



Attached you will find a sample specification for the application of pre-insulated and pre-traced tubing bundle for use in instrumentation and analytical systems. This specification is submitted for your consideration. You may copy, amend and modify this document as needed.

These specifications recommend the use of O'Brien TrueTube EP and TrueTube EPS for specific analytical applications. Through independent testing TrueTube products have demonstrated substantially improved response times over standard 316L (UNS S31603, DIN 1.4404) seamless stainless steel tubing when used for the measurement of moisture and sulfur compounds in gas streams. Because both of these products are available from O'Brien in long continuous lengths they are ideal for analyzer application.

TrueTube EP is suggested for use in all moisture measurement where the lower limit of detection is at or below 10 ppm. Discernable improvement was observed during 'wet up' and 'dry down' transition. The time to detect a change from 10 ppm to 150 ppb was 25 - 60 minutes faster using TrueTube EP. TrueTube EP demonstrated a 40-60% improvement in response time.

The sample specification also suggests TrueTube EPS for low ppm sulfur measurement. Tests using a 500 ppb methylmercaptane in Helium produced a consistent reading within 2 minutes. The same test using traditional 316L seamless stainless steel tubing showed no response for more than 90 minutes. Additionally the 316L seamless tube did not reach a consistent reading for another 75 minutes longer or a total of 2 hours and 45 minutes to transport a sample consistent with the test gas.

Other tests indicate that O'Brien's chemically polished and electropolished tubing provide ideal surface for SilcoTek (Restek) Silcolloy 1000 (Silcosteel) and SilcoNert 2000 (Sufinert) coatings. This combination available as TrueTube FS and TrueTube EPS yielded extremely stable and reproducible results when compared to the same coatings applied to commercial tubing.

Combined with the advantages of O'Brien Tracepak tubing bundles to maintain accurate temperatures TrueTube EP and TrueTube EPS have proven to produce superior response times and improved corrosion resistance when applied to traditionally troublesome analyzer sample transport problems.

Sample Specification for Pre-insulated Tube Bundles and Accessories

1.0 SCOPE

This specification is to be used for:

- 1.1. Sample, process and utility piping less than 25mm (1") in diameter shall utilize pre-insulated and pre-traced tubing bundles when freeze protection, personnel protection or temperature maintenance is required.
- 1.2. Instrument impulse lines
 - 1.2.1. Impulse tubing shall be heat traced to maintain freeze protection at the specified ambient temperature. Pre-traced tubing bundle shall be utilized on tubing runs in excess of 0.5 meter (2 ft). Runs less than 0.5meter (2 ft.) shall be field traced and insulated.
 - 1.2.2. Impulse connections less than 1 meter shall be made with each required connection in its own pre-traced bundle. Eg; Flow transmitters with impulse lines less than 1 meter shall be connected using two sections of tubing bundle each with one process tube and required tracer.
- 1.3. Analyzer and continuous emissions monitoring sample lines, and chemical injection tubing.
 - 1.3.1. Sample lines and chemical injection tubing shall be heat traced to maintain freeze protection or temperature maintenance at the specified ambient temperature. Pre-traced tubing bundle shall be utilized on tubing runs in excess of 0.5 meter (2 ft.). Runs less than 0.5 meter (2 ft.) shall be field traced and insulated.
- 1.4. Steam distribution and condensate return systems less than 10.3 Bar / 186°C (150psi / 366°F).
 - 1.4.1. Tubing less than 25mm (1") in diameter used for self draining steam supply and condensate return systems equipped with automatic freeze protection drains shall utilize pre-insulated tubing bundle.
 - 1.4.2. Tubing less than 25mm (1") in diameter used for steam supply and condensate return that are not self draining and equipped with automatic freeze protection drains shall utilize electrically traced tubing bundle for all runs greater than 1 meter (3 ft.).

2.0 GENERAL REQUIREMENTS

- 2.1. Basic Construction
 - 2.1.1. The bundle must be designed such that the outer jacket temperature will not pose a burn hazard to personnel on the maximum ambient day.
 - 2.1.2. All tube bundle materials must be suitable for installation at -40°C (-40°F).
 - 2.1.3. The thermal insulation shall be nonflammable self-extinguishing, nonhygroscopic and chemically inert and shall have an average water-soluble chloride content of 45 ppm or less with a maximum permissible level of 100 ppm.
 - 2.1.4. The jacket shall be a nonflammable self-extinguishing halogen free thermoplastic continuously extruded through the entire length of the bundle.
 - 2.1.4.1. Optionally the jacket may also be required to meet the antistatic surface resistance requirements of IEC/EN 60079-0:2009 and EN 13463-1:2009.
 - 2.1.5. The dual tubing bundles shall be of parallel (not cabled) construction to reduce work hardening and provide a minimum bend radius with no tube kinking.
 - 2.1.6. Tube bundles with tube diameters less than 19mm (3/4") shall have a 200mm (8") maximum bend radius.
 - 2.1.7. Tube bundles shall be terminated utilizing manufacturer recommended accessories.
 - 2.1.8. Tube bundle shall have colored jackets and custom print text as options.
- 2.2. Electrically Traced
 - 2.2.1. Self regulating heating cables capable of withstanding maximum possible process fluid temperatures shall be used.
 - 2.2.2. Heater cable shall have a metal braid and fluoropolymer overjacket.
 - 2.2.3. Process maintenance tube bundles for Analyzer sample transport or Chemical injection, will be powered from circuit breakers provided by Buyer. The circuits shall be set to maintain temperatures listed in Buyers attached list.
 - 2.2.4. Heater wattage is to be designed and verified by the supplier for both freeze protection and process maintenance applications.
 - 2.2.5. Power connection and entry glands shall be approved for the area classification.
- 2.3. Steam Traced
 - 2.3.1. Steam distribution, tubing bundle shall preferably be used for leads from the supply header to the piping or equipment being traced and from the piping or equipment being traced to the steam trap.

- 2.3.2. Consideration must be given to insure that no more than 10% drop in steam occurs from the supply point to the steam trap connections.
- 2.3.3. Temperature Control
 - 2.3.3.1. Impulse line tracing shall be thermostatically controlled if it is necessary to prevent boiling or vaporizing the process fluid at the high design ambient.
 - 2.3.3.2. Sample transport and CEM lines shall be thermostatically controlled if it is necessary to maintain minimum temperatures.
 - 2.3.3.3. Factory installed RTD and/or T/C sensors shall be shielded from interference and located in a representative ambient location of the bundle.
 - 2.3.3.4. Alternately an additional 3/8" OD tube may be incorporated into the heated core of the bundle to be used as a conduit for field placement of the temperature sensor. O'Brien SensorTube™ or equal shall be specified.
 - 2.3.3.5. Controller shall have:
 - 2.3.3.5.1. Input voltage of 100 – 277 VAC.
 - 2.3.3.5.2. SSR of 30A continuous dual pole.
 - 2.3.3.5.3. Integral independent GFI Alarm and trip set points.
 - 2.3.3.5.4. Continuous voltage monitoring and alarm for excessive and low power.
 - 2.3.3.5.5. Dual independent RTD inputs.
 - 2.3.3.5.6. NEMA 4X enclosure.
 - 2.3.3.5.7. CSA / NEC approved for Class I Div.2 GP A,B,C,D.
- 2.4. TUBING SELECTION
 - 2.4.1. Tube size, wall thickness, construction and material shall be specified and be compatible with the process conditions.
 - 2.4.2. General instrumentation, steam distribution and condensate return
 - 2.4.2.1. Except as specifically allowed or defined all process tubes will be seamless 316L SS with diameter and wall thickness per the specification.
 - 2.4.2.2. 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.
 - 2.4.2.3. ASTM 269 Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
 - 2.4.2.4. ASTM 632 Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small-Diameter) for General Service
 - 2.4.2.5. ASTM A1016 / A1016M Standard Specification for General Requirements for Ferritic Alloy Steel, Austenitic Alloy Steel, and Stainless Steel Tubes
 - 2.4.2.6. NACE MR0175 Standard Material Requirements for Metals for Sulfide Stress Cracking and Stress Corrosion Cracking Resistance in Sour Oilfield Environments
 - 2.4.2.7. Certificate of Conformance per EN 10204 3.1 Inspection Documents for Metallic Products
 - 2.4.3. Analyzer and continuous emissions sample lines
 - 2.4.3.1. All tubing shall be Thermocouple Cleaned (TCC) per ASTM A632-S3
 - 2.4.3.2. Wherever possible tubing shall be one continuous unbroken length from sample point to sample conditioning cabinet or analyzer.
 - 2.4.3.3. All tubing used for critical measurements shall conform to the following additional specifications and requirements based on the concentration of the compound to be measured:
 - 2.4.3.3.1. Critical measurement sample streams requiring chemically-polished tubing must comply with following additional requirements: base material shall be chemically polished passivated smooth bore tube
 - 2.4.3.3.1.1. Chemical-polish and passivation procedure must meet non-volatile residue requirements of ASTM G93 and CGAG4.1.
 - 2.4.3.3.2. For gas and moisture measurements below 10ppm process tubing shall be:
 - 2.4.3.3.2.1. Electropolished tubing, TrueTube EP as supplied by O'Brien Corporation, St. Louis, MO USA or approved equal.

Sample Specification for Pre-insulated Tube Bundles and Accessories

- 2.4.3.3.2.2.
- 2.4.3.3.2.3. Processed and electropolished in a manner consistent with an ID surface finish per ANSI/ASME B46.1 of 10 μ m.
- 2.4.3.3.2.4. Cleaned with deionized water to remove all traces of electrolyte and other contaminants after electropolishing .
- 2.4.3.3.2.5. Dried with Nitrogen containing less than 1 ppm moisture and capped.
- 2.4.3.3.2.6. Continuous length. Orbital welded sticks are not acceptable.
- 2.4.3.3.3. For sulfur compound measurements below 10ppm process tubing shall be:
 - 2.4.3.3.3.1. Electropolished tubing with SilcoNert 2000 (Sulfinert) fused silicon coating, TrueTube EPS as supplied by O'Brien Corporation, St. Louis, MO USA or approved equal.
 - 2.4.3.3.3.2. In compliance with all requirements of Sections 2.4.3.3.1.2 through 2.4.3.3.1.5.

3.0 ENGINEERING DATA REQUIREMENTS

The Seller shall furnish the following data with his quotation.

- 3.1. Model number and complete descriptive literature for all material quoted.
- 3.2. A list of items individually priced for heating enclosures, bundles, seals, tape, jacket patches, boots, equipment tags and nameplates and any other accessories bidder feels may be needed.
- 3.3. A list of items individually priced for tubing bundles including, connection kits, termination kits, boot seals, bulkhead entry enclosure seal, end seal, temperature sensors and any other accessories bidder feels may be needed.
- 3.4. Installation, Operation, and Maintenance Instructions shall cover all the equipment supplied.
- 3.5. Sample Tube Supplier shall provide verification of dew point calculations, electrical requirements, installation requirements, and sample tube specification if requested.
- 3.6. Electric Traced Systems:
 - 3.6.1. Heat load calculations and enclosure heater sizing for stated conditions.
 - 3.6.2. Nominal Cable watt densities at 10°C (50°F) and stated voltages for all proposed cable.
 - 3.6.3. Maximum run lengths per circuit breaker sizing and minimum start-up temperature for each tubing bundle configuration supplied.
 - 3.6.4. Complete installation instructions including the following details: cable splicing and terminating.
- 3.7. Steam Traced Systems:
 - 3.7.1. Maximum trapping distance based on 10% pressure drop.

4.0 ADDITIONAL REQUIREMENTS

- 4.1. Manufacturer's standard quality control tests.
- 4.2. Warranty in regards to the bundle and accessories quoted.
- 4.3. Preparation for Shipment shall be in accordance with Seller's standards.
- 4.4. Seller shall be solely responsible for adequacy of the preparation for shipment to ensure that the material reaches its destination in ex-works condition.