

The solution for reliable operational safety and long service lives for mechanical seals under heavy-duty conditions.

EagleBurgmann®
Rely on excellence

DiamondFace-coated mechanical seal DF-M7S91 in screw booster pumps on ships



Rotating unit of EagleBurgmann type M7 mechanical seal. This universal shaft seal has proven its worth millions of times over.

ECAs (Emission-Controlled Areas) were established a few years ago in the North Sea and Baltic shipping areas, the English Channel and the US and Canadian coastal regions. Ships that operate in these waters must reduce their sulfur emissions to 0.1% m/m. While heavy fuel oil (HFO) is used as a fuel outside these ECAs, ships switch to light fuel oil (MDO - Marine Diesel Oil) with its lower sulfur content within the environmental zones and in harbors.

These fuel changeovers are particularly frequent on cruise liners, which often go to new destinations every day. This puts considerable strain on machines and components, including the booster pumps that transport the fuel from the bunker to the ship's engines under pressure - and consequently the mechanical seals in these pumps, which are designed for stable operating conditions and continuous lubrication of the seal faces.

Problem media, special associated conditions

The seals applied to seal the pump shafts are exposed to extreme stresses due to the lack of lubrication of the seal faces and the constantly changing pressure and temperature conditions.

In addition to the changes between HFO and MDO, the quality of the heavy fuel oil also has a negative effect on the lubrication required for the seal faces, and thus on how reliably the seals function. In HFO operation, water vapor can be mixed in with the fuel to reduce the amount of soot in the exhaust gas. Furthermore, HFO can contain up to 30 % of substances that cannot be defined more precisely according to current standards, and thus can potentially impair the seal. In addition, temperature jumps of around 70 °C (126 °F) occur at the booster pumps and their seals during fuel changes.

As the vertical screw pumps used have mechanical seals installed at the top, gas building up in the seal compartment can also cause a lack of lubrication. Furthermore, the temperature limits for the FKM (fluoroelastomer) secondary seals applied as standard are regularly exceeded.

The operating conditions immediately suggest the application of double mechanical seals, but this is often impossible due to the limited installation space and is undesirable on cost grounds.

Conventional mechanical seals used to achieve a limited service life of 50 to 500 operating hours before unacceptable leakages occurred. This contrasts sharply with the operators' demand for a MTBF of 8,000 hours.

Early wear of the mechanical seals thus caused massive problems for shipyards and cruise ship owners. Time and time again, the unavoidable replacement of seals resulted in a lot of time and money being spent on maintenance.



Vertical screw pumps are used as booster pumps for different grades of fuel.

Solution in sight: DiamondFace

EagleBurgmann DiamondFace is the key to solving such sealing problems. The positive experiences gained from other applications, such as high tolerance to dry running and significantly longer service life, are impressively demonstrated yet again in these applications.

The four booster pumps in each of five cruise liners operated by one of the world's largest ship owners have been equipped with type DFM7S91 single mechanical seals coated with DiamondFace since 2011. While the pumps in the first two ships were retrofitted, the DFM7S91 seals were installed in the other three ships while they were under construction in Papenburg, Germany.

These 20 seals with the high-tech coating have been working perfectly and without a hitch since commissioning. The massive leakages that used to occur have been eliminated and reduced to a minimum. Running times of up to 10,000 hours are now achieved by the M7S91, promoted by its extraordinary tolerance to dry running and the extreme chemical resistance of DiamondFace. This is combined with never before achieved MTBF values, much to the operator's satisfaction.

Seal and operating conditions

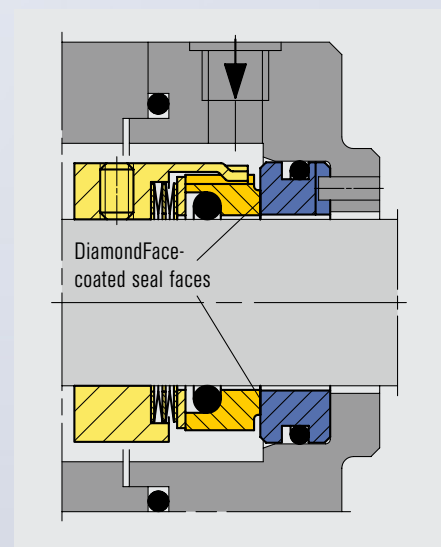
Mechanical seal:
EagleBurgmann DFM7S91/40-00

- Single seal, unbalanced
- Bi-directional
- FFKM secondary seals

Medium HFO: Heavy Fuel Oil HFO-380 (standard)
Temperature: $t = 115\text{ °C}$ (239 °F)

Medium MDO: Diesel
Temperature: $t = 50\text{ °C}$ (122 °F)

Pressure: $p_1 = \text{approx. } 6\text{ bar}$ (87 PSI)
(inlet 5.5 bar (79.7 PSI),
outlet 11.5 bar (166.7 PSI))
Speed: $n = 1,750\text{ min}^{-1}$



EagleBurgmann single mechanical seal DFM7S91. The seal faces of the rotating ring and stationary seat are diamond-coated. Yellow parts - rotating, blue - stationary, gray - housing.

Video: DiamondFace

