

DIFENDER 350

High ductility armoured steel

Material data sheet, edition January 2024¹

DIFENDER 350 is an alloyed quenched and tempered steel with excellent toughness and special resistance to blast stress and splintering. It is preferably used where the highest possible protection against explosion and shock waves is required. Due to the high performance of the steel, customers use it for vehicle armour in the military sector.

Product description

Designation and range of application

DIFENDER 350 is an alloyed, high strength quenched and tempered steel, with a hardness range of 330 – 380 HBW in the delivery condition.

DIFENDER 350 can be supplied in the following dimensions:

Thickness	Width	Length
≥ 6 mm ≤ 80 mm	≤ 2 500 mm	≤ 8 000 mm

On request, other dimensions can be agreed.

Chemical composition

For the ladle analysis, the following max. values in % are applicable:

C	Si	Mn	P	S	Cr	Ni	Mo
0.32	0.50	1.20	0.015	0.005	2.00	3.70	0.70

Typical values for carbon equivalent (CEV) can be submitted up on request.

Delivery condition

The plates are delivered in the quenched and tempered condition.

¹ The current version of this material data sheet can be also found on: www.dillinger.de.

Mechanical properties and ballistic properties

Hardness

Brinell surface hardness at room temperature: 330 - 380 HBW

Tensile test at ambient temperature - transverse test specimens -

Grade	Minimum tensile strength R_m [MPa]	Minimum yield strength $R_{p0.2}$ [MPa]	Minimum elongation A_5 [%]
DIFENDER 350	950	850	11

Impact test on Charpy-V-specimens

Grade	Specimen direction	Impact energy KV_2 [J] at -40 °C
DIFENDER 350	longitudinal/transverse	30

The specified minimum value is the average of 3 specimens. Only one individual value may be below the minimum average value specified, but it must be at least 80 % of that value.

For plate thickness below 12 mm the Charpy-V-notch test can be carried out on Charpy-V-test pieces with reduced width, the minimum size of the sample shall not be less than 5 mm. The minimum specified value decreases proportional to the reduction of the section.

Ballistic properties

The requirements are to be agreed upon request.

Testing

Determination of the chemical composition (ladle analysis) for the above-mentioned elements; the following additional elements can be determined upon request: Al, Cu, N, V, Nb, Ti, B, W.

Determination of the mechanical properties in the delivery condition per heat in ¼ plate width in accordance with EN 10021.

The hardness test is carried out in accordance with ISO 6506-1. The tensile test is preferably carried out on flat rectangular, transverse specimens in accordance with ISO 6892-1.

The impact test will be carried out on Charpy-V-longitudinal and transverse specimens in accordance with ISO 148-1.

The bullet resistance test can be carried out optional upon agreement of the requirements.

The test results are documented in a certificate 3.1 in accordance with EN 10204.

Identification

Unless otherwise agreed, the marking is carried out via low stress steel stamps with at least the following information:

- steel grade (DIFENDER 350)
- heat number
- rolled plate number and single plate number
- the manufacturer's symbol
- inspector's sign

Processing

The entire processing and application techniques are of fundamental importance to the reliability of the products made from this steel. The user should ensure that his design, construction, and processing methods are aligned with the material, correspond to the state-of-the-art that the fabricator must comply with and are suitable for the intended use. The customer is responsible for the selection of the material. The recommendations in accordance with EN 1011 should be observed. The much higher tensile properties of the armoured steel comparing to other steels covered by the standard can lead to a higher crack probability while processing.

Welding and thermal cutting

The heat input during welding and thermal cutting can lead to a decrease in hardness in a small area adjacent to or in the weld seam. This can have an impact on the protection performance of DIFENDER 350. The manufacturer is advised to take this into account in his design.

Forming

The material can be formed by cold bending despite its high hardness. It is recommended that the thermal cutting or shearing edges in the area of the bend should be grinded. The bending speed must be adjusted to the geometry of the processed parts by the fabricator.

Due to the high strength values of DIFENDER 350 in the quenched and tempered condition, the spring-back phenomenon must be considered while cold forming. During the processing, the necessary safety measures must be taken, so that nobody will be exposed to a danger by a possible fracture of the work piece during the forming process.

Heat treatment

DIFENDER 350 is delivered in a heat-treated condition which is ready for assembly. Subsequent heat treatment above 500 °C impairs its properties and is therefore not permissible.

Machining

DIFENDER 350 is suitable for machining. In view of its high delivery hardness a lower cutting speed must be anticipated.

General technical delivery requirements

Unless otherwise agreed, the general technical delivery requirements in accordance with EN 10021 apply.

Tolerances

Unless otherwise agreed, the following tolerances apply:

For width and length tolerances EN 10029 table 2 and 3 will apply.

Thickness [mm]	$6 \leq t \leq 16$	$16 < t \leq 20$	$20 < t \leq 24$	$24 < t \leq 40$	$40 < t \leq 80$
Tolerance [mm]	-0 / +0.8	-0 / +0.9	-0 / +1.0	-0 / +1.0	-0 / +2.0

The flatness tolerances will be in accordance with EN 10029, table 4, steel group H. Smaller flatness tolerances may be agreed upon request.

Surface quality

Unless otherwise agreed, the indications in accordance with EN 10163-2, class B3, apply.

Surface protection

Upon request the plates can be shot blasted and / or primer coated with a product at the manufacturer's choice. In case you wish the application of a shop primer, but you do not specify the shop primer in detail, Dillinger offers shop primers as standard: you will find more information in our brochure „Shot blasted and primer coated heavy plates“ (www.dillinger.de/downloads/).

Ultrasonic testing

Unless otherwise agreed, the indications in accordance with EN 10160, class S2/E2 apply.

General note

If particular requirements, which are not covered in this material data sheet, are to be met by the steel due to its intended use or processing, these requirements are to be agreed before placing the order.

The information in this technical data sheet is a product description. This material data sheet is updated at irregular intervals. The current version is available from the mill or as download at <https://www.dillinger.de/products/>.

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