NLMK Europe – Plate

Quard®

ABRASION RESISTANT STEEL

ABRASION RESISTANT STEELS
QUARD PRO

1. Steel description and applications

QUARD PRO® results from the advanced experience of NLMK Clabecq with high strength steels and associates the best mechanical properties from the both well-known wear plates QUARD 450® and QUARD 500®. It makes QUARD PRO® a unique product and first-choice for several applications that requires the maximum combination between wear resistance and bendability on top of toughness.

Quard PRO is mainly recommended for the following applications:

- screeners
- crushing and pulverizing equipment
- conveyors belts
- buckets and grapples
- scrap presses
- dump truck bodies

2. Technical characteristics

Hardness guarantee

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

Hardness
HBW = 460 - 500

Other mechanical properties (typical values)

Charpy-V notch impact test	Yield Strength (MPa)	Tensile Strength - Transverse - (MPa)	Elongation A5 (%)
50 J (longitudinal at -40°C)	1350	1550	8

Chemical composition The steel is grain refined.

	Max ladle analysis , %								
Thickness	C	Si	Mn	P	S	Cr	Ni	Mo	B
4 - 20 mm	0,25	0,60	1,40	0,025	0,01	0,80	0,80	0,50	0,005

Carbon equivalent, typical values, %		
Plate thickness	CEV(1)	CET(2)
5 - 20 mm	0,54	0,38

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

3. Dimensions

Quard PRO at present is supplied in the following range:

- thickness: 5 - 20 mm
- width: 2000 - 2500 mm

For more information, please check our website or contact your local NLMK Clabecq representative.

4. Flatness, tolerances & surface properties

Quard PRO is delivered with a unique combination of excellent flatness, tight thickness tolerances, and superior surface finish.

Feature	Norm
FLATNESS	- EN 10029: . Class N (standard) & . Class S **PLUS**
THICKNESS tolerance	- meets and exceeds EN 10029 Class A - tighter tolerances upon request **PLUS**
Shape, length, width tolerances	meets EN 10029
SURFACE properties	exceeds the usual market standards, EN 10163-2 Class B3 **PLUS**

5. Delivery conditions

Our Quard plates are supplied as standard in the shotblasted and primed condition. In order to maintain good weldability and laser cutting performance, a low zinc silicate primer is applied. Plates can also be delivered unpainted.

6. Heat treatment

Quard PRO 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 250 °C. Quard PRO is not intended for any further heat treatment.

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7. Ultrasonic testing

Ultrasonic testing (UT), is applied to secure the plate from discontinuities like inclusions, cracks, and porosity. In thickness from 8 mm and above, all plates are UT tested and controlled against class S2, E2, according to EN 10160.

8. General processing recommendations

To obtain optimal workshop productivity when processing Quard PRO, it is essential to use the recommended procedures and tools given below.

Thermal cutting

Plasma and flame cutting can be performed without the need for preheating in thicknesses up to 20 mm, provided the ambient temperature is above 0 °C.
Subsequent to cutting, let the cut parts slowly cool down to room temperature. A slow cooling rate will reduce the risk of cut edge cracking (never accelerate the cooling of the parts).

Cold forming

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

Thickness (mm)	Transverse to rolling (R/t)	Longitudinal to rolling (R/t)	Trans. Width (W/t)	Long. Width (W/t)
t < 8.0	3.0	3.5	12	12
8 ⩽ t < 20	3.5	4.5	14	14

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

Due to the homogeneous properties and narrow thickness tolerances of Quard PRO, variations in springback are 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 PRO has very good weldability, granted by the optimal carbon equivalent of the steel. It can be welded using any of the conventional welding methods, both manual or automatic.

Welding of Quard PRO is recommended to be performed at ambient temperature not lower than +5°C. Subsequent to welding, let the welded parts slowly cool down to room temperature (never accelerate the cooling process of the weld).

If welding using a heat input of 1.7 kJ/mm, preheating is not required in single plate thickness up to 15 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 PRO should be in accordance to EN-1011.

Machining

Quard PRO 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.

For more information regarding welding, cold forming and machining, please consult the respective manuals with technical recommendations on http://qt.nlmk.com

Quard® is a registered trademark of NLMK Clabecq
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