





CARDINAL
UHP

TECH 10CR SPECIFICATION

FOR COILED SEAMLESS 316L STAINLESS STEEL TUBING FOR
USE IN BULK GAS AND FLUID PIPING SYSTEMS.

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

Control Plan

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1 SCOPE

- 1.1 This specification will establish criterion for passivated coiled seamless tubing for the use and installation in bulk gas and fluid piping systems.
- 1.2 This specification is applicable to tubing with outside diameter of 1/8" through 1/2" 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 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

ASTM E 112 Standard Test Methods for Determining Average Grain Size

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 for 1/2" OD tubing and ASTM A632 for all tubing less than 1/2" OD.
- 3.2 Tubing shall conform to ASTM A632 for sizes less than 1/2" OD and ASTM A269 for 1/2" OD, unless otherwise provided herein.
- 3.3 All tubing 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.

- 3.4 All 316L material shall have a sulfur range of 0.005 to 0.012% except for tubing less than 1/4". Tubing less than 1/4" OD can have a Sulfur content from 0.005 to 0.017%.

- 3.5 Tubing shall be seamless.

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 The size, wall thickness, the grade, the heat number, the lot number, the mill order number, and ASTM-A213/A269/1016 (for sizes less than 1/2" OD and greater than or equal to 1/4" OD ASTM-A632 shall replace A269) shall be stenciled continuously on the OD of each tube with indelible ink.

- 4.3 For tubing sizes less than 1/4" OD, there will be stenciling and/or tagging. In addition marking will be by tag or label located on the bag or protective package. Labeling will contain at a minimum the following information size, wall thickness, the grade, the heat number, the lot number, the mill order number, and ASTM-A213/A632/1016.

5 SURFACE FINISHING, CLEANING, AND PACKAGING PROCEDURES

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

6 TESTING AND INSPECTION STANDARDS AND PROCEDURES

- 6.1 Tubing shall be mechanically polished or cold drawn in a manner to obtain a standard ID surface finish of 25 μ m Ra average, 32 μ m Ra maximum per ANSI/ASME B46.1.

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6.2 Tubing shall meet the NVR requirements of ASTM G93-96 Level A and CGA G-4.1

6.3 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

6.4 Tubing 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	Tubing	-0, +5%
End Squareness	Tubing	+/- 1/2 degree
Outside Diameter	Tubing	
	Up to ¼"	+/- 0.003
	¼" – 3/8" inc.	+ 0.004"/-0.002"
Wall Thickness	½"	+/- 0.005"
	Tubing	
	Up to – ½" inc.	+/- 10%
Ovality	Tubing	
	Up to ½"	Per ASTM A632
	½" OD	Per ASTM A269

6.5 The following documentation shall be supplied with all Tech 10CR orders—

6.5.1 Mill Test Reports

6.5.2 Certificate of Conformance: for the following measurements

- Surface Roughness
- Dimensional Tolerances

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