DILLIDUR 500

Wear resistant steel

Material data sheet, edition April 2016[1]

DILLIDUR 500 is a wear resistant steel with a nominal hardness of 500 HBW in delivery condition ex works. DILLIDUR 500 is preferentially used by the customers where very high resistance to wear is required together with good workability and especially good weldability.
Examples of application: earth moving and loading machines, dredgers, skip cars, conveying plants, trucks, cutting edges, knives and breakers, waste elimination and recycling plants.

Product description

Range of application

DILLIDUR 500 can be delivered in thicknesses from 8 mm (1/3 in.)[2] to 100 mm (4 in.)[2], 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
≤ 0.30	≤ 0.70	≤ 1.60	≤ 0.025	≤ 0.010

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

Mo	Ni	Cu	Cr	V	Nb	B
≤ 0.50	≤ 1.0	≤ 0.30	≤ 1.50	≤ 0.08	≤ 0.05	≤ 0.005

The steel is fully killed and fine grain treated.

[1] The current version of this material data sheet can be also found on http://www.dillinger.de.
[2] The approximately converted values in brackets are for information only.

Indicative values for the carbon equivalent:

Plate thickness [mm]	10	40	80
CEV[a]	0.53	0.57	0.67
CET[b]	0.39	0.41	0.44

[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:

470 - 530 HBW for plate thicknesses ≤ 30 mm (1.2 in.)[3]

450 - 530 HBW for plate thicknesses > 30 mm (1.2 in)[3]

Tensile testing on transverse specimens at room temperature (indicative values for 20 mm plate thickness)

Tensile strength: 1 600 MPa (232 ksi)[3]

Yield point: 1 100 MPa (160 ksi)[3]

Elongation: 9 % ($L_o = 5.65 \cdot \sqrt{S_o}$)

In spite of their high tensile properties, DILLIDUR steels are not intended for safety relevant components. For this purpose high strength steels DILLIMAX are available.

Charpy-V impact test on longitudinal specimens (indicative values for 20 mm plate thickness)

Charpy impact energy: 25 J at -20 °C (-4 °F)[3]

Testing

Brinell surface hardness tested once per heat and 40 t.

[3] The approximately converted values in brackets are for information only.

Identification of plates

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

- steel grade (DILLIDUR 500)
- 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 1011-2 (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 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.

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.

The following geometries can usually be achieved by cold forming without the formation of surface defects (where t is the plate thickness):

	Minimum bending radius	Minimum die opening
Transverse direction	7 t	16 t
Longitudinal direction	9 t	20 t

Hot forming

Since DILLIDUR 500 obtains its hardness by accelerated cooling from the austenitizing temperature, 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. This is due to the fact that the cooling conditions at the fabricator's works are generally less adequate than those available during plate production.

The steel can be heated to about 200 °C (390 °F) without any substantial drop in hardness.

Flame cutting and welding

For flame cutting, the following minimum temperatures should be observed: 60 °C (140 °F) for plate thicknesses up to 26 mm, 120 °C (248 °F) for plate thicknesses from 26 up to 70 mm and 150 °C (302 °F) for thicker plates.

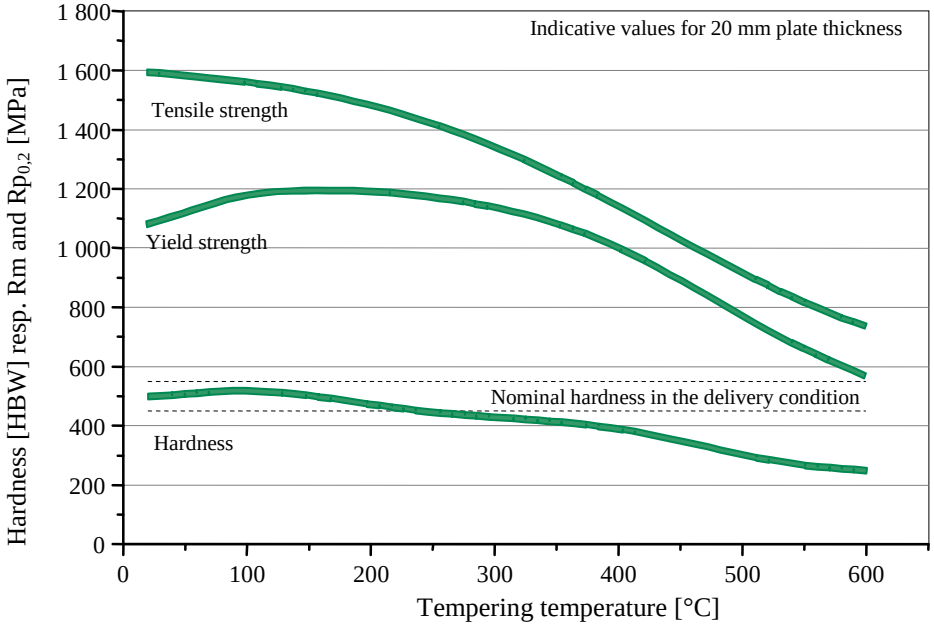
For manual arc welding, basic coated rods with very low residual moisture should be used (and dried if necessary according to the manufacturer's instructions).

Additionally the following recommendations are to be considered:

- For more information about preheating of DILLIDUR 500, please refer to our technical information "*THE CONCEPT TO COMBAT WEAR AND TEAR – DILLIDUR*". Preheating above 200 °C (390 °F) must however be avoided, because it could cause a decrease of the hardness (see diagram).
- 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.

Heat treatment

The following diagram shows the general changes in hardness or strength values in accordance with the heat treatment temperature:



Machining

DILLIDUR 500 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, the tolerances are in accordance with EN 10029, with class A for thickness.

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 or as download at www.dillinger.de.
For more information about application and processing of DILLIDUR 500, please refer to our technical information "*THE CONCEPT TO COMBAT WEAR AND TEAR – DILLIDUR"*.

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