



Scroll Compressors for Vapor Recovery – A Case Study

Natural Gas Star Technology Transfer

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Denver, CO



Introduction

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



Background - Issues



Background of the Case Study

- Current VRUs targeted for causing O₂ 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 90° 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 a Western Division Devon engineer
- We pursued the technology with Emerson and S&R Compression
- We identified a pilot candidate located in a harsh environment with variable ambient temperatures



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Background - Objectives



Evaluation of our current VRU design



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Overcome oxygen entry and increase efficiency

- We wanted to overcome our O₂ 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



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Improve VRU Installation Design

- Enhance installation design of our vent piping by increasing size and avoiding 90° angles
- Mount remote electronic pressure transducer on tank to accurately measure vapor pressure

vs.

pressure transducer mounted at the suction of the VRU



VS.



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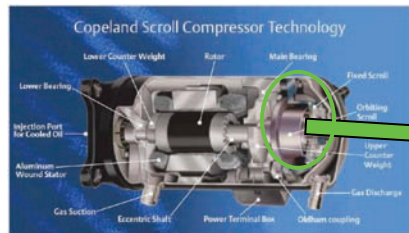
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The Scroll Package



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"

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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



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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



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The Scroll Package - Benefits



Scroll VRU - Benefits

- Variable Frequency Drive (VFD)
 - Adjusts to changing vapor volumes
 - Hibernation mode to reduce risk of O₂ entry and reduce energy consumption
 - Eliminates the need for on/off cycling
 - Longer running, more reliable equipment



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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



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Scroll VRU - Benefits

- Low Maintenance
 - One hour estimated annually
 - Requires an oil change and the replacement of two filters
- Hermetically Sealed
 - Eliminates O₂, oil, and gas leak paths
 - Enhances safety of the unit



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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



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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



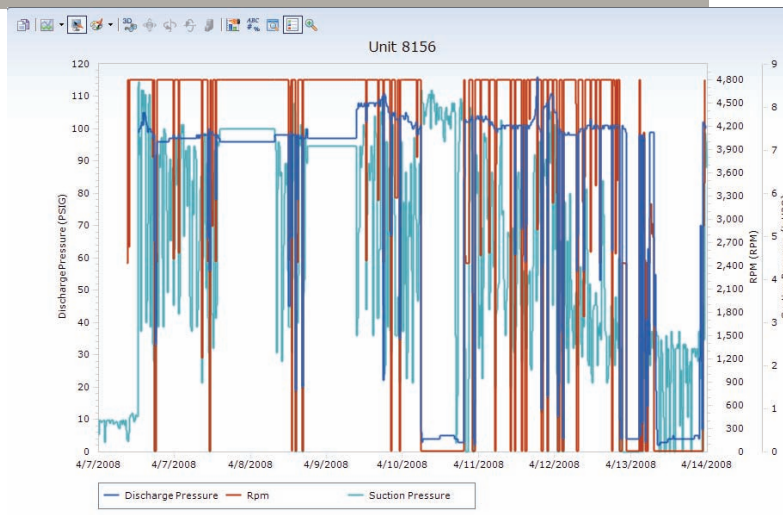
Scroll VRU - Benefits

- 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

February 2008	
Date	Gas Previous Day Flow
2/19/2008	18
2/20/2008	21
2/21/2008	25
2/22/2008	20
2/23/2008	19
2/24/2008	14
2/25/2008	6
2/26/2008	23
2/27/2008	25
2/28/2008	24
2/29/2008	23
	346
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Scroll VRU : Scada-lynx Trending



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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



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Findings



Scroll VRU : Economics

- Average Daily Recovery Rate of 24 MCF
 - Assume 2,000 BTU vapor at \$8/MCF
 - **Daily** = $24 \text{ MCF} \times 2 \text{ (accounting for BTUs)} \times \$8/\text{MCF} = \$384 \text{ daily}$
 - **Monthly** = $\$384/\text{day} \times 30 \text{ days} = \$11,520 \text{ monthly}$
 - **Annually** = $\$11,520/\text{month} \times 12 \text{ months} = \$138,240 \text{ annually}$



Pictures



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Pictures



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Questions?

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Thank You.

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