

TA-Luft compliant sealing solution for
quench oil circulation pumps

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HRK mechanical seals

Information **EN07122**



Since 1995 the Dow Olefinverbund GmbH has been very active in the Central Germany region and with its production sites in Schkopau, Leuna, Boehlen and Teutschenthal it has become the largest plastics manufacturer in former Eastern Germany.

The production chain starts with the cracker, the core of the production site in Boehlen. There the basic chemicals ethylene and propylene as well as further intermediate products for the chemical industry are produced from naphtha as raw material. In 2005 the whole plant was retrofitted with TA-Luft (German clean air directive) compliant sealing systems, including the 4 quench oil circulation pumps described below.

Operating conditions

Medium:
Quench oil or heavy oil with coke particles (pour point at about 100 °C)
Viscosity of process medium: 4 mm²/s or 14 mm²/s at operating temperature
Operating temperature: 165 °C or 215 °C
Operating pressure suction side:
1.4 bara or 1.5 bara
Operating pressure discharge side:
14 bara or 13.2 bara
Operating pressure at the seal: 2 bara
Speed: 1,480 min⁻¹

Equipment with seal and supply system

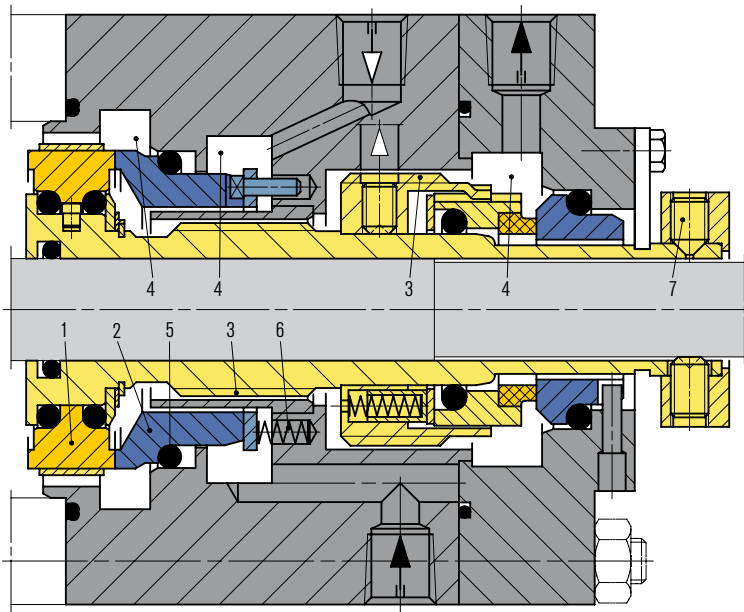
Pumps:
4 horizontal centrifugal pumps, between bearings
Manufacturer: Ruhrpumpen
Seals: HRKS1-DF/13-G11-E2 to E5
Materials: U2Q3K1GG – Q1AM1GG
Mode of operation: Plan 32 + 53
Supply system: TS 2000/M462-D1
Barrier pressure: 3.5 to 4 bara
Barrier medium: Heat transfer oil Renolin Therm 330S, max. temperature 60 °C
Flushing pressure and flow rate:
max. 3 bara with 1.2 m³/h,
max. temperature 90 °C
Flushing medium: Gasoline

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HRKS1-DF/130-G11-E4

Problems with the previous situation and the solution

Quench oil as well as heavy fuel oil come under the "Technical Instructions on Air Quality Control" (TA-Luft), which is why the quench oil circulation pumps had to be retrofitted to TA-Luft compliant seals. Until 2005 single mechanical seals had been in use, which had not fulfilled the TA-Luft requirements regarding a technically leakproof seal solution.

For this reason the single seals were retrofitted to dual mechanical seals. The following properties of the process medium were taken into consideration during the seal selection:

- The process medium contains abrasive solids.
- The solid particles may deposit in the seal, preferably under the dynamically loaded o-ring thus blocking the o-ring's and the spring's movability.
- High pour point of the medium at about 100 °C, which means that the viscosity of the process medium is quite high when starting up the pump. Thus the product tends to stick and harden inside the seal.

In consequence of the above mentioned properties of the medium an HR-seal was selected at the product side. This seal type is very robust, also in combination with media containing solids. Further technical features are the rotating seat, directly located at the impeller and the spring protection sleeves which have successfully proven in practice to protect the springs from deposits of the product. To avoid that the product sticks and hardens in the area of the seal faces and inside the sealing chamber a flush with clean media is used at the product side in the area of the seal faces. Moreover the solids are prevented to enter the sealing chamber.

The original flushing flow rate of 3.6 m³/h could be reduced to 1.2 m³/h without any negative influence on the seal function. A pumping screw supports the circulation of the barrier medium to ensure an optimal cooling and lubrication of the mechanical seals. An additional requirement is that the seal keeps the full functionality even in case of pressure reversal.

The demanding operating conditions are also reflected in the selection of the materials. Tungsten carbide (U2) against silicon impregnated electrographite (Q3): Both materials are less brittle than SiC and are therefore used in combination with high viscosity media to avoid seal face rupture. Beyond this Q3 has good emergency running characteristics and is suitable for high temperature applications.

For the o-rings at the product side a specific perfluoroelastomer suitable for higher temperatures is used.

Successful upgrade to industrial standard

This contemporary seal solution has been successfully in operation since 2005. The operator has upgraded its plant according to the best available technique and fulfils now the demands of legislation in every respect as set out by TA-Luft. Emissions are reduced to a minimum.

Furthermore the service life of the seals could be significantly improved by considering of the specific medium properties and the suitability for pressure reversal.