

HARDOX[®]
WEAR PLATE

THE BEAST



SSAB

PAYLOAD AND SERVICE LIFE

Hardox® wear plate cuts down on weight and extends the service life of steel structures in comparison with regular steel. A lighter truck container made of Hardox® steel means an increased load capacity of 10–20% and even more in some applications. Not only does it reduce the number of trucks on our roads, it also saves fuel and reduces emissions. Whatever the application, Hardox® contributes to a stronger, lighter and more sustainable world. And when the product reaches its final expiration date, 100% of it can be recycled into new strong and energy-saving products.

The extreme wear resistance has always been key to the success of Hardox® wear plate. Today it is harder and tougher than ever, and able to withstand heavy impact without permanent deformation or cracking.

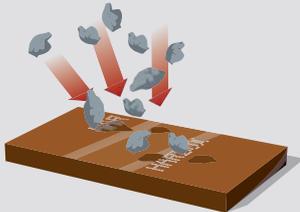
Although primarily intended as a wear plate, the unique combination of hardness and toughness allows it to perform as a load-carrying part in applications such as buckets, dump bodies and containers. With Hardox® steel you can design structures that are wear-resistant, strong and lightweight at the same time.

Hardox® wear plate keeps getting more powerful and versatile. New grades and dimensions are introduced regularly. The traditional Hardox® wear plate has been complemented with tubes and round bars.

If you are a cost-sensitive and performance-oriented steel user, the Hardox® name is all good news! Visit hardox.com for more information about how hard and tough turns into increased payload and longer service life.

HARDNESS AND TOUGHNESS WORKING TOGETHER

Hardness is what gives Hardox® steel its unique wear resistance and structural strength. Hardness minimizes wear since it is difficult for the 'edges' of abrasive material to cut into the material. Hardox® grades deliver high wear resistance during the plate's entire service life. Hardness also means it has excellent yield and tensile strength, properties that keep a structure in shape without being deformed.



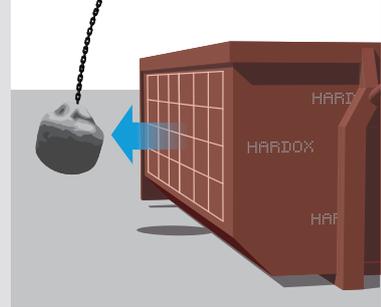
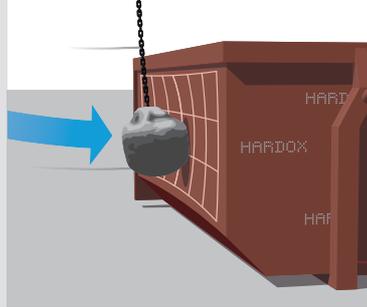
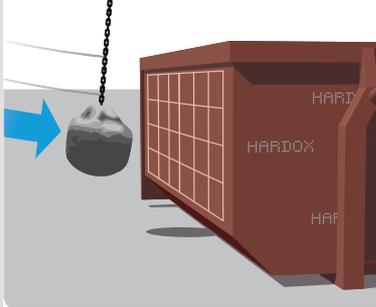
Toughness is the other strong point of Hardox® wear plate. When hardness makes it wear resistant and strong, toughness is what makes it possible to bend, form and weld the material without cracking. If a Hardox® wear plate is stressed beyond its yield point and plastically deformed—on purpose in the workshop or when hit by a heavy rock on site—it will resist cracking and if a localized crack should occur it will resist propagation.



HARDOX® WEAR PLATE AT THE BLINK OF AN EYE

It only takes a fraction of a second to discover the unique performance of Hardox® wear plate. The impact force from large and heavy objects is distributed over the plate, resisting dents and

cracking. The metal absorbs the energy and returns to its original shape in the same way as when a tennis racket hits a ball. That's what impact toughness is all about.



DESIGN AND APPLICATION EXPERTISE

Whatever your application, SSAB will support you in selecting the right Hardox® grade for optimal performance and service life. We are happy to be your material expert partner when developing new and improved applications. Using our WearCalc software you can predict the wear for all types of Hardox® wear plate. Relative service life is calculated based on the wear plate hardness, the wear conditions and the type of abrasive material impacting the surface.

Visit ssab.com/support/calculators-and-tools to access our WearCalc software.

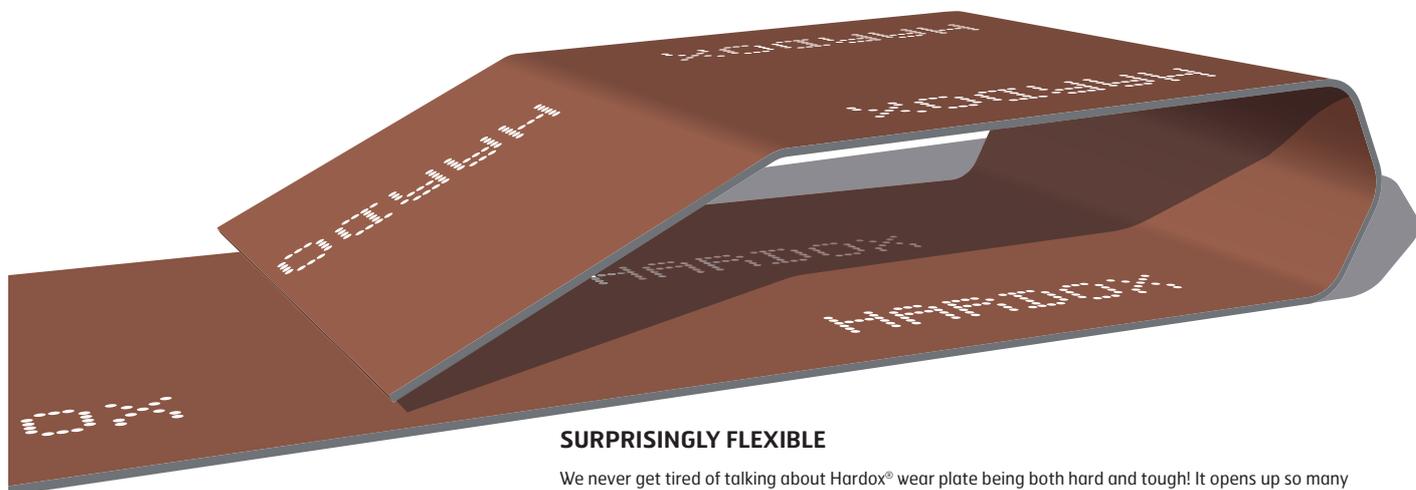
You will gain a lot by thinking about Hardox® as more than a wear plate. If you are wondering why and how, then here is the explanation.

Why? Because the combination of hardness and toughness allows for new innovative ways of designing steel structures and components. Your products will perform better and last longer—giving your business an extra edge. And who doesn't want that.

How? By thinking differently. Which is usually easier said than done. Changing the way steel structures are made involves a new way of thinking for designers, production engineers and sales.

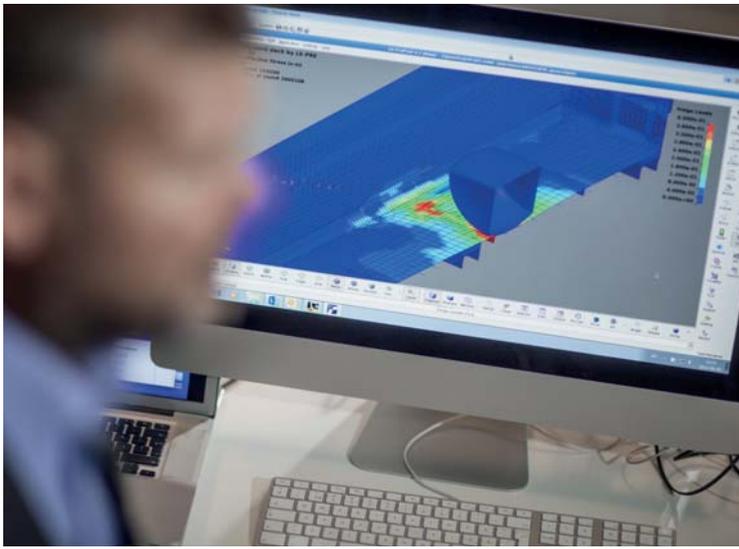
To make change easier, the SSAB Knowledge Service Center and SSAB Tech Support provide support on everything from design and material choice to production techniques and workshop recommendations. Challenge them with your applications and they will be happy to deliver new and improved solutions.

KNOWLEDGE AND SUPPORT FOR YOUR APPLICATIONS



SURPRISINGLY FLEXIBLE

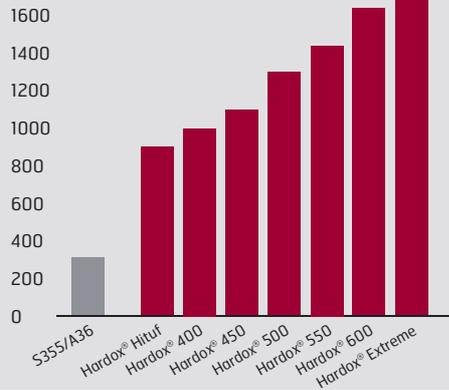
We never get tired of talking about Hardox® wear plate being both hard and tough! It opens up so many possibilities for creative engineers to design wear-resistant, strong and light products that utilize Hardox® wear resistance as well as its potential to perform as a structural steel. Our most popular Hardox® grades even come with a guaranteed toughness value, making them particularly designer-friendly.



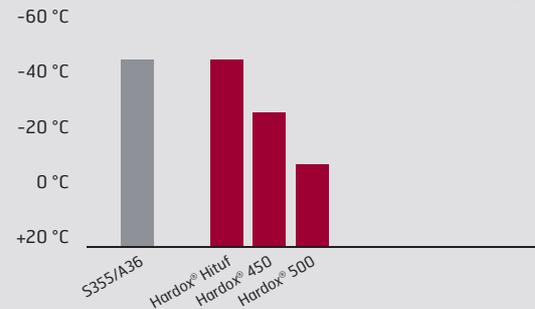
STRENGTH, HARDNESS AND GUARANTEED TOUGHNESS

Yield strength (MPa)

Hardness HBW



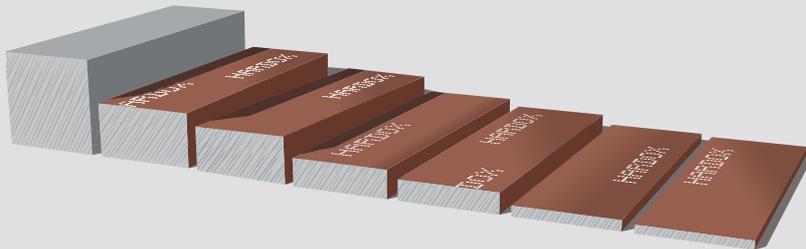
Charpy V approx. min 27 J



The toughness values for Hardox® HiTuf, 450 and 500 are guaranteed minimum values at -40°C, -20°C and 0°C respectively. Compared to a standard S355 steel, Hardox® HiTuf for example has about a three times higher resistance to permanent deformation (hardness) and an equal resistance to cracking (toughness).

FIGHTING WEAR AND WEIGHT

Mild steel	Hardox® 400	Hardox® 450	Hardox® 500	Hardox® 550	Hardox® 600	Hardox® Extreme
S355/A36	38 mm	28 mm	18 mm	14 mm	10 mm	7 mm
80 mm						



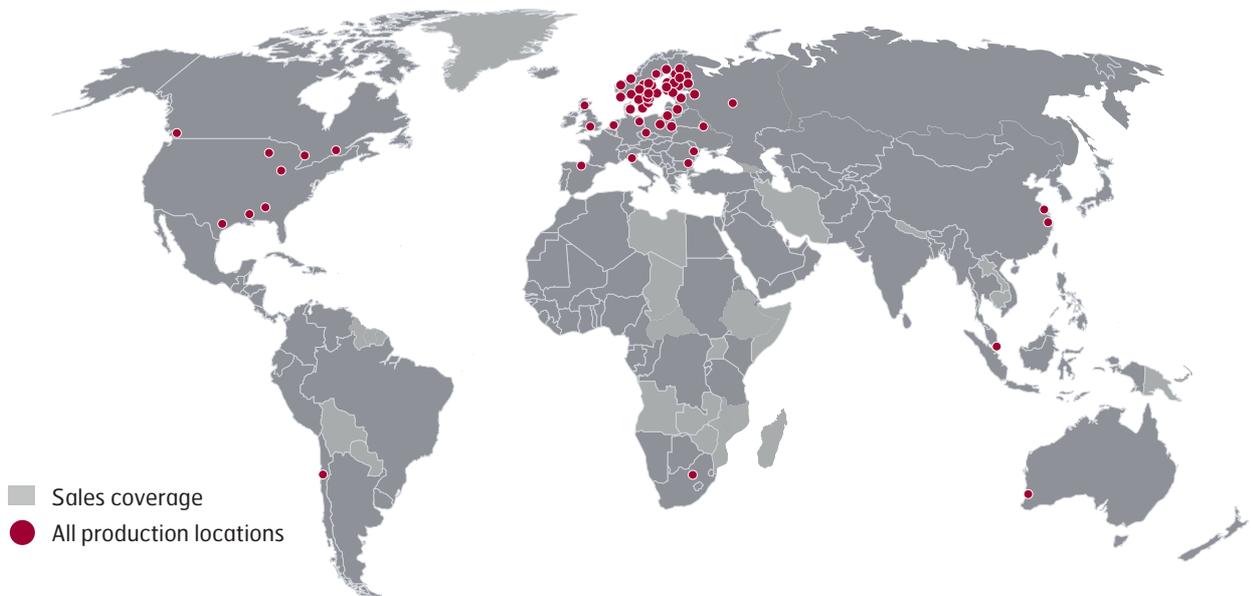
What hardness is right for you? Probably a combination of grades, fighting different wear conditions. A tipper body might have one Hardox® grade in the base and another on the sides in order to provide even service life for the entire body. When calculating relative service life with SSAB's WearCalc software as shown in the illustration, Hardox® Extreme will last more than 10 times longer than mild steel in similar wear conditions.

HARDNESS COMPARISON OF SOME HARDOX® GRADES*

Brinell HBW 10 mm 29.4 kN	Vickers 98 N	Rockwell HRC	Approximate tensile strength MPa	Approximate corresponding grade
400	401	40	1245	Hardox® 400
450	458	44.5	1412	Hardox® 450
500	514	49	1580	Hardox® 500
600	627	55	1940	Hardox® 600

* Tested by SSAB on standard production samples. The data is for guidance only, not as a basis for design and acceptance testing.





AT YOUR SERVICE 24/7

Local availability on a global scale, a fast track supply chain and personal commitment are key factors in our efforts to satisfy our customers.

Quick access to original Hardox® wear plate on your local market means you don't have to make space and tie up capital in an unnecessarily large stock.

The most common Hardox® grades and dimensions can reach you within 48 hours, directly from an SSAB mill or from a local SSAB stock.

Hardox® wear plate has sales and technical support in over 50 countries. Experienced engineers—speaking your local language or English—are on call around the clock, ready to answer your technical questions and take care of any urgent needs. Find your local contact at hardox.com





HIGH VERSATILITY

The variety of dimensions makes Hardox® wear plate suitable for a wide range of designs and products. The outstanding qualities of the flat Hardox® wear plate grades are also available in the form of tubes and round bars. The tubes extend service life when pumping abrasive materials such as wet concrete, soil, gravel and ore slurry. Round bars are the hard-wearing choice in sieve buckets, for example.

All Hardox® products are clearly marked. A unique identification number is stamped on the plates and sheets for traceability. Other data such as dimensions, serial number and heat number are printed before delivery. Knowing your product's unique identity makes workshop processing and quality control so much easier. The identifying marks also come in handy when storing smaller pieces of Hardox® steel for later use.

HARDOX® PLATE AND SHEET					
Hardox® grade	Hardness nominal HBW	Impact toughness CVL typical for 20 mm (¾") J at -40°C (ft-lb at -40°F)	Relative service life interval ¹	CEV/CET typical for 20 mm (¾") ²	Thickness range mm (inches)
Hardox® HiTuf	350	95 (70)		0.55/0.36 ³	40-160 (1.57-6.3)
Hardox® 400	400	45 (33)	1	0.44/0.28	2-130 (0.079 -5.12) ⁴
Hardox® 450	450	50 (37)	1.1-1.7	0.56/0.38	2.5-130 (0.098-5.12) ⁴
				0.39/ 0.31	0.7-2.1 (0.028-0.083) ⁵
Hardox® 500	500	37 (27)	1.3-2.1	0.63/0.41	3-103 (0.118-4.06)
Hardox® 500 Tuf	475-505	45 (33)	1.3-2.1	0.52/0.36	4-25 (0.079-0.985)
Hardox® 550	550	30 (22)	1.5-4.0	0.72/0.48	8-65 (0.315-2.56)
Hardox® 600	600	20 (15)	1.8-8.0	0.76/0.58	6-65, metric only
Hardox® Extreme	650-700	15 (< 11)	2.0-18.0	0.65/0.54	8-19, metric only
Hardox® HiTemp	350-400	60 (44)		0.59/0.40	5-51 (0.197-2)

All plates are produced according to Hardox® wear plate guarantees or better.
 1. Max/min sliding wear by SSAB WearCalc (mild steel 0.2-0.8)
 2. CEV=C+(Mn+6+(Cr+Mo+V)/5+(Cu+Ni)/15; CET=C+(Mn+Mo)10+(Cr+Cu)/20+Ni/40

3. 70 mm (2.76")
 4. Up to 160 mm (6.30") available upon request
 5. Hardox® 450 CR

HARDOX® TUBE				
Hardox® grade	Hardness nominal HBW	Yield strength typical MPa (Ksi)	Diameter external mm (inches)	Wall thickness mm (inches)
Hardox® 400	400	1000-1300 (145-188)	76.1-219.1 (3-8 5/8)	3.0-6.0 (0.118-0.236)
Hardox® 500	500	1200 (> 174)	76.1-133 (3-5.24)	2.0-6.0 (0.079-0.236)

HARDOX® ROUND BAR				
Hardox® grade	Hardness nominal HBW	Impact toughness CVL typical for 20 mm (¾") J at -40°C (Ft-lb at -40°F)	CEV/CET typical for 20 mm (¾")	Bar diameter mm (inches)
Hardox® 400 Bar	400	45 (33)	0.58/0.37	40-70 (1.57-2 ¾)



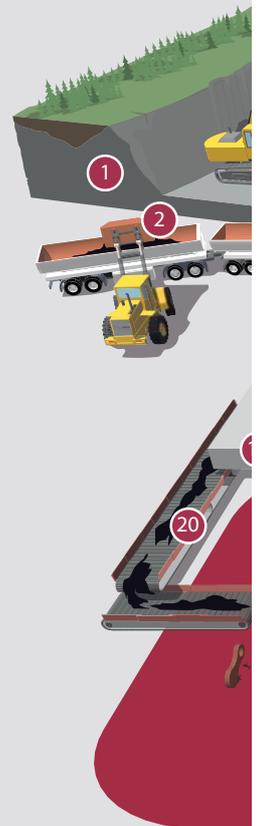
HARDOX



CEMENT PRODUCTION

The cement production process finds use for Hardox® wear plate all the way from the limestone quarry to loading and transporting the final product. The abrasive applications include excavating, crushing, screening and grinding the stone.

1. Open pit
2. Loader and tipper
3. Excavator and dump truck
4. Hopper
5. Conveyor belt
6. Jaw crusher
7. Rubber conveyor belt
8. Crusher screen
9. Cone crusher
10. Chute
11. Conveyor belt
12. Storage bins
13. Elevator buckets
14. Hopper
15. Conveyor belt
16. Raw mill
17. Preheating in cyclones
18. Rotary kiln
19. Clinker cooler
20. Conveyor belt
21. Hammer crusher
22. Hopper
23. Screw conveyor
24. Silos
25. Ball mill
26. Elevator bucket
27. Hopper
28. Silo
29. Transport of finished product
30. Concrete transit mixer
31. Concrete pump truck





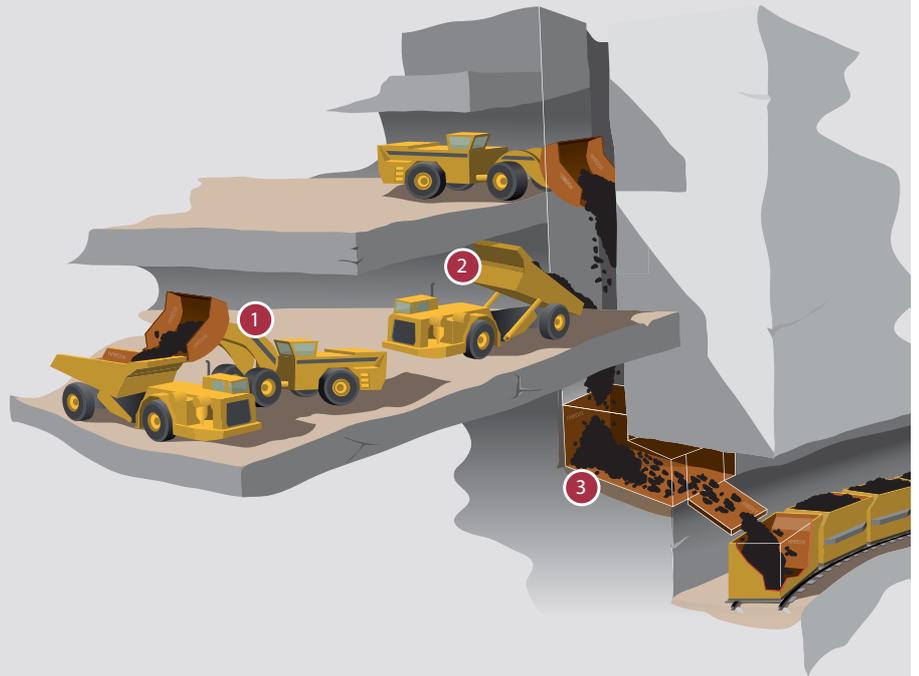
ON SITE



UNDERGROUND MINING

Hardox® wear plate is a reliable and flexible solution for underground mining operations. Its outstanding weldability and workshop-friendly properties make it easy to perform on-site repairs, often inside the mine without having to bring the equipment to the surface. This keeps production up and maintenance costs down.

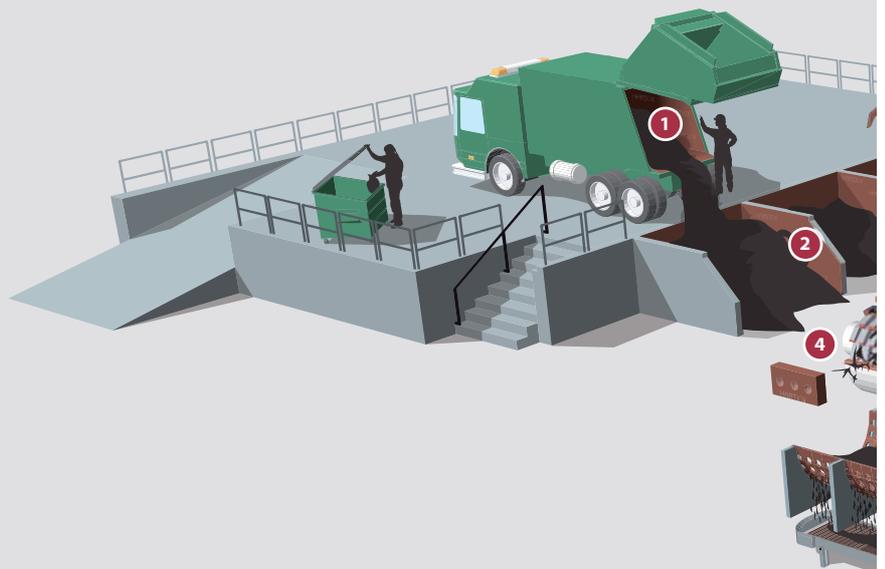
1. Front loader
2. Dump truck
3. Buffer bin
4. Rail road car
5. Discharge site
6. Transfer chute
7. Feeder
8. Screener
9. Crusher
10. Conveyor
11. Measuring bin
12. Skip

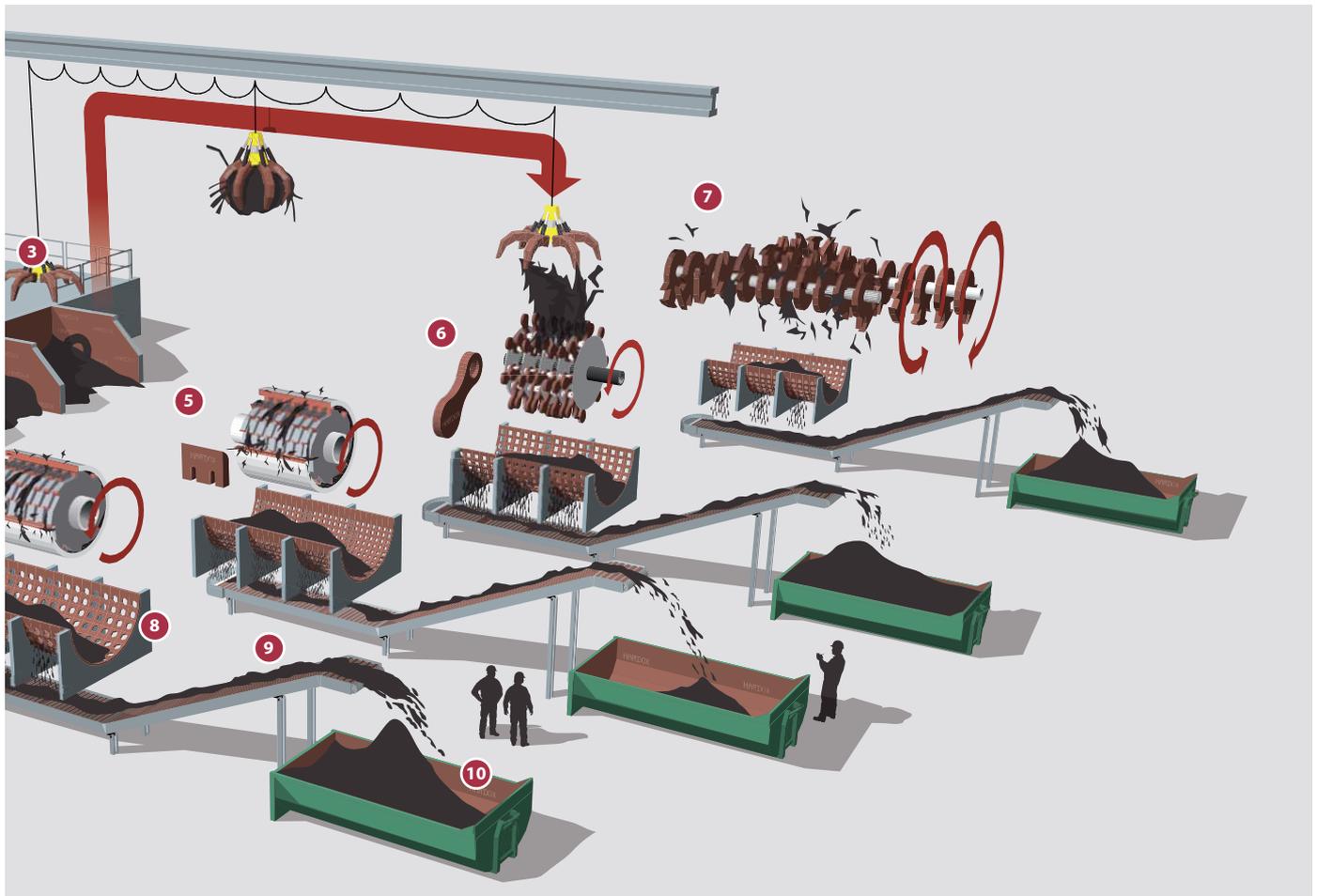
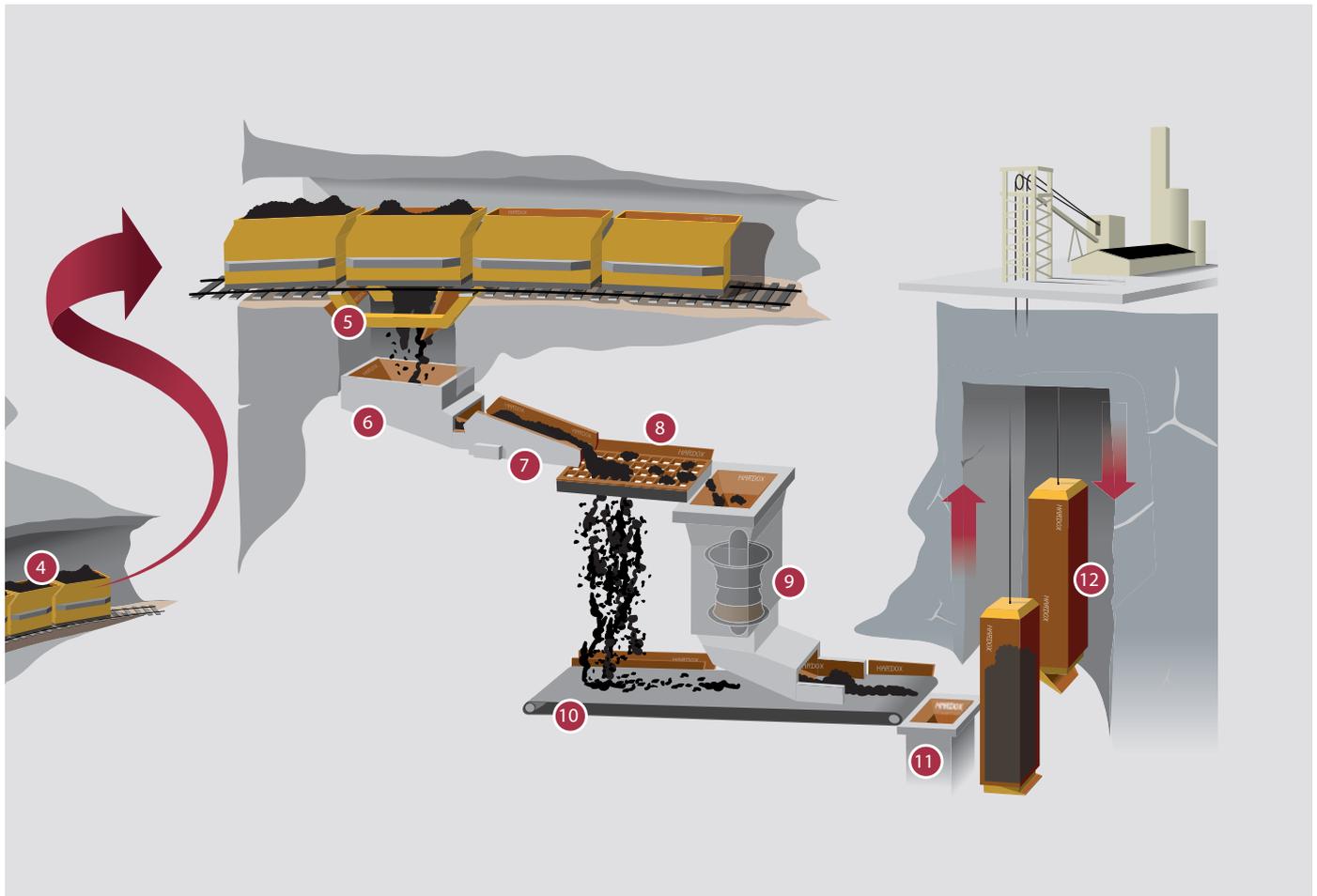


RECYCLING

Recycling processes, such as the fragmentizing of waste, places enormous demands on equipment. In order to stay productive and competitive it is vital to use materials that withstand the abuse. Hardox® wear plate is the solution. Developed specifically for tough demands, Hardox® wear plate allows recyclers and recycling equipment manufacturers to cut costs, improve service life, and optimize production.

1. Garbage truck
2. Liner plates
3. Grapples
4. Prismatic knives
5. Granulator knives
6. Hammer mills
7. Shredders
8. Sieves/screens
9. Conveyor belt
10. Containers





QUARRYING AND OPEN-PIT MINING

Quarrying and open-pit mining operations deliver some of the world's toughest wear challenges. Throughout the whole production flow, Hardox® wear plate's superior wear resistance translates to extended service life between repairs or replacement of parts.

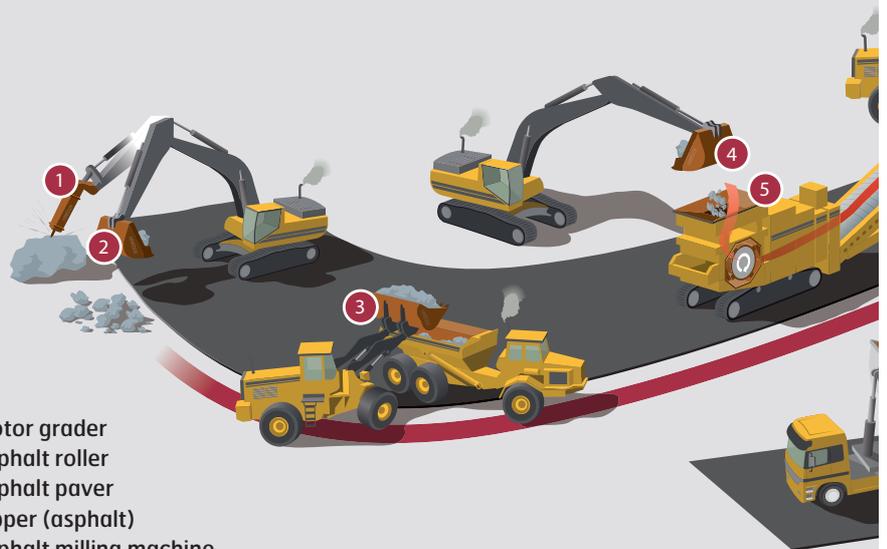
1. Shovel
2. Bulldozer
3. Dump truck
4. Excavator
5. Dump pocket
6. Feeder
7. Screener
8. Jaw crusher
9. Conveyor
10. Transfer chute
11. Hammer crusher
12. Final screening
13. Loader
14. Tipper

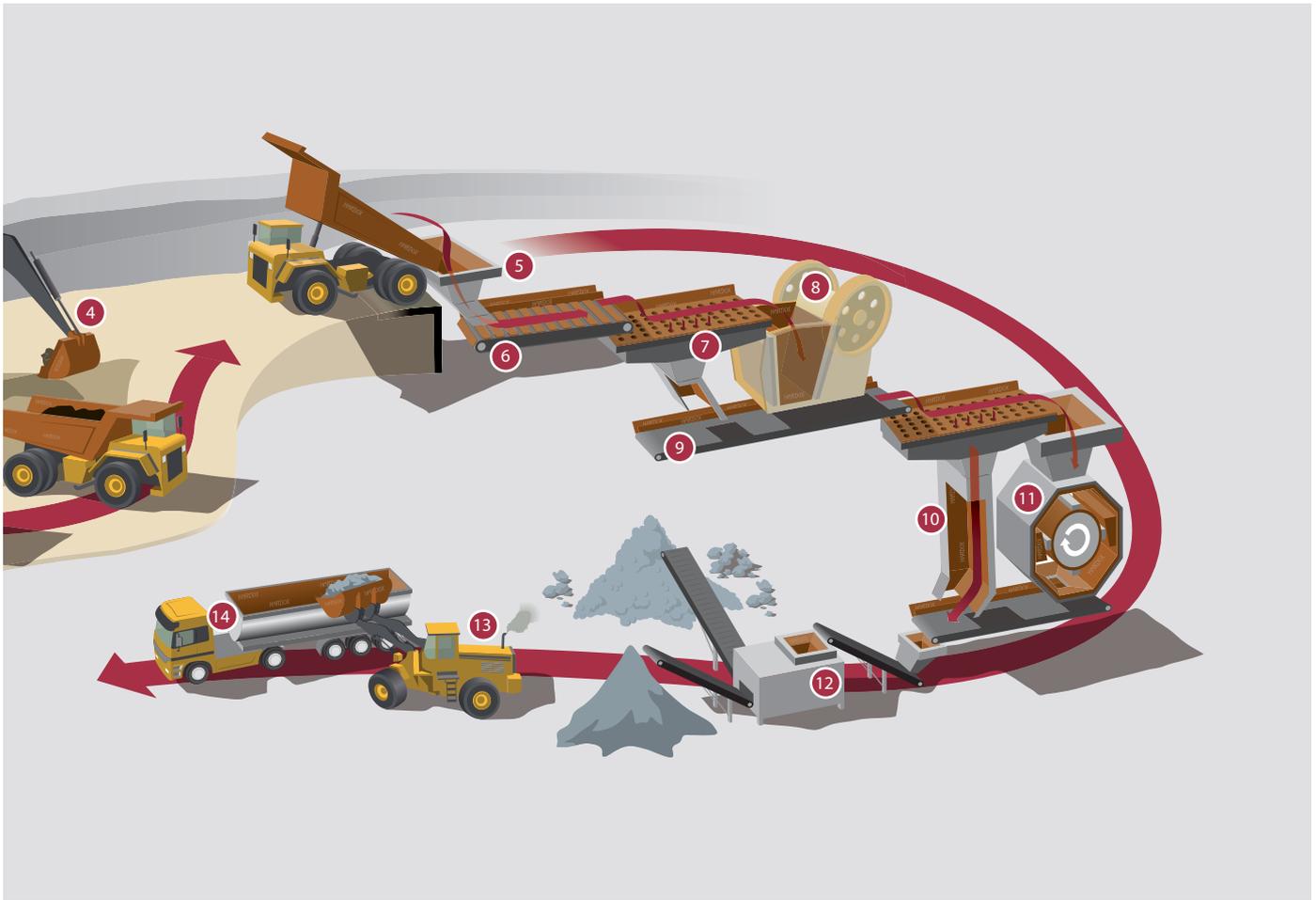


ROAD BUILDING

Road building needs a variety of equipment, from trucks that transport heavy material long distances to machines that withstand extreme wear when breaking ground. The unique properties of Hardox® wear plate take you beyond conventional design thinking. For example, its superior strength allows for thinner steel that lowers overall weight and enables increased payloads.

1. Hydraulic hammer
2. Excavator bucket
3. Bucket
4. Excavator bucket
5. Crusher
6. Bucket
7. Bucket
8. Asphalt plant
9. Tipper (asphalt)
10. Tipper (gravel)
11. Bulldozer
12. Motor grader
13. Asphalt roller
14. Asphalt paver
15. Tipper (asphalt)
16. Asphalt milling machine





MAKING FRIENDS IN THE WORKSHOP

Extreme consistency is a hallmark of Hardox® wear plate from SSAB. Whether you are going to weld, bend or machine the material, you can expect Hardox® to deliver predictable performance. That's a good start for making friends in the workshop.

Using Hardox® wear plate often leads to questions about production processes, workshop methods and material properties.

To ensure your day-to-day operation runs smoothly, you have direct access to our technical support team for advice and troubleshooting in the workshop and on site.

At hardox.com you will find in-depth information about suitable workshop procedures for preheating, welding, cutting, bending and machining Hardox® steel.

TECHNICAL SUPPORT

SSAB customers have quick access to hands-on support and recommendations from local engineers, usually providing assistance in your own language. Our technical support team is backed up by SSAB's worldwide network of sales offices and representatives.

CUTTING EDGE PROPERTIES

FLATNESS

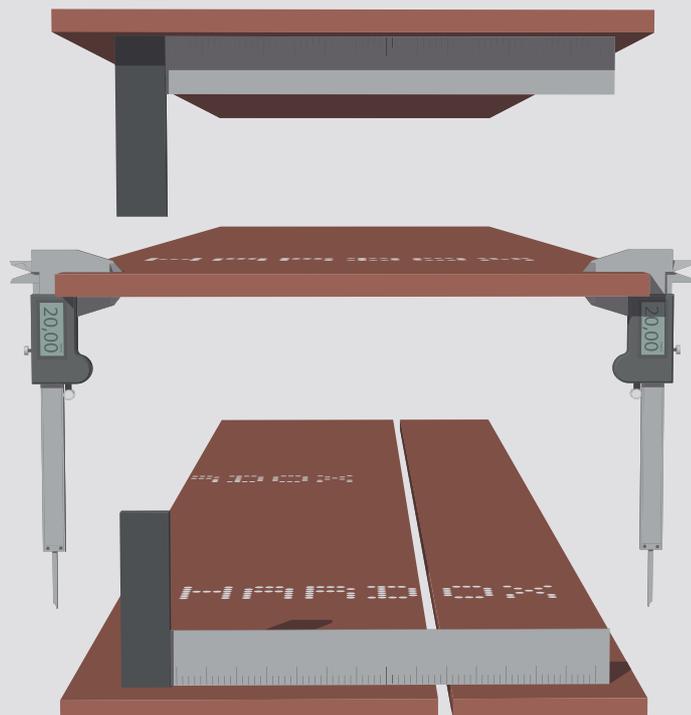
Flatness is good for both production and appearance. Flat plates can easily be welded to each other without problems with the welding gap. And if you are producing equipment with large flat surfaces, they look great when painted or used as 'billboards'.

UNIFORM THICKNESS

The narrow tolerances for thickness guarantees your finished structure will be as light as you expect. And when processing the plate even a fraction of a millimeter counts, since bending force and springback are directly related to the thickness.

INTERNALLY RELAXED

Thanks to careful heat treatment during production, Hardox® wear plate has uniform internal properties. This means that a plate will stay flat when cut into smaller pieces, whether it's cut cold or hot.





MACHINING

Hardox® wear plate is easy to machine. Drilling, countersinking, tapping, turning, and milling is performed with high-speed steel tools.



WELDING

Hardox® wear plate has great weldability to any type of weldable steel. Flatness and narrow thickness tolerances make automatic welding easy, and shorten the time for fit-up and tacking.



BENDING

The uniform properties, close thickness tolerances and smooth surface make Hardox® wear plate well suited to free bending and roll-forming.



CUTTING

Hardox® wear plate is suitable for both hot and cold cutting. Recommended hot methods are oxy-fuel, plasma and laser cutting. For optimal laser-cutting performance you can order Hardox® unpainted and with an enhanced surface finish. When heating is not desired, Hardox® wear plate can be cut cold by water jet, shearing, sawing or grinding.

THE SIGN OF QUALITY

If you want a body that's hard, tough and cost-efficient, it's a good idea to turn to a Hardox In My Body[®] manufacturer. They use Hardox[®] wear plate to make equipment that will weigh less, perform better, last longer, carry more payloads and give better fuel economy.

The combination of hardness and toughness is what makes Hardox[®] an outstanding material. It's extremely resistant to wear, and its structural properties allow it to perform as a load-carrying part in many applications.

Hardox In My Body[®] manufacturers have priority access to SSAB's latest expertise in material technology, applications and manufacturing methods, all of which rapidly translate into better products for you as a customer.



BUCKETS

Hardox[®] wear plate has great structural properties for excavator buckets. The buckets last longer, keep their shape and the wear parts will be easy to change.



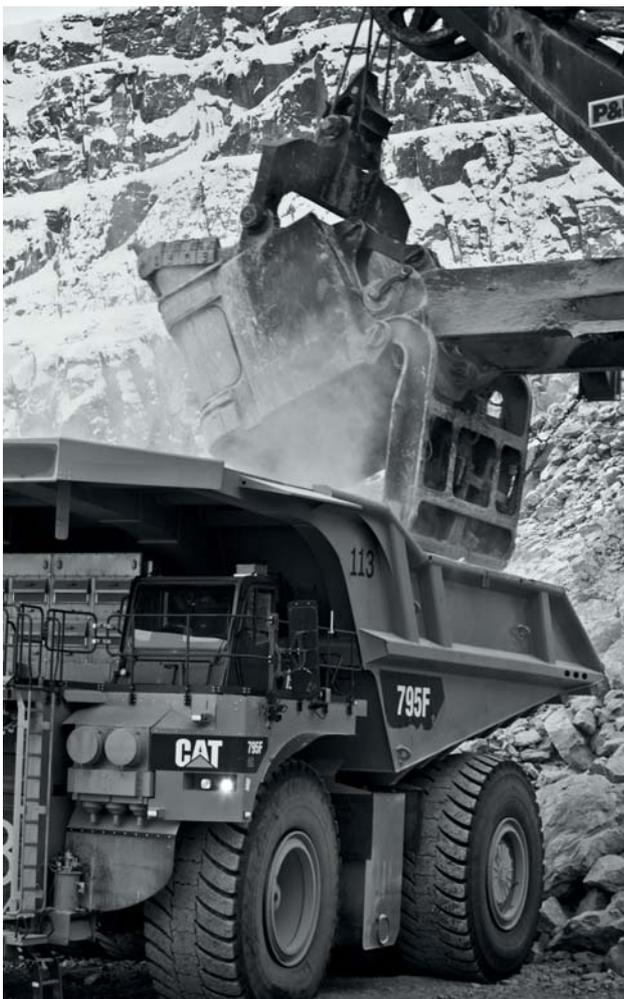
CONTAINERS

Wood chips one day, demolition rubble the next—a container made of Hardox[®] steel handles the toughest of loads and still returns in good shape at the end of the day.

HARDOX®

IN MY BODY

Hardox In My Body® is a trademark sign used only on products from manufacturers certified by SSAB. It's a guarantee that the manufacturer has extensive knowledge of the design and manufacturing of steel products and that the product carrying the sign is made with genuine Hardox® wear plate. hardoxinmybody.com



TIPPER BODIES

Hardox® steel is perfect for designing low-weight and wear-resistant equipment for quarrying, mining and other applications involving the moving of rocks and earth.



TRUCK BODIES

Hardox® steel allows for a design with a minimum of reinforcing beams. Lower air resistance and more load-carrying capacity give better transport economy.

HARDOX WEARPARTS, YOUR ONE STOP WEAR SHOP



What do we mean by calling it a *one stop wear shop*? Simply that Hardox Wearparts® is the place to go for all your wear-related needs.

Hardox Wearparts® is a worldwide supplier of wear solutions. Today there are more than 300 centers in over 75 countries. Companies around the world depend on Hardox Wearparts® to keep their operations running smoothly, without costly disturbances or downtime.

You can order new wear parts made of Hardox® wear plate based on your drawings and instructions. You can also select from a wide range of other replacement parts for your equipment. And you have access to tried-and-tested services for cost-saving pro-active maintenance and repair strategies.

THE MASTERS OF UPTIME

A Hardox Wearparts® shop has access to engineers at SSAB for the latest methods and processes in making wear parts that perform better and last longer.
hardoxwearparts.com



HARDOX[®]

WEAR PLATE

SSAB is a Nordic and US-based steel company. SSAB offers value added products and services developed in close cooperation with its customers to create a stronger, lighter and more sustainable world. SSAB has employees in over 50 countries. SSAB has production facilities in Sweden, Finland and the US. SSAB is listed on Nasdaq Stockholm and has a secondary listing on Nasdaq Helsinki. www.ssab.com.

154-en-Hardox[®] wear plate-The Beast-VI-2017-AplusM-Osterbergs Tryckeri

SSAB
SE-613 80 Oxelösund
Sweden

T +46 155 25 40 00
F +46 155 25 40 73
contact@ssab.com

www.hardox.com

Hardox[®] is a trademark of the SSAB group of companies. All rights reserved. The information contained in this brochure is provided only as general information. SSAB AB accepts no responsibility for the suitability or appropriateness for any specific application. As such, the user is responsible for any and all necessary adaptations and/or modifications required for specific applications.

SSAB