

Research on Sealing Device of Hydraulic Cylinder

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Abstract: Hydraulic cylinder is the actuator of hydraulic system, because of its simple structure and reliable work, it has been widely used in hydraulic system. But at present the hydraulic cylinder in the use process, often appears the problem which the hydraulic oil leaks, this question may cause the operation to fail the accident, the serious even may cause the personal injury, this article solves the hydraulic oil leakage question, through to the hydraulic cylinder structure characteristic, the seal installment characteristic, The sealing problem of the hydraulic cylinder is studied in the application of the thread connection in the sealing of the hydraulic cylinder.

Keywords: Hydraulic cylinder, Sealing device, Threaded connection.

1. INTRODUCTION

At present, the hydraulic technology in the realization of high pressure, high speed, high power, high efficiency, low noise, durability and other requirements have made significant progress, in improving the proportion of control, servo control, CNC technology has also been a lot of new achievements. Hydraulic cylinder is a hydraulic system of the implementation of components, it is the role of the liquid pressure can be converted to moving parts of the mechanical energy, so that moving parts to achieve reciprocating motion or swing. and the hydraulic cylinder seals the good or bad, directly affects the working performance of the hydraulic cylinder, affects the normal use of the entire equipment, the fine sealing device will make the hydraulic cylinder in the modern industry to play a better role.

2. OVERVIEW OF HYDRAULIC CYLINDERS

Hydraulic transmission is a liquid transmission which takes the liquid as the working medium, and the pressure can transmit, transfer and control the power (or energy). And the hydraulic cylinder is the actuating element in the hydraulic system, it has the important position in the hydraulic transmission. The hydraulic cylinder According to the structure characteristic may divide into ^[1]: Piston type, plunger type and swing type three kinds. The piston cylinder and

plunger cylinder are used to realize the linear motion, the output thrust (pull) and the speed, the swing cylinder is used to realize the rotation of less than 360°, and the output torque and angular velocity. Hydraulic cylinder According to its action mode, but also can be divided into single function and double action type two kinds. The liquid pressure in single acting hydraulic cylinder can only make the piston (plunger) Single direction movement, the opposite direction movement must rely on the external force to realize; the double action hydraulic cylinder can realize the movement of two directions by the liquid pressure.

Although the hydraulic cylinder according to the structure characteristic and the function way may divide into many types, but boils down to, the hydraulic cylinder structure mainly by the cylinder body component (cylinder, end cover and so on), the piston component (piston, piston rod and so on), seals and the connection parts and so on basic part.

Among them, whether the correct and reasonable use of the sealing device is to ensure the normal operation of the hydraulic cylinder key [2], because the sealing device is used to prevent the leakage of oil pressure working medium and to prevent the outside air, dust, dirt and foreign body intrusion. When the internal leakage of the working medium, it will reduce the volume efficiency of the hydraulic cylinder, deteriorate the technical performance, even unable to work. A waste of working media when leaked out of the working media, polluted environment, serious can cause mechanical operation failure and personal accident; if air intrusion, will reduce the elastic modulus of the medium, generate cavitation, increase the vibration and noise of the system; After the dust and contaminants invade the system, increase the pollution of the medium, block the gap, increase wear, Reduce the working life, therefore, sealing devices and seals to a large extent determine the pressure level of the hydraulic cylinder, reliability and service life.

3. TYPE AND CHARACTERISTICS OF THE SEALING DEVICE

The sealing device comprises a clearance seal, a sealing part and a dust-proof ring. The three kinds of sealing devices are described below [3]:

(1) Gap sealing: Mainly rely on the small gap between moving parts to prevent leakage, in order to improve the sealing ability of this device, often on the surface of the piston to make a few small annular groove to increase the oil through the gap when the resistance. It is simple in structure, small friction resistance, can withstand high temperature, but the leakage of large, processing requirements are high, after wear can not restore the original sealing ability, only in small size, low pressure, relatively high speed of the cylinder and piston used between the.

(2) Seal seals: seals seal the use of rubber or plastic elasticity of the various sections of the ring to the static, dynamic coordination between the surface to prevent leakage. It is simple in structure, convenient in manufacture, has automatic compensation ability after wear, reliable performance, can be used between cylinder and piston, between cylinder head and piston rod, between piston and piston rod, between cylinder and cylinder head.

① commonly used seals include o-ring, y-ring, V-shaped sealing ring, etc.

② new seals include star (x) seal ring, Zurcon L-shaped sealing ring, M2 type turcon-variseal sealing ring, etc.

③ combined seals: Combined seals are composed of two or more two components, part of which is good lubrication performance, small friction factor, and the other part is a component that acts as an elastomer. The combined seals mainly include coaxial seal ring, Bingley Circle and Rooster Circle.

(3) Dust-proof ring: For the extension of the piston rod part, because it is easy to bring dirt into the hydraulic cylinder, so that the oil is contaminated, seals are worn, so often need to add a dust ring at the piston rod seals, and placed at the end of the piston rod outside the extension. The dust-proof ring mainly includes the ordinary dust-proof ring and the Z-shaped Turcon dust-proof ring.

4. STAR RING SEALING DEVICE RESEARCH

The O-ring can be found that the O-ring is sealed by the positive pressure formed by the elastic deformation of the rubber ring, and its wear compensation is small, and it is easy to produce rolling and twisting in the dynamic seal, which will affect the sealing effect. The pressure distribution of O-rings is shown in Fig. 1 [4].

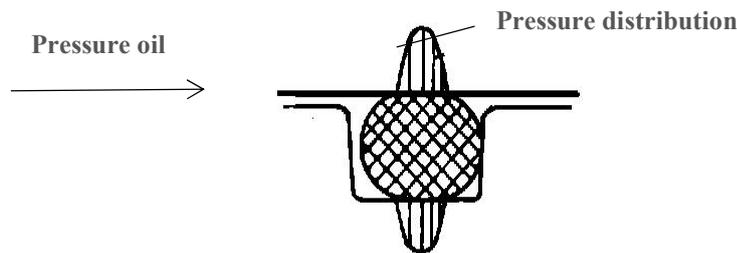


Fig. 1 Pressure distribution diagram of O-ring

Since the 1980s, a number of new seals have been developed, which improve sealing reliability, motion accuracy and comprehensive performance, and the following is an example of Star (x) sealing ring.

Star (X-shaped) sealing ring has four lips, the sealing part is piston and piston rod, the cross-section shape as shown in Fig. 2, the pressure distribution diagram is shown in Fig. 3, which is characterized by:

- (1) In reciprocating movement, will not flip, distort;
- (2) The required radial preload is small, the contact stress is small, and the frictional force is small.
- (3) The contact stress distribution is uniform, and the sealing effect is good;
- (4) The sealing ring can be arranged between two lips; the flying edge does not affect the sealing effect;

(5) Dynamic and static seals can be used, especially in the dynamic seal does not produce rolling and distortion

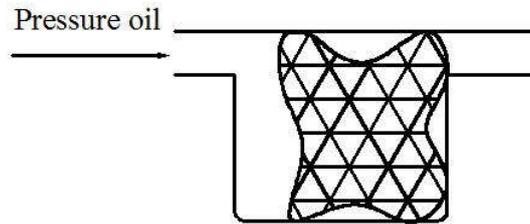


Fig. 2 Shape of a star (X-shaped) Seal RING section

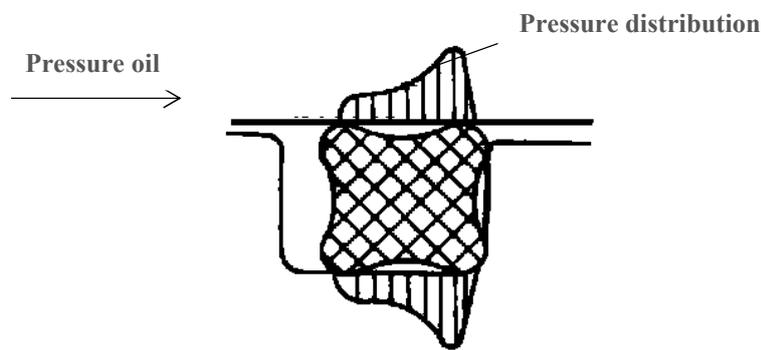


Fig. 3 Pressure distribution diagram of Star (x) sealing ring

5. APPLICATION OF THREADED CONNECTION IN SEALING OF HYDRAULIC CYLINDER

Hydraulic cylinders in the process of use, and sometimes need to be used in conjunction with other parts. As a form of pipe connection, pipe threads are widely used in the connection and sealing of small and medium sized pipelines conveying liquids and gases. Therefore in the actual project, the hydraulic cylinder generally uses the pipe thread connection the way with other parts to use together.

Pipe threads are divided into non-sealing pipe threads and sealing pipe threads. But the non-sealed pipe thread only has the mechanical connection one function, the connection place clearance is big, the leakage is serious. The sealing pipe thread has two functions of mechanical connection and sealing, and the sealing effect is good, and it has been widely used in practical engineering.

Although the sealing pipe thread to a certain extent to reduce the leakage of the working medium, but because the pipe thread seal is dependent on the internal and external thread in the tooth top, tooth side and the full range of the bottom of the tooth to achieve, so any part if there is a gap, will lead to leakage. In order to solve the leakage of pipe threads, the following methods are usually used:

(1) To improve the internal and external thread tooth type and size of the processing requirements to make it as consistent as possible;

(2) after the internal and external thread is screwed, the inner and outer thread itself can be deformed to fill the gap of each part by a certain tightening moment;

(3) and the outer thread is added with a plastic sealing filler.

With the further study of pipe thread, a special threaded joint has been developed, for special threaded joint, thread only bears the connection function, sealing function is realized by main seal, so the non-contact seal can be changed to contact seal, and the sealing performance is improved remarkably. Special threaded connectors have the following advantages [5]:

(1) Special sealing structure, good sealing performance;

(2) The use of eccentric trapezoidal thread, high connection strength, not easy to occur slippage failure;

(3) The number of tightening coils of thread machine decreases, the stress level of thread is reduced, and the stress corrosion is avoided.

(4) The inner wall of the joint is designed with Casement, and the inner diameter of the junction is smooth transition, which avoids the turbulence in the joints and enhances the corrosion resistance of the joints;

(5) with torque abutment, can effectively control the buckle torque and seal surface interference, improve the thread and sealing surface of the ability to resist adhesion.

6. CONCLUSION

The sealing problem of hydraulic cylinder is the main problem existing in hydraulic system of hydraulic cylinder at present, in this paper, the sealing problem of hydraulic cylinder is studied through the characteristics of the structure of the hydraulic cylinder, the characteristics of the sealing device and the application of the thread connection in the sealing of the hydraulic cylinder.

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