

BERINGER MATERIAL SCIENCE

Dear customer!

The great variety of steel grades and brands often creates confusion when it comes to choose a suitable container. Therefore we would like to give our customers a short overview of different steel grades, labeling and material properties.



General Definitions

▶ Yield stress

the yield stress indicates the tension until the material doesn't show any persistent distortions.

Labeling R_{eH} unit: N/mm² or MPa

▶ Tensile strength

represents the tension when material is cracking.

Labeling R_m unit: N/mm² or MPa

▶ Hardness

in general hardness is the mechanical resistance of material against ingression of a block. Hardness is measured by pressing a reference block into the steel and the persistent pit is evaluated. A common method for measuring hardness is the „Brinell Method“. The unit is HBW (W stands for tungsten carbide, because the material is tested with a bullet made of tungsten carbide).



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High-grade steel

▶ Application

high-grade steel is used for construction of products and product parts which are made for regular use e.g. skips and bins.

▶ Labeling

e. g.

S 235 JR + N

S 355 MC

(acc. to EN 10025-2)

(acc. to EN 10149-2)

meanings

Steel:

S

S

min. yield stress:

235 N/mm²

355 N/mm²

impact strength:

JR: ambient temperature (- 20° C)

heat treatment:

N: normalized

M: rolled thermo-mechanically

cold workability:

-

C

▶ Our labeling

we label high-grade steel according to EN 10025-2 or EN 10149-2 without further information about impact strength or other mechanical properties.



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High tensile steel

High tensile steel is steel with a minimum yield stress higher than 355 N/mm^2 .

Due to manufacturing methods, high tensile steel has a high mechanical load capacity and its material usage can be reduced in comparison to high-grade steel at same load capacity..

▶ **Application**

we use high tensile steel for products and product parts which are made for heavy duty use. E. g. top edge profiles and Ro-Ro containers for transport of heavy goods as well as light variation Ro-Ro containers.

▶ **Labeling**

currently it is common to label high tensile steel with a brand name and its yield stress.

e. g. DOMEX[®] 460 MC is a brand name of SSAB. The high tensile steel has a min. yield stress of 460 N/mm^2 . M means „rolled thermo-mechanically“, C means „special cold workability“

The labeling for DOMEX[®] 460 MC according to EN 10149-2 is S 460 MC.

(former: QStE[™] 460).

▶ **Our labeling:**

we label high tensile steel according to EN 10149-2.

High tensile steel

Product advantages achieved by using high tensile steel:

Container weight can be reduced by keeping equal load capacity – due to higher yield stress of high tensile steel.

The weight reduction achieved by using high tensile steel can be calculated by the following formula:

$$h = b \sqrt{\frac{Stb}{St_h}}$$

h = thickness high tensile steel
b = thickness high-grade steel
Stb = yield stress high-grade steel
St_h = yield stress high tensile steel

How much of material thickness can be reduced by using S 460 MC instead of S 235 JR (5mm)?

$$h = 5 \text{ mm} \sqrt{\frac{235 \text{ N/mm}^2}{460 \text{ N/mm}^2}} \Rightarrow h = 3,5 \text{ mm}$$

By using S 460 MC instead of S 235 (5 mm) the thickness of steel plates can be reduced by 1,5 mm to a S 460 MC (3,5 mm) at equal load capacity.



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Wear-resistant steel

wear-resistant is steel with special wear properties due to its hardness. This extreme hardness resulting of high yield stress and tensile strength leads to high elastic recovery characteristics.

▶ Application

we use wear-resistant steel for products and product parts which are made for extreme heavy duty use. E.g. bottom sections of headers and Ro-Ro containers for extreme heavy duty use (e.g. for transport of scrap or demolition waste).

▶ Labeling

currently it is common to label wear-resistant steel with a brand name and the HBW data.

e.g.

HARDOX® 450 is a trademark of SSAB.

The plates have a hardness of 450 HBW.

(there is no official labeling for wear-resistant steel)

▶ Our labeling

in order to avoid brand names we label wear-resistant steel with:

„wear-resistant steel“ and its hardness..

e. g. HARDOX® 450 = wear-resistant steel 450 HBW

Wear-resistant steel

Product advantages achieved by using wear-resistant steel

- ▶ Less buckling, because impact loads are absorbed by material.
- ▶ Empty weight of product can be reduced at equal load capacity, due to high yield stress of material.
- ▶ Easy refurbishment of products possible because of good processing characteristics of wear-resistant steel.
- ▶ Long life-time cycles due to wear resistance of steel.

Overview – selected steel grades and branded materials

Material	Yield stress [N/mm ²]	Tensile strength [N/mm ²]	Hardness [HBW]
S 235 JR	235	360 - 510	approx. 130
S 355 MC	355	430 - 550	approx. 150
DOMEX [®] 460 MC ¹⁾	460	520 - 670	approx. 180
DOMEX [®] 700 MC ¹⁾	700	750 - 950	approx. 250
HARDOX [®] 450 ²⁾	1200	1400	450
RAEX [®] 450 ³⁾	1200	1450	450
XAR [®] 450 ⁴⁾	1200	1400	450
Brinar [®] 450 ⁵⁾	1200	1500	450

1) DOMEX[®] is a brand name of SSAB.

2) HARDOX[®] is a brand name of SSAB.

3) RAEX[®] 450 is a brand name of Rautaruukki Oyj. RTRKS.

4) XAR[®] 450 is a brand name of Thyssen- Krupp Steel Europe.

5) Brinar[®] 450 is a brand name of Ilseburger Grobblech GmbH.