HARDOX®
WEAR PLATE

TECHSUPPORT #55

Upgrading from Hardox 400 to Hardox 450

Upgrading from Hardox 400 to Hardox 450 provides the possibility to increase service life or create lighter structures, and in some cases both. Because of the workshop friendly qualities of Hardox, upgrading is in the majority of cases a smooth process without any increased difficulties in processing.

General information

Mechanical properties	Hardox 450	Hardox 400
Hardness	425 – 475 HB	370-430 HB
Yield strength*	1200 MPa	1000 MPa
Tensile strength*	1400 MPa	1250 MPa
Elongation A_5*	10 %	10 %
Impact toughness at -40 °C*:	40 J	45 J

*Typical value for 20mm plate thickness.

Dimensions	Hardox 450	Hardox 400
Thickness range	3.2 – 80 mm	4.0 – 130 mm
Maximum width	3.3 m	3.3 m

SSAB

Upgrading benefits

Increased wear life

The additional 50 Brinell gained by upgrading to Hardox 450 will increase the wear life. Case studies have shown that it is possible to achieve up to 50% greater wear life and with some applications even more.

Examples of increases in wear life achieved by upgrading from Hardox 400 to Hardox 450 for different materials, sliding wear, according to WearCalc™.

Basalt	Granite	Workshop steel scrap
35 – 45%	75 – 85%	35 – 45%

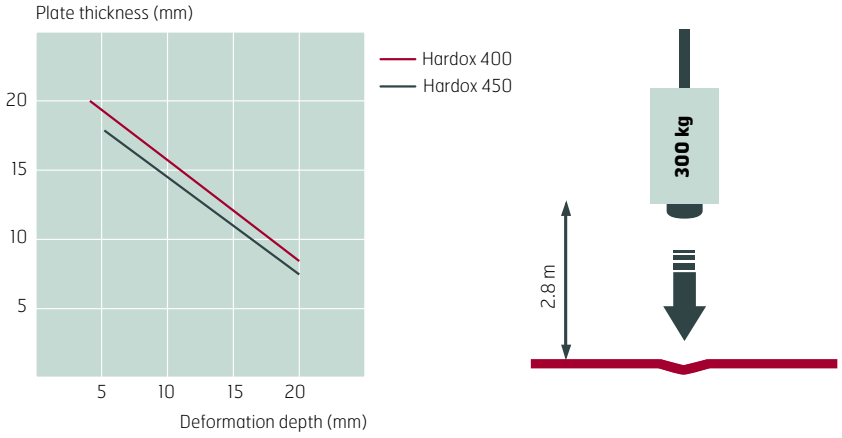
Lighter structure

By converting from Hardox 400 to Hardox 450, thinner plates can be used in your application. Thinner plates mean lighter applications, increasing the maximum payload and profitability. Our customer experience has shown that weight reductions of up to 15% can be achieved, however consideration should be given to buckling, deflection and fatigue strength, when designing.

Improved dent resistance

Upgrading from Hardox 400 to Hardox 450 improves the dent resistance as shown in the figure. In this test, the weight of 300 kg is dropped from a height of 2.8 m onto a test plate 600 x 600 mm.

Results from impact drop tests of Hardox 400 and Hardox 450



Hardox 450 in the workshop

Welding

Hardox 450 can be welded with all conventional arc welding methods intended for welding ordinary and high strength steels. Basic and rutile consumables that give a hydrogen content of maximum 5 ml/100 g should be used. Consumables with a yield strength less than 500 MPa should be used. These consumables reduce the residual stress level in the joint and thus its sensitivity to cold cracking. Preheating can be avoided by using the austenitic stainless steel consumables AWS 307 or AWS 309.

Recommended preheating temperature using heat input of 1.7 kJ/mm and a weld metal hydrogen content of maximum 5 ml/100 g of weld deposit, °C.

Single plate thickness (mm)	Hardox 450	Hardox 400
< 20	Room temperature	Room temperature
20 - 39.9	125	75
40 - 44.9	150	75
45 - 49.9	150	100
50 - 80	150	175
> 80	Out of size range	200

Cutting

All cutting methods can be used: oxy-fuel, plasma, laser, abrasive water jet (AWJ).

Recommendations for oxy-fuel cutting of Hardox 450.
Preheating requirement, °C.

Plate thickness (mm)	Hardox 450	Hardox 400
< 40	No preheating	No preheating
40 – 44.9	100	No preheating
45 – 49.9	100	100
50 – 59.9	150	100
60 – 69.9	150	150
70 – 80	150	150

Reduced cutting speed (mm/min) possible to use without preheating.

Plate thickness (mm)	< 40	40	45	50	60	70	80
Hardox 450	No restrict.	230	200	180	170	160	150
Hardox 400	No restrict.	No restrict.	230	210	200	190	180

Bending

Minimum recommended tool radius (R) and die opening width (W) when the bend line is perpendicular or parallel to the rolling direction.

Thickness (mm)	Perpendicular R / t		Parallel R / t		Perpendicular W / t		Parallel W / t	
	Hardox 450	Hardox 400	Hardox 450	Hardox 400	Hardox 450	Hardox 400	Hardox 450	Hardox 400
t < 8	3.5	2.5	4.0	3.0	10.0	8.5	10.0	10.0
8 ≤ t < 20	4.0	3.0	5.0	4.0	10.0	10.0	12.0	10.0
t ≥ 20	5.0	4.5	6.0	5.0	12.0	12.0	14.0	12.0

The bending force necessary can be calculated by using this formula.

$$P = \frac{1.6 \times b \times t^2 \times R_m}{10000 \times W}$$

W = die opening width (mm)
b = bending length (mm)
t = plate thickness (mm)
R_m = tensile strength (MPa)

The resulting force will be shown in tonnes (1 tonne corresponds to 10kN) with an accuracy of ± 20%.

The tensile strength is higher for Hardox 450, therefore the bending force required increases by approximately 12% of that used when bending a Hardox 400 plate of the same thickness. When upgrading, plate thickness can be reduced by at least 6% if using the Hardox 400 bending force. For example, the force needed when bending 19 mm Hardox 450 is equal to the force needed when bending 20 mm Hardox 400, and bending 5.5 mm Hardox 450 is equal to 6 mm Hardox 400.

Drilling

Drill	HSS-8% Co		Solid cemented carbide		Brazed cemented carbide		Indexable inserts	
	Hardox 450	Hardox 400	Hardox 450	Hardox 400	Hardox 450	Hardox 400	Hardox 450	Hardox 400
Vc [m/min]	7	9	30 – 40	35 – 45	30 – 40	35 – 45	50 – 70	60 – 80
f [mm/rev]	0.05 – 0.30	0.05 – 0.35	0.10 – 0.15	0.10 – 0.15	0.10 – 0.15	0.10 – 0.15	0.06 – 0.14	0.06 – 0.14

Support service

For any further information, please do not hesitate to contact your local SSAB sales representative.

SSAB is a global leader in value added, high strength steel. SSAB offers products developed in close cooperation with its customers to reach a stronger, lighter and more sustainable world.

SSAB employs over 9 200 people in over 45 countries around the world and operates production facilities in Sweden and the US. SSAB is listed on the NASDAQ OMX Nordic Exchange, Stockholm.

For more information, contact us or visit **www.ssab.com**

TS-55-Upgrading from Hardox 400 to Hardox 450-uk-v5-2009

SSAB Oxelösund
SE-613 80 Oxelösund
Sweden

Phone: +46 155-25 40 00
Fax: +46 155-25 40 73
E-mail: contact@ssab.com

www.ssab.com