DEKORON® Unitherm™
Tubing Bundle Experts Since 1962

Dekoron Unitherm LLC
CAPE CORAL, FLORIDA

TECHNICAL UPDATE - TU-1004

SUBJECT: Austenitic Stainless Steels used in Dekoron Unitherm Bundles

Austenitic stainless steel tubing used in Dekoron Unitherm Preinsulated and Traced Tubing bundles is purchased under one or more of the following ASTM Standards[1]: ASTM A-213, A-249, and A-269, or their metric equivalents. The purpose of this update is to detail the differences in these specifications.

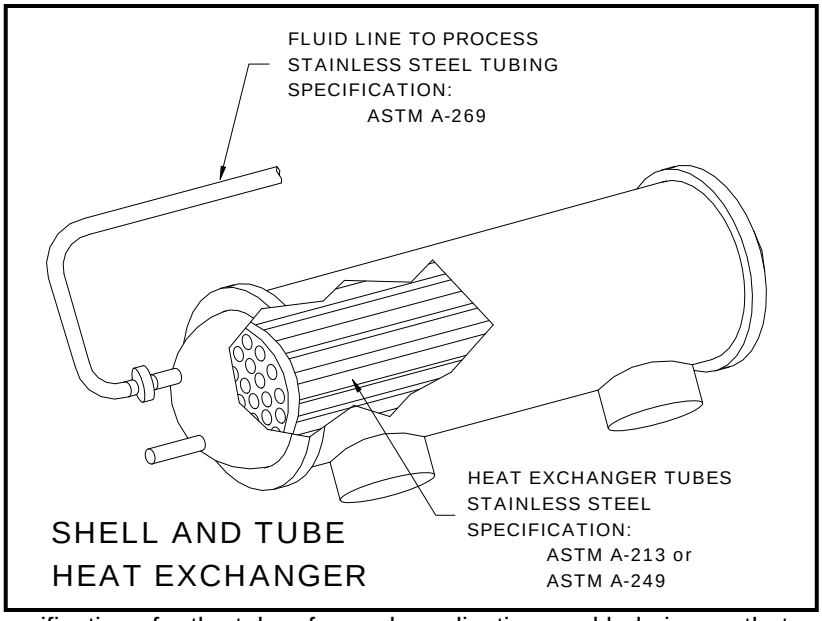
The three Standards listed above can be divided into two main groups: ASTM A-269 is a specification for seamless and welded austenitic stainless steel (300 series) tubing for general service. This tubing is used in applications requiring general corrosion resistance and low or high temperature service. ASTM A-213 and A-249 are specifications for boiler, superheater, and heat exchanger tubes. ASTM A-213 covers seamless austenitic and ferritic steels, while A-249 covers welded austenitic steels. These tubes are generally used inside the boiler, superheater or heat exchanger, not for connection between the boiler and process.

The illustration below shows one of the possible applications for the two types of tubes.

A typical heat exchanger is fabricated using a number of tubes bundled inside a shell. The cooling (or heating) fluid is passed through the large connections on the side of the shell, while the process fluid is circulated though the tubes. The tubes in the heat exchanger are specified to ASTM A-213 or ASTM A-249 so that the tube will be straight and suitable for welding, beading, forging and bending operations used in the construction of the heat exchanger.

The process line is generally specified to ASTM A-269 which provides a corrosion resistant pressure line that can withstand a wide temperature range, be bent and formed during the run to the process, and provide a fit to a number of different type connection systems that may be used in the process.

The tubes inside and outside the boiler or heat exchanger may be constructed from identical materials, but fabricated to different Standards.



SHELL AND TUBE HEAT EXCHANGER

The ASTM Standards provide a minimum set of specifications for the tubes for each application, and help insure that tubing is consistent from order to order.

The table below shows the properties listed for the three ASTM Standards discussed above. For complete data the reader should refer to the ASTM Standards.

It can be seen that the three Standards are very similar in many properties. All have the same physical properties for a given material. The mechanical testing is similar for welded or seamless tubes of different Standards. There are, however, some differences.

The following table points out the major differences between these specifications (with the exception of material grades).

Property	ASTM A-213	ASTM A-249	ASTM A-269
Wall Thickness Specification	minimum wall thickness	nominal wall thickness	nominal wall thickness
OD Variation	+/- 0.004 in.	+/- 0.004 in.	+/- 0.005 in.
Ovality Variation	0.020 in	0.020 in.	0.010 in.
Manufacturing Method	seamless	welded	seamless or welded
Tubing Put-Up	straight lengths*	straight lengths*	coils or straight lengths

*Unstraightened tubing (coils) will be identified on the Certification and wherever the grade designation appears with the suffix letter “U”, for example “316-U”.

It is not unusual for purchasing specifications to cause tubing to meet more than one Standard. For example, a tube purchased to ASTM A-213 in coils, with a nominal wall thickness specified would be identical to a tube purchased to

ASTM A-269 with the same dimensions. In this case, it may be more appropriate to specify ASTM A-269 as the tighter ovality specification makes it more suitable to compression and socket welded fittings

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Tubing Specifiations from ASTM Standards[1]

Standard ⟶	A-213	A-249	A-269
Property			
Scope of Standard	Minimum-wall-thickness, seamless ferritic and austenitic steel, boiler and superheater tubes and austenitic steel heat-exchanger tubes.	Nominal-wall-thickness welded tubes made from various austenitic steels intended for such use as boiler, superheater, heat exchanger or condenser tubes.	Nominal-wall-thickness, stainless steel tubing for general corrosion-resisting and low or high temperature service.
Austenitic Stainless Steel Grades covered in the Standard	TP 201, TP 202, TP 304, TP 304H TP 304L, TP 304N, TP 304LN, TP 309Cb, TP 309H, TP309HCb, TP 309S, TP 310Cb, TP 310H, TP 310HCb, TP 310S, TP 316, TP 316H, TP 316L, TP 316N, TP 316LN, TP 317, TP 317L, TP 321, TP 321H, TP 347, TP 347H, TP 348,TP 348H, TP XM-15, S21500, S30815, S31050, S31254, S31725, S31726, S32615	TP 201, TP 202, TP 304, TP 304H TP 304L, TP 304N, TP 304LN, TP 305, TP 309Cb, TP 309H, TP 309HCb, TP 309S, TP 310Cb, TP 310H, TP 310HCb, TP 310S, TP 316, TP 316H, TP 316L, TP 316N, TP 316LN, TP 317, TP 317L,TP 321, TP 321H, TP 347, TP 347H, TP 348, TP 348H, TP XM-15, TP XM-19, TP XM-29, S31050, S31254, S30815, S31725, S31726	TP 304, TP 304L, TP 304LN, TP 316, TP 316L, TP 316LN, TP 317, TP 321, TP 347, TP 348, TP XM-10, TP XM-11, TP XM-15, TP XM-19, TP XM-29, S31254, S31726, S30600
General Requirements	per ASTM A-450	per ASTM A-450	per ASTM A-450
Tubing Fabrication Method	Seamless Only	Welded Only	Seamless or Welded
Finish	Hot or Cold Finished	Cold Finished	Hot or Cold Finished
Heat Treatment	Required	Required	Required
Tensile Requirements	Tensile Strength 75 ksi Yield Strength 30 ksi (70 ksi Tensile and 25 ksi Yield for “L” grades of TP 304, TP 316)	Tensile Strength 75 ksi Yield Strength 30 ksi (70 ksi Tensile and 25 ksi Yield for “L” grades of TP 304, TP 316)	Not Specified
Hardness Requirements	90 HRB max (TP 3xx – all)	90 HRB max (TP 3xx – all)	90 HRB max (TP 3xx – all)
Allowable Variations in Dimensions	OD +/- 0.004 in (ASTM A-450) Wall +20% -0% (ASTM A-450) Ovality (max OD – min OD) 0.020 in (ASTM A-450)	OD +/- 0.004 in (ASTM A-450) Wall +/- 10% of nominal wall thickness Ovality (max OD – min OD) 0.020 in (ASTM A-450)	OD +/- 0.005 in Wall +/- 15% of nominal wall thickness Ovality (max OD –min OD) 0.010 in
Workmanship, Finish and Appearance	per ASTM A-450	Smooth ends free of burrs, must be straight within 0.030 inches in 3 feet of tubing	per ASTM A-450
Mechanical Testing	Tension, Flattening, Flaring, Hardness, Hydrostatic (or nondestructive electric)	Tension, Flattening, Flange, Reverse-Bend, Hardness, Hydrostatic (or nondestructive electric)	Flaring, Flange, Hardness, Reverse Flattening, Hydrostatic (or nondestructive electric)
Surface Condition	Bright annealed or pickeled	Bright annealed or pickeled	Bright annealed or pickeled
Supplimentary Requirements	S1. Stress-Relieved Annealed Tubes for certain materials S2. Stabilizing Heat Treatment for TP 321, TP 347, TP 348 and others S3. Unstraightened Tubes (Coils) require “-U” designation S4. Intergranular Corrosion Test	S1. Stress-Relieved Annealed Tubes for certain materials S2. Minimum Wall Thickness Specification S3. Air Underwater Pressure Test S4. Stabilizing Heat Treatment for TP 321, TP 347, TP 348 and others S5. Unstraightened Tubes (Coils) require “-U” designation S6. Intergranular Corrosion Test S7. Weld Decay Test	S1. Stress-Relieved Annealed Tubes for certain materials S2. Air Underwater Pressure Test S3. Stabilizing Heat Treatment for TP 321, TP 347, and TP 348 S4. Intergranular Corrosion Test
Product Marking	ASTM A-450 plus heat number and heat treatment lot identification for “H” grades	ASTM A-450 plus heat number and heat treatment lot identification for “H” grades	per ASTM A-450