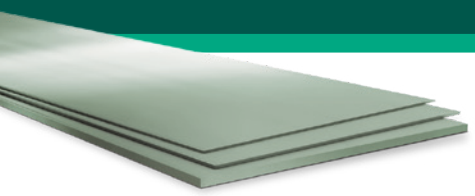
NLMK Clabecq

Quard 400

WEAR RESISTANT STEEL



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.

1. Steel description and applications

QUARD 400 is 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

Hardness guarantee

HARDNESS
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

Other mechanical properties (typical values)

CHARPY-V NOTCH IMPACT TEST	YIELD STRENGTH (MPA)	TENSILE STRENGTH - TRANSVERSE - (MPA)	ELONGATION A5 (%)
45J (longitudinal at -40°C)	1160	1300	10

Chemical composition

The steel is grain refined.

MAX LADLE ANALYSIS, %									
Thickness	C	Si	Mn	P	S	Cr	Ni	Mo	B
4 - 25,40 mm	0,16	0,60	1,40	0,025	0,010	0,50	0,10	0,25	0,005
25,41 - 40 mm	0,17	0,60	1,60	0,025	0,010	1,15	0,10	0,30	0,005

CARBON EQUIVALENT, TYPICAL VALUES, %		
Thickness	CEV(1)	CET(2)
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

(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 400 at present is supplied in the following range:

- thickness: 4 - 40 mm
- width: 1500 - 3100 mm

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

4. Flatness, tolerances & surface properties

QUARD 400 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
THICKNESS tolerance	- meets and exceeds EN 10029 Class A - tighter tolerances upon request
Shape, length, width tolerances	meets EN 10029
SURFACE properties	exceeds the usual market standards, EN 10163-2 Class B3

5. 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.

6. 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 250 °C. QUARD 400 is not intended for any further heat treatment.

Plate/QT/Quard/V07 (09.2024)

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 up, all plates are UT tested and controlled against class S2, E2, according to EN 10160.

8. General processing recommendations

To obtain optimal work shop productivity when processing QUARD 400, 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 40 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 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	Transverse to rolling (R/t)	Longitudinal to rolling (R/t)	Trans. Width (W/t)	Long. Width (W/t)
t < 8.0	2.5	3.0	8	10
8 ≤ t < 20	3.0	4.0	10	10
t ≥ 20	4.5	5.0	12	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 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.

Welding of QUARD 400 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 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.

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.

Plate/QT/Quard/V07 (09.2024)

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.

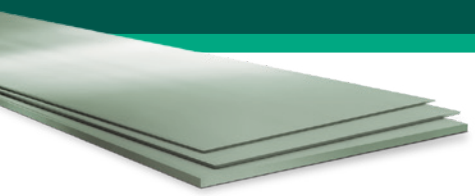
The elements in the data sheet are given for information only and reflect the information known at the time of publishing. This document is intended to give a general guideline for the purchasing and use of the steels only. The transmitter of this document doesn't accept any liability for any error or omission in the content of this document. Values and components quoted must not be considered as being guaranteed unless specifically confirmed separately in writing.

QUARD is a registered trademark of NLMK Clabecq
Rue de Clabecq 101 - B-1460 ITTRE - Belgium
Tel: +32 (0)2 391.91.00 - quard@eu.nlmk.com

NLMK Clabecq

Quard 450

WEAR RESISTANT STEEL



QUARD 450 is a martensitic abrasion resistant steels, with an average hardness of 450 HBW. The steel offers very high resistance to abrasive wear and impact granting a longer service life. The combination of very good cold forming properties and excellent weldability makes **QUARD 450** an optimal choice for most wear applications.

1. Applications

QUARD 450 is mainly recommended for the following applications:

- on road tipper and dumper bodies
- cement drum mixer barrels,
- refuse haulers, scrap containers
- buckets, knives
- feeders, skips, screw conveyors
- mining and earthmoving machinery

2. Technical characteristics

Hardness guarantee

HARDNESS
HBW = 420 - 480

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

Other mechanical properties (typical values)

CHARPY-V NOTCH IMPACT TEST	YIELD STRENGTH (MPA)	TENSILE STRENGTH - TRANSVERSE - (MPA)	ELONGATION A5 (%)
40 J (longitudinal at -40°C)	1250	1400	10

Chemical composition

The steel is grain refined.

MAX LADLE ANALYSIS, %									
Thickness	C	Si	Mn	P	S	Cr	Ni	Mo	B
3,2 mm - 20 mm	0,20	0,60	1,40	0,025	0,010	0,20	0,10	0,25	0,005
20,1 - 40 mm	0,21	0,60	1,60	0,025	0,010	0,75	0,10	0,30	0,005
40,01 - 64 mm	0,23	0,60	1,60	0,025	0,010	1,30	0,50	0,50	0,005

CARBON EQUIVALENT, TYPICAL VALUES, %		
Plate thickness	CEV(1)	CET(2)
3,2 mm - 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

(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 450 at present is supplied in the following range:

- thickness: 3,2 - 64 mm
- width: 1500 - 3100 mm

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

4. Flatness, tolerances & surface propertie

QUARD 450 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
THICKNESS tolerance	- meets and exceeds EN 10029 Class A - tighter tolerances upon request
Shape, length, width tolerances	meets EN 10029
SURFACE properties	exceeds the usual market standards, EN 10163-2 Class B3

5. 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.

6. Heat treatment

QUARD 450 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 450 is not intended for any further heat treatment.

Plate/QT/Quard/V07 (09.2024)

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 up, all plates are UT tested and controlled against class S2, E2, according to EN 10160.

8. General processing recommendations

To obtain optimal work shop productivity when processing QUARD 450, 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 40 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 450 is very well suited for cold forming operations. The minimum recommended R/t ratio when bending of QUARD 450 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	3.5	4.0	10	10
8 ≤ t < 20	4.0	5.0	10	12
t ≥ 20	5.0	6.0	12	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 450, 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 450 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.

Welding of QUARD 450 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 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 450 should be in the accordance to EN-1011.

Machining

QUARD 450 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.

Plate/QT/Quard/V07 (09.2024)

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.

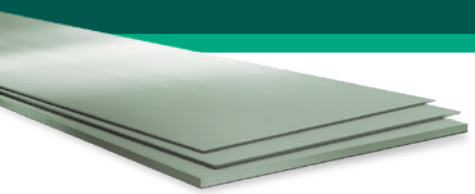
The elements in the data sheet are given for information only and reflect the information known at the time of publishing. This document is intended to give a general guideline for the purchasing and use of the steels only. The transmitter of this document doesn't accept any liability for any error or omission in the content of this document. Values and components quoted must not be considered as being guaranteed unless specifically confirmed separately in writing.

QUARD is a registered trademark of NLMK Clabecq
Rue de Clabecq 101 - B-1460 ITTRE - Belgium
Tel: +32 (0)2 391.91.00 - quard@eu.nlmk.com

NLMK Clabecq

Quard 500

WEAR RESISTANT STEEL



QUARD 500 is a martensitic abrasion resistant steels, with an average hardness of 500 HBW. Its very high resistance to abrasive wear and impact makes it ideal where long service life is required With the combination of superior hardness and strength, **QUARD 500** is an optimal choice for the recycling and mining industry.

1. Applications

QUARD 500 is mainly recommended for the following applications:

- screeners
- crushing and pulverizing equipment
- conveyors belts
- grapples
- scrap presses

2. Technical characteristics

Hardness guarantee

HARDNESS
HBW = 470 - 530

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

Other mechanical properties (typical values)

CHARPY-V NOTCH IMPACT TEST	YIELD STRENGTH (MPA)	TENSILE STRENGTH - TRANSVERSE - (MPA)	ELONGATION A5 (%)
30 J (longitudinal at -40°C)	1500	1700	8

Chemical composition

The steel is grain refined.

MAX LADLE ANALYSIS, %									
Thickness	C	Si	Mn	P	S	Cr	Ni	Mo	B
4 - 20 mm	0,28	0,80	1,60	0,025	0,001	1,00	1,00	0,50	0,005
20,01 - 40 mm	0,30	0,80	1,60	0,025	0,001	1,00	1,00	0,50	0,005
40,01 - 64 mm	0,30	0,80	1,60	0,025	0,001	1,20	1,00	0,50	0,005

CARBON EQUIVALENT, TYPICAL VALUES, %		
Plate thickness	CEV(1)	CET(2)
4 - 20 mm	0,56	0,39
20,01 - 40 mm	0,60	0,42
40,01 - 64 mm	0,70	0,45

(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 500 at present is supplied in the following range:

- thickness: 4 - 64 mm
- width: 1500 - 3100 mm

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

4. Flatness, tolerances & surface propertie

QUARD 500 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
THICKNESS tolerance	- meets and exceeds EN 10029 Class A - tighter tolerances upon request
Shape, length, width tolerances	meets EN 10029
SURFACE properties	exceeds the usual market standards, EN 10163-2 Class B3

5. 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.

6. Heat treatment

QUARD 500 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 500 is not intended for any further heat treatment.

Plate/QT/Quard/V07 (09.2024)

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 up, all plates are UT tested and controlled against class S2, E2, according to EN 10160.

8. General processing recommendations

To obtain optimal work shop productivity when processing QUARD 450, 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 500 is very well suited for cold forming operations. The minimum recommended R/t ratio when bending of QUARD 500 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	3.5	4.5	10	10
8 ≤ t < 20	4.5	5.0	12	14
t ≥ 20	6.0	7.0	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 500, 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 500 has a very good weldability, granted by the optimal carbon equivalent of the steel. It can be welded using any of the conventional welding methods, both as manual or automatic

Welding of QUARD 500 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 12 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 500 should be in the accordance to EN-1011.

Machining

QUARD 500 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.

Plate/QT/Quard/V07 (09.2024)

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.

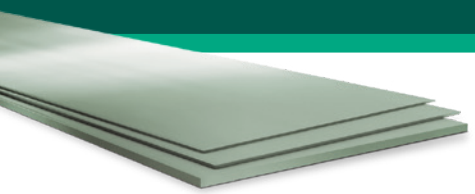
The elements in the data sheet are given for information only and reflect the information known at the time of publishing. This document is intended to give a general guideline for the purchasing and use of the steels only. The transmitter of this document doesn't accept any liability for any error or omission in the content of this document. Values and components quoted must not be considered as being guaranteed unless specifically confirmed separately in writing.

QUARD is a registered trademark of NLMK Clabecq
Rue de Clabecq 101 - B-1460 ITTRE - Belgium
Tel: +32 (0)2 391.91.00 - quard@eu.nlmk.com

NLMK Clabecq

Quard 550

WEAR RESISTANT STEEL



QUARD 550 is a martensitic abrasion resistant steels, with an average hardness of 550 HBW. Its very high resistance to abrasive wear makes it ideal where long service life is required. With the combination of superior hardness and strength, **QUARD 550** is an optimal choice for the recycling, mining and quarry industry.

1. Applications

QUARD 550 is mainly recommended for the following applications:

- linings
- shrouds
- cutting edges
- hammers
- cutters

2. Technical characteristics

Hardness guarantee

HARDNESS
HBW = 520 - 580

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

Other mechanical properties (typical values)

YIELD STRENGTH (MPA)	TENSILE STRENGTH - TRANSVERSE - (MPA)	ELONGATION A5 (%)
1575	1750	7

Chemical composition

The steel is grain refined.

MAX LADLE ANALYSIS, %									
Thickness	C	Si	Mn	P	S	Cr	Ni	Mo	B
6 - 30 mm	0,35	0,80	1,60	0,025	0,001	1,10	1,00	0,50	0,005

CARBON EQUIVALENT, TYPICAL VALUES, %		
Plate thickness	CEV(1)	CET(2)
6 - 30 mm	0,68	0,46

(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 550 at present is supplied in the following range:

- thickness: 6 - 30 mm
- width: 1500 - 3100 mm

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

4. Flatness, tolerances & surface propertie

QUARD 550 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
THICKNESS tolerance	- meets and exceeds EN 10029 Class A - tighter tolerances upon request
Shape, length, width tolerances	meets EN 10029
SURFACE properties	exceeds the usual market standards, EN 10163-2 Class B3

5. Delivery conditions

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

6. Heat treatment

QUARD 550 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 550 is not intended for any further heat treatment.

Plate/QT/Quard/V07 (09.2024)

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 up, all plates are UT tested and controlled against class S2, E2, according to EN 10160.

8. General processing recommendations

To obtain optimal work shop productivity when processing QUARD 550, 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)

Welding

QUARD 550 can be welded using any of the conventional welding methods, both as manual or automatic. Welding of QUARD 550 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 10 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 550 should be in the accordance to EN-1011.

Machining

QUARD 500 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.

Plate/QT/Quard/V07 (09.2024)

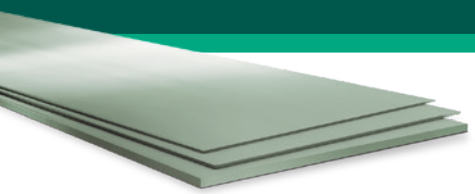
If you want to calculate the optimal parameters for your operations on QUARD and QUEND, download our Q Calculator using the QR code. Available on Google Play and Apple Store.

The elements in the data sheet are given for information only and reflect the information known at the time of publishing. This document is intended to give a general guideline for the purchasing and use of the steels only. The transmitter of this document doesn't accept any liability for any error or omission in the content of this document. Values and components quoted must not be considered as being guaranteed unless specifically confirmed separately in writing.

QUARD is a registered trademark of NLMK Clabecq
Rue de Clabecq 101 - B-1460 ITTRE - Belgium
Tel: +32 (0)2 391.91.00 - quard@eu.nlmk.com

Quard PRO

WEAR RESISTANT STEEL



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.

1. Applications

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

HARDNESS
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

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
8 - 25 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)
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

3. Dimensions

QUARD PRO at present is supplied in the following range:

- thickness: 8 - 25 mm
- width: 2000 - 2500 mm

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

4. Flatness, tolerances & surface propertie

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
THICKNESS tolerance	- meets and exceeds EN 10029 Class A - tighter tolerances upon request
Shape, length, width tolerances	meets EN 10029
SURFACE properties	exceeds the usual market standards, EN 10163-2 Class B3

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 perfor mance, 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 pre-heating temperatures above 250 °C. QUARD PRO is not intended for any further heat treatment.

Plate/QT/Quard/V07 (09.2024)

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.

Plate/QT/QUARD/V07 (09.2024)

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.

The elements in the data sheet are given for information only and reflect the information known at the time of publishing. This document is intended to give a general guideline for the purchasing and use of the steels only. The transmitter of this document doesn't accept any liability for any error or omission in the content of this document. Values and components quoted must not be considered as being guaranteed unless specifically confirmed separately in writing.

QUARD is a registered trademark of NLMK Clabecq
Rue de Clabecq 101 - B-1460 ITTRE - Belgium
Tel: +32 (0)2 391.91.00 - quard@eu.nlmk.com