

# Core 4513

EN 1.4513

## General characteristics

Core 4513 is a 1% molybdenum-alloyed ferritic stainless steel with medium chromium content. It is suitable for use in many corrosive environments, like for instance in the cold end of automotive exhaust systems. Because of its titanium alloying, Core 4513 can be welded in all dimensions without becoming susceptible to intergranular corrosion.

## Typical applications

- Automotive exhaust systems & mufflers
- Decorative trim in automotive applications

## Products & dimensions

### Cold rolled products, available dimensions (mm)

Surface finish		Coil / Strip		Plate / Sheet	
		Thickness	Width	Thickness	Width
2B	Cold rolled, heat treated, pickled, skin passed	0.30-3.00	30-1550	0.30-3.00	350-1325
2BB	Bright-pickled	0.40-3.00	30-1530	0.40-3.00	600-1530
2C	Cold rolled, heat treated	0.80-2.00	30-1500		
2D	Cold rolled, heat treated, pickled	0.40-3.00	30-1530	0.40-3.00	600-1530
2E	Cold rolled, heat treated, mech. desc. pickled	0.50-3.00	30-1530	0.50-3.00	600-1530
2G	Ground	0.40-3.00	30-1530	0.40-3.00	600-1530
2J	Brushed or dull polished	0.40-3.00	30-1530	0.40-3.00	600-1530
2R	Cold rolled, bright annealed	0.05-3.00	3-1500	0.30-3.00	350-1500

### Continuous hot rolled products, available dimensions (mm)

Surface finish		Coil / Strip		Plate / Sheet	
		Thickness	Width	Thickness	Width
1C	Hot rolled, heat treated, not descaled	2.00-8.00	50-1550		
1D	Hot rolled, heat treated, pickled	3.50-6.00	50-1325	3.50-6.00	425-1325
1G	Ground	2.00-3.00	750-1455	2.00-3.00	750-1530
1U	Black hot rolled	2.00-8.00	50-1550		

# Chemical composition

The typical chemical composition for this grade is given in the table below, together with composition limits given for the product according to different standards. The required standard will be fully met as specified on the order.

The chemical composition is given as % by mass.

	C	Mn	Cr	Ni	Mo	N	Other
<b>Typical</b>	<b>0.02</b>		<b>17.0</b>		<b>1.0</b>		<b>Ti</b>
EN 10088-2	≤0.025	≤1.0	16.0-18.0		0.80-1.40	≤0.020	Ti

# Corrosion resistance

Core 4513 has good corrosion resistance in solutions of many halogen-free organic and inorganic compounds over a wide temperature and concentration range. It can withstand many sufficiently diluted organic and mineral acids depending on the temperature and concentration of the solution. Core 4513 may suffer from uniform corrosion in strong organic and mineral acids, as well as in hot concentrated alkaline solutions.

In aqueous solutions containing halogenides, e.g. chlorides or bromides, pitting and crevice corrosion may occur depending on the halogenide concentration, temperature, pH-value, concentration of oxidizing compounds, or crevice geometry, if applicable. The presence of corrosion-inhibiting or accelerating compounds like e.g. transition metal ions or organic compounds may influence the corrosion behavior of Core 4513. Due to its ferritic crystal structure, Core 4513 is not prone to chloride-induced stress corrosion cracking.

Core 4513 can be used for indoor and outdoor applications in rural areas and urban environments where chloride contamination is low. The best material performance is usually reached with the help of adequate design, correct post-weld treatment, and regular cleaning during use (if applicable).

Due to its titanium and niobium content, the risk of sensitisation to intergranular corrosion is strongly reduced when compared to non-stabilized ferritic grades. Core 4513 can be used in the temperature range in which chromium carbides would precipitate in non-stabilized ferritic grades. Its maximum service temperature in dry air is 850 °C. The presence of other corrosive compounds in the hot environment, like water or sulfur compounds may reduce the maximum service temperature significantly.

Pitting corrosion resistance		Crevice corrosion resistance
PRE	CPT	CCT
20	<10	<0

Pitting Resistance Equivalent (PRE) is calculated using the following formula:  $PRE = \%Cr + 3.3 \times \%Mo + 16 \times \%N$

Corrosion Pitting Temperature (CPT) as measured in the Avesta Cell (ASTM G 150), in a 1M NaCl solution (35,000 ppm or mg/l chloride ions).

Critical Crevice Corrosion Temperature (CCT) is obtained by laboratory tests according to ASTM G 48 Method F

For more information on corrosion resistance, please refer to the Outokumpu Corrosion Handbook or contact the our corrosion experts.

# Mechanical properties

Cold rolled coil and sheet	R <sub>p0.2</sub> MPa	R <sub>p1.0</sub> MPa	R <sub>m</sub> MPa	Elongation <sup>1)</sup> %	Impact strength J	Rockwell	HB	HV
<b>Typical (thickness 1 mm)</b>	<b>310</b>	<b>325</b>	<b>470</b>					

Hot rolled coil and sheet	R <sub>p0.2</sub> MPa	R <sub>p1.0</sub> MPa	R <sub>m</sub> MPa	Elongation <sup>1)</sup> %	Impact strength J	Rockwell	HB	HV
<b>Typical (thickness 4 mm)</b>	<b>355</b>	<b>380</b>	<b>490</b>	<b>34</b>			<b>78</b>	

<sup>1)</sup>Elongation according to EN standard:  
A<sub>80</sub> for thickness below 3 mm.  
A for thickness = 3 mm.  
Elongation according to ASTM standard A<sub>2</sub> or A<sub>50</sub>.

## Physical properties

Density kg/dm <sup>3</sup>	Modulus of elasticity GPa	Thermal exp. at 100 °C 10 <sup>-6</sup> /°C	Thermal conductivity W/m°C	Thermal capacity J/kg°C	Electrical resistance μΩm	Magnetizable
7.7	220	10,0	25	460	0.70	Yes

## Fabrication

More detailed information concerning welding procedures can be obtained from the Outokumpu Welding Handbook, available from our sales offices.

## Standards & approvals

Standard	Designation
EN 10088-2	1.4513

## Contacts & Enquiries

Contact your nearest sales office

[www.outokumpu.com/contacts](http://www.outokumpu.com/contacts)

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