



DILLINGER HÜTTE GTS

DILLIDUR 325 L

AIR HARDENED WEAR RESISTANT STEEL

Material No. 1.8705
Material Data Sheet Edition July 2002

DILLIDUR 325 L is successfully applied by the customers where high resistance to wear is required together with good weldability and good machinability, especially if heat treatment or hot forming is provided.

Examples: loading machines, dredgers, skip cars, conveying plants, trucks, cutting edges, knives and breakers.

Product description

Designation and range of application

The production range of the DILLIDUR 325 L plates is 5 mm (0.2 in.) to 50 mm (2 in.) according to the dimensional program. It may be possible to supply other sizes on request.

Chemical composition

Heat analysis, in %:

C	Si	Mn	P	S	Cr
≤ 0.23	0.30 - 0.70	1.2 - 1.7	≤ 0.025	≤ 0.010	1.0 - 1.6

Depending on the thickness, the following alloying elements are used singly or in combination to control full hardening:

Mo	Cu	Ni	V	Nb + V + Ti
≤ 0.5	≤ 0.6	≤ 0.6	≤ 0.20	≤ 0.20

The steel is fully killed and fine-grain treated.

Delivery condition

Normalized. According to thickness, a complementary tempering treatment may be performed.

Mechanical properties in the delivery condition

Thickness [mm]	Hardness at room temperature [HBW]
≤ 15 (0.59 in.)	≥ 280
> 15 (0.59 in.) ≤ 25 (1 in.)	≥ 260
> 25 (1 in.) ≤ 50 (2 in.)	≥ 240

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Auxiliary values for 10 mm (0.4 in.) plate thickness

Hardness	325 HBW
Tensile strength	1000 MPa (145 ksi)
Yield strength	650 MPa (95 ksi)
Elongation	13 % ($l_0 = 5,65\sqrt{S_0}$, transverse specimen)
Toughness	Charpy-V- longitudinal specimens (10 mm x 10 mm) 20 J (15 ft·lbf) at -20 °C (-4 °F)

Testing

Brinell surface hardness tested once per heat and 40 t.

Identification

The marking is carried out via steel stamps with at least the following information:

- the manufacturer's symbol
- the steel designation (DILLIDUR 325 L)
- the heat number
- the rolled plate number

Fabrication properties

The entire fabrication and application techniques are of fundamental importance to the reliability of the products made from this steel. The fabricator should ensure that his calculation, design and fabricating 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.

Flame cutting and welding

General recommendations for welding of high strength steels are indicated in EN 1011. The carbon content of DILLIDUR 325 L must be taken into account when compared with the grades of these recommendations.

Additionally the following recommendations are to be considered:

For flame cutting, a preheating temperature of at least 120 °C (250 °F) is recommended if plate thickness is greater than 10 mm (0.39 in.).

In case of high rigidity of structure, high weld metal hardness, unfavourable atmospheric conditions and generally for thicknesses > 8 mm (0.32 in.), a preheating temperature of 100 - 200 °C (210 - 390 °F) is recommended to reduce the risk of cracking in the welded joint. Welding consumables should be chosen as soft as the construction and wear conditions allow for it. The maximal working temperature is 300 °C (570 °F), for a short period.

Cold forming

Dillidur 325 L can be cold formed in spite of its high hardness. Grinding of the flame cut or sheared edges in the bending area is recommended to avoid crack initiation.

The cold forming operations should be carried out under consideration of the following recommendations (where t is the plate thickness):

	Minimum bending radius	Minimum die opening
Transverse direction	5 t	14 t
Longitudinal direction	6 t	16 t

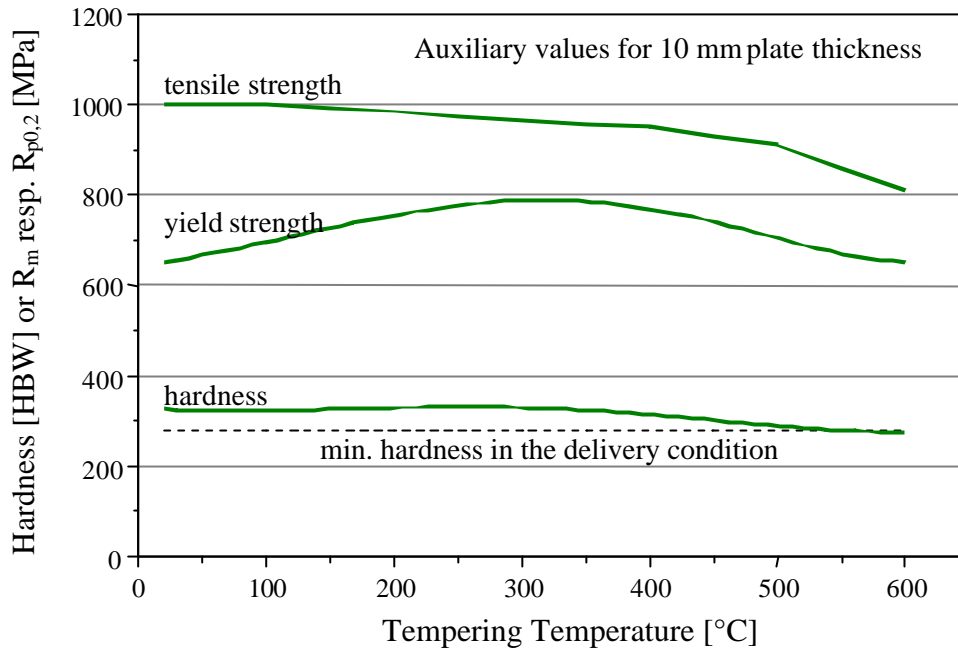
Hot forming and heat treatment

The steel obtains its hardness by normalizing (air cooling from austenitizing temperature, if necessary with additional tempering). Consequently, there is no hardness drop after hot forming if temperature cycles equivalent to normalizing are applied, or if the hot forming process is followed by a normalizing heat treatment.

Normalizing temperature: 920 - 970 °C (1690 - 1780 °F).

If the plates are delivered normalized and tempered, the finished parts must be tempered again after hot forming in a temperature range of 550 - 600 °C (930 - 1110 °F). The steel can be heated to about 500 °C (930 °F) without any substantial drop in hardness.

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



Machining

The steel 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. Drilling with hard metal drills is not necessary.

For milling and sawing, reversible carbide tips with a negative cutting edge are recommended.

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 are applicable.

General note

If for application or manufacturing reasons, particular requirements are demanded of the steel which are not covered in this data sheet, please contact us for special agreement prior to ordering.

The indications in this data sheet are product descriptions. This data sheet is updated at irregular intervals. The latest version is available from the mill or as download at www.dillinger.de.

For more information about application and machining of DILLIDUR 325 L, please refer to our technical publication "DILLIDUR - The concept to combat wear and tear".

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