

Tubular Products Europe



ArcelorMittal

Hot-Finished Structural Hollow Sections The Premium Structural Solution





ArcelorMittal Vision

'Safe, Sustainable Steel' sums up everything we are trying to achieve at ArcelorMittal. We want our business to be sustainable in every sense of the word – a business that is both profitable and responsible. We do this by keeping our people safe and becoming ever more efficient at providing the steel the world needs for construction, transport, manufacturing and all other aspects of everyday life.

ArcelorMittal Welded Hollow Section Solution

Our expertise centers on Welded Hollow Sections in a wide size range. We can propose different steel grades and shapes, including (even though not limited to) round, square, rectangular and elliptical. More than fifty years of experience allows us offer the best combination raw material – manufacturing process for any structural application.

ArcelorMittal Facilities

Karvina – Czech Republic

- Formerly known as Jäkl Karviná
- Renowned for its quality products

Kraków – Poland

- Located in the southern province of Malopolski

Lexy - France

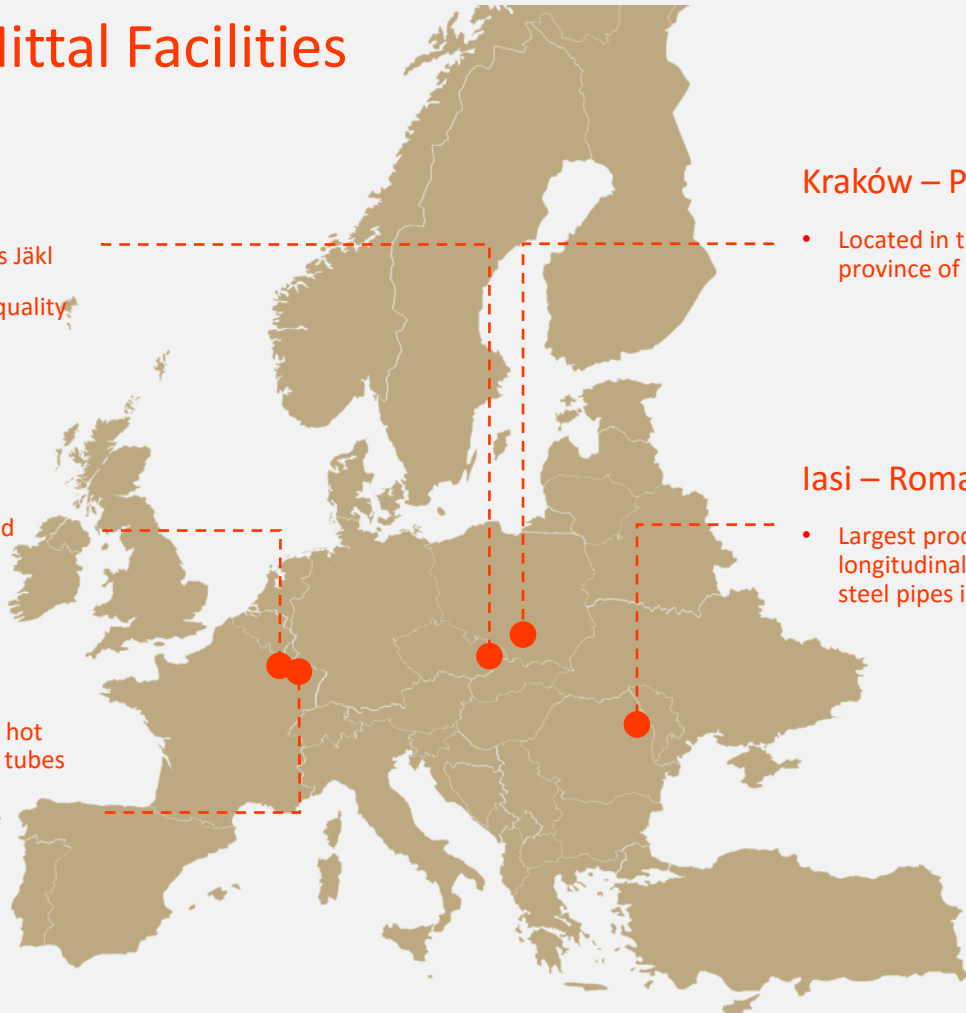
- Largest French producer of welded steel tubes

Iasi – Romania

- Largest producer of longitudinal welded steel pipes in Romania

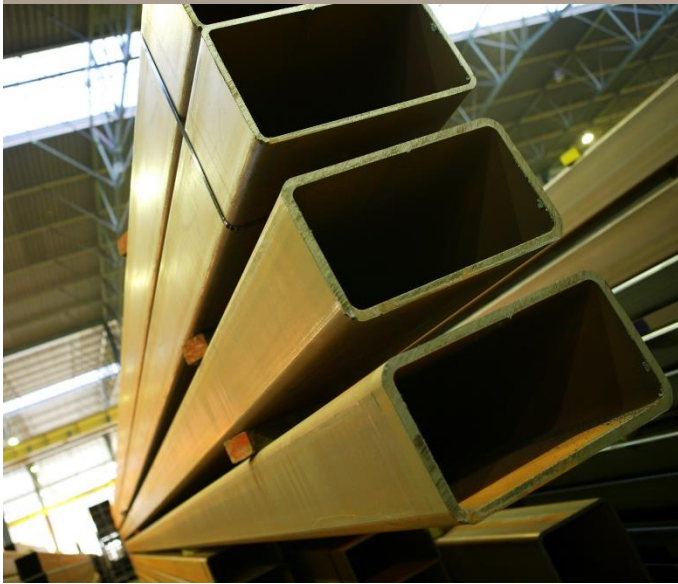
Rettel - France

- Produces cold and hot finished structural tubes in an exceptional dimensional range



Hot Finished Hollow Structural Sections The Premium Choice

ArcelorMittal Hot-Finished Hollow Sections are manufactured by continuous forming at room temperature a steel strip passing through forming stands that progressively bend it into a circular shape entering in welding stand for joining strip edges together by a continuous longitudinal weld seam. After the welding station, the final shape (circular, square, rectangular, etc.) and dimensional precision of tube are achieved by passing through sizing stands. Afterwards, the tube is heated up in furnace for internal residual stresses relief.



This product meets all the EN 10210 requirements.

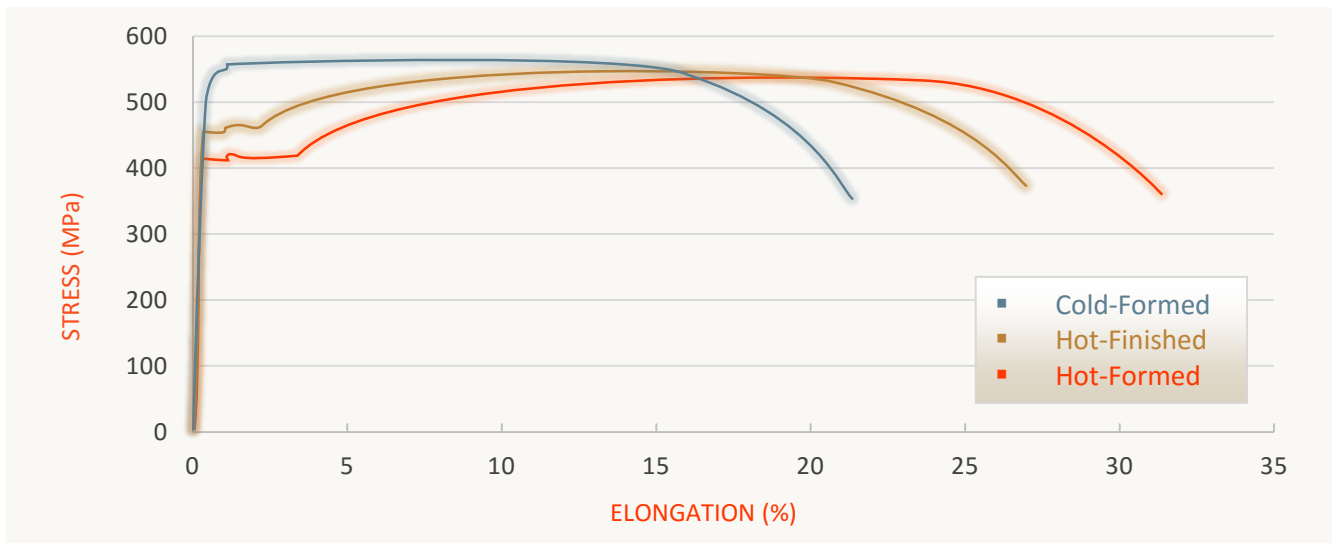
ArcelorMittal manufactures its Hot-Finished Hollow Structural Sections using thermomechanical steels as raw material which improves the features of the product, even overtaking Hot-Formed Hollow Sections' ones (tubes where the final forming process is made at almost 1000 °C, normally manufactured with hot-rolled or even normalized steels).



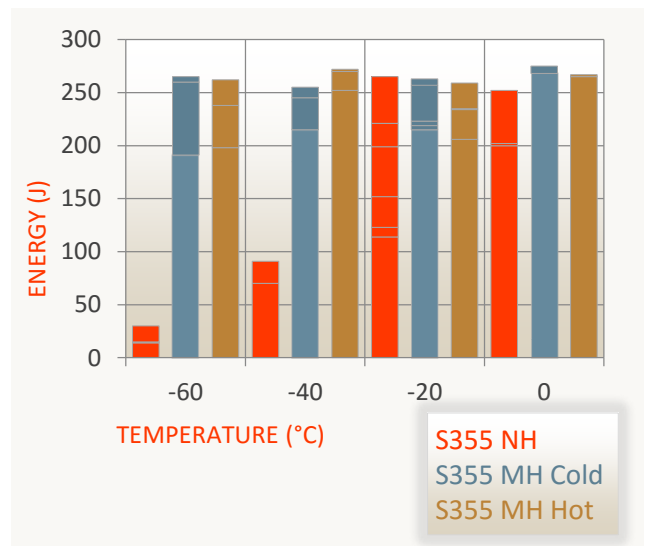
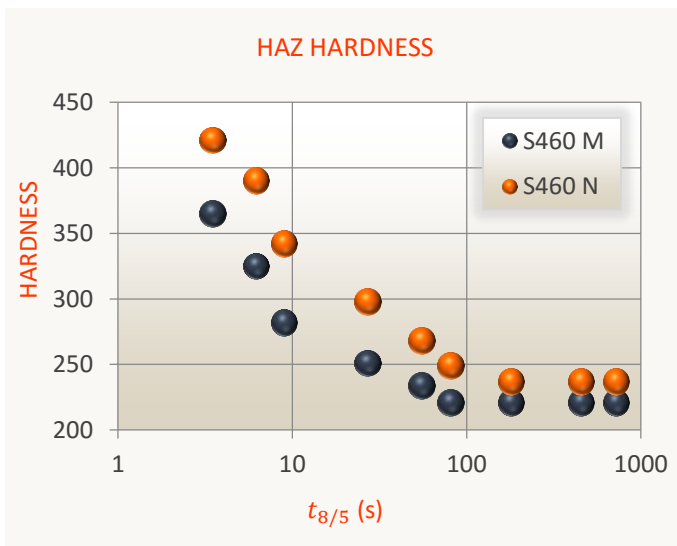
I - Features of ArcelorMittal Hot-Finished Hollow Structural Sections

1.1 Excellent ductility

The Heat Treatment applied on the final product is able to release the internal residual stresses that could have been stuck in the material due to the first Cold-Forming of the strip, in such a way that their behaviour is similar to the rest of Hot-Finished products gathered in EN 10210, i.e. Hot-Formed and Seamless Hollow Sections.



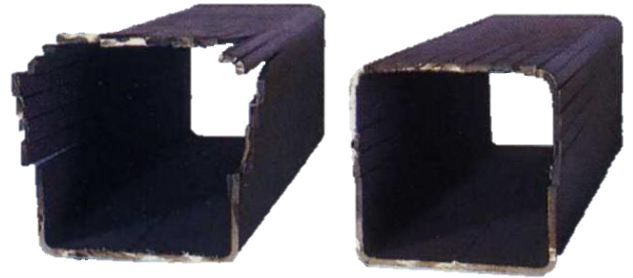
Additionally, the particular combination of manufacturing process + specific raw material used by ArcelorMittal results in Hollow Sections with even better hardness distribution and impact toughness (energy absorption) than equivalent normalized tubes:



I - Features of ArcelorMittal Hot-Finished Hollow Structural Sections

1.2 Optimum static behavior

The specific combination of Cold-Forming + final Heat Treatment employed by ArcelorMittal in its Hot-Finished Hollow Structural Sections leads to an optimum combination of geometry & yield stress with minimum residual stresses that allows the product to use the buckling curve 'a' – the best one for mild steel – for design of elements under compression (see EN 1993-1-1 – Eurocode 3. Part 1-1).



Visual check of residual stresses in Cold-Formed (left) and Hot-Finished (right) tubes

Cross Section		Limits		Buckling about Axis	Buckling Curve	
					S 235 S 275 S 355 S 420	S 460
Rolled Sections		$h/b > 1,2$	$t_f \leq 40$ mm	y - y z - z	a b	a ₀ a ₀
			$40 \text{ mm} \leq t_f \leq 100$	y - y z - z	b c	a a
		$h/b \leq 1,2$	$t_f \leq 100$ mm	y - y z - z	b c	a a
			$t_f > 100$ mm	y - y z - z	d d	c c
Welded I-Sections		$t_f \leq 40$ mm		y - y z - z	b c	b c
		$t_f > 40$ mm		y - y z - z	c d	c d
Hollow Sections		Hot-Finished		Any	a	a₀
		Cold-Formed		Any	c	c

Extract from EN 1993-1-1

The corner radius of ArcelorMittal Hot-Finished Hollow Sections are larger than the equivalent Hot-Formed ones what makes the former stiffer and less prone to local instabilities at the same time being lighter.

I - Features of ArcelorMittal Hot-Finished Hollow Structural Sections



Section	Side (height or width) B	Corner radius R	Flat length of faces c (*)	Mass M	Section Class (**)
Hot-Finished 220x220x5	220	12,5 mm (2,5T)	195 mm	33,1 kg/m	c/T = 39 Class 3 Semicompact
Hot-Formed 220x220x5	220	7,5 mm (1,5T)	205 mm	33,4 kg/m	c/T = 41 Class 4 Slender

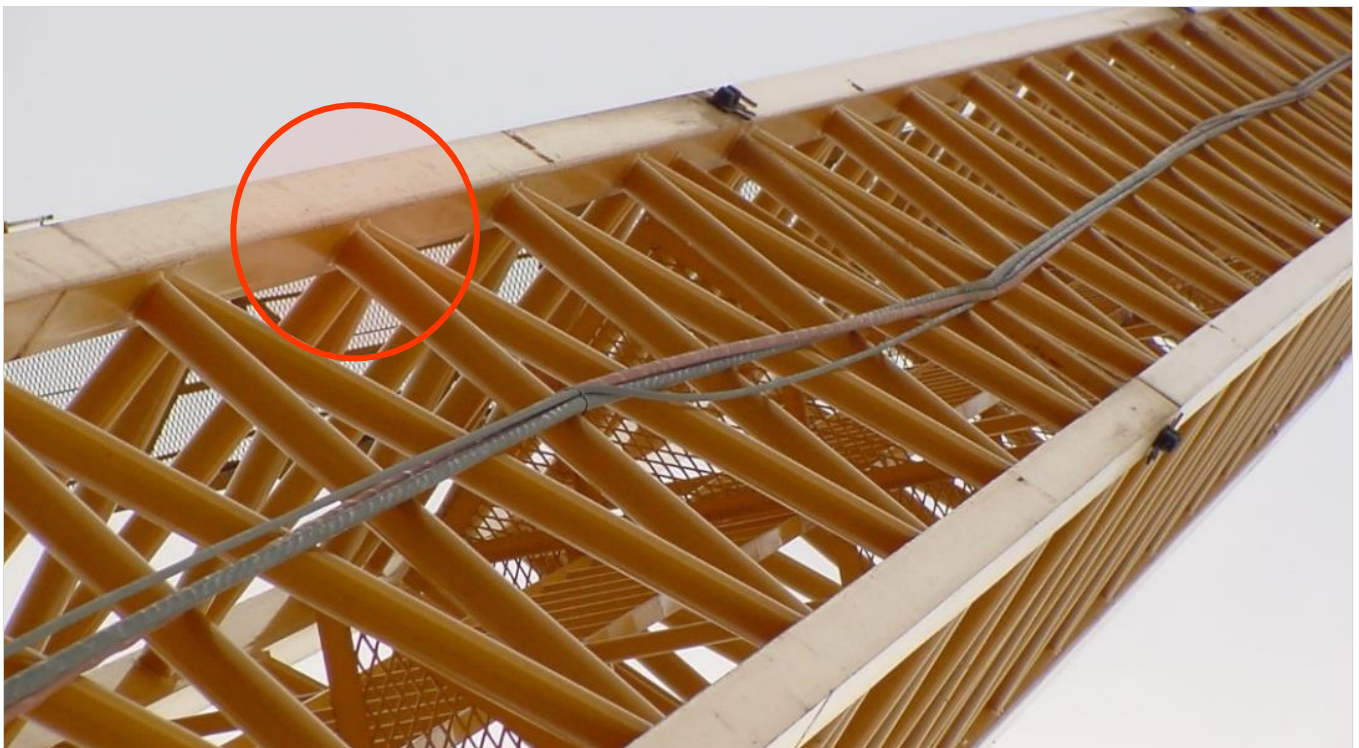
Example:
RHS 220x220x5
S275J0H

(*) Making calculations with actual sizes, 'c' can be calculated as $B - 2R = 220 - 2R$

(**) Acc. to EN 1993-1-1: for steel S275, $c/t \geq 39 \rightarrow$ Class 3; $c/t < 39 \rightarrow$ Class 4

1.3 Long and 'healthy' fatigue life

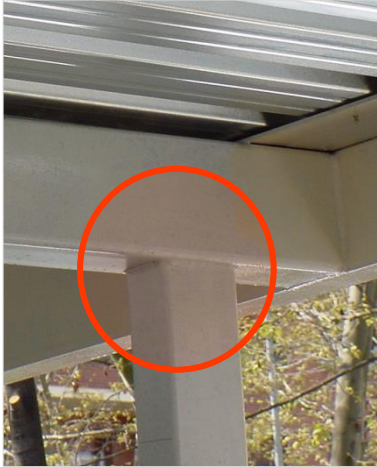
The key factor in the fatigue life of a structure is the connections (whichever structural Hollow Section is used, see EN 1993-1-9 – Eurocode 3. Part 1-9).



The Heat Treatment applied to ArcelorMittal Hot-Finished Hollow Sections assures a great performance in fatigue due to the reduction of the residual stresses induced by the preliminary Cold-Forming process.

I - Features of ArcelorMittal Hot-Finished Hollow Structural Sections

1.4 Superior weldability



The combination of the chosen raw material plus the specific ArcelorMittal manufacturing process allows the welding all around the perimeter of their square and rectangular Hollow Sections (even in corner areas), as well as leading to an outstanding weldability with lower CEV than equivalent normalized steel Hollow Sections (see right-hand side graph below).

Furthermore, the hardness distribution through the non-affected material (BM), the heat-affected zone (HAZ) and the weld seam itself (WM) in ArcelorMittal hot-finished hollow sections (Tubes S355MH Hot Finished) is significantly more homogeneous and present lower average value than any of the other comparative cases (see left-hand side graph below).

■ Tubes S355NH

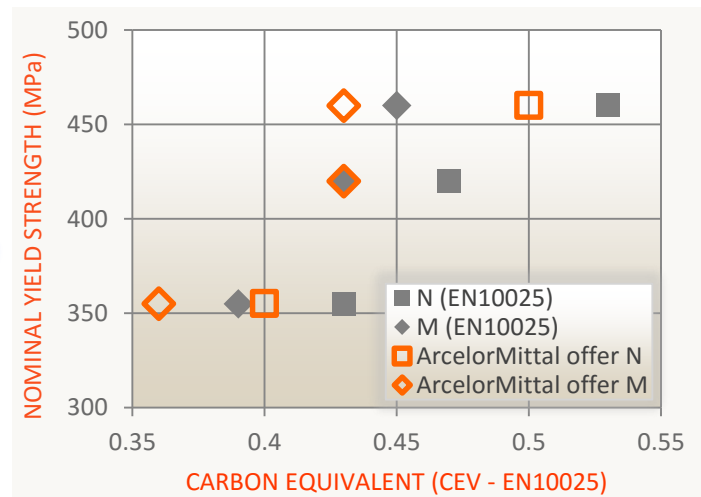
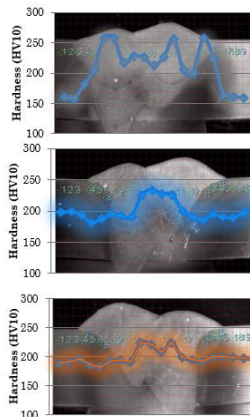
- BM : 157-164 HV10
- HAZ : 182-258 HV10
- WM : 213-228 HV10

■ Tubes S355MH Cold Formed

- BM : 189-203 HV10
- HAZ : 181-200 HV10
- WM : 226-233 HV10

■ Tubes S355MH Hot Finished

- BM : 188-198 HV10
- HAZ : 183-200 HV10
- WM : 207-224 HV10



Max. CEV

II - Conclusion

ArcelorMittal Hot-Finished Hollow Structural Sections constitute the **optimum choice** as **structural tubular element** as it combines excellent **structural performances** (ductility, static behaviour, fatigue behaviour, etc.) with a fantastic **weldability** even in corner areas of square and rectangular Hollow Sections leading to strong, light, stiff, reliable and economic tubular structures.

Within ArcelorMittal we count on a **extensive knowledge** in using Hollow Sections in construction with **experienced Structural Engineers** more than happy to help you optimize your structure. Do not hesitate to contact us.

Technical Hotline for designers and planners:

constructube@arcelormittal.com

Do not hesitate to contact us for any question on tubular construction.



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