

AGS 451KL-D shaft seal

Information **EN06011**



Ammonia combustion reactor in the HAS system at DOMO Caproleuna

DOMO Caproleuna GmbH, a company of the „Chemicals & Polymers“ business division of the DOMO group, runs two production sites at the chemical site Leuna in the east of Germany. Among other things, they manufacture caprolactam which is processed to make polyamide fibres such as Nylon®. The manufacture of caprolactam also requires, among others, hydroxyl ammonium sulphate (HAS) which is produced at Domo Caproleuna as well. Ammonia combustion reactors from the manufacturer Steinmüller Gummersbach are operated in this system. To increase system safety and availability, these reactors were successfully retrofitted with EagleBurgmann type AGS 451 gas-lubricated mechanical seals in 1998.

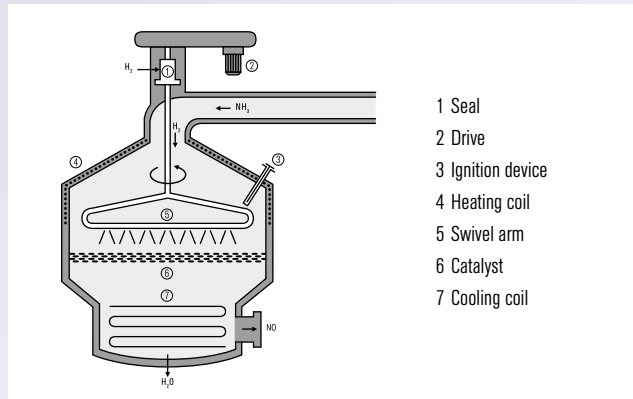
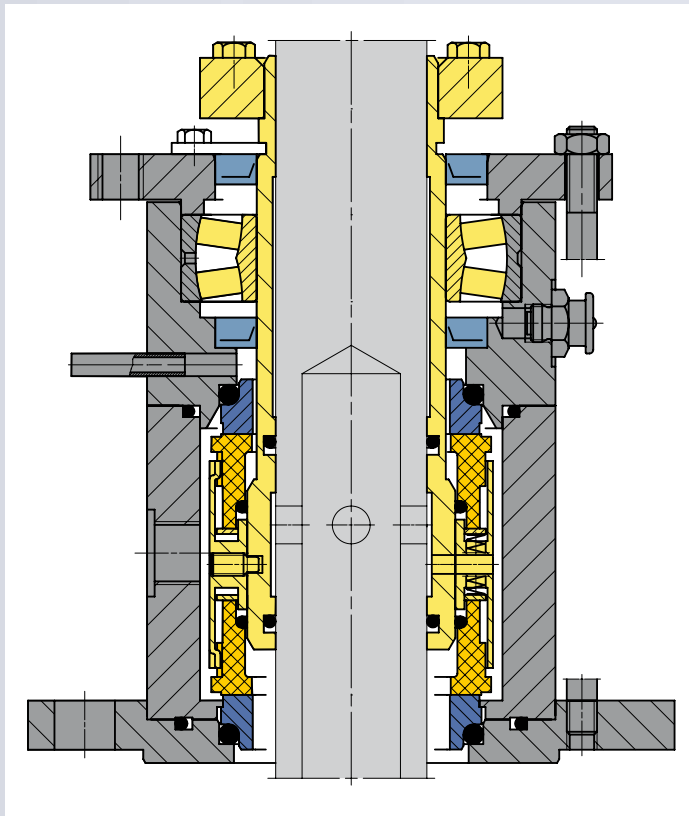
The process

Ammonia (NH_3) is converted to nitrogen monoxide (NO) and water (H_2O) through catalytic combustion. The nitrogen monoxide obtained in this manner is further processed to HAS.

To start up the ammonia combustion reactor, the area of the catalyst is heated to 220 °C. Hydrogen is guided through a hollow shaft to a swivel arm with holes, ignited in the vicinity of the catalyst and thus burned. The shaft rotates during this heating phase. The pressure of the hydrogen is at 3 bara. The required quantity of hydrogen is 135 Nm^3/h . After the operating temperature of the catalyst has

been reached, the rotation of the swivel arm is interrupted and the supply of hydrogen is stopped by closing a quick-acting valve.

The process gas that flows in above the catalyst causes the temperature to rise within a short period of time to 900 °C due to exothermic reaction. The temperature of the process gas is around 180 °C. This temperature is also present at the seal.



Schematic structure of the ammonia combustion reactors.

Gas-lubricated mechanical seal AGS451KL-D

Previous seal caused production stops

During the heating phase, the hydrogen was guided via the lantern ring of a stuffing box packing through the holes to the hollow shaft. The periodic tightening of the packing caused the lantern ring to be pressed down in its position. This caused the partial closure of the holes in the hollow shaft, which considerably hindered the hydrogen supply. The rectification of the false position was only possible by completely disassembling the swivel arm and the reactor cap. This always caused a corresponding production stop. Furthermore, the potential risk of setting the packing on fire presented a high safety risk.

EagleBurgmann AGS as reliable solution

The stuffing box packings with lantern ring were replaced by the gas-lubricated EagleBurgmann AGS. The hydrogen is used as buffer gas and is simultaneously guided through a hole between the atmosphere and product side of the mechanical seal to the hollow shaft. The hydrogen pressure for this was increased on the system side from 2 to 3 bara. A hole in the shaft sleeve limits the quantity to a maximum of 135 Nm³/h.

Significant increase of system availability

Since the retrofit in 1998, the seals operate without failure and to the satisfaction of the customer. The EagleBurgmann solution significantly increased system availability and substantially improved the safety. Moreover, the resulting decreased servicing and maintenance expenditure from the retrofitting contributed to the increased cost-effectiveness of the system.

Operating conditions

Seal type: AGS451KL-D20/40-E4-R,
top drive
Temperature t: 180 °C
Pressure: slight overpressure
Speed: 100 min⁻¹
Materials: BQ1K3GG BQ1K3 / EGG
(Secondary seals of ammonium-proof perfluoro elastomer K3)
Buffer system: System internal hydrogen network
Buffer medium: Hydrogen (H₂)
Buffer pressure: 3 bar