





CARDINAL
UHP

TECH 10 SPECIFICATION

for
FOR SEAMLESS AND WELDED 316L STAINLESS STEEL TUBING AND
FITTINGS FOR USE IN BULK GAS AND FLUID PIPING
Current Issue: 29-August-2018

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Issue Date	Revision Description
28-August-2003	Revised format and updated reference documents.
10-October-2003	Updated Clean room specifications Section 6.6 to ISO Class 7
9February-2007	Updated Contacts, Updated T10 references
10-June-2010	Added Metric Tolerances
29-August-2018	Revised format and updated reference documents.

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The following documents must be reviewed when this specification is revised:

Control Plan

1 SCOPE

- 1.1 This specification will establish criterion for passivated seamless and welded tubing and fittings for the use and installation in bulk gas and fluid piping systems.
- 1.2 This specification is applicable to tubes and fittings with outside diameter sizes of 1/4" through 6" inclusive.
- 1.3 This specification applies to single wall and the carrier tubing for dual contained products.

2 REFERENCE DOCUMENTS

- ASTM A213-EAW†** Standard Specification for Seamless Ferritic and Austenitic Alloy-Steel Boiler, Superheater, and Heat-Exchanger Tubes
† Exception for Average Wall – Nominal wall thickness is used, not minimum wall thickness.
- ASTM A262** Standard Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
- ASTM A269** Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
- ASTM A270** Standard Specification for Seamless and Welded Austenitic Stainless Steel Sanitary Tubing
- ASTM A479** Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels
- ASTM A632** Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small-Diameter) for General Service
- ASTM A 1016/A 1016M** Standard Specification for General Requirements for Ferritic Alloy Steel, Austenitic Alloy Steel, and Stainless Steel Tubes
- ANSI/ASME B46.1** Surface Texture (Surface Roughness, Waviness, and Lay)
- EN 10204 3.1** Inspection Documents for metallic products
- ASME SA213** Seamless ferritic and austenitic alloy steel boiler superheater and heat exchanger tubes
- ISO 9001-2015** Quality Management System.
- ISO 14644-1** Cleanrooms and Associated Controlled Environments - Classification of Air Cleanliness

3 MATERIAL REQUIREMENTS

- 3.1 All tubing shall be produced from TP 316L stainless steel raw material. The chemical composition will follow Table 1 of ASTM A269.
- 3.2 Tubing shall conform to ASTM A632 for sizes less than 1/2" OD and ASTM A269 for sizes greater than or equal to 1/2" OD, unless otherwise provided herein.
- 3.3 Tubing less than or equal to 4" OD shall be bright annealed in a dry hydrogen atmosphere (dew point \leq -40 degrees C), or vacuum annealed (10 micron Hg), at the producing mill. 6" tubing shall be annealed and pickled.
- 3.4 All 316L material shall have a sulfur range of 0.005 to 0.012% for seamless product and 0.005 to 0.017% for welded product.
- 3.5 Bar stock shall conform to the requirements of ASTM A479.

- 3.6 Tubing less than 1/2" OD shall be seamless. Seamless or welded tubing shall be used for 1/2" through 2" OD, depending on the customer purchase requirements. Tubing greater than 2" OD shall be produced from welded raw material.

4 TRACEABILITY AND MARKING REQUIREMENTS

- 4.1 All raw material and finished products shall be mill and heat traceable back to the original mill test report.
- 4.2 Tubing shall be permanently marked with a mechanical etching tool, or other approved method. The mark shall contain: manufacturer's identification, the size and wall thickness, the alloy, the heat number, and the lot in which it was processed.
- 4.3 Fittings shall be permanently marked with a mechanical etching tool, or other approved method. The mark shall contain: manufacturer's identification, the alloy, and the heat number or heat reference code.

5 FITTING FABRICATION PROCEDURES

- 5.1 Fabrication of sub components for tubular tee fittings shall be by pulling, drilling, or notching the joining surfaces prior to welding.
- 5.2 To insure uniform production results, all welding during fitting fabrication shall be performed utilizing a pulsed TIG process. The ID and OD of the fitting shall be purged, during the welding procedure, using a cryogenic source of 99.998% pure argon gas.
- 5.3 The ID of fittings shall be mechanically polished to achieve a uniform finish.
- 5.4 The OD of fittings shall be provided with a uniform 180-grit finish. (Approximately 32 Ra)

6 SURFACE FINISHING, CLEANING, AND PACKAGING PROCEDURES

- 6.1 Mercury or ozone depleting chemicals are not used in the processing of Tech 10 products.
- 6.2 Ends of tubing and fittings shall be faced and squared appropriate for use with automated orbital welding equipment.
- 6.3 Tubing and fittings conform to process identified in ASTM G93-96 and ASTM 632.S-3.
- 6.4 Tubing and fittings shall be passivated in acid for a minimum of 30 minutes at ambient temperature.
- 6.5 After the passivation bath, tubing and fittings shall be rinsed in deionized water baths and dried.
- 6.6 Final cleaning of the tubing and fittings shall take place under ISO Class 7 cleanroom conditions.
- 6.7 After final cleaning, tubing and fittings are purged with 0.005 micron filtered nitrogen and capped with LDPE caps pressed over polyamide nylon film.
- 6.8 Tubing and fittings are individually bagged in 4 - 6 mil polyethylene bags and heat-sealed.
- 6.9 Outer bag shall have identifying label that product has been Cleaned For Oxygen Service.

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7 TESTING AND INSPECTION STANDARDS AND PROCEDURES

- 7.1 Tubing and fittings shall be mechanically polished or cold drawn in a manner to obtain a standard ID surface finish of 25µin Ra average, 32µin Ra maximum per ANSI/ASME B46.1.
- 7.2 Tubing and fittings shall meet the NVR requirements of ASTM G93-96 Level A and CGA G-4.1
- 7.3 The nitrogen gas, utilized for purging and drying is procured to the following, minimum purity specifications:

- Moisture: < 1 ppm
- Oxygen: < 1 ppm
- Total Hydrocarbons: < 1 ppm
- Carbon Dioxide: < 1 ppm

7.4 Tubing and fittings shall be measured with calipers, micrometers, or other acceptable methods, to certify that the finished products conform to the following dimensional requirements:

PARAMETER	COMPONENT	VARIATION FROM NOMINAL
Length	Fittings	+/- 1/16"
	Tubing (Sold in 20 Foot Lengths)	+1/8", -18"
	Tubing (Sold in 6 Meter Lengths)	+100mm, -360mm
Angularity	Fittings	+/- 1/2 degree
End Squareness	Tube and Fittings:	+/- 1/2 degree
Wall Thickness	Tube and Fittings	+/- 10%
Outside Diameter	Tube and Fittings	
	1/8" - 3/8" inc.	+0.004", -0.002"
	1/2" - 1" inc.	+/-0.005"
	1-1/2" - 3" inc. +/-0.010"	
Ovality	4" ~ 6"	+/-0.015"
	Tube and Fittings	Per ASTM A269

- 7.5 All fitting welds are inboard helium leak tested to less than 1 x 10⁻⁹ atm cc/sec. Each fitting is etched with a serial number, which is traceable to the helium leak test lot.
- 7.6 The following documentation shall be supplied with all Tech 10 orders—
 - 7.6.1 Mill Test Reports
 - 7.6.2 Certificate of Conformance: for the following measurements
 - Surface Roughness
 - Dimensional Tolerances
 - Helium Leak Test for welded fittings only.