

# Quard

## WEAR RESISTANT STEEL

**QUARD** is a martensitic wear resistant steel. Its very high resistance to abrasion and impact makes it ideal where long service life is required.

### Applications

- mining and earthmoving machinery
- buckets, knives, grapples
- dumper bodies and on road tippers
- refuse haulers, scrap containers
- screeners crushing andpulverizing equipment
- scrap presses
- cement drum mixer barrels
- feeders, skips, screw conveyors
- conveyors belts
- slurry pipe systems

### Dimensions

QUARD at present is supplied in the following range:

| THICKNESS | | WIDTH |
|---|---|---|
| QUARD 400 | 4 - 40 mm | 1500 - 3100 mm |
| QUARD 450 | 3,2 - 64 mm | |
| QUARD 500 | 4 - 64 mm | 2000 - 2500 mm |
| QUARD 550 | 6 - 30 mm | |
| QUARD PRO | 8 - 25 mm | |

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

### Technical characteristics

#### Hardness guarantee

| HARDNESS | |
|---|---|
| QUARD 400 | HBW = 370 - 430 |
| QUARD 450 | HBW = 420 - 480 |
| QUARD 500 | HBW = 470 - 530 |
| QUARD 550 | HBW = 520 - 580 |
| QUARD PRO | HBW = 460 - 500 |

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.

#### Mechanical properties (typical values)

| Quard | Charpy-V notch impact test (longitudinal at -40°C) | Yield Strength (MPa) | Tensile Strength - Transverse (MPa) | Elongation A5 (%) |
|---|---|---|---|---|
| QUARD 400 | 50 J | 1160 | 1300 | 10 |
| QUARD 450 | 45 J | 1250 | 1400 | 10 |
| QUARD 500 | 30 J | 1500 | 1700 | 8 |
| QUARD 550 | - | 1575 | 1750 | 7 |
| QUARD PRO | 50 J | 1350 | 1550 | 8 |

#### Carbon equivalent

| CARBON EQUIVALENT, TYPICAL VALUES, % | | | |
|---|---|---|---|
| Plate thickness | | CEV(1) | CET(2) |
| QUARD 400 | 4 - 8 mm | 0,36 | 0,25 |
| | 8,01 - 20 mm | 0,40 | 0,28 |
| | 20,01 - 25,4 mm | 0,45 | 0,29 |
| | 25,41 - 40 mm | 0,57 | 0,33 |
| QUARD 450 | 3,2 - 7,99 mm | 0,41 | 0,30 |
| | 8 - 20 mm | 0,41 | 0,32 |
| | 20,01 - 40 mm | 0,56 | 0,37 |
| | 40,01 - 64 mm | 0,64 | 0,40 |
| QUARD 500 | 4 - 20 mm | 0,56 | 0,39 |
| | 20,01 - 40 mm | 0,60 | 0,42 |
| | 40,01 - 64 mm | 0,70 | 0,45 |
| QUARD 550 | 6 - 30 mm | 0,68 | 0,46 |
| QUARD PRO | 8 - 25 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

**NEW**

## Quard PRO

This new grade associates the best mechanical properties from the abrasion resistant plates QUARD 450 and QUARD 500. It makes **QUARD PRO** a unique product and first-choice for several applications that require the maximum combination between wear resistance and bendability on top of toughness.

Plate/QT/Quard/V02 (09.2024)



# Quard

## Flatness, tolerances & surface properties

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

| FEATURE | NORM |
|---|---|
| FLATNESS | EN 10029: - Class N (standard)<br>- Class S |
| THICKNESS tolerance | - meets and exceeds EN 10029 Class A<br>- tighter tolerances upon request |
| Shape, length, width tolerances | meets EN 10029 |
| SURFACE properties | exceeds the usual market standards, EN 10163-2 Class B3 |

## Delivery conditions

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

## Heat treatment

QUARD 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 is not intended for any further heat treatment.

## Ultrasonic testing

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

## General processing recommendations

Due to the properties of QUARD, it's recommended to observe elementary precautions and to strictly follow the instructions given in the norms and in the technical guides before using advanced techniques for cutting,welding, forming, etc...

### Thermal cutting

Provided the ambient temperature is above 0 °C, plasma and flame cutting can be performed without the need for preheating in thicknesses up to:

| Quard | QUARD 400 | QUARD 450 | QUARD 500 | QUARD 550 | QUARD PRO |
|---|---|---|---|---|---|
| no preheating up to | 40 mm | 40 mm | 20 mm | 20 mm | 20 mm |

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

| Quard | Thickness (mm) | Transverse to rolling (R/t) | Longitudinal to rolling (R/t) | Trans. Width (W/t) | Long. Width (W/t) |
|---|---|---|---|---|---|
| QUARD 400 | t < 8.0 | 2.5 | 3.0 | 8 | 10 |
| | 8 ≤ t < 20 | 3.0 | 4.0 | 10 | 10 |
| | t ≥ 20.0 | 4.5 | 5.0 | 12 | 12 |
| QUARD 450 | t < 8.0 | 3.5 | 4.0 | 10 | 10 |
| | 8 ≤ t < 20 | 4.0 | 5.0 | 10 | 12 |
| | t ≥ 20.0 | 5.0 | 6.0 | 12 | 14 |
| QUARD 500 | t < 8.0 | 3.5 | 4.5 | 10 | 12 |
| | 8 ≤ t < 20 | 4.5 | 5 | 12 | 14 |
| | t ≥ 20.0 | 6 | 7 | 16 | 18 |
| QUARD PRO | 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, 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 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 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:

| Quard | QUARD 400 | QUARD 450 | QUARD 500 | QUARD 550 | QUARD PRO |
|---|---|---|---|---|---|
| no preheating up to | 20 mm | 20 mm | 12 mm | 10 mm | 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 should be in accordance to EN-1011.

If you want to calculate the optimal parameters for your operations on Quard and Quend, download our Q Calculator using the QR code. Available on Google Play and Apple Store.

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