Utilize Low Leakage Packing Technology so you can seal today for a greener tomorrow.

Why wait for EPA mandates?

José Veiga
Technical Director
Teadit
SEALING PRODUCTS

Mechanical Packings

PACKING 2236
Certified Extremely Low Emissions Packing Technology

Non-Metallic Gaskets

Restructured PTFE Tealon

Expanded PTFE Products

Compressed Gasket Sheet

Metallic Gaskets

Camprofile Gasket

Jacketed Gaskets

Spiral Wound

Expansion Joints

Flue Duct Expansion Joints

Metallic Bellows Expansion Joints
Teadit R & D Laboratories

Packing Test Benches

Gasket Testing

Materials Testing
Packing Seating Stress

Background: Lack of Standards

Consult packing manufacturer and/or plant engineering department for guidance on torque (FSA)

Tighten the gland bolts to the point where heavy resistance to wrenching is felt

X% of Compression
Packing Seating Stress

ASME – PVP Paper 2008-61214

Teadit and Braskem development

- Develop an Installation Procedure:
  - Similar to flange gaskets
  - Minimum Seating Stress
  - Calculated Installation Stress

![Graph showing leak rate vs. stress for Style B]

- Stress (MPa)
- Leak Rate (mbar l/s)
Minimum Seating Stress

Style A: 55MPa (8000 psi)

Style B: 35MPa (5000 psi)

Style C: 20MPa (2900 psi)

Style D: 25MPa (3600 psi)
Field Tests

Existing Conditions

• **Steam Lines:**
  – pressure: 140 bar (2030 psi)
  – temperature: 550ºC (1022ºF).
  – history of leaks: up to 2000 tons/year

• **Hydrocarbon Lines:**
  – 17,471 valves
  – Leak rates over 500 ppm: 54%
Steam Lines

- 46 valves packed with Style A
- Sizes from 1/2” to 16”
- No leaks after 36 months

Seating Stress:

\[ S_s = S_{\text{min}(0.01)} + P = 69 \text{ MPa} \]
\[ S_{\text{min}(0.01)} = 55 \text{ MPa (8000 psi)} \]
\[ P = 140 \text{ bar (2000 psi)} \]
Field Tests at the Braskem Plant

Hydrocarbon Lines

92% < 250 ppm
94% < 500 ppm

<table>
<thead>
<tr>
<th>Component</th>
<th>&lt;250 ppmv</th>
<th>&gt;250 / &lt;500 ppmv</th>
<th>&gt;500 ppmv</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angular</td>
<td>242</td>
<td>11</td>
<td>54</td>
</tr>
<tr>
<td>Butterfly</td>
<td>24</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Ball</td>
<td>820</td>
<td>29</td>
<td>181</td>
</tr>
<tr>
<td>Gate</td>
<td>11.176</td>
<td>195</td>
<td>527</td>
</tr>
<tr>
<td>Globe</td>
<td>1.574</td>
<td>23</td>
<td>104</td>
</tr>
<tr>
<td>Plug</td>
<td>155</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Mach</td>
<td>7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Others</td>
<td>63</td>
<td>-</td>
<td>3</td>
</tr>
</tbody>
</table>
ASME - PVP2009-77467
THE INFLUENCE OF DIFFERENT BRAIDED PACKING MATERIALS AND NUMBER OF RINGS ON STEM TORQUE AND SEALABILITY
Stem Torque

Friction Force Analysis

Graph showing the relationship between Gland Stress (MPa) and Friction Force (N) for different numbers of rings (2, 4, 5, 7, 9 rings). The graph includes multiple lines with different markers for each category, indicating how friction force increases with gland stress.
Stem Torque

Bottom Ring Residual Axial Stress

![Graph showing the relationship between Gland Stress (MPa) and \( \xi \) for different ring styles: 2 Rings, 4 Rings, 5 Rings, and 7 Rings. The graph illustrates how the residual axial stress changes with increasing Gland Stress for Style D.]

- **Gland Stress (MPa)**
- **\( \xi \) (%)**

- **Style D**
- **Radial Stress**
- **Gland Force**
Valve World Conference 2010 - TEST METHOD TO ANALYSE THE EFFICIENCY OF GALVANIC CORROSION INHIBITORS USED ON PACKINGS
The stem material has great influence on the corrosion.
Corrosion Inhibitors

- Packing Sample P: with Zinc Powder.
- Packing Sample W: with Zinc Wires in the core.
Develop an EXTREME LOW EMISSION packing
• STYLE 4 = High Torque
• STYLE 5 = Torque OK!

STEM TORQUE
Test at Cycling Conditions
[API 622] 77 Mpa - 260°C - 40bar (Methane)
Quantity of Impregnant

STEM TORQUE
Test at Cycling Conditions
[API 622] 77 Mpa - 260°C - 40bar (Methane)

- **STYLE 10 and 12 = High Torque**
- **STYLE 5 and 9 = Torque OK!**
## Teadit Laboratory Tests

### Teadit Research and Development

**Chevron Texaco Fugitive Emission Packing Test Report**

**Static Leakage Chart Reading**

![Static Leakage Chart](chart.png)

<table>
<thead>
<tr>
<th>Cycle Number</th>
<th>Leakage (PPMv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>500</td>
<td>7</td>
</tr>
<tr>
<td>1000</td>
<td>9</td>
</tr>
<tr>
<td>1500</td>
<td>11</td>
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<tr>
<td>2000</td>
<td>13</td>
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<td>2500</td>
<td>15</td>
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<td>3500</td>
<td>19</td>
</tr>
<tr>
<td>4000</td>
<td>21</td>
</tr>
<tr>
<td>4500</td>
<td>23</td>
</tr>
<tr>
<td>5000</td>
<td>25</td>
</tr>
</tbody>
</table>

### Stem Seal Leakage Readings (PPMv)

<table>
<thead>
<tr>
<th>Static Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average:</strong> 1.6</td>
</tr>
<tr>
<td><strong>Maximum:</strong> 10</td>
</tr>
</tbody>
</table>

www.teadit.com
Third Party Tests

Yarmouth Research and Technology, LLC

Static Leakage Chart
Maximum Reading

![Graph showing leakage over cycle number]

<table>
<thead>
<tr>
<th>Stem Seal Leakage Readings (PPMw)</th>
<th>Opening Torque (ft-lb)</th>
<th>Closing Torque (ft-lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static</td>
<td>Dynamic</td>
<td>Torque</td>
</tr>
<tr>
<td>Avg. 4</td>
<td>Max. 4</td>
<td>Avg. 6</td>
</tr>
<tr>
<td>Maximum: 19</td>
<td>20</td>
<td>18</td>
</tr>
</tbody>
</table>

Witness: [Signature]

[State of Maine Professional Engineer Stamp]
Style 2236

Specifications:

- Minimum Temperature: -240°C (-400°F)
- Maximum Temperature: 455°C (850°F)
- Maximum Pressure: 450 bar (6500 psi)
- pH: 0 - 14

Certifications:

- TA-Luft Approval = 1.5 x 10⁻³ mbar.l/s.m (2.7 x 10⁻⁴ mg/s.m)
  (T = 300° C [572 °F], 40 bar [580 PSI] and 5000 cycles)

- Chevron Test Leak Results: <20 PPMv after 10 Thermal Cycles and 5000 Mechanical Cycles

- Fire Tested to API 607 Specifications
Can we do Better?

Yarmouth Research and Technology, LLC

COMBO SET
010-ELE

<table>
<thead>
<tr>
<th>Stem Seal Leakage Readings (PPM)</th>
<th>Opening</th>
<th>Closing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Static</td>
<td>Dynamic</td>
</tr>
<tr>
<td>Average</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Maximum</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

Witness: [Signature]

[License Stamp]

[State of Maine Stamp]

[Signature]

ISA
Combo Set 010-ELE

- Teadit® 010-ELE Combo Set
  - 4 rings of “Packing A” (2236)
  - 1 ring of “Packing B” (2222)

- Specifications
  - Minimum Temperature: - 240 C (- 400 F)
  - Maximum Temperature: 455 C (850 F)
  - Maximum Pressure: 310 bar (4500 psi)
  - pH : 0 – 14 (except strong oxidizers)
Teadit Data

In God We Trust! Mr. Reeves Here is The Data!

Yarmouth Research and Technology

Static Leakage Maximum Readings Velan 4" Valve

Leakage (PPMv)

Cycle Number

Stuffing Box Temperature

Stuffing Box Temp (F)
Teadit iPhone & iPad App
Download Free from App Store
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