CONTENTS

SECTION 1 GENERAL

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) INSTALLATION

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

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

(1) Mast mounting pin

① Check the mast mounting pins for wear, then install pins into the mast support bracket.

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

③ Tighten mounting socket bolts to frame.

· Tightening torque : 35.1~47.5 kgf·m (254~344 lbf·ft)

(2) Tilt cylinder pin

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

(3) Lift cylinder installation and adjustment

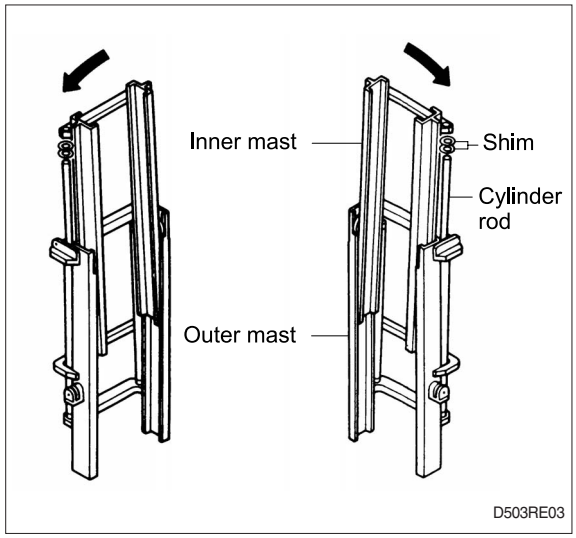
① Assemble the lift cylinder inside the outer mast, then tighten the stopper bolt. If the cylinder assembly has been replaced, adjust as follows so that the left and right cylinders are synchronized at the maximum lifting height.

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

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

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

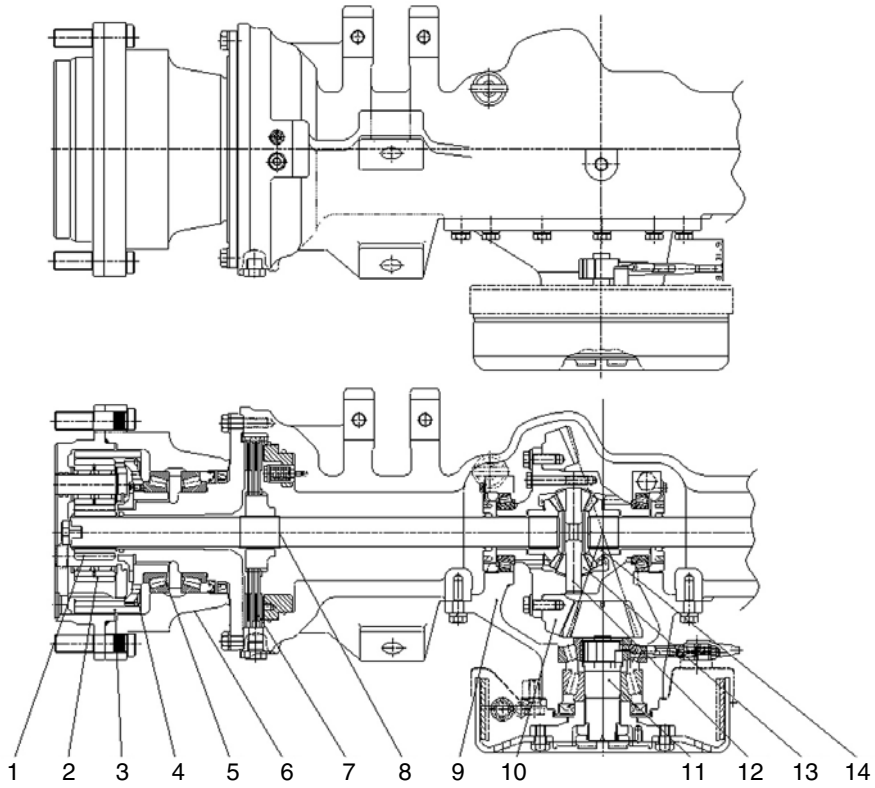
· Shim thickness : 1.0 mm (0.04 in)



SECTION 3 POWER TRAIN SYSTEM

5. DRIVE AXLE

1) STRUCTURE



35D7ETA08

1	Sun gear	6	Hub assy	11	Pinion shaft
2	Planetary gear	7	Disk brake	12	Spider
3	Inner gear	8	Drive shaft	13	Differential pinion gear
4	Inner gear carrier	9	Differential carrier assy	14	Differential side gear
5	Tapered bearing	10	Ring gear		

2) OPERATION

Drive axle which consists of differential carrier assembly (9), drive shaft (8) and hub assembly (6) transmits the drive force from transmission to drive wheel.

Pinion shaft (11) is connected to transmission output shaft and spline.

The power of transmission is transmitted to differential which consists of pinion shaft (11) and ring gear (10) and the differential rotates the drive shaft.

The differential transmits the drive force from transmission to wheels and one wheel's rotation speed is differ from the other.

The differential consists of 4 pinions (13) , 2 side gears (14) and spider and the engagement between 4 pinions (13) and side gear (14) makes a right angle.

Side gear (14) and drive shaft (8) are connected with spline and the drive shaft (8) consists of planetary gear (2), inner gear (3), wheel hub (6) and drive wheels.

No	Condition	Possible causes	Correction
5	Drive wheels do not rotate	(1) Broken axle shaft. a. Loose wheel bearings. b. Axle shaft too short. c. Loose flange studs or nuts. (2) Drive gear teeth have been damaged. (3) Side gear on differential damaged. (4) Differential pinion shaft or spider broken	 · Re-assemble wheel bearings. · Replace drive shaft · Tighten studs or nuts · Exchange damaged drive gear set · Exchange damaged gear · Exchange damaged gear

(2) Using different kinds of shims, adjust shim thickness as measured by previous equation.
Place shims at the bearing place.
Using a jig, assemble drive bearing so that the outer race contact with the bearing place.


35L7ADA03

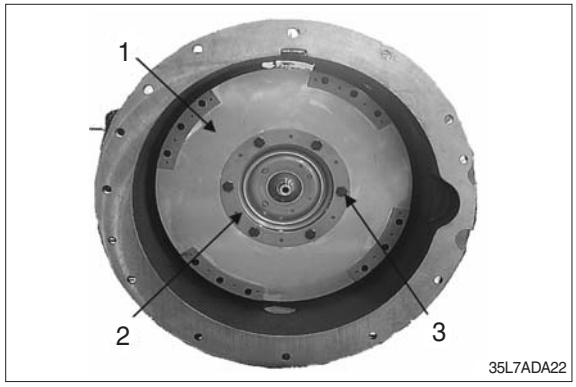
(3) Heat the inner race of bearing to max 100°C and then assemble it to the pinion shaft.
Also inner race should contact with bearing place.


35L7ADA04

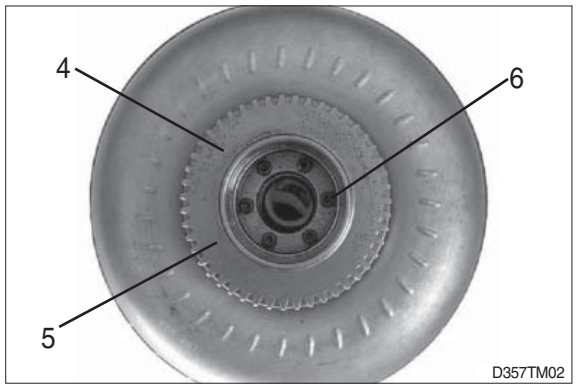
3. DISASSEMBLY OF TRANSMISSION

1) Pull torque converter (1) straight forward and remove from the converter housing.

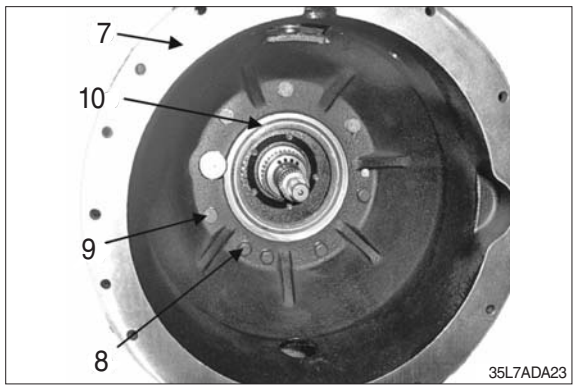
   Remove six bolts (3) and flexible plate (1), plate (2) from the torque converter.



2) Remove six socket bolts (3) and then gear P.T.O input from the the torque converter.



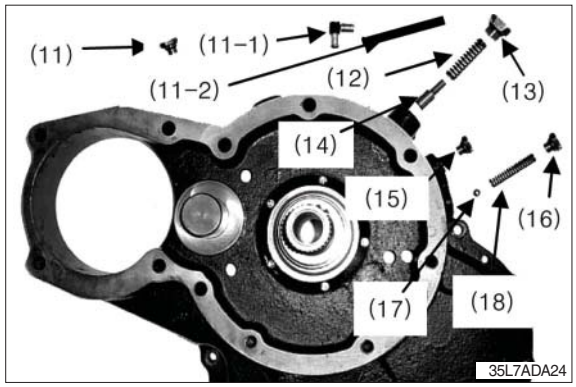
3) Remove four bolts (9) and bolts (8), washes, oil seal (10) from the housing converter (7).



4) Remove plug (16) and o-ring, spring (18) and ball (17) from the bearing plate.

5) Remove plug (13) and spring (12), valve (14).

6) Remove plug (11).



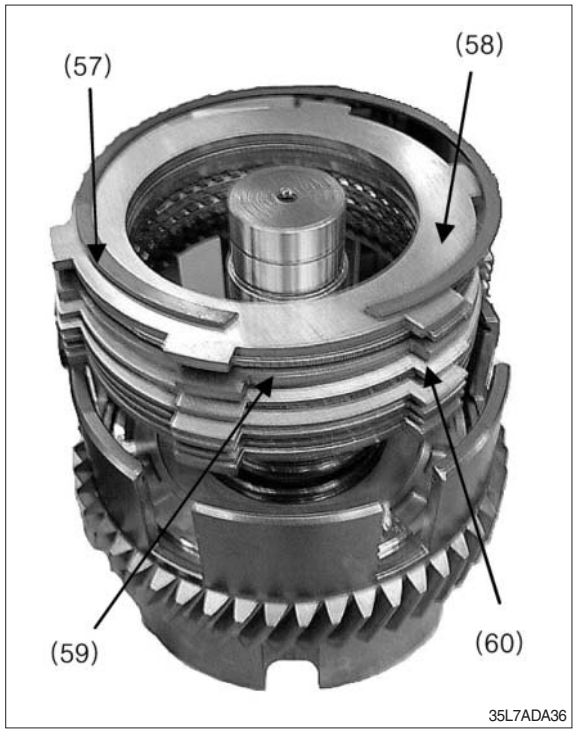
11) Put clean transmission oil on each side of the clutch plates and clutch discs. Install four 2T clutch plates, three 4T clutch plates, five clutch discs and one bending plate in the cylinder with the following procedure.
   (1) Install a clutch plate first, that has guide shape on its outside diameter.
   (2) Next, install a clutch disc that has teeth on its inside diameter.
   (3) Follow steps a and b again until all of four the 2T clutch plates and discs are installed in the cylinder.
   (4) Install a 4T clutch plate, then install a bending plate. In following procedure, bending plate shape will be downward.
   (5) Finaly, install a 4T cluch plate.

12) Use a screwdriver and install snap ring (57) that check all of them in position in the cylinder.

13) Install a three seal rings on the shaft.
※ Be carefully, Do not damage to the seal rings on the counter shaft.

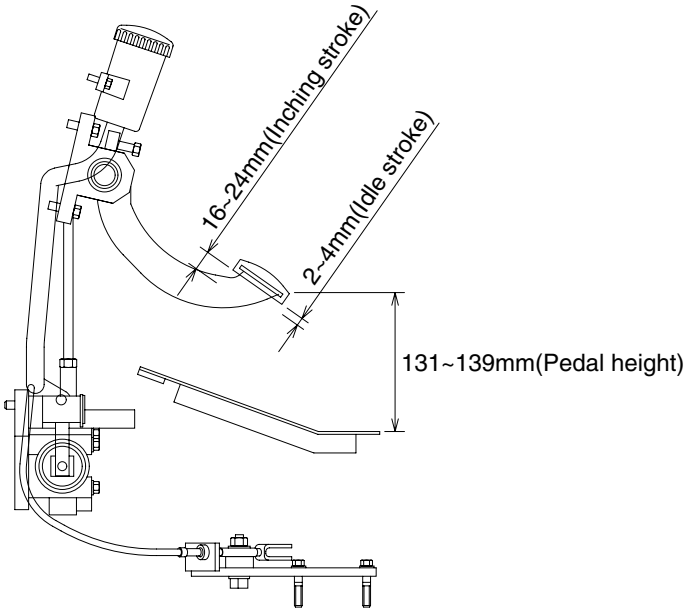
14) For the other side of the counter shaft assembly, follow the procedure in steps 5 through 8.

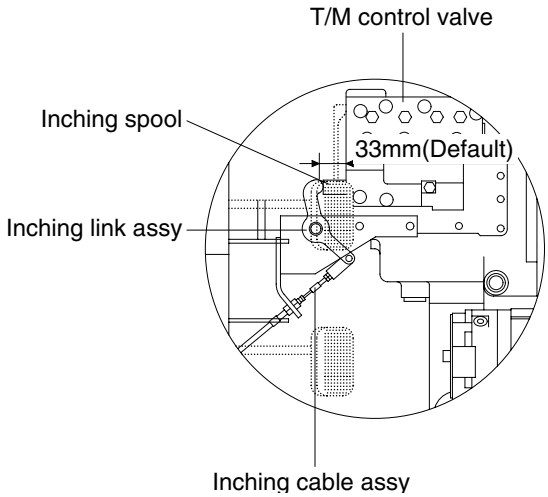
15) Put clean transmission oil on each side of the clutch plates and clutch discs. Install four 2T clutch plates, three 4T clutch plates, five clutch discs and one bending plate in the cylinder with the following procedure.
   (1) First, install a 4T cluch plate.
   (2) Install a 4T clutch plate, then install a bending plate. In following procedure, bending plate shape will be downward.
   (3) Follow steps a and b again until all of four the 2T clutch plates and discs are installed in the cylinder.
   (4) Next, install a clutch disc that has teeth on its inside diameter.
   (5) Finally, Install a clutch plate first, that has guide shape on its outside diameter.



4. INCHING PEDAL AND LINKAGE

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

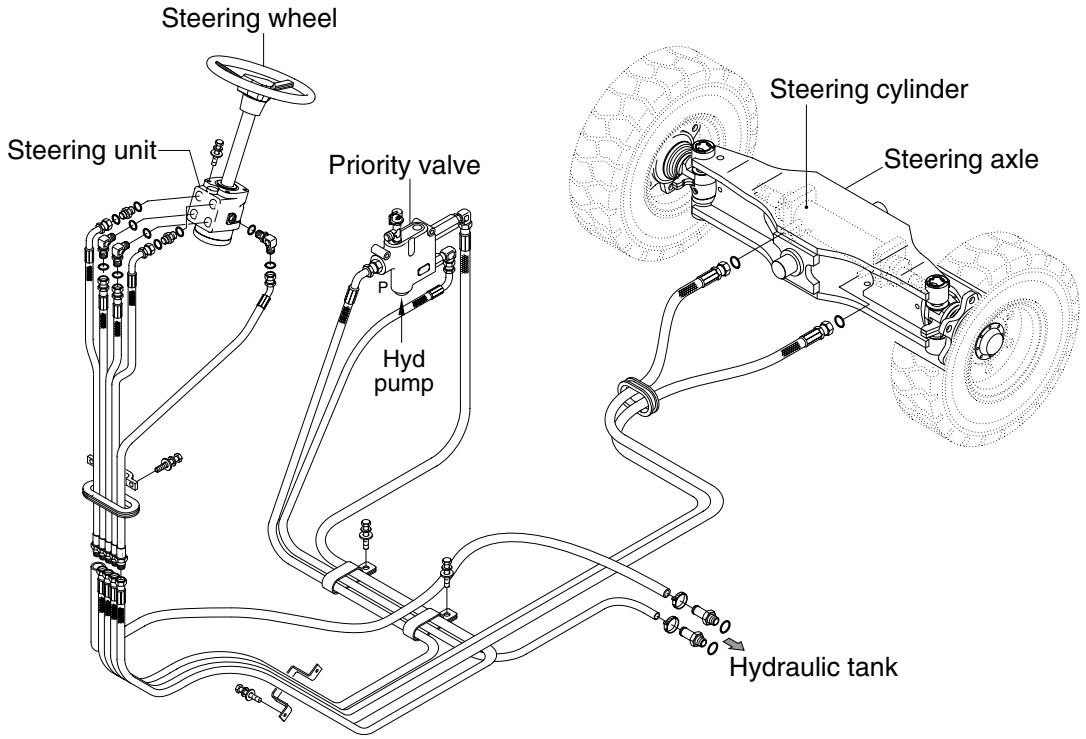




35D9SBS04

GROUP 1 STRUCTURE AND FUNCTION

1. OUTLINE



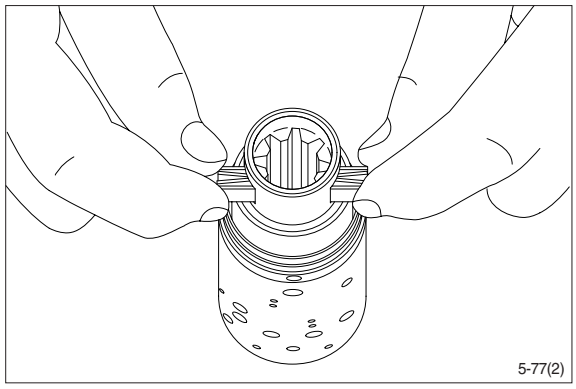
35DS7SE01

The steering system for this machine is composed of steering wheel assembly, steering unit, priority valve 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.

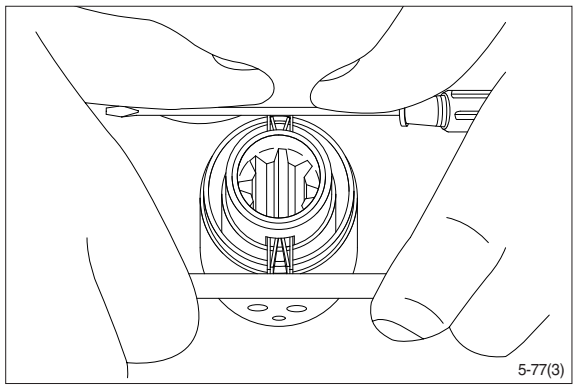
The axle body is unit structure having steering knuckles installed to its both ends by means of kingpins. Hub and wheel are mounted through bearing to spindle of knuckle.

Problem	cause	Remedy
Steering wheel turns unsteadily. Steering system makes abnormal sound or vibration.	· Lockout loosening. · Metal spring deteriorated. · Gear backlash out of adjustment. · Lockout loosening. · Air in oil circuit.	· Retighten. · Replace. · 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.	· Tube replace.
Rod	· Tube inside damage. · Piston seal damage and distortion	· Grind surface with oil store. · Replace
Piston rod bushing inner diameter excessive gap	· Bushing wear.	· Replace

(5) Press the springs together and push the neutral position springs into place in the sleeve.

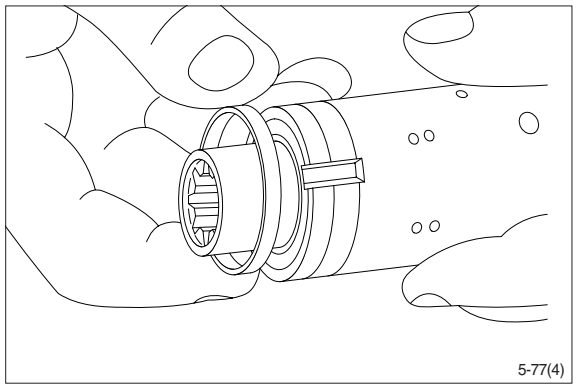

5-77(2)

(6) Line up the springs and center them.

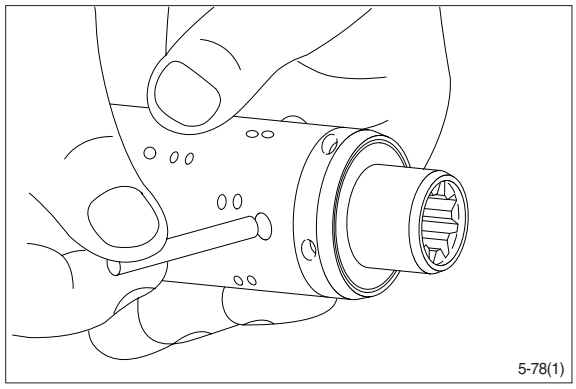

5-77(3)

(7) Guide the ring down over the sleeve.

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


5-77(4)

(8) Fit the cross pin into the spool / sleeve.


5-78(1)

2) DISASSEMBLY

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

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

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

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

(4) Check wear condition of the sealing parts (O-ring, oil seal, dust seal, U-packing, bush). If there are some damage, replace with new parts.

3) CHECK AND INSPECTION

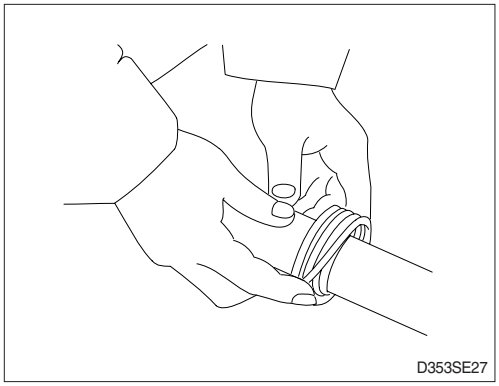
mm (in)

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

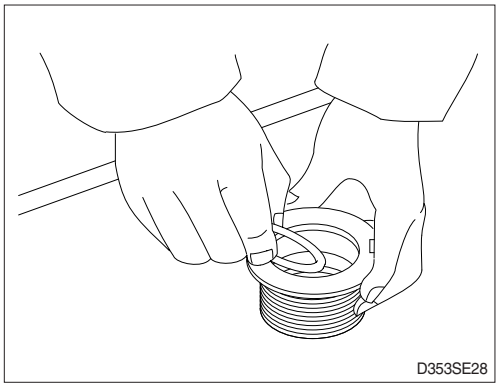
4) ASSEMBLY

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

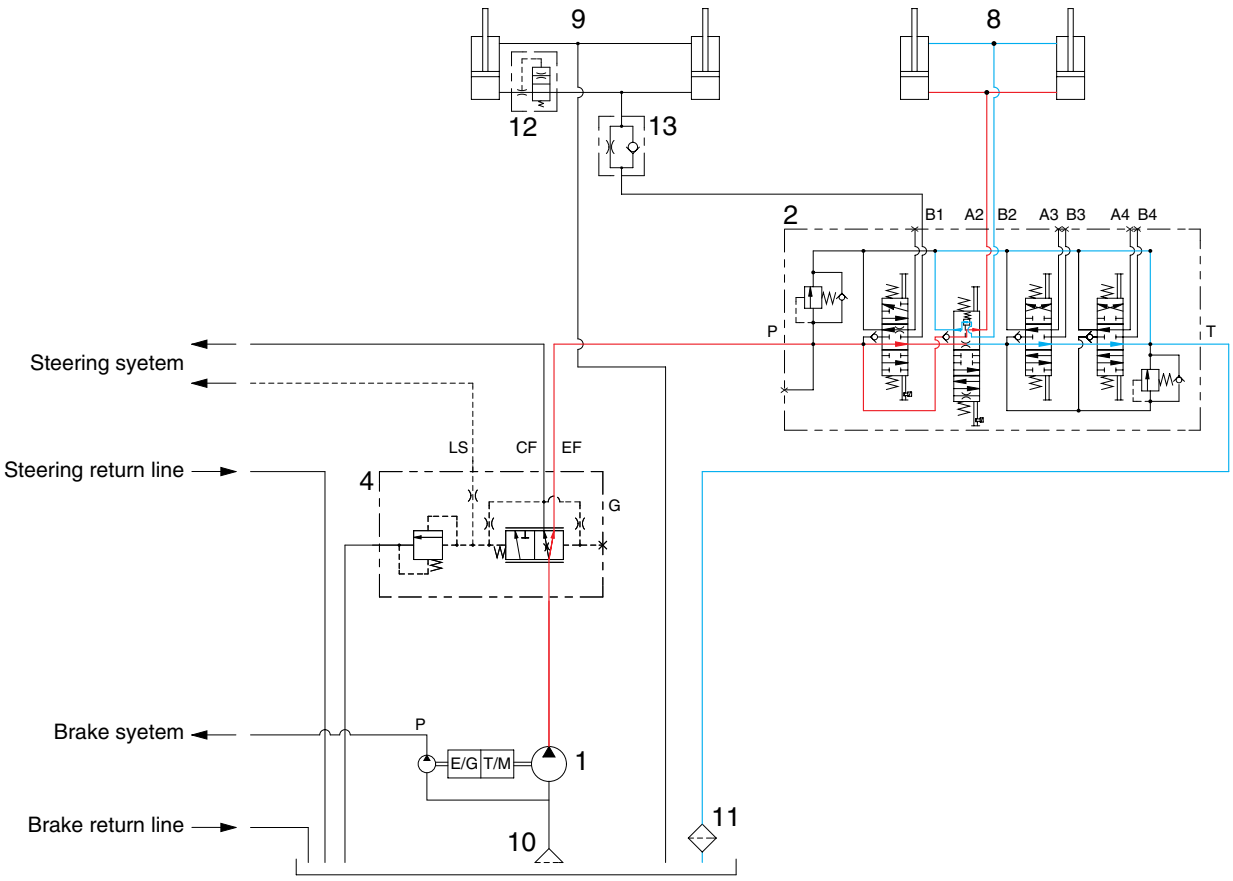
※ Be careful not to scratch the seal too much during installation or it could not be seated properly.



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



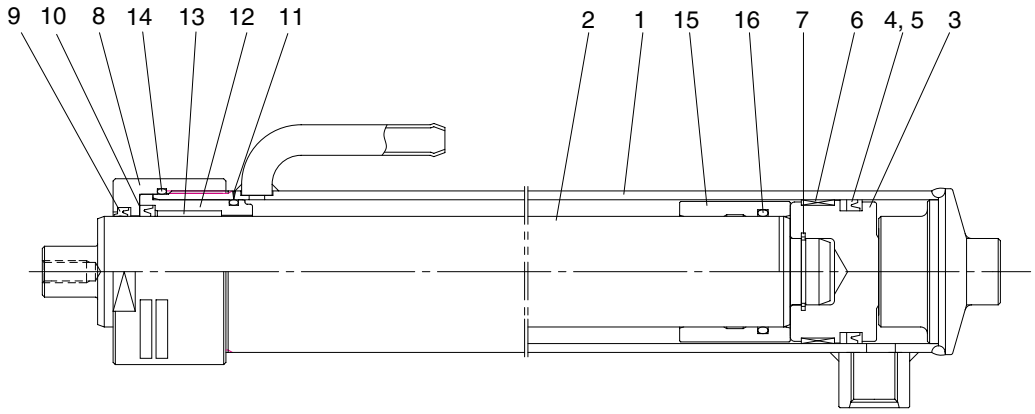
3) WHEN THE TILT CONTROL LEVER IS IN THE FORWARD POSITION



35D7EHS04

When the tilt control lever is pushed forward, the spool on the second block is moved to tilt forward position.
The oil from hydraulic gear pump (1) flows into main control valve (2) through the priority valve (4) and then goes to the large chamber of tilt cylinder (8) by pushing the load check valve of the spool.
The oil at the small chamber of tilt cylinder (8) returns to hydraulic tank at the same time.
When this happens, the mast tilt forward.

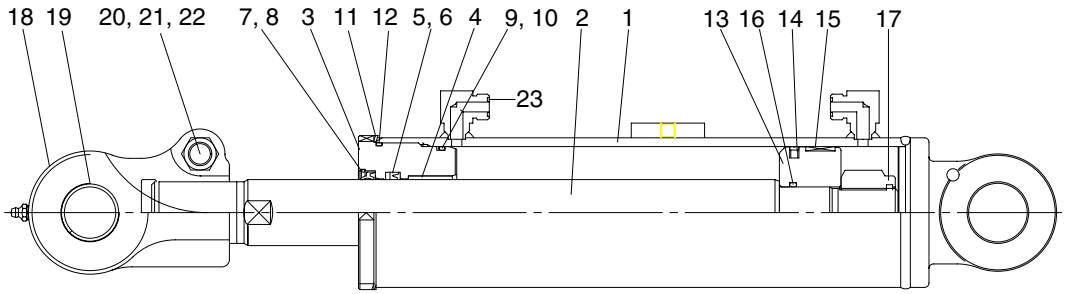
4. LIFT CYLINDER



D357HS12

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

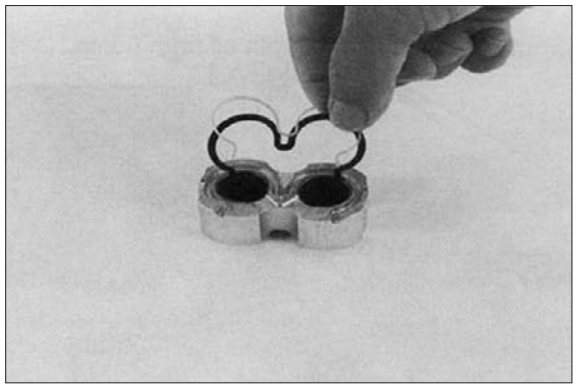
5. TILT CYLINDER



D357HS13

1	Tube assy	9	O-ring	17	Nylon nut
2	Rod	10	Back up ring	18	Rod eye
3	Gland	11	Lock washer	19	DU bushing
4	DU bushing	12	O-ring	20	Hexagon bolt
5	Rod seal	13	Piston	21	Hexagon nut
6	Back up ring	14	Glyd ring	22	Spring washer
7	Dust wiper	15	Wear ring	23	O-ring
8	Snap ring	16	O-ring		

(17) Remove seals from both bearing blocks and discard.



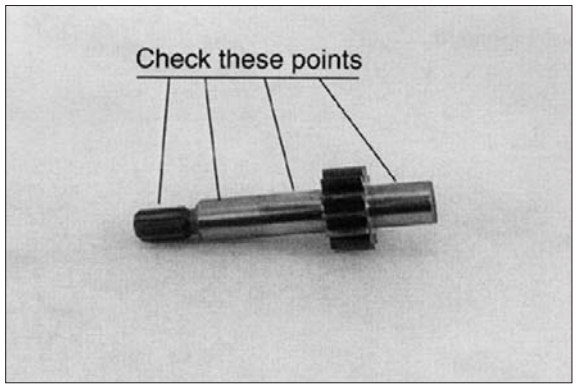
PUMP 11

3) 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.

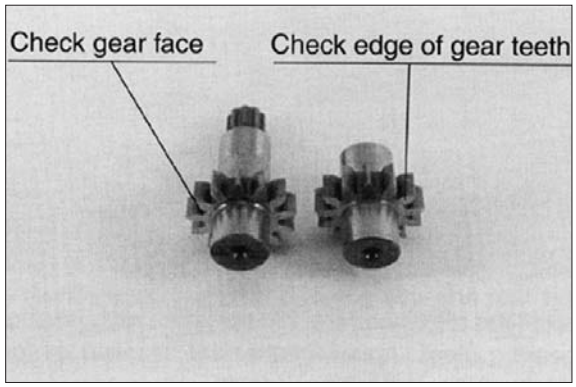
(2) Check drive shaft spline for twisted or broken teeth, check keyed drive shaft for broken or chipped keyway. No marks or grooves on shaft in seal area, some discoloration of shaft is allowable.

(3) Inspect both the drive gear shaft and idler gear shafts at the bearing points and seal area for rough surfaces and excessive wear.



PUMP 12

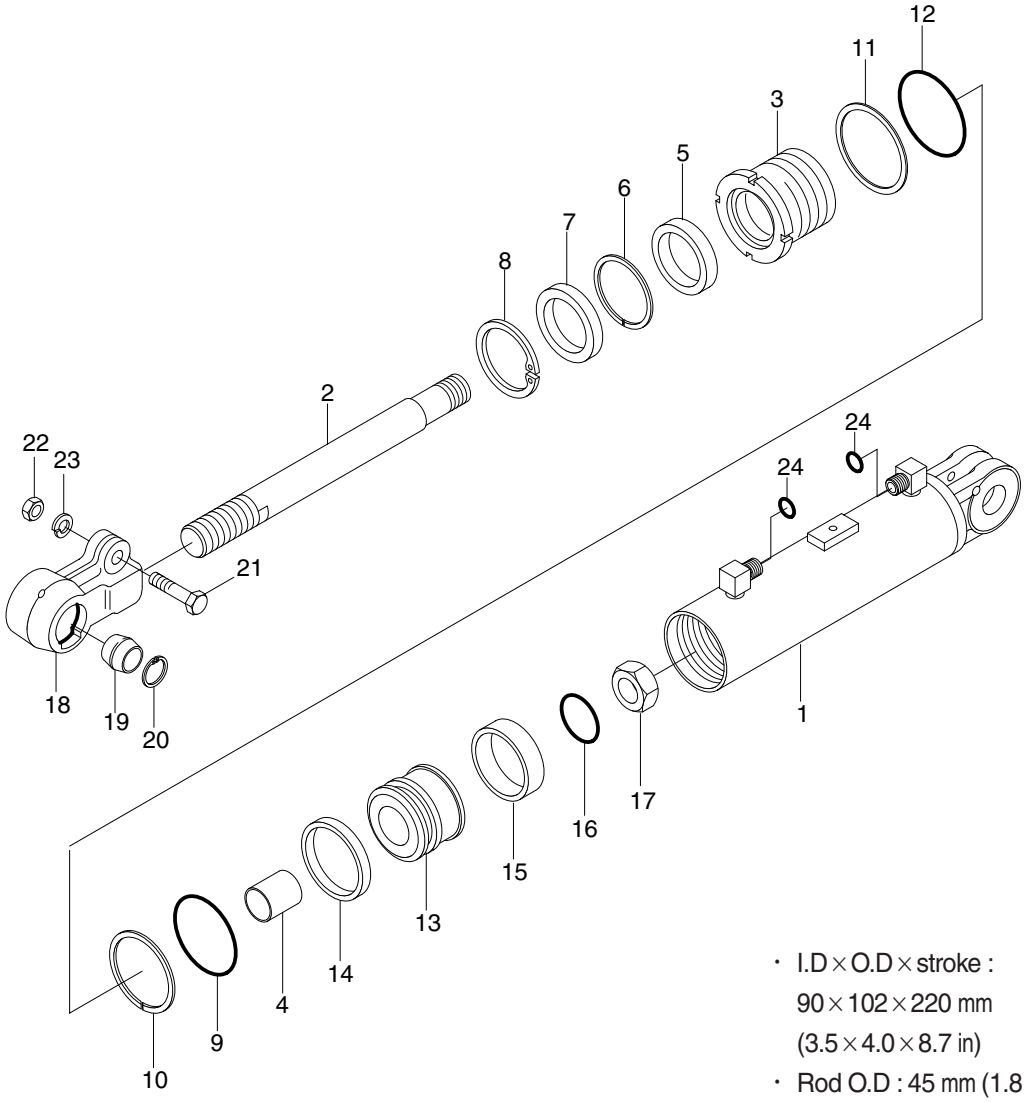
(4) Inspect gear face for scoring or excessive wear. If the face edge of gear teeth are sharp, they will mill into the bearing blocks. If wear has occurred, the parts are unusable.



PUMP 13

5. TILT CYLINDER

1) STRUCTURE

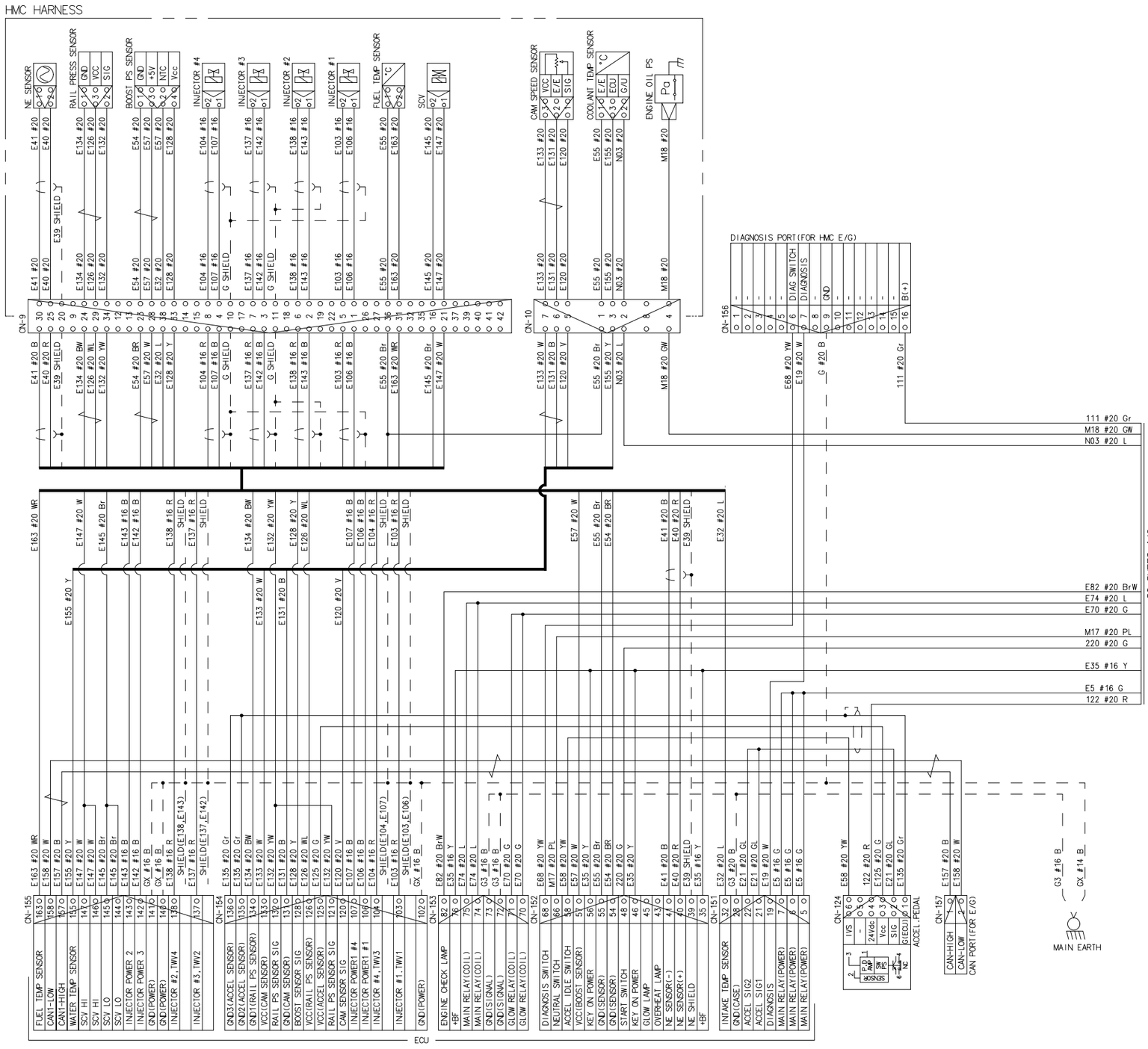


- I.D × O.D × stroke : 90 × 102 × 220 mm (3.5 × 4.0 × 8.7 in)
- Rod O.D : 45 mm (1.8 in)

35DS7HS16

1	Tube assy	9	O-ring	17	Nylon nut
2	Rod	10	Back up ring	18	Rod eye
3	Gland	11	Lock washer	19	Spherical bearing
4	DU bushing	12	O-ring	20	Retaining ring
5	Rod seal	13	Piston	21	Hexagon bolt
6	Back up ring	14	Glyd ring	22	Hexagon nut
7	Dust wiper	15	Wear ring	23	Spring washer
8	Snap ring	16	O-ring	24	O-ring

· ELECTRICAL CIRCUIT (3/4, FRAME 2 OF 2)



21FV-30030-00 3OF4

GROUP 3 COMPONENT SPECIFICATION

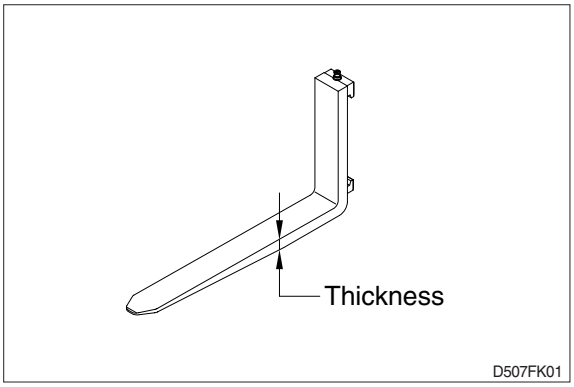
<table>
<tr><th>No</th><th>Part name</th><th>Qty</th><th>Specification</th></tr>
<tr><td>1</td><td>Battery</td><td>2</td><td>12V × 96 AH × 2 EA
RC : 130 min
CCA : 630A</td></tr>
<tr><td>2</td><td>Working lamp</td><td>1</td><td>24V, 70W</td></tr>
<tr><td>3</td><td>License lamp</td><td>1</td><td>24V, 3W × 2</td></tr>
<tr><td>4</td><td>Rear Combination lamp</td><td>2</td><td>24V, 25/10W (Stop/Tail)
24V, 21W (Turn)
24V, 10W (Back Up)</td></tr>
<tr><td>5</td><td>Head lamp</td><td>2</td><td>24V, 70W</td></tr>
<tr><td>6</td><td>Flasher lamp</td><td>2</td><td>24V, 25/10W</td></tr>
<tr><td>7</td><td>Glow relay</td><td>1</td><td>24V, 300A</td></tr>
<tr><td>8</td><td>Relay (4P)</td><td>3</td><td>24V, 20A</td></tr>
<tr><td>9</td><td>Relay (5P)</td><td>3</td><td>24V, 6A</td></tr>
<tr><td>10</td><td>Flasher Unit</td><td>1</td><td>85±10 CM, (21W + 21W) × 2 + 3W × 2</td></tr>
<tr><td>11</td><td>Back buzzer</td><td>1</td><td>24V, 90±5 dB, 60±10 C/M</td></tr>
<tr><td>13</td><td>Horn</td><td>1</td><td>24V, MAX 1.5A, 100 ~ 115 dB</td></tr>
<tr><td>14</td><td>Fuel level sender</td><td>1</td><td>
<table>
<tr><td>Float indicator</td><td>E</td><td>1/2</td><td>F</td></tr>
<tr><td>Resistance (Ω)</td><td>105</td><td>32.5</td><td>5</td></tr>
<tr><td rowspan="2">Tolerance (Ω)</td><td>+0
5</td><td rowspan="2">±2.5</td><td>+0.5
0</td></tr>
</table>
</td></tr>
<tr><td>15</td><td>Master switch</td><td>1</td><td>24V, 180A</td></tr>
<tr><td>16</td><td>Combination switch</td><td>1</td><td>Direction 4.5A, Tail 5A
Head 6A, Horn 4A</td></tr>
<tr><td>17</td><td>Brake switch</td><td>1</td><td>24V, 50W</td></tr>
<tr><td>18</td><td>Working lamp switch</td><td>1</td><td>24V, 8A</td></tr>
<tr><td>19</td><td>Hazard switch</td><td>1</td><td>24V, 8A</td></tr>
<tr><td>20</td><td>Start switch</td><td>1</td><td>24V, 30A</td></tr>
</table>

GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

1. OPERATIONAL CHECKS

1) FORKS

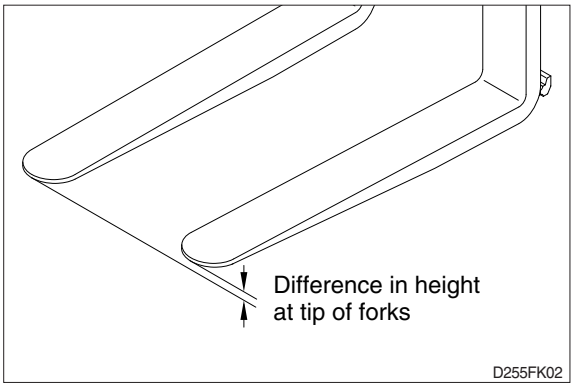
(1) Measure thickness of root of forks and check that it is more than specified value.
EX : ℓ =1200 mm (47 in)



mm (in)

STD Fork assy	Applicable model	Standard	Limit
S173896-02	35D-9S	50 (2.0)	45 (1.7)
F13710010	40D-9S	50 (2.0)	45 (1.7)
F18393603	45D-9S	50 (2.0)	45 (1.7)
F14710011	50D-9SA	60 (2.4)	54 (2.1)

2) Set forks in middle and measure out of parallel and difference in height at the top of forks.



Model	Fork length	Height difference
35D/40D/45D-9S 50D-9SA	below 1500	3 mm
	above 1500	6 mm

3) Most force is concentrated at root of fork and at hook, so use crack detection method to check cracks.

2. MAST

1) Check for cracks at mast stay, tilt cylinder bracket, guide bar, fork carriage and roller shaft weld. Check visually or use crack detection method. Repair any abnormality.
2) Set mast vertical, raise forks about 10cm from ground and check front-to-rear clearance and left-to-right clearance between inner mast and fork carriage, and between outer mast and inner mast. Use these figures to judge if there is any play at roller or rail.
   - Front-to-rear clearance : Within 2.0 mm (0.08 in)
   - Left-to-right clearance : Within 2.5 mm (0.10 in)
3) Check that there is an oil groove in bushing at mast support.
4) Set mast vertical, raise forks about 10 cm from ground, and push center of lift chain with finger to check for difference in tension.
   If there is any difference in tension, adjust chain stopper bolt.
5) Check visually for abnormalities at thread of chain anchor bolt, and at contact surface between chain wheel and chain.
   Rotate chain wheel by hand and check for any play of bearing.