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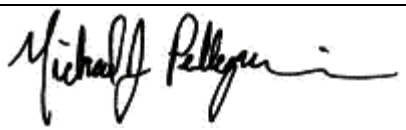	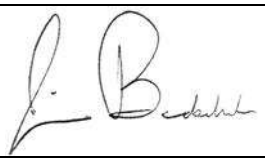
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Issue Date	Revision Description
28-August-2003	Revised format and updated reference documents.
10-October-2003	Updated Clean room specifications Section 6.6 to ISO Class 7
9February-2007	Updated Contacts, Updated T10 references
10-June-2010	Added Metric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

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"
	4" – 6"	+/-0.015"
Ovality	Tube and Fittings	Per ASTM A269

7.5 All fitting welds are inboard helium leak tested to less than 1×10^{-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.