Austenitic stainless steel offer

Grade 201LN

Chemical composition

Elements	C	N	Mn	Cr	Ni	Cu
%	0.025	0.18	7.0	16.30	4.75	0.30

Typical values

European designation [1]
X2CrMnNiN17-7-5/ 1.4371

[1] According to EN 10088-2 [2] According to ASTM A 240

This grade complies 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.
- NFA 36 711 standard "Stainless steel intended for use in contact with foodstuffs, products and beverages for human and animal consumption (non packaging steel)".
- Requirements of NSF/ANSI 51-2009 edition International Standard for "Food Equipment Materials" and of the FDA. (United States Food and Drug Administration) regarding materials used for food contact.
- French Decree No.92-631 dated 8 July 1992 and Regulation No. 1935/2004 of the European Parliament and of the Council of 27 October 2004 on materials and articles intended to come into contact with food (and repealing Directives 80/590/EEC and 89/109/EEC).
- French regulatory paper dated 13.01.1976 relating to materials and articles made of stainless steel in contact with foodstuffs.

General characteristics

The principal features of our grade 201LN (16-5MnL) are:

- Elevated mechanical properties in annealed condition with high elongation
- High work hardening potential
- Very good resistance to intergranular corrosion
- Excellent weldability
- High ductility, strength and toughness at cryogenic temperatures

Applications

- Railroad and transportation
- Cryogenic tanks, storage vessels and piping
- High performance welded structures including those at sub-zero temperatures
- In general all applications where austenitic grade 1.4318 (Type 301LN) is being used, with the advantage of a price stability due to the lower nickel content.

Product range

Forms: sheets, blanks, coils, strips, tubes

Thicknesses: from 0.8 up to 13 mm (consult us for thicknesses <0.8mm)

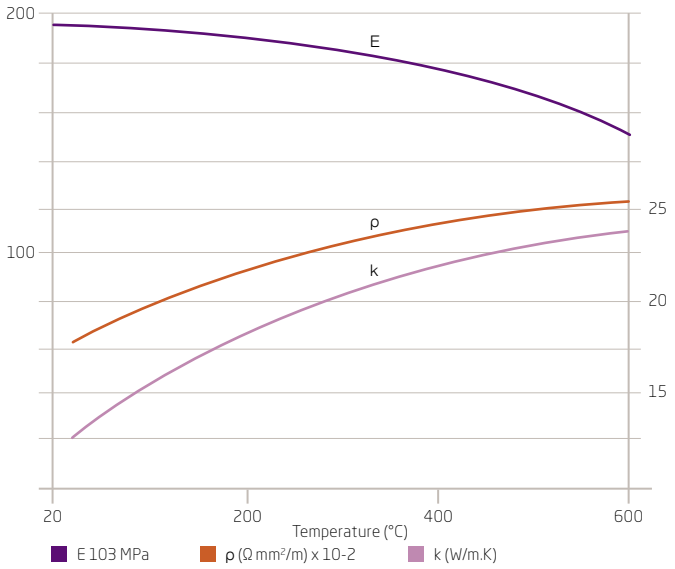
Width: up to 2000 mm according to thickness

Finish: cold rolled, hot rolled according to thickness

Physical Properties

Cold rolled and annealed sheet.

Density	d	kg/dm³	20 °C	7.8
Melting temperature	-	°C	Liquidus	1420
Specific heat	c	J/kg.K	20 °C	500
Thermal conductivity	k	W/m.K	20 °C	15
Mean coefficient of Thermal expansion	α	10^{-6}/K	20-100 °C 20-200 °C 20-400 °C	17.0 17.5 18.5
Electric resistivity	ρ	Ω mm²/m	20 °C	0.7
Magnetic permeability	μ	0.8 kA/m DC or AC	20 °C	1.05
Young's Modulus	E	MPa.10³	20 °C	200



Mechanical properties

In annealed or tempered condition

According to ISO 6892-1, part 1

Test piece perpendicular to rolling direction.

Test piece

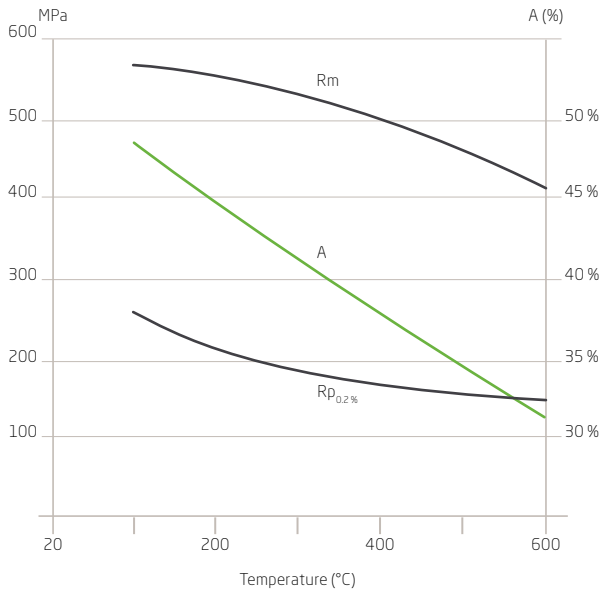
Length = 80mm (thickness < 3mm)

Length = 5.65 * √So (thickness ≥ 3mm)

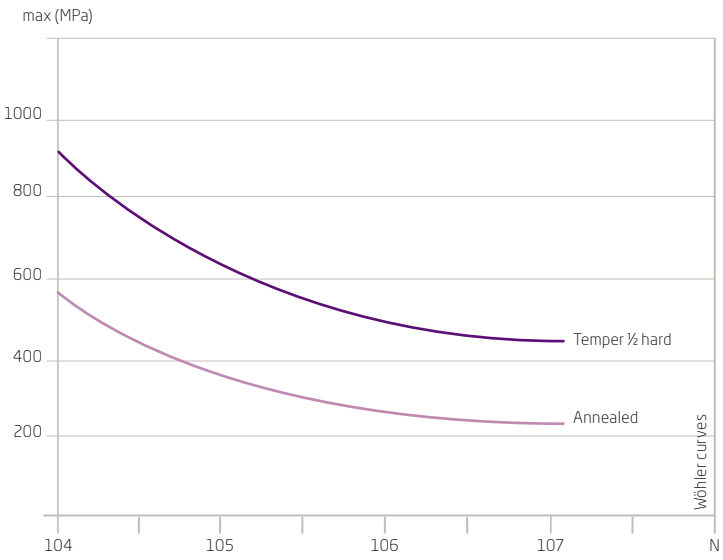
Grades	European designation	ASTM A240	Condition	R_m (1) (MPa)	$Rp_{0.2}$ (2) (MPa)	A (3) %
201LN (16-5MnL)	1.4371	201LN	Annealed	720	360	55
301L (18-7L)	1.4318	301LN	Annealed	765	360	50
316L (18-11ML)	1.4401/4404	316/316L	Annealed	620	300	52
DX2205	1.4462	2205	Annealed	840	620	29
K44	1.4521	444	Annealed	520	370	29

1 MPa = 1 N/mm² Typical values / (1) Ultimate Tensile Strength (UTS) / (2) Yield Strength (YS) / (3) Elongation (A)

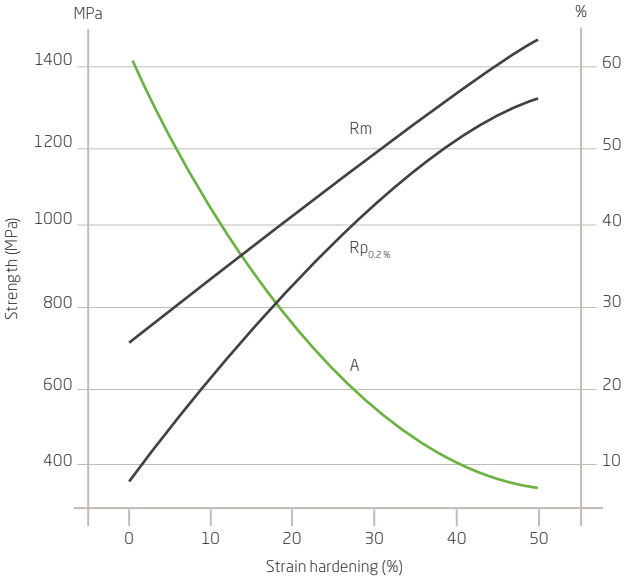
At elevated temperatures

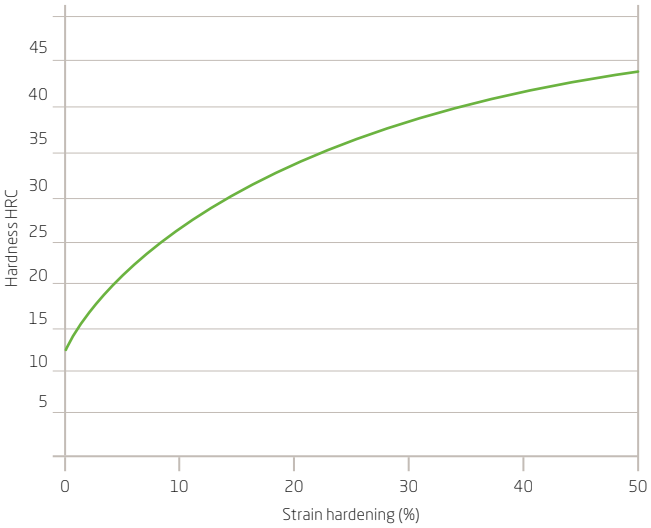


Fatigue resistance

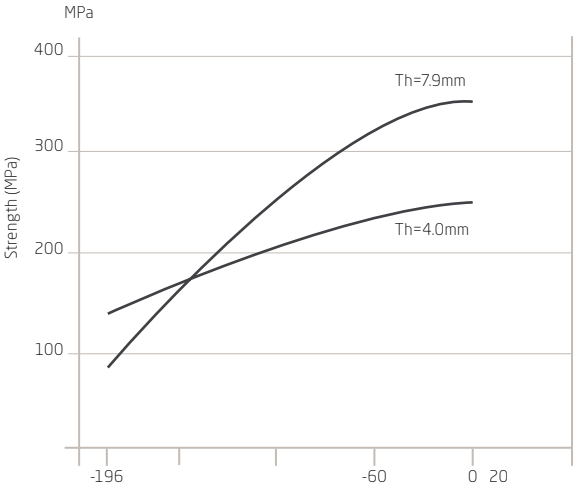


Strength and hardness as a function of strain hardening





Toughness



Average value in J/cm² for two different thicknesses 4.0 and 7.9 mm, corresponds to the specification of the EN10088-2.

The toughness of our 201LN (16-5MnL) is higher than 75 J/cm² at a temperature of -196 °C and higher than 230 J/cm² at a temperature of -60 °C.

Corrosion resistance

Our grade 201LN (16-5MnL) has a good resistance to common types of corrosion, nearly equivalent to 304L (18-9L, 1.4307) in most environments and is particularly recommended in cases where there is a risk of intergranular corrosion.

The atmospheric corrosion resistance is excellent in urban and rural environments.

Corrosion in acids

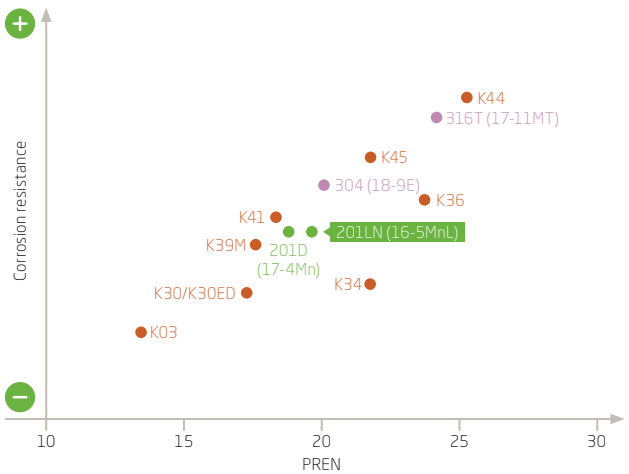
201LN (16-5MnL) is resistant to various acids:

- Phosphoric acid (all solutions) at room temperature
- Nitric acid (36° Baumé) at any temperature
- Formic and lactic acid at room temperature
- Cold organic acids when diluted

In addition, it resists well in salty solutions without chlorides and in foodstuffs.

Pitting corrosion

- Pitting potential in NaCl 0.02M, pH = 6.6 aerated environment at 23 °C is 440mV/SCE
- Critical corrosion current density in H_2SO_4 2M at 23 °C is 500 µA/cm²



Crevice Corrosion

Crevice corrosion is a type of corrosion that can be divided into two processes. During the first process, called initiation, discrete pits are formed within the crevice region if the pH is below the depassivation pH of the grade locally.

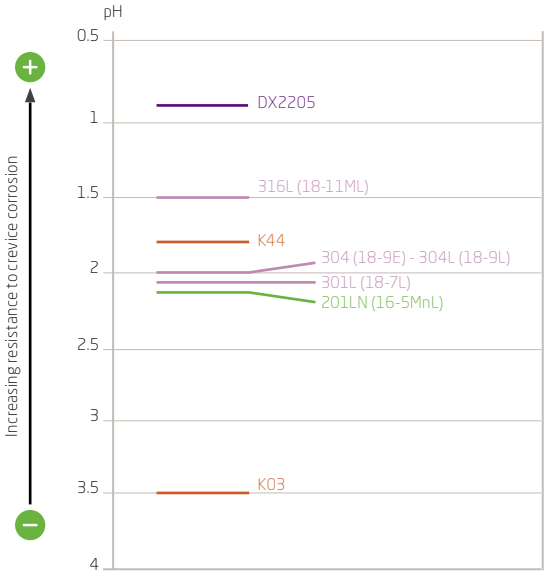
Propagation is the second process and involves the dissolution of metal. To slow down this process, molybdenum and nickel containing grades are to be preferred since both these elements have a positive effect on decreasing the propagation rate.

Intergranular corrosion

201LN (16-5MnL) is recommended where there is a risk of intergranular corrosion since it meets the following requirements of the standard intergranular corrosion tests:

- AFNOR A 05159 (sensitizing treatments T1 and T2)
- EN 114-72
- INDRET (treatment R)

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



Forming

In the annealed condition our 201LN (16-5MnL) can be readily cold formed by all standard processes such as bending, profiling, drawing, deep drawing, roll-forming, spinning, etc.

Due to its elevated mechanical properties and its hardening by cold-forming operations as a result of the nitrogen content, 201LN (16-5MnL) requires larger forming efforts and induces a springback effect. Its forming behaviour is similar to that of 301L (18-7L, 1.4318).

Grades	European designation	ASTM - A240	Condition	LDR*
201LN (16-5MnL)	1.4371	201LN	Annealed	2.0
316L (18-11ML)	1.4401/4404	316/316L	Annealed	2.01
DX2205	1.4462	2205	Annealed	1.90 - 1.95
K44	1.4521	444	Annealed	2.10 - 2.15

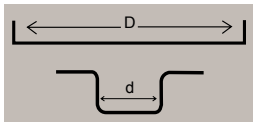
* Limiting Drawing Ratio – 0.8mm thick sheet
Lubricant = Mobilux EP00

Deep drawing (Swift test)

The Swift test is a method to determine the Limiting Drawing Ratio (LDR). This LDR is defined by the maximum ratio between the blank diameter (variable) and the punch diameter (fixed) for which the drawing operation can be performed successfully in one step.

Our grade 201LN (16-5MnL) has got a good bending capacity up to 180°, with very small bending radii for thicknesses below 0.8mm.

For thicker gauges, a bending radius of at least half the thickness of the sheet is recommended. When bending the material, the elastic springback always has to be taken into consideration.



$$LDR = \frac{D_{max}}{d}$$

Welding

Welding process	No filler material	With filler metal			Shielding gas
	Typical thicknesses	Thicknesses	Filler material		
			Rod	Wire	
Resistance: spot, seam	≤ 2 mm				
TIG/PLASMA	< 1.5 mm	> 0.5 mm	ER 308 L [(1)]/G 19 9 L Si [(2)] ER 316L / G 19 12 3 L Si ER 2209 / G 22 9 3 N L Si		Argon (I1) [(3)] Argon + 5 % Hydrogen (R1) Argon + Helium (I3)
MIG		> 0.8 mm		ER 308 L Si / G 19 9 L Si ER 316 L Si / G 19 12 3 L Si ER 2209 / G 22 9 3 N L	Argon + 2 % CO_2 (M12) Argon + 3 % CO_2 + 1 % H_2 (M11)
S.A.W.		> 2 mm		ER 308 L / S 19 9 L ER 316 L / S 19 12 3 L ER 2209 / S 22 9 3 N L	
Electrode		Repairs	E 308 L - 15 / E 19 9 L B 2 2 E 308 L - 17 / E 19 9 L R 3 2 E 316 L - 15 / E 19 12 3 L B 2 2 E 316 L - 16 / E 19 12 3 L R 1 5 E 316 L - 17 / E 19 12 3 L R 3 2 E 2209 - 15 / E 22 9 3 N L B 2 2 E 2209 - 17 / E 22 9 3 N L R 3 2	ER 308 L ER 347	CO_2 H_2
Laser	< 5 mm				Helium

[(1)] AWS A5.9 - [(2)] EN ISO 14343 - [(3)] EN 439

When using the ER308L filler metal, tensile tests can show cracks occuring in the weld. To avoid this, Argon + N2 gas can be used to enhance the mechanical properties of the weld. Weldability is excellent and similar to our 18-9L (1.4307, Type 304L). No heat treatment is necessary after welding. In order to fully restore the corrosion resistance properties, the welds must be chemically or mechanically descaled and subsequently passivated.

Heat treatment and finishing

Annealing

After cold forming (work hardening) and after welding an annealing treatment for a couple of minutes at 1050 ± 25 °C followed by quenching restores the microstructure (recrystallisation and dissolution of carbides) and eliminates internal stresses.
After annealing, pickling followed by passivation is necessary.

Pickling

- Nitric-Hydrofluoric acid mixture (10 % HNO_3 + 2 % HF) at ambient temperature or up to 60 °C.
- Sulfuric-nitric acid mixture (10 % $H2SO_4$ + 0.5 % HNO_3) at 60 °C.
- Descaling pastes for weld areas.

Passivation

- 20-25 % HNO_3 solution (36° Baumé) at 20 °C.
- Passivating pastes for weld areas.

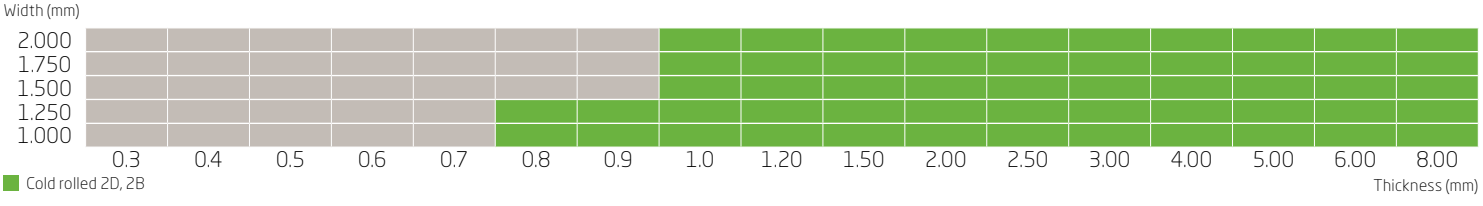
Polishing

The surface of our 201LN (16-5MnL) is suitable for all kinds of polishing, brushing, buffing and satin finishing.

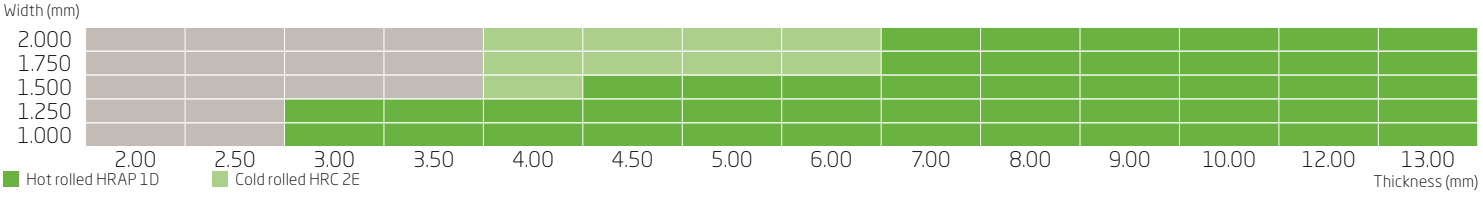
Size range

Our size range is based on our production capabilities. For the latest information per grades on our offer, please consult us.

Cold Rolled



Hot-Rolled and HRC



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