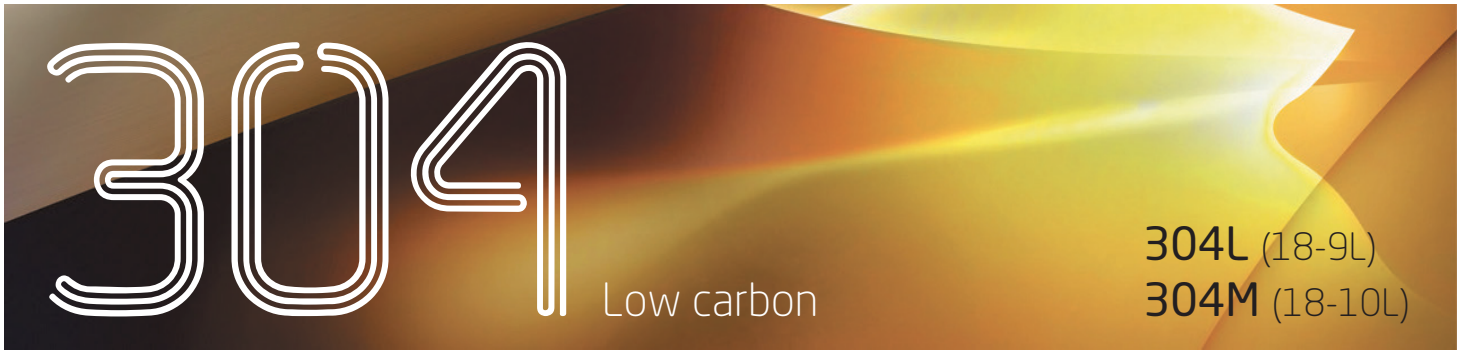
Austenitic Stainless steel offer grade 304



Chemical composition

Elements (%)	C	Si	Mn	Cr	Ni
304L (18-9L)	0.025	0.40	1.40	18.20	8.05
304M (18-10L)	0.025	0.40	1.30	18.20	10.10

Typical values

Grade designation	European designation	American designation	IMDS Nr
304L (18-9L)	X2CrNi18-9/ 1.4307[1]	UNS 30403/ Type 304L[2]	336838649
304M (18-10L)	X2CrNi19-11/ 1.4306[1]	UNS 30403/ Type 304L[2]	336813205

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

These grades comply with:

- Stainless Europe Material Safety Data Sheet n°1: stainless steels (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 F.D.A. (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 January 1976 relating to materials and articles made of stainless steel in contact with foodstuffs.
- Italian Decree of 21st March 1973 : a list of stainless steel types appropriate to « Regulations on the hygiene of packaging, receptacles and tools intended to come into contact with substances for food use or with substances for personal use »
- PED (Pressure Equipment Directive) according to EN 10028-7 and AD2000 Merkblatt W2 and W10 (TÜV W494).
- Lloyd's Register of shipping

General characteristics

The principal features of our grades 304L and 304M are:

- A general purpose grade
- Good resistance to pitting corrosion and crevice corrosion
- Very good resistance to intergranular corrosion
- Good ductility
- Excellent weldability
- Good polishing ability
- Very good drawability for 304M

Applications

- Chemical engineering equipment
- Food industry equipment
- Dairy equipment
- Piping and tubes
- Welded structures
- Cryogenic and food tanks and trailers
- Storage vessels

Product range

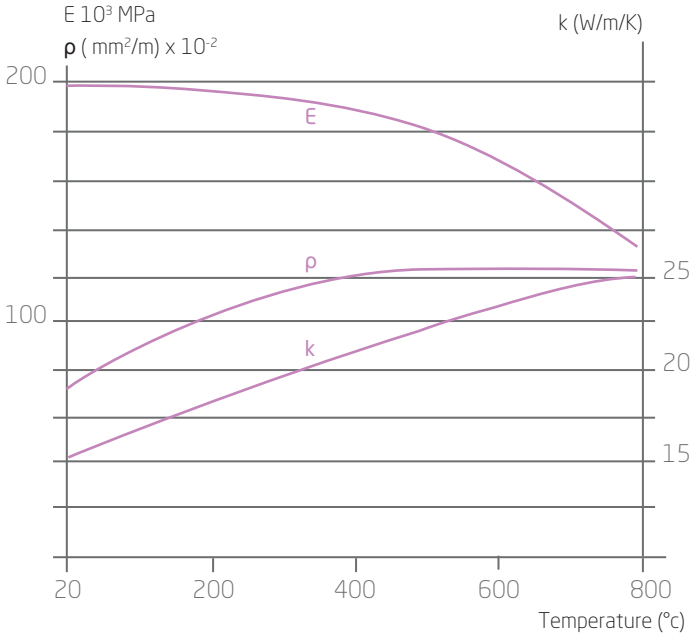
Forms : Sheets, blanks, coils, strips, tubes
Thicknesses : from 0.4 up to 13 mm
Width : up to 2 000 mm according to thickness (only 304L)
Finishes : cold rolled, hot rolled, patterned/tear plate (only 304L), according to thickness.

Physical properties

Cold rolled and annealed sheet.

Density	d	kg/dm³	20 °C	7.9
Melting point		°C	Liquidus	1420
Specific heat	c	J/kg.K	20 °C	500
Thermal conductivity	k	W/m.K	20 °C	15
Mean coefficient of linear expansion	α	10^{-6}/K	20-100 °C 20-200 °C 20-400 °C	16.5 16.0 17.5
Electric resistivity	ρ	Ω mm²/m	20 °C	0.73
Magnetic resistivity	μ	at 0.8 kA/m DC or AC	20 °C	1.01
Young's Modulus	E	MPa.10³	20 °C	200

Poisson's coefficient: 0.30

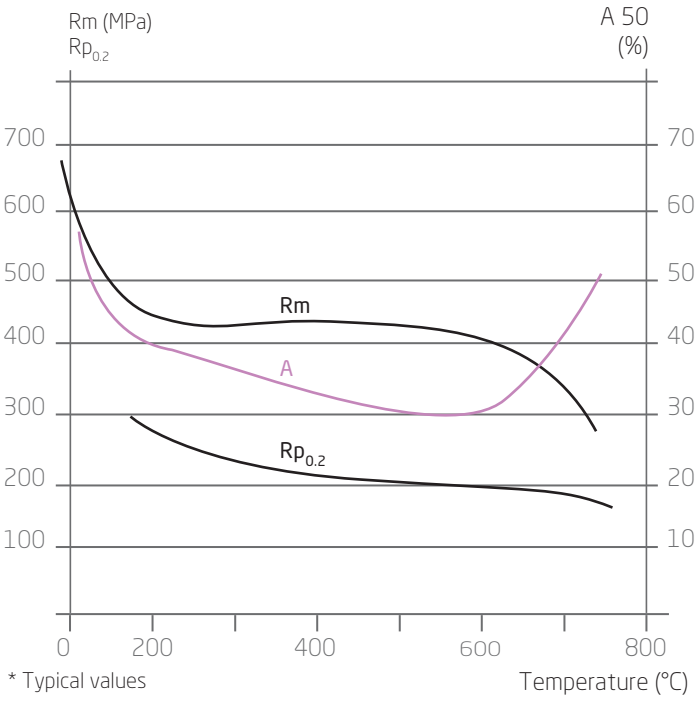


Mechanical properties

In the annealed condition
In accordance with ISO 6892-1, part 1,
Test piece perpendicular to rolling direction.

Test piece
Length = 80 mm (thickness < 3 mm)
Length = 5.65 √ So (thickness ≥ 3 mm).
Cold rolled

At elevated temperatures*

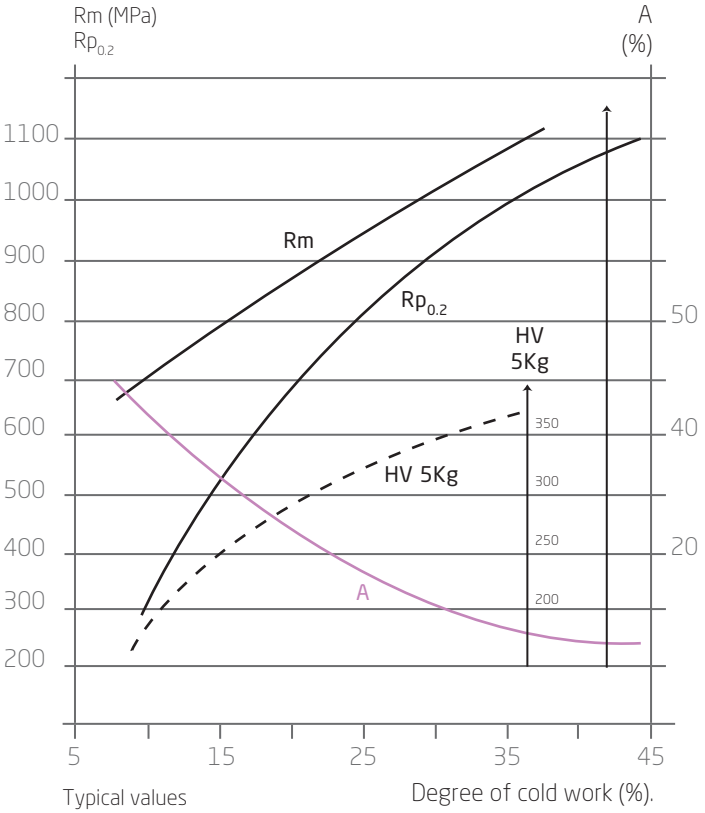


* Typical values

Grades	European designation	ASTM A240	Rm(1) (MPa)	Rp0.2(2) (MPa)	A(3) %
304L (18-9L)	1.4307	304L	630	300	54
304M (18-10L)	1.4306	304L	590	260	55
304 (18-9E)	1.4301	304	650	300	54
201D (17-4Mn)	1.4618 (b)	201.1	665	320	52
K41	1.4509	441(a)	480	310	30
K45	1.4621(b)	445(a)	510	360	29

(1) Ultimate Tensile Strength (UTS). (2) Yield Strength (YS). (3) Elongation (A).
(a) Common designation (b) Pending update of the standard

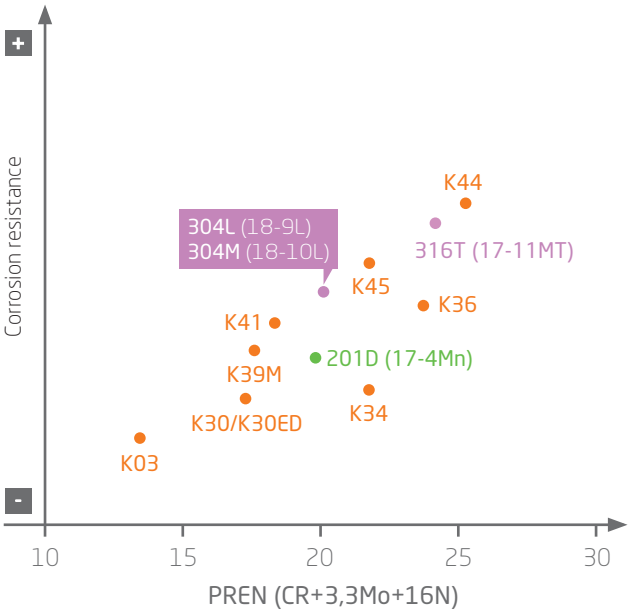
Work-hardened by cold rolling



Corrosion resistance

Our grades 304L and 304M generally exhibit a good resistance to wet corrosion, appropriate for the majority of applications and are especially recommended when there is a risk of intergranular corrosion.
In particular, they meet the requirements of the standard tests defined by EN ISO 3651-2 (sensitizing treatments T1 and T2).
Furthermore they show excellent behavior in urban and rural atmospheres.

Pitting corrosion

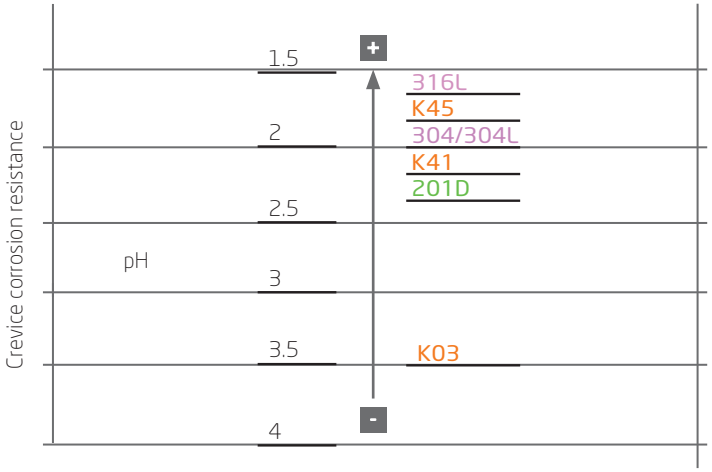


Pitting potential in variations following the temperature and the chloride concentration

Grades	Pitting potential			
	NaCl 0.02/23°C	NaCl 0.02/50°C	NaCl 0.05/23°C	NaCl 0.02/50°C
304L (18-9L)	540 mV	385 mV	305 mV	175 mV

Typical values

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



Crevice Corrosion

Crevice corrosion is a type of corrosion that can be divided in two processes. During the first process, called initiation, discrete pits are formed within the crevice region when locally the pH is below the depassivation pH of the grade.
The propagation is the second process and is involves in the dissolution of metal. To slow down this process, molybdenum and nickel containing grades are to be preferred since both these elements slow down the propagation.

Intergranular corrosion

They meet the requirements of the standard tests defined by EN ISO 3651-2 (sensitizing treatments T1 and T2).

Forming

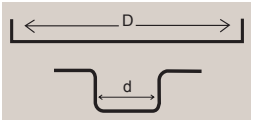
In the annealed condition our grades 304L and 304M can be readily cold formed by standard processes such as bending and profiling and is particularly good in stretch forming processes such as drawing, roll forming, spinning, contour forming, etc.
Some forming operations can be performed more easily at higher temperatures. In that case, subsequent pickling is necessary.

Deep drawing (Swift test)

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

Grades	European designation	ASTM A240	LDR*
304L (18-9L)	1.4307	304L	1.91
304 (18-9E)*	1.4301	304	1.96
201D (17-4Mn)	1.4618 [b]	201.1	1.92
K41	1.4509	441 [a]	2.29
K45	1.4621 [b]	445 [a]	2.28

* Limiting Drawing Ratio – 0.8 mm thick sheet - Lubricant = Mobilux EP00
[a] Common designation [b] Pending update of the standard



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

Bending

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.

Flow turning

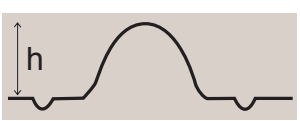
Our grade 304ED (18-9DDQ) (1.4301, Type 304) is the most suitable for this application.
For severe forming operations, our grades 304D (18-9ED) and 304ED (18-9DDQ) are to be preferred.

Stretching

The stretching behaviour is characterized by the dome height (h) of the Erichsen test which is also known as Index ' EI '.

Grades	European designation	ASTM A240	EI* (mm)
304L (18-9L)	1.4307	304L	11.4
304M (18-10L)*	1.4306	304L	11.5
304 (18-9E)	1.4301	304	11.6
201D (17-4Mn)	1.4618 [b]	201.1	11.9
K41	1.4509	441 [a]	9.4
K45	1.4621 [b]	445 [a]	9.5

* Erichsen Index – Lubricant = Mobilux EP00 - Typical values tests done on 0.8mm thick. [a] Common designation [b] Pending update of the standard



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	ER 308 L*	ER 308 L*	Argon Argon + 5% Hydrogen Argon + Helium
PLASMA	< 1.5 mm	> 0.5 mm		ER 308 L*	Argon Argon + 5% Hydrogen Argon + Helium
MIG		> 0.8 mm		ER 308 L(Si)*	Argon + 2% CO_2 Argon + 2% O_2 Argon + 2% CO_2 +1% H_2 Argon + 2% CO_2 +Helium
S.A.W.		> 2 mm		ER 308 L*	
Electrode		Repairs	E 308 L*		
Laser	< 5 mm				Helium Under certain conditions: Argon

* ER 308L (AWS A5.9) = G 19 9 L (NF EN ISO 14343)

Our grades 304L and 304M are designed for welding applications.
Especially if there is a risk of intergranular corrosion, a low carbon grade such as the 304L or the 304M is recommended. In general, heat treatment is not required after welding. However, in order to fully restore the corrosion resistance of the metal, the welds must be mechanically or chemically descaled, then passivated and decontaminated.

Heat treatment and finishing

Annealing

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

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 zones.

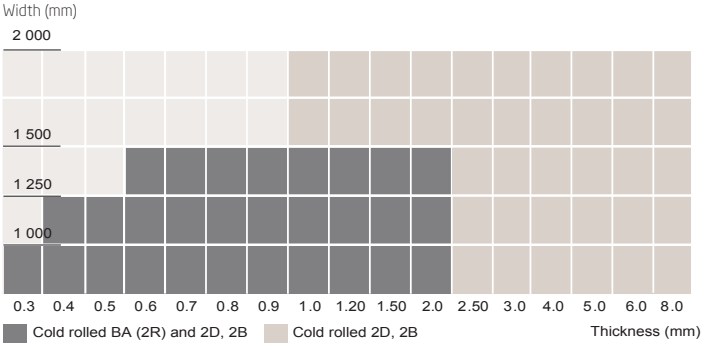
Polishing

The surface of our 304L and our 304M is suitable for all kinds of polishing (grit, scotch-brite, electro polishing).

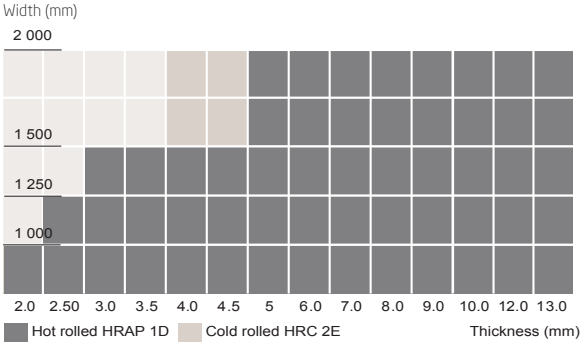
Size range

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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