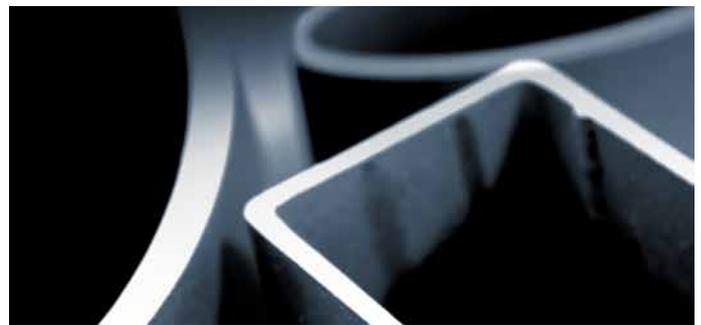


Celsius®

The ultimate hot finished hollow section to EN 10210

There are different types of structural hollow sections, manufactured in different ways and their properties and behaviour depend on how they have been made. The Celsius® range are true hot finished, HFI welded hollow sections, giving many benefits over cold formed, heat treated and even seamless hollow sections.



We can confidently say that Celsius® represents the ultimate hot finished hollow section and that is why Celsius® is the ideal choice for all structural and mechanical applications, including multi-storey columns, space frames, lattice trusses and beams and frames for cranes, machinery & trailers as well as critical parts like axles.

EN 10210 explained

EN 10210 is the standard for hot finished hollow sections, but covers a range of subtly different products. Even with the commonly used yield strength of 355 kN/m, there are different grades, the main ones of which are:

- S355J2H is a non-alloy steel and can be either formed into its final shape while cold and then heat-treated or formed when hot. Minimum heat treatment temperature 580°C.
- S355NH is an alloy steel and must be formed into the final shape above the normalising temperature of 850°C.

Whilst hollow sections which comply with S355NH always satisfy the demands of S355J2H, the same is not true in reverse and many products complying with S355J2H are not fully normalized, with all the benefits that brings.

To ensure the best quality of hot finished hollow sections, always specify S355NH or the Celsius® brand, only from Tata Steel.

Metallurgical homogeneity

Shaping strip steel and welding into a tube alters the metallurgy of the steel, which is why cold formed tubes have inferior properties. Heat-treating a cold-formed tube only partially reduces the metallurgical defects unless carried out at normalising temperatures.

The only way to be sure of full metallurgical homogeneity is to form the final shape of the tube in the normalizing zone, at a temperature >850°C. Normalizing in this way additionally removes any heat affected zones around the weld, effectively forming a seamless tube.

Homogeneous metallurgy is important for several reasons, including:

- The absence of any residual stress which can cause unpredictable behaviour in non-normalized hollow sections, particularly when exposed to fatigue
- Consistent properties right around the section, enabling effective welding with no hard-spots

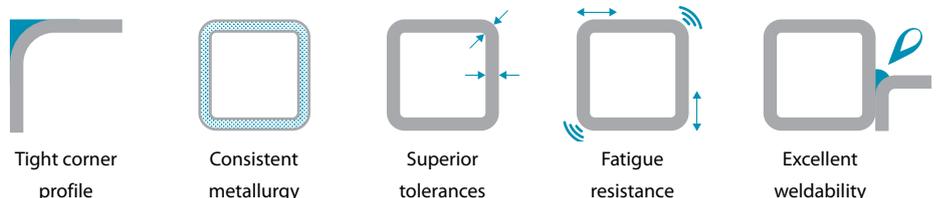
HFI-NH – The best of both worlds

Tubes formed from strip steel by the HFI (High Frequency Induction Welding) process have many advantages over so-called “seamless” tubes which are formed by piercing a hole in a solid piece of steel:

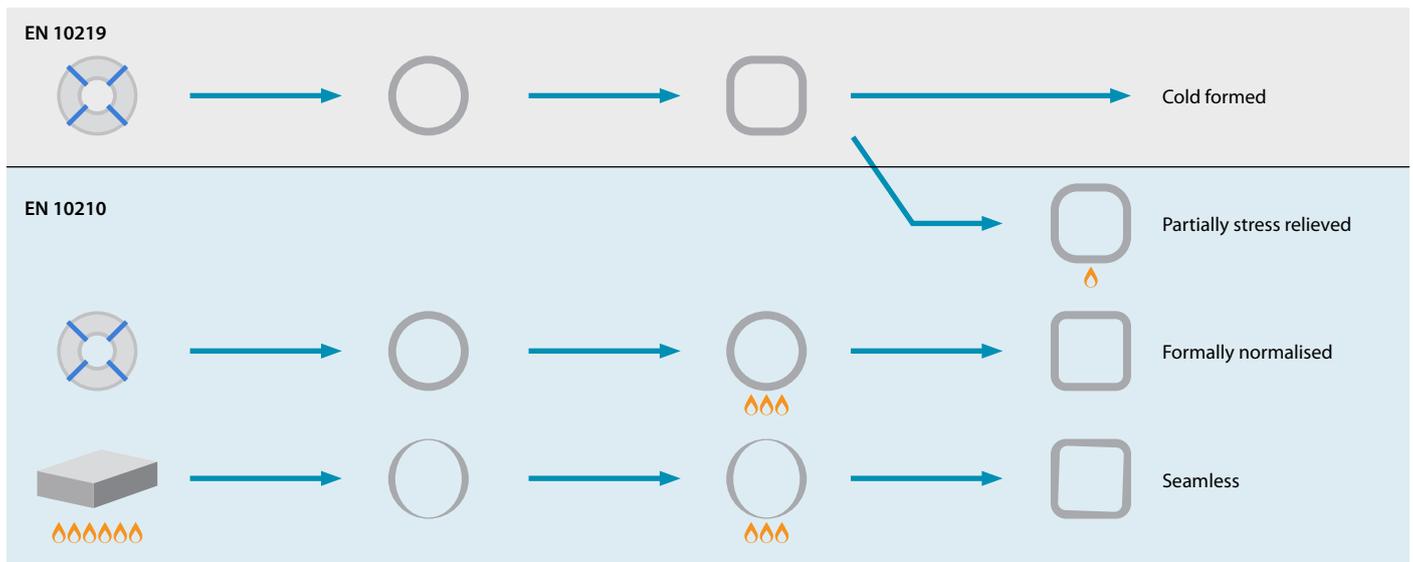
- Wall thickness is much more consistent, being determined in the hot rolled strip steel process – this is included in the EN10210-2 standard which reflects tighter tolerances for HFI formed tubes than seamless.
- Through-thickness metallurgical consistency is also improved because of the strip steel hot rolling process.
- Because HFI tubes are made in a continuous process from strip steel, lengths are much more consistent with better tolerances than seamless.

By forming the final shape at normalizing temperatures, Celsius® hollow sections have all the benefits of seamless tubes with the consistency, quality and tolerances associated with HFI tubes.

Celsius® - the ultimate hot finished hollow section



Manufacturing routes for hollow sections



The Celsius® range

Celsius® is available in a wide range of circular, square, rectangular and elliptical hollow sections:

- CHS – From 42.4 x 3.2mm to 508 x 17.5mm
- SHS – From 40x40 x 3.2mm to 400x400 x 17.5mm
- RHS – From 50x30 x 3.2mm to 500x300 x 17.5mm
- EHS – From 300x150 x 8mm to 500x250 x 16mm

Celsius® is also available in high strength grades S420NH and S460NH alongside the popular S355NH and specialist grades for offshore structures as well as weathering grade. Celsius® S355NH is, in addition, fully compliant with all the requirements of EN 10210 S355J2H.

Celsius® - Hot finished hollow sections to EN 10210

	Circular (CHS)	✓ S355NH
	Square (SHS)	✓ S355NLH
	Rectangular (RHS)	✓ S355 Weathering
	Elliptical (EHS)	✓ S420NH
		✓ S460NH

Hollow sections overview

	EN 10219	EN 10210	Celsius®
Pipe manufacture	HFI	HFI	Seamless
Final shaped tube	Cold formed	Heat treated	Normalized
Grade*	S355J2H	S355J2H	S355NH / S355J2H
Weld-line metallurgy	✗ Wide heat-affected zone	✓ Reduced heat-affected zone	✓✓✓ No heat-affected zone
Corner hardness	✗ Work-hardened corners	✓ Reduced hardening in corners	✓✓✓ Homogeneous metallurgy
Corner radius	✓ Up to 3T	✓ Up to 3T	✓✓✓ < 2T
Tolerances	✓✓✓ Tight tolerances possible	✓✓✓ Tight tolerances possible	✓ Inconsistency in wall thickness
Residual stress	✗ Significant metallurgical stress	✓ Reduced stress	✓✓✓ No metallurgical stress

* Examples given for 355 MPa min yield strength

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Language English PDF TST106:0822

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