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### Gas Compressor Dry Gas Seal

**Penny Sang**

Senior Process Engineer, PEng MIEM, CEng MICHemE, FSEng (TÜV Rheinland)

Dear all, I would like to get opinion regarding the use of dry gas seal in centrifugal compressor. During compressor blowdown, is seal gas still required to be supply to the compressor? Normal seal gas supply is process gas from compressor discharge. Appreciate your valuable opinion. Thanks...

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Mojtaba

**Mojtaba Habibi**

Process Engineer at Wood Group

Based on my experience this depends on compressor shutdown and depressurization philosophy. Usually emergency case like fire and gas detection or compressor seal failure involves compressor shutdown with subsequent automatic depressurization. For other cases compressor will be subjected to pressurised shutdown at settle out pressure with permissive depressurization. During compressor pressurised shutdown the continuity of seal gas should be ensured. I have seen different methods for provision of seal gas to compressor during pressurised shutdown such as external gas supply from available export pipeline, using booster compressor feeding by compressor suction manifold, provision of buffer vessel and etc.

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Penny

**Penny Sang**

Senior Process Engineer, PEng MIEM, CEng MICHemE, FSEng (TÜV Rheinland)

hi mojtaba, thank you for your response. When compressor shutdown with depressurization, not pressurized shutdown, is seal gas supply still required? Process gas still contained in the system at the start of depressurization, is there any concern of damaging the seal due to the leakage of unfiltered process gas through the seal faces or condensation issue?

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Mojtaba

**Mojtaba Habibi**

Process Engineer at Wood Group

"When compressor shutdown with depressurization, not pressurized shutdown, is seal gas supply still required?"

In my view Yes. What is your concern?

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Penny

**Penny Sang**

Senior Process Engineer, PEng MIEM, CEng MICHemE, FSEng (TÜV Rheinland)

I have different opinion from different engineer and vendor. Some said not required as when compressor shutdown, shaft is not rotating, both seal faces already in contact by the force of spring that reduce the leak to the primary seal vent. During blowdown, process gas tends to relieve through the blowdown ro which has less restriction compare to the seal labyrinth. Therefore

the leak through the seal is very minimal. In my current project, compressor vendor can accept no external seal gas supply. However, there is other vendor that insist to have it during the entire blowdown period. During ESD, all system shutdown, no gas supply, will the seal damage?

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Alireza

**Alireza Rashidkhani**

Senior Process Engineer at CH2M HILL

Top Contributor

Hi,

Dry gas seal is used to keep the process gas inside the casing, and away from lube oil. (It can have different arrangements like only primary seal, or with secondary and tertiary separation gases).

The source of supply is either internal (from the compressor discharge) or external depending on the operation mode.

In case the seal gas pressure is not sufficient (For your case it happens when difference between suction and discharge are lower than a set value), (Air operated) booster compressors to be used. These modes are usually limited to start-up, coast-down and SOP.

However, blow-down, comes after a trip, which itself means no rotation and it means that all the required utilities have been supplied to ensure that the compressor is stopped safely.

As to your concern, even if seal gas is supplied during blow-down, due to the stagnant conditions, the mating part and primary part cannot be separated and still remain attached, hence there should not be any concern about gas escape and/or lube oil ingress, hence, you don't need to have your seal gas running into DGS.

Your concern (to my experience) should mainly be about the depressurization rate impact on the seal. I would recommend checking the depressurization rate with the DGS supplier to ensure the pressure reduction rate is safe for your seals (in terms of bars per minute or equal) and to ensure that seals are bi-directional so that reverse rotation is not a concern.

To conclude, it is definitely another fact that seals are proprietary equipment and your DGS supplier should confirm the seal integrity during the depressurization and that will be the final verdict.

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Penny

**Penny Sang**

Senior Process Engineer, PEng MIEM, CEng MIChemE, FSEng (TÜV Rheinland)

Hi, alireza, thanks for supporting my point. I understand that seal integrity is a concern during depressurization. Therefore, we need to limit the blowdown duration to typically 20 bar/minute to maintain the seal integrity. I received another argument that said if the compressor is run by turbine, it will not stop immediately. Therefore, process gas can still leak through the seal as the shaft is still rotating initially. Will that be a concern if the leak is expected to be minimal?

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Alireza

**Alireza Rashidkhani**

Senior Process Engineer at CH2M HILL

Top Contributor

Hi,

sorry for belated reply. Below is my opinion, hopefully can throw some light:

I don't see this leakage as a big concern, during coast down, you have the seal gas supply to the DGS that prevent back flow of the process gas, this should include the whole shut down process till compressor is fully stopped. on the other hand, once the pressure difference across the machine is low, booster compressor on the seal gas panel will kick in to maintain the supply to DGS.

Please note that no compressor stops immediately, so this is not specific to the turbine driver type. Further, your compressor vendor shall ensure a safe shut down and I am sure that they have programmed their UCP and ESD-UCP with proper delays and etc. to land in a safe situation during shut down.

Altogether, you should not be worried about a minimal leakage through your seals as it is a very remote scenario.

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Mojtaba

**Mojtaba Habibi**

Process Engineer at Wood Group

Dear Mr.Rashidkhani,

You mentioned that:

"In case the seal gas pressure is not sufficient (For your case it happens when difference between suction and discharge are lower than a set value), (Air operated) booster compressors to be used. These modes are usually limited to start-up, coast-down and SOP.

However, blow-down, comes after a trip, which itself means no rotation and it means that all the required utilities have been supplied to ensure that the compressor is stopped safely.....Further, your compressor vendor shall ensure a safe shut down and I am sure that they have programmed their UCP and ESD-UCP with proper delays and etc. to land in a safe situation during shut down "

1. Could you please explain what is the difference between "coast down" and "trip" at this part of your explanation?
2. Which set point is usually used for booster compressor start-up? should it be settle out pressure? Which source of gas is feeding booster compressor?
3. Based on your experience how long is reasonable time to keep the compressor at pressurised shutdown state?

Many thanks for your time and help.

Best,  
Mojtaba

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Alireza

**Alireza Rashidkhani**  
Senior Process Engineer at CH2M HILL  
Top Contributor

Dear Mojtaba,

\* Coast down comes after the trip signal is generated. during coast down, compressor rotation speed is reduced till it does not rotate any more.

\* In my compressor experience, vendors were using the set point of 5 bar across the compressor to switch the boosters on. Guess it could be a vendor dependent variable.

\* It was recommended to keep the compressors pressurized by around 4 hours in one of the projects, in the other one it was 8 hours.

Hope it is useful for you.

Regards,  
Alireza

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Mojtaba

**Mojtaba Habibi**  
Process Engineer at Wood Group

Dear Alireza,

You mentioned that:

"In case the seal gas pressure is not sufficient (For your case it happens when difference between suction and discharge are lower than a set value), (Air operated) booster compressors to be used. These modes are usually limited to start-up, coast-down and SOP.

However, blow-down, comes after a trip, which itself means no rotation and it means that all the required utilities have been supplied to ensure that the compressor is stopped safely.

As to your concern, even if seal gas is supplied during blow-down, due to the stagnant conditions, the mating part and primary part cannot be separated and still remain attached, hence there should not be any concern about gas escape and/or lube oil ingress, hence, you don't need to have your seal gas running into DGS."

1. Could you please explain what do you mean by "mating part and primary part" ?
2. From this explanation you mean during pressurised shutdown period (4-8 hours based on your experience) the booster compressor is running and providing seal gas to DGS but during blowdown(either as partial or complete blowdown) no need to have this booster compressor running?

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Benny

**Benny Varghese**  
Commissioning Engineer

- 1) During blow down is seal gas still required to be supply to the compressor- YES
  - 2) Normal seal gas supply is process gas from compressor discharge
  - 3) Seal gas supply pressure required 5 PSI more than balancing pressure(taken from balancing drum & suction side) normally seal gas taken from compressor discharge line because discharge pressure higher than seal gas supply pressure.
- Dry gas seal

Primary seal: - To protect seal the soar gas (process gas)

Secondary seal:-To protect sweet gas (seal gas) should not enter in to bearing housing for that they are using inert gas (nitrogen)as a secondary sealing protection.

Generally an additional line from Compressor discharge common header connecting to the seal gas line

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Alireza

**Alireza Rashidkhani**

Senior Process Engineer at CH2M HILL

Top Contributor

Hi Mojtaba,

1) Mating part is the rotating part of a DGS, and the primary part is the stagnant (non rotating or static part of the seal) rotating part is lifted during rotation due to dynamic force of the fluid between the two parts.

2) I cant remember exactly what was the requirement(goes back to 4 years ago almost). In first glance, compressor pressurized SD looks similar to the conditions before start of blowdown ie. no rotation, hence you may not need the seal gas supply However there is a small difference: in a prolonged pressurized SD, you will have the pressure in the casing for a longer while, that could lead to a considerable process gas ingress and seal contamination. so it is safer to have the seal lines pressurized up to the labyrinth and on the shaft to minimize this. (The pressure difference between the seal gas supply filter and the shaft for my case was 1 bar, but it could be other values as mentioned by others here),

To conclude, as soon as you give the blowdown permissive, you wont need the seal gas supply, as you are loosing the pressure and contamination is more and more unlikely, however, during a pressurized SD, you still may need it.

Below are the different barriers used in a DGS system:

- Seal Gas(primary): Gas injected inboard of a seal or the innermost seal of a set, to prevent the seal being damaged by any constituent or contaminant (solids, liquids etc.) present in the process gas. (May be the same as process gas)

- Buffer Gas (optional): Gas (not process gas) which is injected between a pair of dry gas seals, to ensure that any gas leaking from a seal assembly is acceptable to the environment.

- Separation gas (optional): A supply of inert gas or air fed into the region between the seal - or the outermost seal of a set - and the shaft bearing.

Regards,

Alireza

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