Specification Sheet: 2507 (UNS S32750)

A 25Cr Duplex Stainless Steel

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The impact strength is also high. Alloy 2507 is not recommended for applications which require long exposures to temperatures above 570°F because of the risk of a reduction in toughness.

Applications

- Oil and gas industry equipment
- Offshore platforms, heat exchangers, process and service water systems, fire-fighting systems, injection and ballast water systems
- Chemical process industries, heat exchangers, vessels, and piping
- Desalination plants, high pressure RO-plant and seawater piping
- Mechanical and structural components, high strength, corrosion-resistant parts
- Power industry FGD systems, utility and industrial scrubber systems, absorber towers, ducting, and piping

Standards

ASTM/ASME .. A240 - UNS S32750
EURONORM .. 1.4410 - X2 Cr Ni MoN 25.7.4
AFNOR....... Z3 CN 25.06 Az

Corrosion Resistance

General Corrosion

The high chromium and molybdenum content of 2507 make it extremely resistant to uniform corrosion by organic acids like formic and acetic acid. 2507 also provides excellent resistance to inorganic acids, especially those containing chlorides.

In dilute sulfuric acid contaminated with chloride ions, 2507 has better corrosion resistance than 904L, which is a highly alloyed austenitic steel grade specially designed to resist pure sulfuric acid.

Stainless steel of type 316L (2.5%Mo) cannot be used in hydrochloric acid due to the risk of localized and uniform corrosion. However, 2507 can be used in dilute hydrochloric acid. Pitting need not be a risk in the zone below the borderline in this figure, but crevices must be avoided.

Intergranular Corrosion

2507's low carbon content greatly lowers the risk of carbide precipitation at the grain boundaries during heat treatment; therefore, the alloy is highly resistant to carbide-related intergranular corrosion.

Stress Corrosion Cracking

The duplex structure of 2507 provides excellent resistance to chloride stress corrosion cracking (SCC).

Because of its higher alloy content, 2507 is superior to 2205 in corrosion resistance and strength. 2507 is especially useful in offshore oil and gas applications and in wells with either naturally high brine levels or where brine has been injected to enhance recovery.

Pitting Corrosion

Different testing methods can be used to establish the pitting resistance of steels in chloride-containing solutions. The data above were measured by an electrochemical technique based on ASTM G 61. The critical pitting temperatures (CPT) of several high-performance steels in a 1M sodium chloride solution were determined. The results illustrate the excellent resistance of 2507 to pitting corrosion. The normal data spread for each grade is indicated by the dark gray portion of the bar.

Crevice Corrosion

The presence of crevices, almost unavoidable in practical constructions and operations, makes stainless steels more susceptible to corrosion in chloride environments. 2507 is highly resistant to crevice corrosion.

The critical crevice corrosion temperature of 2507 and several other high-performance stainless steels are shown above.

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Providing Solutions, With Materials and Value Added Products, for Process Industries
Mechanical Properties
Mechanical and Physical Properties
2507 combines high tensile and impact strength with a low coefficient of thermal expansion and high thermal conductivity. These properties are suitable for many structural and mechanical components. The low, ambient, and elevated temperature mechanical properties of 2507 sheet and plate are shown below. All of the test data shown are for samples in the annealed and quenched condition.

2507 is not recommended for applications which require long exposures to temperatures in excess of 570ºF because of the increased risk of a reduction in toughness. The data listed in this document are typical for wrought products and should not be regarded as a maximum or minimum value unless specifically stated.

Heat Treatment
2507 should be solution annealed and quenched after either hot or cold forming. Solution annealing should be done at a minimum of 1925ºF. Annealing should be followed immediately by a rapid air or water quench. To obtain maximum corrosion resistance, heat treated products should be pickled and rinsed.

Welding
2507 possesses good weldability and can be joined to itself or other materials by shielded metal arc welding (SMAW), gas tungsten arc welding (GTAW), plasma arc welding (PAW), flux cored wire (FCW), or submerged arc welding (SAW). 2507/P100 filler metal is suggested when welding 2507 because it will produce the appropriate duplex weld structure.

If welding is to be done on only one surface and post weld cleaning is not possible, GTAW is suggested for root passes. GTAW or PAW should not be done without a filler metal unless post weld cleanup is possible. A heat input of 5-38 kJ/in. should be used for SMAW or GTAW. A heat input of about 50kJ/in. can be used for SAW.

Note
2205 Code Plus Two and 254 SMO are registered trademarks of Outokumpu Stainless, Inc. This technical data and information represents our best knowledge at the time of printing. However, it may be subject to some slight variations due to our ongoing research program on corrosion resistant grades. We, therefore, suggest that information be verified at time of inquiry or order. Furthermore, in service, real conditions are specific for each application. The data presented here is only for the purpose of description and may only be considered as guarantees when our Company has given formal written approval.

Chemical Analysis
Typical Values (Weight %)

<table>
<thead>
<tr>
<th>C</th>
<th>Cr</th>
<th>Ni</th>
<th>Mo</th>
<th>N</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.020</td>
<td>25</td>
<td>7</td>
<td>4.0</td>
<td>0.27</td>
<td>S = 0.001</td>
</tr>
</tbody>
</table>

PREN = [Cr %] + 3.3 [Mo %] + 16 [N %] ≥ 40

Low Temperature Impact Properties

<table>
<thead>
<tr>
<th>Temperature °F</th>
<th>RT</th>
<th>32</th>
<th>-4</th>
<th>-40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ft-lbs</td>
<td>162</td>
<td>162</td>
<td>155</td>
<td>140</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Temperature °F</th>
<th>-76</th>
<th>-112</th>
<th>-148</th>
<th>-320</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ft-lbs</td>
<td>110</td>
<td>44</td>
<td>30</td>
<td>7</td>
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</tbody>
</table>

Elevated Temperature Tensile Properties

<table>
<thead>
<tr>
<th>Temperature °F</th>
<th>68</th>
<th>212</th>
<th>302</th>
<th>392</th>
<th>482</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2% Offset Yield Strength, ksi</td>
<td>80</td>
<td>65</td>
<td>61</td>
<td>58</td>
<td>55</td>
</tr>
<tr>
<td>Ultimate Tensile Strength, ksi</td>
<td>116</td>
<td>101</td>
<td>98</td>
<td>95</td>
<td>94</td>
</tr>
</tbody>
</table>

Physical Properties

| Density          | lb/in³ | 0.28 |
| Modulus of Elasticity | psi x 10⁶ | 29  |
| Coefficient of Thermal Expansion 68-212°F/F | x10⁻⁶/F | 7.2 |
| Thermal Conductivity | Btu/h ft °F | 8.7 |
| Heat Capacity    | Btu/°F | 0.12 |
| Electrical Resistivity | Ω-in x 10⁻⁶ | 31.5 |

Processing
Hot Forming
2507 should be hot worked between 1875ºF and 2250ºF. This should be followed by a solution anneal at 1925ºF minimum and a rapid air or water quench.

Cold Forming
Most of the common stainless steel forming methods can be used for cold working 2507. The alloy has a higher yield strength and lower ductility than the austenitic steels so fabricators may find that higher forming forces, increased radius of bending, and increased allowance for springback are necessary. Deep drawing, stretch forming, and similar processes are more difficult to perform on 2507 than on an austenitic stainless steel. When forming requires more than 10% cold deformation, a solution anneal and quench are recommended.