Sandvik Pressurfect is an austenitic chromium-nickel stainless steel with low carbon content used for high-pressure gasoline direct injection (GDI) fuel system.

**Chemical Composition, wt.%:**
(Nominal, maximum)

<table>
<thead>
<tr>
<th>Element</th>
<th>Nominal, maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon</td>
<td>≤ 0.030</td>
</tr>
<tr>
<td>Silicon</td>
<td>0.50</td>
</tr>
<tr>
<td>Manganese</td>
<td>1.30</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.030</td>
</tr>
<tr>
<td>Sulfur</td>
<td>≤ 0.015</td>
</tr>
<tr>
<td>Chromium</td>
<td>18.50</td>
</tr>
<tr>
<td>Nickel</td>
<td>10.0</td>
</tr>
<tr>
<td>Iron</td>
<td>bal</td>
</tr>
</tbody>
</table>

**Physical Properties:**

- **Density, kg/cm³ (lb/in.³):** 7900 (0.29)
- **Resistivity, μΩ · m (Ω circular-mil/ft):**
  - Cold drawn: 0.180 (108)
  - Heat treated: 0.210 (126)
- **Thermal expansion, mean values, 10⁻⁶/K (10⁻⁶/°F):**
  - Cold drawn, 30–100 °C (86–212 °F): 16.5 (9.2)
  - Cold drawn, 30–200 °C (86–392 °F): 17.0 (9.4)
  - Heat treated, 30–100 °C (86–212 °F): 9.0 (5.0)
  - Heat treated, 30–200 °C (86–392 °F): 9.5 (5.3)
- **Thermal conductivity, W/m·K (Btu/ft·hr·°F):**
  - 20 °C (68 °F): 15 (8.7)
  - 100 °C (212 °F): 16 (9.2)
  - 200 °C (392 °F): 18 (10.4)
- **Specific heat capacity, J/kg·K (Btu/lb·°F):**
  - 20 °C (68 °F): 475 (0.113)
  - 100 °C (212 °F): 500 (0.120)
  - 200 °C (392 °F): 530 (0.127)

**Mechanical Properties:**

- **Modulus of elasticity, GPa (10⁶ psi):**
  - 20 °C (68 °F): 200 (29)
  - 100 °C (212 °F): 194 (28)
  - 200 °C (392 °F): 186 (27)
- **Proof strength, 0.2% offset yield strength, R_p0.2, MPa (ksi):**
  - 20 °C (68 °F): ≥ 210 (≥ 30)
  - 50 °C (122 °F): 190 (28)
  - 100 °C (212 °F): 165 (24)
  - 150 °C (302 °F): 150 (22)
  - 200 °C (392 °F): 140 (20)
- **Tensile strength, R_m, 20 °C (68 °F), MPa (ksi):** 515–680 (75–99)
- **Elongation, 20 °C (68 °F):**
  - \( A \) ≥ 45
  - \( A_\text{2} \) ≥ 35
  - Hardness, HRB, 20 °C (68 °F): ≤ 90

  Elongation \( A \) is based on \( L = 5.65 \sqrt{S_0} \) where \( L_0 \) is the original gauge length and \( S_0 \) the original cross-section.

**Heat Treatment:**

The heat treatment is similar to that of ASTM TP304L. See also “Fabricability”.

**Machinability:**

The machinability is similar to ASTM TP304L.

**Fabricability:**

**Bending.** Annealing after cold bending is not normally necessary, but this point must be decided with regard to the degree of bending and the operating conditions. Heat treatment, if any, should take the form of stress relieving at 850–950 °C (1562–1742 °F), cooling in air, or solution annealing at 1000–1100 °C (1832–2012 °F) and rapid cooling in air or water. Hot bending is carried out at 1100–850 °C (2012–1562 °F) and should be followed by solution annealing.

**Corrosion Resistance:**

**General Corrosion.** Pressurfect has good resistance in:

- Organic acids at moderate temperatures
- Salt solutions, e.g., sulfates, sulfides, and sulfites
- Caustic solutions at moderate temperatures
Pressurfect has better resistance than normal ASTM 304 to oxidizing agents such as nitric acid.

**Pitting and Crevice Corrosion.** The steel may be sensitive to pitting and crevice corrosion even in a solution of relatively low chloride content. Where pitting corrosion is a risk, Pressurfect XP can offer better resistance due to its significantly higher PRE* value.

<table>
<thead>
<tr>
<th>Grade</th>
<th>UNS</th>
<th>%Cr</th>
<th>%Ni</th>
<th>%N</th>
<th>PRE minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressurfect</td>
<td>S30403</td>
<td>18.50</td>
<td>10.00</td>
<td></td>
<td>18.00</td>
</tr>
<tr>
<td>Pressurfect XP</td>
<td>S32304</td>
<td>23.00</td>
<td>4.50</td>
<td>0.10</td>
<td>24.00</td>
</tr>
</tbody>
</table>

*PRE (Pitting Resistance Equivalent) = %Cr + 3.3 × Mo + 16 × %N

**Stress Corrosion Cracking.** Austenitic steels are susceptible to stress corrosion cracking. This may occur at temperatures above approximately 60 °C (140 °F) if the steel is subjected to tensile stresses and at the same time comes into contact with certain solutions, particularly those containing high chloride levels. This should be carefully considered when material is being selected. In applications demanding high resistance to stress corrosion cracking, we recommend the duplex steel Pressurfect XP is recommended.

**Intergranular Corrosion.** Pressurfect has a low carbon content and therefore better resistance to intergranular corrosion than steels of type ASTM 304. Figure 1, which shows the result of testing for 24 hours in boiling Strauss solution (12% sulfuric acid, 6% copper sulfate), confirms the superior resistance of Pressurfect. This is an advantage in complicated welding operations. The good resistance against intergranular attack of Pressurfect is also demonstrated in the Huey test (boiling in 65% nitric acid for 5×48 hours). A maximum corrosion rate of 0.40 mm/year (0.016 in./year) in the annealed condition and 0.60 mm/year (0.024 in./year) in the sensitized (675 °C, or 1247 °F) condition can be met.

**Specification Equivalents:**

**Standards**
- ASTM TP304L
- UNS S30403
- EN 1.4306
- BS 304S11
- JIS SUS304L, SUS304LTB

**Product Standards**
- ASTM A213, A269
- ISO 16061
- JIS G3459, G3463
- EN 10216-5

**Approvals**
- JIS approval for stainless steel tubes
- ASME SA213, SA269

**General Characteristics:**

Pressurfect is an austenitic stainless chromium-nickel steel with a low carbon content used for high-pressure gasoline direct injection (GDI) fuel systems. The grade is characterized by:
- Good corrosion resistance
- Excellent toughness
- Excellent bendability

Service temperature is –50 °C to +100 °C (–58 °F to 212 °F). Prolonged service at elevated temperatures causes decreased hardness when used in the hardened and tempered condition.

**Product Availability:**

**Forms of Supply.** Pressurfect stainless steel tubes are supplied in the bright annealed condition.

**Dimensions.** Outside diameter is 6.35–30.0 mm (0.25–1.2 in.); wall thickness is 0.89–3.0 mm (0.04–0.12 in.).

**Applications:**

This alloy has been developed specifically for high-pressure fuel rails and fuel lines for gasoline direct injection (GDI) systems in next generation internal combustion engines.

**Producer:**

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Fig. 1 Sensitization diagram for Pressurfect and ASTM 304. Testing for 4 h in boiling Strauss solution (12% sulfuric acid, 6% copper sulfate)