Penn Stainless inventory now includes Alloy 410 (UNS S41000) in sheet, plate and processed flat bar. Tubular items may be available upon request.

**GENERAL PROPERTIES**
 Alloy 410 is the basic, general purpose martensitic stainless steel that is used for highly stressed parts and provides good corrosion resistance plus high strength and hardness. Alloy 410 contains a minimum of 11.5% chromium which is just sufficient enough to demonstrate corrosion resistance properties in mild atmospheres, steam, and many mild chemical environments. It is a general purpose grade that is often supplied in the hardened but still machineable condition for applications where high strength and moderate heat and corrosion resistance are required. Alloy 410 displays maximum corrosion resistance when it’s been hardened, tempered, and then polished.

**APPLICATIONS**
 Applications requiring moderate corrosion resistance and high mechanical properties are ideal for Alloy 410. Examples of applications that frequently used Alloy 410 include:

- Cutlery
- Steam and gas turbine blades
- Kitchen utensils
- Bolts, nuts, screws
- Pump and valve parts and shafts
- Mine ladder rugs
- Dental and surgical instruments
- Nozzles
- Hardened steel balls and seats for oil well pumps

**STANDARDS ALLOY 410**
 ASTM/ASME .................UNS S41000
 EURONORM .................X12Cr13
 DIN ..........................2.4660

Alloy 410 (UNS S41000) can be processed by Penn Stainless utilizing the following methods:

- Shear Cutting
- Plasma Cutting
- HQ Plasma Cutting
- Dynamic Water Jet Cutting
- Laser Cutting
- Saw Cutting
- Gauer Processing
- Machine Cutting

Product Offering:

- Sheet
- Plate
- Perforated
- Flate & expanded
- Round bar
- Square bar
- Hex Bar
- Rolled flat bar
- S/E processed bar
- Tubular products
- Structural
CORROSION RESISTANCE
• Good corrosion resistance to atmospheric corrosion, potable water, and to mildly corrosive environments
• Its exposure to everyday activities (sports, food preparation) is generally satisfactory when proper cleaning is performed after exposure to use
• Good corrosion resistance to low concentrations of mild organic and mineral acids

WELDING CHARACTERISTICS
• Readily welded by all standard methods
• To reduce the risk of cracking, it is suggested to pre-heat the work piece to 350 to 400°F (177 to 204°C)
• Post weld annealing is recommended to retain maximum ductility

HEAT TREATMENT
• The proper hot work range is 2000 to 2200°F (1093 to 1204°C)
• Do not work this material below 1650°F (899°C)

CHEMICAL PROPERTIES

<table>
<thead>
<tr>
<th>Type</th>
<th>C (max)</th>
<th>Mn (max)</th>
<th>Si (max)</th>
<th>P (max)</th>
<th>S (max)</th>
<th>Cr</th>
<th>Ni (max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>410</td>
<td>0.15</td>
<td>1.00</td>
<td>1.00</td>
<td>0.04</td>
<td>0.03</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MECHANICAL PROPERTIES

<table>
<thead>
<tr>
<th>Grade</th>
<th>Tensile Strength ksi (MPa) min</th>
<th>Yield Strength 0.2% offset ksi (MPa) min</th>
<th>Elongation (% in 50mm) min</th>
<th>Hardness (Brinell) MAX</th>
<th>Hardness (Rockwell B) MAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>410</td>
<td>65 (450)</td>
<td>30 (205)</td>
<td>20</td>
<td>217</td>
<td>96</td>
</tr>
</tbody>
</table>

MECHANICAL PROPERTIES OF HEAT TREATED 410

<table>
<thead>
<tr>
<th>Heat Treatment</th>
<th>T410 (0.14%C) Hardened 1800°F (982°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rockwell Hardness</td>
</tr>
<tr>
<td>Annealed*</td>
<td>81 HRB</td>
</tr>
<tr>
<td>Hardened &amp; Tempered 400°F (204°C)</td>
<td>43 HRC</td>
</tr>
<tr>
<td>Hardened &amp; Tempered 550°F (288°C)</td>
<td>40 HRC</td>
</tr>
<tr>
<td>Hardened &amp; Tempered 600°F (316°C)</td>
<td>40 HRC</td>
</tr>
<tr>
<td>Hardened &amp; Tempered 800°F (427°C)</td>
<td>41 HRC</td>
</tr>
<tr>
<td>Hardened &amp; Tempered 900°F (482°C)</td>
<td>41 HRC</td>
</tr>
<tr>
<td>Hardened &amp; Tempered 1000°F (538°C)</td>
<td>35 HRC</td>
</tr>
<tr>
<td>Hardened &amp; Tempered 1200°F (649°C)</td>
<td>98 HRB</td>
</tr>
</tbody>
</table>

PHYSICAL PROPERTIES

<table>
<thead>
<tr>
<th>Density lb/in³</th>
<th>Thermal Conductivity (BTU-in/hr- ft. °F)</th>
<th>Electrical Resistivity (in x 10⁸)</th>
<th>Modulus of Elasticity (psi x 10⁶)</th>
<th>Coefficient of Thermal Expansion (in/in)/°F x 10⁴</th>
<th>Specific Heat (BTU/lb/°F)</th>
<th>Melting Range (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>at 68°F: 0.276</td>
<td>14.4 at 212°F</td>
<td>56 at 68°F</td>
<td>29</td>
<td>5.90 at 68 – 392°F</td>
<td>0.11 at 68°F to 212°F</td>
<td>2700 to 2790</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.5 at 68 – 1112°F</td>
</tr>
</tbody>
</table>