Duferco
Clabecq

Abrasion Resistant steel Quard 400

1 Steel description and applications

Quard 400 is a martensitic abrasion resistant steel with an average hardness of 400 HBW. Due to its versatility in terms of high toughness, good cold formability and excellent weldability, Quard 400 combines an outstanding work shop performance and a long lasting wear resistance.

Quard 400 from Duferco Clabecq is mainly recommended for the following applications:

- mining and earthmoving machinery
- crushing and pulverizing equipment
- buckets, knives, crushers, feeders
- presses
- skips
- excavators
- slurry pipe systems
- screw conveyors

2 Technical characteristics

Chemical composition

Heat analysis , %								
C	Si	Mn	P	S	Cr (*)	Ni (*)	Mo (*)	B
≤ 0,16	≤ 0,70	≤ 1,60	≤ 0,025	≤ 0,010	≤ 0,50	≤ 0,25	≤ 0,25	≤ 0,005

(*) depending on thickness, these elements are used to achieve full hardening

Carbon equivalent, typical values, %		
Plate thickness	CEV(1)	CET(2)
8-20 mm	0,45	0,30

(1) CEV = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15
(2) CET = C + (Mn+Mo)/10 + (Cr+Cu)/20 + Ni/40

The steel is fully killed and grain refined.

Mechanical properties*

Yield Strength (MPa)	Tensile Strength - Transverse - (MPa)	Elongation (%)
1050	1250	10

Hardness	Charpy-V notch impact test
HBW = 370 - 430	35J (longitudinal at -40°C)

* typical values

Testing

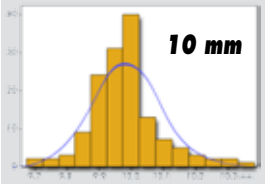
Brinell hardness test, HBW according to EN ISO 6506-1, is performed 1 - 2 mm below the plate surface once per heat and 40 tonnes.

Tolerances and surface properties

Quard 400 meets the tolerances in shape, length, width, thickness and flatness (Class N or S) according to EN 10029. Surface properties according to EN 10163-2 (Class A, Subclass 1) .

Upon request Quard 400 can be delivered with thickness tolerances much closer than specified in EN 10029, giving you the opportunity to enhance your production performance.

Typical thickness tolerance (Duferco Clabecq)



Our Quard plates are supplied as standard in the **shotblasted and painted** condition. They can also be delivered unpainted..

Quard®

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3 Dimensions

Quard 400 at present is supplied in **the following range**:

- thickness: 8 - 20 mm
- width: 1500 - 2500 mm

Duferco Clabecq will continue to broaden its range from 3 to 40 mm. For more information, please check our website or contact your local Duferco Clabecq representative.

4 Heat treatment

Quard 400 receives its properties by quenching and when applicable by subsequent tempering. The properties of the delivery condition can not be retained after exposure at service or preheating temperatures above 250C.
Quard 400 is not intended for any further heat treatment.

5 General processing recommendations

To obtain optimal work shop productivity when processing Quard 400, it is of most importance to use the recommended procedures and tools given below.

Thermal cutting

Flame cutting can be performed without the need for preheating in thicknesses up to 40 mm.
In plasma cutting no preheating is required.

Machining

Quard 400 offers good machinability with HSS and HSS-Co alloyed drills. The feed rate and cutting speed have to be adjusted to the high hardness of the material.
Face milling, counter boring and countersinking are best performed using tools with replaceable cemented carbide inserts.

Cold forming

Quard 400 is very well suited for cold forming operations.
The minimum recommended R/t ratio when bending of Quard 400 is given in the table below:

Thickness (mm)	Transverse to rolling (R/t)	Longitudinal to rolling (R/t)	Width (W/t)
8 - 20	3	4	10

R = Recommended punch radius (mm), t = Plate thickness (mm) , W – Die opening width (mm) (bending angle ≤ 90°)

Due to the homogeneous properties of Quard 400, variations in springback is kept at a low level.
Grinding of flame cut or a sheared edge in the bending area is recommended to further prevent cracking during bending.

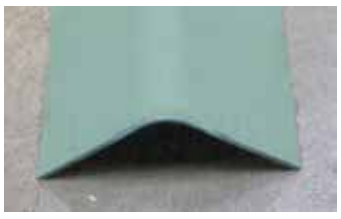
Welding

Quard 400 has a very good weldability, granted by the low carbon equivalent of the steel. It can be welded using any of the conventional welding methods, both as manual or automatic.

If welding using a heat input of 1.7 kJ/mm, preheating is not required in single plate thickness up to 20 mm. The interpass temperature used should not exceed 225° C.

Soft weld consumables, giving low hydrogen weld deposits (<= 5 ml/100g), are recommended. The consumable strength should be as soft as the design and wear mode allows.

In general, the welding recommendation of Quard 400 should be in the accordance to EN-1011.



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