

PERFORM[®] steels for
cold forming
When strength and formability
are needed

ThyssenKrupp Steel Europe
Thinking the future of steel



ThyssenKrupp

PERFORM[®] – high strength, outstanding cold formability

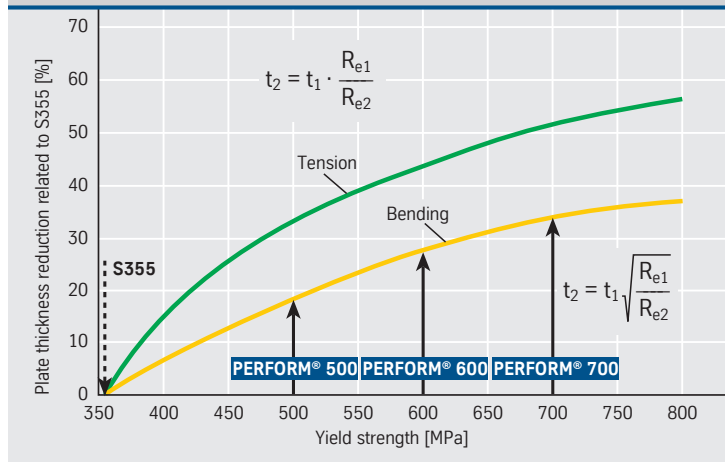
ThyssenKrupp high form **PERFORM[®]**

ThyssenKrupp high form **PERFORM-LC[®]**

Truck manufacture requires high-strength steels capable of reducing gross vehicle weight to allow greater payloads. At the same time, these steels have to be easy to weld and cold-form, for example for the production of truck substructures or the booms of truck mounted cranes.

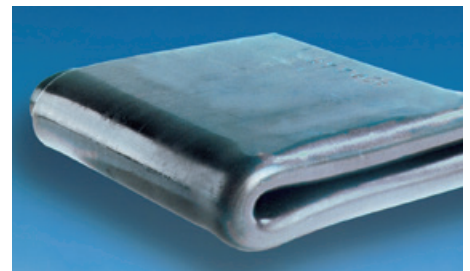
Developed more than 30 years ago by ThyssenKrupp Steel Europe, PAS steels (low-pearlite special structural steels), from now on offered under the brand name PERFORM[®], meet these requirements in full. PERFORM[®] steels contain low amounts of carbon and microalloying elements, resulting in outstanding weldability. They also offer very high cleanliness, achieved by means of ladle metallurgy in the steel melting shop, and an extremely fine-grained microstructure, developed by thermomechanical rolling. From these factors result the excellent ductility and cold formability of PERFORM[®] steels.

Plate thickness reduction related to S355 due to use of high-strength special structural steels for cold forming



PERFORM[®] – a wide spectrum of grades for different applications

PERFORM[®] steels are usually produced via the hot strip mill route as cut-to-length plates with minimum yield strength levels from 315 to 700 MPa. Their chemical composition is characterized by a low carbon content (max. 0.12 %), microalloying with niobium, vanadium and/or titanium, and particularly low levels of phosphorus and sulfur.



Chemical Composition (heat analysis, %)

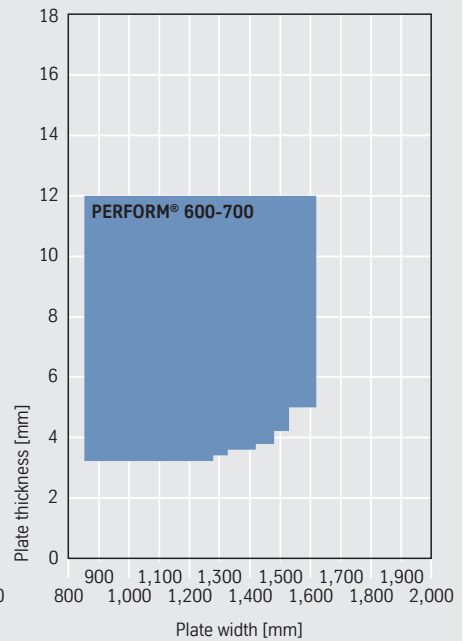
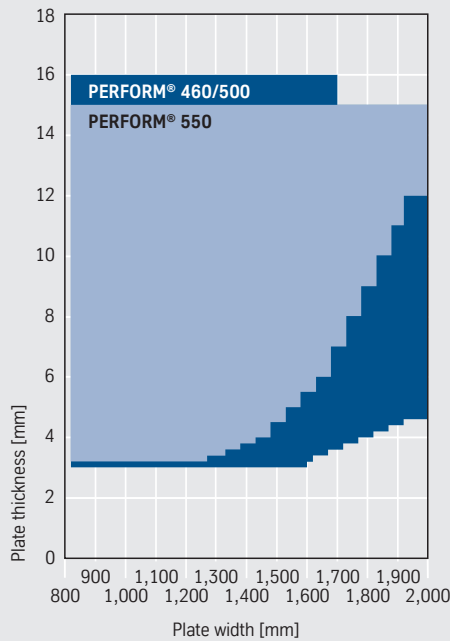
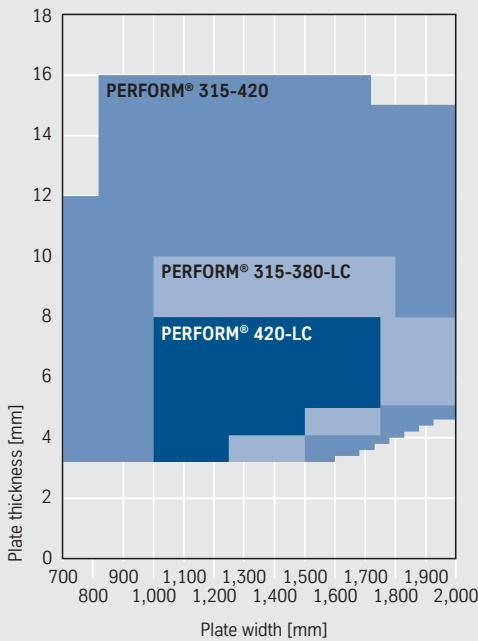
Steel grade	C	Si	Mn	P	S	Nb	V	Ti
PERFORM [®] 315	≤ 0.10	≤ 0.15	≤ 1.30	≤ 0.025	≤ 0.010	≤ 0.05	≤ 0.08	–
PERFORM [®] 355			≤ 1.50			≤ 0.06		
PERFORM [®] 380 ¹⁾			≤ 1.50			≤ 0.07		
PERFORM [®] 420			≤ 1.60			≤ 0.10		
PERFORM [®] 460			≤ 1.60			≤ 0.15		
PERFORM [®] 500			≤ 1.70			≤ 0.15		
PERFORM [®] 550		≤ 1.80	≤ 0.08	–				
PERFORM [®] 600		≤ 1.90						
PERFORM [®] 650		≤ 2.00	–	≤ 0.20				
PERFORM [®] 700		≤ 2.10	≤ 0.60	–				

Notch impact energy can also be demonstrated at a test temperature of –40 °C. The minimum notch impact energy is then 27 J.

¹⁾ Steel grade QStE 380 TM has not been integrated into EN 10149 but is available furthermore as PERFORM[®] 380.

Available sizes for PERFORM[®] and PERFORM[®]-LaserCut (LC), cut-to-length and four-high mill plates

1. Cut-to-length plates



2. Four-high mill plates

PERFORM[®] 380 Thickness: 10 – 20 mm
Width: 1,500 – 3,000 mm
Length: 4,500 – 15,000 mm

3. Four-high mill plates LaserCut

PERFORM[®] 380-LC Thickness: 10 – 14.9 mm Width: max. 2,500 mm
Thickness: 15 – 20 mm Width: max. 3,000 mm Length: 4,500 – 12,000 mm

Other thickness/width combinations are available on inquiry.

Depending on grade, PERFORM[®] cut-to-length plates can be produced in widths up to 2,000 mm. The grade PERFORM[®] 380 can also be produced on a modern four-high reversing mill in thicknesses from 10 to 20 mm and widths up to 3,000 mm.

Due to their outstanding range of properties and high surface quality, cut-to-length plates of PERFORM[®] cold forming steel are ideal for continuous parts manufacture from laser-cut blanks. The close thickness and width tolerances not only benefit press brake forming (more uniform forming

properties, reduced springback), but also contribute to a reduction in gross vehicle weight. They therefore permit increases in productivity in vehicle manufacture.

PERFORM[®] steels have been used successfully for a long time in a variety of applications, including the production of

- vehicle frame structures
- vehicle side and cross members
- booms of truck mounted cranes and concrete pump trucks
- agricultural machinery
- profile structures and containers.



PERFORM[®]-LaserCut (LC) for modern laser cutting shops

Laser cutting machines are increasingly becoming the standard in modern fabricating shops, with parts frequently being produced on automatic laser cutting centers. For applications like these, ThyssenKrupp Steel Europe offers LC (LaserCut) plates in grades PERFORM[®] 315 to PERFORM[®] 420. These plates are ideal for laser cutting.

As LC cut-to-length plates are produced in a smaller size range compared with normal production, they offer particularly favorable residual stress levels. Laser cutting properties are also enhanced by the high surface quality (firmly adherent rolling skin) and low silicon content (< 0.03%) of the plates. Plates in the 3 to 6 mm thickness range can also be supplied pickled/oiled (width: max. 1,600 mm). Thicker plates can be supplied shot blasted and primed.

LC four-high mill plates are generally supplied shot blasted and primed.

For primed plates, a silicate primer with low zinc content is generally used. The good laser cutting properties of plates with a thin primer coating of approximately 15 µm have been proven in various tests.



PERFORM[®] – for problem-free plate fabrication

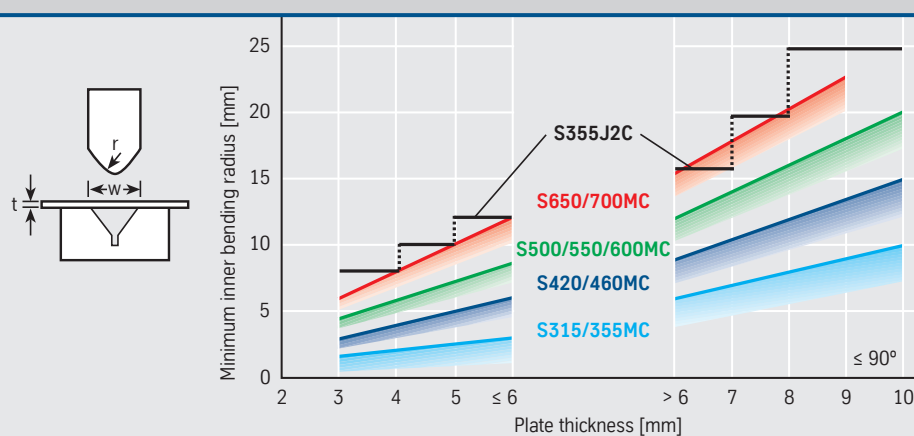
Thanks to their outstanding ductility and cold formability, PERFORM[®] steel plates can be press-brake formed and bent with tight radii despite their high strength. Compared with the cold forming variant S355J2C, much smaller bending radii are recommended for press brake forming.

In many cases, practical experience shows that PERFORM[®] plates can be bent and

press-brake formed without problems using even tighter radii than specified in the standard, provided tooling and machine are in very good condition.

Due to the low carbon and microalloying element contents of PERFORM[®] steels, carbon equivalent values are significantly lower than the corresponding values of S355J2. This results in low hardening and reduced susceptibility to cold cracking during welding. PERFORM[®] steels require practically no preheating for welding.

Recommended minimum inner bending radii based on EN 10149-2 compared with S355J2C

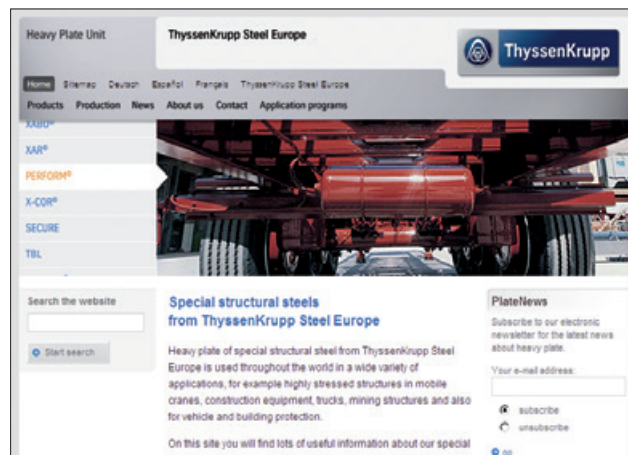


ThyssenKrupp Steel Europe – more than just a plate supplier

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 PERFORM® steels to customers. The close cooperation with first-class steel service centers also makes it possible to offer components which are pre-fabricated 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 PERFORM® 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 information 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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