DILLINGER HÜTTE GTS

DILLIMAX 1100

HIGH STRENGTH FINE GRAINED STRUCTURAL STEEL
QUENCHED AND TEMPERED

Specification DH-E55-A
Edition June 1999

DILLIMAX 1100 is a high strength quenched and tempered, fine grained structural steel with a minimum yield strength of 1100 N/mm² in its delivered condition, whose mechanical properties are achieved by water quenching followed by tempering. The steel is preferentially used for welded steel structures within mechanical constructions, plant constructions and structural steel works, such as machines for structural engineering, conveying plants, hoists, cranes and frameworks.

Product description

Designation and range of application

DILLIMAX 1100 can be delivered with minimum impact values down to -40°C (-40°F) and in thicknesses from 6 to 30 mm (1/4 to 1.2 inches) according to the dimensional program. Plate thicknesses and dimensions, which deviate from the usual dimensional program for this type of steel, may be possible on request.

Chemical composition

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

C	Si	Mn	P	S	Cr *	Ni *	Mo *	V+Nb *	Ti *	B *
≤.18	≤.50	≤1.30	≤.015	≤.010	≤1.5	≤2.5	≤.80	≤.10	≤.010	≤.0040

* Depending on thickness, these elements can be alloyed in combination or singly in different quantities within the above indicated limits.

The steel is fine grained through sufficient aluminium content.

Delivery condition

Water quenched and tempered. Direct quenching after rolling with subsequent tempering is comparable to the conventional water quenching and tempering.

Mechanical and technological properties in the delivery condition

Tensile test at ambient temperature - transverse test specimens -

Plate thickness	Tensile strength	Minimum yield strength	Minimum elongation	
t	R_m	R_{eH} [1]	A_5	$A_{2in.}$ [2]
mm (inches)	N/mm² (ksi)	N/mm² (ksi)	%	%
≤ 30 (1.2)	1200 - 1500 (174 - 218)	1100 (160)	10	11

1) If not apparent, the yield strength $R_{p0.2}$ is measured. 2) These values apply if tested according to ASTM A370.
The values in brackets are for information only.

Impact test on Charpy-V-specimens

Specimen direction	Impact energy A_v in Joules (ft.-lb.) at test temperature of –40°C(-40°F)
longitudinal / transverse	30/27

The specified values are minimum values; they are the average of 3 specimens, whereby the lowest individual value may not be less than 70% of the specified minimum. The values in brackets are only for information. For plate thicknesses below 10 mm the test on Charpy-V-specimens will be performed with reduced width. Therefore, the minimum value of the impact energy will be reduced in proportion to the reduction of the specimen's cross section.

Testing

Tensile and impact tests will be performed on each heat treated plate.

The specimens for the tensile test are prepared according to EN 10 137. Testing is carried out on specimens of gauge length $l_0 = 5.65\sqrt{S_0}$ or $l_0 = 5d_0$ in accordance with EN 10 002-1. Tensile tests according to ASTM A370 may be agreed.

The impact test will be carried out on Charpy-V-specimens in accordance with EN 10 045-1. Unless otherwise agreed, the test will be performed on transverse test specimens taken close to the surface.

Unless otherwise agreed, the test results are documented in a certificate 3.1 B in accordance with EN 10 204.

Identification of plates

The plates are at least marked by stamp with the following information:

- heat number
- plate number
- steel designation (DILLIMAX 1100)
- the manufacturer's brand

In addition, the plates are stenciled with DILLIMAX 1100.

Fabricating properties

The entire fabrication and application techniques are of fundamental importance for the reliability of products manufactured with these steels. The fabricator should ensure that his calculation, design and manufacturing methods are suitable for the intended application, are state of the art and, that they correspond with the properties of the material. The customer is responsible for the selection of the material. The recommendations of the Stahl-Eisen-Werkstoffblatt 088 or ECSC Information Circular No. 2 should be observed.

We recommend to consult us prior to the first working with DILLIMAX 1100.

Cold forming

DILLIMAX 1100 can be cold formed below 200°C (390°F) with regard to its high yield strength. Flame cut or sheared edges in the bending area should be ground before cold forming. Cold forming is depending on deformation rate always related to a hardening of the steel and to a decrease in toughness. This change in the mechanical properties can, as a rule, be partially recovered through a subsequent stress relief heat treatment.

For larger cold forming amounts or if prescribed by regulations, a new quenching and tempering treatment may be necessary to restore the original mechanical properties. In this case we urgently recommend you to consult us prior to ordering.

Hot forming

Hot forming at temperatures above 200°C (390°F) is not allowed. The original quenched and tempered condition will thereby be altered. As a result, a new quenching and tempering treatment is always necessary after hot forming.

It should be noted that when applying a new quenching and tempering treatment, it is not always possible to obtain the same properties as with the original heat treatment at the mill, because of different hot forming equipment, for example. In this respect we recommend you to contact us prior to ordering in all cases where hot forming is required. However, it is the fabricator's responsibility to obtain the required values of the steel through an appropriate heat treatment.

Welding and flame cutting

Due to its high yield strength, the fabrication of DILLIMAX 1100 requires special care. For general welding instructions, please consult the SEW 088. The raised yield strength of the base material must be taken into account when the filler materials are chosen. It should be considered that increased heat input leads to lower tensile properties in the weld metal. Experience has shown that the welding conditions should be chosen so that the cooling time $t_{8/5}$ does not exceed 8 seconds.

To avoid hydrogen-induced cold cracking, only filler materials which add very little hydrogen to the base metal, may be used. Therefore, shielded arc welding should be prefered. For manual arc welding, electrodes with basic coating (type HD < 5 in accordance with DIN 8572), which are dried according to the manufacturer's instructions, should be used.

With increasing plate thicknesses and a high residual stress condition of the weld, low hydrogen annealing directly out of the weld heat is recommended. But, the maximum temperature should not be higher than 200°C (390°F).

For flame cutting, we recommended to preheat greater plate thicknesses.

Tolerances

Unless otherwise agreed, the tolerances will be in accordance with EN 10 029, with class A for thickness and, table 4, steel group H, for the maximum flatness deviation.

Surface quality

Unless otherwise agreed, the specifications will be in accordance with EN 10 163, class A2.

General Note

If particular requirements are demanded and not covered in this data sheet, please contact us with the specifications for our review and agreement prior to ordering.