



## HARDOX 450 PLATE



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### General Product Description

The most popular abrasion-resistant steel with excellent structural properties.

Hardox 450 is an abrasion-resistant steel with a nominal hardness of 450 HBW. Hardox 450 combines good bendability and weldability with an option for guaranteed impact toughness (Hardox 450 Tuf).

The products can be used in many different components and structures that are subject to wear. Hardox 450, with an extra 50 Brinell hardness over our 400 grade, provides better dent and abrasion resistance as well as longer wear life, so you can achieve even greater savings.

### Dimension Range

Hardox 450 and Hardox 450 Tuf are available in thicknesses of 3.2-130 mm. For thickness over 80 mm the preferred width is 1650 mm. More detailed information on dimensions is provided in the dimension program.

### Mechanical Properties

Thickness (mm)	Hardness <sup>1)</sup> (HBW)	Typical yield strength (MPa), not guaranteed
3.2- 80.0	425- 475	1100- 1300
80.1- 103.0	410- 475	1050- 1300
103.1- 130.0	390- 475	1000- 1300

<sup>1)</sup> Brinell hardness, HBW, according to EN ISO 6506-1, on a milled surface 0.5 – 3 mm below surface. At least one test specimen per heat and 40 tons. The nominal material thickness will not deviate more than ± 15 mm from that of the test specimen.

Hardox is through-hardened. Minimum core hardness is 90 % of the guaranteed minimum surface hardness.

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## Impact Properties

Grade	Longitudinal test, typical impact energy, Charpy V 10x10 mm test specimen.	Transverse test, guaranteed impact energy, Charpy V 10x10 mm test specimen.
Hardox 450	50 J/-40 °C	-
Hardox 450 Tuf <sup>1)</sup>	-	Min. 27 J/-20 °C <sup>2)</sup>

<sup>1)</sup> Impact testing is performed on thicknesses  $\geq 6$  mm. For thicknesses between 6 - 11.9 mm, sub-size Charpy V-specimens are used. The specified minimum value is then proportional to the cross-sectional area of the test specimen, compared to a full-size specimen (10 x 10 mm). Impact testing according to ISO EN 148 per heat and thickness group. Average of three tests.

<sup>2)</sup> Single value minimum 70% of specified average.

## Chemical Composition (heat analysis)

C <sup>*)</sup> (max %)	Si <sup>*)</sup> (max %)	Mn <sup>*)</sup> (max %)	P (max %)	S (max %)	Cr <sup>*)</sup> (max %)	Ni <sup>*)</sup> (max %)	Mo <sup>*)</sup> (max %)	B <sup>*)</sup> (max %)
0.26	0.70	1.60	0.025	0.010	1.40	1.50	0.60	0.005

The steel is grain refined. <sup>\*)</sup> Intentional alloying elements.

## Carbon Equivalent CET(CEV)

Thickness	3.2 - 4.9	5.0 - 9.9	10.0 - 19.9	20.0 - 39.9	40.0 - 80.0	80.1 - 130.0
Max CET(CEV)	0.37 (0.48)	0.38 (0.49)	0.39 (0.52)	0.41 (0.60)	0.43 (0.74)	0.41 (0.67)
Typ CET(CEV)	0.29 (0.39)	0.33 (0.45)	0.36 (0.48)	0.38 (0.56)	0.38 (0.61)	0.39 (0.64)

$$CET = C + \frac{Mn + Mo}{10} + \frac{Cr + Cu}{20} + \frac{Ni}{40}$$

$$CEV = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Cu + Ni}{15}$$

## Tolerances

More details are given in SSAB's brochure 41-General Product Information Strenx, Hardox, Armox and Toolox-UK and Hardox® Guarantees or at [www.ssab.com](http://www.ssab.com).

### Thickness

Tolerances according to Hardox Thickness Guarantees. Hardox® Guarantees meet the requirements of EN 10 029 Class A.

### Length and Width

According to SSAB's dimension program. Tolerances according to SSAB's mill edge standards or tolerances that conform to EN 10 029.

### Shape

Tolerances according to EN 10 029.

### Flatness

Tolerances are according to Hardox Flatness Guarantees Class D, which are more restrictive than EN 10 029.

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## Surface Properties

According to EN 10 163-2, Class A Subclass 1.

## Bending

Tolerances are according to Hardox Bending Guarantees Class E. Extra close can be supplied after special agreement.

## Delivery Conditions

The delivery condition is Q or QT (Quenched or Quenched and Tempered). The plates are delivered with sheared or thermally cut edges. Thicknesses over 80 mm are delivered with mill edge as standard. Delivery requirements can be found in SSAB's brochure 41-General product information Strenx, Hardox, Armox and Toolox-UK or at [www.ssab.com](http://www.ssab.com).

## Fabrication and Other Recommendations

Welding, bending and machining

Recommendations can be found in SSAB's brochures at [www.hardox.com](http://www.hardox.com) or consult Tech Support, [techsupport@ssab.com](mailto:techsupport@ssab.com).

Hardox 450 and Hardox 450 Tuf are not intended for further heat treatment. Mechanical properties are achieved by quenching and when necessary by means of subsequent tempering. The properties of the delivery condition cannot be retained after exposure to temperatures in excess of 250 °C.

Appropriate health and safety precautions must be taken when welding, cutting, grinding or otherwise working on this product. Grinding, especially of primer coated plates, may produce dust with a high particle concentration.



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