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Cold drawn seamless heat exchanger tubes

for Process Industries

MANNESMANN
PRECISION TUBES

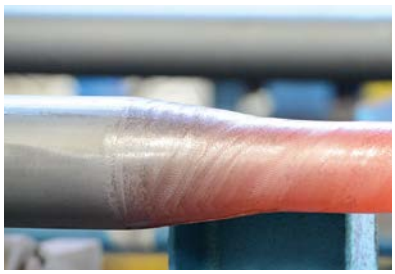
A Member of the Salzgitter Group

Introduction

The tubes described in this brochure are intended for the construction of heat exchange equipment for Process Industries, such as oil refineries, gas condensers or petrochemical plants. These heat exchangers are designed for service temperatures ranging from -100 °C to +625 °C (-150 °F to 1150 °F). Tube parameters (dimensions, steel grade etc) are determined by the design engineers according to the fluids, temperatures and pressures used in the equipment.

Manufacturing process

Tubes are manufactured in the cold drawing plants of Mannesmann Precision Tubes, and more particularly in Vitry-le-François plant. Tubes are cold drawn from hollows supplied mainly by Mannesmannröhren-Werk in Zeithain. Modern and efficient equipment makes it possible to meet the most stringent requirements and to obtain long unit lengths, up to 87 ft according to sizes



Company

Mannesmann Precision Tubes (MPT), based in Mülheim with around 2,300 employees. Worldwide activities and international access – your partner for high quality steel tubes.

Our locations in Germany, France, The Netherlands and Mexico form the basis for high delivery performance and customer satisfaction. Mannesmannröhren-Werk GmbH, based in Zeithain supplies pre-material (seamless hot rolled hollows) to the precision tube mills of the Salzgitter Group.

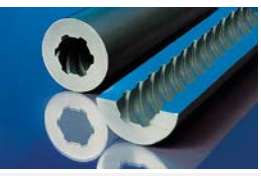
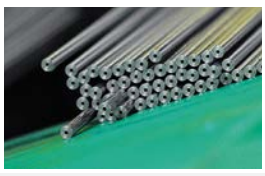
The Group-Structure

The subsidiaries and affiliates of the Business Unit Mannesmann specialize in different steel tube products and are each out in front in their own markets.

Synergy effects as a result of our integration with the Salzgitter Group ensure an outstanding efficiency – from the pre-material to the finished precision steel tube.

Certified Quality Management

A comprehensive continuous quality management system ISO 9001, IATF 16949, ISO 14001 and PED (Pressure Equipment Directive) which encompasses all production stages. This certified quality management system, ensures continuously high quality standards ranging from the pre-material that we select and source, with specific consideration given to the needs of precision tube manufacture, to slitting, welding and drawing facilities all the way through to precise-length centers and galvanizing facilities.



Seamless precision steel tubes with special dimensional accuracy
External diameter: 1.5 – 400 mm
Wall thicknesses: 0.2 – 28.5 mm

Welded precision steel tubes with special dimensional accuracy
External diameter: 20 – 120 mm
Wall thicknesses: 1.0 – 7.5 mm

Welded size-rolled precision steel tubes
External diameter: 25 – 114.3 mm
Wall thicknesses: 1.75 – 8.5 mm

Other diameters on request

Production of seamless and welded precision steel tubes in accordance to international standards e. g.
EN 10305-1, EN10305-2, EN10305-3, EN 10305-4, EN10216 and EN10217, ASTM A 179, A192, A 209, A 210, A 213, A 556 Japan Industrial Standard, British Standards, Other standards on inquiry.

Technical data

Table 1: Main steel grades

Service temperature range	Steel grades	EN 10216-2 10216-3 10216-4	NF A 49-215	DIN 17175 17173 17179	BS 3059-3601 3602-3603 3604-3606	ASTM A 179, A 192 A 209, A 213 A334, A 210, A 199	UNI 5462 663
Low temperature	C Ni	P215 NL P265 NL	TU 42 BT	TIST 35N		Gr 1 Gr 6-Gr A1 Gr 3	
Medium temperature	C Mn	P195 GH P235 GH P265 GH	TU 37-C TU 42-C TU 48-C	St 35.8 St 45.8	320/360 410 440/460	Gr A 179 Gr A 192 Gr C	 Fe 35.2/C 14 C18/Fe 45.2
High temperature	0.3 Mo 0.5 Mo 0.5 Cr 0.5 Mo 1 Cr 0.5 Mo 1.25 Cr 0.5 Mo 5 Cr 0.5 Mo 2.25 Cr 1 Mo	 16 Mo 3 13CrMo 4-5 10CrMo 5-5 X11CrMo5+NT11 10CrMo9-10 X11CrMo9-1 X10CrMoVNb9-1	 TU 15 D 3 TU 15 CD 2-05 TU 10 CD 5-05 TU Z10 CD5-05 TU 10 CD 9-10	 15 Mo 3 13 Cr Mo 4-4 10 CrMo9-10	 243 620 622-490	 T1 T1A T12 T11 T5 T22 T9 T91	 16 Mo 5 14 Cr Mo 3 12CrMo9-10

Steel grades can be specifically designed for example for corrosion resistance
Steel grades is for information. Other grades are available upon request.

Tests

At each manufacturing stage, heat exchanger tubes are submitted to a visual and dimensional inspection. They are also submitted to Eddy current test (straight tubes) or, if requested, to other non destructive tests in accordance with the requirements of the standards and customers' specifications. Mechanical tests, along with flaring and flattening tests, are performed on samples of each order as per the reference standards.

Table 2: Outside diameter and wall thickness

Average wall thickness: (OD - WT) x WT x 0.0246615 kg/m

O.D/wt	BWG		16		14	13		12		11	10	
inch	mm	1.50	1.65	2.00	2.11	2.41	2.50	2.77	3.00	3.05	3.40	4.00
	15.00	0.499		0.641			0.771		0.888			
5/8	15.87		0.579		0.716	0.800		0.895				
	16.00			0.691			0.832		0.962			
	18.00	0.610		0.789			0.956		1.110			
3/4	19.05		0.708		0.881	0.989		1.112		1.203	1.312	
	20.00			0.888			1.079		1.258			
	22.00			0.986			1.202		1.406			
	25.00			1.134			1.387		1.628			2.072
1	25.40		0.966		1.212	1.366		1.546		1.681	1.845	
	28.00			1.282			1.572		1.850			2.368
	30.00			1.381			1.695		1.998			2.565
1 1/4	31.75				1.542	1.744		1.980		2.159	2.377	
	35.00			1.628			2.004		2.368			
1 1/2	38.10				1.873	2.121		2.413		2.636	2.910	
2	50.80				2.534	2.876		3.281		3.592	3.974	
2.37	60.30						3.563	3.930	4.239	4.306	4.771	5.553
2 1/2	63.50						3.761	4.148	4.476	4.547	5.040	5.870

1 lb/ft = 1.48816 kg/m 1 kg/m = 0.67197 lb/ft

Minimum wall thickness: (OD - 1.1 WT) x 1.1 WT x 0.0246615 kg/m

O.D/wt	BWG		16		14	13		12		11	10	
inch	mm	1.50	1.65	2.00	2.11	2.41	2.50	2.77	3.00	3.05	3.40	4.00
	15.00	0.543		0.694			0.831		0.952			
5/8	15.87		0.629		0.776	0.864		0.964				
	16.00			0.749			0.899		1.034			
	18.00	0.665		0.857			1.034		1.196			
3/4	19.05		0.771		0.958	1.072		1.203		1.299	1.412	
	20.00			0.966			1.170		1.359			
	22.00			1.074			1.306		1.522			
	25.00			1.237			1.509		1.766			2.235
1	25.40		1.056		1.321	1.487		1.680		1.824	1.998	
	28.00			1.400			1.712		2.010			2.561
	30.00			1.508			1.848		2.173			2.778
1 1/4	31.75				1.684	1.902		2.157		2.349	2.583	
	35.00			1.780			2.187		2.580			
1 1/2	38.10				2.048	2.318		2.634		2.875		
2	50.80				2.775	3.148		3.588		3.926	4.341	
2.37	60.30						3.903	4.302	4.638	4.711	5.216	6.065
2 1/2	63.50						4.120	4.542	4.899	4.976	5.512	6.412

1 lb/ft = 1.48816 kg/m 1 kg/m = 0.67197 lb/ft Above is an indication of the most usual sizes. Please inquire for other dimensions.

Table 3: Tolerances

Standard	On diameter		On wall thickness
EN 10 216	D ≤ 219,1 mm D	± 0.5% or ± 0.3 mm	± 10% or ± 0.2 mm
NF A 49-215	D ≤ 20 mm: ± 0.10 mm	OD ≤ .8 in.: ± .004 in.	If average wall thickness: ± 9% min. .008 in.
	20 mm < D ≤ 38 mm: ± 0.15 mm	.8 in. < OD ≤ 1.5 in.: ± .006 in.	If minimum wall thickness: + 18%
	38 mm < D ≤ 50 mm: ± 0.25 mm	1.496 in. < OD ≤ 1.969 in.: ± .0098 in.	- 0 %
ASTM A 450 applicable for:	D ≤ 25.4 mm: ± 0.10 mm	OD ≤ .1 in.: ± .004 in.	
A 179	25.4 mm < D ≤ 38.1 mm: ± 0.15 mm	1 in. < OD ≤ 1.5 in.: ± .006 in.	D ≤ 38.10 mm/1.5 in.: -0/+ 20%
A 199	38.1 mm < D ≤ 50.79 mm: ± 0.20 mm	1.5 in. < OD ≤ 1.999 in.: ± .0079 in.	D > 38.10 mm/1.5 in.: -0/+ 22%
A 213			
A 334			
BS 3059	PART 1 CFS & PART 2 CLASS S1	PART 1 CFS & PART 2 CLASS S1	± 7.5%
	± 0.50 % min.: ± 0.10 mm	± 0.50 % min.: ± .004 in.	
	PART 2 CLASS S1	PART 2 CLASS S1	± 10%
	± 0.75 % min.: ± 0.30 mm	± 0.75 % min.: ± .012 in.	
DIN 2391	D ≤ 30 mm: ± 0.08 mm	OD ≤ 1.18 in.: ± .003 in.	
	30 mm < D ≤ 40 mm: ± 0.15 mm	1.18 in. < OD ≤ 1.60 in.: ± .006 in.	± 10%
	40 mm < D ≤ 50 mm: ± 0.20 mm	.574 in. < OD ≤ 1.969 in.: ± .0079 in.	
	50 mm < D ≤ 60 mm: ± 0.25 mm	.969 in. < OD ≤ 2.362 in.: ± .0098 in.	
DIN 17175	± 0.60 % min.: ± 0.25 mm	± 0.60 % min.: ± .010 in.	2 Sn < Ta ≤ 4 Sn -10%/ + 12.5%
			Ta > 4 Sn ± 9%
			Ta = Specified wall thickness
			Sn = Standard wall thickness according to DIN 2448

The individual specifications define the tolerances applicable to heat exchanger tubes. Outside diameter, wall thickness, ovality, eccentricity and length must conform to strict limits, which MPT can easily meet. Please consult if tighter tolerances are required.

Quality

The heat exchanger production line is certified ISO 9002 and products are approved by the main inspection to bodies. Certification

Certification

All heat exchanger tubes are supplied with a mill test certificate (3.1.B in accordance with EN 10204). Upon request, tubes can be inspected and certified by recognised third part inspection agencies.

Table 4: U-Bending

Outside diameter	Wall thickness	Developed length	Radius of bend min.
12.00 mm to 34.00 mm	1.50 mm to 3.81 mm	Mini 2.6 m max 26.500 m	1.5 x OD max 1250 mm (49‘)
.472“ to 1.338“	.059“ to .150“	Mini 8 1/2“ max 86.95‘	

U-bent tubes are shipped in specially designed wooden boxes or crates depending on the destination.

All U-bent tubes can be submitted with the following operations or tests:

- Stress relieving of the bend + 150 mm (5.9") of each leg (standard), over 150 mm upon request,
- Hydrostatic test up to 800 bars (11 603 psi) for radii up to 1100 mm (43“),
- Magnetic particle test for radii up to 500 mm (20“),
- Ultrasonic test of the wall thickness on the bend.

U-bent tubes are shipped in specially designed wooden boxes or crates depending on the destination.

Identification
Tubes are stencilled according to the specification.
Marking and labelling can be adapted to suit your particular needs.

Rust protection
Heat exchanger tubes from MPT can be supplied with three types of surface finish:
without oil, externally oiled or internally and externally oiled. Your choice of protection should take into account the end use of the tubes and the means of transport.

Packaging
Based on our extensive experience with overseas customers, we can offer a comprehensive range of packaging solutions adapted to your needs in bundles or wooden crates.

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