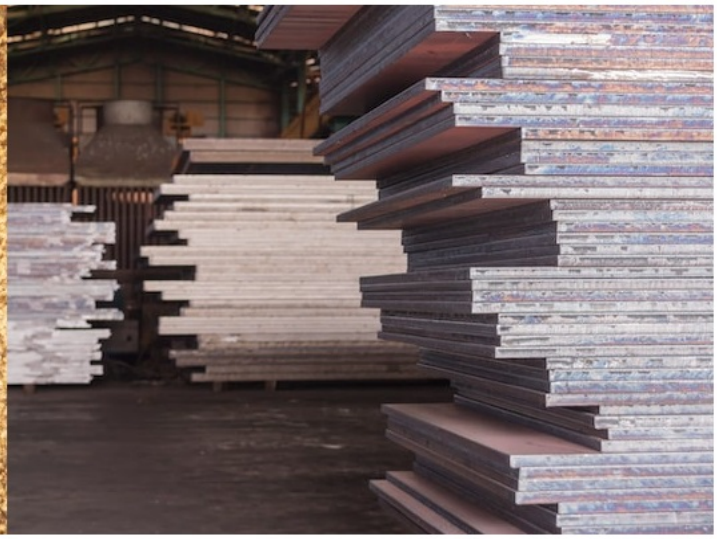
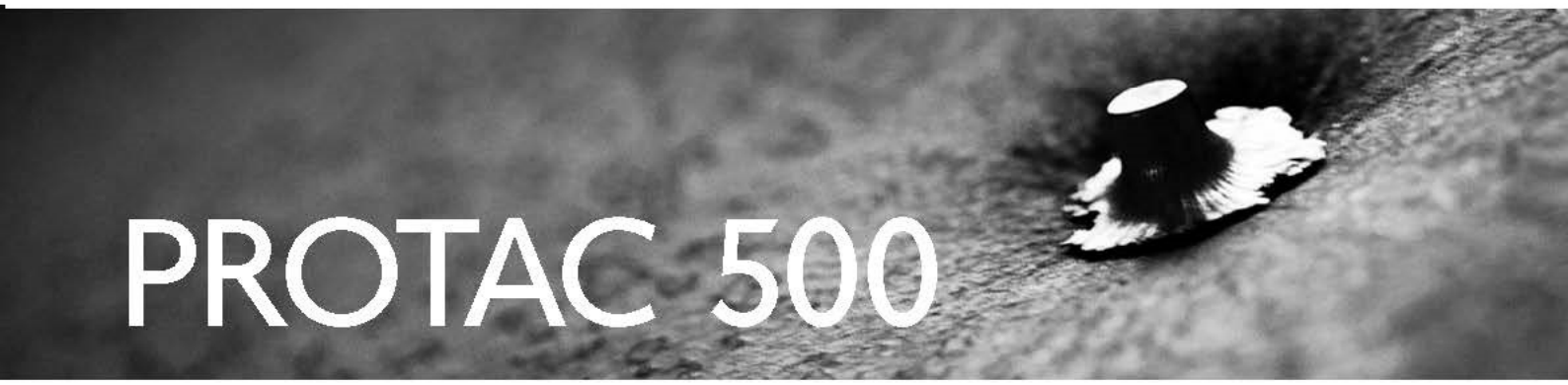
BALLISTIC PROTECTION LEVELS

VPAM-PM 2007					
Typical thickness [mm]	**Level of protection**	**Ammunition**	**ART**	**Projectile weight [g]**	**Velocity of projectile [m/s]**
6.5	PM7	5.56 x 45 (.223 Rem.)	FMJ/PB/SCP	4.0 ± 0.1	950 ± 10
		7.62 x 51 (.308 Win)	FMJ/PB/SC	9.55 ± 0.1	830 ± 10
12.0	PM8	7.62 x 39	FMJ/PB/HCI	7.7 ± 0.1	740 ± 10
14.2	PM9	7.62 x 51 (.308 Win)	FMJ/PB/HC	9.7 ± 0.2	820 ± 10
25.3	PM11	7.62 x 51 (.308 Win)	FMJ/PB/WC	8.4 ± 0.1	930 ± 10

STANAG 4569 AEP55					
Typical thickness [mm]	**Level of protection**	**Ammunition**	**ART**	**Projectile weight [g]**	**Velocity of projectile [m/s]**
9.6	Level 1	7.62 x 51 NATO ball	DM41	9.45 ± 0.1	833 ± 20
		5.56 x 45 NATO SS109	SS109	4.0 ± 0.1	900 ± 20
		5.56 x 45 M193	M193	3.6 ± 0.1	937 ± 20
12.4	Level 2	7.62 x 39	API BZ	7.77	695 ± 20
20.0	Level 3	7.62 x 54 R	B32 API	10.04 ± 0.1	854 ± 20
		7.62 x 51	WC core	8.40 ± 0.1	930 ± 20

NIJ 0108.01					
Typical thickness [mm]	**Level of protection**	**Ammunition**	**ART**	**Projectile weight [g]**	**Velocity of projectile [m/s]**
22.2	Level IV	7.62 x 63	AP M2	10.8 ± 0.2	868 ± 15





PROTAC 500

GENERAL INFORMATION

PROTAC 500 is a high-strength and high-hardness steel used for armour applications. These steel plates have excellent workshop properties regarding welding and bending due to the unique balance between high strength, elongation and impact toughness even at low operating temperatures. Armour components made of PROTAC 500 fulfil the requirements according to the STANAG 4569 AEP55, VPAM-PM 2007 and other ballistic standards. Vehicles and structures made of this steel offer high level of protection against projectile penetration.

STANDARDS

- General technical delivery requirements in accordance with EN 10021.
- Tolerances on dimensions and shape according to EN 10029.
- Delivery requirements for surface condition according to EN 10163-2.
- Ultrasonic testing according to EN 10160.
- Tensile testing at room temperature according to EN ISO 6892-1.
- Impact testing according to EN ISO 148-1.
- Brinell hardness testing according to ISO 6506-1.
- Ballistic testing according to VPAM-PM 2007.
- Ballistic testing according to STANAG 4569 AEP55.
- Ballistic testing according to NIJ 0108.01.

MECHANICAL PROPERTIES

Delivery condition	Thickness [mm]	Surface hardness [HB]
QT (quenched + tempered)	6–25	480–530

* One measurement per plate.

Tensile properties					
Delivery condition	Thickness [mm]	Testing direction	$R_{p0.2}$ [MPa] min.	R_m [MPa] min.	$A_{5.65}$ [%] min.
QT (quenched + tempered)	6–25	transverse	1200	1600	7.5

* Measured on one plate per thickness per heat.

Impact toughness				
Delivery condition	**Thickness [mm]**	**Testing direction**	**Temperature [°C]**	**KV_2 [J]* min.**
QT (quenched + tempered)	6–25	transverse	–20	20

* Measured on one plate per thickness per heat. Measured on standard specimen 10 x 10 x 55 mm. The specified minimum value is the average of 3 tests. One individual value may be below the minimum average value specified, provided that it is not less than 70 % of that value. For plate thickness below 12 mm, subsize specimens shall be used. The minimum values of subsize specimens shall be reduced in direct proportion to the cross-sectional area of the test piece.

DIMENSIONS

PROTAC 500	Hot rolled quarto plates – trimmed edges	Hot rolled quarto plates – untrimmed edges
Thickness [mm]	6–25	6–25
Width [mm]	1000–2500*	1000–2560*
Length [mm]	up to 12500	up to 12500

* Nominal plate thickness 6 and 7 mm available only up to 2000 (2060) mm width.

TOLERANCES ON DIMENSIONS

- Hot-rolled quarto plates: EN 10029

DELIVERY CONDITION

- Hot-rolled quarto plates in quenched and tempered condition.

SURFACE CONDITION

- Sandblasted
- Sandblasted and anti-corrosion painted*

* Maximum width of the anti-corrosion painted plates is 2000 mm. Thickness of the coating is 20–60 µm.

CHEMICAL COMPOSITION

Heat analysis										
PROTAC 500	**C**	**Si**	**Mn**	**P**	**S**	**Cr**	**Ni**	**Mo**	**B**	**CEV***
max. in %	0.30	1.3	0.8	0.02	0.004	1.0	1.5	0.6	0.005	0.72

$$*CEV = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

GENERAL WORKSHOP RECOMMENDATIONS

PROTAC 500 blast and shock protection steel is produced through a carefully controlled alloy design resulting in good welding characteristics. Due to the high mechanical properties, more care is necessary for cold bending, saw-cutting and milling. During the processing in the workshops, the steel shall not be exposed to a temperature over 180 °C which would result in loss of mechanical properties, especially its hardness.

INSPECTION DOCUMENTS

The type of document shall be agreed upon at the time of enquiry and order. A test certificate according to EN 10204/3.1 is issued mandatorily.