30 Years of Pressure Testing on PE-Xa Pipes

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Applications

a) Bus station, Stockholm
b) Airport, Stuttgart
c) Church, Gronau
d) Restaurant, Frankenstein

Fotos by Polytherm / Hewing
Applications

YAM - Dead Sea Salt (Israel); PEX ø 315 mm x 18.6 mm (SDR 17); PEX: Resistance to Abrasion & Corrosion.

Haifa Chemicals (Israel); PEX for Industrial Waste; ø 355 mm x 21 mm (SDR 17); PEX: because corrosive liquid at 60°C
When did it start?

- 1967 Patent from Thomas Engel for PE-Xa
- 1972 First pipes for underfloor heating
- First material: *Lupolen 5261 Z*
How does a pipe look like after 25 years?

80 °C
16.5 bar
σ = 5.4 MPa

95 °C
10.0 bar
σ = 3.3 MPa
How does a pipe look like after 25 years?

95 °C
13.0 bar
\( \sigma = 3.9 \text{ MPa} \)

95 °C
11.4 bar
\( \sigma = 3.7 \text{ MPa} \)
## Test Results:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Degree of Crosslinking</th>
<th>Strain at Break</th>
<th>Yield Stress</th>
<th>Strain at Yield</th>
<th>Test Time</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>86</td>
<td>100</td>
<td>20,1</td>
<td>13</td>
<td>26,3</td>
<td>95</td>
</tr>
<tr>
<td>#2</td>
<td>86</td>
<td>180</td>
<td>21,0</td>
<td>14</td>
<td>28,6</td>
<td>95</td>
</tr>
<tr>
<td>#3</td>
<td>90</td>
<td>390</td>
<td>20,6</td>
<td>12</td>
<td>26,9</td>
<td>80</td>
</tr>
<tr>
<td>#4</td>
<td>88</td>
<td>540</td>
<td>20,3</td>
<td>14</td>
<td>27,4</td>
<td>95</td>
</tr>
<tr>
<td>#5</td>
<td>74</td>
<td>540</td>
<td>20,3</td>
<td>13</td>
<td>27,6</td>
<td>95</td>
</tr>
</tbody>
</table>
### Comparison: Requirements DIN

<table>
<thead>
<tr>
<th>Hoop Stress [MPa]</th>
<th>Minimum Requirement According to PE-RT, DIN 16833 [h]</th>
<th>PE-X, DIN 16892 [h]</th>
<th>Test Results at 95 °C [h]</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,4</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3,5</td>
<td></td>
<td></td>
<td>240589 (27,4 years)</td>
</tr>
<tr>
<td>3,6</td>
<td></td>
<td></td>
<td>230918 (26,3 years)</td>
</tr>
<tr>
<td>3,7</td>
<td></td>
<td></td>
<td>242149 (27,6 years)</td>
</tr>
<tr>
<td>4,0</td>
<td></td>
<td></td>
<td>&gt; 150,000 (17 years, PE-Xb)</td>
</tr>
<tr>
<td>4,4</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4,6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4,7</td>
<td></td>
<td></td>
<td>121647 (13,8 years, PE-Xb)</td>
</tr>
<tr>
<td>4,8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Comparison: PE-X v PE-RT

Graph showing the deterioration of Hoop Stress (σ) over time (h) at different temperatures and standards:

- DIN 16892, 70 °C
- DIN 16892, 80 °C
- DIN 16892, 95 °C
- DIN 16833, 70 °C
- DIN 16833, 80 °C
- DIN 16833, 95 °C

Time [h]: 1, 5, 10, 25, 50 Years

Hoop Stress [MPa]: 6, 6.5, 7, 7.5, 8, 8.5
Feedback from the market in 30 Years of Application

Advantages of PE-X Pipes:

😊 approval for hot and cold water installation
😊 hygienic safe
😊 outstanding long term strength & very good resistance against heat ageing
😊 long service life even with high operation pressure
(> 10 bar at 70°C and 50 years; referring to DIN 16893 or EN 12318 - Class 2)
😊 excellent ESCR value & good impact strength even at low temperatures
😊 no corrosion and no segregation inside the pipe
😊 sound-absorbent and low level of flow noise
😊 low pressure loss because of smooth internal pipe surface
😊 simple thermal insulation
😊 easy to install (no soldering or welding necessary) & easy to change (pipe in pipe system)

😊 More than 30 years of excellent experience