

TPS TECHNITUBE[®]

RÖHRENWERKE GMBH

Seamless TITANIUM-TUBES

✓ In straight and
u-bent condition



SEAMLESS TITANIUM AND TITANIUM ALLOY TUBES FOR CONDENSERS AND HEAT EXCHANGERS

TPS-Technitube Röhrenwerke GmbH, a privately owned company with head office and production mills in Daun, Germany, is known worldwide as a manufacturer of Stainless Steel and Nickel alloy tubes. Due to our investment during the last years in the production process, we have developed an equipment know-how allowing us now also to manufacture tubes in Titanium and its alloys.

The introduction of Titanium products into the delivery programme of TPS-Technitube Röhrenwerke GmbH, therefore, is a logical diversification of the already existing wide range of high performance material grades. Titanium and its alloys provide metallurgical advantages compared to other metals such as excellent corrosion resistance to a great number of oxydizing acid solutions.

Further Advantages:

- Resistant to stress corrosion cracking in chloride and sour gas environments.
- Superior erosion resistance.
- Good formability and weldability.
- Light weight and high strength.
- Increased life expectancy of equipment.

In addition to corrosion resistance, Titanium metals boast high mechanical strength at low weight, high melting point and low thermal expansion coefficient.



Application

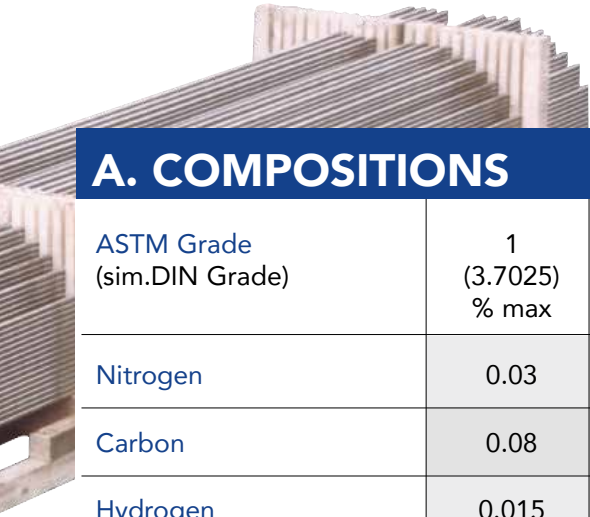
Titanium can be used in the construction of reactors and aircraft, also in chlorine production, for heat exchangers and condensers, in desalination and chemical process equipment. The oil, gas and marine sectors also offer significant applications.



Properties of Titanium

Chemical symbol:	Ti
Atomic number:	22
Density:	4,5 g/cm ³
Melting point:	1667° C but it absorbs oxygen, nitrogen and hydrogen and becomes brittle with prolonged atmospheric exposure at high temperature.
Corrosion resistance:	Excellent; shows better resistance to sea water and marine atmospheres than stainless steel.
Strength:	Except at elevated temperatures, the strength-to-weight ratio exceeds that of both aluminium and stainless steel.

PROPERTIES OF TITANIUM TUBES AS PER ASTM B338 AND ASME SB338



A. COMPOSITIONS

ASTM Grade (sim.DIN Grade)	1 (3.7025) % max	2 (3.7035) % max	3 (3.7055) % max	7 (3.7235) % max	9 (-) % max	11 (3.7225) % max	12 (3.7195) % max
Nitrogen	0.03	0.03	0.05	0.03	0.03	0.03	0.03
Carbon	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Hydrogen	0.015	0.015	0.015	0.015	0.015	0.015	0.015
Iron	0.20	0.30	0.30	0.30	0.25	0.20	0.30
Oxygen	0.18	0.25	0.35	0.25	0.15	0.18	0.25
Aluminium	-	-	-	-	2.5-3.5	-	-
Vanadium	-	-	-	-	2.0-3.0	-	-
Palladium	-	-	-	0.12-0.25	-	0.12-0.25	-
Molybdenum	-	-	-	-	-	-	0.2-0.4
Nickel	-	-	-	-	-	-	0.6-0.9
Residuals/Each	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Residuals/Total	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Titanium	balance	balance	balance	balance	balance	balance	balance

B. MECHANICAL PROPERTIES (ANNEALED)

	MPa	MPa	MPa	MPa	MPa	MPa	MPa
Yield Strength (Min.)*	138	275	380	275	483	138	345
Yield Strength (Max.)*	310	450	550	450	-	310	-
Tensile Strength (Min.)	240	345	450	345	620	240	483
Elongation % (Min.)**	24	20	18	20	15	24	18

*0.2% Offset** in 2 inch or 50 mm

please consult us, if other grades are required

Non-Destructive Testing

Seamless Titanium tubes can be

- Eddy-Current tested
- Ultrasonic tested
- Hydrostatic tested

Certifications

In compliance to customer's specification either according to EN 10204 or ASTM/ASME standard.

Packing

Standard: strong wooden cases.

Tubing and Pipe Specifications

ASTM B 338	=	Seamless and welded tubing.
ASME SB 338	=	Seamless and welded tubing.
ASTM B 337	=	Seamless and welded tubing.
DIN 17861	=	Technical requirement: Seamless tubes and pipes.
DIN 17850	=	Chemical composition: General.
VD/TÜV 230	=	Seamless tubes and pipes.

Sizes and Lengths:

Available in sizes from

9,53 x 0,89 mm

up to 38,00 x 4,00 mm

Lengths: In lengths up to 16.500 mm

Other sizes/lengths on request.



SEAMLESS TITANIUM HEAT EXCHANGER TUBES IN U-BENT CONDITION

Within our production possibilities for straight heat exchanger tubes it is important for us to supply all tubes ready for installation, also already U-bent. Our factory is equipped with extensive bending-facilities inclusively additional facilities for final annealing of the bending area.

Smallest bending radius > 2,0 x Dia.
(depending on OD/Wall-thickness ratio)

smaller radii on request

heat treatment after bending

pressure testing after bending

wall-thickness measurement by ultrasonic method

Seamless tubes and pipes.

The execution and tolerances of TPS U-Hairpin-Tubes are in accordance with our "TPS internal specification for Titanium U-Tubes" which include all our technical experience with Titanium and Titanium Alloys.



ASTM-GRADES	ALLOY FEATURES
Grade 1 (unalloyed Titanium)	is used to increase formability
Grade 2 (unalloyed Titanium)	is the most common Titanium grade for cooling water Systems. Good strength with high ductility, formability, weldability and corrosion resistance.
Grade 3 (unalloyed Titanium)	is specified when higher levels of strength are required.
Grade 7 (unalloyed Titanium)*	enhanced resistance to hot brine crevice corrosion and reducing acids, mechanical properties similar to grade 2 alloy.
Grade 9 (Titanium alloy)	offers excellent corrosion resistance to sea water and is medium-high strength alloy with highest code design allowables.
Grade 11 (unalloyed Titanium)*	Mechanical properties are the same as those of grade 1 however, with greater resistance to corrosion against acid chlorides.
Grade 12 (Titanium alloy)	is more resistant even at temperatures up to 300° C with improved strength and code design allowables over grade 2.

* on request





Headquarter



Project Office



Mill 1



Mill 2

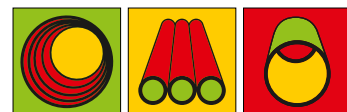
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