Scroll Compressors for Vapor Recovery – A Case Study

Natural Gas STAR Implementation Workshop

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Introduction

- **Background**
  - Issues
  - Objectives
- **The Scroll Package**
- **Benefits**
- **Findings**

Background - Issues

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Background of the Case Study

- Current VRUs targeted for causing O_2 entry
- Conventional VRU Design Issues
  - Created additional “down-time”
  - Resulted in increased emissions and valuable loss of high-BTU vapors
  - Could result in possible compliance issues
- Inefficient Installation Design
  - Undersized vent piping with unnecessary 90º angles create frictional pressure loss
  - Lengthy connective piping contained “fluid traps”
  - Conventional VRU’s typically sized for maximum vapor rate (fixed) and are not designed for frequent on/off cycling

Background of the Case Study

- The scroll VRU technology was introduced to our Corporate Environmental group by Chris Singletary, former production engineer for SE New Mexico
- We pursued the technology with Emerson and S&R Compression
- We identified a pilot candidate located in a harsh environment with variable ambient temperatures

Background - Objectives

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Evaluation of our current VRU design

Overcome oxygen entry and increase efficiency

- We wanted to overcome our O_2 issue
- Eliminate the need for an oxygen sensor
- Reduce distance from the tanks to the VRU
- Eliminate any “fluid traps”
- Increase efficiency and VRU run-time
- Eliminate costly maintenance

Improve VRU Installation Design

- Enhance installation design of our vent piping by increasing size and avoiding 90º angles

- Mount remote electronic pressure transducer on tank to accurately measure vapor pressure

vs.

pressure transducer mounted at the suction of the VRU

VS.

The Scroll Package

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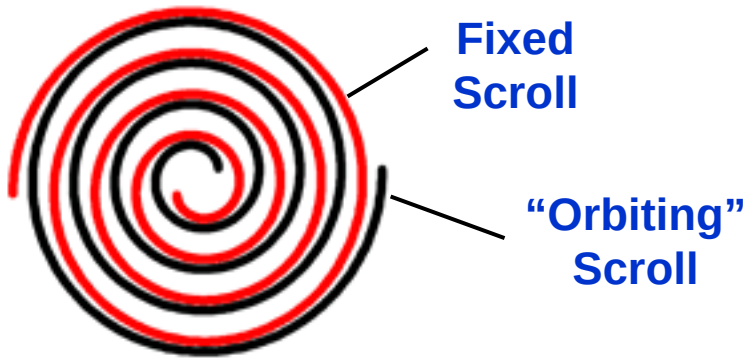
The Copeland Scroll® Module & Compressor from Emerson



Orbiting Scroll "Orbits", Rather Than Rotating

- Commercial refrigeration design basis
- Increased tolerance to liquid slugs or debris events
- Sub-100HP projects, discharge to 345 psig
- Positive displacement, oil flooded design
- Low sound, virtually no vibration, no pulsations
- Hermetically welded motor-compressor, no shaft seals
- Built for variable speed operation (2400-4800 rpm)

Compressor "Module"

Background of the Scroll

- Packaged by S&R Compression, LLC (Tulsa, OK)
  - Established business
  - New to the scroll package and vapor management
  - Invested heavily in R&D for high BTU applications
  - High level of support from management
  - Backed by large investors
  - Expanding territory

Background of the Scroll

- S&R allowed us to pilot the unit free of charge
  - Investment of time and capital
  - Allowed them to enhance technology and improve efficiency
  - A “win-win” for everyone
  - We agreed to replace pilot unit for permanent unit once available

The Scroll Package
- Benefits

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Scroll VRU - Benefits

- Variable Frequency Drive (VFD)
  - Adjusts to changing vapor volumes
  - Hibernation mode to reduce risk of O_2 entry and reduce energy consumption
  - Eliminates the need for on/off cycling
  - Longer running, more reliable equipment

Scroll VRU - Benefits

- Tank Mounted Transducer
  - Allows for more precise, accurate readings of tank pressure
  - Real-time data
  - Controls pressure at the tank rather than pressure within the vent piping

Scroll VRU - Benefits

- Low Maintenance
  - One hour estimated annually
  - Requires an oil change and the replacement of two filters
- Hermetically Sealed
  - Eliminates O_2, oil, and gas leak paths
  - Enhances safety of the unit

Scroll VRU - Benefits

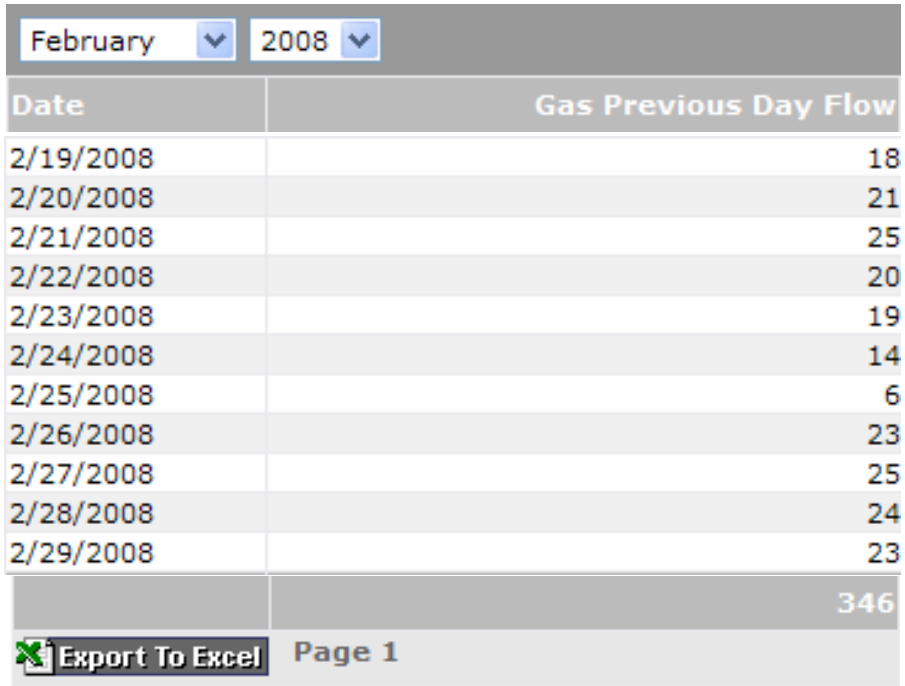
- Very low noise levels
  - Sounds like a refrigeration unit
  - Great application for highly-populated areas
- NGL's not a threat
  - Due to S&R design, impact of liquids within the unit minimized when compared to a standard application
- Skid or trailer mounted
  - Quick mobilization and battery exchange if necessary

Scroll VRU - Benefits

- Optimize HP and Recovery Volumes
  - The installation of parallel modules allows you to match the HP to fluctuating flow rates and pressures
  - Based on the decline rate of a well or a reduction in vapor volume, you can remove a module and apply it elsewhere
  - Allows for quick and efficient vapor recovery flexibility at multiple locations

Scroll VRU - Benefits

- SCADA – Lynx Reports
  - Intelligent automation
  - Ability to trend and review marketing reports
  - Trend and review real-time device detail from the unit
  - View and calculate runtime efficiency and unit status
  - Displays alarms and/or shutdown codes
  - Allows operations to monitor at all times



Scroll VRU : SCADA-lynx Trending

The Scroll Package – Benefits Overview

- Trailer or Skid-mounted packages
- Hermetically sealed design
- Once per year maintenance
  - Quick
  - Low-cost
- Variable Frequency Drive (VFD)
- Few moving parts
- Low noise levels
- Can optimize HP by installing parallel modules, matching HP to fluctuating flow rates and pressures

Findings

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Scroll VRU : Economics

- Average Daily Recovery Rate of 70 MCF
  - Assume 2,000 BTU vapor at $8/MCF
  - **Daily** = 70 MCF × 2 (accounting for BTUs) × $8/MCF = $1,120 daily
  - **Monthly** = $1,120/day × 30 days = $33,600 monthly
  - **Annually** = $33,600/month × 12 months = $403,200 annually

Pictures

Pictures

Questions?

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Thank You.

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