

Mechanical Seal HS-D in PVC Stirred Reactor

Information ED08111

SolVin operates a production plant for PVC (polyvinyl chloride) at Jemeppe in Belgium. PVC is one of the most important plastics and is used mainly in the building industry for window frames, pipes and floor coverings. The core of the plant consists of 24 stirred reactors in vertical arrangement with bottom drive.

Production process

The stirred tank reactors are run discontinuously in batch operation. This means that the tank is filled at the beginning of the process and then set to the required operating conditions. Vinyl chloride and vinyl acetate are used as raw materials. Through polymerization they react to form polymers which at the end of the reaction exist in aqueous solution as a suspension. The agitator must not be stopped while the reaction is in progress as this could result in a runaway reaction, i.e. overheating and even uncontrolled release of chemicals. The PVC suspension as end-product from the polymerisation process is normally called „slurry“. After the polymerisation process the slurry is discharged to centrifugal dryers, to remove most of the mother lye.

Operating conditions

Medium: Monomers vinyl chloride 90 % and vinyl acetate 10%, water, initiator, protective colloid, PVC suspension as reaction product
 Operating temperature: 80 °C
 Operating pressure: Vacuum to 20 bara (standard 16 bara)
 Design pressure: 30 bara
 Speed: 100 min⁻¹

Equipment with seal and supply system

Equipment: Stirred reactor with bottom drive
 Manufacturer: Missenaer Quint (France)
 Seal incl. materials: HS-D/105-E2, AQ2K/M5GE (1.4571) – AQ2VGE (1.4122)
 Mode of operation: Pressurised according to API plan 53 and flush according to API plan 32
 Barrier and flushing medium: Demineralised water.
 The flow rate of 60 l/h is the controlled variable.

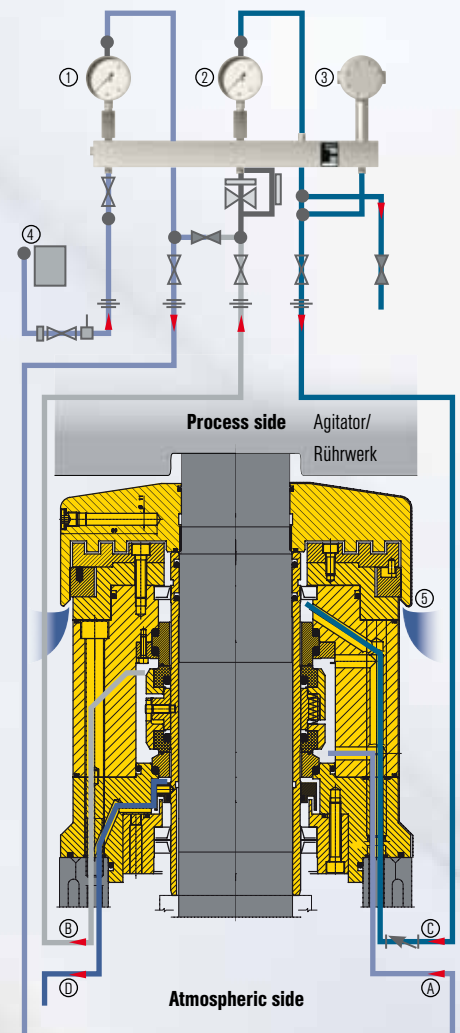
Problems with the previous sealing situation and the solution

Due to short lifetimes of the originally used competitors' seals the maintenance costs for the 24 agitator seals were more than 100.000 € per year during the last 10 years (service contract with J. Crane)
 The main problems were a regular complete destruction of the axial bearing and as a consequence the seal and the shaft were falling down (reason for that was the pressureless operation according to API plan 52 in combination with incorrectly designed bearing loads for this mode of operation) and filling of the flushing chamber with process medium up to the mechanical seal.

By changing from pressureless to pressurized operation the bearing loads could be significantly reduced and the destruction of the axial bearings could be avoided. Beyond this, the outer contour of the labyrinth was optimised in that way that the process medium is prevented to enter the flushing chamber. Also the monitoring was adapted to ensure a positive flushing pressure at any time.

The technical features of the EagleBurgmann seal at a glance:

- Surfaces in contact with the product are polished with $R_a = 0.8 \mu\text{m}$ to prevent the process medium to deposit.
- Flush in front of the seal at product side in combination with lip seal, labyrinth and throttle results in an increase of the reliability due to prevention of deposits in the area of the seal
- Optimisation of the seal chamber concerning fluidic aspects, for example prevention of dead spaces
- Precise drain-off of any leakage by using a drainage facility
- Self-closing, that means the seal will remain closed and will keep the full functionality even in case of pressure reversal or failure of the supply system
- Optimal lubrication of the seal due to HS-grooves at product and atmospheric side



- ① Flowrate transmitter 1 / Durchflusstransmitter 1
- ② Flowrate transmitter 2 and 1 flow control / Durchflusstransmitter 2 und -1 regelung
- ③ Pressure transmitter and manometer / Drucktransmitter und Manometer
- ④ Reservoir with demin. water at 17 bar / Speicher mit demin. Wasser bei 17 bar
- ⑤ Flushing rate: 60 l/h / Spülmenge: 60 l/h
- ⑥ Drainage / Drainage

After one year of successful operation of the first seal, five more reactors were retrofitted to the EagleBurgmann seal design. The remaining reactors will also be retrofitted by and by. The mechanical seals used in this application achieve excellent life times and the maintenance costs could be reduced significantly.