UHS™

Ultra High-strength Seamless, Hot Rolled Hollow Sections from ISMT

ISO 14001:2004
VEXIL BPS MS
E9100811

OHSAS 18001:2007
VEXIL BPS MS
H9100825

BSI REGISTERED
ISO/TS 16949 : 2002

ISMT LIMITED

Solutions You Can Trust

UHS™

Ultra High strength, Seamless, Hot Rolled Hollow Sections from ISMT
(conforming to EN 10210)

WIDEN YOUR POSSIBILITIES

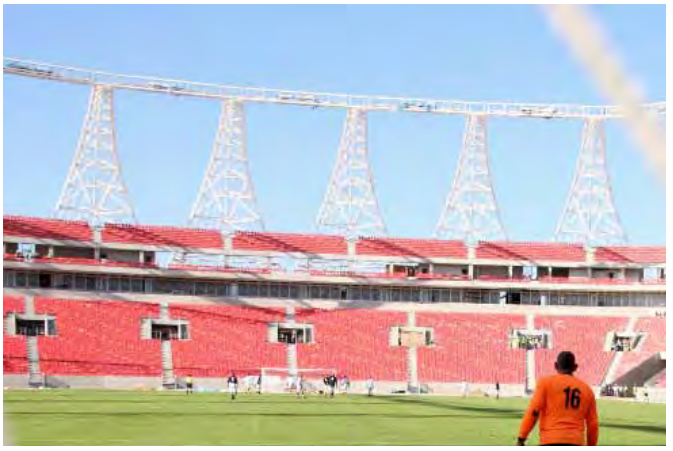
Modern architectural projects make extensive use of seamless hot rolled, hollow sections. These structural elements as a result of their greater load bearing ability, lightness, availability in a wide range of wall thicknesses, and visual appeal, offer the architect unprecedented flexibility in design. The use of these tubes makes possible structures that are slender, light, aesthetically pleasing and yet very strong. If you are looking to create an iconic structure, UHS hollow sections offer numerous options.

UHS hollow sections also find use in a variety of other structural applications such as the construction of off-shore derricks, agricultural machinery, crane booms, material handling systems, ships, and theme park rides. The special fine grain, high strength, quench and tempered UHS hollow sections described in this brochure are particularly well suited for such applications.

INHERENT STRENGTH

Unlike welded hollow sections, which are made by bending a steel strip and welding it longitudinally, a seamless hollow section is made from solid steel billet by piercing and elongating it. The absence of a weld, and the associated discontinuity in metal properties, ensures complete structural integrity of these hollow sections. Furthermore, since these sections are hot rolled and not cold formed as in the case of welded tubes, the material properties are completely uniform along the cross section.

All our tubes conform to European Standards (EN 10210) for hot-finished structural hollow sections.



APPLICATION

- Office buildings
- Industrial structures and bridge construction
- Sports complexes and stadiums
- Airport terminal
- Agricultural and farming equipments
- Frame structures and body work for locomotives
- Machine building
- Off-shore installations
- Ship building and material handling industry

MANUFACTURING PROCESS

At ISMT, we believe the only way to guarantee quality is to stand responsible for the entire process. For this reason, the steel used for the manufacture of UHS hollow sections is produced in-house through the electric arc furnace route maintaining complete control of the entire production process. The raw material mix is chosen and prepared carefully to ensure the highest standards of cleanliness. All heats are fully killed, ladle refined and vacuum degassed before continuous casting into billets. These ultra-clean round steel billets form the starting point for the manufacture of UHS hollow sections.

The round steel billets are first heated to between 1,150 and 1,350° C in a rotary hearth furnace. After heating, these billets pass through a cross-roll piercing mill where a carefully positioned piercing point drives a hole through the solid billets to produce elongated rough hollow blooms. These hollow blooms are then rolled over a mandrel, either through a three roll Assel Mill or through a PQF Mill, and eventually through a stretch reducing mill, to produce accurately sized, hot rolled hollow sections.

Stringent process control continues right through the manufacturing and testing process so that we are able to consistently deliver UHS hollow sections with the exact qualities that are required.

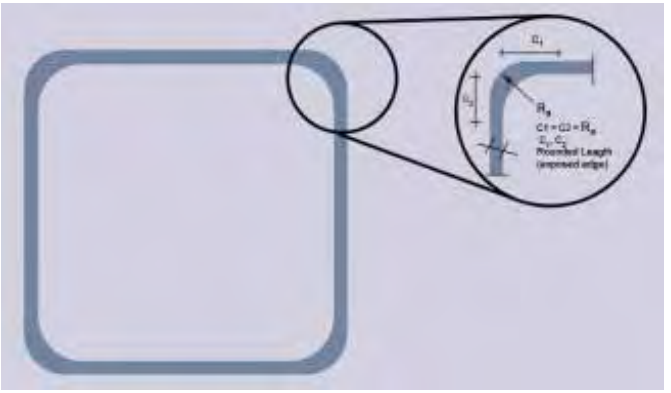
THE UHS ADVANTAGE

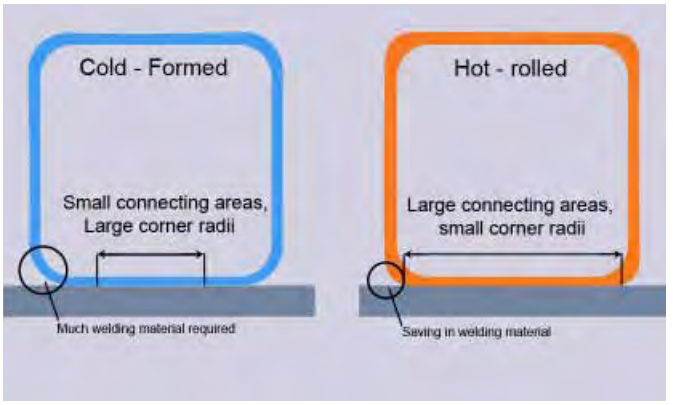
Total metallurgical integrity
UHS hollow sections do not contain any weld and are hot formed. As a result, these have a fully normalized grain structure and uniform hardness along the cross section. Unlike their welded counterparts, these do not suffer from any weak spots, discontinuities in material properties, or residual stresses along the perimeter of the section.

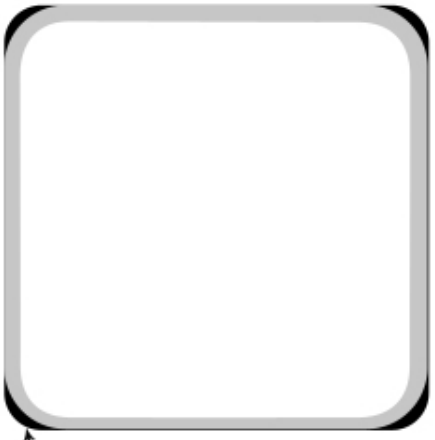
High strength options
These sections are available in a wide range of steel grades including high strength grades that provide additional flexibility in design. These high strength grades include fine-grain steels and quench and tempered steels.

Wide range of wall thicknesses
Unlike welded structural hollows, which are restricted in wall thickness, UHS hollows are available in a very wide range of wall thicknesses - upto 40mm thick. This makes possible the design of structural elements with uniform external diameters under varying loads. For example, following this principle, the column diameter can be kept constant right through the height of the building.

Reduction in welding material and larger connecting areas
Hot rolled hollow sections have smaller corner radii, particularly when higher wall thickness tubes are involved. As a result, the welding material required reduces and the flat contact area increases.







Higher load carrying capability
As a result of the reduced corner radii mentioned above, hot rolled hollow sections have a greater sectional moment and can, therefore, carry higher loads.

Higher buckling loads
Hot rolled seamless sections exhibit better buckling properties than their cold-formed welded counterparts. For this reason, Eurocode 3 norms allow higher buckling loads to be assigned to hot rolled sections.

Effective use of annular space
The empty space within the hollow section can be utilized effectively: UHS columns can be filled with concrete for added strength or with water for fire protection. Alternatively, this space can be used for conveying air-conditioning, electricity or water.

Smaller weld volumes
Weld volumes can be minimized by choosing smaller diameter sections with higher wall thicknesses.

NON-ALLOYED STRUCTURAL STEELS

Chemical Analysis (%)

GRADE	C	Si	Mn	P	S	N
	Specified Thickness (mm)					
	≤ 40					
S235JRH	≤ 0,17	-	≤1,40	≤ 0,040	≤ 0,040	≤ 0,009
S275J0H	≤ 0,20	-	≤1,50	≤ 0,035	≤ 0,035	≤ 0,009
S275J2H	≤ 0,20	-	≤1,50	≤ 0,030	≤ 0,030	-
S355J0H	≤ 0,22	≤ 0,55	≤1,60	≤ 0,035	≤ 0,035	≤ 0,009
S355J2H	≤ 0,22	≤ 0,55	≤1,60	≤ 0,030	≤ 0,030	-
S355K2H	≤ 0,22	≤ 0,55	≤1,60	≤ 0,030	≤ 0,030	-

Carbon equivalents (CEV) %

GRADE	Specified Thickness (mm)	
	≤ 16	>16 ≤40
S235JRH	≤0,37	≤0,39
S275J0H	≤0,41	≤0,43
S275J2H	≤0,41	≤0,43
S355J0H	≤0,45	≤0,47
S355J2H	≤0,45	≤0,47
S355K2H	≤0,45	≤0,47

Mechanical properties

GRADE	Min.Yield Strength (ReH) Mpa		Tensile Strength (Rm) MPa		Elongation % Minimum		Min Impact Strength	
	Specified Thickness (mm)		Specified Thickness (mm)		Specified Thickness (mm)			
					Long.	Transv.	T°C	J
	≤16	>16≤40	≤3	>3≤40	≤40	≤40		
S235JRH	235	225	360-510	360-510	26	24	20	27
S275J0H	275	265	430-580	410-560	23	21	0	27
S275J2H	275	265	430-580	410-560	23	21	-20	27
S355J0H	355	345	510-680	470-630	22	20	0	27
S355J2H	355	345	510-680	470-630	22	20	-20	27
S355K2H	355	345	510-680	470-630	22	20	-20	40

FINE GRAIN STRUCTURAL STEELS

Chemical Analysis (%)

GRADE	S275NH	S275NLH	S355NH	S355NLH	S420NH	S420NLH	S460NH	S460NLH
C	≤ 0.20	≤ 0.20	≤ 0.20	≤ 0.18	≤ 0.22	≤ 0.22	≤ 0.22	≤ 0.22
Si	≤ 0.40	≤ 0.40	≤ 0.50	≤ 0.50	≤ 0.60	≤ 0.60	≤ 0.60	≤ 0.60
Mn	0.50-1.40	0.50-1.40	0.90-1.65	0.90-1.65	1.00-1.70	1.00-1.70	1.00-1.70	1.00-1.70
P	≤ 0.035	≤ 0.030	≤ 0.035	≤ 0.030	≤ 0.035	≤ 0.030	≤ 0.035	≤ 0.030
S	≤ 0.030	≤ 0.025	≤ 0.030	≤ 0.025	≤ 0.030	≤ 0.025	≤ 0.030	≤ 0.025
Nb	≤ 0.050	≤ 0.050	≤ 0.050	≤ 0.050	≤ 0.050	≤ 0.050	≤ 0.050	≤ 0.050
V	≤ 0.08	≤ 0.08	≤ 0.12	≤ 0.12	≤ 0.20	≤ 0.20	≤ 0.20	≤ 0.20
Al tot.	≥ 0.020	≥ 0.020	≥ 0.020	≥ 0.020	≥ 0.020	≥ 0.020	≥ 0.020	≥ 0.020
Ti	≤ 0.03	≤ 0.03	≤ 0.03	≤ 0.03	≤ 0.03	≤ 0.03	≤ 0.03	≤ 0.03
Cr	≤ 0.30	≤ 0.30	≤ 0.30	≤ 0.30	≤ 0.30	≤ 0.30	≤ 0.30	≤ 0.30
Ni	≤ 0.30	≤ 0.30	≤ 0.50	≤ 0.50	≤ 0.80	≤ 0.80	≤ 0.80	≤ 0.80
Mo	≤ 0.10	≤ 0.10	≤ 0.10	≤ 0.10	≤ 0.10	≤ 0.10	≤ 0.10	≤ 0.10
Cu	≤ 0.35	≤ 0.35	≤ 0.35	≤ 0.35	≤ 0.70	≤ 0.70	≤ 0.70	≤ 0.70
N	≤ 0.015	≤ 0.015	≤ 0.020	≤ 0.020	≤ 0.025	≤ 0.025	≤ 0.025	≤ 0.025

Carbon Equivalents (CEV) %

GRADE	Maximum Carbon Equivalent (CEV) For Specified Thickness (mm)	
	≤ 16	>16 ≤40
S275NH	0.40	0.40
S275NLH	0.40	0.40
S355NH	0.43	0.45
S355NLH	0.43	0.45
S420NH	0.50	0.52
S420NLH	0.50	0.52
S460NH	0.53	0.55
S460NLH	**0.53**	**0.55**

Mechanical properties

GRADE	Min.Yield Strength (ReH) Mpa		Tensile Strength (Rm) MPa	Elongation % Minimum		Min Impact Strength	
	Specified Thickness (mm)		Specified Thickness (mm)	Specified Thickness (mm)		T°C	J
	≤ 16	>16 ≤40		Long.	Transv.		
S275NH	275	265	370-510	24	22	-20	40
S275NLH	275	265	370-510	24	22	-50	27
S355NH	355	345	470-630	22	20	-20	40
S355NLH	355	345	470-630	22	20	-50	27
S420NH	420	400	520-680	19	17	-20	40
S420NLH	420	400	520-680	19	17	-50	27
S460NH	460	440	540-720	17	15	-20	40
S460NLH	460	440	540-720	17	15	-50	27

FINE GRAIN, HIGH STRENGTH, QUENCH AND TEMPERED STEELS

ISMT also manufactures UHS hollow sections made of fine grain, high strength steels in various sizes and thicknesses. These tubes find application in the construction of bridges, cranes, off-shore structures, buildings, ships and other structures where reduction of dead weight without any loss of load bearing capacity is critical.

Typical characteristics of these tubes are high yield strengths and good toughness with the guarantee of chemistry that is suitable for welding. Tubes are produced as per following chemical analysis that guarantee the required mechanical properties which generally conform to EN 10297 specification.

Chemical Analysis (%)

C	Mn	Si	P	S	Ni	V	Cr	Mo
≤0.20	≤1.70	≤0.60	≤0.025	≤0.015	≤1.20	≤0.12	≤0.50	≤0.50

CE Maximum Value 0.63%

Mechanical Properties

GRADE	TENSILE PROPERTIES					IMPACT TEST			
	Rp02 (MPa) Min		Rm (MPa) Min		A %	Charpy KV long.		Charpy KV Trasv.	
	Wall Thickness (mm)				Long. Min	(J min) Temperature			
	≤ 20	> 20 ≤ 40	≤ 20 ≤	> 20 ≤ 40 ≤		-20 °C	-50 °C	-20 °C	-50 °C
HS620	620	580	580-720	550-720	17	55	-	27	-
HS690	690	650	770-960	720-930	16	55	-	27	-
HS770	770	700	820-1000	750-960	15	50	-	27	-
HS790	790	730	850-1050	830-1050	13	45	-	20	-

SIZES

Circular Hollow - Sections

Wall Thickness (mm)	Outside Diameter (mm)															
	21.3	33.7	42.4	48.3	60.3	76.1	88.9	101.6	114.3	139.7	168.3	177.8	193.7	219.1	244.5	273
8.0	1.08															
2.6	1.20															
2.9	1.32	2.20	2.82	3.25												
3.2	1.43	2.41	3.09	3.56	4.51	5.75										
3.6	1.57	2.67	3.44	3.97	5.03	6.44	7.51									
4.0	1.71	2.93	3.79	4.37	5.55	7.11	8.38	9.63								
4.5	1.86	3.24	4.21	4.86	6.19	7.95	9.37	10.8	12.2	15.0						
5.0	2.01	3.54	4.61	5.34	6.82	8.77	10.3	11.9	13.5	16.6	20.1					
5.6		3.88	5.08	5.90	7.55	9.74	11.5	13.3	15.0	18.5	22.5					
6.3		4.26	5.61	6.53	8.39	10.8	12.8	14.8	16.8	20.7	25.2	26.6	29.1	33.1		
7.1		4.66	6.18	7.21	9.32	12.1	14.3	16.5	18.8	23.2	28.2	29.9	32.7	37.1		
8.0		5.07	6.79	7.95	10.3	13.4	16.0	18.5	21.0	26.0	31.6	33.5	36.6	41.6	46.7	
8.8			7.29	8.75	11.2	14.6	17.4	20.1	22.9	28.4	34.6	36.7	40.1	45.6	51.2	
10.0			7.99	9.45	12.4	16.3	19.5	22.6	25.7	32.0	39.0	41.4	45.3	51.6	57.8	64.9
12.5					14.7	19.6	23.6	27.5	31.4	39.2	48.0	51.0	55.9	63.7	71.5	80.3
16.0						23.7	28.8	33.8	38.8	48.8	60.1	63.8	70.1	80.1	90.2	101
20.0						27.7	34.0	40.2	46.5	59.0	73.1	77.8	85.7	98.2	111	125
30.0									62.4	81.2	102	109	121	140	159	180
40											127	136	152	177	202	230

Other outside diameter and wall thickness on request (Weight in kg/m)

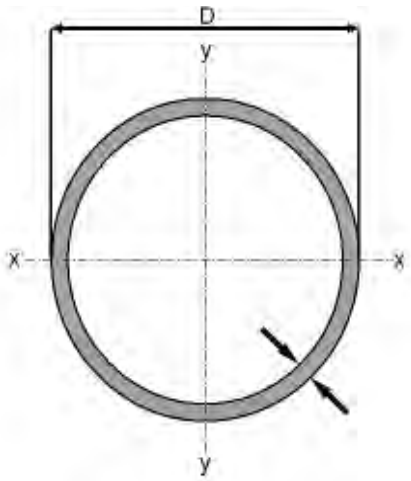
Square Hollow – Sections

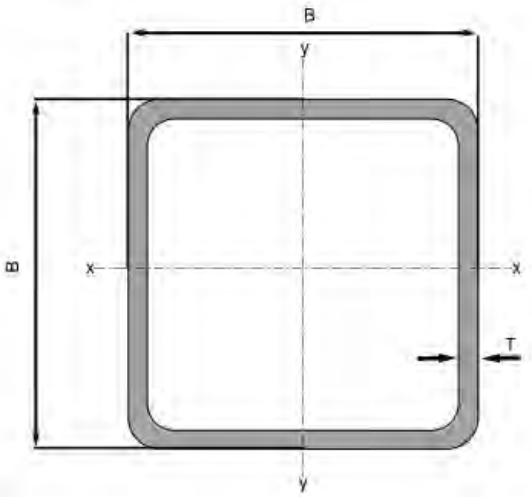
Wall Thickness (mm)	Outside Diameter (mm)										
	40x40	50x50	60x60	70x70	80x80	90x90	100x100	110x110	120x120	140x140	150x150
2.9	3.31	4.22	5.13								
3.2	3.61	4.62	5.62	6.63							
3.6	4.01	5.14	6.27	7.40	8.53	9.66					
4.0	4.39	5.64	6.9	8.15	9.41	10.7	11.9	13.2			
4.5	4.85	6.26	7.67	9.08	10.5	11.9	13.3	14.7	16.1		
5.0	5.28	6.85	8.42	9.99	11.6	13.1	14.7	16.3	17.8	21.0	
5.6	5.78	7.54	7.30	11.1	12.8	14.6	16.3	18.1	19.9	23.4	
6.3	6.33	8.31	10.3	12.3	14.2	16.2	18.2	20.2	22.2	26.1	28.1
7.1	6.91	9.14	11.4	13.6	15.8	18.1	20.3	22.5	24.7	29.2	31.4
8.0		10.0	12.5	15.0	17.5	20.1	22.6	25.1	27.6	32.6	35.1
8.8			13.5	16.3	19.0	21.8	24.5	27.3	30.1	35.6	38.4
10.0			14.9	18.0	21.1	24.3	27.4	30.6	33.7	40.0	43.1
11.0			15.9	19.4	22.8	26.3	29.7	33.2	36.6	43.5	47.0
12.5			17.3	21.3	25.2	29.1	33.0	37.0	40.9	48.7	52.7
14.2							33.6	41.0	45.5	54.4	58.9
16.0									50.1	60.1	65.2
17.5										64.7	70.2
20.0											

Other outside diameter and wall thickness on request (Weight in kg/m)

TOLERANCES

Tolerances will be as per EN 10297 specifications.





Tolerances according to EN 10210–2

Permissible deviation in external dimensions D, B and H = ±1% With a minimum of ±0.5mm.

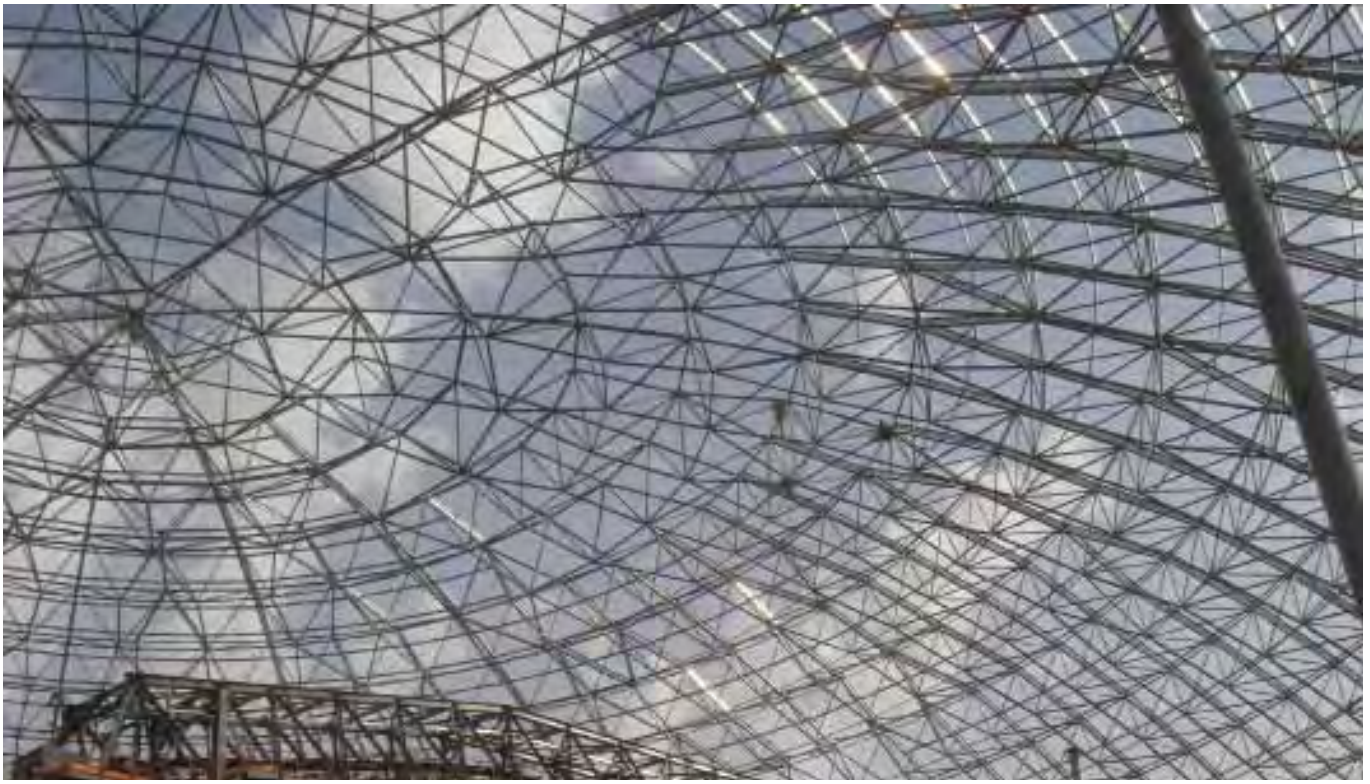
Tolerance on wall thickness T = -10% for seamless section, local deviation of -12.5% are permissible.

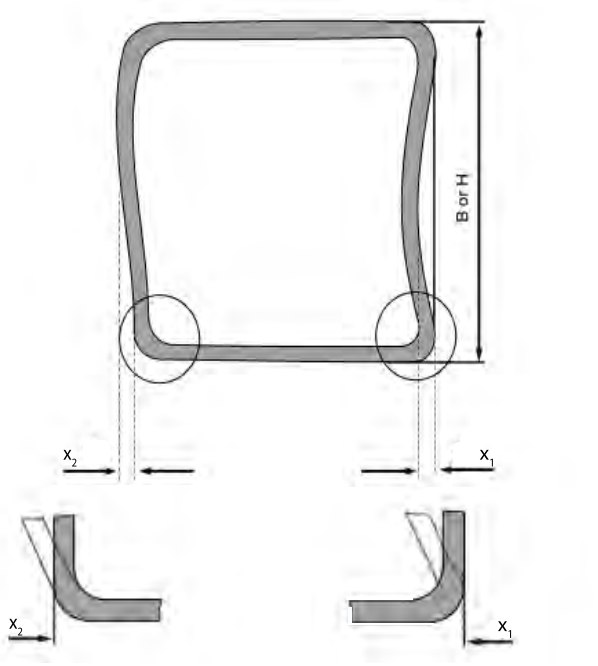
Permissible out-of-roundness 0 = 2%.

Out-of-roundness is calculated using the following equation:

$$0(\%) = \frac{D_{max} - D_{Min}}{D} \times 100$$

In the case of square USH sections, the wall thickness in the straight edge area must be checked. The upper layer of the wall thickness is determined by the maximum weight.



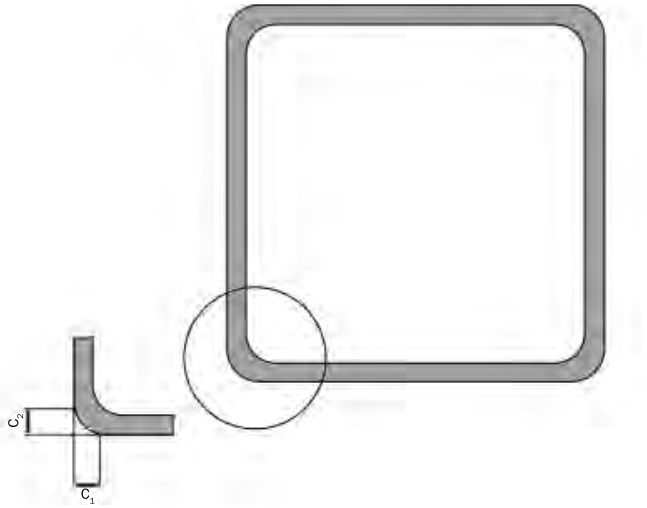


Maximum permissible deviation of squareness of sides = ± 1°

Permissible **curvature** of lateral surfaces concavity/convexity =1%. The value of relative concavity or convexity is calculated as follows:

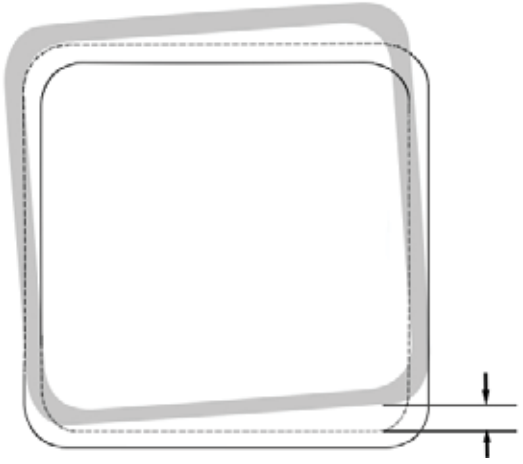
$$\frac{X_1}{\text{Side length}} \times 100\%$$

The value of permissible concavity or convexity apply independent of the tolerances on external dimensions.



External Corner Profile

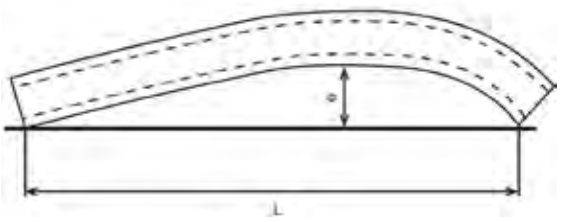
C1 and C2 = max. 3T (wall thickness) the distance between the intersection of the flat side and the corner arc and the intersection of the projections of the flat sides to the corner C1 and C2 shall be measured



The maximum permissible **twist** V is calculated using the following formula: V = 2mm + 0.5mm/m

Permissible **out-of-straightness** = 0.2% related to the total section length, ie. 2mm/m

Maximum **mass** tolerance per section = ±6%, ±8%.



LENGTH AND PERMISSIBLE DEVIATIONS

Type of Length	Available length (mm)	Permissible Deviation	Ordering Information re Length
Mill length	6000 – 16,000	[1])	none
Fixed length	≥2,000	±500	Required fixed length in mm
	≥2,000 ≤6,000 >6,000	–0 +10 –0 +15	Required fixed length in mm

[1]) In case of mill lengths, the required range must be specified.
and 90% of the delivery must within the range.
10% may be shorter but not fall below 75% of the specified lower limit of the length range.

WELDABILITY

All the steel grades indicated in this brochure have been specially developed so that they have a low carbon equivalent and are easily weldable using traditional welding procedures (provided generally accepted technical rules are followed). For very thick sections, precautions should be taken to avoid cold cracking. In such cases, pre-heating prior to welding is advisable.

LENGTHS

Standard lengths supplied by ISMT are from 5 to 10 mtrs long. Tubes in exact length based on specific request can also be supplied.

END PREPARATION

Tubes with square cut ends or bevelled ends can be supplied.

PACKAGING AND MARKING

Each tube is oiled internally and externally and then packed into round/ hexagon bundles. This ensures that tubes are protected from corrosion and that tubes retain their straightness during transport. Our standard marking (painting) includes:

- Name and trade mark
- Dimensions
- Steel designation e.g. EN 10210 – S355J24
- Batch number

INSPECTION AND TESTING

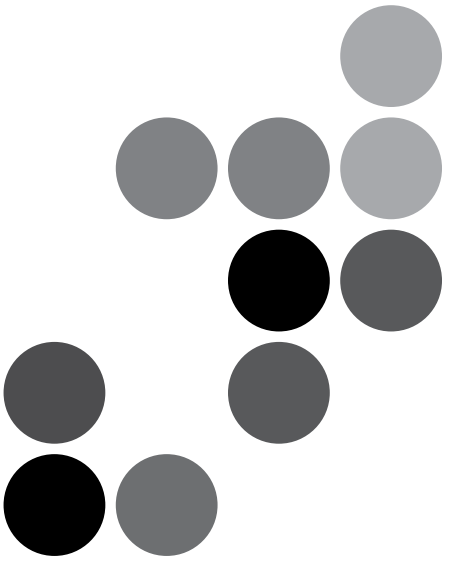
Tubes are subjected to following tests (which conform to EN 10210)

- Cast analysis
- Tensile test
- Impact test
- Visual and dimensional check

ISMT manufactures carbon/alloy steel and seamless tubes for:

- Energy and Power Generation
- Automotive Components
- Hydraulic and Pneumatic Pressure Lines
- Hydraulic Cylinders
- Gas Cylinders
- Mining and Construction
- Bearings
- General Engineering Applications
- Oil and Petroleum Applications

Product details are available on request



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