



# Austenitic stainless steels

18-11ML 18-12MS

18-12ML 18-13MS

## Austenitic stainless steels Very low carbon molybdenum containing

18-11ML	18-12ML	18-12MS	18-13MS
European designation (1)	European designation (1)	European designation (1)	European designation (1)
X5CrNiMo17-12-2/ X2CrNiMo17-12-2	X5CrNiMo17-12-2/ X2CrNiMo17-12-2	X2CrNiMo17-12-3	X2CrNiMo18-14-3
1.4401 / 1.4404	1.4401 / 1.4404	1.4432	1.4435
American designation (2)	American designation (2)	American designation (2)	American designation (2)
AISI 316 / 316L	AISI 316 / 316L	AISI 316 L	AISI 316 L

(1) According to NF EN 10088-2  
(2) According to ASTM A 240

These grades are in accordance with:

- Stainless Europe Material Safety Data Sheet n°1: s tainless steels (European Directive 2001/58/EC).
- European Commission Directive 2000/53/EC for end-of-life vehicles, and to Annex II dated 27 June 2002.
- PED (Pressure Equipment Directive) according to EN 10028-7 and AD2000W2 according to VD TÜV W494.
- Lloyd's Register of Shipping.
- NFA 36 711 Standard «Stainless steel intended for use in contact with foodstuffs, products and beverages for human and animal consumption» (non packaging steel)...

### Chemical composition

Mean values (weight %)

Elements (%)	C	Si	Mn	Cr	Ni	Mo
18-11ML	< 0,030	0,50	1,50	16,80	10,30	2,10
18-12ML	< 0,030	0,50	1,50	17,50	11,20	2,10
18-12MS	< 0,030	0,50	1,50	16,80	11,10	2,60
18-13MS	< 0,030	0,50	1,50	17,80	12,70	2,60

18-11ML 18-12MS  
18-12ML 18-13MS



### General characteristics

The principal features of 18-11ML, 18-12ML, 18-12MS and 18-13MS are:

- good resistance to corrosion in acids and chloride containing media
- excellent resistance to intergranular corrosion, even after welding
- excellent weldability
- high ductility
- excellent polishability.

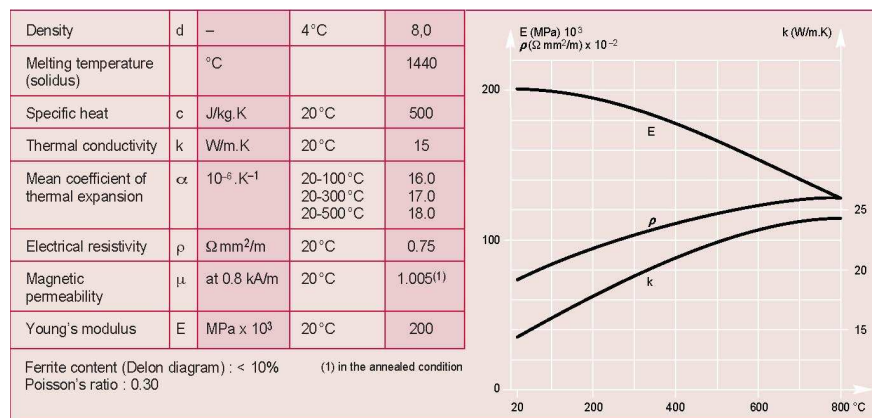
### Typical applications

- Chemical engineering equipment: tanks, tubes
- Food industry equipment: tanks, tubes, pumps
- Marine engineering
- Road transport tanks
- Building industry: architectural components, roofing, etc...

### Product range

- Forms: sheets, blanks, coils, strips, circles
- Thicknesses: 0.4 to 14 mm
- Width: according to thickness, consult us
- Finish: cold rolled or hot rolled, depending on the thickness

### Physical properties (cold rolled sheet)



### Tensile properties

#### Delivery condition

According to NF EN 10002-1 (July 2001), specimen perpendicular to the rolling direction

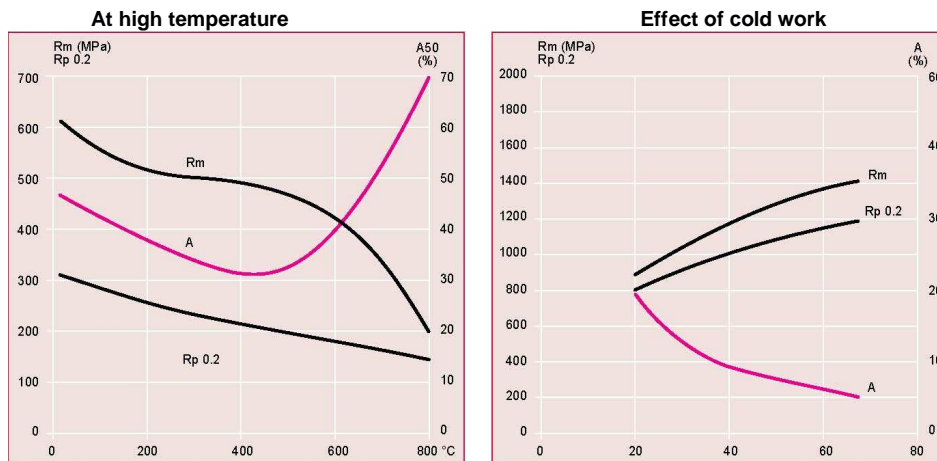
#### Specimen

Lo = 80 mm (thickness < 3 mm)  
Lo = 5,65  $\sqrt{So}$  (thickness  $\geq$  3 mm)

1 MPa = 1 N/mm<sup>2</sup>

	Rm (1) (MPa)	Rp0,2 (2) (MPa)	A (3) (%)
18-11ML	620	340	48
18-12ML	610	320	48
18-12MS	590	310	48
18-13MS	610	310	48

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 18-12ML 18-13MS



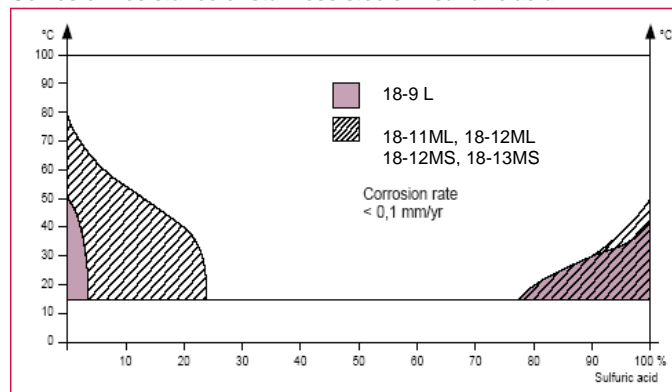
### Corrosion resistance

As shown in the diagrams below, **18-11ML, 18-12ML, 18-12MS** and **18-13MS** have excellent corrosion resistance in acid solutions, and also show good resistance in chloride containing media. They are therefore used for the manufacture of domestic hot water tanks, and for parts in contact with seawater at low temperatures.

**18-11ML, 18-12ML, 18-12MS** and **18-13MS** meet the requirements of standard intergranular corrosion tests:

- EN ISO 3651-2 (sensitizing treatments T1 and T2)
- ASTM A 262
- ex DIN 50914.

#### Corrosion resistance of stainless steels in sulfuric acid

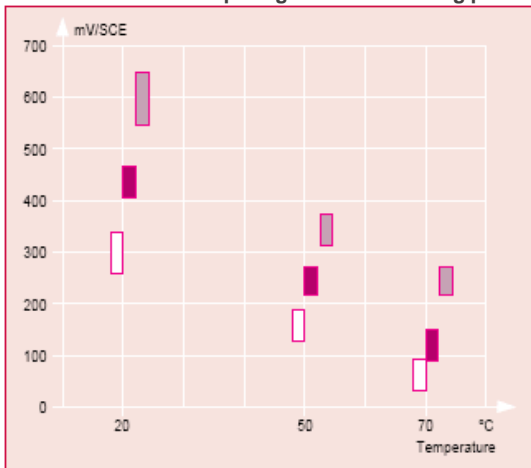


18-11ML 18-12MS  
18-12ML 18-13MS



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Resistance to pitting corrosion. Pitting potential



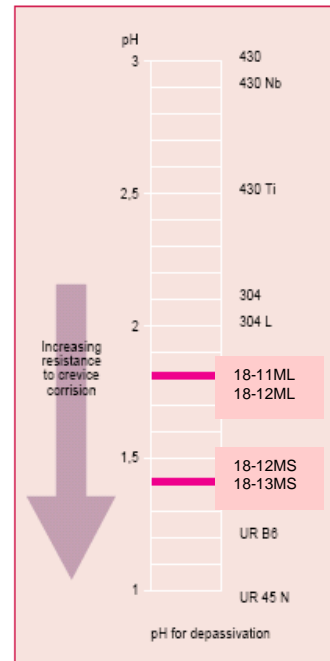
- 18-11ML
- 18-12ML
- 18-12MS
- 18-13MS
- 18-9 E

30 g/l (0.5 M) NaCl solution, pH = 6.6

Resistance to crevice corrosion

The resistance of crevice corrosion is evaluated in terms of pH for depassivation (electrochemical method).

Medium: 2M NaCl.



## Welding

No heat treatment is necessary after welding.

The welds must be mechanically or chemically descaled, then passivated.

For use at temperatures above 500°C, filler metals must be chosen to ensure that the ferrite content in the weld does not exceed 8%.

Welding process	No filler metal	With filler metal		Shielding gas*	
	Typical thicknesses	Thickness	Filler metal		
			Rod	Wire	
Resistance Spot Seam	≤ 2 mm ≤ 2 mm				*Hydrogen and nitrogen forbidden in all cases
TIG	< 1.5 mm	> 0.5 mm	ER 316 L (Si) ER 317 L (Si)	ER 316 L (Si) ER 317 L (Si)	Argon Argon + 5% hydrogen Argon + helium
PLASMA	< 1.5 mm	> 0.5 mm		ER 316 L (Si) ER 317 L (Si)	Argon Argon + 5% hydrogen Argon + helium
MIG		> 0.8 mm		ER 316 L (Si) ER 317 L (Si)	Argon + 2% CO2 Argon + 2% O2 Argon + 2% CO2 + 1% H2 Argon + 2% CO2 + helium
S.A.W		> 2 mm		ER 316 L ER 317 L	
Electrode		Repairs	ER 316 L ER 317 L		
Laser	< 5 mm				Helium. In certain conditions: argon, nitrogen

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## Forming

In the annealed condition, **18-11ML**, **18-12ML**, **18-12MS** and **18-13MS** can be readily cold formed by all standard processes (bending, contour forming, drawing, etc.).

Grade	European designation	AISI	Erichsen deflection* (expansion test)
18-11ML	1.4401/4404	316/316L	11-11.5 (mm)
18-12ML	1.4401/1.4404	316/316L	11-11.5 (mm)
18-12MS	1.4432	316L	11-11.5 (mm)
18-13MS	1.4435	316L	11-11.5 (mm)

\* on 0.8 mm thick sheet

## Heat treatment and finishing

### Annealing

Water quench or air cool from 1050°C ± 25°C.

### Pickling

Nitric-hydrofluoric acid mixture  
(10% HNO<sub>3</sub> + 2% HF), at RT or 60°C.

Sulfuric-nitric acid mixture  
(10% H<sub>2</sub>SO<sub>4</sub> + 0,5% HNO<sub>3</sub>) at 60°C.

Descaling pastes for weld zones.

### Passivation

20-25 % HNO<sub>3</sub> solution at 20°C.

Passivating pastes for weld zones.

### Headquarter :

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