

## KARA Ferritic Stainless Steel

# K39M 17% Chromium, Titanium stabilized

### Chemical Composition

Elements (%)	C	Si	Mn	Cr	Ti
K39M	0.02	0.40	0.30	16.50	0.40

Typical values

European designation	American designation	IMDS
X3CrTi17/1.4510 <sup>(1)</sup>	Type 430 Ti <sup>(2)</sup> UNS S43036	1850418

<sup>(1)</sup> According to NF EN 10088-2    <sup>(2)</sup> According to ASTM A 959

Our grade complies with:

- > Stainless Europe Material Safety Data Sheet no. 1: stainless 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
- > French standard NFA 36 711 "Stainless steel intended for use in contact with foodstuffs, products and beverages for human and animal consumption (excluding packaging)"
- > NSF/ANSI 51-2009 edition international standard for "Food Equipment Materials" and FDA (United States Food and Drug Administration) requirements regarding materials used in contact with foodstuffs
- > French decree No. 92-631, dated 8 July 1992 and European Regulation (EC) No. 1935/2004, dated 27 October 2004, on materials and articles intended to come into contact with food (and abrogative Directives 80/590/EEC and 89/109/EEC)
- > French Ministerial Order, dated 13 January 1976, relating to materials and articles made of stainless steel in contact with foodstuffs
- > Standard EN 10028-7 "Flat products made of steels for pressure purposes, Stainless steels". Steel flat products for pressurised applications (AD 2000 W2 TÜV W494)

### Key Features

- > Our K39M is a variant of K30 with the addition of titanium
- > This grade is excellent weldable, with a good toughness and ductility properties
- > The titanium stabilisation gives to the grade a good inter-granular and pitting corrosion resistance
- > The K39M also has good drawing characteristics

### Applications

- > Appliances: washing machine vat and drum, dishwasher vat
- > Automotive exhaust systems: tubes, silent mufflers, fixing parts

### Product Range

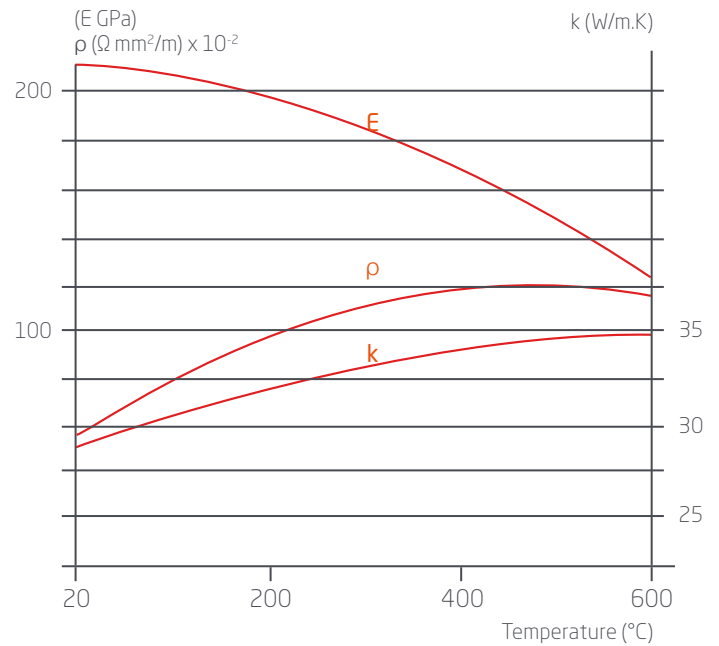
	Coils	Sheets / Blanks	Discs	Precision Strip	Precision Sheet	Tubes
Thickness (mm)	0.40 up to 4	0.40 up to 4	0.38 up to 2.50	0.06 up to 2.50	0.20 up to 2.50	0.80 up to 2
Width (mm)	up to 1,500	up to 1,250	Ø 15 up to 1,000	3 up to 700	40 up to 670	Ø 8 up to 168
Finish	2B / 2D	2B / 2D	2B / 2D	2R / 2B / 2D / 2H / 2F	2R / 2B / 2D / 2H / 2F	2D

Please contact us regarding all other dimensions, forms and finishes.

## Physical Properties

### Cold rolled and annealed sheet

Density	d	kg/dm <sup>3</sup>	20°C	7.7
Melting temperature		°C	Liquidus	1,460
Specific heat	c	J/kg.K	20°C	460
Thermal conductivity	k	W/m.K	20°C	22.5 ±1
Mean thermal expansion coefficient	α	10 <sup>-6</sup> /K	20-100°C	10.0
			20-200°C	10.0
			20-400°C	10.5
Electric resistivity	ρ	Ω mm <sup>2</sup> /m	20°C	0.60
Young's modulus	E	GPa	20°C	220



## Mechanical Properties

### Test piece

Length = 80 mm (thickness < 3 mm)  
 Length = 5.65 √ S<sub>0</sub> (thickness ≥ 3 mm)

### In the annealed condition

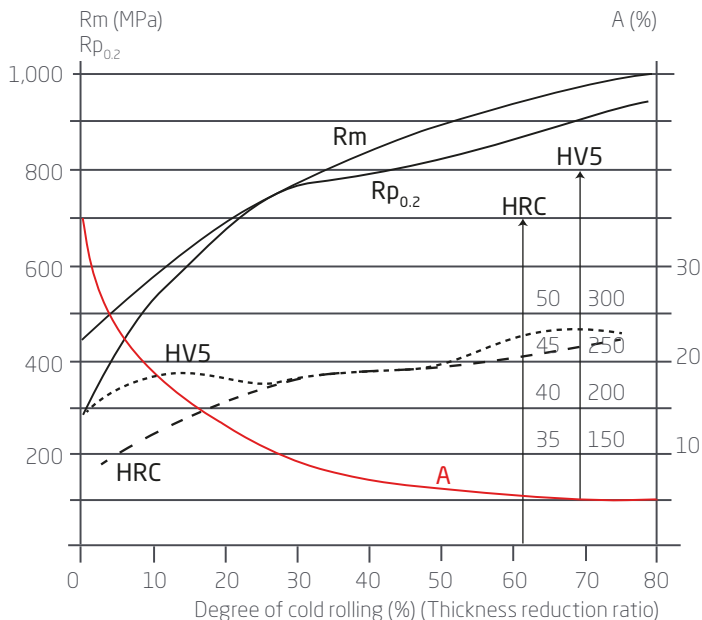
In accordance with ISO 6892-1, part 1  
 Test piece perpendicular to rolling direction

Grade	Condition	Rm <sup>(1)</sup> (MPa)	Rp <sub>0.2</sub> <sup>(2)</sup> (MPa)	A <sup>(3)</sup> %	HRB
K39M	Cold-rolled	450	290	31	70

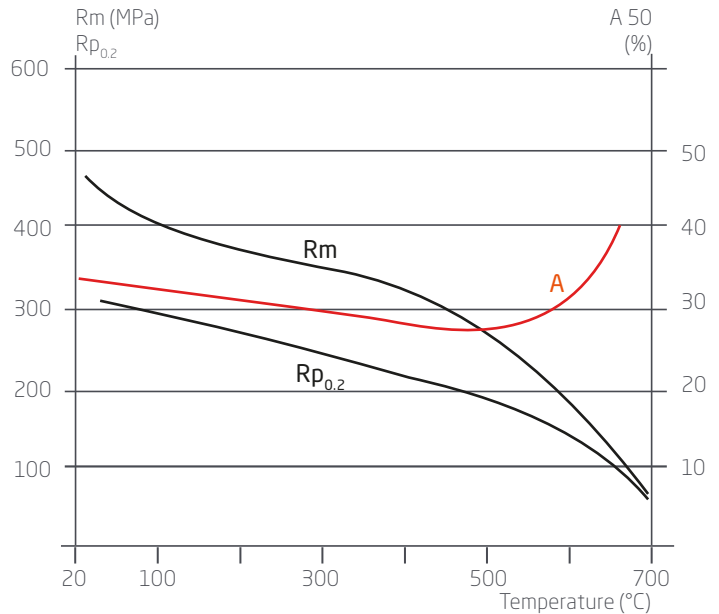
1 MPa = 1 N/mm<sup>2</sup> - Typical values

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

### Effect of cold rolling (Typical values)



### At high temperatures (Typical values)



## Corrosion Resistance

K39M has a broader application range than K30, the result of its titanium stabilisation allowing for good intergranular corrosion resistance. The titanium also stabilises the sulphur enhancing resistance to pitting corrosion. Like all ferritic grades, K39M is not susceptible to stress corrosion. Resistance to welded seam corrosion is similar to that of the parent metal. K39M shows a good resistance to mineral acid (HNO<sub>3</sub>) and cold diluted organic, oxidizing saline solution and cold alkaline. Its resistance to atmospheric corrosion, hot oxidation and hot water is also good.

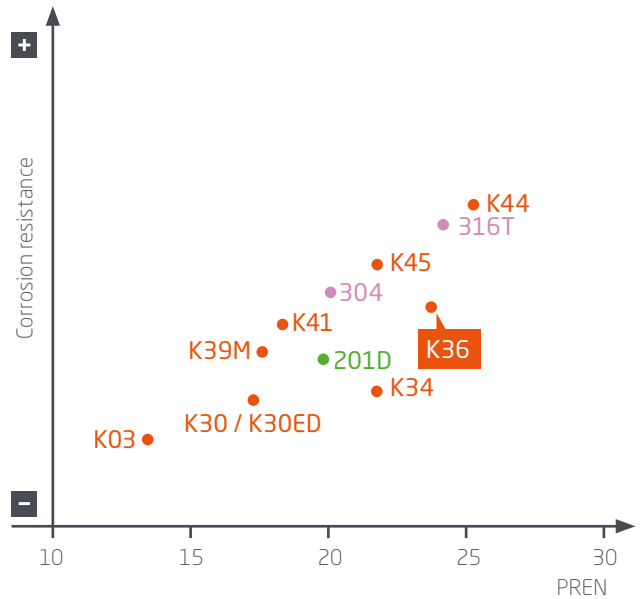
### Resistance to localised corrosion

Grades	Norms		
	ASTM	UNS	EN
K30/K30ED	430	S43000	1.4016
K44	444	S44400	1.4521
K39M	430Ti	S43036	1.4510
201D	201.1	S20100 <sup>(3)</sup>	1.4618 <sup>(2)</sup>
304	304	S30400	1.4301
316L	316	S31600	1.4401
	316L	S31603	1.4404

<sup>(1)</sup>Common designation - <sup>(2)</sup>Pending update of the standard - <sup>(3)</sup>With copper addition and 2010.1 "rich side" properties per ASTM A240

### Pitting corrosion

Typical values of pitting corrosion potential in NaCl 0.02M, 23°C, pH6.6 as a function of PREN (%Cr+3.3%Mo+16%N).



## Forming

Our K39M grade can be cold formed using all common processes (folding, drawing, and bending) in the annealed condition. The bloc bending (bending at 180°) for thickness below 0.8 mm is possible.

For all other thicknesses, the bending radius will be :  $r \geq 0.5t$  (thickness). We recommend forming ferritic grades, and especially K39M, by applying a deep drawing mode, and minimizing the tightening force to the necessary level in order to avoid fold appearance. For very deep drawing operations, which may lead to stretching solicitations, the operation may be made easier by making an intermediate shape with a bigger radius.

### Swift test (restraining mode)

Grades	AISI	EN	LDR* (mm)
K30	430	1.4016	2.05-2.10
K39M	430Ti	1.4510	2.15-2.20
304	304	1.4301	1.95-2.00

Tests performed on typical values using 0.8 mm thickness. \*Limiting drawing ratio

### Erichsen test (cupping)

Grades	European designation	AISI	Erichsen test (mm)
K30	1.4016	430	8.7
K39M	1.4510	430Ti	9.6
304	1.4301	304	11.6

Tests performed on typical values using 0.8 mm thickness.

## Welding

Our K39M grade can be welded both spot and seam welding techniques. Good results are obtained without post treatment so long as the weld is sufficiently forged.

Welding process	No filler material	With filler metal		Shielding gas*	
	Typical thicknesses	Thicknesses	Filler material		
			Rod	Wire	* Hydrogen and nitrogen forbidden in all cases
Resistance: spot, seam	≤ 2 mm				
TIG	< 1.5 mm	> 0.5 mm	G 19 9 L <sup>(1)</sup> or 18LNb <sup>(1)</sup> ER 308L <sup>(2)</sup> or 430LNb n° 1.4316 or 1.4511 <sup>(5)</sup>	G 19 9 L <sup>(1)</sup> or 18LNb <sup>(1)</sup> ER 308L <sup>(2)</sup> or 430LNb n° 1.4316 or 1.4511 <sup>(5)</sup>	Ar Ar + He
PLASMA	< 1.5 mm	> 0.5 mm		G 19 9 LSi <sup>(1)</sup> or 18LNb <sup>(1)</sup> ER 308 L Si <sup>(2)</sup> or 430LNb n° 1.4316 or 1.4511 <sup>(5)</sup>	Ar Ar + He
MIG		> 0.8 mm		G 19 9 LSi <sup>(1)</sup> or 18LNb <sup>(1)</sup> ER 308 L Si <sup>(2)</sup> or 430LNb n° 1.4316 or 1.4511 <sup>(5)</sup>	Ar + 2 % CO <sub>2</sub> Ar + 2 % O <sub>2</sub> Ar + 2 % CO <sub>2</sub> + He
SAW			E 19 9 L <sup>(3)</sup> E 308 L <sup>(4)</sup>		
Laser	< 5 mm				He Under certain conditions: Ar

The addition of hydrogen or nitrogen to the argon should be avoided as this reduces weld ductility. For similar reasons, the use of nitrogen is forbidden and the use of CO<sub>2</sub> is restricted to 3%. In order to restrict grain growth in the HAZ (heat affected zone), the use of excessive welding power must be avoided. For example, in automatic TIG welding, the power should not exceed 2.5 kJ/cm for a sheet thickness of 1.5 mm. As a further example, pulsed MIG/MAG welding has a lower power input than conventional MIG welding and enables better control of both bead geometry and grain size. Post-weld heat treatment is generally not necessary. Welds must be mechanically or chemically descaled and then passivated and decontaminated. Oxyacetylene torch welding must be avoided.

## Heat Treatment and Finishing

### Polishing aptitudes

Ferritic stainless steels are suitable for abrasive strip polishing. However, because of the presence of Nb or Ti stabilizers, such as in K39M, mirror polishing cannot be of high quality. Polishing with abrasives containing iron salt is forbidden. If the stainless steel is polluted by iron or iron salts, a final decontamination treatment will have to be done.

### Annealing

Annealing at 825°C after cold forming

### Pickling

- > Nitric-hydrofluoric acid mixture (10% HNO<sub>3</sub> + 2% HF)
- > Use descaling pastes for weld zones

### Passivation

- > 20-25% cold nitric acid bath at 20°C
- > Use passivating pastes for weld beads

