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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Rio de Janeiro, Brazil
Packing Minimum Seating Stress

Diagram showing components:
- Gland Follower
- Applied Load
- Packing Rings
- Helium Inlet
- Housing

Additional images of equipment and apparatus.

TEADIT
adixen ASM 142
Packing Minimum Seating Stress

**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**

**Ni-Cr Wire Reinforcement Flexible Graphite Packing**
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)

- 2 Rings
- 4 Rings
- 5 Rings
- 7 Rings

**Ni-Cr Wire Reinforcement Flexible Graphite Packing**

- 2 Rings
- 4 Rings
- 5 Rings
- 7 Rings

**Carbon and Flexible Graphite Packing with Graphite impregnation**

- 2 Rings
- 4 Rings
- 5 Rings
- 7 Rings

**Expanded PTFE filled with Barium Sulphate Packing**

- 2 Rings
- 4 Rings
- 5 Rings
- 7 Rings
**Force Transmission**

- Ni-Cr Wire Mesh Reinforced Yarn Flexible Graphite Packing (no impregnation)
  - Most of the applied stress reaches the bottom of the stuffing box.

- Carbon and Flexible Graphite Packing with Graphite impregnation

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

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% &amp; B%</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)

<table>
<thead>
<tr>
<th>Style</th>
<th>Average Leakage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>313 mL/min</td>
</tr>
<tr>
<td>B</td>
<td>107 mL/min</td>
</tr>
<tr>
<td>C</td>
<td>44 mL/min</td>
</tr>
<tr>
<td>D</td>
<td>3 mL/min</td>
</tr>
</tbody>
</table>
Material Degradation and API 607 Simulation

<table>
<thead>
<tr>
<th>Packing</th>
<th>External Leakeage After burn and cool-down (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>

![Graph showing mass loss against temperature](graph.png)

Sample X

![Image of Sample X](sample_images.png)

![Image of STYLE E](style_images.png)
Knife Valve Test

- Drag forces
- Sealability
Knife Valve Test Results

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

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

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

**P_H2O for STYLE A (Synthetic/PTFE)**
Gate Valve Tests

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

API Standard 622 2nd Ed. Simulation (4" CL300) Test Report

API Standard 624 1st Ed. (Draft Apr. 2012) Test Report
Control Valve Testing

ISO 15848-1

Test Results

[Graph showing leakage results over cycle numbers]
Average Mass Loss

- Inhibitor 1: 1010
- Inhibitor 2: 304
- Inhibitor 3: 410
- Inhibitor 4: no Inhibitor
Galvanic Cell Corrosion Test
Gasket Testing

Sealability
(Methane/Helium/Nitrogen)

Flange Bending

Hot Blow-out

Thermal Cycling
(Amb to 400°C/750°F)

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

Sample T
Sample L

SWG 4” 150# graph

SWG 2” 3/600# graph

SWG 6” 300# graph
Thermal Gravimetric Analysis - TGA
Differential Scanning Calorimetry - DSC

Sintered and Unsintered PTFE
Infrared Spectroscopy

The spectrometry graph shows the percentage transmittance (%T) versus wavenumbers in cm⁻¹. Key features include:

- A peak at around 638.97 cm⁻¹
- Another peak at 1202.97 cm⁻¹
- A peak at 1147.74 cm⁻¹

These are characteristic of PTFE (Polytetrafluoroethylene) materials. The equipment used appears to be a Fourier Transform Infrared (FTIR) spectrometer, often utilized for analyzing the chemical composition of materials.
## API 624 Test Rig

<table>
<thead>
<tr>
<th>NPS</th>
<th>API 602</th>
<th>API 600</th>
<th>API 603</th>
<th>API 623</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot;</td>
<td>800</td>
<td>1500</td>
<td></td>
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<tr>
<td>1-1/2&quot;</td>
<td>800</td>
<td>1500</td>
<td></td>
<td></td>
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<tr>
<td>4&quot;</td>
<td>300</td>
<td>900</td>
<td>1500</td>
<td>300</td>
</tr>
<tr>
<td>12&quot;</td>
<td>300</td>
<td>900</td>
<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>
</tbody>
</table>
Thank You!

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