The Influence of SWG on Low Emission Valve Performance

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Agenda

- Introduction
- Objective
- Gasket evaluation parameters
- Testing parameters
- Body/Bonnet design differences
- Results and discussions
- Conclusion
Introduction

• According to API 624, API 641 and API 622 (Draft 3rd edition) the leakage shall not exceed 100 ppmV
• API-624: Leakage from body-bonnet connections shall be corrected prior to test execution.

Objective

• Optimize Spiral Wound Gasket design for valve bonnet low emission VOC applications
Gasket Evaluation Parameters

SS304 with Flexible Graphite SWG:

- Low or high density?
- Inner Ring? Yes / No
- Outer Ring? Yes / No
- Inward Buckling
Gaskets Tested

Low density

SWG

High density

SWG

SWG-IR

SWG Density: windings per inch
Testing Parameters

• Gasket Stress: 10 000 psi
• Room temperature
• Bolt lubrication: Moly Paste
• Test pressure: 40 bar
• Test Media: Methane
• Leak detection: EPA Method 21
• 3 Samples of each gasket
• 1 reading per day for 3 days
After 3 days, all gaskets were stabilized
Body / Bonnet

8”300#
Male and Female

2”600#
Female and Flat Face

2”300#
Male and Female

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# Valve Design Differences

<table>
<thead>
<tr>
<th>2&quot;600#</th>
<th>2&quot;300#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nº of bolts</td>
<td>6</td>
</tr>
<tr>
<td>Bolt diam.</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>Max gasket Stress</td>
<td>23 000 psi</td>
</tr>
<tr>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Bolt diam.</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>Max gasket Stress</td>
<td>47 000 psi</td>
</tr>
</tbody>
</table>

75% of Bolt Yield
Results confirm **PVP2011- 57556 “The influence of winding density in the sealing behavior of spiral wound gasket.”**

- Higher density gaskets have better sealability.
- All tests were performed with high density gaskets.
With x Without Inner Ring

8”300#

Inner Ring = better result
Inward Buckling

8"300#

ASME B16.20: 3.2.5 Inner Ring. “Inward bucking of spiral-wound gaskets has been identified as a potential problem... Inner rings for flexible graphite-filled, spiral-wound gaskets shall be furnished unless the purchaser specifies otherwise.”
With x Without Inner Ring (x Outer ring)

2”600#

Leakage (ppmV)

Inner Ring = better result
Outer Ring = even better
2”600# SWG

Inward buckling

SWG-IR

SWG-IROR

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A 1.5 mm width inner ring was engineered to fit the groove dimensions.
2”300#

SWG

Inward Buckling

SWG-IR

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Conclusions

• Higher density windings improve sealability

• Inner Rings:
  • Improve gasket performance
  • Prevents inward buckling

• Properly engineered Spiral Wound Gaskets will assure API 624 emissions compliance.
Thank you!