GE
Oil & Gas

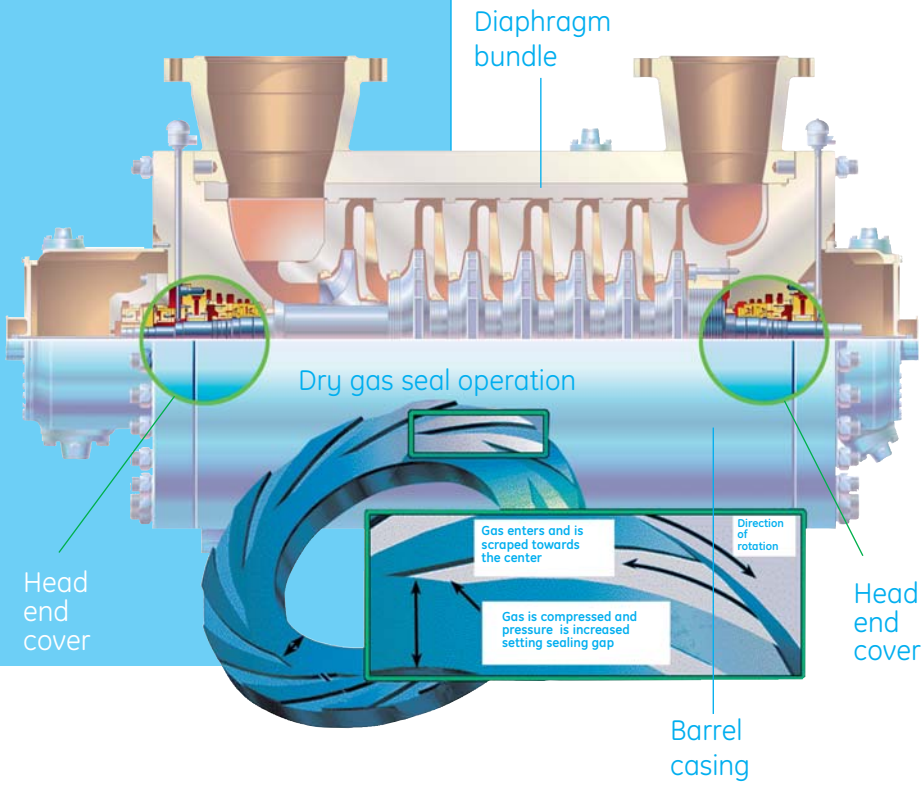
Dry Gas Seal Retrofit

Benefits

- ■□□ Increased production
- ■□□ Higher efficiency
- ■■■ Compliance with environmental regulations
- ■■■ Availability and Reliability
- ■■□ Life extension

Customer benefits of Dry Gas Seal (DGS) vs. Oil Seal include:

- Energy costs are reduced since the seal oil pumps and the heating system for the oil de-gassing tank are no longer required
- Up to 95% reduction in parasitic power losses in the compressor
- Virtual elimination of unscheduled seal maintenance costs. The dry gas seal system has fewer components than an oil sealing system and therefore, shows a lower frequency of unplanned outages
- Considerable reduction in scheduled maintenance costs
- Elimination of contaminated products (either gas contaminated with oil or oil contaminated with gas)
- Major weight and space savings, because overhead tanks are no longer needed
- Seal oil storage, transportation an treatment costs are eliminated
- Compressor venting is not required during compressor shutdown with dry gas seals
- Overall process gas leakage to the atmosphere is very much reduced using dry gas seals
- Lower impact in case of failure. Failure of an oil seal leads to contact of the seal ring with the shaft sleeve with consequent damage to the rotor. With DGS, any contact is limited to the sealing rings that are part of the cartridges and that can be dismantled separately from the compressor bundle



What it is

The sealing of rotating components is one of the critical areas of centrifugal compressor design.
Shaft seals are used to prevent process flow leakage to the atmosphere and are needed to assure compliance with environmental regulations and personnel safety.
DGS are the most widely used system for sealing centrifugal compressor rotating components. In particular, the Tandem DGS, which employs an inert gas injection system, shows extremely low process gas leakage.
Compressors equipped with oil film seals can be upgraded with a DGS system, and DGS retrofit packages can be offered for the majority of centrifugal compressor applications.
As an original compressor manufacturer GE Oil & Gas, is ideally equipped to evaluate the feasibility of the modification. In particular GE can check the rotordynamic behaviour of the modified compressor and find the correct corrections (if necessary) to make the upgrading feasible and safe.
Other seal types and configuration are possible to fit an individual application.

The DGS consists of five parts:
1. Seal cartridge
2. Clean buffer gas system
3. Primary vent
4. Secondary vent
5. Nitrogen/Air injection system

Seal Cartridge

The Tandem DGS with tertiary separation seal consists of three sealing systems.
The first (inboard seal) provides the main process gas compressor seal.
The second (outboard seal) is identical to the first and provides emergency back-up in the event that the inboard seal becomes damaged. The third seal in the cartridge is of a different type (labyrinth or carbon type) and is buffered with nitrogen or air to keep the cartridge free of oil contamination from the compressor lubricating oil system. The inboard and outboard seals consist of a rotating seal ring (seat) and a stationary seal ring (face). The face and seat are commonly called the “primary seal”.
The rotating ring has a pattern of grooves in the sealing surface, whose shape depends on the manufacturer (Flowserve, JohnCrane, EagleBurgmann) and the type of DGS (bi-directional or mono-directional).
When the compressor is not running, sealing is provided by the spring force acting on the stationary ring that maintains contact between the face and the seat.
When the compressor rotates, the gas in the grooves generates hydrodynamic forces that overcome the spring and friction forces to produce a small clearance (3-5 microns) between the static and the rotating ring. In this way, the seal runs with no contact between the faces and no wear.

Clean Buffer Gas System

The seal gas is normally taken from the compressor discharge and filtered by a special duplex filter. A differential pressure control valve controls the filtered gas to inject a constant flow into both seals at each side of the compressor. PDCV assures that the seal gas inlet pressure is higher than that of the process gas within the compressor. This design ensures that the gas seals are supplied only with filtered gas. Depending on the application, further gas treatment may be recommended to prevent liquid condensation in the seal gas supply.

Primary Vent (Leakage Monitoring)

The gas leakage passing through the inboard seal is conducted to a local panel where it is monitored. If the leakage increases, an alarm is activated on the remote control system using the flow transmitter signal. The system will shut down on high-high flow rate in the event of seal failure.
The primary vent lines are connected to a header that leads to the flare.

Secondary Vent

The secondary vent is designed to collect the gas mixture coming from the secondary seal and the nitrogen/air injection system.
The secondary vent lines are connected to an atmospheric vent in a safe location.
The monitoring of the condition of the outboard seal is carried out with the same flow transmitters as for the primary vent lines. A low flow alarm in the primary vent means that the associated outboard leakage has increased above the maximum allowable operating level.
When the presence of process gas in the secondary vent must be avoided, an intermediate buffer gas can be introduced between the inboard and outboard seals. In this case an intermediate labyrinth is necessary.

Nitrogen/Air Injection System

The separation gas that is injected is normally an inert gas (nitrogen or air) taken from the plant supply.
GE Oil & Gas can provide, as an option, a suitably sized nitrogen generation system to feed the dry gas seals.
All instruments, valves and filters for the sealingsystem are packaged and mounted on a local panel including process lines, typically with stainless steel tubing and compression fittings.

How it works

In order to install the DGS cartridges on the existing compressor a detailed analysis has to be carried out. The modification scope of supply depends on compressor's casing geometry and other factors.
For a vertically split (barrel) compressor the modification can be realized with a reduced impact on shutdown because new head flanges or seal housings may be supplied to accommodate the new seal design.
In the cases where rotor shaft modifications are necessary they can be realized on the spare rotor, if available, not affecting the time required for the installation.
The horizontally split compressors may require casing modifications at local workshop or at site.
HP compressor with bell casing or other unique compressor designs require detailed analysis for each case to verify the suitability for the seal upgrade.

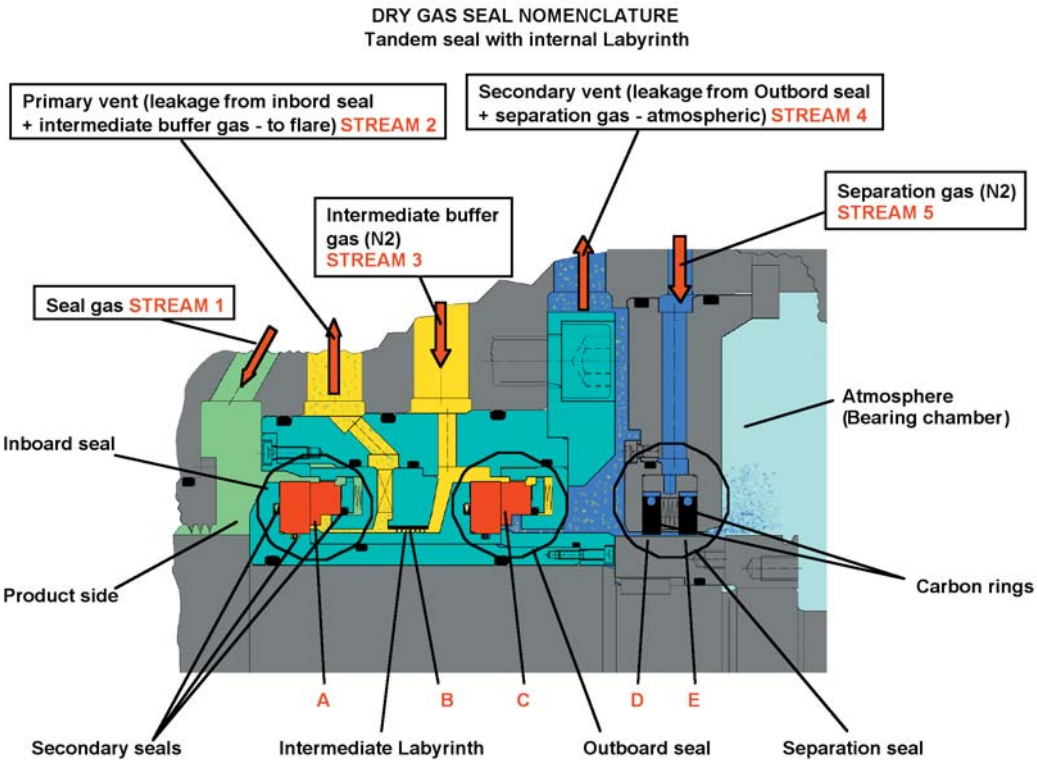
Utility:
Separation gas (Air or Nitrogen):
- Pressure: 4 barg
- Temperature: 0 to 60°C
- Dew-point: ≥ -15°C @ 1 bar

In case of intermediate injection (Nitrogen):
- Pressure: 4 to 6 bar
- Temperature: 0 to 60°C
- Dew-point: ≥ -15°C @ 1 bar

We have experience in highly successful retrofit projects for:
Horizontally-Split Casing Compressor:
- Compressor model: 2MCL457
- Application: ammonia refrigerant
- Scope of supply: casing and rotor modification at headquarters shop, DGS cartridges, DGS local panel.

Barrel Compressor:
- Compressor model: BCL303/A
- Application: Recycle - Refinery
- Scope of supply: DGS cartridges, DGS local panel, head flanges, tilting pad journal bearings

Pipeline Compressor:
- Compressor model: PCL802-1
- Application: natural gas pipeline
- Scope of supply: rotor, casing and head flange modification at headquarters shop, DGS cartridges, DGS local panel, tilting pad journal bearings



GE imagination at work

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