

The innovative and unbeatable sealing solution  
for low vapor margin applications

**EagleBurgmann®**

Rely on excellence

# Mechanical seals DF-(P)DGS6 DiamondFace

**>80%**  
reduced pump leaks

**>5 Years**  
seal service life

# Ethane, propane, carbon dioxide: Light vaporous media sealed safely – in every condition



## Difficult environment: Conventional seals are reaching their limits

The pumps used in liquefied gas fractionation and in the pump stations of the downstream NGL (Natural Gas Liquids) pipelines are API 610 high-performance pumps, e.g. BB3 and BB4 process pumps, and vertical pumps. As a rule, the shafts of these machines are sealed with conventional liquid lubricated mechanical seals. To function correctly, the mechanical seals are reliant on stable operating conditions and continuous lubrication of the sliding surfaces.

NGL processes primarily pump light hydrocarbons (i.e. ethane and propane). In other processes, liquid CO<sub>2</sub> is pumped. Temperature and pressure fluctuations can cause phase transitions between liquid and gas in conjunction with the low vapor pressure margin of the medium at the sealing surfaces. The consequential dry run will damage the mechanical seal and result in seal failure.

An additional cause of failure occurs for standby pumps: pump and seal are often under full pressure for long periods of time (sometimes for months). When the pump is started, the sliding faces of the seal come into direct contact with each other, run dry, and can be damaged or even destroyed in consequence.

## Always better: DF-(P)DGS6 can do more than others

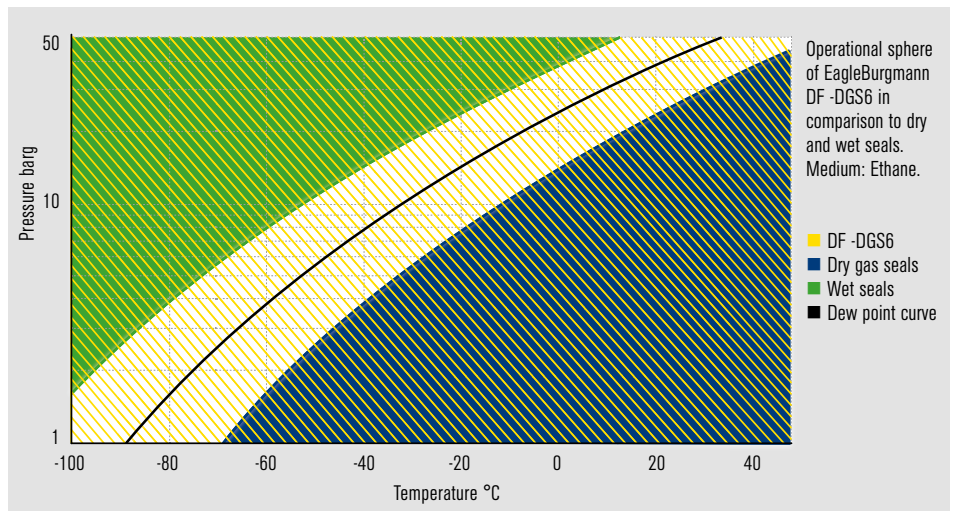
Due to its broad and structured seal faces, the DF-(P)DGS6 runs contact-free and can operate in both modes: gas-lubricated as well as liquid-lubricated. And above all: the sealing system is extremely reliable. In addition to the robust design is the unique diamond bonding of EagleBurgmann: DiamondFace.

DiamondFace bonded sliding faces permit a much smaller sealing gap design. Minimal leakage during operation and optimal leak tightness during standstill – unrivalled by any other seal! DiamondFace also makes the seal extremely robust in transient conditions where contact between the sliding faces can occur.

## This pays off: DF-(P)DGS6 is consistently economical

Noticeably improved plant availability through immensely extended operating periods and significantly increased process reliability through superior seal technology are the advantages correlated with the use of an EagleBurgmann DF-(P)DGS6. As a result, MTBR (Mean Time Between Repair) intervals can be increased from previously just a few weeks or months to more than 5 years. Return of investment (ROI) is achieved rapidly.

In use, the DF-(P)DGS6 shows additional strengths: the seal exhibits low power consumption, has a convincing low leakage rate and does not require an oil supply. They are mostly operated with API Plan 72, 75 and 76. Plan 02, 12 and 13 are optional.





# The reliable solution: EagleBurgmann DF-(P)DGS6



## Features

- DiamondFace bonded primary seal faces
- Safe cupped retainer for rotating ring
- Fully operational in both liquid and gas phases
- Bi-directional
- Ready-to-fit cartridge unit
- Single, double, tandem and tandem seal with intermediate labyrinth available

## Advantages

- Significantly lower leakage rate compared to competition
- Longer life span
- Wear and contact free operation
- Self-cleaning 3-D gas grooves
- High gas film stiffness
- Proven, reliable and economical solution
- Can be adjusted even to extreme narrow installation space – retrofits are easy to implement.

## Operating range\*

Shaft diameter:  $D = 25 \dots 280 \text{ mm} (0.98'' \dots 11.02'')$

Pressure:  $p = 0 \dots 100 \text{ bar} (1,450 \text{ PSI})$

with PTFE option:  $0 \dots 250 \text{ bar} (3,625 \text{ PSI})$

Temperature:  $t = -30 \text{ }^\circ\text{C} \dots 200 \text{ }^\circ\text{C} (-22 \text{ }^\circ\text{F} \dots 392 \text{ }^\circ\text{F})$

with PTFE option:  $-100 \text{ }^\circ\text{C} \dots +200 \text{ }^\circ\text{C}$

$(-148 \text{ }^\circ\text{F} \dots +392 \text{ }^\circ\text{F})$

Sliding velocity:  $v_g = 0.6 \dots 140 \text{ m/s} (2 \dots 459 \text{ ft/s})$

\* For applications outside the operating range mentioned, please inquire.

## Materials

Primary seat and seal face:

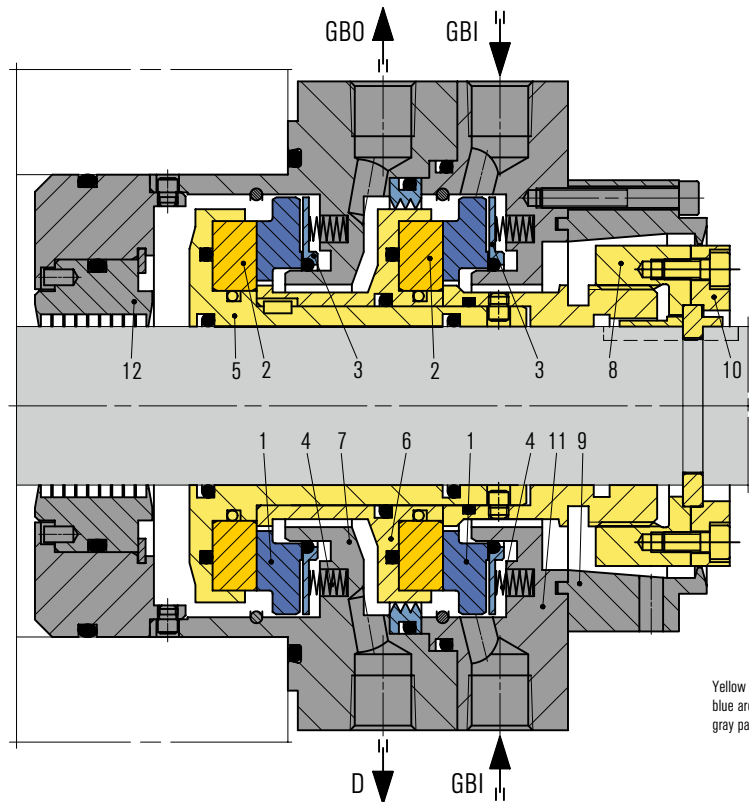
Silicon carbide with DiamondFace bonding

Secondary seat and seal face:

Silicon carbide with DLC coating

Secondary seals: FKM, PTFE (DF-PDGS6)

Metal parts: 1.4006 and other stainless steels, aluminum



Yellow colored seal parts are rotating, blue are stationary, gray parts: housing.

## DF-DGS6

### Tandem seal with intermediate labyrinth

## DF-PDGS6

Version for high pressure and both low and high temperature applications. With U-cups and special dynamic sealing elements. Secondary seals made of PTFE.

Item	Description
1	Seal face, stationary
2	Seat, rotating
3	Thrust ring
4	Spring
5	Shaft sleeve and seat retainer
6	Intermediate sleeve
7	Housing (adapted in size to the installation space)
8	"Adjustable" nut for axial misalignment
9	Split ring
10	Clamping ring
11	Cover
12	Process side labyrinth
GBI	Gas Buffer Inlet
GBO	Gas Buffer Outlet
D	Drain



**To date there are more than 150 seals of the type DF-(P)DGS6 in successful use: in gas processing, NGL fractionation, and in the pumps of NGL pipelines. We would be pleased to provide you with additional references upon request.**

■ Sulzer ethane pumps which are applied in the pipeline of Enterprise Products Operating LP in Mont Belvieu, Texas, USA (picture above) have been sealed successfully by EagleBurgmann DF-DGS6/98-ZT1-U seals since July 2011. The DiamondFace bonded gas seals provide much longer operational life with very low leakage compared to the originally used liquid-lubricated seals.

Operating conditions:  $p = 40.7 \dots 50.3 \text{ barg}$  (590 ... 725 PSIG),  $t = -12.8 \text{ }^\circ\text{C} \dots +21.1 \text{ }^\circ\text{C}$  (+9 °F ... +70 °F),  $n = 3,570 \text{ min}^{-1}$

■ EagleBurgmann DF-DGS6/98-ZT3-U seals are installed in Sulzer Pumps of a fractionation plant in Mont Belvieu, USA, which process mixes NGL streams into purity NGL products like ethane, propane etc.

Operating conditions:  $p = 44,1 \dots 49,6 \text{ barg}$  (640 ... 720 PSIG),  $t = 18 \text{ }^\circ\text{C} \dots 24 \text{ }^\circ\text{C}$  (64.4 °F ... 75.2 °F),  $n = 3,560 \text{ min}^{-1}$

■ A number of EagleBurgmann DGS6/49-TA1-U seals with DiamondFace bonding are applied in Schlumberger pumps in an US based ethane fractionation plant.

Operating conditions:  $p = 62.1 \text{ barg}$  (900 PSIG),  $t = -6.7 \text{ }^\circ\text{C} \dots +150 \text{ }^\circ\text{C}$  (+19.9 °F ... +302 °F),  $n = 3,550 \text{ min}^{-1}$

■ The ITT Industries-Goulds pumps of an ethylene expansion plant in Bayport, Texas, USA are equipped with EagleBurgmann DF-DGS6/108-ZT2-U seals.

Operating conditions:  $p = 24.9 \text{ barg}$  (374.9 PSIG),  $t = -24.3 \text{ }^\circ\text{C} \dots +10 \text{ }^\circ\text{C}$  (-11.7 °F ... +50 °F),  $n = 3,600 \text{ min}^{-1}$

## DiamondFace: A success story

In 2007, EagleBurgmann created a landmark in mechanical seal technology with the introduction of DiamondFace. A microcrystalline bonding with all the attributes of natural diamond is applied to the seal faces by chemical vapor deposition (CVD) at 2,000 °C (3,632 °F) in a vacuum reactor. Thick bonding (up to 15 µm) coupled with extremely flat and uniform seal faces characterize this procedure, which was developed together with the Fraunhofer Institute for Surface Engineering and Thin Films in Braunschweig, Germany.

The bonding adhesion exceeds all known practical requirements. Seal faces with DiamondFace offer excellent thermal conductivity, are extremely hard, resistant to wear, exhibit low friction and highest chemical resistance.

Numerous applications in the fields of oil & gas, refineries, chemical industry, slurry, pharmaceuticals and water supply testify to the added value that DiamondFace can bring to the overall performance of a facility. This innovation has thousands of success stories relating to its application in a vast range of industrial sectors. Worldwide.

Unleash the massive potential of a diamond. With the DiamondFace mechanical seal for your specific applications.



Video:  
DiamondFace

**DiamondFace bonded seal face  
of a DF-(P)DGS6 pump seal with  
bi-directional gas grooves.**

## **Innovative and proven in practice: EagleBurgmann DF-(P)DGS6**

Due to the special technical features (among other things, the broad structured sealing surfaces) and the DiamondFace high performance bonding, **EagleBurgmann DF-(P)DGS6** can easily manage all states of highly vaporous media: gaseous, liquid and evaporation in the sealing gap. They will operate stable and free from contact and wear in all states.

Over 150 DF-(P)DGS6 seals have been successfully deployed to date in the first installation of pumps or exchanged for "Bad Actors" in this field of application.

The result: leakage reduced by up to 80 %, multiplied extended period of use, no failures from dry running, and thus measurably increased availability of the plants of our customers.



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EagleBurgmann is one of the internationally leading companies for industrial sealing technology. Our products are used everywhere where safety and reliability are important: in the oil and gas industry, refining technology, the petrochemical, chemical and pharmaceutical industries, food processing, power, water, mining, pulp & paper, aerospace and many other spheres. Every day, more than 6,000 employees contribute their ideas, solutions and commitment towards ensuring that customers all over the world can rely on our seals. Our modular TotalSealCare service underlines our strong customer orientation and offers tailor-made services for every application.

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