

Metal bellows seal in hot application up to 400 °C.

MFL65 in crude oil residue products

Information **ED09101**



A MFL65 metal bellows seal (stationary unit and counter ring of a single seal) with the typical torque transmission for reducing stress on the bellows.

The Conoco Humber refinery on the east coast of England has been processing 85 million barrels of crude oil a year since 1969. This means that 230,000 barrels per day are processed mainly into benzene, diesel, kerosene, oil, gas.

One critical area is the thermal cracking process. The crude oil residue is processed at approximately 400 °C, at this temperature it is of low enough viscosity to be pumped effectively. This is handled by a barrel pump on the coker unit.

The operating conditions

Medium: heavy crude oil
Temperature: 400 °C
Product pressure: 13.4 bar
Speed: 3,500 min⁻¹
Shaft size: 111 mm
Seal type: MFL65 dual seal arrangement
Barrier fluid system: Plan 54
Barrier medium: gas oil at approx. 80 °C

Problem and challenge

The originally supplied competitor seals had a service life of approximately three months. The end-user asked EagleBurgmann to offer a seal solution with a service life at least twice as long. Leakage from the outboard seal was not allowed to exceed 12 ml/h and a nitrogen purge to prevent coking of the crude oil was not allowed.

Solution from EagleBurgmann

Selective tests have been run in the EagleBurgmann R&D centre and at the end-user's facility. This provided the basis for designing and optimizing a mechanical seal able to meet the specific requirements. The answer was the MFL65-D1/130-E2 dual metal bellows seal.

Due to its edge welded metal bellows made of hardened Inconel[®] 718 (2.4668), the seal does not need a dynamically loaded elastomeric O-ring (the temperature resistance of such a ring would be too low in any case for this application).

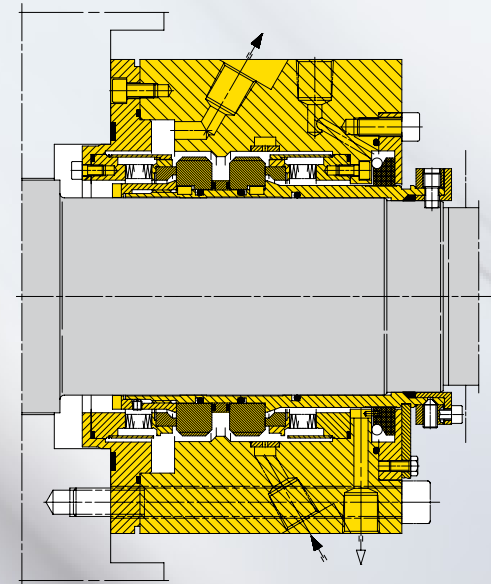
The secondary seal elements on the in and outboard side are made of high temperature resistant graphite. The elastomers are made of Kalrez. A hard/hard (SiC vs SiC) Q22Q1G/K1M6T4(1.4462)-Q22Q1G/VM6T4(1.4571) combination was selected for the face materials. Due to security aspects, the silicon carbide rotating seat was changed to a twin seat version.

To be able to meet the specified leakage values and obtain optimum operating characteristics, the sliding faces were improved by minor design enhancements. Also, optimized lubricating grooves were integrated in the sliding faces to guarantee sufficient lubrication without major increase of the leakage rate.

Long operating times

The EagleBurgmann installation satisfies in every respect the requirements imposed by this extremely demanding application. The seals have now been in operation for more than 4 years. Running periods are limited only by the two year pump inspections. Leakage is approx. 6 ml/h, half the maximum leakage rate permitted by the customer.

ConocoPhillips have achieved a significant reduction in costs through a drastic increase in the MTBF value and are highly satisfied with the performance of the mechanical seal cartridge. Thanks to the positive results it was decided to convert two remaining pumps to this seal type.



MFL65-D1/130-E2 dual seal