



GTEN 2019 Symposium

October 21-23, 2010 | Banff, Alberta

Reducing Methane in Transmission & Storage – Centrifugal Gas Compressors

19-GTEN-304

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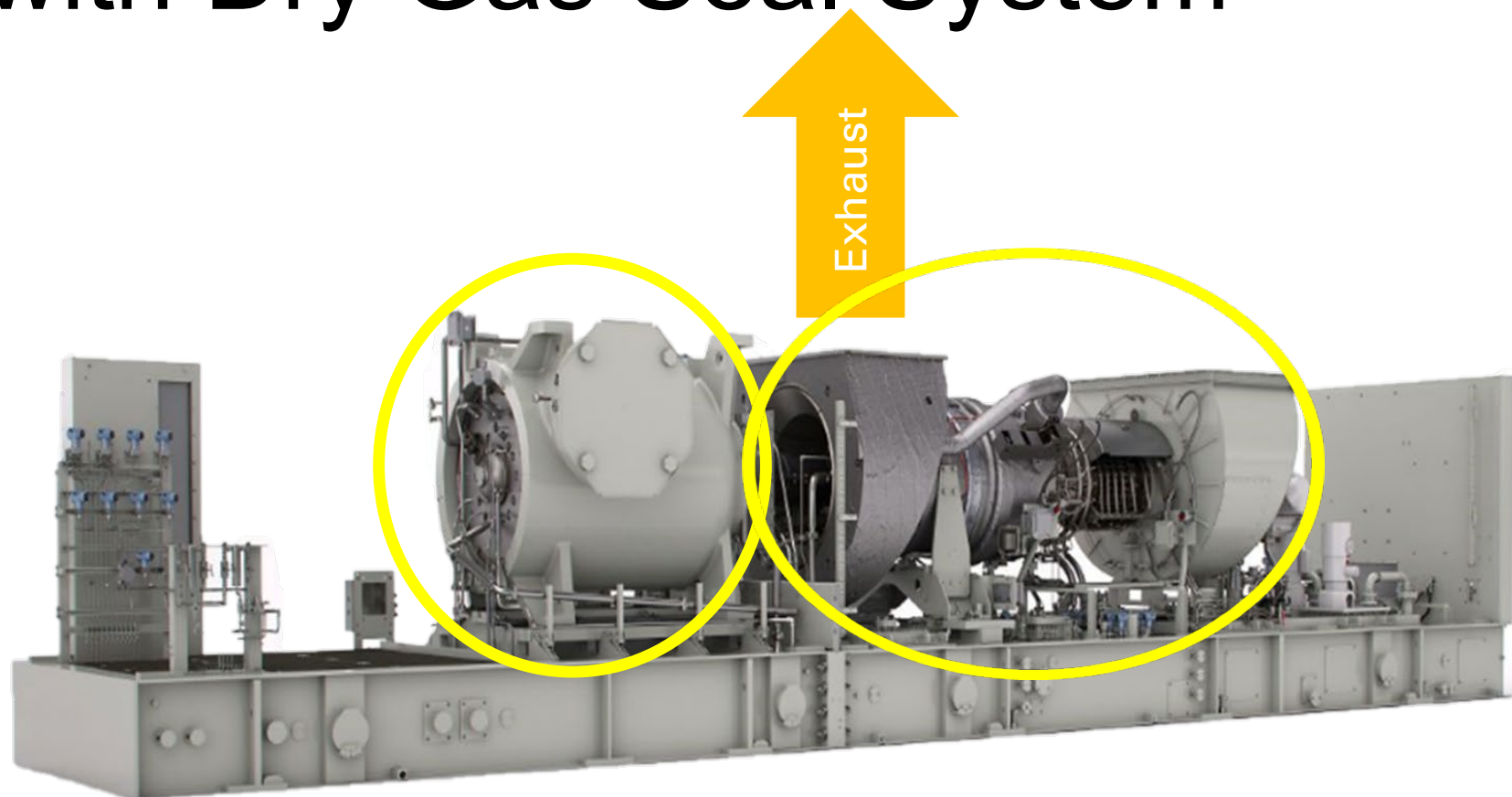


Agenda

- Regulatory Developments for Centrifugal Gas Compressors
- Centrifugal Gas Compressor Methane Emissions
- Methane Emissions Management



Gas Compressor Package with Dry Gas Seal System





Background – Compressor Regulations – N. America (Federal CAN/USA +AB/BC)

- Voluntary Reductions Obviate Regulations
- Production Focus
- EPA 2012 OOOO – ‘Upstream’ Wet Seal Compressors - VOC
- (Paris 2015)
- EPA 2016 OOOOa – Midstream – Methane – DGS NA
- ECCC 2018 – Precedent for World – DGS Limits
 - AB – D060; BC 286/2018 (amends 282/2010 D&P Reg of OGAA)



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CANADA – Centrifugal Compressor Seal Emissions Limits*

Rule	01 Jan 2022	01 Jan 2023
Federal - ECCC		
New		0.14 m3/min (4.94 scfm)
Existing		<5 MW: 0.34 m3/min (12.0 scfm) ≥5 MW: 0.68 m3/min (24.0 scfm)
Alberta – D060		
New (on/after 1/1/22)	0.057 m3/min (2.0 scfm)	
Existing (prior to 1/1/22)		0.17 m3/min (6.0 scfm)
British Columbia – 286/2018		
New (on/after 1/1/21)	0.057 m3/min (2.0 scfm)	
Existing (prior to 1/1/21)	0.17 m3/min (6.0 scfm)	

*Limit per compressor, standard m3/min



Venting and Flaring Limits – CAN Federal – Large Facilities

- **‘LARGE’** = facility producing and receiving at least **60 000 m³ of hydrocarbon gas in any of the previous five years of operations**
- As of **January 1, 2023**, facilities delivering/processing 60,000 m³ of hydrocarbons per year **must not vent more than 15,000 m³ per year**. Exemptions – blowdowns, SUSD, and emergencies.
- As of **January 1, 2023**, facilities using natural-gas-powered **pneumatic controllers** must ensure that on-going emissions remain below **0.17m³ per hour**. Exemptions for safety/response time concerns.
- As of **January 1, 2020...LDAR 3x/yr...repair within 30 days of discovery (operating)** [LEAK = 500 ppmv HCs]

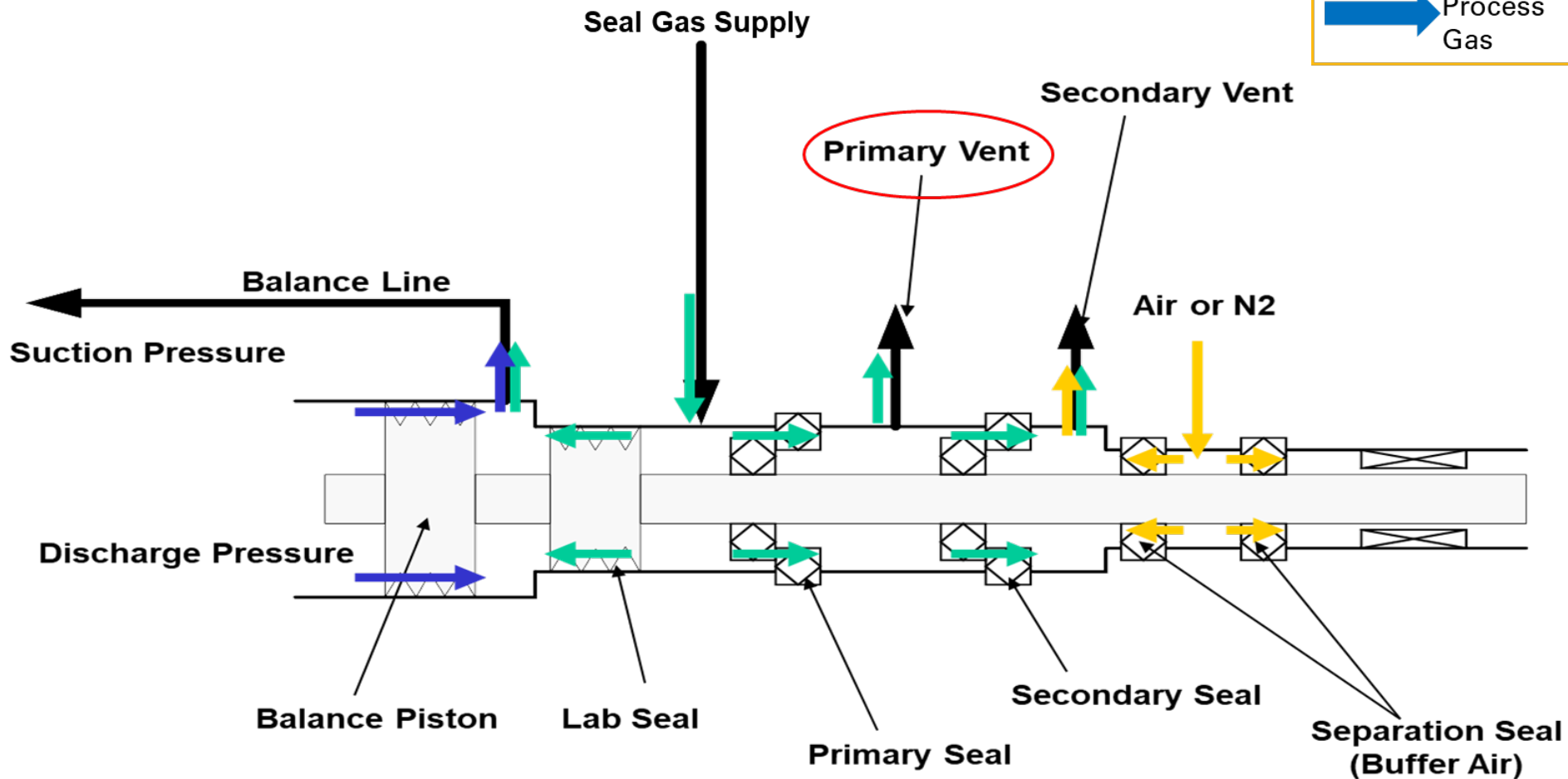
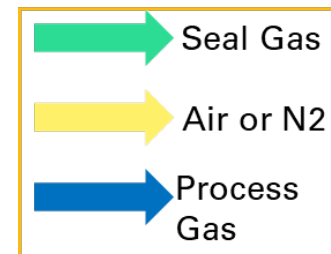


Midstream Compressor Regulations - USA

- EPA 2016 OOOOa
- State Regulations
 - California
 - Colorado (Reg 7)
- New in 2017/18: State Regs AND Permitting - Compressor Stations
 - Colorado, New Mexico
 - Maryland, New York
 - Pennsylvania, Virginia



Dry Seals





Dry Seals

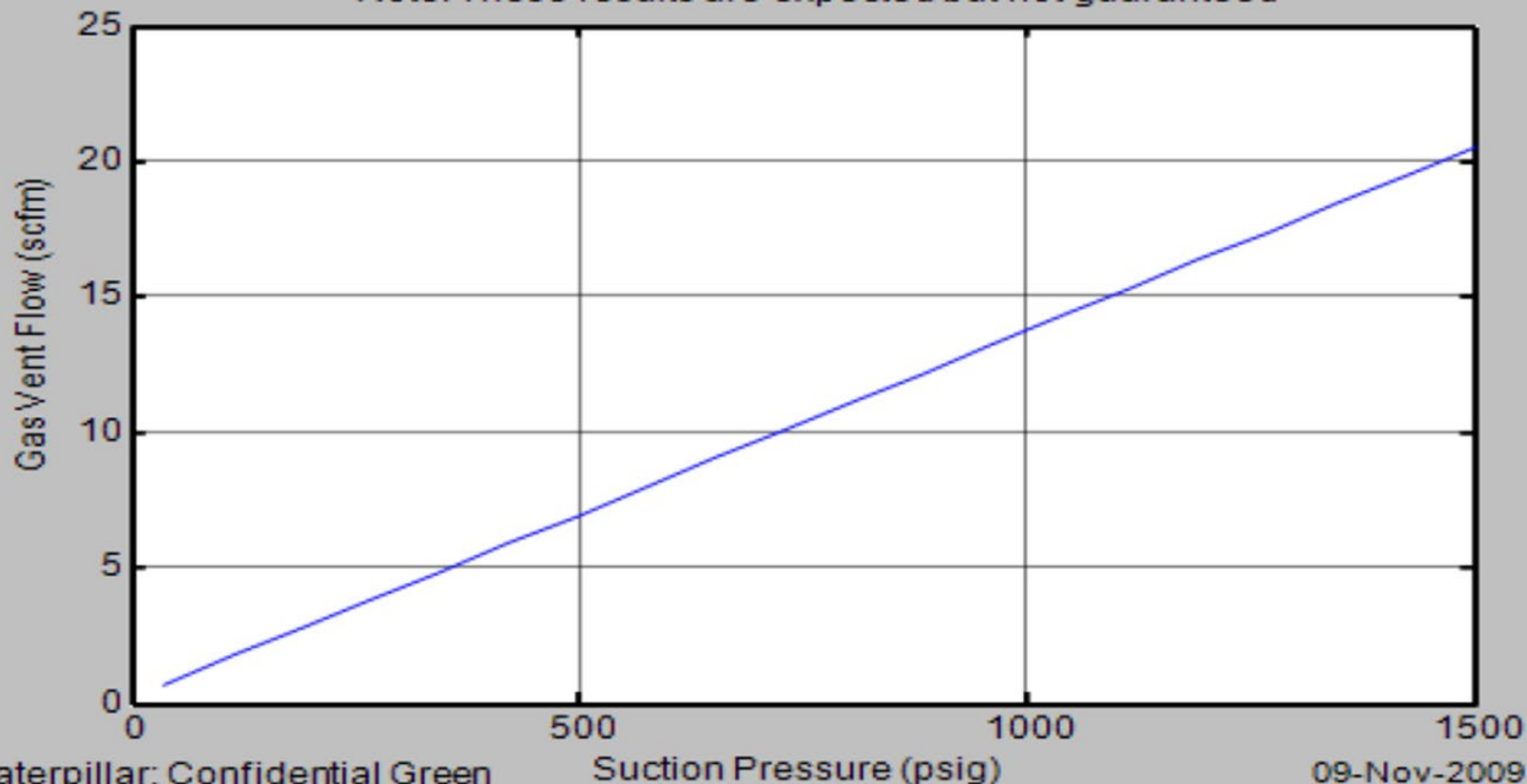
Solar Turbines Incorporated
Compressor Model: C45

Gas Compressor Dry Gas Seal Vented Gas

SG: 0.6 - Gas K: 1.297 - Gas Temperature: 120 ° F

Results based on the maximum dry gas seal dynamic leakage flow

Note: These results are expected but not guaranteed

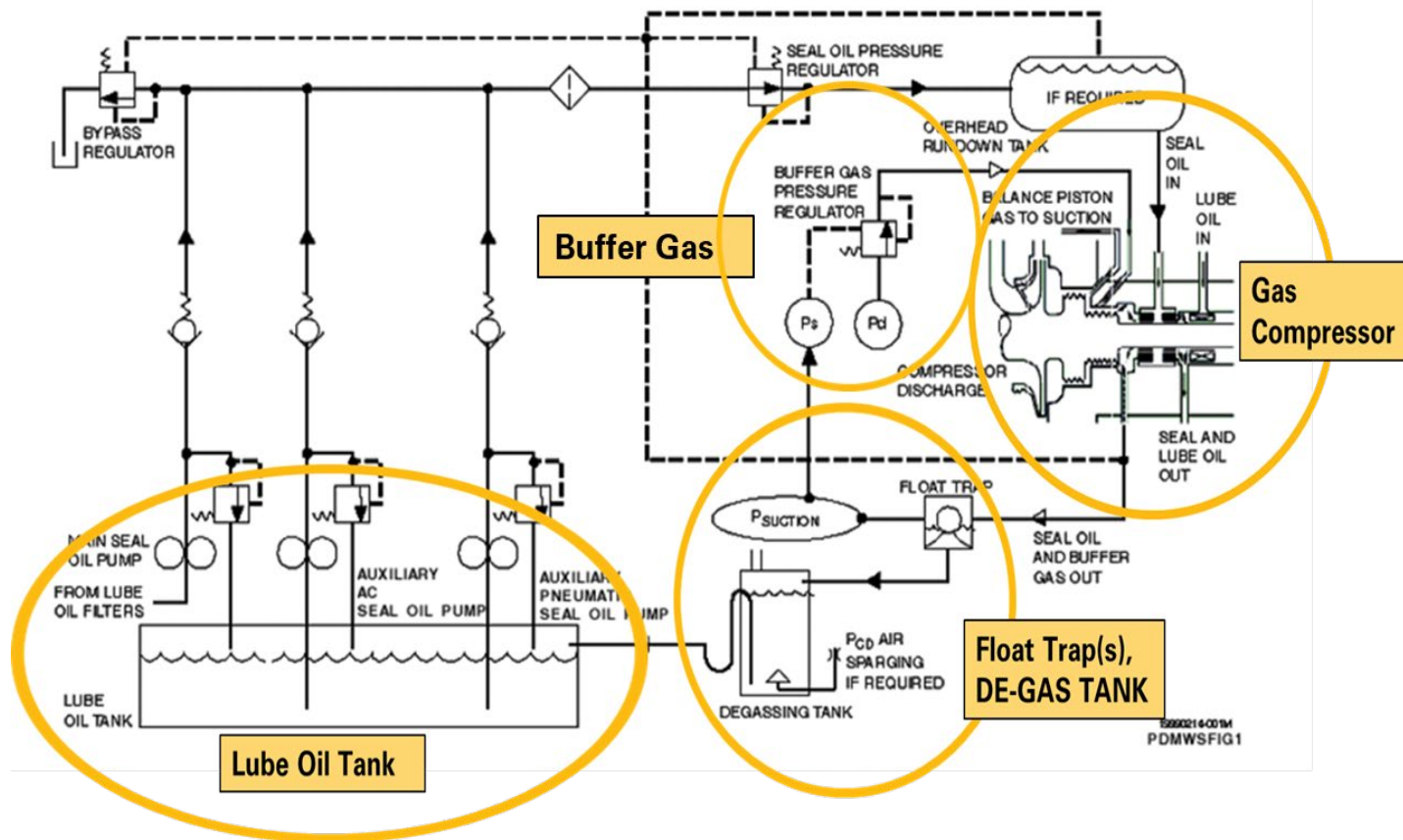




Wet Seals

Wet Seal Emissions

- 40-200 scfm (EPA)
- System Config
 - De-gas
 - Recycle/ Venting
- Measurement
 - Volume
 - AND
 - Speciation





Methane Emissions Management Options



**Wet Seal to Dry Gas Seal
Conversion**

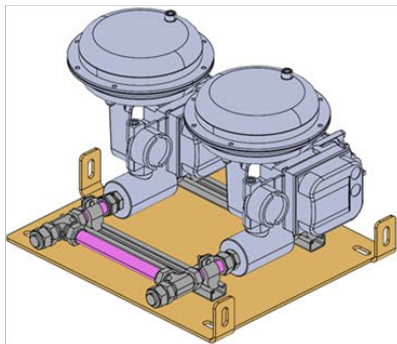


**Electric Seal Gas Booster
to Avoid Venting
(Pressurized Hold)**

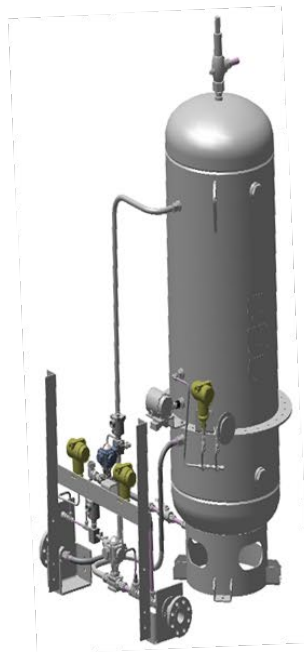




Methane Emissions Management Options - DGS Thermal Oxidation



**Primary Vent
Back Pressure System**



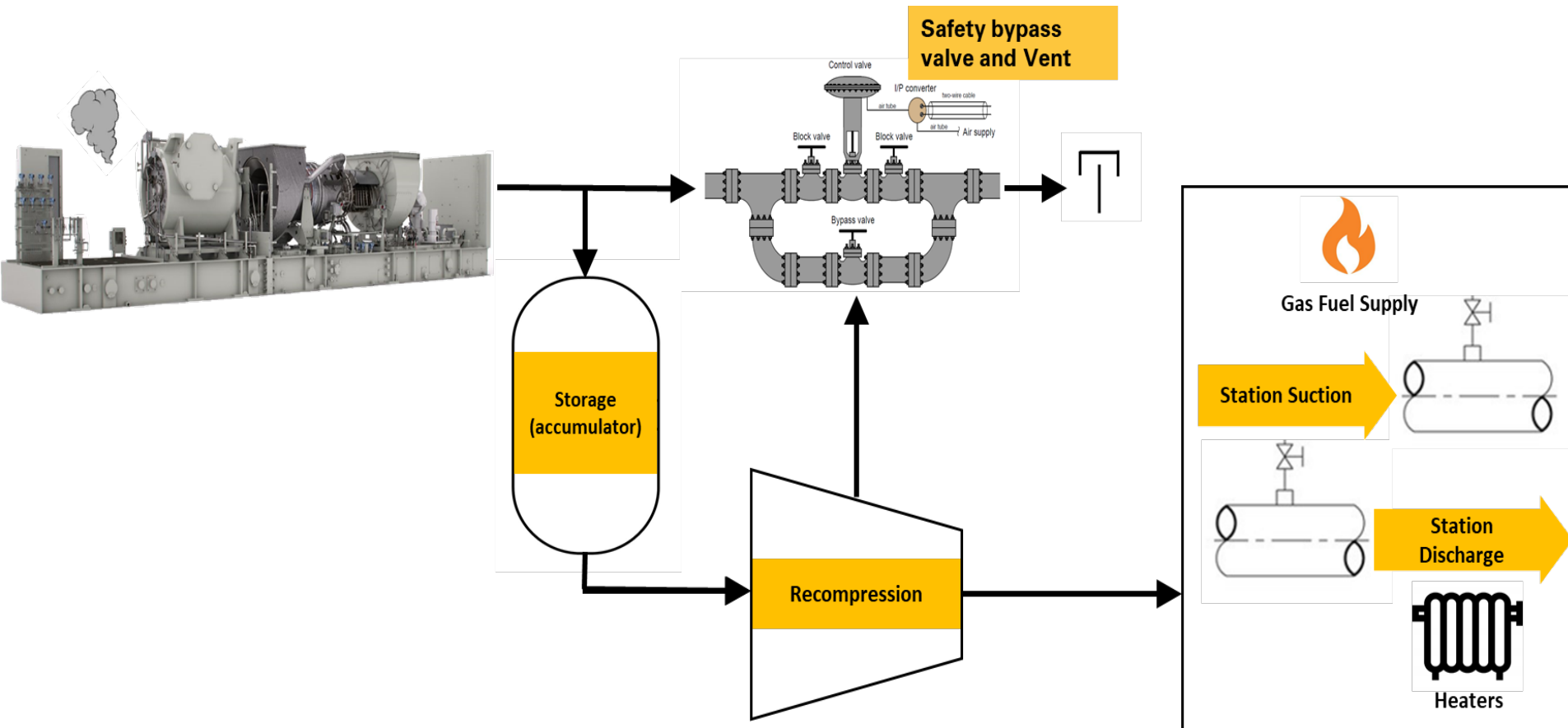
Accumulation System



Enclosed Burner



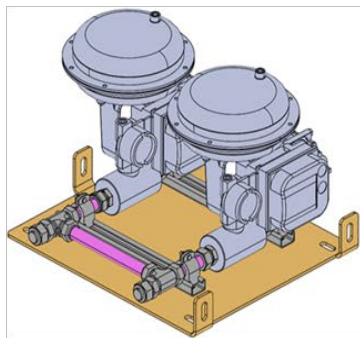
Recompression System Product Concept - DGS





Dry Seal Recompression System

Methane is captured while process compressor is in operation
Pressure is increased from 0.2 bar (3 psi) to 138 bar (2000 psi)



**Primary Vent
Back Pressure System**



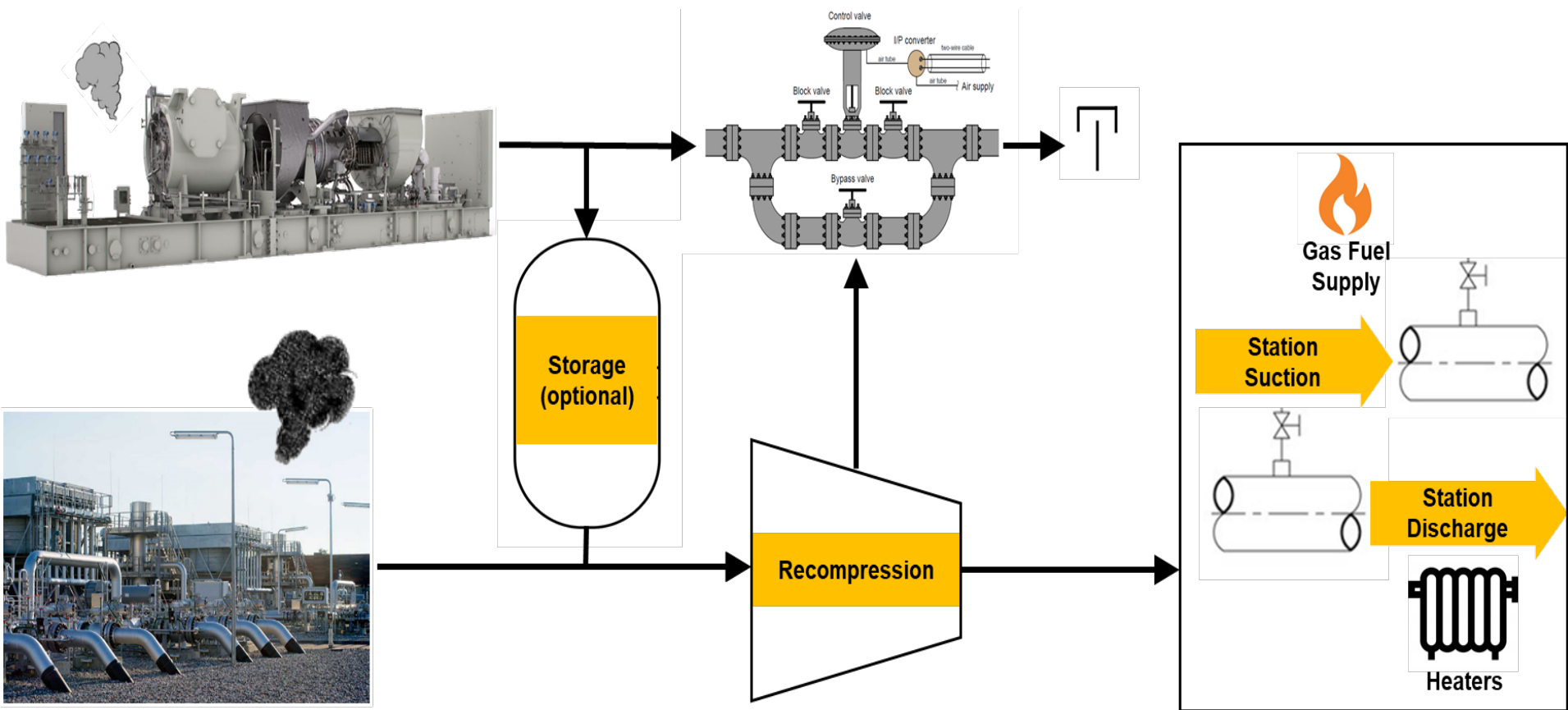
**Accumulation
System**



**Motor-Driven Reciprocating
Compressor**

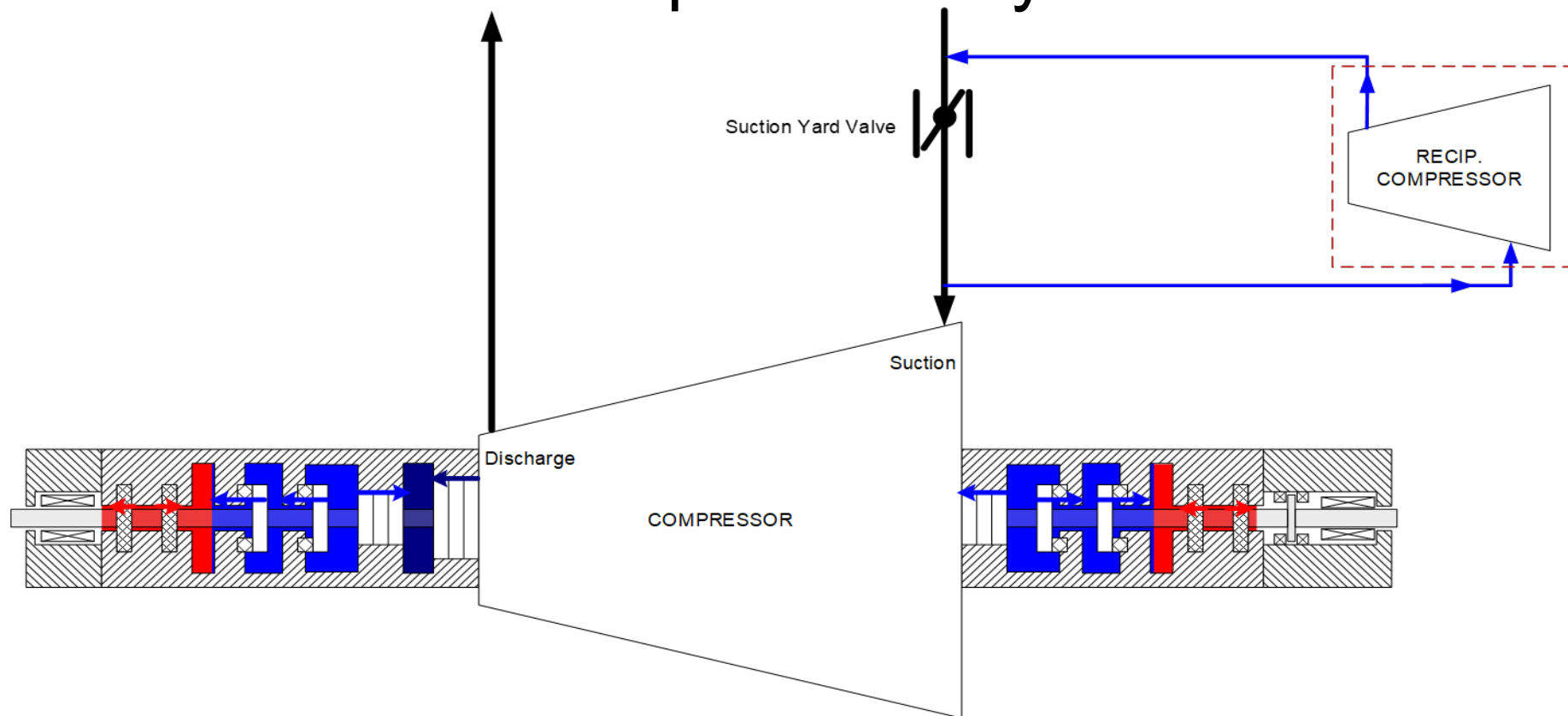


Recompression System Product Concept – DGS and Process Venting





Process Vent Recompression System



Captures gas between suction and discharge valves

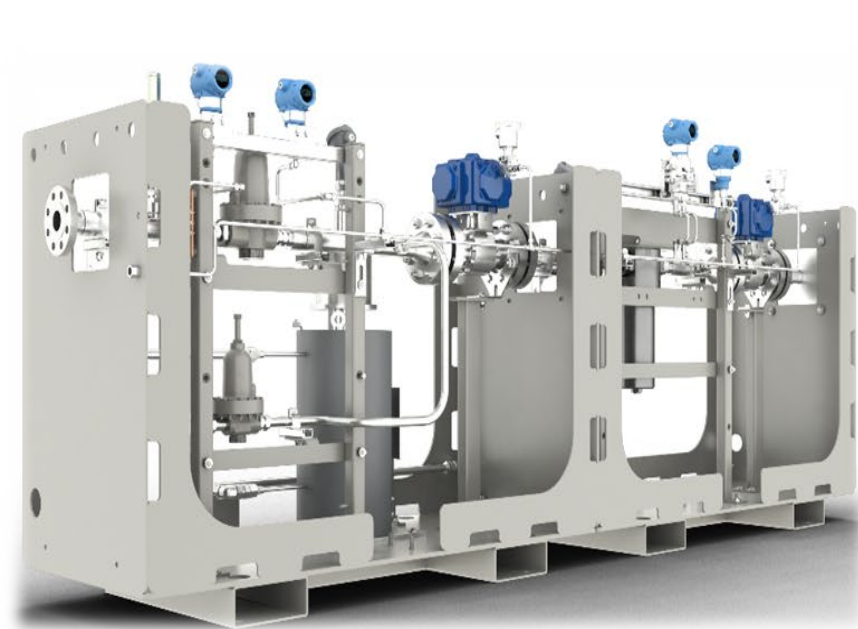
Operational when depressurizing process gas compressor during a non-emergency shutdown

The compressor is depressurized to at least 30 psig before the unit process vent is opened

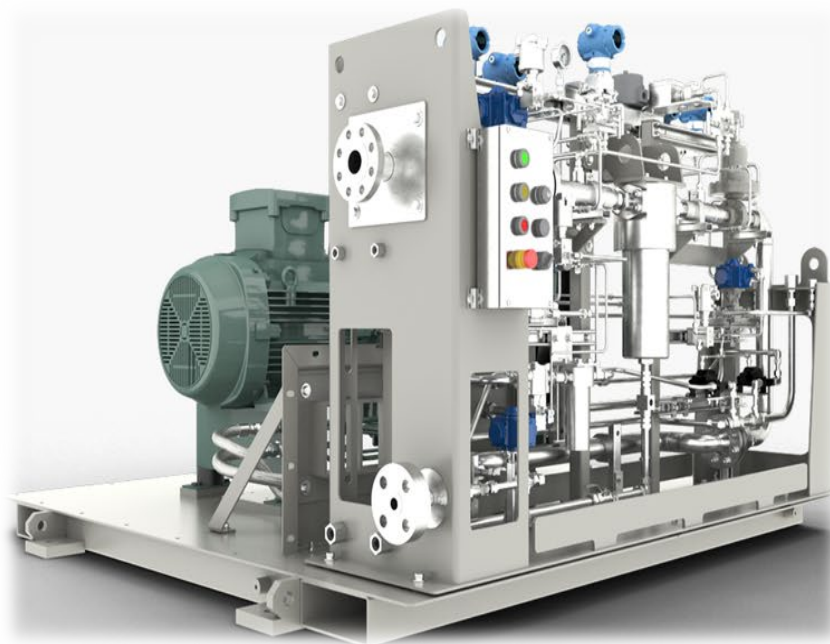


Process Vent Recompression System

Sizing based on depressurization time



Process Gas Recovery & Reconditioning System

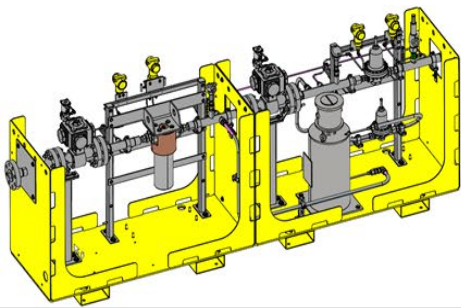


Motor-Driven Reciprocating Compressor

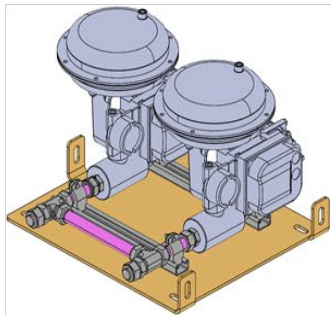


Process & Dry Seal Recompression System

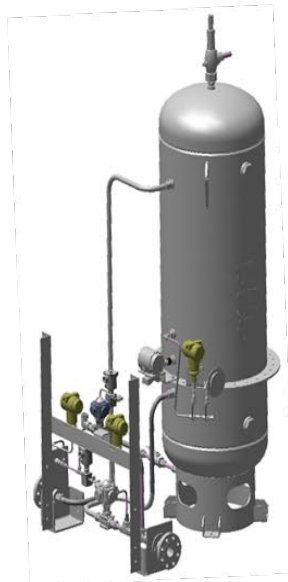
Combination of Process Vent & Dry Seal Solutions



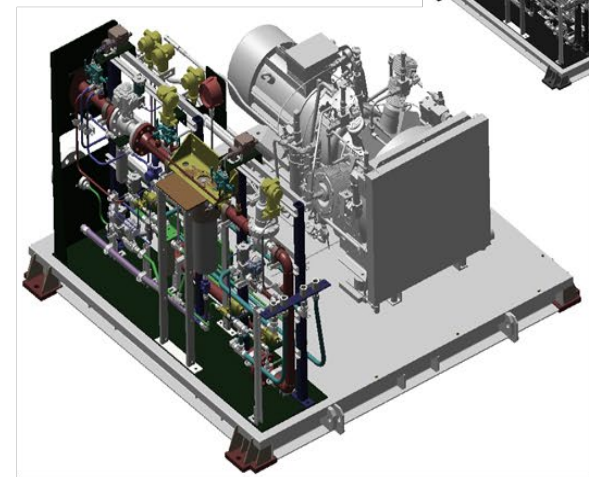
Process Gas Capture & Reconditioning System



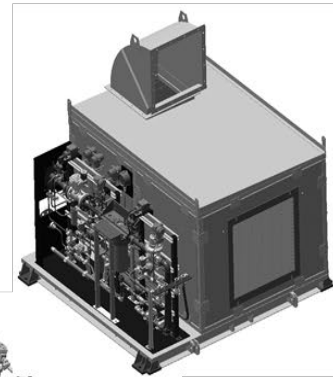
Primary Vent Back Pressure System



Accumulator System



Motor-Driven Reciprocating Compressor





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THANK YOU

Solar Turbines

A Caterpillar Company

