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SECTION 5 STEERING SYSTEM

GROUP 1 STRUCTURE AND FUNCTION

1. OUTLINE



15BT9SS01

The steering system for this truck is composed of steering wheel assembly, steering unit, steering motor, steering axle and pipings. 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 motor.

2. HYDRAULIC CIRCUIT



15BT9SS26

- 1 Hydraulic gear pump
- 2 Priority valve
- 4 Steering unit
- 5 Hydraulic motor

- 8 Suction strainer
- 9 Return filter
- 12 Hydraulic tank

(1) NEUTRAL



15BT9SS04

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

The oil from hydraulic tank(12) enters hydraulic gear pump(1) and pressurized so that the oil flows into the inlet port(P) of steering unit(4).

Oil flows out of T port to the hydraulic tank(12).

(2) LEFT TURN



15BT9SS06

When the steering wheel is turned to the left, the spool(G) within the steering unit(4) connected with steering column turns in left hand direction.

At this time, the oil discharged from hydraulic gear pump(1) flows into the spool(G) of the steering unit(4) through the inlet port(P) and flows to gerotor(H).

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

Oil returned from hydraulic motor(5) returns to hydraulic tank(12).

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

(3) RIGHT TURN



15BT9SS08

When the steering wheel is turned to the right, the spool(G) within the steering unit(4) connected with steering column turn in right hand direction.

At this time, the oil discharged from hydraulic gear pump(1) flows into the spool(G) of the steering unit(4) through the inlet port(P) and flows to gerotor(H).

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

Oil returned from hydraulic motor(5) returns to hydraulic tank(12).

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

3. STEERING UNIT

1) STRUCTURE



- 1 Dust seal
- 2 Retaining ring
- 3 Cap seal
- 4 Thrust bearing
- 5 Ball
- 6 Pin
- 7 Center spring
- 8 Washer
- 9 O-ring
- 10 O-ring
- 11 Rolled screw
- 12 Gerotor set
- 13 Bearing race

- 14 Bore screw
- 15 Drive shaft
- 16 End cap
- 17 Bushing
- 18 Plate
- 19 Cap screw
- 20 Housing
- 21 Spool
- 22 Sleeve
- 23 Relief valve
- 23-1 Plug
- 23-2 O-ring
- 23-3 Spring seat

- 23-4 Spring
- 23-5 Spool
- 23-6 Bushing
- 24 P-port check valve

20B7SS09

- 24-1 Plug
- 24-2 Poppet
- 24-3 Spring seat
- 24-4 Spring
- 25 Suction valve
- 25-1 Roll pin
- 25-2 Ball
- 26 Spacer
- 27 Plate spring

2) OPERATION

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.

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 key switch is ON. Keep clear of the steering wheel when the key switch is ON.

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



20B7SS10

- 1-1 Steering axle
- 1-2 Bracket
- 1-3 Taper roller bearing
- 1-4 Taper roller bearing
- 1-5 Oil seal
- 1-6 Oil seal
- 1-7 Taper roller bearing
- 1-8 Taper roller bearing
- 1-9 Steering axle hub
- 1-10 Plain washer

- 1-11 Split pin
- 1-12 Hub bolt
- 1-13 Hub cap
- 1-14 Steering gear assy
- 1-15 Bearing
 - 2 Hexagon bolt
 - 3 Spring washer
 - 4 Spring pin
 - 5 Pinion
 - 6 Special washer

- 7 Bolt-w/washer
- 8 Lever
- 9 Hexagon bolt
- 10 Spring washer
- 11 Plain washer
- 12 Hexagon nut
- 13 Bracket
- 14 Socket bolt
- 15 Spring washer

2) TIGHTENING TORQUE AND SPECIFICATION



SECTION A - A

20B7SS11

GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

1. OPERATIONAL CHECKS

Check item	Checking procedure
Steering wheel 30-60mm (1.2-2.4 in)	 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 forklift stopped.
Knuckle	Check knuckle visually or use crack detection method. If the knuckle is bent, the tire wear is uneven, so check tire wear.
Steering axle	 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. Min turning radius(Outside) : Refer to page 1-5 (Specifications)
Hydraulic pressure of power steering	Remove cap from check port of priority valve and install oil pressure gauge. Turn steering wheel fully and check oil pressure.

2. TROUBLESHOOTING

1) STEERING SYSTEM

Problem	Cause	Remedy
Steering wheel drags.	Low oil pressure.	· Check lockout. Repair.
	 Bearing faulty. 	· Clean or replace.
	 Spring spool faulty. 	· Clean or replace.
	Reaction plunger faulty.	· Replace.
	· Ball-and-screw assembly faulty.	· Clean or replace.
	· Sector shaft adjusting screw excessi-	· Adjust.
	vely tight.	
	 Gears poorly meshing. 	· Check and correct meshing.
	\cdot Flow divider coil spring fatigued.	· Replace.
Steering wheel fails to return	Bearing faulty.	· Clean or replace.
smoothly.	Reaction plunger faulty.	· Replace.
	Ball-and-screw assy faulty	· Clean or replace.
	Gears poorly meshing.	· Check and correct meshing.

Problem	Cause	Remedy
Steering wheel turns unstea-	Lockout loosening.	· Retighten.
dily.	Metal spring deteriorated.	· Replace.
Steering system makes abn-	\cdot Gear backlash out of adjustment.	· Adjust.
ormal sound or vibration.	Lockout loosening.	· Retighten.
	Air in oil circuit.	· Bleed air.
Abnormal sound heard when	Valve	
steering wheel is turned fully	\cdot Faulty. (Valve fails to open.)	Adjust valve set pressure and check
	Piping	for specified oil pressure.
	Pipe(from pump to power steering	· Benair or replace
	cylinder) dented or clogged.	
Piping makes abnormal	Oil pump	
sounds.	· Lack of oil.	· Add oil.
	 Oil inlet pipe sucks air. 	· Repair.
	Insufficient air bleeding.	 Bleed air completely.
Valve or valve unit makes	Oil pump	
abnormal sounds.	\cdot Oil inlet pipe sucks air.	Repair or replace.
	Valve	
	\cdot Faulty. (Unbalance oil pressure)	\cdot Adjust valve set pressure and check
	Piping	specified oil pressure.
	Pipe(from pump to power steering)	· Repair or replace.
	dented or clogged.	
	Insufficient air bleeding.	· Bleed air completely.
Insufficient or variable oil flow.	\cdot Flow control valve orifice clogged.	· Clean
Insufficient or variable dischar-	Piping	
ge pressure.	\cdot Pipe(from tank to pipe) dented or	· Repair or replace.
	clogged.	
Steering cylinder head	 Packing foreign material. 	· Replace
leakage (Piston rod)	 Piston rod damage. 	\cdot Grind surface with oil stone.
	\cdot Rod seal damage and distortion.	· Replace
	\cdot Chrome gilding damage.	• Grind
Steering cylinder head thread	\cdot O-ring damage.	· Replace
(A little bit leak is no problem)		
Welding leakage	· Cylinder tube damage.	· Tube replace.
Rod	· Tube inside damage.	\cdot Grind surface with oil store.
	\cdot Piston seal damage and distortion	· Replace
Piston rod bushing inner	• Bushing wear.	· Replace
diameter excessive gap		

2) POWER STEERING UNIT

Problem	Cause	Remedy	
Oil leakage	· Fittings loose, worn, or damaged.	\cdot Check and replace the damaged	
		parts.	
	\cdot Deteriorated seals by excessive heat.	\cdot Replace the seals.	
	· Loose screw or its deteriorated	\cdot Replace the sealing and tighten	
	sealing.	screw appropriately.	
	 Internal seals worn or damaged. 	· Replace it.	
	 Damaged seal grooves. 	\cdot Replace the unit or related parts.	
	Housing crack.	\cdot Replace the unit.	
Noise or vibration	\cdot Air inclusion in the system.	\cdot Bleed the air.	
	 Valve timing error when the unit is assembled. 	Correct the timing.	
	Hydraulic pipe noise interference.	\cdot Consult the component manufacturer.	
	\cdot Control valve damage or clogging.	\cdot Replace the valve.	
Heavy steering operation	· Lack of sufficient oil supply.	\cdot Check the pump and the line.	
	Excessive heat.	\cdot Locate the heat source and correct it.	
	· Broken pump.	· Replace it.	
	\cdot Leakage in the line or connections.	· Replace it.	
	 Clogged orifice. 	\cdot Disassemble, clean, and reassemble	
		it.	
	 High back pressure. 	 Adjust the pressure. 	
Irregular or no response	· Broken pump.	· Replace it.	
	Excessive heat.	\cdot Locate the heat source and remove it.	
	 Broken centering spring. 	 Replace it. 	
	 Misalignment with column. 	 Disassemble and adjust it. 	
	 Incorrect piping to the four port. 	· Correct it.	
	\cdot Parts missing.	\cdot Install the parts correctly.	
	 High back pressure. 	 Adjust the pressure. 	
	 Corrosion on the moving parts. 	Replace it.	

GROUP 3 DISASSEMBLY AND ASSEMBLY

1. STEERING UNIT

1) STRUCTURE



- 1 Dust seal
- 2 Retaining ring
- 3 Cap seal
- 4 Thrust bearing
- 5 Ball
- 6 Pin
- 7 Center spring
- 8 Washer
- 9 O-ring
- 10 O-ring
- 11 Rolled screw
- 12 Gerotor set
- 13 Bearing race

- 14 Bore screw
- 15 Drive shaft
- 16 End cap
- 17 Bushing
- 18 Plate
- 19 Cap screw
- 20 Housing
- 21 Spool
- 22 Sleeve
- 23 Relief valve
- 23-1 Plug
- 23-2 O-ring
- 23-3 Spring seat

- 23-4 Spring
- 23-5 Spool
- 23-6 Bushing
- 24 P-port check valve
- 24-1 Plug
- 24-2 Poppet
- 24-3 Spring seat
- 24-4 Spring
- 25 Suction valve
- 25-1 Roll pin
- 25-2 Ball
- 26 Spacer
- 27 Plate spring

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 spanner
6, 8mm and 12mm 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	6.1 ±0.6 (44.1±4.3)
R	3/4 UNF - 16	6.1 ±0.6 (44.1±4.3)
Т	3/4 UNF - 16	6.1 ±0.6 (44.1±4.3)
Р	3/4 UNF - 16	6.1 ±0.6 (44.1±4.3)
Mounting bolt	M10×1.5	5 ±1 (36±7.2)

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. Take out 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) Shake out the check valve ball.



- (9) 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.
- (10) 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.

(11) Press out the cross pin. Use the special screw from the end cover.

5-73(4)





* 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.



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



(13) Press the neutral position springs out of their slots in the spool.



(14) Remove dust seal and O-ring.



Disassembling the pressure relief valve

(15) Screw out the plug using an 8mm hexagon socket spanner.Remove seal washers.



(16) Unscrew the setting screw using an 8mm hexagon socket spanner.



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



(18) The pressure relief valve is now disassembled.

	D353SE13

5) ASSEMBLY

- (1) 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 through the slots in the spool.
- (2) 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).





(3) Line up the spring set.



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



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



(6) Line up the springs and center them.



- (7) Guide the ring down over the sleeve.
- * The ring should be able to rotate free of the springs.



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



(9) Fit bearing races and needle bearing as shown on below drawing.



* Assembly pattern for standard bearings

- 1 Outer bearing race
- 2 Thrust bearing
- 3 Inner bearing race
- 4 Spool
- 5 Sleeve



Installation instruction for O-ring

(10) Turn the steering unit until the bore is horizontal. Guide the outer part of the assembly tool into the bore for the spool / sleeve.



(11) Grease O-ring with hydraulic oil and place them on the tool.





(12) 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.



(13) Press and turn the O-ring into position in the housing.



(14) 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.



Installation instructions for lip seal

(15) Lubricate the lip seal with hydraulic oil and place it on the assembly tool.





(16) Guide the assembly tool right to the bottom.



(17) Press and turn the lip seal into place in the housing.



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



(19) The spool set will push out the assembly tool guide.

The O-ring are now in position.



(20) Turn the steering unit until the bore is vertical again. Put the check valve ball into the hole indicated by the arrow.



(21) Screw the threaded bush lightly into the check valve bore. The top of the bush must lie just below the surface of the housing.

(22) Grease the O-ring with mineral oil approx. viscosity 500 cSt at 20°C.

(23) Place the distributor plate so that the channel holes match the holes in the housing.

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









- (25) Place the cardan shaft as shown so that it is held in position by the mounting fork.
- (26) 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.



(27) 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.



(28) Fit the spacer, if any.



(29) Place the end cover in position.



(30) Fit the special screw with washer and place it in the hole shown.



- (31) Fit the six screws with washers and insert them. Cross-tighten all the screws and the rolled pin.
 - \cdot Tightening torque : 4.0±0.5kgf \cdot m (28.9±3.6lbf \cdot ft)



(32) Place the dust seal ring in the housing.



(33) Fit the dust seal ring in the housing.



- (34) Press the plastic plugs into the connection ports.
- * Do not use a hammer.



2. STEERING AXLE

1) STRUCTURE



20B7SS10

- 1-1 Steering axle
- 1-2 Bracket
- 1-3 Taper roller bearing
- 1-4 Taper roller bearing
- 1-5 Oil seal
- 1-6 Oil seal
- 1-7 Taper roller bearing
- 1-8 Taper roller bearing
- 1-9 Steering axle hub
- 1-10 Plain washer

- 1-11 Split pin
- 1-12 Hub bolt
- 1-13 Hub cap
- 1-14 Steering gear assy
- 1-15 Bearing
- 2 Hexagon bolt
- 3 Spring washer
- 4 Spring pin
- 5 Pinion
- 6 Special washer

- 7 Bolt-w/washer
- 8 Lever
- 9 Hexagon bolt
- 10 Spring washer
- 11 Plain washer
- 12 Hexagon nut
- 13 Bracket
- 14 Socket bolt
- 15 Spring washer

2) CHECK AND INSPECTION



- ① Check for any bend or twist. Slight bend or twist can be straightened by press, however, if not, replace the axle.
- ② Make visual check for cracks or other defects, also check the condition of fit of bearings.
- ③ Check play of axle and sleeve bearing of bracket. Replace the bracket if the play is excessive.

3) DISASSEMBLY

Steering motor

- * Before dismounting steering motor disconnect all hydraulic pipes from the steering motor.
 - ① Loosen socket bolts connecting motor with axle.



Motor bracket

Remove motor bracket with steering sensor.



Steering gears

- Remove castle nut and pull out steering gear.
- ② By loosening hexagon bolt pull out pinion gear from axle bracket.



Axle bracket

- Take off the axle bracket together with the bearing. Be very careful because just before the axle bracket comes off, tapered roller bearing will fall out.
- ② After axle bracket is removed take off the inner race of bearing.
- ③ Pull out oil seal. Don't use same oil seal twice.



Hub

- Pull out split pin and remove castle nut and washer.
- ② Take off the wheel hub together with the bearing. Be very careful because just before the hub comes off, tapered roller bearing will fall out.
- ③ After wheel hub is removed take off the inner race of bearing.
- ④ Pull out oil seal. Don't use same oil seal twice.



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.

Wheel hub

 Mount oil seal and inner race of tapered roller bearing on the axle beam.

The bearing should be well greased before assembling.

- ② Install the outer race of bearing in the wheel center and assemble to the axle beam.
- ③ Put washer in place, tighten with nut and lock with split pin, 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.

· Bearing preload :

```
0.30 \sim 0.35kgf \cdot m (0.20 \sim 0.25lbf \cdot ft)
```

④ Mount the hub cap. Bearing should be well greased before assembling.



Axle bracket

- Mount oil seal and inner race of tapered roller bearing on the axle beam. The bearing should be well greased before assembling.
- ② Install the outer race of the bearing in the axle bracket center and assemble the axle beam.
- ③ Put gear and washer in place, tighten with nut and lock with split pin.
 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.

· Bearing preload :

0.30 ~ 0.35kgf · m (0.20 ~ 0.25lbf · ft)



Steering gears

- * Before assembling, gears should be well greased.
- ① Install pinion gear and tighten hexagon bolt.
- ② Put the steering gear on the axle beam and then assemble the castle nut with the pin.
- When mounting steering axle assembly, remove steering gear and then mount the axle to the frame before reassembling steering gear and castle nut. Castle nut should be tightened until bracket fixed and then loosen to the starting torque of 0.30 ~ 0.35kgf · m (0.20 ~ 0.25lbf · ft) before locking it with a spring pin.
- Pinion gear should be assembled with a parallel key(A8x7x32) included in the hydraulic motor assembly.



Motor bracket

- Assemble motor bracket with steering sensor.
- Be careful of correct position of each parts.



3. HYDRAULIC MOTOR

1) **DISASSEMBLY**

(1) Seal plugs

Put the motor in a holding tool, with the output shaft downward.

For end port version, use 10mm(0.4in) hexagon socket spanner.



(2) Drain plug & washer

A/flat, other version : 19mm(0.75in) Not SAE washer.



(3) Screws, washers(7 off)

Use a 13mm(0.5in) spanner socket.



(4) End cover, gear wheel set, O-ring(2 off) Remove end cover sideways.Keep fingers under the gear wheel set to prevent the parts from falling out.



(5) Cardan shaft, plate, O-ring. Remove orderly.



(6) Output shaft

Shaft and bearings should normally not be removed from housing. However, if necessary for inspection and cleaning, remove the shaft from the housing front end. The rear bearing can thus remain in the housing. After this, turn the motor.



(7) Screws, spigot flange

Use torques-spanner type T30, 9mm (0.35in)screw driver or hexagon socket spanner 4 or 5mm(0.16 or 0.20in).



(8) O-ring, bearing race, shaft seal Use a 2mm(0.08in) screw driver.



(9) Dust seal, needle bearing

Use a 4mm(0.16in) screw driver.



2) ASSEMBLY

- Clean all parts carefully with low aromatic kerosine
- Check all parts carefully and replace if necessary
- Before assembly, lubricate all parts with hydraulic oil and grease rubber parts with vaseline.

(1) Needle bearing

Place needle bearing onto the output shaft side.



(2) Shaft seal

Knock the seal into position in the spigot flange. Check that the seal lies against the cover recess.



(3) Dust seal ring

Place the dust seal ring in the spigot flange and knock it into position with a plastic hammer and appropriate mandrel.



(4) Bearing race, O-ring

Grease the O-ring with vaseline and fit the bearing race and O-ring into the spigot flange.



(5) Spigot flange

Turn so that the holes line up.



(6) Screws(6 off)

- Tightening torque
- Slotted screw M6
 0.5~0.8kgf · m(3.6~5.8lbf · ft)
- ② Hexagon socket screws M5 0.5~1.0kgf · m(3.6~7.2lbf · ft)
- ③ Hexagon socket screws M6 1.2~1.5kgf ⋅ m(8.7~10.8lbf ⋅ ft)
- ④ Torx screws M6 0.5~0.8kgf ⋅ m(3.6~5.8lbf ⋅ ft)
- * Omit spring washer, if the screw head is protruding from spigot flange when screw has been tightened (old OMR metric version only). After this, turn the motor.



(7) Output shaft(1 1/4inch splined shaft)

The rear shaft end of 1 1/4inch splined shafts must be marked before fitted. The mark must be positioned vertically above a communication slot leading up to the front annular channel.

Grease the journals with hydraulic oil.



(8) O-ring, distributor plate

Grease the O-ring and put it in the O-ring groove of the housing.

Turn the distributor plate so that the holes line up.



(9) Cardan shaft

Guide the cardan shaft down into the motor housing.



(10)Gear wheel set, O-rings

Place the O-rings(greased) in the O-ring grooves of the gearwheel.

In gearwheels with non through splines place the gearwheel with the recess in the spline hole facing down towards the housing.



(11) Gear wheel set

Place the gearwheel set on the cardan shaft so that the top of a tooth in the external teeth of the gearwheel are vertically above the key slot in the output shaft(cylindrical or tapered) or the top of a tooth on a 1 inch splined shaft. In motors with 1 1/4 inch splined shaft the tooth top must be positioned vertically above the mark, see point 13.

Turn the gearwheel set counter clockwise until the cardan shaft and the gearwheel start to $mesh(15^{\circ})$.

Turn the gearwheel rim so that the holes made for the screws line up.



(12)End cover

Turn the end cover so that the holes line up.



(13)Washer, screws(7 off)

Use a 13mm spanner socket. • Tightening torque : 3.0~3.5kgf • m(21.7~25.3lbf • ft)



(14)Washer, drain plug

Use a 19mm spanner socket.

 Tightening torque : 3~6kgf · m(21.7~43.4lbf · ft)



(15)Seal plugs(threaded plugs)

Side port version. Screw plastic plugs.

