影响密封件性能的几大因素
several factors that affect the sealing performance

速度是选择密封件必须考虑的因素，我们将速度分为三级：
低速0~5m/s；常速5~10m/s；高速15~25m/s.速度的极限即受到温度的限制，因为速度的提升最后都归结唇口温度的提高，唇口对温度的承受力。

1、运动速度

运动速度很低(<0.03 m/s)时，要考虑设备运行的平稳性和是否出现爬行现象。运动速度很高（>0.8m/s）时，起润滑作用的油膜可能被破坏，密封件因得不到很好的润滑而摩擦发热，导致寿命大大减小，建议聚氨酯或橡塑密封件在0.03 m/s~0.8 m/s速度范围内工作比较适宜。
在超高速状态下需要注意的几个因素：
(1)轴的材料与表面光洁度
(2)轴的静态或动态不同心度
(3)流体的温度
(4)唇口的润滑状态

2、温度

低温会使聚氨酯或橡塑密封件唇口冷冻而变脆易碎弹性降低，造成泄露，甚至整个密封件变得发硬发脆。高温会使密封件体积膨胀、变软，造成运动时密封件摩擦阻力迅速增加和耐压能力降低。建议聚氨酯或橡塑密封件连续工作温度范围-10℃~+80℃。如果提高旋转速度；不佳的表面光洁度；不良的润滑，这些都可以产生摩擦发热，使唇部的温度上升到超过流体温度的50℃。

3、工作压力

有最低启动压力（minimum service pressure）要求。低压工作须选用低摩擦性能、启动阻力小的密封件。在2.5Mpa以下，聚氨酯密封件并不适合；高压时要考虑密封件受压变形的情况，需用防挤出支承环，沟槽加工方面也有特殊要求。此外，不同材质的密封件具有不同的最佳工作压力范围。对于聚氨酯密封件的最佳压力范围为2.5~31.5Mpa。
如需增加抗压能力，可采用强壮的PTFE背托环及独特的唇口设计，使之可以增加承受一定的压力。温度、压力对密封性能的影响是互相关联的，因此要做综合考虑。

4、工作介质

除了严格按照生产厂家的推荐意见选取工作介质外，保持工作介质的清洁至关重要。油液的老化或污染不仅会使系统中的元件发生故障，加快密封件的老化和摩损，而且其中的脏物可能划伤或嵌入油液。在油缸里油液中残留的空气经高压压缩会产生高温使油封烧坏，甚至炭化。为避免这种情况发生，在液压系统运行初始时，应进行排气处理。液压缸也应在低压慢速运行数分钟，确认已排出油液中残留的空气，方可正常工作。

5、侧向负载

活塞上一般必须装支承环，以保证油缸能承受较大的负载。密封件和支承环起完全不同的作用，密封件不能代替支承环负载。有侧向力的液压缸，必须加承载能力较强的支承环（重载时可用金属环），以防油封在偏心的条件下工作引起泄露和异样磨损。

6、液压冲击

产生液压冲击的因素很多，如挖掘机挖斗突然碰到石头，吊机吊起或放下重物的瞬间。除外在因素外，对于高压大流量液压系统，执行元件（液压缸或液压马达等）换向时，如果换向阀性能不太好，很容易产生液压冲击。液压冲击产生瞬间高压可能是系统工作压力的几倍，这样高的压力在极短时间内会将密封件撕裂或将其局部挤入间隙之内，造成严重损坏。一般有液压冲击的油缸应在活塞杆上安装缓冲环和支承环。缓冲环装在密封件的前面吸收大部分冲击压力，支承环防止密封件在高压下挤入间隙，根部被损坏。

密封原理
Theory of sealing

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several factors that affect the sealing performance

1. Velocity of movement

When the velocity of movement is excessive low (<0.03 m/s), both the operating smoothness of the equipment and whether "creeping" phenomenon would be occurred or not should be considered. When the velocity of movement is excessive high (>0.8 m/s), the oil film that plays a lubricating role may be damaged. Thus, the oil seal may become hot due to friction without good lubrication, and its service life shall be significantly decreased.The range of the velocity of urethane or rubber oil seal is suggested to be 0.03 m/s~0.8 m/s.

2. Temperature

Under low temperature, the elasticity of urethane or rubber oil seal may be decreased, thus causes leakage and even the whole oil seal shall become hard and brittle. While at high temperature, the oil seal may expand and become soft, which results in sharply increasing of frictional resistance and decreasing of bearing capacity of the oil seal. The range of continuous operating temperature range for the urethane or rubber oil seal is suggested to be -10℃æ℃æ

3. Working pressure

There is a minimum service pressure request for the sealing element. It's better to choose seals with lw friction property and small starting resistance when working under low pressure environment. PU seal is not suitable for working below 2.5 Mpa; while under high pressure the deformation of seals has to be considered, so that we have to use back-up ring against extrusion whilst there is also a special request for groove machining.
In addition, the best working pressure for seals made from different materials are also different. All in all, the best working pressure scope for PU seal is 2.5 ~ 31.5MPa.

4. Operating media

Besides following the advice recommended by manufacturer to choose the operating media, it is also very important to keep the operating media clean. The aging or pollution of the oil could not only cause some elements of the system to break down, but also speed up aging and damage of the sealing system. Moreover, the dirty stuff caused by aging or pollution would even scratch the seal and cause sealing failure. Furthermore, the residual air in the oil will be heated after high-pressured compression in the cylinder and make the seal ring burned, even carbonized. As a result, in order to avoid this kind of situation occurrence, exhaust processing must be carried out during hydraulic system initial movement. Also, hydraulic cylinder should run slowly for a few minutes under low-pressure environment, to confirm there is no air left in the oil, then start normal working.

5. Lateral load

Normally a back-up ring should be installed on the piston so that oil cylinder can accept higher load. The back-up ring plays completely different role from seal ring. The back-up ring cannot be replaced by the seal ring. Especially in the hydraulic cylinder with lateral force, backup-ring with strong bearing capacity must be used (use metal ring when necessary). Otherwise there will be seepage and attrition when oil seal works under misalignment condition.

6. Hydraulic shock

Hydraulic shock could be caused by many ways, such as a bucket of excavator suddenly collide with a stone or the moment of a crane hoists up or lays down a heavy item. Besides those extrinsic factors, for a high-pressure big-capacity hydraulic system, commutation of the functional element (like hydraulic cylinder or hydraulic motor and so on) will also easily cause hydraulic pressure if the change valve doesn't perform well. The hydraulic shock could cause an instantaneous high pressure which could be possibly several times more than normal working pressure. Such a high pressure can laniate the seal ring in extremely short time or extrude parts of seal ring into the gap, causing a terrible damage. Generally to prevent cylinder from hydraulic shock, it is recommended to install buffer ring and back-up ring on the rod. Buffer ring could absorb most shock strike while back-up ring prevents seal ring from being extruded into gap and making the root part damaged.