



DILLINGER HÜTTE GTS

DILLIMAX 620

HIGH STRENGTH FINE GRAINED STRUCTURAL STEEL
QUENCHED AND TEMPERED

Material Data Sheet Edition June 1997

DILLIMAX 620 is a high strength quenched and tempered, fine grained structural steel with a minimum yield strength of 620 N/mm² in its delivered condition (referring to the lowest thickness range), whose mechanical properties are achieved by water quenching followed by tempering.

DILLIMAX 620 fulfils the requirements of EN 10 137. It 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, flood gates, bridges and frameworks.

Product description

Designation and range of application

The steel can be delivered in three grades:

- **basic (B)** with minimum impact values down to -20°C (-4°F): **DILLIMAX 620 B**
Steel number 1.8914 - S620Q according to EN 10 137

- **high toughness (T)** with minimum impact values down to -40°C (-40°F):
Steel number 1.8927 - S620QL according to EN 10 137

DILLIMAX 620 T

- **extra tough (E)** with minimum impact values down to -60°C (-76°F):
Steel number 1.8987 - S620QL1 according to EN 10 137

DILLIMAX 620 E

DILLIMAX 620 plates can be delivered in thicknesses from 6 to 150 mm (1/4 to 6 inches) according to the dimensional program. 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:

DILLIMAX 620	C	Si	Mn	P	S	Cr	Ni	Mo	V+Nb	B
B,T,E	≤.18	≤.50	≤1.60	≤.020	≤.010	≤1.40	≤1.50	≤.60	≤.10	≤.004

The steel is fine grained through sufficient aluminium content.

Delivery condition

Water quenched and tempered according to EN 10 137.

DILLIMAX 620

Mechanical and technological properties in the delivery condition

Tensile test at ambient temperature - transverse test specimens -

Plate thickness t mm (inches)	Tensile strength R_m N/mm ² (ksi)	Minimum yield strength R_{eH} ¹⁾ N/mm ² (ksi)	Minimum elongation	
			A_5 %	$A_{2in.}$ ³⁾ %
≤ 50 (2)	700 - 890 (101 - 129)	620 (90)	15	16
> 50 (2) ≤ 100 (4)	700 - 890 (101 - 129)	600 (87) ²⁾	15	16
> 100 (4) ≤ 150 (6)	650 - 830 (94 - 120) ²⁾	560 (81) ²⁾	15	16

1) If not apparent, the yield strength $R_{p0.2}$ is measured.

2) Higher minimum values can be arranged on request.

3) These values apply if tested according to ASTM A370.

The values in brackets are only for information.

Impact test on Charpy-V-specimens

DILLIMAX 620	Specimen direction	Impact energy A_v in Joules (ft.-lb.) at test temperature			
		0°C (32°F)	-20°C (-4°F)	-40°C (-40°F)	-60°C (-76°F)
Basic (B)	longitudinal / transverse	40/30 (30/22)	30/27 (22/20)	–	–
High toughness (T)	longitudinal / transverse	50/35 (37/26)	40/30 (30/22)	30/27 (22/20)	–
Extra tough (E)	longitudinal / transverse	60/40 (44/30)	50/35 (37/26)	40/30 (30/22)	30/27 (22/20)

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.

Technological bend test

Formability of the transverse specimen subjected to the technological bend test:

bending angle 180°; mandrel diameter $\geq 2 \times$ specimen thickness

Testing

Tensile and impact tests, and on request bend tests, will be performed according to EN 10 137. Tests on every heat treated plate may be possible on request.

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 at the lowest temperature of the corresponding grade on transverse test specimens taken as follows:

- for plate thicknesses ≤ 40 mm: close to the surface
- for plate thicknesses > 40 mm: 1/4 of the plate thickness

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 620 B, T or E)
- the manufacturer's brand

In addition, the plates are stencilled with DILLIMAX 620 B, T or E.

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.

Cold forming

Cold forming means forming below the maximum allowable stress relief temperature (560°C / 1040°F). DILLIMAX 620 can be cold formed with regard to its high yield strength. Flame cut or sheared edges in the bending area should be grinded before cold forming. Cold forming is 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 recommend you to consult us prior to ordering.

Hot forming

Hot forming means forming at temperatures above the maximum allowable stress relief temperature (560°C / 1040°F). 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 hot forming 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

With increasing yield strength, the fabrication and in particular the welding of steel demands more care. In order to ensure sufficiently high yield strength and toughness in the welding seam, the welding conditions should be selected so that the cooling time $t_{8/5}$ lies between 10 and 22 seconds.

In the choice of the filler materials, the raised yield strength of the base material must be taken into account. It should be considered that increased heat input leads to lower tensile properties in the weld metal. The yield strength is generally thus reduced. If either during or after the production a stress relieve heat treatment is planned, then this must also be considered when selecting the filler materials.

The minimum pre-heat and interpass temperatures to avoid cold cracking are determined by a number of influencing factors, whose effects are described in the supplement to the SEW 088. Due to the low hydrogen input, shielded arc welding and electrodes of type HD<5 in accordance with DIN 8572 should preferably be used.

For general welding instructions, please consult the SEW 088 or ECSC Information Circular No. 2.

Heat treatment

If a stress relieving has to be considered because of constructional regulations, constructive reasons or because it is necessary for the fabrication, please consult us. The properties of structural components can be altered by a stress relief heat treatment.

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. Smaller flatness deviations may be possible on request.

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.

Detailed instructions for flame cutting, welding, machining and, about the structural properties of the DILLIMAX are provided in the brochure "DILLIMAX - HIGH STRENGTH STEEL".