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SPECIFICATION FOR "HEATED INSTRUMENT TUBING – PROCESS APPLICATIONS"

(March 2015)

1.0 SCOPE

This specification outlines the minimum requirements for electrically traced or steam/fluid traced instrument tubing (a.k.a. "tubing bundles", traced lines, sample transport bundles, heated umbilical, and other similar industry names) specifically for this application. Acceptable suppliers are Thermon or their authorized agents.

2.0 CONSTRUCTION

2.1 The process tube(s) and steam/fluid tracer tube and/or electric heat tracing shall be cabled together using an 18.00-24.00-inch (457-610mm) "lay" to insure tube(s) and/or electrical tracing contact is maintained throughout the length of the product. Metallic tubes up to 5/8" (16mm) OD and the tracer tube or electric heating cable shall be spiraled, unless specified otherwise on the production work order. Exceptions to this will be pre-insulated tube products containing a single tube and/or a thermally isolated tracer tube and/or non-metallic tubes. Tubes larger than 5/8" (16mm) OD shall be run parallel, with the tracer tube or electric heater, cabling around the process tube(s), with the exception of straight lengths. For straight length tubing, the tracer, tube or electric may run parallel with the process tube.

2.1.1 In bundles with multiple metallic tubes, each tube shall be identified by a paint or dye mark along its entire length. The paint or dye shall be compatible with the tube and insulation materials. The only exception will be bundles containing non-metallic tubing.

2.1.2 The tube(s) and electric heat tracing shall be wrapped with a combination of non-hygroscopic glass fiber insulation tape having a chloride content less than 50 ppm and heat-reflective foil.

2.1.3 The standard outer jacket material shall be black UV resistant Arctic Thermo-Plastic (ATP) compound with a maximum temperature rating 221°F (105°C). It shall be suitable for installation in conditions as low as -40°F (-40°C). The outer jacket shall have a nominal thickness of .080" (2.03mm). An acceptable alternative material is polyether urethane elastomeric compound (TPU).

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2.1.4 The finished product shall be labeled its entire length with the manufacturer's name, product catalog number, month/year of manufacture and country of origin. Product containing electrical heat tracing cable shall also be labeled "Caution Electric" along its entire length. Long lengths of product shall be coiled and level wound on a wooden spool. When product size and lengths allows, it may be packaged and shipped in a corrugated box. Products manufactured from straight length tubing will be packaged and shipped as straight lengths, in a comparable wooden crate.

3.0 MATERIALS OF CONSTRUCTION

3.1 Tubing

The following tubing specifications shall apply to the process and/or sample tube(s), as well as the tube for heating media in steam or fluid tracing systems. (Also addressed in section 3.3 of this specification.)

3.1.1 Welded stainless steel tubing shall be Type 316 continuous TIG welded, cold drawn and fully annealed. It shall meet or exceed ASTM Standard A-269. Tube hardness shall be RB90 or less, suitable for bending and flaring. The stainless steel tubing shall be available in minimum coil lengths of 500 feet (150 meters) for 1/8" (3mm) O.D. through 3/4" (20mm) O.D. and .028" (.71mm), .035" (.89mm), or .049" (1.25mm) wall thickness.

3.1.2 Seamless stainless steel tubing shall be Type 316 cold drawn and fully annealed. It shall meet or exceed ASTM Standards A-269 and A213 "EAW". Long length coils are preferred for sizes 1/8" (3mm) O.D. through 3/4" (20mm) O.D. and .028" (.71mm), .035" (.89mm), .049" (1.25mm), or .065" (1.5mm) wall thickness. Tube hardness shall be RB90 or less, suitable for bending and flaring.

3.1.3 Copper tubing shall be grade 122 soft annealed and shall meet or exceed ASTM Standards B-68 and B-75. The tubing shall be available in minimum coil lengths of 500 feet (150 meters) for sizes 1/4" (6mm) O.D. through 3/4" (20mm) O.D.

3.1.4 "Teflon" process tubing shall be an extruded[1] fluoropolymer resin of PFA or FEP Grade. Tubing shall be in available in long, continuous coils for sizes 1/8" (3mm) O.D. through 3/4" (20mm) O.D. and minimum wall thickness shall be .030" (.86mm) to .062" (1.57mm).

[1] PTFE tubing can be considered if allowed in the project or facility specifications.

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3.2 Electrical Heat Tracing

The type of electrical heat tracing used in tubing bundles is described by the specific application as outlined in Section 4.0 below. Primary concern shall be given to the system reliability and safety. Heat tracing methods not covered in this specification may be considered as an alternate where temperature and/or watt density are outside the capabilities described.

3.3 Steam and Fluid Heat Tracing

Steam/Fluid traced tubing bundles shall have a tracer tube of copper or stainless steel. The tracer tube shall be 1/4" (6mm), 3/8” (10mm) or 1/2” O.D. (12mm), and shall meet the specification as outlined in section 3.1.

3.4 Thermal Insulation System

The insulation system shall consist of non-hygroscopic (non-wicking) glass-fiber insulation with a total chloride content less than 50 ppm and heat-reflective aluminum foil. The insulation shall be applied in sufficient thickness as to limit the outer jacket surface temperature to 140°F (60°C) maximum in an 80°F (27°C) ambient with no wind and a maximum tube temperature of 400°F (204°C).

3.5 Outer Bundle Jacket

(Refer to section 2.1.3)

4.0 APPLICATION

4.1 Freeze Protection & Low Temperature Maintenance up to 150°F (65°C).

Heat tracing shall be self-regulating, capable of maintaining process temperatures up to 150°F (65°C) and withstanding continuous exposure to tube temperatures of 185°F (85°C) while the heat tracing is de-energized. Heat tracing shall be capable of being cut to length without changing its power output per unit length and heat output shall respond to temperature change.

Long-term stability as established by the service life performance test per IEEE 515 Std-2004, with Thermon BSX™ self-regulating heat tracing preferred.

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4.1.1 Freeze Protection & Medium Process Maintenance up to 250°F (121°C)

All heat tracing shall be self-regulating, capable of maintaining process temperatures up to 250°F (121°C) and continuous exposure to tube temperatures of 400°F (205°C) while heat tracing is de-energized. Heat tracing shall be capable of being cut to length without changing its power output per unit length and heat output shall respond to temperature change.

Long-term stability as established by the service life performance test per IEEE 515 Std-2004, with Thermon HTSX™ self-regulating heat tracing preferred.

4.1.2 Freeze Protection & High Process Maintenance up to 300°F (149°C)

All heat tracing shall be self-regulating, capable of maintaining process temperatures up to 300°F (149°C) and intermittent exposure to tube temperatures of 450°F (232°C) while heat tracing is de-energized. Heat tracing shall be capable of being cut to length without changing its power output per unit length and heat output shall respond to temperature change.

Long-term stability as established by the service life performance test per IEEE 515 Std-2004, with Thermon VSX™ self-regulating heat tracing preferred.

4.1.3 Freeze Protection, High Temperature & Process Maintenance up to 400°F (204°C)

All heat tracing shall be power-limiting and capable of maintaining process temperatures up to 400°F (204°C) and withstand continuous exposure to tube temperatures of 500°F (260°C) while heat tracing is de-energized. Heat tracing shall be capable of being cut to length without changing its power output per unit length and heat output shall respond to temperature change.

Long-term stability as established by the service life performance test per IEEE 515 Std-2004, with Thermon HPT™ power-limiting heat tracing preferred.

5.0 CIRCUIT CONTROL- PROTECTION

5.1 Control and Monitoring for Electrically Traced Tubing

For freeze protection applications where elevated process temperature excursions and/or steam-outs do not exceed the heat tracing exposure rating of the electric tracer, while energized, ambient sensing control is acceptable. For energy conservation, “ambient proportional control” is recommended.

Where elevated excursions are expected and/or where accurate temperatures are to be maintained, tube/line sensing control is required. Depending on the application, electronic controls or mechanical thermostats can be considered.

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For all tube/line sensing applications, care shall be taken to ensure that the temperature sensor is not in direct contact with the electrical heat tracing to create a false reading. The sensor type used must have an exposure temperature rating at or above the tube exposure temperature. The installation of an RTD-type sensor on the tube can be arranged by the tubing bundle manufacturer, or applied in the field.

The RTD sensor shall be connected to a microprocessor-based control and monitoring device such as the Thermon TC device. Note that the TC-101, TC-201, TC-202, and TC-1818 also provide ground leakage equipment protection functions required by most electrical codes.

5.1.1 Circuit Protection for Electrically Traced Tubing

All pertinent electrical codes shall be observed in the installation, operation, and maintenance of all electrical heat tracing installations, including heated instrument tubing. No more than five (5) instrument lines can be connected in parallel with a common electrical circuit protection device, (i.e. circuit breaker).

6.0 Accessories for Connections, Terminations, and Sealing Kits

All electrical heat tracing circuits within the tubing bundle(s) shall be fabricated with the appropriate kits designed specifically for power connections and end terminations. Where the tube sample line is to be electrically heated, the manufacturer of the pre-insulated and heat traced tubing bundle shall also be the manufacturer of the electrical heat tracing.

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*__Also See__:
"Specification for Heated Sample Lines for Dilution and Extractive Analytical Systems", and
"Specification for Freeze Protecting Super-Heated Steam Tubing"

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