TPS TECHNITUBE®
RÖHRENWERKE GMBH

IN-HOUSE BENDING

U-Tubes
for
Heat Exchangers

Made in Germany

UNGGUL PRAKARSA PRISMA

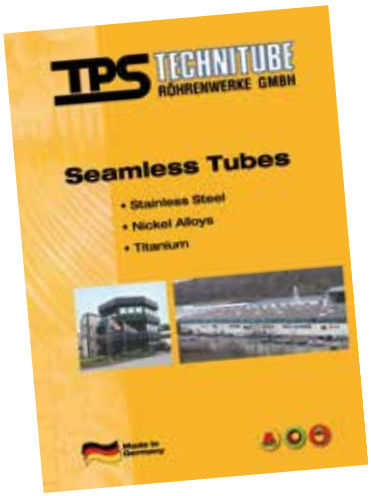
Komplek Ruko Intercon Plaza Blok D No. 9, Jl. Meruya Ilir raya , Srengeseng , Jakarta Barat 11630
Phone : 6221 5890 1302 Email : unggulpp@upp.co.id Web : www.unggulpp.com

TPS Technitube Röhrenwerke GmbH has always been a future-oriented and privately owned organisation, investing heavily in state-of-the-art machinery and equipment to achieve a leading position in its market.

In addition to the production of seamless stainless steel, nickel alloy and titanium alloy tubing TPS manufactures **U-tubes** for the use in heat exchangers, condensers, pre-heaters and other applications.

These U-tubes are manufactured in accordance with the requirements of **DIN 28179, TEMA RCB-2.31, ASTM A/ASME SA 688, ASTM B/ASME SB 163** or according to customer requirements.

The **manufacture of U-tubes** takes place in a separate facility, adjacent to the tube mill, on TPS premises. TPS uses bending equipment which is used exclusively for **stainless steel - nickel alloys and titanium alloys**. Therefore, the risk of contact corrosion will be avoided.



For further technical details, please refer to our catalogue „Seamless Tubes“.

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Your advantages, if you purchase U-tubes from TPS

1 You save money and time

- **You** only have one contact person
- **You** avoid transport damages to the long initial tubes on the way to the bending company
- **You** do not have to pay extra costs for the carriage to the bending company
- **You** benefit from time saving due to the parallel production of the initial tubes and the U-tubes
- **You** may request spare tubes, which we stock for you
- **You** save space and time for assembling the heat exchangers as the U-tubes can be removed radius-wise from the wooden combs

2 Surface quality

- **You** receive tubes which are free from oil and grease as well as free from debris
- **You** receive a metallic bright surface without discolouration on the inner and outer tube

3 Heat treatment of bending area

- **You** can choose between solution or stress relief annealing depending on the material standard
- On demand, we also include the annealing charts

4 Packing

- The U-tubes are secured to the transport-rack using wooden combs in order to avoid damage
- **Your** incoming material inspection is faster and more efficiently due to the accurate packing sorted by radius

5 Quality

- **You** receive a detailed test certificate with all the important measures of the bend along with the inspection certificate 3.1
- **You** are given a warranty of up to 3 years*

* In line with our general terms and conditions of sale we guarantee defect free materials and good workmanship

Heat treatment procedure of bending area

General

According to the German regulation AD-Merkblatt HP7/3, U-Tubes with a radius > 1,3 D are usually not subject to heat treatment after bending.

Should a heat treatment be required, it has to be agreed before order placement.

Cleaning of tube surface

Before the heat treatment of the tube, its surface in the zone that will be annealed is going to be cleaned in order to remove any residue.

Procedure

The bend and maximum 300 mm of the leg will be heated to material-specific temperature through an electric resistance heat treatment.

The measurement of the temperature is going to be accomplished by an automatic infrared camera. The tube interior is going to be rinsed with protective gas to avoid oxidation.

A light oxide layer is permitted according to ASTM A 688. The discolouration on the outer tube surface will be mechanically removed on request.

Method

Solution annealing:
Heating to a temperature according to the material specification, followed by rapid quenching.

Stress relieving:
Rapid heating to a temperature between 550 - 650 °C, followed by slow cooling in still air.

inspection, documentation & packing

Dimensional inspection

The bending radius, the run-out respectively the flattening in the bending area, the wall thinning in the tension zone as well as the overall length are going to be documented once at each machine setting.

Furthermore a test bend of the smallest radius is going to be cut in 4 segments and the minimum wall is going to be documented in the tension zone. On all other radii the measurement of the wall thickness in the tension zone will be performed by an ultrasonic wall thickness measuring device.

Tightness test (optional)

Upon agreement, it is possible to perform a tightness test with demineralized water (deionate) on the U-tubes with a maximum pressure of 400 bar.

The pressure will be held at least 5 seconds.

Dye penetrant test (optional)

Dye penetrant testing of the bending area can be agreed indicating the corresponding radii.

Cleanliness

The cleanliness of the inside and outside surface is inspected on each U-tube.

Test of ree passage

Upon agreement, it is possible to prove the free passage by a ball passage test according to DIN 28179.

Marking

In addition to the marking of the tube, a label that includes the information about the radius and the amount of the tubes is going to be attached at the first layer of each radius.

Packing

The standard packing consists of transport racks with combs and foil protection (in case of transport by truck without reloading). Other packing has to be arranged during the order placement. The removal by radius is assured. If requested, the tube ends may be protected with plastic plugs.

Documentation

Documentation according to EN 10204
- Inspection certificate 3.1. or
- Inspection certificate 3.2 (by third party inspection)
- Test certificate

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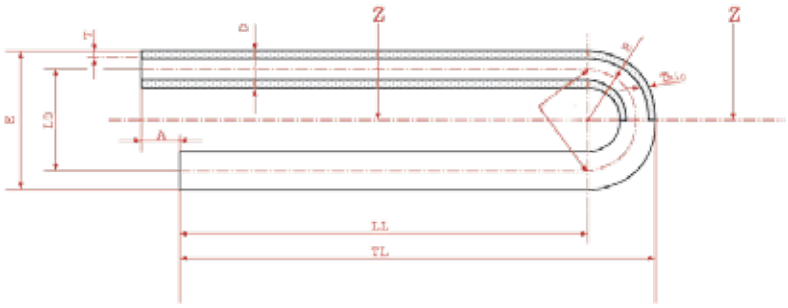
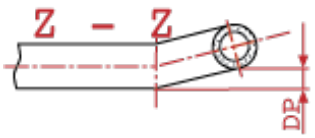
U-tubes

The bending of the straight tubes is carried out according to the applicable specifications DIN28179, TEMA RCB-2.31, ASTM A/ ASME SA 688, ASTM B/ASME SB 163 and/or acc. customer´s specification. Usually seamless tubes of austenitic, ferritic, martensitic and Duplex steels as well as nickel alloy tubes with radii from 1,5D can be bent.

For radii <1,5D tolerances (deviating from the tolerance standard) for ovality/flattening and minimum wall in the bending area have to be agreed. Bending of titanium tubes is possible from radius 2D up.





Meaning of measurements and symbols:

A	leg length difference
E	(2R + D): 2x radius plus outside diameter
D	nominal outside diameter
D_{max}	max. outside diamater
D_{min}	min. outside diamater
LD	leg length distance measured from points of tangency
LL	leg length
TL	total length
R	centerline bend radius
R_{min}	min. radius
T	nominal wall thickness
T_{min}	min. wall thickness in outside bending area
SW	smalles wall thickness of straight tube
O	ovality
DP	deviation from plane of bend
Z	section

Tolerances

Radii tolerance

R 1,5xD - R 200	+/- 1,0 mm
R > 200 - R 400	+/- 1,5 mm
R > 400	+/- 2,0 mm

Wall thinning of bending area

acc. DIN 28179 $T_{min} \geq SW \times \frac{(2\,R + D)}{2 \times (R + D)}$ mm

According to TEMA R-2.3 1 for radii from 1,5D: max. 17% wall thinning based on the minimum wallthickness of the straight tube.

Tolerance on straight leg length

straight leg	≤	5000 mm	- 0/+ 3 mm
straight leg	>	5000 mm ≤ 8000 mm	- 0/+ 5 mm

Difference in leg length

leg length	≤	5000 mm	- 0/+ 3 mm
leg length	>	5000 mm	- 0/+ 5 mm

Tolerance on ovality

Allowable deviation from ovality in %

R ≤ 4D $O = \frac{D}{5\,R} \times 100$

R > 4 D ≤ 5 %

The deviation O of the ovality is calculated as follows:

$O = 200 \times \frac{D_{max} - D_{min}}{D_{max} + D_{min}}$

Flattening on bend (TEMA RCB-2.31 only)

Flattening does not exceed 10% of the nominal diameter

Tolerance on total length

≤ 6000 mm	- 0/+ 5 mm
> 6000 mm	- 0/+ 8 mm

Deviation from plane of bend DP

R ≤ 300 mm	≤ 1,5 mm
R > 300 mm	≤ 2 mm

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Very short delivery time for straight tubes and U-tubes ex stock

TPS - SHUTDOWN SERVICE

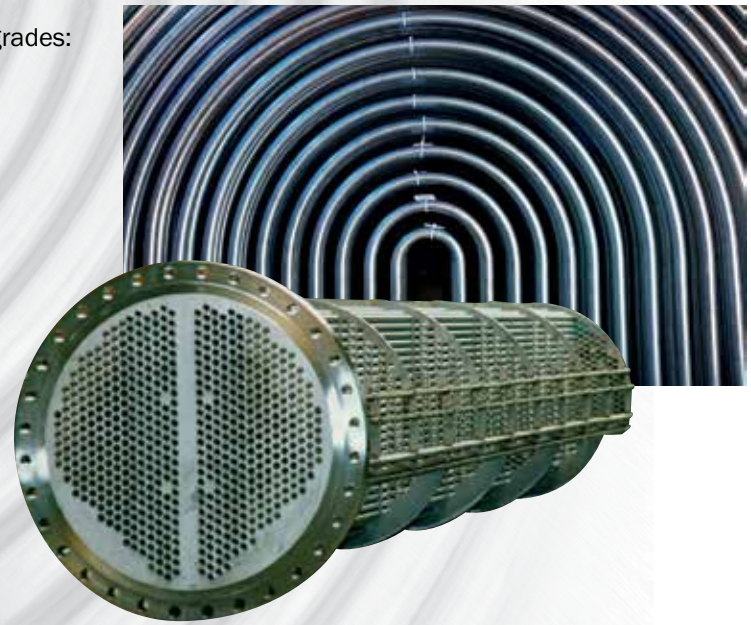
In additon to the production of seamless stainless steel, nickel and titanium alloy tubes, TPS keeps a large stock for heat exchanger tubes to assure a fast supply for our customers.

The wide stock range which includes all common material grades and dimensions, in connection with our special stock service guarantees a delivery „just in time“.

The U-tubes are manufactured in our own bending facility within a short time. Therefore, they can be delivered at short notice based on the stock material.

You can order U-tubes in the following material grades:
· Stainless steel
· Nickel alloys
· Titanium
· Carbon steel
· Low alloy steel
· Aluminium brass
· Admiralty brass
· Copper-nickel alloys

U-tubes within in days – instead of months!



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