



DIWETEN 355

STRUCTURAL STEEL WITH IMPROVED ATMOSPHERIC CORROSION RESISTANCE

Material Data Sheet Edition December 2011

DIWETEN 355 is a structural steel 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.

Due to restricted chemical composition, DIWETEN 355 has a better weldability compared to respective steels produced according to EN 10025-5. Furthermore, DIWETEN 355 has a constant minimum yield strength of 345 MPa for thickness of 16 mm < t ≤ 100 mm.

DIWETEN 355 is used for instance in the field steel constructions like bridges, steel towers and masts, buildings, industrial chimneys, silos and monuments.

Product description

Designation and range of application

DIWETEN 355 can be delivered in thickness from 8 to 150 mm according to our delivery program. Other dimensions are available on request.

DIWETEN 355 completely meets the demands of the steel qualities S355J2W+N and S355K2W+N (material numbers 1.8965 and 1.8967), specified in EN 10025-5. The demands on chemical and mechanical properties in accordance with ASTM A588 Grade K are also met. If an application of the plates in accordance with the ASTM standards is provided, please inform us explicitly in order to respect all the demands of this standard.

DIWETEN 355 can be delivered in thickness up to 150 mm under the designations S355J2W+N and S355K2W+N according to NF EN 10025-5 with the „marque NF-Acier“ (class 21).

For DIWETEN 355, CE-Marking can be applied under the designations S355J2W+N and S355K2W+N according to EN 10025-5 in thickness up to 150 mm.

Chemical composition

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

C	Si	Mn	P	S	Cu	Cr	Ni	Nb	Mo	Zr	Al
≤ 0.16	0.20 - 0.50	0.50 - 1.25	≤ 0.025	≤ 0.010	0.30 - 0.50	0.40 - 0.70	≤ 0.50	0.015 - 0.05	≤ 0.10	≤ 0.05	≥ 0.020

Auxiliary data for the carbon equivalent CEV ¹⁾:

Plate thickness [mm]	30	60
CEV [%]	0.46	0.48

In addition, the weather resistance index of I > 6.0 in accordance with ASTM G 101-01 is valid.

$$I = 26.01 \cdot (\% \text{ Cu}) + 3.88 \cdot (\% \text{ Ni}) + 1.2 \cdot (\% \text{ Cr}) + 1.49 \cdot (\% \text{ Si}) + 17.28 \cdot (\% \text{ P}) - 7.29 \cdot (\% \text{ Cu}) \cdot (\% \text{ Ni}) - 9.10 \cdot (\% \text{ Ni}) \cdot (\% \text{ P}) - 33.39 \cdot (\% \text{ Cu})^2$$

Delivery condition

Normalized or normalizing rolling in accordance with EN 10025-5.

¹⁾ CEV = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15



Mechanical and technological properties in the delivery condition

The mechanical-technological properties are also valid after the stress relief heat treatment at temperatures ≤ 580 °C and soaking time ≤ 60 min.

Tensile test at ambient temperature – transverse test specimens

Plate thickness t [mm]	Minimum yield strength ^{a)} R_{eH} [MPa]	Tensile strength R_m [MPa]	Minimum elongation A_5 [%]
$t \leq 16$	355	490 – 630	20
$16 < t \leq 100$	345		
$100 < t \leq 125$	315	460 – 600	18
$125 < t \leq 150$	295	450 – 600	

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

Higher minimum values for the yield strength can be arranged upon request.

Impact test on Charpy-V-longitudinal specimens

Absorbed energy KV_2 [J] at a test temperature of -20 °C	
Average of 3 tests	Single value
40	28

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 thickness ≤ 12 mm the test can be carried out on Charpy-V-test specimens with reduced width according to EN ISO 148-1. The minimum impact value will be decreased proportionally to the section of the test specimen.

Weld bead bend test

DIWETEN 355 can be delivered with additional weld bead bend test in accordance to SEP 1390 (edition 1996) if specified at the time of the order.

Testing

The testing is performed in accordance EN 10025-5 by tensile test and impact test.

The specimens for the tensile test are prepared according to EN 10025-5. The tensile test is carried out in accordance to EN ISO 6892-1 on specimens of gauge length $L_0 = 5.65 \cdot \sqrt{S_0}$.

Unless otherwise agreed, the impact test is carried out at -20 °C on longitudinal Charpy-V-specimens taken close to the surface 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.

Identification of plates

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

- steel grade (DIWETEN 355)
- heat number
- number of mother plate and individual plate
- the manufacturer's symbol
- authorized inspection representative's sign

Atmospheric corrosion resistance

Atmospheric corrosion resistance means that the steel - due to the chemical composition - presents a higher resistance against atmospheric corrosion in comparison to unalloyed steels because a protective coating on the surface is formed influenced by the weather, which protects the surface and decelerates the normal corrosion process.

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 atmosphere, that enables 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 are extremely depending on 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 (delivery, fabrication and application of steels with improved atmospheric corrosion resistance).

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 and guideline DAST 007 as well as recommendations regarding job safety in accordance with national rules should be observed.

Cold forming

Cold forming means forming below the maximum allowable stress relief temperature (580 °C).

DIWETEN 355 can be cold formed as any comparable structural steel in accordance with EN 10025. In case of higher cold forming ratios, i.e. edging on mechanical presses, it is advisable to consult the steel manufacturer prior to placing the order.

Hot forming

Hot forming means forming at temperatures above A_{C3} . If possible, the hot forming has to be carried out at the normalising temperature with following cooling in still air (see CEN/TR 10347).

Flame cutting and welding

DIWETEN 355 has an excellent weldability if the general technical rules (see EN 1011) are observed. The fabrication by flame cutting and welding has to be carried out similarly to normal unalloyed structural steels of EN 10025 and the same strength and dimensions. However the hardenability of the steel is increased due to the Cu and Cr alloying. The preheat conditions must be adapted to the increased carbon equivalent. 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

A stress relieving of 580 °C maximum and a holding time of maximum 60 min with a heating and cooling speed of 70 - 80 °C/h is recommended.

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 EN 10029, with class A for the thickness and, table 4, steel group L for the maximum flatness tolerance. Smaller flatness tolerances may be possible on request.

Surface quality

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

General note

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

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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