

Energy Transition

Curbing CO₂ Emissions With Seal Gas Recovery Systems

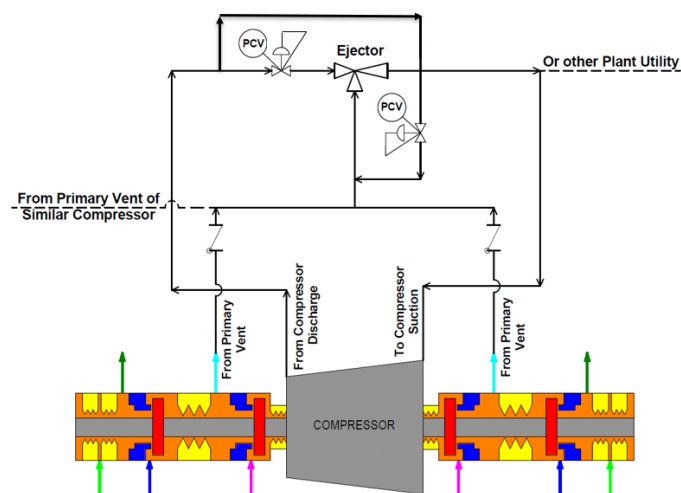
In its [2023 World Energy Outlook](#), the International Energy Agency (IEA) cites the most important measures for reducing oil and gas emissions. Eliminating non-emergency flaring is second only to tackling fugitive methane. Approximately 140 bcm of natural gas is flared globally each year. This represents a major source of emissions and a significant drain on overall operational efficiency. In an oil and gas landscape where flaring and venting emissions are subject to stricter regulations — and more companies have committed to net zero and decarbonization targets — there is a clear need for cost-effective solutions that capture vented process gas.

John Crane's Seal Gas Recovery (SGR) system captures leaked gas and prevents it from entering the flare line. The result is lower emissions, enhanced operational efficiency and the possibility of utilizing captured gas for a more productive purpose.

Working Principle

Dry gas seals leakages from primary seals are continuously released to the flare across the primary vent modules of a seal gas panel. The SGR system diverts this gas from the normal flare line, recompresses it and reinjects it into the process. To accomplish this, it utilizes an ejector fed by an external high-pressure motive gas. The motive gas typically is spilled from the compressor discharge or comes from another available source. The leakage compressed at the discharge of the ejector is injected back into the compressor suction or into an alternative site. These alternative sites could include the suction line of another compressor, a fuel gas heater or another gas seal support system [1].

During upset conditions, the system is capable of bypassing the ejector automatically to restore the original route of leakages to the flare.



SGR basic working scheme – 1

Amid all the challenges of the energy transition, few require more urgent attention than reducing natural gas emissions from non-emergency flaring.



By capturing
leaked gas and
making it available
for other purposes,

John Crane's SGR system equips operators
to meet the latest environmental regulations,
enhance overall efficiency and achieve
tangible progress toward
net zero goals.

Features and Benefits

A “maintenance free” solution, the SGR system does not feature any devices with mobile or wearable components; this maximizes reliability and the mean time between repair (MTBR). The system is also customizable so that it is fully compliant with end user specifications. The compressor shutdown is not mandatory for SGR installation and commissioning.

Through the recovery of valuable process gas, the SGR system enables compliance with the latest governmental and corporate policies on emissions reduction. The system decreases the carbon intensity of the compressor; this can open the door to reduced taxation related to the operation’s carbon footprint.

Beyond the benefits of regulatory compliance, the SGR system also delivers cost savings through recovered process gas, which can be diverted to other purposes to reduce product loss.

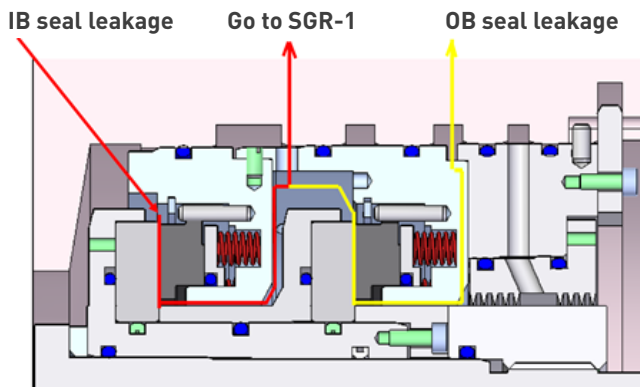
Applications

The SGR system is applicable to centrifugal compressors with tandem dry gas seals (2) and the availability of high-pressure motive fluid. “High value” gas further enhances the SGR system’s value.

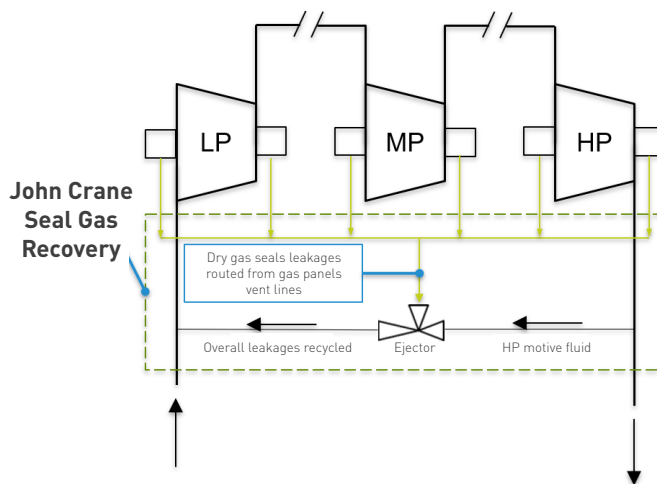
In the case of a nitrogen presence in the primary vent line, the approval of nitrogen reinjection is required from the customer’s process engineering team. In applications with multiple compressor trains, John Crane can engineer custom SGR arrangements and support customers across the conceptual study (3).

Carbon Intensity Savings

To demonstrate the SGR system’s potential carbon intensity savings, consider a methane venting operation with average methane emissions of 18Nm³/h from each dry gas seal of a between-bearing compressor. Assuming continuous operation, the operator would save net 5615 equivalent metric tons of CO₂ per year by utilizing the SGR system. This is equivalent to the average CO₂ yearly emissions of 1220 cars, based on [Environmental Protection Agency estimates](#). In the below example, the value for “Potential Yearly Cash Saved” is driven by the recovered gas value and carbon footprint reduction. John Cane can support the payback assessment, which will vary upon the application, end user and country of installation.



Tandem dry gas seal arrangement – 2



SGR with compressors in series – 3

Recovered gas saving

Specific customer costs of gas until compressor [\$/Nm ³]	0.08
Normal conditions density [kg/m ³]	0.73
Specific customer costs of gas until compressor [\$/ton]	109.6
Total each seal leakage recovered [Nm ³ /h]	18.0
N° of compressors	1
N° of seal per compressor	2
Yearly utilization compressor	100%
Seal leakage recovered [Nm ³ /year]	315360
Seal leakage recovered [kg/year]	230212.8
Seal leakage yearly value [USD]	\$25,228.8
Carbon emissions factor (CO _{2e}) [kg to metric-ton]	0.025
Total annual equivalent CO₂ emissions [metric-ton/year]	5755.32

Energy cost to compress motive fluid

Plant energy cost [\$/kWh]	0.03
Motive fluid [Nm ³ /h]	288
Normal conditions density [kg/m ³]	0.73
Specific compression power motive fluid [kW per kg/h]	0.11
Power [kWh/year]	196471.3
Energy expenditure yearly [USD]	-\$5,894.14
Carbon emissions factor (CO _{2e}) [kg to MWh]	0.0007
Total annual equivalent CO₂ emissions [metric-ton/year]	139.72

Penalties related to emissions - carbon pricing

Emissions trading systems (ETS) per metric-ton [\$]	11,37
Carbon tax per metric-ton [\$]	0.00
Total annual (ETS) potential cost [\$]	63849.39
Total annual carbon tax cost [\$]	0.00
Total yearly carbon pricing [USD]	\$63,849.39
TOTAL YEARLY CASH SAVED [USD]	\$83,184.05

Conclusion

Amid all the challenges of the energy transition, few require more urgent attention than reducing natural gas emissions from non-emergency flaring. By capturing leaked gas and making it available for other purposes, John Crane's SGR system equips operators to meet the latest environmental regulations, enhance overall efficiency and achieve tangible progress toward net zero goals — without impacting the reliability of the whole unit by introducing complex seal solutions or additional rotating machines.

Explore John Crane's full portfolio of greenhouse gas (GHG) emissions management solutions. Then, contact our experts to accelerate your sustainability progress.



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