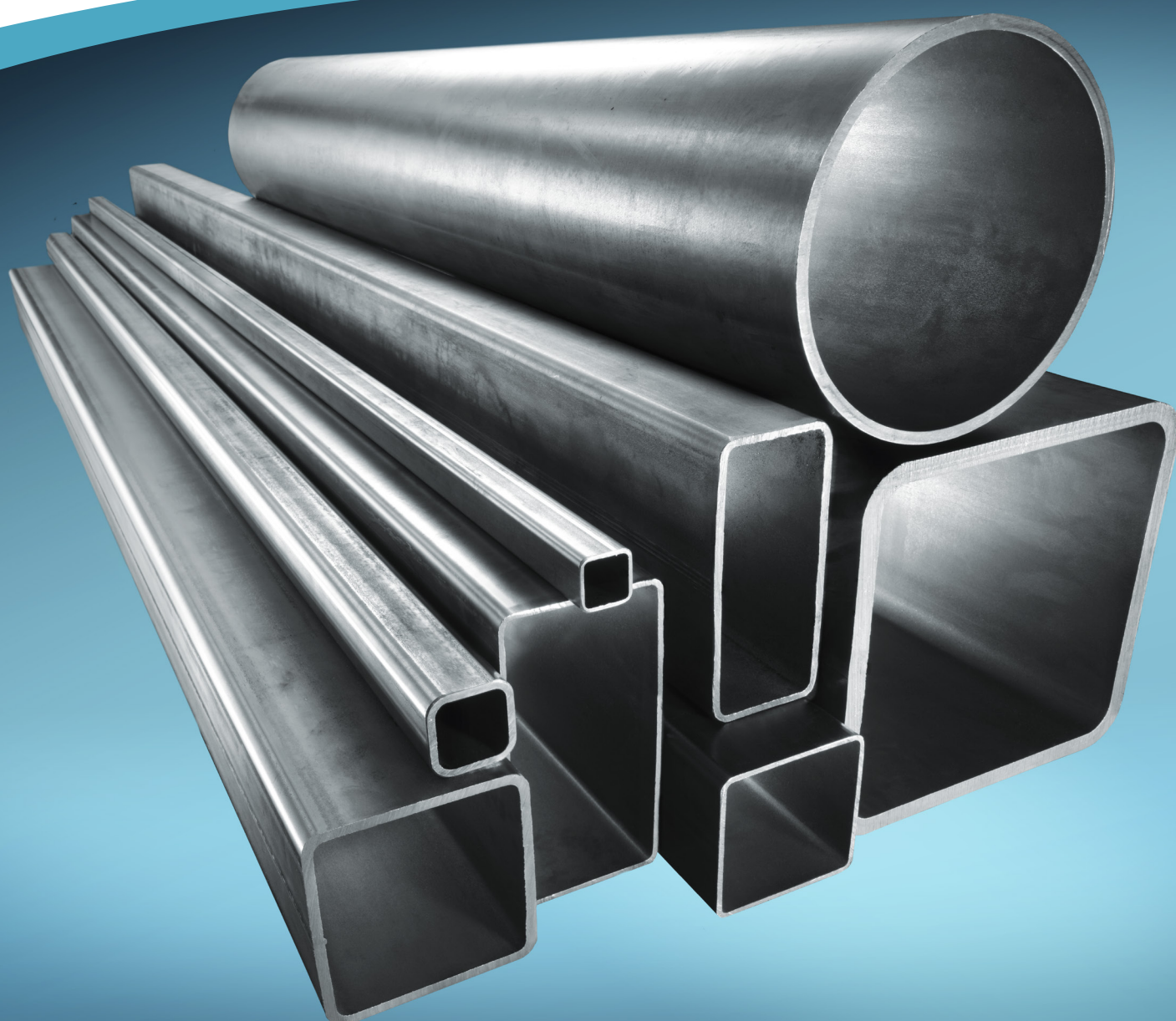


TATA STEEL



Forcon®

The hollow sections you can rely on



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Forcon®

Forcon® is our range of cold formed welded structural hollow sections to EN 10219, available with minimum yield strengths ranging from 235 MPa to 700 MPa. Proven over many years in the field, these engineered solutions meet your needs for accuracy and performance.

Tata Steel Nederland Tubes

With over 100 years of experience in steel tube production in the Netherlands, we are dedicated to finding solutions that support our customers. At three manufacturing sites we produce structural hollow sections, precision tubes and our special galvanised Contiflo® and Forcas® tubes. Our products are used in truck trailers, agricultural machines, greenhouses and stadia, to name but a few.

We take pride in our relationship with customers and build true partnerships which stand the test of time, backed by high quality service.

Why choose Forcon®?

Our **Forcon®** range of premium cold formed welded structural hollow sections is designed to meet exacting specifications and is supported by our extensive customer service and technical expertise. This product is perfect for a wide range of structural and engineering applications, especially those that require specific properties and compliance with design codes.

Take advantage of Forcon® if you are looking FOR CONSistency in all aspects.

BENEFITS

Reliable quality

Our **Forcon®** grades are manufactured to exacting standards, delivering consistent quality and precise dimensional tolerances for optimal results.

Efficient for processing, fabrication, assembly and end use

The optimum fit with advanced dimensional consistency and surface quality, excellent weldability and galvanisability, the variety of steel grades including high strength and the availability of long lengths.

Tailored to meet your needs

Whether it's future designs requiring low weight, high strength and automated processing or renovation projects with unique challenges - we have the solutions to meet your needs.

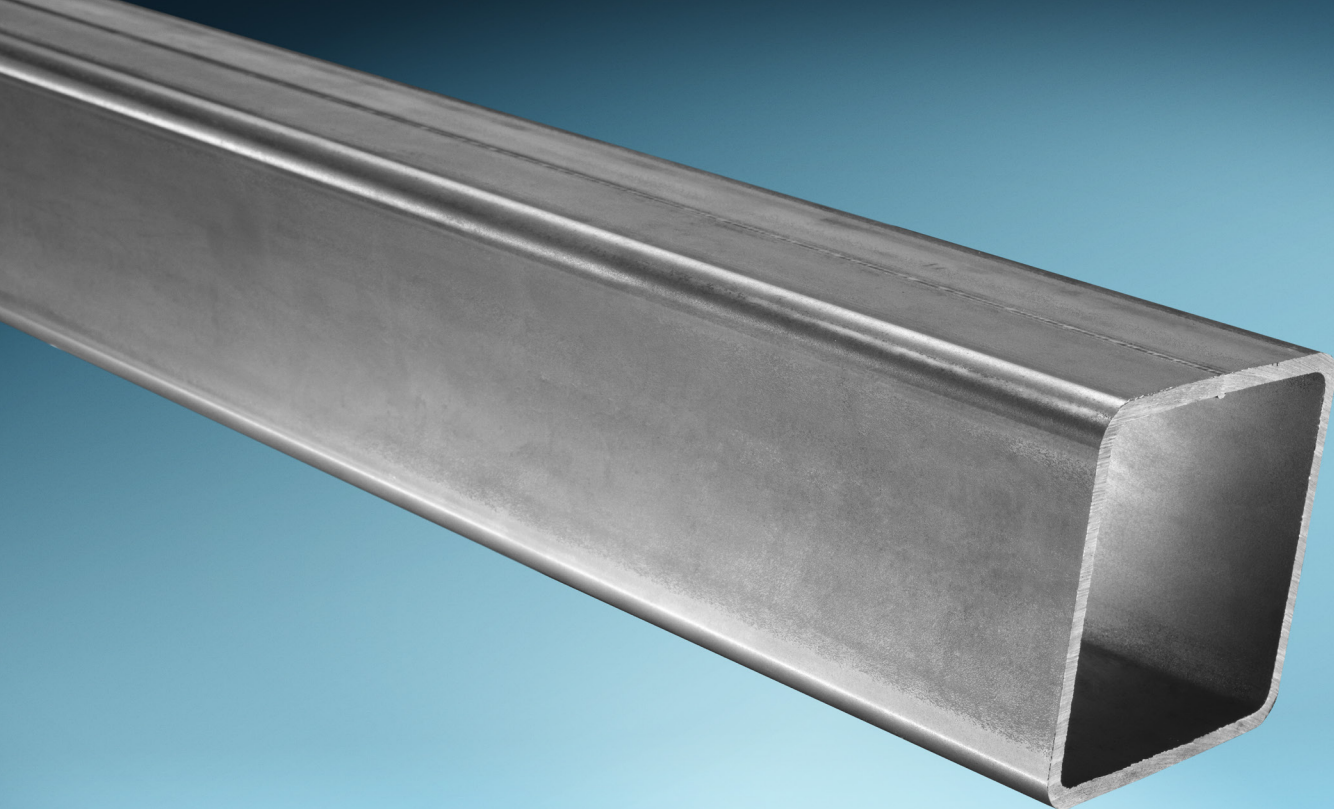
Knowledgeable experts who understand your business

With over a century of expertise in tube manufacturing and a deep commitment to customer collaboration and research, we support you every step of the way. Our commercial and technical service team is here to help and speaks numerous languages.

Made in the Netherlands

Forcon® is locally produced in our tube mills in Maastricht and Zwijndrecht. Our fully integrated steel works in IJmuiden ensures the quality and traceability of our products throughout the whole supply chain.





TECHNICAL DATA

Dimensional tolerances EN 10219: Part 2

	Circular	Square/Rectangular	
Outside dimension (D B and H)	±1% with a min of ±0.50mm and a max of ±10mm	Side length (mm) H,B < 100	Tolerance ±1% with a min of ±0.5mm
		100 ≤ H,B ≤ 200	±0.8%
		H,B > 200	±0.6%
Thickness (T)	For D ≤ 406.4mm T ≤ 5mm ±10% T > 5mm ±0.50mm For D > 406.4mm ±10% with a max of ±2mm	T ≤ 5mm	±10%
		T > 5mm	±0.50mm
Out of roundness (O)	2% for D/T < 100, where D/T ≥ 100 out-of-roundness tolerance to be agreed	–	
Concavity/Convexity (independent tolerance on outside dimensions)	–	Max 0.8% with a min of 0.5mm	
Squareness of side	–	90° ± 1°	
External corner profile	–	T ≤ 6.0	1.6T to 2.4T
(radius need not be tangential to the sides) EN10219: Part 2 Table 3		6.0 < T ≤ 10.0	2.0T to 3.0T
		T > 10.0	2.4T to 3.6T
Twist (V)	–	2mm plus 0.5mm/m length	
Straightness	0.20% of total length & 3mm over any 1m length	0.15% of total length & 3mm over any 1m length	
Mass (M)	±6% on individual lengths	±6% on individual lengths	
Length	-0 +50mm	-0 +50mm	

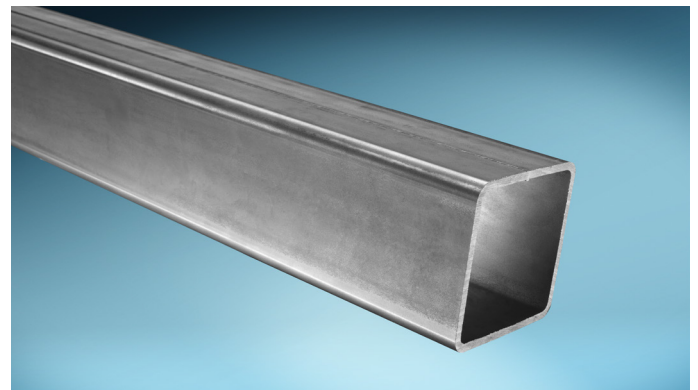
Forcon® 235

Tubes to EN 10219: S235JRH

Forcon® is our range of cold formed structural hollow sections to EN 10219, available with minimum yield strengths ranging from 235 MPa to 700 MPa.

The grade S235JRH is suitable for a variety of applications in construction or mechanical engineering.

Our Forcon® hollow sections are available in a range of popular sizes as well as with the option TT for Tailored Tubes with customised extras.



Forcon® 235 fully complies with the European standard for cold formed welded structural hollow sections of non-alloy and fine grain steels, EN 10219. As all our tubes, they are manufactured to high quality standards and made from fully killed steel. This ensures a more uniform microstructure and makes them easier to process, offering high levels of formability and excellent weldability.

Tolerances

Dimensional tolerances are to EN 10219.

Galvanising suitability

The steel composition complies with category A according to ISO 14713-2:2020, perfectly suitable for hot dip zinc coating.

CE Marking

Forcon® 235 is manufactured and CE marked according to EN 10219 grade S235JRH.

Forcon® TT

Our structural hollow sections are also available as Forcon® TT. For these Tailored Tubes you can choose from several premium options - for example tighter tolerances, a certain position of the weld seam or a scarfed internal weld bead, a superior surface finish or special bundling. We are ready to help you to tailor Forcon® TT to your needs. Our customised Forcon® TT is the key to boosting efficiency in manufacturing.

Technical Support

We want you to get the best from Forcon® hollow sections. Our sales team is always happy to answer your questions on steel selection or available options. And our engineers are available to assist you with the application of Forcon® for efficient and lightweight design.

Inspection & Testing

Forcon® 235 hollow sections are subject to non-specific inspection and testing and are supplied with a test report type 2.2 to EN 10204.

Availability

Forcon® 235 is available across the size range indicated in the below tables. Minimum order quantities may apply and other sizes or thicknesses may be available – please contact your Tata Steel Nederland Tubes representative for details.

Standard lengths of Forcon® 235 are 6m, 12m or 15m, depending on the size and production mill. Special mill lengths from 4.5m up to 20m can be arranged upon request.

Sustainability

Steel is strong, durable, versatile, re-usable and most importantly, it is endlessly 100% recyclable without loss of quality. We take sustainability very seriously and as well as being a member of Responsible Steel™, we have BES 6001 certification and Environmental Product Declarations (EPD's) for our Forcon® hollow sections. To reduce carbon emissions, you can choose from different Zeremis® solutions.

Mechanical properties

Grade	Min. yield strength	Tensile strength	Min. Elongation	Min. impact KV2 at test temperature of 20°C
	R _{eh} (MPa)	R _m (MPa)	A (%)	J
S235JRH	235	360-510	24	27

The impact properties are verified only when the option is specified by the purchaser at the time of enquiry and order.

For thicknesses > 3 mm and section sizes D/T < 15 (round) and (B+H)/2T < 12.5 (square and rectangular) the minimum elongation is reduced by 2. For thicknesses ≤ 3 mm the minimum value for elongation is 17 %.

For thicknesses < 3 mm, a gauge length of Lo = 80 mm shall be used provided a test piece width of 20 mm can be achieved, otherwise a gauge length of 50 mm shall be used with a test piece width of 12.5 mm.

Chemical composition

	C	Si	Mn	P	S	Al _{tot}	CEV
	max.	max.	max.	max.	max.	min.	max.
S235JRH	0.17	-	1.40	0.040	0.040	0.020	0.35

All values are in weight%

Forcon® 235

Circular hollow sections (CHS)

mm	2.0	2.6	3.2	3.6	4.0	5.0	6.0	6.3	8.0	10.0
31.8										
33.7										
38.0										
41.5										
42.4										
44.5										
48.3										
51.0										
57.0										
60.3										
63.5										
70.0										
76.1										
82.5										
88.9										
101.6										
108.0										
114.3										
121.0										
127.0										
139.7										
159.0										
168.3										
193.7										
219.1										
244.5										
273.0										
323.9										

These dimensions are available on request.

Forcon® 235

Rectangular hollow sections (RHS)

mm	2.0	2.5	3.0	3.5	4.0	5.0	6.0	8.0	10.0
30/20									
40/20									
40/30									
50/20									
50/25									
50/30									
50/40									
60/20									
60/30									
60/40									
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180/80									
180/100									
200/80									
200/100									
200/120									
200/150									
220/120									
250/100									
250/150									
300/100									
300/200									

These dimensions are available on request.

These dimensions are regularly rolled.

Forcon® 235

Square hollow sections (SHS)

mm	2.0	2.5	3.0	3.5	4.0	5.0	6.0	8.0	10.0
25/25									
28/28									
30/30									
35/35									
40/40									
45/45									
50/50									
60/60									
70/70									
80/80									
90/90									
100/100									
120/120									
140/140									
150/150									
160/160									
180/180									
200/200									
250/250									

These dimensions are available on request.

These dimensions are regularly rolled.

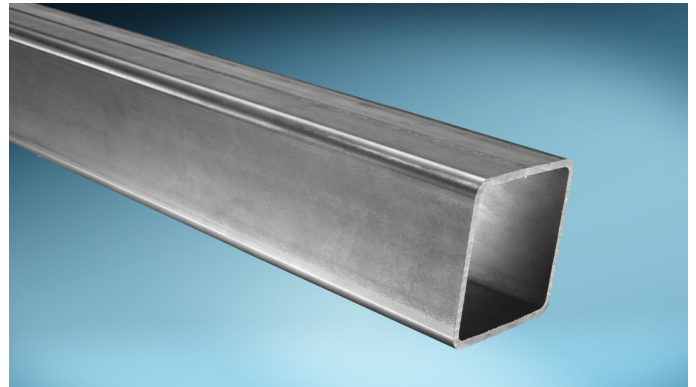
Forcon® 275

Tubes to EN 10219: S275J0H/J2H

Forcon® is our range of cold formed structural hollow sections to EN 10219, available with minimum yield strengths ranging from 235 MPa to 700 MPa.

The grades S275J0H and S275J2H are suitable for a wide variety of applications in construction or mechanical engineering.

Our Forcon® hollow sections are available in a range of popular sizes as well as with the option TT for Tailored Tubes with customised extras.



Forcon® 275 fully complies with the European standard for cold formed welded structural hollow sections of non-alloy and fine grain steel, EN 10219. As all our tubes, they are manufactured to high quality standards and made from fully killed steel. This ensures a more uniform microstructure and makes them easier to process, offering high levels of formability and excellent weldability.

Tolerances

Dimensional tolerances are to EN 10219.

Galvanising suitability

The steel composition complies with category A according to ISO 14713-2:2020, perfectly suitable for hot dip zinc coating.

CE Marking

Forcon® 275 is manufactured and CE marked according to EN 10219 grade S275J0H or S275J2H.

Forcon® TT

Our structural hollow sections are also available as Forcon® TT. For these Tailored Tubes you can choose from several premium options - for example tighter tolerances, a certain position of the weld seam or a scarfed internal weld bead, a superior surface finish or special bundling. We are ready to help you to tailor Forcon® TT to your needs. Our customised Forcon® TT is the key to boosting efficiency in manufacturing.

Technical Support

We want you to get the best from Forcon® hollow sections. Our sales team is always happy to answer your questions on steel selection or available options. And our engineers are available to assist you with the application of Forcon® for efficient and lightweight design.

Inspection & Testing

Forcon® 275 hollow sections in S275J0H are subject to non-specific inspection and testing and are supplied with a test report type 2.2 to EN 10204. Forcon® 275 hollow sections in S275J2H are subject to specific inspection and testing and are supplied with an inspection certificate type 3.1 to EN 10204.

Availability

Forcon® 275 is available across the size range indicated in the below tables. Minimum order quantities may apply and other sizes or thicknesses may be available – please contact your Tata Steel Nederland Tubes representative for details.

Standard lengths of Forcon® 275 are 6m, 12m or 15m, depending on the size and production mill. Special mill lengths from 4.5m up to 20m can be arranged upon request.

Sustainability

Steel is strong, durable, versatile, re-usable and most importantly, it is endlessly 100% recyclable without loss of quality. We take sustainability very seriously and as well as being a member of Responsible Steel™, we have BES 6001 certification and Environmental Product Declarations (EPD's) for our Forcon® hollow sections. To reduce carbon emissions, you can choose from different Zeremis® solutions.

Mechanical properties

Grade	Min. yield strength	Tensile strength		Min. Elongation	Min. impact KV2 at test temperature of	
	R_{eH} (MPa)	R_m (MPa)		A (%)	-20°C	0°C
		T < 3 mm	3 mm ≤ T ≤ 40 mm		J	J
S275J0H	275	430-580	410-560	20		27*
S275J2H	275	430-580	410-560	20	27	

* The impact properties are verified only when the option is specified by the purchaser at the time of enquiry and order.

For section sizes D/T < 15 (circular) and (B+H)/2T < 12.5 (square and rectangular) the minimum elongation is reduced by 2.

For thicknesses < 3 mm, a gauge length of $L_0 = 80$ mm shall be used provided a test piece width of 20 mm can be achieved, otherwise a gauge length of 50 mm shall be used with a test piece width of 12.5 mm.

Chemical composition

	C	Si	Mn	P	S	Al _{tot}	CEV
	max.	max.	max.	max.	max.	min.	max.
S275J0H	0.20	-	1.50	0.035	0.035	0.020	0.40
S275J2H	0.20	-	1.50	0.030	0.030	0.020	0.40

All values are in weight%

Forcon® 275

Circular hollow sections (CHS)

mm	2.0	2.6	3.2	3.6	4.0	5.0	6.0	6.3	8.0	10.0
31.8										
33.7										
38.0										
41.5										
42.4										
44.5										
48.3										
51.0										
57.0										
60.3										
63.5										
70.0										
76.1										
82.5										
88.9										
101.6										
108.0										
114.3										
121.0										
127.0										
139.7										
159.0										
168.3										
193.7										
219.1										
244.5										
273.0										
323.9										

These dimensions are available on request.

Forcon® 275

Rectangular hollow sections (RHS)

mm	2.0	2.5	3.0	3.5	4.0	5.0	6.0	8.0	10.0
30/20									
40/20									
40/30									
50/20									
50/25									
50/30									
50/40									
60/20									
60/30									
60/40									
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160/90									
180/80									
180/100									
200/80									
200/100									
200/120									
200/150									
220/120									
250/100									
250/150									
300/100									
300/200									

These dimensions are available on request.

These dimensions are regularly rolled.

Forcon® 275

Square hollow sections (SHS)

mm	2.0	2.5	3.0	3.5	4.0	5.0	6.0	8.0	10.0
25/25									
28/28									
30/30									
35/35									
40/40									
45/45									
50/50									
60/60									
70/70									
80/80									
90/90									
100/100									
120/120									
140/140									
150/150									
160/160									
180/180									
200/200									
250/250									

These dimensions are available on request.

These dimensions are regularly rolled.

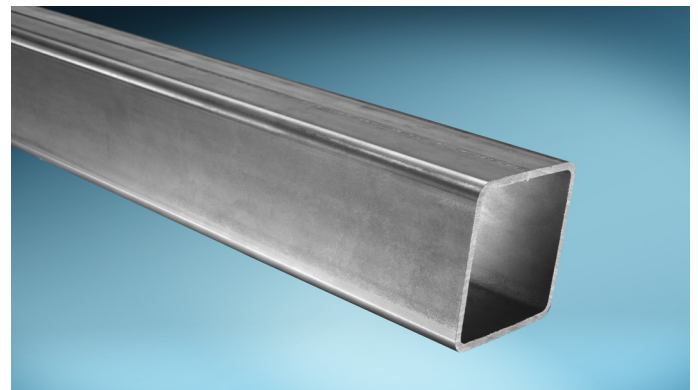
Forcon® 355

Tubes to EN 10219: S355J2H

Forcon® is our range of cold formed structural hollow sections to EN 10219, available with minimum yield strengths ranging from 235 MPa to 700 MPa.

The grade S355J2H is suitable for a wide variety of applications in construction or mechanical engineering.

Our Forcon® hollow sections are available in a range of popular sizes as well as with the option TT for Tailored Tubes with customised extras.



Forcon® 355 fully complies with the European standard for cold formed welded structural hollow sections of non-alloy and fine grain steels, EN 10219. It is batch tested for your assurance and perfect for projects where you require guaranteed minimum strength and mechanical properties.

Tolerances

Dimensional tolerances are to EN 10219.

Weldability

Forcon® 355 tubes fulfil the conditions for welding cold-formed zones and adjacent material described in EN 1993 / Eurocode 3.

Galvanising suitability

The steel composition complies with category A or B according to ISO 14713-2:2020, perfectly suitable for hot dip zinc coating.

CE Marking

Forcon® 355 is manufactured and CE marked according to EN 10219 grade S355J2H.

Forcon® TT

Our structural hollow sections are also available as Forcon® TT. For these Tailored Tubes you can choose from several premium options - for example tighter tolerances, a certain position of the weld seam or a scarfed internal weld bead, a superior surface finish or special bundling. We are ready to help you to tailor Forcon® TT to your needs. Our customised Forcon® TT is the key to boosting efficiency in manufacturing.

Technical Support

We want you to get the best from Forcon® hollow sections. Our sales team is always happy to answer your questions on steel selection or available options. And our engineers are available to assist you with the application of Forcon® for efficient and lightweight design.

Inspection & Testing

Forcon® 355 hollow sections are subject to specific inspection and testing and are supplied with an inspection certificate type 3.1 to EN 10204.

Availability

Forcon® 355 is available across the size range indicated in the below tables. Minimum order quantities may apply and other sizes or thicknesses may be available – please contact your Tata Steel Nederland Tubes representative for details.

Standard lengths of Forcon® 355 are 6m, 12m or 15m, depending on the size and production mill. Special mill lengths from 4.5m up to 20m can be arranged upon request.

Sustainability

Steel is strong, durable, versatile, re-usable and most importantly, it is endlessly 100% recyclable without loss of quality. We take sustainability very seriously and as well as being a member of Responsible Steel™, we have BES 6001 certification and Environmental Product Declarations (EPD's) for our Forcon® hollow sections. To reduce carbon emissions, you can choose from different Zeremis® solutions.

Mechanical properties

Grade	Min. yield strength	Tensile strength		Min. Elongation	Min. impact KV2 at test temperature of -20°C
	R_{eH} (MPa)	R_m (MPa)	T < 3 mm 3 mm ≤ T ≤ 40 mm	A (%)	J
S355J2H	355	510-680	470-630	20	27

For section sizes D/T < 15 (circular) and (B+H)/2T < 12.5 (square and rectangular) the minimum elongation is reduced by 2.

For thicknesses < 3 mm, a gauge length of $L_0 = 80$ mm shall be used provided a test piece width of 20 mm can be achieved, otherwise a gauge length of 50 mm shall be used with a test piece width of 12.5 mm.

Chemical composition

	C	Si	Mn	P	S	Al _{tot}	CEV
	max.	max.	max.	max.	max.	min.	max.
S355J2H	0.22	0.55	1.60	0.030	0.030	0.020	0.45

All values are in weight%

Forcon® 355

Circular hollow sections (CHS)

mm	2.0	2.4	3.2	3.6	4.0	5.0	6.0	6.3	8.0	10.0
31.8										
33.7										
38.0										
41.5										
42.4										
44.5										
48.3										
51.0										
57.0										
60.3										
63.5										
70.0										
76.1										
82.5										
88.9										
101.6										
108.0										
114.3										
121.0										
127.0										
139.7										
159.0										
168.3										
193.7										
219.1										
244.5										
273.0										
323.9										

These dimensions are available on request.

Forcon® 355

Rectangular hollow sections (RHS)

mm	2.0	2.5	3.0	3.5	4.0	5.0	6.0	8.0	10.0
30/20									
40/20									
40/30									
50/20									
50/25									
50/30									
50/40									
60/20									
60/30									
60/40									
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160/80									
160/90									
180/80									
180/100									
200/80									
200/100									
200/120									
200/150									
220/120									
250/100									
250/150									
300/100									
300/200									

These dimensions are available on request.

These dimensions are regularly rolled.

Forcon® 355

Square hollow sections (SHS)

mm	2.0	2.5	3.0	3.5	4.0	5.0	6.0	8.0	10.0
25/25									
28/28									
30/30									
35/35									
40/40									
45/45									
50/50									
60/60									
70/70									
80/80									
90/90									
100/100									
120/120									
140/140									
150/150									
160/160									
180/180									
200/200									
250/250									

These dimensions are available on request.

These dimensions are regularly rolled.

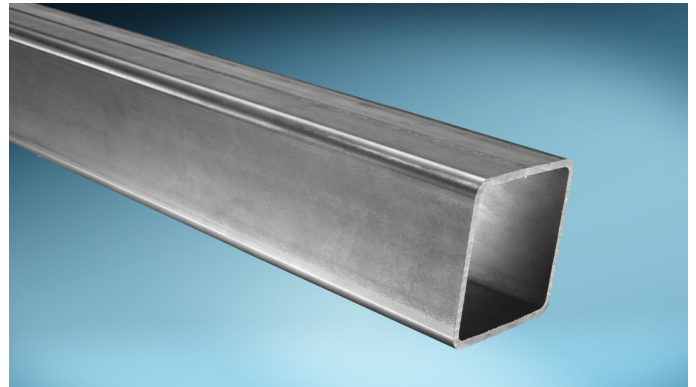
Forcon® 500/600/700

High strength cold formed tubes

Forcon® is our range of cold formed structural hollow sections to EN 10219, available with minimum yield strengths ranging from 235 MPa to 700 MPa.

Using the latest advances in high strength steel, Forcon® 500/600/700 enables lighter-weight and longer spans made from tubes.

Our Forcon® hollow sections are available in a range of popular sizes as well as with the option TT for Tailored Tubes with customised extras.



For agricultural equipment, scissor-lifts, cranes, telehandlers and many other applications, efficiency in use depends on gaining the maximum reach, but without the weight penalty of bulky structures. This is where high strength steel is very beneficial and in particular when combined with the superior quality of Forcon® structural hollow sections.

Our delivery program of high strength Forcon® includes tubes in grades S500MH, S600MH and S700MH. Other steel grades such as S500MLH, S550MH/MLH, S600MLH, S650MH/MLH or S700MLH are available on request, please contact us for details.

Tolerances

Dimensional tolerances are to EN 10219.

Galvanising suitability

The steel composition of Forcon® 500 and Forcon® 600 complies with category A according to ISO 14713-2:2020, perfectly suitable for hot dip zinc coating. The steel composition of Forcon® 700 complies with category C according to ISO 14713-2:2020 and is with $0.030\% < Si < 0.070\%$ also suitable for hot dip zinc coating.

Forcon® TT

Our high strength hollow sections are also available as Forcon® TT. For these Tailored Tubes you can choose from several premium options - for example tighter tolerances, a certain position of the weld seam or a scarfed internal weld bead, a superior surface finish or special bundling. We are ready to help you to tailor Forcon® TT to your needs. Our customised Forcon® TT is the key to boosting efficiency in manufacturing.

Technical Support

We want you to get the best from Forcon® hollow sections. Our sales team is always happy to answer your questions on steel selection or available options. And our engineers are available to assist you with the application of high strength Forcon® for efficient and lightweight design.

Inspection & Testing

Forcon® 500/600/700 hollow sections are subject to specific inspection and testing and are supplied with an inspection certificate type 3.1 to EN 10204.

Availability

Forcon® 500/600/700 is available across the size range indicated in the below tables. Minimum order quantities may apply and other sizes or thicknesses may be available – please contact your Tata Steel Nederland Tubes representative for details.

Standard lengths of Forcon® 500/600/700 are 6m, 12m or 15m, depending on the size and production mill. Special mill lengths from 4.5m up to 20m can be arranged upon request.

Sustainability

Steel is strong, durable, versatile, re-usable and most importantly, it is endlessly 100% recyclable without loss of quality. We take sustainability very seriously and as well as being a member of Responsible Steel™, we have BES 6001 certification and Environmental Product Declarations (EPD's) for our Forcon® hollow sections. To reduce carbon emissions, you can choose from different Zeremis® solutions.

Weldability

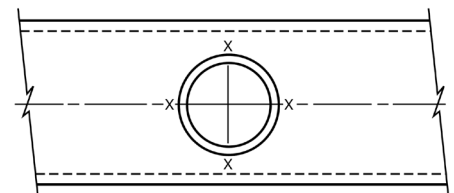
The welding suitability of our high strength cold formed hollow sections Forcon® 500/600/700 is excellent due to their low CEV and the retention of all the beneficial characteristics present in our Forcon® tubes. The standard fundamental recommendations for welding can therefore be applied.

- The advice is to use MAG welding with as little localized heat input as possible without pre-heating and no post heat treatment.
- Where it is necessary to weld two different grades of Forcon®, the welding parameters and procedure for the higher grade should be suitable for both.
- The steel tube should not exceed 500°C for a too long duration to avoid coarsening of the grains.
- t8/5 interval 5-25s.
- Recommended maximum heat input 1.5 kJ/mm.
- Minimum recommended preheat and interpass temperature: Room temperature (approx. 20°C).
- Maximum recommended interpass temperature: 300°C.
- Preheating is not required for sections up to 12mm wall thickness, not even for the combination of different strengths e.g. Forcon®700 to Forcon®355.
- Post weld heat treatment not necessary but if desired recommended holding temperature 550°C-580°C, heating and cooling rate 100°C/h, holding time 2min/mm of wall thickness (min 1h), suitable time at the holding temperature 1-6h.
- The throat thickness of tack welds should be similar to that of the initial root run. The minimum length of a tack weld should be 50mm, but for material less than 12mm thickness should be four times the thickness of the thicker part joined. The ends of the tack welds should be dressed to permit proper fusion into the root run.
- Recommended maximum hydrogen content of weld metal $\leq 10\text{ml H}_2/100\text{g}$.
- Welding wire must be matched to the material – for example ER-70S, G3Si1 showed good results.
- For hollow section joints, it is very important to maintain the correct welding sequence, which has a major influence on shrinkage or residual welding stress of the structures.



For square and rectangular hollow sections the start/stop weld positions should be of the order of five times the wall thickness (5t) from the corners.

For welding circular hollow section bracings to a main or chord member the start/stop weld positions should not be at the positions marked with an X on the adjacent sketch.



Forcon® 500

Mechanical properties

Grade	Min. yield strength	Tensile strength	Min. Elongation		Min. impact KV2 at test temperature of -20°C	
	R _{eh} (MPa)	R _m (MPa)	A (%)	A (%)	J	J
			Long	Trans	Long	Trans
S500MH	500	580-760	11	9	40	20

For thicknesses ≥ 3 mm; for section sizes $D/T \leq 10$ (circular) and $(B+H)/2T \leq 10$ (square and rectangular) the minimum elongation is reduced by 4 and the maximum tensile strength increased by 50 MPa. For section sizes $D/T > 10$ to <15 (circular) and $(B+H)/2T > 10$ to <15 (square and rectangular) the minimum elongation is reduced by 2 and the maximum tensile strength increased by 50 MPa. For thicknesses < 3 mm values shall be agreed between the purchaser and manufacturer.

Chemical composition

	C	Si	Mn	P	S	Cr	Mo	Ni	Al _{tot}	Cu	Nb	Ti	V	N	CEV
	max.	max.	max.	max.	max.	min.	max.	max.	max.	max.	max.	max.	min.	max.	max.
S500MH	0.16	0.60	1.70	0.030	0.020	0.30	0.20	0.80	0.020	0.55	0.090	0.060	0.12	0.025	0.40

CEV exceeds the requirements of EN10219-3:2020; $CEV = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15$

Forcon® 600

Mechanical properties

Grade	Min. yield strength	Tensile strength	Min. Elongation		Min. impact KV2 at test temperature of -20°C	
	R _{eh} (MPa)	R _m (MPa)	A (%)	A (%)	J	J
			Long	Trans	Long	Trans
S600MH	600	650-820	9	7	27	16

For thicknesses ≥ 3 mm; for section sizes $D/T \leq 10$ (circular) and $(B+H)/2T \leq 10$ (square and rectangular) the minimum elongation is reduced by 4 and the maximum tensile strength increased by 50 MPa. For section sizes $D/T > 10$ to <15 (circular) and $(B+H)/2T > 10$ to <15 (square and rectangular) the minimum elongation is reduced by 2 and the maximum tensile strength increased by 50 MPa. For thicknesses < 3 mm values shall be agreed between the purchaser and manufacturer.

Chemical composition

	C	Si	Mn	P	S	Cr	Mo	Ni	Al _{tot}	Cu	Nb	Ti	V	N	CEV
	max.	max.	max.	max.	max.	min.	max.	max.	max.	max.	max.	max.	min.	max.	max.
S600MH	0.16	0.60	1.90	0.020	0.015	0.30	0.50	0.80	0.015	0.55	0.090	0.22	0.20	0.025	0.40

CEV exceeds the requirements of EN10219-3:2020; $CEV = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15$

Forcon® 700

Mechanical properties

Grade	Min. yield strength	Tensile strength	Min. Elongation		Min. impact KV2 at test temperature of -20°C	
	R _{eh} (MPa)	R _m (MPa)	A (%)	A (%)	J	J
			Long	Trans	Long	Trans
S700MH	700	750-950	7	5	27	16

For thicknesses ≥ 3 mm; for section sizes $D/T \leq 10$ (circular) and $(B+H)/2T \leq 10$ (square and rectangular) the minimum elongation is reduced by 4 and the maximum tensile strength increased by 50 MPa. For section sizes $D/T > 10$ to <15 (circular) and $(B+H)/2T > 10$ to <15 (square and rectangular) the minimum elongation is reduced by 2 and the maximum tensile strength increased by 50 MPa. For thicknesses < 3 mm values shall be agreed between the purchaser and manufacturer.

Chemical composition

	C	Si	Mn	P	S	Cr	Mo	Ni	Al _{tot}	Cu	Nb	Ti	V	N	CEV
	max.	max.	max.	max.	max.	min.	max.	max.	max.	max.	max.	max.	min.	max.	max.
S700MH	0.16	0.60	2.10	0.020	0.015	0.30	0.50	0.80	0.015	0.55	0.090	0.22	0.20	0.025	0.42

CEV exceeds the requirements of EN10219-3:2020; $CEV = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15$

Forcon® 500

Circular hollow sections (CHS)

mm	2.0	2.4	3.2	3.6	4.0	5.0	6.0	8.0	10.0
31.8									
33.7									
38.0									
41.5									
42.4									
44.5									
48.3									
51.0									
57.0									
60.3									
63.5									
70.0									
76.1									
82.5									
88.9									
101.6									
108.0									
114.3									
121.0									
127.0									
139.7									
159.0									
168.3									
193.7									
219.1									
244.5									
273.0									
323.9									

Forcon® 500

Square hollow sections (SHS)

mm	2.0	2.5	3.0	3.5	4.0	5.0	6.0	8.0	10.0
25/25									
28/28									
30/30									
35/35									
40/40									
45/45									
50/50									
60/60									
70/70									
80/80									
90/90									
100/100									
120/120									
140/140									
150/150									
160/160									
180/180									
200/200									
250/250									

These dimensions are available on request.

Forcon® 500

Rectangular hollow sections (RHS)

mm	2.0	2.5	3.0	3.5	4.0	5.0	6.0	8.0	10.0
30/20									
40/20									
40/30									
50/20									
50/25									
50/30									
50/40									
60/20									
60/30									
60/40									
60/50									
70/40									
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80/30									
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90/70									
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140/60									
140/80									
150/100									
160/80									
160/90									
180/80									
180/100									
200/80									
200/100									
200/120									
200/150									
220/120									
250/100									
250/150									
300/100									
300/200									

These dimensions are available on request.

Forcon® 600

Circular hollow sections (CHS)

mm	2.0	2.4	3.2	3.6	4.0	5.0	6.0
31.8							
33.7							
38.0							
41.5							
42.4							
44.5							
48.3							
51.0							
57.0							
60.3							
63.5							
70.0							
76.1							
82.5							
88.9							
101.6							
108.0							
114.3							
121.0							
127.0							
139.7							
159.0							
168.3							
193.7							

Forcon® 600

Square hollow sections (SHS)

mm	2.0	2.5	3.0	3.5	4.0	5.0	6.0
25/25							
28/28							
30/30							
35/35							
40/40							
45/45							
50/50							
60/60							
70/70							
80/80							
90/90							
100/100							
120/120							
140/140							
150/150							
160/160							

These dimensions are available on request.

Forcon® 600

Rectangular hollow sections (RHS)

mm	2.0	2.5	3.0	3.5	4.0	5.0	6.0
30/20							
40/20							
40/30							
50/20							
50/25							
50/30							
50/40							
60/20							
60/30							
60/40							
60/50							
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80/60							
81/51							
90/50							
100/40							
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100/60							
100/80							
110/70							
120/40							
120/50							
120/60							
120/80							
120/100							
140/50							
140/60							
140/80							
150/100							
160/80							
160/90							
180/80							
180/100							
200/80							
200/100							
200/120							

These dimensions are available on request.

Forcon® 700

Circular hollow sections (CHS)

mm	2.0	2.4	3.2	3.6	4.0	5.0
33.7						
38.0						
41.5						
42.4						
44.5						
48.3						
51.0						
57.0						
60.3						
70.0						
76.1						
82.5						
88.9						
101.6						
108.0						
114.3						
121.0						
127.0						

Forcon® 700

Square hollow sections (SHS)

mm	2.0	2.5	3.0	3.5	4.0	5.0
30/30						
35/35						
40/40						
45/45						
50/50						
60/60						
70/70						
80/80						
90/90						
100/100						
120/120						

These dimensions are available on request.

Forcon® 700

Rectangular hollow sections (RHS)

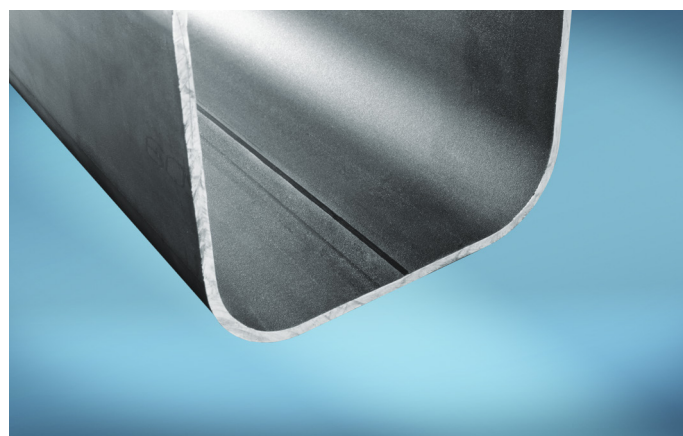
mm	2.0	2.5	3.0	3.5	4.0	5.0
40/20						
40/30						
50/20						
50/25						
50/30						
50/40						
60/20						
60/30						
60/40						
60/50						
70/40						
70/50						
80/30						
80/40						
80/50						
80/60						
81/51						
90/50						
100/40						
100/50						
100/60						
100/80						
110/70						
120/40						
120/50						
120/60						
120/80						
120/100						
140/60						

Forcon® TT

The Tailored Tube

Our Forcon® tubes are reliable, consistent and superior to many other cold formed structural hollow sections on the market. However, we understand that sometimes you need additional features. That's why we offer a range of premium options in addition to our standard product under the brand name Forcon® TT.

Forcon® TT is the tailored tube to meet your needs. With over a century of expertise in tube manufacturing and a deep commitment to customer collaboration and research, we have the solutions for your specific requirements.



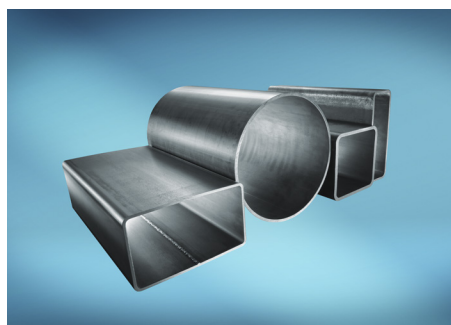
Forcon® TT is a customised cold formed welded structural hollow section. For these tailored tubes you can choose from several premium options - for example tighter dimensional tolerances, a certain position of the weld seam or a scarfed internal weld bead, a superior surface finish or special bundling. This delivers multiple benefits, particularly for automated manufacturing processes. With a minimum yield strength of 235 up to 700 MPa, Forcon® TT is suitable for many applications including agricultural machinery, trailers and cranes.

Forcon® TT enables you to:

- reduce your rejection rate and rework
- save time in tube sorting and machine setting
- save time and money on surface preparation
- refrain from shot blasting
- speed up manufacturing and increase output
- reduce material waste
- receive material and process more efficiently
- enhance your brand and quality
- gain additional security and verification

Tailored technical support

Forcon® TT is backed by technical support tailored to your needs. With knowledge and expertise in steel products, customer processes and applications, our Customer Technical Services team is available at short notice to help you to optimise manufacturing and end product performance. Contact us for more information and to discuss how Forcon® TT could help to improve your efficiency and quality.



Forcon® TT product range

Steel grades:	Range from S235JRH up to S700MH
Shape dimensions (mm):	
- circular:	From 31.8 x 2 up to 323.9 x 10
- rectangular:	From 30 x 20 x 2 up to 300 x 200 x 10
- square:	From 25 x 25 x 2 up to 250 x 250 x 10

Please check your special requirements and possible minimum order quantities with your usual contact at Tata Steel Tubes. Full details of mechanical properties and size range availability for each grade are shown in our grade-specific datasheets.

Weld seam options

Do you need the weld seam at a certain position? Or the internal weld bead scarfed, for example for a telescopic application? Generally we produce our Forcon® hollow sections with the weld seam located at the long side with an untrimmed internal weld bead. However, to make the tube fit for your purpose, we can remove the internal weld bead or offer several options, such as the weld seam positioned at the small side, in the middle or out of the middle of the side of the section (depending on the size).

Improved surface finish

If a high quality tube surface matters to you, this might be an important option. It can even cut out the need for shot blasting. To achieve this excellent surface finish with minimised indentations and scratches, we select only the best feedstock for tube manufacture. In conjunction with optimised process settings, we have also invested in roll cleaning to ensure a smooth tube surface ready for painting. The improved surface quality can also play an important part in reinforcing your brand – enabling a great visual appearance to finished products.

Tighter tolerances

For your repeatable and efficient processing you might need consistently tighter tolerances than required by the standard EN 10219. To make this possible, we exercise stringent control over all aspects of hollow section production. Careful coil selection and slitting plus investment in more accurate sizing and shaping rolls ensure a uniform cross-section. For example you can choose for Forcon® TT special tolerances on the outside dimensions, out of roundness, concavity/convexity, squareness of the side, wall thickness or more precise external corner radii.

Bespoke chemical composition

The chemical composition of our Forcon® tubes is in accordance with the specifications outlined in EN 10219, depending on the steel grade. They are all produced from fully killed steel, containing sufficient nitrogen binding elements and having a fine grain structure. Due to their low CEV, the welding suitability of our Forcon® tubes is excellent. They are suitable for hot dip zinc coating and generally fall into category A according to ISO 14713-2:2020 or occasionally into category B or C, depending on the steel grade. Should you for example need a certain delimitation of the silicon and phosphorus content in order to ensure a homogeneous appearance in hot-dip galvanised constructions – especially when combining hollow sections with other profiles – we can discuss a bespoke chemical composition of the steel for Forcon® TT.

Exact lengths

To enhance your efficiency and save time, you might want to take advantage of our service of cutting the tubes to exact lengths. This will also reduce material waste.

Extra testing







Upon request, we offer additional material testing and inspections beyond the norm requirements. This includes extended mechanical or chemical analyses or specific application-related tests. For example, we have developed a special PON test with a hardened cone which is pressed straight into the weld seam several times over its length as an extra proof for the use of our tubes for towbars.

It is also possible to issue additional or alternative certificates, such as a 3.1 certificate for JRH or JOH steel grades where only a 2.2 certificate is prescribed. Feel free to contact us to discuss your individual testing needs.

Special packaging

Do you require any special packaging such as special bundling, dunnage or slings? If so, please get in touch to explore possible customised options.

Examples of tighter dimensional tolerance options

Description of tolerance	Forcon® TT option	EN 10219
 Size B	B<100mm: Min ±0.25mm; ±0.5% B≤200mm: ±0.4% B>200mm: ±0.3%	B<100mm: Min ±0.5mm; ±1% B≤200mm: ±0.8% B>200mm: ±0.6%
 Concavity/Convexity	Min 0.25mm; Max 0.4% of side	Min 0.5mm; Max 0.8% of side
 Squareness	90°±0.5°	90°±1°
 Corner radius	T≤6mm; $1.8T \leq r_{ext} \leq 2.2T$ T≤10mm; $2.25T \leq r_{ext} \leq 2.75T$ 10mm<T; $2.7T \leq r_{ext} \leq 3.3T$	T≤6mm; $1.6T \leq r_{ext} \leq 2.4T$ T≤10mm; $2T \leq r_{ext} \leq 3T$ 10mm<T; $2.4T \leq r_{ext} \leq 3.6T$
 Size D	Min ±0.25mm ±0.5% Max ±5mm	Min ±0.5mm ±1% Max ±10mm
 Out of roundness	D/T≤100; Max 1% D/T>100; to be agreed	D/T≤100; Max 2% D/T>100; to be agreed

Trimming of the inner weld bead

Capabilities of Forcon® TT

Do you need a tube that provides a clear, unrestricted tube bore?

Tata Steel Nederland Tubes has expanded its capabilities and can now produce a wide range of dimensions and steel grades of our Forcon® TT structural hollow sections to EN 10219 with a scarfed inside weld bead.

Applications

If pipes, hoses or pistons will be located in the tube, if something needs to be plugged in, if the hollow section will be further processed with the aid of an internal tool or to ensure telescopability - in all these cases a clear and unrestricted tube inside is essential. For these applications we can offer a product fit for purpose with the inner weld bead removed.

Technical support

We want you to get the best from Forcon® TT hollow sections. Our sales team is always happy to answer your questions on steel selection or available options. And our engineers are available to assist you with the application of Forcon® TT for efficient and lightweight design.

Tolerances

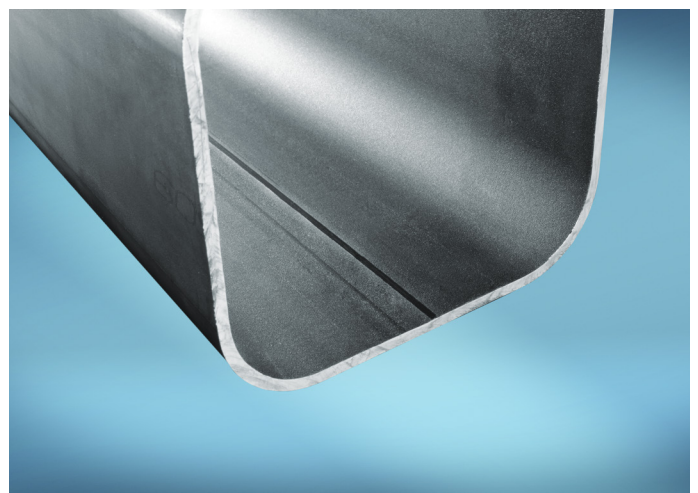
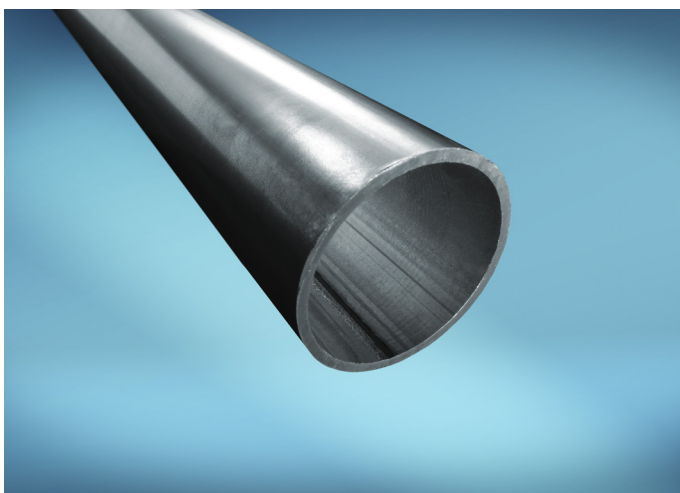
Our standard is a maximum height of the scarfed internal weld bead of +0.3mm. Other specifications on request.

Availability

The scarfing of the internal weld bead is available across the size range indicated in the below tables in the steel grades from S235JRH to S500MH.

Higher steel grades up to S700MH on request.

Minimum order quantities may apply - please contact your Tata Steel representative for details.



Forcon® TT

Rectangular hollow sections (RHS)

HxB / T (mm)	2.0	3.0	4.0	5.0	6.0	6.3	7.1	8.0
30x20								
40x20								
40x30								
50x20								
50x25								
50x30								
50x40								
60x20								
60x30								
60x40								
60x50								
70x40								
70x50								
80x40								
80x50								
80x60								
90x50								
100x40								
100x50								
100x60								
100x80								
110x70								
120x40								
120x50								
120x60								
120x80								
120x100								
140x50								
140x60								
140x80								
150x100								
160x80								
160x90								
180x80								
180x100								
200x80								

Square hollow sections (SHS)

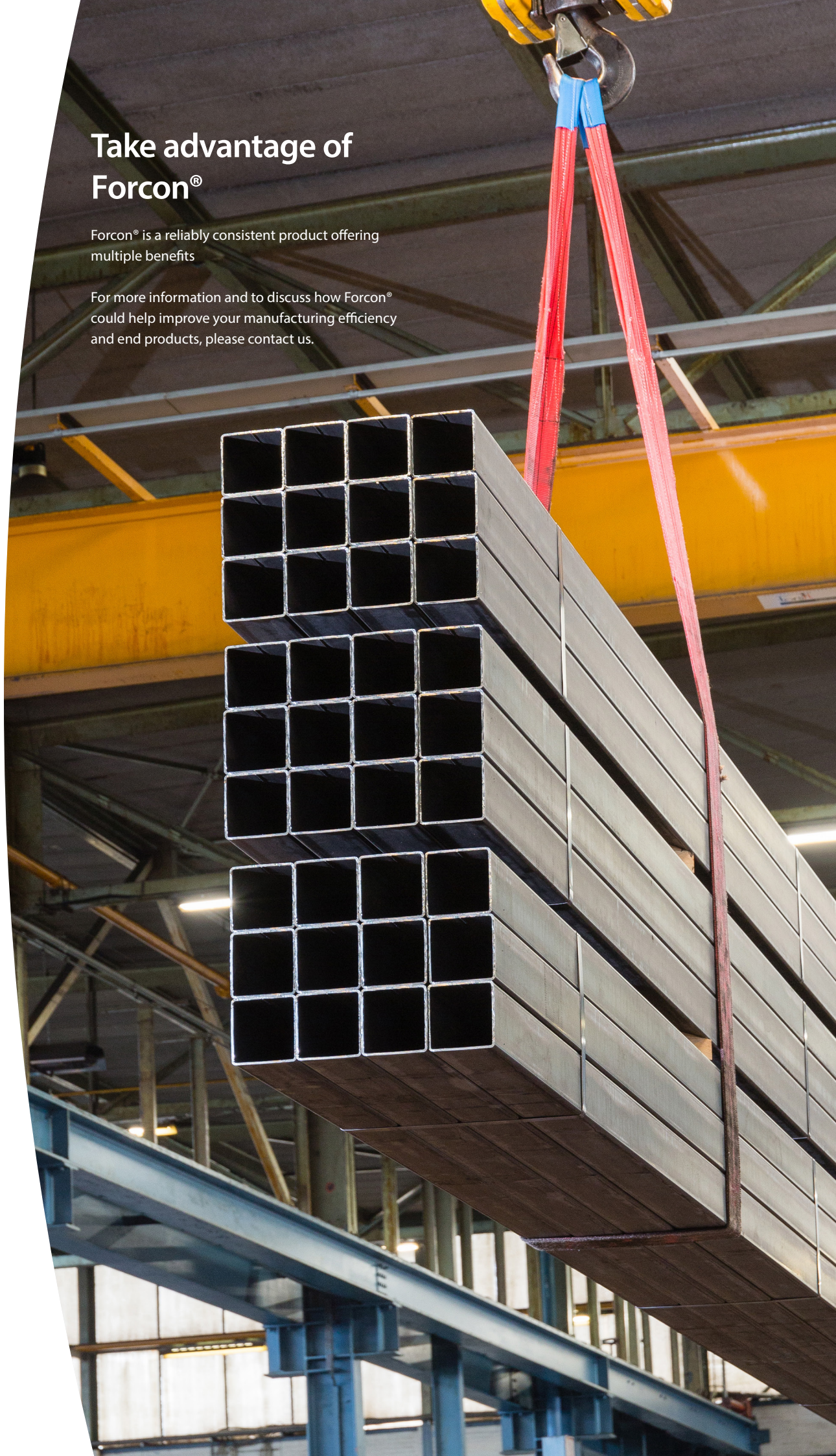
BxB / T (mm)	1.5	2.0	3.0	4.0	5.0	6.0	6.3	7.1	8.0
25x25									
30x30									
35x35									
40x40									
45x45									
50x50									
60x60									
70x70									
80x80									
90x90									
100x100									
120x120									
140x140									

D / T (mm)	1.5	2.0	2.3	2.5	2.9	3.0	4.0	5.0	6.0	6.3	7.1	8.0
28.0												
31.8												
32.0												
33.7												
35.0												
38.0												
40.0												
41.5												
42.0												
42.4												
44.5												
45.0												
48.3												
50.0												
51.0												
54.0												
57.0												
60.0												
60.3												
63.5												
70.0												
76.1												
82.5												
88.9												
101.6												
108.0												
114.3												
121.0												
133.0												
139.7												
146.0												
152.4												
156.0												
158.0												
158.4												
159.0												
160.0												
162.0												
162.4												
168.3												
177.8												

Take advantage of Forcon®

Forcon® is a reliably consistent product offering multiple benefits

For more information and to discuss how Forcon® could help improve your manufacturing efficiency and end products, please contact us.



www.tatasteelnederland.com/tubes

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