

endurance

ENDURANCE

Cold-formed hollow sections offering superior quality and Efficiency benefits





HOLLOW SECTIONS OFFERING SUPERIOR QUALITY AND EFFICIENCY BENEFITS

Steel tubes and sections meeting even the most demanding requirements, complying with the strictest safety requirements while guaranteeing good weldability and optimum processability – this is what

voestalpine Krems stands for. We offer reliable, high-precision and safe solutions using innovative materials technologies setting new pioneering standards.

voestalpine Krems offers three types of cold-formed hollow sections for different conditions and requirements:

endurance
smart

Quality hollow sections for efficient processing

endurance
dynamic

Cold-rolled hollow sections for dynamic loads

endurance
extreme

High-strength hollow sections for extreme conditions



Striking benefits

EXCELLENT

We ensure extremely tight tolerances with regard to strip density, superior mechanical properties and chemical composition through an optimum supply of pre-materials and we guarantee consistent processing result. Even in times where steel products are in short supply.

EFFICIENT

Production at room temperature allows both compliance with the tightest possible cross-sectional and straightness tolerances as well as even, smooth surfaces. Due to the extremely homogenous surface structure when compared to hot-formed hollow sections, no expensive pre-painting finishing processes such as sandblasting are required.

PIONEERING

One step ahead thanks to cold forming:

- » Significantly higher surface quality
- » Improved utilization of thermomechanical fine-grained steels
- » Excellent resistance to brittle fractures thanks to high-quality steel grades
- » Smooth surfaces even when unpickled
- » Savings due to additional pre-coating finishing
- » No limitations when used in combination with high and maximum strength steel grades
- » Eco-friendly thanks to favorable energy footprint
- » Can be also manufactured with thicknesses of 1.5 mm

INTERNATIONAL CERTIFICATES AND APPROVALS

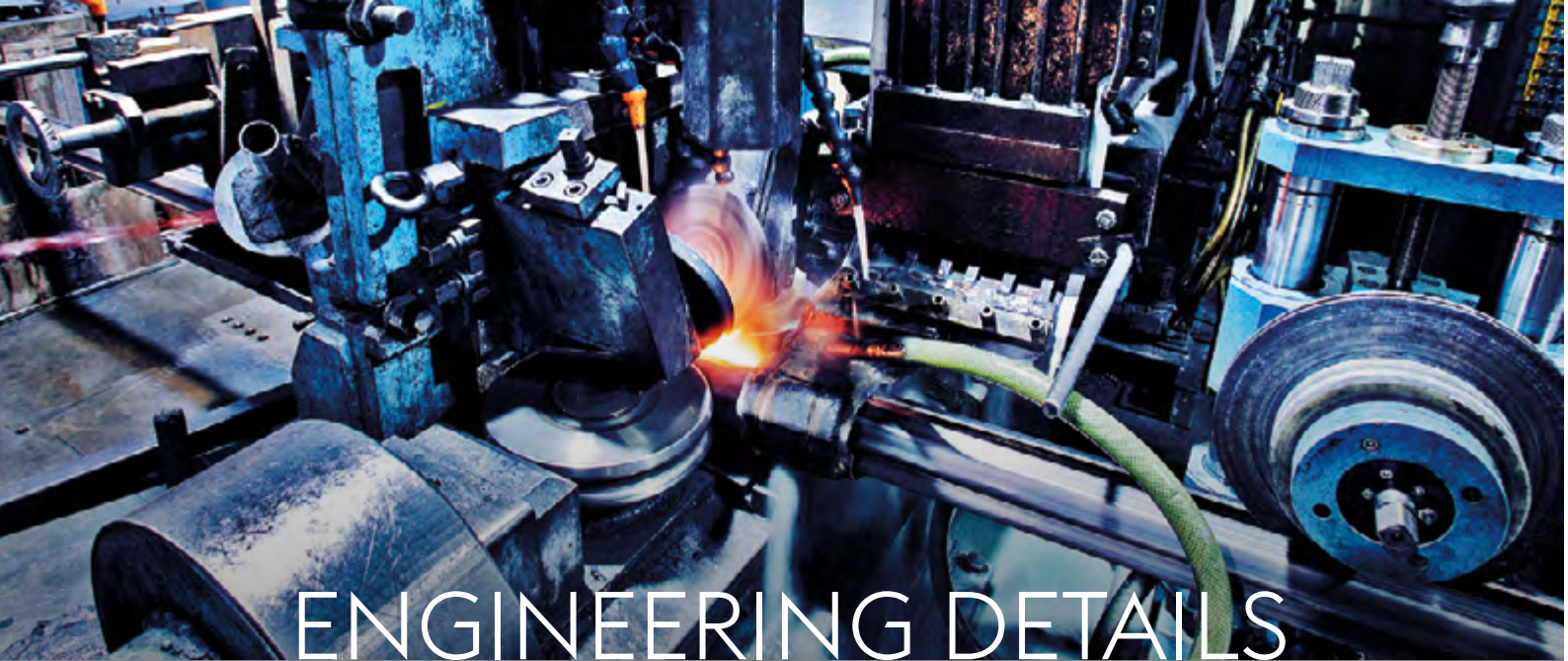
- » ISO 9001 2018
- » ISO 14001 2018
- » ISO TS 16949 2018
- » EC Certificate FPC 0531 - CPD 0009, EN 1090-1
- » EC Certificate FPC 0780 - CPD 62008, EN 10025-1
- » EC Certificate FPC 0780 - CPD 72012, EN 10219-1
- » EN ISO 3834-2
- » OHSAS 18001:2007

TAILORMADE

You can rely on our long years of comprehensive metal-forming know-how and materials expertise – together, we can find the solution that is best suited for your needs and ensures the most favorable cost-benefit ratio. We also offer intermediate dimensions, narrower tolerances as well as special steel grades and solutions. Additionally, we can assist you when it comes to customized geometries, from their development up to actual production, and thus help you save time and development expenses.

SUITABLE FOR HOT-DIP GALVANIZING

All endurance hollow sections can be hot-dip galvanized. Please mention this requirement when ordering higher-strength micro-alloyed steel grades with an S 550 MC strength class and higher.



ENGINEERING DETAILS

Manufacturing process

voestalpine Krems shaped tubes and hollow sections are manufactured continuously from steel strips using state-of-the-art forming technologies. Strips are shaped either directly or by means of a round-tube forming process to achieve the required cross-section. The tubes are then high-frequency

welded and their exterior weld burrs are removed. Having passed through a cooling line, they are rolled in sizing stands until they reach their finished dimensions.

endurance smart

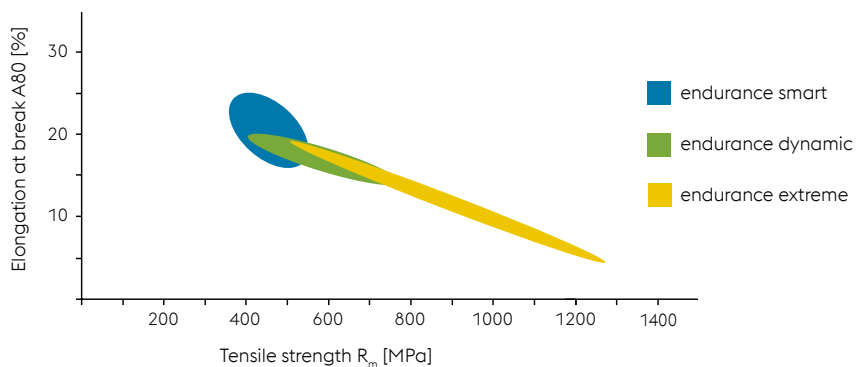
- » Steel grades according to EN 10305-5: E 220 CR2, E 260 CR2, E 320 CR2, E 370 CR2, E420 CR2
- » Structural steel grades according to EN 10219: S235JRH, S275J2H, S355J2H
- » Fine-grained structural steels according to EN 10149 up to S460MC

endurance dynamic

- » voestalpine special grades
- » Micro-alloyed and thermomechanically rolled high-purity steel
- » Yield strength R_{eH} [MPa] 355 – 550

endurance extreme

Fine-grained structural steels according to EN 10149 from S500MC up to S960MC

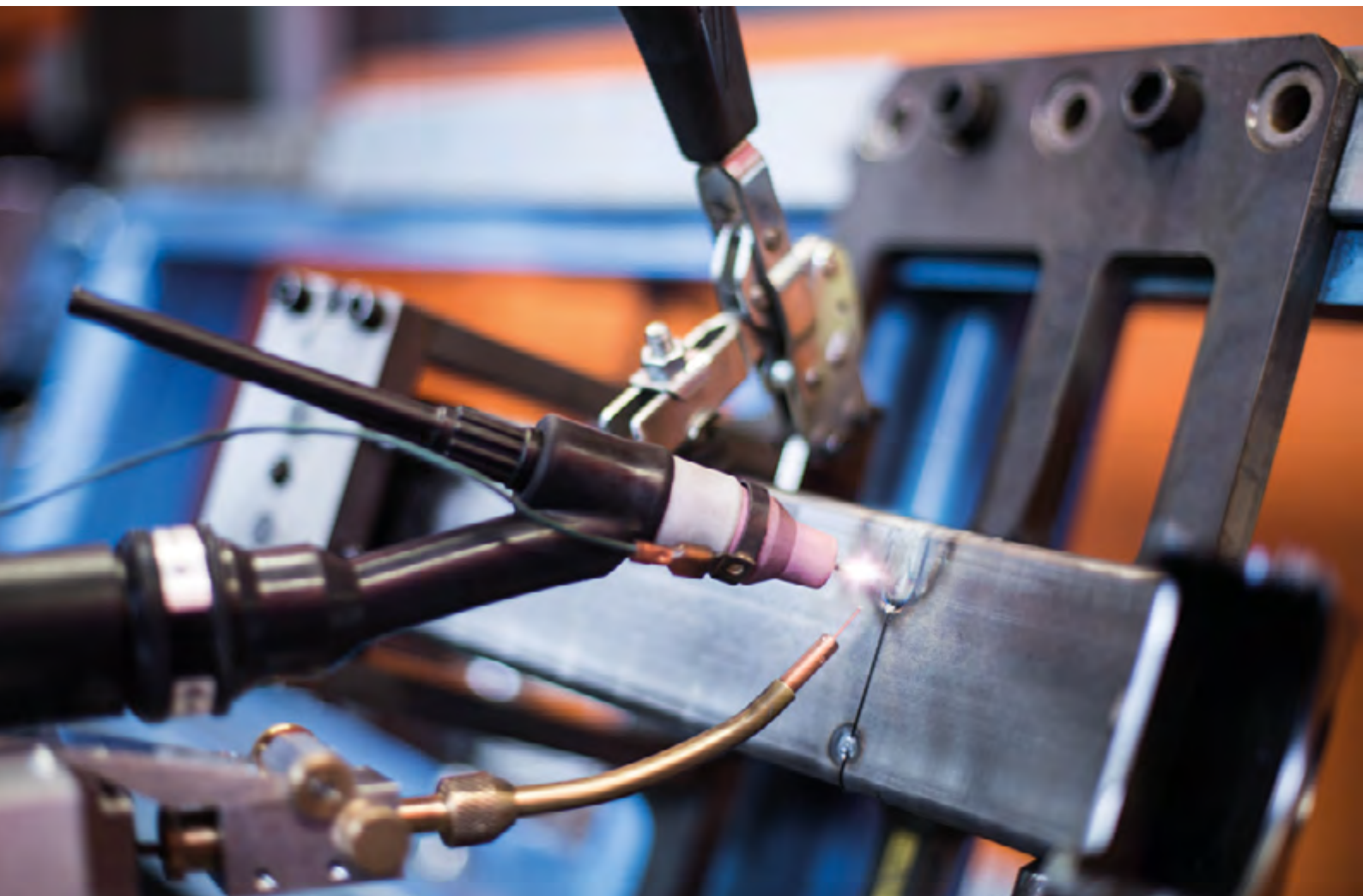


Technical delivery conditions and standards

The manufacturing tolerances of our shaped tubes and hollow sections are in conformity with EN 10305-5 or EN 10219-2 and comply with EN 10305-5 or EN 10219-1 with regard to technical

delivery conditions such as surface finish, tests, quantity tolerances, handling of complaints, etc.

	EN 10219 Part 1 and 2	EN 10305-5
Title	Cold-formed welded structural hollow sections of non-alloy and fine grain steels	Steel tubes for precision applications
Radii/edges	Edge or radii $T \leq 6 \text{ mm}$: 1.6 T to 2.4 T $6 < T \leq 10 \text{ mm}$: 2.0 T to 3.0 T $T > 10 \text{ mm}$: 2.4 T to 3.6 T	Edge area $T \leq 2.5 \text{ mm}$: C max. $1.5 \times T$ $2.5 < T \leq 4 \text{ mm}$: C max. $2.2 \times T$
Straightness	0.15 % of overall length in terms of 1 m: max. 3 mm	Shorter side $\leq 30 \text{ mm}$: $0.0025 \times \text{length}$ Shorter side $> 30 \text{ mm}$: $0.0015 \times \text{length}$ in terms of 1 m: max. 3 mm
Squareness	$\pm 1^\circ$	$\pm 1^\circ$
Curvature of lateral surface	max. 0.8 %. min. 0.5 mm	Curvature within dimensional tolerance
Wall thickness tolerance	$T \leq 5 \text{ mm}$: $\pm 10 \%$ $T > 5 \text{ mm}$: $\pm 0.5 \text{ mm}$ not applicable in edge and weld seam areas	$T \leq 1.5 \text{ mm}$: $\pm 0.15 \text{ mm}$ $T > 1.5 \text{ mm}$: $\pm 10 \%$ or max. $\pm 0.35 \text{ mm}$ (smaller value applicable) upper limits not applicable in edge and weld seam areas
Dimensional tolerances	H, W $< 100 \text{ mm}$: $\pm 1 \%$ (min. 0.5 mm) $100 \leq H, W \leq 200$: $\pm 0.8 \%$ H, W > 200 : $\pm 0.6 \%$	see Table of Standards
Torsion	$v \leq 2 \text{ mm} + 0.5 \text{ mm/m}$	H, W $\leq 30 \text{ mm}$: $v \leq 3 \text{ mm}$ W, H $> 30 \text{ mm}$: $v \leq W, H / 10$



MORE THAN JUST TUBES AND SECTIONS – WORKING STEPS AHEAD

What's more, voestalpine Krems offers you state-of-the-art processing and machining technologies that help you reduce your costs, ranging from bending, laser cutting, drilling, welding, pressing and shaping to post-processing and finishing (single-piece galvanizing, phosphating, EDP coating as well as other coating processes). We integrate these processes

into our production lines and ensure economical solutions. At your request, we can provide you with tailor-made, ready-to-install components to optimize your manufacturing processes and costs even further. You can count on our comprehensive processing, finishing and problem-solving expertise!



» CNC bending



» Plasma cutter



» Spot welding and clinching



» 3D laser cutting



» CNC miter sawing



» Batch sawing



» 3D miter sawing



» Perforation

endurance
smart



COUNT ON A COMPREHENSIVELY TRIED- AND-TESTED SOLUTION

endurance smart stands out due to its easy processability and wide range of application. These high-precision hollow sections are made from the best materials available and excel thanks to corrosion resistance and superior efficiency.

SMART AND SOPHISTICATED ADVANTAGES

Excellent processing and machining characteristics

Easy to cut, weld, finish and join, its high-quality prematerial ensures trouble-free and cost-efficient processing and machining.

Wide range of dimensions

A finely graded range of dimensions allows planners and designers to select the most suitable hollow section dimensions for every type of load. Our offer on stock includes 470 different dimensions.

Aesthetic benefits

Smooth and even surfaces provide the basis for clear-cut, functional design, making for an easy concealed installation of lines and cables.

Standard Program and Standard Steel Grades

Tubes made from pickled hot strips according to EN 10305-5:

- » 1.5 mm - 2 mm wall thickness in steel grade E220+CR2

Tubes made from unpickled hot strips according to EN 10219-1 and EN 10219-2:

- » 1.5 mm - 2.5 mm wall thickness in steel grade S235JRH
- » 3 mm - 6 mm wall thickness in steel grade S275J0H
- » 8 mm + 10 mm wall thickness in steel grade S355J2H

Standard factory length: 6 m and/or 12 m

Minimum quantities on request for:

- » 3 mm + 4 mm wall thickness, pickled according to EN 10305-5 in E220+CR2. Hot strips according to EN 10305-5
- » 3 mm - 6 mm wall thickness according to EN 10219 made from S355J2H unpickled hot strips (some dimensions also available in batches)
- » 6.3 mm wall thickness according to EN 10219 made from S275J0H hot strips, unpickled, or S355J2H
- » 7 mm + 8.8 mm wall thickness according to EN 10219 made from S355J2H hot strips, unpickled
- » Non-standard lengths
- » Other sizes and thicknesses, grades, removal of inner welding seams, special radii, etc.

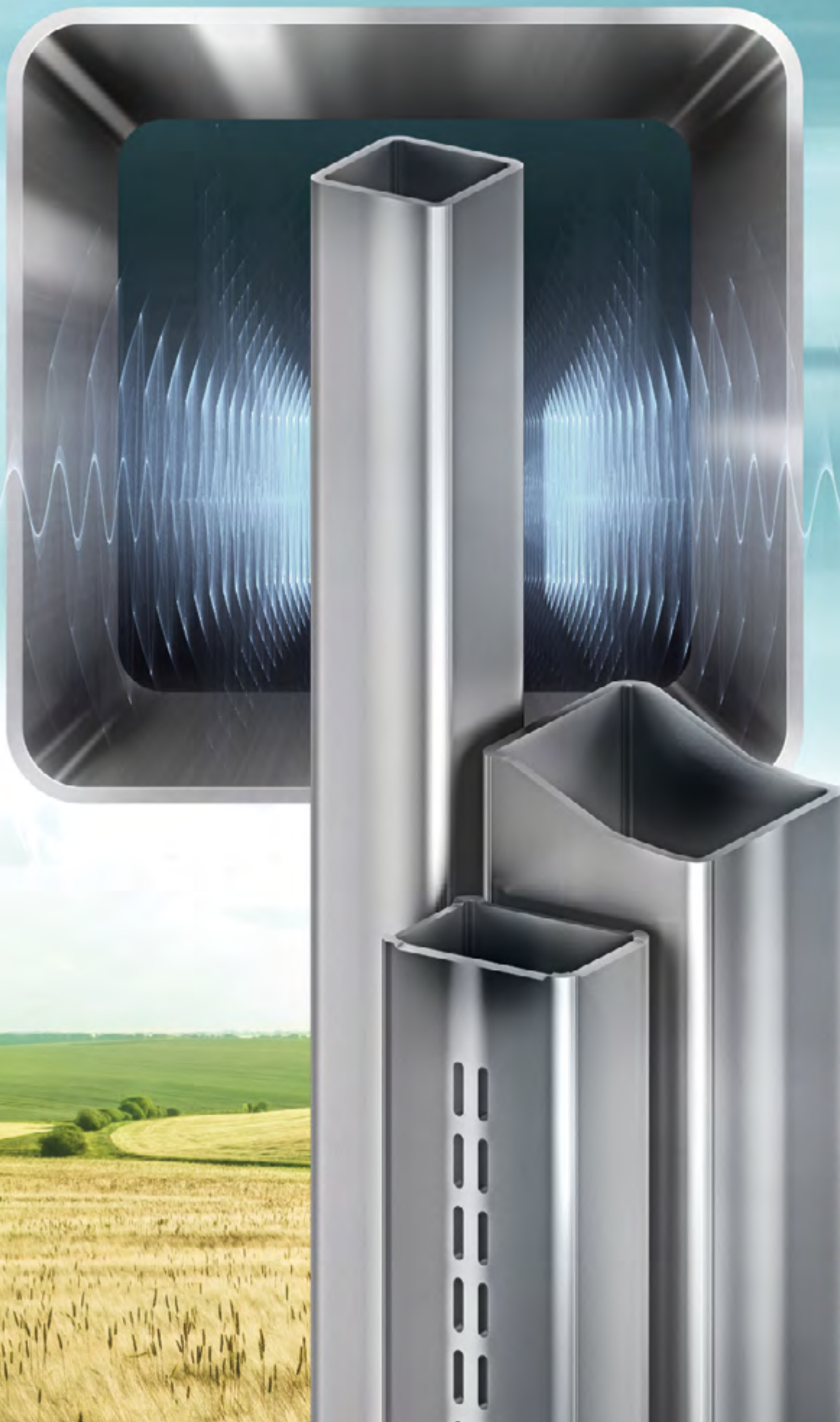
STANDARD PROGRAM AND STANDARD STEEL GRADES

The table below provides an overview of the dimensions and grades of hollow sections we have in stock. We offer standard lengths of 6 and/or 12 m. Do not hesitate to contact us if you have any questions.

Dimensions in stock			Thickness																		
			1.5	2		2.5	3		4		5		6		6.3	7	8	10			
Height	Width	Dimension	E220-CR2	E220-CR2	S235JRH	S250Z150NA	S235JRH	S250Z275NA	S275J2H	S355J2H	S275J2H	S355J2H	S275J2H	S355J2H	S275J2H	S355J2H	S355J2H	S355J2H	S355J2H	S355J2H	
15	15	Square	6	6																	
20	10	Rectangle	6																		
	15	Rectangle		6																	
	20	Square	6	6	6																
25	15	Rectangle	6	6																	
	20	Rectangle		6																	
	25	Square	6	6	6		6		6												
30	10	Rectangle	6																		
	15	Rectangle	6	6																	
	20	Rectangle	6	6	6				6												
	25	Rectangle		6																	
	30	Square	6	6	6		6		6	6	6										
34	34	Square		6																	
35	20	Rectangle	6	6																	
	25	Rectangle		6																	
	35	Square		6	6		6		6	6											
40	20	Rectangle	6	6	6		6		6												
	25	Rectangle		6																	
	30	Rectangle			6		6		6												
	40	Square	6	6	6		6		6/12	6	6	6/12	6/12	6/12							
45	45	Square		6																	
50	20	Rectangle		6	6		6														
	25	Rectangle		6	6				6	6											
	30	Rectangle		6	6		6		6	6	6	6									
	34	Rectangle		6																	
	40	Rectangle		6	6				6												
	50	Square		6	6		6		6/12	6	6/12	6/12	6/12	6/12							12
55	34	Rectangle		6																	
60	30	Rectangle		6	6				6	6	6	6									
	40	Rectangle		6	6		6		6/12	6	6/12	6/12	6	6/12							
	50	Rectangle							6												
	60	Square			6	6		6	6/12	6	6/12	6/12	6/12	6/12	6/12	6/12	6/12	6/12			
70	40	Rectangle		6					6	6	6	6		6							
	50	Rectangle							6		6	6									
	70	Square							6	6		6/12	6/12	6/12							12

Dimensions in stock			Thickness																	
			1.5	2		2.5	3		4		5		6		6.3	7	8	10		
Height	Width	Dimension	E220+CR2	E220+CR2	S235JRH	S250Z150NA	S235JRH	S250Z275NA	S275J2H	S355J2H	S275J2H	S355J2H	S275J2H	S355J2H	S275J2H	S355J2H	S355J2H	S355J2H	S355J2H	S355J2H
80	25	Rectangle							6											
	40	Rectangle		6					6/12	6	6/12	6	6/12	6/12		12				
	50	Rectangle							6/12	6	6	6	6/12	6/12						
	60	Rectangle							6		6	6/12	6/12	6/12	6/12	6/12	6/12			
	80	Square							6/12	6	6/12	6/12	6/12	6/12	6/12	6/12	12		12	
90	50	Rectangle									6									
	90	Square							6		6/12	6	6/12	6/12	12	12			12	
100	34	Rectangle		6																
	40	Rectangle		6					6		6									
	50	Rectangle							6/12	6/12	6/12	6/12	6/12	6/12	6/12	6/12				
	60	Rectangle							6	6	6/12	6/12	6/12	6/12	6/12	6/12				
	80	Rectangle									6		12	12	12	12			12	
	100	Square							6/12	6	6/12	6/12	6/12	6/12	6/12	6/12	12		12	12
110	70	Rectangle									6									
	110	Square									12		12						12	
120	40	Rectangle							6		6									
	60	Rectangle							6		6/12	6/12	6/12	6/12	6/12	6/12				
	80	Rectangle									6/12	6/12	12	12	12	6/12	12		12	12
	100	Rectangle																	12	
	120	Square							12		12	12	12	12	12	12	12		12	12
140	50	Rectangle							12											
	70	Rectangle							12		12	12	12	12	12	12			12	12
	80	Rectangle									12	12	12	12	12	12			12	12
	140	Square							12		12		12	12	12	12	12		12	12
150	50	Rectangle						6/12			12	12	12	12						
	75	Rectangle											12	12	12	12			12	
	100	Rectangle									12	12	12	12	12	12			12	12
	150	Square									12	12	12	12	12	12			12	12
160	80	Rectangle									12	12	12	12	12	12	12		12	12
	90	Rectangle											12	12	12			12	12	12
	160	Square											12	12	12	12			12	12
180	80	Rectangle											12	12	12	12			12	12
	100	Rectangle											12		12	12			12	12
	120	Rectangle													12			12		
	180	Square											12	12	12	12			12	12
	200												12			12			12	
200	80	Rectangle													12				12	
	100	Rectangle								12	12	12	12	12	12	12			12	12
	120	Rectangle													12	12			12	12
	150	Rectangle													12				12	12
	200	Square									12	12	12	12	12	12			12	12
220	120	Rectangle													12	12			12	12
	220	Square													12				12	12
250	100	Rectangle																	12	12
	150	Rectangle										12	12	12					12	12
260	140	Rectangle													12				12	12
	180	Rectangle																	12	12

endurance
dynamic



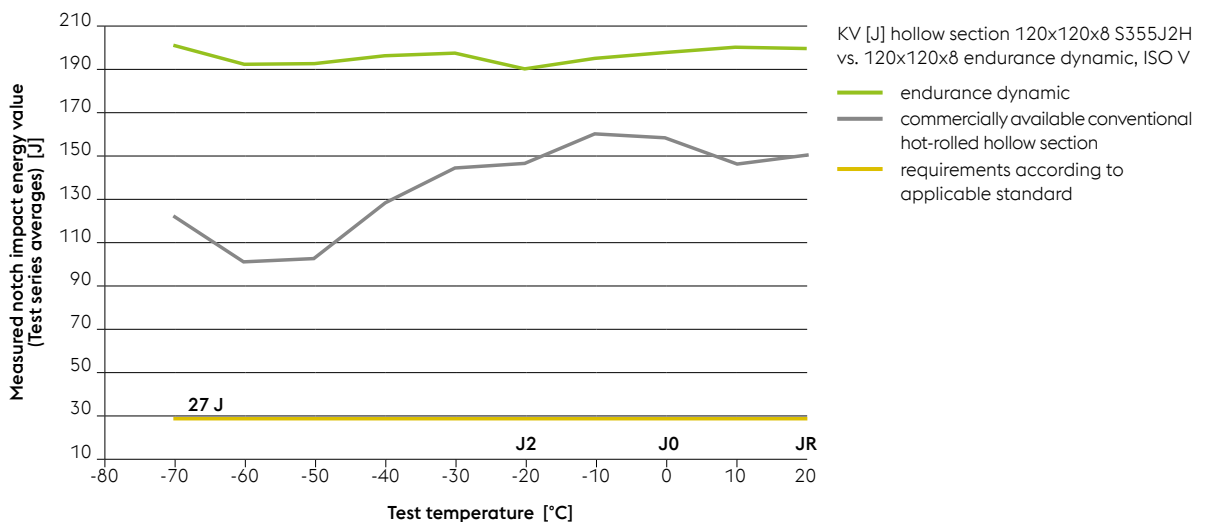
COUNT ON A DYNAMIC SOLUTION FOR DYNAMIC LOADS

endurance dynamic combines the cost benefits of a cold-formed hollow section with the superior quality of a hot-formed one. A special high-purity steel grade developed by voestalpine permits the production of cold-formed hollow sections of outstand-

ing quality. Close collaboration between all departments and experts involved, from materials development to precision manufacturing, helped create a groundbreaking, unrivalled product.

THESE FIGURES SPEAK FOR ENDURANCE DYNAMIC

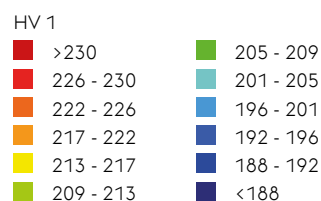
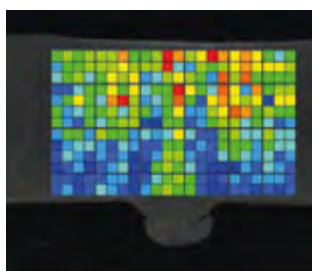
Notch impact energy



EXCESSIVE HARDENING IN THE WELD SEAM AREA

In accordance with EN ISO 15614-1, commercially available cold-rolled hollow sections made of S355J2H may only have up to 380 HV of excessive hardening in the weld seam area. The excessive hardening of

the weld seam of endurance dynamic falls within a range of just 5% of the basic hardness of the material.



endurance
dynamic

A COMPELLING RANGE OF BENEFITS

endurance dynamic has been specifically designed to meet the demanding requirements of agricultural machinery construction.

HIGH DYNAMIC LOAD CAPACITY

TIGHT EDGE RADII

HIGH NOTCH IMPACT STRENGTH

BEST VALUES IN TERMS OF STRAIGHTNESS,
CONCAVITY/CONVEXITY AND TORSION

EXCELLENT WELDABILITY

HIGH SURFACE QUALITY

OUTSTANDING LIFE CYCLE ASSESSMENT



COMPELLING ECONOMIC BENEFITS



HIGH DYNAMIC LOAD CAPACITY

The voestalpine formula for success: with their 'hot-forming equivalent' properties, endurance dynamic hollow sections are ideally suited for dynamic load conditions under cost pressure.

COST OF COLD-FORMED HOLLOW SECTIONS AT HOT-FORMED QUALITY LEVEL

The new generation of voestalpine hollow sections allows replacing hot-formed hollow sections with cold-rolled ones, combining the advantages of both materials.

AN INNOVATIVE MATERIALS CONCEPT

Thermomechanically rolled high-purity steel has significantly improved forming characteristics: cracks form significantly later, more extensive forming can be achieved and tensional peaks arising on inclusions are reduced.

endurance
extreme



RELY ON A COMPELLING POWERFUL SOLUTION!

Highly demanding requirements need powerful performance: endurance extreme hollow and special sections made from high-strength steel grades are singularly sturdy and tough, permitting a radical

reduction of wall thickness and a significant reduction in weight. These robust section solutions are able to withstand even the harshest everyday conditions and static stresses.

MECHANICAL PROPERTIES

Steel grade	Yield strength ReH (MPa)	Tensile strength Rm (Mpa)	Elongation at break A80 min. (up to 3 mm) <small>a) b)</small>	Charpy impact test V -20°C full sample min. (J) <small>b)</small>
S355MC	355	470 bis 630	19	40
S420MC	420	500 bis 660	16	40
S460MC	460	530 bis 720	14	40
S500MC	500	550 bis 750	12	40
S600MC	600	650 bis 870	11	40
S700MC	700	750 bis 950	10	40
S900MC	900	940 bis 110	10	40
S960MC	960	980 bis 1250	8	27

a)...for section dimensions $(W+T)/2 T < 12.5$, minimum elongation decreases by a value of 2.

b)...see EN10219-1 Item 6.7.2 for notch impact energy values for reduced-section samples.

EXTREM SAFETY ADVANTAGES

OUTSTANDING EASE OF PROCESSING AND MACHINING

Despite their high degree of sturdiness, endurance extreme hollow sections boast excellent forming characteristics and weldability and are easy to cut and stamp.

SERIOUS REDUCTION IN WEIGHT

Higher-strength hollow sections can reduce the total weight of parts by up to a third while ensuring the same degree of resilience. This means increased payloads and capacities for containers, cranes and trucks as well as lower fuel consumption for vehicles and allows unique designs and visual design effects, for example in facade engineering.

INCREASED SAFETY

When compared to conventional steel grades, higher-strength hollow sections can boost stability by up to 60% at unchanged wall thicknesses while improving fatigue behavior, thus optimizing safety in many different areas of application.



» Crane production



» Automotive production



» Bus production



» Storage systems

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voestalpine
ONE STEP AHEAD.