VALVE MANUFACTURERS ASSOCIATION OF AMERICA
2014 Technical Seminar & Exhibition

VALVE PACKING & GASKET RESEARCH AND DEVELOPMENT DEVICES

VALVE EMISSIONS COMPLIANCE, STANDARDS & TECHNOLOGY
Planet Hollywood, Las Vegas, NV
March 6 – 7, 2014

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Teadit Ltda.
Rio de Janeiro, Brazil
Packing Minimum Seating Stress

Sealing for a Safer and Greener Tomorrow
Packing Minimum Seating Stress

Ni-Cr Wire Mesh Reinforced Yarn Flexible Graphite Packing (no impregnation)

Ni-Cr Wire Reinforcement Flexible Graphite Packing

Carbon and Flexible Graphite Packing with Graphite impregnation

Expanded PTFE filled with Barium Sulphate Packing

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Packing Drag, Force Transmission and Thermal Expansion Test Rig

1. Stem
2. Gland
3. Bonnet
4. Internally Gaged Bolt
5. Packing
6. Bushing
7. Load Cell
8. Load Cell Base
9. Electrical Resistance
Packing Drag

Ni-Cr Wire Mesh Reinforced Yarn Flexible Graphite Packing (no impregnation)

Ni-Cr Wire Reinforcement Flexible Graphite Packing

Carbon and Flexible Graphite Packing with Graphite impregnation

Expanded PTFE filled with Barium Sulphate Packing

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Force Transmission

- Most of the applied stress reaches the bottom of the stuffing box.

Ni-Cr Wire Mesh Reinforced Yarn Flexible Graphite Packing (no impregnation)

Carbon and Flexible Graphite Packing with Graphite impregnation

Expanded PTFE filled with Barium Sulphate Packing
Thermal Expansion Test Results (Amb. – 212F)

<table>
<thead>
<tr>
<th>Style</th>
<th>Yarn</th>
<th>Filler</th>
<th>Comparative e-PTFE content</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>e-PTFE</td>
<td>None</td>
<td>100% e-PTFE</td>
</tr>
<tr>
<td>B</td>
<td>e-PTFE</td>
<td>Barium Sulphate</td>
<td>B% &lt; A%</td>
</tr>
<tr>
<td>C</td>
<td>e-PTFE</td>
<td>Barium Sulphate</td>
<td>C% &lt; A%, B% &amp; C%</td>
</tr>
<tr>
<td>D</td>
<td>e-PTFE</td>
<td>Graphite</td>
<td>D% &lt; A%, B% &amp; C%</td>
</tr>
</tbody>
</table>
Thermal Expansion Test Results (Amb. – 212F)

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Style | Average Leakage
--- | ---
A | 313 mL/min
B | 107 mL/min
C | 44 mL/min
D | 3 mL/min
Material Degradation and API 607 Simulation

<table>
<thead>
<tr>
<th>Packing</th>
<th>External Leakage After burn and cooldown (5min)</th>
<th>Validation API 607 Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Style E</td>
<td>0.0 mL/min</td>
<td>CERTIFIED</td>
</tr>
<tr>
<td>Style F</td>
<td>0.0 mL/min</td>
<td>CERTIFIED</td>
</tr>
<tr>
<td>Style H</td>
<td>0.2 mL/min</td>
<td>CERTIFIED</td>
</tr>
</tbody>
</table>

Sample X

Sample X
Knife Valve Test

- Drag forces
- Sealability
Knife Valve Test Results

**F_Drag** for STYLE C (ePTFE/Graphite)

**F_Drag** for STYLE A (Synthetic/PTFE)

**P_H2O** for STYLE C (ePTFE/Graphite)

**P_H2O** for STYLE A (Synthetic/PTFE)

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Gate Valve Tests

API 624 (draft)
API 622 (simulation)
Chevron Protocol
ISO 15848-1
VDI 2440
Gate Valve Test Results

Teadit Research and Development
API Standard 622 2nd Ed. Simulation (4” CL300) Test Report

Static Leakage Chart Reading

Leakage (PPM)

Cycle Number

Teadit Research and Development
API Standard 624 1st Ed. (Draft Apr.2012) Test Report

Static Stem Leakage Chart Reading

Leakage (PPM)

Cycle Number
Control Valve Testing

ISO 15848-1

Test Results

Teadit Research and Development
ISO 15848-1 (EPA Method 21) Test Report

Static Stem Leakage Chart

Leakage (PPM)

Retorque

Cycle Number

Temperature
CorroTest

Average Mass Loss

3.00%
2.50%
2.00%
1.50%
1.00%
0.50%
0.00%

Inhibitor 1       Inhibitor 2       Inhibitor 3       Inhibitor 4       no Inhibitor

1010              304               410

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Galvanic Cell Corrosion Test

![Graph showing electrical potential difference over time for different inhibitors.](image)
Gasket Testing

Sealability
(Methane/Helium/Nitrogen)
Flange Bending
Hot Blow-out
Thermal Cycling
(Amb to 400C/750F)

Steel Flanges
- 6” Class 900
- 4” Class 1500
- 8” Class 1500
- 3” Class 150
- 2” Class 300
- 4” Class 2500

GRP
- 3” Class 150

FADU
- 4” Class 150
Gasket Testing Results

SWG 4” 150#

SWG 6” 300#

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Thermal Gravimetric Analysis - TGA

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Differential Scanning Calorimetry - DSC

Sintered and Unsintered PTFE
Infrared Spectroscopy

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API 624 Test Rig

Sealing for a Safer and Greener Tomorrow

<table>
<thead>
<tr>
<th>NPS</th>
<th>API 602</th>
<th>API 600</th>
<th>API 603</th>
<th>API 623</th>
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</thead>
<tbody>
<tr>
<td>3/4&quot;</td>
<td>800</td>
<td>1500</td>
<td>300</td>
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<tr>
<td>1-1/2&quot;</td>
<td>800</td>
<td>1500</td>
<td>600</td>
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<td></td>
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<td>1500</td>
<td>300</td>
</tr>
<tr>
<td>20&quot;</td>
<td>300</td>
<td>900</td>
<td>300</td>
<td>600</td>
</tr>
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Thank You!

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