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1. STRUCTURE

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

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

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

SECTION 1 GENERAL

This section 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

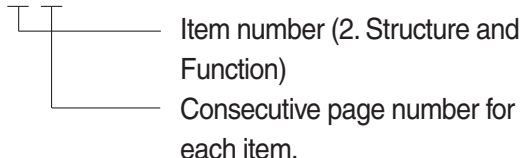
1. See the page number on the bottom of the page.

File the pages in correct order.

2. Following examples shows how to read the page number.

Example 1

2 - 3



3. Additional pages : Additional pages are indicated by a hyphen (-) and number after the page number. File as in the example.

8 - 4

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Added pages

Revised edition mark (①②③···)

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

Revisions

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

Symbols

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

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

3. CONVERSION TABLE

Method of using the Conversion Table

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

Example

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

Convert 55 mm into inches.

- (1) Locate the number 50 in the vertical column at the left side, take this as (a), then draw a horizontal line from (a).
- (2) Locate the number 5 in the row across the top, take this as (b), then draw a perpendicular line down from (b).
- (3) Take the point where the two lines cross as (c). This point (c) gives the value when converting from millimeters to inches. Therefore, 55 mm = 2.165 inches.

2. Convert 550 mm into inches.

- (1) The number 550 does not appear in the table, so divide by 10 (move the decimal point one place to the left) to convert it to 55 mm.
- (2) Carry out the same procedure as above to convert 55 mm to 2.165 inches.
- (3) The original value (550 mm) was divided by 10, so multiply 2.165 inches by 10 (move the decimal point one place to the right) to return to the original value.
This gives 550 mm = 21.65 inches.

Millimeters to inches

(b)

1 mm = 0.03937 in

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

Millimeters to inches

1 mm = 0.03937in

	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
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80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Kilogram to Pound

1 kg = 2.2046lb

	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
 $1 \ell = 0.2642 \text{ U.S. Gal}$

	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	6.076	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
 $1 \ell = 0.21997 \text{ U.K. Gal}$

	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	7.699	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	296.6	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

1 kgf / cm² = 14.2233 lbf / in²

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

TEMPERATURE

Fahrenheit-Centigrade Conversion.

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

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

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

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

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

SECTION 1 GENERAL

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GROUP 1 SAFETY HINTS

Careless performing of the easy work may cause injuries.

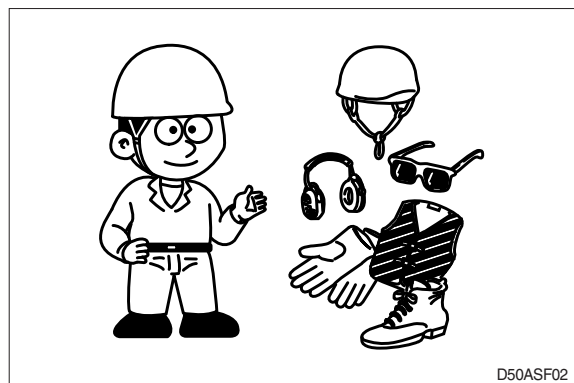
Take care to always perform work safely, at least observing the following.

- Oil is a dangerous substance. Never handle oil, grease or oily clothes in places where there is any fire of flame.

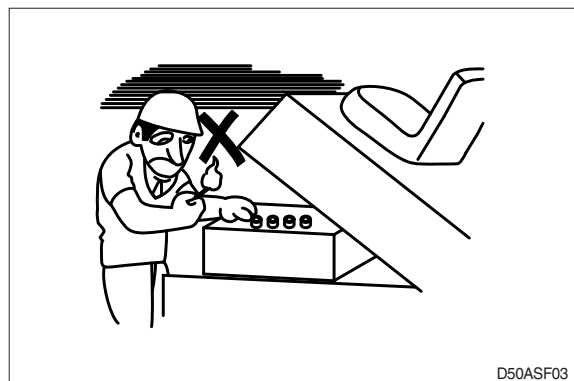
As preparation in case of fire, always know the location and directions for use of fire extinguishers and other fire fighting equipment.



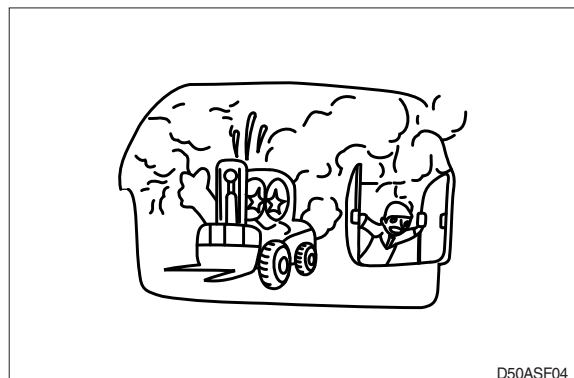
- Wear well-fitting helmet, safety shoes and working clothes. When drilling, grinding or hammering, always wear protective goggles. Always do up safety clothes properly so that they do not catch on protruding parts of machines. Do not wear oily clothes. When checking, always release battery plug.



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

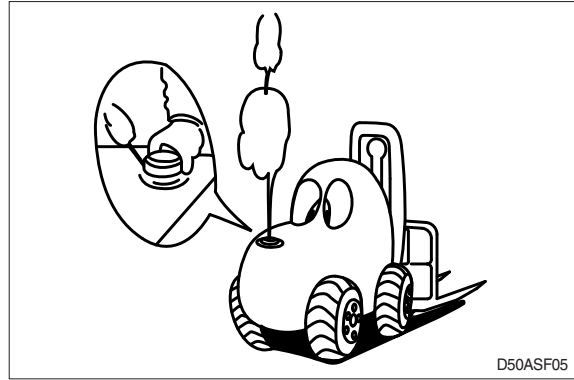


- Exhaust gas is dangerous. Provide adequate ventilation when working a closed space.



⚠ 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.



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



- Hang a caution sign in the operator's compartment (For example **Do not start** or **Maintenance in progress**).

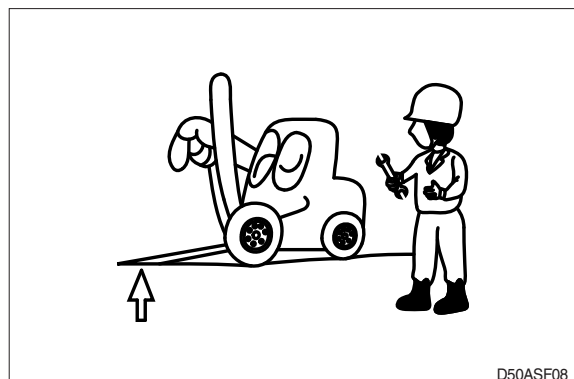
This will prevent anyone from starting or moving the machine by mistake.

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

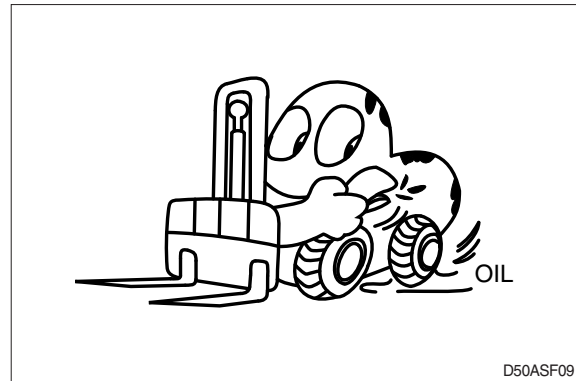


When inspecting the engine is running parts, or near such parts, always stop the engine first. Before checking or servicing accumulator or piping, depress brake pedal repeatedly to release pressure.

- 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.

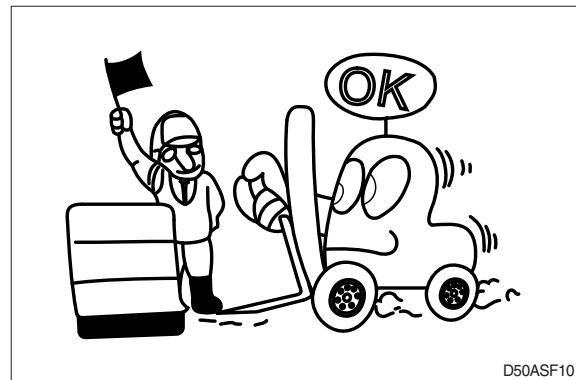


- Immediately remove any oil or grease on the floor of the operator's compartment, or on the handrail. It is very dangerous if someone slips while on the machine.



D50ASF09

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



D50ASF10

- 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.



D50ASF11

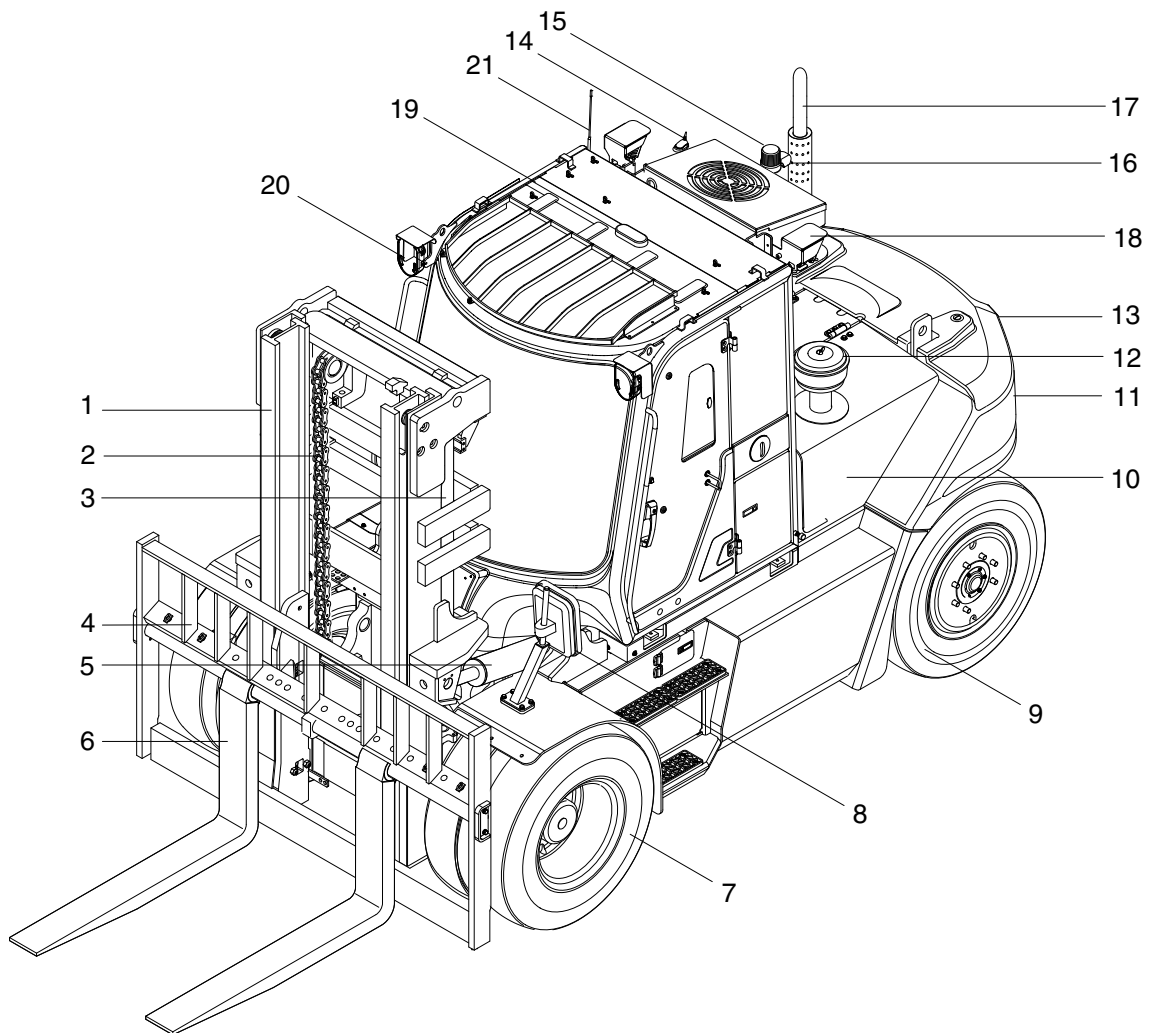
- Always remember that the hydraulic oil circuit is under pressure. When feeding or draining the oil or carrying out inspection and maintenance, release the pressure first.

- 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

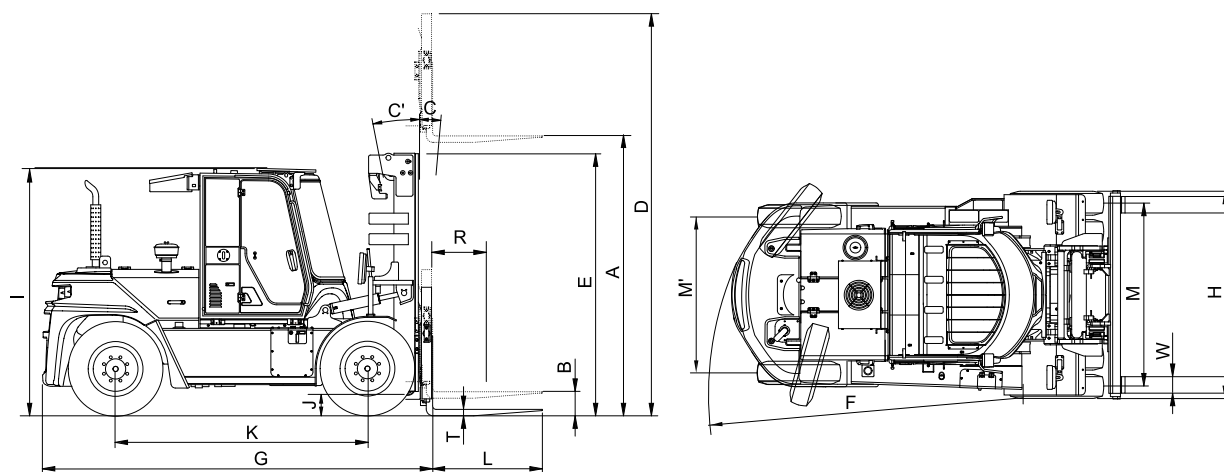
1. MAJOR COMPONENTS



100D9V3CD10

- | | | |
|-------------------------|--------------------------|------------------------------|
| 1 Mast | 8 Rear view mirror | 15 Beacon lamp (option) |
| 2 Lift chain | 9 Rear wheel | 16 Camera (option) |
| 3 Lift cylinder | 10 Body wing cover | 17 Silencer |
| 4 Carriage and backrest | 11 Rear combination lamp | 18 Rear work lamp |
| 5 Tilt cylinder | 12 Preclenaer | 19 Cabin |
| 6 Fork | 13 Counterweight | 20 Head and turn signal lamp |
| 7 Front wheel | 14 Mobile antenna | 21 Antenna |

2. SPECIFICATIONS



100D9V8SP01

Model			Unit	100D-9
Capacity			kg (lb)	10000 (22000)
Load center		R	mm (in)	600 (24")
Weight(Unloaded)			kg (lb)	12779 (27173)
Fork	Lifting height	A	mm (ft·in)	3025 (9' 11")
	Free lift	B	mm (in)	150 (5.9)
	Lifting speed (Unload/Load)		mm/sec (ft/min)	450/400 (88.6/78.7)
	Lowering speed (Unload/Load)			450/450 (78.7/78.7)
	L×W×T	L,W,T	mm (in)	1200×180×75(47.2×7×3)
	Carriage width	N	mm (in)	2265 (89.2)
Mast	Tilt angle (forward/backward)	C/C'	degree	15/10
	Max. height	D	mm (ft·in)	4360 (14' 4")
	Min. height	E	mm (ft·in)	2850 (9' 4")
Body	Travel speed (Unload)		km/h (mph)	33.4 (20.8)
	Gradeability (Load)		%	33.8
	Min. turning radius (Outside)	F	mm (ft·in)	3965 (13' 0")
ETC	System set pressure		bar (psi)	245 (3553)
Overall length		G	mm (ft·in)	4265 (14' 0")
Overall width		H	mm (ft·in)	2265 (7' 5")
Cabin height		I	mm (ft·in)	2680 (8' 10")
Ground clearance		J	mm (in)	250 (9.8)
Wheel base		K	mm (ft·in)	2750 (9' 0")
Wheel tread front/rear		M/M'	mm (ft·in)	1693/1700 (5' 7"/5' 7")

3. SPECIFICATION FOR MAJOR COMPONENTS

1) ENGINE

Item	Unit	Specification
Model	—	Cummins QSF3.8
Type	—	Vertical, 4 cycle DI, diesel engine
Cooling Method	—	Water cooling
Number of cylinders and arrangement	—	4 cylinders, In-line
Firing order	—	1-3-4-2
Combustion chamber type	—	Direct injection
Cylinder bore X stroke	mm (in)	102 × 115 (4.0 × 4.5)
Piston displacement	cc (cu in)	3726 (227.4)
Compression ratio	—	17.2 : 1
Rated gross horse power	ps/rpm	122.4/2200
Maximum torque at rpm	kgf·m/rpm	51/1500
Engine oil quantity	ℓ (U.S. gal)	12 (3.17)
Dry weight	kg (lb)	360 (794)
High idling speed	rpm	2450
Low idling speed	rpm	850
Rated fuel consumption	g/kWh	217
Starting motor	V-kW	24-4.8
Alternator	V-A	28-70
Battery	V-AH	24-80

2) MAIN PUMP

Item	Unit	Specification
Type	—	Gear fixed pump
Model	—	Cassppa PLP
Displacement	cc/rev (in ³ /rev)	35.4 (2.1)+35.4 (2.1)+9.49 (0.5)
Maximum operating pressure	bar (psi)	280 (4061)/280 (4061)/250 (3625)
Rated speed (Max/Min)	rpm	3000/600
Weight	kgf (lbf)	28.7 (408)

3) MAIN CONTROL VALVE (MCV)

Item	Unit	Specification
Type	—	Mono block (3spool), Semi-Mono block (4 / 5spool)
Model	—	Walvoil
Operating method	-	Hydraulic pilot
Maximum flow rated	lpm (U.S. gpm)	160 (42)
Lift/tilt relief valve set pressure (DV1)	bar (psi)	255 (3698)
Attachment oil flow rated (aux1/2/3)	lpm (U.S. gpm)	110 / 110 / 110 (29 / 29 / 29)
Attachment relief valve pressure (DV2)	bar (psi)	140 (2030)

4) STEERING UNIT

Item	Unit	Specification
		100D-9
Type	—	Load sensing
Model	—	VSP 200 LSH
Capacity	cc/rev (in ³ /rev)	200 (12.2)
Steering relief valve set pressure	bar (psi)	160 ~ 165 (2320 ~ 2390)
Weight	kgf (lbf)	5.5 (12)

5) CYLINDER

Index			Unit	Specification
				100D-9
Main lift	V300	Tube bore diameter × Rod diameter × Stroke	mm (in)	85×60×1475 (3.34×2.36×58.1)
Main lift	TS450			85×60×1463 (3.34×2.36×57.6)
Free lift				95×70×767 (3.74×2.76×30.2)
Tilt (15/10 degree)				115×60×307 (4.53×2.36×12.09)
Steering				85×55×149.5 (3.35×2.16×5.89)
Weight	Lift	V300	kgf (lbf)	68.1 (150)
	Tilt	15/10 degree		48 (106)

6) POWER TRAIN DEVICED

Item			Specification	
			100D-9	
Torque converter	Type		3 Element, 1 stage, 2 phases	
	Stall ratio		5.3 : 1	
Transmission	Type		Full auto, power shift	
	Gear shift (F/R)		2/1	
	Adjustment		Electrical single lever type	
	Overhaul ratio	FR	1 : 2.456	2 : 0.946
		RR	1 : 2.494	
Axle	Type		Front-wheel drive type, fixed location	
	Gear ratio		12.86	
	Gear		Ring & pinion gear type	
Wheels	Q'ty (FR/RR)		Double : 4/2	
	Front (drive)		9.00-20-14 PR	
	Rear (steer)		9.00-20-14 PR	
Brakes	Travel		Front wheel, wet disc brake	
	Parking		Calliper disc, SHAR (Spring Actuate Hydraulic Release) type	
Steering	Type		Full hydraulic, power steering	
	Steering angle		75.87° to both right and left angle, respectively	

4. TIGHTENING TORQUE FOR MAJOR COMPONENTS

NO	Item		Size	kgf · m	lbf · ft
1	Engine	Engine mounting bolt	M12 × 1.25	12.3 ± 3.0	89 ± 21.7
2		Engine bracket mounting nut	M10 × 1.5	6.9 ± 1.4	50 ± 10.1
3		Radiator mounting bolt, nut	M10 × 1.5	6.9 ± 1.4	50 ± 10.1
4	Hydraulic system	Hydraulic pump mounting bolt	M16 × 2.0	19 ± 2	137.5 ± 14.5
5		MCV mounting bolt	M 8 × 1.25	2.5 ± 0.5	18 ± 3.6
6		Steering unit mounting bolt	M10 × 1.5	4 ± 0.5	29 ± 3.6
7		Tilt cylinder; rod-end bolt, nut	M20 × 2.5	58 ± 6	420 ± 43.4
8		Tilt cylinder pin; mounting bolt	M10 × 1.5	6.9 ± 1.4	50 ± 10.1
9	Power train system	Transmission mounting bolt, nut	M16 × 2.0	60.5 ± 5.5	438 ± 39.8
10		Torque converter mounting bolt	M10 × 1.5	6.9 ± 1.4	50 ± 10
11		Drive axle mounting bolt, nut	M27 × 3.0	150 ± 15	1085 ± 109
12		Propeller shaft (to axle and TM)	3/8-24 UNF	7.0 ± 0.7	50.6 ± 5.1
13		Steering axle mounting bolt, nut	M18 × 2.5	41.3 ± 6.2	299 ± 44.8
14		Front and rear wheel mounting nut	M22 × 1.5	62.0 ± 9.3	448 ± 67.3
15	Others	Counterweight mounting bolt	M30 × 3.5	100 ± 15	723 ± 108
16		Operator's seat mounting nut	M 8 × 1.25	2.5 ± 0.5	18.1 ± 3.6
17		Cabin mounting bolt	M12 × 1.75	12.8 ± 3.0	92.6 ± 21.7
18		Mast mounting bolt	M20 × 2.5	57.9 ± 8.7	419 ± 63

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"	1-1/4	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	0.42	3.04
S20-40	26 ~ 38	9		
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 SPANNER 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	12 (3.17)	★SAE 5W-40								
			SAE 10W								
			SAE 10W-30								
			SAE 5W-30								
			SAE 15W-40								
			SAE 30								
Torque converter transmission	Transmission oil	20 (5.3)	ATF DEXRON III								
Axle	Gear oil	13 (3.43)	SAE 80W-90								
Brake	Cooling oil	22 (5.8)	HD HYUNDAI OIL BANK Xteer THF 75W-80								
Hydraulic tank	Hydraulic oil	167 (44)	★ISO VG 15								
Cabin tilt hand pump		0.7 (0.2)	ISO VG 32								
			ISO VG 46								
			ISO VG 68								
Fuel tank	Diesel fuel★ ¹	171.5 (45.3)	★ASTM D975 NO.1					ASTM D975 NO.2			
Fitting (Grease nipple)	Grease	-	★NLGI NO.1						NLGI NO.2		
Radiator	Antifreeze : Water	14.2 (3.75)	Ethylene glycol base permanent type (50:50)								
			★Ethylene glycol base permanent type (60 : 40)								

NOTES :

- Engine oil should be API service class CK-4.
- 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.

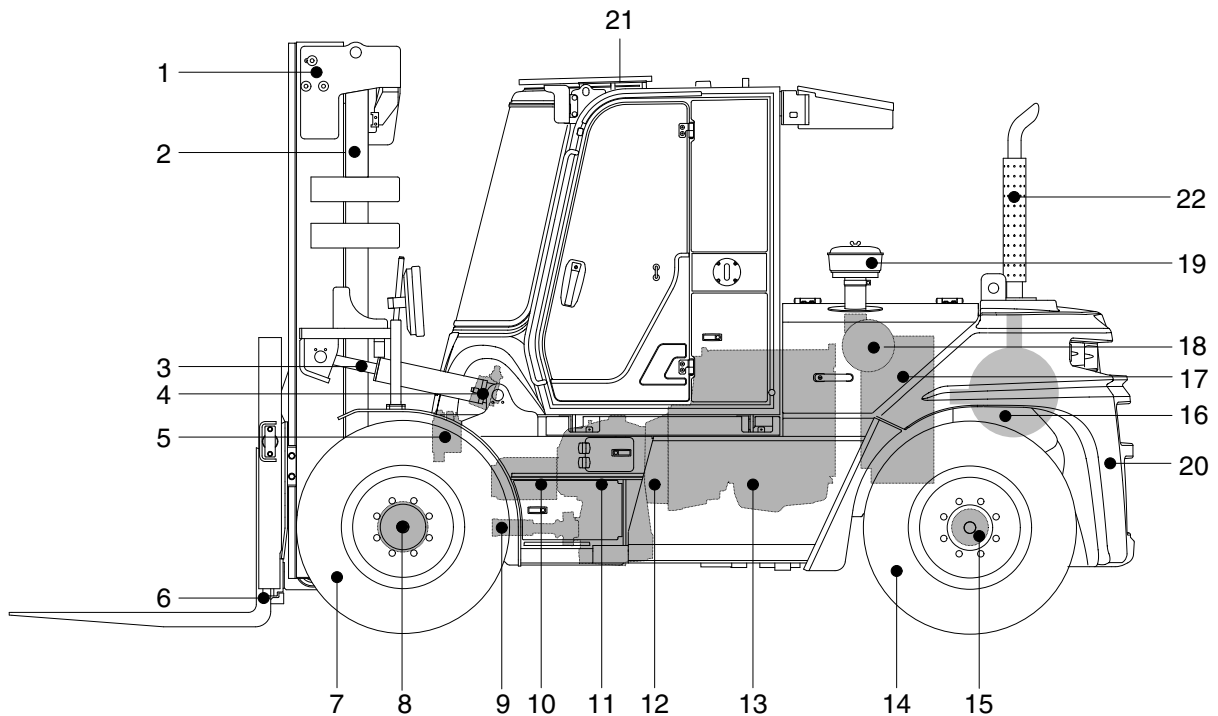
No.	Periodical replacement of safety parts	Interval
1	Lift cylinder hose	Every 1 year (harsh operation) Every 2 years (normal operation)
2	Tilt cylinder hose	
3	Side shift cylinder hose	
4	Brake hose	
5	Hydraulic pump hose	Every 2 years
6	Power steering hose	
7	Coolant hose and clamps	
8	Fuel hose	Every 2 years (harsh operation) Every 4 years (normal operation)
9	Packing, seal, and O-ring of steering cylinder	
10	Lift chain	
11	Hydraulic pump seal kit	Every 3 years
12	Pressure sensor	Every 5 years
13	Mast accumulator (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	2-21

GROUP 1 STRUCTURE



100D9V7PM01

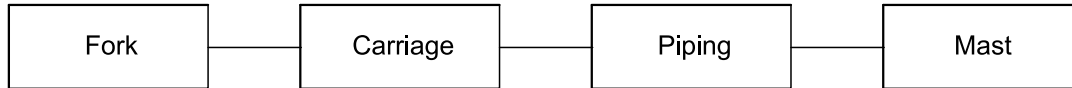
- | | | |
|----------------------|---------------------|------------------|
| 1 Mast | 9 Propeller shaft | 17 Radiator |
| 2 Lift cylinder | 10 Hydraulic pump | 18 Air cleaner |
| 3 Tilt cylinder | 11 Transmission | 19 Precleaner |
| 4 Steering unit | 12 Torque converter | 20 Counterweight |
| 5 Main control valve | 13 Engine | 21 Cabin |
| 6 Fork | 14 Rear wheel | 22 Silencer |
| 7 Front wheel | 15 Steering axle | |
| 8 Drive axle | 16 Aftertreatment | |

GROUP 2 REMOVAL AND INSTALLATION OF UNIT

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

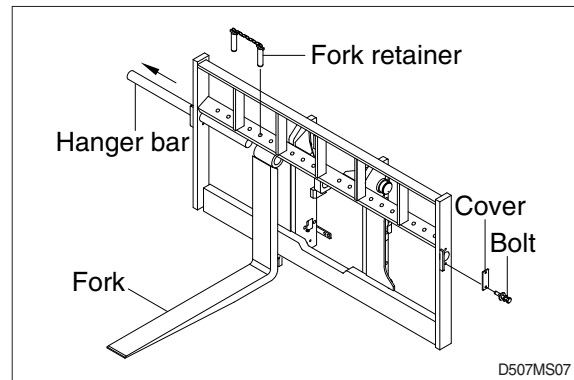
1. MAST

1) REMOVAL



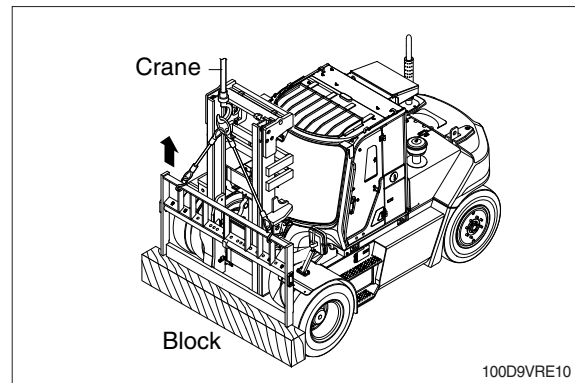
(1) SHAFT TYPE FORKS

- ① Lower the fork carriage until the forks are approximately 25 mm (1 in) from the floor.
 - ② Release fork retainer and remove cover.
 - ③ Slide one hanger bar at a time out of carriage assembly.
 - ④ Remove only one fork at a time.
- ※ On larger forks it may be necessary to use a block of wood.

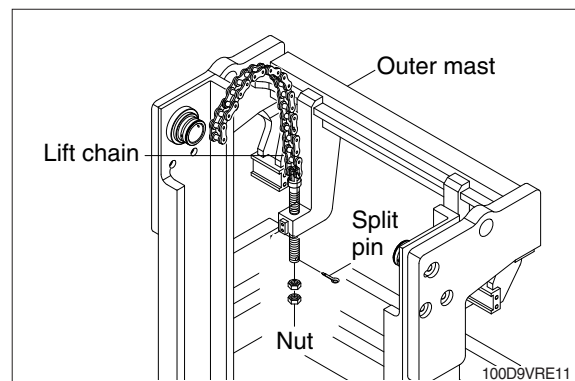


(2) CARRIAGE

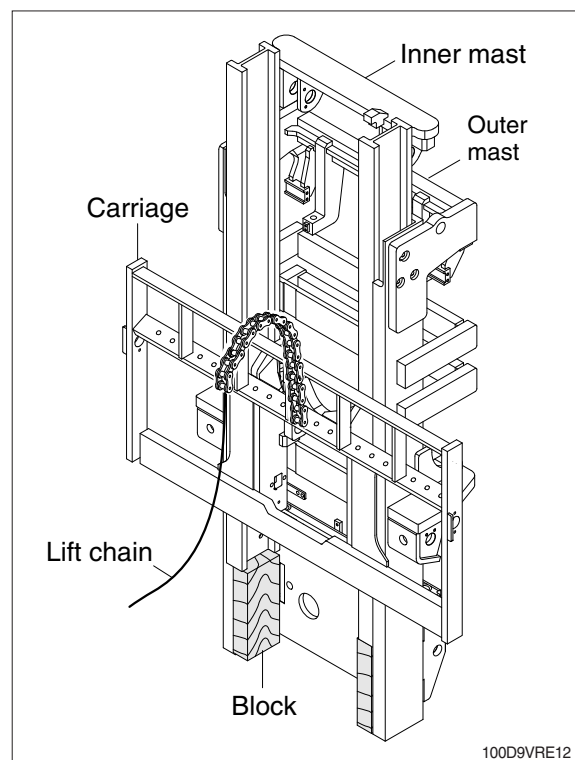
- ① With the mast vertical, raise the carriage high enough to place blocks under the load forks. This is done to create slack in the load chains when the carriage is lowered. Lower the carriage all the way down to the floor. Make sure the carriage is level, this will prevent any binding when the mast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



- ② While supporting lift chains, remove the split pin and nuts from the chain anchor bolts of stationary upright.



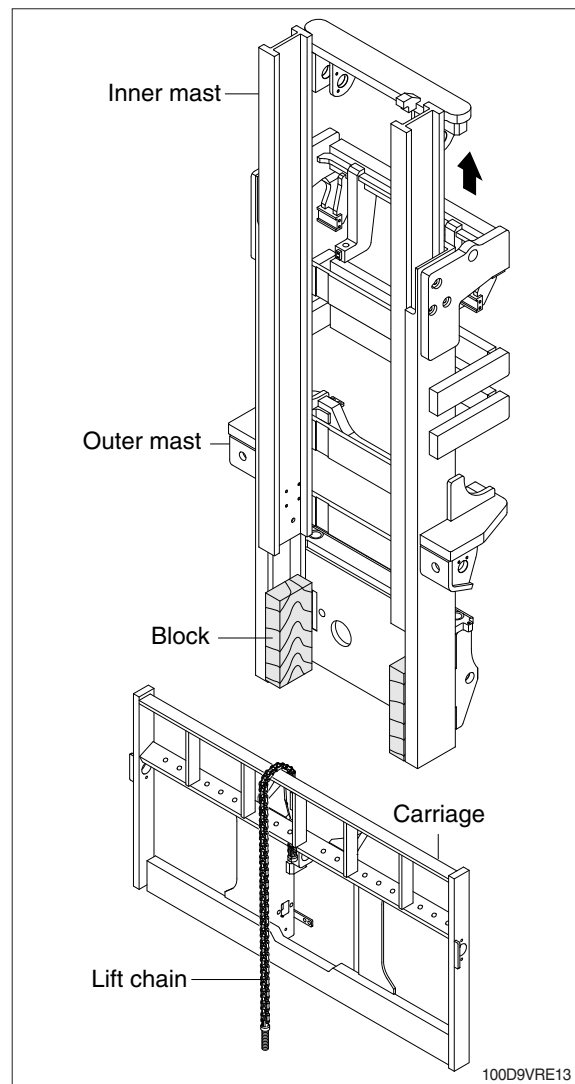
- ③ Pull the chains out of the sheaves and drape them over the front of the carriage.



- 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.

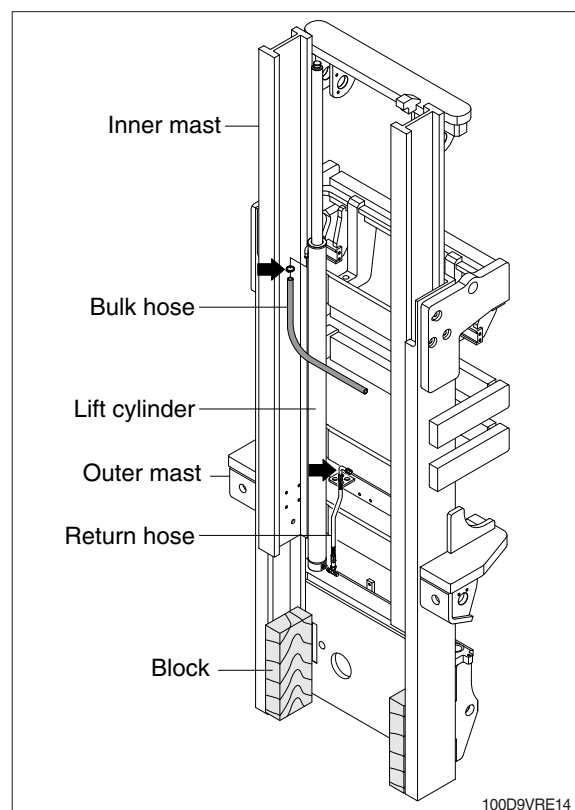
- ※ Inspect all parts for wear or damage.
Replace all worn or damaged parts.



(5) PIPING

- ① Remove the bulk hoses and clamps attached to the cylinder.
② Remove the return hose from the down control valve.

- ※ 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.

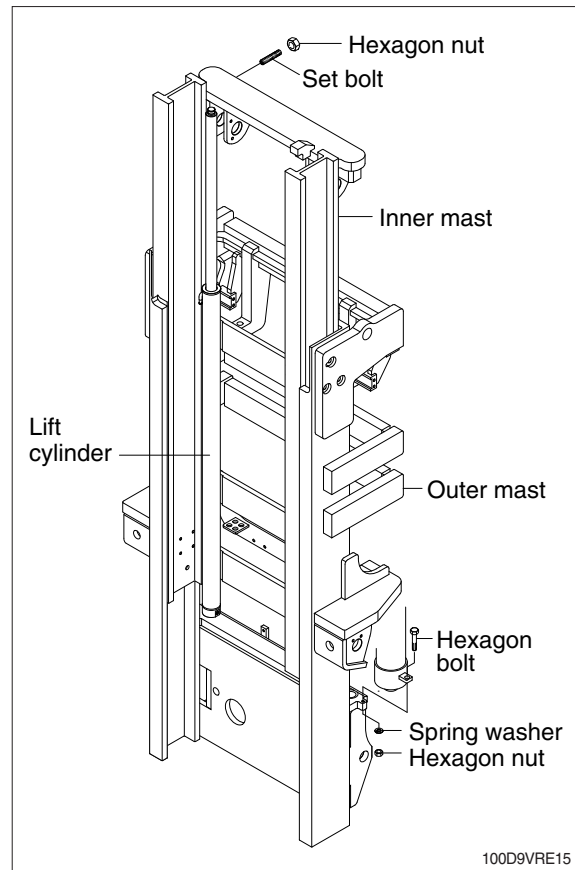


(6) LIFT CYLINDER

- ① Loosen and remove hexagon nuts and set bolts securing 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 the lift cylinder be tightened firmly for safety.

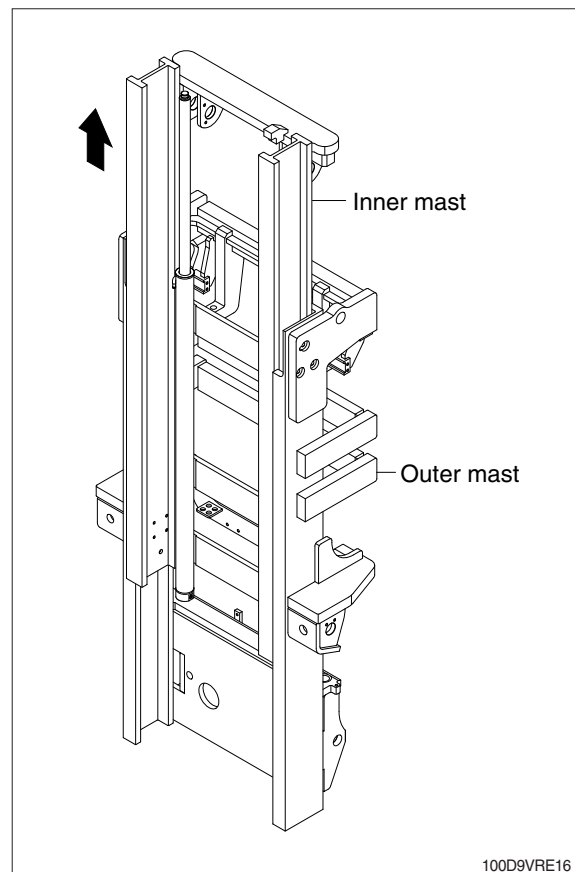
- ③ Loosen and remove hexagon bolts, spring washers and nuts securing lift cylinders to outer mast.
- ④ Using an overhead hoist, slowly raise the inner mast high enough to clear lift cylinder.
- ⑤ Using an overhead hoist, draw out lift cylinder carefully and put down on the work floor.



(7) 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.

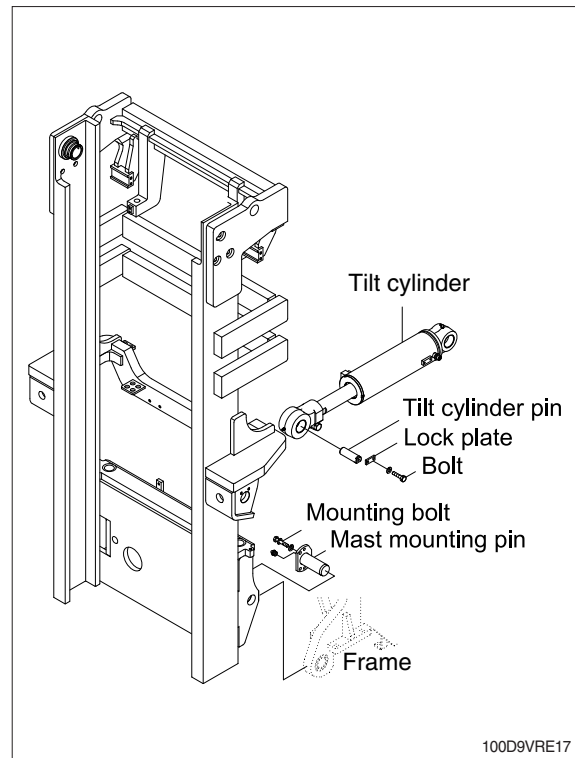


(8) TILT CYLINDER PIN

Loosen the bolt and remove the lock plate and tilt cylinder pin.

(9) MAST MOUNTING PIN

- ① Attach a crane to the stay at the top of the outer mast, and raise it.
 - ② Loosen the mounting bolts and remove the mast mounting pins from frame, then slowly raise outer mast.
- ※ This operation is carried out under the truck, so use a pit, or if there is no pit, jack up the machine and loosen with an impact wrench.



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 MOUNTING PIN

- ① Check the mast mounting pins for wear, then install pins into the mast support bracket and drive axle.
- 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 socket bolts to drive axle unit.
 - Tightening torque : 49.2~66.6 kgf · m (356~481 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 and lock plate by the bolts.

· Tightening torque : 15.8 kgf·m (114 lbf·ft)

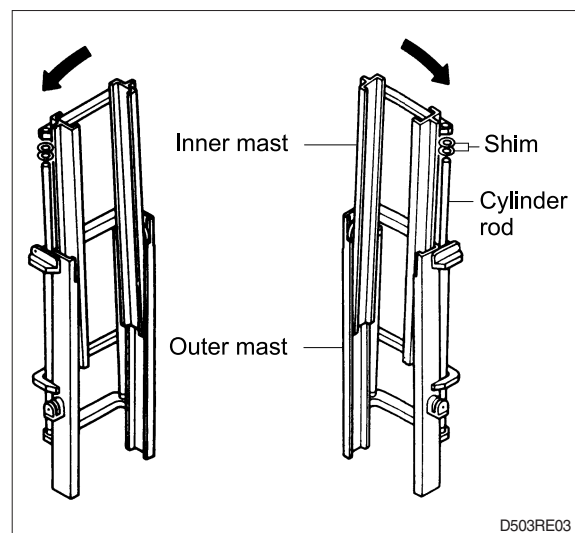
(3) LIFT CYLINDER INSTALLATION AND ADJUSTMENT

- 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.

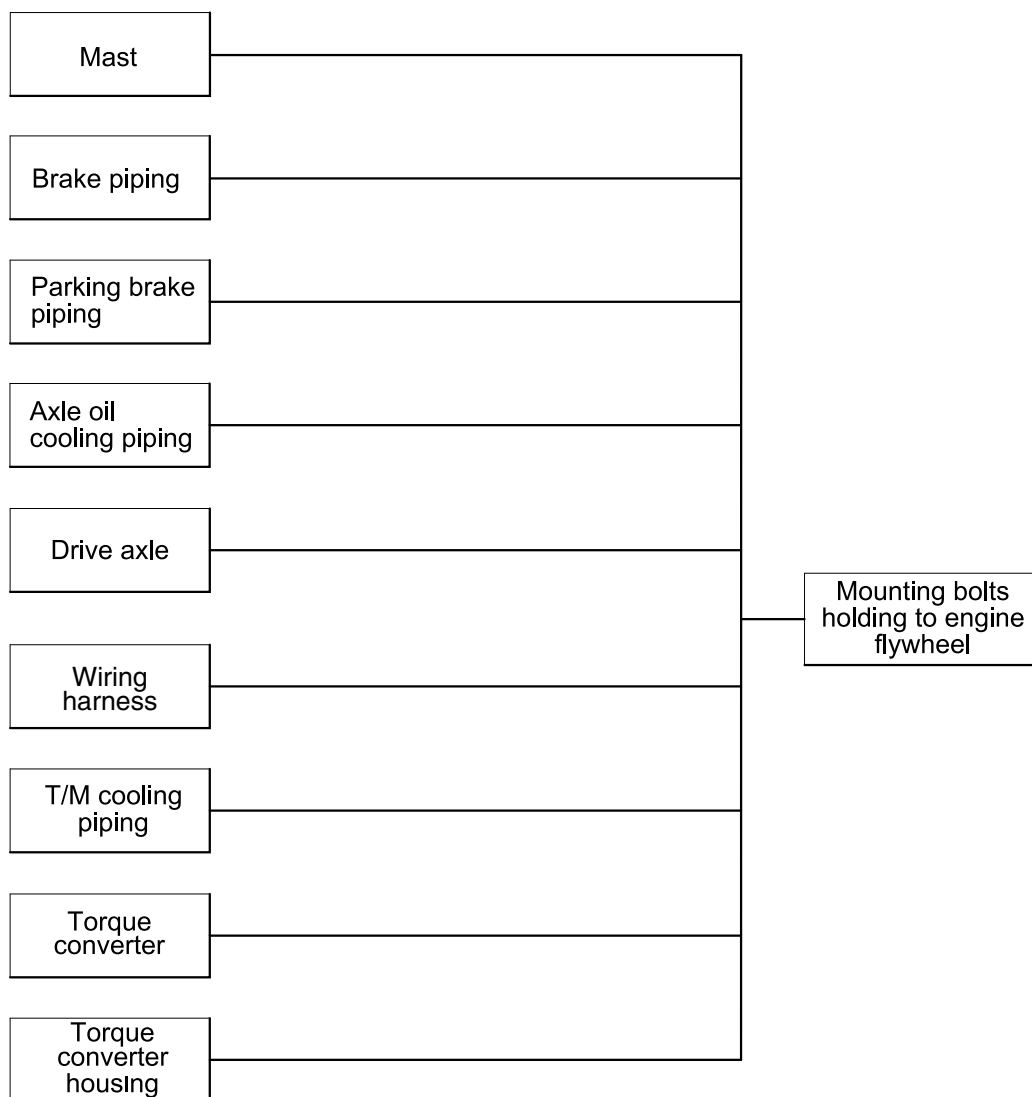
※ If play is to RIGHT, install adjustment shim to RIGHT cylinder.

· Shim thickness : 1.0 mm (0.04 in)



2. POWER TRAIN ASSEMBLY

1) REMOVAL



70D9V2R102

(1) Mast

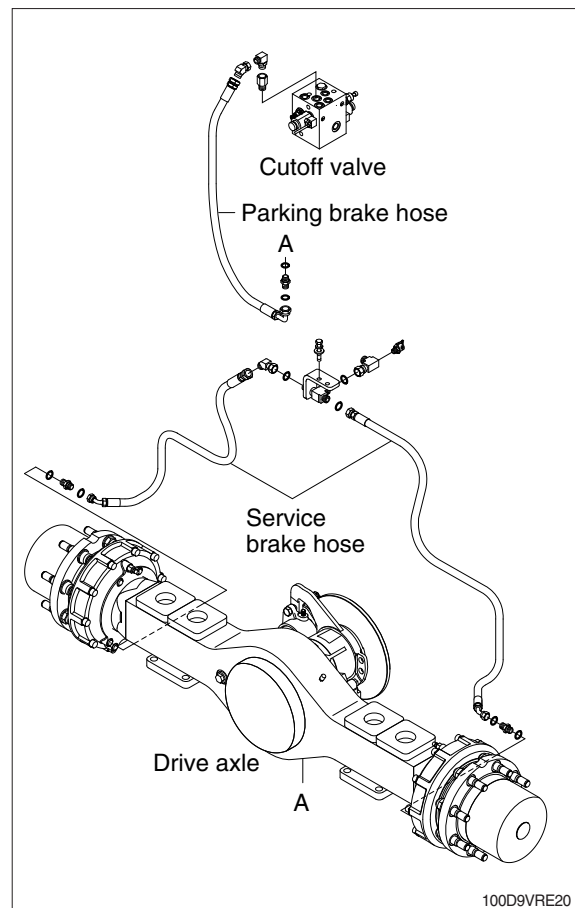
Refer to section on mast (Page 2-2)

(2) Service brake piping

Disconnect the brake hydraulic hoses from the drive axle.

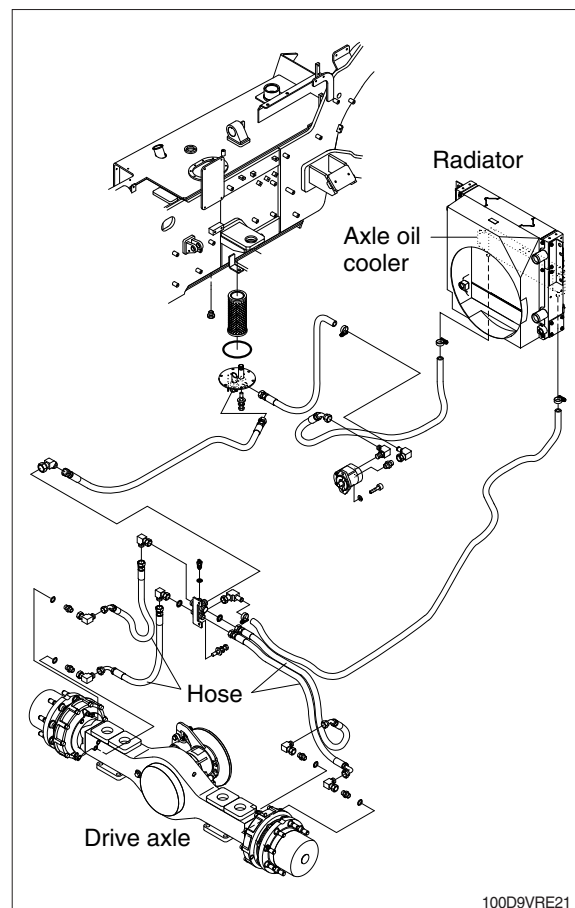
(3) Parking brake piping

Disconnect parking brake hydraulic hoses from the drive axle.



(4) Axle oil cooling piping

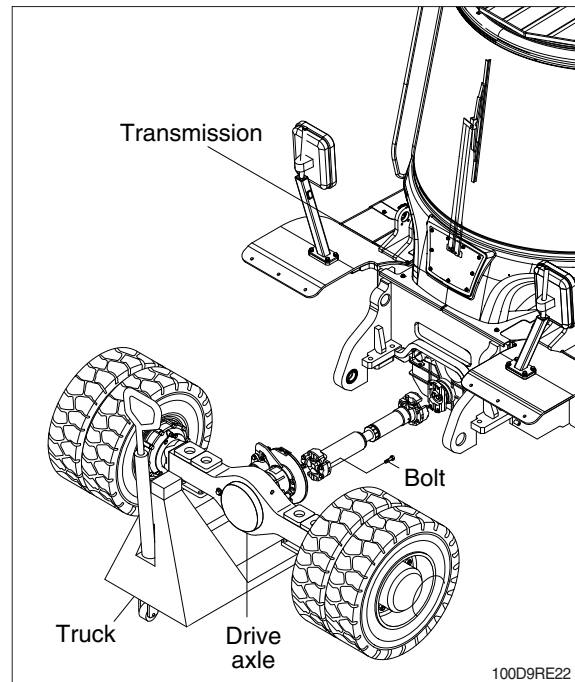
Disconnect the brake cooling hoses from the drive axle.



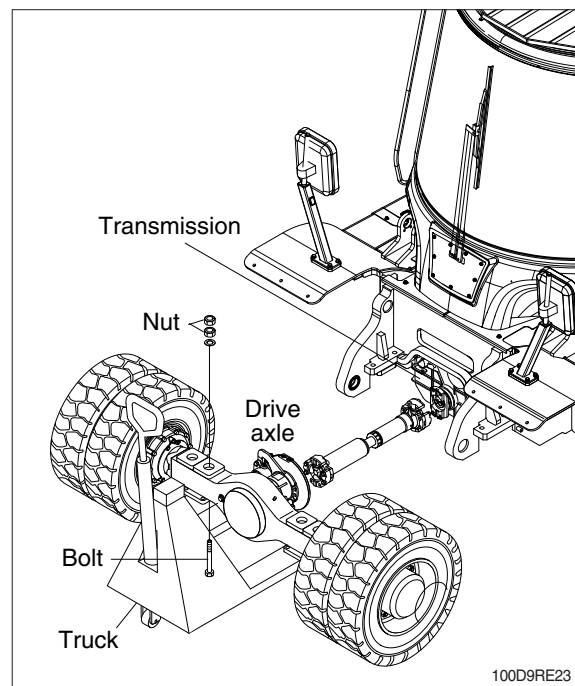
(5) Drive axle

※ Before removing the drive axle unit, drain all of the oil from the axle.

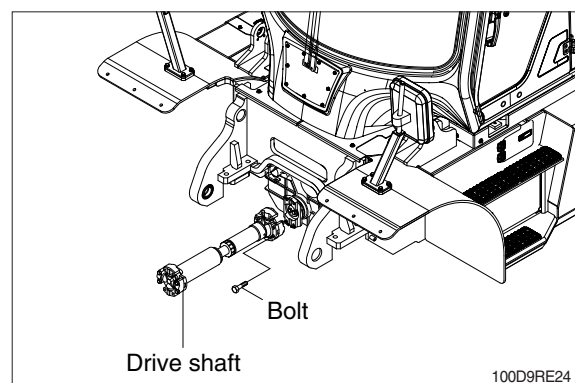
- ① Attach a crane to the tilt cylinder notches on the dashboard and raise the truck.
- ② Loosen hexagonal bolts connecting drive axle to drive shaft.
- ③ Put the block under the front axle and support under the drive axle with a truck.



- ④ Remove drive axle mounting bolts from the frame and then slowly pull out the truck with drive axle to the front.



- ⑤ Remove drive shaft from the transmission by loosening the mounting bolts.



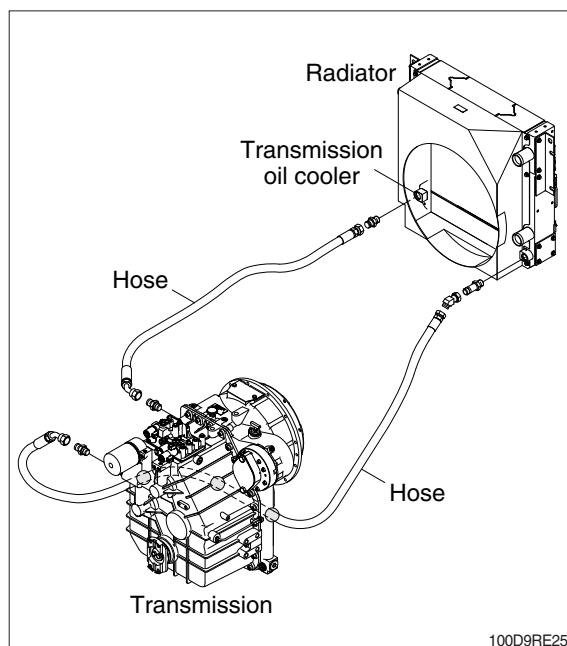
(6) Inching linkage

Remove the inching sensor cable.

(7) Transmission cooling piping

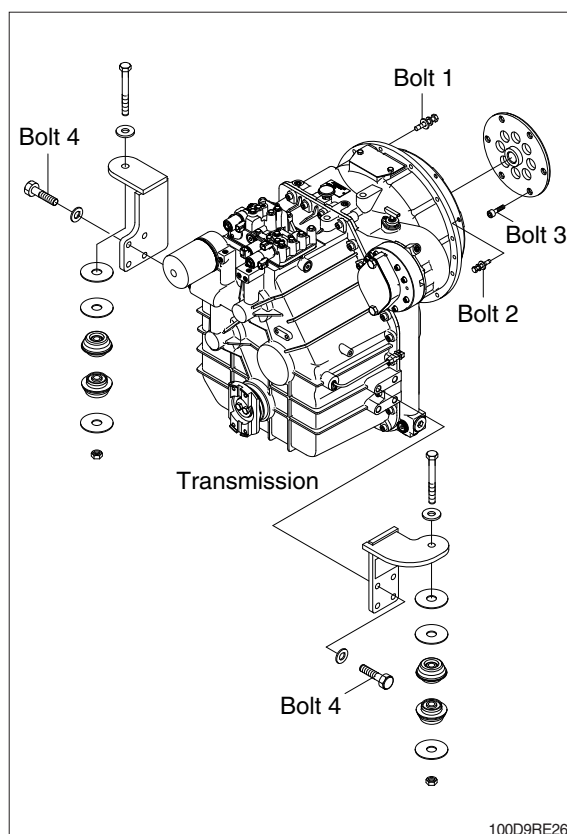
Disconnect cooling hose and connector from the transmission.

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



(8) Transmission assembly

- ① Remove the transmission assembly by loosening the bolts (1, 2, 3) mounted on the engine flywheel housing and the bolts (4) mounted on the bracket.
- ② Using a moving truck slowly, pull out transmission assembly to the front.



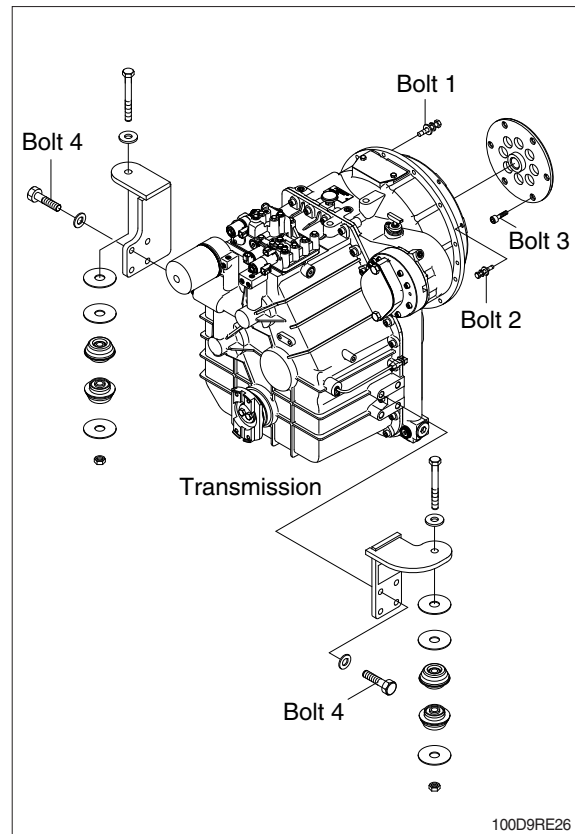
2) INSTALLATION

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

(1) Tightening torque of the mounting bolts for the transmission.

- Bolt 1 : 5.5~8.3 kgf · m (39.8~60.0 lbf · ft)
- Bolt 2 : 5.5~8.3 kgf · m (39.8~60.0 lbf · ft)
- Bolt 3 : 5.5~8.3 kgf · m (39.8~60.0 lbf · ft)
- Bolt 4 : 55~66 kgf · m (398~478 lbf · ft)

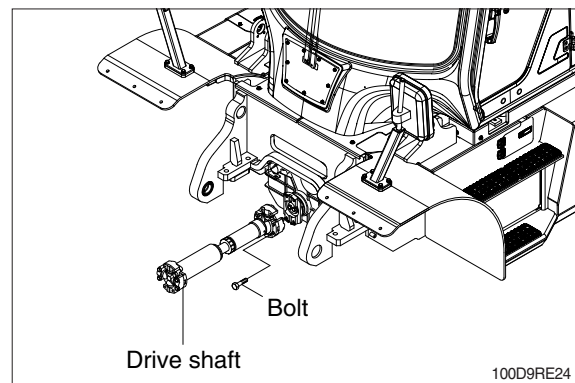
※ Apply loctite #277 on the thread before tightening.



(2) Tightening torque of mounting bolt for the drive shaft.

- 6.3~7.7 kgf · m (45.6~55.7 lbf · ft)

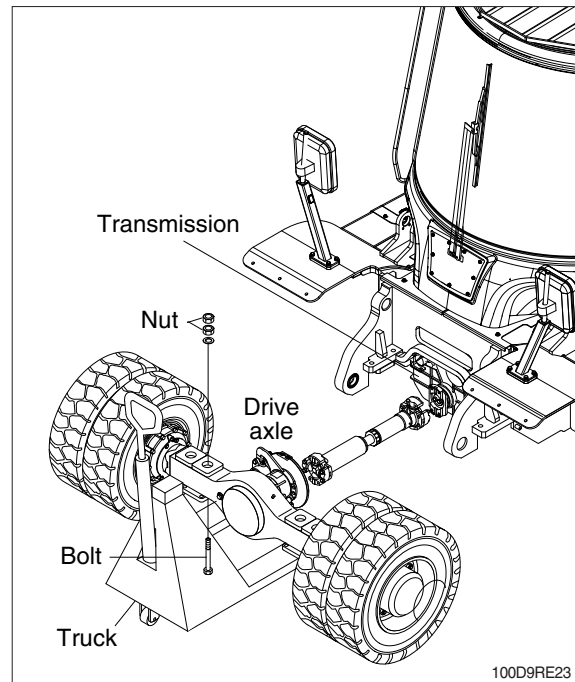
※ Apply loctite #277 on the thread before tightening.



(3) Tightening torque of mounting bolt for the drive axle.

· 135~165 kgf · m (976~1193 lbf · ft)

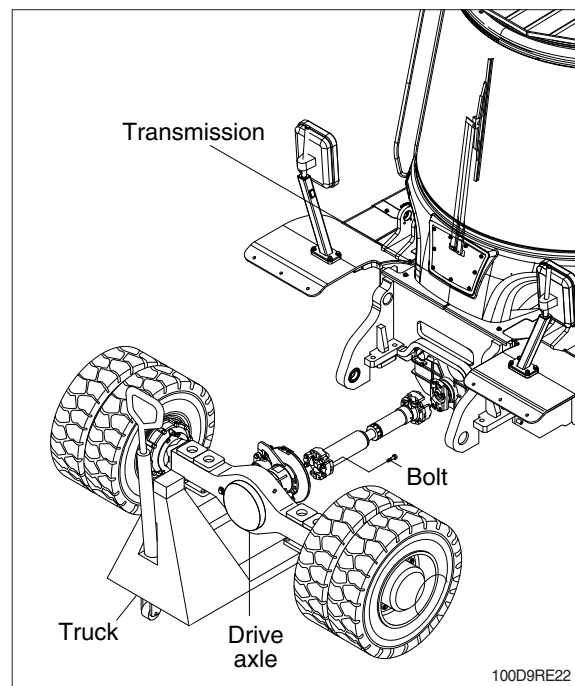
※ **Apply loctite #277 on the thread before tightening.**



(4) Tightening torque of mounting bolt for drive shaft.

· 6.3~7.7 kgf · m (45.6~55.6 lbf · ft)

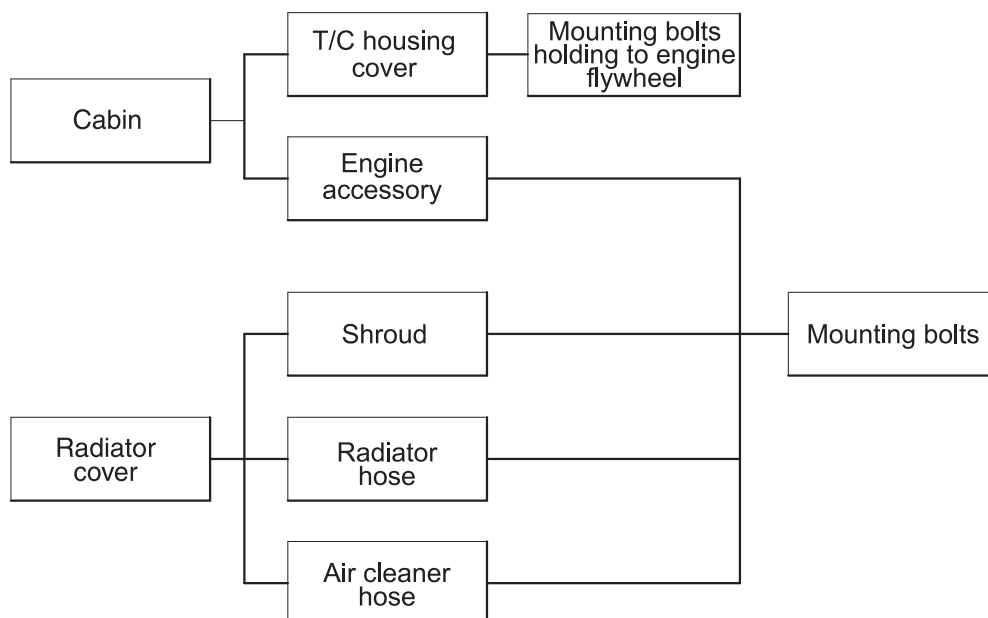
※ **Apply loctite #277 on the thread before tightening.**



3. ENGINE

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

1) REMOVAL



50D9RE25

(1) Engine hood

① Cabin

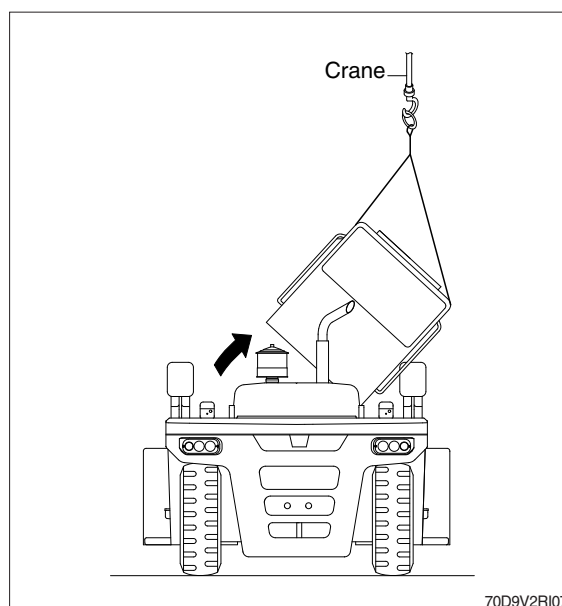
- First, tilt the cabin

※ Refer to the operator's manual page 7-16.

- After remove the wiring for rear combination lamp, work lamp, head lamp and flasher lamp on the stay of the cabin and then raise it with a crane
- Finally remove cabin for removal tilt option cylinder and latch assy.

② Center cover and door assy (LH, RH)

Remove the Center cover and door assy (LH, RH) by loosening the mounting bolts.



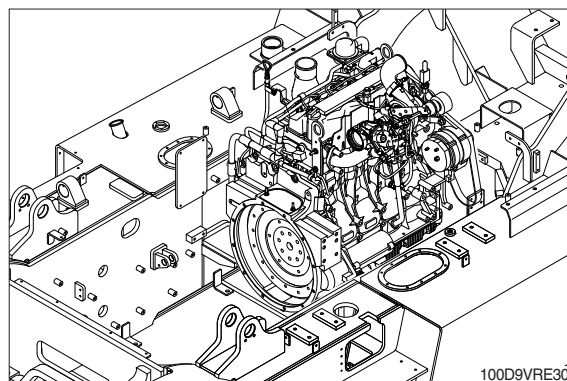
70D9V2R107

- (2) Loosen the bolts mounted on the engine flywheel housing. For details, see page 2-11.

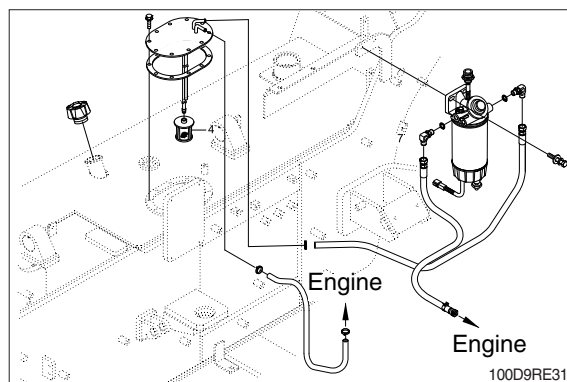
(3) Engine accessory

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

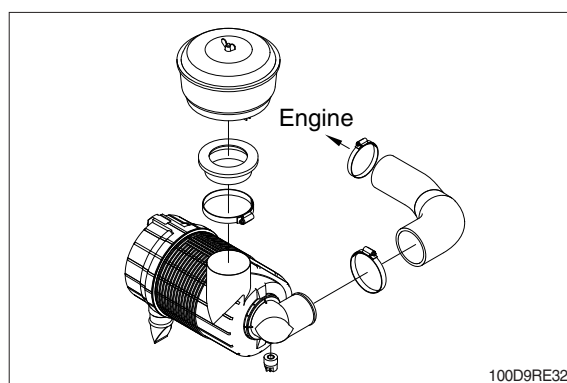
- ① Wiring harness to alternator and starter.
- ② Wiring harness for oil pressure and engine water temperature gauges.
- ③ Cables for meters, buttons and accelerator pedal.



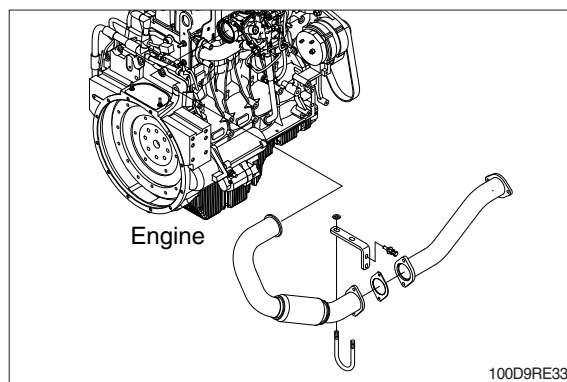
- ④ Hoses to fuel tank.



- ⑤ Hose to the air cleaner.

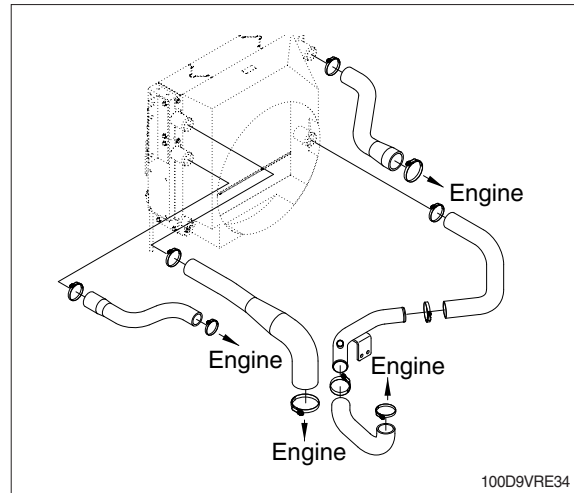


- ⑥ Exhaust pipe.



(4) Radiator hose

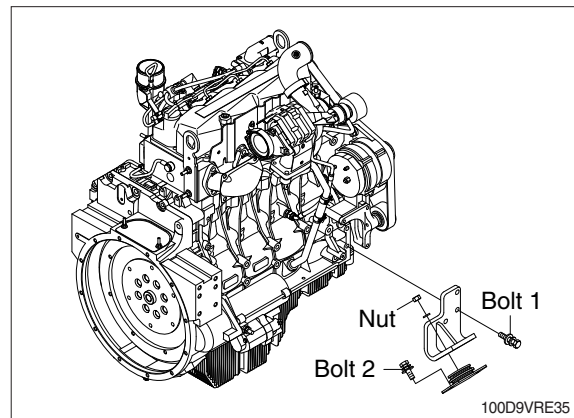
Open the drain valve of the radiator and drain the cooling water, then remove the radiator hose.



(5) Mounting bolt

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

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



2) INSTALLATION

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

(1) Tighten the engine mounting bolts and nuts.

(2) Tighten the engine mounting bracket bolts.

※ **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.**

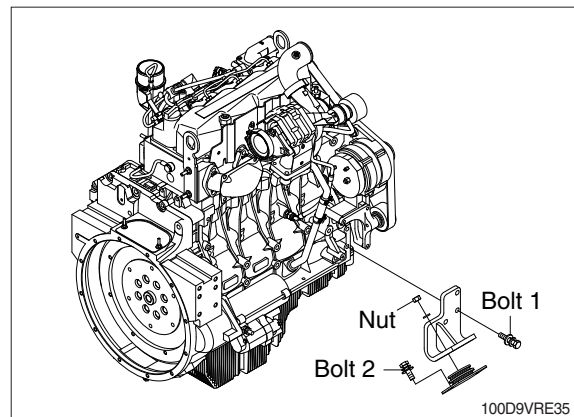
(3) Tightening torque of mounting bolt installing to torque converter housing.

· Bolt 1 : 12.3±3.0 kgf · m (89±21.7 lbf · ft)

· Bolt 2 : 5.5~8.3 kgf · m (39.8~60.0 lbf · ft)

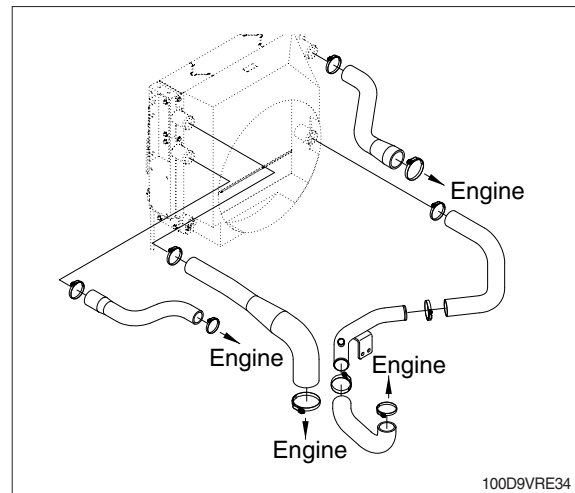
· Nut : 5.5~8.3 kgf · m (39.8~60.0 lbf · ft)

※ **Apply loctite #243 on the thread before tightening.**



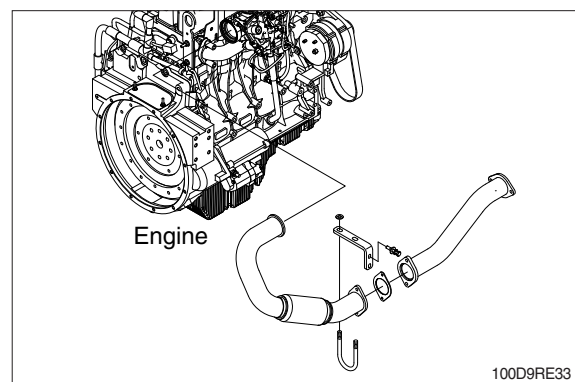
(4) Radiator hoses

Insert the radiator hoses securely and fit the clamps.



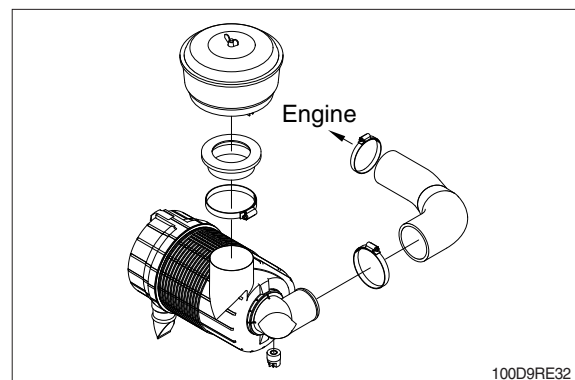
(5) Exhaust pipe

Insert the exhaust pipe to the engine securely and fit a clamp.



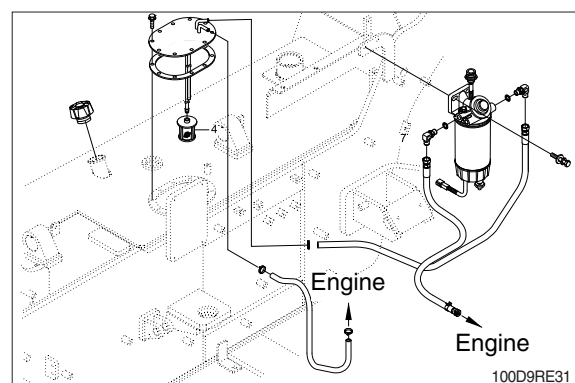
(6) Air cleaner hose

Insert the air cleaner hose securely and fit a clamp.



(7) Fuel hoses

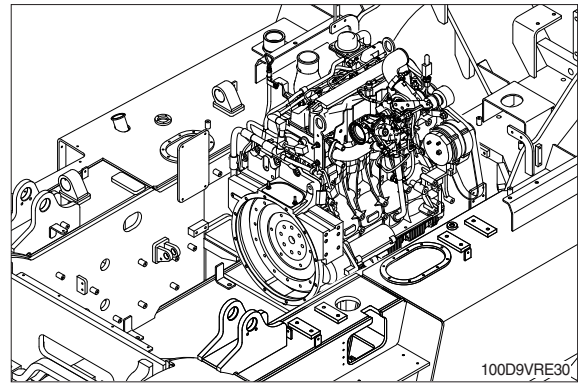
Insert the fuel hoses securely and fit the clamps.



(8) Engine accessory

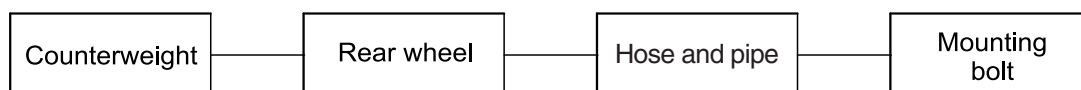
Install all wiring harnesses, cables and hoses around the engine, dashboard and frame.

- ① Wiring harness to alternator and starter.
- ② Wiring harness for oil pressure and engine water temperature gauges.
- ③ Cables for meters, buttons and accelerator pedal.

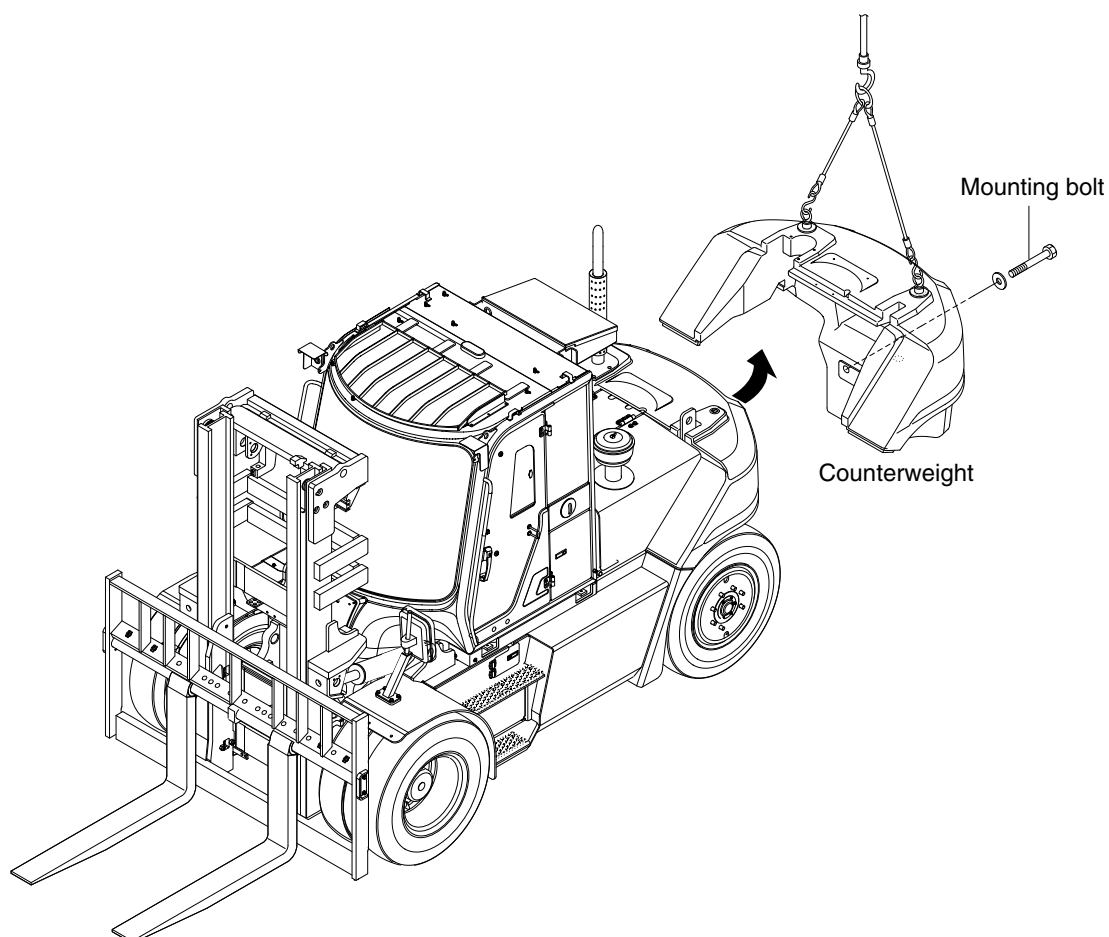


4. STEERING AXLE

1) REMOVAL



D503RE35



100D9VRE40

(1) Counterweight

Hold the counterweight with hoist bars, and raise it with a crane.

Remove the mounting bolts, raise slightly and move it slowly to rear side.

- Weight of counterweight (standard) : 4220 kg (9300 lb)
- Tightening torque : 100 ± 15 kgf·m (723 ± 108 lbf·ft)

※ Apply loctite #277 on the thread before tightening the bolts.

(2) Rear wheel

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

· Tightening torque

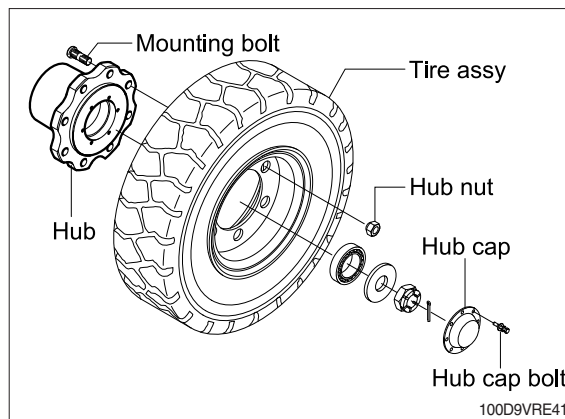
- Hub nut

$66.3 \pm 5 \text{ kgf}\cdot\text{m}$ ($480 \pm 36.2 \text{ lbf}\cdot\text{ft}$)

- Hub cap bolt

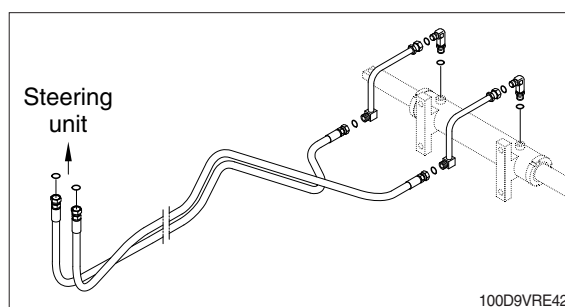
$2.5 \pm 0.5 \text{ kgf}\cdot\text{m}$ ($18.0 \pm 3.6 \text{ lbf}\cdot\text{ft}$)

※ Keep gas tight by applying liquid gasket #1215 on the contact surface of the hub cap before assembling the hub cap.



(3) Hose and piping

- ① Disconnect the hoses from the steering axle and then drain out oil.
- ② Disconnect the pipes from the axle support.



(4) Mounting bolt

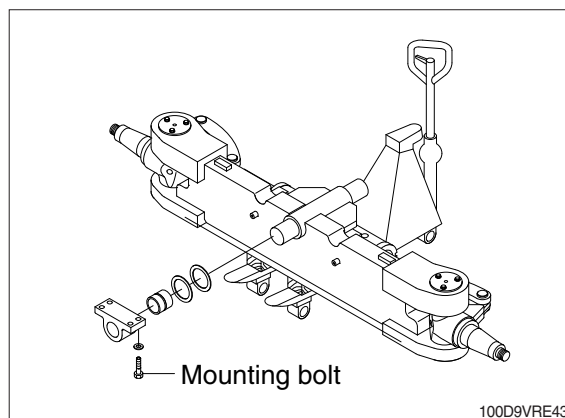
Put a block under the steering axle, support on a truck, and raise the frame with a crane. Remove the mounting bolts installing to the frame, and pull out to the rear.

There are shims between the support and steering axle to prevent play.

· Mounting bolt tightening torque

$49.2 \sim 66.6 \text{ kgf}\cdot\text{m}$ ($356 \sim 482 \text{ lbf}\cdot\text{ft}$)

※ Apply loctite #277 on the thread before tightening.



GROUP 3 MAINTENANCE FOR HOSE

1) MAINTENANCE

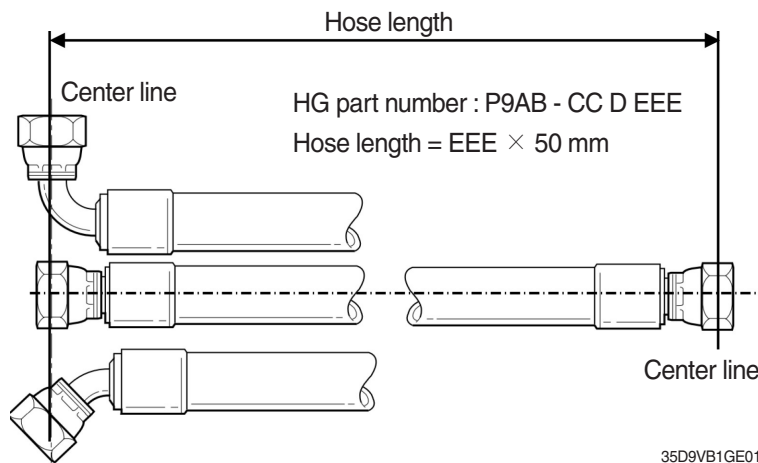
The function and service life of hydraulic components depend to a great extent on how clean the hydraulic oil is. Therefore, it is very important to prevent dirt from entering the hydraulic system. Some simple advice to keep the hydraulic system clean:

- Always clean the area around parts before starting work. If possible, it is better to wash the 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.

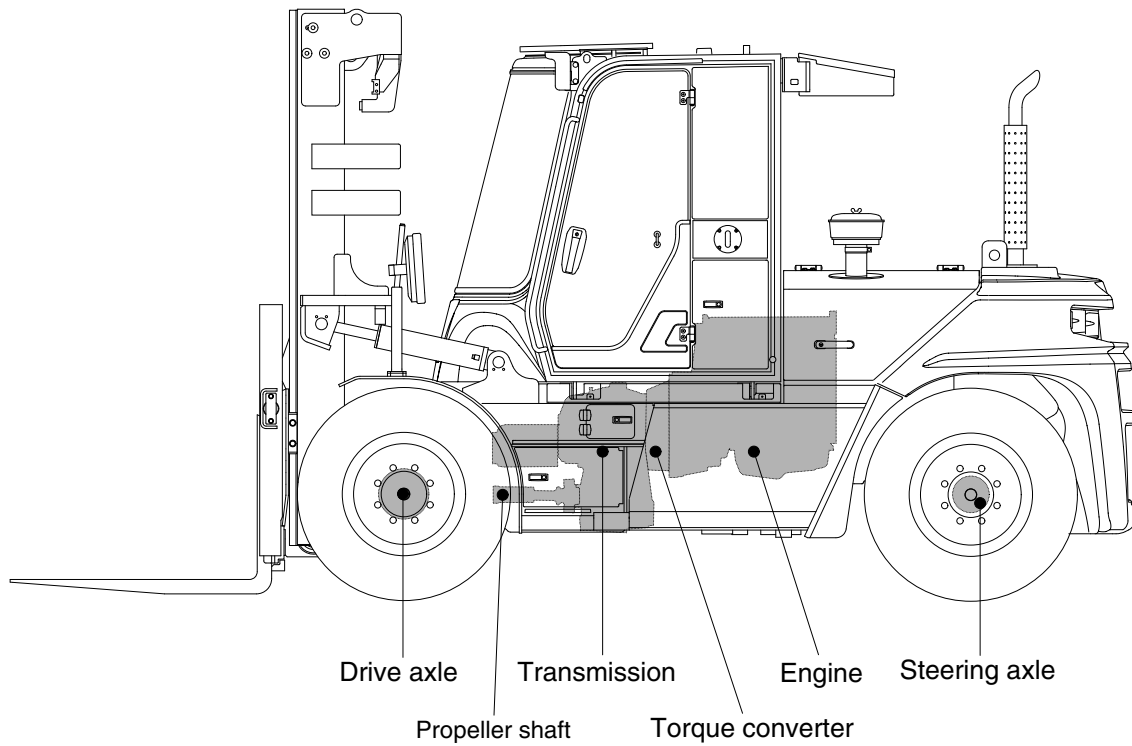
SECTION 3 POWER TRAIN SYSTEM

Group 1	Structure and operation	3-1
Group 2	Disassembly and assembly	3-19
Group 3	Maintenance and troubleshooting	3-51

SECTION 3 POWER TRAIN SYSTEM

GROUP 1 STRUCTURE AND OPERATION

1. STRUCTURE



100D9V3PT01

The power train consists of the following components :

- Torque converter
- Transmission
- Drive shaft
- Drive axle

Engine power is transmitted to the transmission through the torque converter.

The transmission is a hydraulically engaged 2 speed forward, 1 speed reverse power shift type transmission.

The transmission outputs through the universal joints of the drive shaft to drive axle assembly.

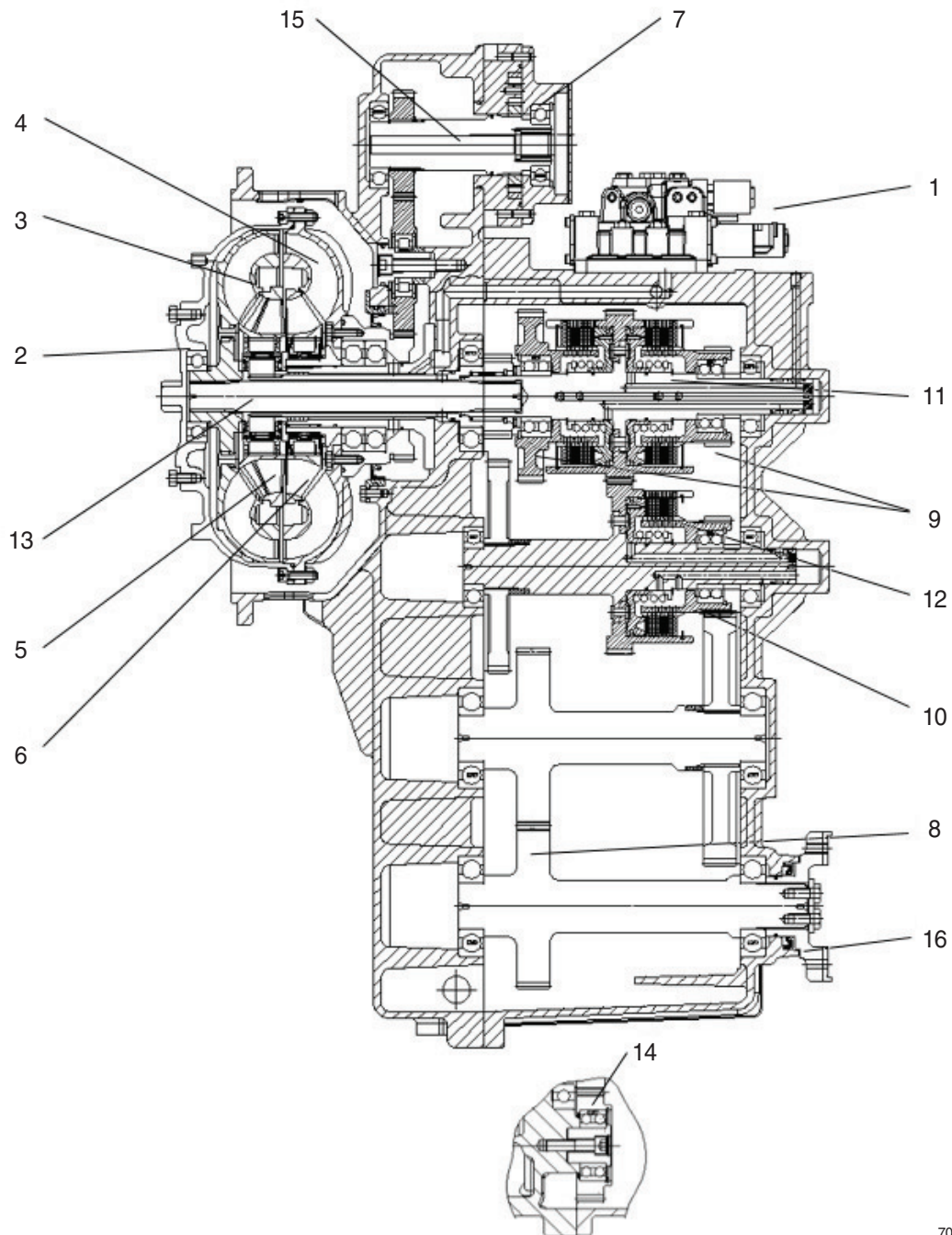
The power transmitted to front axle drives front wheels.

2. SPECIFICATION

Item		Specification
Torque converter	Type	3 Element, 1 stage, 2 phases
	Stall ratio	5.3 : 1
Transmission	Type	Full auto, power shift
	Gear shift (FR/RR)	2/1
	Adjustment	Electrical single lever type
	Overhaul ratio	FR 1 : 2.456 2 : 0.946
		RR 1 : 2.494
Axle	Type	Front-wheel drive type, fixed location
	Gear ratio	12.86
	Gear	Ring & pinion gear type
Wheels	Q'ty (FR/RR)	Double : 4/2
	Front (drive)	9.00-20-14 PR
	Rear (steer)	9.00-20-14 PR
Brakes	Travel	Front wheel, wet disc brake
	Parking	Calliper disc, SHAR (Spring Actuate Hydraulic Release) type
Steering	Type	Full hydraulic, power steering
	Steering angle	75.87° to both right and left angle, respectively

3. TRANSMISSION

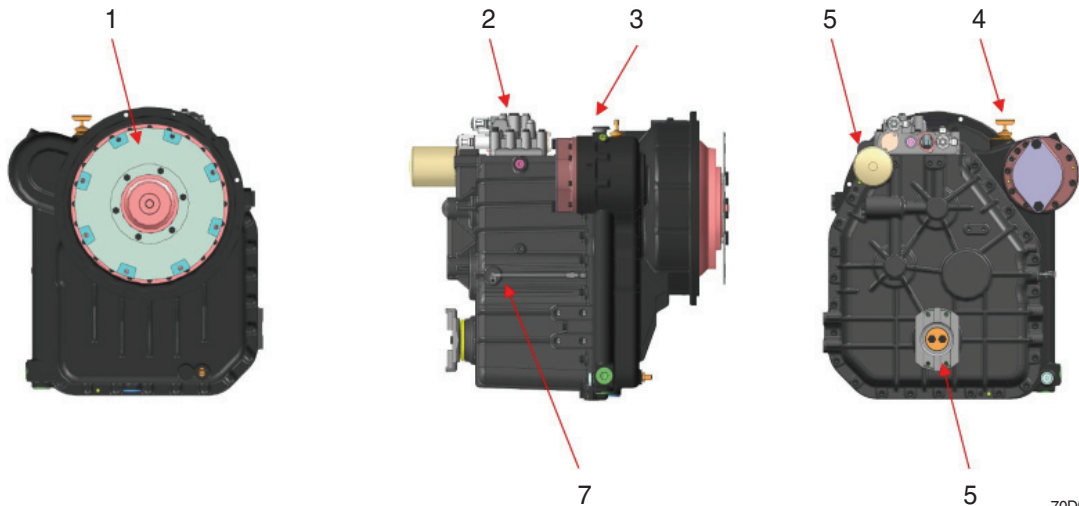
1) STRUCTURE



70D9VB3PS01

- | | | |
|--------------------|------------------------|----------------------|
| 1 Control valve | 7 Charging pump | 13 PTO shaft |
| 2 Torque converter | 8 Output gear | 14 Intermediate gear |
| 3 Turbine | 9 Forward clutch gear | 15 PTO pump shaft |
| 4 Impeller | 10 Reverse clutch gear | 16 Flange yoke |
| 5 1st stator | 11 Forward clutch pack | |
| 6 2nd stator | 12 Reverse clutch pack | |

2) INSTALLATION VIEW



70D9VB3PS02

- | | | | | | |
|---|------------------|---|------------------------------------|---|--------------|
| 1 | Torque converter | 4 | Oil level gauge and tube | 7 | Speed sensor |
| 2 | Control valve | 5 | Oil filter | | |
| 3 | Air breather | 6 | Output (Universal joint link part) | | |

3) OPERATION

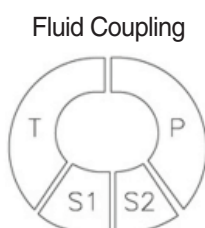
(1) Torque converter

① Converter equipment

- The outside of Impeller is connected with flywheel of engine through cover wheel, front cover and Input plate. The inside of it is supported by Inner race of free wheel through angular contact bearing.
- The engine power is transmitted to Impeller wheel, and that is transmitted to turbine wheel assembly through fluid.
- Turbine wheel assembly is connected with turbine shaft by spline, A gear is fixed in other side of turbine shaft. This gear is working with a gear on output shaft. They are a reduction gear and transmit power to output shaft with flange.
- Stator wheel 2 is fixed in transmission housing through free wheel cam, one way clutch bearing and 2nd stator shaft. When the fluid returns to Impeller wheel from turbine wheel assembly, the reaction torque occurs in Stator wheel. This reaction torque is added to the turbine torque. Therefore, the turbine torque becomes larger than the input torque. In addition when turbine wheel speed is high. Stator wheel does not occur the reaction torque by idling itself.

② Power transmission principle of torque converter

- The mechanism that transmits power through fluid is called "Hydraulic Clutch". This is divided into about two types.
- One is called "Fluid coupling", another is called "Torque Converter". Those main part structures are such as below figures.



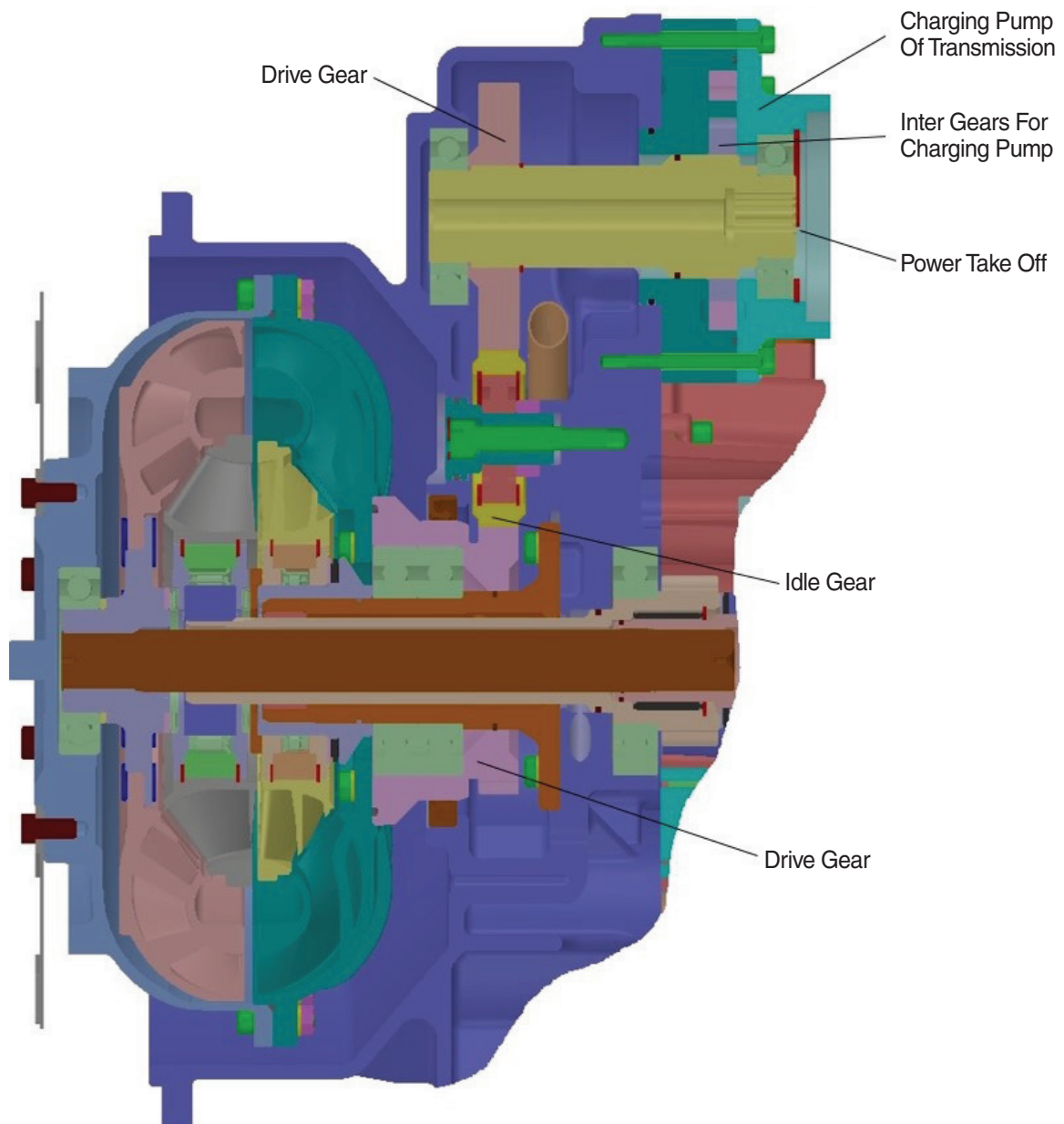
70D9VB3PS03

- P : Pump Wheel (Impeller Wheel)
 T : Turbine Wheel
 S1 : Stator Wheel 1
 S2 : Stator Wheel 2

- c. Fluid coupling consists of impeller and turbine. This is the same principle that the electric fan transmits revolution (power) to the windmill when they are laid face to face.
- d. When the Impeller rotates by engine, the fluid (oil) starts rotating around the axis of rotation and moves outside by centrifugal force.
- e. The fluid flows from the outside of Impeller blades, and flows into the outside of turbine blades faced to Impeller blades.
- f. While the fluid is flowing to the inside along turbine blades, that gives turbine wheel rotation (power). And that returns to the inside of Impeller blades.
- g. Therefore as for the flow of the fluid, at first according as impeller rotates, the rotary flow that the rotary center is the axis of impeller occurs. As a result the eddy flow that circulates between impeller and turbine occurs by centrifugal force.
- h. Fluid coupling must be used the oil as continuous power transmitting medium in the space closed up.
- i. When the difference between impeller speed and turbine speed is large, namely when the load is large for example in case of starting, or in case of going up slope, and so on, the efficiency is low. And it is necessary for turning turbine to input large impeller torque.
- j. In other to exclude this loss. Stator wheel is set between the outlet of turbine and the inlet of impeller. In this way Torque converter is what the transmission efficiency when the load is large is improved.
- k. In fluid coupling, the flow of oil which returns to impeller from turbine makes the power which disturbs impeller rotation.
- l. In torque converter, the flow direction of oil from turbine is changed to the direction which turns impeller by stator wheel. Therefore the efficiency is high when the load is large. Besides, the torque increased than the input torque is transmitted to turbine.
- m. Stator improves the ability of torque converter by idling itself or stopping according to the flow direction of oil in the outlet of turbine.
- n. For example like the vehicle which is running fast, when the load of turbine is small, the difference between impeller speed and turbine speed becomes small.
- o. According as those speeds become this condition, the oil flowing in the outlet of turbine changes the flow angle to the direction of stator rotation. Finally that becomes hitting against the back of stator blade.
- p. And stator becomes large resistance which disturbs the flow, and the efficiency goes down. Then stator of torque converter has a one-way clutch (free wheel) which is pushed by the flow of oil and idles when the fluid (oil) becomes hitting against the back of blade.
- q. In other words, stator is fixed in one direction and increases the torque. If the rotation of stator is reverse direction, stator idles. And stator becomes functioning as fluid coupling when the load is small.

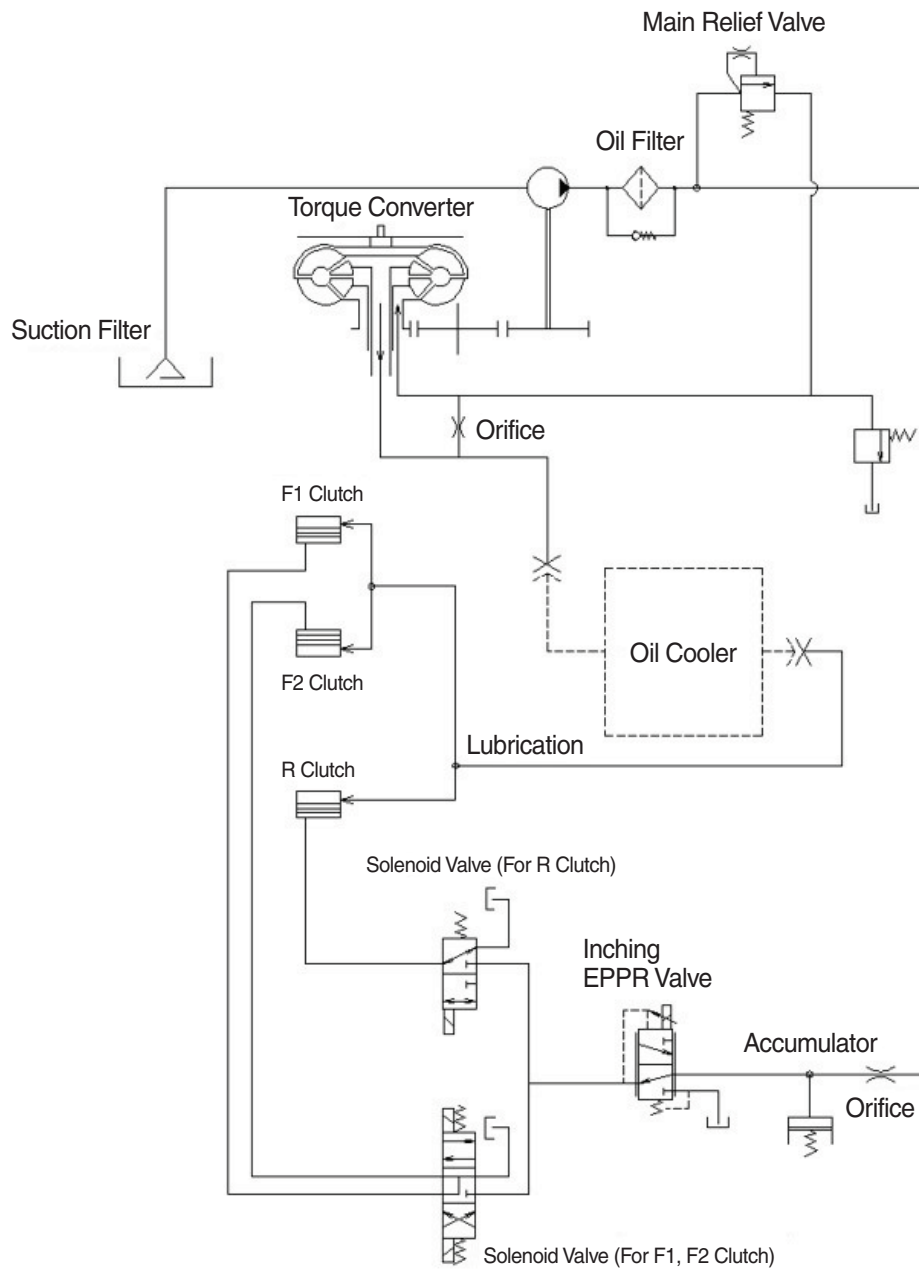
③ Pump drive device

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



70D9VB3PS04

4) HYDRAULIC CIRCUIT

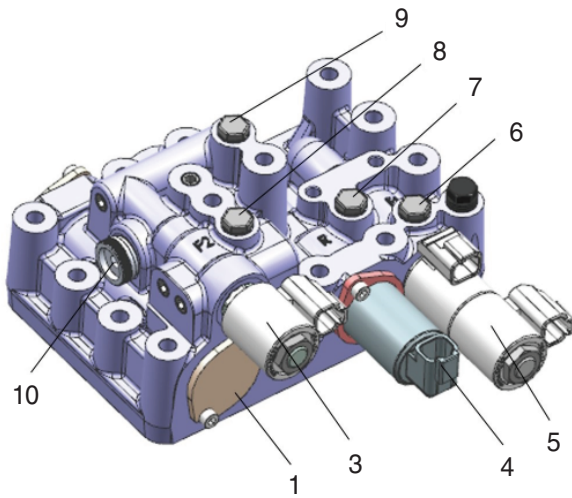


70D9VB3PS05

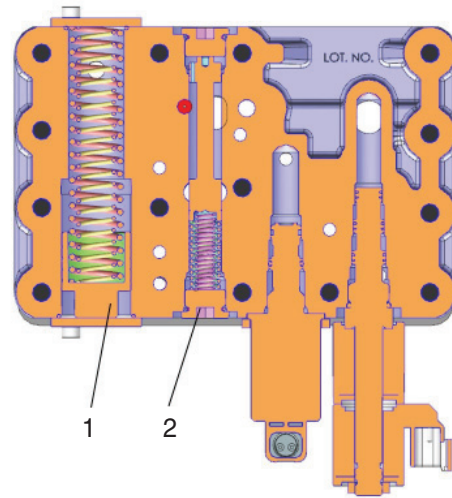
- (1) The oil that is pumped up through the strainer from the oil pump of transmission by charging pump of transmission. And this oil is sent to torque converter through the relief valve for the main pressure of hydraulic clutches.
- (2) The oil that is sent to torque converter flows between the turbine 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 vehicle. And this cooled oil lubricates and cools each parts of transmission like bearings, clutches and so on.

5) CONTROL VALVE

(1) Structure



70D9VB3PS06



70D9VB3PS07

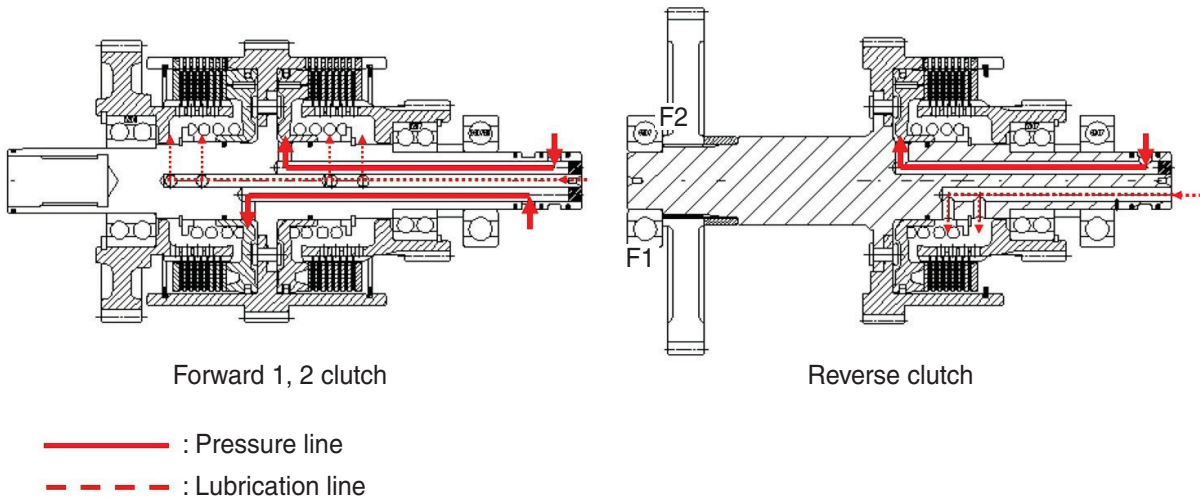
- | | |
|------------------------------------|----------------------------|
| 1 Modulation | 6 Check port for F1 clutch |
| 2 Main relief | 7 Check port for R clutch |
| 3 Solenoid valve for F2 clutch | 8 Check port for F2 clutch |
| 4 EPPR valve for inching | 9 Check port main pressure |
| 5 Solenoid valve for F1 & R clutch | 10 Pressure sensor port |

(2) Assembly

Control valve assembly contains main relief valve for regulating pressure of hydraulic clutch assembly, inching valve for adjusting clutch pressure, accumulator valve for rising up clutch pressure smoothly, solenoid valves for selecting direction (F1, F2, R) and controlling parking brake.

Structure	Operation
Main Relief Valve	This valve regulates the clutch pressure stably.
Inching Valve	This valve adjusts the pressure of clutch through the controlling Inching pedal.
Accumulator Valve	This valve adjusts the pressure of clutch for smooth start when the operator wants to move and change the direction.
Solenoid Valve For Dierction (F1, F2, R)	These valve control the oil flow for moving forward 1, 2 & reverse through voltage signal which is given by direction selector.
Solenoid Valve For Parking	This valve control the oil flow for applying and releasing parking brake.

6) CLUTCH



70D9VB3PS08

(1) Summary

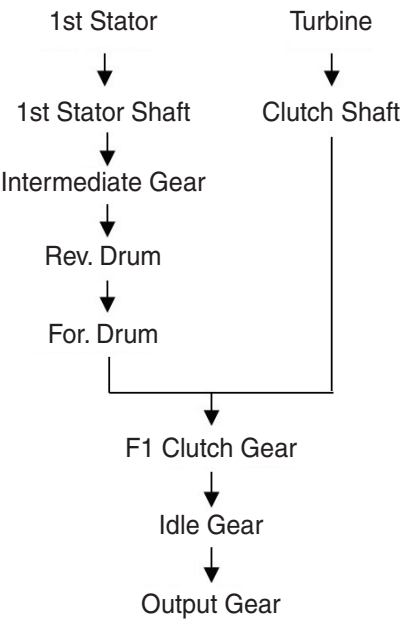
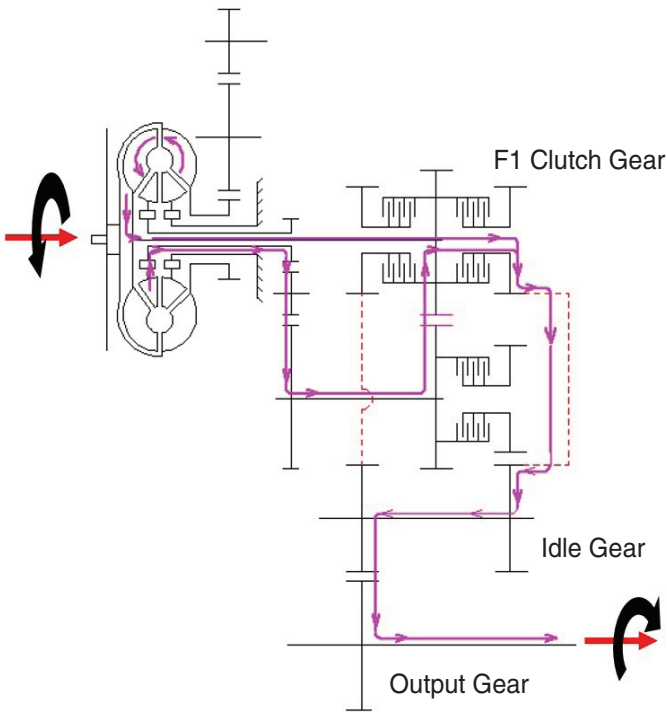
- ① This transmission consists of the forward and reverse shift equipments which is the wet multiple disc type of hydraulic clutch.
- ② There are 7 discs per each clutch which is made by carbon paper.

(2) Clutch shifting

- ① The explain of shift is represented in case of the shift "N (neutral) → F or R" in the vehicle.
- ② F & R solenoid valve become "ON" by voltage signal which is given by gear selector on the vehicle.
- ③ The hydraulic oil that is charged in accumulator valve discharges to the clutch port, and the port is filled.
- ④ After the filling of the port concludes, the oil that comes through the orifice "A" presses the piston of the accumulator slowly. And the clutch is engaged by the prescribed characteristic of pressure up, and the shock in clutch engagement is relieved.
- ⑤ When the clutch engagement concludes and the hydraulic oil becomes regular pressure.
- ⑥ 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.
- ⑦ Therefore the torque that is transmitted to the clutch shaft assembly transmits to the reduction gears.

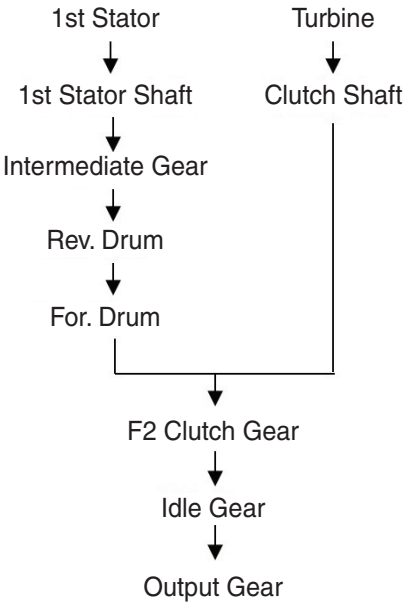
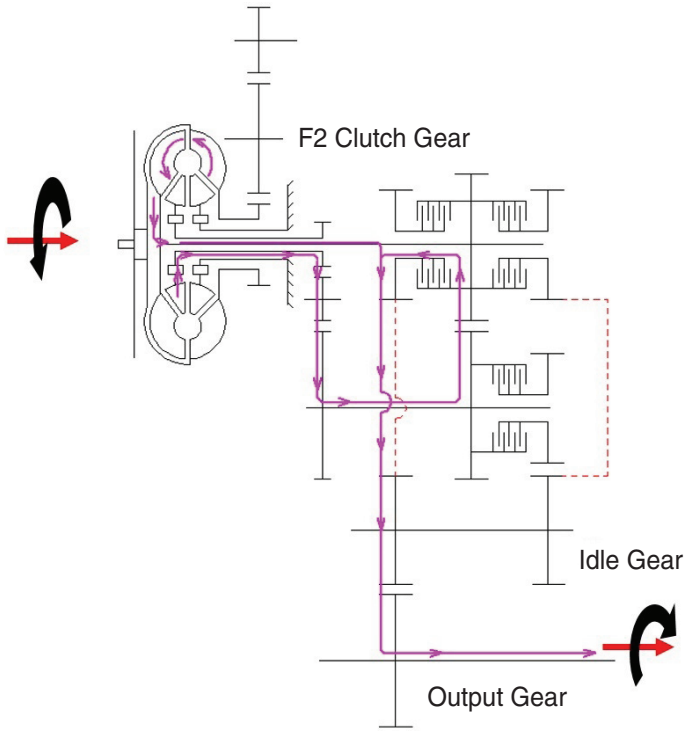
7) POWER FLOW

(1) Forward 1



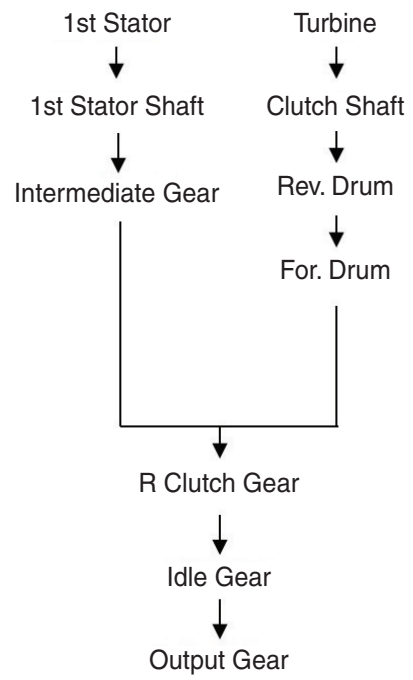
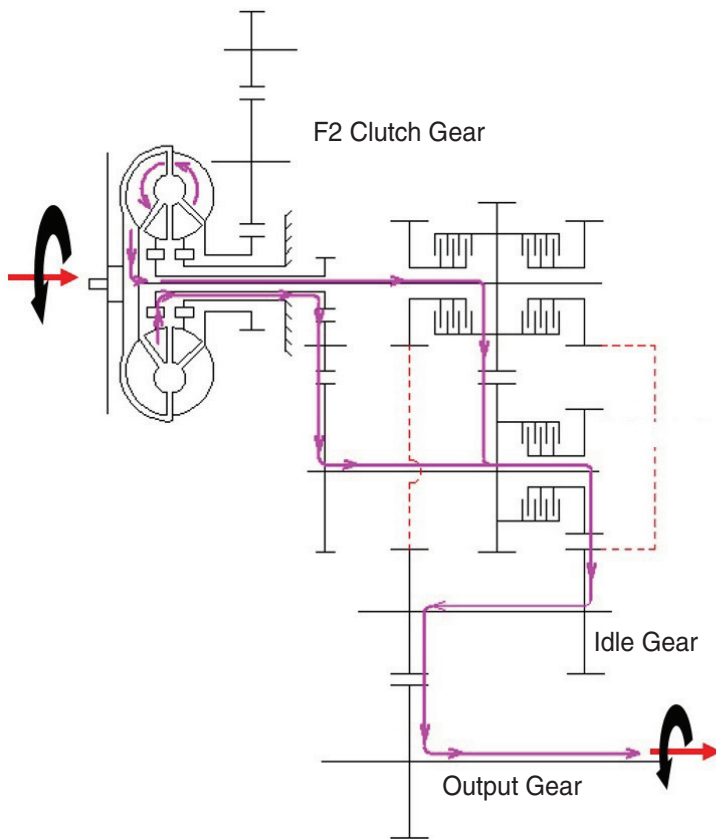
70D9VB3PS09

(2) Forward 2



70D9VB3PS10

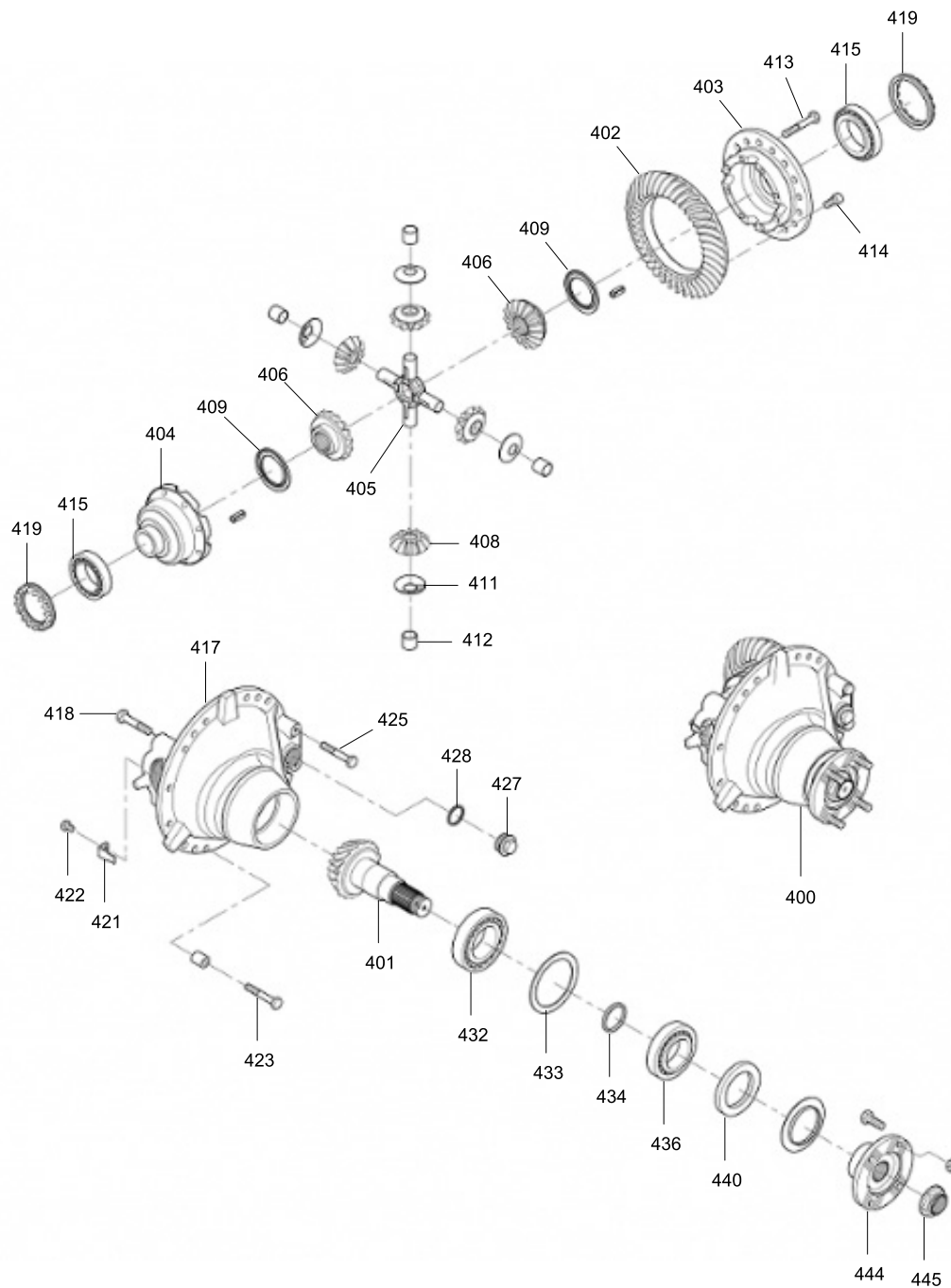
(3) Reverse



70D9VB3PS11

4. DRIVE AXLE (KESSLER)

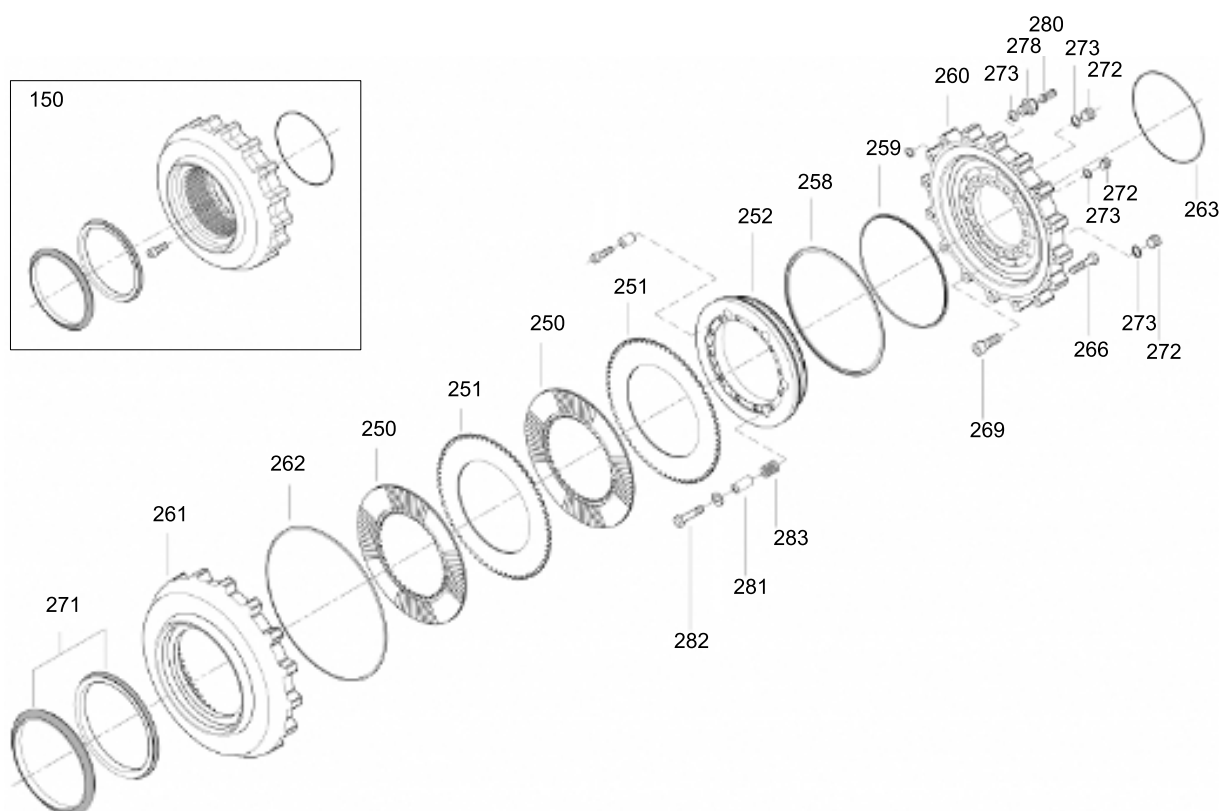
1) STRUCTURE (1/6)



100D9V3DA01

400	Differential & carrier assy	412	Bearing bushing	425	Hexagon screw
401	Drive pinion	413	Hexagon socket screw	427	Screw plug
402	Ring gear	414	Hexagon screw	428	Sealing ring
403	Differential housing	415	Tapered roller bearing	432	Tapered roller bearing
404	Differential housing	417	Differential carrier	433	Disk
405	Differential spider	418	Hexagon screw	434	Ring
406	Differential side gear	419	Setting ring	436	Tapered roller bearing
408	Differential pinion	421	Lock plate	440	Radial seal ring
409	Disk	422	Hexagon screw	444	Drive flange
411	Disk	423	Hexagon screw	445	Adjusting nut

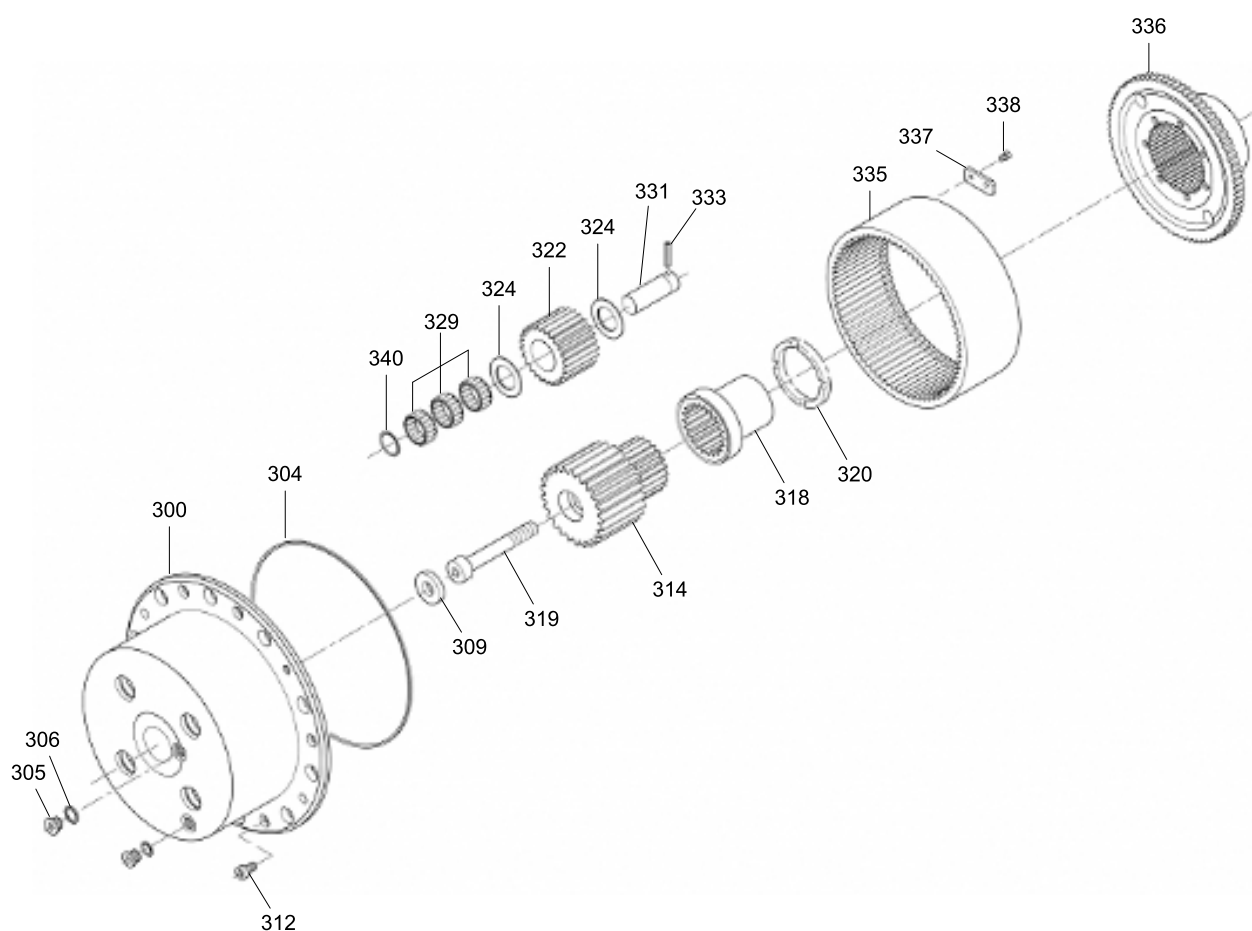
2) STRUCTURE (2/6)



100D9V3DA02

150	Brake assy	261	Housing	273	Sealing ring
250	Friction disc	262	O-ring	278	Bleeding socket
251	Steel disc	263	O-ring	280	Bleeder valve
252	Clutch piston	266	Hexagon socket screw	281	Pipe
258	Gasket	269	Hex sockets crew	282	Hexagon screw with flange
259	Gasket	271	Face seal	283	Compression spring
260	Brake carrier	272	Screw plug		

3) STRUCTURE (3/6)



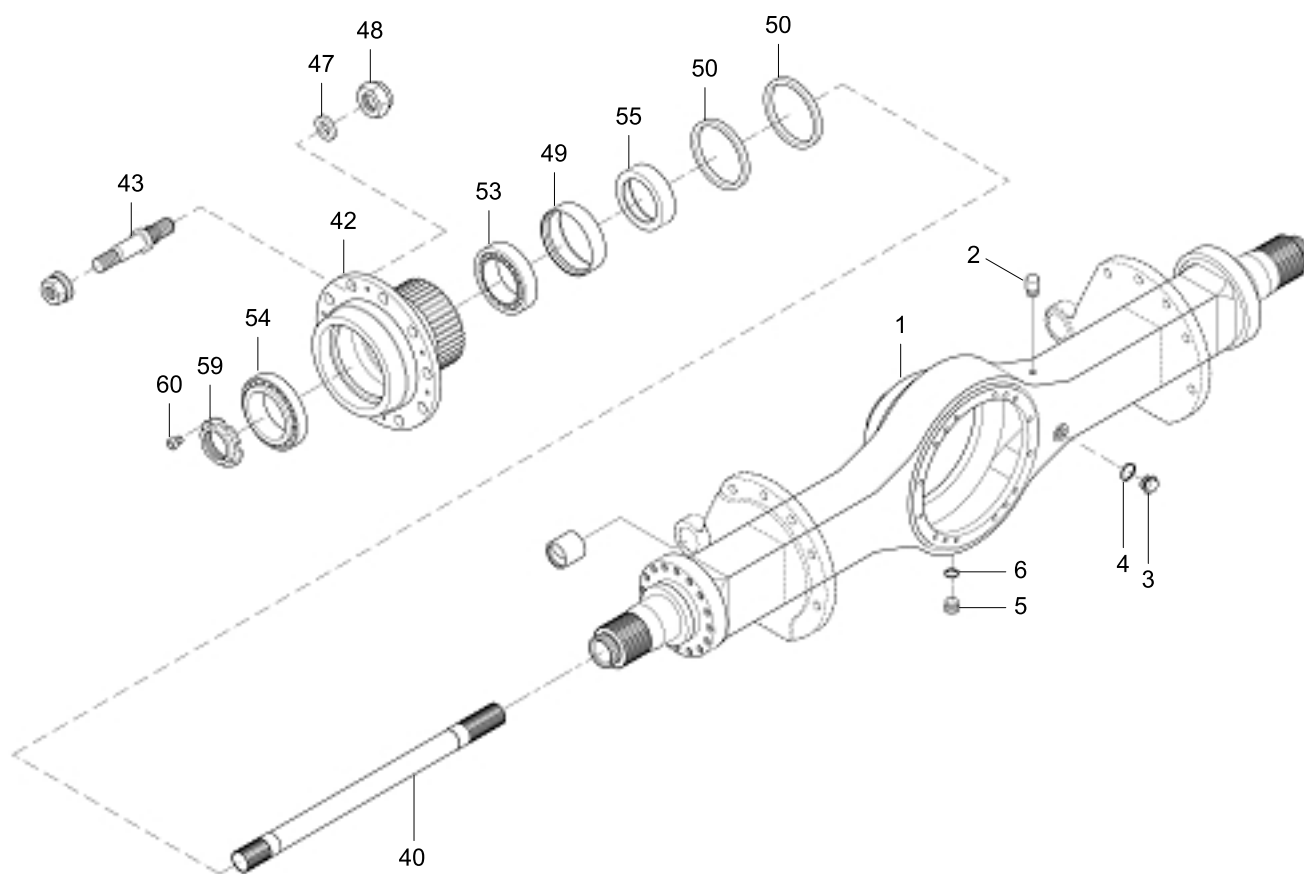
100D9V3DA03

300 Planetary housing
304 O-ring
305 Screw plug
306 Sealing ring
309 Thrust washer
312 Hexagon socket screw
314 Sun gear

318 Sleeve
319 Screw
320 Thrust ring
322 Planetary gear
324 Thrust washer
329 Needle bearing
331 Planetary pin

333 Locking pin
335 Ring gear
336 Ring gear carrier
337 Retainer
338 Hexagon socket screw
340 O-ring

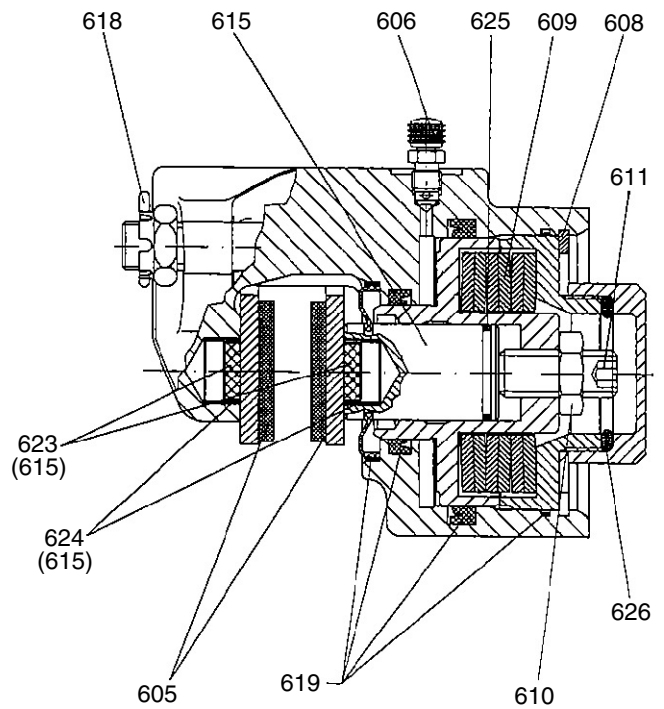
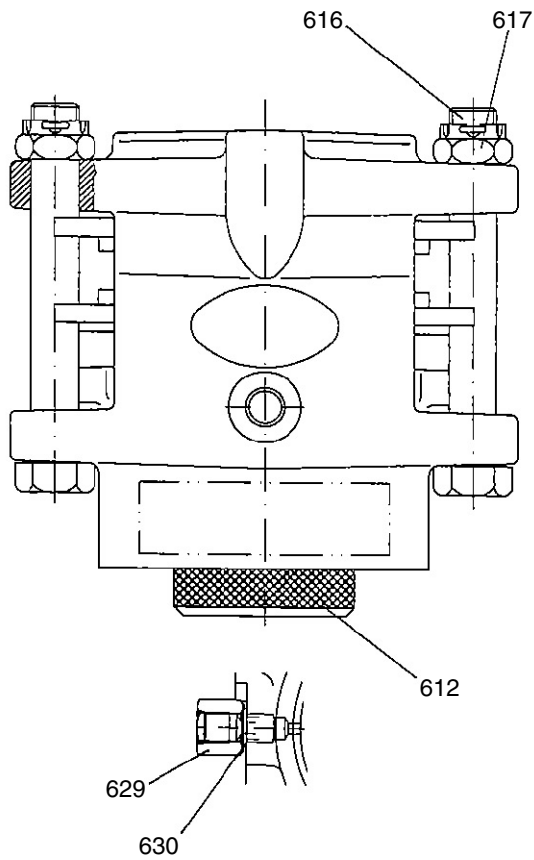
4) STRUCTURE (4/6)



100D9V3DA04

- | | | | | | |
|---|--------------|----|------------|----|----------------------|
| 1 | Axle housing | 40 | Axle shaft | 50 | Radial seal ring |
| 2 | Breather | 42 | Wheel hub | 53 | Taper roller bearing |
| 3 | Plug | 43 | Wheel stud | 54 | Taper roller bearing |
| 4 | Seal | 47 | Disk | 55 | Spacer ring |
| 5 | Screw plug | 48 | Hex nut | 59 | Nut |
| 6 | Seal | 49 | Bushing | 60 | Socket screw |

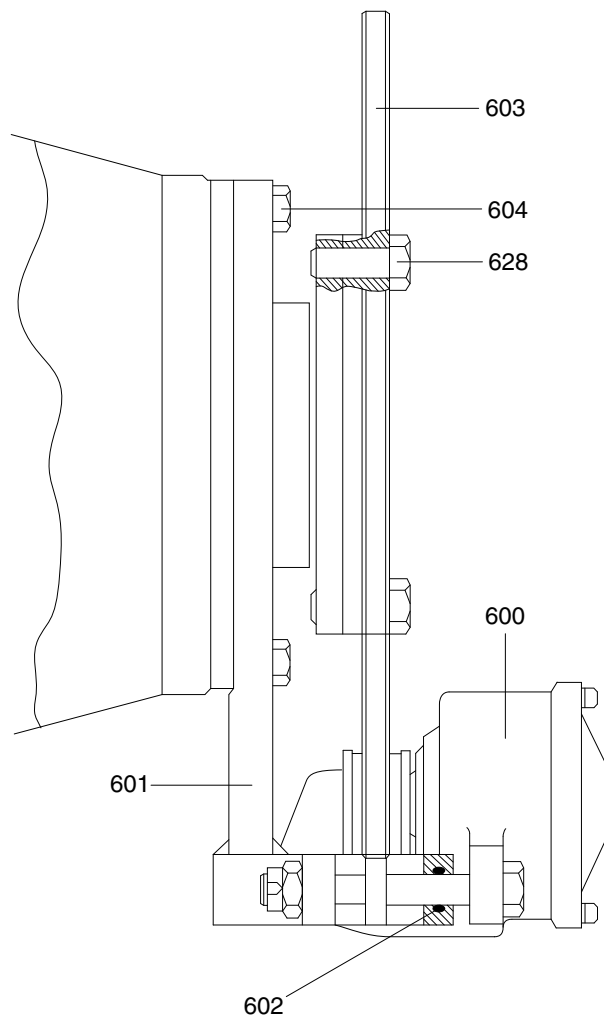
5) STRUCTURE (5/6)



110D9DR05

605	Lining set	612	Cap	623	Magnetic
606	Bleeder valve	615	Pressure bolt	624	Tolerance ring
608	Circlip	616	Hex screw	625	O-ring
609	Dished plate spring	617	Castle nut	626	O-ring
610	Hex nut	618	Split pin	629	Socket screw
611	Set screw	619	Gasket	630	Sealing ring

6) STRUCTURE (6/6)



110D9DR06

600 Parking brake
601 Brake carrier

602 O-ring
603 Disc plate

604 Hex screw
628 Hex screw

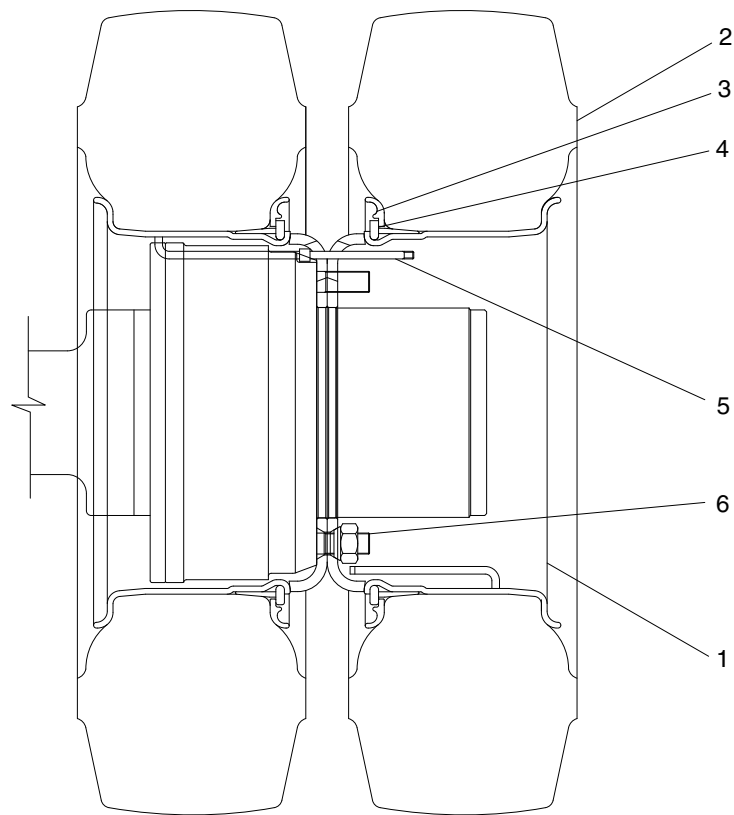
7) OPERATION

Both sides of the housing are supported by the frame and the center is mounted on the transmission case through propeller shaft.

The mast is installed on the front of the drive axle housing. The final deceleration and differential device built in the housing guarantee accurate rotation and smooth operation.

The power from the transmission is transferred through the hypoid pinion, hypoid gear, differential case, the pinion of the differential device and the side gear to the drive axle shaft by the side gear spline and to the hub and wheel mounted on the shaft by high tension bolts.

5. TIRE AND WHEEL



B507AX68

- | | | | | | |
|---|-----------|---|-----------|---|----------------|
| 1 | Wheel rim | 3 | Lock ring | 5 | Valve assembly |
| 2 | Tire | 4 | Side ring | 6 | Wheel nut |

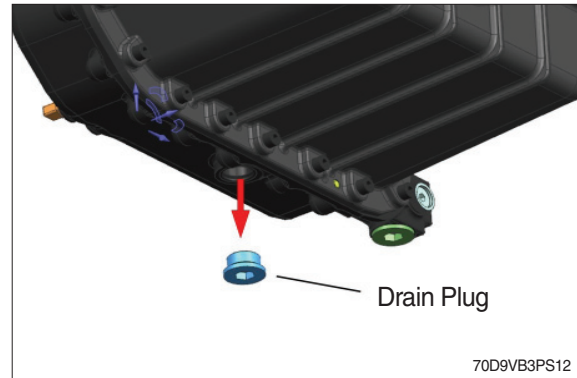
- 1) The tire acts to absorb the shock from the ground surface to the machine, and at the same time they must rotate in contact with the ground to gain the power which drives the machine.
- 2) Various types of tires are available to suit the purpose. Therefore it is very important to select the correct tires for the type of work.

GROUP 2 DISASSEMBLY AND ASSEMBLY

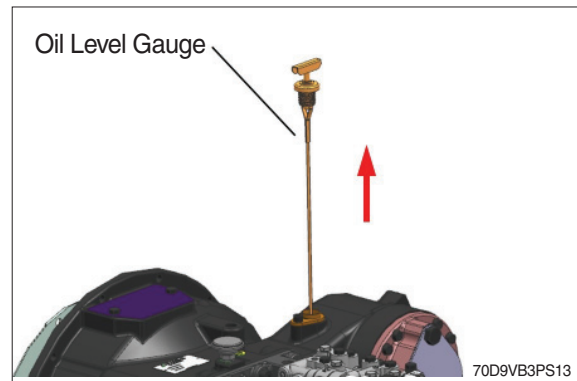
1. DISASSEMBLY OF TRANSMISSION

1) DISASSEMBLY OF TRANSMISSION

- (1) Remove the drain plug. Discharge the transmission oil.

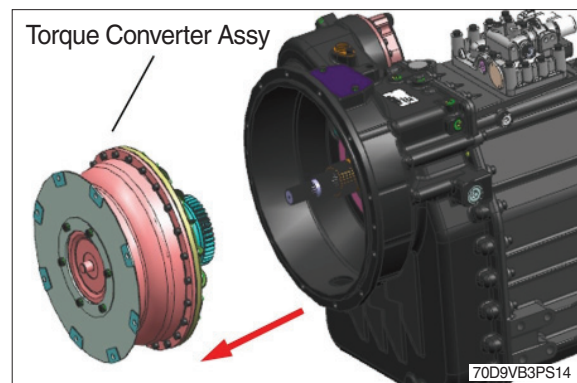


- (2) Remove the oil level gauge.

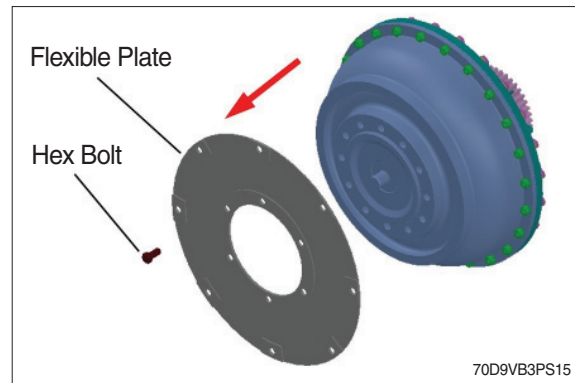


(3) Disassemble the torque converter assy.

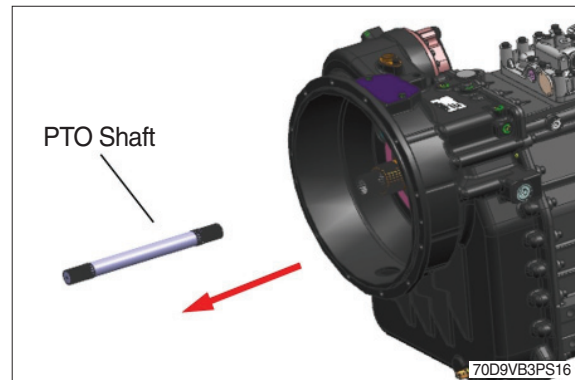
- ① Disassemble the torque converter assy.



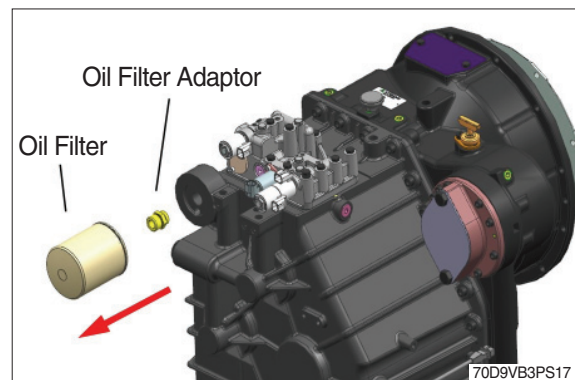
- ② Loosen the hex bolts and separate the flexible plate



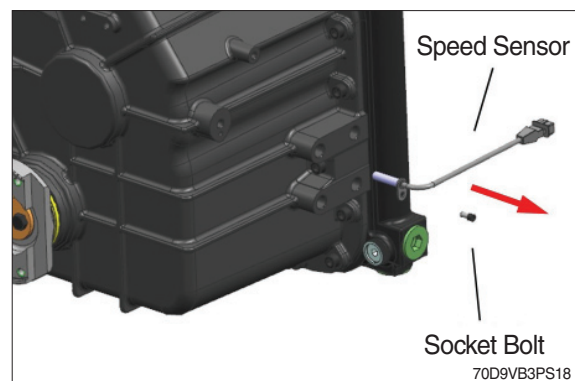
- (4) Disassemble PTO shaft.



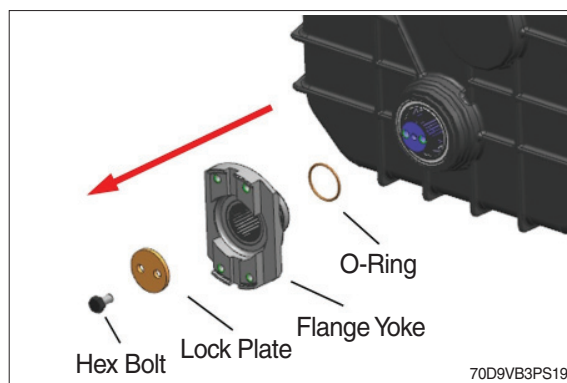
- (5) Remove the oil filter and oil filter adaptor.



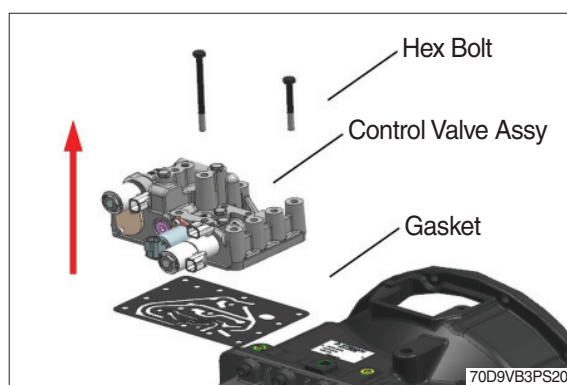
- (6) Disassemble the socket bolt and speed sensor.



- (7) Disassemble the hex bolt. And disassemble the lock plate, flange yoke and O-ring.

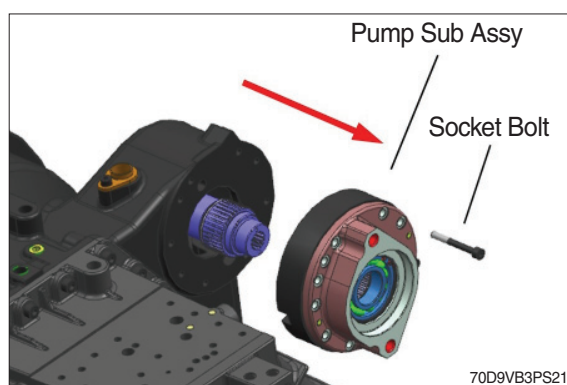


- (8) Disassemble the control valve assy. Loosen the hex bolts (M8×60L 2EA, M8×75L 1EA, M8×110L 2EA, M8×70L 9EA). Separate the control valve ass'y and gasket.

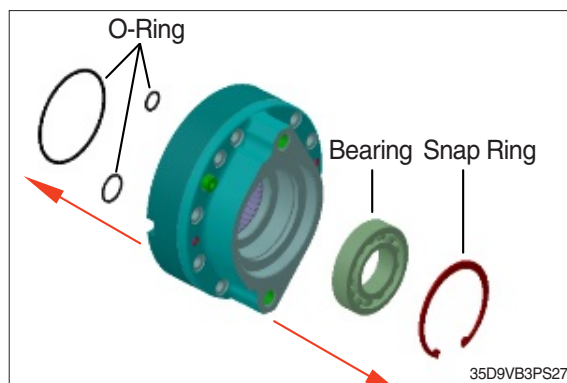


- (9) Disassemble the pump sub assy.

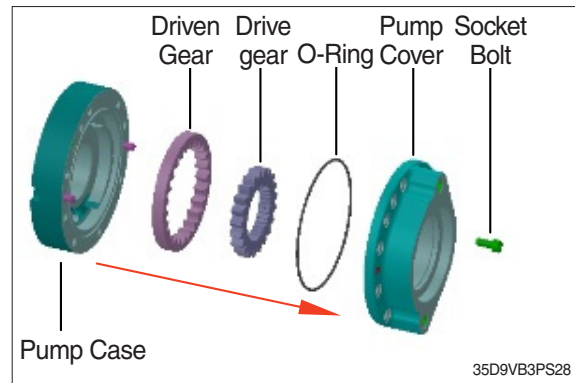
- ① Disassemble the socket bolts and pump assy.



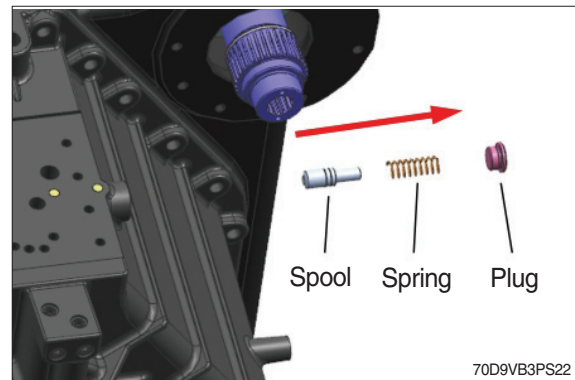
- ② Disassemble the snap ring, bearing and O-rings (3 EA).



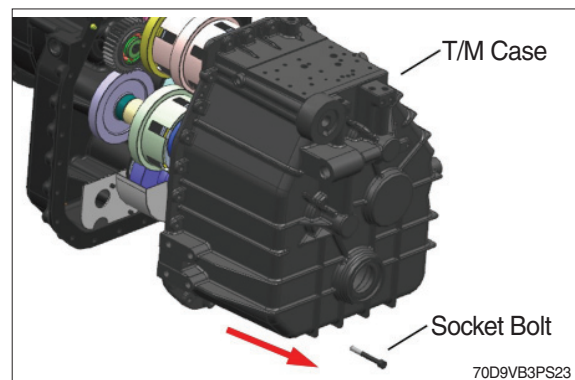
- ② Disassemble the socket bolts. And separate the O-ring, drive gear and driven gear from the pump case.



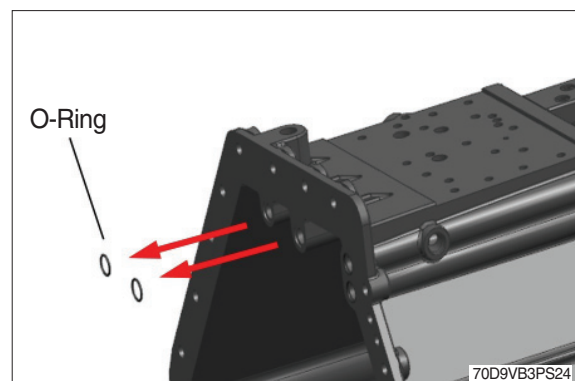
- (10) Remove the plug, spring, spool.



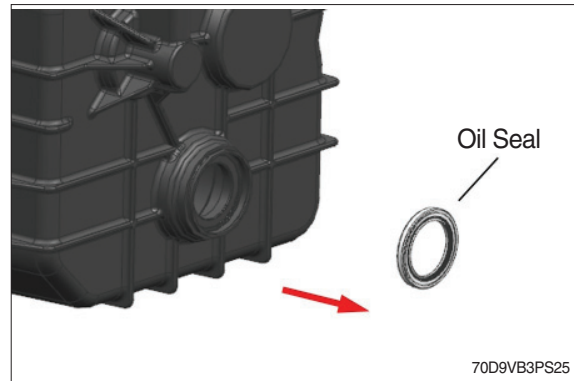
- (11) Loosen the socket bolts. Then separate the T/M case.



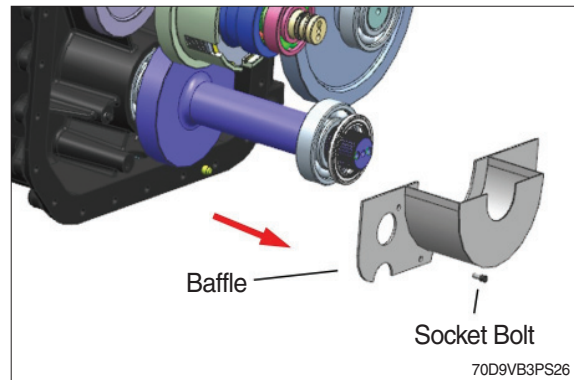
- (12) Remove the O-rings.



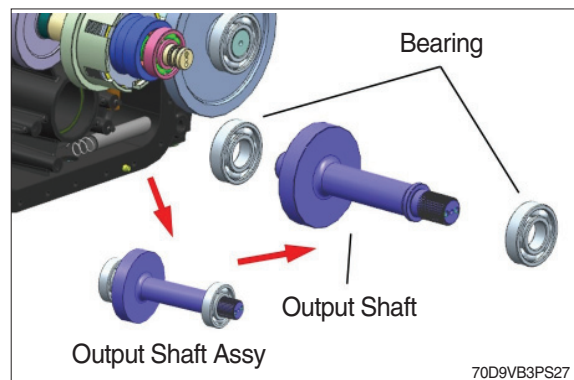
(13) Remove the oil seal.



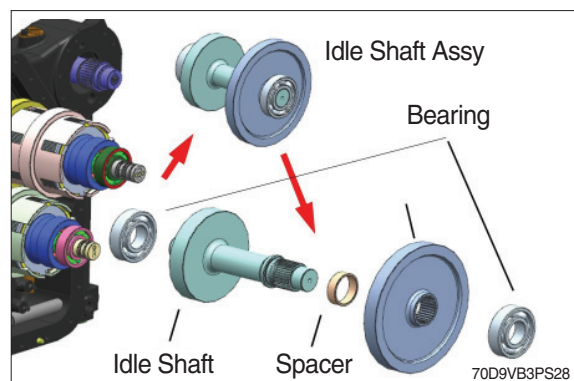
(14) Loosen the socket bolts and remove the baffle.



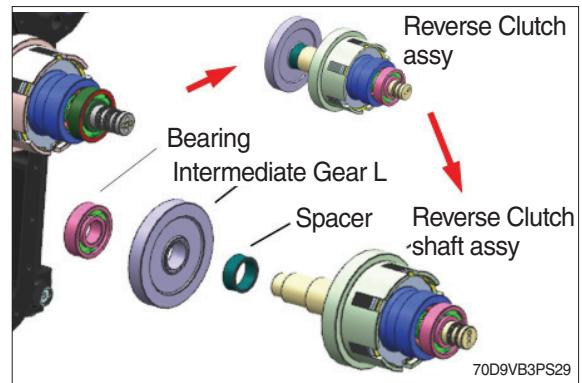
(15) Remove the output shaft assy and disassemble the bearings.



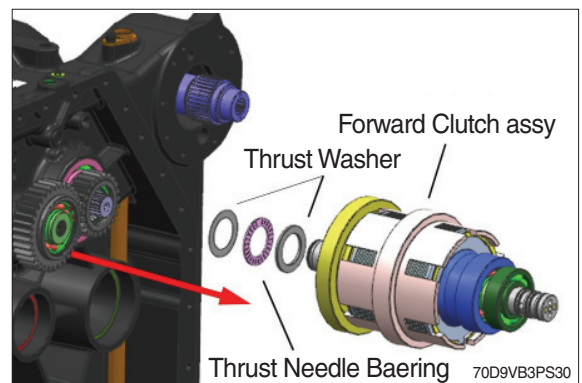
(16) Remove the Idle shaft assy and disassemble the bearings and spacer.



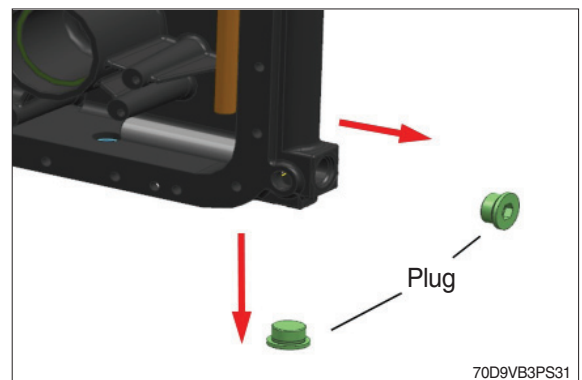
- (17) Remove the reverse clutch assy and disassemble the reverse clutch shaft assy, bearing and spacer.



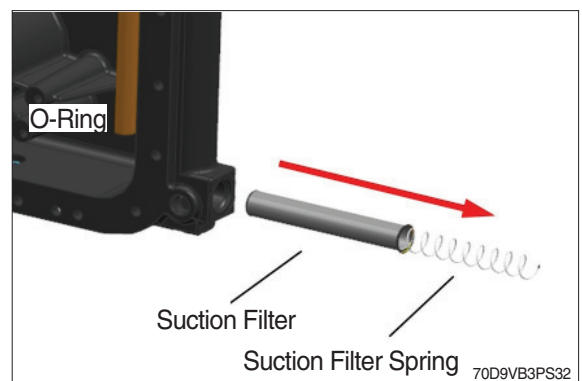
- (18) Remove the Forward clutch assy and disassemble the thrust bearing and washers.



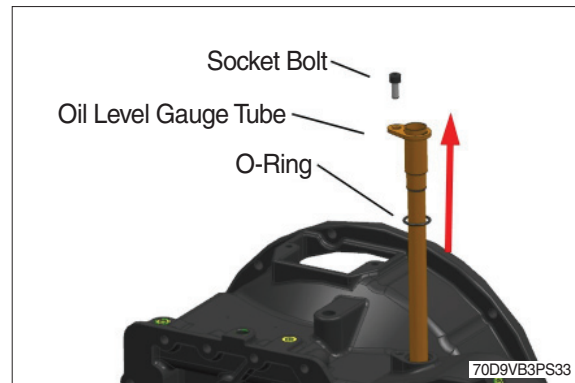
- (19) Remove the plugs.



- (20) Remove the suction filter spring and suction filter.

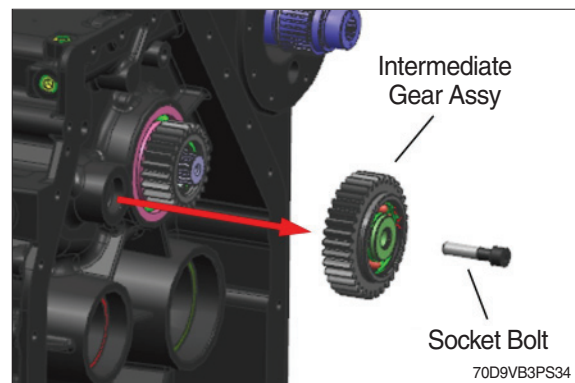


(21) Loosen the socket bolt. And remove the oil level gauge and O-ring.



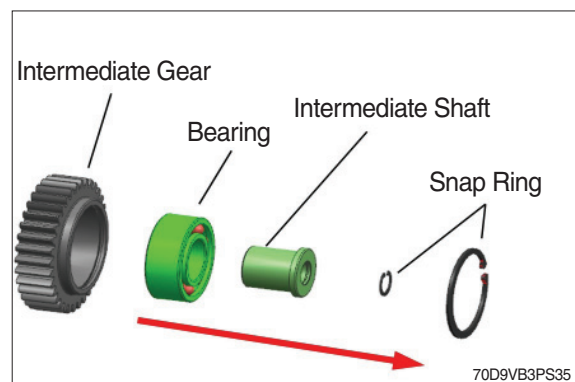
(22) Disassemble intermediate gear sub part.

① Loosen the socket bolt and remove the intermediate gear assy.



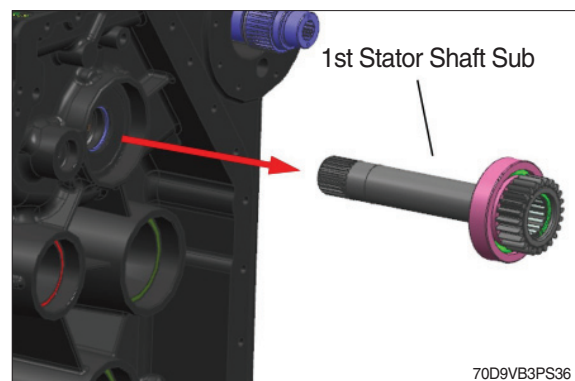
② Remove the snap ring (large) from the intermediate gear. And remove the intermediate shaft and bearing.

③ Remove the snap ring (small) from the intermediate shaft.

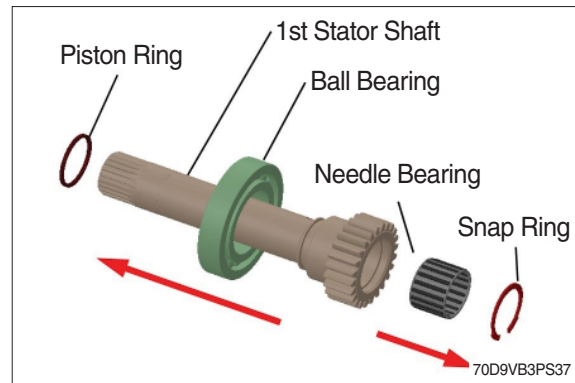


(23) Disassemble the 1st stator sub part.

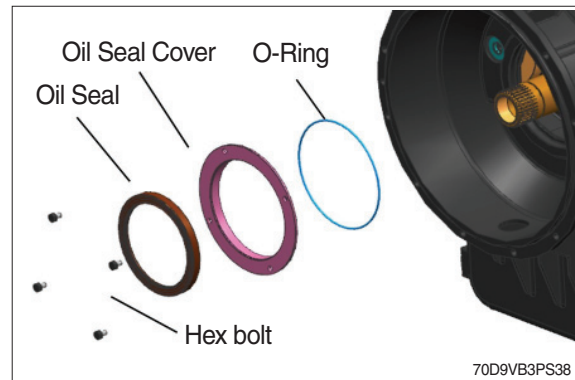
① Remove the 1st stator shaft sub.



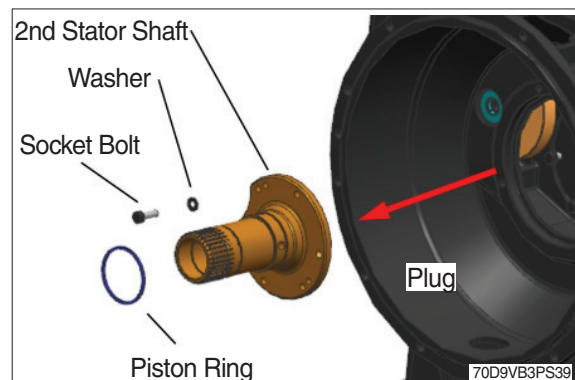
- ② Remove the snap ring and needle bearing. And disassemble the needle bearing.
- ③ Pull off the bearing and remove the thrust piston ring.



- (24) Loosen the hex bolts and remove the oil seal cover, oil seal, and O-ring.



- (25) Loosen the socket bolts and Remove washers, 2nd stator shaft, piston ring.

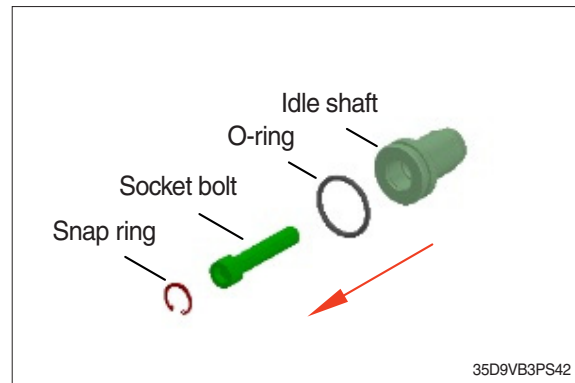


- (26) Disassemble the PTO idle gear part.

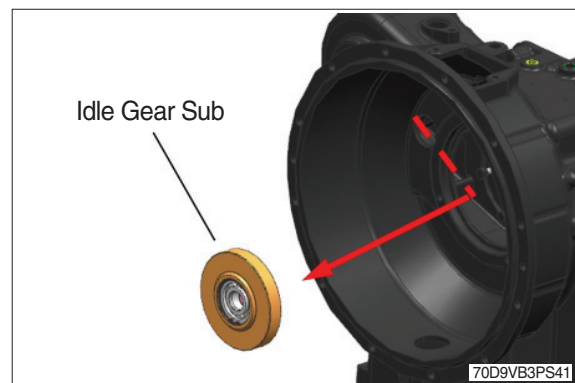
- ① Loosen socket bolt and remove idle shaft assy.
- ※ Do not remove the snap ring.



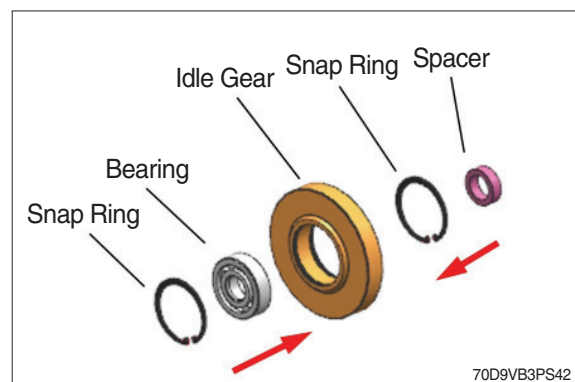
- ② Remove the snap ring, socket bolt, and O-ring from the idle shaft.



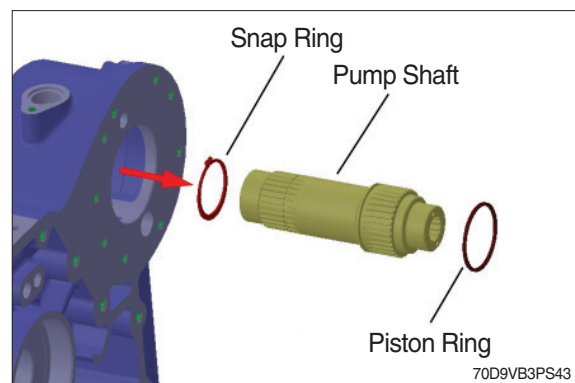
- ③ Remove the idle gear sub through the hole in the T/C housing.



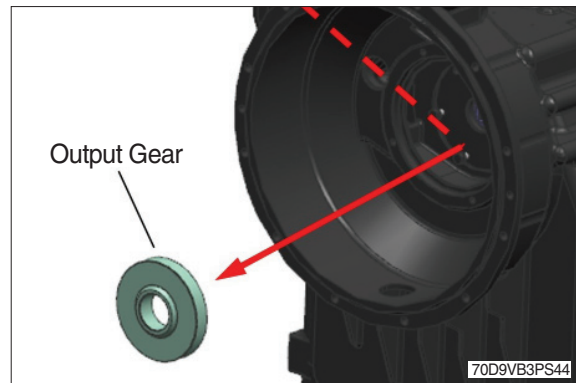
- ④ After disassembling the snap rings, remove the spacer & spacer.



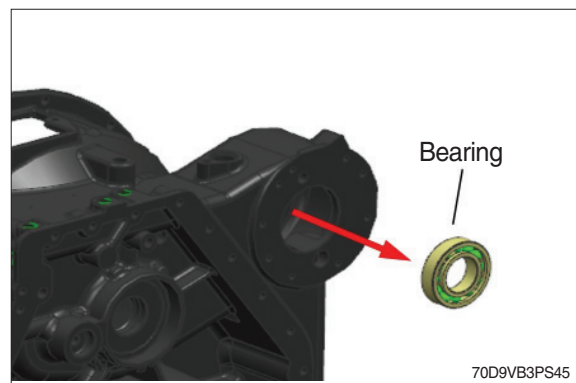
- (27) After remove the pump shaft sub, then disassemble the piston ring and the snap ring.



(28) Remove the output gear through the hole in the T/C housing.

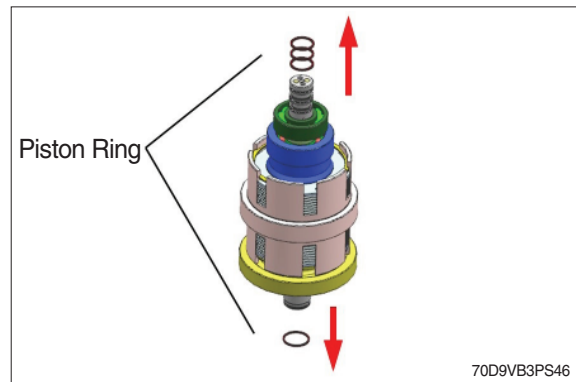


(29) Remove the bearing.

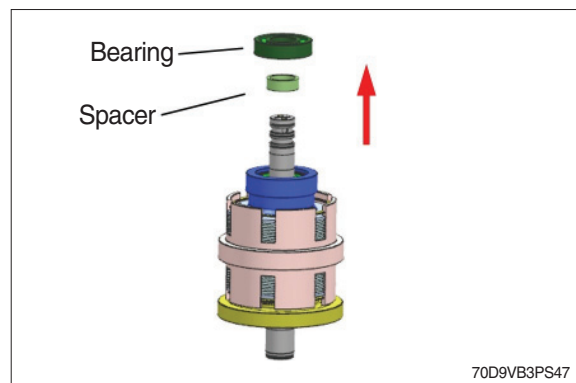


2) DISASSEMBLY OF CLUTCH SUB ASSEMBLY

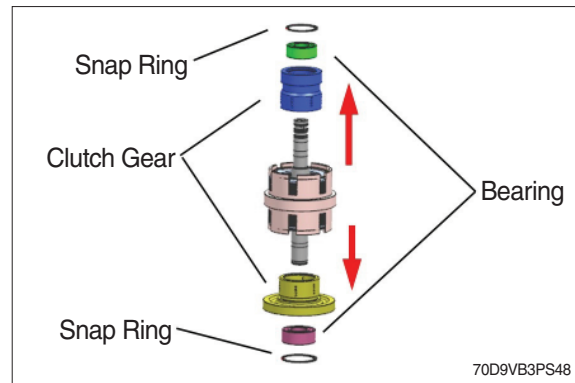
(1) Disengage the piston rings.



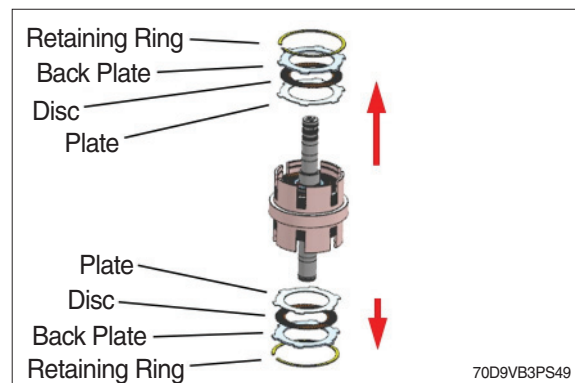
(2) Pull off the bearings and remove the spacer.



- (3) Disassemble the snap rings, pull off the bearings, and disassemble the clutch gears.

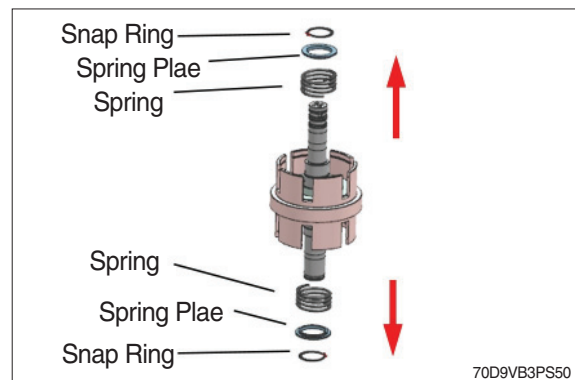


- (4) Disengage the retaining ring. Then remove the back plate, opp. plates and friction plates.

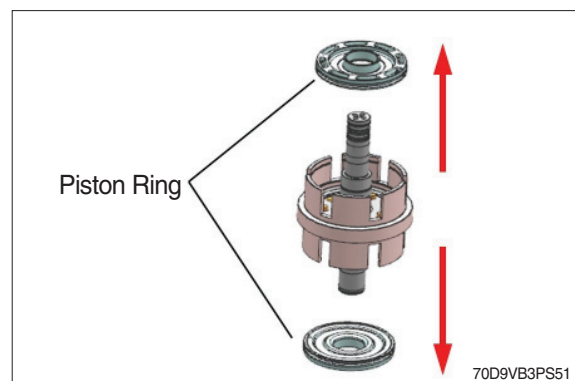


- (5) Remove the snap rings, spring plates and springs.

⚠ 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.



- (6) By means of compressed air, press the piston sub off and remove them.



2. ASSEMBLY OF TRANSMISSION

1) SUB ASSEMBLY OF CLUTCH

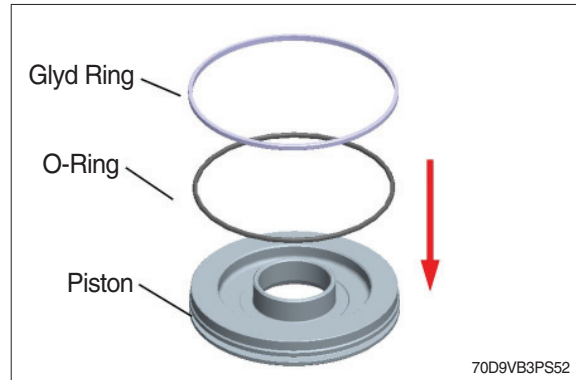
(1) Assemble the piston groove in the O-ring and glyd ring.

※ Apply T/M oil when assembling the O-ring.

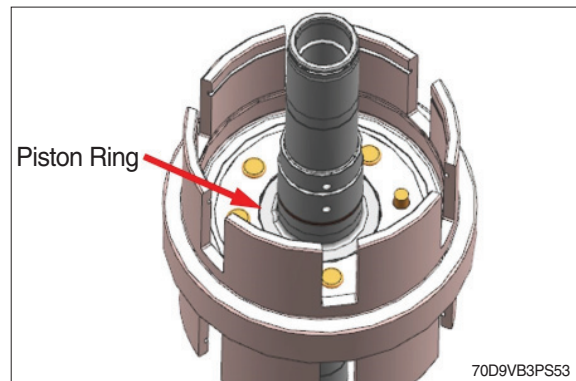
※ How to assemble the glide ring.

① Heat the glide ring.

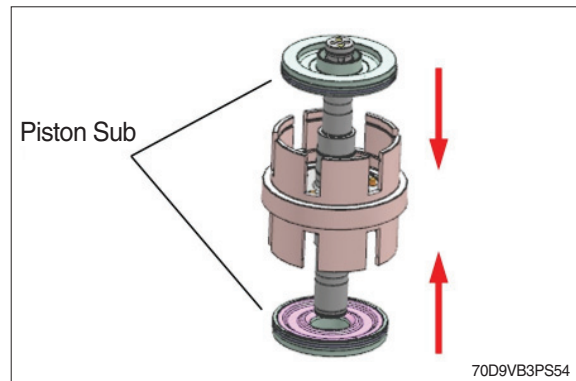
② Assemble the gliding when it becomes loose.



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

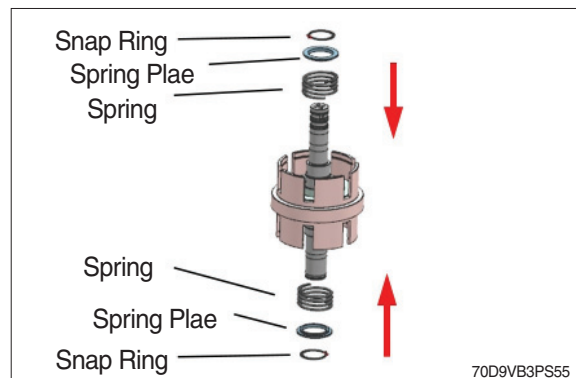


(3) Insert the piston sub into the drum gear.

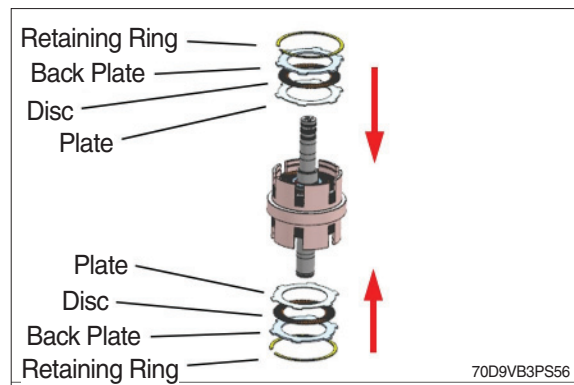


(4) Assemble the spring, spring plate & snap ring.

▲ 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.

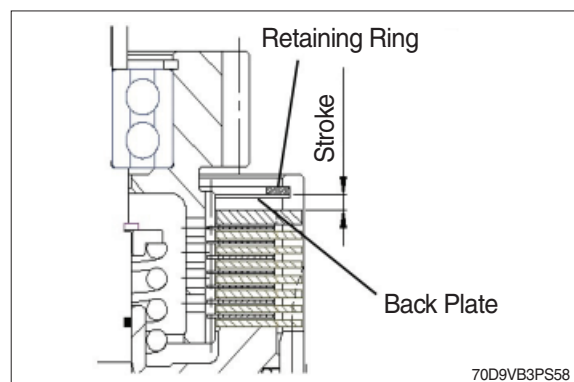
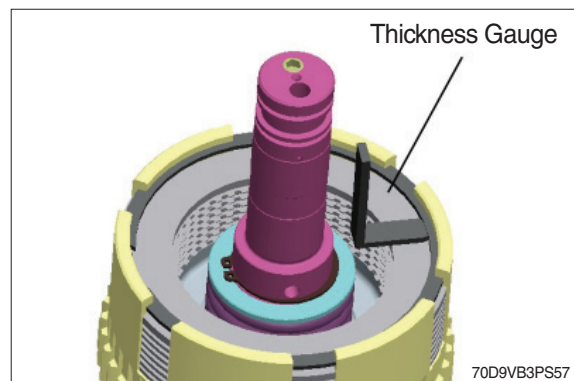


- (6) Measure clearance between the back plate and retaining ring using thickness gauge.

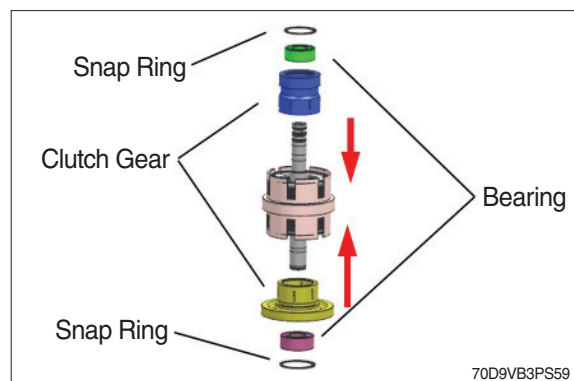
※ **Stroke specification : 3.6 ~ 4.0 mm**

If the measured value is out of the specified range, replace with a suitable retaining ring.

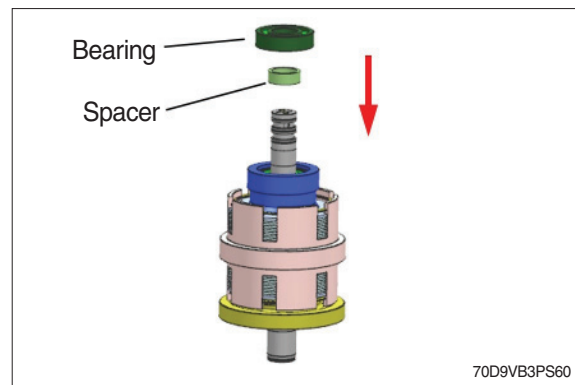
Retaining ring thickness : 2, 2.2, 2.5, 3.1 mm



- (7) After assembling the clutch gear and bearing, fasten the snap ring.

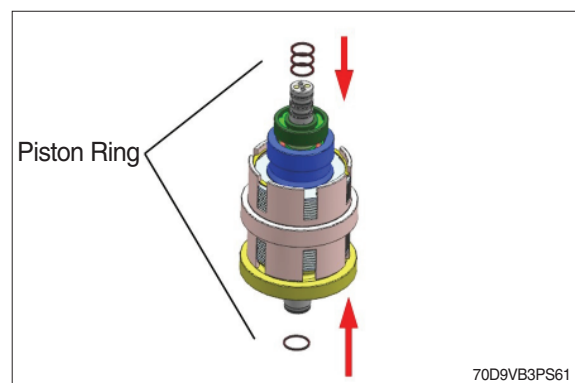


(8) Assemble the spacer and bearing.

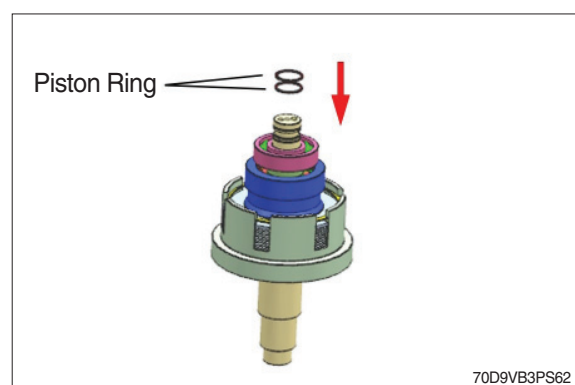


(9) Assemble piston ring.

- ① Forward clutch : fit the piston rings (4 EA) at groove of clutch shaft and oil them.

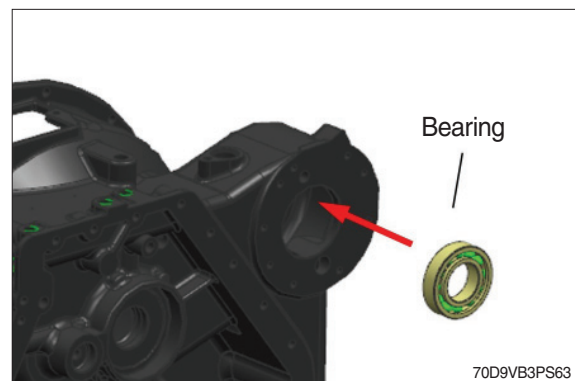


- ② Reverse clutch : fit the piston rings (2 EA) at groove of clutch shaft and oil them.

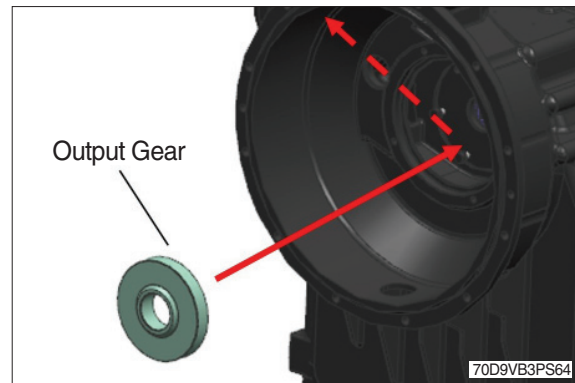


2) ASSEMBLY OF TRANSMISSION

- (1) Insert the bearing into the T/C housing.

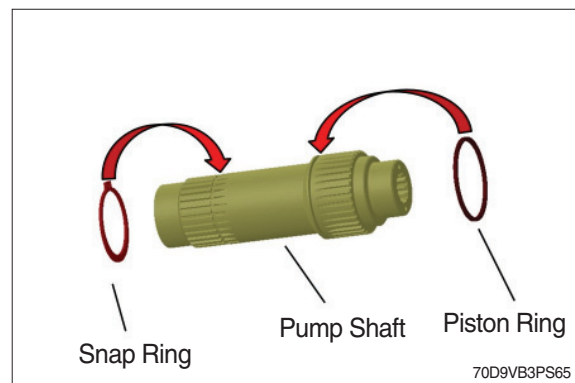


- (2) Insert the output gear through the central hole of the T/C housing.

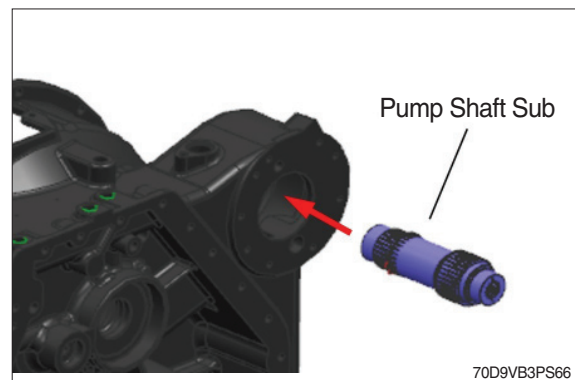


(3) Assemble pump shaft sub part.

- ① Assemble the snap ring & piston ring on pump shaft.
 ※ Cover grease on piston ring.

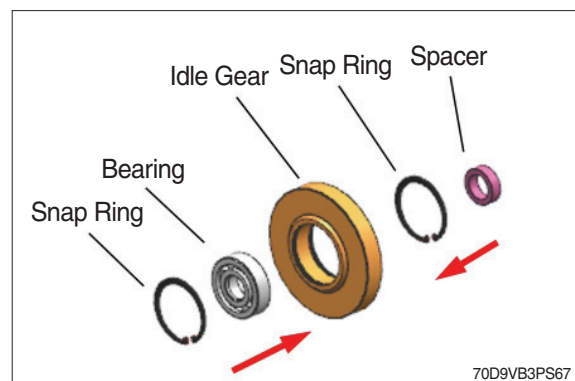


- ② Assemble the pump shaft sub.

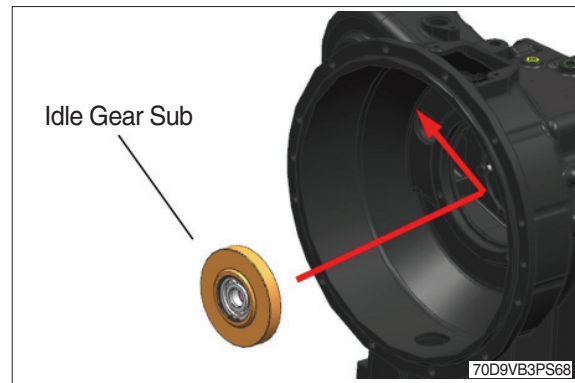


(4) Assemble the idle gear sub.

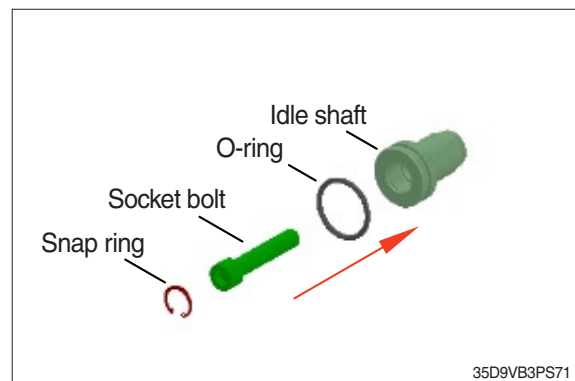
- ① Insert bearing into idle gear and assemble snap rings on both sides.
 ※ Assemble the spacer on one side of the idle gear.



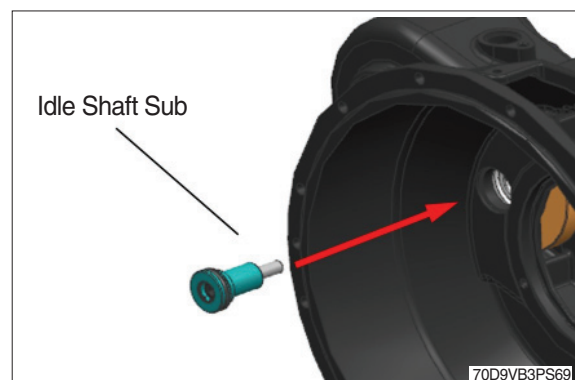
- ② Insert the idle gear sub through the central hole of the T/C housing.



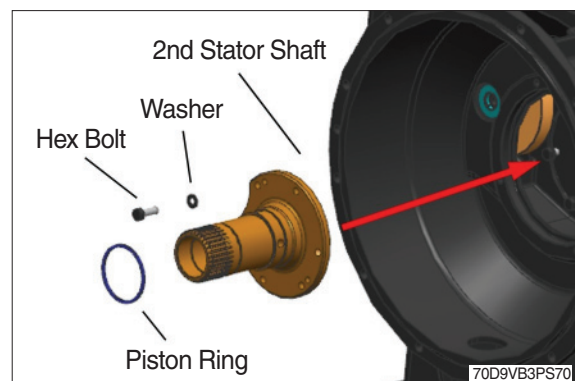
- ③ Assemble socket bolt and snap ring on idle shaft. And assemble o-ring.
 ※ **Cover grease on o-ring.**



- ④ Assemble idle shaft sub.
 · Tightening torque : 10.2 ~ 11.2 kgf·m
 (73.8 ~ 81.0 lbf·ft)
 ※ **Cover Loctite #277 on the screw side of bolt.**



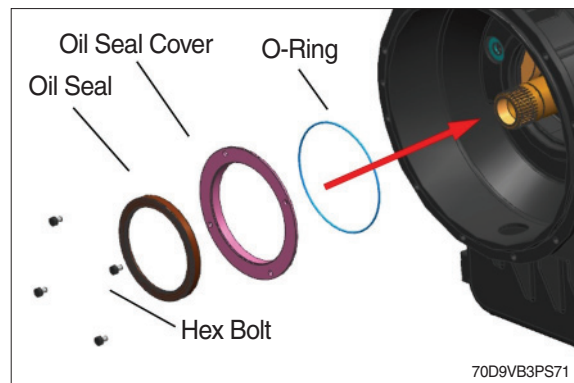
- (5) Assemble piston ring on 2nd stator shaft.
 And assemble 2nd stator shaft, hex bolts and washers on T/C housing.
 · Tightening torque : 3.1 ~ 3.5 kgf·m
 (22.4 ~ 25.3 lbf·ft)
 ※ **Cover loctite #277 on the screw side of bolt and grease on piston ring.**



(6) Assemble the oil seal onto the oil seal cover in advance. After that, assemble the oil seal on the oil seal cover and tighten the bolts.

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

- ※ Spread grease on the seal lip of oil seal.
- ※ Cover loctite #277 on the screw side of bolt and grease the O-ring when assembling.

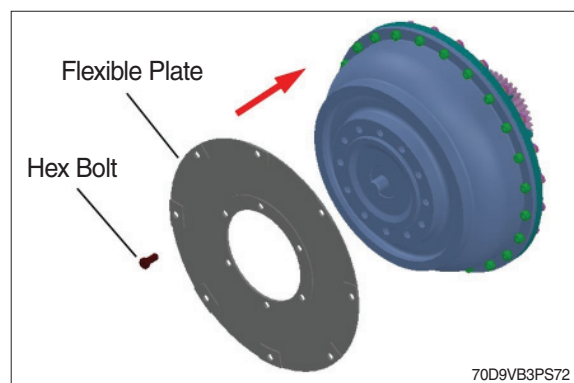


(7) Assemble torque converter part.

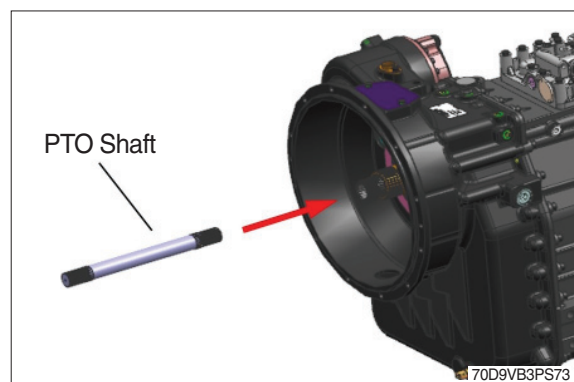
① Assemble the flexible plate and hex bolt on torque converter.

- Tightening torque : 4.1 ~ 4.9 kgf·m
(29.7 ~ 35.5 lbf·ft)

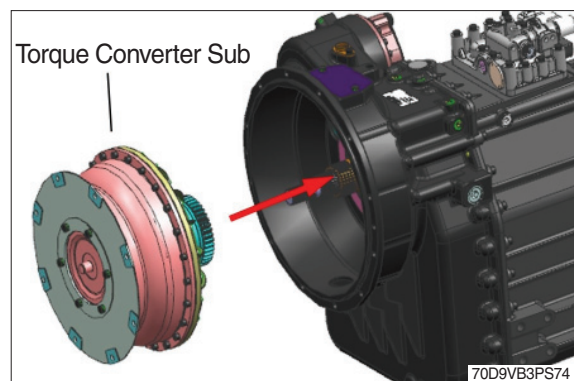
- ※ Cover loctite #277 on the screw side of bolt.



② Assemble PTO shaft.

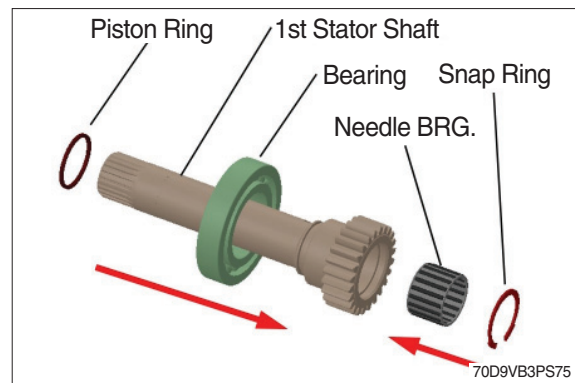


③ Assemble the torque converter sub.

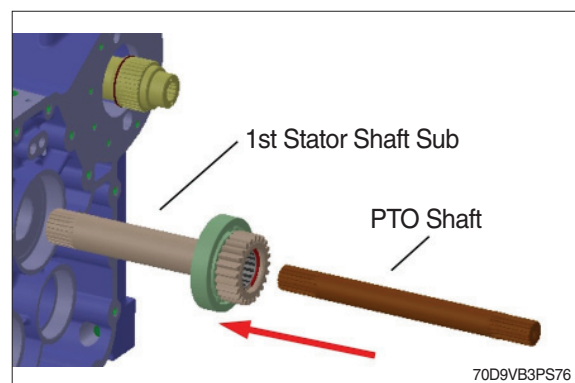


(8) Assemble the needle BRG. & snap ring on 1st stator shaft. And assemble the bearing and piston ring.

※ **Cover grease on piston ring.**

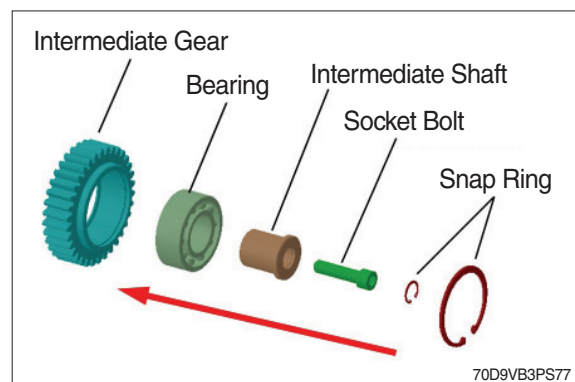


(9) Assemble 1st stator shaft sub and PTO shaft.



(10) Assemble the intermediate shaft sub part.

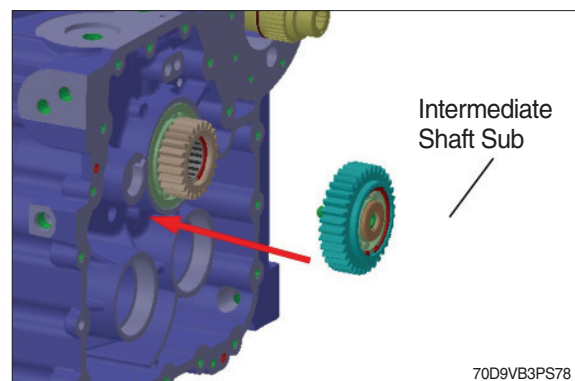
① Assemble the socket bolt and snap ring (small) on intermediate shaft. And assemble the bearing, intermediate shaft and snap ring (large) on intermediate gear.



② Assemble the flexible plate and hex bolt on torque converter.

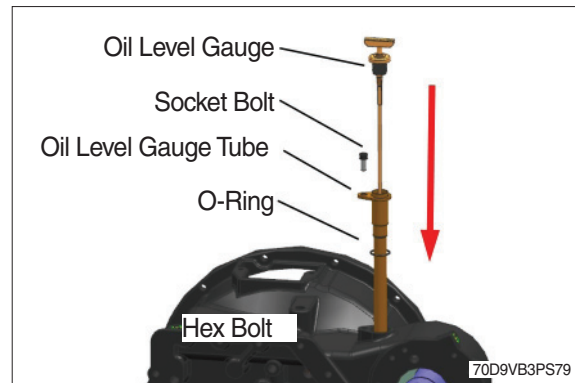
· Tightening torque : 10.2 ~ 11.2 kgf·m
(73.8 ~ 81.0 lbf·ft)

※ **Cover loctite #277 on the screw side of bolt.**

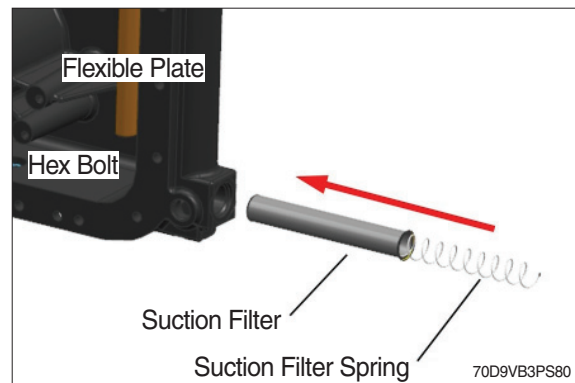


(11) Assemble oil level gauge and tube part.

- ① Assemble the O-ring on oil level gauge tube.
- ※ **Cover grease on O-ring.**
- ② Assemble the oil level gauge tube and bolt on the T/C housing.
 - Tightening torque : 3.1 ~ 3.5 kgf·m
(22.4 ~ 25.3 lbf·ft)
- ※ **Cover Loctite #277 on the screw side of bolt.**
- ③ Assemble the oil level gauge.

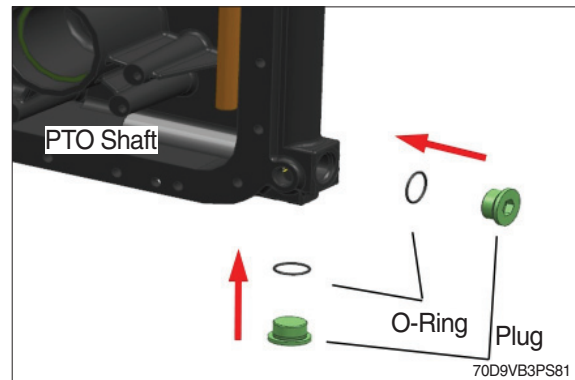


(12) Assemble the suction filter and spring.



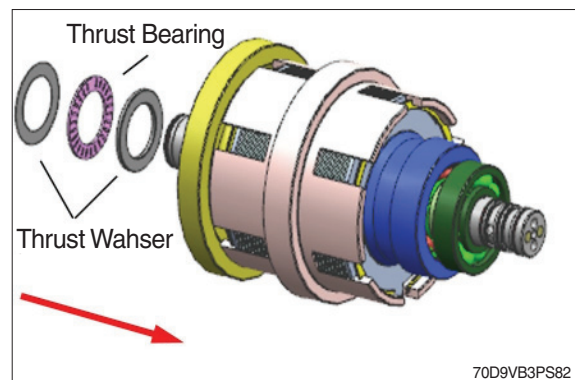
(13) Assemble O-ring and plug. Assemble the plugs, o-rings.

- Tightening torque : 4.1 ~ 4.9 kgf·m
(29.7 ~ 35.5 lbf·ft)
- ※ **Cover grease on O-ring.**

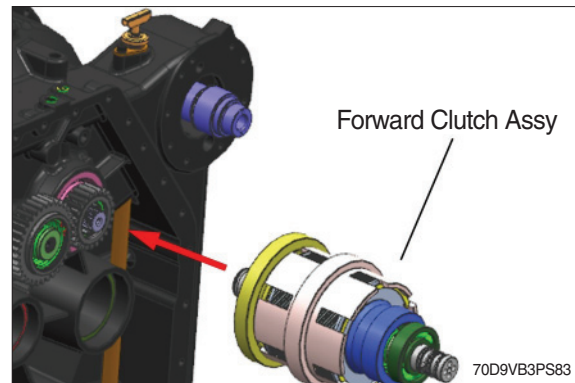


(14) Assemble the thrust washers and bearing on forward clutch sub.

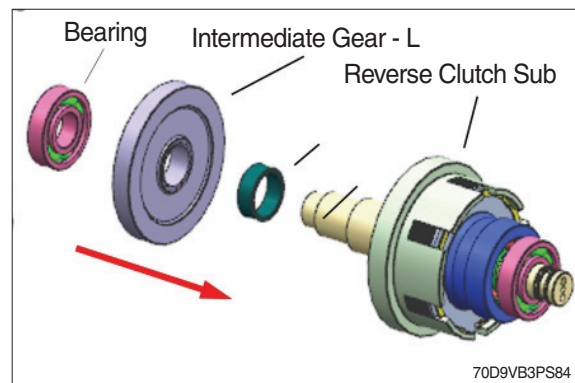
- ※ **Cover grease on the washers and bearing.**



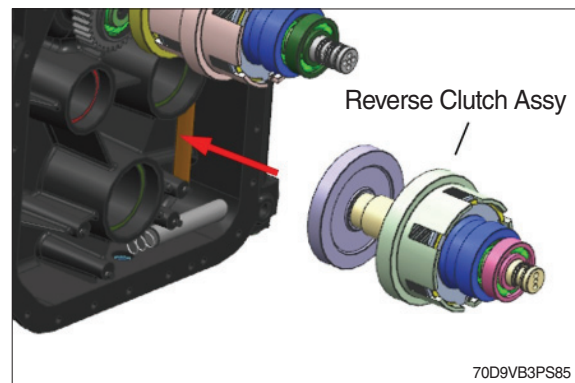
(15) Assemble the forward clutch assy.



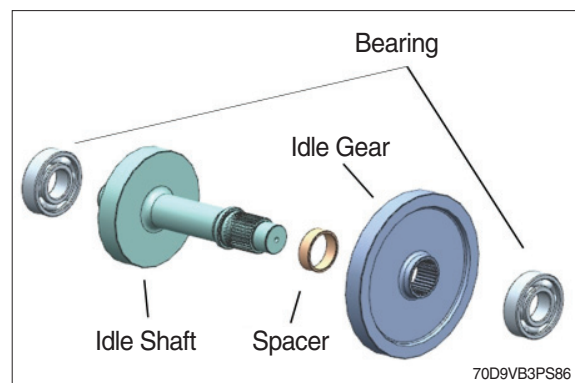
(16) Assemble the spacer, intermediate gear-L, and bearing.



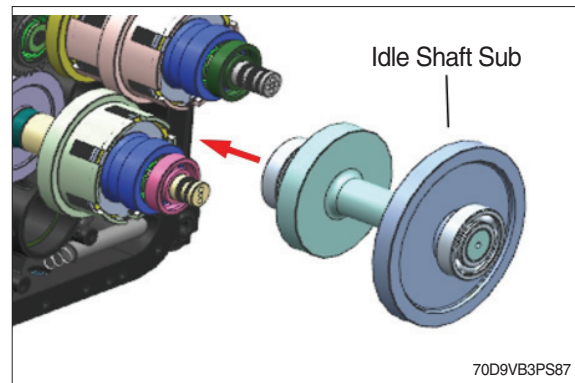
(17) Assemble the forward clutch assy.



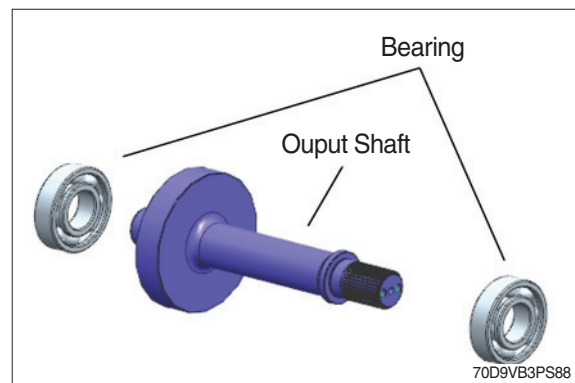
(18) Assemble the spacer, idle gear, and bearings on idle shaft.



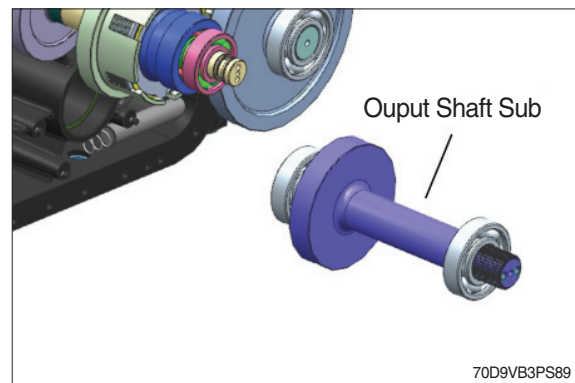
(19) Assemble the idle shaft sub.



(20) Assemble the bearings on output shaft.



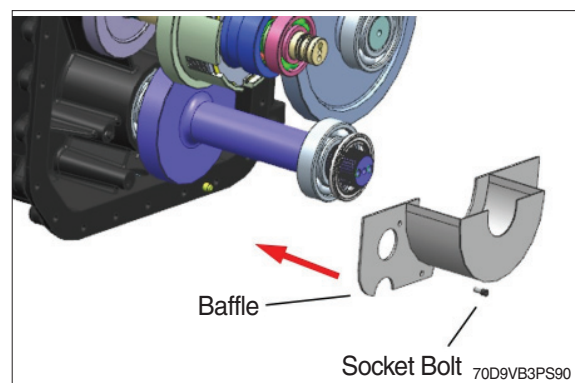
(21) Assemble the output shaft sub.



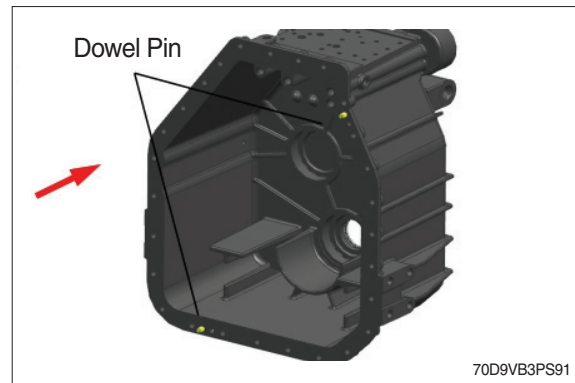
(22) Assemble the baffle and socket bolts.

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

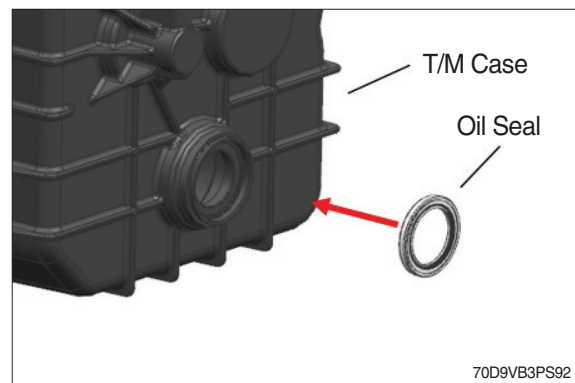
※ Cover Loctite #277 on the screw side of bolt.



(23) Press in the dowel pins (2 EA).



(24) Insert the oil seal into the T/M case.
Spread grease on the seal lip of oil seal.

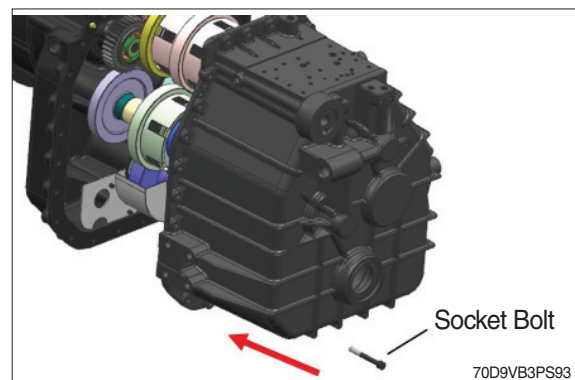


(25) Assemble the T/M case. Tighten the socket bolts.

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

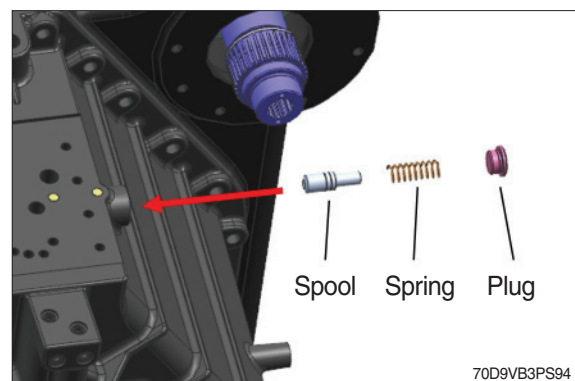
※ Cover Loctite #5127 on the joint surface of T/M case. Do not apply to the bolt holes.

※ Cover Loctite #277 on socket bolt.



(26) Assemble the spool, spring and tighten the plug.

· Tightening torque : 4.1 ~ 5.1 kgf·m
(29.7 ~ 36.9 lbf·ft)



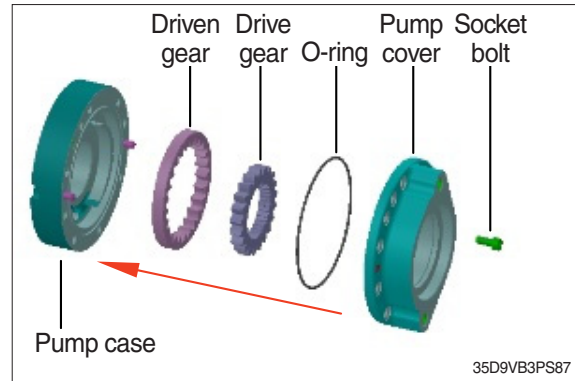
(27) Assemble oil pump sub part.

- ① Assemble the driven gear, drive gear and O-ring on pump case. And assemble the pump cover and socket bolt.

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

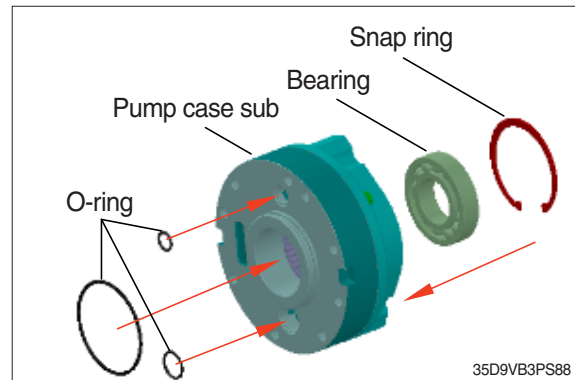
※ **Cover grease on the o-ring.**

※ **Cover Loctite #277 on the screw side of bolt.**



- ② Assemble the O-rings (3 EA) on pump case sub. Overturn assemble bearing and snap ring.

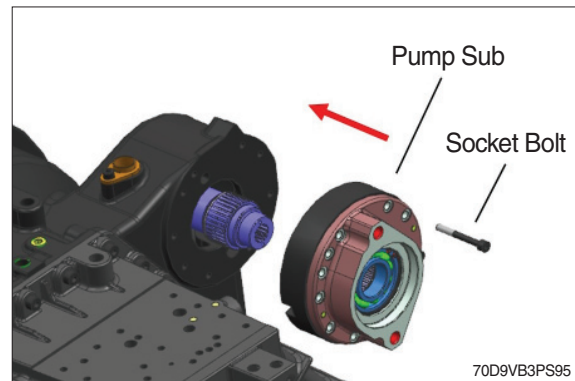
※ **Cover grease on O-ring.**



- ③ Assemble the pump case sub and socket bolt.

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

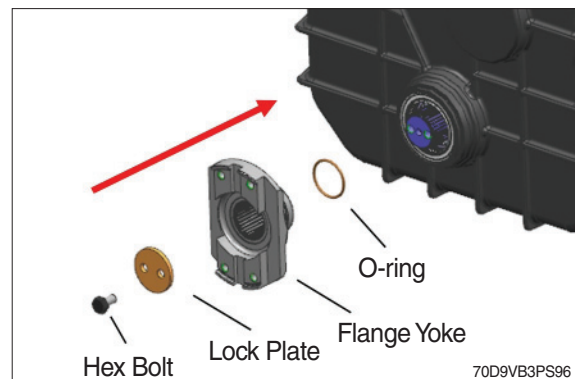
※ **Cover Loctite #277 on the screw side of bolt.**



- (28) Assemble the o-ring, flange yoke, lock plate and hex bolts.**

· Tightening torque : 6.1 ~ 6.6 kgf·m
(44.1 ~ 47.7 lbf·ft)

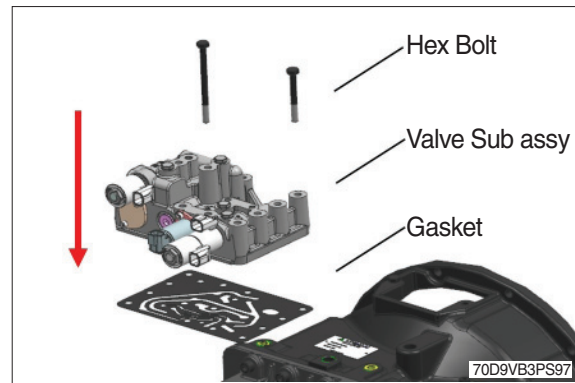
※ **Cover Loctite #277 on the screw side of bolt.**



(29) Assemble the gasket, valve sub and hex bolt.

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

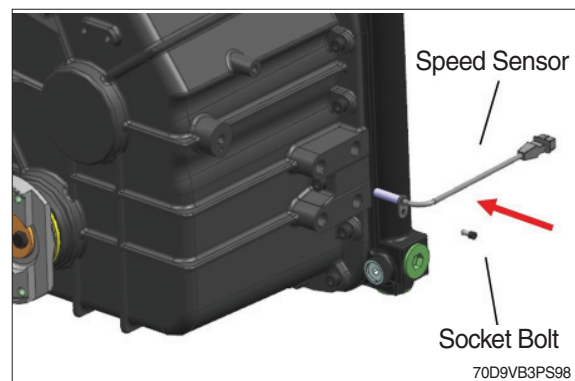
※ **Cover Loctite #277 on the screw side of bolt.**



(30) Assemble the speed sensor and socket bolt.

- Tightening torque : 0.9 ~ 1.1 kgf·m
(6.5 ~ 8.0 lbf·ft)

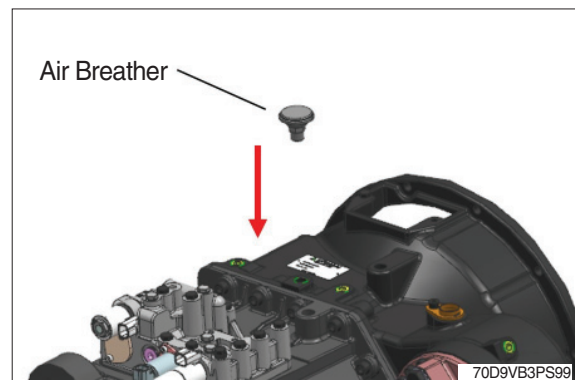
※ **Cover Loctite #277 on the screw side of bolt.**



(31) Assemble the air breather.

- Tightening torque : 1.0 ~ 1.4 kgf·m
(7.2 ~ 10.1 lbf·ft)

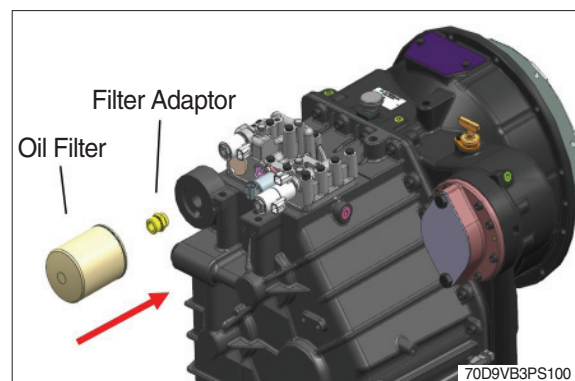
※ **Cover Loctite #577 on the screw side.**



(32) 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.

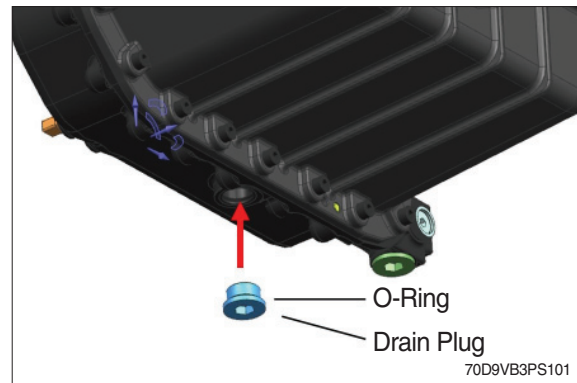
- Tightening torque : 13.3 ~ 14.7 kgf·m
(96.2 ~ 106.3 lbf·ft)



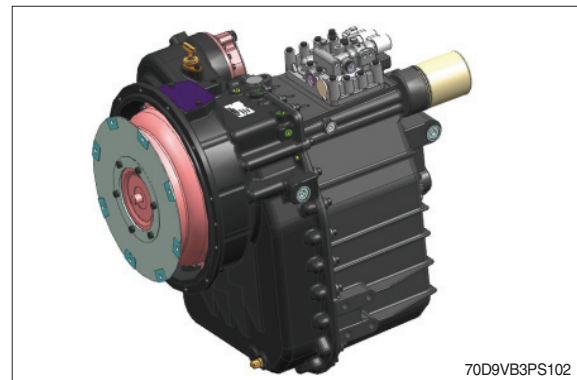
(33) After assembling the O-ring to the plug, assemble it to the T/M case.

· Tightening torque : 4.1 ~ 5.1 kgf·m
(29.7 ~ 36.9 lbf·ft)

※ Grease the O-ring when assembling it.



(34) Complete the transmission assembly.



3. DRIVE AXLE DISASSEMBLY (KESSLER)

1) GENERAL INSTRUCTIONS FOR CORRECT ASSEMBLY AND DISASSEMBLY

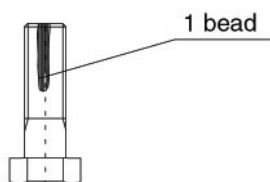
- (1) Disassembly and assembly are to be accomplished only by trained personnel.
- (2) The assembly can be made reverse to the respective disassembly instruction.
- (3) Drain oil before removing, check for presence of metal particles.
- (4) Mark the parts to each other before dismantle.
- (5) Never use a hard object to separate tightly fitted assemblies. To remove bearings, drive flanges and similar parts, use the proper pullers.
- (6) It is recommended that the special tools.
- (7) Do not place parts on a dirty surface.
- (8) Systematically replace used seals, O-rings and, if necessary, bearings on disassembly.
- (9) Clean parts before reassembly.
- (10) Replace or clean corroded parts.
- (11) The cages of bearings rotating in oil are to be coated with oil at reassembly.
- (12) Seal ring treads on flanges, shafts etc. must be preserved with SAE80W-90/API GL-5 before mounting.
- (13) Oil seal rings and particularly the anti-dust lip seals must be filled with grease.
- (14) The universal joint shafts and the axle shafts must not be force mounted (They must slide).
- (15) At mounting of radial seal rings pay attention that there is suffice overlap to the housing bores.
Pay attention for a plain alignment of the radial seal ring. The seal lips always must not be contacted with Loctite.
- (16) The bolted or keyed assemblies safeties are to be checked according to instructions ; in case of doubt, consult Hyundai dealer.
- (17) Refill the oil after assembly.
- (18) Repair weldment is only allowed after consultation with Hyundai.

2) USING OF LOCTITE AND OPERATING SUPPLIES

Kind	Type	Color	Application
Loctite	243	Blue	Lightly locked screws
	262	Red	Middle locked screws
	270	Green	Highly locked screws
	270	Green	Increased coefficient of friction in contact surfaces
	510	Orange	Surface gasket
	572	White	Special gasket
	638	Light-green	Glueing with big width of slit
Epple	33	Grey	Surface gasket
Dirko	-	Grey	Elastic gasket

3) REMARKS FOR WORKING UP LOCTITE AND OPERATING SUPPLIES

- (1) Threads and surfaces have to be cleaned and free from color, oil and grease before applying loctite.
- (2) Loctite will harden under following conditions :
 - ① Exclusion of air
 - ② Metal contact
 - ③ Increased temperature
- (3) Pre-assembly and control tightening has to be made in a short time (5 to 10 min).
- (4) The time between glueing and mounting of the parts should be shorter than 1hour.
Exception : Parts made from nonferrous metal have to be glued within one minute.
- (5) Assembled parts must remain unloaded for at least 24 hours.
- (6) Loctite quantity :
 - At screws :



100D7XL80

- At contact surfaces : Pay attention for a sufficient loctite application.

4) TIGHTENING TORQUE

(1) Standard metric threads

Unit : N · m

Metric standard thread						
Thread	Screw	Nut	Screw	Nut	Screw	Nut
	8.8	8	10.9	10	12.9	12
M4	3.0		4.4		5.1	
M5	5.9		8.7		10	
M6	10		15		18	
M8	25		36		43	
M10	49		72		84	
M12	85		125		145	
M14	135		200		235	
M16	210		310		365	
M8	300		430		500	
M20	425		610		710	
M22	580		830		970	
M24	730		1050		1220	
M27	1100		1550		1800	
M30	1450		2100		2450	

(2) Metric fine threads

Unit : N · m

Metric fine thread						
Thread	Screw	Nut	Screw	Nut	Screw	Nut
	8.8	8	10.9	10	12.9	12
M 8×1	27		39		46	
M10×1	55		81		95	
M10×1.25	52		76		90	
M12×1.25	93		135		160	
M12×1.5	89		130		155	
M14×1.5	145		215		255	
M16×1.5	225		330		390	
M18×1.5	340		485		570	
M20×1.5	475		680		790	
M22×1.5	650		920		1050	
Brake caliper dowel screws (Greased)						
M20×1.5	400 + 100					
M27×2	900 + 100					
Nut for steering stop = 300 Nm						

Regard reduced tightening torque for galvanized bolts and nuts.

(3) Tightening torques of wheel nuts

Dimensions	Phosphor blackened
M20 × 1.5	470 Nm
M22 × 1.5	650 Nm

5) DISASSEMBLY OF DRIVE AXLE

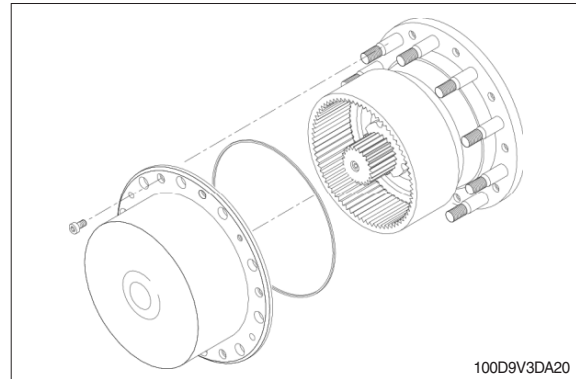
(1) Disassembly of planetary gear

① Drain the oil.

See "Oil change" on page 3-56.

② Loosen and remove mounting bolts.

③ Carefully pull off planetary pot/lid.



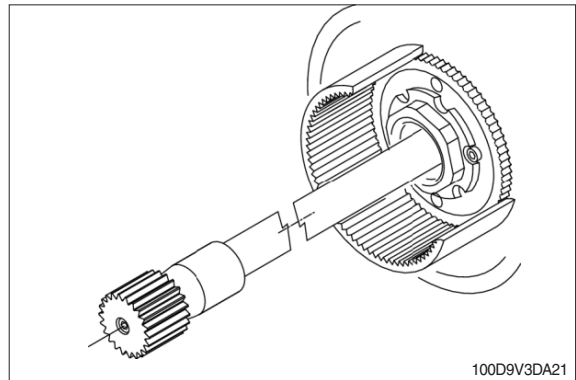
(2) Disassembly of sun gear and axle shaft

※ Observe the length of the axle shaft!

Mount the dismantled axle shaft again onto the same position on the axle.

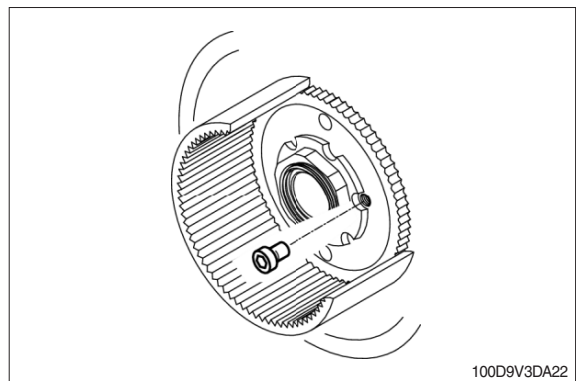
① Pull the sun gear together with the axle shaft of the axle spindle

- Sun gear and axle shaft are screwed together.



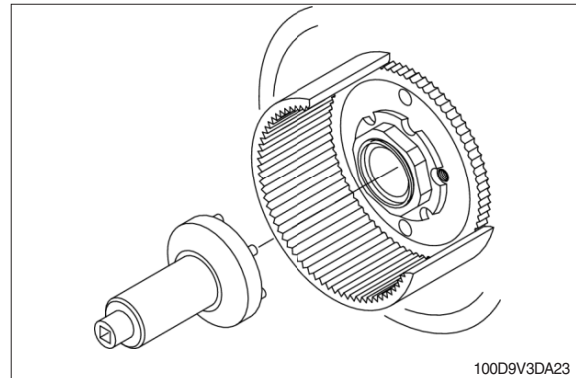
(3) Loosening the wheel bearing adjustment nut

① Loosen the securing screw of the wheel bearing adjustment nut, clean it and deposit safely.



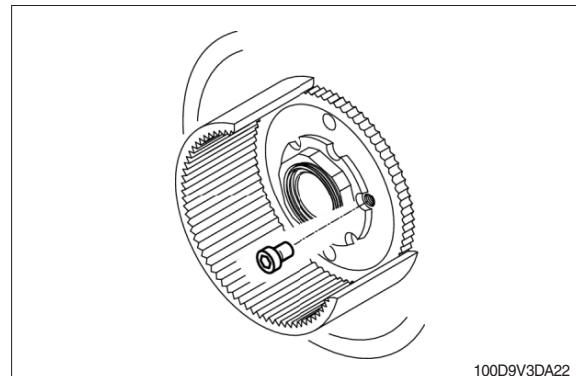
(4) Checking/Retightening the wheel bearing adjustment nut

- ① Put the customer service tool on the wheel bearing adjustment nut and tighten to the specified tightening torque.
 - Customer service tool : Wrench for wheel bearing adjustment nut (see above)
 - Tightening torque for used bearings :
300 Nm
 - Rotate the wheel hub several times while tightening.
 - If it is not possible to secure at this position, the wheel bearing adjustment nut needs to be turned forward to the next possible position for securing.



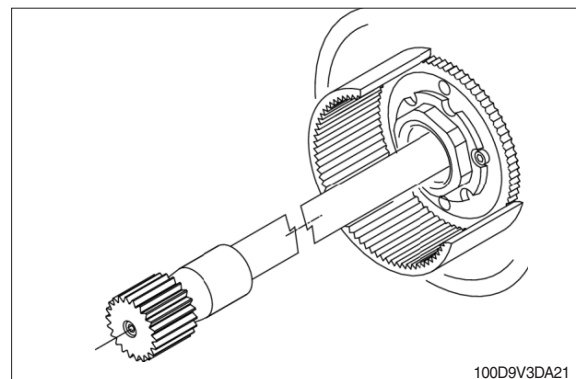
(5) Wheel bearing adjustment nut

- ① Secure the wheel bearing adjustment nut with a screw.
 - Hexagon socket screw
 - Screw securing : Loctite 270
 - Tightening torque : 36 Nm



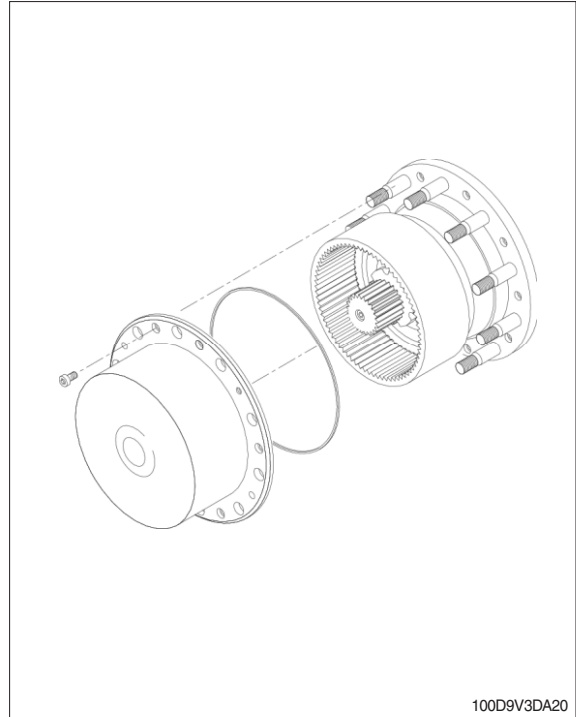
(6) Axle shaft and sun gear

- ① Push the axle shaft screwed together with the sun gear into the axle spindle to the stop.
 - It must be possible to easily slide the axle shaft (by hand) in the inner profile of the differential.
- ② Rotate the hub assembly until one of the oil compensating holes of the ring gear carrier is at the bottom position!



(7) Planetary gear

- ① Insert O-ring into groove of the planetary housing.
 - Sealing of the contact surface between planetary housing and wheel hub
 - Multi-purpose grease prevents the O-ring from falling out during assembly.
- ② Align planetary housing so that it aligns with the corresponding boreholes in the wheel hub.
 - The oil drain plug has to be at the bottom.
- ③ Slide the prepared planetary unit over the wheel bolts.
- ④ Bolt the planetary unit to the wheel hub.
 - Loctite #262
 - Tightening torque
- ⑤ Top up with oil.



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

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

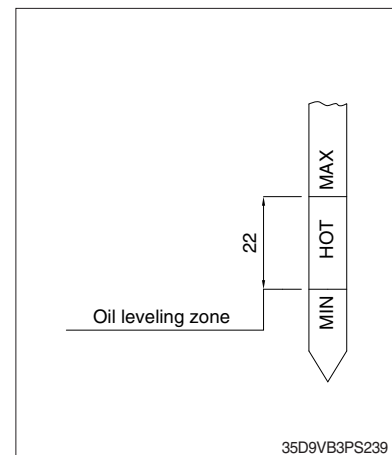
- Please stop the engine (ok), then refuel the oil into transmission until 「HOT」 level of oil level gauge.
- Please change lever "neutrality" position. Then please turn on the engine and keep low idle speed.
- The oil reaches the hydraulic torque converter, cooler and pipe and so on, after start up the engine. Then oil level sink down.
- 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.

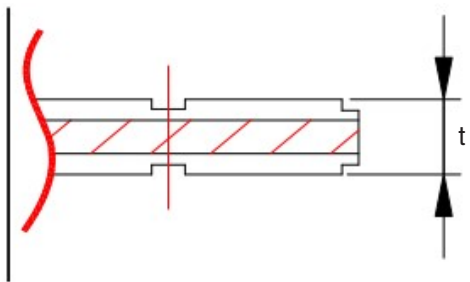
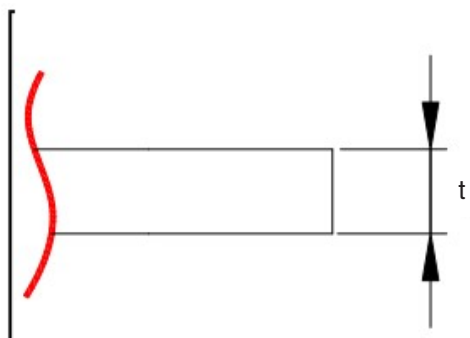
※ **Check the oil level, when the oil temperature is 50℃ ~ 60℃.**

Amount of all oil : about 20 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		2.06	1.56
Plate		2	1.85
Back plate		4	3.85

(4) Period of exchanging parts

Item name \ time	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 2 nd and 4 th time.
Seal ring race plane		Please change the part that exceeds the wear limit.
Sinter plate		Please change the part that exceeds the wear limit.
Stator free wheel part		Please change the abnormal leaf spring.
Sliding surfaces of oil seal		Please change the part that exceeds the wear limit.
Sliding section of clutch piston		
Inside diameter or bush		
Each bearing		
Spring		

(5) Standard of exchanging parts

Classification	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 is abnormally you have to change.	Gear, Shaft	Each gear, Clutch shaft, Turbine shaft, Flange

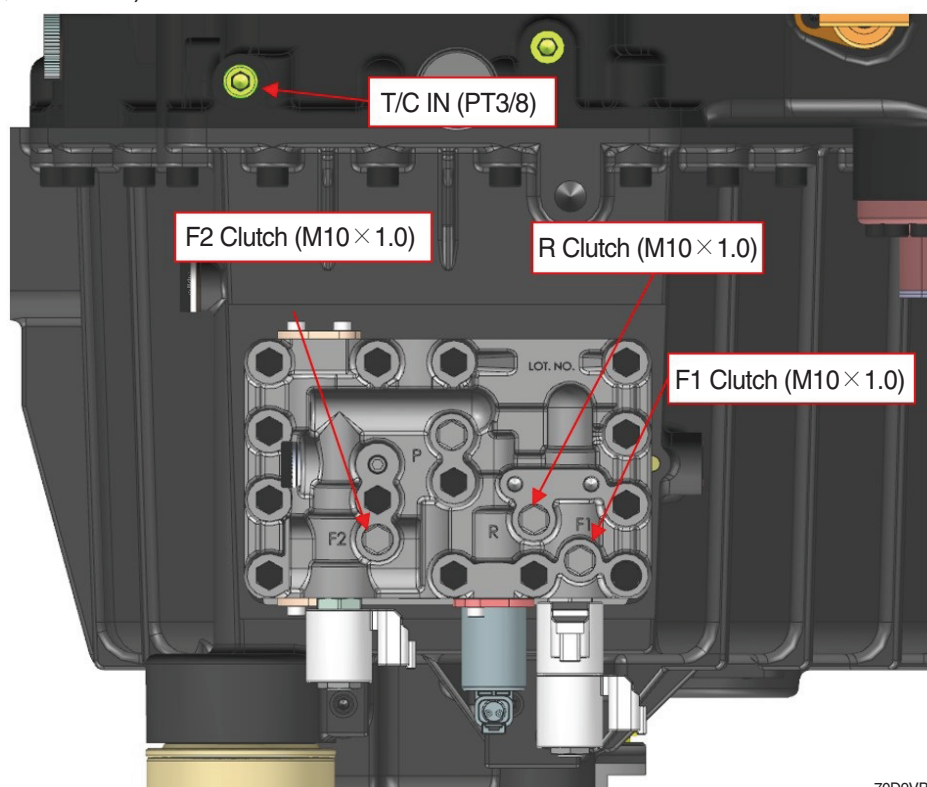
(6) Test

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)



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- Please warming up the engine until the torque converter oil temperature becomes about 50~60°C.
 - Please measure the oil pressure of every required part as below under the low & high idle speed of engine.
 - 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	1.7±0.2	1.7±0.2
Forward 1st	1.7±0.2	1.7±0.2
Forward 2nd		
Reverse		
T/C inlet	0.3 ~ 0.7	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 F1 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) Important remarks

- ① For safety reasons, the operator should verify and service at regular intervals all of the bolted assemblies and all of the important safety locks such as :
 - Wheel nuts
 - Nuts of axle mounting bolts
 - Bolts on the steering components and the brake system parts : if the screws are tightable, the loctite contact breaks loose and remounting is necessary.
 - Corrosion on the carrier elements (such as the axle spindle) is not acceptable for operational safety reasons.
 - Verify seals, oil levels and lubrication at regular intervals.

② Brakes

- Inspect brake lining and brake drum/brake disk regularly as well as wear of brake system parts.
- Inspect the free movement of brake system rod.
- In case of signs of excessive heating, consult a brake specialist or the manufacturer.

(2) Oil change

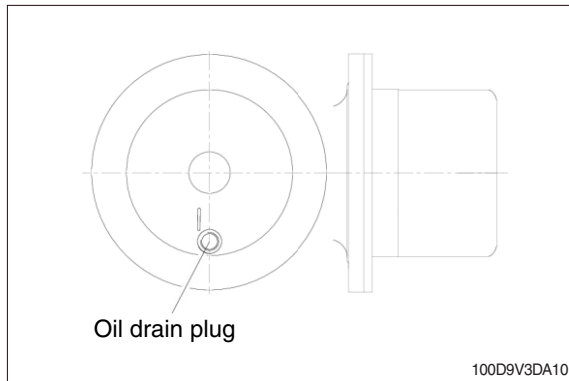
During changing the oil, always follow the stated measures

- ① Place vehicle in horizontal position and jack it up if possible so that complete draining of oil is possible and clean oil can be filled to the correct level.
- ② Make sure that oil has cooled down before draining it.
- ③ Always replace gaskets of the screw plugs with new gaskets. The gaskets are mostly copper rings.
- ④ Pay attention to the specific notes.
- ⑤ The precise position of the lube point can deviate from the illustration. The relevant lube point can be found on the KESSLER product on hand.
- ⑥ Pay attention to the given activity sequence.

(3) Drain oil

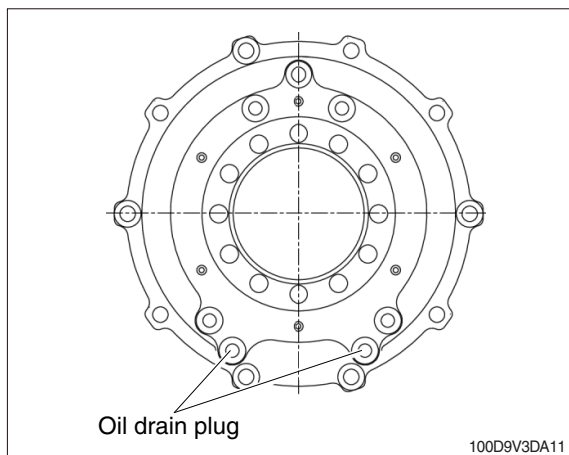
- ※ Differential and carrier assembly, axle housing and hub assembly have a total oil space.
Oil drain has to take place at the complete axle.
- ※ Wet multiple disk brake
Drain the extra oil.

① Hub assembly



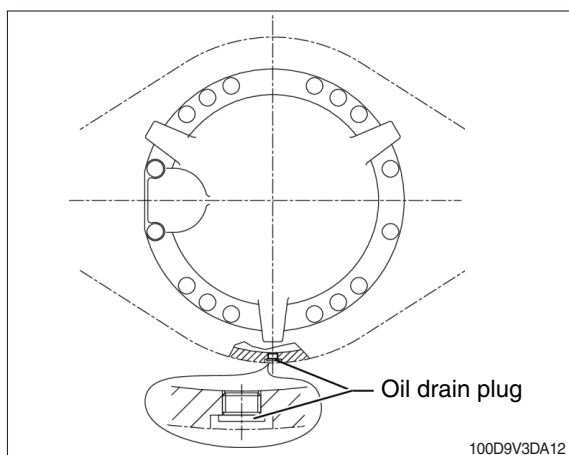
- a. Clean drainage point and oil drain plug.
- b. Rotate the hub assembly until the oil drain plug is at the bottom position (6 o'clock position).
- c. Open the oil drain plug and allow oil to drain.
 - Collect the oil in a suitable container.
 - Dispose of the oil in an environmentally friendly manner.
- d. Clean bore hole and oil drain plug.
- e. Screw oil drain plug back in.

② Wet multiple disk brake



- a. Clean drainage point and oil drain plug.
- b. Open the oil drain plug and allow oil to drain.
 - Collect the oil in a suitable container.
 - Dispose of the oil in an environmentally friendly manner.
- c. Clean borehole and oil drain plug.
- d. Screw oil drain plug back in.

③ Differential and carrier assembly/axle housing:



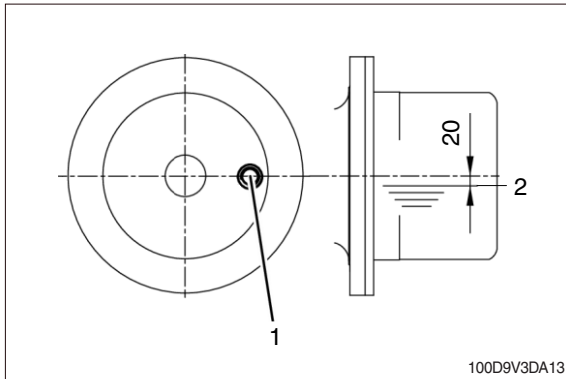
- a. Clean drainage point and oil drain plug.
- b. Open the oil drain plug and allow oil to drain.
 - Collect the oil in a suitable container.
 - Dispose of the oil in an environmentally friendly manner.
- c. Clean borehole and oil drain plug.
- d. Screw oil drain plug back in.

(4) Oil filling and filling level

※ **Differential and carrier assembly, axle housing and hub assembly have a total oil space.**

- All oil drain plugs have to be closed before filling with oil.
- The whole axle is filled with oil from the differential and carrier assembly, axle housing and hub assembly and together.
- The oil level is specified at the respective component (differential and carrier assembly / axle housing and hub assembly).

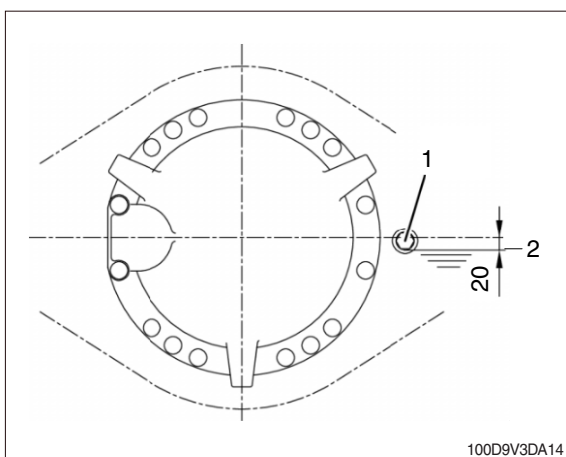
① Hub assembly



- 1 Oil filling and level check point
- 2 Oil level

- a. Clean filling point and oil filling plug.
- b. Turn hub assembly into position.
 - The oil drain plug has to be at the bottom.
- c. Open the oil filling plug.
- d. Fill hub assembly with clean oil until the oil level reaches the filling bore (= inspection bore).
 - Overflow check
 - Oil in accordance with the specified lubricants.
- e. After a few minutes, check the oil level again at the filling bores.
 - Keep filling the hub assembly with oil until the oil level remains constant.
- f. Clean bore hole and oil filling plug.
- g. Screw oil filling plug back in.

② Differential and carrier assembly/axle housing



- 1 Oil filling and level check point
- 2 Oil level

- a. Clean filling point and oil filling plug.
- b. Open oil filling plug.
- c. Fill axle and differential and carrier assembly with clean oil until the oil level reaches the filling bore (= inspection bore).
 - Overflow check
 - Oil in accordance with the specified lubricants.
- d. After a few minutes, check the oil level again at the filling bores.
 - Keep filling the axle until the oil level remains constant.
- e. Clean borehole and oil filling plug.
- f. Screw oil filling plug back in.

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 blades 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 stuck 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.
	Clutch part	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 worn 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) Shiffting 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.
Differential	Loosened bolt for assembling ring gear	Disassemble, check and reassemble the ring gear.
	Damaged ring gear	Replace the ring gear.
	Loosened or worn differential bearing	Disassemble, check, reassemble or replace the differential 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. Thoroughly 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.

(3) Service brake

① Brake overheats.

Locating fault and cause		Measures
Overheating due to excessive duty cycle	Inadequate coolant flow or heat exchange	Install brake cooling system if not already installed on truck.
		Re-analyze and re-size brake cooling system if necessary.
Inadequate coolant flow	Low pump output, blocked filter or coolant lines	Check pump output at different operating modes. Replace filter and check lines.
Low or no coolant	Improper fill or leaks	Check for proper fill level.
	leaking face seal	Replace or reinstall face seal assembly.
	Loosened or damaged plugs.	Tighten drain, fill or forced cooling plug. Replace if damaged.
	Deteriorated or inadequate sealant used at joint.	Disassemble, clean, re-seal and re-assemble bake housing joint.
Brake drags	More than 0.14 MPa pressure applies when brakes released.	Repair hydraulic system so pressure is less than 0.14 MPa when brakes released and while machine is operating in any mode.
	Damaged piston return spring assy	Repair or replace for piston return spring assy.
	Piston not returning	Check piston seals and seal separator.
	Wrong cooling and/or actuation fluid used.	Check piston seals and seal separator for swelling or damaged. Replace as necessary. Purge system and use correct fluid.
	Tighten or damaged splines (ex. friction disc-to-hub driver)	Repair or replace parts.

② Brake does not apply.

Locating fault and cause		Measures
Low or no pressure to brake	Empty fluid reservoir	Fill reservoir to correct level with specified fluid.
	Damaged hydraulic system	Repair hydraulic system.
	Leaked of brake actuation fluid	Refer to "brake leaks actuation fluid" in this manual.
	Parking brake not adjust properly	Adjust parking brake swtich as described in assy of this manual.

③ Brake does not release.

Locating fault and cause		Measures
Truck does not move.	Damaged hydraulic system	Repair hydraulic system.
Brakes dragging	More than 0.14 MPa pressure applied when brakes released.	Repair hydraulic system so pressure is less than 0.14 MPa when brakes released and while machine is operating in any mode.
	Damaged piston return spring assy	Repair or replace piston return spring assy.
	Piston not returning.	Check piston seals for swelling or damage. Replace as necessary.
	Wrong cooling and/or actuation fluid used	Check piston seals for swelling or damage. Purge system and use specified fluid.
	Parking brake not adjusted properly	Adjust parking brake lever as described in assy of this manual.

④ Braking performance

Locating fault and cause		Measures
Noticeable change or decrease in stopping performance.	Inadequate actuation fluid supply to brakes	Replenish fluid in brake system. Check for leakage and correct cause.
	Inadequate pressure to apply brakes	Check brakes apply system. Check for leakage in brake system or brakes, and correct cause.
	Worn or damaged discs	Inspect and replace discs if necessary. ※ As disc wear occurs, make sure brake system can supply adequate fluid to fully apply brakes.
	Overheated seals and/or discs	Inspect and replace discs and seals if necessary.
Brake does not fully apply.	Dirty or contaminated cooling fluid.	Drain and flush cooling fluid from brakes and entire brake system. Replace with approved fluid. In some case, it may necessary to replace discs. Clean or replace filter.
Brake does not fully apply.	Empty fluid reservoir.	Fill reservoir to correct level with specified fluid.
	Damaged hydraulic system	Repair hydraulic system
	Leakage of brake actuation fluid.	Refer to "brake leaks actuation fluid" in this manual.
Brake felt spongy/soft	Brakes or brake system not properly bled.	Bleed brakes and brake system.

SECTION 4 BRAKE SYSTEM

Group 1	Structure and Function	4-1
Group 2	Operational Checks and Troubleshooting	4-26
Group 3	Tests and Adjustments	4-28
Group 4	Disassembly and reassembly	4-31

GROUP 1 STRUCTURE AND FUNCTION

1. OUTLINE

- ※ The brakes are operated by a pressure compensated, closed center hydraulic system. Flow is supplied by a fixed displacement, gear type brake pump.

1) SERVICE BRAKE SYSTEM

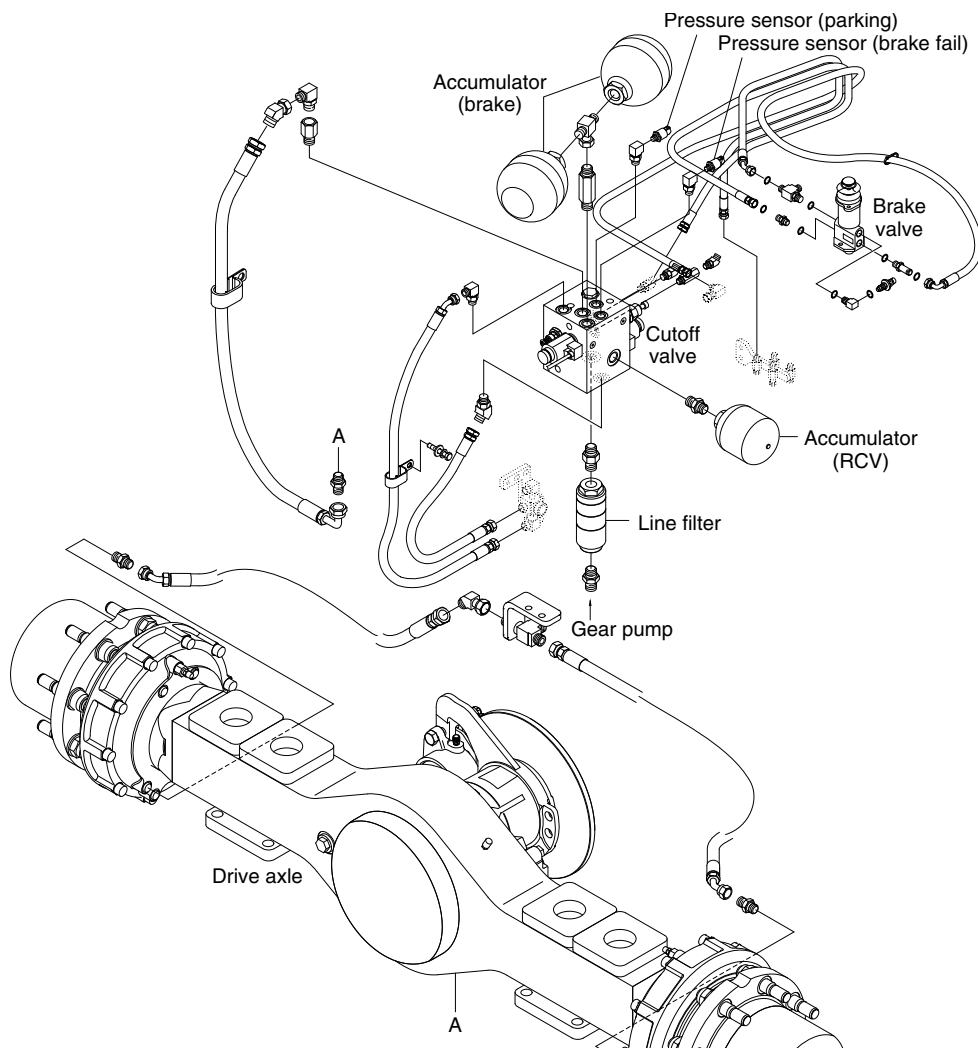
The fixed displacement brake pump supplies flow to the cut-off valve for service brake circuit. It flows to two accumulator. The accumulator has a gas precharge and an inlet check valve to maintain a pressurized volume of oil for reserve brake applications. Oil through the accumulator flows to the brake valves. The brake valve is a closed center design, single circuit operated by a pedal. The brake system contains the following components:

- Gear pump
- Cut-off valve, Line filter, Accumulators, Pressure sensor
- Brake valve, Pressure switch
- Line filter

2) PARKING BRAKE SYSTEM

In the parking brake system, turn parking brake switch ON, the parking brake solenoid valve in the cut off solenoid valve is de-energized and the valve open the drain port.

At the same time, the hydraulic oil in the parking brake return to the tank through the solenoid valve. When the piston is returned by the force of the spring, the parking brake is applied.



3) FULL POWER HYDRAULIC BRAKE SYSTEM

ADVANTAGES - The full power hydraulic brake system has several advantages over traditional brake actuation systems. These systems are capable of supplying fluid to a range of very small and large volume service brakes with actuation that is faster than air brake systems. Figure represents a time comparison between a typical air/hydraulic and full power hydraulic brake actuation system.

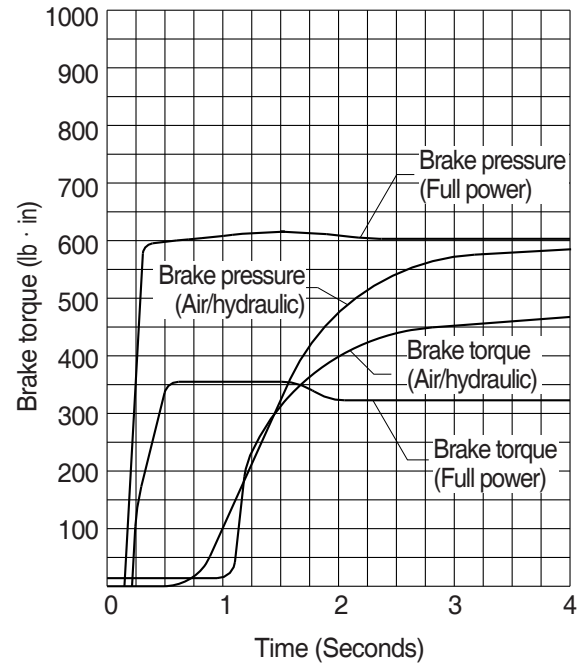
Full power systems can supply significantly higher brake pressures with relatively low reactive pedal forces. The reactive pedal force felt by the operator will be proportional to the brake line pressure being generated. This is referred to as brake pressure modulation.

Another key design feature of full power systems is the ability to control maximum brake line pressure. In addition, because these systems operate with hydraulic oil, filtration can be utilized to provide long component life and low maintenance operation.

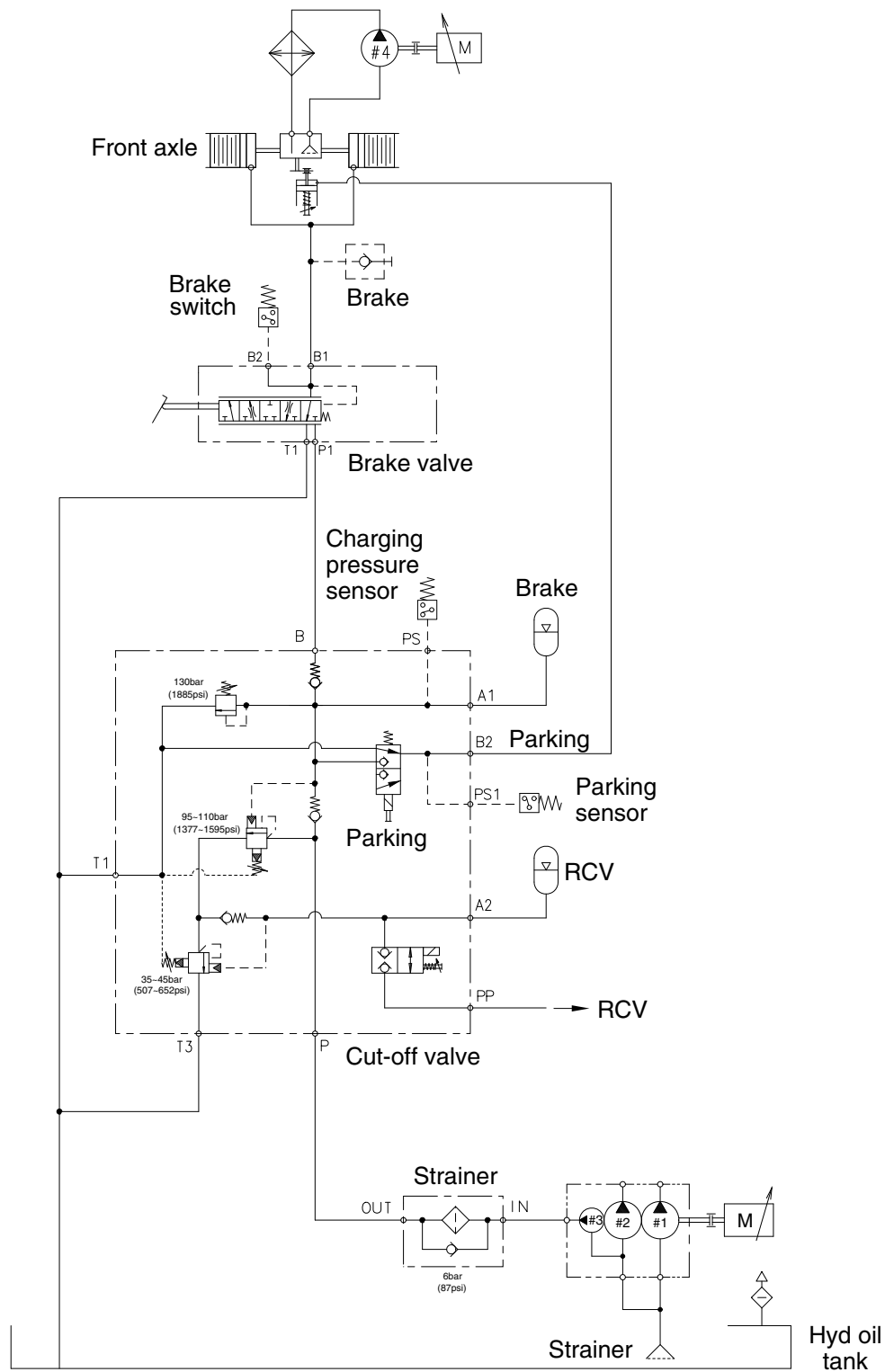
Because these systems are closed center, by using a properly sized accumulator, emergency power-off braking that is identical to power-on braking can be achieved. These systems can be either dedicated, where the brake system pump supplies only the demands of the brake system or non-dedicated, where the pump supplies the demands of the brake system as well as some secondary down stream hydraulic devise.

Another important note is that all seals within these system must be compatible with the fluid medium being used.

**Response time
Full power brake actuation VS
Air/Hydraulic brake actuation**

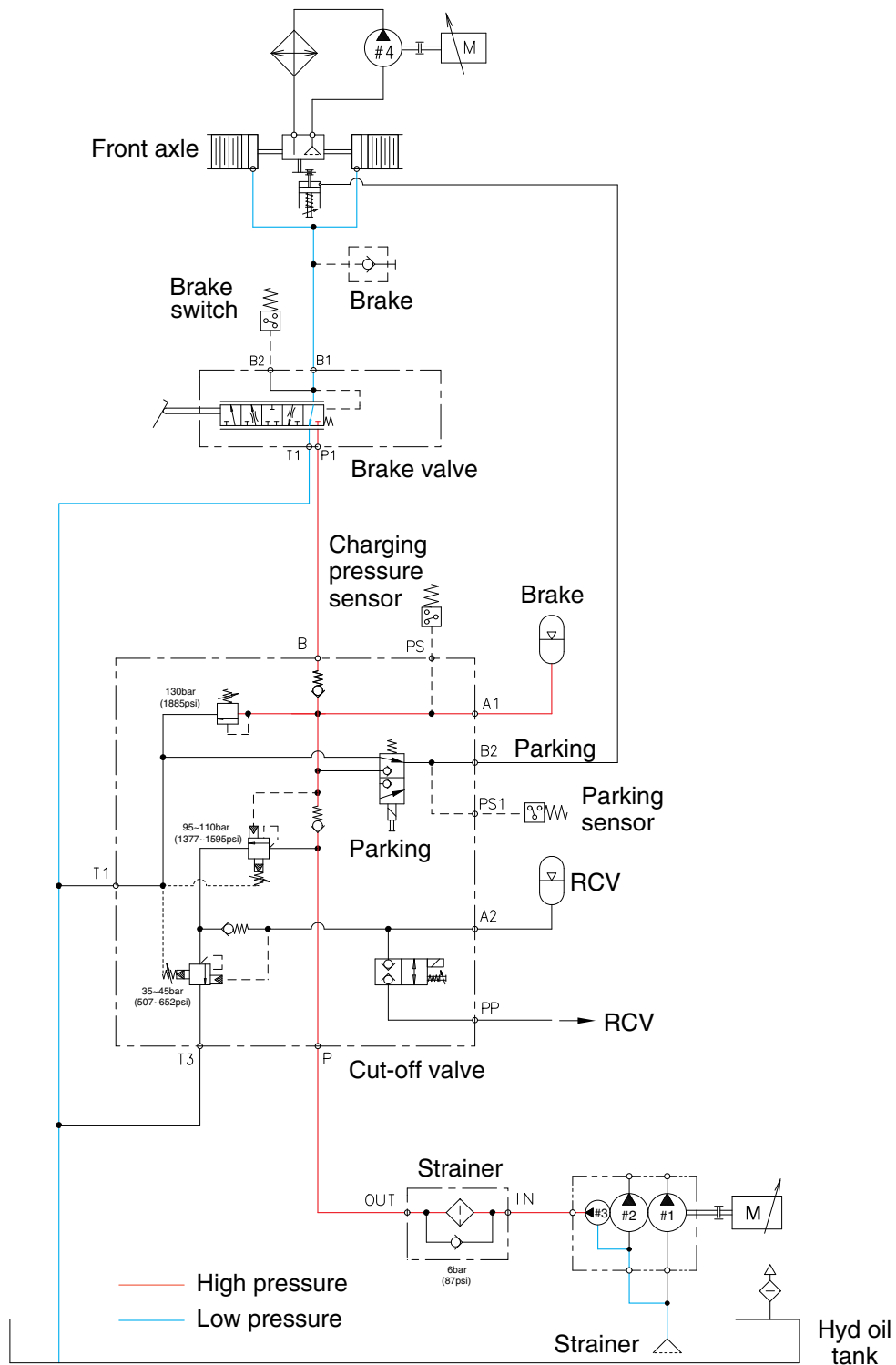


2. HYDRAULIC CIRCUIT



100D94BS10

1) SERVICE BRAKE RELEASED



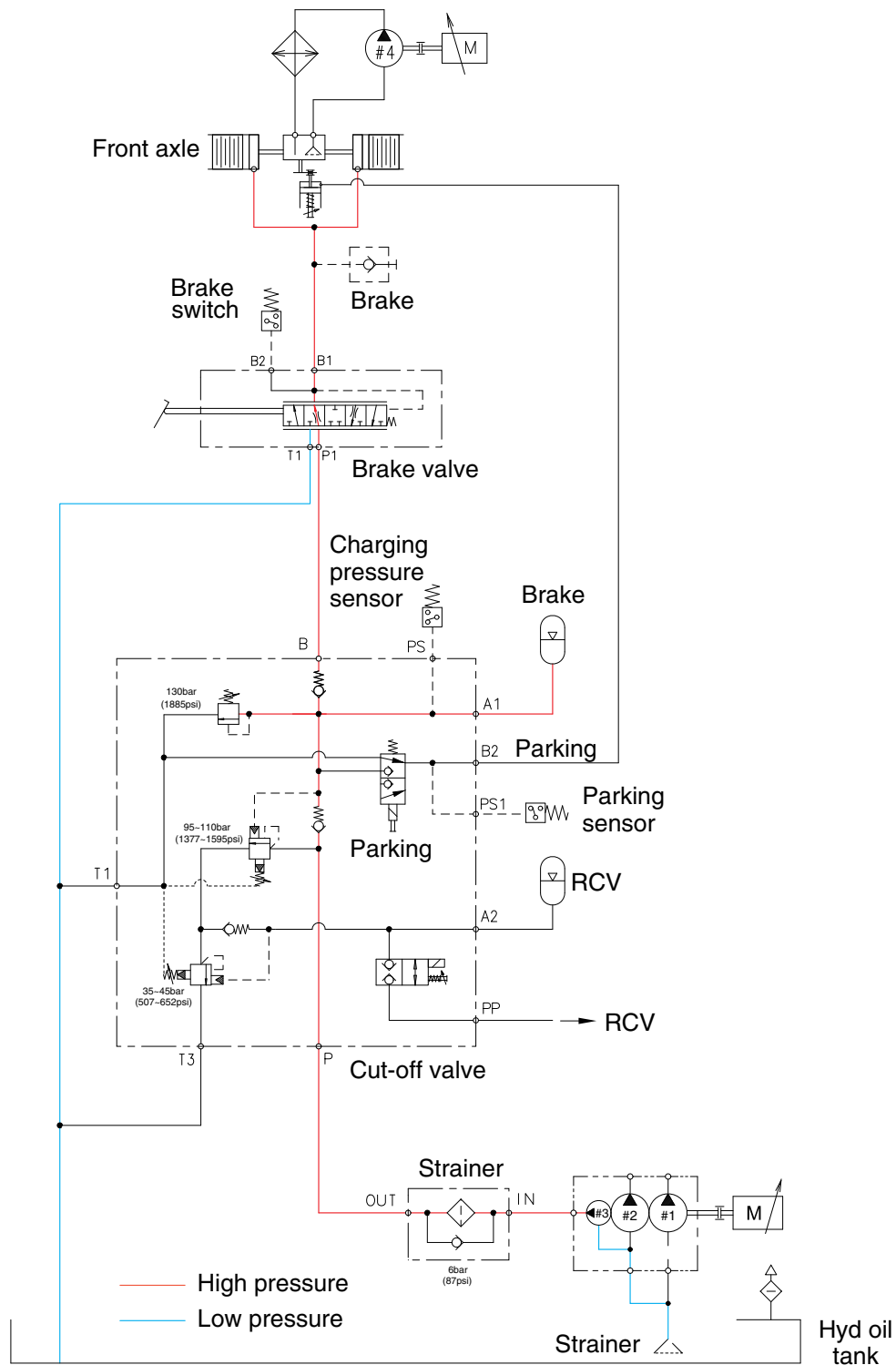
100D94BS11

When the pedal of brake valve is released, the operating force is eliminated by the force of the spring, and the spool is returned.

When the spool removes up, the drain port is opened and the hydraulic oil in the piston of front axle return to the hydraulic oil tank.

Therefore, the service brake is kept released.

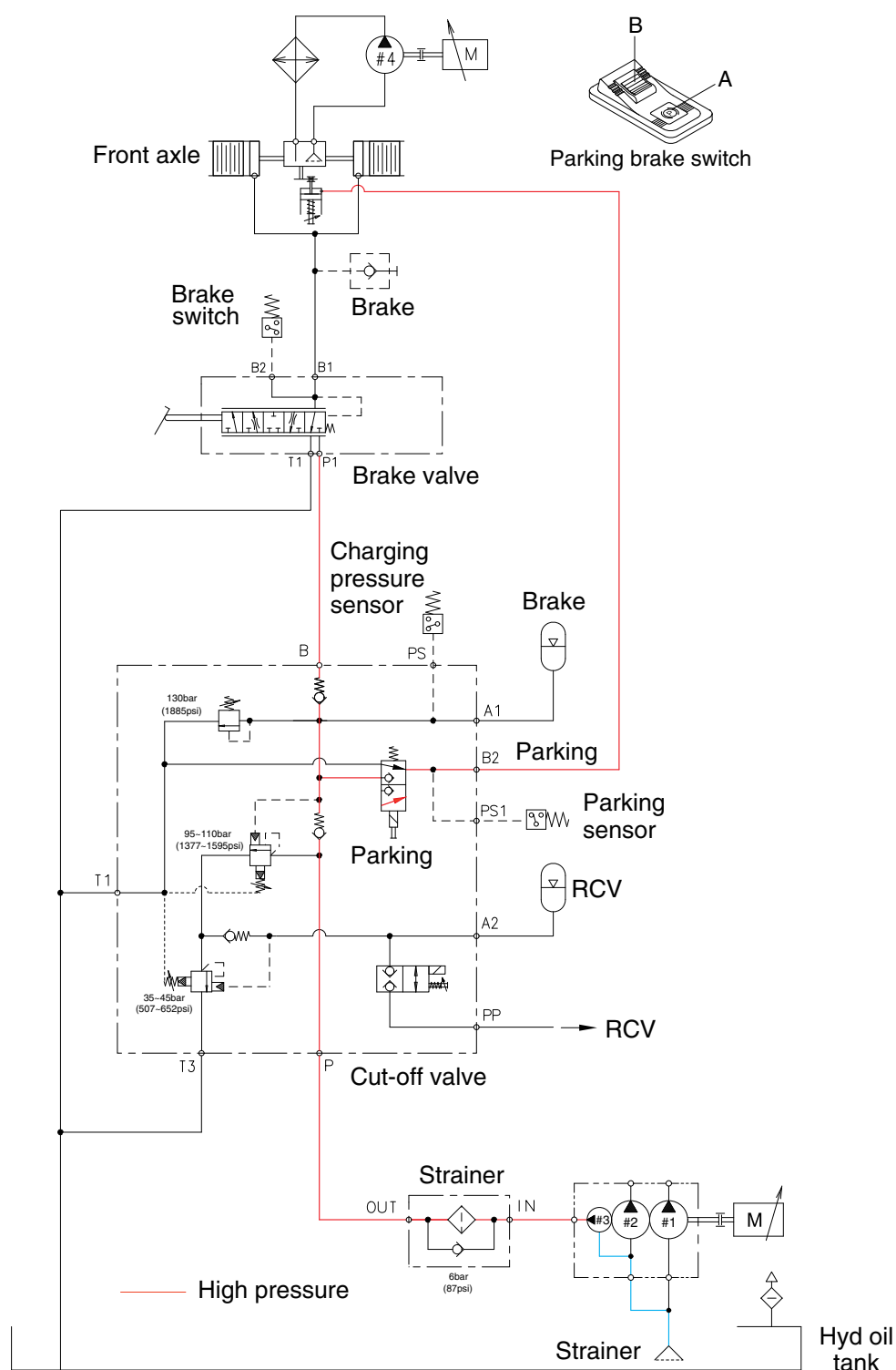
2) SERVICE BRAKE OPERATED



100D94BS12

When the pedal of brake valve is depressed, the operating force overcomes the force of the spring, and is transmitted to the spool. When the spool moves down, the inlet port is opened, and at the same time the hydraulic oil controlled the pressure level by the cut-off valve enters the piston in the front axle. Therefore, the service brake is applied.

3) PARKING BRAKE RELEASED

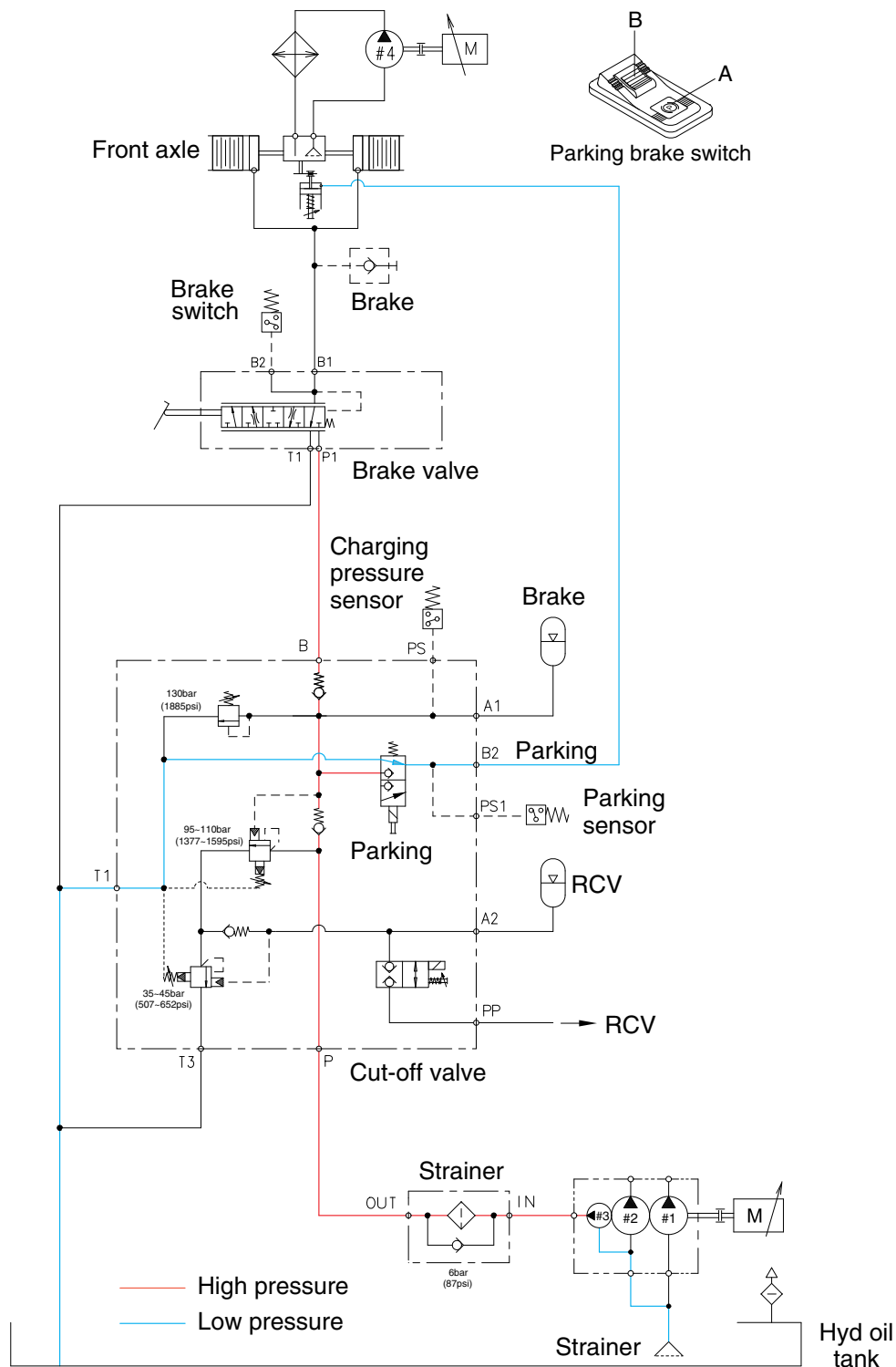


100D94BS13

When the parking brake switch is pressed B position, the parking brake solenoid valve is energized and the hydraulic oil controlled the pressure level by the cut-off valve enters the parking brake. It overcomes the force of the spring and pushes the parking brake piston. This releases the parking brake.

Therefore, the hydraulic oil pressure is applied to the parking brake piston through the solenoid valve and the parking brake is kept released.

4) PARKING BRAKE OPERATED



100D94BS14

When the parking brake switch is pressed A position, the parking brake solenoid valve is de-energized and the valve open the drain port.

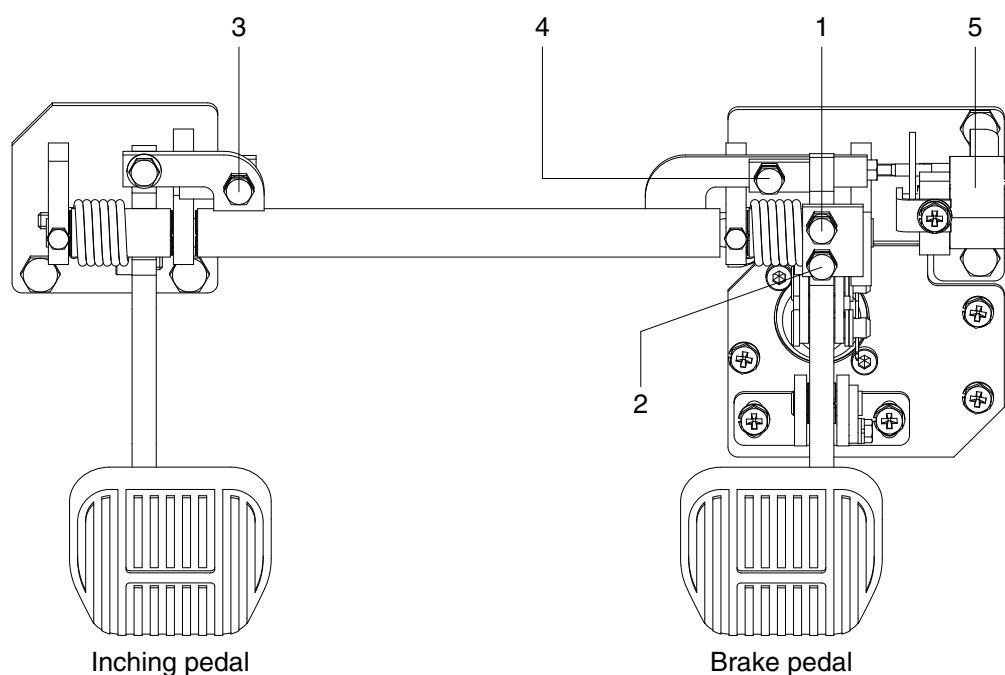
At the same time, the hydraulic oil in the parking brake return to the hydraulic oil tank through the solenoid valve. When the piston is returned by the force of the spring, the parking brake is applied.

5) DO AEB WORK

※ Please refer to page 7-91.

3. INCHING PEDAL AND LINKAGE

The brake pedal serves to actuate the hydraulic brakes on the front axle. At the beginning of the pedal stroke, the inching spool of the transmission control valve is actuated to shift the hydraulic clutch to neutral and turn off the driving force. By treading the pedal further, the brake is applied.



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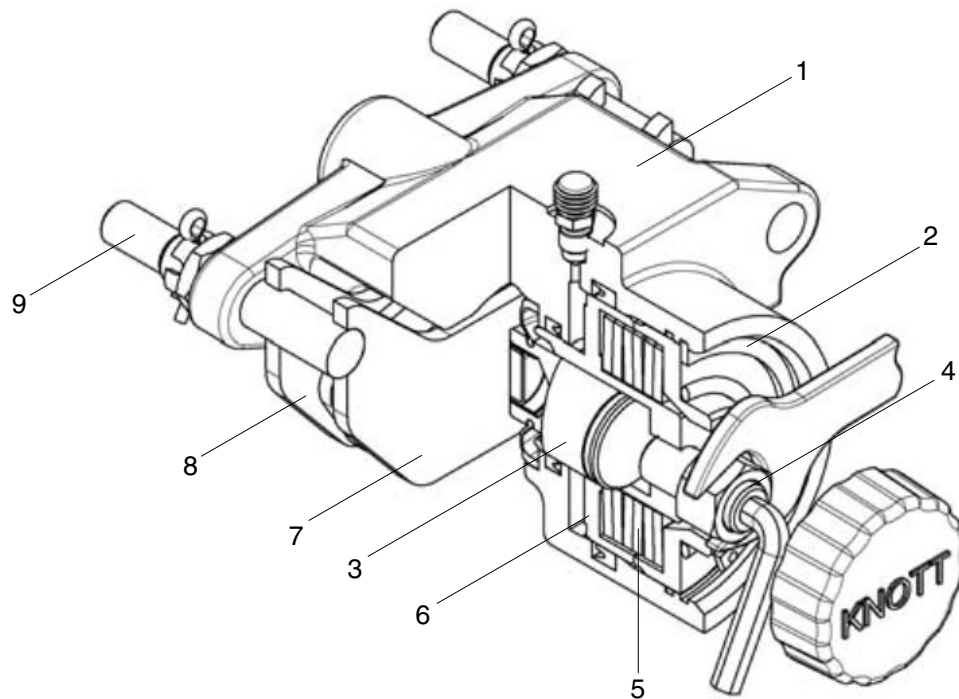
- | | | | | | |
|---|-------------------------|---|--------------------------------------|---|----------------|
| 1 | Brake stopper bolt | 3 | Inching stopper bolt | 5 | Inching sensor |
| 2 | Brake stroke limit bolt | 4 | Brake & inching pedal interlock bolt | | |

1) INITIALIZING THE INCHING SENSOR

Refer to the page of the cluster setting.

4. PARKING BRAKE SYSTEM (KESSLER)

1) STRUCTURE



100D7BS111

1	Housing	4	Adjust screw	7	Lining pad
2	Pressure ring	5	Bank of cup springs	8	Lining pad
3	Thrust bolt	6	Piston	9	Gliding bolt

2) OPERATION

The two identical brake pads slide freely on the guide bolt, which is fastened in the housing. The guide bolts are guided in an additional brake anchor plate which in turn is screwed onto the vehicle, i.e. its axle.

On actuation, the brake generates a clamping force at the brake lining pads, which cause a tangential force/braking moment to be generated at the brake disk, the extent of which depends on the coefficients of friction generated by the linings.

The clamping force is generated by the bank of cup springs, during which the piston is moved together with the adjusting screw, the thrust bolt and the brake pad towards the brake disk.

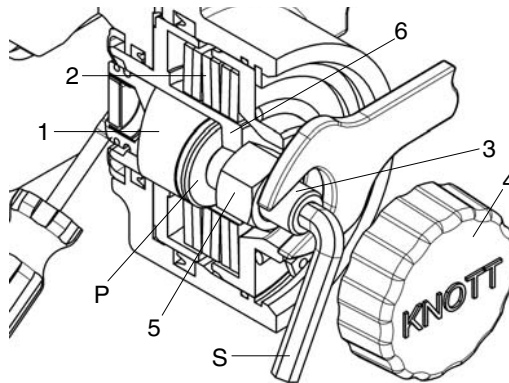
When the brake pad comes into contact with the brake disk, the reaction force shifts the housing onto the guide bolts until the brake pad is also pressed against the brake disk.

The brake is released by complete pre-tensioning of the bank of cup springs. During this process, through application of the necessary release pressure after overcoming the cup spring force, the piston must move back until it comes to rest against the pressure ring.

The clamping force diminishes with wear of the brake lining and brake disk. The brake must be adjusted at the latest at the times indicated by the adjusting specification followings.

3) MOUNTING AND BASIC SETTING REGULATIONS

Basic brake setting is required after mounting new brake lining plates or brake disks, as well as during all repair stages and in the event of insufficient braking performance.



100D7BS112

- | | | | | | |
|---|---------------------|---|-----------|---|---------------|
| 1 | Thrust bolt | 4 | Screw cap | P | Even surface |
| 2 | Bank of cup springs | 5 | Lock nut | S | Socket wrench |
| 3 | Adjusting screw | 6 | Piston | | |

※ All mounting and basic setting work must be carried out on the brake when cold.

(1) Mounting the brake

- ① Stand the vehicle on an even surface and secure against rolling away.
- ② Release the screw cap.
- ③ Release the lock nut (size 24 or 30) and turn the adjusting screw anticlockwise using a size 8 or 10 socket wrench until the pressure bolt comes to rest against the even surface of the piston. In this status, the brake can be mounted onto the brake disk and fastened.
- ④ Mount the pressure connection again.
Apply the necessary release pressure to the brake until the bank of cup springs is completely pre-tensioned. Following carry out the following page basic setting regulation.

(2) BASIC SETTING REGULATION

- ① Turn the adjusting screw manually clockwise until both brake pads make contact with the brake disk. Then it is not longer possible to turn the adjusting screw without exerting a major amount of force.
- ② Turn the adjusting screw anticlockwise in order to set the following rated clearances.

Model	Adjusting screw	Clearance (mm)		Turns
100D-9	FSG 90	Min.	0.5	1/4
		Clearance	1.0	1/2
		Max.	1.5	3/4
	FSG 110 M20 (SW 10)	Min.	1.0	2/5
		Clearance	2.0	4/5
		Max.	3.0	1 1/5

- ③ Hold the adjusting screw in position with a hexagonal socket wrench and lock with lock nut. (50+5 Mm)
 - ④ Mount the screw cap and tighten as far as possible manually.
 - ⑤ Mount the pressure connection in accordance with the instructions of the axle.
- ※ For bleeding the piston chamber use the socket spanner size 13 for the bleeding valve.

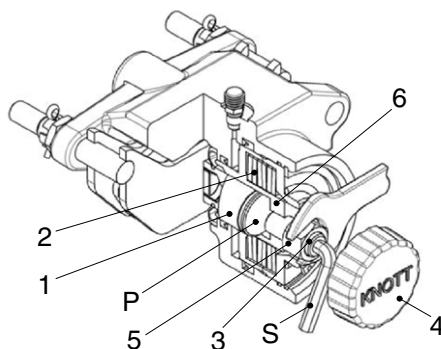
(3) ADJUSTING REGULATIONS

During this adjusting process, the parking brake must be released, i.e. the bank of cup springs must be completely pre-tensioned.

- ① Stand the vehicle on an even surface and secure against rolling away.
 - ② Release the parking brake by using the required release pressure.
 - ③ Release the screw cap and unscrew.
 - ④ Release the lock nut (size 24 or 30) and turn the adjusting screw with socket wrench size 8 or 10 manually clockwise until the two brake pads make contact with the brake disk.
 - ⑤ Turn the adjusting screw anti-clockwise and set the clearance specified in the above table.
 - ⑥ Hold the adjusting screw in position with the hexagonal socket wrench and lock with the lock nut. (50+5 Mm)
 - ⑦ Mount the screw cap and tighten as far as possible manually.
- ※ Actuate the brake valve several times and check the braking efficiency of the parking brake on a slope.

4) EMERGENCY RELEASE OF THE PARKING BRAKE

After the failure of the pressure release the parking brake by using following manual procedure.



100D7BS117

- | | | | | | |
|---|---------------------|---|-----------|---|---------------|
| 1 | Thrust bolt | 4 | Screw cap | P | Even surface |
| 2 | Bank of cup springs | 5 | Lock nut | S | Socket wrench |
| 3 | Adjusting screw | 6 | Piston | | |

- (1) The vehicle has to be secured against rolling away.
- (2) Release the screw cap and unscrew
- (3) Release the lock nut (size 24 or 30) and turn the adjusting screw with socket wrench size 8 or 10 manually counter-clockwise until the brake disc is free.

⚠ For the emergency release is an actuation torque of 40 Nm respectively 70 Nm required.

- (4) Mount the lock nut and the screw cap and tighten both as far as possible manually. (protection against dirt)

⚠ Now, the vehicle do not have any brake function. The vehicle must be secured against moving away with proper means. Before putting the vehicle into operation again, the brake has to be adjusted again. Refer to previous page. "Assembly and basic setting regulations".

5) MAINTENANCE AND REPAIR WORK

(1) Maintenance and exchange of brake pads

The brake pads themselves are maintenance free. All that is required here is a check for damaged parts, as well as inspection to ensure that the brake disk remains easy running.

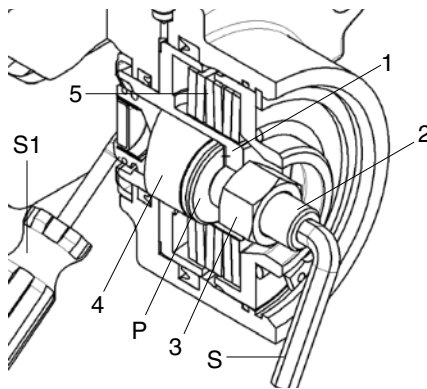
The thickness of the brake lining must be subjected to a visual inspection at regular intervals, which depend on vehicle usage, but every six months at the latest. In the event of a minimal residual lining thickness, these intervals must be reduced accordingly in order to avoid major damage to the brake or disk.

- FSG 90

Min. residual thickness 1.0 mm per lining pad (6 mm carrier plate thickness).

- FSG 100

Min. residual thickness 2.0 mm per lining pad (8 mm carrier plate thickness).



180D7EBS113

1 Piston

2 Adjusting screw

3 Lock nut

4 Thrust bolt

5 Bank of cup spring

S Socket wrench

S1 Screwdriver

P Inside of the piston

※ Only original spare lining plates may be used. If any other spare parts are used, no warranty claims will be accepted either for the brakes or their functional characteristics.

① Stand the vehicle on an even surface and secure against rolling away.

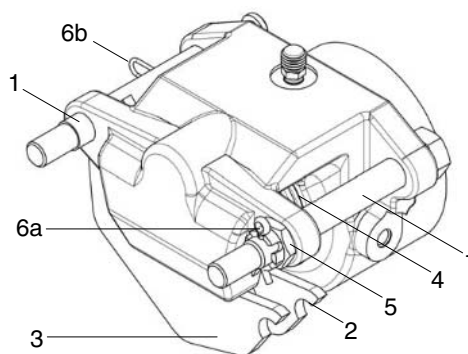
② Release the parking brake by applying the required release pressure.

③ Release the screw cap and unscrew.

④ Release the lock nut (size 24 or 30) and turn the adjusting screw with socket wrench size 8 or

1 0 manually clockwise until it lies flush with the inside of the piston.

⑤ Press back the thrust bolt using a suitable screwdriver until it has contact with the piston.



100D7BS114

- | | | | |
|---|------------------|----|-----------------|
| 1 | Guide bolt | 5 | Castellated nut |
| 2 | Lining pad | 6a | Safety splint |
| 3 | Lining pad | 6b | Safety clip |
| 4 | Permanent magnet | | |

- ⑥ Depending on the free space available, release one of the two guide bolts, removing the safety splint, unscrewing the castellated nut and pulling the guide bolt out of the brake anchor plate. Now, the brake lining pads can be removed tangentially to the brake disk.

※ In the event of minimal clearance, i.e. it is not possible for space reasons to exchange the brake lining plate in accordance with these instructions, the brake must be removed completely. To do this, pull both guide bolts out of the brake anchor plate.

▲ Check the pressure hose. If the pressure hose is too short, it must be unscrewed to remove the brake. Before the pressure hose can be released the brake must be emergency released.

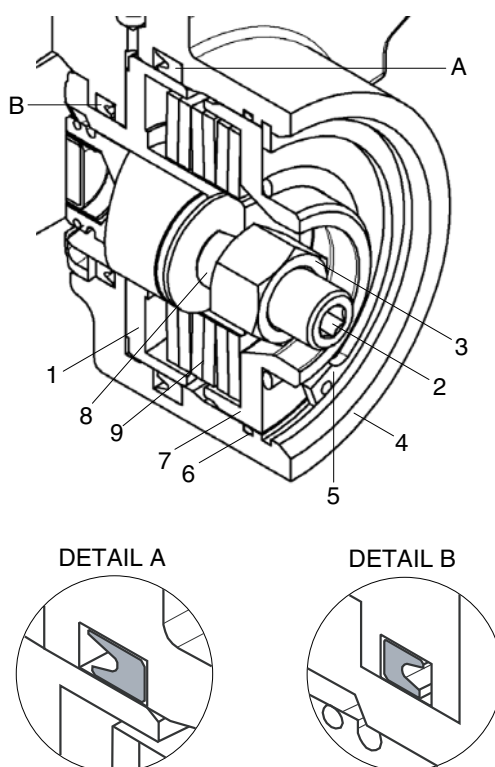
- ⑦ Exchange the brake pads and insert the guide bolts into the brake anchor plate. If you have removed the complete brake you have to amount the brake on both guide bolt again, now.

- ⑧ Check both permanent magnets if they still have sufficient magnetic force to hold the brake lining plates. Should this not be the case, the permanent magnets must also be changed by using a suitable screw driver.

- ⑨ Secure the guide bolt with the castellated nut and the safety splint respective safety clip.

▲ After mounting new brake lining plates or their repair, the brake must be correctly set in accordance with the instructions "Adjusting regulations".

(2) Changing the seal



100D7BS115

1	Piston	5	Circlip	9	Bank of cup spring
2	Adjusting screw	6	Seal	A	Detail of the seal
3	Lock nut	7	Guide bolt	B	Detail of the seal
4	Housing	8	Thrust bolt		

※ Faulty seals must be exchanged in accordance with the instructions below.

- ① Stand the vehicle on an even surface and secure against rolling away.
- ② Release the parking brake by applying the necessary release pressure.
- ③ Release the screw cap and unscrew.
- ④ Release the lock nut (size 24 or 30) and turn the adjusting screw with socket wrench size 8 or 10 manually counter clockwise until the adjuster screw is flush with the inner side of the piston.
- ⑤ Push back the thrust bolt until it has contact with the piston. Following actuate the hand brake valve (No pressure must be in the piston chamber). The bank of cup springs is now completely depressurized.
- ⑥ Unscrew the pressure hose and remove the brake.
- ⑦ Release the circlip and remove the pressure ring of the housing.
- ⑧ Release the bank of cup springs and the piston.

▲ Pay attention to the mounting direction of the seal rings, otherwise leaks can occur.

▲ Use for mounting the new seal rings a suitable mounting needle with rounded edge.
Be careful.

- ⑨ Change all seals and mount the parts of the brake in other way round order. By mounting the piston, the sliding and sealing surfaces must be greased lightly using lubricating grease to DIN 51825. The dust protection cap is fitted with a vulcanized-in steel ring which is used to press it through the locating hole. For exchanging, "lever out" the ring using a suitable tool. The new dust protection cap must be pressed in with the aid of a suitable mounting ring and screw clamps or a lever press.

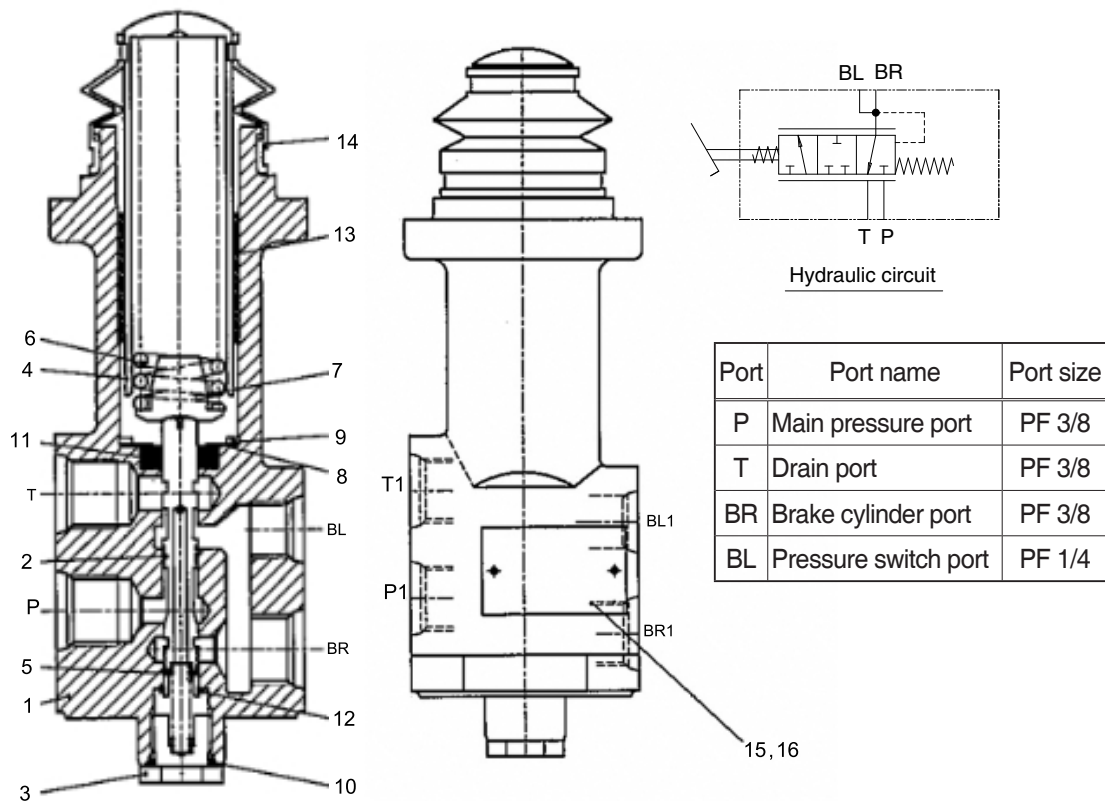
(2) General

Any discovered defects or damage to parts not listed here must naturally be repaired or replaced using original parts.

For any other information not contained in these instructions or for more detailed instructions, please contact Hyundai dealer.

5. BRAKE VALVE

1) STRUCTURE



160D9VBS07

- | | | |
|----------------|-------------------|-----------------|
| 1 Valve body | 7 Spring retainer | 13 DU bushing |
| 2 Spool | 8 Plain washer | 14 Rubber cover |
| 3 Plug | 9 Snap ring | 15 Name plate |
| 4 Brake holder | 10 O-ring | 16 Drive screw |
| 5 Lower spring | 11 Oil seal | |
| 6 Main spring | 12 Snap ring | |

(1) Purpose

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

(2) Ready position

A connection is established between ports (BR) and ports (T) so that the wheel brakes ports (BR) are pressureless via the returns ports (T).

(3) Partial braking

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

The main spring (6) beneath pedal plate (12) is designed in such a way that the braking pressure changes depending on the angle. In the lower braking pressure range, the machine can be slowed sensitively.

When the braking process is commenced, the spool (2) is mechanically actuated via main spring (6). As spool (2) move downward, they will first close returns (T) via the control edges, thus establishing a connection between accumulator ports (P) and ports (BR) for the wheel brake cylinders. The foot force applied now determines the output braking pressure. The control spool (2) is held in the control position by the force applied (Spring assembly above the spool).

After output of the braking pressure, spool (2) is in a partial braking position, causing ports (P) and ports (T) to close and holding the pressure in ports (BR).

(4) Full braking position

When pedal is fully actuated, end position of the brakes is reached and a connection established between accumulator ports (P) and brake cylinder ports (BR). Returns (T) are closed at this point.

When the braking process is ended, a connection is once again established between brake cylinder ports (BR) and return ports (T), closing accumulator ports (P).

(5) Installation requirements

Return lines (T) must be connected directly to the tank.

The connecting lines must be installed in such a way as to permit proper bleeding.

(6) Maintenance of the brake valve

No special maintenance beyond the legal requirements is necessary.

When using high-pressure cleaners on the machine, please make sure that the water jet is not aimed directly at the brake valve (To prevent damaging the bellows).

△ **For safety reasons the whole of the brake valve must be replaced if parts other than those listed above are damaged.**

(7) Repair work

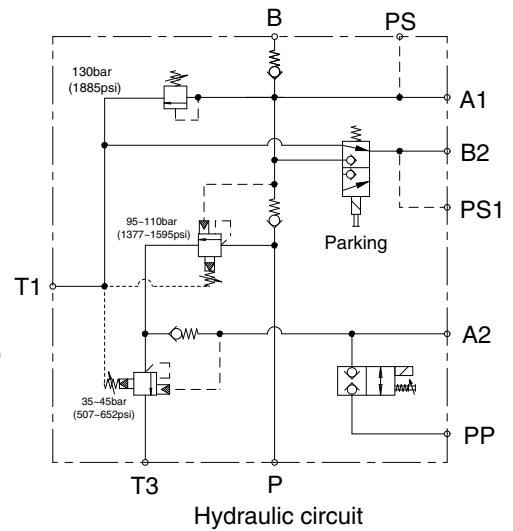
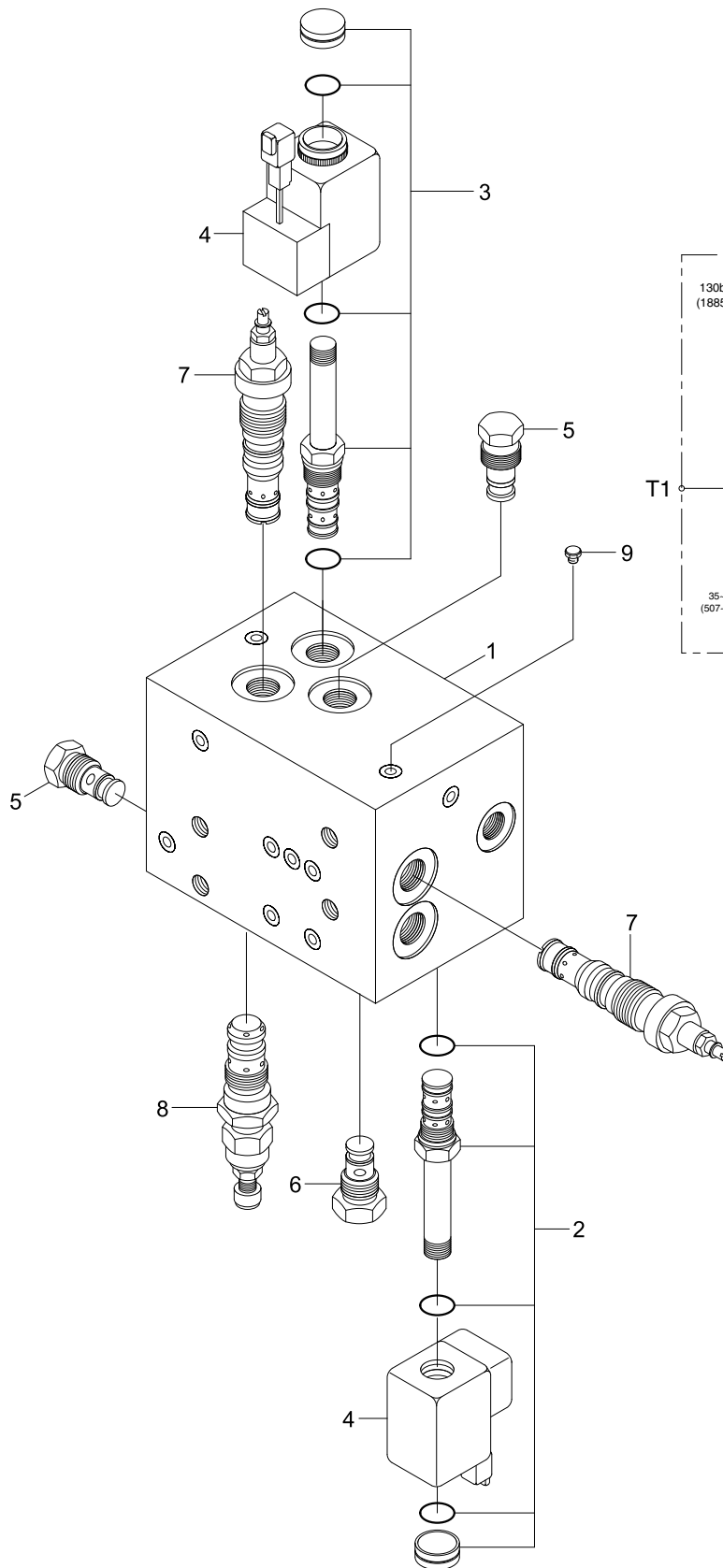
△ **When working on the braking system, always make sure that there is absolutely no pressure in the system. Even when the engine is switched off there will be some residual pressure in the system.**

When doing repair work, make sure your environment is very clean.

Immediately close all open ports on the components and on pipes using plugs.

6. CUT-OFF VALVE

1) STRUCTURE



- 1 Block
- 2 Solenoid valve
- 3 Solenoid valve
- 4 Coil
- 5 Check valve
- 6 Check valve
- 7 Cutoff valve
- 8 Relief valve
- 9 Plug

100D9V4CV01

2) TIGHTENING TORQUE

Item	Name	Hex size	Tightening torque
2	Solenoid valve	27 mm	45 Nm
3	Solenoid valve	27 mm	45 Nm
5	Check valve	22 mm	40 Nm
6	Check valve	22 mm	40 Nm
7	Cutoff valve	27 mm	50 Nm
8	Relief valve	27 mm	50 Nm

2) OPERATION

When the pump works, the oil under the pressure flows into P port.

The oil in P port is stored in the accumulator on A1 port.

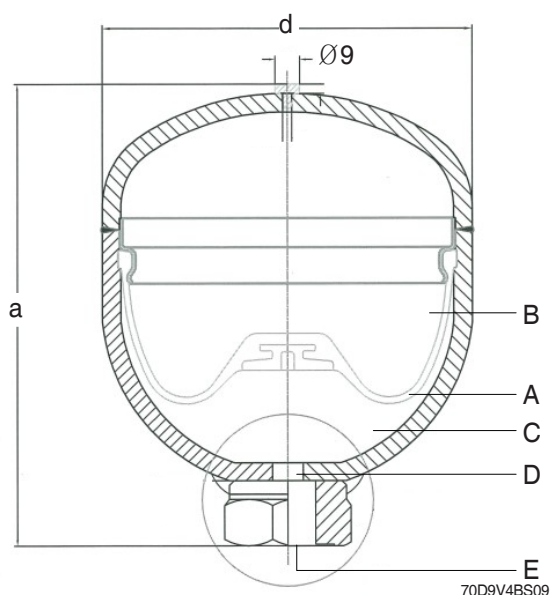
As the pressure on P line rises to 90 bar, the cut off valve (7) starts cut-offing and the oil in the P port is unloaded. The pressure on P line goes down 80 bar by the minute leakage from valve and other factors.

At this pressure, the cut-off valve starts cutting.

This process is repeated in the regular period of 30~40 seconds.

7. BRAKE ACCUMULATOR

1) STRUCTURE



Item	Brake (2 EA)	RCV (1 EA)
Diameter (d)	122 mm	90 mm
Mounting height (a)	145 mm	120 mm
Nominal volume	0.75 ℓ	0.35 ℓ
Priming pressure	50 bar	15 bar
Operating medium	Oil	Oil
Operating pressure	Max. 210 bar	Max. 170 bar
Thread	M18×1.5	PF 1/2
Priming gas	Nitrogen	Nitrogen

A Fluid portion C Diaphragm E Flat port
 B Gas portion D Valve disk

2) OPERATION

(1) Purpose

Fluids are practically incompressible and are thus incapable of accumulating pressure energy. In hydropneumatic accumulators, the compressibility of a gas is utilized to accumulate fluid. The compressible medium used in the accumulators is nitrogen.

In braking systems, the purpose of the accumulators is to store the energy supplied by the hydraulic pump. They are also used as an energy reserve when the pump is not working, as a compensator for any losses through leakage, and as oscillation dampers.

(2) Operation

The accumulator consists of a fluid portion (A) and a gas portion (B) with a diaphragm (C) as a gas-tight dividing element. The fluid portion (A) is connected to the hydraulic circuit, causing the diaphragm accumulator to be filled and the gas volume to be compressed as the pressure rises. When the pressure falls, the compressed gas volume will expand, thus displacing the accumulated pressure fluid into the circuit.

The diaphragm bottom contains a valve disk (D) which, if the diaphragm accumulator is completely empty, closes the hydraulic outlet, thus preventing damage to the diaphragm.

(3) Installation requirements

The accumulators can be fitted in the hydraulic circuit, directly on a component or in blocks on suitable consoles.

They should be fitted in as cool a location as possible.

Installation can be in any position.

(4) Maintenance of the accumulator

No special maintenance beyond the legal requirements is necessary.

The accumulator should be checked annually. It should be replaced if the initial gas pressure has fallen by more than 30% (Please refer to **Performance testing and checking of the accumulator**).

(5) Disposal of the accumulator

Before the accumulator is scrapped, its gas filling pressure must be reduced. For this purpose, drill a hole through gas chamber (B) using a drill approx. 3 mm in diameter. The gas chamber is located on the side opposite the threaded port above the welding seam around the center of the accumulator.

※ **Wear safety goggles when doing this job.**

(6) Performance testing and checking of the accumulator

The accumulator is gradually pressurized via the test pump; until the initial gas pressure is reached, the hydraulic pressure in the accumulator will rise abruptly. This is apparent from gauge **M**. If the initial gas pressure is more than 30% below the prescribed value, the accumulator needs to be replaced. If the measuring process needs to be repeated, wait for intervals of 3 minutes between the individual tests. Any accumulator whose initial gas pressure is insufficient must be scrapped following the instructions under **Disposal of the accumulator**.

The amount of initial gas pressure can also be checked from the vehicle. Start the vehicle's engine. The pump will now supply oil to the accumulators. Until the initial gas pressure is reached, the hydraulic pressure in the accumulator will rise abruptly. This is apparent from the gauge in the cab. If the initial gas pressure is more than 30% below the prescribed value, that initial pressure lies outside the permissible range for **at least one** of the accumulators fitted in the vehicle. This accumulator can be traced only by using the method described above, i.e. all accumulators have to be individually tested. The accumulator whose initial gas pressure is insufficient must be replaced and scrapped following the instruction under **Disposal of the accumulator**.

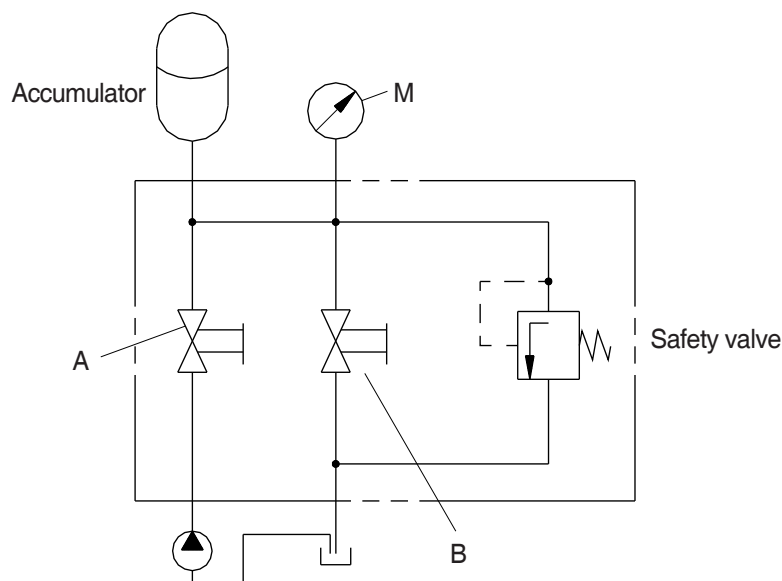
(7) Repair work

△ **When working on the braking system, always make sure that there is absolutely no pressure in the system. Even when the engine is switched off there will be some residual pressure in the system.**

※ **When doing repair work, make sure your environment is very clean.**

Immediately close all open ports on the components and on pipes using plugs.

△ **For safety reasons the accumulators need to be replaced as a whole if damaged.**

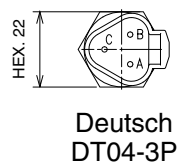
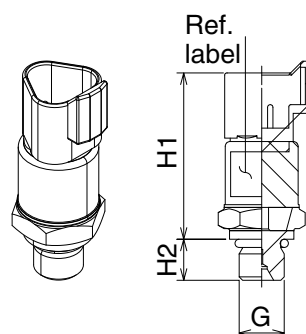


(770-3ATM) 4-23

8. PRESSURE SENSOR AND SWITCH

1) PRESSURE SENSOR

(1) Structure



· Tightening torque : 2.5 ~ 3.0 kgf·m
(18 ~ 21.7 lbf·ft)

Pin map	Function
A	+ Supply
B	- Supply
C	Output

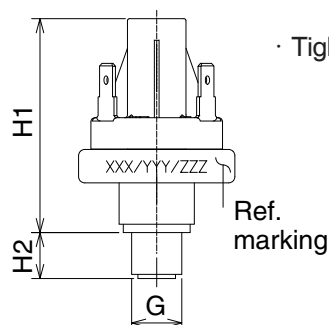
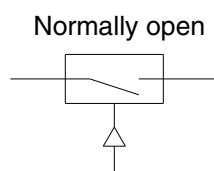
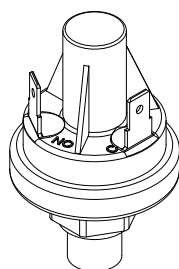
70D9V4BS10

Item	Medium	Thread (G)	H1 (mm)	H2 (mm)	Measuring range (bar)	Cut-off actuating pressure	Voltage (V)	Electrical connections
Charging pressure sensor (PS or PSS)	Oil	9/16-18 UNF	49	12	0 ~ 350	90 ~ 95 bar (1.52 ~ 1.58 V)	Max. 30	CD-3
Parking pressure sensor (PS1 or PSP)	Oil	9/16-18 UNF	49	12	0 ~ 350	90 ~ 95 bar (1.52 ~ 1.58 V)	Max. 30	CD-26

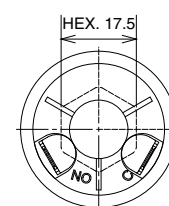
※ O-ring (S611-012001) : 11.89 × 1.98 (AS568-906, NBR Hs90)

2) PRESSURE SWITCH

(1) Structure



· Tightening torque : 2.5 ~ 3.0 kgf·m
(18 ~ 21.7 lbf·ft)



70D9V4BS11

Item	Type	Medium	Thread (G)	H1 (mm)	H2 (mm)	Measuring range (bar)	Actuating pressure	Supply voltage	Electrical connections
Brake lamp pressure switch (B2 or BL)	Normally open	Oil	1/2-20 UNF	49	11	1 ~ 10	5 ± 1 bar (0.56 V)	Max. 45 V	Slip on CD-4

※ O-ring (S611-011001) : 10.52 × 1.82 (AS568-905, NBR Hs90)

2) OPERATION

(1) Purpose

The pressure switches are used to visually or audibly warn the driver of the pressure within the system.

(2) Make contact / circuit closer

The pressure switch can be fitted in the braking system or directly on one of its components.

The system pressure acts on an absorption area within the switch, making an electrical contact as the pressure on that area is increased. The resulting current is used to activate a warning facility, for instance.

(3) Break contact / circuit breaker

The pressure switch can be fitted in the braking system or directly on one of its components.

The system pressure acts on a absorption area within the switch, breaking an electrical contact as the pressure on that area is increased. The current is now broken, e.g. to deactivate a warning facility.

(4) Installation requirements

No special measures need to be taken.

(5) Maintenance of the pressure switch

No special maintenance beyond the legal requirements is necessary.

When using high-pressure cleaners on the vehicle, please make sure that the water jet is not directed at the pressure switch (Corrosion of contacts).

(6) Repair work

△ **When working on the braking system, always make sure that there is absolutely no pressure in the system. Even when the engine is switched off there will be some residual pressure in the system.**

※ When doing repair work, make sure your environment is very clean.

Immediately close all open ports on the components and on pipes using plugs.

※ For safety reasons the pressure switch needs to be replaced as a whole if damaged.

GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

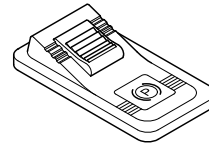
1. OPERATIONAL CHECKS

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 is depressed. Check also change in operating force, and change in position of pedal when pedal is kept depressed.

2) PARKING BRAKE

- (1) Check that parking brake can hold machine in position when loaded on 20% slope. If there is no slope available, travel at low speed and check braking effect of parking brake.



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2. TROUBLESHOOTING

Problem	Cause	Remedy
Insufficient braking force	<ul style="list-style-type: none"> · Hydraulic system leaks oil. · Hydraulic system leaks air. · Disk worn. · Brake valve malfunctioning. · Hydraulic system clogged. 	<ul style="list-style-type: none"> · Repair and add oil. · Bleed air. · Replace. · Repair or replace. · Clean.
Brake acting unevenly. (Machine is turned to one side during braking.)	<ul style="list-style-type: none"> · Tires unequally inflated. · Brake out of adjustment. · Disk surface roughened. · Wheel bearing out of adjustment. · Hydraulic system clogged. 	<ul style="list-style-type: none"> · Adjust tire pressure. · Adjust. · Repair by polishing or replace. · Adjust or replace. · Clean.
Brake trailing.	<ul style="list-style-type: none"> · Pedal has no play. · Piston cup faulty. · Brake valve return port clogged. · Hydraulic system clogged. · Wheel bearing out of adjustment. 	<ul style="list-style-type: none"> · Adjust. · Replace. · Clean. · Clean. · Adjust or replace.
Brake chirps	<ul style="list-style-type: none"> · Brake trailing. · Piston fails to return. · Disk worn. · Disk surface roughened. 	<ul style="list-style-type: none"> · See above. Brake trailing. · Replace. · Replace. · Repair by polishing or replace.
Brake squeaks	<ul style="list-style-type: none"> · Disk surface roughened. · Disk worn. · Excessively large friction between disk plate. 	<ul style="list-style-type: none"> · Repair by polishing or replace. · Replace. · Clean and apply brake grease.
Large pedal stroke	<ul style="list-style-type: none"> · Brake out of adjustment. · Hydraulic line sucking air. · Oil leaks from hydraulic line, or lack of oil. · Disk worn. 	<ul style="list-style-type: none"> · Adjust. · Bleed air. · Check and repair or add oil. · Replace.
Pedal dragging.	<ul style="list-style-type: none"> · Twisted push rod caused by improperly fitted brake valve. · Brake valve seal faulty. 	<ul style="list-style-type: none"> · Adjust. · Replace.

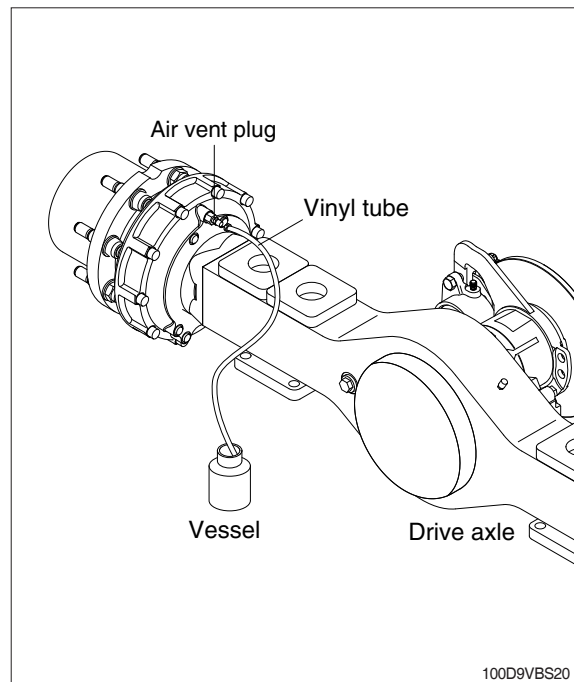
GROUP 3 TESTS AND ADJUSTMENTS

1. AIR BLEEDING OF BRAKE SYSTEM

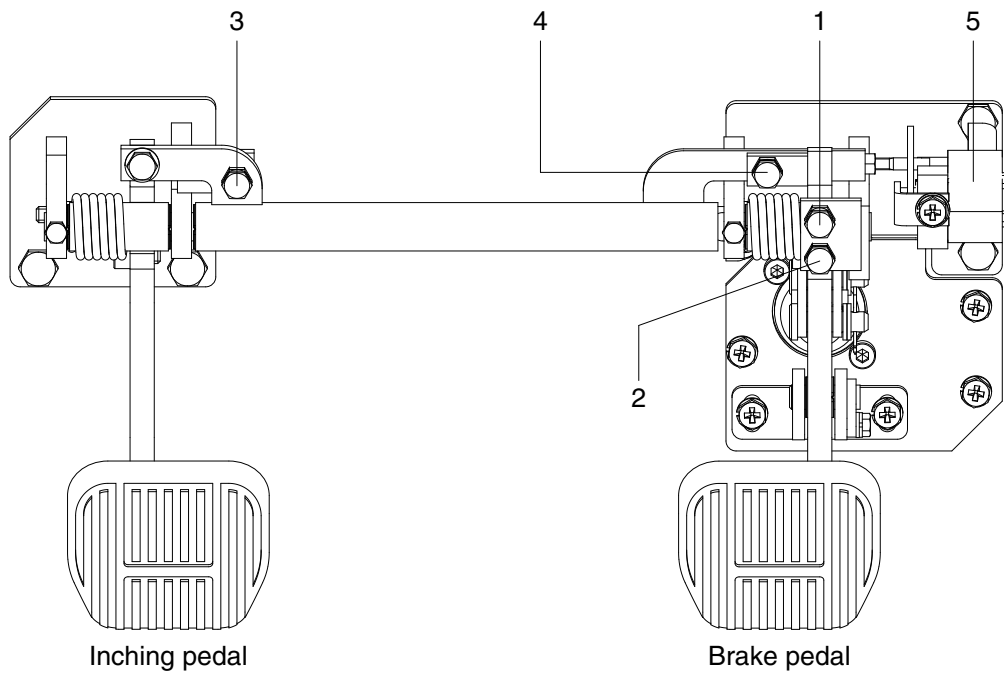
- 1) Air bleeding should be performed by two persons :

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.
- 8) Same way for the opposite side.



2. ADJUSTMENT OF PEDALS



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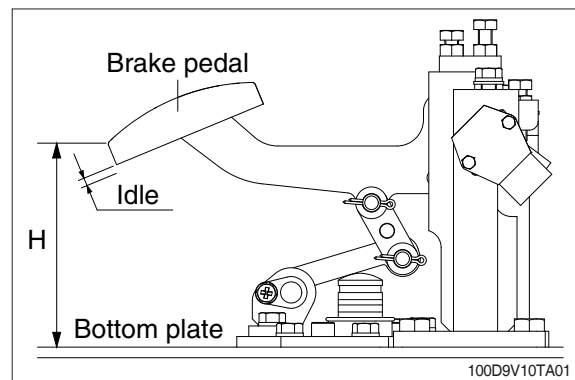
- | | | | | | |
|---|-------------------------|---|------------------------------------|---|----------------|
| 1 | Brake stopper bolt | 3 | Inching stopper bolt | 5 | Inching sensor |
| 2 | Brake stroke limit bolt | 4 | Brake&inching pedal interlock bolt | | |

1) Brake pedal

- Adjust the brake stopper bolt (1) so that pedal height is "H".

Unit : mm

H	IDLE
149 ± 1	0

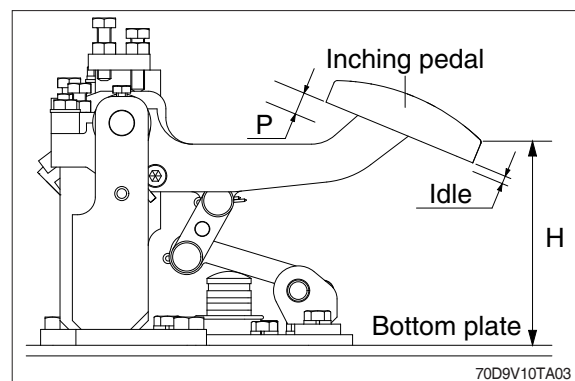


2) Inching pedal

- Adjust inching stopper bolt (3) so that pedal height is "H".
- Adjust rod of inching cable so that inching pedal play is idle stroke when pedal height is "H".
- Adjust the brake and inching pedal interlock bolt (4) so that brake pedal interconnects with inching pedal at inching pedal stroke "P".

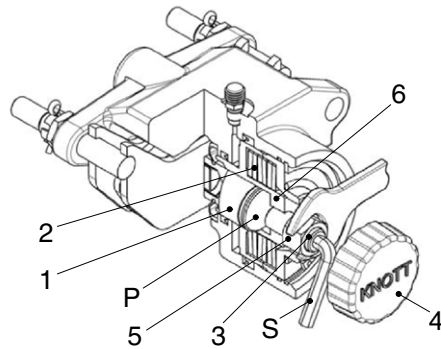
Unit : mm

H	P	IDLE
149 ± 1	7	3



3. EMERGENCY RELEASE OF THE PARKING BRAKE

After the failure of the pressure release the parking brake by using following manual procedure.



100D7BS117

- | | | | | | |
|---|---------------------|---|-----------|---|---------------|
| 1 | Thrust bolt | 4 | Screw cap | P | Even surface |
| 2 | Bank of cup springs | 5 | Lock nut | S | Socket wrench |
| 3 | Adjusting screw | 6 | Piston | | |

- 1) The vehicle has to be secured against rolling away.
- 2) Release the screw cap and unscrew
- 3) Release the lock nut (size 24 or 30) and turn the adjusting screw with socket wrench size 8 or 10 manually counter-clockwise until the brake disc is free.

⚠ For the emergency release is an actuation torque of 40 Nm respectively 70 Nm required.

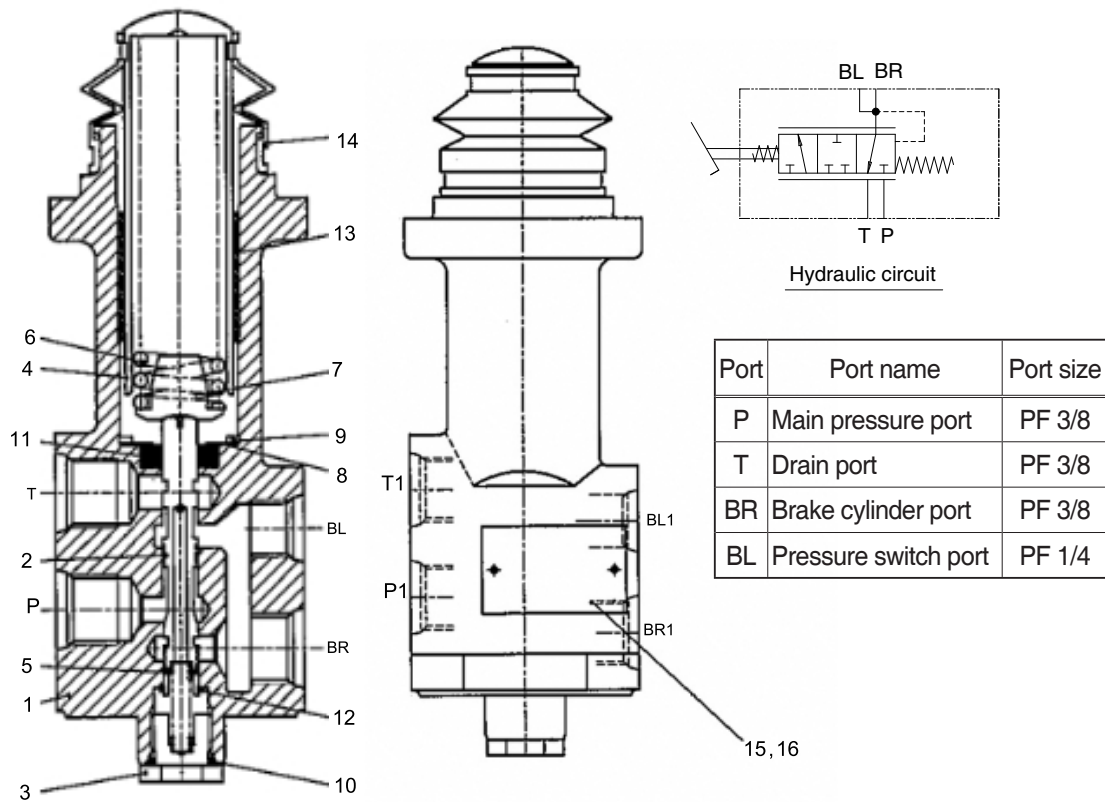
- 4) Mount the lock nut and the screw cap and tighten both as far as possible manually. (protection against dirt)

⚠ Now, the vehicle do not have any brake function. The vehicle must be secured against moving away with proper means. Before putting the vehicle into operation again, the brake has to be adjusted again. Refer to previous page. "Assembly and basic setting regulations".

GROUP 4 DISASSEMBLY AND ASSEMBLY

1. BRAKE VALVE

1) STRUCTURE



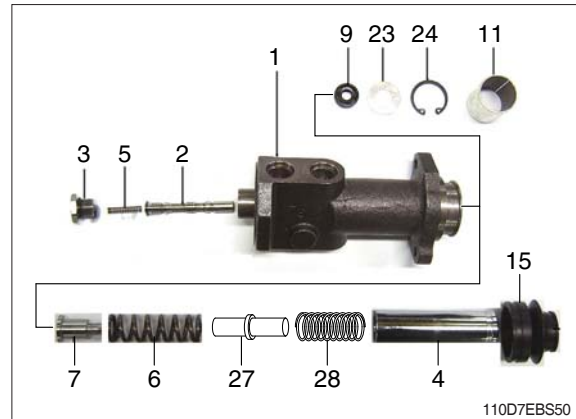
160D9VBS07

- | | | |
|----------------|-------------------|-----------------|
| 1 Valve body | 7 Spring retainer | 13 DU bushing |
| 2 Spool | 8 Plain washer | 14 Rubber cover |
| 3 Plug | 9 Snap ring | 15 Name plate |
| 4 Brake holder | 10 O-ring | 16 Drive screw |
| 5 Lower spring | 11 Oil seal | |
| 6 Main spring | 12 Snap ring | |

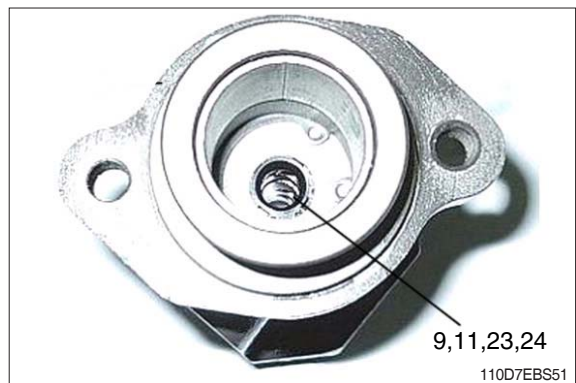
2) REASSEMBLY

(1) Body assembly

- 1 Body
- 2 Spool
- 3 Plug
- 4 Holder
- 5 Spring
- 6 Main spring 1
- 7 Spring retainer 1
- 9 Oil seal
- 11 DU bushing
- 15 Rubber cover
- 23 Plain washer
- 24 Snap ring
- 27 Spring retainer 2
- 28 Main spring 2



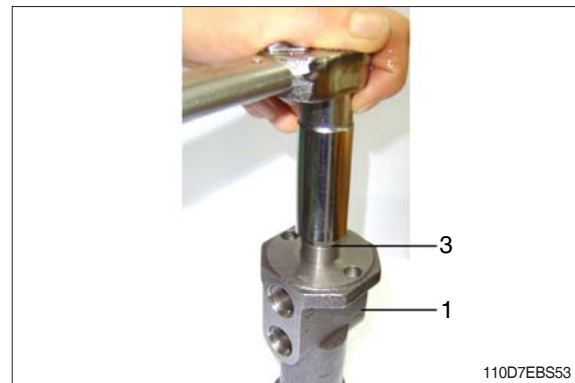
- ① Install oil seal (9), plain washer (23), snap ring (24), DU bushing (11).
- Tool : Jig for dry bearing, snap ring plier.



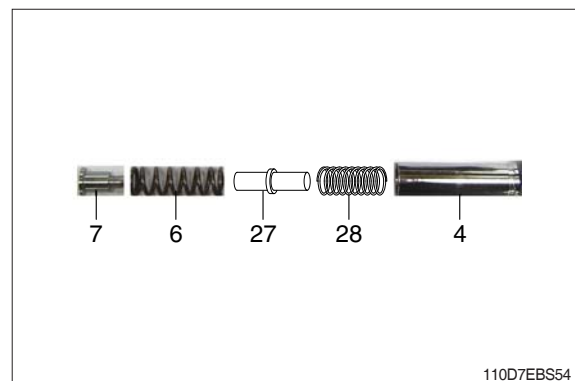
- ② Install spool (2) into body (1).



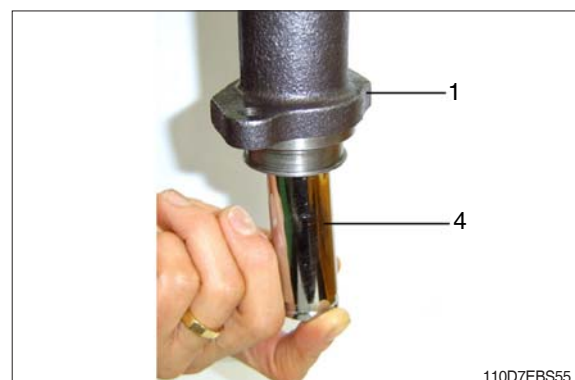
- ③ Tighten plug (3)
- Tool : 19 mm spanner
 - Tightening torque : 14.0~16.5 kgf · m
- ※ Press-in the DU bushing (11) with a exclusive jig.
- ※ Be careful of dust and scrap after washing the parts.



- ④ Spring retainer (7, 27), main spring (6, 28) and holder (4).



- ⑤ Holder (4) → Body (1)



- ⑥ Rubber cover (15)



SECTION 5 STEERING SYSTEM



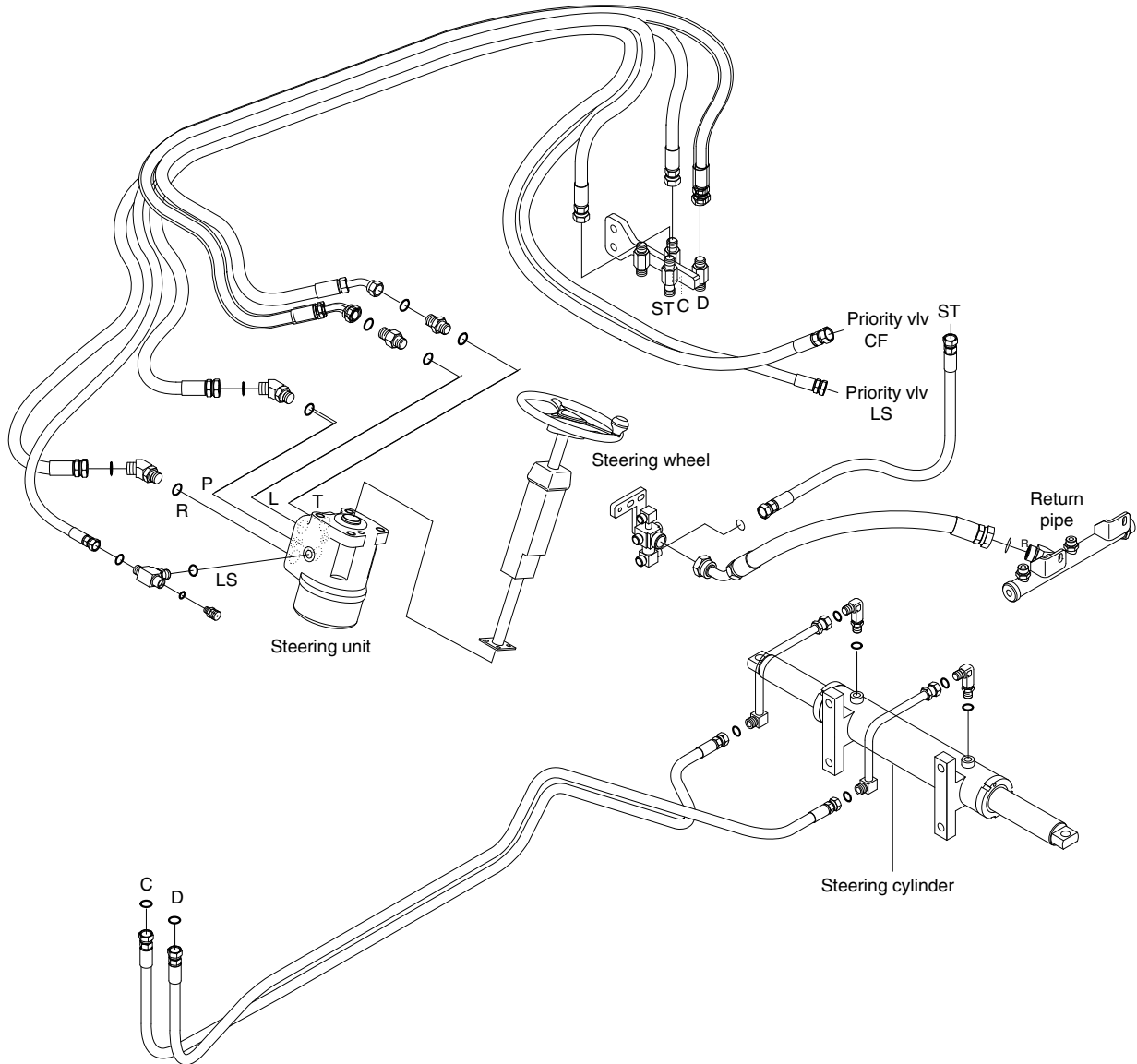
Group 1 Structure and Function 5-1

Group 2 Operational Checks and Troubleshooting 5-18

Group 3 Disassembly and Assembly 5-20

GROUP 1 STRUCTURE AND FUNCTION

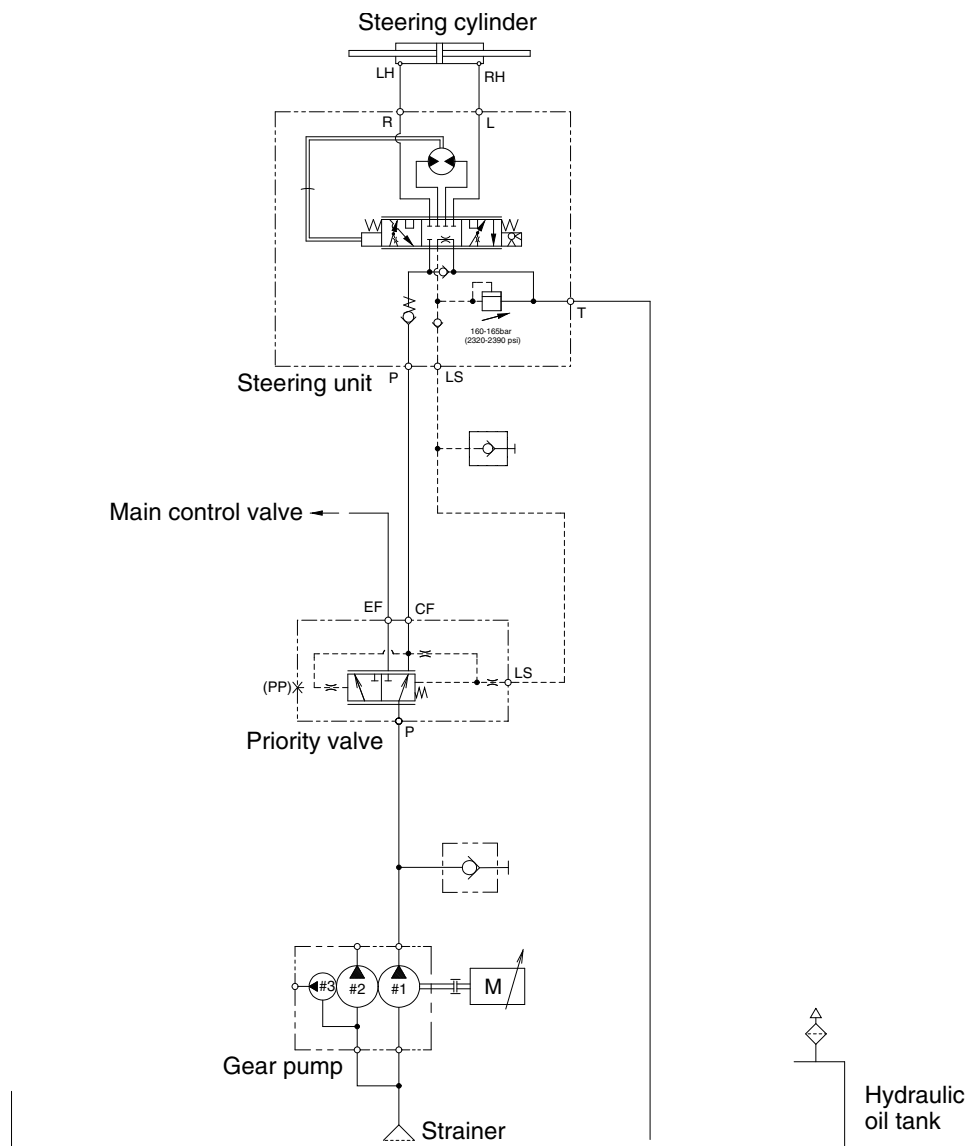
1. OUTLINE



100D9SS01

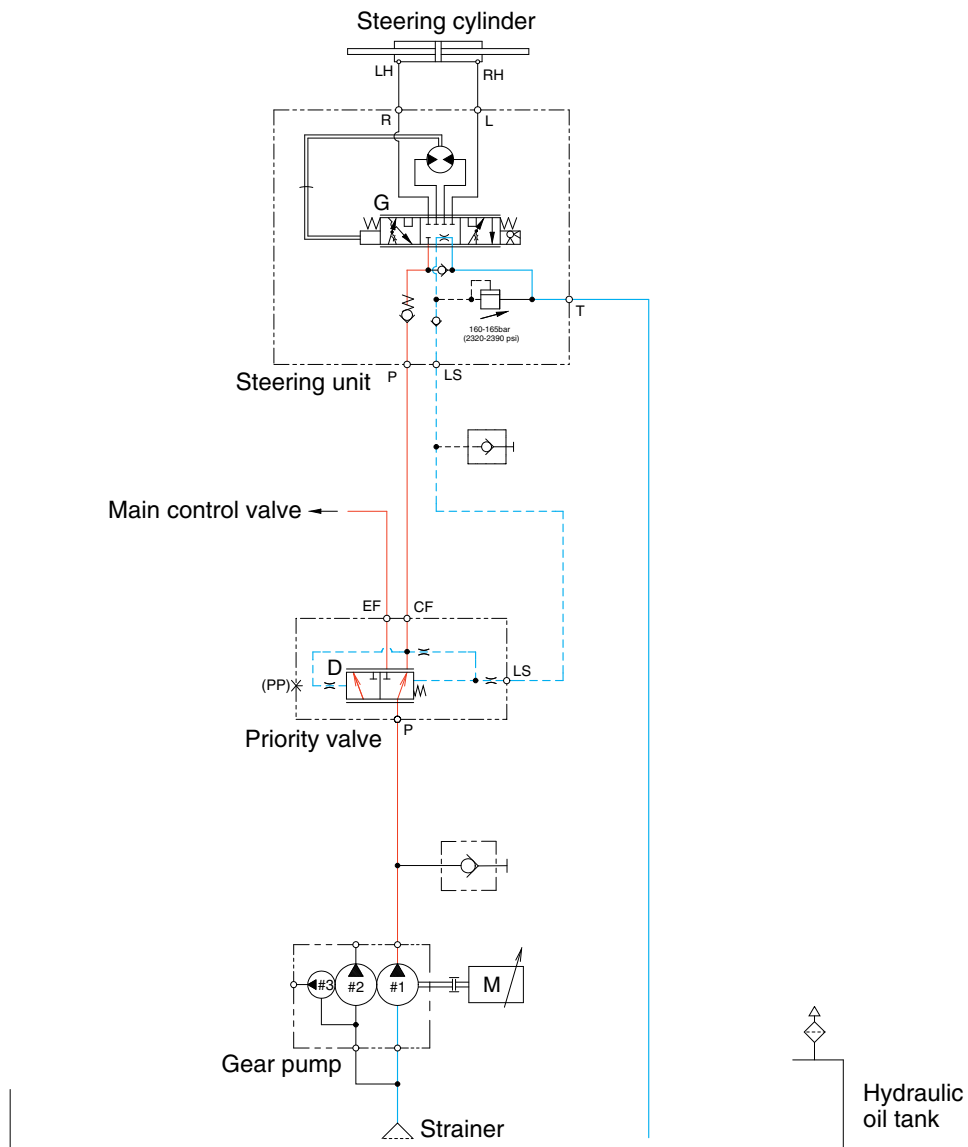
The steering system for this truck is composed of main pump, steering wheel assembly, steering unit, priority valve, steering cylinders, steering axle and piping. The steering axle supports the forklift weight with the rear axle, contains a cylinder and controls the position of the rear tires. The steering 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



100D95SS10

1) NEUTRAL



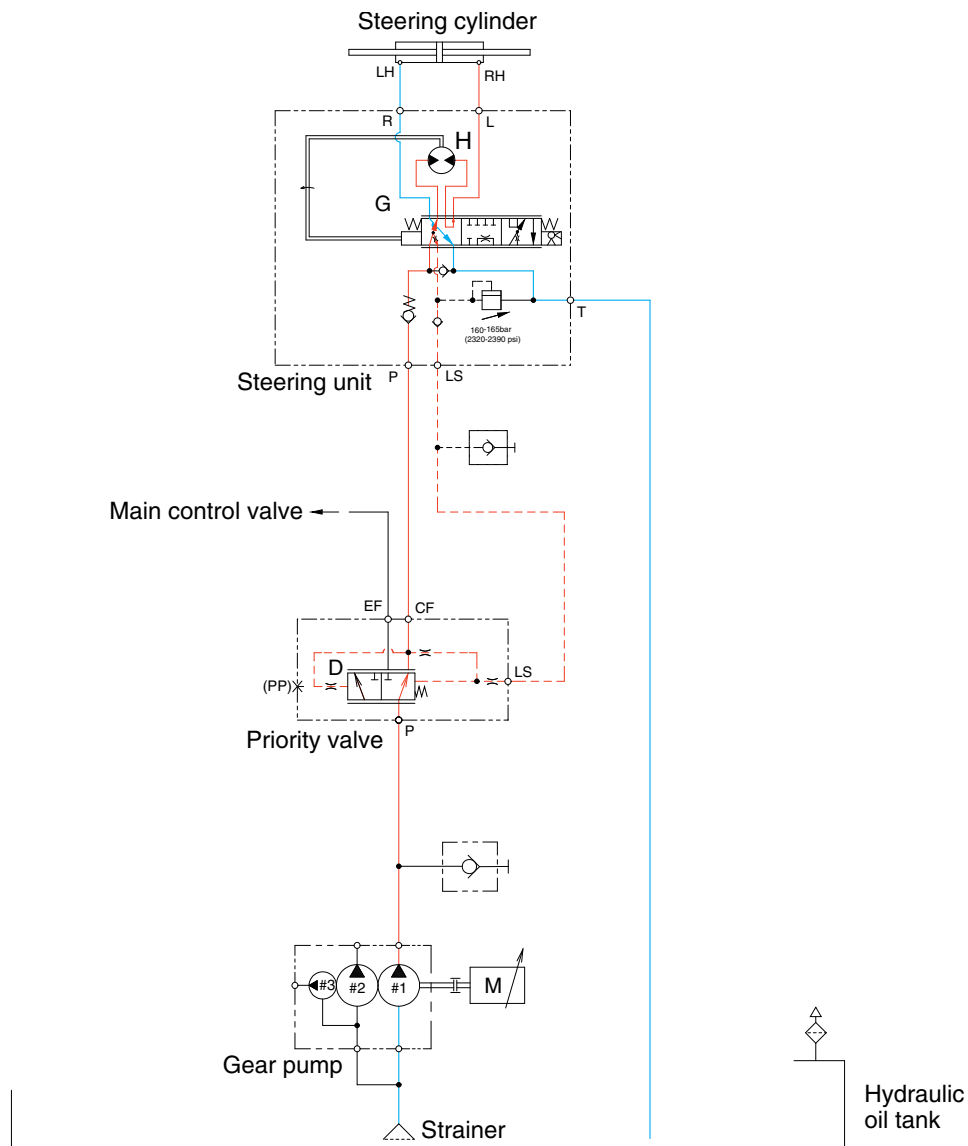
100D95SS11

The steering wheel is not being operated, so control spool (G) does not move.

The oil from hydraulic gear pump enters the port P of priority valve and the inlet pressure oil moves the spool (D) to the left.

Oil flow into LS port to the hydraulic tank, so the pump flow is routed to the main control valve through the EF port.

2) LEFT TURN



100D95SS12

When the steering wheel is turned to the left, the spool (G) within the steering unit connected with steering column turns in left hand direction.

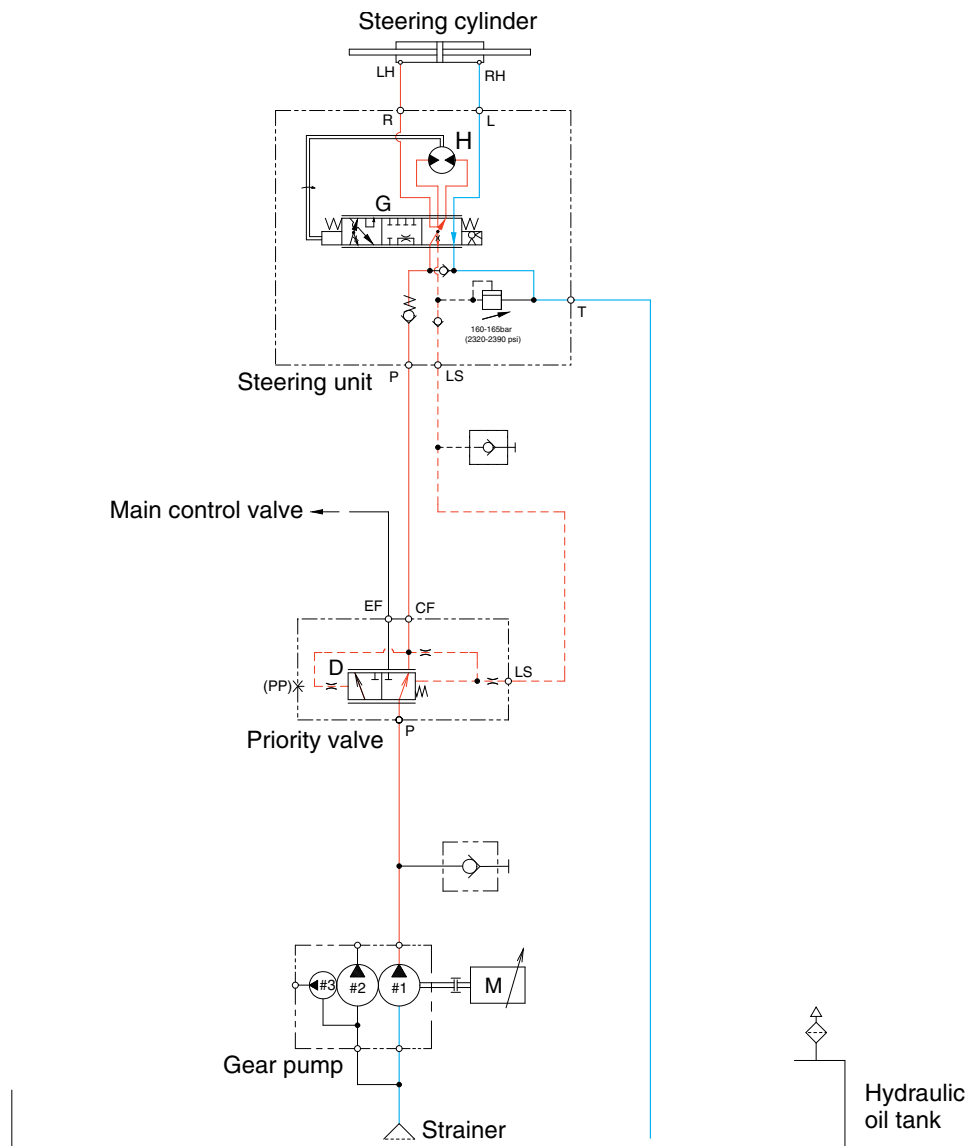
At this time, the oil discharged from the pump flows into the spool (G) the steering unit through the spool (D) of priority valve and flows the gerotor (H).

Oil flow from the gerotor flows back into the spool (G) where it is directed out the left work port (L).

Oil returned from cylinder returns to hydraulic tank.

When the above operation is completed, the machine turns to the left.

3) RIGHT TURN

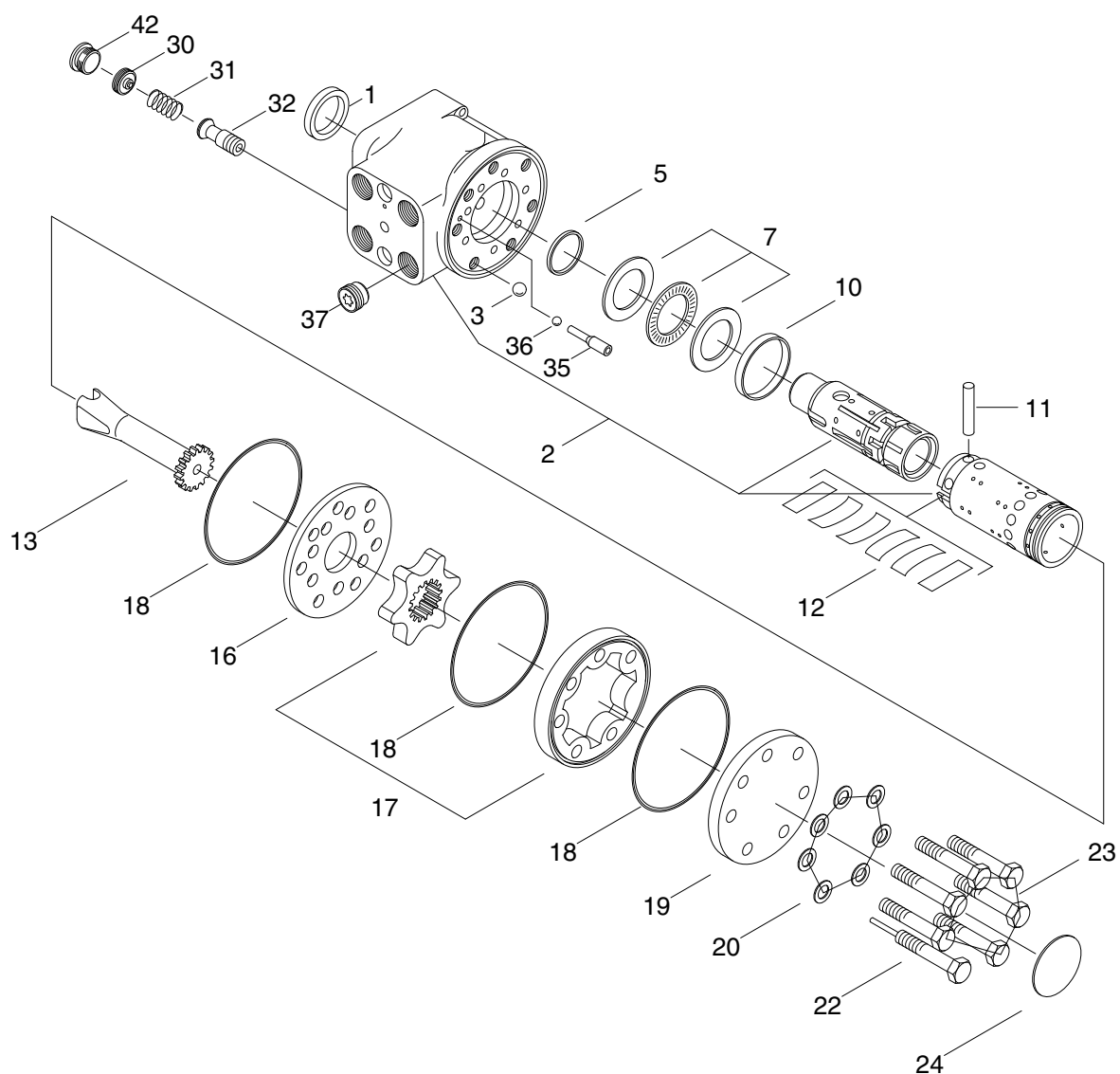


100D95SS13

When the steering wheel is turned to the right, the spool (G) within the steering unit connected with steering column turns in right hand direction.
 At this time, the oil discharged from the pump flows into the spool (G) the steering unit through the spool (D) of priority valve and flows the gerotor (H).
 Oil flow from the gerotor flows back into the spool (G) where it is directed out the right work port (R).
 Oil returned from cylinder returns to hydraulic tank.
 When the above operation is completed, the machine turns to the right.

3. STEERING UNIT

1) STRUCTURE



70D9V5SS06

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

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

A detailed cross-sectional diagram of a variable displacement pump assembly. The diagram shows the internal components, including the rotorset (stator and rotor), drive link, spool, shaft seal, bearing, sleeve, pin, check valve, rotorset (stator/rotor), end-cover, wear plate, spacer, pump return (tank), left, right, pump in, and housing. The diagram is color-coded to distinguish different parts: the housing is grey, the pump return tank is light blue, the left and right pump chambers are light blue, the pump in is light blue, the wear plate is red, the spacer is yellow, the end-cover is red, the rotorset (stator/rotor) is yellow, the drive link is green, the spool is green, the shaft seal is purple, the bearing is blue, the sleeve is blue, the pin is blue, the check valve is blue, and the rotorset (stator/rotor) is yellow.

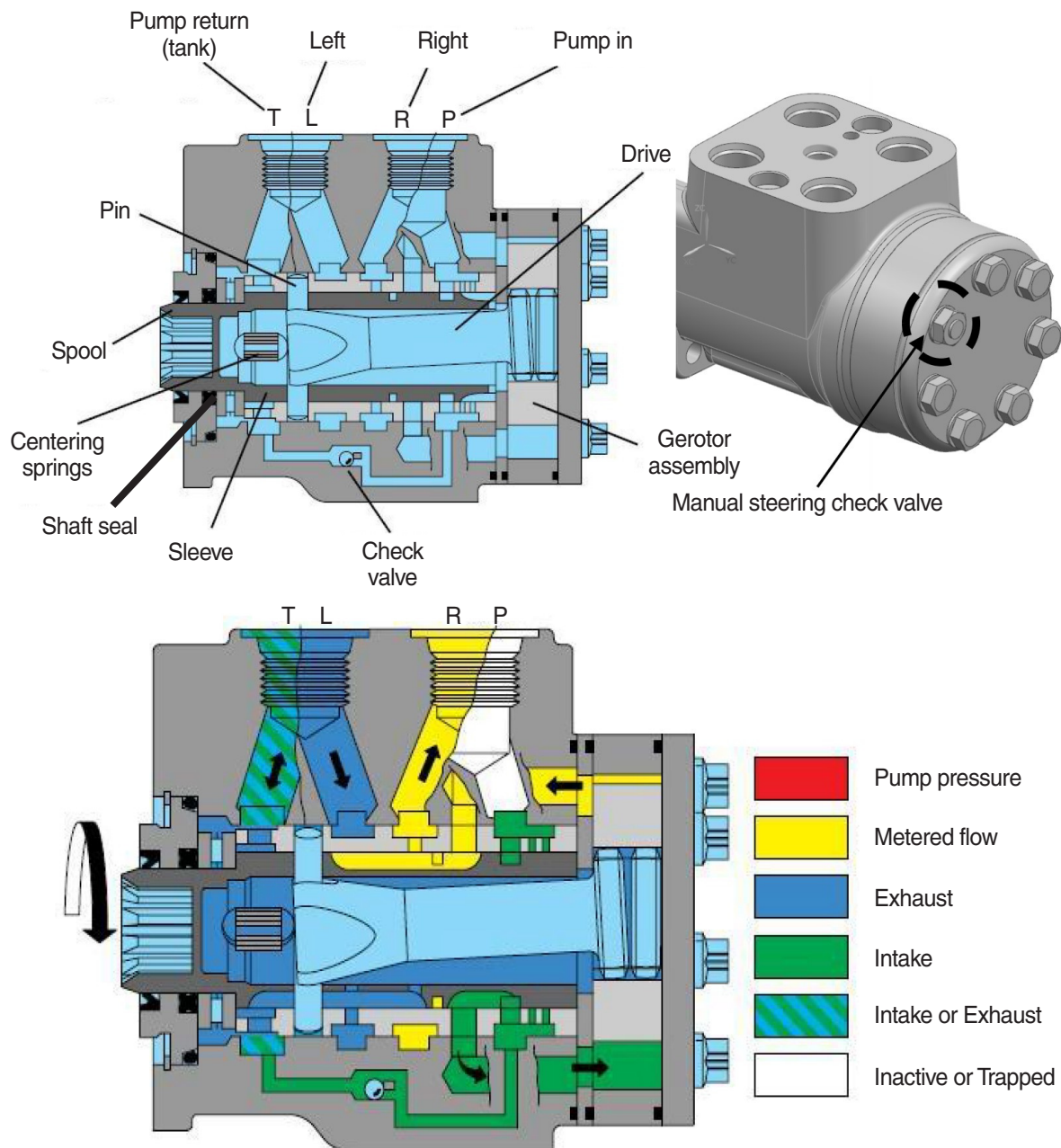
Labels in the diagram include:

- Housing
- Pump return (tank)
- Left
- Right
- Pump in
- Wear plate
- Spacer
- End-cover
- Rotorset (stator/rotor)
- Check valve
- Pin
- Sleeve
- Bearing
- Shaft seal
- Spool
- Drive link

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.

- 5-7

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. 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.

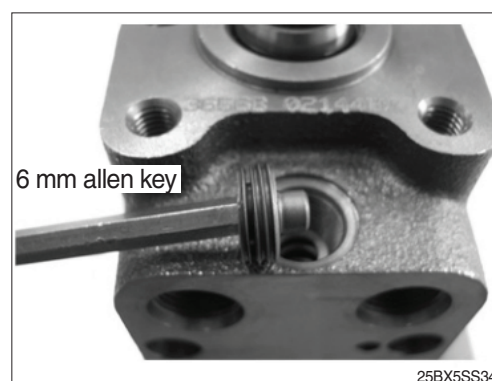
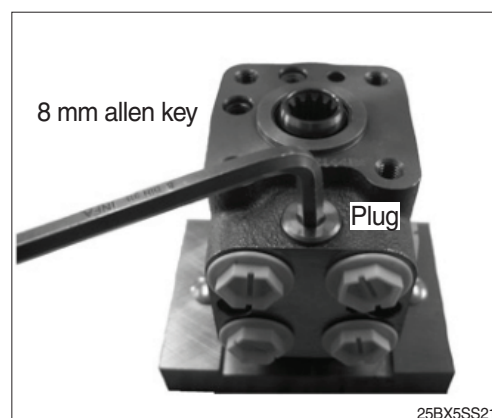
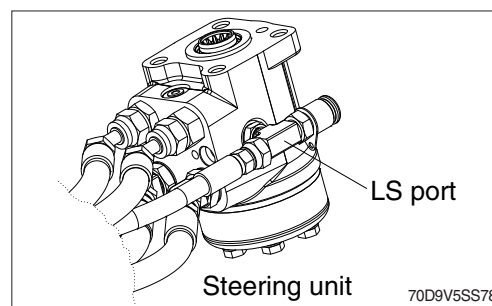
4) RELIEF VALVE PRESSURE TEST AND ADJUSTMENT

(1) Test specification

- Engine speed : low idle rpm
- Oil temperature : 50 ± 5 °C (122 ± 9 °F)
- Steering relief set pressure : 135 ~ 140 bar (1958 ~ 2031 psi)

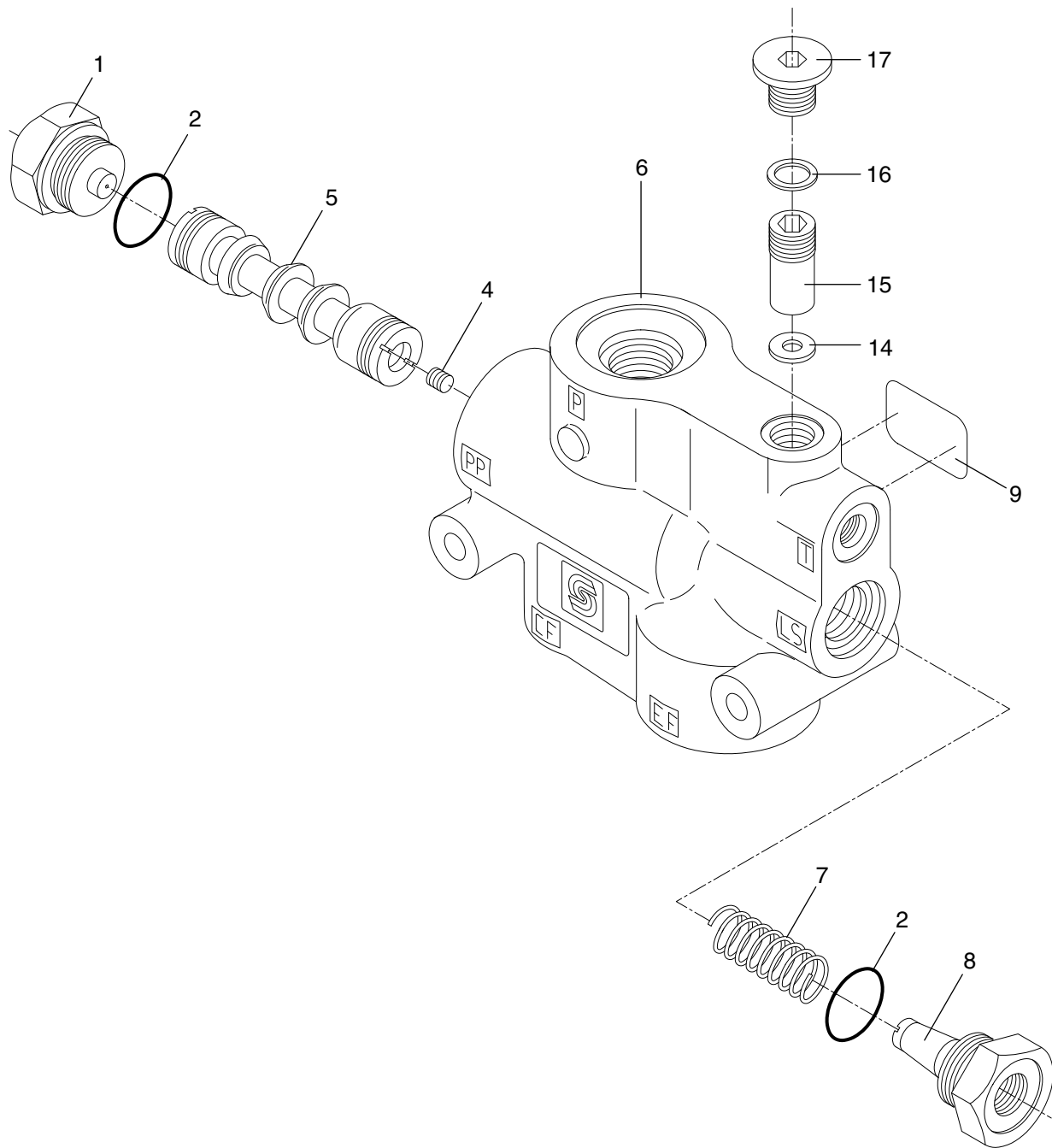
(2) Pressure test and adjustment

- 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 Connect pressure gauge to "LS" pressure check port of the steering unit as shown the illustration.
 - ④ Operate engine at test specifications.
 - ⑤ Turn the steering wheel all the way to a stop and hold it there.
 - ⑥ Check pressure gauge reading. Compare the readings and specifications.
 - ⑦ Loosen the relief valve plug. Turn the adjusting screw to adjust the pressure.
 - Tightening torque : 6.6 ± 0.5 kgf·m (47.9 ± 3.7 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.
 - ⑧ Repeat Step ⑥, ⑦. If pressure is to specifications, remove test equipment.
- △ Do not permit dirt or other contaminants to enter the hydraulic system. Disconnected hoses, tubes, open valves, cylinder fittings, and ports should be protected with clean caps or plugs.



4. PRIORITY VALVE

1) STRUCTURE



3YFJ-03100P

- | | | |
|-----------|--------------|-------------------------------|
| 1 Plug | 6 Housing | 14 Washer (steel) |
| 2 O-ring | 7 Spring | 15 Pressure relief valve |
| 4 Orifice | 8 LS plug | 16 Washer (aluminum.) |
| 5 Spool | 9 Name plate | 17 Pressure relief valve plug |

2) STRUCTURE

The oil from the hydraulic pump flows to the priority valve.

The priority valve supplies a flow of oil to the steering system and lift, tilt system.

The steering flow is controlled by the steering unit to operate the steering cylinder.

The remainder of the oil flow from the pump flows to the main control valve.

3) DISASSEMBLY AND ASSEMBLY

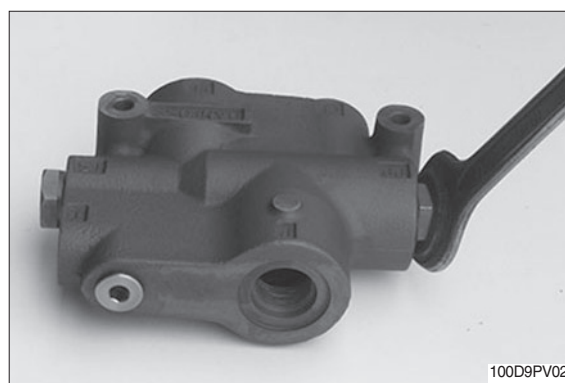
(1) Tools

- Open-end spanner 27 mm
- Multigrip pliers
- Nylon pin
- Hexagon socket wrenches 5, 8 and 10 mm

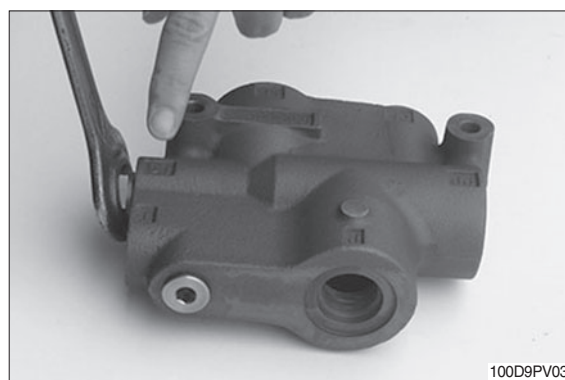


(2) Disassembly

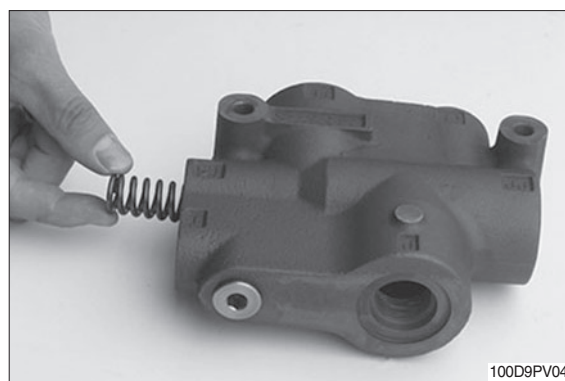
- ① Screw out the PP plug using the open-end spanner. Remove the O-ring.



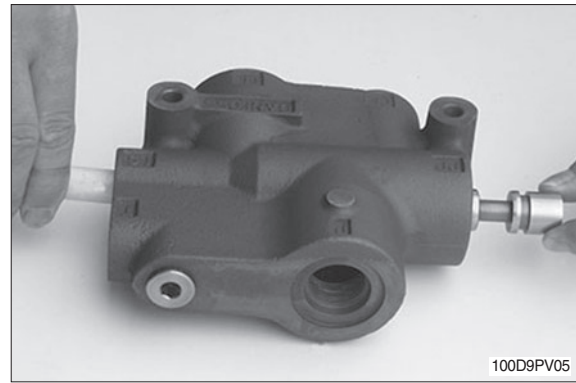
- ② Screw out the LS plug using the open-end spanner. Remove the O-ring.



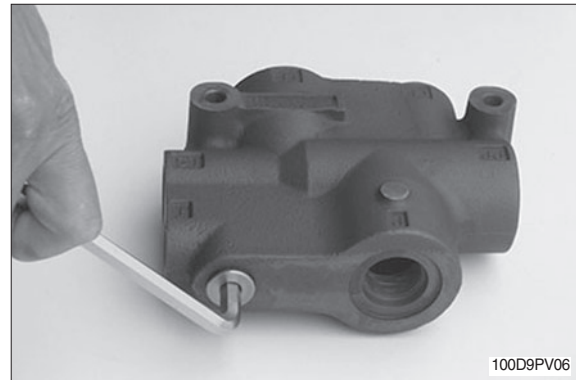
- ③ Take out the spring.



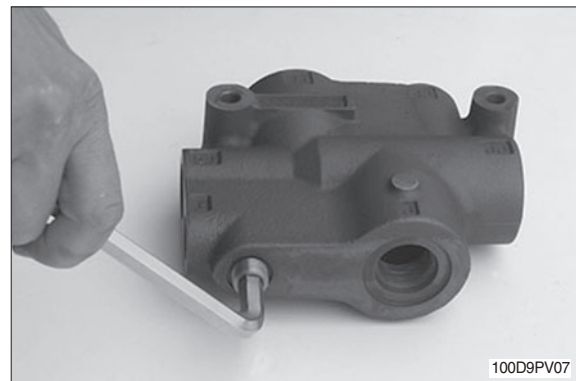
- ④ Press out the spool using the nylon pin.



- ⑤ Screw out the pressure relief valve plug (8 mm hexagon socket wrench).



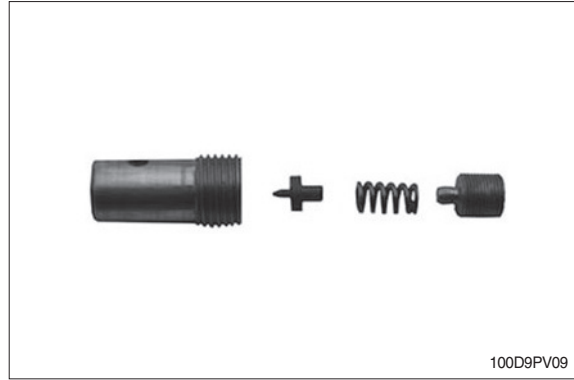
- ⑥ Screw out the pressure relief valve plug (10 mm hexagon socket wrench).



- ⑦ Hold the pressure relief valve firmly with the multigrip pliers and screw out the setting screw (5 mm hexagon socket wrench).



- ⑧ The pressure relief valve consists of valve housing, cone, spring and setting screw.



(3) Cleaning

Clean all parts carefully in low aromatic kerosene.

(4) Inspection and replacement

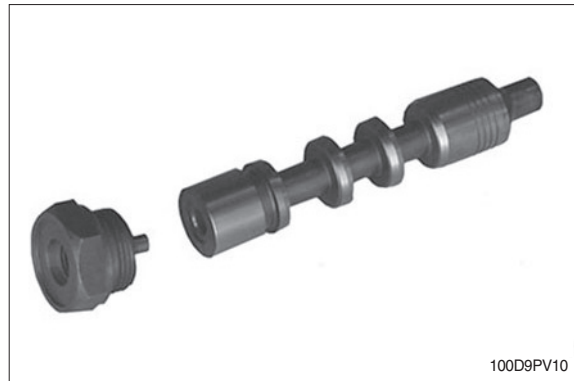
Check all parts carefully and make any replacements necessary.
All O-rings must be replaced.

(5) Lubrication

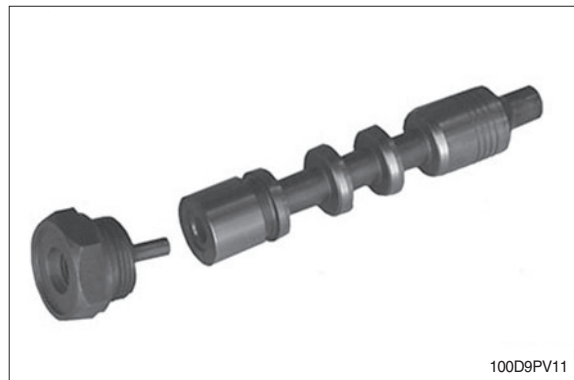
Before assembly, lubricate all parts with hydraulic oil.

(6) Assembly

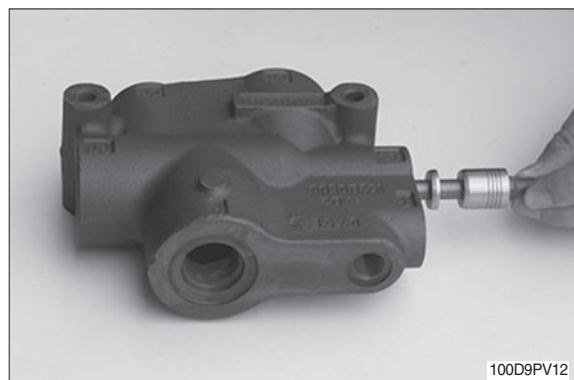
- ① The illustration shows the internal PP spool and internal PP-plug. The internal PP-plug can only be used with the internal PP-spool.



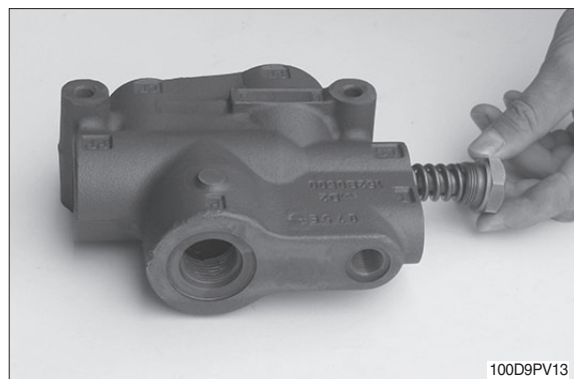
- ② The illustration shows the external PP spool and external PP-plug. The external PP-plug can only be used with the internal PP-spool.



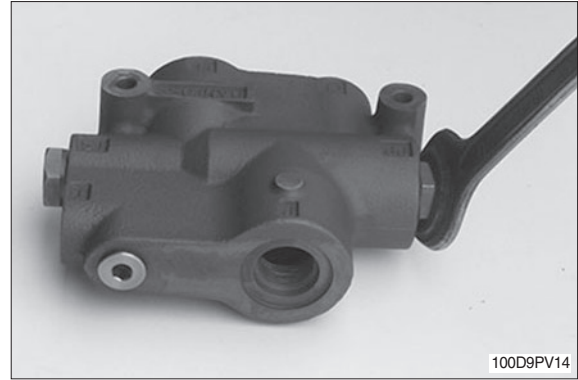
- ③ Guide the spool into the bore.
Use the nylon pin to centre the spool in the bore.



- ④ Guide the spring and LS-plug into the bore.
Remember O-ring



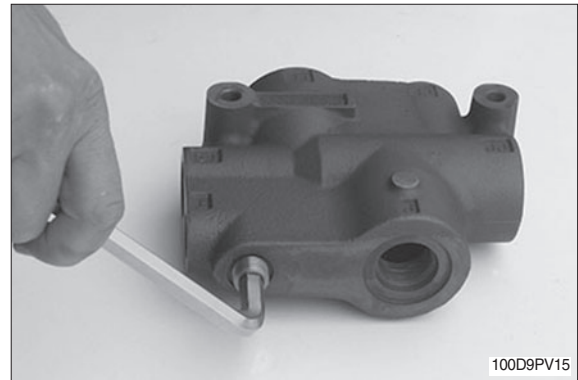
- ⑤ Screw in the PP-plug (with O-ring) and LS-plug (27 mm open-end spanner).



- ⑥ Fit the cone, spring and setting screw in the valve housing (if dismantled). Fit the seal washer (if removed) and the pressure relief valve (10 mm hexagon socket wrench).

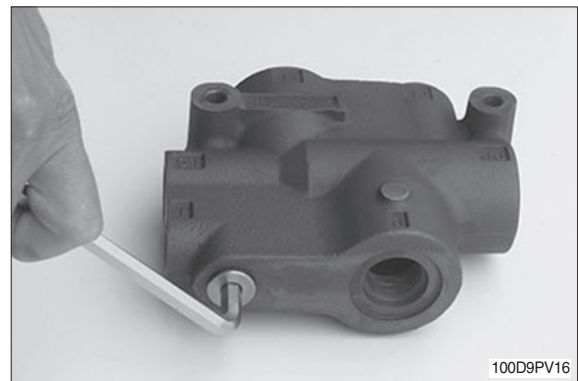
- Tightening torque : 3.1 kgf·m [22.1 lbf·ft]

- ※ Make the pressure setting on a panel or on the vehicle. Pressure setting shall be done at pump flow 80 l/min [21.13 US gal/min]



- ⑦ Fit the seal ring (if removed) and the plug for the pressure relief valve (8 mm hexagon socket wrench).

- Tightening torque : 5.1 kgf·m [36.9 lbf·ft]



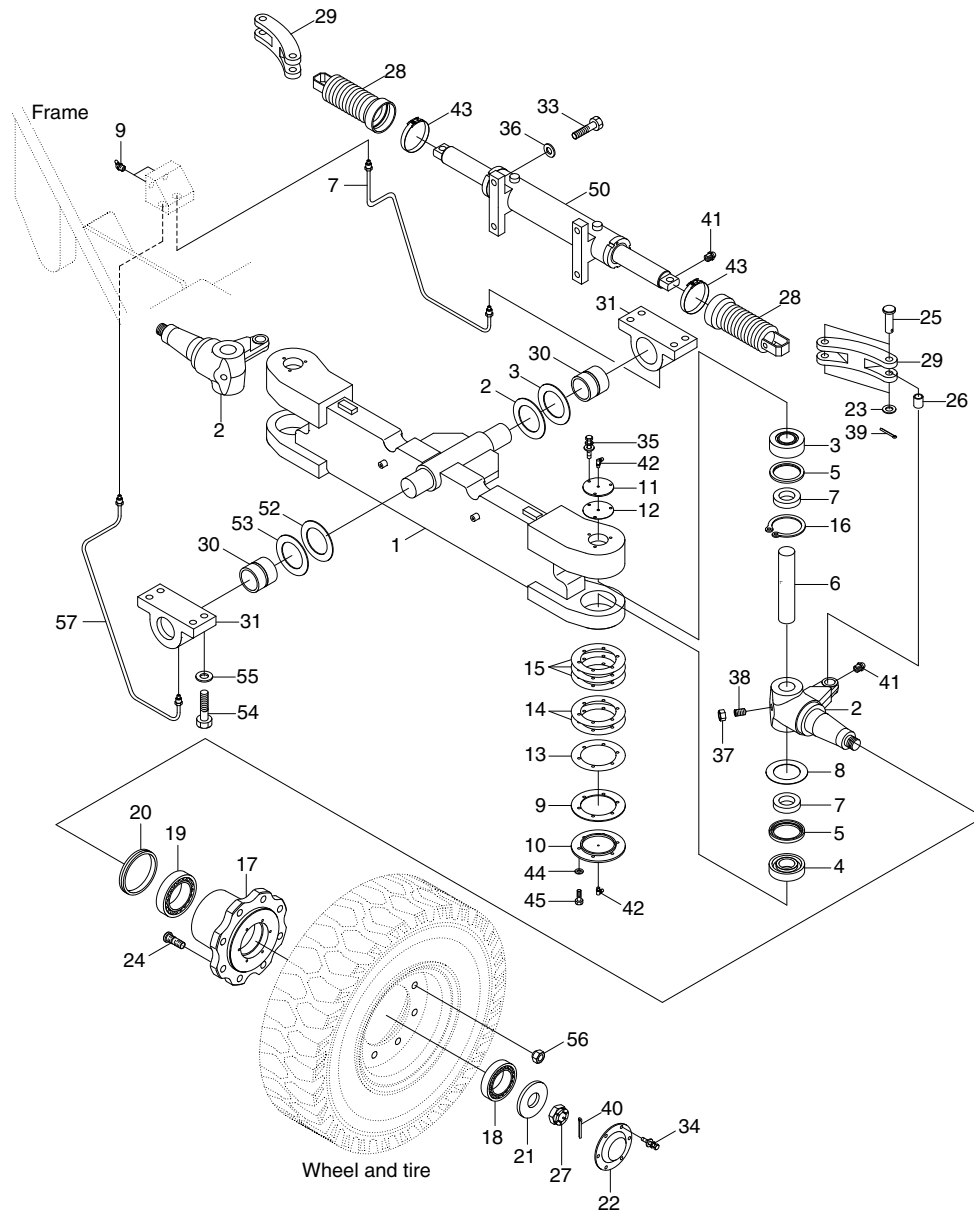
- ⑧ The priority valve is now reassembled



5. STEERING AXLE

1) STRUCTURE

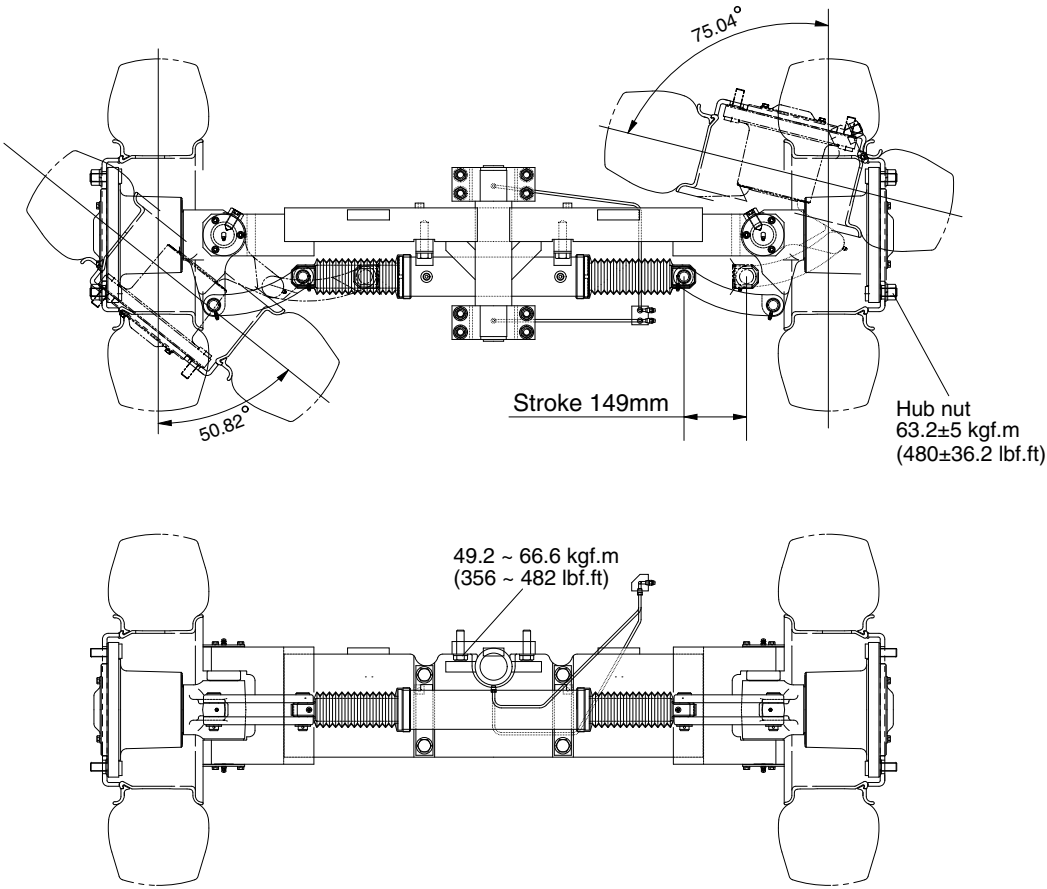
※ Do not remove the stopper bolt unless necessary.



100ID9VSA01

1	Steering axle	15	Shim	28	Boot	42	Grease nipple
2	Axle knuckle	16	Retainer ring	29	Steering link	43	Hose clamp
3	Taper roller bearing	17	Axle hub	30	Pin bushing	44	Plain washer
4	Taper roller bearing	18	Taper roller bearing	31	Support	45	Hex bolt
5	Oil seal	19	Taper roller bearing	33	Hex bolt	50	Steering cylinder
6	King pin	20	Oil seal	34	W/washer bolt	52	Thrust washer
7	Spacer	21	Washer	35	W/washer bolt	53	Thrust washer
8	Spacer	22	Hub cap	36	Harden washer	54	Hex bolt
9	Gasket	23	Special washer	37	Hex nut	55	Harden washer
10	Cover	24	Wheel bolt	38	Set bolt	56	Wheel nut
11	Cover	25	Link pin	39	Split pin	57	Grease pipe
12	Gasket	26	Pin bushing	40	Split pin	58	Grease pipe
13	Shim	27	Slot nut	41	Grease nipple	59	Grease nipple
14	Shim						

2) TIGHTENING TORQUE AND SPECIFICATION

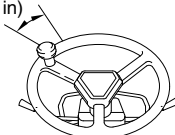


100D9VSA02

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	75.04/50.82
Tread	mm (in)	1700 (66.9)

GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

1. OPERATIONAL CHECKS

Check item	Checking procedure		
Steering wheel 30-60mm (1.2-2.4 in) 	<ul style="list-style-type: none"> 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 rim of steering wheel. If play is too large, adjust at gear box. Test steering wheel play with engine at idling. 		
Knuckle	<ul style="list-style-type: none"> Check knuckle visually or use crack detection method. If the knuckle is bent, the tire wear is uneven, so check tire wear. 		
Steering axle	<ul style="list-style-type: none"> Put camber gauge in contact with hub and measure camber. If camber is not within $0 \pm 0.5^\circ$; rear axle is bent. Ask assistant to drive machine 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. <p>Min turning radius (Outside)</p> <table border="1"> <tr> <td>100D-9</td><td>3965 (13' 0")</td></tr> </table>	100D-9	3965 (13' 0")
100D-9	3965 (13' 0")		
Hydraulic pressure of power steering	<p>Remove plug from the LS port of the steering unit and install oil pressure gauge. Turn steering wheel fully and check oil pressure.</p> <p>※ Oil pressure : 160 ~ 165 bar (2320 ~ 2390 psi)</p>		

2. TROUBLESHOOTING

1) STEERING UNIT

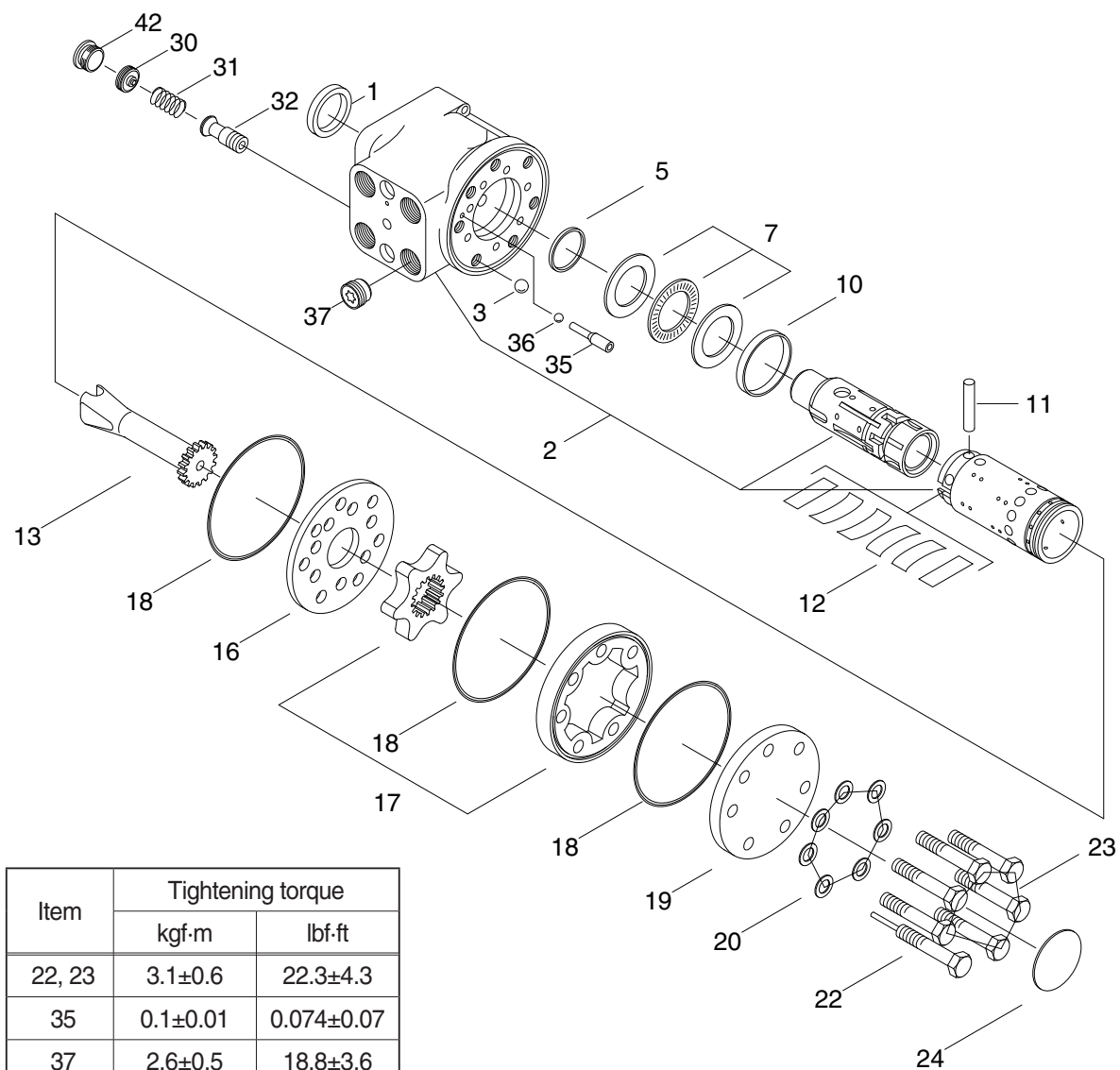
Problem	Cause	Remedy
The steering wheel cannot be rotated.	<ul style="list-style-type: none"> The steering unit column shaft is installed incorrectly or damaged. The oil pressure does not rise. The relief valve is faulty or not closed. LS line (Hose) incorrectly connected. The piping is damaged. 	<ul style="list-style-type: none"> Inspect and correct or replace. Inspect and adjust the relief set pressure. Inspect and correct. Inspect and correct. Replace.
The steering wheel is heavy.	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Adjust the inflating pressure. Inspect and adjust the relief set pressure. Inspect and correct. Inspect and correct or replace.

Problem	Cause	Remedy
The oil pressure does not rise.	<ul style="list-style-type: none"> · 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. 	<ul style="list-style-type: none"> · Inspect and correct. · Inspect and correct. · Inspect and correct or replace. · Replace.
The steering wheel does not return properly.	<ul style="list-style-type: none"> · The tire inflating pressure is low. · The steering unit spool does not move smoothly. · The steering knuckle sliding motion is improper. 	<ul style="list-style-type: none"> · 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.	<ul style="list-style-type: none"> · 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). 	<ul style="list-style-type: none"> · Correct or replace the steering unit. · Replace the steering unit · Replace. · Inspect and correct or replace.
The play is excessive and the vehicle wobbles.	<ul style="list-style-type: none"> · 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. 	<ul style="list-style-type: none"> · 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.	<ul style="list-style-type: none"> · The cylinder piping is connected reversely. 	<ul style="list-style-type: none"> · Inspect and correct.
The steering wheel in the idling state is heavy.	<ul style="list-style-type: none"> · 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. 	<ul style="list-style-type: none"> · 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.	<ul style="list-style-type: none"> · The relief valve is defective. · Air is sucked from the piping. · The piping is blocked (crushed or clogged). 	<ul style="list-style-type: none"> · Correct, inspect the pressure, and adjust. · Inspect and correct or replace. · Inspect and correct or replace.

GROUP 3 DISASSEMBLY AND ASSEMBLY

1. STEERING UNIT

1) STRUCTURE



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

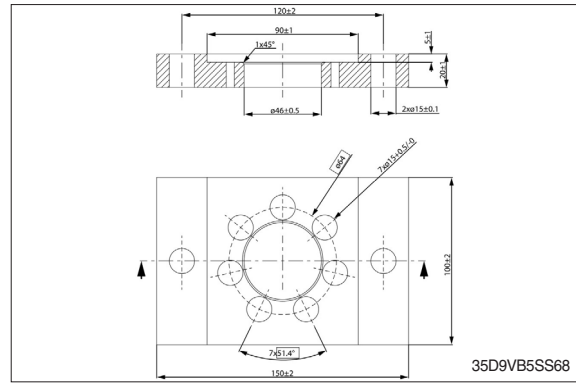
70D9V5SS06

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

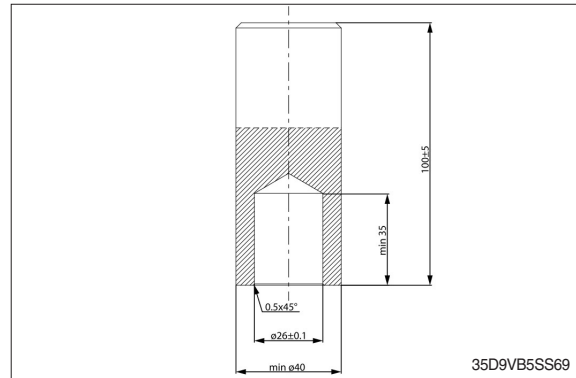
※ Seal kit (EA) : 1 (1), 5 (1), 18 (3), 20 (7)

2) TOOLS

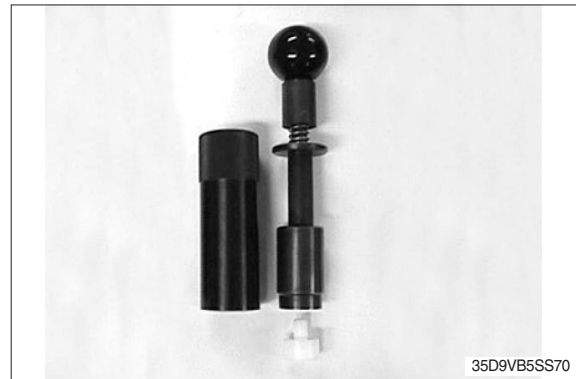
- (1) Holding tool for the entire steering unit.
Material: Appropriate metal or hard plastic.



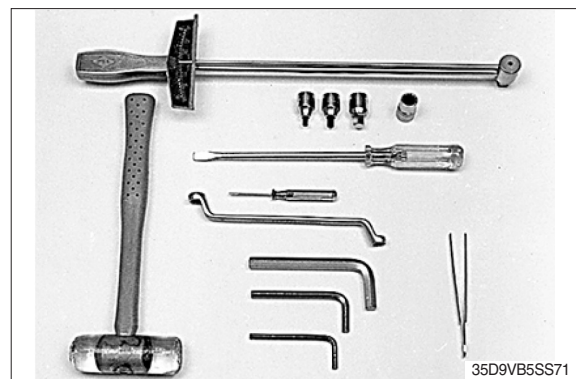
- (2) Assembly tool for dust seal.
Material: Free cutting steel.



- (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

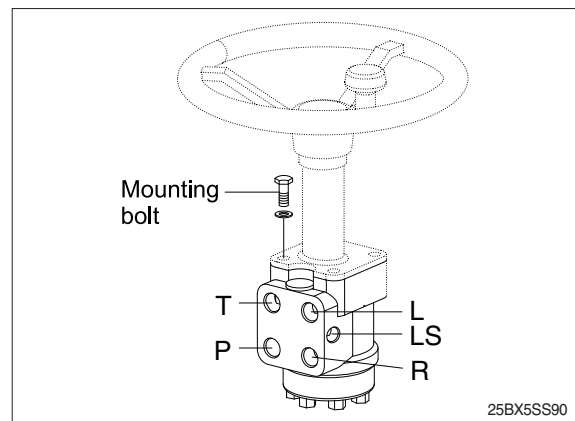
L : Left port

R : Right port

T : Tank port

P : Pump port

LS : Load sensing port



Port	Port size	Tightening torque	
		kgf·m	lbf·ft
L, P, R, T	3/4-16 UNF	6	43.4
LS	7/16-20 UNF	2	14.5
Mounting bolt	M10 × 1.5 × 85 mm	4	28.9

4) DISASSEMBLY

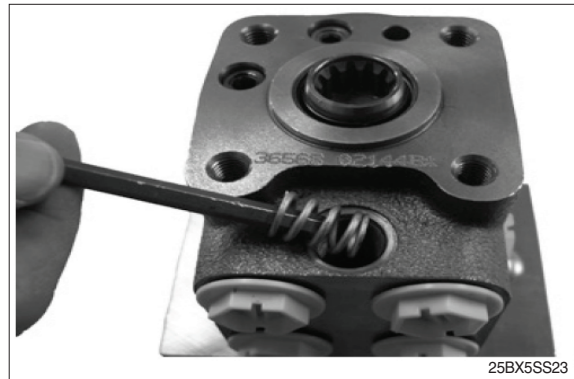
- (1) Screw out the plug (42) for relief valve using an 8 mm allen key. Sealing washer is crimped on the plug.



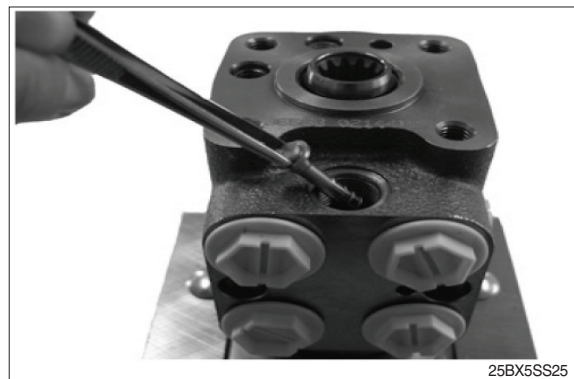
- (2) Screw out the adjusting screw (30) using a 6 mm allen key.



- (3) Remove the spring for relief valve (31).



- (4) Remove the piston for relief valve (32).



- (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.



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



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



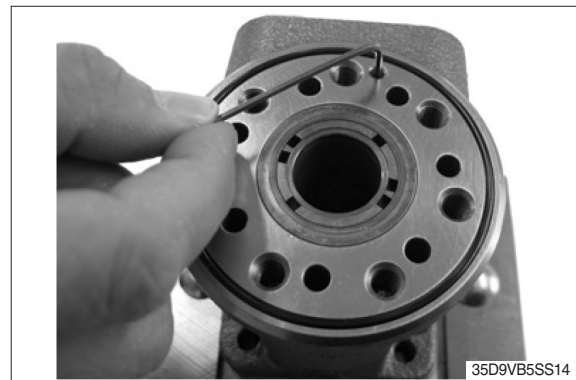
- (8) Remove the cardan shaft (13).



(9) Remove the distributor plate (16).



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



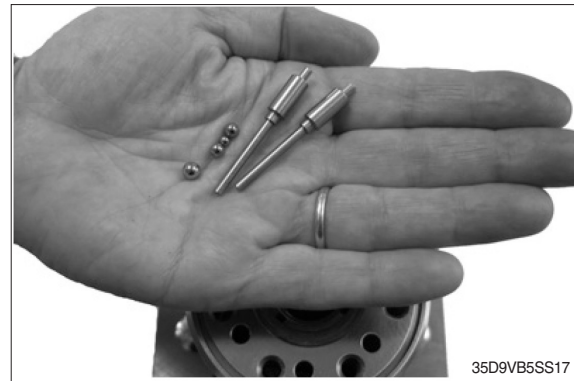
(11) Remove the o-ring (18) from housing.



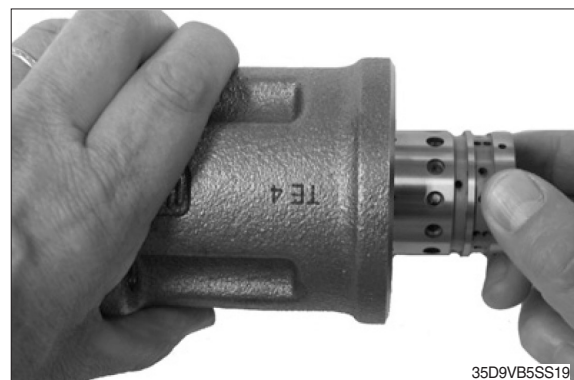
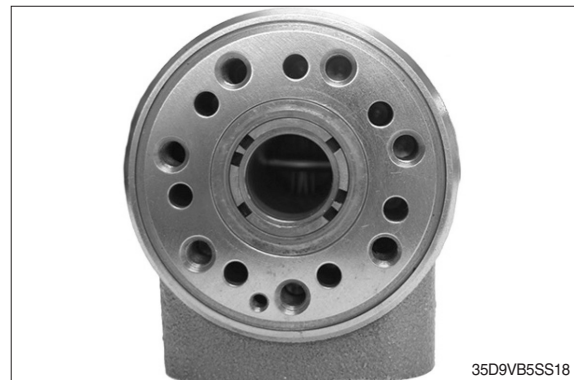
(12) Remove the check valve (37) using a torx bit size T50.



(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.



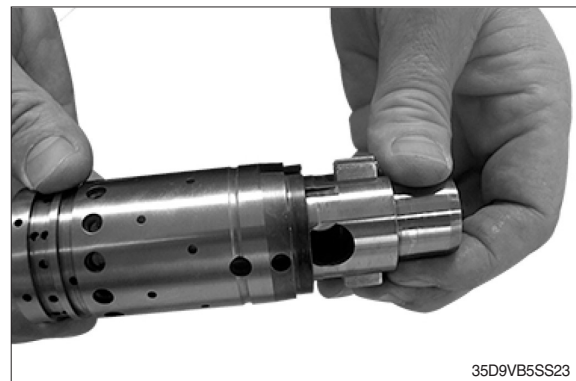
(16) Press out the cross pin (11).



(17) Remove the ring (10).



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



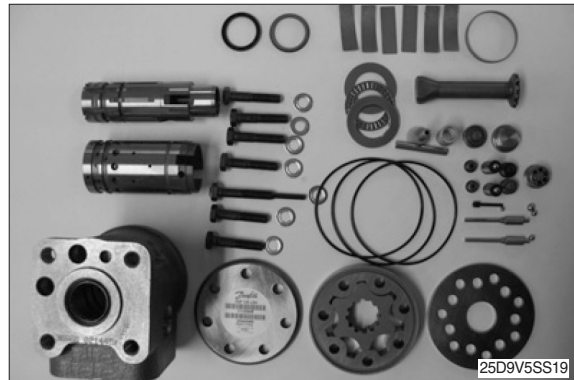
(19) Press the neutral position springs (12) out of the slot of the spool.



- (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.**

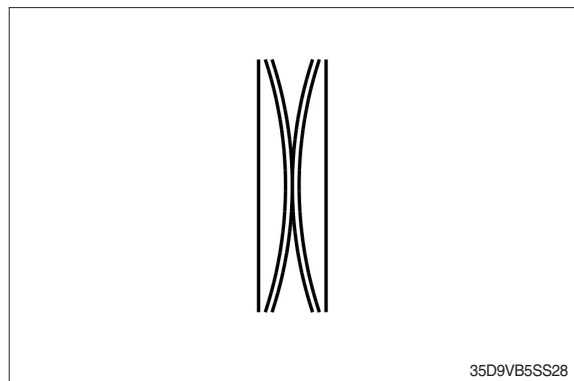


5) ASSEMBLY

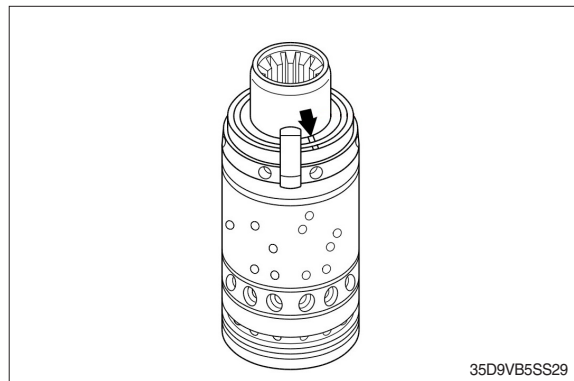
- (1) Place the two flat neutral position springs in the slot. Place the curved springs between the flat ones and press them into place.



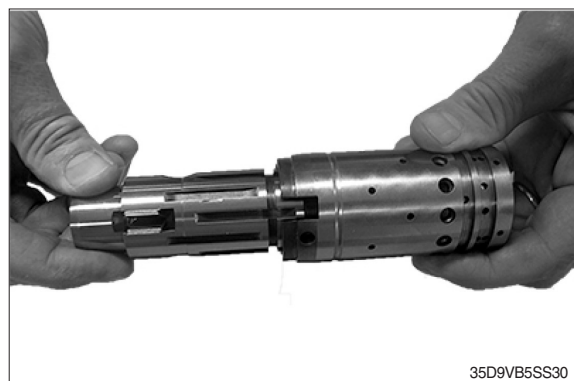
- (2) Configuration of spring set (12). There can be different numbers of curved springs depending on configuration of spring set. There can be 2, 4 or 6 curved springs.



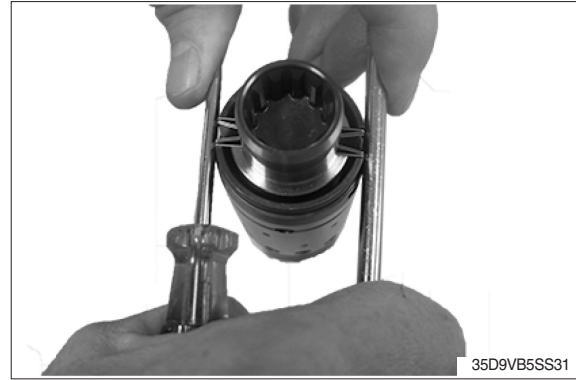
- (3) Some spool and sleeve sets for steering unit must be positioned correctly relatively to each other. Small marks are present on both spool and sleeve close to one of the slots for the spring set. Most spool and sleeve sets for steering unit have no marks, so those can be positioned relatively to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



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



(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.

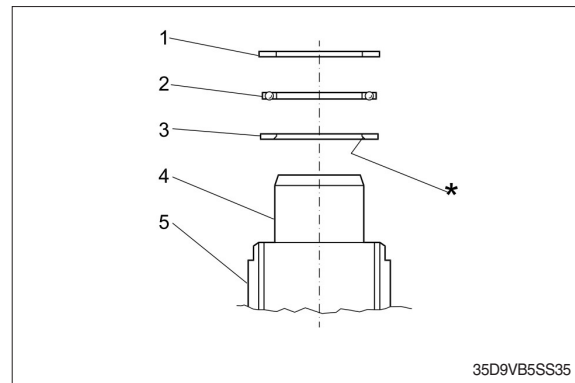


(8) Fit bearing races and needle bearing (7)
as shown on the drawing below.

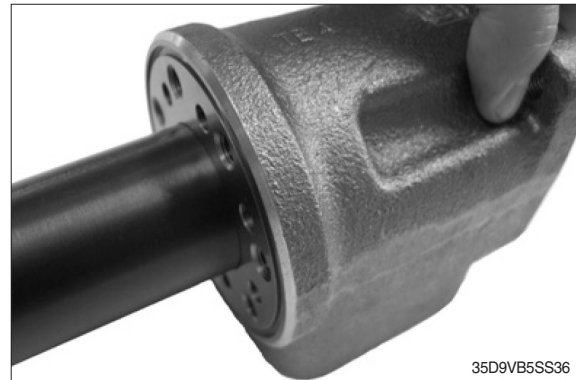


- (9) Assembly pattern for standard bearing 1
Outer bearing race → 2 Needlebearing →
3 Inner bearing race → 4 Spool → 5
Sleeve.

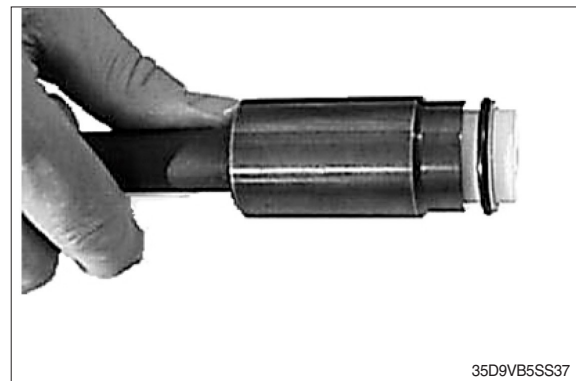
The inside chamfer on the inner bearing race must face the chest of the inner spool.



- (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.



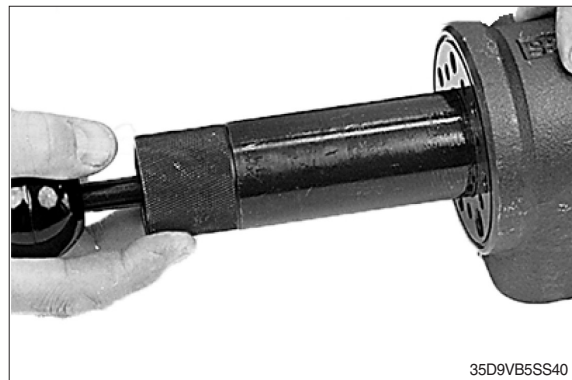
- (13) Hold the outer part of the assembly tool in the bottom of the steering unit housing and guide the inner part of the tool right to the bottom.



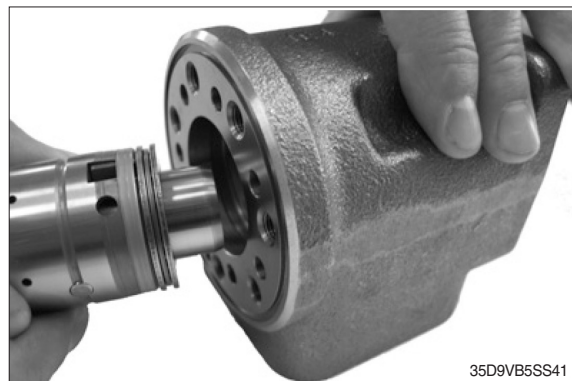
- (14) Press and turn the shaft seal (5) into position in the housing.



- (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.



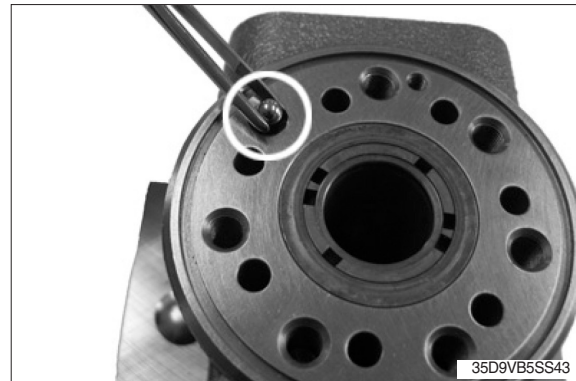
- (16) With a light turning movement, guide the spool and sleeve into the bore.
Fit the spool set holding the cross pin (11) horizontal.



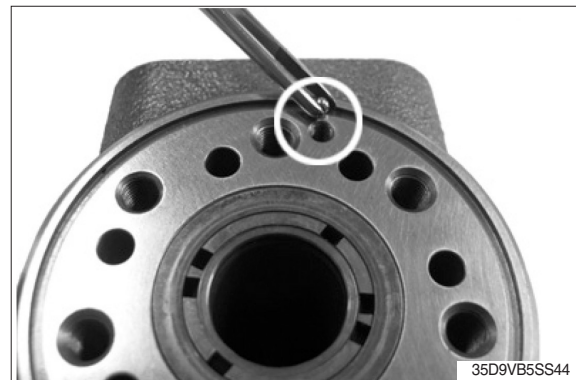
- (17) The spool set will push out the assembly tool guide. The shaft seal (5) are now installed.



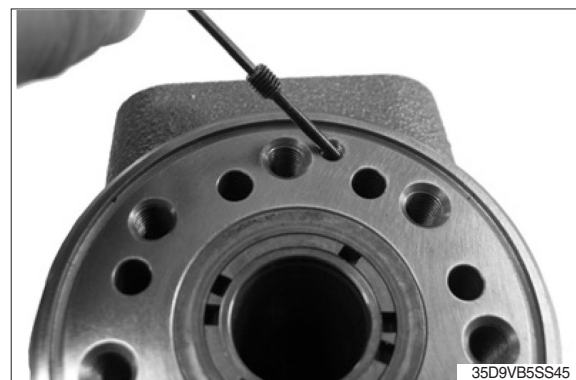
- (18) Place the steering unit housing on the holding tool on the steering column end. Put the check valve ball (3) into the hole indicated by the circle.



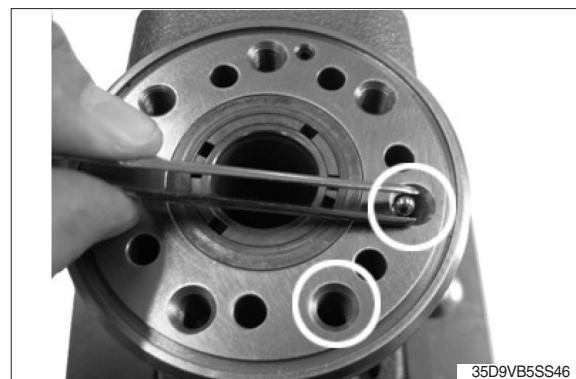
- (19) Place the ball for LS check valve (36) into the hole indicated by the circle.



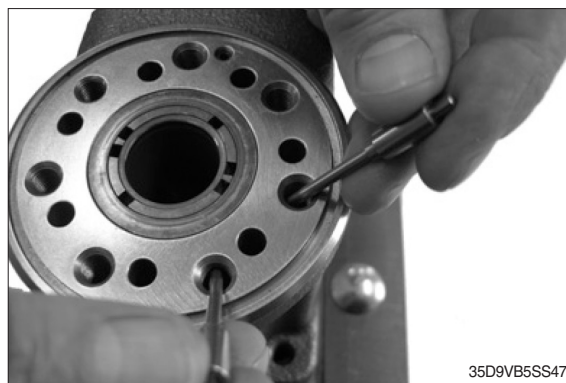
- (20) Screw the ball stop (35) into the LS check valve bore using a 2 mm allen key.
· Tightening torque : 0.1 ± 0.01 kgf·m
(0.72 ± 0.072 lbf·ft)



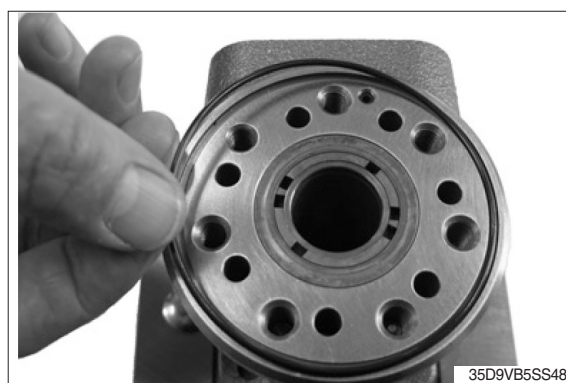
- (21) Place a ball (33) in the two bolt holes indicated by the circles.



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



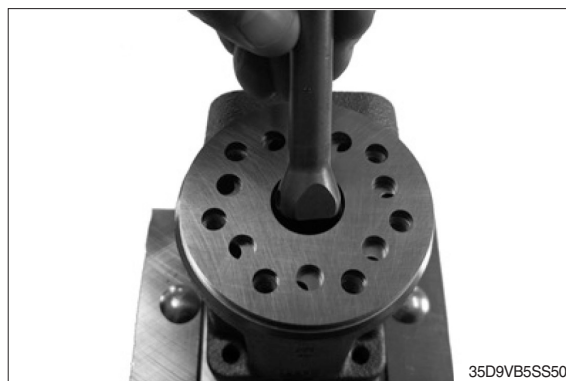
(23) Insert the O-ring (18) in the groove on the housing.



(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 grooves 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.



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



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



- (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)

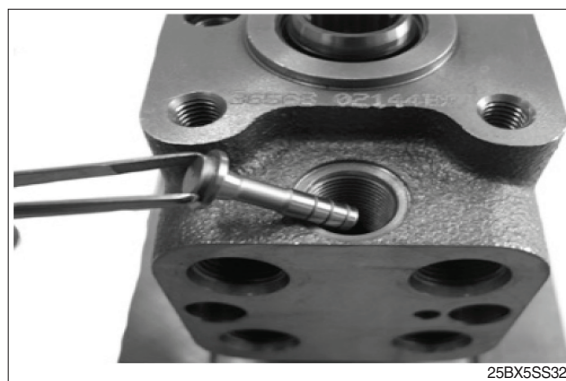


(30) Screw in the check valve (37) into the P-port using a Torx Bit size T50.

- Tightening torque : 2.6 ± 0.5 kgf·m
(18.8 ± 3.6 lbf·ft)



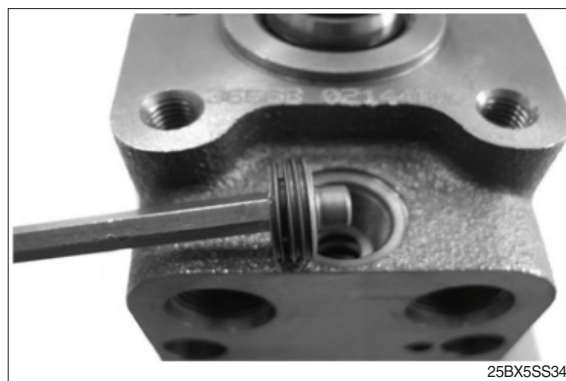
(31) Replace the unit in the holding tool on gear set end. Install the piston (32) to housing.



(32) Install the spring (31) on top of the piston (32).

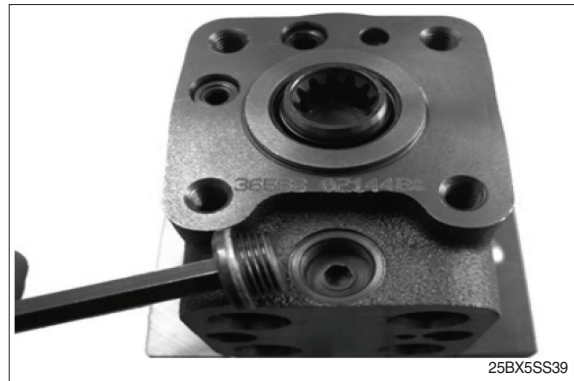


(33) Screw in the adjustment screw (30) using a 6 mm allen key. Make the pressure setting on a test panel according to valve setting specification.



(34) Screw in the plug (42) using a 8 mm allen key.

- Tightening torque : 6.6 ± 0.5 kgf·m
(47.7 ± 3.6 lbf·ft)



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



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

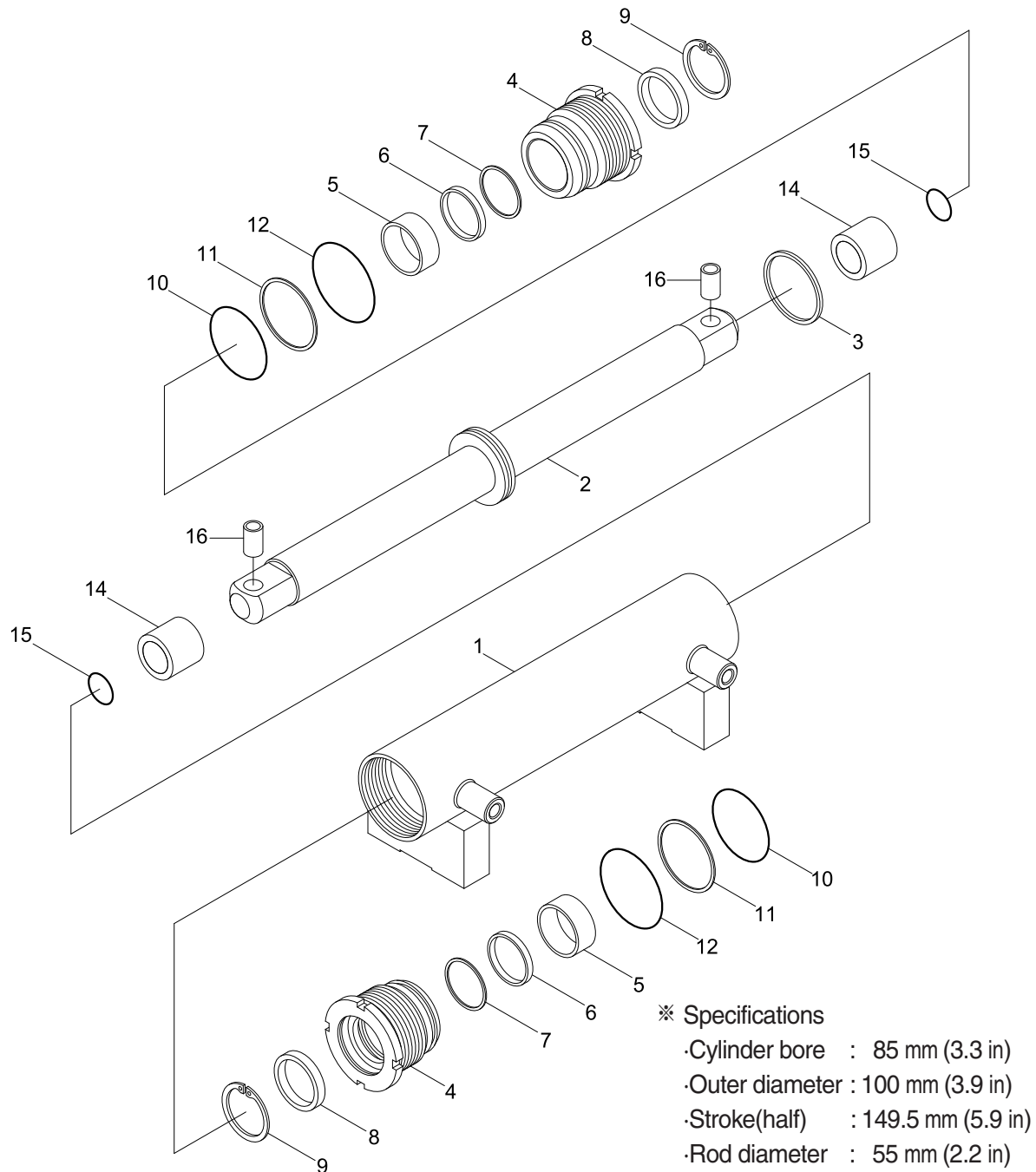


(37) Screw in the plastic plugs into the connection ports to keep the ports clean during storage and transportation.



2. STEERING CYLINDER

1) STRUCTURE



35FQ-09001

- | | | |
|---------------|-----------------|----------------|
| 1 Tube assy | 7 Back up ring | 13 Lock washer |
| 2 Rod assy | 8 Dust wiper | 14 Spacer |
| 3 Piston seal | 9 Snap ring | 15 O-ring |
| 4 Gland | 10 O-ring | 16 Pin bushing |
| 5 DU bushing | 11 Back up ring | |
| 6 Rod seal | 12 O-ring | |

※ Seal kit : 3, 6, 7, 8, 10, 11, 12, 15

2) DISASSEMBLY

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

- (1) Put wooden blocks against the cylinder tube, then hold in & vice.
- (2) Remove the cover 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 (O-ring, oil seal, dust seal, U-packing, bush). If there are some damage, replace with new parts.

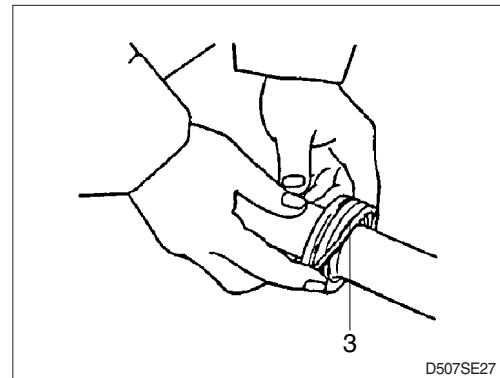
3) CHECK AND INSPECTION

mm (in)

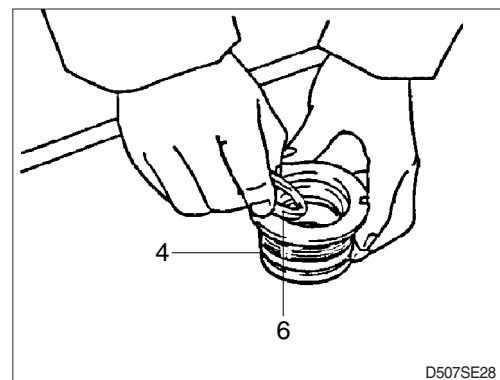
Check item	Criteria		Remedy
	Standard size	Repair limit	
Clearance between piston & cylinder tube	0.05~0.25 (0.002~0.01)	0.4 (0.02)	Replace piston seal
Clearance between cylinder rod & bushing	0.05~0.18 (0.002~0.007)	0.3 (0.01)	Replace bushing
Seals, O-ring	Damage		Replace
Cylinder rod	Dents		Replace
Cylinder tube	Biting		Replace

4) ASSEMBLY

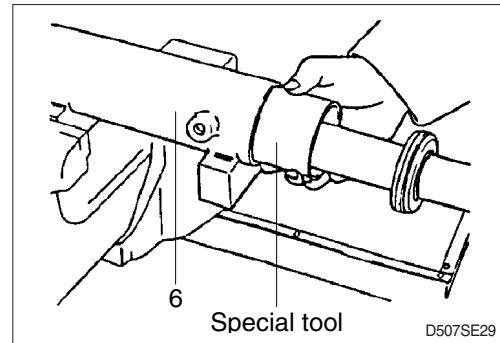
- (1) Install a new piston seal (3) around the groove on the piston.
- ※ Be careful not to scratch the seal too much during installation or it could not be seated properly.



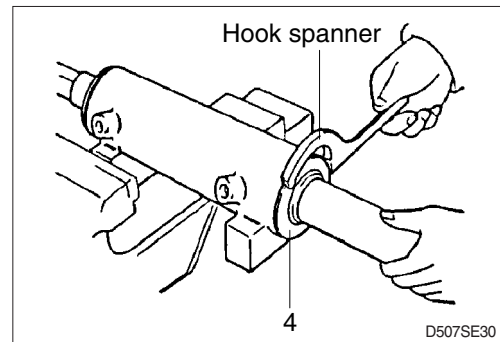
- (2) Install the rod seal (6) to the position in the gland(4) applying a slight coat with grease prior to install.



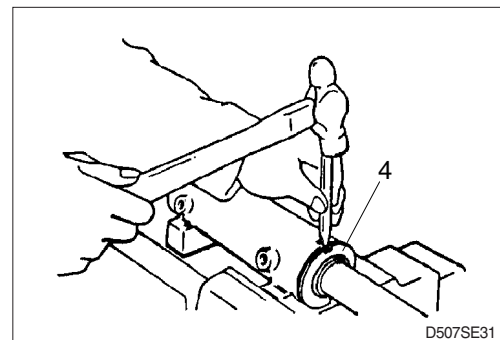
- (3) Install the dust wiper (8) to the gland (4) using a special installing tool. Coat the dust wiper with grease slightly before installing.
- (4) Using a special tool, install gland assembly into the cylinder tube (1).



- (5) Using a hook spanner, install the gland (4) assembly, and tighten it with torque 60 ± 6 kgf·m (434 ± 43 lbf·ft).



- (6) After the gland (4) assembly was installed to the cylinder tube (1), calk at the tube end into the groove on the gland to prevent screw loosening.
- ※ If it is needed to calk again, never calk on the same place.

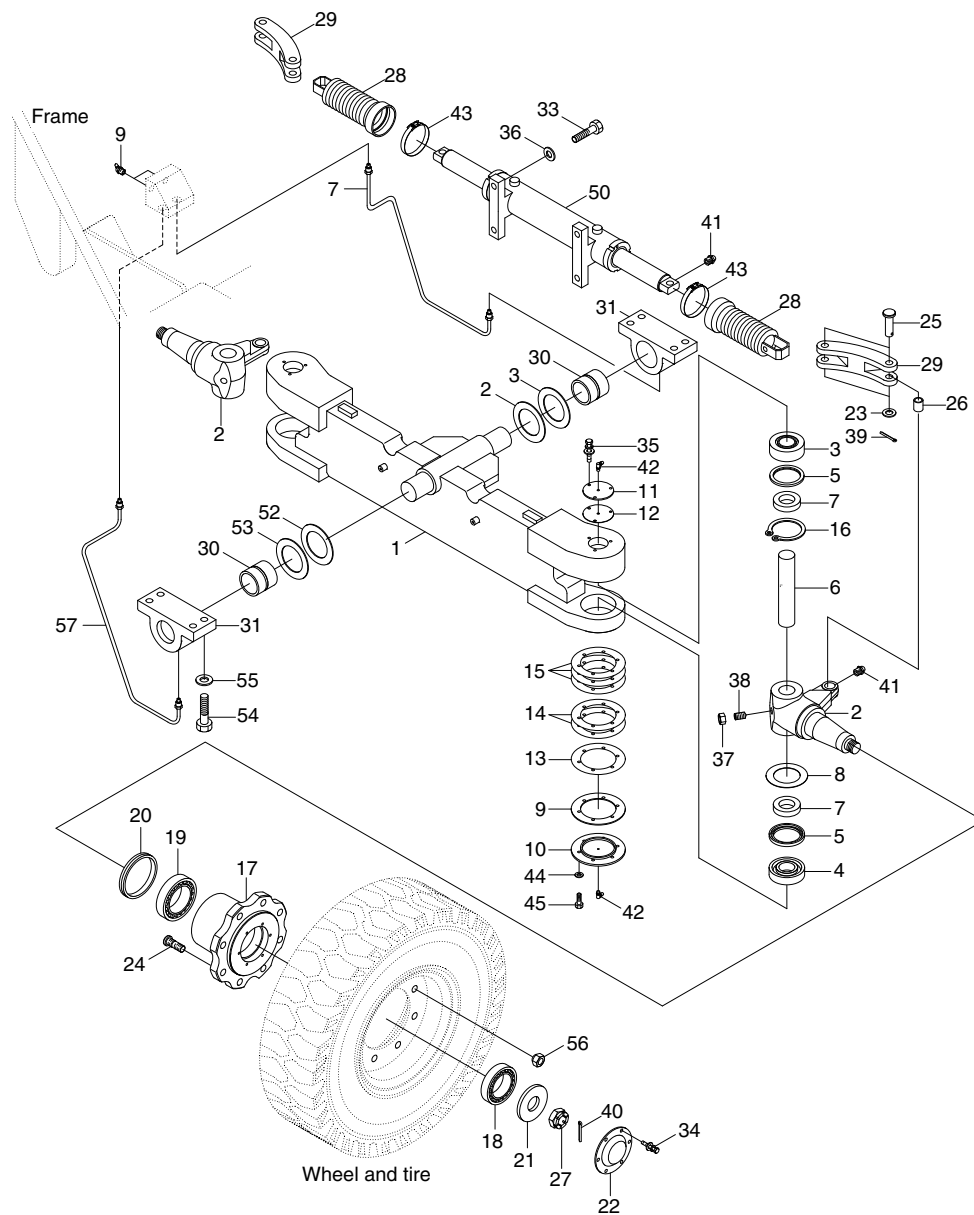


- (7) Move the piston rod back and forth several times for the full distance of its stroke. This helps to seat the ring and seals before applying full hydraulic pressure to the cylinder.
- (8) Install cylinder into trail axle.
- (9) While idling the engine with the rear wheels off the ground, operate 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.

4. STEERING AXLE

1) STRUCTURE

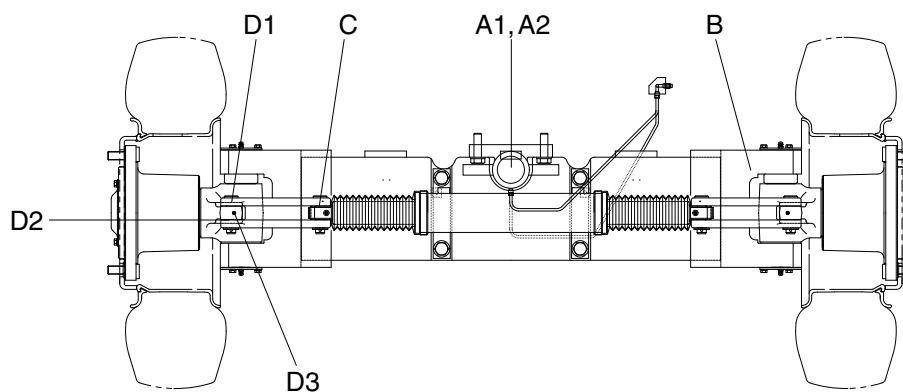
※ Do not remove the stopper bolt unless necessary.



100D9VSA01

1	Steering axle	15	Shim	28	Boot	42	Grease nipple
2	Axle knuckle	16	Retainer ring	29	Steering link	43	Hose clamp
3	Taper roller bearing	17	Axle hub	30	Pin bushing	44	Plain washer
4	Taper roller bearing	18	Taper roller bearing	31	Support	45	Hex bolt
5	Oil seal	19	Taper roller bearing	33	Hex bolt	50	Steering cylinder
6	King pin	20	Oil seal	34	W/washer bolt	52	Thrust washer
7	Spacer	21	Washer	35	W/washer bolt	53	Thrust washer
8	Spacer	22	Hub cap	36	Harden washer	54	Hex bolt
9	Gasket	23	Special washer	37	Hex nut	55	Harden washer
10	Cover	24	Wheel bolt	38	Set bolt	56	Wheel nut
11	Cover	25	Link pin	39	Split pin	57	Grease pipe
12	Gasket	26	Pin bushing	40	Split pin	58	Grease pipe
13	Shim	27	Slot nut	41	Grease nipple	59	Grease nipple
14	Shim						

2) CHECK AND INSPECTION



50D9SE25

unit : mm (in)

No.	Check item			Criteria		Remedy
				Standard size	Repair limit	
A	Shaft	A1	OD of shaft	60 (2.4)	59.5 (2.3)	Replace
		A2	ID of bushing	60 (2.4)	59.5 (2.3)	
B	OD of king pin			50 (2.0)	49.8 (2.0)	
C	OD of steering cylinder pin			22 (0.9)	21.9 (0.9)	
D	Knuckle	D1	OD of pin	22 (0.9)	21.9 (0.9)	Adjust shim
		D2	Vertical play	-	0.2 (0.008)	
		D3	ID of bushing	22 (0.9)	22.5 (0.9)	Replace

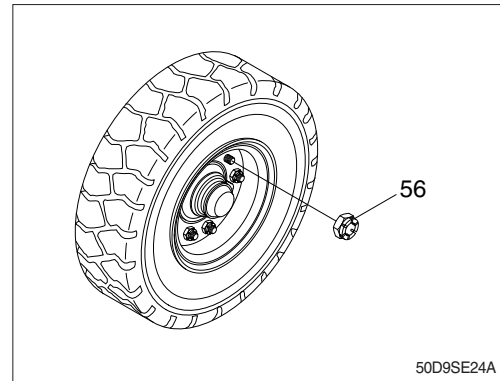
·OD : Outer diameter

·ID : Inner diameter

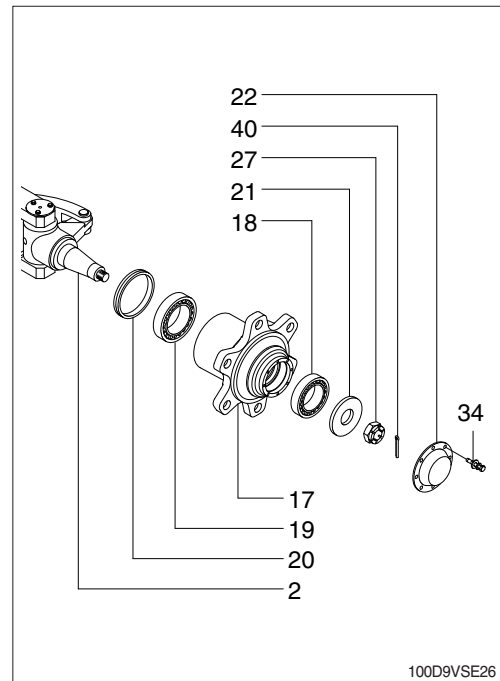
3) DISASSEMBLY

※ 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 balance weight part of the truck.

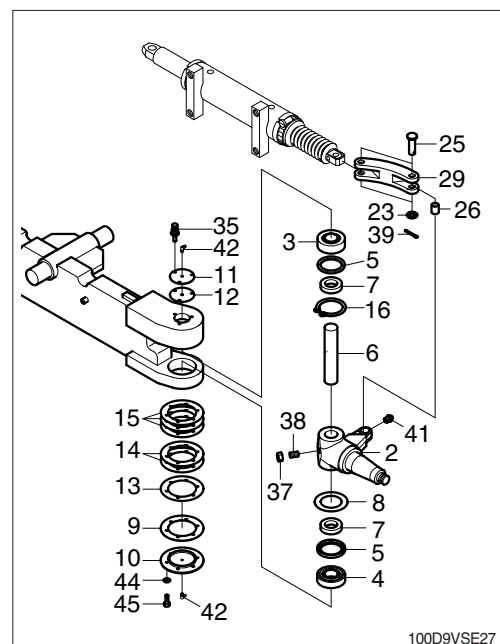
- (1) Loosen the hub nut (56) and take off the steering wheel tire.



- (2) Remove hub cap (22).
- (3) Pull out split pin (40) and remove slotted nut (27), washer (21).
- (4) Using the puller, take off the hub (17) together with the taper roller bearing (18, 19).
※ Be very careful because just before the hub comes off, tapered roller bearing will fall out.
- (5) After hub (17) is removed take off the inner race of taper roller bearing (16, 19).
- (6) Pull out oil seal (20).
※ 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 in the knuckle to protect the threaded portion.



- (8) Loosen set bolt (38) and nut (37).
- (9) Loosen with washer bolt (35) and remove cover (11), gasket (12). Remove grease nipple (42).
- (10) Push out the king pin (6) without damaging the knuckle arm (2).
- (11) At the same time the king pin is removed, pull out the oil seal (5).
- (12) If defect is observed in taper roller bearing (4), pull it out by using extractor.
- (13) Remove split pin (39), special washer (23) and link pin (25).



4) ASSEMBLY

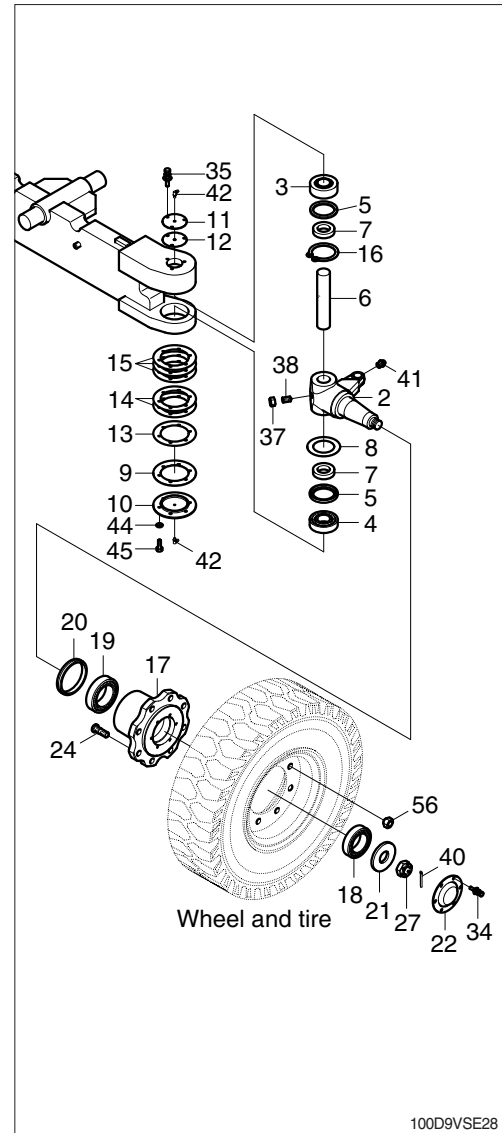
※ In reassembling, have all parts washed, grease applied to lubricating parts, and all expendable items such as oil seal and spring washers replaced by new ones.

Perform the disassembly in reverse order.

- (1) Tighten the set bolt (38) of king pin (6).
- (2) There is a notch in the middle of the king pin (6), make sure that this notch is on the set screw side.
- (3) Do not hammer to drive in taper roller bearing (4) because it will break.
Always use drive-in tool. In assembling the taper roller bearing (3), be sure that the fixed ring of the bearing is placed in position facing the knuckle (2).

(4) Hub

- ※ Mount oil seal (20) and inner race of taper roller bearing (19) on the knuckle. The bearing should be well greased before assembling.
- ※ Install the outer race of the bearing (18) in the wheel center and assemble to the knuckle.
- ※ Put washer (21) in place, tighten with nut (27) and locked with split pin (40). 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.
- ※ Mount the hub cap (22).
Bearing should be well greased before assembling.



SECTION 6 HYDRAULIC SYSTEM

Group 1	Structure and function	6-1
Group 2	Operational checks and troubleshooting	6-28
Group 3	Disassembly and assembly	6-33

GROUP 1 STRUCTURE AND FUNCTION

1. HYDRAULIC SYSTEM OUTLINE

The hydraulic system consists of a variable displacement pump, a control valve (MCV), 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) VARIABLE DISPLACEMENT PUMP

- Lift cylinder ,Tilt cylinder, Steering cylinder, Auxiliary function cylinder

2) MCV

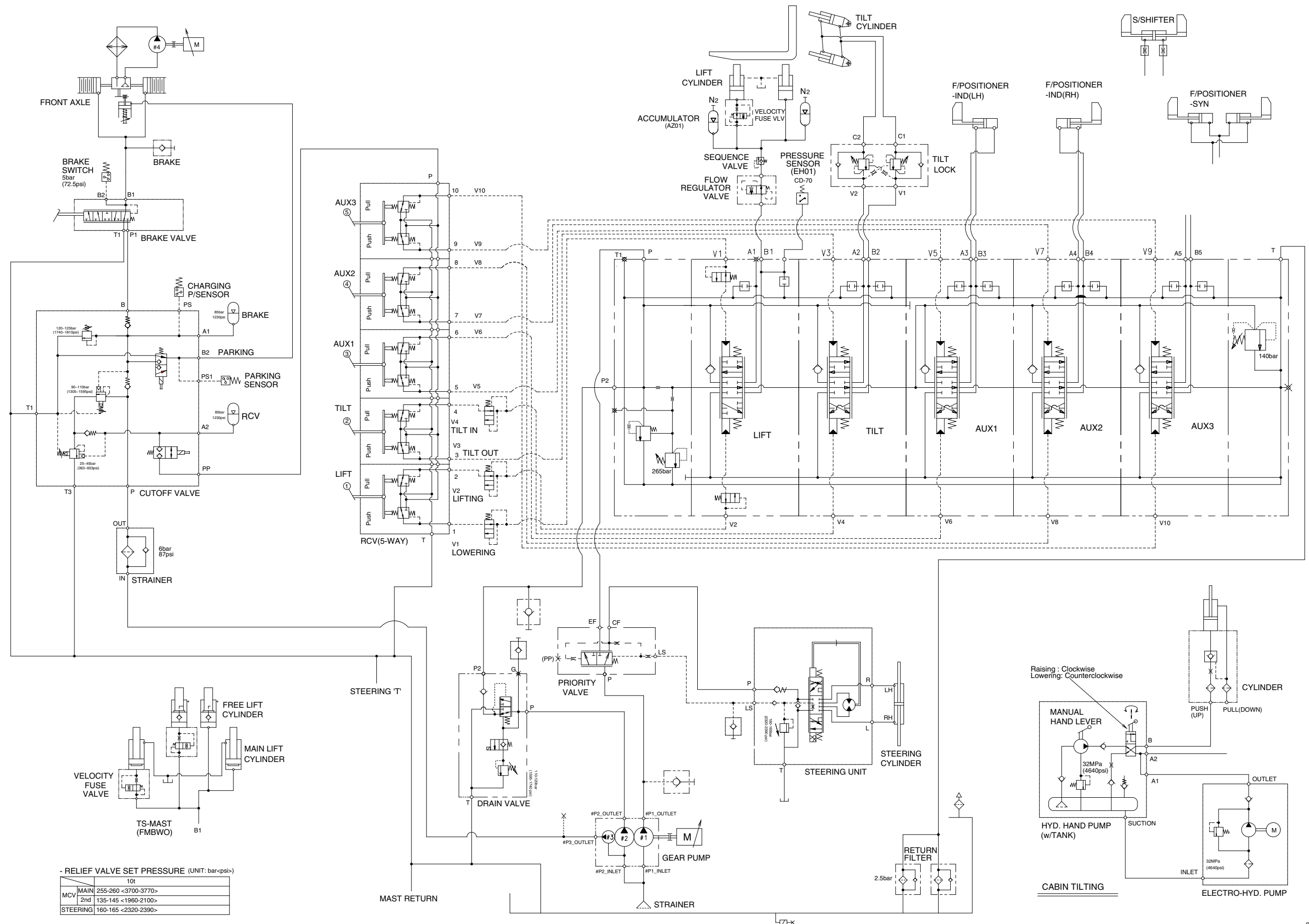
- Lift function, Tilt function, Auxiliary function (Sideshift etc.).

3) RCV

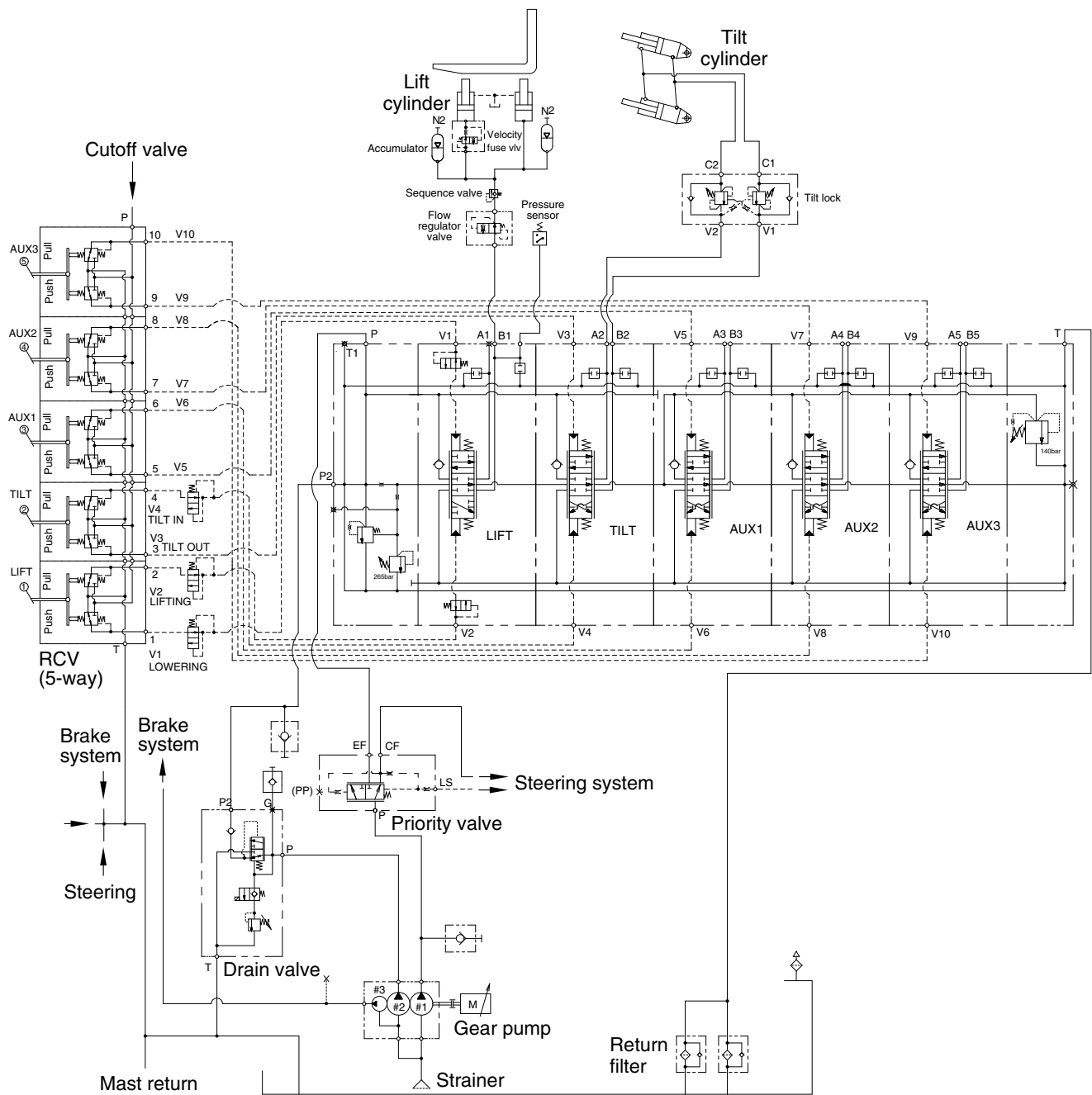
4) HYDRAULIC OIL TANK

- Return filter, Suction strainer, Air breather, Drain plug-magnetic

2. HYDRAULIC CIRCUIT



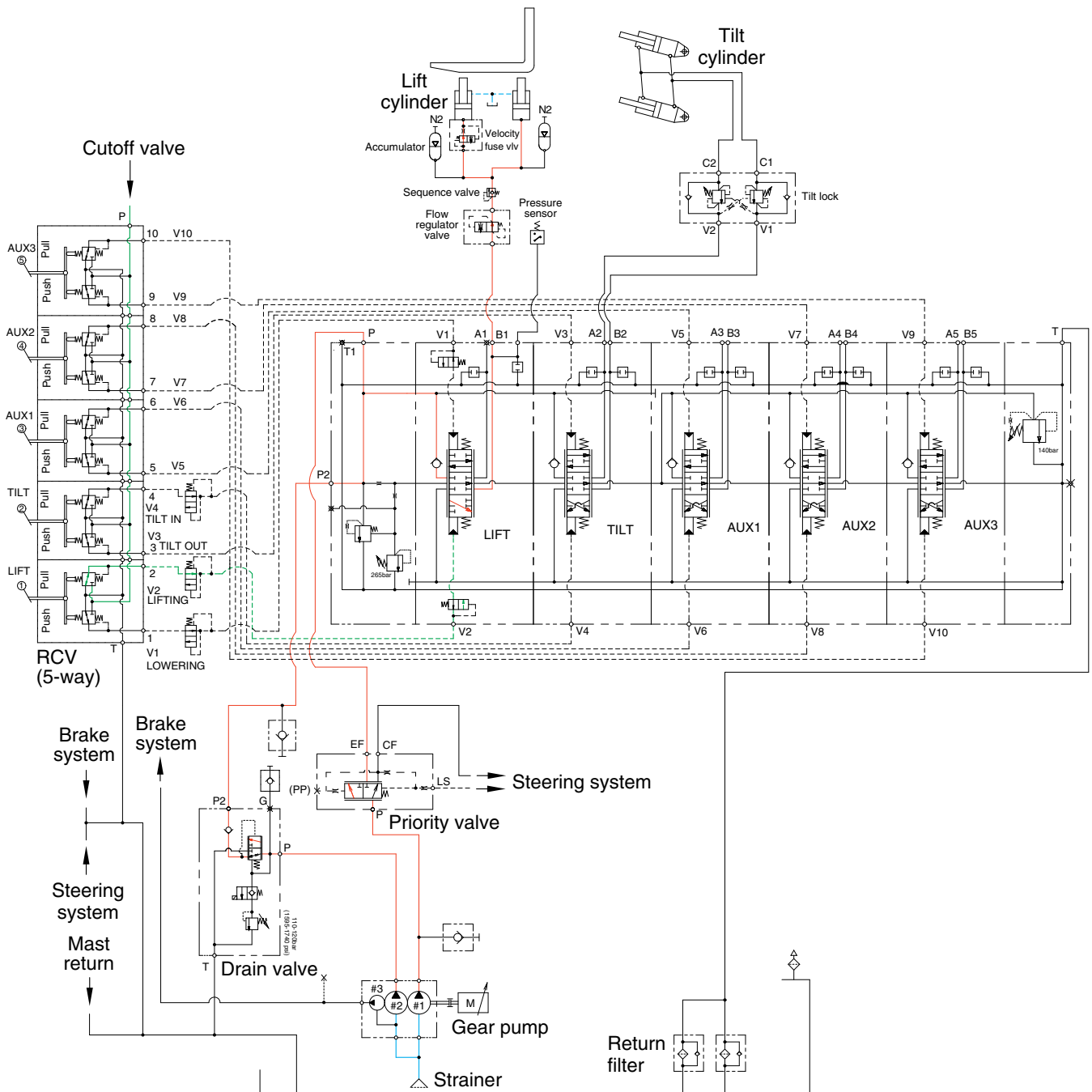
1) WORK EQUIPMENT



100D96HS10

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

2) WHEN THE LIFT CONTROL LEVER IS IN THE LIFT POSITION

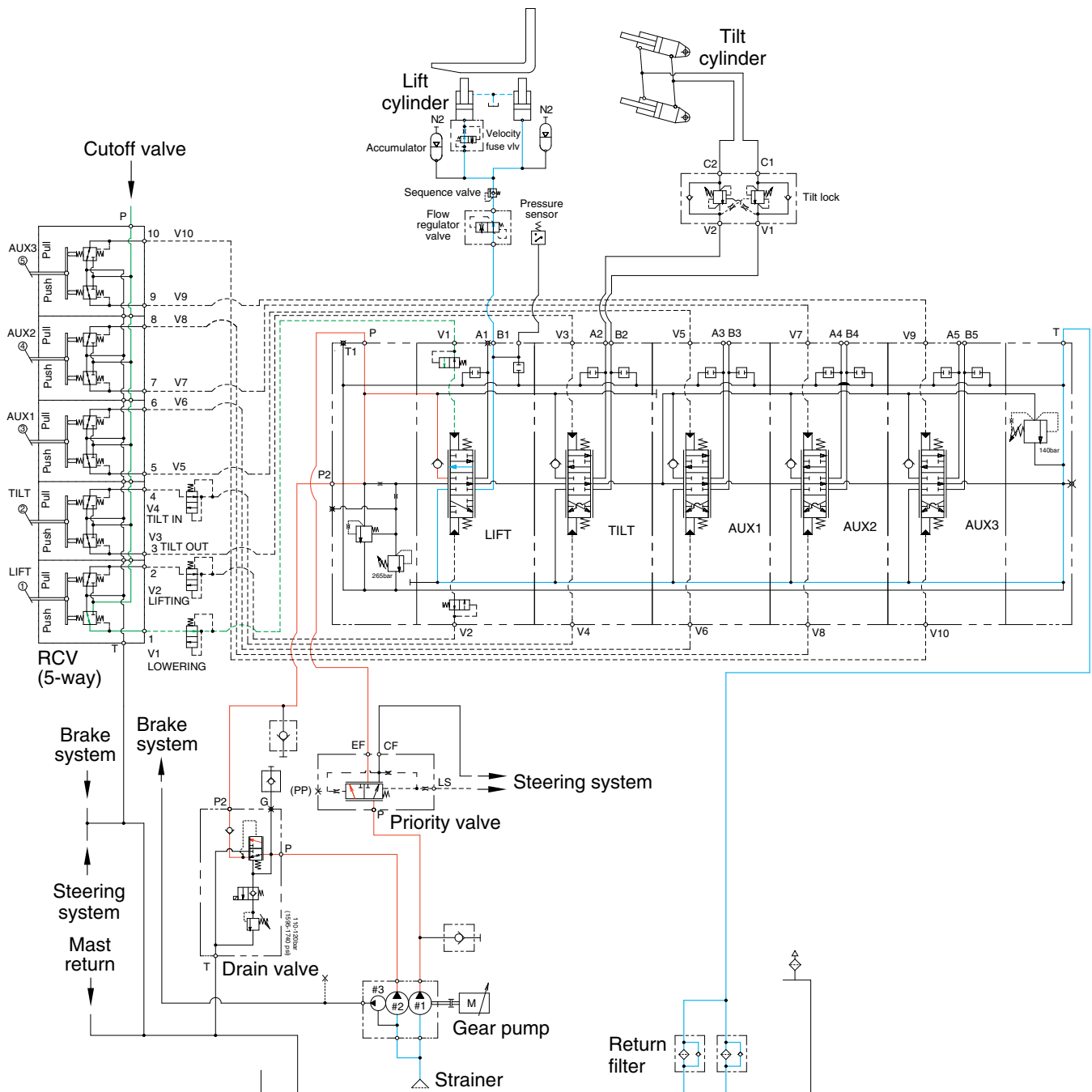


100D96HS11

When the lift control lever is pulled back, the spool on the first block is moves to lift position. The oil from hydraulic gear pump flows into main control valve and then goes to the large chamber of lift cylinder by pushing the load check valve of the spool. 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.

3) WHEN THE LIFT CONTROL LEVER IS IN THE LOWER POSITION

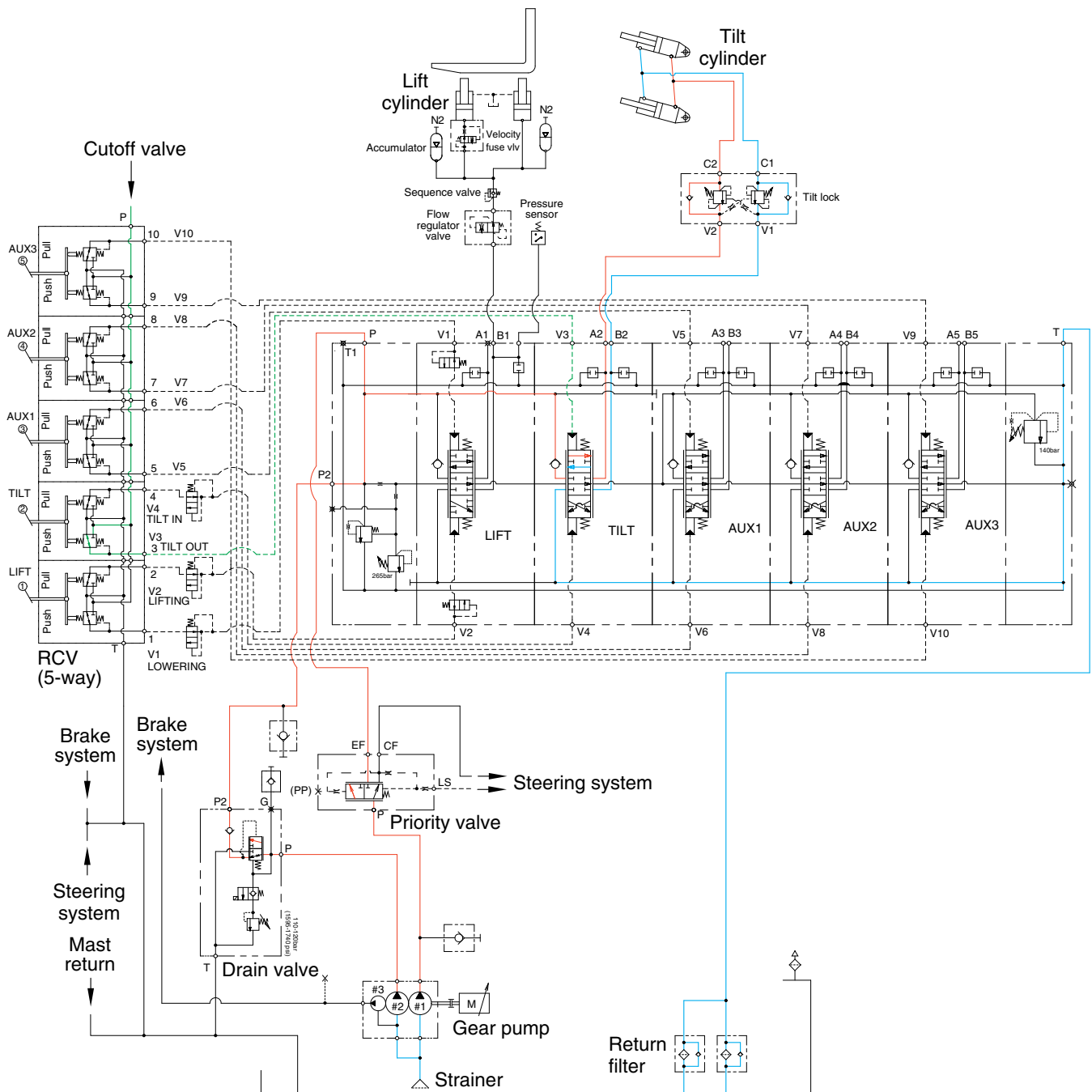


100D96HS12

When the lift control is pushed forward, the spool on the first block is moved to lower position. The work port (B1) and the small chamber and the large chamber are connected to the return passage, so the lift will be lowered due to its own weight.

※ 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



100D96HS13

When the tilt control lever is pushed forward, the spool on the second block is moved to tilt forward position.

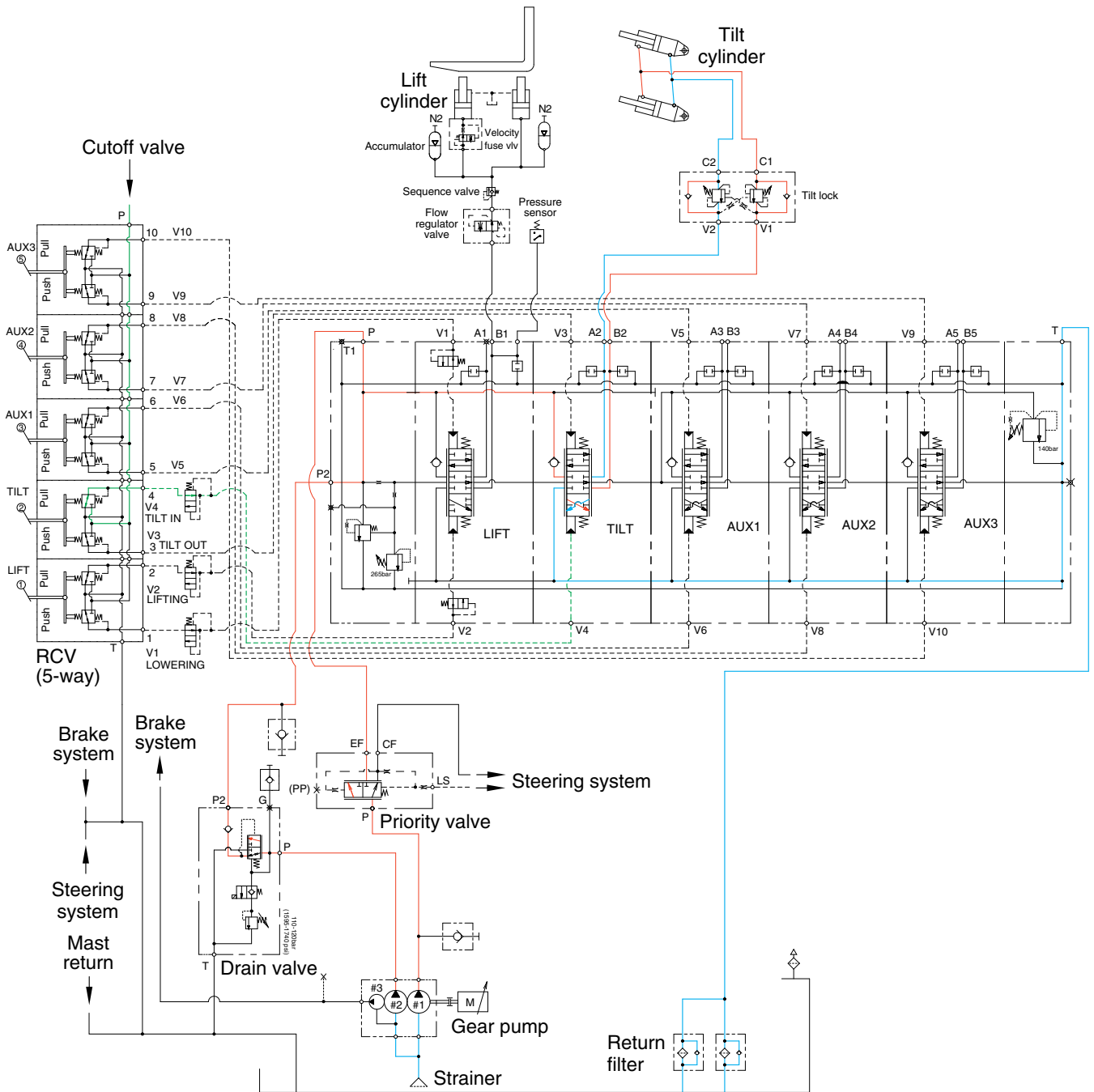
The oil from hydraulic gear pump flows into main control valve and then goes to the large chamber of tilt cylinder by pushing the load check valve of the spool.

The oil at the small chamber of tilt cylinder returns to hydraulic tank 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 TILT CONTROL LEVER IS IN THE BACKWARD POSITION



100D96HS14

When the tilt control lever is pulled back, the spool on the second block is moved to tilt backward position.

The oil from hydraulic gear pump flows into main control valve and then goes to the small chamber of tilt cylinder by pushing the load check valve of spool.

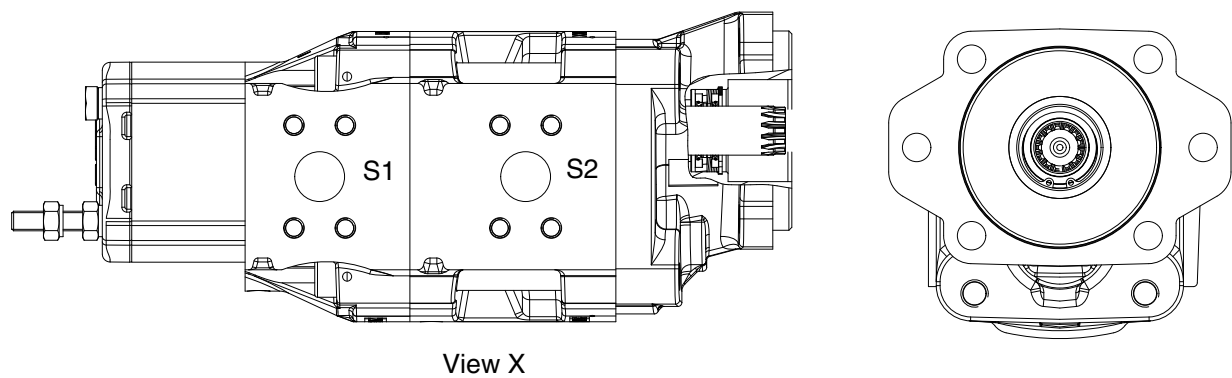
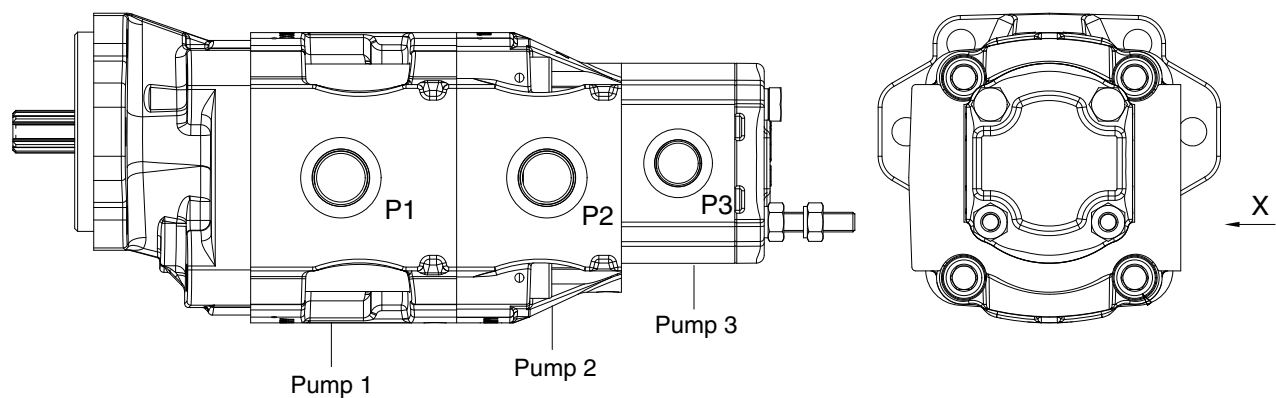
The oil at the large chamber of tilt cylinder returns to hydraulic tank at the same time.

When this happens, the mast tilt backward.

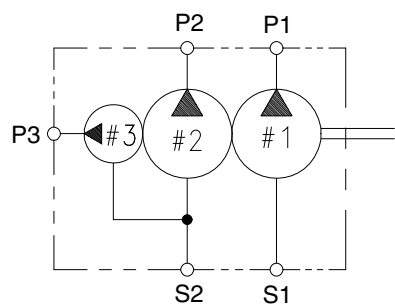
※ The circuit diagram may differ from the equipment, so please check before a repair.

3. HYDRAULIC GEAR PUMP

1) STRUCTURE



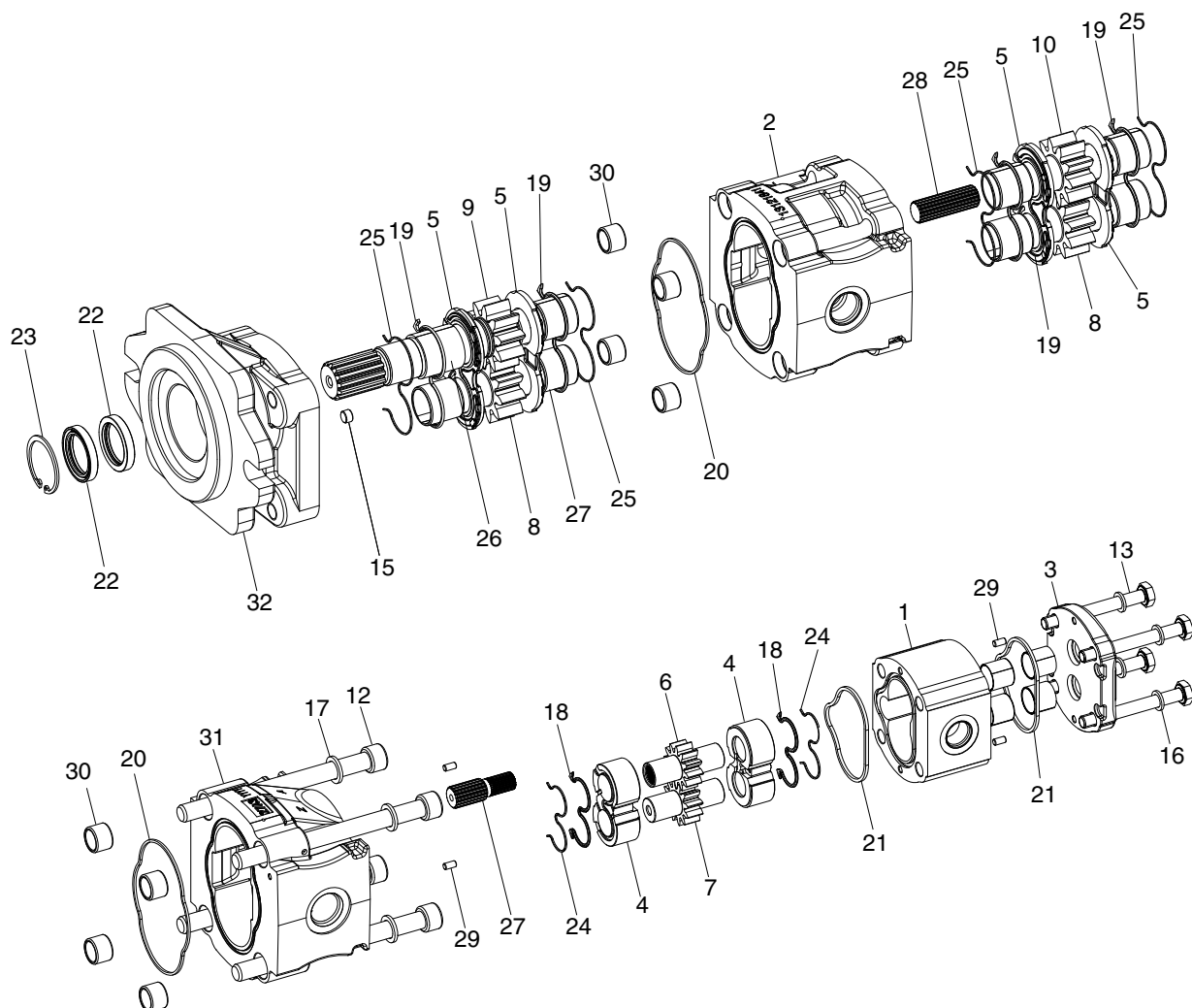
View X



Port	Port name	Size
S1	Pump 1 suction port	25.4
S2	Pump 2 suction port	25.4
P1	Pump 1 delivery port	1 1/16-12
P2	Pump 2 delivery port	1 1/16-12
P3	Pump 3 delivery port	7/8-14

100D9MP01

2) EXPLODED VIEW

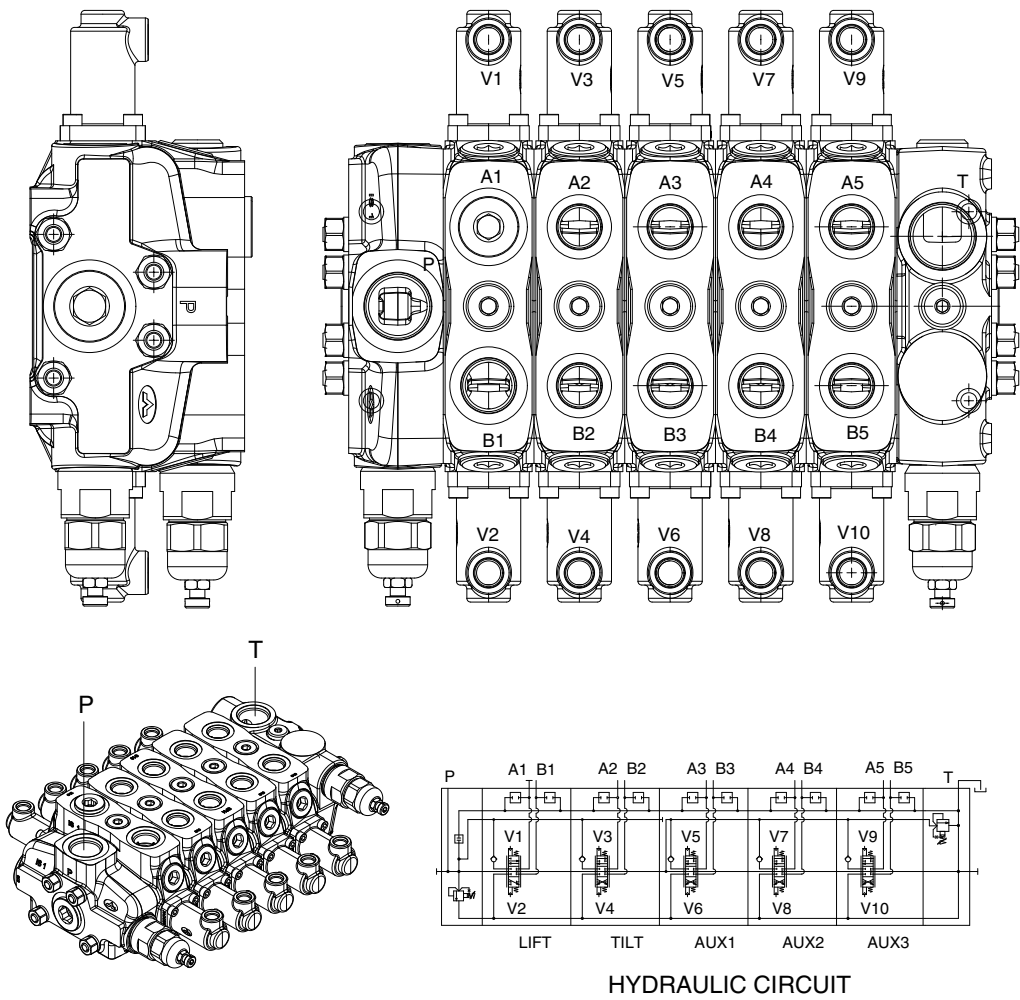


100D9MP02

1	Housing	12	Screw	23	Ring
2	Body	13	Screw	24	Antiextrusion plate
3	Rear cover	14	Nut	25	Antiextrusion ring
4	Thrust plate	15	Screw	26	Sleeve bearing
5	Thrust plate	16	Washer	27	Hub
6	Drive gear	17	Washer	28	Hub
7	Driven gear	18	Seal	29	Dowel pin
8	Driven gear	19	Seal	30	Steel bushing
9	Drive gear	20	Upper seal	31	Body
10	Drive shaft	21	Square seal	32	Front cover
11	Bolt	22	Shaft seal		

4. MAIN CONTROL VALVE

1) STRUCTURE (5 Spool)



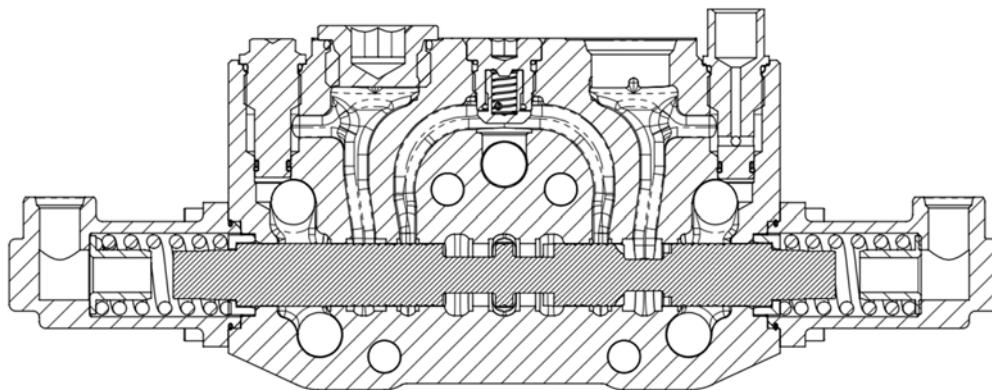
100D9MCV01

Port	Port name	Size
P	Inlet port	1 5/16"-12
T	Tank port	1 5/16"-12
A1~A5	Work port	7/8"-14
B1~B5	Work port	7/8"-14
V1~V10	Pilot port	9/16"-18

2) OPERATION

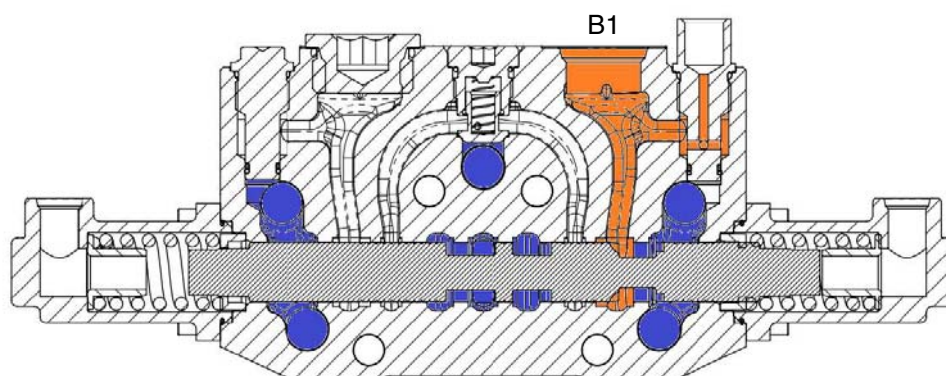
(1) Lift section

① Neutral position



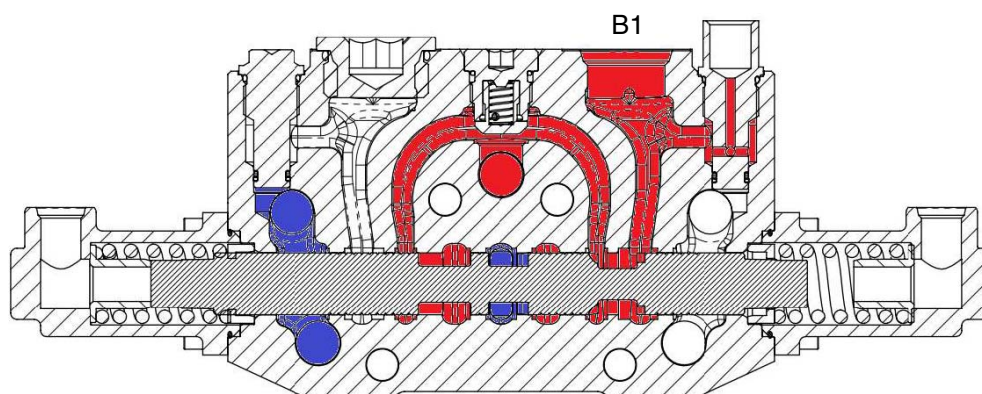
100D9MCV02

② Lower position



100D9MCV03

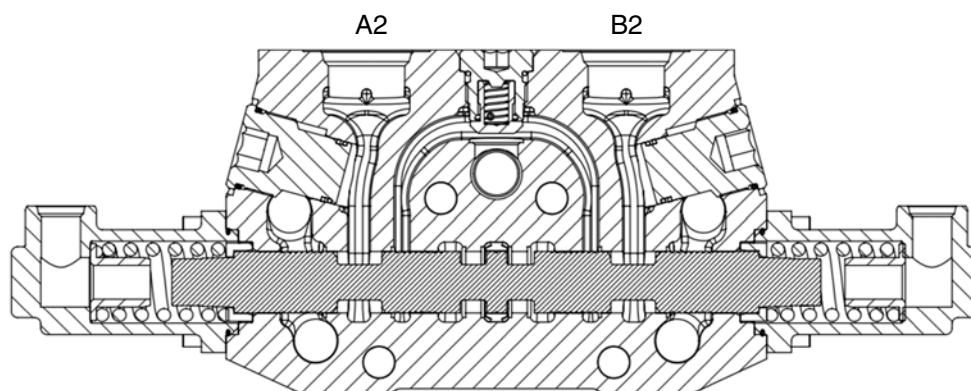
③ Lift position



100D9MCV04

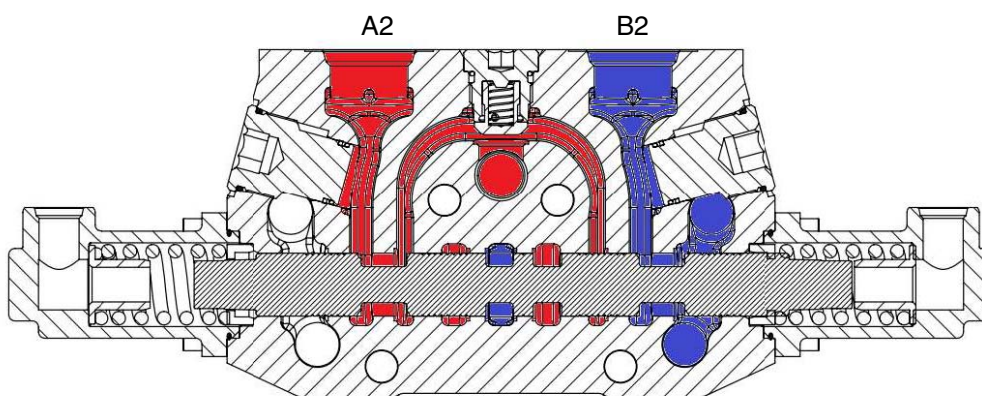
(2) Tilt section

① Neutral position



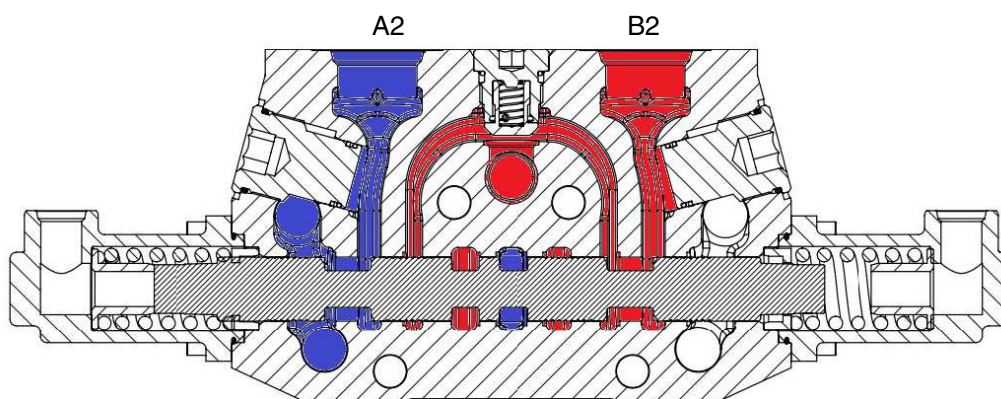
100D9MCV05

② Forward position



100D9MCV06

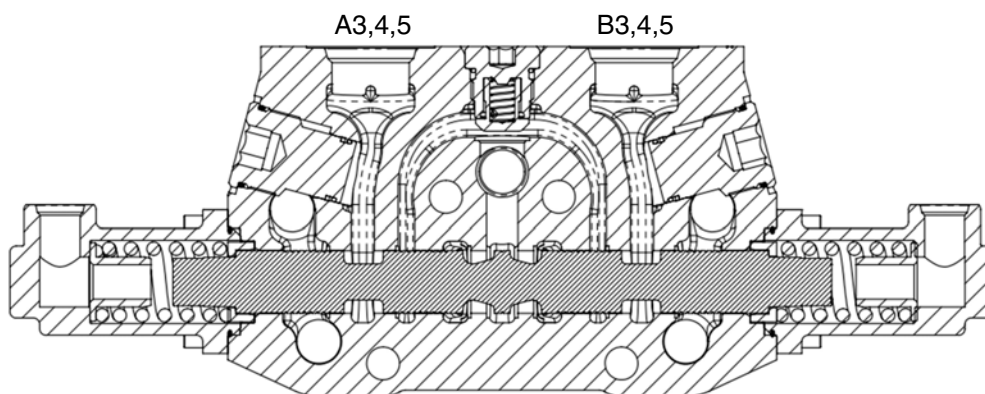
③ Backward position



100D9MCV07

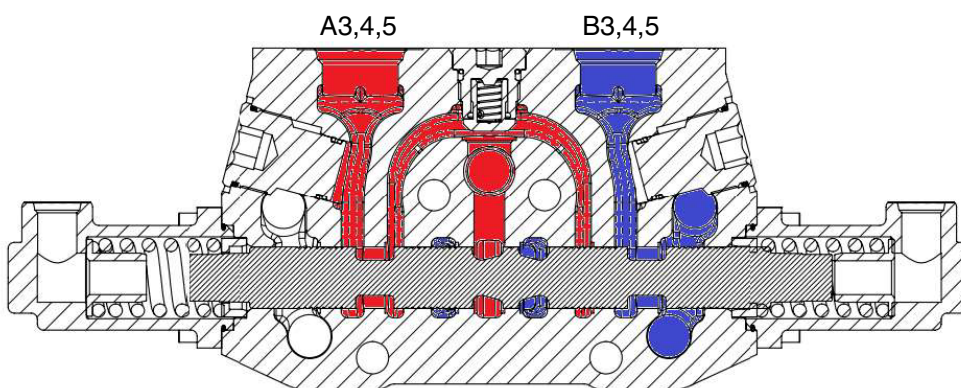
(3) Aux 1, 2, 3 section

① Neutral position



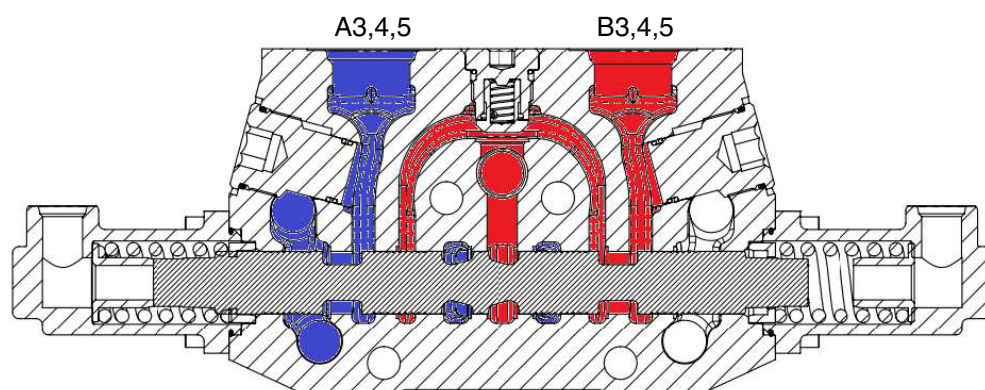
100D9MCV08

② P -> A position



100D9MCV09

③ P -> B position



100D9MCV10

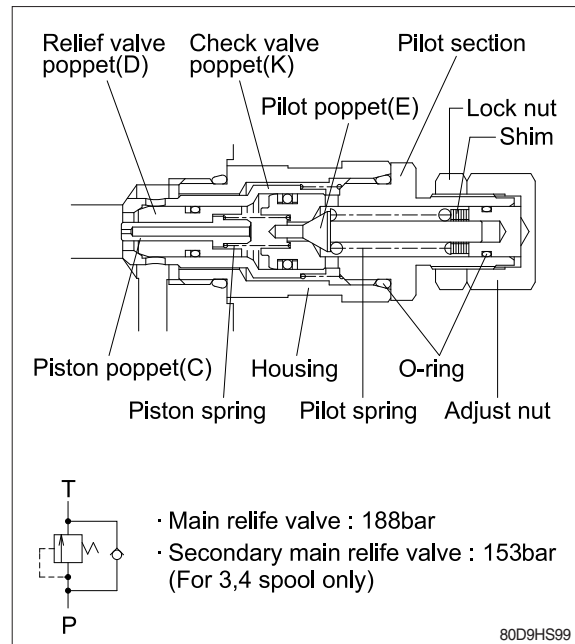
3) MAIN RELIEF VALVE

(1) Pressure setting

A good pressure gauge must be installed in the line which is in communication with the work port relief. A load must be applied in a manner to reach the set pressure of the relief unit.

Procedure

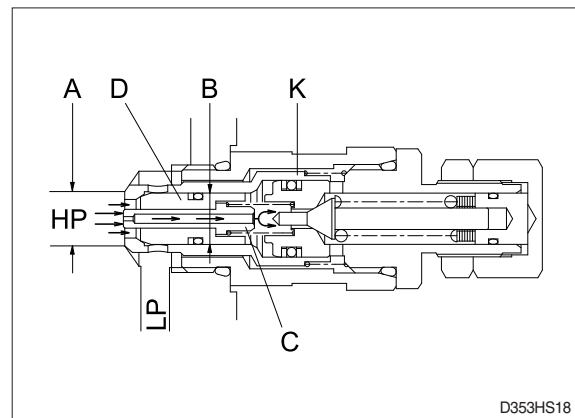
- ① Loosen lock nut.
- ② Set adjusting nut to desired pressure setting.
- ③ If desired pressure setting cannot be achieved, add or remove shims as required.
- ④ Tighten lock nut.
- ⑤ Retest in similar manner as above.



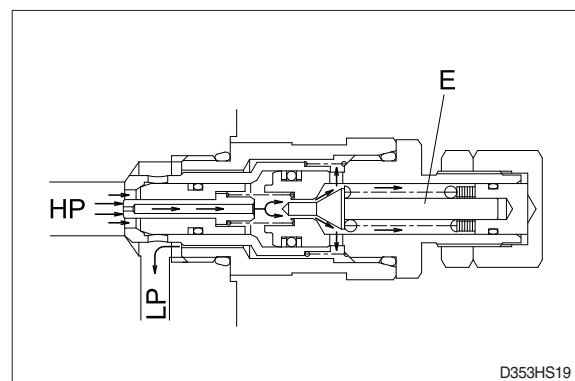
(2) Function

① As work port relief

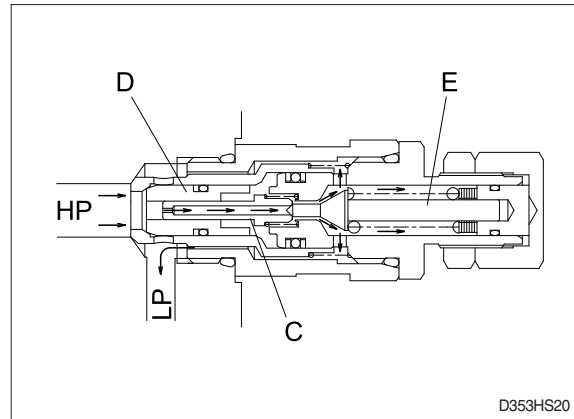
The relief valve is in communication between the high pressure port HP and low pressure LP. Oil is admitted through the hole in poppet C and because of the differential area between diameters A and B relief valve poppet D and check valve poppet K are tightly seated as shown.



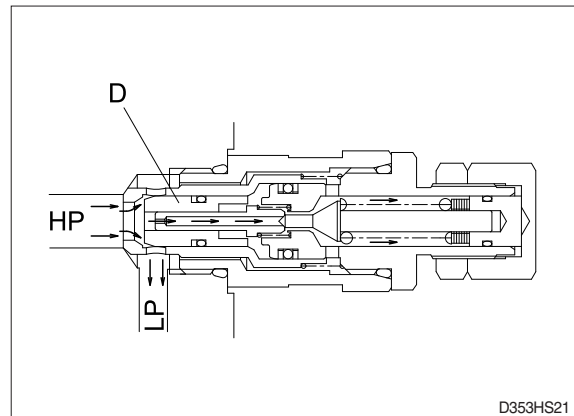
The oil pressure in the high pressure port HP has reached the setting of the pilot poppet spring force and unseats the pilot poppet E and oil flows around the poppet through the cross drilled holes and to the low pressure area LP.



The loss of oil behind poppet C, effected by the opening of pilot poppet E, causes poppet C to move back and seat against pilot puppet E. This shuts off the oil flow to the area behind relief valve poppet D, and causes a low pressure area internally.

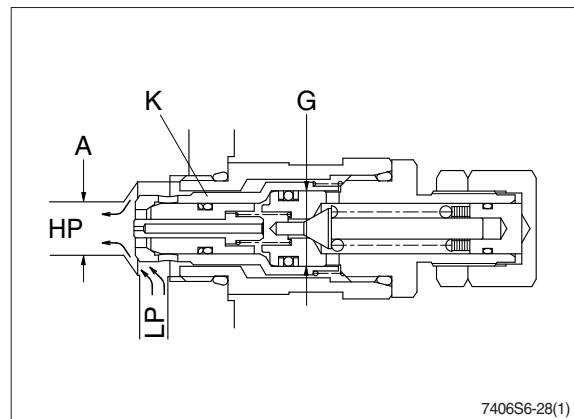


The imbalance of pressure on the inside as compared to that of the high pressure port HP, forces the relief valve poppet D to open and relieve the oil directly to the low pressure chamber LP in the valve.



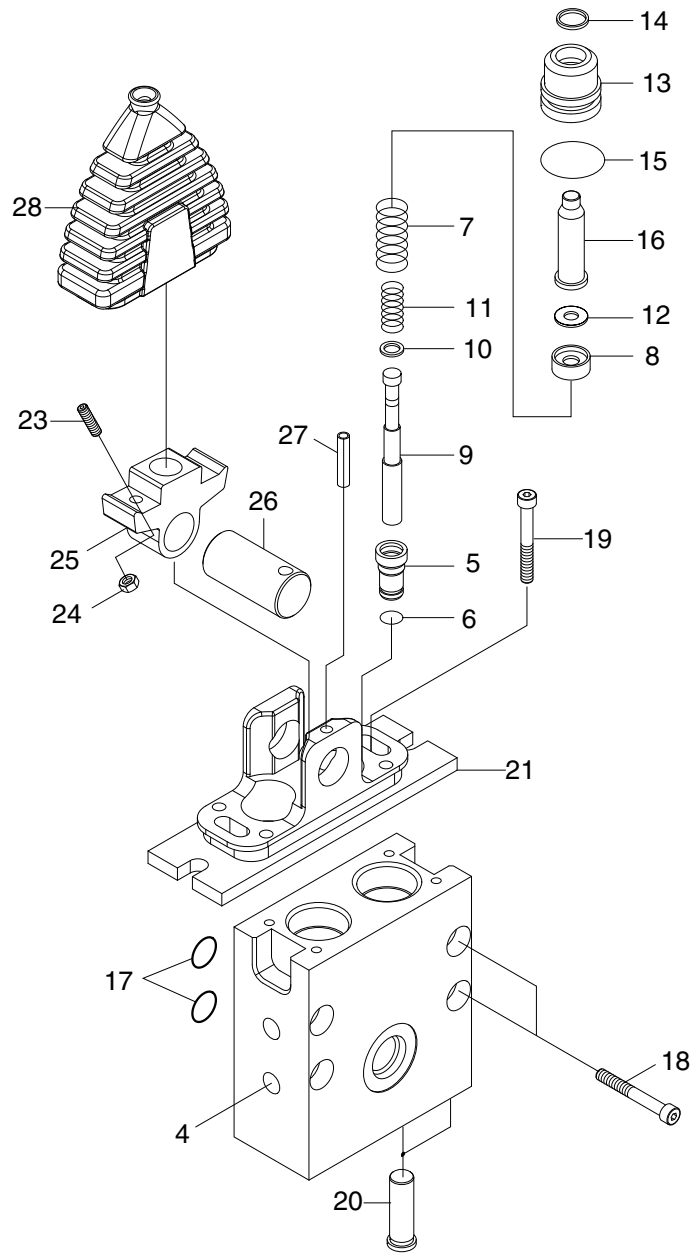
② As anti void

The anti-void unit supplies oil to the high pressure port HP when cavitation has occurred. A lower pressure exists in the port HP compared to the low pressure chamber LP. The difference between the effective area of diameter A and G causes imbalance of the check valve poppet K which unseats, thus allowing oil from the low pressure chamber LP to enter the port HP and fill the void.



5. REMOTE CONTROL VALVE

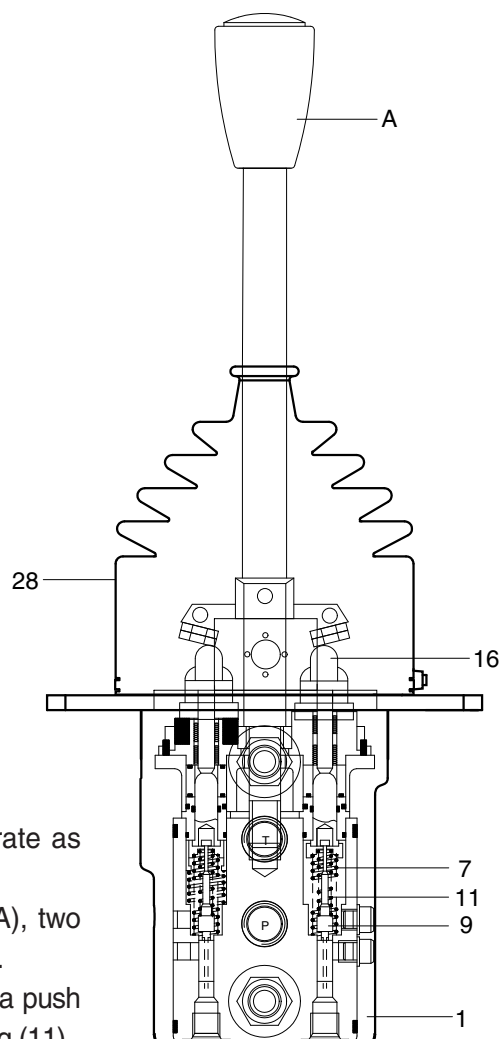
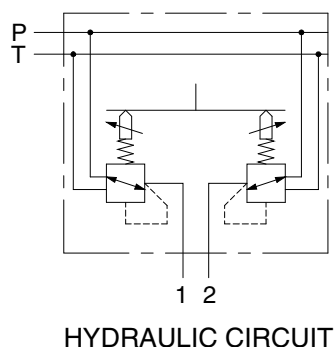
1) STRUCTURE



100D96RCV01

- | | | | | | |
|----|-------------|----|-------------|----|-------------|
| 1 | Body | 12 | Stopper | 21 | Cover |
| 4 | Plug | 13 | Plug | 23 | Socket bolt |
| 5 | Plug | 14 | Oil seal | 24 | Nut |
| 6 | O-ring | 15 | O-ring | 25 | Guide |
| 7 | Spring | 16 | Push rod | 26 | Pin |
| 8 | Spring seat | 17 | O-ring | 27 | Spring pin |
| 9 | Spool | 18 | Socket bolt | 28 | Boot |
| 10 | Shim | 19 | Wrench bolt | | |
| 11 | Spring | 20 | Cap | | |

2) OPERATION



(1) Hydraulic functional principle

Pilot devices with end position locks operate as direct operated pressure reducing valves.

They basically comprise of control lever (A), two pressure reducing valves, body (1) and locks.

Each pressure reducing valve comprises of a push rod kit (16), a metering spring (7) and a spring (11).

At rest, control lever(A) is held in its neutral position by return springs (11). Ports (1, 2) are connected to tank port T.

When control lever (A) is deflected, push rod kit (16) is pressed against return spring (11) and metering spring (7).

Metering spring (7) initially moves docking spool (9) downwards and closes the connection between the relevant port and tank port T. At the same time the relevant port is connected to port P. The control phase starts as soon as docking spool (9) finds its balance between the force from metering spring (7) and the force, which results from the hydraulic pressure in the relevant port (ports 1, 2).

Due to the interaction between docking spool (9) and metering spring (7) the pressure in the relevant port is proportional to the stroke of push rod (16) and hence to the position of control lever (A).

This pressure control which is dependent on the position of the control lever and the characteristics of the control spring permits the proportional hydraulic control of the main directional valves and high response valves for hydraulic pumps.

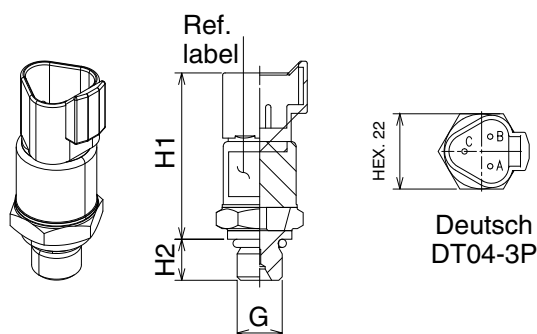
A rubber bellows (28) protects the mechanical components in the housing from contamination.

100D96RCV02

6. PRESSURE SENSORS

1) LOAD PRESSURE SENSOR

(1) Structure



· Tightening torque : 2.5 ~ 3.0 kgf·m
(18 ~ 21.7 lbf·ft)

Pin map	Function
A	+ Supply
B	- Supply
C	Output

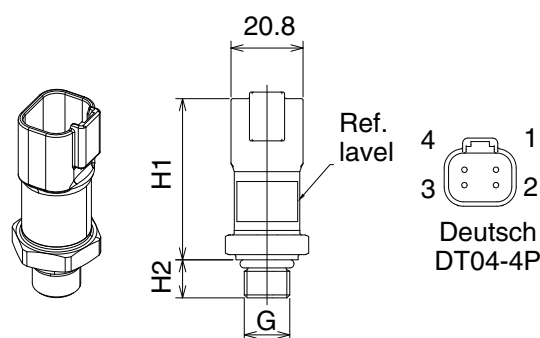
70D9V4BS10

Item	Medium	Thread (G)	H1 (mm)	H2 (mm)	Measuring range (bar)	Voltage (V)	Electrical connections
Fork load pressure sensor	Oil	9/16-18 UNF	49	12	0 ~ 350	5 ± 0.5	CD-70

※ O-ring (S611-012001) : 11.89 × 1.98 (AS568-906, NBR Hs90)

2) PUMP PRESSURE SENSOR

(1) Structure



· Tightening torque : 2.5 ~ 3.0 kgf·m
(18 ~ 21.7 lbf·ft)

Pin map	Function
1	+ Supply
2	- Supply
3	-
4	Output

70D9V6HS15

Item	Medium	Thread (G)	H1 (mm)	H2 (mm)	Measuring range (bar)	Pressure output signal (V)	Voltage (V)	Electrical connections
Pump pressure sensor (LS)	Oil	9/16-18 UNF	49	12	0 ~ 250	1 ~ 5	Max. 30	CD-5

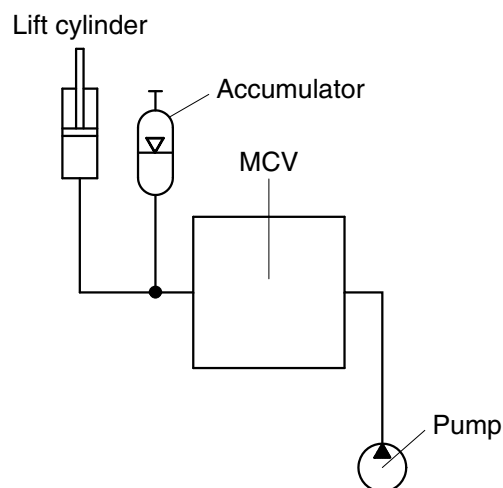
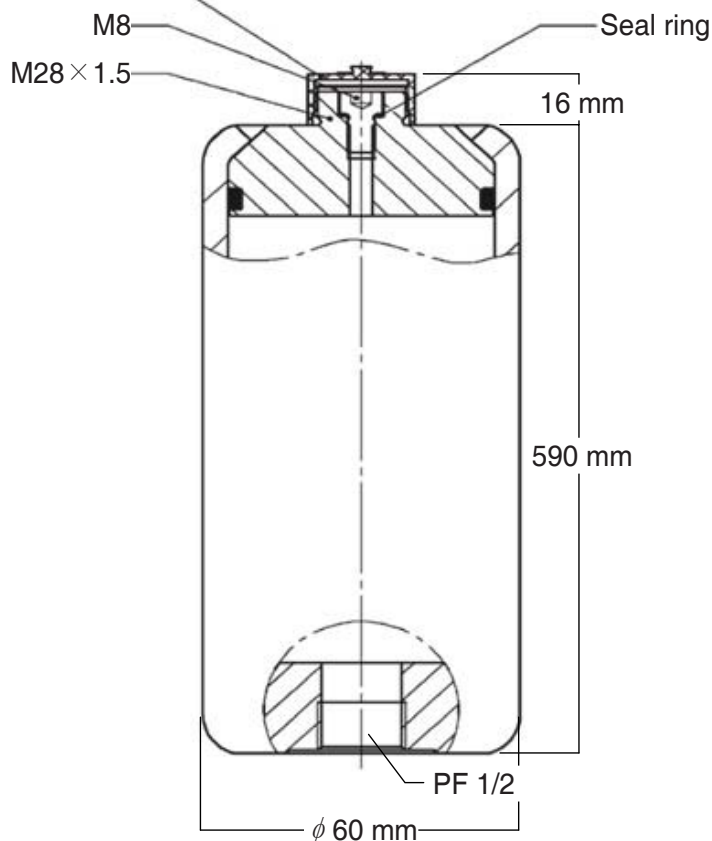
※ O-ring (S611-012001) : 11.89 × 1.98 (AS568-906, NBR Hs90)

7. MAST ACCUMULATOR

1) STRUCTURE

· Tightening torque : 2 kgf·m (14.7 lbf·ft)

Valve protection cap



35D9VB6HS52

35D9VB6HS59

Parts No.	Normal volume	Pre-charging pressure at 20 °C (68 °F)	Gas	Weight
35FV-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 °C (-4 ~ +176 °F), 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 °C (68 °F), 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 tight 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 is recommended to check the filling pressure as follows.

- Initial 250 hour or 6 weeks
- Once 2000 hours or every year.

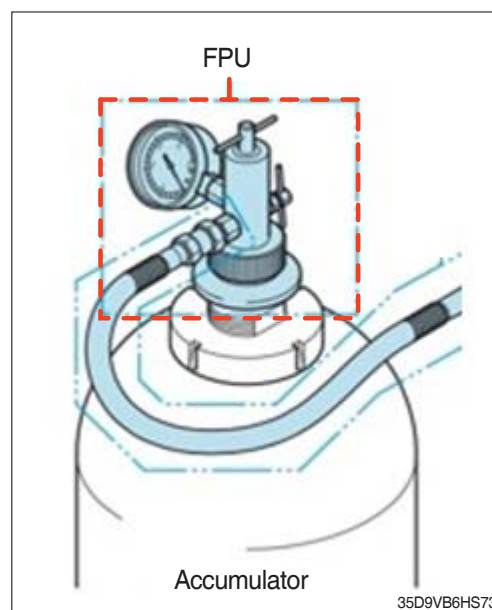
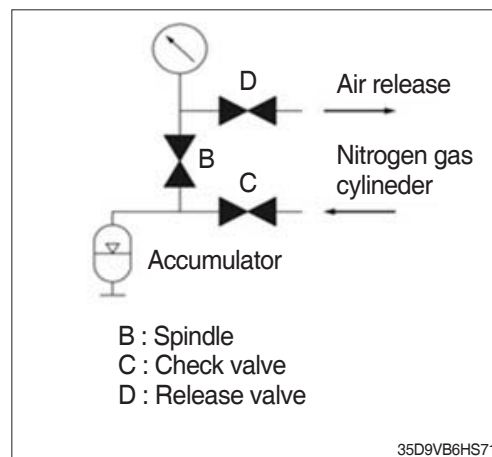
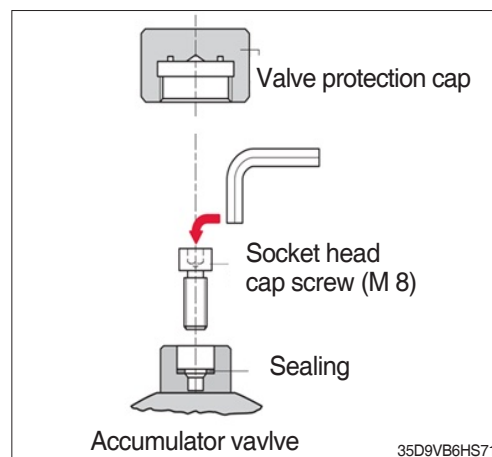
If there is no significant gas loss during the initial inspection, check 2000 hours.

※ 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

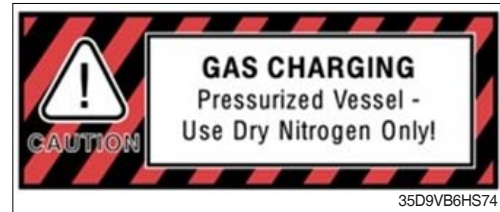
(1) Release

- 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 valve.
- ※ **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 (counterclockwise) and blow out nitrogen gas until the set pressure is confirmed. Pressure is measured at room temperature around 20 °C (68 °F).
- 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.

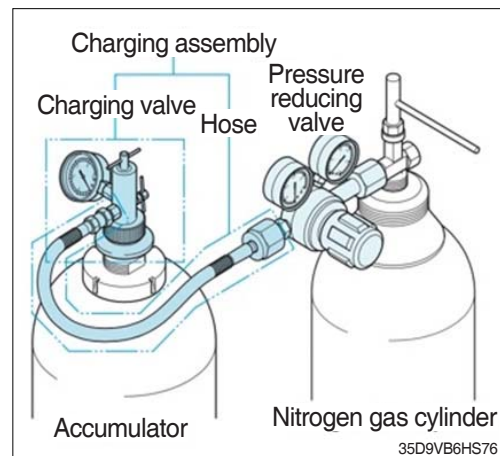
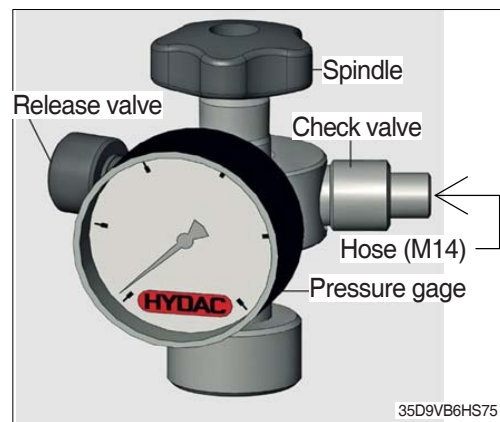


(2) Charging

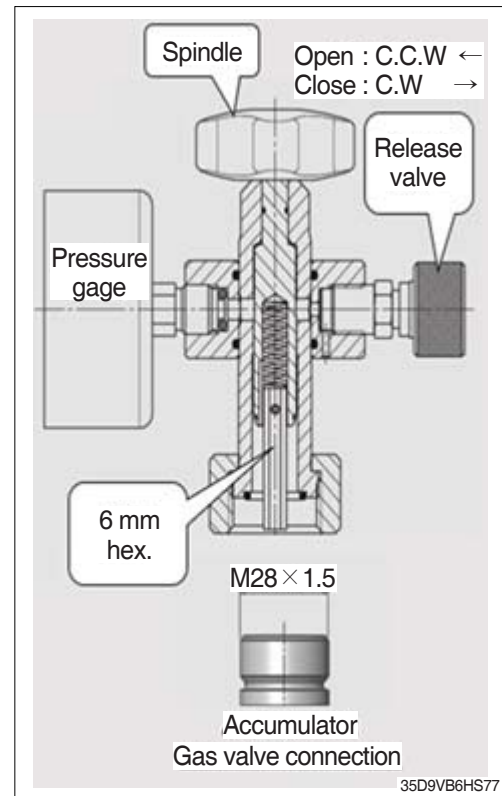
- ※ The filling kit operation method was prepared based on HYDAC product standards.
- ※ Accumulator gas pressure adjustment and charging kit must be purchased separately.
- ※ To recharge nitrogen gas, it is convenient to use the HYDAC FPU-1 unit.
- ▲ **Must be filled with clean nitrogen gas only. Never 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.

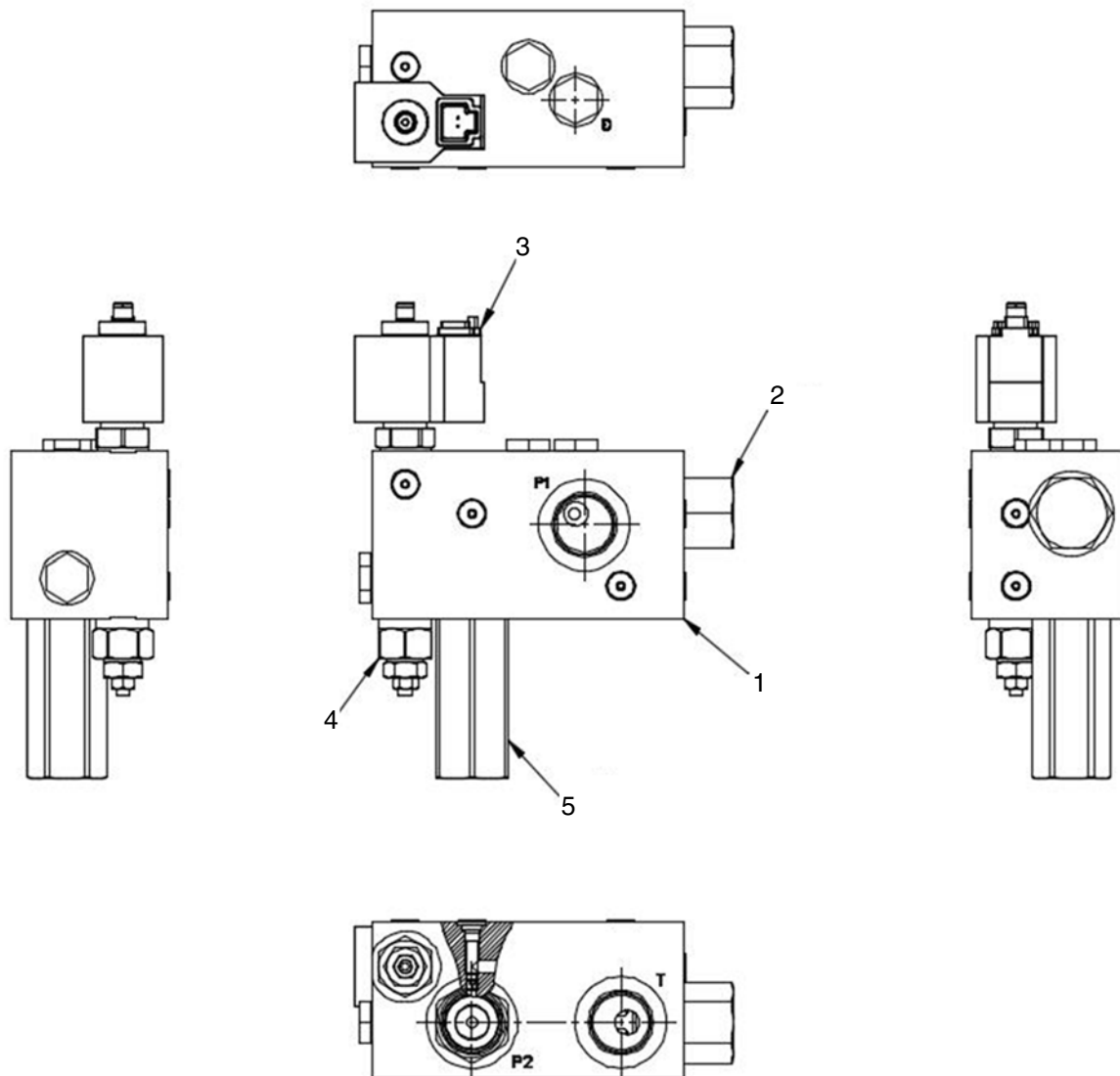


- ⑩ Open the release valve and blow out nitrogen gas in the FPU.
- ※ If there is gas in the charging hose and FPU, it cannot be separated, and it is very dangerous if it is forcibly separated. Be sure to separate the charging hose and after blowing out the gas inside the FPU.
- ⑪ Remove the FPU from 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.



8. DRAIN VALVE

1) STRUCTURE



100D96DV01

- | | | | | | |
|---|-------------|---|----------------|---|-------------|
| 1 | Manifold | 3 | Solenoid valve | 5 | Check valve |
| 2 | Logic valve | 4 | Relief valve | | |

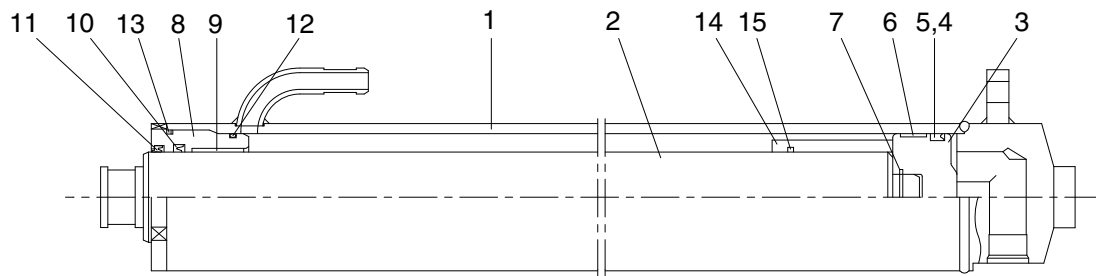
2) OPERATION

The system pressure is reached setting value (110~120 bar), the solenoid valve is energized by the MCU and the oil drains to tank

- Prevent the engine stall in low rpm with load condition.
- High rated flow at rated pressure

9. LIFT CYLINDER

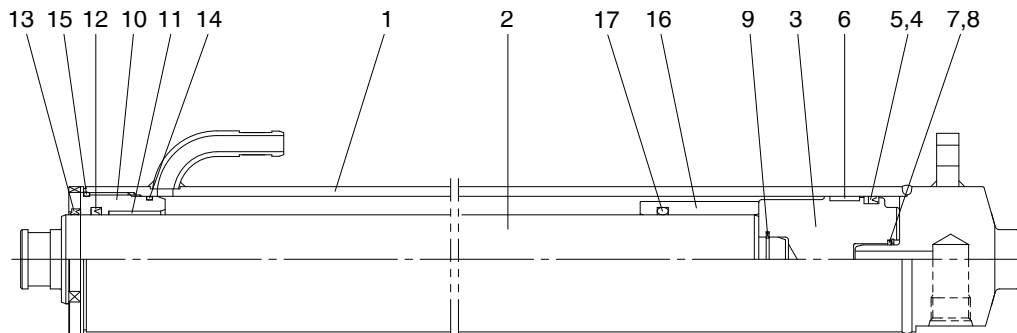
1) V MAST



3YFJ-07020

1	Tube assy	6	Wear ring	11	Dust wiper
2	Rod	7	Cushion seal	12	O-ring
3	Piston	8	Gland	13	O-ring
4	Piston seal	9	Du bushing	14	Spacer
5	Back up ring	10	Rod seal	15	O-ring

2) TS MAST

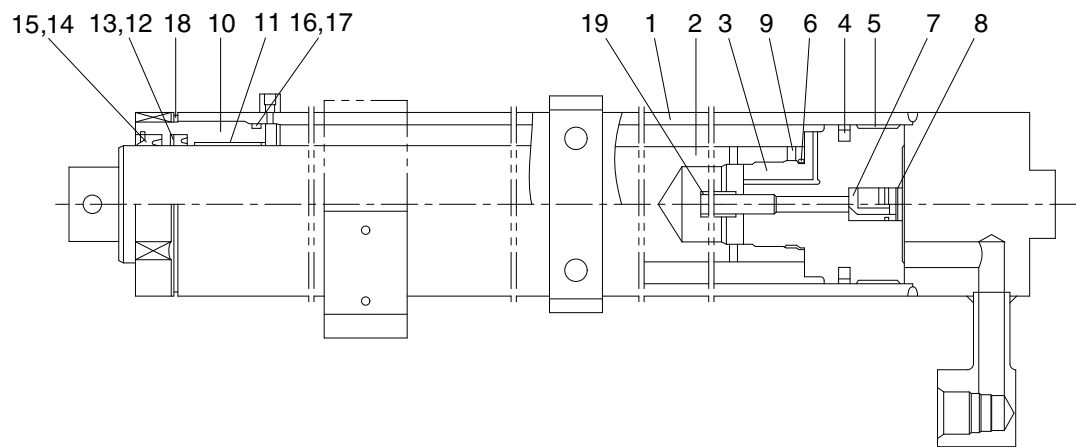


3YFJ-07210

1	Tube assy	7	Cushion seal	13	Dust wiper
2	Rod	8	Retaining ring	14	O-ring
3	Piston	9	Retaining ring	15	O-ring
4	Piston seal	10	Gland	16	Spacer
5	Back up ring	11	Du bushing	17	O-ring
6	Wear ring	12	Rod seal		

10. FREE LIFT CYLINDER

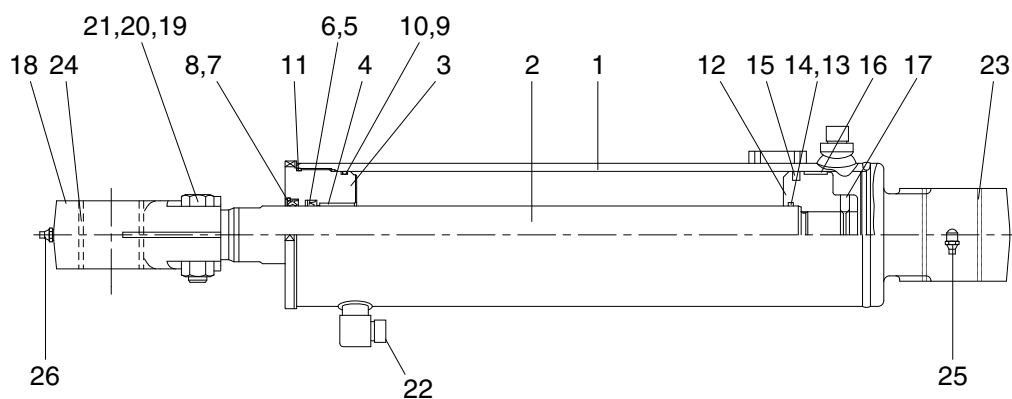
1) TS MAST



3YFJ-17110

- | | | |
|---------------|------------------|-------------------|
| 1 Tube assy | 8 Retaining ring | 15 Retaining ring |
| 2 Rod | 9 Set screw | 16 O-ring |
| 3 Piston | 10 Rod cover | 17 Backup ring |
| 4 Piston seal | 11 Rod bushing | 18 O-ring |
| 5 Wear ring | 12 U-packing | 19 Pipe |
| 6 O-ring | 13 Backup ring | |
| 7 Check valve | 14 Dust wiper | |

11. TILT CYLINDER



3YFJ-08500

1	Tube assy	10	Back up ring	19	Hex bolt
2	Rod	11	O-ring	20	Hex nut
3	Rod cover	12	Piston	21	Spring washer
4	Pin bushing	13	O-ring	22	O-ring
5	U-packing	14	Back up ring	23	Rod bushing
6	Back up ring	15	Piston seal	24	Rod bushing
7	Wiper ring	16	Wear ring	25	Grease nipple
8	Stop ring	17	Set screw	26	Grease nipple
9	O-ring	18	Eye		

GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

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).

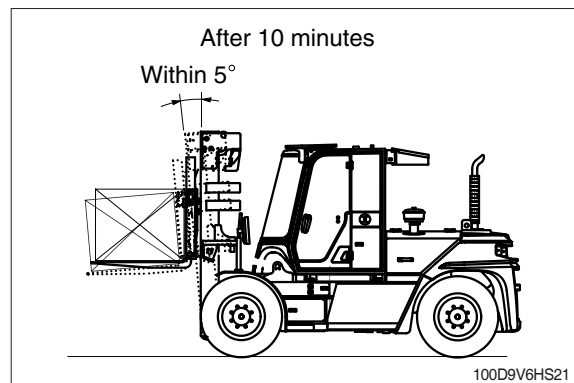
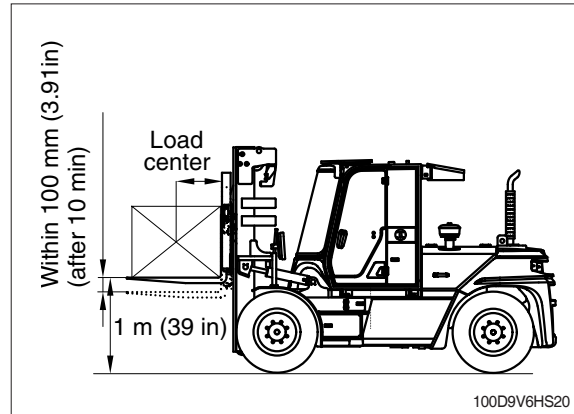
• Check condition

- Hydraulic oil : 45 ± 5 °C (113 ± 41 °F)
- Rated capacity load
- Mast substantially vertical
- Key OFF, operator non-existence

• Hydraulic drift

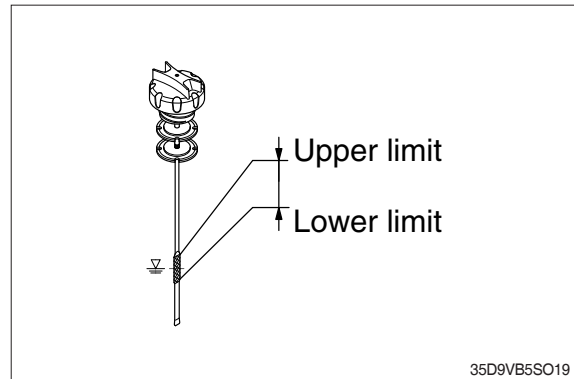
- Down (Downward movement of forks)
: Within 100 mm (3.9 in)
- Forward (Extension of tilt cylinder)
: Within 5°

- (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 outlet port pipe) and return filter (screwed into inlet pipe).



3) CONTROL VALVE

- (1) Raise forks to maximum height and measure oil pressure. Check the oil pressure.

Model	Unit	Pressure
100D-9	bar (psi)	265 (3769)

2. TROUBLESHOOTING

1) SYSTEM

Problem	Cause	Remedy
Large fork lowering speed	<ul style="list-style-type: none"> Seal inside control valve defective. Oil leaks from joint or hose. Seal inside cylinder defective. 	<ul style="list-style-type: none"> Replace spool or valve body. Replace. Replace packing.
Large spontaneous tilt of mast	<ul style="list-style-type: none"> Tilting backward : Check valve defective. Tilting forward : tilt lock valve defective. Oil leaks from joint or hose. Seal inside cylinder defective. 	<ul style="list-style-type: none"> Clean or replace. Clean or replace. Replace. Replace seal.
Slow fork lifting or slow mast tilting	<ul style="list-style-type: none"> 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. High hydraulic oil viscosity. Mast fails to move smoothly. Oil leaks from lift control valve spool. Oil leaks from tilt control valve spool. 	<ul style="list-style-type: none"> Add oil. Bleed air. Replace. Clean filter. Adjust relief valve. Replace packing. Change to SAE10W, class CD engine oil. Adjust roll to rail clearance. Replace spool or valve body. Replace spool or valve body.
Hydraulic system makes abnormal sounds	<ul style="list-style-type: none"> Excessive restriction of oil flow pump suction side. Gear or bearing in hydraulic pump defective. 	<ul style="list-style-type: none"> Clean filter. Replace gear or bearing.
Control valve lever is locked	<ul style="list-style-type: none"> Foreign matter jammed between spool and valve body. Valve body defective. 	<ul style="list-style-type: none"> Clean. Tighten body mounting bolts uniformly.
High oil temperature	<ul style="list-style-type: none"> Lack of hydraulic oil. High oil viscosity. Oil filter clogged. 	<ul style="list-style-type: none"> Add oil. Change to SAE10W, class CD engine oil. Clean filter.
Actuator (cylinder or motor) works slowly or does not operate.	<ul style="list-style-type: none"> Shortage of oil in oil tank. Decrease of relief valve pressure. Spool got stuck. Shortage of oil flow to the valve. 	<ul style="list-style-type: none"> Check the oil level in the oil tank. Install pressure gauge on the circuit, and check the pressure with it by handling the lever. Check that manual lever moves smoothly. Check that lever stroke is enough. Check that oil flow of the pump is within specified rate.

Problem	Cause	Remedy
High oil temperature	<ul style="list-style-type: none"> · Lack of hydraulic oil. · High oil viscosity. · Oil filter clogged. 	<ul style="list-style-type: none"> · Add oil. · Change to SAE10W, class CD engine oil. · Clean filter.
Cylinder lowers considerably under normal circumstance.	<ul style="list-style-type: none"> · Internal leakage of cylinder happens frequently. · Excessive leakage from spool of the valve. · Spool got stuck. · Leakage in a part of the circuit. 	<ul style="list-style-type: none"> · Fit the stop valve on the pipe between valve and cylinder, observe the internal leakage of cylinder. · Check the oil viscosity is not too low. · Check that manual lever moves smoothly. · Check the circuit. Observe leakage from pipes.
Pressure does not increase sufficiently.	<ul style="list-style-type: none"> · Defect of relief valve. · Leakage in a part of the circuit. 	<ul style="list-style-type: none"> · Check the relief valve. · Check the circuit. Observe leakage from pipes.
Temperature rising of the hydraulic oil.	<ul style="list-style-type: none"> · Working with higher pressure than rated pressure. · Low viscosity of oil. · Leakage from a part of the circuit. · Oil leakage in the pump. · Insufficient suction of the pump. 	<ul style="list-style-type: none"> · Check the flow pressure. · Check the sort of oil and viscosity. · Check if the circuit is relieved at all times. · Check if the temperature of pump surface higher 30°C than oil temperature. · Check the oil tank volume. Check if the suction strainer is blocked.
Steering force is heavy.	<ul style="list-style-type: none"> · Defect of steering relief valve. 	<ul style="list-style-type: none"> · Check the steering relief valve.

2) MAIN PUMP

Problem	Cause	Remedy
Unusual noises No or insufficient flow	· Insufficient air bleeding of the hydraulic system.	· Fill the axial piston pump, suction line for the hydraulic pump and the oil tank. · Completely air bleed the pump and hydraulic system. · Inspect and correct or replace. - Installation position
	· Insufficient suction conditions - Viscosity of the hydraulic fluid too high - Suction pressure too low - Impermissible filter in the suction line - Foreign particles in the suction line	· Optimize inlet conditions. - Use suitable hydraulic fluid. - Fill the suction line with hydraulic fluid. - Remove foreign particles from the suction line.
	· Improper mounting of the axial piston pump	· Inspect and correct the mounting of the pump. - Observe tightening torques.
	· Improper mounting of assembled parts (hydraulic lines)	· Mount assembled parts according to the information provided.
	· Pump control valve vibration	· Optimize the adjustment of the axial piston pump and the pressure limitation in the hydraulic system.
	· Mechanical damage to the main pump (e.g. bearing damage)	· Inspect and correct or replace.
No or insufficient flow	· Faulty mechanical drive (e.g. defective coupling & spline) · Hydraulic fluid not in optimal viscosity range	· Inspect and correct or replace. · Check temperature range and use suitable hydraulic fluid.
No or insufficient pressure	· Insufficient pilot pressure or control pressure · Output actuator defective (e.g. hydraulic cylinder)	· Check pilot pressure or control pressure. Inspect and correct. · Inspect and correct.
Pressure Flow fluctuations Instabilities	· Malfunction of the control device of the axial piston pump · Wear or mechanical damage to the axial piston pump · Unstable control signal	· Inspect and correct. · Inspect and correct or replace. · Inspect and correct.
Increased, unusual vibration	· Bearings worn	· Inspect and correct or replace.
Excessively high temperature of hydraulic fluid and housing	· Wrong setting or malfunction in the pressure relief and pressure control valves e.g.) - high pressure relief valve - pressure cut-off - pressure controller · Axial piston pump worn	· Optimize the adjustment of the pressure limitation and pressure control valves of the axial piston pump and the pressure safeguarding in the hydraulic system. · Inspect and correct. · Inspect and correct or replace.

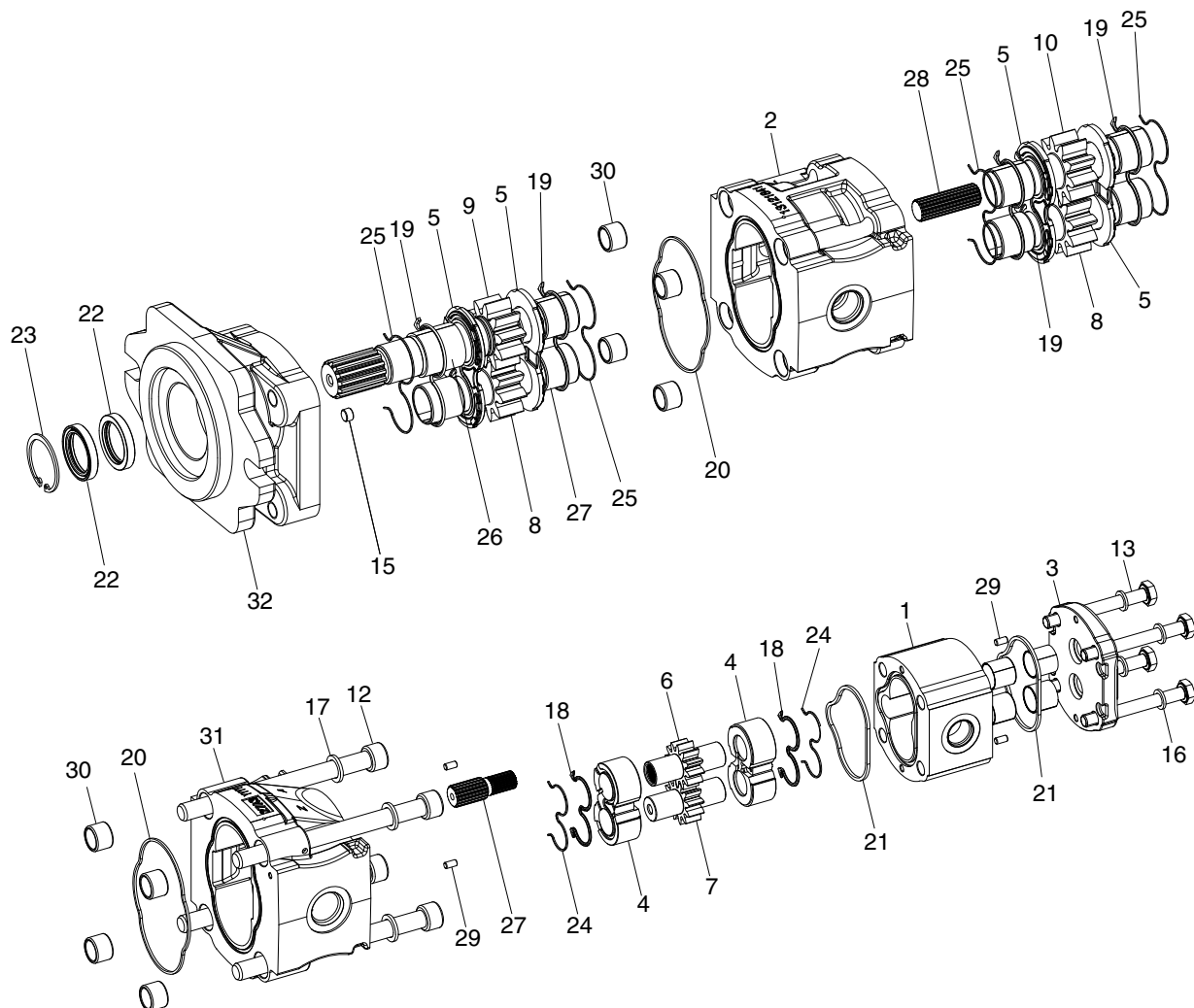
3) CYLINDER

Problem	Cause	Remedy
Oil leaks out from rod cover through rod	<ul style="list-style-type: none"> · Foreign matters on packing. · Unallowable score on rod. · Unusual distortion of dust seal. · Chrome plating is striped. 	<ul style="list-style-type: none"> · Replace packing. · Smooth rod surface with an oil stone. · Replace dust seal. · Replace rod.
Oil leaks out from cylinder rod cover thread	<ul style="list-style-type: none"> · O-ring damaged. 	<ul style="list-style-type: none"> · Replace O-ring.
Rod spontaneously retract	<ul style="list-style-type: none"> · Scores on inner surface of tube. · Unallowable score on the inner surface of tube. · Foreign matters in piston seal. 	<ul style="list-style-type: none"> · Smooth rod surface with an oil stone. · Replace cylinder tube. · Replace piston seal.
Wear (clearance between cylinder tube and wear ring)	<ul style="list-style-type: none"> · Excessive clearance between cylinder tube and wear ring. 	<ul style="list-style-type: none"> · Replace wear ring.
Abnormal noise is produced during tilting operation	<ul style="list-style-type: none"> · Insufficient lubrication of anchor pin or worn bushing and pin. · Bent tilt cylinder rod. 	<ul style="list-style-type: none"> · Lubricate or replace. · Replace.

GROUP 3 DISASSEMBLY AND ASSEMBLY

1. MAIN PUMP

1) STRUCTURE



100D9MP02

1	Housing	12	Screw	23	Ring
2	Body	13	Screw	24	Antiextrusion plate
3	Rear Cover	14	Nut	25	Antiextrusion ring
4	Thrust plate	15	Screw	26	Sleeve bearing
5	Thrust plate	16	Washer	27	Hub
6	Drive gear	17	Washer	28	Hub
7	Driven gear	18	Seal	29	Dowel pin
8	Driven gear	19	Seal	30	Steel bushing
9	Drive gear	20	Upper seal	31	Body
10	Drive shaft	21	Square seal	32	Front cover
11	Bolt	22	Shaft seal		

2) GENERAL INSTRUCTION

(1) Cleanliness

- ① Cleanliness is the primary means of assuring satisfactory hydraulic pump life.

Components such as flanges and covers are best cleaned in soap and hot water, then air dried.

Gears should be washed in solvent, air dried, and oiled immediately.

▲ Certain cleaning solvents are flammable. Do not allow sources of ignition in the area when using cleaning solvents.

- ② Protect all exposed surfaces and open cavities from damage and foreign material.

※ Gear journals and gear faces are super finished. Take care not to touch these surfaces after oil and solvent.

(2) Lubrication of moving parts

During assembly, all running surfaces (bearing and wear plate) must be lightly lubricated with a clean oil or aerosol lubricant.

(3) Tools required for assembly

- ① Socket set (1/2" drive)
- ② Internal snap ring pliers
- ③ Shaft seal sleeve or clear tape
- ④ Torque wrench (30 kgf · m capacity)
- ⑤ Plastic hammer
- ⑥ Torque wrench box end adapters

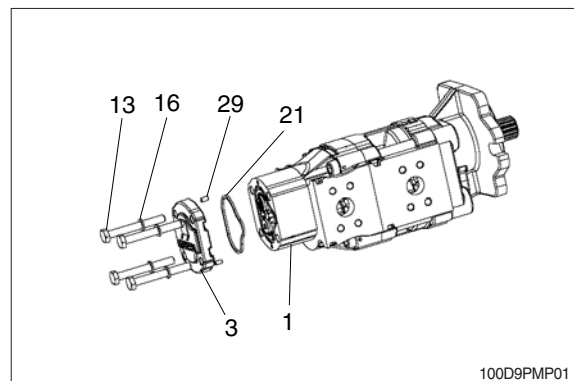
3) DISASSEMBLY

(1) Rear section

- ① Loosen and remove the clamp screw (13) from rear working section (1).

※ Related parts

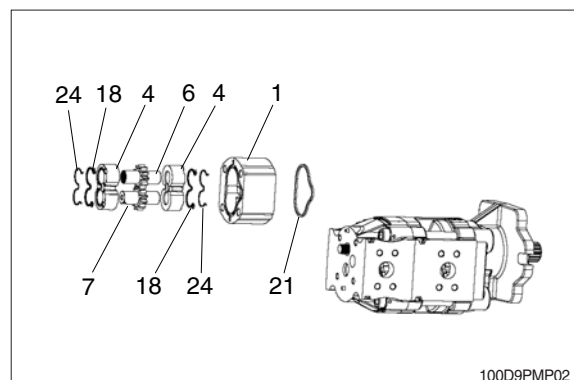
Washer (16), rear cover (3), dowel pin (29) and square-ring (21).



- ② Remove driving gear (6), driven gear (7) with thrust plate parts (4, 18, 24), keeping gear as straight as possible, and working section (1) also.

※ Related parts

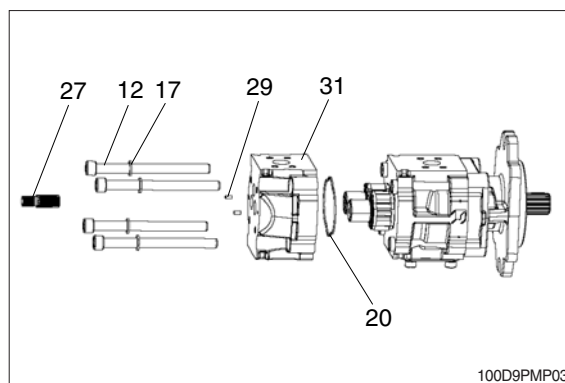
Antiextrusion plate (24), seal (18), thrust plate (4), working body (1) and square ring (21).



(2) Center section

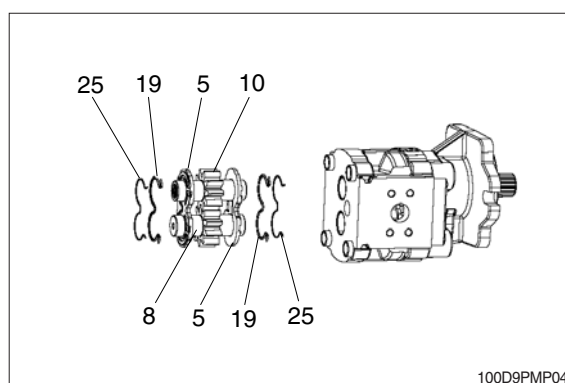
- ① Remove through hub (27) from driving shaft (10).
- ② Loosen and remove the clamp screw (12) with washer (17), and then remove the working section (31) with dowel pin (29).

※ Related parts
Upper seal (20).



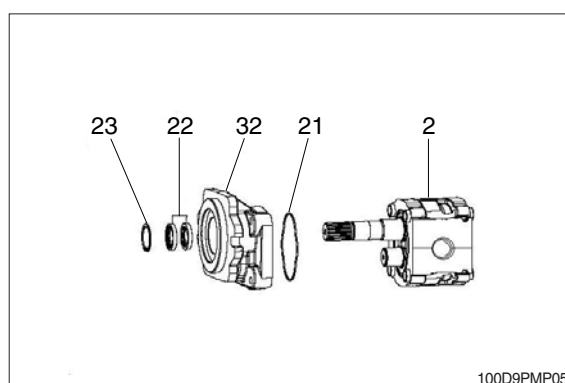
- ③ Remove driving gear (10), driven gear (8) with thrust plate parts (5, 19, 25), keeping gear as straight as possible, from first working body.

※ Related parts
Antiextrusion ring (25), seal (19) and thrust plate (5).



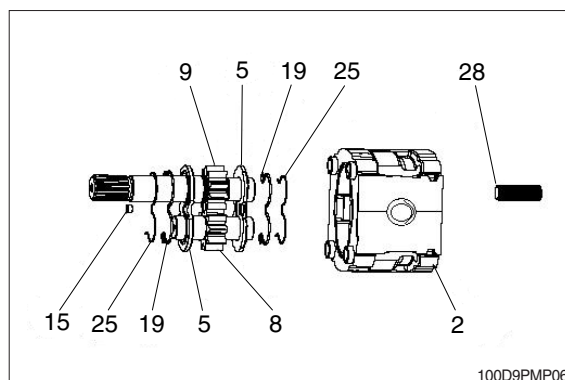
(3) Front section

- ① Remove the snap-ring (23) and shaft seal (22), and then remove mounting flange (32) and square ring (21) from working section (2).



- ② Remove driving gear (9), driven gear (8) with through hub (28) and thrust plate parts (5, 19, 25) from the working body (2), keeping gear as straight as possible.

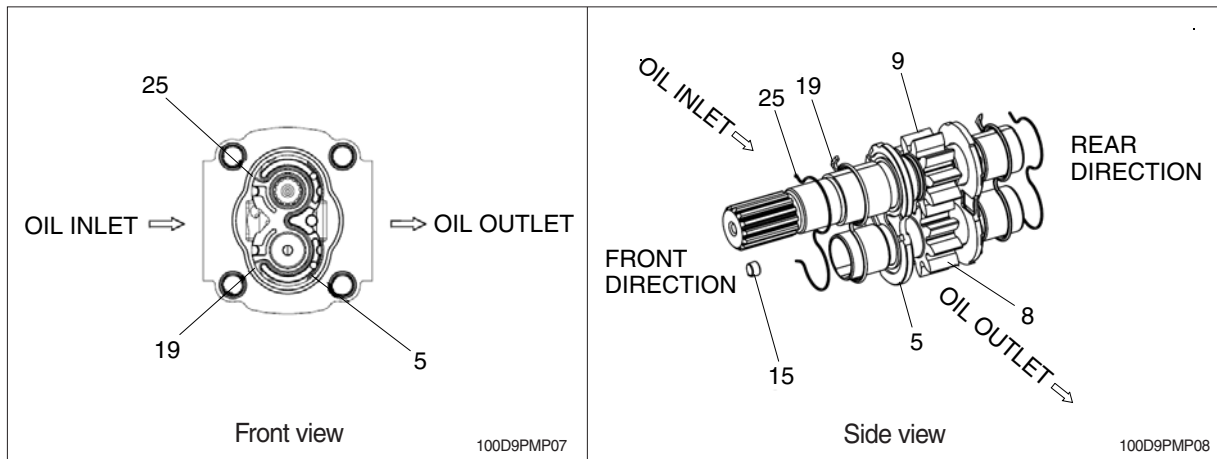
※ Related parts
Screw (15), antiextrusion ring (25), seal (19) and thrust plate (5).



4) REASSEMBLY

※ Information for assembly way of thrust plates

It is important that all of thrust plate parts in this hydraulic pump should be assembled such as below picture during reassembly. Below figures show assembling sequence and direction.



5 Thrust plate

8 Driven gear

9 Drive gear

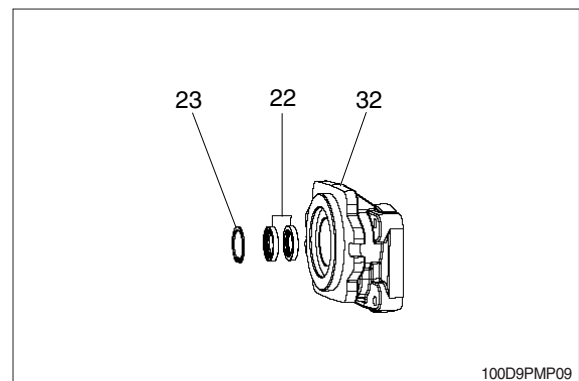
15 Screw

24 Antiextrusion plate

25 Antiextrusion ring

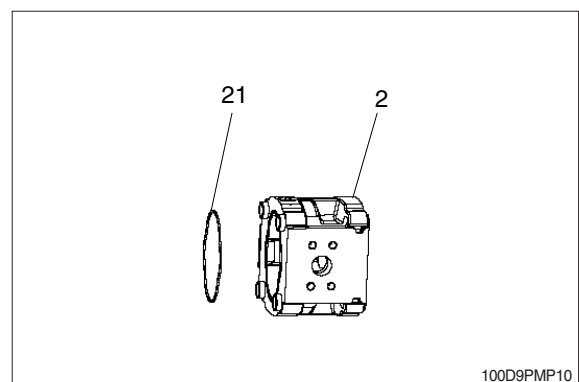
(1) Front cover area

- ① Insert the shaft seal (22) carefully and fit it inside of mounting flange (32) with proper tool.
- ② Fit the snap-ring (23) in pre-arranged position with proper tool.



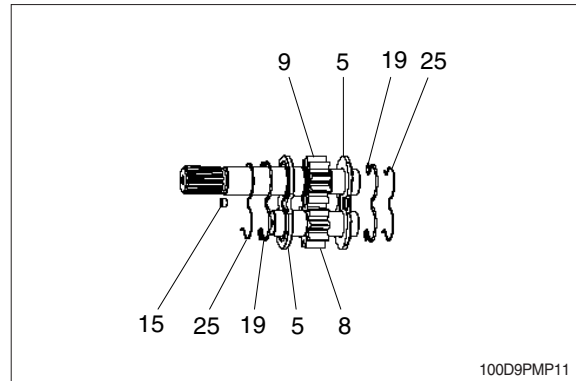
(2) Center section

- ① Fit the square ring (21) on the prearranged groove of the working section (2).
- ※ Smear clean grease on the square ring (21) to avoid drifting away of square ring from the working section (2).



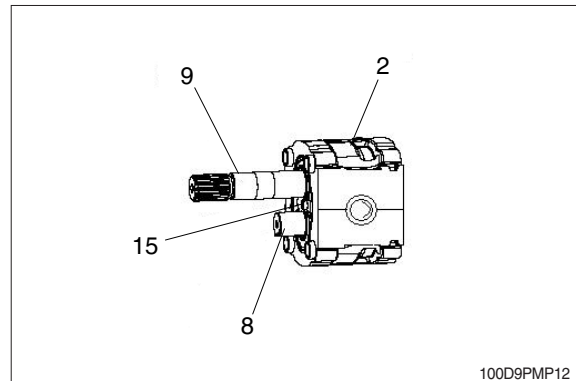
- ② Locate the seal (19) on the groove prearranged on the thrust plate (5).
- ③ Then, locate antiextrusion ring (25) on the groove pre-arranged on the seals (5, 19) with screw (15).

※ Smear clean grease on the seal (19, 25).
(The front and rear thrust plates and seals and antiextrusion ring are same.)

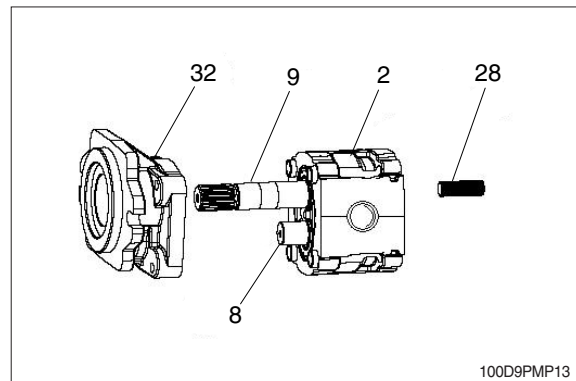


- ④ Insert the drive gear (9) and driven gear (8) into working section (2) while keeping the gears straight.

※ Locate thrust plate (5+19+25) with care for the direction.

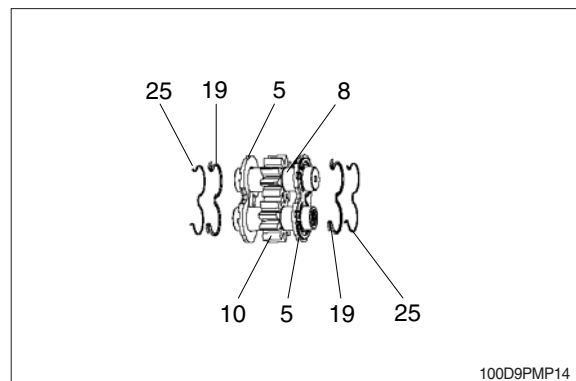


- ⑤ Locate the completed mounting flange (32+22+23) to working section (2) while tacking care not to give any damage on the shaft seal by edge of shaft (9).
- ⑥ Insert the through shaft (28) to rear side of the drive shaft (9).

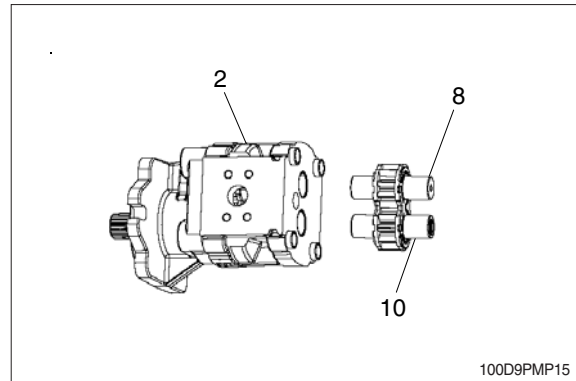


- ⑦ Locate the seal (19) on the groove prearranged on the thrust plate (5).
- ⑧ Then, locate antiextrusion ring (25) on the groove pre-arranged on the seals (5, 19).

※ Smear clean grease on the seal (5, 19)
(The front and rear thrust plates and seals and antiextrusion ring are same.)

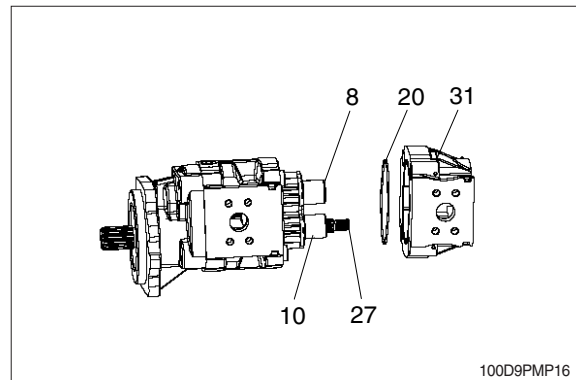


- ⑨ Insert the drive shaft (10) and driven gear (8) including the completed thrust plate (5+19+25) into working section (2) while keeping the plate straight.

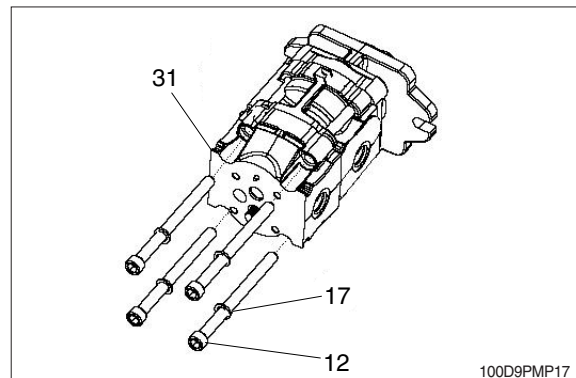


- ⑩ Insert the through shaft (27) into drive shaft (10), and then locate the working body (31) after inserting the squaring ring (20) to body (31).

※ Smear clean grease on the upper seal (20) to avoid drifting away of upper seal from the working body (31).



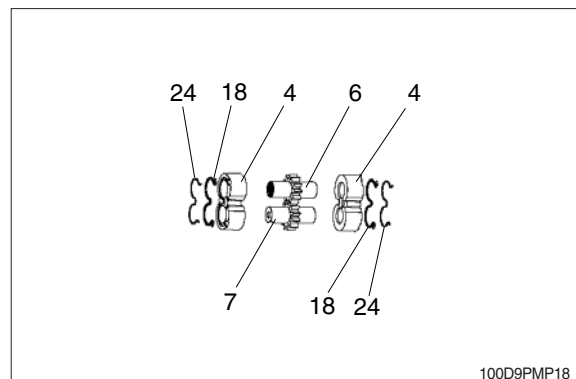
- ⑪ Tighten the bolt (12) with washer (17) in a cross pattern to torque valve of 140 Nm.



(3) Rear section

- ① Locate the seal (18) on the groove prearranged on the thrust plate (4).
 ② Then, locate antiextrusion plate (24) on the groove pre-arranged on the seals (4, 18).

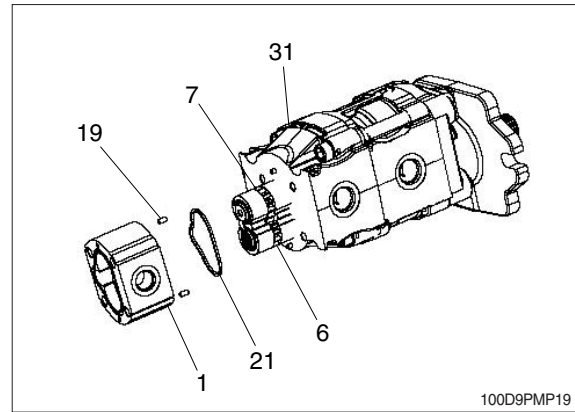
※ Smear clean grease on the seal (4, 18) (The front and rear thrust plates and seals and back-up ring are same.)



③ Locate the drive gear (6) and driven gear (7) with thrust plate parts (4+18+24) into working section (31).

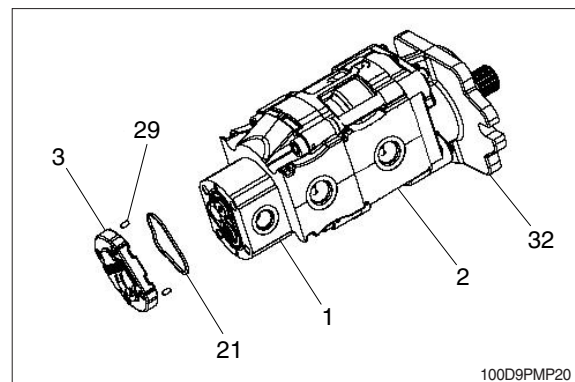
④ Insert the dowel pin into the working section (31) and then, locate the rear working section (1) to working section (31) while keeping the gear straight.

※ Smear clean grease on the square ring (21) to avoid drifting away of square ring from the rear working section (1).



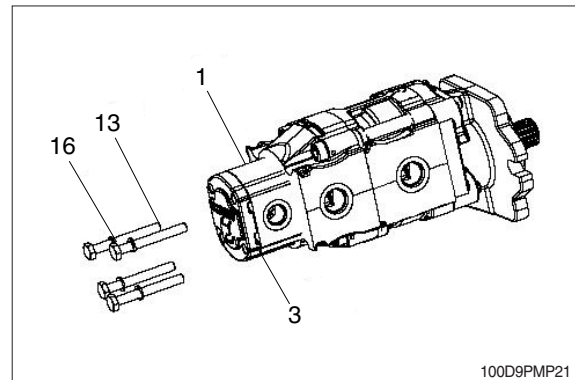
⑤ Locate the rear cover (3) after inserting the square ring (21) and the dowel pin (29) into the rear working section (1).

※ Smear clean grease on the square ring (21) to avoid drifting away of square ring (21) from the rear cover (3).

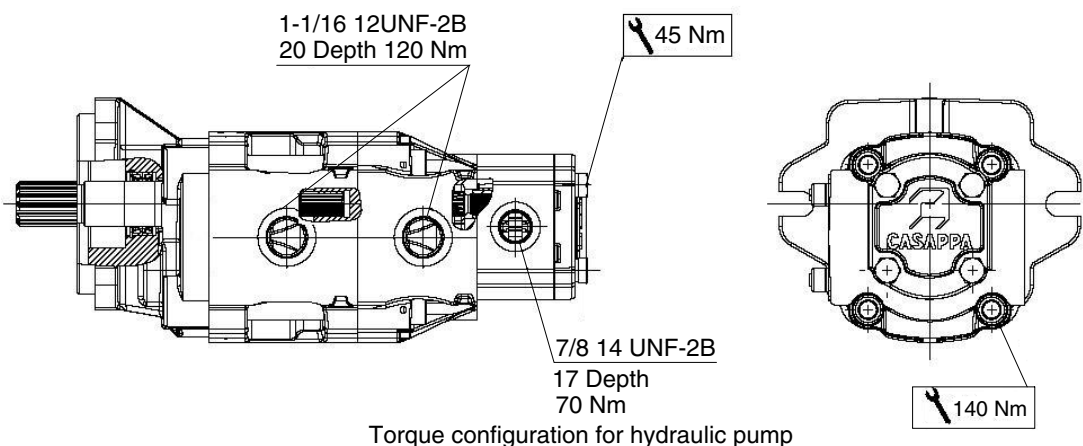


⑥ Tighten the screw (13) with washer (16) in a cross pattern to torque valve of 45 Nm.

※ Check that the pump rotate freely when the driving shaft is turned by hand. If not a thrust plate seal may be pinched.



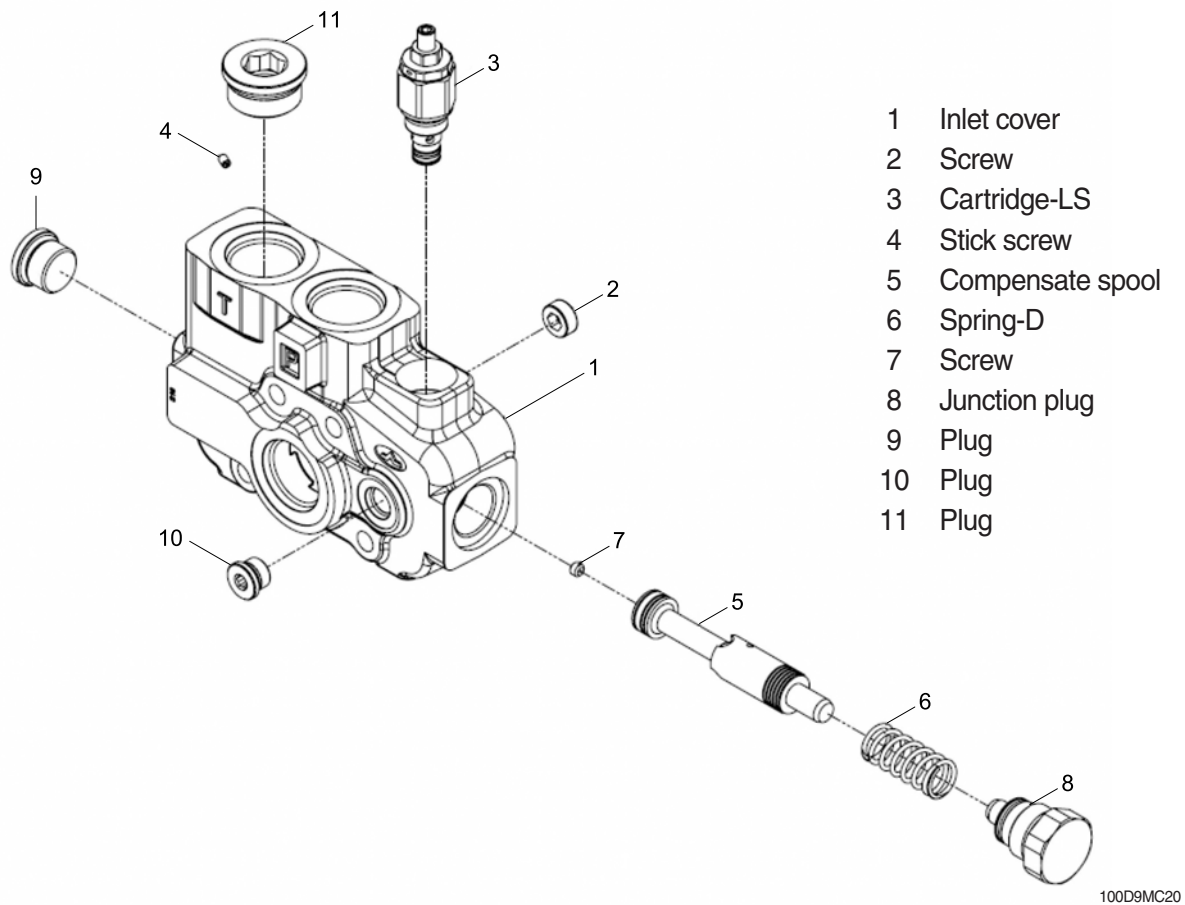
(4) Reference



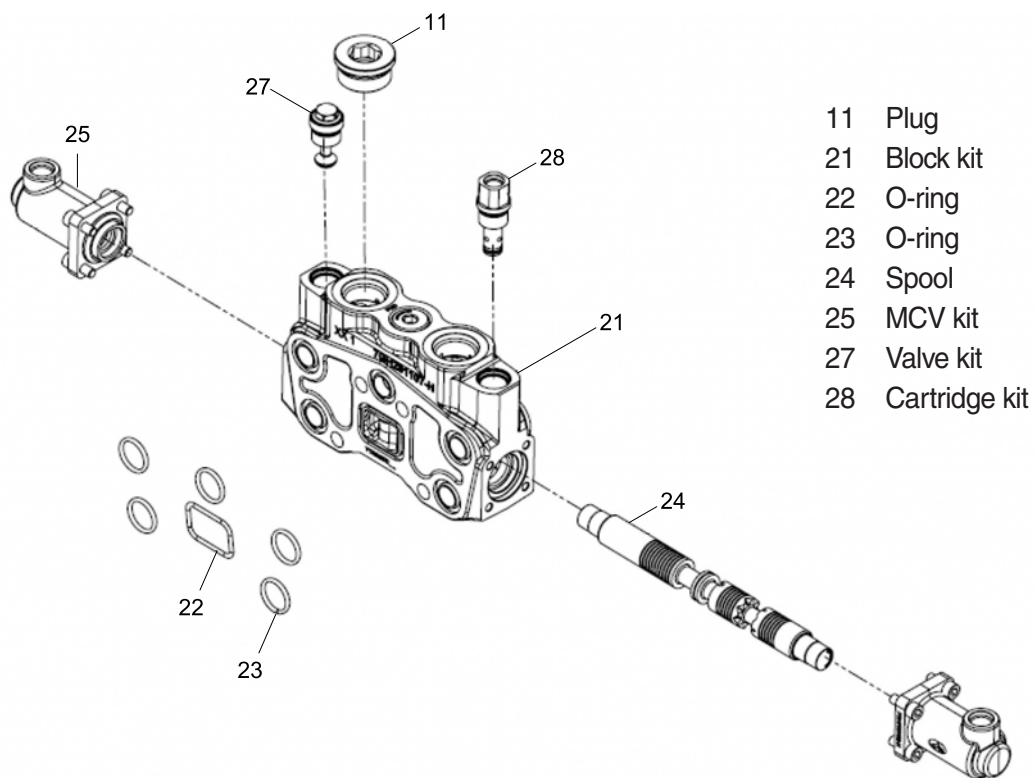
2. MAIN CONTROL VALVE

1) STRUCTURE

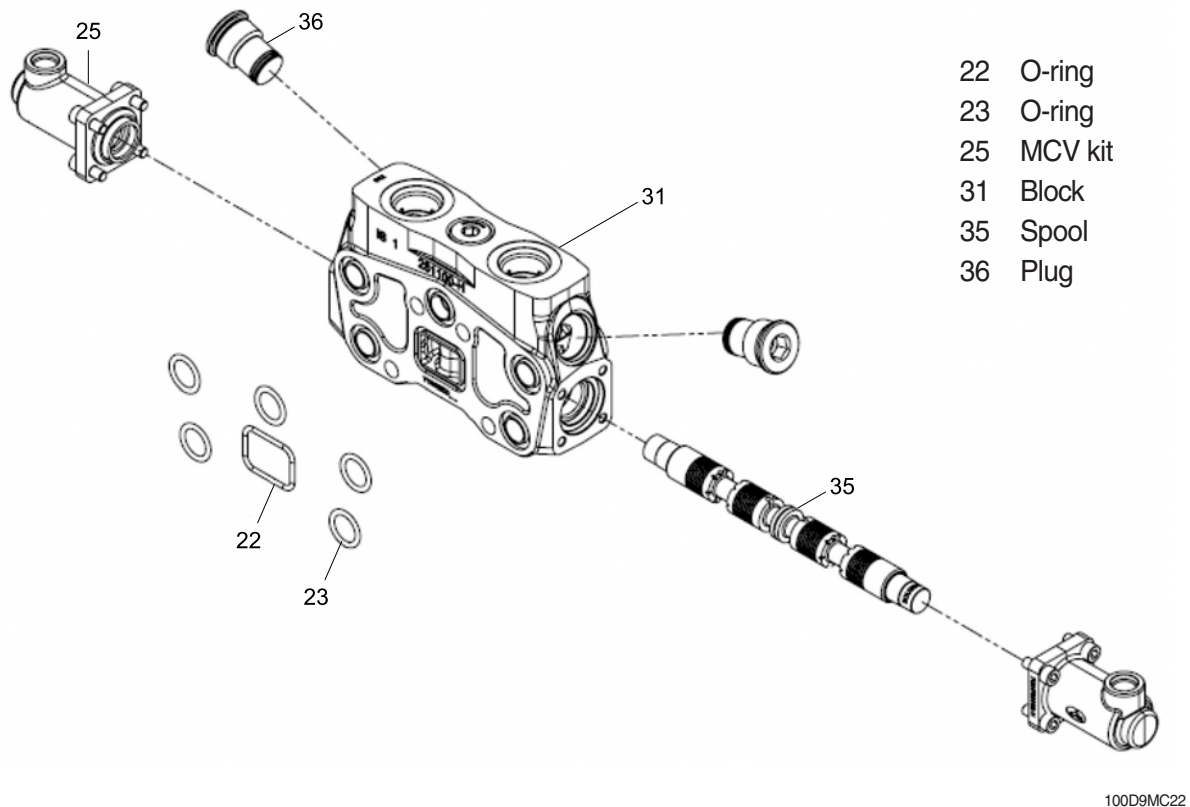
(1) Inlet section



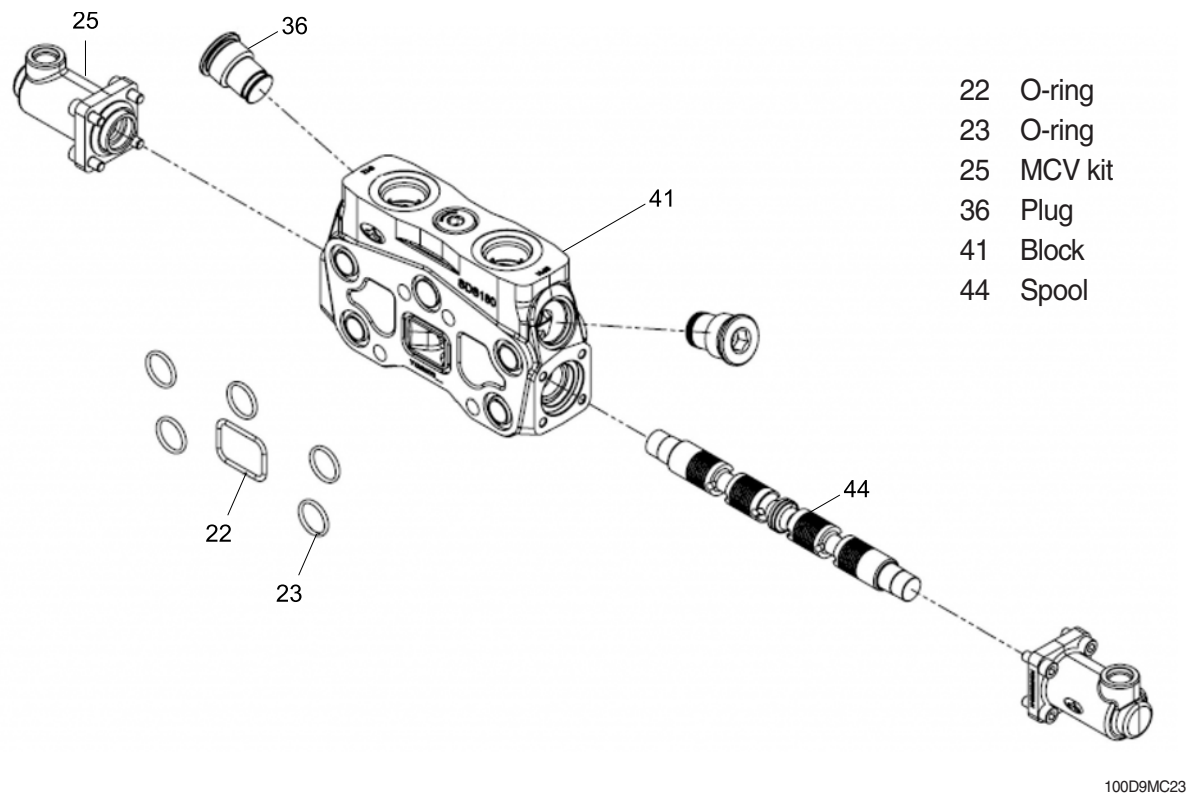
(2) Lift section



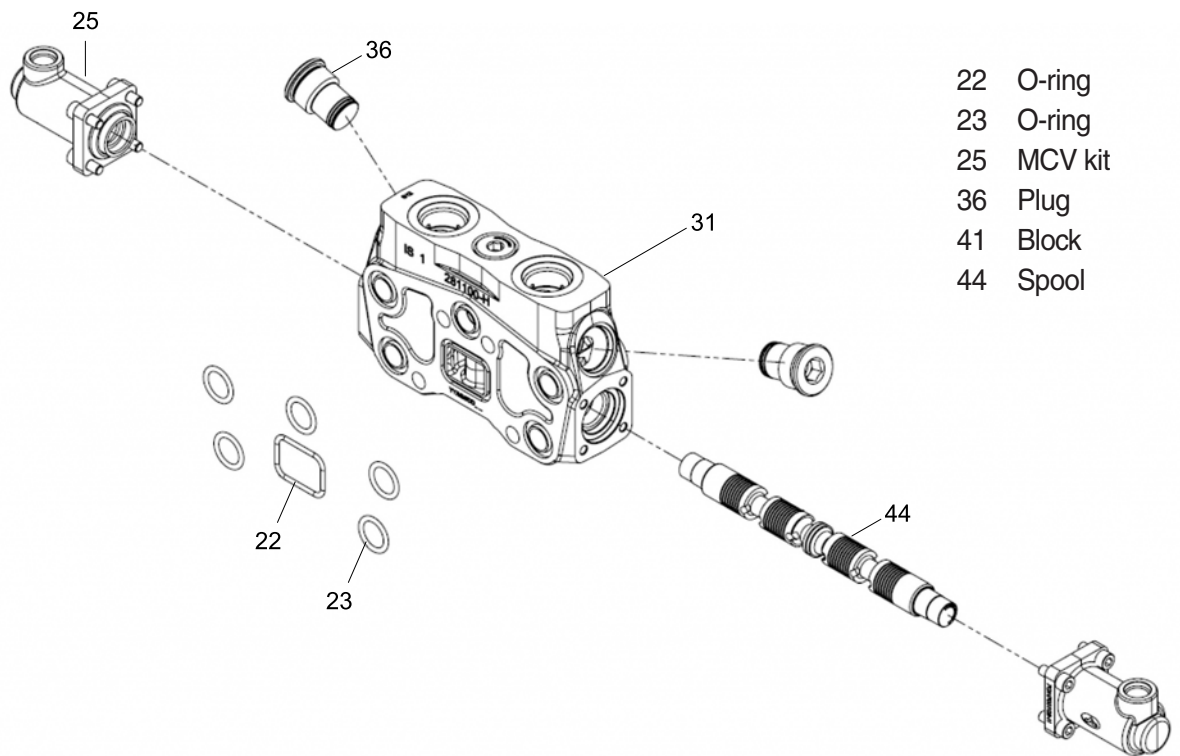
(3) Tilt section



(4) Aux 1 section



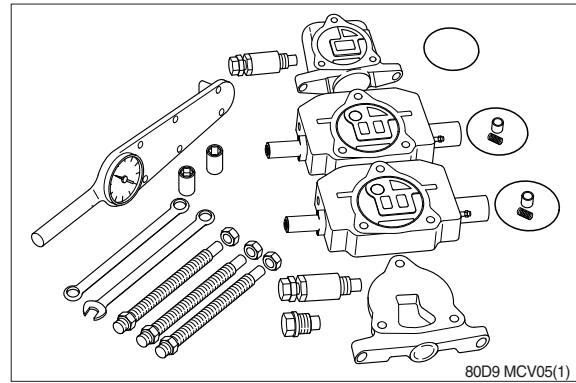
(5) Aux 2, 3 section



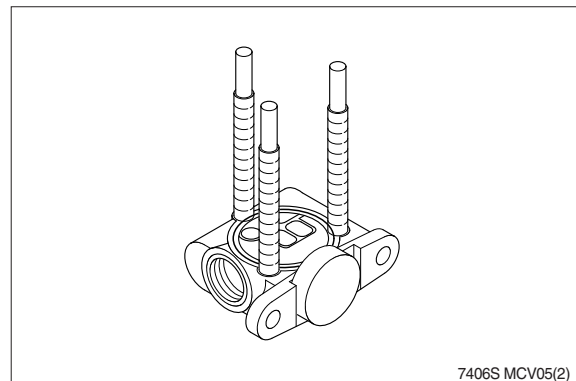
100D9MC24

2) ASSEMBLY

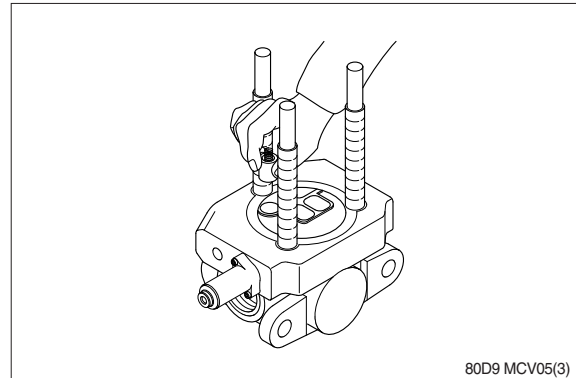
- (1) Lay out valve components on a clean, flat working surface. The inlet assembly will include an O-ring, and the spool section (s) include an O-ring, a load check poppet and a load check spring. Tools required for basic valve assembly include 3/4 and 11/16 open or box end wrenches and a torque wrench with thin wall sockets.



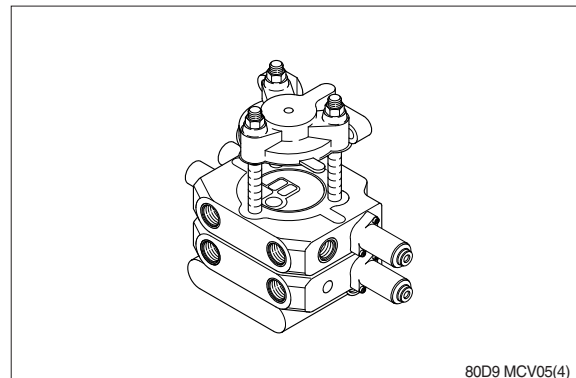
- (2) Assemble tie rod nuts to one end of each tie rod with one or two threads showing. Insert tie rods through tie rod holes of inlet (Large tie rod at top). Lay inlet on end with tie rods up, place O-ring into position.



- (3) Place first spool section (O-ring side up) on inlet section, position O-ring and insert load check poppet (Nose down) and spring (Behind poppet) into load check cavity as shown. Repeat this procedure for each spool section ; The load check springs are compressed by the following sections during assembly.

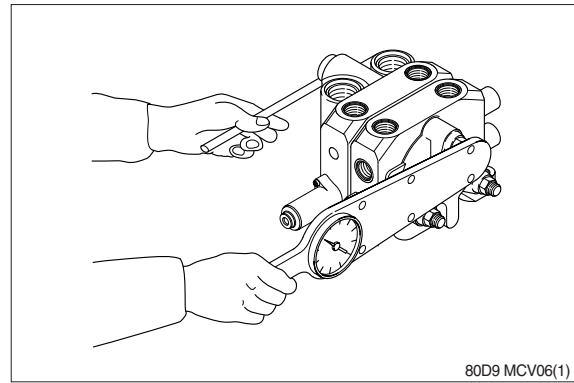


- (4) Position end section on last spool section as shown and hand tighten tie rod nuts. The end section on picture is a "turn around" section without ports. Universal outlet /power beyond section and power beyond and closed center sections are also used as end sections. These end sections do not have O-ring grooves.



- (5) Position valve assembly with the mounting pads of the end sections on a flat surface. To obtain proper alignment of end sections relative to the spool sections apply downward pressure to the end sections ; Snug tie rod nuts to about 10lbf · ft.

Final torque the two 11/16 nuts to 48 ± 5 lbf·ft ; Final torque the 3/4 nut to 74 ± 8 lbf·ft. Check for proper spool movement.

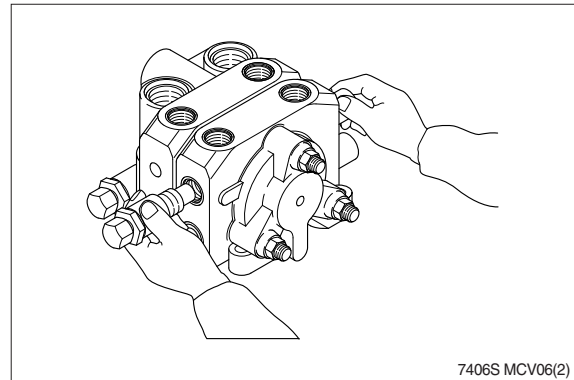


- (6) Install auxiliary valves and plugs and torque to proper specifications.

General assembly notes:

A. Lever assemblies can be installed on section before or after complete valve assembly.

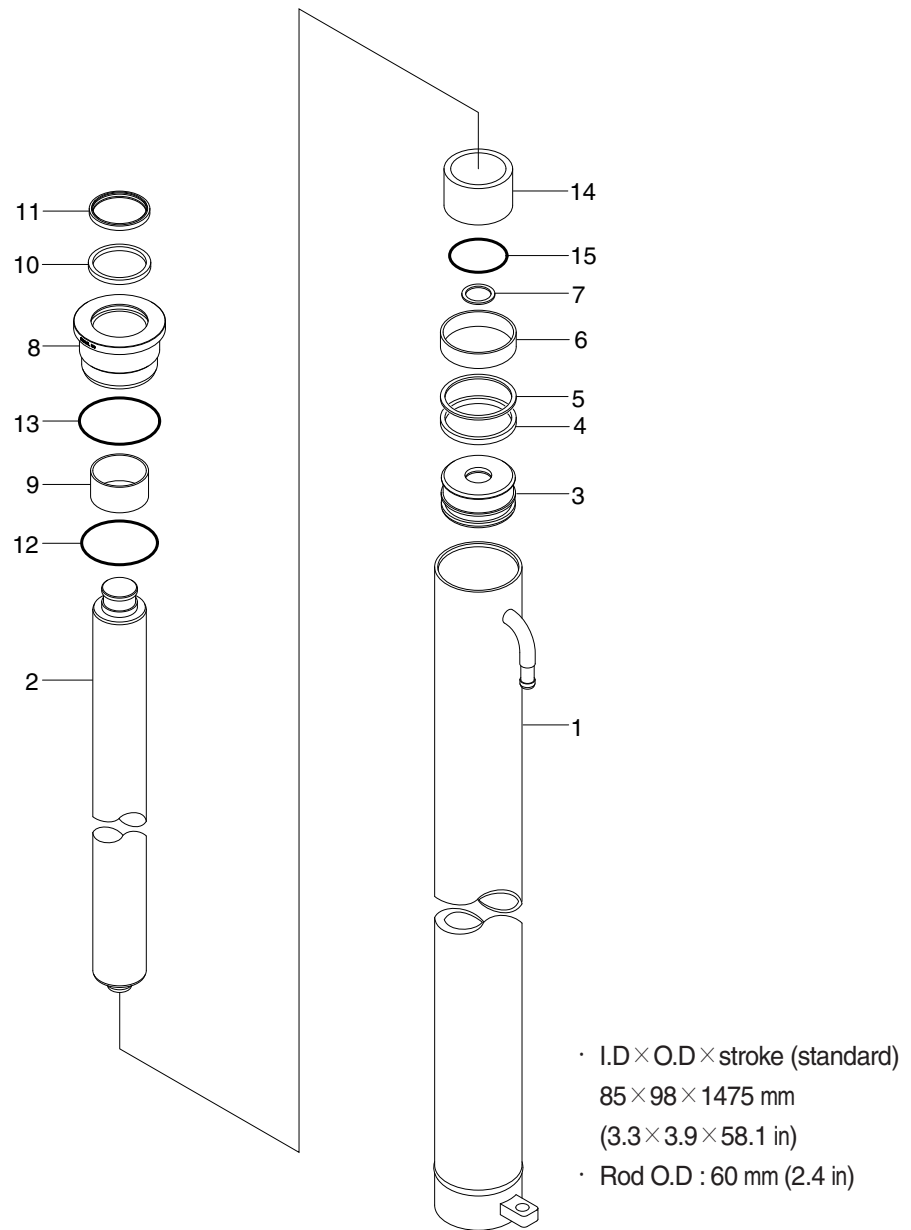
B. The load check and spring may be omitted from assembly in certain circuit conditions (i.e., motor spools).



3. LIFT CYLINDER

1) STRUCTURE

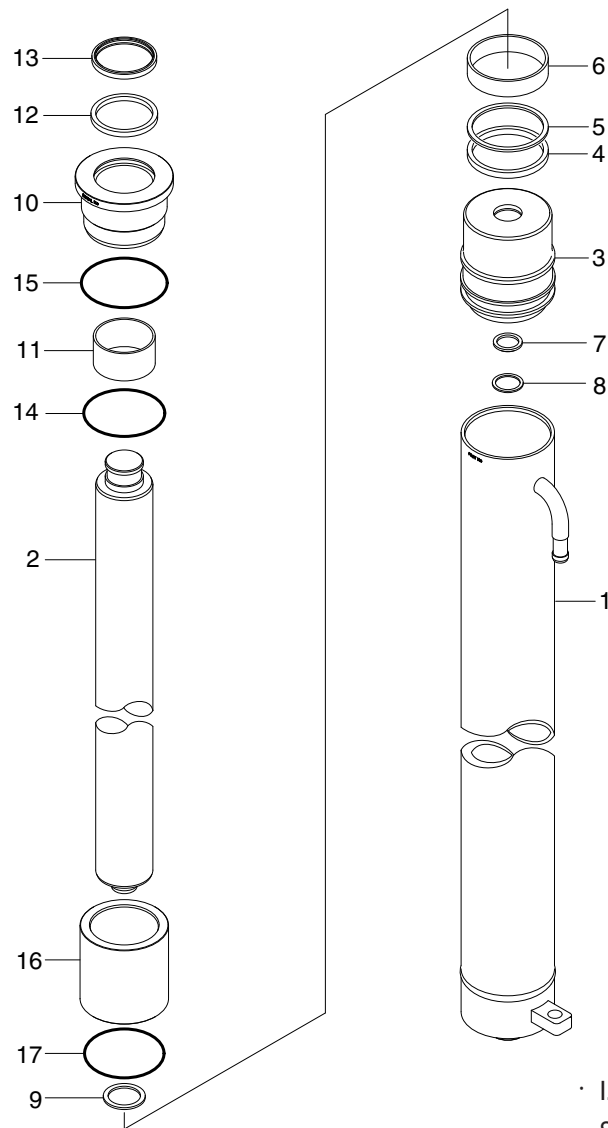
(1) V-mast



3YFJ-07020P

- | | | | | | |
|---|--------------|----|-------------|----|------------|
| 1 | Tube assy | 6 | Wear ring | 11 | Wiper ring |
| 2 | Rod | 7 | Stop ring | 12 | O-ring |
| 3 | Piston | 8 | Rod cover | 13 | O-ring |
| 4 | U-packing | 9 | Rod bushing | 14 | Spacer |
| 5 | Back up ring | 10 | U-packing | 15 | O-ring |

(2) TS-mast

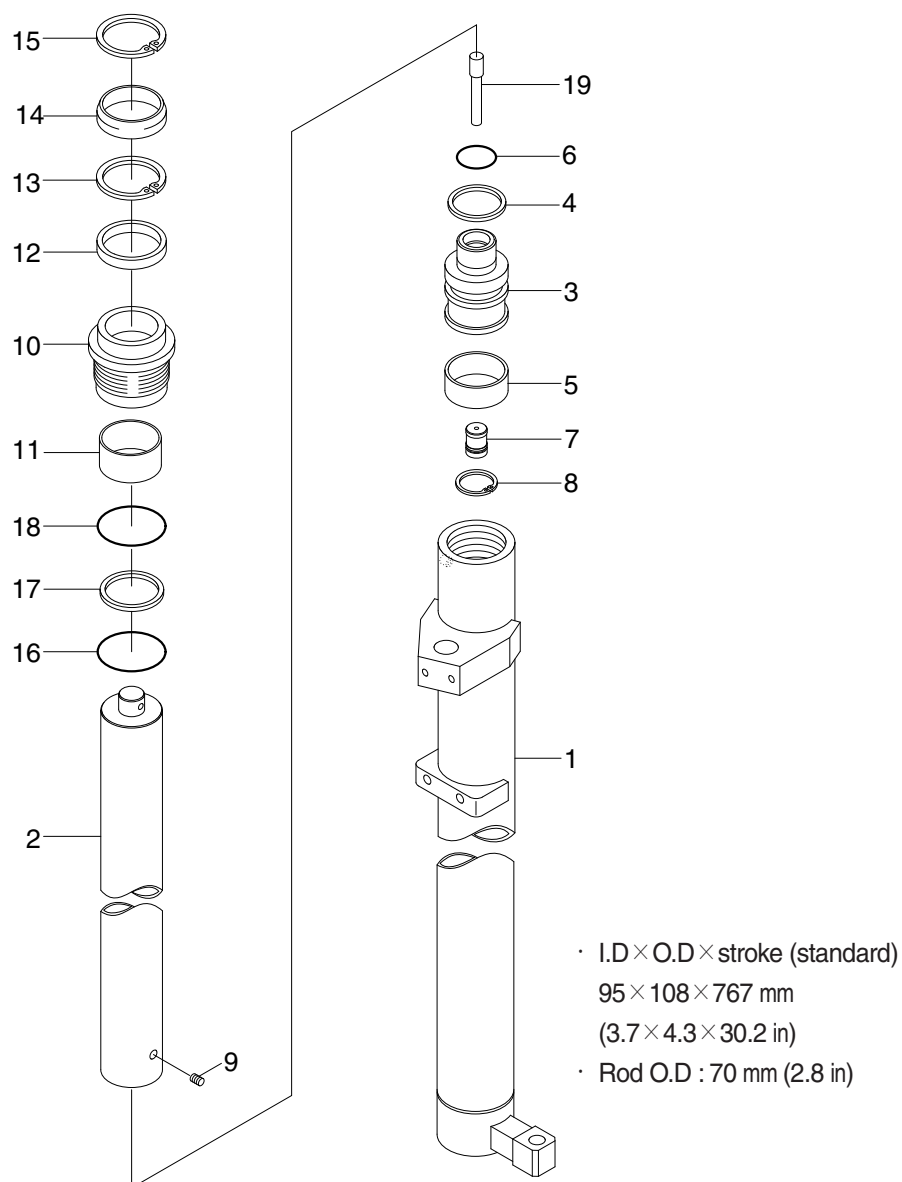


- I.D×O.D×stroke (standard)
85×98×1463 mm
(3.3×3.9×57.6 in)
- Rod O.D : 60 mm (2.4 in)

3YFJ-07210P

- | | | | | | |
|---|--------------|----|---------------|----|------------|
| 1 | Tube assy | 7 | Cushion ring | 13 | Wiper ring |
| 2 | Rod | 8 | Retainer ring | 14 | O-ring |
| 3 | Piston | 9 | Stop ring | 15 | O-ring |
| 4 | U-packing | 10 | Rod cover | 16 | Spacer |
| 5 | Back up ring | 11 | Rod bushing | 17 | O-ring |
| 6 | Wear ring | 12 | U-packing | | |

(3) Free lift (TS-mast)

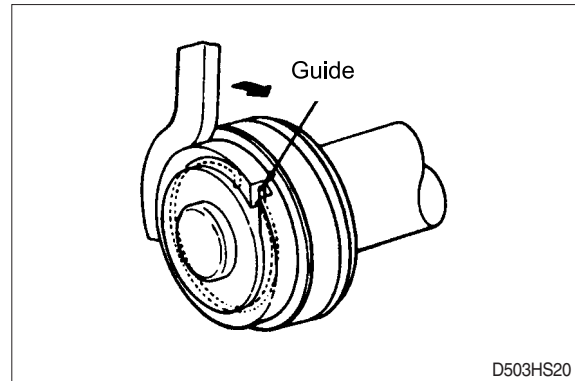


3YFJ-17110P

- | | | | | | |
|---|-------------|----|----------------|----|----------------|
| 1 | Tube assy | 8 | Retaining ring | 15 | Retaining ring |
| 2 | Rod | 9 | Set screw | 16 | O-ring |
| 3 | Piston | 10 | Rod cover | 17 | Backup ring |
| 4 | Piston seal | 11 | Rod bushing | 18 | O-ring |
| 5 | Wear ring | 12 | U-packing | 19 | Pipe |
| 6 | O-ring | 13 | Backup ring | | |
| 7 | Check valve | 14 | Dust wiper | | |

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.



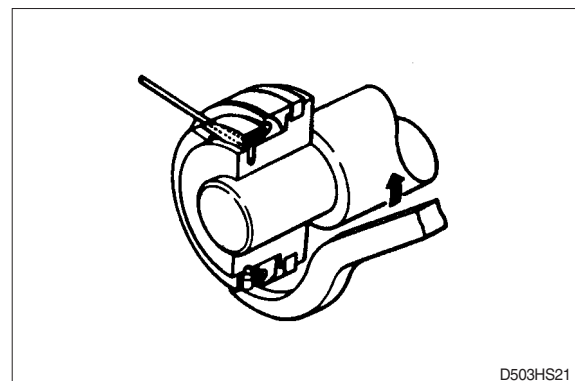
3) CHECK AND INSPECTION

mm (in)

Check item	Standard size	Repair limit	Remedy
Clearance between cylinder rod & bushing	0.05~0.25 (0.002~0.01)	0.4 (0.0015)	Replace bushing
Clearance between piston ring & tube	0.05~0.35 (0.002~0.013)	0.5 (0.02)	Replace piston ring

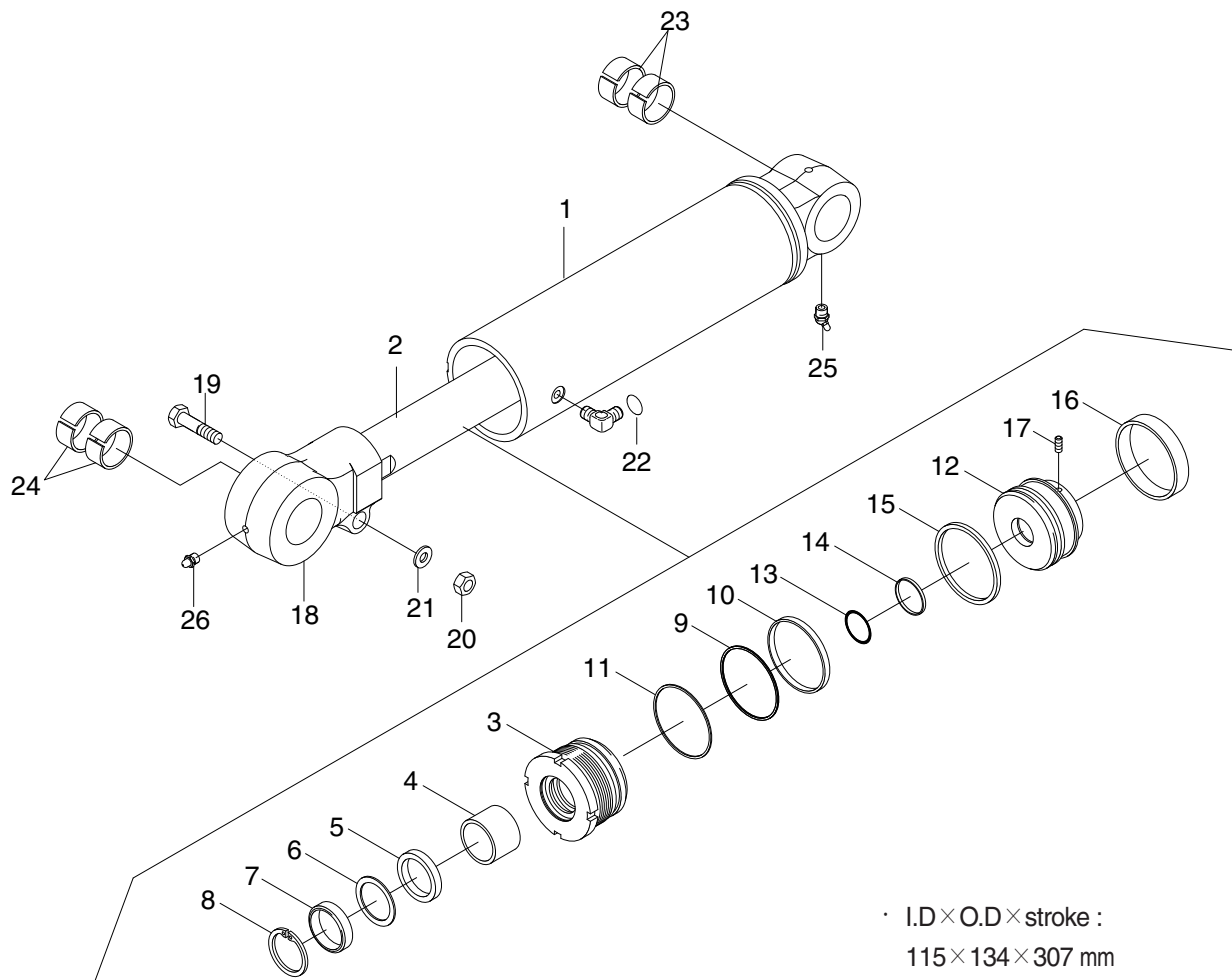
4) ASSEMBLY

- (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



- I.D×O.D×stroke :
115×134×307 mm
(4.5×5.3×12.1 in)
- Rod O.D : 60 mm (2.36 in)

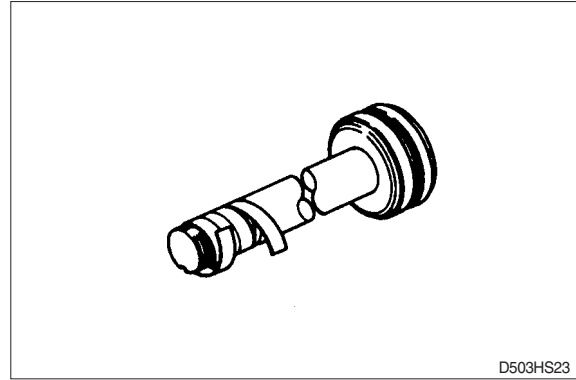
3YFJ-08500P

1	Tube assy	10	Back up ring	19	Hex bolt
2	Rod	11	O-ring	20	Hex nut
3	Rod cover	12	Piston	21	Spring washer
4	Pin bushing	13	O-ring	22	O-ring
5	U-packing	14	Back up ring	23	Pin bushing
6	Back up ring	15	Piston seal	24	Pin bushing
7	Wiper ring	16	Wear ring	25	Grease nipple
8	Stop ring	17	Set screw	26	Grease nipple
9	O-ring	18	Eye		

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)

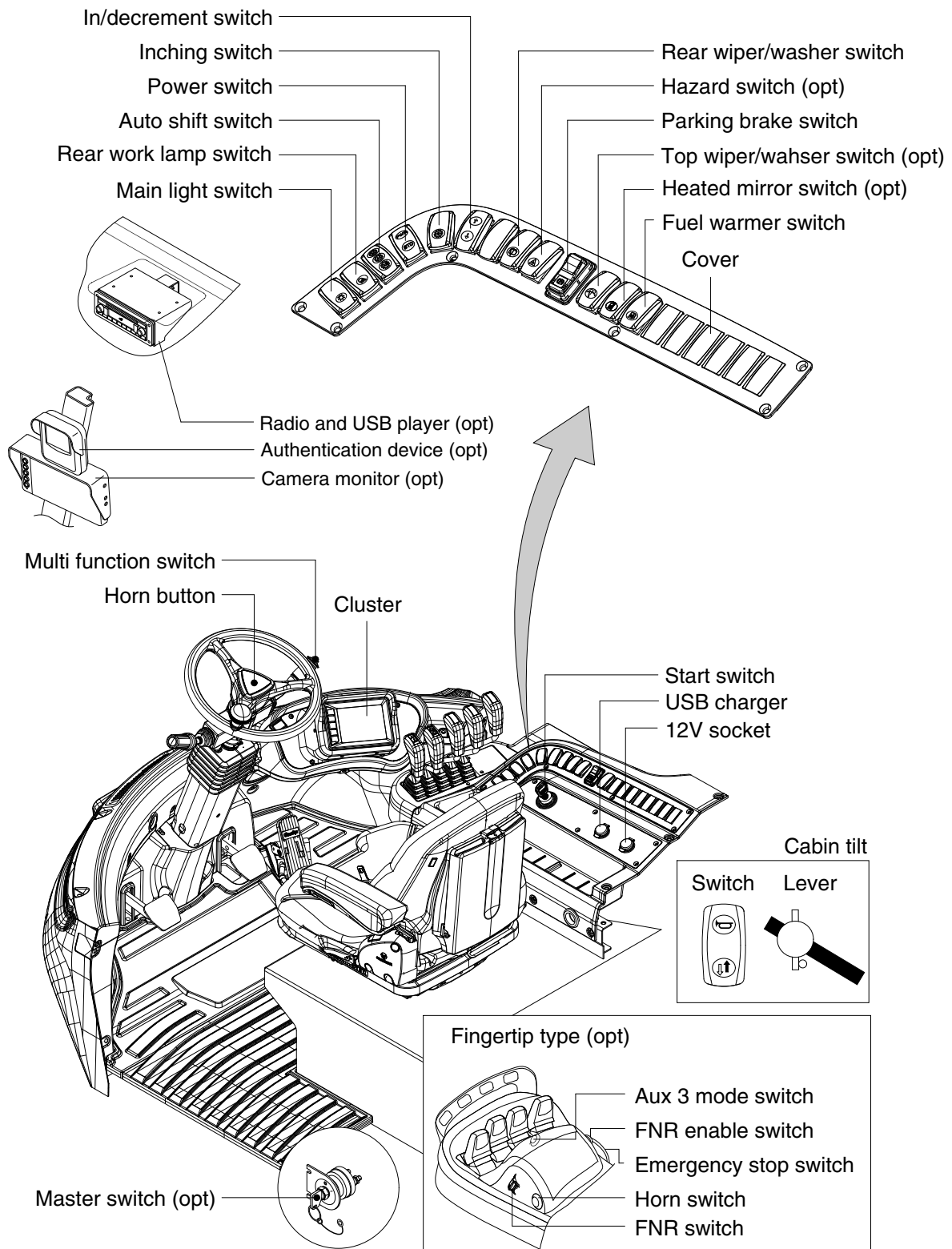
Check item	Standard size	Repair limit	Remedy
Clearance between cylinder rod & bushing	0.072~0.288 (0.003~0.011)	0.5 (0.020)	Replace bushing
Clearance between rod head bushing & pin	0.10~0.35 (0.004~0.014)	0.6 (0.024)	Replace bushing

SECTION 7 ELECTRICAL SYSTEM

Group 1	Component location	7-1
Group 2	Electrical circuit	7-3
Group 3	Cluster	7-20
Group 4	Component specification	7-61
Group 5	Connector destination	7-62
Group 6	Troubleshooting	7-66

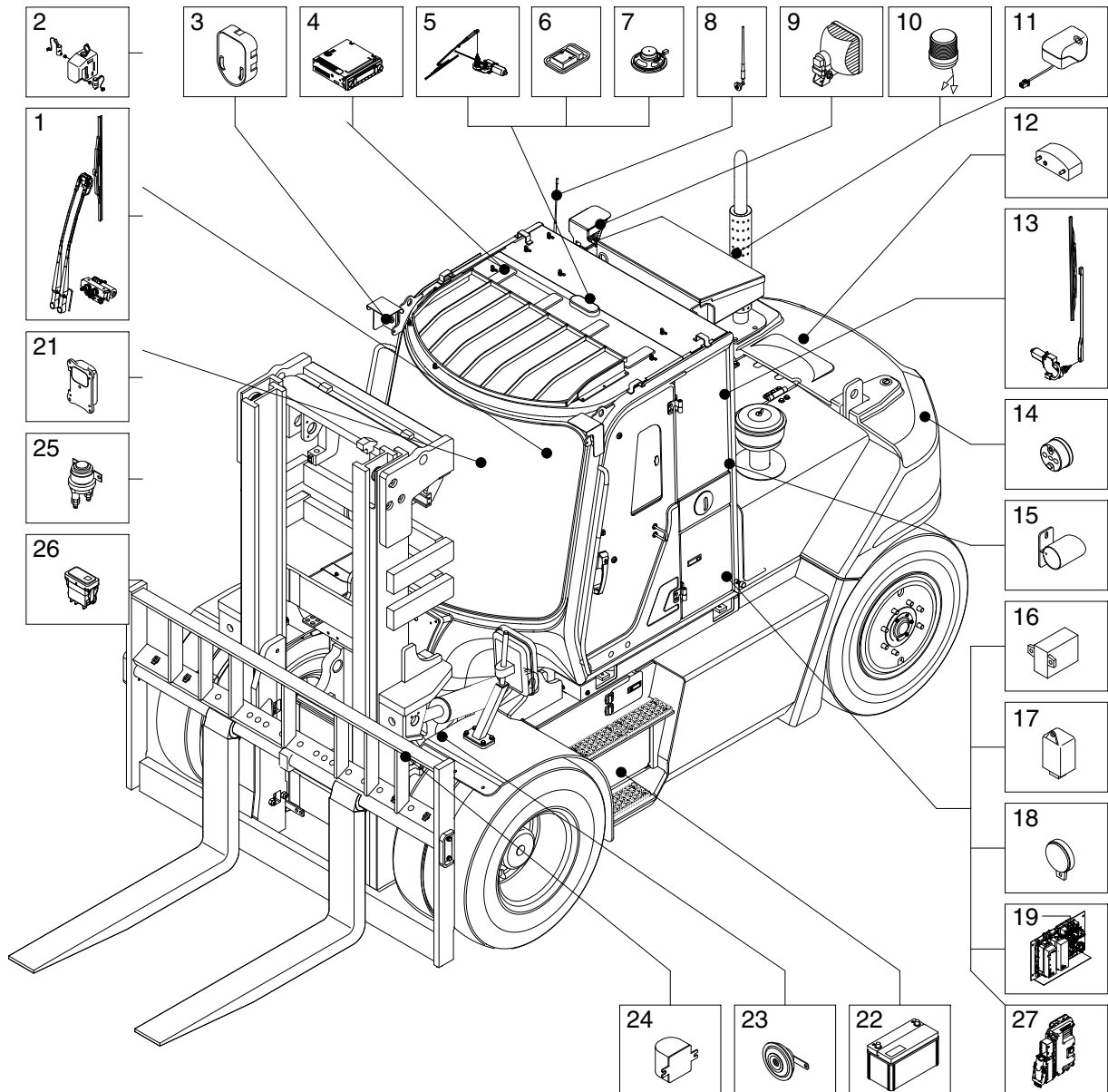
GROUP 1 COMPONENT LOCATION

1. LOCATION 1



100D97ES01

2. LOCATION 2

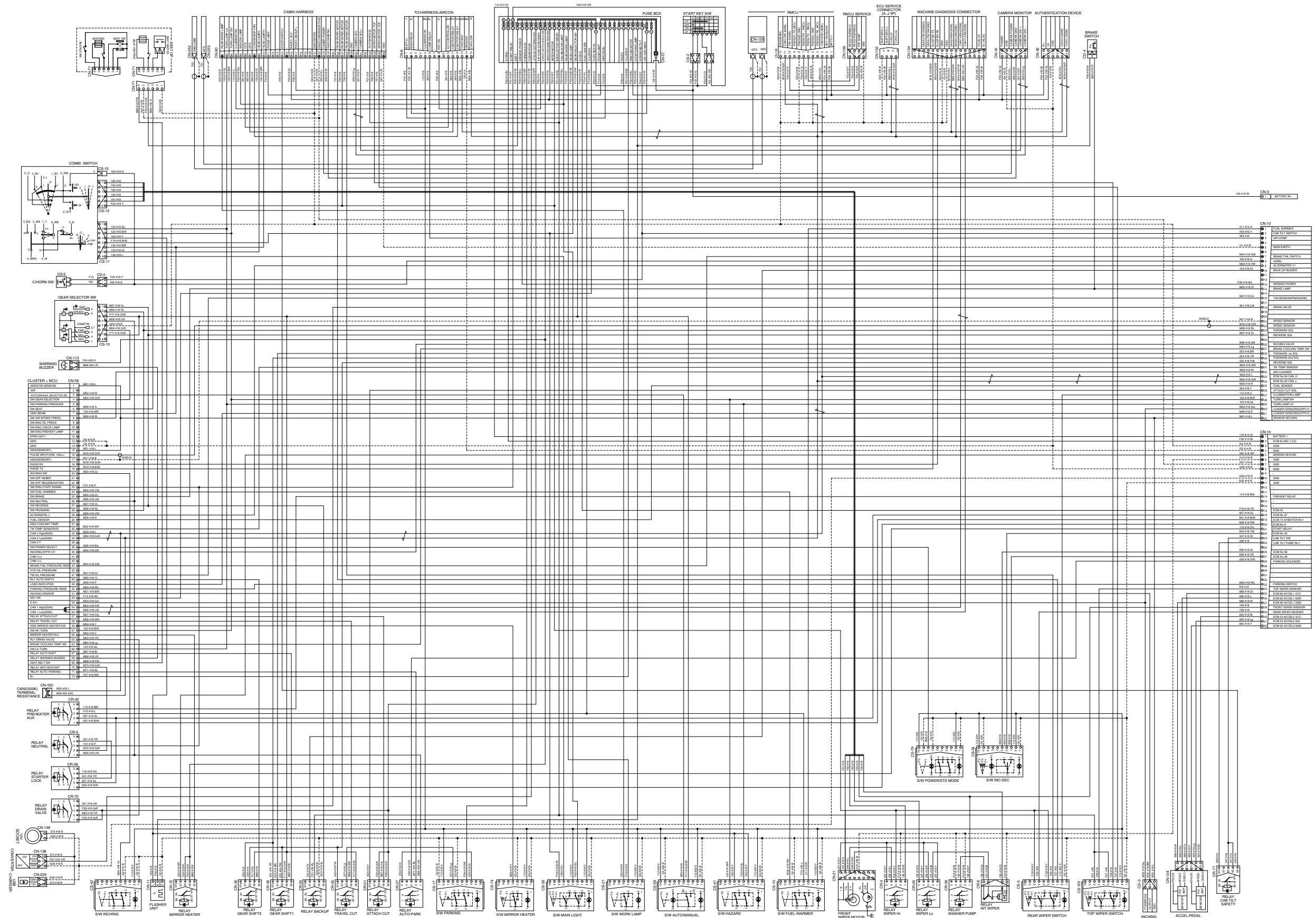


100D97ES02

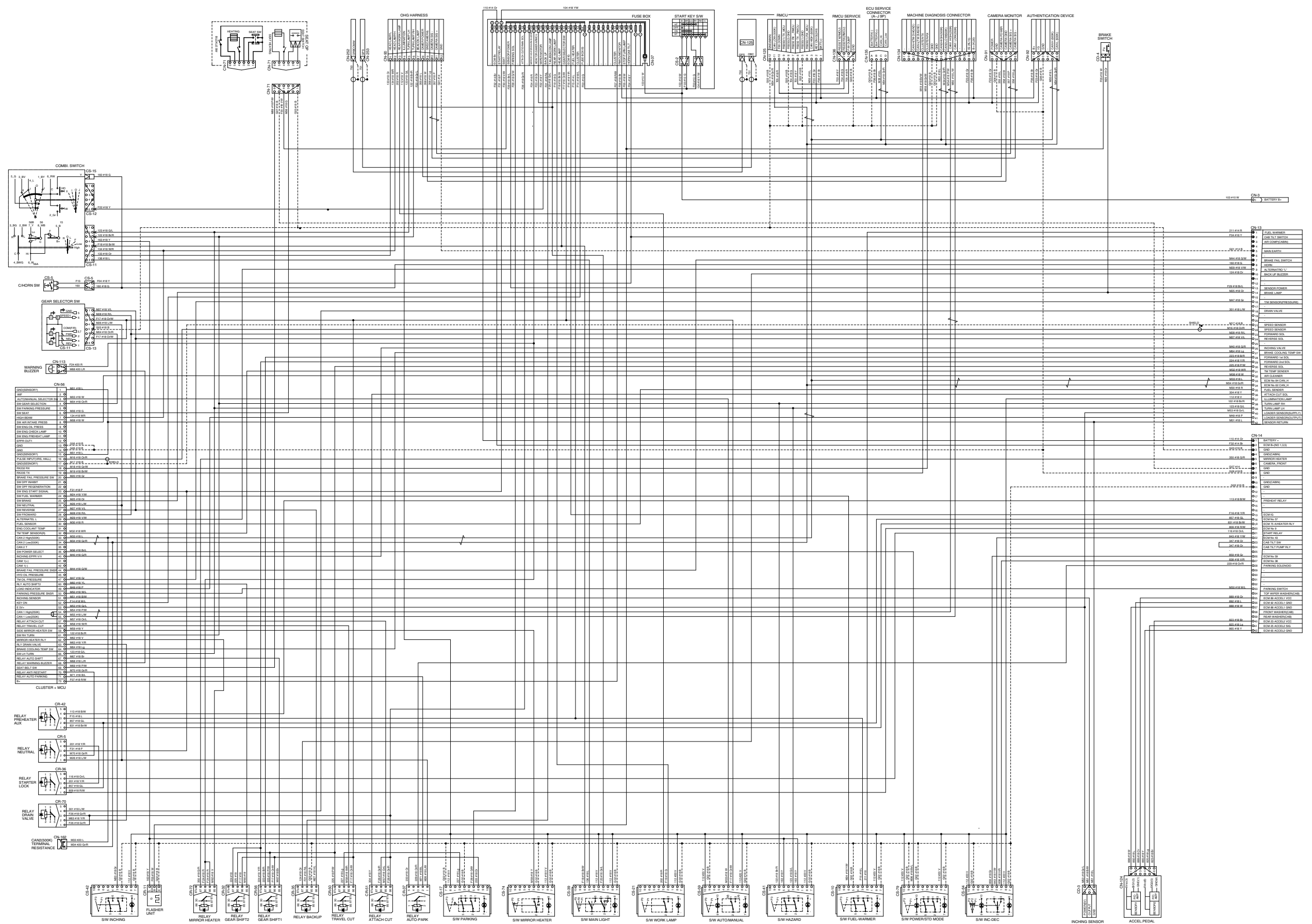
- | | | |
|-----------------------------|--------------------------|-----------------------|
| 1 Wiper assembly | 10 Beacon lamp | 19 ECU |
| 2 Washer reservoir tank | 11 Camera (opt) | 21 RMCU (opt) |
| 3 Head and turn signal lamp | 12 License lamp (opt) | 22 Battery |
| 4 Radio and USB player | 13 Rear wiper assembly | 23 Horn |
| 5 Top wiper assembly (opt) | 14 Rear combination lamp | 24 Angle sensor (opt) |
| 6 Room lamp switch | 15 Back buzzer | 25 Start relay |
| 7 Speaker | 16 Wiper relay | 26 Power ON indicator |
| 8 Mobile antenna | 17 Flasher unit | 27 Safety controller |
| 9 Work lamp | 18 Warning buzzer | |

GROUP 2 ELECTRICAL CIRCUIT

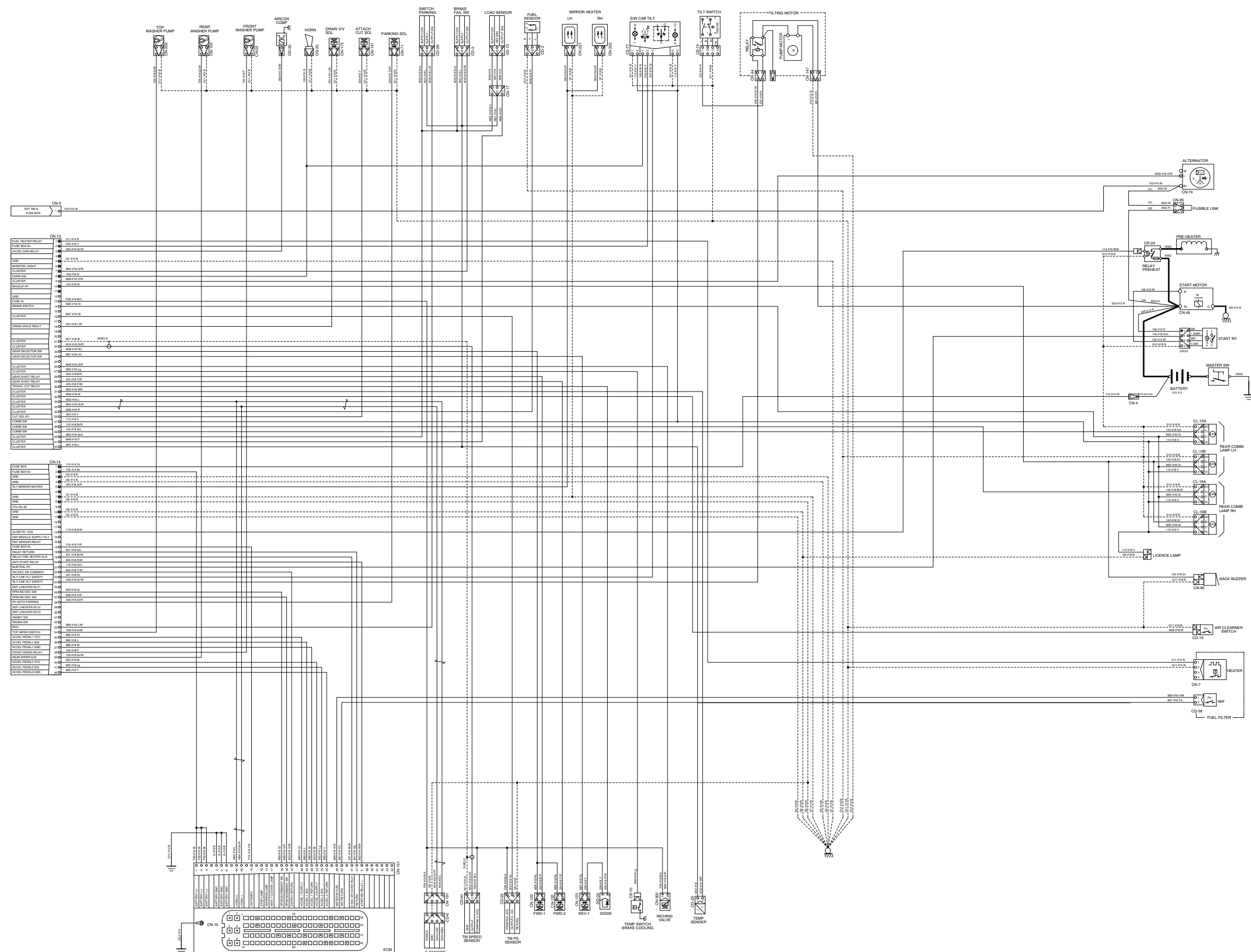
· ELECTRICAL CIRCUIT (1/4, CABIN TYPE)



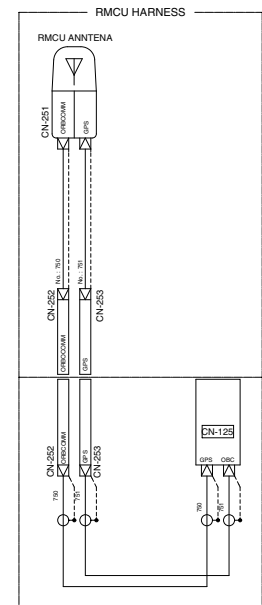
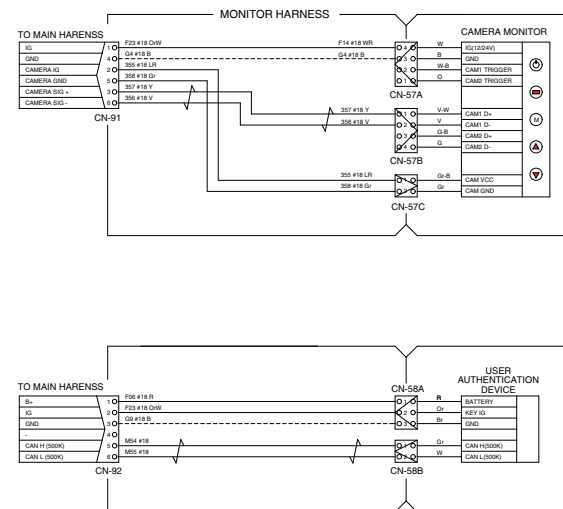
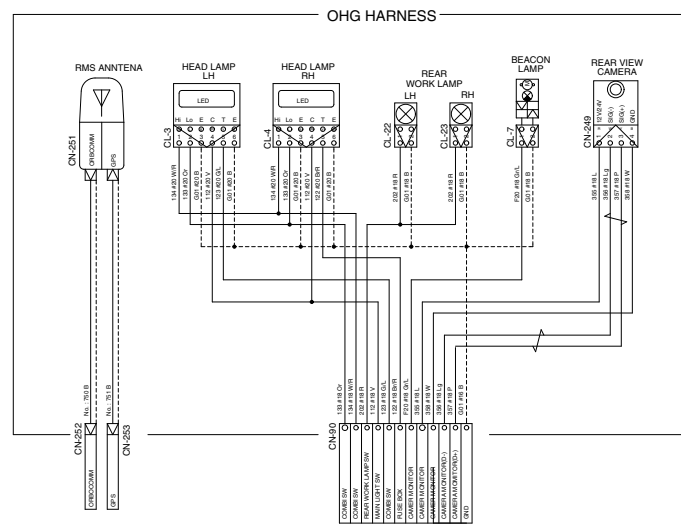
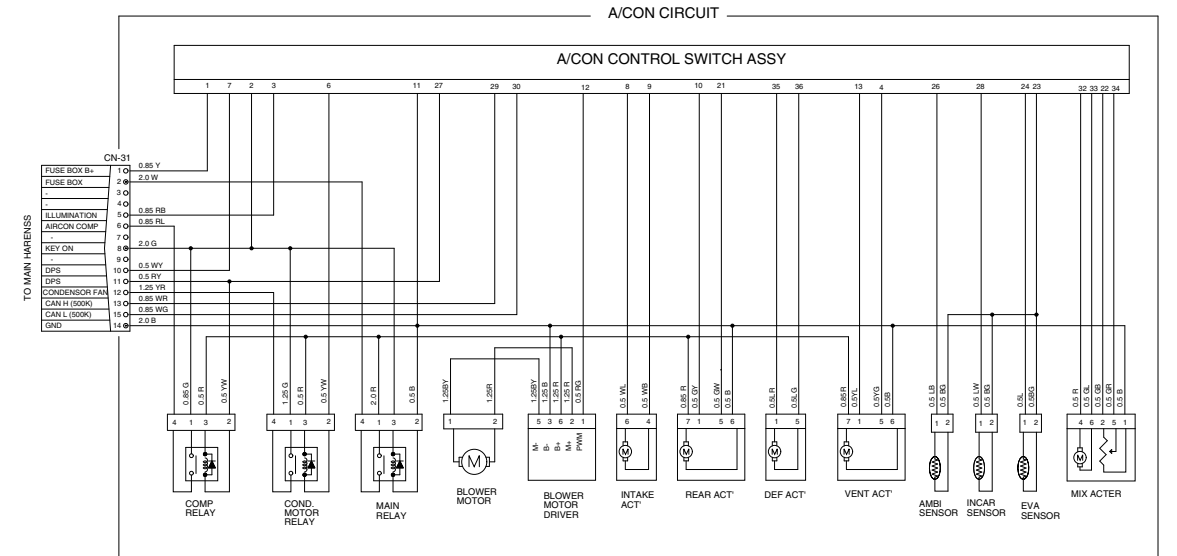
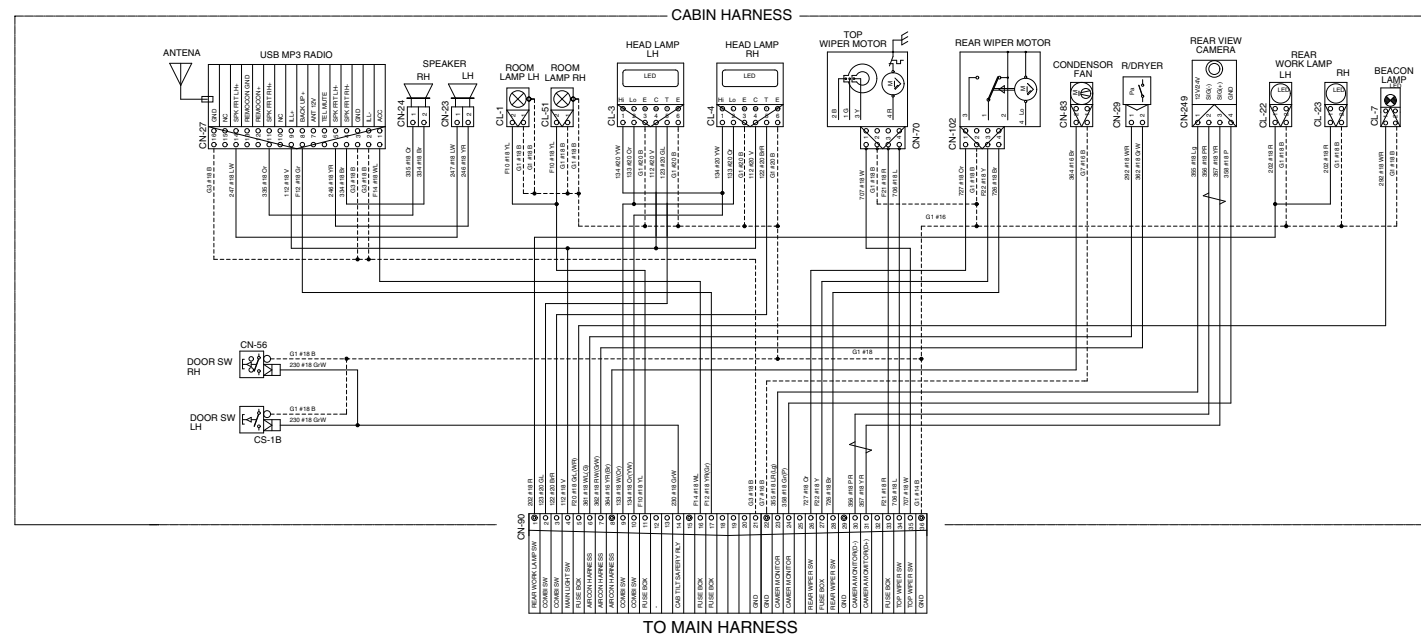
ELECTRICAL CIRCUIT (2/4, OVERHEAD GUARD TYPE)



• ELECTRICAL CIRCUIT (3/4)



ELECTRICAL CIRCUIT (4/4)

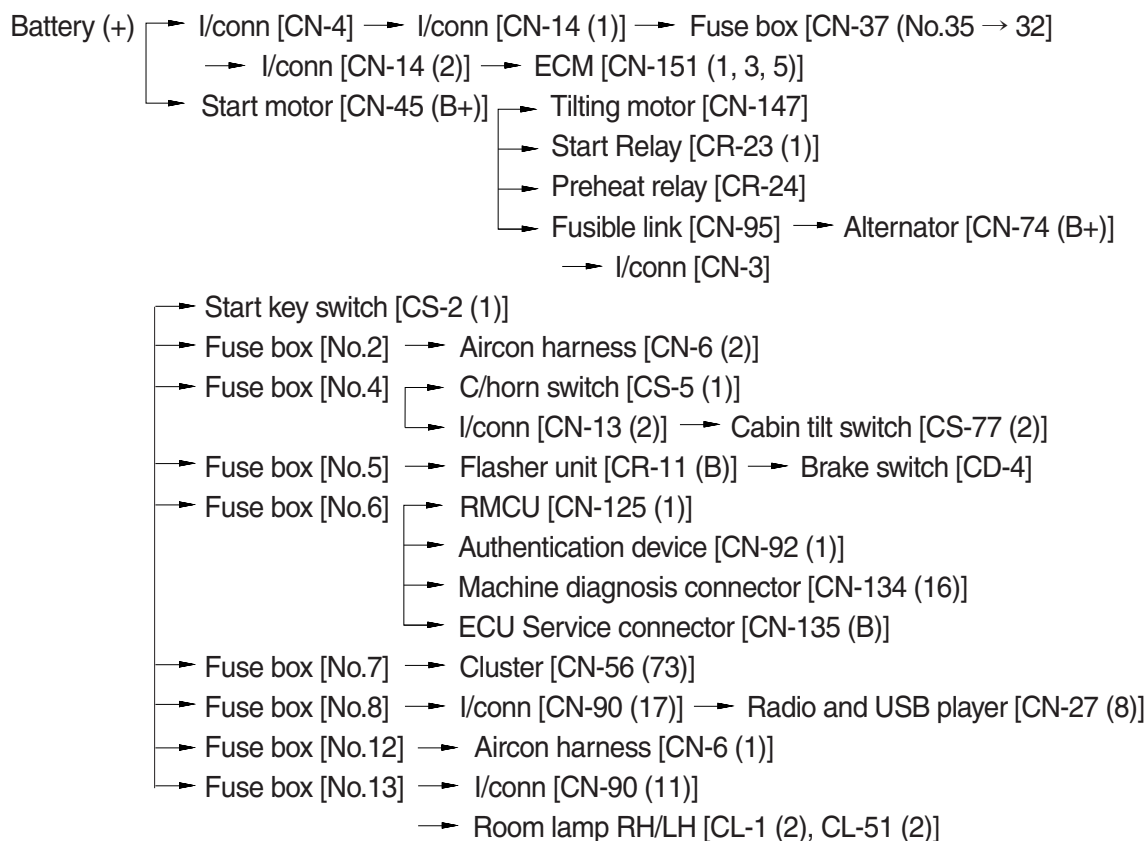


1. POWER CIRCUIT

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

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

1) OPERATING FLOW



※ I/conn : Intermediate connector

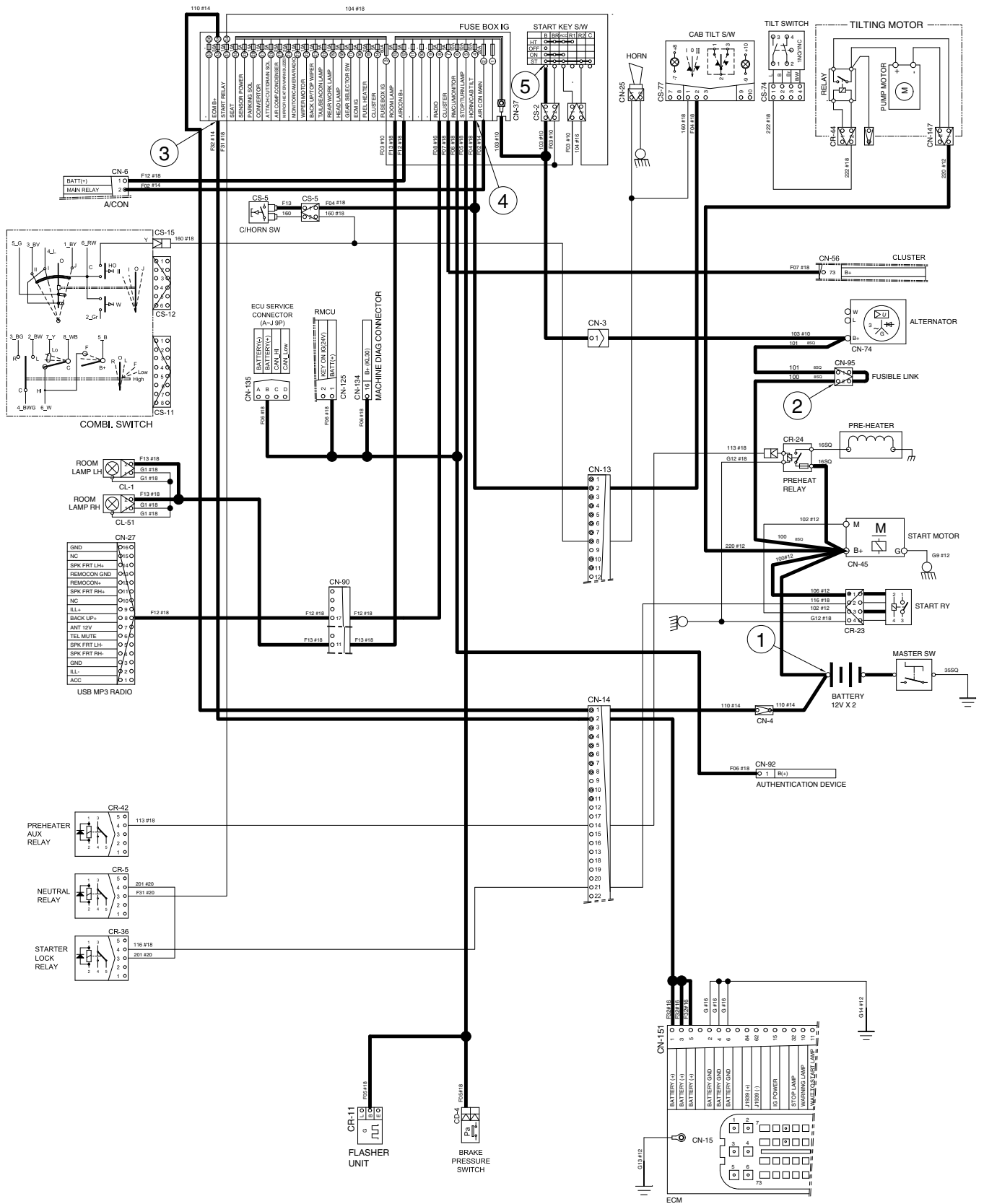
2) CHECK POINT

Engine	Key switch	Check point	Voltage
Stop	OFF	① - GND (Battery (+)) ② - GND (Fusible link) ③ - GND (Fuse No.33) ④ - GND (Fuse No.2~13) ⑤ - GND (Start key)	24V

※ GND : Ground

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

POWER CIRCUIT



100D97EL03

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

2. STARTING CIRCUIT

1) OPERATING FLOW

Battery (+) terminal → Start motor [CN-45 (B+)]

- Fusible link [CN-95] → Alternator [CN-74 (B+)] → I/conn [CN-3 (1)] → Start switch [CS-2 (1)]
- Start relay [CR-23 (1)]
- Heater relay [CR-24]

The engine can be started only when the gear selector lever is in neutral position.

The operator should be seated when starting.

(1) When start switch is in ON position

Start switch ON [CS-2 (2, 1)] → Fuse box [CN-37 (3)]

→ Power is supplied with the electric component

(2) When start key switch is START position

Start switch START [CS-2 (2)] → Fuse box [No. 34→31] → Neutral relay [CR-5 (3)→(4)]

→ Start lock relay [CR-36 (3)→(4)] → I/conn [CN-14 (21)] → Start relay [CR-23 (2)→(4)]

→ Start motor [CN-45 (M)] → Start motor operating

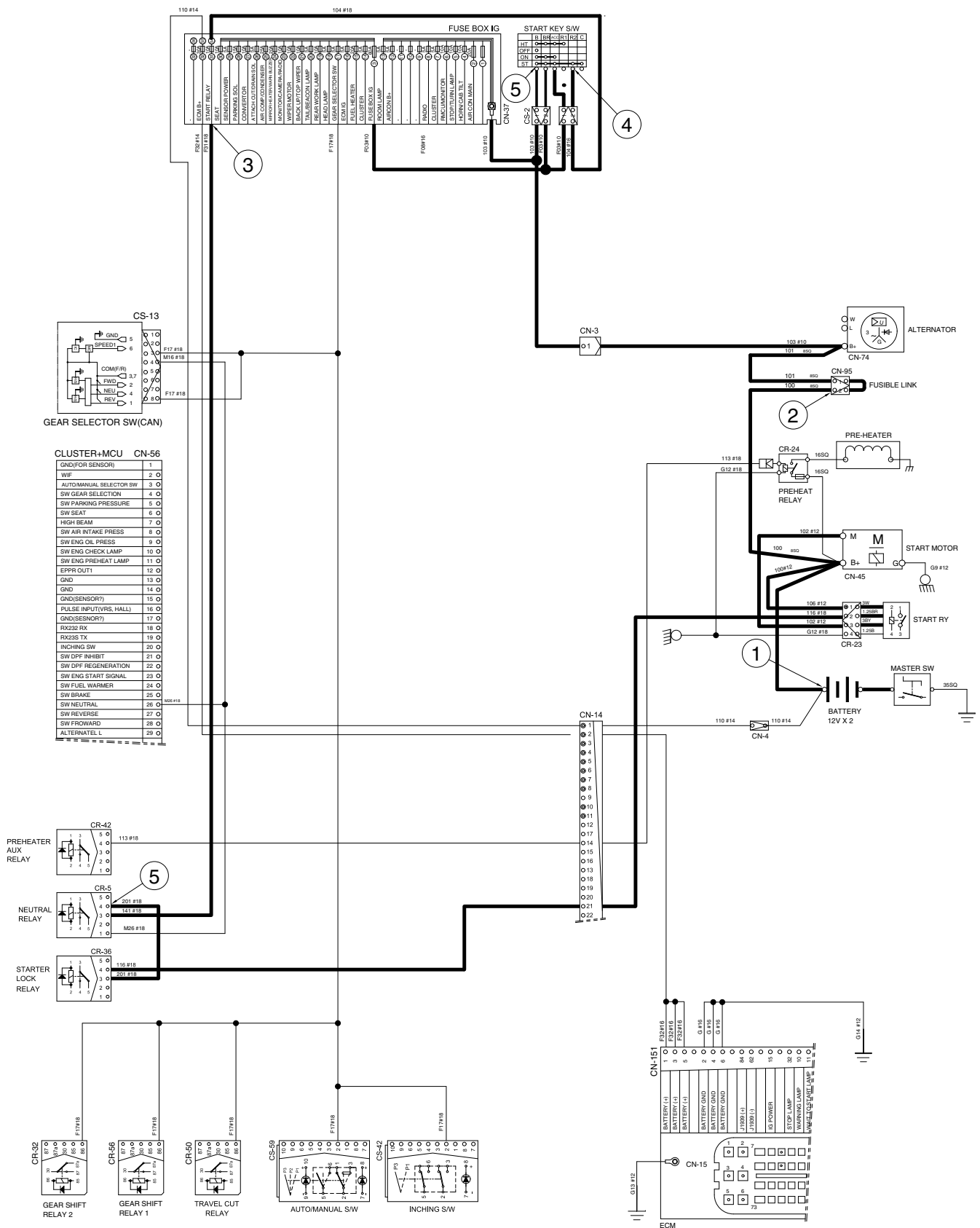
2) CHECK POINT

Engine	Start switch	Check point	Voltage
Running	ON	① - GND (Battery B+) ② - GND (Fusible link) ③ - GND (Fuse box No.31) ④ - GND (Start switch) ⑤ - GND (Neutral relay)	24V

※ GND : Ground

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

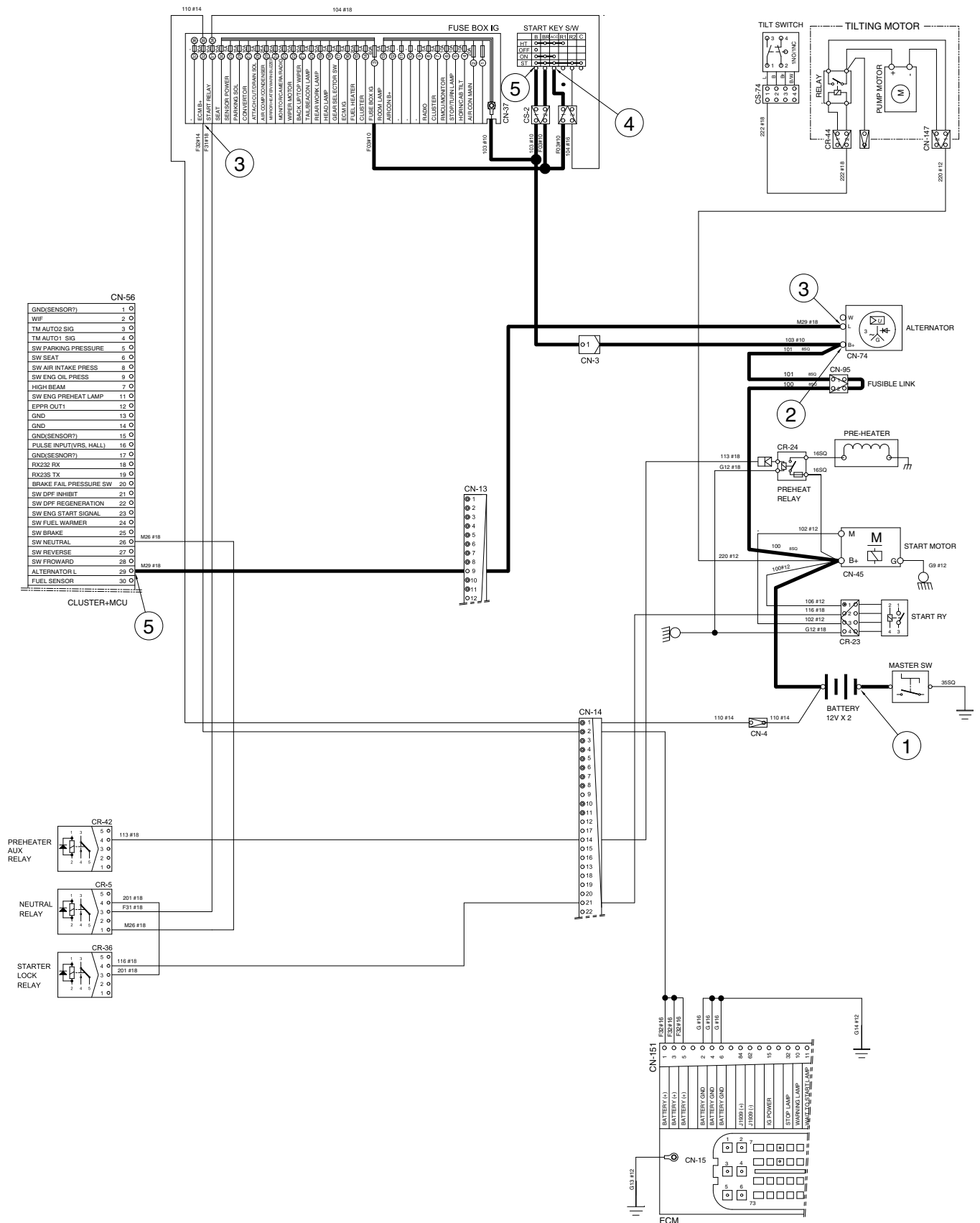
STARTING CIRCUIT



100D97EL04

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

CHARGING CIRCUIT



100D97EL05

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

4. PREHEATING CIRCUIT

Combustion chamber glow plugs are used in order to give satisfactory starting of low ambient temperatures.

1) OPERATING FLOW

Battery (+) terminal → Start motor [CN-45 (B+)] → Preheat relay [CR-24]

When you turn the start switch to the ON position, the preheat relay makes the preheater operated and the engine warm up lamp of the cluster turned ON.

Start switch ON [CS-2 (2)]

→ Fuse box [No.15] → Fuel heater switch [CS-10 (3)→(2)] → I/conn [CN-13 (1)]
→ Fuel heater [CN-7 (1)] → Fuel heater operating
→ ECM [CN-151 (31)] → I/conn [CN-14 (19)] → Preheater aux relay [CR-42 (1)→(4)]
→ I/conn [CN-14 (14)] → Preheater relay [CR-24] → Preheater operating

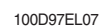
2) CHECK POINT

Engine	Start switch	Check point	Voltage
Stop	ON	① - GND (Battery B+) ② - GND (Fusible link) ③ - GND (Preheater) ④ - GND (preheat relay) ⑤ - GND (Fuel warmer switch) ⑥ - GND (Fuel heater)	24V

※ GND : Ground

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

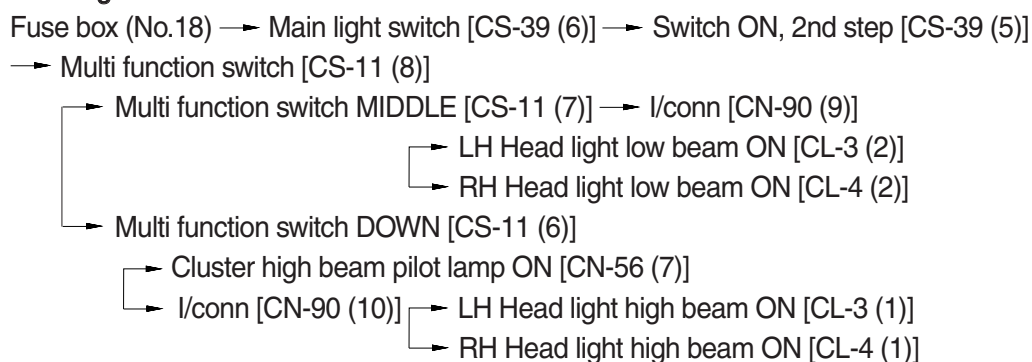
※ The circuit diagram may differ from the equipment, so please check before a repair.



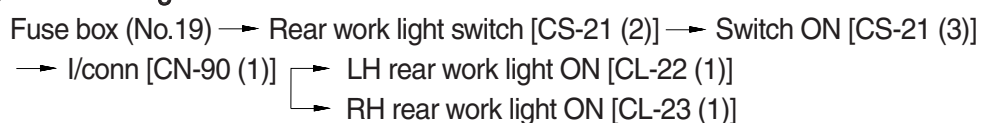
5. HEAD LIGHT AND REAR WORK LIGHT CIRCUIT

1) OPERATING FLOW

(1) Head light



(2) Rear work light



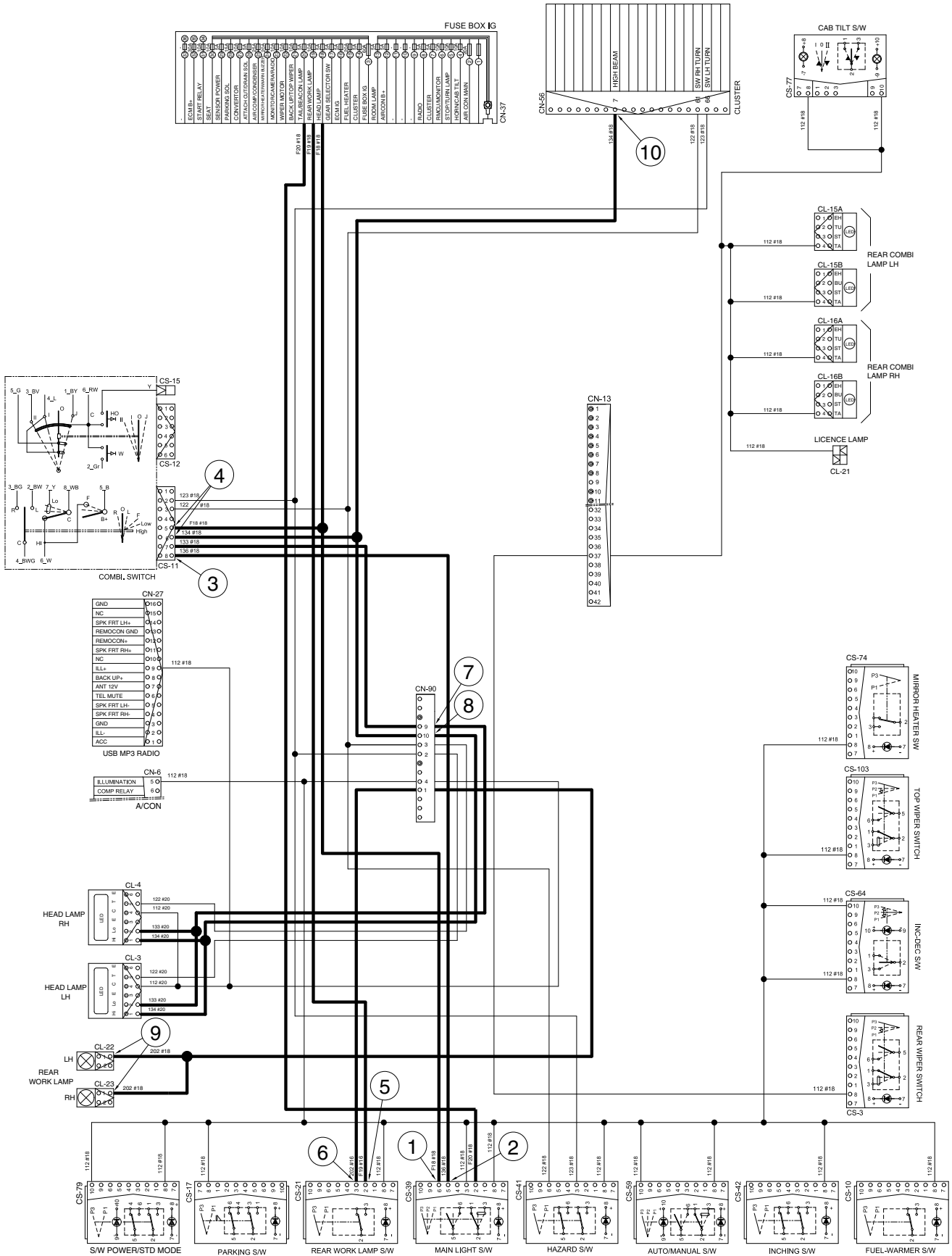
2) CHECK POINT

Engine	Start switch	Check point	Voltage
Stop	ON	① - GND (Main light switch input) ② - GND (Main light switch output) ③ - GND (Multifunction switch input) ④ - GND (Multifunction switch output) ⑤ - GND (Rear work light switch input) ⑥ - GND (Rear work light switch output) ⑦ - GND (Low beam) ⑧ - GND (High beam) ⑨ - GND (Rear work light) ⑩ - GND (Cluster high beam pilot lamp input)	20~25V

※ GND : Ground

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

HEAD LIGHT AND REAR WORK LIGHT CIRCUIT

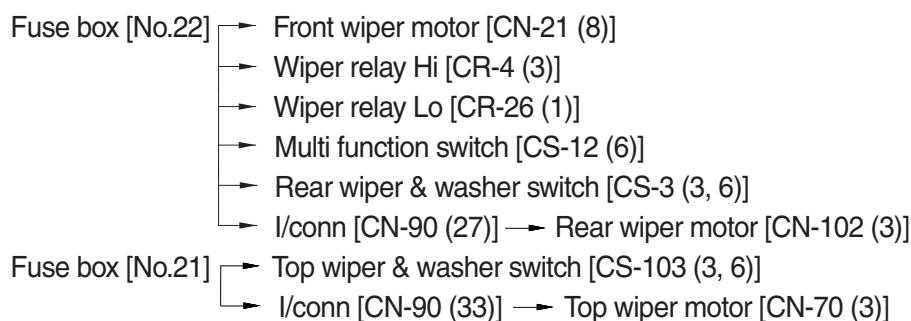


100D97EL08

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

6. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW



(1) Front washer switch ON

- ① Washer switch ON [CS-12 (6)→(2)] → I/conn [CN-14 (38)] → Front washer pump [CN-22 (2)]
→ Washer pump relay [CR-38 (1)→(3)] → Int wiper relay [CR-6 (1)→(2)]
→ Wiper Lo relay [CR-26 (2)→(3)] → Front wiper motor [CN-21 (2)]
→ Wiper motor operating (low)

(2) Front wiper switch ON

- ① INT position
Washer switch ON [CS-12 (6)→(1)] → Int wiper relay [CR-6 (3)→(2)] → Wiper Lo relay [CR-26 (2)→(3)]
Front wiper motor [CN-21 (2)] → Front wiper motor intermittently operating
- ② Lo position
Wiper switch ON [CS-12 (6)→(4)] → Wiper Lo relay [CR-26 (5)→(2)] →
Front wiper motor [CN-21 (2)] → Front wiper motor operating (low)
- ③ Hi position
Wiper switch ON [CS-12 (6)→(3)] → Wiper Hi relay [CR-4 (1)→(4)] →
Front wiper motor [CN-21 (4)] → Front wiper motor operating (high)

(3) Auto-parking (when switch OFF)

Switch OFF [CS-12 (3)] → Wiper relay Lo [CR-26 (5)→(3)] → Front wiper motor [CN-21 (2)] →
Wiper motor stop

(4) Rear wiper and washer switch

- ① Wiper switch ON (1st step)
Wiper switch ON [CS-3 (3)→(2)] → I/conn [CN-90 (36)] → Rear wiper motor [CN-102 (4)] →
Rear wiper motor operating
- ② Washer switch ON (2nd step)
Washer switch ON [CS-3 (6)→(5)] → I/conn [CN-14 (39)] → Rear washer tank [CN-103 (2)] →
Washer operating
Wiper switch ON [CS-3 (3)→(2)] → I/conn [CN-90 (36)] → Rear wiper motor [CN-102 (4)] →
Rear wiper motor operating

(5) Top wiper and washer switch

- ① Wiper switch ON (1st step)
Wiper switch ON [CS-103 (3)→(2)] → I/conn [CN-90 (34)] → Top wiper motor [CN-70 (4)] →
Top wiper motor operating
- ② Washer switch ON (2nd step)
Washer switch ON [CS-103 (6)→(5)] → I/conn [CN-14 (34)] → Top washer tank [CN-202 (2)] →
Washer operating
Wiper switch ON [CS-103 (3)→(2)] → I/conn [CN-90 (34)] → Top wiper motor [CN-70 (4)] →
Top wiper motor operating

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

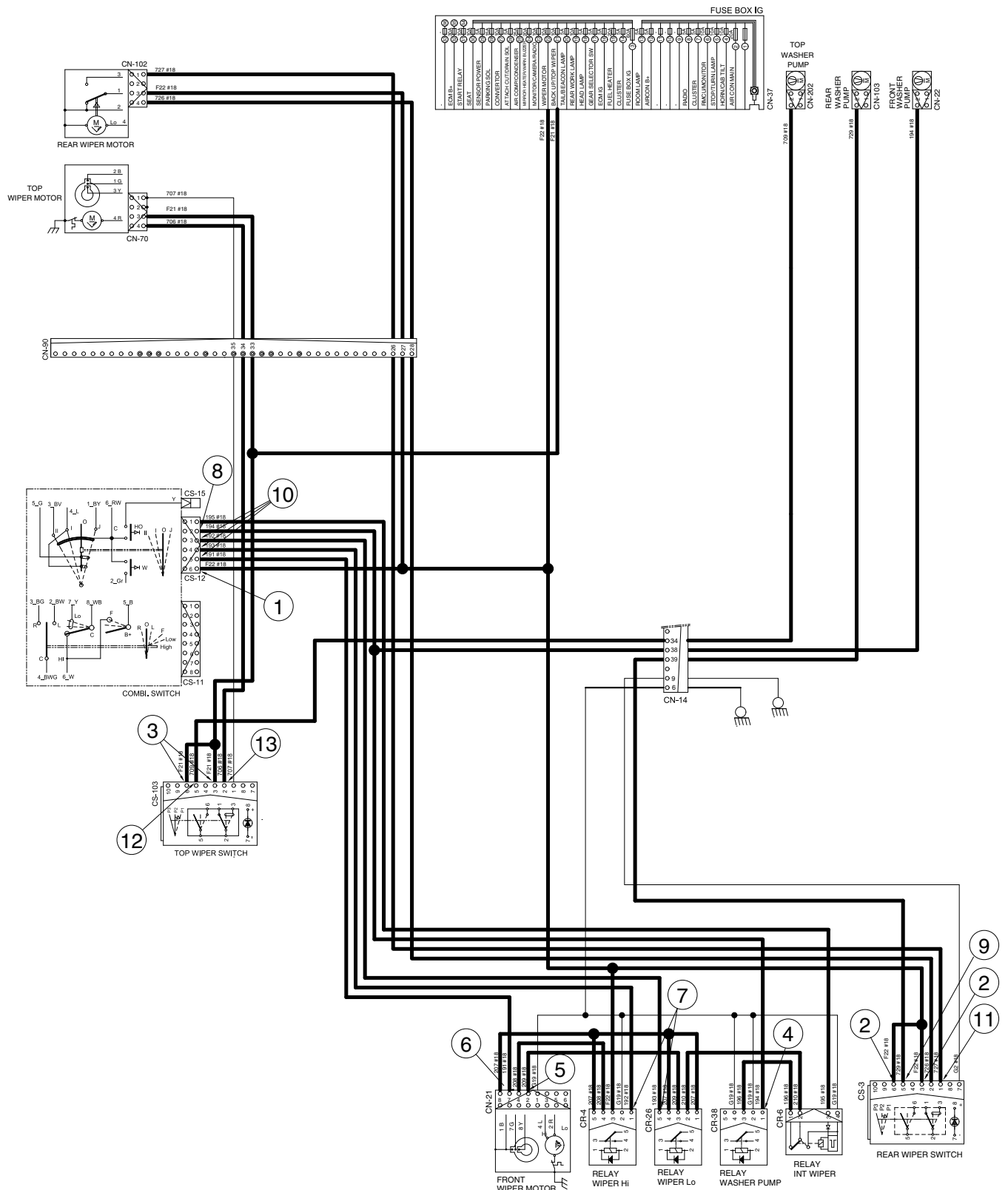
2) CHECK POINT

Engine	Start switch	Check point	Voltage
Stop	ON	① - GND (Front wiper switch power input) ② - GND (Rear wiper switch power input) ③ - GND (Top wiper switch power input) ④ - GND (Washer pump relay power input) ⑤ - GND (Front wiper motor Lo power input) ⑥ - GND (Front wiper motor High power input) ⑦ - GND (Wiper relay power input) ⑧ - GND (Front washer power output) ⑨ - GND (Rear washer power output) ⑩ - GND (Front wiper motor power output) ⑪ - GND (Rear wiper motor power output) ⑫ - GND (Top washer power output) ⑬ - GND (Top wiper motor power output)	20~25V

※ GND : Ground

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

WIPER AND WASHER CIRCUIT



100D97EL09

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

GROUP 3 CLUSTER

1) STRUCTURE

Like following figure, cluster is consisted of LCD and buttons. LCD will indicate the operation and abnormal status of truck to the driver in order to use and maintenance. Also, LCD allows to set and indicate the various modes, monitoring, and gadgets.

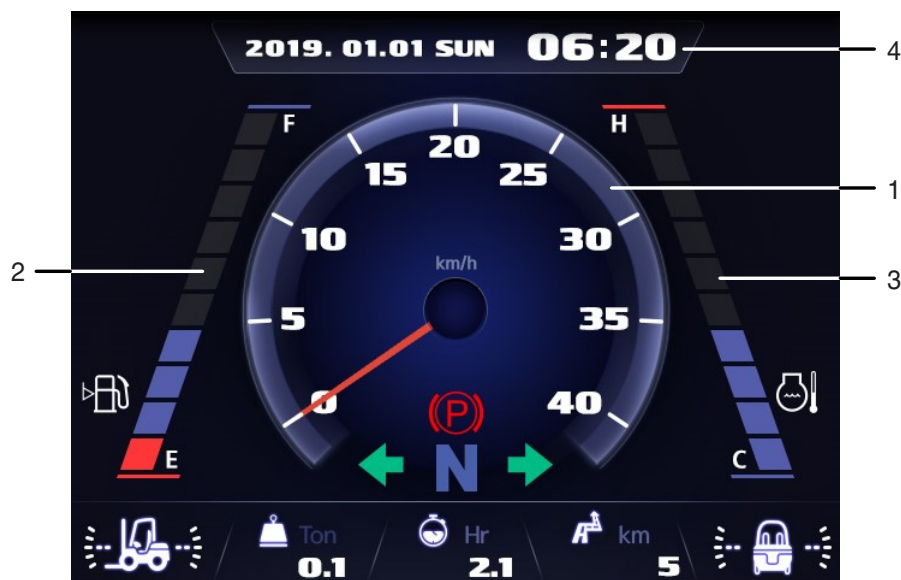
- ※ The cluster installed on this truck does not entirely guarantee the condition of the truck. Daily inspection should be performed according to the operating manual chapter 7. **PLANNED MAINTENANCE AND LUBRICATION.**
- ※ When the cluster provides a warning immediately check the problem, and perform the required action.



2) GAUGE

(1) Operation screen

Operating screen will be displayed if turn on the start switch.



35D9VB3KY04

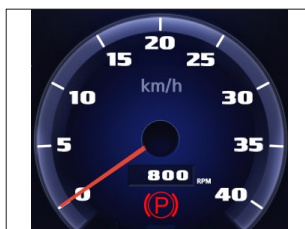
1 Speed meter

3 Coolant temperature gauge

2 Fuel gauge

4 Clock

(2) Speed meter

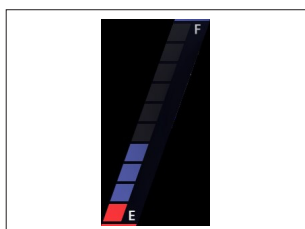


100D9V3KY30


- It indicates the speed of truck and calibrated in miles per hour (mph) or kilometer per hour (km/h).

※ Speed unit can be set in the speed unit menu of display set up at page 7-48.

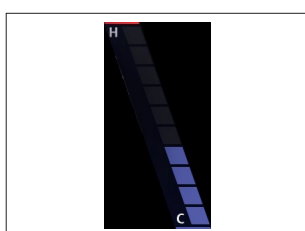
(3) Fuel gauge




35D9VB3KY05

- Fuel gauge displays the approximate amount of fuel remaining in the fuel tank.
- It shall be obtained fuel as soon as warning lamp  lights on.

(4) Coolant temperature gauge



35D9VB3KY06

- It indicates the temperature of the engine coolant.
 - White zone : 40 ~ 120 °C (104 ~ 248 °F)
 - Red zone : Over 120 °C (248 °F)
 - Warning lamp on : Over 115 °C (239 °F)
- If the gauge display in the red zone, or warning lamp  comes on, please stop the engine and inspect the coolant system.

(5) Clock



- It displays current time.
- The time can be adjusted at display Set Up > Time Set Up menu.

3) WARNING LAMPS

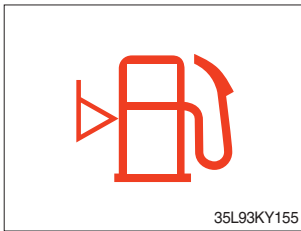


35D9VB3KY08

※ Warning and indicator lamp will display only items that were set as ON, and all warning and indicator except fuel level warning and coolant temperature warning will be displayed in order from the left of screen. And directional indicator lamp will display at the center.

No.	Warning lamp		No.	Warning lamp	
1		Fuel Level warning lamp	10		Clutch protection warning lamp
2		Coolant temperature warning lamp	11		Communication error warning lamp
3		Engine oil pressure warning lamp	12		Brake fail warning lamp
4		Air cleaner warning lamp	13		Seat belt reminder lamp
5		Water in fuel warning lamp	14		Fingertip warning lamp (NA)
6		Engine check warning lamp	15		Transmission warning lamp
7		Engine stop warning lamp	16		FSCU Communication error warning lamp
8		Battery charge warning lamp	17		FSCU warning lamp
9		Transmission oil temperature warning lamp	-	-	-

(1) Fuel level warning lamp



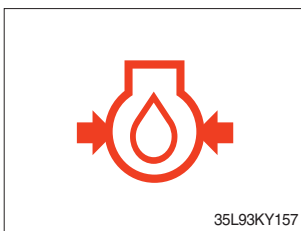
- Warning lamp will be displayed if fuel level is low.
- Please refuel immediately if the lamp is ON.

(2) Coolant temperature warning lamp



- Coolant temperature warning will be lit up when temperature is over 115 °C (239 °F).
- If the warning lamp is on continuously, please inspect the coolant system.

(3) Engine oil pressure warning lamp



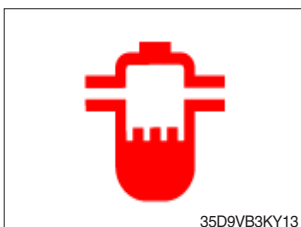
- This warning lamp will be lit up when engine oil pressure is low.
- Stop the engine immediately if the warning lamp is lit up. Please check the engine oil.

(4) Air cleaner warning lamp



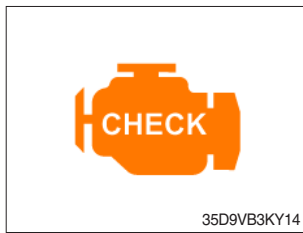
- This warning lamp is lit when air cleaner element is clogged up.
- Please clean up or replace the element.

(5) Water in fuel warning lamp



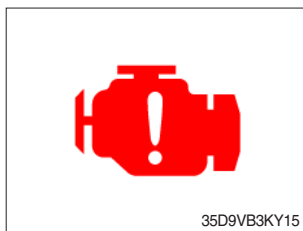
- Light up when water in fuel.
- Stop the engine and please drain the water of the fuel filter.

(6) Engine check warning lamp



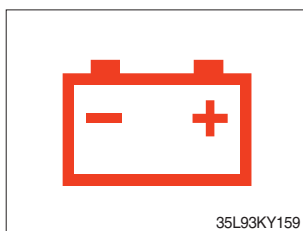
- When the engine is ON, it blinks for about 3 seconds. If the warning light remains on after 3 seconds, there is something wrong with the engine control, fuel supply and so on.
- Check the failure code of cluster.
- ※ **Some engine controls may not start if there is a problem.**
- ※ **Continued operation with the engine warning lamp ON or flashing can damage the exhaust control system, which affects operating performance and fuel consumption. You may also be subject to sanctions related to emission regulations, so be sure to check.**

(7) Engine stop warning lamp



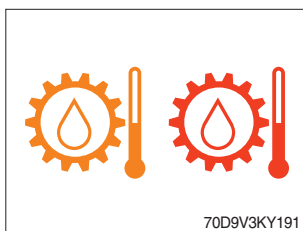
- If the lamp lights on, stop the engine immediately and check the engine.
- ※ **Please contact your Hyundai service center or local dealer.**

(8) Battery charge warning lamp



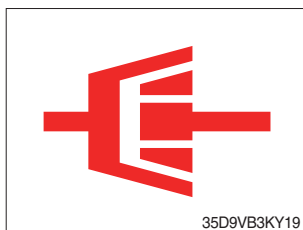
- This warning lamp is lit when battery charging voltage is low.
- Please inspect the battery charging circuit if the warning lamp is lit.

(9) Transmission oil temperature warning lamp



- Transmission oil temperature warning is consisted of two indications.
 - 110 °C (230 °F) or higher : Amber is light up
 - 120 °C (248 °F) or higher : Red is flashing
- When the red lamp lights up during operation, stop the engine and check the truck.

(10) Clutch protection warning lamp



- Warning lamp will be displayed if transmission oil pressure is not enough or while inching operation.
- Please check the transmission when the lamp is displayed without inching operation. If not, the brake performance can be decreased until the problem is resolved.

(11) Communication error warning lamp



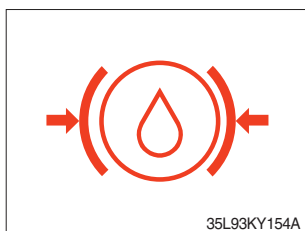
- This warning lamp will be lit up if the communication between cluster-CI and ECU is fail.
- Please check the communication line if the warning lamp is lit up.

(12) FSCU communication error warning lamp (option)



- This warning lamp will be lit up if the communication between MCU and FSCU is fail.
- Please check the communication line between MCU and FSCU if the warning lamp is lit up.

(13) Brake fail warning lamp



- The lamp lights ON when the oil pressure of service brake drops below the normal range.
- When the lamp is ON, stop the engine and check for its cause.

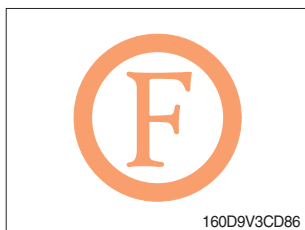
※ **Do not operate until the problems are corrected.**

(14) Fingertip red warning lamp (NA)



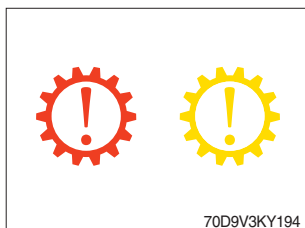
- This lamp lights ON when the forklift truck is in a condition that is serious enough to stop it.
- If the warning light is lit while driving, stop the engine and check the forklift.

(15) Fingertip amber warning lamp (NA)



- This lamp lights ON when there is a problem with the forklift truck system, but the vehicle does not need to be stopped immediately.

(16) Transmission warning lamp



- If the lamp lights on, check the transmission.
- If the red warning light is lit while driving, stop the engine and check the forklift.

(17) Seat belt reminder lamp



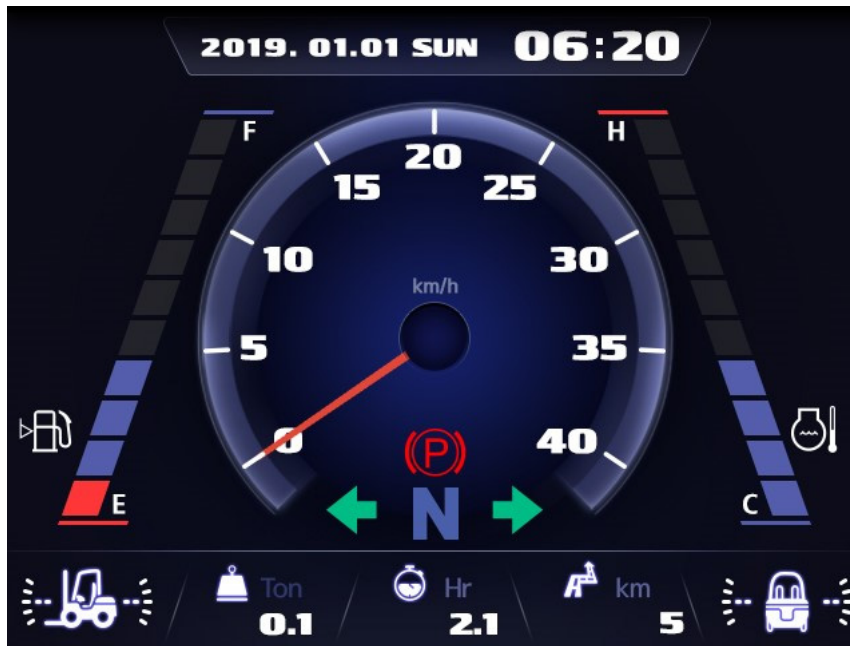
- This lamp will be blinked 5 times, after key on.
- If not wearing a seat belt, this reminder lamp will be displayed (option). (If driving over 4 km/h, it will be activated with buzzer)
- ※ If reminder lamp still displayed after wearing seat belt, Please check the seat belt wiring.

(18) FSCU warning lamp (option)



- If this warning light is lighted, check the failure code of FSCU. (with activating buzzer)
- ※ If the red warning light is lit while driving, stop the engine and check the forklift.

4) INDICATOR LAMPS

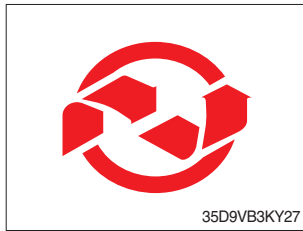


35D9VB3KY24

※ Warning and indicator lamps will display only items that were set as ON, and all warning and indicator except turning indicator lamp and driving indicator lamp will be displayed in order from the left of screen.

No.	Indicator lamp		No.	Indicator lamp	
1		Consumables management indicator lamp	8	N	Driving indicator lamp
2		Engine warning up indicator lamp	9	F F1 F2 F3	
3		Fuel warmer indicator lamp	10	R R1 R2 R3	
4		Parking brake indicator lamp	11	SIDE 	Side mirror heated pilot lamp (option)
5	TILT LOCK	Tilt lock indicator lamp (if installed)	12		DrivingHigh beam indicator lamp
6	OP SS	OPSS indicator lamp	13		Shift mode indicator lamp
7		Driving turn lamp	14		Inching switch on indicator lamp

(1) Consumables management indicator lamp



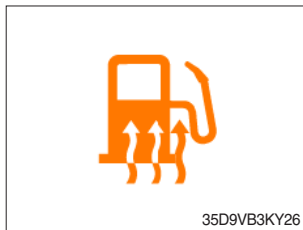
- Light up if consumables which must be replaced are exist.
- The indicator lamp will light up only 3 minutes since start switch ON, and then light OFF.
- Please check the consumables management list in maintenance menu.

(2) Engine warm-up indicator lamp



- The truck senses the engine coolant temperature and warms-up engine when needed.
- When it is happening, the indicator lamp is ON.

(3) Fuel warmer indicator lamp



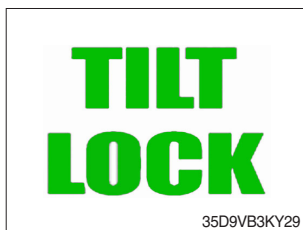
- Light up when fuel warmer is operating. (Controlled by ECU)

(4) Parking brake indicator lamp



- Light up when parking brake is ON.

(5) Tilt lock indicator lamp (if installed)



- The Indicator lamp will be lit up if the tilt lock switch (option) is entered.
- Tilt action will be limited if this Indicator lamp is lit up and the mast is located at 90 degrees.

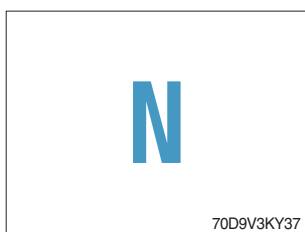
(6) OPSS indicator lamp



- Light up if driver leave seat during operation.
- Truck driving and/or mast control will be blocked if lamp is lit up.
- ※ Please refer to the operator manual page 0-12 for details.

(7) Driving indicator lamp

① Neutral



- This indicator lamp will be lit up when gear selector lever is located in neutral.

② Forward



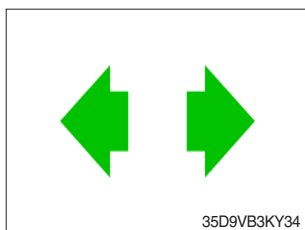
- This indicator lamp will be lit up if the forward gear is selected.

③ Reverse



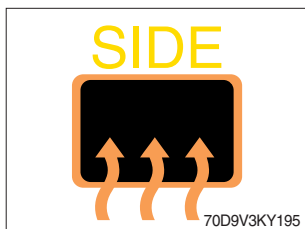
- This indicator lamp will be lit up if the reverse gear is selected.

(8) Driving turn lamp



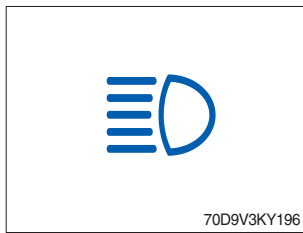
- This indicator lamp will flash if turns on the right or left turn signal.

(9) Side mirror heated indicator lamp (option)



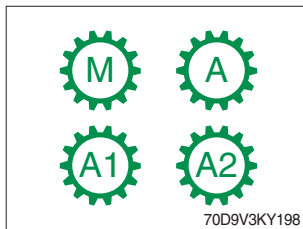
- ① When the heated mirror is operating, the lamp lights ON.

(10) High beam indicator lamp



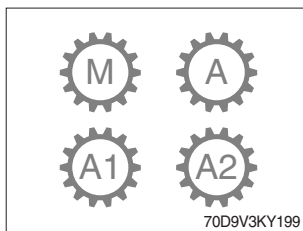
- This indicator is displayed when the vehicle's high beam is on.

(11) Shift mode indicator lamp 1



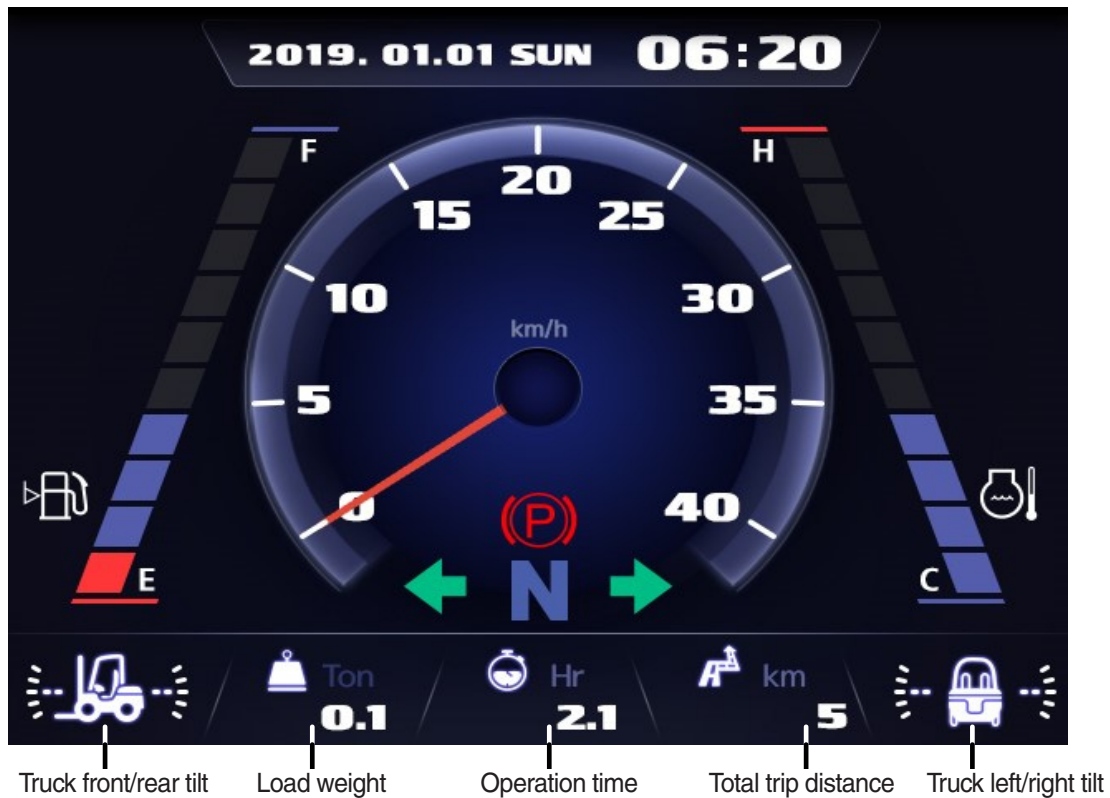
- This indicator shows the current vehicle's shift mode, A1 and A2 are indicated on vehicles with 2nd gear or higher.

(12) Shift mode indicator lamp 2



- This indicator shows the shift mode when activating the 2nd FNR, A1 and A2 are indicated on vehicles with 2nd gear or higher.

5) INFORMATION DISPLAY



35D9VB3KY35

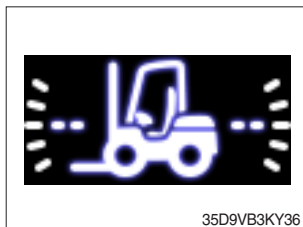
(1) Mast front/rear tilt



70D9V3KY41

- Display the real time tilt of mast.

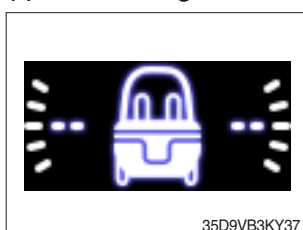
(2) Truck front/rear tilt



35D9VB3KY36

- Display the front and rear tilt of truck in real time.
- The red warning symbol turned on condition.
 - Stop : Tilt angle is higher than 2.3°
 - Driving : Tilt angle is higher than 10.2°

(3) Truck left/right tilt



35D9VB3KY37

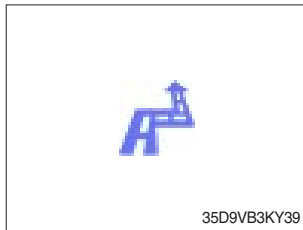
- Display the left and right tilt of truck in real time.
- The red warning symbol turned on condition.
 - Stop : Tilt angle is higher than 3.4°
 - Driving : Tilt angle is higher than 28.0°

(4) Load weight (option)



- Display the load weight.
- Screen will display blurry if the weight sensor has not been mounted.

(5) Total trip distance



- Display total trip distance of the truck.
- Unit of distance is kilometer.

(6) Operation time



- Display the used time of the truck.

(7) Explanation of warning lamp and indicator lamp



- When warning lamp or indicator lamp comes on, please press the enter button to check detailed explanation.
- During pressing the enter button, it keeps the screen to be shown explanation for warning lamp or indicator.

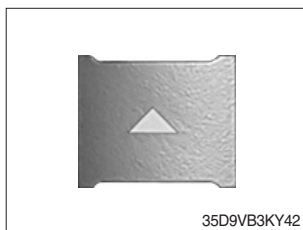
6) BUTTONS

(1) Camera



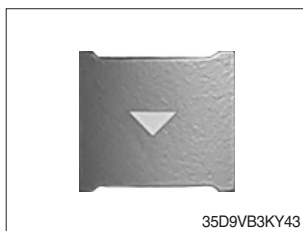
- This switch displays rear camera images. (if the camera is mounted)

(2) UP/Left



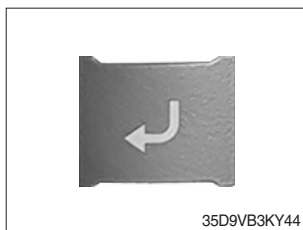
- This switch is used to move upward or leftward in menu or increase the value.

(3) Down/Right



- This switch is used to move downward or rightward in menu or decrease the value.

(4) Enter (select)



- This switch is used to enter into the menu or to select.

(5) Cancel (ESC)



- This switch is used to cancel or move to upper menu.

7) MAIN MENU

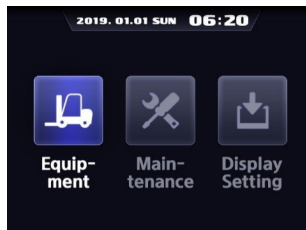
(1) Structure

Menus consist of main menu and sub-menu.

Operation Screen




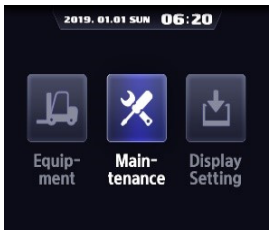
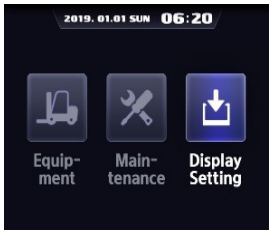
Main Menu Screen



Sub-Menu Screen



70D9VB3KY42

No.	Main menu screen	Sub menu	Explanation
1	 <p>35D9VB3KY47</p>	<ul style="list-style-type: none"> Model select Tilt setting ESL setting Weight sensor setting (option) Camera setting (if installed) Fingertips setting (option, NA) CSC setting (if installed) Auto shift setting (if installed) DCSR setting (if installed) HAC setting (if installed) Vehicle Max speed limit Zero start setting (if installed) Clutch protection beep (if installed) ZF TCU calibration (if installed) Seat belt interlock (option) Cluster-CI info 	<ul style="list-style-type: none"> Diesel, LPG Truck tilt initialize ESL setting, Engine start limit, Delay time Enter the cylinder cross section area, Adjust load weight, Weight display setup Reverse gear interworking DCSR on, Cut-off driving speed, Restore driving speed Maximum speed limitation Cluster-CI information
2	 <p>35D9VB3KY48</p>	<ul style="list-style-type: none"> Failure history Consumables management I/O information 	<ul style="list-style-type: none"> Engine, Transmission failure history Change oil and filter replacement cycle Analog, Digital signal
3	 <p>35D9VB3KY49</p>	<ul style="list-style-type: none"> LCD brightness adjustment User setting A/S phone No. Password change Consumables management 	<ul style="list-style-type: none"> Automatic, Manual Time, Unit, Language Change A/S contact Engine starting password connect Maintenance parts management

(2) Equipment menu

① Model Select (a required setting)

Check under the start switch ON status. Selection will be canceled if press the cancel button.

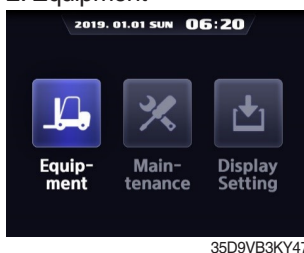
- ※ This is a required setting. Some functions may not be worked properly if you do not select the model.
- ※ If you want to move back to previous page, please enter ESC button in any stage.
- ※ It shall be selected right model to prevent malfunction of truck.

1. NO MODEL



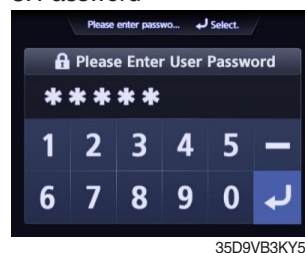
Select the your model.

2. Equipment



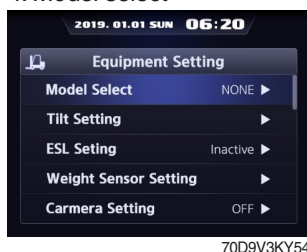
Enter to Equipment.

3. Password



Enter the password.
Default password is "00000".
Password length must be 5~10 digits.

4. Model select



Choose Model Select and enter.

5. Diesel or LPG



Please select the fuel type.

6. Truck weight



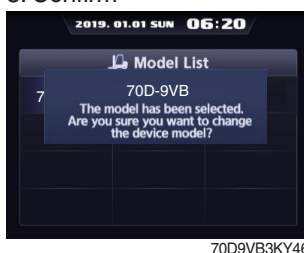
Please select the truck weight level.

7. Truck model



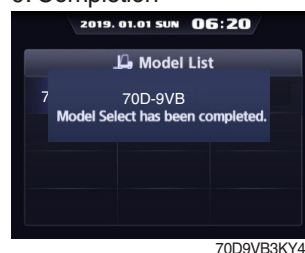
Please select the exact model name.

8. Confirm



Confirm the model which you select.

9. Completion



Model selection is completed.

10. Check



Check the status which is not shown 'NO MODEL' in main display.

② Tilt Setting

a. Setting (Check under the start switch ON status.)

※ The tilt sensor has already been initialized when deliver the truck from factory.

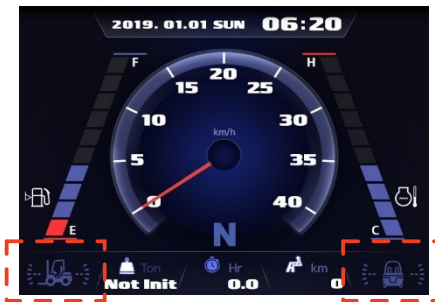
※ Tilt reset if the tilt sensor figure or truck tilt is not horizontal in the flatland.

⚠ You must set tilt in the flatland since this is a horizontal set up.

※ If tilt sensor for mast is mounted (option), locates the mast vertically.

※ Mast maximum angle depends on the truck.

· Truck that has not applied the mast angle sensor

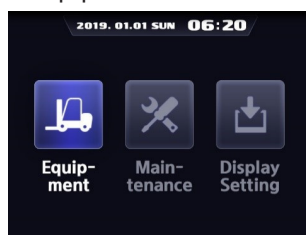


· Truck that has applied the mast angle sensor (option)



70D9VB3KY59

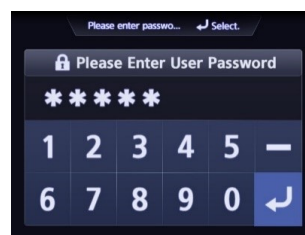
1. Equipment



35D9VB3KY47

Enter to Equipment.

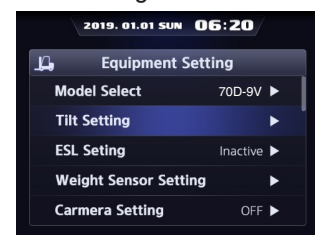
2. Password



35D9VB3KY51

Enter the password.

3. Tilt setting



70D9V3KY50

Choose Tilt Setting and enter.

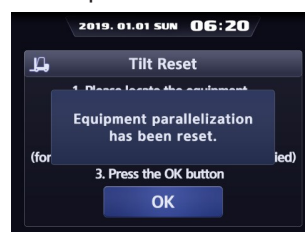
4. Instruction



70D9V3KY51

Follow the instruction showing in the screen.

5. Completion



70D9V3KY52

Setting has been completed.

b. Check functions

a) Check the real time operation by changing angles of truck tilt and mast tilt.

b) Auto-leveling (if installed)

(a) Tilt mast forward or backward.

(b) Start tilting mast toward its vertical position, pushing the auto tilt leveling switch.

(c) Check if the mast stops traveling when it becomes vertical to ground.

c) Forward or backward truck tilt warning (red)

· Stop : $\pm 2.3^\circ$ (1.5 ~ 5 tons)

· Driving : $\pm 10.2^\circ$ (1.5 ~ 5 tons)

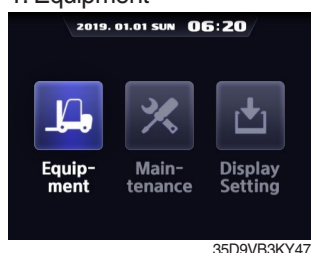
d) Left or right truck tilt warning (red)

- Stop : $\pm 3.4^{\circ}$ (1.5 ~ 5.0 tons)
- Driving

Truck weight	Warning angles (red)
1.5 ~ 2.0 tons	$\pm 20.3^{\circ}$
2.2 ~ 3.3 tons	$\pm 20.8^{\circ}$
3.5 ~ 4.5 tons	$\pm 24.2^{\circ}$
5.0 tons ~	$\pm 28.0^{\circ}$

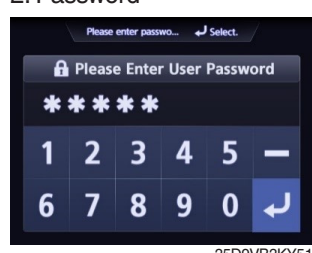
③ ESL (Engine Start Limit) Setting : Default is 'Inactive'

1. Equipment



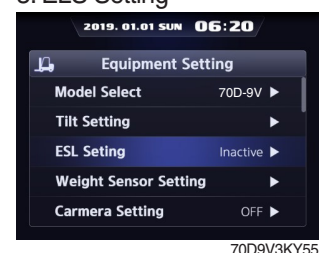
Enter to Equipment.

2. Password



Enter the password.

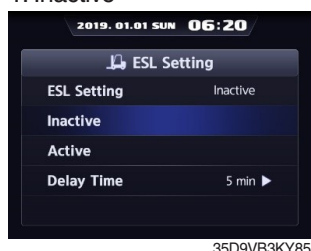
3. ELS Setting



Choose ESL setting and enter.

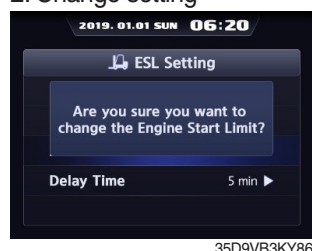
a. Setting

1. Inactive



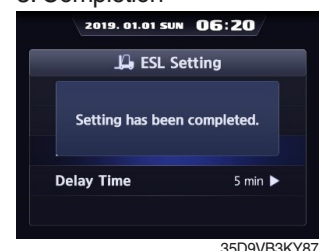
Choose Inactive.

2. Change setting



If you want to change setting, press enter button.

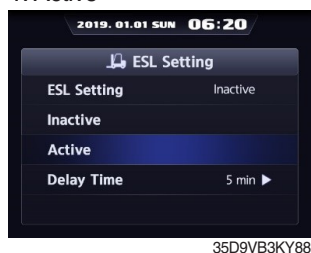
3. Completion



Setting has been completed.

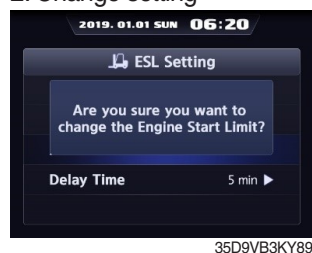
b. Active

1. Active



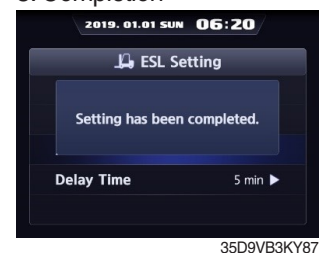
Choose Active.

2. Change setting



If you want to change setting, press enter button.

3. Completion



Setting has been completed.

b. Check functions

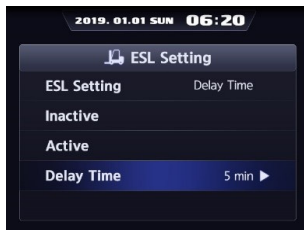
- (a) Set the mode as active and start switch OFF.
 - (b) Upon start switch ON, the password screen pops up and starting is prohibited until the right password has been offered. (But, driver still can start the vehicle if starts within 10 seconds from start switch OFF)
 - (c) Set the mode as 5 min of delay time and start switch OFF.
 - (d) check if vehicle can start within 5 min and start switch OFF.
 - (e) check if vehicle requests password after 5 min.
- ※ **Start switch ON screen (When startup control mode is ON)**



35D9VB3KY90

c. Delay time

1. Delay time



35D9VB3KY91

Choose delay time.

2. Select value



35D9VB3KY92

Select value you want to apply.

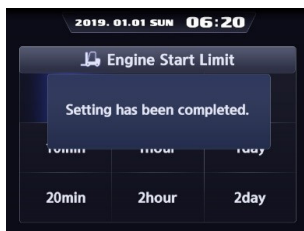
3. Change setting



35D9VB3KY93

If you are sure to change ESL, press enter.

4. Completion



35D9VB3KY94

Setting has been completed.

④ Weight Sensor Setting (option)

Check under the start switch ON status. There are three settings (unload, load, reset) for weight sensor.

※ The weight sensor has already been set when deliver the truck from factory.

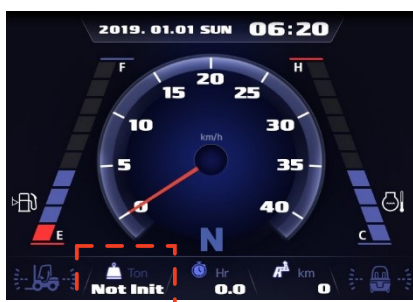
a. Setting Cylinder Cross-Section

※ Cylinder cross-section value

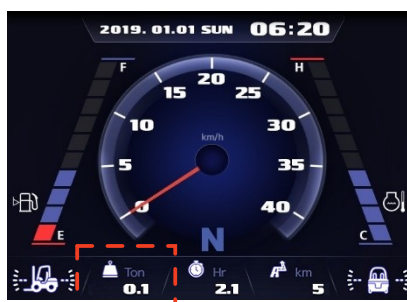
unit : cm^2

Model	Mast type	V-mast	TS-mast
100D-9	V300~500	113.49	141.76
	TS450~500		
	V550~600	141.76	190.07
	TS550~750		

· Truck that has not applied the weight sensor

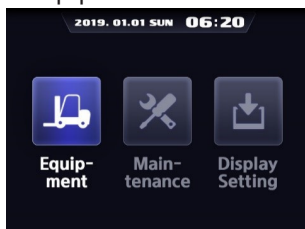


· Truck that has applied the weight sensor (option)



70D9VB3KY63

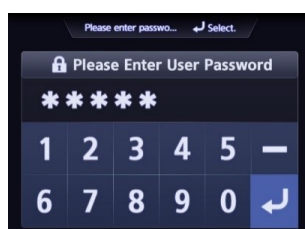
1. Equipment



35D9VB3KY47

Enter to Equipment.

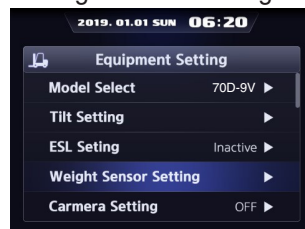
2. Password



35D9VB3KY51

Enter the password.

3. Weight Sensor Setting



70D9V3KY56

Choose Weight Sensor Setting and enter.

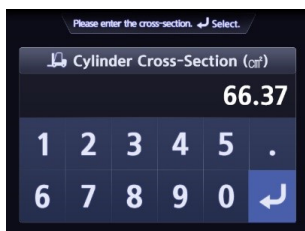
4. Cylinder Cross-Section



70D9V3KY57

Choose Cylinder Cross-Section. If cylinder cross-section is already set up, setting value is shown in initial screen.

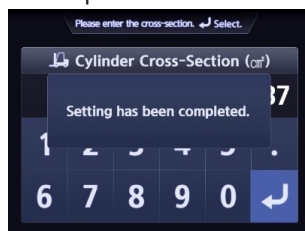
5. Value



35D9VB3KY66

Enter cylinder cross-section value using up or down buttons.

6. Completion



35D9VB3KY67

Setting has been completed.

7. Check

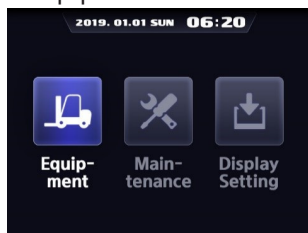


70D9V3KY58

Check the value whether it is right.

b. Unloaded status adjustment

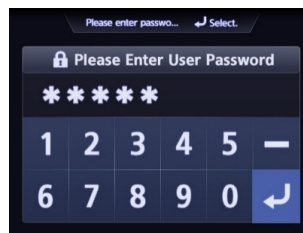
1. Equipment



35D9VB3KY47

Enter to Equipment menu

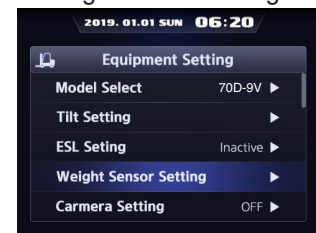
2. Password



35D9VB3KY51

Enter the password

3. Weight Sensor Setting



70D9V3KY56

Choose Weight Sensor Setting

4. Load Weight Adjustment



70D9V3KY59

Choose Load Weight Adjustment and enter.

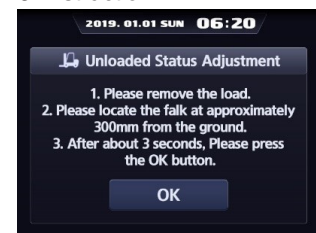
5. Unloaded Status Adjustment



70D9V3KY60

Choose Unloaded Status Adjustment and enter.

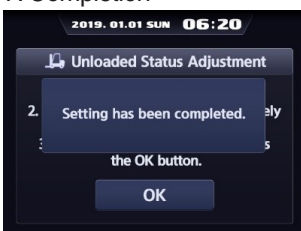
6. Instruction



35D9VB3KY71

Follow the instruction showing in the screen. After finish setting and press enter button

7. Completion



35D9VB3KY72

Setting has been completed.

c. Loaded status adjustment

- ※ Must be prepared to lift up by locating the load on the fork before enter the weight.
- ※ MCU (Main Control Unit) recognizes the weight automatically by detecting the pressure change.
- ※ Must be performed within 30 seconds of the lift task. If it is not completed within 30 seconds, this process will be canceled automatically.
- ※ Accurate weight value is not recognized if other pressure changes that are occurred besides salvage work.
- ※ Perform again, if the measurement malfunction is occurred.

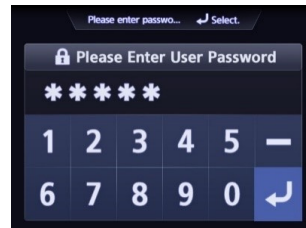
1. Equipment



35D9VB3KY47

Enter to Equipment menu

2. Password



35D9VB3KY51

Enter the password

3. Weight Sensor Setting



70D9V3KY56

Choose Weight Sensor Setting

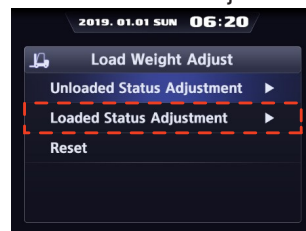
4. Load Weight Adjustment



70D9V3KY59

Choose Load Weight Adjustment and enter.

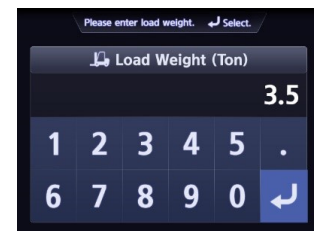
5. Loaded Status Adjustment



70D9V3KY61

Choose Load Weight Adjustment and enter.

6. Value



35D9VB3KY74

Enter load weight using up or down buttons.

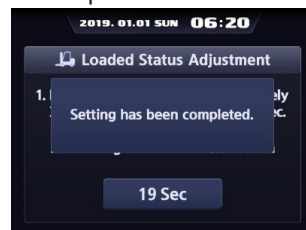
7. Instruction



35D9VB3KY75

Follow the instruction showing in the screen. After finish setting and press enter button. Please proceed the operation within 30 seconds.

8. Completion



35D9VB3KY76

Setting has been completed.

d. Reset

Initialize the all values of 'Unloaded and Loaded Status Adjustment' that were entered previously. (Cylinder cross-sectional area is not initialized.)

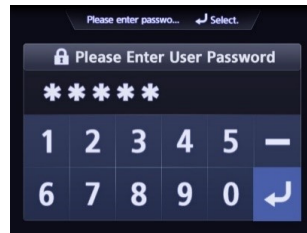
1. Equipment



35D9VB3KY47

Enter to Equipment menu

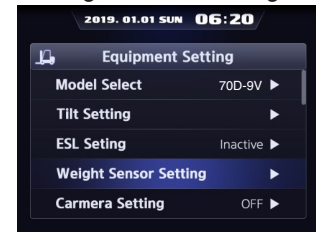
2. Password



35D9VB3KY51

Enter the password

3. Weight Sensor Setting



70D9V3KY56

Choose Weight Sensor Setting

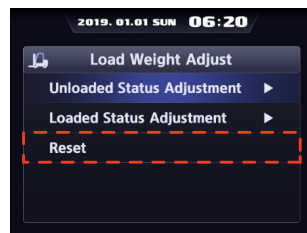
4. Load Weight Adjustment



70D9V3KY59

Choose Load Weight Adjustment and enter.

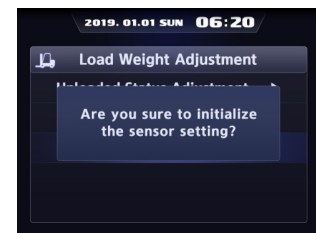
5. Reset



70D9V3KY62

Enter to Reset.

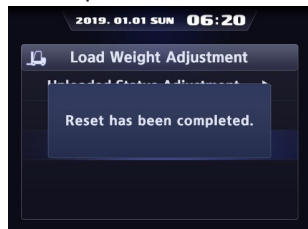
6. Check



70D9V3KY63

Press the enter button.

7. Completion



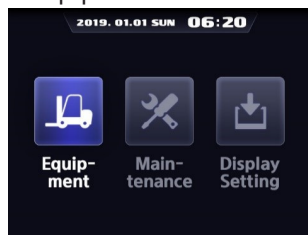
70D9V3KY64

Reset has been completed.

e. Weight Display Setting

Enable to adjust the digit-number fo weight of main screen.

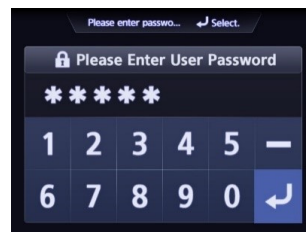
1. Equipment



35D9VB3KY47

Enter to Equipment menu

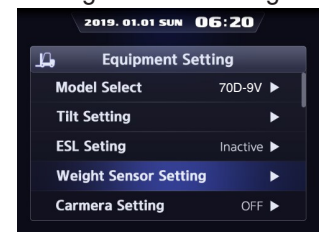
2. Password



35D9VB3KY51

Enter the password

3. Weight Sensor Setting



70D9V3KY56

Choose Weight Sensor Setting

4. Weight Display Setting



70D9V3KY65

Choose weight sensor setting and enter.

5. Unit



35D9VB3KY81

Choose unit what you want to use.

6. Completion



35D9VB3KY80

Setting has been completed.

· 100 kg unit



35D9vB3KY83

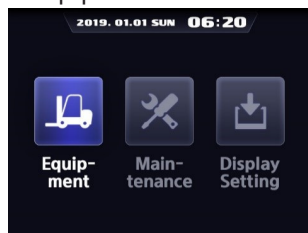
· 10 kg unit



35D9vB3KY83

f. Overload Alarm

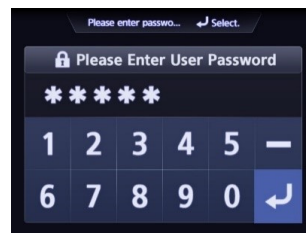
1. Equipment



35D9VB3KY47

Enter to Equipment menu

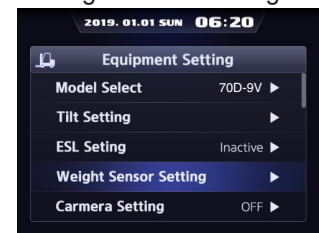
2. Password



35D9VB3KY51

Enter the password

3. Weight Sensor Setting



70D9V3KY56

Choose Weight Sensor Setting

4. Overload alarm



70D9V3KY68

Enter to Overload alarm.

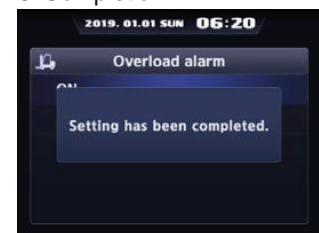
5. Select



35D9VB3KY81

Select ON or OFF.

6. Completion



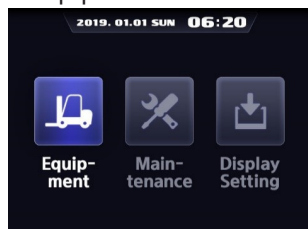
100D9VB3KY80

Setting has been completed.

⑤ Camera Setting (if installed)

- Device setup → Camera setup
- After set the reverse gear interoperation as ON, the screen will be changed from main screen to camera mode if put gear into reverse, and if the gear is changed, screen will be back to the main screen.

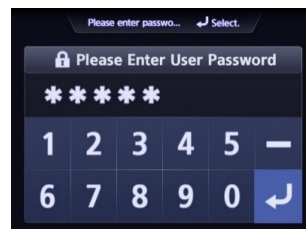
1. Equipment



35D9VB3KY47

Enter to Equipment.

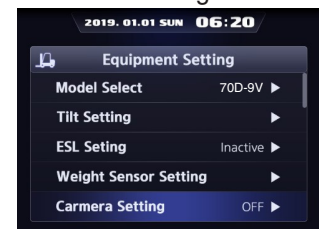
2. Password



35D9VB3KY51

Enter the password

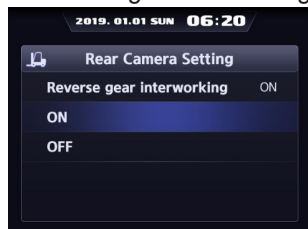
2. Camera Setting



70D9V3KY69

Choose Camera Setting and enter.

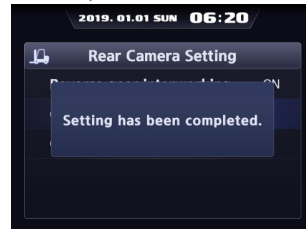
3. Reverse gear interworking



70D9V3KY70

Select ON or OFF.

4. Completion



70D9V3KY71

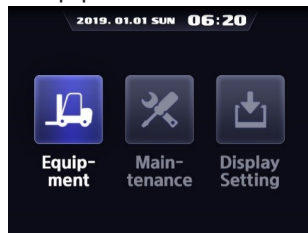
Setting has been completed.



35D9VB3KY98

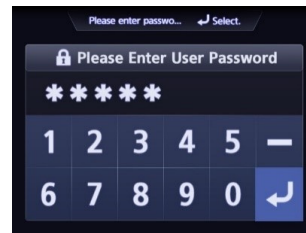
⑥ FingerTips Setting (option, NA)

1. Equipment



Enter to Equipment.

2. Password



Enter the password

3. FingerTips Setting



Choose FingerTips Setting and enter.

a. Lever Position Setting

1. Lever Position Setting



Choose Lever Position Setting and Enter

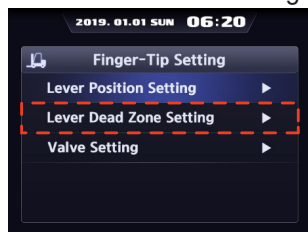
2. Setting

	Voltage	Min	Mid	Max
Lift Lever	0.00V	0.00V	0.00V	0.00V
Tilt Lever	0.00V	0.00V	0.00V	0.00V
Aux1 Lever	0.00V	0.00V	0.00V	0.00V
Aux2 Lever	0.00V	0.00V	0.00V	0.00V

Set minimum and maximum value.

b. Lever Dead Zone Setting

1. Lever Dead Zone Setting



Choose Lever Dead Zone Setting and enter.

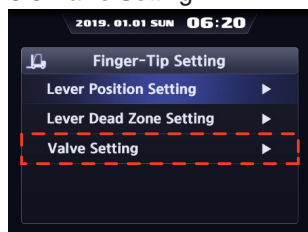
2. Setting

	Upper zone	Lower zone
Lift Lever	0.00V	0.00V
Tilt Lever	0.00V	0.00V
Aux1 Lever	0.00V	0.00V
Aux2 Lever	0.00V	0.00V

Set lever dead zone range.

c. Valve setting

3-3. Valve Setting



Choose Valve Setting and enter.

4. Lift Section Valve



In the Valve Setting, you can set the lift, tilt, AUX1, or AUX2 section valves

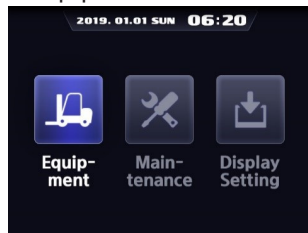
5. Setting.

	Min Open	Max Open	Open Delay	Close Delay
Lifting valve	0mA	0mA	0 ms	0ms
Lowering valve	0mA	0mA	0 ms	0ms

For each valve value, you can adjust the current value and time on the above screen

⑦ CSC (Curve Speed Control) Setting (if installed)

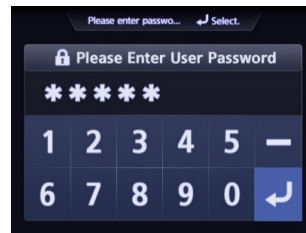
1. Equipment



35D9VB3KY47

Enter to Equipment.

2. Password



35D9VB3KY51

Enter the password

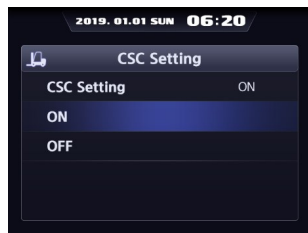
3. CSC Setting



70D9V3KY80

Choose CSC setting and enter.

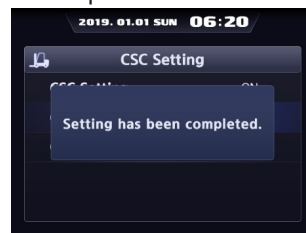
4. Select



70D9V3KY81

Select ON or OFF.

5. Completion



70D9V3KY82

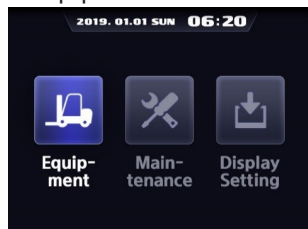
Setting has been completed.

⑧ Auto Shift Setting (if installed)

Enable to turn the function ON or OFF or change the shift speed.

a. Mode Select

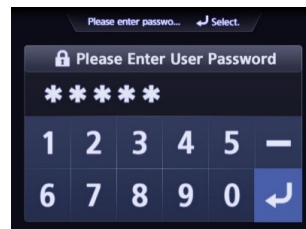
1. Equipment



35D9VB3KY47

Enter to Equipment.

2. Password



35D9VB3KY51

Enter the password

3. Auto Shift Setting



70D9V3KY83

Choose Auto Shift setting and enter.

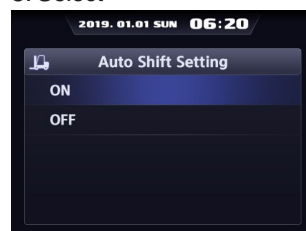
4. Mode Select



70D9V3KY84

Choose Mode Select.

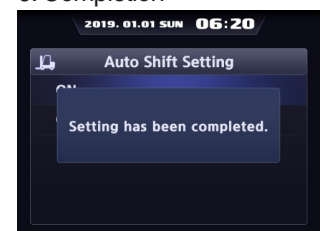
5. Select



70D9V3KY85

Select ON or OFF.

6. Completion



70D9V3KY86

Setting has been completed.

b. Speed Setting

- In case of 1st gear → 2nd gear, it is possible to set up to 7 ~ 10 km/h.
- In case of 2nd gear → 1st gear, it is possible to set up to 4 ~ 5 km/h.

※ Depending on the model, the function can be turned on/off only by an external switch.

3-2. Speed Setting



Choose Speed Setting and enter.

4. Adjustment



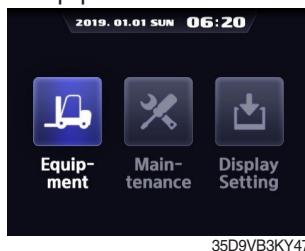
Change the speed value after selecting the shift point that needs to be changed

⑨ DCSR (Direction Change Shock Relief) setting (if installed)

- Set the mode ON. Below is how this feature functions.
- If you are driving at over the block drive speed and then change gear from forward to reverse (or reverse to forward), the gear stays as neutral until the truck reaches the restore drive speed.
- The truck changes direction and starts to travel.

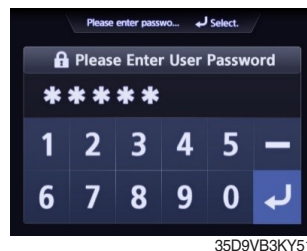
※ Restore drive speed can not be set over the block drive speed.

1. Equipment



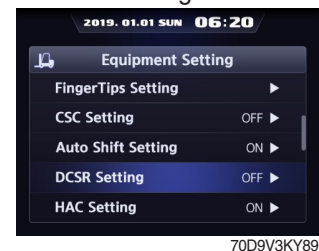
Enter to Equipment.

2. Password



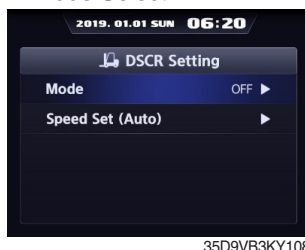
Enter the password

3. DCSR Setting



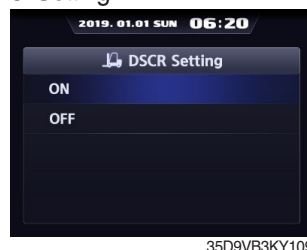
Choose DCSR setting and enter.

4. Mode Select



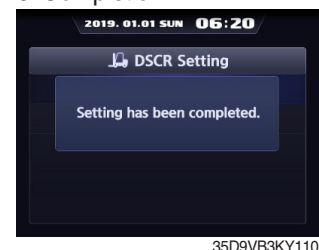
Select Mode Select.

5. Setting



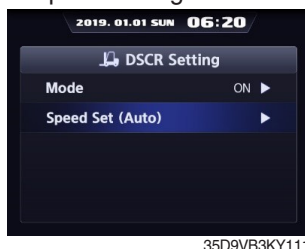
Select ON or OFF.

6. Completion



Setting has been completed.

7. Speed Setting



If you want to change speed setting, enter Speed Setting.

8. Drive Speed



Change speed.

⑩ HAC (Hill Assist Control) Setting (if installed)

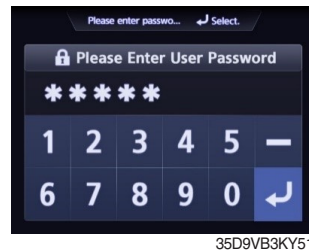
If you are trying to drive in stop status on the hill, the truck does not move backward when the HAC setting is ON.

1. Equipment



Enter to Equipment.

2. Password



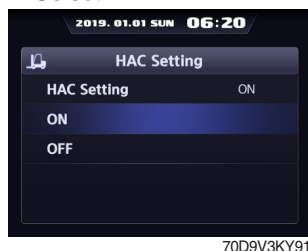
Enter the password

3. HAC Setting



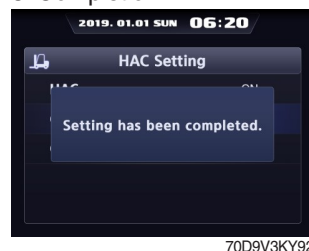
Choose DCSR setting and enter.

4. Select



Select ON or OFF.

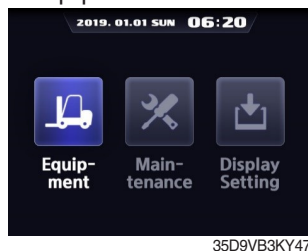
5. Completion



Setting has been completed.

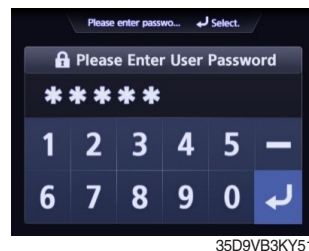
⑪ Vehicle Max Speed Limit

1. Equipment



Enter to Equipment.

2. Password



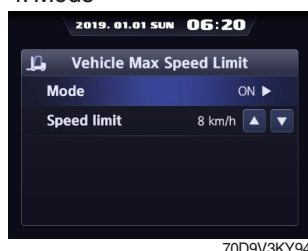
Enter the password

3. Vehicle Max Speed Limit



Choose Vehicle Max Speed Limit and enter.

4. Mode



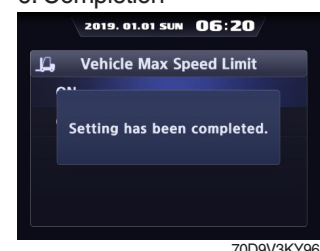
Enter to Mode.

5. Select



Select ON or OFF.

6. Completion



Setting has been completed.

· Limit speed : 10 km/h



The truck does not exceed the limit speed.

⑫ Zero Start Setting (if installed)

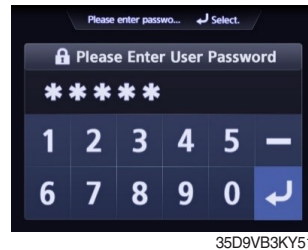
1. Equipment



35D9VB3KY47

Enter to Equipment.

2. Password



35D9VB3KY51

Enter the password

3. Zero Start Setting



70D9V3KY98

Choose Zero Start Setting and enter.

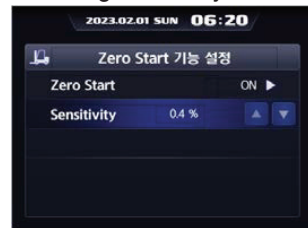
4. Select Sensitivity



100D9V3KY99

Select Sensitivity and press the enter.

5. Setting Sensitivity



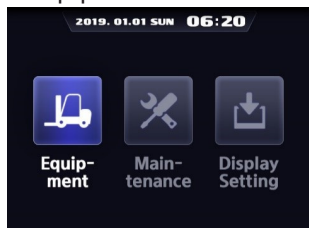
100D9V3KY10

Change value using up/down button and press the enter

※ Default Sensitivity is 0.4% and it can be changed to maximum 4.8%

⑬ Clutch Protection Beep (if installed)

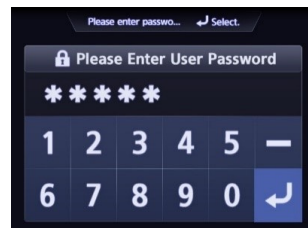
1. Equipment



35D9VB3KY47

Enter to Equipment.

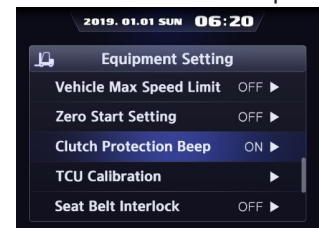
2. Password



35D9VB3KY51

Enter the password

3. Clutch Protection Beep



70D9V3KY101

Choose Clutch Protection Beep and enter.

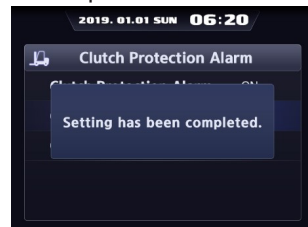
4. Select



70D9V3KY102

Select ON or OFF.

5. Completion



70D9V3KY103

Setting has been completed.

⑭ ZF TCU Calibration (if installed)

Enable to calibrate the inching and clutch of the transmission.

※ Depending on the model, the initial conditions for calibration may be different or the procedure may be automatically skipped.

a. Inching Calibration

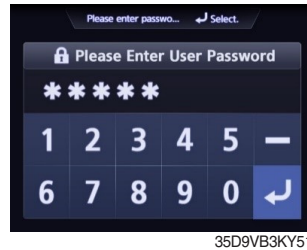
1. Equipment



35D9VB3KY47

Enter to Equipment.

2. Password



35D9VB3KY51

Enter the password

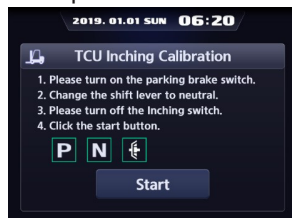
3. ZF TCU Calibration



70D9V3KY127

Choose ZF TCU Calibration and enter.

4. Prepare for Calibration



70D9V3KY128

Before starting calibration, turn on the parking switch, the gear neutral, and the inching switch off.

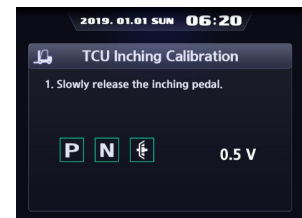
5. Calibration 1



70D9V3KY129

Fully press the inching pedal.

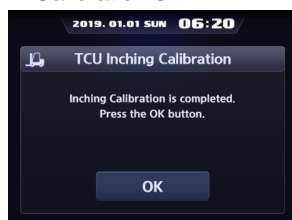
6. Calibration 2



70D9V3KY130

Take your foot off the inching pedal.

7. Calibration 3



70D9V3KY131

Confirm the completion of calibration and press the ESC button or OK button to exit to the menu

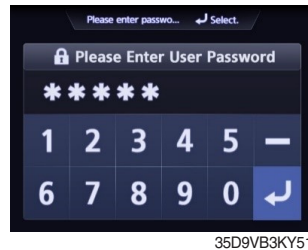
b. Clutch Calibration

2-1. ZF TCU Calibration



Choose ZF TCU Calibration and enter.

2. Password



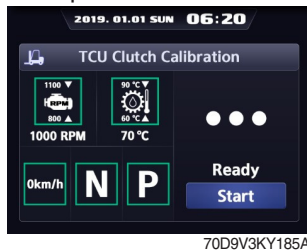
Enter the password

3. ZF TCU Calibration



Choose ZF TCU Calibration and enter.

4. Prepare for Calibration



Before starting calibration, must be satisfied with 5 conditions.

※ Conditions

- 1) Engine RPM 800 to 1100
- 2) T/M temperature 60°C to 90°C
- 3) Truck speed 0 km/h (stop)
- 4) Gear neutral
- 5) Parking switch ON

5. Calibration 1



Wait until the next button is ON.

6. Calibration 1



Enter the next button.

7. Calibration 2



Confirm the completion of calibration and press the ESC button or OK button to exit to the menu

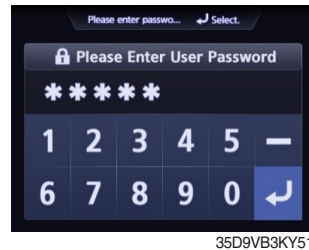
⑮ Seat Belt Interlock (option)

1. Equipment



Enter to Equipment.

2. Password



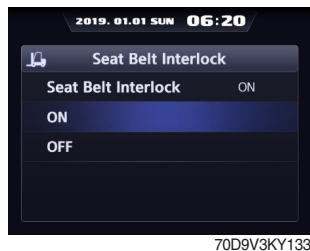
Enter the password (applied master password)

3. Seat Belt Interlock



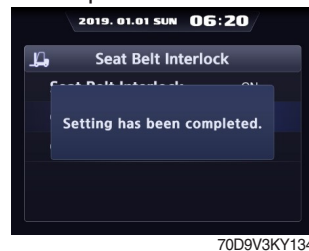
Choose Seat Belt Interlock and enter.

4. Select



Select ON or OFF.

5. Completion



Setting has been completed.

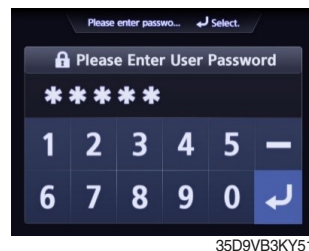
⑯ Cluster-CI

1. Equipment



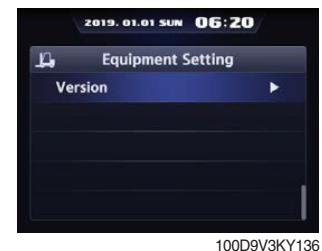
Enter to Equipment.

2. Password



Enter the password

3. Version



Choose Version and enter.

4. Cluster-CI



Choose Cluster-CI and enter.

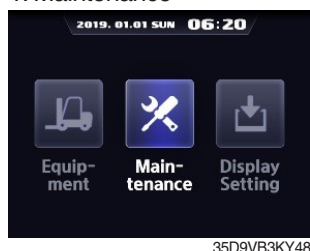
5. Check Version



(2) Maintenance

① Failure History

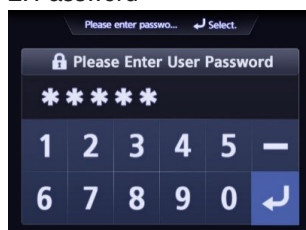
1. Maintenance



35D9VB3KY48

Enter to Maintenance.

2. Password



35D9VB3KY51

Enter the password

3. Failure History



70D9V3KY138

Choose Failure History and enter.

4. Engine or Transmission



70D9V3KY139

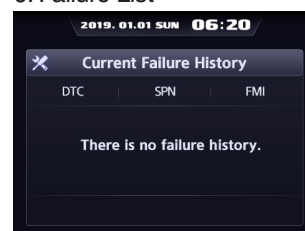
Choose what needs to check.

5. History



70D9V3KY140

6. Failure List



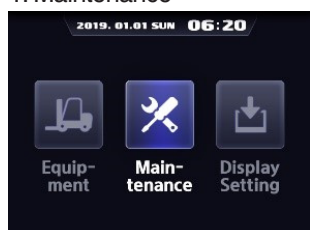
70D9V3KY141

② Consumables Management

- If the consumables replacement cycle has been passed, alarm will be displayed as ON.
- Press the 'Consumables replacement' if replaced the consumables.
- Information about recent replacement (maximum 9) will be displayed.
- If you want to change the cycle, please press the 'Change' button.

※ Refer to the operator manual page 7-12 about periodic replacement parts.

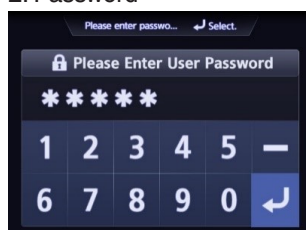
1. Maintenance



35D9VB3KY48

Enter to Maintenance.

2. Password



35D9VB3KY51

Enter the password

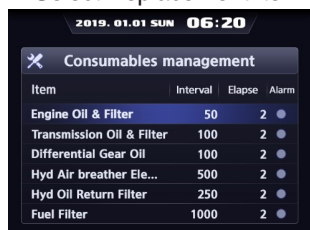
3. Consumables Management



70D9V3KY142

Choose Consumables Management and enter.

4. Select Replacement Item



70D9V3KY143

Select the replaced item.

5. Replacement History



70D9V3KY144

Select Replacement History.

6. Check.



70D9V3KY145

Check history.

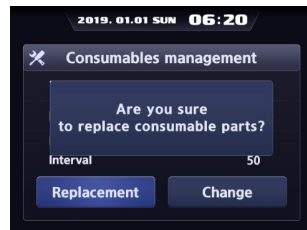
7. Replacement



70D9V3KY146

Select Replacement.

8. Confirm



70D9V3KY147

Press enter button.

9. Change



70D9V3KY148

Select Change.

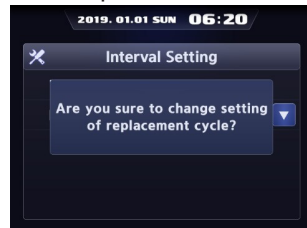
10. Setting Cycle



70D9V3KY149

Change properly the interval.

11. Completion

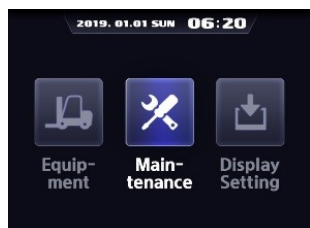


70D9V3KY150

Setting has been completed.

③ I/O Information

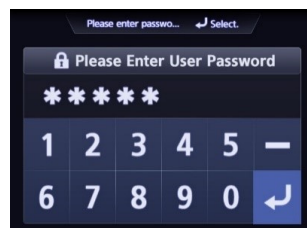
1. Maintenance



35D9VB3KY48

Enter to Maintenance.

2. Password



35D9VB3KY51

Enter the password

3. I/O Information



70D9V3KY151

Choose I/O Information and enter.

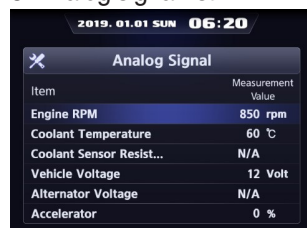
4. Analog signal



35D9VB3KY139

Enter to Analog Signal.

5. Analog signal list



70D9V3KY152

Check the analog signal list.

6. Digital signal



35D9VB3KY141

Enter to Digital Signal

7. Digital signal list



70D9V3KY153

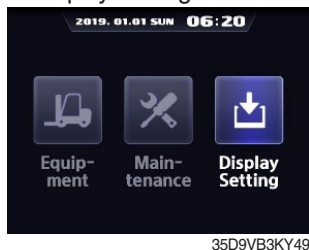
Check the digital signal list.

(3) Display setting

① LCD Brightness Adjustment

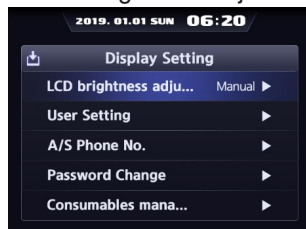
- LCD brightness has two options. (Automatic and Manual modes)
- Manual mode always keeps the selected brightness.
- Brightness : Daytime 100%, Nighttime 50%
- Daytime/Nighttime time zone : 06 ~ 18

1. Display Setting



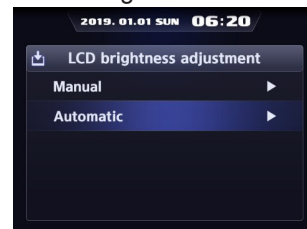
Enter to Display Setting.

2. LCD Brightness Adjustment



Choose LCD Brightness Adjustment and enter.

3. LCD brightness



Select Manual or Automatic.

4. LCD Brightness (Day/Night)



Set day and night brightness in the manual mode.

5. LCD Brightness

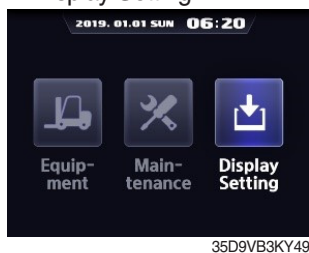


Set LCD brightness in the manual mode.

② User Setting

Enable to set time, unit, and language.

1. Display Setting

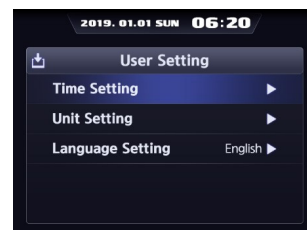


Enter to Display Setting.

2. User Setting



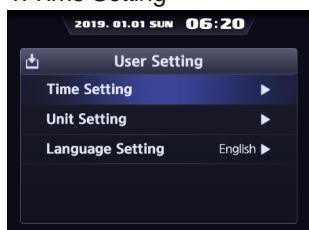
Choose User Setting and enter.



Select Time Setting.

a. Time Setting

1. Time Setting



Select Time Setting.

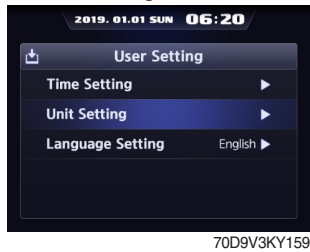
2. Setting



Set time.

b. Unit Setting

1. Unit Setting



70D9V3KY159

Select Unit Setting.

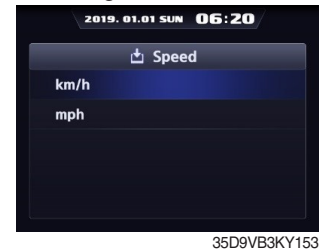
2. Unit Setting List



35D9VB3KY152

Enable to set the unit of speed, weight, temperature and pressure.

3. Setting

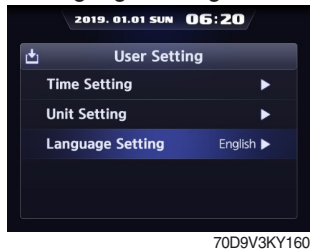


35D9VB3KY153

Set unit.

c. Language Setting

1. Language Setting



70D9V3KY160

Select Language Setting.

2. Setting



70D9V3KY161

Choose a language.

③ A/S Phone No.

1. Display Setting



35D9VB3KY49

Enter to Display Setting.

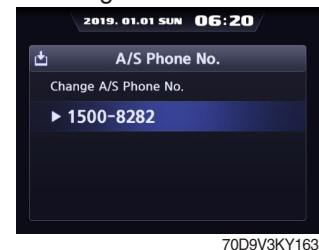
2. A/S Phone No.



70D9V3KY162

Choose A/S Phone No. and enter.

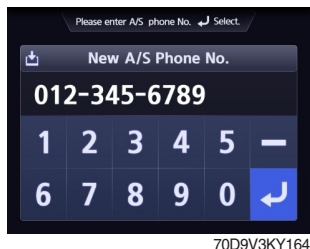
3. Change



70D9V3KY163

Select phone number if you want to change.

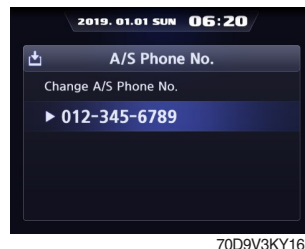
4. New A/S Phone No.



70D9V3KY164

Enter new phone number using up or down buttons and press the enter button.

5. Finish



70D9V3KY165

Contact will be displayed as the modified number.

④ Password Change.

- This function is to allow to change password from default password to user defined password.
- Password length must be 5~10 digits.

※ Since, if you forget the password, you must request the A/S, do not forget the password.

1. Display Setting



35D9VB3KY49

Enter to Display Setting.

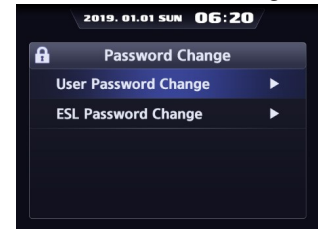
2. Password Change



70D9V3KY166

Choose Password Change and enter.

3. User Password Change

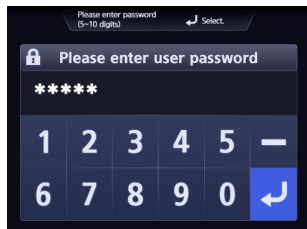


70D9V3KY167

Select User Password Change.

a. User Password Change

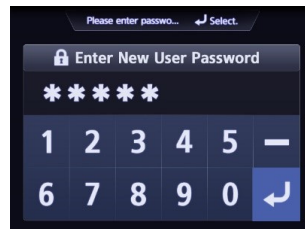
1. Current User Password



70D9V3KY168

Enter the current user passwr.

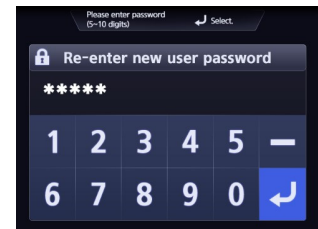
2. New User Password



35D9VB3KY144

Enter a new user password.

3. Re-enter

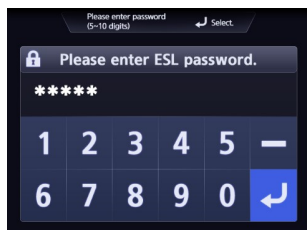


70D9V3KY169

Enter a new user password again.

b. ESL Password Change

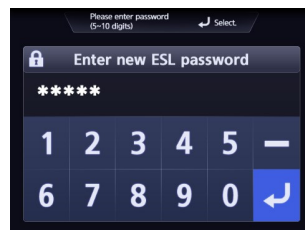
1. Current User Password



70D9V3KY166

Enter the current user password.

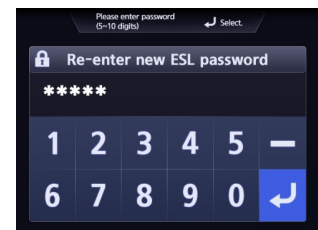
2. New User Password



70D9V3KY167

Enter a new user password.

3. Re-enter



70D9V3KY168

Enter a new user password again.

⑤ Consumables Management

1. Display Setting



35D9VB3KY49

Enter to Display Setting.

2. Conusmables Management



70D9V3KY174

Choose Consumables Management and enter.














3. List



70D9V3KY143

8) CAUSES AND CORRECTION OF CLUSTER WARNING LAMP

No.	Warning lamp types	Symbol	Warning and indicator lamp	Causes and correction
1	Engine oil pressure warning		Engine oil pressure warning lamp	Engine oil pressure is low. Please fill the engine oil
2	Engine warm-up indicator		Engine warm-up indicator lamp	Warm-up will be started.
3	Air cleaner warning		Air cleaner warning lamp	Replace the air cleaner filter.
4	Water in fuel warning		Water in fuel warning lamp	Please drain the water of the fuel filter.
5	Engine check warning		Engine check warning lamp	Check the failure code of cluster.
6	Engine stop warning		Engine stop warning lamp	Check the failure code of cluster.
7	Fuel warmer indicator		Fuel warmer indicator lamp	Warming up the fuel.
8	Transmission oil temperature warning		Transmission oil temperature warning lamp	T/M oil is over temperature condition. 110 °C (230 °F) or higher : Amber 120 °C (248 °F) or higher : Red
9	Parking brake indicator		Parking brake indicator lamp	Parking brake is the operational status.
10	Battery charging warning		Battery charging warning lamp	Battery is not being charged. Please check alternator and wiring.
11	Tilt lock indicator (if installed)		Tilt lock indicator lamp	Auto-leveling is the operational status.
12	OPSS indicator		OPSS indicator lamp	OPSS is working : Driving, lifting, and tilting is locked or the truck is parked status.

No.	Warning lamp types	Symbol	Warning and indicator lamp	Causes and correction
13	Fuel level warning		Fuel level warning lamp	Fuel level is low. Please fill the fuel.
14	Coolant temperature warning		Engine coolant temperature warning lamp	Engine coolant is over temperature condition.
15	Clutch protection warning		Clutch protection warning lamp	Clutch protection warning operation
16	Consumables replacement indicator		Consumables replacement indicator lamp	Consumables replacement cycle has been passed.
17	LH Turn indicator		LH Turning indicator lamp	-
18	RH Turn indicator		RH Turning indicator lamp	-
19	Forward gear		Forward gear, 1 gear, 2 gear, and 3 gear indicator lamp	-
20	Reverse gear		Reverse gear, 1 gear, 2 gear, and 3 gear indicator lamp	-
21	Communication error warning (ECU)		Communication error warning lamp	Communication between cluster-CI and ECU has been failed. Check communication line.
22	Communication error warning (FSCU)		Communication error warning lamp	Communication between cluster-CI and FSCU has been failed. Check communication line.
23	Brake fail warning		Brake fail warning lamp	Stop the engine and check for its cause.
24	Side mirror heated indicator		Side mirror heated pilot lamp	Side mirror heated operation
25	Seat belt reminder		Seat belt reminder lamp	Please wear seat belt

GROUP 4 COMPONENT SPECIFICATION

No	Part name	Qty	Specification												
1	Battery	2	24 V × 80 AH RC : 190 min CCA : 850 A												
2	LED work lamp	2	12~24 V, 20~27 W												
3	License lamp (opt)	1	24 V, 5 W												
4	LED rear combination lamp	2	24 V, LED (turn signal, tail, stop)												
5	LED head and turn lamp	2	24 V, 26 W (high and low), 18 W (low) 24 V, 2.4 W (turn)												
6	Room lamp	1	24 V, 10 W												
7	LED beacon lamp (opt)	1	12~24 V, Max. 0.96 A												
8	Radio and USB player	1	12~32 V, 20 W × 2												
9	Cluster	1	12 V / 24 V												
10	Rear view camera	1	6~32 V, 1.4 W												
11	12V socket	1	12 V, 10 A												
12	Relay (5P)	7	24 V, 20 A												
13	Flasher unit	1	24 V, 85 ± 10 C/M, $(23 \text{ W} + 23 \text{ W}) \times 2 + 3 \text{ W} \times 2$												
14	Back buzzer	1	24 V, 90 ± 5 dB, 60 ± 10 C/M, 300 mA												
15	Warning buzzer	1	24 V, 85 ± 5 dB, 120 ± 20 C/M, 50 mA												
16	Horn	1	24 V, 100~115 dB, 3.5A												
17	Intermittent wiper relay	1	9~16 V, 2.5 A (rated), operating time : 4.5 ± 1 sec												
18	Fuel level sender	1	<table border="1"> <tr> <td>Float indicator</td><td>Empty</td><td>7/14</td><td>Full</td></tr> <tr> <td>Resistance (Ω)</td><td>EC</td><td>350</td><td>50</td></tr> <tr> <td>Tolerance (Ω)</td><td colspan="3">$\pm (R \times 1.5 \% + 1 \Omega)$</td></tr> </table>	Float indicator	Empty	7/14	Full	Resistance (Ω)	EC	350	50	Tolerance (Ω)	$\pm (R \times 1.5 \% + 1 \Omega)$		
Float indicator	Empty	7/14	Full												
Resistance (Ω)	EC	350	50												
Tolerance (Ω)	$\pm (R \times 1.5 \% + 1 \Omega)$														
19	Start switch	1	24 V, 60 A												
20	Parking brake switch	1	24 V, 20 A												
21	Main light switch	1	24 V, 15 A												
22	Auto shift switch	1	24 V, 20 A												
23	Power switch	1	24 V, 20 A												
24	Inhching switch	1	24 V, 20 A												
25	In/decrement switch	1	24 V, 20 A												
26	Rear wiper and washer switch	1	24 V, 20 A												
28	Rear work lamp switch (opt)	1	24 V, 20 A												
29	Hazard switch (opt)	1	24 V, 20 A												
30	Top wiper/washer switch (opt)	1	24 V, 20 A												
31	Multi function switch	1	24 V, 2 A												
32	Gear selector switch	1	24 V, 3.5 A												
33	Master switch (opt)	1	6~36 V, 180 A												
34	Cabin tilt switch	1	24 V, 20 A												

GROUP 5 CONNECTOR DESTINATION

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-3	KET	1	I/conn (frame-main harness)	MG640994-5	MG650943-5
CN-4	KET	1	Battery B+ harness	MG642292	MG650943-5
CN-6	AMP	15	I/conn (main-aircon harness)	2-85262-1	-
CN-7	AMP	4	Fuel heater	2-967325-3	-
CN-12	AMP	26	I/conn (main-safety harness)	1897009-2	1897013-2
CN-13	KET	12	I/conn (main-safety harness)	MG610346	MG640348
CN-14	AMP	42	I/conn (frame-main harness)	936421	936429
CN-15	RINGTERM	-	ECM earth	S820-308000	-
CN-17	AMP	3	I/conn (frame harness-load sensor)	174357-2	174359-2
CN-21	DEUTSCH	8	Front wiper	DT06-8S	-
CN-22	KET	2	Front washer pump	MG610320	-
CN-23	-	2	Speaker (LH)	MG610070	-
CN-24	-	2	Speaker (RH)	MG610070	-
CN-25	KUM	2	Horn	PU465-02627	-
CN-27	-	16	Radio and USB player	PK145-16017	-
CN-29	-	2	Receiver dryer	MG640795	-
CN-30	KUM	1	Aircon compressor	PB625-01027	-
CN-31	AMP	15	I/conn (main-aircon harness)	2-85262-1	-
CN-37	QPL	-	Fuse box main assy	21HN-55010	-
CN-45	HCE	1	Start motor (B+)	S820-310000	-
CN-45	HCE	1	Start motor (M)	S820-205000	-
CN-56	MOLEX	73	Cluster CI	34566-0103	-
CN-57A	MOLEX	4	Monitor power	-	52213-0417
CN-57B	MOLEX	4	Monitor sig	-	52266-0417
CN-57C	MOLEX	2	Monitor trigger	-	52266-0211
CN-58A	DAEDONG	3	User authentication power	110-3PR	-
CN-58B	DAEDONG	2	User authentication CAN	110-2PR	-
CN-65	KET	1	Backup buzzer	ST730018-3	ST750036-2
CN-70	-	4	Top wiper motor	180900	-
CN-71	DEUTSCH	2	Pakring solenoid	DT06-2S	-
CN-71	DEUTSCH	6	Seat switch	DT06-6S	21HN-52080
CN-74	RINGTERM	-	Alternator (B+)	-	S820-306000
CN-74	RINGTERM	-	Alternator (L)	-	S820-105000
CN-83	-	2	Condenser fan	PB625-02027	-
CN-90	AMP	36	I/conn (main-cabin harness)	1743059-2	1743062-2
CN-91	AMP	6	I/conn (main-monitor harness)	174262-2	174264-2
CN-92	KET	6	I/conn (monitor-main harness)	174262-2	174264-2
CN-95	KET	2	Fusible link	-	MG620558

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-98	DEUTSCH	3	Resistor	DT06-3S-EP06	DT04-3S-EP10
CN-102	-	4	Rear wiper motor	180900	-
CN-103	KET	2	Rear washer pump	MG610320	-
CN-113	KET	2	Warning buzzer	MG610320	-
CN-122	DEUTSCH	2	Forward solenoid 1	DT06-2S	-
CN-123	DEUTSCH	2	Reverse solenoid	DT06-2S	-
CN-124	AMP	6	Accel pedal	174262-2	-
CN-125	-	1	ORBCOMM	-	TNC-C-58
CN-125	DEUTSCH	12	I/conn (main harness-RMCU)	DT06-12S	DT04-12P
CN-125	-	1	I/conn (cabin harness-GPS)	-	SMA-C-316R/V
CN-131	DEUTSCH	2	Attach cut solenoid	DT06-2S	-
CN-132	DEUTSCH	2	Forward solenoid 2	DT06-2S	-
CN-134	MOLEX	16	Diagnosis	51115-1601	-
CN-135	DEUTSCH	9	ECU service	HD10-9-1939P	-
CN-136	AMP	4	RMCU service	174257-2	-
CN-138	KET	3	Converter	MG610045	-
CN-139	KET	2	Socket (12 V)	MG610043	-
CN-147	KET	2	Cabin tilt relay switch	MG640188-4	-
CN-151	AMP	94	ECU	1897301-2	-
CN-175	DEUTSCH	2	Drain valve	DT06-2S	-
CN-191	AMP	4	I/conn (frame harness-G sensor)	174257-2	174259-2
CN-202	AMP	2	Washer pump-top	172130-1	-
CN-221	DEUTSCH	2	Heated mirror-LH	DT06-2S	-
CN-222	DEUTSCH	2	Heated mirror-RH	DT06-2S	-
CN-229	AMP	2	USB charger	172434-2	-
CN-249	-	4	Rear view camera	174257-2	174259-2
CN-251	-	1	RMS antenna (ORBCOMM)	FME J1505-58	-
CN-251	-	1	RMS antenna (GPS)	-	FME P1505-316
CN-252	-	1	RMS antenna (ORBCOMM)	TNJ-C-58	TNC-C-58
CN-253	-	1	RMS antenna (GPS)	SMJ-C-316R/V	SMA-C-316R/V
CN-900	DEUTSCH	2	Inching valve	DT06-2S	-
· Switch					
CS-2	KET	2	Start switch	MG610281	MG620282
CS-3	QPL	10	Rear wiper switch	QPL-CN-0001	-
CS-5	KET	2	Center horn	-	MG640322
CS-5A	KET	2	Center horn	MG610320	-
CS-5B	KET	1	Center horn	-	S820-105000
CS-10	QPL	10	Fuel warmer switch	QPL-CN-0001	-
CS-10	KET	1	Brake cooling switch	ST730018-3	-
CS-11	KET	8	Multi function switch	MG610339	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CS-12	KET	6	Multi function switch	MG610335	-
CS-13	AMP	8	Gear selector switch	174982-2	-
CS-15	KET	1	Multi function switch	ST730018-3	-
CS-17	QPL	10	Parking brake switch	QPL-CN-0001	-
CS-21	QPL	10	Work lamp switch	QPL-CN-0001	-
CS-39	QPL	10	Main light switch	QPL-CN-0001	-
CS-41	QPL	10	Hazard switch	QPL-CN-0001	-
CS-42	QPL	10	Inching switch	QPL-CN-0001	-
CS-59	QPL	10	Auto shift switch	QPL-CN-0001	-
CS-64	QPL	10	In/decrement switch	QPL-CN-0001	-
CS-74	DEUTSCH	4	Tilt switch	-	DT04-4P
CS-74	QPL	10	Mirror heater switch	QPL-CN-0001	-
CS-77	QPL	10	Cabin tilt switch	QPL-CN-0001	-
CS-79	QPL	10	Power/standard switch	QPL-CN-0001	-
CS-103	QPL	10	Top wiper/washer switch	QPL-CN-0001	-
· Lamp					
CL-1	-	2	Room lamp (LH)	MG610392	-
CL-3	-	6	Head lamp (LH)	HP285-06021	-
CL-4	-	6	Head lamp (RH)	HP285-06021	-
CL-7	-	2	Beacon lamp	DT06-2S	DT04-2P
CL-15A	AMP	4	Turn/Stop/Tail lamp (black)	184050-2	-
CL-15B	AMP	4	Backup/Stop/Tail lamp (gray)	184050-2	-
CL-16A	AMP	4	Turn/Stop/Tail lamp (black)	184050-2	-
CL-16B	AMP	4	Backup/Stop/Tail lamp (gray)	184050-2	-
CL-21	KET	1	License lamp	ST730018-3	ST750036-2
CL-22	-	2	Rear work lamp (LH)	DT06-2S	-
CL-23	-	2	Rear work lamp (RH)	DT06-2S	-
CL-51	-	2	Room lamp (RH)	MG610392	-
· Relay					
CR-6	KET	4	INT wiper relay	MH610047	-
CR-11	TYCO	3	Fisher unit relay	21LM-01600	-
CR-23	AMP	4	Start relay	172134-1	-
CR-24	RINGTERM	-	Heater relay	S820-106000	-
CR-24	KET	1	Heater relay	ST730018-3	-
CR-32	HELLA	5	Gear shift relay 2	8JA003526-001	-
CR-35	HELLA	5	Back up relay	8JA003526-001	-
CR-44	AMP	2	Cabin tilt relay coil relay	174352-2	-
CR-50	HELLA	5	Travel cut relay	8JA003526-001	-
CR-51	HELLA	5	Attach cut relay	8JA003526-001	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CR-56	HELLA	5	Gear shift relay 1	8JA003526-001	-
CR-71	HELLA	5	Cab tilt safety relay	8JA003526-001	-
CR-72	HELLA	5	Mirror heater relay	8JA003526-001	-
· Sensor and pressure switch					
CD-2	DEUTSCH	3	Fuel sender	DT06-3S-EP06	-
CD-3	DEUTSCH	3	Brake fail pressure switch	DT06-3S	-
CD-3	DELPHI	3	Inching sensor	12110293	-
CD-4	AMP	1	Brake switch	171809-2	-
CD-6	DEUTSCH	4	G-sensor	DT06-4S	-
CD-10	KET	1	Air cleaner switch	ST730057-2	-
CD-17	AMP	2	Speed pickup-engine	1-1418483-1	-
CD-25	DEUTSCH	3	TM pressure/temp sensor	DT06-3S	-
CD-26	DEUTSCH	3	Parking switch	DT06-3S-EP06	-
CD-29	AMP	2	Sump temperature sensor	963040-3	-
CD-38	DEUTSCH	2	Water in fuel sensor	DT06-2S	-
CD-40	KET	3	Speed sensor	MG610327-5	-
CD-70	DEUTSCH	3	Load sensor	DT06-3S	-

GROUP 6 TROUBLESHOOTING

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.	· Recharge battery. · Replace
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 8-4

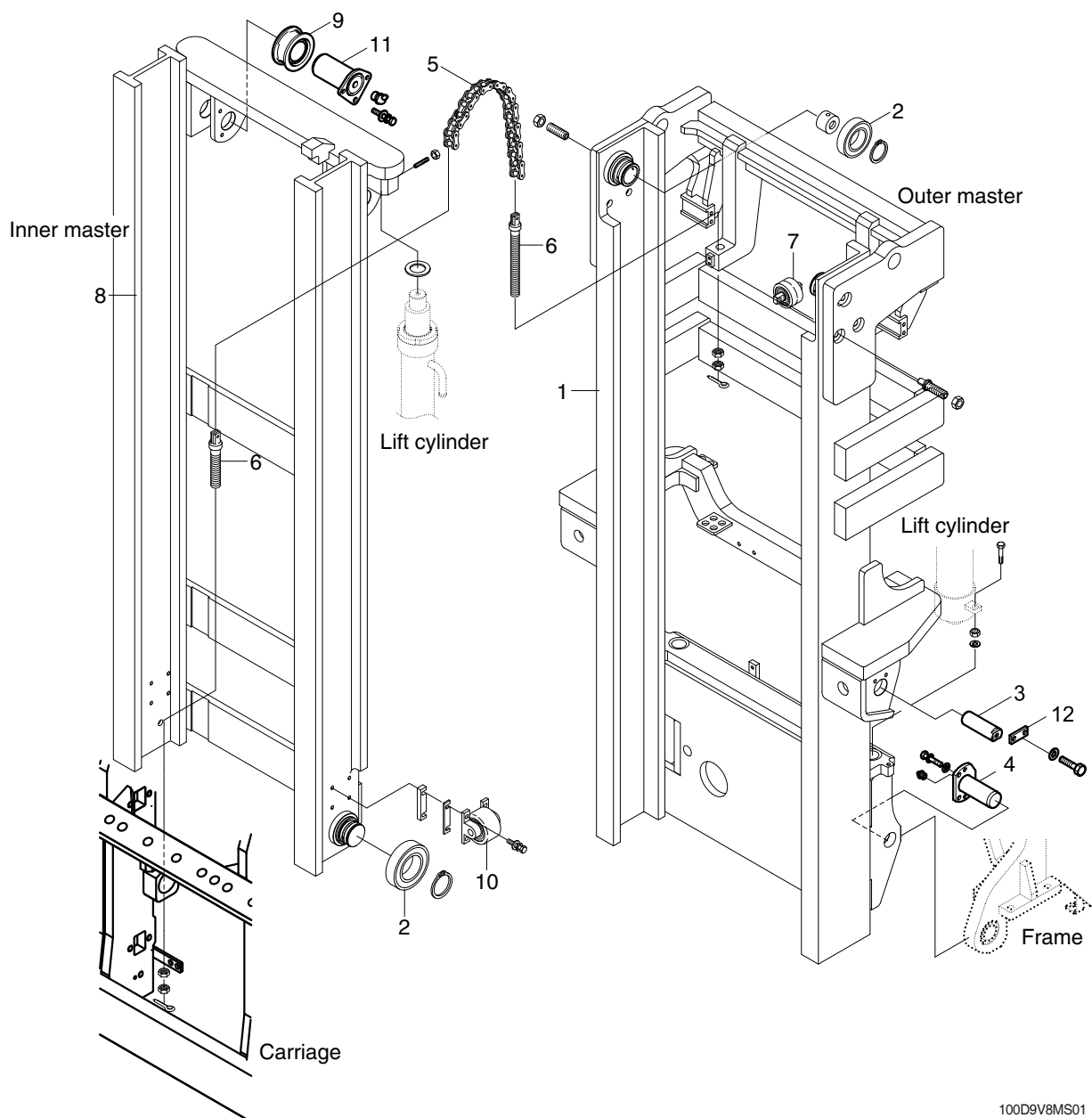
Group 3 Adjustment 8-7

Group 4 Removal and Installation 8-9

SECTION 8 MAST

GROUP 1 STRUCTURE

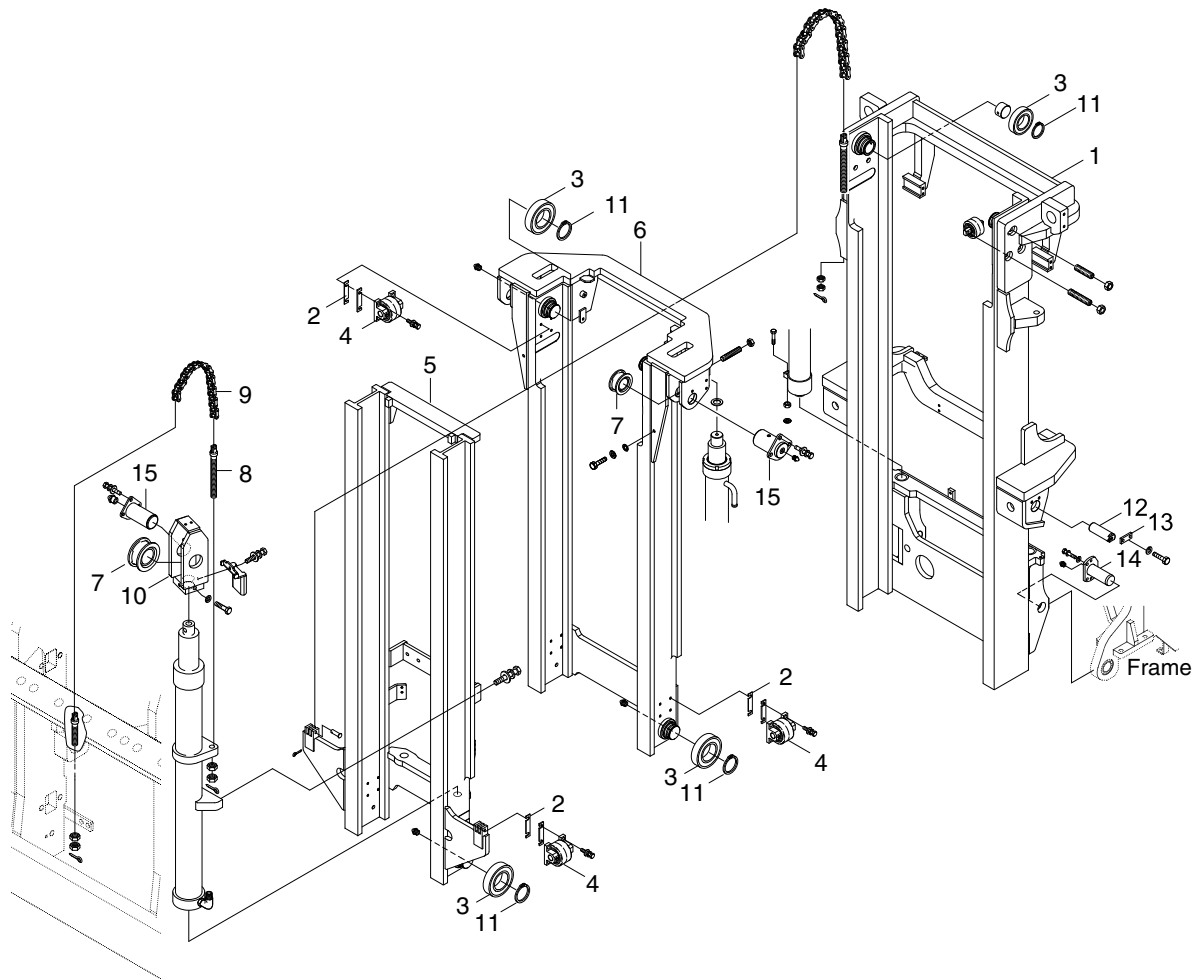
1. 2 STAGE MAST (V MAST)



100D9V8MS01

- | | | | | | |
|---|-------------------|---|---------------------|----|----------------------|
| 1 | Outer mast | 5 | Lift chain | 9 | Chain sheave bearing |
| 2 | Roller bearing | 6 | Anchor bolt | 10 | Side roller bearing |
| 3 | Tilt cylinder pin | 7 | Side roller bearing | 11 | Joint pin |
| 4 | Mast mounting pin | 8 | Inner mast | 12 | Lock plate |

2. 3 STAGE MAST (TS MAST)

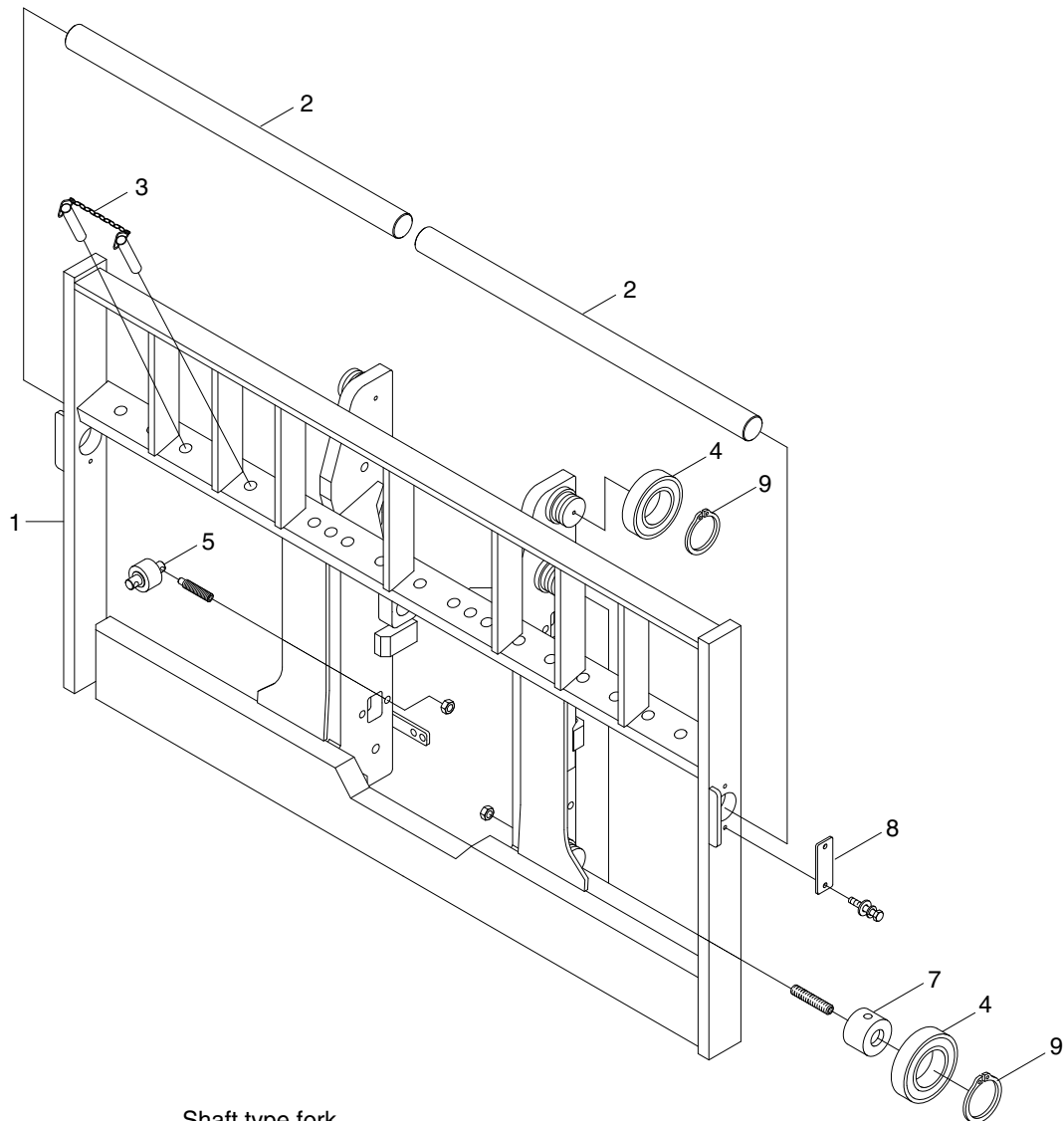


100D9V8MS02

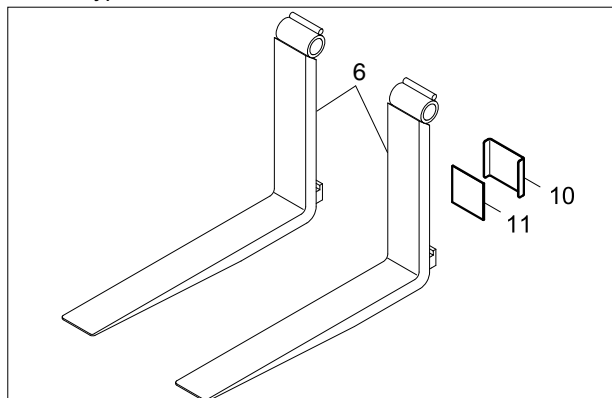
- | | | | | | |
|---|---------------------|----|----------------|----|---------------------|
| 1 | Outer mast | 6 | Middle mast | 11 | Retainer ring |
| 2 | Shim | 7 | Sheave | 12 | Tilt cylinder pin |
| 3 | Load roller bearing | 8 | Anchor bolt | 13 | Lock plate |
| 4 | Side roller bearing | 9 | Chain | 14 | Master mounting pin |
| 5 | Inner mast | 10 | Sheave bracket | 15 | Joint pin |

3. CARRIAGE, BACKREST AND FORK

1) SHAFT TYPE



Shaft type fork



- | | | | | | |
|---|---------------------|---|-------------|----|---------------|
| 1 | Carriage & backrest | 5 | Side roller | 9 | Retainer ring |
| 2 | Hanger bar | 6 | Fork | 10 | Spacer |
| 3 | Fork retaining | 7 | Wear plug | 11 | Spacer |
| 4 | Roller | 8 | Cover | | |

100D9V8MS03

GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

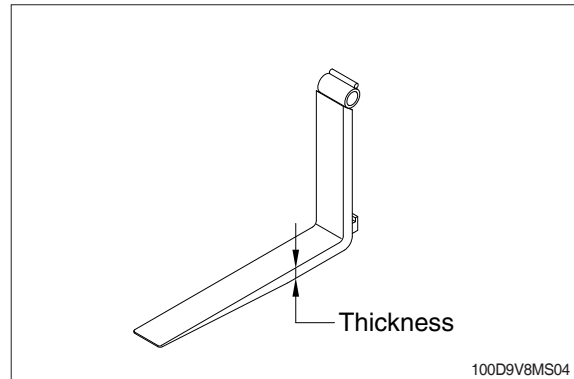
1. OPERATIONAL CHECKS

1) FORKS

- (1) Measure thickness of root of forks and check that it is more than specified value.

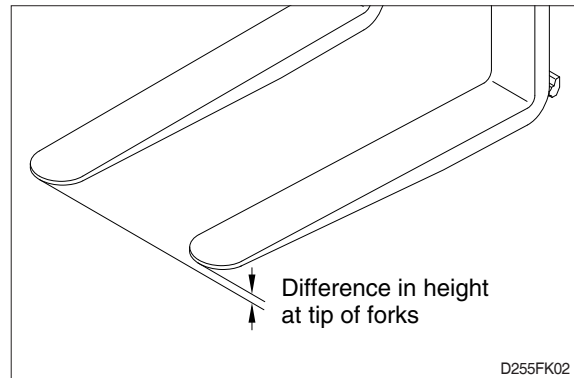
EX : $\ell = 1200$ mm (47 in)

STD Fork assy	Applicable model	mm (in)	
		Standard	Limit
65FQ-70110	100D-9	70 (5.7)	63 (2.4)



- 2) Set forks in middle and measure out of parallel and difference in height at the top of forks.

Model	Fork length	Height difference
100D-9	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 10 cm 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

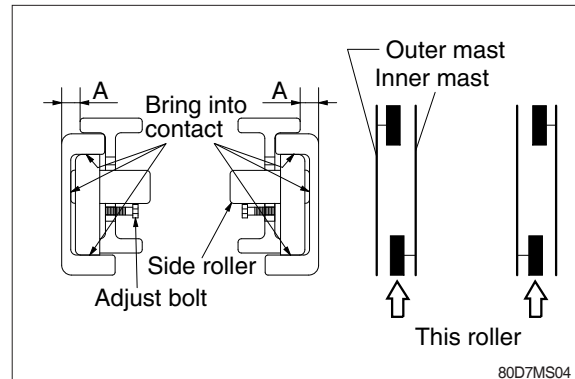
Problem	Cause	Remedy						
Abrasion	Long-time operations causes the fork to wear and reduces the thickness of the fork. Inspection for thickness is needed. · Wear limit : Must be 90% of fork thickness	If the measured value is below the wear limit, replace fork.						
Distortion	Forks are bent out of 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 border="1"><thead><tr><th>Fork length (mm)</th><th>Height difference (mm)</th></tr></thead><tbody><tr><td>equal or below 1500</td><td>3</td></tr><tr><td>above 1500</td><td>4</td></tr></tbody></table>	Fork length (mm)	Height difference (mm)	equal or below 1500	3	above 1500	4	If the measured value exceeds the allowance, replace fork.
Fork length (mm)	Height difference (mm)							
equal or below 1500	3							
above 1500	4							
Fatigue	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.	Repair fork by expert. In case of excessive distortion, replace fork.						

GROUP 3 ADJUSTMENT

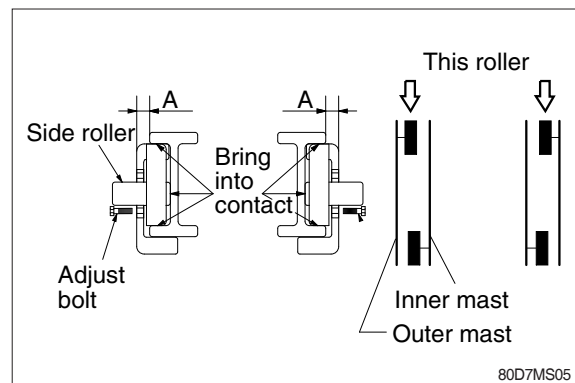
1. MAST LOAD ROLLER

1) INNER/OUTER MAST ROLLER CLEARANCE ADJUSTMENT

- (1) Measure the clearance with the mast overlap at near 480 mm (19 in).
- (2) Shift the inner mast to one side to bring the side roller into contact with the outer mast, and adjust the clearance between the end of inner beam and the outside of outer mast position on the opposite side to the following value by adjust bolt.
 - Reference clearance $A = 43.1 \text{ mm}$



- (3) Distribute the clearance A equally to the left and right.
- (4) After the adjustment, check that the inner mast moves smoothly in the outer mast.

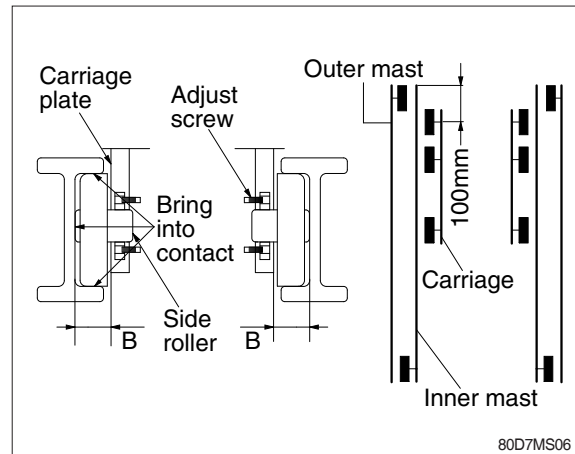


2) CARRIAGE LOAD ROLLER

- (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 side roller into contact with the inner mast, and measure the clearance between inner face of the inner mast and carriage plate at the closest position on the opposite side to the following value by adjust screw.
 - Reference clearance B = 56.9 mm

(3) Distribute the clearance B equally to the left and right.

- (4) After the adjustment, the carriage should move smoothly along the overall mast length.

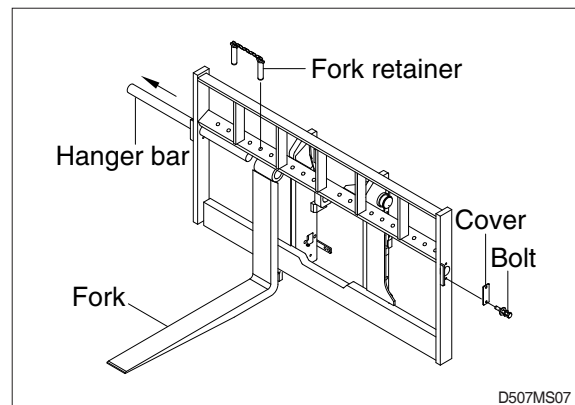


GROUP 4 REMOVAL AND INSTALLATION

1. FORKS

1) SHAFT TYPE

- (1) Lower the fork carriage until the forks are approximately 25 mm (1 in) from the floor.
- (2) Release fork retainer and remove cover.
- (3) Slide one hanger bar at a time out of carriage assembly.
- (4) Remove only one fork at a time.
 - ※ On larger forks it may be necessary to use a block of wood.
- (5) Reverse the above procedure to install load forks.



3. CARRIAGE ASSEMBLY

1) CARRIAGE

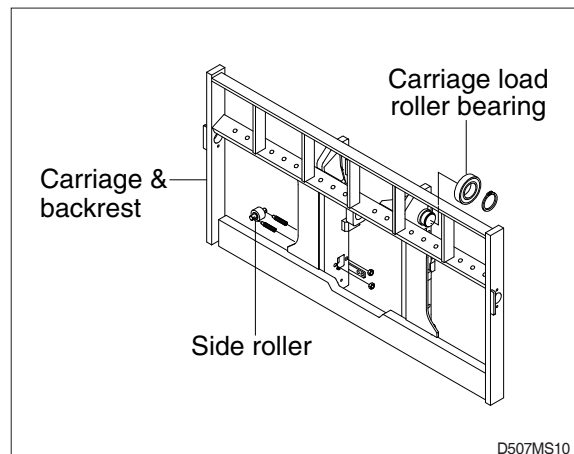
- (1) With the mast vertical, raise the carriage high enough to place blocks under the load forks. This is done to create slack in the load chains when the carriage is lowered. Lower the carriage all the way down to the floor. Make sure the carriage is level, this will prevent any binding when the mast 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 inner mast 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 parts.
 - (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 removal paragraph.
- (2) Loosen and remove nuts, adjust screws and side rollers from carriage side plate.
- (3) Thoroughly clean, inspect and replace all worn or damaged parts.
- (4) Reverse the above procedure to assembly.

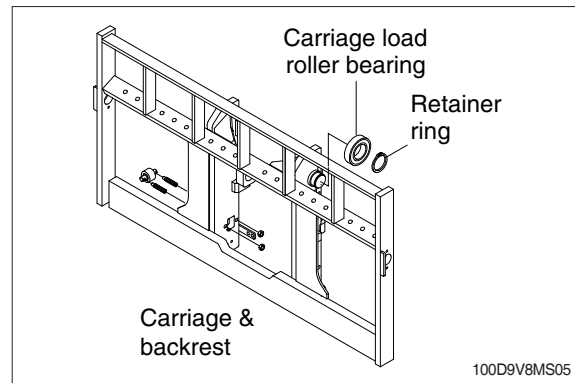
※ Adjustment

- 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 along 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 BEARING

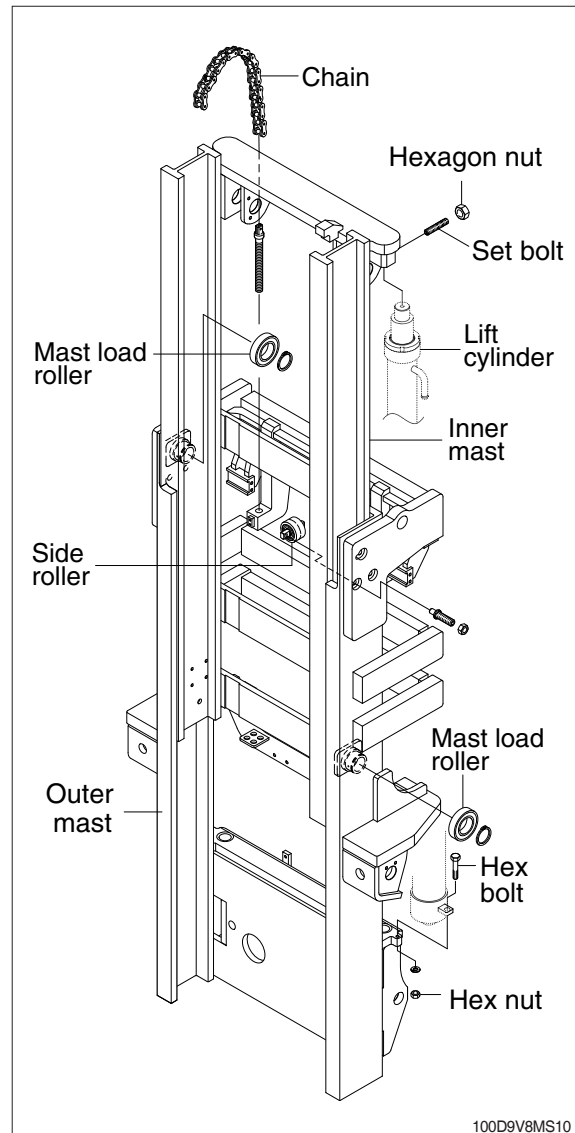
- (1) Remove carriage as outlined in the carriage removal paragraph.
- (2) Using the plier, remove retaining rings from load roller bearing bracket.
- (3) Using a plier, remove load roller bearings from load roller bearing bracket.
- (4) Reverse the above procedure to assemble. Refer to MAST ROLLER ADJUSTMENT paragraph.



4. MAST LOAD ROLLER

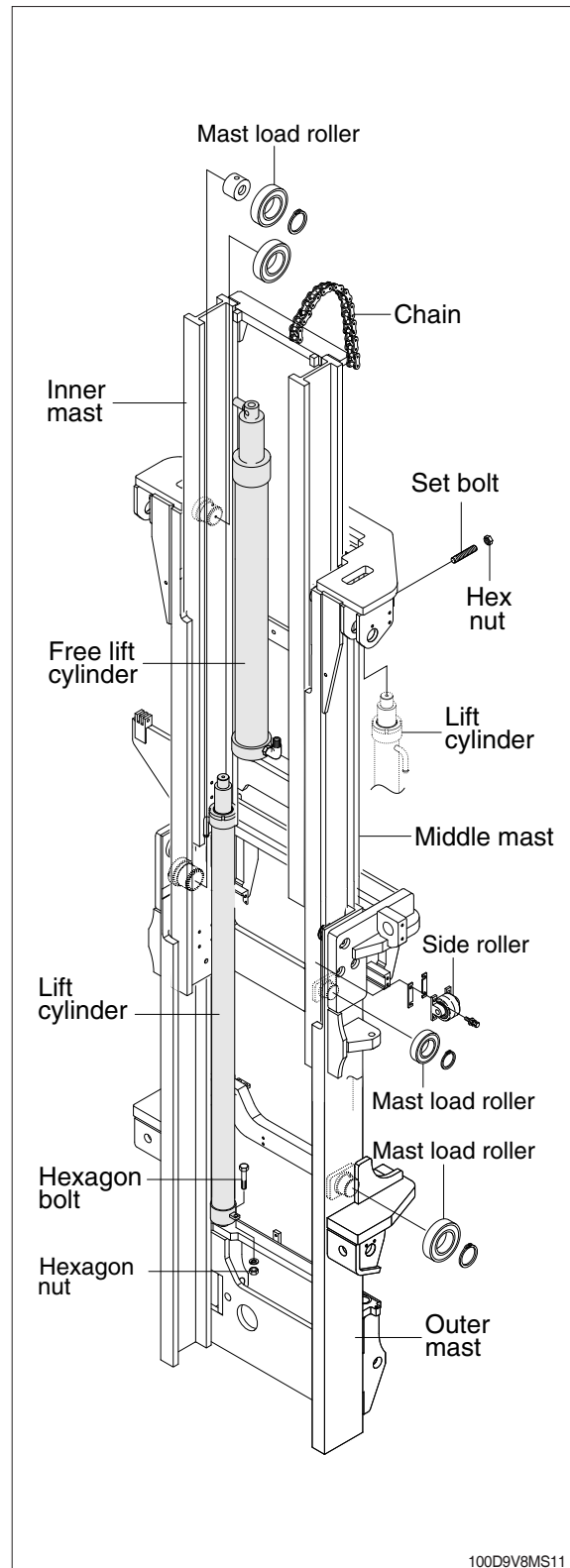
1) 2 STAGE MAST (V MAST)

- (1) Remove the carriage assembly and move them to one side.
- (2) Loosen and remove hexagon nuts and set bolts securing lift cylinders to inner mast.
- (3) Loosen and remove hexagon bolts and nuts securing lift cylinders to outer 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) with ropes to the outer mast.
- (6) Using the overhead hoist, lower inner mast until top and bottom rollers are exposed.
- (7) Using a plier, remove load rollers from load roller bracket. Remove side rollers.
- (8) Thoroughly clean, inspect and replace all worn or damaged parts.
- (9) Reverse the above procedure to assemble. Refer to MAST ROLLER ADJUSTMENT paragraph.
- (10) After completing all necessary steps for load rollers removal, use an overhead hoist to remove sling or chain around upper crossmember of the inner mast section. Lift inner mast upright straight up and out of outer mast section.
- (11) Replace and reverse above procedure to install.
- (12) Make all necessary measurements and adjustments.



3) 3 STAGE MAST(TS MAST)

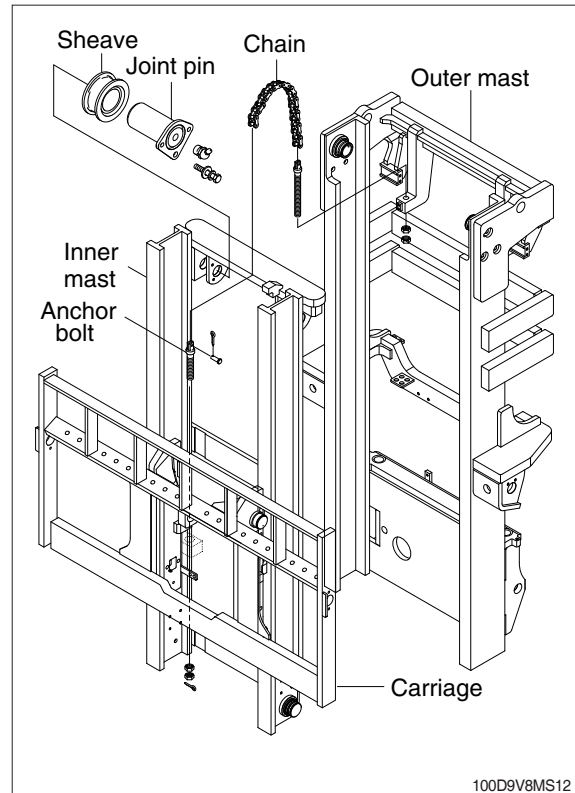
- (1) Remove the carriage assembly and move it to one side.
- (2) Loosen and remove hexagon bolt securing bottom cylinder from outer mast.
- (3) Loosen and remove set bolts and nuts securing lift cylinders to middle mast.
- (4) Attach chains or sling to the inner and middle mast section at top crossmember. 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 4inch 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 supporting 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 plier, remove load rollers from load bracket. Remove side rollers from mast.
- (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 plier, remove load rollers from 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 ADJ-USTMENT Paragraph.



5. CHAIN

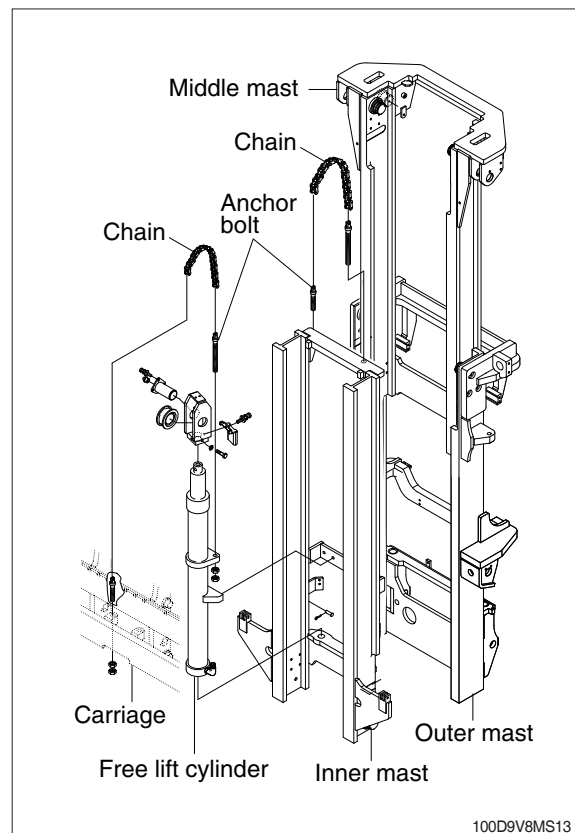
1) CHAIN SHEAVE

- (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 chain 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. Use new split pins in chain anchor pins.



2) REAR CHAIN SHEAVE (TS mast)

- (1) Raise and securely block carriage and inner mast section.
- (2) Remove the split pin securing the chain anchor pins and discard.
- (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) SHEAVE SUPPORT (TS mast)

- (1) Remove the carriage assembly and move to one side.
- (2) After removing bolt to securing sheave support assembly to free lift cylinder.
Attach a sling to the sheave 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 sheave to sheave support.
- (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 procedure to install.

4) REAR CHAIN (TS 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 sheaves, the joints very gradually wear. The stretch a chain develops 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 out 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 phenomenon 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.

(6) Chain side wear

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.

(7) Chain anchors and sheaves

An inspection of the chain system includes a close examination of chain anchors and sheaves. 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. Sheaves 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 mm), 3/4 (19.05 mm), 1 (25.4 mm), 1-1/2 (38.1 mm), 2 (50.8 mm), use side A of scale.
- If pitch is 5/8 (15.875 mm), 1-1/4 (31.75 mm) or 2 (50.8 mm), 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 joints 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 sheaves. 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.