

# Making high strength strip steels work harder

Continuous improvement of product design and quality is critical to success in today's rapidly evolving markets. Stand still and your competitors will overtake you in the rush to provide customers with better performing products that will fulfil their needs more effectively.

The availability of high strength steels which can be up to four times stronger than ordinary mild steel, can help you stay ahead by enabling you to create higher quality products which are either lighter or stronger - or both, whilst cutting your material and production costs.



## Products

Already used extensively in the global automotive industry, high strength steels increasingly are finding application in products ranging from shelving to switchgear and computer enclosures, vehicle wheels, tools, bicycles and child car seats.

A benefit of using steels of higher strength than conventional ones is that components can be made lighter without compromising performance. Equally, it is possible to increase the strength of a product without increasing its weight - a key consideration in the design of products such as automotive components, containers, trailers and cranes.

As a rule of thumb, doubling the strength allows material thickness to be reduced by a third. This can be expressed mathematically as follows:

$$t_{HS} = t_{MS} (R_{eMS}/R_{eHS})^{1/2}$$

$t_{HS}$  = thickness of the high strength steel proposed to replace the mild steel

$t_{MS}$  = thickness of mild steel to be replaced.

$R_{eMS}$  = yield stress of mild steel

$R_{eHS}$  = yield stress of high strength steel

Higher strength steels provide opportunities to design for greater dent resistance, and in certain specialised situations for improved wear resistance. In addition, amongst the group of very high strength steels there are grades which are suitable for use in vehicle protection systems; the use of such steels means the component absorbs large quantities of energy while deforming, in this case as a result of impact.

Our specialist Strip Product Service Centres can supply a full range of forming and drawing qualities in hot rolled, cold reduced and hot dip galvanised grades, including advanced high strength steels up to 1000 N/mm<sup>2</sup> tensile strength. Depending on the detailed product specification, thicknesses available range from 0.45mm to 3.00mm in cold reduced grades, and from 1.5mm to 12mm in hot rolled materials, as detailed below.

## High strength hot rolled steels

Available in a wide variety of strength levels, these steels are suitable for applications including automotive components, construction and earth moving equipment, wheels, tanks and general engineering. The higher the strength level, the greater the potential for downgauging and weight saving. In general, the higher the tensile strength of a material, the greater its fatigue resistance. A number of options are available to designers:

### High strength structural steels to EN 10025:1993

Steels supplied to this specification have guaranteed minimum tensile properties with values determined in the transverse direction. In certain situations, it may be appropriate to carry out impact tests.

Guaranteed minimum yield strength values range from 235 N/mm<sup>2</sup> to 355 N/mm<sup>2</sup>.

### High strength formable (micro-alloyed) steels to EN 10149-2:1996

The formulation and processing of these steels imparts greater formability compared with those conforming to EN 10025. They are supplied in the thermo-mechanically rolled condition, with tensile tests carried out in the longitudinal direction. Dependent upon thickness, impact tests can be carried out if required.

Guaranteed minimum yield strength values range from 315 N/mm<sup>2</sup> to 700 N/mm<sup>2</sup>.

### High strength cold reduced steels

High strength cold reduced strip steels are available in a wide variety of grades and thicknesses making them suitable for a diverse range of applications. Normally, the resulting products would be painted after pressing, followed by suitable surface cleaning and pre-treatment.

### High strength rephosphorized steel

The use of phosphorus provides a range of intermediate high strength steels with excellent formability. Strength in the finished component comes not only from the inherent strength of the raw material, but also from strain hardening as a direct result of the pressing operation. A further increase in strength can result from the combination of strain induced during pressing and stoving at e.g. 170°C following painting. This is known as bake hardening.

Guaranteed minimum yield strength values range from 220 N/mm<sup>2</sup> to 300 N/mm<sup>2</sup>.

### High strength low alloy (HSLA) steels to EN 10268:1999

This family of steels extends the high strength options beyond what is possible with rephosphorised steels. Strength is obtained through grain refinement resulting from small additions of niobium, together with strain hardening. Good control of mechanical properties results from processing involving continuous annealing.

Guaranteed minimum yield strength values range from 220 N/mm<sup>2</sup> to 500 N/mm<sup>2</sup>.

### Dual Phase Steels

If very high strengths are required, combined with a degree of formability, it is necessary to use the unique features of certain types of continuous annealing lines to produce dual phase steels. These steels have excellent stretch formability with a low yield strength compared with tensile strength. The name is a reference to the fact the material comprises ferrite, as do all the steels referred to in this section, and martensite; the ferrite imparts the ductility and the martensite the strength. The more martensite present, the higher the strength of the material. Normally, these products are defined in terms of their guaranteed minimum tensile stresses rather than yield stresses. Bake hardening post painting is a further feature of this type of steel.

Guaranteed minimum tensile strength values range from 400 N/mm<sup>2</sup> to 1400 N/mm<sup>2</sup>.

### High strength hot dip galvanised steels

High strength hot dip galvanised steels are available in a range of types to suit a variety of applications, providing options depending on the balance required between strength and ductility i.e. formability. In all cases excellent corrosion resistance is provided through the sacrificial protection afforded by the coating of zinc.

A minimised spangle finish is offered with a standard chromate rinse to protect against white rust.

### High strength structural steels to EN 10147:2000

These are the basic high strength steels giving guaranteed minimum strength levels and a degree of ductility. Typically, they are used in the building industry for the production of roll formed sections; these materials are suitable for simple bending operations.

Guaranteed minimum yield strength values range from 220 N/mm<sup>2</sup> to 550 N/mm<sup>2</sup>.

### High strength formable steels to EN 10292:2000

These steels are formulated with improved formability in mind. They are characterised by guaranteed minimum elongation values that are superior, strength for strength, to those which apply to the structural grades. As a result, they are suitable for use in more difficult forming operations.

Guaranteed minimum yield strength values range from 260 N/mm<sup>2</sup> to 420 N/mm<sup>2</sup>.

### High strength formable dual phase steels

These steels offer the ultimate combination of high strength, formability and corrosion protection. Additional strength accrues as a result of strain hardening during forming, and if the finished article is painted and stoved, a further increase in strength occurs. As with other steels of this type, dual phase steels are defined and described in terms of their guaranteed minimum tensile strength - not yield stress - before any possible final heat treatment, e.g. paint stoving.

Guaranteed minimum tensile strength values range from 600 N/mm<sup>2</sup> to 1000 N/mm<sup>2</sup>.

### Technical support

Our technical and engineering experts will work with customers from the development phase of projects, to advise on high strength steel specification, component design, formability and processing. They can also undertake parts prototyping and studies into manufacturing feasibility and cost estimation. Not only does this maximise the benefits of utilising high strength steels, but it also optimises the production process from both a technical and economic standpoint, resulting in products that fulfil the most stringent quality, cost and performance parameters.

To help customers take full advantage of these advanced steels, we can draw on Corus's world-class research, development and technology facilities, as well as those of our other supply partners. These include practical testing and evaluation facilities, as well as the latest computer-aided simulation tools such as Finite Element Analysis to aid product development. Expertise is also available in the key areas of pressing, corrosion, welding, adhesives and mechanical fixings.

From initial concept through to design, materials supply and final production we can provide a total integrated service to help customers increase the productivity and profitability of their business.

### Services

We are geared up to provide the highly responsive, flexible level of service that manufacturers need to succeed in today's demanding markets. Our processing facilities enable us to supply high strength steel to exact size and shape; helping customers to optimise material usage and reduce costs, whilst improving productivity and quality.

For the cost-effective production of precision blanks, to a standard maximum length of 4000mm and a width tolerance of +/-0.25mm, we have a number of multi-strand blanking lines. Flatness to within 3mm per metre length is guaranteed, provided this requirement is stated at the time of enquiry and order.

Our centres also offer decoiling facilities, and the industry's most advanced high-speed slitting lines, which are capable of processing coil up to 2000mm wide in a gauge range of 0.12mm to 8.0mm, to a width tolerance of +/-0.127mm.

Our processing facilities are maintained to the highest standards to ensure that material quality, surface finish and flatness is assured from the mill, during processing, to delivery. Great care is also taken during handling, packaging and storage to ensure that products reach customers in prime condition.

These resources are supported by tailored EDI, IT and logistics systems that enable us to check order status or stock availability instantly, minimise order lead times and maintain rapid, reliable deliveries, on a JIT or scheduled basis as required.

### Processing capacity

	Gauge (mm)	Width (mm)	Length (mm)
Multi-strand blanking	0.3 - 3.2	140 - 2000	200 - 15000
Slitting	0.12 - 8	12 - 2000	N/A
Decoiling	0.3 - 13	25 - 2000	100 - 18000
Shearing	0.4 - 13	25 min	6500 max
Laser cutting	1 - 20	2500 max	8000 max

For requirements outside of these dimensions please consult Corus.

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