

HARDOX®

TechSupport

Information from
SSAB Oxelösund.

#26

HARDOX 600 The ultimate wear plate

HARDOX 600 is a wear resistant plate for long wear life and has proved itself extremely successful in reducing maintenance costs as well as for component replacements. *Consult TechSupport no:23 for HARDOX 600 Workshop recommendations.*

Advantages HARDOX 600

What is HARDOX 600

HARDOX 600 is a quenched and tempered martensitic wear plate for extreme abrasion with a typical hardness of 600 Brinell. The HARDOX 600 offers a unique combination of weldability, hardness and toughness and is the only wear plate on the market to reach a hardness of 600 Brinell.

The HARDOX 600 represents a substantial step in the development of four high mill rolled quenched and tempered wear resistant steel plate. Production of HARDOX 600 requires access to an optimal and accurate process control in every step of manufacturing. In contrast to the other HARDOX wear plates the HARDOX 600 is designed only for wear applications and is not intended for structural use.

The HARDOX 600 is delivered in as quenched and tempered condition and should not be used at service temperatures exceeding 250°C.

The HARDOX 600 is today supplied in thicknesses 8 to 50 mm and in 2000 mm width. To optimise the weldability and machining performance two chemical compositions have been selected to cover the present thickness range.

The mechanical properties of HARDOX 600

Hardness (Surface)	570 – 640 HBW
Impact toughness	typical 20J/-40C (longitudinal)
Yield strength	typical 1650 N/mm ²
Tensile strength	typical 2000 N/mm ²
Elongation (A5)	typical 7%



Chemical max composition HARDOX 600

Thickness	C Max	Si Max	Mn Max	P Max	S Max	Cr Max	Ni Max	Mo Max	B ppm	CEV typical	CET typical
8 – 30 mm	0.45	0.70	1.00	0.015	0.010	1.2	2.0	0.80	0.004	0.73	0.55
30.1 – 50 mm	0.47	0.70	1.00	0.015	0.010	1.2	2.0	0.80	0.004	0.84	0.59

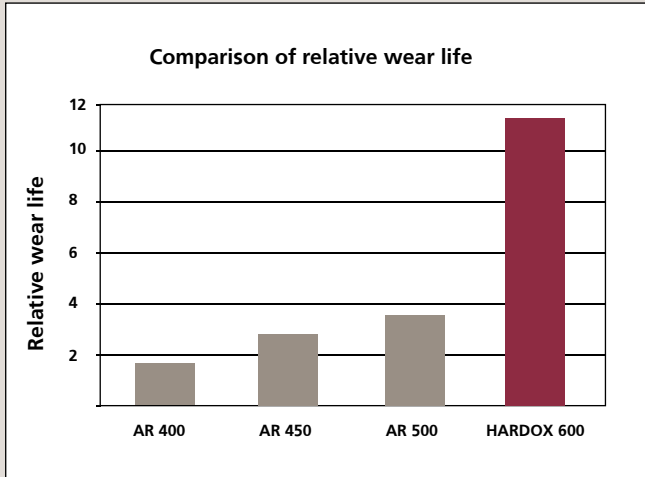
CEV = $C + Mn/5 + [Cr+Mo+V]/5 + [Cu+Ni]/15$
CET = $C + [Mn+Mo]/10 + [Cr+Cu]/20 + Ni/40$

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What can HARDOX 600 replace?

HARDOX 600 the ultimate wear plate

If exposed to sliding wear from very hard abrasives, of about 900 - 1000 Vickers, a substantial increase in wear life can be achieved if using a wear plate of 600 Brinell.



Comparison of relative wear life between AR 400, AR 450, AR 500 and HARDOX 600, in sliding wear from granite (based on WearCalc predictions).

Due to the nature of HARDOX 600 the objective is not only to replace wear plates of less hardness, but also to substitute wear resistant products like hard facing/overlay plates, white iron chromium casting and ceramics.

Below some aspects and consequences are given on white iron chromium castings, overlay plates/hardfacing and ceramics used in application exposed to heavy wear.

White iron chromium castings

The three main types are the Ni-Cr grades (Ni Hards), the Cr-Mo grades and the high Cr-grades. These materials consist of primary precipitated chromium carbides in an austenitic or martensitic matrix.

- The low fracture and impact toughness of the white iron chromium castings increases the crack susceptibility of the wear part produced.
- Due to the composition and carbide fraction, common work shop methods like welding, cutting and machining are hard to perform.
- Castings only permit limited flexibility in component design due to fixed mould sizes, as well as narrow tolerances for reaching optimal fitting.

Hard facing / Overlay wear plate

Overlay plate and hard facing can be divided into a wide range of compositions and hardness levels. Likewise the white iron castings their wear resistance is gained by precipitates of chromium carbides in a martensitic or austenitic matrix.

- Plate distortion and severe cracking is common in some manufactured overlay plate due to the intense heating and cooling during the welding process. This will be detrimental to high impact environments that will cause the overlay to spall and break apart.
- Due to dilution problems associated with welding and thermal spraying of hard facing deposits it is quite common that parts of the hard facing beads will fall off when exposed to heavy abrasion.
- The lack of a smooth surface finish in some wear overlay plates may increase friction and thus cause material hang-up on machinery.

Ceramics

Ceramic materials, such as aluminium and silicon oxides, exhibit exceptional abrasion resistance due to very high hardness (1800 -2000 HV).

- The major draw back of the ceramics in abrasive environments is the low toughness which limits the use to applications exposed only to modest levels of impact.
- Since ceramics are not weldable, alternative and some times more expensive attachment solutions have to be considered.
- Combined with the high material costs it has only been a limited use for ceramic in the heavy abrasive industry.

Due to the limitations and the generally higher material cost, involved in using the materials presented above, the use of HARDOX 600 often provides a suitable and sufficient compromise between steel hardness, impact toughness and fabrication flexibility. Thus the HARDOX 600 wear plate will in many cases turn out to be the most beneficial alternative when considering the wear part manufacturing cost and total cost per service hour.



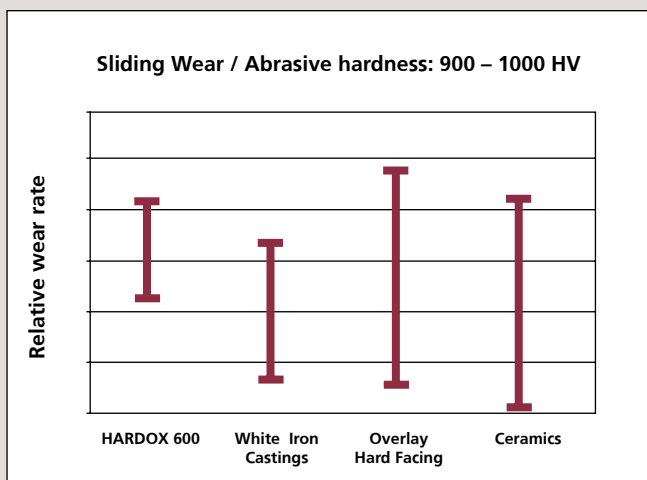
By using cemented carbide tools HARDOX 600 can be machined to complex geometries.

HARDOX 600 wear properties

Functionality of HARDOX 600

The resistance to abrasive wear is not an intrinsic material property, but is dependent on the application. Materials which exhibit superior abrasion resistance under one set of conditions may perform poorly under different circumstances. Material selection is a complex process requiring considerations of wear know-how and practical issues like application design, maintenance routines, work shop requirements, material and fabrication cost.

In the graph below the relative wear life of HARDOX 600 has been compared to different grades of white iron chromium castings, chromium carbide rich hard facing deposits / over lay and ceramics, when exposed to sliding wear from abrasives of hardness 900 -1000 Vickers.



In general HARDOX 600 shows a somewhat inferior wear resistance compared to these types of wear resistant materials. However, during certain conditions HARDOX 600 has shown a wear resistance equal to or better than chromium carbide rich castings and hard facing deposits.

When considering functionality it is not only the wear resistance, in terms of hardness or fraction of hard chromium carbides, that determines the performance of the wear part but the material crack susceptibility. In this case HARDOX 600 offers an impact toughness that exceeds the toughness of white iron castings, ceramics, over lay and hard facing deposits.

HARDOX 600 advantages

Other advantages gained by HARDOX 600 substituting White Chromium castings, Overlay Plates and Hard Facing deposits, are:

- Good availability of steel plates.
- All properties are inherent in the as delivered plate.
- No extra heat treatment.
- Large areas can be protected at a relatively low cost
- Provides uniform and consistent properties within the plate
- Machining, welding and cutting can easily be performed using standard work shop set up.
- Easy and quick manufacturing of spare parts for direct installation and replacement.
- Easy to reach narrow tolerances on fabricated components.
- Provides a unique combination of hardness, yield strength and impact toughness to permit low weight wear parts design.
- Superior impact toughness.

There is no single steel or product type that is the best suited for every wear application, but we are confident that the HARDOX 600 has a strong position in the group of wear resistant materials commonly used in applications exposed to extreme abrasion.

Advantages HARDOX 600

- + High wear resistance
 - + Machinable
 - + Easy access to steel plate
 - + Uniform properties
 - + Weldable
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- = Lower cost per service hour



HARDOX 600 in applications

HARDOX 600 in applications

HARDOX 600 has been successfully used as linings in various applications, i.e. conveyor systems, wear strips, feeders, chutes and concrete mixers. Within the recycling industry HARDOX 600 has been utilized in rotating hammers as well as in shredder knives.

To get the best state of performance it is important that your HARDOX 600 wear part is attached to a rigid support for limiting the flexing. It is also preferable if additional stresses from structural loads can be kept to a low level.

For more information concerning "HARDOX 600 in applications" contact our technical support on www.ssabox.com/techsupport



HARDOX 600 in concrete brick mould, table and compactors.



HARDOX 600 as lining in mineral transporters.

HARDOX 600 – Application gallery



HARDOX 600 as linings in concrete mixer.



HARDOX 600 in log(stone) washing paddles.



HARDOX 600 in hammers for waste fragmentation and recycling.



HARDOX 600 in shredder knives.

HARDOX®

WEAR PLATE

HARDOX wear plate only from SSAB Oxelösund.
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