BOURGEAT

Les Abrets, 04-01-2011

Nous déclarons sous notre responsabilité que les inox utilisés pour la fabrication de nos produits sont conformes aux normes ou directives :
We declare in own responsibility that the stainless-steel used for the manufacture of our products are in compliance with technical standards

- Arrêté du 13 janvier 1976
- *French Order dated 13 January 1976*
- Règlement 1935/2004/CE du 27/10/04 (et des textes le modifiant)
- *Regulation no.1935/2004 of the European Parliament and of 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)*
- Norme Française NFA 36-711 d'Avril 2002
- *Standard NFA 36-711*

Relatif aux matériaux et objet en aciers inoxydables destinés à entrer en contact avec des denrées alimentaires
Relating materials and stainless steel objects intented to come into contact with foodstuffs

Fabien GENETIER
Responsable Qualité
Quality Manager

BOURGEAT – 1, rue Adrien Bourgeat - BP 19 - 38490 Les Abrets France
Tél 04 76 32 14 44 – Fax Distribution 04 76 32 25 96 – Fax Production 04 76 32 25 68
SAS au capital de 5 428 800 Euros – N°SIRET 397 79 8 539 00011 – Code APE 287 L - RCS Bourgoin-Jallieu B 397 798 539 – N°TVA FR 70397798539

Stainless Europe

ArcelorMittal

KARA ferritic stainless steel offer: grade K45

Chemical composition

Elements	C	Si	Mn	Cr	Nb	Cu
%	0.015	0.25	0.20	20.20	0.40	0.50

Typical values

European designation		American designation
X2CrNbCu21	1. 4621 [1]	(UNS 44500) [2]

[1] According to European designation

[2] According to ASTM A 240

This 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 Annex II dated 27 June 2002.
- Standard NFA 36 711"Stainless steel intended for use in contact with foodstuffs, products and beverages for human and animal consumption" (non packaging steel).
- The requirements of NSF/ANSI 51 – 2007 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 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 Order dated 13 January 1976 relating to materials and articles made of stainless steel in contact with foodstuffs.

General characteristics

The principal features of our grade **K45** are:

- Resistance to pitting corrosion equivalent to grade 1.4301, Type 304
- Suitable for exposure in moderately corrosive industrial and urban environments,
- Good resistance to salt spray test,
- Excellent polishability,
- Good mechanical properties at high temperatures.

Applications

- Automotive: internal and external decorative trims, model name plates, sill and door protectors, roof rails, hub caps and lock-nuts, various fasteners and accessories.
- External parts of refrigerated trailers.
- Household appliances and domestic equipment.
- Cookware.
- Commercial food equipment, various parts and equipment for catering.
- Elevators, doors and cabins.
- Construction: traditional roofing, roofing profiles, self-supporting trays, façade, cassette panels, composite panels, street furniture, decoration, accessories.

Product range

Forms: sheets, blanks, coils, strips, circles.
Thicknesses: 0.4 to 2.0 mm.
Width: according to thickness, consult us.
Finish: cold rolled according to thickness.

K45
Niobium stabilized 20% chromium ferritic stainless steel

KARA key for value

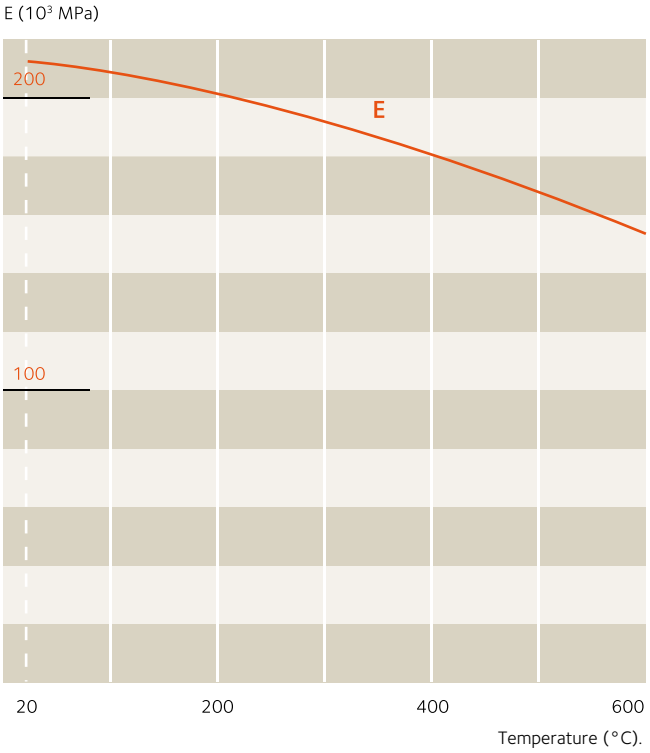
Physical properties

(Cold rolled sheet - annealed*)

Density	d	kg/dm³	20°C	7.7
Melting temperature		°C		1500
Specific heat	c	J/kg.K	20°C	450
Thermal conductivity	k	W/m.K	20°C	21.3
Mean coefficient of thermal expansion	a	10^{-6}/K	20-200°C 20-400°C 20-600°C 20-800°C	11.5 12 12.6 13.5
Electric resistivity	p	Ω.mm²/m	20°C	0.70
Magnetic permeability	µ	at 0.8 kA/m DC or AC	20°C	550
Young's modulus	E	MPa.10³	20°C	210

* Typical values.

Young's modulus at high temperature



Mechanical properties

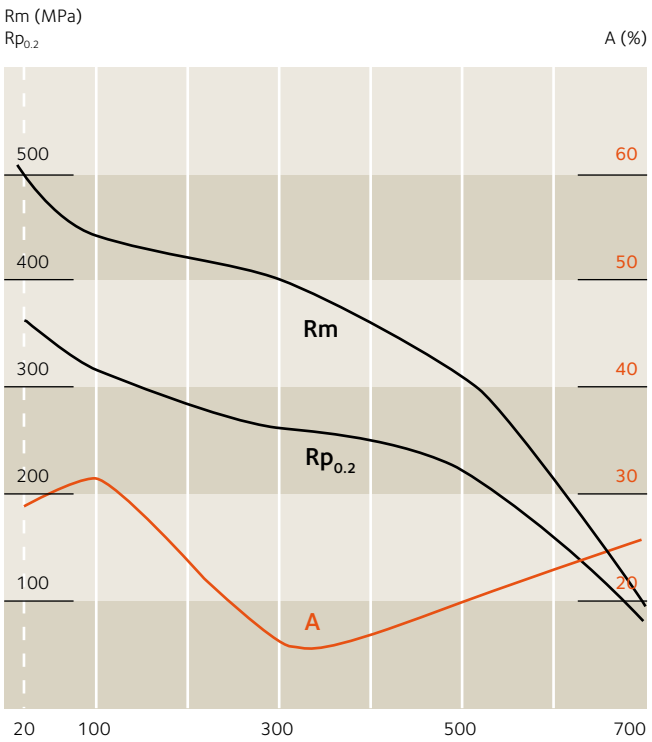
Annealed condition
In accordance with NF EN 10002-1 (July 2001), specimen perpendicular to the rolling direction

Specimen
Lo = 80 mm (thickness < 3 mm)
Lo = 5.65 √ So (thickness ≥ 3 mm)

Condition	R_m (1) (MPa)	$R_{p_{0.2}}$ (2) (MPa)	A (3) (%)	HRB
Cold rolled*	510	360	29	78

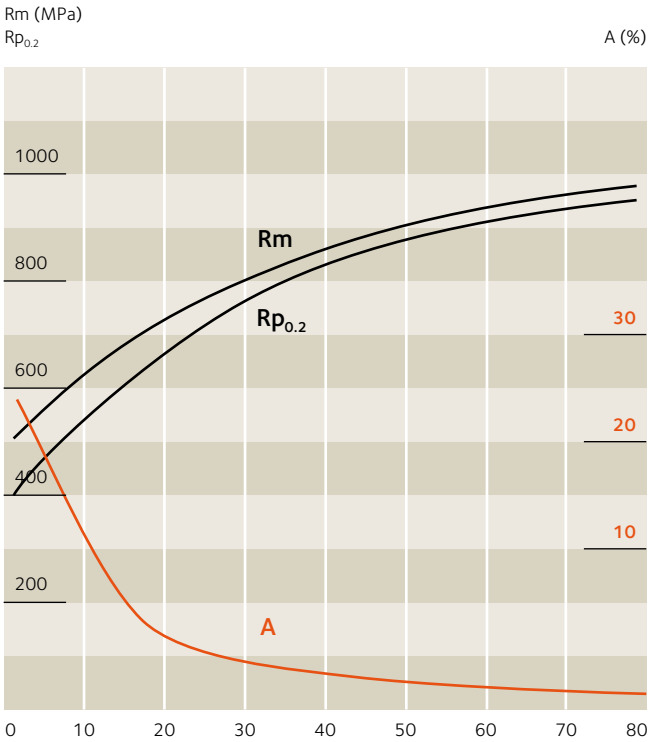
1 MPa = 1 N/mm². * Typical values.
(1) Ultimate Tensile Strength (UTS). (2) Yield Strength (YS). (3) Elongation (A).

At high temperature*



* Typical values.

Effect of cold rolling*



Corrosion resistance

The chromium content in excess of 20% in this grade confers good resistance to pitting corrosion equivalent to grade 1.4301, Type 304.

Our grade **K45** has good resistance to urban and rural atmospheres and to fresh water.

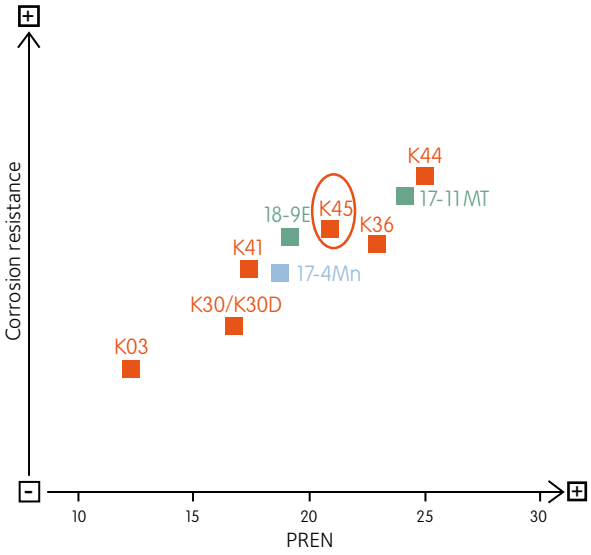
K45 also exhibits good resistance to salt spray corrosion and is not suseptible to stress corrosion cracking.

Localised corrosion resistance

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 update of the standard.
(3) With copper addition and 201.1 «rich side» properties per ASTM A240.

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 grade **K45** can be cold formed using all common processes (folding, contour forming, bending, deep drawing, slitting, etc.).

Thicknesses less than 0.7 mm can be folded sharply through 180°, while for larger thicknesses, the minimum bending radius r is related to the thickness t by r ≥ 0.5 t.

Deep drawing operations are facilitated by the production of a large radius preform.

Welded tube bending

The bending ratios permissible with **K45** are given in the table below, based on laboratory results for a bending angle of 90°, where D is the tube diameter and R is the bending radius.

Bending	Ra = R/D mini*
40 mm Ø x 1.5 mm tube	1.3
50 mm Ø x 1.5 mm tube	1.3

* Typical values tests done on 2 mm thick.

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

Erichsen test (expansion test)

Grade designation	European designation	ASTM A 240	Erichsen test* (mm)
K45	1.4621	UNS44500	10.8

* Typical values tests done on 2 mm thick.

Welding

Our grade **K45** can be resistance welded by spot or seam techniques. Good results are obtained without the need for post treatment provided that the forming of the weld is sufficient.

Welding process	No 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 316 L (Si)	ER 316 L (Si)	Argon Argon + Helium
PLASMA	< 1.5 mm	> 0.5 mm		ER 316 L (Si)	Argon Argon + Helium
MIG		> 0.8 mm		ER 316 L (Si)	Argon + 2% CO_2 Argon + 2% O_2 Argon + 2% CO_2 + Helium
S.A.W		> 2 mm		ER 316 L	
Electrode		Repairs	E 316 L		
Laser	< 5 mm				Helium Argon in certain conditions

The addition of hydrogen or nitrogen to the argon must be avoided since these gases decrease the ductility of the welds. For the same reason, nitrogen shielding must not be employed, while additions of CO_2 must be limited 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, power should not exceed 2.5 kJ/cm for a sheet thickness of 1.5 mm.

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.

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

Oxyacetylene torch welding should be avoided.

Heat treatment and finishing

Annealing

Thorough pickling is necessary prior to any heat treatment operation.

After cold work, annealing for a few minutes at 825-850°C followed by rapid cooling enables the microstructure to be restored.

Pickling

Nitric-hydrofluoric acid mixture
(10% HNO_3 + 2% HF)
Descaling pastes for weld zones.

Passivation

20-25 % HNO_3 solution at 20 °C.

Passivating pastes for weld zones.

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
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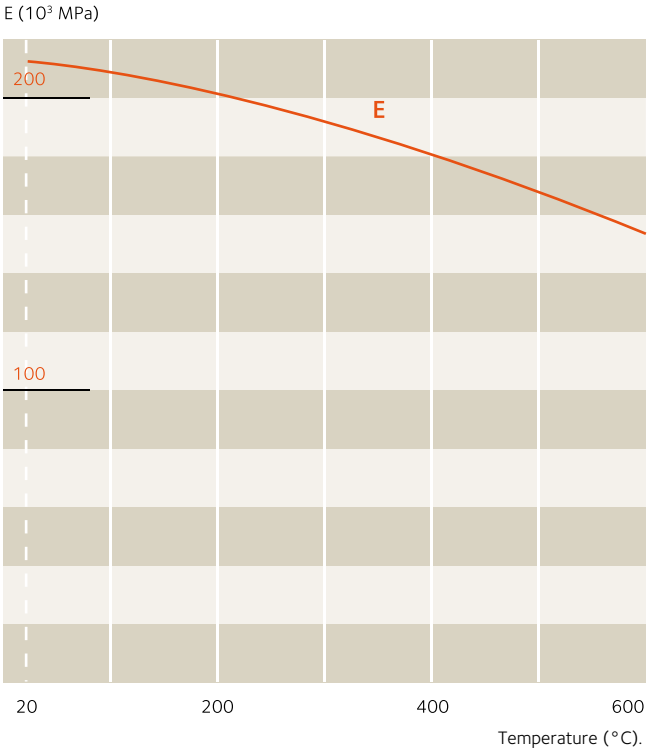

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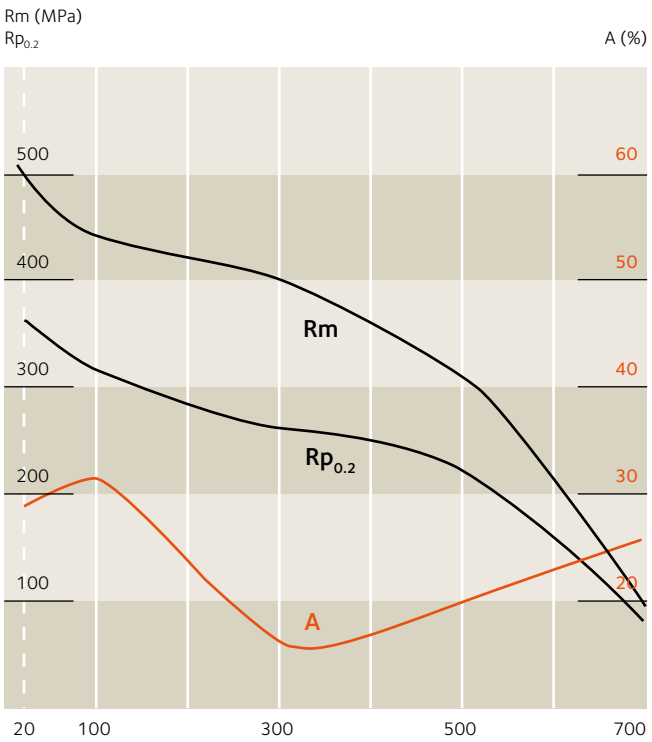

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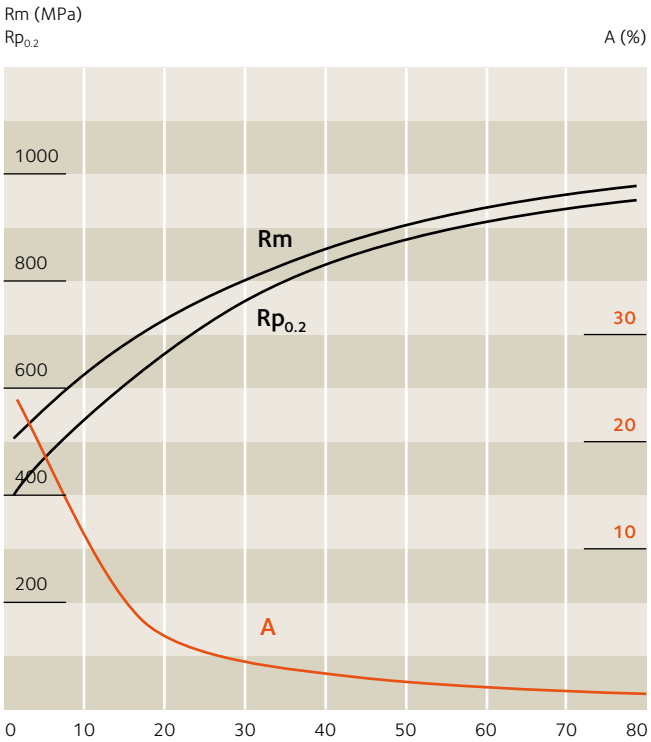

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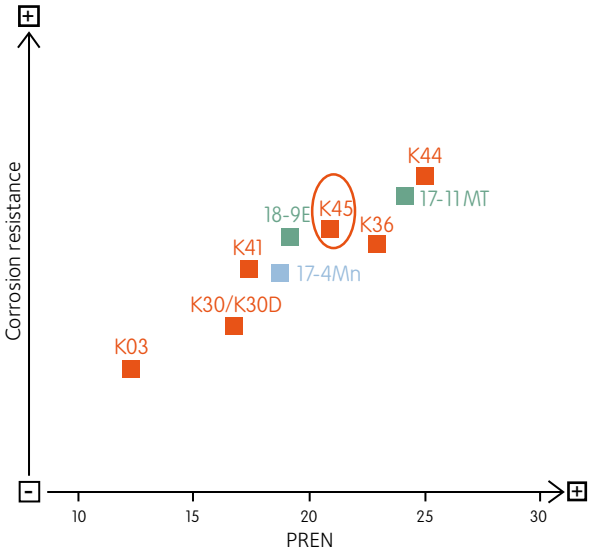

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www.arcelormittal.com/stainlesseurope
www.arcelormittal.com/stainlesseurope/kara
stainless.europe@arcelormittal.com

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