S355J2WP

Weather resistant structural steels

Material no.	1.8946
according to	DIN EN 10025-5
Tensile strength class	B

Usage

These weather-resistant structural steel grades are used for manufacturing welded, riveted or bolted structures, e. g. in bridge, façade and vehicle construction. In general, the specific rust-building properties of Allwesta steel grades make surface protections of structures built of this steel grade unnecessary, provided that the ‚Stahl-Eisen-Werkstoffblatt‘ (Iron and steel material sheet) 087 'Wetterfeste Baustähle, Richtlinien für die Lieferung, Verarbeitung und Anwendung' (Weatherresistant structural steel, guidelines for delivery, processing and application) is observed.

The user of these steel grades must make sure that his calculation, design and processing methods are appropriate for the material and comply with the state-of-theart. The good properties of Allwesta steel grades are not negatively affected by cold or hot-forming. The minimum bending radii according to table 6 of EN 10025-5 are recommended for cold-forming. Suitability for cold-forming must be agreed upon in the order.

If mechanical properties have been significantly modified by heavy cold-forming, either stress relief annealing or normalised may be applied. Normalised should also be applied following hotforming outside of the temperature range of 750–1,050 °C and after overheating.

Chemical composition [1] [2]

(in percent by weight)

	min.	max.
C		0.12%
Si		0.75%
Mn		1.00%
P	0.06%	0.15%
S		0.030%
Cu	0.25%	0.55%
Cr	0.30%	1.25%
Ni		0.65%

1) Heat analysis

2) The steel grades contain at least one of the following elments: Al_{total}: ≥0,020 %, Nb: 0,015–0,060 %, V: 0,02–0,12 %, Ti: 0,02–0,10 %. If a combination of these elements is present, at least one of them is contained with the specified minimum content.

Mechanical properties [1]

Nom. thick. e	Yield strength R_{eH}
≤16 mm	≥ 355 MPa
>16 mm	≥ 345 MPa

Nom. thick. e	Tensile strength R_m
<3 mm	510 – 680 MPa
≥ 3 mm	470 – 630 MPa

Nom. thick. e	Total elong. A [2] (long./trans.)
1.5<e≤2 mm	≥ 16/14 %
2<e≤2.5 mm	≥ 17/15 %
2.5<e<3 mm	≥ 18/16 %
e ≥3 mm	≥ 22/20 %

1) The tensile test values given in the table apply to longitudinal samples; in case of strip and sheet steel of widths of ≥600 mm they apply to transverse samples.

2) It applies to nominal thickness e:
e < 3 mm: A_{80}
e ≥ 3 mm: A_5

Notch impact energy [1]

Temperature	Notch impact energy
-20 °C	≥ 27 J

1) Average values of 3 samples; one individual value may fall short of the required minimum value by not more than 30 %. The sample width shall equal the product thickness if the latter is between 6 and 10 mm. The tests are performed by using samples similar to Charpy-V samples. The values specified in the table above are to be reduced proportionally to the sample width.

2) The notch impact energy values must be proved, if it has been agreed upon in the order.

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Available dimensions

Hot-rolled coils unpickled, mill edge

Thickness in mm	Width in mm
2,00 – 2,24	900 –1400
2,25 – 2,49	900 –1450
2,50 – 2,99	900 –1500
3,00 – 3,99	900 –1680
4,00 – 12,70	900 –1750

Hot-rolled slit strip

Thickness in mm	Width in mm
2,00 – 2,24	100 – 690
2,25 – 2,49	100 – 715
2,50 – 2,99	100 – 740
3,00 – 4,60	100 – 800
4,61 – 6,00	116 – 800
6,01 – 7,00	175 – 800
7,01 – 8,00	233 – 800

Widths < 100 mm on request

Formation of a protective coating

Unlike unalloyed constructional steels, when copper is added as an alloy in weather-resistant steels, a barrier layer forms when the steel comes into contact with the atmosphere. This layer contains alkaline copper sulphate (see diagram below).

In the case of the phosphorous-alloyed steel grades Allwesta 510 P and Allwesta 510 FP (S355JOWP and S355J2WP), the barrier layer is also strengthened by alkaline copper phosphate.

Depending on the environmental conditions, the formation of this barrier layer takes approx. 1,5–3,5 years and prevents water, oxygen and sulphur dioxide from coming into contact with the surface of the steel. There is then no further corrosion.

The prerequisites for the formation of the protective coating are as follows:

- No permanent moisture
- Uniform run-off of rainwater
- Avoidance of small cracks (capillary formation)
- Protective coating to protect against condensation water on the inside
- Absence of chlorides (seawater, near to the coast)
- Permanent fluctuation between moisture and dryness
- Avoidance of electrochemical local elements

As the protective coating forms, the colour changes from light brown to brown to brown-violet; the surface becomes dark brown / violet and grainy. The colour changes, depending on the incidence of light and the weather conditions.

Salzgitter Flachstahl should like to point out that, during the formation of the protective coating, specks may form as a result of the washout of rust; this should be taken into account in the design.

Welding

The steel grades of the Allwesta series can be perfectly welded both manually and using automatic equipment by means of all known welding processes. However, the quality of the weld joint depends on the welding process, the welding conditions and the selection of the correct filler metals. Suitably alloyed filler metals shall be used if the same requirements regarding weather resistance are made on the basic material and the weld metal and if the structure is not to be provided with a painting coat. In general, pre-heating prior to welding or torch-cutting is not necessary. Only when external temperatures drop below -5 °C should the metal be pre-heated to approx. 150 °C.

Condition of delivery, scope of testing and certificate

Flat products made of Allwesta steel grades have the condition of delivery +N (normalised rolled). The provisions of EN 10025-5 shall apply for delivery and inspection.

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