



SECURE 450

Protection Steels



**ILSENBURGER
GROBBLECH**

A Member of the Salzgitter Group

Armour steel	Steel grade	Material No.	Issue
ILG-Short Name	EN-Short Name		
Heavy Plate	SECURE 450	-	-
			04/2022

SCOPE OF APPLICATION

These material data sheet applies to the alloyed, liquid quenched and tempered, high-strength special steel **SECURE 450** with a hardness of 400 - 480 HBW for civil applications in thicknesses from 6 to 20 mm. The steel is supplied with defined ballistic properties. Higher plate thicknesses are available on request.

APPLICATION

The steel may be used at the discretion of the purchaser for purposes of ballistic protection mainly for applications such as armoured limousines and transporters of valuables. The entire processing technique is of fundamental importance for the good performance of the products made of this steel. The processor must assure himself that his methods of calculation, design and working conform with the material to be used, meet the latest requirements of technical progress, and are suited to the proposed application.

The selection of the material is up to the purchaser.

CHEMICAL COMPOSITION (heat analysis, %)

Thick-ness	C	Si	Mn	P	S	Cr	Mo	Ni	Al
	≤ 0.20	≤ 0.5	≤ 1.6	≤ 0.020	≤ 0.005	≤ 1.0	≤ 0.07	≤ 2.25	≤ 0.05

The steel is fine-grained. The nitrogen is set to nitrides.

DELIVERY CONDITION

Quenched and tempered (see paragraph "Heat Treatment")

TYPICAL MECHANICAL PROPERTIES in the state of delivery condition at room temperature (transverse specimens according to DIN EN ISO 6892-1, method B). Charpy-V test according to DIN EN ISO 148-1 (transverse specimens).

Yield strength R_{eH}^* MPa	Tensile strength R_m MPa	Elongation at fracture A %	Impact energy Av - 40 °C, J
1	1,250 - 1,450	8	40

*If yielding occurs, the yield is determined as $R_{p0.2}$.

BALLISTIC PROPERTIES

The following calibers may be used for ballistic protection testing: .44 Magnum, 5.56 mm x 45 (SS 92 or SS 109), 7.62 mm x 51 NATO (AP/Smk or Ball). Other test conditions and conditions for plate thicknesses greater than 20 mm are available on request. For civilian use, e.g. protective structures or armored civilian vehicles, it is advisable to follow the test conditions for bullet resistance according to DIN EN 1522 (Windows, doors, shutters and blinds and C Bullet Resistance Requirements and Classification) or DIN EN 1063 (Glass in building - Security glazing).

SCOPE OF TESTING

Unless otherwise agreed upon in the order, the tests listed below will be performed during inspection: Hardness testing will be determined once per 40t of a heat. Ultrasonic testing according to DIN EN 10160, quality class S1 and a ballistic test on request. All test results are documented by inspection certificates following DIN EN 10204-3.1.

Extended scope of testing as agreed.

COLD FORMING

The steel is generally processed by cold forming. The forming force and the amount of elastic recovery are greater than that of conventional structural steels. Cutting edges must be ground, flash trimmed and smoothly rounded before forming. The minimum bending radius for **SECURE 450** should not be less than four times the plate thickness (bending axis transverse to the rolling direction) and not less than five times the plate thickness (bending axis parallel to the rolling direction). The ratio of the tool opening should be twice the bending radius. Cold forming of plates must be performed at low forming speed at room temperature. Preheating is not recommended. Subsequent heat treatment to reduce stiffening and to improve toughness properties caused by cold forming must be restricted to a maximum temperature of 250 °C.

HOT FORMING

Hot forming is possible, however, with restrictions. It revokes the original quenched and tempered condition. After hot forming, renew quenching and tempering corresponding to the delivery condition.

HEAT TREATMENT

The steel is generally given the required properties by conventional quenching and tempering, i.e. austenitizing followed by quenching and tempering. Direct hardening after rolling with subsequent tempering is considered equivalent to conventional quenching and tempering according to DIN EN 10137-2. The heat treatment depends on the chemical composition and the plate thickness. It should be noted that temperatures above 250 °C should be avoided when processing the steel, as it may lose its excellent properties at higher temperatures.

THERMAL CUTTING

When worked properly, the steel can be flame and fusion cut without restrictions. The same conditions apply as for other unalloyed steels. The surface condition of the products has a marked influence on the cutting conditions and the achievable quality of the cut surface. For high quality requirements of the cut surface, clean the top and bottom surfaces of the workpiece in the kerf area. Scale, rust, and impurities of any kind must be removed. At workpiece temperatures below 5 °C and if the flame-cut edges are to be cold-formed during further processing, preheating to about 150 °C during flame cutting is recommended.

WELDING

If due consideration is given to the general rules for welding, this steel is weldable both manually and automatically. Manual arc welding and shielding gas welding are preferable. Plate thickness, hydrogen content of the weld metal and heat input during welding, may require preheating and post heating. The recommendations of STAHL-EISEN Material Specification Sheet 088 or DIN EN 1011-2 must be observed. The inner temperature should not exceed 250 °C.

Note that filler metals currently available cannot ensure that strength properties of the welded metal correspond to those of the base metal. In the interest of cold-crack resistance of the welded joints, only filler materials which produce a weld metal with a very low hydrogen content should be used. Ensure that the cooling rate in the weld area is moderate. For details, please refer to our welding recommendations and processing brochures.

To ensure that the properties of the steel are not unacceptably impaired by the thermal stress during welding, it is necessary to limit the energy respectively. The level of the energy per unit length depends on the welding process, the plate thickness, the preheating temperature, the seam shape, and the structural requirements.

NOTES

Unless otherwise agreed upon in the order, the delivery will be subjected to the conditions outlined in DIN EN 10021.

For quarto plates, dimensional deviations are based on DIN EN 10029, unless other conditions are agreed.

Thickness tolerances are according to the table shown above (paragraph "Dimensions and tolerances").

The plates will be supplied with a maximum flatness tolerance according to DIN EN 10029, class N (smaller flatness tolerances by special agreement). The flatness is determined in acc. to DIN EN 10029.

For surface quality requirements DIN EN 10163 is applicable.

As per special agreement, it is possible to supply plates descaled or descaled and primed.

SOURCES OF SUPPLY

DIN EN-, DIN EN ISO-Normen

Beuth Verlag GmbH, 10772 Berlin, Germany

Steel-Iron Material Sheets

Beuth Verlag GmbH, 10772 Berlin, Germany

Recommendations for thermal cutting of SECURE steels

Ilseburger Grobblech GmbH, Veckenstedter Weg 10,
38871 Ilseburg, Germany

Recommendations for the welding of SECURE steels

Ilseburger Grobblech GmbH, Veckenstedter Weg 10,
38871 Ilseburg, Germany

Publication of Ilseburger Grobblech GmbH

"Safety steels made from heavy plate.

Steels for a safe life. Steels for a safe life."

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