



DRESSER RAND

Carbon Dioxide Compression

ASME - IGTI Turbo Expo

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Safe Harbor Disclosure



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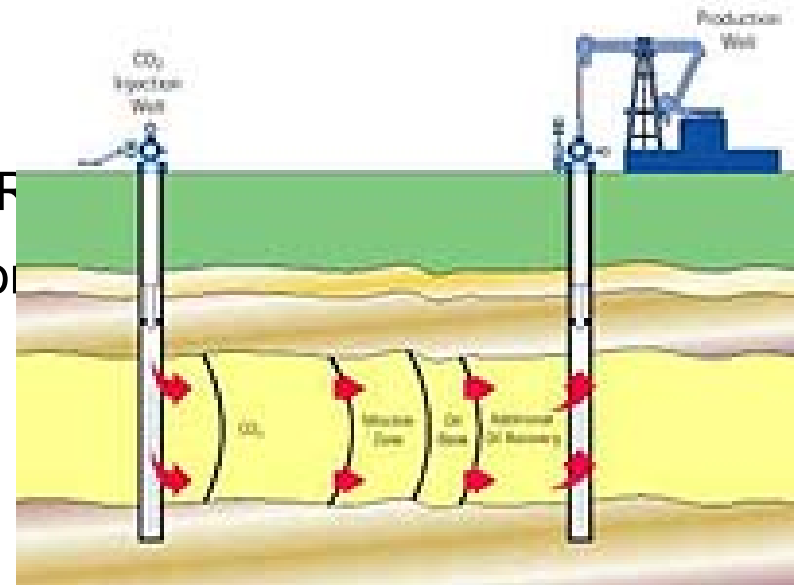
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CO2 Compression Applications

- ◆ **CO2 pipeline transmission**
- ◆ **CO2 production**
- ◆ **CO2 injection - enhanced oil recovery**
- ◆ **Feedstock for urea & fertilizer plants**
- ◆ **Food & beverage processing**
- ◆ ***Greenhouse gas sequestration***

CO₂ Miscible Flooding

- ◆ CO₂ Injection for EOR has a four-fold benefit
 - Lowers viscosity of the oil in place.
 - Provides a measure of pressure drive.
 - Can penetrate more types of rocks better than other enhancing agents.
 - leaves a cleaner well.
- ◆ CO₂ Injection proven to be one of the most efficient EOR methods since its introduction in the early 70's.



CO2 Compression Experience

◆ Centrifugal

- 93 units, first shipped in 1948, most recent 2007
- Max discharge pressure = 2,580 psig (178 bar)
- Max inlet flow = 48,300 acfm (82,100 m³/hr)
- Max power = 15,600 bhp (11,640 kW)
- Total installed power > 350,000 bhp (>261MW)
- Installed in 16 different countries

Datum Multistage Centrifugal



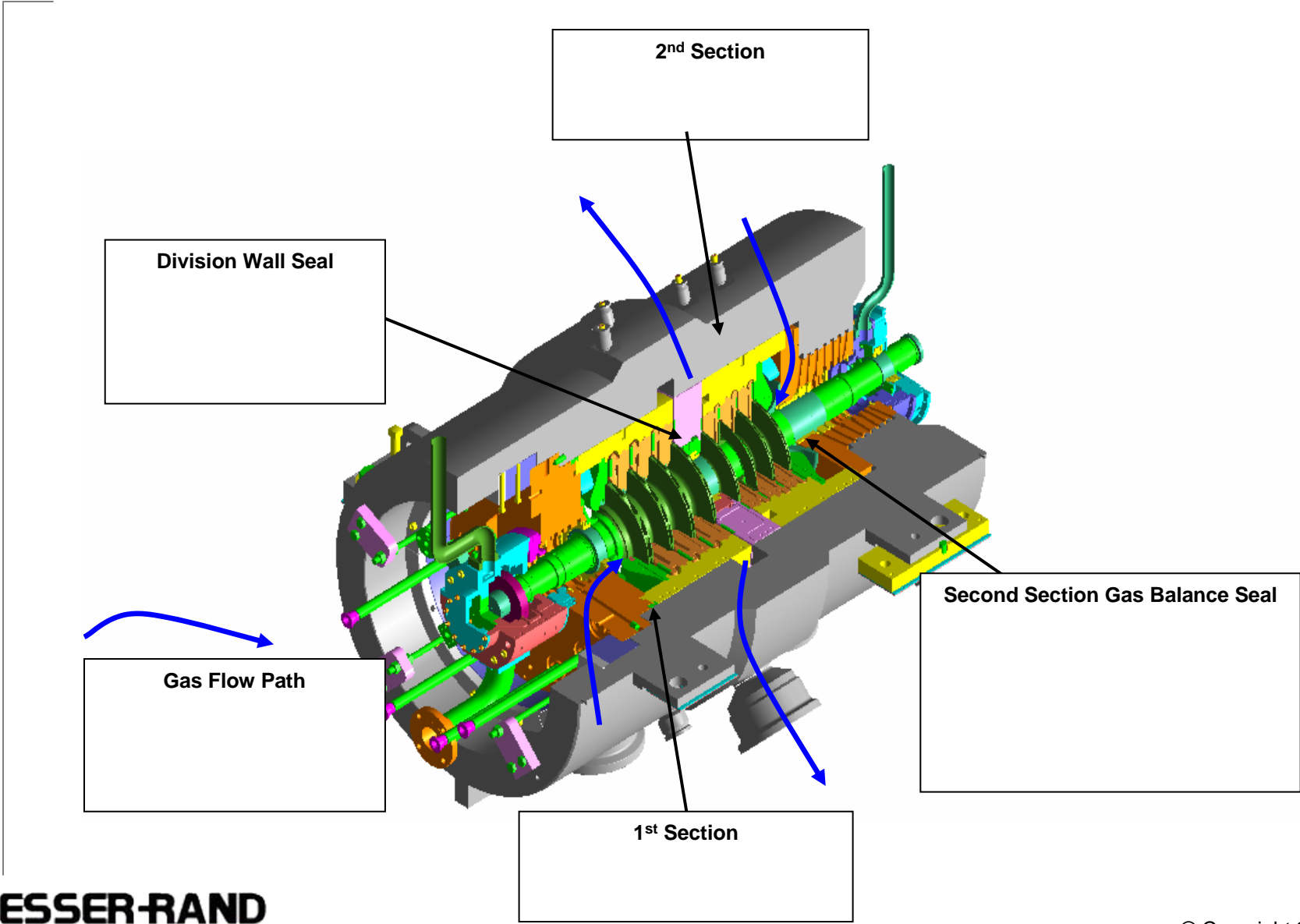
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Typical CO2 Booster Compressor - D20R7S



Typical CO₂ Injection Compressor



CO2 Centrifugal Compression Train Urea Process - Pakistani Fertilizer Plant



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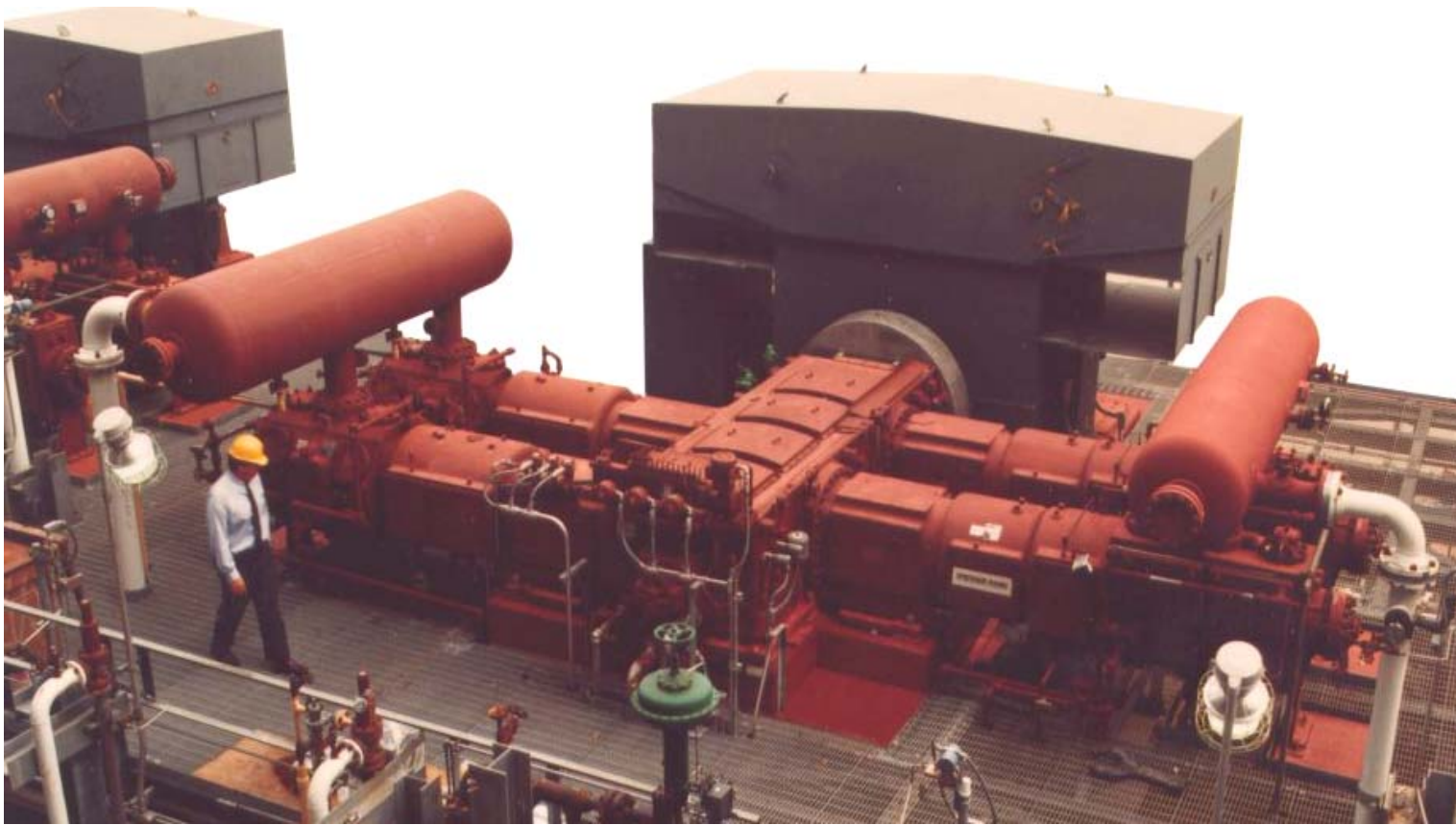
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CO2 Compression Experience

◆ Reciprocating

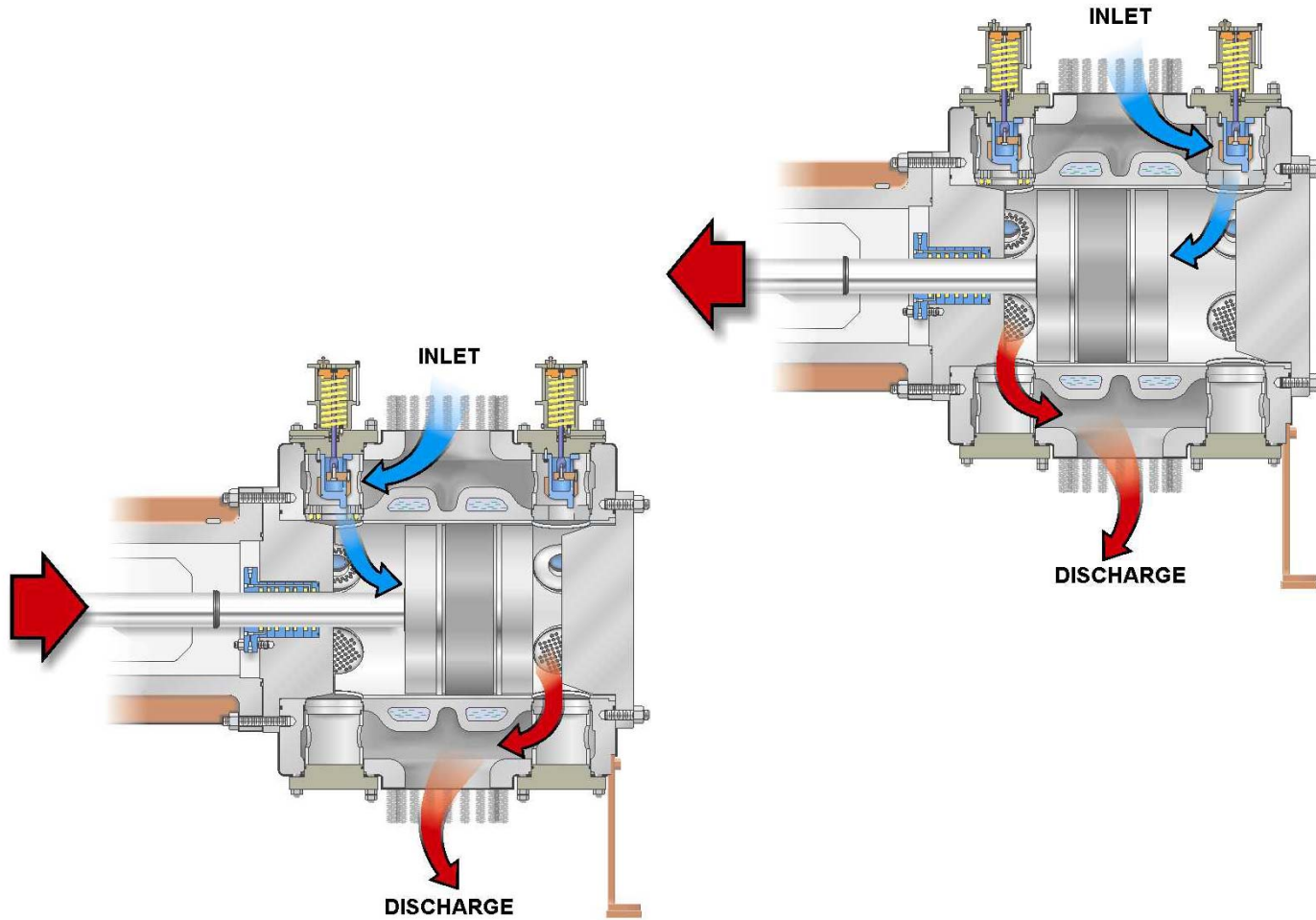
- 227 units, first shipped in 1928, most recent 2007
- Max discharge pressure = 6,000 psig (414 bar)
- Max inlet flow = 2,712 acfm (4,600 m³/hr)
- Max power = 8,000 bhp (5,968 kW)
- Total installed power > 530,000 bhp (>395MW)

Process Reciprocating Compressor

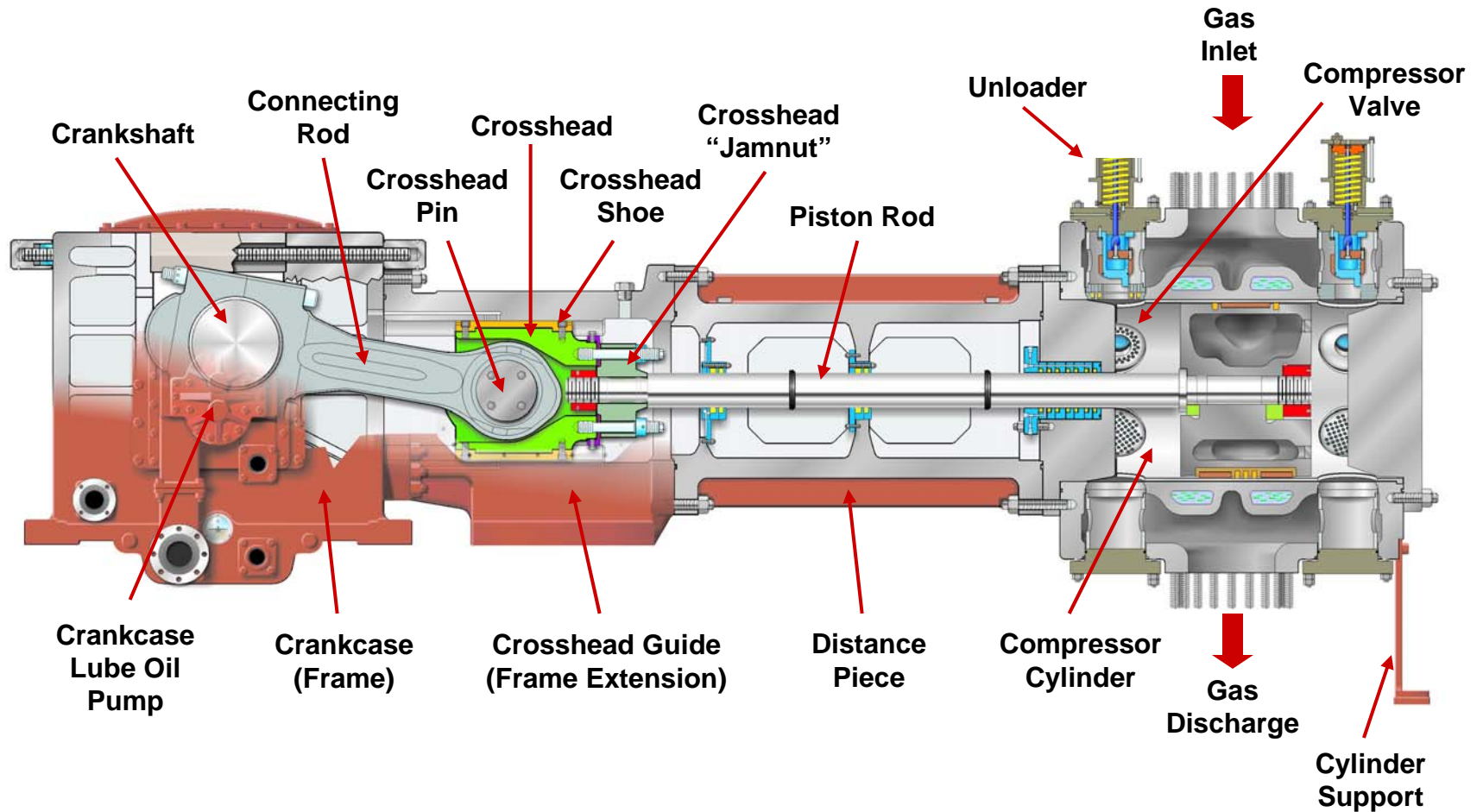


**5,500 HP HHE-VL Process Reciprocating Compressor on Hydrogen Makeup
Service in USA Gulf Coast Refinery**

Gas Flow



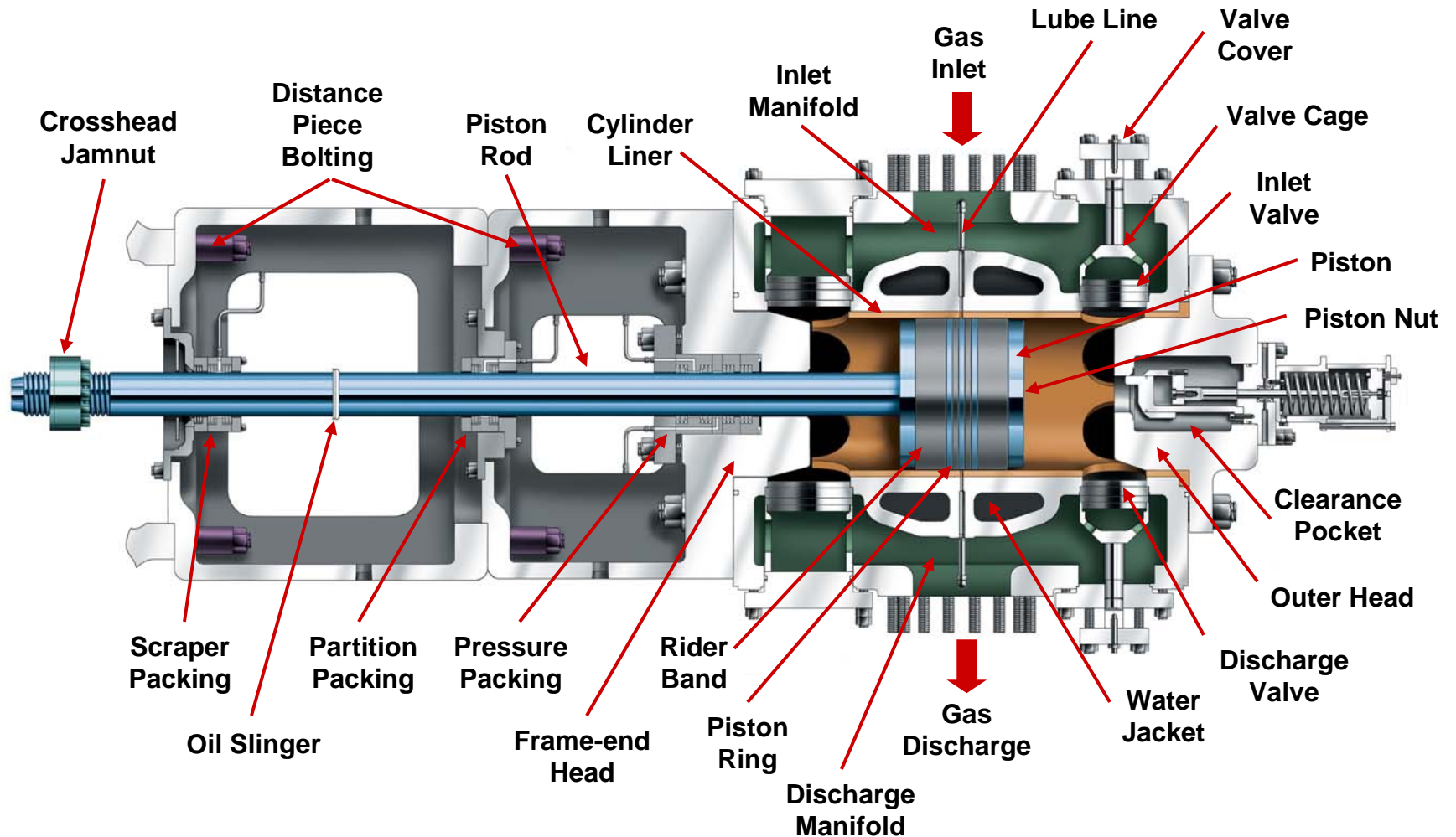
Frame & Running Gear



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Compressor Cylinder Details



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Challenges with CO₂ Compression

- ◆ The presence of water together with CO₂ creates carbonic acid which is corrosive to carbon steels. The use of stainless steel for any components in contact with wet CO₂ eliminates the problem.
- ◆ Similarly, the presence of water with CO creates iron carbonyl upon contact with carbon steel. Again, the use of stainless steels for solves the problem.

Future Considerations...

- ◆ Increasing the amount of interstage cooling will reduce the overall power required for CO₂ compression.
- ◆ Advanced interstage cooling concepts are being investigated to improve the effectiveness of existing water cooled stationary diaphragms.

Thank You !

Questions?

