

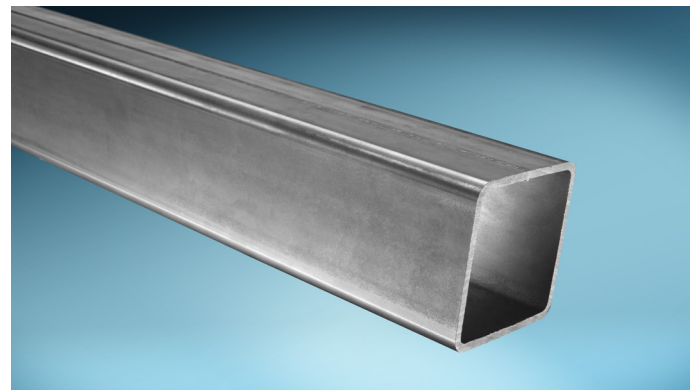
Forcon® 500/600/700

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

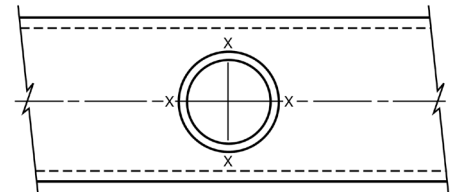
The welding suitability of our high strength cold formed hollow sections Forcon® 500/600/700 is excellent due to their low CEV and the retention of all the beneficial characteristics present in our Forcon® tubes. The standard fundamental recommendations for welding can therefore be applied.

- 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									
70/50									
80/30									
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110/70									
120/40									
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140/50									
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							
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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						
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70/40						
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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						

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