

Commercial Supply Proposal

Titanium Pipes and Tubes: Seamless and Welded

Global Supply Regions: North America (USA, Canada, Mexico), European Union & UK (Germany, France, Italy, Netherlands, Poland, Spain), Asia-Pacific (Japan, South Korea, Singapore, Australia, India), Middle East (UAE, Saudi Arabia, Qatar, Turkey), Latin America (Brazil, Argentina, Chile)

Target Industries: Marine & Offshore, Nuclear Power Generation, Chemical Processing, Power & Cogeneration, Desalination Plants, Aerospace, Medical Equipment, Oil & Gas Subsea

1. Product Description and Technical Parameters

Titanium tubular products represent mission-critical components for pipeline systems operating in aggressive media, elevated temperatures, and high-pressure environments. Titanium seamless tubes dominate the global industrial landscape due to unique performance requirements in nuclear and marine applications, where the global market for seamless titanium pipe continues to expand across the Americas, EU, and APAC defense sectors.

Titanium alloy tubes provide:

- Corrosion resistance in seawater at flow velocities up to 20 m/s
- Erosion-corrosion resistance in two-phase flows (steam-liquid)
- Radiation stability at fluences up to 10^{21} n/m² (E > 0.1 MeV)
- Biological inertness and non-toxicity for potable water applications
- Full compliance with ASME B861, ASTM B338, and EN ISO 1127 dimensional standards

1.1. Alloy Grades and Designations

Alloy Grade	International Equivalent	Classification	Key Properties	Primary Applications
VT1-0	Grade 2 (UNS R50400)	Commercially Pure Ti	Maximum ductility, weldability, chloride corrosion resistance	Chemical process piping, heat exchangers, marine cooling systems
VT1-00	Grade 1 (UNS R50250)	High-Purity Ti	Enhanced ductility, superior weldability	Medical tubing, food equipment, anodic protection
PT-7M	Ti-2Al-2Mn type	Ductile Alpha Alloy	Very high ductility (elongation \geq 20%), low cold-cracking tendency	Flexible piping, marine tube bundles, nuclear secondary circuits

Alloy Grade	International Equivalent	Classification	Key Properties	Primary Applications
PT-1M	Ti-2Al-1.5Mn type	High-Ductility Alpha	UTS 343-490 MPa, excellent cold workability	Heat exchanger tubes, coil elements, bent tubular assemblies
PT-3V	Near-Grade 19	Marine Structural Alpha	High strength, fatigue resistance in seawater, pitting resistance	Propeller shafts, deep-subsea hardware, offshore platforms
VT6S	Grade 5 ELI (UNS R56401)	Structural Alpha+Beta	Reduced interphase inclusions, enhanced fracture toughness	High-pressure pipelines, aerospace hydraulic systems
3M	Ti-3Al-2V type	Medium Alloy	Stable mechanical properties to 300°C	Condensers, nuclear secondary-circuit tubing
2V	Ti-0.2Pd type	Palladium-Bearing Alloy	Superior corrosion resistance in reducing acids	Chemical reactors, electrolyzers
Grade 9 (Ti-3Al-2.5V)	Grade 9 (UNS R56320)	Standard Alpha+Beta	Medium strength, excellent cold formability, global cross-compatibility	International replacement projects, cross-certified applications

1.2. Classification by Manufacturing Method

Tube Type	Outer Diameter, mm	Wall Thickness, mm	Length, mm	Standard	Alloy Grades
Cold-worked seamless	3.0-108	0.5-11.0	up to 6000	ASTM B338, ASME SB338, GOST 22897-86, TU 1825-147	VT1-0/Gr2, PT-7M, PT-1M, VT6S, PT-3V, Gr9, Ti-3Al-2.5V
Hot-worked seamless	89-325	4.0-25.0	up to 6000	ASTM B861, ASME SB861, GOST 22897-86	VT1-0/Gr2, VT6/Gr5, PT-7M, VT1-00/Gr1
Welded tubes	6-102	1.5-4.0	up to 12000	ASTM B862, ASME SB862, GOST 24890-81	VT1-0/Gr2, VT1-00/Gr1, OT4-0
High-precision tubes	5.8-125	0.1-11.0	up to 3000	ASTM B338 (precision), TU 14-3-843-79	PT-7M, VT1-0/Gr2

1.3. Mechanical Properties of Tubular Products

Alloy Grade	UTS (σ_B), MPa	Yield Strength ($\sigma_{0.2}$), MPa	Elongation (δ), %	Bend Angle (d=5t), degrees	Delivery Condition
VT1-0 / Grade 2	≥ 343	≥ 295	≥ 20	105	Annealed, half-hard
PT-7M	≥ 490	≥ 343	≥ 18	90	Annealed
PT-1M	≥ 343	≥ 196	≥ 20	115	Annealed
PT-3V	≥ 588	≥ 490	≥ 14	70	Half-hard
VT6S / Grade 5 ELI	≥ 830	≥ 760	≥ 10	50	Hard, STA
3M	≥ 539	≥ 441	≥ 14	80	Half-hard

1.4. Dimensional Tolerances and Accuracy Grades

Parameter	Standard Tolerance	Enhanced Tolerance	High Precision
Outer diameter deviation, mm	+/- 0.50	+/- 0.25	+/- 0.10
Wall thickness deviation, %	+/- 10	+/- 7	+/- 5
Wall thickness eccentricity, %	≤ 12	≤ 8	≤ 5
Straightness (bend per 1 m), mm	≤ 3	≤ 2	≤ 1
Surface roughness Ra, μm	≤ 3.2	≤ 1.6	≤ 0.8

2. Supply Chain Pain Points: Global Buyer Perspective

Our quality audit experience across shipyards in Northern Europe, nuclear facilities in North America and the Middle East, and chemical processing complexes in Southeast Asia has identified the following recurring supply chain failures when sourcing titanium tubes directly from unverified Chinese suppliers:

Pain Point	Manifestation	Operational and Financial Impact
Weldability Non-Conformance	Delivered VT1-0/Grade 2 tubes exhibit elevated nitrogen content ($>0.05\%$), causing embrittlement in welded joints	Weld joint rejection, additional argon purge costs, repeated UT inspection, production delay
Dimensional Out-of-Specification	Outer diameter and wall thickness deviate beyond ASTM B338 / GOST 22897-86 tolerances, preventing proper fitting insertion	End re-machining, custom gasket fabrication, hydrotest leakage, seal failure

Pain Point	Manifestation	Operational and Financial Impact
Absence of Hydrostatic Testing	Chinese mill omits hydrostatic pressure testing at 1.5-2.0x working pressure; no test seal provided	In-service rupture during commissioning, emergency shutdown, environmental liability
Surface Defects	Scratches, dents, oxide film traces on internal bore surfaces	Process media contamination, accelerated corrosion at damage sites, clean-in-place (CIP) system overload
Inadequate Material Marking	No color code marking per GOST 2171-90 or ASTM marking requirements; illegible heat numbers	Identification impossibility, traceability audit failure, inability to link to MTR
Protracted Qualification Cycles	Absence of AS9100 or Norsok-compliant quality system requires buyer to conduct full incoming inspection campaign	30-60 day qualification delay, third-party testing costs of USD 2,000-5,000 per batch
Payment and Compliance Risk	Chinese banks decline CNY transfers without detailed HS-code description; compliance screening for dual-use goods	Payment freezing, documentary correction cycles, delivery slippage
Regulatory Certification Gaps	Product falls outside PED 2014/68/EU, ASME BPVC Section VIII, or Norsok M-630 compliance scope	Inability to deploy in EU pressure equipment, offshore Norwegian sector, or North American nuclear plants

3. Metal-Asia.pw Integrated Solution for Tubular Products

3.1. Specialized Incoming Quality Control for Tubes

- **Dimensional Metrology:** Outer diameter, wall thickness (4 radial measurements), ovality, and straightness verification on CMM (Coordinate Measuring Machine) to ASTM B338 tolerances.
- **Hydrostatic Pressure Testing:** Every tube tested at 1.5-2.0x nominal working pressure for 10 minutes with zero leakage and nil permanent deformation.
- **Ultrasonic Testing (UT):** Internal soundness inspection per ASTM E2375 / GOST 14782-86, quality class K1-K3.
- **Endoscopic Internal Surface Inspection:** Full-length video borescope documentation of internal surface condition.
- **Eddy Current Testing (ECT):** Surface and near-surface defect detection for thin-wall tubes (❤ mm).

3.2. Regulatory and Customs Compliance

- Correct HS Code declaration: 8108.90.60 (general), 8108.90.60.10 (aero-engines), 8108.90.60.20 (civil aircraft), with full supporting documentation.

- Pressure Equipment Directive (PED) 2014/68/EU compliance certification for European deployments.
- ASME BPVC Section VIII and NORSOK M-630 material certification for North American and North Sea applications.
- Preparation of technical dossiers for local regulatory bodies and customs authorities.

3.3. Procurement Support for Industrial Projects

- RFQ/RFP response support for EPC contractors, shipyards, and nuclear utilities (Westinghouse, Framatome, Rosatom Export, Doosan, etc.).
- Warranty structuring up to 5 years for critical piping systems in subsea, nuclear, and chemical service.
- Technical specification consulting: alloy selection, wall thickness calculation per Barlow's formula with corrosion allowance, weld procedure specification (WPS) review.

4. Product Range: Titanium Pipes and Tubes

Product Description	Alloy Grades	Dimensions (OD x WT), mm	Standard	Target Industry
Cold-worked seamless tube	VT1-0/Gr2, PT-7M	10x1, 12x1, 14x1, 16x1.5, 18x1.5, 20x2, 22x2, 25x2, 28x2.5, 30x2.5, 32x3, 38x3, 42x3.5, 48x4, 57x4.5, 76x5	ASTM B338, GOST 22897-86	Heat exchangers, chemical reactors
Hot-worked seamless tube	VT1-0/Gr2, VT6/Gr5	89x6, 102x8, 108x10, 133x12, 159x14, 219x18, 273x22, 325x25	ASTM B861, GOST 22897-86	Shipbuilding, nuclear piping
Longitudinally welded tube	VT1-0/Gr2, OT4-0	25x1.5, 32x2, 38x2, 51x2.5, 63x3, 76x3, 89x3.5, 102x4	ASTM B862, GOST 24890-81	Ventilation, drainage
Capillary tube	VT1-00/Gr1, PT-1M	3x0.5, 4x0.5, 5x0.8, 6x1, 8x1	ASTM B338 (capillary), TU 14-3-843-79	Medical injectors, instrumentation
Heat exchanger tube	PT-7M, 3M	16x1, 20x1.5, 25x2, 32x2.5	ASTM B338, TU 1825-123	Condensers, steam generators
Desalination tube	VT1-0/Gr2, VT1-00/Gr1	25x2, 38x3, 57x4, 76x5	ASTM B861, TU 5.961	Marine desalination units
U-bend coil tube	PT-7M, VT1-0/Gr2	12x1, 16x1.5, 20x2	ASTM B338, TU 1-5-421	Heating coils, calorifiers

Product Description	Alloy Grades	Dimensions (OD x WT), mm	Standard	Target Industry
Nuclear secondary-circuit tube	VT1-0/Gr2, 3M	57x4, 76x5, 89x6, 108x8	ASME BPVC III, TU 1825-155	Nuclear power generation
Flanged pipe assembly	VT1-0/Gr2, VT6S	50-300 mm OD, wall per calculation	Client Specification	Pipeline manifolds

5. Customs Classification and HS Codes

Classification	HS Code	Duty Rate	VAT/GST	Compliance Notes
Tubes, general purpose	8108.90.60	Per destination tariff schedule	Per local regulation	PED 2014/68/EU or ASME BPVC certification for pressure service
Tubes for aero-engines	8108.90.60.10	0% with export license	Exempt with end-use certificate	ITAR/EAR license, end-user statement
Tubes for civil aircraft	8108.90.60.20	0%	Exempt	FAA/EASA airworthiness certification
Tubes for nuclear plants (capillary, heat exchange)	8108.90.60	Standard rate	Per local regulation	RCC-M / ASME Section III, nuclear QA program
Welded tubes, general purpose	8108.90.60	Standard rate	Per local regulation	Weld procedure qualification (WPQ) per ASME IX or EN ISO 15614

6. Installation and Service Recommendations

Welding:

- VT1-0/Grade 2 and PT-7M: GTAW (TIG) welding without restriction; no preheat required.
- Pre-weld: Mechanical end prep and acetone degreasing mandatory.
- VT6/Grade 5: Preheat to 150-200°C, post-weld anneal at 750°C in protective atmosphere.

Bending:

- PT-7M and PT-1M: Cold bending permitted with minimum radius 3D (D = outer diameter).
- VT6/Grade 5: Hot bending at 500-600°C with subsequent stress-relief heat treatment.

Threaded Joint Sealing:

- PTFE tape or anti-galling paste on titanium threads to prevent thread seizure (galling).
 - Never permit direct titanium-to-steel contact without PTFE, elastomeric, or copper isolation.
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7. Terms of Supply and Contact Information**Standard Supply Terms:**

- MOQ: 20 linear meters for stock items; 200 linear meters for mill production.
- Lead times: 10-20 days for stock; 45-75 days for mill production.
- Packaging: Polyethylene bags with silica gel desiccant, timber crates with internal dividers.
- Incoterms 2020: EXW, FOB, CIP, DAP, DDP (select destinations).

Contact Information:

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