

DILLIMAX 965

High strength fine grained structural steel,
quenched and tempered

Material data sheet, edition January 2024¹

DILLIMAX 965 is a high strength, fine grained and weldable structural steel with a minimum yield strength of 960 MPa (140 ksi)² in its delivery condition (referring to the lowest thickness range).

DILLIMAX 965 is preferentially used by the customers for welded steel structures within mechanical constructions, plant constructions and structural steel works, such as machines for structural engineering, conveying plants, hoists and cranes.

Product description

Designation and range of application

DILLIMAX 965 can be delivered in three qualities as follows:

- **Basic (B)** with minimum impact values at -20 °C (-4 °F)²: **DILLIMAX 965 B**
Material No. 1.8941 – S960Q according to EN 10025-6
- **Tough (T)** with minimum impact values at -40 °C (-40 °F)²: **DILLIMAX 965 T**
Material No. 1.8933 – S960QL according to EN 10025-6
- **Extra tough (E)** with minimum impact values at -60 °C (-76 °F)²: **DILLIMAX 965 E**
Material No. 1.8934 – S960QL1 according to EN 10025-6

DILLIMAX 965 can be delivered in thicknesses from 6 to 160 mm (¼ to 6.3 in.)² according to the dimensional programme.

For DILLIMAX 965, under the designations DILLIMAX 965 B/S960Q, DILLIMAX 965 T/S960QL and DILLIMAX 965 E/S960QL1, a CE marking according to EN 10025-1 is applied in thicknesses up to 125 mm (4.9 in.)², unless otherwise agreed.

Chemical composition

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

DILLIMAX 965	C	Si	Mn	P	S	Cr	Ni	Mo	V+Nb	B
B, T, E	0.20	0.50	1.40	0.018	0.005	0.90	2.0	0.70	0.10	0.004

The steel is fine grained through sufficient aluminium content.

¹ The current version of this material data sheet can be also found on: www.dillinger.de.

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

The limiting CEV^a values are lower than the values given in EN 1025-6:

Plate thickness t [mm] (in.) ^c	DILLIMAX 965 max. CEV ^a (CET ^b) [%]	See EN 10025-6 max. CEV ^a [%]
t ≤ 50 (2)	0.70 (0.43)	0.82
50 (2) < t ≤ 125 (4)		0.85
125 (4) < t ≤ 160 (6.3)		-

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

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

^c The approximately converted values in brackets are for information only.

Even lower carbon equivalent values may be agreed on request.

Delivery condition

The plates are water quenched and tempered according to EN 10025-6.

Mechanical properties in the delivery condition

Tensile test at ambient temperature - transverse test specimens –

Plate thickness t [mm] (in.) ^b	Tensile strength R _m [MPa] (ksi) ^b	Minimum yield strength R _{eH} ^a [MPa] (ksi) ^b	Minimum elongation	
			A ₅ [%]	A _{2in} ^c [%]
t ≤ 50 (2)	980 - 1 150 (142 - 167)	960 (140)	12	13
50 (2) < t ≤ 60 (2.4)	950 - 1 100 (138 - 160)	930 (135)		
60 (2.4) < t ≤ 125 (4.9)	900 - 1 100 (130 - 160)	850 (123)		
125 (4.9) < t ≤ 150 (6)	850 - 1 050 (123 - 152)	800 (116)	10	10
150 (6) < t ≤ 160 (6.3)	800 - 1 050 (116 - 152)	780 (113)		

^a If not apparent, the yield strength R_{p0.2} is measured instead.

^b The approximately converted values in brackets are for information only.

^c These values apply if tested according to ASTM A370.

Impact test on Charpy-V-specimens

DILLIMAX 965 Specimen direction	Basic (B) KV ₂ [J] (ft.-lb.) ^b at -20 °C (-4 °F)		Tough (T) KV ₂ [J] (ft.-lb.) ^b at -40 °C (-40 °F)		Extra tough (E) KV ₂ [J] (ft.-lb.) ^b at -60 °C ^a (-76 °F)	
	long.	transv.	long.	transv.	long.	transv.
according to EN 10025-6	30	27	30	27	30	27

^a only for thicknesses up to 125 mm

^b The approximately converted values in brackets are for information only.

The specified minimum value is the average of 3 tests. One individual value may be below the minimum average value specified, provided that it is not less than 70 % of that value. For plate thicknesses below 12 mm, the test can be carried out on Charpy-V test pieces with reduced width; the minimum width must be 5 mm. The minimum impact value will be decreased proportionally.

Testing

Tensile and impact tests will be performed according to EN 10025-6 once per heat and 60 t. Tests on every heat treatment unit may be possible on request.

The test pieces are taken and prepared according to parts 1 and 6 of EN 10025.

The tensile test is carried out on specimens of gauge length $L_0 = 5,65 \cdot \sqrt{S_0}$ respectively $L_0 = 5 \cdot d_0$, in accordance with EN ISO 6892- 1. Tensile tests according to ASTM A370 may be agreed. The impact test will be carried out on longitudinal Charpy-V-specimens in accordance with EN ISO 148-1 using a 2 mm striker.

Unless otherwise agreed, the test results are documented in an inspection certificate 3.1 in accordance with EN 10204.

Identification

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

- steel grade (e.g. DILLIMAX 965 B, T or E)
- heat number
- number of mother plate and individual plate
- the manufacturer's symbol
- inspection representative's sign

Processing

The entire processing and application techniques are of fundamental importance to the reliability of 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 of the EN 1011 (welding) and CEN/TR 10347 (forming) as well as recommendations regarding job safety in accordance with national rules should be observed.

Please refer to the corresponding processing information for more details.

General technical delivery requirements

Unless otherwise agreed, the general technical delivery requirements in accordance with EN 10021 apply.

Tolerances

Unless otherwise agreed, the tolerances will be in accordance with EN 10029, with class A for thickness and table 4, steel group H, for the maximum flatness deviation. Smaller flatness deviations may be possible on request prior to order.

Surface Quality

Unless otherwise agreed, the specifications will be in accordance with EN 10163-2, class A2.

Ultrasonic testing

Unless otherwise agreed, DILLIMAX 965 fulfils the requirements of class S₁E₁ in accordance with EN 10160.

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.

Contact

AG der Dillinger Hüttenwerke
Tel.: +49 6831 47 3454
e-mail: info@dillinger.biz
P.O. Box 1580
66748 Dillingen / Saar
Germany

You can find your contact person on www.dillinger.de.