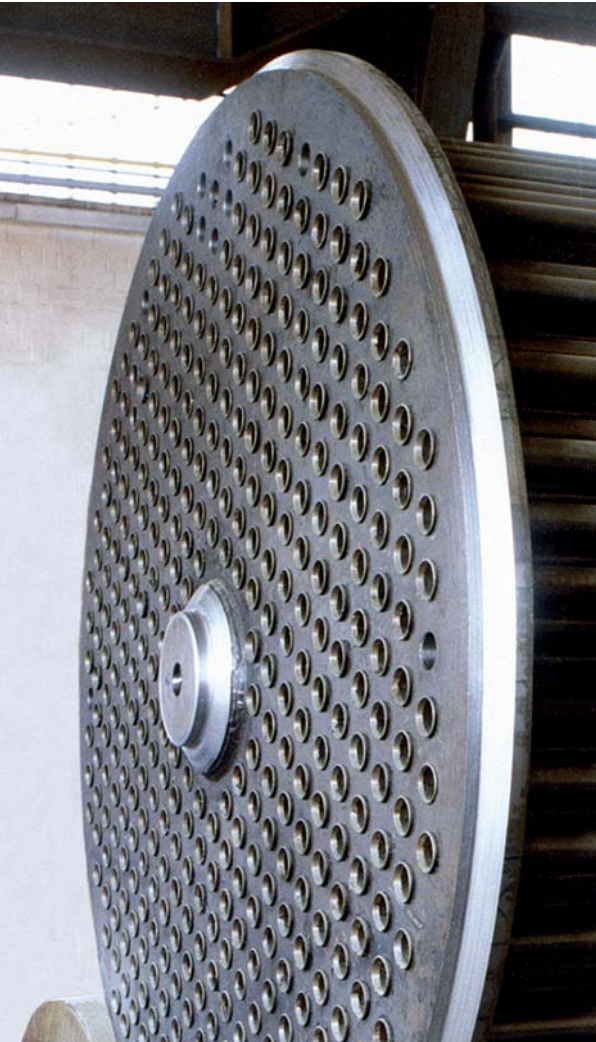




Tubular solutions for the Solar Power Industry

Rise in success with precision



Precision tubes designed for CSP industry applications

Solar collectors ①

- Tubes adapted for solar heat capture and fluid transfer in solar field.

Heat storage and release ② ③

- Perfectly adapted to different heat transfer fluids as oil, molten salt and water.

Precision tubes for Feedwater Heaters ④

- High resistance to the demanding water-steam heat exchanging environments (corrosion, high temperatures, high pressure).

Solar Boiler ⑤

- Rifled tubes, optimized profile to raise the thermal efficiency.

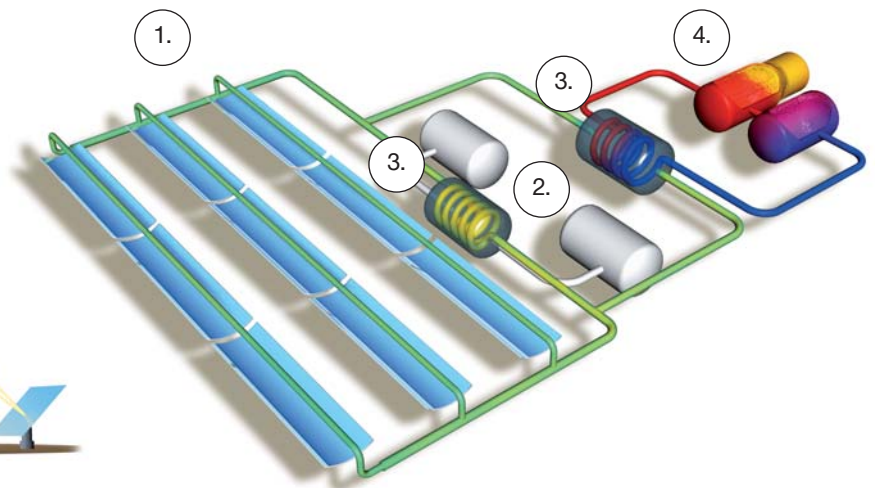
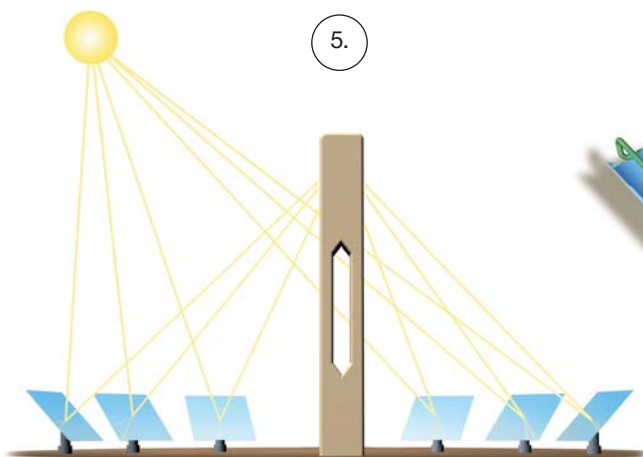
Turn innovation into money

The SMP technical customer support team offers:

- Partnership in innovation
- Special tube design according to your specifications
- R&D support worldwide
- Technical assistance

The quality you can trust

- 100% of the precision tubes for CSP applications are fully tested and delivered with certificates including chemical composition and mechanical properties.
- 100% of the precision tubes for CSP applications are manufactured in plants certified ISO 16949, ISO 9001 and ISO 14001.
- More than 40 years of experience and cooperation working with the main actors of the Power Generation Industry worldwide guarantee a unique large know-how in precision tube manufacturing for the energy sector.



1. Solar field, 2. Heat storage tank, 3. Heat exchanger, 4. Steam turbine and power generator, 5 Solar Boiler

Technical Data

Product range and steel grades

| Complete product range | |
|------------------------|--|
| Length | Maximum length of 26.5 meters/85'11" |
| Type of tubes | Welded, Seamless and Rifled Tubes |
| Bending | Straight and U-bent tubes |
| Type of steel | Carbon steel and alloy steel |
| OD | Min 15.87 mm (5/8") / Max 63.5 mm (2.5") |
| WT | Min 1.5 mm / Max 4 mm |

Main Steel grades

Temperature/Grade Low Temperature Medium Temperature High Temperature

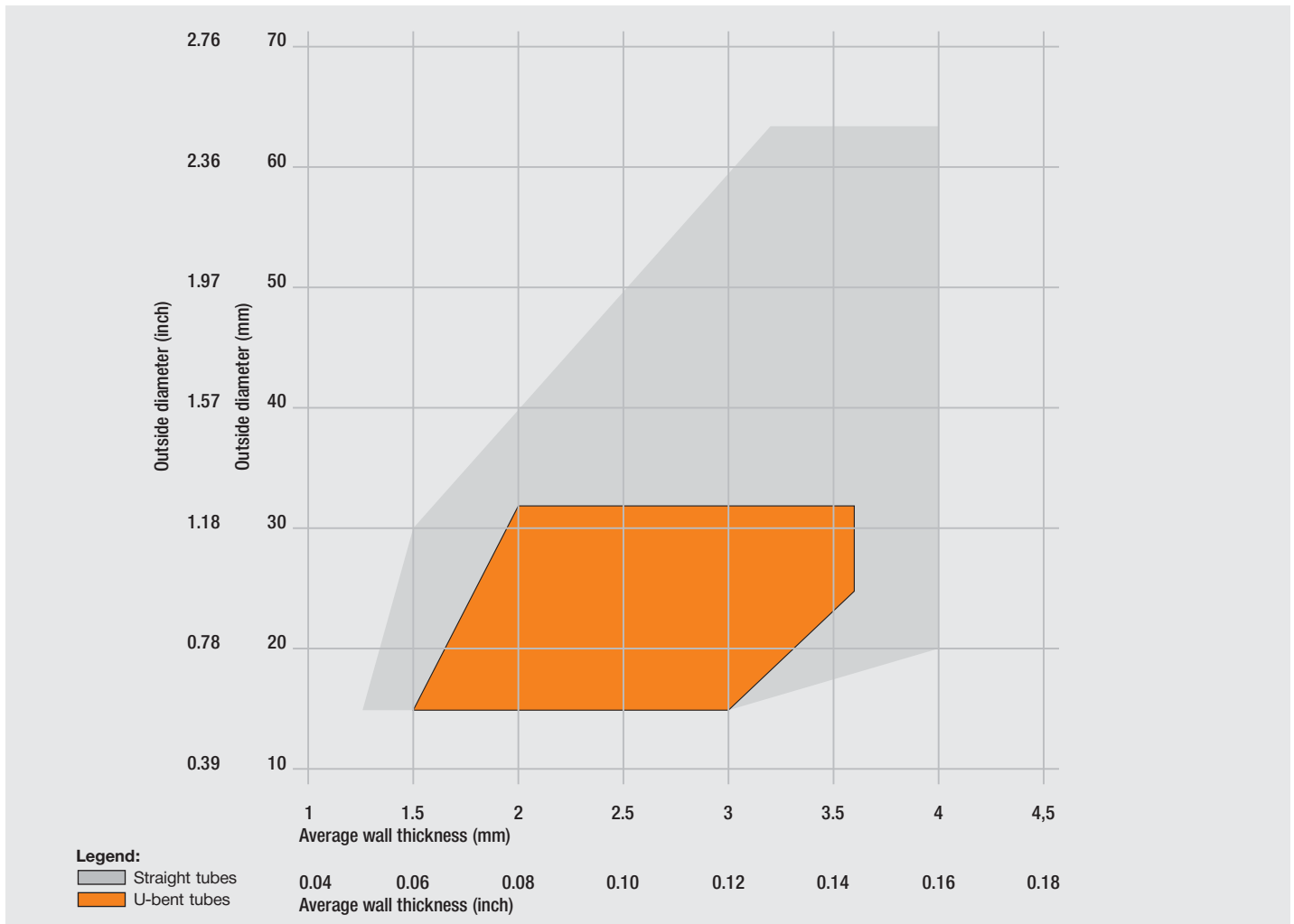
| | | | |
|---|----------------------|-------------------------------------|-----------------------------|
| ASTM A179, A192, A209, A213, A334, A210, A556 | Gr 1 Gr 6 Gr 3 | Gr A1 Gr A179 Gr A192 Gr C | T1 T1A T12 T11 T5 T22 |
|---|----------------------|-------------------------------------|-----------------------------|

Other standards (EN, BS, NFA DIN, BS, UNI) are available upon request

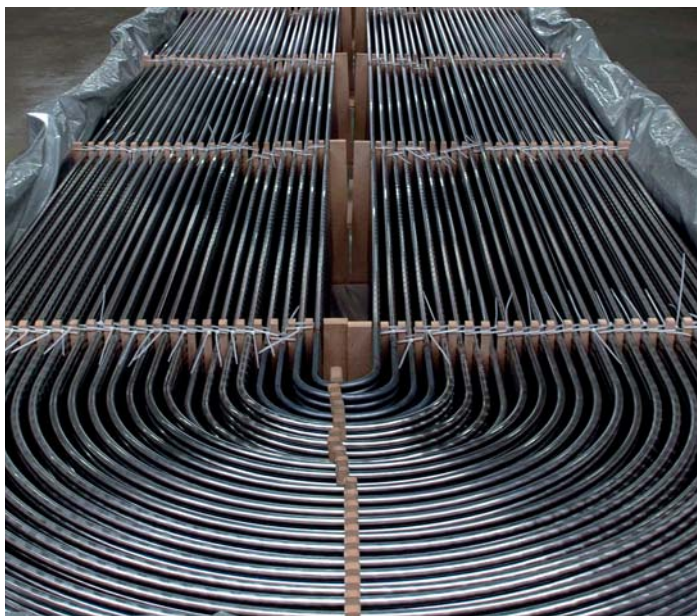
Tolerances

| | | Tolerances in Outside Diameter (OD) | | Tolerances in Wall Thickness | |
|------|-------|-------------------------------------|---|----------------------------------|--|
| ASTM | A 450 | OD < 25.4 mm: ± 0.10 mm | OD < 1 inch: ± .004 inch | | |
| | | 25.4 mm < OD < 38.1 mm: ± 0.15 mm | 1 inch < OD < 1.5 inch: ± .006 inch | OD < 38.10 mm/1.5 inch: -0/+ 20% | |
| | | 38.1 mm < OD < 50.8 mm: ± 0.20 mm | 1.5 inch < OD < 1.999 inch: ± .008 inch | OD < 38.10 mm/1.5 inch: -0/+ 22% | |

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 SMP can easily meet. Please consult if tighter tolerances are required.



Other sizes are available upon request. Please inquire for details.



U-Bending

Outside diameter
15.88 mm to 31.75 mm
5/8 to 1.25"

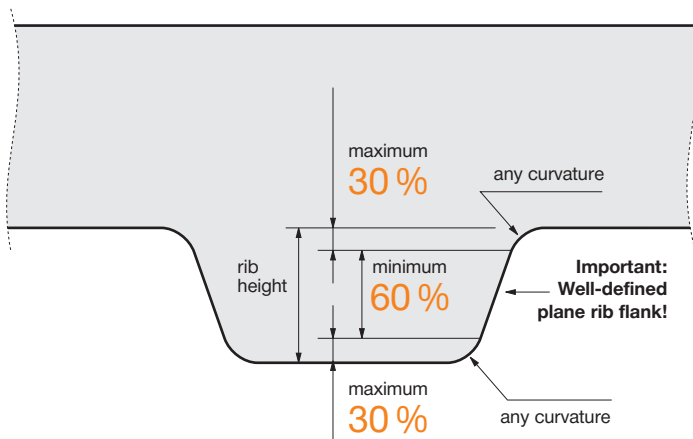
Wall thickness
1.50 mm to 3.81 mm
.059" to .150"

Developed length
Min 2.6 m max 26.500 m
Min 8 1/2" max 85'11"

Radius of bend min.
Min 1.5 x OD
Max 1250 mm

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



Rifled tubes: three main criteria are key points for optimized profile

- optimized lead angle
- increased rib height
- maximized plane rib flank
- Additional information and detailed size range are available in our **Rifled tubes** leaflet

Other specifications

Certification

All 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.

Identification

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

Rust protection

Tubes from SMP 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.

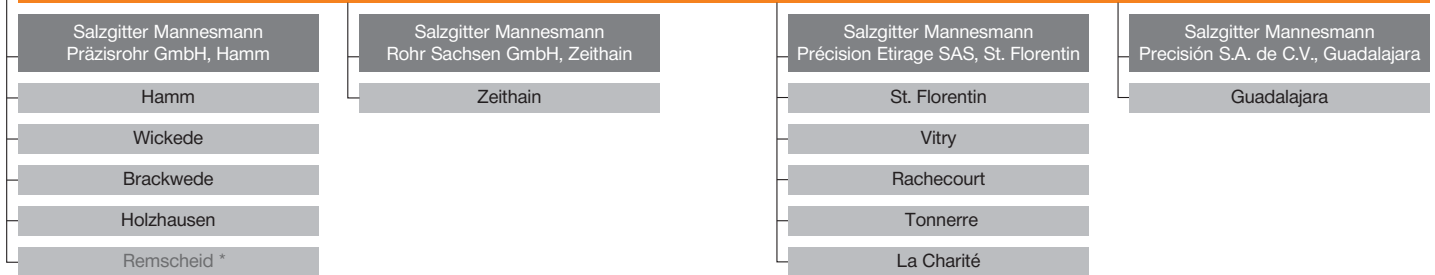
Packaging

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.

Salzgitter AG

Mannesmannröhren-Werke GmbH

Salzgitter Mannesmann Precision GmbH



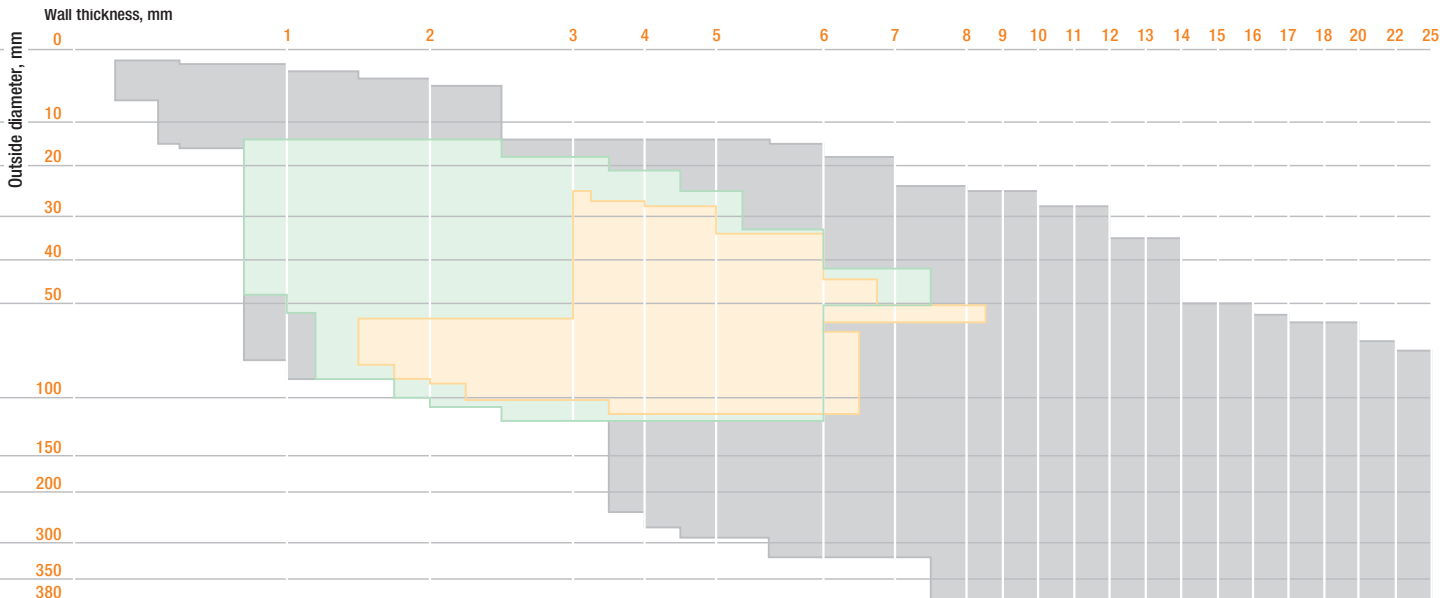
*A Company of Salzgitter Mannesmann Stainless Tubes GmbH

Salzgitter Mannesmann Precision

Following the takeover of Vallourec Précision Etirage (VPE), France, by the Salzgitter AG, the new European market leader of cold-drawn seamless and welded precision steel tubes has been founded under the name of Salzgitter Mannesmann Precision GmbH. As a leading European manufacturer Salzgitter Mannesmann Precision offers a wide range of products and services with great scope for intelligent, tubing-related solutions.

The Group-Structure

Effective synergies are a result of our integration with the Salzgitter Group ensure an outstanding efficiency - from the pre-material to the finished precision steel tube. The affiliated group companies ensure a comprehensive supply guarantee regarding the complete value-added chain in production of precision steel tubes and is therewith the basis for the high performance in deliveries and customer satisfaction. Today, Mannesmannröhren-Werke (MRW) manages the Group's Tube Division. The Division has numerous subsidiaries and affiliated companies.



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.

Seamless precision steel tubes of special dimensional accuracy according to DIN EN 10305-1
 Outside diameter: 1.5 - 380 mm
 Wall thicknesses: 0.2 - 25.0 mm

Welded precision steel tubes of special dimensional accuracy according to DIN EN 10305-2
 Outside diameter: 20 - 120 mm
 Wall thicknesses: 1.0 - 7.5 mm

Welded size-rolled precision steel tubes according to DIN EN 10305-3
 Outside diameter: 25 - 114.3 mm
 Wall thicknesses: 1.75 - 8.5 mm

Salzgitter Mannesmann Precision Etirage SAS

Direct Contact Sales:

Avenue Jean Juif

BP 77 – Z.I.

51300 Vitry-le-François, France

Phone: +33 3 26 41 23 97

Fax: +33 3 26 41 23 32

E-mail: marketing@smp-tubes.fr

Salzgitter Mannesmann Precision GmbH

Wiesenstraße 36

45473 Mülheim/Ruhr, Germany

www.smp-tubes.com

Your local contact:

