

DILLIDUR 500 T

Through hardened wear resistant steel

Material data sheet, edition April 2016

DILLIDUR 500 T is a highly wear resistant steel with a nominal hardness of 500 HBW (Brinell) in delivery condition ex works. T stands for elevated through thickness hardness properties.

DILLIDUR 500 T is used where very high hardness and resistance to wear is required over the whole plate thickness. Examples are parts of shredders, mills, other recycling equipment and gear rims.

Product Description

Range of application

DILLIDUR 500 T can be delivered in thicknesses from 30 mm (1.2 in.)¹ to 100 mm (4 in.)¹ according to the dimensional program. Other dimensions may be possible on request.

Chemical composition

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

C	Si	Mn	P	S
≤ 0.32	≤ 0.70	≤ 1.80	≤ 0.025	≤ 0.0015

Depending on thickness, the following alloying elements may be used singly or in combination:

Mo	Ni+Cu	Cr	V	Nb	B
≤ 0.50	≤ 1.20	≤ 1.50	≤ 0.08	≤ 0.05	≤ 0.004

The steel is fully killed and fine grain treated.

¹ The approximately converted values in brackets are for information only.

Indicative values for the carbon equivalent:

Plate thickness [mm]	50	80
CEV ^a	0.56	0.66
CET ^b	0.42	0.45

^a $CEV = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15$

^b $CET = C + (Mn + Mo)/10 + (Cr + Cu)/20 + Ni/40$

Delivery condition

Controlled water quenched.

Mechanical properties in the delivery condition

Hardness

Brinell surface hardness at room temperature: 450 - 530 HBW

DILLIDUR 500 T is designed to have a constant through thickness hardness. The minimum hardness throughout the plate cross section is at least 90 % of the minimum surface hardness.

Charpy-V impact test on longitudinal specimens

(indicative value for a plate thickness of 50 mm)

Charpy impact energy: 35 J at -20 °C (-4 °F)²

Testing

Brinell surface hardness tested once per heat and 40 t.

A hardness test through the plate thickness on a test specimen and impact testing according to EN ISO 148-1 per heat on Charpy-V test specimen can be agreed.

Identification of plates

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

- steel grade (DILLIDUR 500 T)
- heat number
- number of mother plate and individual plate
- the manufacturer's symbol
- authorized inspection representative's sign

² The approximately converted values in brackets are for information only.

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 1011-2 (Welding) and CEN/TR 10347 (Forming) as well as recommendations regarding job safety in accordance with national rules should be observed while considering the higher strength and hardenability.

Cold forming

DILLIDUR 500 T can be cold formed by bending in spite of its high hardness and strength. It should be paid attention to the fact that with increasing yield strength, the required forces for the forming operation also increase, even if the plate thickness remains unchanged. The spring-back also increases. Grinding of the flame cut or sheared edges in the bending area is recommended to avoid crack initiation. In order to avoid the risk of cracking from the edges, flame cut or sheared edges should be ground in the area that is to be cold formed. It is also advisable to round the plate edge slightly on the outside of the bend coming under tension stress during bending. For large cold forming amounts we recommend you to consult the plate manufacturer prior to ordering. During the processing, the necessary safety measures have to be taken, so that nobody will be exposed to a danger by a possible fracture of the work piece during the forming process.

Hot forming

DILLIDUR 500 T obtains its hardness by accelerated cooling from the austenitizing temperature. Thus, hot forming without major hardness loss is only possible if a renewed quenching treatment is carried out after forming. However, the hardness achieved by means of such a treatment may differ from that measured in the delivery condition, if the cooling capacities at the fabricator's workshop vary from the original quenching. DILLIDUR 500 T can be heated to about 200 °C (390 °F) without any substantial loss of hardness.

Flame cutting and welding

Due to its relatively high alloying content, DILLIDUR 500 T requires special care during flame cutting and welding. For flame cutting, the following minimum temperatures should be respected: 150 °C (300 °F) for plate thickness up to 60 mm and 175 °C (345 °F) for larger thickness. The temperature shall not fall below this temperature during the entire cutting process.

The minimum preheat temperature shall be reached throughout the whole thickness of the plate. This is possible by preheating in furnaces or preheating by flame with slow warming with soft flame from the lower subsurface and controlling the temperature at the upper subsurface. After flame cutting the flame cut parts shall cool down slowly. Therefore, it is beneficial to leave the cut parts in the frame wrapped in insulation material e.g. an insulation blanket. Because sharp inner corners increase the risk of hardness cracks, the minimum inner radius of flame cuts shall be 10 mm.

In order to reduce the risk of hydrogen induced cracks in the heat affected zone and the weld metal, welding of DILLIDUR 500 T requires special care regarding the welding process, the filler materials and the welding parameters.

Shielded arc welding shall be preferred because it introduces very little hydrogen provided that the gas protection is correct. For manual arc welding, electrodes with basic coating (very low hydrogen type HD<5ml/100 g in accordance with ISO 3690), stored and dried according to the manufacturer's instructions, are to be used.

Weld metals with low yield strength are preferred for tack, root and filler passes. If welds are exposed to wear, only the final passes should be welded with consumables producing a hardness matching the parent plate. The preheat and interpass temperatures for welding shall be 150 - 200 °C (300 - 390 °F). If "soft" consumables are applied the interpass temperature may be lowered after the execution of buttering passes. The welding with hardfacing electrodes may require more particular conditions. The corresponding recommendations of the consumable manufacturers and the needs of the parent material have to be combined.

Guidance for the choice of filler metals can be found in our technical information "*THE CONCEPT TO COMBAT WEAR AND TEAR – DILLIDUR*".

Machining

DILLIDUR 500 T can be machined with HSS-drills and especially with HSS-Co-alloyed drills with a satisfactory service life if the drill advance and cutting speed are correspondingly accommodated.

General technical delivery requirements

Unless otherwise agreed, the general technical requirements in accordance with EN 10021 are applicable.

Tolerances

Unless otherwise agreed, tolerances are in accordance with EN 10029 class A for the thickness and table 4, steel group H (normal) for the maximum flatness deviation. Special flatness requirements as EN 10029, table 5, steel group H can be agreed.

Internal condition

DILLIDUR 500 T will be ultra-sonic tested acc. to EN 10160. The limits of class S₁/E₁ are respected.

Surface quality

Unless otherwise agreed, the provisions in accordance with EN 10163-2, class A2 are applicable.

General note

If special 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 data sheet is a product description. This data sheet is updated at irregular intervals. The current version is relevant. The latest version is available from the mill.

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