

## Docol Tube 780DP

### General Product Description

Docol<sup>®</sup> Tube 780DP is advance high-strength formable precision tube made from dual-phase steel with high tensile strength, improved formability or enhanced proofed yield strength. Available in circular, rectangular and square shapes, it comes with different coating and surface options including cold rolled (uncoated), galvanized, galvanealed and galfan. Customized shapes and other tailoring options are available upon request. Typically used in automotive industry where durability, formability and energy absorption are important.

### Dimension Range

Docol Tube 780DP is available at circular, square and rectangular shapes.

Circular	16 - 76 mm
Square	19x19 - 60x60 mm
Rectangular	25x15 - 80x40 mm
Wall thickness	1.0 - 2.0 mm
Mill length	6000 mm

Other shapes, sizes and lengths are available upon request.

### Dimensions

#### Circular

Diameter	1.0 mm (kg/m)	1.25 mm (kg/m)	1.5 mm (kg/m)	2.0 mm (kg/m)
16 mm	0.370	0.455	0.536	
18 mm	0.419	0.516	0.610	
19 mm	0.444	0.547	0.647	
20 mm	0.469	0.578	0.684	0.888
22 mm	0.518	0.640	0.758	0.986
25 mm	0.592	0.732	0.869	1.13
28 mm	0.666	0.825	0.980	1.28
30 mm	0.715	0.886	1.05	1.38
32 mm	0.765	0.948	1.13	1.48
35 mm	0.838	1.04	1.24	1.63
36 mm	0.863	1.07	1.28	1.68
38 mm	0.912	1.13	1.35	1.78
40 mm	0.962	1.20	1.42	1.87
41 mm		1.22	1.46	1.92
44 mm		1.32	1.57	2.07
48 mm		1.44	1.72	2.27
50 mm			1.79	2.37
55 mm			1.98	2.61
57 mm			2.05	2.71
60 mm			2.16	2.86
63.5 mm			2.29	3.03
76 mm			2.76	3.65

**Square**

Height x Width	1.0 mm (kg/m)	1.25 mm (kg/m)	1.5 mm (kg/m)	2.0 mm (kg/m)
19 x 19 mm	0.545	0.665		
20 x 20 mm	0.576	0.704		
22 x 22 mm	0.639	0.812	0.962	
25 x 25 mm	0.733	0.901	1.06	
25.4 x 25.4 mm	0.746	0.916	1.08	
30 x 30 mm	0.890	1.10	1.30	1.68
32 x 32 mm		1.18	1.39	1.80
35 x 35 mm		1.29	1.53	1.99
40 x 40 mm			1.77	2.31
50 x 50 mm			2.24	2.93
60 x 60 mm				3.56

**Rectangular**

Height x Width	1.0 mm (kg/m)	1.25 mm (kg/m)	1.5 mm (kg/m)	2.0 mm (kg/m)
25 x 15 mm	0.576	0.704		
30 x 10 mm	0.576	0.704	0.826	
30 x 15 mm	0.655	0.802		
30 x 20 mm	0.733	0.901	1.06	
30 x 25 mm	0.785	0.999	1.18	1.52
35 x 15 mm	0.733	0.901	1.06	
35 x 20 mm	0.812	0.999	1.18	1.52
40 x 20 mm	0.890	1.10	1.30	1.68
40 x 25 mm	0.969	1.20	1.42	1.84
40 x 30 mm		1.29	1.53	1.99
45 x 15 mm	0.890	1.10	1.30	1.68
50 x 20 mm		1.29	1.53	1.99
50 x 25 mm		1.39	1.65	2.15
50 x 30 mm		1.49	1.77	2.31
50 x 40 mm		1.69	2.00	2.62
50.8 x 25.4 mm			1.68	2.19
60 x 20 mm			1.77	2.31
60 x 30 mm			2.00	2.62
60 x 40 mm			2.24	2.93
70 x 25 mm			2.12	2.78
70 x 30 mm			2.24	2.93
70 x 50 mm				3.56
80 x 20 mm				2.93
80 x 40 mm				3.56

**Mechanical Properties**

Grade	Yield strength $R_{p0.2}$ (min MPa)	Tensile strength $R_m$ (MPa)	Elongation A (min %)
CR600Y780T-DP	600	780	7
CR600Y780T-DH	600	780	12
CR700Y800T-DP	700	800	7

## Chemical Composition

Grade	C (max %)	Si (max %)	Mn (max %)	P (max %)	S (max %)	Nb+Ti (max %)	Cr+Mo (max %)	B (max %)	Cu (max %)
CR600Y780T-DP	0.18	0.80	2.50	0.050	0.010	0.15	1.40	0.005	0.20
CR600Y780T-DH	0.18	0.80	2.50	0.050	0.010	0.15	1.40	0.005	0.20
CR700Y800T-DP	0.18	0.80	2.50	0.050	0.010	0.15	1.40	0.005	0.20

Chemical composition meets the requirements of VDA 239-100.

## Tolerances

### Circular

Characteristic	Circular precision tubes Tolerances based on the requirements of EN 10305-3
Outside diameter (D) <sup>1)</sup>	
D < 20	±0.12 mm
20 ≤ D < 32	±0.15 mm
32 ≤ D < 44	±0.20 mm
44 ≤ D < 55	±0.25 mm
55 ≤ D < 70	±0.30 mm
70 ≤ D < 80	±0.35 mm
Out-of-roundness	The diameter tolerances include the out-of-roundness
Thickness (T)	T ≤ 1.5 mm: ±0.15 mm T > 1.5 mm: ±10% of nominal thickness or ±0.35 mm whichever is the smaller
Straightness	Maximum 0.15% of measured length
Height of internal weld bead, g;	
Bead removed	g ≤ 0.3 mm
Bead not removed	g < 1.0 mm, when T ≤ 1.5 mm g < 0.8 × T, when 1.5 mm < T ≤ 2.0 mm
Mill length	0/+50 mm, standard length 6000 mm
Exact length, single cutting	Agreed at the time of enquiry and order
Exact length, bundle cutting	Agreed at the time of enquiry and order

1) For a maximum distance of 100 mm, the ends may, due to the cutting method, have diameters outside the tolerances

## Square

Characteristic	Square precision tubes Tolerances based on the requirements of EN 10305-5
Outside dimensions (H) and (B), longer side <sup>1)</sup>	
H < 25 mm	±0.20 mm
25 ≤ H < 40 mm	±0.25 mm
40 ≤ H < 60 mm	±0.30 mm
60 ≤ H < 70 mm	±0.35 mm
Side concavity and convexity	Included in outside dimension tolerance
Thickness (T)	T ≤ 1.5 mm: ±0.15 mm T > 1.5 mm: ±10% of nominal thickness or ±0.35 mm whichever is the smaller
Straightness	Maximum 0.15% of measured tube length when shorter side length > 30 mm Maximum 0.25% of measured tube length when the shorter side length ≤ 30 mm
Location of weld seam from the centre line	On narrow side for square and rectangular, optionally on wide side. On wide side for flat oval and ellipse. ± 10% of side length or ± 3 mm, whichever is greater.
Height of internal weld bead (g)	
Bead removed	g ≤ 0.3 mm
Bead not removed	g < 1.0 mm, when T ≤ 1.5 mm g < 0.8 x T, when 1.5 mm < T ≤ 2.0 mm
Squareness of sides	90° ± 1°
Corner profile	R ≤ 4.0 x T, typically R ≤ 2.5 x T
Twist (V)	V ≤ 3 mm for B and H ≤ 30 mm V ≤ B/10 or ≤ H/10 for B or H > 30 mm
Mill length	0/+50 mm, standard length 6000 mm
Exact length, single cutting	Agreed at the time of enquiry and order
Exact length, bundle cutting	Agreed at the time of enquiry and order

1) For a maximum distance of 100 mm, the ends may, due to the cutting method, have diameters outside the tolerances

**Rectangular**

Characteristic	Rectangular precision tubes Tolerances based on the requirements of EN 10305-5
Outside dimensions (H) and (B), longer side <sup>1)</sup>	
H < 25 mm	±0.20 mm
25 ≤ H < 40 mm	±0.25 mm
40 ≤ H < 60 mm	±0.30 mm
60 ≤ H < 70 mm	±0.35 mm
70 ≤ H < 80 mm	±0.40 mm
80 ≤ H < 90 mm	±0.50 mm
Side concavity and convexity	Included in outside dimension tolerance
Thickness (T)	T ≤ 1.5 mm: ±0.15 mm T > 1.5 mm: ±10% of nominal thickness or ±0.35 mm whichever is the smaller
Straightness	Maximum 0.15% of measured tube length when shorter side length > 30 mm Maximum 0.25% of measured tube length when the shorter side length ≤ 30 mm
Location of weld seam from the centre line	On narrow side for square and rectangular, optionally on wide side. On wide side for flat oval and ellipse. ± 10% of side length or ± 3 mm, whichever is greater.
Height of internal weld bead (g)	
Bead removed	g ≤ 0.3 mm
Bead not removed	g < 1.0 mm, when T ≤ 1.5 mm g < 0.8 x T, when 1.5 mm < T ≤ 2.0 mm
Squareness of sides	90° ± 1°
Corner profile	R ≤ 4.0 x T, typically R ≤ 2.5 x T
Twist (V)	V ≤ 3 mm for B and H ≤ 30 mm V ≤ B/10 or ≤ H/10 for B or H > 30 mm
Mill length	0/+50 mm, standard length 6000 mm
Exact length, single cutting	Agreed at the time of enquiry and order
Exact length, bundle cutting	Agreed at the time of enquiry and order

1) For a maximum distance of 100 mm, the ends may, due to the cutting method, have diameters outside the tolerances

**Coatings and Surfaces**

Surface designation and general usability		
UC	Uncoated (cold rolled)	Paintability or chromium plating are required
GI	Zinc coated (zinc 99%)	Corrosion resistance is required
ZA	Galfan coated (zinc 95%-aluminium 5%)	Superior corrosion resistance and demanding forming are required
GA	Galvannealed coated (zinc 90%-iron 10%)	Corrosion resistance and paintability are required

Surface is lightly oiled to protect it from corrosion during transportation and short-term storaging. By request, tubes can be delivered dry, however in that case SSAB will not be responsible for any possible rust.

Surface roughness, Ra	
UC	< 0,6 µm

Different metal coatings and minimum coating mass			
Coating thickness	Zinc (GI)	Galfan (ZA)	Galvannealed (GA)
$\mu\text{m}^3$ )	$\text{g}/\text{m}^2$ <sup>1)</sup>	$\text{g}/\text{m}^2$ <sup>2)</sup>	$\text{g}/\text{m}^2$ <sup>1)</sup>
7	GI50/50		GA50/50
8	GI60/60		GA60/60
20	GI115/115	ZA255	

1) Minimum coating mass -  $\text{g}/\text{m}^2$  refers the coating mass for each side in  $\text{g}/\text{m}^2$  according to VDA 239-100.

2) Minimum coating mass -  $\text{g}/\text{m}^2$  refers the total weight of coatings on both sides of a 1  $\text{m}^2$  plate.

3) Theoretical guidance values for coating thickness per surface.

Indicative specification for proper coating selection			
Coating type	Coating mass [ $\text{g}/\text{m}^2$ ]	Coating life - marine [year]	Properties
GI	50/50	10	Good weldability and formability with tolerable corrosion resistance.
GI	115/115	25	Good combination of corrosion resistance and usability.
ZA	255	80	Superior corrosion resistance in marine condition
GA	50/50	15	Superior paint adhesion and corrosion resistance as painted. Weldability in same level as cold rolled material under proper welding conditions.
GA	60/60	17	Superior paint adhesion and corrosion resistance as painted. Weldability in same level as cold rolled material under proper welding conditions.
GA	140	20	Superior paint adhesion and corrosion resistance as painted. Weldability in same level as cold rolled material under proper welding conditions.

## Delivery Conditions

The tubes are not intended to undergo any heat treatment after welding and sizing as that may alter the mechanical properties of the material (+CR2 delivery condition according to EN10305-3 and -5).

The tubes are oiled with anti-corrosive oil (S4 condition according to EN 10305-3 and -5).

## Fabrication and Other Recommendations

### Further Fabrication

Pre-heating of the tubes before bending and welding may lower the strength of the material. Docol Tube 800 is not suitable for hot dip galvanizing. Outside the welded area the surface roughness (Ra) is typically 0.25-0.75  $\mu\text{m}$ .

### Bending

The bendability of Docol Tube 800 steels is good and the recommended minimum bending radius is 2.5 x tube diameter. The optimal radial gap between mandrel and inside wall of the tube should be in the range of 0.10 to 0.15 mm.

### Welding

Docol Tube 800 tubes have very low content of alloying elements in relation to the high strength of the steels and the weldability of Docol Tube 800 is very good. Recommendations in accordance to Eurocode 3 apply for welding.

For information and recommendations for welding Docol Tube 800, see welding brochure for SSAB Docol products and Steelfacts at [www.ssab.com](http://www.ssab.com).

For information concerning fabrication, see SSAB's brochures on [www.ssab.com](http://www.ssab.com) or consult Tech Support. Appropriate health and safety precautions must be taken when welding, cutting, grinding or otherwise working on the product.

## Contact Information

[www.ssab.com/contact](http://www.ssab.com/contact)