

ThyssenKrupp Steel Europe

Security steel Heavy plate	Steel grade		Material No.	Material Specification
	TKSE-Short name	EN-Short name		
	SECURE MS special[®]	-	-	1935 June 2011

Scope

This Material Specification applies to the high-strength thermomechanically rolled special steel SECURE MS special[®] (ThyssenKrupp security steel for civil use) with a hardness from 350 to 450 HBW and 2.0 to 3.5 mm in thickness. This steel is delivered with defined properties of ballistic protection.

Application

The steel may be used at the discretion of the purchaser for purposes of ballistic protection for civil use.

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, designing 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, %)

C	Si	Mn	P	S	Cr
≤ 0.20	≤ 1.00	≤ 2.00	≤ 0.020	≤ 0.005	≤ 1.00

The steel has a fine-grained microstructure. Nitrogen is absorbed to form nitrides by means of Al.

Delivery condition: Thermomechanically rolled

Hardness at room temperature in delivery condition: 350 - 450 HBW

The Brinell hardness shall be determined in accordance with ISO 6506-1.

Typical mechanical properties in the state of delivery condition at room temperature (transverse specimens according to ISO 6892-1, method B).

Minimum yield strength R_{eH} ^{*)} MPa	Tensile strength R_m MPa	Minimum elongation at fracture A, %
900	1200 - 1450	8

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

Ballistic Properties

The table shows the required minimum plate thickness of steel grade SECURE MS special[®]. According to these classes, bullet resistance testing can be agreed for inspection purposes.

EN 1063 / EN 1522 Class	Weapon		Bullet		Test conditions	SECURE MS special [®]
	Type	Calibre	Type	Mass [g]	Bullet velocity ¹⁾ [m·s ⁻¹]	requested thickness [mm]
BR / FB 2	hand-gun	9 mm Luger	FJ/RN/SC	8.0	400 ± 10	2.0
BR / FB 3	hand-gun	.357 Magnum	FJ/CB/SC	10.2	430 ± 10	2.4
BR / FB 4	hand-gun	.44 Magnum	FJ/FN/SC	15.6	440 ± 10	2.7

FJ/RN: Full metal jacket, round nose
FJ/FN: Full metal jacket, flat nose

FJ/CB: Full metal jacket, coned bullet
SC: Soft core (lead)

¹⁾ Strike velocity, ≤ 2.5 m from front of sample

Number of tests

Unless otherwise agreed upon in the order, the tests listed below will be performed during inspection:

- Hardness testing: One test at each end of the rolling unit. The hardness shall be determined on a grinded surface.
- Thickness measurement: One test per rolling unit
- Bullet resistance testing: according to the order specification

All test results are documented by inspection certificates following EN 10204-3.1.

General processing information

Prior to any processing, it is advisable to make use of the information available from the steel producer in order to draw on that experience for the processing.

The following information can deal with only a few essential points. The recommendations given in STAHL-EISEN-Werkstoffblatt 088 (Weldable fine grained structural steels, guidelines for processing, in particular for welding) correspondingly apply to this steel as well.

Recommendations for welding are also given in EN 1011 part 1 and part 2 - Welding, Recommendation for welding of metallic materials -.

Cold forming

Plates of the steel grade SECURE MS special[®] can be cold formed at ambient temperature under consideration of their strength. Cutting edges must be grinded and flash trimmed before forming. With forming parallel to rolling direction generally higher bevel radii are required. Cold forming of plates must be performed at low deformation rate at room temperature. Preheating is not recommended (see *paragraph "Heat treatment"*).

Minimum bevel radii		Minimum die widths	
r/t (⊥ to rolling direction)	r/t (to rolling direction)	W/t (⊥ to rolling direction)	W/t (to rolling direction)
3.0	3.5	15	18

Heat treatment

Plates of steel grade SECURE MS special[®] are not suitable for heat treatment, because temperatures above 250 °C can lead to a change of the mechanical properties.

Dimensions and thickness tolerances

Thickness, mm	Width, mm	Length, mm	Thickness tolerances, mm
2.0 - 3.5	800 - 1250	1000 - 6000	-0 / +0.5

General information

Unless otherwise agreed upon in the order, the delivery will be governed by the conditions outlined in EN 10021.

The admissible tolerances are based on EN 10051, unless other terms have been agreed upon.

The plates will be supplied with a maximum flatness tolerance according to EN 10029, table 4, steel type H.

Thickness tolerances are listed in the table above (*paragraph "Dimensions and thickness tolerances"*).

For surface quality requirements EN 10163 is applicable.

The plates generally will be supplied pickled and oiled.

Publisher`s addresses

EN-, ISO Standards

Beuth Verlag GmbH, Postfach, D-10772 Berlin

STAHL-EISEN-Werkstoffblätter

Verlag Stahleisen GmbH, Postfach 10 51 64, D-40042 Düsseldorf

Recommendation for thermal cutting of SECURE steels

ThyssenKrupp Steel Europe AG, D-47161 Duisburg

Recommendation for welding of SECURE steels

ThyssenKrupp Steel Europe AG, D-47161 Duisburg

ThyssenKrupp Steel Europe brochure "Ballistic steels. Making life saver."

ThyssenKrupp Steel Europe AG, D-47161 Duisburg