

RELY ON EXCELLENCE

Cost advantages on a grand scale: Pump seal in Nonflow operation

White Paper

Sealing technology offers great potential for reducing costs and resources in many areas of application. Examples can be quickly found especially in pulp and paper production. After all, the manufacturing processes there consume immense amounts of water. This can be significantly reduced by using seals with "Nonflow" operation. For the operator that is a great advantage - both in terms of ecology and economy.



**Nonflow operation =
closed water circuit =
nearly zero water supply**



**Conventional operation =
Open barrier fluid circuit =
continuous water supply**

Water consumption largest lever

10 liters: This is the amount of water consumed in the production of a single DIN A4 sheet of paper, according to the German Water Protection Association (Vereinigung Deutscher Gewässerschutz), (source: http://vdg.durstige-gueter.de/das_projekt.html). Designing production plants and components in an optimal, process-oriented manner offers a great lever for reducing water consumption. Sealing technology in this context plays an important role.

The decisive factor is the operation of a seal in Nonflow mode. To explain: Double mechanical seals in pulp pumps of the pulp and paper industry are usually supplied with fresh water from an open barrier fluid circuit. Fresh water is continuously supplied to the seal as a barrier fluid. This is pressurized to prevent product leakage to the atmosphere and serves to lubricate and cool the sealing system. After passing through, the water is drained off. In Nonflow operation, on the

other hand, the water circulates in a closed system.

This type of closed system usually consists of pipes, valves and a storage tank. It also includes measuring and control devices for monitoring the temperature, buffer pressure and flow rate. Water is filled in once and remains in the system, shut off by the valves, throughout the entire service life of the seal. Only a negligibly small amount of fresh water is fed from the production plant's water network to compensate for the leakage. Since the pressure in the water network is generally higher than the product pressure, it is also suitable as buffer pressure.

Compared to conventional double mechanical seals, the seal systems designed for the Nonflow operating mode have additional bores and spiral grooves inside the housing. This allows the barrier fluid to circulate inside the seal between the product side and the atmosphere side. The frictional heat

is conducted to the product side and the cooled sealing water flows back from the product side to the atmosphere side, driven by the rotary motion of the shaft. The seal acts like a heat exchanger. The typically obligatory thermosiphon container for dual action mechanical seals is not required.

Selecting optimum materials

The materials also play an important role for seals that are operated in Nonflow mode. While conventional seal face pairings consist of carbon material and stainless steel, the combination of carbon material and silicon carbide enables improved sliding behavior and lower friction losses. This also reduces the overall temperature development due to friction in the seal.

Advantages of Nonflow technology

- Reduction of water consumption
- Reduction of seal contamination
- Cost advantage due to extended service life of the seal

Benefit I:

Enormous reduction in water consumption

The advantages of Nonflow operation are obvious: Water consumption is reduced to a fraction of the quantity normally required. Assuming, for example, a magnitude of 30 seal units, the consumption is as follows:

- Packings: 10 l per minute / 142,560 m³ per year
- Mechanical seal standard mode: 4 l per minute / 57,024 m³ per year
- Mechanical seal Nonflow: 0.000152828 l per minute / 2.25 m³ per year

Benefit II:

Cost advantages for plant operators

As well as ecological benefits, the resource-saving operating mode also involves economic advantages for paper producers. As a result, the annual water saving corresponds to a cost reduction of around 2,000 euros per pump. There is great potential in this: Paper mills with pumps equipped with Nonflow seals can save up to six-figure cubic meters of water each year. Kotka Mills in Southern Finland is a good example of this: Here, 41 pumps were retrofitted with Nonflow technology. The annual consumption for the seal supply since then has been reduced by 181,000 cubic meters.

Benefit III:

Less contamination, increased service life

A further advantage is that Nonflow seals are less susceptible to contamination. The water enters the seal housing once. After the line is sealed off, it is present statically. This eliminates the need for large amounts of flowing water - and thus also the entry of dirt particles which gradually accumulate in the seal. In a worst case scenario, the dirt particles could block the seal, given the considerable amounts of dirt that accumulate during operation. For example, 10 ppm of solids over the course of the year equals 19 kilograms of dirt. A Nonflow seal will not allow this amount to pass through. This increases their service life by a factor of 3.

Result

Double mechanical seals are successfully used in Nonflow operation by many companies worldwide. One key area is the paper and pulp industry in Finland. In addition, Nonflow technology can also be used in the pharmaceutical, chemical and food industries. The benefits for plant operators are apparent. Nonflow seals have proven themselves many times over. The significant reduction in water consumption and contamination and the resulting increase in the average operating life of the seals achieves significant cost benefits. The prospects for seals with Nonflow technology are promising: The determined operating conditions allow the use of corresponding systems for an estimated 80 percent of rotating shafts in production facilities in almost all industries.



Broad range of applications:

- Paper industry
- Pulp industry
- Pharmaceutical industry
- Chemical industry
- etc.

Operating conditions of Nonflow capable cartridge seals

Nonflow seals can be used at sliding velocities of 10 meters per second (33 ft/s) and maximum pressures of 10 bar (145 PSI). Water with less hardness and less dissolved substances is suitable as a barrier fluid. EagleBurgmann offers the proven mechanical seals Cartex-DN and LP-D as cartridge or semi cartridge for Nonflow use in pumps. Both products are available in different versions for a wide range of applications that are of interest not only to the pulp and paper industry but also to the chemical industry, for example.



Dual seal Cartex-DN

- Cartridge
- Independent of direction of rotation, double pressure balanced
- Integrated pumping device
- Variants for eccentric screw pumps (-Vario) and gas-lubricated version (-GSDN)

Operating range

- Sliding velocity: $v_g = 10$ m/s (33 ft/s)
- Pressure: $p_1 = 10$ bar (145 PSI)
- Temperature: $t_1 = 80$ °C (176 °F)

Discover the advantages of the Cartex-DN double seal here.



Dual seal LP-D

- Integrated seal for Sulzer A pumps
- Semi cartridge unit
- Independent of direction of rotation, double pressure balanced
- Internal barrier fluid circulation
- Static springs on both sides
- Shrink-fitted seal faces have a large clearance to the shaft
- Robust, optimized design for Nonflow use

Operating range

- Sliding velocity: $v_g = 10$ m/s (33 ft/s)
- Pressure: $p_1 \text{ max} = 10$ bar (145 PSI)
- Temperature: $t = +5$ °C ... $+100$ °C ($+41$ °F ... $+212$ °F)

Discover the advantages of the DP-D double seal here.



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