EagleBurgmann®

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RELY ON EXCELLENCE

Dry Gas Seal Solutions

A guide to a safer and more reliable operation of compressors

10 cases with indications, causes and remedies

Compressor, process, seals and gas supply:

Every single machine component contributes to the safe and proper function of the compressor. Only optimal interaction will ensure their efficient and proper operation. The right choice of components is the basis for:

- **Reliability**
- **Safety**
- **TCO (Total Cost of Ownership)**
- **Sustainability**

When the compressor repeatedly reaches critical or suboptimal operating conditions, the interaction of the attributes mentioned above will be thrown off balance. Product losses, standstill and/or repairs are the result.
Disruptive factors can be divided into three categories:

- Seal contamination
- Operation issues
- Leakage | Loss of product

On the following pages are descriptions of 10 cases whose indications, causes and solutions with benefits should assist you in recognizing and solving problems in the functionality of the compressor.

CASE 1–3 SEAL CONTAMINATION

CASE 4–6 OPERATION ISSUES

CASE 7–10 LEAKAGE LOSS OF PRODUCT

CASE 1

SEAL CONTAMINATION

Lube oil migration from bearing into dry gas seal

Typically affected:

All centrifugal compressors

Indications

- 21 % of dry gas seal failures are caused by lube oil migration*
- Short operating life of dry gas seal
- Dry gas seal failures
- Lube oil at secondary vent casing drain
- Oil in the secondary vent chamber
- Lube oil contamination of dry gas seal
- Fluctuating pressure in primary vent

Causes

- The installed separation seal is not securely separating the bearing oil from the dry gas seal
- During stand-still lube oil is likely to migrate into the gap between dry gas seal face and seat (bearing side)
- During start-up, this can lead to sticking seal faces resulting in increased break-away torque of the secondary dry gas seal
- Finally, there is a risk of damage of torque transmission mechanism and/or broken seal faces
- A combination of oil and dirt can lead to hang-ups

EagleBurgmann solution

- CobaSeal – coaxial static lift-off type separation seal

Results and benefits

Reduced costs:

- No more unplanned compressor shut-downs due to lube oil migration
- Up to 90 % reduction on nitrogen can save more than 50,000 € per compressor and year compared with labyrinths

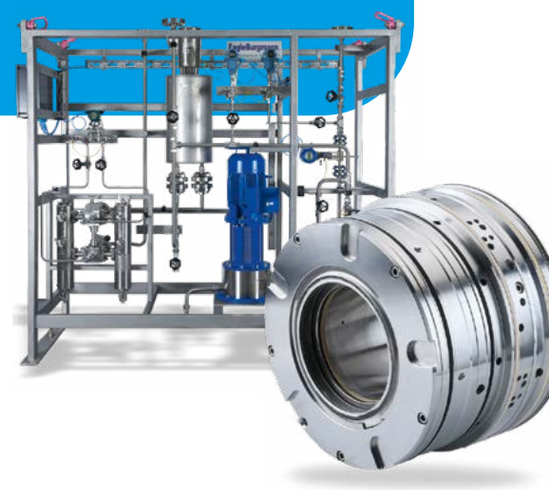
Increased safety

- No process gas leakage to bearings in case of seal failure

CASE 2

SEAL CONTAMINATION

Seal contamination in dynamic operation



Typically affected:

Upstream, midstream, applications with upstream gas treatment (glycol)

Indications

- 43 % of dry gas seal failures are caused by seal gas supply contamination*
- Short operating life of dry gas seal
- Dry gas seal failure
- Variation on primary vent pressure/flow
- Primary dry gas seal contaminated with particles and liquids

Causes

- Seal gas contaminated with particles and liquids (rust, oil, TEG (triethylene glycol), condensates, ...)
- Liquids in the sealing gap result in high friction forces leading to higher temperatures and higher torques (dynamic operation)
- This can result in wear of the seal faces, thermal cracks in the seal faces and/or high leakage alarms

EagleBurgmann solution

- RoTechSeal – dry gas seal with robust seal features
- Gas conditioning skid

Results and benefits

Increased reliability:

- Increased lifetime of dry gas seals
- No more unplanned seal related compressor shut-downs
- Reduced service costs

* Source: SWRI & GMRC, Analysis of historical dry gas seal failures - Data in natural gas compressors.

CASE 3

SEAL CONTAMINATION

Seal contamination during pressurized stand-still

Typically affected:

All applications with risk of seal contamination in static conditions, e.g. pipelines, export compressors

Indications

- 34 % of dry gas seal failures are caused by process gas contamination*
- Dirt and liquid contamination found during regular seal service
- Signs of high break-away torque due to liquids "glueing" the seal faces together during start up

Causes

- No primary seal gas supply during stand-still
- Therefore, unfiltered process gas can contaminate the dry gas seal
- Additionally, low temperatures at stand-still can cause that some components of the process gas transform to liquids within the seals

EagleBurgmann solution

- RoTechBooster – centrifugal seal gas booster

Results and benefits

Increased reliability:

- Increased lifetime of dry gas seals
- No more unplanned seal related compressor shut-downs

Further information on RoTechBooster

* Source: SWRI & GMRC, Analysis of historical dry gas seal failures - Data in natural gas compressors.

CASE 4

OPERATION ISSUES

Operation in contact mode (low speed)

Typically affected:

Single shaft compressors, machines driven by steam turbines, pipelines

Indications

- Short operating life, dry gas seal failure
- Low pressure/flow on primary vent
- DGS: Strong contact between sliding faces (mainly secondary seal)

Causes

- Operation in contact mode (stationary seal face and rotating seat of the DGS in contact), e.g. low speed turning, ratcheting and/or long coast-down curves (more than originally specified)
- Extended contact operation causes wear of the sliding surfaces and clogging of the grooves, affecting the lift-off effect and leading to increased torque and temperatures
- Finally, it can lead to thermal cracks in the seal faces and/or leakage alarms on primary vent

EagleBurgmann solution

- DiamondFace coated seal faces (all conditions)
- DGS32 – dry gas seal with carbon seal face (limitations on temperature, pressure and leakage)

Results and benefits

Increased reliability:

- Increased lifetime of dry gas seals
- No more unplanned seal related compressor shut-downs

CASE 5

OPERATION ISSUES

Operation in contact mode with dry nitrogen

Typically affected:

All compressors

Indications

- Wear of carbon dry gas seal faces or contacting separation seal rings

Causes

- Carbon faces offer excellent dry running capabilities. However, if the supplied nitrogen is too dry (i.e. cryogenic source, very pure), the carbon faces will wear due to increased friction and lack of humidity
- The carbon dust can contaminate the gas grooves and affect the lift-off capability
- Increased wear can shorten the seal life time

EagleBurgmann solution

- DiamondFace coated seal faces (all conditions)
- DGS32 – dry gas seal with special grade carbon seal face (limitations on temperature, pressure and leakage)
- CobaSeal – coaxial static lift-off type separation seal
- CSR – contacting carbon ring separation seal with special grade carbon

Results and benefits

Increased reliability:

- Increased lifetime of dry gas seals and separation seals
- No more unplanned seal related compressor shut-downs

CASE 6

OPERATION ISSUES

Low reliability of piston seal gas booster

Typically affected:

All compressors which include a piston seal gas booster in their seal supply system

Indications

- Unavailability of seal gas booster
- Frequent seal gas booster failures
- High service cost / wear on seal gas booster parts
- Low seal gas flow supplied by installed booster
- Unreliable operation of seal gas booster, especially after long time of non-operation

Causes

Piston booster have numerous parts:

- For example small valves are controlling the air supply to the booster and can have problems with icing or contamination
- Also, the piston rings can wear out
- Therefore the service intervals of piston seal gas booster systems are usually short

EagleBurgmann solution

- RoTechBooster – centrifugal seal gas booster

Results and benefits

Increased reliability:

- 24,000 h service interval
- No more booster failures
- Reduced energy consumption
- No limitation with regard to continuous operation

Further information on RoTechBooster

CASE 7

LEAKAGE | LOSS OF PRODUCT

Methane emissions while compressor stands still

Typically affected:

Pipeline and gas storage compressors which are vented frequently

Indications

- High loss of valuable process gas and emission of big amounts of unflared environmentally harmful gas (e.g. methane)

Causes

- Many compressors, especially in pipelines or gas storages, must be vented when they are in stand-still mode due to the limited continuous operation of displacement seal gas boosters
- The venting shall prevent dry gas seal contamination, when the piston booster is switched off

EagleBurgmann solution

- RoTechBooster – centrifugal seal gas booster

Results and benefits

Reduced costs:

- RoTechBooster allows pressurized stand-still
- Saves up to 50,000 € per compressor and year in valuable process gas

Reduced emissions:

- Reduced environmentally harmful gas emissions

Further information on RoTechBooster

CASE 8

LEAKAGE | LOSS OF PRODUCT

Methane emissions during operation and shutdown

Typically affected:

Natural gas compressors

Indications

- Process gas losses on compressors with gas-lubricated or oil-lubricated mechanical seals due to leakage, flaring, and venting.

Causes

- Leakage occurs for technical reasons, releasing methane into the environment directly or producing CO_2 emissions when the compressor is flared.
- When a compressor is shutdown, it is usually vented to prevent dirt and moisture from entering the seal chamber.

EagleBurgmann solution

- CobaDGS zero emission seal – optionally available with high-pressure nitrogen generator

Results and benefits

Increased reliability:

- Prevents about 228,000 m^3 process gas loss (per compressor/year)
- Extreme robustness significantly reduces efforts for maintenance and repair

Eliminates emissions:

- Most climate-friendly sealing solution for turbo compressors

Video: CobaDGS one-stop solution

CASE 9

LEAKAGE | LOSS OF PRODUCT

Excessive loss of process gas

Typically affected:

All centrifugal compressors

Indications

- Dry gas seal leakage of process gas, associated with high costs

Causes

- Every dry gas seal has a small leakage. But leakage rates can be very different depending on seal technology, and often there is potential to substantially reduce leakage rates
- In many processes (i.e. methane, refrigeration), it makes sense to reduce leakage in order to reduce associated costs and emissions

EagleBurgmann solution

- PDGS10 and DGS21 – standard seals for high pressures and low leakage, or another individual leakage optimized solution

Results and benefits

Reduced costs:

- PDGS seals can significantly decrease leakage rates
- Reduction of 100 Nl/min saves over 25,000 €* per year and compressor in valuable process gas

Reduced emissions:

- Reduced environmentally harmful gas emissions

* Based on gas cost of 0.25 €/m³

CASE 10

LEAKAGE | LOSS OF PRODUCT

Outdated oil seals with high leakage and high power consumption

Typically affected:

Compressors with oil-lubricated seals installed

Indications

- High power consumption of sealing system
- High seal oil consumption
- H_2S emission possible
- Oil contaminated process gas
- High and undetectable process gas leakage to atmosphere

Causes

- Oil seals (especially oil bushing seals with a shaft clearance) have relatively high oil consumption which can contaminate the process gas
- The gas leakage is coming from the degassing tanks, where seal oil, contaminated with process gas, is going through, before it is re-used
- The power loss is resulting from friction of the oil seals and the oil pumps which are supplying the seals

EagleBurgmann solution

EagleBurgmann provides outstanding sealing solutions for upgrade projects:

- Oil-to-gas: Short tandem seal (Single DGS + CobaSeal)
- Oil-to-oil: WRS – mechanical oil seal

Results and benefits

Reduced costs:

- Can save up to 100,000 € per year in operational costs
- Can save up to 300,000 € per year in process gas

Ease of implementation:

- Minor or no modification needed to compressor casing with Short Tandem Seal (Single DGS + CobaSeal)

Reduced emissions:

- Reduced environmentally harmful gas emissions

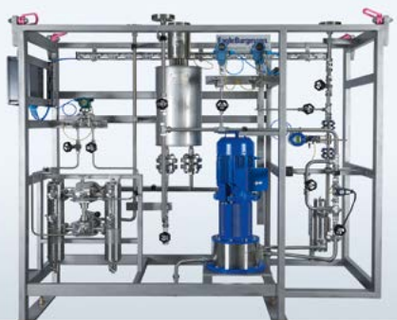
All EagleBurgmann compressor seals at a glance

Compressor seals

- **DGS** – standard seals
- **PDGS** – high pressure seals
- **CobaDGS** – zero emission seals
- **RoTechSeal** – for demanding applications
- **MDGS** – for screw compressors
- **TDGS** – for steam turbines
- **DF-DGS6/PDGS6** – for low vapor margin applications
- **NF941**– for special applications
- **WRS** – oil-lubricated seals
- **EBU800** – oil-lubricated seals

Separation seals

- **CSE** – non-contacting carbon ring seal
- **CSR** – contacting carbon ring seal
- **CobaSeal** – co-axial gaslubricated seal



Gas supply systems

- **SMS –** modular seal management systems and gas conditioning skids
- **RoTechBooster –** centrifugal seal gas booster

Technology

- **DiamondFace** – microcrystalline diamond coating

EagleBurgmann – fast and reliable compressor seal services

With our comprehensive network of special DGS Centers of Competence (CoC) around the world, we support our customers with consulting, assembly, overhaul, repair and acceptance testing services for their dry gas seals.The DGS Centers of Competence are equipped with state-of-the-art machines and dynamic or static testing facilities.

The advantage of the DGS CoC's:

- Global certification according to EagleBurgmann standards
- Worldwide, local support for compressor seals
- Assembly, overhaul and repair of DGS on-site at the CoC
- Reduced costs
- Increased plant availability and improved reliability

Website EagleBurgmann seals for compressors

EagleBurgmann – at the leading edge of industrial sealing technology

Our products are used wherever safety and reliability count: in the industries of oil & gas, refineries, petrochemicals, chemicals, pharmaceuticals, food, energy, water and many more. About 6,000 employees contribute their ideas, solutions and dedication every day to ensure that customers around the globe can rely on our seals. With our modular TotalSealCare Service, we emphasize our strong customer orientation and offer custom-tailored services for every need.
Rely on excellence.

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