Extrusion

To seal well, O-ring must be flexible when squeezed between two surfaces. When the pressure is high and it is highly compressed, O-ring cuts into the walls of the bed and in proportion to the sealing surface pressures. In diametrical excessive clearance between the sealing surface and such high pressure durability of elastomer which is produced by the O-ring is not enough, the ring extrusion and "perform" in a diametrical clearance and is injured, often quite visible, thus loss of continuity of seal. The result is mechanical damage as whitening, split and explode in extreme cases of O-ring. Particular attention should be paid for use of silicone O-rings, which reduces resistance to pressure at high temperatures.

Most elastomeric seals are designed to operate at ambient pressure to about 1 500 psi (~ 10 342,5kPa). At very high values of pressure, the seal must be sufficiently resilient to prevent extrusion into the gap. The graph at right illustrates the recommended combinations of diametrical clearance, hardness of the seal and pressure values.

To avoid extrusion for use in environments with high pressure, can reduce the gap, to enhance the performance of elastomer or use back-up rings. The bearing rings are made of durable polymer materials and are used by countries with low pressure in the bed of the seal to prevent extrusion.

Reference: 1 psi (pound per square inch) = 6,895 kPa

1 inch = 2,54 cm.

Compression settlement

Compression settlement is the loss of elasticity of the elastomer, causing permanent shrinkage, deformation and consequent loss of sealing properties. The reasons for this distortion is rooted in the conditions of operation: too high operating temperature, low quality or wrong choice of elastomer, inappropriate design of the bed, chemical incompatibility with the working fluids. Statistically, this is the most likely cause of damage to the O-rings. Basically, this behavior is due to destruction of molecular bonds due to external influences and can be explained as follow: in the strained state secondary vulcanization elastomer undergoes as a result of heating and pressing. Lower quality materials are generally more susceptible to compression subsidence, although subsidence in such poor shape is observed in each O-ring, i.e. no O-ring, once installed and used can not recover its original shape after stopping work.

Spiraling damage

So called “spiral disability” is characteristic external features. You immediately recognize the spiral cut surface of the O-ring, which over time leads to the final destruction of the sealant. This type of failure occurs when the pressure on the intersection of O-ring is uneven and results in twisting and spiraling injury. Such damage can occur if the pace of the dynamic seal is too long and breach the surface lubricated film, thereby causing direct contact between rubber and metal. There is also an opportunity to ring now is spiral before embedding it in bed because of a discrepancy between the internal diameter of the O-rings and cross-sectional dimension of the cord. In conclusion, the main reasons for spiraling impairment: - connections are too eccentric – insufficient or improper lubrication surface – excessive roughness of the surface of the dynamic seal, leading to disruption of lubrication film – pre-built spiral O-rings. To avoid this kind of problem should be given consideration when maximum residue ring embedding in bed, and the availability of sufficient and adequate lubrication of the surface of the O-ring.

Explosive decompression

Because all elastomers are permeable, when working in gaseous environments with high pressure is possible between the molecular bonds of the elastomer to penetrate the different gases and form microscopic pores. Amount of gas permeating the O-ring is proportional to the pressure that it causes, and at a time when this pressure falls sharply, the gas entered the molecular structure of rubber could explode thereby inflicting significant damage as a sealing surface. However, not all gases have the same effect: light gases such CO_2 or helium penetrate the elastomer more and faster as the oxygen and at a pressure lower than 30 bars gas generally have less destructive effect. This kind of damage can be avoided by reducing the contact area of the ring with the gas (by using smaller diameter cross section) or the pressure is reduced more slowly.

Wear

When using O-rings as dynamic seals or gaskets should be given maximum attention to the problem of wear due to friction: the greater the friction surface of the elastomer, the grearer the wear. Excessive dynamic loads, lack of lubrication, rough surfaces, the presence of impurities in the fluid or excessive compression causing such unwanted wear. Under the action of oscillating pressure does O-ring begins to move in bed, which accelerates wear. Unlike compression subsidence, wear leads to flattening of one side of the O-ring. To prevent this problem, we encourage you to pay maximum attention to the surface of the O-ring is better finished, it can no more bumps, and this can only be fitted well lubricated O-rings.

Externalities

Of all the previously listed faults, the most common are those due to external factors. If O-ring is in contact with incompatible external factor, even under ideal conditions, the other can cause destruction of the O-ring to complete impracticability for a short time. As already pointed out all elastomers are permeable. If an elastomer is not allowed contact with a foreign element (aggressive fluid contact) when this element penetrate between the molecules can causes absorption or extraction of a certain chemical elements are not mutually exclusive processes: in fact may happen that the contact fluid extract some elements of the elastomer, while helping to absorb others. The result is an increase or decrease the volume of the O-ring, sometimes in significant amounts, as well as a drastic deterioration in performance, characteristic of the elastomer. If the material swell, it softens and loses some of its pressing force, and if the contract is reduced overall compression and resistance to pressure O-ring. To avoid this problem is important to carefully clarify the characteristics of all fluids, which may even in limited quantities to come in contact with the seal, and check their compatibility with the chosen elastomer. Such information is contained in the tables of compatibility of various elastomers. STS respective working environment.

Among the external factors can be classified and temperatures exceed recommended. These temperatures cause secondary vulcanization of O-rings and hardening of the material, making it brittle. Too high temperatures can result and the dynamic friction.

Cracks resulting from ozone effects

Effect of ozone typically occurs notably in the presence of excessive stretching of the O-ring, and depending on the amount of sunlight falling on its surface. Excessive stretching (what is considered stretching more than 6-10% of inner diameter, depending on material) causes cracks in the surface of the O-ring. These cracks are formed more quickly under pressure and usually occur with material, fragile ozone and weathering (such as NBR), which attacks the molecular structure of the elastomers. The occurrence of cracks may be due to the installation of already deformed rings and excessive tension in both the deformed part. Elevated temperatures and high concentrations of oxygen or ozone part. Elevated temperatures and high concentrations of oxygen or ozone accelerates this process. Ozone attack on undistorted surface cause so-called “freezing-effect” until the ozone impact on pre-deformed by surface tension cases a characteristic cracks, usually along the stretching, which are often completely destroy the ring. To limit potential damage from ozone recommended O-rings can be stored in warehouses as long as possible and must be installed before use.