

### 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. 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 is available in thicknesses of 3.2 - 130 mm (1/8 - 5.12") as plate, as sheet in thicknesses 2.0 - 8.0 mm (0.079 - 0.315") and as CR sheet in thicknesses 0.7 - 2.1 mm (0.028 - 0.083"). For thicknesses over 80 mm (3.15") the preferred width is 1650 mm (64.96"). More detailed information on dimensions is provided in the dimension program.

### Mechanical Properties

Grade	Thickness (mm)	Hardness <sup>1)</sup> (HBW)	Tensile strength R <sub>m</sub> (MPa), guaranteed	Typical yield strength (MPa), not guaranteed
Hardox® 450 CR sheet	0.7 - 2.10	425 - 475 <sup>2)</sup>	1370 - 1600	1250
Hardox® 450 sheet	2.0 - 8.0	425 - 475	-	1250
Hardox® 450 plate	3.2 - 80.0	425 - 475	-	1250
Hardox® 450 plate	80.1 - 103.0	410 - 475	-	1250
Hardox® 450 plate	103.1 - 130.0	390 - 475	-	1250

<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.

<sup>2)</sup> Hardness test is not performed or guaranteed for Hardox 450 cold rolled material. The hardness interval is a conversion from the tensile strength.

The nominal thickness of supplied plates will not deviate more than +/- 15 mm from the thickness of the test specimen used for hardness testing.

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

### 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 sheet & plate	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 ≥ 6 mm. For thicknesses between 6 - 11.9 mm, sub-size Charpy V-specimens are used. The specified minimum value is 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)

Grade	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 %)
CR sheet	0.18	0.25	1.30	0.015	0.004	0.10	0.10	0.04	0.003
Sheet & plate	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	CR sheet 0.7 - 2.10	sheet 2.0 - 8.0	plate 3.2 - 4.9	plate 5.0 - 9.9	plate 10.0 - 19.9	plate 20.0 - 39.9	plate 40.0 - 80.0	plate 80.1 - 130.0
Max CET(CEV)	0.33 (0.44)	0.35 (0.48)	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)	0.31 (0.39)	0.26 (0.39)	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 for plate. For sheet, the guarantees meet the requirements of 1/2 EN 10 051 and EN 10 131 for cold rolled sheet products.

## Length and Width

According to SSAB's dimension program. For plate, the tolerances are according to SSAB's mill edge standard or tolerances that conform to EN 10 029 and EN 10 131 for cold rolled sheet. Tolerances conform to EN 10 051 for sheet, tighter tolerances available on request.

## Shape

Tolerances according to EN 10 029 for plate, EN 10 051 for sheet and EN 10 131 for cold rolled sheet.

## Flatness

Tolerances are according to Hardox® Flatness Guarantees Class D for plate, which are more restrictive than EN 10 029. For sheet, the tolerances are according to Hardox® Flatness Guarantees Class A, that offer narrower tolerances compared to EN 10 051. Cold rolled sheet tolerances are according to Hardox® Flatness Guarantees Class B.

## Surface Properties

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

## Bending

Bendability for plate is according to Hardox® Bending Guarantees Class E. For sheet, the bendability is according to Hardox® Bending Guarantees Class C for cold rolled sheet and Class B for sheet.

## Delivery Conditions

The delivery condition is Q or QT (Quenched or Quenched and Tempered). Hardox® 450 plates are delivered with sheared or thermally cut edges, and thicknesses over 80 mm are delivered with mill edge as standard. Hardox® 450 sheets are delivered with an as-rolled surface and mill edge as standard. Hardox® 450 cold rolled sheets (0.70 - 2.10 mm (0.028 - 0.083")) are supplied as cold rolled surface.

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 (482 °F).

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.

## Contact Information

[www.ssab.com/contact](http://www.ssab.com/contact)