Stainless Europe

ArcelorMittal

KARA ferritic stainless steel offer: grade K36

Chemical composition

Elements	C	Si	Mn	Cr	Mo	Nb
%	0.015	0.40	0.25	17.5	1.25	0.40

Typical values

European designation		American designation
X6CrMoNb17-1	1. 4526 (1)	Type 436 (2)

(1) In accordance with NF EN 10088-2

(2) In accordance with ASTM A 240

Our grade complies with:

- Stainless Europe Materials Safety Data Sheet No. 1: stainless steels (European Directive 2001/58/EC).
- European Directive 2000/53/EC relating to end-of-life vehicles and Annex II dated 27 June 2002.
- French standard NFA 36 711 "Non packaging steel - Stainless steel intended for use in contact with foodstuffs, products and beverages for human and animal consumption".
- NSF/ANSI 51-2002 edition international standard for "Food Equipment Materials" and the requirements of the FDA (United States Food and Drug Administration) regarding materials used in contact with foodstuffs.
- French decree No. 92-631 dated 8 July 1992 and European Regulation (EC) No. 1935/2004 of 27 October 2004 on materials and articles intended to come into contact with food (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.

General characteristics

Our K36 grade is characterised by:

- Good resistance to pitting corrosion,
- Good performance in industrial atmosphere,
- Good performance in salt spray environment,
- Good formability, free from "roping",
- Excellent polishability,
- Its elevated mechanical properties at high temperature.

Applications

- Wheel trims, nut caps and interior and exterior automotive decorative mouldings.
- External components of refrigerated trailers.
- Domestic electrical appliances.
- Kitchen utensils.
- Decorative profiles for furniture.
- External facades and interior fittings for buildings.

Product range

Forms: sheets, blanks, coils, strip, discs.
Thicknesses: from 0.40 to 5.0 mm.
Width: according to thickness; consult us.
Finishes: cold-rolled, hot-rolled according to thickness.

K36

17% chromium niobium-stabilised ferritic stainless steel with molybdenum addition

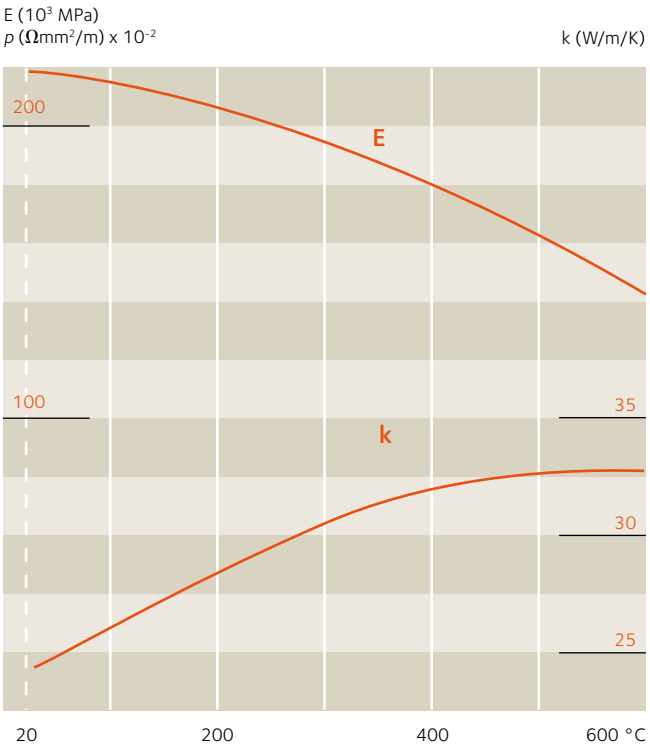
KARA key for value

Physical properties

On cold-rolled sheet.

In the annealed condition.

Density	d	kg/dm³	20 °C	7.7
Melting point		°C	Liquidus	1480
Specific heat	c	J/kg.K	20 °C	440
Thermal conductivity	k	W/m.K	20 °C	30
Mean coefficient of linear expansion	a	10^{-6}/K	20-200 °C 20-400 °C 20-600 °C 20-800 °C	11.7 12.1 12.7 14.2
Electrical resistivity	p	h.mm²/m	20 °C	0.70
Magnetic permeability	µ	à 0.8 kA/m DC ou AC	20 °C	550
Modulus of elasticity	E	MPa.10^3	20 °C	220



Mechanical properties

In the annealed condition

In accordance with EN 10002 -1 (July 2001), test specimen perpendicular to the rolling direction.

Test specimen

Lo = 80 mm (ép. < 3 mm)

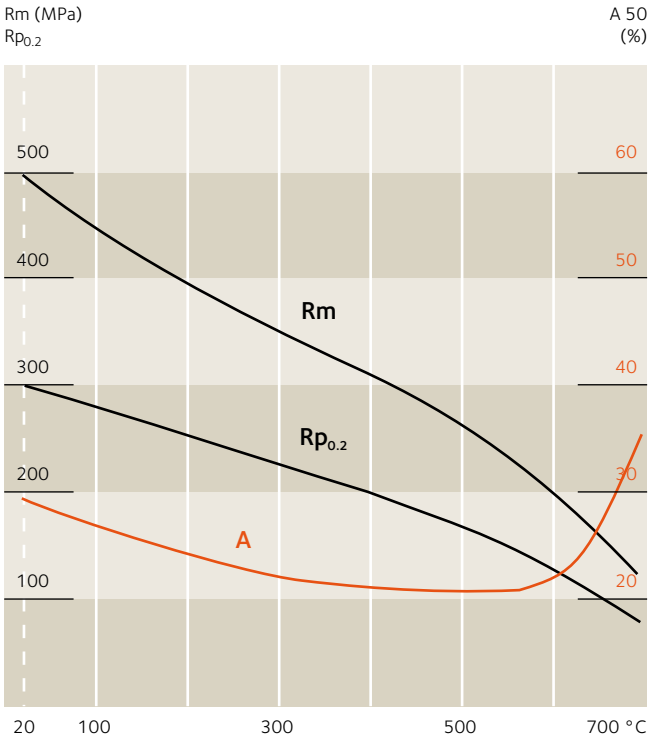
Lo = 5.65 √ So (ép. ≥ 3 mm)

Condition	Rm [1] (MPa)	$Rp_{0.2}$ [2] (MPa)	A [3] (%)	HRB
Cold-rolled*	520	370	29	80

1 MPa = 1 N/mm². * Typical values.

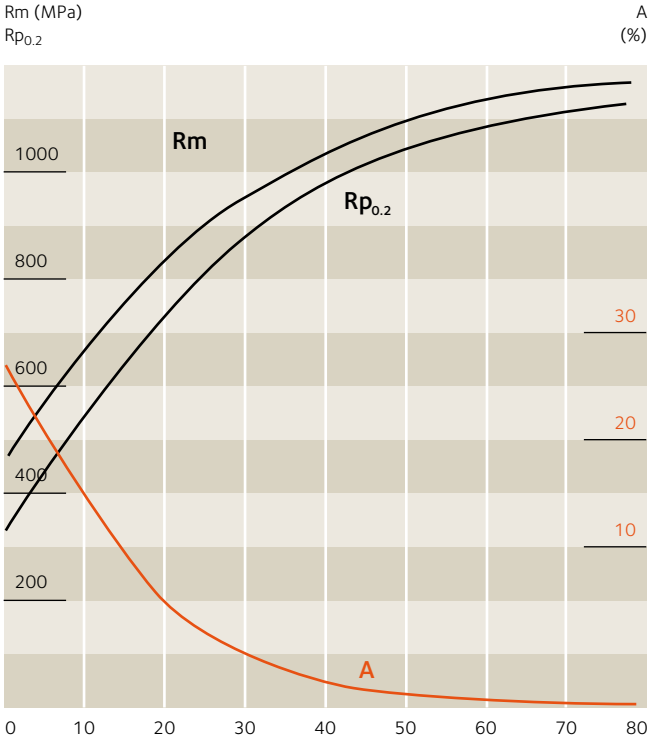
[1] Ultimate Tensile Strength (UTS). [2] Yield Strength (YS). [3] Elongation (A).

At high temperatures*



*Typical values.

Work-hardened by cold rolling



Corrosion resistance

The addition of molybdenum provides this grade with good resistance to pitting corrosion and enables extension of its field of application.

Our K36 grade has good resistance to urban and rural atmospheres and to fresh water.

K36 offers good performance in a salt spray environment,

Like all ferritic grades, this steel is not susceptible to stress corrosion

Resistance to localised corrosion

Grade designations	Standards		
	ASTM Designations		EN
	Type	UNS	
K03		S41003	1.4003
K30/K30D	430	S43000	1.4016
K41	441 (1)	S43932	1.4509
K45	445 (1)	S44500	1.4621 (2)
K36	**436**	**S43600**	**1.4526**
K44	444	S44400	1.4521
17-4Mn	201.1	S20100 (3)	1.4618 (2)
18-9 E	304	S30400	1.4301
17-11 MT	316Ti	S31635	1.4571

(1) Common designation.
(2) Pending revision of standard.
(3) With copper addition and "rich side" properties of 201.1, ASTM A240.

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

Forming

Our **K36** can be cold formed using all common processes (folding, contour forming, bending, deep drawing, slitting). Thicknesses less than 0.7 mm can be folded sharply through 180°. For greater thicknesses, the minimum bend radius will be: r > 0.5t (thickness).
Deep drawing operations can be facilitated by the production of a large-radius preform.

Bending of welded tubes

The bending ratios permissible with **K36** are given in the table below, based on laboratory tests for a bending angle of 90°, where D is the tube diameter and R is the bending radius.

Bending of butt seam tube

Bending (laboratory results)	Ra = R/D mini
Tube Ø 40 x 1.5	1.3
Tube Ø 50 x 1.5	1.3

Ra = bending ratio
D = tube diameter
R = bend radius
Angle 90°

Welding

Our **K36** grade can be resistance welded by spot or seam techniques.
Good results are obtained without post treatment provided that the weld is sufficiently forged.

Welding process	Without filler metal	With filler metal			Shielding gas*
	Typical thicknesses	Thicknesses	Filler metal		* Hydrogen and nitrogen forbidden in all cases
			Rod	Wire	
Resistance: Spot, Seam	≤ 2 mm				
TIG	< 1.5 mm	> 0.5 mm	ER 316L (Si)		Argon Argon + Helium
PLASMA	< 1.5 mm	> 0.5 mm		ER 316L (Si)	Argon Argon + Helium
MIG		> 0.8 mm		ER 316L (Si)	Argon + 2 % CO_2 Argon + 2 % O_2 Argon + 2 % CO_2 + Helium
S.A.W.		> 2 mm		ER 316L	
Electrode		Repair	ER 316L		
Laser	< 5 mm				Helium Under certain conditions: Argon

The addition of hydrogen or nitrogen to the argon must be avoided as this reduces weld ductility. For similar reasons, the use of nitrogen is forbidden and use of CO2 is restricted to 3%.
In order to restrict grain growth in the HAZ, 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

Heat treatment

Parts must be thoroughly descaled prior to any heat treatment operation.
After cold work, annealing for a few minutes at 825-850°C followed by rapid cooling enables restoration of the microstructure.

Pickling

Nitric-hydrofluoric acid mixture (10% HNO3 + 2% HF).
Descaling pastes for weld zones.

Passivation

20-25% cold nitric acid bath.
Passivating pastes for weld beads.

Head office
ArcelorMittal Paris
Stainless Europe
1-5 rue Luigi Cherubini
FR-93212 La Plaine Saint-Denis Cedex
www.arcelormittal.com/stainlesseurope
www.arcelormittal.com/stainlesseurope/kara
stainless.europe@arcelormittal.com

Information
Tel. : (33) 1 71 92 06 52
Fax : (33) 1 71 92 07 97