

Abrasion Resistant steels

Quard®



Quard®

ABRASION RESISTANT STEEL

1 Applications

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

Quard is mainly recommended for the following applications:

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

2 Dimensions

Quard at present is supplied in the following range:

	Thickness	Width
Quard 400	4 - 50 mm	1500 - 3100 mm
Quard 450	3,2 - 64 mm	
Quard 500	4 - 40 mm	
Quard 550	6 - 20 mm	

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

3 Technical characteristics

Hardness guarantee

	Hardness	
Quard 400	HBW = 370 - 430	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.
Quard 450	HBW = 420 - 480	
Quard 500	HBW = 470 - 530	
Quard 550	HBW = 520 - 580	

Other mechanical properties (typical values)

	Charpy-V notch impact test (longitudinal at -40°C)	Yield Strength (MPa)	Tensile Strength - Transverse (MPa)	Elongation A5 (%)
Quard 400	40 J	1160	1300	10
Quard 450	35 J	1250	1400	10
Quard 500	30 J	1500	1700	8
Quard 550	/	1575	1750	7

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	40,01 mm - 50 mm	0,64	0,36
	3,2 - 7,99 mm	0,41	0,30
	8 - 20 mm	0,41	0,32
	20,01 - 40 mm	0,56	0,37
Quard 500	40,01 - 64 mm	0,64	0,40
	4 - 20 mm	0,57	0,40
Quard 550	20,01 - 40 mm	0,61	0,43
	6 - 20 mm	0,68	0,46

⁽¹⁾ CEV = C+Mn/6+ (Ni+Cu)/15+ (Cr+Mo+V)/5
⁽²⁾ CET = C+Mn/8+ (Ni+Ni)/10+ (Ni)/40+ (Cr+Cu)/20

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:

	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

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.

4 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.



5 Heat treatment

Guard 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. Guard is not intended for any further heat treatment.

6 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.

7 Technical precautions

Due to the properties of Guard, 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... Our technical experts are at your disposal for any request or requirement.

For more information regarding welding, cold forming and machining, please consult the respective manuals with technical recommendations on www.guard.me

Extra High Strength Structural Steel

Quend®



1 Applications

Quend is extra high strength structural steel produced as quenched and tempered.

Quend is recommended for the following applications:

- truck chassis
- lifting and hoisting equipment
- handling equipment
- trailers
- crane booms
- stabilising support
- undercarriage

2 Dimensions

Quend is currently supplied in the following range:

	Thickness	Width
Quend 700	4 - 64 mm	1500 - 3100 mm
Quend 900	4 - 35 mm	
Quend 960	4 - 30 mm	
Quend 1100	4 - 12 mm	

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

3 Technical characteristics

Tensile properties

TRANSVERSE TESTING			
	Yield strength Rp 0.2	Tensile Strength Rm	Elongation A5
Quend 700	700 MPa min	780 - 930 MPa	14% min
Quend 900	900 MPa min	940 - 1100 MPa	12% min
Quend 960	960 MPa min	980 - 1150 MPa	12% min
Quend 1100	1100 MPa min	1250 - 1500 MPa	10% min

Impact toughness

	Minimum values at		
	0 °C	-20 °C	-40 °C
Quend 700	35 J	30 J	27 J
Quend 900	35 J	30 J	27 J
Quend 960	35 J	30 J	27 J
Quend 1100	35 J	30 J	27 J

Transverse testing according to EN 10025 option 30.
Thickness < 12 mm
sub-sized Charpy V specimen have been used.

Testing according to EN 10025.

Carbon equivalent

	Carbon equivalent, typical values, %		
	Plate thickness	CEV ⁽¹⁾	CET ⁽²⁾
Quend 700	4 - 15 mm	0,45	0,29
	15.01 - 25 mm	0,44	0,30
	25.01 - 40 mm	0,45	0,30
	40.01 - 64 mm	0,54	0,33
Quend 900	4 - 35mm	0,57	0,36
Quend 960	4 - 30 mm	0,57	0,36
Quend 1100	4 - 12 mm	0,57	0,36

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

Cold forming

Quend is very well suited for cold forming operations.

Quend complies with the S690QL, S890QL and S960QL bending requirements but offer even closer R/t ratios:

Minimum recommended R/t ratio when bending of Quend

	Thickness (mm)	Transverse to rolling (R/t)	Longitudinal to rolling (R/t)	Trans. Width (W/t)	Long. Width (W/t)
Quend 700	t < 8.0	1.5	2.0	8	9
	8 ≤ t < 20	2.0	3.0	8	9
	t ≥ 20.0	3.0	4.0	9	10
Quend 900	t < 8.0	2.5	3.0	9	10
	8 ≤ t < 20	3.0	4.0	9	10
	t ≥ 20.0	4.0	5.0	10	12
Quend 960	t < 8.0	2.5	3.0	9	10
	8 ≤ t < 20	3.0	4.0	9	10
	t ≥ 20.0	4.0	5.0	10	12
Quend 1100	t < 6.0	3.5	4	10	10
	6 ≤ t < 12	4.5	5	10	12

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 Quend, 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.

4 Delivery conditions

Quend is delivered as quenched and tempered. Our Quend plates are supplied as standard in the **shotblasted and painted** 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.



5 Heat treatment

The mechanical properties of Quend has been obtained by quenching and tempering. For not losing the guaranteed properties of Quend, the plate should not be used in applications requiring hot working and service temperatures above 550 °C for Quend 700, Quend 900 and Quend 960. In the case of Quend 1100, service temperature should be kept below 200°C.

6 Ultrasonic testing

Ultra sonic 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.

7 Technical precautions

Due to the properties of Quend, 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... Our technical experts are at your disposal for any request or requirement.

For more information regarding welding, cold forming and machining, please consult the respective manuals with technical recommendations on www.quend.me