CONTENTS

FOREWORD

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.

1) Filing method
   See the page number on the bottom of the page.
   File the pages in correct order.

2) Revised edition mark(①②③…)

   When a manual is revised, an edition mark is recorded on the bottom outside corner of the pages.
   Revisions
   Revised pages are shown at the list of revised pages on the between the contents page and section 1 page.
   Symbols
   So that the shop manual can be of ample practical use, important places for safety and quality are marked with the following symbols.

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

3 CONVERSION TABLE

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

Example

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

   ① Locate the number 50in the vertical column at the left side, take this as a, then draw a horizontal line from a.
   ② Locate the number 5in 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, 55mm
   = 2.165 inches.

2) Convert 550mm into inches.
   ① The number 550 does not appear in the table, so divide by 10(Move the decimal point one place to the left) to convert it to 55mm.
   ② Carry out the same procedure as above to convert 55mm to 2.165 inches.

   ③ The original value(550mm) 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 550mm = 21.65 inches.

   Millimeters to inches ⓑ 1mm = 0.03937 in

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

90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

ⓐ

Millimeters to inches 1mm = 0.03937in

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

Kilogram to Pound 1kg = 2.2046lb

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

SJ

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

Liter to U.K. Gallon 1ℓ = 0.21997 U.K.Gal

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

kgf•m to lbf•ft 1kgf•m = 7.233lbf•ft

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

kgf/cm2 to lbf/in2 1kgf / cm2 = 14.2233lbf / in2

	0	1	2	3	4	5	6	7	8	9
0		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 versa 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.

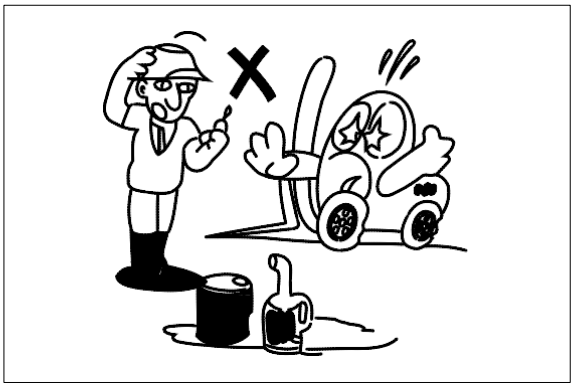
If it is desired to convert from Centigrade to Fahrenheit degrees, consider the center column as a table of Centigrade values, and read the corresponding Fahrenheit temperature on the right.

℃	℃/℉	℉	℃	℃/℉	℉	℃	℃/℉	℉	℃	℃/℉	℉
-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

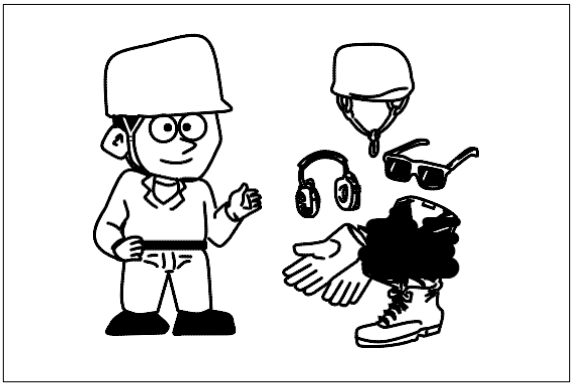
SECTION 1 GENERAL

GROUP1 SAFETY HINT

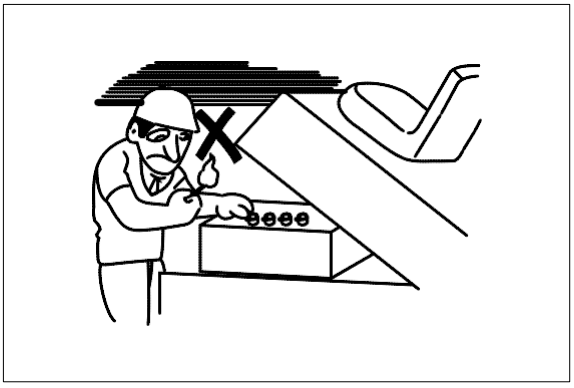
Careless performing of the easy work may cause injuries
Take care to always perform work safely, at least observing the following.
• Oil is a dangerous substance. Never handle oil, grease or oily clothes in places where there is any fire of flame.
As preparation in case of fire, always know the location and directions for use of fire extinguishers and other firefighting equipment.



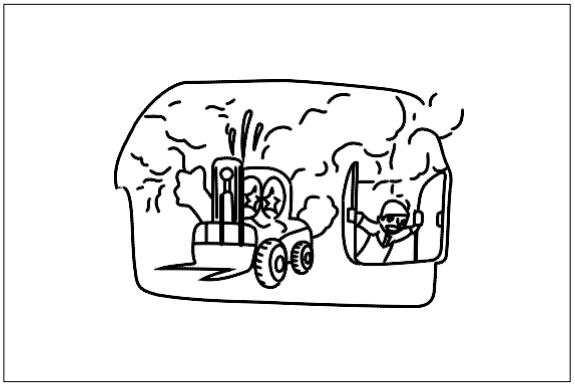
Wear well-fitting helmet, safety shoes and working clothes. When drilling, grinding or hammering, always wear protective goggles. Always do up safety clothes properly so that they do not catch on protruding parts of machines. Do not wear oily clothes.
When checking, always release battery plug.



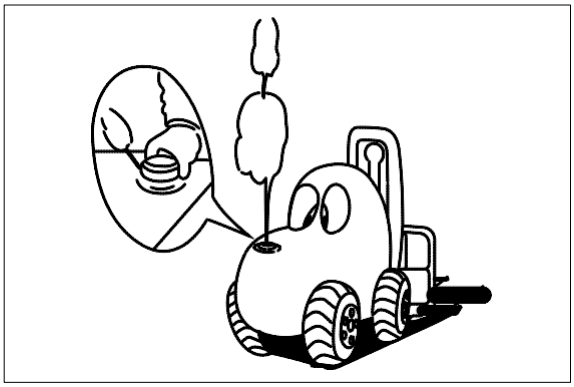
• Flames should never be used instead of lamps. Never use a naked flame to check leaks or the level of oil or electrolyte.



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

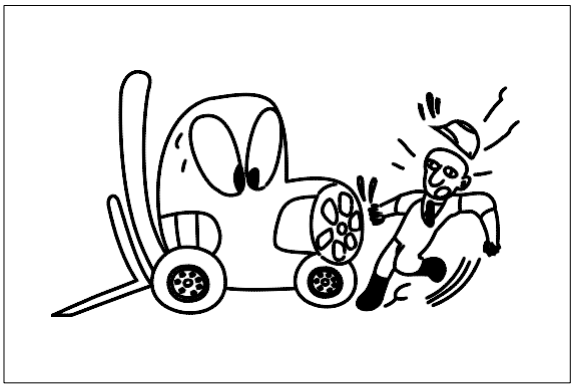


Be particularly careful when removing the radiator cap and the hydraulic oil tank filler cap, if this is done immediately after using the machine, there is a danger that boiled oil may spurt out.
• The procedure for releasing the hydraulic pressure is as follows: lower the fork to the ground, and stop the engine (Motor), move the control levers to each position two or three times.

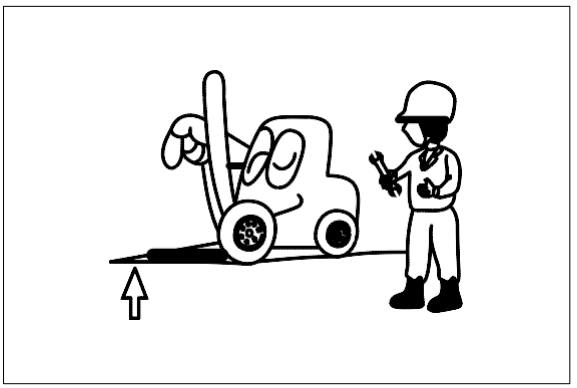


• When working on top of the machine, be careful not to lose your balance and fall.

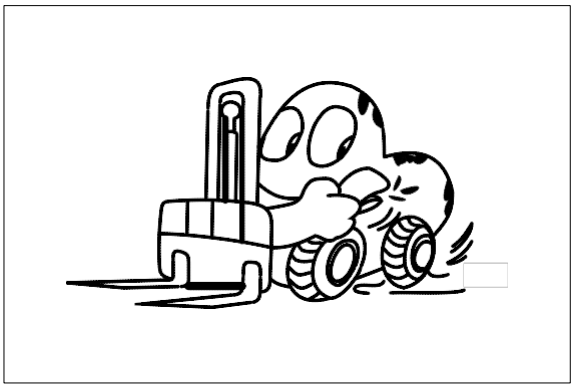
• Hand a caution sign in the operator's compartment (For example Do not start or Maintenance in progress).
This will prevent anyone from starting or moving the machine by mistake.
It is extremely dangerous to try to check the fan belt tension while the engine is running.



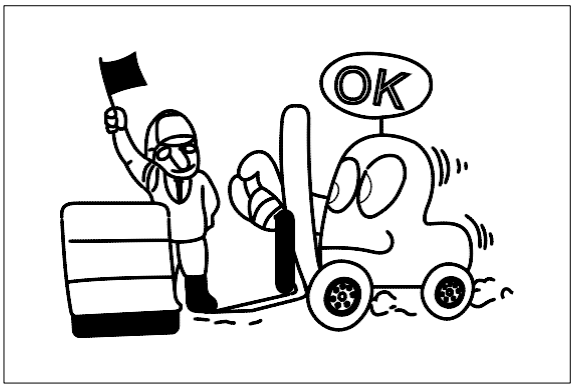
When inspecting the engine is running parts, or near such parts, always stop the engine first.
Before checking or servicing accumulator or piping, depress brake pedal repeatedly to release pressure.
• Park the machine on firm, flat ground.
Lower the fork to the ground and stop the engine.
Return each lever to NEUTRAL and apply the brake lock.



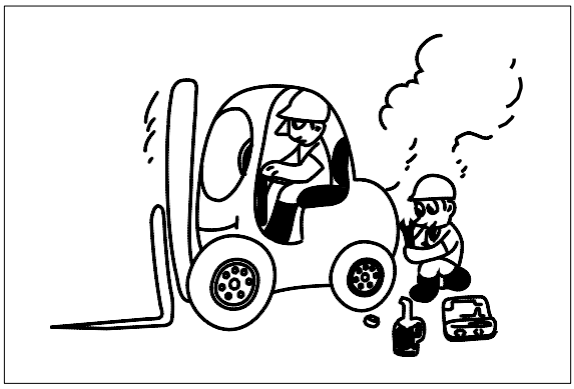
• Immediately remove any oil or grease on the floor of the operator's compartment, or on the handrail. It is very dangerous if someone slips while on the machine.



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



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



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

• Thoroughly clean the machine. In particular, be careful to clean the filler caps, grease fittings and the area around the dipsticks. Be careful not to let any dirt or dust into the system.
• Always use HYUNDAI Forklift genuine parts for replacement.
• Always use the grades of grease and oil recommended by HYUNDAI Forklift.
Choose the viscosity oil 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.

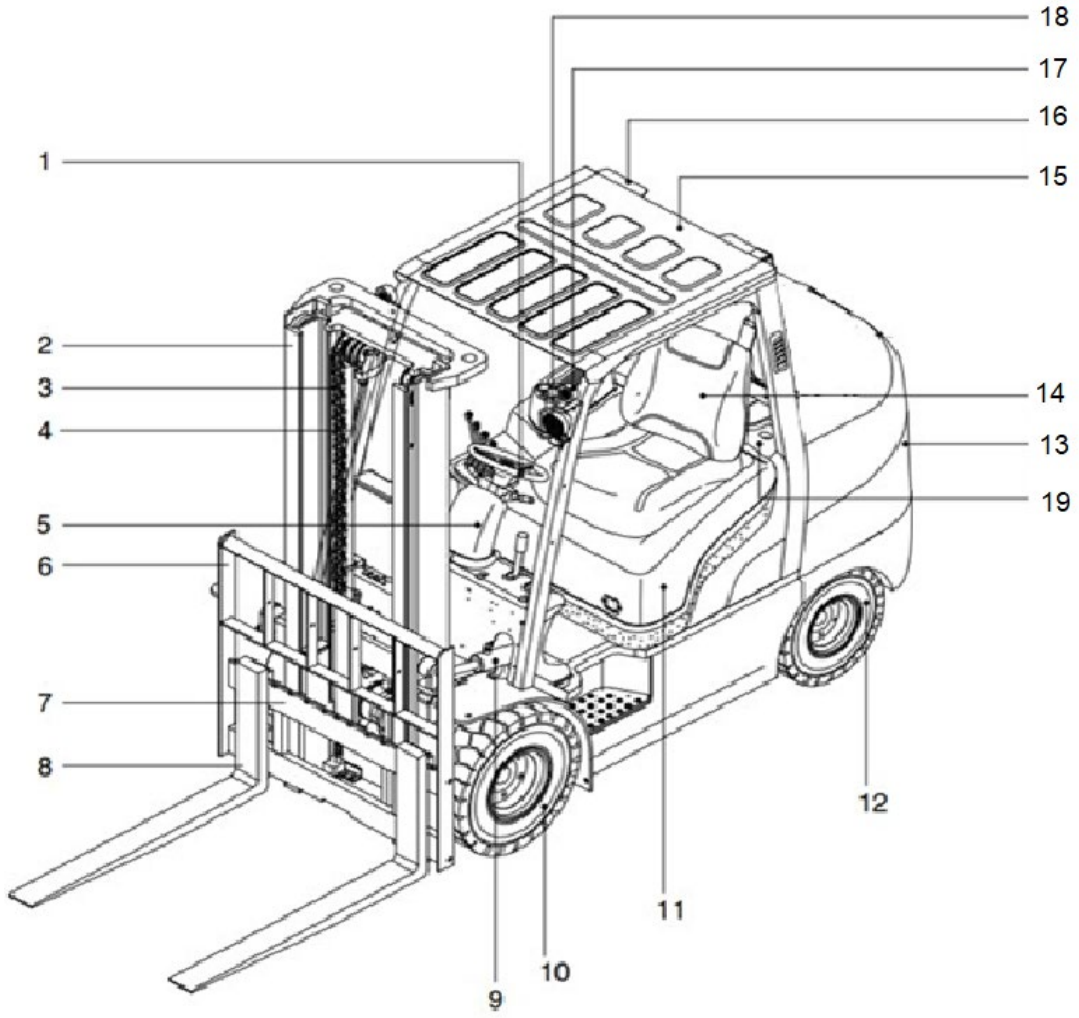
• Before draining the oil, warm it up to a temperature of 30 to 40℃.

• 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.

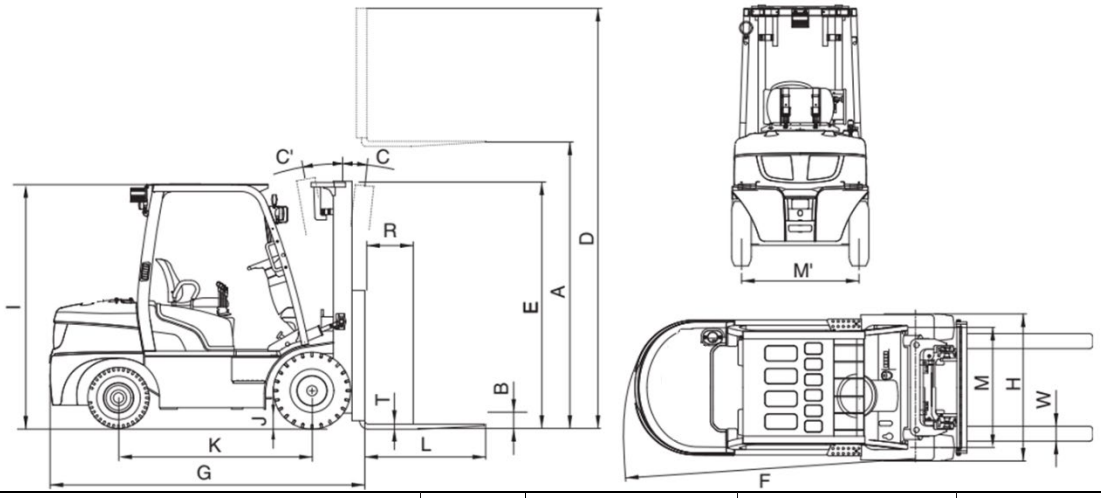
GROUP2 SPECIFICATIONS

1 GENERAL LOCATIONS



1	Steering wheel	8	Forks	15	Overhead guard
2	Mast	9	Tilt cylinder	16	Rear combination lamp
3	Lift chain	10	Front wheel	17	Turn signal lamp
4	Lift cylinder	11	Bonnet	18	Head lamp
5	Cluster	12	Rear wheel	19	Sub bonnet
6	Backrest	13	Counterweight		
7	Carriage	14	Seat		

2 SPECIFICATIONS



Model			Unit	25LE-7U	30LE-7U	35LE-7U
Capacity			kg	2500	3000	3500
Load center		R	mm	500	500	500
Weight (Unloaded)			kg	3728	4173	4595
Fork	Lifting height	A	mm	3005	3005	3005
	Free lift	B	mm	155	155	155
	Lifting speed (Unload/Load)		mm/sec	450/550	450/550	450/550
	Lowering speed (Unload/Load)		mm/sec	500/360	500/360	500/360
	L×W×T	L,W,T	mm	1050×122×45	1050×122×45	1050×122×45
Mast	Tilt angle(forward/backward)	C/C'	degree	6/10	6/10	6/10
	Max height	D	mm	4185	4185	4185
	Min height	E	mm	2025	2040	2040
Body	Travel speed		km/h	18.0/19.1	18.9/20.1	18.7/20.1
	Grade ability		%(°)	30.0	23.9	21.2
	Min turning radius (Outside)	F	mm	2313	2398	2455
ETC	Hydraulic oil tank		L	STD:40/OPT:50	STD:40/OPT:50	STD:40/OPT:50
	Fuel tank (Gasoline)		L	48.2	48.2	48.2
Overall length		G	mm	3685	3742	3827
Overall width		H	mm	1230	1230	1230
Overhead guard height		I	mm	2180	2180	2180
Ground clearance (Load)		J	mm	145	145	145
Wheelbase		K	mm	1650	1700	1700
Wheel tread front/rear		M,M'	mm	1005/980	1005/980	1005/980

3 SPECIFICATION FOR MAJOR COMPONENTS

1) Engine

Item	Unit	Specification
Model	-	MITSUBISHI / S4S
Type	-	4-cycle, vertical
Cooling Method	-	Water cooled
Number of cylinders and arrangement	-	4 cylinders, In line
Firing order	-	1-3-4-2
Cylinder bore X stroke	mm	94X120
Piston displacement	cc	3331
Compression ratio	-	22:1
Rated gross horse power	KW/rpm	35.3/2250
Maximum gross torque at rpm	N•m/rpm	177/1700
Engine oil quantity	L	8
Dry weight	kg	245
High idling speed	rpm	2480±20
Low idling speed	rpm	770±20
Rated fuel consumption	g/kW•h	265
Starting motor	V-kW	12 - 2.2
Alternator	V-A	12 - 50
Battery	V-AH	12 - 60

2) Main pump

Item	Unit	Specification
Type	-	Gear
Capacity	mL/r	28.4
Maximum operating pressure	bar	250
Rated speed (Max/Min)	rpm	400~3500

3) Main control valve

Item	Unit	Specification
Type	-	Sectional
Operating method	-	Mechanical
Relief valve pressure (Main/Aux)	bar	210/165
Flow capacity	lpm	76

4) Steering unit

Item	Unit	Specification
Type	-	Load sensing/Non load reaction/Dynamic signal
Capacity	cc/rev	125
Back pressure	bar	25
Input torque	N.m	1.4±0.2

5) Power train devices

Item			Specification
Torque converter	Type		3 Element, 1 stage, 2 phase
	Stall ratio		2.94:1
Transmission	Type		Power shift
	Gear shift (FR/RR)		1/1
	Adjustment		Electrical single lever type
	Gear ratio	FR	1.51
		RR	1.51
Axle	Type		Front-wheel drive type
	Gear ratio		10.909
	Gear		Ring &pinion gear type
Wheels	Q'ty (FR/RR)		Single : 2/2
	Front	2.5 TON	7.00-12-14PR
		3.0~3.3 TON	28x9-15-16PR
	Rear	2.5 TON	6.0-9-10PR
		3.0~3.3 TON	6.5-10-12PR
Brakes	Travel		Front wheel, Wet disc brake
	Parking		Wet disc brake/toggle
Steering	Type		Hydraulic, power steering
	Steering angle		56°to both right and left angle, respectively

4 TIGHTENING TORQUE OF MAJOR COMPONENTS

NO	Item		Size	kgf·m	lbf·ft
1	Engine	Engine mounting bolt, nut	M12×1.25	12.5±2.5	90±18
2		Radiator mounting bolt, nut	M 8×1.25	2.5±0.5	18.1±3.6
3		Torque converter mounting	M10×1.25	6.9±1.4	50±10
4	Hydraulic	MCV mounting bolt, nut	M10×1.5	4.0±0.5	29±3.6
5		Steering unit mounting bolt	M10×1.5	4.0±0.5	29±3.6
6	Power train system	Transmission mounting bolt,	M16×2.0	7.5	54
7		Drive axle mounting bolt, nut	M20×1.5	65±3	470±21.7
8		Steering axle mounting bolt,	M20×2.5	58±8.5	420±61
9		Front wheel mounting nut	M20×1.5	40±10	289±72
10		Rear wheel mounting nut	M16×1.5	25±2	181±14
11	Others	Counterweight mounting bolt	M30×3.5	215±33	1555±239
12		Operator's seat mounting nut	M8×1.25	2.5±0.5	18.1±3.6
13		Head guard mounting bolt	M12×1.75	6.2	44.8

5 TORQUE CHART

Use following table for unspecified torque.

1) BOLT AND NUT

① Coarse thread

Bolt size	8T		10T	
	kgf·m	lbf·ft	kgf·m	lbf·ft
M 6 × 1.0	0.85 ~ 1.25	6.15 ~ 9.04	1.14 ~ 1.74	8.2 ~ 12.6
M 8 × 1.25	2.0 ~ 3.0	14.5 ~ 21.7	2.73 ~ 4.12	19.7 ~ 29.8
M10 × 1.5	4.0 ~ 6.0	28.9 ~ 43.4	5.5 ~ 8.3	39.8 ~ 60
M12 × 1.75	7.4 ~ 11.2	53.5 ~ 79.5	9.8 ~ 15.8	71 ~ 114
M14 × 2.0	12.2 ~ 16.6	88.2 ~ 120	16.7 ~ 22.5	121 ~ 167
M16 × 2.0	18.6 ~ 25.2	135 ~ 182	25.2 ~ 34.2	182 ~ 247
M18 × 2.5	25.8 ~ 35.0	187 ~ 253	35.1 ~ 47.5	254 ~ 343
M20 × 2.5	36.2 ~ 49.0	262 ~ 354	49.2 ~ 66.6	356 ~ 482
M22 × 2.5	48.3 ~ 63.3	350 ~ 457	65.8 ~ 98.0	476 ~ 709
M24 × 3.0	62.5 ~ 84.5	452 ~ 611	85.0 ~ 115	615 ~ 832
M30 × 3.5	124 ~ 168	898 ~ 1214	169 ~ 229	1223 ~ 1655
M36 × 4.0	174 ~ 236	1261 ~ 1703	250 ~ 310	1808 ~ 2242

② Fine thread

Bolt size	8T		10T	
	kgf·m	lbf·ft	kgf·m	lbf·ft
M 8 × 1.0	2.17 ~ 3.37	15.7 ~ 24.3	3.04 ~ 4.44	22.0 ~ 32.0
M10 × 1.25	4.46 ~ 6.66	32.3 ~ 48.2	5.93 ~ 8.93	42.9 ~ 64.6
M12 × 1.25	7.78 ~ 11.58	76.3 ~ 83.7	10.6 ~ 16.0	76.6 ~ 115
M14 × 1.5	13.3 ~ 18.1	96.2 ~ 130	17.9 ~ 24.1	130 ~ 174
M16 × 1.5	19.9 ~ 26.9	144 ~ 194	26.6 ~ 36.0	193 ~ 260
M18 × 1.5	28.6 ~ 43.6	207 ~ 315	38.4 ~ 52.0	278 ~ 376
M20 × 1.5	40.0 ~ 54.0	289 ~ 390	53.4 ~ 72.2	386 ~ 522
M22 × 1.5	52.7 ~ 71.3	381 ~ 515	70.7 ~ 95.7	512 ~ 692
M24 × 2.0	67.9 ~ 91.9	491 ~ 664	90.9 ~ 123	658 ~ 890
M30 × 2.0	137 ~ 185	990 ~ 1338	182 ~ 248	1314 ~ 1795
M36 × 3.0	192 ~ 260	1389 ~ 1879	262 ~ 354	1893 ~ 2561

2) PIPE AND HOSE (FLARE TYPE)

Thread size	Width across flat(mm)	kgf·m	lbf·ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130
1"	41	21	152
1-1/4"	50	35	253

3) PIPE AND HOSE (ORFS TYPE)

Thread size	Width across flat(mm)	kgf·m	lbf·ft
9/16-18	19	4	28.9
11/16-16	22	5	36.2
13/16-16	27	9.5	68.7
1-3/16-12	36	18	130
1-7/16-12	41	21	152
1-11/16-12	50	35	253

4) FITTING

Thread size	Width across flat(mm)	kgf·m	lbf·ft
1/4"	19	4	28.9
3/8"	22	5	36.2
1/2"	27	9.5	68.7
3/4"	36	18	130
1"	41	21	152
1-1/4"	50	35	253

6 FUEL AND LUBRICANTS

Service point	Kind of fluid	Capacity/L (U.S. gal)	Ambient temperature ℃
			50 -30 -20 -10 0 10 20 30 40
Engine oil pan	Engine oil	8 (2.11)	15W-40
Torque converter transmission	ATF Oil	9 (2.38)	10W30 ATF or DEXRON SERIES
Axle	Gear oil	6.5 (1.72)	MOBIL 424 or SHELL SPIRAX S4 TXM
Hydraulic tank	Hydraulic oil	STD: 31 (7.9) OPT: 38 (10)	L-HM32
Fuel tank	LPG	30 (7.9)	LPG
	Gasoline	48.2 (12.7)	GASOLINE
Fitting (Grease nipple)	Grease	-	Unity(grease)
Brake reservoir tank	Brake oil	0.25 (0.06)	VG32
Radiator	Antifreeze: Water=50:50	11.5 (3.04)	FD-2

NOTES:

1. SAE numbers given to engine oil should be selected according to ambient temperature.
2. For engine oil used in engine oil pan, use SAE 10W oil when the temperature at the time of engine start up is below 0˚C , even if the ambient temperature in daytime is expected to rise to 10˚C or more.
3. If any engine oil of API service class CF is used instead of class CH4 engine oil, the frequency of oil change must be doubled.

★ : Cold region
Russia, CIS, Mongolia

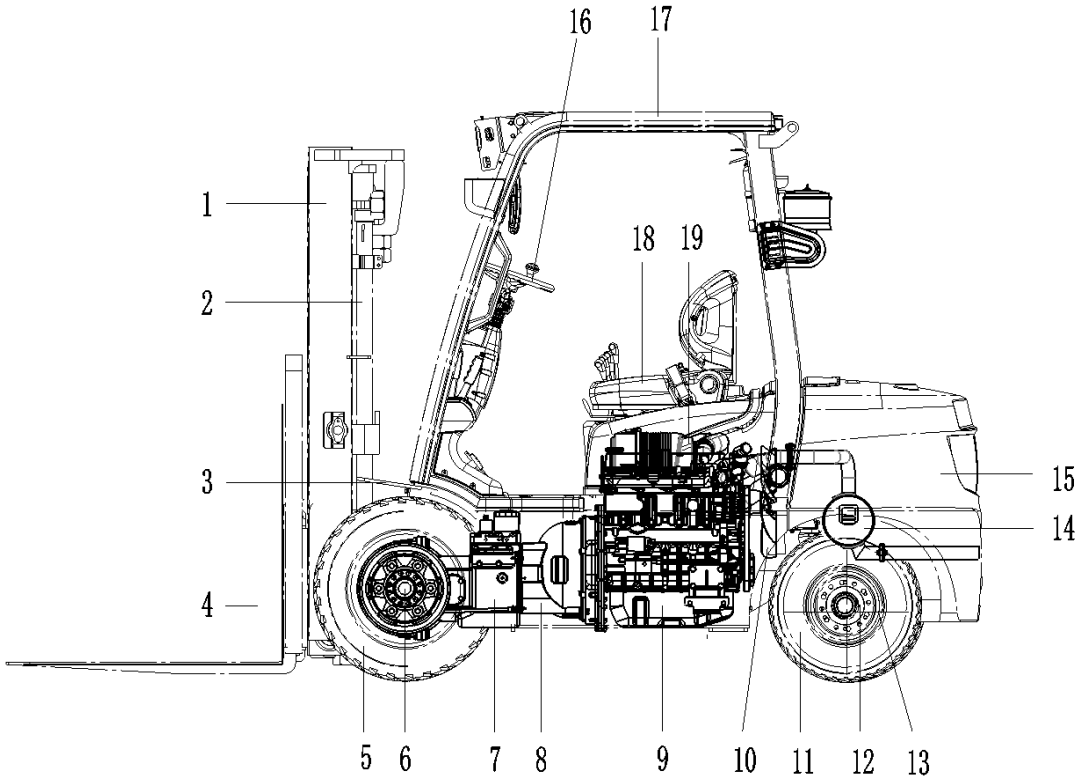
GROUP3 PERIODIC REPLACEMENT

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	Fuel hose	Every 2 to 4 years
2	Hydraulic pump hose	Every 2 years
3	Power steering hose	Every 2 years
4	Packing, seal, and O-ring for steering cylinder	Every 2 to 4 years
5	Lift chain	Every 2 to 4 years
6	Lift cylinder hose	Every 1 to 2 years
7	Tilt cylinder hose	Every 1 to 2 years
8	Side shift cylinder hose	Every 1 to 2 years
9	Dust seals for master cylinder	Every 1 years
10	Brake hose or tube	Every 1 to 2 years
11	Brake reservoir tank tube	Every 2 to 4 years
12	Intake air line	Every 2 years
13	Coolant	Every 2 years
14	Radiator hoses and clamps	Every 2 years

SECTION2 REMOVAL AND INSTALLATION OF UNIT

GROUP1 STRUCTURE



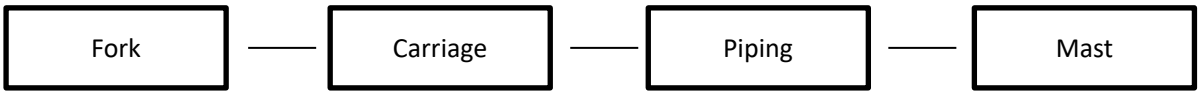
1	Mast	8	Torque converter	15	Counterweight
2	Lift cylinder	9	Engine	16	Steering wheel
3	Tilt cylinder	10	Fan	17	Overhead guard
4	Fork	11	Rear wheel	18	Seat
5	Front wheel	12	Steering cylinder	19	Air cleaner
6	Drive axle	13	Steering axle（Rear）		
7	Transmission	14	Muffler		

GROUP2 REMOVAL AND INSTALLATION OF UNIT

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

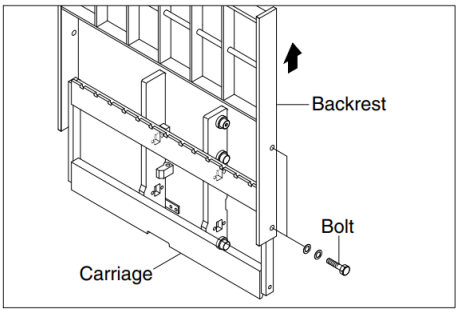
1 MAST

1) REMOVAL



A. Forks

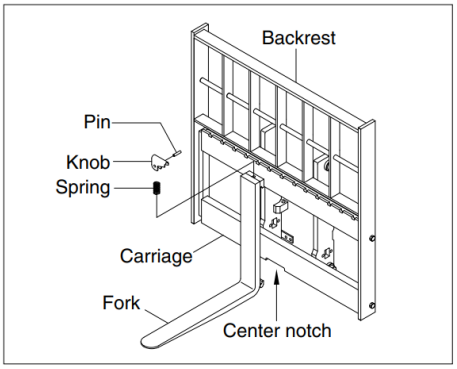
a) Lower the fork carriage until the forks are approximately 25mm (1in) from the floor.
b) Turn knob up and slide one fork at a time toward the center of the carriage where a notch has been cut in the bottom plate for easy removal.
c) Remove only one fork at a time.



※ On larger forks it may be necessary to use a block of wood.

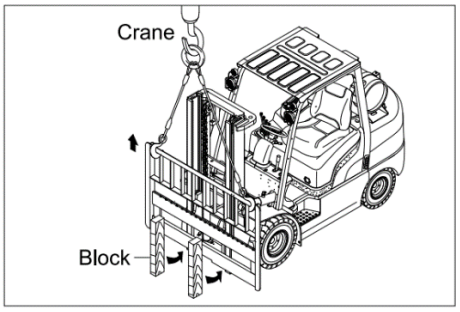
B. Backrest (If necessary)

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

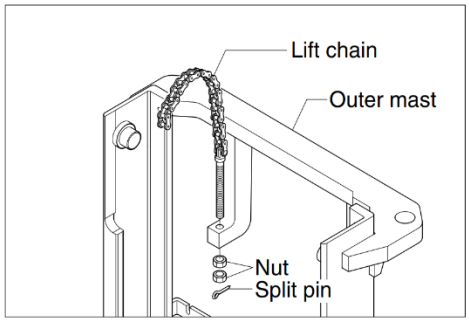


C. Carriage

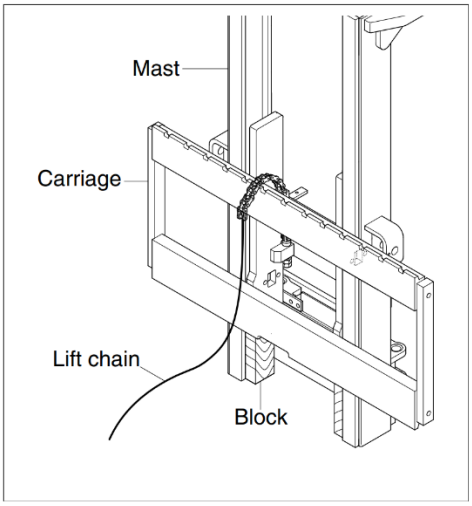
a) With the mast vertical, raise the carriage high enough to place blocks under the load forks. This is done to create slack in the load chains when the carriage is lowered. Lower the carriage all the way down to the floor. Make sure the carriage is level, this will prevent any binding when the mast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



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

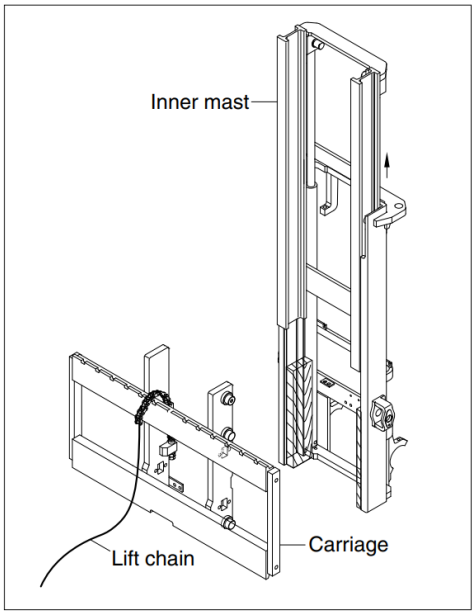


b) Pull the chains out of the sheaves and drape them over the front of the carriage



d) 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.

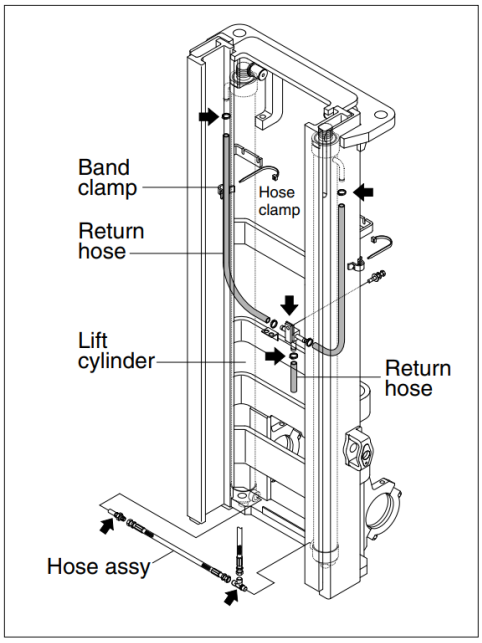


D. Piping

a) Remove the return hoses and clamps attached to the cylinder.

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

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



E. Lift cylinder

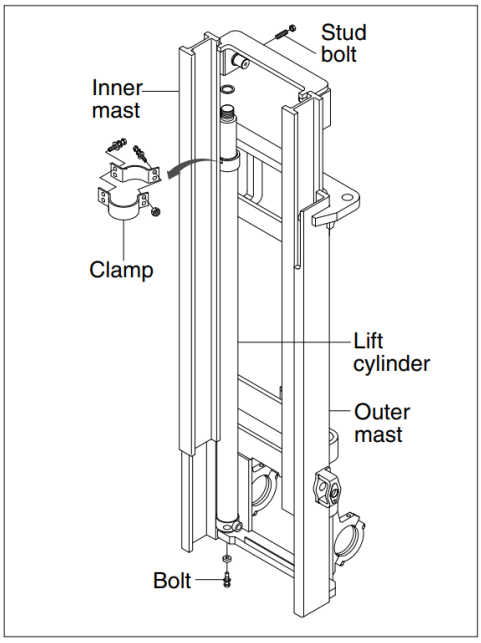
a) Loosen hexagonal bolts and remove washers securing the lift cylinders to inner mast.

b) Bind the lift cylinder with overhead hoist rope and pull up so that the rope has no slack or binding.
Make sure that the lift cylinder be tightened firmly for safety.

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

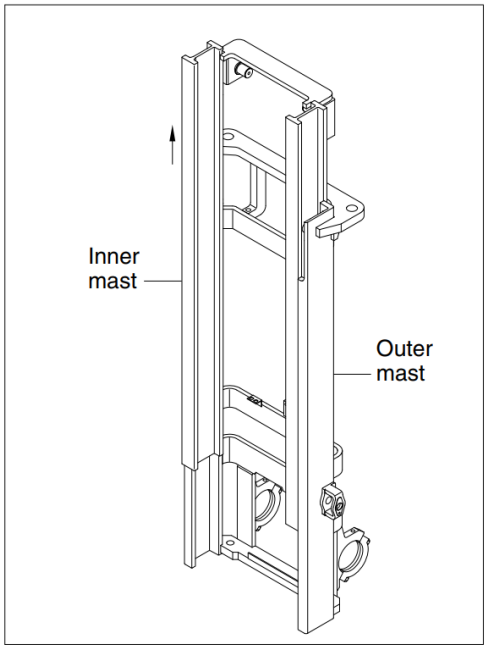
d) Using an overhead hoist, slowly raise the inner mast high enough to clear lift cylinder.

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



F. Inner mast

a) 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.



G. Tilt cylinder pin

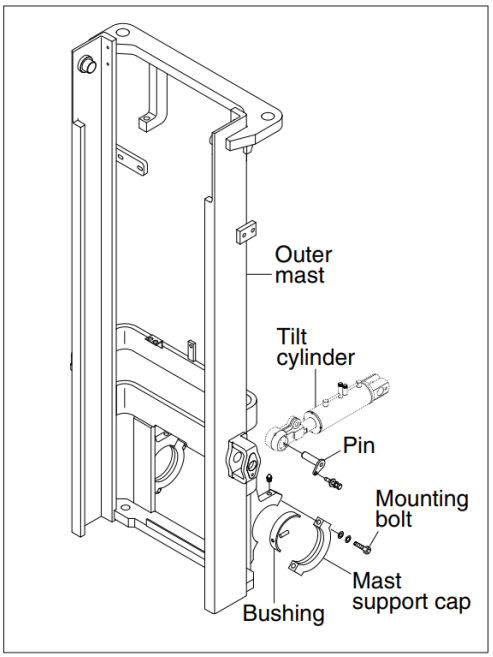
Hold the mast with a crane, remove the bolt of the pin, then remove the pin.

H. Mast support cap

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

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

b) Remove the mounting bolts from the cap, then slowly raise the outer mast.



2) INSTALLATION

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

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

A. Mast support cap

a) Check the mast support cap and spring pin for wear.

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

c) Tighten mounting bolts to mast support cap. Apply loctite #277.
Tightening torque: 23.4±3.5kgf•m (169±25.3 lbf•ft)

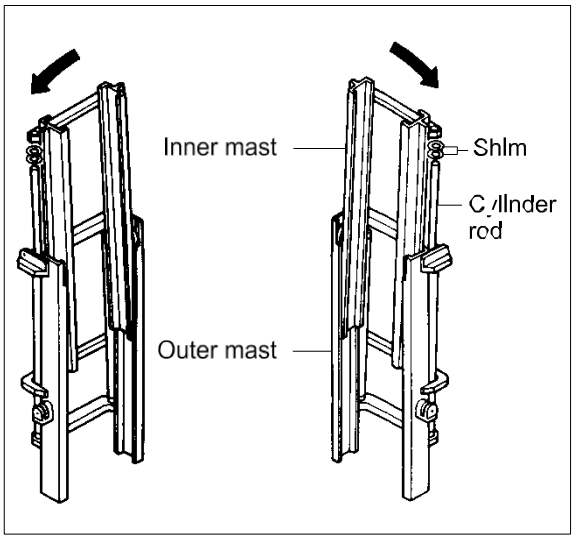
B. Tilt cylinder pin

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

C. Lift cylinder installation and adjustment.

a) 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.

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

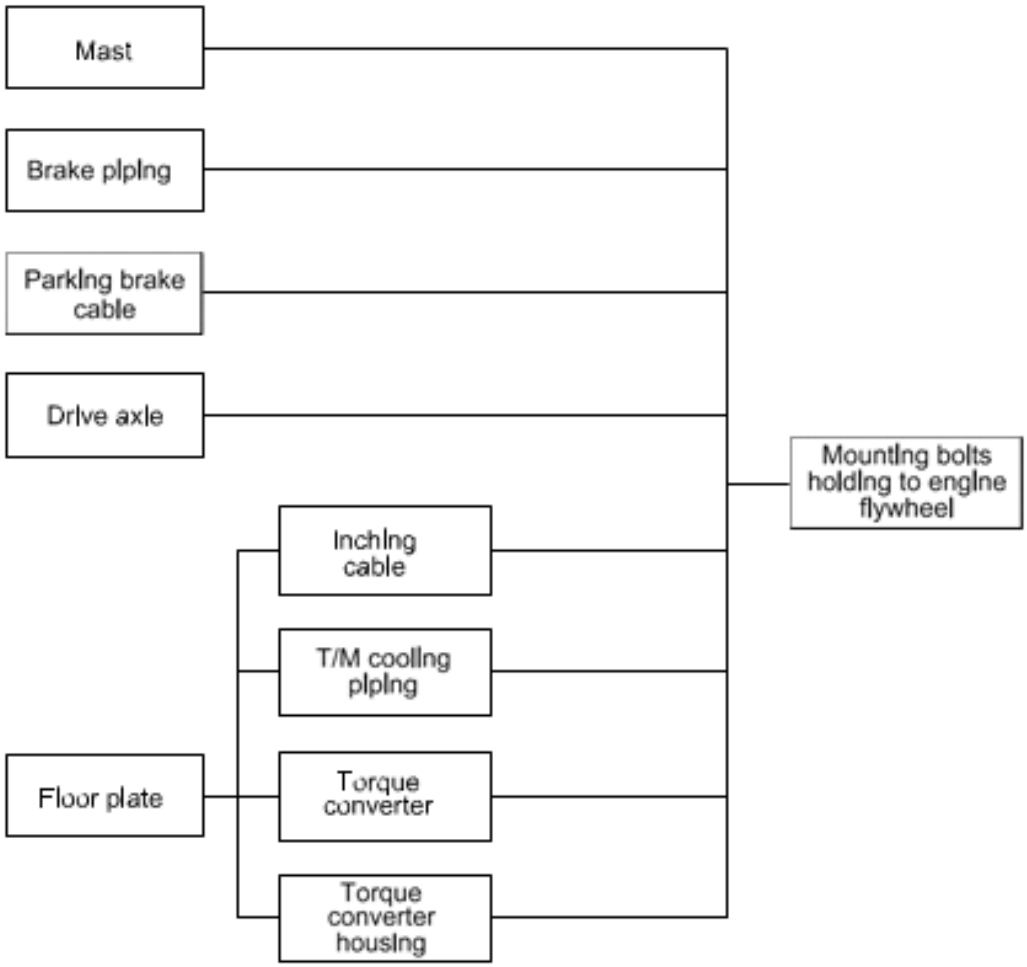


※ If play is to LEFT, install adjustment shim to LEFT cylinder.

※ If play is to RIGHT, install Adjustment shim to RIGHT cylinder.
Shim thickness: 1.0mm(0.04in)

2 POWER TRAIN ASSEMBLY

1) REMOVAL

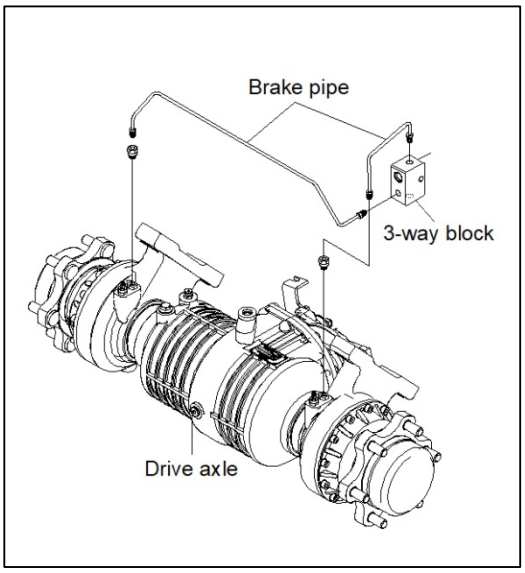


① Mast

Refer to the chapter MAST.

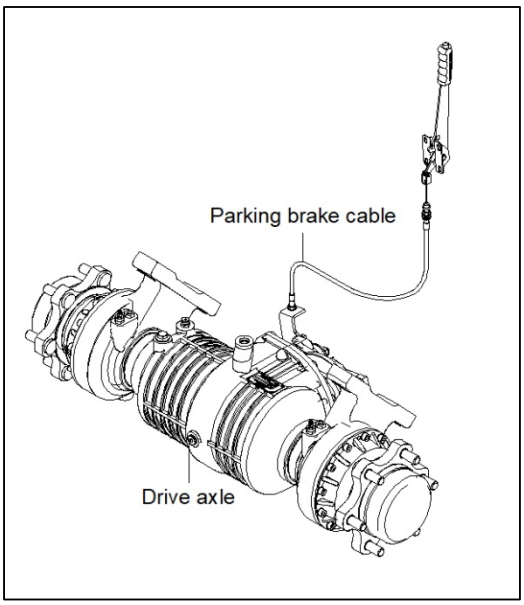
② Brake piping

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



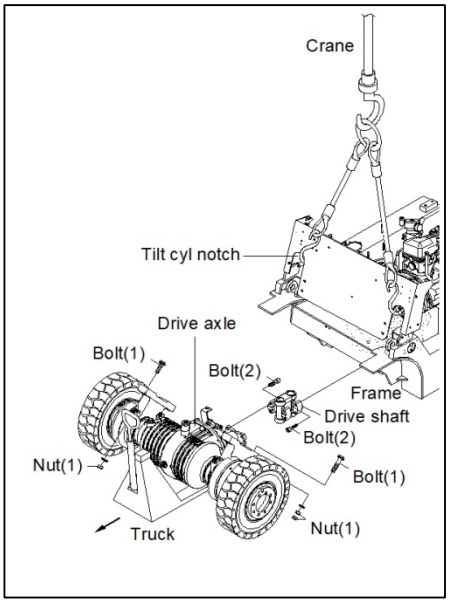
③ Parking brake cable

Disconnect parking brake cable from hand brake.



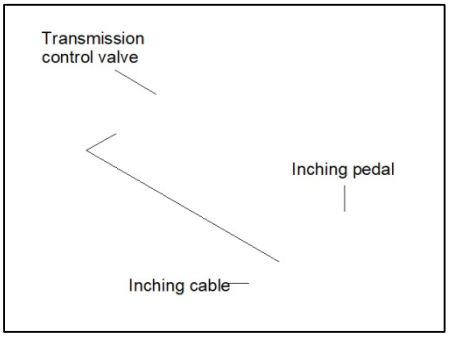
④ Drive axle

a) Attach a crane to the tilt cylinder notches on the dashboard and raise the machine.
b) Loosen hexagonal bolts (1) connection drive axle to the transmission.
c) Put the block under the drive axle and support under the drive axle with a truck.
d) Remove drive axle mount bolts (2) from the frame and then slowly pull out the truck with drive axle to the front.



⑤ Inching linkage

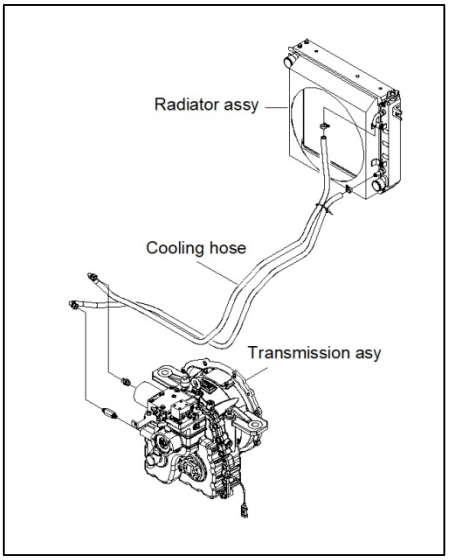
Remove the clevis pin from the transmission control valve.



⑥ Transmission cooling piping

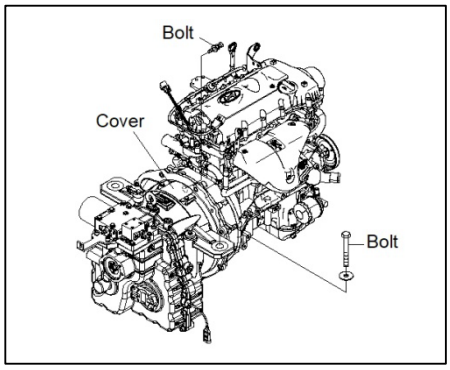
a) Disconnect cooling hose from the transmission.

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

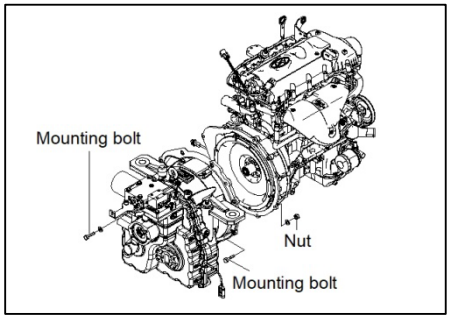


⑦ Transmission

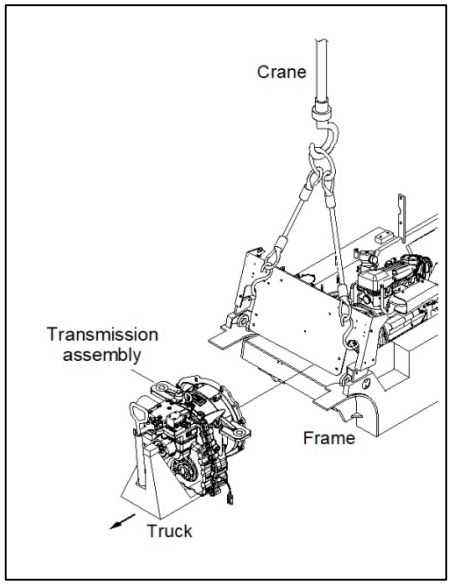
a) Remove the cover on top face of the Transmission housing then remove the 8mounting bolts installed on the engine flywheel. To rotate the flywheel, remove 1 mounting bolt, then insert a turning tool in the mounting hole. One man must turn the engine fan by hand while the other turns the flywheel.



b) Remove Transmission from the engine flywheel housing by loosening the 8 mounting bolts.



c) Using a moving truck slowly, pull out transmission assembly to the front.



2) INSTALLATION

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

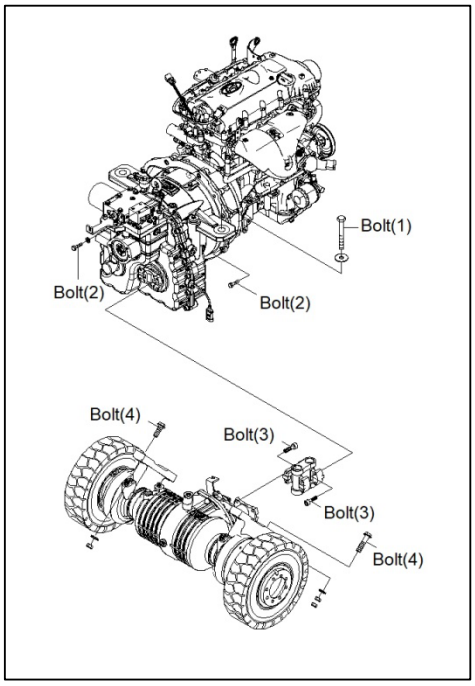
B. Tightening torque

Bolt (1): 5.9~8.9kgf•m

Bolt (2): 2.7~4.1kgf•m

Bolt (3): 7.8~11.6kgf•m

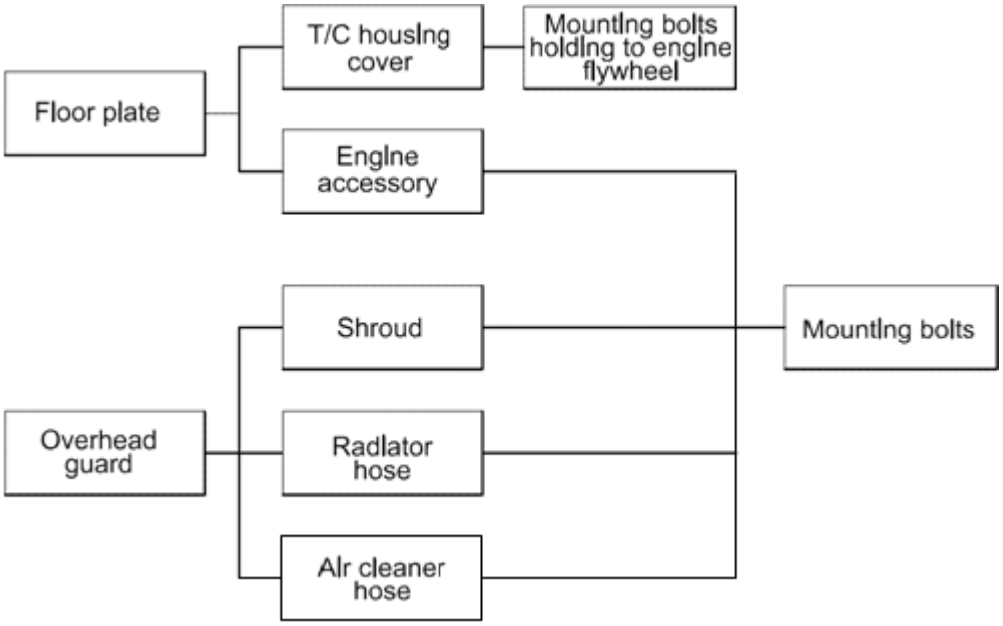
Bolt (4): 18.9~25.2±3 kgf•m



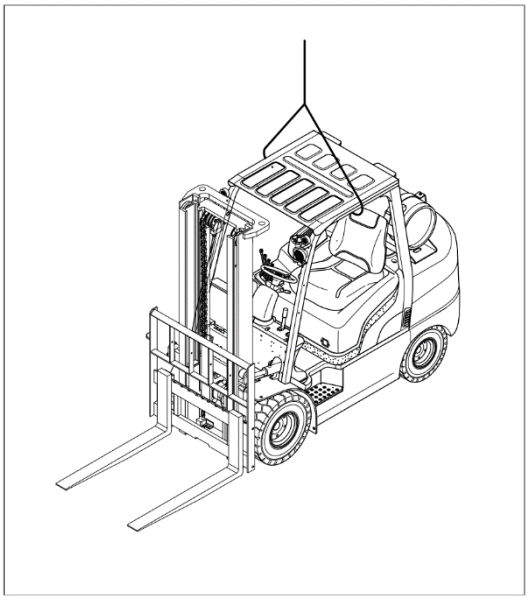
3 ENGINE

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

1) REMOVAL



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

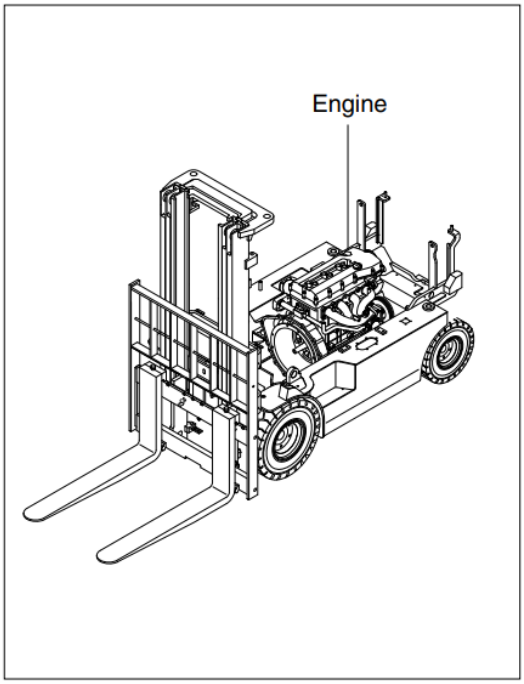


Remove the torque converter housing cover, mounting bolts installed to flywheel housing.
For details, see section 2.

2. Engine accessory

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

a) Wiring harness to alternator and starter.
b) Wiring harness for oil pressure and engine water temperature gauges.
c) Cables for meters, buttons and accelerator pedal.
d) Hoses to fuel tank and air cleaner.
e) Exhaust pipe.



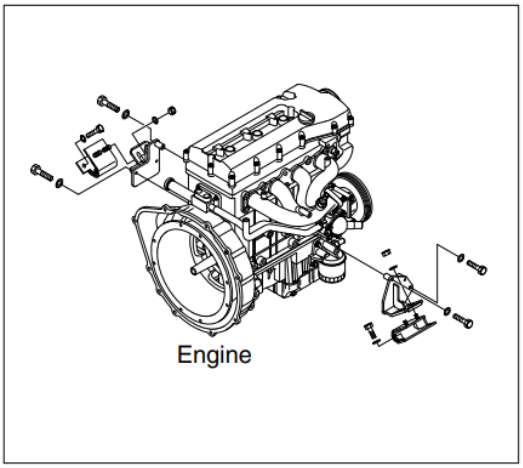
3. Radiator hose

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

4. Mounting bolt

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

※ When sliding the engine, be careful of the collision 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

Bolt(1):5.5~8.3kgf•m(39.8~60.0 lbf•ft)

Bolt(2):10~15kgf•m(72.3~108lb f•ft)

Bolt(3):10~15kgf•m(72.3~108lb f•ft)

④ Tightening torque of mounting bolt installing to torque converter housing.5.5~8.3kgf•m (40~60lbf•ft)

⑤ Radiator hoses

Distance to insert hose: 40mm (1.57in)

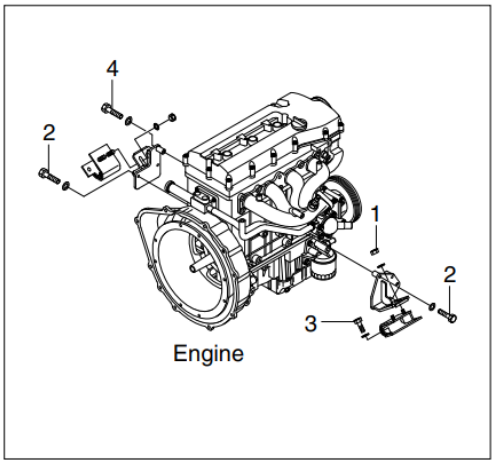
⑤ Air cleaner hose

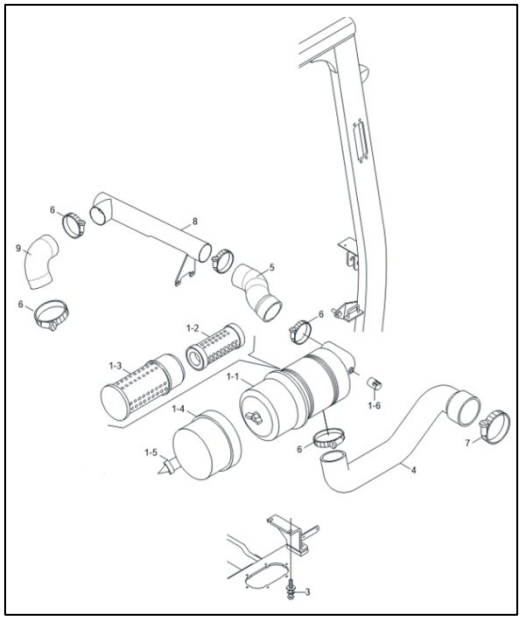
a) Insert the air cleaner hose securely and fit a clamp.

b) Distance to insert hose

Air cleaner hose: 35mm (1.4in)

Engine end: 35mm (1.4in)

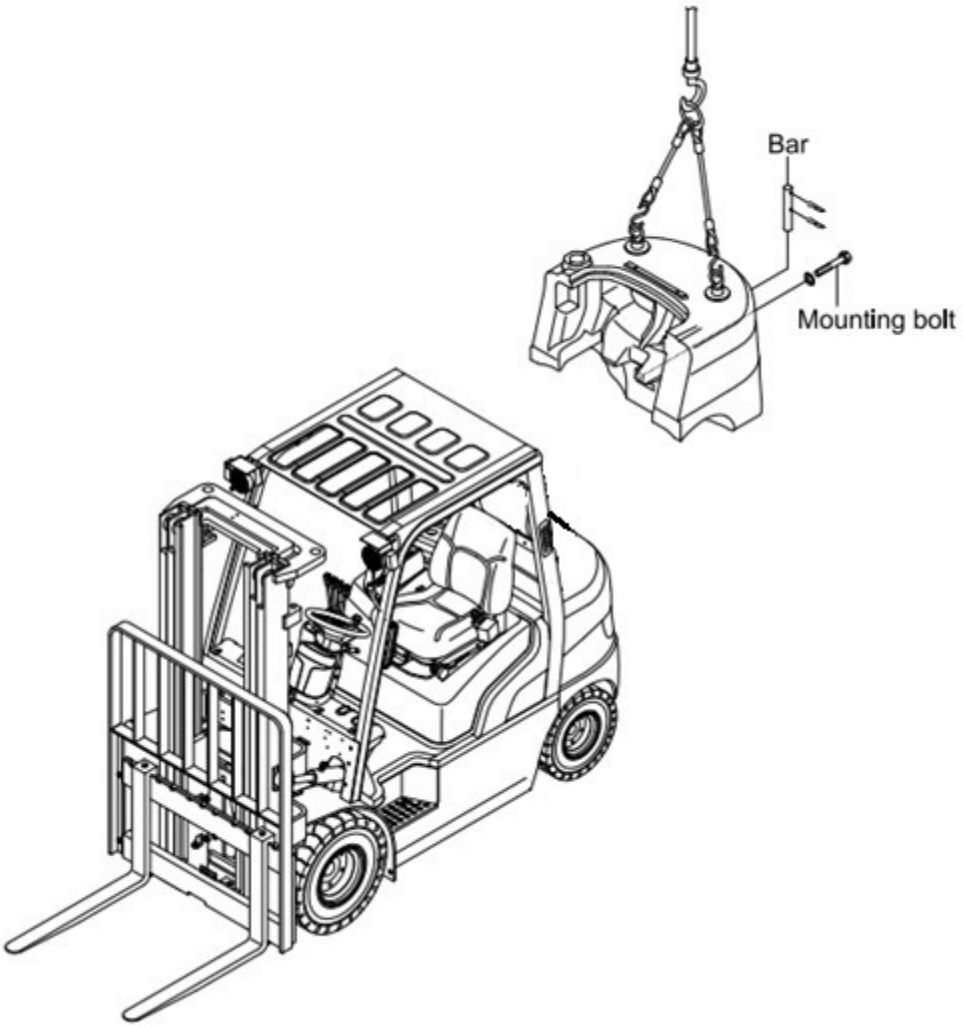




4 STEERING AXLE

1) REMOVAL

Counter weight→Rear wheel→Hose→Mounting bolt



① Counterweight

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

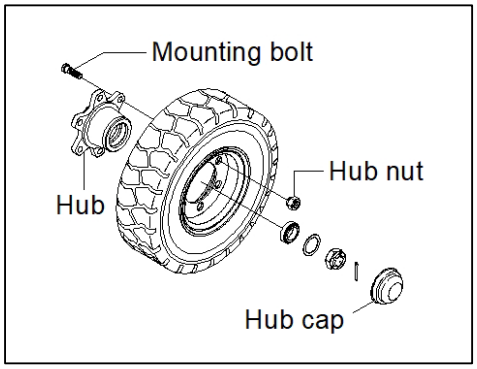
Remove the mounting bolts, raise slightly and move it slowly to rear side.

•Weight of counterweight(standard)

25LE-7U	1390kg (3060lb)	30LE-7U	1740kg (3840lb)
35LE-7U	1950kg (4300lb)	-	-

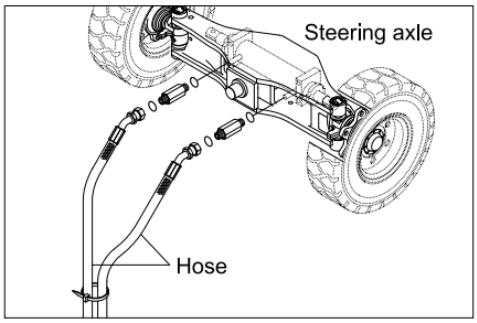
② Rear wheel

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



③ Hose

After draining out oil in the hoses, disconnect the hoses from the steering axle.

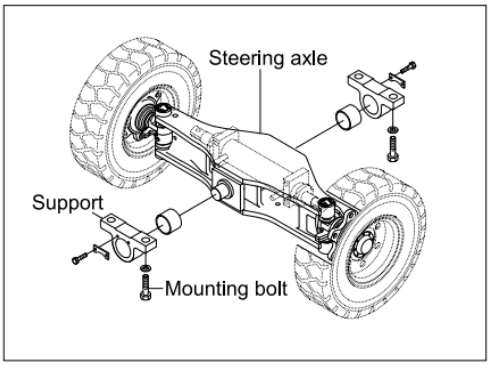


④ Mounting bolt

Put a block under the steering axle, support on a truck, a raise the frame with a crane.

Remove the mounting bolts installing to the frame, and pull out to the rear.

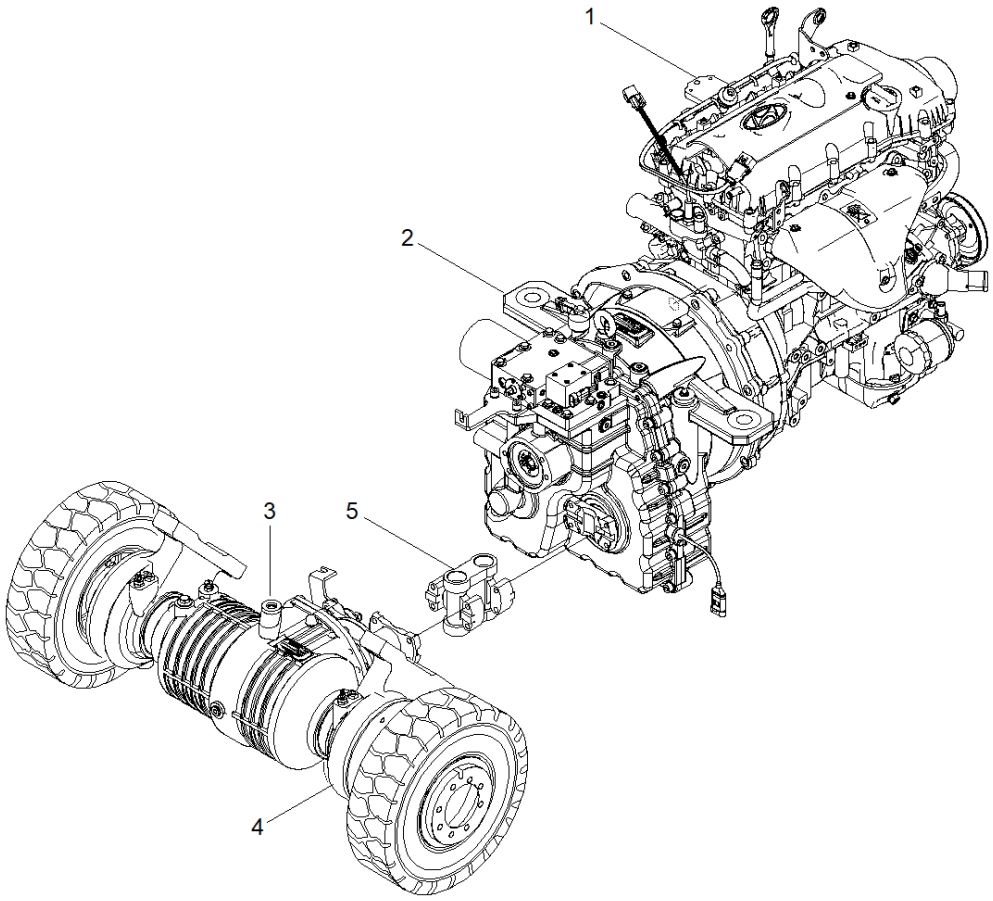
There are shims between the support and steering axle to prevent play.



SECTION3 POWER TRAIN SYSTEM

GROUP1 STRUCTURE

1. POWER TRAIN DIAGRAM



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

GROUP2 TRANSMISSION

1. OVERVIEW

The hydraulic transmission is composed of hydraulic torque converter and hydraulic transmission.

The torque converter used in the hydraulic transmission is a single-stage two-phase three-working impeller integrated hydraulic torque converter. The hydraulic torque converter makes the hydraulic transmission have the auto gasket adaptability of hydraulic transmission output, it can change the output torque and speed with the external load, and can absorb and eliminate the shock vibration from the engine and the external load on the transmission system.

The hydraulic transmission is a power shift transmission with one shift in front and one shift in reverse. The shift mode is electromagnetic control power shift and with inching valve and modulation valve, which makes the operation simple, convenient, stable start, and greatly reduces the labor intensity of the operator.

The hydraulic transmission is connected to the wet brake axle through the drive shaft assembly, which transfers the engine power to the wheels through the wet brake axle of the hydraulic transmission drive shaft assembly to achieve flexible transmission.

The hydraulic transmission and the engine together through the cushion, respectively supported on the frame, can effectively reduce the damage of the vibration of the vehicle to the engine and the transmission, protect the transmission and the engine, and reduce the impact of the engine vibration on the vehicle, so as to improve the comfort of the vehicle driving.

2. TECHNICAL SPECIFICATION

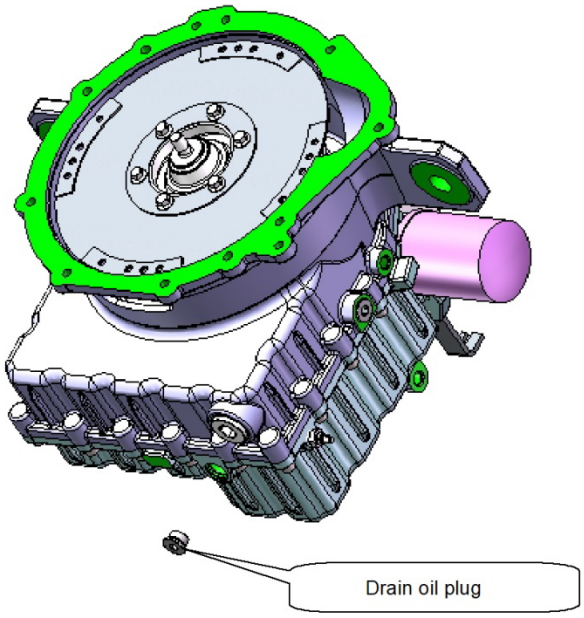
The main transmission parameters are shown below.

<table>
<tr><td colspan="3">Item</td><td>Specification</td></tr>
<tr><td colspan="3">Gasketched engine Maximum power KW</td><td>48</td></tr>
<tr><td colspan="3">Gasketched engine Maximum speed r/min</td><td>2700</td></tr>
<tr><td colspan="3">Gasketched engine Maximum output torque , N.m</td><td>224</td></tr>
<tr><td colspan="2" rowspan="2">Transmission ratio</td><td>F</td><td>1.51</td></tr>
<tr><td>R</td><td>1.51</td></tr>
<tr><td colspan="3">Main oil pressure: MPa</td><td>1.1-1.3</td></tr>
<tr><td colspan="3">Torque converter oil inlet pressure MPa</td><td>0.3-0.7</td></tr>
<tr><td rowspan="5">Torque -converter</td><td colspan="2">Model</td><td>YJH265G-7</td></tr>
<tr><td colspan="2">effective diameter mm</td><td>265</td></tr>
<tr><td colspan="2">Torque coefficient in the zero-speed working condition</td><td>2.9±0.15</td></tr>
<tr><td colspan="2">Maximum efficiency</td><td>≥78％</td></tr>
<tr><td colspan="2">Nominal torque of impeller under zero-speed condition N.m</td><td>41±1.5</td></tr>
<tr><td colspan="2">Maximum efficiency impeller nominal moment N.m</td><td>39±1.5</td></tr>
<tr><td colspan="3">Rotation direction</td><td>Forward direction: from the input end as clockwise or
c-clockwise from the output</td></tr>
<tr><td colspan="2">Work oil</td><td>TM</td><td>No.6 (winter), No.8 (summer) hydraulic transmission oil</td></tr>
<tr><td colspan="3">Working oil temperature ℃</td><td>70℃-100℃</td></tr>
<tr><td colspan="3">Maximum working oil temperature ℃</td><td>120 (not more than 5 minutes)</td></tr>
<tr><td colspan="3">Overall dimensions / length, width and height</td><td>620×511×485</td></tr>
<tr><td colspan="3">Net weight kg</td><td>132</td></tr>
</table>

3. MAINTENANCE

1) OIL LEVEL INSPECTION (ENGINE IDLE CHECK)

Park the vehicle on the flat road , fill oil, neutral operation for 2 minutes, then check the position of the oil level, the oil should be within the specified range of the oil gauge. If not, refill or open the oil plug to discharge the oil. The position of the drain plug is shown in the following figure:

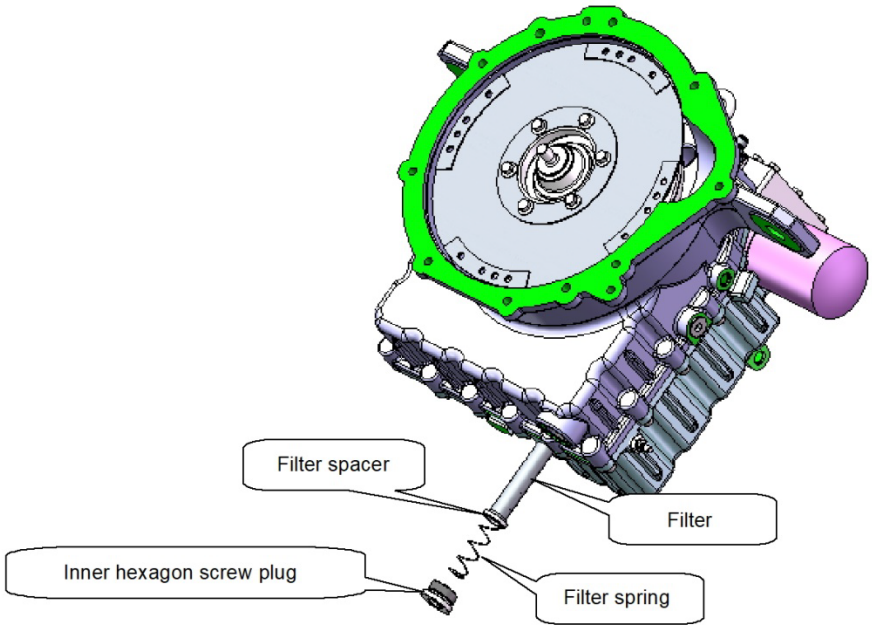


2) CHANGE THE OIL, CHECK AND CLEAN THE FILTER STRAINER

(1) Start the engine, run it for about ten minutes, and shut it down.

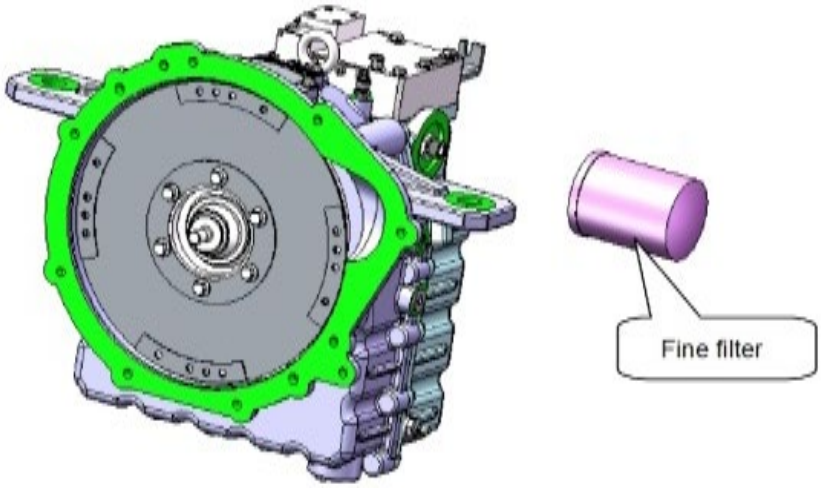
(2) Remove the oil plug and discharge the oil. Tighten the drain plug after the oil drain.

(3) Remove the inner hexagon screw plug assembly, remove the filter spring, remove the filter and clean the filter with the cleaning agent.



(4) After cleaning, the dry compressed gas is blown from the outside of the filter to the inside, and it is installed when it is completely dry. Note: If any damage is found on the filter, replace a new one.

(5) Remove the oil filter and replace it.



(6) Refill oil (according to the above 1).

(7) The transmission oil and fine filter shall be replaced and clean the filter 500 hours after the first time use; it shall be replaced every 1000 hours thereafter ; then the transmission oil, fine filter and filter shall be replaced every 2000 hours.

4. INTERNAL STRUCTURE AND WORKING PRINCIPLE

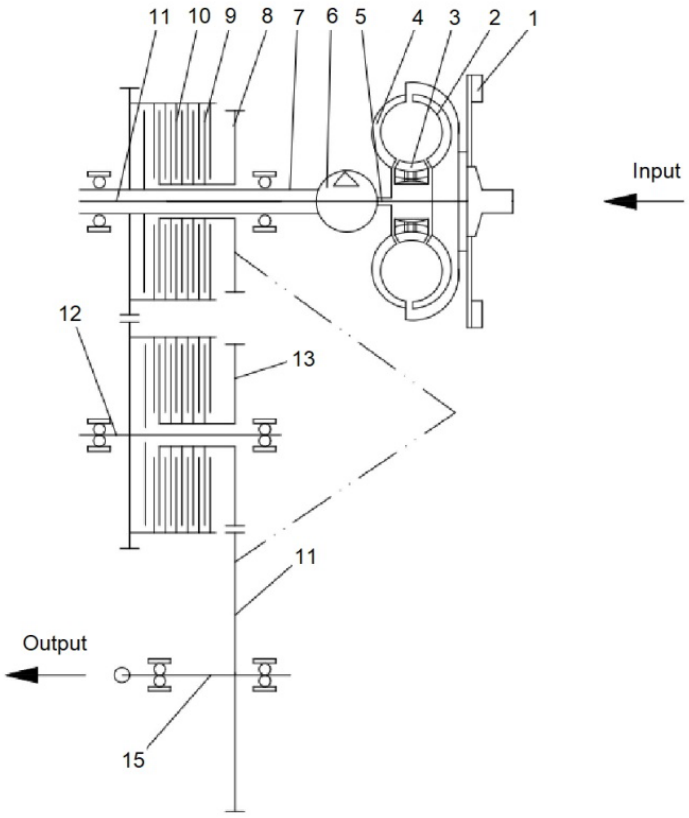
1) WORKING PRINCIPLE

(1) Transmission principle

The transmission diagram of hydraulic transmission is shown in following page. The hydraulic torque converter is driven by the engine through the elastic coupling coupling plate (1), which drives the impeller (4) to rotate, making the liquid flow into the turbine (2) at high speed along the direction of its blade, and pushing the turbine to rotate. The stator (3) causes the torque converter to transmit the torque to the hydraulic transmission input shaft assembly (7), while transmitting the torque to the turbine pump through the turbine shaft (11).

When in the forward shift, the backward shift and clutch is idle, and the transmission order is: 7→ 10→ 9 → 8 →14 → 15→ output.

When in the backward shift, the forward shift and clutch is idling, and the transmission order is: 7 → 12 → 10 → 13→ 14 → 15 →output.

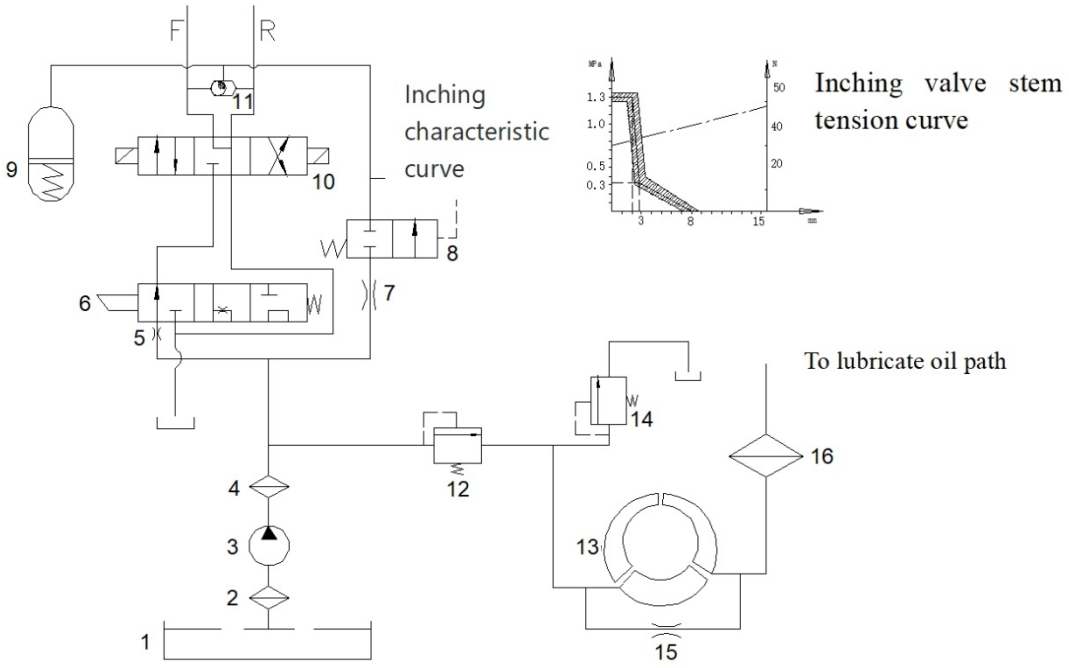


1 Elastic coupling plate
2 Turbine
3 Stator
4 Impeller
5 Turbine shaft
6 Oil pump
7 Oil pump
8 Input shaft assembly
9 Clutch gear
10 Friction plate
11 Spacer
12 Turbine shaft
13 Intermediate shaft assembly (backward gear clutch)
14 Clutch gear
15 Output gear
16 Output flange

The forward and backward clutches are controlled by the electromagnetic power shift control valve. Oil pump (6) is a cycloid gear pump, which is directly driven by the engine through the impeller. The oil pump provides pressure oil to the system. The oil after the hydraulic torque converter enters the radiator on the vehicle, and then enters the transmission to lubricate friction plate, bearing and gear.

(2) Hydraulic pressure principle

The hydraulic transmission circuit diagram see below.



1 Oil tank	7 φ1.4 compensation hole	13 Torque converter
2 Filter	8 Compensation switch valve	14 Torque converter overflow valve
3 Oil supply pump	9 Accumulator	15 φ3 pressure relief hole
4 Fine filter	10 Electromagnetic steering valve	16 Vehicle cooler
5 φ1.3 throttle hole	11 Switch valve	
6 Inching valve	12 Main pressure valve	

After the engine is started, the supply pump (3) suck the oil through the filter (2) from the transmission tank (1). The oil passes through the fine filter (4), enters the main pressure valve (12) and the oil is divided into two parts. Part of the oil enters the torque converter (13) through the torque converter overflow valve (14), and enters the vehicle cooler (16),after cooling , enters into the transmission oil path, there is a φ3 pressure relief hole between the inlet and outlet of the torque converter, to ensure that the pressure of the torque converter is high at the moment of cold start of the vehicle, at the same time, to ensure the lubricating oil quantity of the vehicle when the torque converter overflow valve is open.

The other part enters the inching valve (6) after passing the throttle hole 5. When the inching pedal is not applied, the oil flows through the inching valve into the electromagnetic steering valve (10). The electromagnetic steering valve controls the flow of the oil to R, F or neutral according to the electrical signal given by the vehicle combination switch (the oil flows directly into the oil tank in neutral).

When the inching pedal is applied, the oil enters the tank directly from the inching valve, and the clutch pressure oil is cut off.

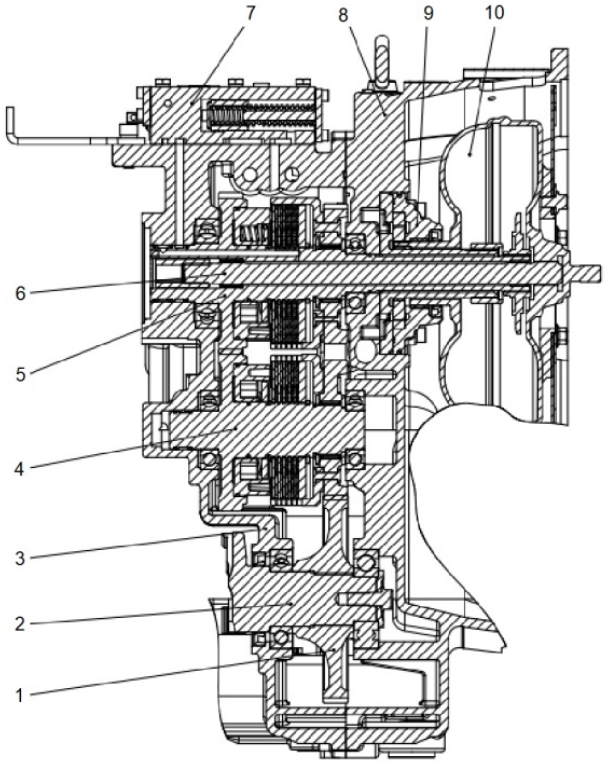
When the vehicle is in the forward shift, the shuttle valve (11) moves off the oil circuit between the accumulator (9) and the backward gear, connecting the oil circuit between the forward gear and the accumulator. It can effectively slow down the rise speed of the clutch pressure and reduce the impact. When the clutch pressure reaches a certain value, the compensation switch valve (8) opens, the pressure oil enters the clutch through the compensation hole (7), and the clutch can reach the working pressure more quickly and improve the reaction speed of the vehicle. The accumulator and the compensation switch valve form a modulation valve. On the contrary, when the vehicle is in the reverse shift, the accumulator is connected with the backward gear oil circuit to play a modulation role.

2) STRUCTURE INTRODUCTION

(1) Structure Introduction

The structure diagram of the hydraulic transmission is shown below.. The power of the engine is input to the input shaft assembly (5) of the transmission by the spline coupling of the torque converter (10).

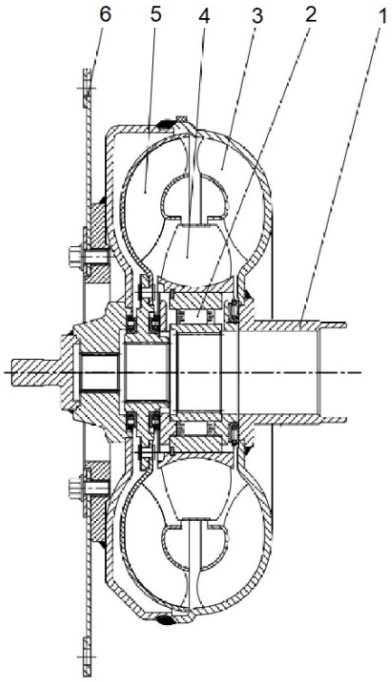
The transmission is mainly composed of major components such as input shaft assembly (5), intermediate shaft assembly (4), turbine shaft 6, output gear (1), output flange (2), electromagnetic steering control valve assembly (7), oil supply pump assembly (9), torque converter housing (8), transmission housing (3) and so on. The forward or backward clutch operation is controlled by the electromagnetic control valve to realize the changing of direction, and the power is transmitted to the universal coupling through the output gear and the output flange.



1 Output gear
2 Output flange
3 Transmission housing assembly
4 Intermediate shaft assembly (reverse clutch)
5 Input shaft assembly (forward clutch)
6 Turbine shaft
7 Solenoid control valve assembly
8 Torque converter housing assembly
9 Oil pump assembly
10 Torque converter assembly

(2) Hydraulic torque converter

The hydraulic transmission uses a welded torque converter and is not removable.



1	Clutch	3	Pump	5	Turbine
2	Directional clutch	4	Impeller	6	Elastic plate

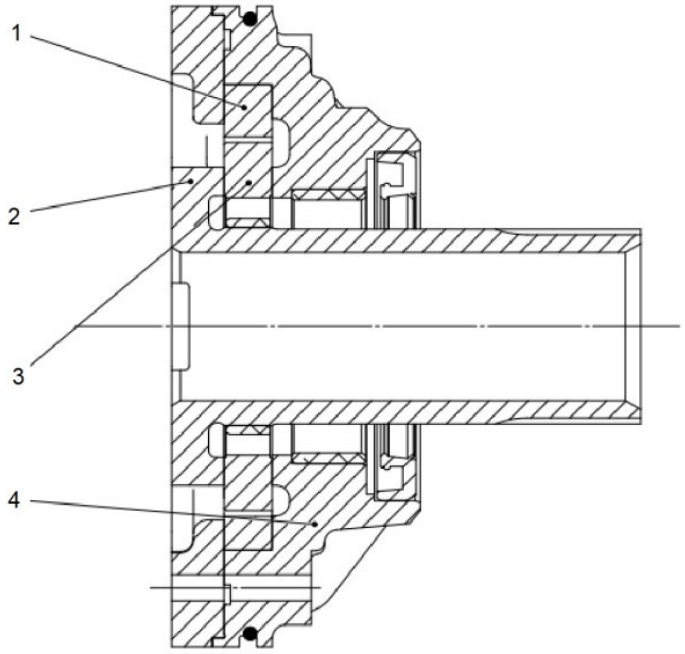
The hydraulic torque converter is mainly composed of impeller, turbine, stator and elastic plate. The elastic plate (6) is directly connected to the engine flywheel. The impeller (3) converts the mechanical energy of the engine into the kinetic energy of the working oil through the elastic plate, and makes the liquid flow into the turbine (5) at high speed along the direction of the blade, pushing the turbine to rotate, and the turbine shaft transmits the torque and speed to the transmission. After the flow flows from the turbine, it enters the stator (4). When the torque converter is under a large load, the turbine is affected by

the load, in low torque, large torque stage, stator is wedged by one-way clutch (2) and it cannot rotate, the flow on the torque will act on the turbine, the torque on the turbine is equal to the torque on impeller and stator, so the output torque is greater than the input torque, produce autogasketic torque, when the ratio of turbine speed and the impeller speed is greater than a certain value, the stator is free from rotation and torque termination, this state is called coupling.

When the engine starts, the impeller speed is synchronized with the engine, and the impeller drives the transmission oil supply pump to provide the pressure oil for the system.

(3) Oil supply pump assembly

See figure below for the assembly structure diagram of oil supply pump. The oil supply pump assembly is mainly composed of inner gear ring (1), stator seat (2), driving gear (3), pump body 4 and other parts, the oil supply pump assembly is installed on the torque converter housing, stator seat (2) is connected with the torque converter stator through spline, the pump body (4) is casted with high pressure cavity and low pressure cavity, driving gear (3) is connected with the torque converter impeller, driven by the engine, drive the inner gear ring (1) to rotate, the internal mesh cycloid pump to supply oil to the system.

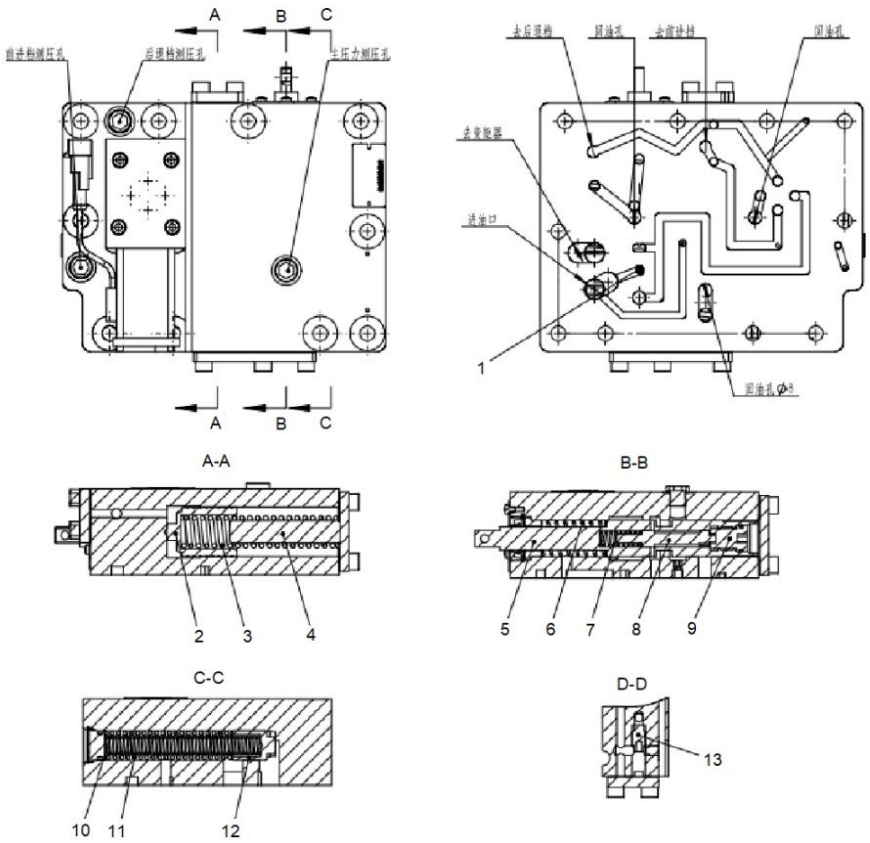


1	Inner gear ring	3	Driving gear
2	Stator seat	4	Pump body

(4) Control valve assembly

The position of control valve assembly is shown below. The control valve is a comprehensive integrated valve block, with high integration, compact space structure and reasonable layout. It mainly consists of inching valve, modulation valve and switch valve.

See B-B for the structure diagram of the inching valve. The inching valve is mainly used to cut off the oil intake of the clutch. When the inching valve stem is connected to the inching pedal connecting rod, when the inching valve pedal is pressed, the inching valve stem moves outward. When the inching valve stem moves outward 2mm, the clutch starts to step down and the clutch pressure drops to a certain pressure, the friction plate slips to make the vehicle achieve the inching effect; when the inching valve stem moves outward 8mm, the clutch pressure drops to 0, the clutch friction plate and the spacer cannot be combined, and the vehicle stops moving; when the inching valve stem moves outward 12mm, the stroke of the inching valve stem stops.



1	φ1.3 damping plug	5	Inching valve stem	9	Plug
2	Modulation valve core	6	Return spring	10	Overflow valve outer spring
3	Modulation spring	7	Control spring	11	Relief valve inner spring
4	limit column	8	Control core	12	Fixed pressure valve core

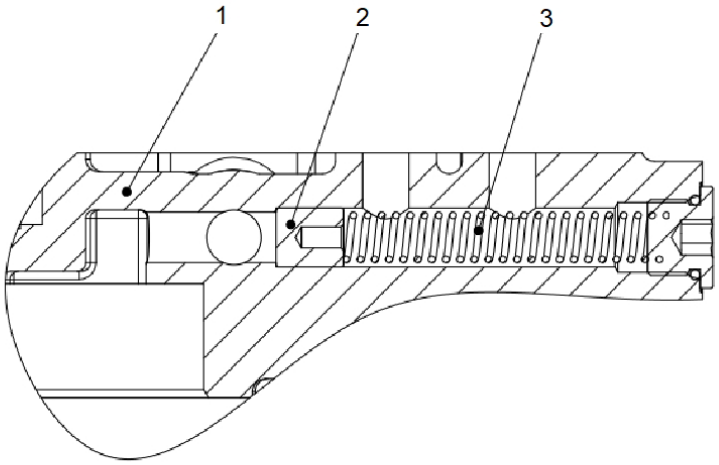
The modulation valve structure diagram see A-A, which is used to reduce the shock generated during clutch binding and separation.

See C-C for the structure diagram of the main regulation valve assembly. The main regulation valve controls the clutch oil pressure within the 1.1MPa-1.3MPa range. Part of oil flows into the electromagnetic reversing control valve to achieve shift; part of oil flows into the overflow valve.

See D-D for the structure diagram of the switch valve. The switch valve can introduce the oil of the modulation valve into the forward clutch or the backward clutch according to the control of the solenoid valve, so that the modulation valve can play a modulation role.

(5) The overflow valve

The overflow valve assembly structure diagram is as shown below. The overflow valve is also called the torque converter relief valve. The overflow valve controls the oil pressure within 0.3MPa-0.7MPa and flows into the torque converter.



1 Torque converter housing 2 Core 3 Spring

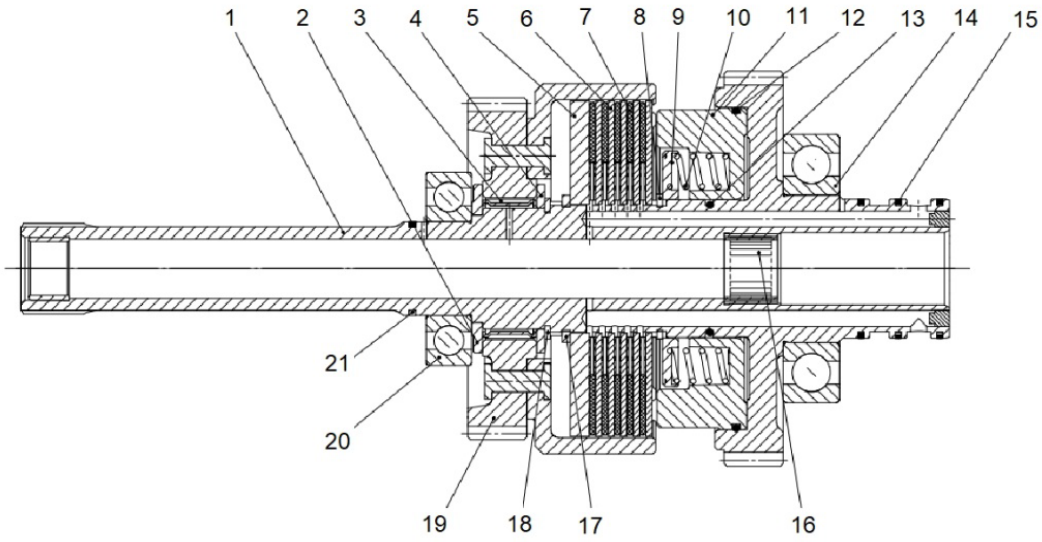
(6) Clutch

The wet multi-friction hydraulic clutch is installed on the input shaft and middle shaft of the hydraulic transmission (see below), and the pressure oil is distributed to the forward or backward clutch through the control valve to achieve forward and backward shift. All gears in the transmission are normally engaged gears.

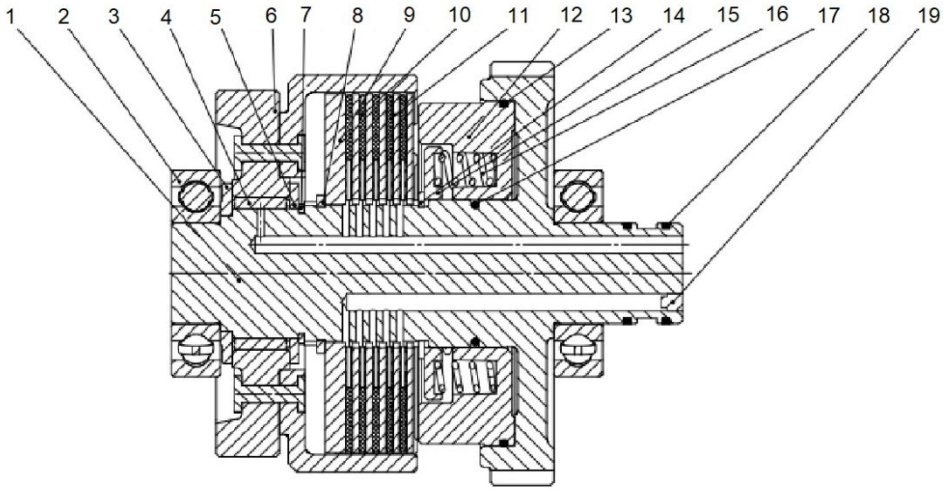
Each clutch of the clutch assembly in the transmission consists of five spacers (8), five friction plates (7), one gasket (5), and one piston (11).

The outer ring of the piston is equipped with the O-ring (12) and the O-ring (13) is fitted on the input shaft to ensure sealing when the piston is working. In neutral, the piston does not move, and the spacer and the friction plate are separated.

When shifting, the oil pressure acts on the piston, the spacer and the friction plate to press each other to transfer the power from the torque converter to the clutch gear by the friction force.



1	Input shaft assembly	8	Elastic retaining ring	15	Sealing ring
2	Thrust ring	9	Spring seat	16	Needle bearing
3	Needle roller bearing	10	Spring	17	Snap ring 50
4	Thrust ring B	11	Piston	18	Snap ring 45
5	End plate	12	O-ring	19	Clutch assembly
6	Spacer	13	O-ring	20	Ball bearing
7	Friction plate	14	Ball bearing	21	Seal ring



1	Intermediate shaft	8	Snap ring 50	15	Spring seat
2	Ball Bearing	9	End plate	16	Spring
3	Thrust ring	10	Friction plate	17	O-ring
4	Needle roller bearing	11	Spacer	18	Seal ring
5	Thrust ring B	12	Piston	19	Rivet
6	Clutch assembly	13	O-ring		
7	Snap ring 45	14	Snap ring		

5. DISASSEMBLY AND ASSEMBLY

1) PRECAUTIONS

(1) The order of transmission disassembly and assembly process is basically opposite.

(2) When disassembling the transmission, the parts should be handled and put gently to prevent them from bumping and damaging. After disassembly, the parts should be placed in an order.

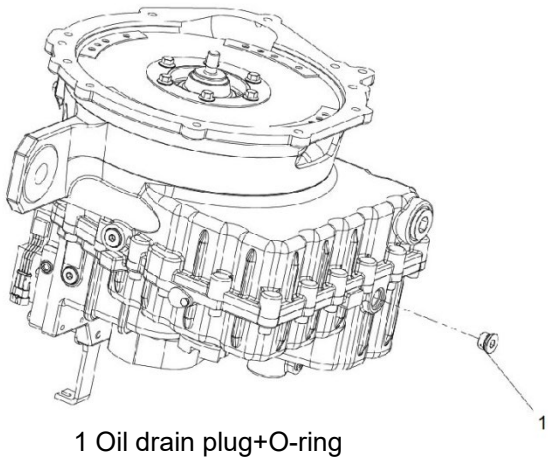
(3) The adjusting spacers in the transmission shall be returned to the original place according to the quantity during disassembly, and shall not be added or replaced at will.

(4) The disassembly process shall be operated in strict accordance with the above instructions, and casual disassembly and brutal operation are strictly prohibited.

2) DISASSEMBLY AND ASSEMBLY

(1) Before disassemble the transmission, discharge the residual oil, and replace the O- ring at the oil discharge plug. After drain the residual oil, tighten the oil discharge plug (1) back to the transmission.

① Oil drain plug+O-ring
- Tightening torque : 35-40N.m
- Tool : 10 mm hexagonal rotary sleeve

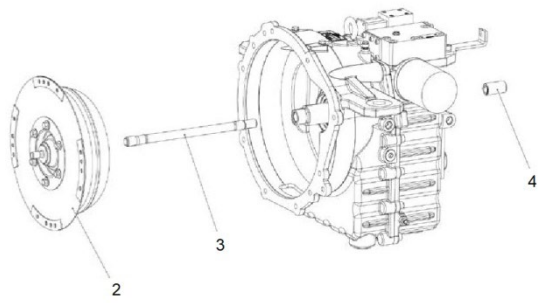


1 Oil drain plug+O-ring

(2) Remove torque converter assembly (2), input (PTO) shaft (3) and spline sleeve assembly (4).

① Torque converter assembly

※ The installation needs to be rotated while pushing in.



2 Torque converter assembly
3 Input (PTO) shaft
4 Spline sleeve assembly

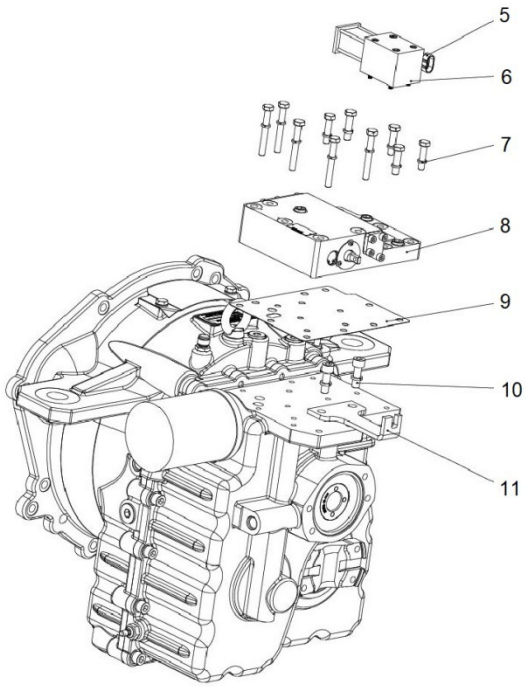
(3) Remove the solenoid control valve (6) and pay attention to the four O-rings at the bottom of the solenoid valve.
Remove the installation bolt (7), remove the control valve assembly (8) and the paper gasket (9).
If the paper gasket is damaged, replace the paper gasket, clean the residual paper gasket on the control valve surface and the housing surface, and prevent the residual paper gasket from entering the control valve and the housing hole.
Remove the installation bolt (10) and remove the bracket (11).

① Solenoid control valve
- Tightening torque : 3-5N.m
- Tool : 4mm hexagonal wrench.

② Bolt + elastic Gasket (10)
- Tightening torque: 22-30N.m

※ The installation shall be diagonally tightened.

③ Paper gasket
- Wear parts(replaced when disassembly)

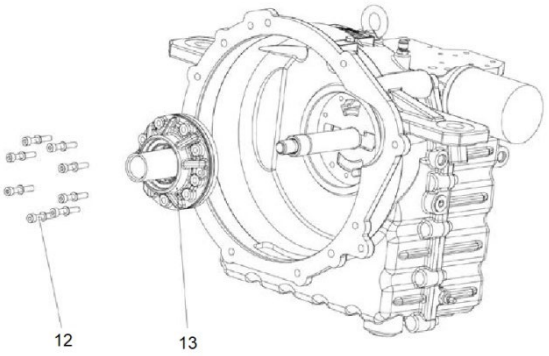


5 Waterproof connector
6 Solenoid control valve
7 Bolt + elastic Gasket (10)
8 Control valve
9 Paper gasket
10 Bolt + Gasket (2)
11 Stand

(4) Remove the fixing bolt (12) and remove the oil pump assembly (13).

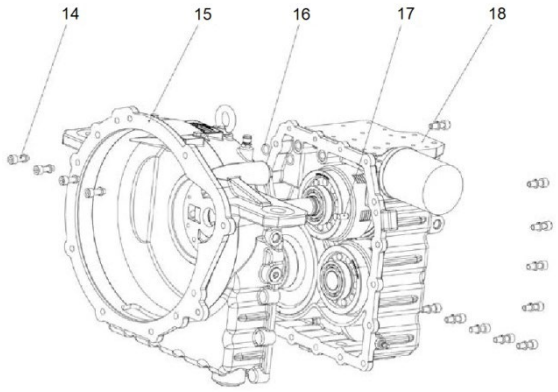
① Bolt + copper gasket (5 pieces)
- Tightening torque: 22-30N.m
- Tool : 6 mm inner hexagonal rotary sleeve

※ The installation shall be diagonally tightened



13 Oil pump assembly
12 Bolt + copper gasket (5 pieces)

(5) Remove the bolts (14) and remove the torque converter housing assembly (15). During the installation, clean the residual sealant of the binding surface of the torque converter housing and the transmission housing. Meanwhile, a little anaerobic glue should be applied at the binding surface during the installation. Finally, remove positioning pin (16) and O-ring (17). Note that because the O-ring is a plane seal here, the O-ring must be replaced during installation, and this O-ring is not allowed for reuse.



14 Bolt + elastic Gasket (19 pieces)
15 The torque converter housing assembly
16 Cylinder positioning pin
17 O-ring
18 Transmission housing assembly

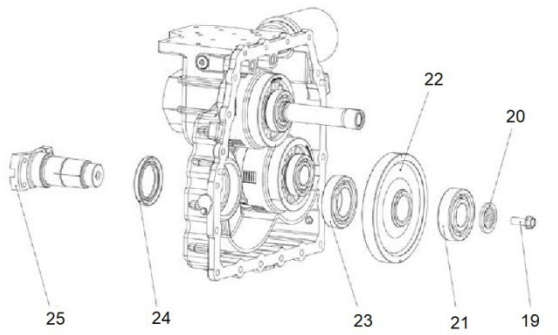
① Bolt + elastic Gasket (19 pieces)
- Tightening torque: 45-59N.m
- Tool : 8 mm hexagonal rotary sleeve.

② O-ring
- Wear parts (replaced when disassembly)

(6) Remove the bolts (19), remove the space plate (20), remove the output flange (25) and successively remove the bearing (21), output gear (22), bearing (23) and oil seal (24).

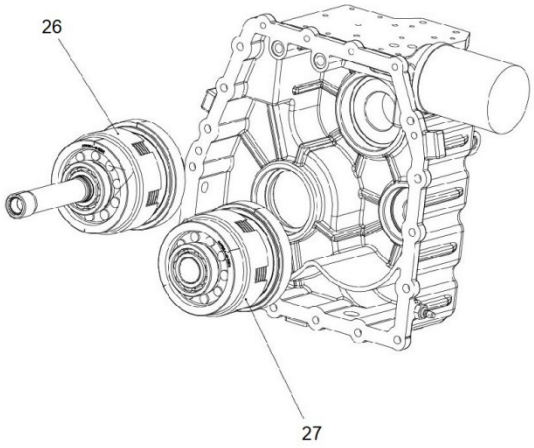
① Bolt
- Tightening torque: 110-130N.m
- Tool : 18 mm outer hexagonal sleeve.

② Oil seal
- Wear parts (replaced when disassembly)



19 Bolt
20 Space plate
21 Deep-groove ball bearing
22 Output gear
23 Deep-groove ball bearing
24 Oil seal
25 Output flange

(7) Remove input shaft assembly (26) and reverse gear clutch assembly (27).



27 Input shaft assembly
28 Reverse-gear clutch assembly

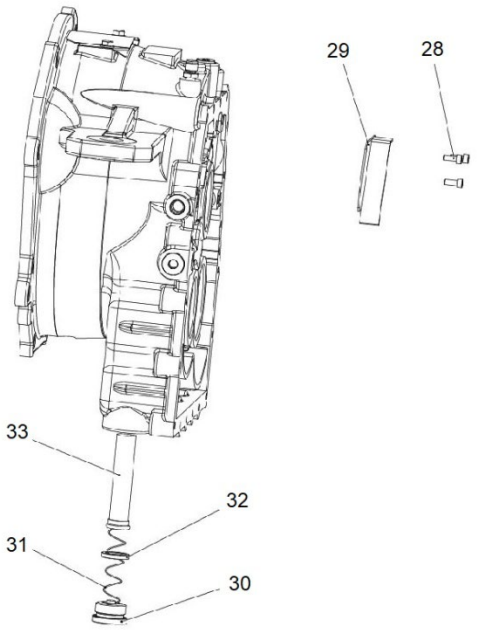
(8) Remove the bolts (28), remove the oil baffle assembly (29), remove the filter plug (30), remove the filter spring (31), the filter separator (32) and the filter assembly (33).

① Bolts (3 pieces)
- Tightening torque: 9-12N.m
- Tool : 5 mm hexagonal rotary sleeve

② Filter plug
- Tool : 19 mm hexagonal rotary sleeve

③ The filter assembly
- Wear parts (replaced when disassembly)

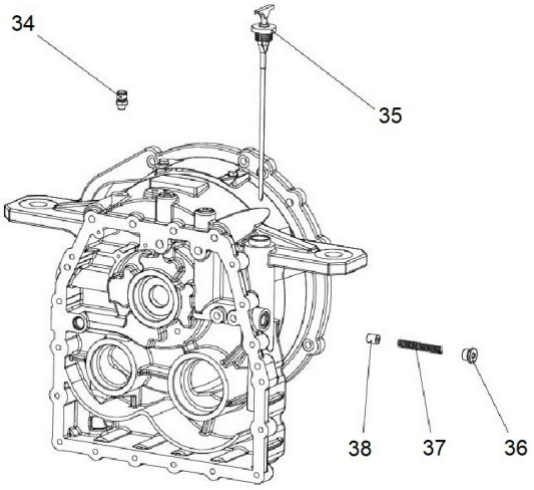
※ Clean it every 500 hours and replace it every



28 Bolts (3 pieces)
29 Oil baffle assembly
30 Filter plug
31 The filter spring
32 Filter spacer
33 The filter assembly

(9) Remove the vent plug (34), remove the oil gauge assembly (35), remove the inner hexagon plug assembly (36), and remove the spring (37) and the piston (38). Replace the O-ring when installing the inner hexagonal screw plug assembly.

① Internal hexagon screw plug assembly
- Tightening torque 30-45N.m
- Tool : 8mm hexagonal rotary sleeve



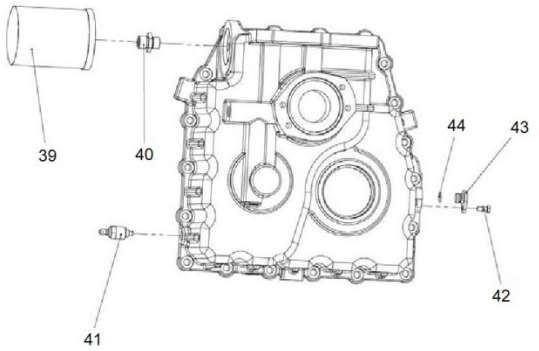
34 Normally open air vent plug
35 Oil gauge assembly
36 Internal hexagon screw plug assembly
37 Spring
38 Pistons

(10) Remove the oil filter (39) and the pipe connector (40), with filter wrench, remove the temperature switch (41), remove the bolts (42), remove the speed sensor plug (43) and the O-ring (44).

① Filter
- Wear parts (replaced when disassembly)
- Replaced every 500 hours
- Tightening torque: 35-40N.m
- Tool : Filter wrench

② Bolt + elastic gasket
- Tightening torque: 10-12N.m
- Tool :10mm outer hexagonal sleeve

③ O-ring
- Wear parts (replaced when disassembly)



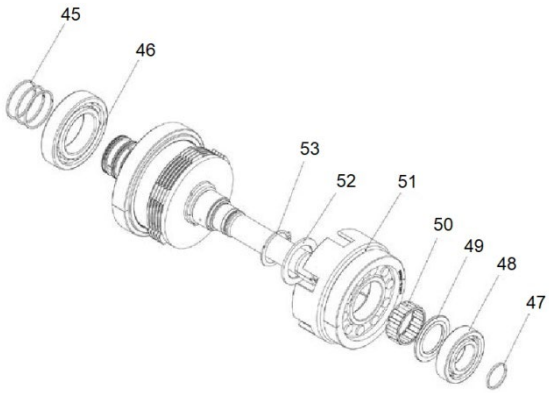
39 Filter
40 Pipe connector
41 Temperature switch
42 Bolt + elastic gasket
43 Speed sensor plug
44 O ring

(11) Remove the seal ring (second) (45), remove the bearing (46), the seal ring (first) (47), remove the bearing (48), and then remove the thrust ring (49), bearing (50), clutch assembly (51), thrust ring (52), and snap ring (53).

① Seal Ring 2 (3 pieces)
- Wear parts (replaced when disassembly)

② Seal ring 1
- Wear parts (replaced when disassembly)

③ Snap ring
- Tool : Snap ring plier

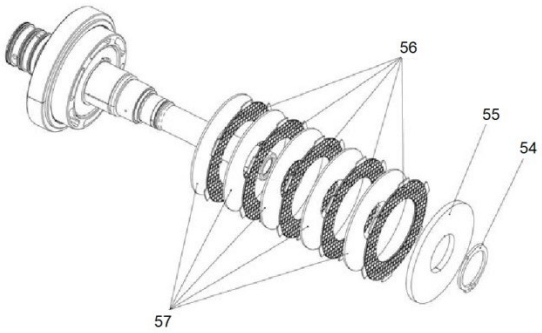


45 Seal Ring 2 (3 pieces)
46 Deep-groove ball bearing
47 Seal ring 1
48 Deep-groove ball bearing
49 Thrust ring
50 Needle-roller bearing
51 Clutch assembly
52 Thrust ring
53 Snap ring

(12) After removing the snap ring (54), remove the end plate (55), the friction plate (56) and the spacer (57) successively.

① Snap ring for shaft
- Tool : Snap ring plier

② Friction
- Wear parts (replaced when disassembly)

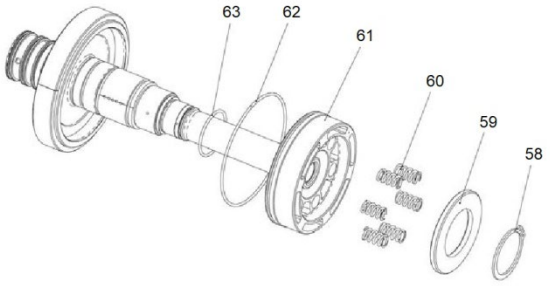


54 Snap ring for shaft
55 End plate
56 Friction
57 Spacer

(13) Remove snap ring (58), remove spring seat (59), return spring (60), remove pistons (61), O-rings (62) and (63).

① Snap ring for shaft
- Tool : circlip plier

② O-ring (62, 63)
- Wear parts (replaced when disassembly)

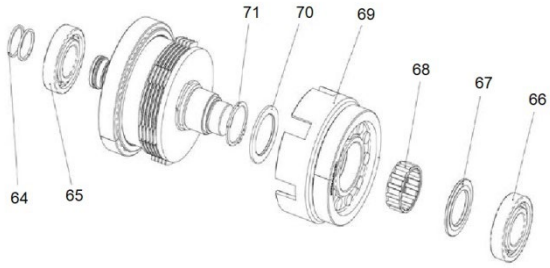


58 Snap ring for shaft
59 Spring seat (clutch)
60 Piston return spring (6 pieces))
61 Pistons
62 O-ring
63 O-ring

(14) Remove the seal ring (64), remove the bearings (65) and (66), and remove the thrust ring (67), then remove the bearing (68), the clutch assembly (69), the thrust ring (70) and the snap ring (71).

① Seal ring
- Wear parts (replaced when disassembly)

② Snap ring for shaft
- Tool : Circlip plier

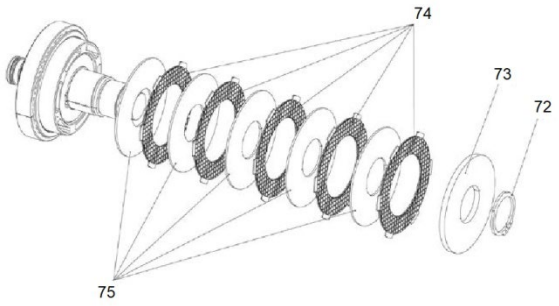


64 Seal ring (2)
65 Deep-groove ball bearing
66 Deep-groove ball bearing
67 Thrust ring
68 Needle-roller bearing
69 Clutch- assembly
70 Thrust ring
71 Snap ring for shaft

(15) After removing the shaft snap ring (72), remove the end plate (73), the friction plate (74) and the spacer (75) in turn.

① Snap ring for the shaft
- Tool : Circlip plier

② Friction plates (5 pieces)
- Wear parts (replaced when disassembly)

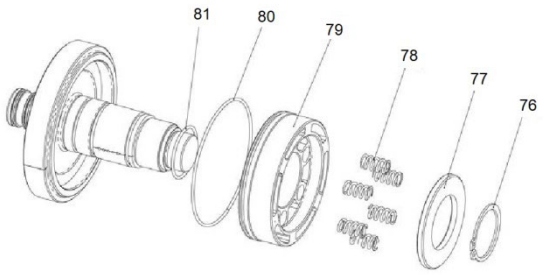


72 Snap ring for the shaft
73 End plate
74 Friction plates (5 pieces)
75 Spacer (5 pieces)

(16) Remove shaft snap ring 76, remove spring seat 77, return spring 78, remove piston 79, O-ring 80,81.

① Snap ring for shaft
- Tool : Circlip plier

② O-ring (80, 81)
- Wear parts (replaced when disassembly)



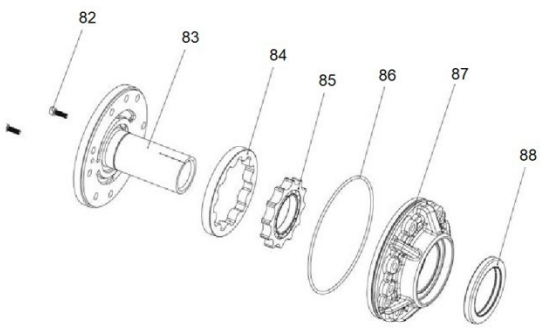
76 Snap ring for shaft
77 Spring seat (clutch)
78 Piston return spring (6 pieces)
79 Pistons
80 O-ring
81 O-ring

(17) After removing screw (82), remove pump body assembly (87), O-ring (86), oil pump drive gear assembly (85), oil pump inner gear (84) and oil seal (88).

① Screw (2 pieces)
- Tool : 4mm hexagonal wrench

② O-ring
- Wear parts (replaced when disassembly)

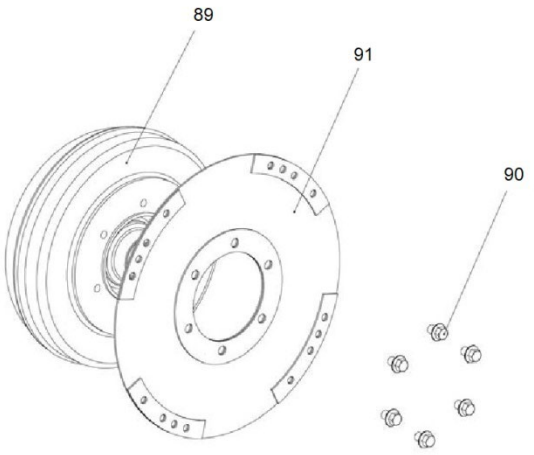
③ Oil seal
- Wear parts (replaced when disassembly)



82 Screw (2 pieces)
83 Oil inlet shaft sleeve (stator seat)
84 Inner gear ring
85 Oil pump drive gear assembly
86 O-ring
87 Pump body assembly
88 Oil seal

(18) Remove the bolts (91) and remove the input plate assembly (90).

① Hexagonal flange bolts (6 pieces)
- Tightening torque: 42-50N.m
- Tool : 16mm outer hexagonal sleeve



89 The torque converter assembly
90 The input plate assembly
91 Hexagonal flange bolts (6 pieces)

GROUP3 DRIVE AXLE

1. OVERVIEW

The wet brake axle is composed of main reduction components and hub reduction components.

The main reduction component is composed of a pair of spiral bevel gears, differential assembly, brake flange, input flange, manual brake and other important components. Its structure is simple and easy to maintain.

The differential assembly is composed of two planetary gears and two half shaft gears, and it drives the half shaft tire through the half shaft gears, to achieve power output.

The hub reduction components is composed of three planetary gears, sun gear and ring gear.

The wet brake axle adopts fully closed wet driving brake and caliper type parking brake.

Wet service brake structure is composed of piston, spring seat, internal and external friction plate, pressure plate and other important components. The surplus fit between the piston and the spring seat can compensate for the wear of the friction plate to improve the service life of the friction plate. At the same time, multiple friction plate structure is used so that big brake moment can be obtained under small friction plate pressure. and the fully closed structure effectively prevent the immersion of mud, water, oil, make the brake stable. Its overall structure is simple, low noise, easy to maintain.

Carper type parking brake is composed of important parts such as brake flange and manual brake. By rotating the mechanical manual, the manual brake rolls the inner steel ball along the rolling path, and finally makes the two friction plates clamp between the brake disc, so as to meet the braking effect. At the same time, a tensile spring is added to the manual, so that the manual brake can easily return to the initial state after releasing the brake, and effectively prevent the phenomenon that the friction plate is not removed in time. manual brake with friction plate parking, has a long service life, and easy to replace the advantages.

2. TECHNICAL SPECIFICATION

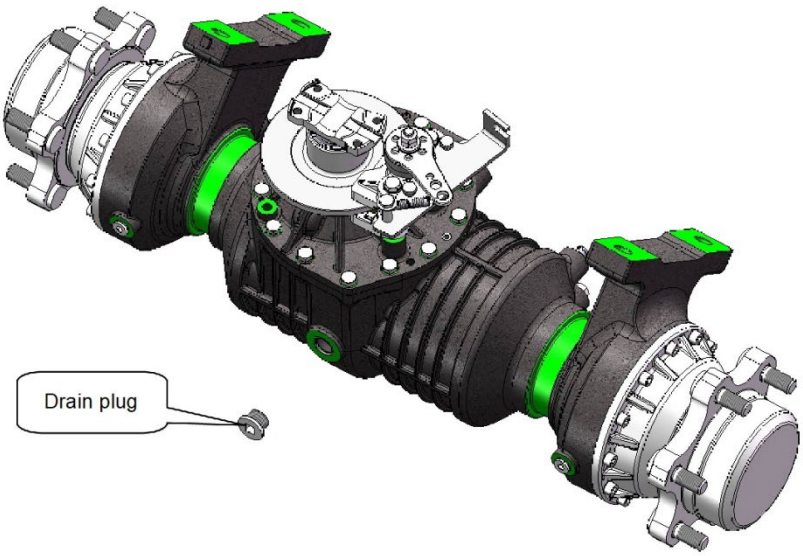
The main transmission parameters are shown below.

Item	Specification
Maximum output torque: N.m	11,000
Maximum static load N	184,000
Service brake type	Wet brake
Maximum driving brake torque: N.m	13197@60bar
Main brake energy absorption level J	421,364
Main brake oil specifications	Mineral oil
Main brake oil quantity c	4.2
Parking brake type	Dry caliper brake
Parking brake control	Manual brake
Maximum parking brake torque: N.m	5434
Hub reduction	Have
Module of gear	Bevel gear: m=5.6
	Differential gear: m=5.688
	Gear: m=2.25
Transmission ratio	Bevel gear: 2.667
	Hub reduction: 4.091
Drive axle oil	Mobil 424
Net weight (no oil) Kg	200kg

3. MAINTENANCE

1) OIL LEVEL INSPECTION

Park the vehicle on the flat road and fill oil until the oil coming out from the oil level plug. The position of the drain plug is shown in the following figure:



2) Axle oil shall be replaced after 500 hours of first use; then oil shall be replaced every 2000 hours.

4. INTERNAL STRUCTURE AND WORKING PRINCIPLE

1) WORKING PRINCIPLE

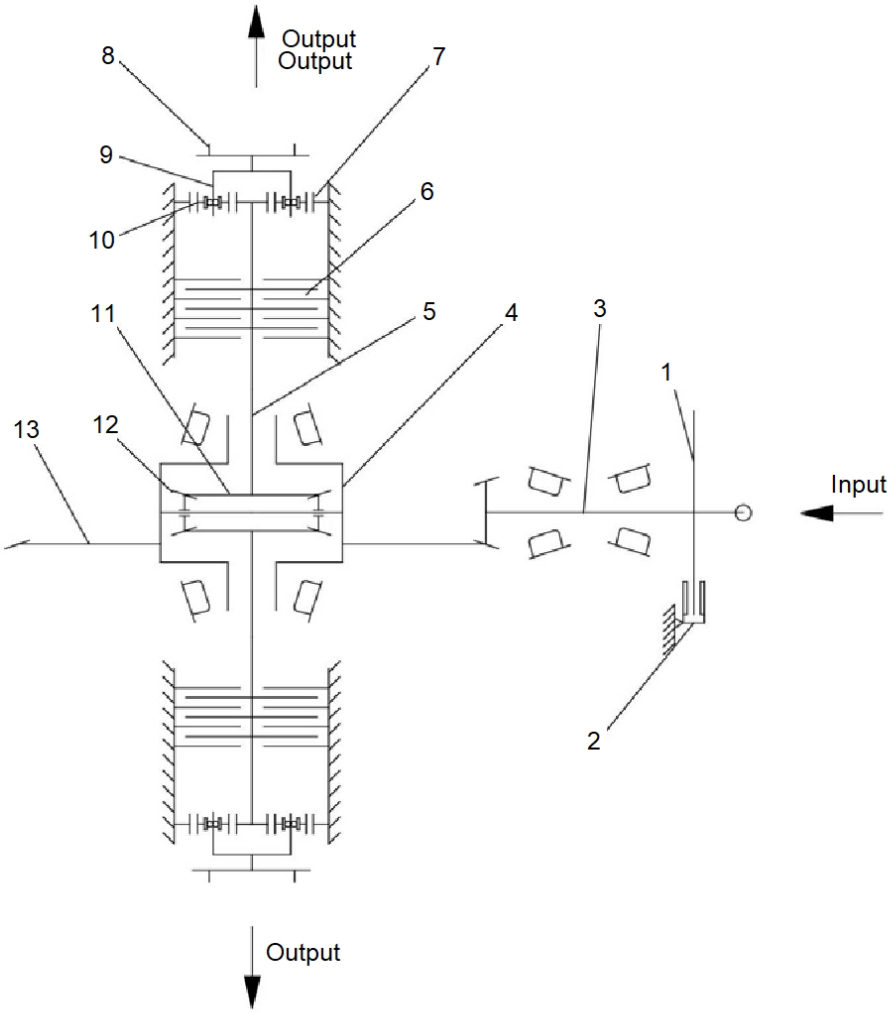
(1) TRANSMISSION PRINCIPLE

For the transmission diagram of the wet brake axle, see figure below. The input flange transfers the output force of the transmission to the brake flange (1) through the drive shaft, and then to the bevel pinion (3). The bevel big gear (13) drives the differential assembly (4) to rotate, and finally turns the hub (8).

The brake fluid enters into the piston, thus pushing the friction plate group (6) to brake the drive shaft (5), and finally achieving the service brake effect.

The parking brake uses the manual brake (2) to clamp the brake flange in order to meet the parking effect.

When in forward or backward gear, the transmission order is: part 1-- part 3 -part 13- part 5 -part 10- part 9 -part 8 -output.



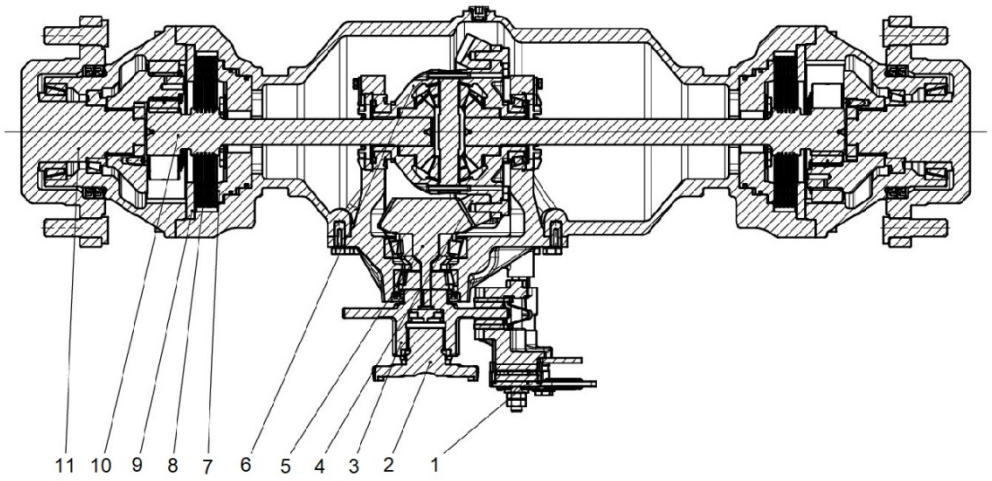
2) STRUCTURAL INTRODUCTION

(1) Structure Introduction

See figure below for wet brake axle structure of drive axle. The power of the transmission is fed to the input flange (2) of the wet brake axle through the drive shaft.

The wet brake axle is mainly composed of major components such as manual brake (1), input flange (2), brake flange (3), bevel big gear (4), bevel pinion (5), differential assembly (6), piston (7), friction (8), pressure plate (9), drive shaft (10) and hub component (11).

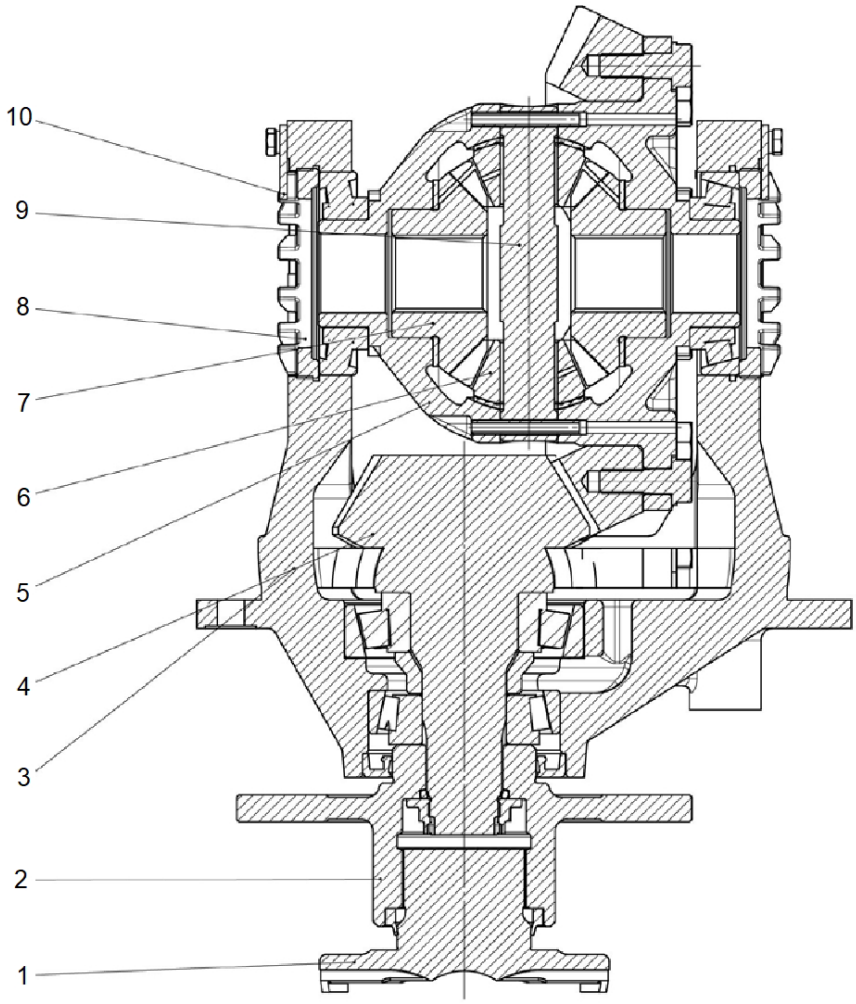
The force is transferred to the main reduction part by the input flange and output to the hub side.



1	Manual brake	5	Bevel pinion	9	Pressure plate
2	Input flange	6	Differential assembly	10	Drive shaft
3	Brake flange	7	Piston	11	Hub components
4	Bevel large gear	8	Friction plate		

(2) Main reduction components

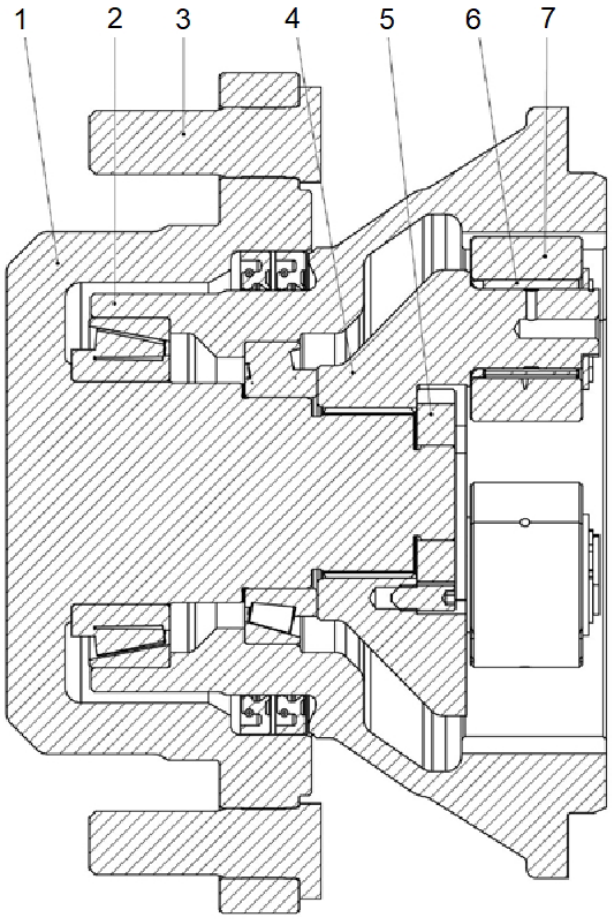
See figure below for the structure diagram of the main reduction components. The main reduction is mainly composed of input flange (1), brake flange (2), differential seat assembly (3), bevel assembly (4), differential housing (5), 2 planetary gears (6), 2 half shaft gears (7), adjustment nut (8), planetary gear shaft (9), stop sheet (10) and other parts. The thrust washer and washer are installed between the differential housing and the planetary gear and the half-shaft gear.



1	Input flange	5	Differential housing	9	Planetary gear shaft
2	Brake flange	6	Planetary gear	10	Stop sheet
3	Differential seat assembly	7	Half shaft gear		
4	Bevel assembly	8	Adjusting nut		

(3) Hub reduction parts

See figure below for the structure diagram of the hub reduction parts. The hub reduction parts are mainly composed of hub (1), ring gear (2), hub bolt (3), planetary carrier (4), lock nut (5), full rolling needle (6), planetary gear (7) and other parts.



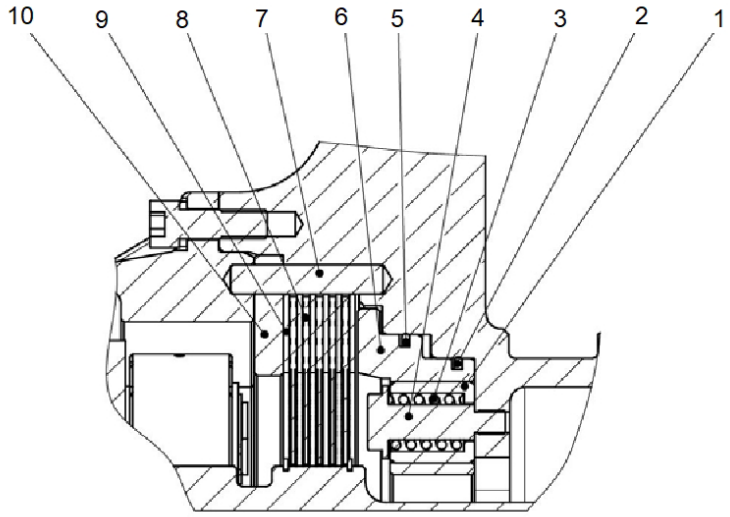
1	Hub	4	Planetary carrier	7	Planetary gear
2	Ring gear	5	Lock nut		
3	Hub bolt	6	Full needle		

(4) Service brake components

See figure below for the structure diagram of the service brake parts. The service brake parts are mainly composed of important parts such as spring seat (1), D ring (1) (2), spring (3), return spring screw (4), D ring (2) (5), piston (6), mandrel (7), inner friction plate (8), outer friction plate (9), press plate (10) and so on.

The brake pump drives the brake fluid into the two D rings (2) and (5) in the piston (6), push the piston (6), because the piston (6) and spring seat (1) are surplus fit, can compensate the wear of the friction plate, so that the piston (6) presses the inner friction plate (8), outer friction plate (9) and pressure plate (10), brake the drive shaft, and finally achieve the effect of service brake.

When the brake fluid is not filled, the piston (6) is returned to the initial state by returning spring (3), separating the piston (6) from the friction plate set and releasing the drive shaft to achieve the driving effect.



1	Spring seat	5	D ring (2)	9	Outer friction disc
2	D ring (I)	6	Piston	10	Pressure plate
3	Return spring	7	Mandrel		
4	Return spring screw	8	Inner friction disc		

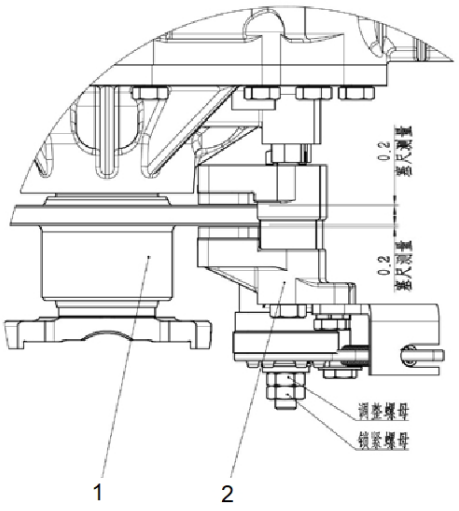
(5) Parking brake parts

See figure below for the structure diagram of the parking brake parts. The parking brake component is composed of brake disc (1) and manual brake (2).

Manual brake clearance requirement: unilateral clearance between brake disc and friction plate 0.2mm (both sides)

Specification for clearance adjustment of manual brake: select 0.2mm gauge to put on both sides of the brake disc and brake gasket, tighten the adjustment nut to achieve the clearance requirements, then tighten the lock nut, and confirm whether the clearance is met again. Lift the front wheels to accelerate, and measure whether the brake flange and manual brake temperature are abnormal.

If improperly adjusted, it is easy to wear , or even burn out.



1 Brake flange 2 Manual brake

5. DISASSEMBLY AND ASSEMBLY

1) PRECAUTIONS

(1) The sequence of the wet brake axle disassembly and the assembly process is basically the opposite.

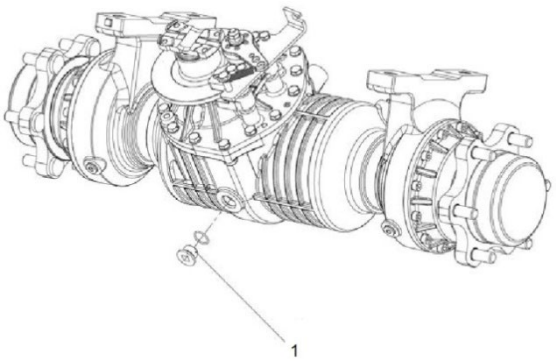
(2) When disassembling the wet brake axle, it should be taken gently and put gently to prevent the parts from bumping and damaging. After disassembly, the parts should be placed in an order.

(3) The adjustment spacers in the wet brake axle shall be installed back to the original place according to the quantity during disassembly, and shall not be added or replaced at will.

(4) The disassembly process shall be operated in strict accordance with the above instructions, and blind disassembly and brutal operation are strictly prohibited.

2) DISASSEMBLY AND ASSEMBLY

(1) Before dismantling the wet brake axle, the residual oil in the axle should be discharged, and the O-ring at the oil drain plug should be replaced. After releasing the residual oil, the oil drain plug (1) should be screwed back to the wet brake axle.

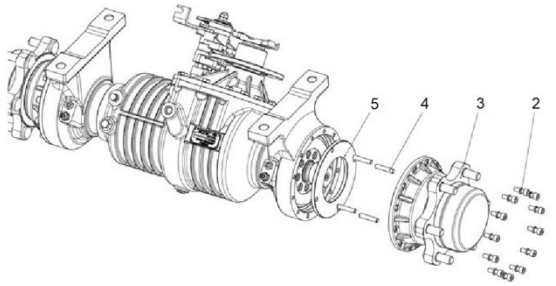


1 Oil drain plug+O-ring

(2) Remove bolt (2) on one side of the wet brake axle and remove hub components (3), mandrel (4) and pressure plate (5).

① Bolt + elastic gasket (12 pcs)
- Tightening torque: 65-78N.m
- Tooling, tools 8mm inner hexagonal sleeve head

※ The installation shall be tightened diagonally



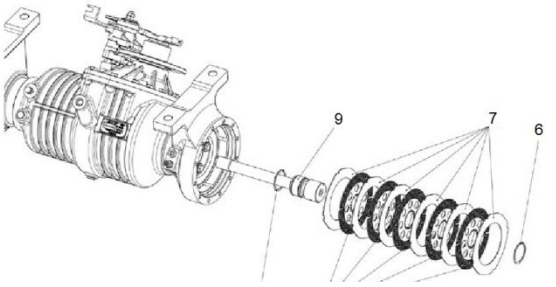
2 Bolt + elastic gasket (12 pcs)
3 Hub parts
4 Mandrel (4 part)
5 Pressure plate

(3) Remove snap ring (6), remove the outer friction disc (7), inner friction disc (8) and drive shaft (9), and remove the other snap ring.

① Snap ring (2 pcs)
- Wear parts (replaced when disassembly)

② Internal friction disc (5 pcs)
- Wear parts (replaced when disassembly)

※ The orientation of the inner friction plate hole is consistent



6 Snap ring (2 pcs)
7 External friction disc (6 pcs)
8 Internal friction disc (5 pcs)
9 Drive shaft (sixth)

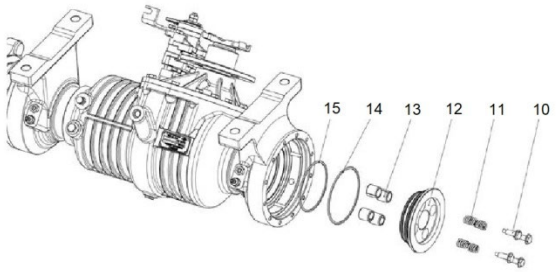
(4) Remove the return spring screw (10), remove the return spring (11), the piston (12), and remove the return spring seat (13), the D rings (14) and (15).

① Return spring screw (4 part)
- Tightening torque 30-36N.m
- Tool : 17mm outer hexagonal sleeve

※ Clearance requirement

0.6-0.7mm

② D ring (first and second)
- Wear parts (replaced when disassembly)



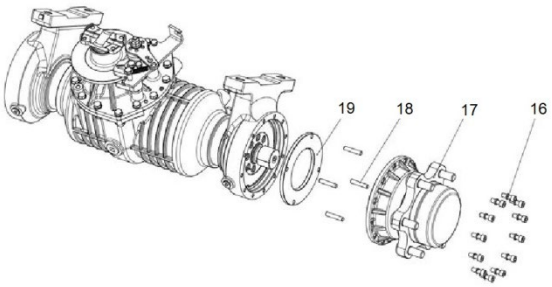
10 Return spring screw (4 part)
11 Return spring (4 part)
12 Pistons
13 Return spring seat (4 part)
14 D-ring (first)
15 D-ring (second)

(5) Remove the bolts (16) on the other side of the axle, and remove the hub components (17), the mandrel (18), and the pressure plate (19).

① Bolt + elastic gasket (12 pcs)
- Tightening torque: 65-78N.m
- Tool : 8mm inner hexagonal sleeve head

※ The installation shall be

tightened diagonally



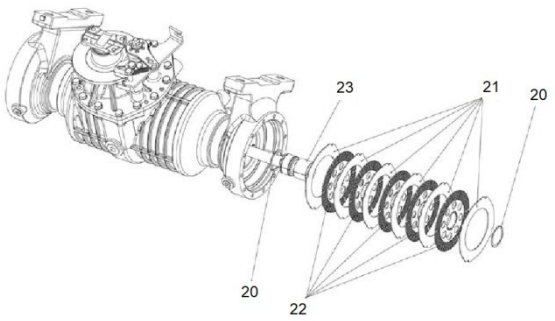
16 Bolt + elastic gasket (12 pcs)
17 Hub components
18 Mandrel (4 pcs)
19 Pressure plate

(6) Remove the snap ring 20, remove the outer friction disc 21, the inner friction disc 22 and the drive shaft 23, and remove the other snap ring.

① Snap ring (2 pcs)
- Wear parts (replaced when disassembly)
- Tool : Circlip plier

② Internal friction disc (5 pcs)
- Wear parts (replaced when disassembly)

※ The orientation of the inner friction disc hole is consistent



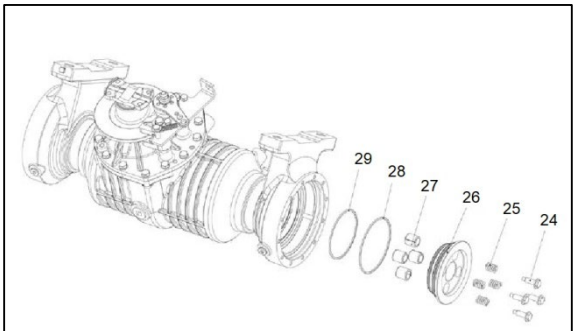
20 Snap ring (2 pcs)
21 External friction disc (6pcs)
22 Internal friction disc (5 pcs)
23 Drive shaft (fifth)

(7) Remove the return spring screw (4 part) (24), return spring (25), pistons (26), return spring seat (4 part) (27), D-ring (first) (28) and D-ring (second) (29)

① Return spring screw (4 part)
- Tightening torque of 30-36N.m
- Tool : 17mm outer hexagonal sleeve

※ Clearance requirement 0.6-0.7mm

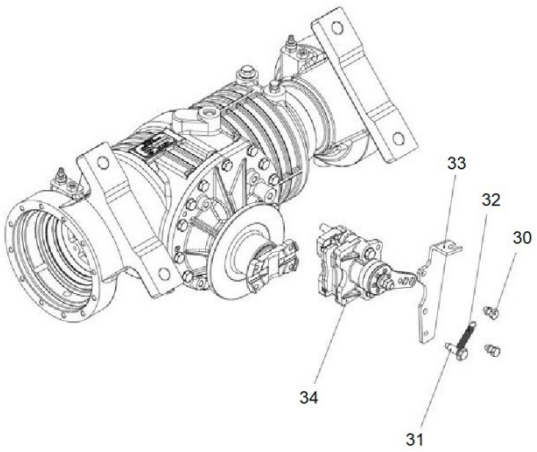
② D ring (first and second)
- Wear parts (replaced when disassembly)



24 Return spring screw (4 part)
25 Return spring
26 Pistons
27 Return spring seat (4 part)
28 D-ring (first)
29 D-ring (second)

(8) Remove manual brake 34, remove bolt 30, remove limit screw 31, tensile spring 32, and manual brake bracket 34.

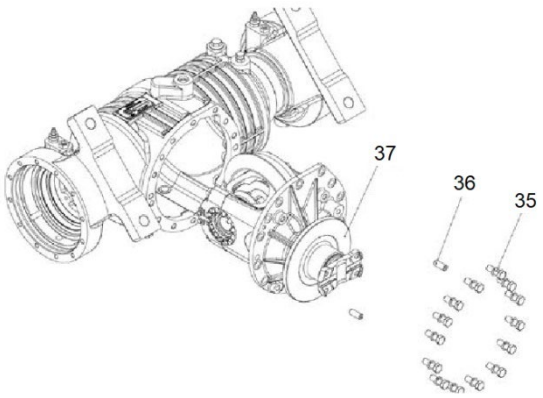
① Bolt + Mad (2 part)
- Tool : 16mm outer hexagonal sleeve



30 Bolt + Mad (2 part)
31 Limit screw
32 Tensile spring
33 Manual brake bracket
34 Manual brake

(9) Remove bolts (35), cylinder pin (36) and remove main reduction (37).

① Bolt + gasket (14 part)
- Tightening torque: 110-130N.m
- Tool : 16mm outer hexagonal sleeve



35 Bolt + gasket (14 part)
36 Cylindrical pin (2 part)
37 The main reduction

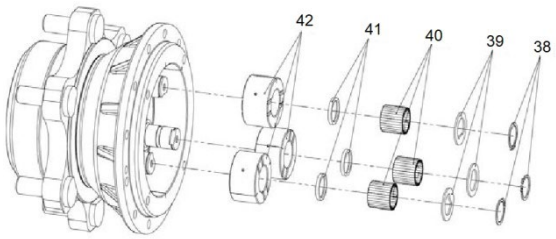
(10) Remove the elastic snap ring 38 for the shaft and remove the baffle 39,needle bearing 40, needle spacer 41 and planetary gear 42.

① Elastic snap ring for shaft (3 pcs)

※ Special snap ring tooling

② Planetary gear (3 pcs)

※ Requirements for planetary gear and ring gear backlash: 0.164-0.238



38 Elastic snap ring for shaft (3 pcs)
39 Baffle (3 pcs)
40 Needle roller bearing (3pcs)
41 Roller spacer (3 pcs)
42 Planetary gear (3 pcs)

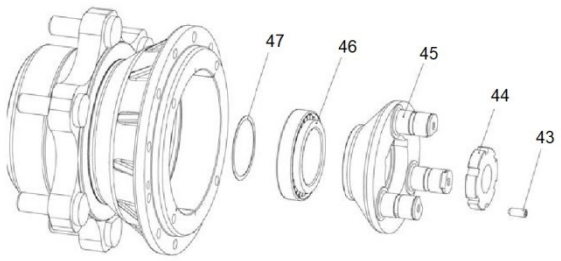
(11) Remove the hexagonal cone end tightening screw 43 and nut 44, remove the planetary carrier 45, tapered roller bearing 46 and adjustment gasket 47

Hexagonal cone end set screw
- Tightening torque: 25-30N.m
- Tool : 3mm inner hexagonal sleeve head Nut
- Tightening torque: 260-280N.m

※ Nut special tooling

Adjustment gasket

※ The theoretical range of the adjustment gasket: 0.35-0.55



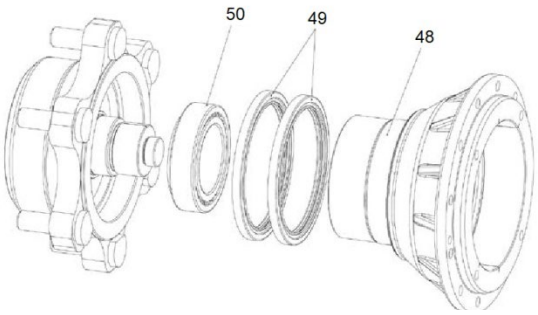
43 Hexagonal cone end set screw
44 Nut
45 Planetary carrier
46 Tapered roller bearing
47 Adjustment gasket

(12) Remove ring gear (48), two oil seals (49) and taper roller bearing (50). When installing the oil seal, apply high performance multi-purpose grease S2 V100 3 between the oil sealing lip and the two oil seals.

① Oil seal (2 pcs)

※ Oil seal pressed depth H1:

2 and H2:13

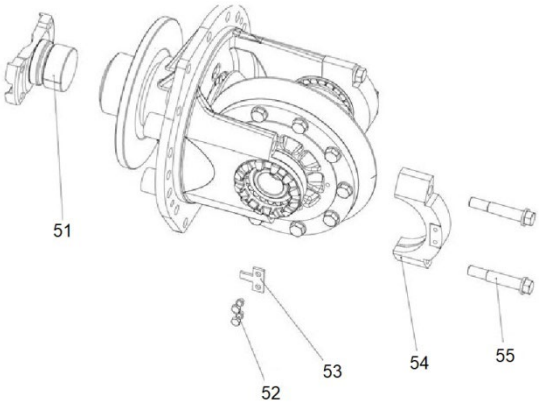


48 The ring gear
49 Oil seal (2 pcs)
50 Tapered roller bearing

(13) Remove the input flange (51), remove the bolts (52) and anti loose cushion (53) on both sides of the differential seat, remove the differential seat bolt (55), and remove the bearing seat (54).
When installing the input flange, apply high performance multi- utility grease S2 V100 3 on the spline in the brake flange.

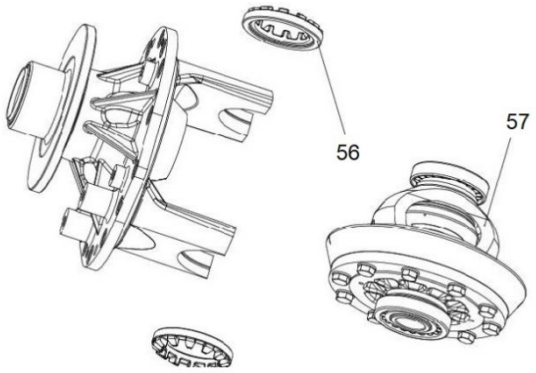
① Bolt + gasket (4 part)
- Tightening torque: 13-16N.m
- Tool :10mm outer hexagonal sleeve

② Differential seat bolts (4 part)
- Tightening torque: 110-130N.m
- Tool :16mm outer hexagonal sleeve



51 Input flange
52 Bolt + gasket (4 part)
53 Anti-loose gasket (2 part)
54 Bearing seat (2 part)
55 Differential seat bolts (4 part)

(14) Remove the adjusting nut (56) on both sides and remove the differential assembly and big arc gear.

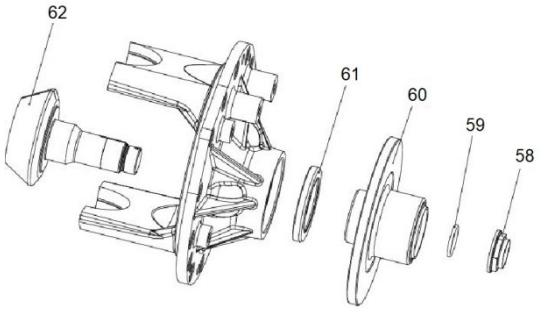


56-Adjustment nut (2 pcs)
57-Differential assembly + big arc gear

(15) Remove the lock nut (58), remove the O-ring (59), brake flange + dust ring (60) and oil seal (61), and tap the small arc gear (62).

① Lock nut
- Tightening torque: 180-200N.m

② O-ring
- Wear parts (replaced when disassembly)



58-Lock nut
59-Oring
60-Brake flange + dust ring
61-Oil seal
62-small arc gear

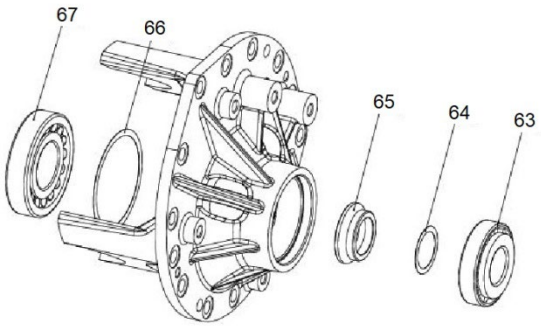
(16) Remove the taper roller bearing (63), remove the adjustment gasket (64) and the bush (65); tap the taper roller bearing (67), and remove the adjustment gasket (66).

① Adjustment gasket (64)

※ Theoretical range of the adjustment gasket:
0.225-0.475

② Adjustment gasket (66)

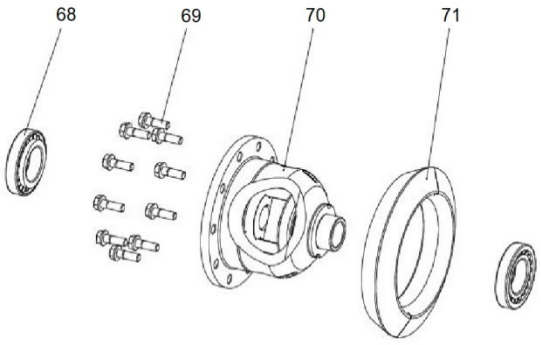
※ Theoretical range of the adjustment gasket:
0.445-0.855



63 Tapered roller bearing
64 Adjustment gasket
65 Bush
66 Adjustment gasket
67 Tapered roller bearing

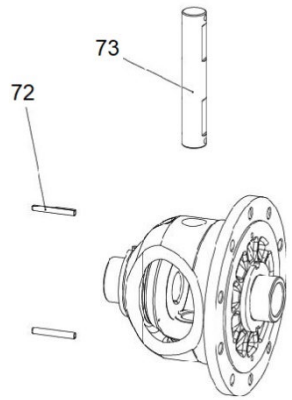
(17) Remove the taper roller bearing 68, bevel big gear bolt 69, and remove the arc big gear 71.

① Bevel big gear bolt (10)
- Tightening torque: 65-70N.m
- Tool : 16mm outer hexagonal sleeve



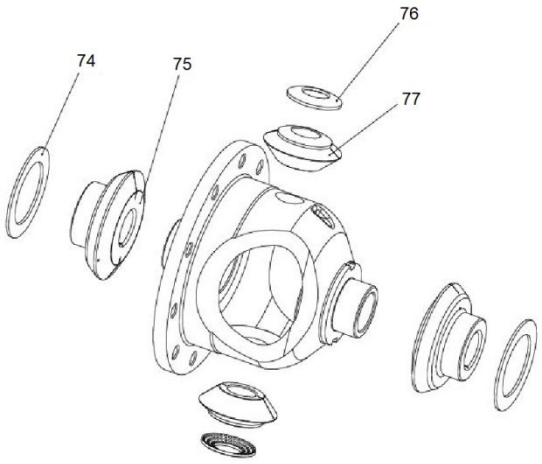
68 Taper roller bearings (2 pcs)
69 Bevel big gear bolt (10)
70 The differential assembly
71 Arc big gear

(18) Tap out the two sides cylindrical pins (72) and remove the planetary shaft (73).



72 Cylindrical pin
73 Planetary gear shaft

(19) Remove the half-shaft gear (75) and thrust washer (74), planetary gear (77) and washer (76) from the differential housing.



74 The thrust washer
75 Half-shaft gear
76 Gasket
77 Planetary gear

SECTION4 BRAKE SYSTEM

GROUP1 STRUCTURE AND FUNCTION

1 OUTLINE

There are two brake systems, the foot brake system and the hand brake system. The foot brake adopts the brake system of oil type at drive axle.
Oil pressure is generated in maximum 140kgf/cm2 through brake oil input path of the left and right drive axle housing, this pressure allows the piston brake to advance and compresses a friction plate and a plate.
So, when the transportation travels, it is possible to brake.
The parking brake works by the hand brake installed on parking drum which is linked to the output shaft of the forward clutch.

2 SPECIFICATION

1) DRUM BRAKE

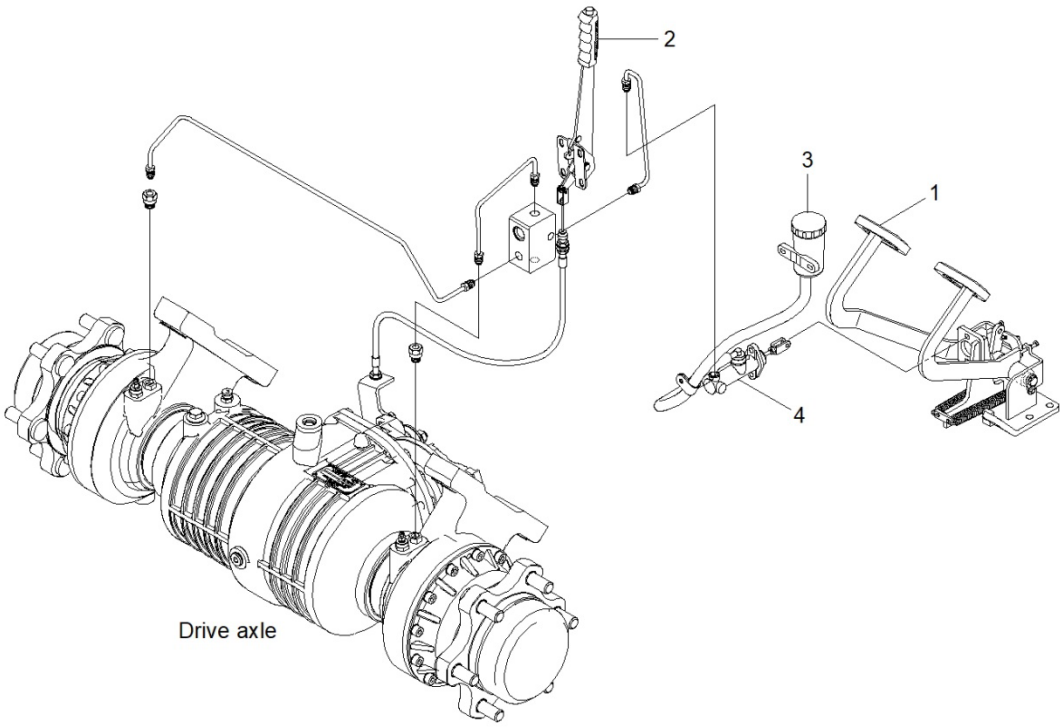
Item		Specification
Type		Wet disc brake
Master cylinder full stroke (Non boosted)		28mm
Pedal adjustment	Pedal height	116.5 mm
	Play	1~3mm
Brake oil		Caltex DOT3

2) PARKING BRAKE

Item	Specification
Type	Toggle Lever Type
Parking lever stroke / Cable stroke	40 deg. / 57mm

3 BRAKE PEDAL AND PIPING

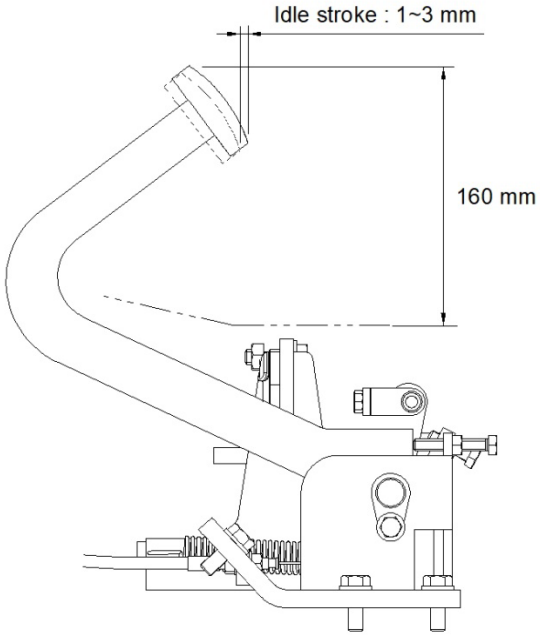
1) STRUCTURE

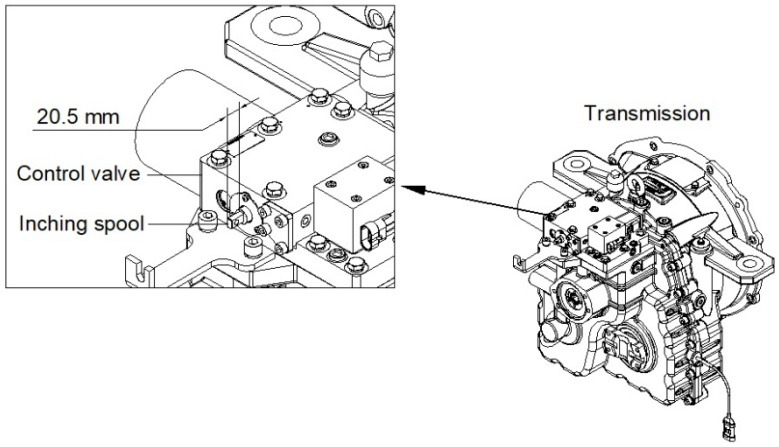


1	Brake pedal	3	Reservoir tank assembly
2	Parking lever assembly	4	Brake master cylinder

4 INCHING PEDAL AND LINKAGE

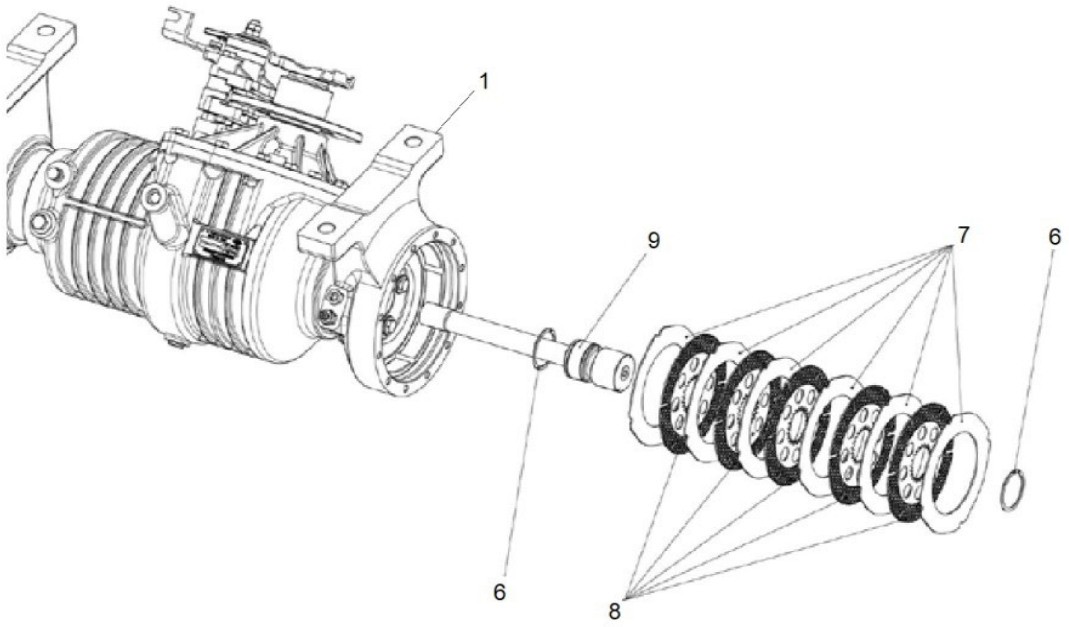
The brake pedal serves to actuate the hydraulic brakes on the drive axle. At the beginning of the pedal stroke, the inching spool of the transmission control valve is actuated to shift the hydraulic clutch to neutral and turn off the driving force. By treading the pedal further, the brake is applied.





5 WET DISK BRAKE

1) STRUCTURE



1	Drive axle housing	7	Outer friction disc	9	Drive shaft
6	Snap ring	8	Inner friction disc		

2) OPERATION

Sealed up structure of hydraulic disk brake system secures good brake performance even in the high humid or dusty area.

Because it is possible to use the brake semi-permanently, there is no need to replace or change the lining as drum type brake do.

Major components are outer plates (7), inner friction plates (8), piston (not shown), and brake housing.

Braking force is applied by restricting the drive force from drive shaft and spline collar.

GROUP2 OPERATIONAL CHECKS AND TROUBLESHOOTING

1 OPERATIONAL CHECKS

1) BRAKE PIPING

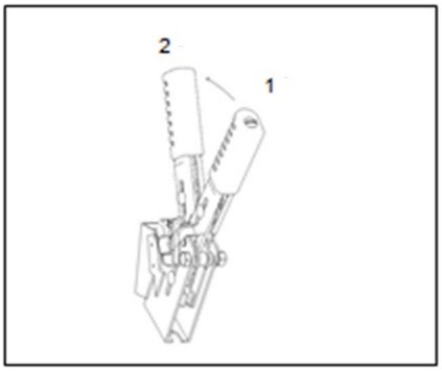
① Check pipes, hoses and joints for damage, oil leakage or interference.

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

2) PARKING BRAKE

① Operating force of parking lever is 35 - 40 kgf•m (253 - 290lbf•ft).

② 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.



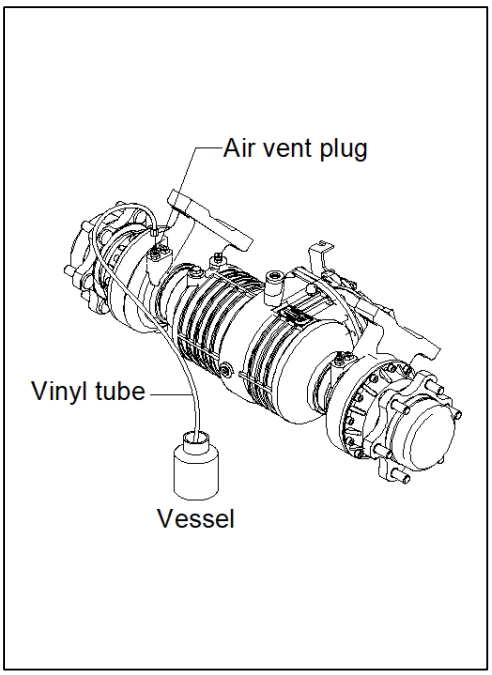
2 TROUBLESHOOTING

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

GROUP3 TESTS AND ADJUSTMENTS

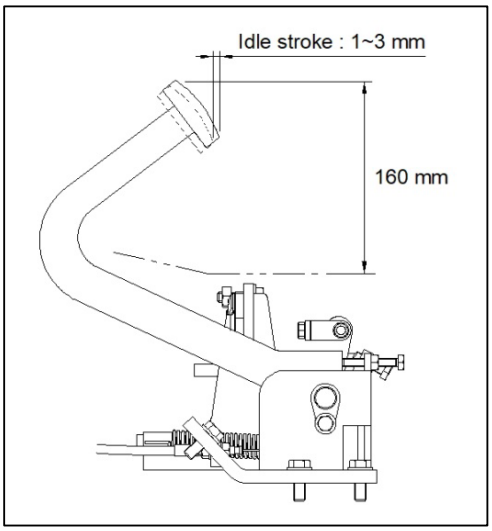
1 AIR BLEEDING OF BRAKESYSTEM

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



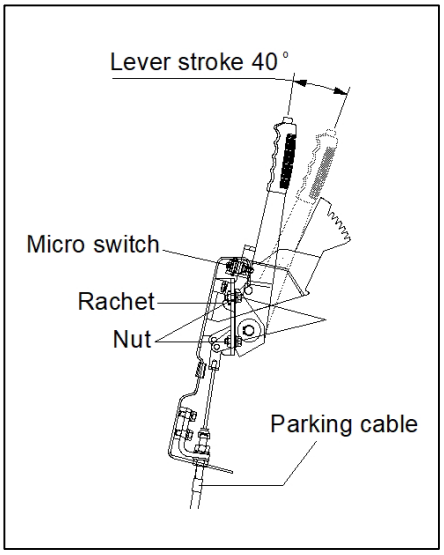
2 ADJUSTMENT OF PEDAL

1) BRAKE PEDAL
   ① Pedal height from floor plate
   Adjust with stopper bolt.
   •Pedal height: 160mm (6.3in)
   ② Idle stroke
   Adjust with rod of master cylinder
   •Play: 1~3mm



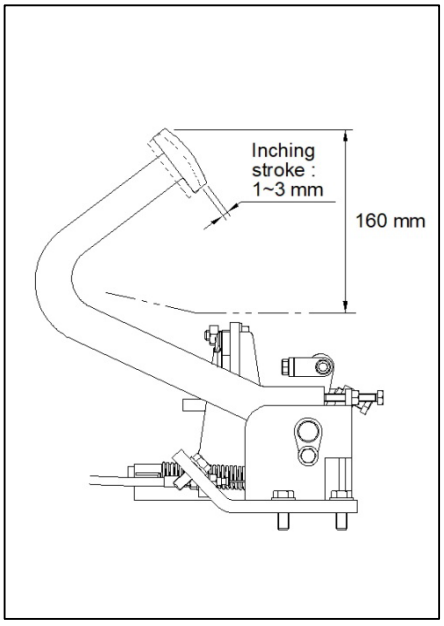
3 MICRO SWITCH FOR PARKING BRAKE (IF EQUIPPDE)

1) After assembling parking brake and parking cable, put the parking brake lever released.
   Loosen the nut for parking brake plate to play up and down.
   Move up the plate so that the stopper can be contacted with the pin and then reassemble nut.
   •Micro switch stroke when parking brake is applied: 2~3mm (0.08 ~ 0.1in)



4 INCHING PEDAL

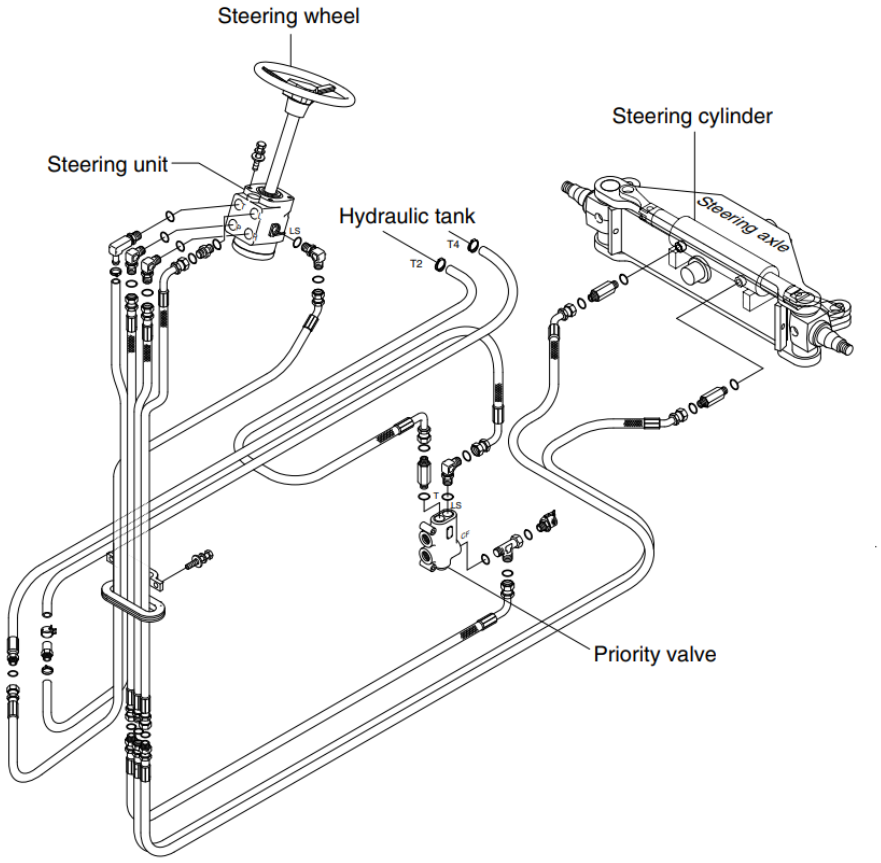
1) Pedal height from floor plate
   Adjust with stopper bolt.
   •Pedal height: 160mm (6.3in)
2) Adjust bolt so that brake pedal interconnects with inching pedal at inching pedal stroke 1~3mm.



SECTION5 STEERING SYSTEM

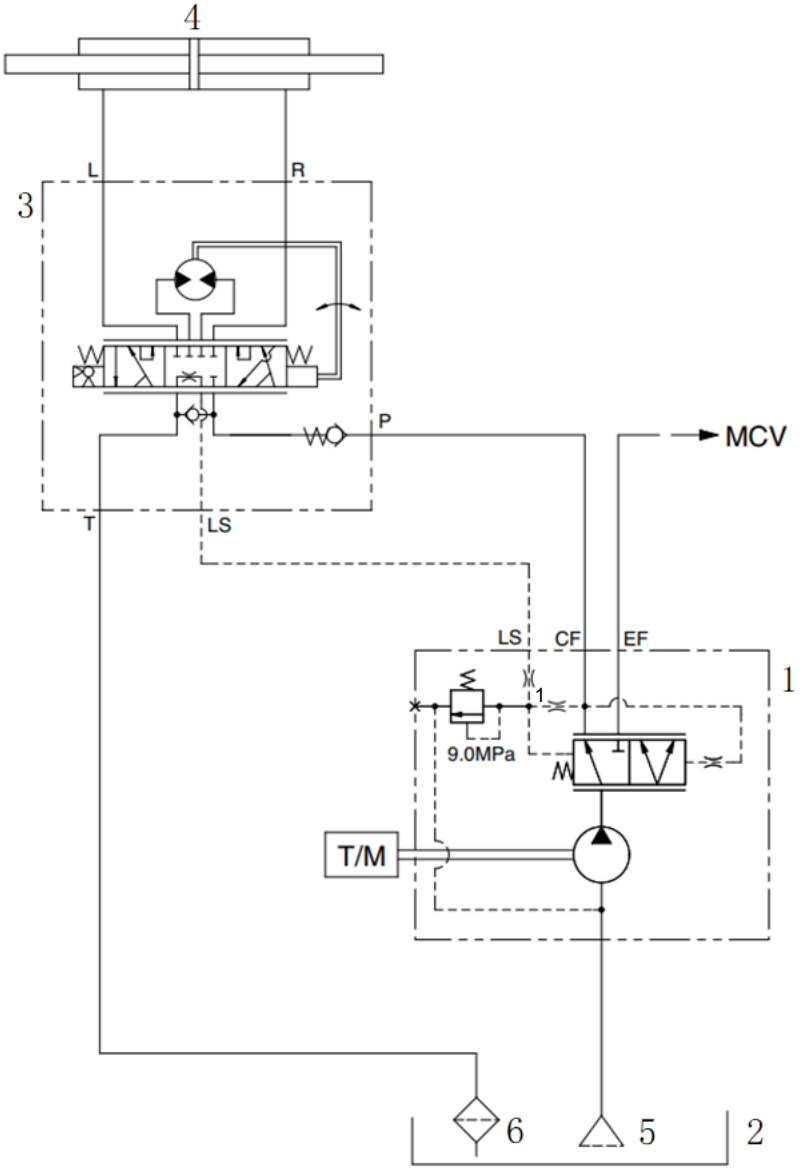
GROUP1 STRUCTURE AND FUNCTION

1 OUTLINE



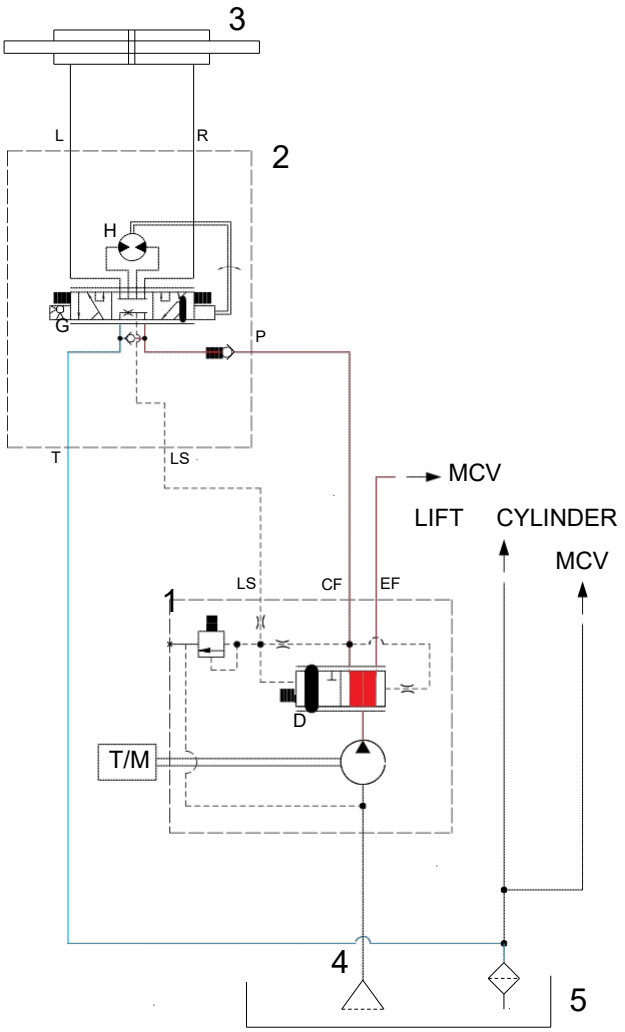
The steering system for this machine is composed of steering wheel assembly, steering unit, steering cylinder, steering axle and piping. The steering force given to the steering wheel enters the steering unit through the steering column. The required oil flow is sensed by the function of the control section of the unit, and pressurized oil delivered from the hydraulic pump is fed to the steering cylinder. The force produced by the steering cylinder moves the knuckle of steering tires through the intermediate link.
The axle body is unit structure having steering knuckles installed to its both ends by means of kingpins. Hub and wheel are mounted through bearing to spindle of knuckle.

2 HYDRAULIC CIRCUIT



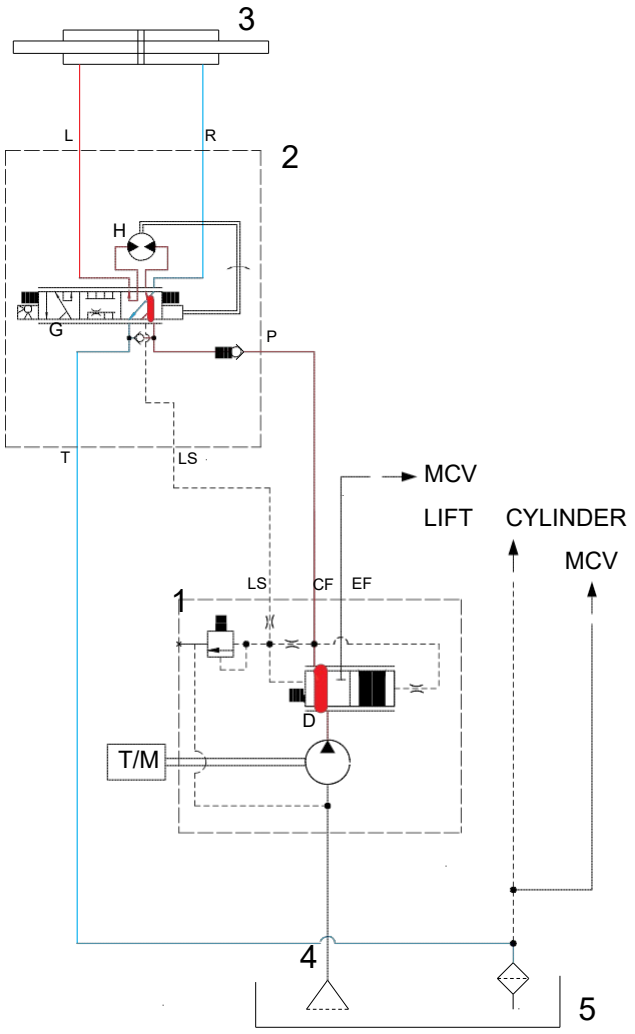
1	Gear pump	4	Steering cylinder
2	Hydraulic tank	5	Return filter
3	Steering unit	6	Suction strainer

1) NEUTRAL



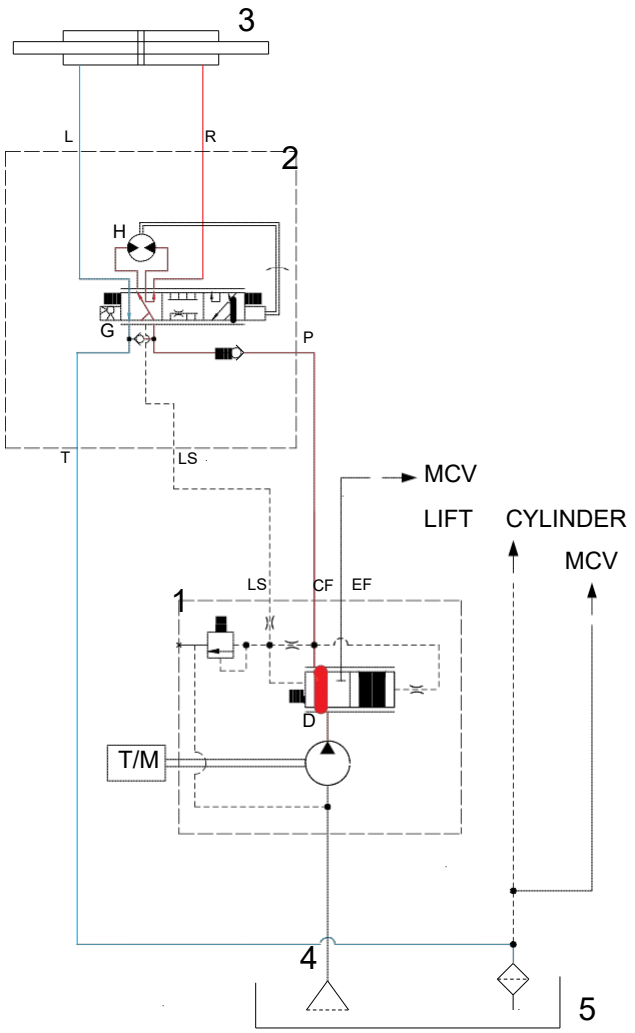
The steering wheel is not being operated so control spool (G) does not move.
The oil from hydraulic gear pump (1) enters priority valve and the inlet pressure oil moves the spool
(D) to the left.
Oil flow into LS port to the hydraulic tank (5).
So, the pump flow is routed to the main control valve.

2) LEFT TURN



When the steering wheel is turned to the left, the spool (G) within the steering unit (2) connected with steering column turns in left hand direction.
At this time, the oil discharged from the pump flows into the spool (G) within the steering unit (2)
through the spool (D) of priority valve and flows to the gerotor (H).
Oil flow from the gerotor (H) flows back into the spool (G) where it is directed out of the left work port (L).
Oil returned from cylinder returns to hydraulic tank (5).
When the above operation is completed, the machine turns to the left.

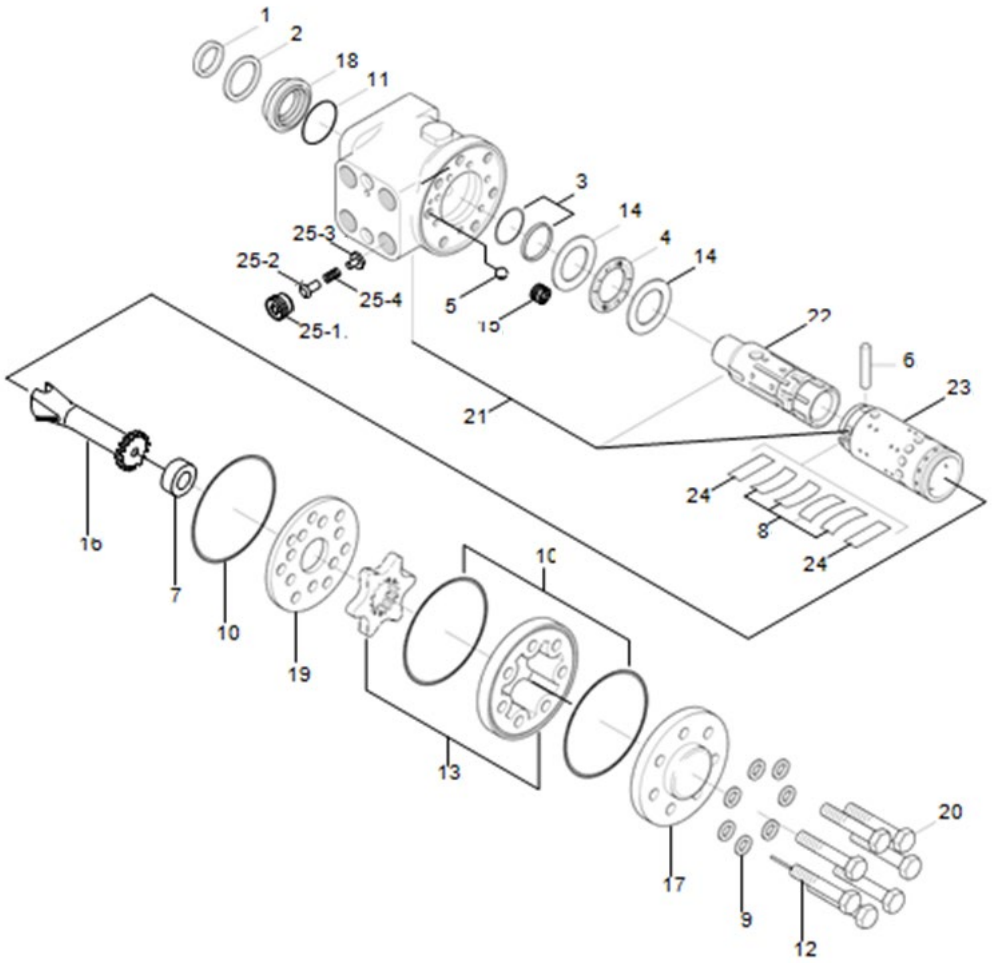
3) RIGHT TURN



When the steering wheel is turned to the right, the spool (G) within the steering unit (2) connected with steering column turns in right hand direction.
At this time, the oil discharged from the pump flows into the spool (G) where it is directed out of the right work port (R).
Oil returned from cylinder returns to hydraulic tank (5).
When the above operation is completed, the machine turns to the right.

3 STEERING UNIT

1) STRUCTURE



1	Dust seal	11	O-ring	21	Housing
2	Retaining ring	12	Rolled screw	22	Spool
3	Cap seal	13	Gear set	23	Sleeve
4	Thrust bearing	14	Bearing race	24	Plate spring
5	Ball	15	Bore screw	25	P-port check valve.
6	Pin	16	Drive	25-1	Plug
7	Spacer	17	End cap	25-2	Poppet
8	Center spring	18	Gland bushing	25-3	Spring seat
9	Washer	19	Plate	25-4	Spring
10	O-ring	20	Cap screw		

2) OPERATION

① The steering unit is composed of the control valve (rotary valve) and the metering device. The control valve controls the flow of oil from the pump in the interior of the unit depending on the condition of the steering wheel. The metering device is a kind of hydraulic motor composed of a stator and a rotor. It meters the required oil volume, feeds the metered oil to the power cylinder and detects cylinder's motion value, that is, cylinder's motion rate.

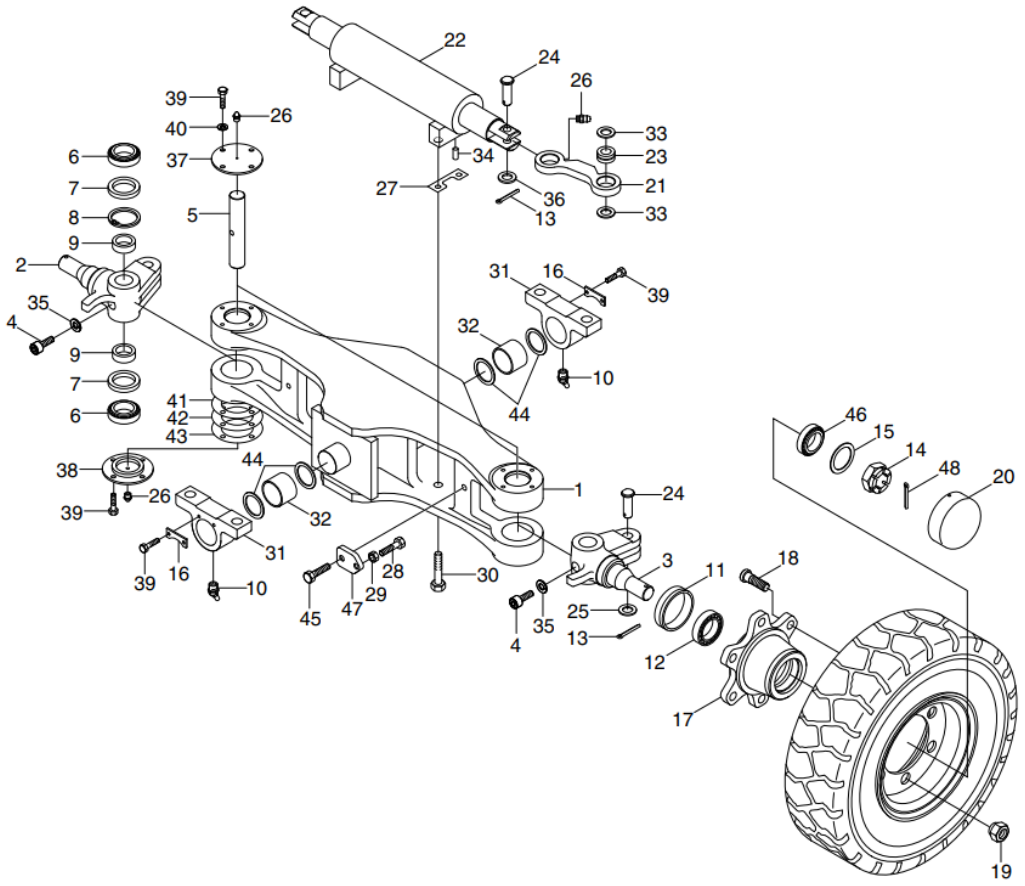
② When the steering wheel is turned, the spool turns, the oil path is switched and the oil is fed into the metering device. As a result, the rotor is caused to run by oil pressure, and the sleeve is caused to run through the drive shaft and cross pin. Therefore, when the spool is turned, the spool turns by the same value in such a manner that it follows the motion of the spool. Steering motion can be accomplished when this operation is performed in a continuous state.

⚠ **If the hoses of the steering system are incorrectly connected, the steering wheel can turn very rapidly when the engine is started. Keep clear of the steering wheel when starting the engine.**

③ The centering spring for the spool and sleeve is provided to cause the valve to return to the neutral position. It is therefore possible to obtain a constant steering feeling, which is transmitted to the hands of the driver. Return to the center position occurs when the steering wheel is released.

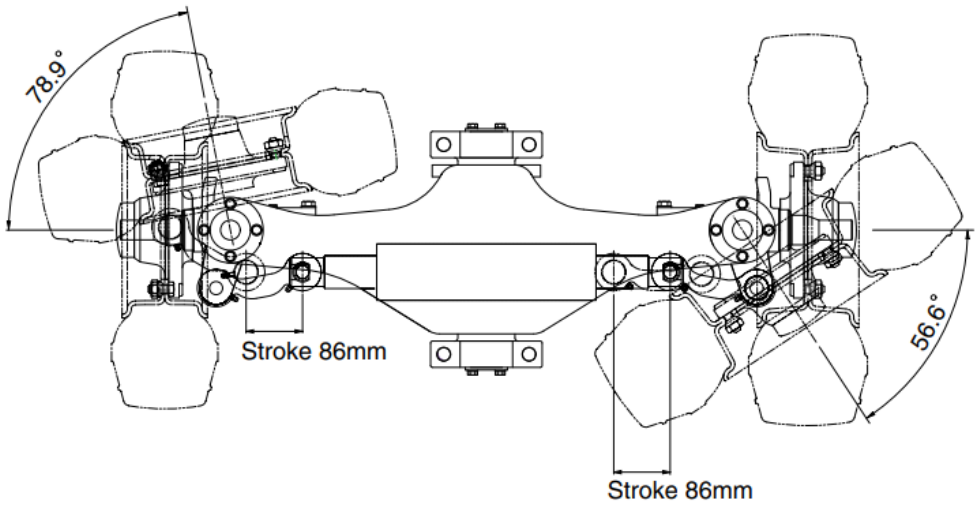
4 STEERING AXLE

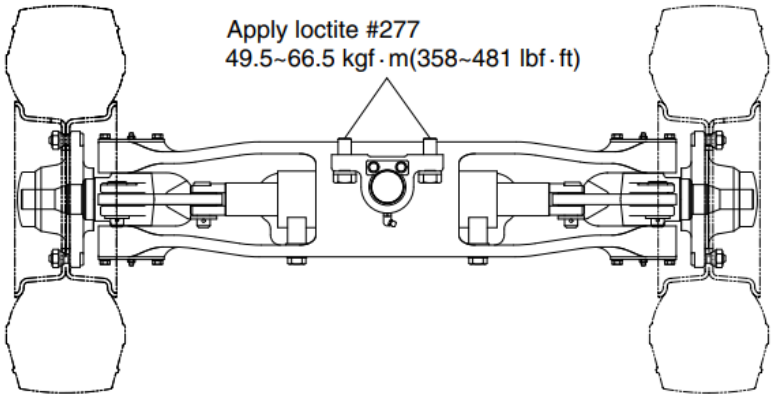
1) STRUCTURE



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

2) TIGHTENING TORQUE AND SPECIFICATION

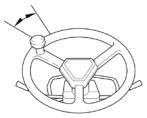




Type	Unit	Center pin support single shaft
Structure of knuckle	-	Elliott type
Toe-in	degree	0
Camber	degree	0
Caster	degree	0
King pin angle	degree	0
Max steering angle of wheels (Inside/Outside)	degree	79 / 56
Tread	mm	970

GROUP2 OPERATIONAL CHECKS AND TROUBLESHOOTING

1 OPERATIONAL CHECKS

<table>
<tr><th>Check item</th><th>Checking procedure</th></tr>
<tr><td>Steering wheel
30-60mm
(1.2-2.4 in)
  </td><td>• 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 30~60mm at rim of steering wheel. If play is too large, adjust at gear box.
Test steering wheel play with engine at idling.</td></tr>
<tr><td>Knuckle</td><td>• Check knuckle visually or use crack detection method. If the knuckle is bent, the tire wear is uneven, so check tire wear.</td></tr>
<tr><td>Steering axle</td><td>• Put camber gauge in contact with hub and measure camber.
If camber is not within 0±0.5°; rear axle is bent.
• Ask assistant to drive 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±100mm (±4in) of specified value, adjust turning angle stopper bolt.
Min turning radius (Outside)
<table><tr><td>25LE-7U</td><td>2076mm(82in)</td></tr><tr><td>30LE-7U</td><td>2136mm(84in)</td></tr><tr><td>35LE-7U</td><td>2136mm(84in)</td></tr></table></td></tr>
<tr><td>Steering axle
Hydraulic pressure of power steering</td><td>Remove plug from outlet port of flow divider and install oil pressure gauge.
Turn steering wheel fully and check oil pressure.

※ Oil pressure : 90kgf/cm2 (1280psi)</td></tr>
</table>

2 TROUBLESHOOTING

Problem	Cause	Remedy
Steering wheel drags.	•Low oil pressure.	•Check lockout. Repair.
	•Bearing faulty.	•Clean or replace.
	•Spring spool faulty.	•Clean or replace.
	•Reaction plunger faulty.	•Replace.
	•Ball-and-screw assembly faulty.	•Clean or replace.
	•Sector shaft adjusting screw excessively tight.	•Adjust.
	•Gears poorly meshing.	•Check and correct meshing.
	•Flow divider coil spring fatigued.	•Replace.
Steering	•Bearing faulty.	•Clean or replace.

wheel fails to return smoothly.	•Reaction plunger faulty. •Ball-and-screw assy faulty •Gears poorly meshing.	•Replace. •Clean or replace. •Check and correct meshing.

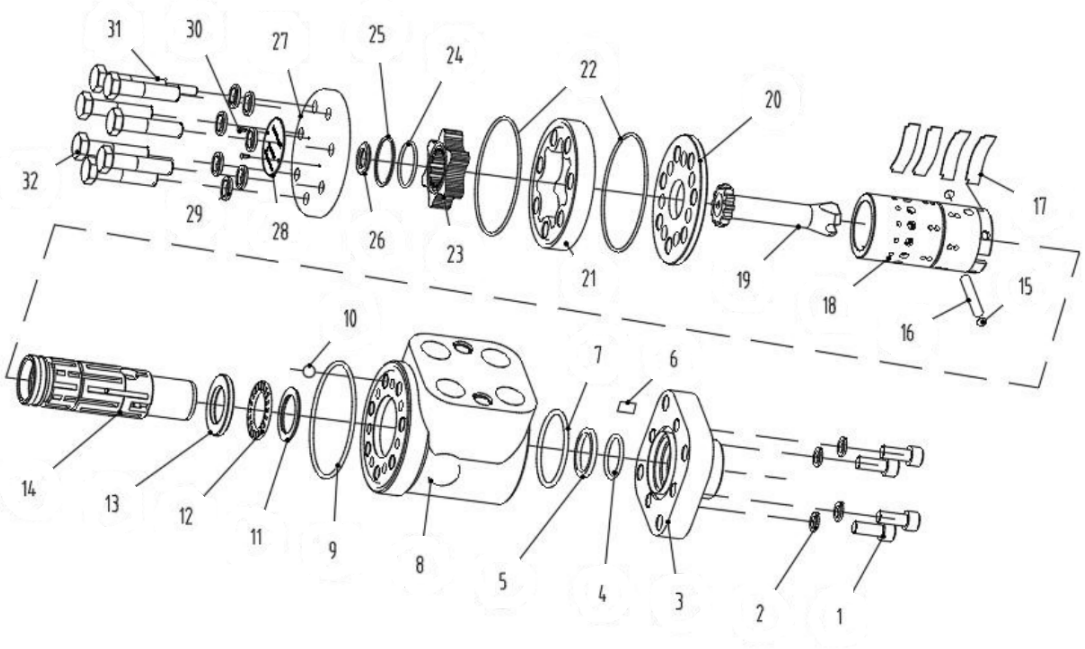
Problem	Cause	Remedy
Steering wheel turns unsteadily.	•Lockout loosening. •Metal spring deteriorated.	•Retighten. •Replace.
Steering system makes abnormal sound or vibration.	•Gear backlash out of adjustment. •Lockout loosening. •Air in oil circuit.	•Adjust. •Retighten. •Bleed air.
Abnormal sound heard when steering wheel is turned fully	Valve •Faulty. (Valve fails to open.) Piping •Pipe (from pump to power steering cylinder) dented or clogged.	 •Adjust valve set pressure and check for specified oil pressure. •Repair or replace.
Piping makes abnormal sounds.	Oil pump •Lack of oil. •Oil inlet pipe sucks air. •Insufficient air bleeding.	 •Add oil. •Repair. •Bleed air completely.
Valve or valve unit makes abnormal sounds.	Oil pump •Oil inlet pipe sucks air. Valve •Faulty. (Unbalance oil pressure) Piping •Pipe (from pump to power steering) dented or clogged. •Insufficient air bleeding.	 •Repair or replace. •Adjust valve set pressure and check specified oil pressure. •Repair or replace. •Bleed air completely.
Insufficient or variable oil flow.	•Flow control valve orifice clogged.	•Clean
Insufficient or variable discharge pressure.	Piping •Pipe (from tank to pipe) dented or clogged.	 •Repair or replace.
Steering cylinder head leakage (Piston rod)	•Packing foreign material. •Piston rod damage. •Rod seal damage and distortion. •Chrome gilding damage.	•Replace •Grind surface with oil stone. •Replace •Grind
Steering cylinder head thread	•O-ring damage.	•Replace

(A little bit leak is no problem)		
Welding leakage	•Cylinder tube damage.	•Tube replace.
Rod	•Tube inside damage. •Piston seal damage and distortion	•Grind surface with oil store. •Replace
Piston rod bushing inner diameter excessive gap	•Bushing wear.	•Replace

GROUP3 DISASSEMBLY AND ASSEMBLY

1 STEERING UNIT

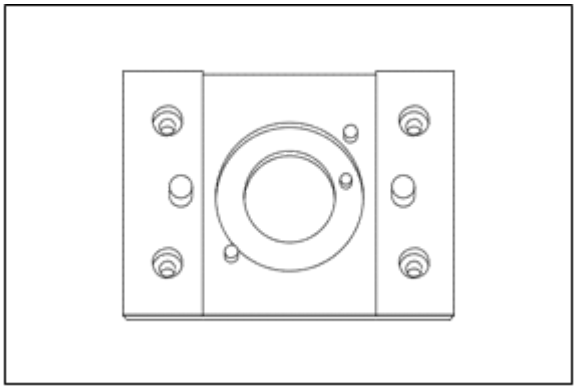
1) STRUCTURE



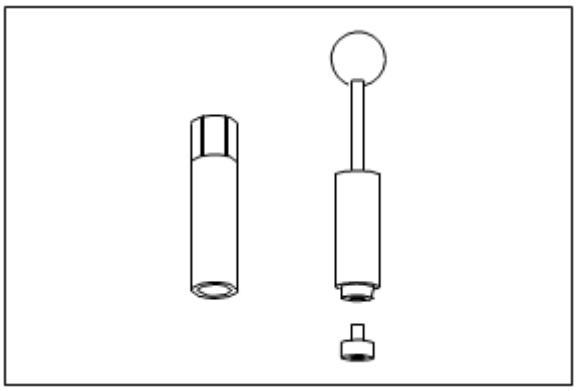
1	Bolt-socket	12	Needle Roller Thrust Bearing	23	Rotor
2	Washer-Spring	13	Washer	24	O-Ring 29×2
3	Cap-Front	14	Spool	25	Ring
4	O-Ring	15	Washer	26	Limited Post
5	X-Type Seal Ring	16	Pin	27	Cap-Rear
6	Screw-Bore	17	Spring-Plate	28	Nameplate
7	O-Ring	18	Sleeve	29	Washer
8	Housing	19	Drive	30	Rivet
9	O-Ring 82×1.9	20	Plate	31	Screw-Rolled
10	Ball	21	Stator	32	Bolt-Hex
11	Baffle Ring	22	O-Ring 82×1.9		

2) TOOLS

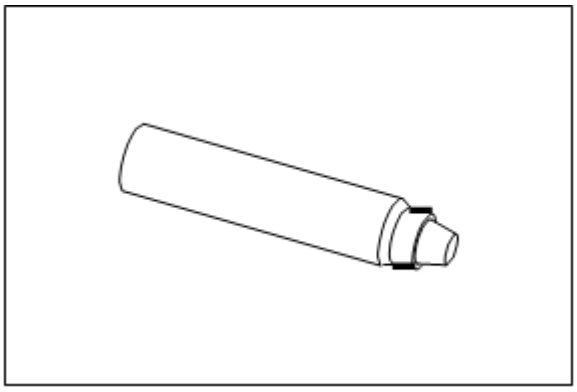
① Holding tool



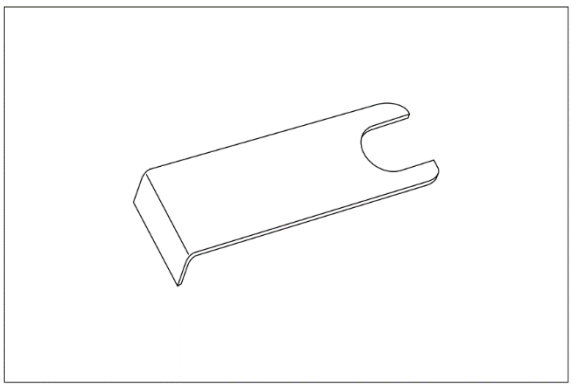
② Assembly tool for O-ring and kin-ring.



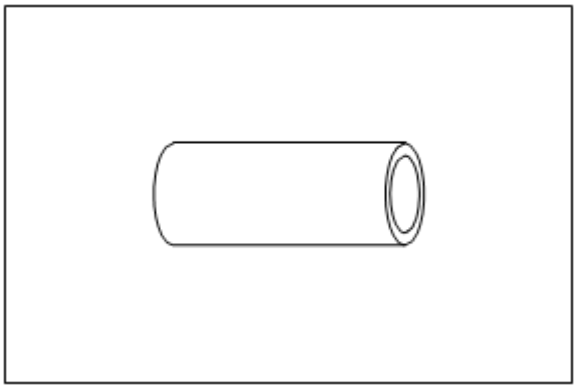
③ Assembly tool for lip seal.



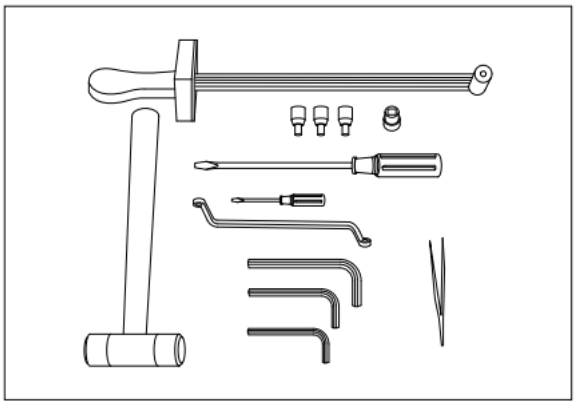
④ Assembly tool for cardan shaft.



⑤ Assembly tool for dust seal.



⑥ Torque wrench 0~7.1kgf•m (0~54.4lbf•ft) 13mm socket spanner6, 8mm and 12 mm hexagon sockets 12mm screwdriver 2mm screwdriver 13mm ring spanner 6, 8 and 12mm hexagon socket spanners Plastic hammer Tweezers



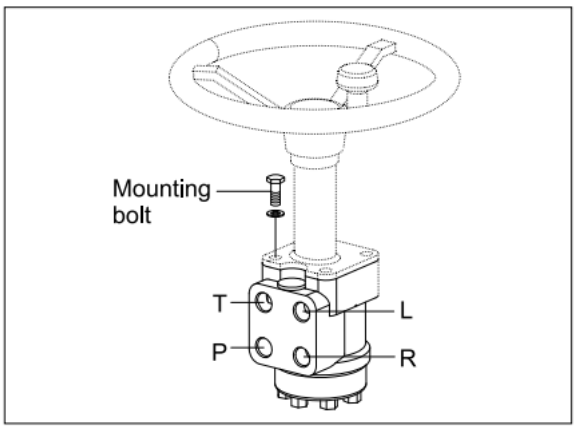
3) TIGHTENING TORQUE

L : Left port

R : Right port

T : Tank

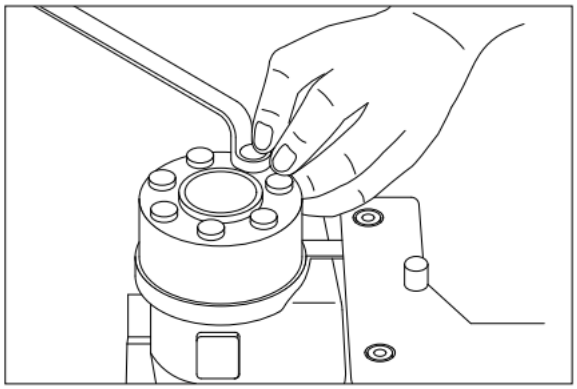
P : Pump



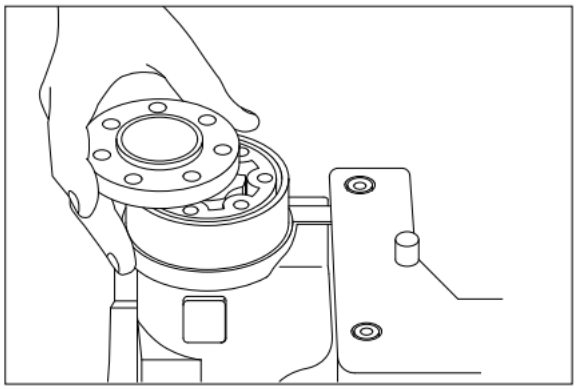
Port	Size	Torque [kgf•m(lbf•ft)]
L	3/4 UNF - 16	13 (94)
R	3/4 UNF - 16	13 (94)
T	3/4 UNF - 16	13 (94)
P	3/4 UNF - 16	13 (94)
Mounting bolt	M10×1.5	4.0 ±0.5 (29±3.6)

4) DISASSEMBLY

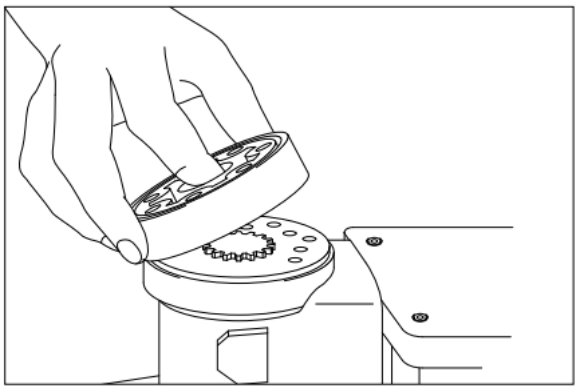
① Disassemble steering column from steering unit and place the steering unit in the holding tool. Screw out the screws in the end cover (6-off plus one special screw).



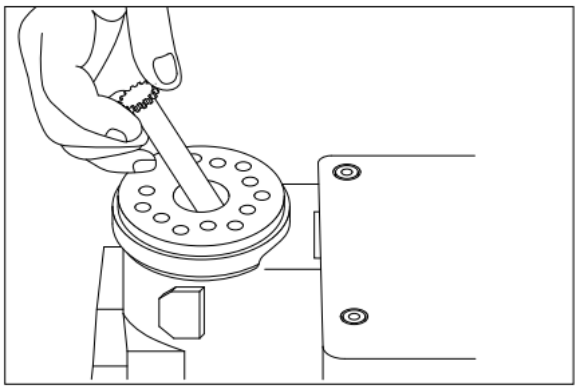
② Remove the end cover, sideways.



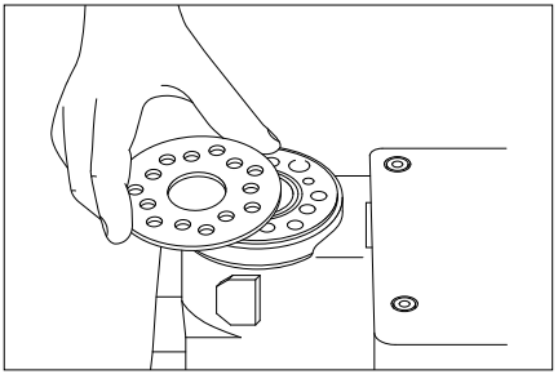
③ Lift the gearwheel set (With spacer if fitted) off the unit. Takeout the two O-rings.



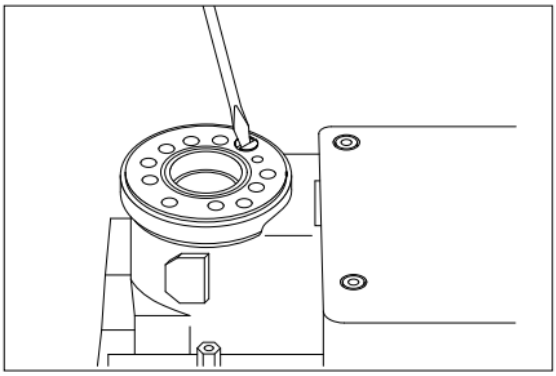
④ Remove cardan shaft.



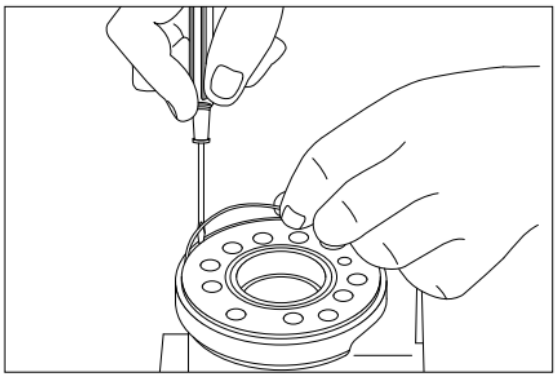
⑤ Remove distributor plate



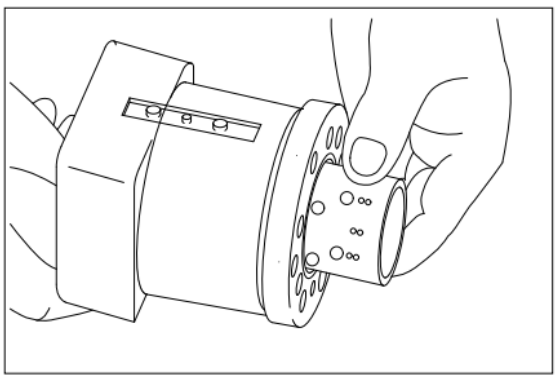
⑥ Screw out the threaded bush over the check valve.



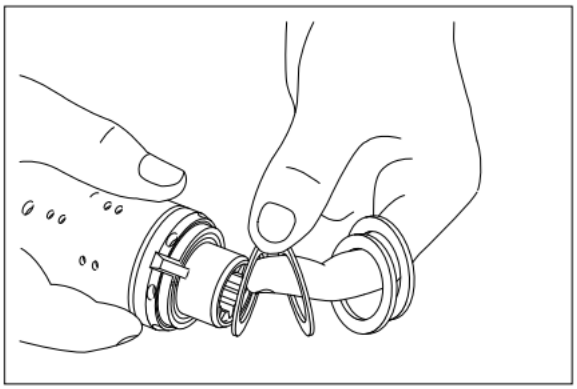
⑦ Remove O-ring.



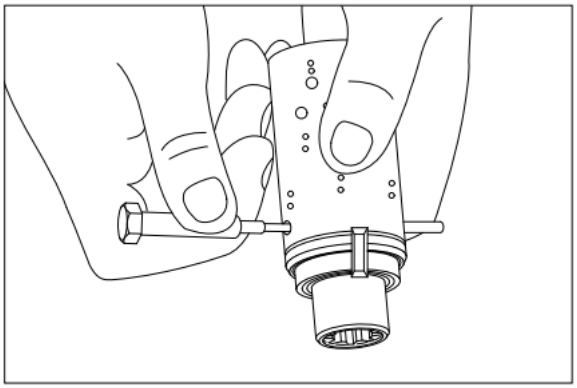
⑧ Take care to keep the cross pin in the sleeve and spool horizontal. The pin can be seen through the open end of the spool.
Press the spool inwards and the sleeve, ring, bearing races and thrust bearing will be pushed out of the housing together.



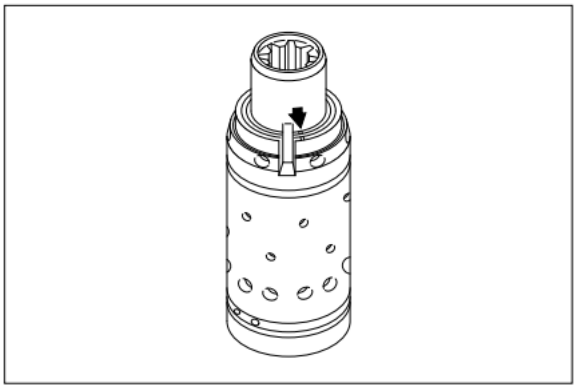
⑨ Take ring, bearing races and thrust bearing from sleeve and spool. The outer (Thin) bearing race can sometimes "stick" in the housing, therefore check that it has come out.



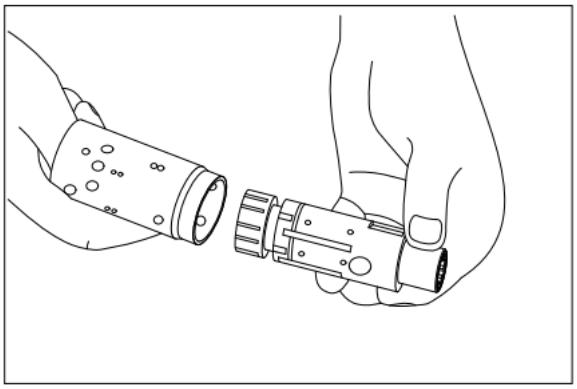
⑩ Press out the cross pin.
Use the special screw from the end cover.



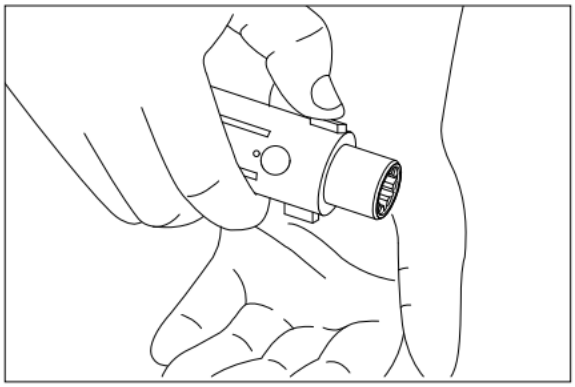
※ A small mark has been made with a pumice stone on both spool and sleeve close to one of the slots for the neutral position springs (See drawing). If the mark is not visible, remember to leave a mark of your own on sleeve and spool before the neutral position springs are disassembled.



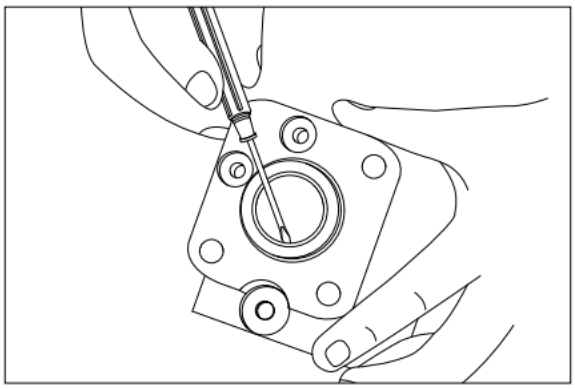
⑪ Carefully press the spool out of the sleeve.



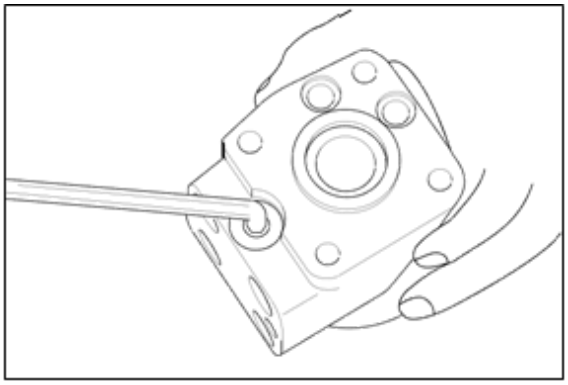
⑫ Press the neutral position springs out of their slots in the spool.



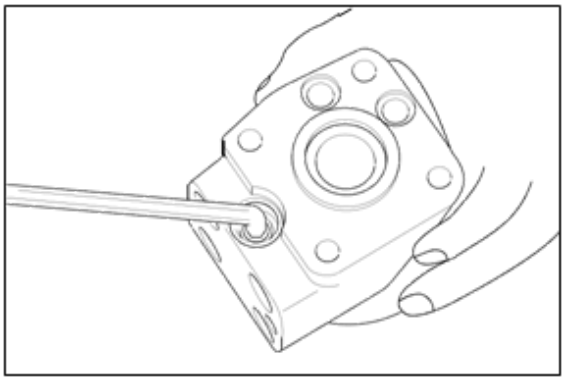
⑬ Remove dust seal and O-ring.



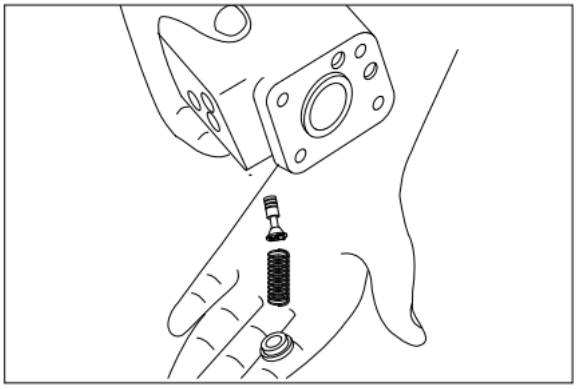
⑭ Disassembling the pressure relief valve Screw out the plug using an 8mm hexagon socket spanner.
Remove seal washers.



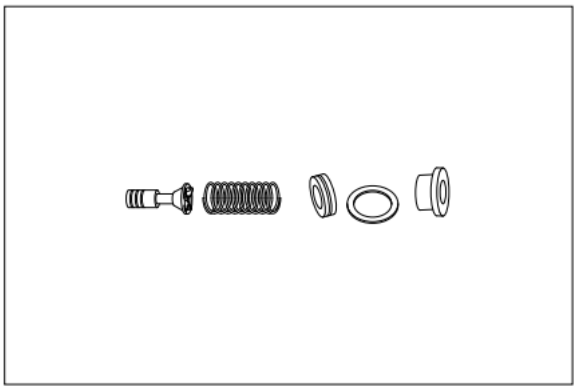
⑮ Unscrew the setting screw using
an 8mm hexagon socket spanner.



⑯ Shake out spring and piston. The valve seat is bonded into the housing and cannot be removed.

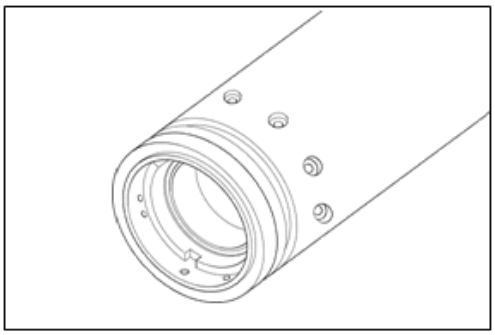


⑰ The pressure relief valve is now disassembled.



5) ASSEMBLY

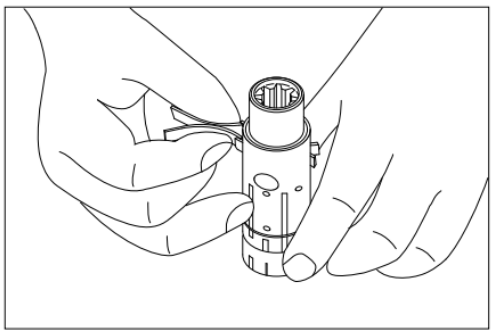
A. Assemble spool and sleeve.



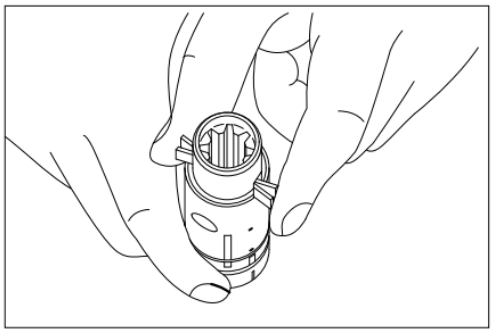
※ When assembling spool and

Sleeve only one of two possible ways of positioning the spring slots is correct.
There are three slots in the spool And three holes in the sleeve in the end of the spool / sleeve opposite to the end with spring slots.
Place the slots and holes opposite each other so that parts of the holes in the sleeve are visible

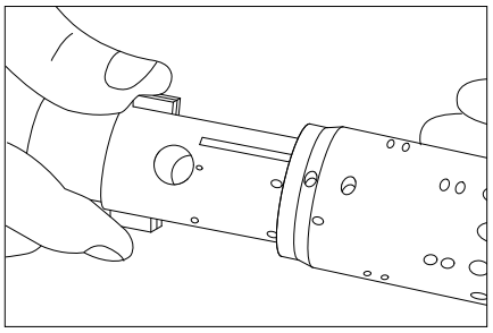
B. Place the two flat neutral position springs in the slot.
Place the curved springs between the flat ones and press them into place (see assembly pattern).



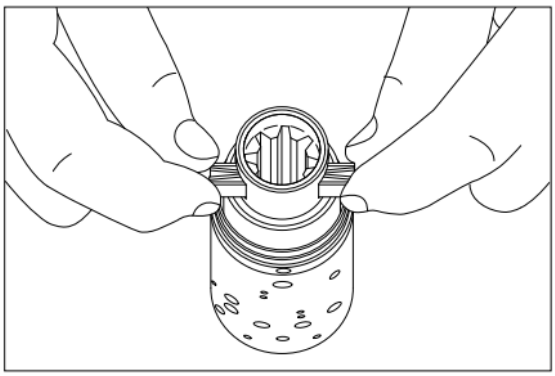
C. Line up the spring set.



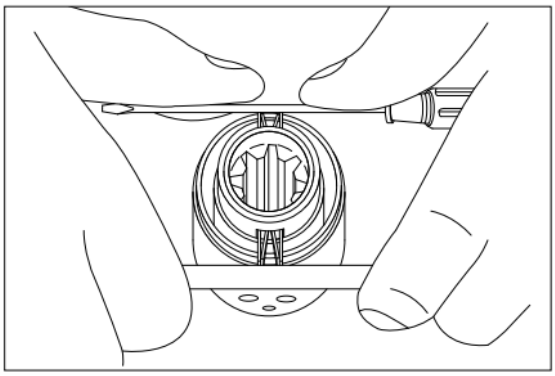
D. Guide the spool into the sleeve.
Make sure that spool and sleeve are placed correctly in relation to each other.



E. Press the springs together and push the neutral position springs into place in the sleeve.

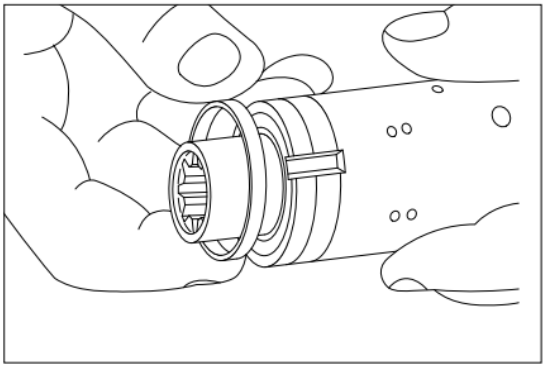


F. Line up the springs and center them.

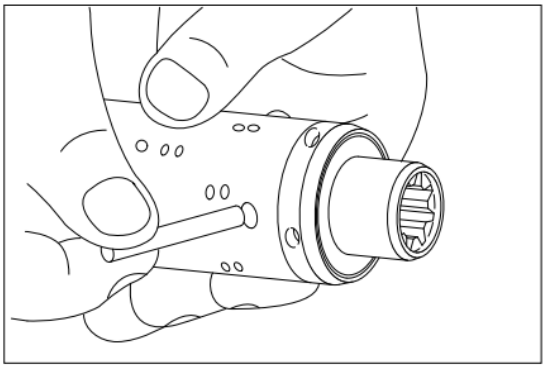


G. Guide the ring down over the sleeve.

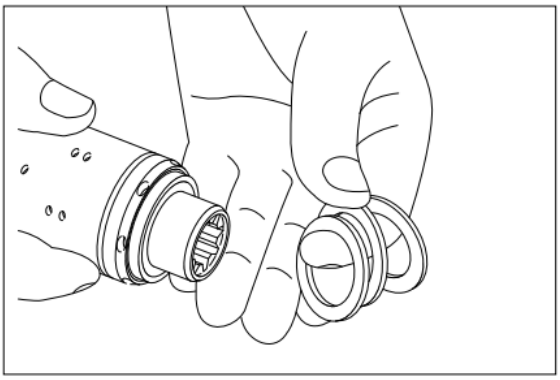
※ The ring should be able to rotate free of the springs.



H. Fit the cross pin into the spool / sleeve.

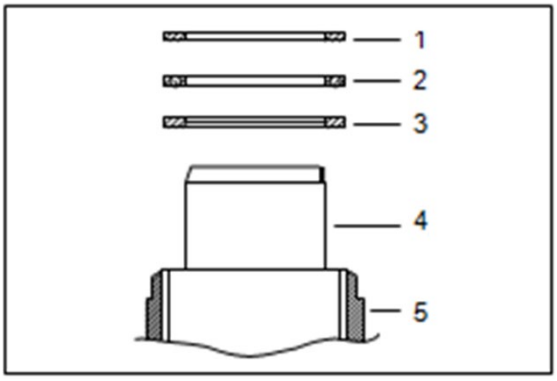


I. Fit bearing races and needle bearing as shown on below drawing.

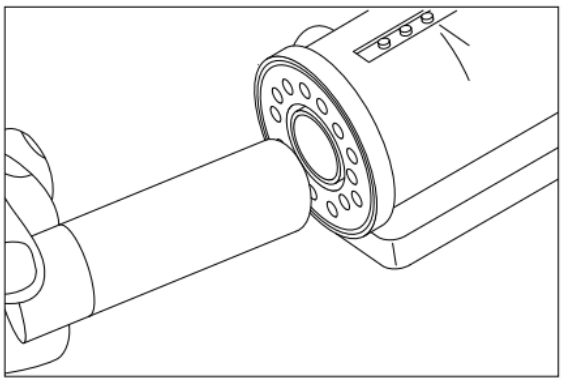


※ Assembly pattern for standard bearings

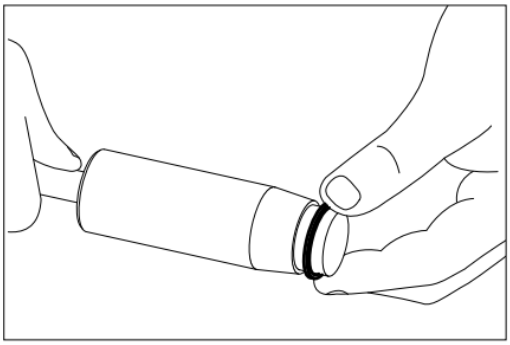
a) Outer bearing race
b) Thrust bearing
c) Inner bearing race
d) Spool
e) Sleeve

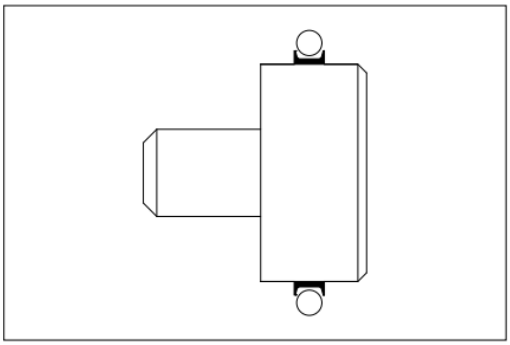


J. Installation instruction for O-ring
Turn the steering until the bore is horizontal. Guide the outer part of the assembly tool into the bore for the spool / sleeve.

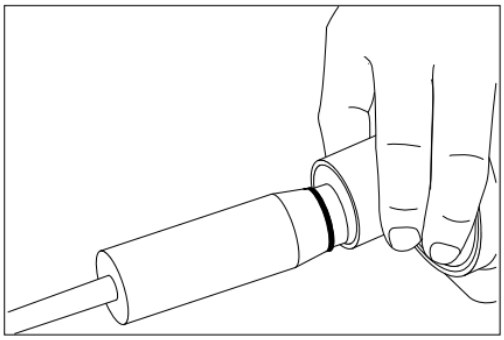


K. Grease O-ring with hydraulic oil and place them on the tool.

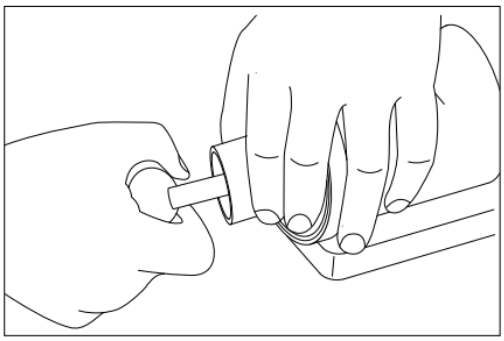




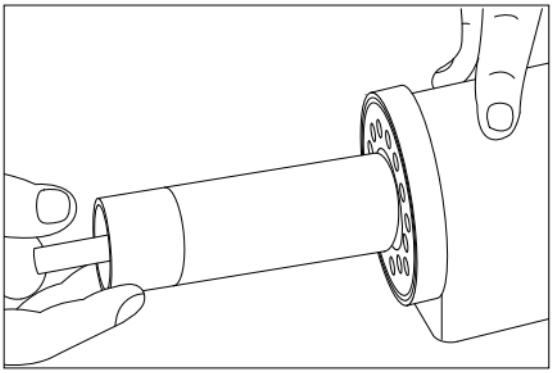
L. Hold the outer part of the assembly tool in the bottom of the steering unit housing and guide the inner part of the tool right to the bottom.



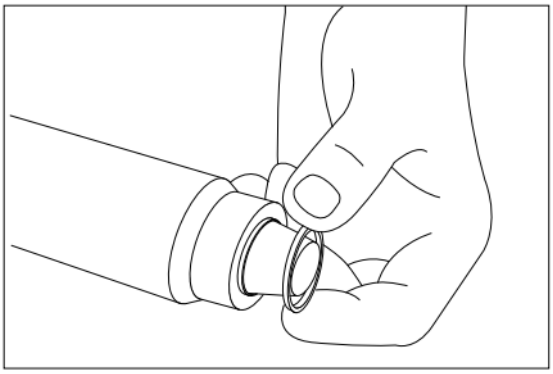
M. Press and turn the O-ring into position in the housing.

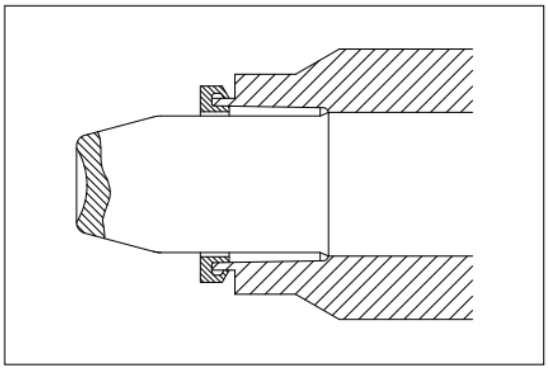


N. Draw the inner and outer parts of the assembly tool out of the steering unit bore, leaving the guide from the inner part in the bore.

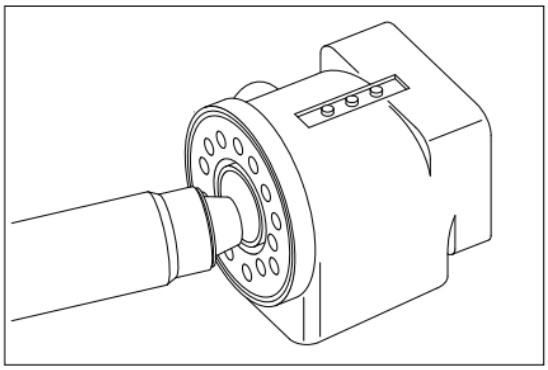


O. Installation instructions for lip seal
Lubricate the lip seal with hydraulic oil and place it on the assembly tool.

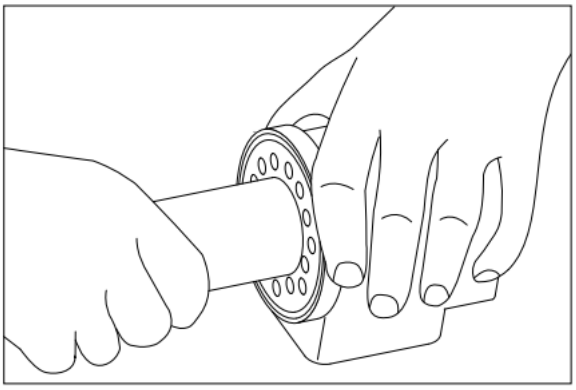




P. Guide the assembly tool right to the bottom.

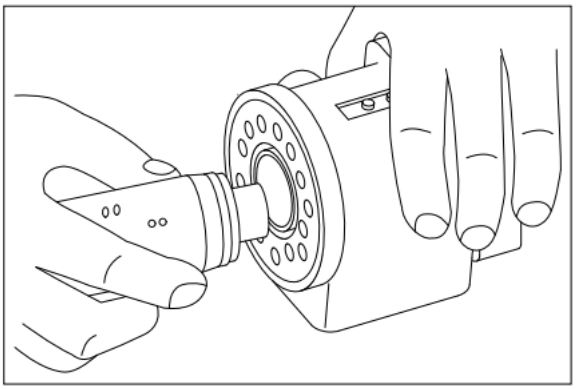


Q. Press and turn the lip seal into place in the housing.

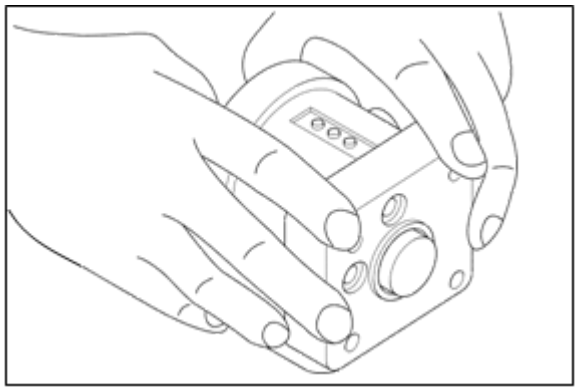


R. With a light turning movement, guide the spool and sleeve into the bore.

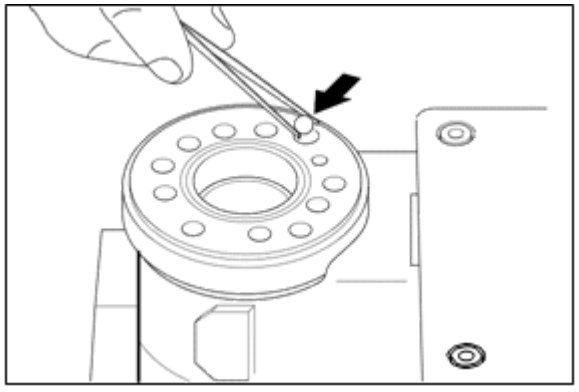
※ Fit the spool set holding the cross pin horizontal.



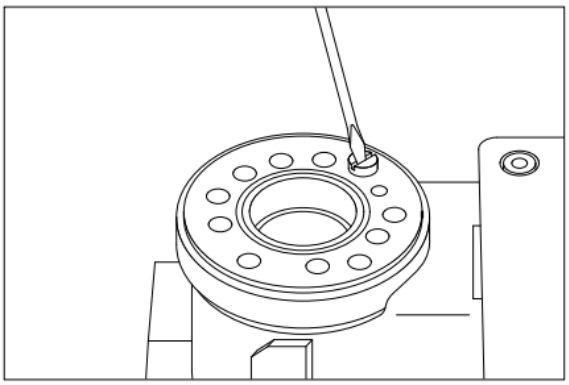
S. The spool set will push out the Assembly tool guide. The O-ring are now in position.



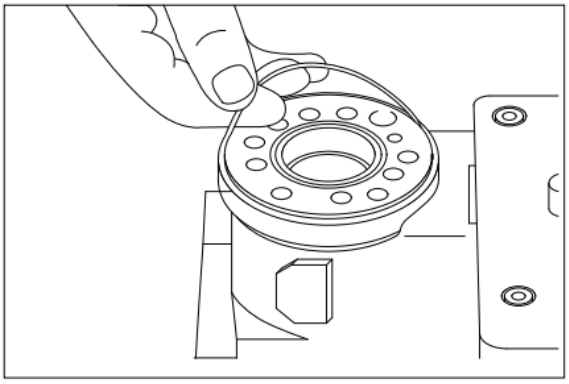
T. Turn the steering unit until the Bore is vertical again.
Put the check valve ball into the hole indicated by the arrow.



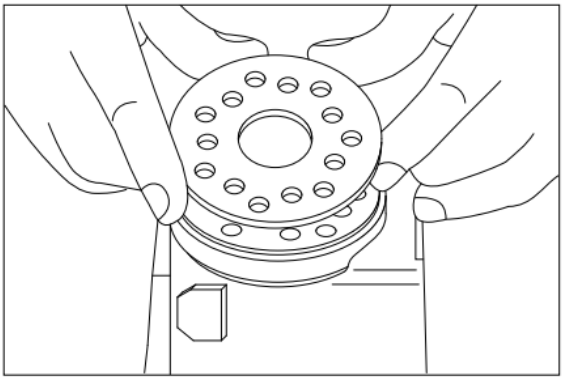
Screw the threaded bush lightly Into the check valve bore.
The top of the bush must lie just below the surface of the housing.



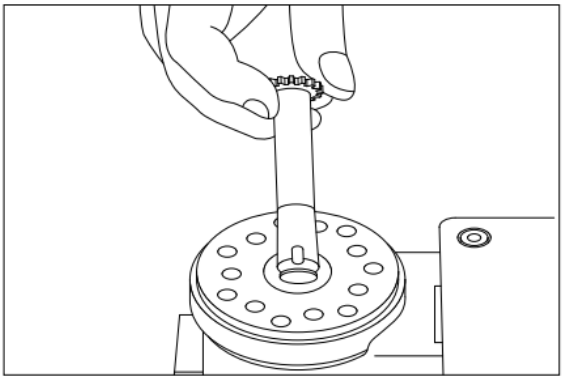
U. Grease the O-ring with mineral oil approx. viscosity 500cst at 20℃.



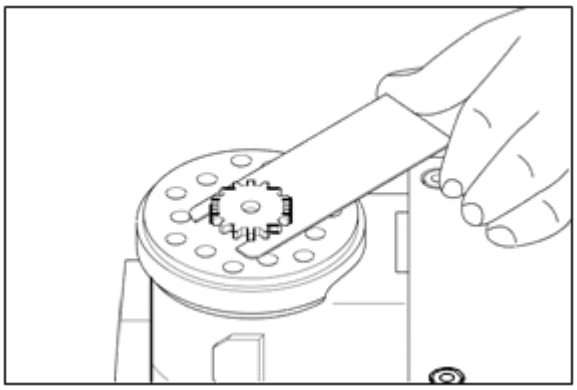
V. Place the distributor plate so that the channel holes match the holes in the housing.



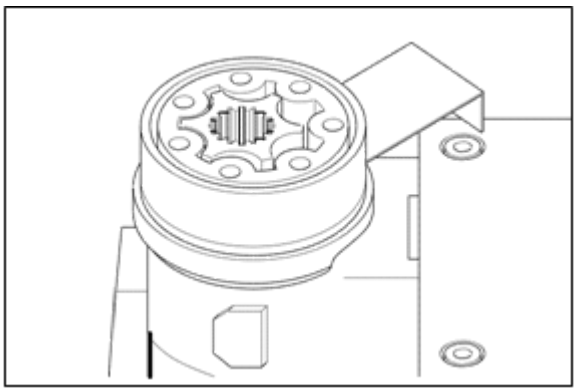
W. Guide the cardan shaft down into the bore so that the slot is parallel with the connection flange.



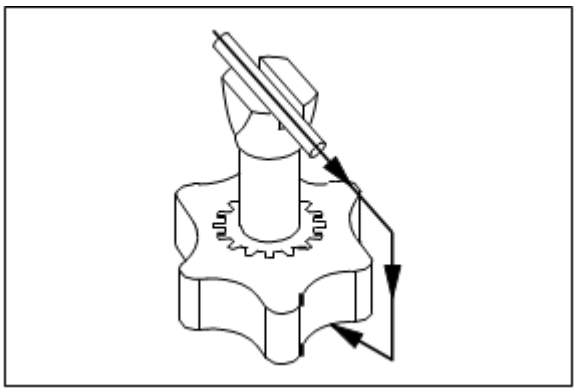
Place the cardan shaft as shown so that it is held in position by the mounting fork.



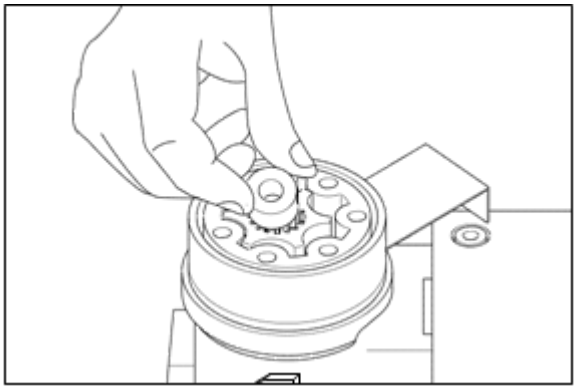
X. Grease the two O-rings with mineral oil approx. viscosity 500cst at 20°C and place them in the two grooves in the gear rim.
Fit the gearwheel and rim on the cardan shaft.



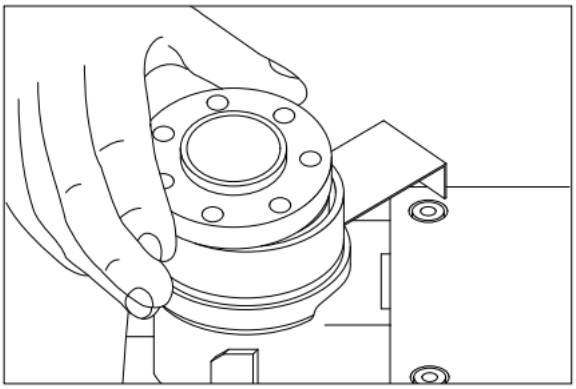
Y. Important
Fit the gearwheel (Rotor) and cardan shaft so that a tooth base in the rotor is positioned in relation to the shaft slot as shown.
Turn the gear rim so that the seven through holes match the holes in the housing.



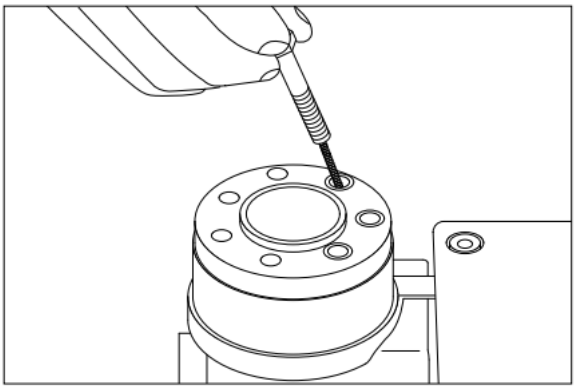
Z. Fit the spacer, if any.



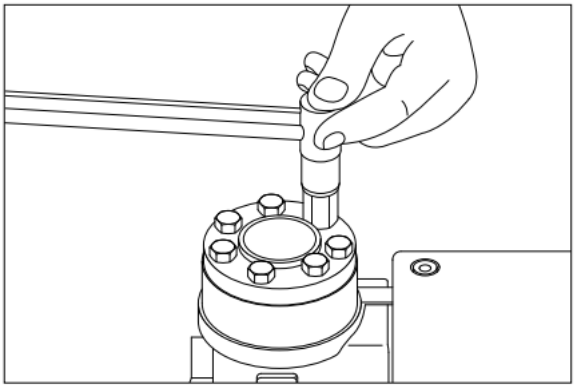
AA. Place the end cover in position.



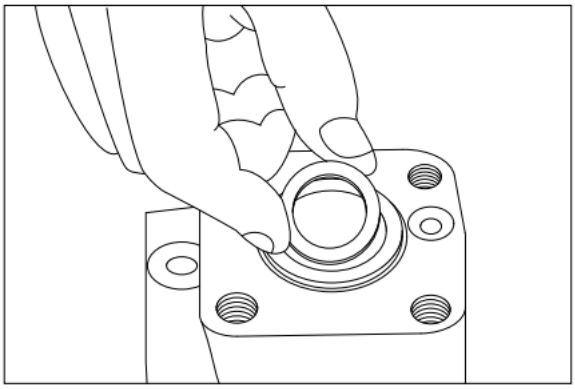
BB. Fit the special screw with washer and place it in the hole shown.



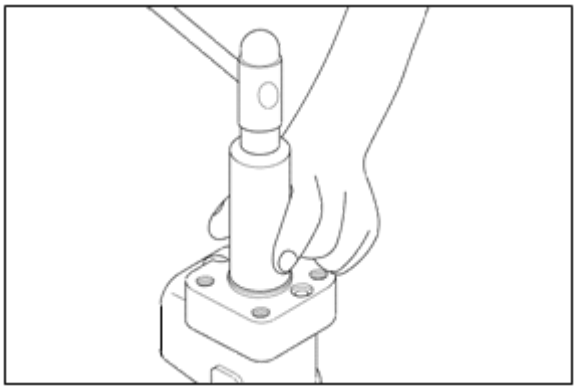
CC. Fit the six screws with washers and insert them.
Cross-tighten all the screws and the rolled pin.
•Tightening torque:
3.0 ± 0.6kgf•m (21.7 ± 4.3lbf•ft)



DD. Place the dust seal ring in the housing.

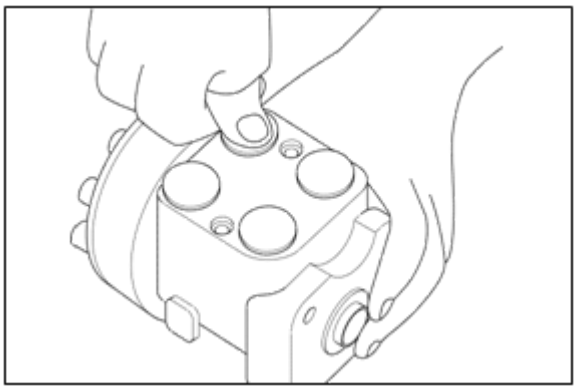


GG.Fit the dust seal ring in the housing



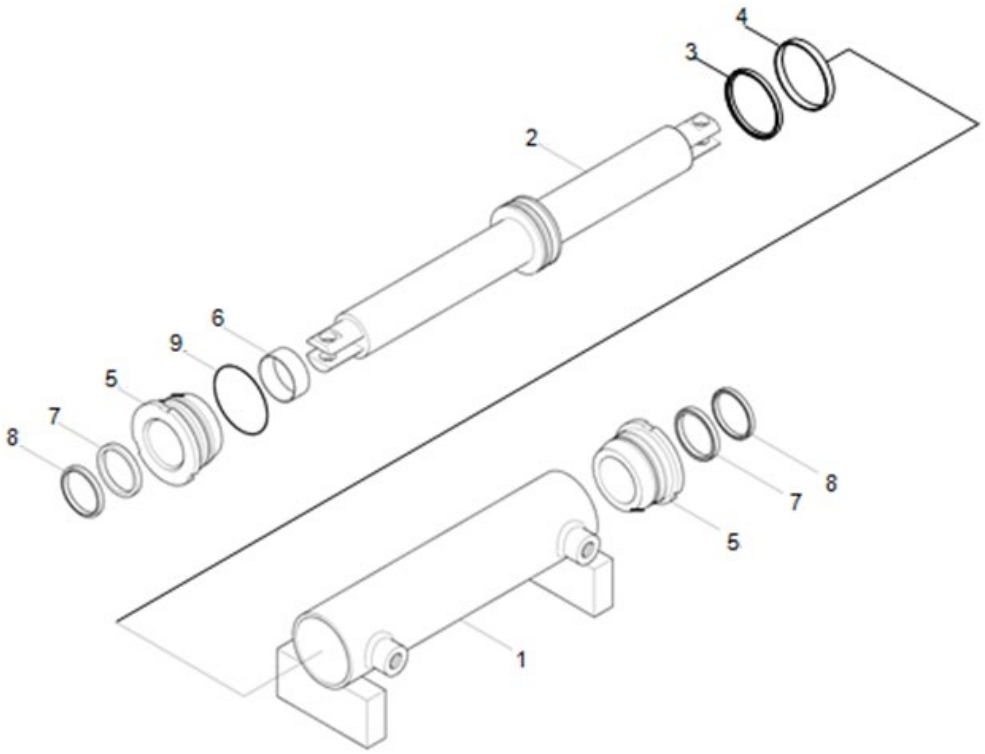
HH.Press the plastic plugs into the connection ports.

※ Do not use a hammer!



2 STEERING CYLINDER

1) STRUCTURE



1	Tube assembly	6	Bushing
2	Rod assembly	7	U-packing
3	Piston seal	8	Dust wiper
4	Wear ring	9	O-ring
5	Gland		

2) DISASSEMBLY

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

① Put wooden blocks against the cylinder tube, then hold in a vice.
② Remove the gland by hook a wrench in the notch of cylinder head and turn counter-clockwise. (3) Remove the cylinder rod and piston from the tube.
③ Check wear condition of the sealing parts. If there are some damages, replace with new parts.

3) CHECK AND INSPECTION

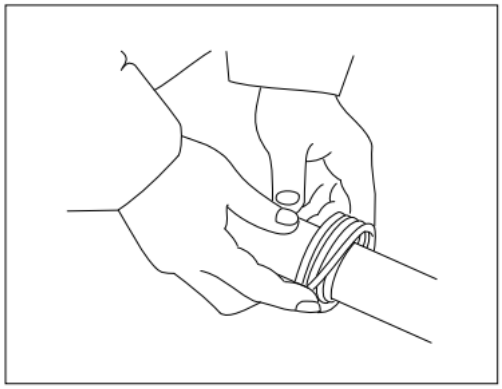
mm(in)

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

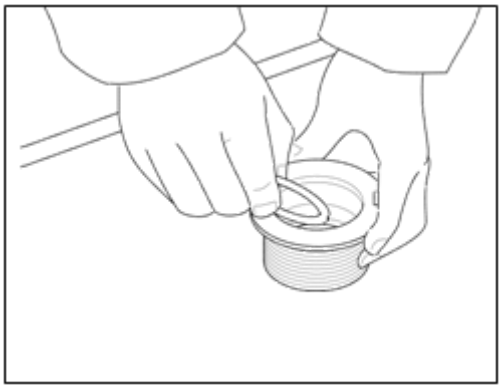
4) ASSEMBLY

A. Install a new piston seal the groove on the piston.

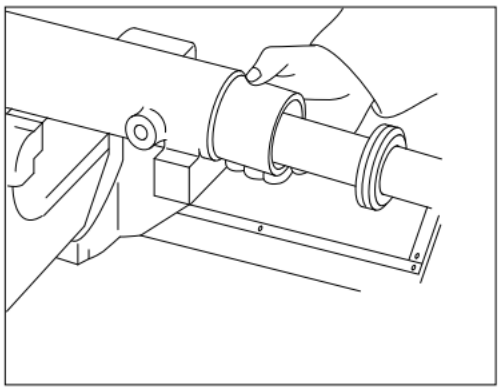
※ Be careful not to scratch the seal too much during installation or it will not seat properly.



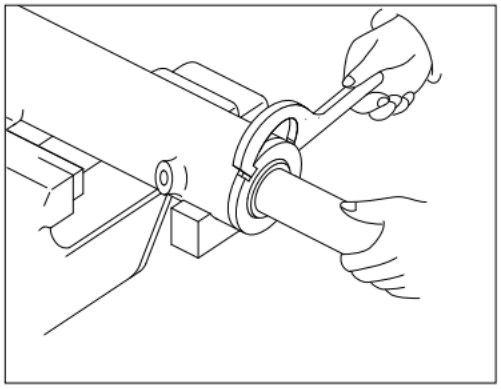
B. Install the rod seal to the position in the gland applying a slight coat with grease prior to install.



C. Install the dust wiper to the gland using a special installing tool. Coat the dust wiper with grease slightly before installing.
D. Set a special tool the cylinder, gland assembly into the cylinder tube.

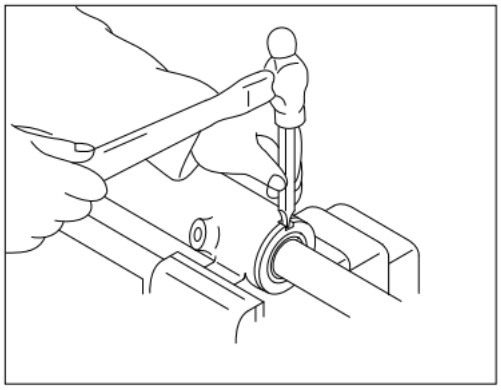


E. Using a hook spanner, install the gland assembly, and tighten it with torque 45±4.5kgf•m (325±32.5lbf•ft).



F. After the gland assembly was Installed to the cylinder tube, calk at the tube end into the groove on the gland to prevent screw loosening.

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



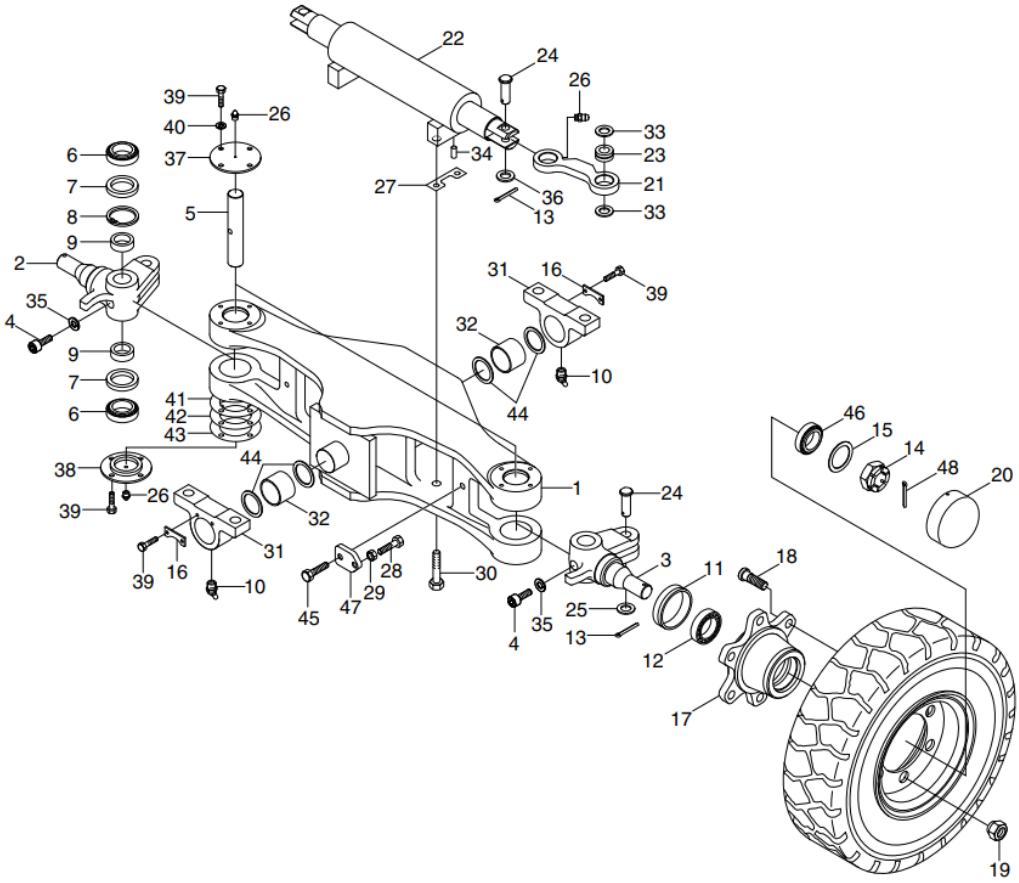
G. Move the piston rod back and forth several times for the full distance of its stroke. This helps to seat the ring and seals before applying full hydraulic pressure to the cylinder.
H. Install cylinder into steering axle.
I. While idling the engine with the rear wheels off the ground, operate the steering 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.

J. Stop the engine, lower the floating rear wheels, and check pump joints for oil leaks and looseness and retighten, them as required.

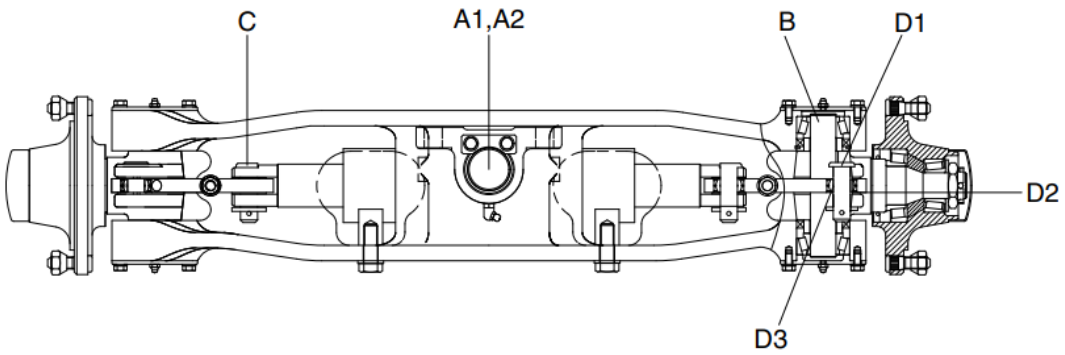
3 STEERING AXLE

1) STRUCTURE



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

2) CHECK AND INSPECTION



unit: mm(in)

No.	Check item			Criteria		Remarks
				Standard size	Repair limit	
A	Shaft	A1	OD of shaft	55(2.2)	54.5(2.1)	Replace
		A2	ID of bushing	55(2.2)	55.5(2.2)	
B	OD of king pin			35(1.4)	34.5(1.4)	
C	OD of steering cylinder pin			20(0.8)	19.5(0.8)	
D	Knuckle	D1	OD of pin	20(0.8)	19.5(0.8)	
		D2	Vertical play	-	-	Adjust with shims
		D3	ID of bushing	20(0.8)	20.5(0.8)	Replace

•OD : Outer diameter
•ID : Inner diameter

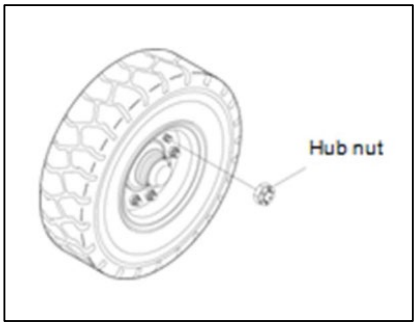
3) DISASSEMBLY

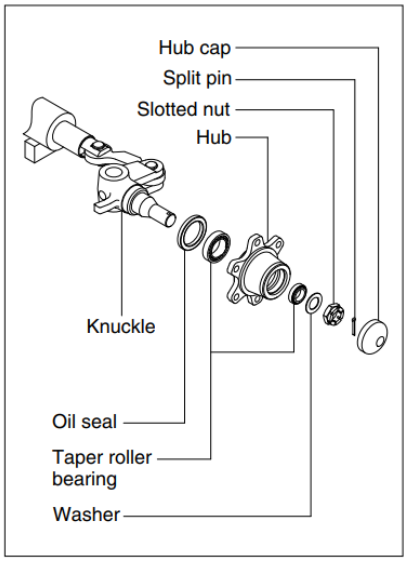
※Servicing work on the knuckle part can be carried out without removing the axle assy from chassis. The work can be done by jacking up the counter weight part of the truck.

A. Loosen the hub nut and take off the steering wheel tire.
B. Remove Hub cap.
C. Pull out split pin and remove slotted nut.
D. Using the puller, take off the hub together with the roller bearing.

※Be very careful because just before the hub comes off, tapered roller bearing will fall out.

E. After hub is removed, take off the inner race of roller bearing.





F. Pull out oil seal.

※Don't use same oil seal twice.

G. 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.

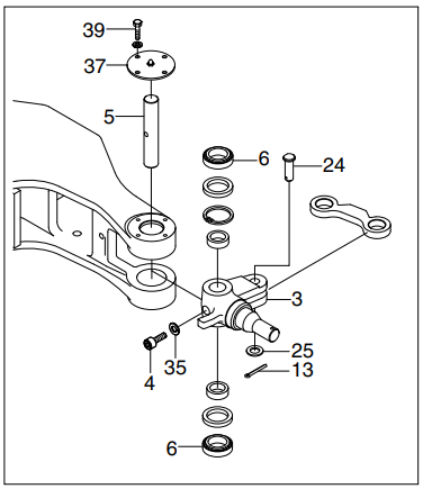
H. Loosen special bolt (4) and spring washer (35).

I. Remove hexagon bolt (39) and upper cover (37).

J. Push out the king pin (5) without damaging the knuckle arm (3).

K. If defect is observed in bearing (6), pull it out by using extractor.

L. Remove spilt pin (13), plain washer (25) and link pin (24).



4) ASSEMBLY

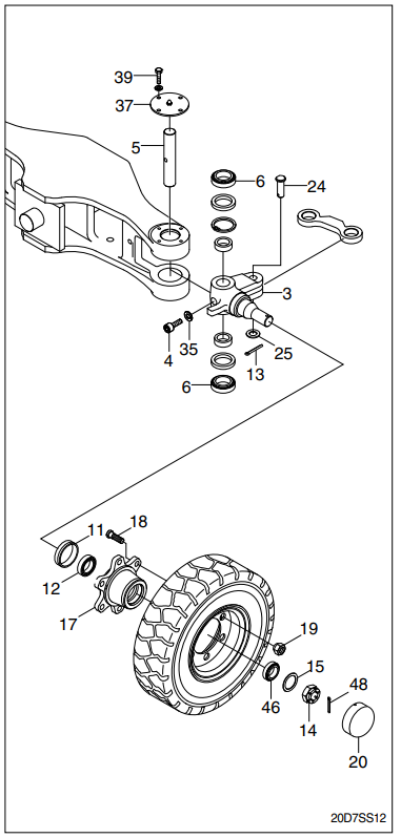
※ In reassembling, have all parts washed, grease applied to lubricating parts, and all expendable items such as oil seal and spring washers replaced by new ones.
Perform the disassembly in reverse order.

A. Tighten the special bolt (4) and washer (35) of king pin (5).

B. There is a notch in the middle of the king pin (5), make sure that this notch is on the special bolt side.

C. Do not hammer to drive in bearing (6) because it will break.
Always use drive-in tool.
Be sure that the fixed ring of the bearing is placed in position facing the knuckle (3).

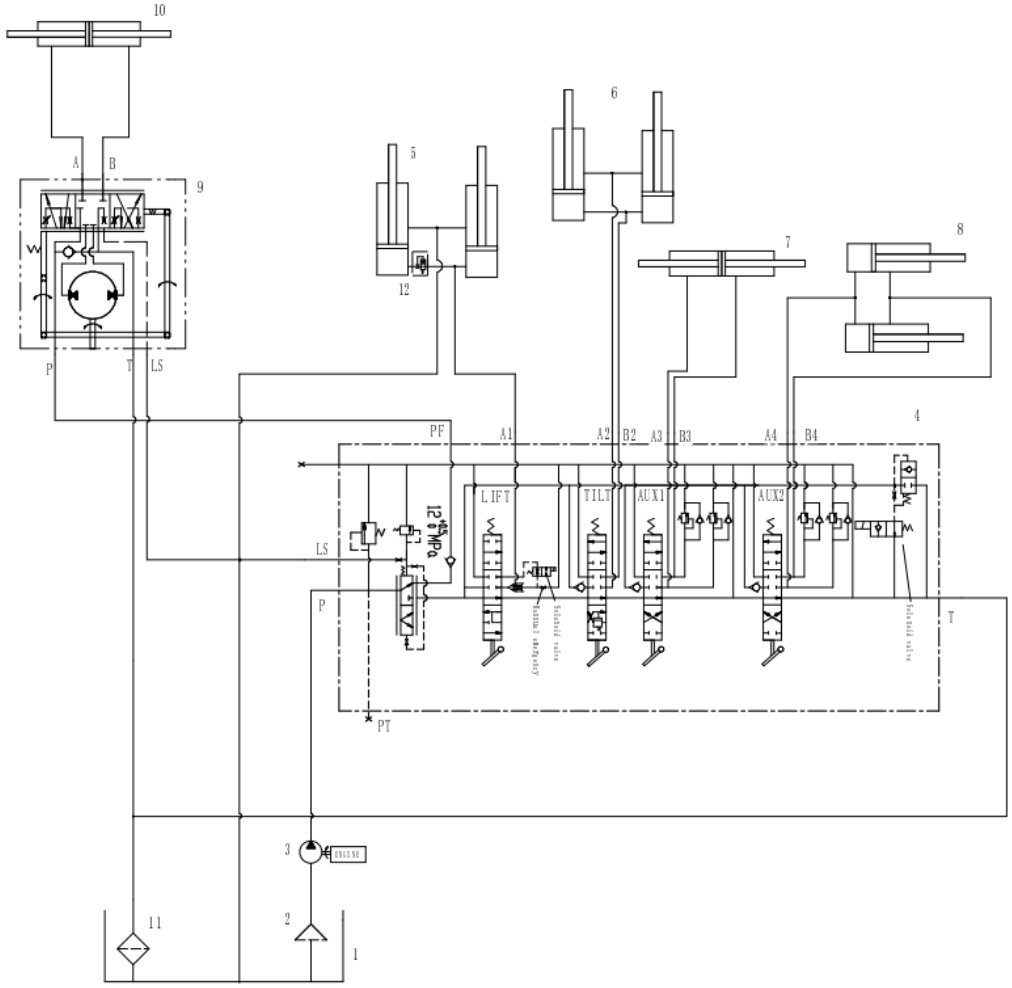
D. Hub
- Mount oil seal (11) and inner race of tapered roller bearing (12) on the knuckle. The bearing should be well greased before assembling.
- Install the outer race of the bearing (46) in the wheel center and assemble to the knuckle.
- Tighten nut (14) and lock with split pin (48). In locking with split pin, locate the hole for the split pin by turning the nut back 1/6 of a turn. Adjust the preload of bearing.
- Mount the hub cap (20). Bearing should be well greased before assembling.



SECTION6 HYDRAULIC SYSTEM

GROUP1 STRUCTURE AND FUNCTION

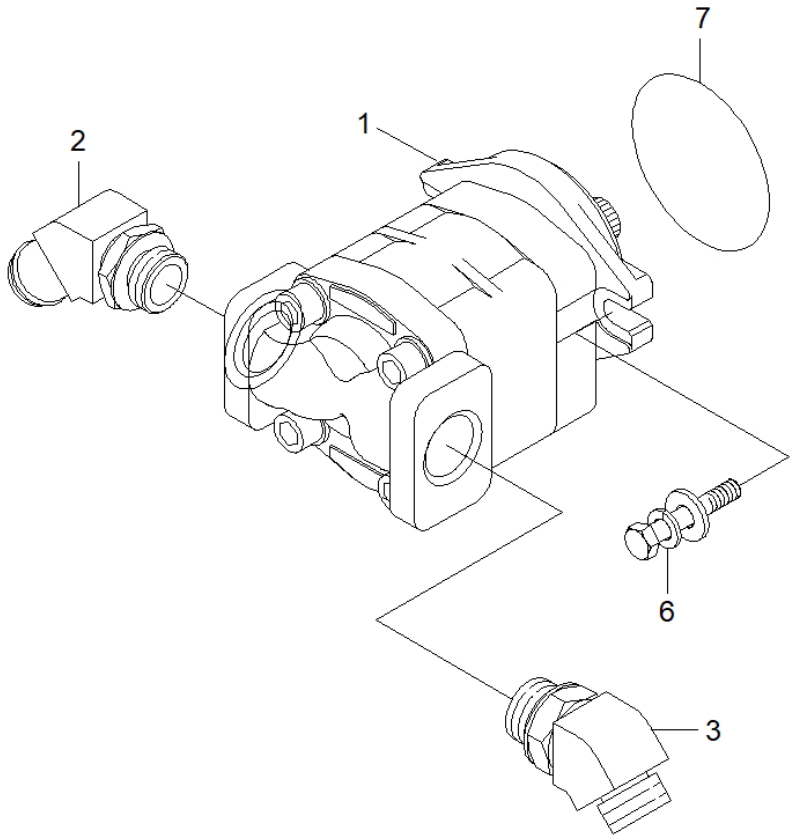
1 HYDRAULIC CIRCUIT



1	Hydraulic tank	7	Side shift cylinder
2	Suction strainer	8	Fork positioner cylinder
3	Hydraulic gear pump	9	Steering unit
4	Main control valve	10	Steering cylinder
5	Lift cylinder	11	Return filter
6	Tilt cylinder	12	Down safety valve

2 HYDRAULIC GEAR PUMP

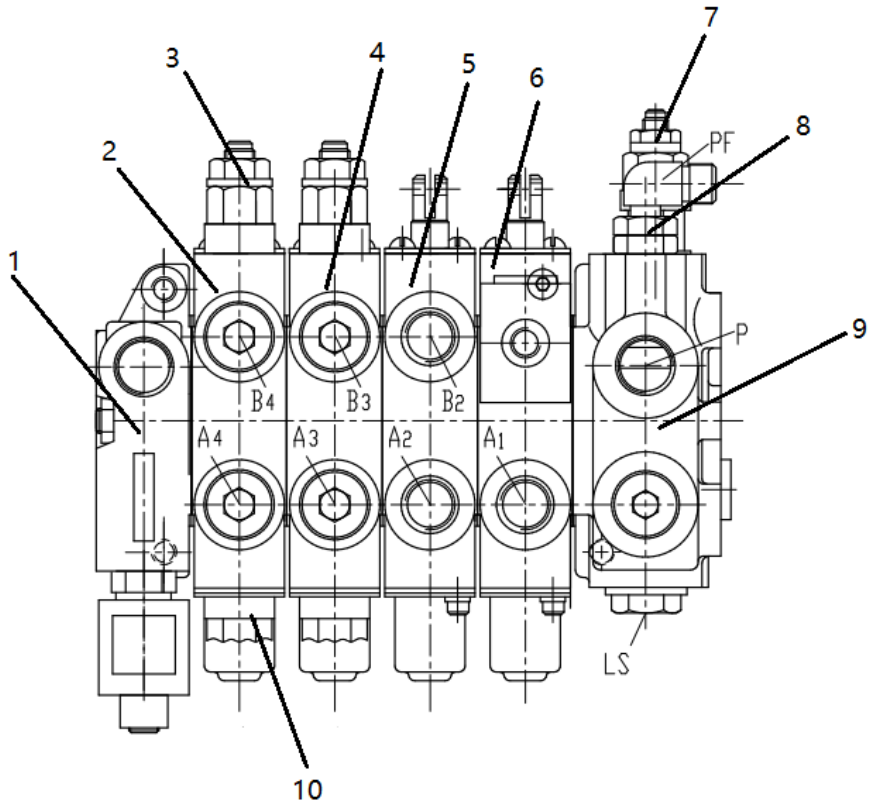
1) STRUCTURE



1	GEAR PUMP ASSY	3	Elbow-45 deg.	5	Elbow-45 deg. ORFS
2	BOLT-W/WASHER HEX	4	O-RING		

MAIN CONTROL VALVE

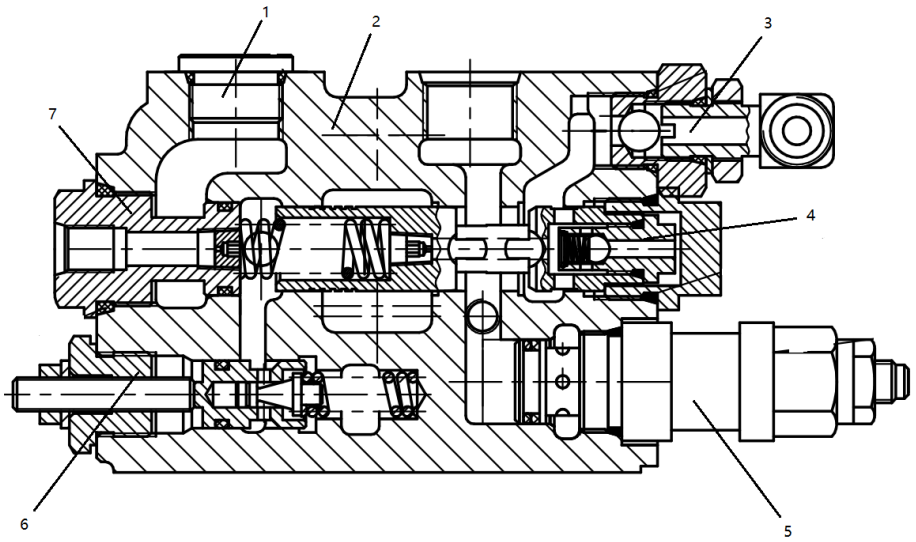
1) STRUCTURE (4- Spool)



1	T cover	6	Lift block assy
2	Aux2 block assy	7	Main Relief valve
3	Aux Relief valve	8	PF port fitting
4	Aux1 block assy	9	inlet block assy
5	Tilt block assy	10	Aux Relief valve

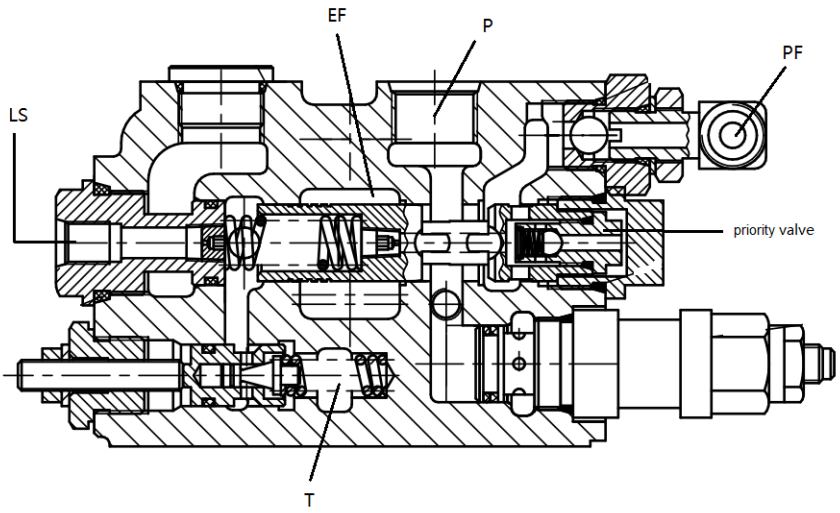
2) INLET SECTION OPERATION

① Structure and description



1	plug	5	Relief valve
2	Body	6	Steering relief valve
3	PF port fitting	7	LS port fitting
4	priority valve		

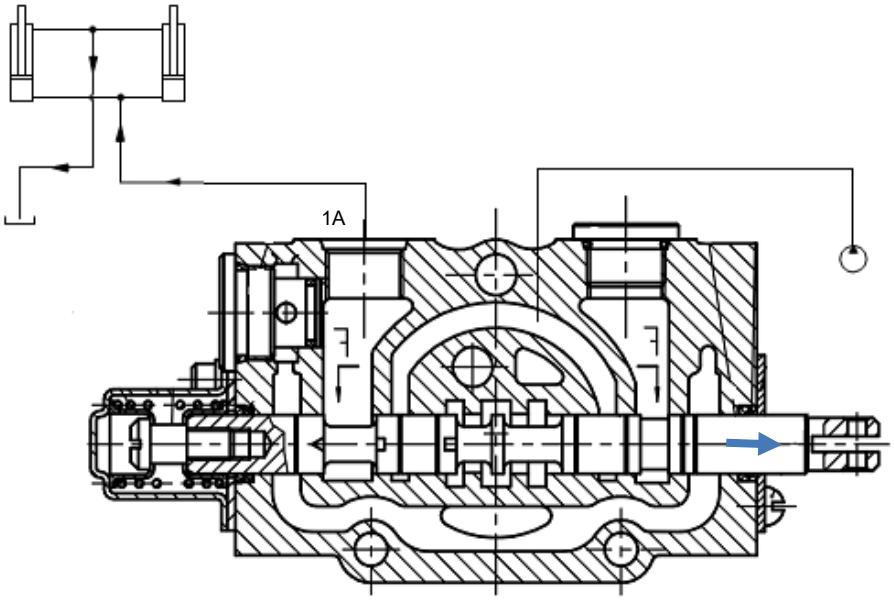
② Operation



The P port is the pump oil inlet, the PF port is connected to the steering unit inlet, the EF port is connected to the working valve, the LS port is connected to the steering unit control port, and the T port is the safety valve return port. When the oil is in the P port, the hydraulic oil is preferentially supplied to the PF port through the priority valve.

3) LIFT SECTION OPERATION

① Lift position

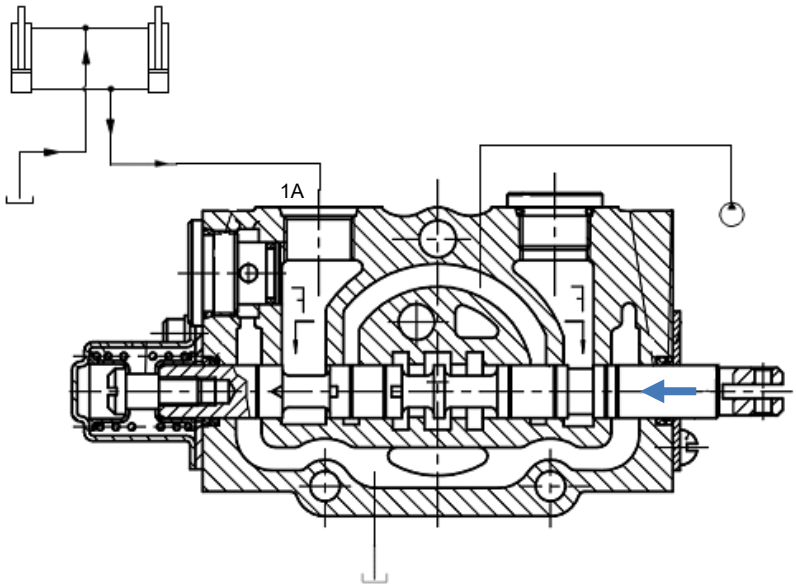


When the lift control lever is pulled back, the spool moves to the right and the neutral passage is closed.

The oil supplied from the pump flow into lift cylinder port(1A). The pump pressure reaches proportionally the load of cylinder.

The return oil from cylinder flows into the tank.

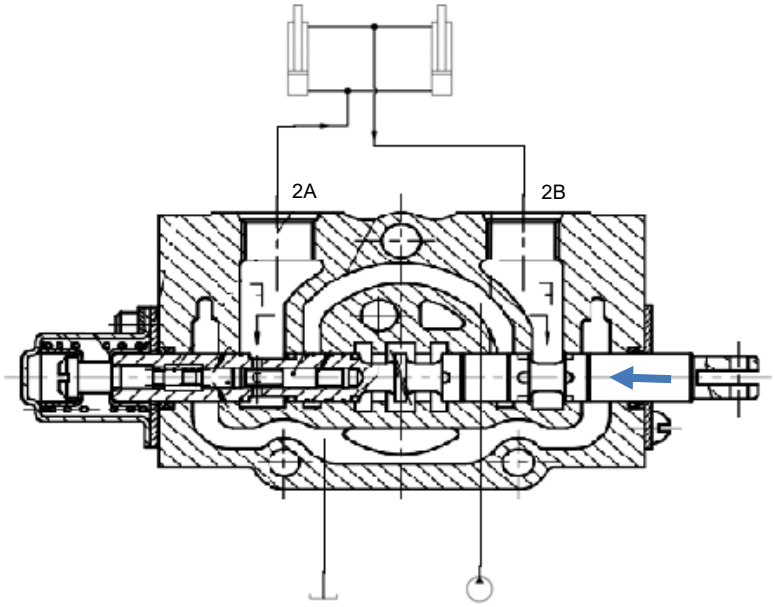
② Lower position



When the lift control lever is pushed forward, the spool moves to the left and the neutral passage is closed.
The spool moves to the lift lower position, opening up the neutral passage to tank and (1A) → T.
In lift lower position the fork drops due to its own weight.

4) TILT SECTION OPERATION

① Tilt forward position

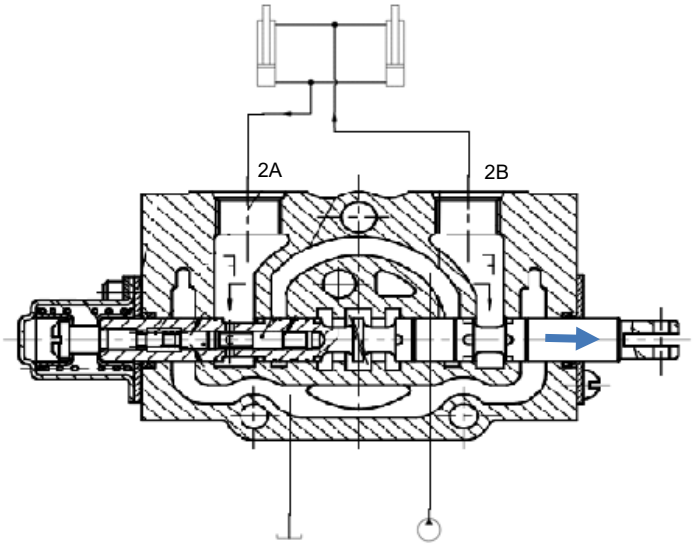


When the tilt control lever is pushed forward, the spool moves to the left and the neutral passage is closed.

The oil supplied from the pump flow into tilt cylinder port(2B). The pump pressure reaches proportionally the load of cylinders.

The return oil from cylinder port(2A) flows into the tank through the hole of the tilt lock spool.

② Tilt backward position



When the tilt control lever is pulled back, the spool moves to the right and the neutral passage is closed.
The oil supplied from the pump flows into tilt cylinder port(2A). The pump pressure reaches proportionally the load of cylinder.
The return oil from cylinder port(2B) flows into the tank via the low-pressure passage.

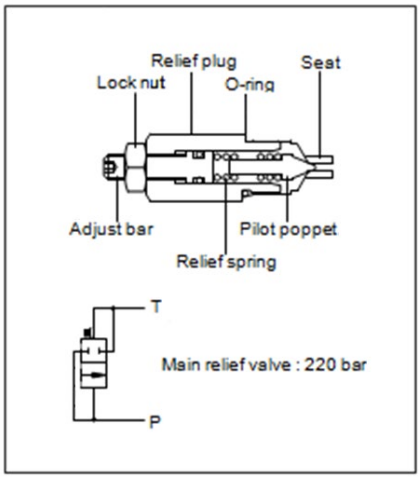
5) MAIN RELIEF VALVE

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.

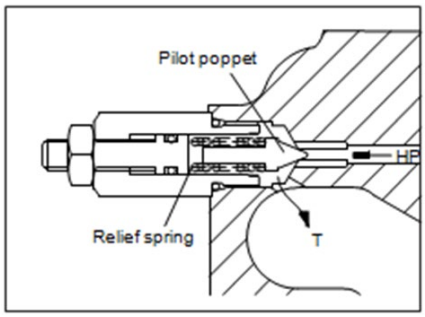
Procedure

- Loosen lock nut.
- Set adjusting bar to desired pressure setting.
- Tighten lock nut.
- Retest in similar manner as above.

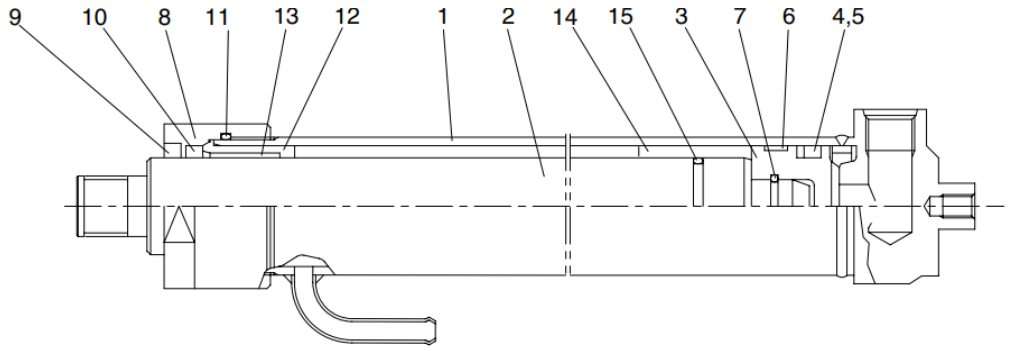


② Operation

Pressurized oil over the relief pressure pushes pilot poppet and flows to tank passage, therefore the system pressure keeps under the adjusted relief pressure.

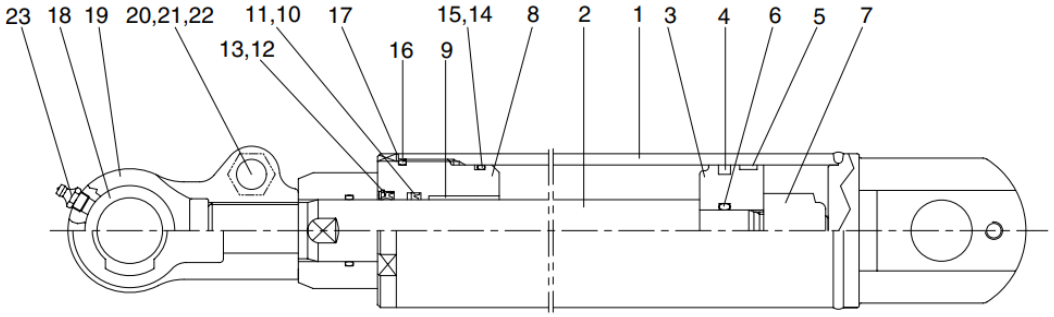


3 LIFT CYLINDER



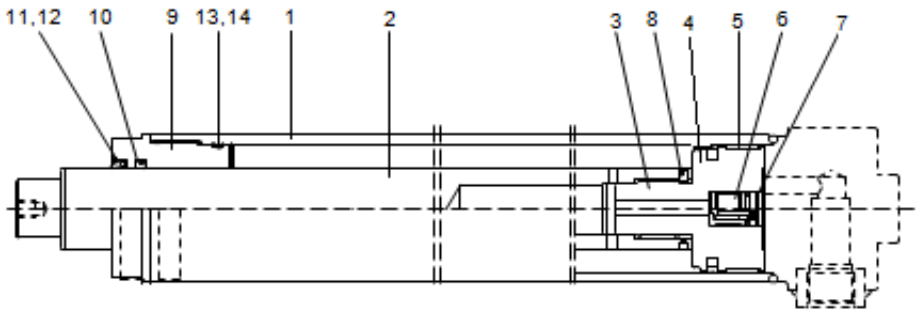
1	Tube assembly	6	Wear ring	11	O-ring
2	Rod	7	Retaining ring	12	Guide
3	Piston	8	Gland	13	DU bushing
4	Piston seal	9	Dust wiper	14	Spacer
5	Back up ring	10	Rod seal	15	O-ring

4 TILT CYLINDER



1	Tube assembly	9	Bushing	17	Washer
2	Rod	10	U-packing	18	Eye
3	Piston	11	Back up ring	19	Bushing
4	Glyd. ring	12	Dust wiper	20	Hexagon bolt
5	Wear ring	13	Stop ring	21	Spring washer
6	O-ring	14	O-ring	22	Lock nut
7	Hexagon nut	15	Back up ring	23	Grease nipple
8	Gland	16	O-ring		

5 FREE LIFT CYLINDER



1	Tube assembly	6	Check valve	11	Dust wiper
2	Rod	7	Retaining ring	12	Retaining ring
3	Piston	8	Set screw	13	O-ring
4	Piston seal	9	Gland	14	Back up ring
5	Wear ring	10	U-packing		

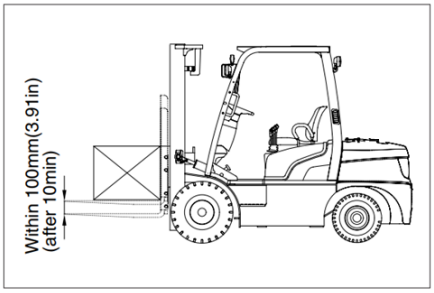
GROUP2 OPERATIONAL CHECKS AND TROUBLESHOOTING

1 OPERATIONAL CHECKS

1) CHECK ITEM

① Check visually for deformation, cracks or damage of rod.

② Set mast vertical and raise 1m from ground. Wait for 10 minutes and measure hydraulic drift (amount forks move down and amount mast tilts forward).

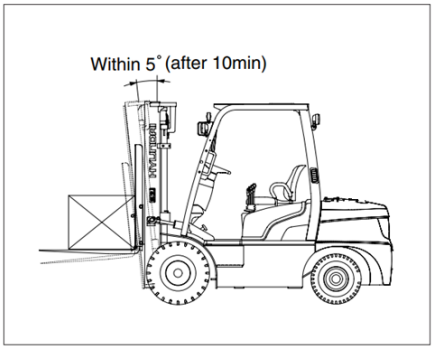


•Check condition

- Hydraulic oil: Normal operating temp
- Mast substantially vertical.
- Rated capacity load.

•Hydraulic drift

- Down (Downward movement of forks)
: Within 100mm (3.9in)
- 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.
Check that clearance between tilt cylinder bushing and mounting pin is within standard range.

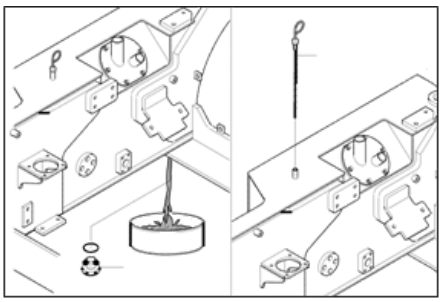
mm (in)

Standard	Under 0.6 (0.02)

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 line filter (screwed into inlet pipe). Line filter uses paper element, so replace periodically (every 6 months or 1000 hours)



Drain plug Oil dipstick

③ Raise forks to maximum height and measure oil pressure.

④ Check that oil pressure is 220 kgf/cm2. (3130 psi)

2 TROUBLESHOOTING

1) SYSTEM

Problem	Cause	Remedy
Large fork lowering speed.	•Seal inside control valve defective. •Oil leaks from joint or hose. •Seal inside cylinder defective.	•Replace spool or valve body. •Replace. •Replace packing.
Large spontaneous tilt of mast.	•Tilting backward: Check valve defective. •Tilting forward: tilt lock valve defective. •Oil leaks from joint or hose. •Seal inside cylinder defective.	Clean or replace. •Clean or replace. •Replace. •Replace seal.
Slow fork lifting or slow mast tilting.	•Lack of hydraulic oil. •Hydraulic oil mixed with air. •Oil leaks from joint or hose. •Excessive restriction of oil flow on pump suction side. •Relief valve fails to keep specified pressure. •Poor sealing inside cylinder. •High hydraulic oil viscosity. •Mast fails to move smoothly. •Oil leaks from lift control valve spool. •Oil leaks from tilt control valve spool.	•Add oil. •Bleed air. •Replace. •Clean filter. •Adjust relief valve. •Replace packing. •Change to L-HM32. •Adjust roll to rail clearance. •Replace spool or valve body. •Replace spool or valve body.
Hydraulic system makes abnormal sounds.	•Excessive restriction of oil flow pump suction side. •Gear or bearing in hydraulic pump defective.	•Clean filter. •Replace gear or bearing.
Control valve lever is locked	•Foreign matter jammed between spool and valve body. •Valve body defective.	•Clean. •Tighten body mounting bolts uniformly.
High oil temperature.	•Lack of hydraulic oil. •High oil viscosity. •Oil filter clogged.	•Add oil. •Change to L-HM32. •Clean filter.

2) HYDRAULIC GEAR PUMP

Problem	Cause	Remedy
Pump does not develop full pressure.	•System relief valve set too low or leaking. •Oil viscosity too low. •Pump is worn out.	•Check system relief valve for proper setting. •Change to proper viscosity oil. •Repair or replace pump.
Pump will not pump oil.	•Reservoir low or empty. •Suction strainer clogged.	•Fill reservoir to proper level. •Clean suction strainer.
Noisy pump caused by cavitation.	•Oil too thick. •Oil filter plugged. •Suction line plugged or too small.	•Change to proper viscosity. •Clean filters. •Clean line and check for proper size.
Oil heating.	•Oil supply low. •Contaminated oil. •Setting of relief valve too high or too low. •Oil viscosity too low.	•Fill reservoir to proper level. •Drain reservoir and refill with clean oil. •Set to correct pressure. •Drain reservoir and fill with proper viscosity.
Foaming oil.	•Low oil level. •Air leaking into suction line. •Wrong kind of oil.	•Fill reservoir to proper level. •Tighten fittings, check condition of line. •Drain reservoir, fill with non-foaming oil.
Shaft seal leakage.	•Worn shaft seal. •Worn shaft in seal area.	•Replace shaft seal. •Replace drive shaft and seal.

3) MAIN RELIEF VALVE

Problem	Cause	Remedy
Can get pressure	•Poppet D, E or K stuck open or contamination under seat.	•Check for foreign matter between poppets D, E or K and their mating parts. Parts must slide freely.
Erratic pressure	•Pilot poppet seat damaged.	•Replace the relief valve. •Clean and remove surface marks for free movement.
Pressure setting not correct	•Normal wear. Lock nut & adjust screw loose.	•See page 136 for how to set pressure on work main relief.
Leaks	•Damaged seats. •Worn O-rings. •Parts sticking due to contamination.	•Replace the relief valve. •Install seal and spring kit. •Disassemble and clean.

4) LIFT CYLINDER

Problem	Cause	Remedy
Oil leaks out from gland through rod.	•Foreign matters on packing. •Unallowable score on rod. •Unusual distortion of dust seal. •Chrome plating is striped.	•Replace packing. •Smooth rod surface with an oil stone. •Replace dust seal. •Replace rod.
Oil leaks out from cylinder gland thread.	•O-ring damaged.	•Replace O-ring.
Rod spontaneously retract.	•Scores on inner surface of tube. •Unallowable score on the inner surface of tube. •Foreign matters in piston seal.	•Smooth rod surface with an oil stone. •Replace cylinder tube. •Replace piston seal.
Wear (clearance between cylinder tube and wear ring)	•Excessive clearance between cylinder tube and wear ring.	•Replace wear ring.
Abnormal noise is produced during tilting operation.	•Insufficient lubrication of anchor pin or worn bushing and pin. •Bent tilt cylinder rod.	•Lubricate or replace. •Replace.

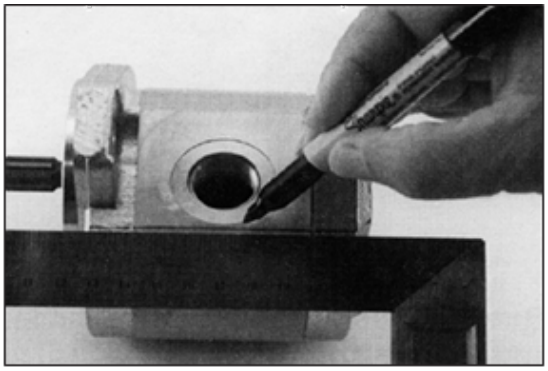
GROUP3 DISASSEMBLY AND ASSEMBLY

1 HYDRAULIC GEAR PUMP

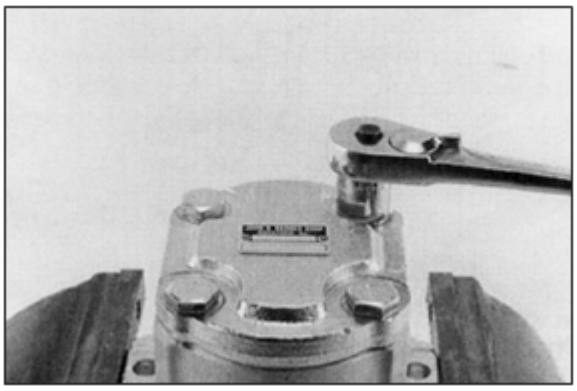
※ Tools required

•Metric socket set
•Internal snap ring pliers
•Shaft seal sleeve
•Torque wrench

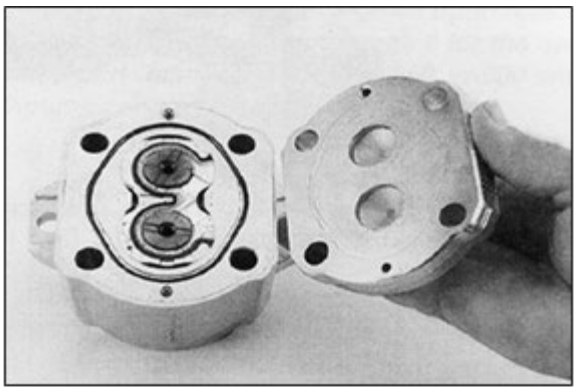
1) It is very important to work in a clean work area when repairing hydraulic products. Plug ports and wash exterior of pump with a proper cleaning solvent before continuing.
2) Remove port plugs and drain oil from pump.
3) Use a permanent marker pen to mark a line across the mounting flange, gear housing and end cover.
   This will assure proper reassembly and rotation of pump.
4) Remove key from drive shaft if applicable.



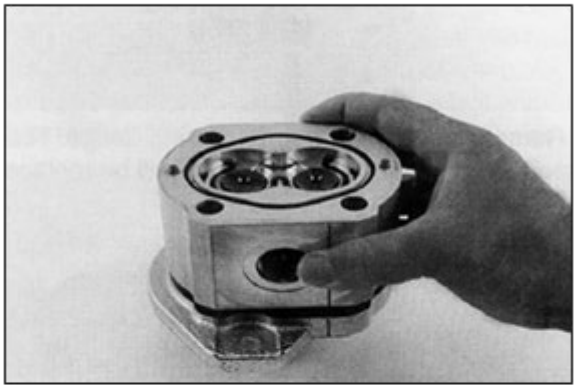
5) Clamp mounting flange in a protected jaw vise with pump shaft facing down.
6) Loosen the four metric hexagon head bolts.
7) Remove pump from vise and place on clean work bench, remove the four-hexagon head bolts and spacers applicable.



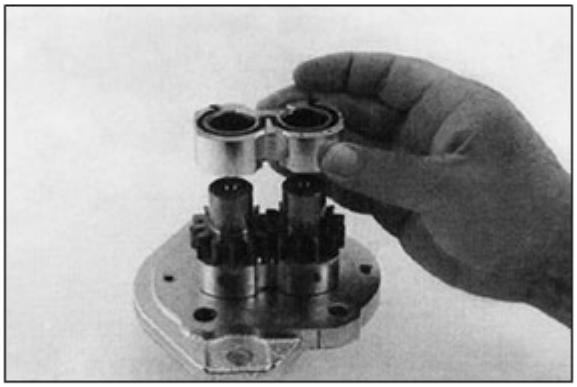
8) Lift and remove end cover.



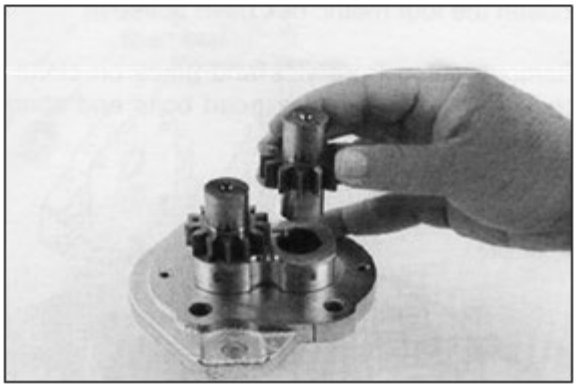
9) Carefully remove gear housing and place on work bench. Make sure the rear bearing block remains on the drive and idler shafts.



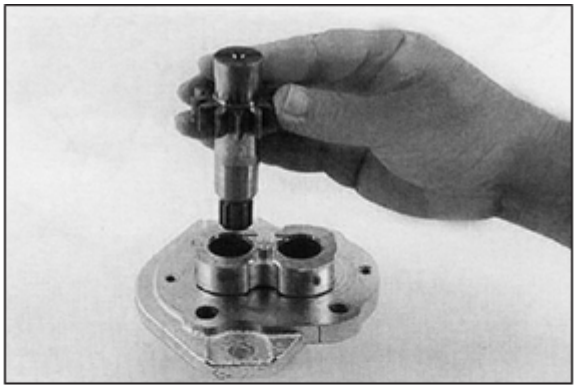
10) Remove rear bearing block from drive and idler shafts.



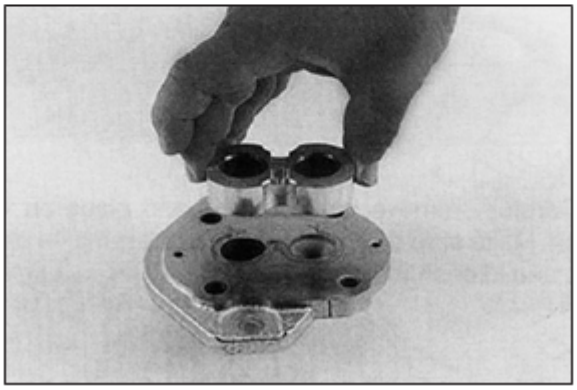
11) Remove idler shaft from bearing block.



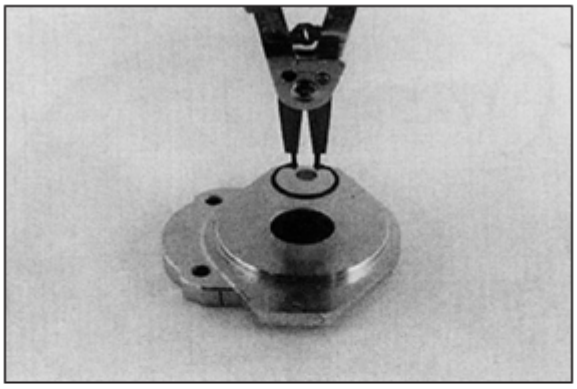
12) Remove drive shaft from mounting flange.
There is no need to protect the shaft seal as it will be replaced as a new item.



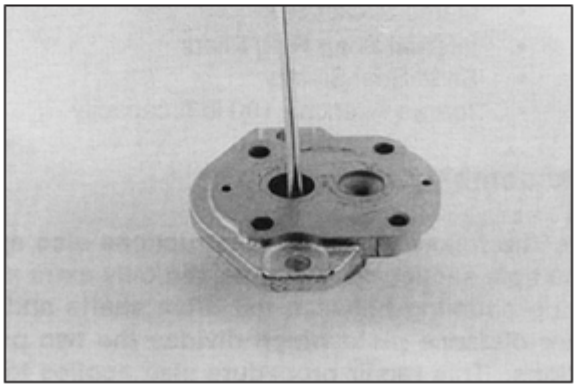
13) Remove the front bearing block.



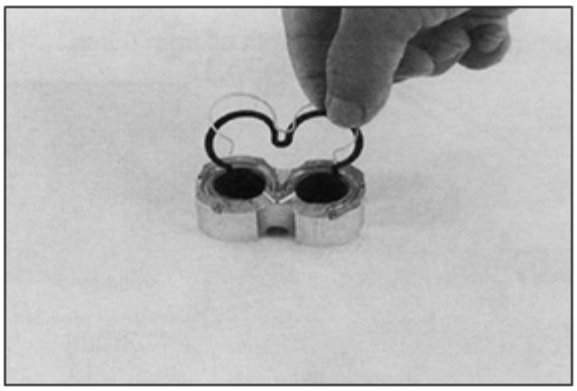
14) Turn mounting flange over, with shaft seal up, and remove the retaining ring with proper snap ring pliers.



15) Remove the oil seal from Mounting flange, be careful not to scratch the seal bore.
16) Remove the dowel pins from the gear housing. Do not lose pins.

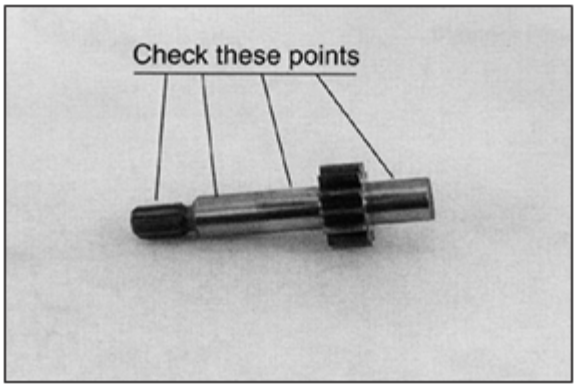


17) Remove seals from both bearing blocks and discard.

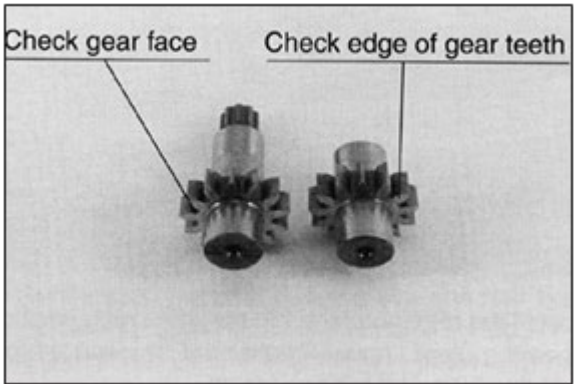


2 INSPECT PARTS FOR WEAR

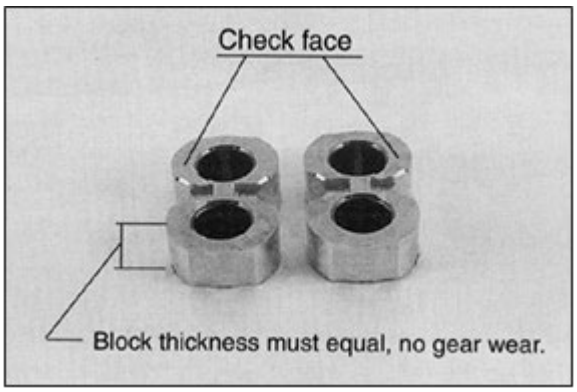
1) Clean and dry all parts thoroughly prior to inspection. It is not necessary to inspect the seals as they will be replaced as new items.
2) Check drive shaft spline for twisted or broken teeth, check keyed drive shaft for broken or chipped keyway. No marks or grooves on shaft in seal
area, some discoloration of shaft is allowable.
3) Inspect both the drive gear shaft and idler gear shafts at the bearing points and seal area for rough surfaces and excessive wear.



4) Inspect gear face for scoring or excessive wear. If the face edge of gear teeth is sharp, they will mill into the bearing
blocks.
If wear has occurred, the parts are unusable.



5) Inspect bearing blocks for excessive wear or scoring on the surfaces which are in contact with the gears.
   Also inspect the bearings for excessive wear or scoring.
6) Inspect the area inside the gear housing.
   It is normal for the surface inside the gear housing to show a clean "wipe" on the inside surface on the intake side.
   There should not be excessive wear or deep scratches and gouges.



※ General information

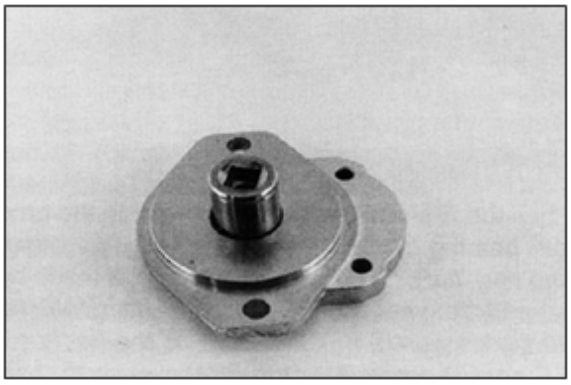
It is important that the relationship of the mounting flange, bearing blocks and gear housing is correct.
Failure to properly assemble this pump will result with little or no flow at rated pressure.

※ This pump is not bi-rotational.

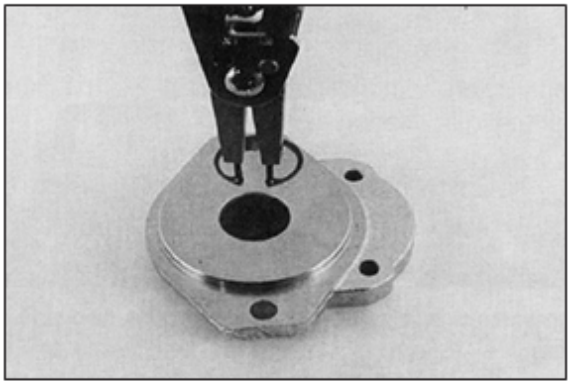
3 ASSEMBLY

※New seals should be installed upon reassembly of pump.

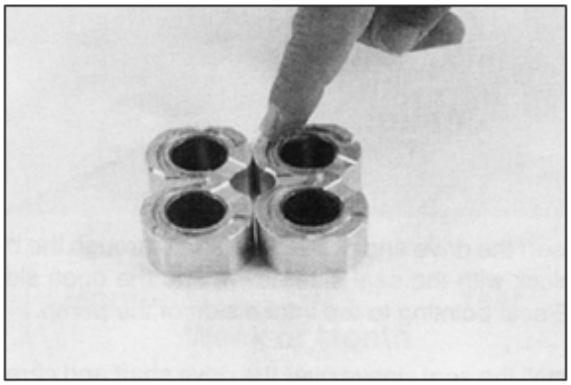
1) Install new shaft seal in mounting flange with part number side facing outboard. Press the seal into the seal bore until the seal reaches the bottom of the bore. Uniform pressure must be used to prevent misalignment or damage to the seal.



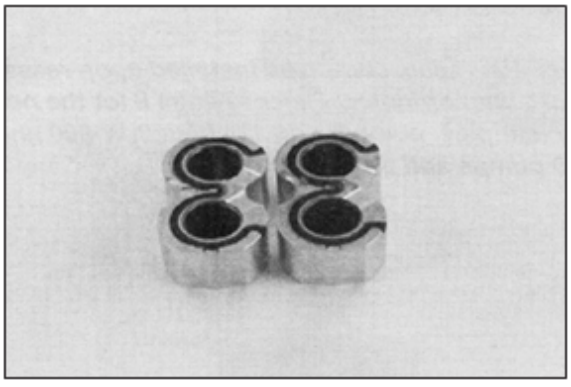
2) Install retaining ring in groove in seal bore of mounting flange.
3) Place front and back bearing blocks on a clean surface with the E-seal grooves facing up.
   Apply a light coating of petroleum jelly in the grooves.
   Also coat the E-seal and backup with the petroleum jelly, this will help keep the seals in place during assembly.



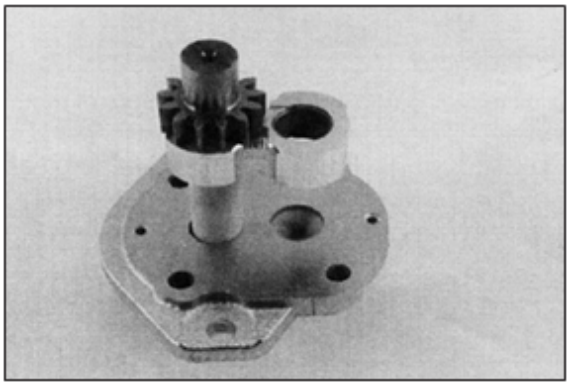
4) Place the E-seals, flat side outward, into the grooves in both bearing blocks.
   Follow by carefully placing the backup ring, flat side outward, in the groove made by the E-seal and the groove in the bearing block
5) Place mounting flange, with shaft seal side down, on a clean flat surface.



6) Apply a light coating of petroleum jelly to the exposed face of the front bearing block.

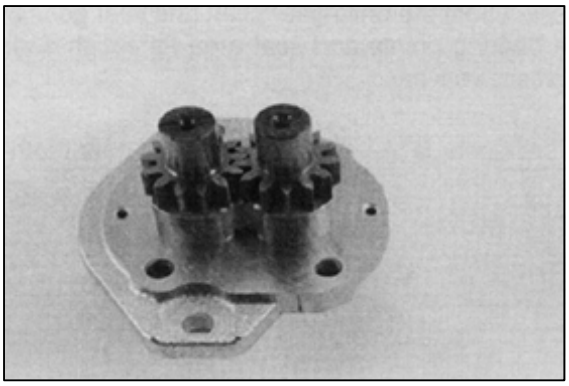


7) Insert the drive end of the drive shaft through the bearing block with the seal side down, and the open side of the E-seal pointing to the intake side of the pump.

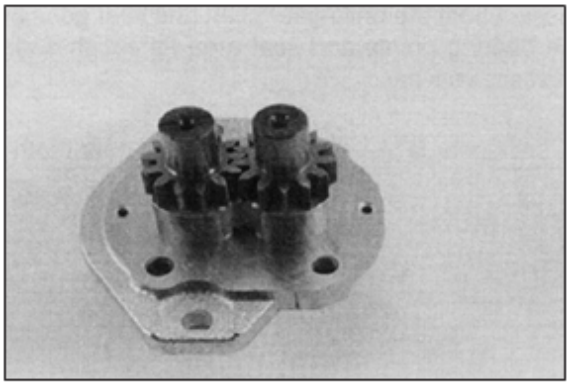


8) Install the seal sleeve over the drive shaft and carefully slide the drive shaft through the shaft seal. Remove the seal sleeve from shaft.

9) Install the idler gear shaft in the remaining position in the bearing block.
Apply a light coat of clean oil to the face of the drive and idler gears.

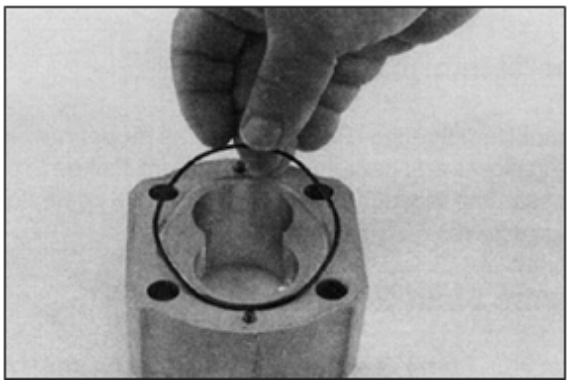


10) Pick up the rear bearing block, with seal side up and with open end of the E-seal facing the intake side of the pump, place over the drive and idler gear shafts.

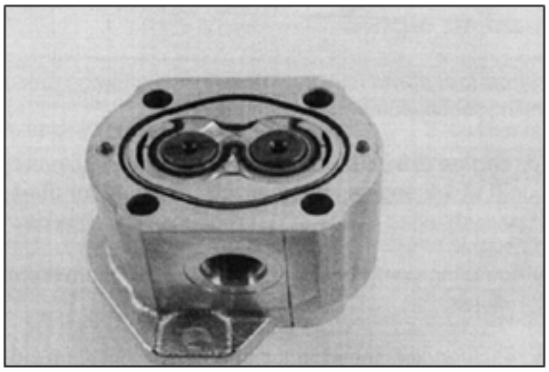


11) Install two dowel pins in the holes in the mounting flange or two long dowel pins through gear housing if pump is a multiple section pump.

12) To install the O-rings in the gear housing, apply a light coating of petroleum jelly in the grooves on both sides of the gear housing. Also coat the new O-ring and install them in the grooves.

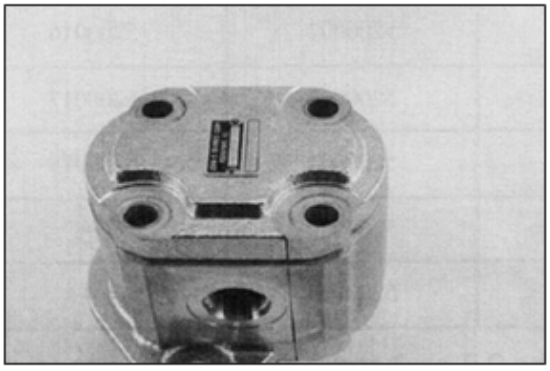


13) Gently slide the gear housing over the rear bearing block assembly, slide housing down until the housing engages the dowel pins.
Press firmly in place with hands, do not force or use any tool.
Check to make sure the intake port in the housing in on the same side as the open end of the E-seal and that the marked lines on the mounting flange and gear housing are in alignment.

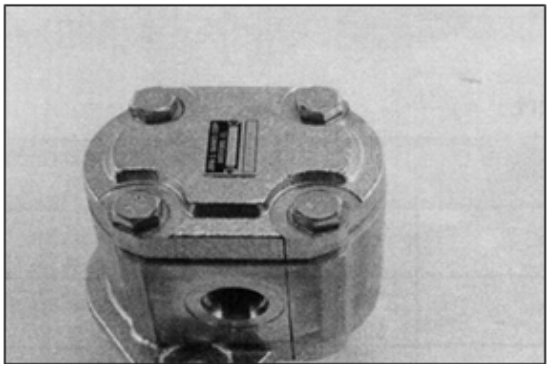


14) The surface of the rear bearing block should be slightly below the face of the gear housing.
If the bearing block sits higher than the rear face of the gear housing then the E-seal or O-ring have shifted out of the groove. If this is the case, remove the gear housing and check for proper seal installation.

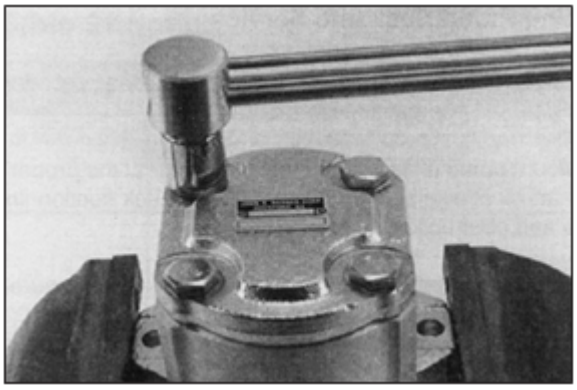
15) Install the two remaining dowel pins in the rear of the gear housing and place the end cover over the back of the pump.



16) Install the four spacers and hexagon head bolts through the bolt holes in the end cover, hand tighten.



17) Place mounting flange of the pump back in the protected jawed vise and alternately torque the bolts.
•Tighten torque: 3.0~4.0kgf•m (22~29lbf•ft)

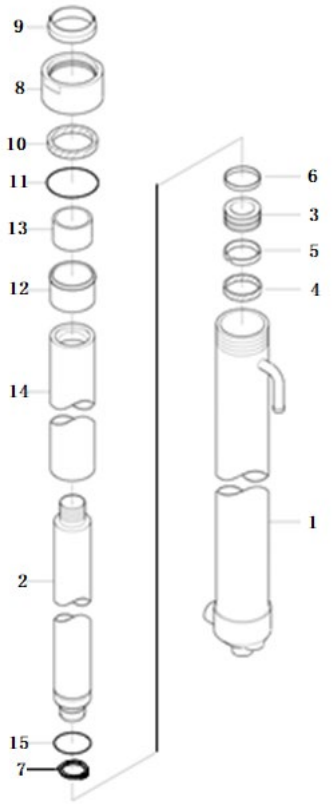


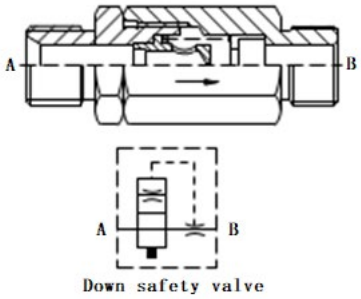
18) Remove pump from vise.

19) Place a small amount of clean oil in the inlet of the pump and rotate the drive shaft away from the inlet one revolution. If the drive shaft binds, disassemble the pump and check for assembly problems, then reassemble the pump.

4 LIFT CYLINDER

1) STRUCTURE

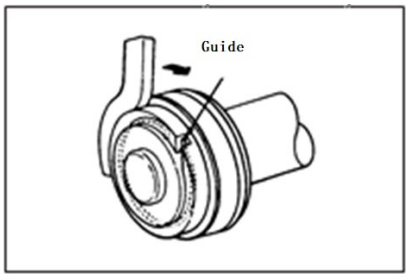




1	Tube assy	6	Wear ring	11	O-ring
2	Rod assy	7	Retaining ring	12	Guide
3	Piston	8	Gland	13	Du bushing
4	Piston seal	9	Dust wiper	14	Spacer
5	Back up ring	10	Rod seal	15	O-ring

2) DISASSEMBLY

① Hold the cylinder tube in a vice, loosen the cylinder head and remove it. Remove the spacer from the cylinder tube and knock out the bushing. Hook a wrench in the hole in the retainer at the piston end and turn. Lever up the edge of the guide, then turn the guide in again, and the guide can be removed.

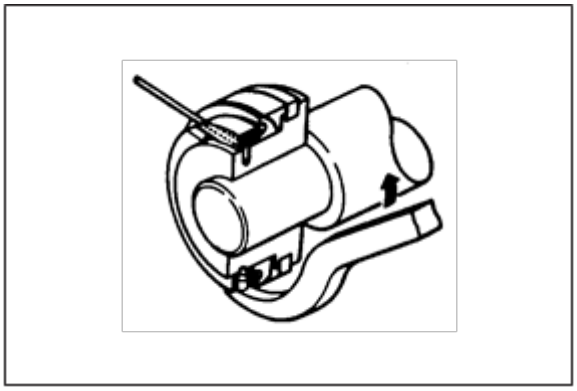


② CHECK AND INSPECTION mm(in)

Check item	Standard size	Repair limit	Remedy
Clearance between cylinder rod & bushing	0.072~0.288 (0.003~0.011)	0.5 (0.020)	Replace bushing
Clearance between piston ring & tube	0.05~0.030 (0.002~0.012)	0.5 (0.020)	Replace piston ring

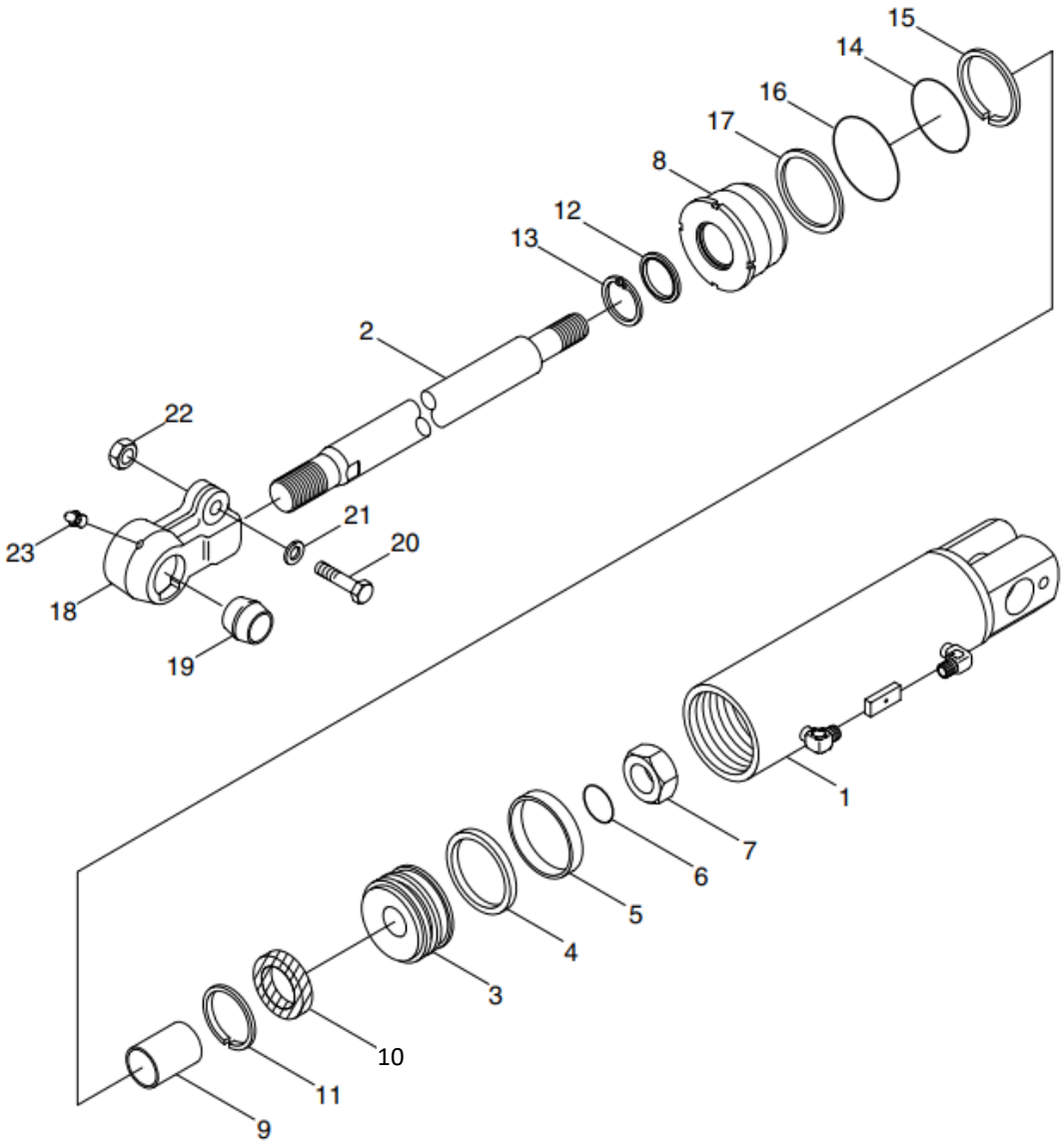
③ ASSEMBLY

Soak the piston ring in hydraulic oil at a temperature of 40 to 50℃, 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.



5 TILT CYLINDER

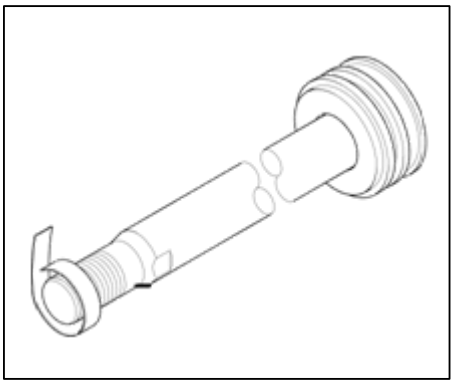
3) STRUCTURE



1	Tube assembly	9	Bushing	17	Washer
2	Rod	10	U-packing	18	Eye
3	Piston	11	Back up ring	19	Bushing
4	Guide ring	12	Dust wiper	20	Hexagon bolt
5	Wear ring	13	Stop ring	21	Spring washer
6	O-ring	14	O-ring	22	Lock nut
7	Nylon nut	15	Back up ring	23	Grease nipple
8	Rod cover	16	O-ring		

4) DISASSEMBLY

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.

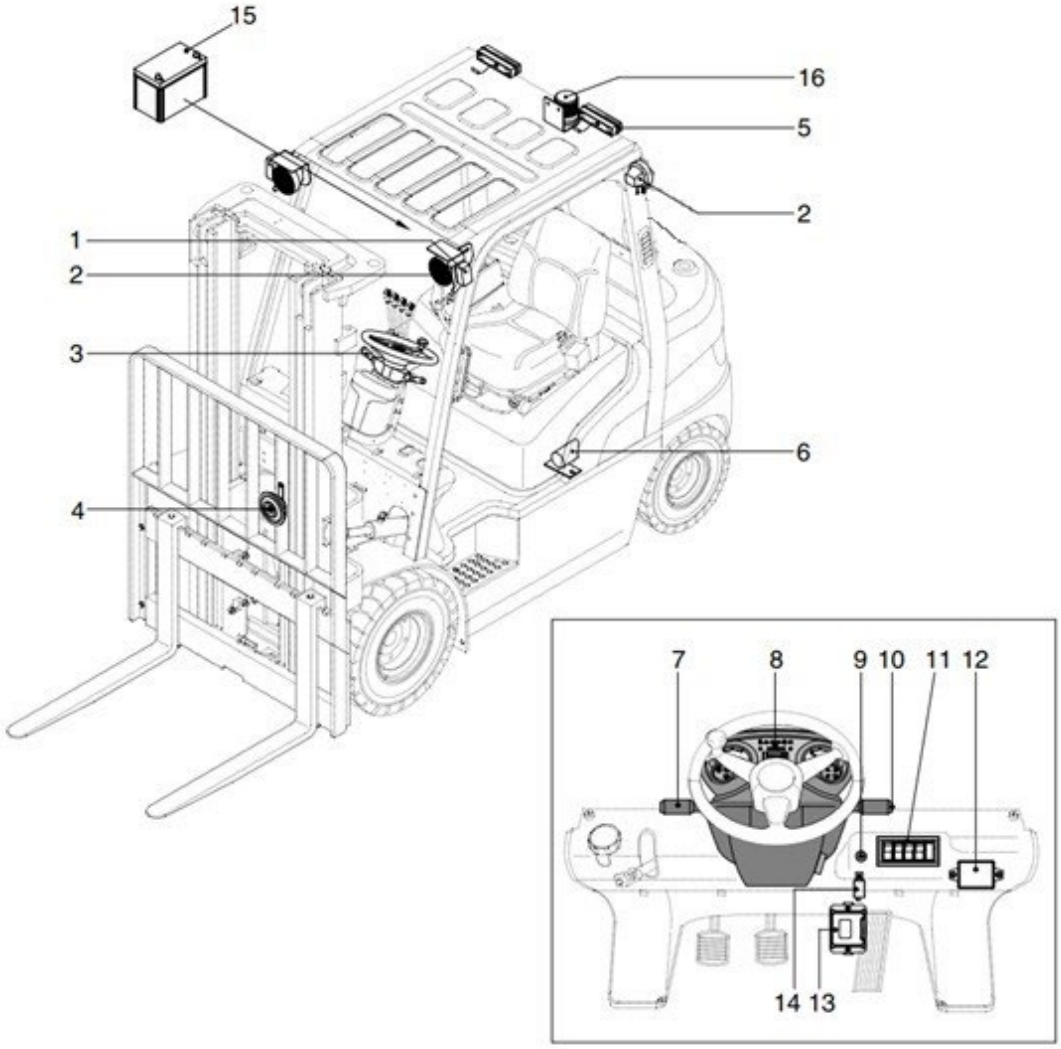


5) CHECK AND INSPECTION mm (in)

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

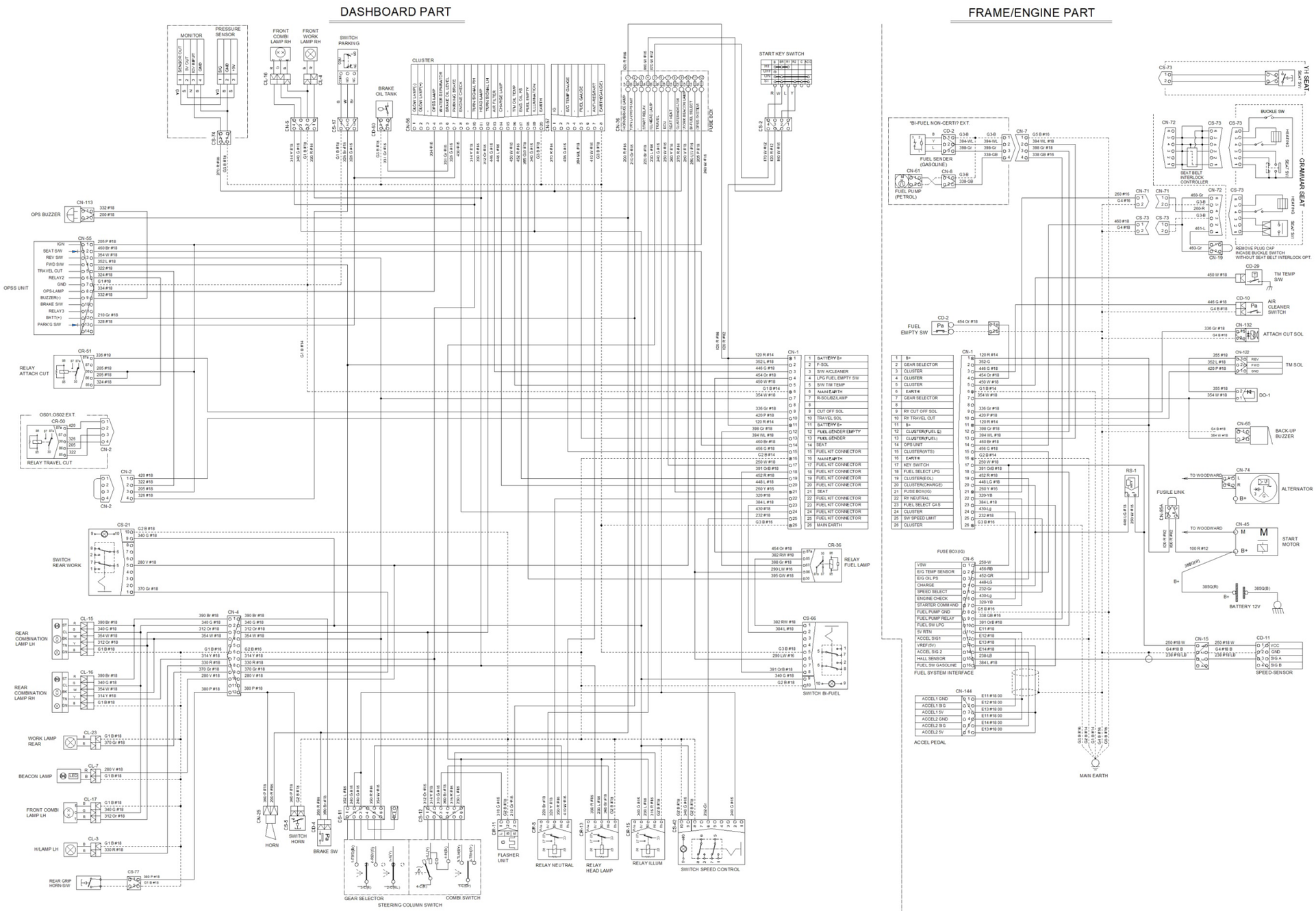
SECTION7 ELECTRICAL SYSTEM

GROUP1 COMPONENT LOCATION



1	Flasher lamp	7	Forward-reverse lever	13	OPSS unit
2	Work lamp	8	Operating panel	14	Flasher unit
3	Combination switch	9	Start switch	15	Battery
4	Horn assembly	10	Light switch	16	Beacon lamp
5	Combination lamp	11	Switch board		
6	Back buzzer	12	Fuse box		

GROUP2 ELECTRICAL CIRCUIT

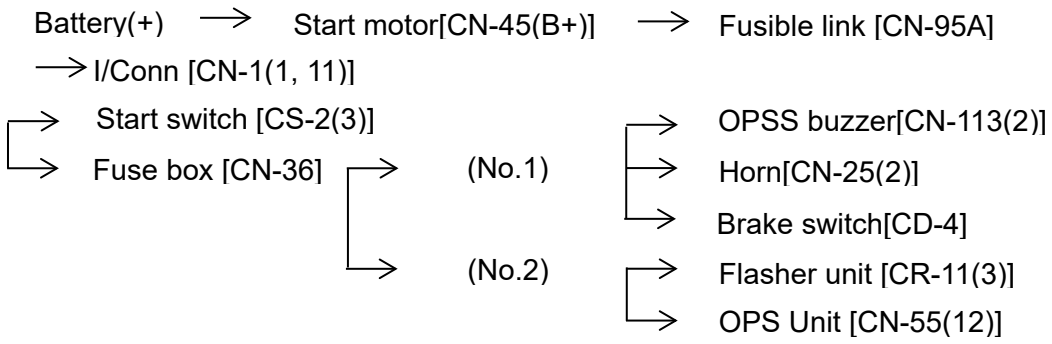


MEMORANDUM

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.

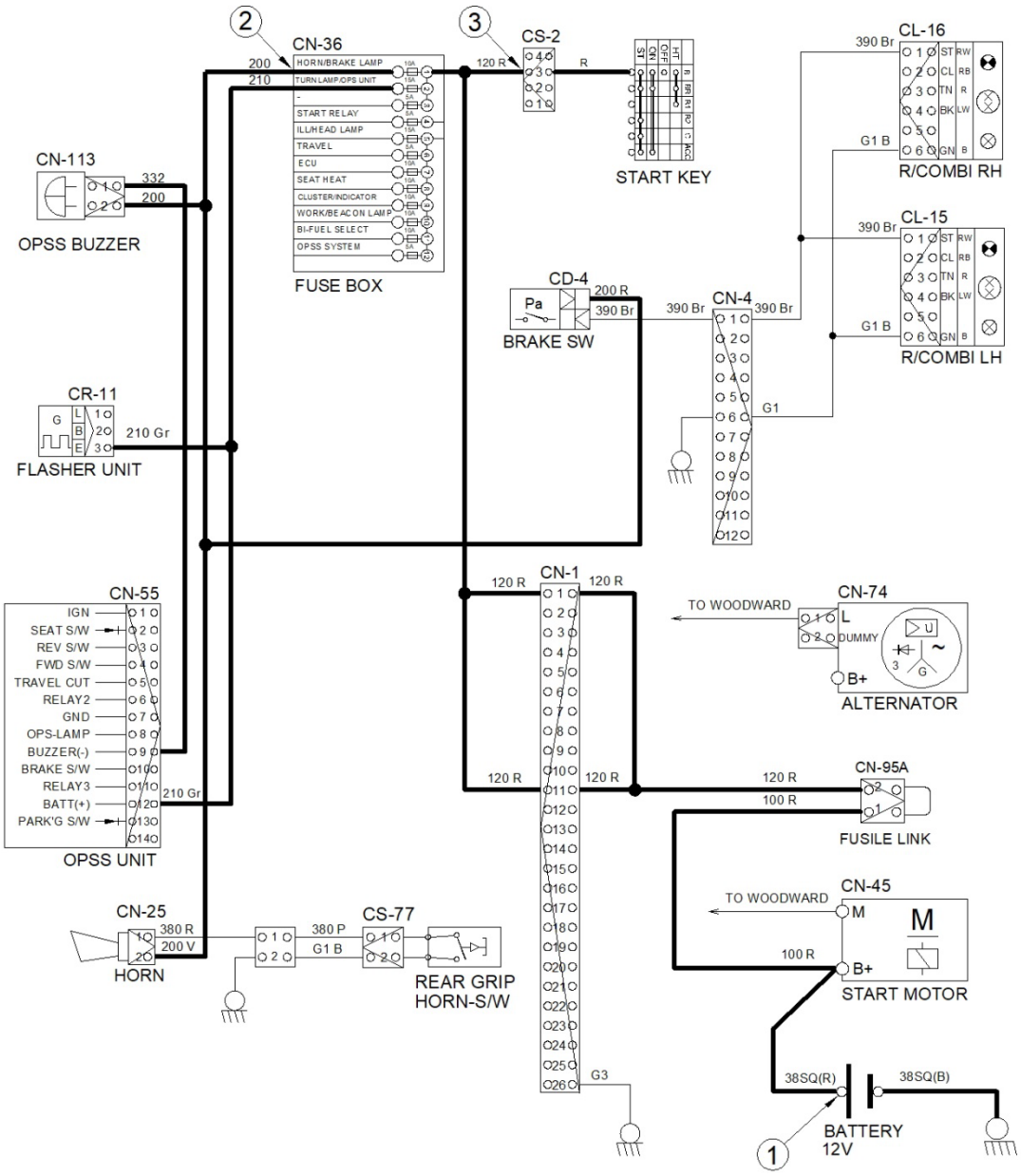
1) OPERATING FLOW



2) CHECK POINT

Engine	Key switch	Check point	Voltage
STOP	OFF	① - GND (Battery(+)) ② - GND (Fuse No.1) ③ - GND (Start key)	10 ~ 13V

POWER CIRCUIT



2. STARTING CIRCUIT

1) OPERATING FLOW

Battery(+) terminal ⟶ Start motor[CN-45(B+)] ⟶ Fusible link [CN-95A] ⟶ I/Conn [CN-1(1, 11)] ⟶ Start motor [CS-2(3)]

※The engine can be started only when the gearshift is in neutral position.

① When start key switch is in ON position

Start switch ON [CS-2(4)] ⟶ Fuse box[No. 5] ⟶ Combi switch [CS-12(6)]

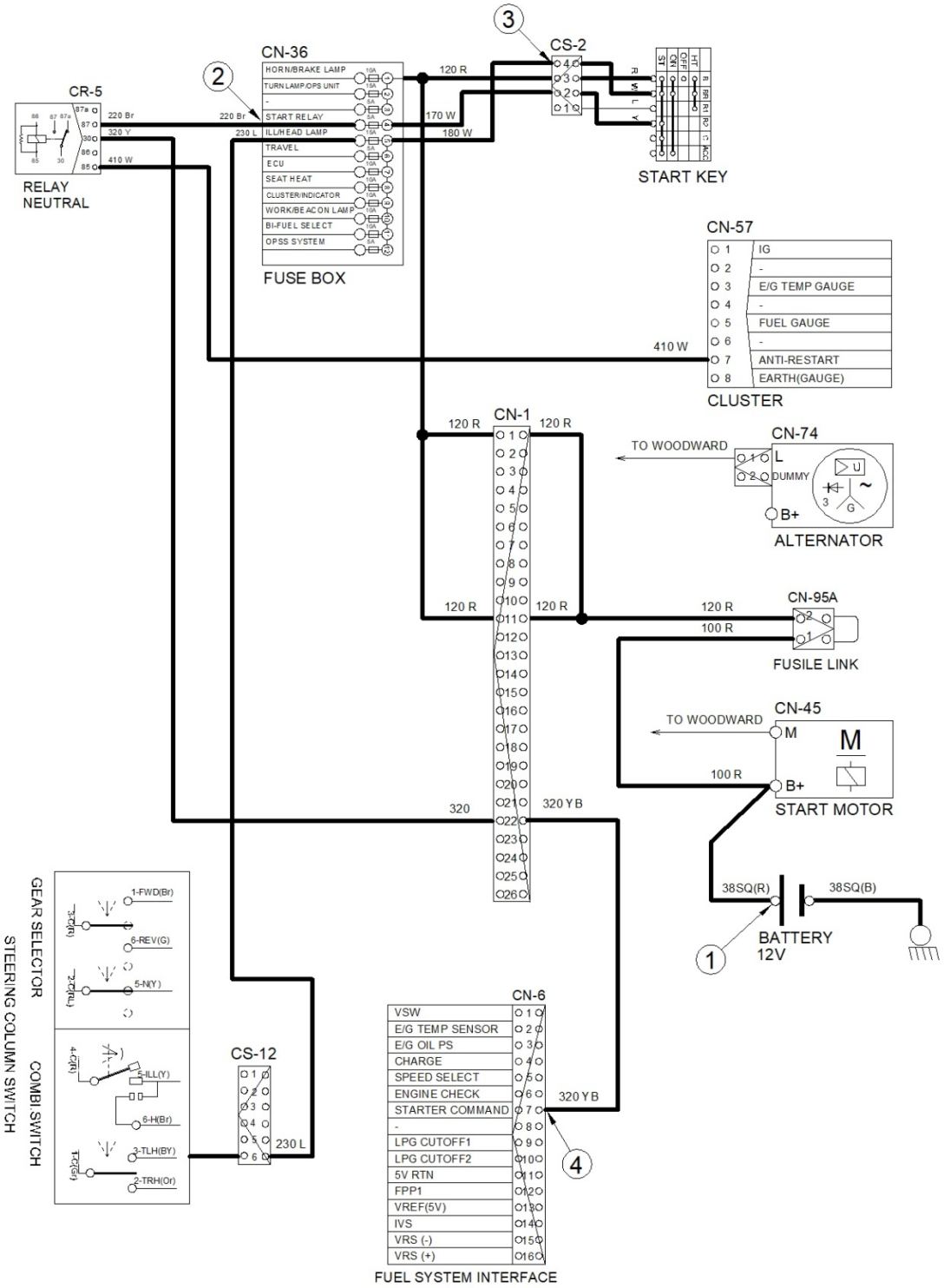
② When start key switch is START position

Start switch START[CS-2(2)] → Fuse box [CN-36(4)] → Neutral relay [CR-5(87-30)] → I/Conn[CN-1(22)] → Fuel system interface[CN-6(7)] → Start motor [CN-45(M)]

2) CHECK POINT

Engine	Key switch	Check point	Voltage
Running	ON	① - GND (Battery B+) ② - GND (Fuse box No.4) ③ - GND (Start key) ④ - GND (F/sys interface)	10 ~ 14.5V

STARTING CIRCUIT



GROUP3 COMPONENT SPECIFICATION

No	Part name	Q'ty	Specification	Remark
1	Battery	1	CCA: 550A 20HR: 60AH 6-QW-93(230x172x200)	
2	Working lamp	1	9-36V, 12W（3W×4）	
4	Combination lamp	2	12V, 21W(T/S)　12V, 10W(Back) 12V, 5W (Tail) 12V, 5W(Stop)	
5	Head lamp	2	9-36V, 12W（3W×4）	
6	Flasher lamp	2	12V, 21W(T/S), 12V, 4W(Tail)	
7	Flasher & Relay	1	12V, 40A (Relay) 5W + 21W X 2+5W + 21W X 2 12V, 80A (Relay-Power)	
8	Back horn	1	12V, 105±5dB, 75±5C/M	
9	Horn	1	12V, MAX 4A, 105~118dB	
10	Combination switch	1	60W+60W+60W+60W+60W+60W+50 W	
11	Start switch	1	12V/24V, 15~28A	
12	OPSS unit	1	12V/24V, MAX 0.5A(at 12V)	
13	Relay (4P)	2	12V, 80A	
14	Relay (5P)	2	12V, 40A	

GROUP4 CONNECTOR DESTINATION

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-1	AMP	26	I/conn (Dashboard harness-frame harness)	1897009-2	1897013-2
CN-2	KET	4	I/conn (Dashboard harness-travel harness)	MG610331	MG640333
CN-4	KET	12	I/conn (Dashboard harness-head guard harness)	MG610346	MG640348
CN-5	KET	4	Support harness-RH	MG610047	MG620046
CN-6	AMP	16	I/conn (Fuel sys harness-frame harness)	368050-1	-
CN-7	KET	2	I/conn (Frame harness-bi-fuel ext.)	MG610331	MG640333
CN-8	-	2	Fuel pump harness	-	-
CN-15	AMP	4	Speed sensor	282088-1	282106-1
CN-17	KET	4	Power output for cabin	MG610047	MG620046
CN-19	KET	2	Backup Plugin	21N4-01310	MG620558
CN-25	AMP	2	Horn	171809-2	-
CN-36	-	-	Fuse box	21HF-10500	-
CN-45	RING TERM	-	Start motor	LA208	-
CN-55	KET	14	OPSS unit	MG610350	MG640352
CN-56	AMP	20	Cluster	368511-1	-
CN-57	AMP	8	Cluster	368540-1	-
CN-60	AMP	4	Monitor	174257-2	174259-2
CN-61	-	2	Fuel pump	-	-
CN-65	AMP	2	Back buzzer	174352-2	-
CN-71	KET	2	Seat heat	MG610043	MG620042
CN-72	-	6	Seat belt interlock controller	-	-
CN-74	RING TERM	1	Alternator B+	S820-105000	-
CN-74	MHI	2	Alternator	MB084-014	-
CN-95A	KET	2	Fusible link	21N4-01311	MG620558
CN-113	AMP	2	OPSS buzzer	174352-2	174354-2
CN-122	AMP	3	T/M SOL	282087-1	-
CN-132	AMP	2	Attach cut sol	174352-2	174354-2
CN-133	AMP	2	Attach cut sol	174352-2	174354-2
CN-144	AMP	6	Accel. pedal	174262-2	-
Switch					
CS-2	KET	4	Start switch	MG610047	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CS-5	RING TERM	-	Horn switch	LA105	-
CS-11	RING TERM	6	Gear selector switch	DJ7061-6.3-21	-
CS-12	RING TERM	6	Combination switch	-	DJ7061-6.3-11
CS-17	KET	3	Parking switch	MG610045	-
CS-21	DAEDONG	10	Rear work switch	250-10PRG	-
CS-42	DAEDONG	10	Speed control switch	250-10PRG	-
CS-66	DAEDONG	10	Bi-fuel switch	250-10PRG	-
CS-73	AMP	2	Seat switch	174352-2	174354-2
CS-74	AMP	2	Load sensor	174352-2	174354-2
CS-77	AMP	2	Rear grip horn switch	174352-2	174354-2
Lamp					
CL-3	KET	1	Head lamp-LH	ST730018-3	ST750036-3
		1			
CL-4	KET	1	Head lamp-RH	ST730018-3	ST750036-3
		1			
CL-7	KET	1	Beacon lamp	ST730018-3	ST750036-3
		1			
CL-15	KET	1	Combination lamp-LH	ST730018-3	ST750036-3
		1			
		1			
		1			
		1			
CL-16	KET	1	Flasher lamp-RH	ST730018-3	ST750036-3
		1			
		1			
CL-16	KET	1	Combination lamp-RH	ST730018-3	ST750036-3
		1			
		1			
		1			
		1			
CL-17	KET	1	Flasher lamp-LH	ST730018-3	ST750036-3
		1			
		1			
CL-23	KET	1	Rear working lamp	ST730018-3	ST750036-3
		1			

Relay					
CR-5	KET	5	Neutral relay	MG640927	-
CR-11	KET	3	Flasher unit	S810-003702	-
CR-13	KET	5	Head lamp relay	MG640927	-
CR-15	KET	5	Tail lamp relay	MG640927	-
CR-36	KET	5	Fuel lamp relay	MG640927	-
CR-50	-	4	Travel cut relay	-	-
CR-51	KET	5	Attach cut relay	MG640927	-
Sensor and pressure switch					
CD-2	KET	3	Fuel empty switch	MG610320	-
CD-4	AMP	1	Brake switch	171809-1	-
CD-10	KET	1	Air cleaner switch	ST730057-2	-
CD-29	AMP	1	T/M temp switch	172320-2	-
CD-60	KET	2	Brake oil tank	MG610320	MG640322
DO-1	AMP	2	Diode	174352-2	21EA-50550
RS-1	AMP	2	Resistor	174352-2	21FT-10811

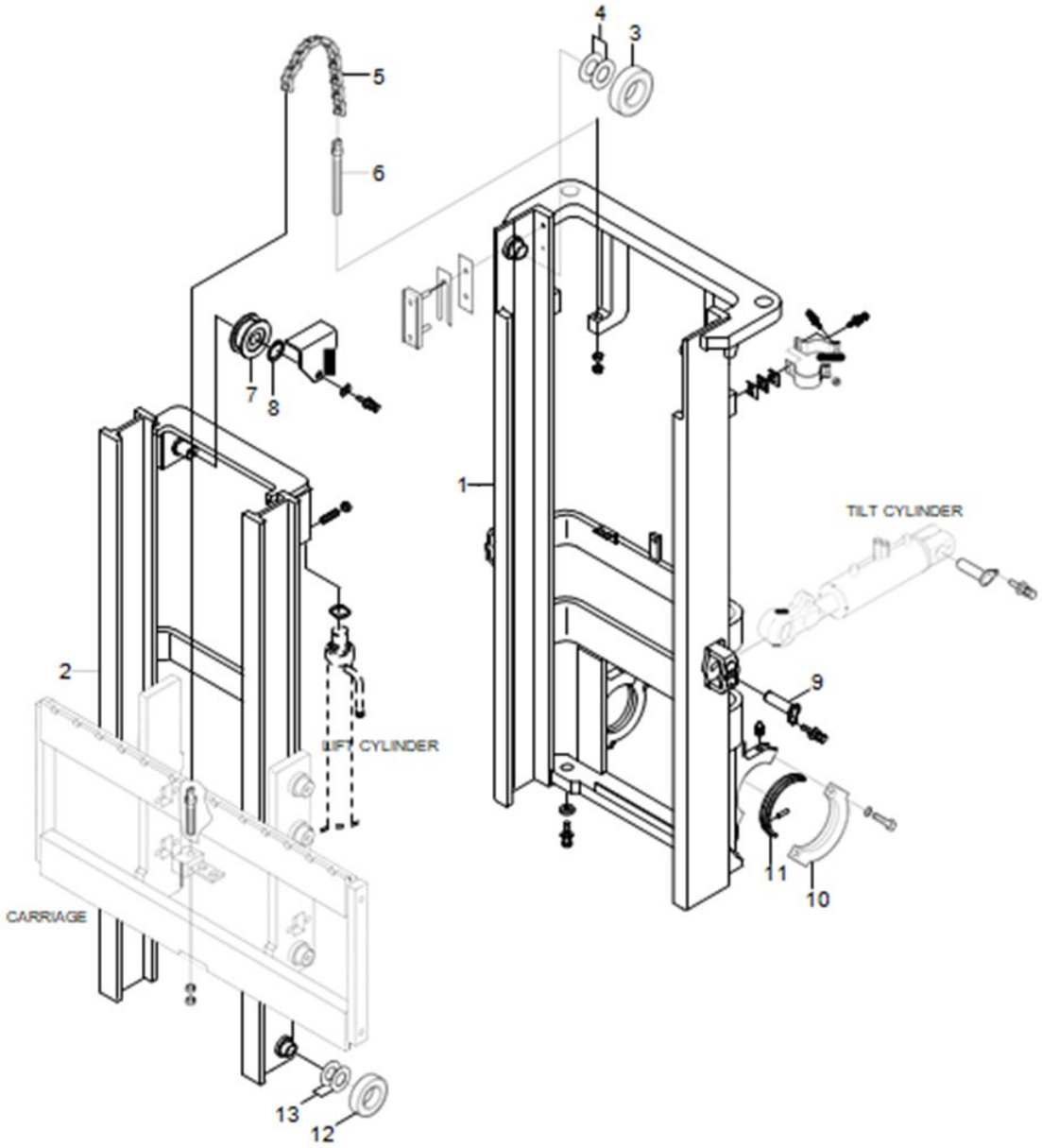
GROUP5 TROUBLESHOOTING

Trouble symptom	Probable cause	Remedy
Lamps dimming even at maxi- mum engine speed.	•Faulty wiring.	•Check for loose terminal and disconnected wire.
Lamps flicker during engine operation.	•Improper belt tension.	•Adjust belt tension.
Charge lamp does not light during normal engine operation.	•Charge lamp defective. •Faulty wiring.	•Replace. •Check and repair.
Alternator makes abnormal sounds.	•Alternator defective.	•Replace
Starting motor fails to run.	•Faulty wiring. •Insufficient battery voltage.	•Check and repair. •Recharge battery.
Starting motor pinion repeats going in and out.	•Insufficient battery voltage.	•Recharge battery.
Excessively low starting motor speed.	•Insufficient battery voltage. •Starting motor defective.	•Recharge battery. •Replace
Starting motor comes to a stop before engine starts up.	•Faulty wiring. •Insufficient battery voltage.	•Check and repair. •Recharge battery.
Heater signal does not become red.	•Faulty wiring. •Glow plug damaged.	•Check and repair. •Replace
Engine oil pressure caution lamp does not light when engine is stopped (with starting switch left in “ON" position).	•Caution lamp defective. •Caution lamp switch defective.	•Replace •Replace

SECTION8 MAST

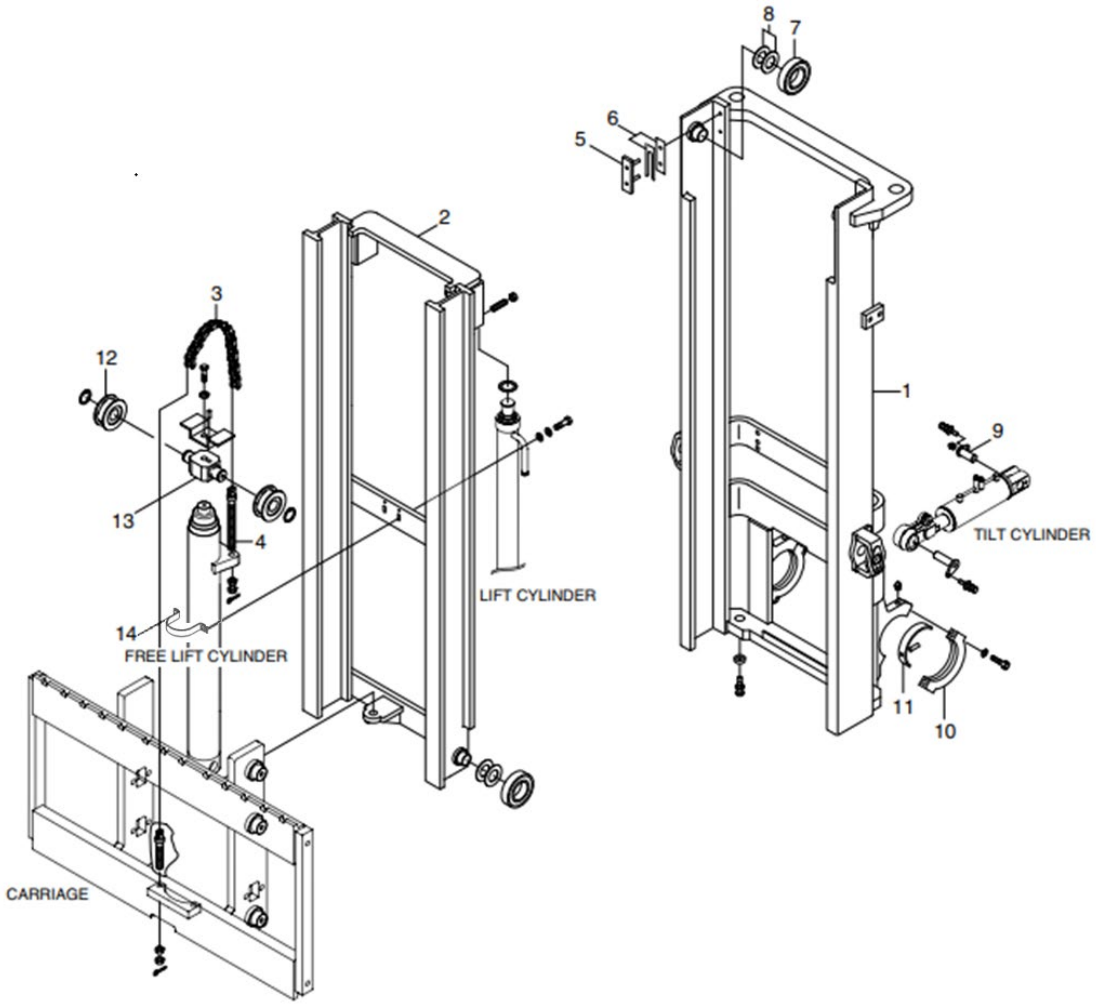
GROUP1 STRUCTURE

1 2 STAGE MAST (V MAST)



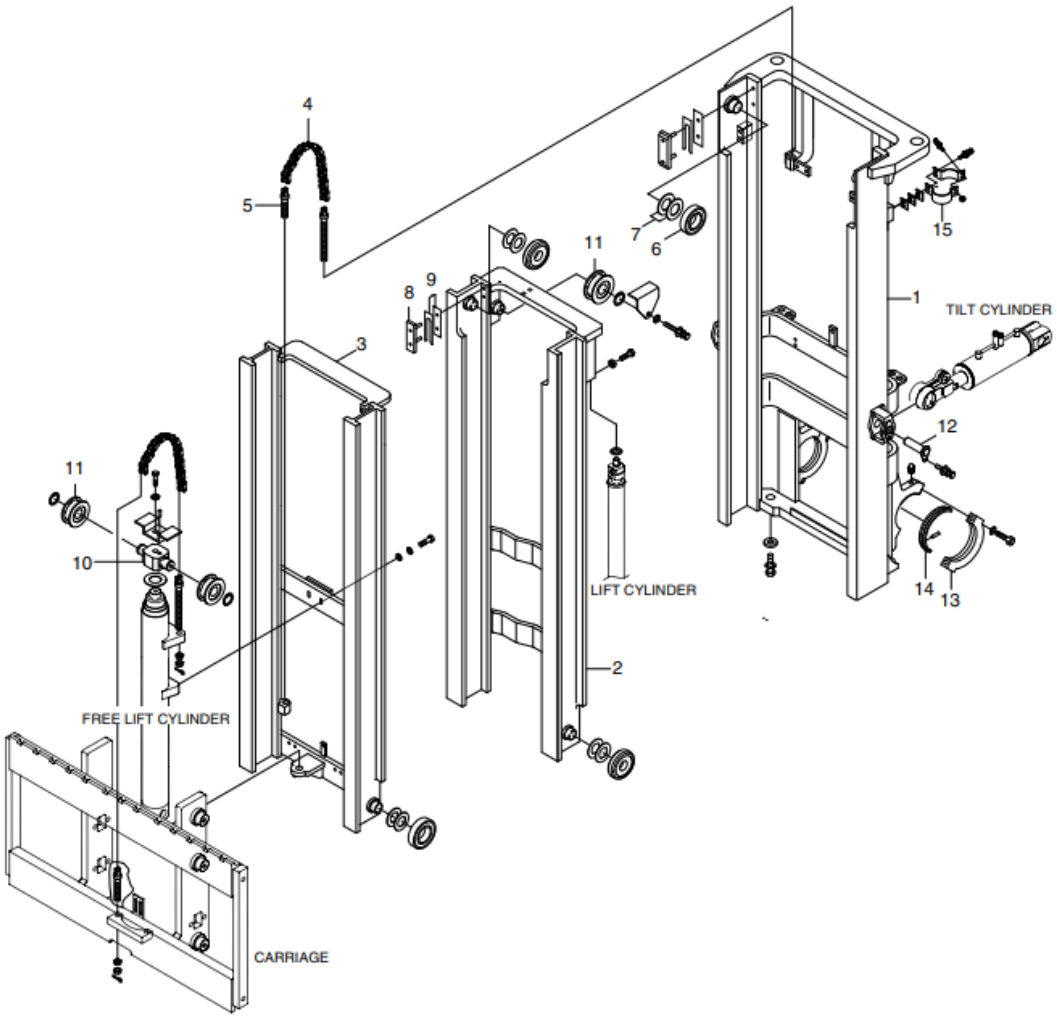
1	Outer mast	6	Anchor bolt	10	Trunnion cap
2	Inner mast	7	Chain wheel bearing	11	Bushing
3	Roller	8	Retaining ring	12	Roller
4	Shim (0.5, 1.0t)	9	Tilt cylinder pin	13	Shim (0.5, 1.0t)
5	Chain				

2 2 STAGE MAST (VF MAST)



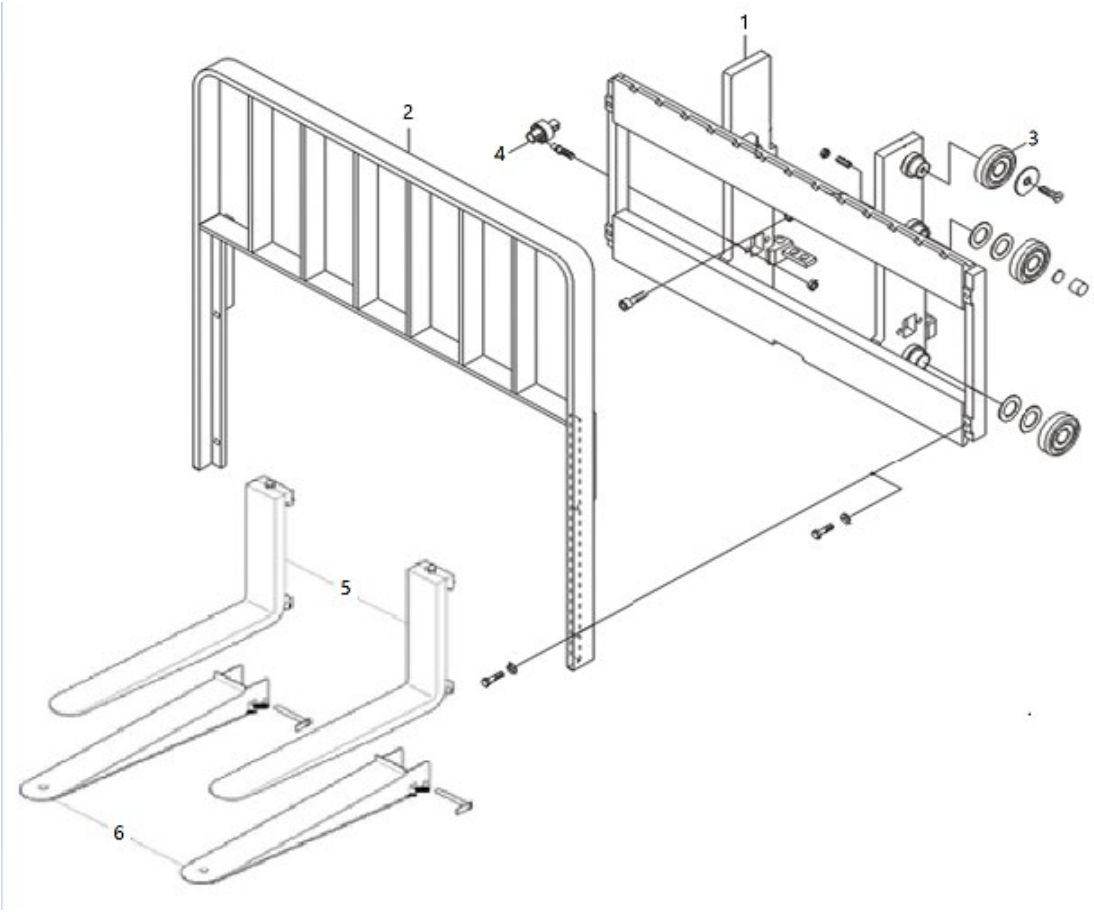
1	Outer mast	6	Shim (0.5, 1.0t)	11	Bushing
2	Inner mast	7	Roller	12	Sheave
3	Chain	8	Shim (0.5, 1.0t)	13	Sheave bracket
4	Anchor bolt	9	Tilt cylinder pin	14	Clamp
5	Back up liner	10	Support cap		

3 3 STAGE MAST (TF MAST)



1	Outer mast	6	Roller	11	Sheave
2	Middle mast	7	Shim (0.5, 1.0t)	12	Tilt cylinder pin
3	Inner mast	8	Back up liner	13	Support cap
4	Chain	9	Shim (0.5, 1.0t)	14	Bushing
5	Anchor bolt	10	Sheave bracket	15	Clamp

4 CARRIAGE, BACKREST AND FORK

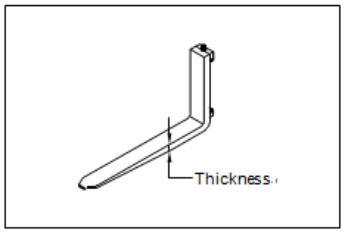


1	Backrest	3	Load roller	5	Fork assembly
2	Carriage	4	Side roller	6	Extension fork

GROUP2 OPERATIONALCHECKS AND TROUBLESHOOTING

1 OPERATIONAL CHECKS

1) FORKS



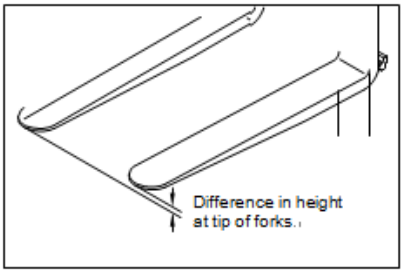
① Measure thickness of root of forks and check that it is more than specified value.
EX: ℓ=1050mm(41.3in)

mm(in)

STD Fork assy	Applicable mode	Standard	Limit
64HN-21030	25LE-7U	45(1.8)	40(1.6)
64HN-31020	30LE-7U	45(1.8)	40(1.6)
64HN-31020	35LE-7U	45(1.8)	40(1.6)

② Set forks in middle and measure difference in height at top of forks.

Model	Fork length (mm)	Height difference(mm)
25LE-7U,	900~1800	3
30LE-7U,	900~1150	3
35LE-7U,	1150~1800	6



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 2.0mm(0.08in)
•Left-to-right clearance: Within 2.5mm (0.10in)

③ Check that there is an oil groove in bushing at mast support.

④ Set mast vertical, raise forks about 10cm from ground, and push center of lift chain with finger to check for difference in tension.
If there is any difference in tension, adjust chain stopper bolt.

⑤ Check visually for abnormalities at thread of chain anchor bolt, and at contact surface between chain wheel and chain.
Rotate chain wheel by hand and check for any play of bearing.

2 TROUBLESHOOTING

1) MAST

Problem	Cause	Remedy
Forks fail to lower.	•Deformed mast or carriage.	•Disassemble, repair or replace.
Fork fails to elevate	•Faulty hydraulic equipment. •Deformed mast assembly.	•See troubleshooting hydraulic pump and cylinders in section 6, hydraulic system. •Disassemble mast and replace damaged parts or replace complete mast assembly.
Slow lifting speed and insufficient handling capacity.	•Faulty hydraulic equipment. •Deformed mast assembly.	•See troubleshooting hydraulic pump and cylinders in section 6, hydraulic system. •Disassemble mast and replace damaged parts or replace complete mast assembly.
Mast fails to lift smoothly.	•Deformed masts or carriage. •Faulty hydraulic equipment. •Damaged load and side rollers. •Unequal chain tension between LH & RH sides. •LH & RH mast inclination angles are unequal. (Mast assembly is twisted when tilted)	•Disassembly, repair or replace. •See Troubleshooting Hydraulic Cylinders, pump and control valve in section 6, hydraulic system. •Replace. •Adjust chains. •Adjust tilt cylinder rods.
Abnormal noise is produced when mast is lifted and lower- ed.	•Broken load roller bearings. •Broken side roller bearings. •Deformed masts. •Bent lift cylinder rod. •Deformed carriage. •Broken sheave bearing.	•Replace. •Replace. •Disassemble, repair or replace. •Replace. •Replace. •Replace.
Abnormal noise is produced during tilting operation.	•Insufficient lubrication of anchor pin, or worn bushing and pin. •Bent tilt cylinder rod.	•Lubricate or replace. •Replace.

2) FORKS

<table>
<tr><th>Problem</th><th>Cause</th><th>Remedy</th></tr>
<tr><td>Abrasion</td><td>Long-time operations cause the fork to wear and reduces the thickness of the fork. Inspection for thickness is needed.
•Wear limit: Must be 90% of fork thickness</td><td>If the measured value is below the wear limit, replace fork.</td></tr>
<tr><td>Distortion</td><td>Forks are bent out of shape by a number of reasons such as overloading, glancing blows against walls and objects, and picking up load unevenly.
<table>
<tr><th>Fork length（mm）</th><th>Height difference（mm）</th></tr>
<tr><td>Equal or below 1500</td><td>3</td></tr>
<tr><td>Above 1500</td><td>4</td></tr>
</table></td><td>If the measured value exceeds the allowance, replace fork.</td></tr>
<tr><td>Fatigue</td><td>Fatigue failure may result from the fatigue crack even though the stress to fork is below the static strength of the fork. Therefore, a daily inspection should be done.
•Crack on the fork heel.
•Crack on the fork weldments.</td><td>Repair fork by expert. In case of excessive distortion, replace fork.</td></tr>
</table>

GROUP3 ADJUSTMENT

1 MAST LOAD ROLLER (V, VF MAST)

1) INNER/OUTERMASTROLLER CLEAR-ANCE ADJUSTMENT

① Measure the clearance with the mast overlap at near 480mm.

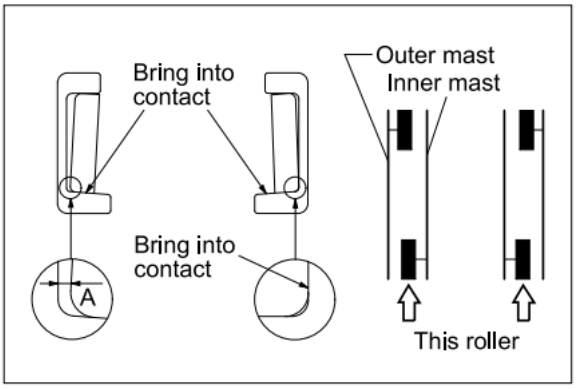
② Shift the inner mast to one side to bring the roller into contact with the outer mast, and adjust the clearance between the roller side face and mast at the closest position on the opposite side to the following value by inserting the inner/outer mast roller shim.

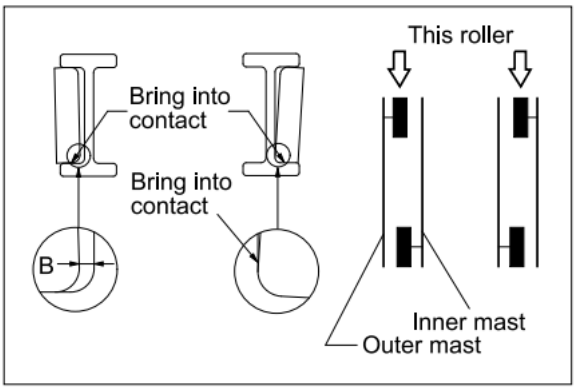
•Standard clearance A, B = 0~0.6mm

•Shim thickness 0.5, 1.0mm

③ Distribute the shim thickness equally to the left and right roller. Refer to Mast load roller and back up liner, removal and Installation.

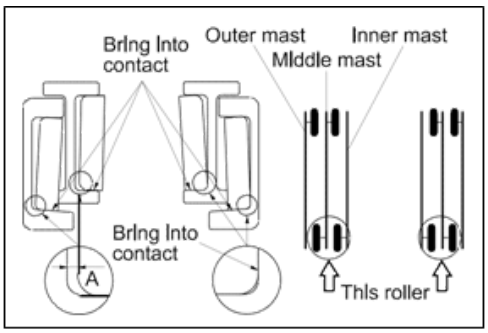
④ After the adjustment, check that the inner mast moves smoothly in the outer mast.





2 MAST LOAD ROLLER (TF MAST)

1) INNER AND MIDDLE MAST ROLLER CLEARANCE ADJUSTMENT



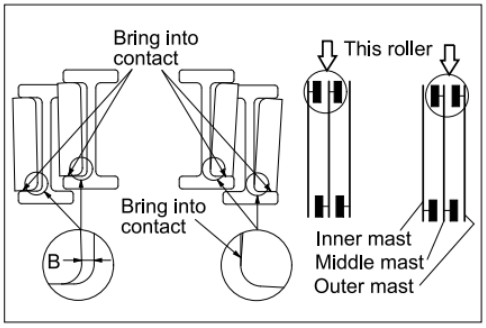
① Measure the clearance with the mast overlap at near 480mm.

② Shift the inner mast to one side to bring the roller into contact with the outer mast and the middle mast, and adjust the clearance between the roller side face and mast at the closest position on the opposite side to the following value by inserting the inner and middle mast roller shim, respectively.
- •Standard clearance A = 0~0.6mm
- •Shim thickness 0.5, 1.0mm

③ Distribute the shim thickness equally to the left and right roller. Refer to Mast load roller and back up liner, removal and Installation.

④ After the adjustment, check that the inner mast moves smoothly in the middle mast, and the middle mast moves smoothly in the outer mast.

2) OUTER AND MIDDLE MAST UPPER ROLLER CLEARANCE ADJUSTMENT.



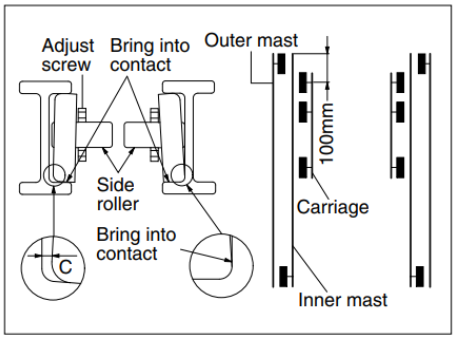
① Measure the clearance with the mast overlap at near 480mm.

② Shift the inner mast to one side to bring the roller into contact with the outer mast and the middle mast, and adjust the clearance between the roller side face and mast at the closest position on the opposite side to the following value
by inserting the outer and middle mast roller shim, respectively.
- •Standard clearance B = 0~0.6mm
- •Shim thickness 0.5, 1.0mm

③ Distribute the shim thickness equally to the left and right roller. Refer to Mast load roller and back up liner, removal and installation.

④ After the adjustment, check that the inner mast moves smoothly in the middle mast, and the middle mast moves smoothly in the outer mast.

3) CARRIAGE LOAD ROLLER



① Measure the clearance when the center of the carriage upper roller is 100mm from the top of the inner mast.

② Measure the clearance at upper, middle and lower rollers after loosen the adjust screws from the side rollers. Shift the carriage to one side to bring the roller into contact with the inner mast, and measure the clearance between the roller side face and mast at the closest position on the opposite side to the following value by inserting the carriage roller shim.

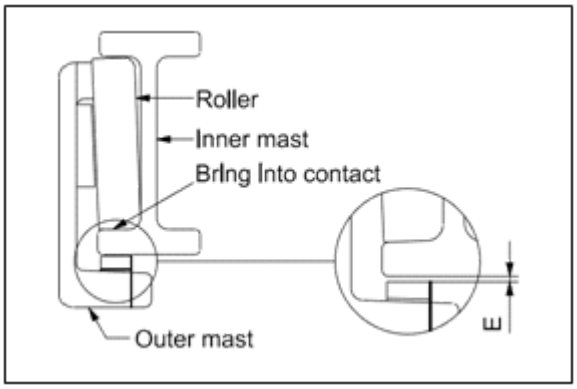
•Standard clearance C = 0~0.6mm

•Shim thickness 0.5, 1.0mm

③ Distribute the shim thickness equally to the left and right roller. Refer to Carriage assembly.

④ After the adjustment, the carriage should move smoothly along the overall mast

4) MAST BACK UP LINER



① Measure the clearance with the middle mast at the bottom position.

② With the middle mast in contact with the outer mast roller, adjust the clearance between the mast back up liner and middle mast to the following value by inserting the back up liner shim.

•Standard clearance

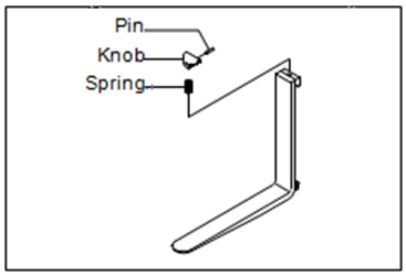
E = 0.2 ~ 0.6mm

•Shim thickness 0.5, 1.0mm

③ After the adjustment, the mast should move smoothly.

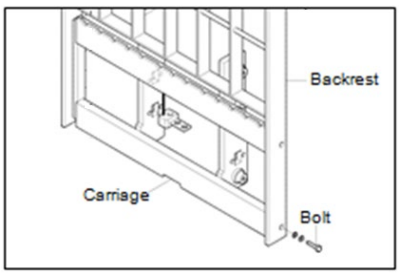
GROUP4 REMOVAL AND INSTALLATION

1 FORKS



1) Lower the fork carriage until the forks are approximately 25mm(1inch) from the floor.
2) Turn knob up and slide forks, one by one, toward the center of the carriage where a notch has been cut in the bottom plate for easy removal.
3) Remove the fork one by one. On larger Fork sit may be necessary to use a block of wood.
4) Reverse the above procedure to install load forks.

2 BACKREST



1) Remove bolts securing backrest to fork carriage. Lift backrest straight up and remove from carriage.
2) Position backrest on carriage and lower in place. Install and tighten bolts.

3 CARRIAGE ASSEMBLY

1) CARRIAGE

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

② While supporting lift chains, remove the split pin and slide out chain anchor pins from the chain anchors of stationary upright.

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

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

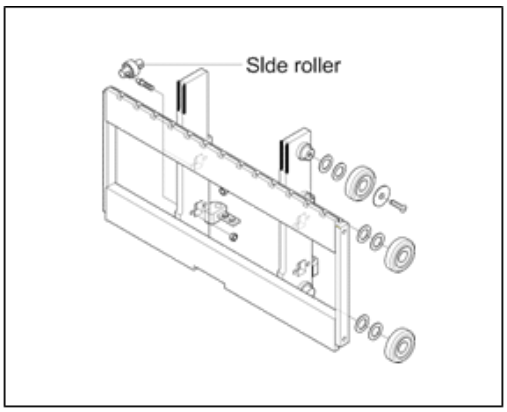
⚠ Make sure carriage remains on floor and does not bind while mast is being raised.

⑤ Inspect all parts for wear or damage. Replace all worn or damaged pars.

⑥ Reverse the above steps to reinstall.

⚠ Replace the split pin of chain anchor with new one.

2) SIDE ROLLER

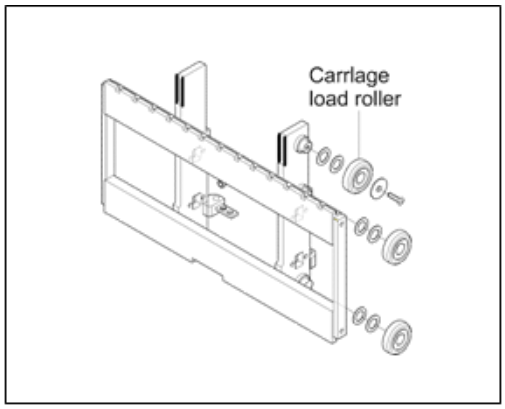


① Remove carriage as outlined in the carriage assembly and removal paragraph.
② Loosen and remove nuts, adjust screws and side rollers from carriage side pate.
③ Thoroughly clean, inspect and replace all worn or damaged parts.
④ Reverse the above procedure to assembly.

※ Adjustment

• Once carriage is properly installed, loosen nuts and adjust screws, (if not already done) allowing carriage to be centered in the inner mast.
• Adjust side roller by tightening screw until side roller just makes contact with mast.
Back off approximately 1/10 turn on screw and tighten nut to lock screw in place.
• Run carriage up and down for the inner mast to be sure the carriage has free movement and does not stick.
Also, make sure chains are properly adjusted. Refer to chain adjustment paragraph. Make adjustment when necessary and recheck operation of carriage.

3) CARRIAGE LOAD ROLLER



① Remove carriage as outlined in the carriage assembly removal paragraph.
② Loosen and remove flat head bolts and plain washers from top load roller bracket.
③ Using a prayer, remove load rollers from load roller bracket.
④ Reverse the above procedure to assemble.
Refer to MAST ROLLER ADJUSTMENT paragraph.

MAST LOAD ROLLERANDBACK UP LINER

① 2 stage mast (V mast)

a) Remove the carriage assembly and move them to one side.

b) Loosen and remove hexagon bolts and washers securing lift cylinders to inner mast.

c) Loosen and remove hexagon bolts and nuts securing lift cylinders to inner mast.

d) Attach chains or sling to the inner mast section at top cross member. Using an overhead hoist, slowly raise the inner mast high enough to clear lift cylinder.

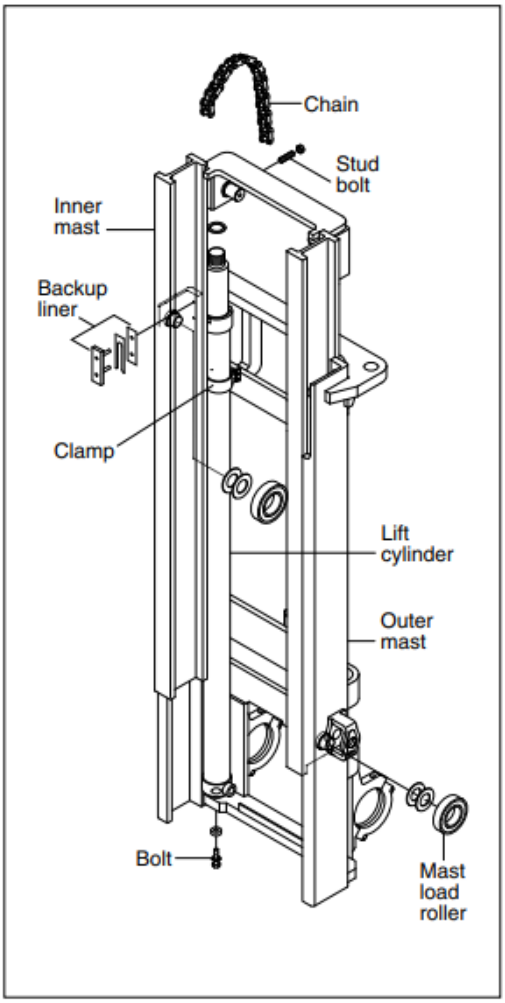
e) After lowering the lift cylinder rods, and disconnecting lift cylinder hose, tilt the lift cylinders LH and RH and them with ropes to the outer mast.

f) Using the overhead hoist, lower inner mast until top and bottom rollers and back up liners are exposed.

g) Using a prayer, remove load rollers from load roller bracket. Remove back up liners and shims.

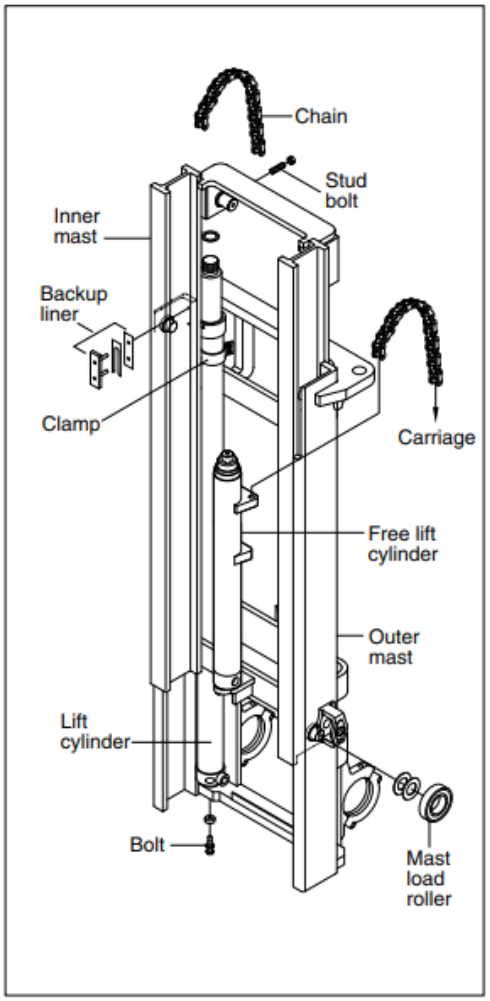
h) Thoroughly clean, inspect and replace all worn or damaged parts.

i) Reverse the above procedure to assemble. Refer to MAST LOAD ROLLERADJUSTMENT paragraph.



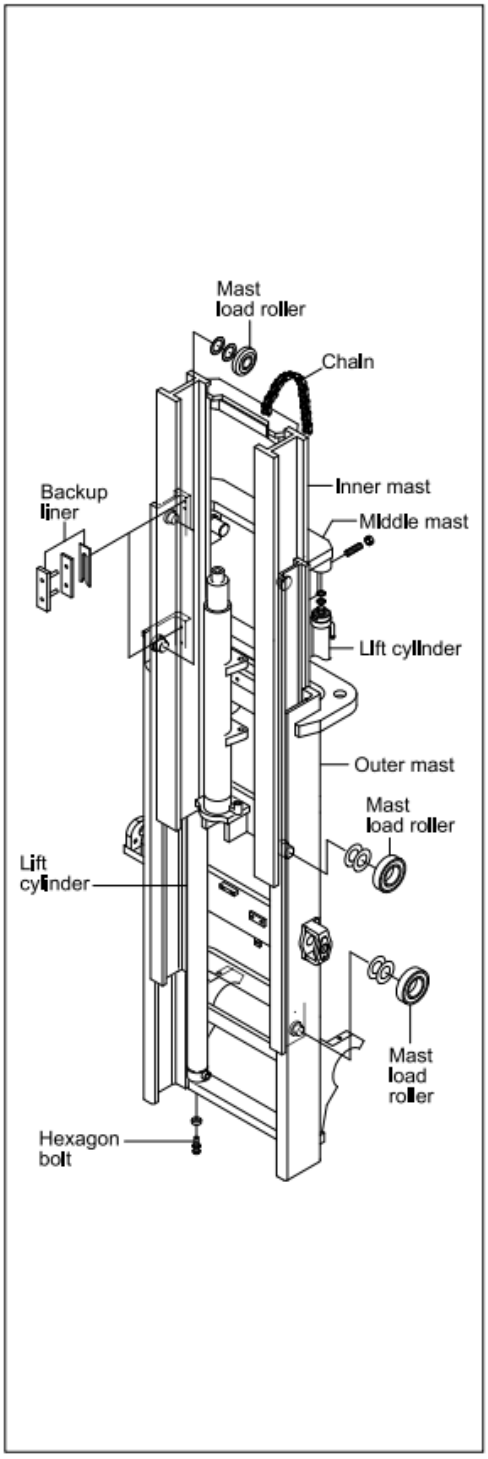
② 2 stage mast (VF mast)

a) Remove free lift chain connected between carriage and free lift cylinder.
b) Remove the carriage assembly and move them to one side.
c) Loosen and remove hexagon bolts and washers securing lift cylinders to inner mast.
d) Loosen and remove hexagon bolts and nuts securing lift cylinders to inner mast.
e) Attach chains or sling to the inner mast section at top cross member. Using an overhead hoist, slowly raise the inner mast high enough to clear lift cylinder.
f) After lowering the lift cylinder rods, and disconnecting lift cylinder hose, tilt the lift cylinders LH and RH and them with ropes to the outer mast.
g) Using the overhead hoist, lower inner mast until top and bottom rollers and back up liners are exposed.
h) Using a prayer, remove load rollers from load roller bracket. Remove backup liners and shims.
i) Thoroughly clean, inspect and replace all worn or damaged parts.
j) Reverse the above procedure to assemble. Refer to MAST LOAD ROLLER ADJUSTMENT paragraph.



③ 3 stage mast (TF mast)

a) Remove the carriage assembly and move to one side.
b) Loosen and remove hexagon bolt securing bottom cylinder from outer mast.
c) Loosen and remove bolts and special washers securing lift cylinders to middle mast.
d) Attach chains or sling to the inner and middle mast section at top cross member. Using an overhead hoist, slowly raise the uprights high enough to clear lift cylinder.
e) 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.
f) Using the overhead hoist raise inner and middle masts. Place 4-inch block of wood under the free lift cylinder bracket of the inner mast then lower mast sections (this will create slack in the chains).
g) Remove retaining rings securing chain sheaves to sheave support brackets. While support chains, remove chain sheaves and let chains hang free. The upper outer and lower middle mast rollers and back up liners are now exposed.
h) Using a prayer, remove load rollers from load bracket. Remove back up liners and shims.
i) Attach chains or sling to the middle mast section at top cross member. Using an overhead hoist, slowly raise the middle mast until top and bottom rollers are exposed.
j) Using a player, remove load rollers from load roller bracket.



k) Thoroughly clean, inspect and replace all worn or damaged parts.
l) Reverse the above procedure to assemble. Refer to MASTLOAD ROLLER ADJUSTMENT paragraph.

4) ELEVATING MAST

① Inner mast (V, VF mast)

a) After completing all necessary steps for load rollers and back up liner removal use an overhead hoist and sling or chain around upper cross member of the inner mast section.
b) Lift inner mast upright straight up and out of outer mast section.
c) Replace and reverse above procedure to install. Make all necessary measurements and adjustments.

② Inner and middle mast (TF mast)

a) After completing all necessary steps for load rollers and back up liner removal. Remove rear chains and sheave support if not already done.
b) Disconnect free lift cylinder hose. Drain hose into a suitable pan or container and cap hose.
c) While supporting free lift cylinder assembly, remove bolts and washers securing cylinder to mast cross member.
d) Place a sling around free lift cylinder and attach to an overhead hoist. Slowly raise and move cylinder to one side.
e) Attach chains or sling to the inner mast section at top cross member. Using an overhead hoist, slowly raise the upright straight up and out of middle mast section.
f) Attach chains or sling to the middle mast section at top cross member. Using an overhead hoist, slowly raise the upright straight up and out of outer mast section.
g) Replace upright and reverse above procedure to install. Make all necessary measurements and adjustments.

5) CHAIN

① Chain sheave (V, VF mast)

a) 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.

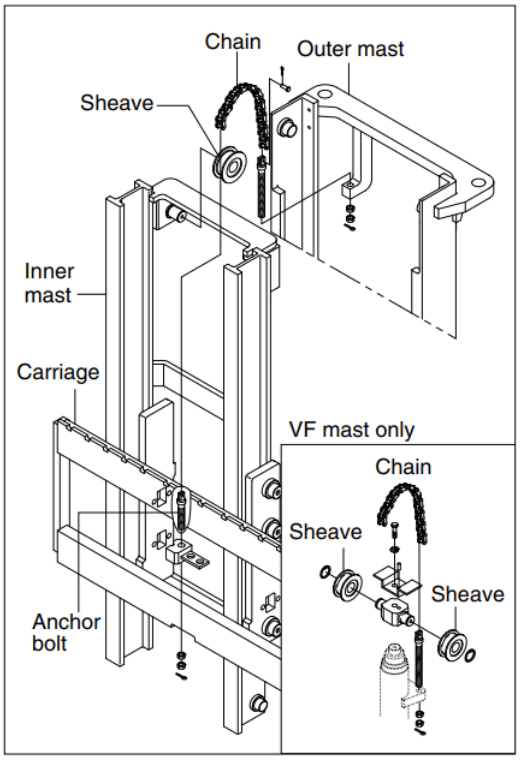
b) Remove the split pin securing the chain anchor pins and discard.
While supporting the chains, remove the chain anchor pins and drape the chains over the carriage.

c) Remove retaining ring securing sheaves to sheave support. Remove sheaves with bearings.

d) Remove bearing retaining ring from sheave and press bearings from sheaves.

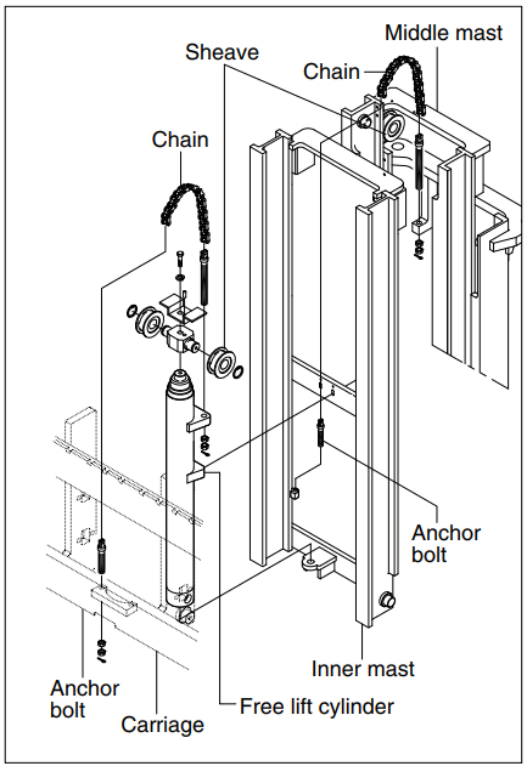
e) Thoroughly clean, inspect and replace all worn or damaged parts.

f) Reverse the above to assemble and install. Use new split pins in chain anchor pins.



② Rear chain sheave (TF mast)

a) Raise and securely block carriage and inner mast section.
b) Remove the split pin securing the chain anchor pins and discard. While supporting the chains, remove the chain anchor pins from outer mast section.
c) Remove chains.
d) Remove retaining ring securing chain sheaves to sheave support.
Pry off sheaves with bearings.
e) Remove bearing retaining ring from sheave and press bearings from sheaves.
f) Thoroughly clean, inspect and replace all worn or damaged parts.
g) Reverse the above procedure to assemble and install. Use new split pins in chain anchor pins.



③ Chain wheel bearing support (TF mast)

a) Remove the carriage assembly and move to one side.
b) After removing bolt to securing chain wheel bearing support assembly to free lift cylinder.
   After a sling to the chain wheel bearing support assembly, using an overhead hoist, lift support assembly straight up and off of free lift cylinder. Move assembly to work area.
c) Remove retaining ring securing chain wheel bearing to chain wheel bearing support.
d) Remove bearing retaining ring from chain wheel bearing and press bearings from chain wheel bearings.
e) Thoroughly clean, inspect and replace all worn or damaged parts.
f) Reverse the above procedure to install.

④ Rear chain (TF mast)

a) Remove the carriage assembly and move to one side. Refer to carriage removal and installation.
b) Raise and securely block truck approximately 6 inches from the floor.
c) 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.
d) Remove split pins and chain anchor pins securing chains to chain anchor (part of inner mast).
e) While supporting the chains, remove split and chain anchor pins securing chains to chain anchors attached to outer mast section.
f) Remove chains.
g) 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

a) 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.
b) Place a wooden block under the carriage and lower the carriage on the block.
c) While supporting the chains, remove split pins and chain anchor pins from chain anchors.
d) Remove chains and wash them with solvent. Refer to this section for Load chain inspection and maintenance.
e) 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:

a) Wear

As the chain flexes on and off the chain wheel bearings, 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.

b) 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.

c) 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.

d) Tight joints

e) 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.

f) 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.

g) 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.

h) Chain anchors and chain wheel bearings

An inspection of the chain system includes a close examination of chain anchors and chain wheel bearings. Check chain anchors for wear, breakage and misalignment.

Anchors with worn or broken fingers should be replaced. Anchors should be adjusted to eliminate twisting or other misalignment in the chain. When chain is misaligned, load is not distributed uniformly between the plates. Prolonged operation will result in premature fatigue failure. Chain wheel bearings with badly worn flanges and outside diameter should be replaced. Heavy flange wear indicates chain misalignment.

i) 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(12.7mm), 3/4(19.05mm), 1(25.4mm), 1-1/2(38.1mm), 2(50.8mm), use side A of scale.

•If pitch is 5/8(15.875mm), 1-1/4(31.75mm) or 2(50.8mm), 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

a) 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).

b) 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 chain wheel bearing. Broken, cracked or worn anchor must be replaced using the new anchor pin and split pin. Do not paint newly replaced chain after it has been installed.

c) 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.

d) 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.