



**CARDINAL**  
UHP

## TECH CM SPECIFICATION

for  
304 AND 316 STAINLESS STEEL TUBING FOR USE IN BULK GAS,  
VACUUM AND INSTRUMENTATION TUBING SYSTEMS FOR  
THERMOCOUPLE CLEAN APPLICATIONS  
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28-August-2003	Revised format and updated reference documents.
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Control Plan



# TECH CM SPECIFICATION

304 AND 316 STAINLESS STEEL TUBING FOR USE IN BULK GAS, VACUUM AND INSTRUMENTATION TUBING SYSTEMS FOR THERMOCOUPLE CLEAN APPLICATIONS



## 1 SCOPE

- 1.1 This specification will establish criterion for passivated seamless and welded tubing for use and installation in bulk gas, vacuum, and instrumentation piping systems requiring Thermocouple Clean tubing.
- 1.2 This specification is applicable to tubing with outside diameter sizes of 1/4" through 6" inclusive.

## 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 A249** Standard Specification for Welded Austenitic Steel Boiler, Superheater, Heat-Exchanger, and Condenser Tubes

**ASTM A269** Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service

**ASTM A632-S3** Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small-Diameter) for General Service

**ASTM A 1016/A 1016M** General Requirements for Carbon, Ferritic Alloy, and Austenitic Alloy Steel Tubes

**ISO 9001-2015** Quality Management System.

## 3 MATERIAL REQUIREMENTS

- 3.1 All tubing shall be produced from TP 316L or TP 304L stainless steel, depending on customer requirements. The chemical composition will follow Table 1 of ASTM A269. Seamless tubing shall be manufactured and tested to ASTM 213 or ASTM 249 with dimensional tolerances conforming to ASTM A269.
- 3.2 Tubing shall be manufactured and tested to ASTM A269.

- 3.3 Seamless or welded tubing shall be used for 1/4" 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 marked with the size and wall thickness, the alloy, and the heat number.

## 5 FITTINGS

- 5.1 Use Tech 10 fittings with Tech CM tubing.

## 6 CLEANING, AND PACKAGING PROCEDURES

- 6.1 Mercury or ozone depleting chemicals are not used in the processing of Tech CM products.
- 6.2 All tubing shall be thermocouple cleaned and capped in accordance with ASTM A632 - S3.
- 6.3 All Tubing shall be passivated. Tubing shall be rinsed in deionized water following passivation. Final drying agent will be UHP grade bulk nitrogen, filtered at point of use.
- 6.4 The OD of tubing shall be provided with a mill finish and mill finished ends.
- 6.5 Tubing is capped, bulk bagged in 4 – 6 mill polyethylene bags and heat-sealed for sizes less than 1" diameter.

## 7 TESTING AND INSPECTION STANDARDS AND PROCEDURES

- 7.1 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		+1/2", -18"
Wall Thickness	1/4" - 3/8" inclusive	+/- 15%
	1/2" - 6" inclusive	+/- 10%
Outside Diameter	1/4" - 1" inclusive	+/- 0.005"
	1-1/2" - 3" inclusive	+/- 0.010"
	4"	+/- 0.015"
	6"	+/- 0.030"
Ovality		Per ASTM A269

- 7.2 The following documentation shall be supplied with all CM orders—

### 7.2.1 Mill Test Reports

- 7.2.2 Certificate of Conformance: for the following measurements
  - Dimensional Tolerances