Wear-resistant special structural steel Heavy plate	Steel grade	Material number	Material specification
	XAR 500	**1.8734**	704 February 2001

Scope

Application

The steel may be used at the discretion of the purchaser for wear-exposed structures, e.g. excavating, mining and earth-moving machinery, truck dump bodies, conveying, crushing and pulverizing equipment, scrap presses and paving moulds.

The processing and application techniques as a whole are of fundamental importance for the successful use of the products fabricated of this steel. The processor/fabricator must assure himself, that his design and work methods are appropriate for the material, are state-of-the-art and are suitable for the envisaged purpose.

The selection of the material is left up to the purchaser.

Chemical composition (heat analysis, %)

C	Si	Mn	P	S	Cr	Mo	B
≤ 0.28	≤ 0.80	≤ 1.50	≤ 0.025	≤ 0.010	≤ 1.00	≤ 0.50	≤ 0.005

The steel has a fine-grained microstructure. Nitrogen is absorbed to form nitrides by means of Al and, where applicable, Ti. The steel may contain up to 1,5 % Ni.

Delivery condition : quenched or quenched and tempered (see paragraph "Heat treatment").

Hardness at room temperature in the delivery condition: 450 - 530 HB

The Brinell hardness shall be determined in accordance with ISO 6506.

Properties typical of 15 mm plate thickness

Carbon equivalent CET (%)	[CET = C + (Mn + Mo) /10 + (Cr +Cu) /20 + Ni/40]	: 0.41
Carbon equivalent CE (%)	[CE = C + Mn/6 +(Cr + Mo + V) /5 + (Ni + Cu) /15]	: 0.62
Yield strength (MPa) *)		: 1300
Tensile strength (MPa)		: 1600
Elongation at fracture A (%)		: 9
Notch-bar impact energy at -20 °C on Charpy V-longitudinal test specimens (J)		: 25

*) 1 MPa = 1 N/mm^2

Number of tests

Unless otherwise agreed upon in the order, the Brinell hardness shall be determined from each heat. The hardness shall be measured roughly 1 mm below the surface.

General processing information

Prior to any processing, it is advisable to make use of the information available from the steel producer in order to draw on that experience for the processing. The following information can deal with only a few essential points. The recommendations given in STAHL-EISEN-Werkstoffblatt 088 (Weldable fine-grained structural steels, guidelines for processing, in particular for welding) correspondingly apply to this steel as well.

Recommendations for welding are also given in EN 1011 part 1 and part 2 - Welding, Recommendation for welding of metallic materials -.

It is left to the discretion of the processor/fabricator to decide which of the familiar precautions must be adopted to avoid cracking during thermal cutting and welding under the prevailing construction and fabrication conditions.

Cold forming

The products made of this steel are suitable for cold bending provided, that consideration is given to the high hardness. The formability of steel decreases with increasing hardness. This has to be kept in mind when forming. The forming must take place at a slow and steady rate, the cut edges must be deburred and the plates heated, if necessary, prior to the forming. A final stress-relieving is not necessary for this steel.

Machinability

In spite of its high wear resistance, the steel exhibits good machinability if sufficiently heavy machine-tools and sharp carbide-tipped tools are used. The feed rate and cutting speed have to be adjusted to the high hardness of the material.

Heat treatment

Plates of the XAR 500 grade receive the required properties as a result of austenitizing and follow-on quenching in special facilities and, where applicable, tempering below A_{c1}. Direct quenching after hot-rolling is considered equivalent to conventional quenching. The heat treatment depends on the chemical composition and the product thickness. To avoid hardness losses, the steel must not be heated above 250 °C.

Thermal cutting

Preferably the flame-cutting process is used. For small product thicknesses, however, the plasma cutting process is used in the interest of minimum distortion.
Preheating is not normally necessary when flame-cutting thicknesses up to around 10 mm. However, if the workpiece temperature is below +5 °C, or the cut edges are to be cold-formed in the course of further processing, preheating to about 150 °C should be considered in the interest of cold cracking resistance.

Welding

If due consideration is given to the general rules for welding, this steel is weldable both manually and automatically. To prevent cold cracking in the welded joints only welding consumables giving welds of very low hydrogen content should be used.

Preheating is not generally necessary for welding with austenitic filler metals.

When using ferritic consumables preheating should be considered depending on the plate thickness according to SEW 088.

The preheat temperature level for welding depends on the plate thickness and the residual stress state of the structure. The working temperature should not go beyond 250 °C.

The wear resistance of components fabricated of XAR 500 may be increased with the aid of wear resistant layers deposited by means of welding or metal spraying.

General information

Unless otherwise agreed upon in the order, the delivery will be governed by the conditions outlined in EN 10021.

The admissible tolerances are based on EN 10051 for plates cut from hot strip and EN 10029 for four-high mill plates, unless other terms have been agreed upon.

The plates will be supplied with a maximum flatness tolerance according to EN 10029, table 4, steel type H.
Smaller flatness tolerances can be agreed upon at the time of ordering.

For surface quality requirements EN 10163 is applicable.

As per special agreement it is possible to supply plates descaled or descaled and primed.

Publisher`s addresses

DIN EN-Normen, ISO-Normen	Beuth Verlag GmbH, Postfach, D-10772 Berlin
STAHL-EISEN-Werkstoffblätter	Verlag Stahleisen mbH, Postfach 10 51 64, D-40042 Düsseldorf
TKS brochure „Processing of Wear-Resistant Special Structural Steels“	Thyssen Krupp Stahl AG , D-47161 Duisburg