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DIWETEN 460+M

Fine grained structural steel with improved atmospheric corrosion resistance, thermomechanically rolled

Material data sheet, edition June 2025[1]

DIWETEN 460+M is a higher strength fine grained structural steel[2] with improved atmospheric corrosion resistance. Due to its chemical composition, this material develops a patina with increased resistance against the atmospheric corrosion in comparison with the normal structural steels.
DIWETEN 460+M has minimum yield strength of 460 MPa in its delivery condition ex works (referring to the lowest thickness range).
DIWETEN 460+M fulfills the requirements of EN 10025-5. The thermomechanical rolling process allows using less alloying elements, leading to a lower carbon equivalent and hence an improved weldability compared to normalized weathering steels of the same strength.
DIWETEN 460+M can therefore especially be used in steel constructions for bridges and high-rise buildings where a higher strength weathering steel with good weldability is demanded.

Product description

Designation and range of application
DIWETEN 460+M can be delivered in thicknesses from 8 to 150 mm according to the dimensional programme for thermomechanically rolled steels (table 2).
DIWETEN 460+M is certified with impact test of -20°C as DIWETEN 460+M/S460K2W+M or with or with impact test of -50°C as DIWETEN 460+M/S460J5W+M. The CE-marking certificate is issued in accordance with EN 10025-1, unless otherwise agreed in thicknesses up to 150 mm.

All DIWETEN steels can be supplied in thicknesses up to 150 mm with the „marque NF-Acier“.

Chemical composition
For the ladle analysis the following limiting values are applicable in %:

C	Si	Mn	P	S	Nb	V	Al	Ti	Cr	Ni	Mo	Cu	N
≤ 0.11	≤ 0.50	≤ 1.40	≤ 0.020	≤ 0.003	≤ 0.05	≤ 0.08	≥ 0.020	≤ 0.02	0.37 -0.80	≤ 0.50	≤ 0.08	0.25 -0.4	≤ 0.01

[1] The current version of this material data sheet can be also found on www.dillinger.de.
[2] Steels with fine grain structure with an equivalent index of ferritic grain size ≥ 6 determined in accordance with EN ISO 643.

Overview carbon equivalents:

Plate thickness t [mm]	DIWETEN 460+M CET[a] [%] max.	DIWETEN 460+M CEV[b] [%] typical	DIWETEN 460+M CEV [%] max.	See EN 10025-5 CEV [%] max.
8 ≤ t ≤ 63	0.28	0.43	0.45	0.52
63 < t ≤ 100	0.29	0.44	0.45	0.52
100 < t ≤ 150	0.30	0.45	0.47	0.52

[a] CET = C + (Mn + Mo)/10 + (Cr + Cu)/20 + Ni/40
[b] CEV = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15

Delivery condition
Thermomechanically rolled (short designation +M).

Mechanical properties

Tensile test at ambient temperature – transverse test specimens

Plate thickness t [mm]	Minimum yield strength R_{eH} [MPa]	Tensile strength R_m [MPa]	Minimum elongation A_5 [%]
t ≤ 16	460	530 - 710	17
16 < t ≤ 40	440		
40 < t ≤ 63	430		16
63 < t ≤ 80	410		15
80 < t ≤ 100	400		
100 < t ≤ 150	385	490 - 660	15

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

Impact test on Charpy-V longitudinal specimens

DIWETEN 460+M	Test temperature [°C]	min. Absorbed energy KV_2 [J]	
		Average value	Single value
S460K2W+M	-20	40	28
S460J5W+M	-50	27	19

The specified average value is the average of 3 tests. One individual value may be below the average value specified. Subsize specimens are admitted for plate thickness ≤ 12 mm, the minimum specimen width is 5 mm. The minimum impact energy will be decreased proportionally

Testing

Tensile test and impact tests are carried out with respect to EN 10025-5 once per heat, 60 t and thickness range as specified for the yield strength. Tests on every mother plate are possible on request. The test pieces are taken and prepared according to parts 1 and 5 of EN 10025. The tensile test is carried out on specimens of gauge length $L_o = 5.65 \cdot \sqrt{S_o}$ respectively $L_o = 5 \cdot d_o$, in accordance with EN ISO 6892-1. Unless otherwise agreed, the impact test is carried out on longitudinal Charpy-V-specimens using a 2 mm striker in accordance with EN ISO 148-1.
Unless otherwise agreed, the test results are documented in a certificate 3.1 in accordance with EN 10204.

Order options

1)Tensile and impact test are carried out on each mother plate according to EN 10025-5
2)Additional Charpy-V-test for thicknesses ≥ 40 mm in ¼ thickness, other test conditions according to EN 10025-5

Identification of plates

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

- The steel grade (DIWETEN 460+M S460K2W+M or DIWETEN 460+M S460J5W+M)
- The heat number
- The number of mother plate and individual plate
- The manufacturer’s sign
- The inspection representative’s sign

Atmospheric corrosion resistance

Atmospheric corrosion resistance means that the DIWETEN steels - due to its chemical composition - presents an improved resistance against atmospheric corrosion. This resistance is caused by an auto-protective layer that forms on the base material. It develops depending on weather conditions, particularly when having a succession of dry and wet periods. This layer protects the surface and slows down the normal rust formation.
Generally, the corrosion velocity decreases with increasing service life. Even after the formation of the patina, a total stop of the corrosion process is not achieved.
However, the patina offers - in comparison to unalloyed steels - a better protection against atmospheric corrosion in industrial, city or rural atmospheres, enabling the application of uncoated steels under certain circumstances.
Initial formation, time of development and protective effect of the patina on steels with improved atmospheric corrosion resistance depend on several factors. The decisive factors here are the constructional design and the atmospheric and environmental conditions in the respective case.
In any case, usual constructional standards for the construction with steels with improved atmospheric corrosion resistance are to be observed, as i.e. the German guideline DASt 007 (“Lieferung, Verarbeitung und Anwendung wetterfester Baustähle”) or the European Design Guide ECCS / CECM / EKS ("European design guide for the use of weathering steel in bridge construction") or the Cerema/UGE French information note “Aciers autopatinables, recommandations pour leur utilisation en structure des tabliers des ponts et passerelles “.

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 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, guideline DASt 007, SEW 088 as well as recommendations regarding job safety in accordance with national and European rules (i.e. ECCS-Design-Guide) should be observed.

Cold forming
DIWETEN 460+M can be cold formed as any comparable structural steel in accordance with EN 10025, i.e. formed at temperatures below 580 °C. Cold forming is always related to a hardening of the steel and to a decrease in toughness. This change in the mechanical properties can in general be partially recovered through a subsequent stress relief heat treatment. Flame cut or sheared edges in the bending area should be ground before cold forming. For larger cold forming degrees we recommend consulting us prior to ordering.

Hot forming
Hot forming, i.e. forming at temperatures above 580 °C, leads to changes in the original material condition. It is impossible to re-establish the same material properties that had been achieved during the original manufacture through a further treatment. Therefore hot forming is not permitted.

Flame cutting and welding
DIWETEN 460+M has despite its higher strength and weathering property a good weldability if the general technical rules (see EN 1011) are respected. However the hardenability of the steel is increased due to the Cu and Cr alloying. Owing to the low carbon content oxygen cutting, plasma and laser cutting can be carried out up to large thickness without preheating. The preheat conditions during welding have to be adapted to the slightly increased carbon equivalent compared to non-weathering thermomechanically rolled steels. If necessary, the corrosion resistance of the welding deposit has to be assured by selection of adequate weld metals or other anti-corrosion measures.

Heat treatment
Welded joints of DIWETEN 460+M are usually used in welded condition. If a stress relief heat treatment is necessary, it is carried out in the temperature range between 530 and 580 °C with cooling in still air. The holding time should not exceed 4 hours (even if multiple operations are carried out). For differing heat treatment requirements, we recommend consulting us prior to ordering.

General technical delivery requirements

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

Tolerances

Unless otherwise agreed, tolerances are in accordance with 10029, with class A for the thickness.

Surface quality

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

Ultrasonic testing

Unless otherwise agreed, DIWETEN 460+M meets the requirements of class S_1E_1 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 as occasion demands. The latest version is available from the mill or as download at www.dillinger.de.

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