

## Austenitic stainless steel offer

# Aperam 201D with manganese

### Chemical composition

Elements (%)	C	N	Mn	Cr	Ni	Cu	S
201D	0.05	0.10	6.0	16.8	4.6	1.6	≤ 0.002

Typical values

#### European designation

#### American designation

X9CrMnNiCu17-8-5-2/1.4618 <sup>(1)</sup>

Type 201 <sup>(2)</sup>

<sup>(1)</sup> According to prEN10088-2, Dec. 2011

<sup>(2)</sup> With copper addition and mechanical properties of the 201-1 "rich side"

These grades comply with:

- > Stainless Europe Material Safety Data Sheet n°1 (European Directive 2001/58/EC).
- > European Directive 2000/53/EC on end-of-life vehicles and later modifications.
- > Standard NFA 36 711 "Stainless Steel intended for use in contact with foodstuffs, products and beverages for human and animal consumption (non packaging steel)".

### Key features

The principal features of our grade 201D are :

- > A well-balanced chemical composition (low nickel combined with copper addition), making the grade as easy to work with as our traditional 8% nickel austenitic grade 304
- > A very low sulphur content combined with the chromium content, guaranteeing pitting corrosion resistance close to that of grade 1.4301, Type 304
- > A minimum nickel content of 4.5% which provides crevice corrosion resistance similar to grade 1.4310, Type 301
- > Good formability without risk of delayed cracking after deep drawing
- > Good weldability
- > Good polishing ability
- > A dimensional offer identical to the grade 1.4301, Type 304

### Applications

- > Chemical industry equipment
- > Food industry equipment
- > Piping and tubing
- > Industrial and food storage vessels
- > Dairy equipment
- > Profiles, general metalwork, construction

### Product range

	Coils	Sheets / Blanks
Thickness (mm)	0.50 up to 13	0.50 up to 13
Width (mm)	up to 2,000	80 up to 2,000
Finish	2R / 2B / 2D / 1D	2R / 2B / 2D / 1D

## Physical properties

### Cold rolled and annealed sheet

Density	d	kg/dm <sup>3</sup>	4°C	7.7
Specific heat	c	J/kg.K	20°C	500
Thermal conductivity	k	W/m.K	20°C	15
Young's Modulus	E	GPa	20°C	200

## Mechanical properties

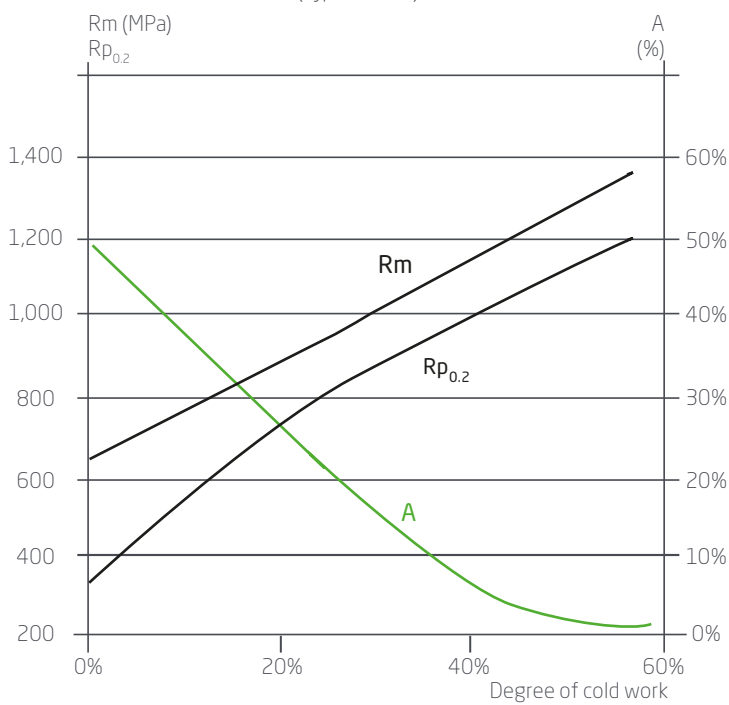
### Test piece

Length = 80 mm (thickness < 3 mm)  
 Length =  $5.65 \sqrt{S_0}$  (thickness  $\geq$  3 mm)  
 Cold rolled

### In the annealed condition

In accordance with ISO 6892-1, part 1  
 Test piece perpendicular to rolling direction

### Work hardened condition (Typical values)

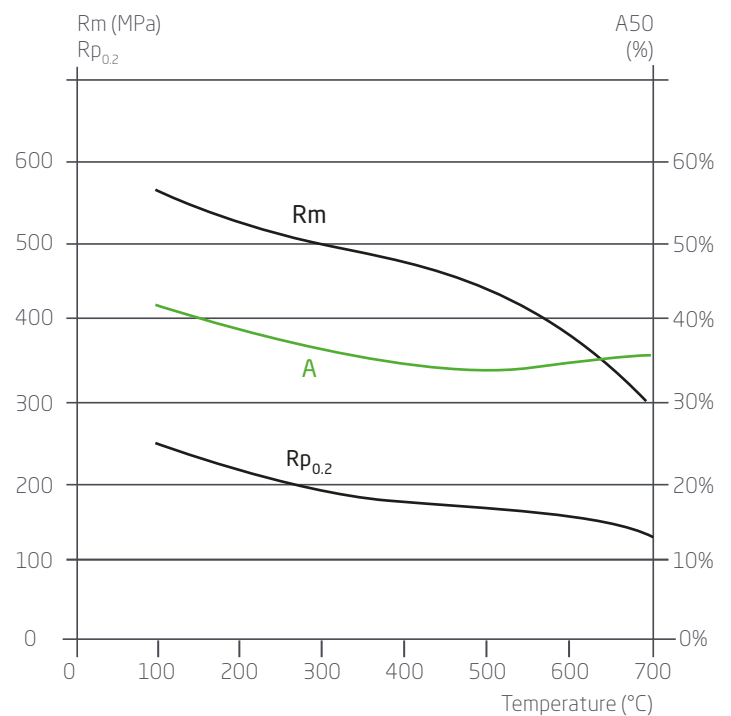


Grade	European designation	ASTM A240	Rm <sup>(1)</sup> (MPa)	Rp <sub>0.2</sub> <sup>(2)</sup> (MPa)	A <sup>(3)</sup> %	HRB
201D	1.4618	201.1	665	320	52	87

1 MPa = 1 N/mm<sup>2</sup> - Typical values

<sup>(1)</sup> Ultimate Tensile Strength (UTS) - <sup>(2)</sup> Yield Strength (YS) - <sup>(3)</sup> Elongation (A)

### At high temperatures (Typical values)



## Corrosion resistance

Our grade 201D has good resistance to common types of corrosion and is well suited to urban as well as rural atmospheres and fresh water. In all cases, periodic cleaning of exterior surfaces is necessary to maintain the original finish.

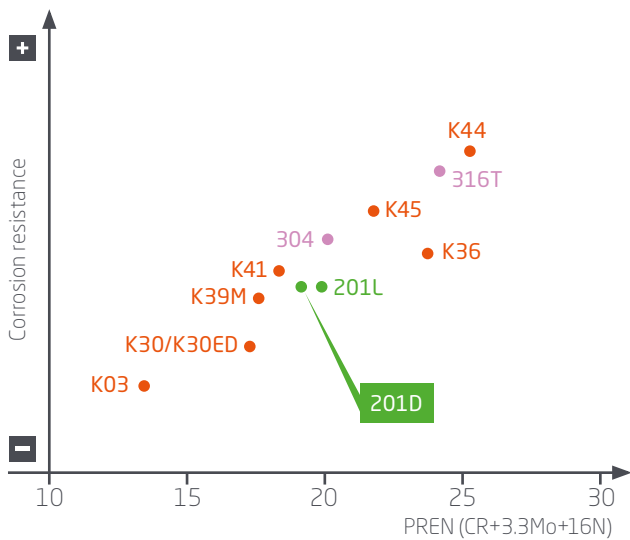
Sulphides are preferential sites for the initiation of pitting corrosion. The very low sulphur content of 201D improves the pitting corrosion resistance in comparison with grade 1.4372, Type 201 and makes it nearly equivalent to that of grade 1.4301, Type 304.

The addition of copper enhances general corrosion resistance in a reducing acidic environment such as sulphuric acid solutions (H<sub>2</sub>SO<sub>4</sub>).

Due to the fact that the chromium and nickel content is lower, 201D is slightly less efficient than grade 1.4301, Type 304 in acid environments with halogens. In case of grade 1.4301, Type 304 substitution, the risk of crevice and stress corrosion must be considered carefully.

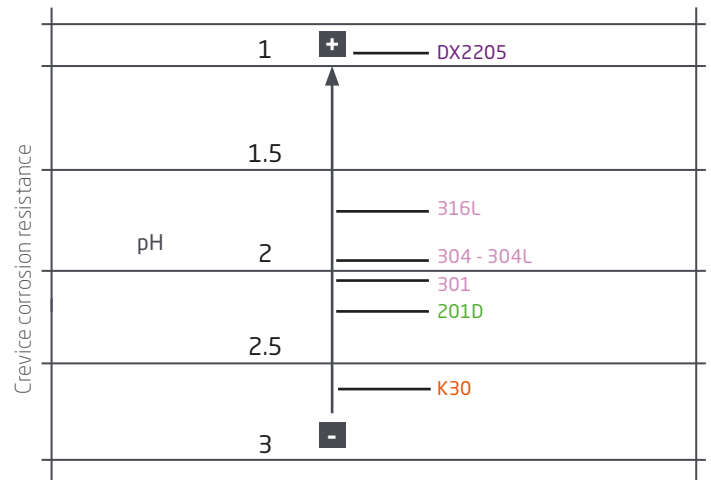
### Pitting potential

Typical pitting potential values in NaCl 0.02M at 23°C and pH6 as a function of the PREN (%Cr+3.3%Mo+16%N).



### Crevice corrosion

Depassivation pH in a deaerated NaCl 2M environment at 23°C



## Forming

In the annealed condition, our grade 201D can be readily cold formed by processes such as bending, profiling, drawing, roll forming, spinning etc.

For severe deep drawing, our grade 304ED is recommended. Some forming operations can be performed more easily at higher temperature. In that case, subsequent pickling is necessary.

### Stretching

Stretching behaviour is characterised by the dome height of the Erichsen test, whereas the limiting drawing ratio quantifies the drawing behaviour. In contrast to the conventional low nickel grades such as 201D behaves similarly to Type 304.

### Bending

Good bending capacity up to 180°, with very small bending radii for thicknesses below 0.8 mm. For thicker gauges, a bending radius of at least half the thickness of the sheet is recommended.

### Flow turning

Our grade 304ED is the most suitable for this application.

Grades	Erichsen cup test (mm)	Limiting Drawing Ration (LDR)	Delayed Cracking
201D	14.1	1.95-2.07	No
304L	14.0	1.95-2.06	No
201	14.1	2.00-2.05	Yes

Thickness 3 mm - EN 1.4372, Type 201

## Welding

Welding process	No filler material	With filler metal		Shielding gas	
	Typical thicknesses	Thicknesses	Filler material		* Hydrogen and nitrogen forbidden in all cases
			Rod	Wire	
Resistance: spot, seam	≤ 2 mm				
TIG	< 1.5 mm	> 0.5 mm	W.Nr 1.4370 ER 309L (Si) ER 316L (Si)	ER 308 L (Si) W.Nr 1.4370 ER 347 (Si)	Ar Ar + 5% H Ar + He
PLASMA	< 1.5 mm	> 0.5 mm		ER 308 L (Si) W.Nr 1.4370 ER 347 (Si)	Ar Ar + 5% H Ar + He
MIG		> 0.8 mm		ER 308 L (Si) W.Nr 1.4370 ER 347 (Si)	Ar + 2% CO <sub>2</sub> Ar + 2% O <sub>2</sub> Ar + 3% CO <sub>2</sub> + 1% H <sub>2</sub> Ar + He
SAW		> 2 mm		ER 308 L ER 347	
Electrode		Repairs	E 308 E 308 L E 347		
Laser	< 5 mm				He Under certain circumstances: Ar N

No heat treatment is necessary after welding. In order to fully restore the corrosion resistance of the metal, the welds must be mechanically or chemically descaled, then passivated and decontaminated.

Our grade 201D contains the same amount of carbon as Type 304 and has the same resistance to intergranular corrosion. It is compliant with ISO 3651-2 Method A (Moneypenny Strauss = 16% sulphuric acid/copper sulphate). If there is a risk of intergranular corrosion, a solution annealing treatment (1,050/1,100°C) must be carried out. However, in this case a low carbon grade such as 304L or titanium stabilised grades such as 321 are recommended.

## Heat treatment and finishing

### Annealing

After forming, annealing for a few minutes at 1,050 ±25°C, followed by water quenching or air cooling, regenerates the structure (recrystallisation and dissolution of carbides) and eliminates internal stresses after the following operations:

- > Cold forming (work hardening)
- > Welding (risk of intergranular corrosion in the weld joint). After annealing, pickling followed by passivation is necessary

### Pickling

- > Nitric-Hydrofluoric acid mixture (10% HNO<sub>3</sub> + 2% HF) at ambient temperature or up to 60°C

- > Heat treatment and finishing Sulfuric-nitric acid mixture (10% H<sub>2</sub>SO<sub>4</sub> + 0.5% HNO<sub>3</sub>) at 60°C
- > Use descaling pastes for weld areas

### Passivation

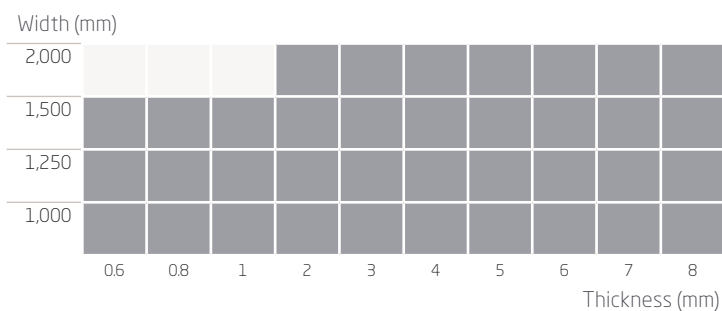
- > 20-25% HNO<sub>3</sub> solution at 20°C
- > Use passivating pastes for weld areas

### Polishing

201D has a similar surface finish to Type 304 making it equally suitable for all kinds of polishing (grit, scotch-brite, electropolishing).

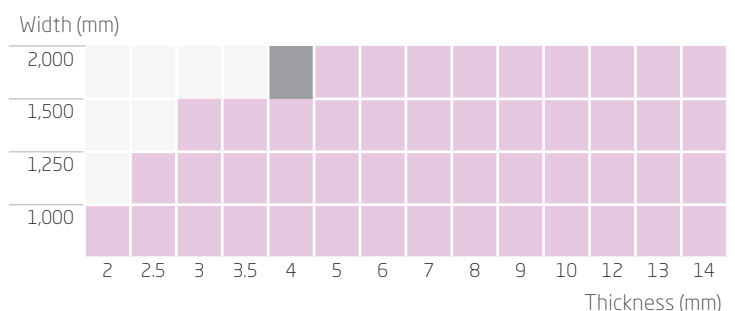
## Size range

### Cold Rolled



■ 2D - 2B

### Hot Rolled and HRC



■ Hot rolled HRAP - 1D ■ Cold rolled HRC - 2E



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