Comparing Compressors

Stringent regulations require Vapour Recovery Units (VRU) to be operational at all times. Equipment failure risks high financial penalties because emissions must then be released into the atmosphere through ignited flare stacks or atmospheric venting.

The reliability of Piper VRUs are key to the profitable operation of heavy oil recovery plants in Alberta’s Oil Sands and other parts of the world.

The Cumulative Costs:

Scheduled Maintenance chart below demonstrates the stark difference between the Liquid Ring and Rotary Vane units when comparing material and man-hour costs of scheduled maintenance.

Assumptions:

1. $60 per man-hour
2. Cost escalation factor of 5% applied to each 5 year period
3. Standard Teresso mineral oil used for the cost of consumables
4. Rotary Vane compressor requires annual blade replacement due to performance conditions (costing is included).

<table>
<thead>
<tr>
<th>Cumulative Costs: Scheduled Maintenance</th>
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<tbody>
<tr>
<td>Years in Operation</td>
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<tr>
<td>After 1 Year</td>
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<td>After 5 Years</td>
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<td>After 10 Years</td>
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<td>After 15 Years</td>
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<td>After 20 Years</td>
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<td>After 25 Years</td>
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<td>After 30 Years</td>
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<td><strong>Total</strong></td>
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The costs of scheduled maintenance over 30 years of operation for a Rotary Vane compressor VRU compared to a Liquid Ring VRU compressor is $3.3 million to $728 thousand respectively; a difference of more than $2.58 million.

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It is essential that VRUs be capable of handling varying capacities and compositions of water vapour, light hydrocarbons, H2S, CO2 and asphalines coming from the tank to ensure an environmentally sound operation.

In heavy oil applications where there are often elevated temperatures and the potential of high concentrations of the constituents, liquid ring compressors have been extremely reliable when incorporated into a VRU module.

### Long Term Savings

The operational savings over thirty years exceeds $2.58 million when using a liquid ring compressor.

### The Cumulative Costs:

Scheduled Maintenance chart demonstrates that the operation of a Rotary Vane VRU requires significantly more consumables and maintenance costs over a thirty-year period compared to a Liquid Ring VRU.

### Environmentally Sound Operation

It is essential that VRUs be capable of handling varying capacities and compositions of water vapour, light hydrocarbons, H2S, CO2 and asphalines coming from the tank to ensure an environmentally sound operation.

Tanks are used throughout the Energy Industry to store product prior to pumping to the plant or pipeline. If the Vapour Recovery Unit (VRU) does not operate or provide sufficient capacity, the increase in pressure will be relieved directly to the atmosphere through relief valves on the tank.

Piper is known for the seamless integration of design, engineering and manufacturing. We are customer-focused and custom build VRUs to meet specific needs. They deliver consistent performance and bring a significant return on investment through lower maintenance costs and the recapture of hydrocarbons.

Other types of compressors, such as vane and screw, have difficulty compressing wet vapour and may condense liquid during the compression cycle.

Consequently, the compression of liquid damages the vane or screw compressor with an incompressible fluid, with asphaltine build up, or hydrocarbon liquid diluting the lubricating fluid of the compressor.

### Piper Process Systems VRU Modules

- Fully automated stop start of one or multiple compressors without operator intervention
- 0% to 100% fully automatic capacity control
- Ability to manage a wide variety of potential inlet vapour compositions
- Easy maintenance and serviceability
- Proven module function
- Very high reliability (on stream factor)
- Packages are built for easy transport

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