

# **SERVICE MANUAL**

**SL225 SL450 DUAL-PURPOSE SWIVELS**



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ENGINEERING CO., LTD.  
THE PEOPLE'S REPUBLIC OF CHINA**

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## **PREFACE**

SL dual-purpose swivels are one of the hoisting equipment of drilling rig. During normal drilling operation, they are mainly used for suspending the drill stem, providing a connection between the hoisting equipment(non-rotating) and rotary tools and a passageway for the flow of drilling mud into the drill stem. Thus they have higher load capacities and better sealing performance.

SL dual-purpose swivels are available for use with hooks, Kelly bars that meet API specifications or are equivalent to API Spec.

The instruction gives a detailed description of technical specifications, structure, operation and service for the swivels in order that customers understand them thoroughly. Proper application of it may extend the service life, ensure the safety & reliability, and improve the production efficiency.

A recommended spare parts list will be provided with customers for ordering spare parts. For those parts not included in the list, reference may be made to Parts Drawing List. And write the number of drawing and denomination of parts to be required.

A serial number is assigned to each swivel. Customers shall mention the model & serial number of swivel when ordering spare parts or making inquiries.

The company has the right to change the model and design of swivels at any time without notice and without incurring any obligation.

The company recommends customers to use the replaceable parts made by us. Applying parts not belong to us may reduce the performance of products.

**Lanzhou LS Petroleum Equipment Engineering Co., Ltd.**

## 1 TECHNICAL SPECIFICATIONS

Content		Model			
		SL225-3	SL225-2	SL450- II	SL450-5
Max. dead load	kN	2250		4500	
Max. speed	rpm	300			
Max. working pressure	Mpa	35			
I.D of the stem	Dmm	75			
Coupling threads	to the stem(REG)	6 5/8" LH		7 5/8" LH	
	To the Kelly(REG)	6 5/8" LH			
Gooseneck thread	API STD 5B	4" - 8TPI			
Model of air motor		FMS -20			
Rated speed	rpm	2800			
Power	kw	14.7			
Rated pressure	Mpa	0.6			
Air consumption	m3/min	17			
Inlet line		1 1/2"			
Rated spinning speed	rpm	92			
Max. spinning moment	N.m	3000			
Weight	kg	2402		3310	
	A mm	2880		3015	
	B mm	1026		1096	
	C mm	1065			
	D mm	63		82	
	E mm	115			

## 2 STRUCTURE & PRINCIPLE OF OPERATION

### 2.1 Structure

SL dual-purpose swivels (Figure 2 & 3) consist of the rotary part, stationary part, supporting part, sealing part, and screwing part. The rotary part covers the stem (14) and coupling (24). The stationary part includes the body (29), gooseneck support (2), bottom (28) (or oil retainer), gooseneck (36), bail (37), and bail pin (39). The supporting part is composed of the main bearing (15), upper centralizing (hold-down) bearing (11), and lower centralizing bearing (17). The

sealing part covers the packing assembly (3), and upper & lower oil seals (8). And the screwing part (Figure 5 & 6) contains the air motor, gear, and one-way air-controlled clutch.

The stem carries the total weight of drilling string and pressure of drilling fluid. The coupling threads to the stem and to the Kelly conform to thread sizes specified in API Spec 7.

The stem is a hollow component. The top of it is connected to the packing assembly (Fig.4) and the lower to the coupling. The middle of it is located at the main bearing. The both ends of it are supported by bearings. The upper centralizing bearing also prevents the stem from traveling upwards during drilling operations. At the top end of the bearing there is a rubber umbrella (4) to prohibit the flow of drilling mud into the inside of swivel. Between the stem and the coupling is installed an O-ring (23) to prevent the high-pressure fluid from doing damage to the threads and serve the function of sealing.

The bail is linked up with the body by two pins and suspends the swivel from the hook. The body is a load carrying component and also an oil sump used to lubricate & cool the main bearing & centralizing bearings. The top & the lower of it are separately connected to the gooseneck support & the oil retainer. On the side of the gooseneck support is there a buffer (12) to prevent the elevator link from dashing against the body. Inside of it are mounted the centralizing bearings & two oil seals (8), opposite to each other, to avert oil loss and incursion of drilling fluid & other foreign matters into it. On the top of it is there a threaded hole with the oil gauge (38), which serves the function of discharge valve. When the atmosphere pressure of the body is greater than that of outside, the valve can automatically open and exhaust. The gooseneck is fastened on the upper flange of the top of the gooseneck support. On the top of it is there a tapered thread hole for the use of logging wells. During normal drilling operations, the hole is screwed with the plug (1) to stop loss of high-pressure fluid. One end of the gooseneck is linked up with the packing assembly and the other end with the rotary hose by the sleeve (34) (The inner line-pipe threads of the sleeve are in conformity with requirements of API Std 5B). Inside of the oil retainer covers the lower centralizing bearing. Under it there are three oil seals (21) for the use of sealing the lubricant in the body.

The packing assembly is located between the gooseneck and the stem and forms a passageway for drilling mud. It is an indispensable component for sealing the high-pressure mud. It is of the self-sealing & quick-dismount structure. In case of the wash pipe & the packing worn and replaced, just

unscrew the upper & the lower packing gland nuts and take out the whole assembly sideway without removing the gooseneck & the rotary hose. The replacement procedures are very simple. They can be changed with rig stopped at any time during normal drilling operations.

The air motor and drive mechanism are connected to the lower part of gooseneck support (2) with bolts and nuts (31). They are important components of screwing part. By operating the air-controlled console (Fig.1) is made the clockwise or counterclockwise of spinning. In case of the vanes of air motor (see the service manual of air motor) and the inner & outer friction disc of one-way friction clutch worn out and replaced, screw the bolts (Fig.5-2), dismantle the air motor & the position selector valve (Fig.5-1, 19) and take out the drive mechanism. After the air motor and drive mechanism have been removed, cover them with the gooseneck support by the plate & gasket, then fix them with the bolts and take them as common swivel for use.

## 2.2 Drive & Air control principle of the screwing part (Fig. 6) (Air control system is an independent part. When ordering, customers shall indicate it in the contract)

2.2.1 The two pairs of gears (for two-step reduction) are driven with the air motor and torque is transmitted to the stem so as to reach the purpose of spinning.

2.2.2 The clockwise or counterclockwise of spinning is made by air control. The compressed air passes through the air filter (3), oil fogger (4), two-way tee air control valve (5) and comes into the position selector valve (13). Operating 2+2 gear air switch (Fig. 1 air control console) will change the direction of the position selector valve and the rotation of air motor to serve the purpose of spinning. In case of the handle I of air control console in "OFF" position, actuate the core of two-way tee air control valve and cut off air source.

Using the air control console do as follows:

- 1) Turn on the cut-off valve
- 2) Turn the handle II to the position "FWD" or "REV", depending on the need of spinning.
- 3) Turn the handle I to the position "ON".

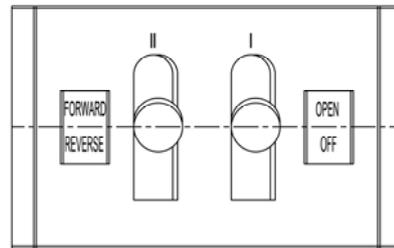


FIG1. DUAL-PURPOSE SWIVEL AIR CONTROL CONSOLE

## 3 USE OF NEW SWIVELS

SL dual-purpose swivels have been tested on load of the main bearings, water pressure (static, dynamical), and spinning before leaving the factory. They are shipped without oil.

**3.1** Unscrew the oil gauge and fill L-CKC150 closed industrial gear oil (to the top-level mark of the oil gauge). Make sure that lubricant is clean.

**3.2** Inspect the stem to see that it can rotate smoothly by one operator with a chain tong one meter in length.

**3.3** Apply lubricant to the oil sites by a grease gun.

**3.4** Inspect the upper & the lower packing gland nuts (Fig.4-1,10), sleeve nut (Fig.2-35), and coupling (Fig.2-24) for tightness. Unscrew the coupling, coat it with lubricant and retighten it with the tong to ensure a good connection and protect the threads against damage.

**3.5** Check the air piping for connection and inflation.

**3.6** The air filter (Fig.6-3) should be installed vertically.

**3.7** The air motor should not be allowed to run in non-load condition.

**3.8** A new swivel shall be used first for less deep wells and later for more deep wells to ensure its service life.

## **4 LUBRICATION**

**4.1** The oil level in the swivel body shall be inspected once a shift and not be lower than min. level mark on the oil gauge. The lubricant should be changed every two months. For a new or repaired swivel, oil should be changed after each subsequent 200 hours of operation of swivel. Drain off dirty oil and rinse away all sediments, and then refill with L-CKC150 closed industrial gear oil.

**4.2** The bail pin, packing assembly, upper & lower oil seals, air motor, and drive mechanism shall be lubricated once a shift with lithium-base grease (#1 in Winter, #2 in Summer). Lubricating the packing assembly shall be made under no pressure to ensure the wash pipe & each packing be grease more effectively.

**4.3** The oil fogger should be checked at regular intervals and fill with L-AN15 engine oil.

## **5 REPLACEMENT OF THE PACKING ASSEMBLY**

### **5.1 Disassembling(see Fig.4)**

Unscrew, by striking with a hammer, the upper & lower packing gland nuts (LH) (1, 10) and push them up & down respectively until they are flush with the wash pump (6). Finally take out the packing assembly sideways.

### **5.2 Inspection**

**5.2.1** Separate the lower packing gland housing (12) from the wash pipe (6). Remove the grease fitting (7) & the lower packing gland nut (10). Turn the screw (8) by 2-3 revolutions in counterclockwise and take out of the lower packing gland housing (9), spacers (13,14), lower spacer (15), and packing (4).

**5.2.2** Take the snap ring (2) off the top of wash pipe and remove the wash pipe

(6) & the upper packing gland nut (1). Then take out of the upper packing gland housing (3), packing (4), and top spacer (16).

5.2.3 Take out of the O-rings (9,17) and thoroughly clean grease and mud of all components.

5.2.4 Inspect the upper packing spacer and washpipe's splines for wear. Check the wash pipe for uneven wear or damage, if necessary, replace it.

### **5.3 Installation**

The accepted and the replaced components shall be remounted.

5.3.1 Fill with grease the lip of packing (4), the top spacer (16), and the top packing spacer (3). In proper order (see Fig.4) mount the top spacer, packing, and top spacer into the upper packing gland housing (5) and then into the upper packing gland nut. Mount this assembly carefully onto the spliced end of wash pipe, then insert the snap ring into the groove of wash pipe.

5.3.2 Fill with grease the lip of packing (4), the lower spacer (15), spacers(13,14), the V-shaped groove of lower packing spacer (11). In proper order (Fig.4) mount the lower spacer, spacers, packing, and lower packing spacer into the lower packing gland housing (12). Caution: The hole of spacer (14) shall be aligned with the grease fitting hole of lower packing gland housing. Screw in the screw (8) and tighten it before turning it counterclockwisely by one fourth of a revolution. Then mount the lower packing assembly and its nut onto the wash pipe.

5.3.3 Mount the O-rings (9,17) into the top & the lower packing spacers (3,11). On the top of lower packing gland housing (12) is installed the grease fitting (7). Then mount the packing assembly into the swivel and tighten the upper & the lower packing gland nuts.

## **6 MAINTENANCE AND SERVICES**

### **6.1 Disassembling at the time of repairing shall be done as follows:**

- (1) It is advisable to slacken the coupling under the stem before removing the swivel from the drilling rig.
- (2) Remove the air system (30) and other pipings.
- (3) Put the swivel in its upright position.
- (4) Remove the plug (18) and drain oil.
- (5) Dismantle the air motor and drive mechanism (32).
- (6) Dismantle the packing assembly in light of "Replacement of the packing assembly".
- (7) Remove the rubber umbrella (4) over the stem.
- (8) Remove the gooseneck (36) and its support (2) (incl.the oil seal (8) & the outer race of upper centralizing bearing (11) ).
- (9) Remove the shims (9).
- (10) Dismantle the stem assembly (incl. stem, upper race of main bearing, inner races of upper & lower centralizing bearings, and upper & lower bushings)

(5, 26)

- (10) Take out of the cage, roller, and lower race from the swivel body.
- (11) Remove the oil retainer (28), slightly strike the outer race of lower centralizing bearing, remove the gland. After that, remove the retainer (22), three oil seals (21) and spacer (20). Last, remove the grease fitting (27) and lower O-ring (16) (only for SL450 swivel).

## **6.2 Inspection and Replacement of Components**

6.2.1 It is advisable to renew the oil seals and O-rings each time when dismantling and inspecting the swivel & its components.

6.2.2 Inspect the rollers & races of bearings for failure, corrosion or cracks. If there is any defect on the main bearing, replace it with a new one. The upper & lower races of the main bearing are not interchangeable. Because the transition fit exists between the upper race and the stem, the race needs striking to be separated from the stem when dismantling. If necessary, heating them to 65~100°C will facilitate the dismantling.

6.2.3 The vanes of air motor are expandable and shall be checked & replaced at regular intervals by the repair factory concerned, no removing at random.

6.2.4 When the drilling rig is to be moved, all the openings of components & relevant pipings shall be plugged or sealed to prevent the incursion of dust, sand, slurry, etc.

## **6.3 Reassembling**

6.3.1 Fill the lips of oil seal (8) with grease and mount them into the gooseneck support. Note the two oil seals are opposed to each other and separated from each other by the spacer (6). Then fasten them with the snap ring (10) and mount the outer race of centralizing bearing (11) into the gooseneck support by striking it lightly.

6.3.2 Mount the outer race of the lower centralizing bearing (17) into the oil retainer (28) by striking it gently and then fasten the oil retainer on the body.

6.3.3 Put the assembled body upright on the stand and mount the lower race, rollers, and cage of the main bearing into the body.

6.3.4 Mount the stem assembly into the body.

6.3.5 Rotate the stem assembly slightly to ensure the main bearing is mounted steadily.

6.3.6 Mount the assembled gooseneck support onto the body and connect the bail to the body with the pin.

6.3.7 Rotate the stem assembly again to check all bearings for steadiness.

6.3.8 Check up on the clearance between the lower face of flange of the gooseneck support and the upper face of the body. Then remove the gooseneck support and put in adequate shims (9) to ensure the axial clearance of bearing is 0.05mm~0.25mm

6.3.9 Mount the gooseneck support onto the body and tighten them with studs

(7).

6.3.10 Mount the rubber umbrella, the gooseneck, the packing assembly, the air motor & drive mechanism (32), the air supply system and the coupling.

6.3.11 Mount the grease fittings, screw in the plugs and fill the swivel with lubricant.

## 7 INSPECTION AND ADJUSTMENT

Inspection and adjustment are the key links of the assembling work. The conditions of adjustment have tremendous influence upon the service life of components. It is advisable to inspect and adjust the swivel as follows:

**7.1** Inspect the contact between the face of upper race of main bearing and the face of stem. The clearance between them is 0.03mm, i.e., a 0.03mm feeler cannot pass between them.

**7.2** The axial clearance of the upper centralizing bearing (11) shall be adjusted with the shim (9) between the gooseneck support and the body. The clearance is 0.05mm~0.25mm.

**7.3** The following run-outs shall be checked with the help of a dial indicator.

7.3.1 Check the hole of gooseneck support for run-out (within 0.20mm) in light of Fig.7.

7.3.2 Check the gooseneck for run-out (within 0.30mm) in light of Fig.8.

7.3.3 Check the mud pipe for run-out (within 0.30mm) in light of Fig.9.

In case of the actual run-outs beyond the specified limits, slacken the upper & lower packing gland nuts and strike the wash pipe gently to change the tightness of screws, adjusting the run-outs between the gooseneck support & the gooseneck and making the packing assembly to the optimal operation.

7.3.4 Air motor and drive mechanism (Fig.5)

1) When installing the nut (18), adjust the tightness of bearings (4,5) [rotate the gear (16) by hand] and then fix it.

2) Inspect the clearance between the inner & outer of friction disc (11~13, 6~10). The value should be 0.5mm~0.8mm. Otherwise adjust it by the shim (15).

7.3.5 The contact point between the gear (Fig.2-13) and the gear shaft (Fig.5-14) of the stem shall be less than 40% along addendum and 60% along length.

7.3.6 Connect the air motor, drive mechanism & air control system and inspect them as the operating procedures in 2.2.2 section:

1) Is the piping unimpeded?

2) Does the air control console operate freely and the clockwise or counterclockwise revolution meet requirements?

3) Does the one-way friction clutch work normally?

## 8 TRANSPORTATION AND PRESERVATION

**8.1** Fasten the swivel on the wood-skid horizontally. Wrap the position selector valve and discharge orifice of the air motor in plastic cloth or stop them with wood plugs. Equip the coupling under the stem with the thread protector(25) and the inner coupling on the gooseneck with the plug (33). The swivel is nudely packed and shipped.

**8.2** For transportation & installation, the swivel shall be lifted with a crane. It is unallowable to tug or trail it on the ground.

**8.3** For long-term storage of dual-purpose swivels, put them into a dry, ventilated place to prevent from rust. For these used swivels, clean out the engine oil and sediment in the body and apply antirust oil to the threads, bearings, exposed surface, then store them.

## 9 TABLES ATTACHED

Table 2 A List of Recommended Spare Parts

Denomination	Drawing No. & Sizes				Qty
	SL450-II	SL450-5	SL225-3	SL225-2	
O-ring D4-4-66	155x8.6				1
O-ring D4-4-66	120x5.7				2
O-ring D4-4-66	560x8.6				1
O-ring D4-4-66	165x8.6				1
O-ring D4-4-66	135x5.7				1
Oil seal D7-1-67	220x260x18				2
Oil seal D7-1-67			220x260x18		5
Oil seal D7-1-67	250x290x18				3
Packing assembly	104.05.30.00				1
Mud packing	104.05.30.00				5
Spring collar	104.05.30.04-1				1
Mud pipe	104.05.30.03				1
Upper sleeve	104.05.08-1				1
Lower sleeve	104.15.17-1		104.06.15		1
Outer friction lining I	104.07.06.07				1
Ditto II	104.07.06.08				1
Ditto III	104.07.06.09				1
Ditto IV	104.07.06.10				1

Drawing No. & Sizes				Qty
Denomination	SL450- II	SL450-5	SL225-3	
Ditto V	104.07.06.11			2
Inner friction lining I	104.07.06.31			2
Ditto II	104.07.06.32			1
Ditto III	104.07.06.33			2

Table 3 A List of Bearings

SL225-3	SL225-2	SL450-II	SL450	No. of one unit
9019456Q	19954EQ			1
2007140	2007140			1
32240	32148			1

Table 4 A List of Special Tools

Denomination	No. of one unit
Wrench for socket head screw GB5356-85 (s=10)	1
Wrench for socket head screw GB5356-85 (s=12)	1
Wrench for socket head screw GB5356-85 (s=17)	1

**Caution:**

For max. load, the swivel shall be used above -18 °C. When the swivel is to be used below -18 °C, the cryogenic properties of material thereof shall be confirmed. And prior to use, necessary preventive action shall be taken.

**10 FIGURES ATTACHED**

- Figure 2 SL450 Dual-Purpose Swivel
- Figure 3 SL225 Dual-Purpose Swivel
- Figure 4 The Packing Assemblies
- Figure 5 Air Motor & Drive Mechanism
- Figure 6 Spinner Driving and Air Control Sketch
- Figure 7 Inspection & Adjustment In Assembling
- Figure 8 Inspection & Adjustment In Assembling
- Figure 9 Inspection & Adjustment In Assembling

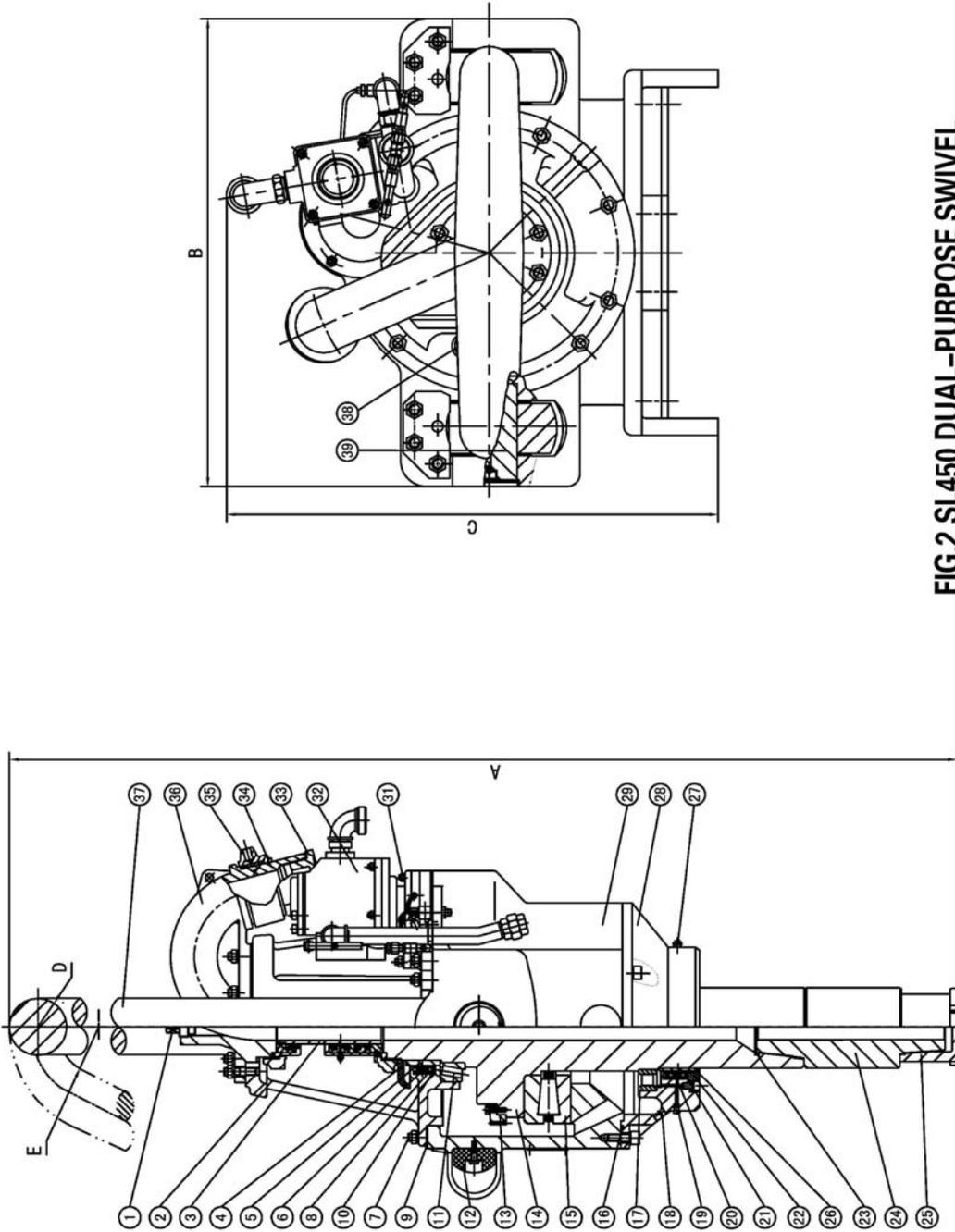


FIG.2 SL450 DUAL-PURPOSE SWIVEL

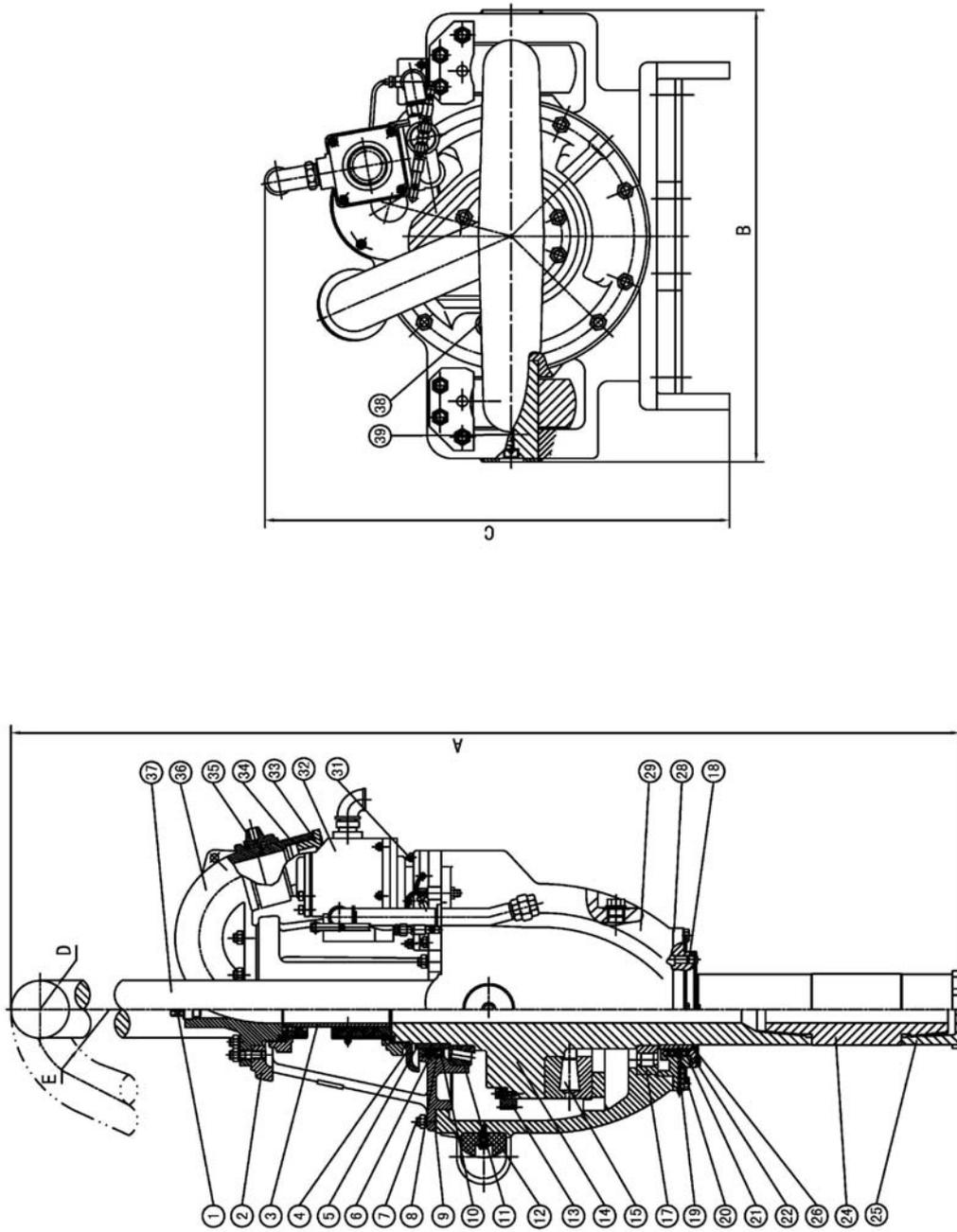
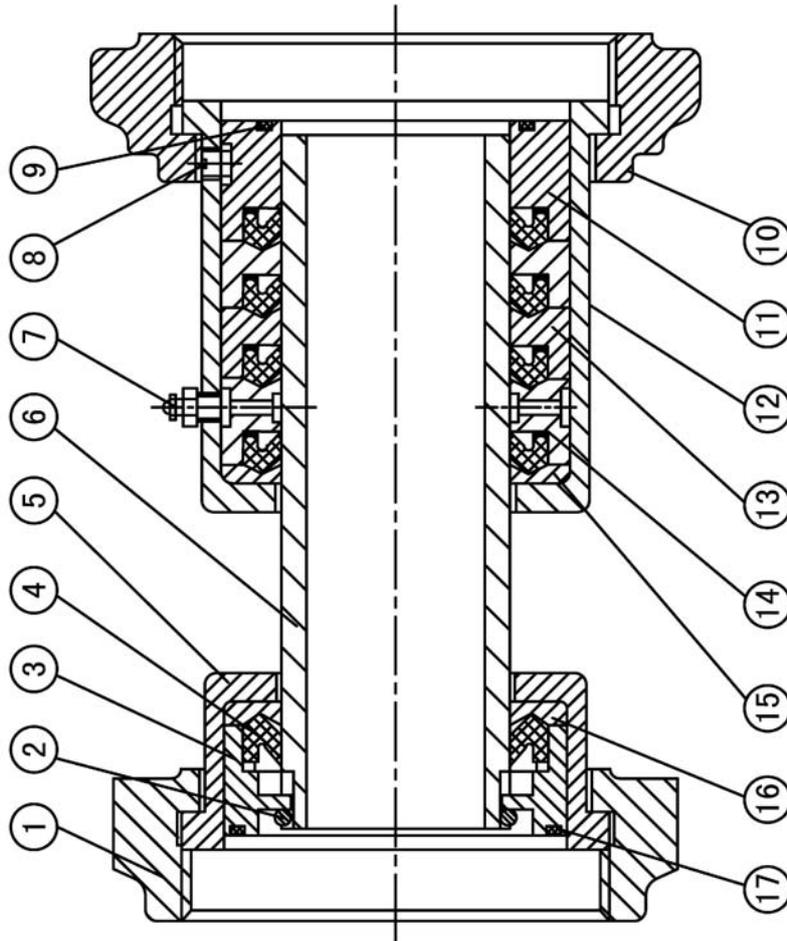


FIG.3 SL225 DUAL-PURPOSE SWIVEL



**FIG.4 THE PACKING ASSEMBLY**

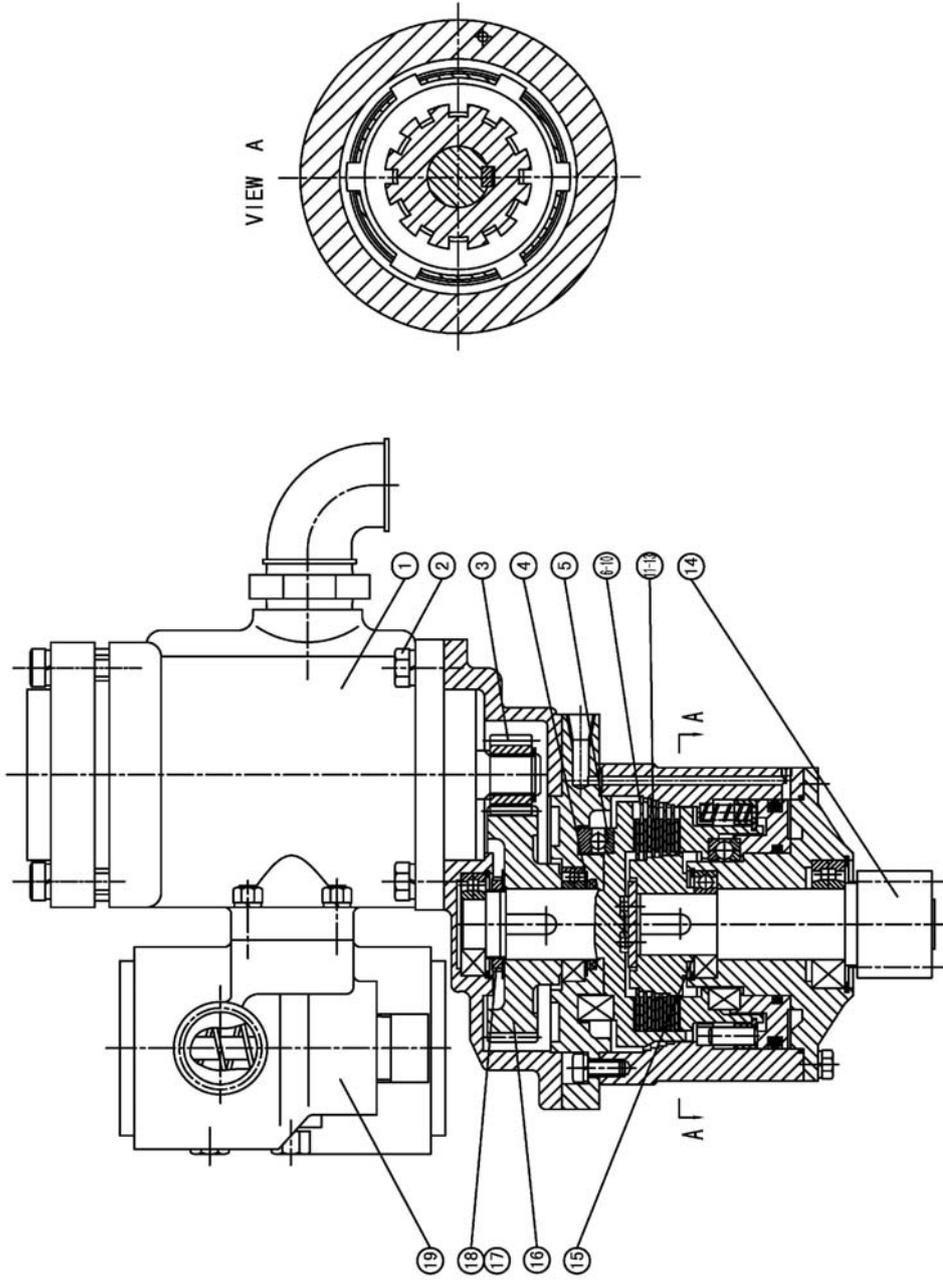
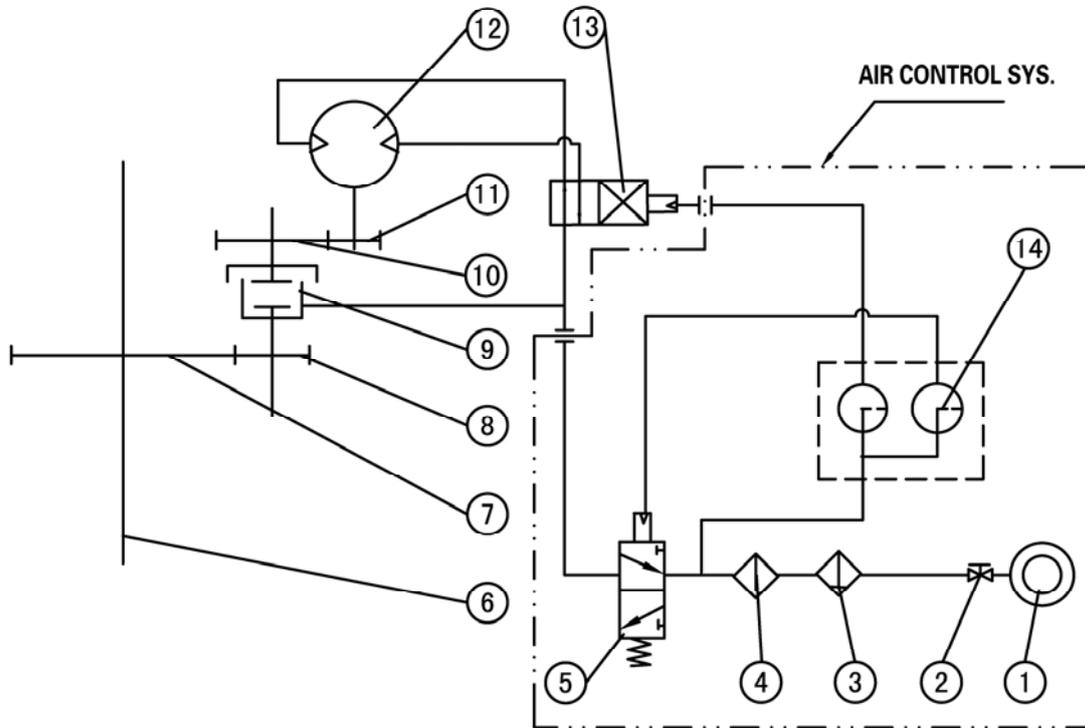


FIG.5 SL450- II PNEUMATIC MOTOR AND TRANSMISSION SYSTEM



- |                                     |                             |
|-------------------------------------|-----------------------------|
| 1. AIR SUPPLY                       | 8. PINION-STEM              |
| 2. CUT-OFF VALVE                    | 9. ONE-WAY PNEUMATIC CLUTCH |
| 3. OIL FOGGIER                      | 10. GREA                    |
| 4. OIL OR WATER REMOVER             | 11. PINION                  |
| 5. TWO-POSITION TEE PNEUMATIC VALVE | 12. PNEUMATIC MOTOR         |
| 6. STEM                             | 13. PNEUMATIC CONTROL VALVE |
| 7. RING GEAR                        | 14. 2+2 GEAR AIR SWITCH     |

**FIG.6 OPERATION of the DRIVE MECHANISM of the SCREWING PART and PNEUMATIC CONTROL**

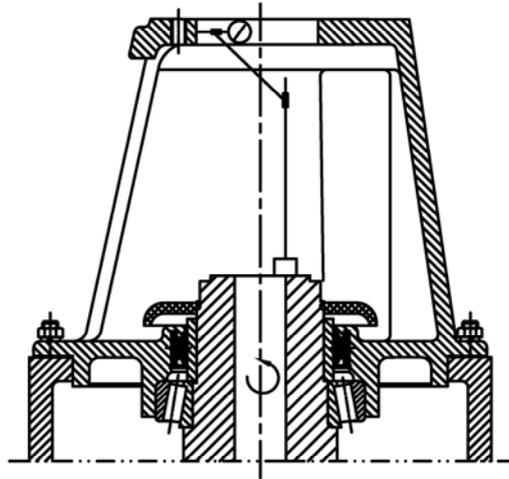


Fig.7 Inspection and Adjustment During Assembling

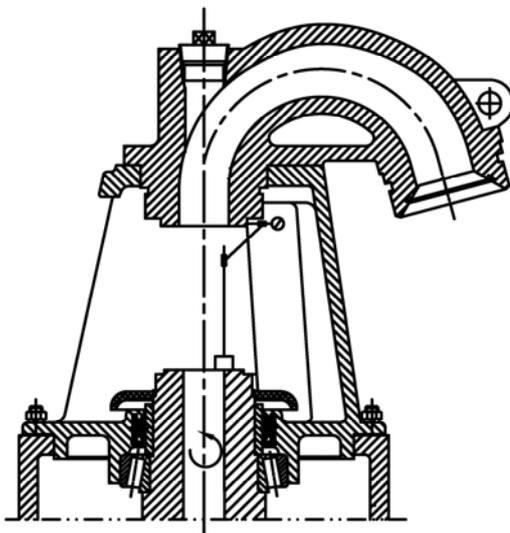


Fig.8 Inspection and justment During Assembling

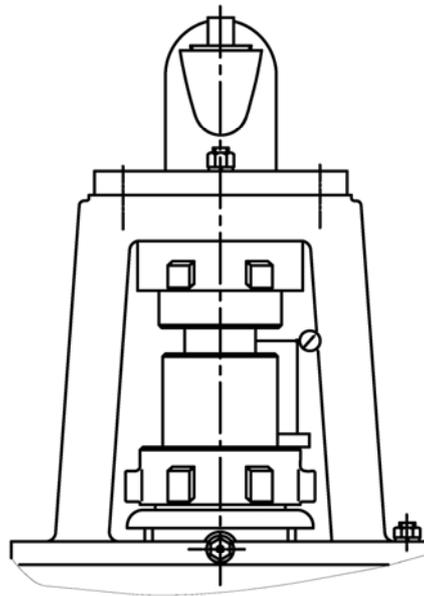


Fig.9 Inspection and justment During Assembling