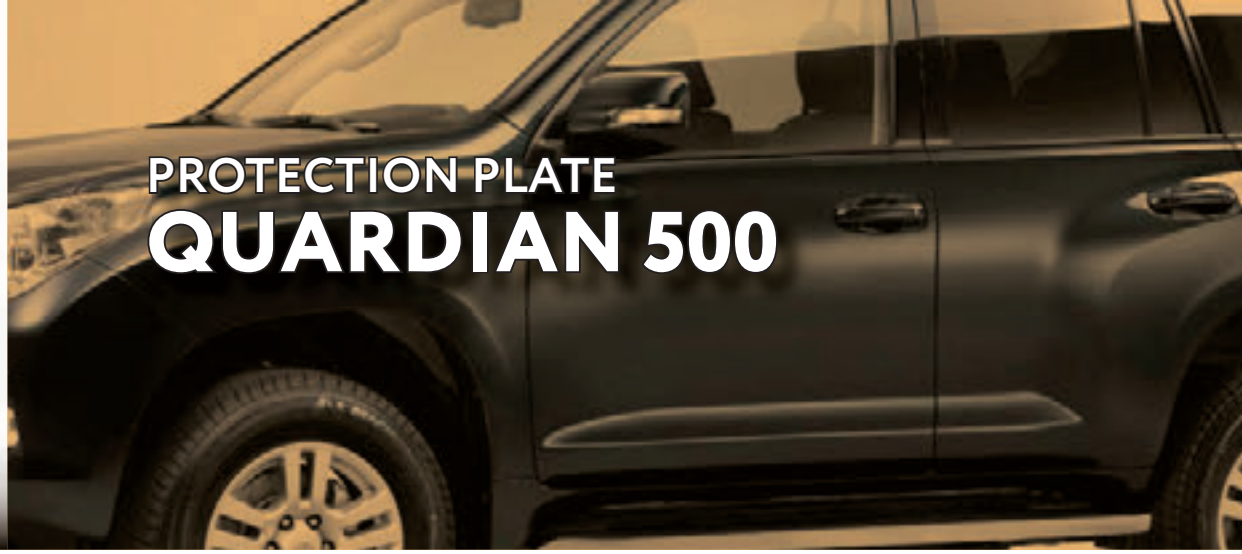
NLMK Clabecq

Quardian®
HIGH PROTECTION STEEL



PROTECTION PLATE
QUARDIAN 500

1. Steel description and applications

Quardian 500 is a protection plate steel, which combines excellent properties in ballistic resistance with high strength and an average hardness of 500 HBW.
Quardian 500 is mainly recommended for the **following applications**:

- armoured limousines
- patrol vehicules
- valuable transporters
- protected buildings
- shooting stands
- secured containers
- armoured personnel carriers

The selection of the material is up to the purchaser. This material complies to NFA 36-800-THD2, MIL DTL 46100E, EN 1522, VPAM PM 2007. Other testing conditions or standard specifications can be performed on customer request.

2. Dimension

Quardian 500 at present is supplied in the **following range**:

- thickness: 3.6 - 40 mm
- width: 1500 - 3100 mm

NLMK Clabecq carries on the extension of its dimensional program of Quardian 500 in order to propose quickly a thickness range from 3.2 to 50 mm. For more information, please contact your local NLMK Clabecq representative.

3. Technical characteristics

Quardian 500 is delivered as quenched and tempered.

Hardness guarantee

Hardness
HBW = 480 - 540

Brinell hardness test, HBW according to EN ISO 6506-1, is performed 1 - 2 mm below the plate surface once per heat treatment individual

Other mechanical properties (minimum values)

	Tensile properties according to EN 10002-1		
Charpy V Impact toughness according to EN 10045-1*	Yield Strength (MPa)	Tensile properties (MPa)	Elongation A5 (%)
24J (longitudinal at -40 °C)	1200	1450-1800	8

*Average of 3 tests. Single value min 70% of specified average. Thickness <12 mm subsized Charpy V specimen have been used.

Chemical composition The steel is grain refined.

Max ladle analysis , %								
C	Si	Mn	P	S	Cr	Ni	Mo	B
0.3	0.4	1.2	0.015	0.01	0.8	1.2	0.6	0.005

4. Flatness, tolerances & surface properties

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

5. Delivery conditions

Our Quardian plates are supplied as standard in the shot-blasted 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

Quardian 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 200 °C.
Quardian 500 is not intended for any further heat treatment.

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 Quardian 500, 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 10 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

Care should be taken during all bending due to the high strength of the plate and the high bending force necessary. The minimum recommended R/t ratio when bending of Quardian 500 is given in the table below:

Thic-kness (mm)	Trans-verse to rolling (R/t)	Longitu-dinal to rolling (R/t)	Trans. Width (W/t)	Long. Width (W/t)
t ⩽ 8.0	5	5	10	12
8 < t < 15	6	6	12	14
t⩾15	7	9	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 Quardian 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

Quardian 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 Quardian 500 is recommended to be performed at ambient temperature not lower than +15°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 200 °C.

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

In general, the welding recommendation of Quardian 500 should be in the accordance to EN-1011.

9. Plate thickness requirements vs protection levels

EN 1522

	Calibre	Type of bullet	Weight of the bullet	Velocity (m/s)	Shooting distance	Min thickness plate
FB3	.357 Mag	Full Jacket / Coned Bulled / Soft Core	10.2 g	430 ± 10	5	3,6
FB4	.357 Mag .44 Rem.Mag	Full Jacket / Coned Bulled / Soft Core Full Jacket / Flat Nose / Soft Core	10.2 g 15.6 g	430 ± 10 440 ± 10	5	4
FB5	5.56 x 45 mm	SS109	4.0 g	950 ± 10	10	6.5
FB6	5.56 x 45 mm 7.62 x 51 mm	SS109 M80 NATO BALL	4.0 g 9.5 g	950 ± 10 830 ± 10	10	6.5
FB7	7.62 x 51 mm	P 80 NATO AP	9.7 g	820 ± 10	10	14

Class VPAM 22

	Calibre & Type of bullet	Speed (m/s)	Distance, m	Min thickness plate
L6	7,62x39 Ball M43	720 ± 10	10	4
L7	5.56x45 FJ/PB (SS109) 7.62x51 FJ/PB/SC (NATO Ball)	950 ± 10 830 ± 10	10	6.5
L8	7,62x39 Ball FMJ/PB/HCl BZ	740 ± 10	10	12
L9	7.62x51 FJ/PB/HC1 (NATO AP)	820 ± 10	10	14.5

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