

XAR[®] wear-resistant steels

Solution to your wear problems

ThyssenKrupp Steel Europe
Thinking the future of steel



XAR® steels – ThyssenKrupp Steel Europe's solution to your wear problems

ThyssenKrupp
high hard

XAR®

XAR® (eXtra Abrasion Resistant) steels are ThyssenKrupp Steel Europe's solution for applications where problems and cost increases are the results of wear and abrasion. Thanks to the high level of hardness achieved through the special chemical composition of the XAR® steels and their quenching and tempering heat treatment, abrasion can be minimized and product service life extended. XAR® steels were developed in the Heavy Plate Unit of ThyssenKrupp Steel Europe, one of the world's leading producers of flat steel products. The first XAR® plates were produced more than 40 years ago in Duisburg. Since then, remarkable developments have been made with grades now available in plate thicknesses ranging from 4 to 100 mm, tailored for all applications, e.g. in mining technology, earth moving equipment, steel mills, cement works and agricultural machinery.

Different XAR® grades for different applications

The standard wear-resistant steel grade is XAR® 400, which can increase product service life to five times that of conventional structural steel. XAR® 400 combines high wear resistance with good cold formability and weldability. It is the most frequently used wear-resistant steel worldwide for many different applications. A heat-resistant XAR® 400 W variant is also available where hardness and wear resistance at higher temperatures up to 400°C are required, for instance in cement works.

Some applications are only subject to low or moderate wear. XAR® 300 was developed for these applications. This steel is produced via normalizing rolling without any heat treatment and therefore has a very good price/performance ratio, combined with excellent surface quality.

XAR® 450 is the best choice where requirements call for higher wear resistance combined with virtually the same processing characteristics as the standard XAR® 400 grade. XAR® 450 is expected to increasingly replace the standard XAR® 400 steel grade in the future.

XAR® 500 steel, which is formable and weldable, is available for even higher abrasive wear. For extreme abrasive wear applications (without impulsive load) ThyssenKrupp Steel Europe offers its XAR® 600 grade. Due to its exceptional hardness, cold-forming of this steel is not recommended.

For applications placing increased toughness requirements on the wear plate, XAR® HT is the right choice with its combination of wear resistance and extremely high notch impact strength.



Wear-resistant XAR® steels for different applications



Balanced alloying concepts for simple processing and wear resistance

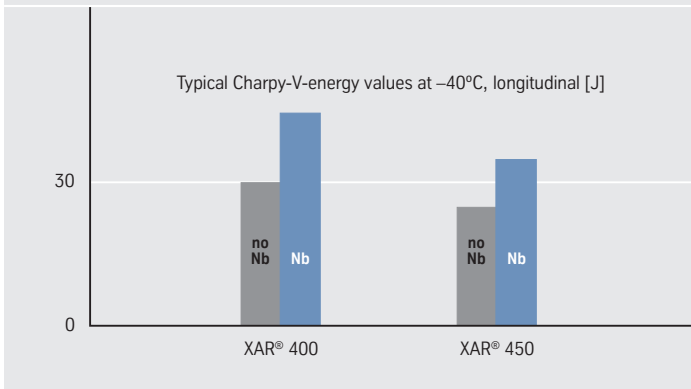
The recently published expert opinion of the Institute of Tribology at the Mannheim University of Applied Sciences confirms that “within the range of low-alloyed, wear-resistant special structural steels with good processing characteristics, ThyssenKrupp Steel Europe’s XAR® steels with hardness values from 300 to 600 HB represent an optimum concept with regard to steel composition, manufacturing process and microstructure”. Extensive wear investigations carried out on our XAR® steels have shown that optimum abrasion resistance is achieved through their high hardness and in particular the specific alloying with Cr and Nb. Toughness and cold-forming behavior as well as resistance to impact wear are increased through the Nb-microalloying. Cr-alloying improves wear resistance, especially in aggressively corrosive media.

The lean analysis concepts and low carbon equivalent of our XAR® steels make cutting and welding easier and provide better cold forming properties with tight bending radii. For instance MAG welding without preheating is possible up to a thickness of 20 mm (40 mm combined thickness) for XAR® 400 plates and up to 15 mm (30 mm combined thickness) for XAR® 450 plates. 10 mm thick XAR® 400 plates can be bent with radii as small as $r/t \geq 4.0$ (10 mm thick XAR® 450 plates with $r/t \geq 5.0$).

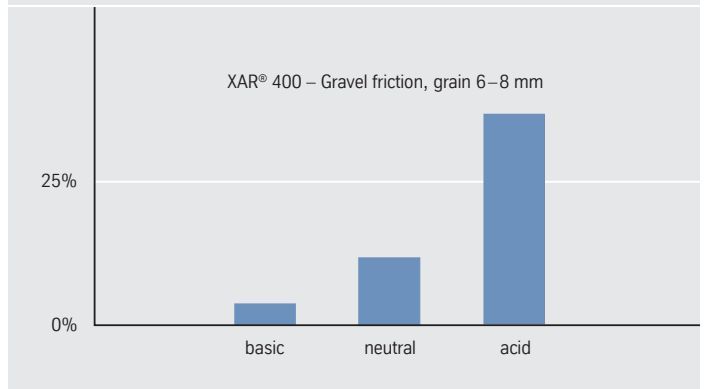
Hardness and chemical composition				
Steel grade	Delivery condition	Thickness range [mm]	Hardness [HBW]	Alloying
XAR® 300	normalized	4 – 50	$\geq 270^*$	~ 0.20% C**, Cr(Mo)-alloyed
XAR® HT	quenched (+ tempered)	40 – 100	310 – 370	~ 0.25% C**, CrMo(Ni)-alloyed
XAR® 400		4 – 100	370 – 430	~ 0.15% C**, Cr(Mo)-alloyed
XAR® 400 PREMIUM		40 – 100	370 – 430	~ 0.16% C**, CrNiMo-alloyed
XAR® 400 W		4 – 40	360 – 440	~ 0.25% C**, Cr(Mo)-alloyed
XAR® 450		4 – 100	420 – 480	~ 0.19% C**, Cr(Mo)-alloyed
XAR® 450 PREMIUM		40 – 100	420 – 480	~ 0.21% C**, CrNiMo-alloyed
XAR® 500		4 – 100	470 – 530	~ 0.25% C**, CrMo(Ni)-alloyed
XAR® 500 PREMIUM		40 – 100	470 – 530	~ 0.26% C**, CrNiMo-alloyed
XAR® 600		4 – 50	> 550	~ 0.35% C**, CrNiMo-alloyed

* plate thickness ≤ 20 mm ** plate thickness 15 mm

Toughness improvement by Nb-microalloying



Improvement of wear resistance with 1% Cr



Hot strip plates for weight optimized structures

Weight plays an important role in many structures. Therefore, restricted thickness tolerances are often required. ThyssenKrupp Steel Europe can produce XAR® steels via two different routes. Hot strip mill production offers the advantage of very close thickness tolerances of ± 0.2 mm which are lower than the usual thickness tolerances of four-high mill plates and also lower than the tolerances usually required by customers. In addition to weight-saving potential, the

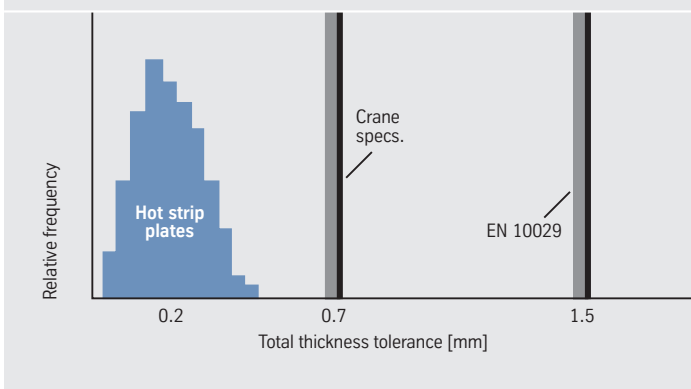
extremely uniform plate thickness of XAR® plates cut from hot strip also offers advantages with regard to cold forming.

Modern shot blasting and priming line offers high surface quality

Plates are delivered shot blasted and primed to meet the highest surface quality requirements. Shot blasting and priming is carried out on a modern line at ThyssenKrupp Steel Europe. A low-zinc silicate primer is usually

applied with an even coat 12–18 μ m thick. Investigations have shown that plates with this primer can be cut by laser without any problems. The inorganic content means that the primer can be welded over, making removal of the primer before welding generally unnecessary.

Statistical thickness tolerance distribution for hot strip plates



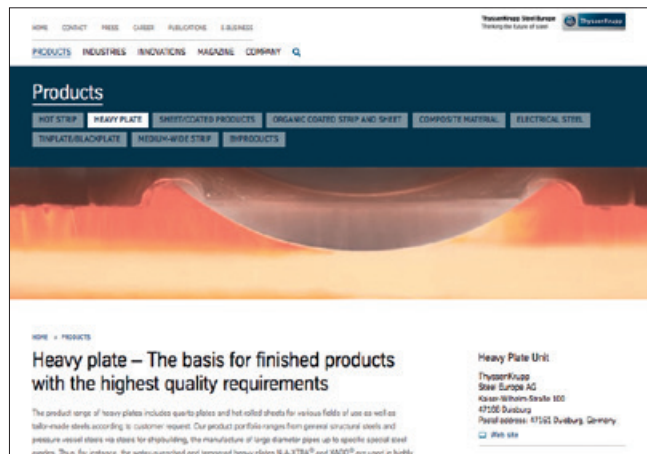
ThyssenKrupp Steel Europe – more than just a plate supplier

ThyssenKrupp Steel Europe is more than a reliable plate supplier. The expansion of the worldwide distribution network is aimed not just to guarantee the availability and just-in-time delivery of XAR® steels to customers. The close cooperation with first-class steel service centers also makes it possible to offer components which are prefabricated by means of cutting, cold forming or welding. In this way ThyssenKrupp Steel Europe meets the steadily growing demands of its customers for quality, service and delivery performance.

The online world of ThyssenKrupp Steel Europe's special structural steels

Optimized processing and application of XAR® steels require a close cooperation between supplier and customer. A comprehensive technical customer service has therefore been established to provide support in terms of all material processing and design questions.

Visit our website at www.thyssenkrupp-steel-europe.com/plate for further infor-



mation about our special structural steels, including data sheets and processing recommendations. In addition, you can find your personal sales or technical customer service contact. ProWeld, a computer software developed by ThyssenKrupp Steel Europe for calculating welding parameters, can also be ordered via our internet homepage.

General note

All statements as to the properties or utilization of the materials and products mentioned in this brochure are for the purpose of description only. Guarantees in respect of the existence of certain properties or utilization of the material mentioned are only valid if agreed upon in writing.

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