WHEN DEPENDABLE PERFORMANCE IS CRITICAL

# TESCORP ERU EMISSIONS RECOVERY UNIT LINE

***Mitigating methane emissions from compressor packing***
***Designed specifically for "wet gas" & "dry gas" applications***

## TESCORP Environmental Legacy

For over 35 years, TESCORP has been a leader in specialized engineered solutions - for vent gas emissions for both the oilfield and process industries. These have been mostly unique applications, requiring unique solutions to solve various emission problems. Our designs have been specific to the application, the type of gases to be recovered, and the specific environmental conditions or specifications. Our solutions have covered applications ranging from high-vacuum systems with pressures below 10 torr to very high pressure wet and corrosive gases in the pressure ranges in excess of 5000 psi. Our systems have been utilized in extreme environments from the hot and humid jungles of South America to -40 degree artic temperatures and conditions of North Dakota and Alaska. TESCORP has always been able to provide a solution for the most demanding applications and will continue to do so. However, we are now pleased to expand our services and expertise to a standard line of products specifically designed to meet the needs of the oilfield, for economical and efficient vapor emission systems.

**Prices Available Upon Request**

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## The TESCORP ERU Packing Emission Solution

- The EPA has recognized the issue of fugitive emissions emitted from compressor packing boxes, gas-operated control valves and pumps contribute up to 72.4 BCF of methane per year into the atmosphere. All packing systems leak under normal conditions. Continued servicing, packing replacement or flaring of these gas emissions is costly and not a total solution. The TESCORP VentMaster ERU recovers and returns these gases back to the process through a simple and affordable process
- TESCORP has designed, tested, and is manufacturing a standard “gas vapor emissions recovery system” for use with existing gas compression systems and gas-operated components
- This system allows existing dry gas pipeline compressor systems to meet the requirements for compliance to EPA “New Source Performance Standards” (40 CFR 60 Subpart 0000a)

## TESCORP “ERU" Product Line - Dry Gas & Wet Gas

1. Specifically designed for saturated “wet” gases that have been problematic for many compressor applications, the VentMaster line of compression systems are all designed to accept saturated gases and to add “super heat” in the compression cycle to maintain temperature in excess of dew point and therefore eliminate any chance of condensation within the compression process. H2S sour gas options available

2. Specifically designed for easy installation and operation in all oilfield environments, the TESCORP VentMaster series is designed and constructed to be a standardized modular system, utilizing commonality of parts and systems for quick deliveries and a low cost purchase and installation

**Design features are:**

- All gas condensation is accomplished in the inter-cooler or after-cooler sections of the system with post, 2-phase separation, specifically designed for these gases and liquid content.
- Designed for all existing oilfield environments, from extreme hot to extreme cold applications. All VentMaster Vapor Recovery Units are constructed with environmental equipment enclosures to protect the equipment from the elements and to provide acoustic noise dampening for better environmental and personnel protection.
- The units are all constructed per applicable code, i.e. ASME, ANSI, and NEC for safe field installation and operation.
- All maintenance items are designed to be easily accessible to the operator through enclosure doors or removable panels.
- The TESCORP-constructed PLC control panel with pre-programmed logic algorithms allows the VentMaster systems to be easily configured to operate at various pressures and flows as may be needed to meet various emission applications.

# Problem Summary - Mitigating methane emissions from compressor packing

In a recent EPA study released in the Natural Gas STAR Program, "Estimates of Methane Emissions by Segment in the United States", the following information was stated concerning methane leakage into the environment:

- Methane emissions account for 9.5% of all greenhouse gases. These emissions when based upon CO2, have a comparative effect on the environment that is 25 times that of equivalent CO2
- The energy industry is the 2nd largest source of methane emissions
- A 2018 study of these gas emissions as reported by the EPA, estimated these methane emissions total approximately 175 MMTCO2e per year to the environment

> Of that total, 19% was emitted from the Transmission and Storage facilities within the oil and gas industry

>That equates to an emission source of approximately 34 MMTCO2e.The breakdown of those emission leaks is:

- 0.68 MMTCO2e from gas operated Pneumatic Controllers
- 15.0 MMTCO2e from gas compression equipment seal & packing leaks
- 3.1 MMTCO2e from Centrifugal Compressors
- 11.9 MMTCO2e from Reciprocating Compressors

- Additionally, the same report indicated that the gas processing industry accounted for an additional 12 MMTCO2e of emissions per year to the atmosphere. A similar breakdown of the leaks can also be attributed to:
  - 0.68 MMTCO2e from gas operated Pneumatic Controllers
  - 15.0 MMTCO2e from gas compression equipment
  - 1.0 MMTCO2e from Centrifugal Compressors
  - 1.56 MMTCO2e from Reciprocating Compressors

***Source: Source: Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 - 2018, US EPA, April 2020***

## Leakage from compressor rod packing

Most of these emission sources can be captured and restored back to the process without emitting them to the environment.

Without considering the emissions with the other previously stated sources, the compressor rod packing leakage will be used as the example problem and a reasonable solution discussed.

## Description of gas emissions source

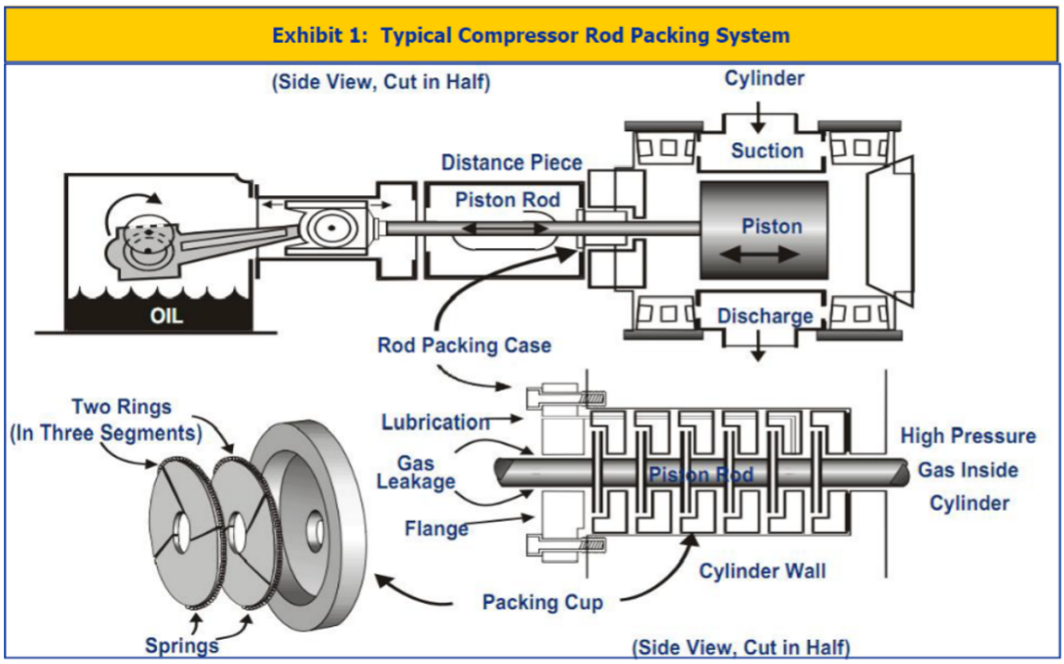
- Reciprocating compressors in the oil and gas industry commonly emit natural gas (where methane is the main component) during normal operation and during standby under pressure. These emissions can be vented from the rod packing and blowdowns or as fugitives from the various compressor components

# Reducing methane emissions from compressor rod packing systems

- More than 51,000 reciprocating compressors are operating in the U.S. natural gas industry, each with an average of four cylinders, representing over 200,000 piston rod packing systems in service. Reciprocating compressors normally have multiple cylinders, and each cylinder piston rod has a packing case. Reciprocating compressor maintenance practices may vary and rod packing vents may be configured.

**These systems contribute over:**

- 72.4 Bcf per year of methane emissions to the atmosphere, one of the largest sources of emissions at natural gas compressor stations
- All packing systems leak under normal conditions, the amount of which depends on cylinder pressure, fitting and alignment of the packing parts, and amount of wear on the rings and rod shaft
- Under the best conditions, even new packing systems properly installed on a smooth, well-aligned shaft can be expected to leak a minimum of 11.5 scfh. Higher leak rates are a consequence of fit, alignment of the packing parts, and wear
- As the system ages, however, leak rates will increase from wear on the packing rings and piston rod. One Natural Gas STAR Partner reported measuring emissions of 900 scfh on one compressor rod




## Leakage typically occurs from four areas:

- Around the packing case through the nose gasket
- Between the packing cups, which are typically mounted metal-to-metal against each other
- Around the rings from slight movement in the cup groove as the rod moves back and forth
- Between the rings and piston rod

***Source: From existing Climate & Clean Air Coalition published documents.***
***CCAC OGMP – Technical Guidance Document Number 4: Reciprocating Compressors Modified: April 2017***

**Emission Factors**

**Table 4.2: Default Emission Factors for Reciprocating Compressor Rod Packing [A,B,C]**

| Industry Sector | Methane Emission Factor | |
|---|---|---|
| | Methane Emission Factor (scm/hour-compressor) | Methane Emission Factor (scf/hour-compressor) |
| Production (Well Pads)[17] | 0.031 | 1.08 |
| Gathering & Boosting[18] | 2.4 | 85.5 |
| Processing[19] | 4.03 | 142.5 |
| Transmission[20] | 5.3 | 188.1 |
| Storage[21] | 6.5 | 229.5 |

[A] These compressor-based operating emission factors assume an average number of cylinders per compressor as follows: Production (4), Gathering and Boosting (3.3), Processing (2.5), Transmission (3.3), and Storage (4.5).
[B] Methane content by sector: Production (79 percent); Processing (87 percent); Transmission, Storage, and Distribution (94 percent). (Source: EPA. Natural Gas STAR Lessons Learned. https://www.epa.gov/sites/production/files/2016-06/documents/ll_rodpack.pdf.)
[C] A factor of 150% should be applied to default operating emission factors for standby under pressure factors. https://www.epa.gov/sites/production/files/2016-06/documents/ll_compressorsoffline.pdf .|

- Lubricating oil injected into the packing helps seal the rings and cups, reduces wear caused by operation, and lowers heat build-up that accelerates ring wear. But over the thousands of hours of typical compressor operation, rings wear and leakage increases. Average leakage of large, high-pressure reciprocating compressors ranges from 24 to 150 scfh
- Factors other than normal wear can also contribute to emissions, such as faulty installation and damaged components (cups, rings, gaskets)

## The Problem Summation:

- All compressor packing assemblies leak
- Even with new packing installed, there is a continuous source of leakage to the atmosphere
- With even the reduced levels of leakage acquired with new and more sophisticated packing, there is still a significant amount of leakage
- Assuming the minimum amount of leakage with new packing @ 11 to 12 scfh per piston rod packing assembly X 200,000 piston rod packing assemblies that are estimated to exist in the United States, the new projected minimum is in the range of 20+ Bcf per year

***These gas emissions can be recovered and reentered back into the gas process system.

# TESCORP ERU EMISSIONS RECOVERY UNIT LINE

**The Tescorp "VentMaster ERU" captures and returns the vent gases back to the process.**