EagleBurgmann®
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RELY ON EXCELLENCE

Service life of three years and more

Solution - Dry-running agitator seal SeccoMix R in paddle dryers

For some years now there has been a trend in the pharmaceutical industry to use gas-lubricated and dry running mechanical seals without barrier fluid to avoid contamination of the product wherever possible. For agitators with usually low speeds, dry-running mechanical seals have proven to be very reliable.

The paddle dryer separates the active substance from the solvent

Under moderate operating conditions, dry-running mechanical seals are more robust and service friendly than non-contacting mechanical gas seals.

Also available now are specific hygienic designs which are easy to clean and sterilize, with materials which meet the requirements of the U.S. Food & Drug Administration (FDA) and the United States Pharmacopeia (USP), Class VI.

A global pharmaceutical company with headquarters in Switzerland took a leading role when they started the so-called "oil free" project several years ago. The objective was to convert liquid-lubricated mechanical seals to dry-running or non-contacting mechanical gas seals wherever possible. In most cases, the company decided to convert to dry-running mechanical seals because they were perceived to be more robust and service friendly than non-contacting mechanical gas seals.

Large axial shaft movement

As an example, dry-running "SeccoMix R" mechanical seals have been successfully in operation in seven paddle dryers in a production plant in England for several years. In this plant, the company produces active pharmaceutical ingredients (APIs) for drugs by chemical synthesis in batch operation mode. The paddle dryers are used to separate the produced active substance from the solvent.

The rotating shaft of the horizontal dryers with bearings on both sides is equipped with mixing elements. Heating is provided via a double jacket and a hollow shaft. The dryers are operated with vacuum to atmospheric pressure and moderate temperatures between - 20 °C and +90 °C (-4 °F ... +194 °F). In case of cleaning or sterilization, higher temperatures of up to 160 °C can occur for a short time. Rotational speed is 20 min^{-1} and therefore very low. For a shaft diameter of 200 mm (7.87"), this means a sliding speed of 0.1 m/s (0.32 ft/s) for the mechanical seal. These operating conditions are typical of paddle dryers, but many of them are also operated under pressure or at higher temperatures.

Barrier fluid for seals is a risk factor in the pharmaceutical industry as it could contaminate the active ingredients produced. A globally active company is playing it safe and replacing liquid lubricated mechanical seals in paddle dryers with dry-running mechanical seals.

In the first fit, the paddle dryers were equipped with liquid-lubricated "HSMR" seals from EagleBurgmann which were converted to dry-running SeccoMix R-seals in the course of the "oil free" project. Each dryer has a mechanical seal on the drive and non-drive end, initially with the same design at each end. However, it became evident that the axial movement of the shaft at the non-drive end, due to thermal expansion, was too large to be compensated by the seal itself.

Service life of more than three years

Frequent axial movements due to the shaft length and numerous temperature changes also have to be compensated. The SeccoMix R at the non-drive end was therefore equipped with a fixed bearing and wipers. The bearing fixes the seal axially at the shaft sleeve of the mechanical seal, and the wipers allow relative movements between shaft and shaft sleeve. After this modification, all seals at the site in England will run with a service life of three years or more.

The SeccoMix R double seals are operated with a barrier gas of mostly nitrogen which prevents the product from leaking to the atmosphere. The process side of the mechanical seal protrudes into the vessel, i.e. the flow conditions are optimal for good cleaning properties. Attention was also given to a construction with little dead space and a hygienically flawless surface quality. All materials in contact with the product, such as sliding materials and secondary seals, are FDA approved. The bearing grease is approved in accordance with NSF H1 and therefore suitable for food and pharma applications.

Minimal abrasion

Under the moderate operating conditions of this application, shedding and abrasion of the seal face material is extremely low, particularly with regard to the overall capacity of the vessel of about 3,000 l. Not all of the abraded material goes into the dryer because most of it remains inside the seal housing.

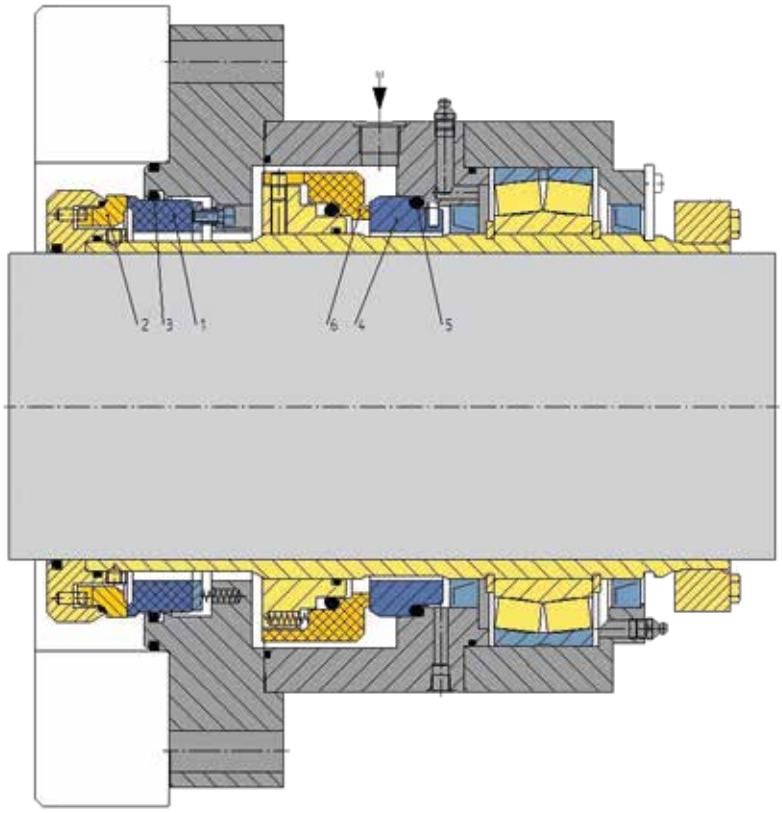
The solvents used in the production process at this English production site carry the risk of an explosive atmosphere, which means the requirements regarding explosion protection regulation and Directive 2014/34/EC must be considered. In the present case, the mechanical seal must be suitable for category 2 (zone 1) and temperature class T3. Category 2 means that an explosive atmosphere can occasionally occur at the seal during normal operation, and the temperature class is dependent on the medium properties. T3 means a maximum temperature of 200 °C (392 °F) for the surface exposed to the product. SeccoMix R seals can meet these demands without any difficulties. Even if temperature class T4 were required, which permits a maximum surface temperature of up to 135 °C (275 °F), it is possible to use SeccoMix R after checking the operating conditions.

Result

The bottom line is that dry-running mechanical seals are a reliable alternative to liquid-lubricated seals, especially for moderate operating conditions. This often applies to agitators and other engineered equipment with agitators, filter dryers and nutsche filters. Pharmaceutical applications nowadays are increasingly accepting dry-running mechanical seals. The Swiss pharmaceutical company is very satisfied with the dry-running seals from EagleBurgmann.

Operating conditions

- Shaft diameter:
  d = 200 mm (7.87")
- Pressure:
  Vacuum to 1 barg (14 PSIG)
- Temperature:
  t = -20 °C ... +90 °C (-4 °F ... +194 °F)
- Sliding velocity:
  v_g = 0.1 m/s (0.32 ft/s)
- Medium:
  Wet pharmaceutical product



Section drawing of
SeccoMix R seal

1 = Seal face, product side
2 = Seat, product side
3 = Dynamic O-ring
4 = Seat, atmosphere side
5 = O-ring
6 = Seal face, atmosphere side

Yellow areas:
rotating parts of the seal

Blue areas:
stationary parts of the seal

Gray areas:
shaft and housing parts

SeccoMix R at a glance

- Easy to install Cartridge unit for all drive types
- Buffered with nitrogen, dry running
- Very easy to clean due to low-gap design on the product side
- No contamination of product through buffer fluid
- Simple, cost-effective and virtually maintenance-free supply system
- SeccoMix R3 shaft sleeve is not in contact with the product, i.e. no design in special material required for corrosive media
- Metal-free design on the product side easy to implement
- Torque transmission without shaft damage
- Use in ATEX applications possible upon request
- FDA-compliant materials (sliding materials and secondary seals) possible
- Standard diameter seals can be supplied very quickly
- Very quick and easy to adapt to customer-specific designs

EagleBurgmann – at the leading edge of industrial sealing technology

Our products are used wherever safety and reliability count: in the industries of oil & gas, refineries, petrochemicals, chemicals, pharmaceuticals, food, power, water and many more. About 6,000 employees contribute their ideas, solutions and dedication every day to ensure that customers around the globe can rely on our seals. With our modular TotalSealCare Service, we emphasize our strong customer orientation and offer custom-tailored services for every need. **Rely on excellence.**

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