

DIFENDER 600

High strength armoured steel

Material data sheet, edition May 2021¹

DIFENDER 600 is an alloyed, high strength quenched and tempered steel with a resistance against bullet impacts. It is used as an add-on protection to destroy the bullet core and prevent the penetration into softer (armoured) steels. Due to its performance the steel is used by the customers for civil and military protection systems.

Product description

Definition and range of application

DIFENDER 600 is an alloyed, high strength quenched and tempered steel, with a hardness range of 570 – 640 HBW in the delivery condition.

DIFENDER 600 can be supplied in the thickness range between 6 – 25 mm.

Dimensions are to be agreed during inquiry.

Chemical composition

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

| C | Si | Mn | P | S | Cr | Ni | Mo |
|------|------|------|-------|-------|------|------|------|
| 0.55 | 1.00 | 1.50 | 0.010 | 0.005 | 1.50 | 4.50 | 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 also be found on www.dillinger.de/downloads.

Mechanical and ballistic properties

Hardness

Brinell surface hardness at room temperature: 570 – 640 HBW

Tensile testing on transverse specimens at room temperature

| Minimum tensile strength R _m [MPa] | Minimum yield strength R _{p0,2} [MPa] | Minimum elongation A ₅ [%] |
|---|--|---|
| 1,650 | 1,350 | 6 |

Charpy-V impact test

DIFENDER 600 offers impact energy values KV₂ of 10 J at -40 °C (longitudinal and transverse to the rolling direction).

The specified minimum value is the average of 3 tests. Only one individual value may be below the minimum average value specified, provided that it is not less than 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.

Properties under ballistic impacts

The requirements have to be agreed upon request.

Testing and documentation

Determination of the chemical composition (ladle analysis) for the above mentioned elements; the following additional elements can be determined upon request: Al, Cu, 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 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 of plates

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

- steel grade (DIFENDER 600)
- heat number
- number of mother plate and individual plate
- 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 has to 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 high tensile properties of the armoured steel 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 bullet resistance properties of DIFENDER 600. The manufacturer is advised to take this into account in his design.

Forming

The material cannot be formed by cold bending, because of its high hardness.

One would be exposed to a danger by a possible fracture of the work piece during the forming process.

Heat treatment

DIFENDER 600 is delivered in a heat treatment condition which is ready for assembly. Subsequent heat treatment above 150 °C impairs its ballistic properties and is therefore not permissible.

Machining

DIFENDER 600 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] | $6 \leq t \leq 16$ | $16 < t \leq 20$ | $20 < t \leq 25$ |
| Tolerance [mm] | -0 / +0.8 | -0 / +0.9 | -0 / +1.0 |

Flatness tolerances for instance according EN 10029 to 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“ (<http://www.dillinger.de/downloads>).

Ultrasonic testing

Unless otherwise agreed, indications be 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 www.dillinger.de/downloads.

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