brake is applied and front wheel is locked.

(2) Position 2
Parking brake is released.

※ **Before moving the truck be sure the parking brake is released.**



35D9FOM21A

2. TROUBLESHOOTING

1) BRAKE SYSTEM

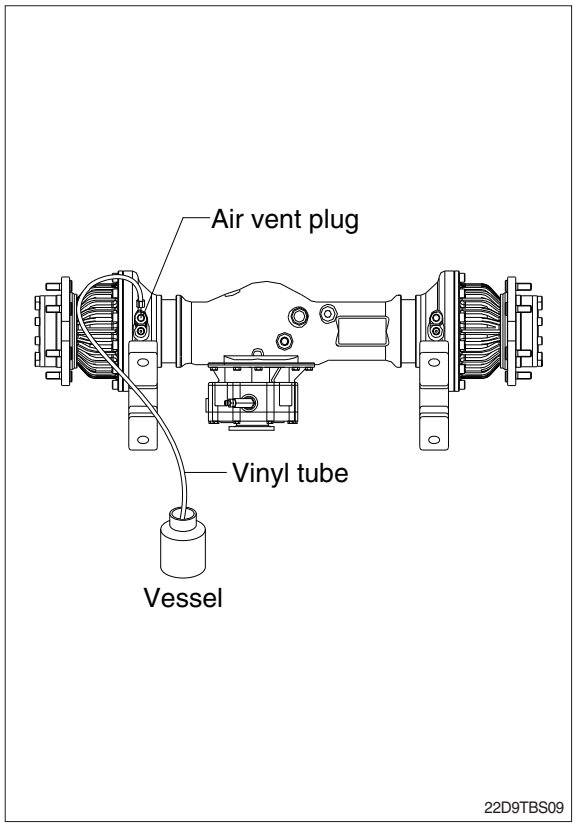
Problem	Cause	Remedy
1. Insufficient braking force	· Hydraulic system leaks oil. · Hydraulic system leaks air. · Disk worn. · Brake valve malfunctioning. · Hydraulic system clogged.	· Repair and add oil. · Bleed air. · Replace. · Repair or replace. · Clean.
2. Brake acting unevenly. (Machine is turned to one side during braking.)	· Tires unequally inflated. · Brake out of adjustment. · Disk surface roughened. · Wheel bearing out of adjustment. · Hydraulic system clogged.	· Adjust tire pressure. · Adjust. · Repair by polishing or replace. · Adjust or replace. · Clean.
3. Brake trailing.	· Pedal has no play. · Piston cup faulty. · Brake valve return port clogged. · Hydraulic system clogged. · Wheel bearing out of adjustment.	· Adjust. · Replace. · Clean. · Clean. · Adjust or replace.
4. Brake chirps	· Brake trailing. · Piston fails to return. · Disk worn. · Disk surface roughened.	· See above. · Replace. · Replace. · Repair by polishing or replace.
5. Brake squeaks	· Disk surface roughened. · Disk worn. · Excessively large friction between disk plate.	· Repair by polishing or replace. · Replace. · Clean and apply brake grease.
6. Large pedal stroke	· Brake out of adjustment. · Hydraulic line sucking air. · Oil leaks from hydraulic line, or lack of oil. · Disk worn.	· Adjust. · Bleed air. · Check and repair or add oil. · Replace.
7. Pedal dragging.	· Twisted push rod caused by improperly fitted brake valve. · Brake valve seal faulty.	· Adjust. · Replace.

2) BRAKE SYSTEM OF THE DRIVE AXLE

Trouble symptom	Probable cause	Remedy
1. Inoperation of brake		
1) Service brake	· Non-inject or lack of brake oil	· Check oil level, set correct oil volume
	· Damage of brake seal	· Replace piston seal.
	· Wrong assemble brake seal	· After disassembly and adjust or replace part
	· Detect of slide on seal (Axle housing, pistion)	· Replace related part
	· Mix particle of slide on seal	· Wash slide part or replace piston seal
	· Damage of friction plate and plate	· After disassembly and adjust or replace part
	· Defect of material (or oil line)	· After disassembly and replace the part
2) Parking brake	· Damage of parking spring	· After disassembly and replace the part
	· Wrong assembly of parkgin spring	· After disassembly and adjust or replace part
	· Damage of friction plate and plate	· After disassembly and adjust or replace part
2. Impossible release of brake		
1) Service brake	· Failure of return at service brake piston	· After disassembly and adjust or replace part
	· Damage of friction plate and plate	· After disassembly and adjust or replace part
2) Leakage of parking brake	· Damage of brake seal	· After disassembly and replace the part
	· Wrong assemble brake seal	· After disassembly and adjust or replace part
	· Detect of slide on seal (Axle housing, Pistion)	· Replace related part
	· Mix particle of slide on seal	· Wash slide part or replace piston seal
	· Defect of material (or oil line)	· After disassembly and replace the part
3. Deterioration of brake	· Inadequate actuation fluid supply to brake	· Supply standard oil, replace seal of brake system
	· Inadequate pressure to apply brakes	· Check or replace of brake seal and brake oil line
	· Worn or damaged discs	· After disassembly and adjust or replace part
	· Air enter into brake system	· Remove air by air breather
	· Deform parking spring	· After disassembly and replace the part

1. AIR BLEEDING OF BRAKE SYSTEM

1) Air bleeding should be performed by two persons :
   One rides on truck for depressing and releasing brake pedal : the other person is on the ground and removes cap from air vent plug on wheel cylinder.
2) Block the front wheel securely and apply parking brake.
3) Start the engine.
4) Attach a vinyl tube to air vent plug and immerse other end of tube into a vessel filled with hydraulic oil.
5) Loosen air vent plug by turning it 3/4 with a wrench. Depress brake pedal to drain oil mixed with air bubbles from plug hole.
6) Depress brake pedal until no air bubbles come out of air vent plug hole.
7) After completion of air bleeding, securely tighten air vent plug. Install cap on plug.



2. ADJUSTMENT OF PEDAL

1) BRAKE PEDAL

(1) Pedal height from floor plate

Adjust with stopper bolt.

· Pedal height : 118±2 mm (4.6±0.08 in)

(2) Idle stroke

Adjust with rod of master cylinder

· Play : 2~4 mm (0.08~0.16 in)

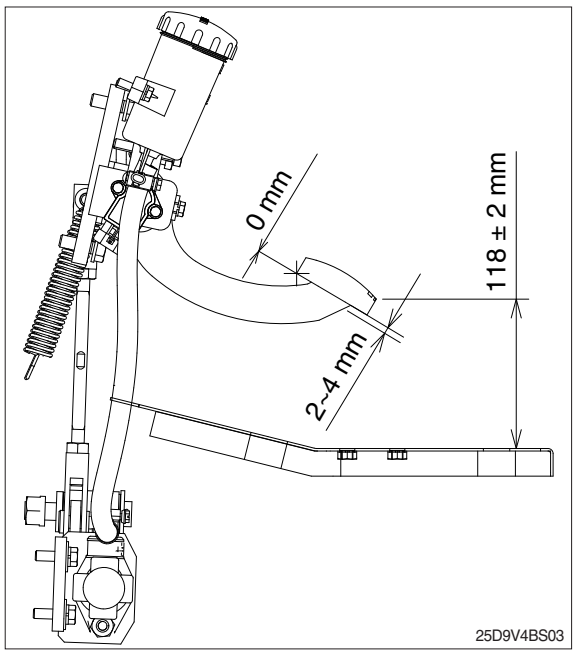
2) INCHING PEDAL

(1) Pedal height from floor plate

Adjust with stopper bolt.

· Pedal height : 118±2 mm (4.6±0.08 in)

(2) Adjust bolt so that brake pedal interconnects with inching pedal at inching pedal stroke 0 mm.

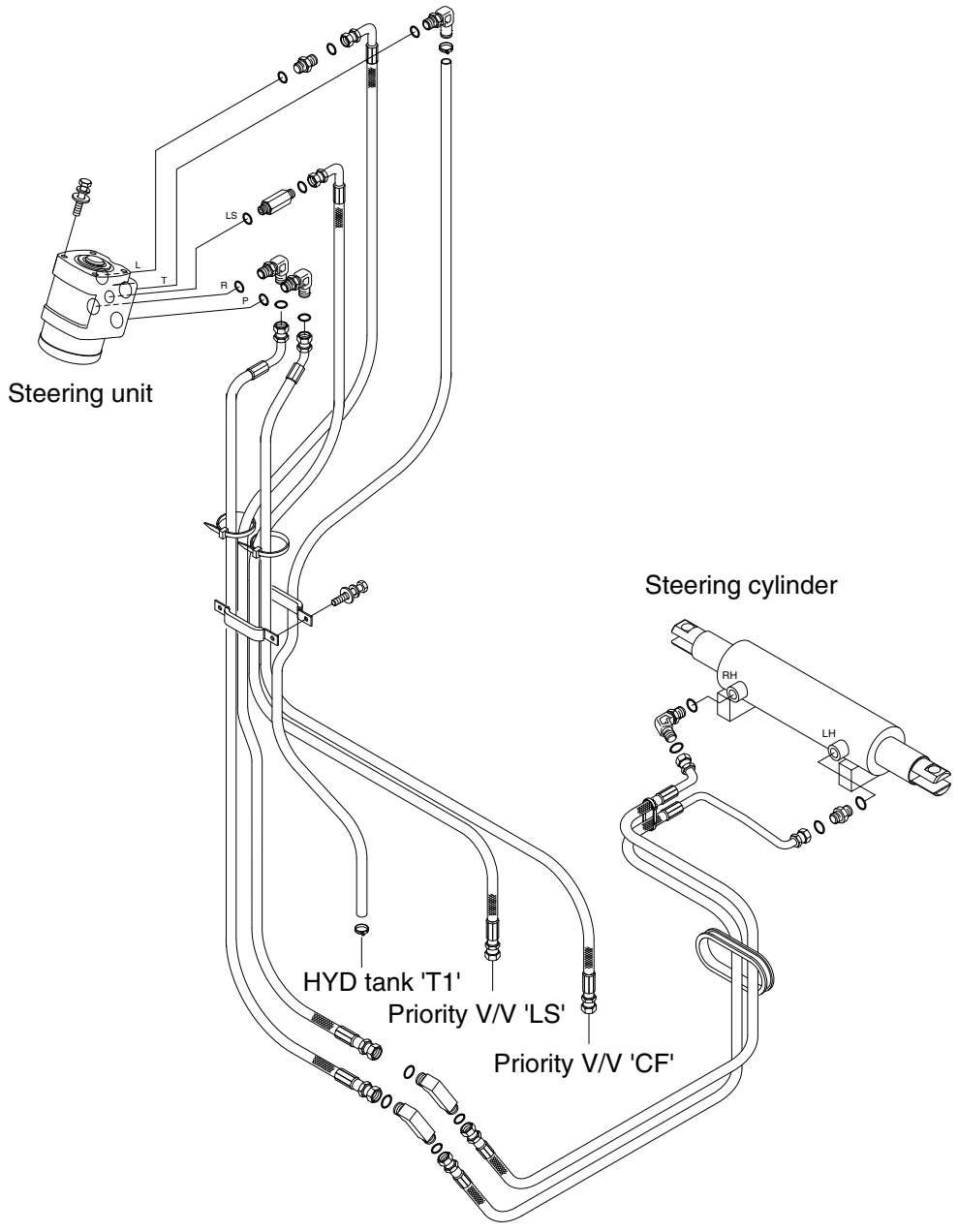


SECTION 5 STEERING SYSTEM

Group 1 Structure and function 5-1
Group 2 Operational checks and troubleshooting 5-13
Group 3 Disassembly and assembly 5-16

GROUP 1 STRUCTURE AND FUNCTION

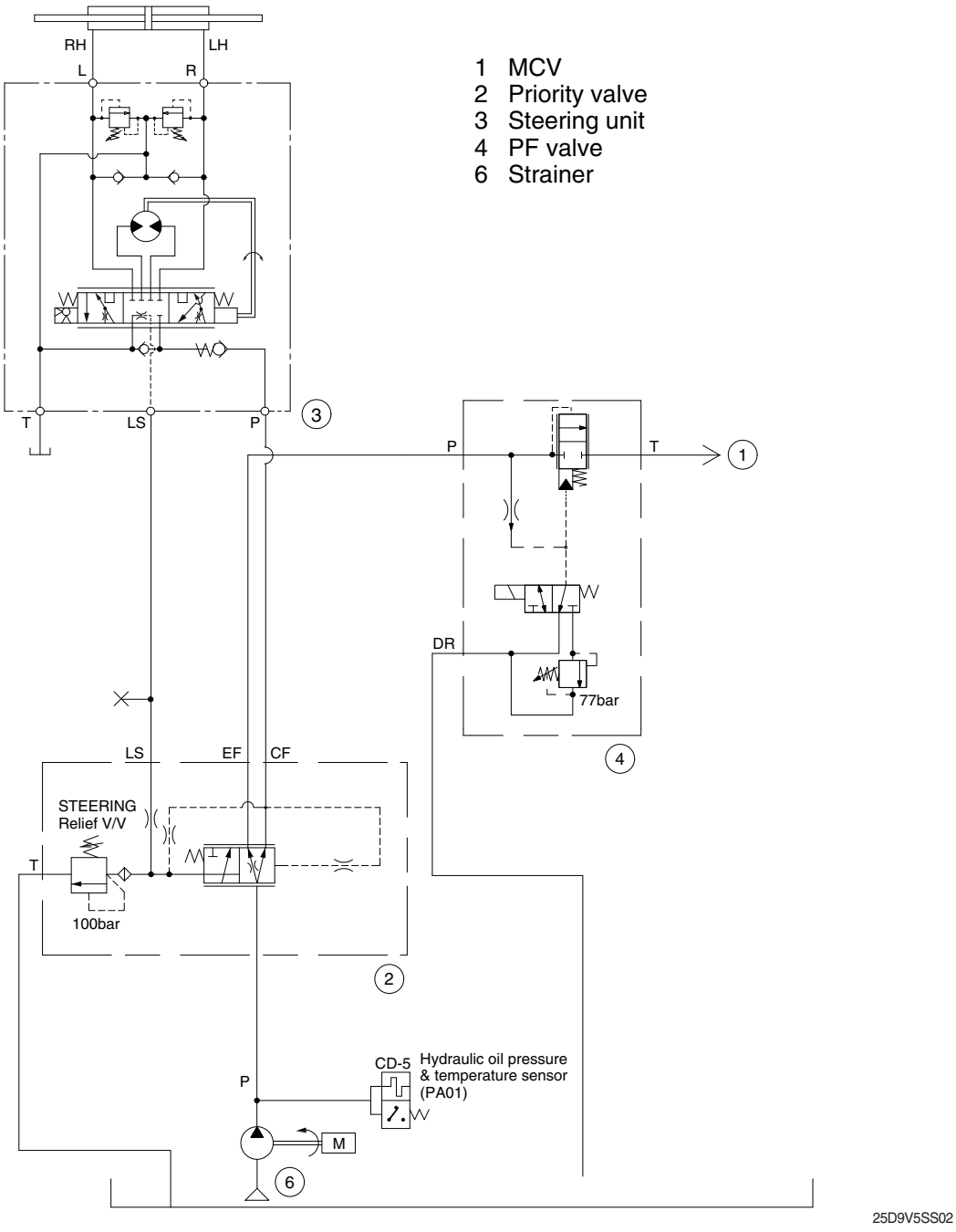
1. OUTLINE



The steering system for this truck is composed of pump, steering wheel assembly, steering unit, priority valve (or dual flow divider), steering cylinders, steering axle and piping. The steering axle supports the forklift weight with the rear axle, contains a cylinder and controls the position of the rear tires. The steering axle body is unit structure having steering knuckles installed to its both ends by means of king pins. Hub and wheel are mounted through bearing to spindle of knuckle. When the steering wheel is turned, the rotation torque is transmitted to the steering unit, and the hydraulic oil in the steering unit is transmitted to the steering axle hydraulic cylinder through the hose, so that the forklift moves left and right. The force produced by the steering cylinders moves the knuckle of rear tires through the intermediate link. Refer to the illustration for the location of the steering system components.

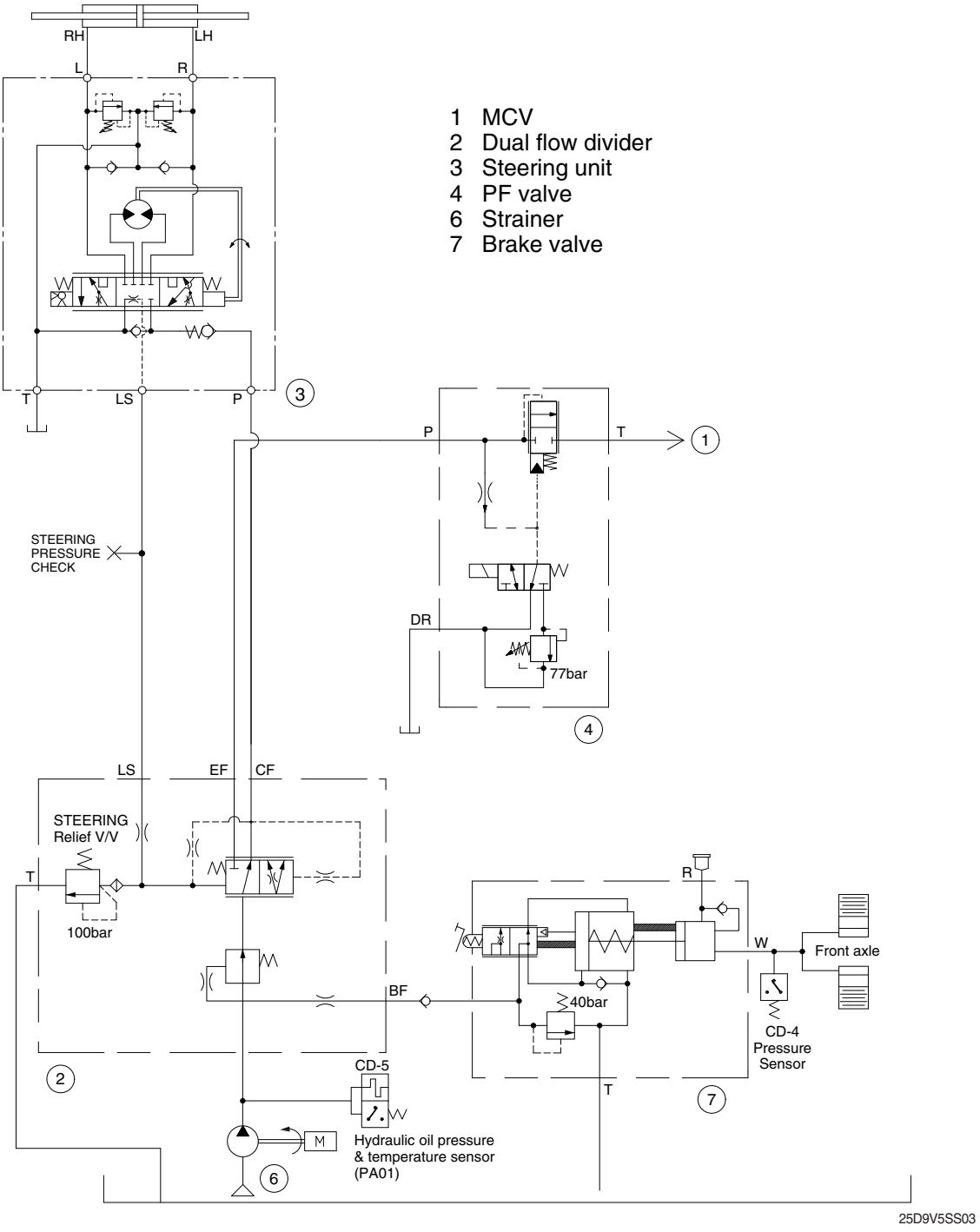
2. HYDRAULIC CIRCUIT

· NON-BOOSTER TYPE BRAKE



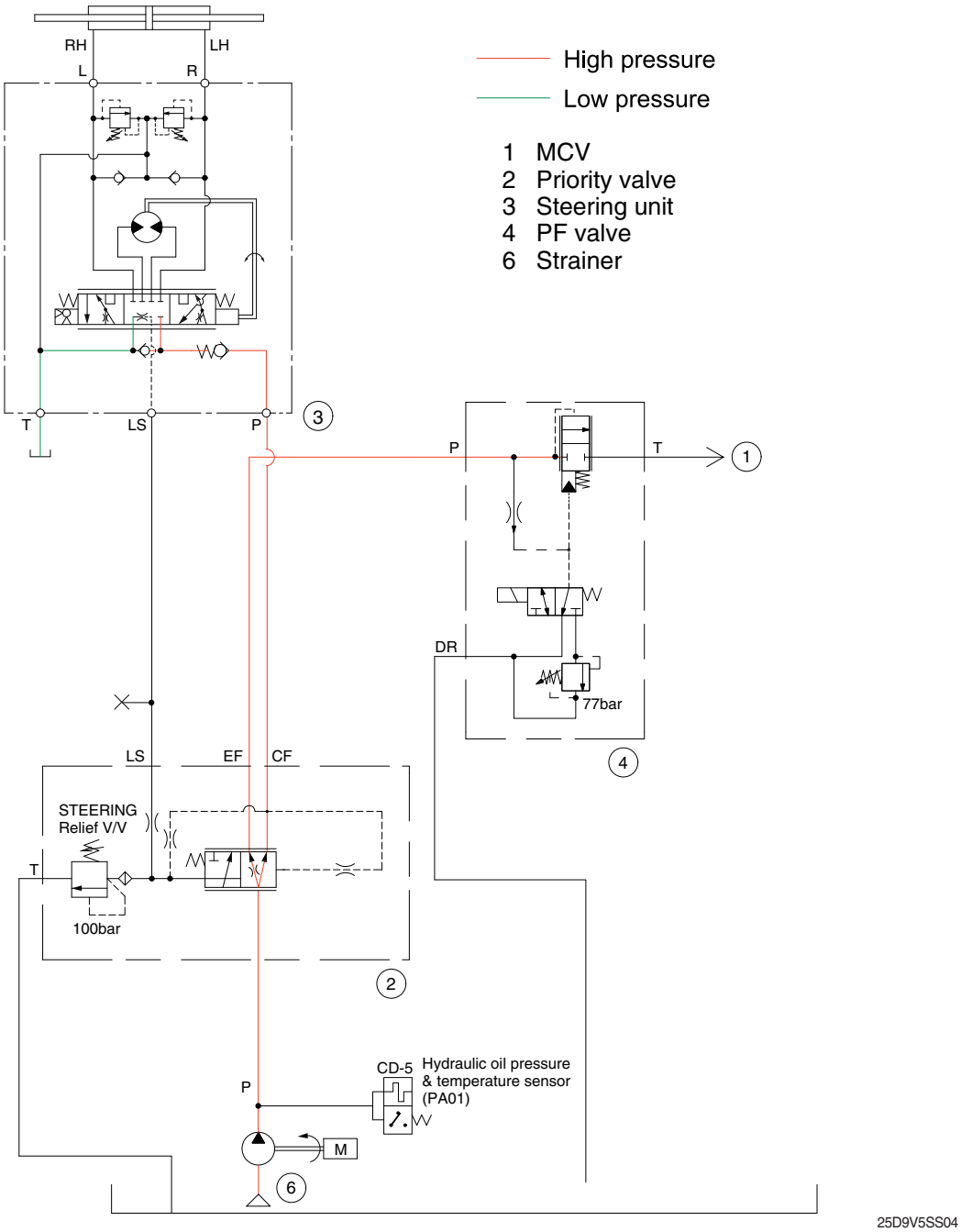
The hydraulic oil discharged from the pump flows to the priority valve (2). When the driver operates the steering wheel, the steering unit (3) is supplied with pressure oil preferentially by the priority valve operation circuit. The oil passages in the steering unit are changed over to direct the hydraulic pressure from the priority valve to the steering cylinder, which extends or contracts depending on the hydraulic pressure, thereby steering the truck. The excess flow of the pump generated at this time flows to the MCV and the tank through the priority valve EF flow path.

· BOOSTER TYPE BRAKE (OPTION)



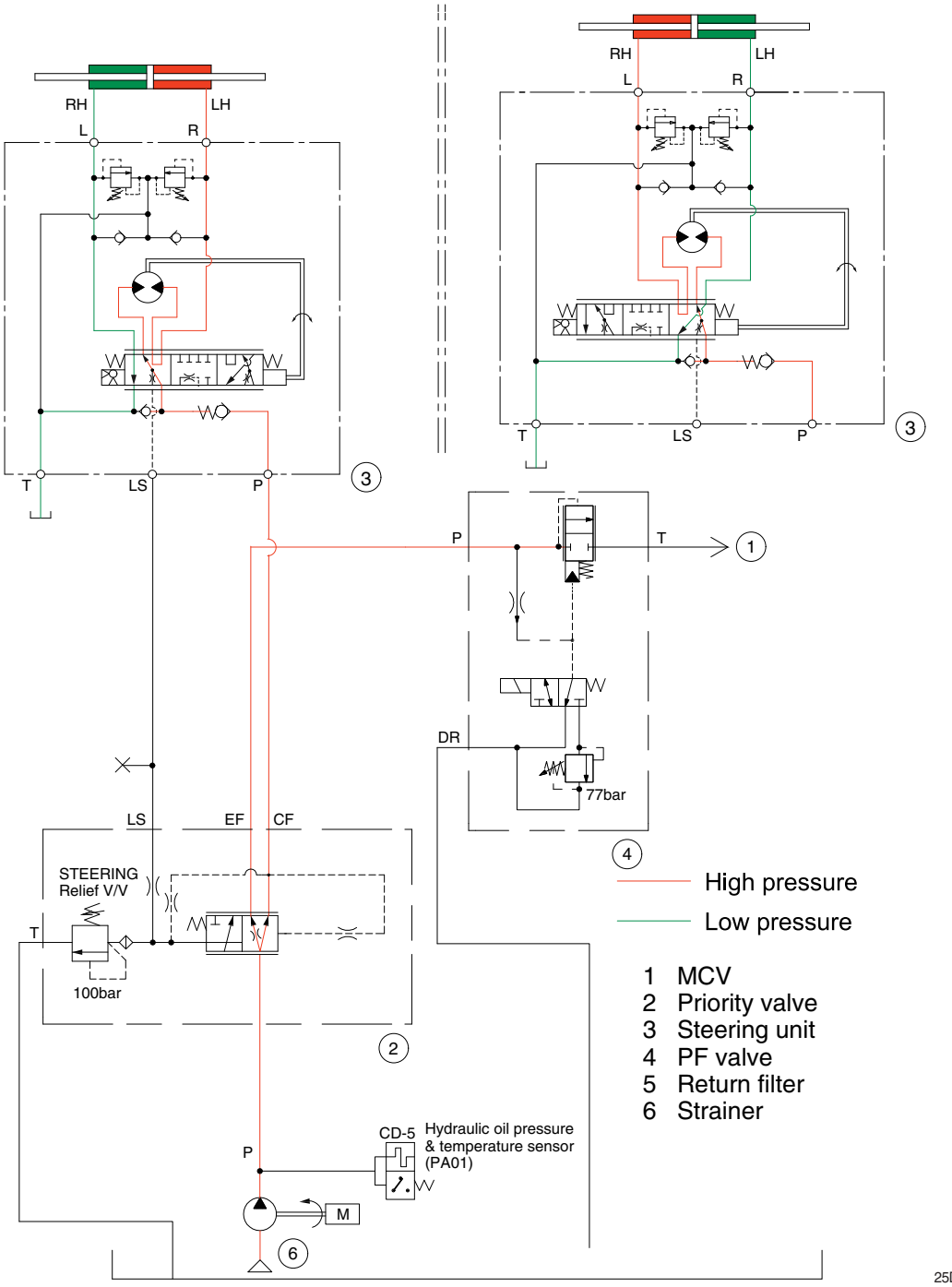
The hydraulic oil discharged from the pump flows to the dual flow divider (2). When the driver operates the steering wheel, the steering unit (3) is supplied with pressure oil preferentially by the dual flow divider operation circuit. The oil passages in the steering unit are changed over to direct the hydraulic pressure from the dual flow divider to the steering cylinder, which extends or contracts depending on the hydraulic pressure, thereby steering the truck. The excess flow of the pump generated at this time flows to the MCV and the tank through the dual flow divider EF flow path.

1) NEUTRAL



When the engine is running and the steering wheel is not being turned, the steering unit spool and sleeve set are aligned (neutral position). Oil flow through the valve is blocked from entering the left or right steering ports. The pressure on the pilot side of the priority valve spool controls the spool to move in the opposite direction (spring direction). This movement causes the pump discharge flow to flow to the MCV through the EF passage. In this neutral position, a small amount of oil is constantly bled through the dynamic orifice. The oil then flows into the LS hose piping and returns to the tank through the steering unit spool and sleeve set. This dynamic flow prevents initial hard spot when steering is turned rapidly or abruptly.

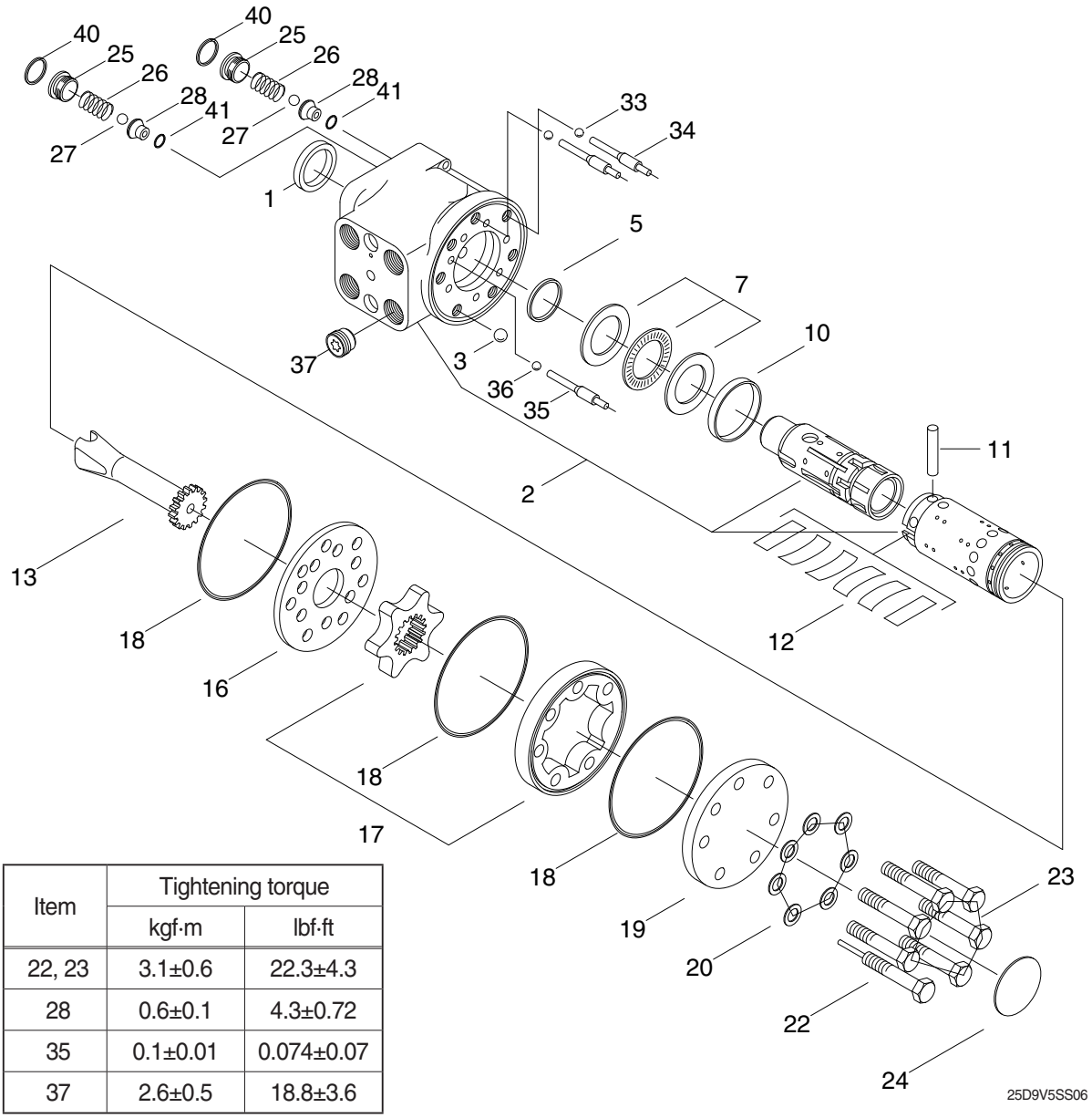
2) LEFT OR RIGHT TURN



When the engine is running and the steering wheel is being turned, the steering unit spool and sleeve set rotates. The passage opens to allow oil to flow into the internal gerotor gear of the steering unit. The oil flow causes the gerotor pump to rotate. Oil flows back into the steering valve spool and sleeve set and out to the left or right steering ports depending on the direction of steering wheel rotation. At the same time, the LS circuit blocks the return to the hydraulic tank and is connected to the CF port to sense the pressure required to turn the steering wheel. As the required pressure increases or decreases in the LS circuit, the priority valve spool moves to meet the flow and pressure required to rotate the tire. When the steering cylinder reaches the end of the stroke, a relief valve in the steering circuit releases LS pressure into the hydraulic tank. The priority valve spool moves and directs the pump flow through the EF passage to the MCV.

3. STEERING UNIT

1) STRUCTURE

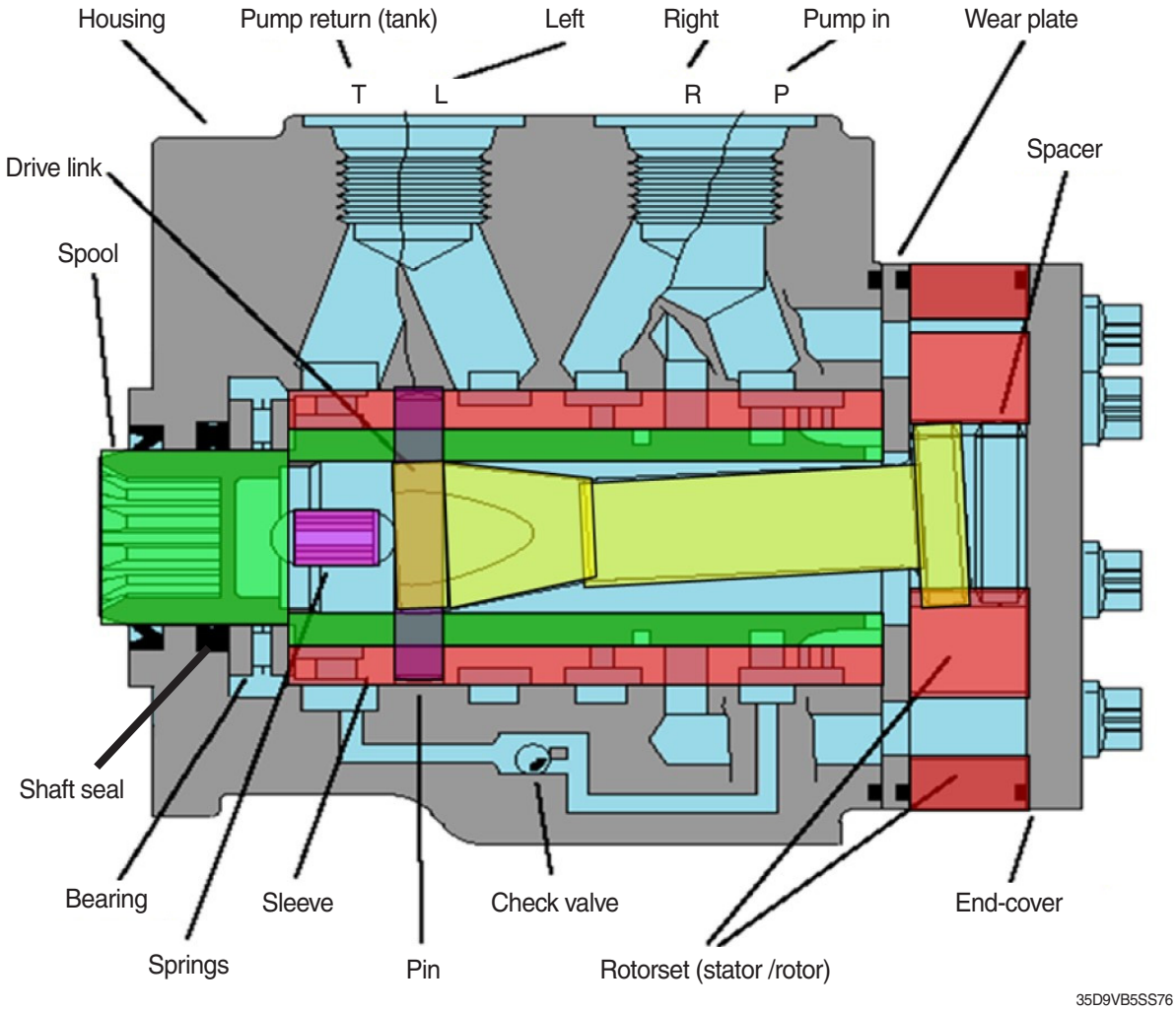


Item	Tightening torque	
	kgf·m	lbf·ft
22, 23	3.1±0.6	22.3±4.3
28	0.6±0.1	4.3±0.72
35	0.1±0.01	0.074±0.07
37	2.6±0.5	18.8±3.6

1	Dust seal ring	18	O-ring	31	Spring
2	Housing and spool/sleeve	19	End over	32	Piston
3	Ball	20	Washer	33	Ball
5	Shaft seal	22	Pin bolt screw	34	Bushing
7	Bearing assembly	23	Screw	35	Ball
10	Ring	24	Model / Code label	36	Ball
11	Cross pin	25	Adjusting screw	37	Check valve
12	Set of springs	26	Spring	40	O-ring
13	Cardan shaft	27	Ball	41	O-ring
16	Distributor plate	28	Seat	42	Plug
17	Gearwheel set	30	Adjusting screw		

※ Seal kit (EA) : 1 (1), 5 (1), 18 (3), 20 (7), 40 (2), 41 (2)

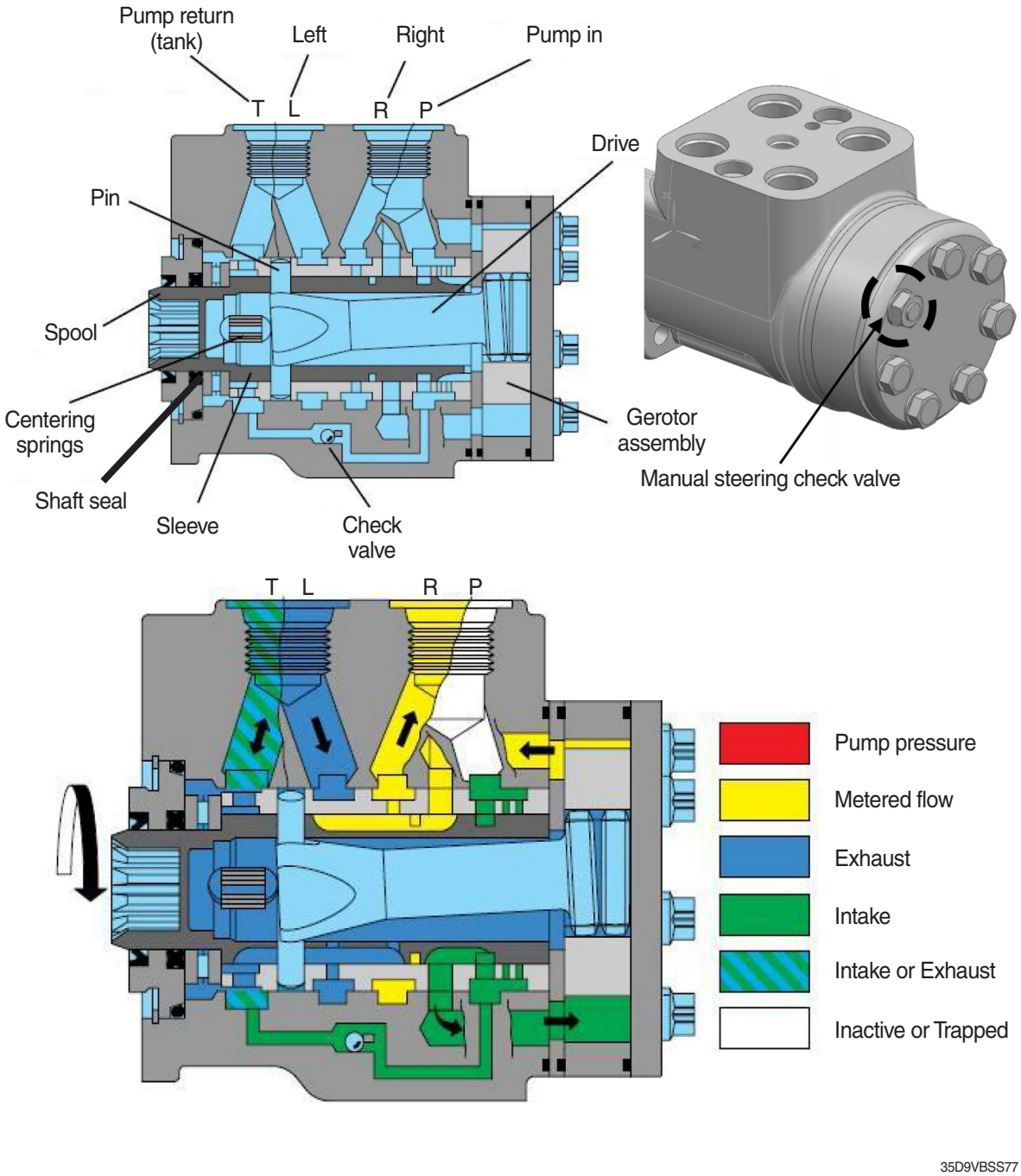
2) OPERATION



The steering unit is a closed center circuit and consists of a rotary valve (spool + sleeve set) and a metering gear set. With a LS (load sensing) dynamic circuit, even when the viscosity of the oil is low in winter, it operates smoothly without jamming the steering wheel and reduces the impact of the steering wheel due to rapid rotation or kickback of the tire. The LS circuit in the valve is used to control the operation of the priority valve spool. Steering relief valve oil flows through an internal flow path to the tank return line. The relief valve is set lower than the AUX relief valve set pressure in the MCV.

- Manual steering check valve : converts unit to hand operated pump for limited manual steering.
- Inlet check valve (P port) : Prevents oil from returning through the steering unit when pressure on the cylinder side is greater than pressure on the inlet side to prevent steering wheel kick.
- LS relief valve : Limits maximum pressure in the steering circuit.
- Anti-cavitation valve for cylinder ports : (R & L) protects steering circuit against vacuum (cavitation) conditions.
- Shock valve for cylinder ports : (R & L) protects hoses against pressure surge created by ground forces on the steering axle.

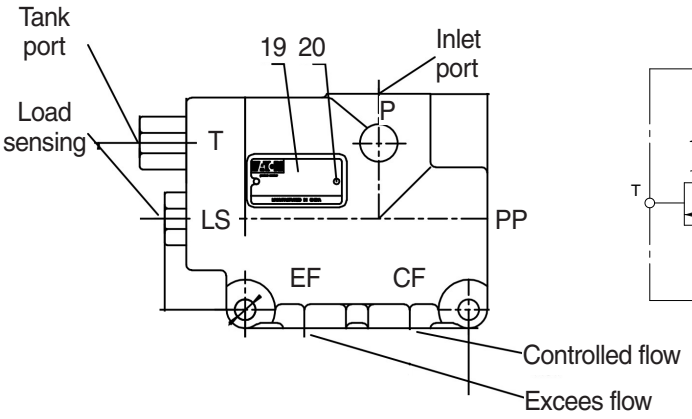
3) MANUAL STEERING (EMERGENCY)

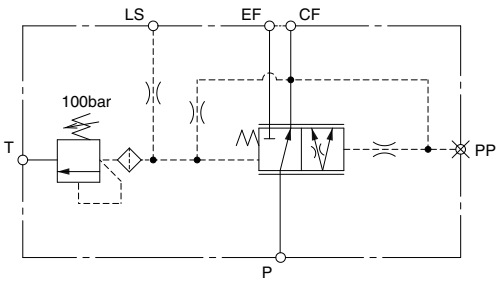


35D9VBSS77

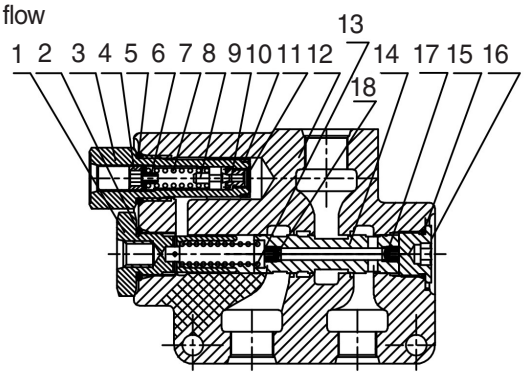
When the engine is not running and the steering wheel is being turned, the priority divider valve spool is pushed against the end stop by spring force. In this position, oil flow opens to the spool and sleeve set and the EF port closes. As the steering wheel turns, a vacuum is created in the supply line between the priority valve and the steering unit spool and sleeve set. As the spool and sleeve set rotates, a passage opens to allow oil to flow to the inner gerotor gear set of the steering unit. Oil trapped in the steering port passes through the manual steering check valve and feeds through the gerotor gear to the opposite side of the steering cylinder, enabling manual steering.

4. PRIORITY VALVE





Item/Port	Port size	Tightening torque	
		kgf·m (±0.5)	lbf·ft (±3.7)
1 (LS) 3 (T) 16 (PP)	-	5.1	36.9
LS, T	7/16-20UNF	2.5	18
CF	3/4-16 UNF	6	43.4
EF, P	1-1/16-12 UN	9.5	68.7



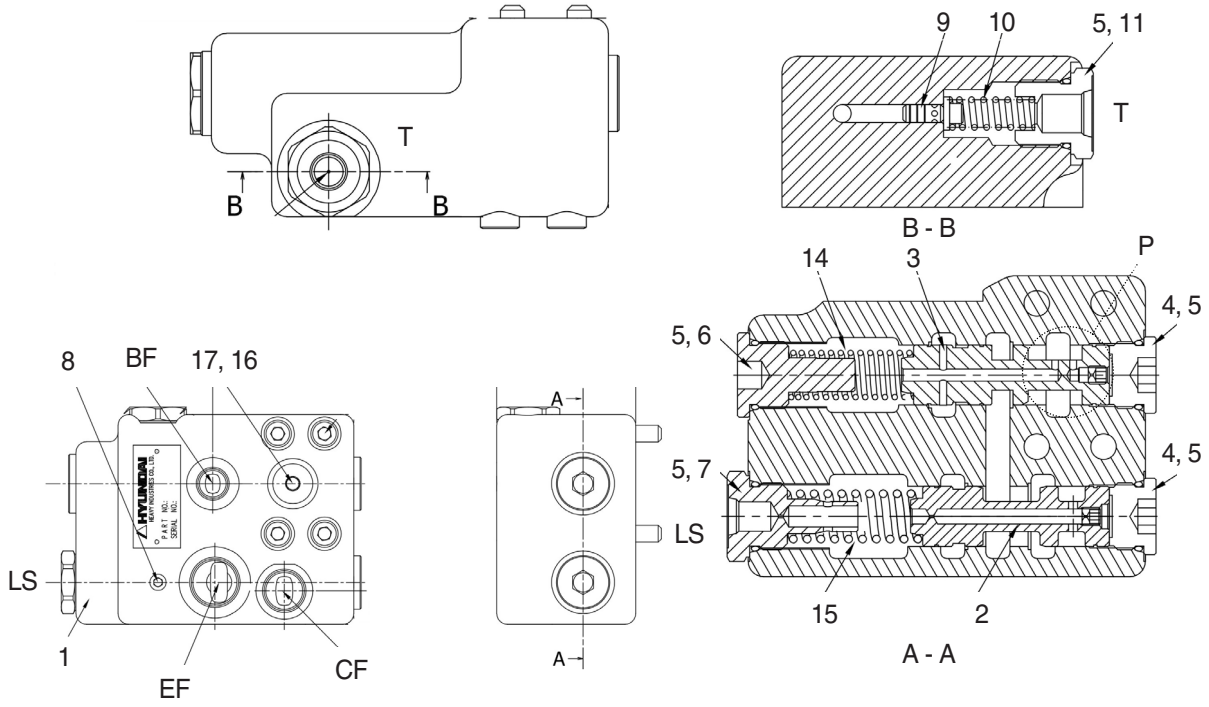
25D9VSS13

1	Plug	8	Seat-valve	15	O-ring
2	O-ring	9	Poppet	16	Plug
3	Plug	10	Sleeve	17	Orifice
4	Screw-seat	11	Filter	18	Orifice
5	O-ring	12	Housing	19	Name plate
6	Seat-spring	13	Spring	20	Rivet
7	Spring	14	Spool		

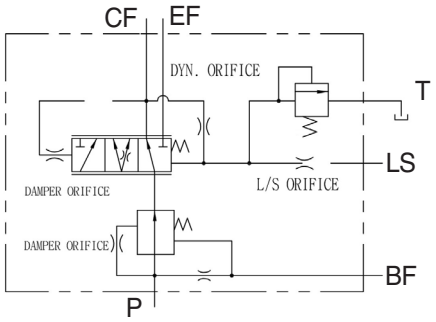
※ Relief valve kit : 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

The priority valve is located on the top of the pump and is influenced by the LS signal from the steering unit to ensure that the steering circuit receives sufficient feed. This valve always keeps the steering force and speed constant against changes in the pump discharge flow rate, and gives priority to hydraulic oil to the steering circuit.

5. DAUL FLOW DIVIDER (BRAKE BOOSTER TYPE, OPTION)



Item/Port	Port size	Tightening torque	
		kgf·m (±0.5)	lbf·ft (±3.7)
4, 6, 7, 11	-	7	516
8	-	0.45±0.05	3.3±0.37
LS, T, BF	9/16-18 UNF	3	21.7
CF	3/4-16 UNF	6	43.4
EF	7/8-14 UNF	9.5	68.7



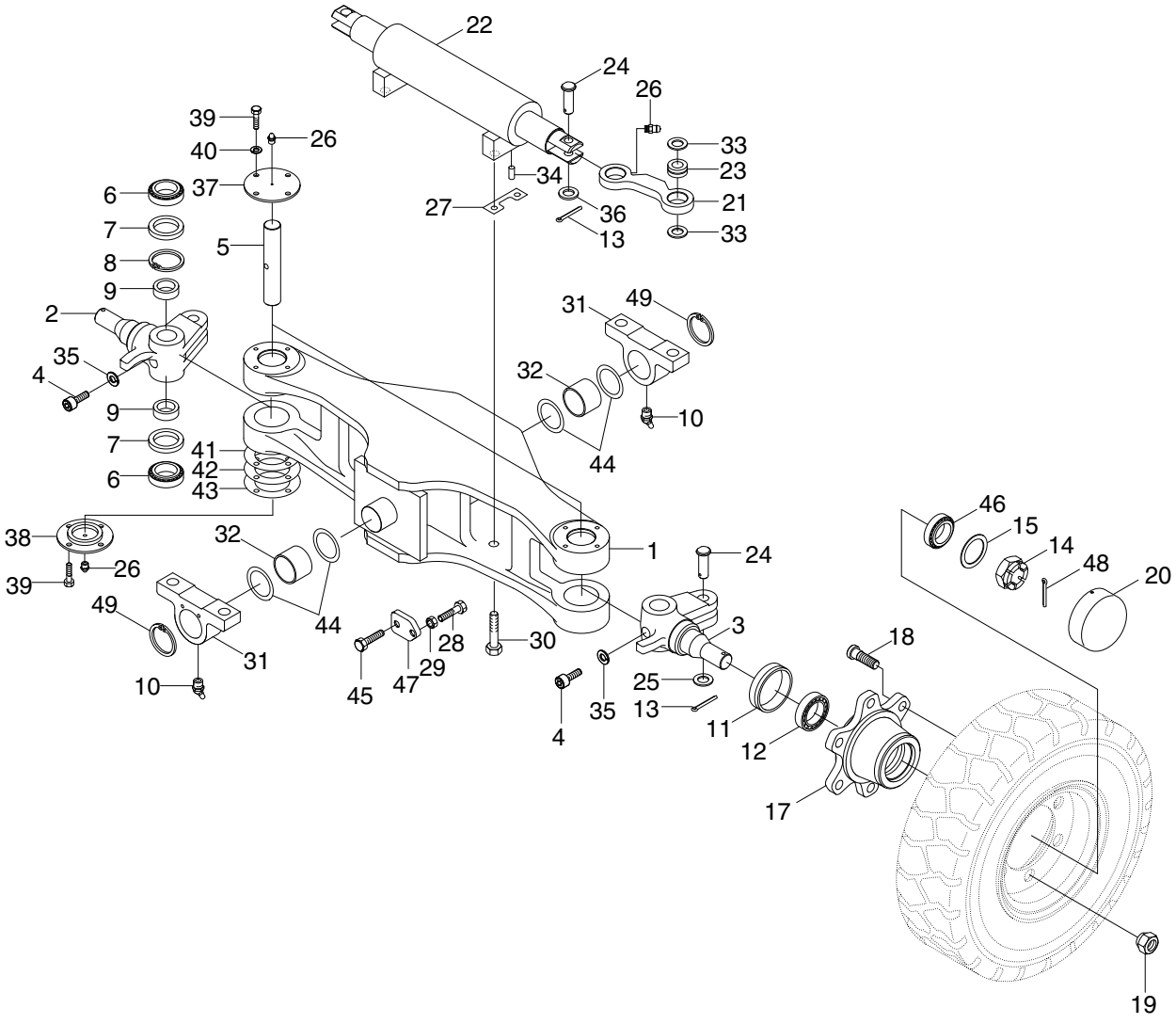
25D9V5SS07

1	Block	6	Plug-BF	11	Plug-relief
2	Spool-CF	7	Plug-LS	14	Sping-BF
3	Spool-BF	8	Plug	15	Spring-CF
4	Plug	9	Poppet-relief	16	Plug
5	O-ring	10	Spring-relief	17	O-ring

This dual flow divider is one of the spool-type flow dividers that split flow through pressure-compensated fixed orifices. The pressure-compensation feature ensures near-equal flow through the orifices - even when inlet and/or outlet pressures fluctuate. The flow of port CF (controlled flow) is delivered into the steering unit, and port CF always has the same flow when the pump is producing that flow or more. Excess pump flow goes through port EF (excess flow) to actuators via the directional control valves. Therefore this dual flow divider maintains constant flow from the CF port. Any additional flow passes out the EF port.

6. STEERING AXLE

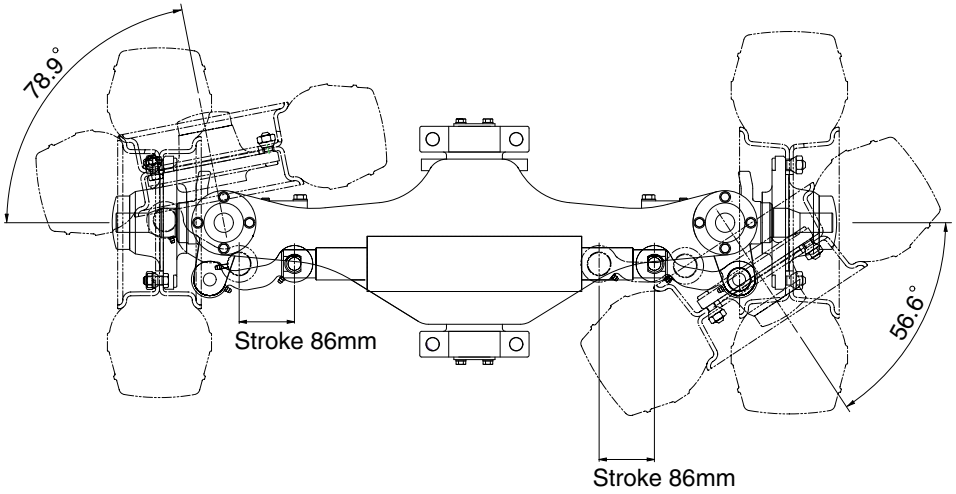
1) STRUCTURE

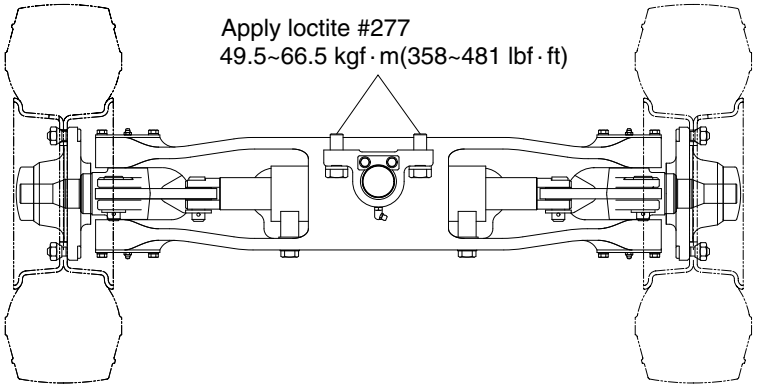


22D9SS07

1	Steering axle	18	Hub bolt	34	Pin
2	Knuckle-RH	19	Hub nut	35	Spring washer
3	Knuckle-LH	20	Hub cap	36	Hardened washer
4	Special bolt	21	Steering link	37	Upper cover
5	King pin	22	Steering cylinder	38	Lower cover
6	Taper roller bearing	23	SPH plain bearing	39	Hex bolt
7	Oil seal	24	Steer link pin	40	Spring wahser
8	Retaining ring	25	Plain washer	41	Shim (0.1)
9	Collar	26	Grease nipple	42	Shim (0.15)
10	Grease nipple	27	Lock plate	43	Shim (0.3)
11	Oil seal	28	Bolt	44	Spacer(0.5)
12	Taper roller bearing	29	Hex nut	45	Hex bolt
13	Split pin	30	Hex bolt	46	Taper roller bearing
14	Nut	31	Trunnion block	47	Plate
15	Washer	32	Bushing	48	Split pin
17	Hub	33	Thrust washer	49	Retaining ring

2) TIGHTENING TORQUE AND SPECIFICATION



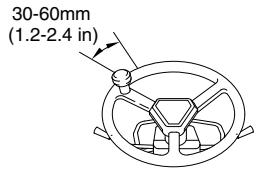


20D7SS08

Type	Unit	Center pin support single shaft
Structure of knuckle	-	Elliott type
Toe-in	degree	0
Camber	degree	0
Caster	degree	0
King pin angle	degree	0
Max steering angle of wheels(Inside/Outside)	degree	78.9/56.6
Tread	mm (in)	980 (38.6)

GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

1. OPERATIONAL CHECKS

Check item	Checking procedure
Steering wheel 	· Set rear wheels facing straight forward, then turn steering wheel to left and right. Measure range of steering wheel movement before rear wheel starts to move. Range should be 30~60 mm at rin of steering wheel. If play is too large, adjust at gear box. Test steering wheel play with engine at idling.
Knuckle	· Check knuckle visually or use crack detection method. If the knuckle is bent, the tire wear is uneven, so check tire wear.
Steering axle	· Put camber gauge in contact with hub and measure camber. If camber is not within 0±0.5° ; rear axle is bent. · Ask assistant to drive truck at minimum turning radius. · Fit bar and a piece of chalk at outside edge of counterweight to mark line of turning radius. · If minimum turning radius is not within±100 mm (±4 in) of specified value, adjust turning angle stopper bolt. Min turning radius (Outside) - 25D-9V/VS : 2352 mm (93 in) - 30D-9V/VS : 2427 mm (96 in) - 35DN-9V/VS : 2480 mm (98 in)
Hydraulic pressure of power steering	Remove screw coupling from CF port of priority valve and install oil pressure gauge. Turn steering wheel fully and check oil pressure. ※ Oil pressure : 100 bar (1450 psi)

2. TROUBLESHOOTING

1) STEERING UNIT

Problem	Cause	Remedy
The steering wheel cannot be rotated.	· The steering unit column shaft is installed incorrectly or damaged. · The oil pressure does not rise. · The relief valve is faulty or not closed. · LS line (Hose) incorrectly connected. · The piping is damaged.	· Inspect and correct or replace. · Inspect and adjust the relief set pressure. · Inspect and correct. · Inspect and correct. · Replace.
The steering wheel is heavy.	· The tire inflating pressure is low. · The oil pressure does not rise. · The high and low pressure hoses are connected reversely. · The power steering cylinder rod is bent or the piston is sticking.	· Adjust the inflating pressure. · Inspect and adjust the relief set pressure. · Inspect and correct. · Inspect and correct or replace.
The oil pressure does not rise.	· The high and low pressure hoses are connected reversely. · The relief valve is faulty or not closed. · The oil pump function is degraded or the oil volume is insufficient. · The power steering cylinder piston packing is damaged.	· Inspect and correct. · Inspect and correct. · Inspect and correct or replace. · Replace.
The steering wheel does not return properly.	· The tire inflating pressure is low. · The steering unit spool does not move smoothly. · The steering knuckle sliding motion is improper.	· Adjust the inflating pressure. · Correct or replace the steering unit · Add the lubricant or correct.
The steering wheel does not return (lateness) to the neutral position when released.	· The steering unit spool does not move smoothly. · The steering unit column shaft is damaged. · The centering spring is damaged. · The piping is blocked (crushed or clogged).	· Correct or replace the steering unit. · Replace the steering unit · Replace. · Inspect and correct or replace.
The play is excessive and the vehicle wobbles.	· Oil moves in the steering unit. · The steering unit spool is not moving correctly. · Air is sucked from the piping. · The steering unit column shaft is defective.	· Replace the steering unit. · Correct or replace the steering unit. · Inspect and correct or replace. · Inspect and correct or replace.
The tires are steered opposite to the steering wheel operated direction.	· The cylinder piping is connected reversely.	· Inspect and correct.

Problem	Cause	Remedy
The steering wheel in the idling state is heavy.	· Oil moves in the steering unit. · The relief valve is not functioning correctly. · Air is sucked from the piping. · The piping is blocked (crushed or clogged). · The end cap set screw is tightened to an excessive torque.	· Replace the steering unit. · Inspect and correct. · Inspect and correct or replace. · Inspect and correct or replace. · Tighten uniformly to the specified torque.
Abnormal noise is generated.	· The relief valve is defective. · Air is sucked from the piping. · The piping is blocked (crushed or clogged).	· Correct, inspect the pressure, and adjust. · Inspect and correct or replace. · Inspect and correct or replace.

2) PRIORITY VALVE

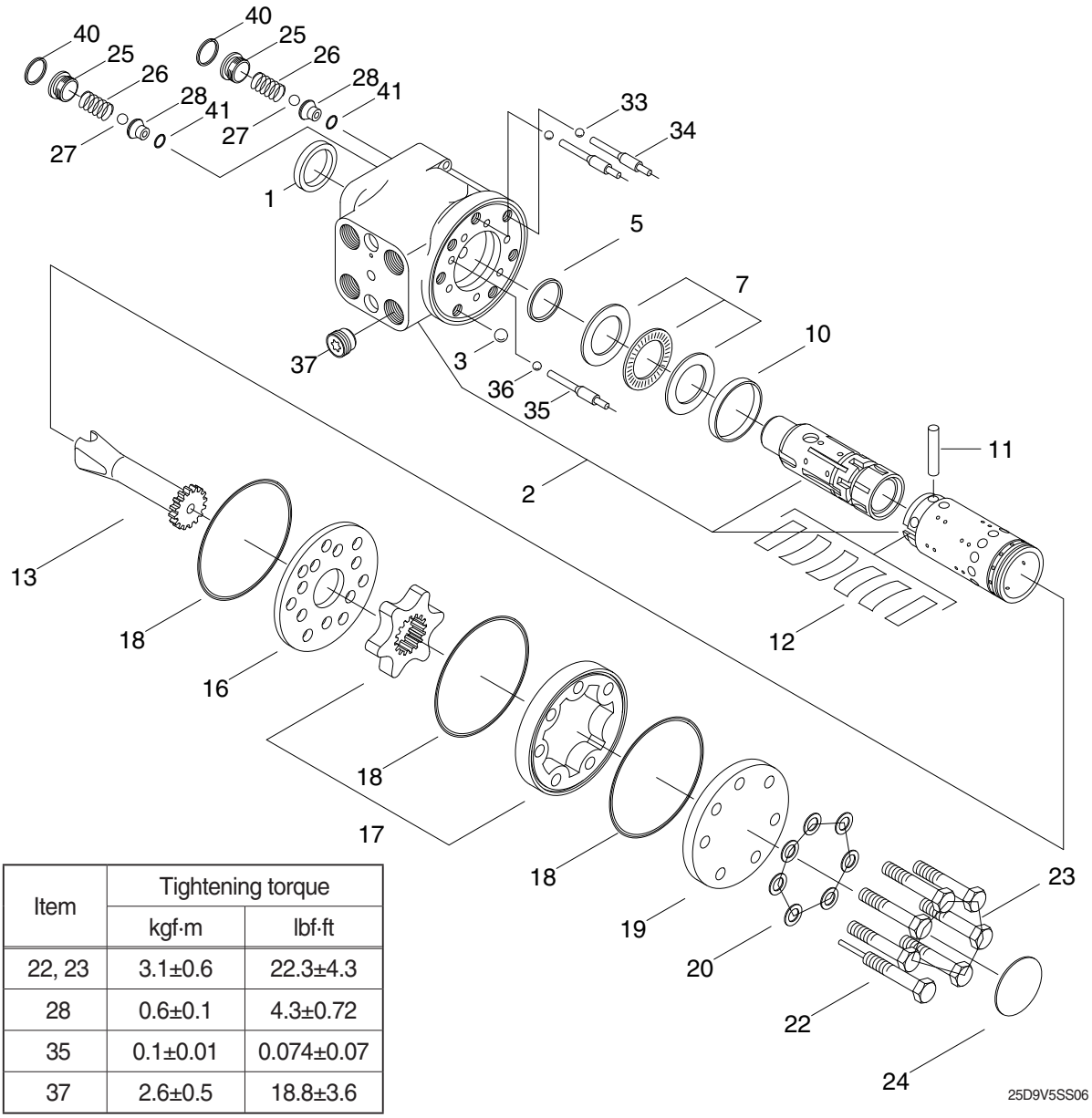
Problem	Check point	Remedy
Springs scratche, wear or fall.	· Those of having critical scratches or wear and those of below the repair limit must be replaced with a new one.	· Replace.
Spools scratche or wear on sliding surface.	· Extremely small scratches must be removed with sandpaper. · Those of having critical scratches or wear must be replaced with a new one.	· Replace.
O-ring	· Those of having scratches on the seal or having critical wear must be replaced with a new one.	· Replace.

3) DAUL FLOW DIVIDER (BRAKE BOOSTER TYPE, OPTION)

Problem	Check point
BF flow is out of specification	· Check the other material (chip, particles, …) is in the bore and on the spool and in orifices. · Check the orifices' sizes in the spool (3).
CF flow is out of specification	· If it flow too much and EF too less or not, check the other material (chip, particles, …) is stuck in the block land into CF · Check the orifices' sizes in the spool (2).
EF flow is out of specification	· If there is hydraulic shock in actuators while on/off(or push/pull) operation switching, check the orifices' sizes in the spool (2).
LS flow is out of specification	· Check the clearance of the Bore and Spool (2). · Check the orifices' sizes in the spool (2), plug orifice (7) and spring (15).
Pressure Engagement is out of specification	· Check the parts of LS relief valve and its inserted direction is in normal. · Check the other material (chip, particles, …) is in the long drill holes and on the poppet (9).

1. STEERING UNIT

1) STRUCTURE



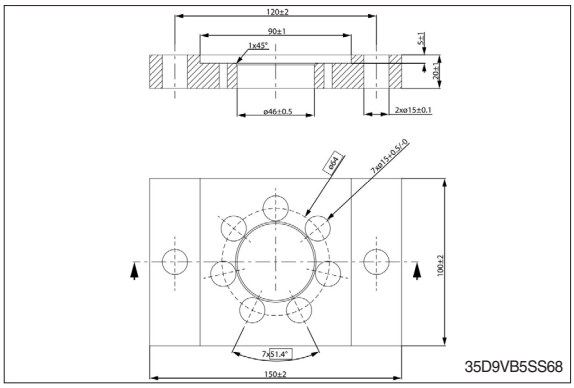
Item	Tightening torque	
	kgf·m	lbf·ft
22, 23	3.1±0.6	22.3±4.3
28	0.6±0.1	4.3±0.72
35	0.1±0.01	0.074±0.07
37	2.6±0.5	18.8±3.6

1	Dust seal ring	18	O-ring	31	Spring
2	Housing and spool/sleeve	19	End over	32	Piston
3	Ball	20	Washer	33	Ball
5	Shaft seal	22	Pin bolt screw	34	Bushing
7	Bearing assembly	23	Screw	35	Ball
10	Ring	24	Model / Code label	36	Ball
11	Cross pin	25	Adjusting screw	37	Check valve
12	Set of springs	26	Spring	40	O-ring
13	Cardan shaft	27	Ball	41	O-ring
16	Distributor plate	28	Seat	42	Plug
17	Gearwheel set	30	Adjusting screw		

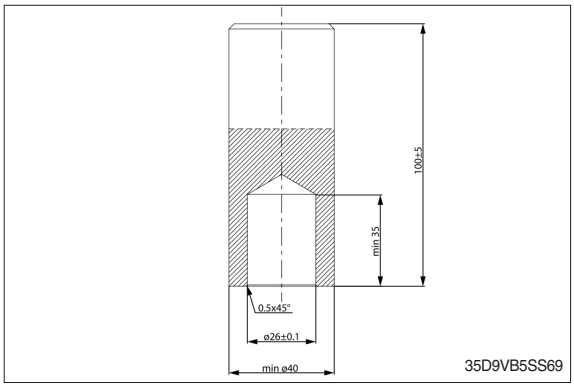
※ Seal kit (EA) : 1 (1), 5 (1), 18 (3), 20 (7), 40 (2), 41 (2)

2) TOOLS

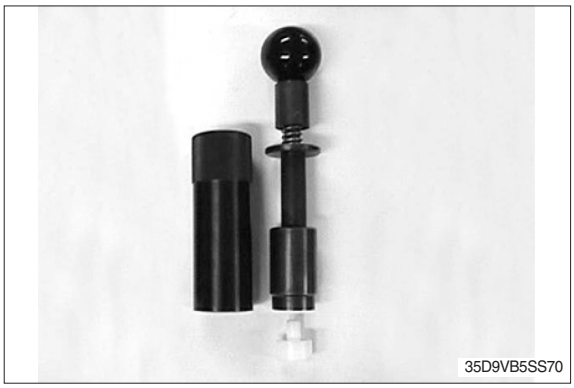
(1) Holding tool for the entire steering unit.
Material: Appropriate metal or hard plastic.



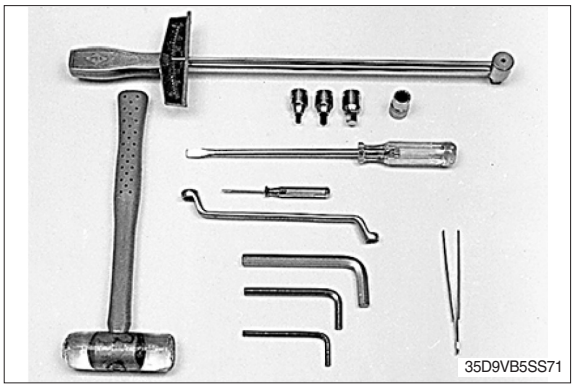
(2) Assembly tool for dust seal.
Material: Free cutting steel.



(3) Assembly tool for shaft seal, O-ring/Roto Glyd type:
Code number: 11092408.

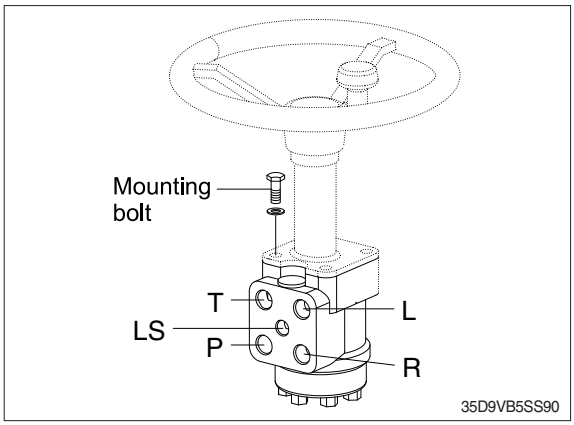


(4) Torque wrench
- 13 mm socket spanner
- 2 mm, 7/64 inch (2.75 mm) Allen key
- Torx Bit size T50
- 12 mm screwdriver
- 2 mm screwdriver
- 13 mm ring spanner
- Plastic hammer
- Tweezers



3) TIGHTENING TORQUE

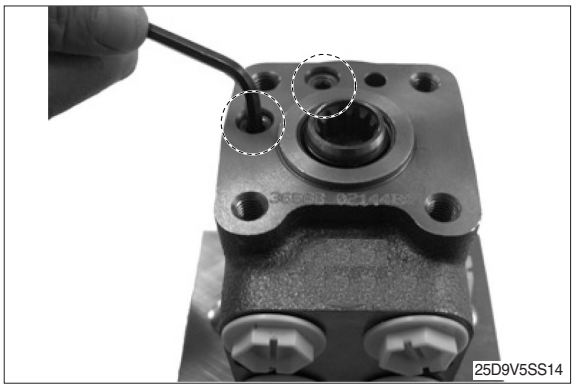
L : Left port
R : Right port
T : Tank port
P : Pump port
LS : Load sensing port



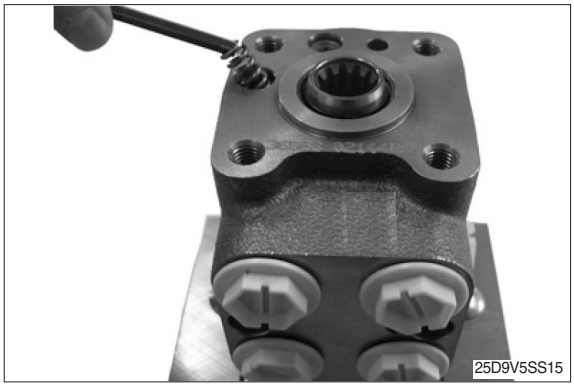
Port	Port size	Tightening torque	
		kgf·m	lbf·ft
L, R, T, P	3/4-16 UNF	6	43.4
LS	7/16-20UNF	2.5	18.4
Mounting bolt	M10×30 mm	4	28.9

4) DISASSEMBLY

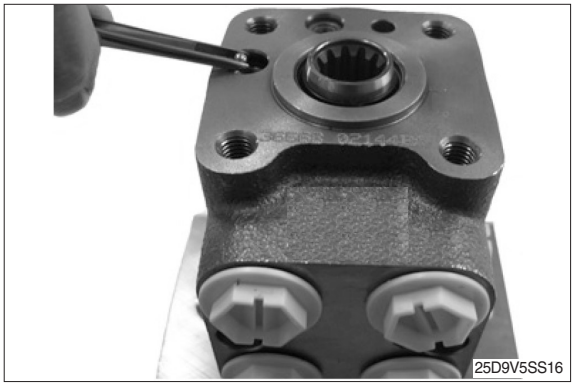
(1) Arise off the plastic protection plugs from the two shock valves. Screw out the adjusting screw for shcok valves (25) using a 5 mm allen key. O-ring (40) is fitted on adjusting screw (25).



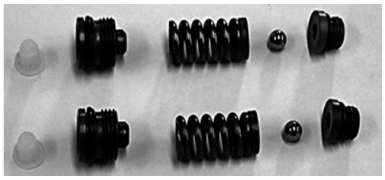
(2) Remove the springs (26) with trust pads for shock valves.

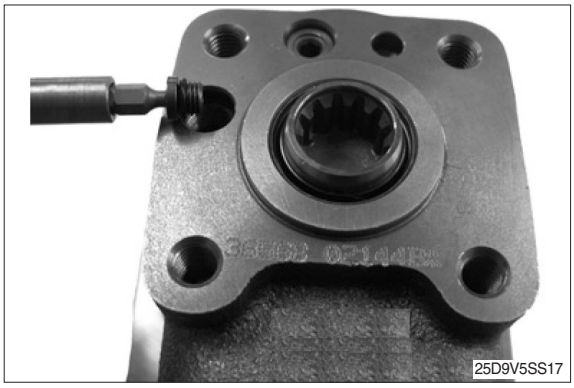


(3) Remove the balls (27) for shock valves.



(4) Screw out the seats (28) for shock valves using a 7/64 inch (2.75 mm) allen key. O-ring (41) is fitted on seat (28).
The shock valves are now dismantled.





(5) Replace the unit in the holding tool on steering column end.
Remove the screws (22 and 23) with washers (20) using a 13 mm ring spanner or top wrench.



35D9VB5SS09

(6) Remove the end cover (19), sideways.

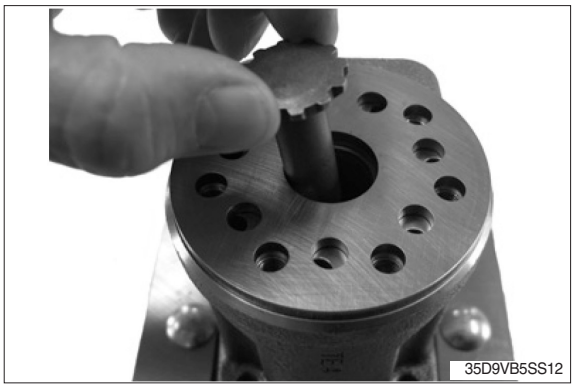


35D9VB5SS10

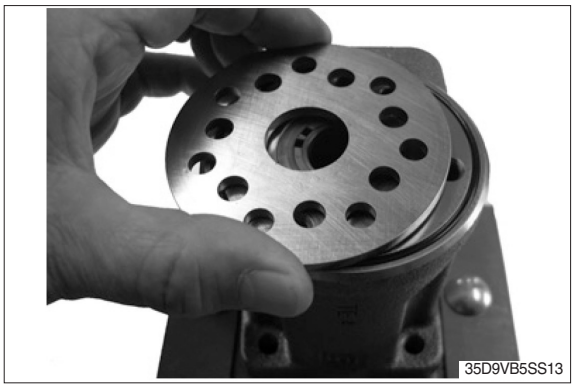
(7) Lift the gearwheel set (17) off the unit. Remove the two o-rings (18).


35D9VB5SS11

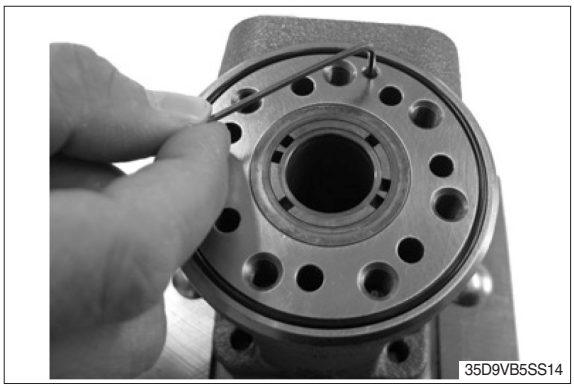
(8) Remove the cardan shaft (13).


35D9VB5SS12

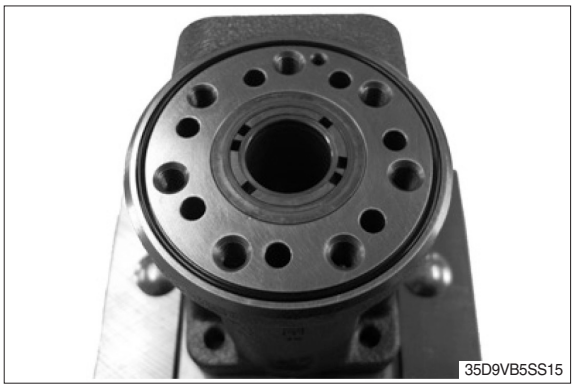
(9) Remove the distributor plate (16).



(10) Screw out the ball stop (35) using a 2 mm allen key.



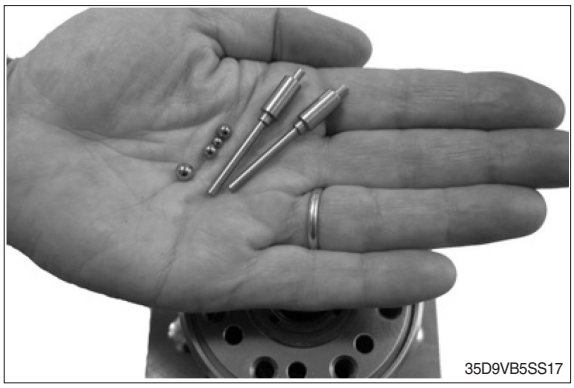
(11) Remove the o-ring (18) from housing.



(12) Remove the check valve (37) using a torx bit size T50.

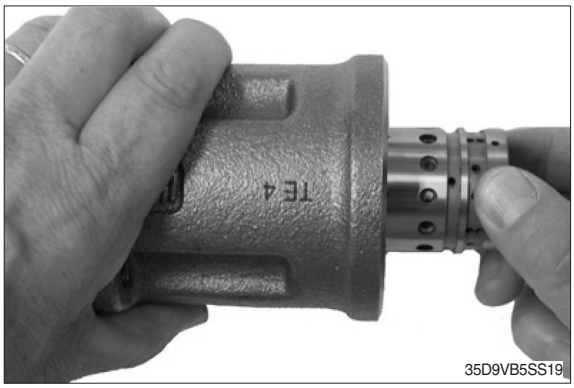


(13 Shake out the check valve ball (3), suction valve pins (34), balls (33 and 36).



(14) Place the housing with the ports facing down on the work bench. Ensure that the cross pin (11) in the spool and sleeve set (2) is in the horizontal position. The pin (11) can be observed through the open end of the spool. Press the spool (2) inwards (from the housing mounting face end) and the sleeve (2), ring (7) and bearing assembly (6) will be pushed out of the housing together.





(15) Take the bearing races and needle bearing (7) from the spool and sleeve set (2). The outer bearing (7) race can sometimes “stick” in the housing, therefore check that it has come out.



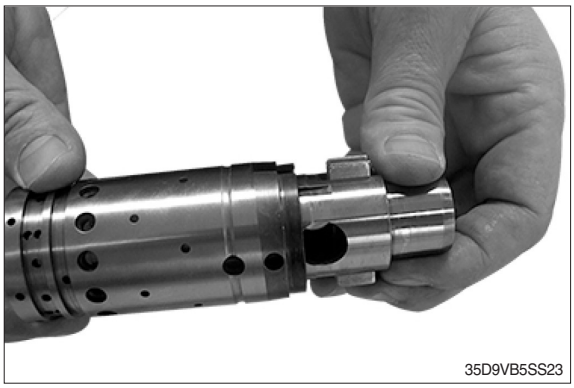
(16) Press out the cross pin (11).



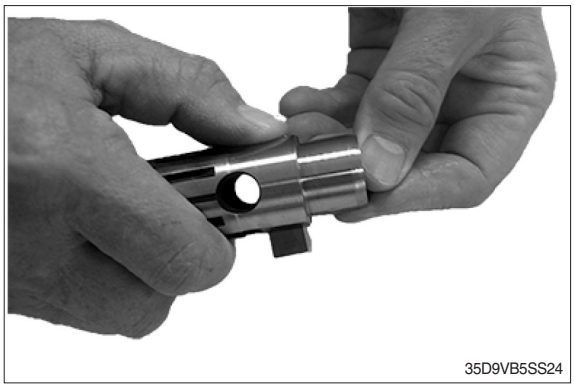
(17) Remove the ring (10).



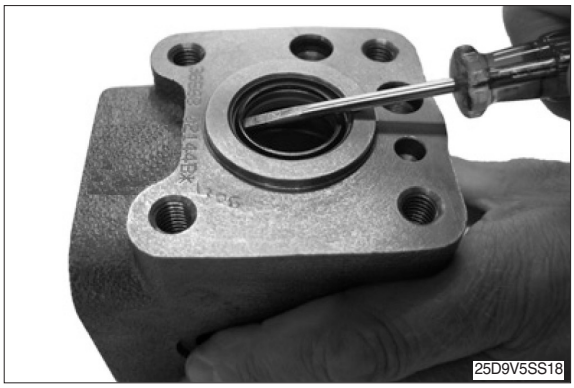
(18) Carefully press the spool out of the sleeve.



(19) Press the neutral position springs (12) out of the slot of the spool.



(20) Remove dust seal (1) and shaft seal (Roto Glyd) (5) carefully with a screw driver or similar tool.



(21) The steering unit is now completely dismantled.

※ **Clean all parts carefully in shellsol K or similar cleaner fluid.**

※ **Inspection and replacement Replace all seals and washers. Check all parts carefully and make any replacements as is necessary.**

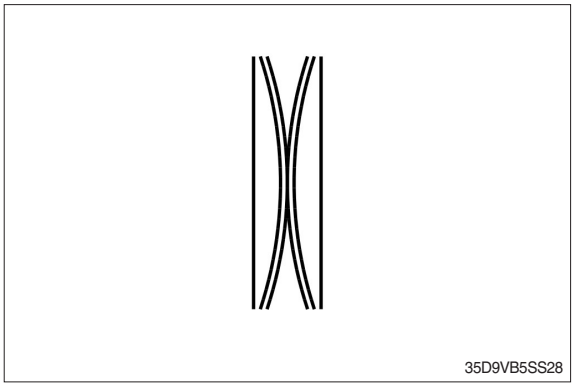


5) ASSEMBLY

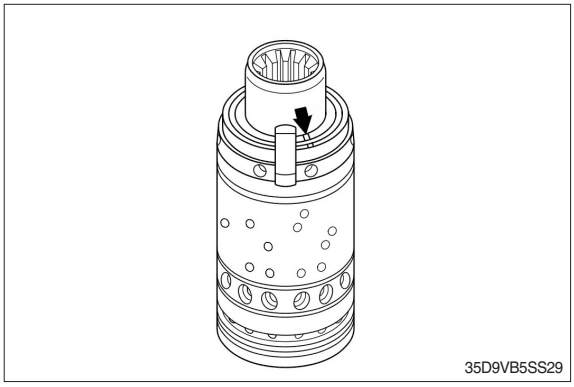
(1) Place the two flat neutral position springs in the slot. Place the curved springs between the flat ones and press them into place.


35D9VB5SS27

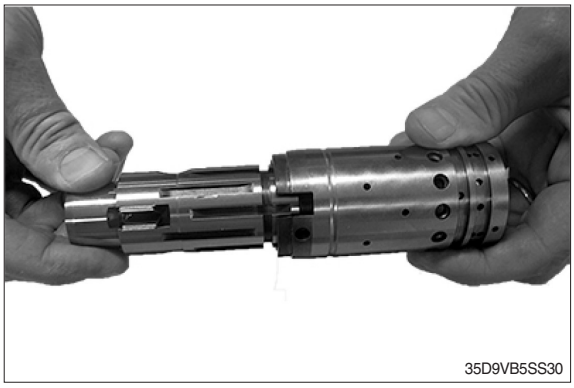
(2) Configuration of spring set (12). There can be different numbers of curved springs depending on configuration of spring set. There can be 2, 4 or 6 curved springs.


35D9VB5SS28

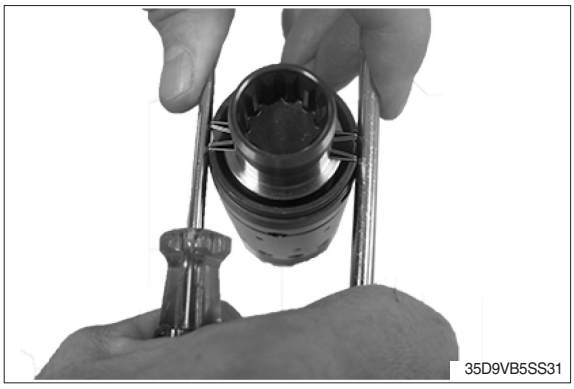
(3) Some spool and sleeve sets for steering unit must be positioned correctly relatively to each other. Small marks are present on both spool and sleeve close to one of the slots for the spring set. Most spool and sleeve sets for steering unit have no marks, so those can be positioned relatively to each other in any of the 2 positions possible.


35D9VB5SS29

(4) Guide the spool into the sleeve (2). Make sure the centering springs (12) are placed into the slot.


35D9VB5SS30

(5) Line up the spring set (12).



(6) Guide the ring (10) down over the sleeve. The ring should be able to move free of the springs.



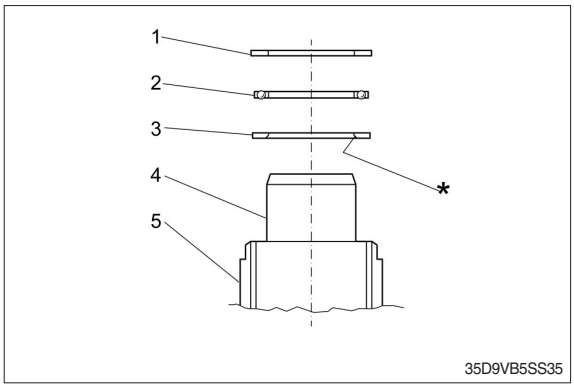
(7) Fit the cross pin (11) into the spool/sleeve.



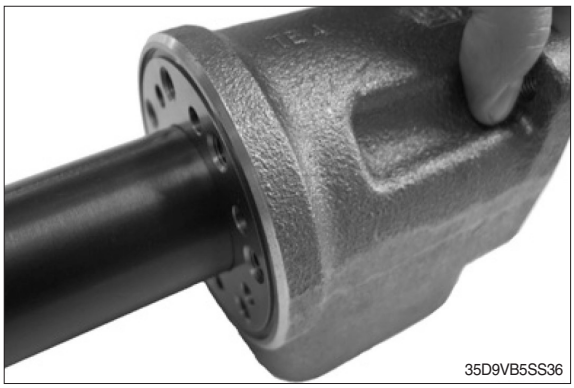
(8) Fit bearing races and needle bearing (7) as shown on the drawing below.



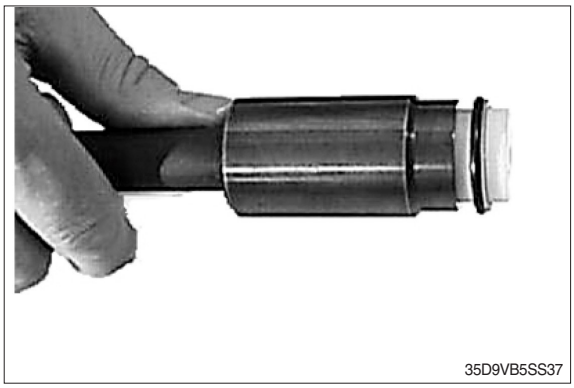
(9) Assembly pattern for standard bearing 1 Outer bearing race → 2 Needlebearing → 3 Inner bearing race → 4 Spool → 5 Sleeve.
The inside chamfer on the inner bearing race must face the chest of the inner spool.



(11) Place the steering unit housing with the port face down on the work bench. Guide the outer part of the assembly tool for shaft seal into the bore for the spool/ sleeve set (2).



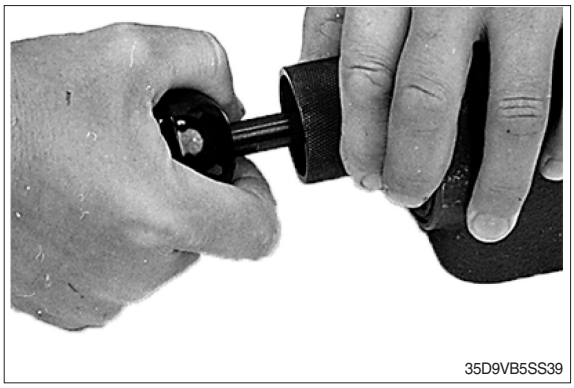
(10) Grease the shaft seal (Roto Glyd, 5) with hydraulic oil and place them on the tool. Ensure that the Roto Glyd seal is placed on the insertion tool as per the photograph.



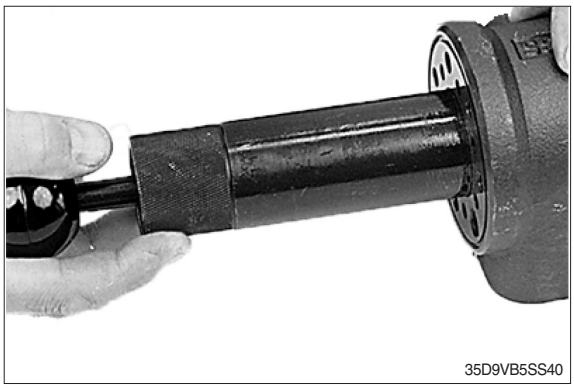
(13) Hold the outer part of the assembly tool in the bottom of the steering unit housing and guide the inner part of the tool right to the bottom.



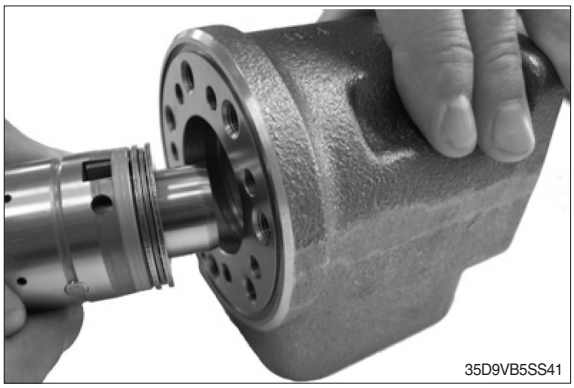
(14) Press and turn the shaft seal (5) into position in the housing.



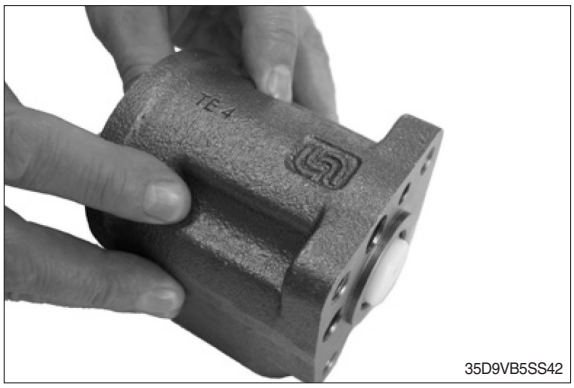
(15) Draw the inner and outer parts of the assembly tool out of the steering unit bore, leaving the guide from the inner part in the bore.



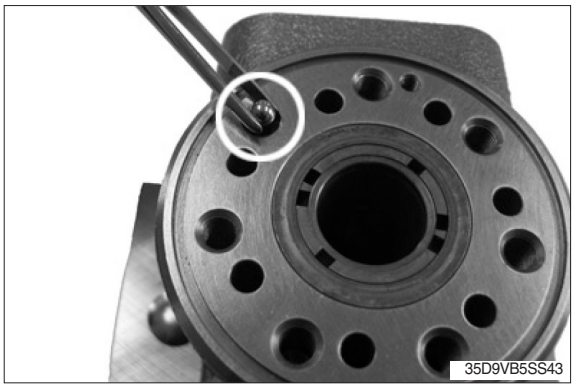
(16) With a light turning movement, guide the spool and sleeve into the bore.
Fit the spool set holding the cross pin (11) horizontal.



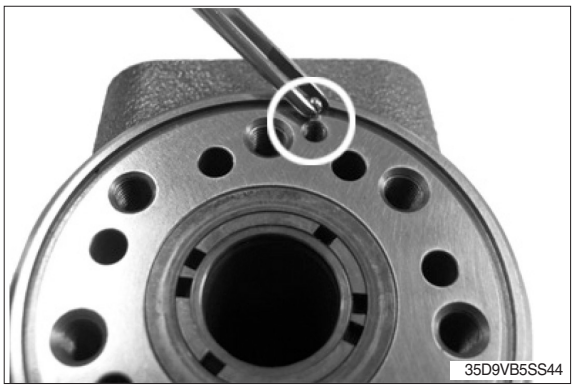
(17) The spool set will push out the assembly tool guide. The shaft seal (5) are now installed.



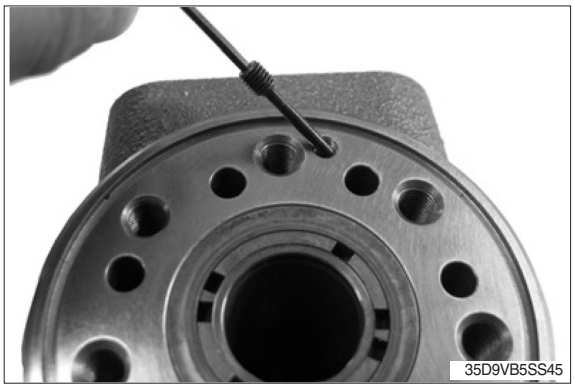
(18) Place the steering unit housing on the holding tool on the steering column end. Put the check valve ball (3) into the hole indicated by the circle.



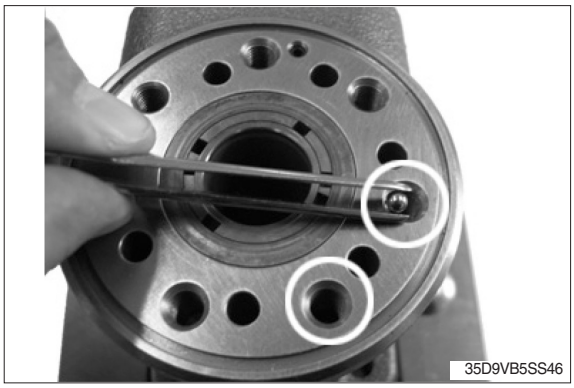
(19) Place the ball for LS check valve (36) into the hole indicated by the circle.



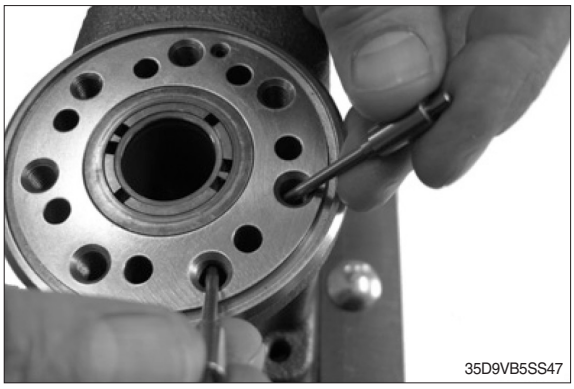
(20) Screw the ball stop (35) into the LS check valve bore using a 2 mm allen key.
· Tightening torque : 0.1±0.01 kgf·m
(0.72±0.072 lbf·ft)



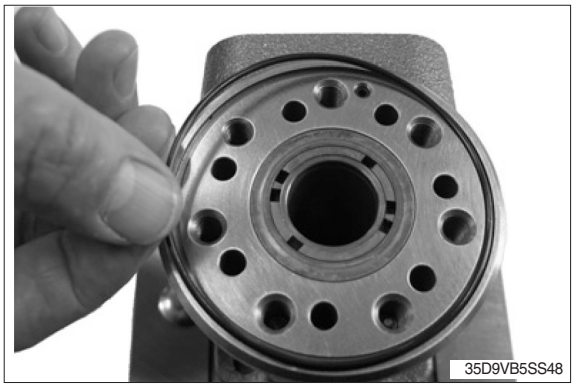
(21) Place a ball (33) in the two bolt holes indicated by the circles.



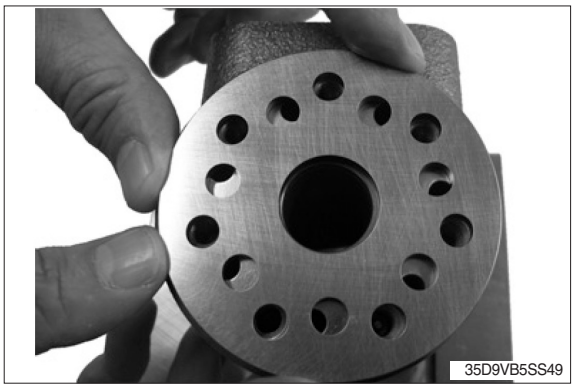
(22) Place the pins (34) in the same two bolt holes.



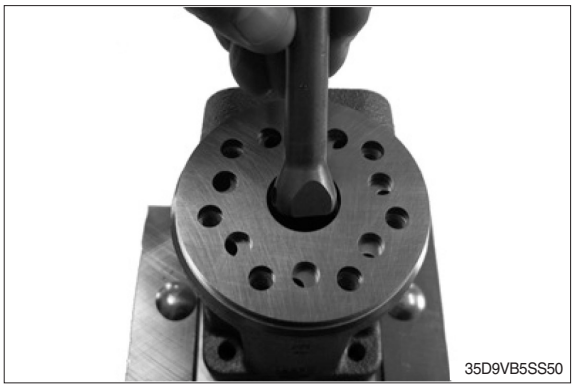
(23) Insert the O-ring (18) in the grove on the housing.



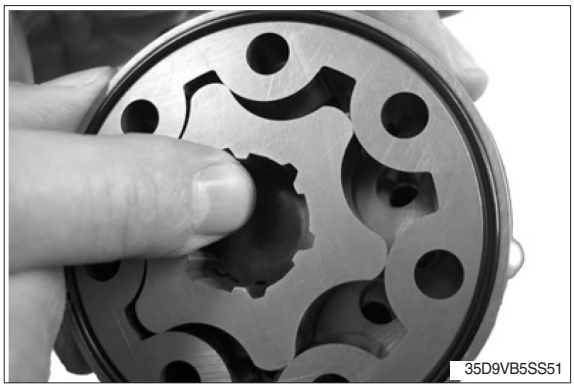
(24) Place the distributor plate (16) so that the channel holes match the thread holes in the housing.



(25) Guide the cardan shaft (13) down into the bore so that the slot is parallel with the connection flange ports and lines up with the cross pin (11).



(26) Place the 2 o-rings (18) in the two groves in the gear rim. Fit the gearwheel and rim (17) on the cardan shaft (13).
Place the gear wheel side with all the deeper splines facing downwards. Only this side will fit on the cardan shaft due to all gear sets used in steering unit have timing securing: splines of gear wheel and cardan shaft can only be assembled with correct timing. Line up the gear rim holes to match the thread holes of the housing.

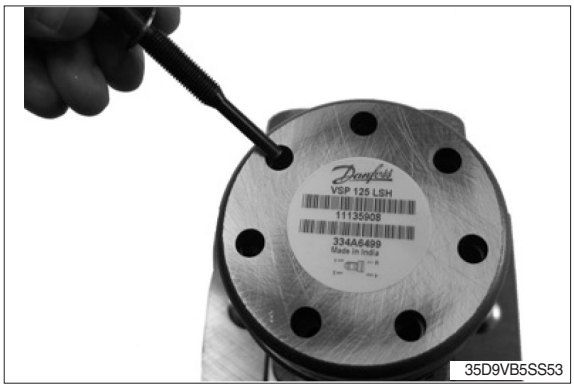

35D9VB5SS51

(27) Place the end cover (19) in position. Ensure that the bar codes and writing are parallel with port face.

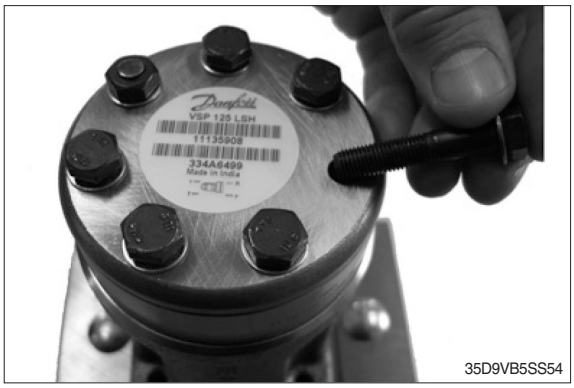


35D9VB5SS52

(28) Fit the pin bolt screw (22) with washer (20) and place it in the hole shown.


35D9VB5SS53

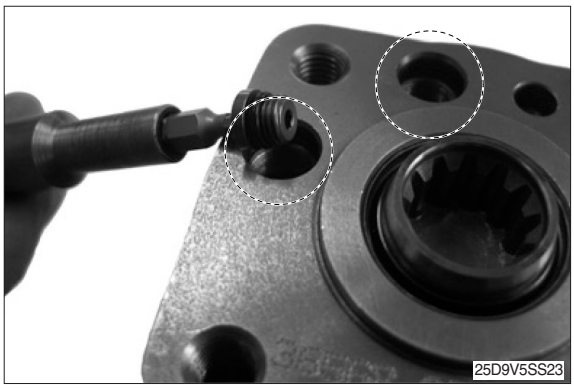
(29) Fit the six screws (23) with new washers (20) and insert them. Use a 13 mm top wrench. Cross-tighten all the screws (22 and 23) with a torque
· Tightening torque : 3.1±0.6 kgf·m
(22.4±4.3 lbf·ft)


35D9VB5SS54

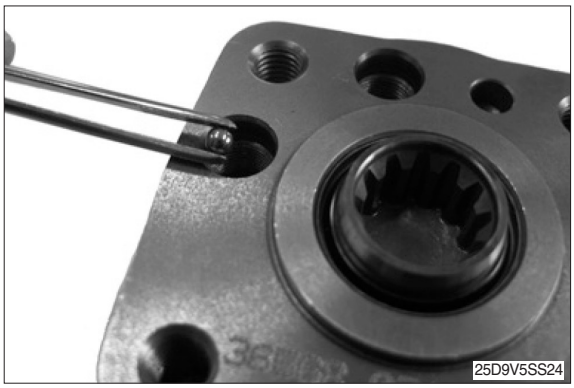
(30) Screw in the check valve (37) into the P-port using a Torx Bit size T50.
· Tightening torque : 2.6±0.5 kgf·m
(18.8±3.6 lbf·ft)



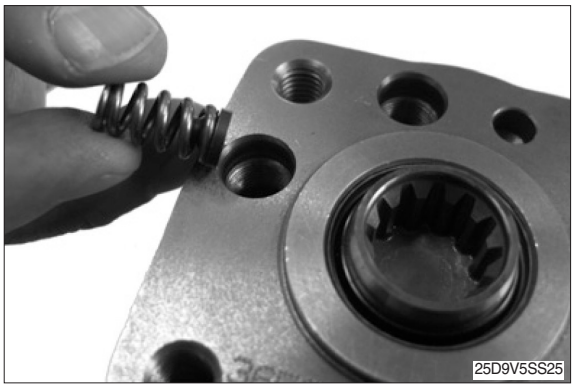
(31) Replace the unit in the holding tool on gear set end.
Place o-ring (41) on the shock valve seats (28). Screw in the seats (28) using a 7/64 inch (2.75 mm) mm Allen key into the cavities indicated by the circles.
· Tightening torque : 0.6±0.1 kgf·m
(4.3±0.72 lbf·ft)



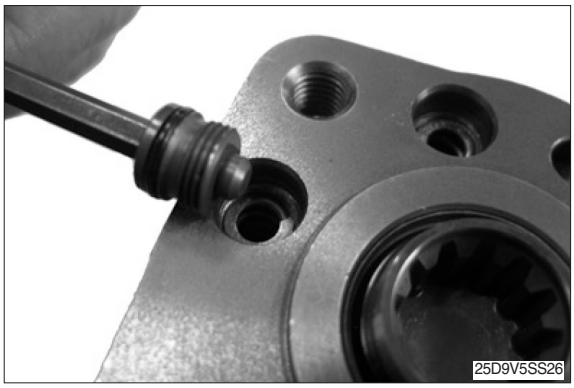
(32) Place one ball (27) in each of the shock valve cavities.



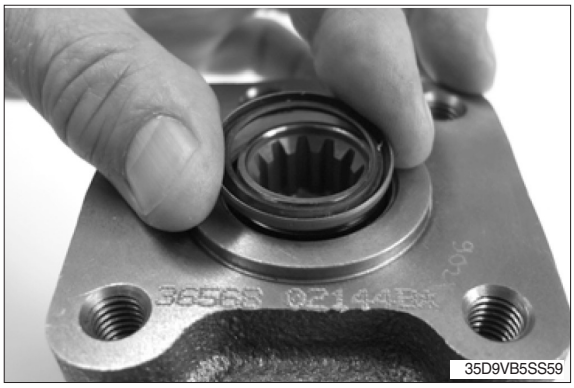
(33) Place springs with trust pads (26) over the two balls.



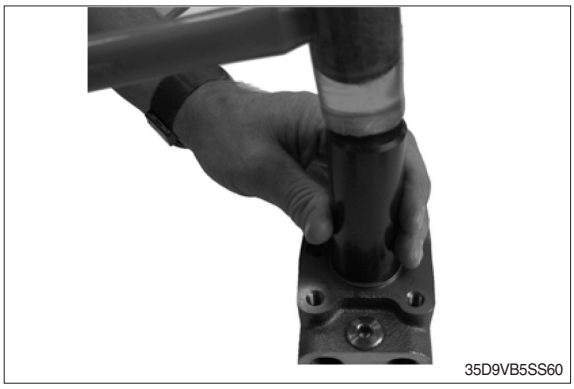
(34) Place o-rings (40) on adjusting screws (25). Screw in the two adjusting screws (25) using a 5 mm allen key. Make the pressure setting on a test panel according to valve setting specification.


25D9V5SS26

(35) Place the dust seal ring (1) in the housing.

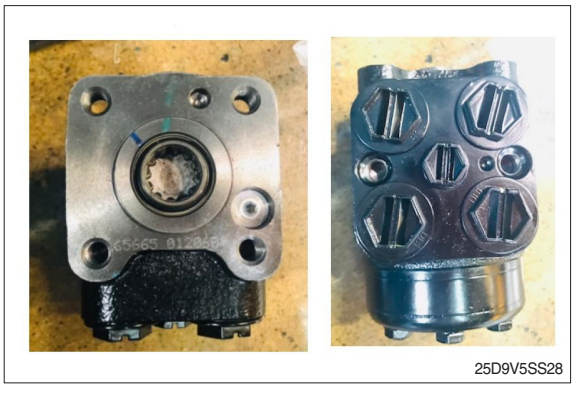

35D9VB5SS59

(36) Fit the dust seal ring in the housing using special tool for dust seal assembly and a plastic hammer.


35D9VB5SS60

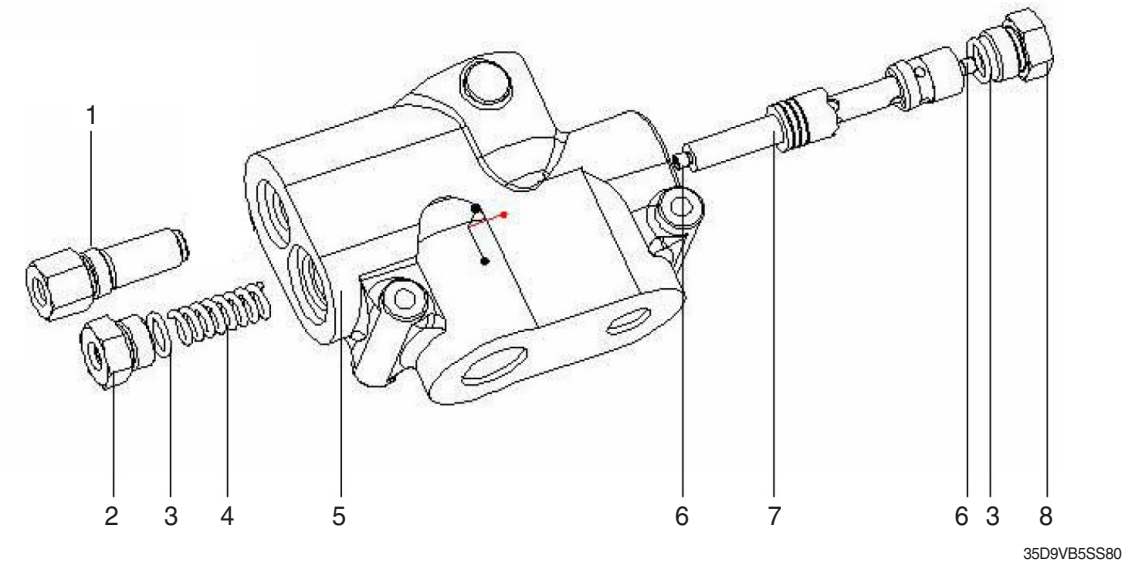
(37) After finalizing the entire assembly, screw in the plastic plugs into the connection ports to keep the ports clean during storage and transportation.

※ **Refer to the relief valve and LS port pressure test and adjustment.**


25D9V5SS28

2. PRIORITY VALVE

1) STRUCTURE



1	Relief valve kit	4	Spring compression	7	Spool
2	Plug	5	Housing	8	Plug
3	O-ring	6	Throttle		

2) DISASSEMBLY

※ Check that the priority valve has not been damaged during transportation.

※ Clean the working area before operation.

※ If needed, components must be replaced exclusively by serviceman.

(1) Clamp the unit in vice. Loosen the plug (using 27 mm wrench) and screw out. Be careful of the spring.



(2) Take out the spring vertically.



(3) Unscrew the plug in the opposite side using the 27mm wrench.



(4) Press out the spool by hand.

※ **It is strongly recommended that relief valve cartridge not be adjusted by customer. If necessary, it must be done by Eaton representative. Approximately 800psi per revolution of the adjusting screw.**



(5) Clean all metal parts in clean solvent. Blow dry with air. Do not wipe dry with cloth or paper towel because lint or other matter can get into the hydraulic system and cause damage.

3) ASSEMBLY

※ Before assembly, lubricate all parts with normal hydraulic oil.

(1) Position the valve horizontally and insert the spool into its bore. Pay attention to spool direction and ensure spool moves smoothly.



(2) Insert the spring into the bore.



(3) Screw in the two plugs and tighten.
· Tightening torque : 5.1±0.5 kgf·m
(36.9±3.7 lbf·ft)



3. DUAL FLOW DIVIDER (BRAKE BOOSTER TYPE, OPTION)

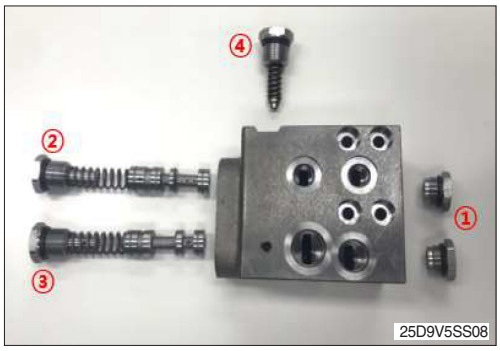
1) CAUTION FOR ASSEMBLY AND DISASSEMBLY

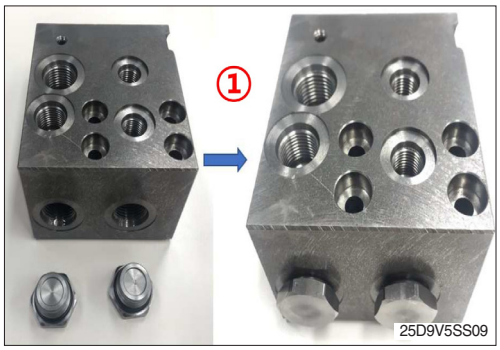
(1) Disassembly and assembly should be performed very carefully at a clean place so that any foreign material such as dust or sand can not intrude into the dual flow divider.
(2) For disassembly of the dual flow divider, you should start disassembly after fully understanding the structure of the valve with structural drawings and reference drawings.
(3) In case the dual flow divider needs to be placed unassembled for a while, it must be treated with rust prevent oil and sealed to prevent rusting.
(4) Even in case disassembly and assembly of the dual flow divider is not performed smoothly, do not hit or treat any part of the product roughly.
(5) After disassembly, attach ID tags to each part for accurate assembly.
(6) For o-rings and back up-rings, install new ones. And be sure not to damage one during assembly (Apply grease on the parts for smooth assembly).
(7) Fasten bolts, nipples and plugs with the specified standard torque.
(8) Be careful not to damage the o-ring contacting parts for preventing oil leakage.

2) ASSEMBLY

△ **When disassembling, avoid mis-assembly through marking work. Pay attention to the location of the BF and CF spools and the spool assembly direction. Pay attention to the shape and assembly position of the plug and spring.**

(1) Assemble the plugs into the port on the side of the block.
· Tightening torque : 7 kgf·m
(50.6 lbf·ft)



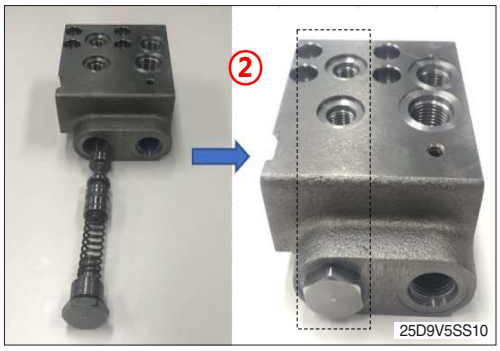


(2) Check the location of hole on the side. Assemble the spool, spring and plug into the left hole.

· Tightening torque : 7 kgf·m (50.6 lbf·ft)

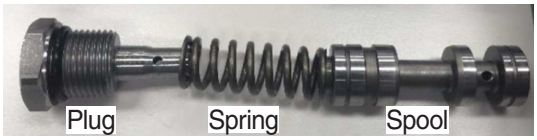


<BF spool assembly>

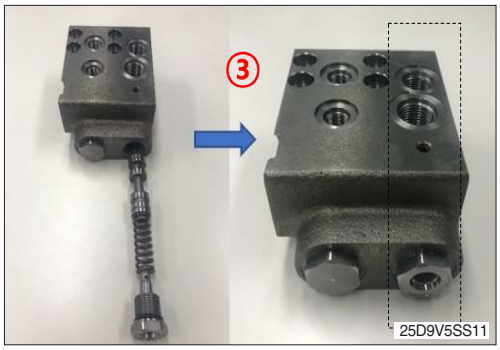


(3) Insert and assemble into the hole which is left in other side of the block with the spool, spring, plug. Notice that the parts are mixed with other locations.

· Tightening torque : 7 kgf·m (50.6 lbf·ft)



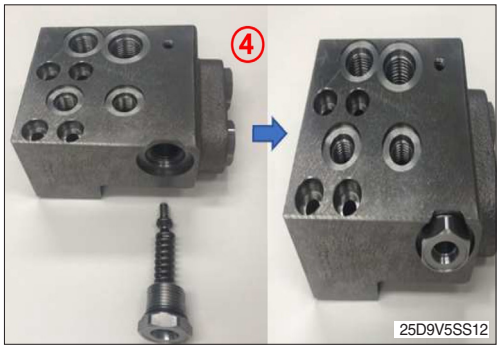
<CF spool assembly>



(4) Assemble the remaining relief valve in the hole located on the upper side.

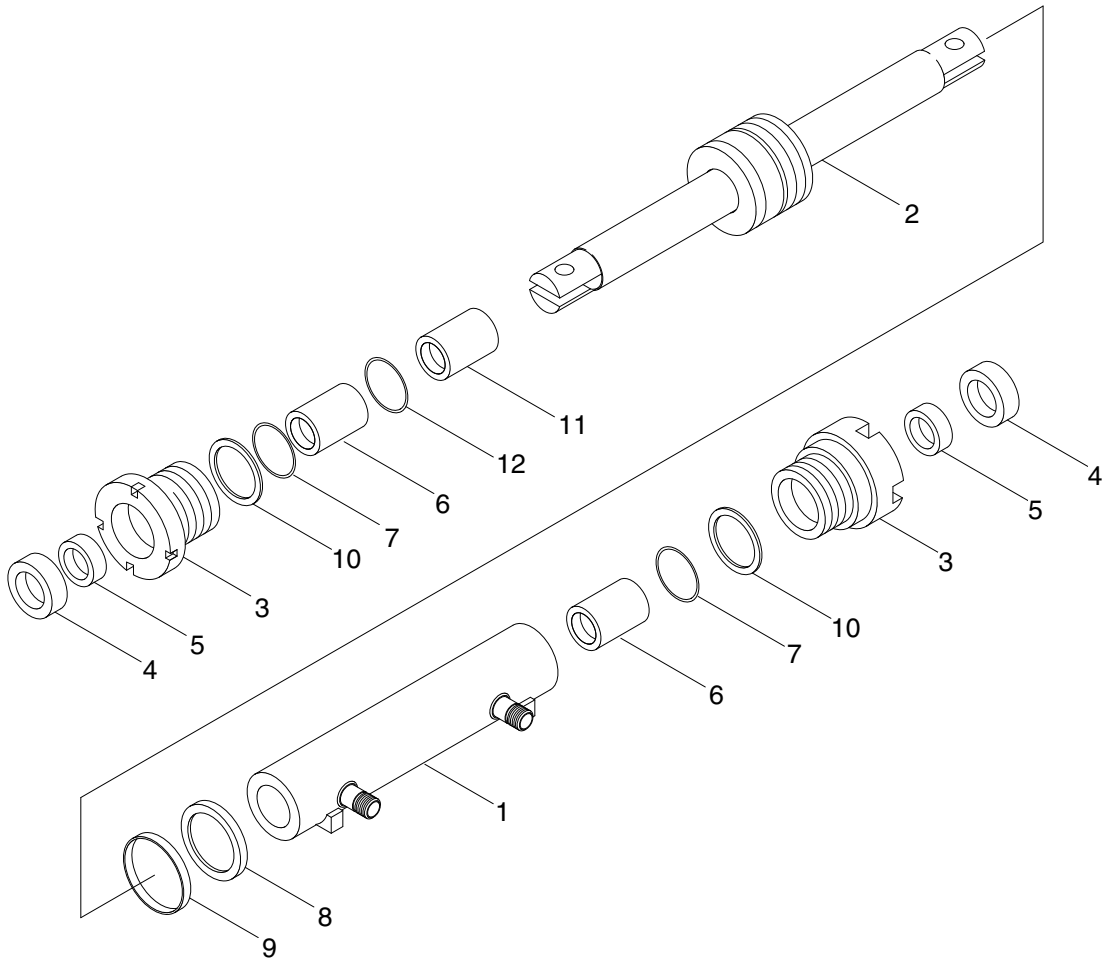
· Tightening torque : 7 kgf·m (50.6 lbf·ft)





4. STEERING CYLINDER

1) STRUCTURE



22D9SS11

1	Tube assembly	5	Rod seal	9	Wear ring
2	Rod assembly	6	DU bushing	10	Lock washer
3	Rod cover	7	O-ring	11	Spacer
4	Dust wiper	8	Piston seal	12	O-ring

2) DISASSEMBLY

※ Before disassembling steering cylinder, release oil in the cylinder first.

(1) Put wooden blocks against the cylinder tube, then hold in a vice.

(2) Remove the gland by hook a wrench in the notch of cylinder head and turn counter-clockwise.

(3) Remove the cylinder rod and piston from the tube.

(4) Check wear condition of the sealing parts. If there are some damage, replace with new parts.

3) CHECK AND INSPECTION

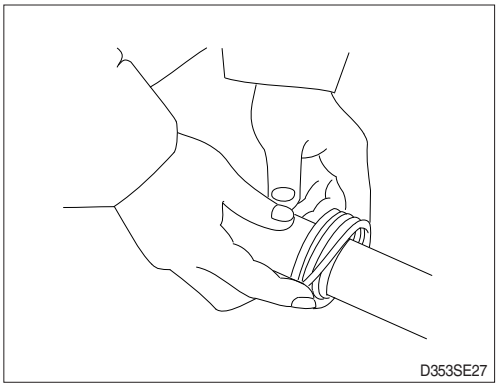
mm (in)

Check item	Criteria		Remedy
	Standard size	Repair limit	
Clearance between piston & cylinder tube	0.064~0.137 (0.0025~0.0054)	0.180 (0.0070)	Replace piston seal
Clearance between cylinder rod & bushing	0.024~0.112 (0.0009~0.0044)	0.120 (0.0049)	Replace bushing
Seals, O-ring	Damage		Replace
Cylinder rod	Dents		Replace
Cylinder tube	Biting		Replace

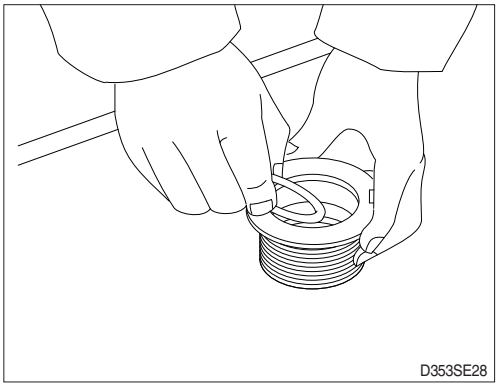
4) ASSEMBLY

(1) Install a new piston seal the groove on the piston.

※ Be careful not to scratch the seal too much during installation or it will not seat properly.

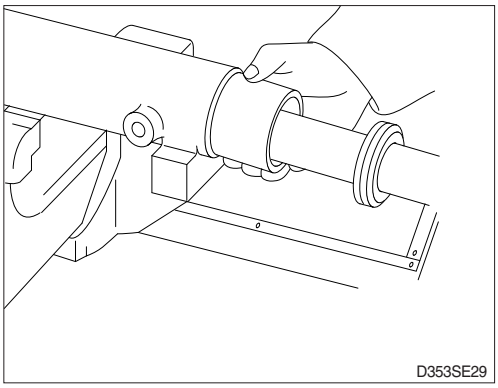


(2) Install the rod seal to the position in the gland applying a slight coat with grease prior to install.

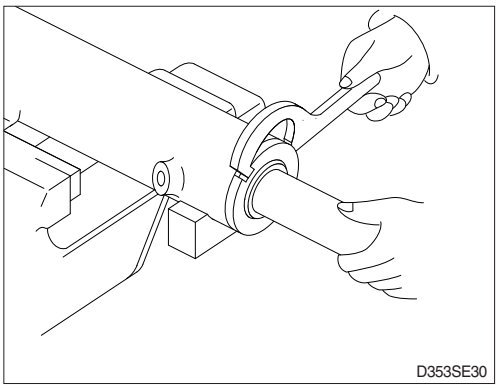


(3) Install the dust wiper to the gland using a special installing tool. Coat the dust wiper with grease slightly before installing.

(4) Set a special tool the cylinder, gland assembly into the cylinder tube.

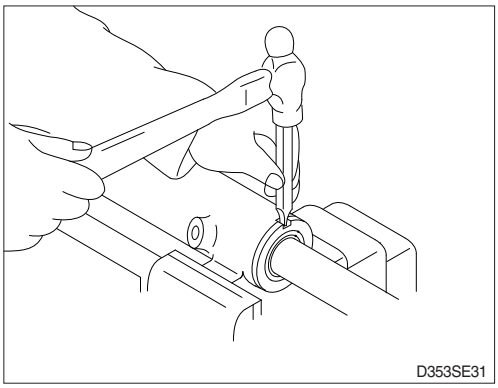

D353SE29

(5) Using a hook spanner, install the gland assembly, and tighten it with torque 60±6 kgf · m (434±43 lbf · ft).


D353SE30

(6) After the gland assembly was installed to the cylinder tube, calk at the tube end into the groove on the gland to prevent screw loosening.

※ If it need calking again, never using previous calking position.


D353SE31

(7) Move the piston rod back and forth several times for the full distance of its stroke. This helps to seat the ring and seals before applying full hydraulic pressure to the cylinder.

(8) Install cylinder into trail axle.

(9) While idling the engine with the rear wheels off the ground, operate the steering wheel left and right alternately.

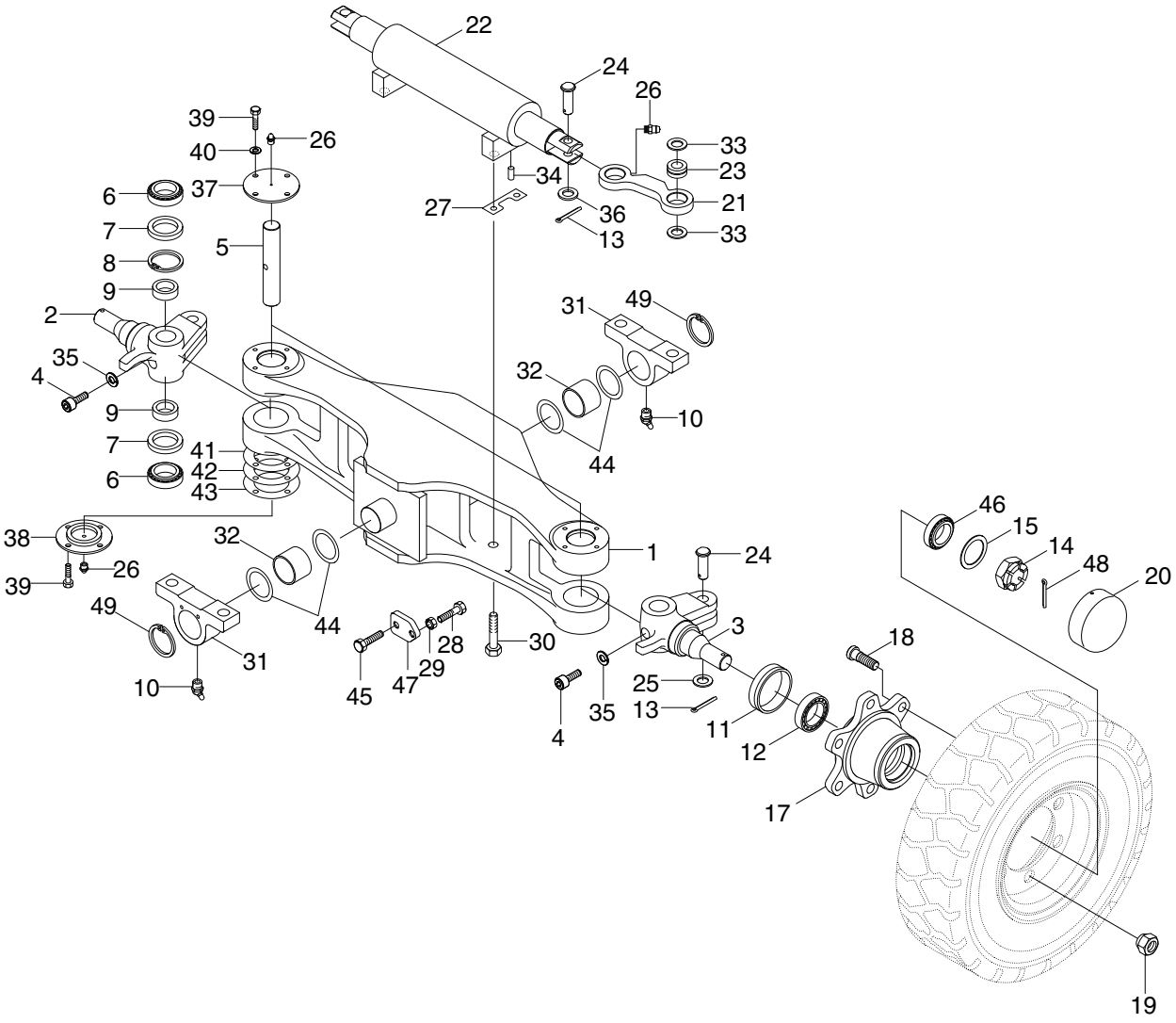
※ Then, repeat the above operation at gradually increasing engine rpm. This releases air from the system and completes preparation for operation.

(10) Stop the engine, lower the floating rear wheels, and check pump joints for oil leaks and looseness and retighten, them as required.

5. STEERING AXLE

1) STRUCTURE

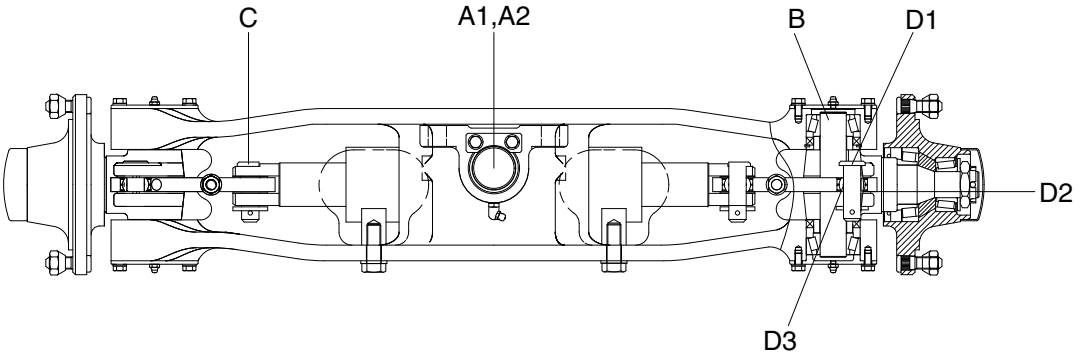
※ Do not remove the stopper bolt unless necessary.



22D9SS07

1	Steering axle	18	Hub bolt	34	Pin
2	Knuckle-RH	19	Hub nut	35	Spring washer
3	Knuckle-LH	20	Hub cap	36	Hardened washer
4	Special bolt	21	Steering link	37	Upper cover
5	King pin	22	Steering cylinder	38	Lower cover
6	Taper roller bearing	23	SPH plain bearing	39	Hex bolt
7	Oil seal	24	Steer link pin	40	Spring wahser
8	Retaining ring	25	Plain washer	41	Shim (0.1)
9	Collar	26	Grease nipple	42	Shim (0.15)
10	Grease nipple	27	Lock plate	43	Shim (0.3)
11	Oil seal	28	Bolt	44	Spacer(0.5)
12	Taper roller bearing	29	Hex nut	45	Hex bolt
13	Split pin	30	Hex bolt	46	Taper roller bearing
14	Nut	31	Trunnion block	47	Plate
15	Washer	32	Bushing	48	Split pin
17	Hub	33	Thrust washer	49	Retaining ring

2) CHECK AND INSPECTION



20D7SS10

unit : mm (in)

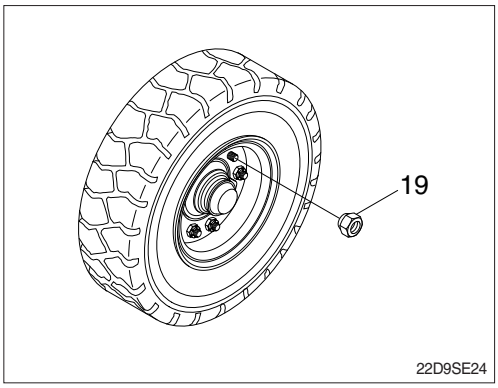
No.	Check item			Criteria		Remarks
				Standard size	Repair limit	
A	Shaft	A1	OD of shaft	55 (2.2)	54.5 (2.1)	Replace
		A2	ID of bushing	55 (2.2)	55.5 (2.2)	
B	OD of king pin			35 (1.4)	34.5 (1.4)	
C	OD of steering cylinder pin			20 (0.8)	19.5 (0.8)	
D	Knuckle	D1	OD of pin	20 (0.8)	19.5 (0.8)	
		D2	Vertical play	-	-	Adjust with shims
		D3	ID of bushing	20 (0.8)	20.5 (0.8)	Replace

· OD : Outer diameter
· ID : Inner diameter

3) DISASSEMBLY

※ Servicing work on the knuckle part can be carried out without removing the axle assy from chassis. The work can be done by jacking up the counter weight part of the truck.

(1) Loosen the hub nut (19) and take off the steering wheel tire.



(2) Remove hub cap (20).

(3) Pull out split pin (48) and remove slotted nut (14).

(4) Using the puller, take off the hub (17) together with the roller bearing (12, 46).

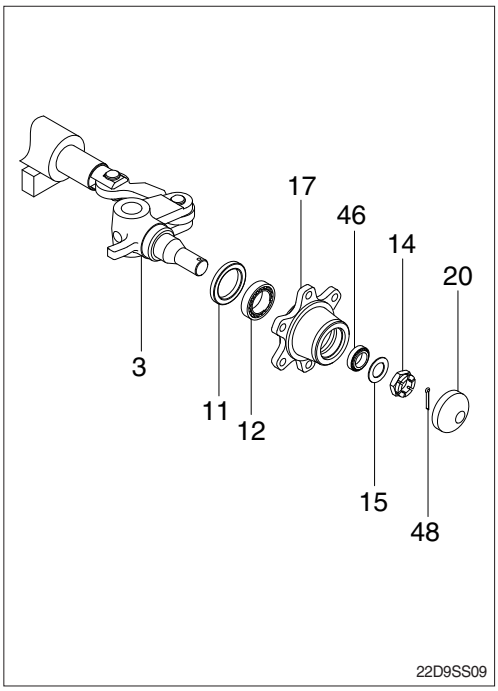
※ Be very careful because just before the hub comes off, tapered roller bearing (12, 46) will fall out.

(5) After hub is removed take off the inner race of roller bearing (12).

(6) Pull out oil seal (11).

※ Don't use same oil seal twice.

(7) Repeat the same procedure for the other side. Moreover, when disassembling is completed, part the slotted nut (14) in the knuckle (3) to protect the threaded portion.



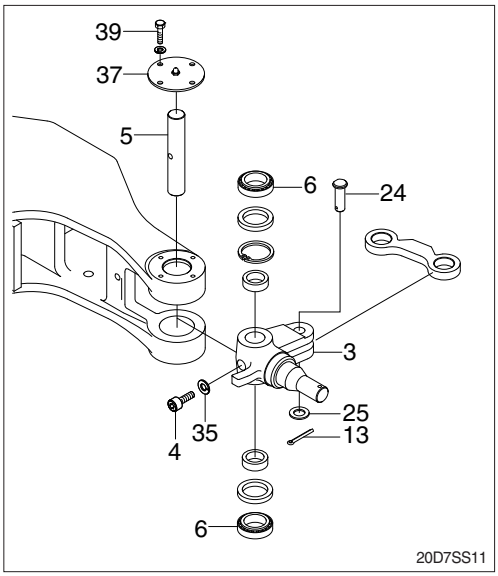
(8) Loosen special bolt (4) and spring washer (35).

(9) Remove hexagon bolt (39) and upper cover (37).

(10) Push out the king pin (5) without damaging the knuckle arm (3).

(11) If defect is observed in bearing (6), pull it out by using extractor.

(12) Remove spilt pin (13), plain washer (25) and link pin (24).



4) ASSEMBLY

※ In reassembling, have all parts washed, grease applied to lubricating parts, and all expendable items such as oil seal and spring washers replaced by new ones.

Perform the disassembly in reverse order.

(1) Tighten the special bolt (4) and washer (35) of king pin (5).

(2) There is a notch in the middle of the king pin (5), make sure that this notch is on the special bolt side.

(3) Do not hammer to drive in bearing (6) because it will break.
Always use drive-in tool.
Be sure that the fixed ring of the bearing is placed in position facing the knuckle (3).

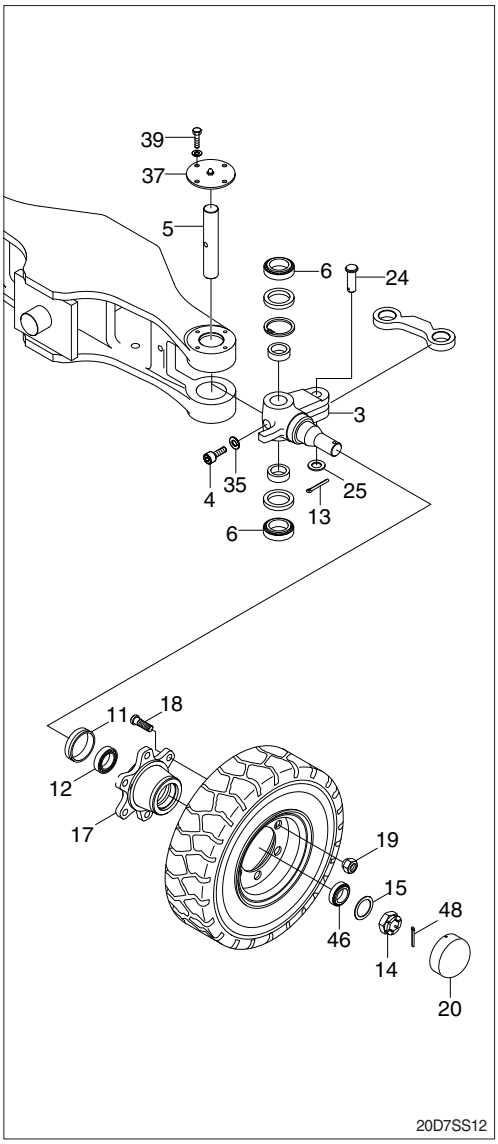
(4) Hub

① Mount oil seal (11) and inner race of tapered roller bearing (12) on the knuckle. The bearing should be well greased before assembling.

② Install the outer race of the bearing (46) in the wheel center and assemble to the knuckle.

③ Tighten nut (14) and lock with split pin (48). In locking with split pin, locate the hole for the split pin by turning the nut back 1/6 of a turn.
Adjust the preload of bearing.

④ Mount the hub cap (20).
Bearing should be well greased before assembling.



SECTION 6 HYDRAULIC SYSTEM

Group 1 Structure and function 6-1
Group 2 Operational checks and troubleshooting 6-33
Group 3 Disassembly and assembly 6-37

GROUP 1 STRUCTURE AND FUNCTION

1. HYDRAULIC SYSTEM OUTLINE

The hydraulic system consists of a main pump, a control valve (MCV or ECV), lift cylinders and tilt cylinders. Refer to below followings. The oil is supplied from the tank at the left side of the frame. The hydraulic return filter is installed inside in the hydraulic tank. For the high-pressure piping, the o-ring fitting method (ORFS) that provides high sealing performance is employed to improve hydraulic system serviceability.

1) MAIN PUMP

· Lift cylinder ,Tilt cylinder, Steering cylinder, Auxiliary function cylinder

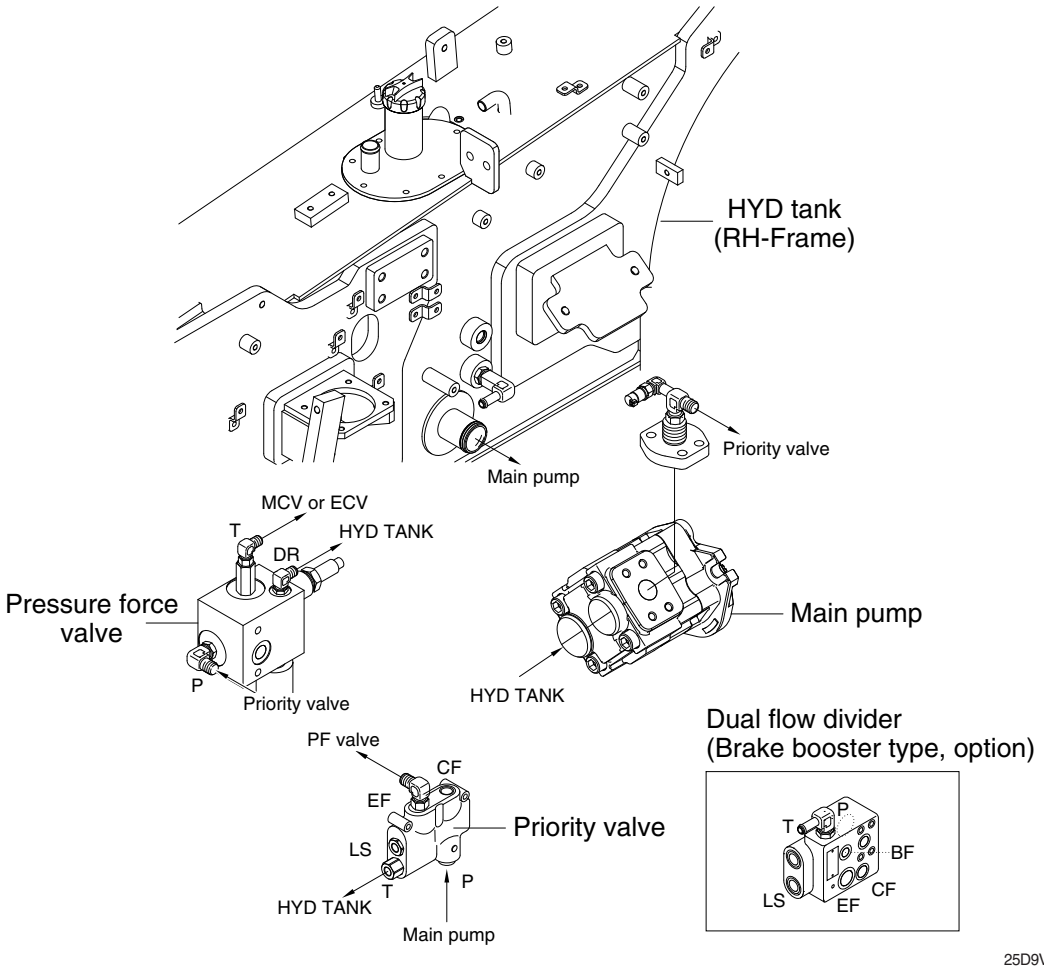
2) MCV OR ECV

· Lift function, Tilt function, Auxiliary function (Sideshift etc.), Fingertip controller (ECV)

3) HYDRAULIC OIL TANK

· Return filter, Suction Strainer, Air breather, Drain plug-magnetic

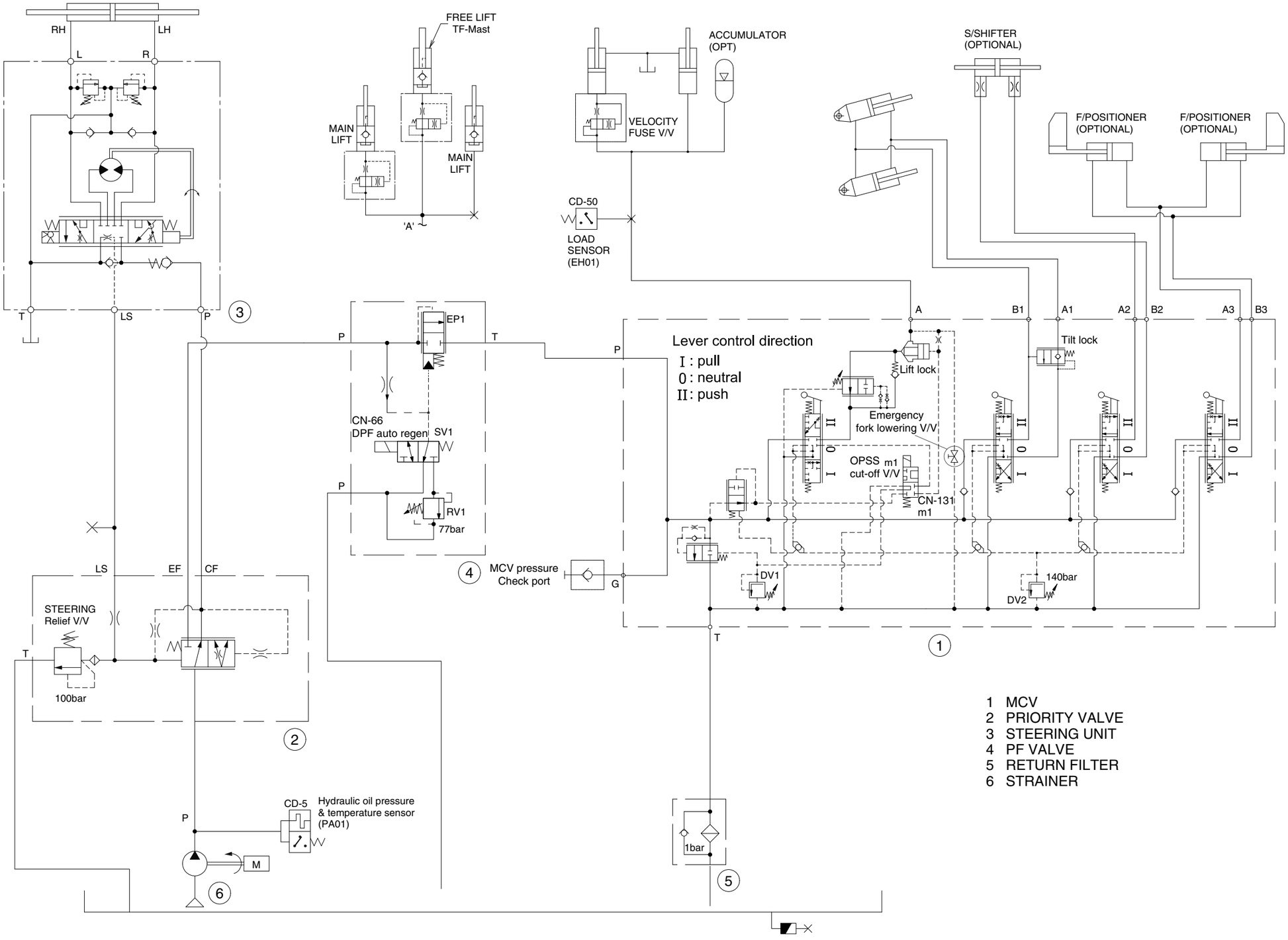
4) PRESSURE FORCED VALVE



25D9V6HS01A

2. HYDRAULIC CIRCUIT

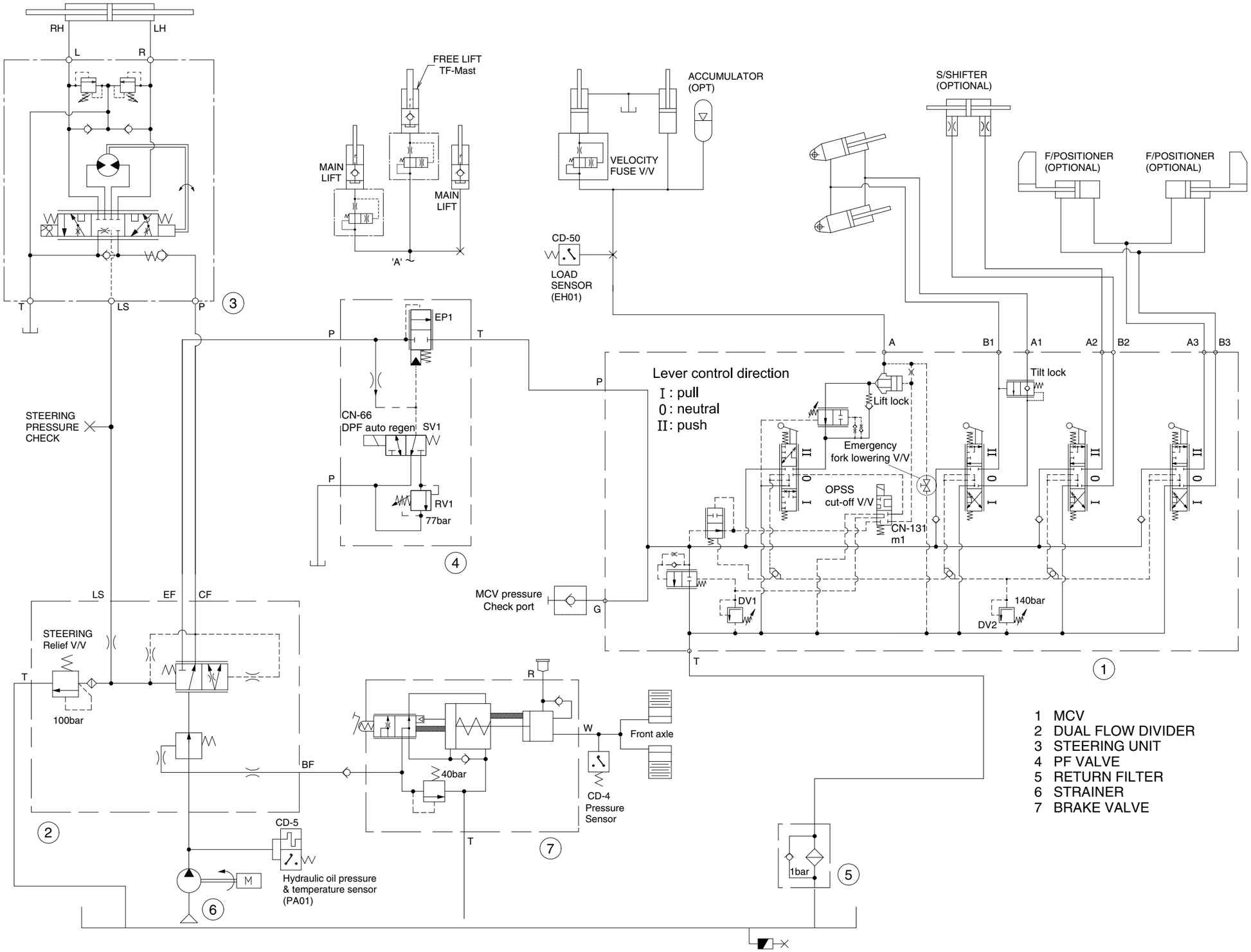
1) NON-BOOSTER BRAKE TYPE



1 MCV
2 PRIORITY VALVE
3 STEERING UNIT
4 PF VALVE
5 RETURN FILTER
6 STRAINER

33HN-06010-00

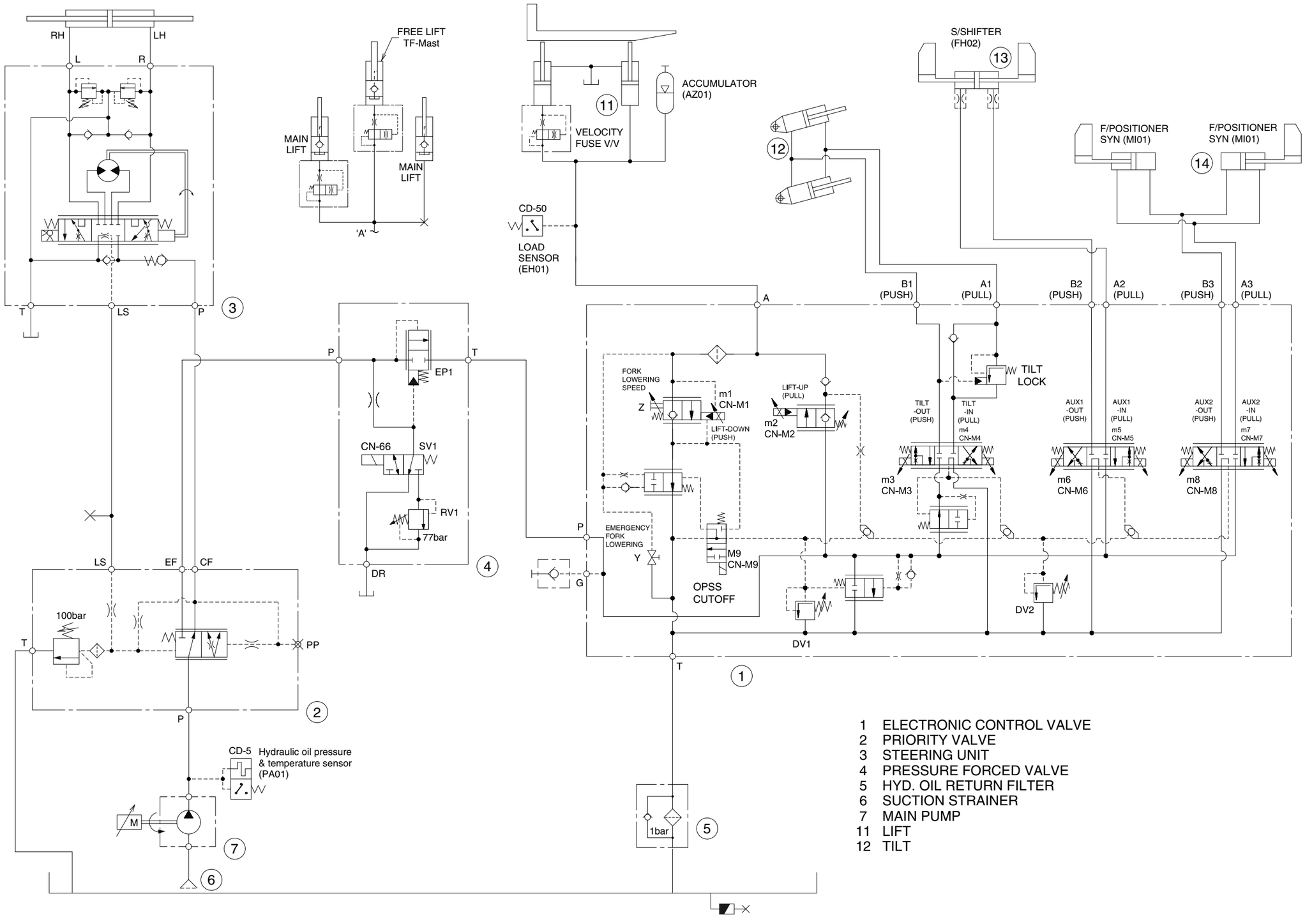
2) BOOSTER BRAKE TYPE (OPTION)



1 MCV
2 DUAL FLOW DIVIDER
3 STEERING UNIT
4 PF VALVE
5 RETURN FILTER
6 STRAINER
7 BRAKE VALVE

33HN-06110-00

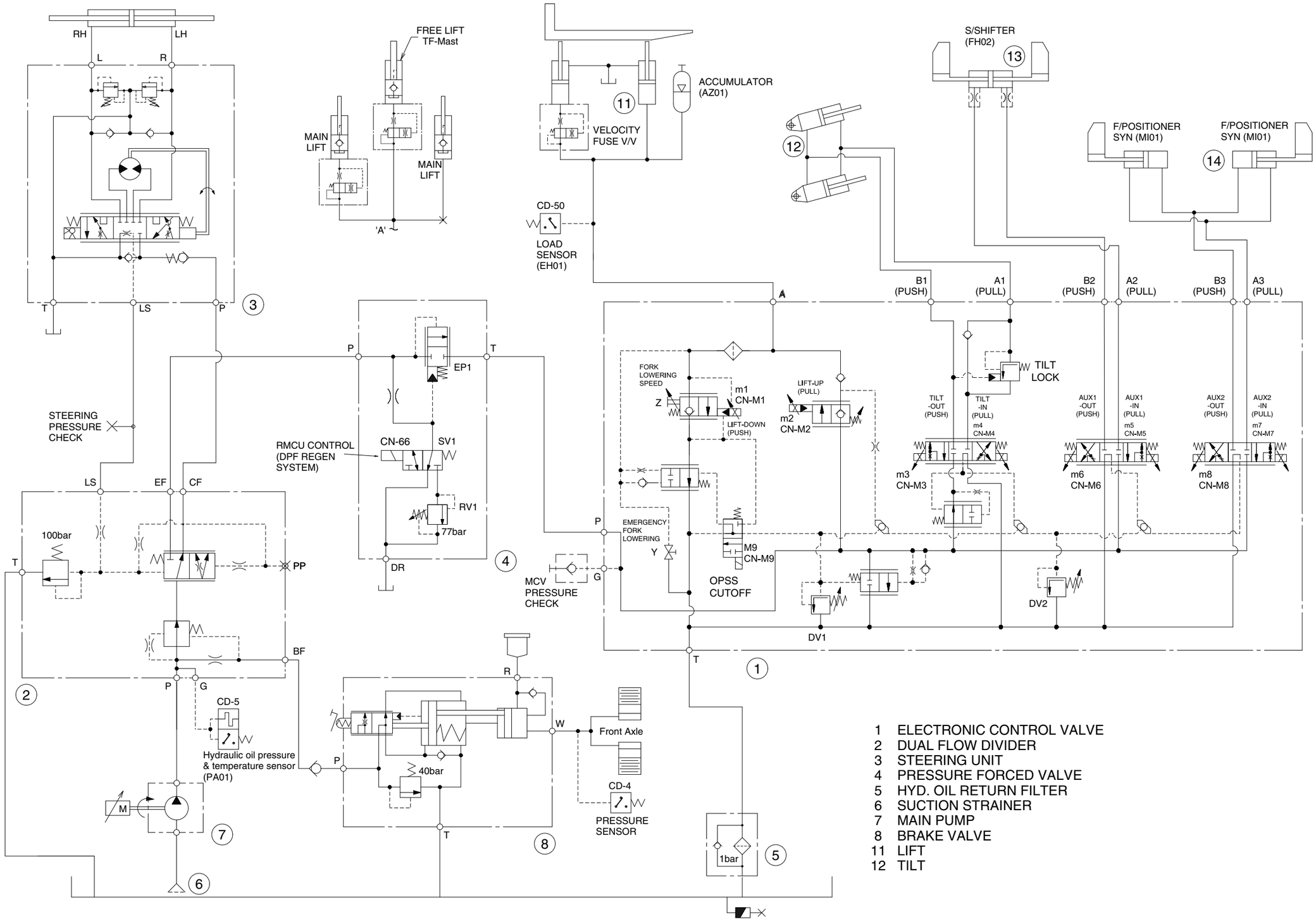
3) FINGERTIP, NON-BOOSTER BRAKE TYPE (OPTION)



1 ELECTRONIC CONTROL VALVE
2 PRIORITY VALVE
3 STEERING UNIT
4 PRESSURE FORCED VALVE
5 HYD. OIL RETURN FILTER
6 SUCTION STRAINER
7 MAIN PUMP
11 LIFT
12 TILT

33HN-06020-00

4) FINGERTIP, BOOSTER BRAKE TYPE (OPTION)

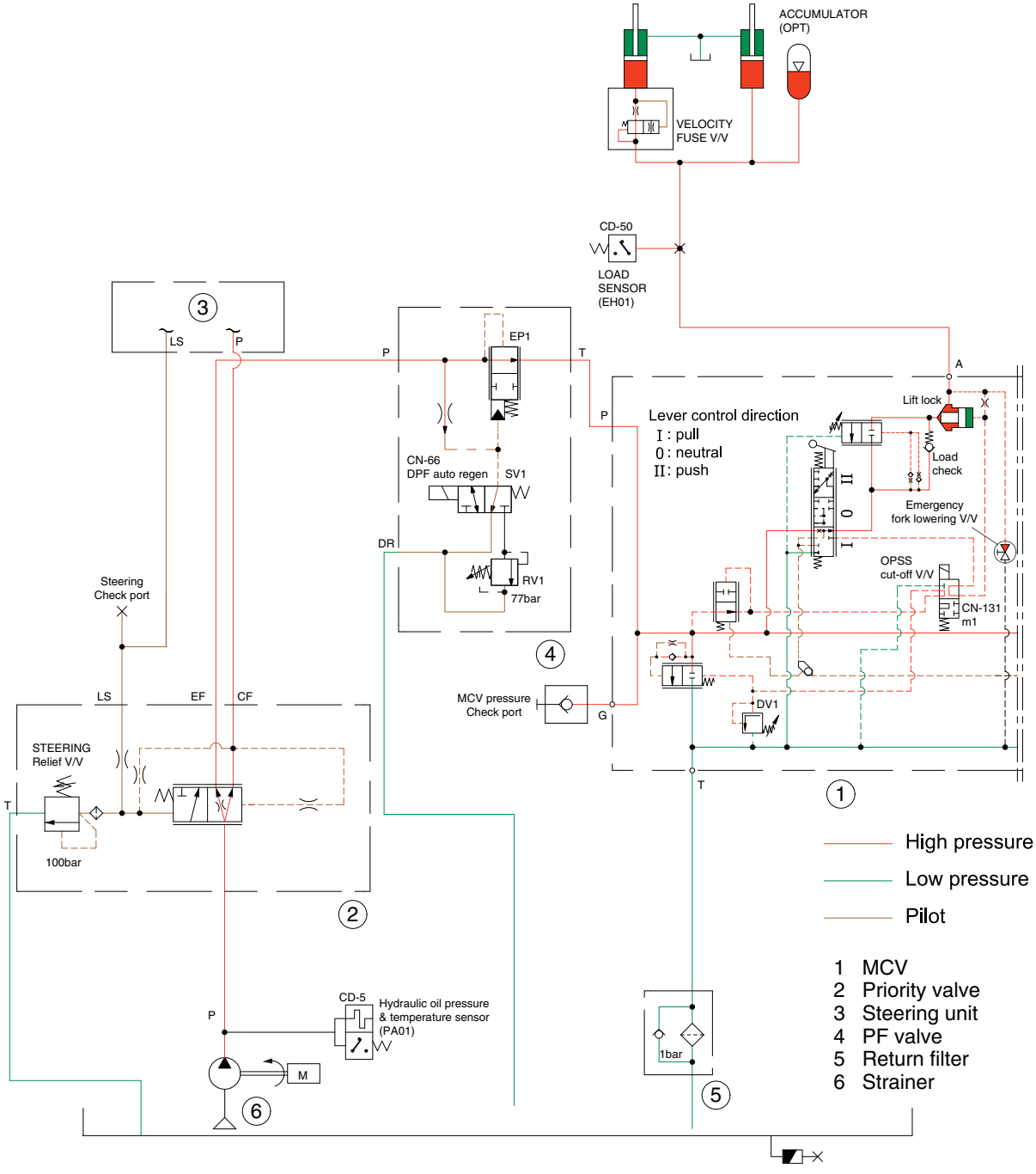


1 ELECTRONIC CONTROL VALVE
2 DUAL FLOW DIVIDER
3 STEERING UNIT
4 PRESSURE FORCED VALVE
5 HYD. OIL RETURN FILTER
6 SUCTION STRAINER
7 MAIN PUMP
8 BRAKE VALVE
11 LIFT
12 TILT

33HN-06120-00

3. WORK EQUIPMENT HYDRAULIC CIRCUIT

1) WHEN THE LIFT CONTROL LEVER IS IN THE LIFT POSITION

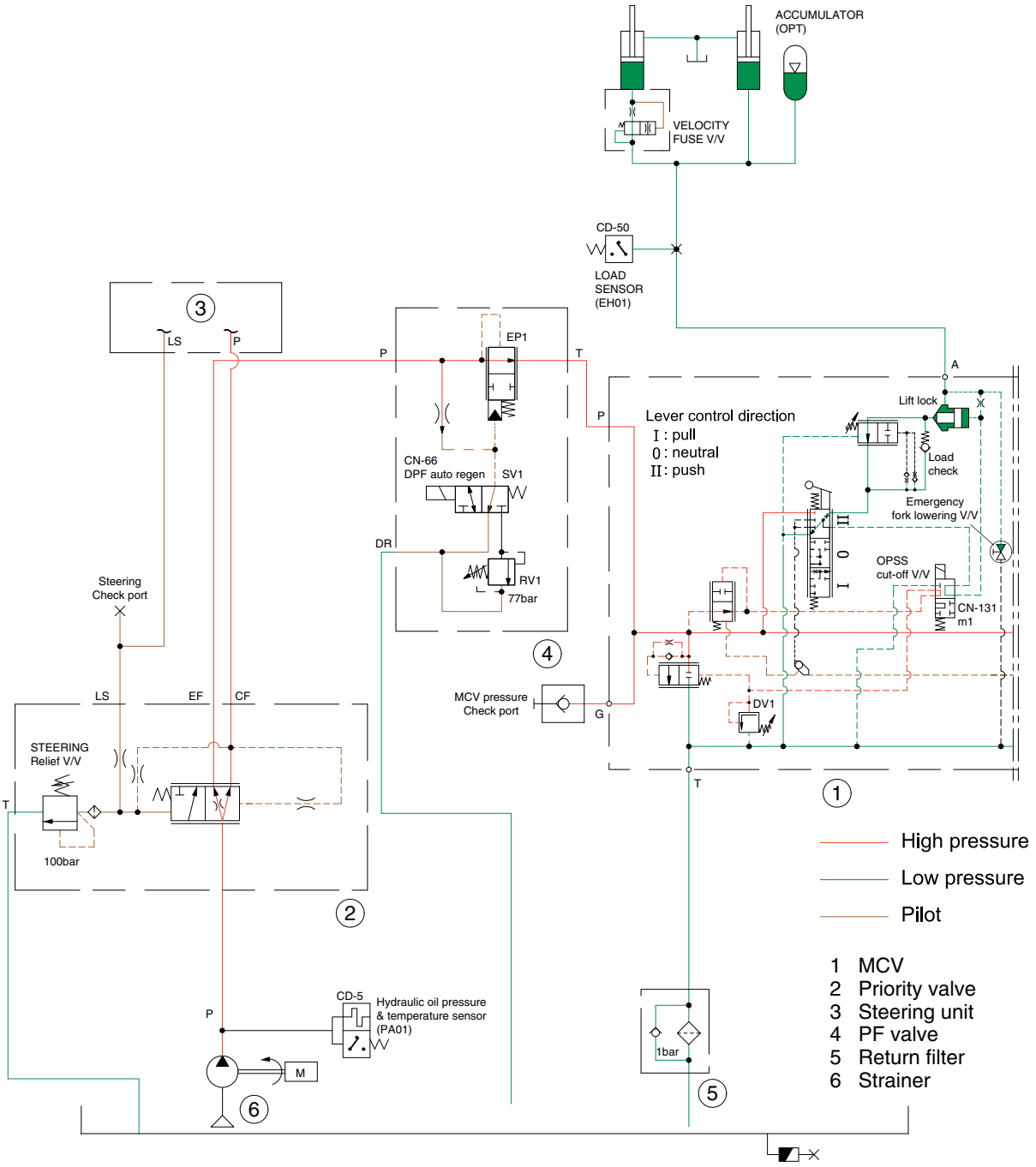


25D9V6HS02

When the lift control lever is pulled back, the spool in the first block is moves to lift position.
The oil from the pump flows into main control valve (1) through the priority valve (2). Then goes to the large chamber of lift cylinder by pushing the load check valve of the spool and lift lock valve.
The oil from the small chamber of lift cylinder returns to hydraulic oil tank at the same time.
When this happens, the forks go up.

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

2) WHEN THE LIFT CONTROL LEVER IS IN THE LOWER POSITION

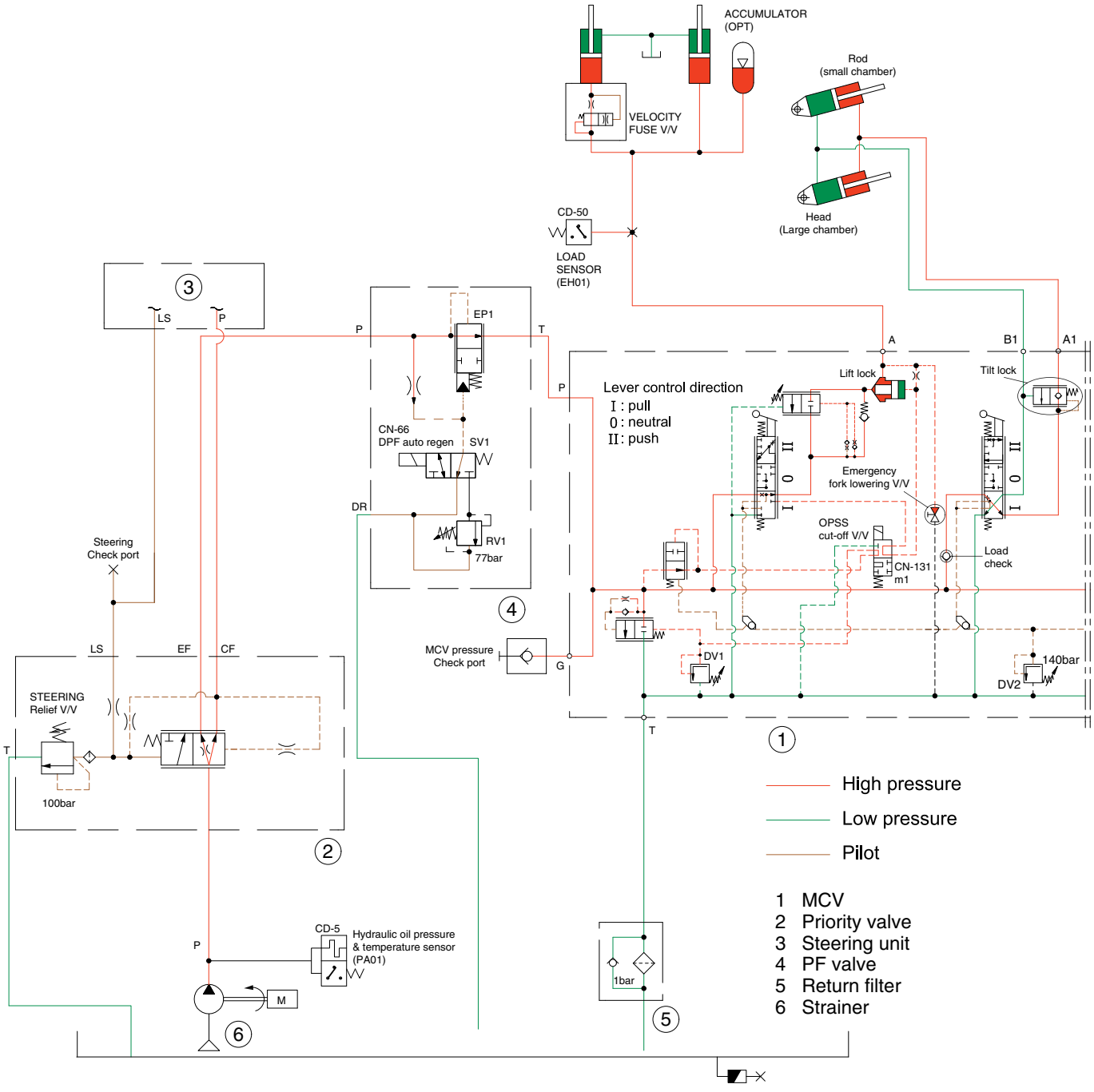


25D9V6HS03

When the lift control is pushed forward, the spool in the first block is moved to lower position.
The work port and the small chamber and the large chamber are connected to the return passage, so the forks will be lowered due to its own weight.

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

3) WHEN THE TILT CONTROL LEVER IS IN THE BACKWARD POSITION



25D9V6HS04

When the tilt control lever is pulled back, the spool in the second block is moved to tilt backward position.

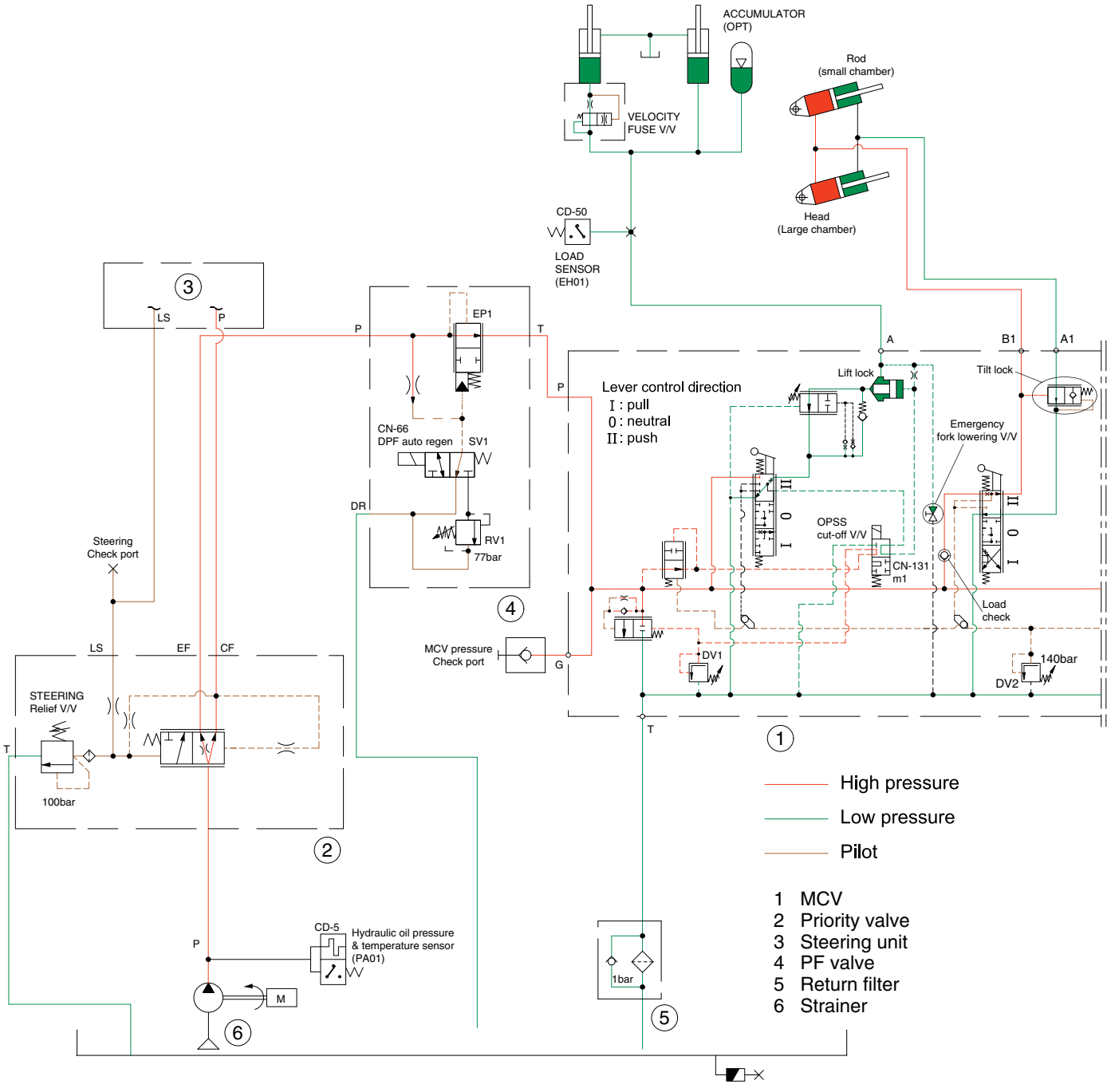
The oil from the pump flows into main control valve (1) through the priority valve (2). Then goes to the small chamber of tilt cylinder by pushing the load check valve of the spool and tilt lock valve.

The oil at the large chamber of tilt cylinder returns to hydraulic oil tank through the hydraulic oil cooler and return filter at the same time.

When this happens, the mast tilt backward.

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

4) WHEN THE TILT CONTROL LEVER IS IN THE FORWARD POSITION



25D9V6HS05

When the tilt control lever is pushed forward, the spool in the second block is moved to tilt forward position.

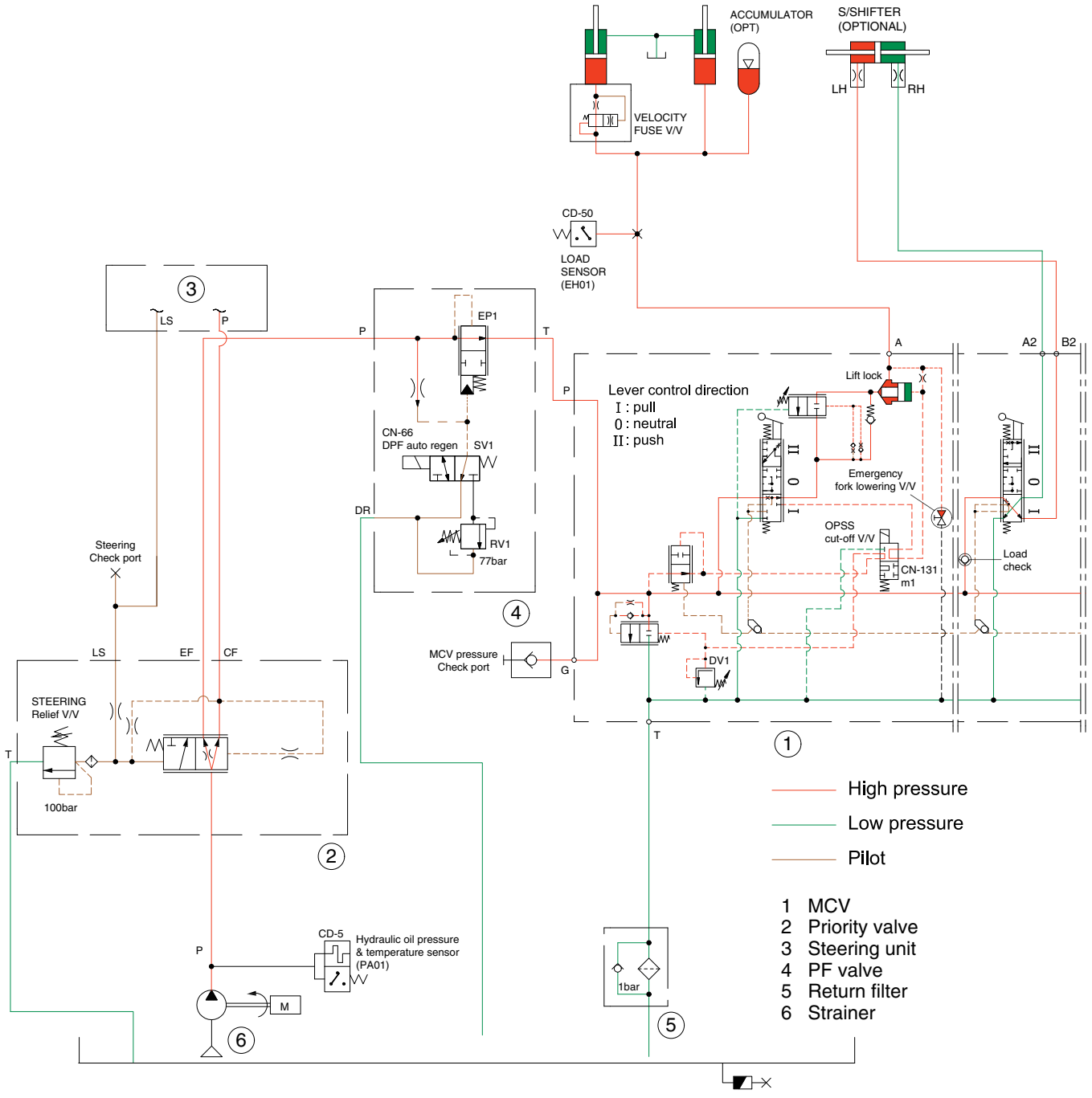
The oil from the pump flows into main control valve (1) through the priority valve (2). Then goes to the large chamber of tilt cylinder by pushing the load check valve of the spool and tilt lock valve.

The oil at the small chamber of tilt cylinder returns to hydraulic oil tank through the hydraulic oil cooler and return filter at the same time.

When this happens, the mast tilt forward.

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

5) WHEN THE SIDE SHIFTER LEVER IS IN THE RIGHT POSITION (OPTION)



25D9V6HS06

When the side shifter lever is pulled backward, the spool in the third block is moved to side shifter right position.

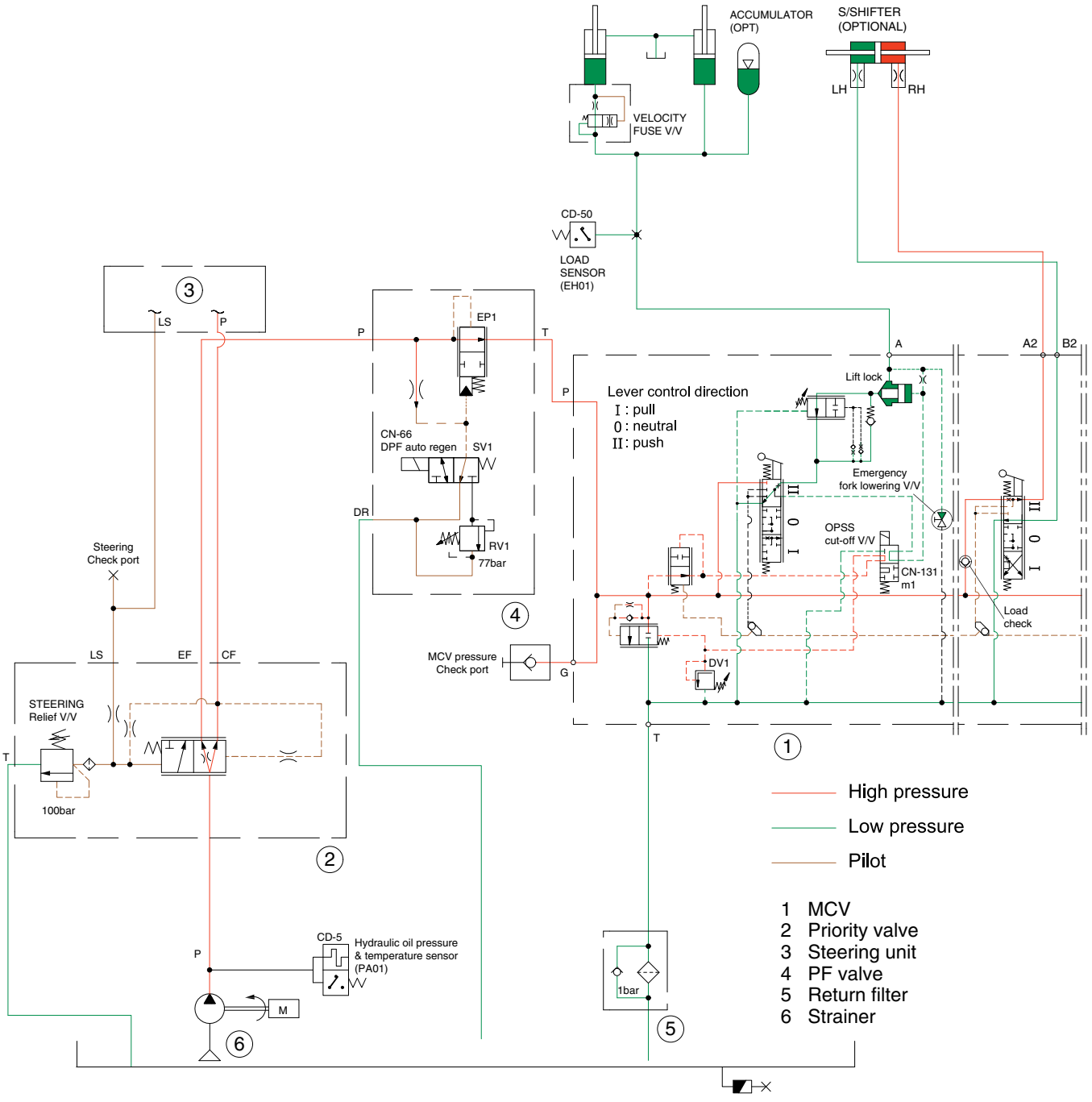
The oil from the pump flows into main control valve (1) through the priority valve (2). Then goes to the LH chamber of side shifter cylinder by pushing the load check valve of the spool.

The oil at the RH chamber of side shifter cylinder returns to hydraulic oil tank through the hydraulic oil cooler and return filter at the same time.

When this happens, the side shifter goes right.

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

6) WHEN THE SIDE SHIFTER LEVER IS IN THE LEFT POSITION (OPTION)



25D9V6HS07

When the side shifter lever is pushed forward, the spool in the third block is moved to side shifter left position.

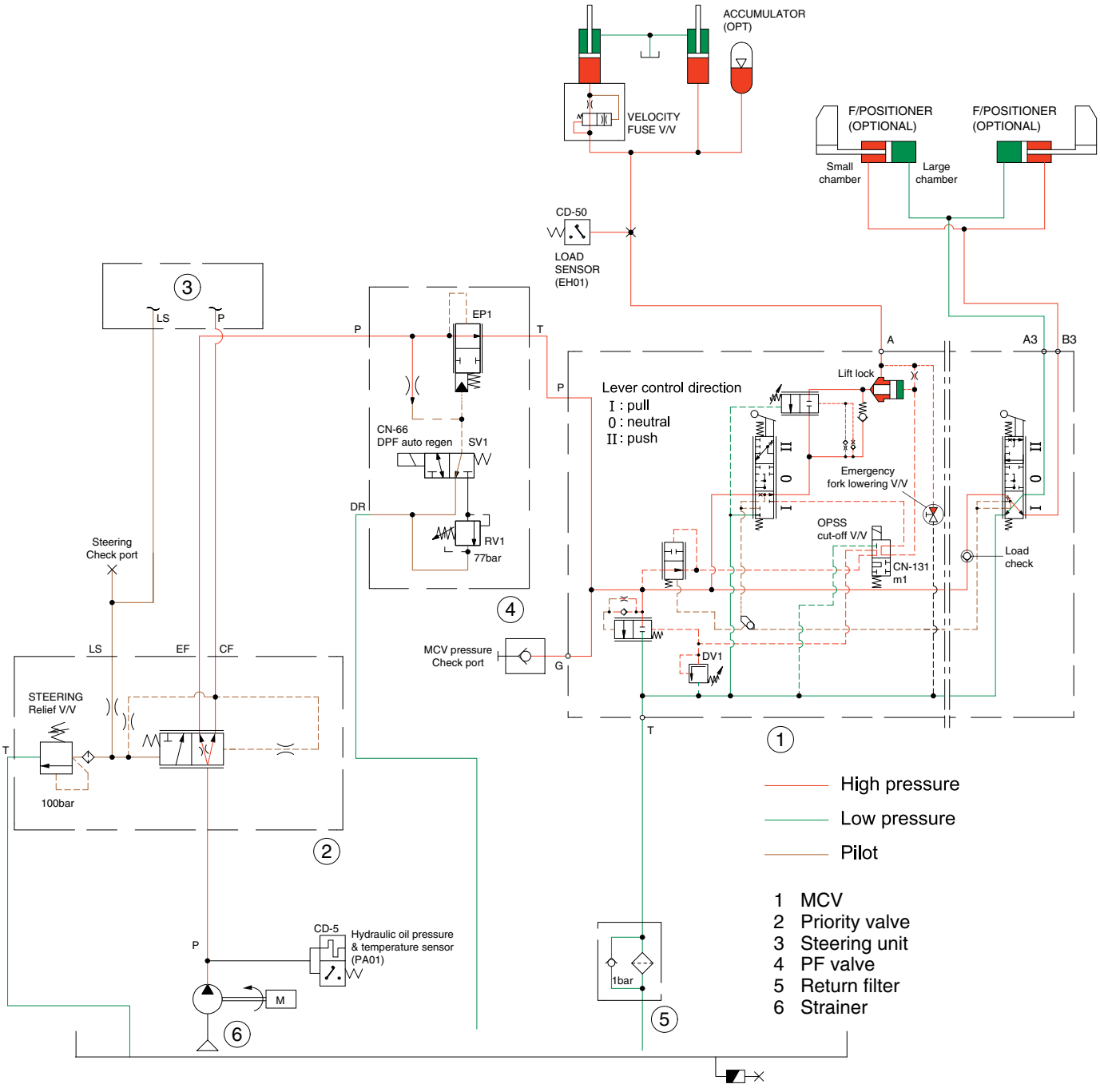
The oil from the pump flows into main control valve (1) through the priority valve (2). Then goes to the RH chamber of side shifter cylinder by pushing the load check valve of the spool.

The oil at the LH chamber of side shifter cylinder returns to hydraulic oil tank through the hydraulic oil cooler and return filter at the same time.

When this happens, the side shifter goes left.

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

7) WHEN THE FORK POSITIONER LEVER IS IN THE SPREAD-OUT POSITION (OPTION)



25D9V6HS15

When the fork positioner lever is pulled backward, the spool in the fourth block is moved to fork positioner spread out position.

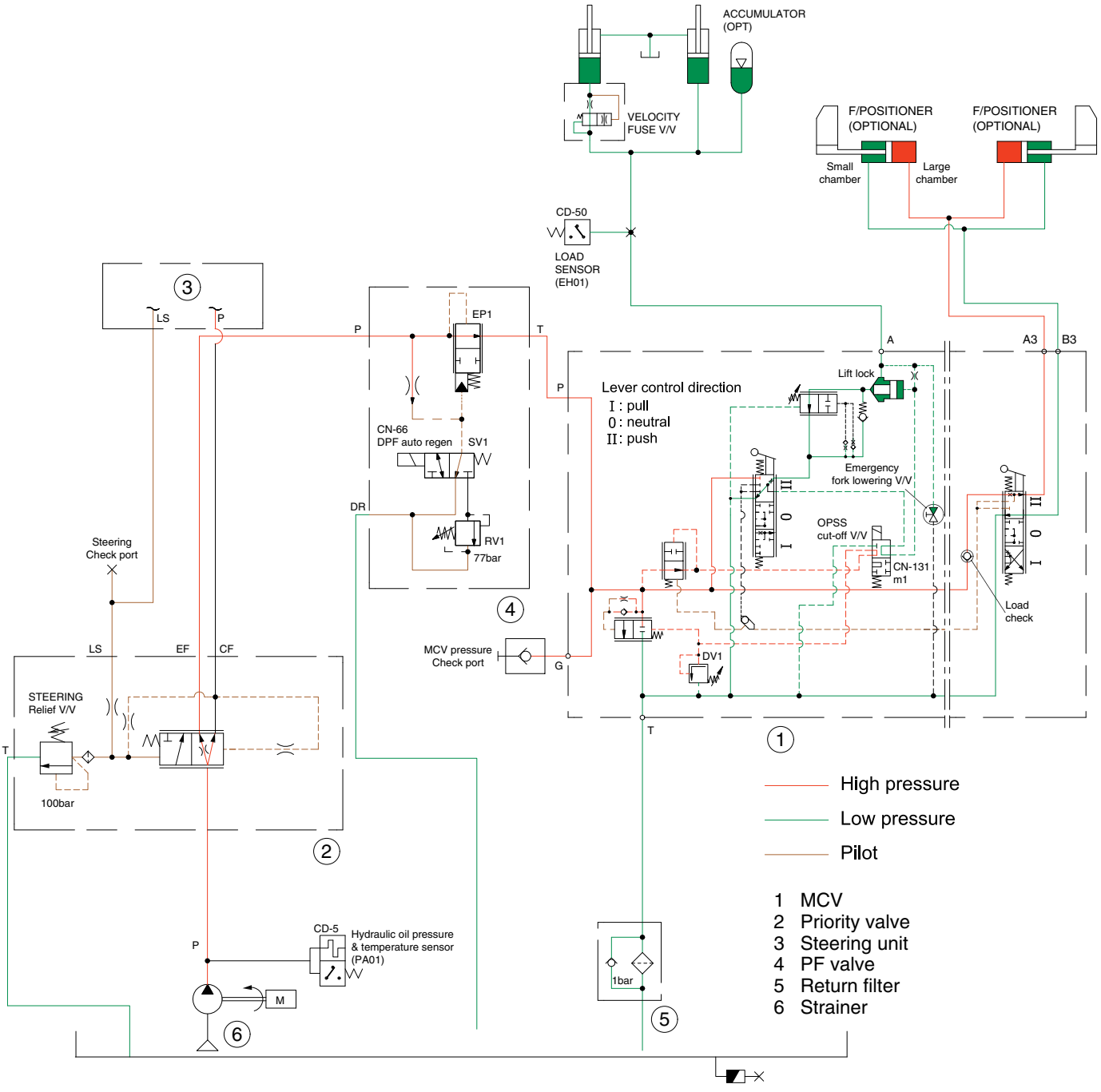
The oil from the pump flows into main control valve (1) through the priority valve (2). Then goes to the large chamber of fork positioner cylinder by pushing the load check valve of the spool.

The oil at the small chamber of fork positioner cylinder returns to hydraulic oil tank through the hydraulic oil cooler and return filter at the same time.

When this happens, the forks are spread out.

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

8) WHEN THE FORK POSITIONER LEVER IS IN THE CLOSE POSITION (OPITON)



25D9V6HS16

When the fork positioner lever is pushed forward, the spool in the fourth block is moved to fork positioner spread out position.

The oil from the pump flows into main control valve (1) through the priority valve (2). Then goes to the small chamber of fork positioner cylinder by pushing the load check valve of the spool.

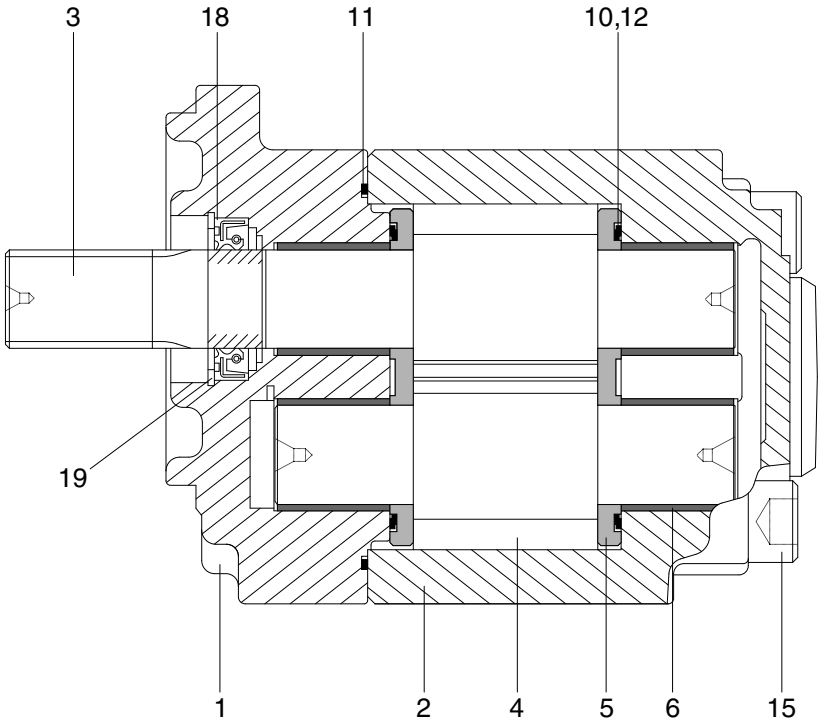
The oil at the large chamber of fork positioner cylinder returns to hydraulic oil tank through the hydraulic oil cooler and return filter at the same time.

When this happens, the forks are close.

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

2. HYDRAULIC GEAR PUMP

1) STRUCTURE



22D9HS14-1

1	Front cover	5	Side gear	12	Back up ring
2	Body	6	Bushing	15	Bolt
3	Drive gear	10	Gasket (3-shaped)	18	Oil seal
4	Driven gear	11	O-ring	19	Retaining ring

※ Seal kit (EA) : 10 (2), 11 (1), 12 (2), 18 (1), 19 (1)

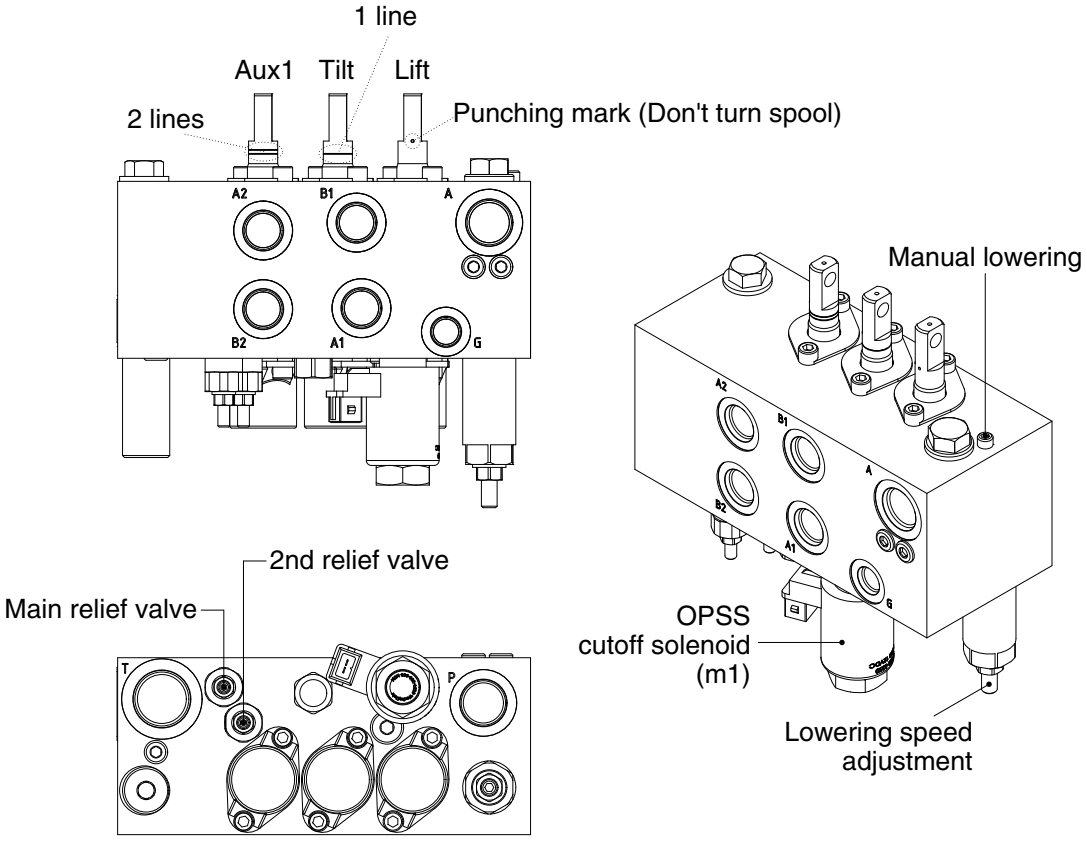
(2) Operation

This pump comprises of a front cover and a body bolted together. The gear journals are supported by bushings (6) to give high volumetric and mechanical efficiencies.

3. MAIN CONTROL VALVE

1) STRUCTURE

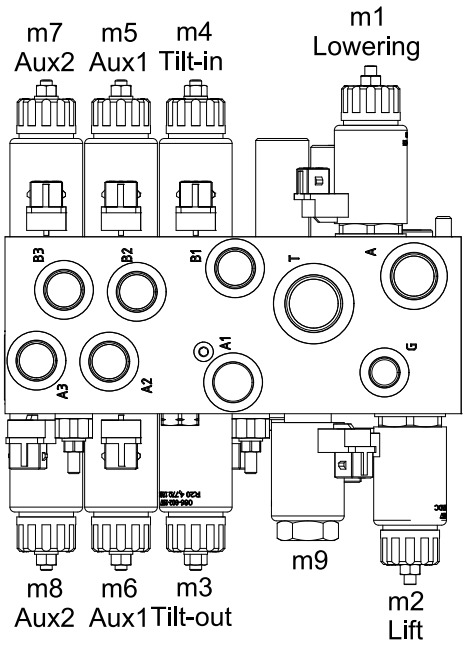
(1) 3 spool

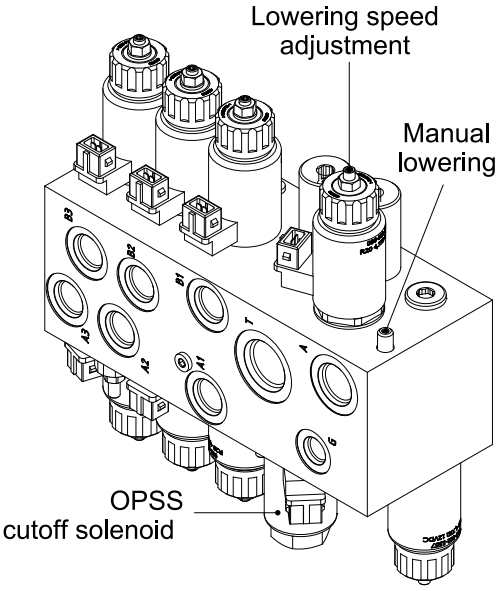


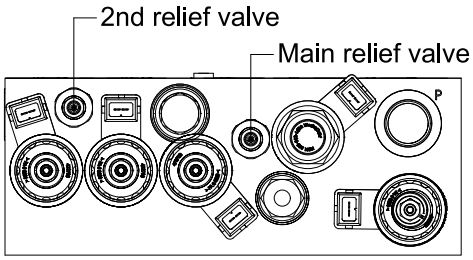
25D9V6HS08

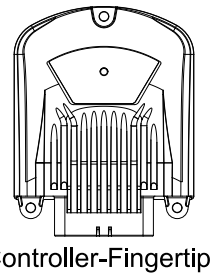
Port	Port name	Port size	Tightening torque	
			kgf·m	lbf·ft
A	Lift / Lower	7/8-14 UNF	7	50.6
A1, B1	Tilt rod / head	3/4-16 UNF	5	36.2
A-, B-	Aux 1, Aux 2	3/4-16 UNF	5	36.2
P	Inlet	7/8-14 UNF	7	50.6
T	Outlet	1 1/16-12 UN	9.5	68.7
G	Gauge, Pilot	9/16-18UNF	3	21.7
m1	Cuttoff solenoid	-	4	28.9
	Coil	-	0.7	5.1

(2) Fingertip MCV (option)









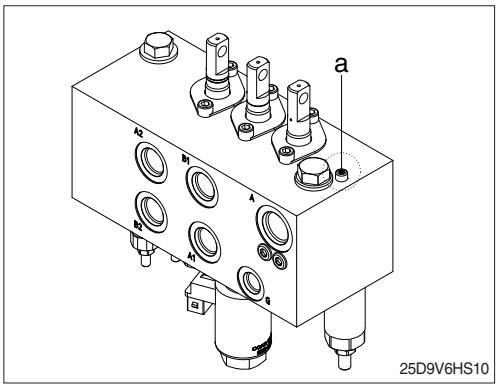
25D9V6HS09

Port	Port name	Port size	Tightening torque	
			kgf·m	lbf·ft
A	Lift / Lower	7/8-14 UNF	7	50.6
A1, B1	Tilt rod / head	3/4-16 UNF	5	36.2
A-, B-	Aux 1, Aux 2	3/4-16 UNF	5	36.2
P	Inlet	7/8-14 UNF	7	50.6
T	Outlet	1 1/16-12 UN	9.5	68.7
G	Gauge	9/16-18UNF	3	21.7

2) FUNCTION

(1) Emergency fork lowering

In case that the mast can't be lowered due to a problem in the controller, activate the emergency lowering valve on the MCV assy by rotating the valve (a).



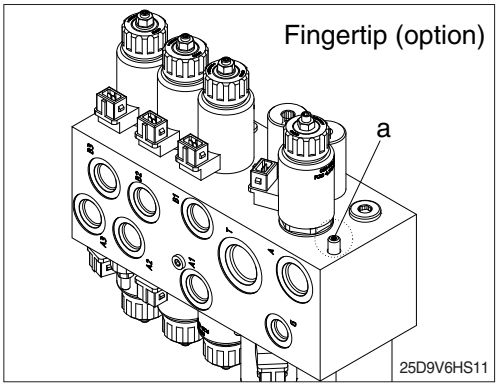
⚠ Manual override features are intended for emergency use, not for continuous-duty operation.

① Open the bonnet.

② Use the L-wrench (3 mm) to slowly undo the screw for the emergency lowering feature in an anti-clockwise direction until lowering begins.

※ **Do not undo the screw more than 1.5 turns.**

※ **If lowering still does not begin, there is a mechanical block. Do not under any circumstances continue to unscrew the emergency lowering feature.**



③ After lowering is complete, the screw must be screwed back in again

※ **Do not exceed a tightening torque of maximum 0.25 kgf·m (1.81 lbf·ft).**



⚠ When operating the emergency lowering valve in order to lower the mast inevitably, always make certain that any person should not stand or pass under the mast, the fork and platform so as to avoid from unexpected accident such as severe personal injury or death.

(2) **Cutoff solenoid for hydraulic blocking**

This device is a mast interlock that prevents the hydraulic functions of the MCV from being activated unless the driver is seated. In addition, it is a key lowering interlock device that prevents the fork from descending even when the ignition key is turned off. This safety function is defined in ISO 3691-1 and should not be arbitrarily disabled in the MCV.

(3) Relief valve

① Main relief valve (DV1)

The main relief valve limits the maximum pressure for the lift and tilt functions. If the lift or tilt function is operated simultaneously with the auxiliary function, the maximum pressure of the lift or tilt function is limited by the 2nd relief valve pressure setting. Typically the main relief valve would not require any field adjustment. If adjustment is necessary, refer to next page for main relief valve test and adjustment.

② 2nd relief valve (DV2)

The secondary relief valve limits the maximum pressure of the auxiliary function and is set lower than the main relief valve. Secondary relief valves may require pressure adjustment depending on the type of attachment.

※ If pressure adjustment is required, it is recommended to adjust within 90% of the main relief valve set pressure (e.g. 200 × 0.9=180 bar). If the main relief valve is too close to the set pressure, a problem of inter-circuit interference may occur. Refer next page for relief valve test and adjustment for adjustment instructions.

3) RELIEF VALVE PRESSURE TEST AND ADJUSTMENT

(1) Test specification

- Engine speed : high idle rpm
- Oil temperature : 50 ± 5 ℃ (122 ± 9 ℉)
- MCV relief set pressure
  - Main : 200 ± 3 bar (2900 ± 43 psi)
    ★175 ± 3 bar (2540 ± 43 psi) / ★ : EU, AN corporate sales equipment (25D-9V/VS)
  - 2nd : 140 ± 3 bar (2030 ± 43 psi)
- Tools : spanner 10 mm, hex. wrench 3 mm

⚠ In general, the main relief valve (DV1) should not be adjusted for boosting applications in the field. Increasing the main relief valve pressure above the specified set pressure can damage the equipment.

⚠ Inspect the relief valve in a safe and clean environment.

⚠ Make sure that there is no other person around the equipment during operation and testing.

⚠ Even after turning off the engine, hydraulic oil may remain in the hydraulic system. To prevent personal injury, lower the fork completely down to the ground. (The mast chain has to be released loosely so that the fork is completely lowered.)

⚠ Before disassembling, tightening, removing, or adjusting piping components (hoses, fittings, plugs, etc.), be sure to turn off the engine. Completely remove the pressure inside the circuit by moving the MCV control lever two or three times in the forward and backward direction. Also opening the hydraulic tank cap and remove the pressure. (If the hydraulic tank breather filter is clogged, the pressure in the tank may remain.)

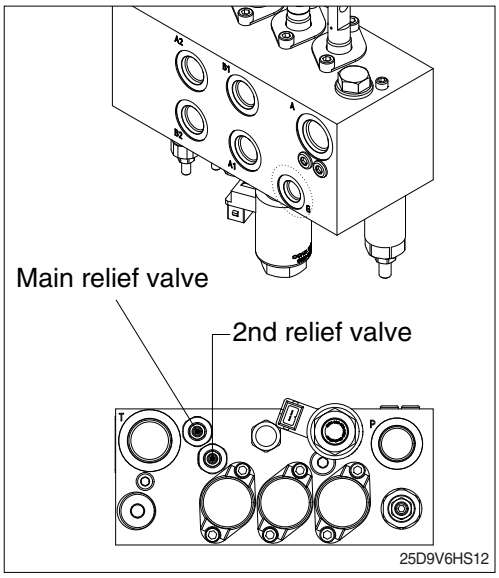
⚠ **Hot hydraulic oil can cause serious burns to skin. Do not touch hydraulic components or oil during test. Make sure hydraulic oil has cooled to safe temperature before installing or removing test equipment.**

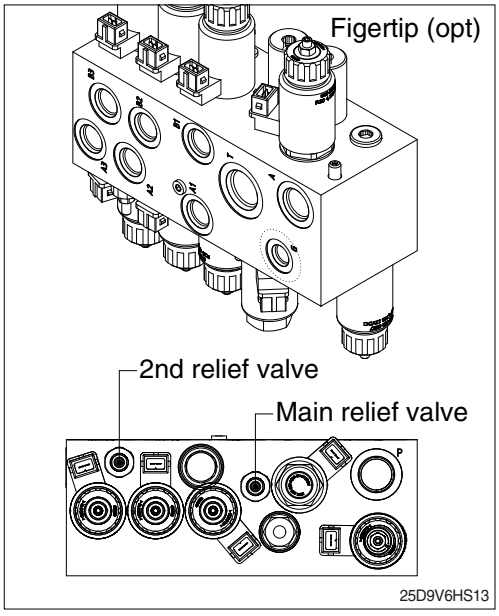
⚠ **Hydraulic oil under pressure can be injected into skin. Lower forks to ground and relieve all circuit pressure before removing test plugs from valve.**

① Operate hydraulic system until the oil temperature is within test specification. See Hydraulic WarmUp Procedure.
② Lower the fork to the ground, stop the engine, and apply the parking brake switch.
③ Open the bonnet
④ Connect a pressure gauge to the “G” pressure check port on the MCV.
⑤ Operate engine at test specifications.
⑥ Pull the lift lever to raise the fork all the way and hold it.
⑦ Check pressure gauge reading. Compare the readings and specifications.
⑧ Loosen the MCV relief valve locknut (10 mm) and turn the adjusting (3 mm) screw to adjust the pressure.
- Tightening torque : 0.25 kgf·m (1.81 lbf·ft)
- If pressure is lower than specification, turn relief valve adjusting screw clockwise.
- If the pressure is higher than the specification, turn the adjusting screw counterclockwise.

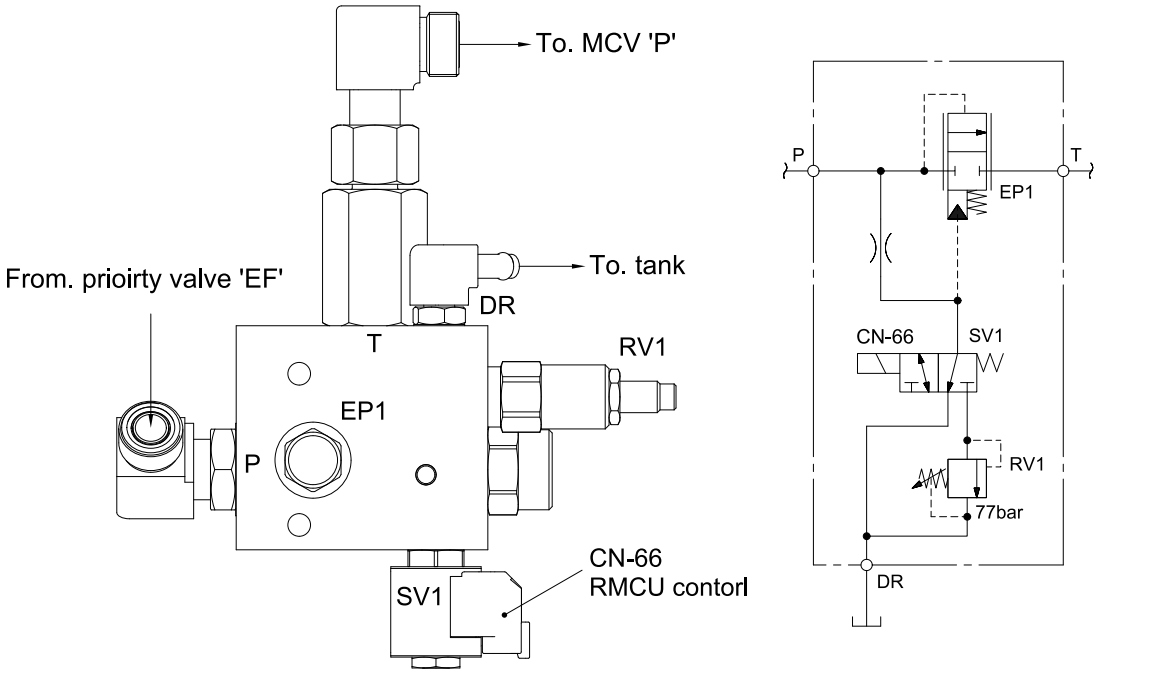
⚠ **The MCV relief valve adjustment screw is very sensitive. Operate in 1/4 turn increments to avoid system overpressure.**

⑨ Repeat step ⑦, ⑧. If pressure is to specifications, remove test equipment.





4. PRESSURE FORCED ALVE



25D9V6HS14

Port	Port size	Component	Related issues	Remarks
P	G 3/4	Priority valve 'EF'	-	-
T	G 3/4	MCV 'P' or ECV 'P'	-	-
DR	9/16-18 UNF	Hydraulic oil tank	Back pressure	-

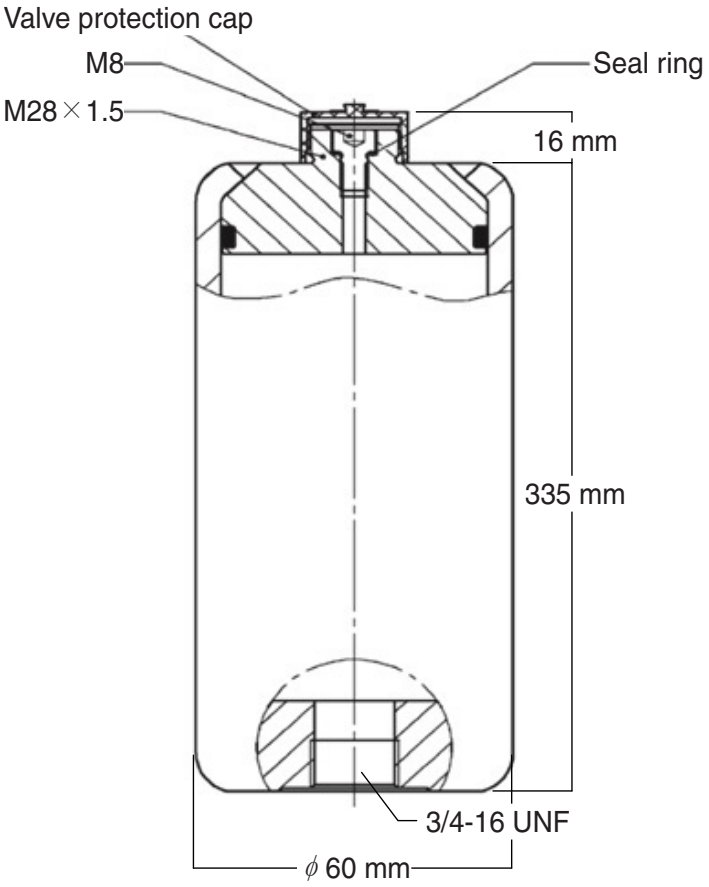
It is a DPF Aiding hydraulic system that helps the engine aftertreatment system. It is possible to work with the working device during automatic regeneration. However, there is a difference between the working device and the running operation when the automatic reproduction rice production is simultaneous, and the forced reproduction (stopping reproduction) is required when the automatic reproduction is not completed.

This valve follows the RMCU control method according to the DPF Aiding Level condition. Noise is generated because pressure is created to remove DPF during the control process.

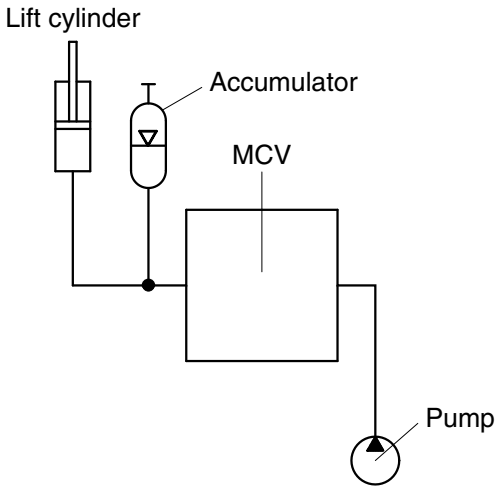
The control method includes operating temperature conditions for preventing an abnormal rise in oil temperature.

5. MAST ACCUMULATOR

1) STRUCTURE



35D9VB6HS52



35D9VB6HS59

Parts No.	Normal volume	Pre-charging pressure at 20 ℃ (68 ℉)	Gas	Weight
35HN-05000	0.5 ℓ (0.13 U.S. gal)	25 bar (363 psi)	Nitrogen gas N_2	4. 8 kg (10.6 lb)

※ Max. working pressure : 280 bar (4000 psi), shell, rod material : carbon steel

※ Permitted operating temperature : -20 ~ +80 ℃ (-4 ~ +176 ℉), seal material : NBR/PUR

The mast accumulator is installed in the hydraulic line of the lift cylinder to absorb fork vibration and reduce hydraulic pulsation, which acts as a shock absorber to reduce vibration that may occur when climbing slopes or driving on rough road surfaces. This helps to prevent damage to fragile items such as glass or ceramics (porcelain) by ensuring the stability of the truck. In addition, when applied to hydraulic attachments (e.g. paper roll clamps, carton clamps, etc.), it can be configured and utilized to help reduce damage to the load through "prevent slipping of loads".

※ The accumulator works effectively under light and heavy loads. The higher the load, the smaller the absorption effect.

※ Compared with the case without the accumulator, this device can repeat overrun and underrun for a certain period of time when the fork stops. The phenomenon is slightly different depending on the load conditions, so please understand its characteristics before operation.

2) PRE-CHARGE PRESSURE

The accumulator is supplied pre-charged with nitrogen gas. The pre-fill pressure provided is indicated on the label of the accumulator shell or engraved on the surface of the top shell of the accumulator. A gas valve connection terminal is provided on the top of the accumulator to adjust the filling pressure (depending on the load or workplace conditions) as needed.

· First, it can be adjusted in the range of 6 ~ 50 bar (87 ~ 725 psi), and more can be adjusted.

· Based on temperature of 20 ℃ (68 ℉), charging is prohibited under high temperature conditions.

3) MAINTENANCE

⚠ **Under no circumstances should the piston accumulator be welded, soldered or mechanically repaired.**

(1) Normal checks

The basic maintenance instructions for the piston type mast accumulator are as follows. To maintain trouble-free operation, it is recommended to perform the following maintenance procedures regularly.

· Check that the connection is tihgt and there are no oil or gas leaks.

· Check the fastening parts.

· Accumulator pre-charge pressure test

(2) Checking for oil leakage into the gas side

Hydraulic oil in the accumulator may leak to the gas side through the piston seal. Check this in the following way. In this case, there is oil leakage on the gas side, so replace the accumulator.

· If a higher filling pressure than the previous test is found.

· When oil or oil mist comes out when loosening the M8 screw with a 6 mm hex. wrench.

※ **If there is oil leakage inside the accumulator, it is recommended not to repair it and replace the parts.**

· The supplied HYDAC SK280 piston accumulator is a non-repairable sealed product.

· It is an economical product with excellent durability and non-repairable structure, optimizing size and weight to reduce costs.

(3) Pre-charge pressure testing and frequency

※ **Check the charging pressure of the accumulator after completely draining the hydraulic oil from the lift cylinder line. If the cylinder line is not fully evacuated, the gas filling pressure may look different. Also, when disconnecting the accumulator connection piping, the pressure oil in the cylinder line must be discharged first.**

It t is recommended to check the filling pressure as follows.

· Initial 250 hour or 6 weeks

· Once 2000 hours or every year.

If there is no significant gas loss during the initial inspection, check 2000 hours.

※ **if the truck continues to run in harsh workplace (or high operating temperature) conditions, it should be tested more often.**

4) GAS RELEASE AND CHARGING

(1) Release

① Loosen the plastic cap and loosen the M8 screw tightly locked to the gas valve connection on the top of the accumulator with a 6 mm hex. wrench and lock it again.

② Connect FPU to the accumulator gas vlave.

※ **Release valve (D) be sure to connect while locked.**

③ Open the accumulator valve (counterclockwise) with the spindle of the FPU and check the gas.

④ Open the release valve of FPU slowly (counter-clockwise) and blow out nitrogen gas until the set pressure is confirmed. Pressure is measured at room temperature around 20 ℃ (68 ℉).

⑤ When the set pressure is reached, close the release valve (clockwise) and close the accumulator valve with the spindle.

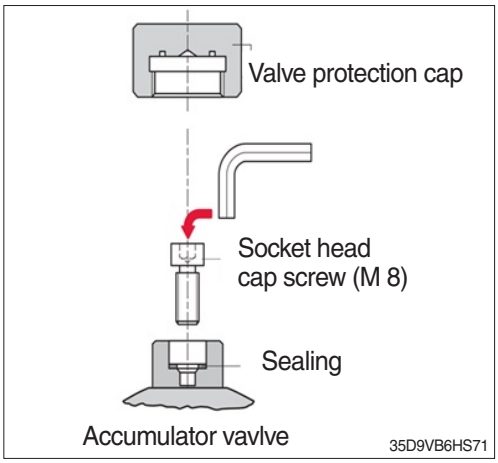
⑥ Wait 5-10 minutes for the filled nitrogen gas pressure to stabilize, then recheck the set pressure and adjust if necessary.

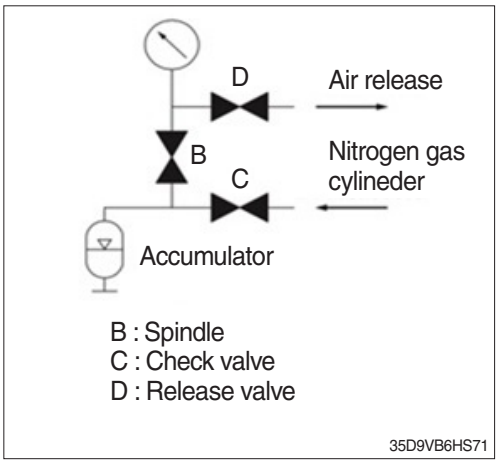
⑦ Open the release valve and blow out gas in the FPU.

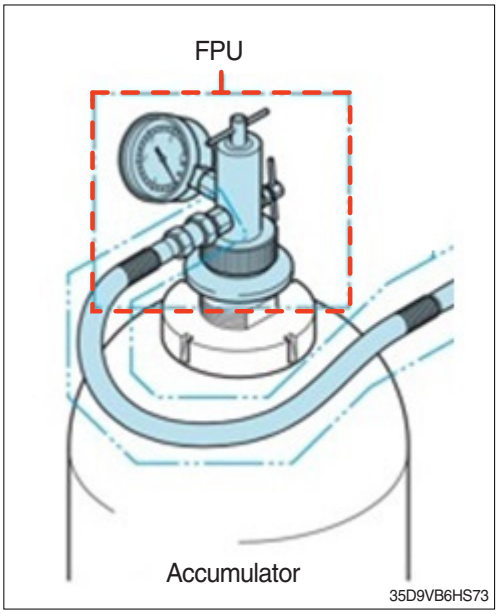
※ **If there is gas in the charging hose and FPU, it cannot be separated, and it is very dangerous if it is forcibly separated. Be sure to separate the charging hose and after blowing out the gas inside the FPU.**

⑧ Separate the FPU from the accumulator.

⑨ Tighten the M8 screw on the top of the accumulator to 2.0 kgf·m (15 lbf·ft) and tighten the plastic cap by hand.







(2) Charging

※ **The filling kit operation method was prepared based on HYDAC product standards.**

※ **Accumulator gas pressure adjustment and charging kit must be purchased separately.**

※ **To recharge nitrogen gas, it is convenient to use the HYDAC FPU-1 unit.**

⚠ **Must be filled with clean nitrogen gas only. Never use oxygen or air. Explosion hazard. Basically, nitrogen must use a minimum class 4.0. (99,99 %, filtering < 3 µm)**



① Connect the charging hose to the nitrogen gas cylinder and FPU. Be sure to connect the release valve while it is closed. The release valve has a structure that lengthens when locked and decreases when released.

② Loosen the plastic cap and loosen the M8 screw tightly locked to the gas valve connection on the top of the accumulator with a 6 mm hex. wrench and lightly lock it again.

③ Connect FPU to the accumulator.

④ Using the spindle of FPU, open the M8 screw on the top of the accumulator. (counterclockwise)

⑤ Slowly open the valve of the nitrogen gas cylinder and check the pressure of the gas injected into the accumulator.

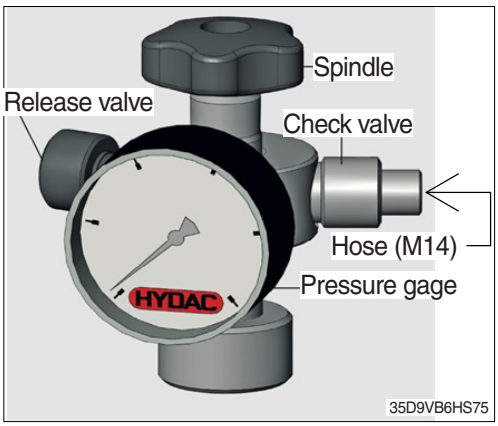
⑥ When filling is complete, close the gas valve of the accumulator using the valve of the nitrogen gas cylinder and the spindle of the FPU.

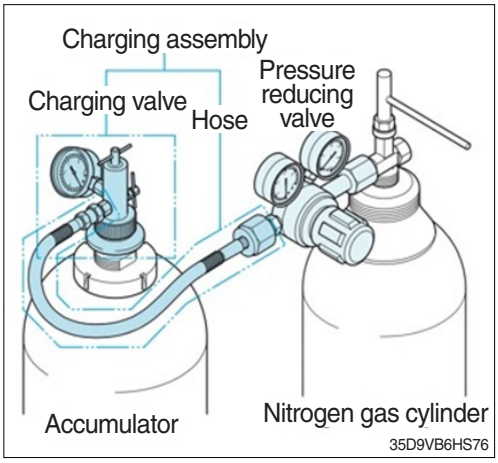
※ **When adding nitrogen to the accumulator filled with nitrogen gas, wait 5-10 minutes for the temperature and pressure of the gas mixture to stabilize, then check the pressure again and adjust if necessary.**

⑦ Open the release valve of FPU to remove nitrogen from the charging hose and FPU.

⑧ Using the spindle of FPU, open the accumulator valve, check the gauge, and adjust the release valve to blow out the accumulator nitrogen to the desired pressure.

⑨ When the desired pressure is reached, close the release valve of the FPU and close the gas valve of the accumulator using the spindle.



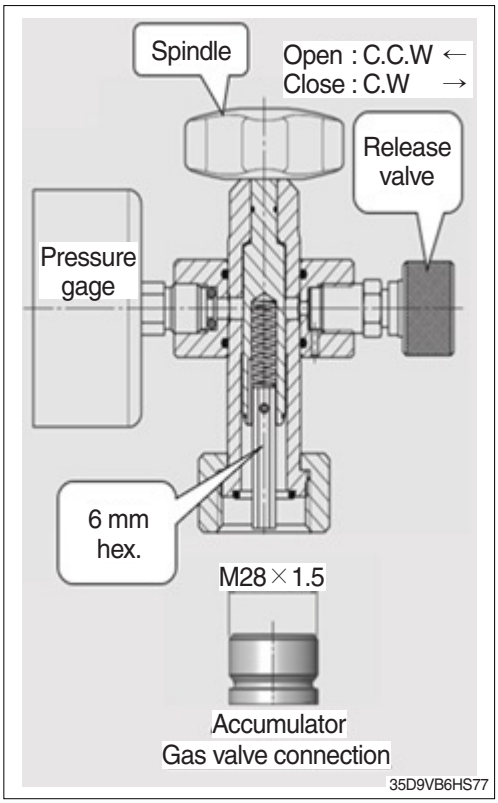


⑩ Open the release valve and blow out nitrogen gas in the FPU.

※ **If there is gas in the charging hose and FPU, it cannot be separated, and it is very dangerous if it is forcibly separated. Be sure to separate the charging hose and after blowing out the gas inside the FPU.**

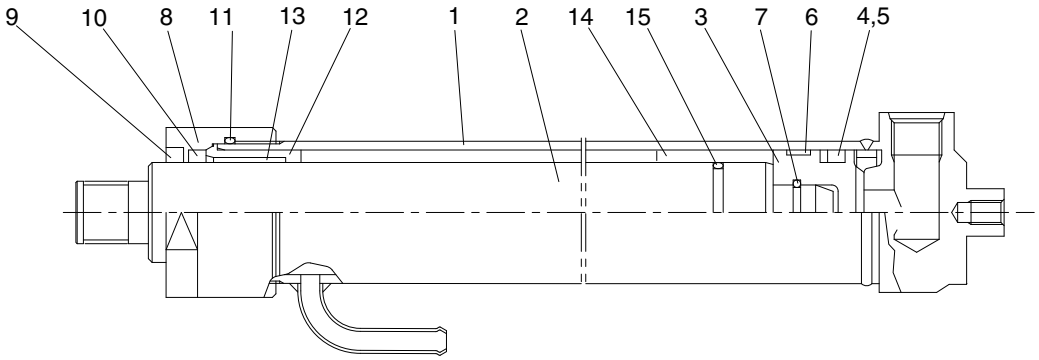
⑪ Remove the FPU from the accumulator.

⑫ Tighten the M8 screw on the top of the accumulator to 2.0 kgf·m (15 lbf·ft) and tighten the plastic cap by hand.



6. LIFT CYLINDER

1) V-MAST

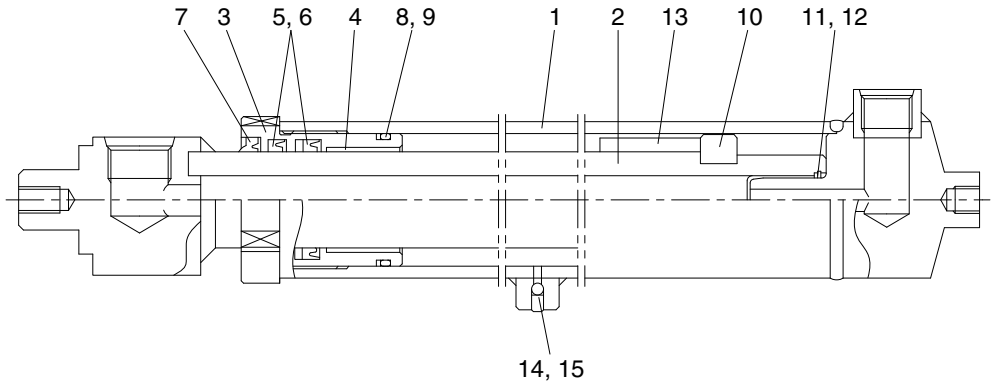


D255HS18

1	Tube assembly	6	Wear ring	11	O-ring
2	Rod	7	Retaining ring	12	Guide
3	Piston	8	Gland	13	DU bushing
4	Piston seal	9	Dust wiper	14	Spacer
5	Back up ring	10	Rod seal	15	O-ring

※ Seal kit : 4 ~ 6, 9 ~ 11

2) VF AND VS-MAST

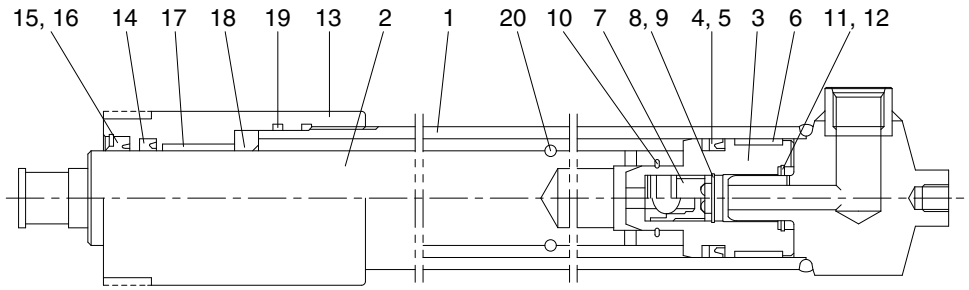


22B9FHS20

1	Tube assembly	6	Back up ring	11	Cushion seal
2	Rod assy	7	Dust wiper	12	Retaining ring
3	Rod cover	8	O-ring	13	Spacer
4	Rod bushing	9	Back up ring	14	Steel ball
5	U-packing	10	Piston ring	15	Set screw

※ Seal kit : 5 ~ 9, 11, 15

3) TF AND TS-MAST

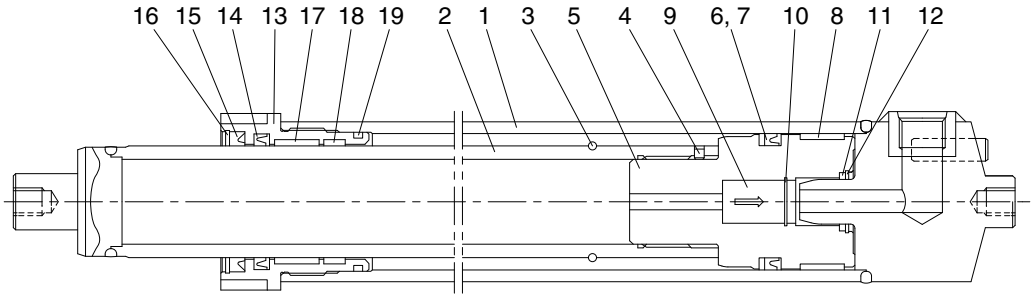


22B9FHS21

1	Tube assembly	8	Spacer	15	Dust wiper
2	Rod	9	Retaining ring	16	Retaining ring
3	Piston	10	Stop ring	17	Rod bushing
4	U-packing	11	Cushion seal	18	Spacer
5	Back up ring	12	Retaining ring	19	O-ring
6	Wear ring	13	Rod cover	20	Stop ring
7	Check valve	14	U-packing		

※ Seal kit : 4 ~ 6, 14, 15, 19

4) QF-MAST (LH)

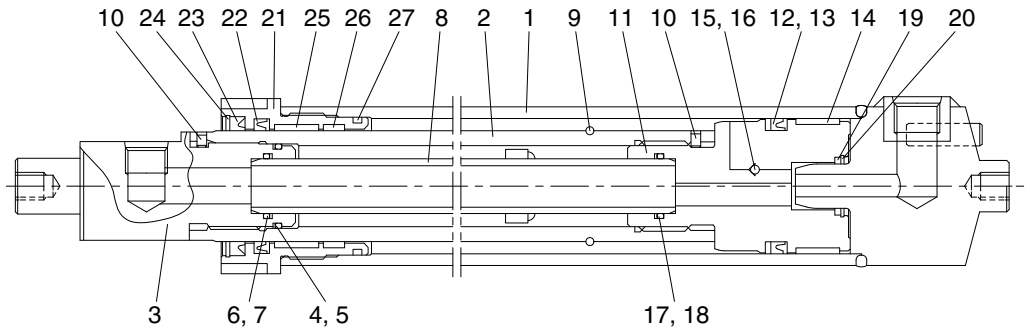


22B9FHS22

1	Tube assembly	8	Wear ring	15	Dust wiper
2	Rod assembly	9	Check valve	16	Retaining ring
3	Stop ring	10	Retaining ring	17	Wear ring
4	Set screw	11	Cushion seal	18	Dust ring
5	Piston	12	Retaining ring	19	O-ring
6	U-packing	13	Rod cover		
7	Back up ring	14	U-packing		

※ Seal kit : 6 ~ 8, 14, 15, 17 ~ 19

5) QF-MAST (RH)

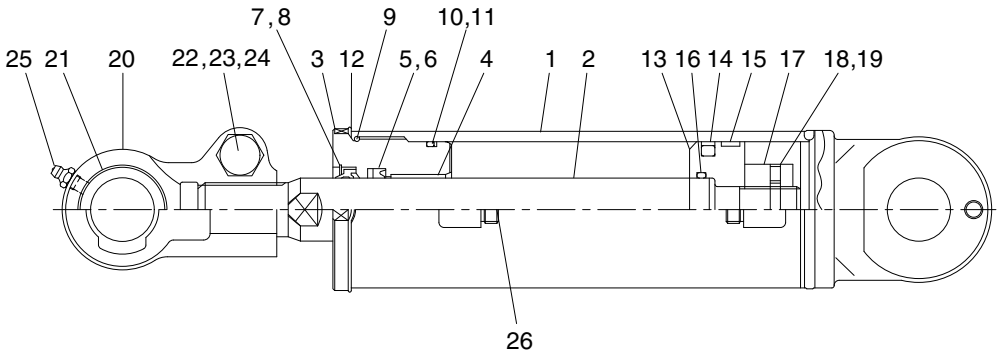


22B9FHS23

1	Tube assembly	10	Set screw	19	Cushion seal
2	Rod	11	Piston	20	Retaining ring
3	Rod end	12	Back up ring	21	Rod cover
4	O-ring	13	U-packing	22	U-packing
5	Back up ring	14	Wear ring	23	Dust wiper
6	O-ring	15	Check valve	24	Retaining ring
7	Back up ring	16	Retaining ring	25	Wear ring
8	Inner rod assembly	17	O-ring	26	Dust ring
9	Stop ring	18	Back up ring	27	O-ring

※ Seal kit : 4 ~ 7, 12 ~ 14, 17 ~ 19, 22, 23, 25~ 27

7. TILT CYLINDER



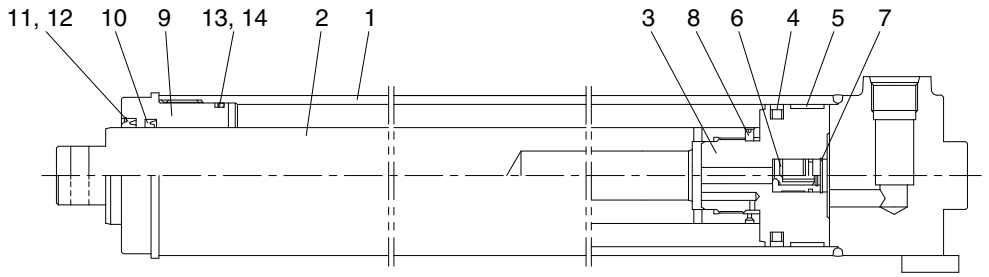
22D9HHS23

1	Tube assembly	10	O-ring	19	Socket bolt
2	Rod	11	Back up ring	20	Rod eye
3	Gland	12	Lock washer	21	Spherical bearing
4	DU bushing	13	Piston	22	Hexagon bolt
5	Rod seal	14	Piston seal	23	Hexagon nut
6	Back up ring	15	Wear ring	24	Spring washer
7	Dust wiper	16	O-ring	25	Grease nipple
8	Snap ring	17	Lock nut	26	O-ring
9	O-ring	18	Steel ball		

※ Seal kit (EA) : 5 ~ 7 (1), 9 ~ 11 (1), 14 ~ 16 (1), 26 (2)

8. FREE LIFT CYLINDER

1) VF-MAST AND TF-MAST (35DN-9V/VS)

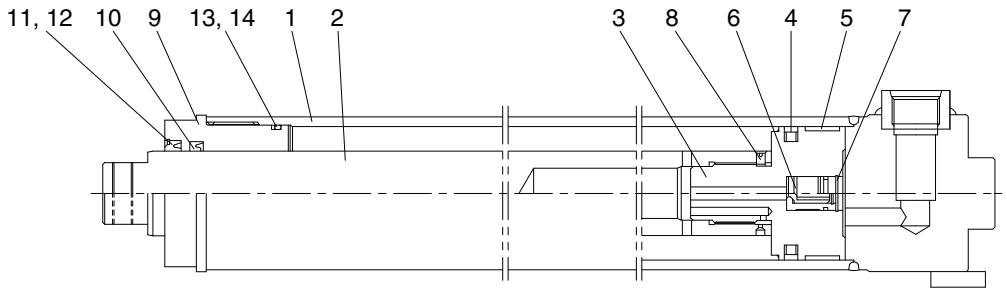


25L9AHS34

1	Tube assembly	6	Check valve	11	Dust wiper
2	Rod	7	Retaining ring	12	Retaining ring
3	Piston	8	Set screw	13	O-ring
4	Piston seal	9	Rod cover	14	Back up ring
5	Wear ring	10	U-packing		

※ Seal kit : 4, 5, 10, 11, 13, 14

2) TF-MAST (25/30D-9V/VS)

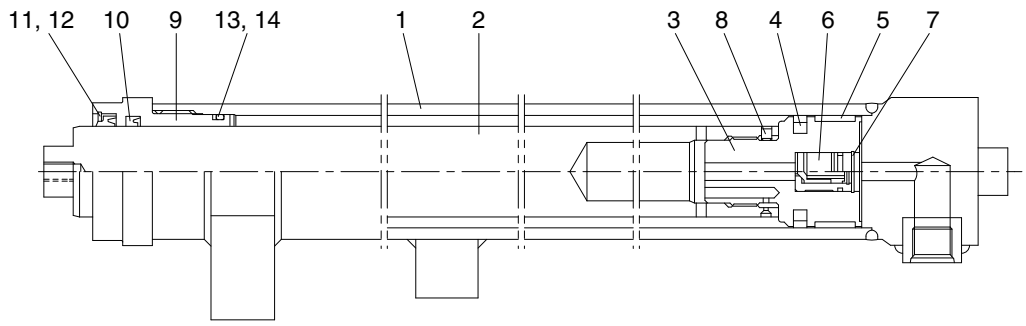


25L9AHS35

1	Tube assembly	6	Check valve	11	Dust wiper
2	Rod	7	Retaining ring	12	Retaining ring
3	Piston	8	Set screw	13	O-ring
4	Piston seal	9	Rod cover	14	Back up ring
5	Wear ring	10	U-packing		

※ Seal kit : 4, 5, 10, 11, 13, 14, 16

3) VS AND TS-MAST (35DN-9V/VS)

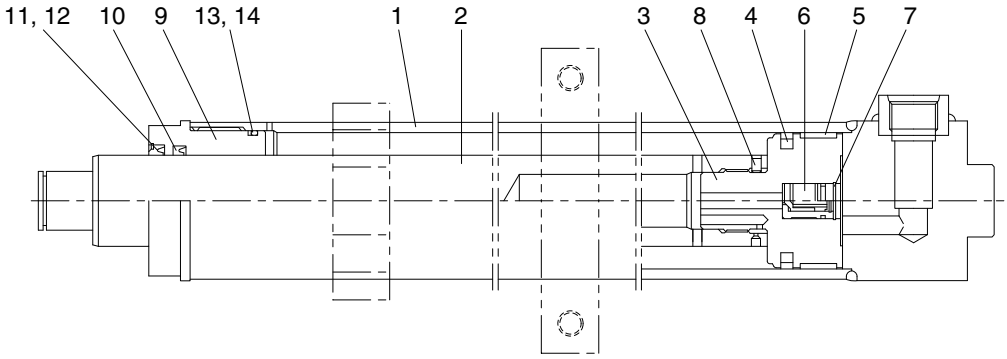


25L9AHS36

1	Tube assembly	6	Check valve	11	Dust wiper
2	Rod	7	Retaining ring	12	Retaining ring
3	Piston	8	Set screw	13	O-ring
4	Piston seal	9	Rod cover	14	Back up ring
5	Wear ring	10	U-packing		

※ Seal kit : 4, 5, 10, 11, 13, 14

4) TS-MAST (25/30D-9V/VS)

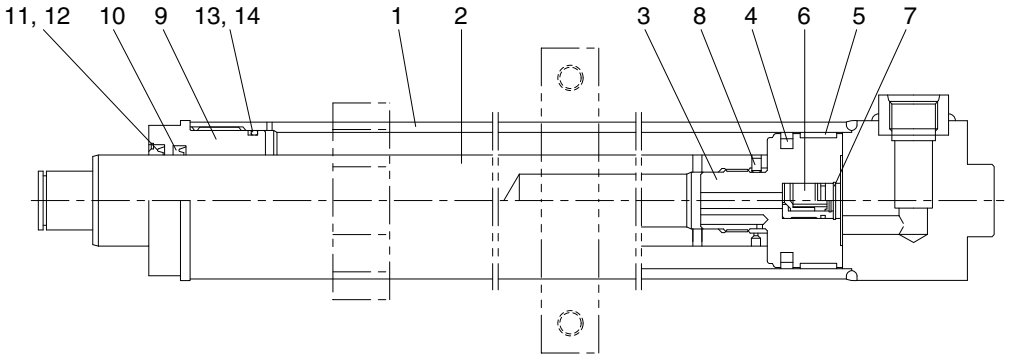


25L9AHS37

1	Tube assembly	6	Check valve	11	Dust wiper
2	Rod	7	Retaining ring	12	Retaining ring
3	Piston	8	Set screw	13	O-ring
4	Piston seal	9	Rod cover	14	Back up ring
5	Wear ring	10	U-packing		

※ Seal kit : 4, 5, 10, 11, 13, 14, 16

5) QF-MAST



25L9AHS38

1	Tube assembly	6	Check valve	11	Dust wiper
2	Rod	7	Retaining ring	12	Retaining ring
3	Piston	8	Set screw	13	O-ring
4	Piston seal	9	Rod cover	14	Back up ring
5	Wear ring	10	U-packing		

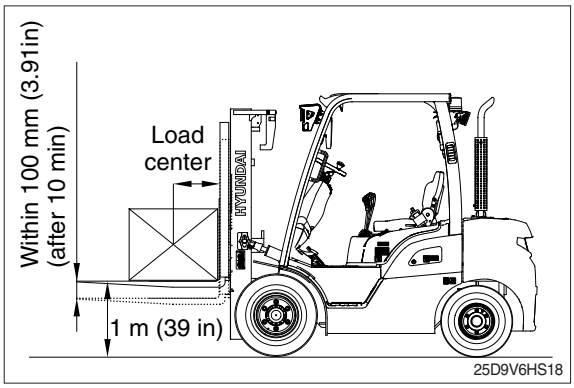
※ Seal kit : 4, 5, 10, 11, 13, 14, 16

1. OPERATIONAL CHECKS

1) CHECK ITEM

(1) Check visually for deformation, cracks or damage of rod.

(2) Set mast vertical and raise 1 m (39 inch) from ground. Wait for 10 minutes and measure hydraulic drift (amount forks move down and amount mast tilts forward).

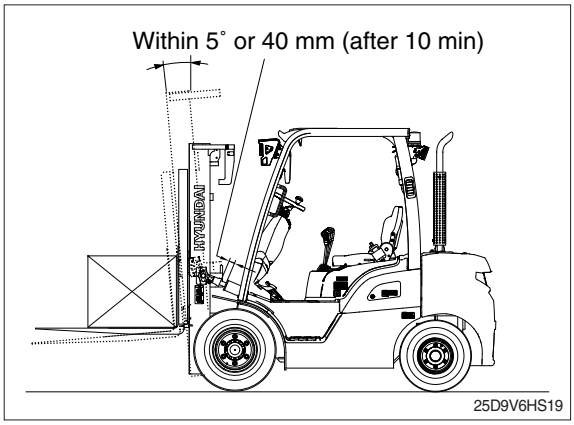


· **Check condition**

- Hydraulic oil : 45±5 ℃ (113±41 ℉)
- Rated capacity load
- Mast substantially vertical
- Key OFF, operator non-existence

· **Hydraulic drift**

- Down (Downward movement of forks)
  : Within 100 mm (3.9 in)
- Forward (Extension of tilt cylinder)
  : Within 5° or 40 mm (1.6 in)

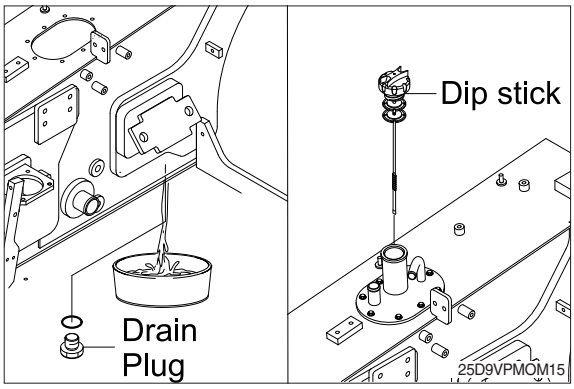


(3) If the hydraulic drift is more than the specified value, replace the control valve or cylinder packing.

2) HYDRAULIC OIL

(1) Using dipstick, measure oil level, and oil if necessary.

(2) When changing hydraulic oil, clean suction strainer (screwed into suction pipe) and return filter (screwed into return pipe).



3) CONTROL VALVE

(1) Raise forks to maximum height and measure oil pressure. Check the oil pressure.

Model	Unit	Prssure
25/30D-9V, 35DN-9V 25/30D-9VS, 35DN-9VS	bar (psi)	200 ± 3 (2900 ± 43)
★25D-9V/VS		★175 ± 3 (2540 ± 43)

★ : EU, AN corporate sales equipment

2. TROUBLESHOOTING

1) SYSTEM

Problem	Cause	Remedy
Large fork lowering speed.	· Seal inside control valve defective. · Oil leaks from joint or hose. · Seal inside cylinder defective.	· Replace spool or valve body. · Replace. · Replace packing.
Large spontaneous tilt of mast.	· Tilting backward : Load check valve defective. · Tilting forward : tilt lock valve defective. · Oil leaks from joint or hose. · Seal inside cylinder defective.	· Clean or replace. · Clean or replace. · Replace. · Replace seal.
Slow fork lifting or slow mast tilting.	· Lack of hydraulic oil. · Hydraulic oil mixed with air. · Oil leaks from joint or hose. · Excessive restriction of oil flow on pump suction side. · Relief valve fails to keep specified pressure. · Poor sealing inside cylinder. · Pump detctive. · Mast fails to move smoothly. · Oil leaks from lift control valve spool. · Oil leaks from tilt control valve spool.	· Add oil. · Bleed air. · Replace. · Clean filter. · Adjust relief valve. · Replace packing. · Replace pump. · Adjust roll to rail clearance. · Replace spool or valve body. · Replace spool or valve body.
Hydraulic system makes abnormal sounds.	· Excessive restriction of oil flow pump suction side. · Gear or bearing in hydraulic pump defective.	· Clean filter. · Replace pump.
Control valve lever is locked	· Foreign matter jammed between spool and valve body. · Valve body defective.	· Clean. · Tighten body mounting bolts uniformly.
High oil temperature.	· Lack of hydraulic oil. · Priority valve spool flow path is blocked. · Oil filter clogged.	· Add oil. · Replace priority valve. · Clean filter.

2) HYDRAULIC GEAR PUMP

Status	Possible factors	Solutions
Leakage from the oil seal	· Reverse rotation. · Abnormal high pressure in the inlet. · Damage to the seal lip due to foreign objects. · Sealed parts of the shaft damaged or worn out. · Poor shaft centering.	· Rotate the pump to the right way. · Keep the designated pressure. · Replace the oil seal with new one. · Adjust centering. · Change the pump.
Oil leakage from the joint of cover or body	· Looseness of the bolts or breakage of the cover and body. · Degradation or damage of the oil seal caused by heat curing of the gasket.	· Tighten bolt and keep the designated pressure. · Replace the gasket with new one. · Change the pump.
Oil leakage from port	· Looseness of breakage of the port fittings. · Breakage of the seals for fittings. · Breakage of the ports.	· Tighten the fittings and keep the designated pressure. · Replace the seals for fittings with new ones. · Change the pump.
Reduction of the oil amount getting out from the outlet or no pressure produced	· Shortage of the oil in the tank. · Intermal leakage due to abnormal high-temperature or inappropriate viscosity of oil. · Degradation of the performance due to the oil contamination. · Cavitations due to negative pressure. · Breakage of the internal parts. · Reverse rotation.	· Apply the appropriate kind and amount of oil in the tank and change the cooling system. · Change the contamination oil. · Make sure if the the appropriate length and width of inlet pipe are applied and avoid prducing negative pressure by replacing the filter with new one. · Open the inlet valve. · Change the pump. · Rotate the pump to the pump to the right way and avoid prducing the abnormal high-temperature in the inlet.
Rising temperature of pump or oil	· Abnormal generation of heat due to the frequent operation of the pressure control valves. · Damage of the internal parts.	· Set the pressure appropriately. · Change the pump.
Noise and vibration	· Poor installation. · Cavitations. · Intake of air. · Vibration of the pipes and mounting flanges. · Chattering of the relief valves. · Damage of the shaft seal.	· Adjust centering. · Make sure if the the appropriate length and width of inlet pipe are applied and avoid prducing negative pressure by replacing the filter with new one. · Fill the tank with oil and avoid taking air into the inlet pipes. · Reinforce the pipes and mounting flange and prevent resonating. · Replace the relief valve with new one. · Change the pump.

※ Once you disassemble the pump, its performance may not recover after the reassembly.

※ Change the assembly if the pump breaks down.

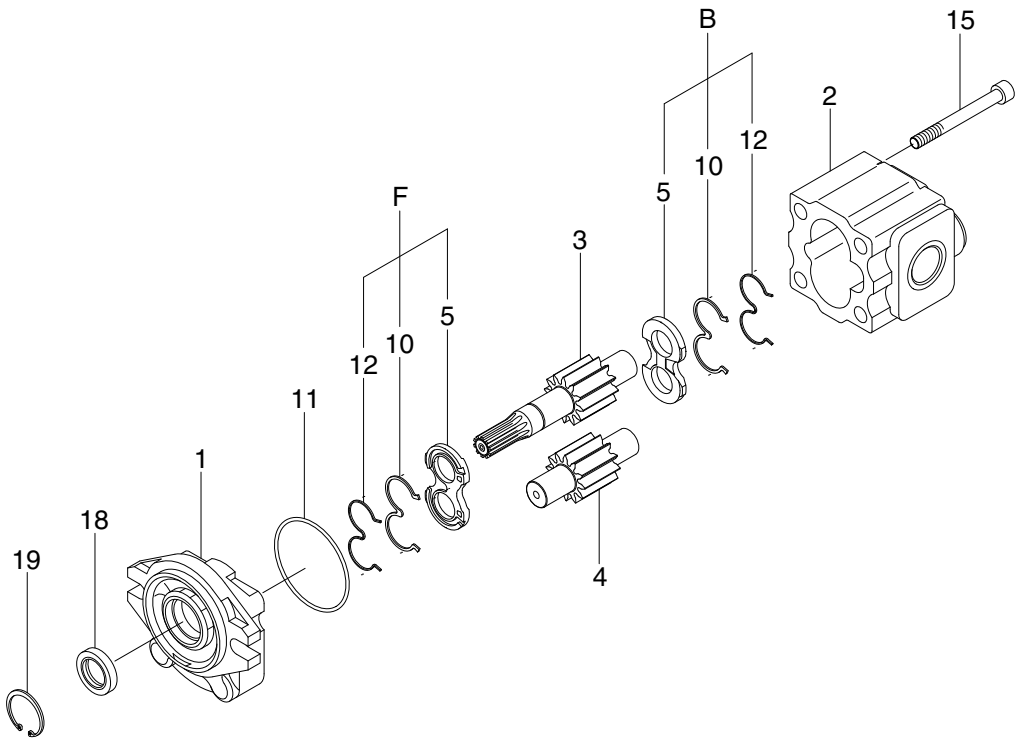
※ If the disassembly is inevitable, you need to consult the Hyundai service center or dealer.

3) LIFT AND TILT CYLINDER

Problem	Cause	Remedy
Oil leaks out from gland through rod.	· Foreign matters on packing. · Unallowable score on rod. · Unusual distortion of dust seal. · Chrome plating is striped.	· Replace packing. · Smooth rod surface with an oil stone. · Replace dust seal. · Replace rod.
Oil leaks out from cylinder gland thread.	· O-ring damaged.	· Replace O-ring.
Rod spontaneously retract.	· Scores on inner surface of tube. · Unallowable score on the inner surface of tube. · Foreign matters in piston seal.	· Smooth rod surface with an oil stone. · Replace cylinder tube. · Replace piston seal.
Wear(clearance between cylinder tube and wear ring).	· Excessive clearance between cylinder tube and wear ring.	· Replace wear ring.
Abnormal noise is produced during tilting operation.	· Insufficient lubrication of anchor pin or worn bushing and pin. · Bent tilt cylinder rod.	· Lubricate or replace. · Replace.

1. HYDRAULIC GEAR PUMP

1) STRUCTURE



22D9HS14-2

1	Front cover	5	Side gear	12	Back up ring
2	Body	6	Bushing	15	Bolt
3	Drive gear	10	Gasket (3-shaped)	18	Oil seal
4	Driven gear	11	O-ring	19	Retaining ring

※ Seal kit (EA) : 10 (2), 11 (1), 12 (2), 18 (1), 19 (1)

2) DISASSEMBLY AND ASSEMBLY

(1) Safety precautions

※ The installation, piping, maintenance disassembling, inspection, etc. of this product are requsted to be executed by the workers who have technical knowledge, or under the instruction of such workers.

※ For detaching, interrupt the operation of system including this product and detach it for the piping and equipment after the temperature on the surface of product has been cooled down completely (approx 40˚C or less).
Otherwise, there is a danger of an oil leak or getting burned.

※ When the reassembled product fails to recover its performance, do not attempt to use it.
If it is used forcibly, the equipment or system may be broken.

※ When disaposing the product, discharge the oil and dispose, it as an industrial waste.

※ To use the product safely, be sure to relevant laws regarding safety.

(2) Disassembly

※ Before disassembling the pump, check the oil seal, pump body and cover joints and other oil leaks.

⚠ Remove rust, dirt and dust from the shaft end and pump body. Otherwise, the parts may be damaged or the parts may get inside the pump during disassembly and receive a false diagnosis of the pump.

※ The pump has symmetrical parts. Before disassembling the pump, mark the parts in the manner indicated in "Disassembly Procedure" to ensure correct reassembly. To do this, use oil paint to prevent damage to the parts.

※ Disassembly is a means of finding the source of a problem. Follow the pump disassembly procedure.

※ Check new packings, gaskets and oil seals before disassembly.

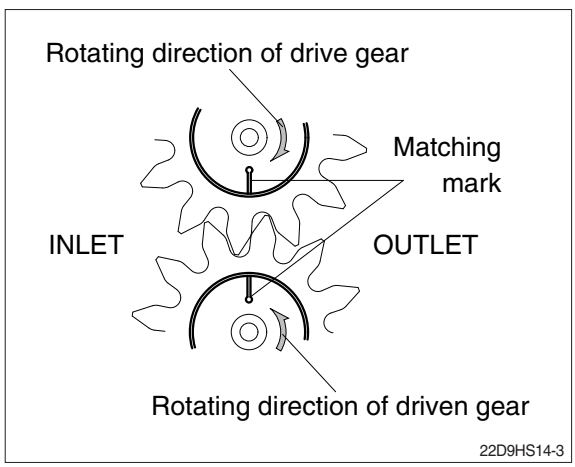
① Fix the mounting parts of front cover with the body side up to the vice.

② Mark on the joints between the front cover (1) and body (2) before disassembling.

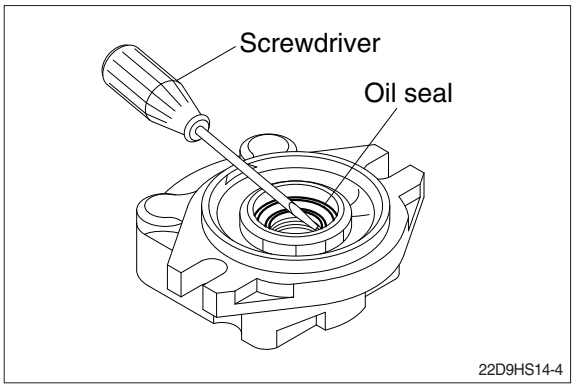
③ Remove the four bolts (15) and disassemble the parts in order starting with the body.
Please see the instructions below.

④ Mark on the shaft ends of the body side.

⑤ Since the pair of side plates (5), 3-shape gaskets (10) and back-ups (12) are assembled in different directions, put the tag on each pair to distinguish where the part is used for. (They are shown as "F" and "B" in the exploded view drawing.)



⑥ After removing the C-shape retaining ring, apply the end of screwdriver, etc. to the inner side of oil seal to detach.



(3) Assembly

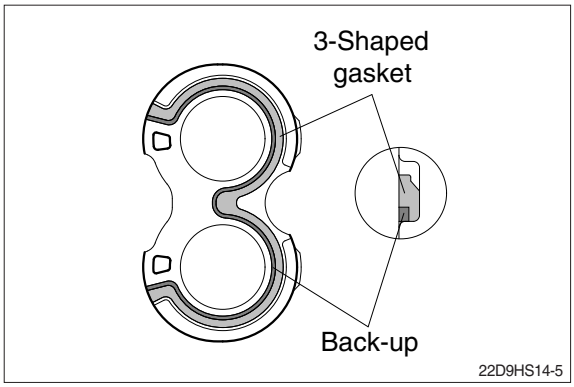
① Replace these items (10, 11, 12, 18, 19) with new ones.

② Clean each part to remove dust before reassembling.

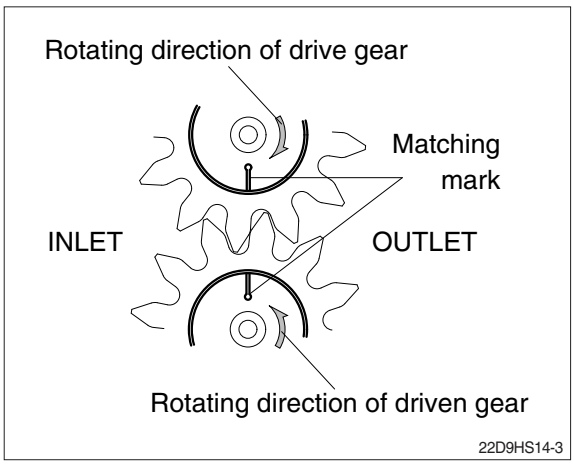
③ Put the body (2) on the worktable with its hole for the gear up.

④ Reassemble the parts in order except for oil seal, retaining ring and bolts.

· Fix the 3-shaped gasket (10) and back-up (12) to the side plate (5) by using grease to prevent them from being twisted or caughts.



· Fix the drive gear and driven gear by matching each mark.

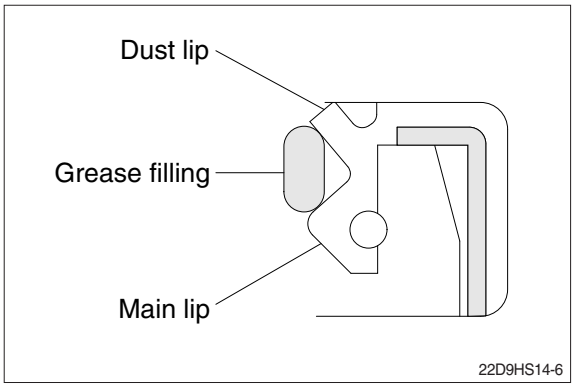


⑤ Invert the assembled pump to make the front cover down and fix the mounting parts to the vice.

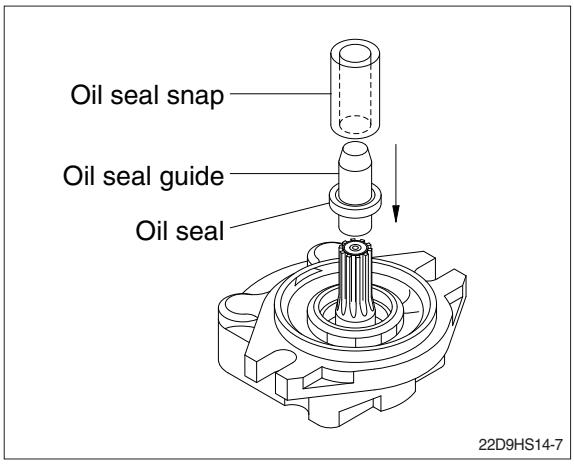
⑥ Tighten 4 bolts evenly by 9.0~9.5 kgf·m (65.1~68.7 lbf·ft) torque.

⑦ Invert the assembled pump again to make the front cover up and fix the body to the vice.

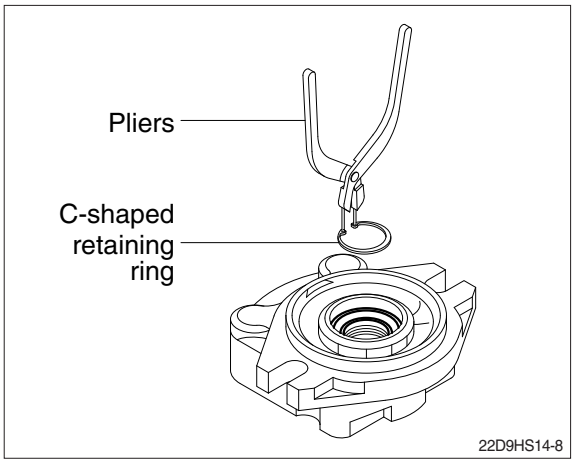
⑧ Fill the dent between the main lip and dust lip of oil seal with grease.



⑨ Fill the oil seal into the hole by using the oil seal guide and oil seal snap.



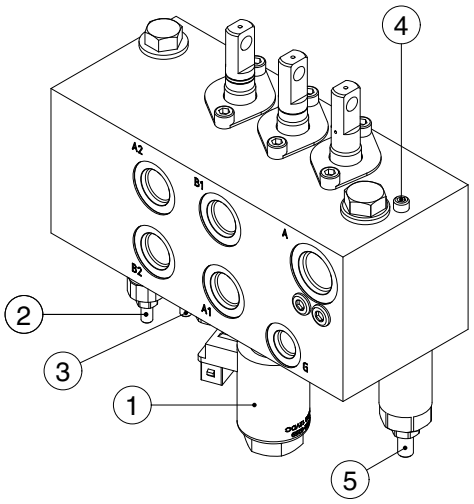
⑩ Attach the C-shaped retaining ring for hole.



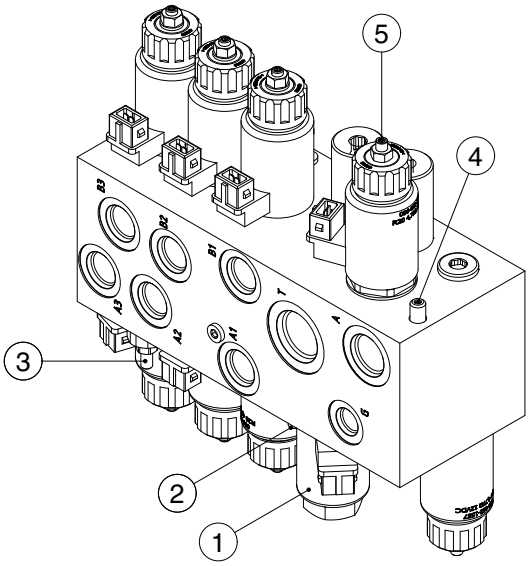
2. MAIN CONTROL VALVE

1) STRUCTURE

Manual



Fingertip (option)



25D9V6HS17

1 OPSS cutoff solenoid
2 Main relief valve (DV1)
3 2nd reilief valve (DV2)
4 Emergency fork lowering
5 Fork lowering speed adjustment

2) DISASSEMBLY AND ASSEMBLY

(1) Cutoff solenoid

※ The pictures is for reference only and the actual MCV shape may be different.

① Park the forklift safely and full lower the forkcarriage.

② Operate the lever in the engine off (key ON) state to discharge the pressure oil in the MCV.

③ Open the bonnet. Loosen nut of the cutoff solenoid and remove coil from the check valve.

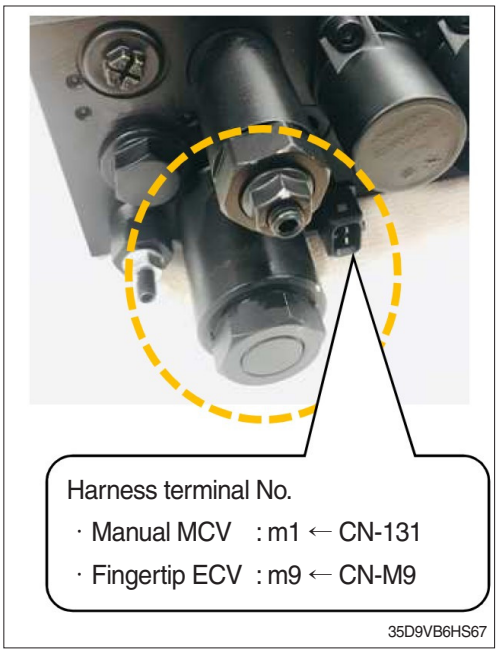
④ Clean the check valve and valve block so that opened valve block cannot become contaminated.

⑤ Loosen the check valve with spanner 17 mm (0.7 in). Apply a light coat of hydraulic oil to the o-rings of the new check valve and insert a new check valve and screw in tightly.

· Tightening torque : 4 kgf·m (28.9 lbf·ft)

⑥ Refit the solenoid coil according to the direction and tighten with the o-ring side of the nut facing the coil.

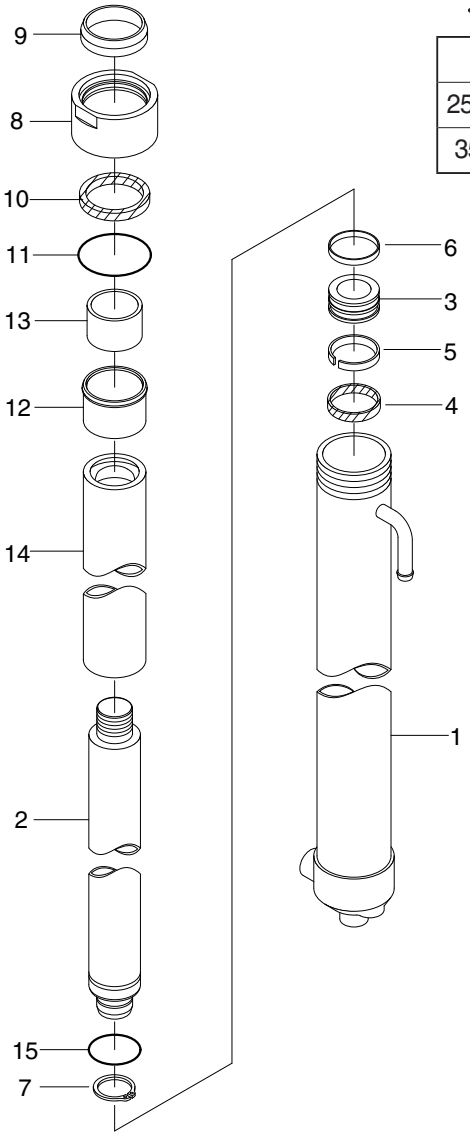
· Tightening torque : 0.7 kgf·m (5.1 lbf·ft)





3. LIFT CYLINDER

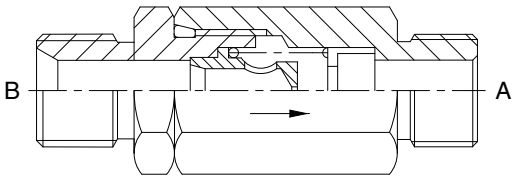
1) STRUCTURE

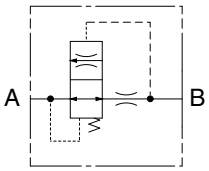


· Specification (V330, standard)

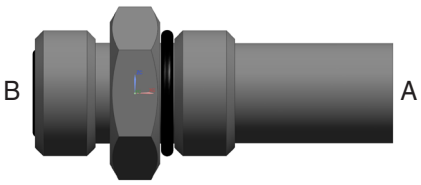
Unit : mm (in)

Model	Tube I.D	Tube O.D	Stroke	Rod O.D
25/30D-9V/VS	50 (2.0)	58 (2.3)	1630 (64.2)	40 (1.4)
35DN-9V/VS	55 (2.2)	63 (2.5)	1630 (64.2)	45 (1.8)





Down safety valve

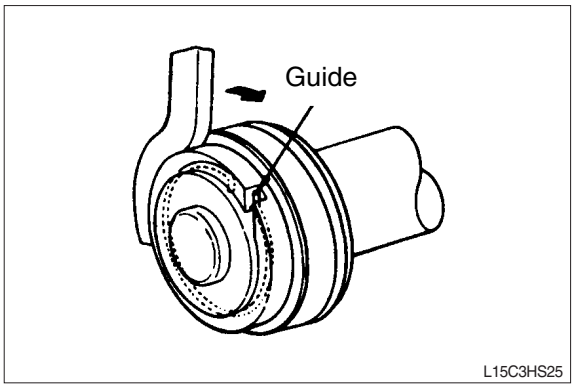


25D9V6HS20

1	Tube assy	6	Wear ring	11	O-ring
2	Rod assy	7	Retaining ring	12	Guide
3	Piston	8	Gland	13	Du bushing
4	Piston seal	9	Dust wiper	14	Spacer
5	Back up ring	10	Rod seal	15	O-ring

2) DISASSEMBLY

(1) Hold the cylinder tube in a vice, loosen the cylinder head and remove it.
Remove the spacer from the cylinder tube and knock out the bushing. Hook a wrench in the hole in the retainer at the piston end and turn. Lever up the edge of the guide, then turn the guide in again and the guide can be removed.



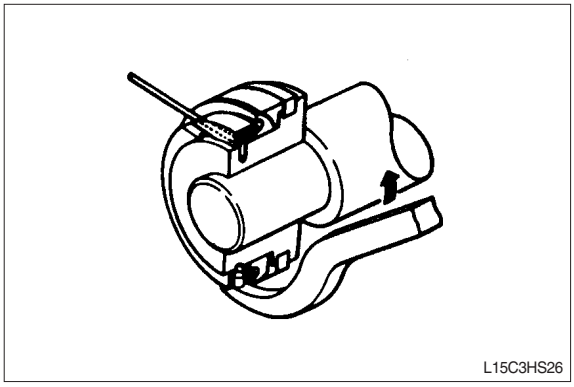
3) CHECK AND INSPECTION

mm (in)

Check item	Standard size	Repair limit	Remedy
Clearance between cylinder rod & bushing	0.072~0.288 (0.003~0.011)	0.5 (0.020)	Replace bushing
Clearance between piston ring & tube	0.05~0.030 (0.002~0.012)	0.5 (0.020)	Replace piston ring

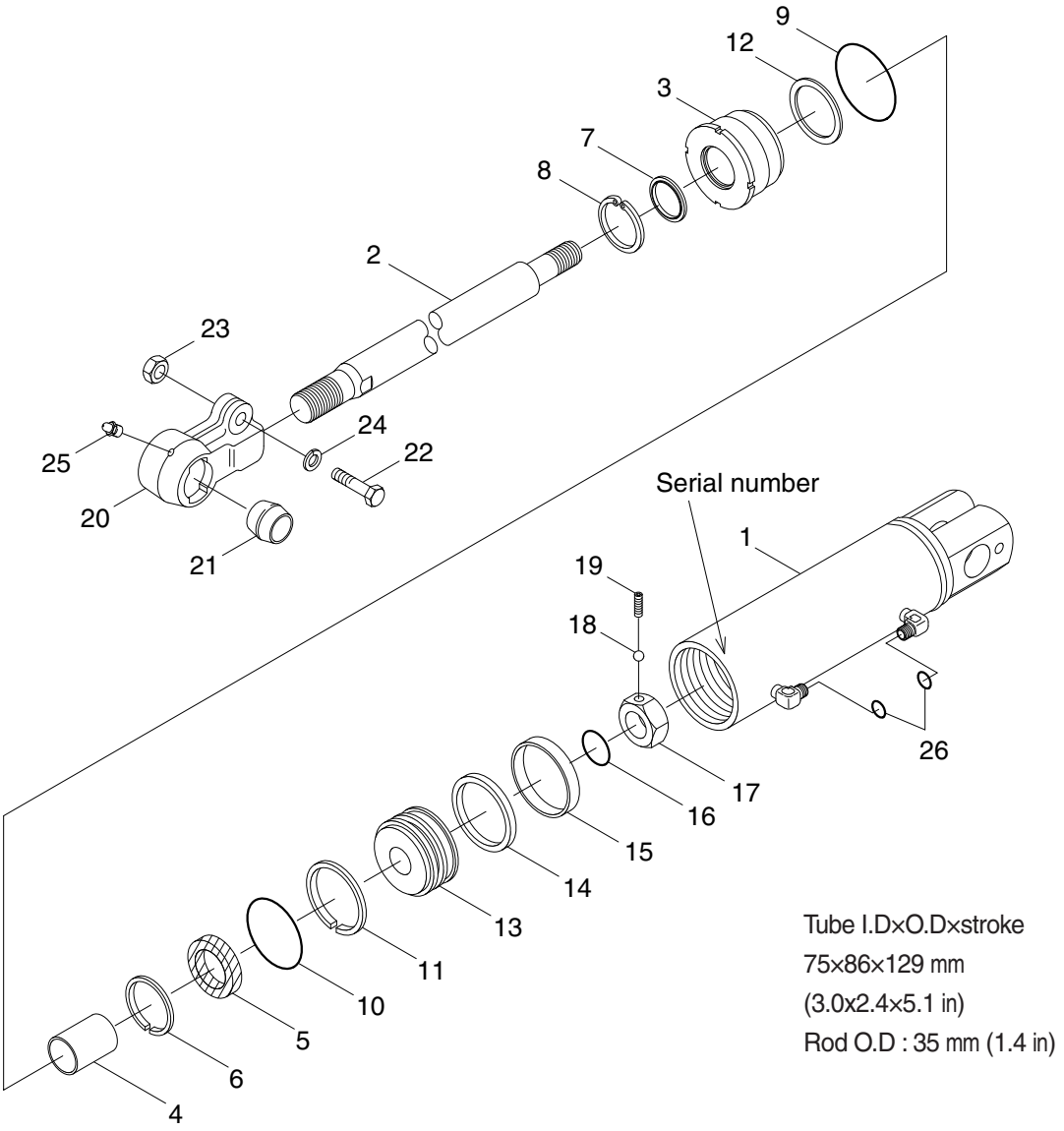
4) ASSEMBLY

(1) Soak the piston ring in hydraulic oil at a temperature of 40 to 50°C, expand the inside diameter and assemble on the piston. Install a piston seal.
Bend the edge of the guide and rotate it to install the guide completely.



4. TILT CYLINDER

1) STRUCTURE

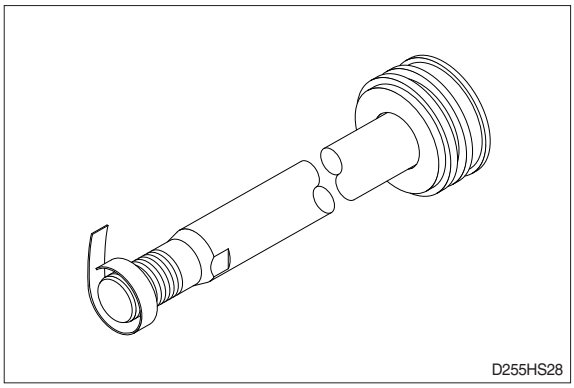


25L9AHS43

1	Tube assembly	10	O-ring	19	Socket screw
2	Rod	11	Back up ring	20	Rod eye
3	Gland	12	Lock washer	21	Spherical bearing
4	DU-bushing	13	Piston	22	Hexagon bolt
5	Rod seal	14	Piston seal	23	Hexagon nut
6	Back up ring	15	Wear ring	24	Spring washer
7	Dust wiper	16	O-ring	25	Grease nipple
8	Snap ring	17	Lock nut	26	O-ring
9	O-ring	18	Steel ball		

2) DISASSEMBLY

(1) Hold the parallel parts of the cylinder tube bottom in a vice and mark the rod head end to show how much it is screwed in, then remove the rod head. Next, hook a wrench into the notch at the cylinder head and remove the cylinder head from cylinder tube.
When doing this, wind tape round the threaded part of the rod and be careful not to damage the dust seal and rod seal inside cylinder head.



3) CHECK AND INSPECTION

mm (in)

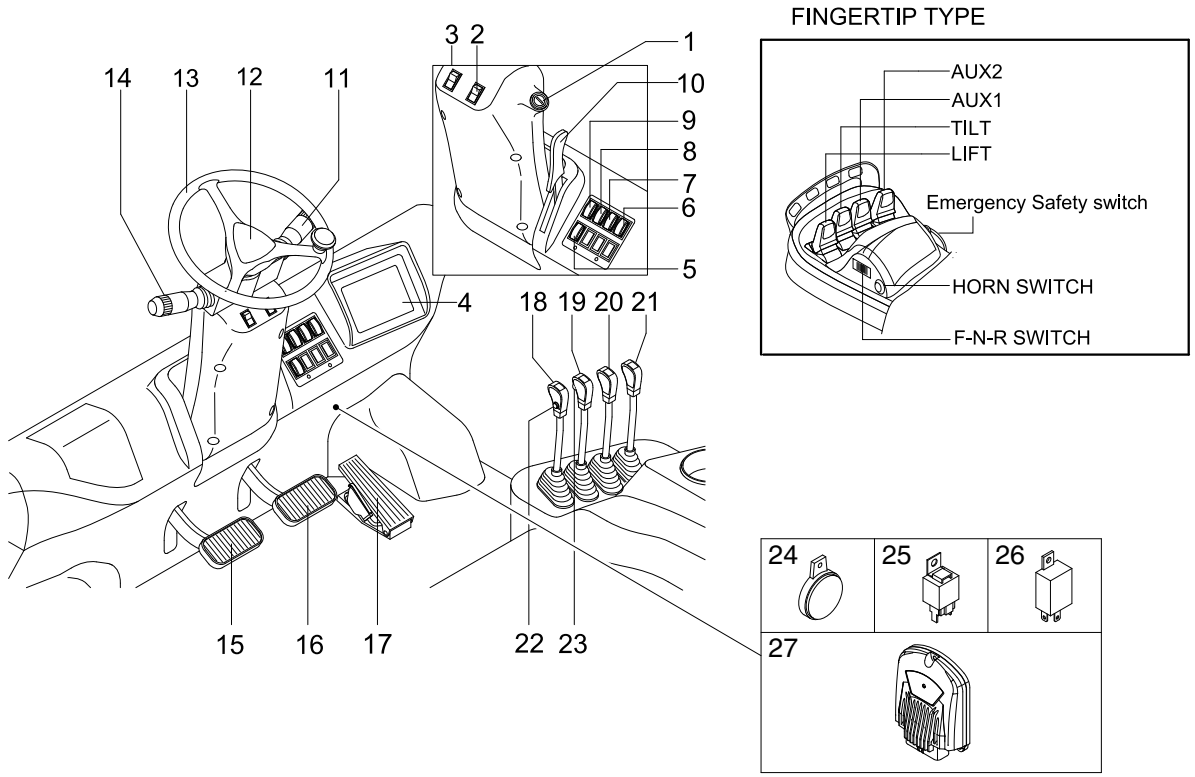
Check item	Standard size	Repair limit	Remedy
Clearance between cylinder rod & bushing	0.072~0.288 (0.003~0.011)	0.5 (0.020)	Replace bushing
Clearance between rod head bushing & pin	0.10~0.35 (0.004~0.014)	0.6 (0.024)	Replace bushing

SECTION 7 ELECTRICAL SYSTEM

Group 1 Component location ····· 7-1
Group 2 Electrical circuit ····· 7-3
Group 3 Component specification ····· 7-23
Group 4 Connector destination ····· 7-24
Group 5 Troubleshooting ····· 7-32

GROUP 1 COMPONENT LOCATION

1. LOCATION 1

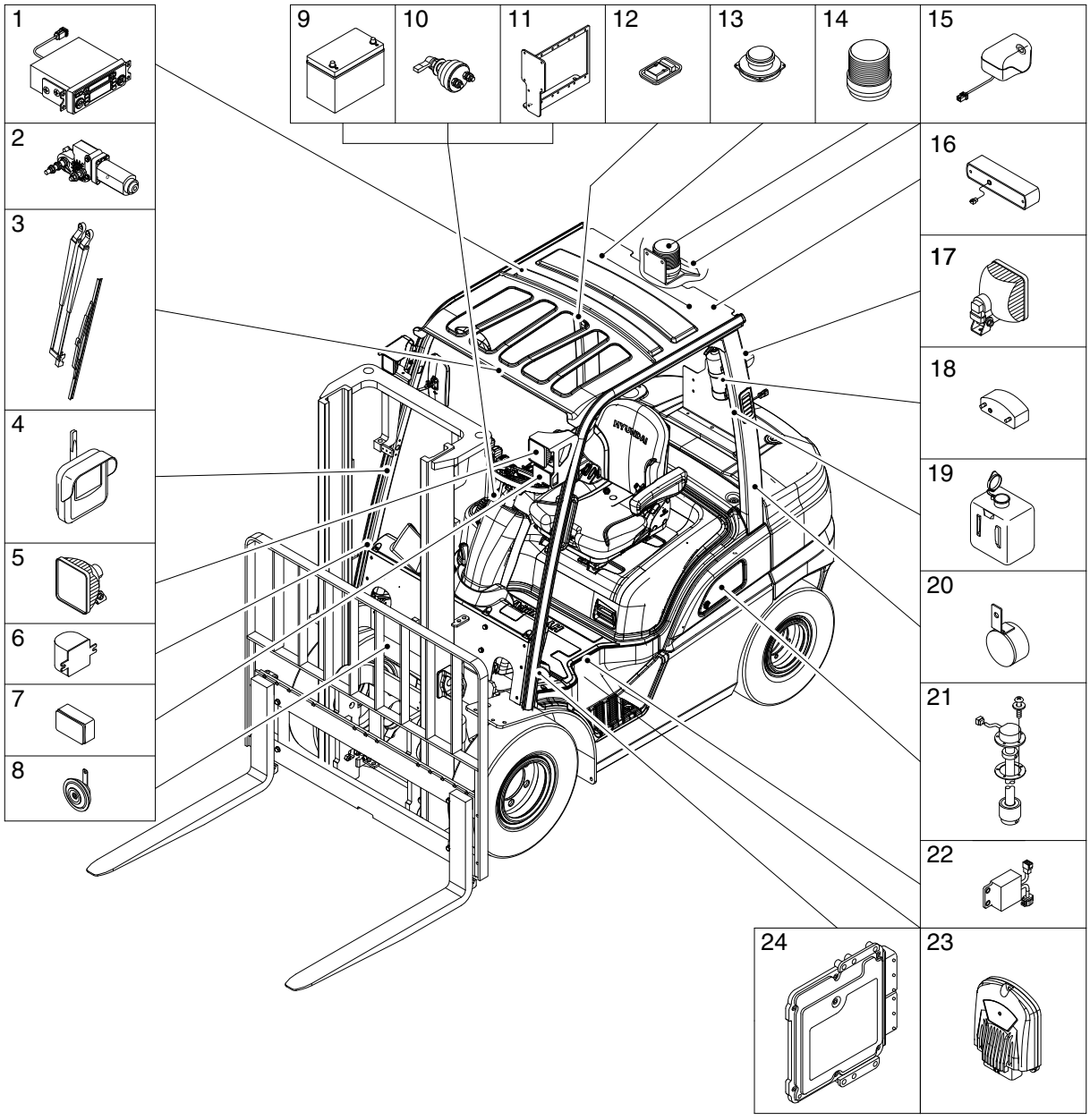


25D9V7ES08

1	Start switch	10	Steering wheel lock lever	19	Tilt lever
2	Parking brake switch	11	Turn signal switch	20	Attach lever 1 (opt)
3	Hazard lamp switch (opt)	12	Horn button	21	Attach lever 2 (opt)
4	Cluster	13	Steering wheel	22	FNR and horn switch (opt)
5	DPF Regeneration switch	14	Forward-reverse lever	23	Auto tilt leveling switch (opt)
6	Front wiper/washer switch (opt)	15	Inching pedal	24	Warning buzzer
7	Beacon switch (opt)	16	Brake pedal	25	Power relay
8	Main light switch	17	Accelerator pedal	26	Flasher unit
9	Engine mode switch	18	Lift lever	27	TCU

△Familiarize yourself with the controls and follow safe operating procedures.

2. LOCATION 2

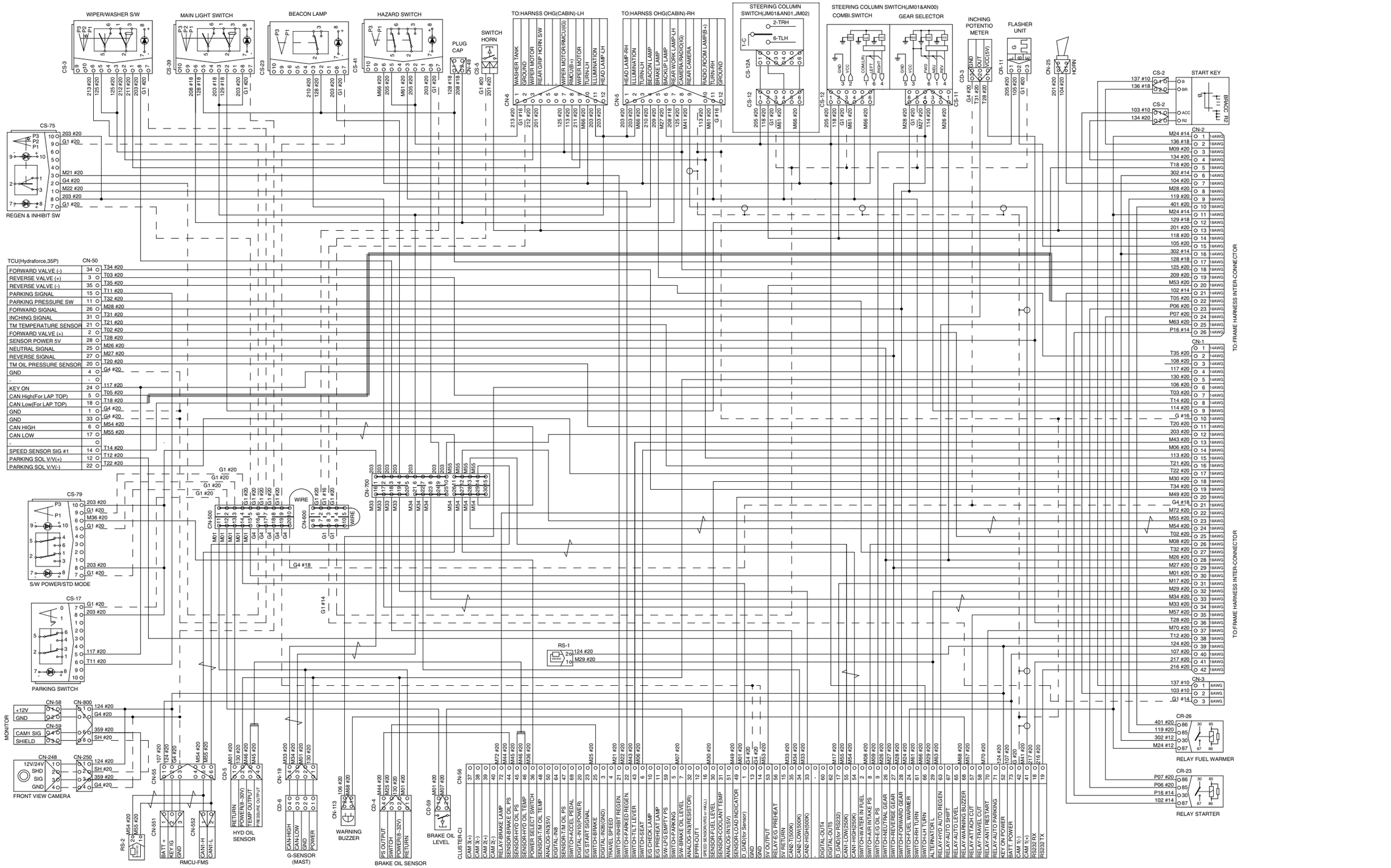


25D9V7ES01

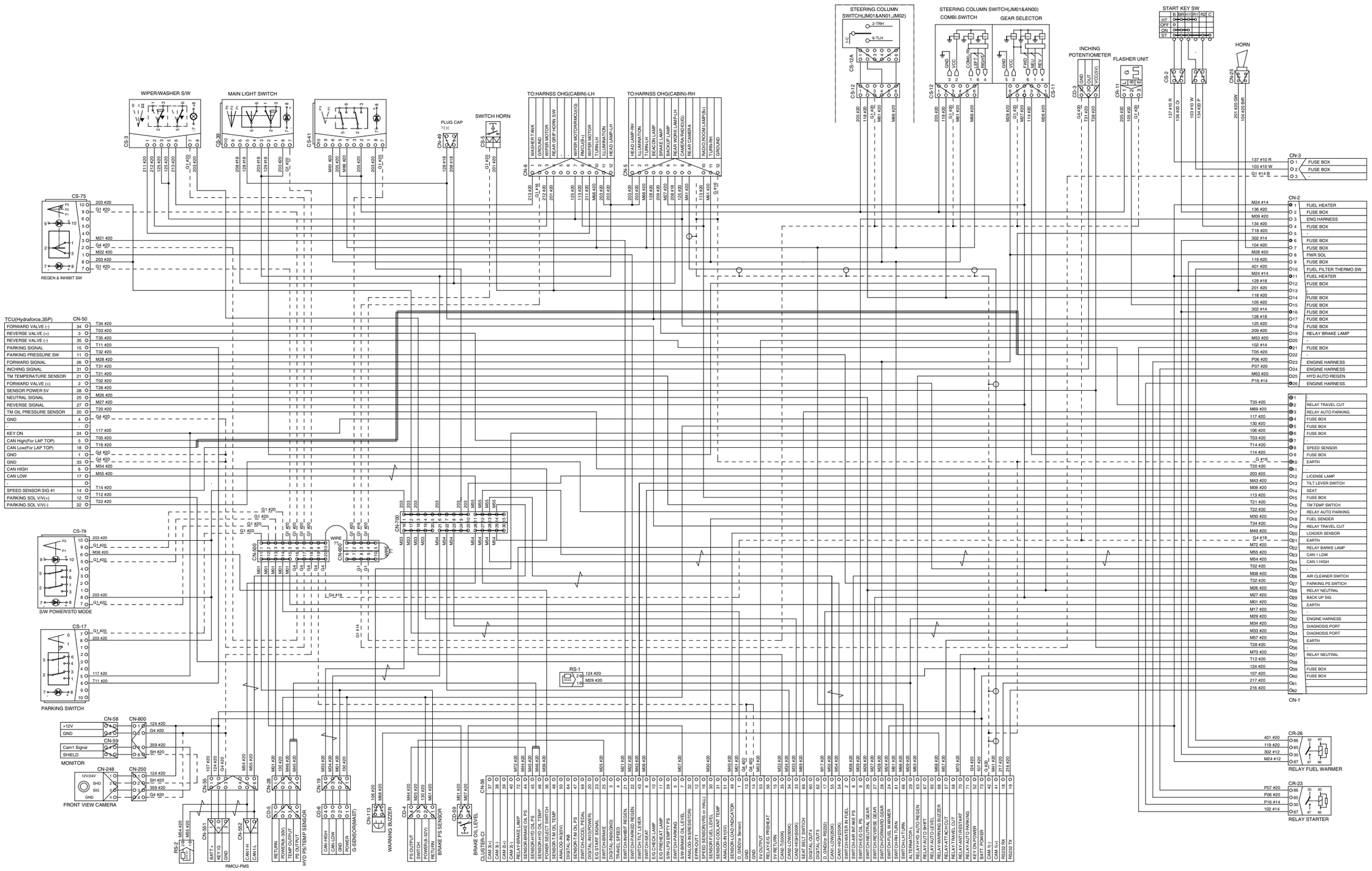
1	Radio&USB player (opt)	9	Battery	17	Work lamp (opt)
2	Wiper motor (opt)	10	Master switch (opt)	18	Licence lamp (opt)
3	Wiper arm&blade (opt)	11	Fuse&Relay box	19	Washer tank (opt)
4	Monitor (opt)	12	Room lamp (opt)	20	Back buzzer (opt)
5	Head lamp	13	Speaker (opt)	21	Fuel sender
6	Angle sensor (opt)	14	Beacon lamp (opt)	22	FNR controller (opt)
7	Turn signal lamp	15	Rear camera (opt)	23	Fingertip controller (opt)
8	Horn	16	Rear combination lamp	24	ECU

GROUP 2 ELECTRICAL CIRCUIT (25/30D-9V, 35DN-9V)

· ELECTRICAL CIRCUIT (1/8, DASHBOARD, 25D-9V : -#0023, 30D-9V : -#0019, 35DN-9V : -#0029)

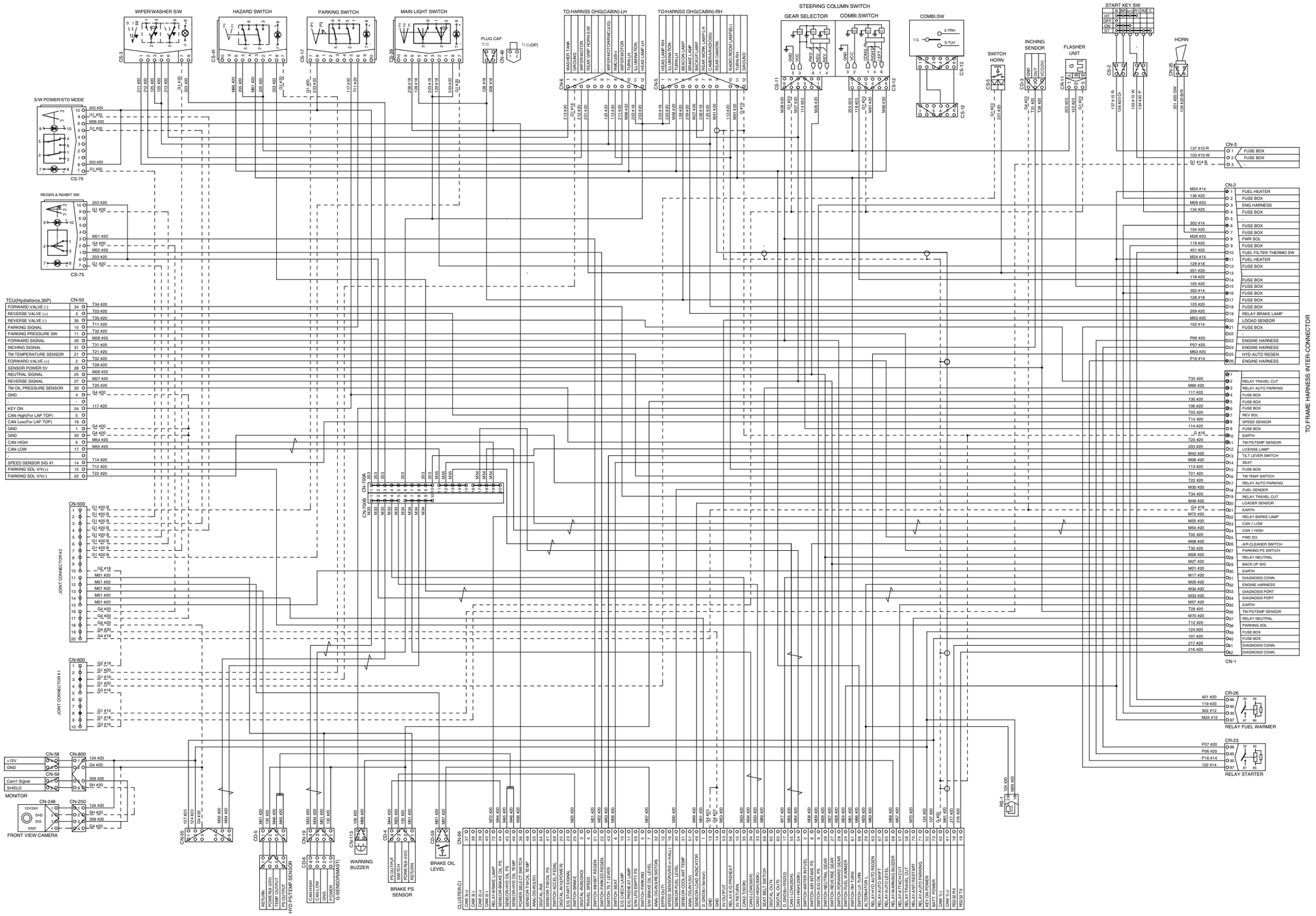


· ELECTRICAL CIRCUIT (1/8, DASHBOARD, 25D-9V : #0024-#0258, 30D-9V : #0020-#0538, 35DN-9V : #0030-#0255)



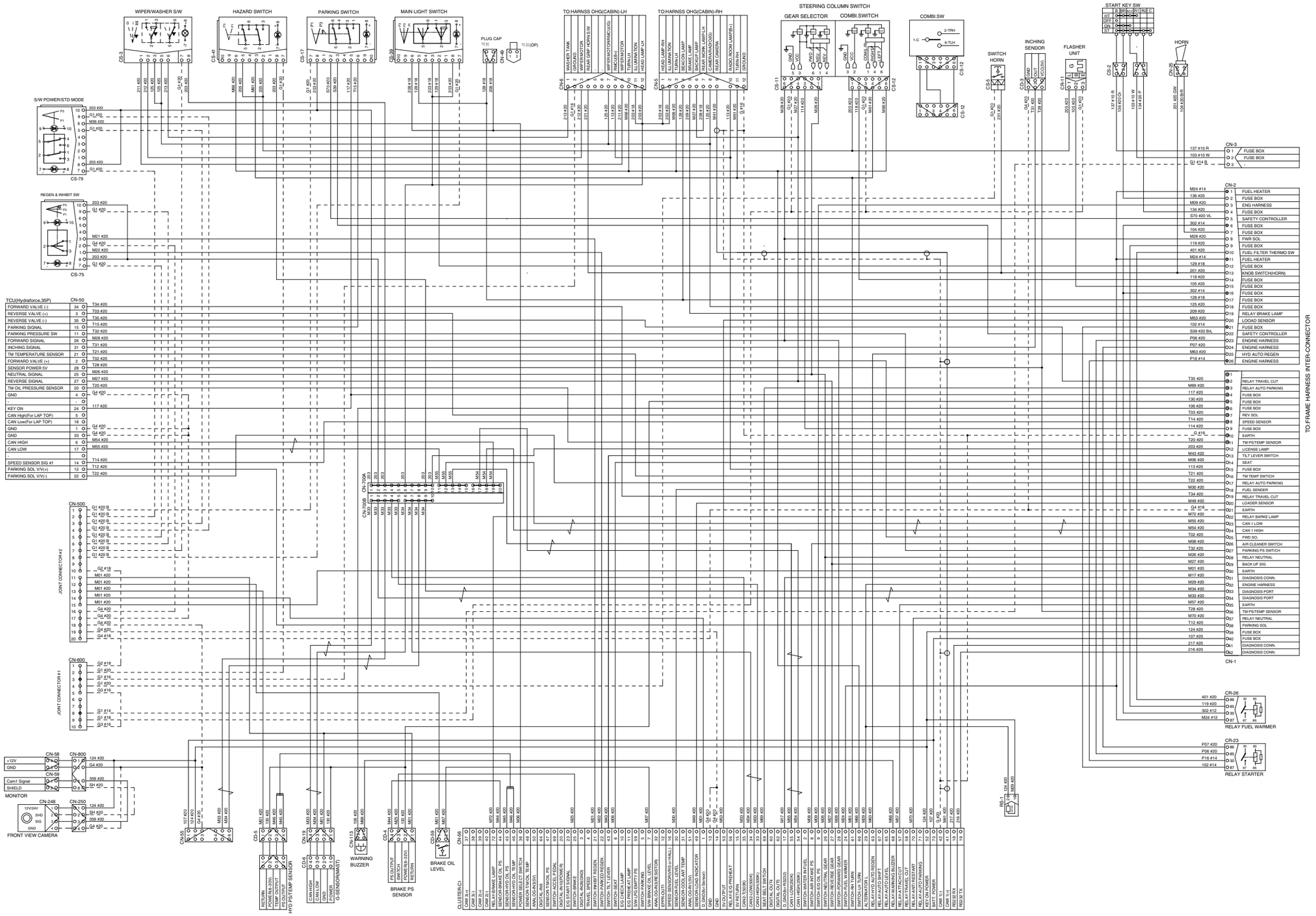
26HN-60014-00

· ELECTRICAL CIRCUIT (1/8, DASHBOARD, 25D-9V : #0259-#0700, 30D-9V : #0539-#2116, 35DN-9V : #0256-#0752)



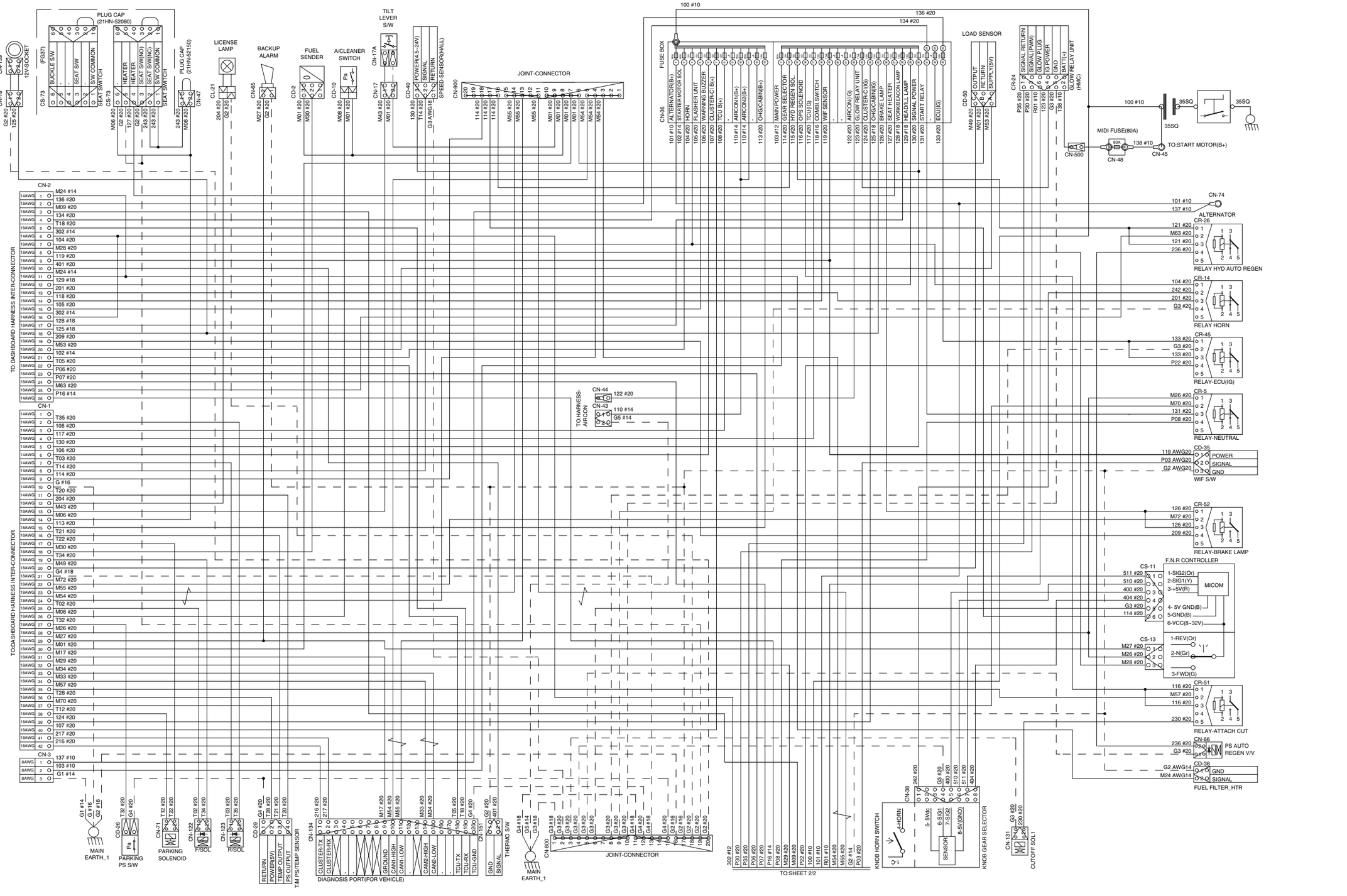
26HN-05601-00 1OF7

· ELECTRICAL CIRCUIT (1/8, DASHBOARD, 25D-9V : #0701-, 30D-9V : #2117-, 35DN-9V : #0753-)



26HN-05602-00 1OF8

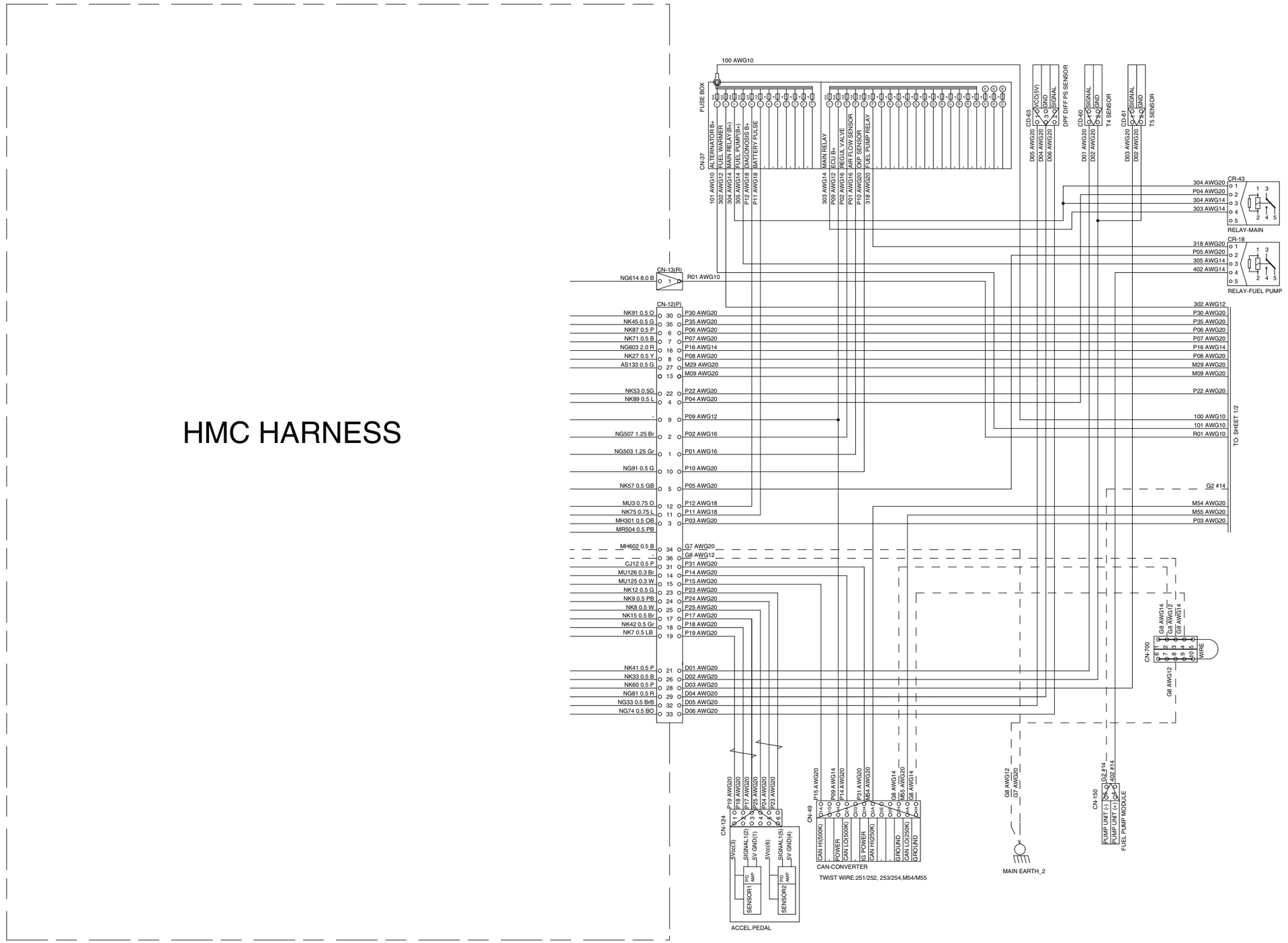
· ELECTRICAL CIRCUIT (2/8, FRAME 1 OF 2, 25D-9V : -#0064, 30D-9V : -#0050, 35DN-9V : -#0088)



26HN-60023-00 1OF2

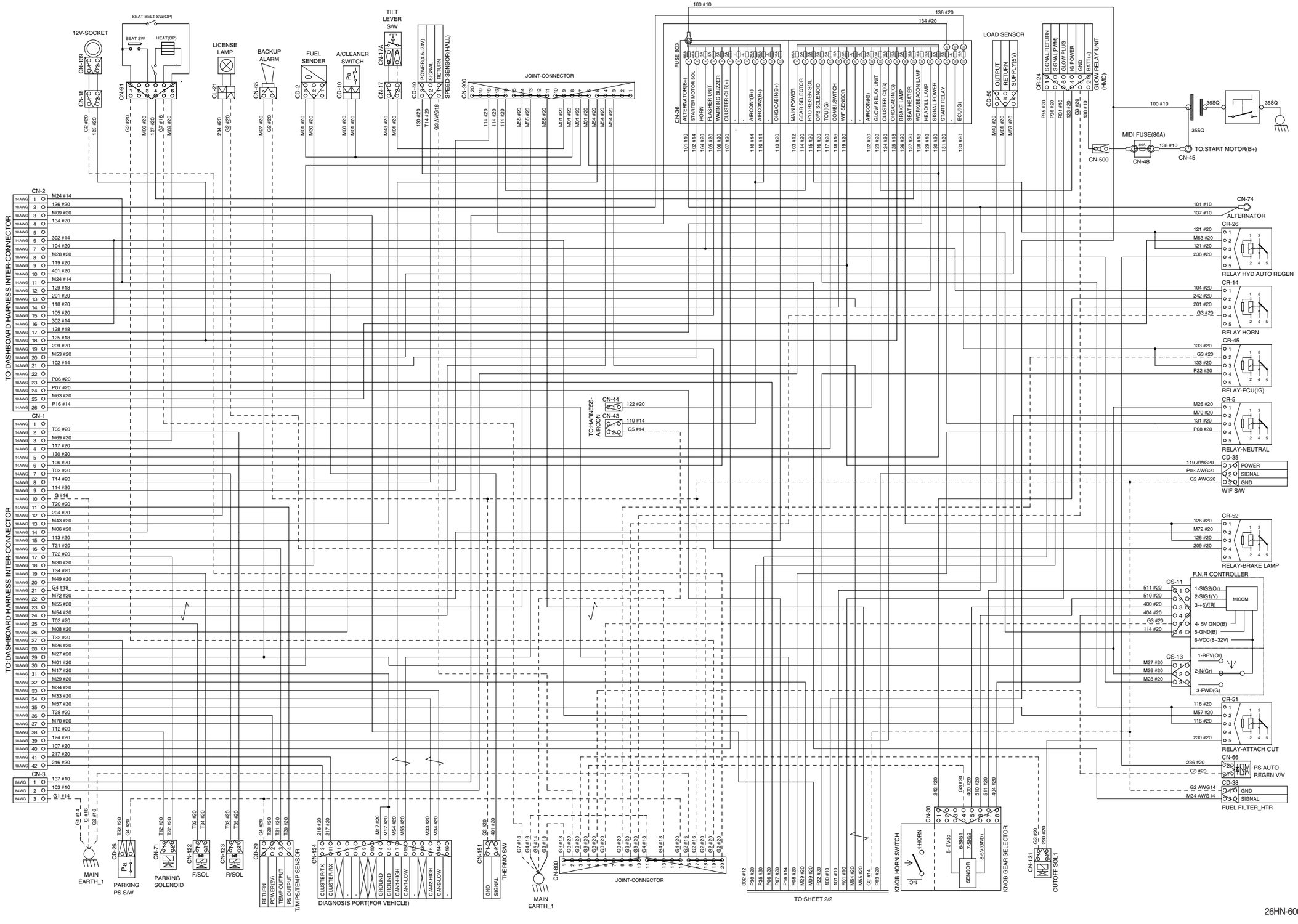
· ELECTRICAL CIRCUIT (3/8, FRAME 2 OF 2, 25D-9V : -#0064, 30D-9V : -#0050, 35DN-9V : -#0088)

HMC HARNESS



26HN-60023-00 2OF2

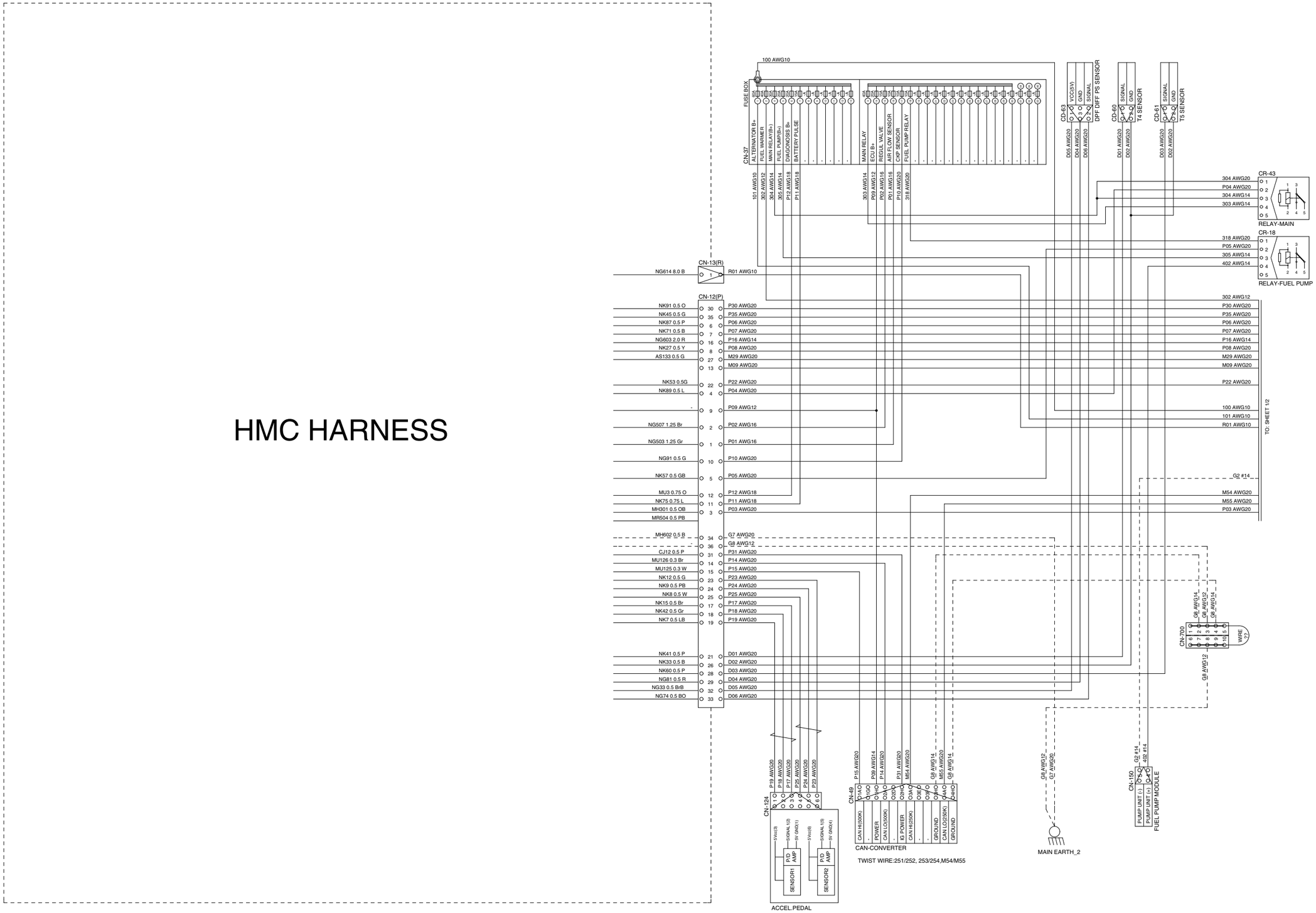
· ELECTRICAL CIRCUIT (2/8, FRAME 1 OF 2, 25D-9V : #0065-#0258, 30D-9V : #0051-#0538, 35DN-9V : #0089-#0255)



26HN-60024-00 1OF2

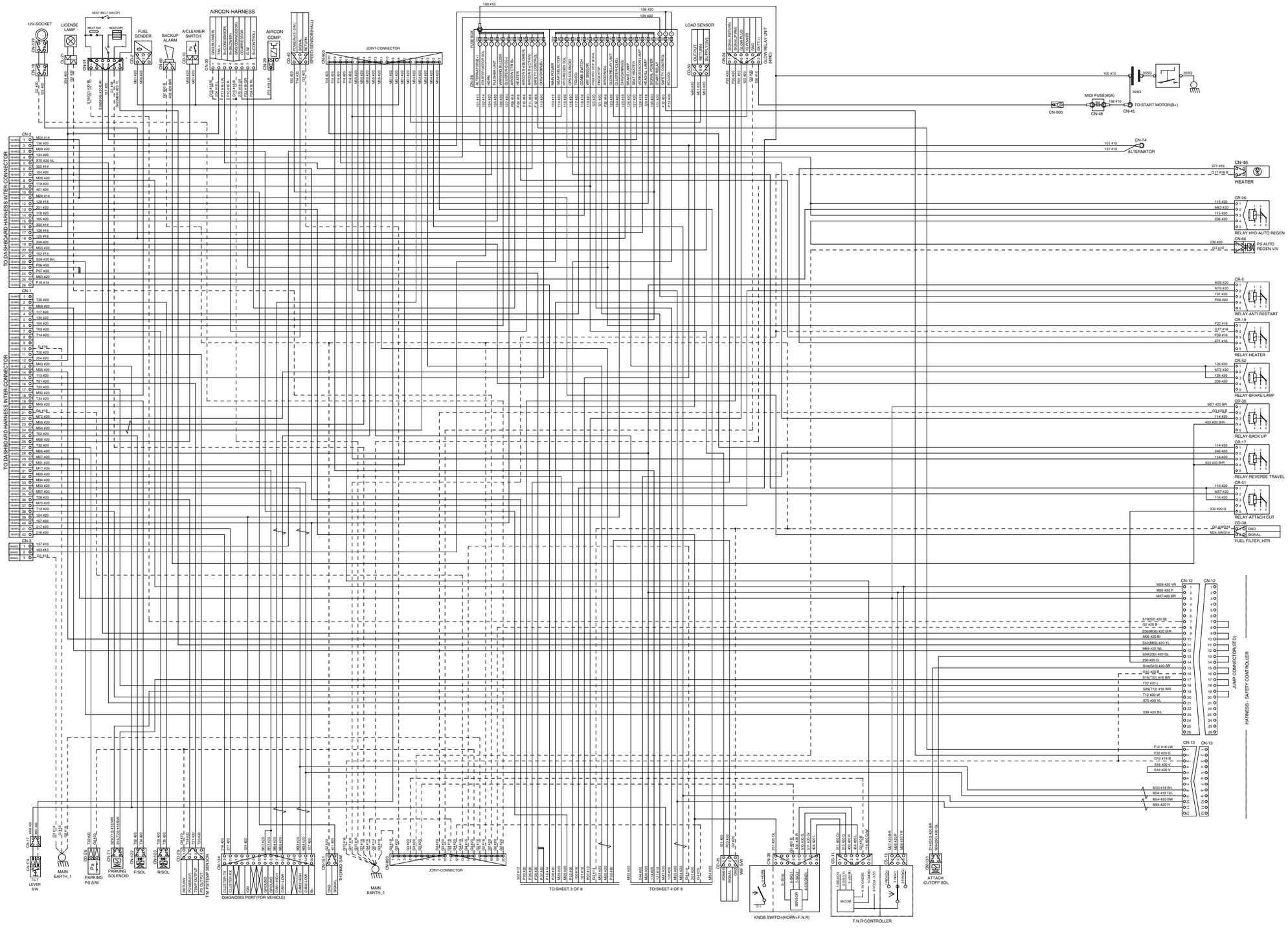
· ELECTRICAL CIRCUIT (3/8, FRAME 2 OF 2, 25D-9V : #0065-#0258, 30D-9V : #0051-#0538, 35DN-9V : #0089-#0255)

HMC HARNESS



26HN-60024-00 2OF2

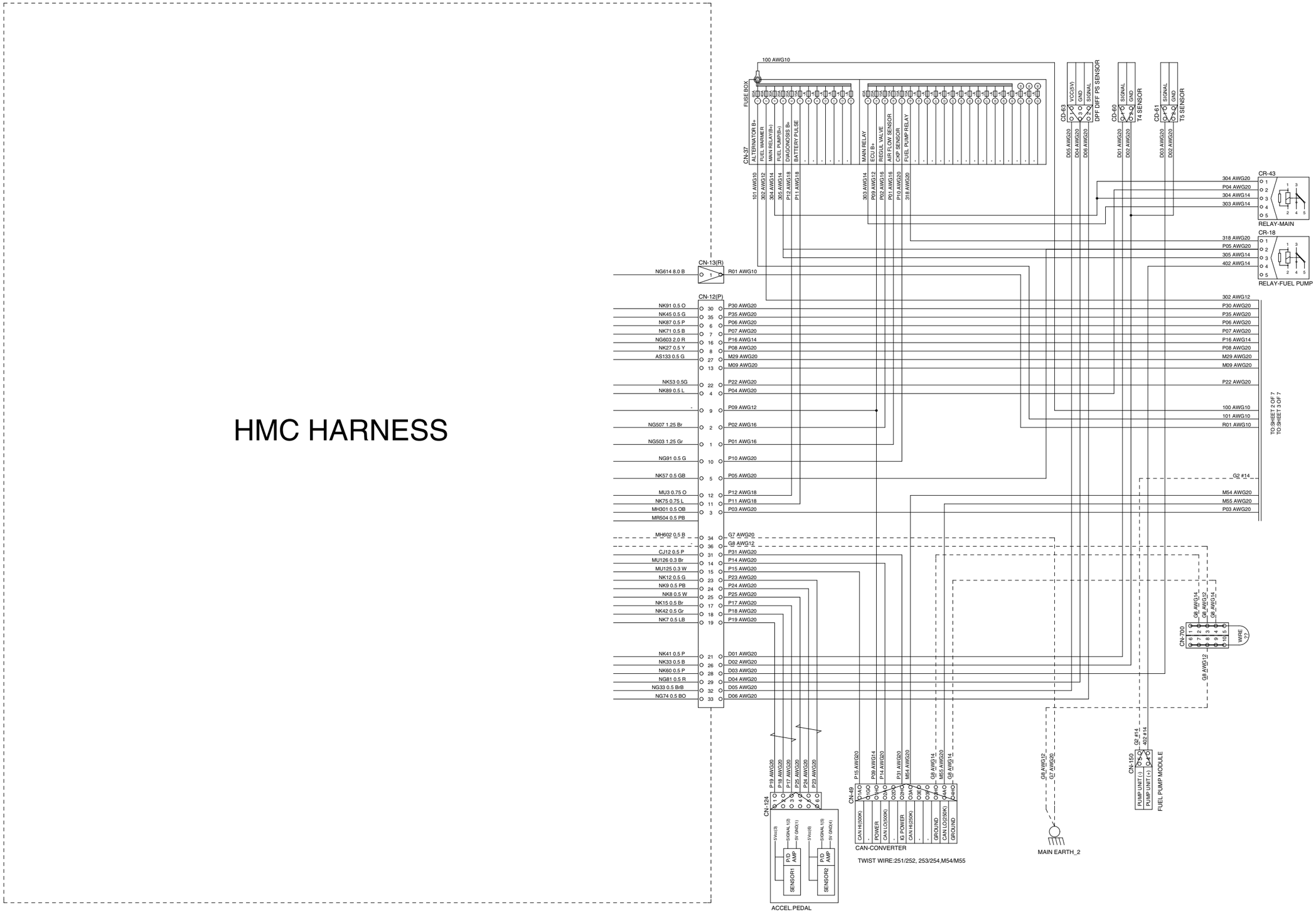
· ELECTRICAL CIRCUIT (2/8, FRAME 1 OF 2, 25D-9V : #0259-#0700, 30D-9V : #0539-#2116, 35DN-9V : #0256-#0752)



26HN-05601-00 2OF7

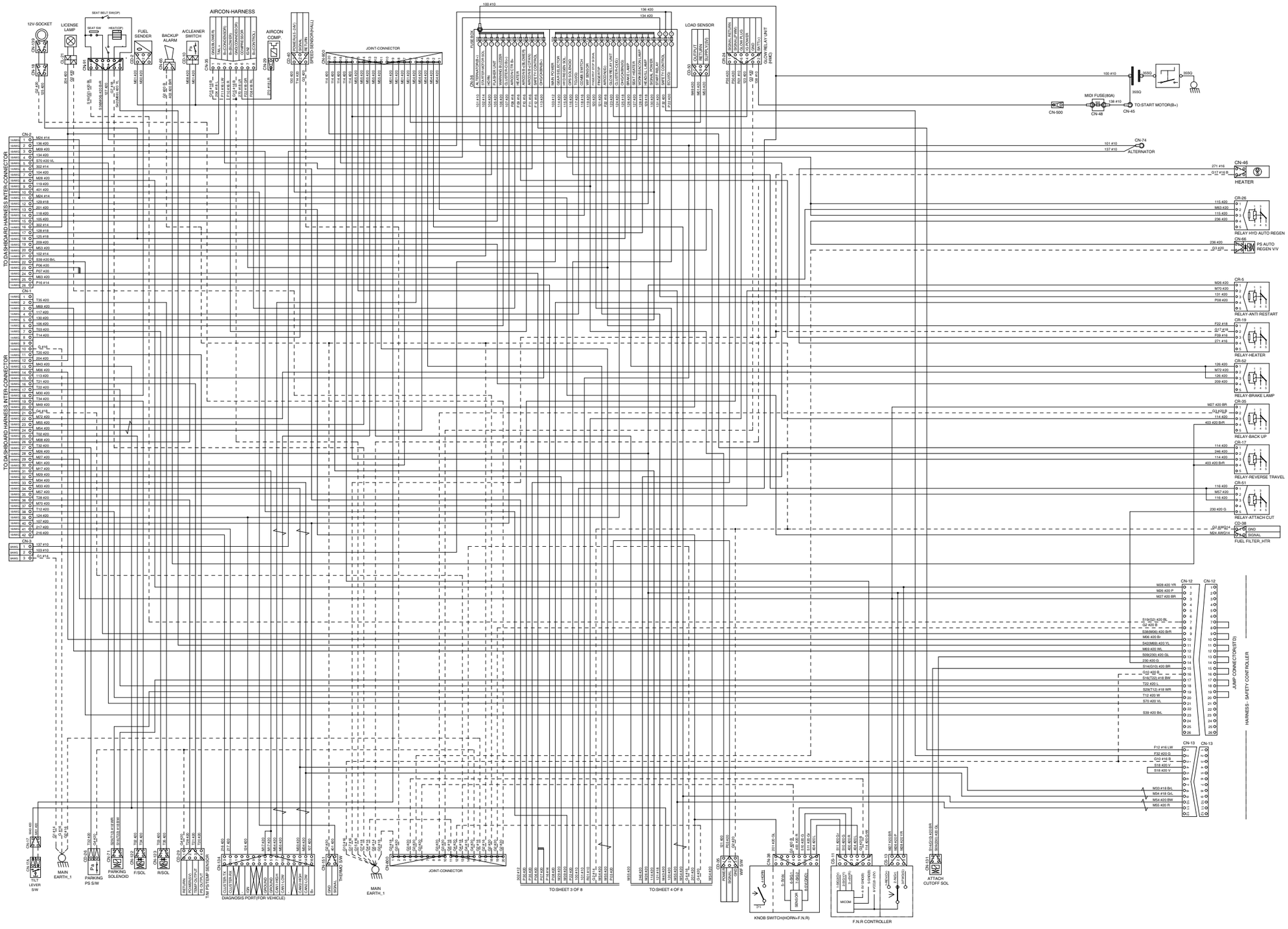
· ELECTRICAL CIRCUIT (3/8, FRAME 2 OF 2, 25D-9V : #0259-#0700, 30D-9V : #0539-#2116, 35DN-9V : #0256-#0752)

HMC HARNESS



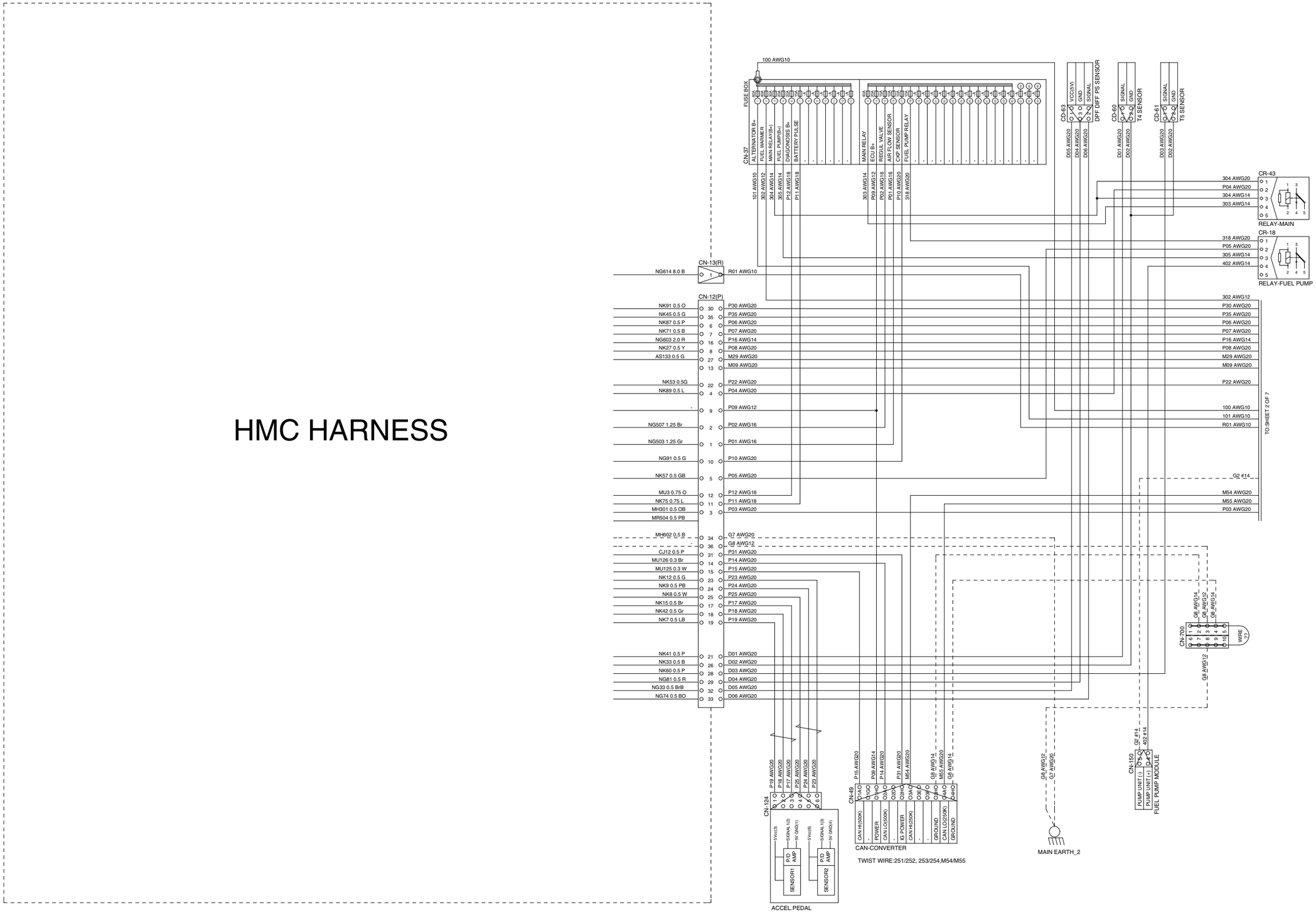
26HN-05601-00 4OF7

· ELECTRICAL CIRCUIT (2/8, FRAME 1 OF 3, 25D-9V : #0701-, 30D-9V : #2117-, 35DN-9V : #0753-)



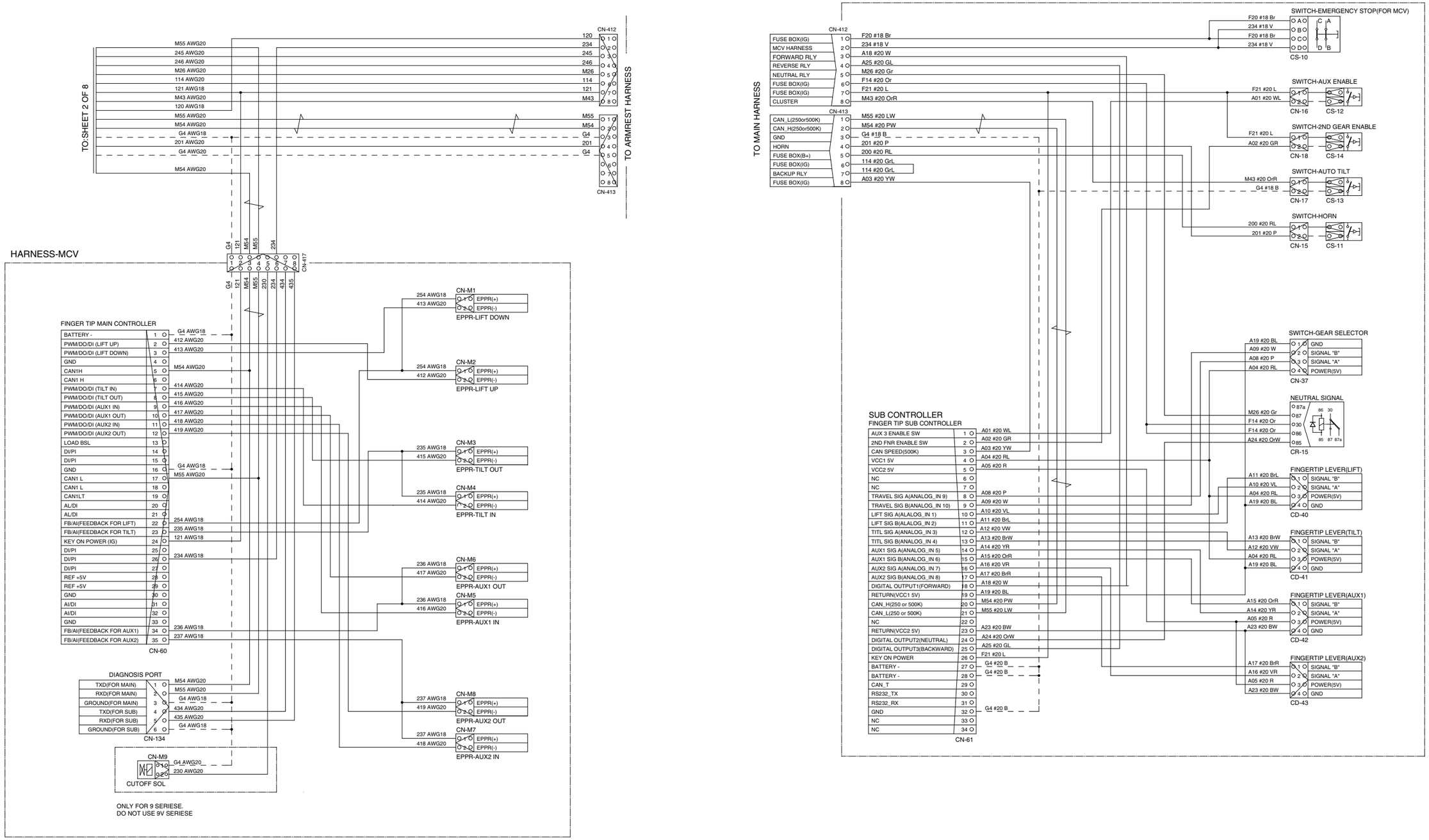
· ELECTRICAL CIRCUIT (3/8, FRAME 2 OF 3, 25D-9V : #0701-, 30D-9V : #2117-, 35DN-9V : #0753-)

HMC HARNESS



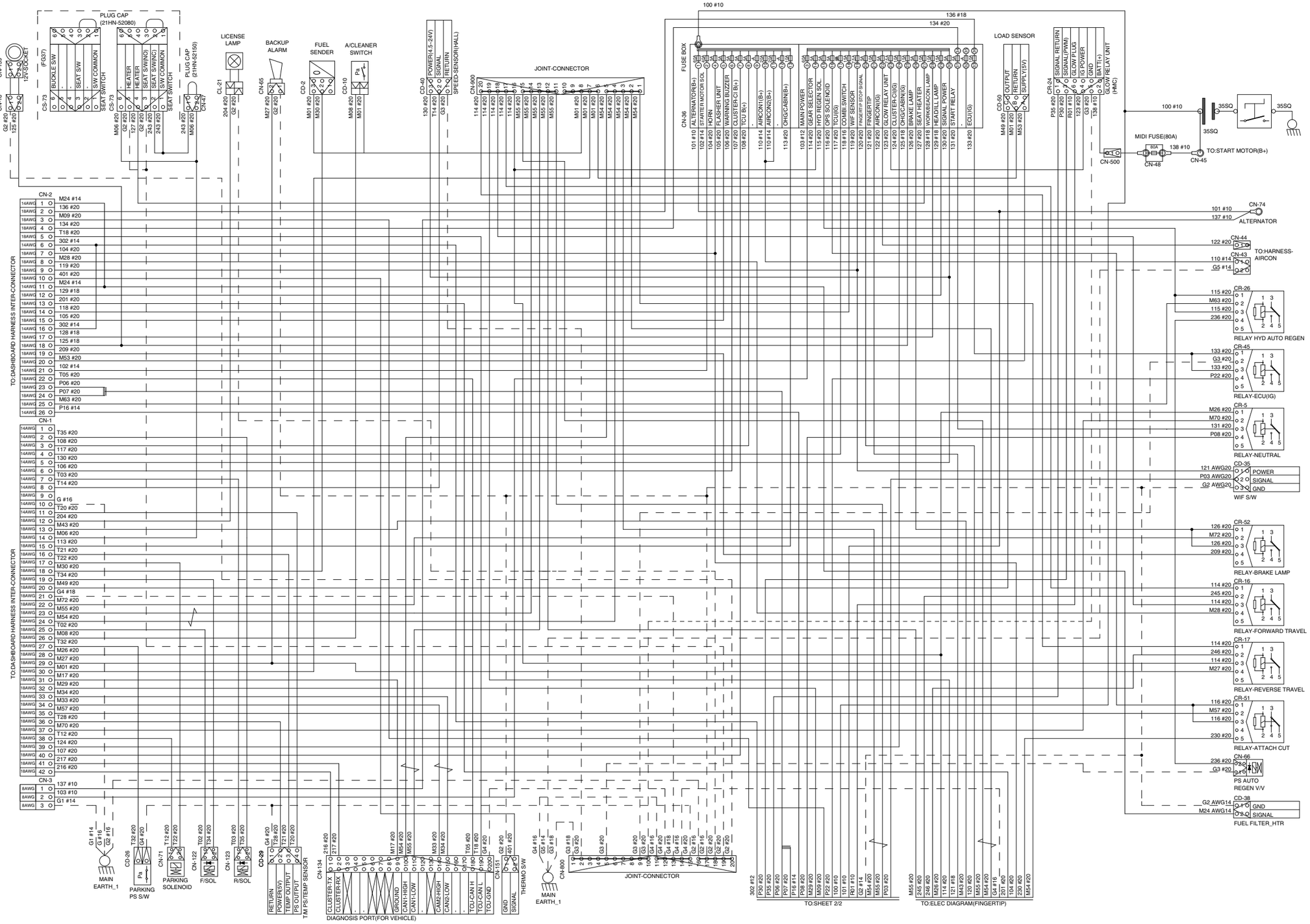
26HN-05602-00 3OF8

· ELECTRICAL CIRCUIT (3/8, FRAME 3 OF 3, 25D-9V : #0701-, 30D-9V : #2117-, 35DN-9V : #0753-)



26HN-05602-00 4OF8

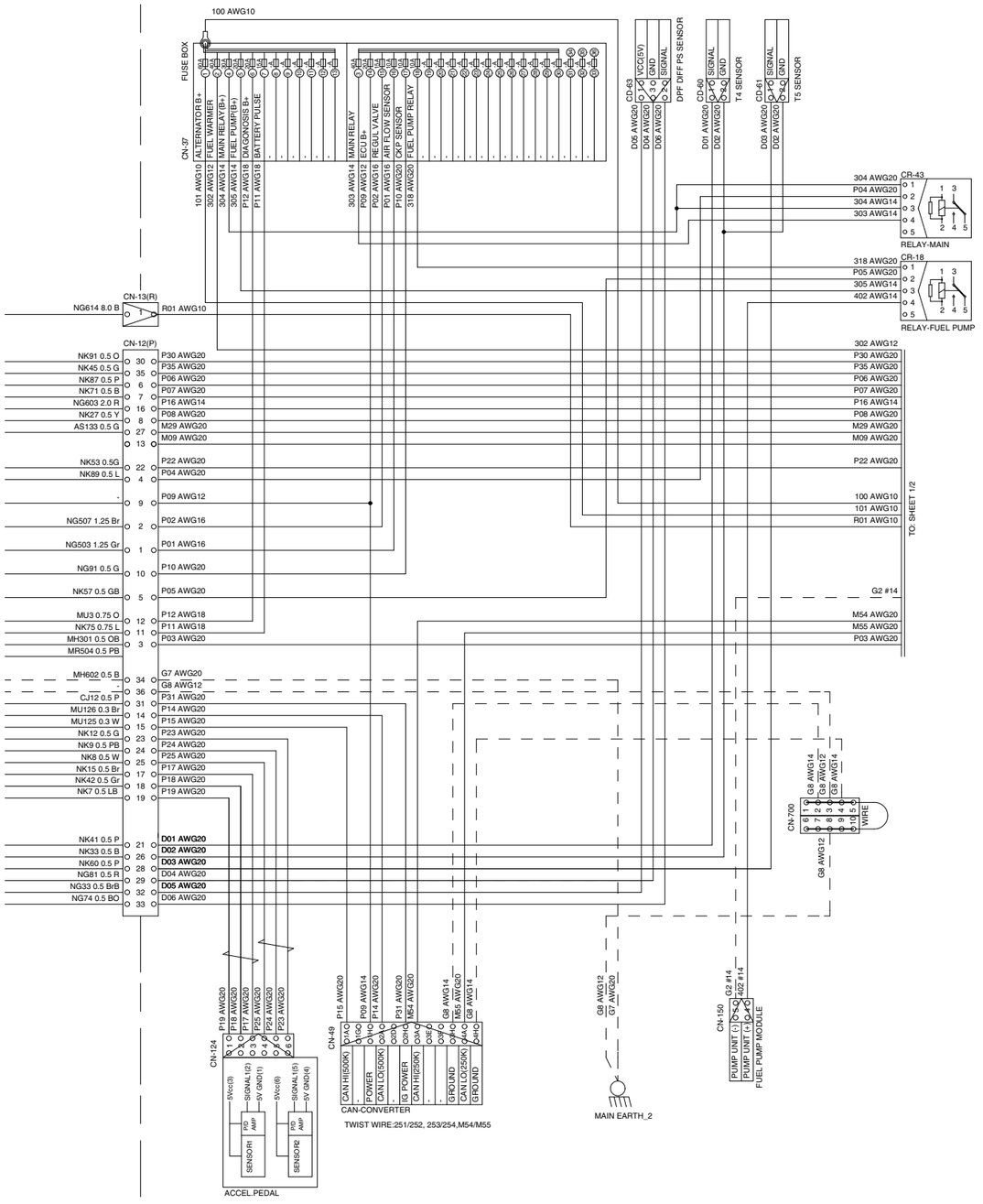
· ELECTRICAL CIRCUIT (4/8, FRAME-FINGERTIP 1 OF 2, 25D-9V : -#0064, 30D-9V : -#0050, 35DN-9V : -#0088)



26HN-60123-00 1OF2

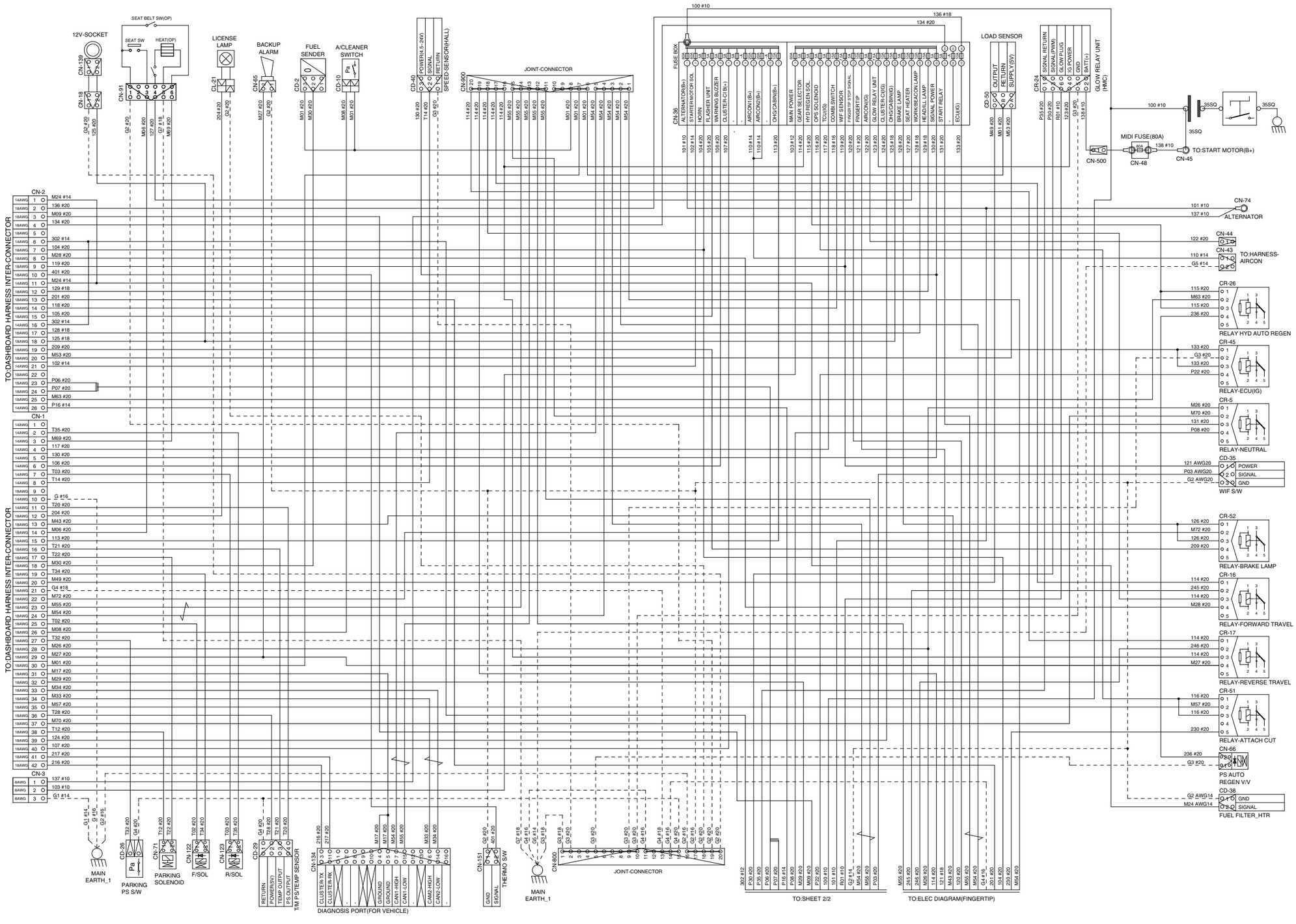
· ELECTRICAL CIRCUIT (5/8, FRAME-FINGERTIP 2 OF 2, 25D-9V : -#0064, 30D-9V : -#0050, 35DN-9V : -#0088)

HMC HARNESS



26HN-60123-00 2OF2

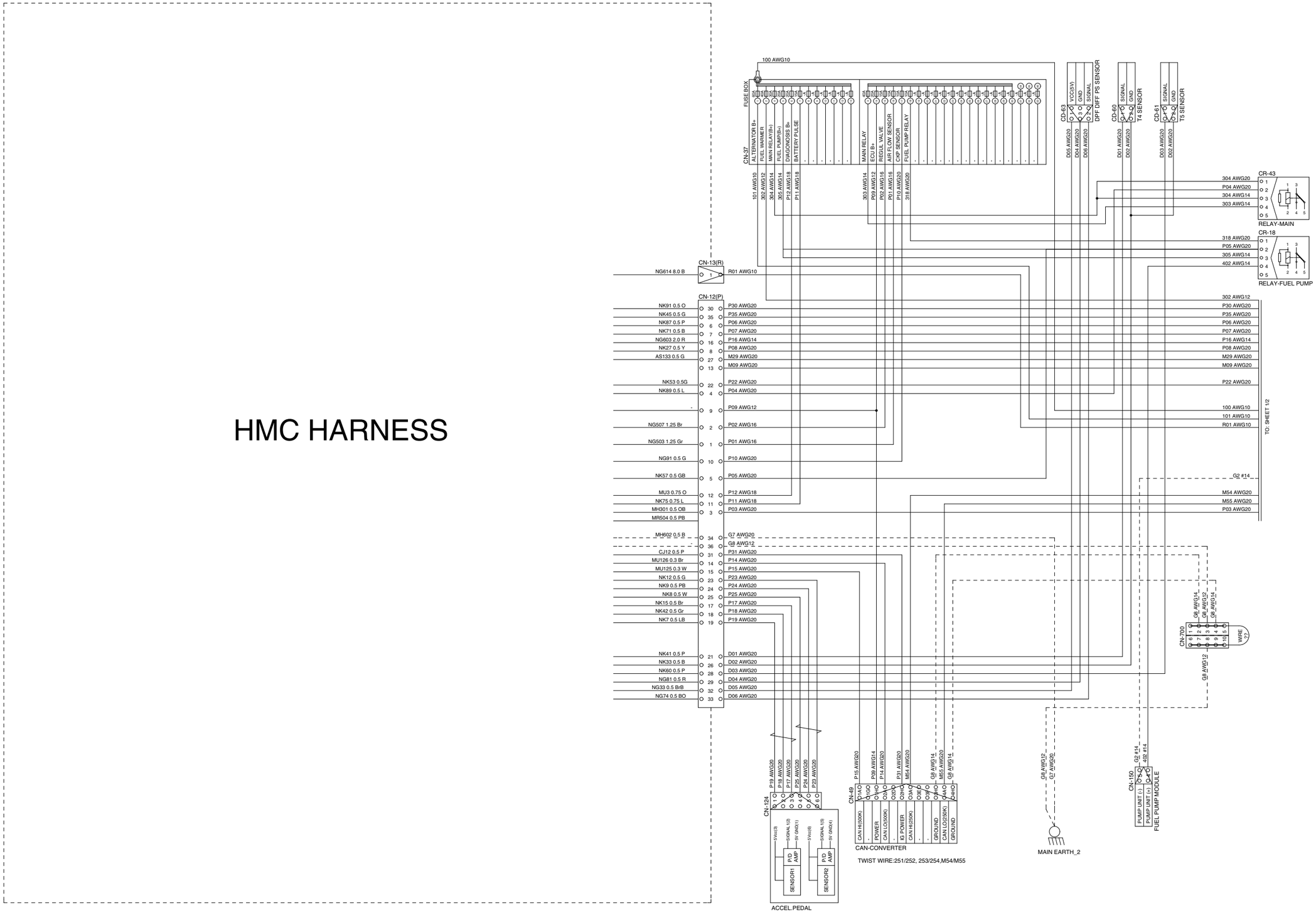
· ELECTRICAL CIRCUIT (4/8, FRAME-FINGERTIP 1 OF 2, 25D-9V : #0065-#0258, 30D-9V : #0051-#0538, 35DN-9V : #0089-#0255)



26HN-60124-00 1OF2

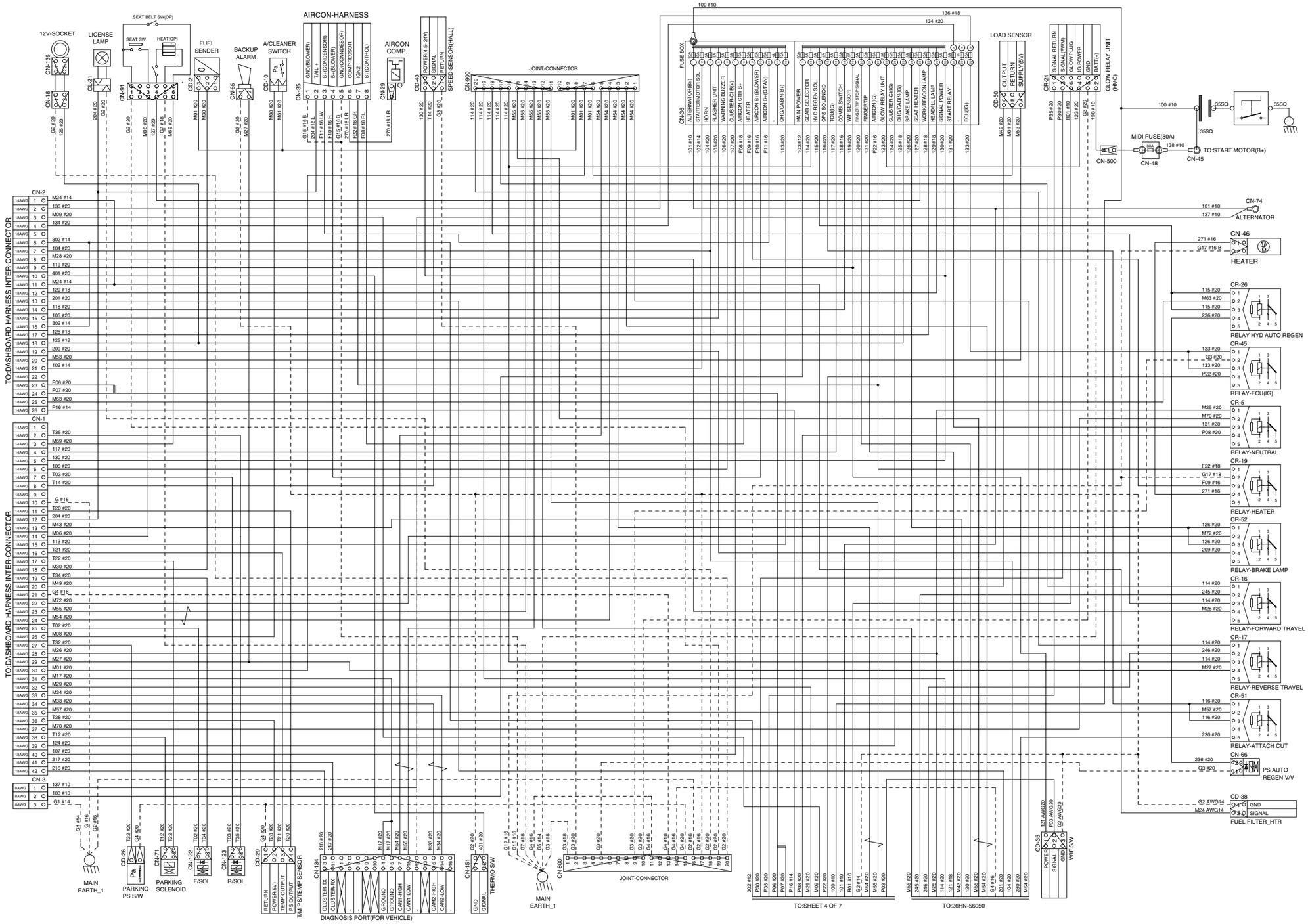
· ELECTRICAL CIRCUIT (5/8, FRAME-FINGERTIP 2 OF 2, 25D-9V : #0065-#0258, 30D-9V : #0051-#0538, 35DN-9V : #0089-#0255)

HMC HARNESS



26HN-60124-00 2OF2

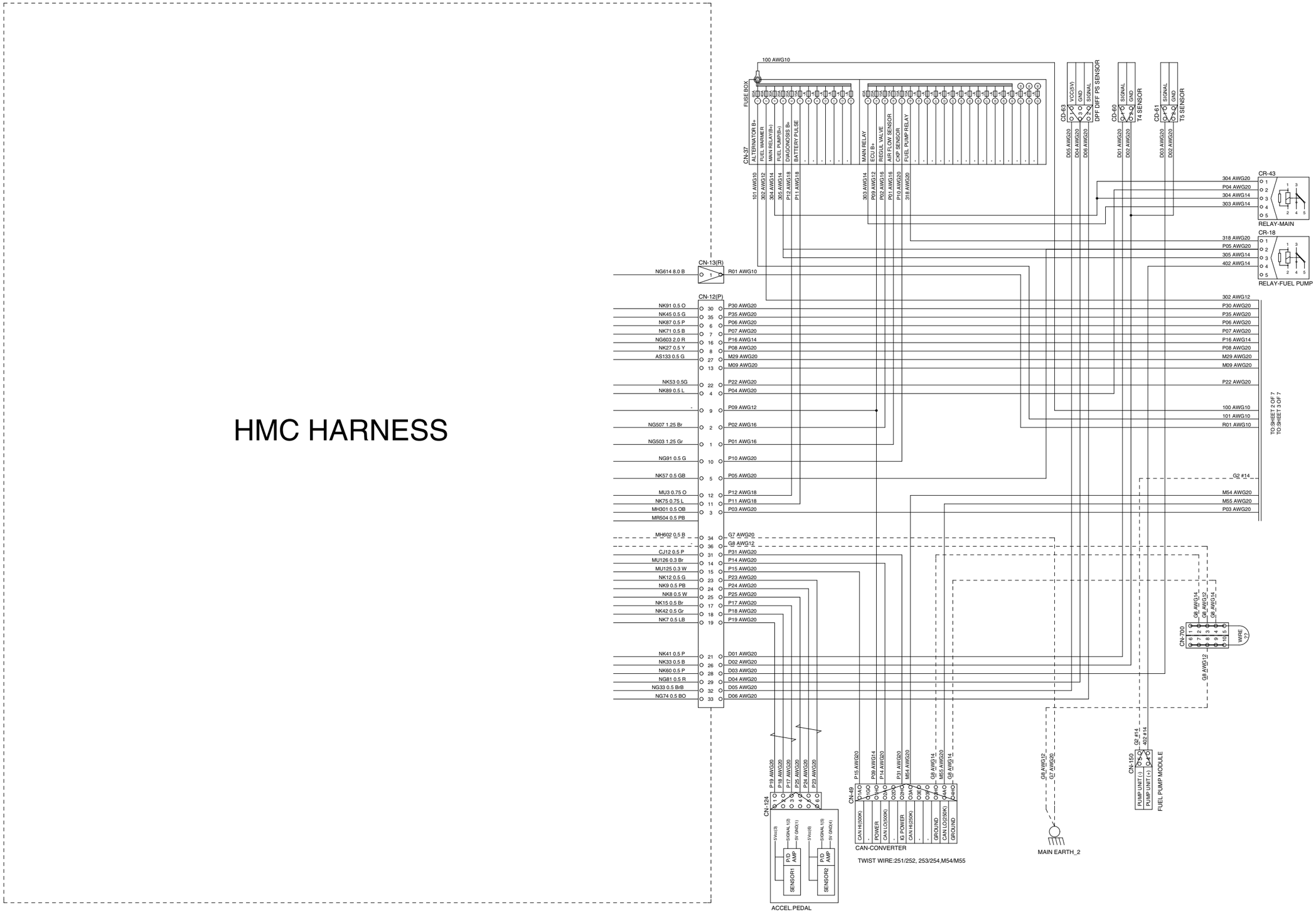
· ELECTRICAL CIRCUIT (4/8, FRAME-FINGERTIP 1 OF 2, 25D-9V : #0259-#0700, 30D-9V : #0539-#2116, 35DN-9V : #0256-#0752)



26HN-05601-00 3OF7

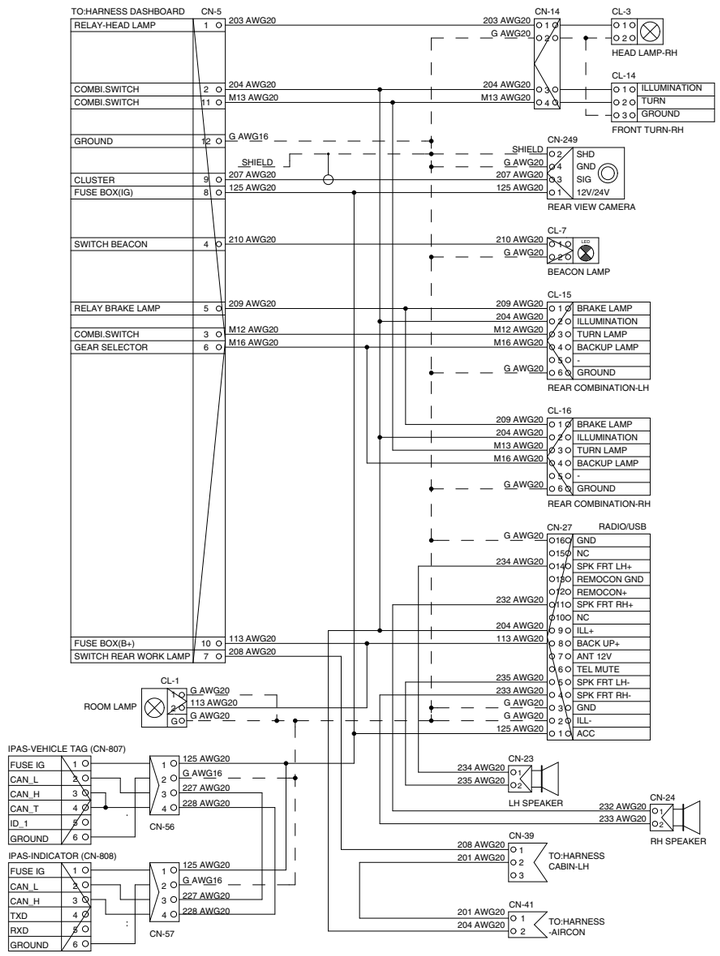
· ELECTRICAL CIRCUIT (5/8, FRAME-FINGERTIP 2 OF 2, 25D-9V : #0259-#0700, 30D-9V : #0539-#2116, 35DN-9V : #0256-#0752)

HMC HARNESS

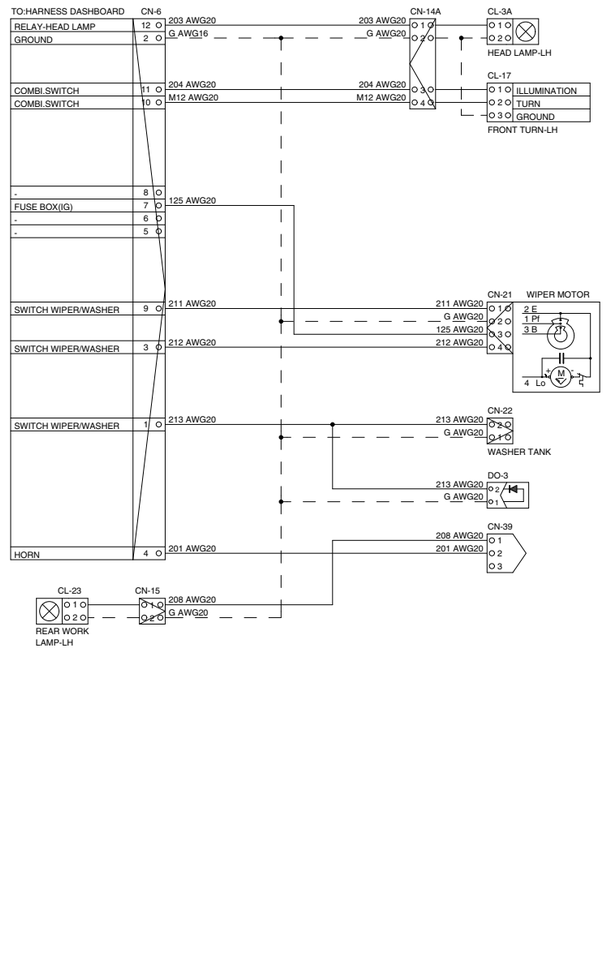


· ELECTRICAL CIRCUIT (6/8, CABIN WITH AIRCON, 25D-9V : -#0258, 30D-9V : -#0538, 35DN-9V : -#0255)

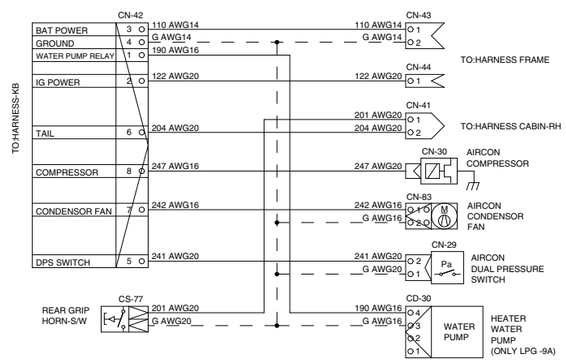
*ELEC.DIAGRAM OF HARNESS CABIN-RH



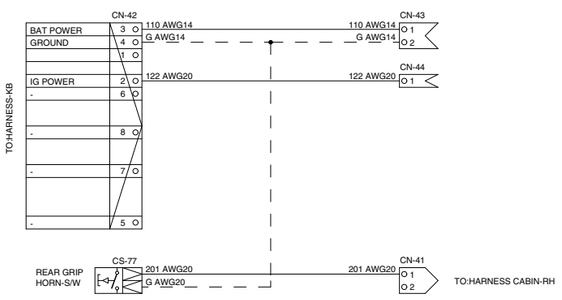
*ELEC.DIAGRAM OF HARNESS CABIN-LH



*ELEC.DIAGRAM OF HARNESS-AIRCON(AIRCON+HEATER)



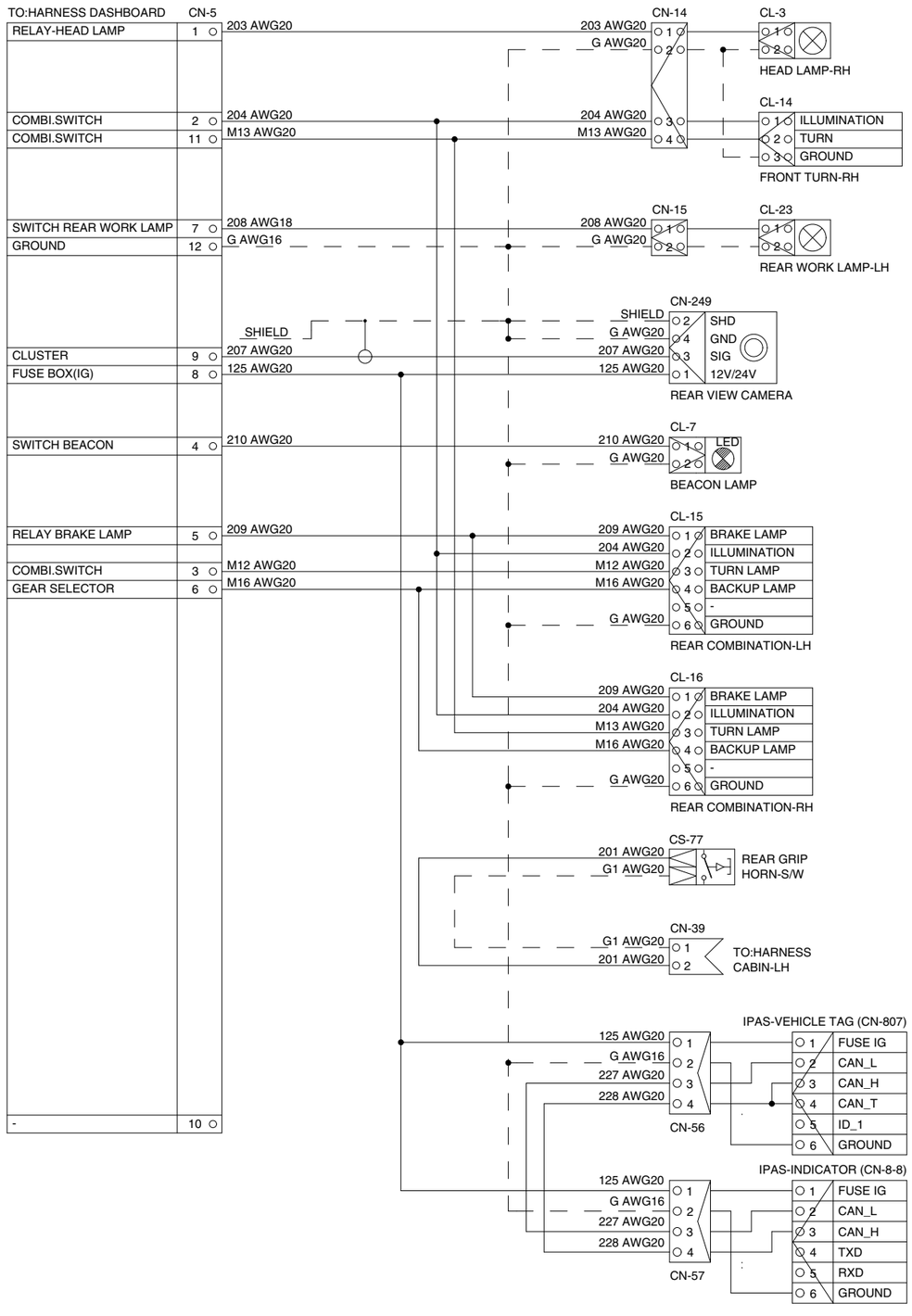
*ELEC.DIAGRAM OF HARNESS-HEATER(HEATER ONLY)



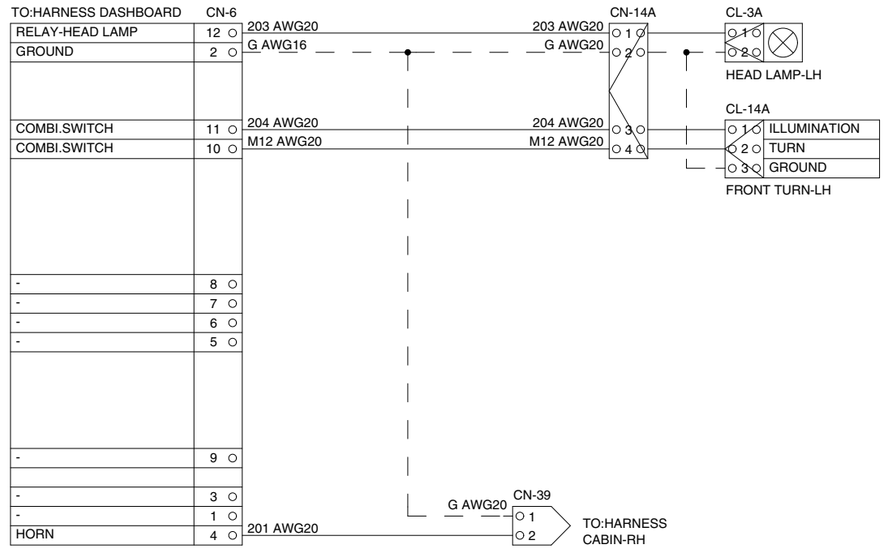
21HN-40082-00

· ELECTRICAL CIRCUIT (7/8, OVERHEAD GUARD, 25D-9V : -#0258, 30D-9V : -#0538, 35DN-9V : -#0255)

*ELEC.DIAGRAM OF HARNESS OHG-RH



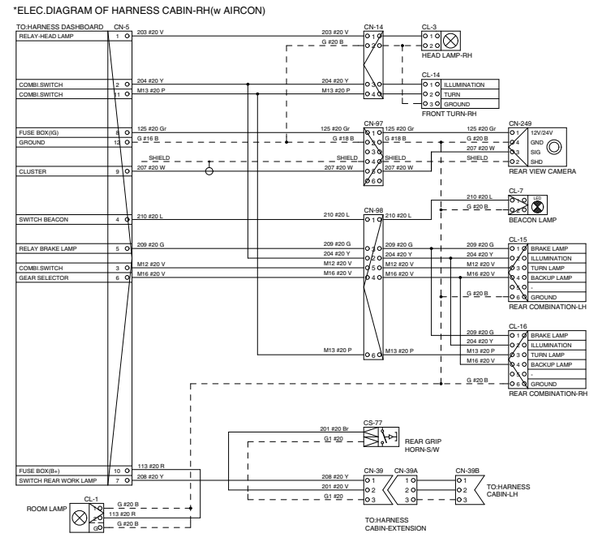
*ELEC.DIAGRAM OF HARNESS OHG-LH



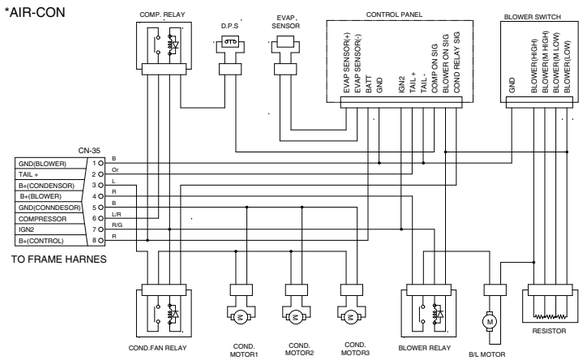
21HN-50044-00

· ELECTRICAL CIRCUIT (6~7/8, CABIN, OVERHEAD GUARD, 25D-9V : #0259-#0700, 30D-9V : #0539-#2116, 35DN-9V : #0256-#0752)

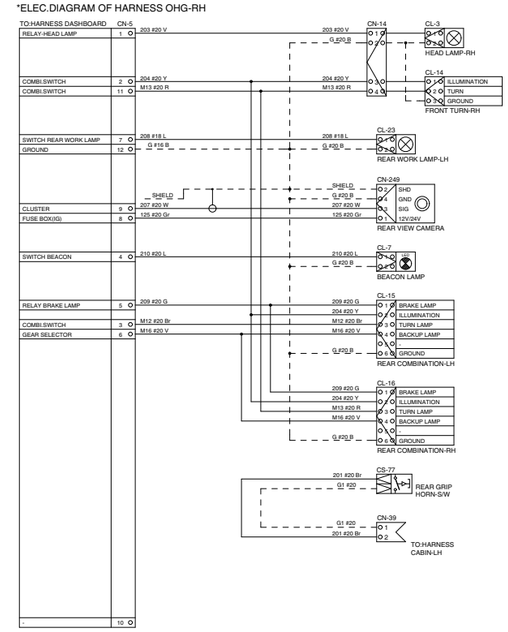
*ELEC.DIAGRAM OF HARNESS CABIN-RH(w AIRCON)



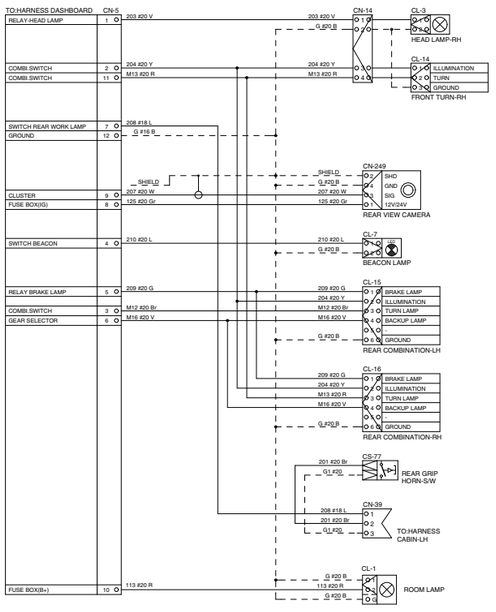
*AIR-CON



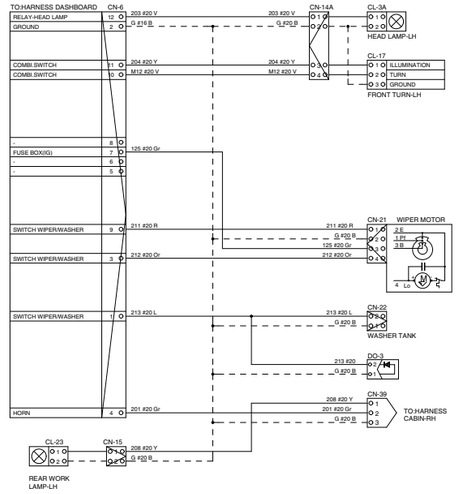
*ELEC.DIAGRAM OF HARNESS OHG-RH



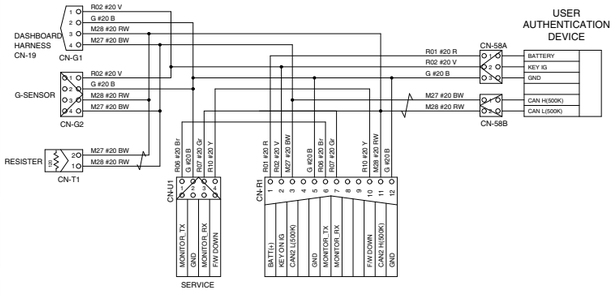
*ELEC.DIAGRAM OF HARNESS CABIN-RH(PARTIAL, w/o AIRCON)



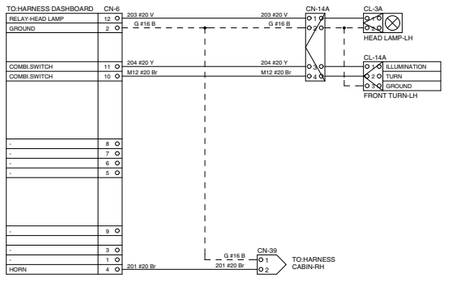
*ELEC.DIAGRAM OF HARNESS CABIN-LH



* RMCU HARNESS



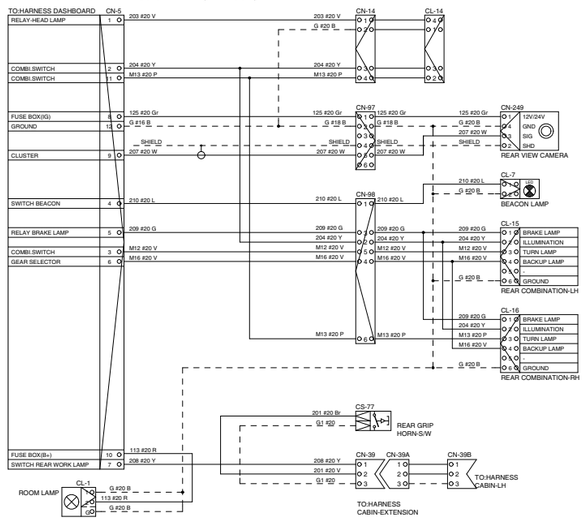
*ELEC.DIAGRAM OF HARNESS OHG-LH



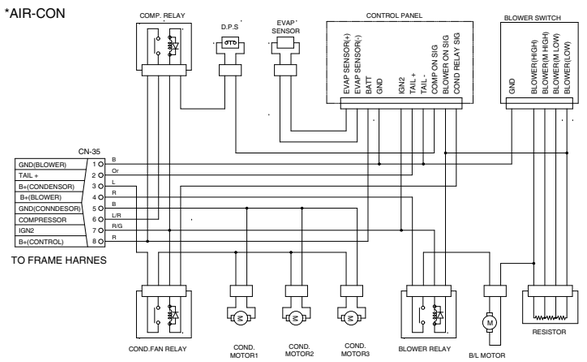
21HN-04100-00

· ELECTRICAL CIRCUIT (6~7/8, CABIN, OVERHEAD GUARD, 25D-9V : #0701-, 30D-9V : #2117-, 35DN-9V : #0753-)

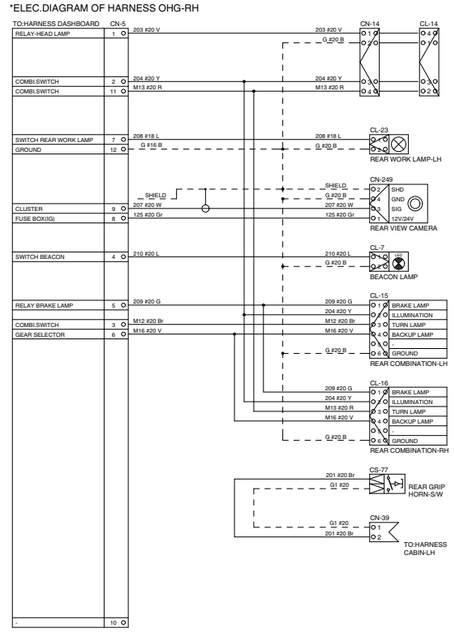
*ELEC.DIAGRAM OF HARNESS CABIN-RH(w AIRCON)



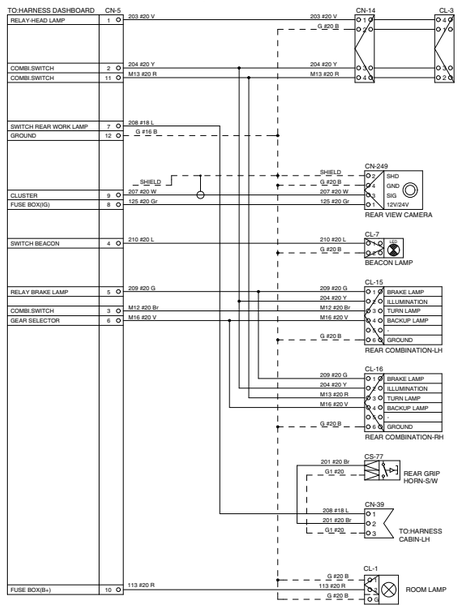
*AIR-CON



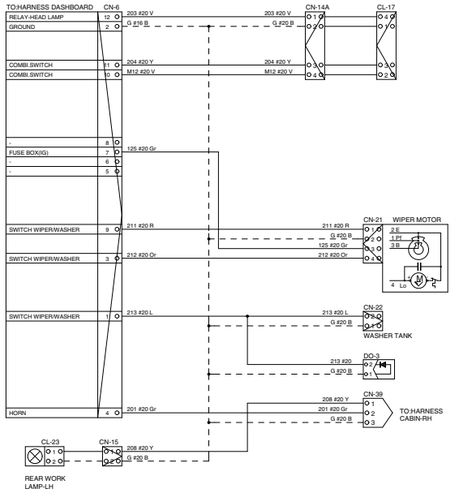
*ELEC.DIAGRAM OF HARNESS OHG-RH



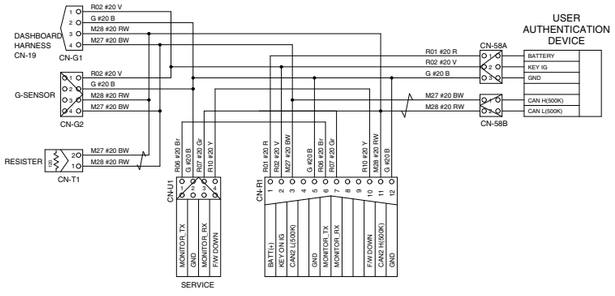
*ELEC.DIAGRAM OF HARNESS CABIN-RH(PARTIAL, w/o AIRCON)



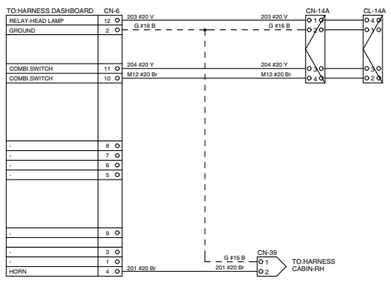
*ELEC.DIAGRAM OF HARNESS CABIN-LH



* RMCU HARNESS

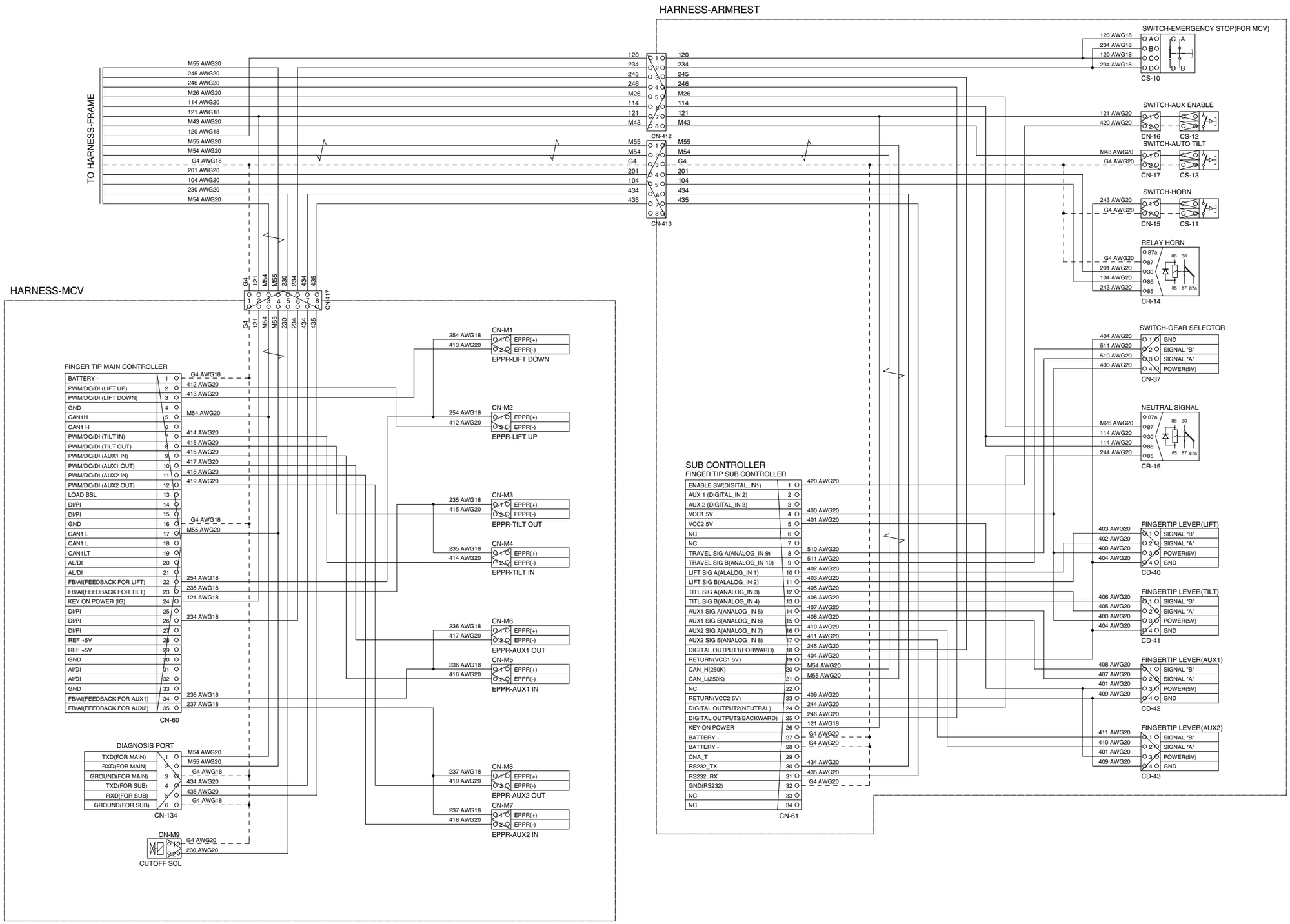


*ELEC.DIAGRAM OF HARNESS OHG-LH



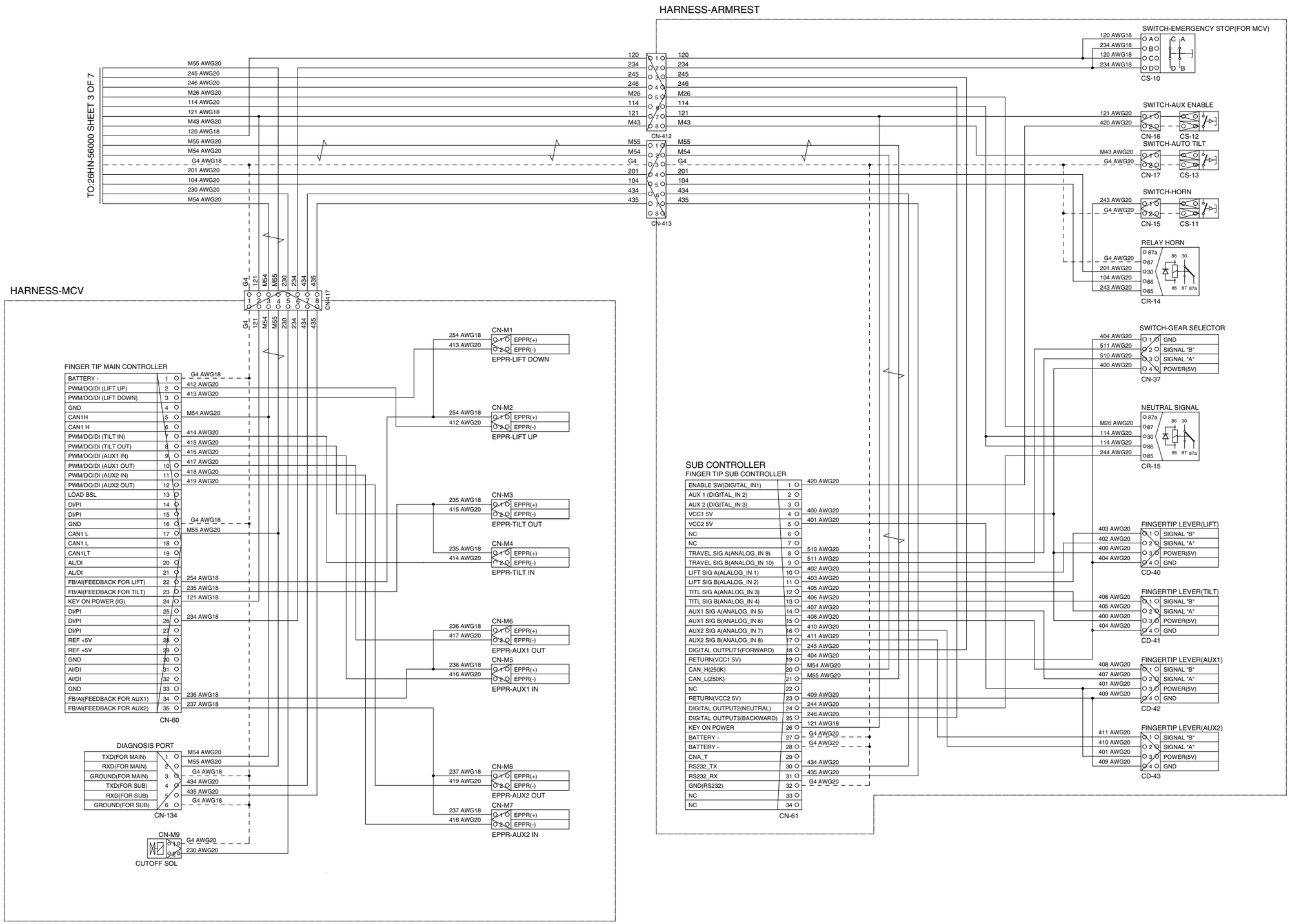
21HN-04102-00

· ELECTRICAL CIRCUIT (8/8, MCV, ARMREST-FINGERTIP, 25D-9V : -#0258, 30D-9V : -#0538, 35DN-9V : -#0255)



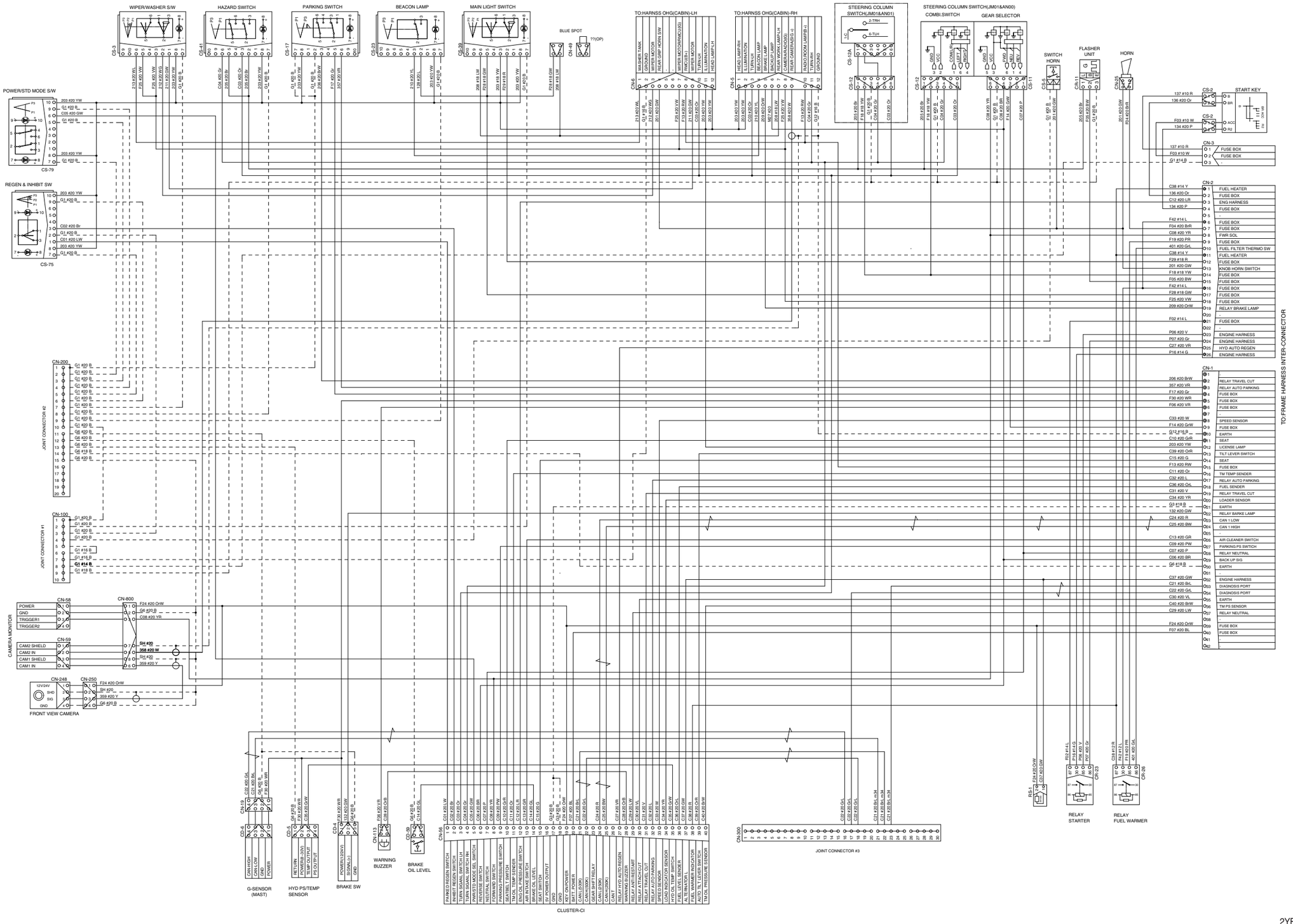
26HN-60034-00

· ELECTRICAL CIRCUIT (8/8, MCV, ARMREST-FINGERTIP, 25D-9V : #0259-, 30D-9V : #0539-, 35DN-9V : #0256-)

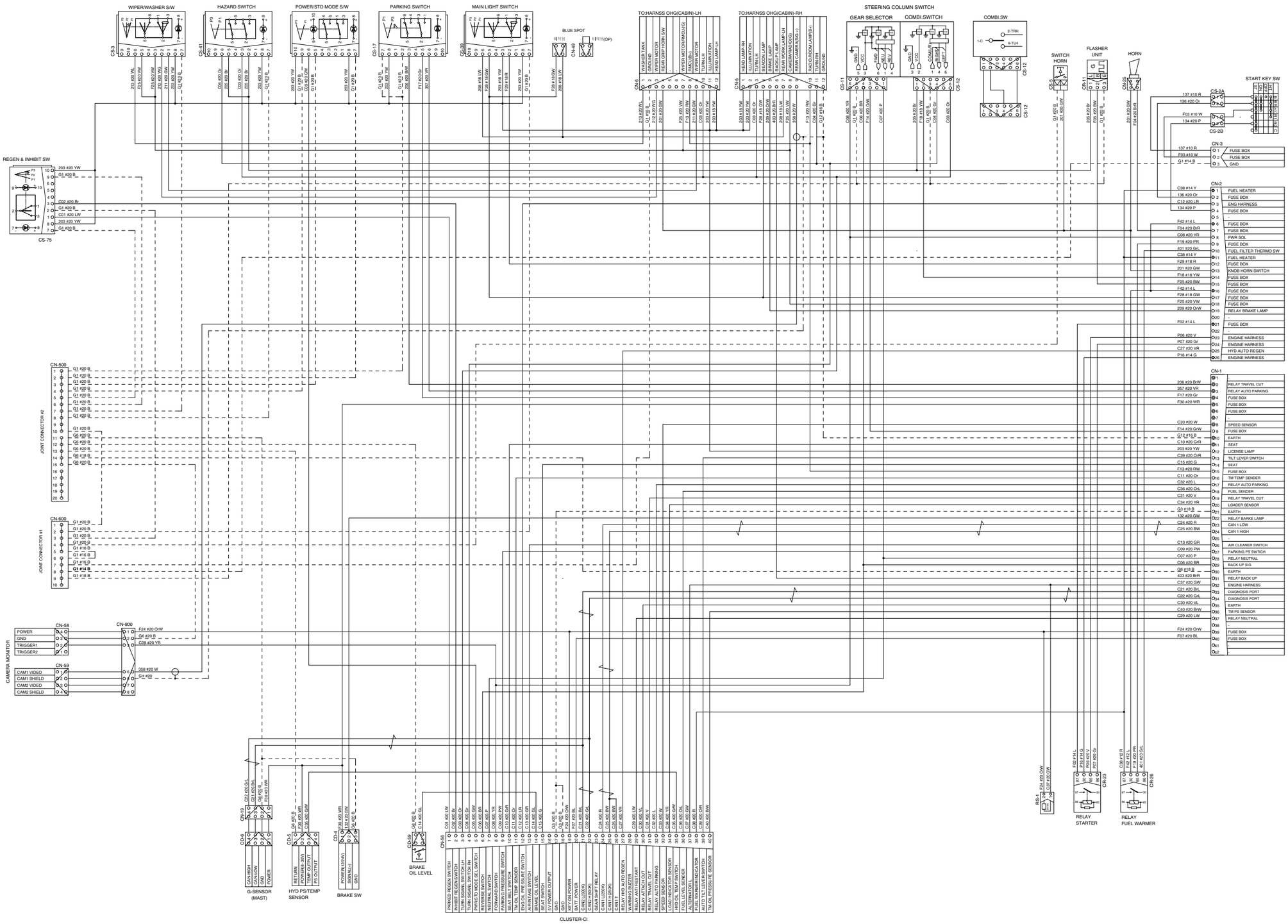


26HN-05650-00

· ELECTRICAL CIRCUIT (1/4, DASHBOARD, 25D-9VS : #0117-#0258, 30D-9VS : #0122-#0538, 35DN-9V : #0178-#0255)

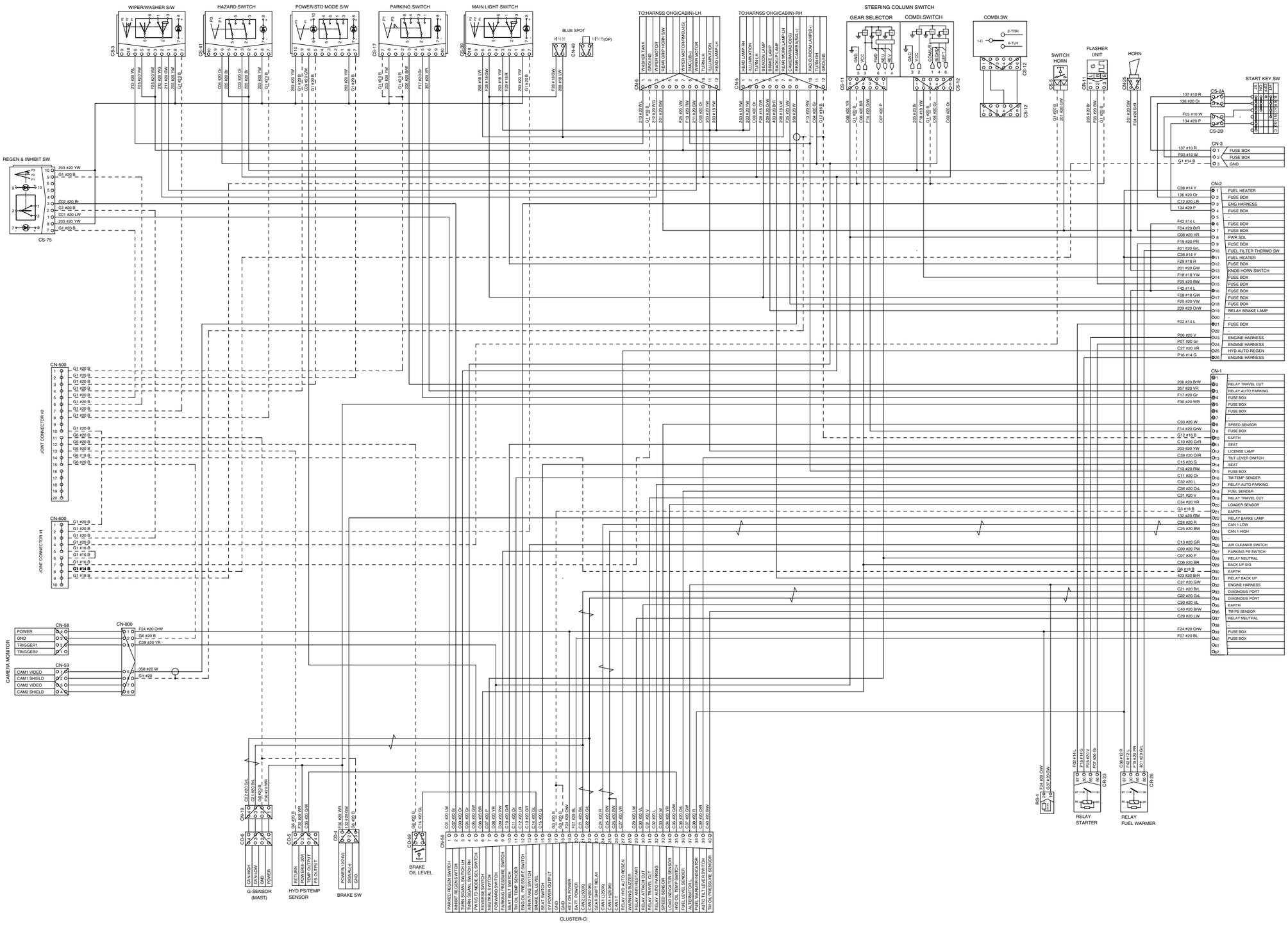


· ELECTRICAL CIRCUIT (1/4, DASHBOARD, 25D-9VS : #0259-#0700, 30D-9VS : #0539-#2116, 35DN-9VS : #0256-#0752)



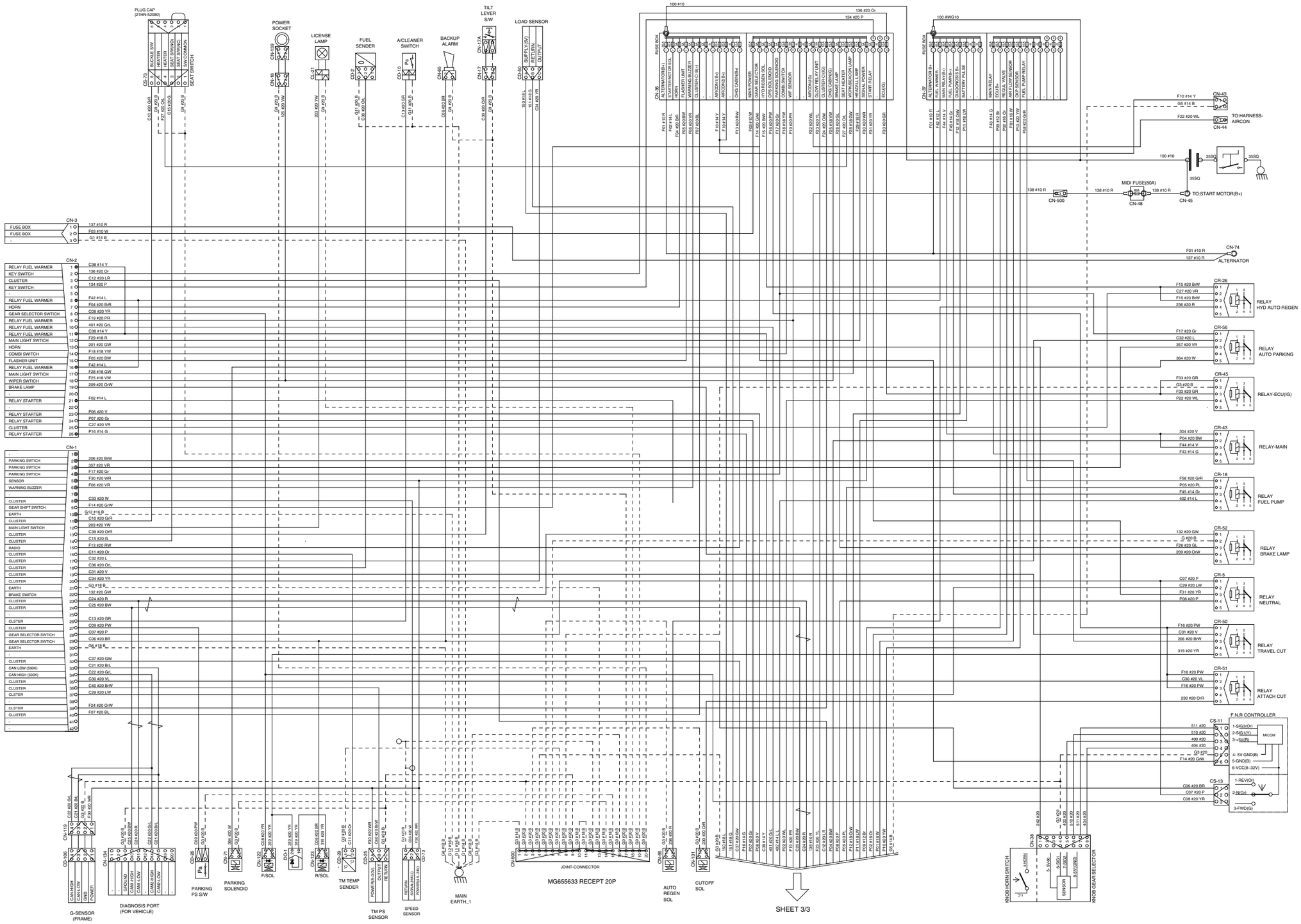
26HN-05601-00 5OF7

· ELECTRICAL CIRCUIT (1/4, DASHBOARD, 25D-9VS : #0701-, 30D-9VS : #2117-, 35DN-9VS : #0753-)



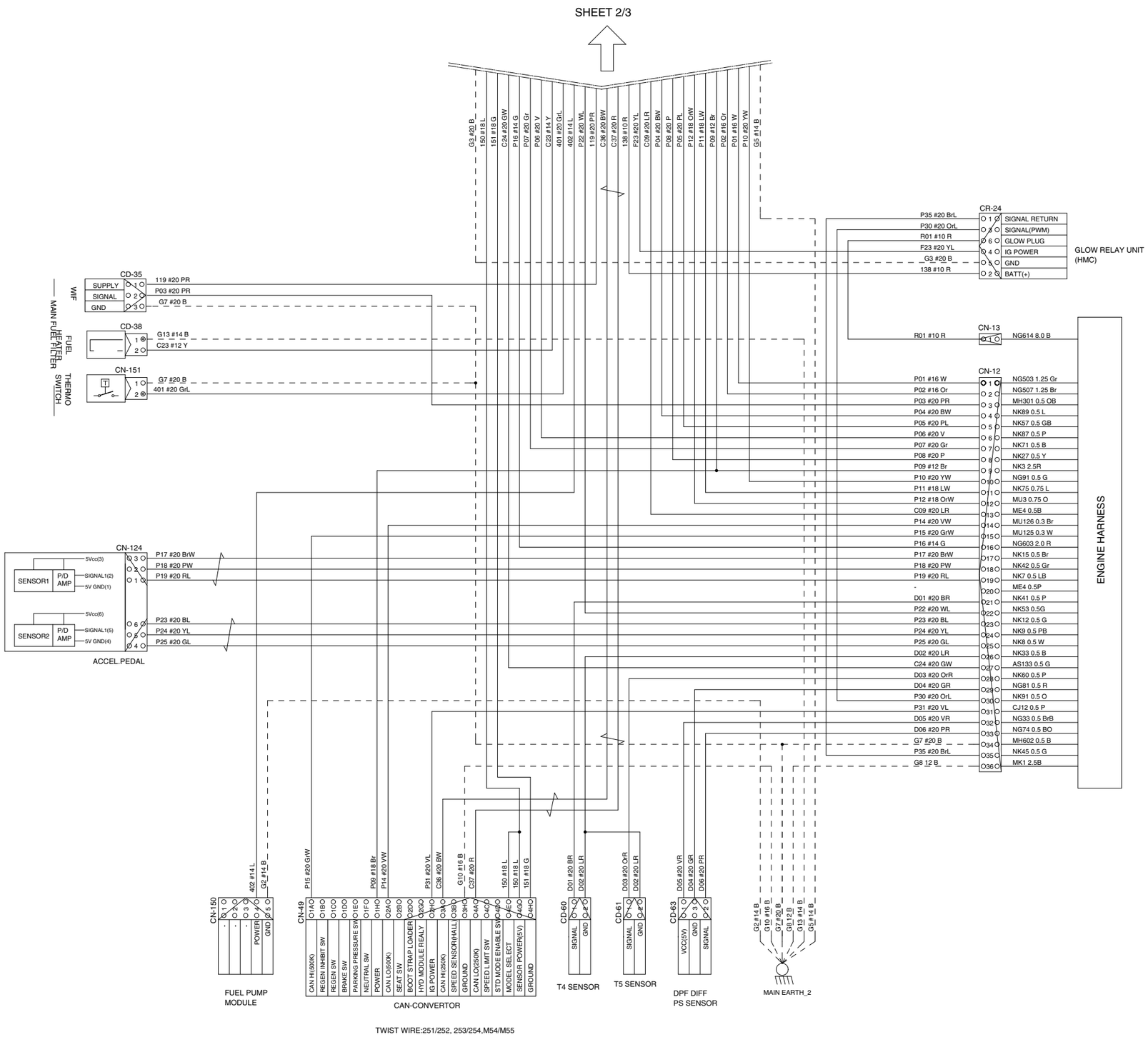
26HN-05602-00 5OF8

· ELECTRICAL CIRCUIT (2/4, FRAME 1 OF 2, 25D-9VS : #0117-#0258, 30D-9VS : #0122-#0538, 35DN-9V : #0178-#0255)



2YFG-11011-00 2OF3

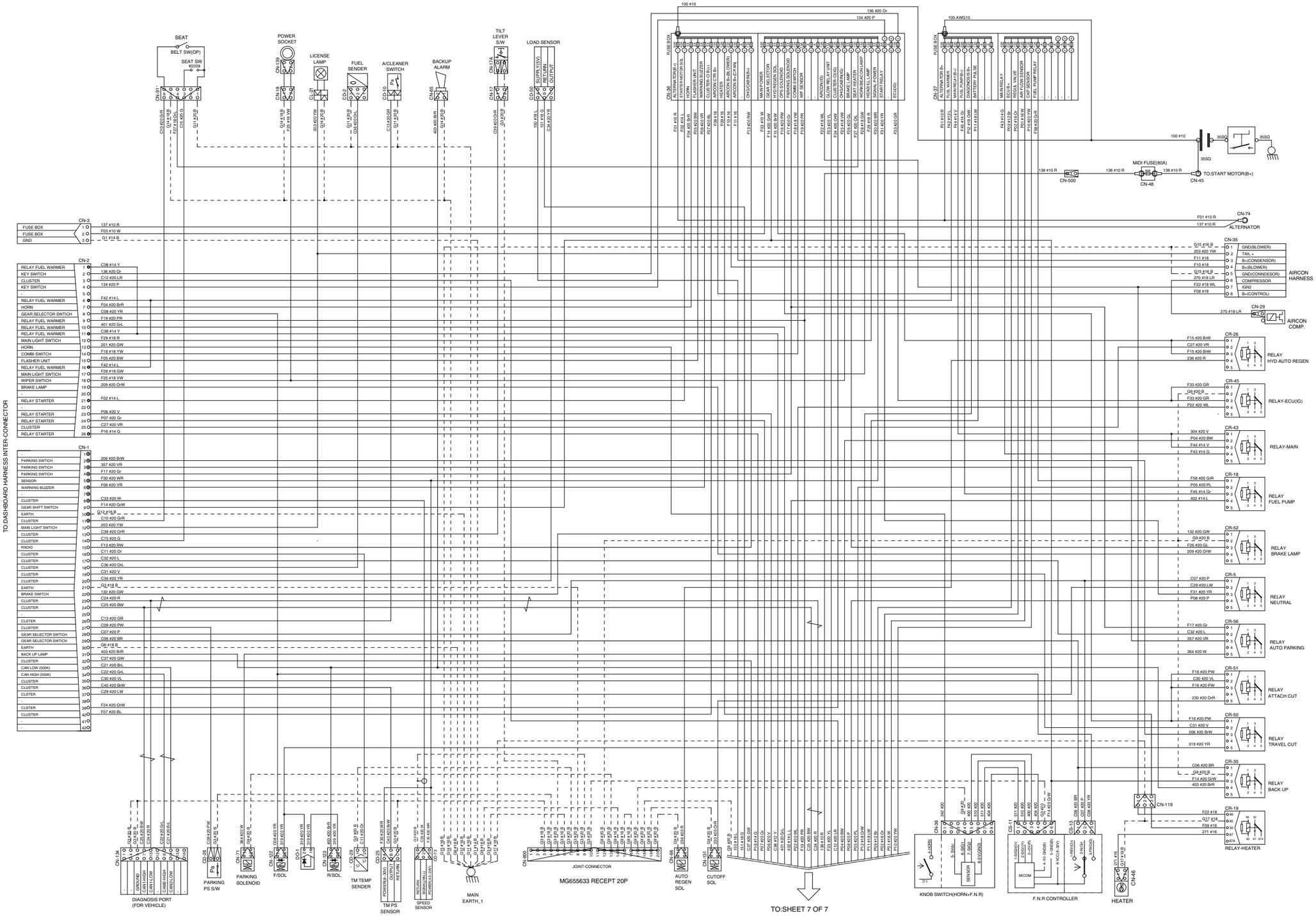
· ELECTRICAL CIRCUIT (2/4, FRAME 2 OF 2, 25D-9VS : #0117-#0258, 30D-9VS : #0122-#0538, 35DN-9V : #0178-#0255)



TWIST WIRE:251/252, 253/254,M54/M55

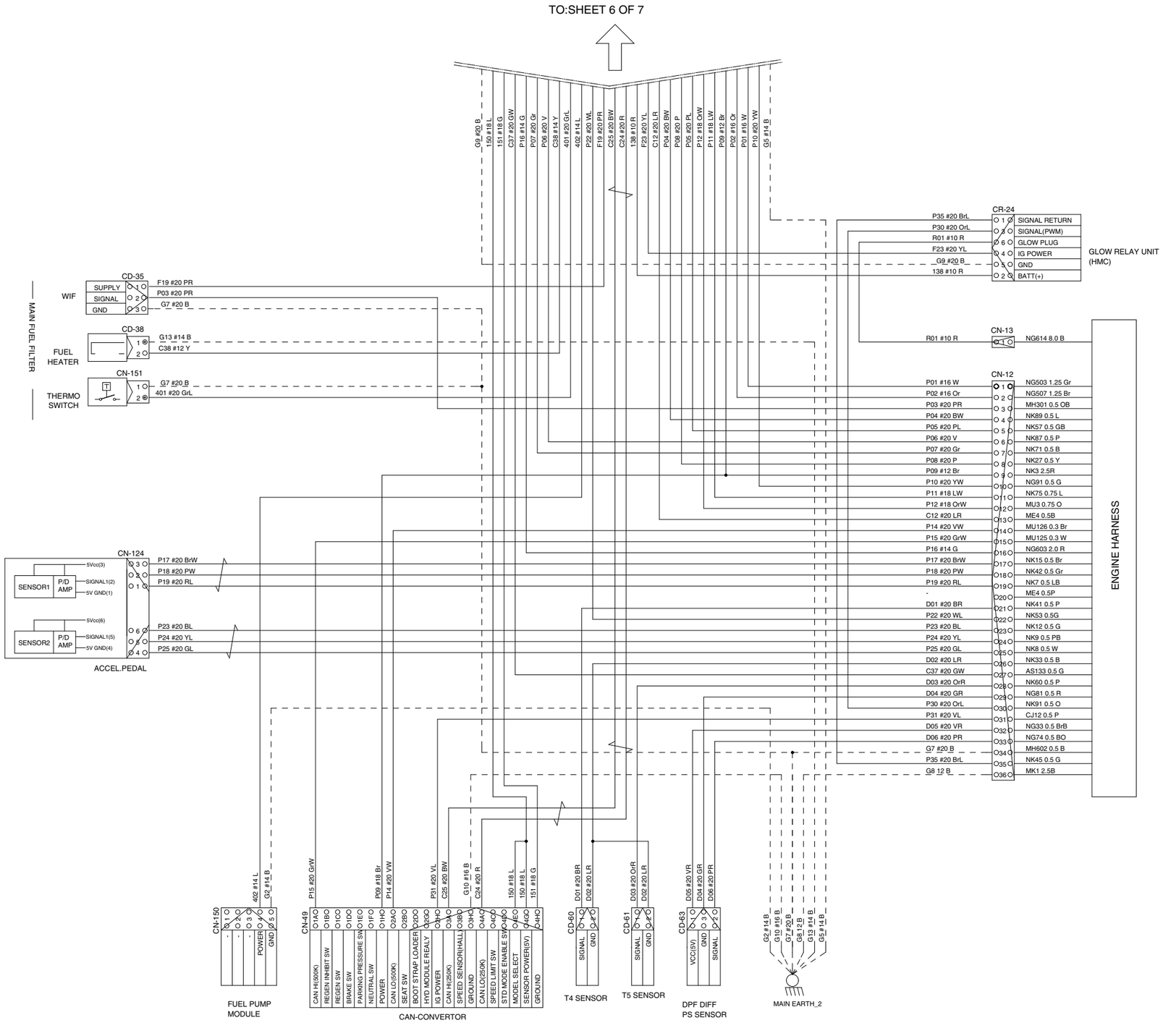
2YFG-11011-00 3OF3

· ELECTRICAL CIRCUIT (2/4, FRAME 1 OF 2, 25D-9VS : #0259-#0700, 30D-9VS : #0539-#2116, 35DN-9VS : #0256-#0752)



26HN-05601-00 6OF7

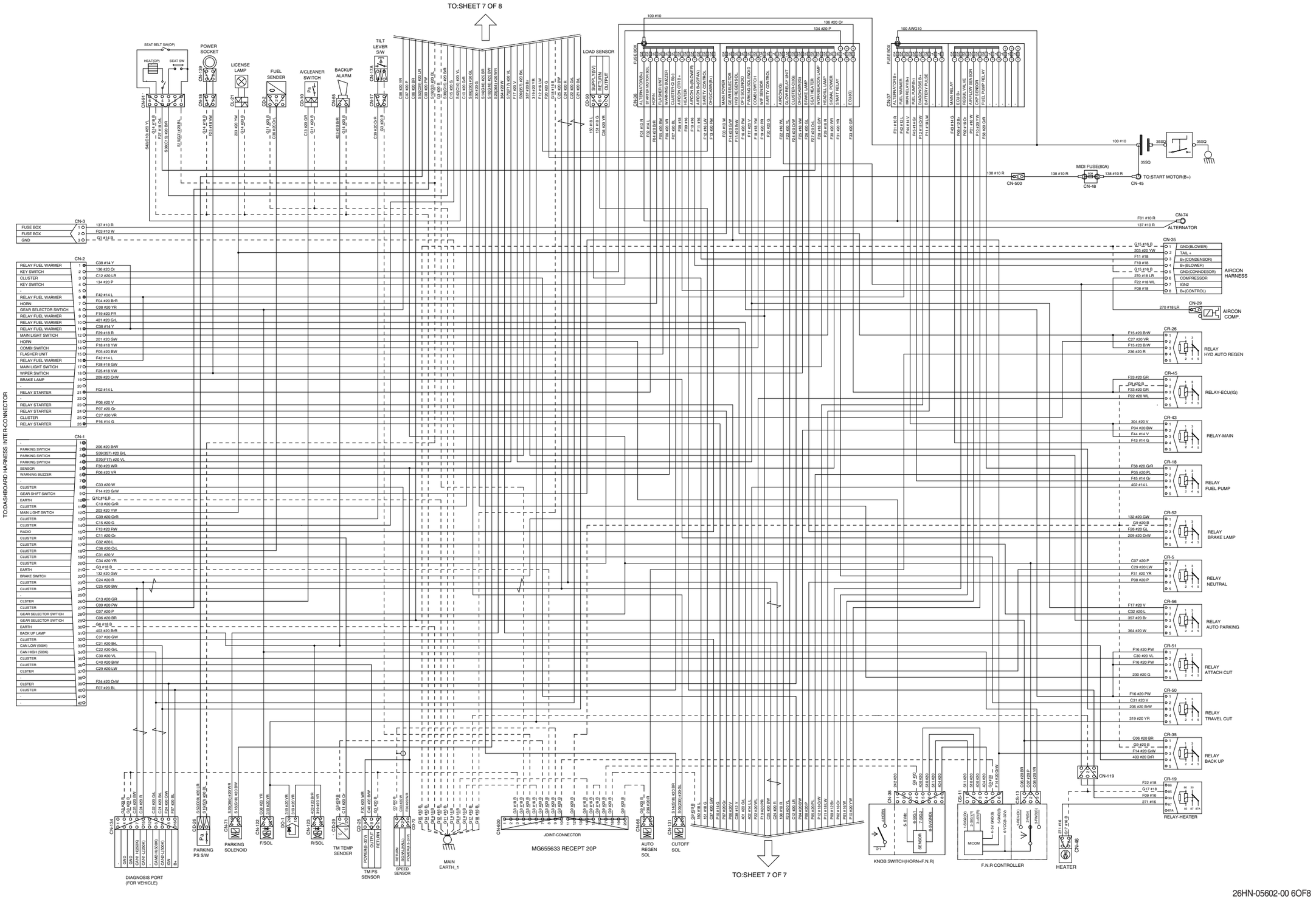
· ELECTRICAL CIRCUIT (2/4, FRAME 2 OF 2, 25D-9VS : #0259-#0700, 30D-9VS : #0539-#2116, 35DN-9VS : #0256-#0752)



TWIST WIRE:251/252, 253/254,M54/M55

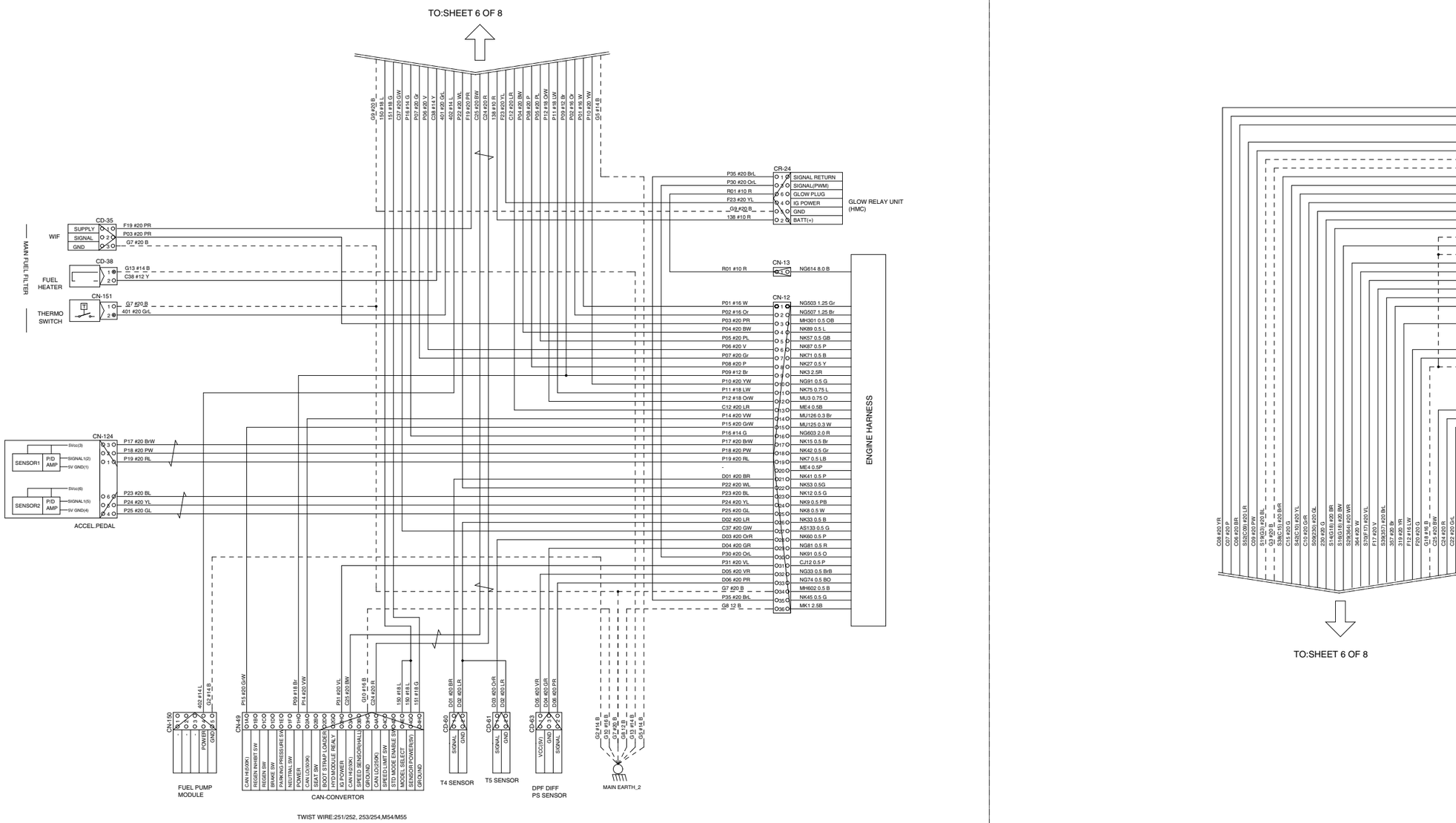
26HN-05601-00 7OF7

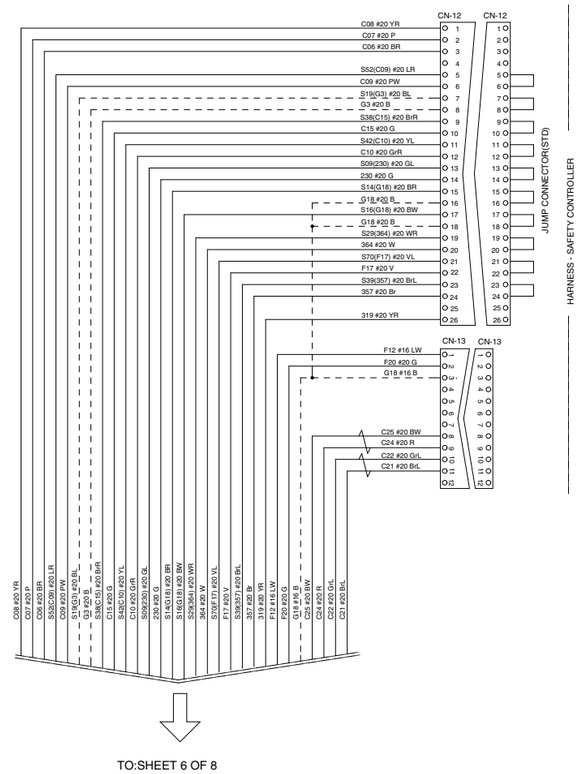
· ELECTRICAL CIRCUIT (2/4, FRAME 1 OF 3, 25D-9VS : #0701-, 30D-9VS : #2117-, 35DN-9VS : #0753-)



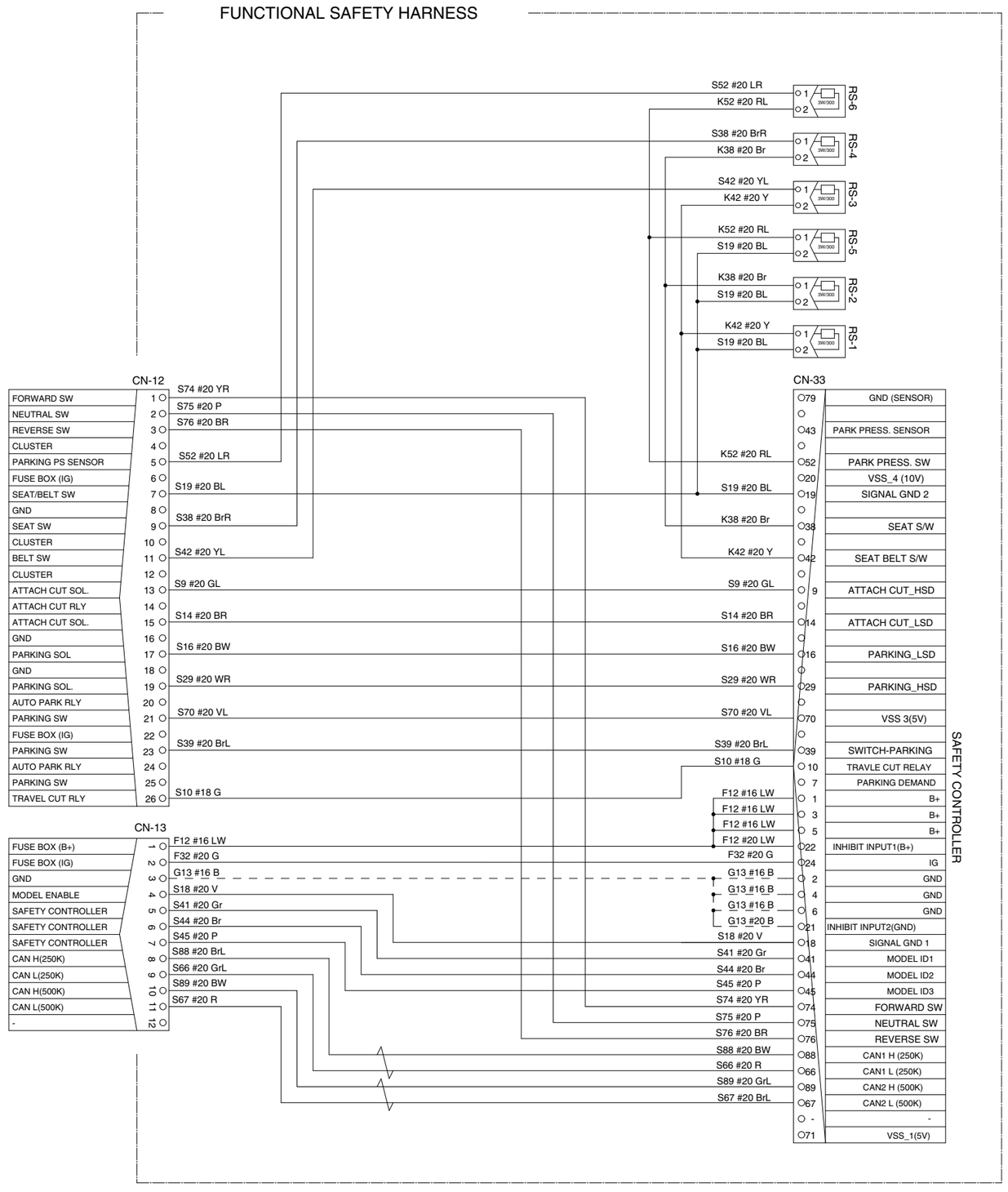
26HN-05602-00 6OF8

· ELECTRICAL CIRCUIT (2/4, FRAME 2 OF 3, 25D-9VS : #0701-, 30D-9VS : #2117-, 35DN-9VS : #0753-)





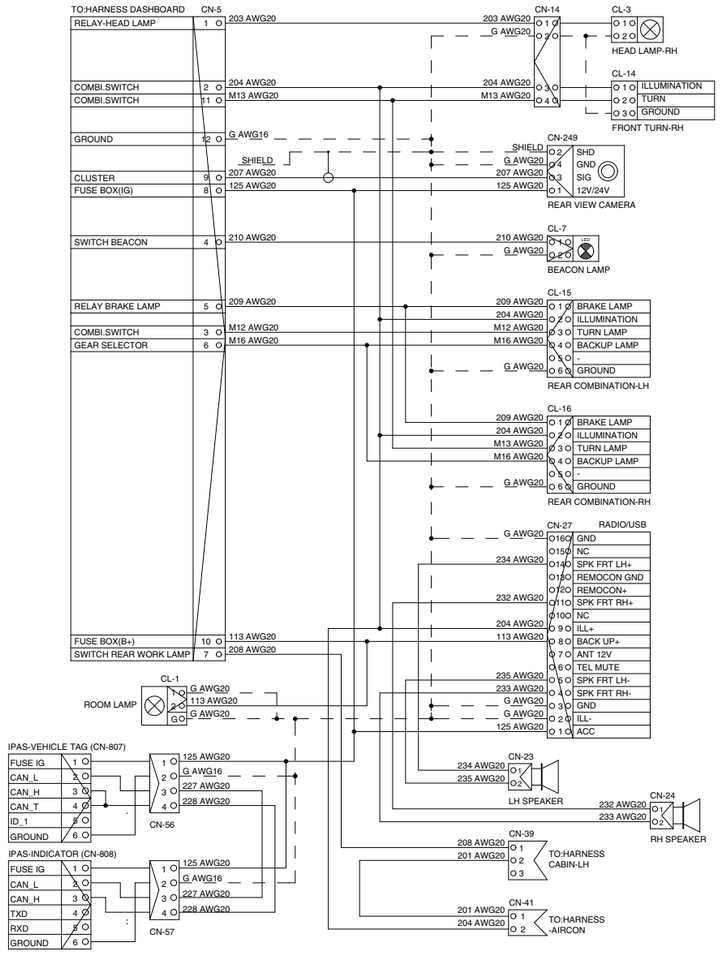
· ELECTRICAL CIRCUIT (2/4, FRAME 3 OF 3, 25D-9VS : #0701-, 30D-9VS : #2117-, 35DN-9VS : #0753-)



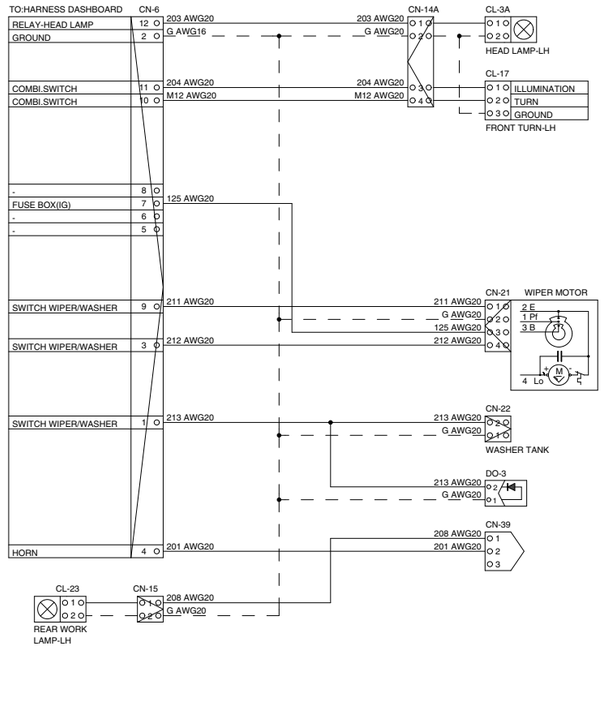
26HN-05602-00 8OF8

· ELECTRICAL CIRCUIT (3/4, CABIN WITH AIRCON, 25D-9VS : #0117-#0258, 30D-9VS : #0122-#0538, 35DN-9VS : #0178-#0255)

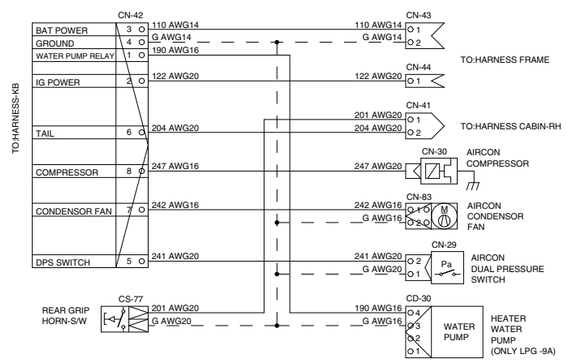
*ELEC.DIAGRAM OF HARNESS CABIN-RH



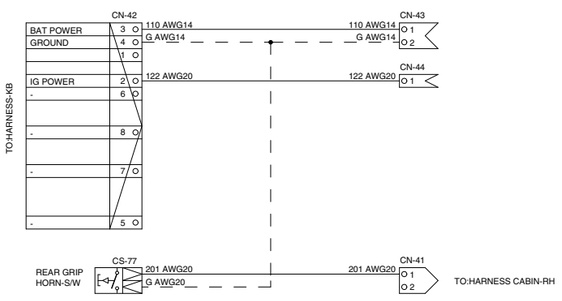
*ELEC.DIAGRAM OF HARNESS CABIN-LH



*ELEC.DIAGRAM OF HARNESS-AIRCON(AIRCON+HEATER)

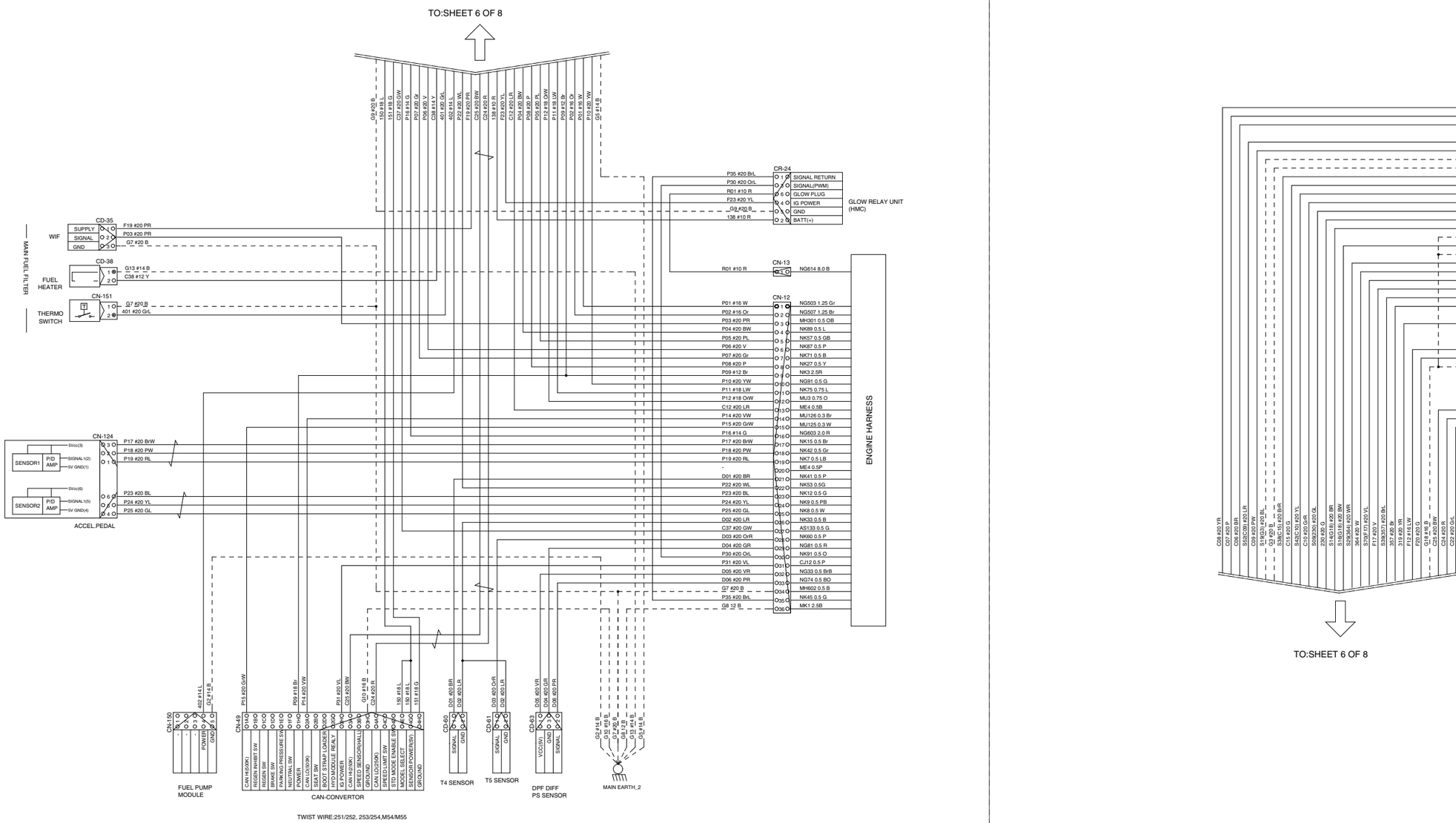


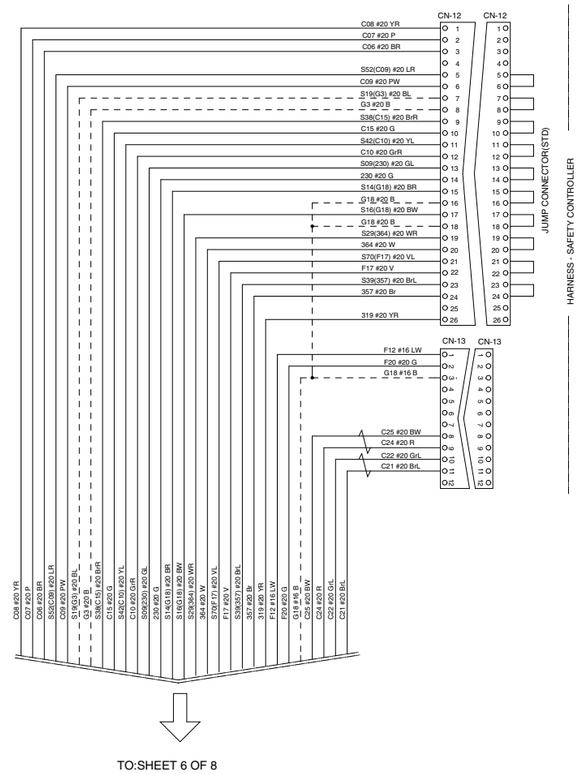
*ELEC.DIAGRAM OF HARNESS-HEATER(HEATER ONLY)



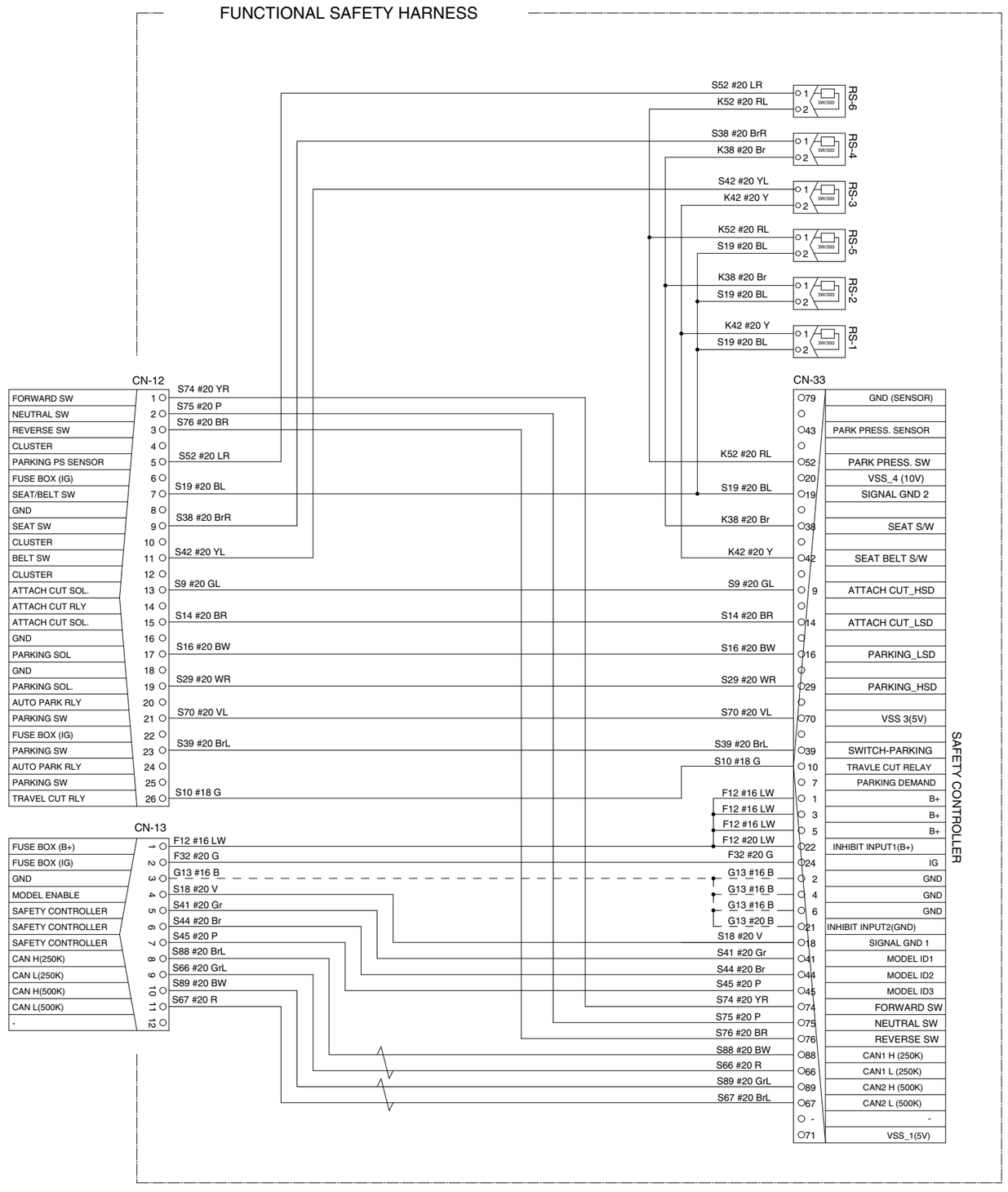
21HN-40082-00

· ELECTRICAL CIRCUIT (2/4, FRAME 2 OF 3, 25D-9VS : #0701-, 30D-9VS : #2117-, 35DN-9VS : #0753-)





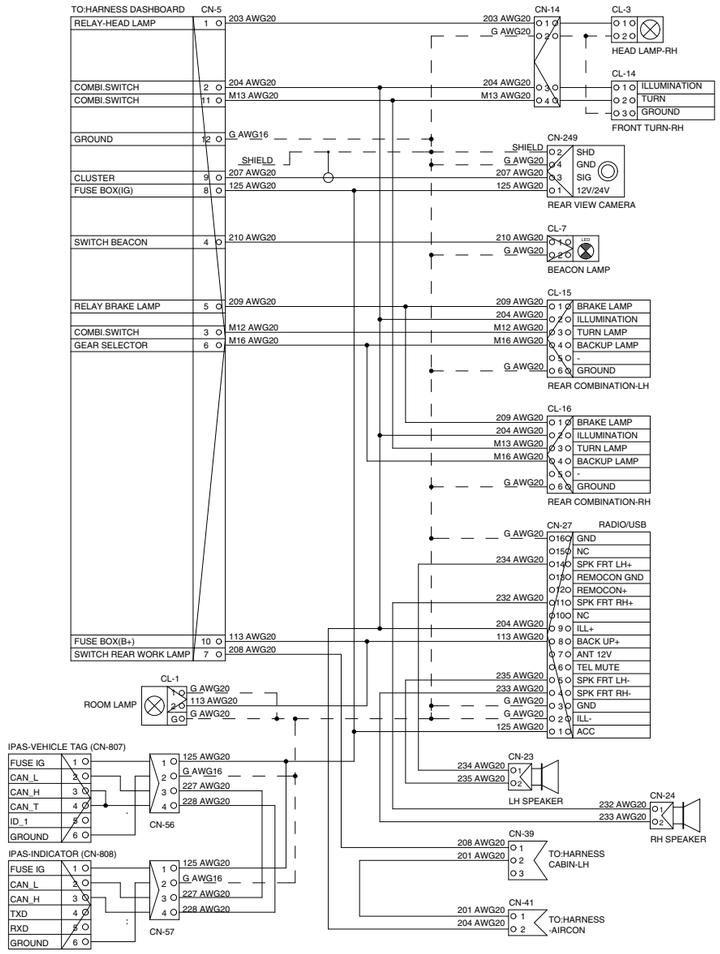
· ELECTRICAL CIRCUIT (2/4, FRAME 3 OF 3, 25D-9VS : #0701-, 30D-9VS : #2117-, 35DN-9VS : #0753-)



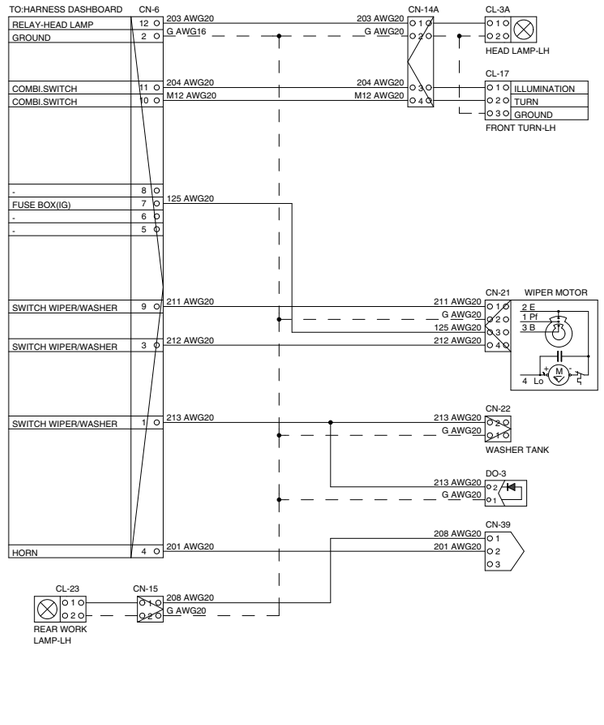
26HN-05602-00 8OF8

· ELECTRICAL CIRCUIT (3/4, CABIN WITH AIRCON, 25D-9VS : #0117-#0258, 30D-9VS : #0122-#0538, 35DN-9VS : #0178-#0255)

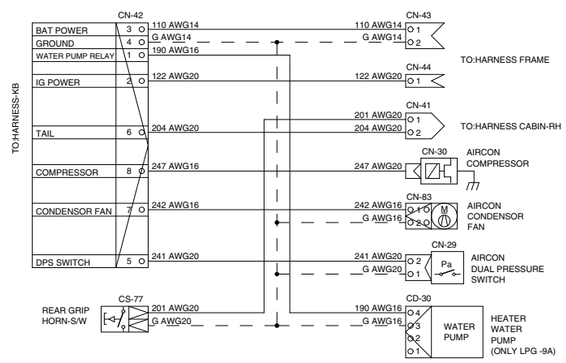
*ELEC.DIAGRAM OF HARNESS CABIN-RH



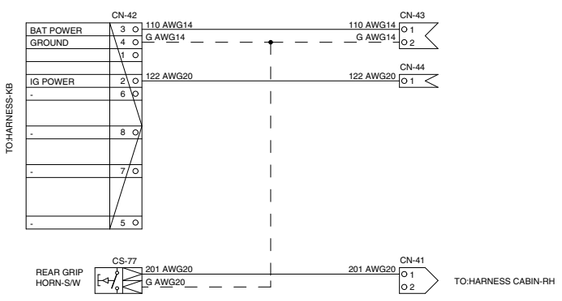
*ELEC.DIAGRAM OF HARNESS CABIN-LH



*ELEC.DIAGRAM OF HARNESS-AIRCON(AIRCON+HEATER)



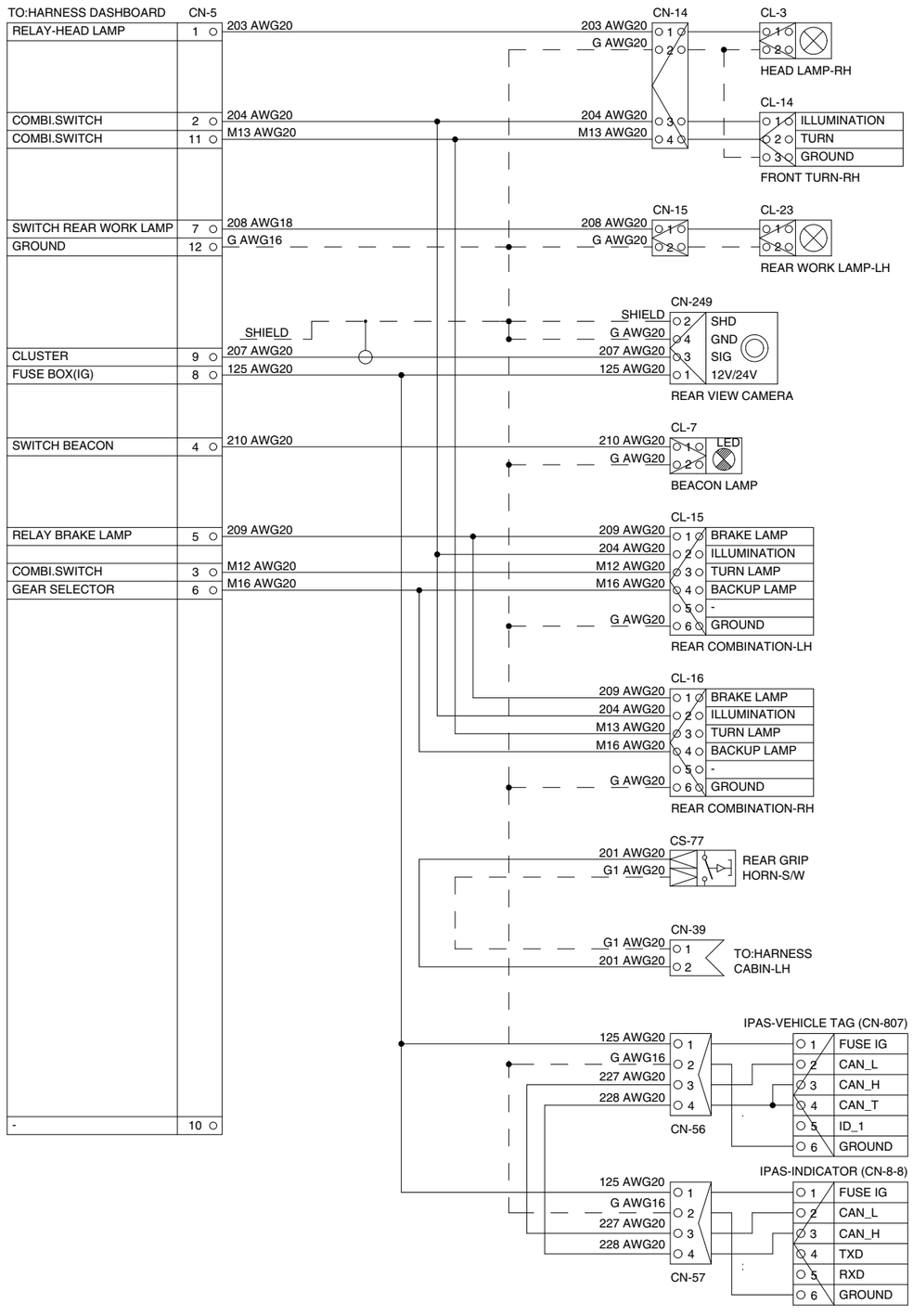
*ELEC.DIAGRAM OF HARNESS-HEATER(HEATER ONLY)



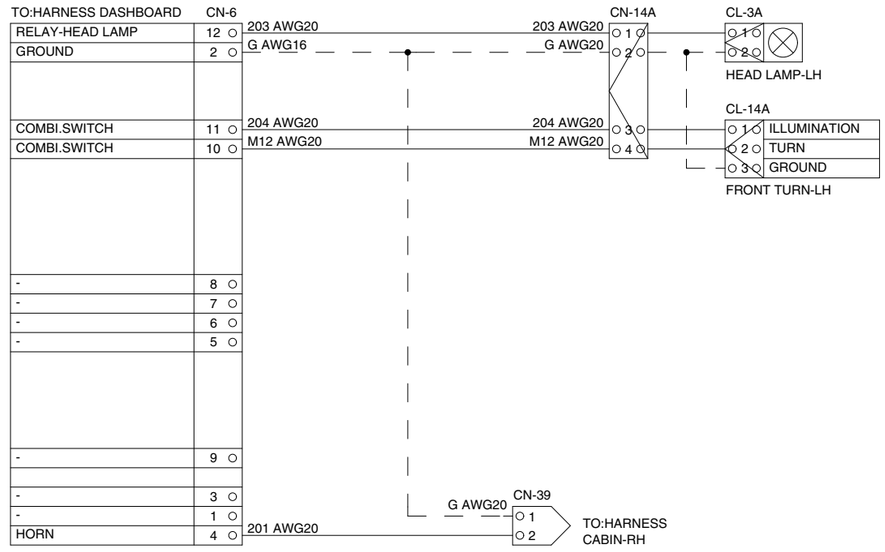
21HN-40082-00

· ELECTRICAL CIRCUIT (4/4, OVERHEAD GUARD, 25D-9VS : #0117-#0258, 30D-9VS : #0122-#0538, 35DN-9VS : #0178-#0255)

*ELEC.DIAGRAM OF HARNESS OHG-RH

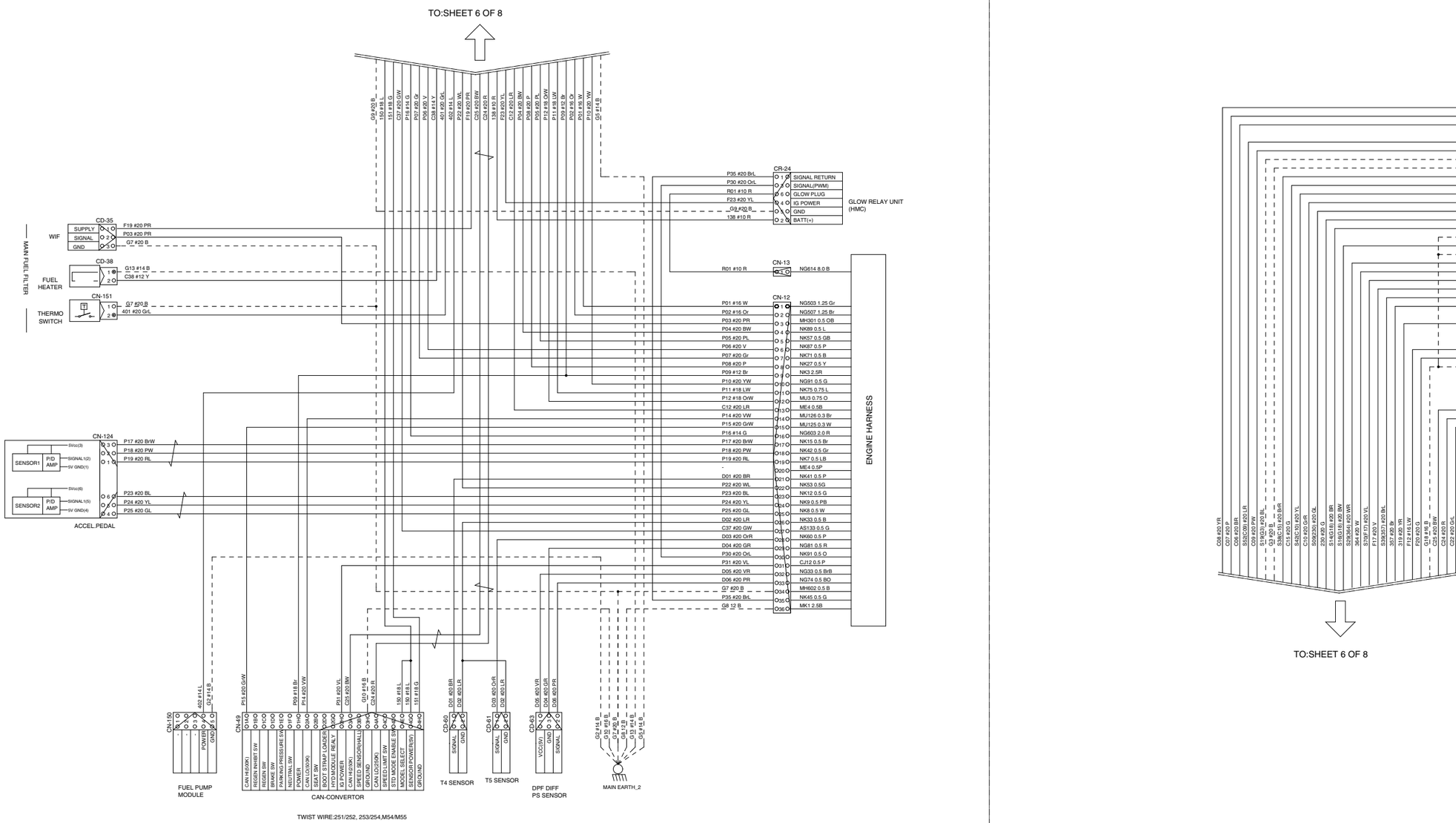


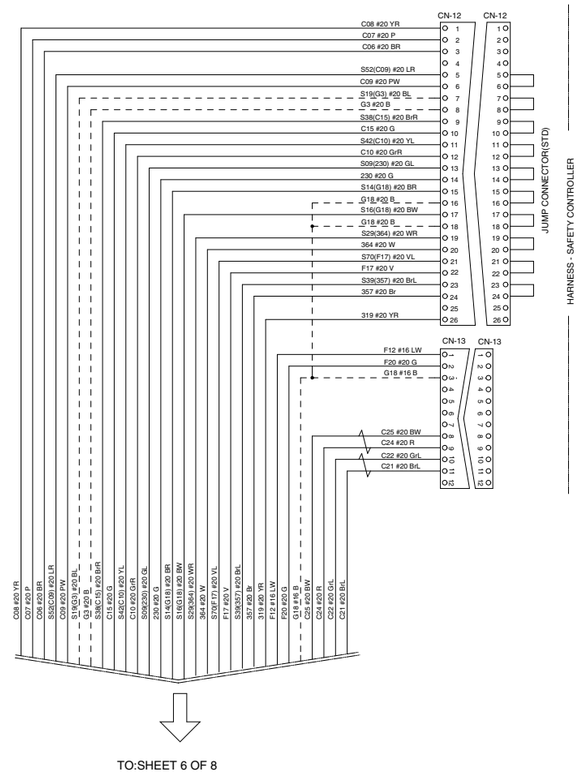
*ELEC.DIAGRAM OF HARNESS OHG-LH



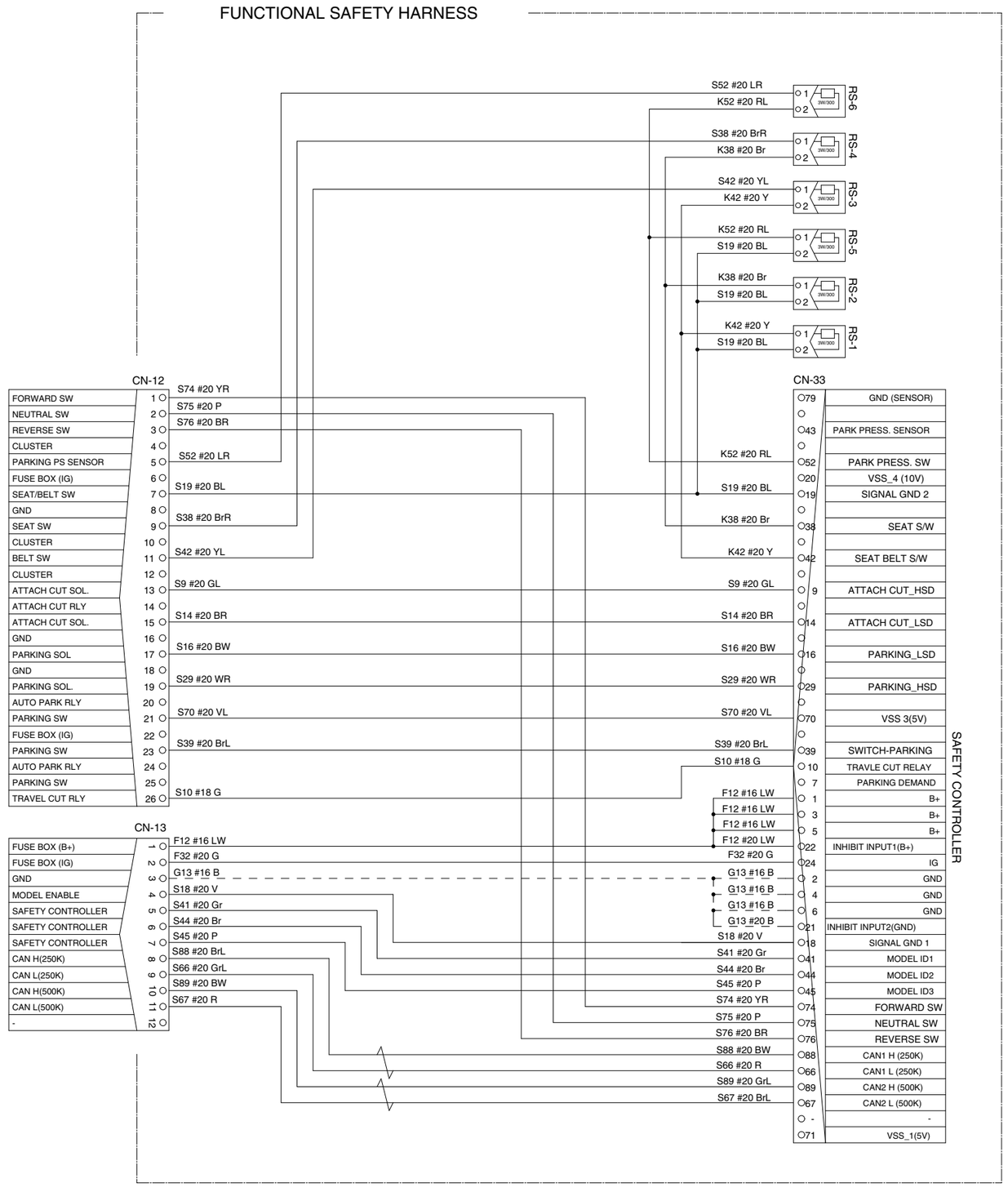
21HN-50044-00

· ELECTRICAL CIRCUIT (2/4, FRAME 2 OF 3, 25D-9VS : #0701-, 30D-9VS : #2117-, 35DN-9VS : #0753-)





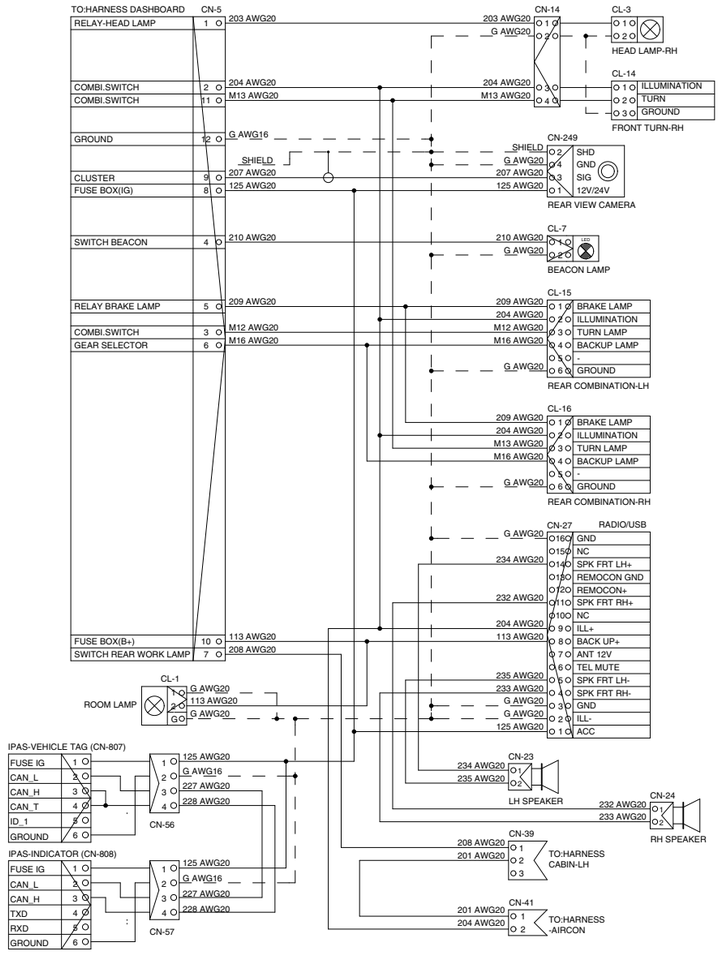
· ELECTRICAL CIRCUIT (2/4, FRAME 3 OF 3, 25D-9VS : #0701-, 30D-9VS : #2117-, 35DN-9VS : #0753-)



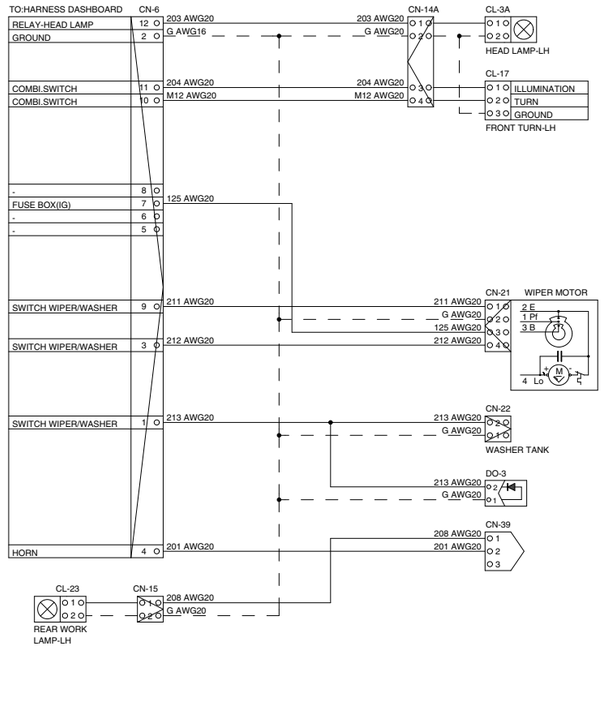
26HN-05602-00 8OF8

· ELECTRICAL CIRCUIT (3/4, CABIN WITH AIRCON, 25D-9VS : #0117-#0258, 30D-9VS : #0122-#0538, 35DN-9VS : #0178-#0255)

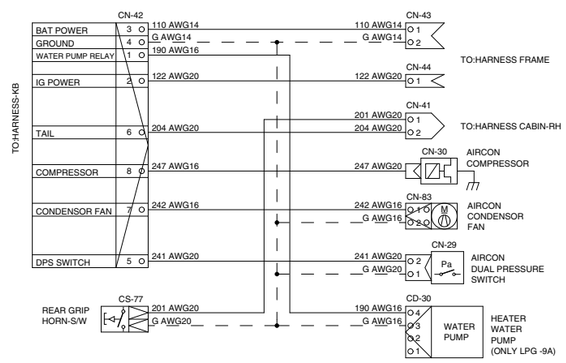
*ELEC.DIAGRAM OF HARNESS CABIN-RH



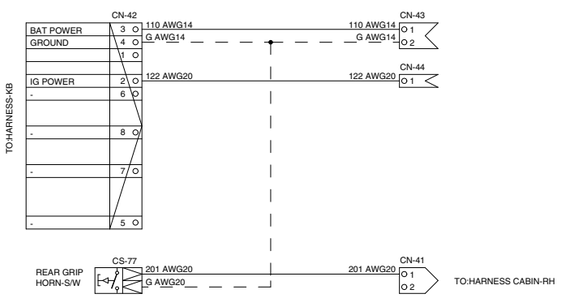
*ELEC.DIAGRAM OF HARNESS CABIN-LH



*ELEC.DIAGRAM OF HARNESS-AIRCON(AIRCON+HEATER)



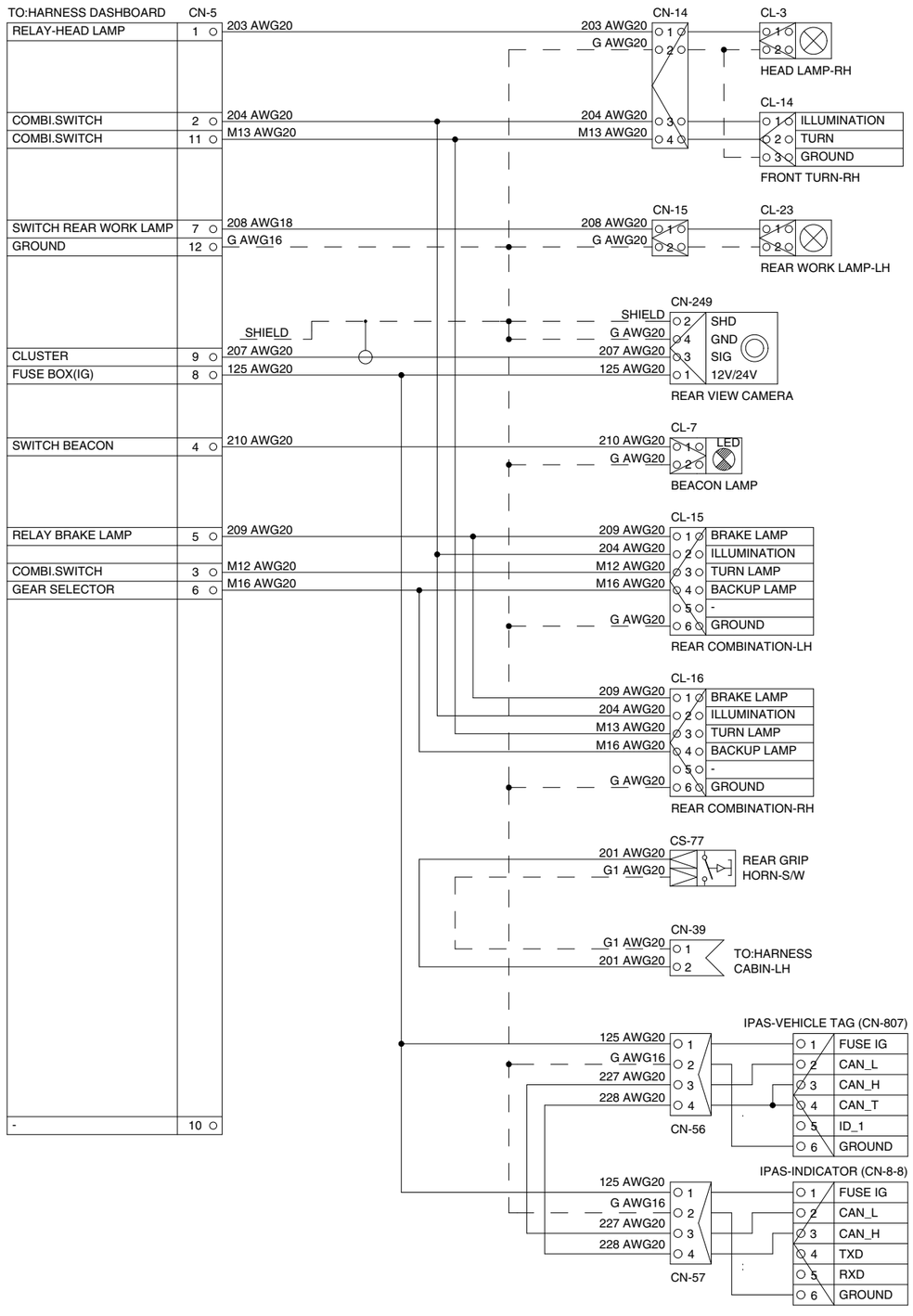
*ELEC.DIAGRAM OF HARNESS-HEATER(HEATER ONLY)



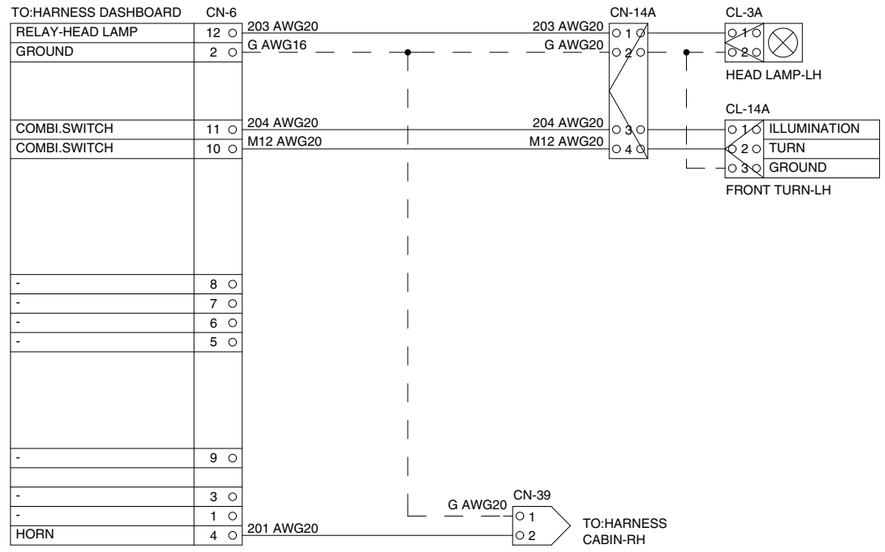
21HN-40082-00

· ELECTRICAL CIRCUIT (4/4, OVERHEAD GUARD, 25D-9VS : #0117-#0258, 30D-9VS : #0122-#0538, 35DN-9VS : #0178-#0255)

*ELEC.DIAGRAM OF HARNESS OHG-RH



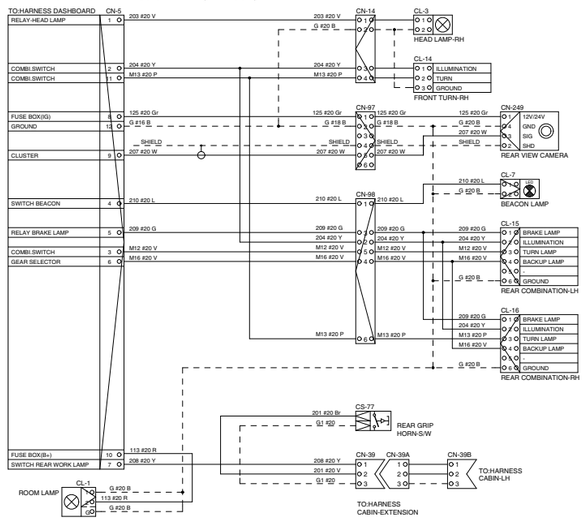
*ELEC.DIAGRAM OF HARNESS OHG-LH



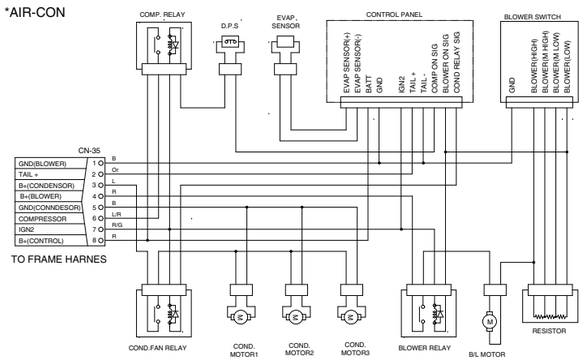
21HN-50044-00

· ELECTRICAL CIRCUIT (3~4/4, CABIN, OVERHEAD GUARD, 25D-9VS : #0259-#0700, 30D-9VS : #0539-#2116, 35DN-9VS : #0256-#0752)

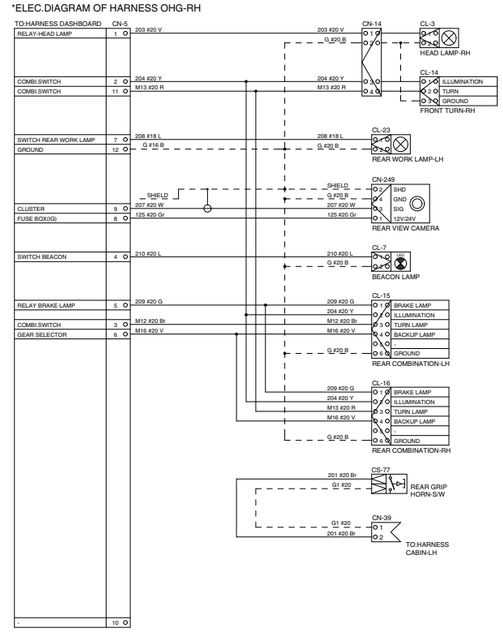
*ELEC.DIAGRAM OF HARNESS CABIN-RH(w AIRCON)



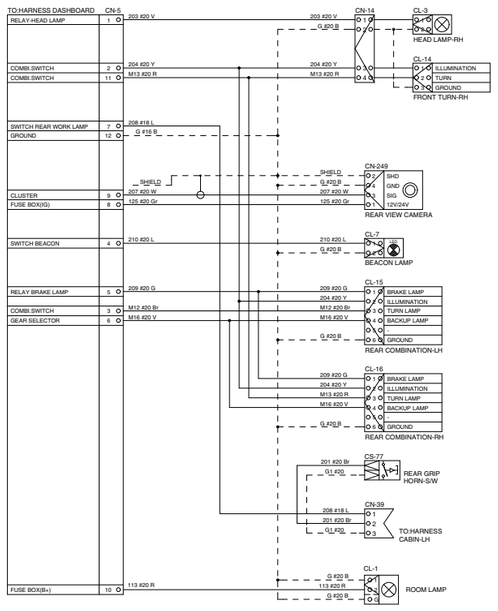
*AIR-CON



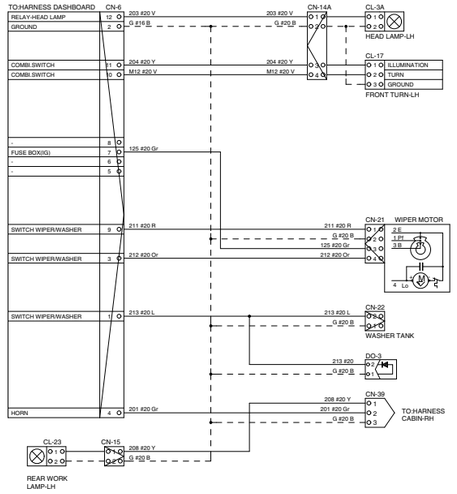
*ELEC.DIAGRAM OF HARNESS OHG-RH



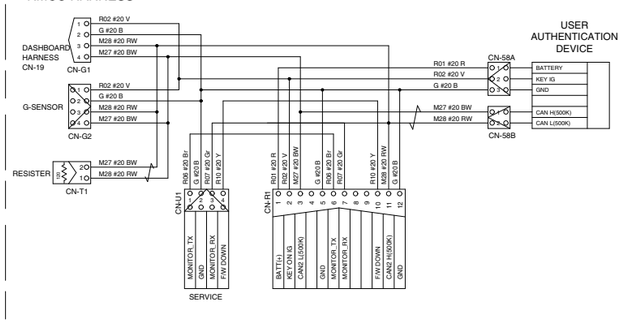
*ELEC.DIAGRAM OF HARNESS CABIN-RH(PARTIAL, w/o AIRCON)



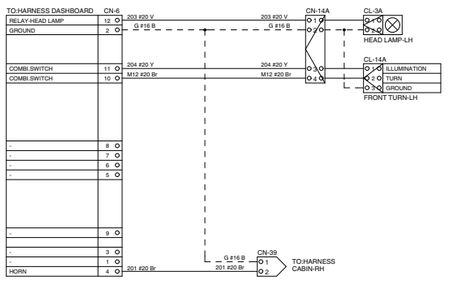
*ELEC.DIAGRAM OF HARNESS CABIN-LH



* RMCU HARNESS

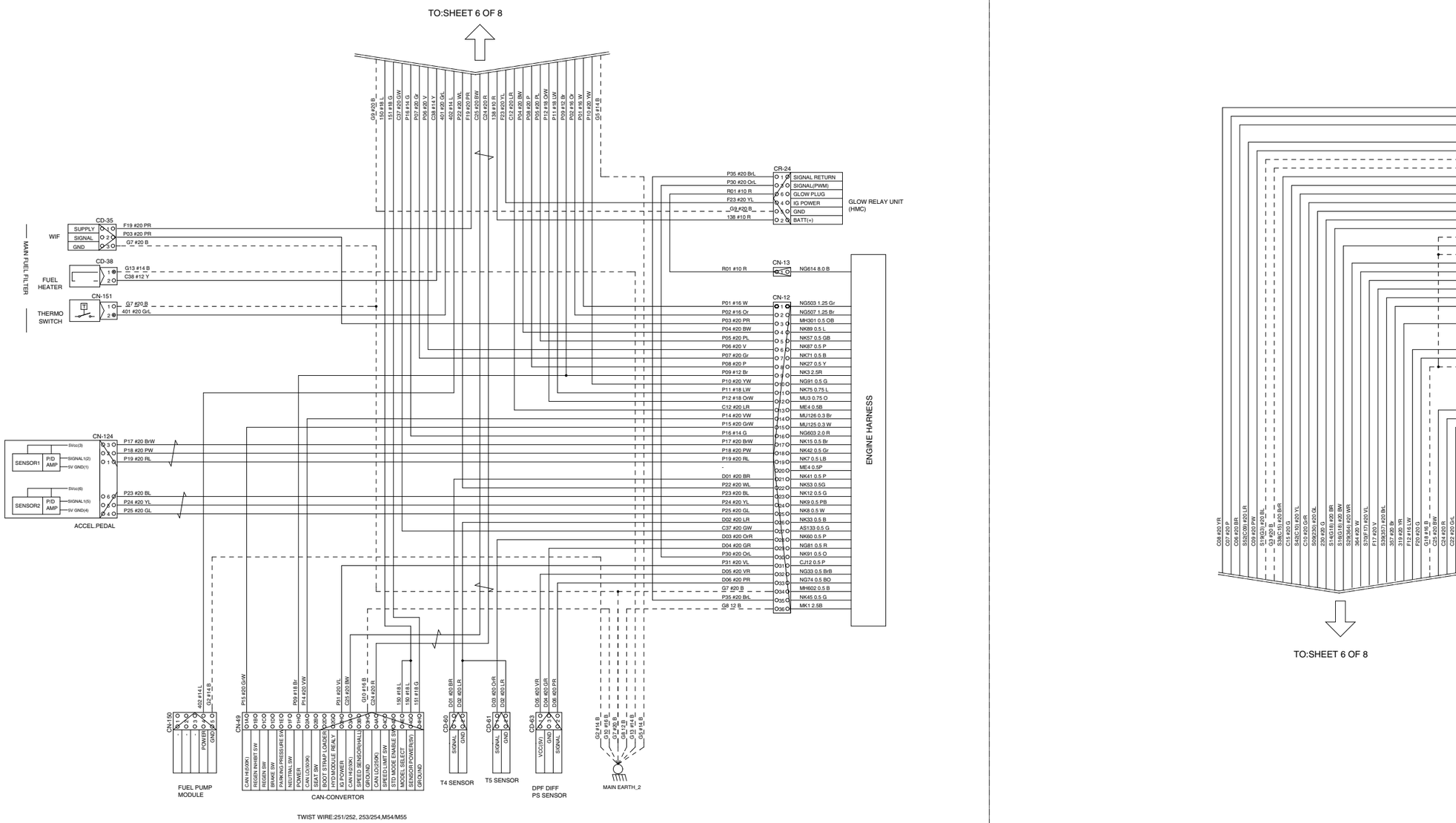


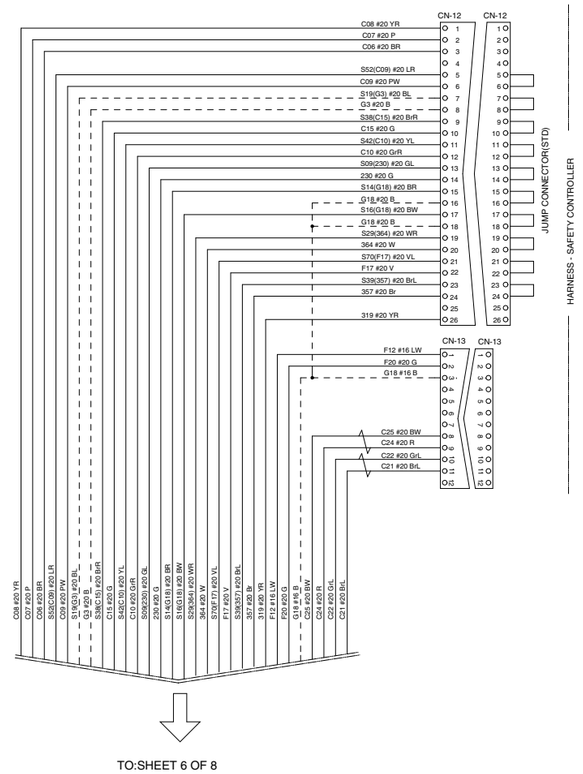
*ELEC.DIAGRAM OF HARNESS OHG-LH



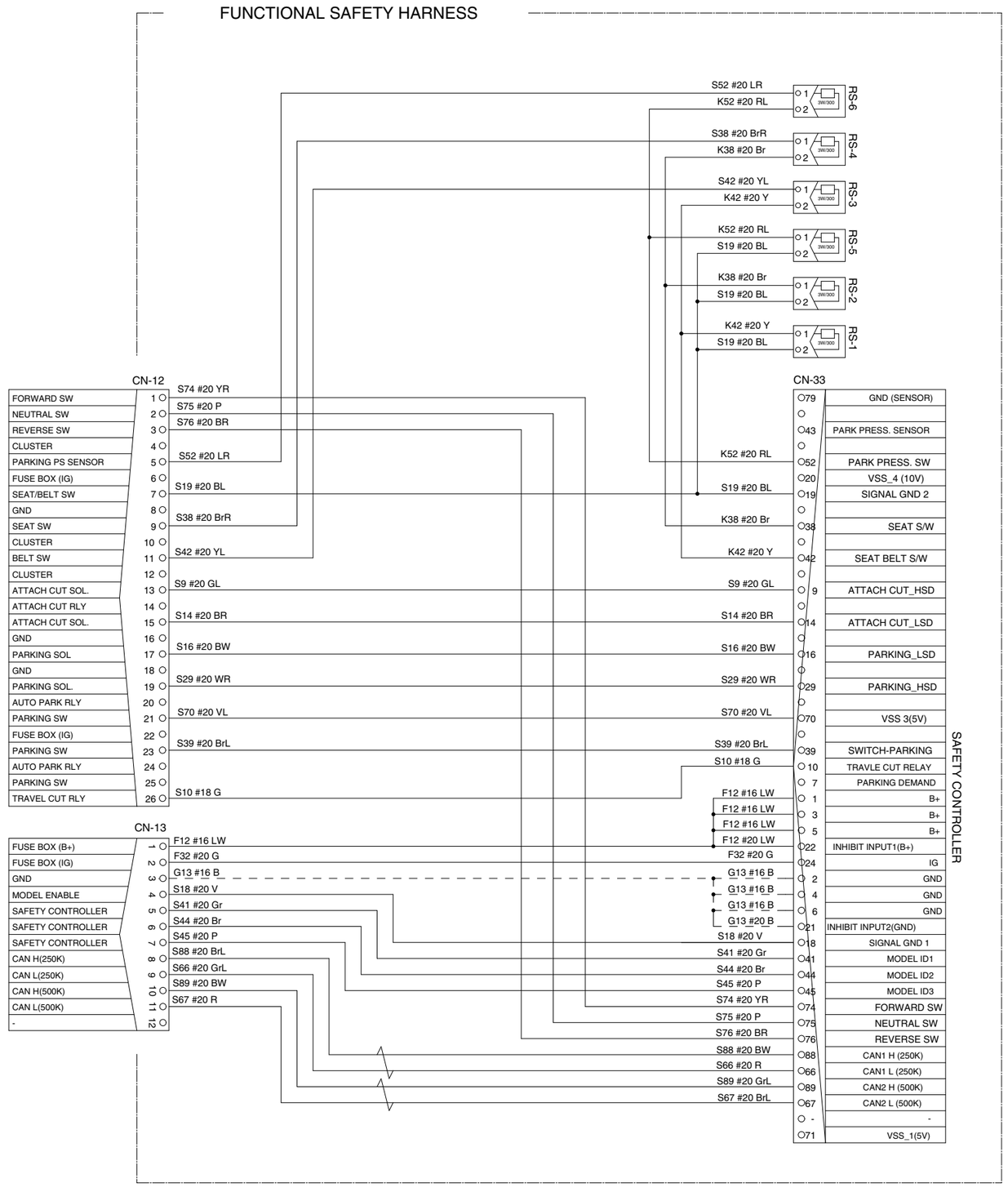
21HN-04100-00

· ELECTRICAL CIRCUIT (2/4, FRAME 2 OF 3, 25D-9VS : #0701-, 30D-9VS : #2117-, 35DN-9VS : #0753-)





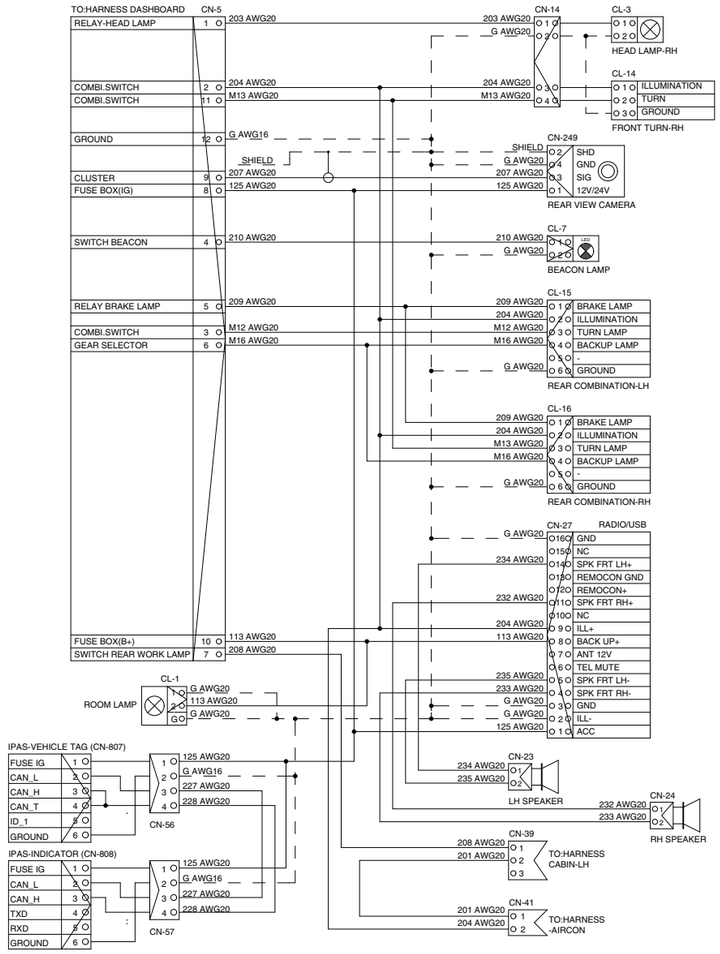
· ELECTRICAL CIRCUIT (2/4, FRAME 3 OF 3, 25D-9VS : #0701-, 30D-9VS : #2117-, 35DN-9VS : #0753-)



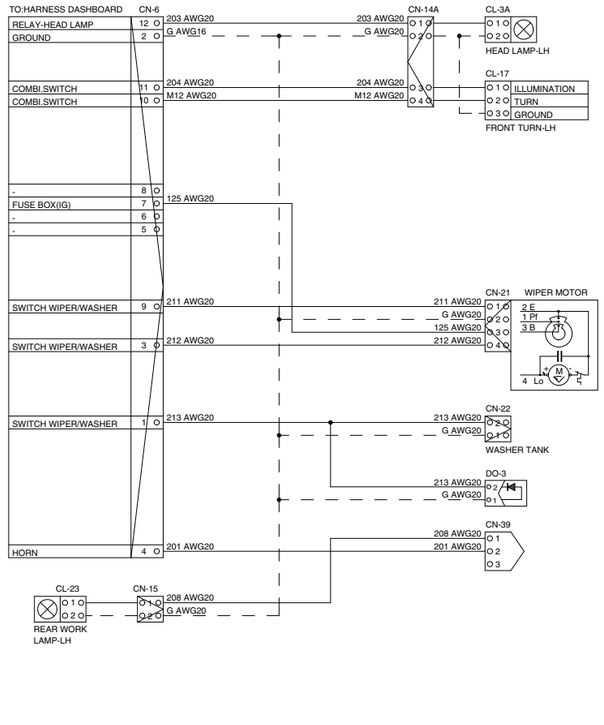
26HN-05602-00 8OF8

· ELECTRICAL CIRCUIT (3/4, CABIN WITH AIRCON, 25D-9VS : #0117-#0258, 30D-9VS : #0122-#0538, 35DN-9VS : #0178-#0255)

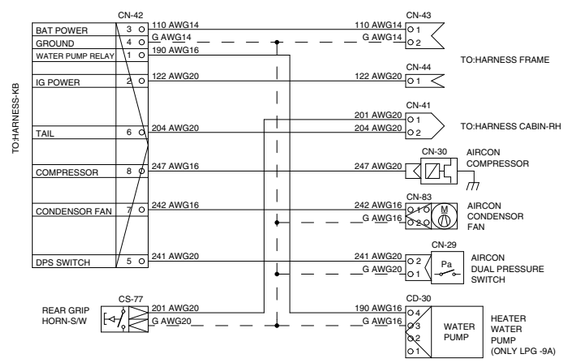
*ELEC.DIAGRAM OF HARNESS CABIN-RH



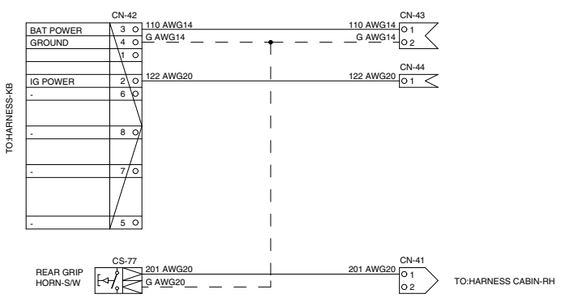
*ELEC.DIAGRAM OF HARNESS CABIN-LH



*ELEC.DIAGRAM OF HARNESS-AIRCON(AIRCON+HEATER)



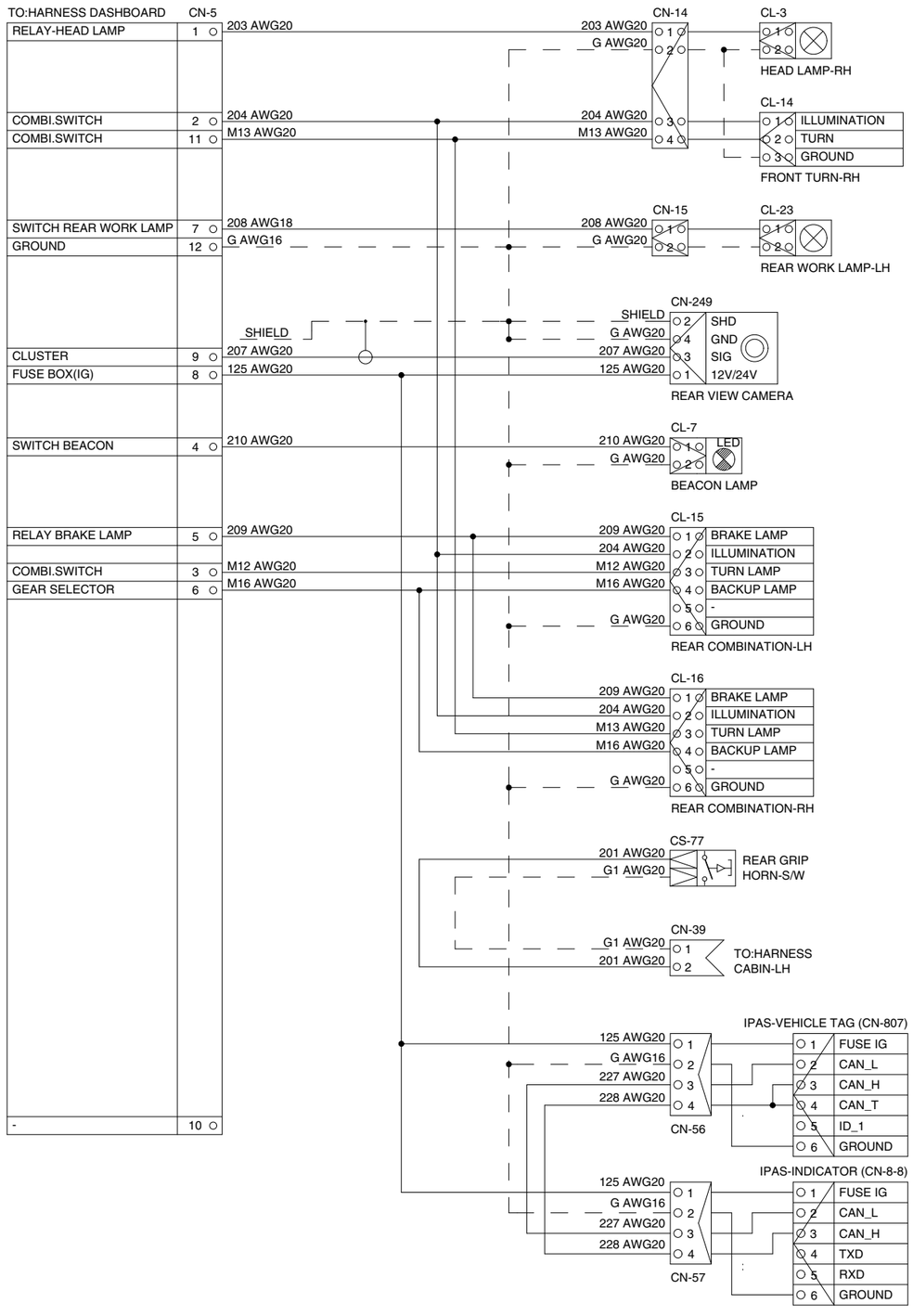
*ELEC.DIAGRAM OF HARNESS-HEATER(HEATER ONLY)



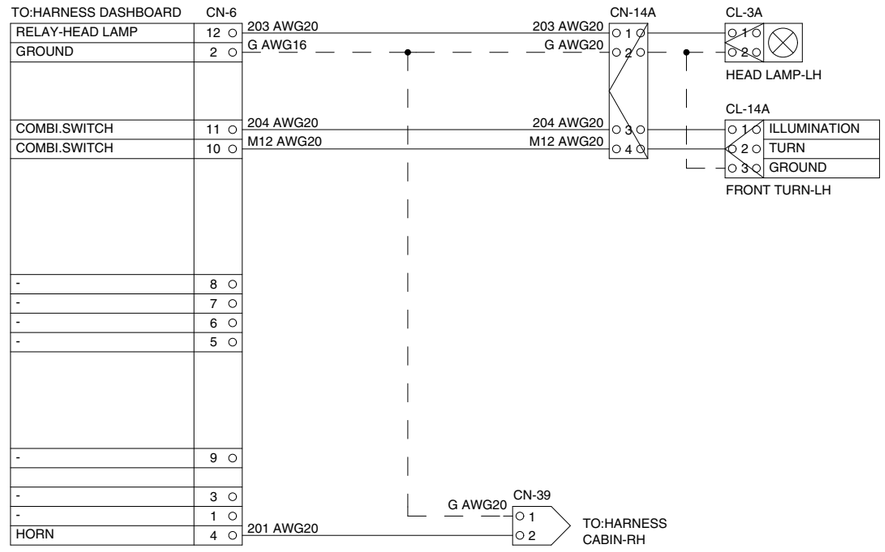
21HN-40082-00

· ELECTRICAL CIRCUIT (4/4, OVERHEAD GUARD, 25D-9VS : #0117-#0258, 30D-9VS : #0122-#0538, 35DN-9VS : #0178-#0255)

*ELEC.DIAGRAM OF HARNESS OHG-RH



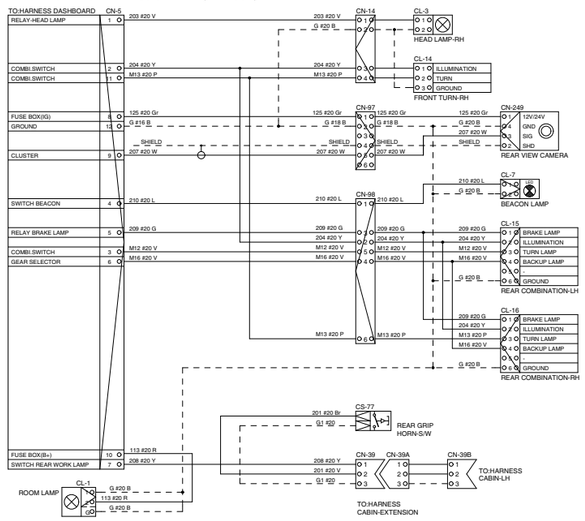
*ELEC.DIAGRAM OF HARNESS OHG-LH



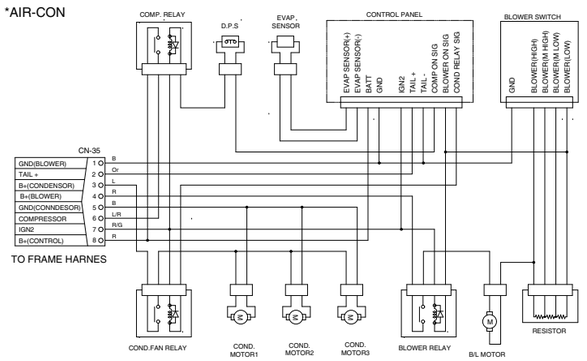
21HN-50044-00

· ELECTRICAL CIRCUIT (3~4/4, CABIN, OVERHEAD GUARD, 25D-9VS : #0259-#0700, 30D-9VS : #0539-#2116, 35DN-9VS : #0256-#0752)

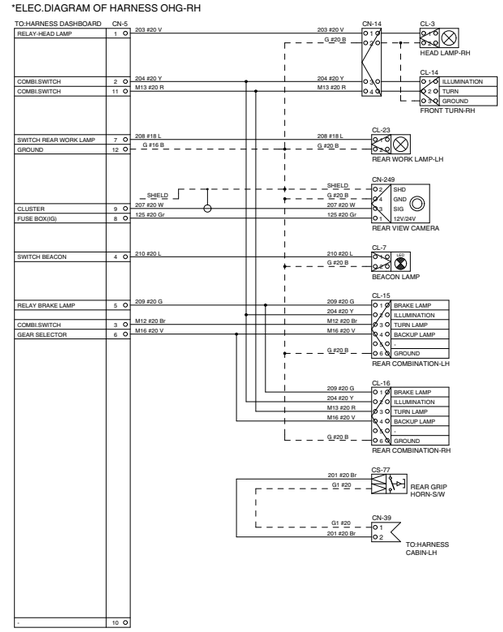
*ELEC.DIAGRAM OF HARNESS CABIN-RH(w AIRCON)



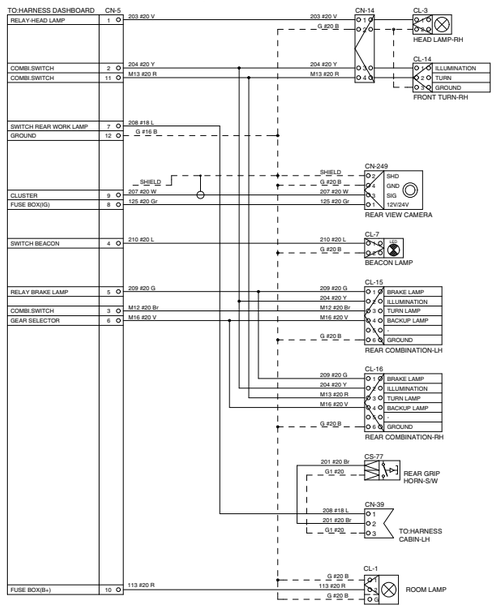
*AIR-CON



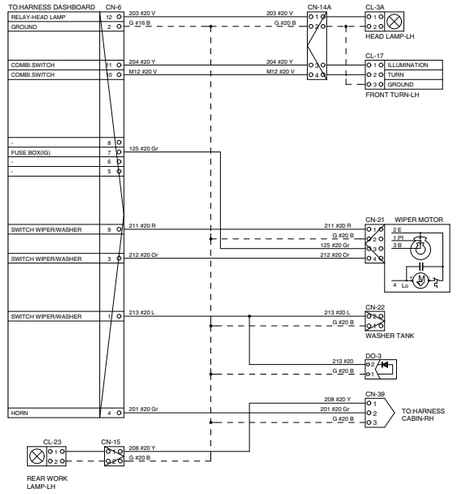
*ELEC.DIAGRAM OF HARNESS OHG-RH



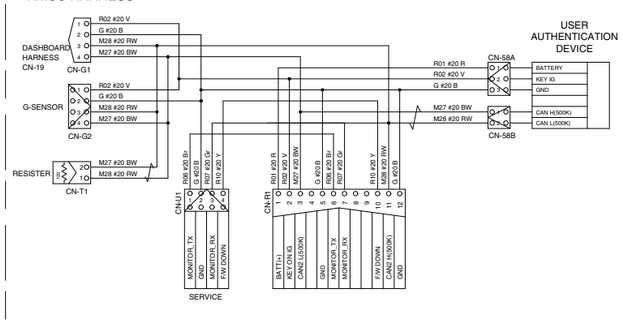
*ELEC.DIAGRAM OF HARNESS CABIN-RH(PARTIAL, w/o AIRCON)



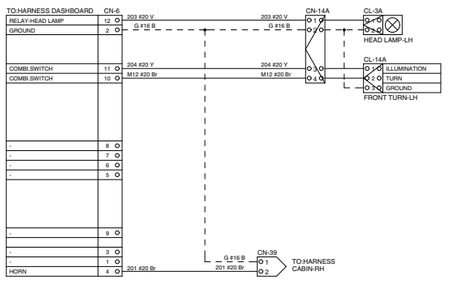
*ELEC.DIAGRAM OF HARNESS CABIN-LH



* RMCU HARNESS



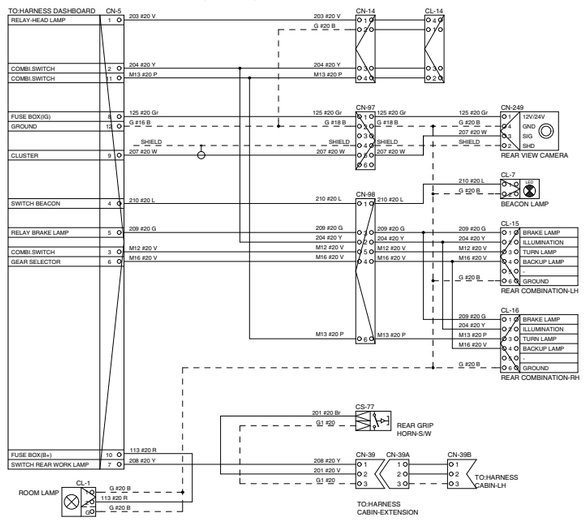
*ELEC.DIAGRAM OF HARNESS OHG-LH



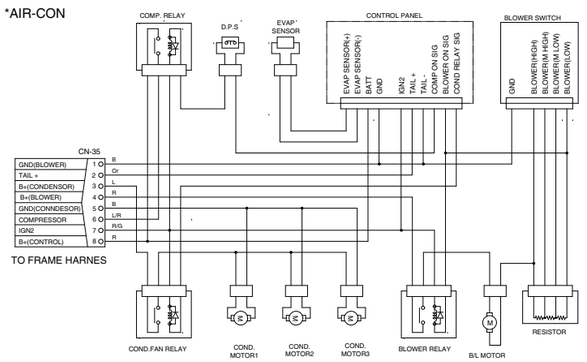
21HN-04100-00

· ELECTRICAL CIRCUIT (3~4/4, CABIN, OVERHEAD GUARD, 25D-9VS : #0701-, 30D-9VS : #2117-, 35DN-9VS : #0753-)

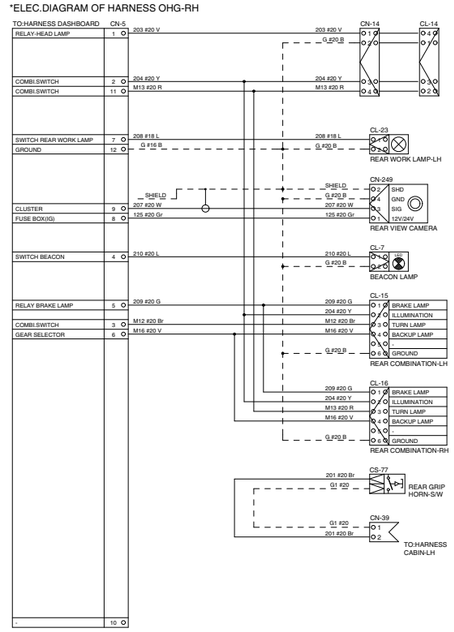
*ELEC.DIAGRAM OF HARNESS CABIN-RH(w AIRCON)



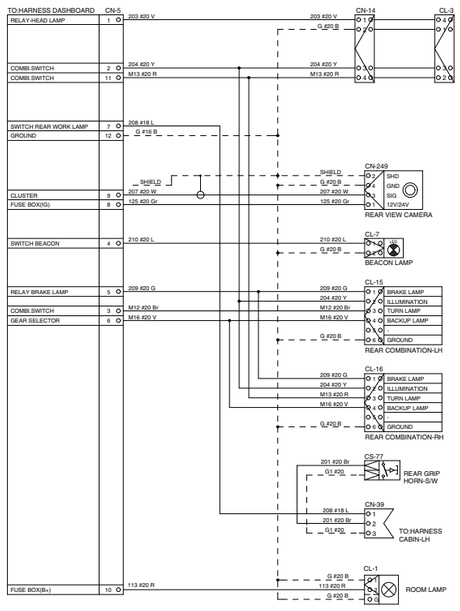
*AIR-CON



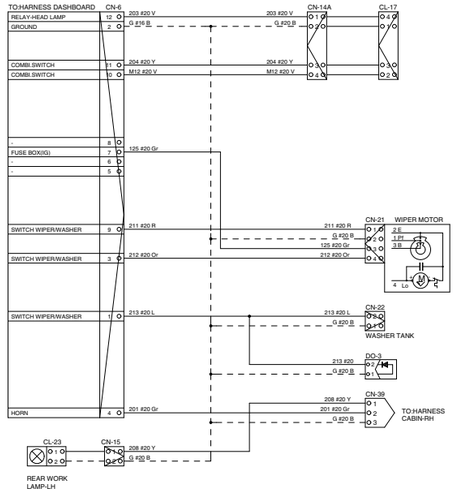
*ELEC.DIAGRAM OF HARNESS OHG-RH



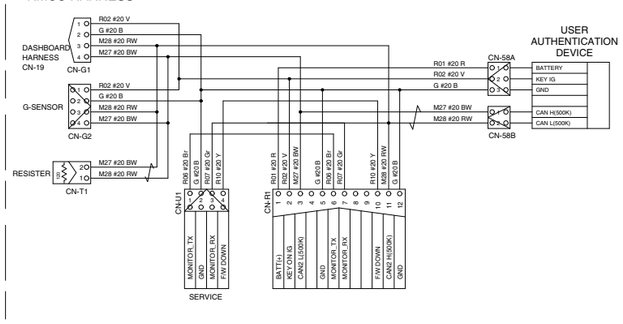
*ELEC.DIAGRAM OF HARNESS CABIN-RH(PARTIAL, w/o AIRCON)



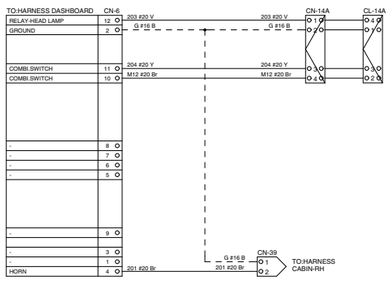
*ELEC.DIAGRAM OF HARNESS CABIN-LH



* RMCU HARNESS



*ELEC.DIAGRAM OF HARNESS OHG-LH



21HN-04102-00

1. POWER CIRCUIT

The negative terminal of the battery is grounded to the truck chassis.
When the start switch is in the off position, the current flows from the positive battery terminal.

1) OPERATING FLOW

Battery (+)

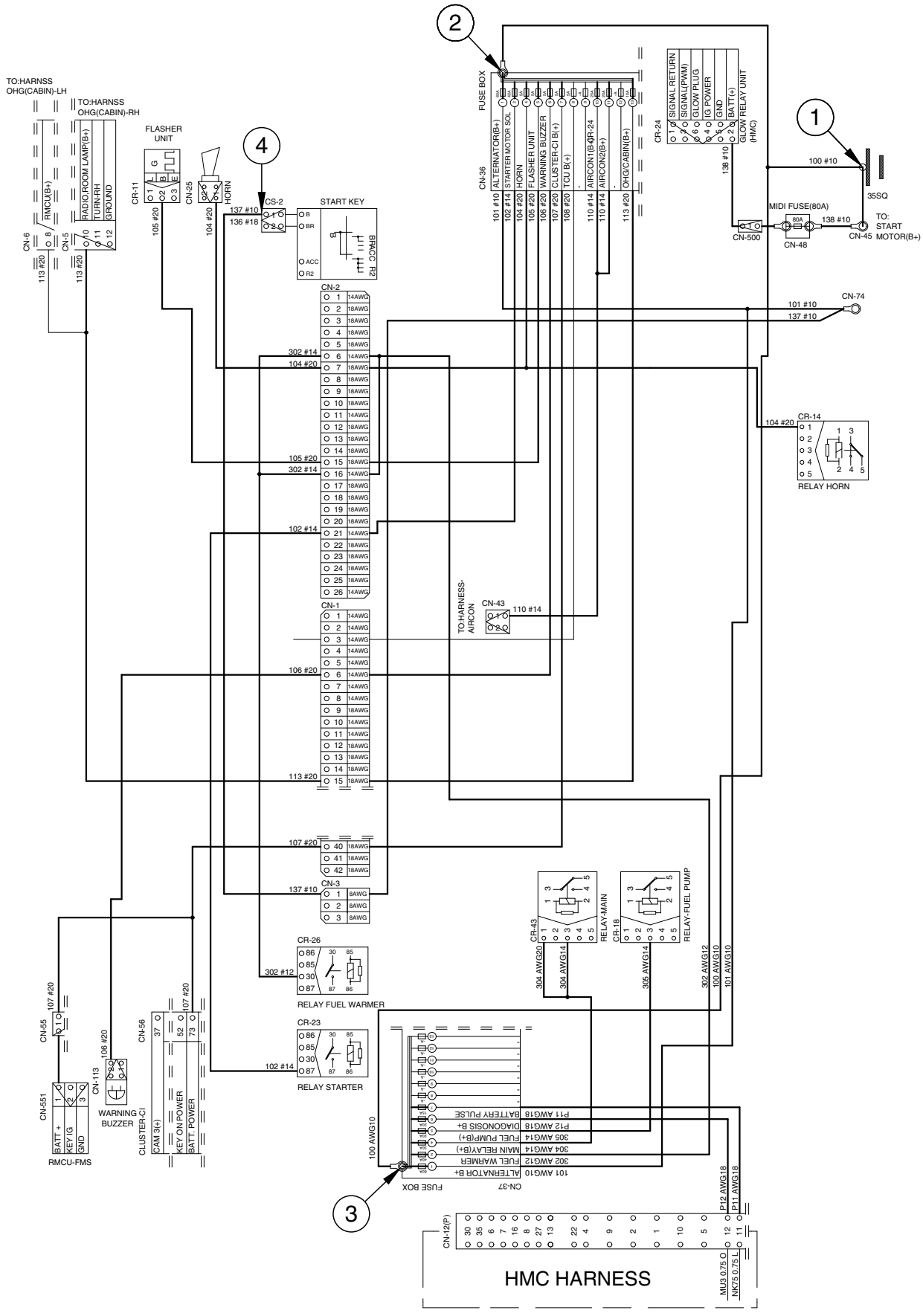
- → Start motor [CN-45 (B+)] → Midi fuse [CN-48] → I/conn [CN-500] → Glow controller [CR-24]
- → Fuse box [CN-36]
  - [No.1] → Alternator [CN-74 (B+)] → I/conn [CN-3 (1)] → Start switch [CS-2 (1)]
  - [No.2] → I/conn [CN-2 (21)] → Starter relay [CR-23]
  - [No.4] → I/conn [CN-2 (7)] → Horn [CN-25 (1)]
  - [No.5] → I/conn [CN-2 (15)] → Flasher unit [CR-11(2)]
  - [No.6] → I/conn [CN-1(6)] → Warning buzzer [CN-113 (1)]
  - [No.7] → I/conn[CN-1(4)] → Cluster-CI [CN-56 (18)]
  - [No.10] → I/conn[CN-43 (1)] → To air conditioner harness
  - [No.11] → I/conn[CN-43 (1)] → To air conditioner harness
  - [No.13] → I/conn[CN-1 (15)] → OHG/Cabin-RH harness [CN-5 (10)
- → Fuse box [CN-37]
  - [No.1] → Alternator [CN-74 (B+)] → I/conn [CN-3 (1)] → Start switch [CS-2 (1)]
  - [No.2] → I/conn [CN-2 (6)] → Fuel warmer relay [CR-26]
  - [No.4] → Main relay [CR-43 (1)]
  - [No.5] → Fuel pump relay [CR-18]
  - [No.6] → Diagnosis [CN-12 (12)]
  - [No.7] → Battery pulse [CN-12 (11)]

2) CHECK POINT

Engine	Key switch	Check point	Voltage
Stop	OFF	① - GND [Battery (+)] ② - GND [Fuse box (CN-36 B+)] ③ - GND [Fuse box (CN-37 B+)] ④ - GND [Start key (B+)]	12 V

※ GND : Ground

POWER CIRCUIT



2. STARTING CIRCUIT

1) OPERATING FLOW

Battery (+)
→ Start motor [CN-45 (B+)]
→ Fuse box [CN-36, No.1] → Alternator [CN-74 (B+)] → I/conn [CN-3 (1)]
→ Start switch [CS-2 (1)]

※ The engine can be started only when the gearshift is in neutral position.

(1) When start key switch is in ON position

Start switch ON [CS-2 (1)] → I/conn[CN-3 (2)] → Fuse box [CN-36 (No.3)]

(2) When start key switch is START position

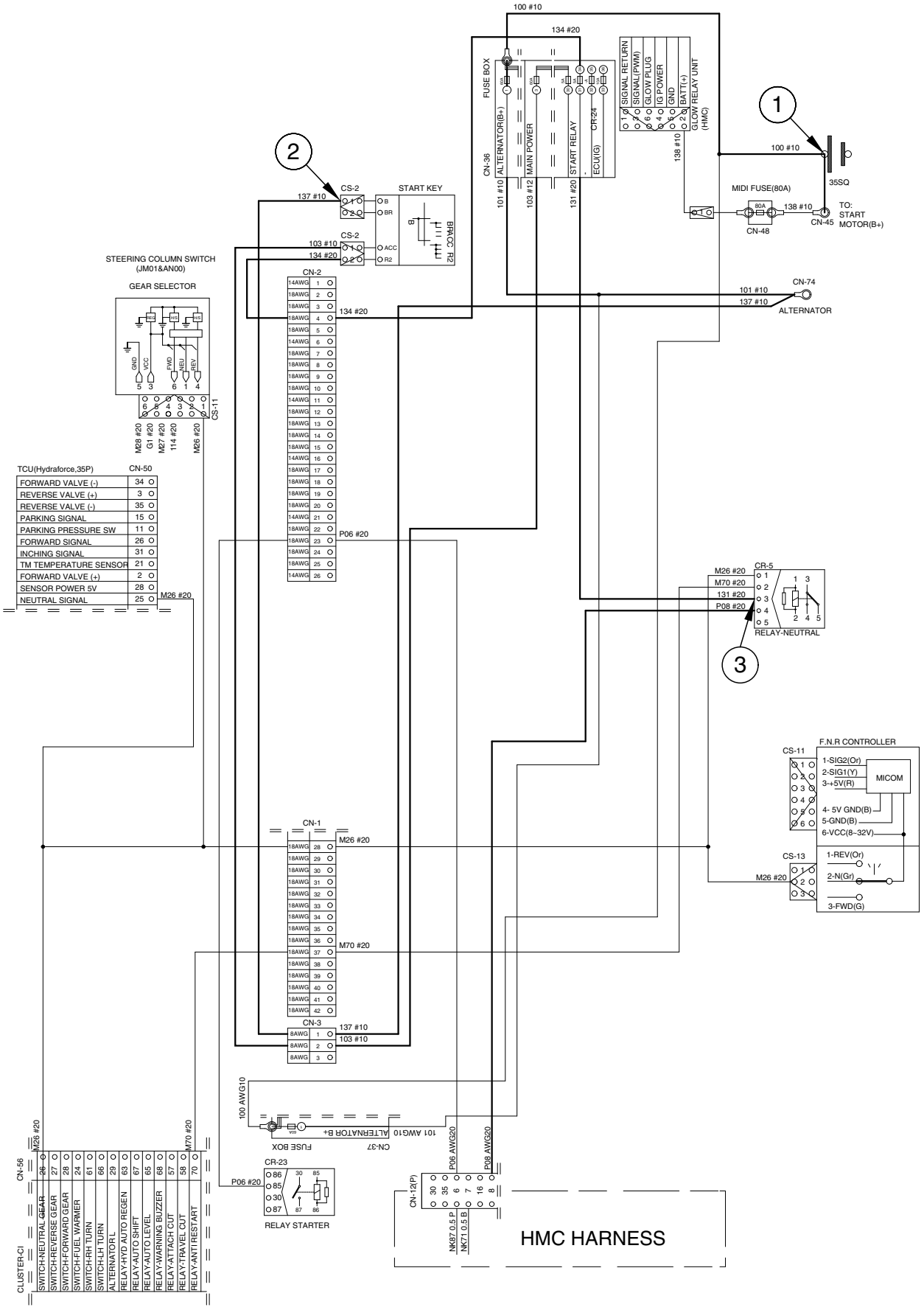
Start switch START [CS-2 (2)] → I/conn [CN-2 (4)] → Fuse box [CN-36 (No.34 → 31)]
→ Neutral relay [CR-5 (3) → (4)] → HMC Harness [CN-12 (8)] → Start motor operating

2) CHECK POINT

Engine	Key switch	Check point	Voltage
Running	ON	① - GND (Battery B+) ② - GND (Start key) ③ - GND (Neutral relay)	12 V

※ GND : Ground

STARTING CIRCUIT



25D9V7ES03

3. CHARGING CIRCUIT

When the starter is activated and the engine is started, the operator release the start switch to the ON position. Charging current generated by operating alternator flows into the battery.
The current also flows from alternator to each electrical component through the fuse box.

1) OPERATING FLOW

(1) Warning flow

Alternator [CN-74 (1)] → I/conn [CN-1 (32)] → Cluster-CI [CN-56 (29)] → Charging warning lamp

(2) Charging flow

Alternator [CN-74 (B+)] → Fuse box [CN-36 (NO.1 → B+)] → Battery (+) terminal → Charging

2) CHECK POINT

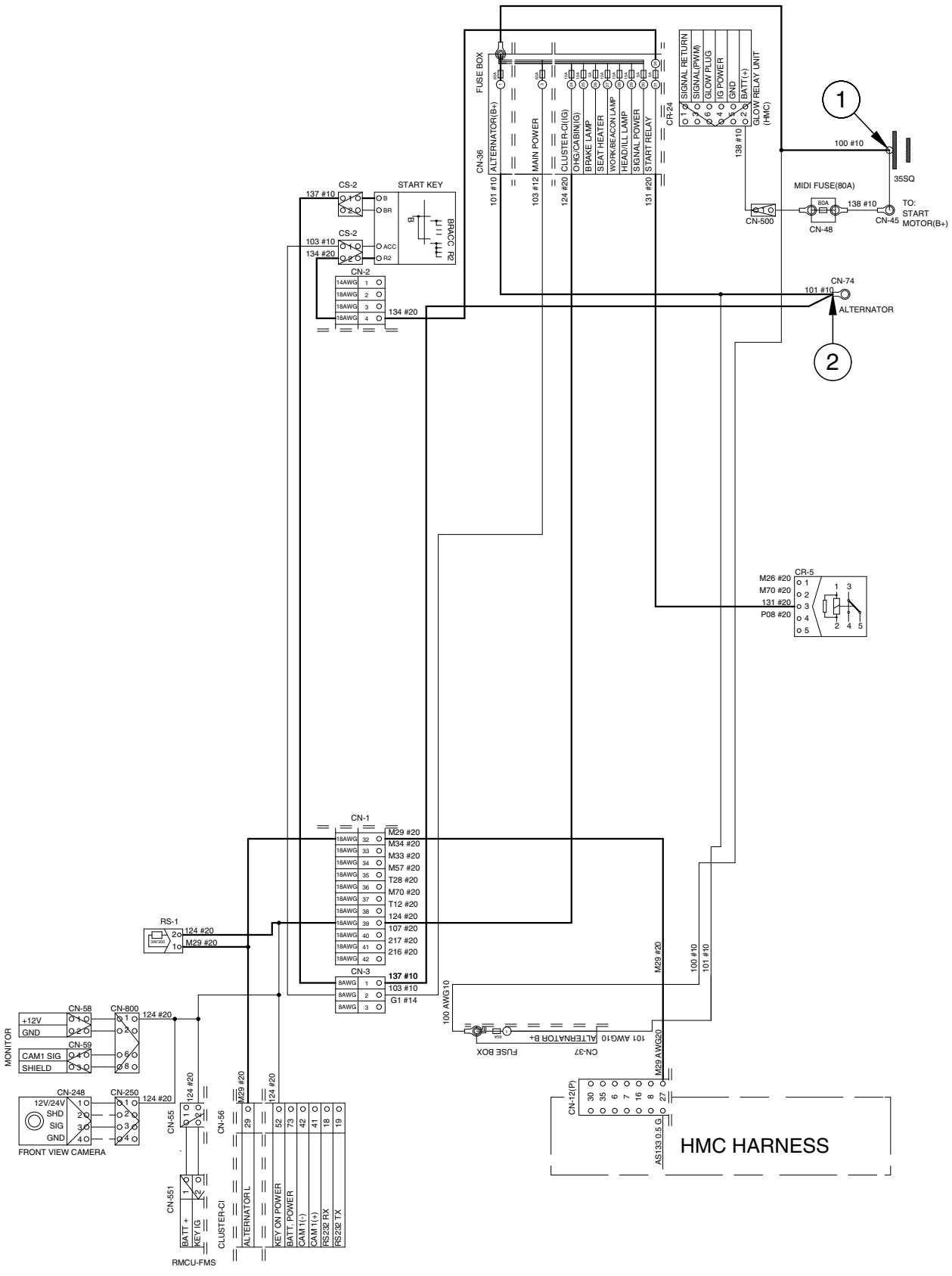
Engine	Key switch	Check point	Voltage
Running	ON	① - GND (Battery voltage) ② - GND (Alternator B+)	12 V

※ GND : Ground

※ Cautions

1. When using an arc welder, always disconnect the ground lead from the battery to prevent alternator or battery damage.
2. Attach the welding ground clamp as close to the weld area as possible to prevent welding current from damaging the bearings of the alternator.
3. Do not disconnect the battery when the engine is running. The voltage surge can damage the diode and resistors in the electrical system.
4. Do not disconnect an electric wire before the engine is stopped and the switches are OFF.

CHARGING CIRCUIT



25D9V7ES04

4. PREHEATER AND FUEL WARMER CIRCUIT

Combustion chamber glow plugs are used in order to give satisfactory starting of low ambient temperatures.

1) OPERATING FLOW

(1) **Preheater**

Battery (+) terminal → Start motor [CN-45 (B+)] → Midi fuse [CN-48] → I/conn [CN-500] → Glow controller [CR-24]

※ When you turn the start switch to the ON position, the glow relay makes the glow plugs operated and the glow lamp of the cluster turned ON.

(2) **Fuel heater**

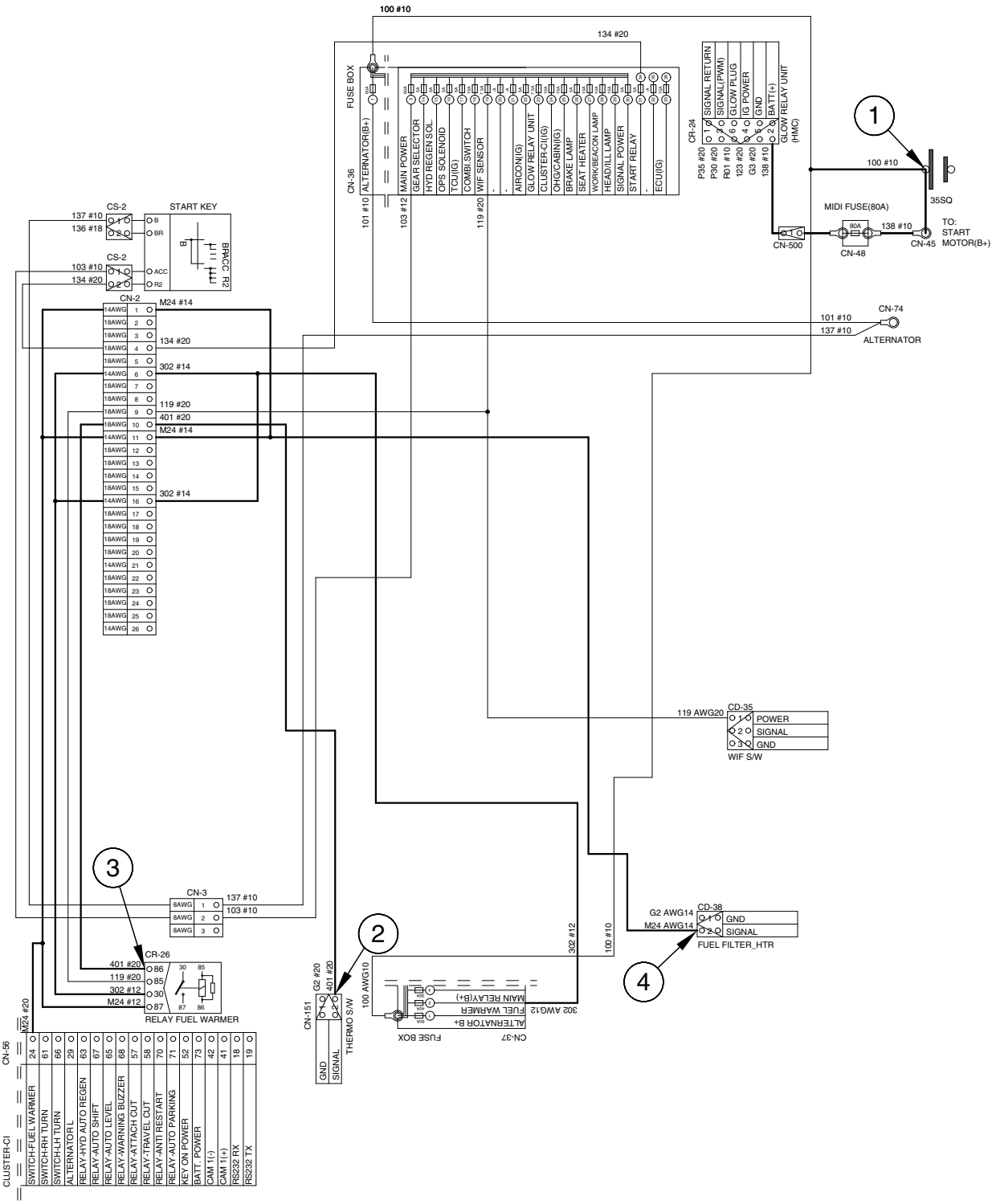
Thermo switch [CN-151 (2)] → I/conn [CN-2 (10)] → Fuel warmer relay [CR-26 (86)]
Fuse box [CN-37 (No.2)] → I/conn [CN-2 (6)] → Fuel warmer relay [CR-26 (30 → 87)] → I/conn [CN-2 (11)] → Fuel filter-heater [CD-38]

2) CHECK POINT

Engine	Key switch	Check point	Voltage
Stop	ON	① - GND (Battery B+) ② - GND (Themo switch) ③ - GND (Fuel warmer relay) ④ - GND (Fuel filter-heater)	12 V

※ GND : Ground

PREHEATER AND FUEL WARMER CIRCUIT



25D9V7ES05

5. HEAD LIGHT AND REAR WORK LIGHT CIRCUIT

1) OPERATING FLOW

(1) **Head light**

Fuse box [CN-36 (No.29)] → I/conn [CN-2 (12)] → Main light switch [CS-39 (2)]
Switch ON [CS-39 (3)] → I/conn [CN-6 (12)] → Head lamp ON [CL-3 (1), CL-3A (1)]

(2) **Rear work light**

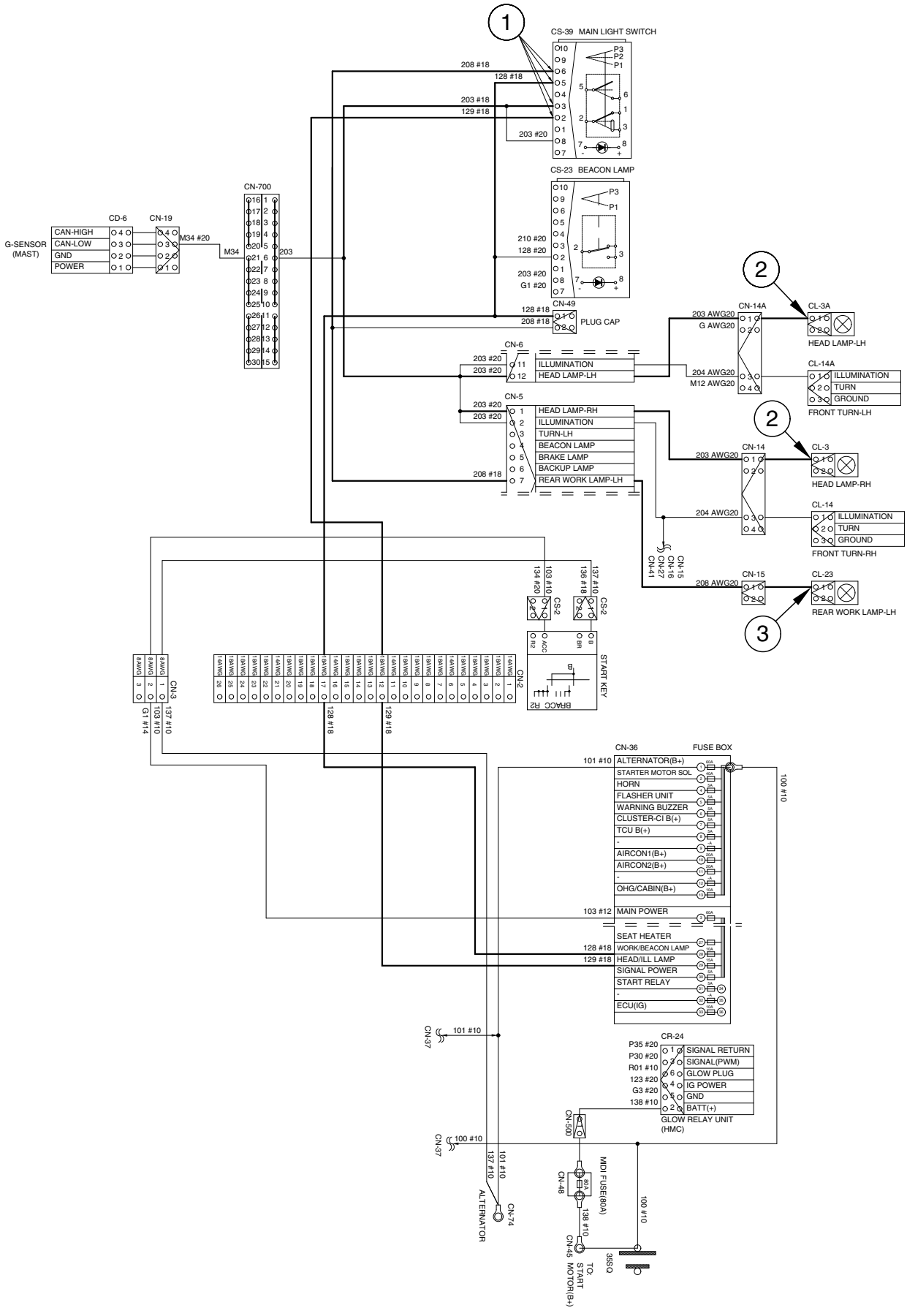
Fuse box [CN-36 (No.28)] → I/conn [CN-2 (17)] → Main light switch [CS-39 (5)]
Switch ON [CS-39 (6)] → I/conn [CN-5 (7)] → Rear work light ON [CL-23 (1)]

2) CHECK POINT

Engine	Key switch	Check point	Voltage
OFF	ON	① - GND (Main light switch) ② - GND (Head light) ③ - GND (Rear work light)	10 ~ 12.5 V

※ GND : Ground

HEAD LIGHT AND REAR WORK LIGHT CIRCUIT



25D9V7ES06

6. FRONT WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

Fuse box [CN-36 (No.25)] → I/conn [CN-2 (18)] → Front wiper & washer switch [CS-3 (3, 5)]
→ I/conn [CN-6 (7)] → Wiper motor [CN-21 (3)]

(1) **Front wiper and washer switch ON (1st step)**

Front wiper & washer switch [CS-3 (2)] → I/conn [CN-6 (3)] → Front wiper motor [CN-21 (4)]
→ Front wiper motor operating

(2) **Front wiper & washer switch ON (2nd step)**

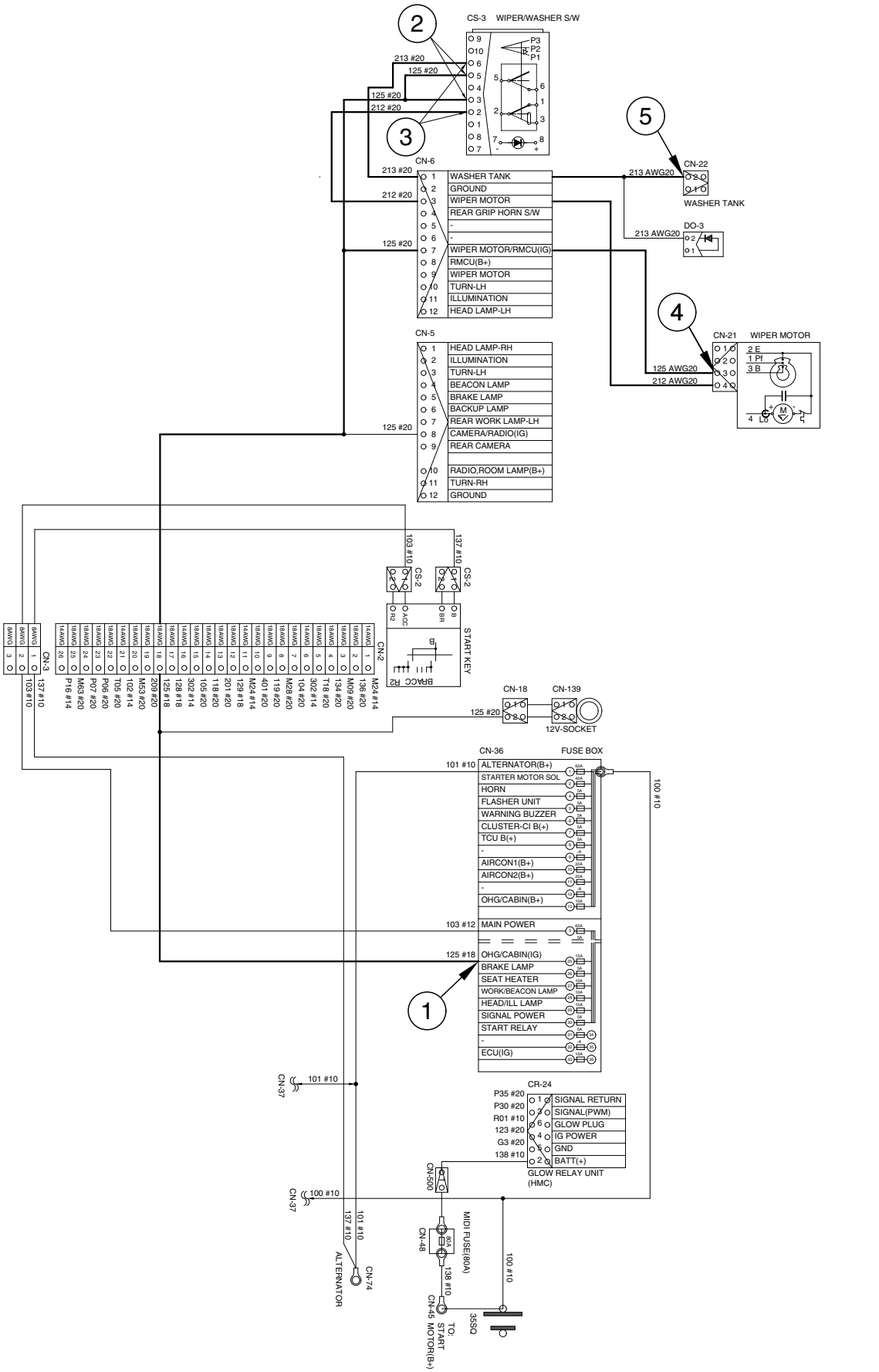
Front wiper & washer switch [CS-3 (2)] → I/conn [CN-6 (3)] → Front wiper motor [CN-21 (4)]
→ Front wiper motor operating
Front wiper & washer switch [CS-3 (6)] → I/conn [CN-6 (1)] → Front wiper motor [CN-22 (2)]
→ Front washer pump operating

2) CHECK POINT

Engine	Key switch	Check point	Voltage
Stop	ON	① - GND (Fuse box No.25) ② - GND (Front wiper & washer switch power input) ③ - GND (Front wiper & washer switch output) ④ - GND (Front wiper motor power input) ⑤ - GND (Front washer pump power input)	10 ~ 12.5 V

※ GND : Ground

FRONT WIPER AND WASHER CIRCUIT



25D9V7ES07

GROUP 3 COMPONENT SPECIFICATION

<table>
<tr><th>No</th><th>Part name</th><th>Qty</th><th>Specification</th></tr>
<tr><td>1</td><td>Battery</td><td>1</td><td>12V×90 AH
RC : 150 min
CCA : 720 A</td></tr>
<tr><td>2</td><td>Work lamp</td><td>1</td><td>12V, 55W</td></tr>
<tr><td>3</td><td>Work lamp (LED, opt)</td><td>1</td><td>12V, 22W</td></tr>
<tr><td>4</td><td>License lamp (opt)</td><td>1</td><td>12V, 10W</td></tr>
<tr><td>5</td><td>Rear combination lamp (LED)</td><td>2</td><td>12V, 1.6/0.2W (Stop/Tail)
12V, 1.1W (Turn)
12V, 1.1W (Back Up)</td></tr>
<tr><td>6</td><td>Flasher lamp</td><td>2</td><td>12V, 0.5/2.2W (posit/turn signal)</td></tr>
<tr><td>7</td><td>Beacon lamp (LED/opt)</td><td>1</td><td>12V, max. 0.800A</td></tr>
<tr><td>8</td><td>Camera (opt)</td><td>1</td><td>12V, 1.32W</td></tr>
<tr><td>9</td><td>Flasher unit relay (3P)</td><td>1</td><td>12V, 20A</td></tr>
<tr><td>10</td><td>Relay (5P)</td><td>10</td><td>12V, 20A</td></tr>
<tr><td>11</td><td>Flasher Unit</td><td>1</td><td>12V, 85±10 CM, (23W + 23W)×2 + 3W×2</td></tr>
<tr><td>12</td><td>Back buzzer</td><td>1</td><td>12V, 90±5 dB, 60±10 C/M</td></tr>
<tr><td>13</td><td>Horn</td><td>1</td><td>12V, MAX 3.5A, 105 ~ 120 dB</td></tr>
<tr><td>14</td><td>Cluster-CI</td><td>1</td><td>12V, 15W</td></tr>
<tr><td>15</td><td>G-sensor (Mast angle) (opt)</td><td>1</td><td>12V, 5W</td></tr>
<tr><td>16</td><td>Fuel level sender</td><td>1</td><td>
<table>
<tr><td>Float indicator</td><td>E</td><td>4/8</td><td>F</td></tr>
<tr><td>Resistance (Ω)</td><td>700</td><td>350</td><td>50</td></tr>
<tr><td rowspan="2">Tolerance (Ω)</td><td>−0%</td><td rowspan="2">±5%</td><td>+0%</td></tr>
<tr><td>+5%</td><td>−5%</td></tr>
</table>
</td></tr>
<tr><td>17</td><td>Master switch (opt)</td><td>1</td><td>12V, 180A</td></tr>
<tr><td>18</td><td>Gear selector switch</td><td>1</td><td>12V, 3.5A</td></tr>
<tr><td>19</td><td>Combination switch</td><td>1</td><td>Direction : 12V, 3.5A
Multi-function switch : 12V, 2A</td></tr>
<tr><td>20</td><td>Rear worklamp switch (opt)</td><td>1</td><td>12V, 15A</td></tr>
<tr><td>21</td><td>Hazard switch (opt)</td><td>1</td><td>12V, 15A</td></tr>
<tr><td>22</td><td>Fuel warmer switch</td><td>1</td><td>12V, 15A</td></tr>
<tr><td>23</td><td>Beacon lamp switch (opt)</td><td>1</td><td>12V, 15A</td></tr>
<tr><td>24</td><td>Wiper/washer switch (opt)</td><td>1</td><td>12V, 15A</td></tr>
<tr><td>25</td><td>Accelerator pedal</td><td>1</td><td>12V, input voltage 5Vdc, current 16~20mA</td></tr>
<tr><td>26</td><td>Parking switch</td><td>1</td><td>12V, 15A</td></tr>
<tr><td>27</td><td>OPSS buzzer</td><td>1</td><td>12V, 50mA max, 80~90dB</td></tr>
<tr><td>28</td><td>Socket assy (opt)</td><td>1</td><td>12V, 10A</td></tr>
<tr><td>29</td><td>Blue spot (LED, opt)</td><td>1</td><td>12V, 8W</td></tr>
</table>

GROUP 4 CONNECTOR DESTINATION

1. FRAME HARNESS

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-1	AMP	42	Dashboard Harness	-	0-936429-2
CN-2	AMP	26	Dashboard Harness	1897009-2	-
CN-3	KET	3	Dashboard Harness	-	MG652290-5
CN-12	KUM	36	HMC E/G Garness	HP645-36021	-
CN-13	KET	1	HMC E/G Garness	MG613801-5	-
CN-17	KET	2	Tilt Lever Switch	MG610320	-
CN-18	AMP	2	Socket(12V) Harness	174352-2	174354-2
CN-36	QPL	-	Fuse Box #1	21HN-55010	-
CN-37	QPL	-	Fuse Box #2	21HN-55010	-
CN-38	KET	8	KNOB Gear Seletor	-	MG640341
CN-43	KET	2	Aircon Harness	MG642928-5	MG652934-5
CN-44	KET	1	Aircon Harness	MG610278	MG640280
CN-45	HCE	-	Start Motor	-	-
CN-47	KET / QPL	2	PLUGGING CAP	MG610320	21HN-52150
CN-48	LITTLE FUSE	-	MIDI FUSE HOLDER	-	-
CN-49	MOLEX	32	CAN Converter	64319-3211	-
CN-65	KET	2	Backup Alarm	-	MG640322
CN-66	DEUTSCH	2	PS Auto Regen V/V	DT06-2S	-
CN-71	DEUTSCH	2	Parking SOL	DT06-2S	-
CN-74	HCE	1	Alternator	-	-
CN-122	DEUTSCH	2	Forward SOL	DT06-2S	-
CN-123	DEUTSCH	2	Reverse SOL	DT06-2S	-
CN-124	AMP	6	Accel Pedal	174262-2	-
CN-131	AMP	2	Cut-off SOL1	347887-3	-
CN-134	KET	20	Diagnosis Port	MG652863	-
CN-150	AMP	5	Fuel Pump Module	MG641521-4	-
CN-151	DELPHI	2	Thermo Switch	282080-1	-
CN-500	KET	1	Start Motor	MG613801-5	MG643800-5
CN-700	KET	10	Joint Connector #3	MG621725-5	MG651727-2
CN-800	KET	20	Joint Connector #1	MG655633	MG645695-5
CN-900	KET	20	Joint Connector #2	MG621818	MG651824-4
· Relay					
CR-24	FCI	6	GLOW Relay Unit	F308210	-
· Switch					
CS-11	AMP	6	F.N.R Controller B	174262-2	174264-2

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CS-13	AMP	3	F.N.R Controller A	174357-2	174359-2
CS-73	DEUTSCH	6	Seat Swtich	DT06-6S	21HN-52080
· Lamp					
CL-21	KET	1	License Lamp	ST730018-3	ST750036-3
· Sensor, sender					
CD-2	KET	3	Fuel Sender	MG610327	-
CD-10	KET	1	Air-Cleaner Switch	ST730057-2	-
CD-26	AMP	1	Parking PS Switch	171809-2	-
CD-29	DEUTSCH	4	T/M PS/Temp Sensor	DT06-S4	-
CD-35	AMP	3	WIF Switch	936251-2	-
CD-38	AMP	2	Fuel Filter HTR	10737780	-
CD-40	AMP	3	Speed Sensor	MG610327-5	-
CD-50	DEUTSCH	3	Load Sensor	DT06-3S	DT04-3P
CD-60	DELPHI	2	T4 Sensor	33401219	-
CD-61	DELPHI	2	T5 Sensor	33401218	-
CD-63	KET	3	DPF Diff PS Sensor	MG644453-5	-

2. FRAME HARNESS (FIGERTIP, OPTION)

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-1	AMP	42	Dashboard Harness	-	0-936429-2
CN-2	AMP	26	Dashboard Harness	1897009-2	-
CN-3	KET	3	Dashboard Harness	-	MG652290-5
CN-12	KUM	36	HMC E/G Garness	HP645-36021	-
CN-13	KET	1	HMC E/G Garness	MG613801-5	-
CN-18	AMP	2	Socket(12V) Harness	174352-2	174354-2
CN-36	QPL	-	Fuse Box #1	21HN-55010	-
CN-37	QPL	-	Fuse Box #2	21HN-55010	-
CN-43	KET	2	Aircon Harness	MG642928-5	MG652934-5
CN-44	KET	1	Aircon Harness	MG610278	MG640280
CN-45	HCE	-	Start Motor	-	-
CN-47	KET / QPL	2	PLUGGING CAP	MG610320	21HN-52150
CN-48	LITTLE FUSE	-	MIDI FUSE HOLDER	-	-
CN-49	MOLEX	32	CAN Converter	64319-3211	-
CN-65	KET	2	Backup Alarm	-	MG640322
CN-66	DEUTSCH	2	PS Auto Regen V/V	DT06-2S	-
CN-71	DEUTSCH	2	Parking SOL	DT06-2S	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-74	HCE	1	Alternator	-	-
CN-122	DEUTSCH	2	Forward SOL	DT06-2S	-
CN-123	DEUTSCH	2	Reverse SOL	DT06-2S	-
CN-124	AMP	6	Accel Pedal	174262-2	-
CN-134	KET	20	Diagnosis Port	MG652863	-
CN-150	AMP	5	Fuel Pump Module	MG641521-4	-
CN-151	DELPHI	2	Thermo Switch	282080-1	-
CN-412	AMP	8	Armrest Harness	-	174984-2
CN-413	AMP	8	Armrest Harness	174982-2	-
CN-500	KET	1	Start Motor	MG613801-5	MG643800-5
CN-700	KET	10	Joint Connector #3	MG621725-5	MG651727-2
CN-800	KET	20	Joint Connector #1	MG655633	MG645695-5
CN-900	KET	20	Joint Connector #2	MG621818	MG651824-4
· Relay					
CR-24	FCI	6	GLOW Relay Unit	F308210	-
· Switch					
CS-73	DEUTSCH	6	Seat Swtich	DT06-6S	21HN-52080
· Lamp					
CL-21	KET	1	License Lamp	ST730018-3	ST750036-3
· Sensor, sender					
CD-2	KET	3	Fuel Sender	MG610327	-
CD-10	KET	1	Air-Cleaner Switch	ST730057-2	-
CD-26	AMP	1	Parking PS Switch	171809-2	-
CD-29	DEUTSCH	4	T/M PS/Temp Sensor	DT06-S4	-
CD-35	AMP	3	WIF Switch	936251-2	-
CD-38	AMP	2	Fuel Filter HTR	10737780	-
CD-40	AMP	3	Speed Sensor	MG610327-5	-
CD-50	DEUTSCH	3	Load Sensor	DT06-3S	DT04-3P
CD-60	DELPHI	2	T4 Sensor	33401219	-
CD-61	DELPHI	2	T5 Sensor	33401218	-
CD-63	KET	3	DPF Diff PS Sensor	MG644453-5	-

3. DASHBOARD HARNESS

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-1	AMP	42	Frame Harness	0-936421-2	-
CN-2	AMP	26	Frame Harness	-	1897013-2
CN-3	KET	3	Frame Harness	MG642292-5	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-5	KET	12	OHG (Cabin) - RH Harness	-	MG640348
CN-6	KET	12	OHG (Cabin) - LH Harness	-	MG640348
CN-19	AMP	4	G-Sensor (Mast)	174257-2	-
CN-25	MOLEX	2	Horn	35825-0211	-
CN-28	DEUTSH	4	HYD PS/Temp Sensor	DT06-4S	-
CN-49	AMP	2	Blue Spot EXT	174352-2	-
CN-50	AMP	35	TCU	776164-4	-
CN-55	KET	6	RMCU-FMS	-	MG640337
CN-56	MOLEX	73	Cluster CI	0-936421-2	-
CN-113	KET	2	Warining Buzzer	MG610320	-
CN-250	AMP	4	Front View Camera	174257-2	-
CN-500	KET	20	Joint Connector #2	MG655633	-
CN-600	KET	10	Joint Connector #1	MG621725-5	-
CN-700	AMP	30	Joint Connector #3	2005499-7	-
CN-800	KET	8	Monitor	-	MG640341
· Relay					
CR-11	DAEDONG	3	Flasher Unit	312 CIHUNG 3P	-
CR-23	KET	4	Starter Relay	MG612017-5	-
CR-26	KET	4	Fuel Warmer Relay	MG612017-5	-
· Switch					
CS-2	KET	2	Starter Key Swithc	MG610281	MG620282
CS-3	CALRING	10	Wiper Washer	21HN-56300	-
CS-5	HCE	-	Horn Switch	-	-
CS-11	KET	6	Gear Selector	-	MG640337
CS-12	KET	6	Combi Switch	MG610335	-
CS-17	CALRING	10	Parking Switch	21HN-56300	-
CS-23	CALRING	10	Beacon Lamp Switch	21HN-56300	-
CS-39	CALRING	10	Main Light Switch	21HN-56300	-
CS-41	CALRING	10	Hazard Swtich	21HN-56300	-
CS-75	CALRING	10	Regen Inhibit Switch	21HN-56300	-
CS-79	CALRING	10	Power / STD Mode Switch	21HN-56300	-
· Sensor, sender					
CD-3	DELPHI	3	Inching Potentiometer	12110293	-
CD-4	DEUTSH	4	Brake PS sensor	DT06-4S	-
CD-59	KET	2	Brake Oil Level	MG610320	-
RS-1	AMP	2	Resistor 1	174352-2	-

4. CABIN LH-HARNESS

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-6	KET	12	Dashboard Harness	MG610346	-
CN-14A	DAEDONG	4	Head/Turn Lamp Harness	110-4PR G	-
CN-15	DAEDONG	2	Rear Work Lamp Harness	110-2PR G	-
CN-21	AMP	4	Wiper Motor	180900	-
CN-22	KET	2	Washer Tank	MG640605	-
CN-39	KET	3	Cabin Harness-RH	-	MG640329
· Diode					
DO-3	AMP	2	Diode	174352-2	-

5. CABIN RH-HARNESS

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-5	KET	12	Dashboard Harness	MG610346	-
CN-14	DAEDONG	4	Head/Turn Lamp Harness	110-4PR	-
CN-23	KET	2	Speaker-LH	MG610070	-
CN-24	KET	2	Speaker-RH	MG610070	-
CN-27	KUM	16	USB/Radio	PK145-16017	-
CN-39	KET	3	Cabin-LH Harness	MG610327	-
CN-41	KET	2		MG610320	MG640322
CN-56	MOLEX	4	IPAS-Vehicle Tag	52213-0417	52266-0417
CN-57	MOLEX	4	IPAS-Indicator	52213-0417	52266-0417
CN-249	AMP	4	Rear View Camera	174257-2	174259-2
· Lamp					
CL-1	KET	2	Room Lamp	MG610392	-
CL-7	DEUTSCH	2	Beacon Lamp	DT06-2S	DT04-2P
CL-15	DAEDONG	6	Rear Combi Lamp-LH	110-6PR	-
CL-16	DAEDONG	6	Rear Combi Lamp-RH	110-6PR	-

6. AIRCON AND HEATER HARNESS

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-29	KET	2	Aircon Dual Pressure Switch	MG640795	-
CN-30	KET	1	Aircon Compressor	MG610041	-
CN-41	KET	2	Cabin Harness-RH	-	MG640322
CN-42	KET	8	Harness-KB	MG610271	-
CN-43	KET	2	Frame Harness	MG642928-5	-
CN-44	KET	1	Frame Harness	MG610278	-
CN-83	KUM	2	Aircon Condensor Fan	PB625-02027	-
· Switch					
CS-77	KET	1	Rear Grip Horn Switch	ST730018-3	ST750036-3

7. HEATER HARNESS

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-41	KET	2	Cabin Harness-RH		MG640322
CN-42	KET	8	Harness-KB	MG610278	
CN-43	KET	2	Frame Harness	MG642928-5	
CN-44	KET	1	Frame Harness	MG610278	
· Switch					
CS-77	KET	1	Rear Grip Horn Switch	ST730018-3	ST750036-3

8. OHG LH-HARNESS

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-6	KET	12	Dashboard Harness	MG610346	-
CN-39	KET	3	OHG Harness-RH	-	MG640329
· Lamp					
CL-14A	DAEDONG	4	Harness Head/Turn Lamp	110-4PR	-

9. OHG RH-HARNESS

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-5	KET	12	Dashboard Harness	MG610346	-
CN-14	DAEDONG	4	Harness Head/Trun Lamp	110-4PR	-
CN-39	KET	2	OHG Harness-LH	MG610320	-
CN-56	MOLEX	4	IPAS-Vehicle Tag	52213-0417	52266-0417
CN-57	MOLEX	4	IPAS-Indicator	52213-0417	52266-0417
CN-249	AMP	4	Rear View Camera	174257-2	174259-2
· Switch					
CS-77	KET	1	Rear Grip Horn Switch	ST730018-3	ST750036-3
· Lamp					
CL-7	DEUTSCH	2	Beacon Lamp	DT06-2S	DT04-2P
CL-15	DAEDONG	6	LH-Rear Combi Lamp	110-6PR	-
CL-16	DAEDONG	6	RH-Rear Combi Lamp	110-6PR	-
CL-23	DAEDONG	2	LH-Rear Work	110-2PR	-

10. MCV HARNESS

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-60	AMP	35	Fingertip Main Controller	776164-4	-
CN-134	KET	6	Diagnosis Port	MG610335	MG642554
CN-417	KET	8	Frame Harness	MG640341	-
CN-M1	AMP	2	Lift Down	347887-3	-
CN-M2	AMP	2	Lift Up	347887-3	-
CN-M3	AMP	2	Tilt Out	347887-3	-
CN-M4	AMP	2	Tilt In	347887-3	-
CN-M5	AMP	2	AUX1 In	347887-3	-
CN-M6	AMP	2	AUX1 Out	347887-3	-
CN-M7	AMP	2	AUX2 In	347887-3	-
CN-M8	AMP	2	AUX2 Out	347887-3	-
CN-M9	AMP	2	Cut-off SOL	347887-3	-

11. ARMREST HARNESS

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-15	MOLEX	2	Switch Horn	52213-0211	-
CN-16	MOLEX	2	Switch Aux Enable	52213-0211	-
CN-17	MOLEX	2	Switch Auto Tilt	52213-0211	-
CN-37	MOLEX	4	Switch Direction	52213-0417	-
CN-61	AMP	34	Fingertip Sub controller	4-1437290-1	-
CN-412	AMP	9	Frame Harness	174982-2	-
CN-413	AMP	9	Frame Harness	-	174984-2
· Relay					
CR-14	KET	5	Relay Horn	MG640927	-
CR-15	KET	5	Relay Neutral Signal	MG640927	-
· Switch					
CS-10	HONEYWELL	4	Emergency Stop Switch	21HU-92250	-
· Sensor, sender					
CD-40	MOLEX	4	Lift Lever	52266-0417	-
CD-41	MOLEX	4	Tilt Lever	52266-0417	-
CD-42	MOLEX	4	Aux1 Lever	52266-0417	-
CD-43	MOLEX	4	Aux2 Lever	52266-0417	-

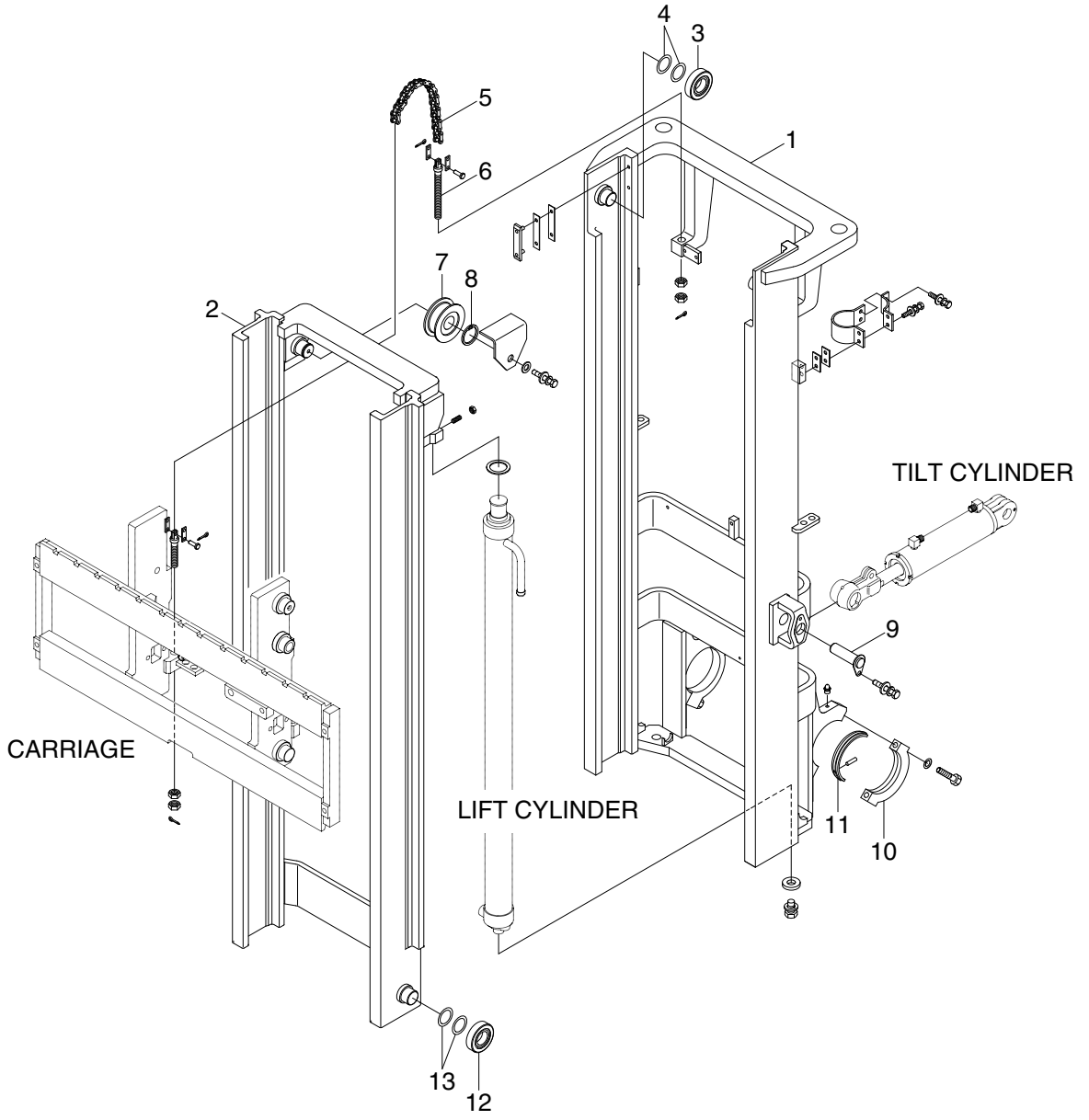
Trouble symptom	Probable cause	Remedy
Lamps dimming even at maximum engine speed.	· Faulty wiring.	· Check for loose terminal and disconnected wire.
Lamps flicker during engine operation.	· Improper belt tension.	· Adjust belt tension.
Charge lamp does not light during normal engine operation.	· Charge lamp defective. · Faulty wiring.	· Replace. · Check and repair.
Alternator makes abnormal sounds.	· Alternator defective.	· Replace
Starting motor fails to run.	· Faulty wiring. · Insufficient battery voltage.	· Check and repair. · Recharge battery.
Starting motor pinion repeats going in and out.	· Insufficient battery voltage.	· Recharge battery.
Excessively low starting motor speed.	· Insufficient battery voltage. · Starting motor defective.	· Recharge battery. · Replace
Starting motor comes to a stop before engine starts up.	· Faulty wiring. · Insufficient battery voltage.	· Check and repair. · Recharge battery.
Heater signal does not become red.	· Faulty wiring. · Glow plug damaged.	· Check and repair. · Replace
Engine oil pressure caution lamp does not light when engine is stopped (with starting switch left in"ON" position).	· Caution lamp defective. · Caution lamp switch defective.	· Replace · Replace

SECTION 8 MAST

Group 1 Structure 8-1
Group 2 Operational Checks and Troubleshooting 8-5
Group 3 Adjustment 8-8
Group 4 Removal and Installation 8-11

GROUP 1 STRUCTURE

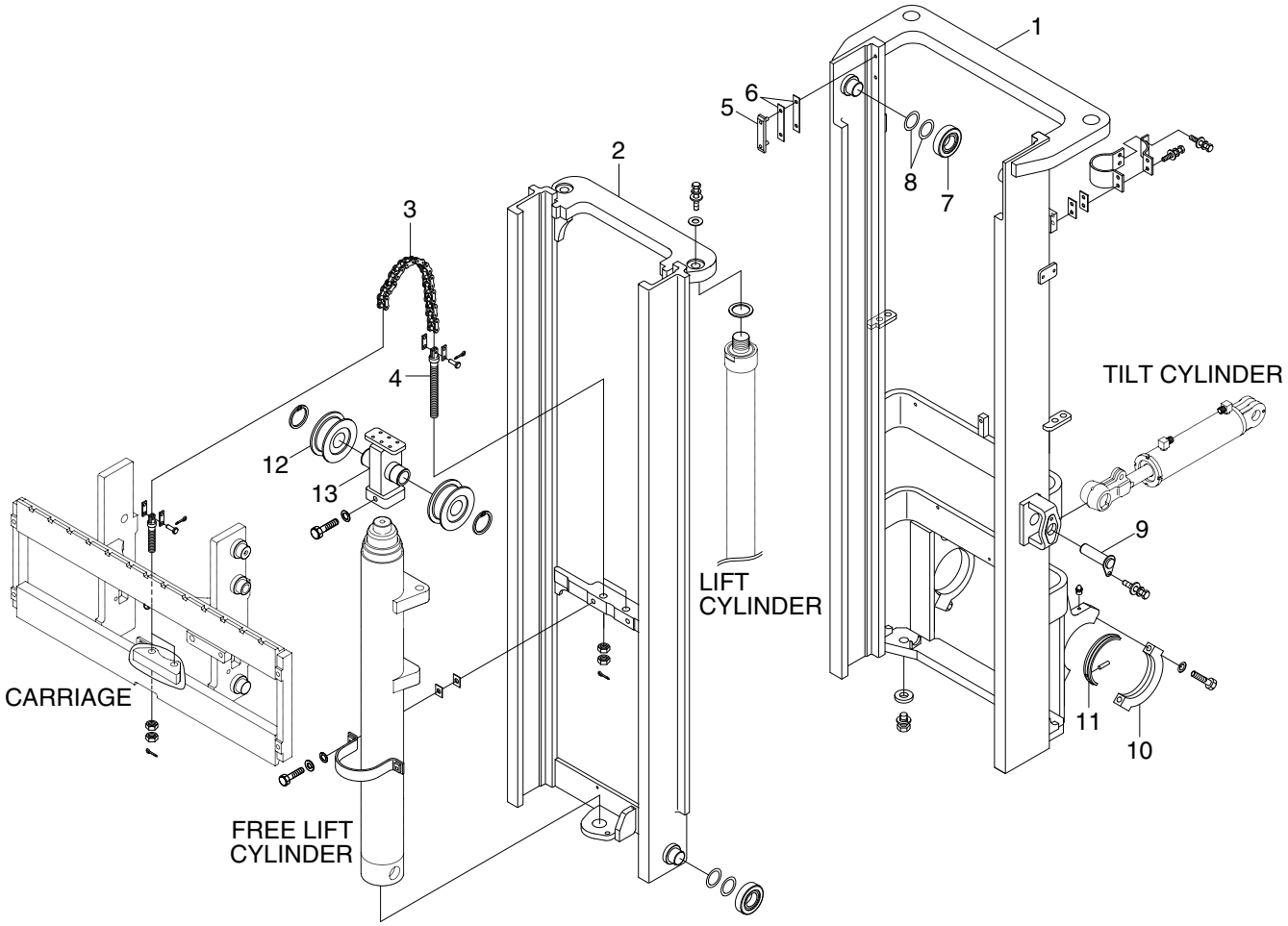
1. 2 STAGE MAST (V MAST)



22D9MS01

1	Outer mast	6	Anchor bolt	11	Bushing
2	Inner mast	7	Chain wheel bearing	12	Roller
3	Roller	8	Retaining ring	13	Shim (0.5, 1.0t)
4	Shim (0.5, 1.0t)	9	Tilt cylinder pin		
5	Chain	10	Trunnion cap		

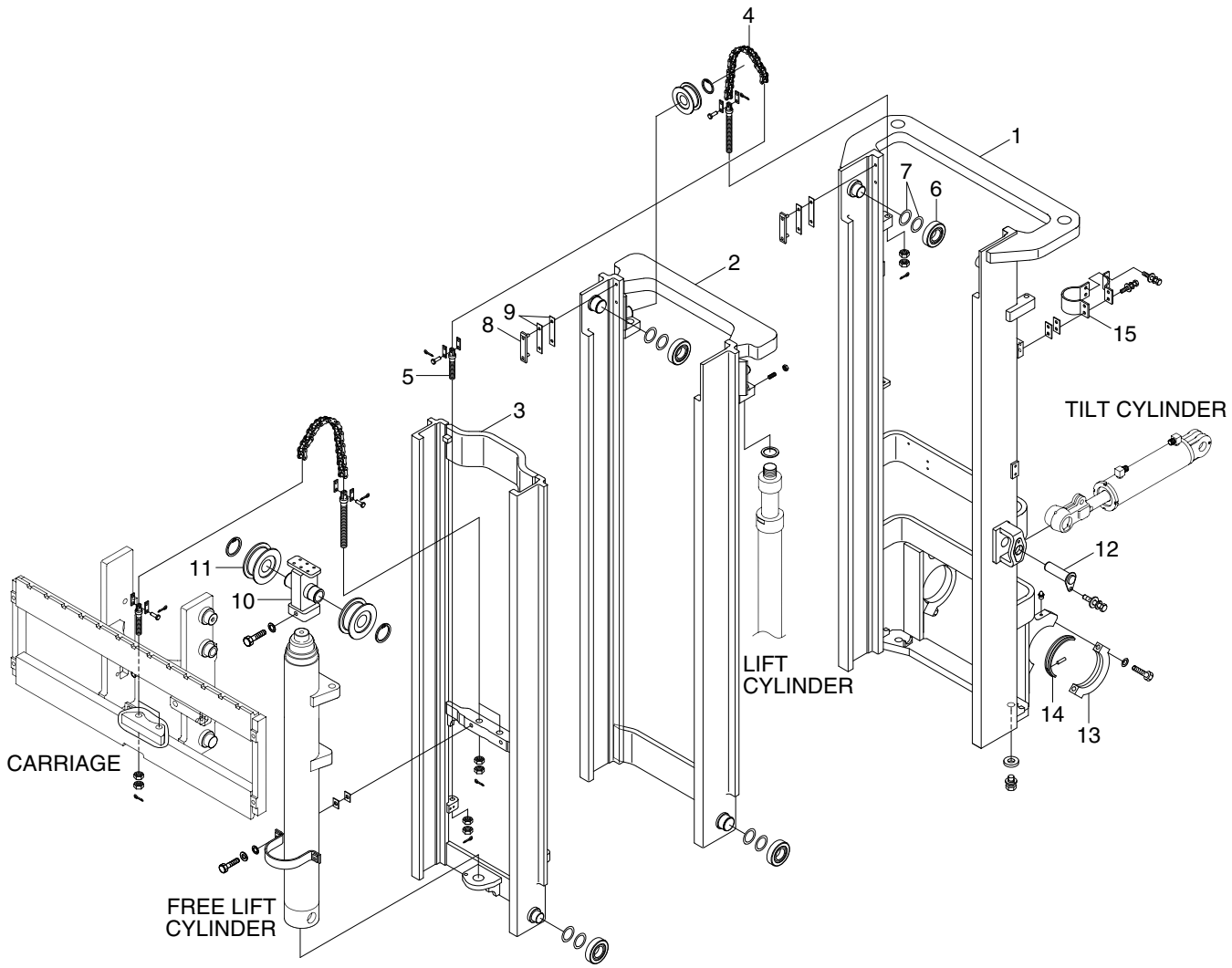
2. 2 STAGE MAST (VF MAST)



22D9MS02

1	Outer mast	6	Shim (0.5, 1.0t)	11	Bushing
2	Inner mast	7	Roller	12	Sheave
3	Chain	8	Shim (0.5, 1.0t)	13	Sheave bracket
4	Anchor bolt	9	Tilt cylinder pin		
5	Back up liner	10	Support cap		

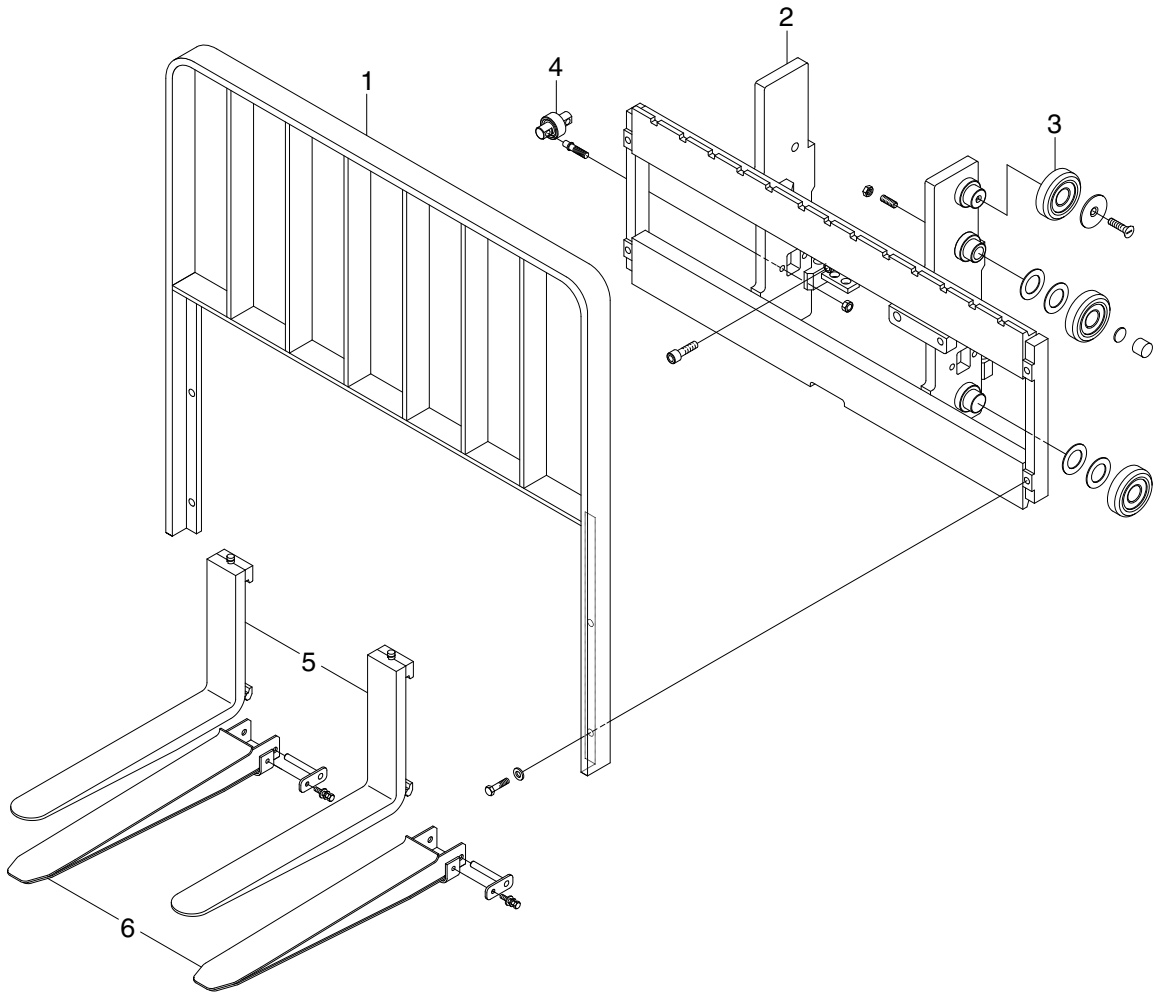
3. 3 STAGE MAST (TF MAST)



22D9MS21

1	Outer mast	6	Roller	11	Sheave
2	Middle mast	7	Shim (0.5, 1.0t)	12	Tilt cylinder pin
3	Inner mast	8	Back up liner	13	Support cap
4	Chain	9	Shim (0.5, 1.0t)	14	Bushing
5	Anchor bolt	10	Sheave bracket	15	Clamp

4. CARRIAGE, BACKREST AND FORK



22D9MS03

1	Backrest	3	Load roller	5	Fork assembly
2	Carriage	4	Side roller	6	Extension fork

GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

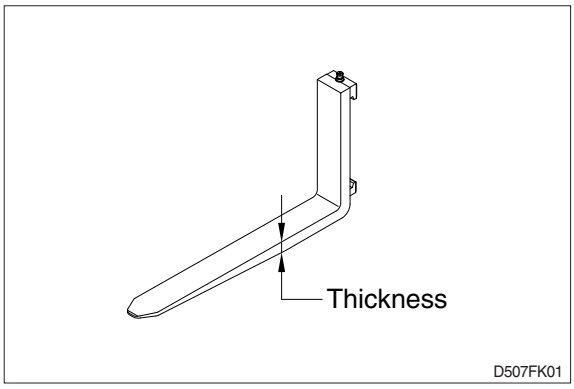
1. OPERATIONAL CHECKS

1) FORKS

(1) Measure thickness of root of forks and check that it is more than specified value.
EX : ℓ = 1050 mm (41.3 in)

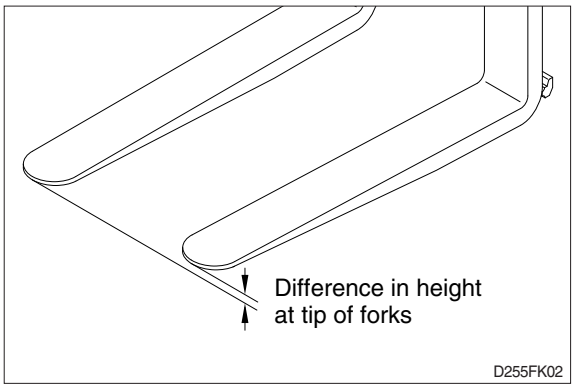
mm (in)

STD Fork assy	Applicable model	Standard	Limit
64HN-21030	25D-9V/VS	45 (1.8)	40 (1.6)
64HN-31020	30D-9V/VS 35DN-9V/VS	45 (1.8)	40 (1.6)



(2) Set forks in middle and measure out of parallel and difference in height at top of forks.

Fork length	Height difference
equal or below 1500	3 mm
above 1500	4 mm



(3) Most force is concentrated at root of fork and at hook, so use crack detection method to check cracks.

2. MAST

1) Check for cracks at mast stay, tilt cylinder bracket, guide bar, fork carriage and roller shaft weld. Check visually or use crack detection method. Repair any abnormality.
2) Set mast vertical, raise forks about 10cm from ground and check front-to-rear clearance and left-to-right clearance between inner mast and fork carriage, and between outer mast and inner mast. Use these figures to judge if there is any play at roller or rail.
   · Front-to-rear clearance : Within 2.0 mm (0.08 in)
   · Left-to-right clearance : Within 2.5 mm (0.10 in)
3) Check that there is an oil groove in bushing at mast support.
4) Set mast vertical, raise forks about 10cm from ground, and push center of lift chain with finger to check for difference in tension.
   If there is any difference in tension, adjust chain stopper bolt.
5) Check visually for abnormalities at thread of chain anchor bolt, and at contact surface between chain wheel and chain.
   Rotate chain wheel by hand and check for any play of bearing.

2. TROUBLESHOOTING

1) MAST

Problem	Cause	Remedy
Forks fail to lower.	· Deformed mast or carriage.	· Disassemble, repair or replace.
Fork fails to elevate	· Faulty hydraulic equipment. · Deformed mast assembly.	· See troubleshooting hydraulic pump and cylinders in section 6, hydraulic system. · Disassemble mast and replace damaged parts or replace complete mast assembly.
Slow lifting speed and insufficient handling capacity.	· Faulty hydraulic equipment. · Deformed mast assembly.	· See troubleshooting hydraulic pump and cylinders in section 6, hydraulic system. · Disassemble mast and replace damaged parts or replace complete mast assembly.
Mast fails to lift smoothly.	· Deformed masts or carriage. · Faulty hydraulic equipment. · Damaged load and side rollers. · Unequal chain tension between LH & RH sides. · LH & RH mast inclination angles are unequal. (Mast assembly is twisted when tilted)	· Disassembly, repair or replace. · See Troubleshooting Hydraulic Cylinders, pump and control valve in section 6, hydraulic system. · Replace. · Adjust chains. · Adjust tilt cylinder rods.
Abnormal noise is produced when mast is lifted and lowered.	· Broken load roller bearings. · Broken side roller bearings. · Deformed masts. · Bent lift cylinder rod. · Deformed carriage. · Broken sheave bearing.	· Replace. · Replace. · Disassemble, repair or replace. · Replace. · Replace. · Replace.
Abnormal noise is produced during tilting operation.	· Insufficient lubrication of anchor pin, or worn bushing and pin. · Bent tilt cylinder rod.	· Lubricate or replace. · Replace.

2) FORKS

<table>
<tr><th>Problem</th><th>Cause</th><th>Remedy</th></tr>
<tr><td>Abrasion</td><td>Long-time operations causes the fork to wear and reduces the thickness of the fork.
Inspection for thickness is needed.
· Wear limit : Must be 90% of fork thickness</td><td>If the measured value is below the wear limit, replace fork.</td></tr>
<tr><td>Distortion</td><td>Forks are bent out of shape by a number of reasons such as overloading, glancing blows against walls and objects, and picking up load unevenly.
· Difference in fork tip height
<table><tr><th>Fork length (mm)</th><th>Height difference (mm)</th></tr><tr><td>equal or below 1500</td><td>3</td></tr><tr><td>above 1500</td><td>4</td></tr></table></td><td>If the measured value exceeds the allowance, replace fork.</td></tr>
<tr><td>Fatigue</td><td>Fatigue failure may result from the fatigue crack even though the stress to fork is below the static strength of the fork. Therefore, a daily inspection should be done.
· Crack on the fork heel.
· Crack on the fork weldments.</td><td>Repair fork by expert.
In case of excessive distortion, replace fork.</td></tr>
</table>

1. MAST LOAD ROLLER (V, VF MAST)

1) INNER/OUTER MAST ROLLER CLEARANCE ADJUSTMENT

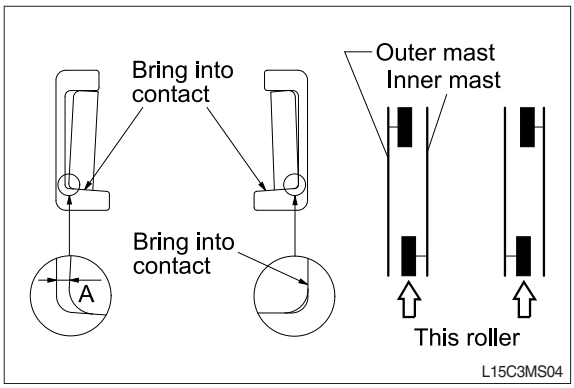
(1) Measure the clearance with the mast overlap at near 480 mm.

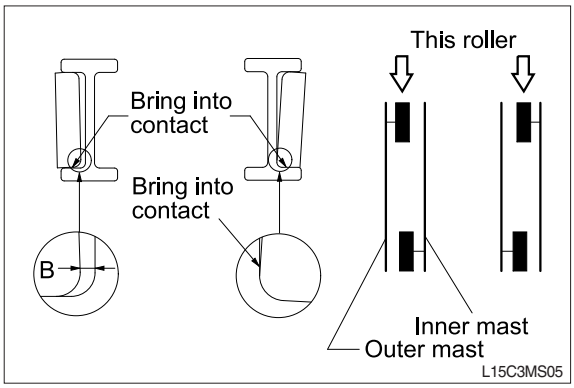
(2) Shift the inner mast to one side to bring the roller into contact with the outer mast, and adjust the clearance between the roller side face and mast at the closest position on the opposite side to the following value by inserting the inner/outer mast roller shim.

- Standard clearance A, B = 0~0.6 mm
- Shim thickness 0.5, 1.0 mm

(3) Distribute the shim thickness equally to the left and right roller. Refer to Mast load roller and back up liner, removal and Installation.

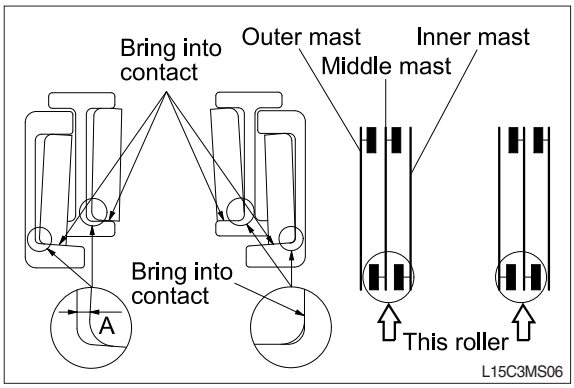
(4) After the adjustment, check that the inner mast moves smoothly in the outer mast.





2. MAST LOAD ROLLER (TF MAST)

1) INNER AND MIDDLE MAST ROLLER CLEARANCE ADJUSTMENT



(1) Measure the clearance with the mast overlap at near 480 mm.

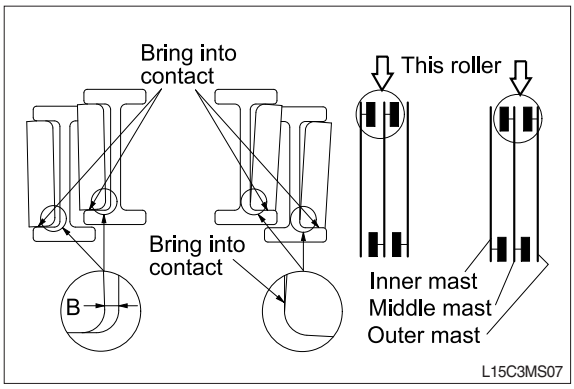
(2) Shift the inner mast to one side to bring the roller into contact with the outer mast and the middle mast, and adjust the clearance between the roller side face and mast at the closest position on the opposite side to the following value by inserting the inner and middle mast roller shim, respectively.

- Standard clearance A = 0~0.6 mm
- Shim thickness 0.5, 1.0 mm

(3) Distribute the shim thickness equally to the left and right roller. Refer to Mast load roller and back up liner, removal and Installation.

(4) After the adjustment, check that the inner mast moves smoothly in the middle mast, and the middle mast moves smoothly in the outer mast.

2) OUTER AND MIDDLE MAST UPPER ROLLER CLEARANCE ADJUSTMENT.



(1) Measure the clearance with the mast overlap at near 480 mm.

(2) Shift the inner mast to one side to bring the roller into contact with the outer mast and the middle mast, and adjust the clearance between the roller side face and mast at the closest position on the opposite side to the following value by inserting the outer and middle mast roller shim, respectively.

- Standard clearance B = 0~0.6 mm
- Shim thickness 0.5, 1.0 mm

(3) Distribute the shim thickness equally to the left and right roller. Refer to Mast load roller and back up liner, removal and Installation.

(4) After the adjustment, check that the inner mast moves smoothly in the middle mast, and the middle mast moves smoothly in the outer mast.

3) CARRIAGE LOAD ROLLER

(1) Measure the clearance when the center of the carriage upper roller is 100 mm from the top of the inner mast.

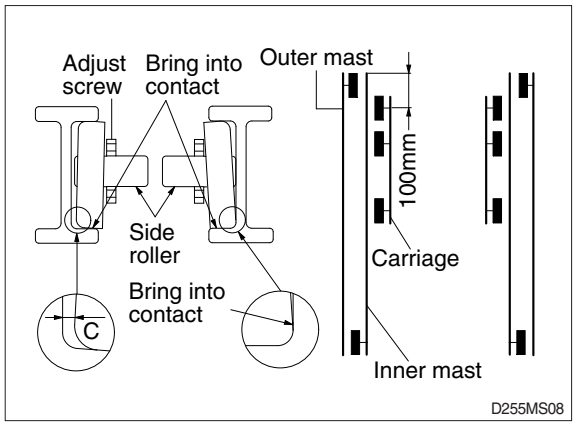
(2) Measure the clearance at upper, middle and lower rollers after loosen the adjust screws from the side rollers. Shift the carriage to one side to bring the roller into contact with the inner mast, and measure the clearance between the roller side face and mast at the closest position on the opposite side to the following value by inserting the carriage roller shim.

· Standard clearance C = 0~0.6mm

· Shim thickness 0.5, 1.0mm

(3) Distribute the shim thickness equally to the left and right roller. Refer to Carriage assembly.

(4) After the adjustment, the carriage should move smoothly along the overall mast length.



4) MAST BACK UP LINER

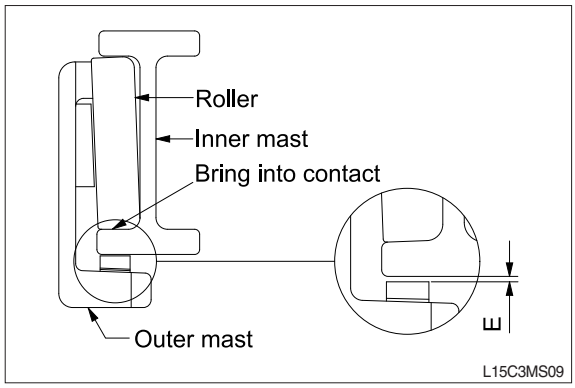
(1) Measure the clearance with the middle mast at the bottom position.

(2) With the middle mast in contact with the outer mast roller, adjust the clearance between the mast back up liner and middle mast to the following value by inserting the back up liner shim.

· Standard clearance E = 0.2 ~ 0.6 mm

· Shim thickness 0.5, 1.0 mm

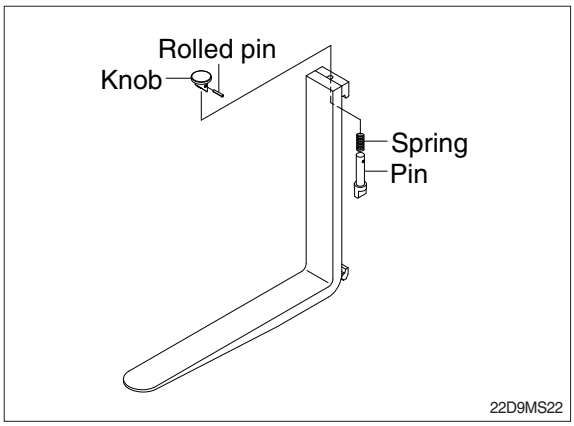
(3) After the adjustment, the mast should move smoothly.



GROUP 4 REMOVAL AND INSTALLATION

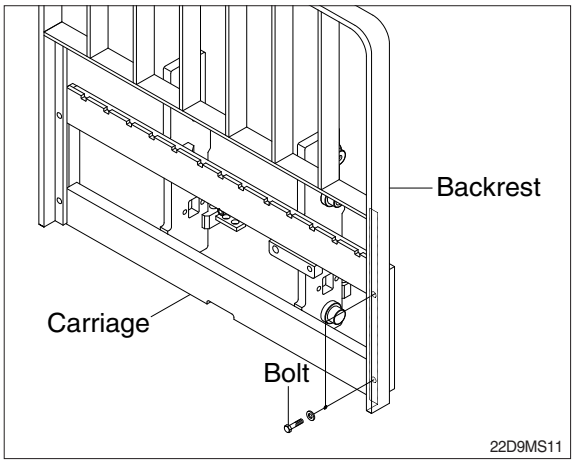
1. FORKS

1) Lower the fork carriage until the forks are approximately 25 mm (1 inch) from the floor.
2) Turn the knob up and slide forks, one by one, toward the center of the carriage where a notch has been cut in the bottom plate for easy fork removal.
3) Remove the fork one by one. On larger forks it may be necessary to use a block of wood.
4) Reverse the above procedure to install load forks.



2. BACKREST

1) Remove bolts securing backrest to fork carriage. Disassemble the backrest from the carriage.
2) Position backrest on carriage and lower in place. Install and tighten bolts.



3. CARRIAGE ASSEMBLY

1) CARRIAGE

(1) With the mast vertical, raise the carriage high enough to place blocks under the load forks. This is done to create slack in the load chains when the carriage is lowered. Lower the carriage all the way down to the floor. Make sure the carriage is level, this will prevent any binding when the mast is raised.
(2) While supporting lift chains, remove the split pin and slide out chain anchor pins from the chain anchors of stationary upright.
(3) Pull the chains out of the sheaves and drape them over the front of the carriage.
(4) Slowly raise elevating upright until mast clears top of fork carriage. Move carriage to work area and lower mast.

⚠ **Make sure carriage remains on floor and does not bind while mast is being raised.**

(5) Inspect all parts for wear or damage. Replace all worn or damaged pars.
(6) Reverse the above steps to reinstall.

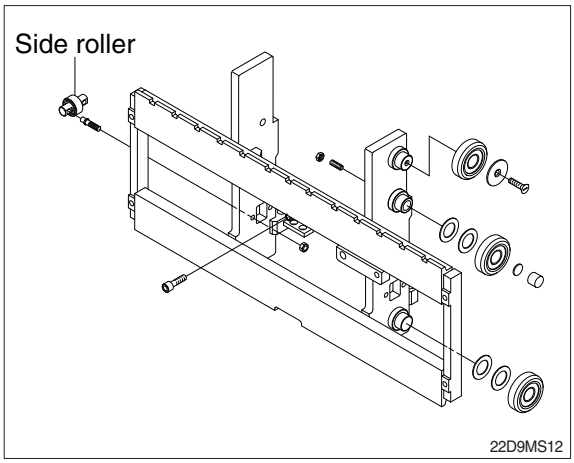
⚠ **Replace the split pin of chain anchor with new one.**

2) SIDE ROLLER

(1) Remove carriage as outlined in the carriage assembly and removal paragraph.
(2) Loosen and remove nuts, adjust screws and side rollers from carriage side pate.
(3) Thoroughly clean, inspect and replace all worn or damaged parts.
(4) Reverse the above procedure to assembly.

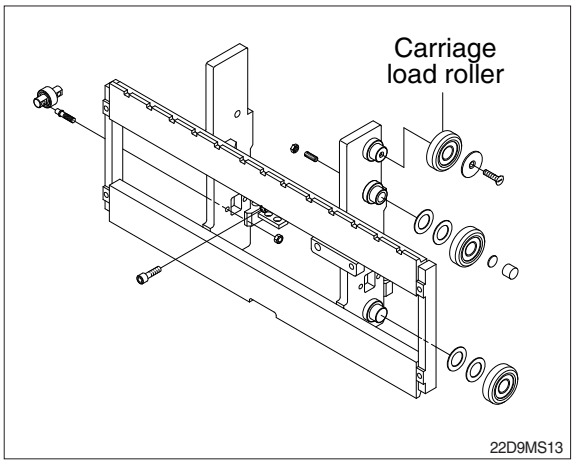
※ **Adjustment**

· Once carriage is properly installed, loosen nuts and adjust screws, (if not already done) allowing carriage to be centered in the inner mast.
· Adjust side roller by tightening screw until side roller just makes contact with mast. Back off approximately 1/10 turn on screw and tighten nut to lock screw in place.
· Run carriage up and down for the inner mast to be sure the carriage has free movement and does not stick. Also, make sure chains are properly adjusted. Refer to chain adjustment paragraph. Make adjustment when necessary and recheck operation of carriage.



3) CARRIAGE LOAD ROLLER

(1) Remove carriage as outlined in the carriage assembly removal paragraph.
(2) Loosen and remove flat head bolts and plain washers from top load roller bracket.
(3) Using a pryer, remove load rollers from load roller bracket.
(4) Reverse the above procedure to assemble. Refer to MAST ROLLER ADJUSTMENT paragraph.



4) MAST LOAD ROLLER AND BACK UP LINER

(1) 2 stage mast (V mast)

① Remove the carriage assembly and move them to one side.

② Loosen and remove hexagon bolts and washers securing lift cylinders to inner mast.

③ Loosen and remove hexagon bolts and nuts securing lift cylinders to inner mast.

④ Attach chains or sling to the inner mast section at top crossmember. Using an overhead hoist, slowly raise the inner mast high enough to clear lift cylinder.

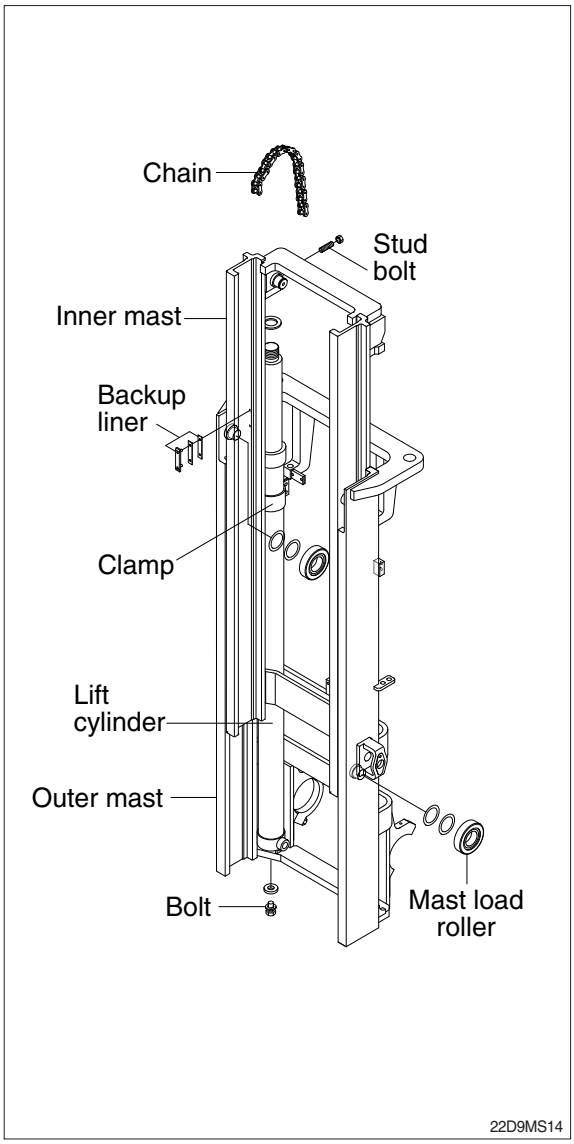
⑤ After lowering the lift cylinder rods, and disconnecting lift cylinder hose, tilt the lift cylinders LH and RH and them with ropes to the outer mast.

⑥ Using the overhead hoist, lower inner mast until top and bottom rollers and back up liners are exposed.

⑦ Using a pryer, remove load rollers from load roller bracket. Remove back up liners and shims.

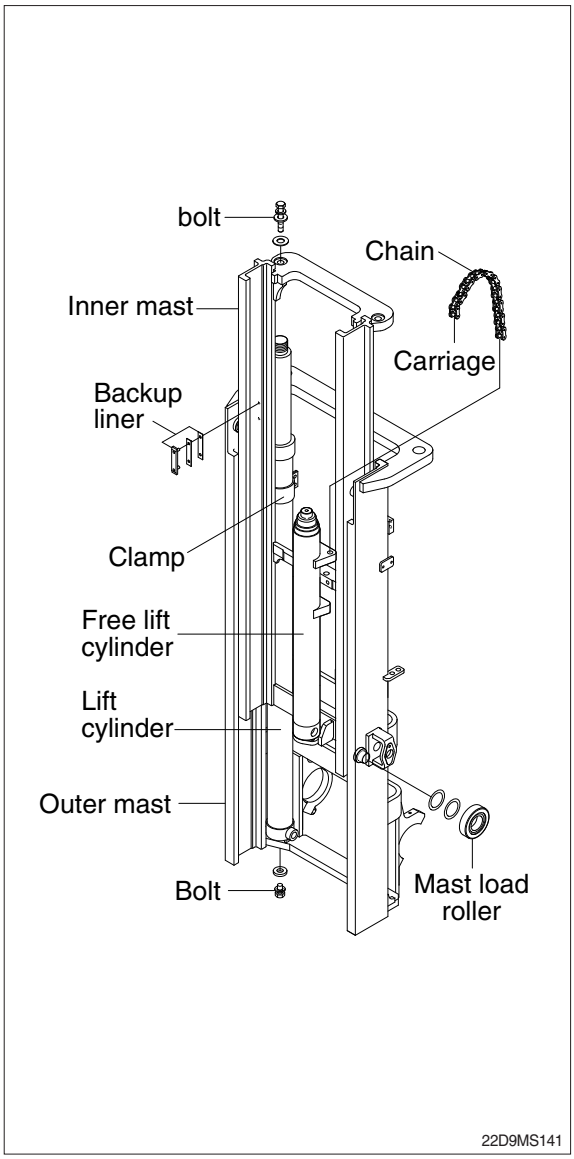
⑧ Thoroughly clean, inspect and replace all worn or damaged parts.

⑨ Reverse the above procedure to assemble. Refer to MAST LOAD ROLLER ADJUSTMENT paragraph.



(2) 2 stage mast (TF mast)

① Remove free lift chain connected between carriage and free lift cylinder.
② Remove the carriage assembly and move them to one side.
③ Loosen and remove hexagon bolts and washers securing lift cylinders to inner mast.
④ Loosen and remove hexagon bolts and nuts securing lift cylinders to inner mast.
⑤ Attach chains or sling to the inner mast section at top crossmember. Using an overhead hoist, slowly raise the inner mast high enough to clear lift cylinder.
⑥ After lowering the lift cylinder rods, and disconnecting lift cylinder hose, tilt the lift cylinders LH and RH and them with ropes to the outer mast.
⑦ Using the overhead hoist, lower inner mast until top and bottom rollers and back up liners are exposed.
⑧ Using a pryer, remove load rollers from load roller bracket. Remove back up liners and shims.
⑨ Thoroughly clean, inspect and replace all worn or damaged parts.
⑩ Reverse the above procedure to assemble. Refer to MAST LOAD ROLLER ADJUSTMENT paragraph.



(2) 3 stage mast (TF mast)

① Remove the carriage assembly and move to one side.

② Loosen and remove hexagon bolt securing bottom cylinder from outer mast.

③ Loosen and remove bolts and special washers securing lift cylinders to middle mast.

④ Attach chains or sling to the inner and middle mast section at top crossmember. Using an overhead hoist, slowly raise the uprights high enough to clear lift cylinder.

⑤ After lowering the lift cylinder rods, and disconnecting lift cylinder hose, tilt the lift cylinders LH and RH and tie them with ropes to the outer mast.

⑥ Using the overhead hoist raise inner and middle masts. Place 4 inch block of wood under the free lift cylinder bracket of the inner mast then lower mast sections (this will create slack in the chains).

⑦ Remove retaining rings securing chain sheaves to sheave support brackets. While support chains, remove chain sheaves and let chains hang free. The upper outer and lower middle mast rollers and back up liners are now exposed.

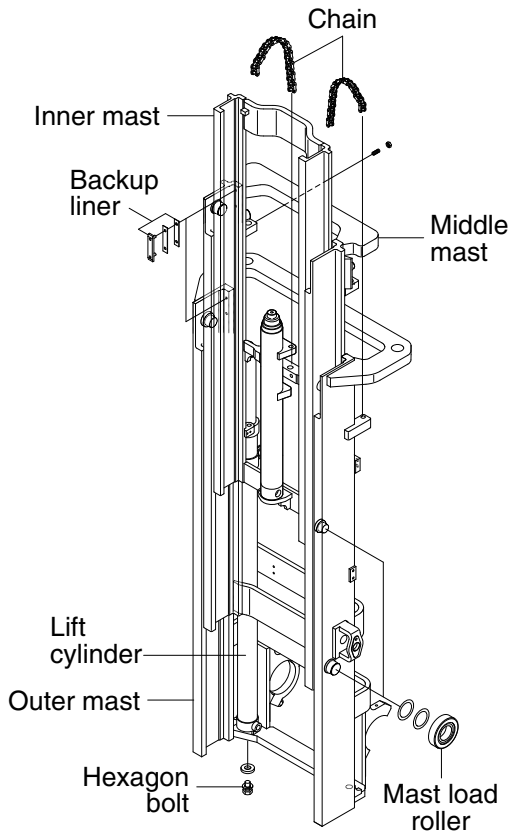
⑧ Using a pryer, remove load rollers from load bracket. Remove back up liners and shims.

⑨ Attach chains or sling to the middle mast section at top crossmember. Using an overhead hoist, slowly raise the middle mast until top and bottom rollers are exposed.

⑩ Using a player, remove load rollers from load roller bracket.

⑪ Thoroughly clean, inspect and replace all worn or damaged parts.

⑫ Reverse the above procedure to assemble. Refer to MAST LOAD ROLLER ADJUSTMENT paragraph.



22D9MS15

5) ELEVATING MAST

(1) Inner mast (V, VF mast)

① After completing all necessary steps for load rollers and back up liner removal use an overhead hoist and sling or chain around upper crossmember of the inner mast section.

② Lift inner mast upright straight up and out of outer mast section.

③ Replace and reverse above procedure to install. Make all necessary measurements and adjustments.

(2) Inner and middle mast (TF mast)

① After completing all necessary steps for load rollers and back up liner removal. Remove rear chains and sheave support if not already done.

② Disconnect free lift cylinder hose. Drain hose into a suitable pan or container and cap hose.

③ While supporting free lift cylinder assembly, remove bolts and washers securing cylinder to mast crossmember.

④ Place a sling around free lift cylinder and attach to an overhead hoist. Slowly raise and move cylinder to one side.

⑤ Attach chains or sling to the inner mast section at top crossmember. Using an overhead hoist slowly raise the upright straight up and out of middle mast section.

⑥ Attach chains or sling to the middle mast section at top crossmember. Using an overhead hoist slowly raise the upright straight up and out of outer mast section.

⑦ Replace upright and reverse above procedure to install. Make all necessary measurements and adjustments.

6) CHAIN

(1) Chain sheave (V, VF mast)

① Place a sling around carriage and attach to an overhead hoist. Lift carriage high enough so that the tension on the chain over sheaves is relieved after the carriage is blocked. Position wooden blocks under the carriage and lower it.

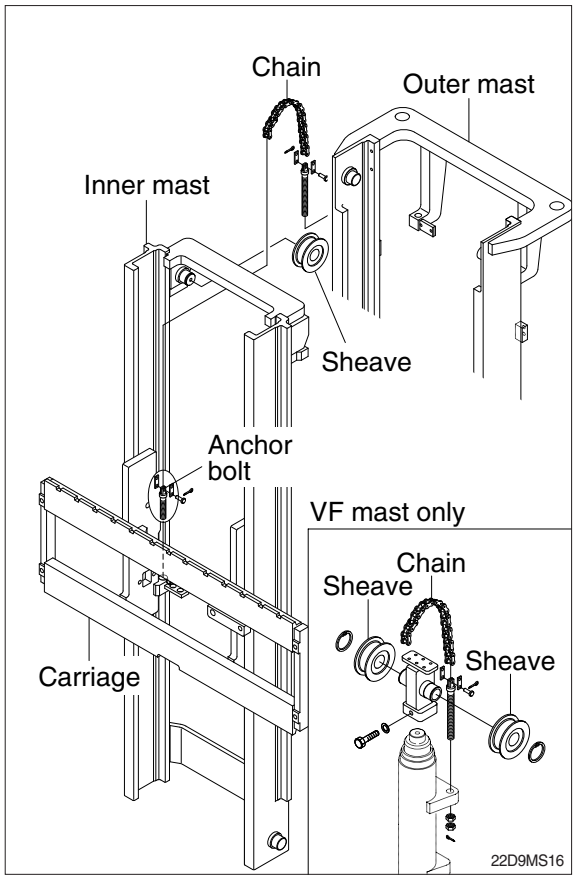
② Remove the split pin securing the chain anchor pins and discard. While supporting the chains, remove the chain anchor pins and drape the chains over the carriage.

③ Remove retaining ring securing sheaves to sheave support. Remove sheaves with bearings.

④ Remove bearing retaining ring from sheave and press bearings from sheaves.

⑤ Thoroughly clean, inspect and replace all worn or damaged parts.

⑥ Reverse the above to assemble and install.



(2) Rear chain sheave (TF mast)

① Raise and securely block carriage and inner mast section.

② Remove the split pin securing the chain anchor pins and discard. While supporting the chains, remove the chain anchor pins from outer mast section.

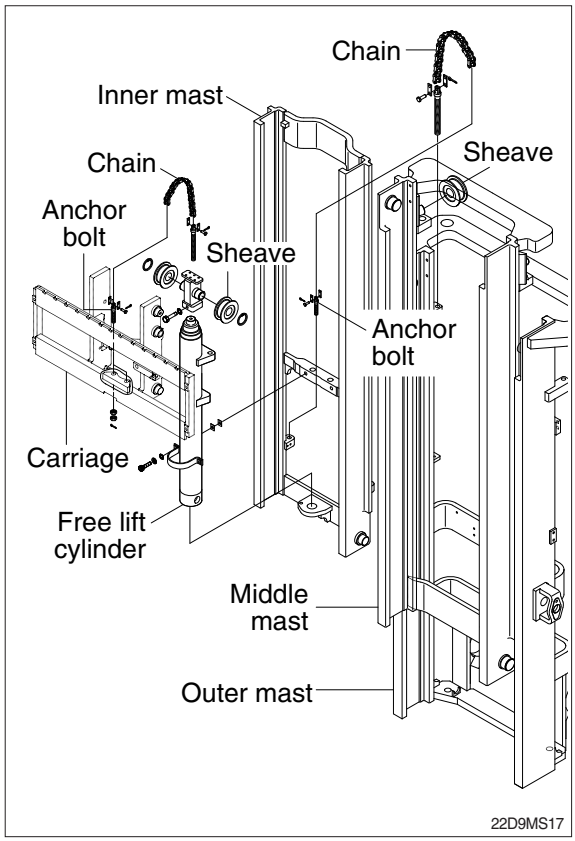
③ Remove chains.

④ Remove retaining ring securing chain sheaves to sheave support. Pry off sheaves with bearings.

⑤ Remove bearing retaining ring from sheave and press bearings from sheaves.

⑥ Thoroughly clean, inspect and replace all worn or damaged parts.

⑦ Reverse the above procedure to assemble and install. Use new split pins in chain anchor pins.



(3) Chain wheel bearing support (TF mast)

① Remove the carriage assembly and move to one side.
② After removing bolt to securing chain wheel bearing support assembly to free lift cylinder.
After a sling to the chain wheel bearing support assembly. Using an overhead hoist, lift support assembly straight up and off of free lift cylinder. Move assembly to work area.
③ Remove retaining ring securing chain wheel bearing to chain wheel bearing support.
④ Remove bearing retaining ring from chain wheel bearing and press bearings from chain wheel bearings.
⑤ Thoroughly clean, inspect and replace all worn or damaged parts.
⑥ Reverse the above procedure to install.

(4) Rear chain (TF mast)

① Remove the carriage assembly and move to one side. Refer to carriage removal and installation.
② Raise and securely block truck approximately 6 inches from the floor.
③ Using a sling or chain around inner mast section attached to an overhead hoist, slowly raise inner mast until there is enough slack in the chains to remove them. Block inner mast section.
④ Remove split pins and chain anchor pins securing chains to chain anchor(part of inner mast).
⑤ While supporting the chains, remove split and chain anchor pins securing chains to chain anchors attached to outer mast section.
⑥ Remove chains.
⑦ Reverse the above to assemble and install. Use new split pins in chain anchor pins. Refer to this section for Load chain lubrication and adjustment.

(5) Carriage chain

① Place a sling around carriage front plate and attach to an overhead hoist. Lift and secure carriage high enough so that split and chain anchor pins on carriage can be easily be removed. Remove chain anchor pins from carriage and drape chains out over carriage.
② Place a wooden block under the carriage and lower the carriage on the block.
③ While supporting the chains, remove split pins and chain anchor pins from chain anchors.
④ Remove chains and wash them with solvent. Refer to this section for Load chain inspection and maintenance.
⑤ Reverse the above procedure to assemble and install. Use new split pins in chain anchor pins. Refer to this section for Load chain lubrication and adjustment.

(6) Load chain inspection and maintenance

After every 200 hours of truck operation, lift chains should be inspected and lubricated inspect for the following chain conditions :

① Wear

As the chain flexes on and off the chain wheel bearings, the joints very gradually wear. The stretch a chain developes in service is due to material being worn off pin outer diameter and pitch hole inner diameter on the inside plate.

Chain wear can be measured using a wear scale or steel tape. When chains have elongated 2%, they should be discarded. When checking chain wear, be sure to measure a segment of chain that operates over a sheave. Do not repair chains by cutting our the worn section and splicing in a new piece. If part of the chain is worn, replace all the chains on the truck.

② Rust and corrosion

Chains used on lift trucks are highly stressed precision components. It is very important that the “as-manufactured” ultimate strength and fatigue strength be maintained throughout the chain service life. Corrosion will cause a major reduction in the load-carrying capacity of lift chain or roller chain because corrosion causes side plate cracking.

③ Cracked plate

The most common cause of plate cracking is fatigue failure. Fatigue is a penomenon that affects most metals and many plastics. After many repeated heavy loads, the plates may crack and the chains will eventually break. Fatigue cracks are almost always found through the pitch holes perpendicular to the pitch line. Contrast this failure mode to the random failures caused by stress-corrosion cracking. If cracks are present, replace all the chain on the truck. Noise in the chain indicates that the plate is on the verge of cracking and will be failed before long.

④ Tight joints

All joints in lift chain should flex freely. Tight joints resist flexure, increase internal friction, thus increasing chain tension required to lift a given load. Increased tension accelerates wear and fatigue problems.

Tight joints in lift chains can be caused by :

· Bent pins or plates.
· Rusty joints.
· Peened plate edges.

Oil rusty chains and replace chains with bent or peened components.

⑤ Protruding or turned pins

Heavily loaded chains operating with lube generate tremendous friction between pins and plates. In extreme cases, the frictional torque in the joint can actually turn pins in the press-fit outside plates. If chain is allowed to operate in this condition, the pins slowly work out of the chain causing chain failure. Turned pins can be quickly spotted because the flats on the V heads are no longer in line. Chains with turned or protruding pins should be replaced immediately. Do not attempt to repair the chain by driving pins back into the chain.

Chain side wear

⑥ A wear pattern on pin heads and outside plates indicates misalignment. This condition damages chain and sheaves as well as increasing internal friction in the chain system.

Chain anchors and chain wheel bearings

⑦ An inspection of the chain system includes a close examination of chain anchors and chain wheel bearings. Check chain anchors for wear, breakage and misalignment.

Anchors with worn or broken fingers should be replaced. Anchors should be adjusted to eliminate twisting or other misalignment in the chain. When chain is misaligned, load is not distributed uniformly between the plates. Prolonged operation will result in premature fatigue failure. Chain wheel bearings with badly worn flanges and outside diameter should be replaced. Heavy flange wear indicates chain misalignment.

⑧ Chain wear scale

The chain can be checked for wear or stretching with the use of a chain wear scale. Stretching of a chain is due to the elongation of the pitch holes and wearing of the pin O.D. The greatest amount of stretching occurs at the areas of the chain that flex over the sheaves most frequently. Check the chain at this point with a scale. The wear scale has instructions printed on the sides for use in determining chain stretch and are as follows :

· Determine pitch length of chain using 6 inch scale on one side of wear scale.
· If pitch is 1/2(12.7㎜), 3/4(19.05㎜), 1(25.4㎜), 1-1/2(38.1㎜), 2(50.8㎜), use side A of scale.
· If pitch is 5/8(15.875㎜), 1-1/4(31.75㎜) or 2(50.8㎜), use side B.
· Align point A or B to center of a pin and note position of the opposite A or B point.
· If other point also lines up with a pin, the chain is worn and should be replaced.

If any of the above conditions exists(cracked plates, turned pins, stretching etc), the chains should be replaced in pairs as a complete assembly. Order chains by part number to insure the correct chain length, pitch and material specifications.

(7) Load chain lubrication and adjustment

① Lubrication

The most important consideration in field maintenance of lift chains is lubrication. Hard working, heavily loaded chains cannot be expected to give satisfactory wear life without scheduled periodic re-lubrication. Like all bearing surfaces, the precision manufactured, hardened steel, joint-wearing surfaces require a film of oil between mating parts to prevent rapid wear. Oil must penetrate the chain joint to prevent wear. Applying oil to external surfaces will prevent rust, but oil must flow into the live bearing surfaces for maximum wear life. Frequency of re-lube will vary with operating conditions and environment, the best estimate of lube period is 200 hours. Trucks parked outdoors or trucks in extremely severe service, may require more frequent re-lube to maintain an oil film on all chain surface.

· Wipe off the old oil with a clean cloth and blow out the remaining dirt with compressed air.

⚠ Wear eye protection.

· With a clean brush, apply EP-140 extreme pressure lubricant or heavy motor oil (40W).

② Replacement

Replace chains as a pair. It will be virtually impossible to maintain uniform loading between the strands if a new chain is put into service opposite an old chain. The jonts in the old chain will be greater than that on the new chain, greatly complicating the problem of maintaining equal chain tension. The new chain will wear more slowly causing it to bear the major portion of the load resulting in premature wear and fatigue failure. Don't steam clean or decrease new chains.

The manufacturer's grease is effective in reducing wear and corrosion. If the original factory lube is dried out or wiped off, soak the new chain in heavy engine oil for at 1/2 hour prior to installing on truck. After the old chains have been stripped from the mast, very carefully inspect chain anchors and chain wheel bearing. Broken, cracked or worn anchor must be replaced using the new anchor pin and split pin. Do not paint newly replaced chain after it has been installed.

③ **Adjustment**

Chain adjustments are important for the following reasons :

- Equal loading of chain.
- Proper sequencing of mast.
- Prevent over-stretching of chains.
- Prevent chains from jumping off sheaves if they are too loose.

④ **Adjustment procedure**

- With mast in its fully collapsed and vertical position, lower the fork to the floor.
- Adjust the chain length by loosening or tightening nut on the chain anchor.
  After making adjustment on the mast, be sure to tighten the nut.