



60 rue de la Tuilerie - 38920 Crolles - France
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STEELS RAEX 400

PRESENTATION

Steel Raex 400 is steel of very high hardness resisting wears by abrasion and impacts. Resulting from recent and modern rolling mills allowing a quenching water fast and controlled, steel Raex 400 is of a great purity and present a perfect dimensional stability. It replaces the traditional structural steels advantageously making it possible to reduce the costs of maintenance in way significant. Its qualities of abrasive resistant are approximately 4 times higher than that of a steel S 235 JR. In spite of its high mechanical strength and its raised hardness, steel Raex 400 presents good aptitudes for cutting, working, drilling and welding. It can be delivered in thicknesses of 2,5 to 60mm. The low thicknesses are particularly appreciated by the manufacturers of buckets.

FIELDS OF APPLICATION

Crushers, screens, feeders, pockets of weighing, skips, chutes, hoppers, wear blades, conveyors, cups, knives, pinions toothed, tipcart, loaders, tippers, trucks, earthmovers, general purpose excavators, pipes of handling, screw conveyors, presses, etc...

CHIMICAL COMPOSITION

C %	Si %	Mn	P	S	Al	Cr	Ni	Mo	B
0.23	0.70	1.70	0.030	0.015	0,060	1,50	0,70	0.50	0.004

MECHANICAL CHARACTERISTICS

- Tensile Strength : 1250 N/mm²
- Elasticity limits : 1000 N/mm²
- Lengthening % : 10
- Hardness : 380 - 420 HB

WELDING

- **manual** : Basics electrodes : STEELARC MTD - STEELARC 70
(1) Electrodes Ni-Cr : STEELARC 1810 - STEELARC 310
- **semi-automatic** : ISAFIL ACIER - ISAFIL 80G - ISAFIL F 71 SG
(1) ISAFIL 1632 G - ISAFIL FLS 703
(1) recommended for assembly of steel RAEX 400 with different steels.

HEAT TRAITEMENT

Steel RAEX 400 should not be heated beyond 200°C if one wishes to preserve his hardness.

FOLDING, ROLLING, DRILLING and WELDING

Thank you to consult our booklet of information concerning the placement of steel RAEX.

DIMENSIONS PLATES QUARTO

Formats : 1000 x 2000 - 2000 x 3000 - 2000 x 6000.

Thicknesses : 5 - 6 - 8 - 10 - 12 - 15 - 20 - 25 - 30 - 35 - 40 - 50 - 60 mm.

DIMENSIONS OF UNROLLED AND FLATTENED PLATES

Formats : Width 1000 to 1560mm - Length 2000 to 12000mm according to the thicknesses.

Thicknesses : 2,5 - 3 - 4 - 5 - 6 - 7 mm.



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Placement of steels RAEX

- **Placement of steel Raex**

In spite of their high mechanical strength and their raised hardness, RAEX Steels present a good weldability and a good aptitude for working.

- **Designation of the grade of steel**

Raex 400, Raex 450, Raex 500

Brinell Hardness average : 400 HBW, 450 HBW, 500 HBW

Chemical and mechanical characteristics,
see tables 1 and 2.

- **Dimensional Program**

Sheets and plates quarto, see table 3.

- **Delivery condition**

Steels are delivered at the soaked state.

- **Tolerances**

Sheets quarto : Thickness Standard EN 10029 Classe A.
Width and length EN 10029. Flatness standard EN 10029,
Classe N normal flatness tolerances, type of steel : H.
Sheets : Thickness, width and length standard EN 10051.
Flatness standard EN 10029 Classe N, type of steel : H.

- **Surface quality**

Standard EN 10 10163-2 Classe A3.

Recharging by welding after elimination of the defects of
surface is prohibited.

- **Steels Hardness**

Hardness HBW of steel is given according to the standard
EN ISO 6505-1.

- **Skin-pass and flatness (Dead Flat pro-cess)**

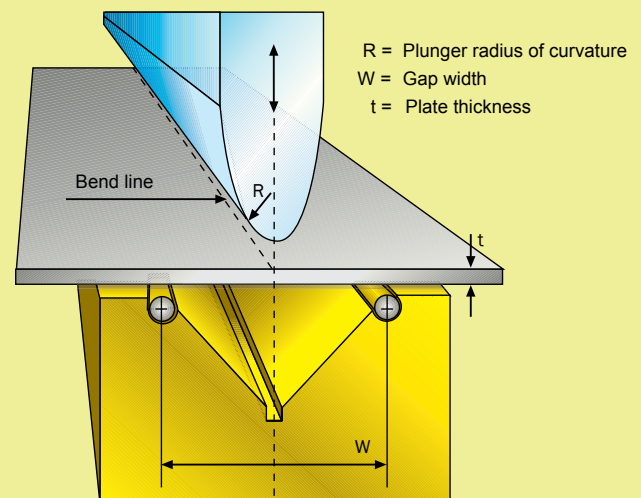
Rolling skin-pass of the coils, known as "Dead Flat process" (DF), causes a work hardening of the metal which erases the stage of elastic limit of steels and fixes the mechanical characteristics. This rolling of completion eliminates the residual stresses and allows the production of sheets having an excellent flatness. It facilitates the control of the deformations after welding and is appropriate very well for the series production of folded parts. The rolling skin-pass avoids the planing of the parts cut out in steels DF. It also improves the surface quality of the film them Raex and reduces the geometrical irregularities of surfaces (roughness). Our products make it possible to simplify the cycles of production This process DF is systematically specified on the certificate machines.

- **Control Documents**

On request of the customers, we provide for our Raex Steels, a standard statement of control 2.2 or one certificate of reception 3.1 in conformity with the standard EN 10204. On the control documents, are reproduced the chemical composition of steel like its hardness.

- **Flanging and free bending**

Figure 1



- The surface hardness of the upper edges of the die groove must be greater than the hardness of the plate that is to be bent. In the structure shown in the figure, the upper edge of the die groove is equipped with 20 mm iron rods with the hardness of approximately 53 HRC.
- The grooves in which the iron rods are located must be kept clean.
- Widening the die groove decreases the need for bending force but increases springback.
- Springback:
Raex 400 9° – 13°
Raex 500 10° – 15°



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STEELS RAEX

Mechanical Characteristics - Dimensional Programs

• Chemical composition

Table 1

	Thickness mm		Maximum content of % (analyzes on cast)									
	Sheets	Plates quarto	C	Si	Mn	P	S	Al	Cr	Ni	Mo	B
Raex 400	2,5 – 12	5 – 30	0,23	0,70	1,70	0,030	0,015	0,060	1,50	0,40	0,50	0,004
	–	(30) – 60	0,24	0,70	1,70	0,030	0,015	0,060	1,00	0,70	0,50	0,004
Raex 450	3 – 12	6 – 60	0,26	0,70	1,70	0,030	0,015	0,060	1,00	0,70	0,50	0,004
Raex 500	3 – 12	5 – 60	0,30	0,70	1,70	0,030	0,015	0,060	1,00	0,80	0,50	0,004

Aluminium (Al) and / or titane (Ti) to fixe the azote (N),

• Mechanical characteristics

Table 2

	Thickness mm		Elasticity Limit	Breaking Load	Lengthening	Hardness	Resilience	
	Sheets	Plates quarto	R _{p0,2} N/mm ²	R _m N/mm ²	A ₅ %	HB	t °C	KV J
Raex 400	2.5 – 12	5 – 15	1000	1250	10	360 – 420	-40	30
	–	(15) – 30	1000	1250	10	360 – 450	-40	20
	–	(30) – 60	1100	1400	8	360 – 480	-40	20
Raex 450	3 – 12	6 – 60	1200	1450	8	425 – 475	-40	20
Raex 500	3 – 12	5 – 60	1250	1600	8	450 – 530	-30	20

Indicative Values

• Dimensional Program

Table 3

Sheets

	Thickness mm	Width mm ¹⁾	Length max. mm
Raex 400	2.5 – 6	1000 – 1560	12 000
Raex 400	(6) – 12	1000 – 1540	6 000
Raex 450	3 – 6	1000 – 1560	12 000
Raex 450	(6) – 12	1000 – 1540	6 000
Raex 500	3 – (4)	1000 – 1350	6 000
Raex 500	4 – 12	1000 – 1540	6 000

¹⁾ The exact width depends of the thickness

Plates quarto

	Thickness mm ¹⁾	Width mm ²⁾	Length max. mm
Raex 400/450/500	5 – 60	1750 – 2500	6 000

¹⁾ For plates with a higher thickness with 60 mm and length higher than 6m, thank you to consult as a preliminary.
For Raex 450, the thickness minimum is of 6 mm.

²⁾ The exact width depends of the thickness.



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Steels RAEX - FOLDING AND WELDING

• Free folding

Tableau 1

	Thickness mm	Free folding < 90° Ray R of the punch / thickness: R/t direction of folding / direction of rolling		Opening W of the matrix Thickness: W/t		Folding to 90° groove - V W/t
		Transversal	Longitudinal	Transversal	Longitudinal	
Raex 400	2.5 – 6	3	3	9	9	≈ 15
Raex 400	(6) – 20	3	4	9	11	≈ 15
Raex 450	3 – 20	4	5	11	13	≈ 15
Raex 500	5 – 20	≈ 10	≈ 12	23	27	–

Recommandations for the folding.

Thank you to consult our technique department for the folding of sheets thickness higher than 20 mm .

• Temperature of heating °C

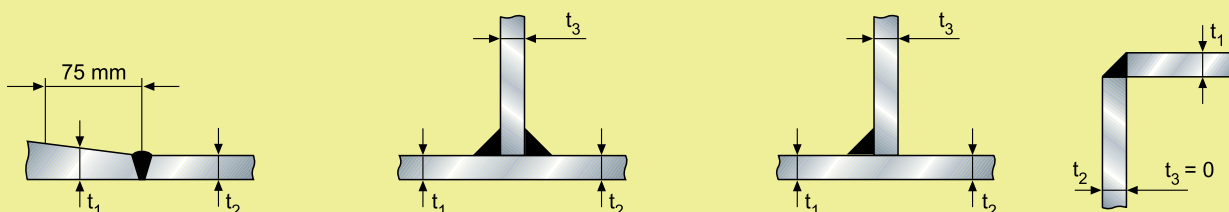
Tableau 2

	Welding Process Hydrogen content in the added metal (HD)	Minimum metal energy. E kJ/mm	Combinated thickness t, mm											
			10	20	30	40	50	60	70	80	90	100	110	120
Raex 400	Wire Full MAG HD ≤ 5 ml / 100g	1,5	20		50		75	125	150					
		2	20					125			150			
		2,5	20					100			125			
	Wire full MAG HD = 5 - 10 ml / 100 g	1,5	20		100		125		175			200		
		2	20		100		125	150		175				
		2,5	20					75	125	150		175		
	Metal arc welding under HD = 5 - 10 ml / 100 g	1,5	20		50	100	125	150	175					
		2	20					75	125	150		175		
		2,5	20					100		125	150			
Raex 500	Wire full MAG HD ≤ 5 ml / 100g	1,5	20	75	125	150		175						
		2	20		75		125		150		175			
		2,5	20					75	125	150		175		
	Wire full MAG HD = 5 - 10 ml / 100 g	1,5	20	150	175	200 ¹⁾								
		2	20	100	150	175	200 ¹⁾							
		2,5	20	50	100	150	200 ¹⁾							
	Metal arc welding under HD = 5 - 10 ml / 100 g	1,5	20	100	150	175	200 ¹⁾							
		2	20	50	100	150	200 ¹⁾							
		2,5	20	50		100	200 ¹⁾							

¹⁾ A pre-heating with an higher temperature with 200°C affects mechanical characteristics of metal basic. To consult our engineering service if you want to derogate from this rule.

$$E = \frac{60 \cdot U \cdot I}{100 \cdot v} \quad E = \text{Welding energy (kJ/mm)} \quad I = \text{Intensity of the current of welding (A)}$$

$$U = \text{Tension (V)} \quad v = \text{Speed progress (mm/min)}$$



t_1 : Average thickness to 75 mm
of the axis of the cord of the welding
Combinated thickness $t = t_1 + t_2$

Symmetrical and simultaneous
execution of the two cords
Combinated thickness $t = 1/2 \cdot (t_1 + t_2 + t_3)$

Combinated thickness $t = t_1 + t_2 + t_3$