

## S355NC

High-strength steel for cold-forming,  
normalised rolled

Material no.	<b>1.0977</b>
according to	<b>DIN EN 10149-3</b>
Tensile strength class	<b>B</b>

### Usage

This steel grade is used for cold-formed components of the most varied designs. Its fields of application include the manufacture of :

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

The user of this steel grade 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.

This steel grade offers 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.

### Processing

This steel grade may be hot-formed without affecting the material properties negatively. This applies in particular to the

temperature range of 850–1.050 °C. Normalised at 900–950 °C (holding time after temperature equalisation: 1–2 minutes per millimetre of plate thickness) is required only if the mechanical and technological properties are to be restored to an ‘asdelivered’ condition following forming operations outside of the temperature range given above or after cold-forming or if the regulations in force call for normalised. However, such a heat treatment or stress relief annealing at 530–580 °C (holding time: 30 minutes after thermal equilibrium has been achieved for all product thicknesses) will not be necessary.

### Chemical composition <sup>1) 2)</sup>

(in percent by weight)

	min.	max.
<b>C</b>		<b>0.18%</b>
<b>Si</b>		<b>0.50%</b>
<b>Mn</b>		<b>1.60%</b>
<b>P</b>		<b>0.025%</b>
<b>S</b>		<b>0.015% <sup>2)</sup></b>
<b>Al</b>	<b>0.015% <sup>2)</sup></b>	
<b>Nb</b>		<b>0.09%</b>
<b>V</b>		<b>0.10%</b>
<b>Ti</b>		<b>0.15%</b>

1) Heat analysis

2) The maximum content of Nb+V+Ti shall not exceed 0.22%.

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

4) The minimum value of Al<sub>total</sub> content does not apply if the steel contains sufficient quantities of nitrogen-fixing elements.

### Mechanical properties <sup>1)</sup>

Nom. thick. e	Yield strength R <sub>eH</sub>
	≥ 355 MPa

Nom. thick. e	Tensile strength R <sub>m</sub>
	470 – 610 MPa

Nom. thick. e	Total elongation A <sub>2</sub> <sup>2)</sup>
< 3 mm	≥ 20 %
e ≥ 3 mm	≥ 25 %

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

2) It applies to nominal thickness e:  
e < 3 mm: A<sub>80</sub>  
e ≥ 3 mm: A<sub>5</sub>

### 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  $\leq 90^\circ$ )

Nom. thick. e	smallest bending radius
$\leq 3$ mm	0.25 e
$3 < e \leq 6$ mm	0.5 e
$> 6$ mm	1.0 e

### 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

Widths  $< 900$  mm and thicknesses  $> 12.70$  mm on request

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

### Welding

This steel grade can be perfectly welded both manually and using automatic equipment by means of all known welding pro-

cesses. However, the quality of the weld joint depends on the welding process, the welding conditions and the selection of the correct filler metals. The welding wires and electrodes approved in this strength category must be used as filler metals. Basic coated electrodes are recommended for manual welding.

In general, pre-heating prior to welding or torch-cutting is not necessary. At outside temperatures below  $+5^\circ\text{C}$ , pre-heating to approx.  $150^\circ\text{C}$  should be carried out; the same applies to plate thicknesses  $\geq 12,5$  mm.

Subsequent normalised or stress relief annealing is required only if called for in the regulations or if operating and manufacturing conditions make a reduction of the residual welding stresses appear useful. In addition to this, the guidelines for processing weldable fine-grain structural steel grades according to 'Stahl-Eisen- Werkstoffblatt' (Iron and steel material sheet) 088 must be observed.

### Condition of delivery, scope of testing and certificate

The provisions of EN 10149-3. The products are delivered in a condition obtained by normalised rolling.