**Zapp 28 Slicklines/Wirelines Datasheet**

**Wire**

Zapp is certified according to ISO 9001

**Zapp 28**

is a high-alloy austenitic stainless steel suitable for service in highly corrosive oil and gas environments.

The grade is characterized by

- Very good corrosion resistance in H2S, CO2 and chloride containing environments.
- Very good resistance to pitting owing to its high PRE* value of 38 minimum
- General corrosion comparable to or better than Alloy 825
- Tensile strength equivalent to ASTM 316
- Very good performance in elevated temperatures (geothermal wells)
- Entirely non-magnetic properties

*PRE, Pitting Resistance Equivalent = %Cr + 3.3 x %Mo + 16 x %N

**Chemical composition (nominal) %**

<table>
<thead>
<tr>
<th>%</th>
<th>C</th>
<th>Si</th>
<th>Mn</th>
<th>P</th>
<th>S</th>
<th>Cr</th>
<th>Ni</th>
<th>Mo</th>
<th>Cu</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≤ 0.020</td>
<td>0.6</td>
<td>2.0</td>
<td>≤ 0.025</td>
<td>≤ 0.010</td>
<td>27.0</td>
<td>31.0</td>
<td>3.5</td>
<td>1.0</td>
</tr>
</tbody>
</table>

**Forms of supply**

Zapp 28 slicklines are supplied cold drawn and degreased, on steel spools, in continuous lengths, without welds.

**Product program**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Breaking loads</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>N</td>
<td>lbf</td>
</tr>
<tr>
<td>2,083</td>
<td>5,109</td>
<td>1,149</td>
</tr>
<tr>
<td>2,337</td>
<td>6,431</td>
<td>1,446</td>
</tr>
<tr>
<td>2,667</td>
<td>8,377</td>
<td>1,883</td>
</tr>
<tr>
<td>2,743</td>
<td>8,862</td>
<td>1,992</td>
</tr>
<tr>
<td>3,175</td>
<td>11,872</td>
<td>2,669</td>
</tr>
<tr>
<td>3,810</td>
<td>17,096</td>
<td>3,843</td>
</tr>
<tr>
<td>4,064</td>
<td>19,451</td>
<td>4,373</td>
</tr>
</tbody>
</table>

**Standards**

- UNS: N08028
- EN Number: 1.4563
- EN Name: X1NiCrMoCu 31-27-4
Mechanical properties

Zapp 28 is tested and certified in accordance with a minimum tensile strength. Proof strength is approximately 90% of the tensile strength. Zapp 28 is able, therefore, to resist high loads without permanent set of the wire.

<table>
<thead>
<tr>
<th>Proof strength</th>
<th>Tensile strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>( R_{0.2} )</td>
<td>( R_m )</td>
</tr>
<tr>
<td>MPa</td>
<td>ksi</td>
</tr>
<tr>
<td>( \geq 1,350 )</td>
<td>( \geq 200 )</td>
</tr>
<tr>
<td>( \geq 1,500 )</td>
<td>( \geq 220 )</td>
</tr>
</tbody>
</table>

Corrosion resistance

Pitting

Zapp 28 has very good resistance to pitting because of high contents of chromium and molybdenum. Critical pitting temperatures (CPT) as a function of the chloride content and pH are presented in Figures 1 and 2.

Figure 1. CPT for various alloys in neutral chloride solutions at 300 mV SCE.

Figure 2. CPT in 3% NaCl as a function of pH at 600 mV SCE.
Stress corrosion cracking (SCC) in chloride environments
The combination of stresses up to the proof strength and chlorides leads to a risk of stress corrosion cracking. In austenitic steels the increased nickel content together with an increased stability against pitting corrosion will lead to an increased resistance against stress corrosion cracking.

Stress corrosion cracking (SCC) in in H₂S/Cl- environment
Tensile specimens from cold-worked Zapp 28 and Zapp 2205-SW were tested in the NACE TM-01-77 type of environment, modified in that the temperature was increased to 90 °C (194 °F). At this temperature, 100 % H₂S at atmospheric pressure corresponds to 100 kPa (14.5 psi) NaCl varied up to 10 %.

Figure 3. SCC resistance in oxygen-bearing (about 8 ppm) neutral chloride solutions. Testing time: 1,000 hours.

Applied strength equal to proof strength at testing time. The curve for AISI 304/304L and 316/316L is based on experimental data and practical experience. The data for the other grades are based on test results of tube material.

Figure 4. Constant-load SCC tests in acidified aqueous solution. Stress = 0.2 % proof strength at testing temperature, 90 °C (194 °F). Testing time 500 hours. Zapp 28 and Zapp 2205-SW tested in the cold worked condition. AISI 420 quenched and tempered.

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Last revision: December 2019