

# Seal development improves reliability of pumps for polymer latex

Ellen Klier, Group Marketing, EagleBurgmann Germany GmbH & Co Kg, Wolfratshausen, Germany

**Preventing problems with mechanical seals that are used on pumps and reactors which handle polymer dispersions (latex) is a major engineering challenge. Essentially, the problem is that polymer dispersions are not thermodynamically stable and they tend to coagulate. Polymer particles form compact agglomerations that can quickly bring a production process to a halt. EagleBurgmann Germany GmbH & Co Kg has developed a sealing strategy specifically for this difficult application, which provides a cost-effective, long-term solution, as this case study explains.**

An EagleBurgmann service centre has been working on behalf of Infracor GmbH, which operates the Marl Chemical Park – one of the largest integrated sites in Europe – to help support local companies.

Three production facilities at the Chemical Park belong to PolymerLatex GmbH, a joint venture formed during 1996 by Bayer, Degussa and Röhm. PolymerLatex is a leading producer of synthetic latex. From its European production base, the firm supplies products to customers in the construction, moulded foam, glove/latex dip, adhesives, paper, carpet and textile industries worldwide.

## Dispersion

Latex is a dispersion of tiny polymer particles in water. The milky fluid contains about 50% water by weight. The diameter of the latex particles is in the order of ten-thousandths of a millimetre. The polymer core is surrounded by a polar shell that interacts with water, stabilising the dispersion.

Synthetic polymer dispersions are produced by polymerisation of monomers in aqueous solution in a reactor. Mechanical seals are used on the pumps at all stages of the dispersion production process, including raw material in-feed, polymerisation, dispersion processing and finished product tank storage. The pumps run continuously or discontinuously at different stages during the process.

## Demanding application

The engineering challenge is to design seals for the pumps that are used to handle the latex dispersions.

The problems are particularly acute in process steps where the dispersion contains latex laden with residual monomers – for example, during dispersion processing.

All of the process stages in the production process run at a low temperature and pressure. One major reason why more extreme production conditions are avoided is that polymer dispersions are not thermodynamically stable and tend to coagulate, making the medium difficult to pump.

Adhesiveness, which is desirable in the finished product, can cause leakage or total failure of the

seals. Latex adheres to the warmest surface – the seal faces – and diffuses after only a few hours in between the sliding faces. The seals then open against the force of the buffer pressure. Ensuring that the shaft seals do not leak is particularly important in this difficult step of the process.

## Causes of seal failure

Double mechanical seals are pressurised with buffer fluid. The buffer pressure – acting in the direction of the product side (latex) – decreases in the seal gap. As a result, latex and the buffer medium intermix on the product side. Frictional heat in the seal gap causes agglomeration of the polymer particles.

When this happens, the seal gap opens and the seal becomes ineffective. The buffer fluid can then leak out, or latex can penetrate the buffer chamber, causing the seal to fail.

To avoid this scenario, the EagleBurgmann engineering team had to come up with a seal design that prevents contact between the seal and

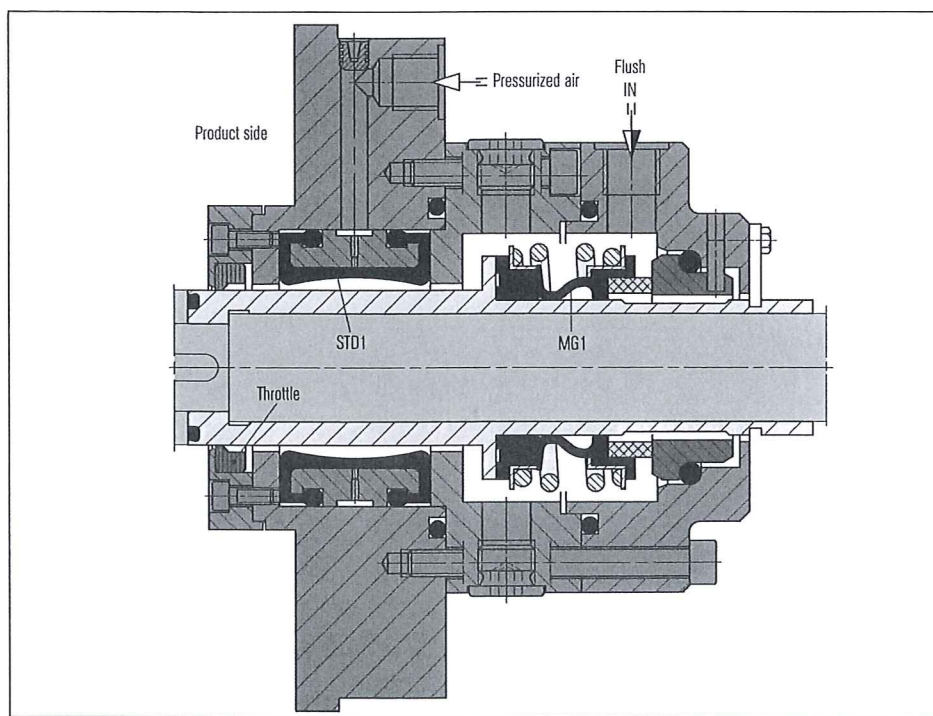


Figure 1. The EagleBurgmann enhancement ensures trouble-free operation: the MG1 single mechanical seal with throttle and STD1 shut-down seal.



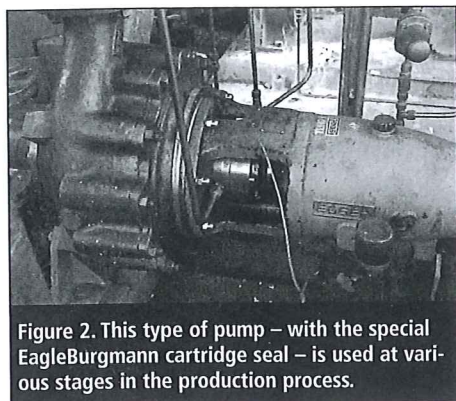


Figure 2. This type of pump – with the special EagleBurgmann cartridge seal – is used at various stages in the production process.

the product. There are a variety of duties with some pumps running continuously and others intermittently. These two different operating modes required different approaches to sealing.

## Customised sealing Discontinuous operation

For discontinuous operation, the seal supplier chose an MG1/65-G9 single seal (Figure 1).

To prevent contact with the latex, a throttle was added so that the product-side seal can be flushed with clean water. Water is used in the production process anyway, so using it in limited quantities does not cause problems.

To prevent flush water from totally flooding the pump, when the pump is shut down, and to ensure that residual latex in the pump does not penetrate the mechanical seal, an

STD1 shut-down seal was installed in the seal cartridge. The seal is automatically pressurised with compressed air following a time delay after the pump is shut down.

The bellows seal presses against the shaft, separating the medium from the mechanical seal. Flushing can remain activated during this operation. Nothing flows into the process during this time. Before the pump is restarted, the compressed air is automatically shut off, the bellows retracts from the shaft and the pump starts running. In trouble-free operation, with external flush, seal service-life now extends well beyond one year.

## Continuously running pumps

For the continuously running pumps (Figure 2) that handle latex containing monomers, an enhanced version of a seal that complies with clean air regulations (TA-Luft) was developed.

This is a double Cartex cartridge seal with throttle for controlled flushing in the direction of the impeller. A knife-edge (Figure 3) is placed on the product-side seal face to provide an added margin of safety, ensuring that the mechanical seal does not fail because of insufficient flushing. No shut-down seal is needed because the pump runs continuously.

## Seal development

Development and optimisation of the seals for this project included the rubber-bellows single seal for discontinuous operation and the double car-

tridge seal, with flush throttle ring on the product side and a knife-edge face, discussed above.

This development also created an opportunity to optimise the pumps and significantly increase their service life. Because of the shear forces involved, lumps can form behind the impeller, blocking the impeller and causing the motor to shut down as a result of overload. The back vanes on the impellers have now been removed, reducing the shear forces and preventing agglomeration. These modifications, along with other improvements which extend the total service life of the pumps, were only possible in conjunction with the modified seal system.

The operating mode of the seal is also unusual, as there is no pressurised buffer system. An external water supply is used for the buffer and flush system. The central water supply ensures high availability. An FLC flow controller ensures a constant, defined flush flow, which is not dependent on pressure.

## Efficiency and productivity gains

Eight seals are now running continuously and one is operating in discontinuous mode. The customer is completely satisfied with the results.

'The level of collaboration between our company and the EagleBurgmann's service centre has been excellent since day one. Through a very constructive and professional joint effort, we very quickly developed initial prototypes which provided a solution to what appeared to be an intractable problem,' commented Christian Scholten, Engineering Manager, PolymerLatex.

Subsequent development work has been equally satisfactory. Service life in the most problematic process stage has been increased dramatically from just a few hours of operation to as much as 1.5 years. Based on the good results so far, PolymerLatex is planning to deploy additional modified Cartex seals at the plant.

'The service centre provides a local "mechanical seal development resource" and "a source of inspiration for improvement", offering us significant added value. It helps us to achieve sustained technology improvement,' added Scholten.

The service life of the seals that are currently installed is much higher – as much as three years, in some cases – than the seals that were used previously. Even when pumps are removed and cleaned, in most cases the seals are re-installed "without repair".

### Contact:

EagleBurgmann Germany GmbH & Co Kg, Äußere Sauerlacher Str. 6–10, 82515 Wolfraatshausen, Germany.  
Tel: +49 8171 23 1453, Fax +49 8171 23 1095,  
Email: ellen.klier@de.eagleburgmann.com,  
Web: www.eagleburgmann.com

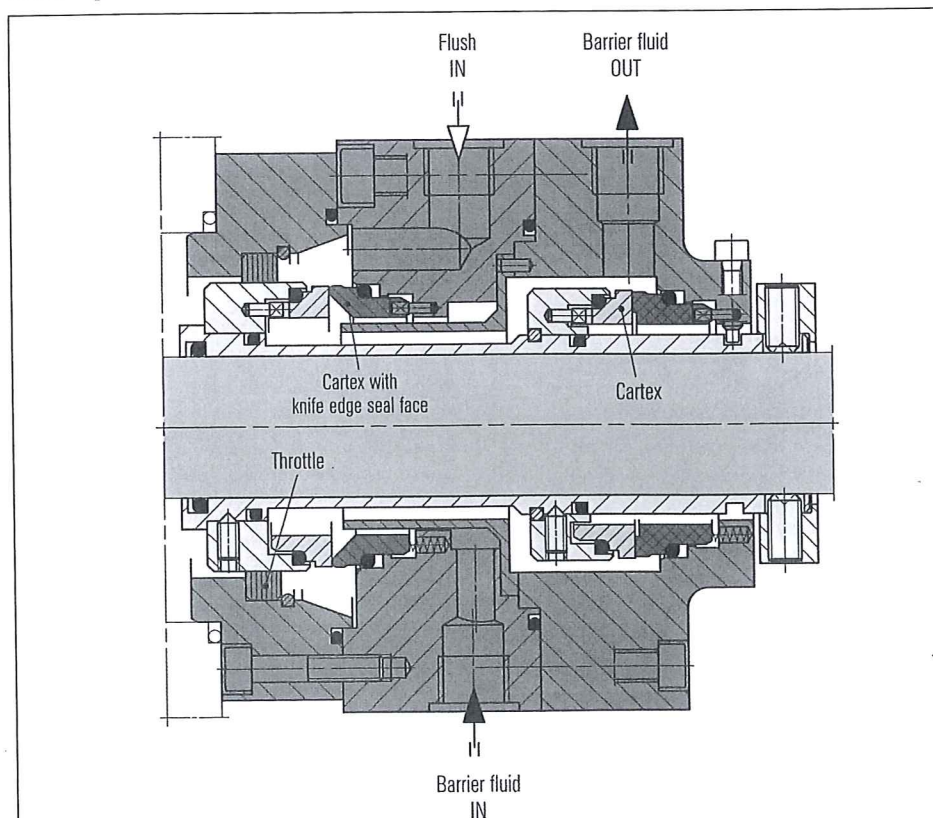


Figure 3. The Cartex cartridge seal with throttle and knife-edge face.