

S650MC

High-strength steels for cold-forming,
thermomechanically-rolled

Material no.	1.8976
according to	DIN EN 10149-2
Tensile strength class	D

Usage

The steel grades of the S315MC to S700MC series are used for cold-formed components of the most varied designs. Their fields of application include the manufacture of:

- Longitudinal beams
- Frames
- Cold-pressed parts
- Cold-rolled sections
- and Structural pipes

The user of these steel grades must make sure that his calculation, design and processing methods are appropriate for the material. The forming process used must be suitable for the intended application and comply with the state-of-the-art; it is of fundamental importance to the processing behaviour of these steel grades.

These steel grades offer excellent bending, flanging, cold-bordering and folding properties in both longitudinal and transverse direction. The bending radii specified below should be observed as minimum values.

Chemical composition ^{1) 2)} (in percent by weight)

	min.	max.
C		0.120%
Si		0.600%
Mn		2.000%
P		0.025%
S		0.015% ³⁾
Al	0.015%	
Nb		0.090%
V		0.200%
Ti		0.220%
Mo		0.500%
B		0.005%

1) Heat analysis

2) The maximum content of Nb+V+Ti shall not exceed 0.220%.

3) If agreed in the order, the sulphur content is 0.010% max.

Mechanical properties ¹⁾

Nom. thick. e	Yield strength R _{eH}
	≥ 650 MPa

Nom. thick. e	Tensile strength R _m
	700 – 880 MPa

Nom. thick. e	Total elongation A ³⁾
< 3 mm	≥ 10 %
≥ 3 mm	≥ 12 %

1) The tensile test values given in the table apply to longitudinal samples.

2) In case the thickness is > 8 mm, the yield strength values may be reduced by 20 N/mm².

3) It applies to nominal thickness e:
e < 3 mm: A₈₀
e ≥ 3 mm: A₅

Notch impact energy

If agreed in the order, the notch impact energy is proved using longitudinal samples at -20 °C. The average notch impact energy from 3 samples must be 40 J minimum. 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 required minimum values are to be reduced proportionally to the sample width.

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Smallest bending radius

(Smallest recommended bending radius
bending angles $\geq 90^\circ$)

Nom. thick. e	smallest bending radius
≤ 3 mm	$1.5 \times e$
$3 < e \leq 6$ mm	$2.0 \times e$
> 6 mm	$2.5 \times e$

Heat treatment

Normalised and stress relief annealing above 580 °C with long holding times results in a reduction of yield strength and tensile strength as compared to the 'as-delivered' condition which is why such heat treatments should be avoided. It also follows that these steel grades are not suitable for hot-forming. If low-voltage annealing is necessary to compensate the welding stresses, the recommended annealing time between 530 °C and 580 °C is 30 minutes for all product thicknesses and steel grades.

Available dimensions

Hot-rolled coils unpickled, mill edge

Thickness in mm	Width in mm
2.00 – 2.99	900 – 1300
3.00 – 3.99	900 – 1450
4.00 – 6.00	900 – 1500

Widths < 900 mm and thicknesses > 6.00 mm on request

Hot-rolled slit strip

Thickness in mm	Width in mm
2.50 – 2.99	100 – 640
3.00 – 4.60	100 – 690
4.61 – 6.00	140 – 740

Widths < 100 mm on request

Welding

These steel grades can be welded both manually and using automatic equipment by means of all electrical welding processes provided the general technical rules are observed. No major hardness increases appear in the heat-affected zone. Preheating is not necessary under normal welding conditions and down to workpiece temperatures of +5 °C. Below +5 °C, pre-heating to 150 °C is recommended.

The welding wires and electrodes approved in the respective strength category must be used as filler metals.

In addition to this, the general meaning of the detailed information provided in 'Stahl-Eisen-Werkstoffblatt' (Iron and steel material sheet) 088 must be observed.

Condition of delivery, scope of testing and certificate

The provisions of EN 10149-2, chapters 7.2 and 8 shall apply for delivery and inspection. The products are delivered in a thermomechanically-rolled condition.