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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 LPG SYSTEM
This section explains principle, component, operation and troubleshooting.
SECTION 9 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.

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

2) Convert 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
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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

Liter to U.S. Gallon 1ℓ = 0.2642 U.S.Gal

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

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

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

kgf•m to lbf•ft 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 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

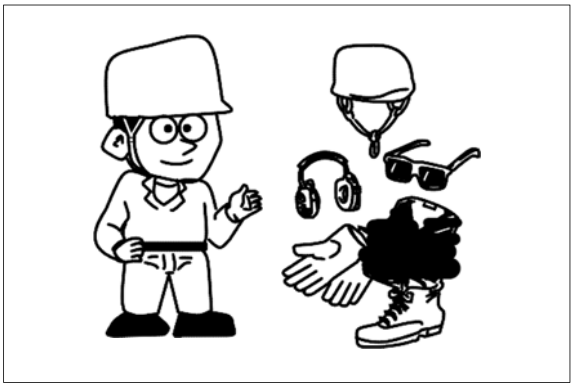
SECTION 1 GENERAL

Group 1 Safety Hints----------12-15
Group 2 Specifications----------16-23
Group 3 Periodic replacement ----------24

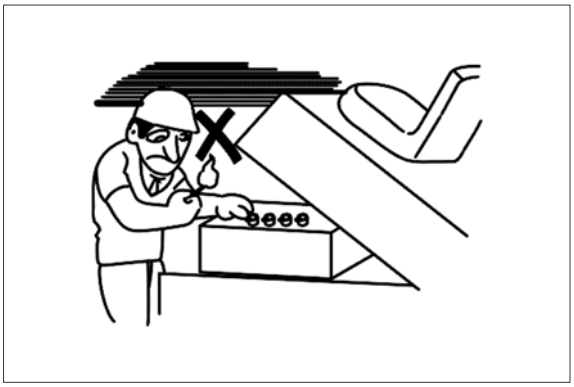
GROUP1 SAFETY HINTS

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

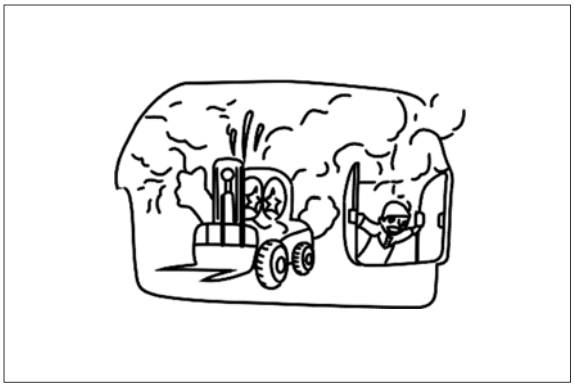
Wear well-fitting helmet, safety shoes and working clothes. When drilling, grinding or hammering, always wear protective goggles. Always do up safety clothes properly so that they do not catch on protruding parts of machines. Do not wear oily clothes.
When checking, always release battery plug.



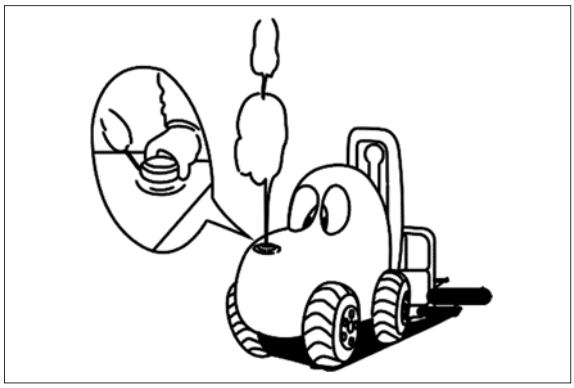
• Flames should never be used instead of lamps. Never use a naked flame to check leaks or the level of oil or electrolyte.



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



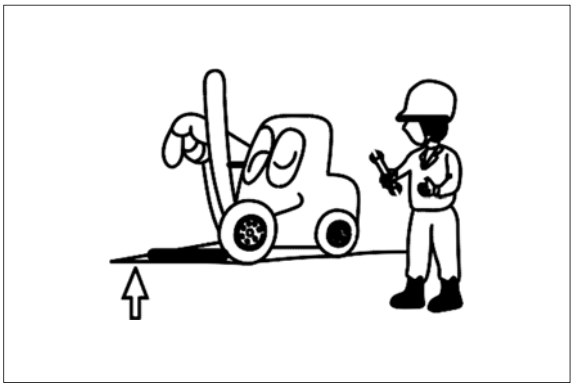
Be particularly careful when removing the radiator cap and the hydraulic oil tank filler cap, if this is done immediately after using the machine, there is a danger that boiled oil may spurt out.
• The procedure for releasing the hydraulic pressure is as follows, lower the fork to the ground, and stop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



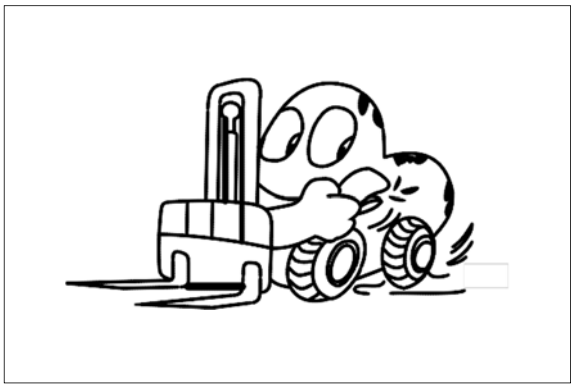
• When working on top of the machine, be careful not to lose your balance and fall.

• 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.

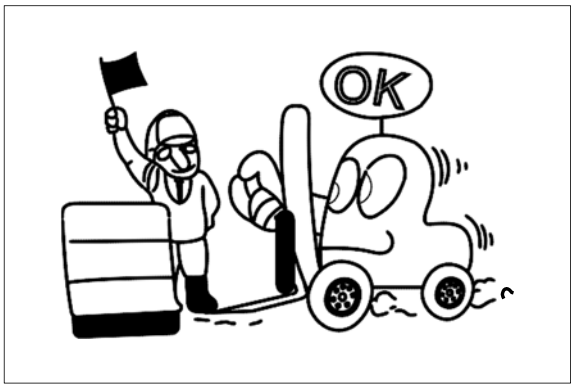
When inspecting the engine is running parts, or near such parts, always stop the engine first.
Before checking or servicing accumulator or piping, depress brake pedal repeatedly to release pressure.
• Park the machine on firm, flat ground. Lower the fork to the ground and stop the engine.
Return each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

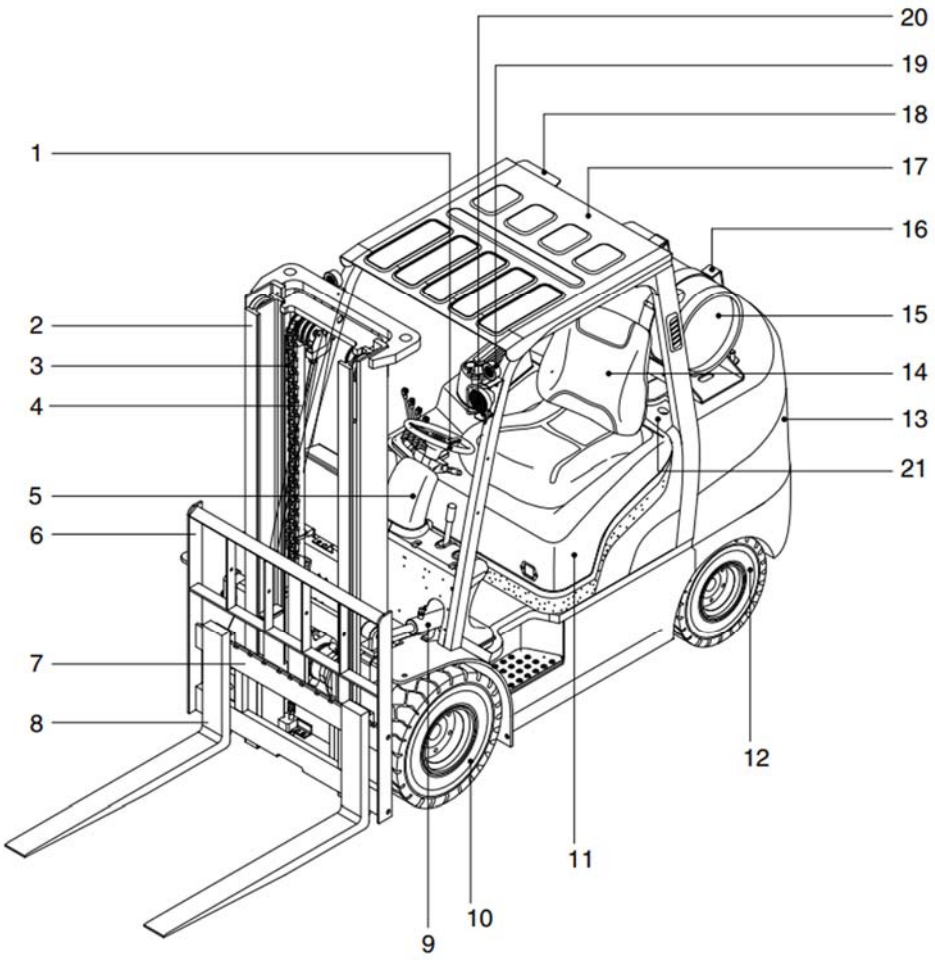
• Before draining the oil, warm it up to a temperature of 30 to 40℃.

• 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.

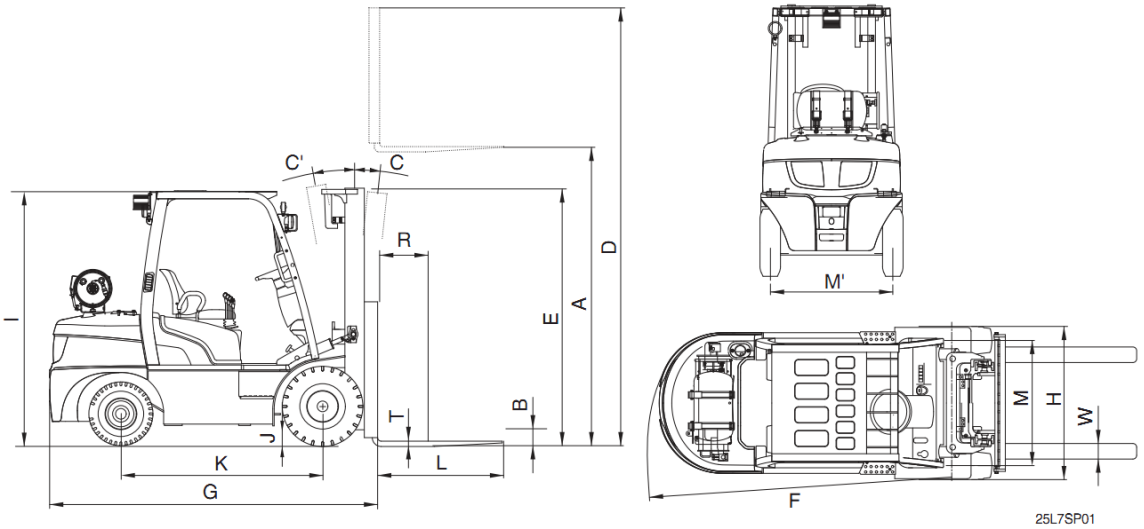
GROUP2 SPECIFICATIONS

1 GENERAL LOCATIONS



1	Steering wheel	8	Forks	15	LPG Tank
2	Mast	9	Tilt cylinder	16	Clamp
3	Lift chain	10	Front wheel	17	Overhead guard
4	Lift cylinder	11	Bonnet	18	Rear combination lamp
5	Cluster	12	Rear wheel	19	Turn signal lamp
6	Backrest	13	Counterweight	20	Head lamp
7	Carriage	14	Seat	21	Sub bonnet

2 SPECIFICATIONS



Model			Unit	25LE-7	30LE-7	35LE-7
Capacity			kg	2500	3000	3500
Load center		R	mm	500	500	500
Weight (Unloaded)			kg	3732	4139	4512
Fork	Lifting height	A	mm	3005	3005	3005
	Free lift	B	mm	155	155	155
	Lifting speed (Unload/Load)		mm/sec	550/660	450/550	450/550
	Lowering speed (Unload/Load)		mm/sec	580/460	480/350	480/350
	L×W×T	LWT	mm	1050×100×45	1050×125×45	1050×125×45
Mast	Tilt angle(forward/backward)	C/C'	degree	6/10	6/10	6/10
	Max height	D	mm	3465	3465	3465
	Min height	E	mm	2040	2040	2040
Body	Travel speed		km/h	18.5/17.4	18.5/17.4	18.5/17.4
	Gradeability		% (°)	20	20	19
	Min turning radius (Outside)	F	%	2310	2395	2430
ETC	Hydraulic oil tank		ℓ	30 (60 MAX.)	30 (60 MAX.)	30 (60 MAX.)
	Fuel tank (Gasoline)		ℓ	30 (60 MAX.)	30 (60 MAX.)	30 (60 MAX.)
Overall length		G	mm	3685	3740	3815
Overall width		H	mm	1102	1102	1102
Overhead guard height		I	mm	2170	2170	2170
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	-	GCT/GK25
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	89X100
Piston displacement	cc	2488
Compression ratio	-	8.7
Rated gross horse power	KW/rpm	35/2550
Maximum gross torque at rpm	N•m/rpm	1765/1600
Engine oil quantity	L	4.4
Dry weight	kg	245
High idling speed	rpm	2550±20
Low idling speed	rpm	850±20
Rated fuel consumption	g/kWh	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	245
Rated speed (Max/Min)	rpm	3000/400

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	mL/r	125
Back pressure	Bar	25
Input torque	N•m	1.4±0.2

5) Power train devices

Item			Specification
Torque converter	Model		YJH265
	Type		-
	Stall ratio		3.05
Transmission	Type		Power shift
	Gear shift (FR/RR)		1/1
	Adjustment		Electrical single lever type
	Gear ratio	FR	17.4972
		RR	17.4972
Axle	Type		Dry
	Gear ratio		1:1
	Gear		integrated structure type
Wheels	Q'ty (FR/RR)		Single: 2/2 Double: 4/2
	Front	2.5 TON	Single: 28×9-15-14PR
			Double: 28×9-15-14PR
		3.0~3.3 TON	Single: 28×9-15-14PR
			Double: 28×9-15-14PR
	Rear	2.5 TON	6.0-9-10PR
		3.0~3.3 TON	6.5-10-10PR
Brakes	Travel		Front wheel, dry drum brake
	Parking		Ratchet, dry drum brake
Steering	Type		Hydrostatic, power steering
	Steering angle		79°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	M14×1.5	18±2	130±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 RECOMMENDED LUBRICANTS

Service point	Kind of fluid	Capacity	Ambient temperature℃（℉）						
			-20	-10	0	10	20	30	40
			(-4)	(14)	(32)	(50)	(68)	(86)	(104)
Engine oil pan	Engine oil	6.5L	15W/40						
Torque converter transmission	transmission oil	9L	8#						
Drive Axle	Gear oil	6.5L	85/90 GL-5						
Hydraulic tank	Hydraulic oil	STD:35L OPT:40L	L-HM32						
Fuel tank	LPG	50L	LPG						
	Gasoline（Dual fuel system）	20L	92#						
Fitting (Grease nipple)	Grease		NLGI No.1						
					NLGI No.2				
Brake reservoir tank	Brake oil	0.25L	Caltex DOT3						
Radiator	Antifreeze: Water=50:50	11.1L	Ethylene glycol base permanent type						

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℃ , even if the ambient temperature in daytime is expected to rise to 10℃ or more.**

GROUP3 PERIODIC REPLACEMENT

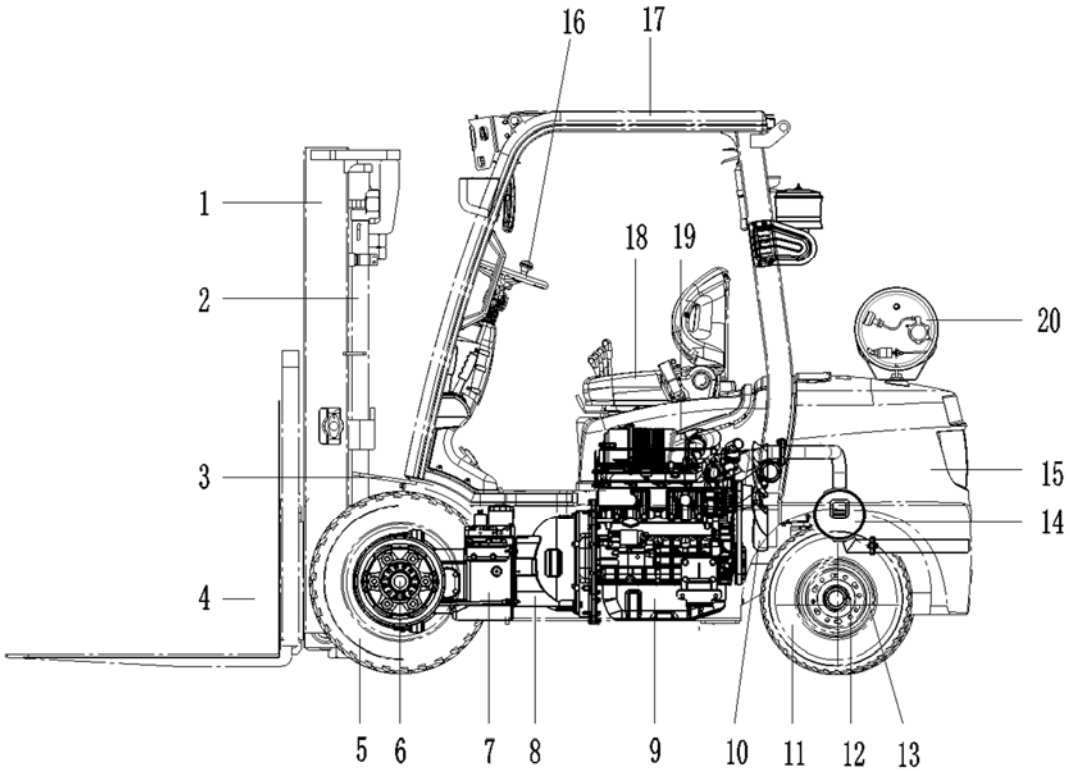
For operation safety, never fail to perform periodic maintenance or make periodic replacement of the consumable parts listed in the following.
These parts may deteriorate in time and are susceptible to wear. It is difficult to estimate the degree of wear at time of periodic maintenance; therefore, even 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

Group 1 Structure ---------- 26
Group 2 Removal and Installation of Unit ---------- 27-41

GROUP1 STRUCTURE



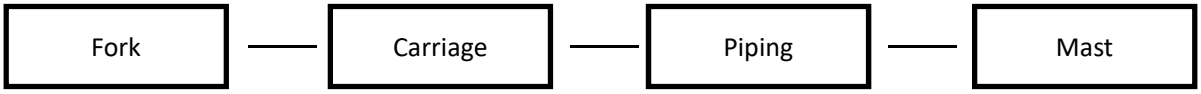
1	Mast	8	Torque converter	15	Counterweight
2	Lift cylinder	9	Engine	16	Steering wheel
3	Tilt cylinder	10	Fan	17	Overhead guard
4	Fork	11	Rear wheel	18	Seat
5	Front wheel	12	Steering cylinder	19	Air cleaner
6	Drive axle	13	Steering axle（Rear）	20	LPG tank
7	Transmission	14	Muffler		

GROUP2 REMOVAL AND INSTALLATION OF UNIT

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

1 MAST

1) REMOVAL



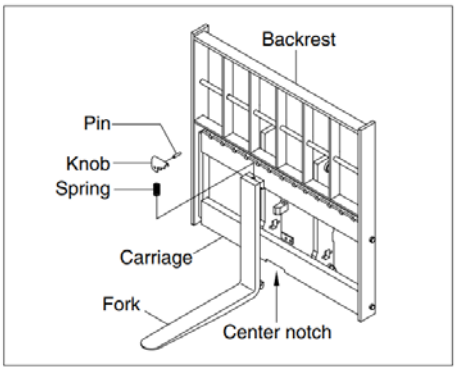
A. Forks

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.

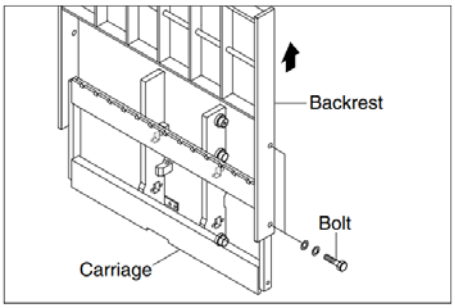
c) Remove only one fork at a time.

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



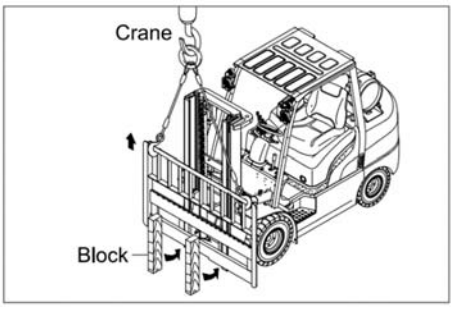
B. Backrest (If necessary)

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

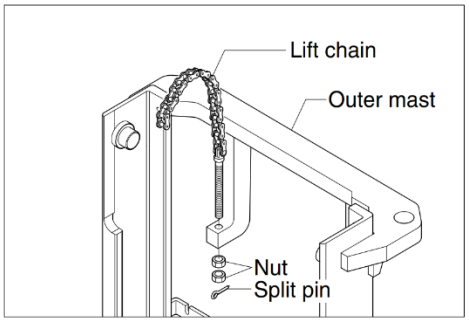


C. Carriage

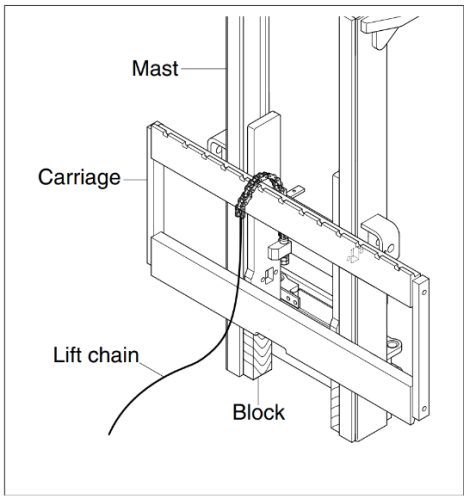
a) With the mast vertical, raise the carriage high enough to place blocks under the load forks. This is done to create slack in the load chains when the carriage is lowered. Lower the carriage all the way down to the floor. Make sure the carriage is level, this will prevent any binding when the mast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



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



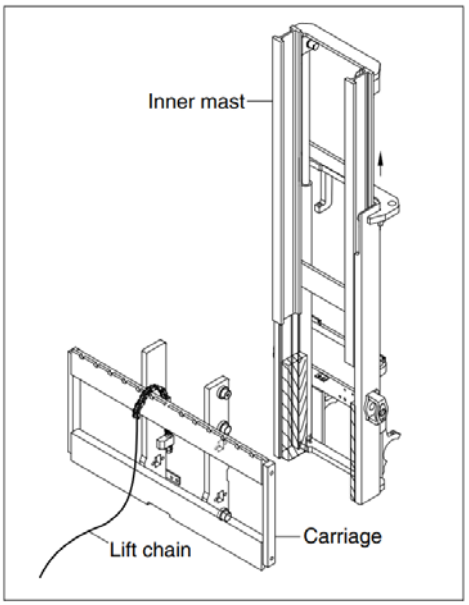
c) Pull the chains out of the sheaves and drape them over the front of the carriage



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.

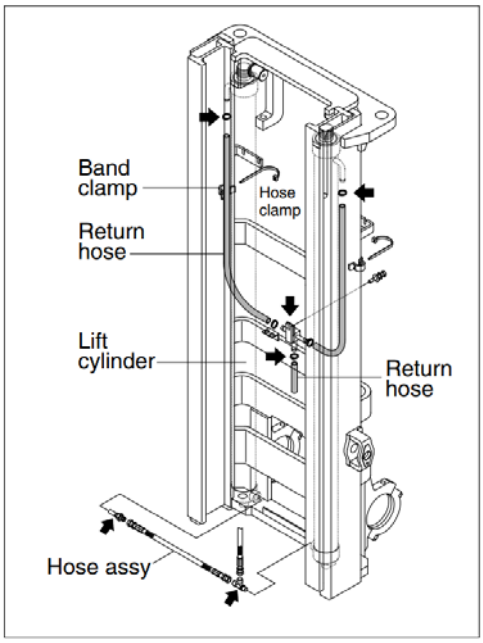


D. Piping

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

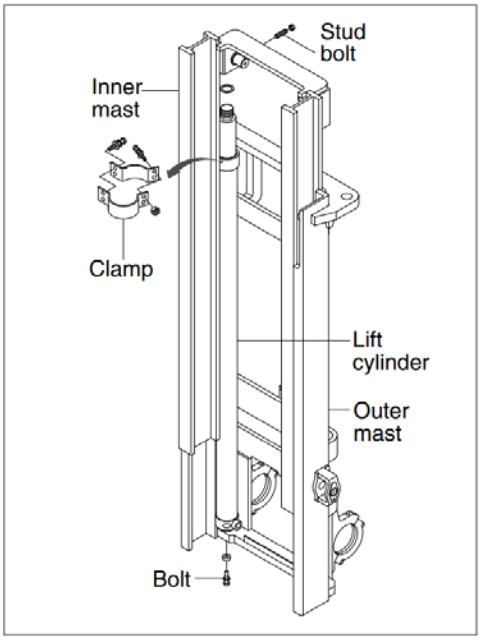
a) Loosen hexagonal bolts and remove washers securing the lift cylinders to inner mast.

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.

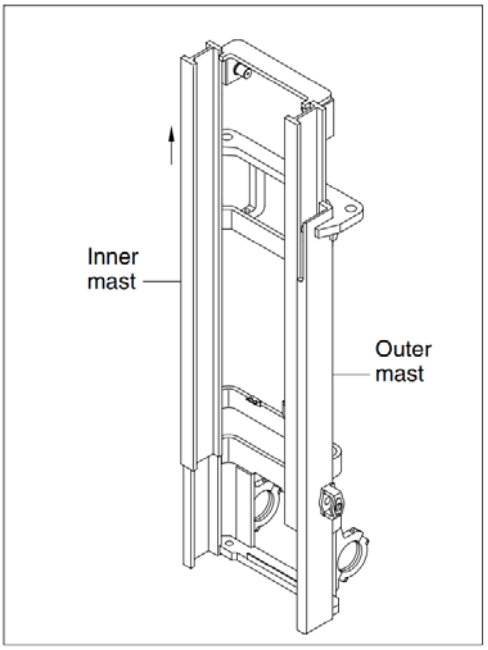
d) Using an overhead hoist, slowly raise the inner mast high enough to clear lift cylinder.

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

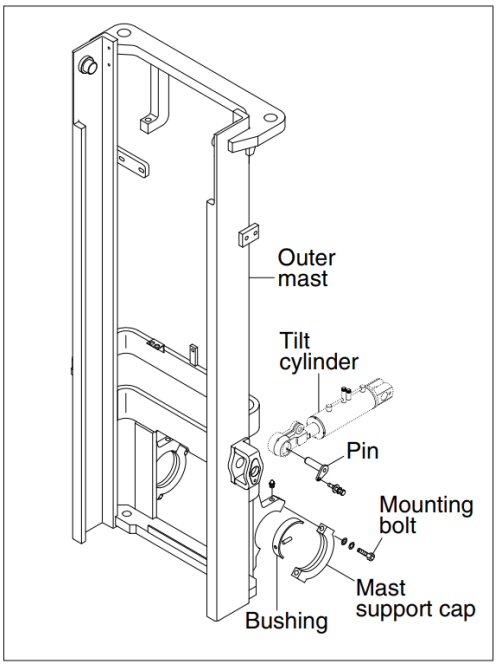
Hold the mast with a crane, remove the bolt of the pin, then remove the pin.

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

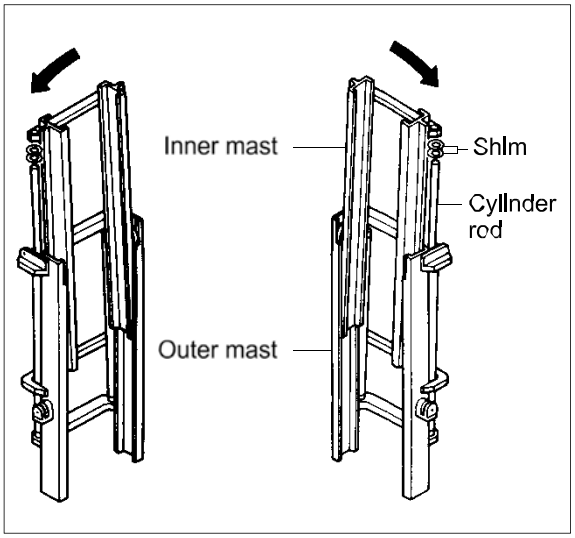
a) Assemble the lift cylinder inside the outer mast, then tighten the stopper bolt. If the cylinder assembly has been replaced, adjust as follows so that the left and right cylinders are synchronized at the maximum lifting height.

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.

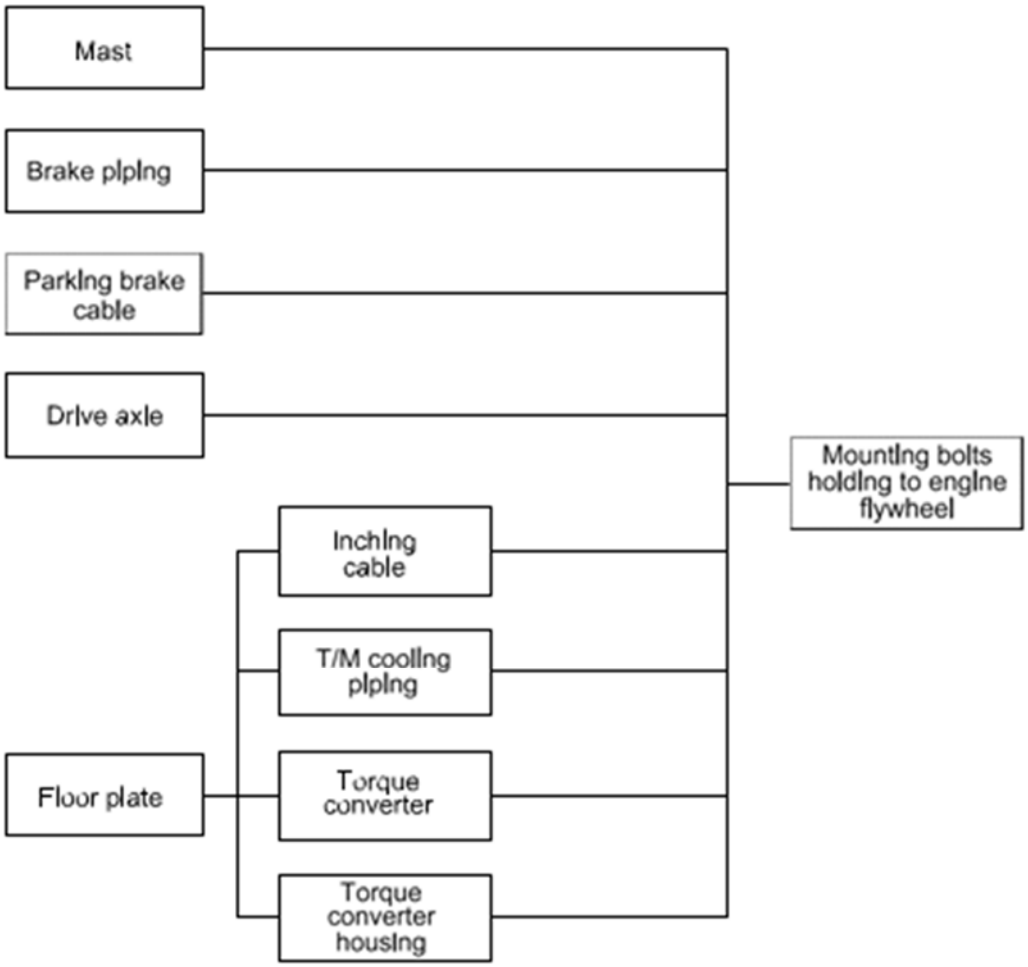
※ If play is to RIGHT, install Adjustment shim to RIGHT cylinder.

Shim thickness: 1.0mm(0.04in)



2 POWER TRAIN ASSEMBLY

1) REMOVAL

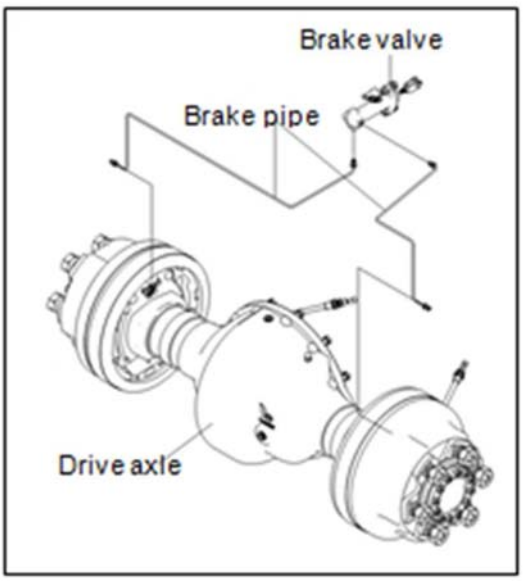


A. Mast

Refer to the chapter MAST.

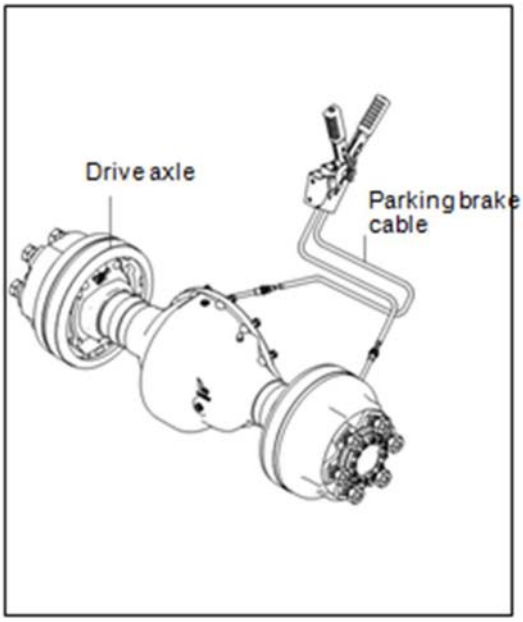
B. Brake piping

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



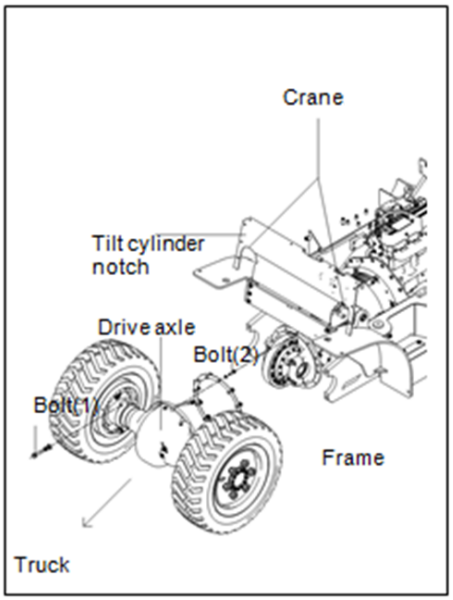
C. Parking brake cable

Disconnect parking brake cable from hand brake.



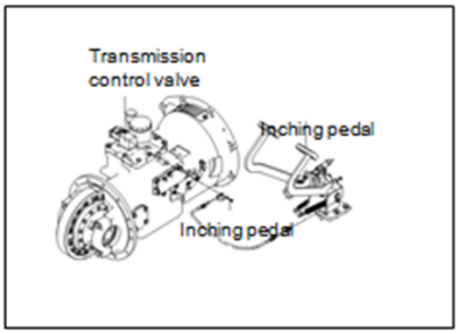
D. Drive axle

a) Attach a crane to the tilt cylinder notches on the dashboard and raise the machine.
b) Loosen hexagonal bolts (1) connection rive 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.



E. Inching linkage

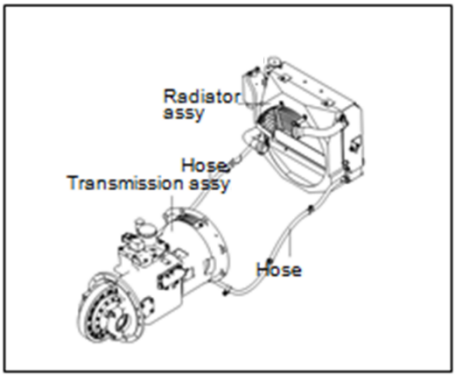
Remove the clevis pin from the transmission control valve.



F. Transmission cooling piping

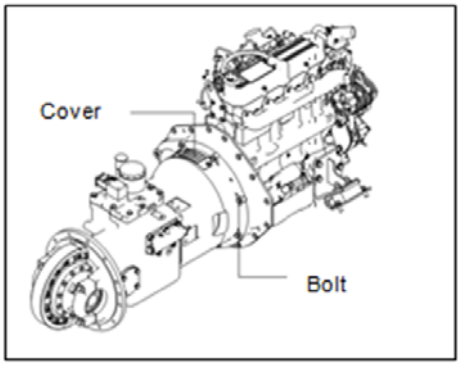
a) Disconnect cooling hose from the transmission.

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

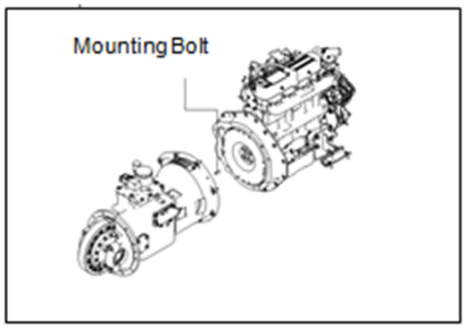


G. Transmission

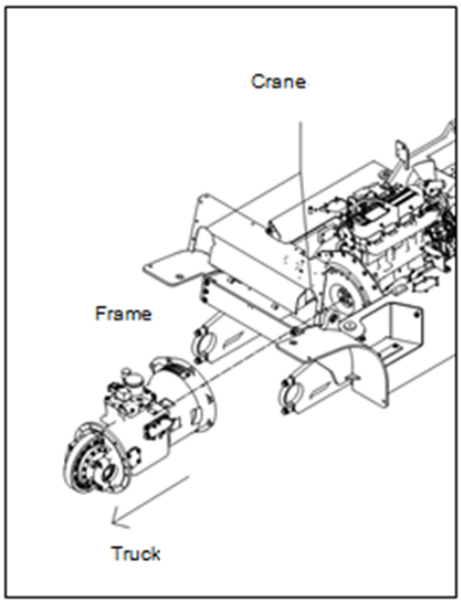
a) Remove the cover on top face of the Transmission housing then remove the 8mounting bolts installed on the engine flywheel. To rotate the flywheel, remove 1 mounting bolt, then insert a turning tool in the mounting hole. One man must turn the engine fan by hand while the other turns the flywheel.



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.

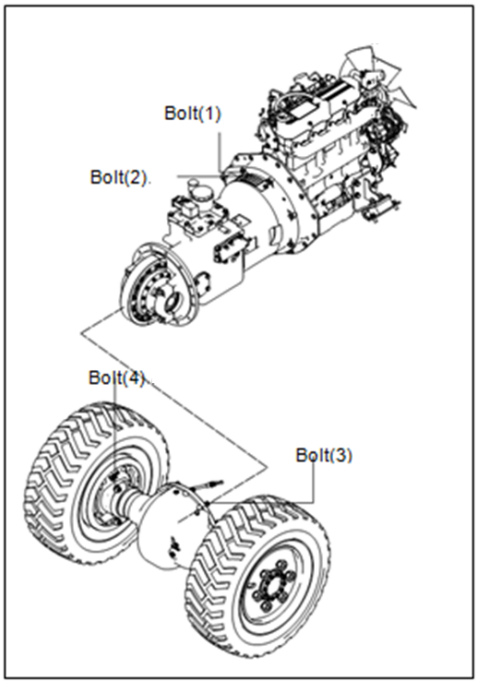
B. Tightening torque

Bolt (1) : 5.9~8.9kgf•m

Bolt (2) : 2.7~4.1kgf•m

Bolt (3) : 7.8~11.6kgf•m

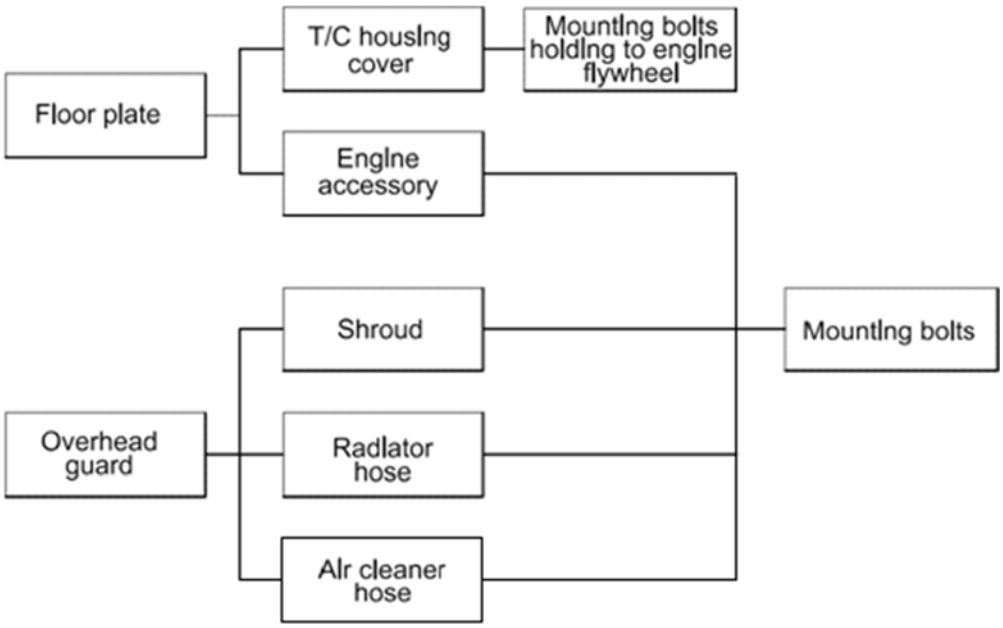
Bolt (4) : 18.9~25.2±3 kgf•m



3 ENGINE

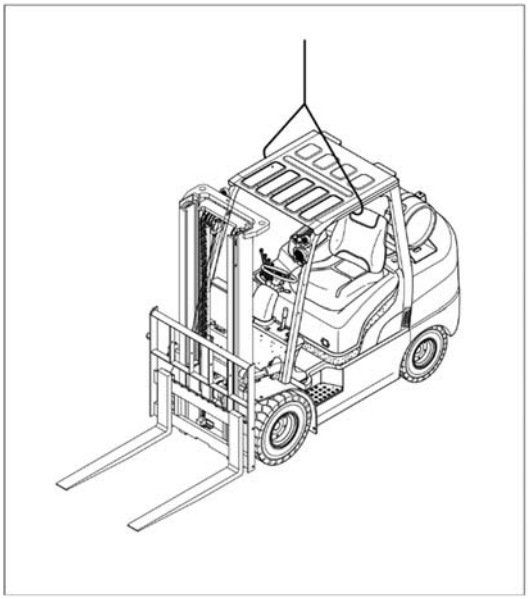
Lever the torque converter, transmission and front axle inside the frame, then remove the engine assembly.

1) REMOVAL

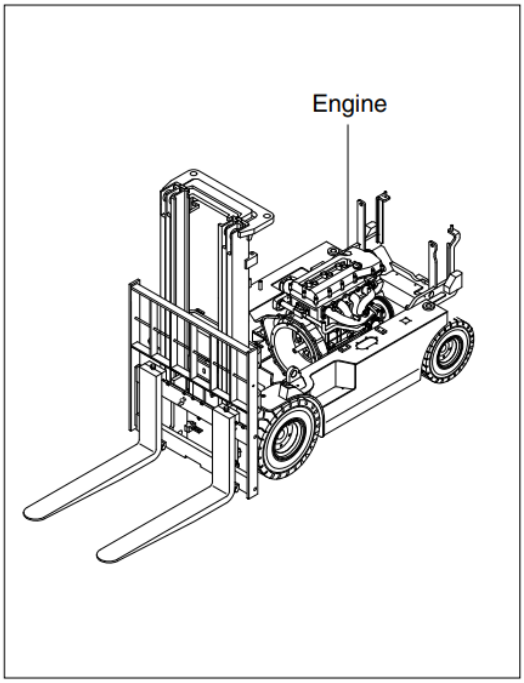


A. Overhead guard

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.



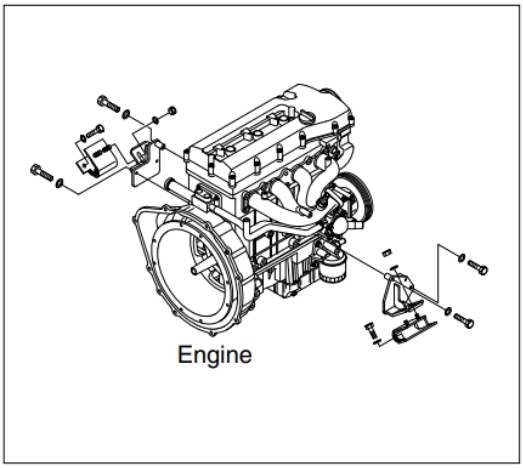
B. Engine accessory
Remove all wiring harnesses, cables and hoses around the engine, dashboard and frame.

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.

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

D. 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(39.8~60.0lbf•ft)
Bolt (2):
10~15kgf•m(72.3~108lbf•ft)
Bolt (3):
10~15kgf•m(72.3~108lbf•ft)

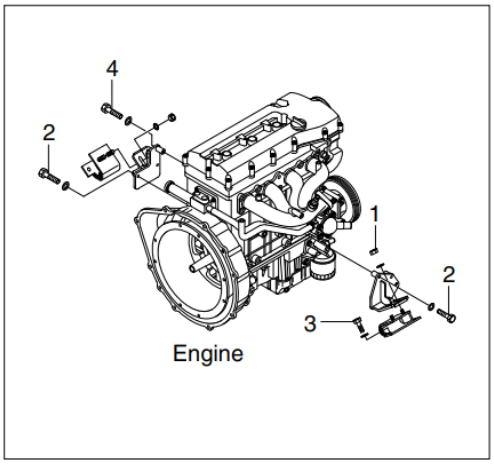
④ Tightening torque of mounting bolt installing to torque converter housing.5.5~8.3kgf•m (40~60lbf•ft)

⑤ Radiator hoses
Distance to insert hose: 40mm (1.57in)

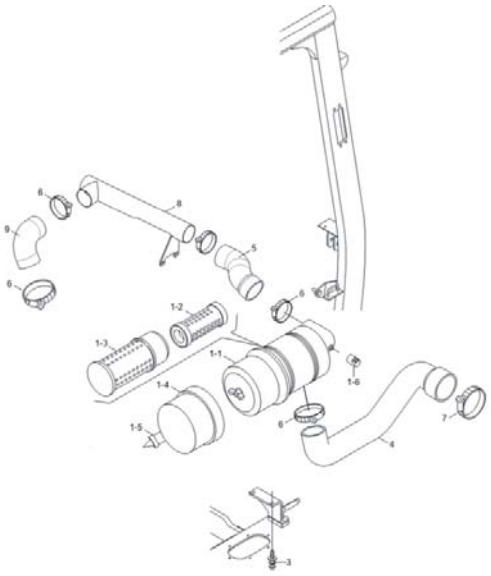
⑤ Air cleaner hose

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)



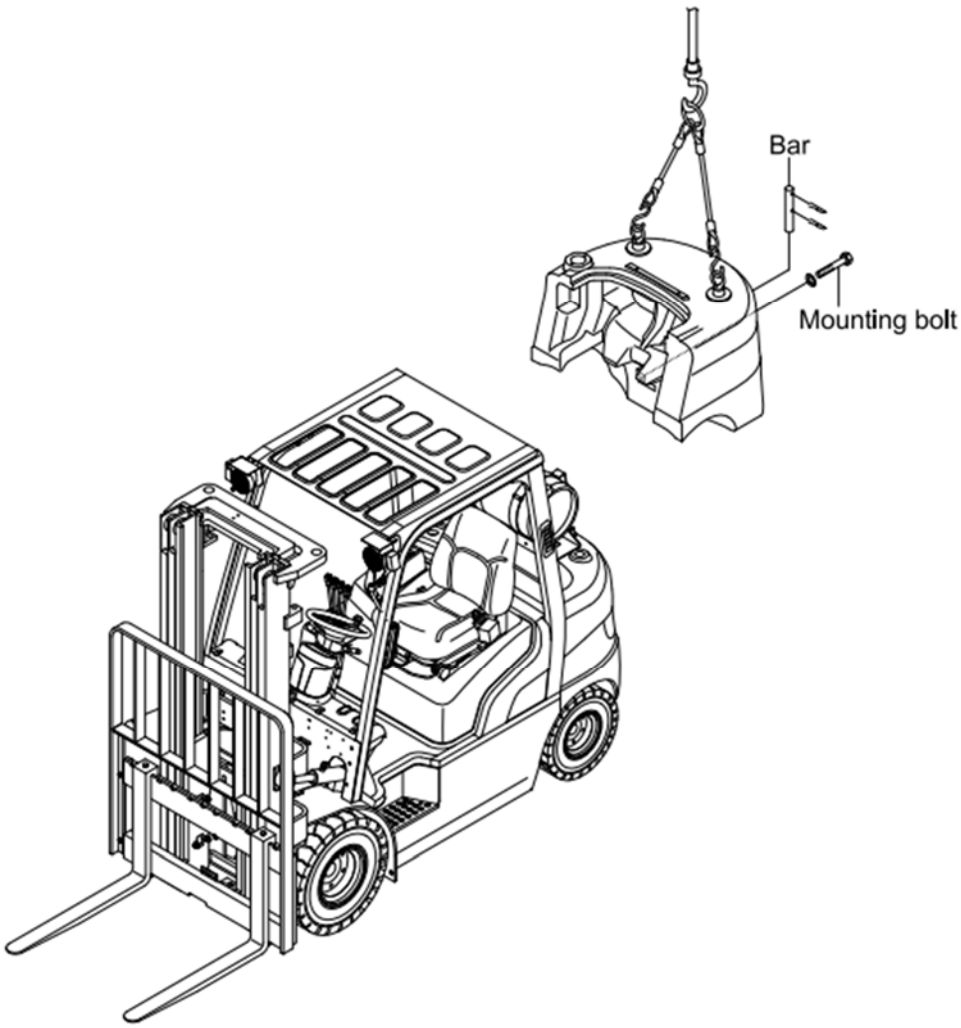
Engine



4 STEERING AXLE

1) REMOVAL

Counterweight→Rear wheel→Hose→Mounting bolt



① Counterweight

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

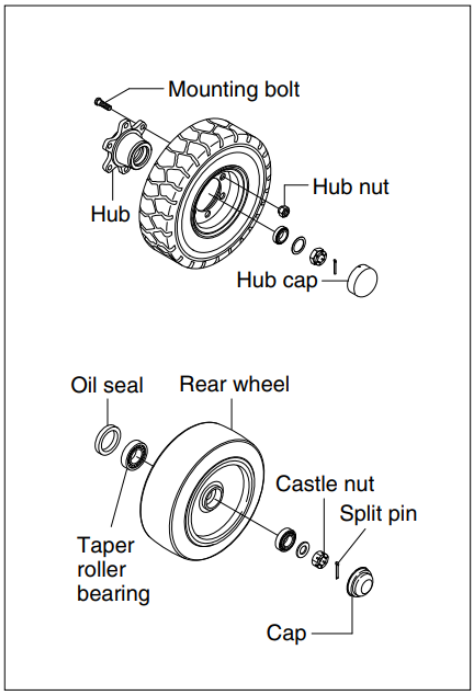
Remove the mounting bolts, raise slightly and move it slowly to rear side.

•Weight of counterweight(standard)

25LE-7	1390kg (3064lb)	30LE-7	1656kg (3651lb)
35LE-7	2031kg (4478lb)		

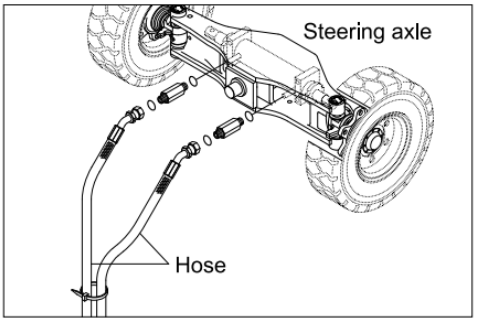
② Rear wheel

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.

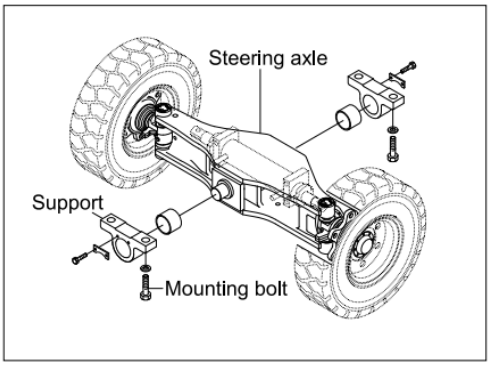


④ Mounting bolt

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.



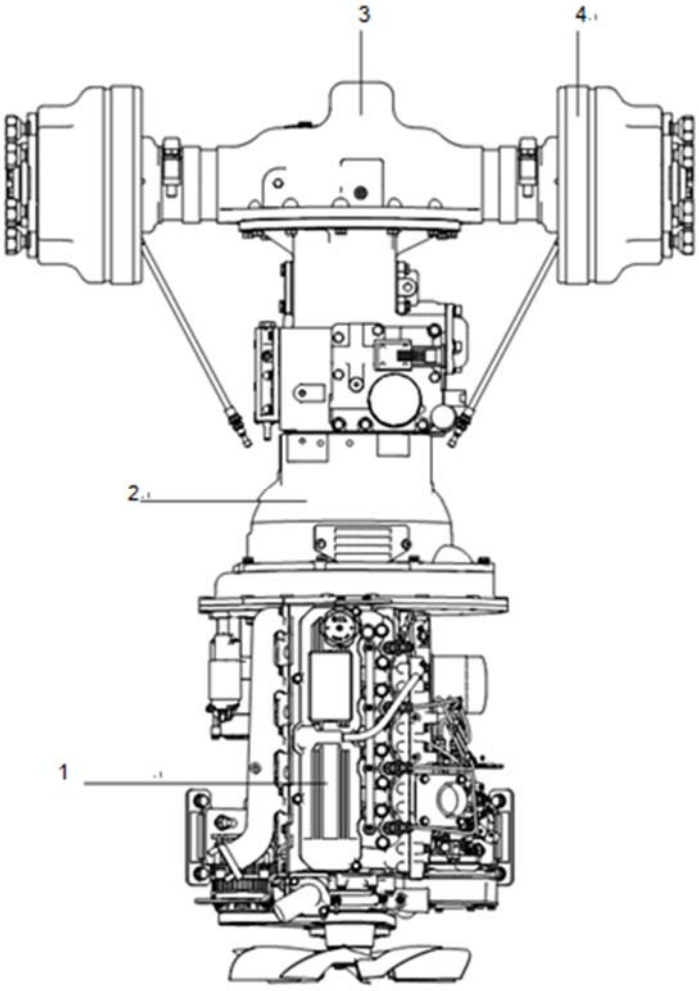
SECTION3 POWER TRAIN SYSTEM

Group 1 Structure and Operation ---------- 43-45
Group 2 Disassembly and assembly and troubleshooting---------- 46-67

GROUP1 STRUCTURE AND OPERATION

1 POWER TRAIN DIAGRAM

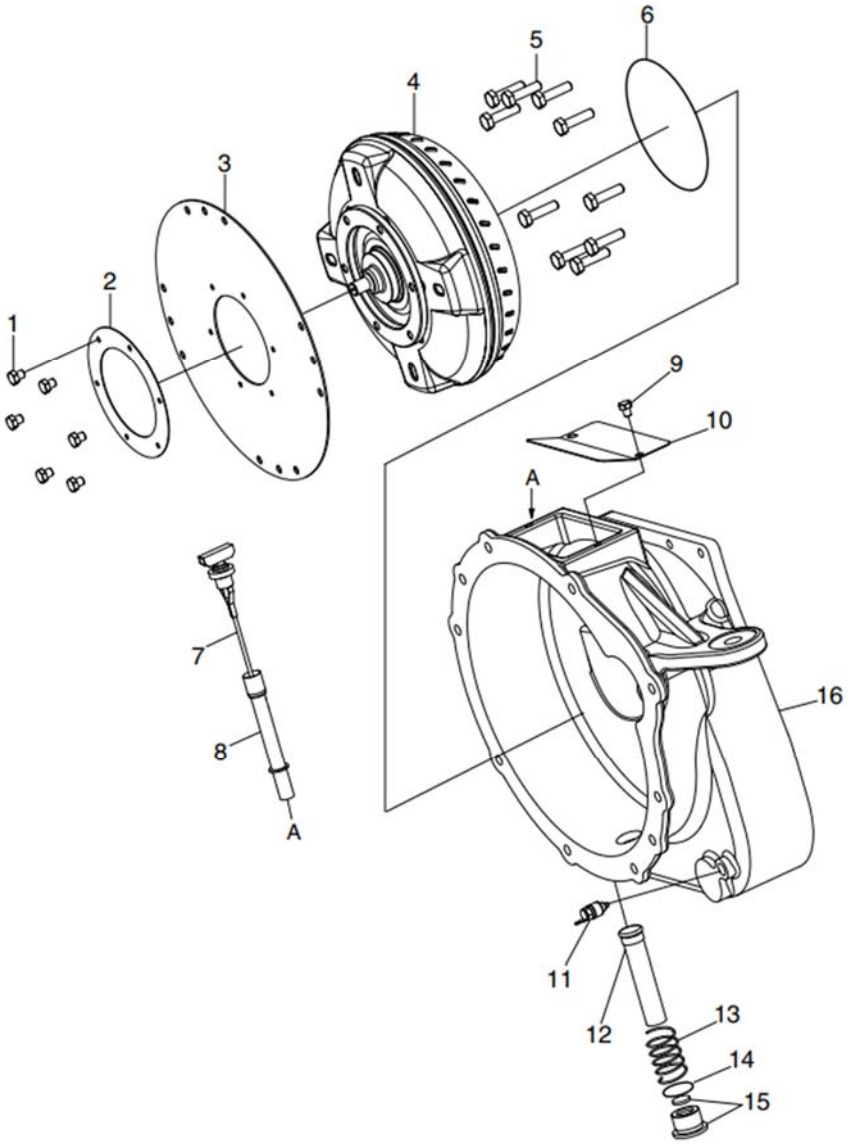
STRUCTURE



1	Engine	3	Drive axle
2	Transmission	4	Brake

2 TORQUE CONVERTER

1) STRUCTURE



1	Bolt	9	Bolt
2	Plate	10	Torque converter housing cover
3	Flexible plate	11	Temperature sensor
4	Torque converter assembly	12	Inner oil strainer
5	Bolt	13	Oil strainer spring
6	O-ring	14	O-ring
7	Oil level gauge	15	Oil strainer plug
8	Oil level gauge guide	16	Torque converter housing

2) OPERATION

A. The torque converter is connected with a flywheel by a flexible plate, engine output is delivered from the flywheel to the flexible plate.
B. The exterior of the torque converter is protected by the torque converter housing.
C. The torque converter housing forms the oil path for the oil pump, it includes the oil strainer filtering sucked oil through this oil path and the oil level gauge measuring oil level of the transmission inside.

GROUP2 DISASSEMBLY AND ASSEMBLY AND TROUBLESHOOTING

1 Parameters

Table 1 Main technical parameters of gearbox

Items		JHTY30
Matching engine rated power KW		35.3
Matching engine rated speed r/min		2250
Transmission ratio	Forward gear	17.4972
	Back gear	17.4972
Main oil pressure MPa		1.1—1.5
Torque converter inlet pressure MPa		0.3—0.7
Electrical device (voltage/power)		12V•DC/26W
Torque converter	Model	YJH265
	Effective diameter mm	265
	Torque converter coefficient at zero speed	≥3.05
	Highest efficiency	＞0.79
	Nominal torque of pump impeller under zero speed condition N•m	33±1.65
	Nominal torque of pump impeller in the highest efficiency working condition N•m	31±1
Rotation direction (facing the input end)		Clockwise
Working fluid		No. 6 and No. 8 hydraulic transmission oil
Working oil temperature ℃		80—100
Maximum working oil temperature ℃		120 (no more than 5min)
Dimensions (L×W×H) mm x mm x mm		885x470x500
Net mass kg		183

1) Maintenance and adjustment

① Oil level check

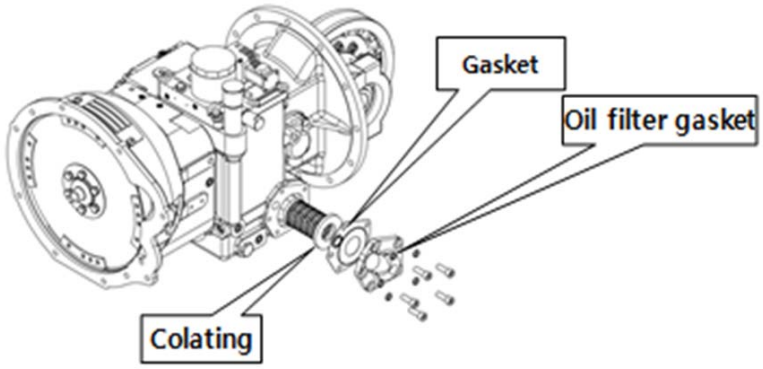
Fill in the oil and drive in neutral for 5 minutes. After turning off the engine, check the oil level of the oil dipstick. The oil should be within the specified range of the dipstick.

② Change the oil, check and clean the filter

a) Start the engine, run for about ten minutes, and then stop.

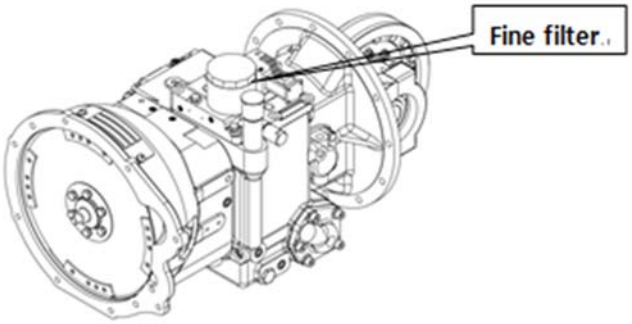
b) Remove the oil drain plug to drain the oil. Tighten the drain plug after draining the oil.

c) Remove the fixing bolts, remove the oil filter seat assembly, remove the coarse filter and clean the coarse filter with kerosene. (Note: If the paper pad is damaged during disassembly, clean up the remaining paper pad on the bonding surface and replace with a new one).



d) After cleaning, blow dry compressed air from the inner side of the coarse filter to the outer side, and install it when it is completely dry. Note: If any damage is found on the strainer, it needs to be replaced with a new strainer.

e) Remove and replace the fine filter.



f) Refill oil (perform the above 1).

g) After the new machine is used for 100 hours, the fine filter should be replaced and the coarse filter should be cleaned; the fine filter should be replaced and the coarse filter should be cleaned every 500 hours after use; the coarse filter should be replaced every 2000 hours of use.

2) Internal structure and working principle

① Working principle

a) Transmission principle

The transmission diagram of the hydraulic transmission gearbox is shown in Figure 1. The hydraulic torque converter is driven by the engine through the elastic coupling plate 1 to drive the pump wheel 4 to rotate, so that the liquid flow flows into the turbine 2 at a high speed along the direction of its blades and pushes the turbine to rotate. The guide wheel 3 causes the torque converter to generate a pitch change function, and transmits the torque to the hydraulic transmission gearbox input shaft assembly 11 through the turbine shaft. When the forward gear is engaged, the reverse clutch is idling, and the transmission sequence is piece 11 → piece 7 → piece 20 → piece 19 → piece 17 → piece 12 → piece 13 to drive the differential 15 to output. When the reverse gear is engaged, the forward clutch is idling, and the transmission sequence is piece 11 → piece 10 → piece 18 → piece 21 → piece 20 → piece 19 → piece 17 → piece 12 → piece 13 to drive the differential 15 to output. The forward and reverse clutches are controlled by the shift control valve. The oil pump 6 is an internal gear pump, which is driven by the engine through the diameter of the pump wheel. The oil pump provides pressure oil to the system. After the hydraulic torque converter works, the oil enters the radiator on the vehicle, and then enters the gearbox to lubricate the friction plates, bearings and gear.

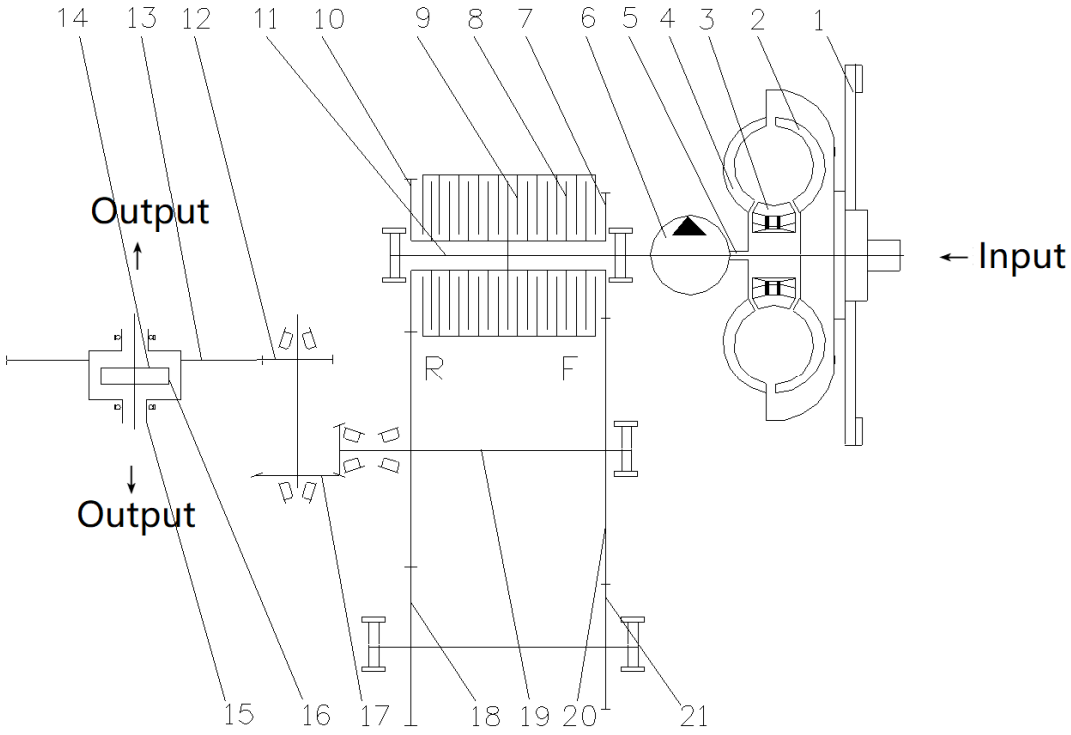


Figure 1 The schematic diagram of JHTY30B hydraulic transmission gearbox

1	Elastic coupling plate	8	friction plate	15	differential assembly
2	Turbine	9	separator	16	planet gear
3	Guide wheel	10	reverse gear	17	helical bevel gear
4	Pump wheel	11	input shaft assembly	18	idler shaft
5	Turbine shaft	12	tooth shaft	19	output shaft
6	Oil pump	13	gear ring	20	output gear
7	forward gear	14	half shaft gear	21	idler

b) Principle of oil circuit

The schematic diagram of the oil circuit of the hydraulic transmission gearbox is shown in Figure 2. In the figure, F represents the forward gear and R represents the reverse gear.

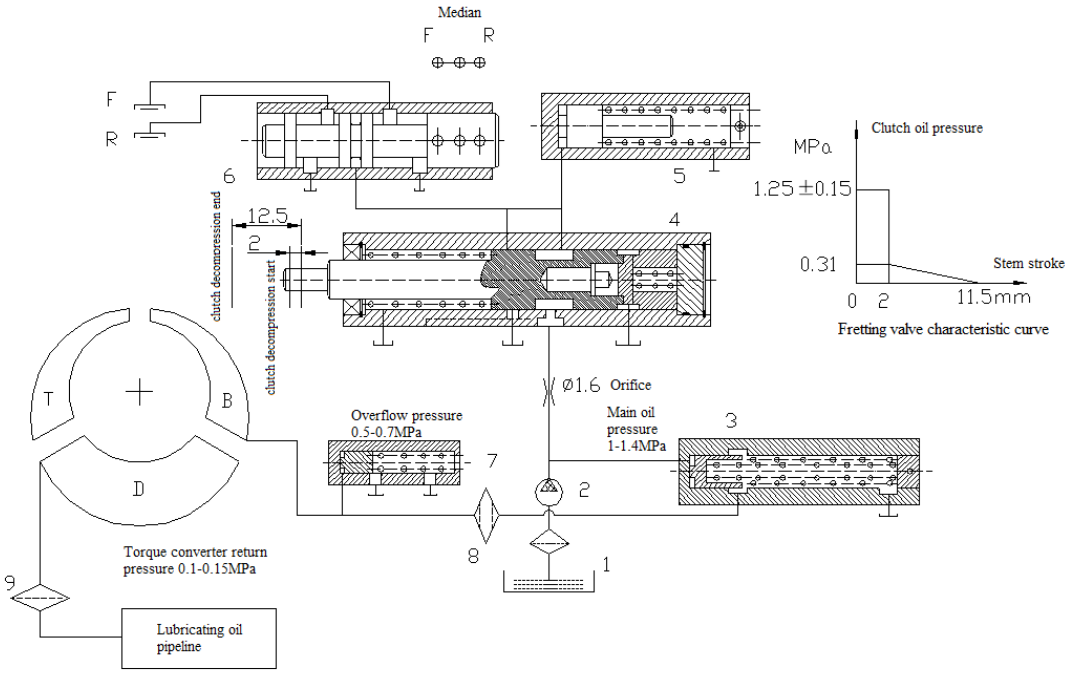


Figure 2 Schematic diagram of oil circuit of JHTY30B hydraulic transmission gearbox

1	Oil filter	4	Micro valve	7	Safety valve
2	Oil pump	5	Buffer valve	8	Oil filter
3	Main pressure regulating valve	6	Electromagnetic shift valve	9	Car cooler

② Structure introduction

a) Introduction to the structure

The structure diagram of the hydraulic transmission gearbox is shown in Figure 3, and its working principle is as described above. The hydraulic transmission gearbox is composed of four parts: a hydraulic torque converter, a gearbox and a reducer. The power of the engine is input to the clutch assembly 6 of the gearbox by the torque converter turbine shaft through the spline connection through the pitch changing action of the torque converter. The gearbox includes clutch assembly 6, idler gear 11, output gear 12, idler shaft 9, cover and solenoid control valve assembly 5, micro valve assembly 14, oil supply pump assembly 4 and other major parts and components. The reducer is mainly composed of output shaft 10, spiral bevel gear 16, gear shaft 1, etc. The two ends of the gear shaft are supported by tapered roller bearings 2, and both ends are equipped with adjusting shims to adjust the color impression and backlash of the spiral bevel gear. And bearing clearance. The power transmitted from the gearbox is decelerated by the reducer and is generated by the differential assembly 15 to drive the half shaft gears and the half shafts to the wheels. Piece 8 is a gearbox housing, in which gears, shift clutches, reduction gears, differentials, etc. are installed, and it also functions as an oil tank.

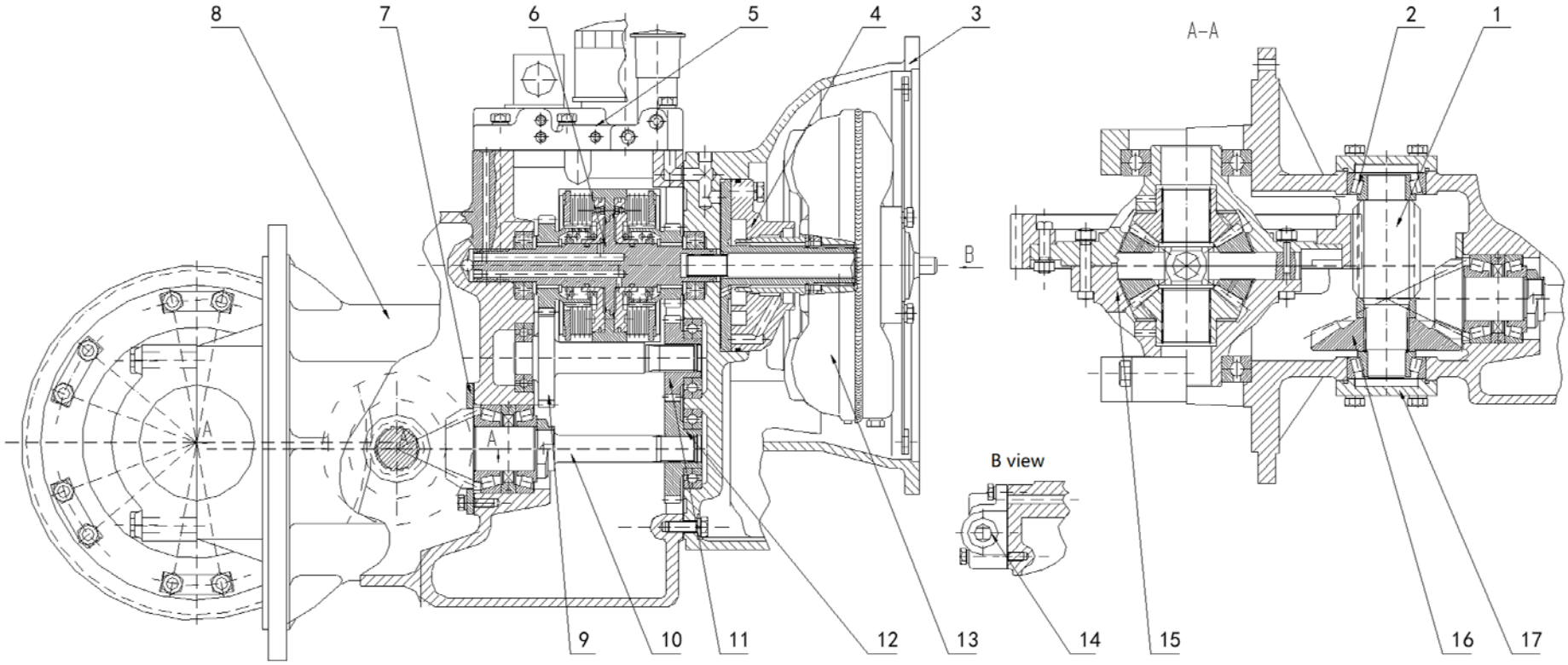


Figure 3 Hydraulic transmission structure diagram

1. Gear shaft 2. Tapered roller bearings 3. Torque converter housing assembly 4. Fuel supply pump assembly 5. Cover and solenoid control valve assembly
6. Clutch assembly 7. Support sheet 8. Housing 9. Idler shaft 10. Output shaft 11. Idler 12. Output gear 13. Hydraulic torque converter assembly
14. Micro valve assembly 15. Differential assembly 16. Spiral bevel gear 17. Bearing cap

b) hydraulic torque converter

The structure diagram of YJH265 hydraulic torque converter is shown in Figure 4. It is mainly composed of turbine shaft 8, pump wheel 10, guide wheel 4, turbine 3, elastic coupling plate 2 and other components.

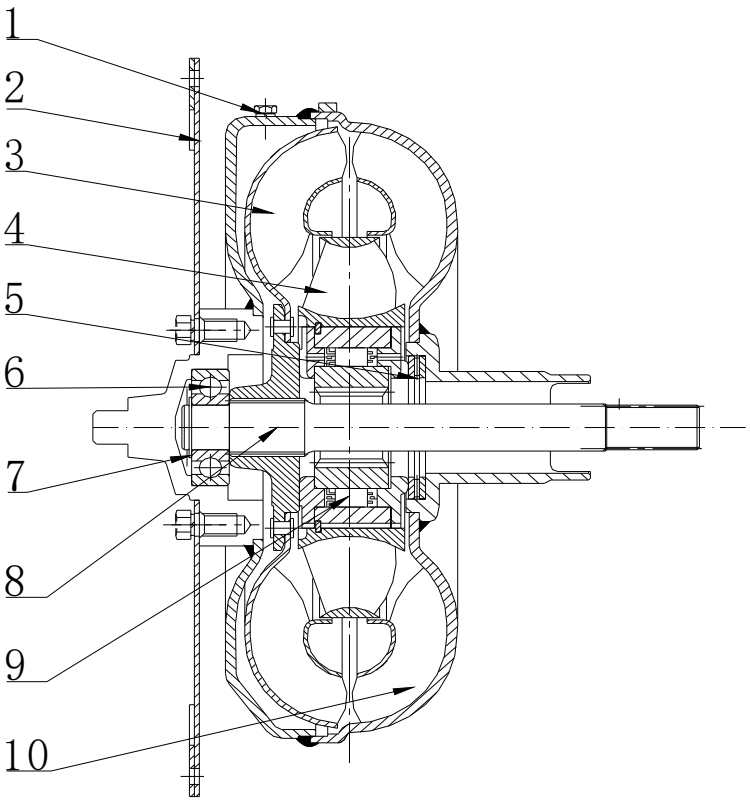


Figure 4 YJH265 torque converter structure diagram

1	Oil drain plug	5	Thrust bearing	9	one-way clutch
2	Elastic plate	6	Ball bearing	10	pump wheel
3	Turbine	7	retaining ring		
4	Guide wheel	8	turbo shaft		

The pump wheel 10 is connected with the engine flywheel through the elastic connecting plate 2. The pump wheel converts the engine model energy into the kinetic energy of the working fluid, and causes the lead blades of the liquid flow to flow into the turbine 3 at a high speed, which drives the turbine to rotate, which is output by the turbine shaft 8 and transmits torque and speed to the gearbox. After the liquid flows out of the turbine, it enters the guide wheel 4. When the torque converter is in a torque-changing stage with a large load and a low turbine speed, the guide wheel is wedged by the one-way clutch and cannot rotate. The torque acting on the guide wheel by the liquid flow is counteracted on the turbine, causing the torque on the turbine to be equal to that of the pump. Between the torque of the wheel and the guide wheel, the output torque is greater

than the input torque, and an automatic torque conversion is generated. When the ratio of the turbine speed to the pump wheel speed is greater than a certain value, the guide wheel disengages and rotates freely, and the torque conversion ends. This state is Coupling state.

YJH265 is a press-welding hydraulic torque converter, which cannot be disassembled.

c) Fuel supply pump assembly

The structure diagram of the YQX30-3000 oil supply pump assembly is shown in Figure 5. The oil supply pump assembly is mainly composed of driving gear 1, guide wheel seat 2, passive gear 3, pump casing 4 and other parts. The fuel supply pump assembly is installed on the torque converter housing. The guide wheel seat 2 is connected with the torque converter guide wheel through splines. The pump housing 4 is a casting with a high-pressure cavity and a low-pressure cavity. The driving gear 1 and the torque converter pump. The wheels are connected and driven by the engine to drive the driven gear 3 to rotate, forming an internal gear pump to supply oil to the system.

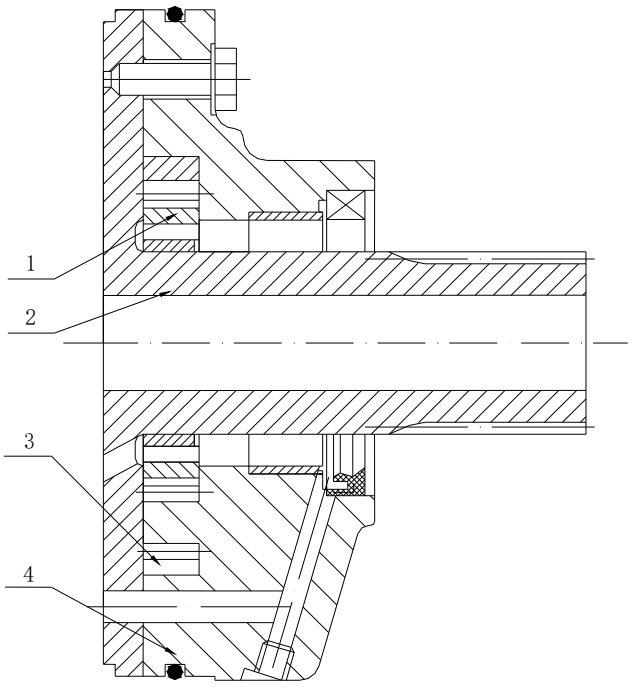


Figure 5 YQX30-3000 oil supply pump assembly structure diagram

1	Drive gear	3	Passive gear
2	Guide wheel seat	4	Pump housing

d) Micro valve assembly

The structure diagram of YQX30-5000 micro valve assembly is shown in Figure 6. The micro valve assembly is mainly composed of micro slide valve 13, micro valve body 12, spring 8, micro valve stem 7, and other parts. The micro valve assembly is installed on the outside of the gearbox. The micro-motion valve stem is connected to the micro-motion pedal connecting rod. When the micro-motion pedal is depressed, the micro-motion valve stem moves outwards. When the micro-motion valve stem moves outwards by 2mm, the clutch begins to depressurize, and the clutch pressure drops to a certain value. When a pressure is applied, the friction plate slips and the vehicle achieves a fretting effect; when the fretting valve stem moves 12.5mm outward, the clutch pressure drops to 0, the clutch friction plate and the spacer cannot be combined, and the vehicle stops moving; when the fretting valve stems When the rod moves 29mm outwards, the stroke of the micro-moving valve rod ends.

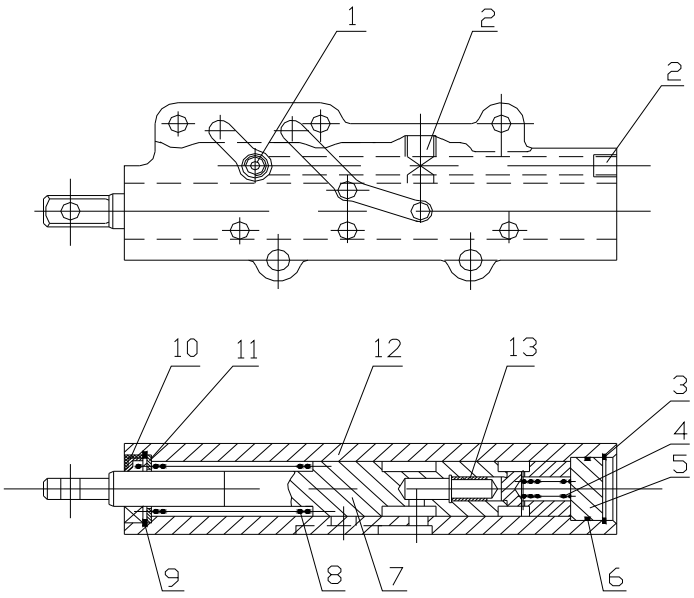


Figure 6 YQX30-5000 micro valve assembly structure diagram

1	Screw plug	6	O-ring	11	cushion
2	Screw plug	7	Micro valve stem	12	micro-motion valve body
3	Retaining ring for hole	8	spring	13	micro-motion spool valve
4	Spring	9	retaining ring for hole		
5	Blocking	10	oil seal		

e) Clutch

The YQX38-1000 clutch assembly structure diagram is shown in Figure 7. It is used for JHTY30B hydraulic transmission gearbox. The clutch assembly consists of input shaft 9, forward gear 4, piston 2, clutch housing 22, friction plate 19, spacer 18, Return spring 5, reverse gear 6, sealing ring 8 and other parts and components. The left and right clutches are wet multi-plate hydraulic clutches, each equipped with 4 spacers and friction plates that are assembled alternately. The clutch shell is welded to the input shaft as a whole, and the pressure oil is distributed through the control valve into the forward or reverse clutch to achieve forward movement. Reverse gear shift. There is a sealing ring 6 on the outer circle of the piston, and a 0-shaped sealing ring 3 is installed on the input shaft to ensure that the clutch is sealed. When in neutral, no pressure oil enters the clutch, and the piston recalls the smell under the spring force of the return spring, so that the diaphragm and the friction plate are in a separated state. When shifting gears, oil pressure acts on the piston to combine the diaphragm and the friction plate, and the power from the torque converter is transmitted to the forward gear or the reverse gear by friction.

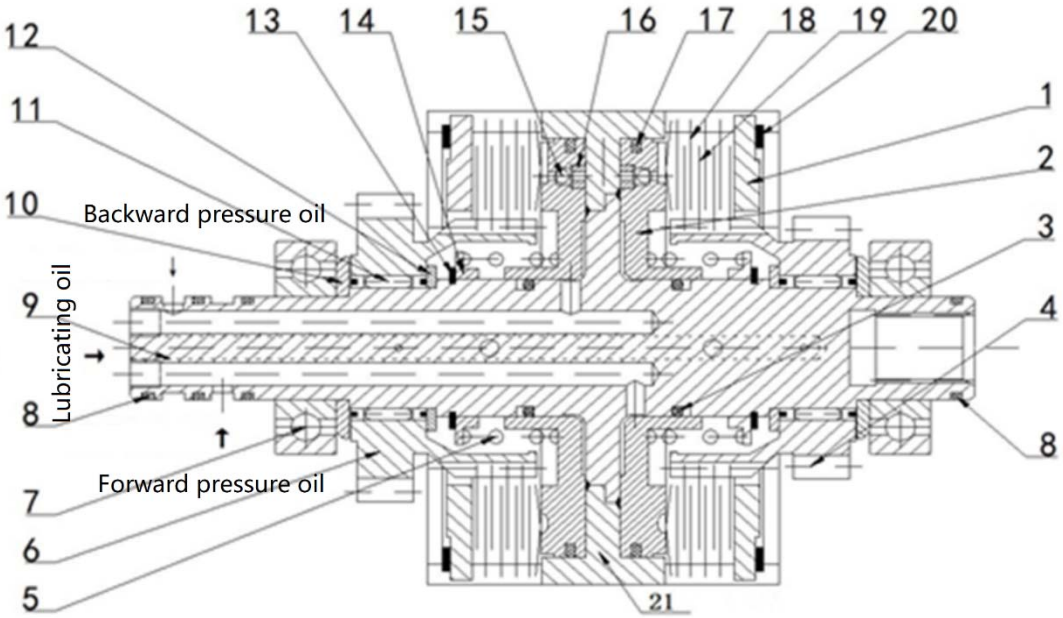


Figure 7 YQX38-1000 Clutch assembly structure diagram

1	end plate	8	seal ring (A)	15	Steel ball
2	piston	9	input shaft	16	Plug
3	O-ring	10	thrust ring (A)	17	Seal ring(B)
4	forward gear	11	needle roller bearing	18	Spacer
5	return spring	12	thrust ring (B)	19	Friction plate
6	reverse gear	13	Retaining ring for shaft	20	Snap ring
7	bearing	14	Spring seat	21	Input shaft assembly

f) Differential assembly

The structure diagram of the YQX30-2000 differential assembly is shown in Figure 9. It is used in the JHTY30B hydraulic transmission gearbox and is supported on the gearbox housing by ball bearings 8 at both ends. The differential assembly is equipped with two side gears 9 and four planetary gears 10. The planetary gears are supported by a cross gear shaft 2, wherein the gear shaft 2 is fixed on the left and right differential housings 3 and 7. The thrust washer 1 and the washer 11 are installed between the differential housing, the planetary gears and the side gears. The differential housing is made into a left and right split type, the left differential housing 7 and the right differential housing 3 are connected by bolts 4, and the ring gear 5 is fixed to the right differential housing 3 with bolts 4.

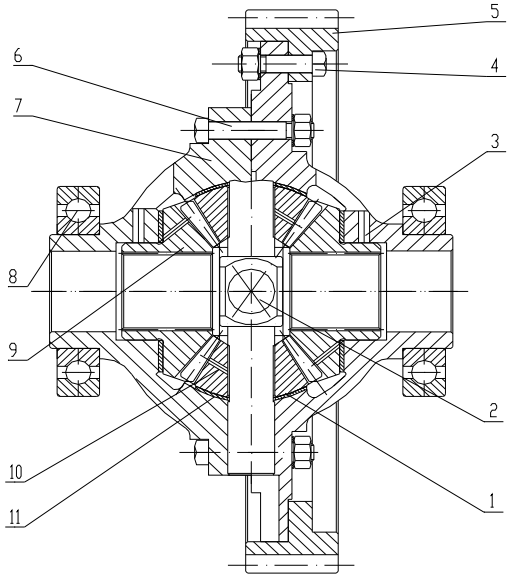


Figure 8 YQX30-2000 differential assembly structure diagram

1	Thrust washer	5	Gear ring	9	half shaft gear
2	Cross gear shaft	6	Bolt	10	planet gear
3	Right differential case	7	Left differential case	11	washer
4	Bolt	8	bearing		

g) Cover and control valve assembly

The structure diagram of YQXD30-4000 covers and control valve assembly is shown in Figure 10 and 11. It is composed of solenoid valve 1 and housing cover 2 and control valve assembly 3. The control valve assembly is installed on the inner side of the housing cover. The housing cover is equipped with solenoid valve 1 and torque converter oil inlet overflow valve 4 to keep the torque converter oil inlet pressure at 0.5MPa-0.7 MPa.

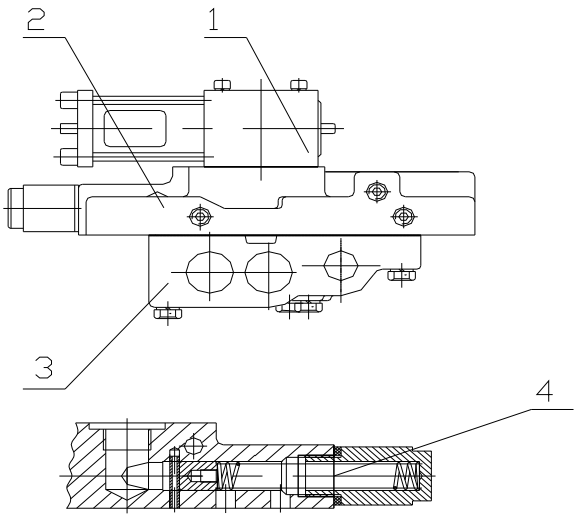


Figure 9 YQXD30-4000 cover and control valve structure diagram

1	Solenoid valve	3	Control valve assembly
2	Housing cover	4	Relief valve

The general structure diagram of YQXD30-4100 control valve is shown in Figure 11. It is composed of main pressure valve 1, reverse buffer valve 2, forward buffer valve 3 and so on. The main pressure valve controls the clutch oil pressure in the range of 1.1MPa-1.4 MPa, part of the oil enters the control valve through the micro valve to realize gear shifting; part of the oil enters the overflow valve to adjust the oil pressure within the range of 0.5MPa-0.7 MPa, and then enter the torque converter to work. The cushion valve is used to reduce the impact when the clutch is engaged and disengaged.

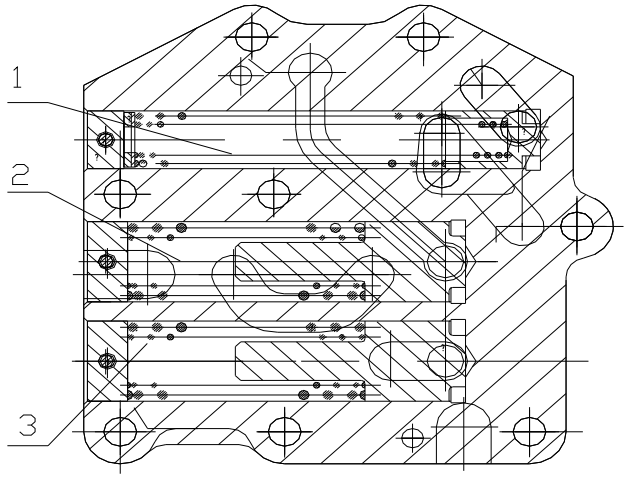
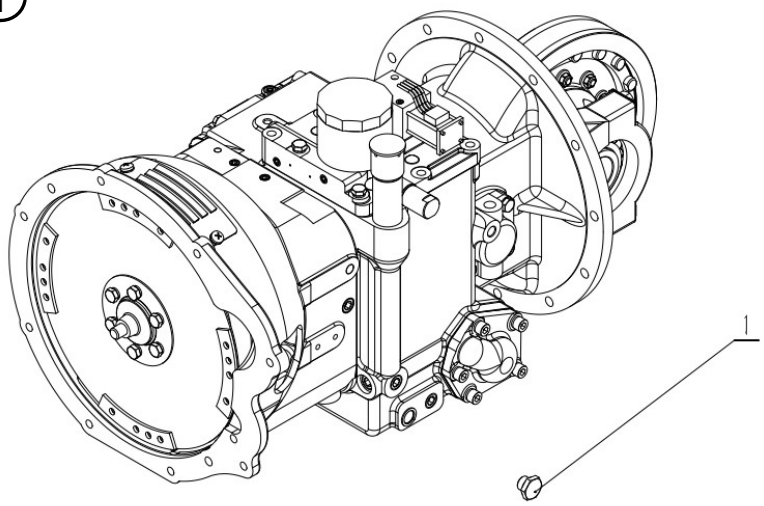


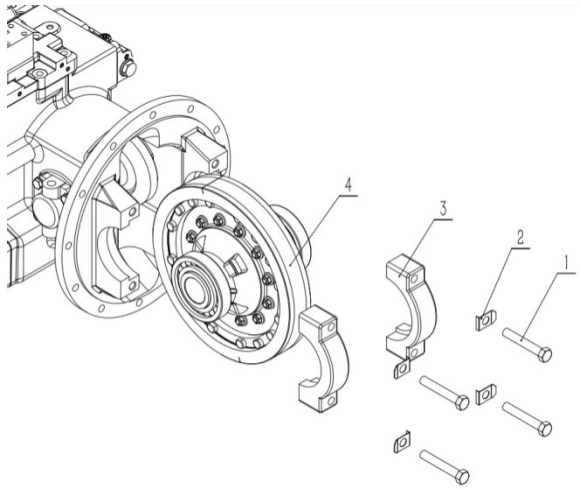
Figure 10 YQXD30-4100 control valve assembly structure diagram

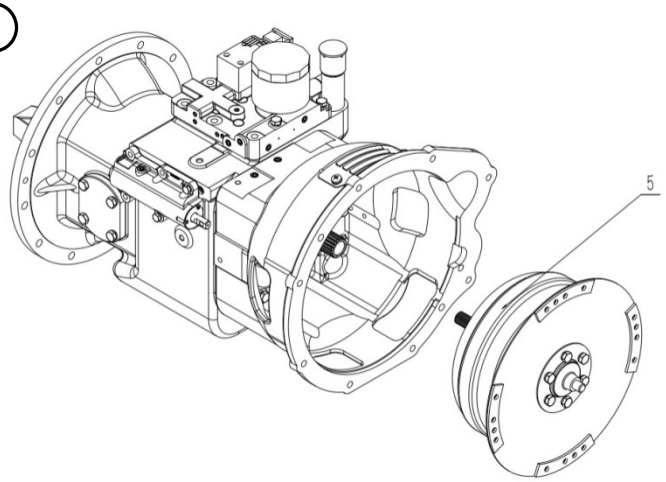
1 Main pressure valve
2 Reverse gear cushion valve
3 Forward gear cushion valve

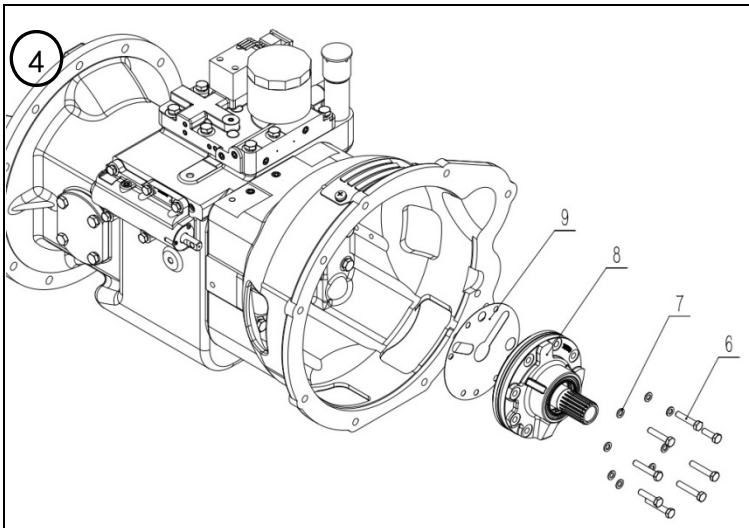
3) Disassembly and assembly

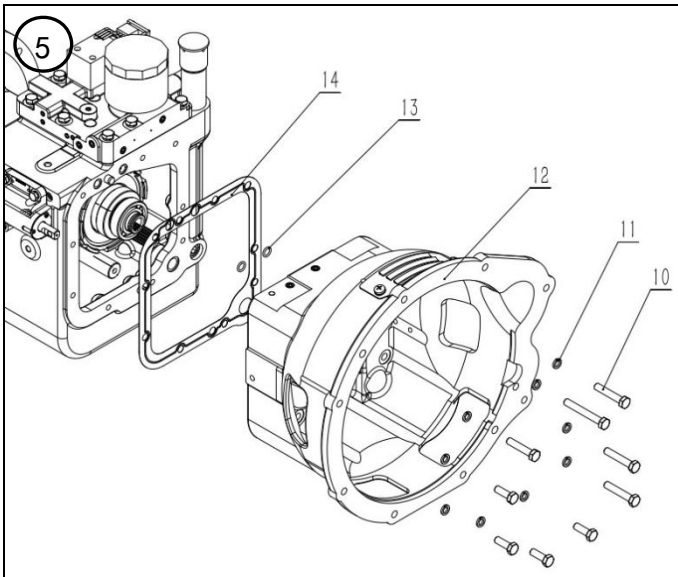
① Gearbox disassembly and assembly

1  		Before disassembling the gearbox, drain the residual oil in the box and replace the gasket at the oil drain plug. After draining the residual oil, screw the drain plug back to the gearbox.
Parts description	Characteristic requirements	Tooling, tools
1- Oil drain plug	a. Tightening torque 80-100N.m b. Replace the gasket after disassembly	27mm outer hexagon socket

2  		Turn off the lock plate 2, remove the bolt 1 and the bearing seat 3, remove the differential assembly 4, and reinstall the bearing seat in the original position after removing the differential to prevent the bearing seat from being misplaced; installation Attention should be paid to the position of the bearing seat. The left and right sides must not be interchanged. The bolt tightening torque is required to be 132-165N.m. The lock plate must be locked after installation.
Parts description	Characteristic requirements	Tooling, tools
1-bolt	Tightening torque 132-165N.m	21mm outer hexagon socket
2- lock piece	Replace after disassembly	
3-Bearing frame	Left and right are not interchangeable	
4-Differential assembly		

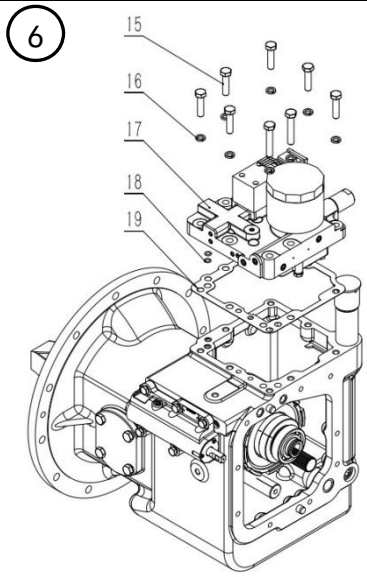
3  		Remove the torque converter assembly 5.
Parts description	Characteristic requirements	Tooling, tools
5- Torque converter assembly	Rotate and push in while installing	

4  		Remove the fixing bolt 6 and remove the oil supply pump assembly 8. If the paper pad is damaged during installation, clean the remaining paper pad on the joint surface and replace it with a new one. After disassembly, replace the gasket 7 at the bolt. The tightening torque of the bolt is required to be 22-30N.m.
Parts description	Characteristic requirements	Tooling, tools
6-bolt	Tightening torque 22-30N.m	12mm outer hexagon socket
7-seal	Wearing parts	
8-Oil pump assembly	The O-ring on the outer circle needs to be replaced after disassembling the assembly (Wearing parts)	
9-Paper pad	Wearing parts	



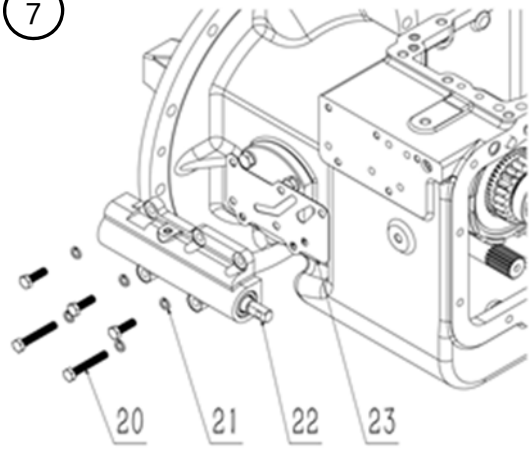
Remove the fixing bolts, and remove the torque converter housing assembly 12. When disassembling, pay attention to the large and two small three O-rings on the joint surface; if the paper pad is damaged during installation, clean the remaining paper pad on the joint surface. Replace with a new paper pad.

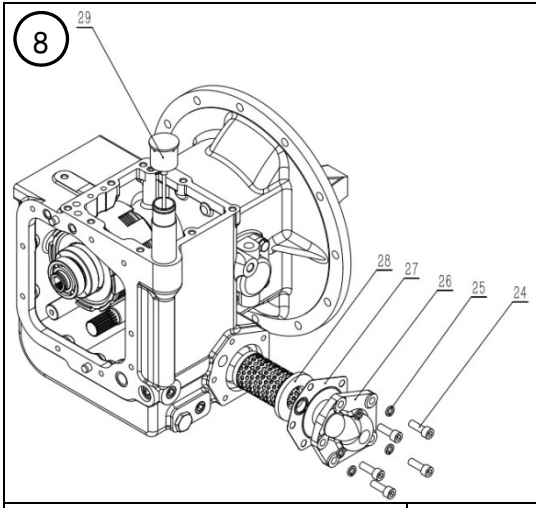
Parts description	Characteristic requirements	Tooling, tools
10-bolt	Tightening torque 45-59N.m	16mm outer hexagon socket
11-Spring cushion		
12-Torque converter housing assembly		
13-O ring	Wearing parts	
14-Paper pad	Wearing parts	

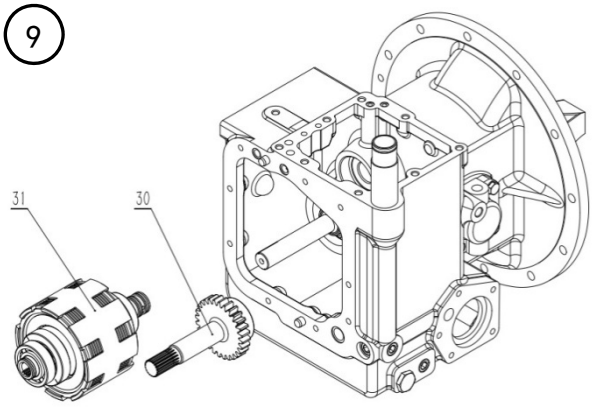


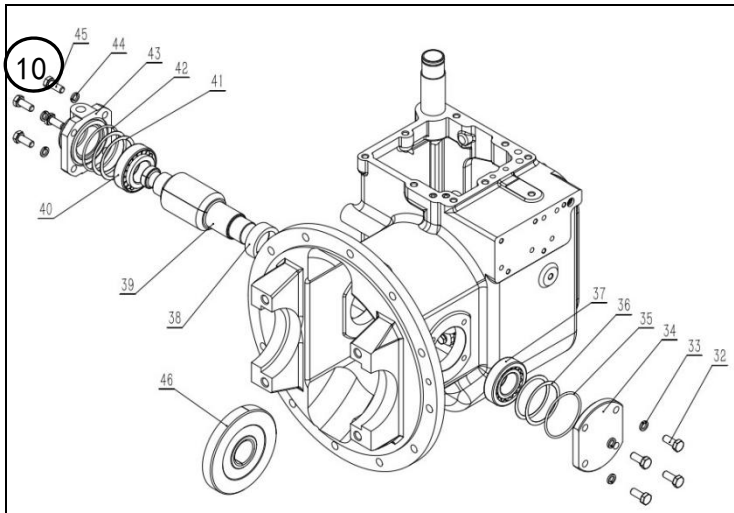
Remove the fixing bolts and remove the control valve assembly 17; pay attention to the two O-rings on the joint surface when disassembling; if the paper pad is damaged during installation, clean the remaining paper pad on the joint surface and replace it with a new one.

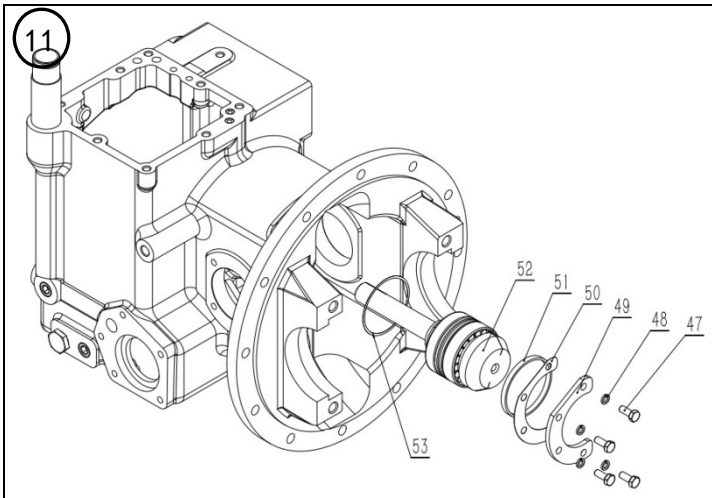
Parts description	Characteristic requirements	Tooling, tools
15-bolt	Tightening torque 45-59N.m	16mm outer hexagon socket
16-Spring cushion		
17-Control valve assembly		
18-O ring	Wearing parts	
19-Paper pad	Wearing parts	

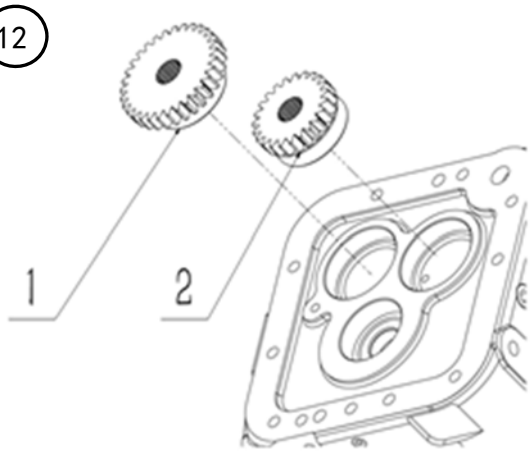
7 		Remove the fixing bolts and remove the micro valve assembly 22; pay attention to the two O-rings on the joint surface when disassembling; if the paper pad is damaged during installation, clean the remaining paper pad on the joint surface and replace it with a new one. When installing the bolts, the tightening torque of the bolts requires 22-30N.m.
Parts description	Characteristic requirements	Tooling, tools
20-bolt	Tightening torque 22-30N.m	13mm outer hexagon socket
21-Spring cushion		
22-Micro valve assembly		
23-Paper pad	Wearing parts	

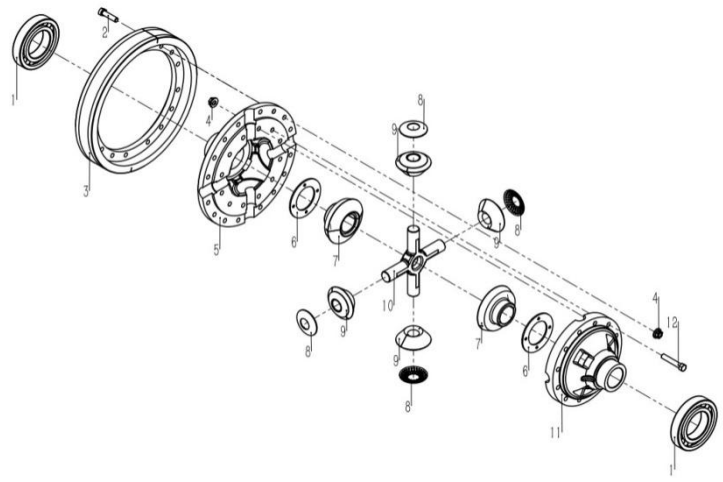
8 		Remove the fixing bolts and remove the oil filter seat assembly 26; if the paper pad is damaged during installation, clean the remaining paper pad on the bonding surface. Replace the paper pad with a new one, clean and check the coarse filter, and replace the coarse filter if necessary.
Parts description	Characteristic requirements	Tooling, tools
24-bolt	Tightening torque 45-59N.m	8mm hex socket
25-Spring cushion		
26-oil filter seat		
27-Paper pad	Wearing parts	
28-Filter assembly	500 hours cleaning, 2000 hours replacement	
29-Dipstick assembly		

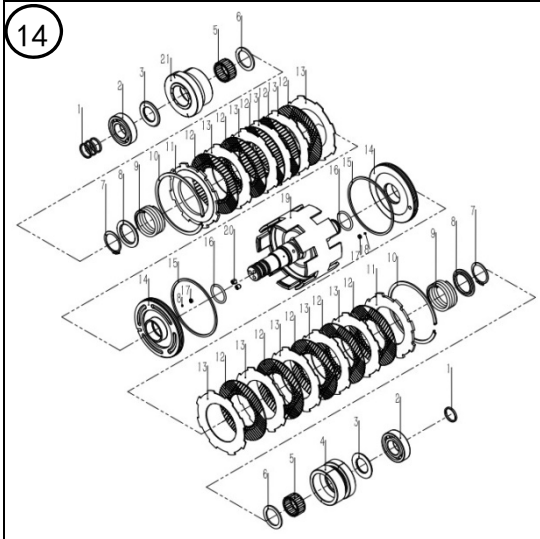
9  		Use a crowbar to gently remove the clutch assembly and idler shaft.
Parts description	Characteristic requirements	Tooling, tools
30-Idler		
31-Clutch assembly		

10  		Remove the bearing caps 33 (42) at both ends, and remove the pinion 38 and the driven spiral bevel gear 45. When installing, note that the adjustment pads 34 and 39 at both ends should be installed back to the original place according to the quantity and position at the time of disassembly.
Parts description	Characteristic requirements	Tooling, tools
32(45)-bolt	Tightening torque 45-59N.m	16mm outer hexagon socket
33(44)-Spring cushion		
33(43)-end cap		
35(42)-O-ring		
37(40)-bearing		
36(41)-Adjustment pad	Adjust the thickness of the pad and the left and right sequence cannot be changed at will	
38-bush		
39-pinion		
46-driven spiral bevel gear		

11  		Remove the fixing bolts and remove the output shaft assembly 51. When installing, pay attention to the adjustment pads 52 and 49 should be installed back to the original place according to the amount of disassembly.
Parts description	Characteristic requirements	Tooling, tools
47-bolt	Tightening torque 22-30N.m	13mm outer hexagon socket
48-Spring cushion		
49-support sheet		
50-Adjustment pad	The thickness of the adjustment pad cannot be changed at will	
51-collar		
52-active spiral bevel gear assembly		
53-Adjustment pad	The thickness of the adjustment pad cannot be changed randomly	

12  		Use a crowbar to remove the output gear 1 and the idler gear 2; pay attention to the installation positions of the 2 gears during installation, and do not install them backwards.
Parts description	Characteristic requirements	Tooling, tools
1- output gear	The installation position of the two gears cannot be changed	
2- idler		

13 		Remove the ring gear 3, open the differential, take out the internal planetary gear 9 and the side gear 7; pay attention to check the wear of gaskets 6 and 8 during installation, and replace new gaskets if necessary. All bolts here need to be used the torque wrench is tightened, and the tightening torque is 70-80N.m.
Parts description	Characteristic requirements	Tooling, tools
1-bearing		
2-bolt		
3-gear ring		
4-nut	Tightening torque 70-80N.m	15mm outer hexagon socket
5-Differential left half shell	When installing, it needs to be aligned with the right half of the differential according to the processing mark	
6-washer		
7-Axle shaft gear	After the installation is complete, the half shaft gear needs to be able to rotate flexibly	
8-Planetary gear		
9-bowl washer		
10- cross shaft		
11-Differential right half shell	When installing, it needs to be aligned with the left half of the differential according to the processing mark	
12-bolt	When installing, it needs to be aligned with the right half of the differential according to the processing mark	

<table>
<tr><td colspan="2">14
  </td><td>Remove the bearing and clutch gear 3 at both ends, remove the retaining ring 7 and remove the friction plates 8, 9, and then remove the retaining ring 11 to take out the return spring 13 and the piston assembly 14; check the wear of each friction plate before installation, if necessary, replace the friction plate, and replace the sealing ring 16 (4 pieces) after disassembly.</td></tr>
<tr><td>Parts description</td><td>Characteristic requirements</td><td>Tooling, tools</td></tr>
<tr><td>1- Sealing ring A</td><td>Wearing parts</td><td></td></tr>
<tr><td>2-bearing</td><td></td><td></td></tr>
<tr><td>3-Thrust ring B</td><td></td><td></td></tr>
<tr><td>4-forward clutch gear</td><td></td><td></td></tr>
<tr><td>5-Needle bearing</td><td></td><td></td></tr>
<tr><td>6-Thrust ring A</td><td></td><td></td></tr>
<tr><td>7-shaft retaining ring</td><td></td><td></td></tr>
<tr><td>8-spring seat</td><td></td><td></td></tr>
<tr><td>9-Return spring</td><td></td><td></td></tr>
<tr><td>10-Circlip</td><td rowspan="2">After installation, the gap between the circlip and the end plate should be ensured to be 1.1-1.3mm</td><td rowspan="2">Feeler gauge</td></tr>
<tr><td>11-end plate</td></tr>
<tr><td>12-Internal friction plate</td><td>2000 hours replacement</td><td></td></tr>
<tr><td>13- spacer</td><td>Wearing parts</td><td></td></tr>
<tr><td>14-piston</td><td></td><td></td></tr>
<tr><td>15-seal ring B</td><td>Wearing parts</td><td></td></tr>
<tr><td>16-O ring</td><td>Wearing parts</td><td></td></tr>
<tr><td>17-plug</td><td></td><td></td></tr>
<tr><td>18-steel ball</td><td></td><td></td></tr>
<tr><td>19-Input shaft assembly</td><td></td><td></td></tr>
<tr><td>20-plug</td><td></td><td></td></tr>
<tr><td>21-Reverse gear clutch gear</td><td></td><td></td></tr>
</table>

② Matters needing attention

a) The sequence of disassembly and assembly of the gearbox is basically the opposite.
b) When disassembling and assembling the gearbox, handle it with care to prevent parts from bumping and damage. After disassembly, the parts must be placed in an orderly manner. The parts that need to be reassembled must be cleaned with kerosene and dried with dry high-pressure air before assembly.
c) The adjustment gaskets in the gearbox are required to be installed back to the original place according to the disassembled quantity, and shall not be added, reduced or replaced at will.
d) The disassembly and assembly process must be operated in strict accordance with the above-mentioned instructions, and blind disassembly and brutal operation are strictly prohibited.

SECTION4 BRAKE SYSTEM

Group 1 Structure and function ---------- 69-78
Group 2 Operational checks and troubleshooting ---------- 79-80
Group 3 Tests and adjustments ---------- 81-82

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

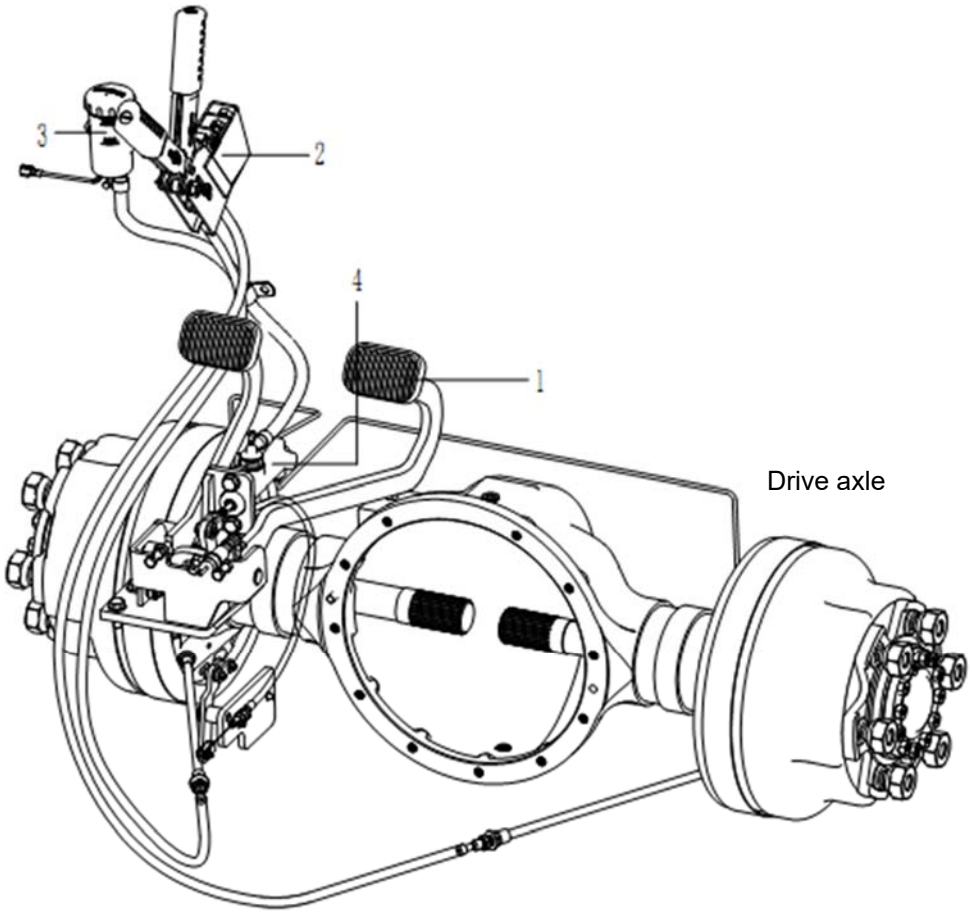
Item		Specification
Type		Dry drum brake
Master cylinder full stroke (Non boosted)		28mm
Pedal adjustment	Pedal height	160mm
	Play	1~3mm
Brake oil		Caltex DOT3

2) PARKING BRAKE

Item	Specification
Type	Ratchet, internal expanding mechanical type
Parking lever stroke / Cable stroke	48.3°/ 11.7mm

3 BRAKE PEDAL AND PIPING

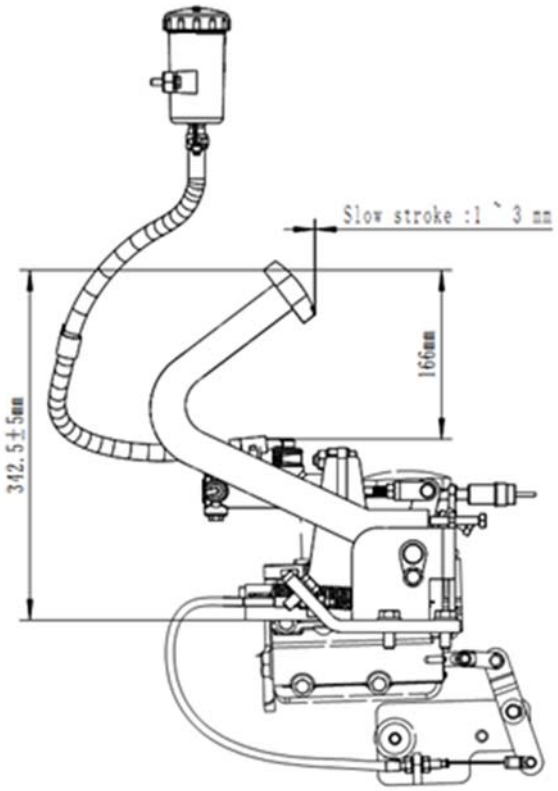
1) STRUCTURE

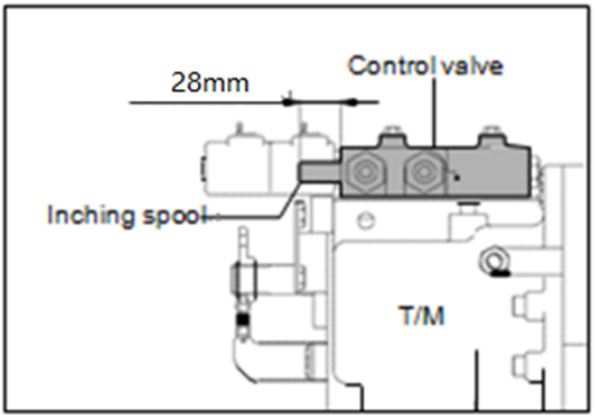


1	Brake pedal	3	Reservoir tank assembly
2	Parking lever assembly	4	Brake master cylinder

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 DRY DISK BRAKE

Two Types	Front wheel Brake，Internal expanding and Hydraulic
Pedal lever ratio	7.52
Master cylinder bore	19.05mm
Wheel Brake	2-3.5t
Type	Two Servo mechanism with Parking Brake
Slave cylinder bore	28.58
Size of friction plate（length×width×depth）	348×76×8mm
Area of Friction Plat	264 cm^2×4
Brake drum bore	314mm
Parking Brake	Front wheel Brake，Internal expanding and Hydraulic

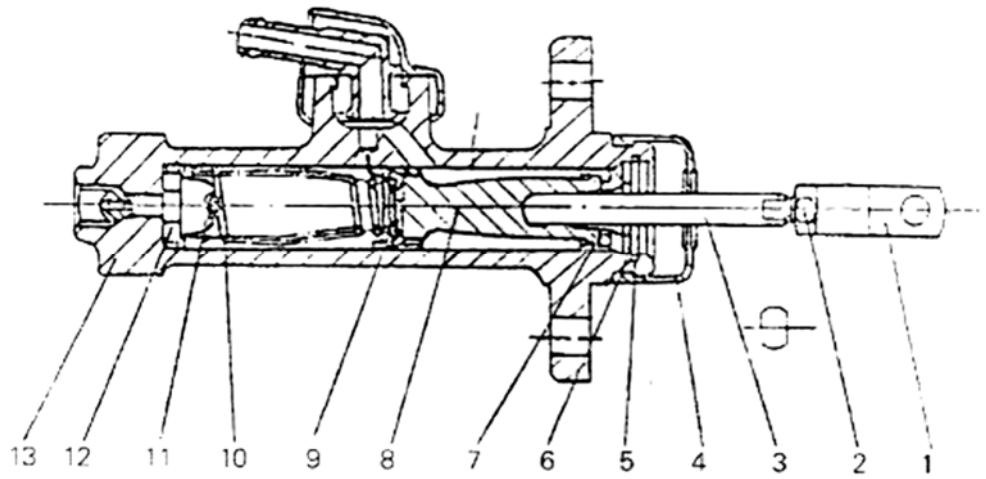
5.1Summary

Brake System is front wheel brake，which made up by brake master cylinder, Brake and Brake pedal.

5.2 Brake master cylinder

It's including one valve seat, one return spring, and cup,piston, subsidiary cup. Fastening ends with tab washer and tab wire, preventing dust and dirt from getting in with dust cover, pushing Brake pedal will push rod then moving brake master cylinder. When push Brake pedal, push rod push piston, brake fluid return to oil tank by oil return port until master cup block the oil return port. After master cup blocking the oil return port, brake fluid in front piston part will be compressed and return spring open, then flow in slave cylinder by brake pipeline. Brake fluid push every slave cylinder and every piston extend outward, friction plat and brake drum will be touched, finally achieving slow down or brake. At the same time, the behind part in piston will be filled with brake fluid, which flowed by oil return port and intake port. Releasing brake pedal, the piston will be pushed by return spring, brake fluid in every brake slave cylinder also will be pushed by brake shoe return spring, the brake fluid flow in brake master cylinder (the front part in position),

piston come back to the position, brake fluid in brake master cylinder flow back to oil tank by oil return port. The pressure will be adjusted to a certain proportion with the pressure in brake slave cylinder, putting the cup in slave cylinder in the right piston to prevent oil from spilling, and removing air-resistor which might arise in emergent brake.



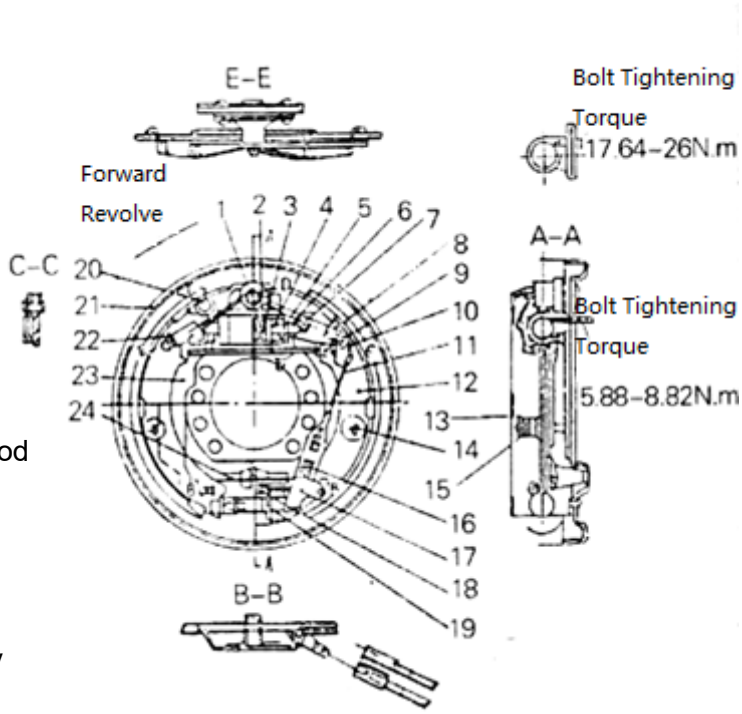
Brake master cylinder

1	Lug	5	Tab wire	9	Master cup	13	Body
2	Lock nut	6	Tab washer	10	Spring		
3	Push rod	7	Subsidiary cup	11	Return spring		
4	Dust cover	8	Piston	12	Valve seat		

5.3 Wheel Brake

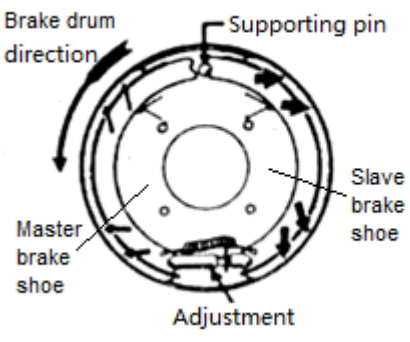
Wheel Brake is Internal expanding and Hydraulic, constitute by brake shoe, spring, slave cylinder, adjustment and base plate, two brakes are set up in both ends of front axle. One end of brake shoe is connected to support pin, another end is connected to gap adjustment and pushed to base plate by spring and compression spring pull rod. Master brake shoe is equipped with manual pull rod, slave brake shoe is equipped with adjust rod which is a part of automatic gap adjustment.

1 Brake slave cylinder assembly
2 Spring
3 Cup
4 Piston
5 Slave cylinder cover
6 Piston carrier rod
7 Brake shoe return spring
8 Friction plate
9 Spring
10 Manual push-rod
11 Spring stay device
12 Brake shoe
13 Compression spring seat
14 Compression spring pull rod
15 Compression spring
16 Spring
17 Pawl
18 Spring
19 Gap adjustment assembly
20 Pin
21 Base plate
22 Brake shoe return spring
23 Manual pull-rod
24 Brake cable assembly

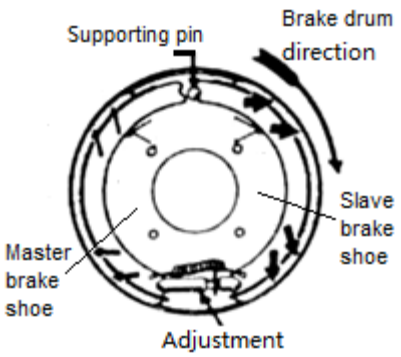


3t,3.5t Wheel Brake

Brake of forward as follows, by operating brake slave cylinder, master brake shoe and slave brake shoe each acted upon by two forces which are equal but opposite in direction, friction plate and brake drum are touched, master brake shoe will be pushed to adjustment by the friction which create between in friction plate and brake drum. Then, a force is created in gap adjustment, which is bigger than the force used in operating brake slave cylinder, and it will push slave brake shoe, the top of slave brake shoe will be pushed to supporting pin powerful, so then a quite big brake force creates. On the other hand, the operation of brake is opposite in backward, but the brake force is the same direction with forward.



Forward



Backward

5.4 Automatic gap adjustment

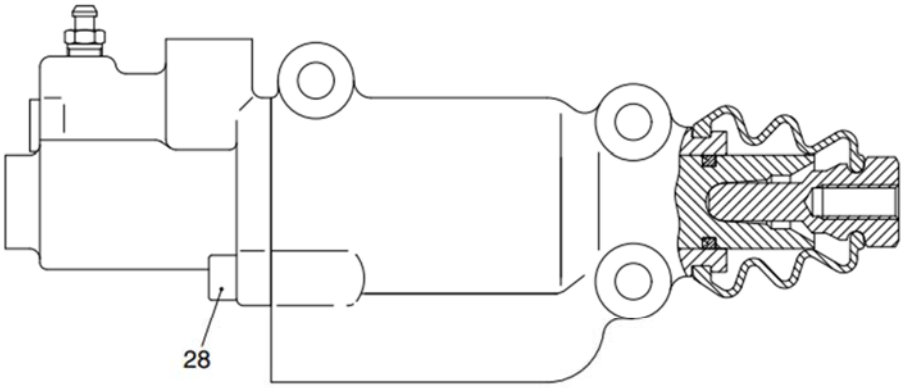
(The following is 2t brake theory, 2-3.5t are same as 2t)

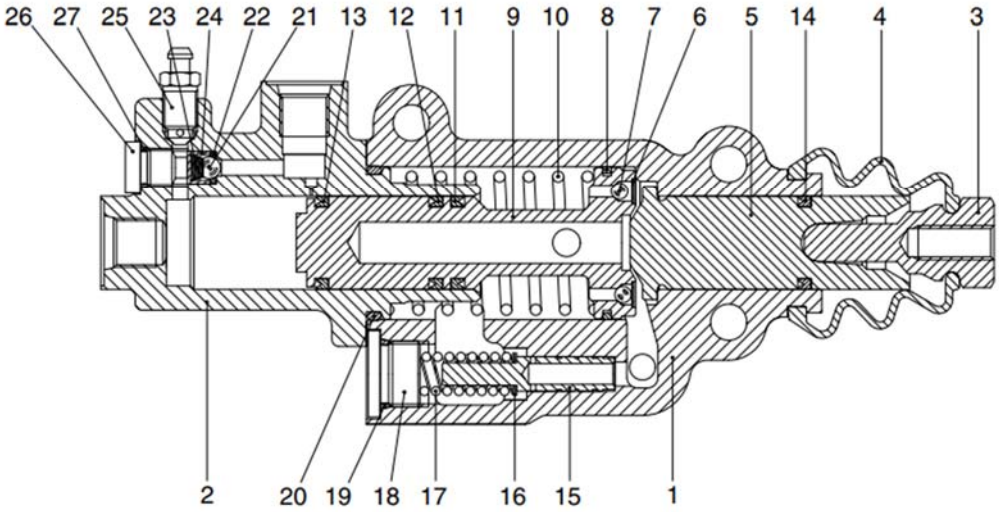
Automatic gap adjustment can keep distance of friction plate and brake drum in 0.4-0.45mm（3-3.5t, 0.25-0.4mm） automatically. But it only works in backward brake. In backward, brake shoe will disconnect when push brake pedal, so then, master brake shoe and slave brake shoe touch brake drum and turn together until the top of master brake shoe start touching supporting pin.

At the same time, when slave brake shoe is away from supporting pin, part A which is a part of adjust rod is pulled comparatively, so adjust rod will revolves around part B, part C descend and part D turn left, finally achieving adjust automatically. When pushing brake pedal harder, the pressure on both ends of adjustment will be bigger, the resistance in screw thread also will be bigger, which result in part D cannot turn anymore.

6 BRAKE VALVE

1) STRUCTURE

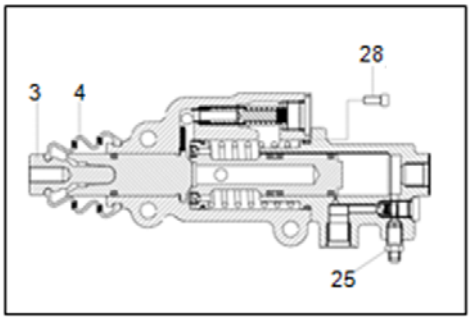




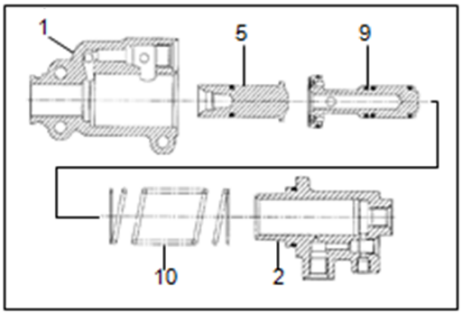
1	Front housing	11	Seal	20	O-ring
2	Rear housing	12	Seal	21	Check ball
3	Push rod	13	Seal	22	O-ring
4	Bellows	14	Seal	23	Check spring
5	Master piston	15	Relief piston	24	Cage
6	Lock washer	16	Shim	25	Air bent
7	Piston ball	17	Relief spring	26	Check plug
8	Piston ring	18	Relief plug	27	O-ring
9	Servo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

2) DISASSEMBLY

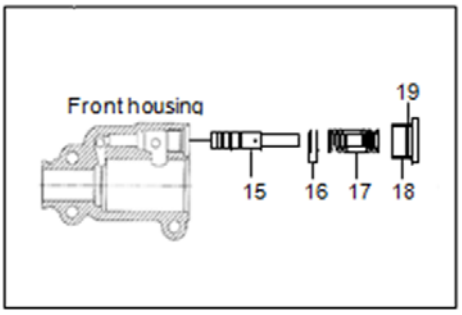
① Remove push rod (3), bellows (4), air vent (25) and bolt (28).



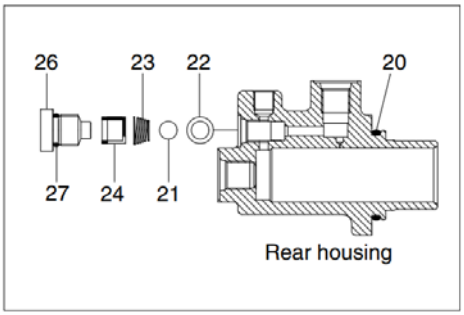
② Remove front housing (1), rear housing (2), servo spring (10), servo piston (9) and master piston (5).



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



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



3) INSPECTION AND ASSEMBLY

① Clean all parts thoroughly and lubricate the parts either with mineral or with hydraulic oil, according to their use destination.
② All single parts are to be checked for damage and replaced, if required.
③ Assembly is in opposite order to disassembly.
④ Seal kit: XKAU-00176

Use only brake fluid (Caltex DOT3) into the compensation reservoirs.

GROUP2 OPERATIONAL CHECKS & TROUBLESHOOTING

1 OPERATIONAL CHECKS

1) BRAKE PIPING

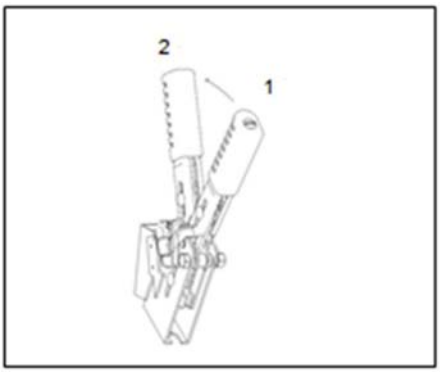
① Check pipes, hoses and joints for damage, oil leakage or interference.

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.



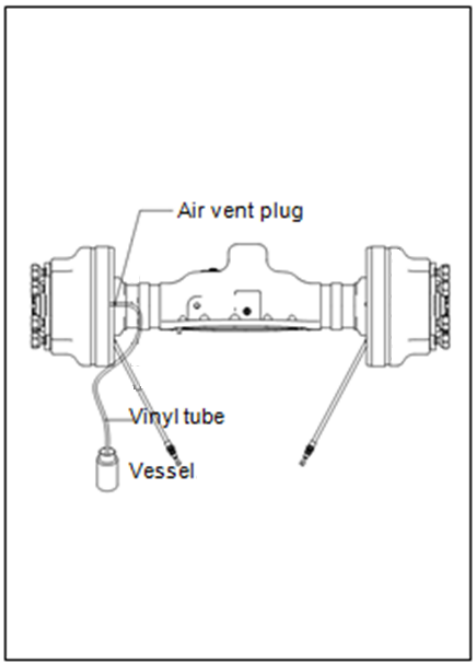
2 TROUBLESHOOTING

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

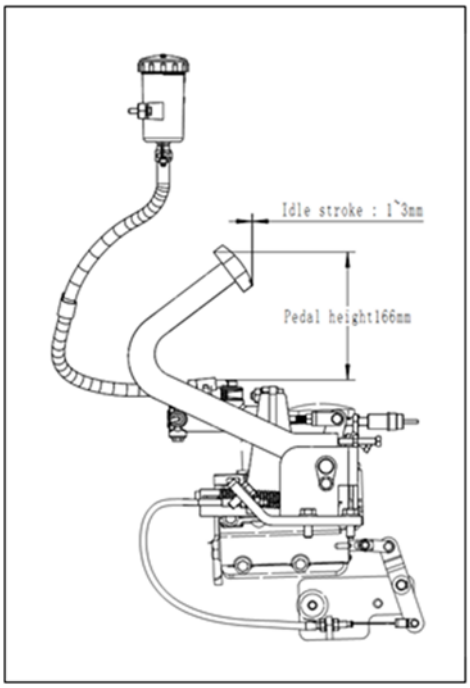
1 AIR BLEEDING OF BRAKESYSTEM

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.



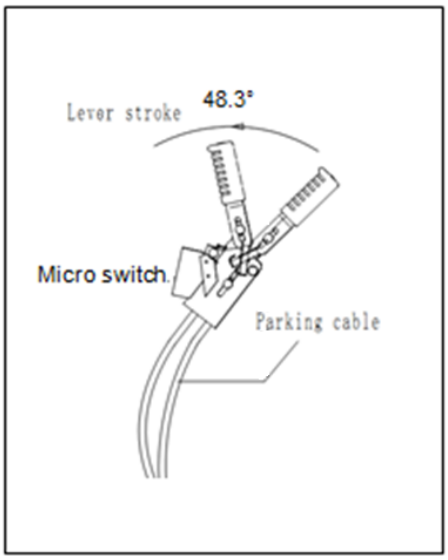
2 ADJUSTMENT OF PEDAL

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



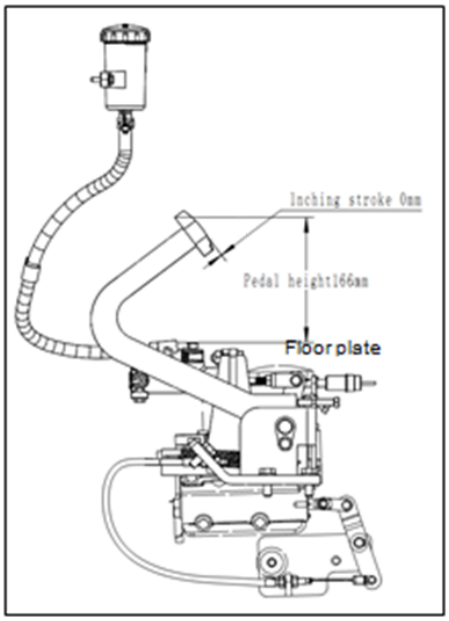
3 MICRO SWITCH FOR PARKING BRAKE (IF EQUIPPDE)

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 0mm.

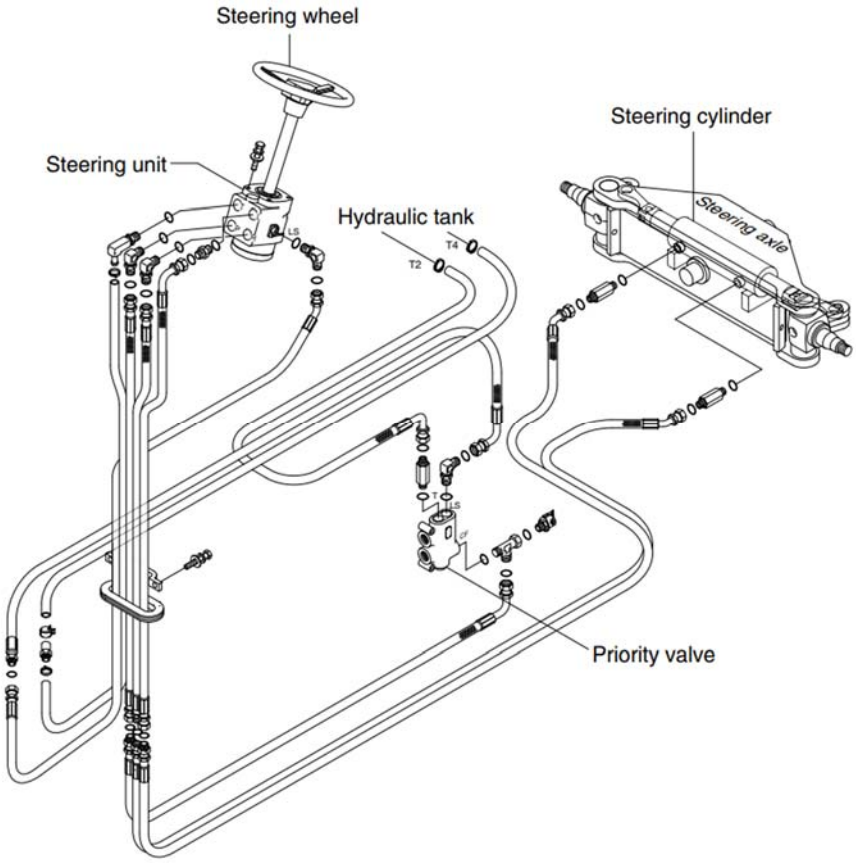


SECTION 5 STEERING SYSTEM

Group 1 Structure and Function ---------- 84-91
Group 2 Operational Checks and Troubleshooting ----------92-95
Group 3 Disassembly and Assembly ----------96-120

GROUP 1 STRUCTURE AND FUNCTION

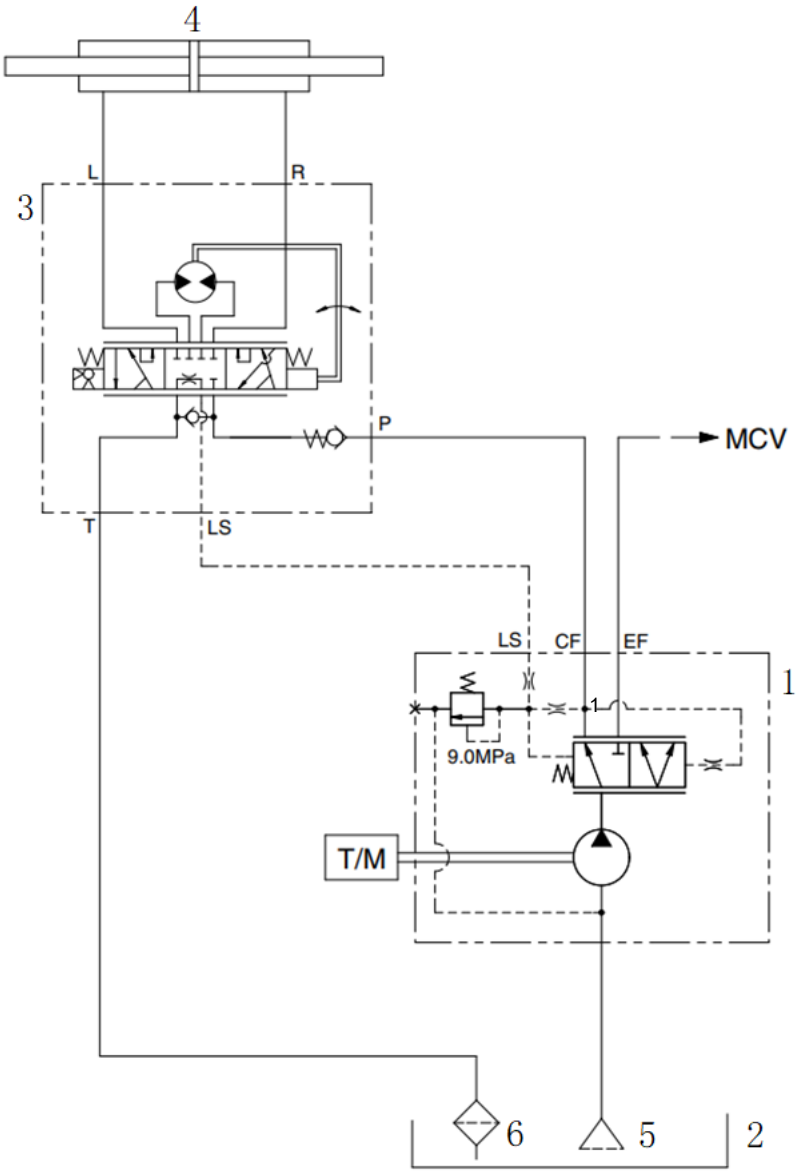
1 OUTLINE



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.

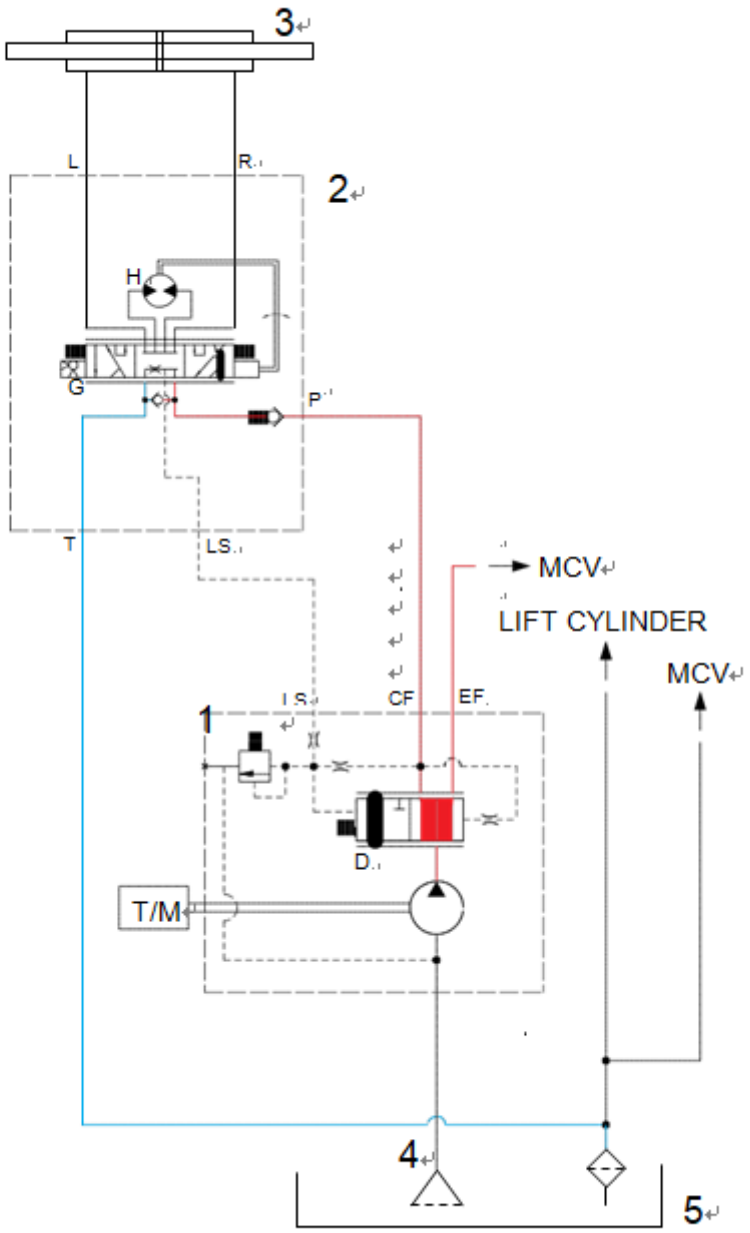
The axle body is unit structure having steering knuckles installed to its both ends by means of kingpins. Hub and wheel are mounted through bearing to spindle of knuckle.

2 HYDRAULIC CIRCUIT



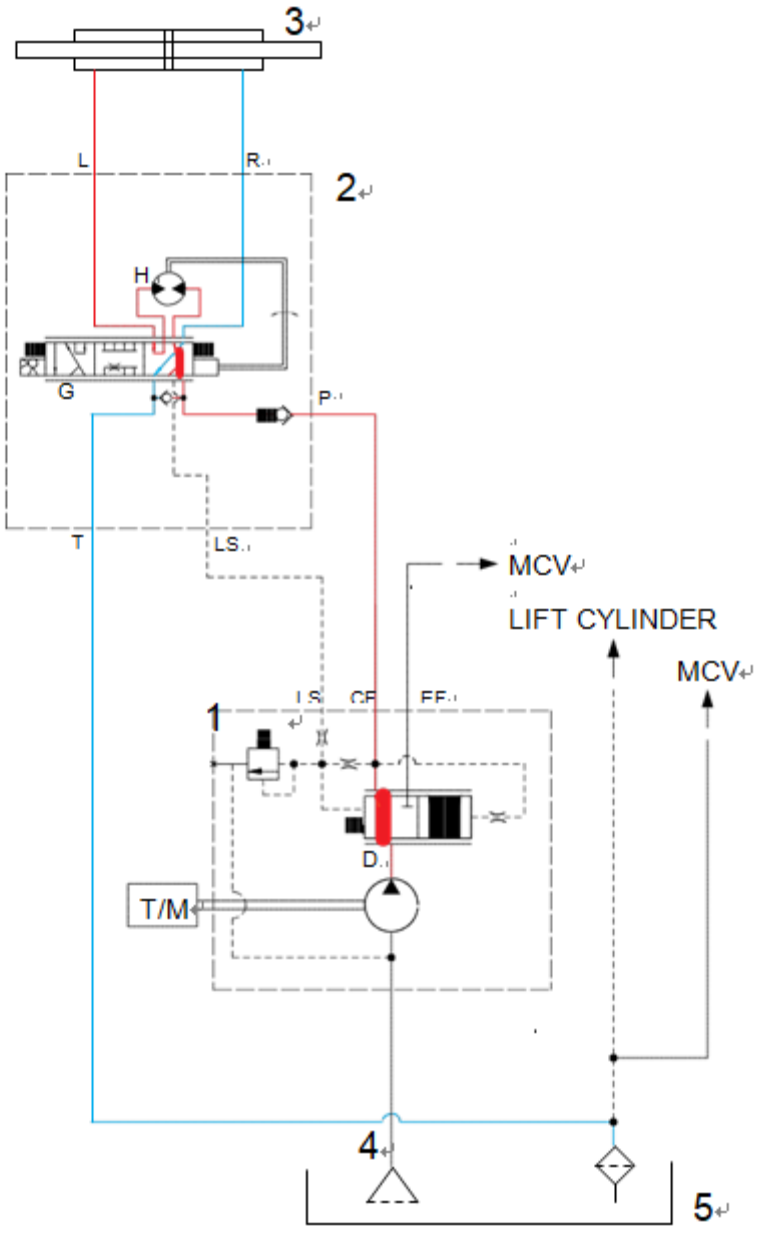
1	Gear pump	4	Steering cylinder
2	Hydraulic tank	5	Return filter
3	Steering unit	6	Suction strainer

1) NEUTRAL



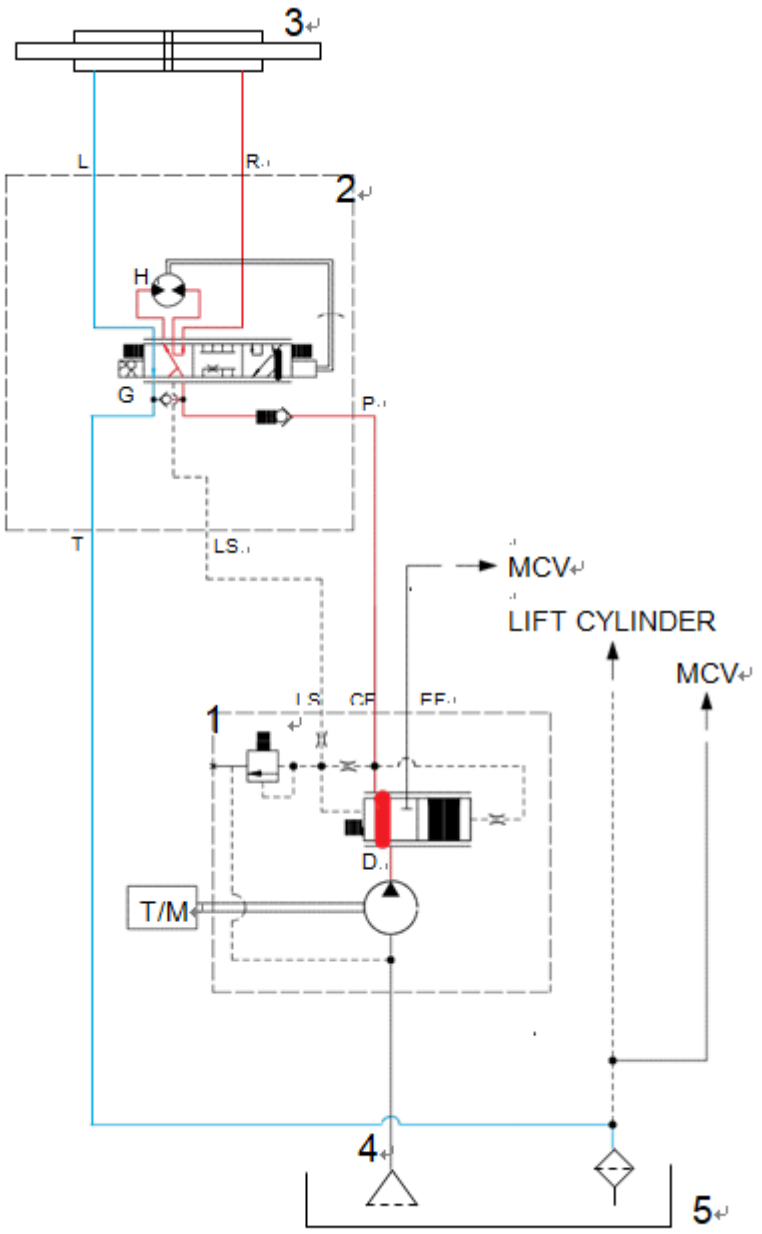
The steering wheel is not being operated so control spool (G) does not move.
The oil from hydraulic gear pump (1) enters priority valve and the inlet pressure oil moves the spool
(D) to the left.
Oil flow into LS port to the hydraulic tank (5).
So, the pump flow is routed to the main control valve.

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.

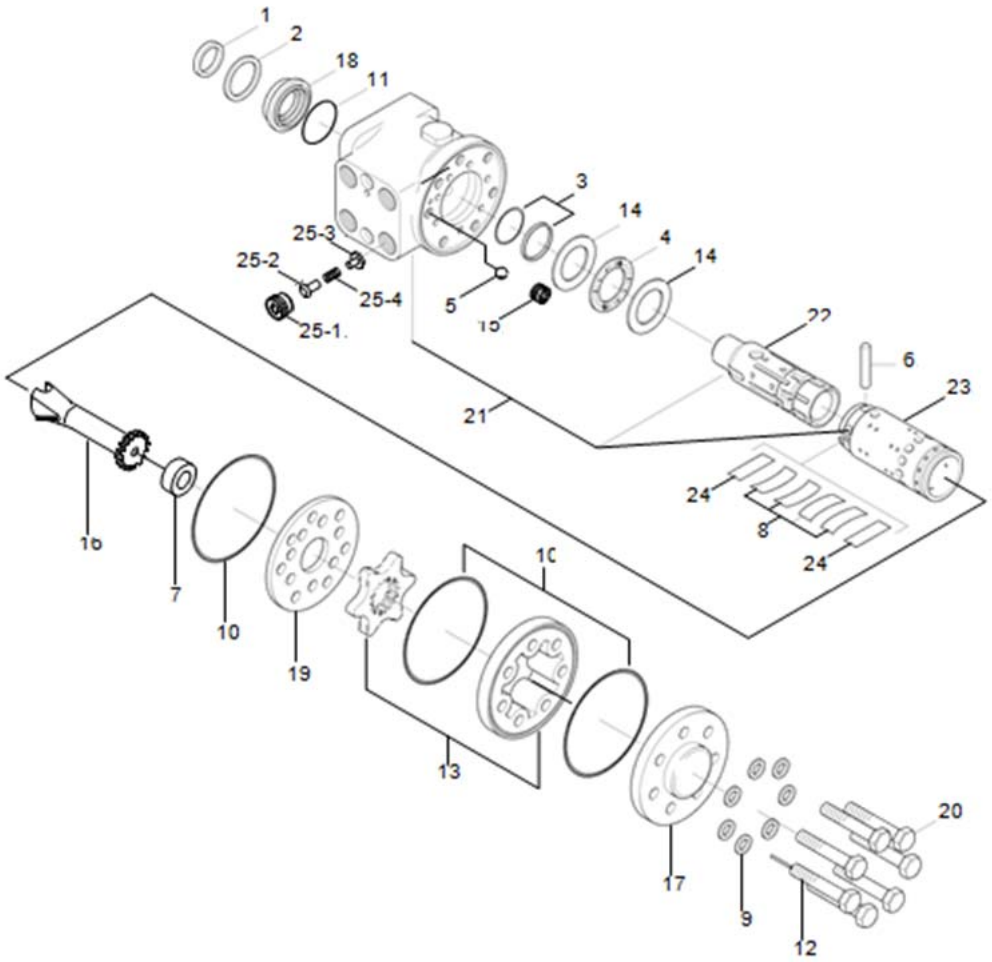
3) RIGHT TURN



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 Oil Pump 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.

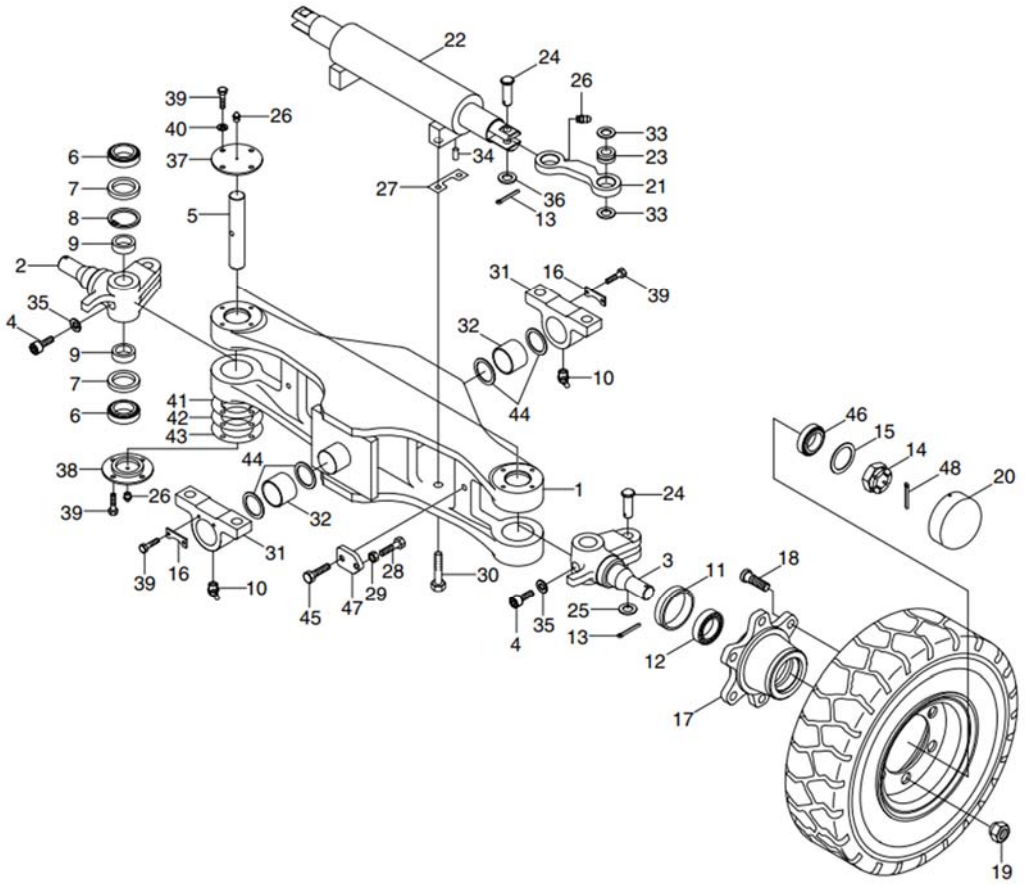
② When the steering wheel is turned, the spool turns, the oil path is switched and the oil is fed into the metering device. As a result, the rotor is caused to run by oil pressure, and the sleeve is caused to run through the drive shaft and cross pin. Therefore, when the spool is turned, the spool turns 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.

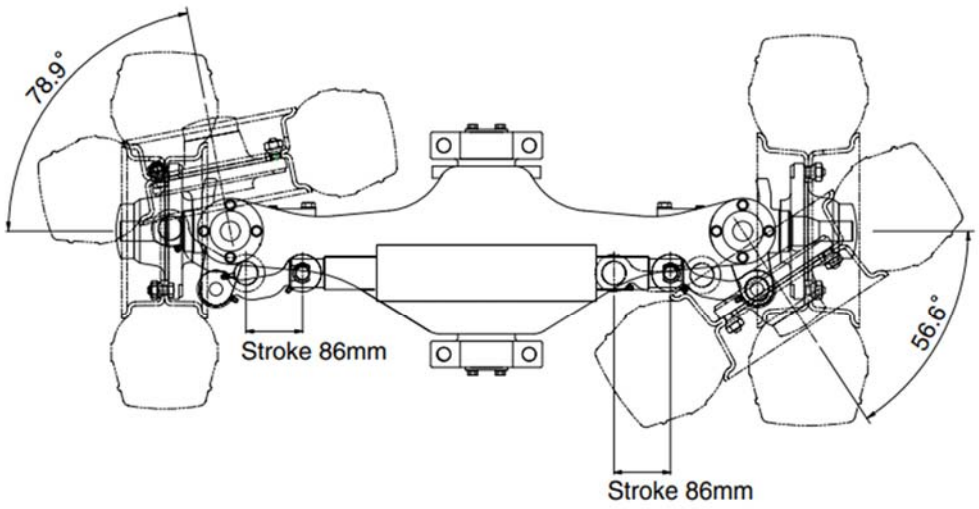
4 STEERING AXLE

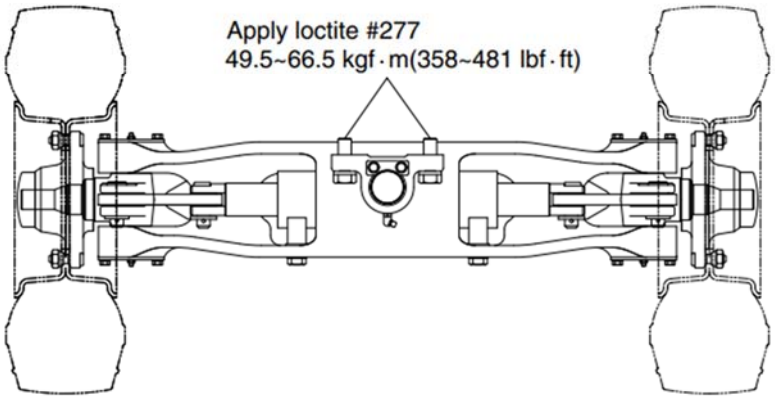
1) STRUCTURE



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 & 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-7</td><td>2076mm(82in)</td></tr><tr><td>30LE-7</td><td>2136mm(84in)</td></tr><tr><td>35LE-7</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. •Bearing faulty. •Spring spool faulty. •Reaction plunger faulty. •Ball-and-screw assembly faulty. •Sector shaft adjusting screw excessively tight. •Gears poorly meshing. •Flow divider coil spring fatigued.	•Check lockout. Repair. •Clean or replace. •Clean or replace. •Replace. •Clean or replace. •Adjust. •Check and correct meshing. •Replace.
Steering wheel fails to return smoothly.	•Bearing faulty. •Reaction plunger faulty. •Ball-and-screw assembly errors •Gears poorly meshing.	•Clean or replace. •Replace. •Clean or replace. •Check and correct meshing.

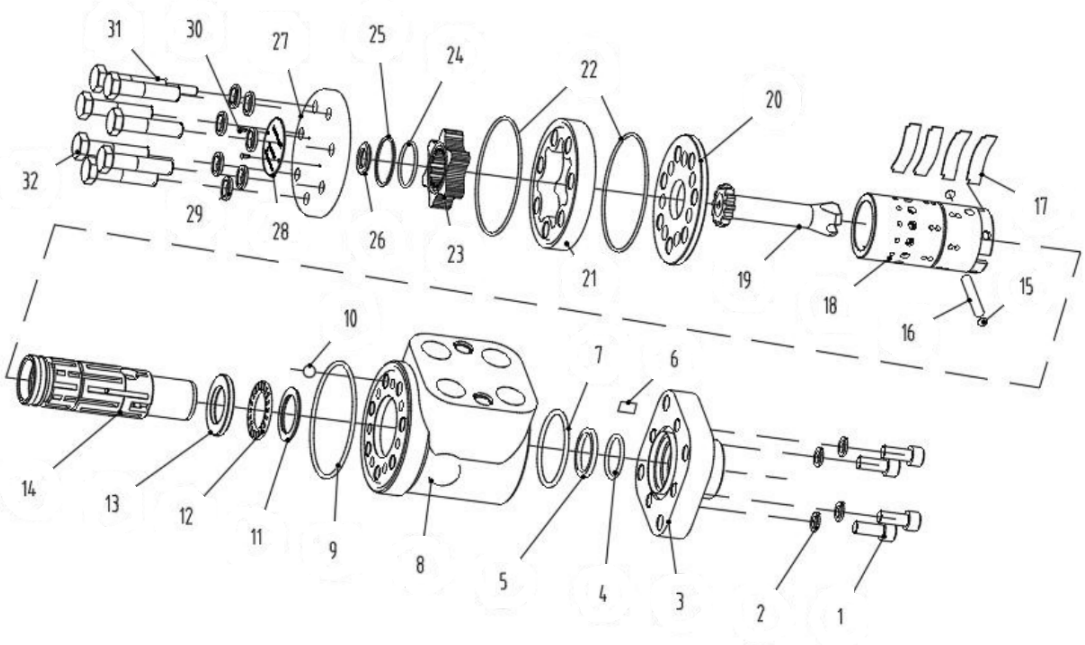
Problem	Cause	Remedy
Steering wheel turns unsteadily.	•Lockout loosening. •Metal spring deteriorated.	•Retighten. •Replace.
Steering system makes abnormal sound or vibration.	•Gear backlash out of adjustment. •Lockout loosening. •Air in oil circuit.	•Adjust. •Retighten. •Bleed air.
Abnormal sound heard 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 (A little bit leak is no problem)	•O-ring damage.	•Replace

Welding leakage	•Cylinder tube damage.	•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

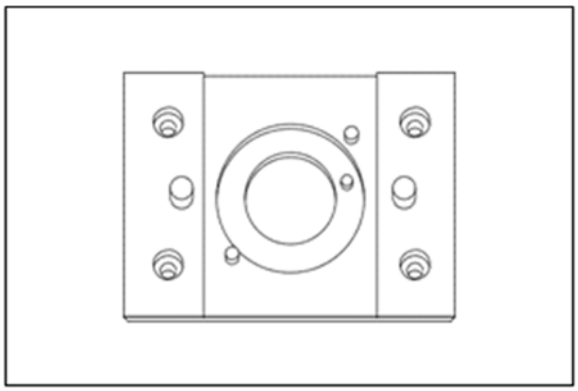
1) STRUCTURE



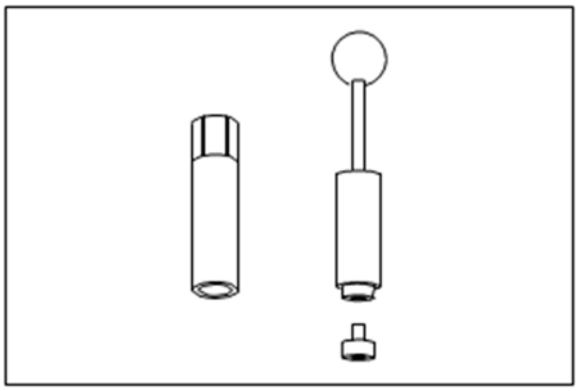
1	Bolt-socket	12	Needle Roller Thrust Bearing	23	Rotor
2	Washer-Spring	13	Washer	24	O-Ring 29×2
3	Cap-Front	14	Spool	25	Ring
4	O-Ring	15	Washer	26	Limited Post
5	X-Type Seal Ring	16	Pin	27	Cap-Rear
6	Screw-Bore	17	Spring-Plate	28	Nameplate
7	O-Ring	18	Sleeve	29	Washer
8	Housing	19	Drive	30	Rivet
9	O-Ring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

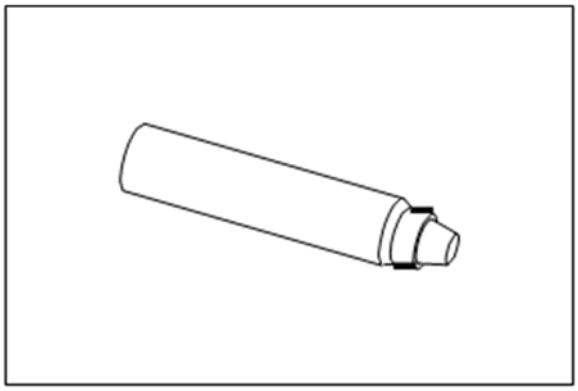
① Holding tool



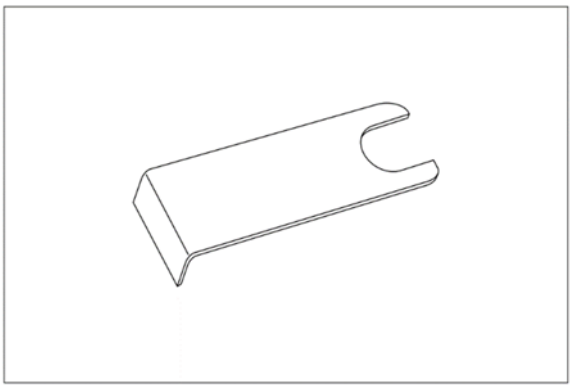
② Assembly tool for O-ring and kin-ring.



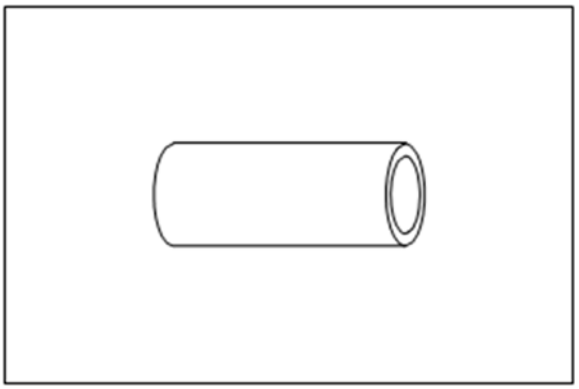
③ Assembly tool for lip seal.



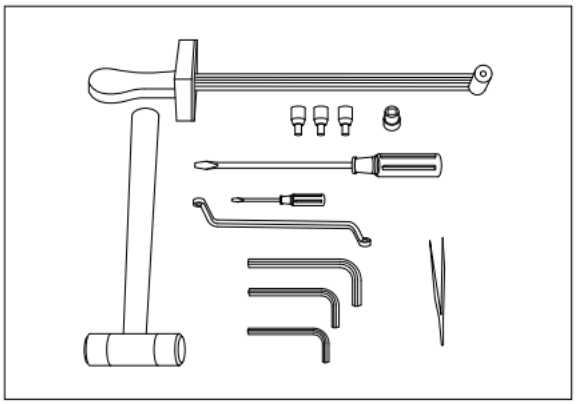
④ Assembly tool for cardan shaft.



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



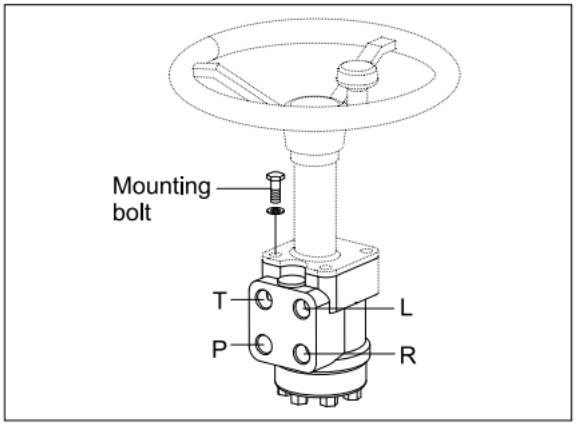
3) TIGHTENING TORQUE

L: Left port

R: Right port

T: Tank

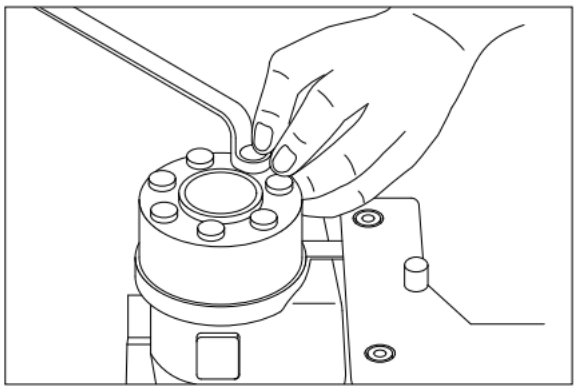
P: Pump



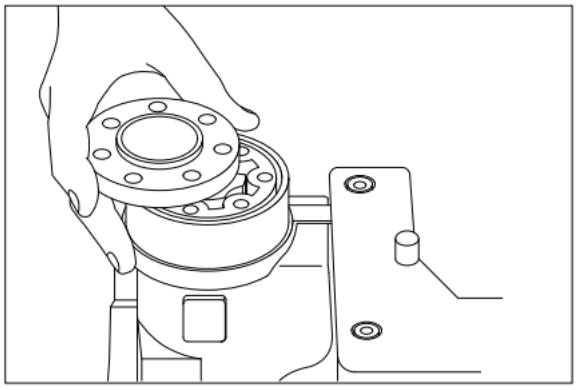
Port	Size	Torque [kgf•m(lbf•ft)]
L	3/4 UNF - 16	13 (94)
R	3/4 UNF - 16	13 (94)
T	3/4 UNF - 16	13 (94)
P	3/4 UNF - 16	13 (94)
Mounting bolt	M10×1.5	4.0 ±0.5 (29±3.6)

4) DISASSEMBLY

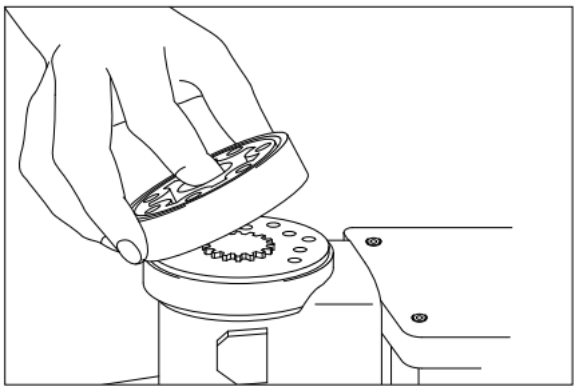
① Disassemble steering column from steering unit and place the steering unit in the holding tool. Screw out the screws in the end cover (6-off plus one special screw).



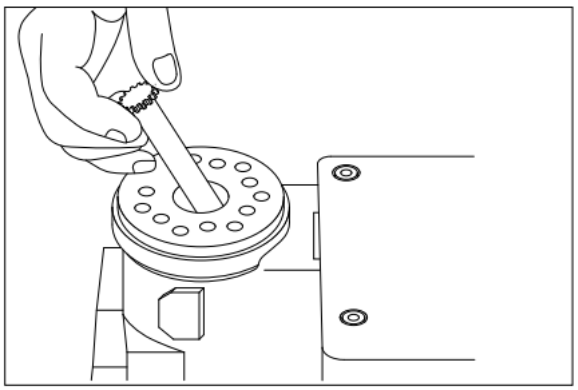
② Remove the end cover, sideways.



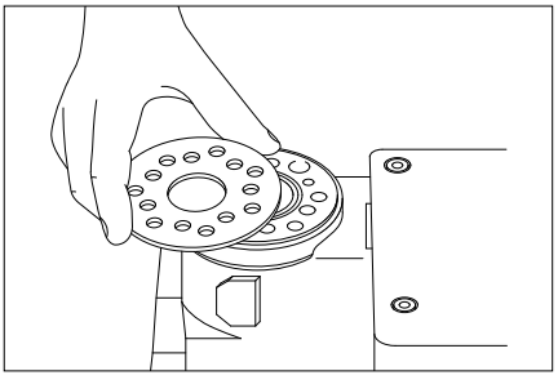
③ Lift the gearwheel set (With spacer if fitted) off the unit. Takeout the two O-rings.



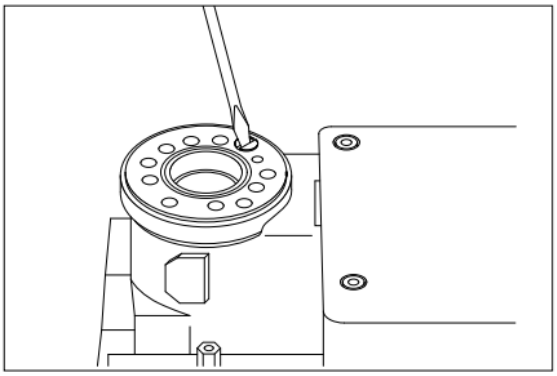
④ Remove cardan shaft.



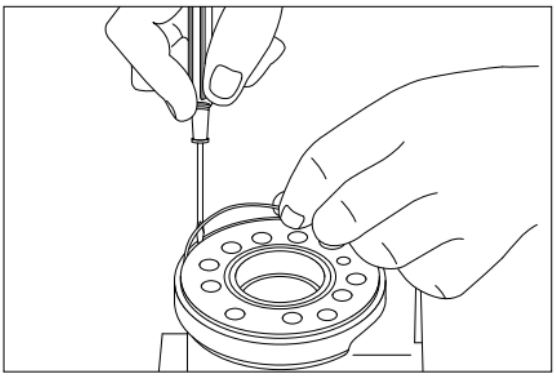
⑤ Remove distributor plate



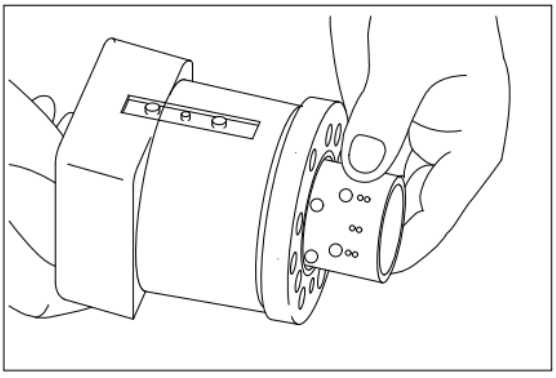
⑥ Screw out the threaded bush over the check valve.



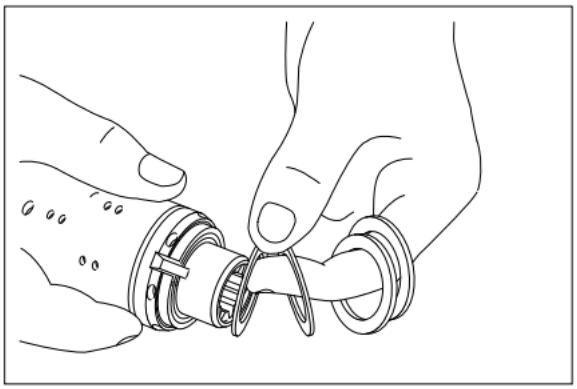
⑦ Remove O-ring.



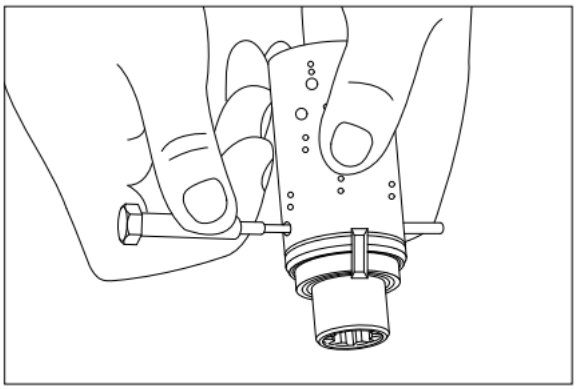
⑧ Take care to keep the cross pin in the sleeve and spool horizontal. The pin can be seen through the open end of the spool.
Press the spool inwards and the sleeve, ring, bearing races and thrust bearing will be pushed out of the housing together.



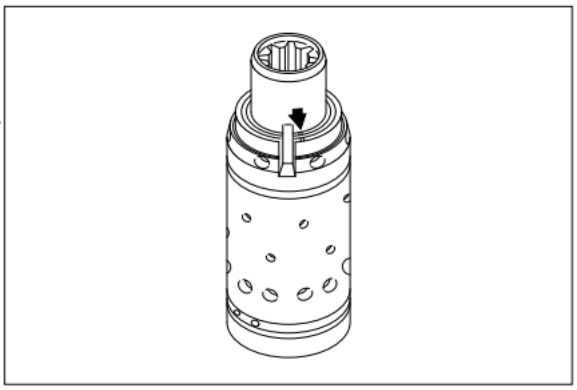
⑨ Take ring, bearing races and thrust bearing from sleeve and spool. The outer (Thin) bearing race can sometimes "stick" in the housing, therefore check that it has come out.



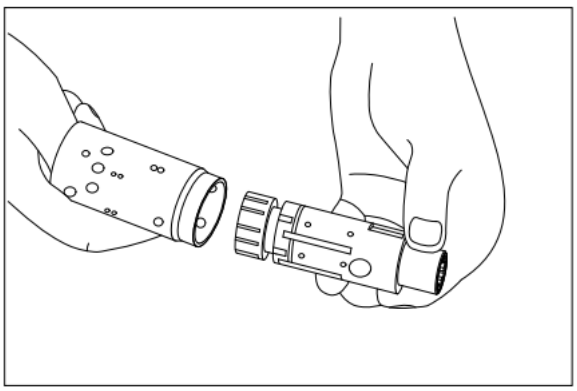
⑩ Press out the cross pin.
Use the special screw from the end cap.



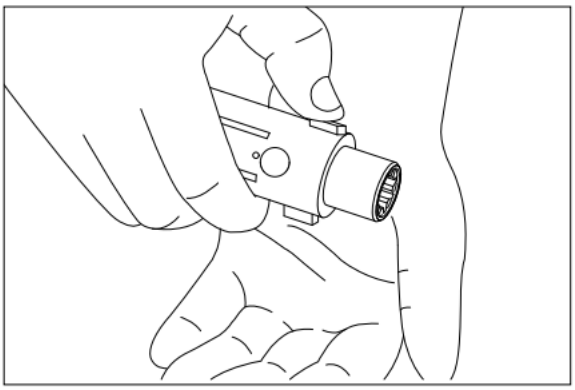
※ A small mark has been made with a pumice stone on both spool and sleeve close to one of the slots for the neutral position springs (See drawing). If the mark is not visible, remember to leave a mark of your own on sleeve and spool before the neutral position springs are disassembled.



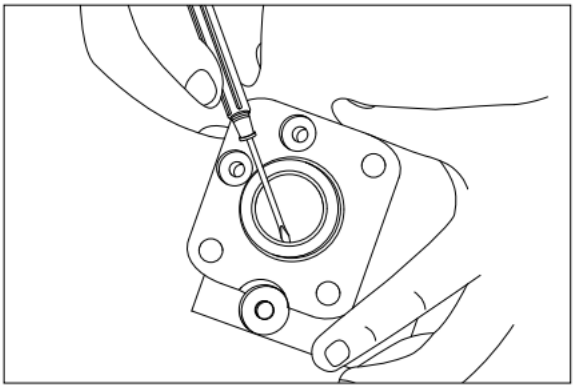
⑪ Carefully press the spool out of the sleeve.



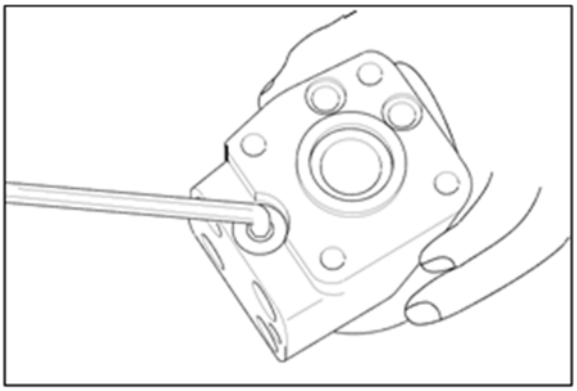
⑫ Press the neutral position springs out of their slots in the spool.



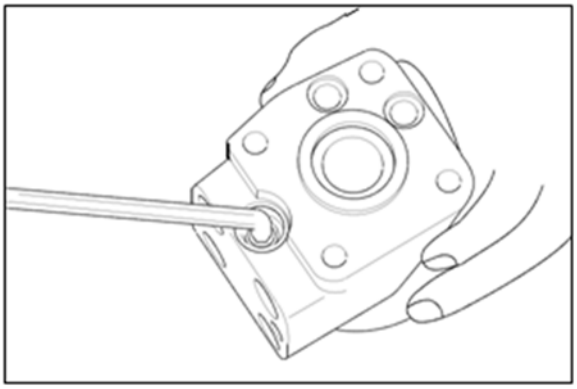
⑬ Remove dust seal and O-ring.



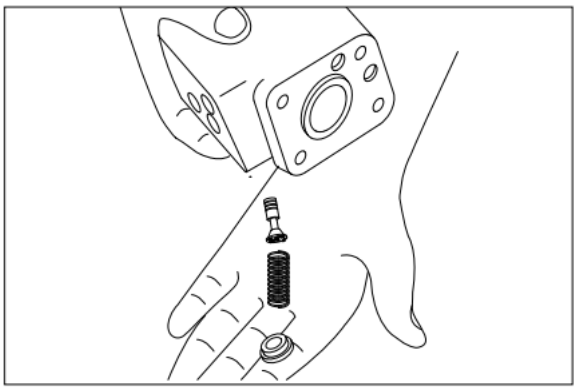
⑭ Disassembling the pressure relief valve
Screw out the plug using an 8mm hexagon socket spanner.
Remove seal washers.



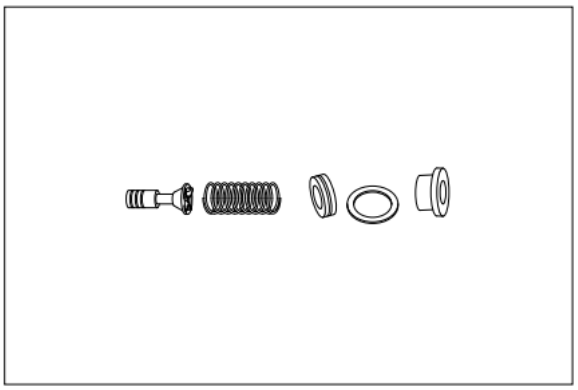
⑮ Unscrew the setting screw using an 8mmhexagon socket spanner.



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



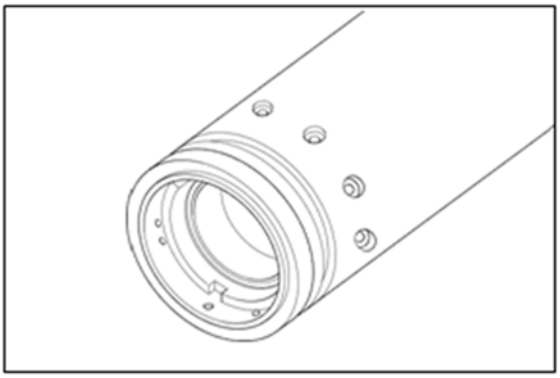
17 The pressure relief valve is now disassembled.



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.

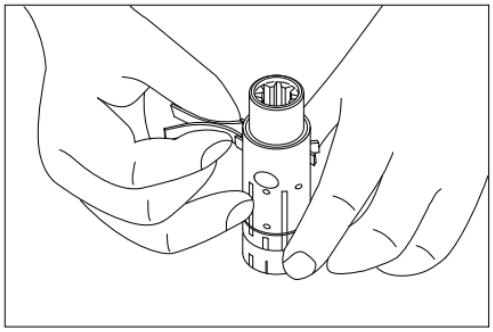


There are three slots in the spool And three holes in the sleeve in the end of the spool / sleeve opposite to the end with spring slots.

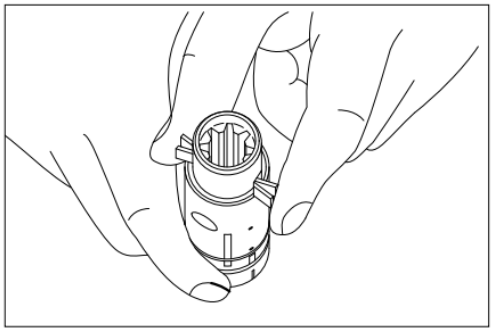
Place the slots and holes opposite each other so that parts of the holes in the sleeve are visible

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).

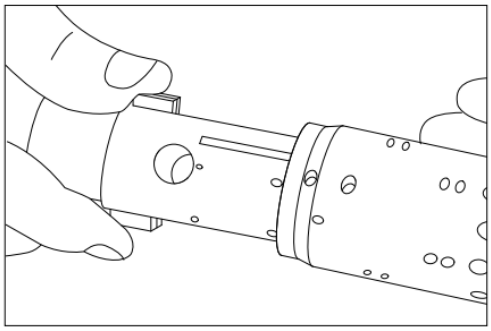


C. Line up the spring set.

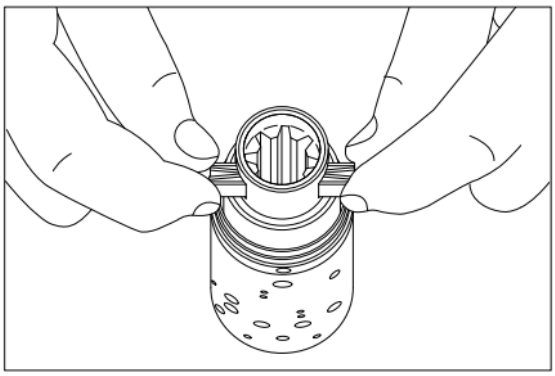


D. Guide the spool into the sleeve.

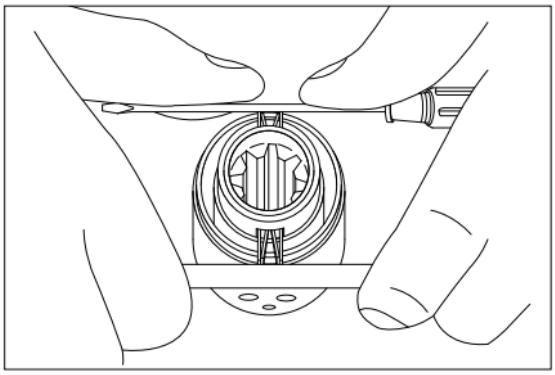
Make sure that spool and sleeve are placed correctly in relation to each other.



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

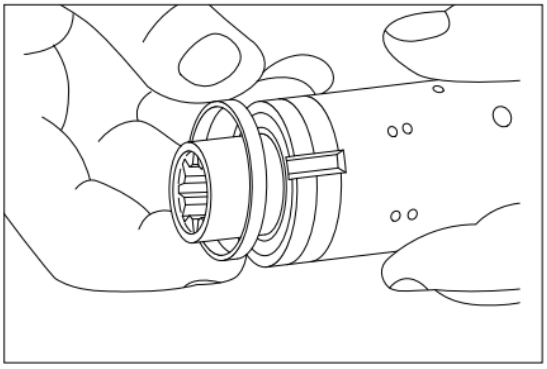


F. Line up the springs and center them.

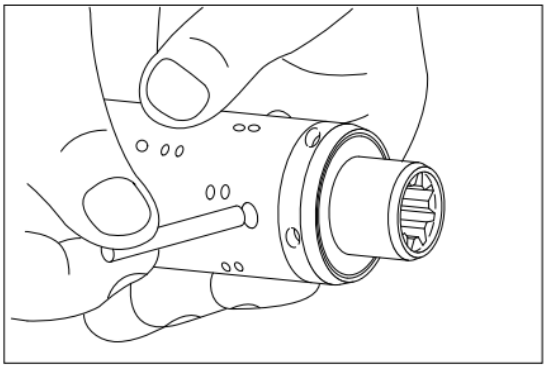


G. Guide the ring down over the sleeve.

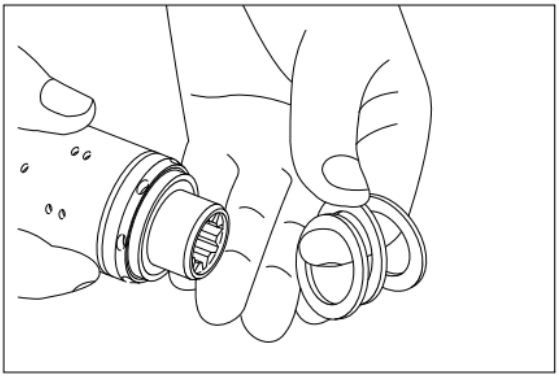
※ The ring should be able to rotate free of the springs.



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

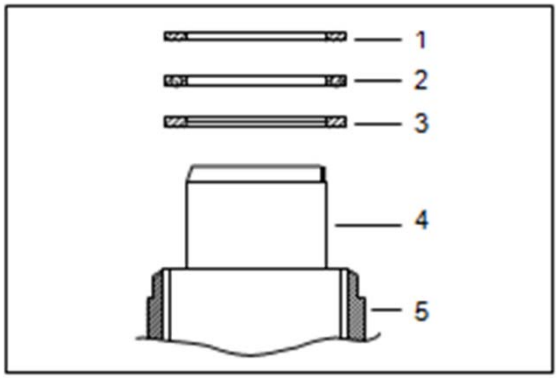


I. Fit bearing races and needle bearing as shown on below drawing.

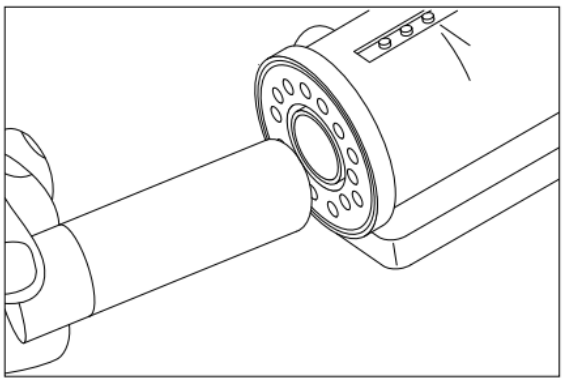


※ Assembly pattern for standard bearings

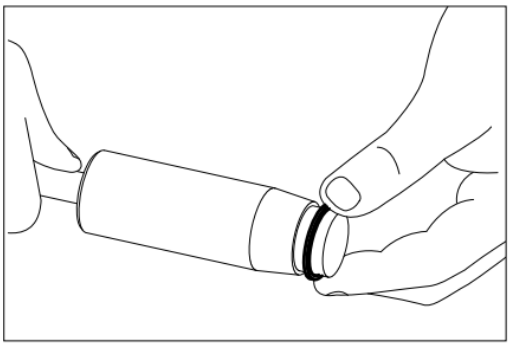
a) Outer bearing race
b) Thrust bearing
c) Inner bearing race
d) Spool
e) Sleeve

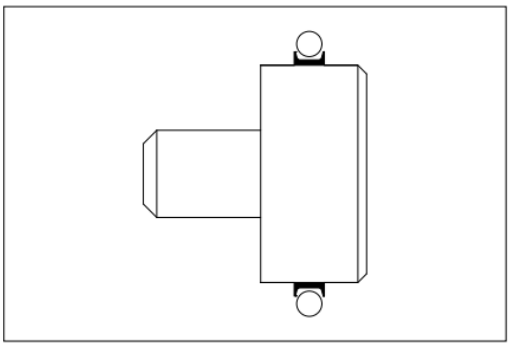


J. Installation instruction for O-ring
Turn the steering until the bore is horizontal. Guide the outer part of the assembly tool into the bore for the spool / sleeve.

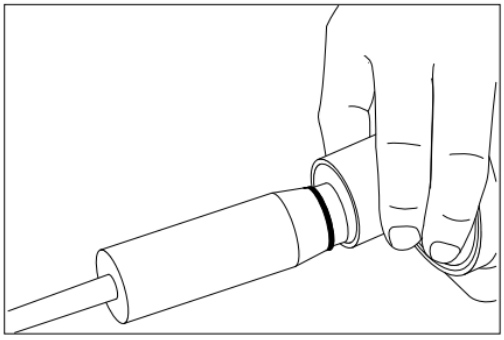


K. Grease O-ring with hydraulic oil and place them on the tool.

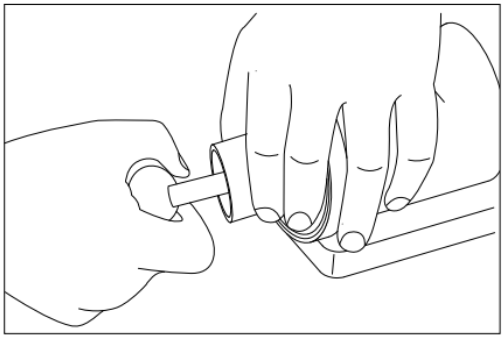




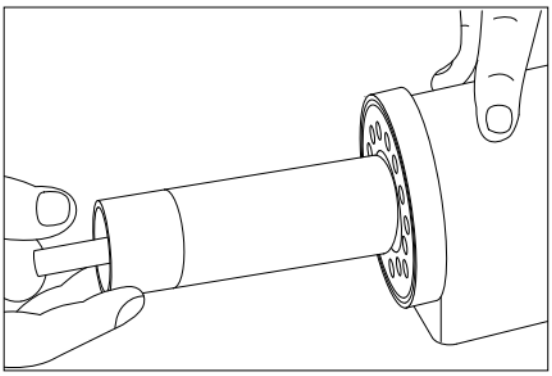
L. Hold the outer part of the assembly tool in the bottom of the steering unit housing and guide the inner part of the tool right to the bottom.



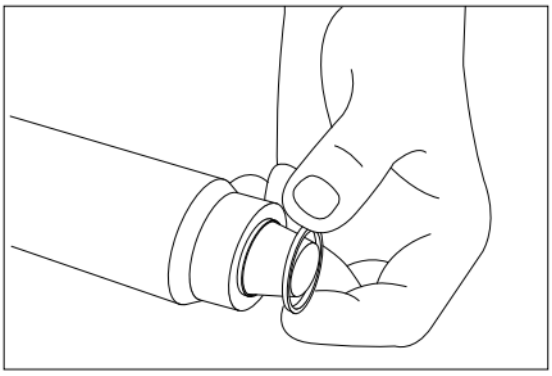
M. Press and turn the O-ring into position in the housing.

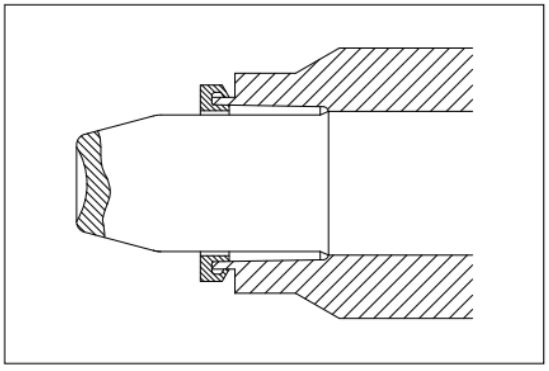


N. Draw the inner and outer parts of the assembly tool out of the steering unit bore, leaving the guide from the inner part in the bore.

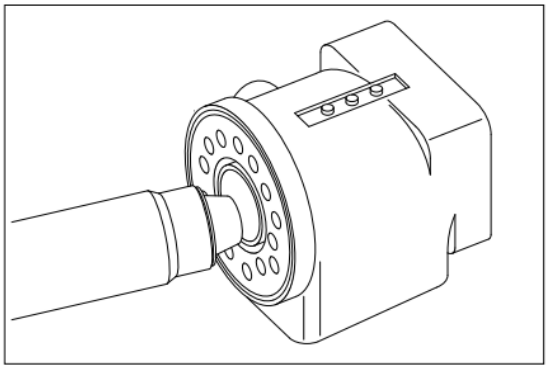


O. Installation instructions for lip seal
Lubricate the lip seal with hydraulic oil and place it on the assembly tool.

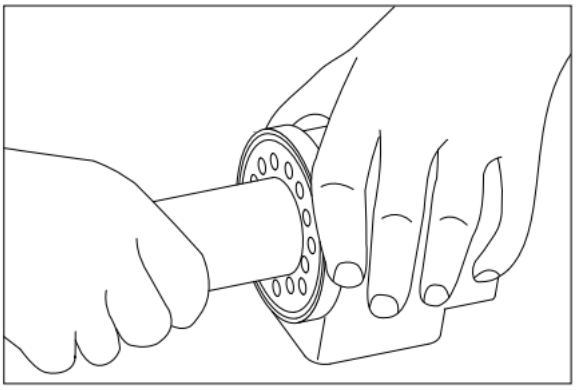




P. Guide the assembly tool right to the bottom.

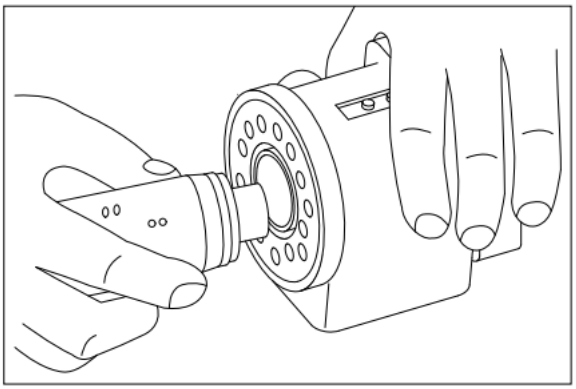


Q. Press and turn the lip seal into place in the housing.

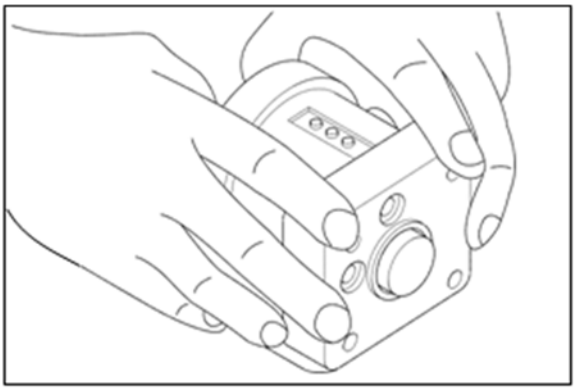


R. With a light turning movement, guide the spool and sleeve into the bore.

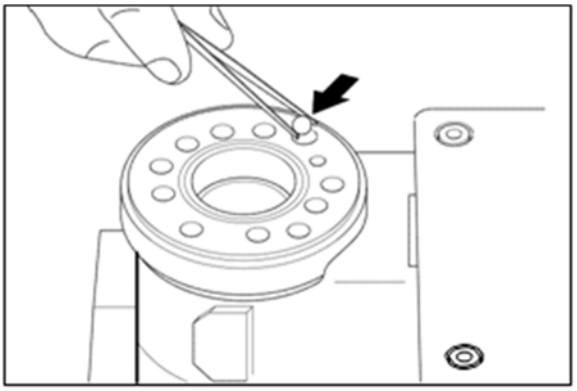
※ Fit the spool set holding the cross pin horizontal.



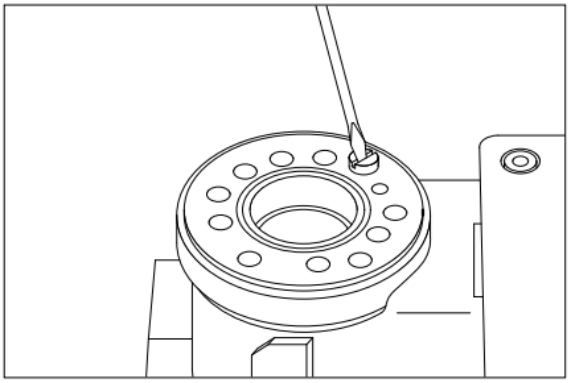
S. The spool set will push out the Assembly tool guide. The O-ring are now in position.



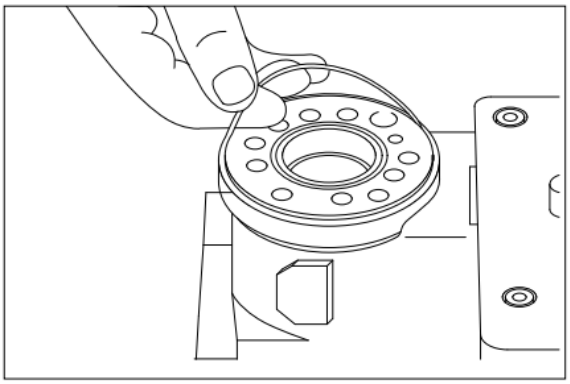
T. Turn the steering unit until the Bore is vertical again.
Put the check valve ball into the hole indicated by the arrow.



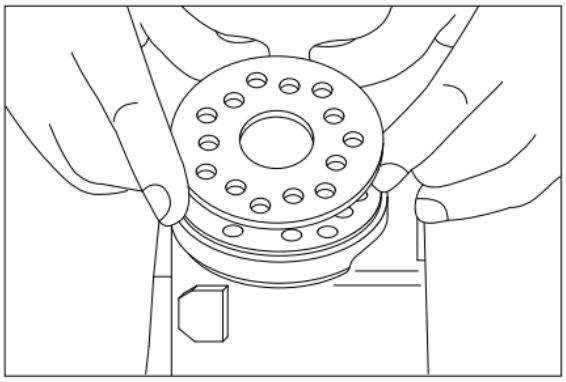
U. Screw the threaded bush lightly Into the check valve bore.
The top of the bush must lie just below the surface of the housing.



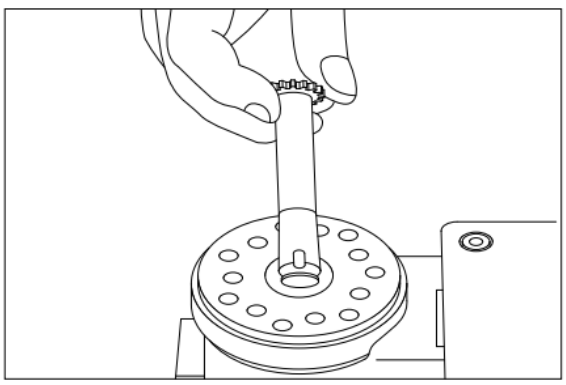
V. Grease the O-ring with mineral oil approx. viscosity 500 cst at 20℃.



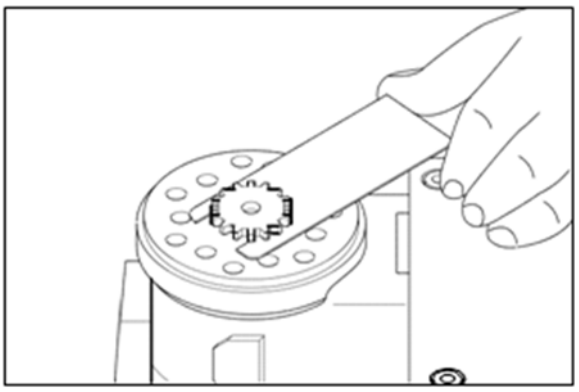
W. Place the distributor plate so that the channel holes match the holes in the housing.



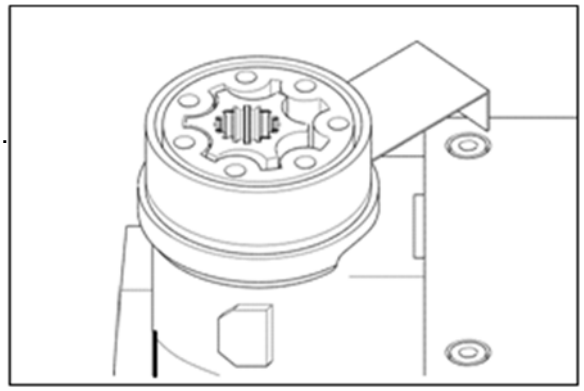
X. Guide the cardan shaft down into the bore so that the slot is parallel with the connection flange.



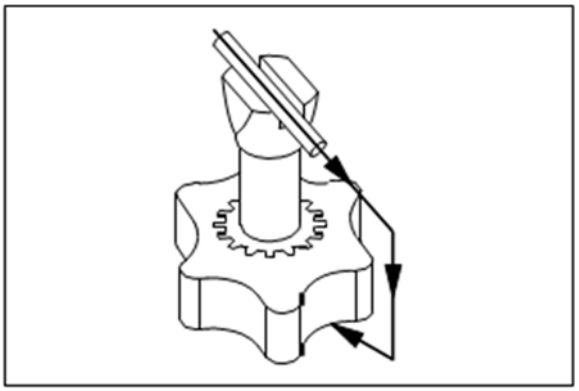
Y. Place the cardan shaft as shown so that it is held in position by the mounting fork.



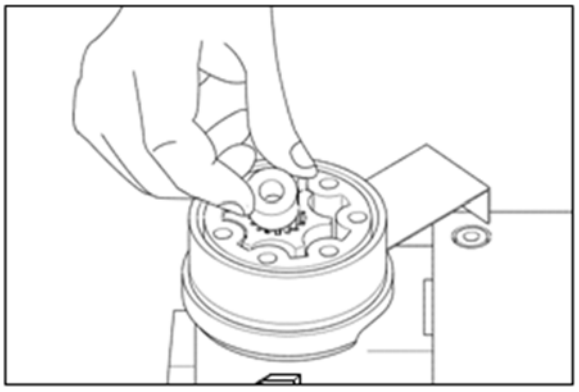
Z. Grease the two O-rings with mineral oil approx. viscosity 500 cst at 20°C and place them in the two grooves in the gear rim. Fit the gearwheel and rim on the cardan shaft.



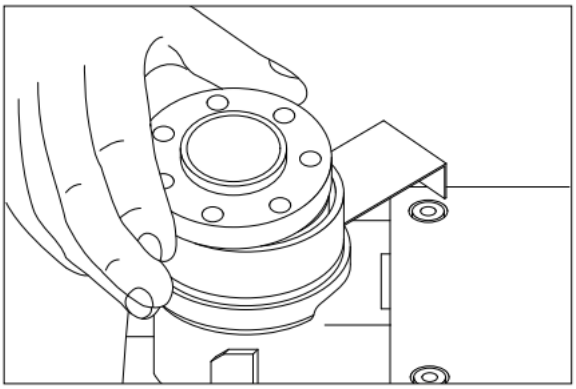
AA. Important
Fit the gearwheel (Rotor) and cardan shaft so that a tooth base in the rotor is positioned in relation to the shaft slot as shown.
Turn the gear rim so that the seven through holes match the holes in the housing.



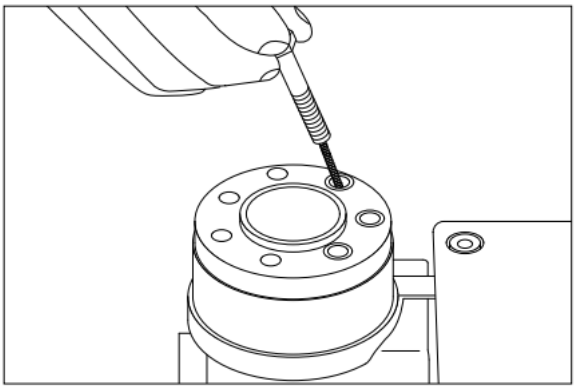
BB. Fit the spacer, if any.



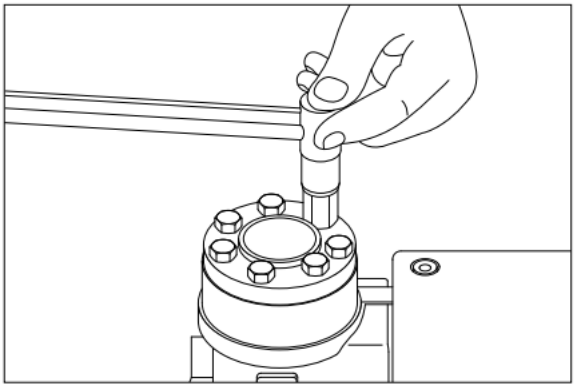
CC. Place the end cover in position.



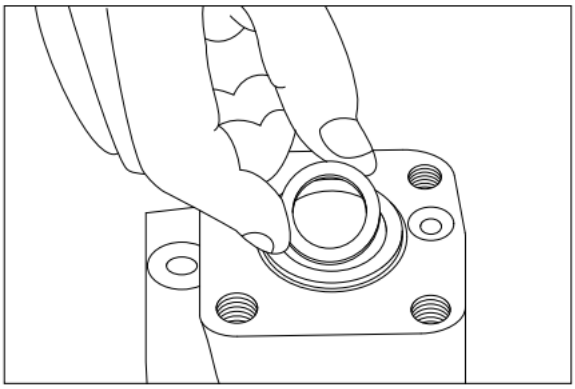
DD. Fit the special screw with washer and place it in the hole shown.



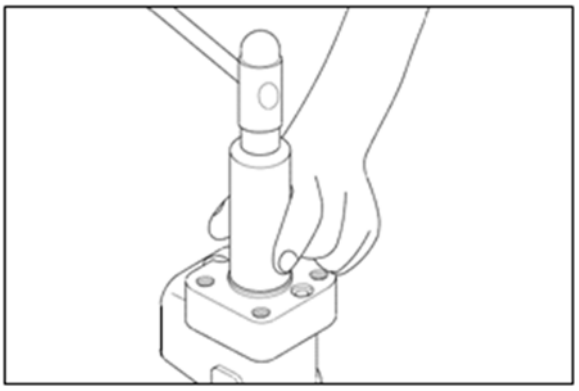
EE. Fit the six screws with washers and insert them.
Cross-tighten all the screws and the rolled pin.
•Tightening torque:
3.0 ± 0.6kgf•m (21.7 ± 4.3lbf•ft)



FF. Place the dust seal ring in the housing.

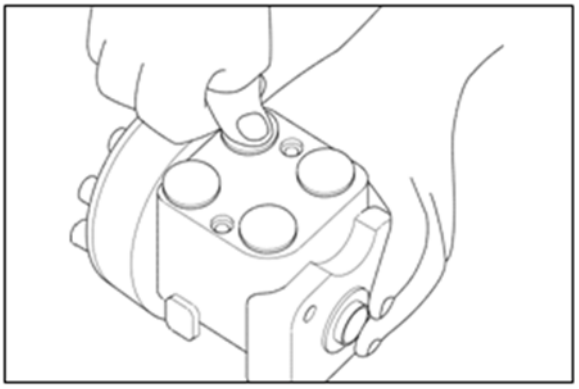


GG.Fit the dust seal ring in the housing.



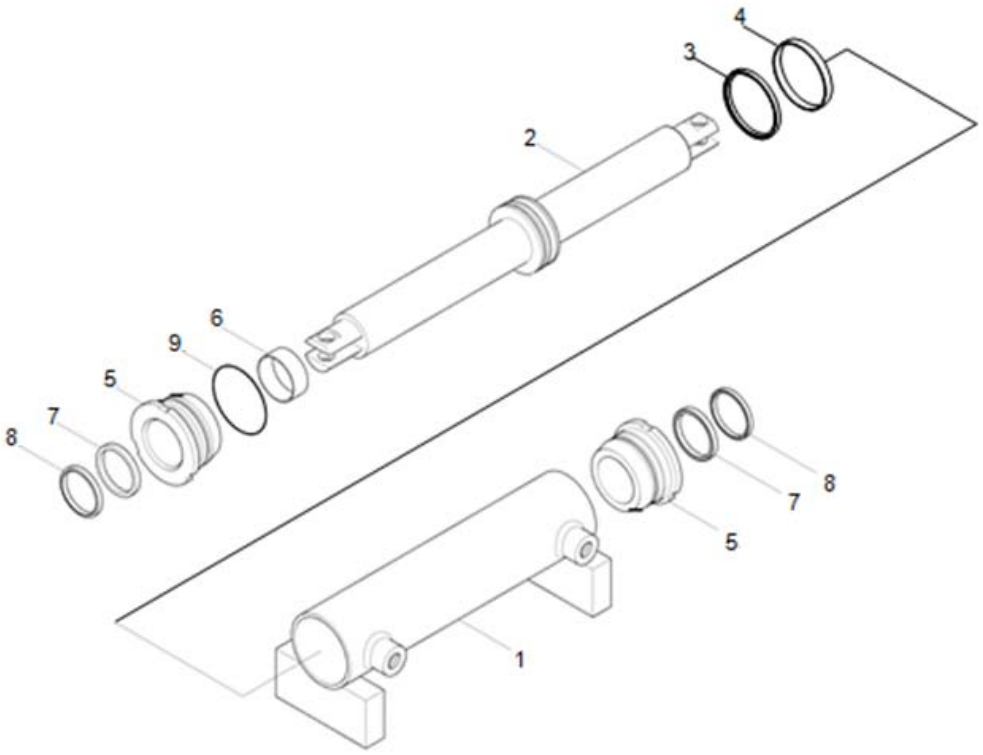
HH.Press the plastic plugs into the connection ports.

※ 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

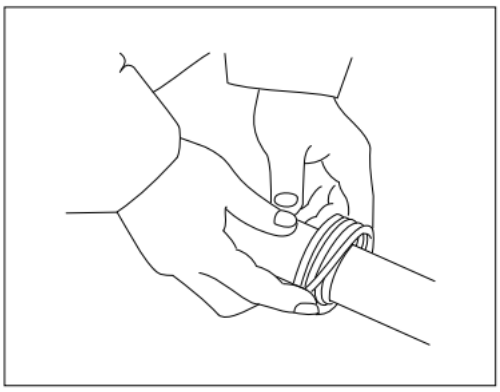
mm(in)

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

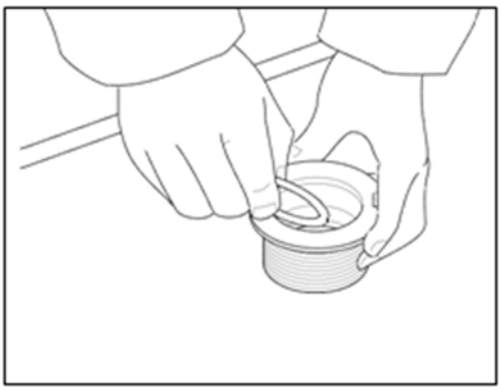
4) ASSEMBLY

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

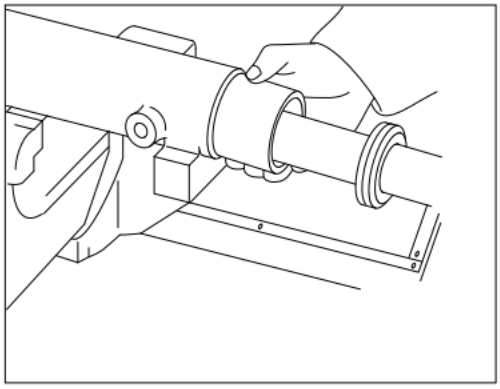
※ Be careful not to scratch the seal too much during installation or it will not seat properly.



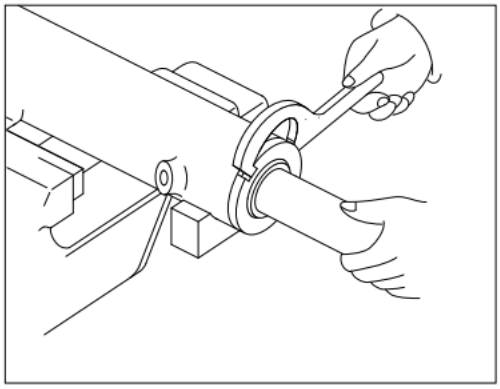
B. Install the rod seal to the position in the gland applying a slight coat with grease prior to install.



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.

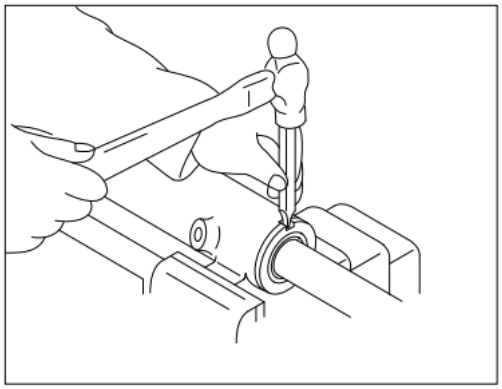


E. Using a hook spanner, install the gland assembly, and tighten it with torque 45±4.5kgf•m (325±32.5lbf•ft).



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.



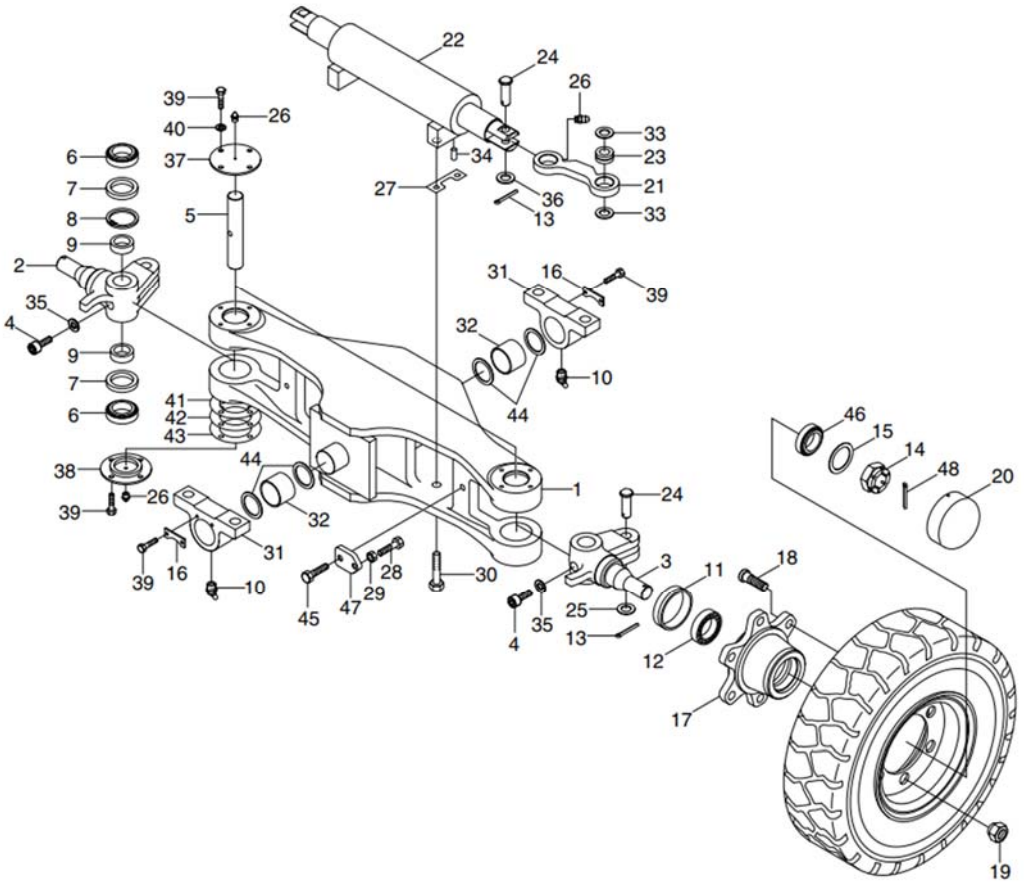
G. Move the piston rod back and forth several times for the full distance of its stroke. This helps to seat the ring and seals before applying full hydraulic pressure to the cylinder.
H. Install cylinder into steering axle.
I. While idling the engine with the rear wheels off the ground, operate the steering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

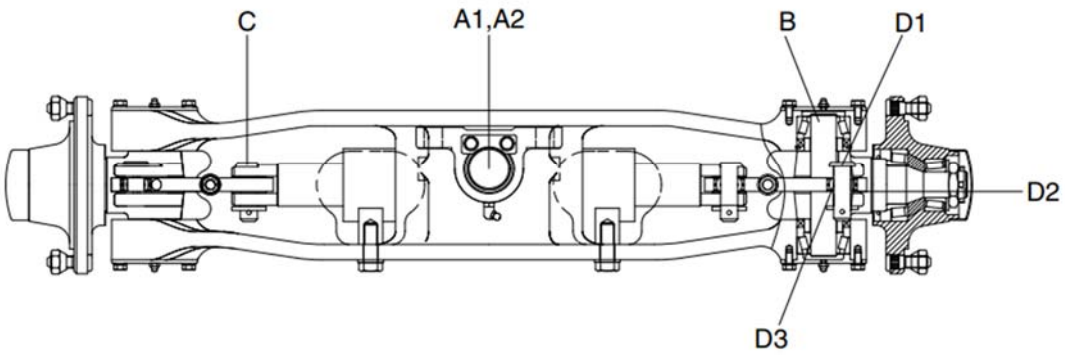
3 STEERING AXLE

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

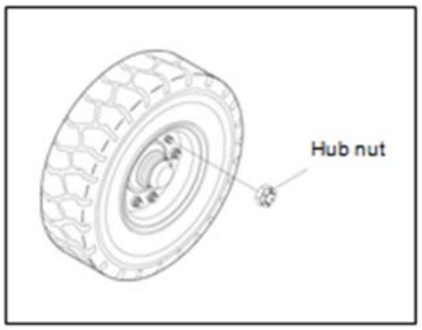
•OD: Outer diameter

•ID: Inner diameter

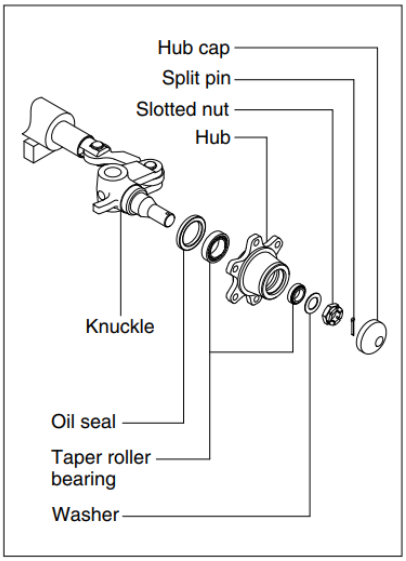
3) DISASSEMBLY

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

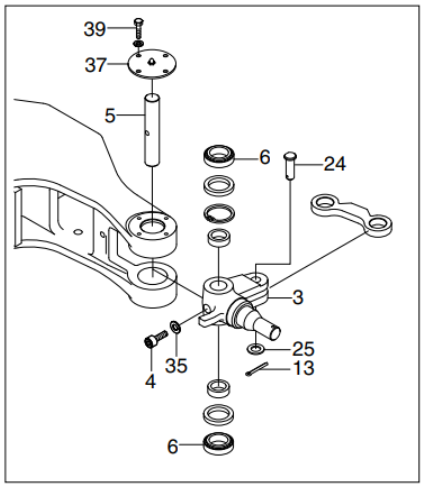
A. Loosen the hub nut and take off the steering wheel tire.



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.

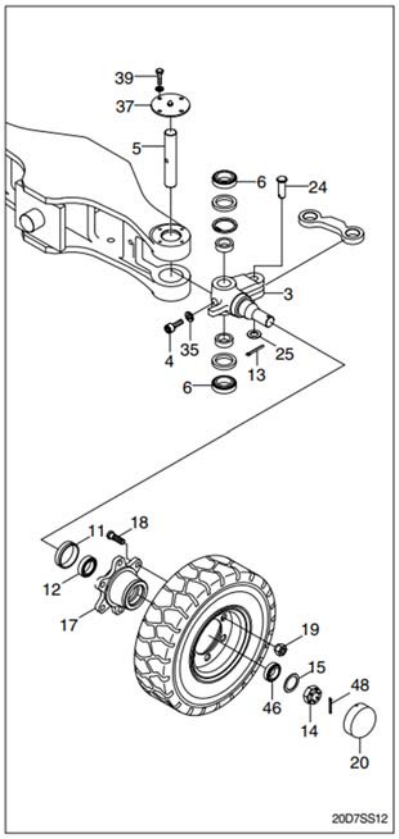
Perform the disassembly in reverse order.

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.

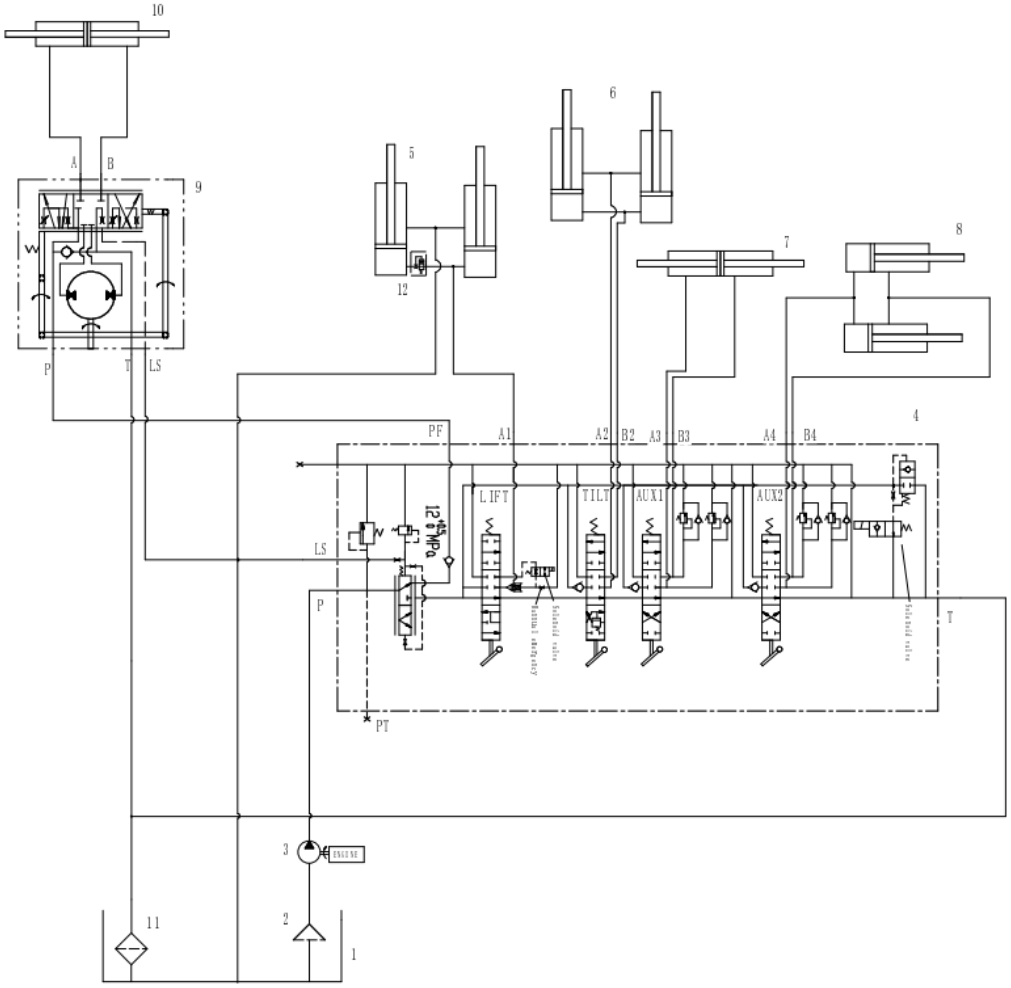


SECTION 6 HYDRAULIC SYSTEM

Group 1 Structure and Function ----------122-133
Group 2 Operational Checks and Troubleshooting ----------134-137
Group 3 Disassembly and Assembly ----------138-151

GROUP1 STRUCTURE AND FUNCTION

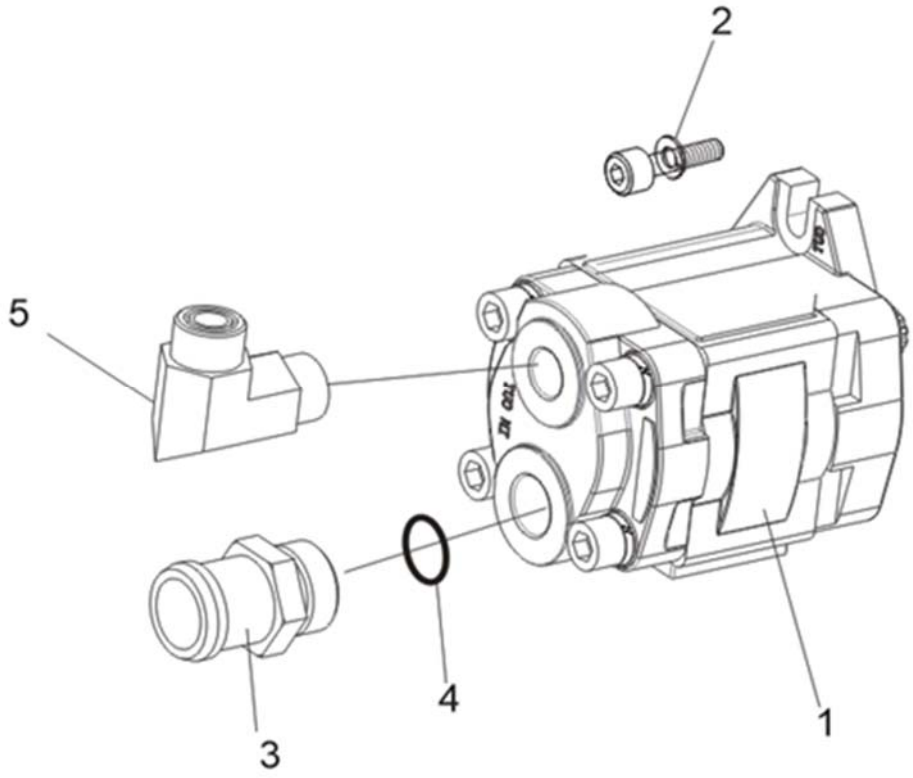
1 HYDRAULIC CIRCUIT



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

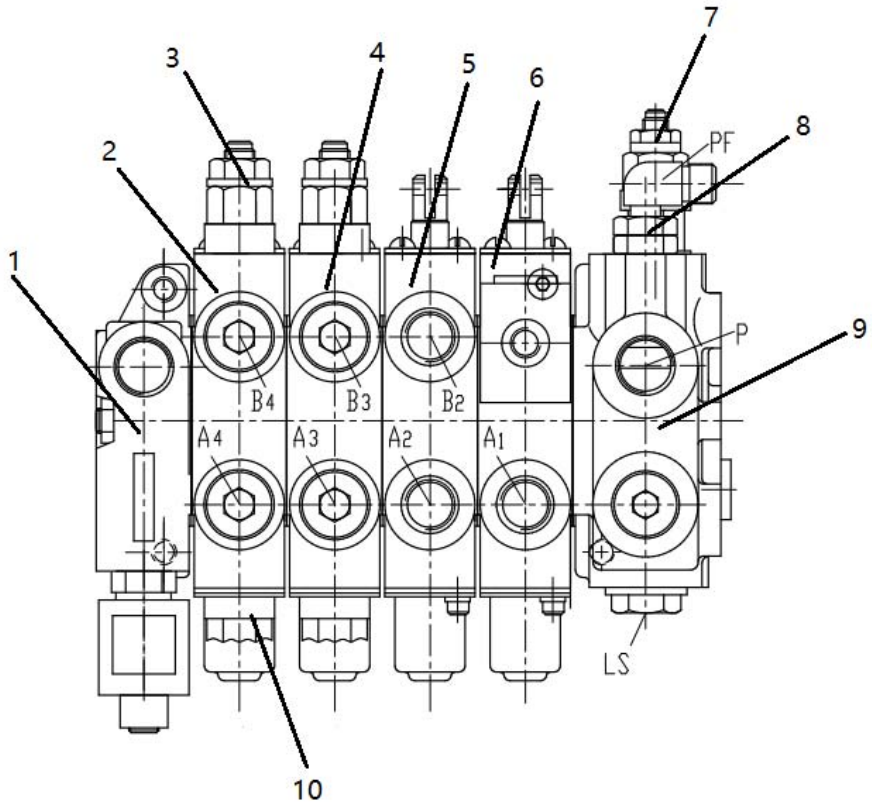
1) STRUCTURE



1	GEAR PUMP ASSY	3	CONNECTOR	5	ELBOW-90
2	BOLT-W/WASHER HEX	4	O-RING		

3 MAIN CONTROL VALVE

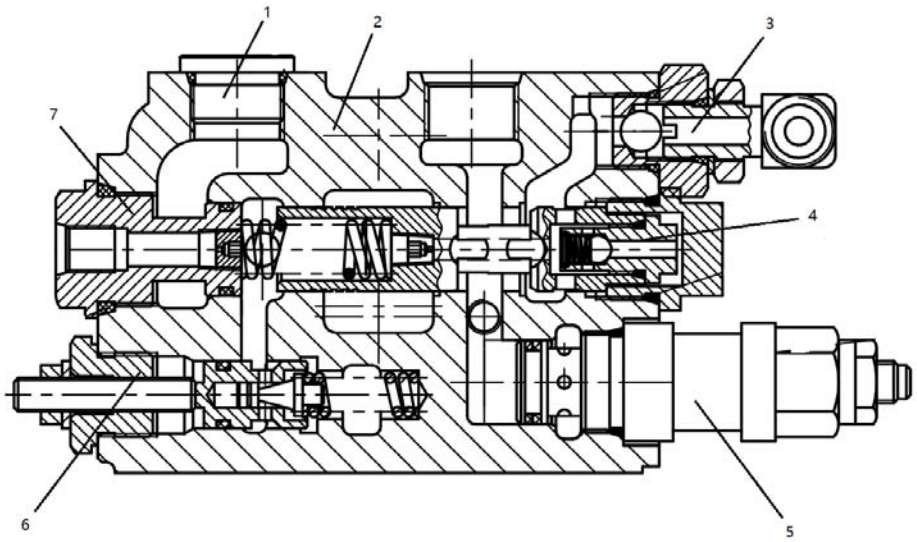
1) STRUCTURE (4- Spool)



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

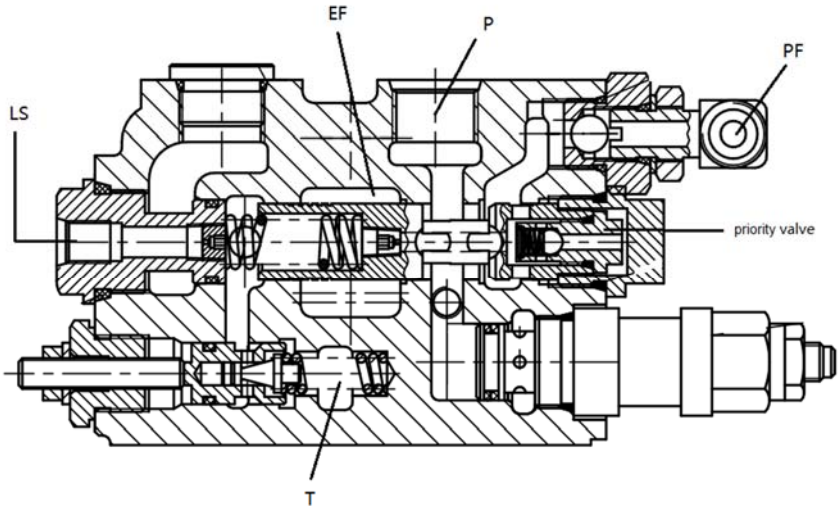
2) INLET SECTION OPERATION

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		

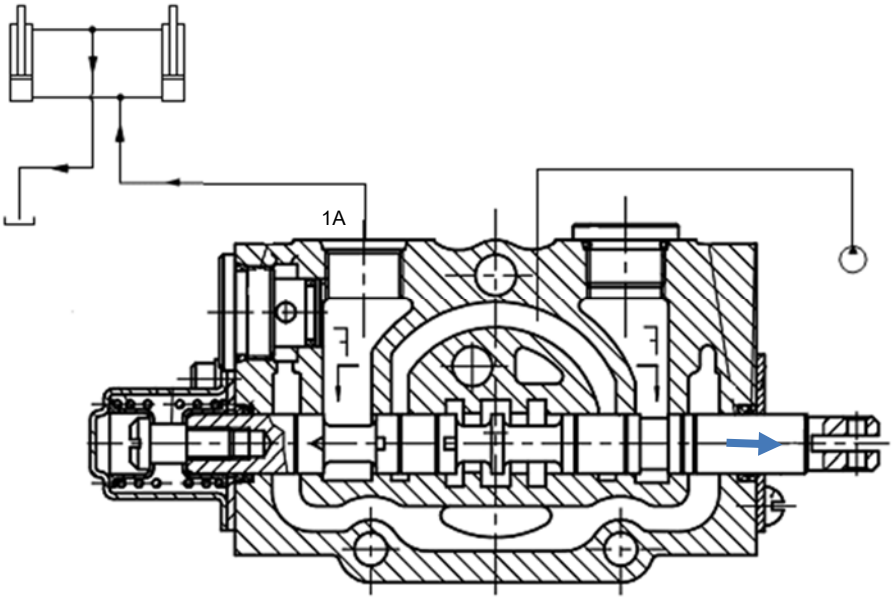
② Operation



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

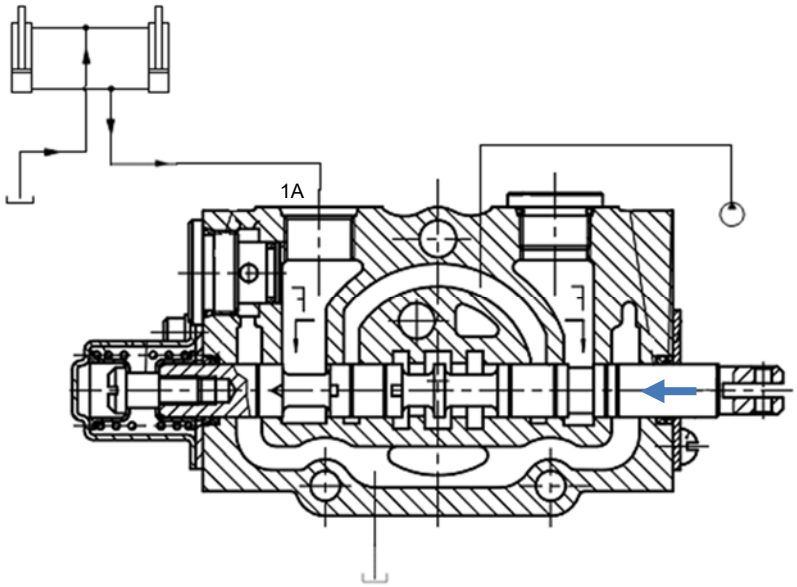


When the lift control lever is pulled back, the spool moves to the right and the neutral passage is closed.

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.

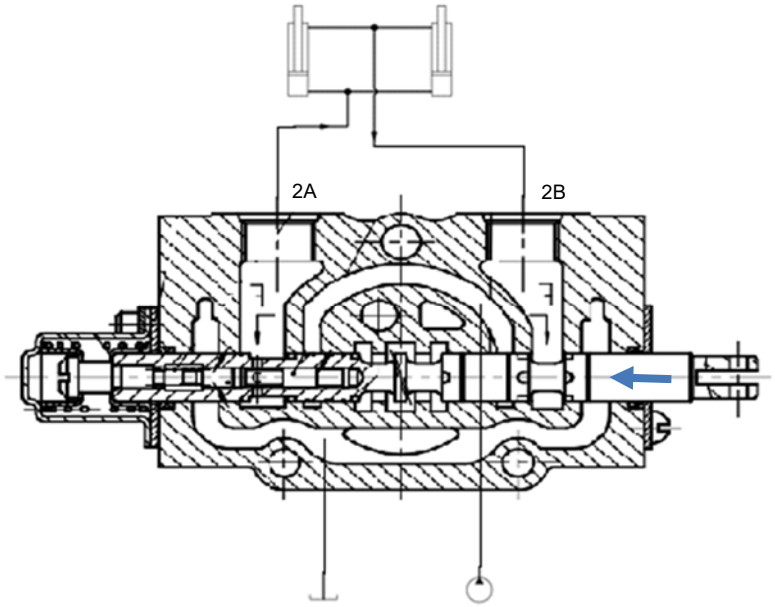
② Lower position



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

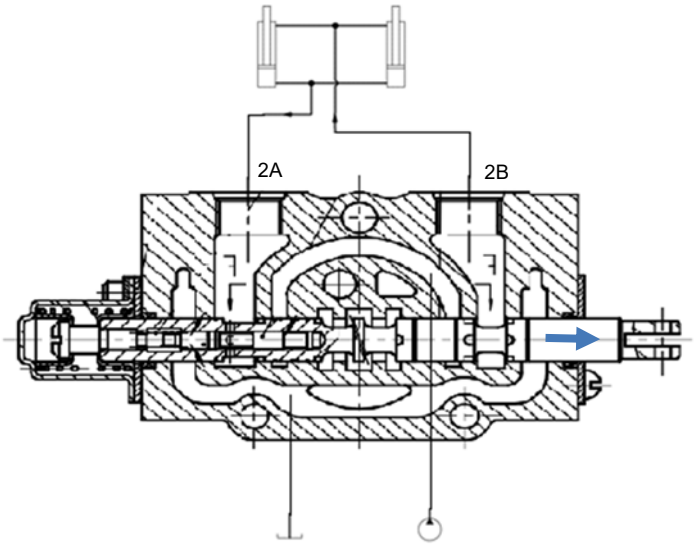


When the tilt control lever is pushed forward, the spool moves to the left and the neutral passage is closed.

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.

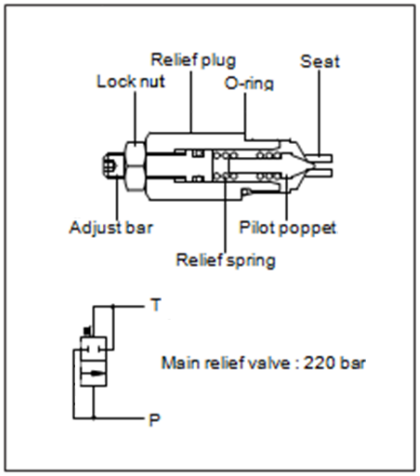
5) MAIN RELIEF VALVE

① Pressure setting

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

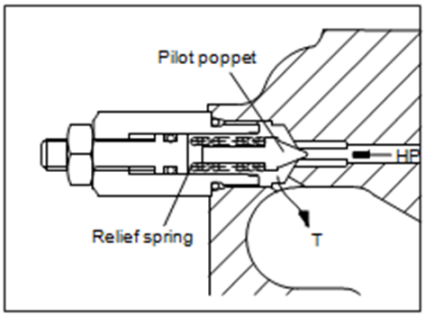
Procedure

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

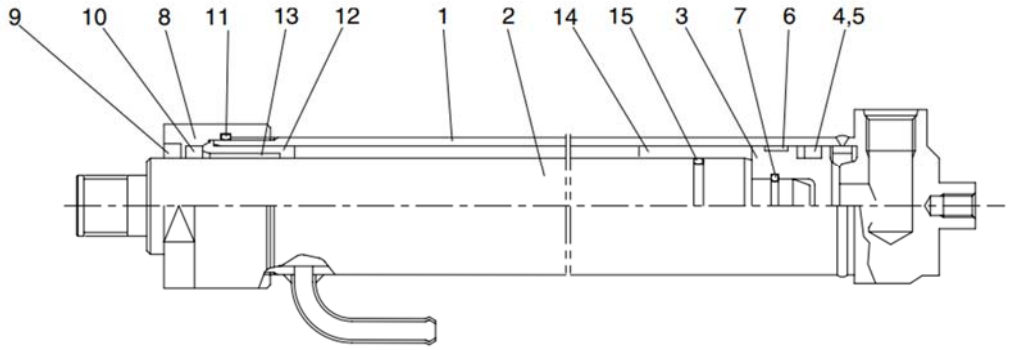


② Operation

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

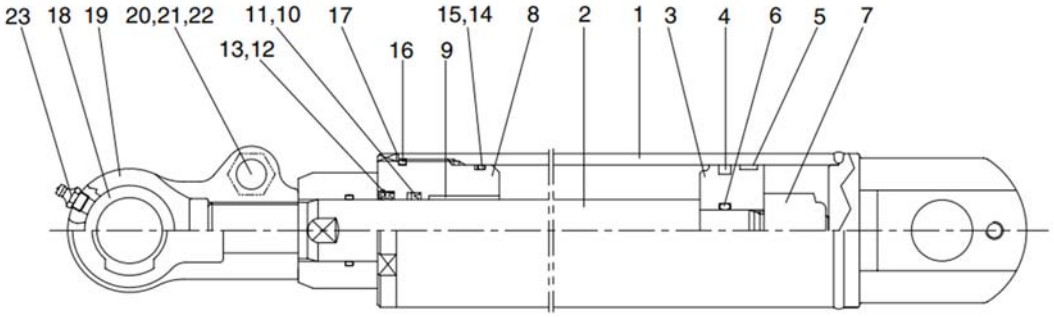


4 LIFT CYLINDER



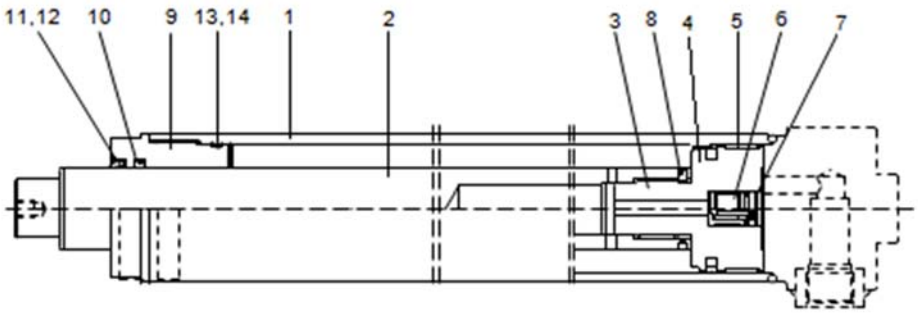
1	Tube assembly	6	Wear ring	11	O-ring
2	Rod	7	Retaining ring	12	Guide
3	Piston	8	Gland	13	DU bushing
4	Piston seal	9	Dust wiper	14	Spacer
5	Back up ring	10	Rod seal	15	O-ring

5 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	Seal 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		

6 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		

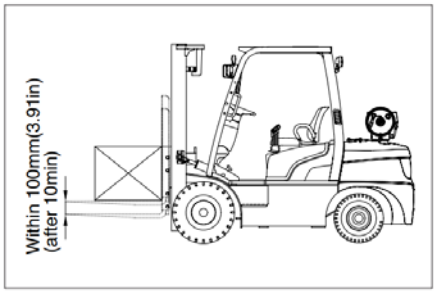
GROUP2 OPERATIONAL CHECKS AND TROUBLESHOOTING

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).

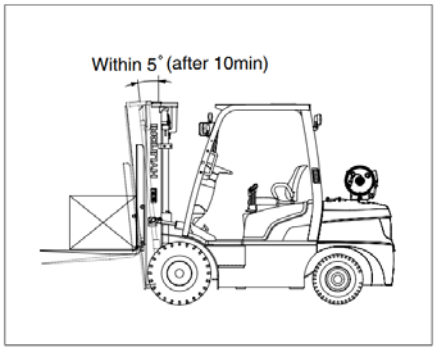


•Check condition

- 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 with in standard range.

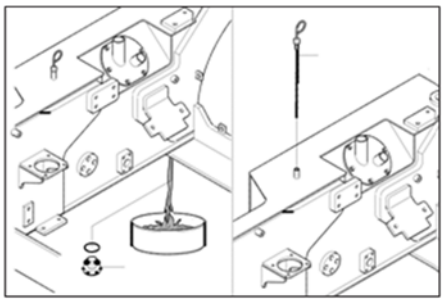
mm (in)

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 SAE10W, class CF engine oil. •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 SAE10W, class CF engine oil. •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 section 6 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 retracts.	•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

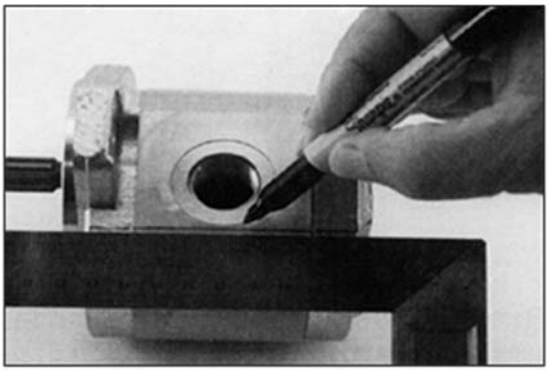
•Metric socket set

•Internal snap ring pliers

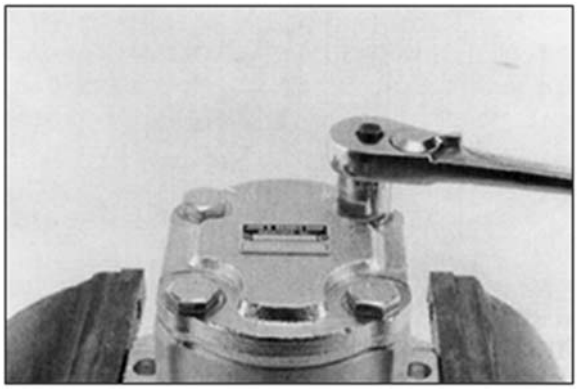
•Shaft seal sleeve

•Torque wrench

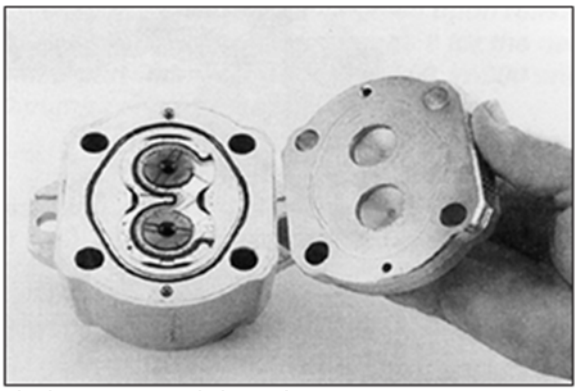
1) It is very important to work in a clean work area when repairing hydraulic products. Plug ports and wash exterior of pump with a proper cleaning solvent before continuing.
2) Remove port plugs and drain oil From pump.
3) Use a permanent marker pen to mark a line across the mounting flange, gear housing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



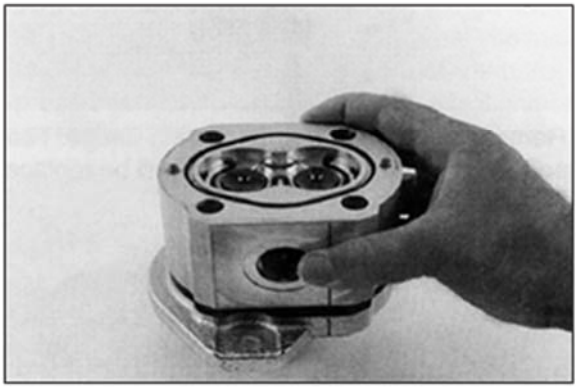
5) Clamp mounting flange in a protected jaw vise with pump shaft facing down.
6) Loosen the four metric hexagon head bolts.
7) Remove pump from vise and place on clean work bench, remove the four hexagonal head bolts and spacers applicable.



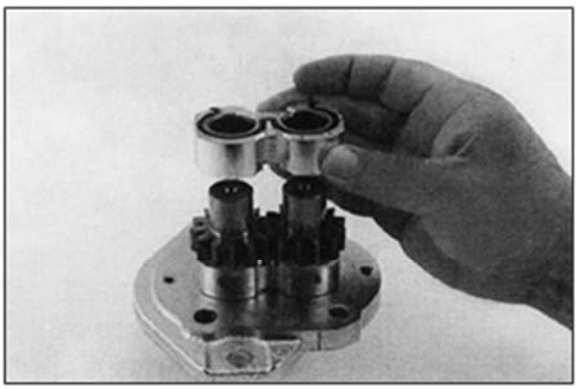
8) Lift and remove end cover.



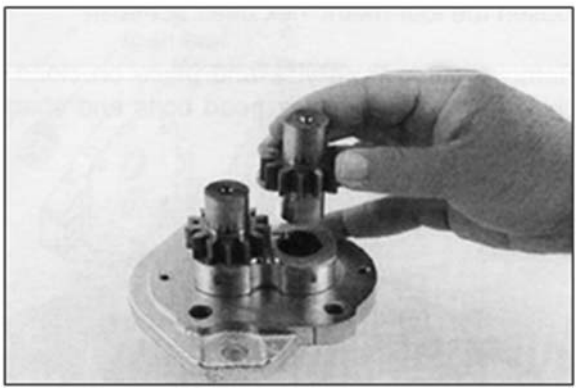
9) Carefully remove gear housing and place on work bench.
Make sure the rear bearing block remains on the drive and idler shafts.



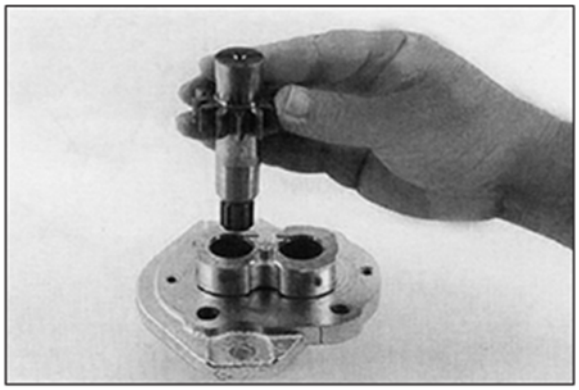
10) Remove rear bearing block from drive and idler shafts.



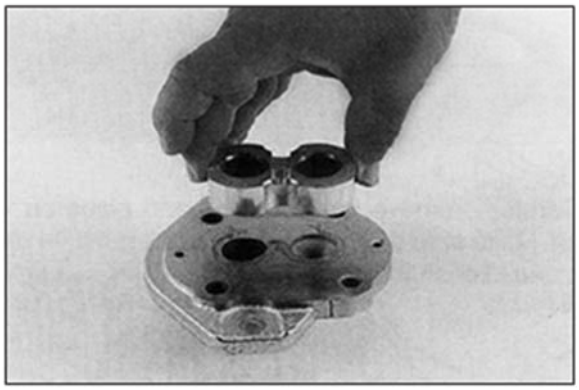
11) Remove idler shaft from bearing block.



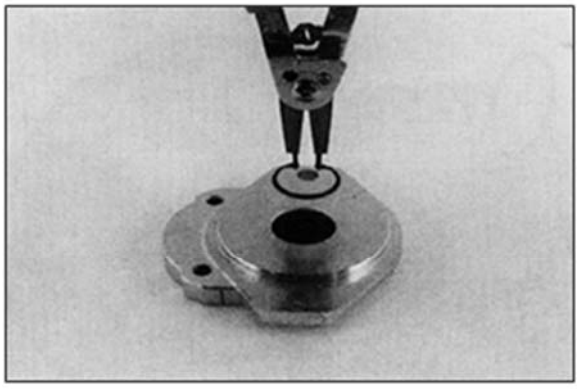
12) Remove drive shaft from mounting flange.
There is no need to protect the shaft seal as it will be replaced as a new item.



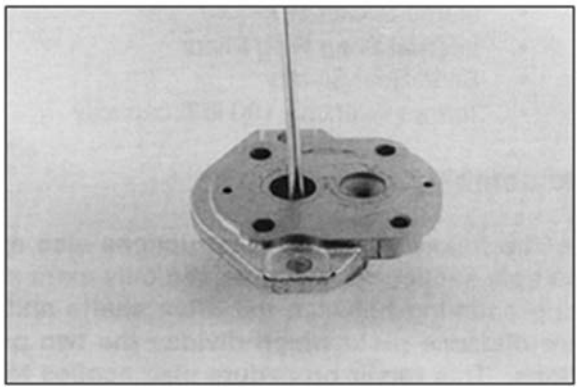
13) Remove the front bearing block.



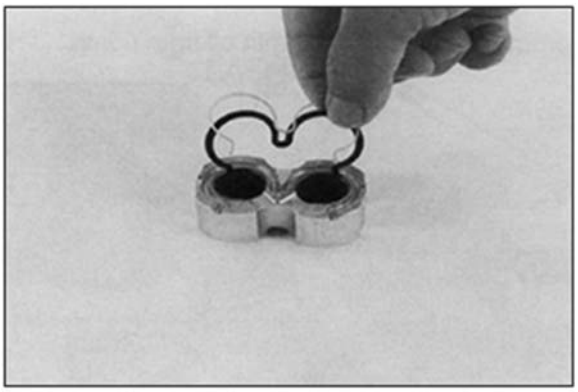
14) Turn mounting flange over, with shaft seal up, and remove the retaining ring with proper snap ring pliers.



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

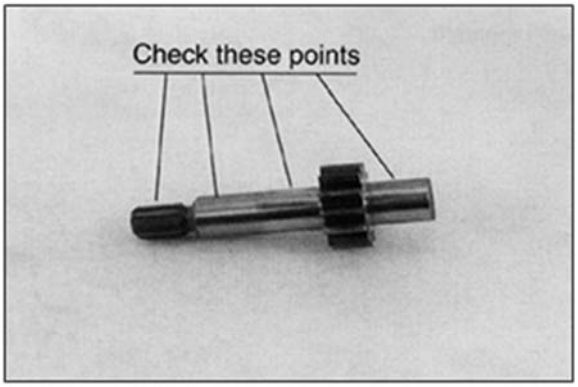


17) Remove seals from both bearing blocks and discard.

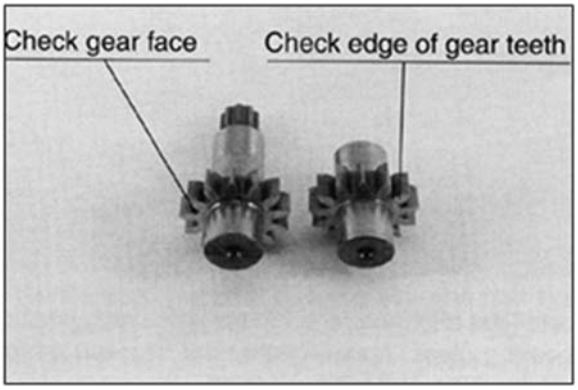


2 INSPECT PARTS FOR WEAR

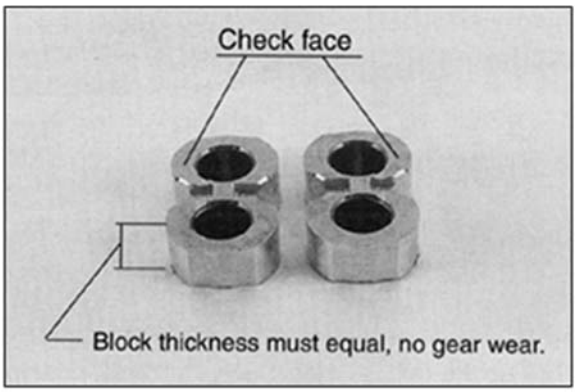
1) Clean and dry all parts thoroughly prior to inspection. It is not necessary to inspect the seals as they will be replaced as new items.
2) Check drive shaft spline for twisted or broken teeth, check keyed drive shaft for broken or chipped keyway.
   No marks or grooves on shaft in seal area, some 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

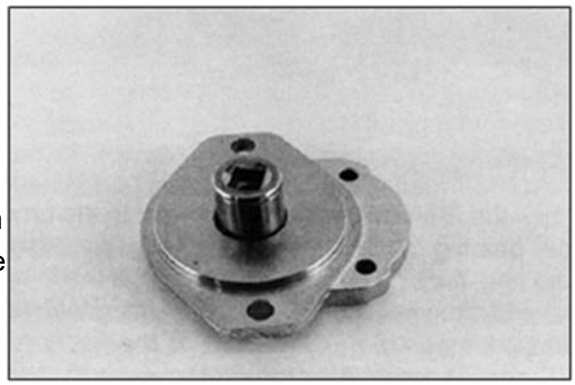
It is important that the relationship of the mounting flange, bearing blocks and gear housing is correct. Failure to properly assemble this pump will result with little or no flow at rated pressure.

※ This pump is not bi-rotational.

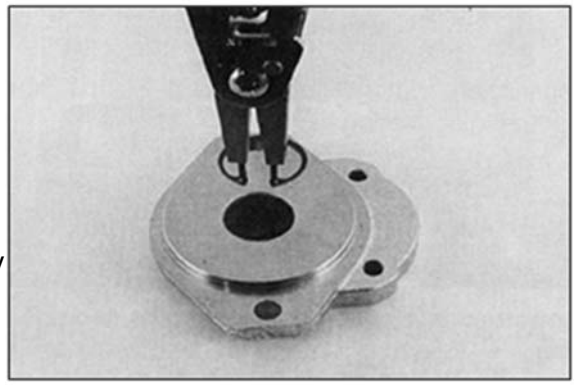
3 ASSEMBLY

※New seals should be installed upon reassembly of pump.

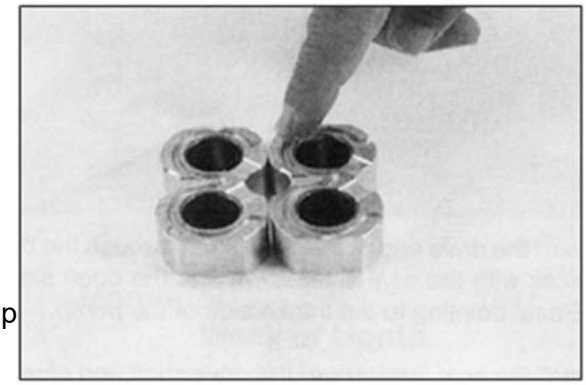
1) Install new shaft seal in mounting flange with part number side facing outboard. Press the seal into the seal bore until the seal reaches the bottom of the bore. Uniform pressure must be used to prevent misalignment or damage to the seal.



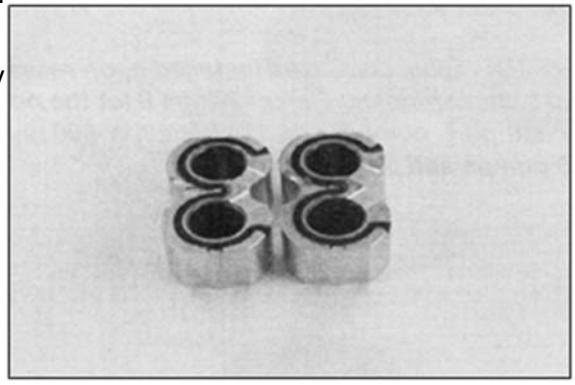
2) Install retaining ring in groove in seal bore of mounting flange.



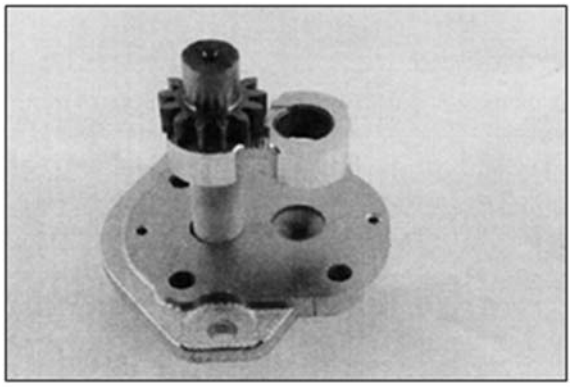
3) Place front and back bearing blocks on a clean surface with the E-seal grooves facing up.
Apply a light coating of petroleum jelly in the grooves.
Also coat the E-seal and backup with the petroleum jelly, this will help keep the seals in place during assembly.



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.
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.

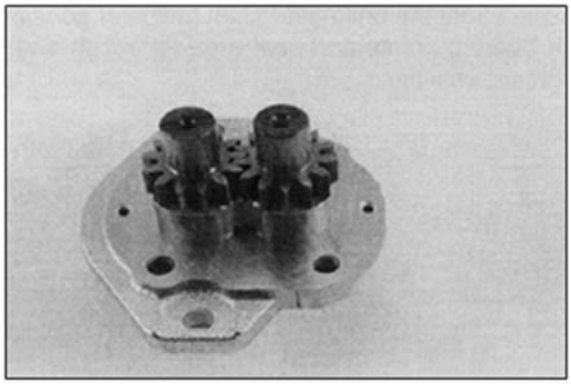


7) Insert the drive end of the drive shaft through the bearing block with the seal side down, and the open side of the E-seal pointing to the intake side of the pump.

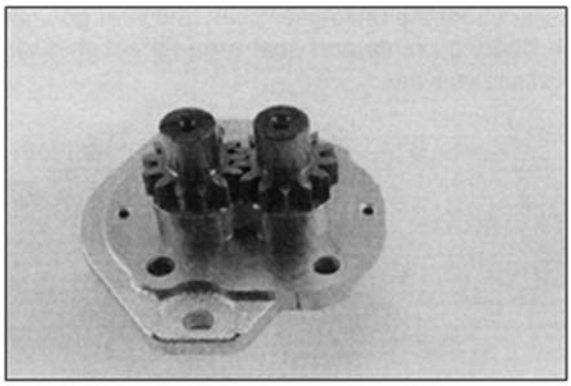


8) Install the seal sleeve over the drive shaft and carefully slide the drive shaft through the shaft seal. Remove the seal sleeve from shaft.

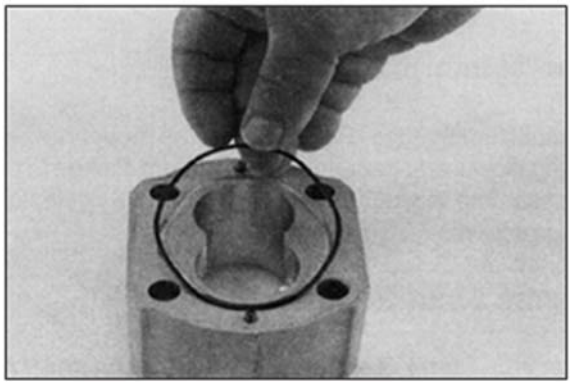
9) Install the idler gear shaft in the remaining position in the bearing block.
Apply a light coat of clean oil to the face of the drive and idler gears.



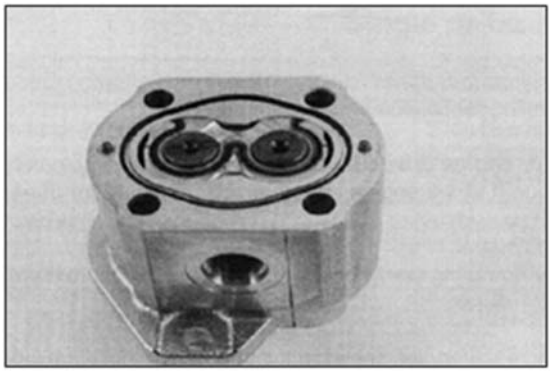
10) Pick up the rear bearing block, with seal side up and with open end of the E-seal facing the intake side of the pump, place over the drive and idler gear shafts.
11) Install two dowel pins in the holes in the mounting flange or two long dowel pins through gear housing if pump is a multiple section 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.

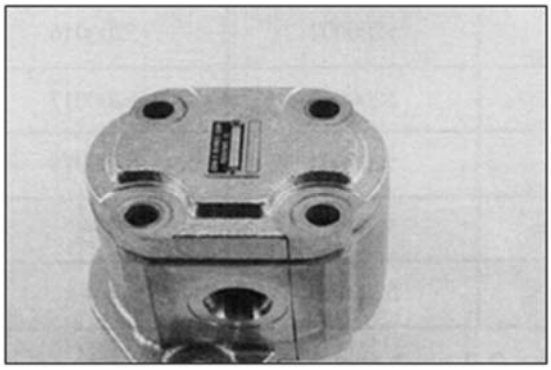


13) Gently slide the gear housing over the rear bearing block assembly, slide housing down until the housing engages the dowel pins.
Press firmly in place with hands, do not force or use any tool.
Check to make sure the intake port in the housing in on the same side as the open end of the E-seal and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

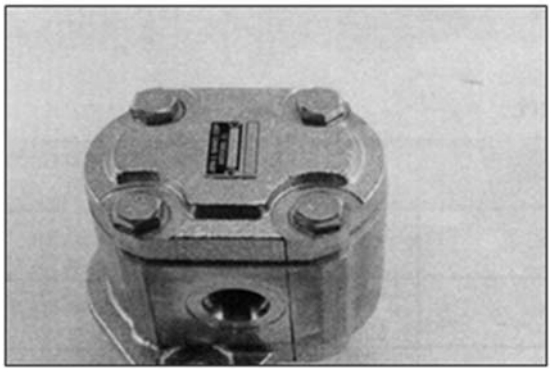


14) The surface of the rear bearing block should be slightly below the face of the gear housing.
If the bearing block sits higher, then the rear face of the gear housing then the E-seal or O-ring have shifted out of the groove. If this is the case, remove the gear housing and check for proper seal installation.

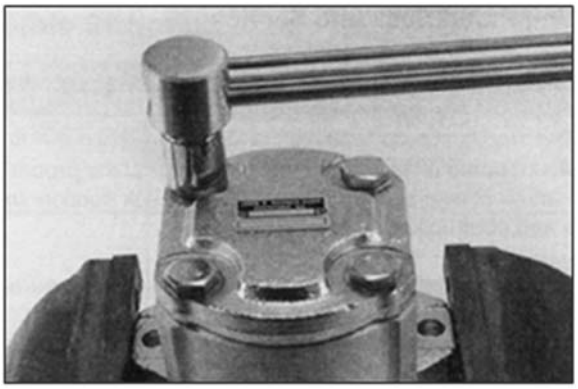
15) Install the two remaining dowel pins in the rear of the gear housing and place the end cover over the back of the pump.



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



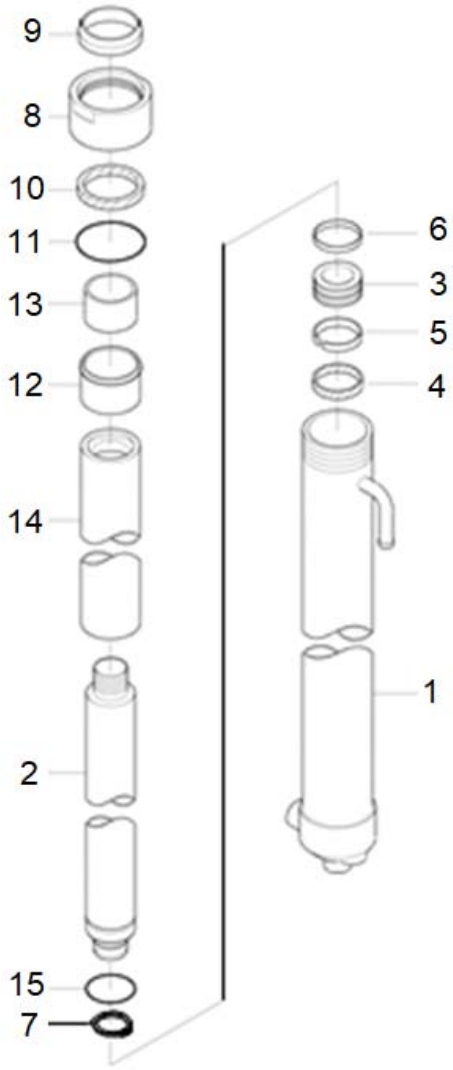
17) Place mounting flange of the pump back in the protected jawed vise and alternately torque the bolts.
    •Tighten torque: 3.0~4.0kgf•m (22~29lbf•ft)

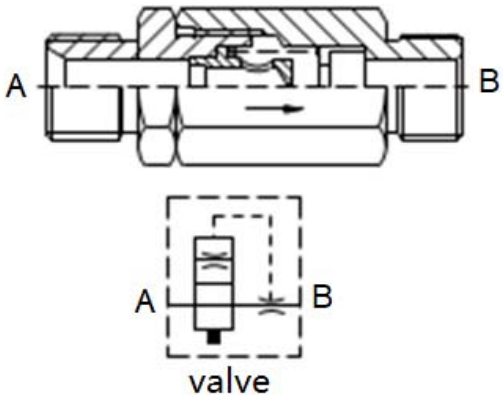


18) Remove pump from vise.
19) Place a small amount of clean oil in the inlet of the pump and rotate the drive shaft away from the inlet one revolution. If the drive shaft binds, disassemble the pump and check for assembly problems, then reassemble the pump.

4 LIFT CYLINDER

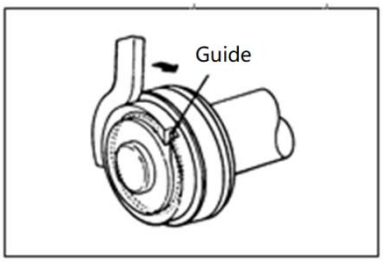
1) STRUCTURE





1	Tube assembly	6	Wear ring	11	O-ring
2	Rod assembly	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



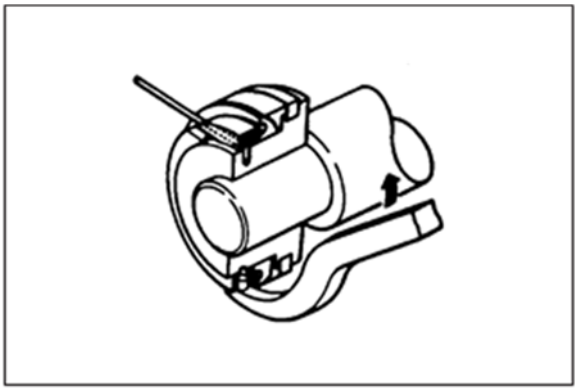
① Hold the cylinder tube in a vice, loosen the cylinder head and remove it. Remove the spacer from the cylinder tube and knock out the bushing. Hook a wrench in the hole in the retainer at the piston end and turn. Lever up the edge of the guide, then turn the guide again and the guide can be removed.

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

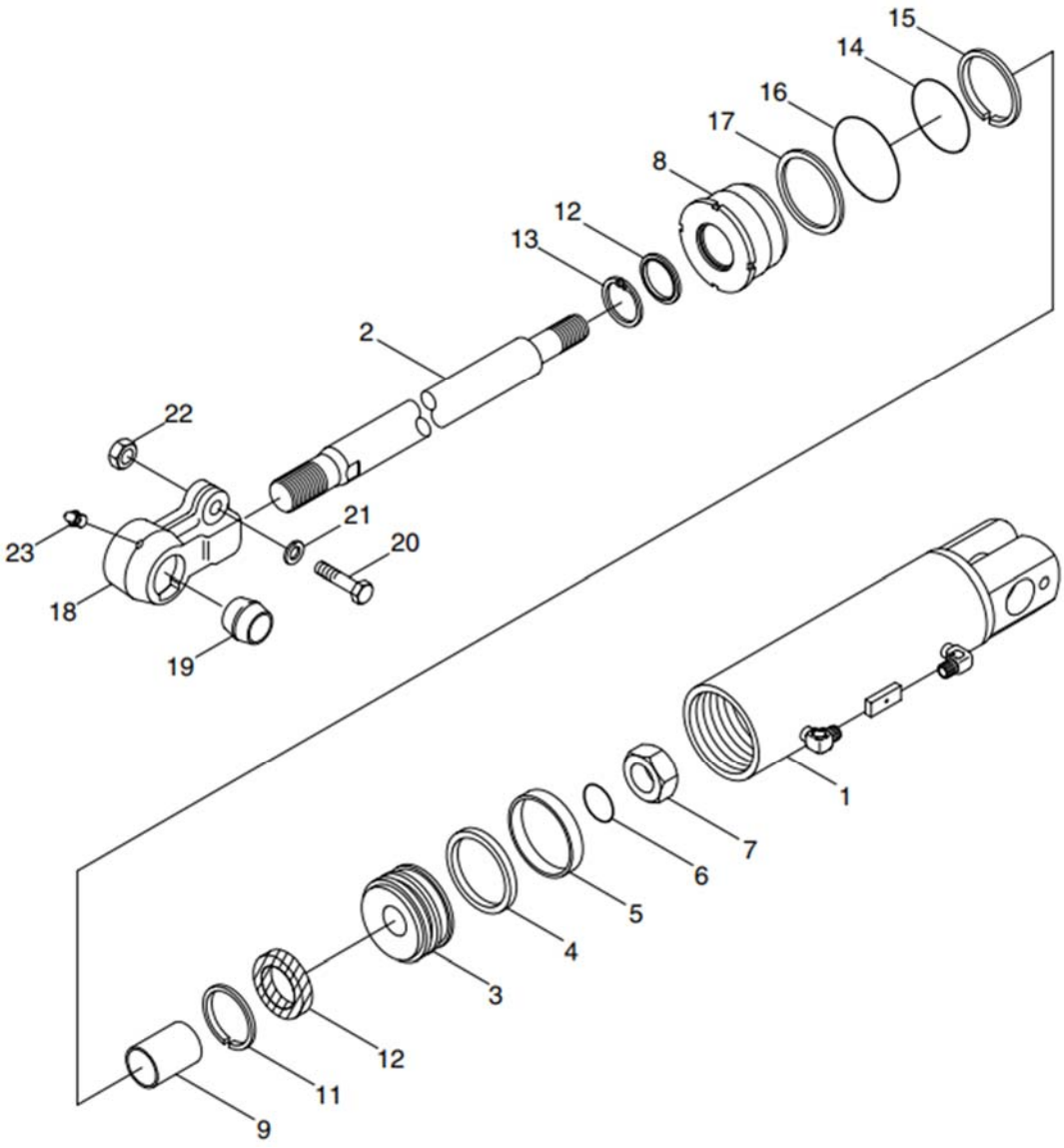
③ ASSEMBLY

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

1) STRUCTURE

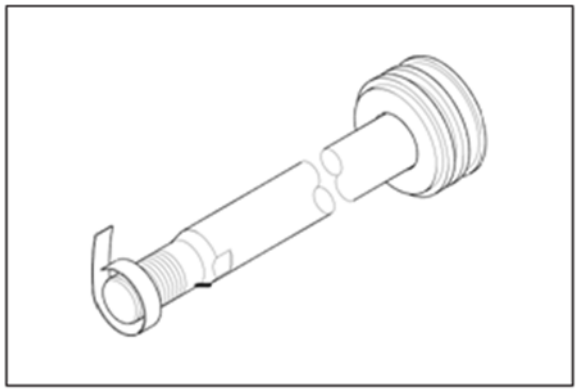


1	Tube assembly	9	Bushing	17	Washer
2	Rod	10	U-packing	18	Eye
3	Piston	11	Back up ring	19	Bushing
4	Seal ring	12	Dust wiper	20	Hexagon bolt
5	Wear ring	13	Stop ring	21	Spring washer
6	O-ring	14	O-ring	22	Lock nut
7	Nylon nut	15	Back up ring	23	Grease nipple
8	Rod cover	16	O-ring		

2) 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.



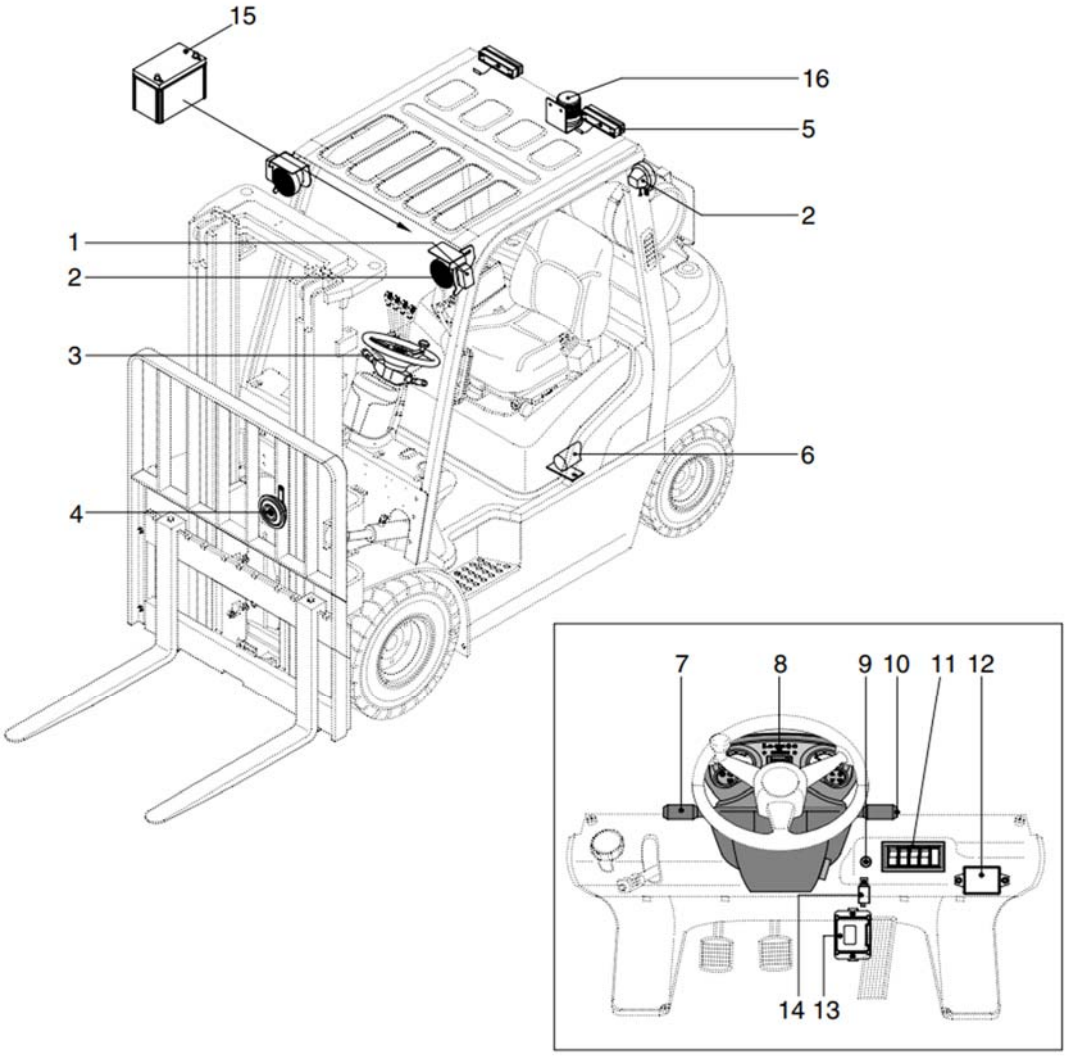
3) CHECK AND INSPECTION mm (in)

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

SECTION7 ELECTRICAL SYSTEM

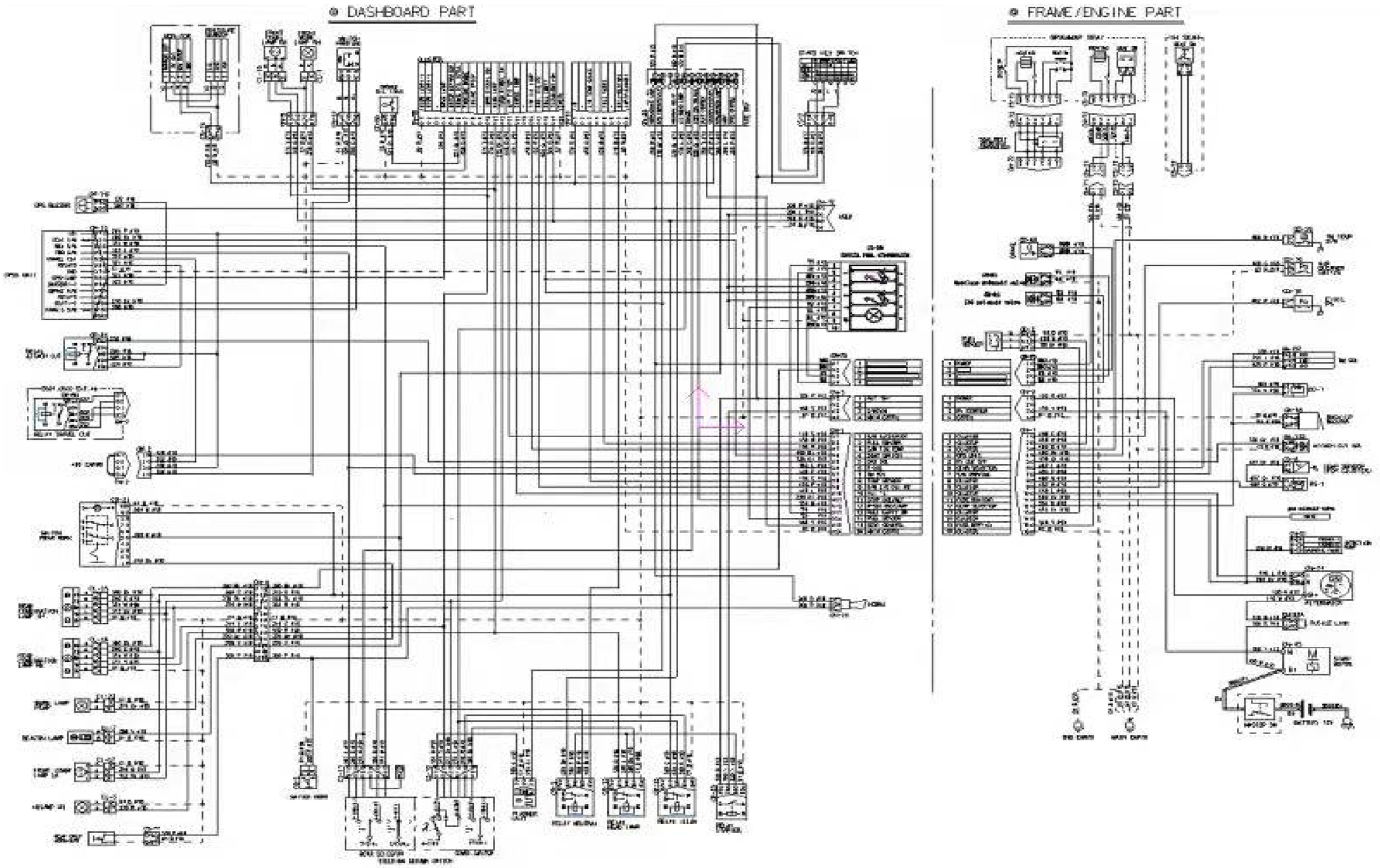
Group 1 Component Location ----------153
Group 2 Electrical Circuit ----------154-158
Group 3 Component Specification ----------159
Group 4 Connector Destination ---------- 160-162
Group 5 Troubleshooting ----------163

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

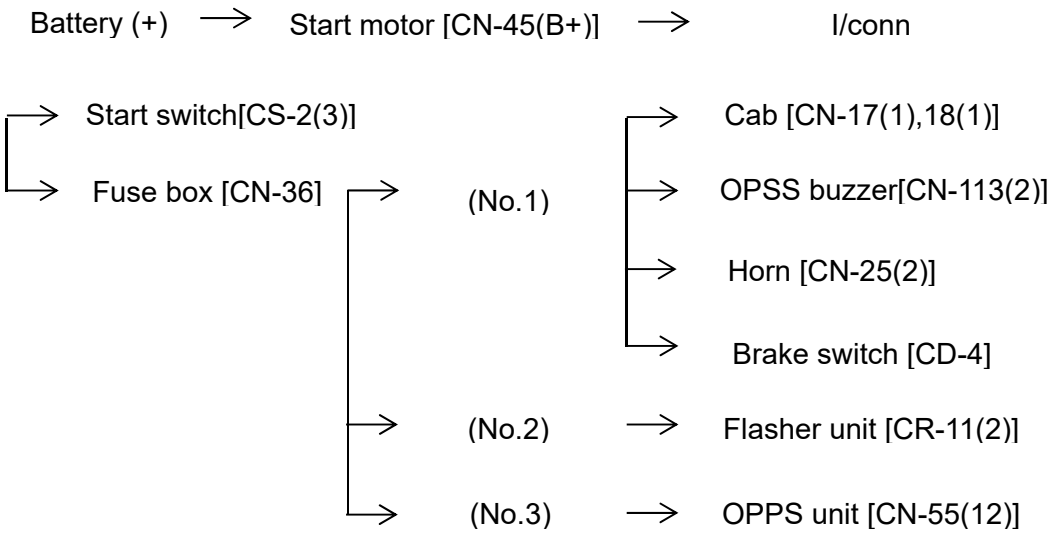


MEMORANDUM

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.

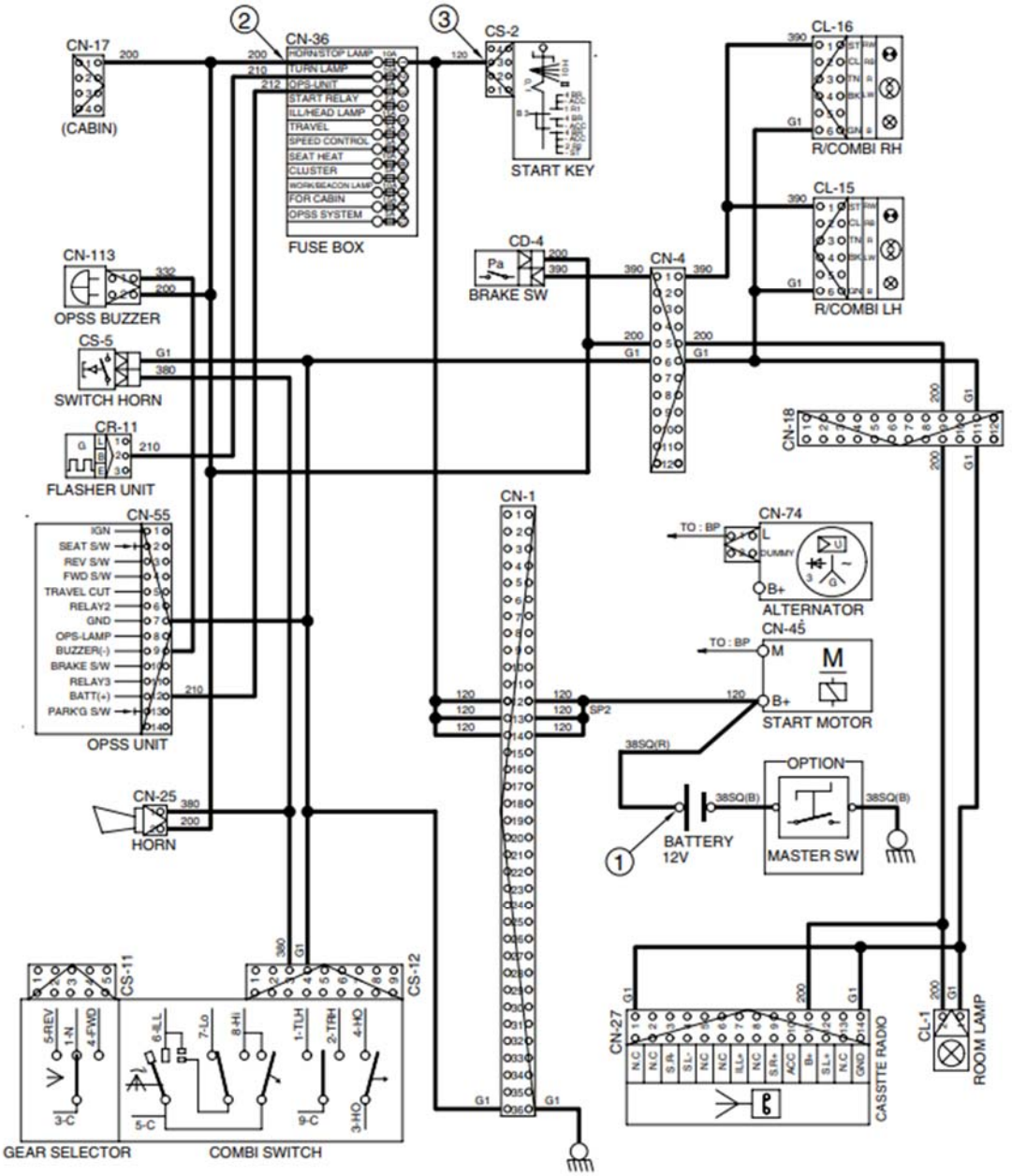
1) OPERATING FLOW



2) CHECK POINT

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

POWER CIRCUIT



2 STARTING CIRCUIT

1) OPERATING FLOW

Battery (+) terminal → Start motor [CN-45(B+)] → I/conn [CN-1(12,13,14)] → Start switch

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

① When start key switch is in ON position

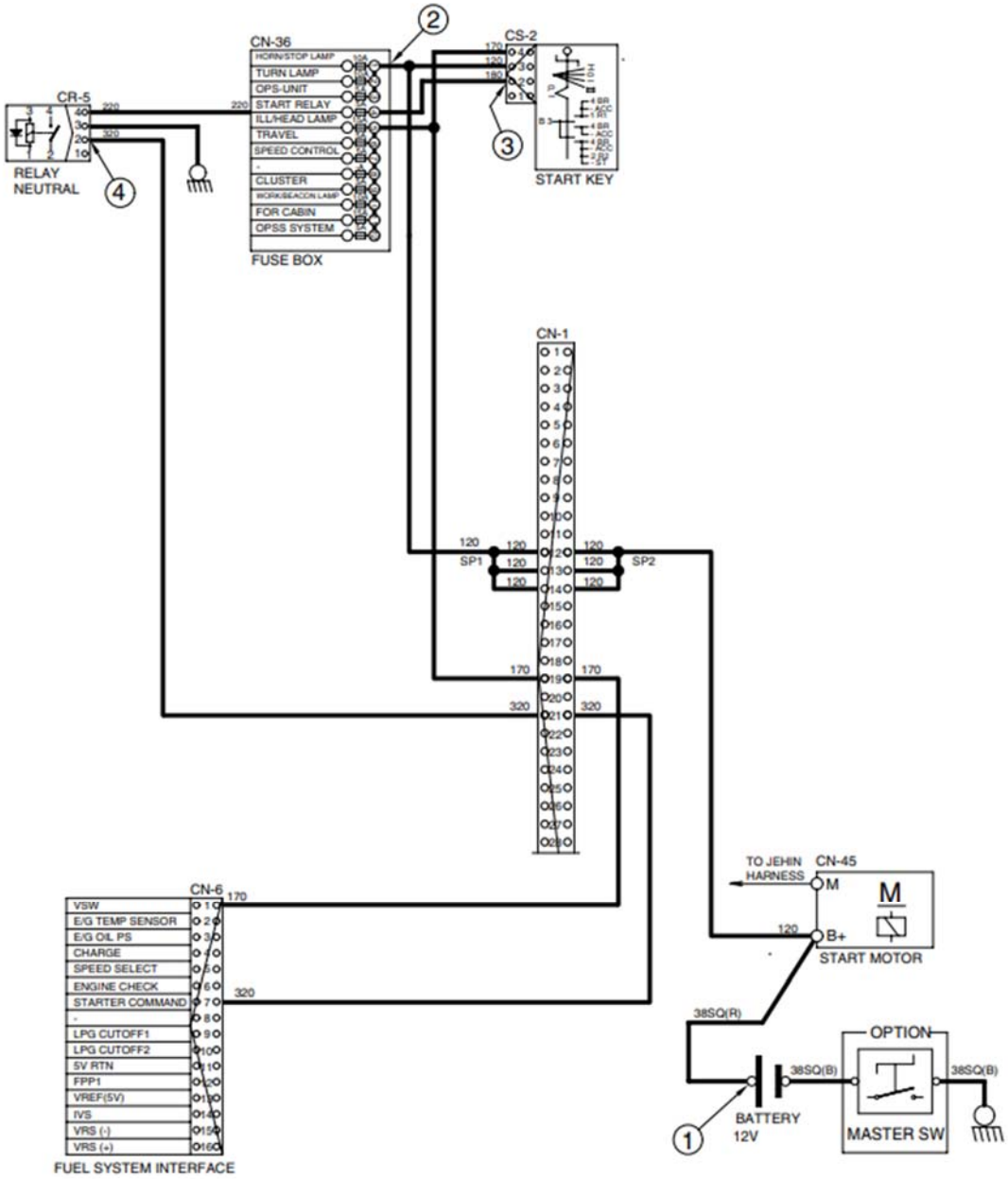
Start switch ON [CS-2(4)] → Fuse box [No. 5]
→ I/conn [CN-1(19)] → Fuel system interface [CN-6(1)]

② When start key switch is START position

Start switch START[CS-2(2)] → Fuse box[CN-36(4)] → Neutral relay[CR-5(4→2)] I/conn[CN-1(21)] → Fuel system interface[CN-6(7)]

2) CHECK POINT

Engine	Key switch	Check point	Voltage
Running	ON	①GND (Battery B+) ②GND (Fuse box No.5) ③GND (Start key) ④GND (Neutral relay)	10 ~ 14.5V


CR-5
RELAY
NEUTRAL
CN-36
HORN/STOP LAMP
TURN LAMP
OPS-UNIT
START RELAY
ILL/HEAD LAMP
TRAVEL
SPEED CONTROL
CLUSTER
WORK/BEACON LAMP
FOR CABIN
OPSS SYSTEM
FUSE BOX
CS-2
START KEY
CN-1
SP1
SP2
CN-6
VSW
E/G TEMP SENSOR
E/G OIL PS
CHARGE
SPEED SELECT
ENGINE CHECK
STARTER COMMAND
LPG CUTOFF1
LPG CUTOFF2
5V RTN
FPP1
VREF(5V)
IVS
VRS (-)
VRS (+)
FUEL SYSTEM INTERFACE
TO JEHIN HARNESS
CN-45
M
B+
START MOTOR
38SQ(R)
38SQ(B)
OPTION
BATTERY
12V
MASTER SW

GROUP3 COMPONENT SPECIFICATION

No	Part name	Qty	Specification	Remark
1	Battery	1	CCA: 750A 20HR: 93AH 6-QW-93(300×170×225)	
2	Working lamp	1	9-36V, 12W（3W×4）	
3	License lamp	1	12V, 3.4W×2	
4	Combination lamp	2	12V, 0.5W×4(T/S)12V, 0.5W×4(Back) 12V, 0.5W×4 (Tail) 12V, 0.5W×4(Stop)	
5	Head lamp	2	9-36V, 12W（3W×4）	
6	Flasher lamp	2	12-24V, 0.8W	
7	Flasher & Relay	1	12V, 40A (Relay) 12V, (21W+21W) ×2+(5W+5W) ×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+50W	
11	Start switch	1	12V/24V, 15~28A	
12	OPSS unit	1	12V/24V, MAX 0.5A(at 12V)	
13	Relay (4P)	2	12V, 40A	
14	Relay (5P)	2	12V, 40A	

GROUP4 CONNECTOR DESTINATION

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-1	AMP	16	I/conn (Dashboard harness-frame harness)	368047-1	368050-1
CN-2	KET	4	I/conn (Dashboard harness-travel harness)	MG610331	MG640333
CN-3	KET	3	I/conn (Dashboard harness-frame harness)	MG642292-5	MG652290-5
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	2	I/conn (Dashboard harness-frame harness)	174352-2	174354-2
CN-7	KET	2	I/conn (Dashboard harness-frame harness)	MG642928-5	MG652934-5
CN-17	KET	4	Power output for cabin	MG610047	MG620046
CN-25	AMP	2	Horn	171809-2	-
CN-36	-	-	Fuse box	21HF-10500	-
CN-45	YAZAKI	-	Start motor	7123-6214-40 、 S820-208000	-
CN-55	KET	14	OPSS unit	MG610350	MG640352
CN-56	AMP	20	Cluster	368511-1	-
CN-57	AMP	8	Cluster	368540-1	-
CN-65	AMP	2	Back buzzer	174352-2	-
CN-70		4	I/conn (Dashboard harness-frame harness)	MG610047	MG620046
CN-71	KET	2	Seat heat	MG610043	MG620042
CN-74	RING TERM	1	Alternator B+	S820-105000	-
CN-74	YAZAKI	2	Alternator	7223-6224-40	-
CN-80		1	Brake switch	DJ7021-6.3-21	-
CN-81		2	LPG Gasoline solenoid valve		DJ3021Y-2.5-11
CN-82		2	solenoid valve		DJ3021Y-2.5-11
CN-87	SUMITOMO	2	Injection pump	6098-0131	-
CN-95A	KET	2	Backup Plugin	21N4-01310	MG620558
CN-95B	KET	2	Backup Plugin	21N4-01310	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-132A	AMP	2	Attach cut sol	174352-2	174354-2
Switch					
CS-2	KET	4	Start switch	MG610047	-
CS-5	RING TERM	-	Horn switch	DJ431-6	-
CS-11	RING TERM	5	Gear selector switch	DJ7061-6.3-21	-
CS-12	RING TERM	9	Combination switch	-	DJ7061-6.3-11
CS-17	KET	3	Parking switch	MG610045	-
CS-21	SWF	8	Rear work switch	DJ7086-6.3-21	-

		2		DJ7021A-2.8-21	-
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

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
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			
		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			
		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-23	KET	4	Starter relay	MG612017-5	
CR-51	KET	5	Attach cut relay	MG640927	
					-
Sensor and pressure switch					

CD-2	KET	3	Fuel level sensor	MG610045	-
CD-4	RING TERM	2	Brake switch	DJ7021-6.3-21	-
CD-8	MHI	1	E/G water temp sensor	ST730018-3	
CD-10	KET	1	Air cleaner switch	ST730057-2	-
CD-18	KET	1	E/G Oil Pressure Sensor switch	ST730057-2	
CD-29	AMP	1	T/M temp switch	171809-2	-
DO-1	AMP	2	Diode	174352-2	21EA-50550
RS-1	KET	2	Resistor	MG610043	21HA-40110

GROUP 5 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. •Electric 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 LPG SYSTEM

Group 1 Loop LPG forklift truck system components principle -----165-175
Group 2 Gas filling and operation ----------176-179
Group 3 Handling of accidents and emergencies ----------180
Group 4 Troubleshooting ----------181-186

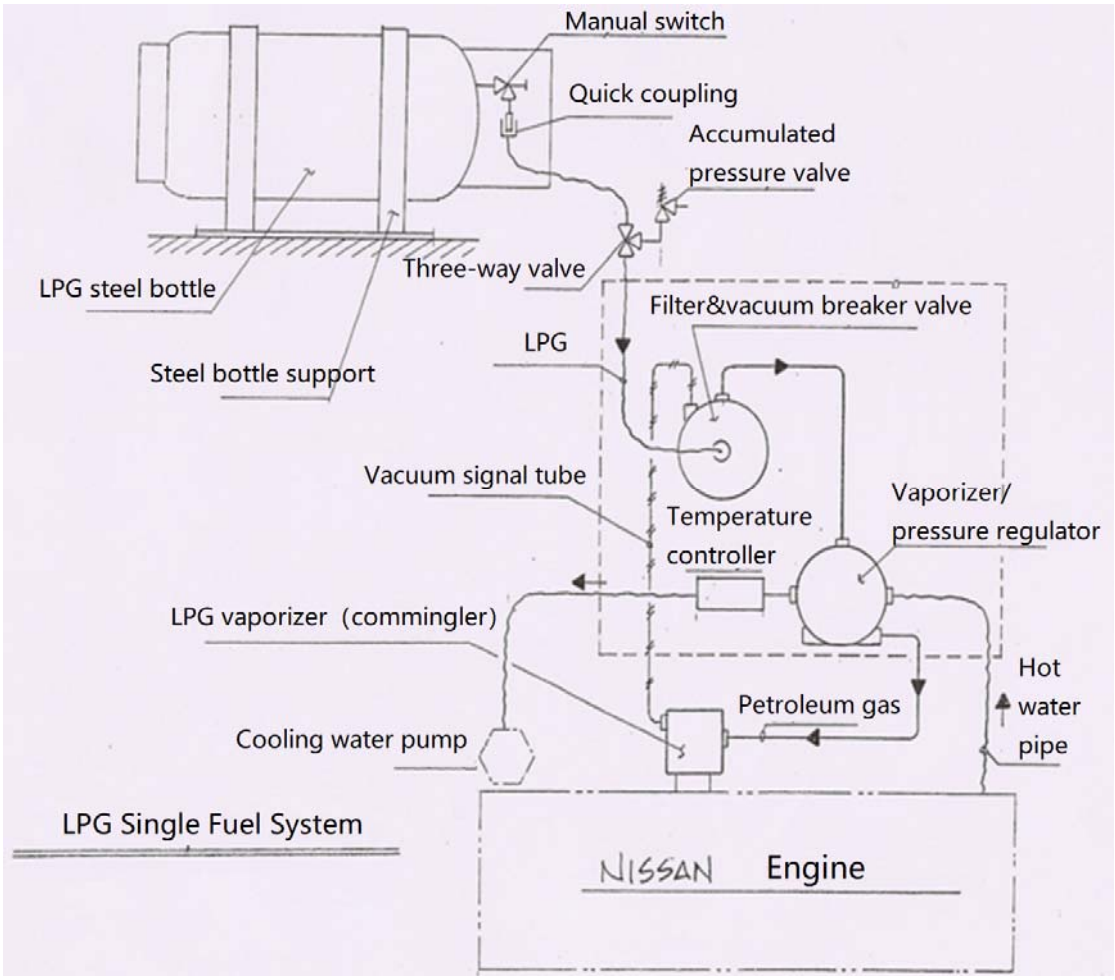
GROUP1 OPEN LOOP LPG FORKLIFT TRUCK SYSTEM COMPONENTS PRINCIPLE

1. SYSTEM SPECIFICATIONS

The LPG forklift is a conversion device mounted on the original gasoline engine to allow it to accept LPG as fuel. There are basically two kinds of modification:
a. Dual fuel system: After the forklift is refitted, the original gasoline engine system remains, so the forklift can use both fuels. The converter has a toggle switch that allows the operator to choose which one to use for fuel.
b. Single fuel system: After the forklift is refitted, the pressure relief valve and the gasoline pump of the original gasoline system have been removed, and the liquefied gas mixer has been replaced. At this time, the forklift can only use liquefied gas as fuel

2. PRINCIPLE OF CONVERSION SYSTEM

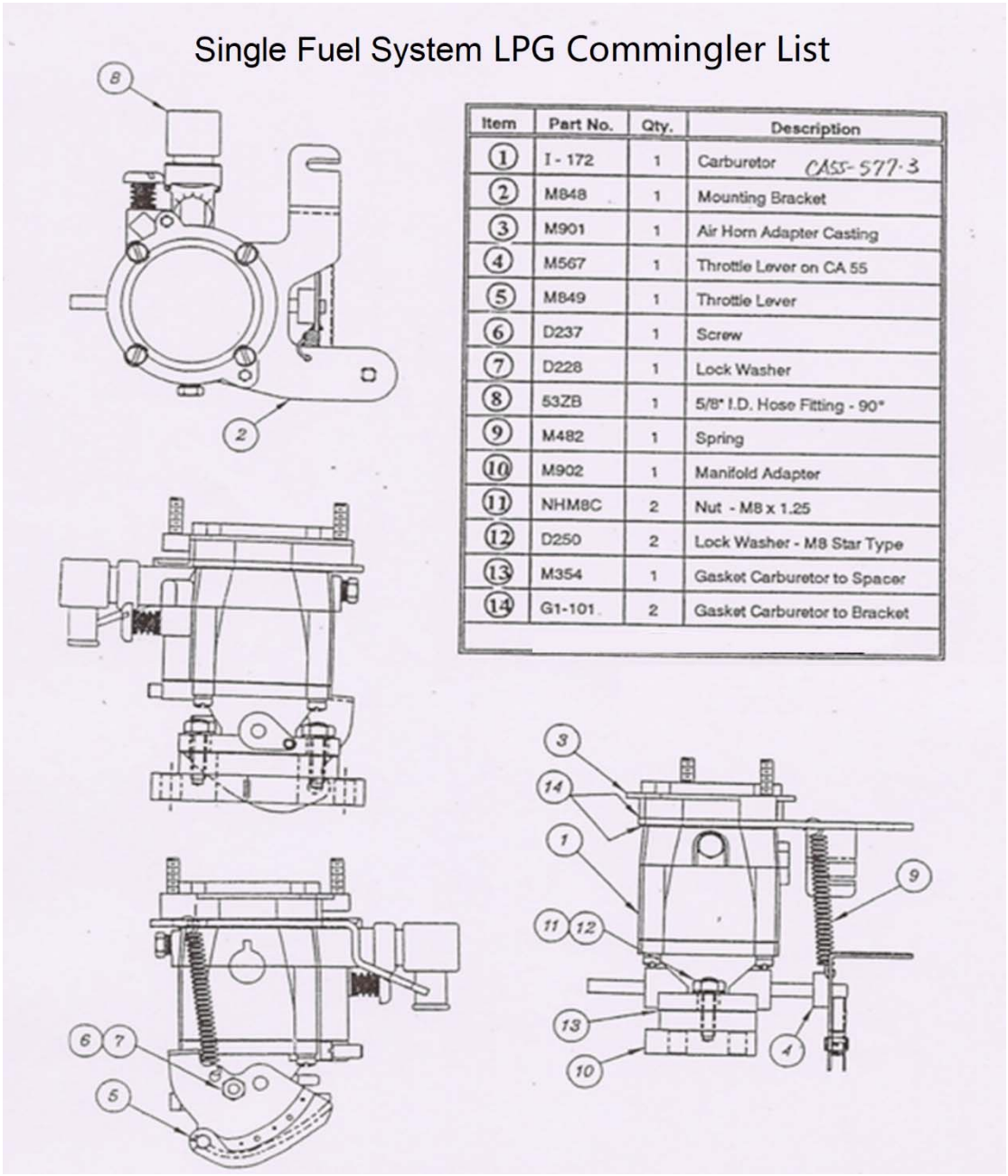
The principle of dual fuel and single fuel LPG conversion system is generally similar with minor differences. Please refer to the attached diagrams.



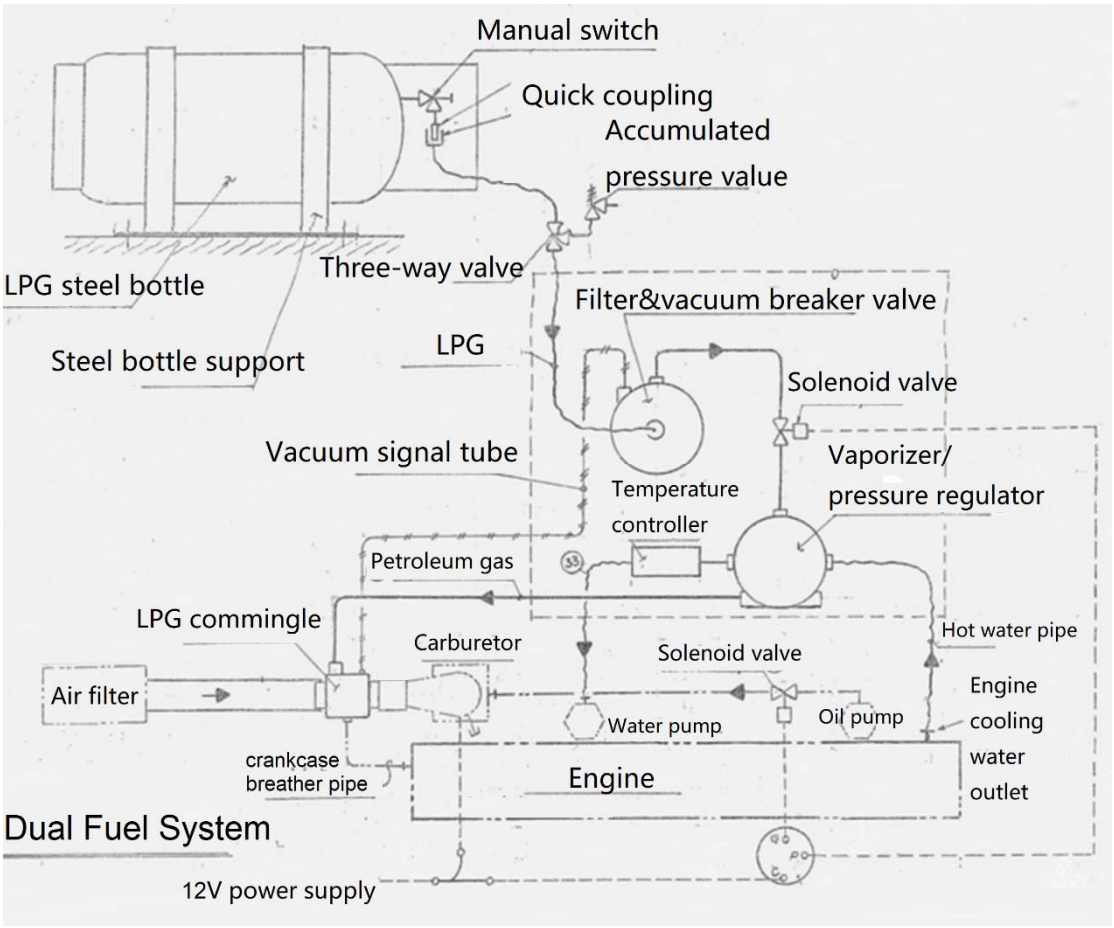
1) Dual fuel system will still use gasoline as fuel, so the original gasoline engine parameters (Idling and ignition timing, etc.) have not changed. But the basic

characteristics of LPG fuel are different from gasoline (air-fuel ratio, combustion rate, heat content, etc.). As a result, the output power of the internal combustion engine at the highest speed will be slightly worse than that of the original gasoline engine (about 90-95%). But a well-tuned dual fuel forklift will not be able to tell the difference under normal operation.

2) Single fuel system, because gasoline is no longer used, the ignition timing can be slightly increased within the limits allowed by the original gasoline engine by several degrees, and the appropriate Angle can be selected within the range of 2~6 degrees to give full play to the maximum efficiency of liquefied gas.



Item	Part No.	Qty.	Description
1	I - 172	1	Carburetor CA55-577-3
2	M848	1	Mounting Bracket
3	M901	1	Air Horn Adapter Casting
4	M567	1	Throttle Lever on CA 55
5	M849	1	Throttle Lever
6	D237	1	Screw
7	D228	1	Lock Washer
8	53ZB	1	5/8" I.D. Hose Fitting - 90°
9	M482	1	Spring
10	M902	1	Manifold Adapter
11	NHM8C	2	Nut - M8 x 1.25
12	D250	2	Lock Washer - M8 Star Type
13	M354	1	Gasket Carburetor to Spacer
14	G1-101	2	Gasket Carburetor to Bracket



LPG forklifts are divided into single and dual fuel systems, which are slightly different in system structure. Dual fuel forklifts retain the gasoline carburetor and add the fuel switch.

The structural system of LPG forklift truck is illustrated by the structure diagram of dual fuel system (See above). The working principle is as follows: LPG is stored in the cylinder. Before the forklift starts, open the manual switch at the outlet of the cylinder. Liquid LPG will pass through the filter/vacuum cut-off valve, on the one hand, the impurities in the liquid LPG will be removed, on the other hand, when the internal combustion engine stops running for some reason, the vacuum signal from the carburetor will disappear, and the internal vacuum valve will immediately close (the first safety lock), cutting off the flow of LPG. LPG flow to voltage regulator/ relief valve, the LPG in the heated vaporization into gas, and two depressions are required to reach the pressure condition of the internal combustion engine. However, the internal valve is still in the normally closed state, only when the internal combustion engine operation caused by vacuum suction began to flow (second safety lock), its vaporization process needs to absorb a lot of heat, in order to prevent the device from freezing, the engine hot water must be directed to the voltage regulator/ relief valve.

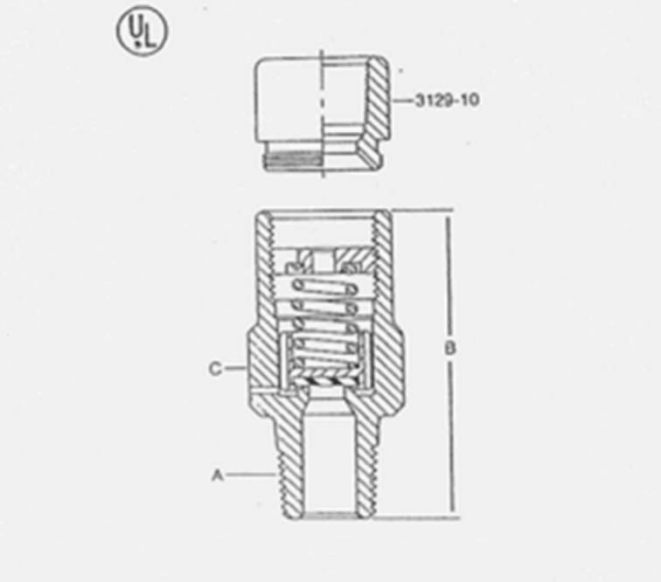
At this time, the gaseous LPG enters the LPG mixer and only starts to flow out when the vacuum suction is caused during the operation of the internal combustion engine (the third safety lock). During this time, THE LPG will mix with

the clean air in a certain proportion and become combustible gas into the combustion chamber of the engine, so that the engine can run normally and produce power.

Dual fuel system in the choice of burning gasoline, just open the fuel switch, the system will automatically close the LPG supply system through the solenoid valve, the gasoline supply system can work normally.

3. PIPELINE PRESSURE RELIEF VALVE

Based on safety considerations, if there is residual liquid gas in the gas pipeline system, in order to prevent its expansion due to heat and lead to pipeline burst, it is necessary to install this device. When the internal pressure reaches 2.64MPa, it will automatically start and vent.



4. FILTER/ VACUUM CUT-OFF VALVE

It has two functions:

A. Filter screen to remove impurities in the gas, so as not to enter the downstream vaporization equipment to cause obstruction
B. When the internal combustion engine stops running for some reason, the vacuum signal from the carburetor disappears and the internal valve immediately closes, cutting off the gas flow to the gasoline engine.

Refer to the attached Section (FIG.1)

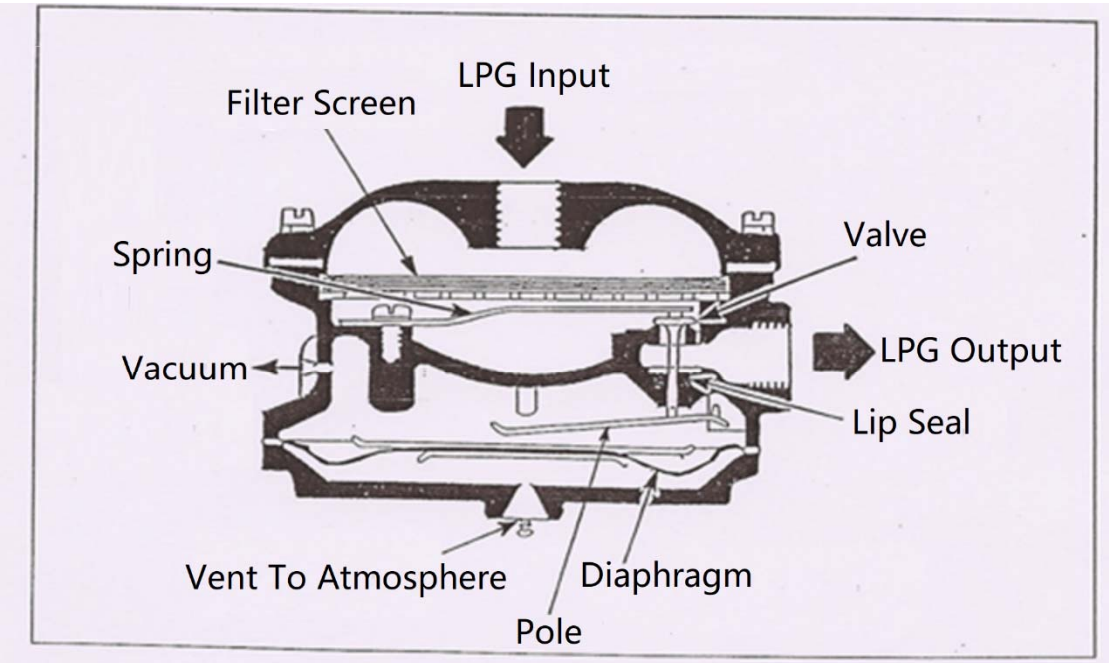


FIG.1 Filter/Vacuum Break Valve

Principle：The fuel filter valve is under spring or electromagnetic pressure, usually closed, and requires an electromagnetic or vacuum signal from the running engine to open. This is the first "lock" in the IMPCO vehicle system safety device. Once the engine stops running, the fuel flow stops automatically. The filter valve opens when it receives a normal electromagnetic or vacuum signal, allowing 150PSI gas to flow to the voltage regulator/ relief valve.

Above the device is a filter chamber, with a filter screen, the function is to prevent foreign matter from entering the fuel system, if the accumulation of foreign matter too much will affect the air, so it must be periodically inspected, cleaned or replaced.

When the engine is stationary, the valve inside the device is closed by the spring sheet above it, so that the LPG liquid cannot flow.

Vacuum signal must reach 490Pa to open valve. When the engine flameout and stops running, the vacuum signal disappears, the device will automatically shut down and cut off LPG, so it is a safety equipment.

5. VOLTAGE REGULATOR/ RELIEF VALVE

It has two functions：

① Liquid gas is heated here and transformed into gas, so it is also called "evaporator".

② The gas reaches the pressure required by gasoline internal combustion engine through two-stage decompression process, but the internal valve is normally closed. Only when vacuum suction (negative pressure) from internal combustion engine operation reaches 372.4Pa it starts to flow out. In the process of gas vaporization, a large amount of external heat is absorbed, so the hot water pipe of the internal combustion engine needs to be introduced into the shell to heat up, so as to prevent ice from causing internal failure.

Refer to the attached Section (FIG. 2)

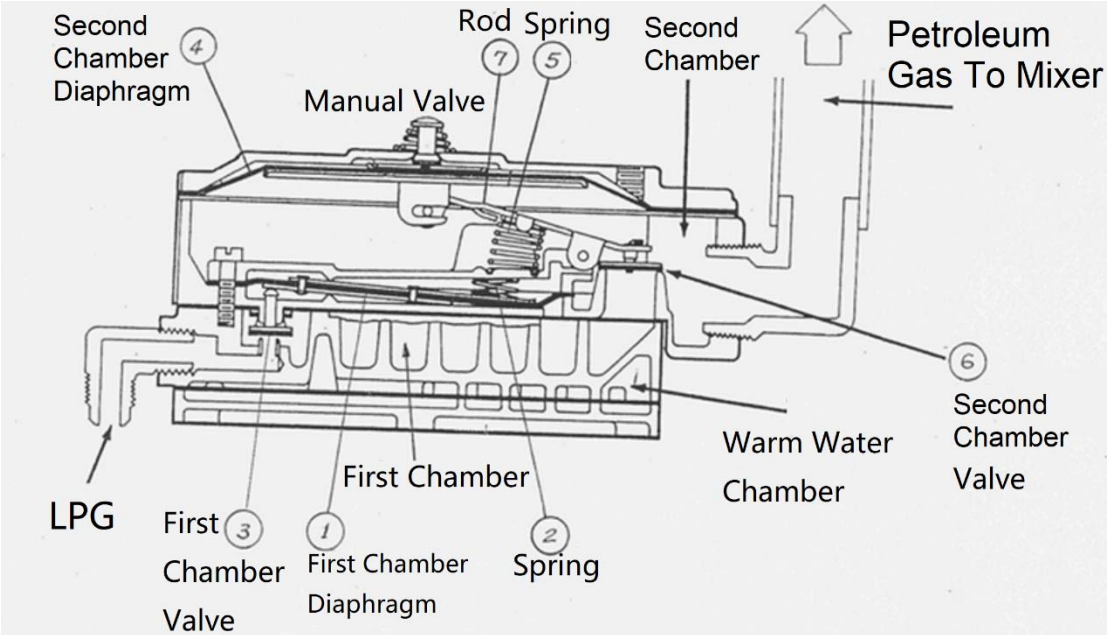


FIG.2 VOLTAGE REGULATOR/ RELIEF VALVE

The principle: IMPCO's LPG pressure regulating valves are secondary valves because they lower the pressure in two steps from medium to low and measure the gas output by referring to a negative pressure signal from the air/fuel mixer.

Normally, the regulating valve is closed and a signal from the mixer is required to open the valve in the second chamber for fuel to flow in. If the engine stops running at this point, the fuel flow will stop automatically, which is the second safety "lock" in the IMPCO vehicle system safety device. The amount of fuel sent by the pressure regulating valve is proportional to the strength of the vacuum signal. Upon receiving the vacuum signal from the mixer, the pressure regulating valve opens and gas flows into the mixer. As the gas flows through the regulating valve, the pressure drops in two steps from bottle pressure to just below atmospheric pressure.

The device has two functions:

① Convert liquid LPG to vapor state

② Adjust the outlet pressure of steam LPG to the required starting pressure

The structure of the device is mainly divided into two parts:

a) First chamber: the first stage of step-down to 10KPa

a) Second chamber: the second stage step-down to 372.4Pa

• First stage antihypertensive effect:

① When there is no LPG under the primary chamber diaphragm (1), the pressure of the spring (2) above it presses the diaphragm downward, resulting in the primary chamber valve (3) being in the "normally open state" through the action of the ejector rod.

② When liquid LPG is introduced into the device and passes through the valve (3), it rapidly expands and naturally vaporizes into vapor state, filling the primary chamber. At this time, its gaseous pressure resists the pressure of spring (2) in

the opposite direction and pushes the primary diaphragm (1) upward, resulting in the closure of the primary chamber valve (3).

③ The above two actions continuously alternate operation, so that the indoor vapor gas pressure is maintained at about 10KPa.

④ Liquid gas absorbs a lot of "latent heat" around in the process of vaporization, which will lead to the phenomenon of ice inside the device. In order to prevent the phenomenon of gas loss, the cooling water must be imported into the engine to indirectly heat up in the "warm water chamber" to prevent freezing.

• Second-stage antihypertensive effect:

① When the pressure of the diaphragm (4) and its spring (5) of the secondary chamber is in equilibrium, the valve (6) of the secondary chamber is in "normally closed state".

② When the engine is started, the vacuum suction is passed into the lower part of the diaphragm (4) of the secondary chamber of the device through the LPG mixer, causing the diaphragm to move down, and the valve (6) of the secondary chamber is "open" through the action of the ejector rod (7).

③ The vapor gas piled up below the secondary valve (6) flows rapidly into the secondary room at this time, and the vapor pressure pushes the diaphragm (4) up in the opposite direction, making the secondary valve (6) close again.

④ The above two actions continuously alternate operation, so that the secondary indoor pressure is maintained at 372.4Pa.

⑤ The opening time of the secondary valve (4) is proportional to the strength of the vacuum suction of the engine. Therefore, according to the requirements of the engine, the accurate flow of vapor gas can be introduced into the LPG mixer and properly mixed with the intake air volume to achieve the best air-fuel ratio.

The function of manual valve is to press down the diaphragm of the secondary chamber (4) and open the valve (6) of the secondary chamber when necessary, so that the gaseous gas flows into the secondary chamber.

6. THERMOSTAT

Its function is to keep the temperature of the hot water within a certain range, in hot conditions, not due to overheating and cause propane cracking in the valve, but in cold conditions can continue to allow gas vaporization. At the same time to protect the diaphragm, prolong its life.

7. GAS PRESSURE REDUCING VALVE (MIXER)

The combustion air and gas fuel enter the internal combustion engine at the right mixture ratio here, so it is also called the mixer.

After modification, the air-fuel ratio must be adjusted on the pressure reducing valve.

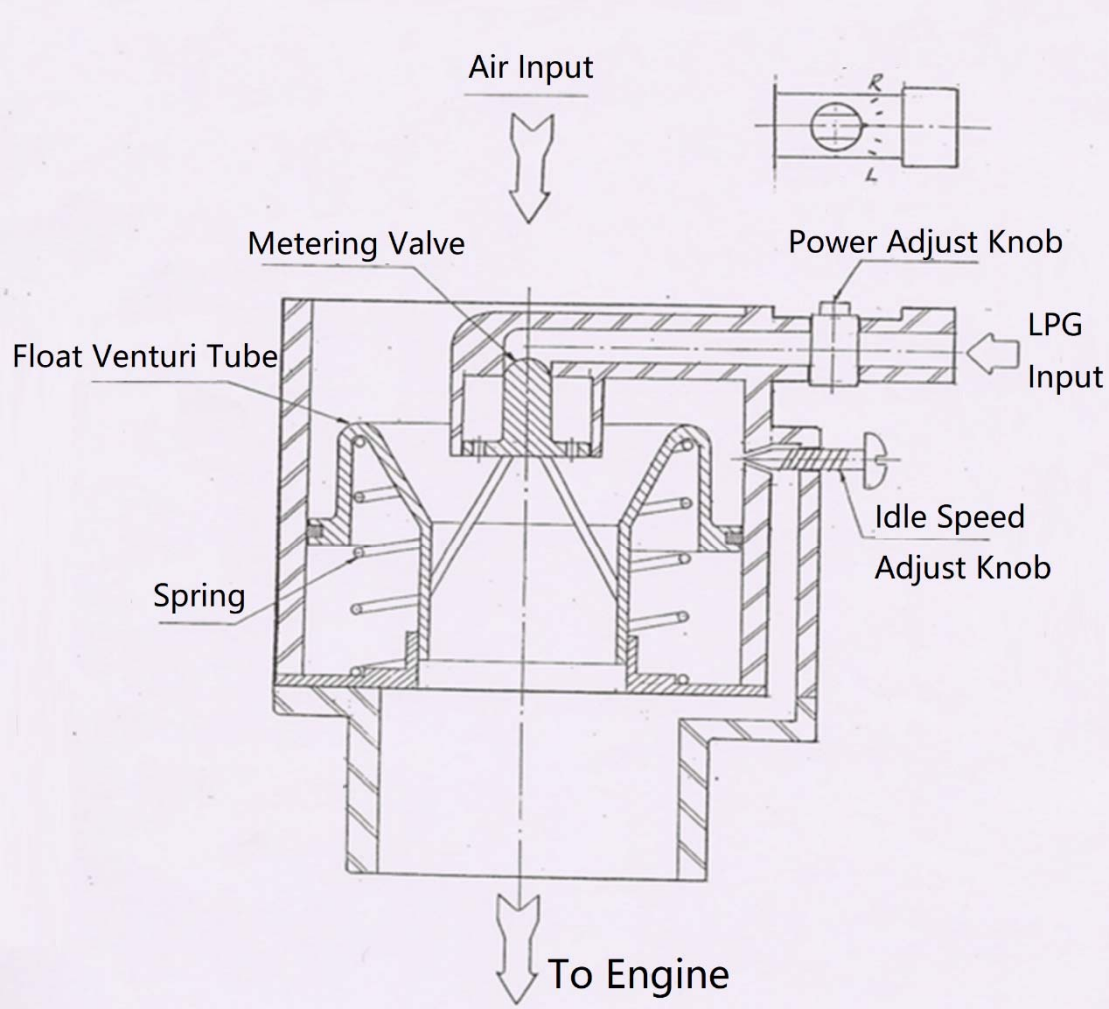


FIG.3 Mixer

The principle: IMPCO's LPG mixer restrictor nozzles are usually closed and require a vacuum signal from the running engine to draw fuel out of the nozzle. This is the third installment of the IMPCO vehicle system safety device.

Once the engine stops rotating, the restrictor nozzle will close and automatically disconnect the fuel flow. When the mixer receives a vacuum signal from the engine, the air valve opens (the size of the opening is proportional to the amount of air entering the engine) so that the fuel from the regulator enters and mixes with the air in the appropriate proportion. The mixture enters the engine cylinder through the intake manifold, where it is compressed, ignited, and burned.

① Refer to the attached section (FIG. 3)

② Under normal conditions, the gas metering valve of the device is closed, and there is no gas inflow.

③ When the engine starts, the air flows through the central "floating air valve", causing the spring to compress and the air valve to move down, causing the "LPG metering valve" to open, allowing the LPG inflow to mix with the air.

④ The greater the engine suction, the greater the opening of the "LPG metering valve", the more LPG inflow.

⑤ The gas flow rate can be adjusted by "power adjustment button". Turn its index to R (thick), the flow increases, turn to L (light) will reduce.

⑥ "Idle speed control button" is to bypass the appropriate amount of inlet air below the mixer, so when this button is turned in, the fuel mixture ratio becomes thicker and when it is spun out, it becomes lighter.

8. SOLENOID VALVE

The switch device for using two fuels according to the driver's intention is the gasoline solenoid valve and the LIQUEFIED petroleum gas solenoid valve, both of which are normally closed.

9. PRECAUTIONS FOR USE:

① LPG contains non-volatile substances, which can easily damage the diaphragm and seals. If the quality is not good, the sewage outlet should be opened every 2 months to remove LPG deposits.

a) If the filter screen is not too dirty, you can use compressed air in the opposite direction to blow off the accumulated impurities, if it is too dirty, you must replace the new parts: the filter screen cannot be cleaned with any solvent, if the old screen is used, pay attention to the normal installation direction is the dirty side toward the liquefied gas inlet.

b) If the internal accumulation of impurities and tar, must be cleaned, preferably with warm soapy water or neutral soap for cleaning (do not use any solvent). After cleaning, check the inside carefully for any damage or abnormal phenomena, and illuminate the diaphragm with strong light to check for small holes or cracks. Is it still resilient? Has it aged or hardened? Liquefied petroleum gas vehicles have a special phenomenon in the tar dissolved in liquid fuel is liquefied petroleum gas, can penetrate filter, but in the downstream of the pressure reducing valve (or pressure regulating valve), in the process of evaporation and decomposition, accumulated inside the relief valve caused heavy tar precipitation, the diaphragm doesn't work, and caused the vehicle failure. In general, the entire gas system will be replaced only if there is serious damage to the installation. Otherwise, replacement parts or renovations can be carried out using repair kits.

② For dual-fuel forklifts, at least 15 to 20 minutes of work with gasoline every day, in order to maintain the good working state of the gasoline engine, otherwise, the life of the valve seat will be reduced due to long-term lubrication.

③ For dual-fuel forklift trucks, when starting the engine with gasoline, as long as the switch is placed in the "gasoline" position, but when starting with LPG, the gasoline in the carburetor should be burned out first. To do this, the switch must be placed in the middle position (i.e., no gas or oil) and then switched to the "LPG" position after the gasoline in the carburetor has burned out.

④ If LPG is not to be used for a long time, it is necessary to burn or exhaust the LPG in the pipe and evaporator, and open the evaporator drain hole, release the dirty liquid, and then clean the evaporator. Otherwise, non-volatile substances in THE

LPG can deposit on the seals and diaphragm, corroding the seals and diaphragm.

⑤ Forklift should clean the mixer once a year, check and adjust the engine emissions, but also after removing the pipeline filter with compression blowing dirt in the pipeline filter, to prevent airway blockage.

10. TAR DISCHARGE METHOD

A workplace ready for maintenance should consider:

① The surrounding environment should be well ventilated and assisted by fans when necessary to diffuse possible liquefied gas leakage.

② Fireworks, heat sources or equipment that may produce sparks are strictly prohibited around, such as grinder, grinder, etc.

③ There should be no low-lying areas in the vicinity, such as repair ditches, where there may be liquefied air flow.

④ Prepare necessary fire extinguishing equipment, fire extinguishers or water sources.

Methods:

a) At the user site, it is necessary to wait for the forklift to work for several hours (1 ~ 2 hours in summer, 2 ~ 3 hours in winter). When the engine is shut down, the tar can be released according to the following steps. At this time, the tar has basically dissolved into liquid for outflow.

b) Stop the forklift, lower the fork frame to the lowest level, fix and turn off the front and rear wheels, remove the cathode of the battery.

c) Close the outlet of the LPG cylinder or remove the high-pressure hose of the quick joint.

d) After determining to cut off the air source, turn the switch to LPG position (dual fuel forklift) and press the accelerator pedal in neutral state to burn off the remaining LPG gas, which approximately needs to last 3 to 5 minutes until the engine completely stops.

e) Pad the bottom of the angle joint of the air outlet of "pressure regulating valve (or pressure reducer)" with gauze, sponge paper and other oil-absorbing objects.

f) Remove the clamp of the intake hose (here is the low-pressure pipe) from the LPG pressure reducing valve to the mixer, loosen the half circle of the angle coupling of the Inch 5/8 taper thread counterclockwise, so that its outlet is vertical to the ground (6 o 'clock direction).

g) If there are lots of tar, there will be hot black oily liquid out of the water, dripping onto the gauze, tissue and other oil-absorbing objects, need to be placed for about 15 minutes.

h) After the tar is exhausted, tighten the taper thread right Angle joint, cover the air pipe, tighten the clamp.

i) Apply soapy water or similar solution to each joint and start the engine to detect possible leaks and retighten.

j) Remove the external tar and dust adhesive that flows out of the shell. Pay special attention to whether there is a vent hole of φ1.0 on one side of the primary

chamber of the pressure reducing valve. If so, open it with a needle.

k) According to the quality of LPG gas, tar should be released regularly.
It should be at least once every two months if the LPG quality is not good

Figure 1 below shows that the LPG gas used by the user's forklift truck contains too much tar. The photo obviously shows that the tar leaking out of the casing of the pressure reducing valve blocks the breathing hole on one side of the primary chamber of the pressure reducing valve.

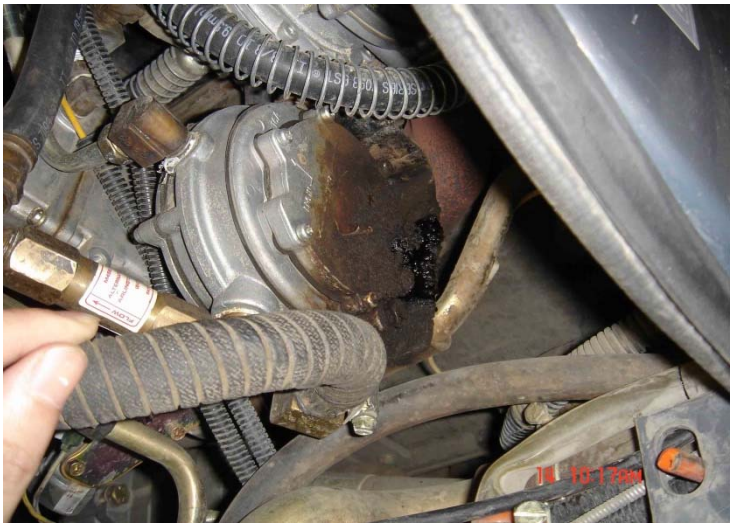


FIG. 1

Views 2 and 3 show that opening the outlet pipe at the interface between the pressure relief valve and the mixer, a large amount of black tar like coffee immediately flows out of the nozzle, which takes more than 10 minutes to basically clean up.

FIG. 2

FIG. 3

GROUP2 GAS FILLING AND OPERATION

1. GAS FILLING

LPG forklift if fuel used up and not let the engine off, when the cylinder liquefied petroleum gas used up, the driver would feel power decreases, but still running at the remnants of liquefied gas bottle a distance, the driver not to step on the gas and the car drove to safe location, prepare inflatable (dual fuel system, at this time you can switch to petrol to continue running for a period of time.

① There are two ways for LPG forklifts to refuel:

a) According to the design of the forklift, the cylinder can be removed and replaced with a new cylinder filled with liquefied gas.

b) Direct inflation to the cylinder, this method refers to the factory has its own gas equipment, when the forklift needs to be inflated, the forklift will drive to the gas station, directly inflated, do not have to unload the cylinder.

② No matter what kind of gas filling method is adopted, matters needing attention should be noted:

a) Filling or replacing must be carried out in a place with good ventilation and safety and in accordance with local fire protection standards.

b) The forklift must stop and turn off, and the operator must leave the driver's seat

c) No fireworks or close to heat source, fire source and low depression around (to avoid the accumulation of liquefied gas)

d) Handle cylinders with care. Do not bump, throw or roll them on the ground after they are unloaded from the forklift.

e) Filling must be carried out by trained and experienced personnel

f) During the filling process, the filling personnel must monitor the whole process and shall not leave the site.

③ Filling. steps

a) Before decanting, tighten the manual switch at the outlet and let the engine continue to run at idle speed until the fuel in the tube is burned out

b) There is a quick joint at the outlet of the liquid outlet valve of the cylinder, which is unscrewed and separated (because the male and female joints have reverse installation inside, so both ends will not be deflated, and a little leakage is normal). The female joint is fixed at the male joint on the support to prevent accidents caused by the unscrewing of the liquefied gas hose.

c) Carefully remove the cylinder, place the cylinder in an upright position, and connect the charging connector to the charging valve of the cylinder (spare with the vehicle).

d) When charging, tighten the filling valve on the bottle.

e) Open the "80% liquid level hole" on the bottle by hand, pull the spanner on the inflatable gun, and start to add air.

f) When the liquid level in the cylinder reaches 80%, white fog will emerge from the "80% liquid level hole". At this time, stop refueling immediately, tighten the 80% liquid level hole to close, and remove the air gun. At this time, a little leakage occurs, which is normal

(Warning: because liquefied gas will expand when heated in the bottle, the gas must not exceed 80%!)

g) Check the liquid level gauge and observe whether the indicator is correct.

h) If the filling valve on the cylinder is still constantly leaking liquefied gas, it means that there may be foreign matter in the internal one-way check valve and it cannot be switched on normally. At this time, the air gun can be re-set and a small amount of liquefied gas can be added to blow away the foreign matter. If the situation does not improve, the cylinder can no longer be used and should be repaired.

i) Carefully handle the aerated cylinder, place it back on the forklift support and secure it.

j) Combine the quick connector back again to ensure tightening.

k) Open the manual switch on the cylinder to let the liquefied gas out and check whether the quick connector is deflated.

④ It is recommended that the operator develop the habit of checking cylinders each time the cylinder is decanted or gassed as follows:

a) Whether there is serious dent, scratch or rust on the cylinder body

b) Whether the appearance of all accessories on the cylinder is obviously damaged, whether there is any air leakage phenomenon

c) Whether the safety relief valve on the cylinder is blocked by foreign matter and whether the blue plastic cap is broken or missing

Note: In the event of any of the above, the cylinder shall not be used or filled and should be replaced and repaired

⑤ Especially, to emphasize here is the purity of liquefied gas use has direct impact to the operation of the forklift truck, if the liquefied gas contains impurities, foreign bodies, the tar composition, water, or too much, will be within the liquefied gas system on the pipes and fittings cause congestion, and malfunction, light engine operation, power output, or even cause the engine flameout, start is not easy to wait for a phenomenon

Recommendation:

a) LPG fuel with high purity and low content of impurities, moisture and tar should be used as far as possible

b) If the user's local gas source is not good, it is necessary to implement regular maintenance, in order to remove the foreign body and tar accumulated in the liquefied gas system, replace the filter screen, etc., to ensure the smooth operation of the engine; The poorer the fuel quality, the shorter the repair cycle

c) When the temperature drops below zero, the natural evaporation rate of LPG slows down, so it is advisable to add more propane in LPG to facilitate evaporation.

⑥ After being used for a period of time, there will be residual liquid in the cylinder. You can erect the cylinder in an open space without fire, open the "80% liquid level hole", let the residual liquid drain out, and then drain water upside down

2. PRE-STARTUP CHECK

a. According to the inspection items of ordinary gasoline or diesel forklift truck.
b. Check whether the cylinder is firm and whether the LPG system is abnormal
c. Open the manual switch on the cylinder to check whether the system leaks
d. Start the engine and check whether the operation is normal

3. ENGINE STARTING METHOD

a. Verify that the manual valve on the cylinder is fully open
b. The starting mode is exactly the same as the general gasoline engine, the only difference is that there is no need to step on the accelerator
c. For dual fuel systems, the switch valve must be turned to the "LPG" position
d. In a cold day， it is best to warm the car for two or three minutes and let the cooling water system of the engine heat up before running, so as to ensure that warm water flows to the "pressure relief valve", accelerate its vaporization, and do not frost caused by improper air supply or flout.

4. OPERATION OF THE LPG FORKLIFT

The operation of the LPG forklift is exactly the same as that of the general gasoline engine.

5. SPECIAL NOTES FOR DUAL FUEL SYSTEM

1. Dual-fuel system switching method
a. The switch should be implemented after the forklift stops, never in the running operation state
b. When switching from gasoline to liquefied GAS, the engine continues to run at a rapid speed. At this time, switch the switch from "GAS" (gasoline) position to the central position, continue to burn out the accumulated gasoline in the carburetor until the engine is turned off. At this time, switch the valve to "LPG" (liquefied GAS) position and restart
c. When switching from liquefied GAS to gasoline, you can directly turn the switch valve from "LPG" position to "GAS" position (do not need to stay in the central "OFF" position).

2. Although the dual fuel system mainly burns liquefied gas, its gasoline system still needs to pay attention to the following matters:
a. Keep the petrol tank at least 1/4 full in case of emergency
b. Occasionally change to gasoline, to ensure that the gasoline system is not idle for too long and failure, it is recommended to burn 10 kilograms of gasoline per month

GROUP3 HANDLING OF ACCIDENTS AND EMERGENCIES

1. ODOR

Generally, liquefied gas is filled with odorous agent, so it is easy to detect the leakage situation, if you smell the odor:

a. Immediately move the forklift to a well-ventilated place, turn off the engine and make sure there are no fireworks nearby

b. Tighten and close the manual switch on the cylinder

c. Carefully and step by step check each pipeline, joint and LPG conversion device, find out the leakage parts

d. Maintenance by qualified or experienced technicians

2. ACCIDENT

a. Stop immediately and turn off the engine

b. Tighten and close the manual switch on the cylinder

c. Make sure there are no fireworks near the forklift truck. If necessary, use fan to disperse air leakage

d. Check and repair by qualified or experienced technicians

3. FIRE

a. Tighten the manual switch on the cylinder to close if possible

b. If a water source is nearby, pour water over the cylinder to keep it cool

c. Notify the fire department immediately

d. If cylinders also catch fire, evacuate the area immediately

GROUP4 TROUBLESHOOTING

1. ENGINE CANNOT BE STARTED WITH LIQUEFIED GAS

a. Check whether the manual switch on the cylinder is fully on
b. Check the level gauge on the cylinder to observe the amount of liquid in the cylinder
c. The overflow valve may be accidentally closed. In this case, tighten the manual switch and close it first, stay for five seconds and then slowly unscrew it again to make the overflow valve automatically reset and open
d. (Dual fuel system) checks whether the switch is at "LPG"
e. (Dual fuel system) start engine with gasoline
f. Inform our designated repair shop, send it to the factory for repair.

2. CONDITIONS SHOULD NOT BE REPAIRED

When the driver encounters the following conditions, considering the attribution of guarantee liability, the driver should not carry out repairs by himself:
a. Unable to start with liquefied gas
b. Difficulty or poor startup
c. Device can start but cannot work smoothly.
d. Flameout by accident
e. Unstable at idle speed
f. Idle speed is too high
g. Tempering
h. Accelerating rocky
i. Performance is poor at high speed.

3. FACTORY MAINTENANCE

When the LPG forklift truck breaks down and is sent to the factory for maintenance, the owner (or driver) should first describe the symptoms of the problem Often the so-called failure of the driver, may be caused by the lack of understanding of the liquefied gas system or incorrect operation, at this point, experienced personnel are required to do the correct demonstration and guidance. If necessary, the forklift should be operated by a professional to determine the crux of the problem

4. CHECK GASOLINE ENGINE

The problem of LPG forklift is not necessarily caused by the LPG conversion device, but often caused by the ignition system, intake system or cooling system of the gasoline engine. Therefore, before the diagnosis of LPG, it is necessary to confirm that the equipment and performance of the original gasoline engine are normal.
(If the dual fuel system fails when using liquefied gas, you can first change the fuel back to gasoline and run the forklift to see if the problem still exists, so that you can judge whether the problem is the original gasoline engine.)

5. PRELIMINARY INSPECTION PROCEDURE

Preliminary inspection procedure before diagnosing the LPG system is as follows:

a. Whether the storage of liquefied gas in the cylinder is sufficient?

b. Is the manual switch on the "overflow valve" on the cylinder fully open?

c. Is there freezing or frosting in the LPG pipeline or any LPG conversion device?

d. Whether the high-pressure and low-pressure liquefied gas pipelines are deformed, twisted, loosed or leaking?

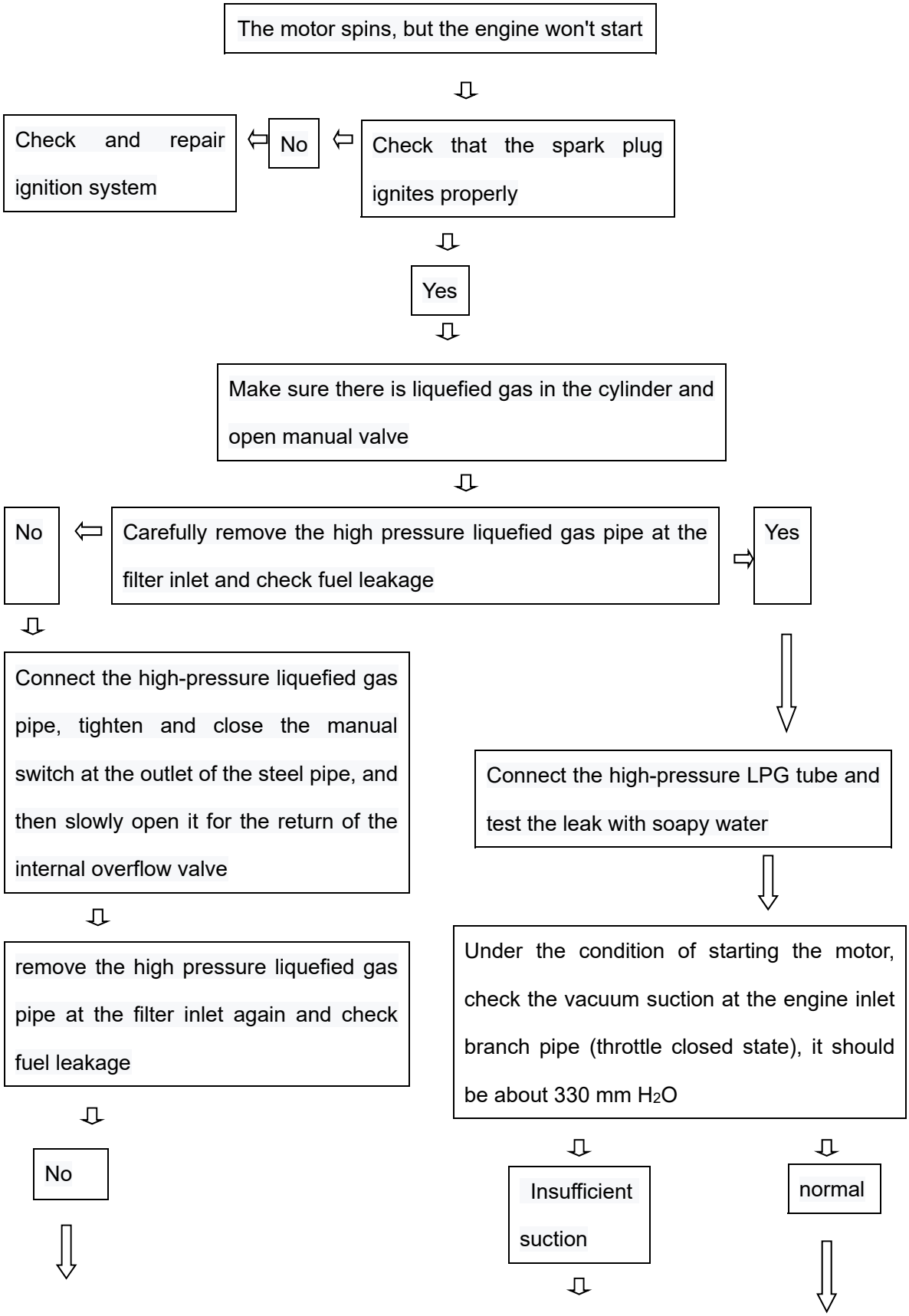
e. Does "vacuum signal tube" have the above phenomenon?

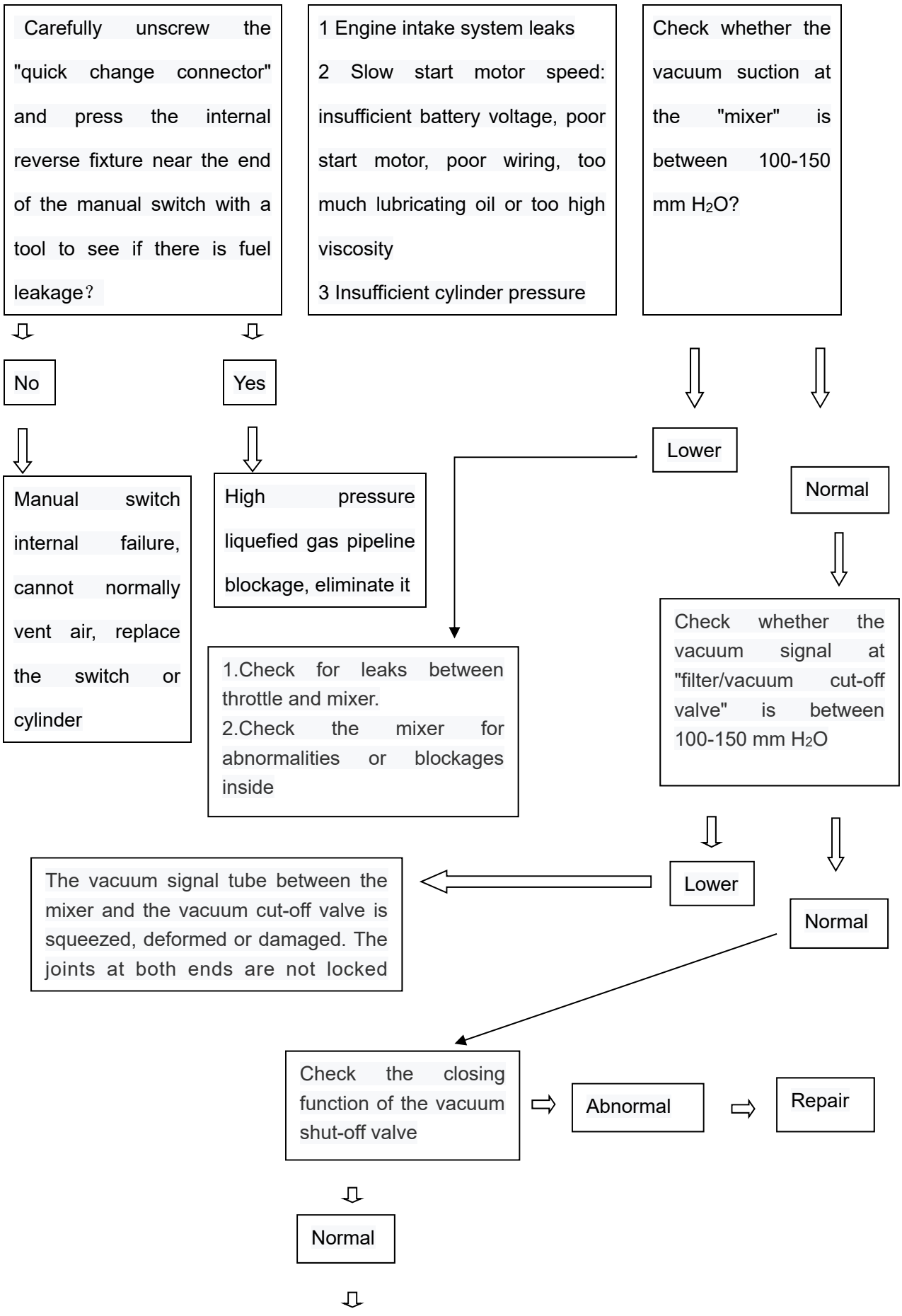
f. Does the cooling water pipe connected to the "pressure reducing valve/voltage regulator" have the above phenomenon?

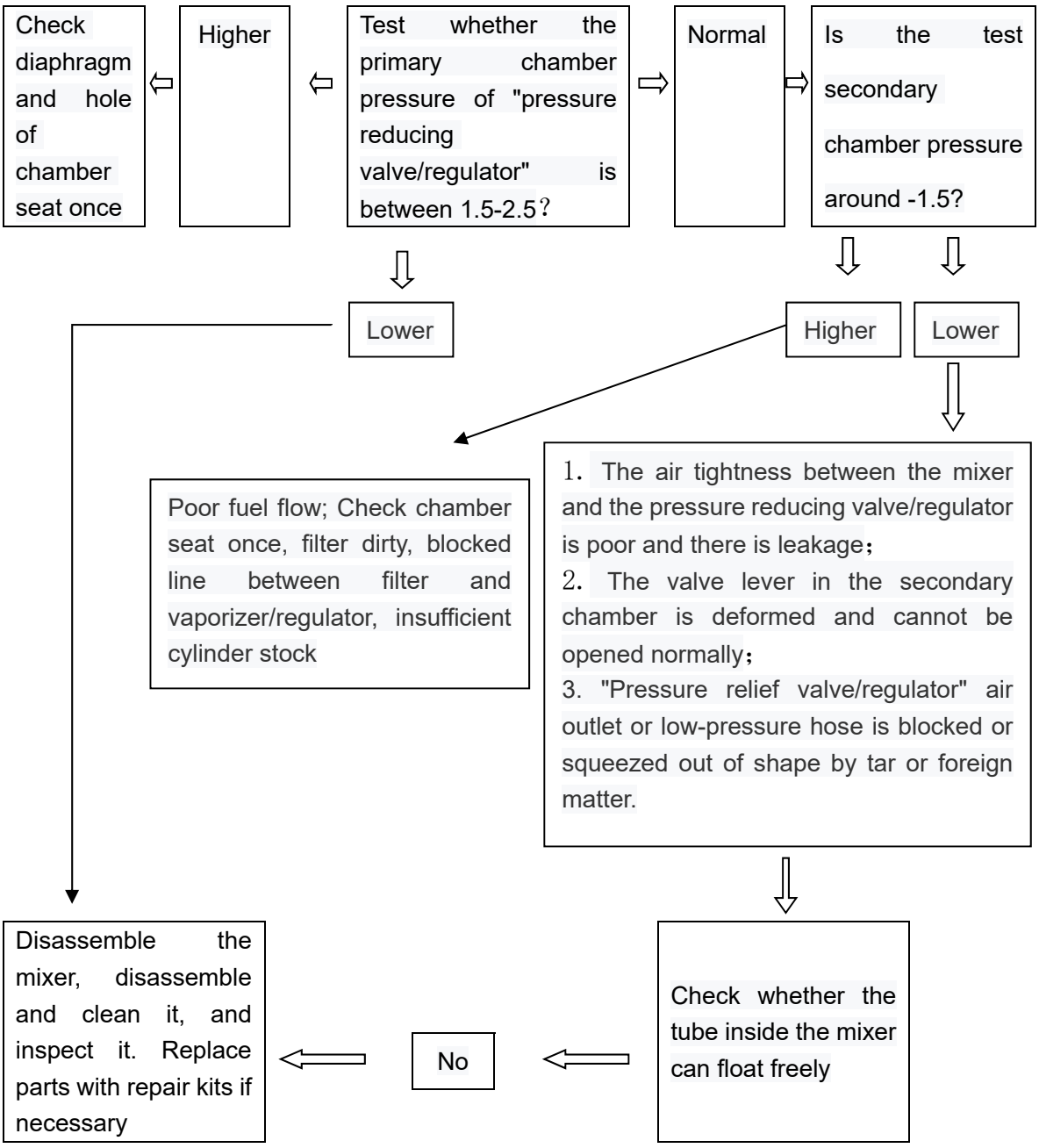
g. Is the ignition system normal (remove a spark plug and check the spark condition of its ignition)?

h. Is there any passive tampering in the LPG conversion device?

6. TROUBLESHOOTING FLOWCHART




Carefully unscrew the "quick change connector" and press the internal reverse fixture near the end of the manual switch with a tool to see if there is fuel leakage?
1 Engine intake system leaks
2 Slow start motor speed: insufficient battery voltage, poor start motor, poor wiring, too much lubricating oil or too high viscosity
3 Insufficient cylinder pressure
Check whether the vacuum suction at the "mixer" is between 100-150 mm H_2O?
No
Yes
Lower
Normal
Manual switch internal failure, cannot normally vent air, replace the switch or cylinder
High pressure liquefied gas pipeline blockage, eliminate it
1.Check for leaks between throttle and mixer.
2.Check the mixer for abnormalities or blockages inside
Check whether the vacuum signal at "filter/vacuum cut-off valve" is between 100-150 mm H_2O
Lower
Normal
The vacuum signal tube between the mixer and the vacuum cut-off valve is squeezed, deformed or damaged. The joints at both ends are not locked
Check the closing function of the vacuum shut-off valve
Abnormal
Repair
Normal


Check diaphragm and hole of chamber seat once
Higher
Test whether the primary chamber pressure of "pressure reducing valve/regulator" is between 1.5-2.5?
Normal
Is the test secondary chamber pressure around -1.5?
Lower
Higher
Lower
Poor fuel flow; Check chamber seat once, filter dirty, blocked line between filter and vaporizer/regulator, insufficient cylinder stock
1. The air tightness between the mixer and the pressure reducing valve/regulator is poor and there is leakage;
2. The valve lever in the secondary chamber is deformed and cannot be opened normally;
3. "Pressure relief valve/regulator" air outlet or low-pressure hose is blocked or squeezed out of shape by tar or foreign matter.
Disassemble the mixer, disassemble and clean it, and inspect it. Replace parts with repair kits if necessary
No
Check whether the tube inside the mixer can float freely

7. TROUBLE SHOOTING CHECKLIST

troubleshooting	
Item	Introduction
1	Close the manual "overflow valve" at the upper outlet of the cylinder completely and leave it for about 5 seconds to hear a slight "click" inside, then slowly open the manual valve. Introduction：There is a "super flow valve" in the "overflow valve", which could not see on the outside of the cylinder. This is a safety device, its role is to when the liquefied gas hose or other components within the system caused by accidentally broken when a large number of leaks, can automatically and quickly close the overflow valve, prevent further liquefied gas leaked out, and when the leakage situation stops, the " super flow valve" will automatically replace, return to the on state. Because the internal spring of this " super flow valve " is very sensitive, sometimes the manual valve will open too fast, resulting in its accidental closure, so the above measures must be taken to re-open it.
2	Reasons for the blockage： a. foreign body accumulation in the pipeline (especially in newly modified vehicles). b. The pipe is excessively concave or deformed. The way in which the foreign body in the tube is discharged: a. Refer to "LPG system correct disassembly steps", pay attention to safety, no fireworks! b. Close the cylinder air outlet manual valve c. Remove the connector at the LPG inlet of "filter/vacuum cut-off valve" d. Open the cylinder manual valve, make the liquefied gas briefly ejected two or three times, blow out the foreign matter e. If there is still blockage, replace the pipe
3	Remove the "filter/vacuum cut-off valve", decompose it step by step for maintenance, and replace the parts if necessary. Introduction：The filter heart in the filter is too dirty, will cause the pressure difference to the liquid gas in circulation, and lead to the local vaporization of liquid fuel here. If this phenomenon occurs, the outside of the filter will feel cold, and even frost phenomenon, seriously affect the gas, resulting in the internal combustion engine horsepower weakened or even flout
4	Test "primary chamber" and "secondary chamber" exhaust pressure

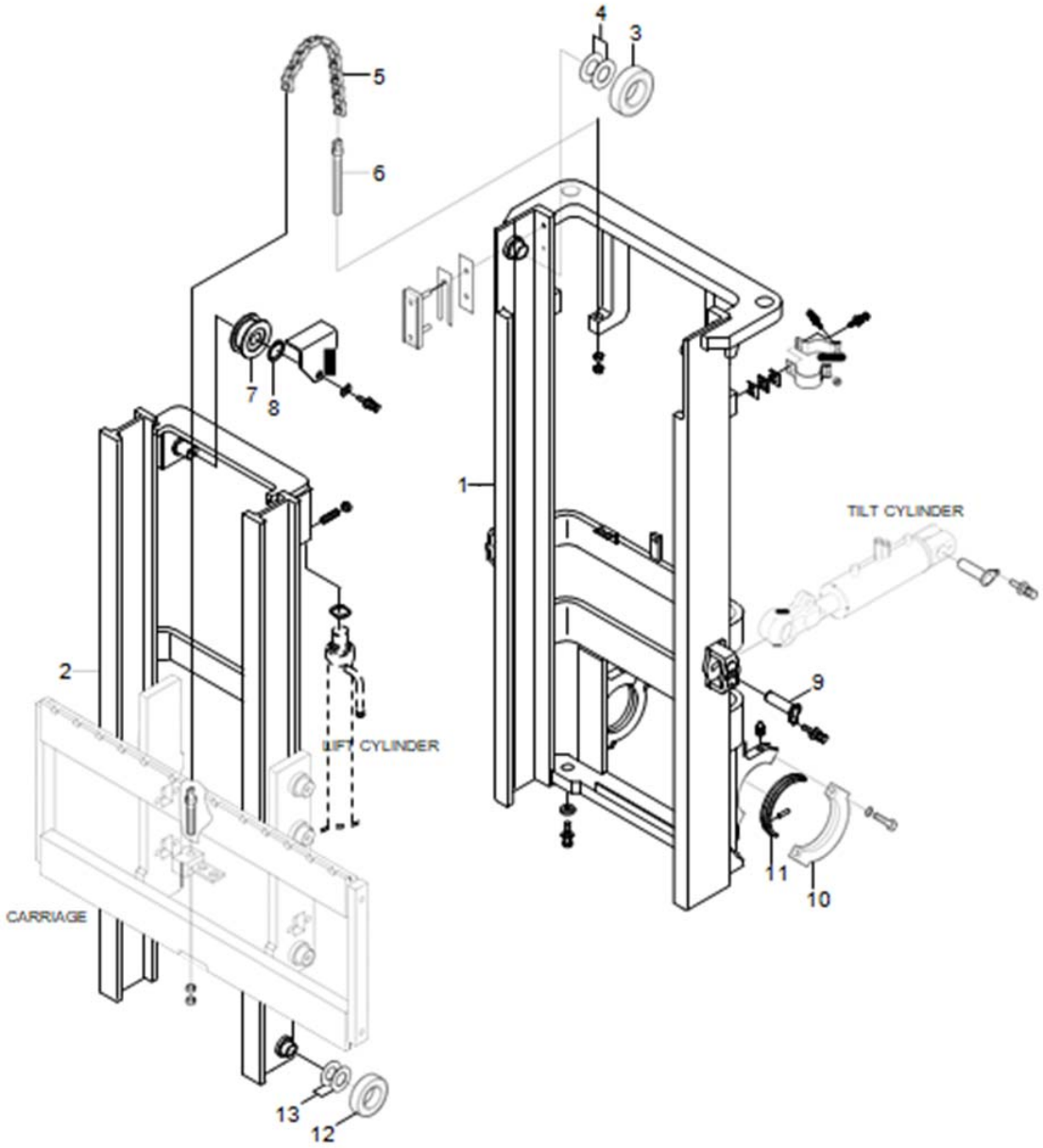
5	Check and repair the following: a. The engine cooling water level is too low. b. fan belt is loose or broken. c. Cooling system leakage. d. Cooling pump failure e. The temperature controller is faulty
6	Remove the "pressure reducing valve/regulator", and then step by step to examine the inside. a. Clean internal parts including diaphragm with warm soapy water b. After the diaphragm is dried, check whether there is crack hole or other damage under strong light, whether there is still elasticity, no aging or hardening? c. Check the air tightness of the "secondary chamber" valve.
7	Check if there is tar accumulation inside? Wash it with warm soapy water
8	Firstly, before disassembling the mixer, check that the internal floating Venturi tube is operating properly as follows: a. Remove the hose connecting the front end of the mixer and the air filter. b. Start the engine and run at idle speed. c. Check the floating vente tube inside the "mixer", a little movement should be visible at the initial engine start, more obvious when press the accelerator hard. d. If there is no obvious movement when press the accelerator hard, it means that the suction at the "mixer" is insufficient, and there is air leakage between the "mixer" and the engine (Vacuum suction at the "mixer" should be at least 100-150 mmH_2O). e. If there is no air leakage, further disassemble the mixer to decompose and inspect the inside. Secondly, clean the inside of the "mixer" with warm soapy water and air dry. Check whether foreign matter is removed. Are there any visible scratches or burning caused by the engine backfiring? Check valve seat for damage and deformation? Replace the parts if necessary.
10	A small amount of gasoline is discharged into the engine, which has no obvious effect in high-speed operation, but when the engine returns to idle speed, there will be instability, or even flameout: a. Carefully remove the gasoline solenoid valve, close to one end of the pressure reducing valve, start the engine to check for leakage. b. Check whether the solenoid valve line is correct and firm.

SECTION9 MAST

Group 1 Structure ----------188-191
Group 2 Operational Checks and Troubleshooting ----------192-194
Group 3 Adjustment ----------195-197
Group 4 Removal and Installation ----------198-210

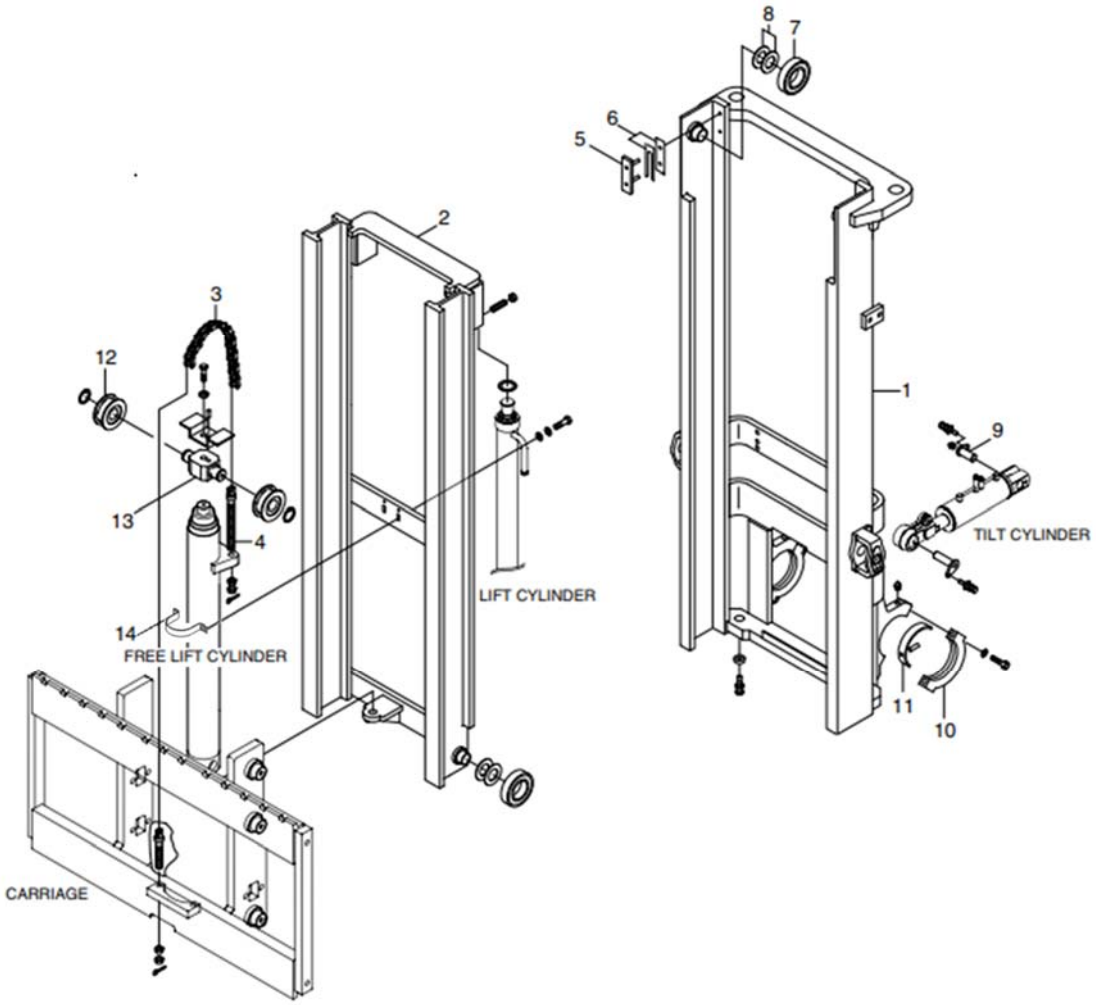
GROUP1 STRUCTURE

1 2 STAGE MAST (V MAST)



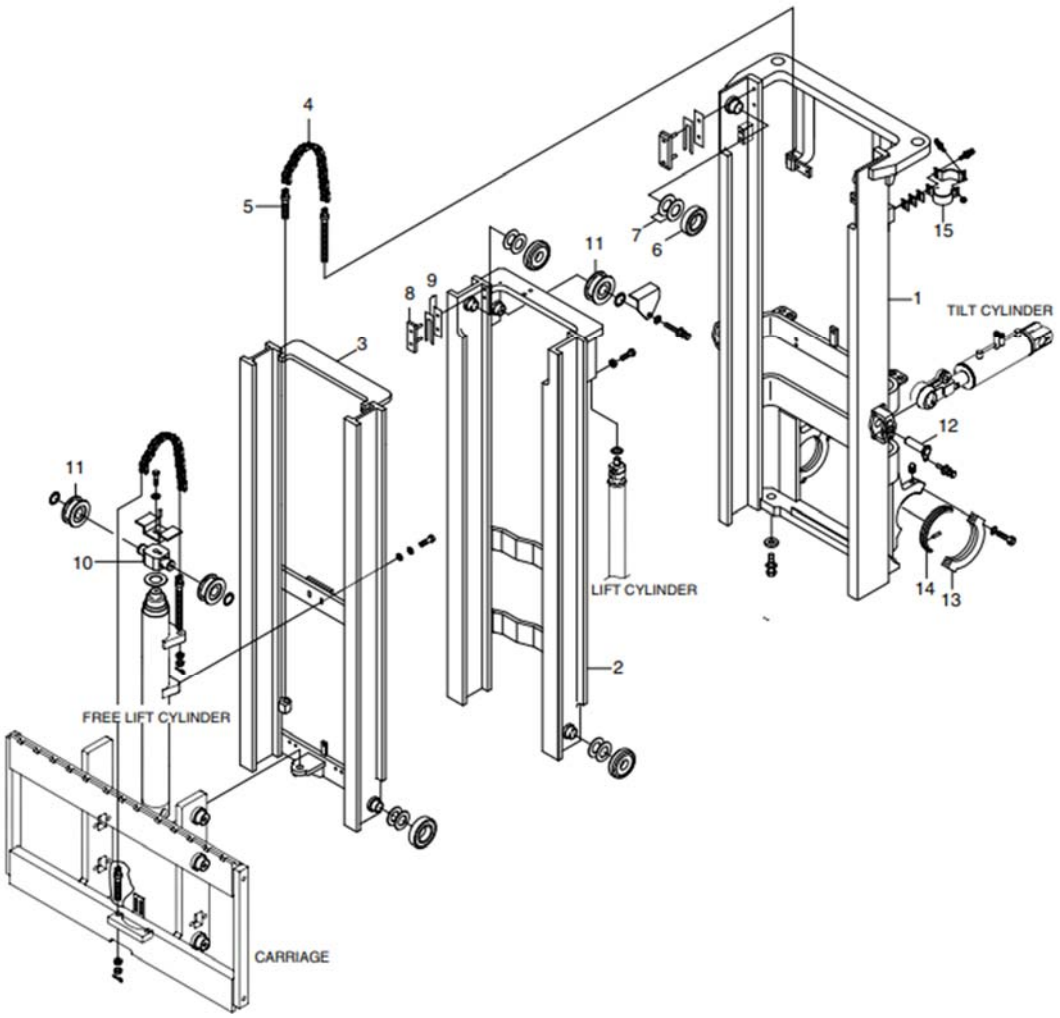
1	Outer mast	6	Anchor bolt	10	Trunnion cap
2	Inner mast	7	Chain wheel bearing	11	Bushing
3	Roller	8	Retaining ring	12	Roller
4	Shim (0.5, 1.0t)	9	Tilt cylinder pin	13	Shim (0.5, 1.0t)
5	Chain				

2 2 STAGE MAST (VF MAST)



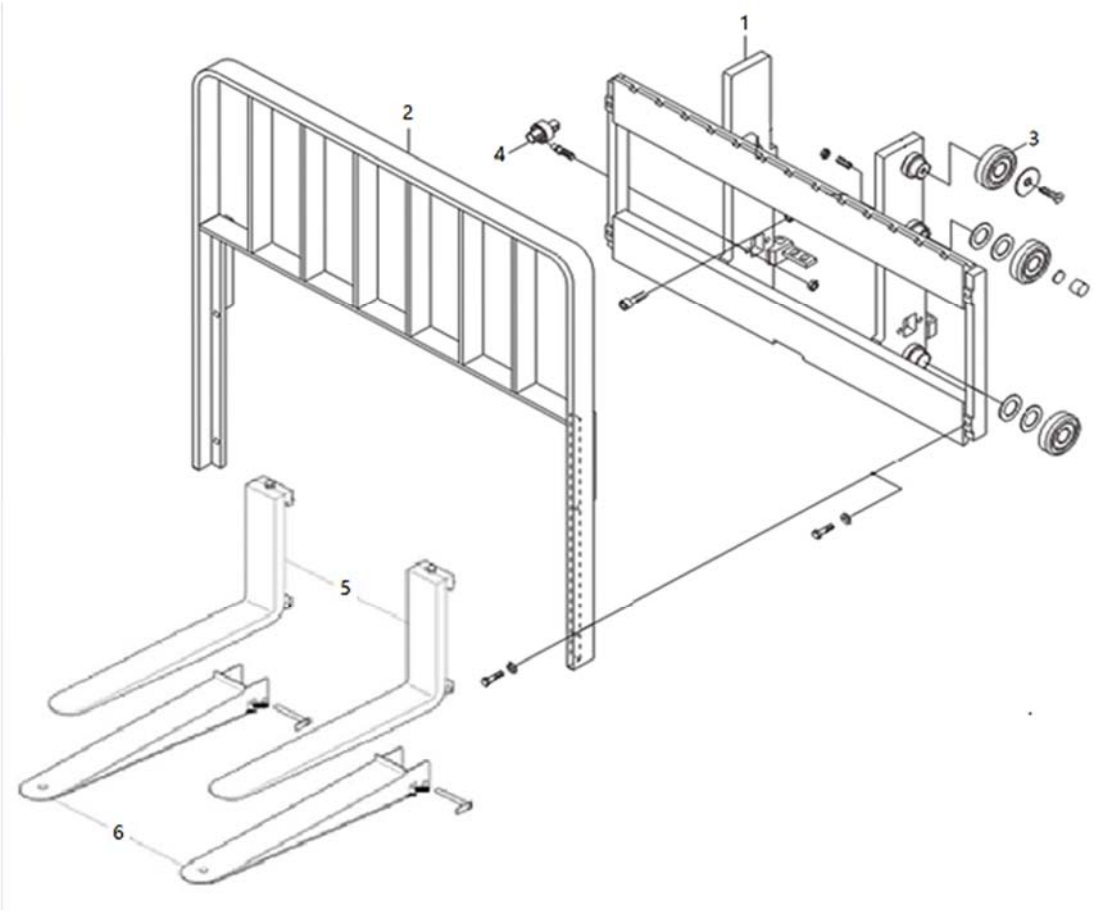
1	Outer mast	6	Shim (0.5, 1.0t)	11	Bushing
2	Inner mast	7	Roller	12	Sheave
3	Chain	8	Shim (0.5, 1.0t)	13	Sheave bracket
4	Anchor bolt	9	Tilt cylinder pin	14	Clamp
5	Back up liner	10	Support cap		

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 ANDTROUBLESHOOTING

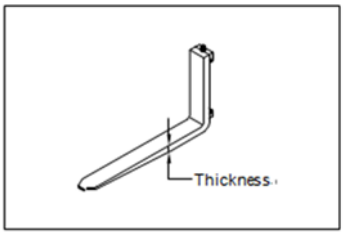
1 OPERATIONAL CHECKS

1) FORKS

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

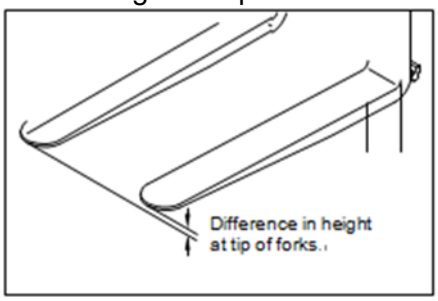
mm(in)

STD Fork assembly	Applicable mode	Standard	Limit
64HN-21030	25LE-7	45(1.8)	40(1.6)
64HN-31020	30LE-7	45(1.8)	40(1.6)
64HN-31020	35LE-7	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-7,	900~1800	3
30LE-7,	900~1150	3
35LE-7,	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 lowered.	•Broken load roller bearings. •Broken side roller bearings. •Deformed masts. •Bent lift cylinder rod. •Deformed carriage. •Broken sheave bearing.	•Replace. •Replace. •Disassemble, repair or replace. •Replace. •Replace. •Replace.
Abnormal noise is produced during tilting operation.	•Insufficient lubrication of anchor pin, or worn bushing and pin. •Bent tilt cylinder rod.	•Lubricate or replace. •Replace.

2) FORKS

Problem	Cause	Remedy
Abrasion	Long-time operations 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	If the measured value is below the wear limit, replace fork.
Distortion	Forks are bent out of shape by a number of reasons such as overloading, glancing blows against walls and objects, and picking up load unevenly. •Difference in fork tip height: 15mm •Difference in fork tip width: 35mm	If the measured value exceeds the allowance, replace fork.
Fatigue	Fatigue failure may result from the fatigue crack even though the stress to fork is below the static strength of the fork. Therefore, a daily inspection should be done. •Crack on the fork heel. •Crack on the fork weldments.	Repair fork by expert. In case of excessive distortion, replace fork.

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.

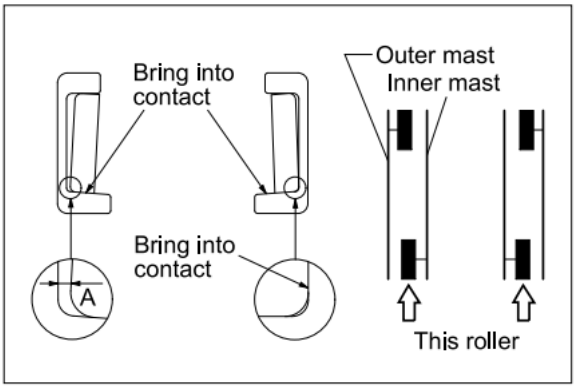
② Shift the inner mast to one side to bring the roller into contact with the outer mast, and adjust the clearance between the roller side face and mast at the closest position on the opposite side to the following value by inserting the inner/outer mast roller shim.

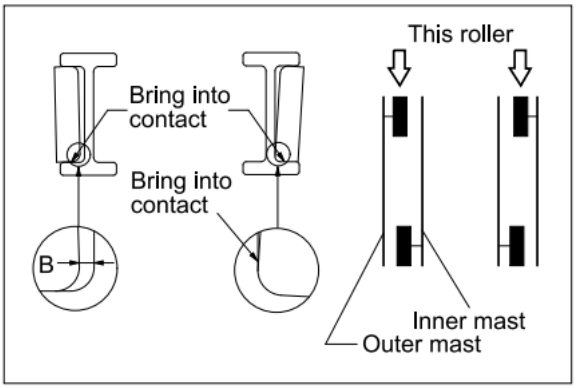
•Standard clearance A, B = 0~0.6mm

•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.

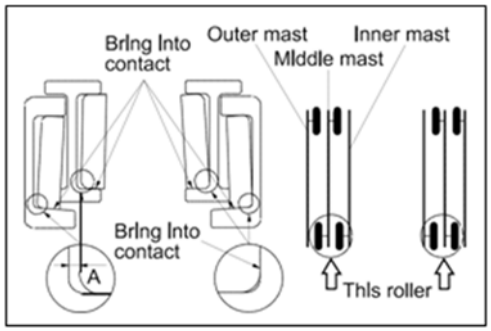
④ After the adjustment, check that the inner mast moves smoothly in the outer mast.





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 and middle masts, 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.

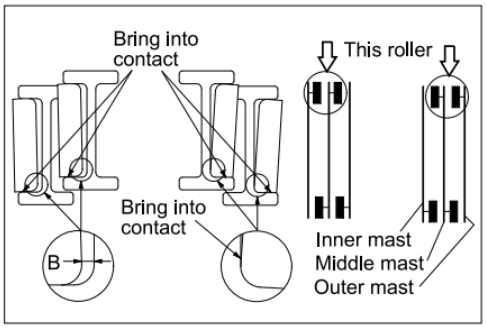
•Standard clearance A = 0~0.6mm

•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 if 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

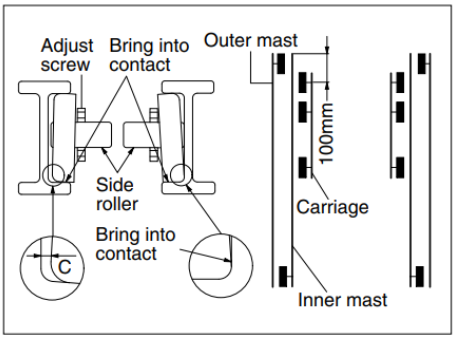
•Shim thickness 0.5, 1.0mm

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

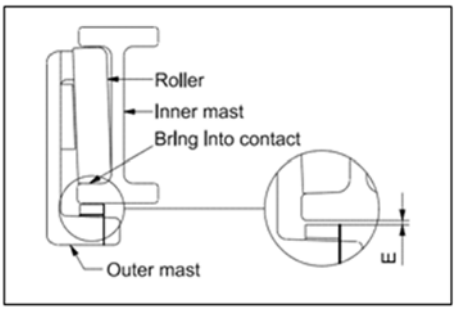
③ Distribute the shim thickness equally to the left and right roller. Refer to Carriage assembly.

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.

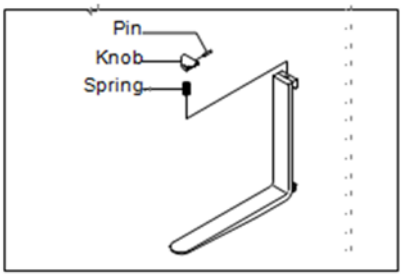
② With the middle-mast in contact with the outer-mast roller, adjust the clearance between the mast back up liner and middle mast to the following value by inserting the back up liner shim.
•Standard clearance E = 0.2 ~ 0.6mm
•Shim thickness 0.5, 1.0mm



③ After the adjustment, the mast should move smoothly.

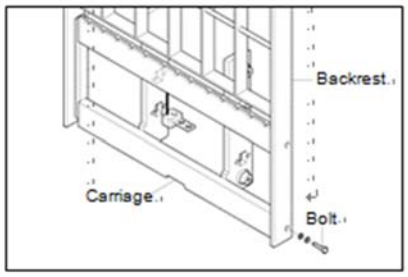
GROUP4 REMOVAL AND INSTALLATION

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.

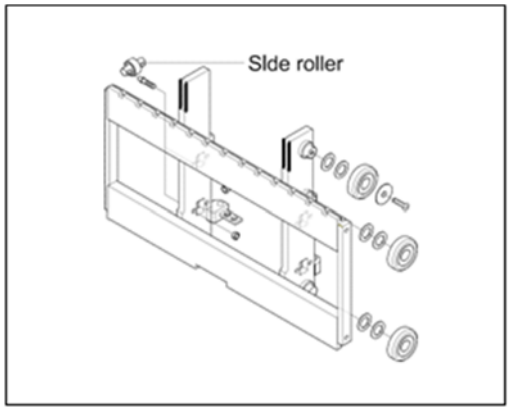
⑤ Inspect all parts for wear or damage. Replace all worn or damaged pars.

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.

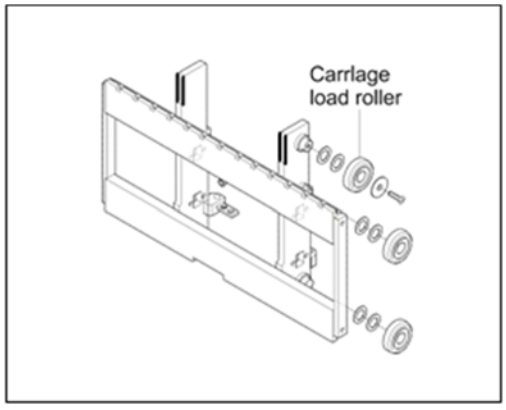


※ Adjustment

• 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 Remove load rollers from load roller bracket.
④ Reverse the above procedure to assemble. Refer to MAST ROLLER ADJUSTMENT paragraph.



4) MAST LOAD ROLLERANDBACK UP LINER

① 2 stage mast (V mast)

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

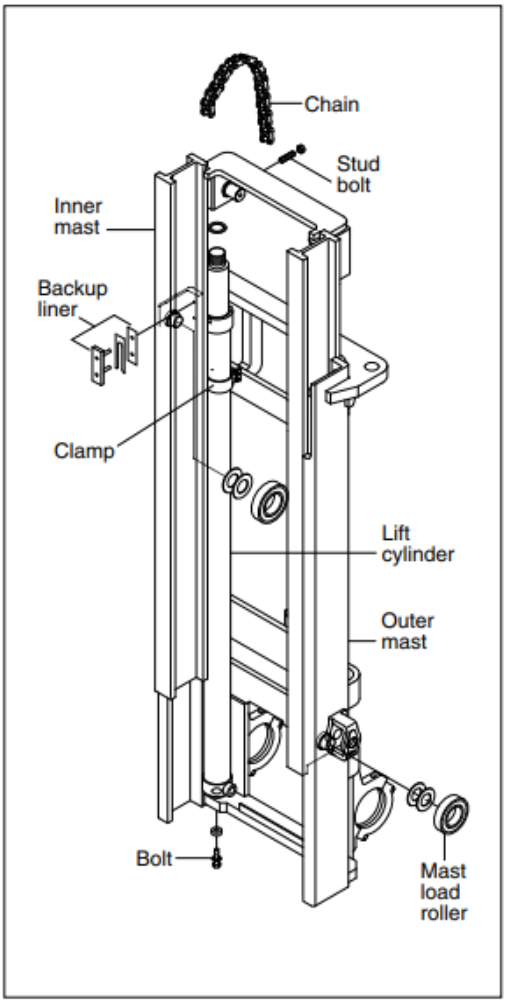
b) Loosen and remove hexagon bolts and washers securing lift cylinders to inner mast.

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 crossmember. 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.



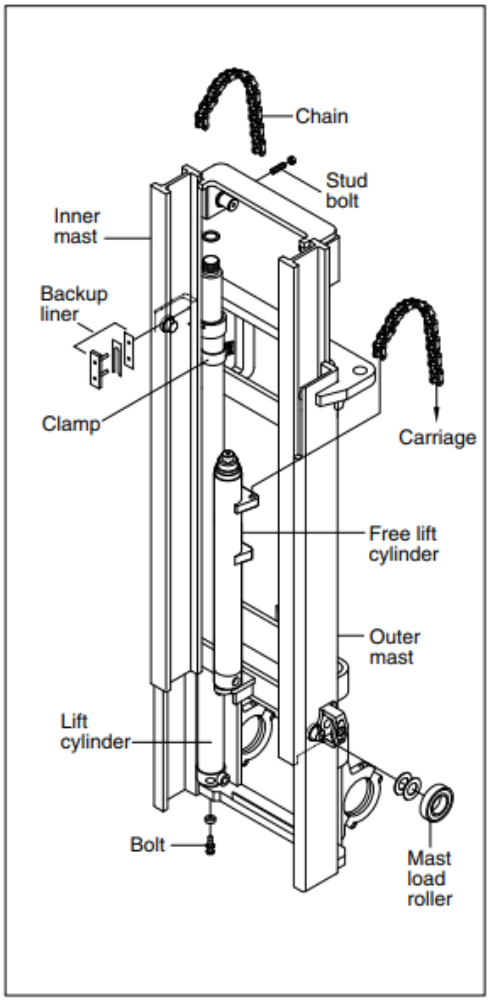
g) Remove load rollers from load roller bracket. Remove back up liners and shims.

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)

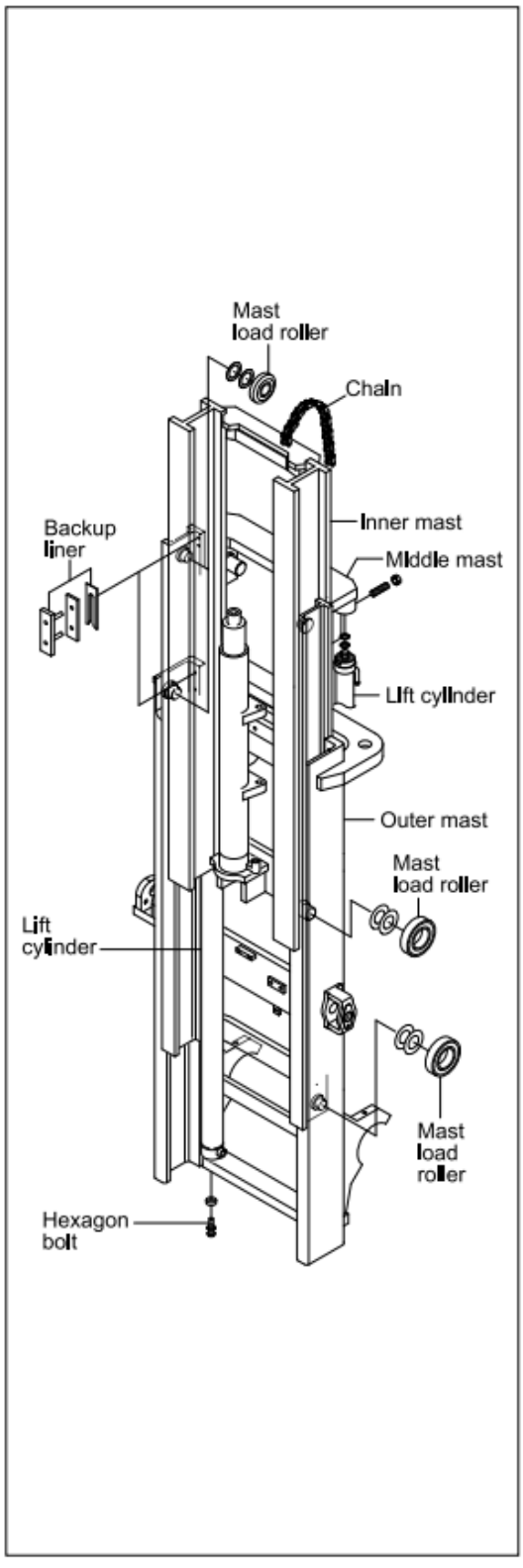
a) Remove free lift chain connected between carriage and free lift cylinder.
b) Remove the carriage assembly and move them to one side.
c) Loosen and remove hexagon bolts and washers securing lift cylinders to inner mast.
d) Loosen and remove hexagon bolts and nuts securing lift cylinders to inner mast.
e) Attach chains or sling to the inner mast section at top crossmember. 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) 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 LOADROLLERADJUSTMENT 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 crossmember. 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 inches 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) Remove load rollers from load bracket. Remove back up liners and shims.
i) Attach chains or sling to the middle mast section at top crossmember. Using an overhead hoist, slowly raise the middle mast until top and bottom rollers are exposed.
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.



5) 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 crossmember 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 crossmember.
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 crossmember. 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 crossmember. 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.

6) 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.

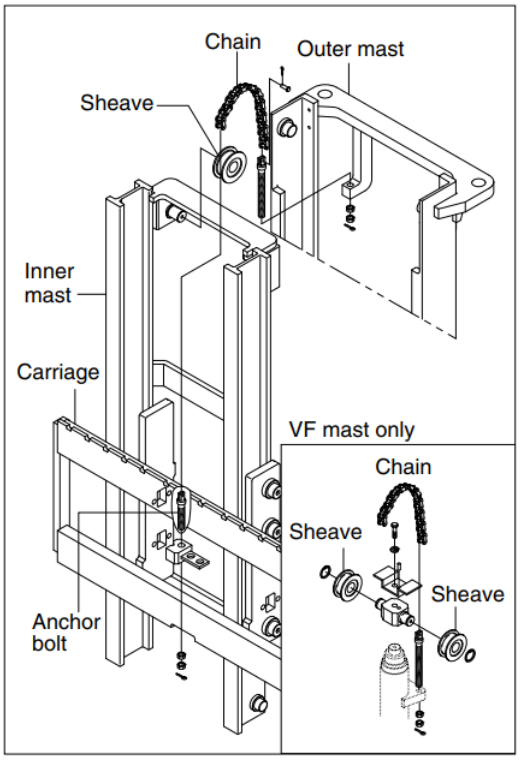
b) Remove the split pin securing the chain anchor pins and discard.
While supporting the chains, remove the chain anchor pins and drape the chains over the carriage.

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.

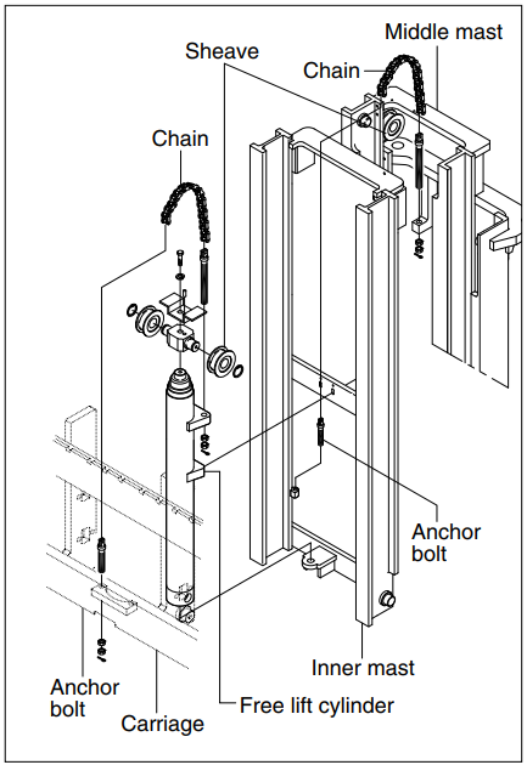
e) Thoroughly clean, inspect and replace all worn or damaged parts.

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 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 inches 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 environments changing, 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 joint 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.